Panasonic
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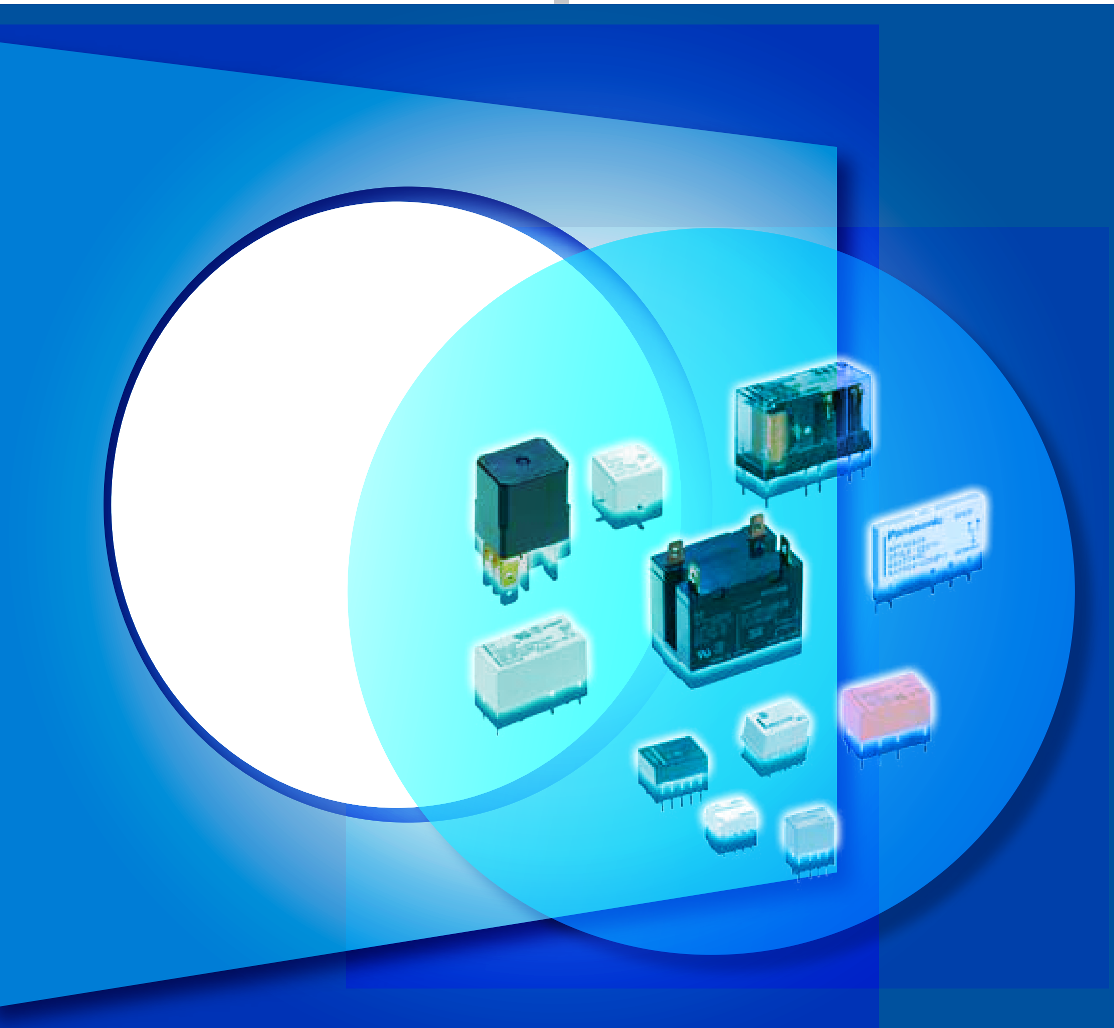
PART2: PHOTOMOS & SOLID STATE RELAYS

RELAY CATALOG PART 1

ELECTROMECHANICAL RELAYS



Notes and Guidelines

Panasonic is part of a large worldwide group selling relays and associated switching products under different brand names in different territories. The conditions of use in some territories may differ from those customary in Europe. In particular there are often major differences in regard to national and international specifications, such as UL, CSA, VDE, SEV, EVE, SEMKO, etc. Thus, when considering contact loads as stated in this catalogue (e.g. 10 A, 30 VDC for the SP relay) it should be understood that these values are not necessarily an absolute maximum but tested ratings. Mostly the stated value has been tested for a certain life expectancy as stated by the manufacturer or the respective test house. Thus, under different conditions, the stated “maximum” may, in practice, be safely exceeded.

Therefore consideration should be given to each specific application for:

- rating and type of load
- switching frequency - cycles per second (or minute)
- environmental conditions

A general statement of compliance on data sheets, publicity, etc. concerning industrial standards, approvals or certification may imply compliance to a certain standard is available. However, because of the multiplicity of types available, in general not all types within the product family are covered to the same extent by the standard. Thus, in the event of a specific query regarding a particular product and its compliance with the standard, users are asked to refer to Panasonic for detailed information.

In case of uncertainty, contact should be made with Panasonic locally to ascertain the likelihood of the relay meeting the required life expectancy in the specific planned operational circumstances. It is also pointed out that in this book, and in deviation from EN / IEC 61810-1, operational life data is given under a normal ambient temperature of about 25°C.

The features and specifications quoted have been carefully tested using modern methods and represent the values which are to be expected with a product in new condition at room temperature. They are not guaranteed values and may change during operational life or due to ambient influences. Statistical test information covering major operating features is available on request. Panasonic reserves the right to make alterations and changes to specifications without notice from time to time as may be deemed necessary.

Application of the EC Directives to All-or-Nothing Relays

1 EMC Directive

The EMC Directive concerns primarily the finished products. In applying the Directive to components, the Guidelines[1] should be consulted to determine whether the component in question has a “direct function”. Electric motors, power supply units or temperature controls represent examples of such components with “direct function”. These types of components must be provided with a CE marking.

Components which are integrated into a device, such as relays, do not have an independent function of their own. A given relay may perform differing functions in different devices. Consequently, all-or-nothing relays must be considered components without “direct function” which are not subject to the EMC Directive.

All-or-nothing - be they electro-mechanical relays or solid state relays - shall not be labeled with a CE marking nor shall a declaration of conformity be issued within the scope of the EMC Directive.

2 Low Voltage Directive

Relays with terminals for printed boards/plug-and-socket connections do not come within the purview of the Low Voltage Directive.

The Low Voltage Directive concerns electrical equipment intended for incorporation into a device as well as equipment intended for direct use. In the case of electrical equipment which is considered a basic component intended for incorporation into other electrical equipment, the properties and safety of the final product will be largely dependent on how it is integrated: as such, these components do not fall within the Low Voltage Directive and shall not be CE marked. The Guidelines[2] specifically cite electro-mechanical basic components such as connectors, relays with terminals for printed circuit boards and micro switches. They are therefore not subject to the scope of the Low Voltage Directive.

Except for larger relays which may, for example, find application in switching cabinets, the same considerations apply to common-place relays with plug-in connections available also with printed board terminals. Here again, safety is a function of the individual application. In evaluating these relays’ performance from the perspective of the Low Voltage Directive, the same conclusion is reached as with the printed board relay. As such, CE marking is not mandatory for this type of relay.

3 Machinery Directive

The Machinery Directive differentiates between machines, machine parts and safety components. Relays are not part of any of these categories. The listing of safety components in Appendix IV is conclusive and does not include relays.

Consequently, a CE marking shall not be affixed nor shall a declaration of conformity or manufacturer’s declaration be issued under the Machinery Directive.

As of this moment, none of the aforementioned directives require CE marking for all-or-nothing relays[3].

4 RoHS Directive

The substances prohibited by the RoHS Directive (Pb, Hg, Cd, Cr^{+6}, PBB, PBDE) concern 10 categories of devices that are mostly, but not entirely, intended for private use. Components such as relays are not listed in these categories. Therefore they do not directly fall within the scope of this directive. However, if the user employs relays in devices that fall within the scope of this directive, the user must also acknowledge the substances prevented. In order to adapt to this situation in good time, all Panasonic relays are generally RoHS compliant.

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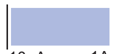
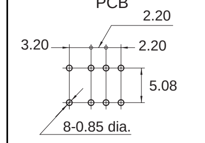
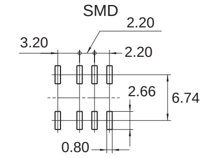
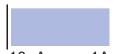
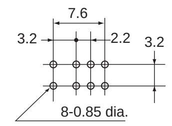
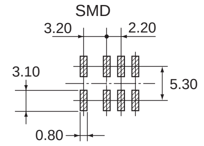
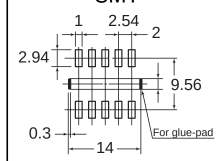
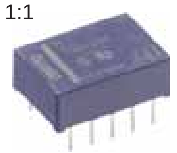
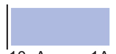
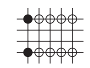
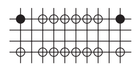
1. Guidelines (version dated March 22, 2007) for the Application of the Council Directive 2004/108/EC.
2. Guidelines (version dated August 2007) for the Application of the Council Directive 2006/95/EC.
3. This writing deals exclusively with “non-specified-time all-or-nothing relays”. The abbreviated term “all-or-nothing relay” has been introduced merely for purposes of convenience. The term includes solid state all-or-nothing relays.

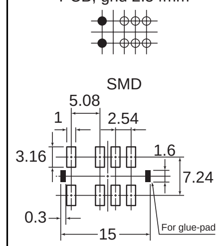
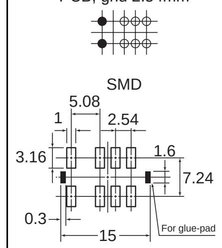
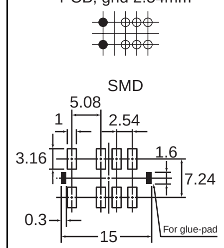
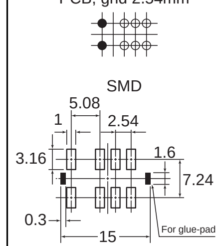
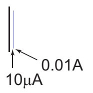
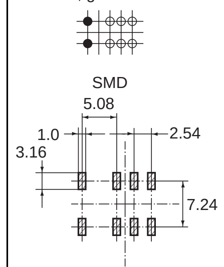
Table of Contents

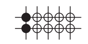
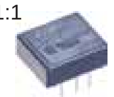
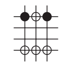
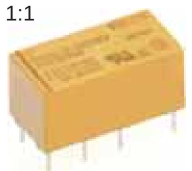
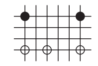
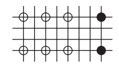
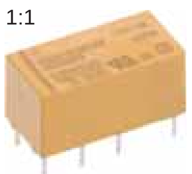
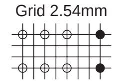
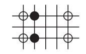
Alphabetical List of Relays

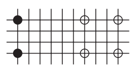
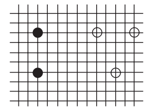
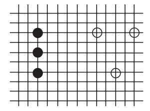
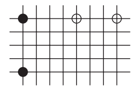
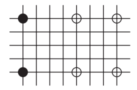
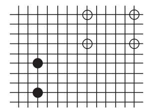
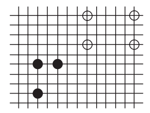
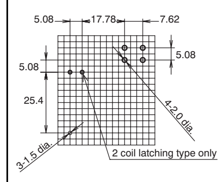
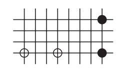
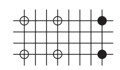
Selector Chart

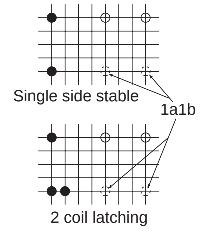
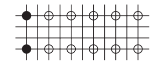
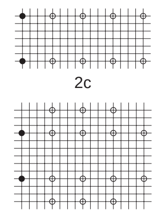
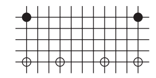
About the Selector Chart
This selector chart is designed to help you quickly select a relay best suited for your needs. Please note: the values given for switching current and switching voltage do not necessarily indicate standard operating conditions. For the nominal switching capacity and other critical values, please refer to the respective data sheet. In case of doubt, please contact your Panasonic representative.

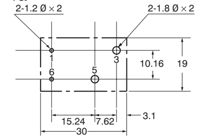
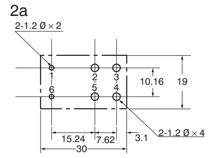
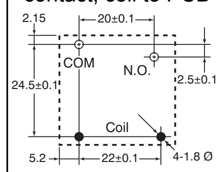
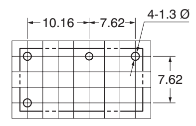
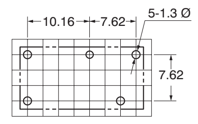
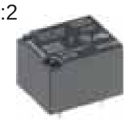
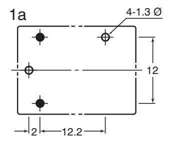
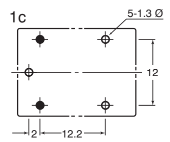
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
							Between open contacts	Between contact sets	Contacts to coil			
★GQ (SMD) 1:1  10.6 x 7.2 x 5.2/5.4mm	• Compact flat body saves space • Outstanding surge resistance • The use of twin crossbar contacts ensures high contact reliability • High sensitivity 100mW type available	**Max.:** 1A **Min.:** 10µA 	• 110V DC • 125V AC	2c	(DC) 1.5, 3, 4.5, 6, 9, 12, 24V	**Single side stable:** 140mW (1.5 - 12V DC) 230mW (24V DC) **1 coil latching:** 100mW (1.5V - 12V DC) 120mW (24V DC)	750Vrms	1000Vrms	1500Vrms	1,500V FCC 2,500V Telcordia	PCB, SMT PCB  SMD 	62 UL, CSA, BSI
★GN (SMD) 1:1  10.6 x 5.7 x 9.0mm	• Compact slim body saves space • Outstanding surge resistance • The use of twin crossbar contacts ensures high contact reliability • High sensitivity 100mW type available	**Max.:** 1A **Min.:** 10µA 	• 110V DC • 125V AC	2c	(DC) 1.5, 3, 4.5, 6, 9, 12, 24V	**Single side stable:** 140mW (1.5 - 12V DC) 230mW (24V DC) **1 coil latching:** 100mW (1.5V - 12V DC) 120mW (24V DC)	750Vrms	1000Vrms	1500Vrms	1,500V FCC 2,500V	PCB, SMT PCB  SMD 	57 UL, CSA, BSI
★TQ (SMD) 1:1  14 x 9 x 5.6mm	• Ultra low profile 5.8mm • Surge withstand 2,500V • 3 types of surface-mount terminals available	**Max.:** 2A **Min.:** 10µA 	• 220V DC • 125V AC	2c	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V	**Single side stable:** 140mW (up to 12V DC) 200mW (24V DC) 300mW (48V DC) **1 coil latching:** 70mW (up to 12V DC) 100mW (24V DC) **2 coil latching:** 140mW (up to 12V DC) 200mW (24V DC)	1000Vrms	1500Vrms	1500Vrms	1,500V FCC 2,500V Telcordia	SMT 	87 UL, CSA
TQ (THT) 1:1  14 x 9 x 5mm	• 1,500V FCC • 4-pole model available	**Max.:** 1A **Min.:** 10µA 	• 110V DC • 125V AC	2c, 4c	(DC) 3, 4.5, 5, 6, 9, 12, 24, 48V	**Single side stable:** 140mW (3 - 12V DC) 200mW (24V DC) 300mW (48V DC) **1 coil latching:** 100mW (3 - 12V DC) 150mW (24V DC) **2 coil latching:** 200mW (3 - 12V DC) 300mW (24V DC)	750Vrms	1000Vrms	1000Vrms	1,500V FCC	PCB Grid 2.54mm  2c  4c	87 UL, CSA

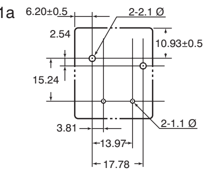
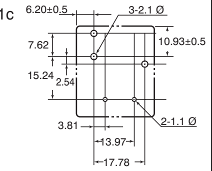
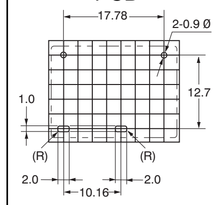
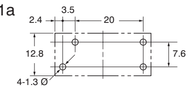
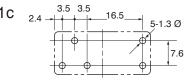
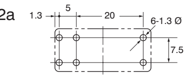
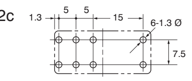
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
							Between open contacts	Between contact sets	Contacts to coil			
★TX (SMD) 1:1  15 x 7.4 x 8.2mm	• Surge withstand 2,500V • Breakdown voltage between contacts and coil 2,000V • 3 types of surface-mount terminals available • Added new pin layout (LT type) in 2 coil latching type	**Max.:** 2A **Min.:** 10µA 	• 220V DC • 220V AC	2c	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V	**Single side stable:** 140mW (up to 24V DC) 270mW (48V DC) **1 coil latching:** 100mW **2 coil latching:** 200mW	1000Vrms	1000Vrms	2000Vrms	1,500V FCC 2,500V Telcordia	PCB, SMT PCB, grid 2.54mm 	99 UL, CSA, BSI
★TX-TH (SMD) 1:1  15 x 7.4 x 8.2mm	• Controlled 7.5A inrush current • 2 types of pin layouts • 3 types of surface mount terminals available	**Max.:** 7.5A **Min.:** 10µA 	• 220V DC • 250V AC	2c	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V	**Single side stable:** 140mW (up to 24V DC) 270mW (48V DC) **1 coil latching:** 100mW (up to 24V DC) **2 coil latching:** 140mW (up to 24V DC)	1000Vrms	1000Vrms	2000Vrms	1,500V FCC 2,500V Telcordia	PCB, SMT PCB, grid 2.54mm 	126 UL, CSA, BSI
TX-D (SMD) 1:1  15 x 7.4 x 8.2/8.4mm	• High-insulation relay that conforms to the insulation level provided for in the EN41003 • 3 types of surface-mount terminals available • High-insulation relay that conforms to the insulation level provided for in the EN60950 • Surge breakdown voltage 6kV (contacts to coil) available	**Max.:** 2A **Min.:** 10µA 	Break Before Make: • 220V DC • 250V AC Make Before Break: • 125V DC • 125V AC	2c	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24V	**Single side stable:** 200mW (1.5 - 12V DC) 230mW (24V DC) **1 coil latching:** 150mW (1.5 - 12V DC) 170mW (24V DC)	1000Vrms	1000Vrms	3000Vrms	6,000V for fax machines & lighting ballasts	PCB, SMT PCB, grid 2.54mm 	107 UL, CSA, BSI
TX-S (SMD) 1:1  15 x 7.4 x 8.2/8.4mm	• Higher sensitivity • Nominal operating power, 50mW • 1,500V FCC • 3 types of surface-mount terminals available • Added new pin layout (LT type) in 2 coil latching type	**Max.:** 1A **Min.:** 10µA 	• 110V DC • 125V AC	2c	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24V	**Single side stable:** 50mW (1.5 - 12V DC) 70mW (24V DC) **1 coil latching:** 35mW (1.5 - 12V DC) 50mW (24V DC) **2 coil latching:** 70mW (1.5 - 12V DC) 150mW (24V DC)	750Vrms	1000Vrms	1800Vrms	1,500V FCC 2,500V Telcordia	PCB, SMT PCB, grid 2.54mm 	119 UL, CSA, BSI
SX (SMD) 1:1  15 x 7.4 x 8.2/10mm	• High contact reliability over a long life has been made possible for low level loads • High sensitivity of 50mW • Low thermal electromotive force	**Max.:** 0.01A **Min.:** 10µA 	• 10V DC	2c	(DC) 1.5, 3, 4.5, 6, 9, 12, 24V	**Single side stable:** 50mW (1.5 - 12V DC) 70mW (24V DC) **1 coil latching:** 35mW (1.5 - 12V DC) 50mW (24V DC) **2 coil latching:** 70mW (1.5 - 12V DC) 150mW (24V DC)	750Vrms	1000Vrms	1000Vrms	-	PCB, SMT PCB, grid 2.54mm 	71 UL, CSA, BSI

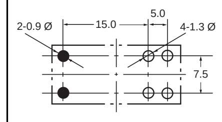
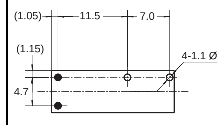
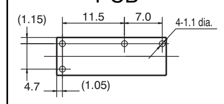
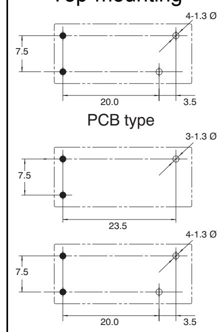
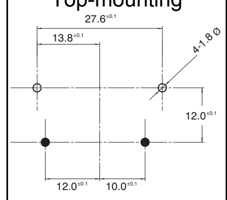
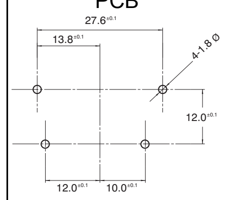
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
							Between open contacts	Between contact sets	Contacts to coil			
TN 1:1  14 x 5.6 x 9.8mm	• Slim size • 1,500V FCC	**Max.:** 1A **Min.:** 10µA 	• 110V DC • 125V AC	2c	(DC) 3, 4.5, 5, 6, 9, 12, 24, 48V	**Single side stable:** 140mW (up to 12V DC) 200mW (24V DC) 300mW (48V DC) **1 coil latching:** 100mW (3 - 12V DC) 150mW (24V DC) **2 coil latching:** 200mW (3 - 12V DC) 300mW (24V DC)	750Vrms	1000Vrms	1000Vrms	1,500V FCC	PCB Grid 2.54mm 	82 UL, CSA
TK 1:1  10.6 x 9 x 4mm	• Low profile 4mm • High contact capacity 2A • Surge withstand voltage between contact and coil 2,500V	**Max.:** 2A **Min.:** 10µA 	• 220V DC • 220V AC	1c	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24V	**Single side stable:** 140mW (up to 12V DC) 270mW (24V DC) **1 coil latching:** 100mW (3 - 12V DC) 150mW (24V DC) **2 coil latching:** 200mW (1.5 - 9V DC) 250mW (12V DC) 400mW (24V DC)	750Vrms	1000Vrms	1500Vrms	1,500V FCC 2,500V Telcordia	PCB Grid 2.54mm 	76 UL, CSA
DS 1:1  20 x 9.9 x 9.8mm	• 1500V FCC • High switching power • Floc type discontinued	**Max.:** 2A **Min.:** 10µA 	• 220V DC • 250V AC	1c, 2c	(DC) 1.5, 3, 5, 6, 9, 12, 24, 48V	**M type:** **Single side stable:** 400mW **1 coil latching:** 180mW **2 coil latching:** 360mW **S type:** **Single side stable:** 200mW **1 coil latching:** 90mW **2 coil latching:** 180mW	1000Vrms (DS1-S: 500Vrms)	1000Vrms	1500Vrms (DS1-S: 1000Vrms)	1,500V FCC	PCB Grid 2.54mm  1c  2c	48 UL, CSA
★**DS2Y** 1:1  20 x 9.9 x 9.3mm	• High sensitivity • 2 Form C contact • 1,500V FCC • Sealed construction	**Max.:** 2A **Min.:** 10µA 	• 220V DC • 250V AC	2c	(DC) 1.5, 3, 5, 6, 9, 12, 24, 48V	**Single side stable:** 200mW (up to 24V DC) 300mW (48V DC)	750Vrms	1000Vrms	1000Vrms	1,500V FCC	PCB Grid 2.54mm 	54 UL, CSA
HY 1:1  12 x 7.4 x 10.1mm	• High sensitivity 150mW / 200mW	**Max.:** 1A **Min.:** 10µA 	• 60V DC	1c	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24V	**Standard:** 200mW **High sensitivity:** 150mW	500Vrms	-	1000Vrms	-	PCB Grid 2.54mm 	67 UL, CSA

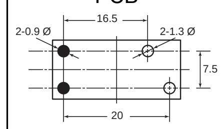
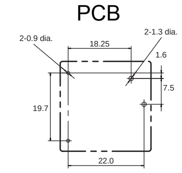
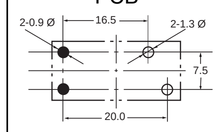
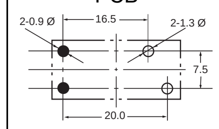
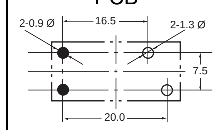
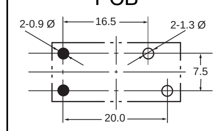
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current (Min.: see data sheet)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage Between open contacts	Breakdown voltage Between contact sets	Breakdown voltage Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
★DE 1:2  25 x 12.5 x 12.5mm	• Conforms to VDE0631 • Low operating power • Compact body saves space • Creepage & clearance distance >Min 8mm	**Max.:** 10/16A (1a) 10A 16A 8A (1a1b, 2a) 8A	• 230V DC • 440V AC	1a, 1a1b, 2a	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V	**Single side stable:** 200mW **1 coil latching:** 100mW **2 coil latching:** 200mW	1000Vrms	4000Vrms (1a1b, 2a)	5000Vrms	12,000V	PCB Grid 2.54mm 	132 UL, CSA, VDE, TÜV
DJ 1:2  29 x 13 x 16/16.5mm	• Latching type • Compact with high capacity • Creepage & clearance distance > 8mm • Optional available with manual test button	**Max.:** 16A 16A	• 125V DC • 400V AC	1a, 1b, 1c, 1a1b, 2a, 2b, 2c	(DC) 5, 6, 12, 24, 48V	**Single side stable:** 250mW **1 coil latching:** 150mW **2 coil latching:** 250mW	1000Vrms	-	4000Vrms	10,000V	PCB Grid 2.54mm  Single side stable, 1 coil latching (1c)  2 coil latching (1c)	136 VDE, TÜV, UL, CSA, SEV
DK 1:2  20 x 15 x 10mm	• Large capacity in small size • High sensitivity • High breakdown voltage	**Max.:** 10A (1a) 10A 8A (1a1b, 2a) 8A	• 125V DC • 400V AC	1a, 1a1b, 2a	(DC) 3, 5, 6, 9, 12, 24V	**Single side stable:** 200mW **2 coil latching:** 200mW	1000Vrms	4000Vrms	4000Vrms	10,000V	PCB Grid 2.54mm  1a  1a1b, 2a	145 VDE, TÜV, UL, CSA, SEV
DQ 1:2  38 x 29 x 17.3mm	• Latching type • Compact with high capacity • High insulation	**Max.:** 30A 30A	• 250V DC • 250V AC	1a	(DC) 4.5, 6, 9, 12, 24V	**1 coil latching:** 500mW **2 coil latching:** 1000mW	1500Vrms	-	4000Vrms	10,000V	PCB Grid 2.54mm  1 coil latching  2 coil latching	152 UL, CSA
DQM 1:2  44 x 40.4 x 17.3mm	• 60A Miniatur-Starkstromrelais • Latching type • High insulation	**Max.:** 60A 60A	• 250V AC	1a	(DC) 4.5, 6, 9, 12, 24V	**1 coil latching:** 500mW **2 coil latching:** 1000mW	1500Vrms	-	4000Vrms	10,000V	PCB 	155
★DSP 1:2  20.2 x 11 x 10.5mm	• High switching capacity • High sensitivity • High contact welding resistance • High breakdown voltage	**Max.:** 8A (1a) 8A 5A (1a1b, 2a) 5A	• 220V DC • 400V AC	1a, 1a1b, 2a	(DC) 3, 5, 6, 9, 12, 24V	**Single side stable:** 300mW **1 coil latching:** 150mW **2 coil latching:** 300mW	1000Vrms	2000Vrms	3000Vrms	5,000V	PCB Grid 2.54mm  1a  1a1b, 2a	159 TÜV, UL, CSA, SEV

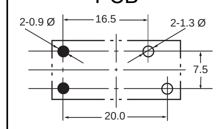
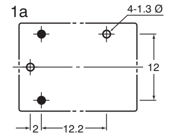
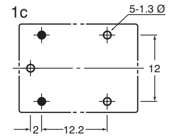
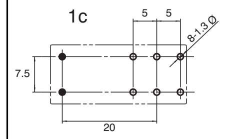
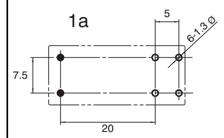
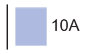
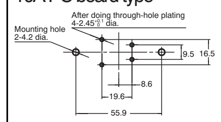
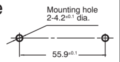
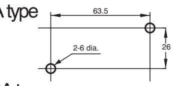
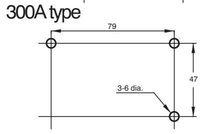
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current (Min.: see data sheet)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
							Between open contacts	Between contact sets	Contacts to coil			
DY 1:2  20 x 15 x 9.7mm	• Latching type available • Socket available	**Max.:** 10A (1a) 10A 8A (1a1b) 8A	• 125V DC • 380V AC	1a, 1a1b	(DC) 3, 5, 6, 12, 24V	**Single side stable:** 200mW **2 coil latching:** 200mW	1000Vrms	4000Vrms	4000Vrms	10,000V	PCB Grid 2.54mm 	166 TÜV, UL, CSA
S 1:2  28 x 12 x 10.4mm	• High sensitivity • High vibration and shock resistance • Low thermal electromotive force (approx. 3μV) • Latching type available	**Max.:** 4A **Min.:** 100μA 4A 100μA	• 200V DC • 250V AC	2a2b, 3a1b, 4a	(DC) 3, 5, 6, 12, 24, 48V	**Single side stable:** ~200mW (3V - 24V DC) 271mW (48V DC) **1 coil latching:** ~100mW (3V - 24V DC) 144mW (48V DC) **2 coil latching:** ~200mW (3V - 24V DC) 355mW (48V DC)	750Vrms	1000Vrms	1500Vrms	-	PCB Grid 2.54mm 	179 UL, CSA
SP 1:2  2c: 50 x 25.6 x 22mm 4c: 50 x 36.8 x 22mm	• High sensitivity • High vibration and shock resistance • Wide switching range • Latching type available	**Max.:** 15A 15A	• 110V DC • 250V AC	2c, 4c	(DC) 3, 5, 6, 12, 24, 48V	**Single side stable:** 300mW **2 coil latching:** 300mW	1500Vrms	3000Vrms	3000Vrms	-	PCB, Plug-in Grid 2.54mm 	185 UL, CSA, TÜV
ST 1:2  31 x 14 x 11.3mm	• High capacity in small size • High inrush capability • Latching type available	**Max.:** 8A **Min.:** 1mA 1mA 8A	• 250V DC • 400V AC	1a1b, 2a	(DC) 3, 5, 6, 9, 12, 24, 48V	**Single side stable:** 240mW **1 coil latching:** 130mW **2 coil latching:** 240mW	1200Vrms	2000Vrms	3750Vrms	6,000V	PCB Grid 2.54mm  (Single side stable)	192 UL, CSA, SEV, VDE, TV rating

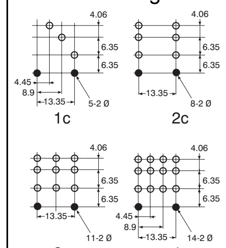
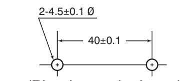
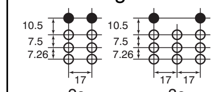
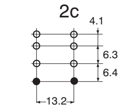
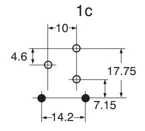
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current (Min.: see data sheet)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
							Between open contacts	Between contact sets	Contacts to coil			
JC 1:2  30 x 19 x 30.4mm	• Class B coil type available • TV-rated type available • High dielectric withstanding 10,000V surge • Special type with blow-out magnet for high DC loads available	**Max.:** 15A 15A	• 250V AC **Blow-out magnet type:** • 250V DC	1a, 2a	(DC) 5, 6, 12, 24, 48V	900mW (1a) 1000mW (2a)	2000Vrms	2000Vrms (2a)	4000Vrms	10,000V	PCB, Plug-in, Top-mounting 1a  2a 	290 UL, VDE, SEV, SEMKO CSA, complies with TV5
JM 1:2  Slim: 30.4 x 16 x 26.5mm Flat: 31 x 28.5 x 17.2mm	• Super welding resistance • High surge resistance • Compact high capacity relay for inductive load	**Max.:** 20A 20A	• 100V DC • 250V AC	1a	(DC) 5, 6, 9, 12, 24, 48V	900mW	1000Vrms	-	5000Vrms	10,000V	PCB, Top mount contact, coil to PCB  Flat TMP type	296 TÜV, UL, CSA, VDE
★ **JQ** 1:2  20 x 10 x 15.6mm	• High electrical noise immunity • High switching capacity • High surge voltage 8,000V	**Standard:** **Max.:** 5A 5A **Power type:** **Max.:** 10A 10A	• 277V AC	1a, 1c	(DC) 3, 5, 6, 9, 12,18, 24, 48V	200mW (1a) 400mW (1c)	1000Vrms (1a) 750Vrms (1c)	-	4000Vrms	8,000V	PCB  1a  1c	301 UL, CSA, TÜV, VDE, SEMKO
JS 1:2  22 x 16 x 16mm	• Ultra-miniature size with universal terminal footprint • High switching capacity 10A	**Max.:** 10A 10A	• 100V DC • 277V AC	1a, 1c	(DC) 5, 6, 9, 12, 18, 24, 48V	360mW	750Vrms	-	1500Vrms	-	PCB 1a  1c 	306 TÜV, VDE, UL, CSA, complies with TV5

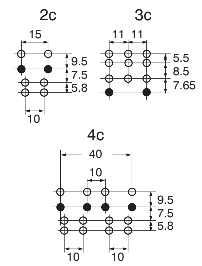
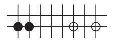
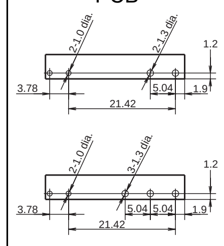
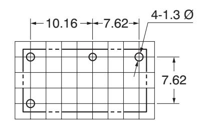
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current (Min.: see data sheet)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage: Between open contacts	Breakdown voltage: Between contact sets	Breakdown voltage: Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
JT-V 1:2  PCB: 31.9 x 26.9 x 20.2mm TMP: 32.2 x 27.4 x 27.9mm	• Surge withstand voltage: Min. 6kV • High switching capacity • 2 contact arrangements • Class F type as standard	**Max.:** 30A 30A	• 30V DC • 277V AC	1a, 1c	(DC) 12, 18, 24, 48V	1000mW	-	1200Vrms	3500Vrms	6,000V	PCB Top-mounting 1a  1c  (TMP)	309 UL, C-UL
JV-N 1:2  22 x 16 x 10.9mm	• Compact, flat type with low 10.9mm profile	**Max.:** 16A 16A	• 110V DC • 277V AC	1a	(DC) 4.5, 6, 9, 12, 24, 48, 100V	(DC) 200mW (4.5V - 48V) (DC) 600mW (100V)	1000Vrms	-	2500Vrms	4,500V	PCB 	312 UL, CSA, TÜV
★ **JW** 1:2  28.6 x 12.8 x 20mm	• High dielectric withstanding for transient protection • Class B coil insulation types available	**Standard:** **Max.:** 5A (2a, 2c) 5A **High capacity:** **Max.:** 10A (1a, 1c) 10A	• 100V DC • 440V AC	1a, 1c, 2a, 2c	(DC) 5, 6, 9, 12, 18, 24, 48V	530mW	1000Vrms	3000Vrms (2a, 2c)	5000Vrms	10,000V	PCB 1a  1c  2a  2c 	315 TÜV, VDE, UL, CSA, SEV, complies with TV5, SEMKO

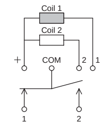
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current (Min.: see data sheet)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage Between open contacts	Breakdown voltage Between contact sets	Breakdown voltage Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
LA 1:2  24 x 12 x 25mm	• Slim type: 2 Form A • High insulation resistance between contact and coil	**Standard:** **Max.:** 3A (3A rated) 3A **Power type:** **Max.:** 5A (5A, TV-4 rated) 5A	• 30V DC • 277V AC	2a	(DC) 12, 24V	530mW	1000Vrms	1000Vrms	4000Vrms	10,000V	PCB 	320 TÜV, UL, CSA, SEV, SEMKO
★**LD** 1:2  20.3 x 7 x 15mm	• Slim type: width 7mm	**Max.:** 3A 3A	• 30V DC • 277V AC	1a	(DC) 4.5, 5, 6, 9, 12, 18, 24V	200mW	750Vrms	-	4000Vrms	10,000V	PCB 	323 TÜV, UL, CSA, VDE
LD-P 1:2  20.3 x 7 x 15mm	• Slim (7mm) power relay • 200mW coil power	**Max.:** 5A 5A	• 30V DC • 277V AC	1a	(DC) 5, 6, 9, 12, 18, 24V	200mW	750Vrms	-	4000Vrms	10,000V	PCB 	326 UL, C-UL, VDE
LE 1:2  28.6 x 12.4 x 24.9mm	• Ideal for magnetron and heater loads • Excellent heat resistance • High sensitive version available	**Max.:** 16A 16A	• 277/400V AC	1a	(DC) 5, 6, 9, 12, 18, 24, 48V	**Standard:** 400mW **High sensitivity:** 200mW	1000Vrms	-	4000Vrms	10,000V	PCB, Top-mounting  PCB type TMP type	330 TÜV, UL, CSA, VDE
LF 1:2  30.1 x 15.7 x 23.3mm	• Ideal for compressor and inverter loads • High insulation resistance	**Max.:** 25A 25A	• 250V AC	1a	(DC) 5, 6, 9, 12, 18, 24V	900mW	1000Vrms	-	5000Vrms	10,000V	PCB, Top-mounting  TMP type	335 UL, CSA, TÜV, VDE, SEMKO
★**LF-G1/LF-G2** 1:2  30.1 x 15.7 x 23.3mm	• Ideal for compressor and inverter loads • High insulation resistance	**Max.:** 22A 22A **Max.:** 31A 31A	• 250V AC	1a	(DC) 9, 12, 18, 24V	1400mW	2500Vrms	-	4000Vrms	6,000V	PCB 	339 UL, C-UL,VDE

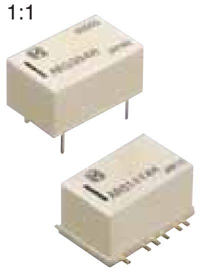
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current (Min.: see data sheet)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage Between open contacts	Breakdown voltage Between contact sets	Breakdown voltage Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
LK 1:2  24 x 11 x 25mm	• High inrush current capability • High insulation resistance between contact and coil	**Max.:** 5A 5A	• 30V DC • 277V AC	1a	(DC) 5, 9, 12, 24V	530mW	1000Vrms	-	4000Vrms	10,000V	PCB 	344 UL, CSA, TÜV, SEV, SEMKO, VDE
LK-F 1:2  26.3 x 10 x 26.1mm	• Low profile relay (10mm height) The height has been reduced 60% compared with other LK relays. • High sensitivity: 250mW • Silent version available (approx. reduction of 10dB) • TV standards compatible:TV-5 and TV-8	**Max.:** TV-5: 5A (AC) 5A TV-8: 8A (AC) 8A	• 277V AC	1a	(DC) 5, 9, 12, 24V	250mW	1000Vrms	-	4000Vrms	10,000V	PCB 	347 UL, TÜV, SEMKO
LK-G 1:2  24 x 11 x 25mm	• Contact gap: 1mm • Wide lineup / 3 types available • High insulation resistance • Slim profile • High noise immunity	**Max.:** 10A 10A **Max.:** 16A 16A	• 277V AC	1a	(DC) 5, 9, 12, 24V	530mW	1000Vrms	-	4000Vrms	10,000V	PCB 	353 UL, CSA, TÜV
LK-P 1:2  24 x 11 x 25mm	• High switching capacity 10A 277V AC • High insulation • High inrush current capability	**Max.:** 10A 10A	• 30V DC • 277V AC	1a	(DC) 12, 24V	530mW	1000Vrms	-	4000Vrms	10,000V	PCB 	357 UL, CSA, TÜV, SEV, SEMKO, VDE, TV rating
LK-Q 1:2  24 x 11 x 25mm	• Reduced noise (10dB quieter than previous LK relay) • High sensitivity (nominal operating power 250mW) • Compliant with TV standards (TV-5 and TV-8) • Slim shape	**Max.:** TV-5: 5A (AC) 5A TV-8: 8A (AC) 8A	• 30V DC • 277V AC	1a	(DC) 5, 9, 12, 24V	250mW	1000Vrms	-	4000Vrms	10,000V	PCB 	360 UL, CSA, TÜV, SEV, SEMKO, VDE, TV rating
LK-S 1:2  24 x 11 x 25mm	• High sensitivity 250mV • High inrush current capability • High insulation resistance between contact and coil	**Max.:** 5A 5A	• 30V DC • 277V AC	1a	(DC) 5, 9, 12, 24V	250mW	1000Vrms	-	4000Vrms	10,000V	PCB 	364 UL, CSA, TÜV, SEV, SEMKO, VDE, TV rating

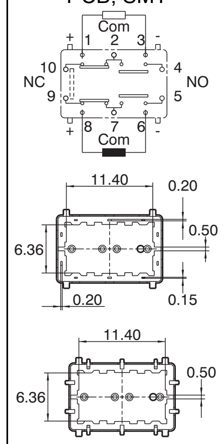
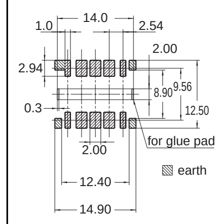
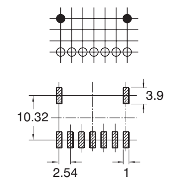
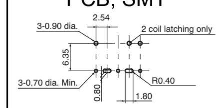
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current (Min.: see data sheet)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
							Between open contacts	Between contact sets	Contacts to coil			
LK-T 1:2  24 x 11 x 25mm	• High inrush current capability • High insulation resistance • High noise immunity realized by the card separation structure between contact and coil	**Max.:** 8A 	• 277V AC	1a	(DC) 5, 9, 12, 24V	250mW	1000Vrms	-	4000Vrms	10,000V	PCB 	367 UL, CSA, TÜV, SEV, SEMKO, VDE, TV rating
LS 1:2  19.5 x 15.5 x 14.8mm	• 10A compact cube power relay • Universal footprint • EN60335/4 compliant	**Max.:** 10A 	• 277V AC	1a, 1c	(DC) 5, 6, 9, 12, 18, 24, 48V	360mW	750Vrms	-	1500Vrms	-	PCB 1a  1c 	371 UL, CSA, VDE
★**LZ** 1:2  28.8 x 12.5 x 15.7mm	• Low profile relay (15.7mm) • Low operating power (400mV) • High temperature resistant (105°C)	**Max.:** 16A 	• 250V DC • 440V AC	1a, 1c	(DC) 5, 9, 12, 18, 24, 48V	400mW	1000Vrms	-	5000Vrms	10,000V	PCB 1c  1a 	374 VDE, UL, CSA
EP 1:8 mm   62.4 x 37.9 x 31.3 66.8 x 37.9 x 45  75.5 x 40 x 79  111 x 63 x 74.7	• High capacity to cut off DC voltage in a compact relay • No arc space required • Safety construction • Low operating noise • High contact reliability	**Max.:** 10A  80A  300A 	• 400V DC	1a	(DC) 12, 24, 48, 100V	Max.: 1.4W (10A) 4.5W (80A) 4 - 40W (300A)	2500Vrms	-	2500Vrms	-	PCB 10A PC board type  10A TM type  80A type  300A type 	171 -

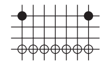
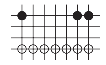
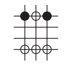
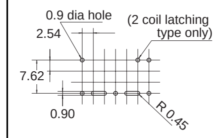
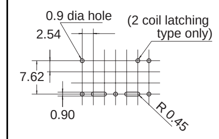
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current (Min.: see data sheet)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage Between open contacts	Breakdown voltage Between contact sets	Breakdown voltage Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
HC 1:2  27.2 x 20.8 x 35.2mm	• Wide applications • Versatile range • Foot print compatible with competitive types	**Max.:** 10A **Min.:** 1mA  1mA 10A	• 30V DC • 250V AC	1c, 2c, 3c, 4c	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48,120, 240V	(DC) 900mW (AC) 1.2VA	700Vrms	700Vrms	2000Vrms	-	PCB, Plug-in, Top-mounting  1c 2c 3c 4c	198 VDE, UL, CSA, SEV, TV rating
HE/ HE PV 1:3  50 x 33 x 35.8mm	• High dielectric withstanding 10,000V surge • High inrush resistance (TV-15: 1 form A) (TV-10: 2 form A)	**Max.:** 30A  30A **Max.:** 50A  50A	• 100V DC • 277V AC	1a, 2a	(DC) 6, 12, 24, 48, 110V (AC) 12, 24, 48,120, 240V	(DC) 1920mW (AC) 1.7 - 2.7VA	2000Vrms	4000Vrms	5000Vrms	10,000V	Top-mounting Panel cutout  (Plug-in terminal type) (Screw terminal type) (NEMA terminal type) (Screw terminal type, wide pitch)	225 TÜV, UL, CSA, VDE, TV rating
HG 1:3  2c: 44 x 36 x 56mm 3c: 36 x 36 x 56mm 4c: 68 x 36 x 56mm	• High capacity 20A	**Max.:** 20A  20A	• 125V DC • 250V AC	2c, 3c, 4c	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 115, 220, 240V	**2c:** (DC): ~1400mW (AC): ~3.6VA **3c:** (DC): ~1600mW (AC): ~5.2VA **4c:** (DC): ~2000mW (AC): ~7.6VA	2000Vrms	2000Vrms	2000Vrms	-	Plug-in  2c 3c 4c	239 UL, CSA
HJ 1:2  28 x 21.5 x 35/38mm	• 2 contact arrangements same footprint as our popular HC relay • Coil breakdown detection-function (AC type with LED only) • Convenient screw terminal sockets with finger protection also available • Test button type available	**Max.:** 7A  7A	• 30V DC • 250V AC	2c, 4c	(DC) 12, 24, 48, 110V (AC) 12, 24, 48, 100, 120, 200, 220/240V	(DC) 900 mW (AC) 1.2 - 1.5VA	1000Vrms	2000Vrms	2000Vrms	-	Plug-in 2c  4c	248 VDE, UL, CSA, SEV, TV rating
HL 1:2  27.2 x 20.8 x 35.4mm	• Large capacity • Compact size • Footprint compatible with competitive types	**Max.:** 15A **Min.:** 1mA  1mA 15A	• 30V DC • 250V AC	1c, 2c	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 120, 240V	(DC) 900 - 1000mW (AC) 1.2 - 1.3VA	1000Vrms	1500Vrms	2000Vrms	-	PCB, Plug-in, Top-mounting 1c  2c	259 UL, CSA, complies with TV5

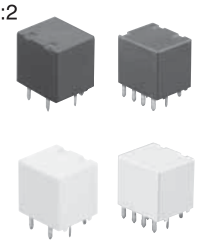
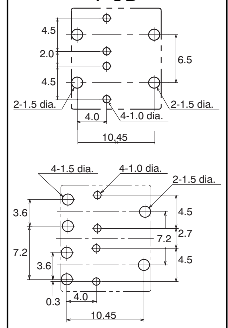
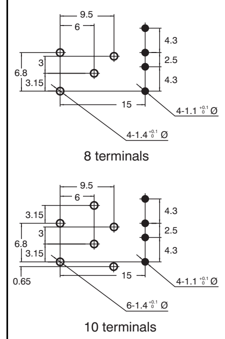
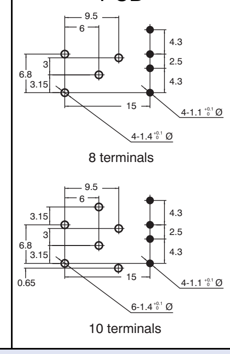
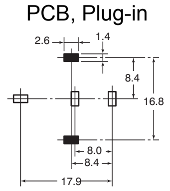
Type ★ = Popular Type (Picture scale: DIN A4)	**Features**	**Switching current** (Min.: see data sheet)	**Max. switching voltage**	**Contact arrangement**	**Coil voltage**	**Coil power**	**Breakdown voltage** Between open contacts	Between contact sets	Contacts to coil	**Surge withstand voltage**	**Mounting method** (bottom view)	**Page Approvals**
HN 1:2  29 x 13 x 28mm	• Slim and compact size • High reliability	**Max.:** 5A 5A	• 30V DC • 250V AC	1c, 2c	(DC) 5, 6, 12, 24, 48V (AC) 100, 120, 240V	(DC) 530mW (AC) 0.9VA	1000Vrms	3000Vrms	5000Vrms	-	Plug-in, Screw terminal -	267 UL, C-UL, (VDE)
HP 1:2  36 x 25 x 44.5mm	• High reliability	**Max.:** 10A 10A	• 125V DC • 250V AC	2c, 3c, 4c	(DC) 12, 24, 48, 110V (AC) 12, 24, 48, 115, 220, 240V	**2c:** (DC): ~1500mW (AC): ~2.0VA **3c:** (DC): ~1500mW (AC): ~3.1VA **4c:** (DC): ~1500mW (AC): ~4.8VA	2000Vrms	2000Vrms	2000Vrms	-	Plug-in 	277 VDE, UL, CSA, SEV
PA 1:2  20 x 5 x 12.5mm	• Slim size permits higher density mounting • Wide switching capacity • High surge voltage 4,000V • High breakdown voltage 2,000V	**Max.:** 5A 5A	• 110V DC • 250V AC	1a	(DC) 5, 6, 9, 12, 18, 24V	120mW (5 - 18V) 180mW (24V)	1000Vrms	-	2000Vrms	4,000V	PCB Grid 2.54mm 	378 TÜV, UL, CSA
★**PF** 1:2  28 x 5 x 15mm	• Slim size permits higher density mounting • Wide switching capacity • High surge voltage 6,000V • High breakdown voltage 4,000V • Creepage & clearance distance > 8mm	**Max.:** 6A 6A	• 300V DC • 400V AC	1a, 1c	(DC) 4.5, 5, 6, 12, 18, 24, 48, 60V	170mW (5 - 24V) 217mW (48V) 175mW (60V)	1000Vrms	-	4000Vrms	6,000V	PCB 	382 UL, C-UL, VDE
PQ 1:2  20 x 10 x 15.6mm	• High electrical noise immunity • High sensitivity 200mW • High surge voltage 8,000V	**Max.:** 5A 5A	• 110V DC • 250V AC	1a	(DC) 3, 5, 6, 9, 12, 18, 24V	200mW	1000Vrms	-	4000Vrms	8,000V	PCB 	388 UL, CSA, TÜV, SEV, SEMKO, VDE

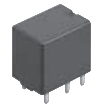
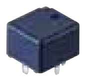
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage: Between open contacts	Breakdown voltage: Between contact sets	Breakdown voltage: Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
RV SPDT 1:1  15.9 x 15.9 x 11.2mm	• Ultra small coaxial switch • Excellent HF characteristics (up to 26.5 GHz, 50W) • PIN and SMA terminals available • 2-coil latching type helps reduce power consumption • Failsafe type available • Reverse type available HF Characteristics at 18GHz/ SMA type: • Isolation min. 40dB • Insertion loss max. 0.7dB • V.S.W.R. max. 1.7	**HF:** 50W (3GHz)	-	SPDT	(DC) 4.5, 12, 24V	700mW	500Vrms	500Vrms	500Vrms	-	PIN, SMA 	397 -
RD SPDT 1:2  34 x 13.2 x 39mm	• Coaxial relay • Up to 26.5GHz (18GHz) • Impedance 50Ω HF Characteristics at 18GHz: • Isolation min. 60dB • Insertion loss max. 0.5dB • V.S.W.R. max. 1.5dB • TTL Version available	**DC:** 100mA (indicator) **HF:** 120W (3GHz)	• 30V DC (indicator)	SPDT	(DC) 4.5, 5, 12, 24V	**Single side stable:** 840-970mW (4.5, 12, 24V) **2 coil latching:** 700-900mW (4.5, 12, 24V) **Latching with TTL driver (self cut-off function):** 5, 12, 24V	500Vrms	500Vrms	500Vrms	-	SMA	397 -
RD TRANSFER 1:2  32 x 32 x 39mm	• Coaxial relay • Up to 26.5GHz (18GHz) • Impedance 50Ω HF Characteristics at 18GHz: • Isolation min. 60dB • Insertion loss max. 0.5dB • V.S.W.R. max. 1.5dB • TTL Version available	**DC:** 100mA (indicator) **HF:** 120W (3GHz)	• 30V DC (indicator)	DPDT	(DC) 4.5, 5, 12, 24V	**Single side stable:** 1540-1670mW (4.5, 12, 24V) **2 coil latching:** 1200-1400mW (4.5, 12, 24V) **Latching with TTL driver (self cut-off function):** 5, 12, 24V	500Vrms	500Vrms	500Vrms	-	SMA	397 -
RD SP6T 1:4  80 x 80 x 39.5mm	• Coaxial relay • Up to 13GHz (18GHz) • Terminated type available • Impedance 50Ω HF Characteristics at 13GHz: • Isolation min. 65dB • Insertion loss max. 0.4dB • V.S.W.R. max. 1.5dB	**DC:** 100mA (indicator) **HF:** 120W (3GHz)	• 30V DC (indicator)	SP6T	(DC) 4.5, 5, 12, 24V	**Single side stable:** 840mW (4.5, 12V) 970mW (24V) **Latching:** 700mW (SET 4.5V) 750mW (SET 12V) 900mW (SET 24V)	500Vrms	500Vrms	500Vrms	-	SMA	397 -

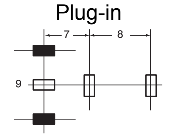
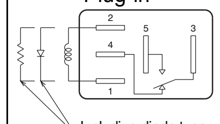
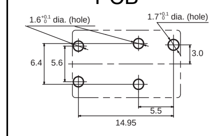
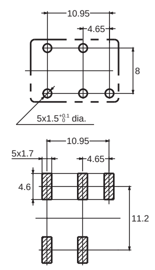
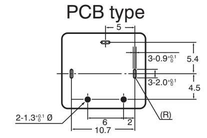
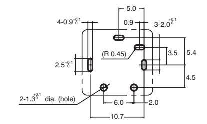
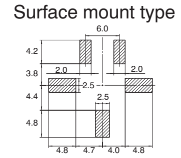
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current	Max. switching voltage	Contact arrangement	Coil voltage
★**RJ (SMD)** 1:1  14 x 9 x 8.2mm	• Shielded HF relay • Up to 8GHz • Impedance 50Ω HF Characteristics at 5GHz: • Isolation min. 35dB • Insertion loss max. 0.5dB • V.S.W.R. max.1.25	**DC:** 0.3A **HF:** 1W (5GHz)	• 30V DC	2c	(DC) 3, 4.5, 12, 24V
RA 1:1  14.7 x 9.7 x 5.9mm	• HF relay in SMT version • Up to 1GHz • Impedance 50Ω HF Characteristics at 1GHz: • Isolation min. 20dB • Insertion loss max. 0.3dB • V.S.W.R. max. 1.2	**DC:** 1A **HF:** 3W (1GHz, carrying point to carrying current)	• 30V DC	2c	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V
RE (SMD) 1:1  20.2 x 11.2 x 8.9/9.6mm	• HF relay • Up to 2.6GHz • Impedance 50/75Ω • SMT and PCB version available HF Characteristics at 2.6GHz • Isolation min 30dB • Insertion loss max. 0.7dB • V.S.W.R. max. 1.7	**DC:** 0.5A **HF:** 1W (2.6GHz)	• 30V DC	1c	(DC) 3, 4.5, 6, 9, 12, 24V
★**RS (SMD)** 1:1  14 x 8.6 x 7/8mm	• HF relay • Up to 3GHz • Impedance 50/75Ω • Silent type available HF Characteristics at 3GHz: • Isolation min. 30dB • Insertion loss max. 0.3dB • V.S.W.R. max. 1.4	**DC:** 0.5A **HF:** 10W (3GHz, contact carrying)	• 30V DC	1c	(DC) 3, 4.5, 9, 12, 24V

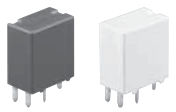
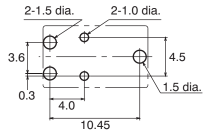
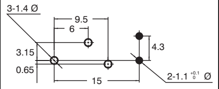
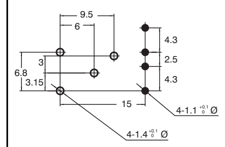
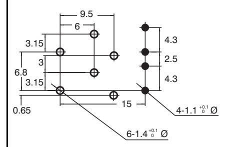
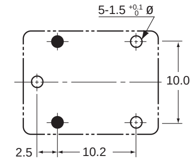
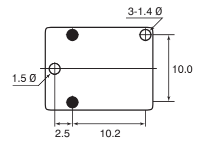
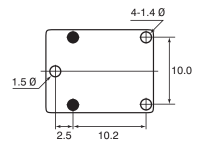
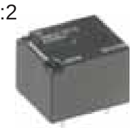
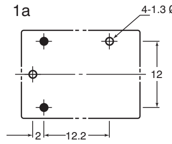
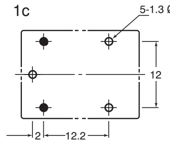
Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
	Between open contacts	Between contact sets	Contacts to coil			
Single side stable: 200mW **2 coil latching:** 150mW	500Vrms	500Vrms	500Vrms	-	PCB, SMT 	415 -
Single side stable: 140mW (1.5 - 12V) 200mW (24V) 300mW (48V) **1 coil latching:** 70mW (1.5 - 12V) 100mW (24V) **2 coil latching:** 140mW (1.5 - 12V) 200mW (24V)	750Vrms	1000Vrms	1000Vrms	-	SMT Suggested mounting pads (Top view) 	392 -
Single side stable: 200mW	500Vrms	-	1000Vrms	-	PCB, SMT Grid 2.54mm 	411 -
Single side stable: 200mW **1 coil latching:** 200mW **2 coil latching:** 400mW	500Vrms	-	1000Vrms	-	PCB, SMT 	430 -

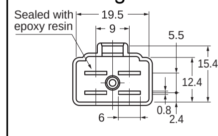
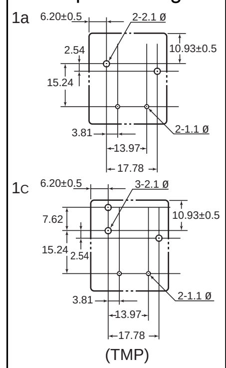
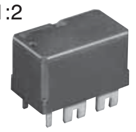
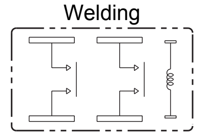
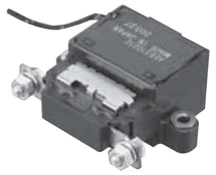
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
							Between open contacts	Between contact sets	Contacts to coil			
RK 1:1  20.2 x 11.2 x 9.7mm	• HF relay for broadcasting • Up to 1.5GHz • Impedance 50/75Ω HF Characteristics: • Isolation min. 60dB (at 1.5GHz) • Insertion loss max. 0.3dB (at 900MHz) • V.S.W.R. max. 1.5dB (at 900MHz) • Latching types available	**DC:** 0.5A **HF:** 10W	• 30V DC	1c	(DC) 3, 4.5, 5, 6, 9, 12, 24V	**Single side stable:** 200mW **1 coil latching:** 200mW **2 coil latching:** 400mW	500Vrms	-	1000Vrms	-	PCB Grid 2.54mm  Single side stable 1 coil latching  2 coil latching	420 -
RP 1:1  10.6 x 9 x 4mm	• Low profile HF relay • Up to 1.8GHz • Impedance 50Ω HF Characteristics at 1.8GHz: • Isolation min. 10dB • Insertion loss max. 1dB • V.S.W.R. max. 1.3	**DC:** 0.1A **HF:** 1W (1.8GHz)	• 30V DC	1c	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24V	**Single side stable:** 140mW (1.5 - 12V) 270mW (24V)	750Vrms	-	1500Vrms	-	PCB Grid 2.54mm 	425 -
RX 1:1  20.5 x 12.4 x 9.4mm	• Shielded HF-Relay • Up to 3 GHz • Impedance 50Ω HF Characteristics at 2.5GHz • Isolation min. 60dB • Insertion loss max. 0.2dB • V.S.W.R. max. 1.2	**DC:** 0.5A **HF:** 10W (2.5GHz)	• 30V DC	1c	(DC) 3, 4.5, 6, 9, 12, 24V	**Single side stable:** 200mW **1 coil latching:** 200mW **2 coil latching:** 400mW	500Vrms	-	1000Vrms	-	PCB  	447 -
RX-P 1:1  20.5 x 12.4 x 9.2mm	• Shielded HF-Relay • 60W contact carrying power • Up to 2.5 GHz • Impedance 50Ω HF Characteristics at 2.5GHz • Isolation min. 60dB • Insertion loss max. 0.2dB • V.S.W.R. max. 1.2	**DC:** 0.5A **HF:** 40W (2.5GHz)	• 30V DC	1c	(DC) 3, 4.5, 6, 9, 12, 24V	**Single side stable:** 200mW **1 coil latching:** 200mW **2 coil latching:** 400mW	500Vrms	-	1000Vrms	-	PCB  	451 -

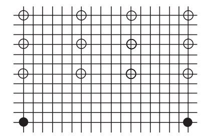
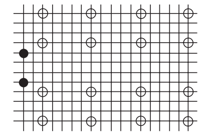
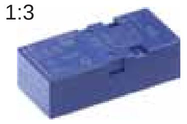
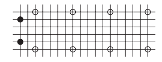
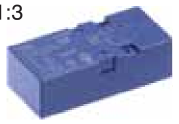
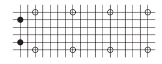
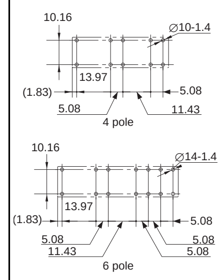
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current (Min.: see data sheet)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage: Between open contacts	Breakdown voltage: Between contact sets	Breakdown voltage: Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
Twin												
★**CJ** 1:2  8 Pin Print: 13.7 x 12.2 x 13.5mm PiP: 13.7 x 12.2 x 13.8mm 10 Pin Print: 14.4 x 12.2 x 13.5mm PiP: 14.4 x 12.2 x 13.8mm	• Super miniature size • High capacity in a compact body • H-bridge type available • Pin in Paste available	**Max.:** 20A (N.O.) 10A (N.C.)	• 16V DC	1c, 1c x 2	(DC) 12V	**Standard:** 800mW **High sensitivity:** 640mW	500Vrms	-	500Vrms	-	PCB 	475 -
★**CT** 1:2  17.4 x 14 x 13.5mm	• Ultra small size • Twin (1 Form C x 2) • H-bridge type available • Pin in Paste available	**Max.:** 20A (N.O.) 10A (N.C.)	• 16V DC	1c, 1c x 2	(DC) 12V	800mW	500Vrms	-	500Vrms	-	PCB 	507 -
★**CT POWER** 1:2  17.4 x 14 x 13.5mm	• Ultra small size • Twin (1 Form C x 2) • Footprint same as CT standard type • 30A switching capacity (motor load) • Silent operation • Pin in Paste available • H-bridge type available	**Max.:** 30A (N.O.) 10A (N.C.)	• 16V DC	1c, 1c x 2	(DC) 12V	1000mW	500Vrms	-	500Vrms	-	PCB 	513 -
Single												
CB 1:2  26 x 22 x 25mm	• 40 A rating at 85°C (185°F) • ISO type terminals • High shock resistance for drop test requirements • Low temperature rise	**Max.:** 70A (N.O. H type) 40A (1a, 1c N.O.) 30A (1c N.C.)	• 16V DC (12V DC type) • 32V DC (24V DC type)	1a, 1c	(DC) 12, 24V	1400mW (12V DC type) 1800mW (24V DC type) 1800mW (12V DC, H type)	500Vrms	-	500Vrms	-	PCB, Plug-in  (PCB standard type)	464 -

Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current (Min.: see data sheet)	Max. switching voltage	Contact arrangement	Coil voltage
★CM 1:2  20 x 15 x 22mm	• Half the size, replaces Mini-ISO relay • Wide line-up • Micro-ISO terminal type	**Max.:** 35A (N.O.) 35A 20A (N.C.) 20A	• 16V DC (12V DC type) • 32V DC (24V DC type)	1a, 1c	(DC) 12, 24V
CV 1:2  22.5 x 15 x 15.7mm	• Low profile • Low temperature rise • Low sound pressure level • Wide line-up • Micro-ISO terminal type	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1a, 1c	(DC) 12V
CN-H 1:2  17 x 10.6 x 18.3mm	• Best space savings in its class • Replaces micro ISO relay • High current-carrying capacity • Sealed type	**Max.:** 30A	• 16V DC	1a	(DC) 12V
CN-M 1:2  15,5 x 11 x 14.4mm	• Space-saving design • High switching capacity (up to 30A) • Pin in Paste type available	**Max.:** 30A (N.O.) 30A 25A (N.C.) 25A	• 16V DC	1a, 1c	(DC) 12V
★CP 1:2  14 x 13 x 9.5mm	• Low profile • High capacity • Simple footprint enables ease of PC board layout • 24V DC type available on request	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1a, 1c	(DC) 12V, 24V
CP POWER 1:2  14 x 13 x 10.5mm	• Low profile • High capacity type: 45A maximum carrying current	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1a, 1c	(DC) 12V
★CP (SMD) 1:2  14 x 13 x 9.5mm	• Low profile • High capacity • Simple footprint enables ease of PC board layout	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1c	(DC) 12V

Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
	Between open contacts	Between contact sets	Contacts to coil			
1500mW (12V DC type) 1800mW (24V DC type)	500Vrms	-	500Vrms	-	Plug-in 	481 -
800mW	500Vrms	-	500Vrms	-	Plug-in  Including diode type, including resistor type also available	518 -
450mW 640mW	500Vrms	-	500Vrms	-	PCB 	486 -
640mW	500Vrms	-	500Vrms	-	PCB 	490 -
640mW	500Vrms	-	500Vrms	-	PCB PCB type 	495 -
450mW 640mW	500Vrms	-	500Vrms	-	PCB 	499 -
640mW	500Vrms	-	500Vrms	-	SMT Surface mount type 	495 -

Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current (Min.: see data sheet)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage Between open contacts	Breakdown voltage Between contact sets	Breakdown voltage Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
★CJ 1:2  Print : 13.5 x 12.2 x 7.2mm PiP : 13.8 x 12.2 x 7.2mm	• Super miniature size • High capacity in a compact body • Pin in Paste type available	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1c, 1c x 2	(DC) 12V	**Standard:** 800mW **High sensitivity:** 640mW	500Vrms	-	500Vrms	-	PCB 	475 -
★CT 1:2  17.4 x 7.2 x 13.5mm	• Ultra small size • Twin (1 Form C x 2) • H-bridge type available • Pin in Paste type available	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1c, 1c x 2	(DC) 12V	800mW	500Vrms	-	500Vrms	-	PCB 	507 -
★CT POWER 1:2  17.4 x 7.2 x 13.5mm	• Ultra small size • Twin (1 Form C x 2) • Footprint same as CT standard type • 30A switching capacity (motor load) • Silent operation • H-bridge type available • Pin in Paste type available	**Max.:** 30A (N.O.) 30A 10A (N.C.) 10A	• 16V DC	1c, 1c x 2	(DC) 12V	1000mW	500Vrms	-	500Vrms	-	PCB  8 terminals  10 terminals	513 -
CQ 1:2  17 x 13 x 16.6mm	• Quiet • Less space required	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1c	(DC) 12V	640mW	500Vrms	-	500Vrms	-	PCB 	503 -
★JJM 1:2  15.5 x 12 x 13.9mm	• Compact (half-size) • Perfect for automobile electrical systems	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1a, 1c	(DC) 12V	640mW	500Vrms	-	500Vrms	-	PCB 	538 -
JJM-DM 1:2  15.5 x 12 x 13.9mm	• Small size • Standard terminal pitch employed • Double make contact arrangement	**Max.:** 2 x 6A 6A 6A	• 16V DC	Double make contact	(DC) 12V	1000mW	500Vrms	-	500Vrms	-	PCB 	542 -
JS-M 1:2  22 x 16 x 16.4mm	• Low pick-up voltage for high ambient use	**Standard:** **Max.:** 10A 10A **High capacity:** **Max.:** 15A 15A	• 16V DC	1a, 1c	(DC) 9, 12V	640mW	750Vrms	-	1500Vrms	-	PCB 1a  1c 	546 -

Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current (Min.: see data sheet)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage: Between open contacts	Breakdown voltage: Between contact sets	Breakdown voltage: Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
CA 1:2  21.5 x 14.4 x 37mm	• Small size • Light weight • Completely water tight • Automotive direct plug-in	**Max.:** 20A (1a, 1.4W type) 20A 30A (1a, 1.8W type) 30A 20A (1b, 1c) 20A	• 15V DC (1c - 12V DC type) • 16V DC (1a, 1b - 12V DC type) • 30V DC (1c - 24V DC type)	1a, 1b, 1c	(DC) 12, 24V	1800mW 1400mW (type S)	500Vrms	-	500Vrms	-	Plug-in  1a, 1b	458 -
Special Types												
EV 1:8 mm 	• Small size & light weight • No arc space is required • Safety construction • Low operating noise • High contact reliability	**Max.:** 10A (1a) 10A 20A (1a) 20A 80A (1a) 80A 120A (1a) 120A 300A (1a) 300A	• 400V DC	1a	(DC) 12, 24V	**Stable:** • 1240mW (10A, 12/24V) • 3900mW (20A, 12V) • 4200mW (80A/120A, 12/24V) • 3600mW (300A, 12V) • 3800mW (300A, 24V) **Inrush:** • 37.9W (300A, 12V) • 44.4W (300A, 24V)	2500Vrms	-	2500Vrms	-	Screw terminal or TM with terminal protection cover -	530 -
JT-N 1:2  PCB: 31.9 x 26.9 x 20.2mm TMP: 32.2 x 27.4 x 27.9mm	• High switching capacity • Charging of electric vehicles 115V/230V AC	**Max.:** 30A (1a) 30A 20A (1c N.O.) 20A 10A (1c N.C.) 10A	• 30V DC • 277V AC	1a, 1c	(DC) 5, 6, 9, 12, 15, 18, 24V	800mW	1200Vrms	-	2500Vrms	-	PCB, Top-mounting 	549 UL, CSA
CW 1:2  32 x 18 x 26mm	• Ideal relay for high output, 3-phase motors (Electric Power Steering) • High cut-off current capability • High carrying current	**Max.:** 120A	• 14V DC	2a	(DC) 12V	1400mW	500Vrms	-	500Vrms	-	Welding 	523 -
EB 1:2  70 x 80 x 34mm	• Automotive high-capacity DC cutoff relay • Supports even 42V vehicles	**Max.:** 100A (1a) 100A	• 42V DC	1a	(DC) 12, 24, 36V	5000mW	1500Vrms	-	2500Vrms	-	Screw terminal -	526 -

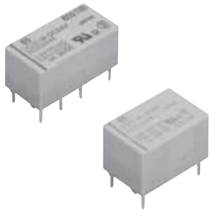
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
							Between open contacts	Between contact sets	Contacts to coil			
SFN4D 1:3  53.3 x 33 x 14.5mm	• Polarised relay with forcibly guided contacts according to EN50205, Type B • Safety double contact • Extremely small total power loss • Relay height: 14.5mm	**Max.:** 8A **Min.:** 10mA 10mA 8A	• 500V DC • 500V AC	4a, 2b	(DC) 5, 9, 12, 16, 18, 21, 24, 36, 48, 60V	390mW (5 - 24V) 420mW (36 - 60V)	2500Vrms	4000Vrms	5000Vrms	-	PCB Grid 2.5mm  4a2b	563 UL, CSA, SEV, TÜV
SF4D 1:3  53.3 x 33 x 16.5mm	• Polarised relay with forcibly guided contacts according to EN50205, Type B • Safety double contact	**Max.:** 8A **Min.:** 10mA 10mA 8A	• 400V DC • 400V AC	4a, 4b	(DC) 5, 9, 12, 18, 21, 24, 36, 48, 60V	500mW	2500Vrms	2500Vrms	2500Vrms	-	PCB Grid 2.54mm  4a4b	560 UL, CSA, SEV, TÜV
SF2D 1:3  53.3 x 25 x 16.5mm	• Polarised relay with forcibly guided contacts according to EN 50205, Type A • Safety double contact • For applications according to EN 50155 • IEC/EN 60335-1 (GWT) compliant	**Max.:** 8A **Min.:** 10mA 10mA 8A	• 400V DC • 400V AC	2a, 2b	(DC) 5, 9, 12, 18, 21, 24, 36, 48, 60V	500mW	2500Vrms	2500Vrms	2500Vrms	-	PCB Grid 2.54mm  2a2b	554 UL, CSA, SEV, TÜV
SF3 1:3  53.3 x 25 x 16.5mm	• Polarised relay with forcibly guided contacts according to EN 50205, Type A • For applications according to EN 50155 • IEC/EN 60335-1 (GWT) compliant	**Max.:** 8A **Min.:** 10mA 10mA 8A	• 400V DC • 400V AC	3a, 1b	(DC) 5, 9, 12, 18, 21, 24, 36, 48, 60V	500mW	2500Vrms	2500Vrms	2500Vrms	-	PCB Grid 2.54mm  3a1b	557 UL, CSA, SEV, TÜV
SFS 1:3  40 x 13 x 24mm  50 x 13 x 24mm	• Polarised relay with forcibly guided contacts according to EN 50205, Type A • 4-pole and 6-pole type with various contact arrangements • Slim profile reduces mounting area • PC board sockets and DIN-rail terminal socket available	**Max.:** 6A **Min.:** 1mA 1mA 6A	• 30V DC • 250V AC	2a2b, 3a1b, 4a2b, 5a1b, 3a3b	(DC) 12, 16, 18, 21, 24, 48V	360mW (4 poles) 500mW (6 poles)	1500Vrms	2500Vrms/ 4000Vrms	4000Vrms	-	PCB 	571 UL, CSA, TÜV

Signal Relays

Panasonic
ideas for life

Long seller, backed by product variety and high reliability

DS RELAYS



FEATURES

1. **Breakthrough height of 9.8 mm .386 inch beats the 10 mm .394 inch limit**
   1c and 2c all have the same height (9.8 mm .386 inch). The width of the relay is also the same (9.9 mm .390 inch). Since the only size variable is the length, the shared form makes mounting on printed printing wiring boards easy.
2. **Suitable for use in difficult environments**
   Epoxy resin seals the parts and cut off the external atmosphere, thus enabling use in difficult environments.
3. **Can be used with automatic solder and automatic wash systems**
   Automatic soldering and automatic washing can be carried out once the parts are mounted on PC boards.
4. **Gold-clad twin contacts ensure high reliability**
   Highly stable gold cladding on the contacts ensures that contact resistance changes little over time. Furthermore, the use of twin contacts, a configuration that performs with superior contact reliability, ensures extremely low contact failure rates even under low level loads.
5. **Polarized magnetic circuits realize resistance to shock and vibration**
   High-performance polarized magnetic circuits that utilize the energy of permanent magnets have made it possible to create relays with strong resistance to shock and vibration.
6. **DIL terminal array enables use of IC sockets**
7. **Widening scope of application with multicontact latching**
   In addition to single side stable types, you can take advantage of the memory of functions of convenient 1 coil or 2 coil latching relays.

TYPICAL APPLICATIONS

Besides telecommunications, measuring devices, office equipment, computers and related equipment, DS relays are also recommended for a broad range of applications including business devices, audio systems, and industrial equipment.

ORDERING INFORMATION

DS [ ] E - [ ] - [ ] - [ ] - [ ]

Contact arrangement
1: 1 Form C
2: 2 Form C

Sensitivity
M: 400 mW nominal operating power
S: 200 mW nominal operating power

Operating function
Nil: Single side stable
L2: 2 coil latching

Nominal coil voltage
DC 3, 5, 6, 9, 12, 24, 48 V

Nil: Standard polarity type
R: Reverse polarity type

Note: 1 coil latching type are manufactured by lot upon receipt of order.
Reverse polarity types available (add suffix-R)

TYPES

1. Standard type

Contact arrangement	Nominal coil voltage	Single side stable type	2 coil latching type
		Part No.	Part No.
1 Form C	1.5V DC	DS1E-M-DC1.5V	DS1E-ML2-DC1.5V
	3V DC	DS1E-M-DC3V	DS1E-ML2-DC3V
	5V DC	DS1E-M-DC5V	DS1E-ML2-DC5V
	6V DC	DS1E-M-DC6V	DS1E-ML2-DC6V
	9V DC	DS1E-M-DC9V	DS1E-ML2-DC9V
	12V DC	DS1E-M-DC12V	DS1E-ML2-DC12V
	24V DC	DS1E-M-DC24V	DS1E-ML2-DC24V
	48V DC	DS1E-M-DC48V	DS1E-ML2-DC48V
2 Form C	1.5V DC	✂ DS2E-M-DC1.5V	✂ DS2E-ML2-DC1.5V
	3V DC	DS2E-M-DC3V	DS2E-ML2-DC3V
	5V DC	DS2E-M-DC5V	DS2E-ML2-DC5V
	6V DC	DS2E-M-DC6V	DS2E-ML2-DC6V
	9V DC	DS2E-M-DC9V	DS2E-ML2-DC9V
	12V DC	DS2E-M-DC12V	DS2E-ML2-DC12V
	24V DC	DS2E-M-DC24V	DS2E-ML2-DC24V
	48V DC	DS2E-M-DC48V	DS2E-ML2-DC48V

Standard packing: Tube: 50 pcs.; Case: 500 pcs.

2. High sensitivity type

Contact arrangement	Nominal coil voltage	Single side stable type	2 coil latching type
		Part No.	Part No.
1 Form C	1.5V DC	DS1E-S-DC1.5V	DS1E-SL2-DC1.5V
	3V DC	DS1E-S-DC3V	DS1E-SL2-DC3V
	5V DC	DS1E-S-DC5V	DS1E-SL2-DC5V
	6V DC	DS1E-S-DC6V	DS1E-SL2-DC6V
	9V DC	DS1E-S-DC9V	DS1E-SL2-DC9V
	12V DC	DS1E-S-DC12V	DS1E-SL2-DC12V
	24V DC	DS1E-S-DC24V	DS1E-SL2-DC24V
	48V DC	DS1E-S-DC48V	DS1E-SL2-DC48V
2 Form C	1.5V DC	✂ DS2E-S-DC1.5V	✂ DS2E-SL2-DC1.5V
	3V DC	DS2E-S-DC3V	DS2E-SL2-DC3V
	5V DC	DS2E-S-DC5V	DS2E-SL2-DC5V
	6V DC	DS2E-S-DC6V	DS2E-SL2-DC6V
	9V DC	DS2E-S-DC9V	DS2E-SL2-DC9V
	12V DC	DS2E-S-DC12V	DS2E-SL2-DC12V
	24V DC	DS2E-S-DC24V	DS2E-SL2-DC24V
	48V DC	DS2E-S-DC48V	DS2E-SL2-DC48V

Standard packing: Tube: 50 pcs.; Case: 500 pcs.
Notes: 1. 1 coil latching type are manufactured by lot upon receipt of order. ✂
2. Reverse polarity types available (add suffix-R)

RATING

1. Coil data

1) Single side stable type

Type	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 50°C 122°F)
Standard (M) type	1.5V DC	70%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	266.7mA	5.63Ω	400mW	1 Form C: 120%V of nominal voltage 2 Form C: 150%V of nominal voltage
	3V DC			133.3mA	22.5Ω		
	5V DC			80.0mA	62.5Ω		
	6V DC			66.7mA	90Ω		
	9V DC			44.4mA	203Ω		
	12V DC			33.3mA	360Ω		
	24V DC			16.7mA	1,440Ω		
	48V DC			8.3mA	5,760Ω		
High sensitivity (S) type	1.5V DC	1 Form C: 80%V or less of nominal voltage 2 Form C: 70%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	133.3mA	11.3Ω	200mW	1 Form C: 160%V of nominal voltage 2 Form C: 200%V of nominal voltage
	3V DC			66.7mA	45Ω		
	5V DC			40.0mA	125Ω		
	6V DC			33.3mA	180Ω		
	9V DC			22.2mA	405Ω		
	12V DC			16.7mA	720Ω		
	24V DC			8.3mA	2,880Ω		
	48V DC			4.2mA	11,520Ω		

2) 2 coil latching type

Type	Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. applied voltage (at 50°C 122°F)
				Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
Standard (M) type	1.5V DC	70%V or less of nominal voltage (Initial)	70%V or less of nominal voltage (Initial)	240mA	240mA	6.25Ω	6.25Ω	360mW	360mW	1 Form C: 120%V of nominal voltage 2 Form C: 150%V of nominal voltage
	3V DC			120mA	120mA	25Ω	25Ω			
	5V DC			72mA	72mA	69.4Ω	69.4Ω			
	6V DC			60mA	60mA	100Ω	100Ω			
	9V DC			40mA	40mA	225Ω	225Ω			
	12V DC			30mA	30mA	400Ω	400Ω			
	24V DC			15mA	15mA	1,600Ω	1,600Ω			
	48V DC			7.5mA	7.5mA	6,400Ω	6,400Ω			
High sensitivity (S) type	1.5V DC	1 Form C: 80%V or less of nominal voltage 2 Form C: 70%V or less of nominal voltage (Initial)	1 Form C: 80%V or less of nominal voltage 2 Form C: 70%V or less of nominal voltage (Initial)	120mA	120mA	12.5Ω	12.5Ω	180mW	180mW	1 Form C: 160%V of nominal voltage 2 Form C: 200%V of nominal voltage
	3V DC			60mA	60mA	50Ω	50Ω			
	5V DC			36mA	36mA	139Ω	139Ω			
	6V DC			30mA	30mA	200Ω	200Ω			
	9V DC			20mA	20mA	450Ω	450Ω			
	12V DC			15mA	15mA	800Ω	800Ω			
	24V DC			7.5mA	7.5mA	3,200Ω	3,200Ω			
	48V DC			3.75mA	3.75mA	12,800Ω	12,800Ω			

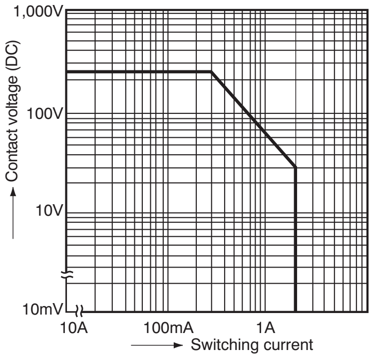
2. Specifications

Characteristics	Item		Specifications	
Contact	Arrangement		1 Form C	2 Form C
	Initial contact resistance, max.		Max. 50 mΩ (By voltage drop 6 V DC 1A)	
	Contact material		Ag+Au clad	
Rating	Nominal switching capacity		2 A 30 V DC (resistive load)	
	Max. switching power		60 W, 125 VA (resistive load)	
	Max. switching voltage		220 V DC, 250 V AC	
	Max. carrying current		3 A	
	Min. switching capacity (Reference value)*1		10μA 10m V DC	
	Nominal operating power		Single side stable (M type: 400 mW, S type: 200 mW); latching (M type: 360 mW, S type: 180 mW)	
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.	
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1min. (500 Vrms for 1min: 1 Form C high sensitivity type) (Detection current: 10mA.)	
		Between contact and coil	1,500 Vrms for 1min. (1,000 Vrms for 1min: 1 Form C high sensitivity type) (Detection current: 10mA.)	
	Temperature rise		Max. 65°C (By resistive method, nominal coil voltage applied to the coil, contact carrying current: 2A.)	
	Operate time [Set time] (at 20°C 68°F)		Max. 10 ms [10 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.)	
	Release time [Reset time] (at 20°C 68°F)		Max. 5 ms [10 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)	
Mechanical characteristics	Shock resistance	Functional*2	Min. 490 m/s^2	Min. 490 m/s^2
		Destructive	Min. 980 m/s^2 (Half-wave pulse of sine wave: 6 ms.)	
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3.3 mm (Detection time: 10μs.)	
		Destructive	10 to 55 Hz at double amplitude of 5 mm	
Expected life	Mechanical		Min. 10^8 (10^7: 1 Form C latching type) (at 600 cpm)	
	Electrical		Min. 5×10^5 rated load (at 60 cpm)	
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –40°C to +70°C –40°F to +158°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)	
	Max. operating speed (at rated load)		60 cpm	
Unit weight			Approx. 3 g .11 oz	Approx. 4g .14oz

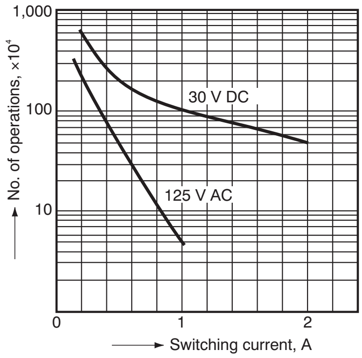
*1This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10V DC, 10mA max. level])
*2Half-wave pulse of sine wave: 11ms; detection time: 10μs
*3Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

1. Maximum switching capacity

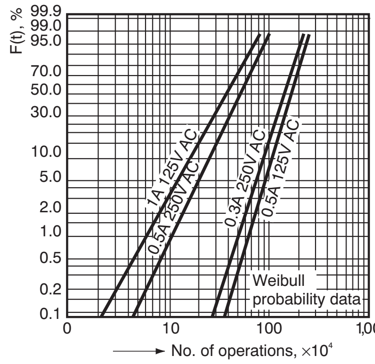


2. Life curve (Resistive load)



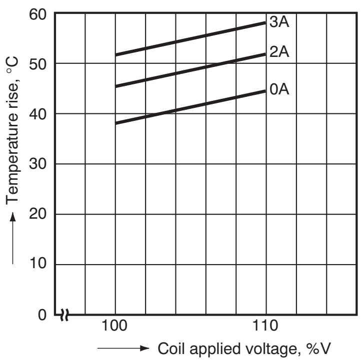
3. Contact reliability for AC loads

Tested sample: DS2E-M-DC24V 10 pcs.
Operating speed: 20 cpm.
Detection level: 200 mΩ



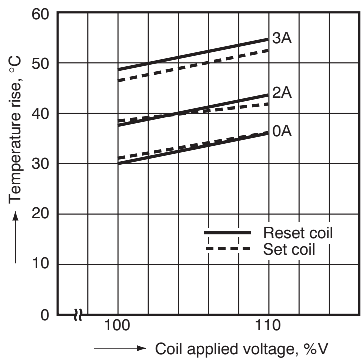
4-(1). Coil termperature rise
(2 Form C single side stable type)

Tested sample: DS2E-M-DC12V
Point measured: Inside the coil
Ambient temperature: 18° to 19°C 64° to 66°F



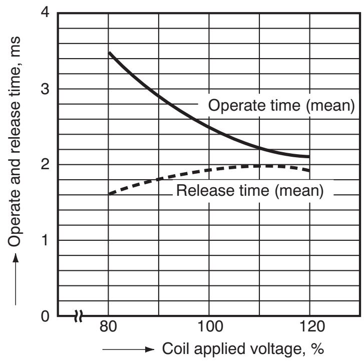
4-(2). Coil temperature rise
(2 Form C 2 coil latching type)

Tested sample: DS2E-ML2-DC12V
Point measured: Inside the coil
Ambient temperature: 20° to 21°C 68° to 70°F

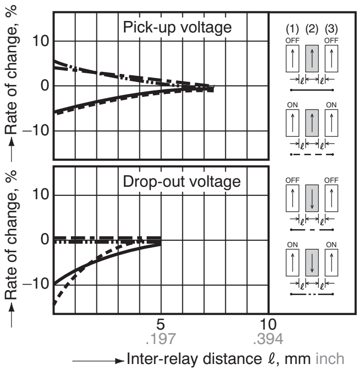


5. Operate and release time characteristics
(2 Form C single side stable type)

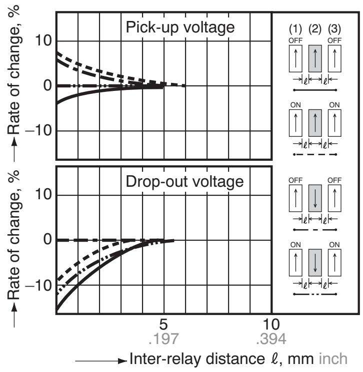
Test condition: Without diode connected to coil in parallel



6-(1). Influence of adjacent mounting
(1 Form C)



6-(2). Influence of adjacent mounting
(2 Form C)



Signal

DIMENSIONS (mm inch)

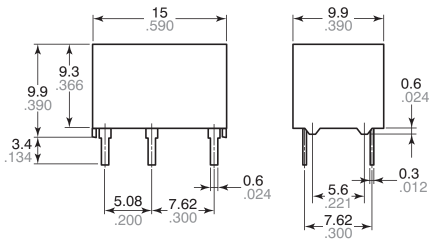
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

DS (1 Form C)

Single side stable, 2 coil latching

External dimensions

CAD Data

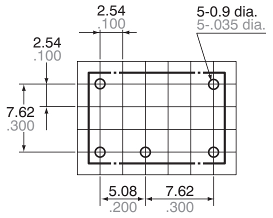


General tolerance: ±0.3 ±.012

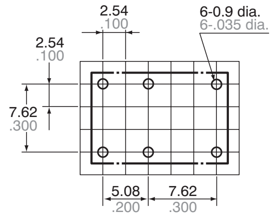
Note: External dimensions of 1 coil latching types are same as single side stable type.

PC board pattern (Bottom view)

Single side stable

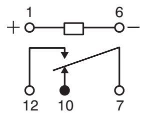


2 coil latching



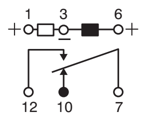
Schematic (Bottom view)

Single side stable



(Deenergized condition)

2 coil latching



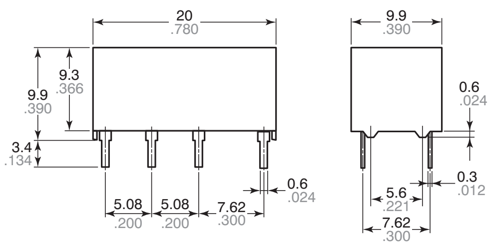
(Reset condition)

Tolerance: ±0.1 ±.004

Single side stable

External dimensions

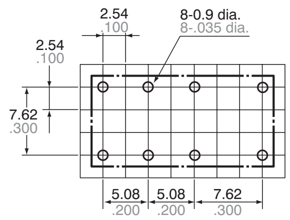
CAD Data



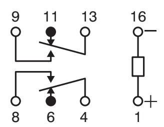
General tolerance: ±0.3 ±.012

Note: External dimensions of 1 coil latching types are same as single side stable type.

PC board pattern (Bottom view)



Schematic (Bottom view)



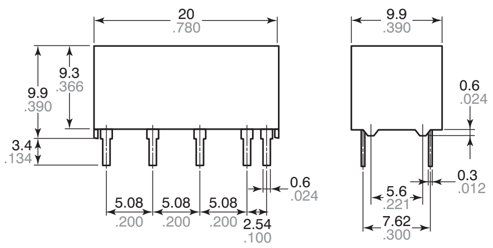
(Deenergized condition)

Tolerance: ±0.1 ±.004

DS (2 Form C)
2 coil latching

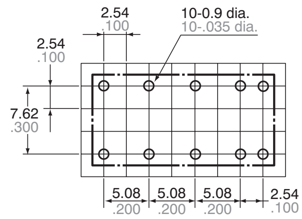
External dimensions

CAD Data

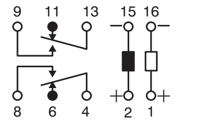


General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



Schematic (Bottom view)



(Reset condition)

Tolerance: ±0.1 ±.004

NOTE

Coil connection
When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
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MINIATURE RELAY

DS2Y RELAYS

FEATURES

1. **2 Form C contact**
2. **High sensitivity-200 mW nominal operating power**
3. **High breakdown voltage**
   1500 V FCC surge between open contacts
4. **DIP-2C type matching 16 pin IC socket**
5. **Sealed construction**

TYPICAL APPLICATIONS

1. **Telecommunication equipment**
2. **Office equipment**
3. **Computer peripherals**
4. **Security alarm systems**
5. **Medical equipment**

ORDERING INFORMATION

DS2Y-S [ ] - [ ] - [ ]

Operating function
Nil: Single side stable

Nominal coil voltage
DC 1.5, 3, 5, 6, 9, 12, 24, 48 V

Polarity
Nil: Standard polarity
R: Reverse polarity

Notes: 1. Reverse polarity types available (add suffix-R)
2. UL/CSA approved type is standard.

TYPES

Contact arrangement	Nominal coil voltage	Single side stable type
		Part No.
2 Form C	1.5V DC	DS2Y-S-DC1.5V
	3V DC	DS2Y-S-DC3V
	5V DC	DS2Y-S-DC5V
	6V DC	DS2Y-S-DC6V
	9V DC	DS2Y-S-DC9V
	12V DC	DS2Y-S-DC12V
	24V DC	DS2Y-S-DC24V
	48V DC	DS2Y-S-DC48V

Standard packing: Tube: 50 pcs.; Case: 500 pcs.

RATING

1. Coil data

Single side stable type

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 50°C 122°F)
1.5V DC	70%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	132.7mA	11.3Ω	200mW	200%V of nominal voltage
3V DC			66.7mA	45Ω		
5V DC			40mA	125Ω		
6V DC			33.3mA	180Ω		
9V DC			22.2mA	405Ω		
12V DC			16.7mA	720Ω		
24V DC			8.3mA	2,880Ω		
48V DC			6.3mA	7,680Ω	300mW	

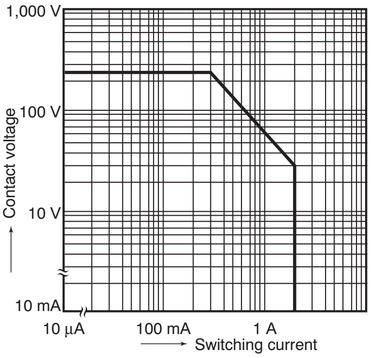
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		2 Form C
	Initial contact resistance, max.		Max. 50 mΩ (By voltage drop 6 V DC 1A)
	Contact material		Ag+Au clad
Rating	Max. switching power		60 W, 62.5 VA (resistive load)
	Max. switching voltage		220 V DC, 250 V AC
	Max. switching current		2 A
	Max. carrying current		3 A
	Minimum operating power		Approx. 98 mW (147 mW: 48 V)
	Nominal operating power		Approx. 200 mW (300 mW: 48 V)
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500V DC) Measurement at same location as "Initial breakdown voltage" section.
	Breakdown voltage (Initial)	Between open contacts	750 Vrms for 1min. (Detection current: 10mA.)
		Between contact sets	1,000 Vrms for 1min. (Detection current: 10mA.)
		Between contact and coil	1,000 Vrms for 1min. (Detection current: 10mA.)
	FCC surge breakdown voltage between contacts and coil		1,500 V
	Temperature rise (at 20°C 68°F)		Max. 65°C with nominal coil voltage across coil and at nominal switching capacity
	Operate time [Set time] (at 20°C 68°F)		Approx. 4 ms [approx. 3 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.)
	Release time [Reset time] (at 20°C 68°F)		Approx. 3 ms [approx. 3 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 490 m/s^2 (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)
		Destructive	Min. 980 m/s^2 (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3.3 mm (Detection time: 10μs.)
		Destructive	10 to 55 Hz at double amplitude of 5 mm
Expected life	Mechanical		Min. 10^8
	Electrical		5×10^5 (1 A 30 V DC), 10^5 (2 A 30 V DC)
Conditions	Conditions for operation, transport and storage*		Ambient temperature: –40°C to +70°C –40°F to +158°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed (at rated load)		60 cpm
Unit weight			Approx. 4g .14oz

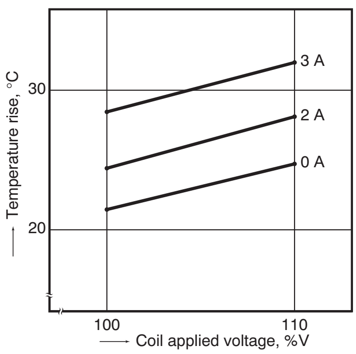
* Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

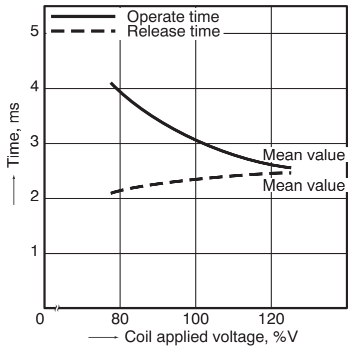
1. Maximum switching capacity



2. Coil temperature rise (Single side stable)
Tested sample: DS2Y-S-DC12V, 5 pcs.
Measured portion: Inside the coil
Ambient temperature: 21°C to 25°C 70°F to 77°F

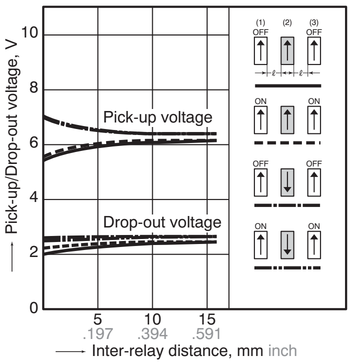


3. Operate/release time for single side stable (Without diode)
Tested sample: DS2Y-S-DC12V, 10 pcs.
Ambient temperature: 20°C 68°F



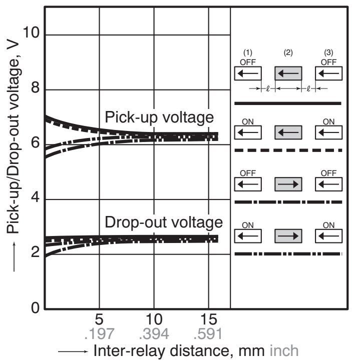
4-(1) Influence of adjacent mounting
Tested sample: DS2Y-S-DC12V, 10 pcs.
Ambient temperature: 20°C 68°F

TEST METHOD
1. Apply nominal voltage to No. (1) and (3) DS2Y relays.
2. Measure pick-up voltage and drop-out voltage of No. (2) relay when inter-relay distance (ℓ) changes.



4-(2) Influence of adjacent mounting
Tested sample: DS2Y-S-DC12V, 10 pcs.
Ambient temperature: 20°C 68°F

TEST METHOD
1. Apply nominal voltage to No. (1) and (3) DS2Y relays.
2. Measure pick-up voltage and drop-out voltage of No. (2) relay when inter-relay distance (ℓ) changes.



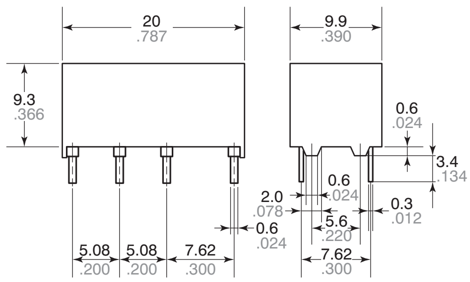
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

Single side stable

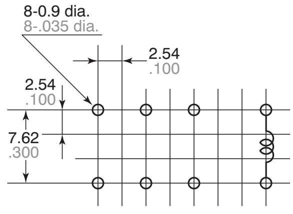
CAD Data

External dimensions



General tolerance: ±0.3 ±.012

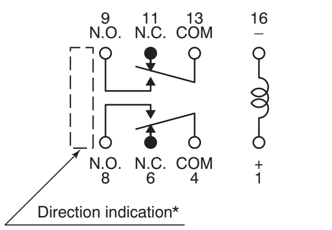
PC board pattern (Copper-side view)



matching 16 pin IC socket

Tolerance: ±0.1 ±.004

Schematic (Bottom view)
(Deenergized position)



*A polarity bar shows the relay direction.

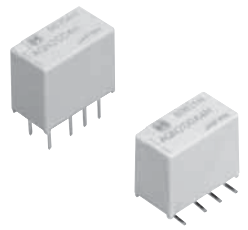
For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

High sensitivity of nominal operating power 100mW is achived. Compact slim body saves space.

GN RELAYS (AGN)

Signal



FEATURES

1. Compact slim body saves space.
Thanks to the small surface area of 5.7 mm × 10.6 mm .224 inch × .417 inch and low height of 9.0 mm .354 inch, the packaging density can be increased to allow for much smaller designs.

2. High sensitivity single side stable type (Nominal operating power: 100mW) is available.

3. Outstanding surge resistance
Surge breakdown voltage between contacts and coil:
2,500 V 2×10 μs (Telcordia)
Surge breakdown voltage between open contacts:
1,500 V 10×160 μs (FCC part 68)

4. The use of twin crossbar contacts ensures high contact reliability.
AgPd contact is used because of its good sulfide resistance. Adopting low-gas molding material. Coil assembly molding technology which avoids generating volatile gas from coil.

5. Increased packaging density
Due to highly efficient magnetic circuit design, leakage flux is reduced and changes in electrical characteristics from components being mounted close-together are minimized. This all means a packaging density higher than ever before.

6. Nominal operating power: 140 mW

7. Outstanding vibration and shock resistance
Functional shock resistance: 750 m/s^2
Destructive shock resistance: 1,000 m/s^2
Functional vibration resistance: 10 to 55 Hz (at double amplitude of 3.3 mm .130 inch)
Destructive vibration resistance: 10 to 55 Hz (at double amplitude of 5 mm .197 inch)

8. Sealed construction allows automatic washing.

TYPICAL APPLICATIONS

1. Telephone switchboard
2. Telecommunications equipment
3. Security
4. Measurement equipment
5. Consumer electronic and audio visual equipment

ORDERING INFORMATION

AGN [2] [ ] [0] [ ] [ ][ ] [ ]

Contact arrangement
2: 2 Form C

Operating function
0: Single side stable
1: 1 coil latching
6: High sensitivity single side stable type

Type of operation
0: Standard type (B.B.M.)

Terminal shape
Nil: Standard PC board terminal
A: Surface-mount terminal A type
S: Surface-mount terminal S type

Nominal coil voltage (DC)
1H: 1.5V 03: 3V 4H: 4.5V 06: 6V 09: 9V
12: 12V 24: 24V

Packing style
Nil: Tube packing
X: Tape and reel packing (picked from 1/2/3/4 pin side)
Z: Tape and reel packing (picked from 5/6/7/8 pin side)

TYPES

1. Standard PC board terminal

Nominal coil voltage	Single side stable	1 coil latching	High sensitivity single side stable
	Part No.	Part No.	Part No.
1.5V DC	AGN2001H	AGN2101H	AGN2601H
3V DC	AGN20003	AGN21003	AGN26003
4.5V DC	AGN2004H	AGN2104H	AGN2604H
6V DC	AGN20006	AGN21006	AGN26006
9V DC	AGN20009	AGN21009	AGN26009
12V DC	AGN20012	AGN21012	AGN26012
24V DC	AGN20024	AGN21024	AGN26024

Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.

2. Surface-mount terminal

1) Tube packing

Nominal coil voltage	Single side stable	1 coil latching	High sensitivity single side stable
	Part No.	Part No.	Part No.
1.5V DC	AGN200❑1H	AGN210❑1H	AGN260❑1H
3V DC	AGN200❑03	AGN210❑03	AGN260❑03
4.5V DC	AGN200❑4H	AGN210❑4H	AGN260❑4H
6V DC	AGN200❑06	AGN210❑06	AGN260❑06
9V DC	AGN200❑09	AGN210❑09	AGN260❑09
12V DC	AGN200❑12	AGN210❑12	AGN260❑12
24V DC	AGN200❑24	AGN210❑24	AGN260❑24

❑: For each surface-mounted terminal identification, input the following letter. A type: A, S type: S
Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.

2) Tape and reel packing

Nominal coil voltage	Single side stable	1 coil latching	High sensitivity single side stable
	Part No.	Part No.	Part No.
1.5V DC	AGN200❑1HZ	AGN210❑1HZ	AGN260❑1HZ
3V DC	AGN200❑03Z	AGN210❑03Z	AGN260❑03Z
4.5V DC	AGN200❑4HZ	AGN210❑4HZ	AGN260❑4HZ
6V DC	AGN200❑06Z	AGN210❑06Z	AGN260❑06Z
9V DC	AGN200❑09Z	AGN210❑09Z	AGN260❑09Z
12V DC	AGN200❑12Z	AGN210❑12Z	AGN260❑12Z
24V DC	AGN200❑24Z	AGN210❑24Z	AGN260❑24Z

❑: For each surface-mounted terminal identification, input the following letter. A type: A, S type: S
Standard packing: Tape and reel: 500 pcs.; Case: 1,000 pcs.
Notes: 1. Tape and reel packing symbol “-Z” is not marked on the relay. “X” type tape and reel packing (picked from 1/2/3/4-pin side) is also available.
2. Please inquire if you require a relay, between 1.5 and 24 V DC, with a voltage not listed.

RATING

1. Coil data

1) Single side stable type

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC	75%V or less of nominal voltage* (Initial)	10%V or more of nominal voltage* (Initial)	93.8mA	16Ω	140mW	150%V of nominal voltage
3V DC			46.7mA	64.2Ω		
4.5V DC			31mA	145Ω		
6V DC			23.3mA	257Ω		
9V DC			15.5mA	579Ω		
12V DC			11.7mA	1,028Ω		
24V DC			9.6mA	2,504Ω	230mW	120%V of nominal voltage

2) 1 coil latching type

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC	75%V or less of nominal voltage* (Initial)	75%V or less of nominal voltage* (Initial)	66.7mA	22.5Ω	100mW	150%V of nominal voltage
3V DC			33.3mA	90Ω		
4.5V DC			22.2mA	202.5Ω		
6V DC			16.7mA	360Ω		
9V DC			11.1mA	810Ω		
12V DC			8.3mA	1,440Ω		
24V DC			5.0mA	4,800Ω	120mW	

*Pulse drive (JIS C 5442-1996)

3) High sensitivity single side stable type

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC	80%V or less of nominal voltage* (Initial)	10%V or more of nominal voltage* (Initial)	66.7mA	22.5Ω	100mW	150%V of nominal voltage
3V DC			33.3mA	90Ω		
4.5V DC			22.2mA	202.5Ω		
6V DC			16.7mA	360Ω		
9V DC			11.1mA	810Ω		
12V DC			8.3mA	1,440Ω		
24V DC			5.0mA	4,800Ω	120mW	120%V of nominal voltage

*Pulse drive (JIS C 5442-1996)

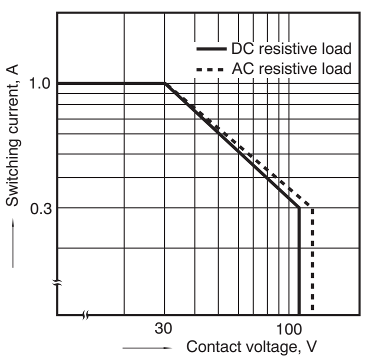
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		2 Form C
	Initial contact resistance, max.		Max. 100 mΩ (By voltage drop 6 V DC 1A)
	Contact material		Stationary contact: AgPd+Au clad Movable contact: AgPd
Rating	Nominal switching capacity		1 A 30 V DC, 0.3 A 125 V AC (resistive load)
	Max. switching power		30 W (DC), 37.5 V A (AC) (resistive load)
	Max. switching voltage		110 V DC, 125 V AC
	Max. switching current		1 A
	Min. switching capacity (Reference value)*1		10μA 10 mV DC
	Nominal operating power	Single side stable	140mW (1.5 to 12 V DC), 230mW (24 V DC)
		High sensitivity single side stable type	100mW (1.5 to 12 V DC), 120mW (24 V DC)
		1 coil latching	
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as "Initial breakdown voltage" section.
	Breakdown voltage (Initial)	Between open contacts	750 Vrms for 1min. (Detection current: 10mA)
		Between contact and coil	1,500 Vrms for 1min. (Detection current: 10mA)
		Between contact sets	1,000 Vrms for 1min. (Detection current: 10mA)
	Surge breakdown voltage (Initial)	Between open contacts	1,500 V (10×160μs) (FCC Part 68)
		Between contacts and coil	2,500 V (2×10μs) (Telcordia)
	Temperature rise (at 20°C 68°F)		Max. 50°C (By resistive method, nominal coil voltage applied to the coil; contact carrying current: 1A.)
	Operate time [Set time] (at 20°C 68°F)		Max. 4 ms [Max. 4 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.)
	Release time [Reset time] (at 20°C 68°F)		Max. 4 ms [Max. 4 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 750 m/s² (Half-wave pulse of sine wave: 6 ms; detection time: 10μs.)
		Destructive	Min. 1,000 m/s² (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3.3 mm (Detection time: 10μs.)
		Destructive	10 to 55 Hz at double amplitude of 5 mm
Expected life	Mechanical		Min. 5 × 10^7 (at 180 cpm)
	Electrical		Min. 10^5 (1 A 30 V DC resistive), 10^5 (0.3 A 125 V AC resistive) (at 20 cpm)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: (Single side stable, 1 coil latching type) –40°C to +85°C –40°F to +185°F (High sensitivity single side stable type) –40°C to +70°C –40°F to +158°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed (at rated load)		20 cpm
Unit weight			Approx. 1 g .035 oz

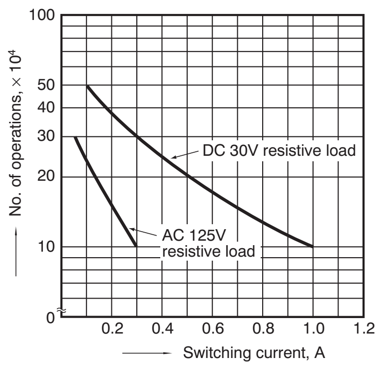
Notes: *1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

1. Max. switching capacity

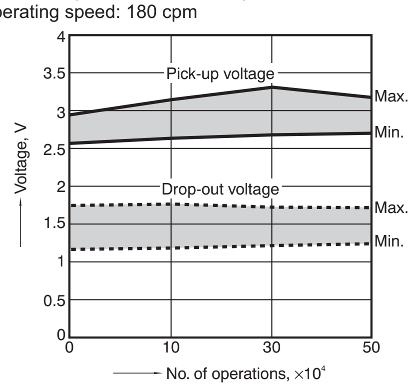


2. Life curve



3. Mechanical life

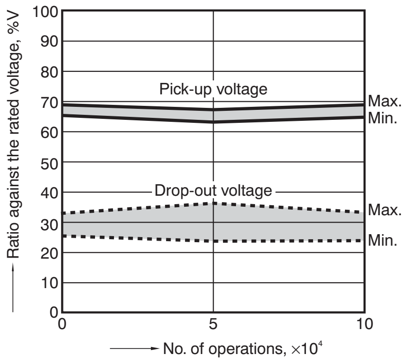
Tested sample: AGN2004H, 15 pcs.
Operating speed: 180 cpm



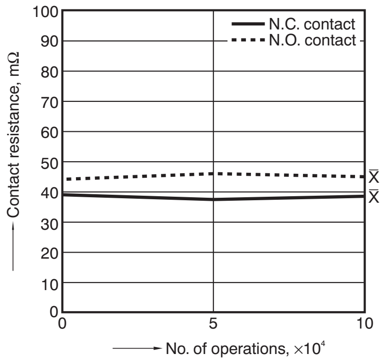
4. Electrical life (1A 30V DC resistive load)

Tested sample: AGN2004H, 6 pcs.
Operating speed: 20 cpm

Change of pick-up and drop-out voltage

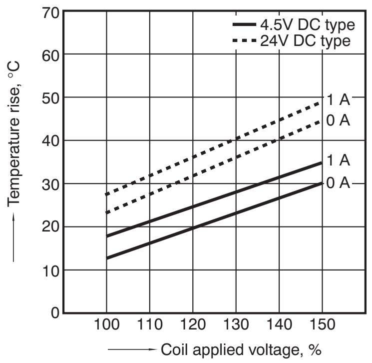


Change of contact resistance



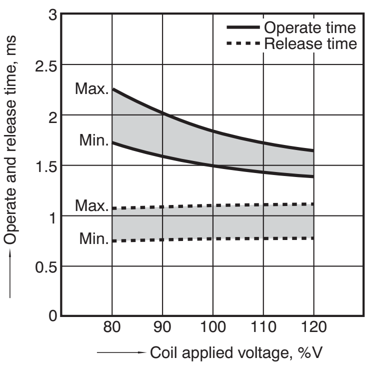
5. Coil temperature rise

Tested sample: AGN2004H, AGN20024, 6 pcs.
Point measured: Inside the coil
Ambient temperature: Room temperature



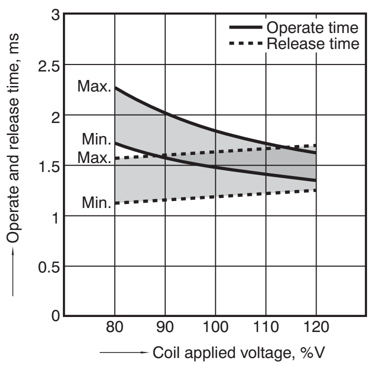
6-(1). Operate and release time (without diode)

Tested sample: AGN2004H, 6 pcs.



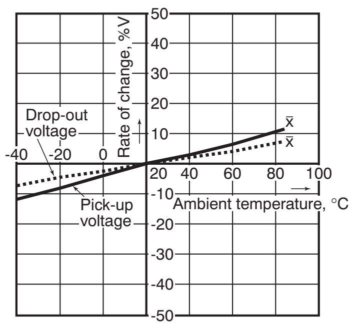
6-(2). Operate and release time (with diode)

Tested sample: AGN2004H, 6 pcs.



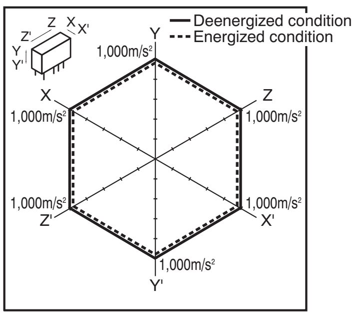
7. Ambient temperature characteristics

Tested sample: AGN2004H, 6 pcs.



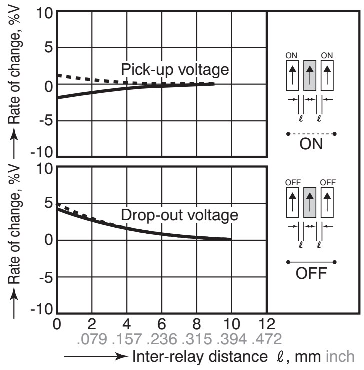
8. Malfunctional shock

Tested sample: AGN2004H



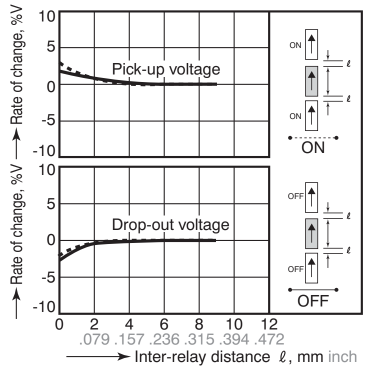
9-(1). Influence of adjacent mounting

Tested sample: AGN20012, 6 pcs.



9-(2). Influence of adjacent mounting

Tested sample: AGN20012, 6 pcs.

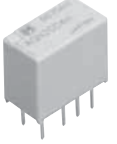


DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

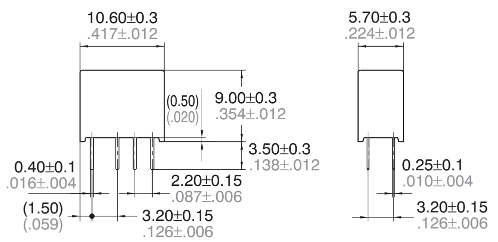
1. PC board terminal

CAD Data

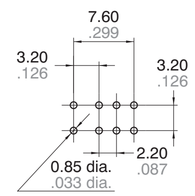


External dimensions

Standard type



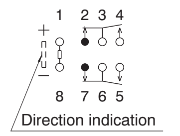
PC board pattern



Tolerance: ±0.1 ±.004

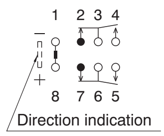
Schematic (Bottom view)

Single side stable
High sensitivity
single side stable



(Deenergized condition)

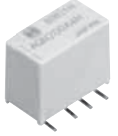
1 coil latching

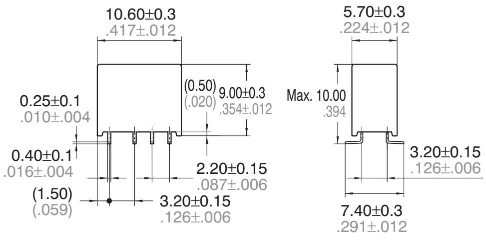
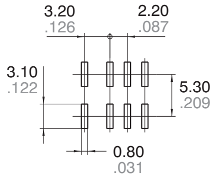
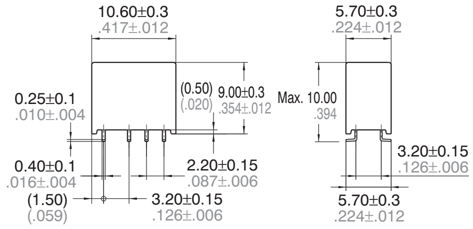
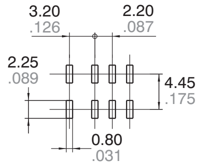


(Reset condition)

2. Surface-mount terminal

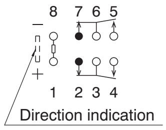
CAD Data



Type	External dimensions	Suggested mounting pad (Tolerance: ±0.1 ±.004)
	Single side stable/1 coil latching/High sensitivity single side stable	Single side stable/1 coil latching/High sensitivity single side stable
A type		
S type		

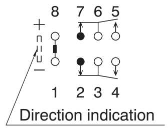
Schematic (Top view)

Single side stable
High sensitivity single side stable



(Deenergized condition)

1 coil latching

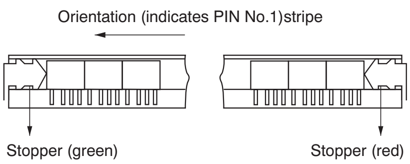


(Reset condition)

NOTES

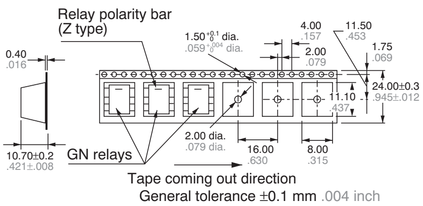
1. Packing style

1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.

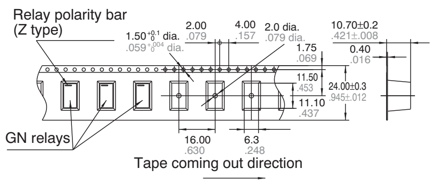


2) Tape and reel packing
(A type)
(1)-1 Tape dimensions

mm inch

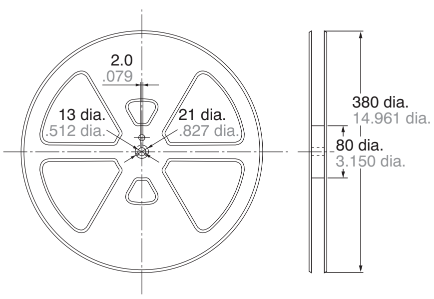


(S type)
(1)-2 Tape dimensions



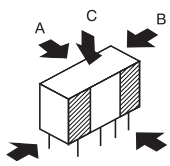
(2) Dimensions of plastic peel

mm inch



2. Automatic insertion

To maintain the internal function of the relay, the chucking pressure should not exceed the values below.
Chucking pressure in the direction A: 4.9 N {500gf} or less
Chucking pressure in the direction B: 9.8 N {1 kgf} or less
Chucking pressure in the direction C: 9.8 N {1 kgf} or less



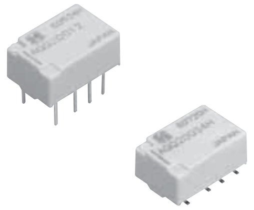
Please chuck the ▨ portion.
Avoid chucking the center of the relay.
In addition, excessive chucking pressure to the pinpoint of the relay should be avoided.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

High sensitivity of nominal operating power 100mW is achieved. Ultra small package & Flat type

GQ RELAYS (AGQ)



FEATURES

1. **Compact flat body saves space.**
   With a small footprint of 10.6 mm (L) × 7.2 mm (W) .417 inch (L) × .283 inch (W) for space savings, it also has a very short height of 5.2 mm .205 inch. (Standard PC board type.)
2. **High sensitivity single side stable type (Nominal operating power: 100mW) is available.**
3. **Outstanding surge resistance**
   Surge breakdown voltage between contacts and coil:
   2,500 V 2×10 μs (Telcordia)
   Surge breakdown voltage between open contacts:
   1,500 V 10×160 μs (FCC part 68)
4. **The use of twin crossbar contacts ensures high contact reliability.**
   AgPd contact is used because of its good sulfide resistance. Adopting low-gas molding material. Coil assembly molding technology which avoids generating volatile gas from coil.
5. **Increased packaging density**
   Due to highly efficient magnetic circuit design, leakage flux is reduced and changes in electrical characteristics from components being mounted close-together are minimized. This all means a packaging density higher than ever before.
6. **Nominal operating power: 140 mW**
7. **Outstanding vibration and shock resistance**
   Functional shock resistance: 750 m/s^2
   Destructive shock resistance: 1,000 m/s^2
   Functional vibration resistance: 10 to 55 Hz (at double amplitude of 3.3 mm .130 inch)
   Destructive vibration resistance: 10 to 55 Hz (at double amplitude of 5 mm .197 inch)
8. **Sealed construction allows automatic washing.**

TYPICAL APPLICATIONS

1. **Telephone switchboard**
2. **Telecommunications equipment**
3. **Security**
4. **Measurement equipment**
5. **Consumer electronic and audio visual equipment**

ORDERING INFORMATION

AGQ | 2 | ☐ | 0 | ☐ | ☐☐ | ☐

Contact arrangement
2: 2 Form C

Operating function
0: Single side stable
1: 1 coil latching
6: High sensitivity single side stable type

Type of operation
0: Standard type (B.B.M.)

Terminal shape
Nil: Standard PC board terminal
A: Surface-mount terminal A type
S: Surface-mount terminal S type

Nominal coil voltage (DC)
1H: 1.5V 03: 3V 4H: 4.5V 06: 6V 09: 9V
12: 12V 24: 24V

Packing style
Nil: Tube packing
X: Tape and reel packing (picked from 1/2/3/4 pin side)
Z: Tape and reel packing (picked from 5/6/7/8 pin side)

TYPES

1. Standard PC board terminal

Nominal coil voltage	Single side stable	1 coil latching	High sensitivity single side stable
	Part No.	Part No.	Part No.
1.5V DC	AGQ2001H	AGQ2101H	AGQ2601H
3V DC	AGQ20003	AGQ21003	AGQ26003
4.5V DC	AGQ2004H	AGQ2104H	AGQ2604H
6V DC	AGQ20006	AGQ21006	AGQ26006
9V DC	AGQ20009	AGQ21009	AGQ26009
12V DC	AGQ20012	AGQ21012	AGQ26012
24V DC	AGQ20024	AGQ21024	AGQ26024

Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.

2. Surface-mount terminal

1) Tube packing

Nominal coil voltage	Single side stable	1 coil latching	High sensitivity single side stable
	Part No.	Part No.	Part No.
1.5V DC	AGQ200❑1H	AGQ210❑1H	AGQ260❑1H
3V DC	AGQ200❑03	AGQ210❑03	AGQ260❑03
4.5V DC	AGQ200❑4H	AGQ210❑4H	AGQ260❑4H
6V DC	AGQ200❑06	AGQ210❑06	AGQ260❑06
9V DC	AGQ200❑09	AGQ210❑09	AGQ260❑09
12V DC	AGQ200❑12	AGQ210❑12	AGQ260❑12
24V DC	AGQ200❑24	AGQ210❑24	AGQ260❑24

❑: For each surface-mounted terminal identification, input the following letter. A type: A, S type: S
Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.

2) Tape and reel packing

Nominal coil voltage	Single side stable	1 coil latching	High sensitivity single side stable
	Part No.	Part No.	Part No.
1.5V DC	AGQ200❑1HZ	AGQ210❑1HZ	AGQ260❑1HZ
3V DC	AGQ200❑03Z	AGQ210❑03Z	AGQ260❑03Z
4.5V DC	AGQ200❑4HZ	AGQ210❑4HZ	AGQ260❑4HZ
6V DC	AGQ200❑06Z	AGQ210❑06Z	AGQ260❑06Z
9V DC	AGQ200❑09Z	AGQ210❑09Z	AGQ260❑09Z
12V DC	AGQ200❑12Z	AGQ210❑12Z	AGQ260❑12Z
24V DC	AGQ200❑24Z	AGQ210❑24Z	AGQ260❑24Z

❑: For each surface-mounted terminal identification, input the following letter. A type: A, S type: S
Standard packing: Tape and reel: 900 pcs.; Case: 1,800 pcs.
Notes: 1. Tape and reel packing symbol “-Z” is not marked on the relay. “X” type tape and reel packing (picked from 1/2/3/4-pin side) is also available.
2. Please inquire if you require a relay, between 1.5 and 24 V DC, with a voltage not listed.

RATING

1. Coil data

1) Single side stable type

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC	75%V or less of nominal voltage* (Initial)	10%V or more of nominal voltage* (Initial)	93.8mA	16Ω	140mW	150%V of nominal voltage
3V DC			46.7mA	64.2Ω		
4.5V DC			31mA	145Ω		
6V DC			23.3mA	257Ω		
9V DC			15.5mA	579Ω		
12V DC			11.7mA	1,028Ω		
24V DC			9.6mA	2,504Ω	230mW	120%V of nominal voltage

2) 1 coil latching type

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC	75%V or less of nominal voltage* (Initial)	75%V or less of nominal voltage* (Initial)	66.7mA	22.5Ω	100mW	150%V of nominal voltage
3V DC			33.3mA	90Ω		
4.5V DC			22.2mA	202.5Ω		
6V DC			16.7mA	360Ω		
9V DC			11.1mA	810Ω		
12V DC			8.3mA	1,440Ω		
24V DC			5.0mA	4,800Ω	120mW	

*Pulse drive (JIS C 5442-1996)

3) High sensitivity single side stable type

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC	80%V or less of nominal voltage* (Initial)	10%V or more of nominal voltage* (Initial)	66.7mA	22.5Ω	100mW	150%V of nominal voltage
3V DC			33.3mA	90Ω		
4.5V DC			22.2mA	202.5Ω		
6V DC			16.7mA	360Ω		
9V DC			11.1mA	810Ω		
12V DC			8.3mA	1,440Ω		
24V DC			5.0mA	4,800Ω	120mW	120%V of nominal voltage

*Pulse drive (JIS C 5442-1996)

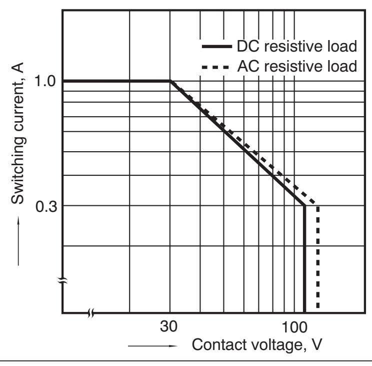
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		2 Form C
	Initial contact resistance, max.		Max. 100 mΩ (By voltage drop 6 V DC 1A)
	Contact material		Stationary contact: AgPd+Au clad Movable contact: AgPd
Rating	Nominal switching capacity		1 A 30 V DC, 0.3 A 125 V AC (resistive load)
	Max. switching power		30 W (DC), 37.5 V A (AC) (resistive load)
	Max. switching voltage		110 V DC, 125 V AC
	Max. switching current		1 A
	Min. switching capacity (Reference value)*1		10μA 10 mV DC
	Nominal operating power	Single side stable	140mW (1.5 to 12 V DC), 230mW (24 V DC)
		High sensitivity single side stable type	100mW (1.5 to 12 V DC), 120mW (24 V DC)
		1 coil latching	
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	750 Vrms for 1min. (Detection current: 10mA)
		Between contact and coil	1,500 Vrms for 1min. (Detection current: 10mA)
		Between contact sets	1,000 Vrms for 1min. (Detection current: 10mA)
	Surge breakdown voltage (Initial)	Between open contacts	1,500 V (10×160μs) (FCC Part 68)
		Between contacts and coil	2,500 V (2×10μs) (Telcordia)
	Temperature rise (at 20°C 68°F)		Max. 50°C (By resistive method, nominal coil voltage applied to the coil; contact carrying current: 1A.)
	Operate time [Set time] (at 20°C 68°F)		Max. 4 ms [Max. 4 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.)
	Release time [Reset time] (at 20°C 68°F)		Max. 4 ms [Max. 4 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 750 m/s^2 (Half-wave pulse of sine wave: 6 ms; detection time: 10μs.)
		Destructive	Min. 1,000 m/s^2 (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3.3 mm (Detection time: 10μs.)
		Destructive	10 to 55 Hz at double amplitude of 5 mm
Expected life	Mechanical		Min. 5×10^7 (at 180 cpm)
	Electrical		Min. 10^5 (1 A 30 V DC resistive), 10^5 (0.3 A 125 V AC resistive) (at 20 cpm)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: (Single side stable, 1 coil latching type) –40°C to +85°C –40°F to +185°F (High sensitivity single side stable type) –40°C to +70°C –40°F to +158°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed (at rated load)		20 cpm
Unit weight			Approx. 1 g .035 oz

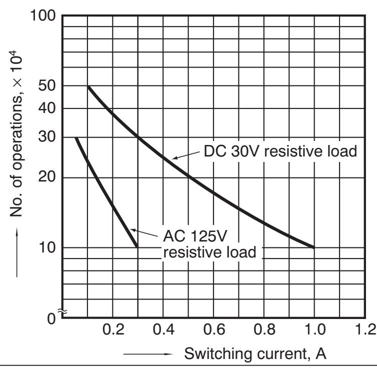
*1This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

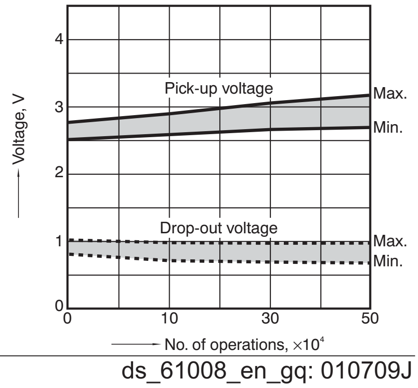
1. Max. switching capacity



2. Life curve



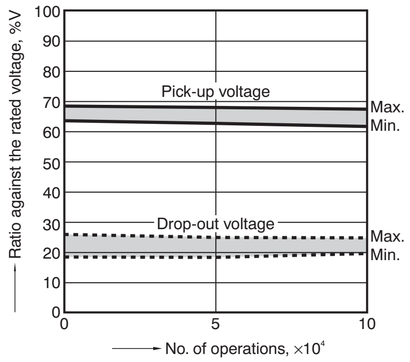
3. Mechanical life
Tested sample: AGQ200A4H, 6 pcs.
Operating speed: 180 cpm



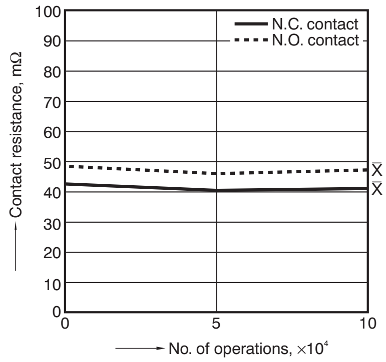
4. Electrical life (1A 30V DC resistive load)

Tested sample: AGQ200A4H, 6 pcs.
Operating speed: 20 cpm

Change of pick-up and drop-out voltage

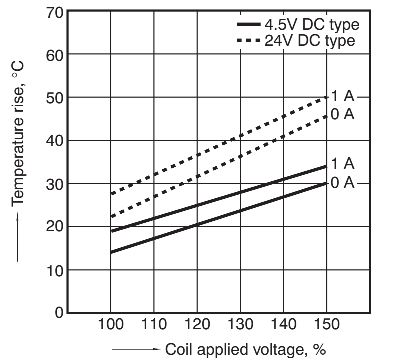


Change of contact resistance



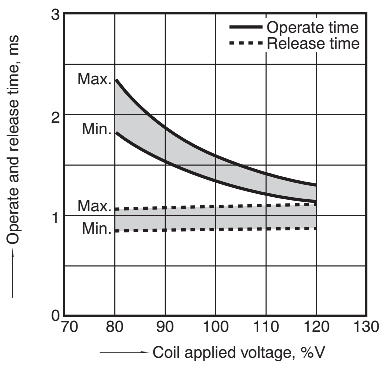
5. Coil temperature rise

Tested sample: AGQ200A4H, AGQ200A24, 6 pcs.
Point measured: Inside the coil
Ambient temperature: Room temperature



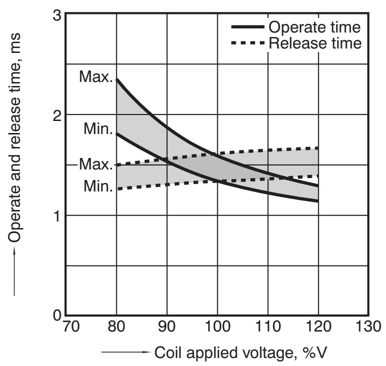
6-(1). Operate and release time (without diode)

Tested sample: AGQ2004H, 10 pcs.



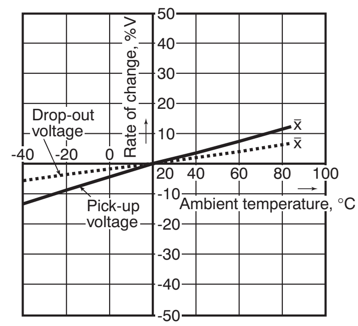
6-(2). Operate and release time (with diode)

Tested sample: AGQ2004H, 10 pcs.



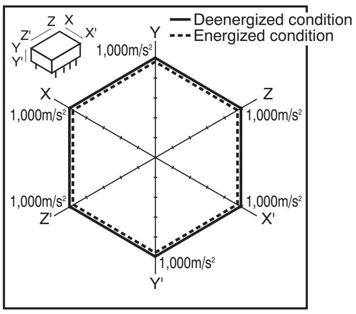
7. Ambient temperature characteristics

Tested sample: AGQ200A4H, 6 pcs.



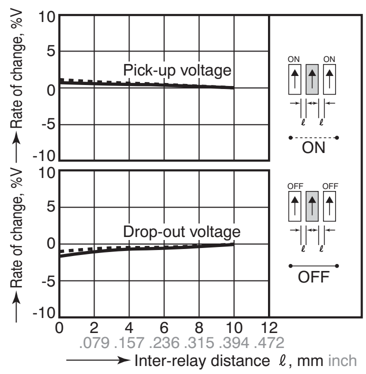
8. Malfunctional shock

Tested sample: AGQ200A4H, 6 pcs.



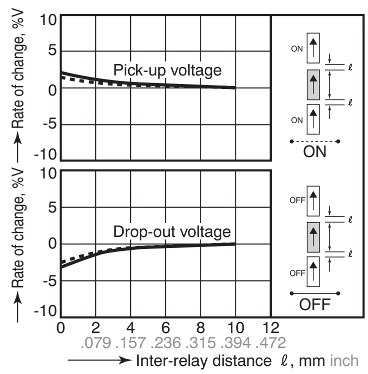
9-(1). Influence of adjacent mounting

Tested sample: AGQ20012, 6 pcs.



9-(2). Influence of adjacent mounting

Tested sample: AGQ20012, 6 pcs.

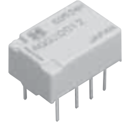


DIMENSIONS (mm inch)

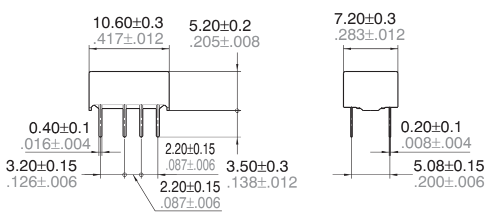
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. PC board terminal

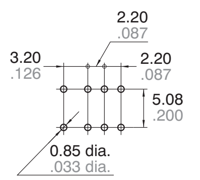
CAD Data



External dimensions



PC board pattern

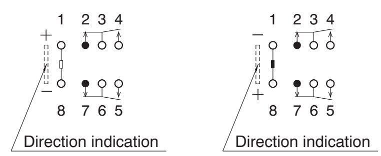


Tolerance: ±0.1 ±.004

Schematic (Bottom view)

Single side stable
High sensitivity
single side stable

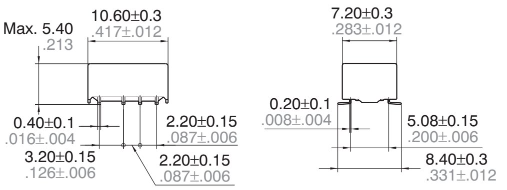
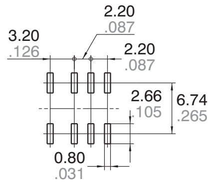
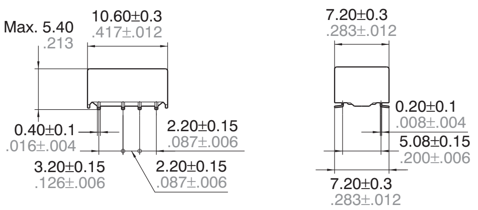
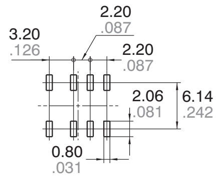
1 coil latching



(Deenergized condition) (Reset condition)

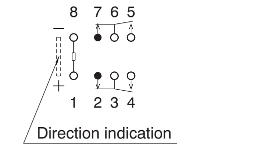
2. Surface-mount terminal

CAD Data

<table>
<tr><th rowspan="2">Type</th><th>External dimensions</th><th>Suggested mounting pad (Tolerance: ±0.1 ±.004)</th></tr>
<tr><th>Single side stable/1 coil latching/High sensitivity single side stable</th><th>Single side stable/1 coil latching/High sensitivity single side stable</th></tr>
<tr><td>A type</td><td></td><td></td></tr>
<tr><td>S type</td><td></td><td></td></tr>
</table>

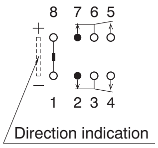
Schematic (Top view)

Single side stable
High sensitivity single side stable



(Deenergized condition)

1 coil latcing

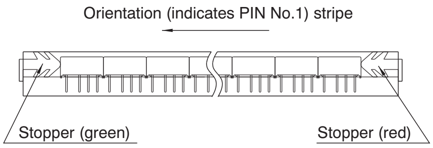


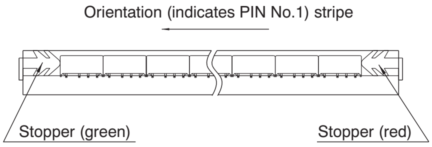
(Reset condition)

NOTES

1. Packing style

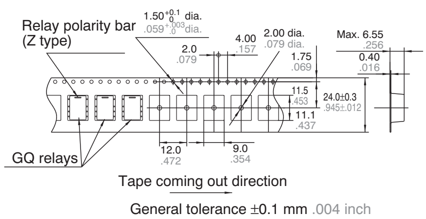
1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.



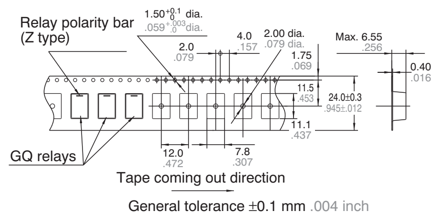


2) Tape and reel packing
(A type)
(1)-1 Tape dimensions

mm inch

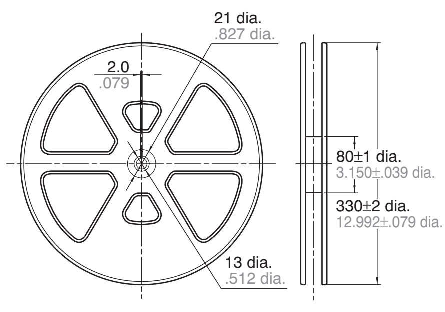


(S type)
(1)-2 Tape dimensions



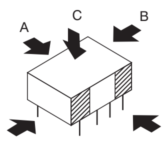
(2) Dimensions of plastic peel

mm inch



2. Automatic insertion

To maintain the internal function of the relay, the chucking pressure should not exceed the values below.
Chucking pressure in the direction A : 9.8 N {1 kgf} or less
Chucking pressure in the direction B : 9.8 N {1 kgf} or less
Chucking pressure in the direction C : 9.8 N {1 kgf} or less



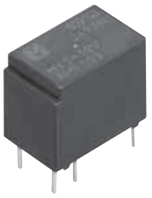
Please chuck the ▨ portion.
Avoid chucking the center of the relay.
In addition, excessive chucking pressure to the pinpoint of the relay should be also avoided.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

Non-polarized 1 Form C relay that realizes nominal operating power of 150 mW

HY RELAYS



FEATURES

1. **Nominal operating power:**
   High sensitivity of 150mW (Single side stable type)
   A nominal operating power of 150 mW (minimum operating power of 84 mW) has been achieved.
2. **The use of gold-clad twin contacts ensures high contact reliability.**
3. **Sealed construction**

TYPICAL APPLICATIONS

1. **Automotive equipment**
   Automirrow controller
   Retractable head light controller
2. **Push button device: Dial pulsing**
3. **Portable video tape recorders and audio devices**
4. **Computer peripherals**

ORDERING INFORMATION

HY [1] [ ] - [ ]

Contact arrangement
1: 1 Form C

Sensitivity
Nil: High sensitivity 150 mW
Z: Standard 200 mW

Nominal coil voltage (DC)
1.5, 3, 4.5, 5, 6, 9, 12, 24 V

Note: In case of 5 V drive circuit, it is recommended to use 4.5 V type relay.

TYPES

Contact arrangement	Nominal coil voltage	150mW type	200mW type
		Part No.	Part No.
1 Form C	1.5V DC	HY1-1.5V	HY1Z-1.5V
	3V DC	HY1-3V	HY1Z-3V
	4.5V DC	HY1-4.5V	HY1Z-4.5V
	5V DC	HY1-5V	HY1Z-5V
	6V DC	HY1-6V	HY1Z-6V
	9V DC	HY1-9V	HY1Z-9V
	12V DC	HY1-12V	HY1Z-12V
	24V DC	HY1-24V	HY1Z-24V

Standard packing: Tube: 50 pcs.; Case: 2,000 pcs.

RATING

1. Coil data

Contact arrangement	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 70°C 158°F)
1 Form C	1.5V DC	75%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	100mA	15Ω	150mW	140%V of nominal voltage
	3V DC			50mA	60Ω		
	4.5V DC			33.3mA	135Ω		
	5V DC			30mA	166Ω		
	6V DC			25mA	240Ω		
	9V DC			16.7mA	540Ω		
	12V DC			12.5mA	960Ω		
	24V DC			6.25mA	3,840Ω		
	1.5V DC	75%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	133.3mA	11.25Ω	200mW	120%V of nominal voltage
	3V DC			66.7mA	45Ω		
	4.5V DC			44.5mA	101.2Ω		
	5V DC			40mA	125Ω		
	6V DC			33.3mA	180Ω		
	9V DC			22.2mA	405Ω		
	12V DC			16.7mA	720Ω		
	24V DC			8.3mA	2,880Ω		

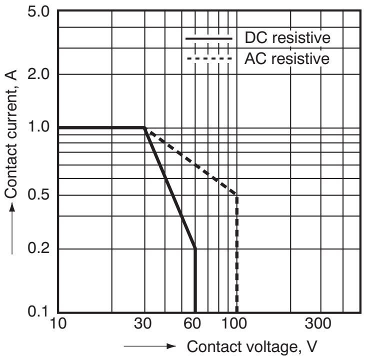
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form C
	Initial contact resistance, max.		Max. 100 mΩ (By voltage drop 6 V DC 1A)
	Contact material		Ag+Au clad
Rating	Nominal switching capacity		1 A 30 V DC (resistive load)
	Max. switching power		30 W (DC) (resistive load)
	Max. switching voltage		60 V DC
	Max. carrying current		2 A
	Max. switching current		1 A (30 V DC)
	Min. switching capacity (Reference value)*1		1mA 1 V DC
	Nominal operating power		150/200mW
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1min. (Detection current: 10mA)
		Between contact and coil	1,000 Vrms for 1min. (Detection current: 10mA)
	Temperature rise (at 20°C 68°F)		Max. 50°C (By resistive method, nominal coil voltage applied to the coil, nominal switching capacity.)
	Operate time [Set time] (at 20°C 68°F)		Max. 5 ms (Nominal coil voltage applied to the coil, excluding contact bounce time.)
	Release time [Reset time] (at 20°C 68°F)		Max. 4 ms (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 98 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10µs.)
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1 mm (Detection time: 10µs.)
		Destructive	10 to 55 Hz at double amplitude of 2 mm
Expected life	Mechanical		Min. 10^7 (at 180 cpm)
	Electrical		Min. 10^5 (1 A 30 V DC resistive) (at 20 cpm)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +70°C –40°F to +158°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed (at rated load)		20 cpm
Unit weight			Approx. 1.8 g .063 oz

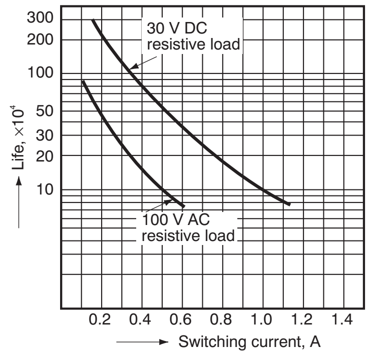
*1This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

1. Maximum switching power

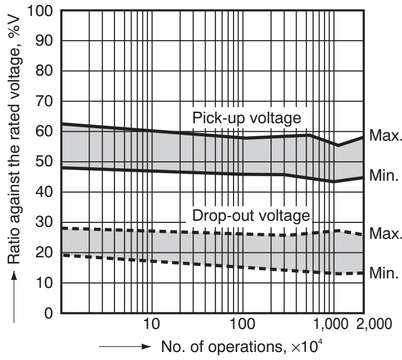


2. Life curve



3. Mechanical life

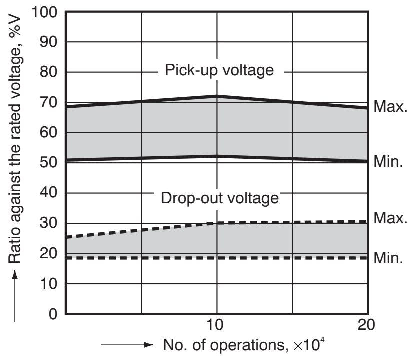
Tested sample: HY1Z-12V, 10 pcs.
Ambient temperature: 20°C to 25°C 68°F to 77°F



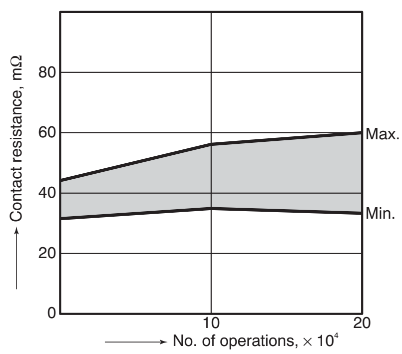
4. Electrical life

Tested sample: HY1-12V, 6 pcs.
Condition: 1 A 30 V DC resistive load, 30 cpm

Change of pick-up and drop-out voltage

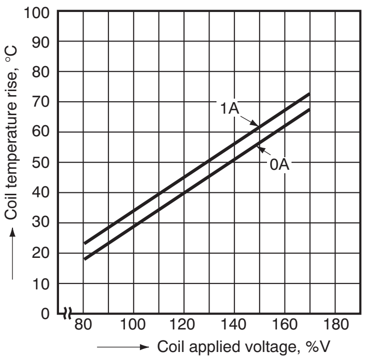


Change of contact resistance



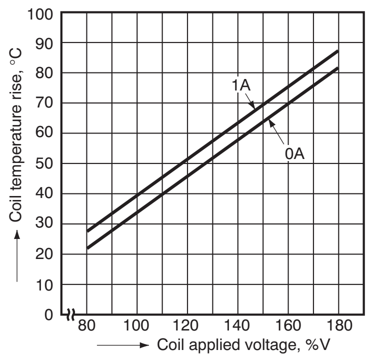
5-(1). Coil temperature rise (150 mW high sensitivity type)

Tested sample: HY1-9V, 5 pcs.
Ambient temperature:24°C 75°F



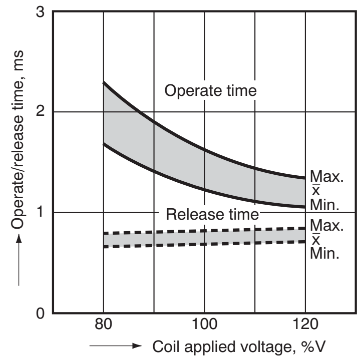
5-(2). Coil temperature rise (200 mW Standard type)

Tested sample: HY1Z-12V, 5 pcs.
Ambient temperature: 23°C 74°F



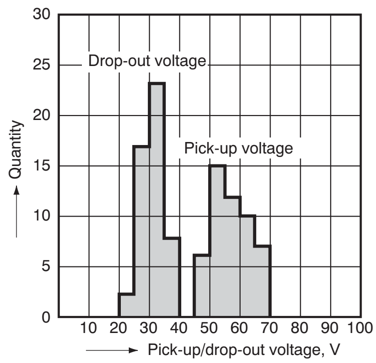
6. Operate/release time characteristics

Tested sample: HY1Z-12V, 5 pcs.
Ambient temperature: 25°C 77°F



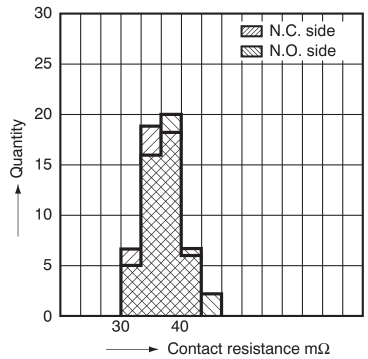
7. Distribution of pick-up and drop-out voltages

Tested sample: HY1-12V, 50 pcs.
Ambient temperature: 23°C 74°F



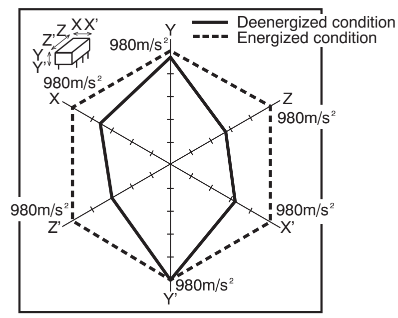
8. Distribution of contact resistance

Tested sample: HY1-12V, 50 pcs.
N.C. side N.O. side



9. Malfunction shock

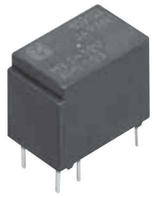
Tested sample: HY1Z-12V, 6 pcs.



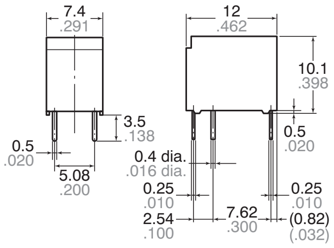
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data

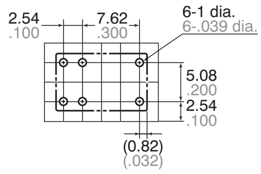


External dimensions



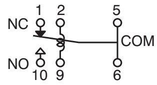
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

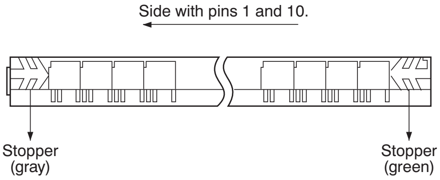
Schematic (Bottom view)



NOTE

1. Packing style

1) As shown in the diagram below, the relays are presented in tube packages with pins 1 and 10 on the left. Be sure to maintain relays in the correct orientation when mounting on PC boards.



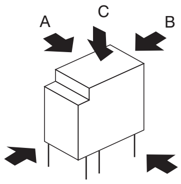
2. Automatic insertion

To maintain the internal function of the relay, the chucking pressure should not exceed the values below.

Chucking pressure in the direction A:
4.9 N {500gf} or less

Chucking pressure in the direction B:
4.9 N {500gf} or less

Chucking pressure in the direction C:
4.9 N {500gf} or less



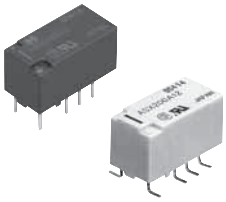
Avoid chucking the center of the relay. In addition, excessive chucking pressure to the pinpoint of the relay should be avoided.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

HIGH SENSIBILITY RELAY WITH GUARANTEED LOW LEVEL SWITCHING CAPACITY

SX RELAYS (ASX)



FEATURES

1. **High contact reliability over a long life has been made possible for low level loads.**
   Using a low level load (1 mV 10μA to 10 V 10 mA) 10^7 operations were achieved with a static contact resistance of Max. 100 mΩ (voltage drop of 20 mV, 1 mA, 1 kHz) and a dynamic contact resistance of Max. 1 Ω (Measurement delay 10 ms, voltage drop of 20 mV, 1 mA, 1 kHz).
2. **High sensibility of 50 mW**
   By using the highly efficient polar magnetic circuit “seesaw balance armature mechanism”, a rated power consumption of 50 mW (for single side stable type) has been achieved.
3. **Low thermal electromotive force**
   Reducing the heat from the coil enables a thermal electromotive force of 3 μV or less.

TYPICAL APPLICATIONS

This relay will be used for the low level load for measuring instruments or others where a stable contact resistance is required.

ORDERING INFORMATION

ASX 2 ☐ 0 ☐ ☐☐ ☐

Contact arrangement
2: 2 Form C

Operating function
0: Single side stable
1: 1 coil latching
2: 2 coil latching

Type of operation
0: Standard type (B.B.M.)

Terminal shape
Nil: Standard PC board terminal
A: Surface-mount terminal (A type)

Nominal coil voltage (DC)
1H: 1.5V 03: 3V 4H: 4.5V 06: 6V 09: 9V
12: 12V 24: 24V

Packing style
Nil: Tube packing
X: Tape and reel packing (picked from 1/3/4/5 pin side)
Z: Tape and reel packing (picked from 8/9/10/12 pin side)

TYPES

1. Standard PC board terminal

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching
		Part No.	Part No.	Part No.
2 Form C	1.5V DC	ASX2001H	ASX2101H	ASX2201H
	3V DC	ASX20003	ASX21003	ASX22003
	4.5V DC	ASX2004H	ASX2104H	ASX2204H
	6V DC	ASX20006	ASX21006	ASX22006
	9V DC	ASX20009	ASX21009	ASX22009
	12V DC	ASX20012	ASX21012	ASX22012
	24V DC	ASX20024	ASX21024	ASX22024

Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.

2. Surface-mount terminal

1) Tube packing

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching
		Part No.	Part No.	Part No.
2 Form C	1.5V DC	ASX200A1H	ASX210A1H	ASX220A1H
	3V DC	ASX200A03	ASX210A03	ASX220A03
	4.5V DC	ASX200A4H	ASX210A4H	ASX220A4H
	6V DC	ASX200A06	ASX210A06	ASX220A06
	9V DC	ASX200A09	ASX210A09	ASX220A09
	12V DC	ASX200A12	ASX210A12	ASX220A12
	24V DC	ASX200A24	ASX210A24	ASX220A24

Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.

2) Tape and reel packing

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching
		Part No.	Part No.	Part No.
2 Form C	1.5V DC	ASX200A1HZ	ASX210A1HZ	ASX220A1HZ
	3V DC	ASX200A03Z	ASX210A03Z	ASX220A03Z
	4.5V DC	ASX200A4HZ	ASX210A4HZ	ASX220A4HZ
	6V DC	ASX200A06Z	ASX210A06Z	ASX220A06Z
	9V DC	ASX200A09Z	ASX210A09Z	ASX220A09Z
	12V DC	ASX200A12Z	ASX210A12Z	ASX220A12Z
	24V DC	ASX200A24Z	ASX210A24Z	ASX220A24Z

Standard packing: Tape and reel: 500 pcs.; Case: 1,000 pcs.
Note: Tape and reel packing symbol "-Z" is not marked on the relay. "X" type tape and reel packing (picked from 1/3/4/5-pin side) is also available.

RATING

1. Coil data

1) Single side stable type

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC	80%V or less of nominal voltage* (Initial)	10%V or more of nominal voltage* (Initial)	33.3mA	45Ω	50mW	150%V of nominal voltage
3V DC			16.7mA	180Ω		
4.5V DC			11.1mA	405Ω		
6V DC			8.3mA	720Ω		
9V DC			5.6mA	1,620Ω		
12V DC			4.2mA	2,880Ω		
24V DC			2.9mA	8,229Ω	70mW	

2) 1 coil latching type

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC	80%V or less of nominal voltage* (Initial)	80%V or less of nominal voltage* (Initial)	23.3mA	64.3Ω	35mW	150%V of nominal voltage
3V DC			11.7mA	257Ω		
4.5V DC			7.8mA	579Ω		
6V DC			5.8mA	1,029Ω		
9V DC			3.9mA	2,314Ω		
12V DC			2.9mA	4,114Ω		
24V DC			2.1mA	11,520Ω	50mW	

3) 2 coil latching type

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. applied voltage (at 20°C 68°F)
			Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
1.5V DC	80%V or less of nominal voltage* (Initial)	80%V or less of nominal voltage* (Initial)	46.7mA	46.7mA	32.1Ω	32.1Ω	70mW	70mW	150%V of nominal voltage
3V DC			23.3mA	23.3mA	129Ω	129Ω			
4.5V DC			15.6mA	15.6mA	289Ω	289Ω			
6V DC			11.7mA	11.7mA	514Ω	514Ω			
9V DC			7.8mA	7.8mA	1,157Ω	1,157Ω			
12V DC			5.8mA	5.8mA	2,057Ω	2,057Ω			
24V DC			6.3mA	6.3mA	3,840Ω	3,840Ω	150mW	150mW	

*Pulse drive (JIS C 5442-1996)

Signal

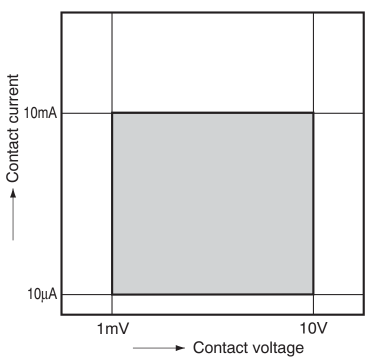
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		2 Form C
	Static contact resistance (During initial and electric life tests)		Max. 100 mΩ (By voltage drop of 20 mV 1 mA [1kHz]) (By nominal switching capacity: No. of operations: 10^7)
	Dynamic contact resistance (During initial and electric life tests)		Max. 1 Ω (By voltage drop of 20 mV 1 mA [1 kHz], Measurement delay 10 ms after applying nominal coil voltage) (By nominal switching capacity: No. of operations: 10^7)
	Contact material		Stationary contact: AgPd+Au clad Movable contact: AgPd
Rating	Nominal switching capacity		10 mA 10 V DC (resistive load)
	Max. switching power		0.1 W (resistive load)
	Max. switching voltage		10 V DC
	Max. switching current		10 mA DC
	Min. switching capacity (Reference value)*1		10 µA 1 mV DC
	Nominal operating power	Single side stable	50mW (1.5 to 12 V DC), 70mW (24 V DC)
		1 coil latching	35mW (1.5 to 12 V DC), 50mW (24 V DC)
		2 coil latching	70mW (1.5 to 12 V DC), 150mW (24 V DC)
Electrical characteristics	Insulation resistance (Initial)		Min. 10,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	750 Vrms for 1min. (Detection current: 10mA)
		Between contact and coil	1,000 Vrms for 1min. (Detection current: 10mA)
		Between contact sets	1,000 Vrms for 1min. (Detection current: 10mA)
	Surge breakdown voltage (Initial)	Between open contacts	1,500 V (10×160µs) (FCC Part 68)
		Between contacts and coil	2,500 V (2×10µs) (Telcordia)
	Temperature rise (at 20°C 68°F)		Max. 50°C (By resistive method, nominal coil voltage applied to the coil; contact carrying current: 10mA.)
	Operate time [Set time] (at 20°C 68°F)		Max. 5 ms [Max. 5 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.)
	Release time [Reset time] (at 20°C 68°F)		Max. 5 ms [Max. 5 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 750 m/s^2 (Half-wave pulse of sine wave: 6 ms; detection time: 10µs.)
		Destructive	Min. 1,000 m/s^2 (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3.3 mm (Detection time: 10µs.)
		Destructive	10 to 55 Hz at double amplitude of 5 mm
Expected life	Mechanical		Min. 5 × 10^7 (at 750 cpm)
	Electrical		Min. 10^7 (10 mA 10 V DC resistive load) (at 750 cpm)
Thermal electromotive force			Max. 3µV (at nominal voltage applied to the coil)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +70°C –40°F to +158°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed (at rated load)		750 cpm
Unit weight			Approx. 2 g .071 oz

*1This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

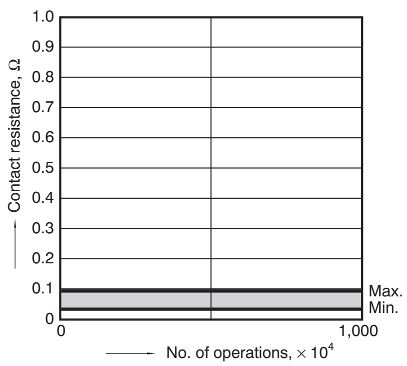
REFERENCE DATA

1. Switching capacity range



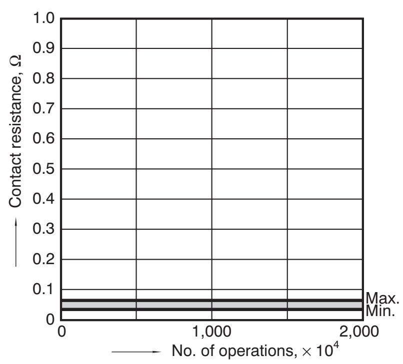
2-(1). Change in dynamic contact resistance (10 mA 10 V DC resistive load)

Tested sample: ASX20012, 10 pcs.
Operating speed: 750 cpm
Measured condition: 10 ms after applying nominal coil voltage, using voltage drop of 20 mV, 1 mA, 1 kHz.

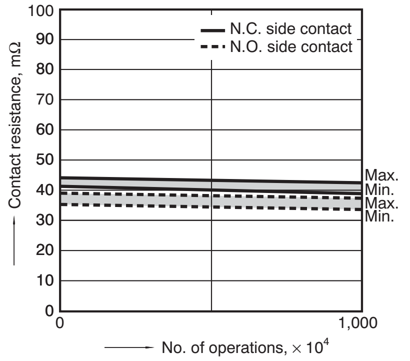


2-(2). Change in dynamic contact resistance (10 µA 1 mV DC resistive load)

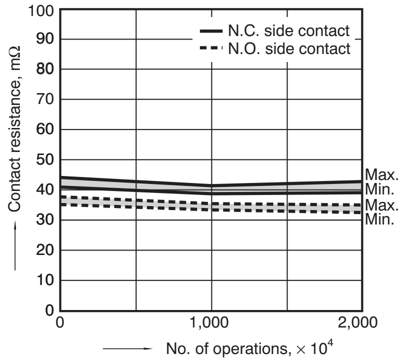
Tested sample: ASX20012, 10 pcs.
Operating speed: 750 cpm
Measured condition: 10 ms after applying nominal coil voltage, using voltage drop of 20 mV, 1 mA, 1 kHz.



3-(1). Change in static contact resistance
(10 mA 10 V DC resistive load)
Tested sample: ASX20012, 10 pcs.
Operating speed: 750 cpm



3-(2). Change in static contact resistance
(10 μA 1 mV DC resistive load)
Tested sample: ASX20012, 10 pcs.
Operating speed: 750 cpm

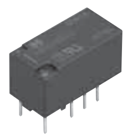


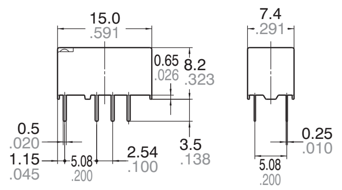
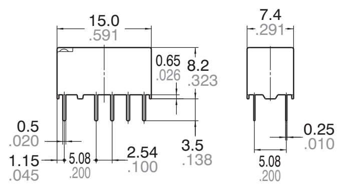
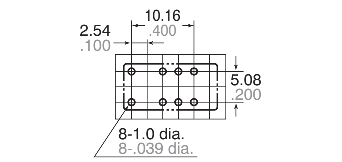
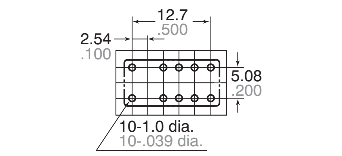
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. Standard PC board terminal

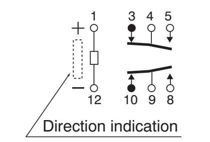
CAD Data



External dimensions (General tolerance: ±0.3 ±.012)		PC board pattern (Tolerance: ±0.1 ±.004)	
Single side stable/1 coil latching	2 coil latching	Single side stable/1 coil latching	2 coil latching
			

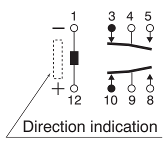
Schematic (Bottom view)

Single side stable



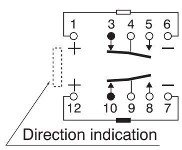
(Deenergized condition)

1 coil latching



(Reset condition)

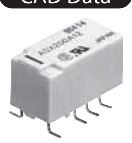
2 coil latching

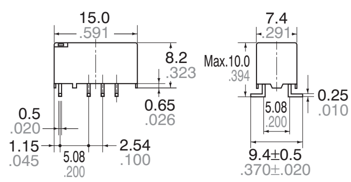
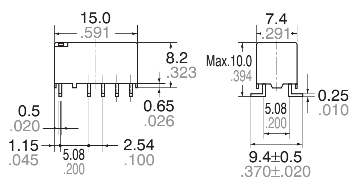
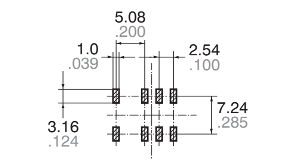
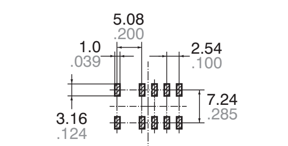


(Reset condition)

2. Surface-mount terminal

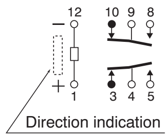
CAD Data



Type	External dimensions (General tolerance: ±0.3 ±.012)		Suggested mounting pad (Tolerance: ±0.1 ±.004)	
	Single side stable/1 coil latching	2 coil latching	Single side stable/1 coil latching	2 coil latching
A type				

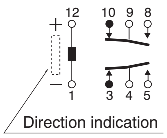
Schematic (Top view)

Single side stable



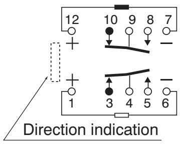
(Deenergized condition)

1 coil latching



(Reset condition)

2 coil latching

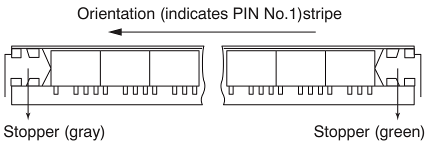


(Reset condition)

NOTES

1. Packing style

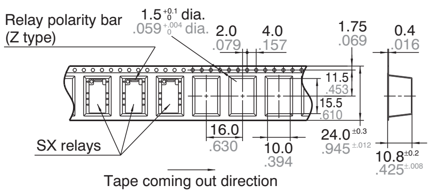
1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.



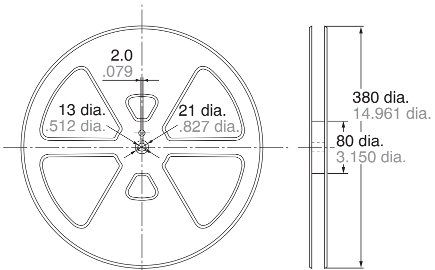
2) Tape and reel packing

(A type)

(1) Tape dimensions mm inch



(2) Dimensions of plastic reel mm inch



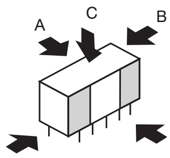
2. Automatic insertion

To maintain the internal function of the relay, the chucking pressure should not exceed the values below.

Chucking pressure in the direction A: 4.9 N {500gf} or less

Chucking pressure in the direction B: 9.8 N {1 kgf} or less

Chucking pressure in the direction C: 9.8 N {1 kgf} or less



Please chuck the ▭ portion.

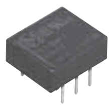
Avoid chucking the center of the relay.

In addition, excessive chucking pressure to the pinpoint of the relay should be avoided.

For Cautions for Use, see Relay Technical Information (page 582).

**4 mm height!
2 A high capacity
1 Form C type ultra thin,
super miniature relay**

TK RELAYS



FEATURES

1. Compact and flat type
10.6(L) × 9.0(W) × 4.0(H) .417(L) × .354(W) × .157(H)

2. High contact capacity: 2 A

3. Outstanding surge resistance
Surge breakdown voltage between contact and coil:
2,500 V 2 × 10 μsec. (Telcordia)
Surge breakdown voltage between open contacts:
1,500 V 10 × 160 μsec. (FCC part 68)

**4. Initial breakdown voltage:
1,500 Vrms for 1 min. (Between contact and coil)**

**5. Nominal operating power:
High sensitivity of 140mW (Single side stable type)**
By using the highly efficient polar magnetic circuit “seesaw balance mechanism”, a nominal operating power of 140 mW (minimum operating power of 79 mW) has been achieved.

6. Outstanding vibration and shock resistance
Functional shock resistance: 750 m/s²
Destructive shock resistance: 1,000 m/s²
Functional vibration resistance: 10 to 55 Hz (at double amplitude of 3.3 mm .130 inch)
Destructive vibration resistance: 10 to 55 Hz (at double amplitude of 5 mm .197 inch)

**7. The use of gold-clad twin crossbar contacts ensures high contact reliability.
*We also offer a range of products with AgPd contacts suitable for use in low level load analog circuits (Max. 10V DC 10 mA).
*SX relays designed for low level loads are also available.**

8. Self-clinching terminal also available

9. Pre-soldering terminal

10. Sealed construction allows automatic washing.

TYPICAL APPLICATIONS

1. Computer peripherals
2. Telephone devices and telecommunications equipment
3. Crime and disaster prevention equipment
4. Machine tools

ORDERING INFORMATION

TK [1] - [ ] - [ ] - [ ]

Contact arrangement
1: 1 Form C

Operating function
Nil: Single side stable
L: 1 coil latching
L2: 2 coil latching

Terminal shape
Nil: Standard PC board terminal
H: Self-clinching terminal

Nominal coil voltage (DC)
1.5, 3, 4.5, 5, 6, 9, 12, 24V

Note: In case of 5 V drive circuit, it is recommended to use 4.5 V type relay.

Signal

TYPES

1) Standard PC board terminal

Contact arrangement	Nominal coil voltage	Single side stable Part No.	1 coil latching Part No.	2 coil latching Part No.
1 Form C	1.5V DC	TK1-1.5V	TK1-L-1.5V	TK1-L2-1.5V
	3V DC	TK1-3V	TK1-L-3V	TK1-L2-3V
	4.5V DC	TK1-4.5V	TK1-L-4.5V	TK1-L2-4.5V
	5V DC	TK1-5V	TK1-L-5V	TK1-L2-5V
	6V DC	TK1-6V	TK1-L-6V	TK1-L2-6V
	9V DC	TK1-9V	TK1-L-9V	TK1-L2-9V
	12V DC	TK1-12V	TK1-L-12V	TK1-L2-12V
	24V DC	TK1-24V	TK1-L-24V	TK1-L2-24V

Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.

2) Self-clinching terminal

Contact arrangement	Nominal coil voltage	Single side stable Part No.	1 coil latching Part No.	2 coil latching Part No.
1 Form C	1.5V DC	TK1-H-1.5V	TK1-L-H-1.5V	TK1-L2-H-1.5V
	3V DC	TK1-H-3V	TK1-L-H-3V	TK1-L2-H-3V
	4.5V DC	TK1-H-4.5V	TK1-L-H-4.5V	TK1-L2-H-4.5V
	5V DC	TK1-H-5V	TK1-L-H-5V	TK1-L2-H-5V
	6V DC	TK1-H-6V	TK1-L-H-6V	TK1-L2-H-6V
	9V DC	TK1-H-9V	TK1-L-H-9V	TK1-L2-H-9V
	12V DC	TK1-H-12V	TK1-L-H-12V	TK1-L2-H-12V
	24V DC	TK1-H-24V	TK1-L-H-24V	TK1-L2-H-24V

Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.

RATING

1. Coil data

1) Single side stable

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC	75%V or less of nominal voltage* (Initial)	10%V or more of nominal voltage* (Initial)	93.8mA	16Ω	140mW	150%V of nominal voltage
3V DC			46.7mA	64.3Ω		
4.5V DC			31mA	145Ω		
5V DC			28.1mA	178Ω		
6V DC			23.3mA	257Ω		
9V DC			15.5mA	579Ω		
12V DC			11.7mA	1,028Ω		
24V DC			11.3mA	2,133Ω	270mW	120%V of nominal voltage

2) 1 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC	75%V or less of nominal voltage* (Initial)	75%V or less of nominal voltage* (Initial)	66.7mA	22.5Ω	100mW	150%V of nominal voltage
3V DC			33.3mA	90Ω		
4.5V DC			22.2mA	202.5Ω		
5V DC			20mA	250Ω		
6V DC			16.7mA	360Ω		
9V DC			11.1mA	810Ω		
12V DC			8.3mA	1,440Ω		
24V DC			6.3mA	3,840Ω	150mW	120%V of nominal voltage

*Pulse drive (JIS C 5442-1986)

3) 2 coil latching

<table>
<tr><th rowspan="2">Nominal coil voltage</th><th rowspan="2">Set voltage
(at 20°C 68°F)</th><th rowspan="2">Reset voltage
(at 20°C 68°F)</th><th colspan="2">Nominal operating current
[±10%] (at 20°C 68°F)</th><th colspan="2">Coil resistance
[±10%] (at 20°C 68°F)</th><th colspan="2">Nominal operating power</th><th rowspan="2">Max. applied voltage
(at 20°C 68°F)</th></tr>
<tr><th>Set coil</th><th>Reset coil</th><th>Set coil</th><th>Reset coil</th><th>Set coil</th><th>Reset coil</th></tr>
<tr><td>1.5V DC</td><td rowspan="8">75%V or less of nominal voltage*
(Initial)</td><td rowspan="8">75%V or less of nominal voltage*
(Initial)</td><td>133.9mA</td><td>133.9mA</td><td>11.2Ω</td><td>11.2Ω</td><td rowspan="6">200mW</td><td rowspan="6">200mW</td><td rowspan="6">150%V of nominal voltage</td></tr>
<tr><td>3V DC</td><td>66.7mA</td><td>66.7mA</td><td>45Ω</td><td>45Ω</td></tr>
<tr><td>4.5V DC</td><td>44.5mA</td><td>44.5mA</td><td>101.2Ω</td><td>101.2Ω</td></tr>
<tr><td>5V DC</td><td>40mA</td><td>40mA</td><td>125Ω</td><td>125Ω</td></tr>
<tr><td>6V DC</td><td>33.3mA</td><td>33.3mA</td><td>180Ω</td><td>180Ω</td></tr>
<tr><td>9V DC</td><td>22.2mA</td><td>22.2mA</td><td>405Ω</td><td>405Ω</td></tr>
<tr><td>12V DC</td><td>20.8mA</td><td>20.8mA</td><td>576Ω</td><td>576Ω</td><td>250mW</td><td>250mW</td><td>120%V of nominal voltage</td></tr>
<tr><td>24V DC</td><td>16.7mA</td><td>16.7mA</td><td>1,440Ω</td><td>1,440Ω</td><td>400mW</td><td>400mW</td><td>110%V of nominal voltage</td></tr>
</table>

*Pulse drive (JIS C 5442-1986)

2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form C
	Initial contact resistance, max.		Max. 50 mΩ (By voltage drop 6 V DC 1A)
	Contact material		Ag+Au clad
Rating	Nominal switching capacity		2 A 30 V DC (resistive load)
	Max. switching power		60 W (DC) (resistive load)
	Max. switching voltage		220 V DC
	Max. switching current		2 A
	Min. switching capacity (Reference value)*1		10μA 10mV DC
	Nominal operating power	Single side stable	140 mW (1.5 to 12 V DC), 270 mW (24 V DC)
		1 coil latching	100 mW (1.5 to 12 V DC), 150 mW (24 V DC)
		2 coil latching	200 mW (1.5 to 9 V DC), 250 mW (12 V DC), 400 mW (24 V DC)
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as "Initial breakdown voltage" section.
	Breakdown voltage (Initial)	Between open contacts	750 Vrms for 1 min. (Detection current: 10 mA)
		Between contact and coil	1,500 Vrms for 1 min. (Detection current: 10 mA)
	Surge breakdown voltage (Initial)	Between open contacts	1,500 V (10×160μs) (FCC Part 68)
		Between contacts and coil	2,500 V (2×10μs) (Telcordia)
	Temperature rise (at 20°C 68°F)		Max. 50°C (By resistive method, nominal coil voltage applied to the coil; contact carrying current: 2A.)
	Operate time [Set time] (at 20°C 68°F)		Max. 3 ms [Max. 3 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.)
	Release time [Reset time] (at 20°C 68°F)		Max. 2 ms [Max. 3 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 750 m/s² (Half-wave pulse of sine wave: 6 ms; detection time: 10μs.)
		Destructive	Min. 1,000 m/s² (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3.3 mm (Detection time: 10μs.)
		Destructive	10 to 55 Hz at double amplitude of 5 mm
Expected life	Mechanical		Min. 10^8 (Single side stable), Min. 5×10^7 (1 or 2 coil latching) (at 180 cpm)
	Electrical		Min. 10^5 (2 A 30 V DC resistive) (at 20 cpm)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to 85°C –40°F to 185°F*3; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed (at rated load)		20 cpm
Unit weight			Approx. 1 g .035 oz.

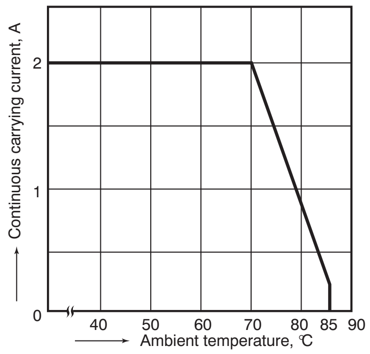
*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10V DC, 10mA max. level])
*2Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

*3 The maximum ambient temperature allows for coil temperature rise at maximum allowable coil voltage.
As for the applicable range of continuous carrying current against temperature, please refer to "Maximum value of continuous carrying current" chart. (Page 79)

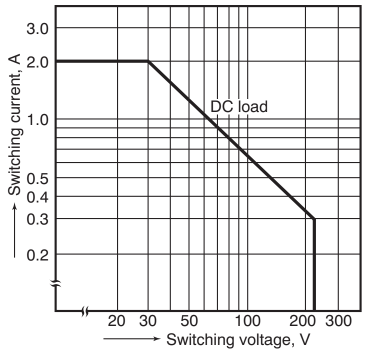
REFERENCE DATA

1. Maximum value of continuous carrying current

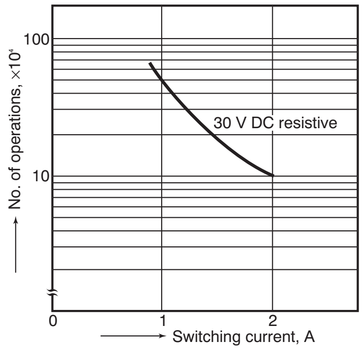
Test conditions:
Coil applied voltage: 110% of rated voltage
Continuous carrying current: 1,000 hours



2. Maximum switching capacity

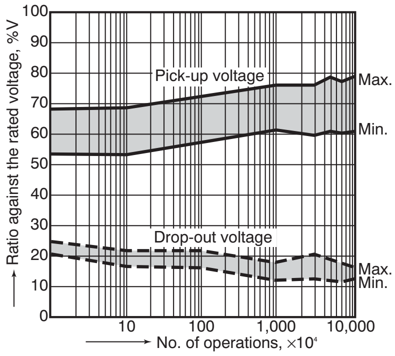


3. Life curve



4. Mechanical life

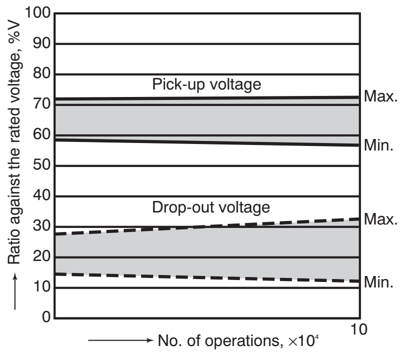
Tested sample: TK1-12V, 8 pcs.
Switching frequency: 30 Hz



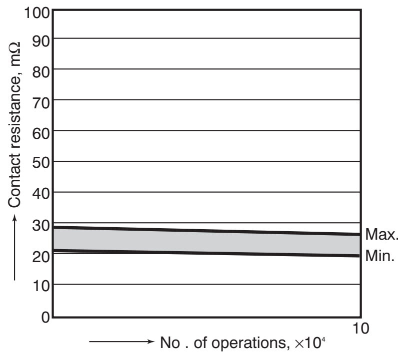
5. Electrical life (DC load)

Tested sample: TK1-12V, 10 pcs.
Condition: 2 A 30 V DC resistive load, 20 cpm

Change of pick-up and drop-out voltage

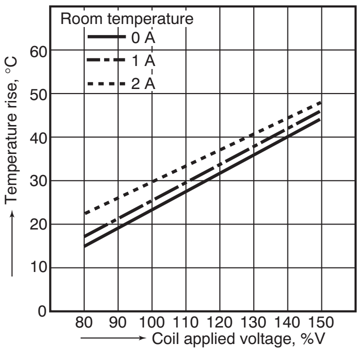


Change of contact resistance



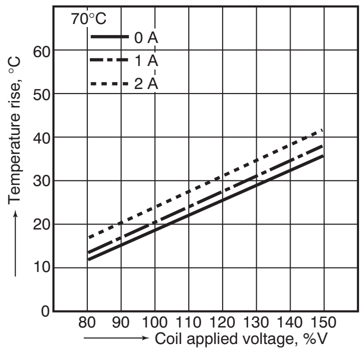
6.-(1) Coil temperature rise

Tested sample: TK1-12V, 6 pcs.
Measured portion: Inside the coil
Ambient temperature: 25°C 77°F



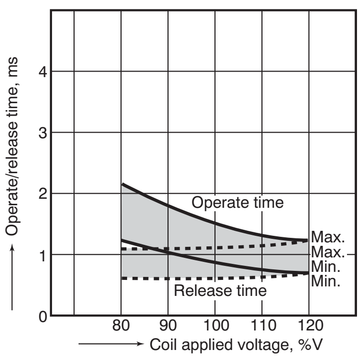
6.-(2) Coil temperature rise

Tested sample: TK1-12V, 6 pcs.
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



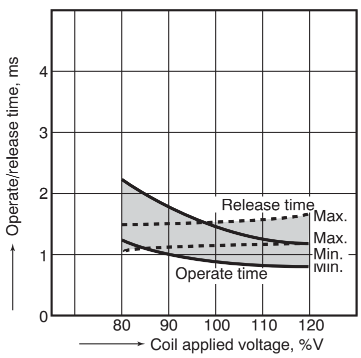
7.-(1) Operate/release time characteristics

Tested sample: TK1-5 V, 50 pcs.
<Without diode>



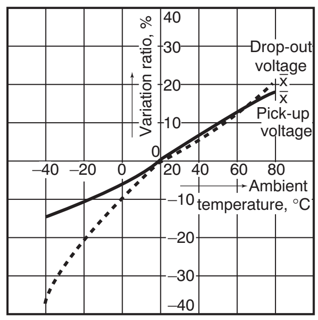
7.-(2) Operate/release time characteristics

Tested sample: TK1-5 V, 50 pcs.
<With diode>

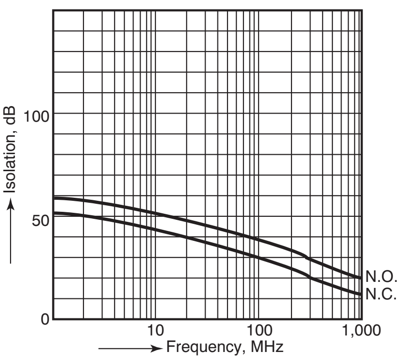


8. Ambient temperature characteristics

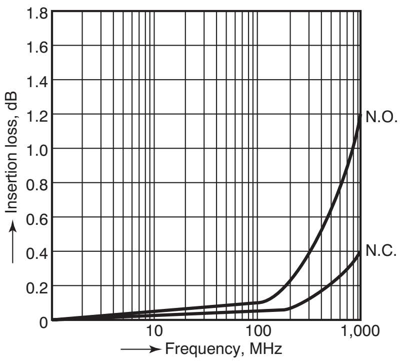
Tested sample: TK1-12V, 5 pcs.



9.-(1) High-frequency characteristics (Isolation)

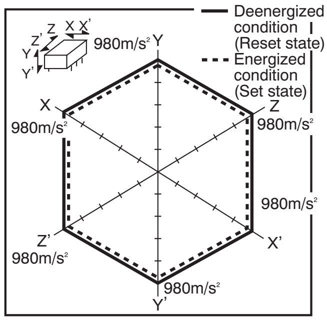


9.-(2) High-frequency characteristics (Insertion loss)

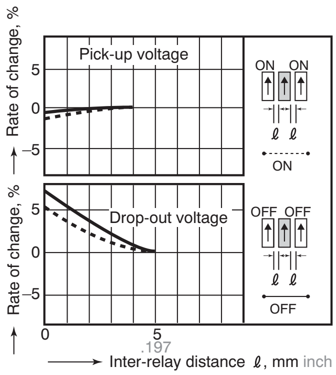


10. Malfunctional shock

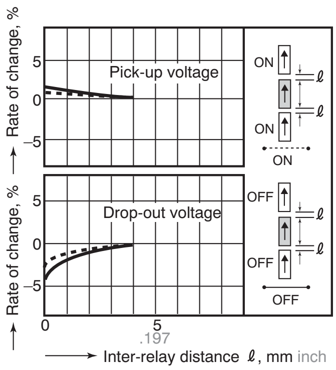
Tested sample: TK1-12V, 6 pcs. (single side stable); TK1-L2-12V, 6 pcs. (latching)



11.-(1) Influence of adjacent mounting

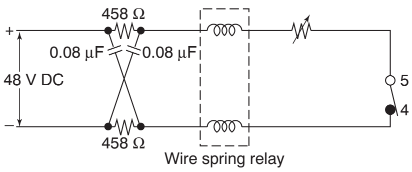


11.-(2) Influence of adjacent mounting

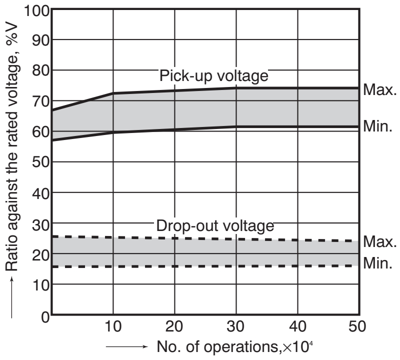


12. Actual load test (35 mA 48 V DC wire spring relay load)

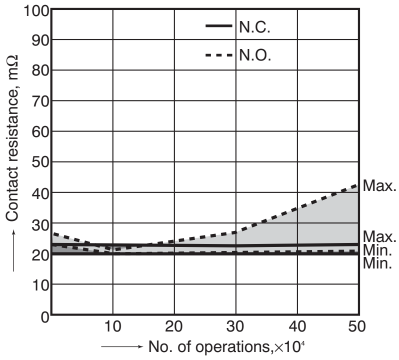
Circuit



Change of pick-up and drop-out voltage



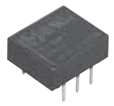
Change of contact resistance



DIMENSIONS (mm inch)

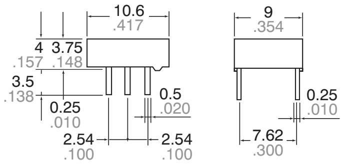
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data

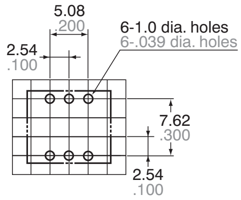


External dimensions

Standard PC board terminal

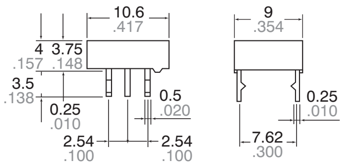


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

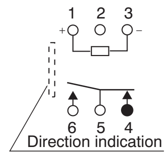
Self-clinching terminal



General tolerance: ±0.3 ±.012

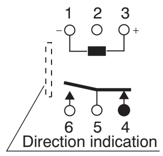
Schematic (Bottom view)

Single side stable



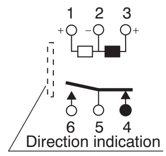
(Deenergized condition)

1-coil latching



(Reset condition)

2-coil latching

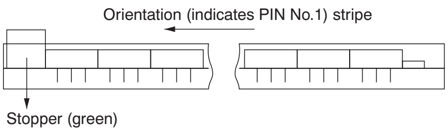


(Reset condition)

NOTES

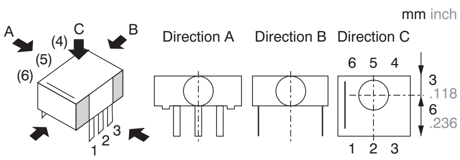
1. Packing style

The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.



2. Automatic insertion

To maintain the internal function of the relay, the chucking pressure should not exceed the values below.
Chucking pressure in the direction A:
9.8 N {1 kgf} or less
Chucking pressure in the direction B:
29.4 N {3 kgf} or less
Chucking pressure in the direction C:
9.8 N {1 kgf} or less



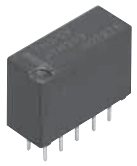
Please chuck the portion.
Avoid chucking the center of the relay.
In addition, excessive chucking pressure to the pinpoint of the relay should be avoided.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

Space reduction down to footprint of 5.6 mm × 14 mm² realized

TN RELAYS



FEATURES

1. **2 Form C Slim type**
   14.0(L) × 9.0(W) × 5.0(H) .551(L) × .354(W) × .197(H)
   Small header area makes higher density mounting possible
2. **Nominal operating power:**
   High sensitivity of 140mW (Single side stable type)
   By using the highly efficient polar magnetic circuit "seesaw balance mechanism", a nominal operating power of 140 mW (minimum operating power of 79 mW) has been achieved.
3. **Surge breakdown voltage:**
   1500 V FCC Part 68
4. **Outstanding vibration and shock resistance**
   Functional shock resistance: 490 m/s²
   Destructive shock resistance: 980 m/s²
   Functional vibration resistance:
   10 to 55 Hz (at double amplitude of 3 mm .118 inch)
   Destructive vibration resistance:
   10 to 55 Hz (at double amplitude of 5 mm .197 inch)
5. **High density mounting possible**
   High-efficiency magnetic circuits ensure low magnetic flux leakage. Because characteristics are little changed by proximity mounting, high-density mounting is possible.
6. **The use of gold-clad twin crossbar contacts ensures high contact reliability.**
   ***We also offer a range of products with AgPd contacts suitable for use in low level load analog circuits (Max. 10V DC 10 mA).**
   ***SX relays designed for low level loads are also available.**
7. **Low thermal electromotive force**
   As well as low power consumption of 140 mW, use of a structure with separate coil and contact sections has reduced thermal electromotive force to the low level of approximately 5 μV.
8. **Latching types also available.**
9. **Self-clinching terminal also available.**
10. **Sealed construction allows automatic washing.**

TYPICAL APPLICATIONS

- **Communications**
- **Measurement equipment**
- **OA equipment**
- **Industrial machines**

ORDERING INFORMATION

TN 2 - ☐ - ☐ - ☐

Contact arrangement
2: 2 Form C

Operating function
Nil: Single side stable
L: 1 coil latching
L2: 2 coil latching

Terminal shape
Nil: Standard PC board terminal
H: Self-clinching terminal

Nominal coil voltage (DC)*
3, 4.5, 5, 6, 9, 12, 24, 48V

Notes: 1. *48 V coil type: Single side stable only
2. In case of 5 V drive circuit, it is recommended to use 4.5 V type relay.

Signal

TYPES

1. Standard PC board terminal

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching
		Part No.	Part No.	Part No.
2 Form C	3V DC	TN2-3V	TN2-L-3V	TN2-L2-3V
	4.5V DC	TN2-4.5V	TN2-L-4.5V	TN2-L2-4.5V
	5V DC	TN2-5V	TN2-L-5V	TN2-L2-5V
	6V DC	TN2-6V	TN2-L-6V	TN2-L2-6V
	9V DC	TN2-9V	TN2-L-9V	TN2-L2-9V
	12V DC	TN2-12V	TN2-L-12V	TN2-L2-12V
	24V DC	TN2-24V	TN2-L-24V	TN2-L2-24V
	48V DC	TN2-48V	—	—

Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.

2. Self-clinching terminal

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching
		Part No.	Part No.	Part No.
2 Form C	3V DC	TN2-H-3V	TN2-L-H-3V	TN2-L2-H-3V
	4.5V DC	TN2-H-4.5V	TN2-L-H-4.5V	TN2-L2-H-4.5V
	5V DC	TN2-H-5V	TN2-L-H-5V	TN2-L2-H-5V
	6V DC	TN2-H-6V	TN2-L-H-6V	TN2-L2-H-6V
	9V DC	TN2-H-9V	TN2-L-H-9V	TN2-L2-H-9V
	12V DC	TN2-H-12V	TN2-L-H-12V	TN2-L2-H-12V
	24V DC	TN2-H-24V	TN2-L-H-24V	TN2-L2-H-24V
	48V DC	TN2-H-48V	—	—

Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.
Note: Types (“-3” to the end of part No.) designed to withstand strong vibration caused, for example, by the use of terminal cutters, can also be ordered.
However, please contact us if you need parts for use in low level load and low thermal power.

RATING

1. Coil data

1) Single side stable

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
3V DC	75%V or less of nominal voltage* (Initial)	10%V or more of nominal voltage* (Initial)	46.7mA	64.3Ω	140mW	150%V of nominal voltage
4.5V DC			31.1mA	145Ω		
5V DC			28.1mA	178Ω		
6V DC			23.3mA	257Ω		
9V DC			15.5mA	579Ω		
12V DC			11.7mA	1,028Ω		
24V DC			8.3mA	2,880Ω	200mW	
48V DC			6.25mA	7,680Ω	300mW	120%V of nominal voltage

2) 1 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
3V DC	75%V or less of nominal voltage* (Initial)	75%V or less of nominal voltage* (Initial)	33.3mA	90Ω	100mW	150%V of nominal voltage
4.5V DC			22.2mA	202.5Ω		
5V DC			20mA	250Ω		
6V DC			16.7mA	360Ω		
9V DC			11.1mA	810Ω		
12V DC			8.3mA	1,440Ω		
24V DC			6.3mA	3,840Ω	150mW	

3) 2 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. applied voltage (at 20°C 68°F)
			Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
3V DC	75%V or less of nominal voltage* (Initial)	75%V or less of nominal voltage* (Initial)	66.7mA	66.7mA	45Ω	45Ω	200mW	200mW	150%V of nominal voltage
4.5V DC			44.4mA	44.4mA	101.2Ω	101.2Ω			
5V DC			40mA	40mA	125Ω	125Ω			
6V DC			33.3mA	33.3mA	180Ω	180Ω			
9V DC			22.2mA	22.2mA	405Ω	405Ω			
12V DC			16.7mA	16.7mA	720Ω	720Ω			
24V DC			12.5mA	12.5mA	1,920Ω	1,920Ω	300mW	300mW	120%V of nominal voltage

*Pulse drive (JIS C 5442-1986)

2. Specifications

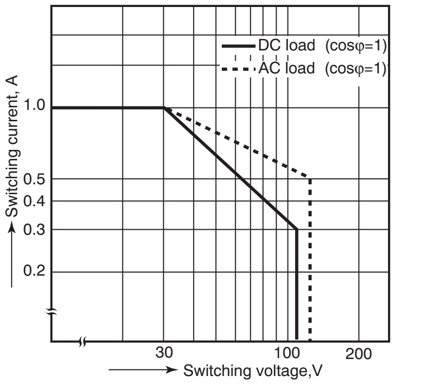
Characteristics	Item		Specifications
Contact	Arrangement		2 Form C
	Initial contact resistance, max.		Max. 60 mΩ (By voltage drop 6 V DC 1A)
	Contact material		Ag+Au clad
Rating	Nominal switching capacity		1 A 30 V DC, 0.5 A 125 V AC (resistive load)
	Max. switching power		30 W (DC), 62.5 VA (AC) (resistive load)
	Max. switching voltage		110 V DC,125 V AC
	Max. switching current		1 A
	Min. switching capacity (Reference value)*1		10μA 10mV DC
	Nominal operating power	Single side stable	140 mW (3 to 12 V DC), 200 mW (24 V DC), 300 mW (48 V DC)
		1 coil latching	100 mW (3 to 12 V DC), 150 mW (24 V DC)
		2 coil latching	200 mW (3 to 12 V DC), 300 mW (24 V DC)
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	750 Vrms for 1 min. (Detection current: 10 mA)
		Between contact and coil	1,000 Vrms for 1 min. (Detection current: 10 mA)
		Between contact sets	1,000 Vrms for 1 min. (Detection current: 10 mA)
	Surge breakdown voltage (Initial)	Between open contacts	1,500 V (10×160μs) (FCC Part 68)
	Temperature rise (at 20°C 68°F)		Max. 50°C (By resistive method, nominal coil voltage applied to the coil; contact carrying current: 1A.)
	Operate time [Set time] (at 20°C 68°F)		Max. 3 ms [Max. 3 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.)
	Release time [Reset time] (at 20°C 68°F)		Max. 3 ms [Max. 3 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 490 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3 mm (Detection time: 10μs.)
		Destructive	10 to 55 Hz at double amplitude of 5 mm
Expected life	Mechanical		Min. 10^8 (at 180 cpm)
	Electrical		Min. 2×10^5 (1 A 30 V DC resistive), Min. 10^5 (0.5 A 125 V AC resistive) (at 20 cpm)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to 70°C –40°F to 158°F; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed (at rated load)		20 cpm
Unit weight			Approx. 1.5 g .053 oz

*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10V DC, 10mA max. level])

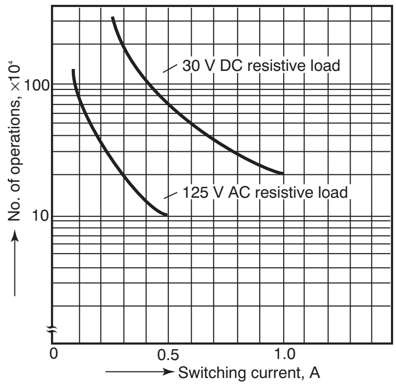
*2Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

1. Maximum switching capacity

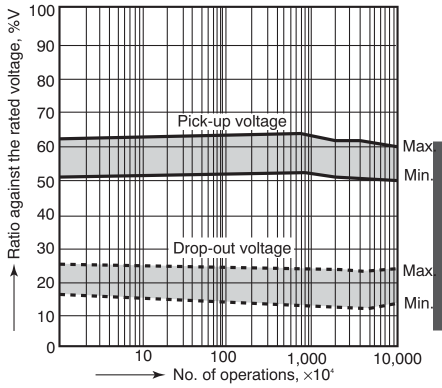


2. Life curve



3. Mechanical life

Tested sample: TN2-12V, 10 pcs.

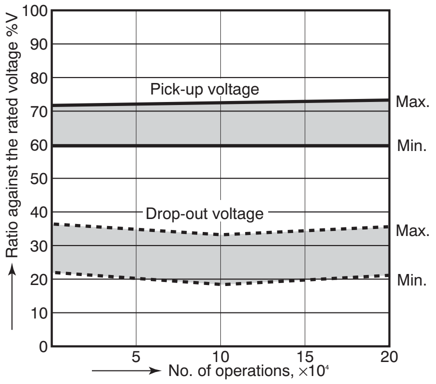


4. Electrical life (DC load)

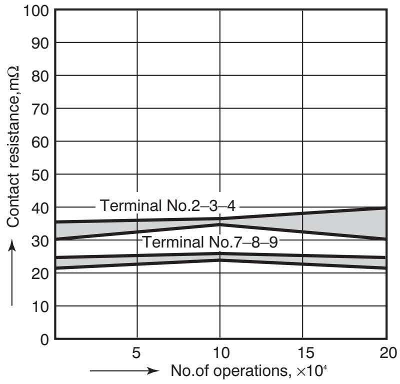
Tested sample: TN2-12V, 10 pcs.

Condition: 1 A 30 V DC resistive load, 20 cpm

Change of pick-up and drop-out voltage



Change of contact resistance

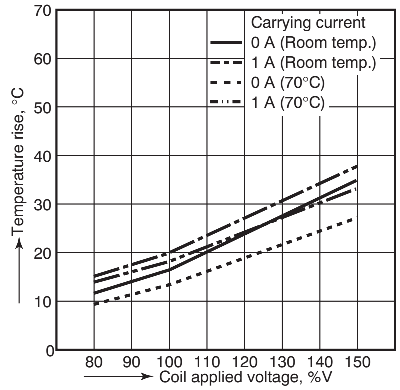


5. Coil temperature rise

Tested sample: TN2-12V

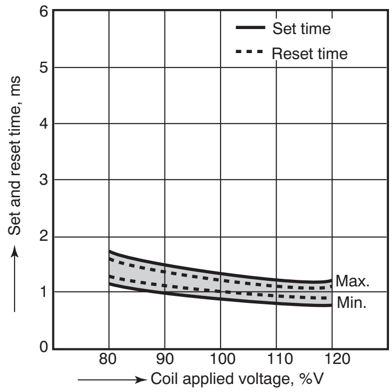
Point measured: Inside the coil

Ambient temperature: Room temperature (25° to 26°C), 70°C (77° to 79°F), 158°F



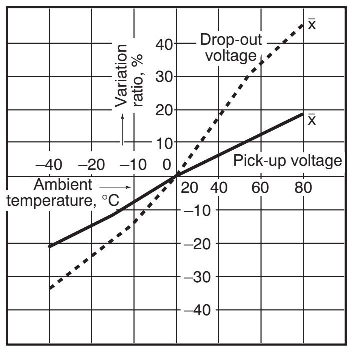
6. Set/reset time characteristics

Tested sample: TN2-L2-12V, 5 pcs.



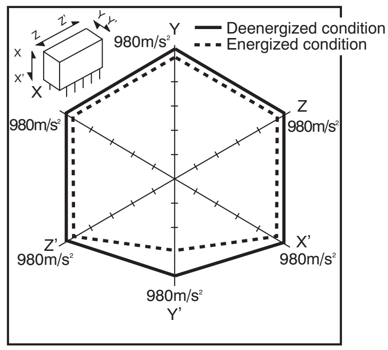
7. Ambient temperature characteristics

Tested sample: TN2-12V, 5 pcs.



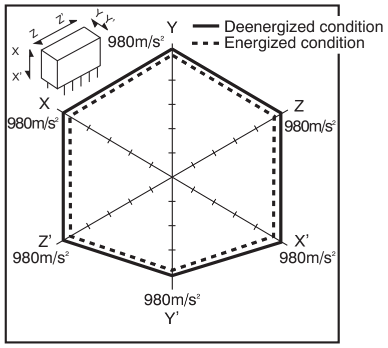
8-(1). Malfunctional shock (single side stable)

Tested sample: TN2-12V, 6 pcs.

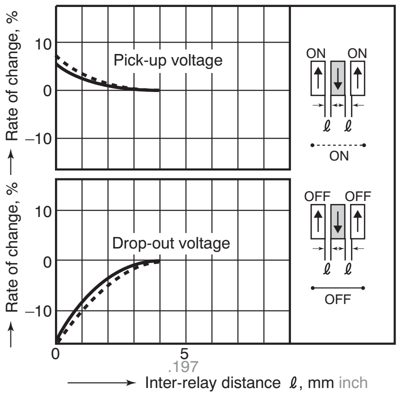


8-(2). Malfunctional shock (latching)

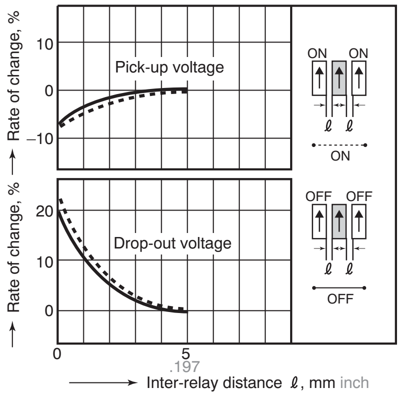
Tested sample: TN2-L2-12V, 6 pcs.



9-(1). Influence of adjacent mounting

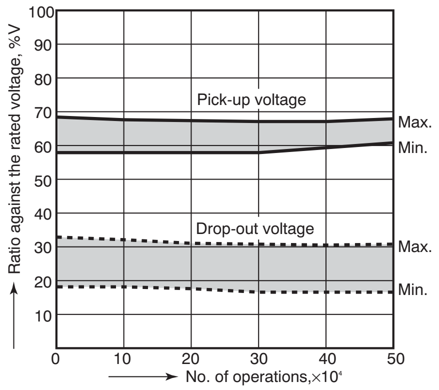


9-(2). Influence of adjacent mounting

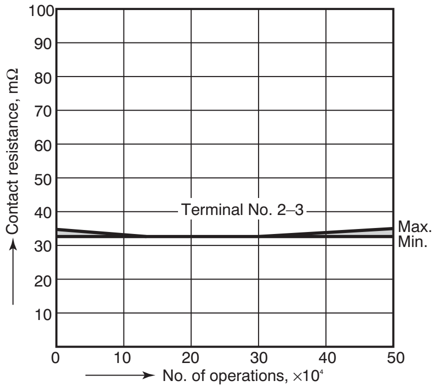


10. Actual load test (35 mA 48 V DC wire spring relay load)
Tested sample: TN2-12V, 5 pcs.

Change of pick-up and drop-out voltage



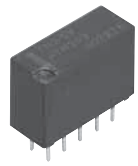
Change of contact resistance



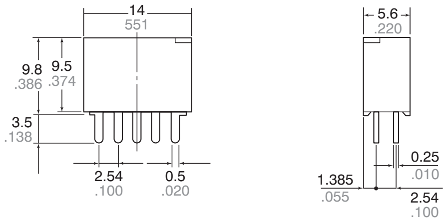
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

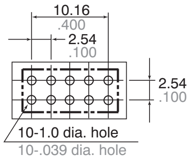
CAD Data



External dimensions
Standard PC board terminal

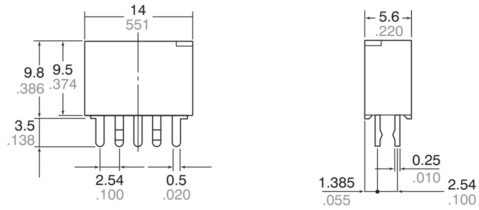


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

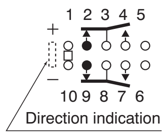
Self-clinching terminal



General tolerance: ±0.3 ±.012

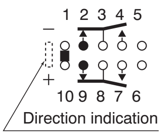
Schematic (Bottom view)

Single side stable



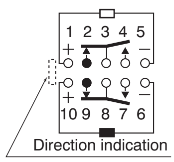
(Deenergized condition)

1-coil latching



(Reset condition)

2-coil latching

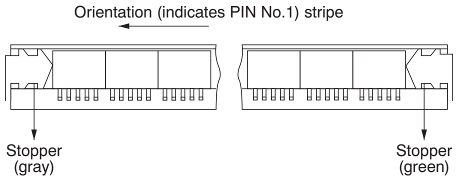


(Reset condition)

NOTES

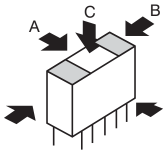
1. Packing style

The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.



2. Automatic insertion

To maintain the internal function of the relay, the chucking pressure should not exceed the values below.
Chucking pressure in the direction A:
9.8 N {1 kgf} or less
Chucking pressure in the direction B:
9.8 N {1 kgf} or less
Chucking pressure in the direction C:
4.9 N {500gf} or less



Please chuck the ▭ portion.

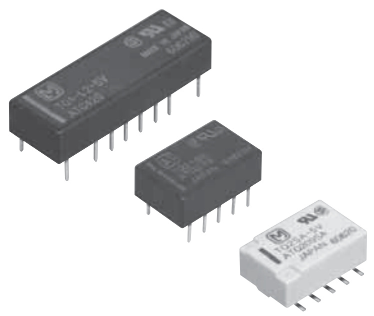
Avoid chucking the center of the relay. In addition, excessive chucking pressure to the pinpoint of the relay should be avoided.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

Leading the market, our 5 mm 2-pole surface mount relays comply with JIS C0806

TQ RELAYS



FEATURES

1. Flat compact size
14.0(L) × 9.0(W) × 5.0(H) .551(L) × .354(W) × .197(H)

2. Nominal operating power:
High sensitivity of 140mW (2 Form C single side stable type)
By using the highly efficient polar magnetic circuit “seesaw balance mechanism”, a nominal operating power of 140 mW (minimum operating power of 79 mW) has been achieved (4 Form C single side stable type is 280 mW).

3. Suitable for SMD automatic insertion (SA type)
With a height of 5.6 mm .220 inch, the relays meet JIS C 0806 specifications.

4. High density mounting possible
High-efficiency magnetic circuits ensure low magnetic flux leakage. Because characteristics are little changed by proximity mounting, high-density mounting is possible.

5. The use of gold-clad twin crossbar contacts ensures high contact reliability.

6. DIL terminal array enables use of IC sockets.

7. Low thermal electromotive force
As well as low power consumption of 140 mW, use of a structure with separate coil and contact sections has reduced thermal electromotive force to the low level of approximately 5 μV. Surface mount types achieve approximately 2 μV.

8. Latching types also available

9. Self-clinching terminal also available

10. A range of surface-mount types also available
SA: Low-profile surface-mount terminal type
SL: High connection reliability surface-mount terminal type
SS: Space saving surface-mount terminal type

11. M.B.B. contact types available

TYPICAL APPLICATIONS

1. Communications
2. Measurement equipment
3. OA equipment
4. Industrial machines

ORDERING INFORMATION

TQ [2] [ ] - [ ] - [ ] - [ ] - [ ]

Contact arrangement
2: 2 Form C
4: 4 Form C

Terminal shape
Nil: Standard PC board terminal
H: Self-clinching terminal
SA: SA type
SL: SL type
SS: SS type

Operating function
Nil: Single side stable
L: 1 coil latching
L2: 2 coil latching

MBB function
Nil: Standard (B.B.M.) type
2M: 2M.B.B. type

Nominal coil voltage (DC)*
1.5 (SMD only), 3, 4.5, 5, 6, 9, 12, 24, 48V

Packing style
Nil: Tube packing
X: Tape and reel (picked from 1/2/3/4/5-pin side)
Z: Tape and reel packing (picked from the 6/7/8/9/10-pin side)

Notes: 1. *48 V coil type: Single side stable only
2. In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

TYPES

■ Standard PC board terminal and self-clinching terminal

1. Standard (B.B.M.) type

1) Standard PC board terminal

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching
		Part No.	Part No.	Part No.
2 Form C	3V DC	TQ2-3V	TQ2-L-3V	TQ2-L2-3V
	4.5V DC	TQ2-4.5V	TQ2-L-4.5V	TQ2-L2-4.5V
	5V DC	TQ2-5V	TQ2-L-5V	TQ2-L2-5V
	6V DC	TQ2-6V	TQ2-L-6V	TQ2-L2-6V
	9V DC	TQ2-9V	TQ2-L-9V	TQ2-L2-9V
	12V DC	TQ2-12V	TQ2-L-12V	TQ2-L2-12V
	24V DC	TQ2-24V	TQ2-L-24V	TQ2-L2-24V
	48V DC	TQ2-48V	—	—
4 Form C	3V DC	TQ4-3V	TQ4-L-3V	TQ4-L2-3V
	4.5V DC	TQ4-4.5V	TQ4-L-4.5V	TQ4-L2-4.5V
	5V DC	TQ4-5V	TQ4-L-5V	TQ4-L2-5V
	6V DC	TQ4-6V	TQ4-L-6V	TQ4-L2-6V
	9V DC	TQ4-9V	TQ4-L-9V	TQ4-L2-9V
	12V DC	TQ4-12V	TQ4-L-12V	TQ4-L2-12V
	24V DC	TQ4-24V	TQ4-L-24V	TQ4-L2-24V
	48V DC	TQ4-48V	—	—

Standard packing (2 Form C): Tube: 50 pcs.; Case: 1,000 pcs.
Standard packing (4 Form C): Tube: 25 pcs.; Case: 500 pcs.

2) Self-clinching terminal

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching
		Part No.	Part No.	Part No.
2 Form C	3V DC	TQ2H-3V	TQ2H-L-3V	TQ2H-L2-3V
	4.5V DC	TQ2H-4.5V	TQ2H-L-4.5V	TQ2H-L2-4.5V
	5V DC	TQ2H-5V	TQ2H-L-5V	TQ2H-L2-5V
	6V DC	TQ2H-6V	TQ2H-L-6V	TQ2H-L2-6V
	9V DC	TQ2H-9V	TQ2H-L-9V	TQ2H-L2-9V
	12V DC	TQ2H-12V	TQ2H-L-12V	TQ2H-L2-12V
	24V DC	TQ2H-24V	TQ2H-L-24V	TQ2H-L2-24V
	48V DC	TQ2H-48V	—	—
4 Form C	3V DC	TQ4H-3V	TQ4H-L-3V	TQ4H-L2-3V
	4.5V DC	TQ4H-4.5V	TQ4H-L-4.5V	TQ4H-L2-4.5V
	5V DC	TQ4H-5V	TQ4H-L-5V	TQ4H-L2-5V
	6V DC	TQ4H-6V	TQ4H-L-6V	TQ4H-L2-6V
	9V DC	TQ4H-9V	TQ4H-L-9V	TQ4H-L2-9V
	12V DC	TQ4H-12V	TQ4H-L-12V	TQ4H-L2-12V
	24V DC	TQ4H-24V	TQ4H-L-24V	TQ4H-L2-24V
	48V DC	TQ4H-48V	—	—

Note: Types (“-3” to the end of part No.) designed to withstand strong vibration caused, for example, by the use of terminal cutters, can also be ordered.
However, please contact us if you need parts for use in low level load.

2. M.B.B. type

1) Standard PC board terminal

Contact arrangement	Nominal coil voltage	Single side stable
		Part No.
2 Form C	3V DC	TQ2-2M-3V
	4.5V DC	TQ2-2M-4.5V
	5V DC	TQ2-2M-5V
	6V DC	TQ2-2M-6V
	9V DC	TQ2-2M-9V
	12V DC	TQ2-2M-12V
	24V DC	TQ2-2M-24V

Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.

2) Self-clinching terminal

Contact arrangement	Nominal coil voltage	Single side stable
		Part No.
2 Form C	3V DC	TQ2H-2M-3V
	4.5V DC	TQ2H-2M-4.5V
	5V DC	TQ2H-2M-5V
	6V DC	TQ2H-2M-6V
	9V DC	TQ2H-2M-9V
	12V DC	TQ2H-2M-12V
	24V DC	TQ2H-2M-24V

Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.
Notes: 1. Latching types are available by request. Please consult us for details.
2. UL/CSA approved (UL file No.:E 43149, CSA file No.: LR26550)
3. Types (“-1” to the end of part No.) designed to withstand strong vibration caused, for example, by the use of terminal cutters, can also be ordered. However, please contact us if you need parts for use in low level load and low thermal power.

■ Surface-mount terminal

1) Tube packing

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching
		Part No.	Part No.	Part No.
2c	1.5V DC	TQ2S❑-1.5V	TQ2S❑-L-1.5V	TQ2S❑-L2-1.5V
	3V DC	TQ2S❑-3V	TQ2S❑-L-3V	TQ2S❑-L2-3V
	4.5V DC	TQ2S❑-4.5V	TQ2S❑-L-4.5V	TQ2S❑-L2-4.5V
	5V DC	TQ2S❑-5V	TQ2S❑-L-5V	TQ2S❑-L2-5V
	6V DC	TQ2S❑-6V	TQ2S❑-L-6V	TQ2S❑-L2-6V
	9V DC	TQ2S❑-9V	TQ2S❑-L-9V	TQ2S❑-L2-9V
	12V DC	TQ2S❑-12V	TQ2S❑-L-12V	TQ2S❑-L2-12V
	24V DC	TQ2S❑-24V	TQ2S❑-L-24V	TQ2S❑-L2-24V
	48V DC	TQ2S❑-48V	—	—

❑: For each surface-mounted terminal identification, input the following letter. SA type: A, SL type: L, SS type: S
Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.

2) Tape and reel packing

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching
		Part No.	Part No.	Part No.
2 Form C	1.5V DC	TQ2S❑-1.5V-Z	TQ2S❑-L-1.5V-Z	TQ2S❑-L2-1.5V-Z
	3V DC	TQ2S❑-3V-Z	TQ2S❑-L-3V-Z	TQ2S❑-L2-3V-Z
	4.5V DC	TQ2S❑-4.5V-Z	TQ2S❑-L-4.5V-Z	TQ2S❑-L2-4.5V-Z
	5V DC	TQ2S❑-5V-Z	TQ2S❑-L-5V-Z	TQ2S❑-L2-5V-Z
	6V DC	TQ2S❑-6V-Z	TQ2S❑-L-6V-Z	TQ2S❑-L2-6V-Z
	9V DC	TQ2S❑-9V-Z	TQ2S❑-L-9V-Z	TQ2S❑-L2-9V-Z
	12V DC	TQ2S❑-12V-Z	TQ2S❑-L-12V-Z	TQ2S❑-L2-12V-Z
	24V DC	TQ2S❑-24V-Z	TQ2S❑-L-24V-Z	TQ2S❑-L2-24V-Z
	48V DC	TQ2S❑-48V-Z	—	—

❑: For each surface-mounted terminal identification, input the following letter. SA type: A, SL type: L, SS type: S
Standard packing: Tape and reel: 500 pcs.; Case: 1,000 pcs.
Note: Tape and reel packing symbol “-Z” is not marked on the relay. “X” type tape and reel packing (picked from 1/2/3/4-pin side) is also available.

RATING

■ Standard PC board terminal and self-clinching terminal

1. Coil data

[Standard (B.B.M.) type]

1) Single side stable (2 Form C)

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
3V DC	75%V or less of nominal voltage* (Initial)	10%V or more of nominal voltage* (Initial)	46.7mA	64.3Ω	140mW	150%V of nominal voltage
4.5V DC			31.1mA	144.6Ω		
5V DC			28.1mA	178Ω		
6V DC			23.3mA	257Ω		
9V DC			15.5mA	579Ω		
12V DC			11.7mA	1,028Ω		
24V DC			8.3mA	2,880Ω	200mW	
48V DC			6.25mA	7,680Ω	300mW	120%V of nominal voltage

2) 1 coil latching (2 Form C)

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
3V DC	75%V or less of nominal voltage* (Initial)	75%V or less of nominal voltage* (Initial)	33.3mA	90Ω	100mW	150%V of nominal voltage
4.5V DC			22.2mA	202.5Ω		
5V DC			20mA	250Ω		
6V DC			16.7mA	360Ω		
9V DC			11.1mA	810Ω		
12V DC			8.3mA	1,440Ω		
24V DC			6.3mA	3,840Ω	150mW	

3) 2 coil latching (2 Form C)

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. applied voltage (at 20°C 68°F)
			Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
3V DC	75%V or less of nominal voltage* (Initial)	75%V or less of nominal voltage* (Initial)	66.7mA	66.7mA	45Ω	45Ω	200mW	200mW	150%V of nominal voltage
4.5V DC			44.4mA	44.4mA	101.2Ω	101.2Ω			
5V DC			40mA	40mA	125Ω	125Ω			
6V DC			33.3mA	33.3mA	180Ω	180Ω			
9V DC			22.2mA	22.2mA	405Ω	405Ω			
12V DC			16.7mA	16.7mA	720Ω	720Ω			
24V DC			12.5mA	12.5mA	1,920Ω	1,920Ω	300mW	300mW	120%V of nominal voltage

4) Single side stable (4 Form C)

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
3V DC	75%V or less of nominal voltage* (Initial)	10%V or more of nominal voltage* (Initial)	93.8mA	32Ω	280mW	150%V of nominal voltage
4.5V DC			62.2mA	72.3Ω		
5V DC			56.2mA	89Ω		
6V DC			46.5mA	129Ω		
9V DC			31.1mA	289Ω		
12V DC			23.3mA	514Ω		
24V DC			11.7mA	2,056Ω		
48V DC			8.3mA	5,760Ω	400mW	120%V of nominal voltage

5) 1 coil latching (4 Form C)

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
3V DC	75%V or less of nominal voltage* (Initial)	75%V or less of nominal voltage* (Initial)	66.6mA	45Ω	200mW	150%V of nominal voltage
4.5V DC			44.4mA	101.2Ω		
5V DC			40mA	125Ω		
6V DC			33.3mA	180Ω		
9V DC			22.2mA	405Ω		
12V DC			16.7mA	720Ω		
24V DC			8.3mA	2,880Ω		

6) 2 coil latching (4 Form C)

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. applied voltage (at 20°C 68°F)
			Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
3V DC	75%V or less of nominal voltage* (Initial)	75%V or less of nominal voltage* (Initial)	133mA	133mA	22.5Ω	22.5Ω	400mW	400mW	150%V of nominal voltage
4.5V DC			88.9mA	88.9mA	50.6Ω	50.6Ω			
5V DC			80mA	80mA	62.5Ω	62.5Ω			
6V DC			66.6mA	66.6mA	90Ω	90Ω			
9V DC			44.4mA	44.4mA	202.5Ω	202.5Ω			
12V DC			33.3mA	33.3mA	360Ω	360Ω			
24V DC			16.7mA	16.7mA	1,440Ω	1,440Ω			

*Pulse drive (JIS C 5442-1986)

[M.B.B. type]

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
3V DC	80%V or less of nominal voltage* (Initial)	10%V or more of nominal voltage* (Initial)	66.7mA	45Ω	200mW	150%V of nominal voltage
4.5V DC			44.4mA	101Ω		
5V DC			40mA	125Ω		
6V DC			33.3mA	180Ω		
9V DC			22.2mA	405Ω		
12V DC			16.7mA	720Ω		
24V DC			8.3mA	2,880Ω		

*Pulse drive (JIS C 5442-1986)

2. Specifications

Characteristics	Item		Specifications	
Contact	Arrangement		2 Form C, 2 Form D (M.B.B.)	4 Form C
	Initial contact resistance, max.		Max. 50mΩ (By voltage drop 6 V DC 1A)	
	Contact material		Ag+Au clad	
Rating	Nominal switching capacity		1 A 30 V DC, 0.5 A 125 V AC*1 (resistive load)	
	Max. switching power		30 W (DC), 62.5 V A (AC)*1 (resistive load)	
	Max. switching voltage		110 V DC, 125 V AC*1	
	Max. switching current		1 A	
	Min. switching capacity (Reference value)*2		10μA 10mV DC	
	Nominal operating power	Single side stable	Standard (B.B.M) type: 140 mW (3 to 12 V DC), 200 mW (24 V DC), 300 mW (48 V DC) M.B.B. type: 200 mW	280 mW (3 to 24 V DC), 400 mW (48 V DC)
		1 coil latching	100 mW (3 to 12 V DC), 150 mW (24 V DC)	200 mW
		2 coil latching	200 mW (3 to 12 V DC), 300 mW (24 V DC)	400 mW
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.	
	Breakdown voltage (Initial)	Between open contacts	Standard (B.B.M) type: 750 Vrms for 1min. (Detection current: 10 mA), M.B.B. type: 300 Vrms for 1 min. (Detection current: 10 mA)	
		Between contact and coil	1,000 Vrms for 1min. (Detection current: 10 mA)	
		Between contact sets	1,000 Vrms for 1min. (Detection current: 10 mA)	
	Temperature rise (at 20°C 68°F)		Max. 50°C (By resistive method, nominal coil voltage applied to the coil; contact carrying current: 1A.)	
	Operate time [Set time] (at 20°C 68°F)		Max. 3 ms [Max. 3 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.)	
	Release time [Reset time] (at 20°C 68°F)		Max. 3 ms [Max. 3 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)	
Mechanical characteristics	Shock resistance	Functional	Min. 490 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)	
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 ms.)	
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3 mm (Detection time: 10μs.)	
		Destructive	10 to 55 Hz at double amplitude of 5 mm	
Expected life	Mechanical (at 180 cpm)		Standard (B.B.M) type: Min. 10^8, M.B.B. type: Min. 10^7	
	Electrical (at 20 cpm)		Standard (B.B.M) type: Min. 2×10^5 (1 A 30 V DC resistive), Min. 10^5 (0.5 A 125 V AC resistive) M.B.B. type: Min. 10^5 (1 A 30 V DC resistive)	
Conditions	Conditions for operation, transport and storage*3		Standard (B.B.M) type: Ambient temperature: –40°C to +70°C –40°F to +158°F; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature) M.B.B. type: Ambient temperature: –40°C to +50°C –40°F to +122°F; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)	
	Max. operating speed (at rated load)		20 cpm	
Unit weight			Approx. 1.5 g .053 oz	Approx. 3 g .106 oz.

Notes: *1 AC is standard (B.B.M) type only.
*2 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10V DC, 10mA max. level])
*3Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

■ Surface-mount terminal

1. Coil data

1) Single side stable

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC	75%V or less of nominal voltage* (Initial)	10%V or more of nominal voltage* (Initial)	93.8mA	16Ω	140mW	150%V of nominal voltage
3V DC			46.7mA	64.3Ω		
4.5V DC			31mA	145Ω		
5V DC			28.1mA	178Ω		
6V DC			23.3mA	257Ω		
9V DC			15.5mA	579Ω		
12V DC			11.7mA	1,028Ω		
24V DC			8.3mA	2,880Ω	200mW	
48V DC			6.3mA	7,680Ω	300mW	120%V of nominal voltage

2) 1 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC	75%V or less of nominal voltage* (Initial)	75%V or less of nominal voltage* (Initial)	46.9mA	32Ω	70mW	150%V of nominal voltage
3V DC			23.3mA	128.6Ω		
4.5V DC			15.6mA	289.3Ω		
5V DC			14mA	357Ω		
6V DC			11.7mA	514Ω		
9V DC			7.8mA	1,157Ω		
12V DC			5.8mA	2,057Ω		
24V DC			4.2mA	5,760Ω	100mW	

3) 2 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. applied voltage (at 20°C 68°F)
			Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
1.5V DC	75%V or less of nominal voltage* (Initial)	75%V or less of nominal voltage* (Initial)	93.8mA	93.8mA	16Ω	16Ω	140mW	140mW	150%V of nominal voltage
3V DC			46.7mA	46.7mA	64.3Ω	64.3Ω			
4.5V DC			31mA	31mA	145Ω	145Ω			
5V DC			28.1mA	28.1mA	178Ω	178Ω			
6V DC			23.3mA	23.3mA	257Ω	257Ω			
9V DC			15.5mA	15.5mA	579Ω	579Ω			
12V DC			11.7mA	11.7mA	1,028Ω	1,028Ω			
24V DC			8.3mA	8.3mA	2,880Ω	2,880Ω	200mW	200mW	

*Pulse drive (JIS C 5442-1986)

2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		2 Form C
	Initial contact resistance, max.		Max. 75 mΩ (By voltage drop 6 V DC 1A)
	Contact material		AgNi type+Au clad
Rating	Nominal switching capacity		2 A 30 V DC, 0.5 A 125 V AC (resistive load)
	Max. switching power		60 W (DC), 62.5 VA (AC) (resistive load)
	Max. switching voltage		220 V DC, 125 V AC
	Max. switching current		2 A
	Min. switching capacity (Reference value)*1		10µA 10mV DC
	Nominal operating power	Single side stable	140 mW (1.5 to 12 V DC), 200 mW (24 V DC), 300 mW (48 V DC)
		1 coil latching	70 mW (1.5 to 12 V DC), 100 mW (24 V DC)
		2 coil latching	140 mW (1.5 to 12 V DC), 200 mW (24 V DC)
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1 min. (Detection current: 10 mA)
		Between contact and coil	1,500 Vrms for 1 min. (Detection current: 10 mA)
		Between contact sets	1,500 Vrms for 1 min. (Detection current: 10 mA)
	Surge breakdown voltage (Initial)	Between open contacts	1,500 V (10×160µs) (FCC Part 68)
		Between contacts and coil	2,500 V (2×10µs) (Bellcore)
	Temperature rise (at 20°C 68°F)		Max. 50°C (By resistive method, nominal coil voltage applied to the coil; contact carrying current: 2A.)
	Operate time [Set time] (at 20°C 68°F)		Max. 4 ms [Max. 4 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.)
	Release time [Reset time] (at 20°C 68°F)		Max. 4 ms [Max. 4 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 750 m/s^2 (Half-wave pulse of sine wave: 6 ms; detection time: 10µs.)
		Destructive	Min. 1,000 m/s^2 (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3.3 mm (Detection time: 10µs.)
		Destructive	10 to 55 Hz at double amplitude of 5 mm
Expected life	Mechanical		Min. 10^8 (at 180 cpm)
	Electrical		Min. 10^5 (2 A 30 V DC resistive), Min. 2×10^5 (1 A 30 V DC resistive), Min. 10^5 (0.5 A 125 V AC resistive) (at 20 cpm)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +85°C –40°F to +185°F, Max. –40°C to +70°C (2A) Max. –40°F to +158°F (2A); Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed (at rated load)		20 cpm
Unit weight			Approx. 2 g .071 oz

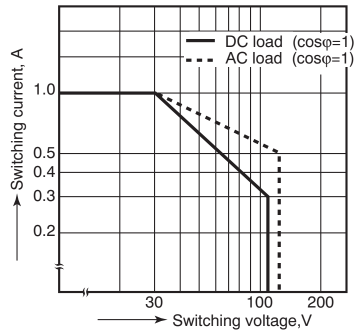
Notes: *1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10V DC, 10mA max. level])

*2Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

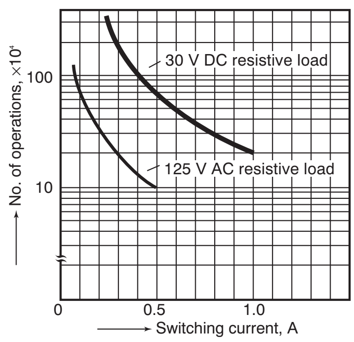
REFERENCE DATA

■ Standard PC board terminal and self-clinching terminal

1. Maximum switching capacity

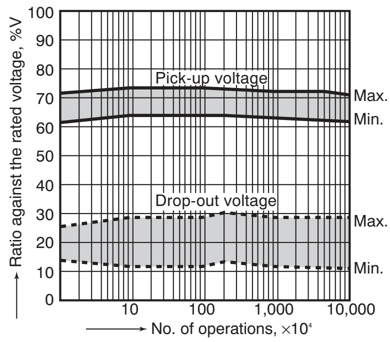


2. Life curve



3. Mechanical life

Tested sample: TQ2-12V, 10 pcs.

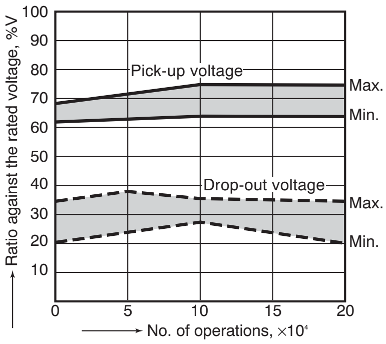


4.-(1) Electrical life (DC load)

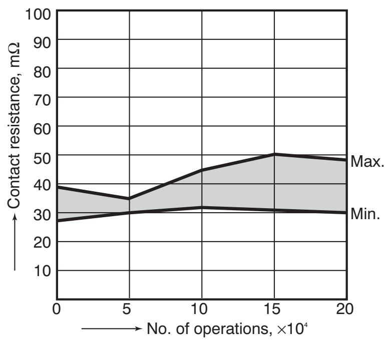
Tested sample: TQ2-12V, 6 pcs.

Condition: 1 A 30 V DC resistive load, 20 cpm

Change of pick-up and drop-out voltage



Change of contact resistance

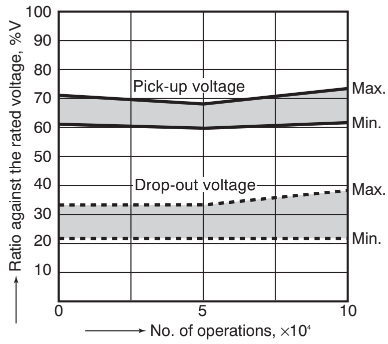


4.-(2) Electrical life (AC load)

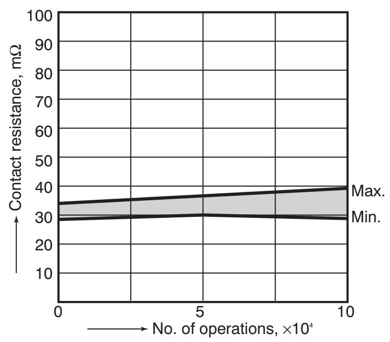
Tested sample: TQ2-12V, 6 pcs.

Condition: 0.5 A 125 V AC resistive load, 20 cpm

Change of pick-up and drop-out voltage



Change of contact resistance

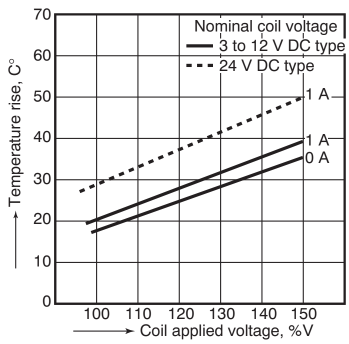


5. Coil temperature rise (2C)

Tested sample: TQ2-12V

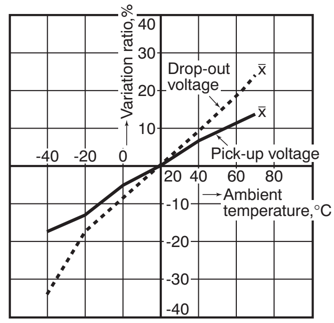
Measured portion: Inside the coil

Ambient temperature: 30°C 86°F

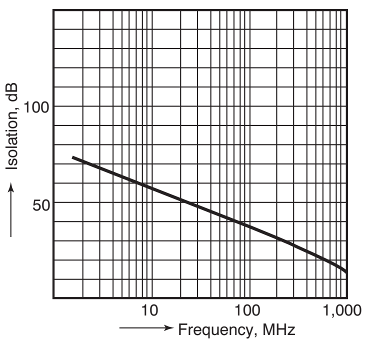


6. Ambient temperature characteristics

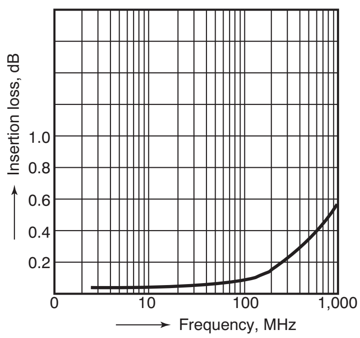
Tested sample: TQ2-12V, 5 pcs.



7.-(1) High-frequency characteristics (Isolation)

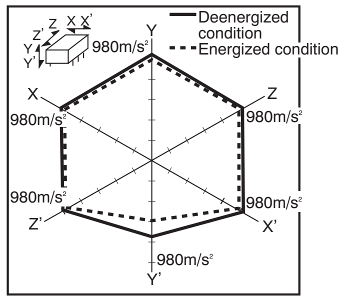


7.-(2) High-frequency characteristics (Insertion loss)

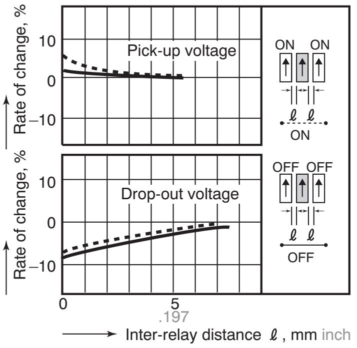


8. Malfunctional shock (single side stable)

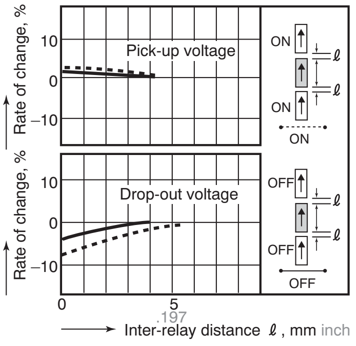
Tested sample: TQ2-12V, 6 pcs.



9.-(1) Influence of adjacent mounting

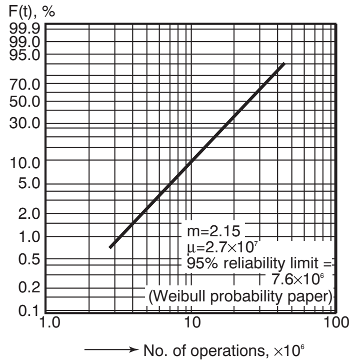


9.-(2) Influence of adjacent mounting



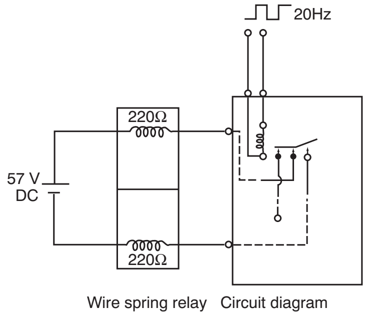
10. Contact reliability (1 mA 5 V DC resistive load)

Tested sample: TQ2-12V
Condition: Detection level 10 W

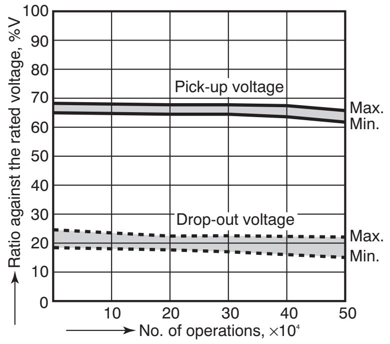


11. Actual load test (35 mA 48 V DC wire spring relay load)

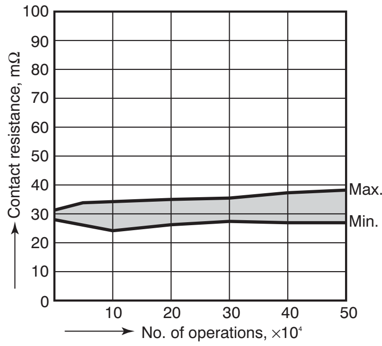
Circuit



Change of pick-up and drop-out voltage

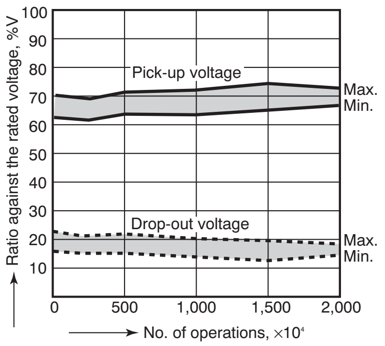


Change of contact resistance

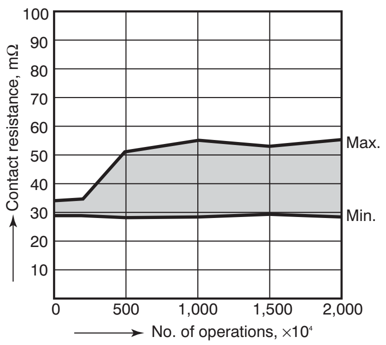


12. 0.1 A 53 V DC resistive load test

Change of pick-up and drop-out voltage

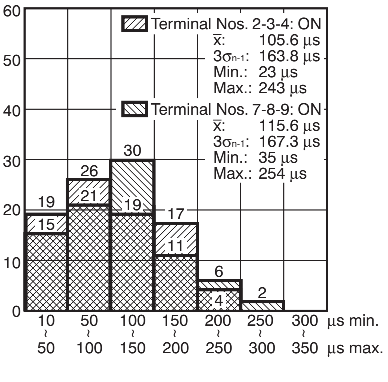


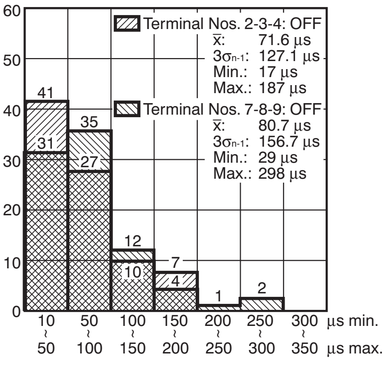
Change of contact resistance



13. Distribution of M.B.B. time

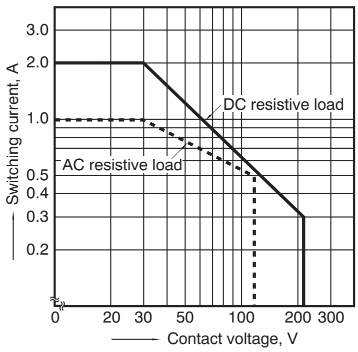
Tested sample: TQ2-2M-5V, 85 pcs.



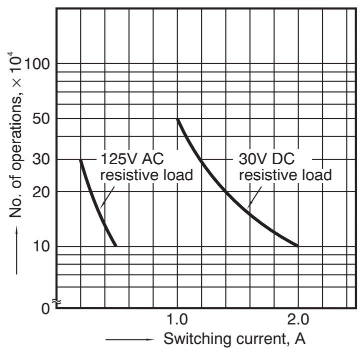


■ Surface-mount terminal

1. Maximum switching capacity

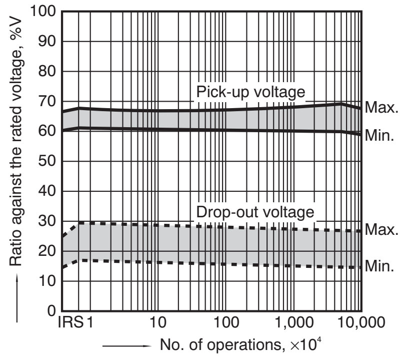


2. Life curve



3. Mechanical life (mounting by IRS method)

Tested sample: TQ2SA-12V, 10 pcs.



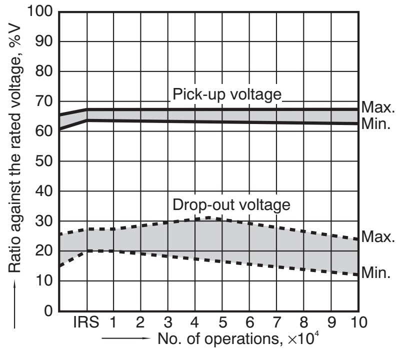
4.-(1) Electrical life (2 A 30 V DC resistive load)

Tested sample: TQ2SA-12V, 6 pcs.

Operating speed: 20 cpm

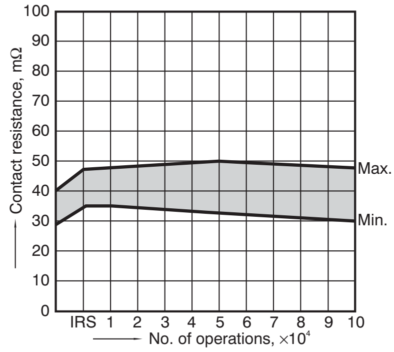
Change of pick-up and drop-out voltage

(mounting by IRS method)



Change of contact resistance

(mounting by IRS method)



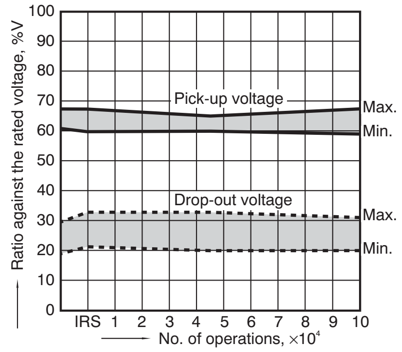
4.-(2) Electrical life (0.5 A 125 V AC resistive load)

Tested sample: TQ2SA-12V, 6 pcs

Operating speed: 20 cpm

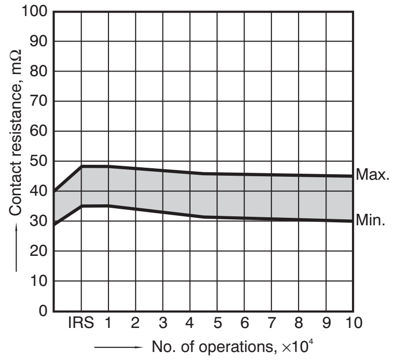
Change of pick-up and drop-out voltage

(mounting by IRS method)



Change of contact resistance

(mounting by IRS method)

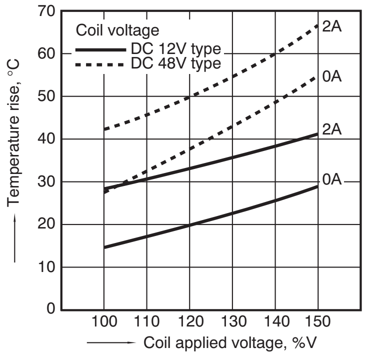


5. Coil temperature rise

Tested sample: TQ2SA-12V, 6 pcs.

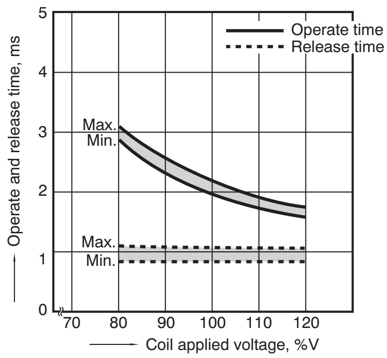
Point measured: Inside the coil

Ambient temperature: 25°C 77°F



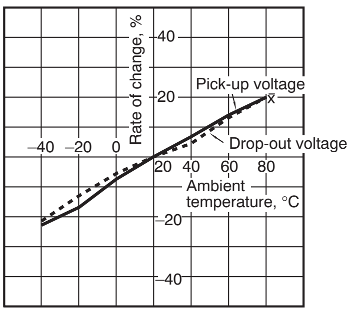
6. Operate/release time

Tested sample: TQ2SA-12V, 6 pcs.

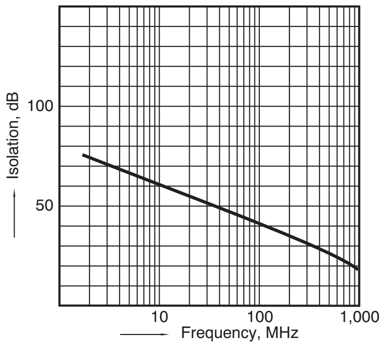


7. Ambient temperature characteristics

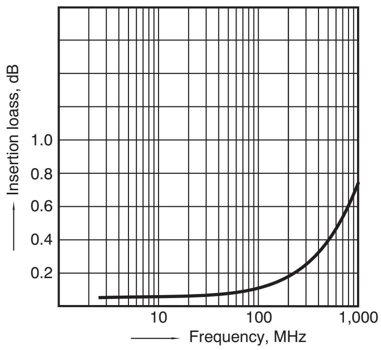
Tested sample: TQ2SA-12V, 5 pcs.



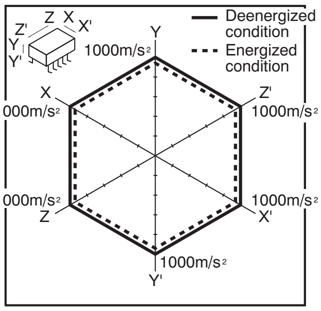
8.-(1) High-frequency characteristics (Isolation)



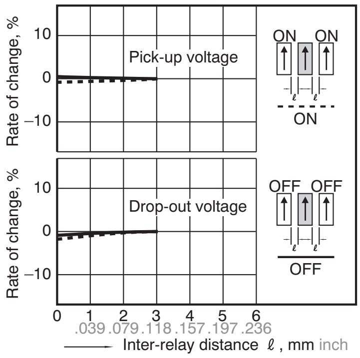
8.-(2) High-frequency characteristics (Insertion loss)



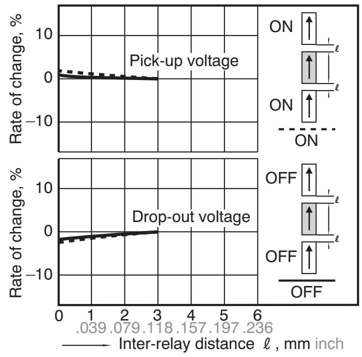
9. Malfunctional shock (single side stable)
Tested sample: TQ2SA-12V, 6 pcs



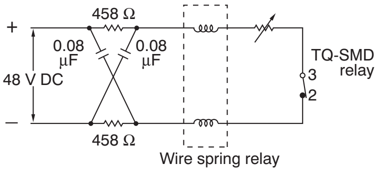
10.-(1) Influence of adjacent mounting
Tested sample: TQ2SA-12V, 5 pcs.



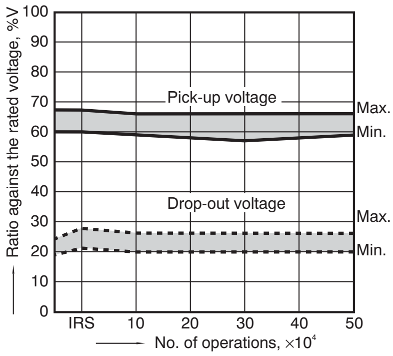
10.-(2) Influence of adjacent mounting
Tested sample: TQ2SA-12V, 6 pcs.



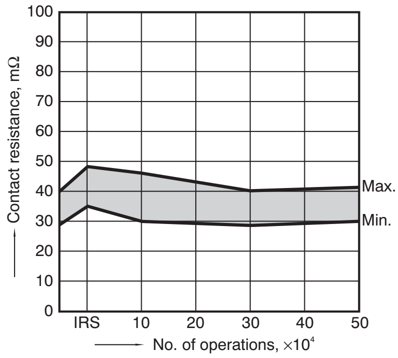
11. Pulse dialing test
(35 mA 48 V DC wire spring relay load)
Tested sample: TQ2SA-12V, 6 pcs.
Circuit



Change of pick-up and drop-out voltage
(mounting by IRS method)



Change of contact resistance
(mounting by IRS method)



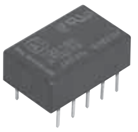
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. Standard PC board terminal and Self-clinching terminal

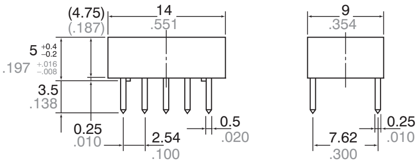
1) 2 Form C

CAD Data

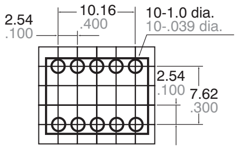


External dimensions

Standard PC board terminal

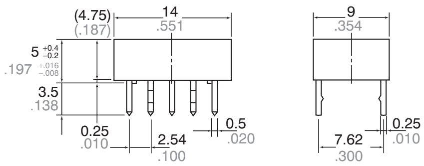


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

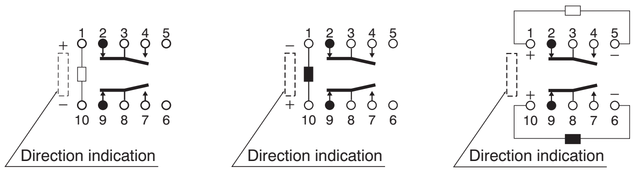
Self-clinching terminal



General tolerance: ±0.3 ±.012

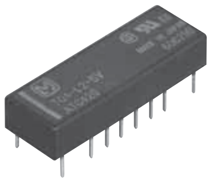
Schematic (Bottom view)

Single side stable | 1-coil latching | 2-coil latching



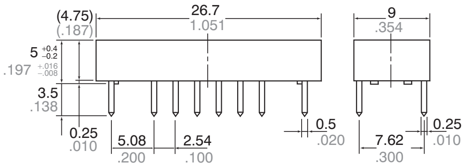
(Deenergized condition) | (Reset condition) | (Reset condition)

2) 4 Form C

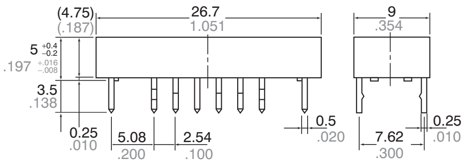


External dimensions

Standard PC board terminal

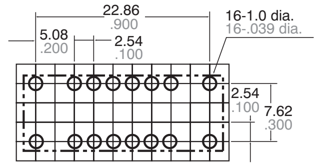


Self-clinching terminal



General tolerance: ±0.3 ±.012

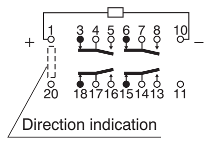
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

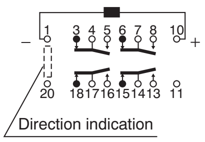
Schematic (Bottom view)

Single side stable



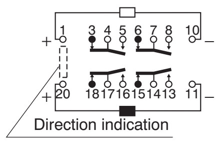
(Deenergized condition)

1-coil latching



(Reset condition)

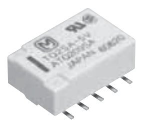
2-coil latching

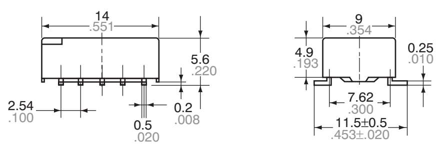
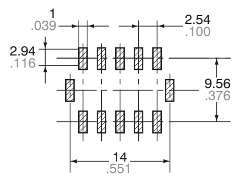
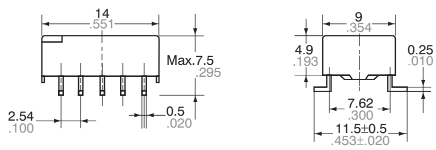
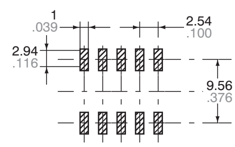
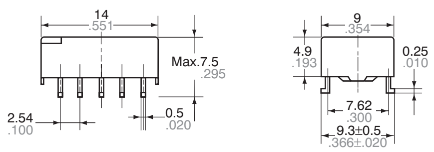
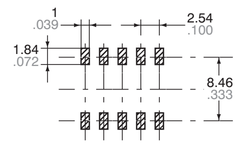


(Reset condition)

Signal

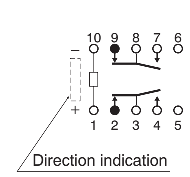
2. Surface-mount terminal



Type	External dimensions (General tolerance: ±0.3 ±.012)	Suggested mounting pad (Top view) (Tolerance: ±0.1 ±.004)
SA type		
SL type		
SS type		

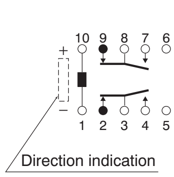
Schematic (Top view)

Single side stable



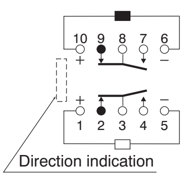
(Deenergized condition)

1-coil latching



(Reset condition)

2-coil latching

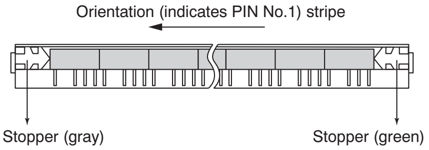


(Reset condition)

NOTES

1. Packing style

1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.

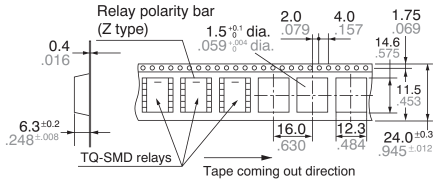


2) Tape and reel packing (surface-mount terminal type)

(1) Tape dimensions

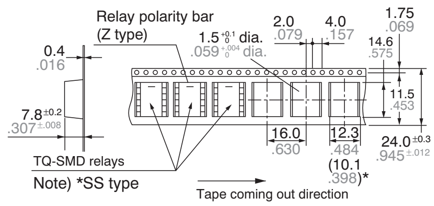
(i) SA type

mm inch



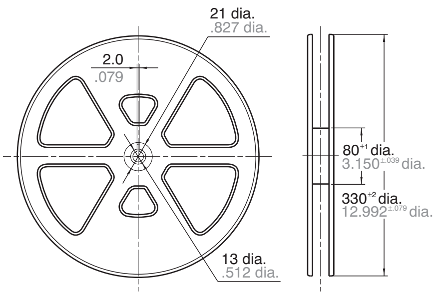
(ii) SL, SS type

mm inch



(2) Dimensions of plastic reel

mm inch



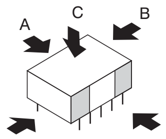
2. Automatic insertion

To maintain the internal function of the relay, the chucking pressure should not exceed the values below.

Chucking pressure in the direction A:
9.8 N {1 kgf} or less

Chucking pressure in the direction B:
9.8 N {1 kgf} or less

Chucking pressure in the direction C:
9.8 N {1 kgf} or less



Please chuck the portion.
Avoid chucking the center of the relay.
In addition, excessive chucking pressure to the pinpoint of the relay should be avoided.

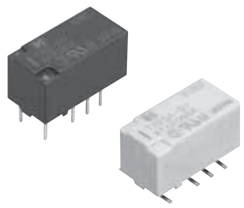
For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

New pin layout (LT type) added. Best seller with broad lineup and AC 2000 V breakdown voltage.

TX RELAYS

Signal



FEATURES

1. **2,000 V breakdown voltage between contact and coil**
   The body block construction of the coil that is sealed at formation offers a high breakdown voltage of 2,000 V between contact and coil, and 1,000 V between open contacts.
2. **Outstanding surge resistance**
   Surge breakdown voltage between open contacts:
   1,500 V 10×160μ sec. (FCC part 68)
   Surge breakdown voltage between contact and coil:
   2,500 V 2×10μ sec. (Bellcore)
3. **Nominal operating power: High sensitivity of 140mW**
   By using the highly efficient polar magnetic circuit “seesaw balance mechanism”, a nominal operating power of 140 mW (minimum operating power of 79 mW) has been achieved.
4. **High contact capacity: 2 A 30 V DC**
5. **Compact size**
   15.0(L) × 7.4(W) × 8.2(H) .591(L) × .291(W) × .323(H)
6. **The use of gold-clad twin crossbar contacts ensures high contact reliability.**
   ***We also offer a range of products with AgPd contacts suitable for use in low level load analog circuits (Max. 10V DC 10 mA).**
   ***SX relays designed for low level loads are also available.**
7. **Outstanding vibration and shock resistance**
   Functional shock resistance: 750 m/s^2
   Destructive shock resistance: 1,000 m/s^2
   Functional vibration resistance: 10 to 55 Hz (at double amplitude of 3.3 mm .130 inch)
   Destructive vibration resistance: 10 to 55 Hz (at double amplitude of 5 mm .197 inch)
8. **Sealed construction allows automatic washing.**
9. **A range of surface-mount types is also available**
   SA: Low-profile surface-mount terminal type
   SL: High connection reliability surface-mount terminal type
   SS: Space saving surface-mount terminal type

TYPICAL APPLICATIONS

1. **Communications (xDSL, Transmission)**
2. **Measurement**
3. **Security**
4. **Home appliances, and audio/visual equipment**
5. **Automotive equipment**
6. **Medical equipment**

ORDERING INFORMATION

TX 2 [ ]-[ ]-[ ]-[ ]-[ ]-[ ]

Contact arrangement
2: 2 Form C

Surface-mount availability
Nil: Standard PC board terminal type or self-clinching terminal type
SA: SA type
SL: SL type
SS: SS type

Operating function
Nil: Single side stable
L: 1 coil latching
L2: 2 coil latching
LT: 2 coil latching

Terminal shape
Nil: Standard PC board terminal or surface-mount terminal
H: Self-clinching terminal

Nominal coil voltage (DC)*
1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V

Contact material
Nil: Standard contact (Ag+Au clad)
1: AgPd contact (low level load); AgPd+Au clad (stationary), AgPd (movable)

Packing style
Nil: Tube packing
X: Tape and reel (picked from 1/3/4/5-pin side)
Z: Tape and reel packing (picked from the 8/9/10/12-pin side)

Notes: 1. *48 V coil type: Single side stable only
2. In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

TYPES

1. Standard PC board terminal

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching (L2)	2 coil latching (LT)
		Part No.	Part No.	Part No.	Part No.
2 Form C	1.5V DC	TX2-1.5V	TX2-L-1.5V	TX2-L2-1.5V	TX2-LT-1.5V
	3V DC	TX2-3V	TX2-L-3V	TX2-L2-3V	TX2-LT-3V
	4.5V DC	TX2-4.5V	TX2-L-4.5V	TX2-L2-4.5V	TX2-LT-4.5V
	5V DC	TX2-5V	TX2-L-5V	TX2-L2-5V	TX2-LT-5V
	6V DC	TX2-6V	TX2-L-6V	TX2-L2-6V	TX2-LT-6V
	9V DC	TX2-9V	TX2-L-9V	TX2-L2-9V	TX2-LT-9V
	12V DC	TX2-12V	TX2-L-12V	TX2-L2-12V	TX2-LT-12V
	24V DC	TX2-24V	TX2-L-24V	TX2-L2-24V	TX2-LT-24V
	48V DC	TX2-48V	—	—	—

Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.
Note: Please add “-1” to the end of the part number for AgPd contacts (low level load).

2. Self-clinching terminal

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching (L2)	2 coil latching (LT)
		Part No.	Part No.	Part No.	Part No.
2 Fom C	1.5V DC	TX2-H-1.5V	TX2-L-H-1.5V	TX2-L2-H-1.5V	TX2-LT-H-1.5V
	3V DC	TX2-H-3V	TX2-L-H-3V	TX2-L2-H-3V	TX2-LT-H-3V
	4.5V DC	TX2-H-4.5V	TX2-L-H-4.5V	TX2-L2-H-4.5V	TX2-LT-H-4.5V
	5V DC	TX2-H-5V	TX2-L-H-5V	TX2-L2-H-5V	TX2-LT-H-5V
	6V DC	TX2-H-6V	TX2-L-H-6V	TX2-L2-H-6V	TX2-LT-H-6V
	9V DC	TX2-H-9V	TX2-L-H-9V	TX2-L2-H-9V	TX2-LT-H-9V
	12V DC	TX2-H-12V	TX2-L-H-12V	TX2-L2-H-12V	TX2-LT-H-12V
	24V DC	TX2-H-24V	TX2-L-H-24V	TX2-L2-H-24V	TX2-LT-H-24V
	48V DC	TX2-H-48V	—	—	—

Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.
Note: Please add “-1” to the end of the part number for AgPd contacts (low level load).

3. Surface-mount terminal

1) Tube packing

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching (L2)	2 coil latching (LT)
		Part No.	Part No.	Part No.	Part No.
2c	1.5V DC	TX2S❑-1.5V	TX2S❑-L-1.5V	TX2S❑-L2-1.5V	TX2S❑-LT-1.5V
	3V DC	TX2S❑-3V	TX2S❑-L-3V	TX2S❑-L2-3V	TX2S❑-LT-3V
	4.5V DC	TX2S❑-4.5V	TX2S❑-L-4.5V	TX2S❑-L2-4.5V	TX2S❑-LT-4.5V
	5V DC	TX2S❑-5V	TX2S❑-L-5V	TX2S❑-L2-5V	TX2S❑-LT-5V
	6V DC	TX2S❑-6V	TX2S❑-L-6V	TX2S❑-L2-6V	TX2S❑-LT-6V
	9V DC	TX2S❑-9V	TX2S❑-L-9V	TX2S❑-L2-9V	TX2S❑-LT-9V
	12V DC	TX2S❑-12V	TX2S❑-L-12V	TX2S❑-L2-12V	TX2S❑-LT-12V
	24V DC	TX2S❑-24V	TX2S❑-L-24V	TX2S❑-L2-24V	TX2S❑-LT-24V
	48V DC	TX2S❑-48V	—	—	—

❑: For each surface-mounted terminal identification, input the following letter. SA type: A, SL type: L, SS type: S
Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.
Note: Please add “-1” to the end of the part number for AgPd contacts (low level load).

2) Tape and reel packing

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching (L2)	2 coil latching (LT)
		Part No.	Part No.	Part No.	Part No.
2 Form C	1.5V DC	TX2S❑-1.5V-Z	TX2S❑-L-1.5V-Z	TX2S❑-L2-1.5V-Z	TX2S❑-LT-1.5V-Z
	3V DC	TX2S❑-3V-Z	TX2S❑-L-3V-Z	TX2S❑-L2-3V-Z	TX2S❑-LT-3V-Z
	4.5V DC	TX2S❑-4.5V-Z	TX2S❑-L-4.5V-Z	TX2S❑-L2-4.5V-Z	TX2S❑-LT-4.5V-Z
	5V DC	TX2S❑-5V-Z	TX2S❑-L-5V-Z	TX2S❑-L2-5V-Z	TX2S❑-LT-5V-Z
	6V DC	TX2S❑-6V-Z	TX2S❑-L-6V-Z	TX2S❑-L2-6V-Z	TX2S❑-LT-6V-Z
	9V DC	TX2S❑-9V-Z	TX2S❑-L-9V-Z	TX2S❑-L2-9V-Z	TX2S❑-LT-9V-Z
	12V DC	TX2S❑-12V-Z	TX2S❑-L-12V-Z	TX2S❑-L2-12V-Z	TX2S❑-LT-12V-Z
	24V DC	TX2S❑-24V-Z	TX2S❑-L-24V-Z	TX2S❑-L2-24V-Z	TX2S❑-LT-24V-Z
	48V DC	TX2S❑-48V-Z	—	—	—

Standard packing: Tape and reel: 500 pcs.; Case: 1,000 pcs.
Notes: 1. Tape and reel packing symbol “-Z” is not marked on the relay. “X” type tape and reel packing (picked from 1/2/3/4-pin side) is also available.
2. Please add “-1” to the end of the part number for AgPd contacts (low level load).

RATING

1. Coil data

1) Single side stable

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC	75%V or less of nominal voltage* (Initial)	10%V or more of nominal voltage* (Initial)	93.8mA	16Ω	140mW	150%V of nominal voltage
3V DC			46.7mA	64.3Ω		
4.5V DC			31mA	145Ω		
5V DC			28.1mA	178Ω		
6V DC			23.3mA	257Ω		
9V DC			15.5mA	579Ω		
12V DC			11.7mA	1,028Ω		
24V DC			5.8mA	4,114Ω		
48V DC			5.6mA	8,533Ω	270mW	120%V of nominal voltage

2) 1 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC	75%V or less of nominal voltage* (Initial)	75%V or less of nominal voltage* (Initial)	66.7mA	22.5Ω	100mW	150%V of nominal voltage
3V DC			33.3mA	90Ω		
4.5V DC			22.2mA	202.5Ω		
5V DC			20mA	250Ω		
6V DC			16.7mA	360Ω		
9V DC			11.1mA	810Ω		
12V DC			8.3mA	1,440Ω		
24V DC			4.2mA	5,760Ω		

3) 2 coil latching (L2, LT)

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. applied voltage (at 20°C 68°F
			Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
1.5V DC	75%V or less of nominal voltage* (Initial)	75%V or less of nominal voltage* (Initial)	133.9mA	133.9mA	11.2Ω	11.2Ω	200mW	200mW	150%V of nominal voltage
3V DC			66.7mA	66.7mA	45Ω	45Ω			
4.5V DC			44.5mA	44.5mA	101.2Ω	101.2Ω			
5V DC			40mA	40mA	125Ω	125Ω			
6V DC			33.3mA	33.3mA	180Ω	180Ω			
9V DC			22.2mA	22.2mA	405Ω	405Ω			
12V DC			16.7mA	16.7mA	720Ω	720Ω			
24V DC			8.3mA	8.3mA	2,880Ω	2,880Ω			

*Pulse drive (JIS C 5442-1986)

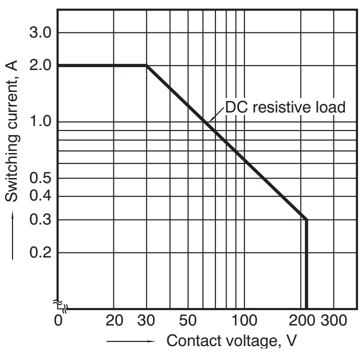
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		2 Form C
	Initial contact resistance, max.		Max. 100 mΩ (By voltage drop 6 V DC 1A)
	Contact material		Standard contact: Ag+Au clad, AgPd contact (low level load): AgPd+Au clad (stationary), AgPd (movable)
Rating	Nominal switching capacity		Standard contact: 2 A 30 V DC, AgPd contact: 1 A 30 V DC (resistive load)
	Max. switching power		Standard contact: 60 W (DC), AgPd contact: 30 W (DC) (resistive load)
	Max. switching voltage		220V DC
	Max. switching current		Standard contact: 2 A, AgPd contact: 1 A
	Min. switching capacity (Reference value)*1		10μA 10mV DC
	Nominal operating power	Single side stable	140 mW (1.5 to 24 V DC), 270 mW (48 V DC)
		1 coil latching	100 mW (1.5 to 24 V DC)
		2 coil latching	200 mW (1.5 to 24 V DC)
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1min. (Detection current: 10mA)
		Between contact and coil	2,000 Vrms for 1min. (Detection current: 10mA)
		Between contact sets	1,000 Vrms for 1min. (Detection current: 10mA)
	Surge breakdown voltage (Initial)	Between open contacts	1,500 V (10×160μs) (FCC Part 68)
		Between contacts and coil	2,500 V (2×10μs) (Telcordia)
	Temperature rise (at 20°C 68°F)		Max. 50°C (By resistive method, nominal coil voltage applied to the coil; contact carrying current: 2A.)
	Operate time [Set time] (at 20°C 68°F)		Max. 4 ms [Max. 4 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.)
	Release time [Reset time] (at 20°C 68°F)		Max. 4 ms [Max. 4 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 750 m/s² (Half-wave pulse of sine wave: 6 ms; detection time: 10μs.)
		Destructive	Min. 1,000 m/s² (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3.3 mm (Detection time: 10μs.)
		Destructive	10 to 55 Hz at double amplitude of 5 mm
Expected life	Mechanical		Min. 10^8 (at 180 cpm)
	Electrical		Min. 10^5 (2 A 30 V DC resistive), 5×10^5 (1 A 30 V DC resistive) (at 20 cpm)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +85°C (up to 24 V coil) –40°F to +185°F (up to 24 V coil) [–40°C to +70°C (48 V coil) –40°F to +158°F (48 V coil)]; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed (at rated load)		20 cpm
Unit weight			Approx. 2 g .071 oz

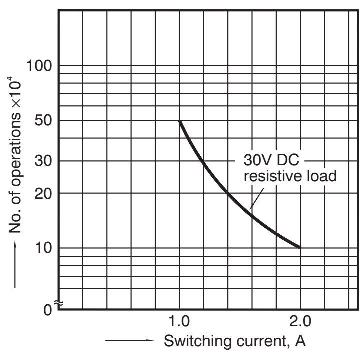
*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (AgPd contact type or SX relays are available for low level load switching [10V DC, 10mA max. level])
*2Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

1. Maximum switching capacity

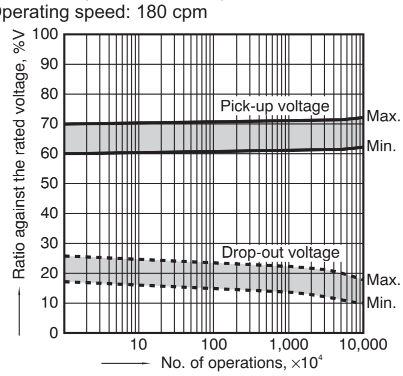


2. Life curve



3. Mechanical life

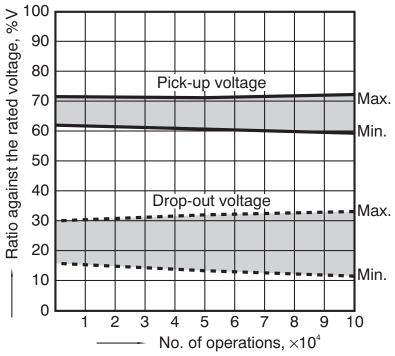
Tested sample: TX2-5V, 10 pcs.
Operating speed: 180 cpm



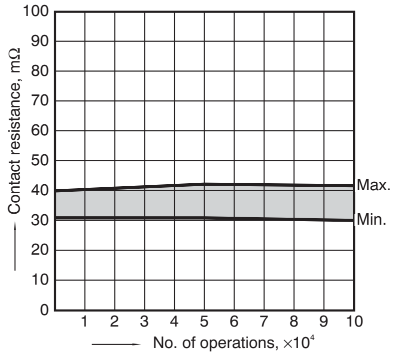
4. Electrical life (2A 30V DC resistive load)

Tested sample: TX2-5V, 6 pcs.
Operating speed: 20 cpm

Change of pick-up and drop-out voltage

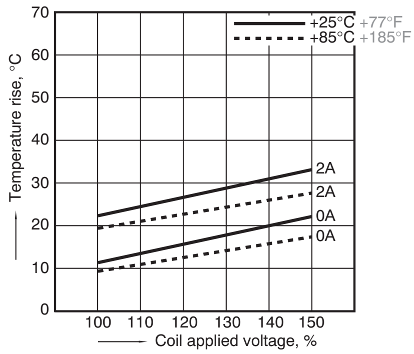


Change of contact resistance



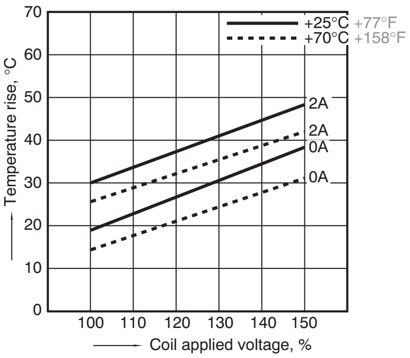
5-(1). Coil temperature rise

Tested sample: TX2-5V, 6 pcs.
Point measured: Inside the coil
Ambient temperature: 25°C 77°F, 85°C 185°F



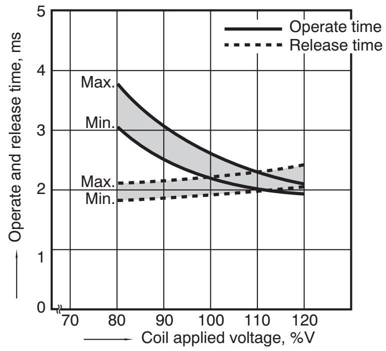
5-(2). Coil temperature rise

Tested sample: TX2-48V, 6 pcs.
Point measured: Inside the coil
Ambient temperature: 25°C 77°F, 70°C 158°F



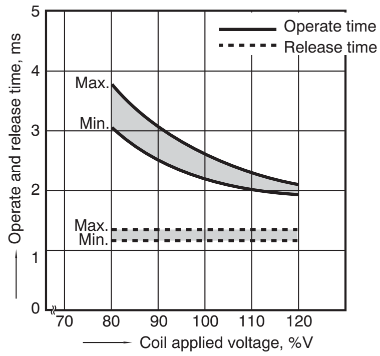
6-(1). Operate and release time (with diode)

Tested sample: TX2-5V, 10 pcs.



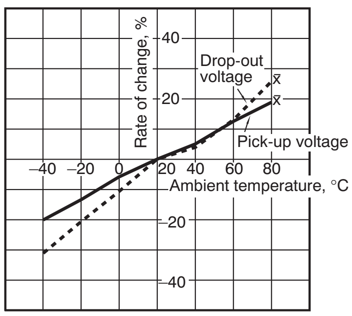
6-(2). Operate and release time (without diode)

Tested sample: TX2-5V, 10 pcs.



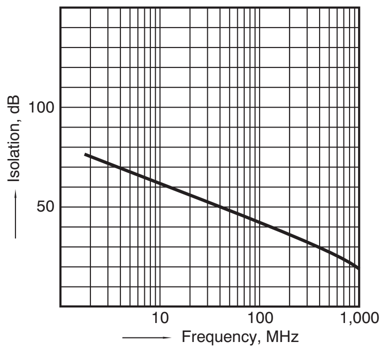
7. Ambient temperature characteristics

Tested sample: TX2-5V, 5 pcs.



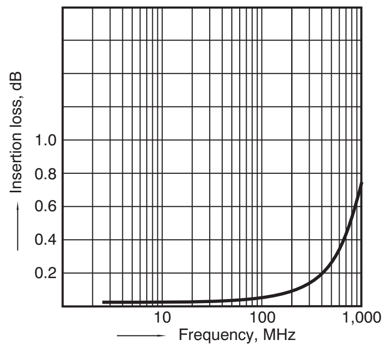
8-(1). High frequency characteristics (Isolation)

Tested sample: TX2-12V, 2 pcs.



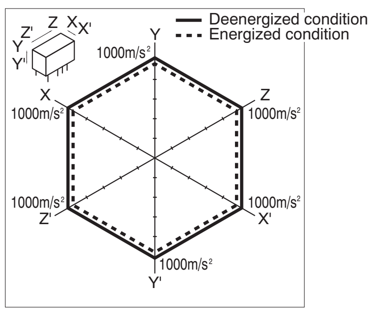
8-(2). High frequency characteristics (Insertion loss)

Tested sample: TX2-12V, 2 pcs.



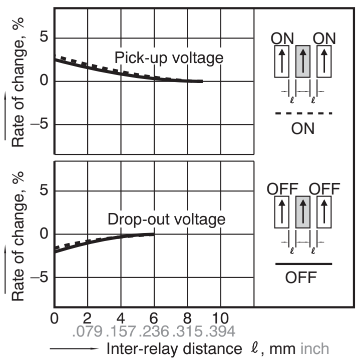
9 Malfunctional shock (single side stable)

Tested sample: TX2-5V, 6 pcs.



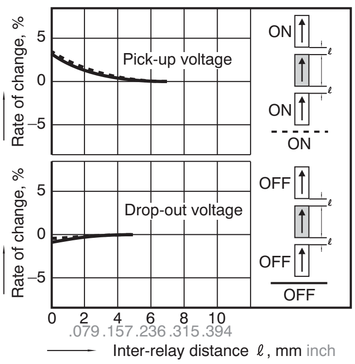
10-(1). Influence of adjacent mounting

Tested sample: TX2-12V, 6 pcs.



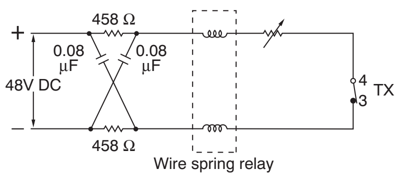
10-(2). Influence of adjacent mounting

Tested sample: TX2-12V, 6 pcs.

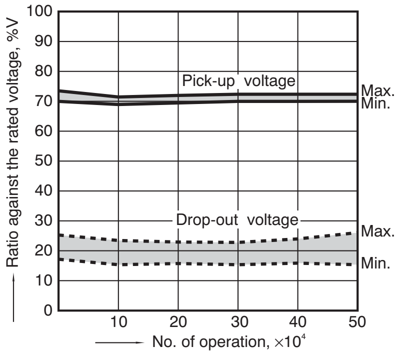


11. Pulse dialing test
Tested sample: TX2-5V, 6 pcs.
(35 mA 48 V DC wire spring relay load)

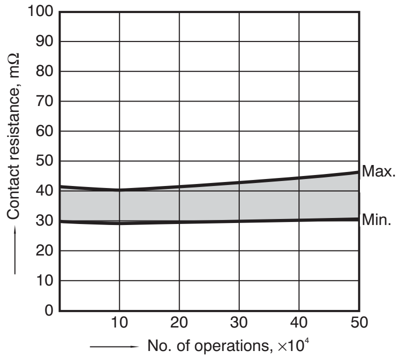
Circuit



Change of pick-up and drop-out voltage



Change of contact resistance



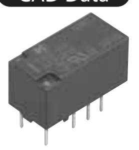
Note: Data of surface-mount type are the same as those of PC board terminal type.

DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. Standard PC board terminal and self clinching terminal

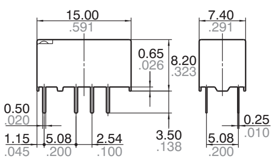
CAD Data



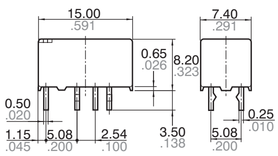
Single side stable and 1 coil latching type

External dimensions

Standard PC board terminal



Self clinching terminal

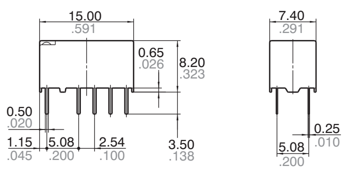


General tolerance: ±0.3 ±.012

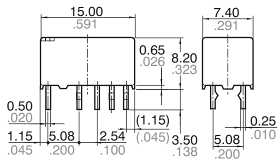
2 coil latching type (L2, LT)

External dimensions

Standard PC board terminal

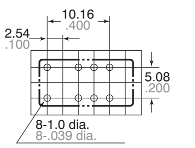


Self clinching terminal



General tolerance: ±0.3 ±.012

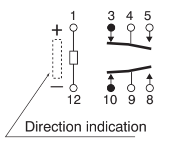
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

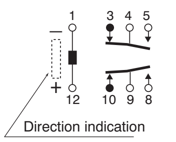
Schematic (Bottom view)

Single side stable



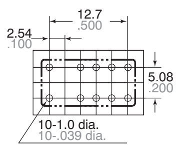
(Deenergized condition)

1 coil latching



(Reset condition)

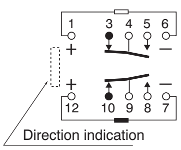
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

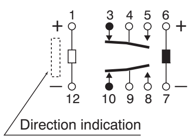
Schematic (Bottom view)

2 coil latching (L2)



(Reset condition)

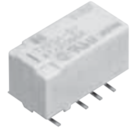
2 coil latching (LT)

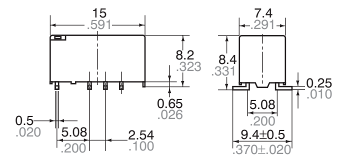
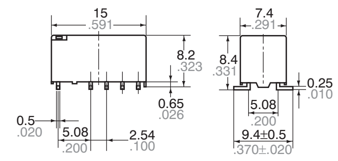
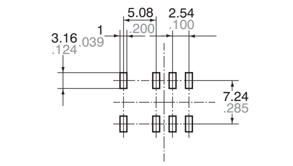
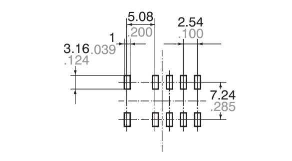
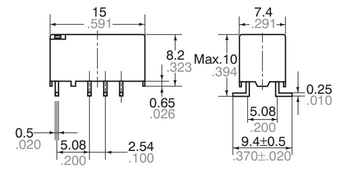
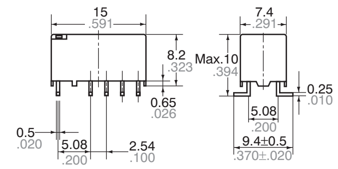
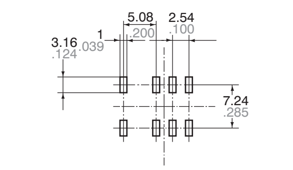
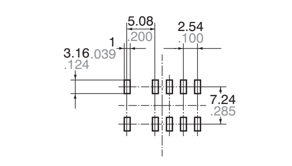
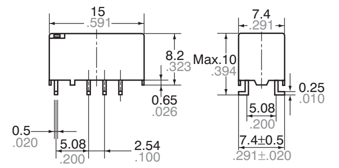
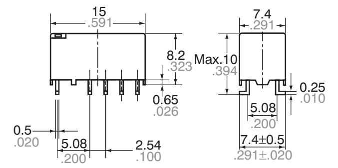
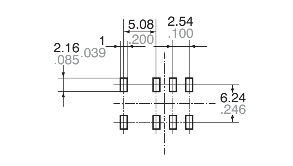
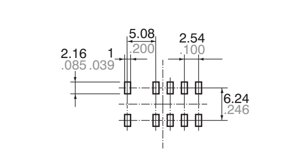


(Reset condition)

2. Surface-mount terminal

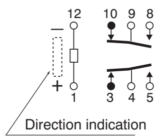
CAD Data



Type	External dimensions (General tolerance: ±0.3 ±.012)		Suggested mounting pad (Top view) (Tolerance: ±0.1 ±.004)	
	Single side stable and 1 coil latching type	2 coil latching type (L2, LT)	Single side stable and 1 coil latching type	2 coil latching type (L2, LT)
SA type				
SL type				
SS type				

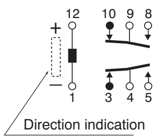
Schematic (Top view)

Single side stable



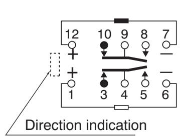
(Deenergized condition)

1 coil latching



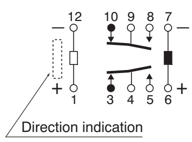
(Reset condition)

2 coil latching (L2)



(Reset condition)

2 coil latching (LT)

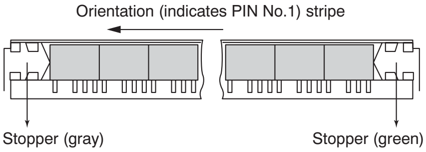


(Reset condition)

NOTES

1. Packing style

1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.

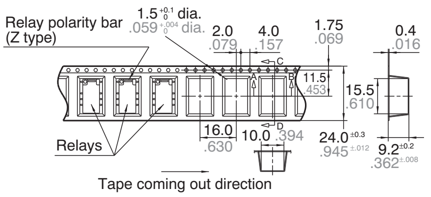


2) Tape and reel packing (surface-mount terminal type)

(1) Tape dimensions

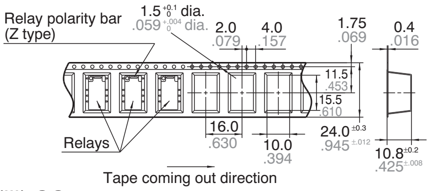
(i) SA type

mm inch



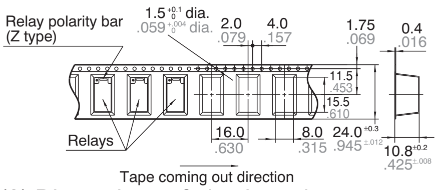
(ii) SL type

mm inch



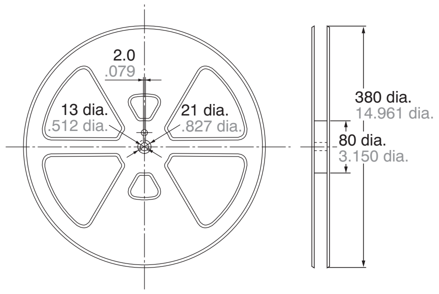
(iii) SS type

mm inch



(2) Dimensions of plastic reel

mm inch



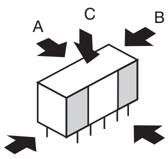
2. Automatic insertion

To maintain the internal function of the relay, the chucking pressure should not exceed the values below.

Chucking pressure in the direction A:
4.9 N {500gf} or less

Chucking pressure in the direction B:
9.8 N {1 kgf} or less

Chucking pressure in the direction C:
9.8 N {1 kgf} or less



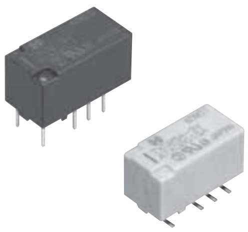
Please chuck the ▭ portion.
Avoid chucking the center of the relay.
In addition, excessive chucking pressure to the pinpoint of the relay should be avoided.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

TX-D RELAYS

High breakdown voltage type is available (1.5 kV between open contacts)



FEATURES

1. **Lineup now includes high breakdown voltage type that achieves breakdown voltage between open contacts of 1,500 V AC.**
   Surge breakdown voltage between open contacts:
   1,500 V 10 × 160 µsec. (FCC part 68)
   Surge breakdown voltage between contact and coil:
   6,000 V 1.2 × 50 µsec. (EN60950)
2. **Approved to the supplementary insulation class in the EN standards (EN60950).**
   The insulation distance between the contact and coil meet the supplementary insulation class of the EN60950 standards as required for equipment connected to the telephone lines in Europe.
   Satisfies the following conditions:
   • Clearances: 2.0 mm .079 inch or more
   • Creepage distance: 2.5 mm .098 inch or more
3. **3,000 V breakdown voltage between contact and coil. (Surge breakdown voltage 6,000 V type)**
   The body block construction of the coil that is sealed formation offers a high breakdown voltage of 3,000 V between contact and coil.
4. **Nominal operating power: High sensitivity of 200mW**
   By using the highly efficient polar magnetic circuit “seesaw balance mechanism”, a nominal operating power of 200 mW has been achieved.
5. **High contact capacity: 2 A 30 V DC**
6. **High contact reliability achieved with gold-clad crossbar twin contacts and the use of gas expelling materials during formation.**
   *We also offer a range of products with AgPd contacts suitable for use in low level load analog circuits (Max. 10V DC 10 mA).
   *SX relays designed for low level loads are also available.
   (Surge breakdown voltage 2,500 V type only)
7. **Outstanding vibration and shock resistance.**
   Functional shock resistance: 750 m/s^2
   Destructive shock resistance: 1,000 m/s^2
   Functional vibration resistance: 10 to 55 Hz (at double amplitude of 3.3 mm .130 inch)
   Destructive vibration resistance: 10 to 55 Hz (at double amplitude of 5 mm .197 inch)
8. **Sealed construction allows automatic washing.**
9. **A range of surface-mount types is also available.**
   SA: Low-profile surface-mount terminal type
   SL: High connection reliability surface-mount terminal type
   SS: Space saving surface-mount terminal type
10. **M.B.B. type available (Surge breakdown voltage 2,500 V type only)**

TYPICAL APPLICATIONS

1. **Facsimile**
2. **Modem**
3. **Communications (xDSL)**
4. **Medical equipment**
5. **Automotive equipment**
6. **Security**

ORDERING INFORMATION

TXD 2 ☐ - ☐ - ☐ - ☐ - ☐ - ☐ - ☐

Contact arrangement
2: 2 Form C

Surface-mount availability
Nil: Standard PC board terminal or self-clinching terminal
SA: SA type SL: SL type SS: SS type

Operating function
Nil: Single side stable L: 1 coil latching

Type of operation
Nil: Standard type
2M: M.B.B. type (Surge breakdown voltage 2,500 V and Single side stable type only)

Terminal shape
Nil: Standard PC board terminal or surface-mount terminal
H: Self-clinching terminal

Nominal coil voltage (DC)
1.5, 3, 4.5, 5, 6, 9, 12, 24V

Contact material/Surge breakdown voltage (between contact and coil)/Breakdown (between open contacts)
Nil: Standard contact (Ag+Au clad), 2,500 V/1,000 V
1: AgPd contact (low level load); AgPd+Au clad (stationary), AgPd (movable), 2,500 V/1,000 V
3: Standard contact (Ag+Au clad), 6,000 V/1,500 V
4: AgPd contact (low level load); AgPd+Au clad (stationary), AgPd (movable), 6,000 V/1,500 V
6: Standard contact (Ag+Au clad), 6,000 V/1,000 V
7: AgPd contact (low level load); AgPd+Au clad (stationary), AgPd (movable), 6,000 V/1,000 V

Packing style
Nil: Tube packing
X: Tape and reel (picked from 1/3/4/5-pin side)
Z: Tape and reel packing (Picked from the 8/9/10/12-pin side)

Note: In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

TYPES

1. Standard (B.B.M.) type/Surge breakdown voltage (between contact and coil) 2,500 V/ Breakdown voltage (between open contacts) 1,000 V

1) Standard PC board terminal

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching
		Part No.	Part No.
2 Form C	1.5V DC	TXD2-1.5V	TXD2-L-1.5V
	3V DC	TXD2-3V	TXD2-L-3V
	4.5V DC	TXD2-4.5V	TXD2-L-4.5V
	5V DC	TXD2-5V	TXD2-L-5V
	6V DC	TXD2-6V	TXD2-L-6V
	9V DC	TXD2-9V	TXD2-L-9V
	12V DC	TXD2-12V	TXD2-L-12V
	24V DC	TXD2-24V	TXD2-L-24V

Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.
Note: Please add “-1” to the end of the part number for AgPd contacts (low level load).

2) Self-clinching terminal

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching
		Part No.	Part No.
2 Form C	1.5V DC	TXD2-H-1.5V	TXD2-L-H-1.5V
	3V DC	TXD2-H-3V	TXD2-L-H-3V
	4.5V DC	TXD2-H-4.5V	TXD2-L-H-4.5V
	5V DC	TXD2-H-5V	TXD2-L-H-5V
	6V DC	TXD2-H-6V	TXD2-L-H-6V
	9V DC	TXD2-H-9V	TXD2-L-H-9V
	12V DC	TXD2-H-12V	TXD2-L-H-12V
	24V DC	TXD2-H-24V	TXD2-L-H-24V

Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.
Note: Please add “-1” to the end of the part number for AgPd contacts (low level load).

3) Surface-mount terminal

(1) Tube packing

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching
		Part No.	Part No.
2 Form C	1.5V DC	TXD2S❑-1.5V	TXD2S❑-L-1.5V
	3V DC	TXD2S❑-3V	TXD2S❑-L-3V
	4.5V DC	TXD2S❑-4.5V	TXD2S❑-L-4.5V
	5V DC	TXD2S❑-5V	TXD2S❑-L-5V
	6V DC	TXD2S❑-6V	TXD2S❑-L-6V
	9V DC	TXD2S❑-9V	TXD2S❑-L-9V
	12V DC	TXD2S❑-12V	TXD2S❑-L-12V
	24V DC	TXD2S❑-24V	TXD2S❑-L-24V

❑: For each surface-mount terminal identification, input the following letter. SA type: A, SL type: L, SS type: S
Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.
Note: Please add "-1" to the end of the part number for AgPd contacts (low level load).

(2) Tape and reel packing

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching
		Part No.	Part No.
2 Form C	1.5V DC	TXD2S❑-1.5V-Z	TXD2S❑-L-1.5V-Z
	3V DC	TXD2S❑-3V-Z	TXD2S❑-L-3V-Z
	4.5V DC	TXD2S❑-4.5V-Z	TXD2S❑-L-4.5V-Z
	5V DC	TXD2S❑-5V-Z	TXD2S❑-L-5V-Z
	6V DC	TXD2S❑-6V-Z	TXD2S❑-L-6V-Z
	9V DC	TXD2S❑-9V-Z	TXD2S❑-L-9V-Z
	12V DC	TXD2S❑-12V-Z	TXD2S❑-L-12V-Z
	24V DC	TXD2S❑-24V-Z	TXD2S❑-L-24V-Z

❑: For each surface-mount terminal identification, input the following letter. SA type: A, SL type: L, SS type: S
Standard packing: Tape and reel: 500 pcs.; Case: 1,000 pcs.
Notes: 1. Tape and reel packing symbol "-Z" is not marked on the relay. "X" type tape and reel packing (picked from 1/3/4/5-pin side) is also available.
2. Please add "-1" to the part number for AgPd contacts (low level load). (Ex. TXD2SA-1.5V-1-Z)

2. M.B.B type/Surge breakdown voltage (between contact and coil) 2,500 V/ Breakdown voltage (between open contacts) 1,000 V

1) Standard PC board terminal

Contact arrangement	Nominal coil voltage	Single side stable
		Part No.
2 Form C	1.5V DC	TXD2-2M-1.5V
	3V DC	TXD2-2M-3V
	4.5V DC	TXD2-2M-4.5V
	5V DC	TXD2-2M-5V
	6V DC	TXD2-2M-6V
	9V DC	TXD2-2M-9V
	12V DC	TXD2-2M-12V
	24V DC	TXD2-2M-24V

Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.

2) Self-clinching terminal

Contact arrangement	Nominal coil voltage	Single side stable
		Part No.
2 Form C	1.5V DC	TXD2-2M-H-1.5V
	3V DC	TXD2-2M-H-3V
	4.5V DC	TXD2-2M-H-4.5V
	5V DC	TXD2-2M-H-5V
	6V DC	TXD2-2M-H-6V
	9V DC	TXD2-2M-H-9V
	12V DC	TXD2-2M-H-12V
	24V DC	TXD2-2M-H-24V

Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.

3) Surface-mount terminal

(1) Tube packing

Contact arrangement	Nominal coil voltage	Single side stable
		Part No.
2 Form C	1.5V DC	TXD2S❏-2M-1.5V
	3V DC	TXD2S❏-2M-3V
	4.5V DC	TXD2S❏-2M-4.5V
	5V DC	TXD2S❏-2M-5V
	6V DC	TXD2S❏-2M-6V
	9V DC	TXD2S❏-2M-9V
	12V DC	TXD2S❏-2M-12V
	24V DC	TXD2S❏-2M-24V

❏: For each surface-mount terminal identification, input the following letter. SA type: A, SL type: L, SS type: S
Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.

(2) Tape and reel packing

Contact arrangement	Nominal coil voltage	Single side stable
		Part No.
2 Form C	1.5V DC	TXD2S❏-2M-1.5V-Z
	3V DC	TXD2S❏-2M-3V-Z
	4.5V DC	TXD2S❏-2M-4.5V-Z
	5V DC	TXD2S❏-2M-5V-Z
	6V DC	TXD2S❏-2M-6V-Z
	9V DC	TXD2S❏-2M-9V-Z
	12V DC	TXD2S❏-2M-12V-Z
	24V DC	TXD2S❏-2M-24V-Z

❏: For each surface-mount terminal identification, input the following letter. SA type: A, SL type: L, SS type: S
Standard packing: Tape and reel: 500 pcs.; Case: 1,000 pcs.
Notes: 1. Types designed to withstand strong vibration caused, for example, by the use of terminal cutters, can also be ordered.
However, please contact us if you need parts for use in low level load. (Ex. TXD2SA-2M-1.5V-1-Z)
2. Tape and reel packing symbol “-Z” is not marked on the relay. “X” type tape and reel packing (picked from 1/3/4/5-pin side) is also available.

3. Standard (B.B.M.) type/Surge breakdown voltage (between contact and coil) 6,000 V/ Breakdown voltage (between open contacts) 1,000 V

1) Standard PC board terminal

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching
		Part No.	Part No.
2 Form C	1.5V DC	TXD2-1.5V-6	TXD2-L-1.5V-6
	3V DC	TXD2-3V-6	TXD2-L-3V-6
	4.5V DC	TXD2-4.5V-6	TXD2-L-4.5V-6
	5V DC	TXD2-5V-6	TXD2-L-5V-6
	6V DC	TXD2-6V-6	TXD2-L-6V-6
	9V DC	TXD2-9V-6	TXD2-L-9V-6
	12V DC	TXD2-12V-6	TXD2-L-12V-6
	24V DC	TXD2-24V-6	TXD2-L-24V-6

Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.
Note: Please add “-7” to the end of the part number for AgPd contacts (low level load).

2) Self-clinching terminal

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching
		Part No.	Part No.
2 Form C	1.5V DC	TXD2-H-1.5V-6	TXD2-L-H-1.5V-6
	3V DC	TXD2-H-3V-6	TXD2-L-H-3V-6
	4.5V DC	TXD2-H-4.5V-6	TXD2-L-H-4.5V-6
	5V DC	TXD2-H-5V-6	TXD2-L-H-5V-6
	6V DC	TXD2-H-6V-6	TXD2-L-H-6V-6
	9V DC	TXD2-H-9V-6	TXD2-L-H-9V-6
	12V DC	TXD2-H-12V-6	TXD2-L-H-12V-6
	24V DC	TXD2-H-24V-6	TXD2-L-H-24V-6

Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.
Note: Please add “-7” to the end of the part number for AgPd contacts (low level load).

3) Surface-mount terminal

(1) Tube packing

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching
		Part No.	Part No.
2 Form C	1.5V DC	TXD2S❑-1.5V-6	TXD2S❑-L-1.5V-6
	3V DC	TXD2S❑-3V-6	TXD2S❑-L-3V-6
	4.5V DC	TXD2S❑-4.5V-6	TXD2S❑-L-4.5V-6
	5V DC	TXD2S❑-5V-6	TXD2S❑-L-5V-6
	6V DC	TXD2S❑-6V-6	TXD2S❑-L-6V-6
	9V DC	TXD2S❑-9V-6	TXD2S❑-L-9V-6
	12V DC	TXD2S❑-12V-6	TXD2S❑-L-12V-6
	24V DC	TXD2S❑-24V-6	TXD2S❑-L-24V-6

❑: For each surface-mount terminal identification, input the following letter. SA type: A, SL type: L, SS type: S
Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.
Note: Please add “-7” to the end of the part number for AgPd contacts (low level load).

(2) Tape and reel packing

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching
		Part No.	Part No.
2 Form C	1.5V DC	TXD2S❑-1.5V-6-Z	TXD2S❑-L-1.5V-6-Z
	3V DC	TXD2S❑-3V-6-Z	TXD2S❑-L-3V-6-Z
	4.5V DC	TXD2S❑-4.5V-6-Z	TXD2S❑-L-4.5V-6-Z
	5V DC	TXD2S❑-5V-6-Z	TXD2S❑-L-5V-6-Z
	6V DC	TXD2S❑-6V-6-Z	TXD2S❑-L-6V-6-Z
	9V DC	TXD2S❑-9V-6-Z	TXD2S❑-L-9V-6-Z
	12V DC	TXD2S❑-12V-6-Z	TXD2S❑-L-12V-6-Z
	24V DC	TXD2S❑-24V-6-Z	TXD2S❑-L-24V-6-Z

❑: For each surface-mount terminal identification, input the following letter. SA type: A, SL type: L, SS type: S
Standard packing: Tape and reel: 500 pcs.; Case: 1,000 pcs.
Notes: 1. Tape and reel packing symbol “-Z” is not marked on the relay. “X” type tape and reel packing (picked from 1/3/4/5-pin side) is also available.
2. Please add “-7” to the part number for AgPd contacts (low level load). (Ex. TXD2SA-1.5V-7-Z)

4. Standard (B.B.M.) type/Surge breakdown voltage (between contact and coil) 6,000 V/ Breakdown voltage (between open contacts) 1,500 V (High breakdown voltage type)

1) Standard PC board terminal

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching
		Part No.	Part No.
2 Form C	1.5V DC	TXD2-1.5V-3	TXD2-L-1.5V-3
	3V DC	TXD2-3V-3	TXD2-L-3V-3
	4.5V DC	TXD2-4.5V-3	TXD2-L-4.5V-3
	5V DC	TXD2-5V-3	TXD2-L-5V-3
	6V DC	TXD2-6V-3	TXD2-L-6V-3
	9V DC	TXD2-9V-3	TXD2-L-9V-3
	12V DC	TXD2-12V-3	TXD2-L-12V-3
	24V DC	TXD2-24V-3	TXD2-L-24V-3

Standard packing: Tube: 40 pcs.; Case: 800 pcs.
Note: Please add “-4” to the end of the part number for AgPd contacts (low level load).

2) Surface-mount terminal

(1) Tube packing

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching
		Part No.	Part No.
2 Form C	1.5V DC	TXD2S❑-1.5V-3	TXD2S❑-L-1.5V-3
	3V DC	TXD2S❑-3V-3	TXD2S❑-L-3V-3
	4.5V DC	TXD2S❑-4.5V-3	TXD2S❑-L-4.5V-3
	5V DC	TXD2S❑-5V-3	TXD2S❑-L-5V-3
	6V DC	TXD2S❑-6V-3	TXD2S❑-L-6V-3
	9V DC	TXD2S❑-9V-3	TXD2S❑-L-9V-3
	12V DC	TXD2S❑-12V-3	TXD2S❑-L-12V-3
	24V DC	TXD2S❑-24V-3	TXD2S❑-L-24V-3

❑: For each surface-mount terminal identification, input the following letter. SA type: A, SL type: L, SS type: S
Standard packing: Tube: 40 pcs.; Case: 800 pcs.
Note: Please add “-4” to the end of the part number for AgPd contacts (low level load).

(2) Tape and reel packing

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching
		Part No.	Part No.
2 Form C	1.5V DC	TXD2SA-1.5V-3-Z	TXD2SA-L-1.5V-3-Z
	3V DC	TXD2SA-3V-3-Z	TXD2SA-L-3V-3-Z
	4.5V DC	TXD2SA-4.5V-3-Z	TXD2SA-L-4.5V-3-Z
	5V DC	TXD2SA-5V-3-Z	TXD2SA-L-5V-3-Z
	6V DC	TXD2SA-6V-3-Z	TXD2SA-L-6V-3-Z
	9V DC	TXD2SA-9V-3-Z	TXD2SA-L-9V-3-Z
	12V DC	TXD2SA-12V-3-Z	TXD2SA-L-12V-3-Z
	24V DC	TXD2SA-24V-3-Z	TXD2SA-L-24V-3-Z

*Only for SA type.
Standard packing: Tape and reel: 500 pcs.; Case: 1,000 pcs.
Notes: 1. Tape and reel packing symbol “-Z” is not marked on the relay. “X” type tape and reel packing (picked from 1/3/4/5-pin side) is also available.
2. Please add “-4” to the part number for AgPd contacts (low level load). (Ex. TXD2SA-1.5V-4-Z)

RATING

1. Coil data

[Standard (B.B.M.) type]

1) Single side stable

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. applied voltage (at 20°C 68°F)
			Surge breakdown voltage: 2,500V/6,000 V	Surge breakdown voltage: 6,000 V (High breakdown voltage)	Surge breakdown voltage: 2,500V/6,000 V	Surge breakdown voltage: 6,000 V (High breakdown voltage)	Surge breakdown voltage: 2,500V/6,000 V	Surge breakdown voltage: 6,000 V (High breakdown voltage)	
1.5V DC	75%V or less of nominal voltage* (Initial)	10%V or more of nominal voltage* (Initial)	132.7mA	187.5mA	11Ω	8Ω	200mW	280mW	120%V of nominal voltage
3V DC			66.7mA	93.5mA	45Ω	32Ω			
4.5V DC			44.4mA	62.5mA	101Ω	72Ω			
5V DC			40.0mA	56.2mA	125Ω	89Ω			
6V DC			33.3mA	46.5mA	180Ω	129Ω			
9V DC			22.2mA	31.1mA	405Ω	289Ω			
12V DC			16.7mA	23.3mA	720Ω	514Ω			
24V DC			9.6mA	12.9mA	2,504Ω	1,858Ω	230mW	310mW	

2) 1 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. applied voltage (at 20°C 68°F)
			Surge breakdown voltage: 2,500V/6,000 V	Surge breakdown voltage: 6,000 V (High breakdown voltage)	Surge breakdown voltage: 2,500V/6,000 V	Surge breakdown voltage: 6,000 V (High breakdown voltage)	Surge breakdown voltage: 2,500V/6,000 V	Surge breakdown voltage: 6,000 V (High breakdown voltage)	
1.5V DC	75%V or less of nominal voltage* (Initial)	75%V or less of nominal voltage* (Initial)	100.0mA	153.1mA	15Ω	10Ω	150mW	230mW	120%V of nominal voltage
3V DC			50.0mA	76.9mA	60Ω	39Ω			
4.5V DC			33.3mA	51.1mA	135Ω	88Ω			
5V DC			30.0mA	46.3mA	166Ω	109Ω			
6V DC			25.0mA	38.5mA	240Ω	156Ω			
9V DC			16.7mA	25.6mA	540Ω	352Ω			
12V DC			12.5mA	19.2mA	960Ω	626Ω			
24V DC			7.1mA	10.4mA	3,388Ω	2,304Ω	170mW	250mW	

[M.B.B. type]

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC	75%V or less of nominal voltage* (Initial)	10%V or more of nominal voltage* (Initial)	166.7mA	9Ω	250mW	120%V of nominal voltage
3V DC			83.3mA	36Ω		
4.5V DC			55.6mA	81Ω		
5V DC			50.0mA	100Ω		
6V DC			41.7mA	144Ω		
9V DC			27.8mA	324Ω		
12V DC			20.8mA	576Ω		
24V DC			11.3mA	2,133Ω	270mW	

*Pulse drive (JIS C 5442-1986)
*Only for surge breakdown voltage of 2,500 V.

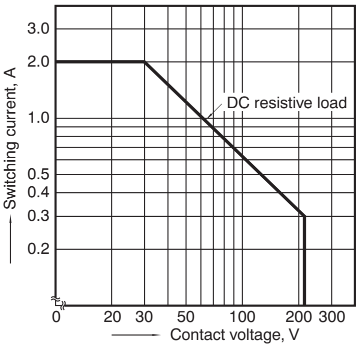
2. Specifications

Characteristics	Item		Specifications	
			2 Form C	2 Form D (M.B.B.type)*1
Contact	Arrangement		2 Form C	2 Form D (M.B.B.type)*1
	Contact resistance (Initial)		Max. 100 mΩ (By voltage drop 6 V DC 1A)	
	Contact material		Standard contact: Ag+Au clad, AgPd contact (low level load): AgPd+Au clad (stationary), AgPd (movable)	
Rating	Nominal switching capacity		Standard contact: 2 A 30 V DC, AgPd contact: 1 A 30 V DC (resistive load)	1 A 30 V DC (resistive load)
	Max. switching power		Standard contact: 60 W (DC), AgPd contact: 30 W (DC) (resistive load)	30 W (DC) (resistive load)
	Max. switching voltage		220 V DC	110 V DC
	Max. switching current		Standard contact: 2 A, AgPd contact: 1 A	1 A
	Min. switching capacity (Reference value)*2		10μA10mV DC	
	Nominal operating power	Single side stable	Surge breakdown voltage 2,500 V and 6,000 V types: 200mW (1.5 to 12 V DC), 230mW (24 V DC) Surge breakdown voltage 6,000 V (High breakdown voltage) type: 280mW (1.5 to 12 V DC), 310mW (24 V DC)	250mW (1.5 to 12 V DC), 270mW (24 V DC)
		1 coil latching	Surge breakdown voltage 2,500 V and 6,000 V types: 150mW (1.5 to 12 V DC), 170mW (24 V DC) Surge breakdown voltage 6,000 V (High breakdown voltage) type: 230mW (1.5 to 12 V DC), 250mW (24 V DC)	—
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.	
	Breakdown voltage (Initial)	Between open contacts	Surge breakdown voltage 2,500 V and 6,000 V types: 1,000 Vrms for 1min. (Detection current: 10mA) Surge breakdown voltage 6,000 V (High breakdown voltage) type: 1,500 Vrms for 1min. (Detection current: 10mA)	500 Vrms for 1min. (Detection current: 10mA)
		Between contact and coil	Surge breakdown voltage 2,500 V type: 2,000 Vrms for 1min. (Detection current: 10mA) Surge breakdown voltage 6,000 V and 6,000 V (High breakdown voltage) types: 3,000 Vrms for 1min. (Detection current: 10mA)	2,000 Vrms for 1min. (Detection current: 10mA)
		Between contact sets	1,000 Vrms for 1min. (Detection current: 10mA)	
	Surge breakdown voltage (Initial)	Between open contacts	1,500 V (10×160μs) (FCC Part 68)	—
		Between contacts and coil*1	Surge breakdown voltage 2,500 V type: 2,500 V, 2 × 10μs (Telcordia) Surge breakdown voltage 6,000 V and 6,000 V (High breakdown voltage) types: 6,000 V, 1.2 × 50μs	2,500 V, 2 × 10μs (Telcordia)
	Temperature rise (at 20°C 68°F)		Max. 50°C 122°F (By resistive method, nominal coil voltage applied to the coil; contact carrying current: 2A [1A: M.B.B.].)	
	Operate time [Set time] (at 20°C 68°F)		Max. 4 ms [Max. 4 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.)	
	Release time [Reset time] (at 20°C 68°F)		Max. 4 ms [Max. 4 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)	
Mechanical characteristics	Shock resistance	Functional	Min. 750 m/s² (Half-wave pulse of sine wave: 6 ms; detection time: 10μs.)	Min. 500 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6 ms.)	
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3.3 mm (Detection time: 10μs.)	
		Destructive	10 to 55 Hz at double amplitude of 5 mm	
Expected life	Mechanical		Min. 10^8 (at 180 cpm)	Min. 10^7 (at 180 cpm)
	Electrical		Min. 10^5 (2 A 30 V DC resistive), Min. 5×10^5 (1 A 30 V DC resistive) (at 20 cpm)	Min. 10^5 (1 A 30 V DC resistive) (at 20 cpm)
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –40°C to +85°C –40°F to +185°F; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)	
	Max. operating speed (at rated load)		20 cpm	
Unit weight			Approx. 2 g .071 oz	

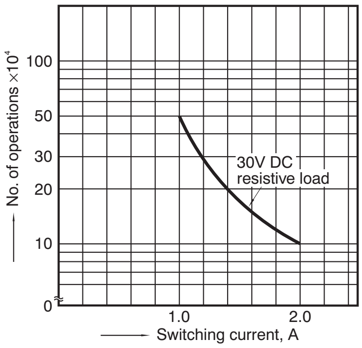
*1 M.B.B. type models are only available in 2,500 V surge breakdown voltage type.
*2 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (AgPd contact type or SX relays are available for low level load switching [10V DC, 10mA max. level])
*3The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

1. Maximum switching capacity

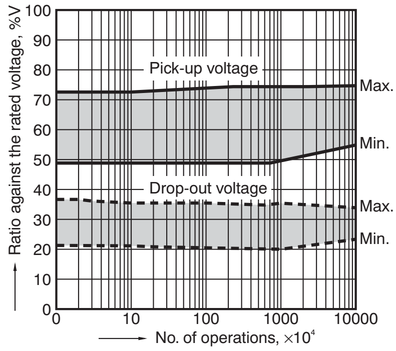


2. Life curve



3. Mechanical life

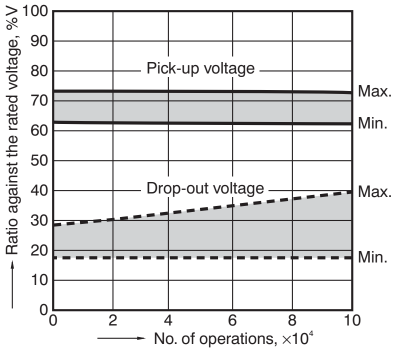
Tested sample: TXD2-5V, 10 pcs.
Operating speed: 180 cpm



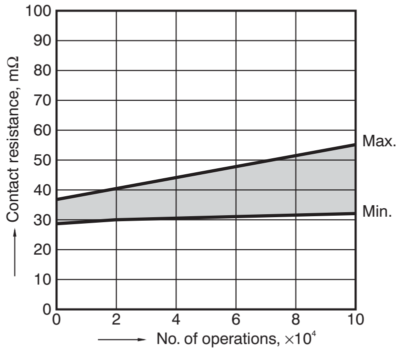
4. Electrical life (2 A 30 V DC resistive load)

Tested sample: TXD2-5V, 6 pcs.
Operating speed: 20 cpm

Change of pick-up and drop-out voltage

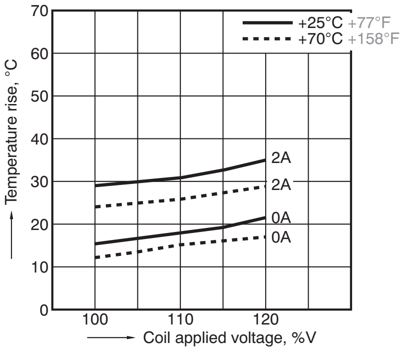


Change of contact resistance



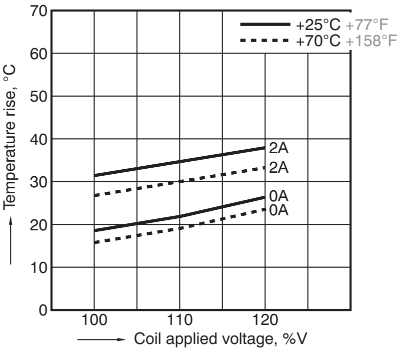
5-(1). Coil temperature rise

Tested sample: TXD2-5V, 6 pcs.
Measured portion: Inside the coil
Ambient temperature: 25°C 77°F, 70°C 158°F



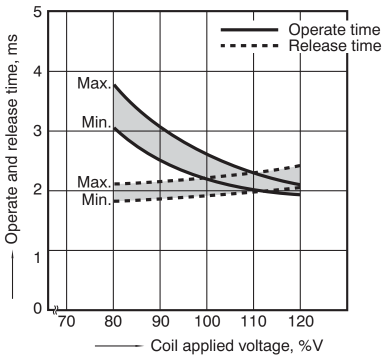
5-(2). Coil temperature rise

Tested sample: TXD2-24V, 6 pcs.
Measured portion: Inside the coil
Ambient temperature: 25°C 77°F, 70°C 158°F



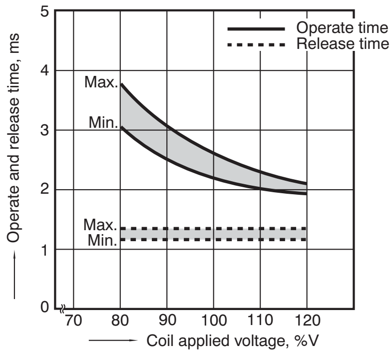
6-(1). Operate/release time characteristics (with diode)

Tested sample: TXD2-5V, 10 pcs.



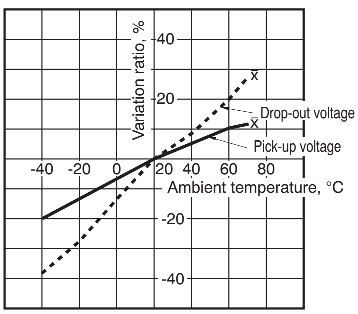
6-(2). Operate/release time characteristics (without diode)

Tested sample: TXD2-5V, 10 pcs.



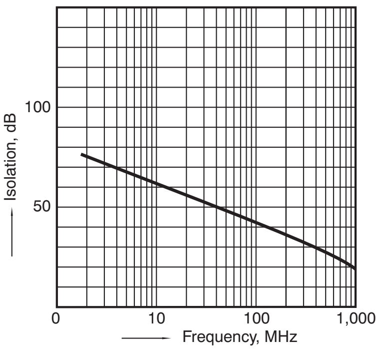
7. Ambient temperature characteristics

Tested sample: TXD2-5V, 5 pcs.



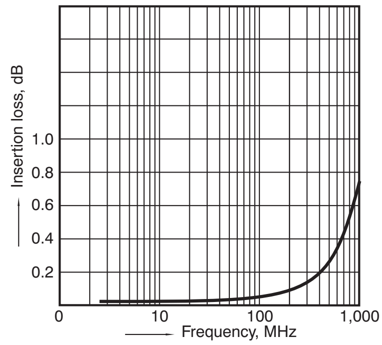
8. High-frequency characteristics (Isolation)

Tested sample: TXD2-12V, 2 pcs.



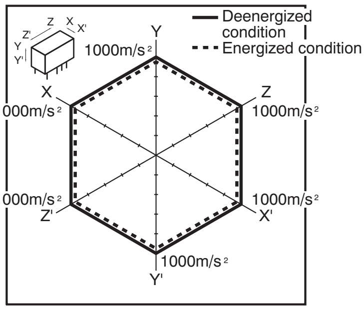
9. High-frequency characteristics (Insertion loss)

Tested sample: TXD2-12V, 2 pcs.



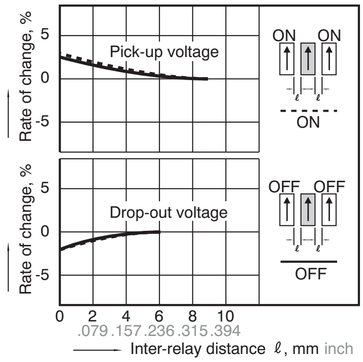
10. Malfunctional shock (single side stable)

Tested sample: TXD2-5V, 6 pcs



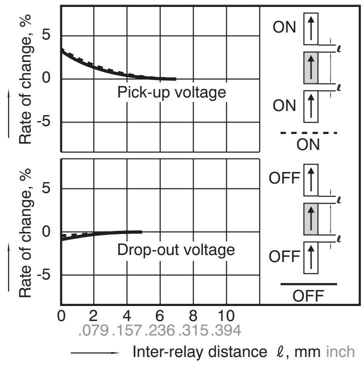
11-(1). Influence of adjacent mounting

Tested sample: TXD2-12V, 6 pcs.



11-(2). Influence of adjacent mounting

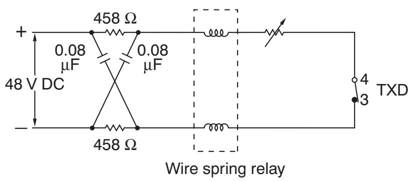
Tested sample: TXD2-12V, 6 pcs.



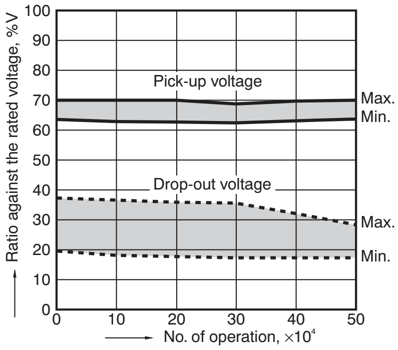
12. Actual load test (35 mA 48 V DC wire spring relay load)

Tested sample: TXD2-5V, 6 pcs.

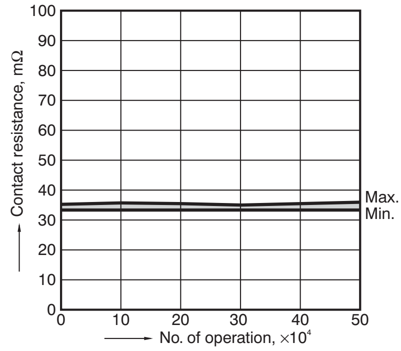
Circuit



Change of pick-up and drop-out voltage



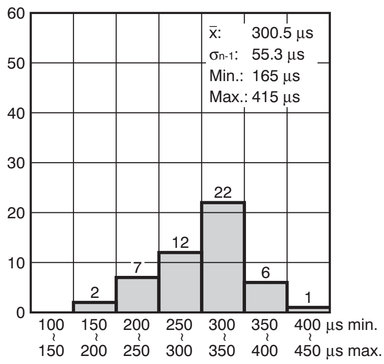
Change of contact resistance



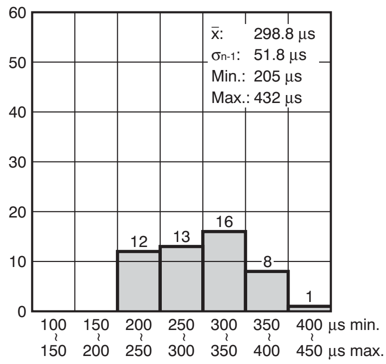
13-(1). Distribution of M.B.B. time

Tested sample: TXD2-2M-5V, 50 pcs.

Terminal No. 3-4-5: ON



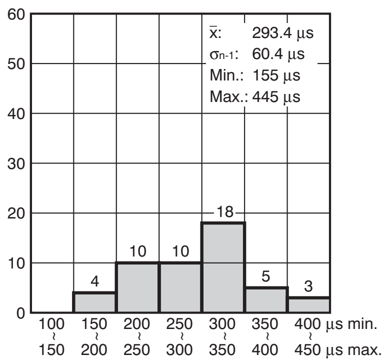
Terminal No. 3-4-5: OFF



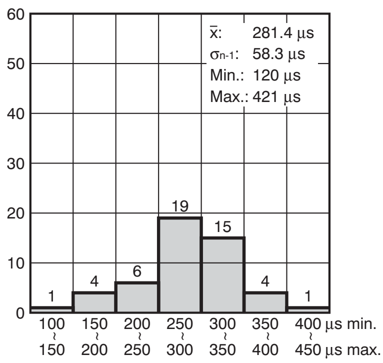
13-(2). Distribution of M.B.B. time

Tested sample: TXD2-2M-5V, 50 pcs.

Terminal No. 8-9-10: ON

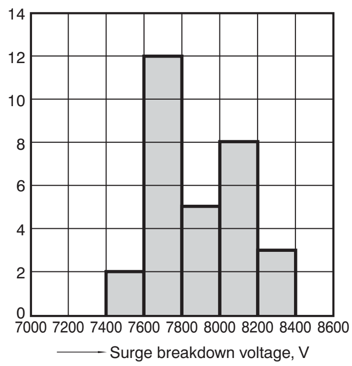


Terminal No. 8-9-10: OFF



14. Surge breakdown voltage test

Tested sample: TXD2-3V-6, 30 pcs.



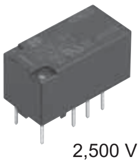
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. Surge breakdown voltage
2,500 V and 6,000 V types

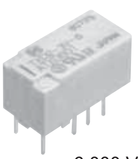
1) Standard PC board terminal and self-clinching terminal

CAD Data



2,500 V type

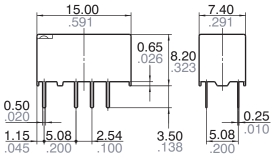
CAD Data



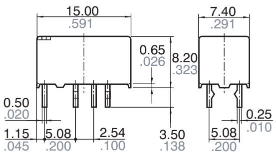
6,000 V type

External dimensions

Standard PC board terminal

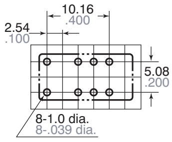


Self clinching terminal



General tolerance: ±0.3 ±.012

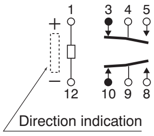
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

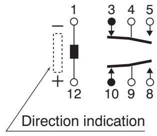
Schematic (Bottom view)

Single side stable



(Deenergized condition)

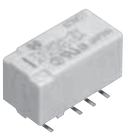
1 coil latching

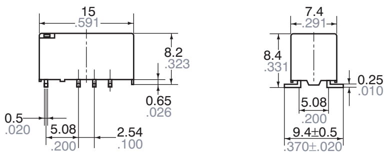
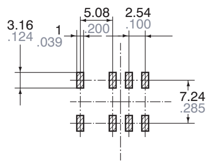
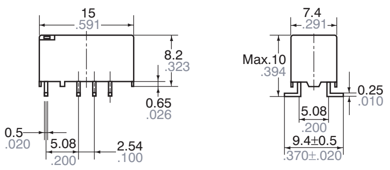
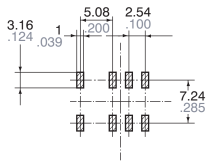
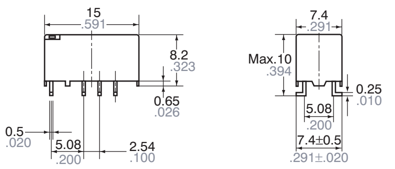
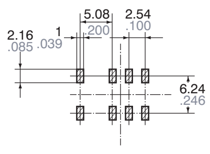


(Reset condition)

2) Surface-mount terminal

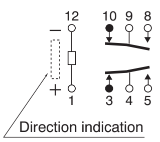
CAD Data



Type	External dimensions (General tolerance: ±0.3 ±.012)	Suggested mounting pad (Top view) (Tolerance: ±0.1 ±.004)
	Single side stable and 1 coil latching	Single side stable and 1 coil latching
SA type		
SL type		
SS type		

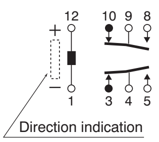
Schematic (Top view)

Single side stable



(Deenergized condition)

1 coil latching

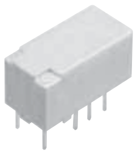


(Reset condition)

2. Surge breakdown voltage 6,000 V (High breakdown voltage type)

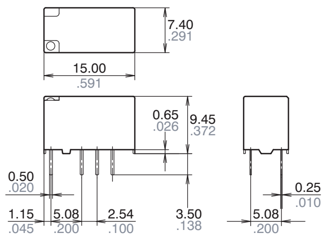
1) Standard PC board terminal

CAD Data



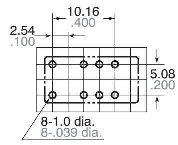
External dimensions

Standard PC board terminal



General tolerance: ±0.3 ±.012

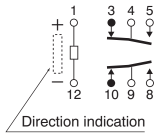
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

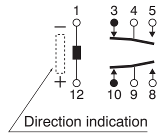
Schematic (Bottom view)

Single side stable



(Deenergized condition)

1 coil latching

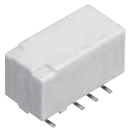


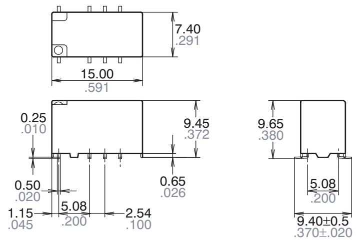
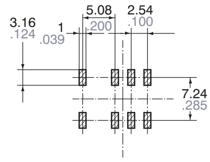
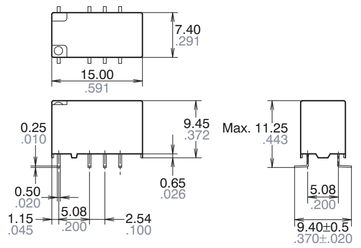
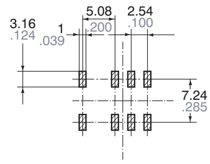
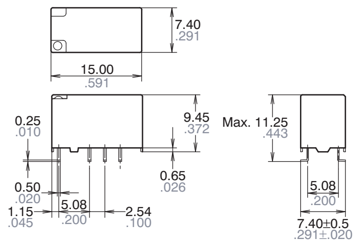
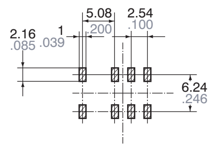
(Reset condition)

Signal

2) Surface-mount terminal

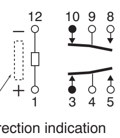
CAD Data



Type	External dimensions (General tolerance: ±0.3 ±.012)	Suggested mounting pad (Top view) (Tolerance: ±0.1 ±.004)
	Single side stable and 1 coil latching	Single side stable and 1 coil latching
SA type		
SL type		
SS type		

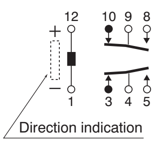
Schematic (Top view)

Single side stable



(Deenergized condition)

1 coil latching



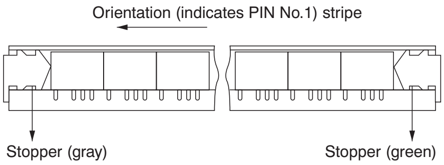
(Reset condition)

NOTES

1. Packing style

1) Tube packing

The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.

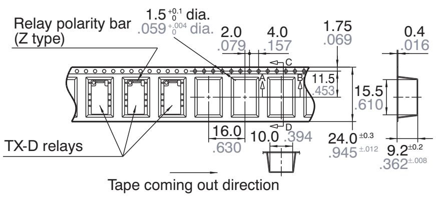


2) Tape and reel packing (surface-mount terminal type)

(1) Tape dimensions

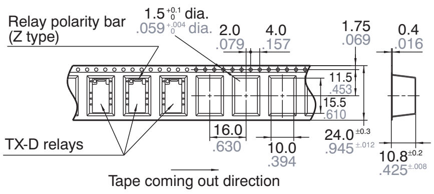
(i) SA type

mm inch



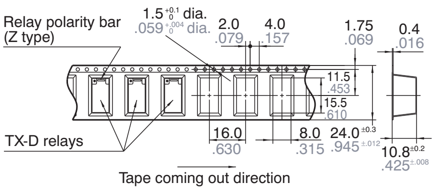
(ii) SL type

mm inch



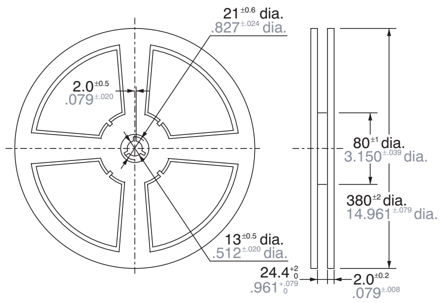
(iii) SS type

mm inch



(2) Dimensions of plastic reel

mm inch

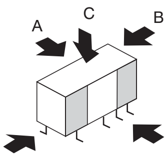


3) Ambient temperature when transporting and during storage with the product in its original packaging:

–40 to +70°C –40 to +158°F

2. Automatic insertion

To maintain the internal function of the relay, the chucking pressure should not exceed the values below.

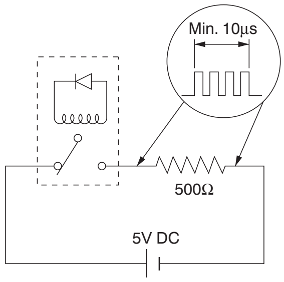


Chucking pressure in the direction A:
4.9 N {500gf} or less
Chucking pressure in the direction B:
9.8 N {1 kgf} or less
Chucking pressure in the direction C:
9.8 N {1 kgf} or less
Please chuck the portion.
Avoid chucking the center of the relay.
In addition, excessive chucking pressure to the pinpoint of the relay should be avoided.

3. M.B.B. type

A small OFF time may be generated by the contact bounce during contact switching. Check the actual circuit carefully.

If the relay is dropped accidentally, check the appearance and characteristics including M.B.B. time before use.



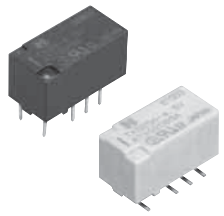
Measuring condition of M.B.B. time

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

New pin layout (LT type) added. Ultra high sensitivity realized at 50 mW nominal operating power

TX-S RELAYS



FEATURES

1. **Nominal operating power: High sensitivity of 50mW**
   By using the highly efficient polar magnetic circuit "seesaw balance mechanism", a nominal operating power of 50 mW (minimum operating power of 32 mW) has been achieved.
2. **Compact size**
   15.0(L) × 7.4(W) × 8.2(H) .591(L) × .291(W) × .323(H)
3. **High contact reliability**
   High contact reliability is achieved by the use of gold-clad twin crossbar contacts, low-gas formation materials, mold sealing the coil section, and by controlling organic gas in the coil.
   ***We also offer a range of products with AgPd contacts suitable for use in low level load analog circuits (Max. 10V DC 10 mA).**
   ***SX relays designed for low level loads are also available.**
4. **Outstanding surge resistance**
   Surge breakdown voltage between open contacts:
   1,500 V 10×160 μsec. (FCC part 68)
   Surge breakdown voltage between contact and coil:
   2,500 V 2×10 μsec. (Telcordia)
5. **Low thermal electromotive force (approx. 0.3 μV)**
   The structure of the mold-sealed body block of the coil section achieves nominal operating power of 50 mW and high sensitivity, along with low thermal electromotive force, reduced to approximately 0.3 μV.
6. **A range of surface-mount types is also available.**
   SA: Low-profile surface-mount terminal type
   SL: High connection reliability surface-mount terminal type
   SS: Space saving surface-mount terminal type
7. **Sealed construction allows automatic washing.**

TYPICAL APPLICATIONS

1. **Communications (XDSL, Transmission)**
2. **Measurement**
3. **Security**
4. **Home appliances, and audio/visual equipment**
5. **Automotive equipment**
6. **Medical equipment**

ORDERING INFORMATION

TXS 2 [ ] - [ ] - [ ] - [ ] - [ ] - [ ]

Contact arrangement
2: 2 Form C

Surface-mount availability
Nil: Standard PC board terminal type or self-clinching terminal type
SA: SA type
SL: SL type
SS: SS type

Operating function
Nil: Single side stable
L: 1 coil latching
L2: 2 coil latching
LT: 2 coil latching

Terminal shape
Nil: Standard PC board terminal or surface-mount terminal
H: Self-clinching terminal

Nominal coil voltage (DC)
1.5, 3, 4.5, 6, 9, 12, 24V

Contact material
Nil: Standard contact (Ag+Au clad)
1: AgPd contact (low level load); AgPd+Au clad (stationary), AgPd (movable)

Packing style
Nil: Tube packing
X: Tape and reel (picked from 1/3/4/5-pin side)
Z: Tape and reel packing (picked from the 8/9/10/12-pin side)

TYPES

1. Standard PC board terminal

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching (L2)	2 coil latching (LT)
		Part No.	Part No.	Part No.	Part No.
2 Form C	1.5V DC	TXS2-1.5V	TXS2-L-1.5V	TXS2-L2-1.5V	TXS2-LT-1.5V
	3V DC	TXS2-3V	TXS2-L-3V	TXS2-L2-3V	TXS2-LT-3V
	4.5V DC	TXS2-4.5V	TXS2-L-4.5V	TXS2-L2-4.5V	TXS2-LT-4.5V
	6V DC	TXS2-6V	TXS2-L-6V	TXS2-L2-6V	TXS2-LT-6V
	9V DC	TXS2-9V	TXS2-L-9V	TXS2-L2-9V	TXS2-LT-9V
	12V DC	TXS2-12V	TXS2-L-12V	TXS2-L2-12V	TXS2-LT-12V
	24V DC	TXS2-24V	TXS2-L-24V	TXS2-L2-24V	TXS2-LT-24V

Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.
Note: Please add “-1” to the end of the part number for AgPd contacts (low level load).

2. Self-clinching terminal

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching (L2)	2 coil latching (LT)
		Part No.	Part No.	Part No.	Part No.
2 Form C	1.5V DC	TXS2-H-1.5V	TXS2-L-H-1.5V	TXS2-L2-H-1.5V	TXS2-LT-H-1.5V
	3V DC	TXS2-H-3V	TXS2-L-H-3V	TXS2-L2-H-3V	TXS2-LT-H-3V
	4.5V DC	TXS2-H-4.5V	TXS2-L-H-4.5V	TXS2-L2-H-4.5V	TXS2-LT-H-4.5V
	6V DC	TXS2-H-6V	TXS2-L-H-6V	TXS2-L2-H-6V	TXS2-LT-H-6V
	9V DC	TXS2-H-9V	TXS2-L-H-9V	TXS2-L2-H-9V	TXS2-LT-H-9V
	12V DC	TXS2-H-12V	TXS2-L-H-12V	TXS2-L2-H-12V	TXS2-LT-H-12V
	24V DC	TXS2-H-24V	TXS2-L-H-24V	TXS2-L2-H-24V	TXS2-LT-H-24V

Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.
Note: Please add “-1” to the end of the part number for AgPd contacts (low level load).

3. Surface-mount terminal

1) Tube packing

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching (L2)	2 coil latching (LT)
		Part No.	Part No.	Part No.	Part No.
2 Form C	1.5V DC	TXS2S❏-1.5V	TXS2S❏-L-1.5V	TXS2S❏-L2-1.5V	TXS2S❏-LT-1.5V
	3V DC	TXS2S❏-3V	TXS2S❏-L-3V	TXS2S❏-L2-3V	TXS2S❏-LT-3V
	4.5V DC	TXS2S❏-4.5V	TXS2S❏-L-4.5V	TXS2S❏-L2-4.5V	TXS2S❏-LT-4.5V
	6V DC	TXS2S❏-6V	TXS2S❏-L-6V	TXS2S❏-L2-6V	TXS2S❏-LT-6V
	9V DC	TXS2S❏-9V	TXS2S❏-L-9V	TXS2S❏-L2-9V	TXS2S❏-LT-9V
	12V DC	TXS2S❏-12V	TXS2S❏-L-12V	TXS2S❏-L2-12V	TXS2S❏-LT-12V
	24V DC	TXS2S❏-24V	TXS2S❏-L-24V	TXS2S❏-L2-24V	TXS2S❏-LT-24V

❏: For each surface-mounted terminal identification, input the following letter. SA type: A, SL type: L, SS type: S
Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.
Note: Please add “-1” to the end of the part number for AgPd contacts (low level load).

2) Tape and reel packing

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching (L2)	2 coil latching (LT)
		Part No.	Part No.	Part No.	Part No.
2 Form C	1.5V DC	TXS2S❏-1.5V-Z	TXS2S❏-L-1.5V-Z	TXS2S❏-L2-1.5V-Z	TXS2S❏-LT-1.5V-Z
	3V DC	TXS2S❏-3V-Z	TXS2S❏-L-3V-Z	TXS2S❏-L2-3V-Z	TXS2S❏-LT-3V-Z
	4.5V DC	TXS2S❏-4.5V-Z	TXS2S❏-L-4.5V-Z	TXS2S❏-L2-4.5V-Z	TXS2S❏-LT-4.5V-Z
	6V DC	TXS2S❏-6V-Z	TXS2S❏-L-6V-Z	TXS2S❏-L2-6V-Z	TXS2S❏-LT-6V-Z
	9V DC	TXS2S❏-9V-Z	TXS2S❏-L-9V-Z	TXS2S❏-L2-9V-Z	TXS2S❏-LT-9V-Z
	12V DC	TXS2S❏-12V-Z	TXS2S❏-L-12V-Z	TXS2S❏-L2-12V-Z	TXS2S❏-LT-12V-Z
	24V DC	TXS2S❏-24V-Z	TXS2S❏-L-24V-Z	TXS2S❏-L2-24V-Z	TXS2S❏-LT-24V-Z

❏: For each surface-mounted terminal identification, input the following letter. SA type: A, SL type: L, SS type: S
Standard packing: Tape and reel: 500 pcs.; Case: 1,000 pcs.
Notes: 1. Tape and reel packing symbol “-Z” is not marked on the relay. “X” type tape and reel packing (picked from 1/2/3/4-pin side) is also available.
2. Please add “-1” to the end of the part number for AgPd contacts (low level load). (Ex. TXS2SA-1.5V-1-Z)

RATING

1. Coil data

1) Single side stable

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC			33.3mA	45Ω		
3V DC			16.7mA	180Ω		
4.5V DC			11.1mA	405Ω		
6V DC	80%V or less of nominal voltage* (Initial)	10%V or more of nominal voltage* (Initial)	8.3mA	720Ω	50mW	150%V of nominal voltage
9V DC			5.6mA	1,620Ω		
12V DC			4.2mA	2,880Ω		
24V DC			2.9mA	8,229Ω	70mW	

2) 1 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC	80%V or less of nominal voltage* (Initial)	80%V or less of nominal voltage* (Initial)	23.3mA	64.3Ω	35mW	150%V of nominal voltage
3V DC			11.7mA	257Ω		
4.5V DC			7.8mA	579Ω		
6V DC			5.8mA	1,029Ω		
9V DC			3.9mA	2,314Ω		
12V DC			2.9mA	4,114Ω		
24V DC			2.1mA	11,520Ω	50mW	

3) 2 coil latching (L2, LT)

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. applied voltage (at 20°C 68°F)
			Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
1.5V DC	80%V or less of nominal voltage* (Initial)	80%V or less of nominal voltage* (Initial)	46.7mA	46.7mA	32.1Ω	32.1Ω	70mW	70mW	150%V of nominal voltage
3V DC			23.3mA	23.3mA	129Ω	129Ω			
4.5V DC			15.6mA	15.6mA	289Ω	289Ω			
6V DC			11.7mA	11.7mA	514Ω	514Ω			
9V DC			7.8mA	7.8mA	1,157Ω	1,157Ω			
12V DC			5.8mA	5.8mA	2,057Ω	2,057Ω			
24V DC			6.3mA	6.3mA	3,840Ω	3,840Ω	150mW	150mW	

*Pulse drive (JIS C 5442-1986)

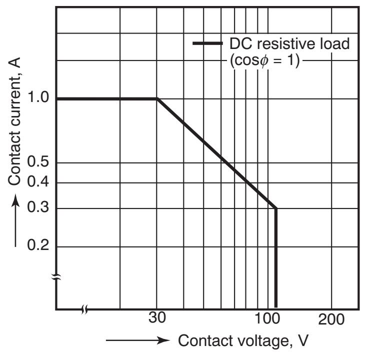
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		2 Form C
	Initial contact resistance, max.		Max. 100 mΩ (By voltage drop 6 V DC 1A)
	Contact material		Standard contact: Ag+Au clad, AgPd contact (low level load): AgPd+Au clad (stationary), AgPd (movable)
Rating	Nominal switching capacity		1 A 30 V DC (resistive load)
	Max. switching power		30 W (DC) (resistive load)
	Max. switching voltage		110V DC
	Max. switching current		1 A
	Min. switching capacity (Reference value)*1		10μA 10mV DC
	Nominal operating power	Single side stable	50 mW (1.5 to 12 V DC), 70 mW (24 V DC)
		1 coil latching	35 mW (1.5 to 12 V DC), 50 mW (24 V DC)
		2 coil latching	70 mW (1.5 to 12 V DC), 150 mW (24 V DC)
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	750 Vrms for 1min. (Detection current: 10mA)
		Between contact and coil	1,800 Vrms for 1min. (Detection current: 10mA)
		Between contact sets	1,000 Vrms for 1min. (Detection current: 10mA)
	Surge breakdown voltage (Initial)	Between open contacts	1,500 V (10×160μs) (FCC Part 68)
		Between contacts and coil	2,500 V (2×10μs) (Telcordia)
	Temperature rise (at 20°C 68°F)		Max. 50°C (By resistive method, nominal coil voltage applied to the coil; contact carrying current: 1A.)
	Operate time [Set time] (at 20°C 68°F)		Max. 5 ms [Max. 5 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.)
	Release time [Reset time] (at 20°C 68°F)		Max. 5 ms [Max. 5 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 750 m/s² (Half-wave pulse of sine wave: 6 ms; detection time: 10μs.)
		Destructive	Min. 1,000 m/s² (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3.3 mm (Detection time: 10μs.)
		Destructive	10 to 55 Hz at double amplitude of 5 mm
Expected life	Mechanical		Min. 5×10^7 (at 180 cpm)
	Electrical		Min. 2×10^5 (1 A 30 V DC resistive) (at 20 cpm)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +70°C –40°F to +158°F; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed (at rated load)		20 cpm
Unit weight			Approx. 2 g .071 oz

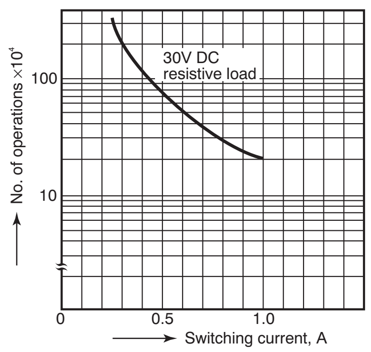
*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (AgPd contact type or SX relays are available for low level load switching [10V DC, 10mA max. level])
*2Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

1. Maximum switching capacity

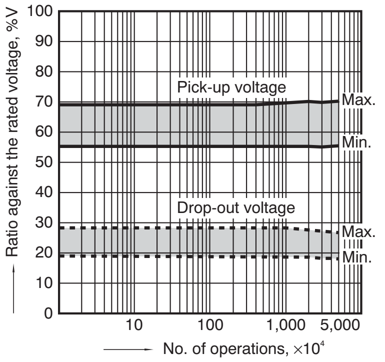


2. Life curve



3. Mechanical life

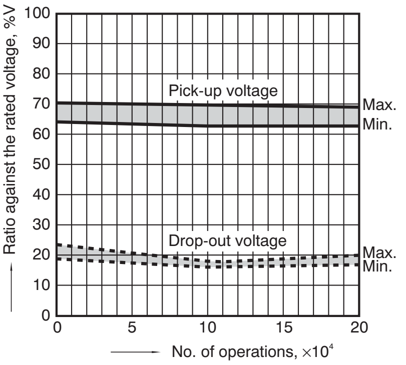
Tested sample: TXS2-4.5V, 10 pcs.
Operating speed: 180 cpm



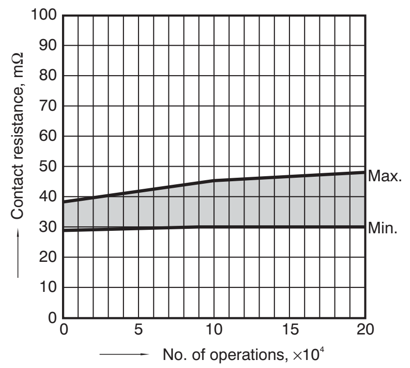
4. Electrical life (1 A 30 V DC resistive load)

Tested sample: TXS2-4.5V, 6 pcs.
Operating speed: 20 cpm

Change of pick-up and drop-out voltage

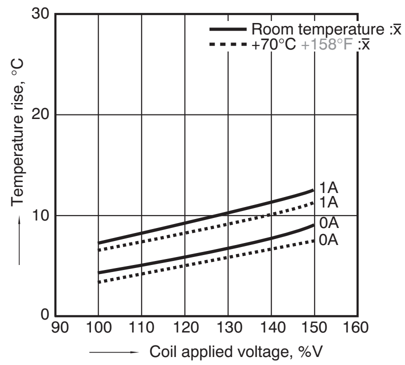


Change of contact resistance



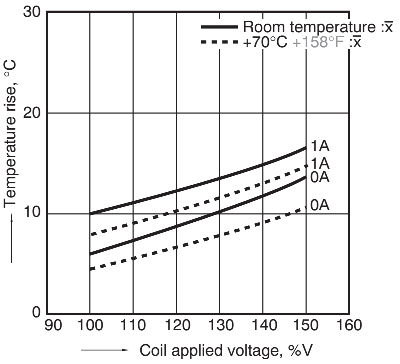
5-(1). Coil temperature rise

Tested sample: TXS2-4.5V, 6 pcs.
Point measured: Inside the coil
Ambient temperature: 25°C 77°F, 70°C 158°F



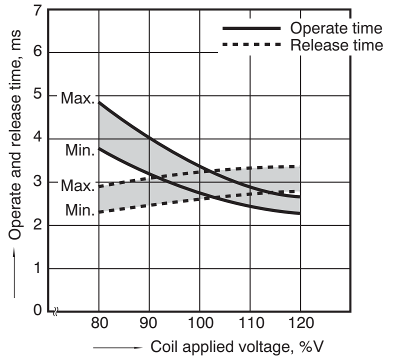
5-(2). Coil temperature rise

Tested sample: TXS2-24V, 6 pcs.
Point measured: Inside the coil
Ambient temperature: 25°C 77°F, 70°C 158°F



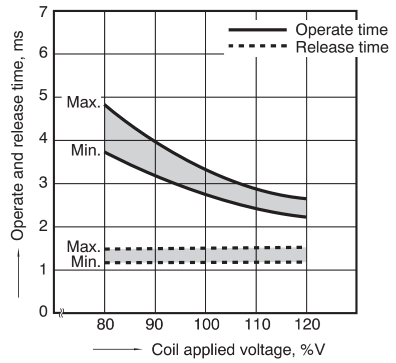
6-(1). Operate and release time (with diode)

Tested sample: TXS2-4.5V, 10 pcs.



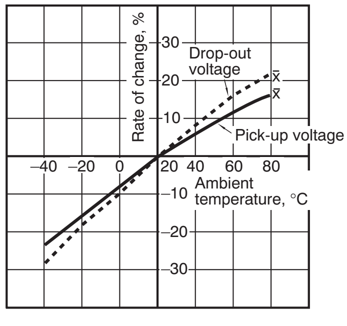
6-(2). Operate and release time (without diode)

Tested sample: TXS2-4.5V, 10 pcs.



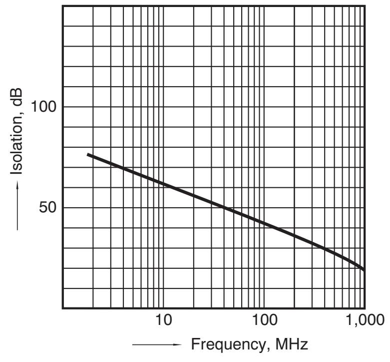
7. Ambient temperature characteristics

Tested sample: TXS2-4.5V, 5 pcs.



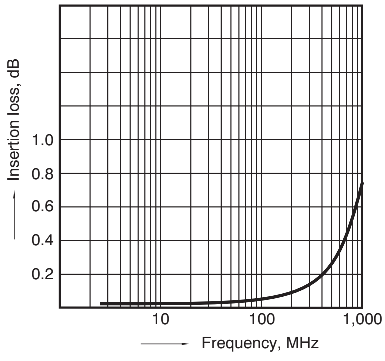
8-(1). High frequency characteristics (Isolation)

Tested sample: TXS2-4.5V, 2 pcs.



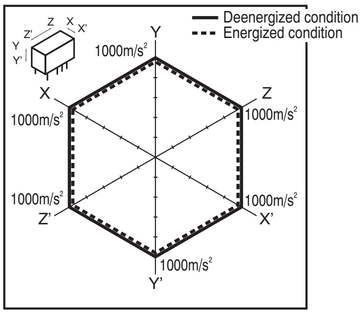
8-(2). High frequency characteristics (Insertion loss)

Tested sample: TXS2-4.5V, 2 pcs.



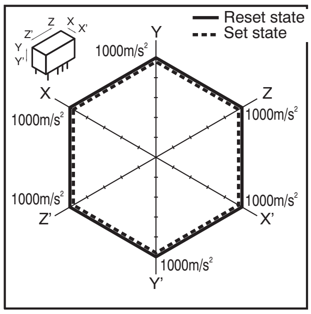
9-(1). Malfunctional shock (single side stable)

Tested sample: TXS2-4.5V, 6 pcs.



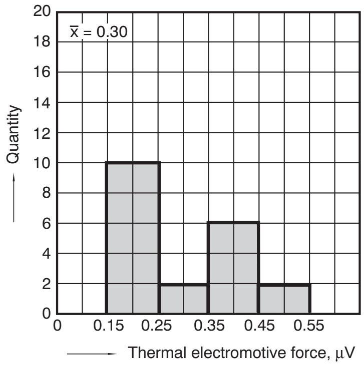
9-(2). Malfunctional shock (latching)

Tested sample: TXS2-L2-4.5V, 6 pcs.



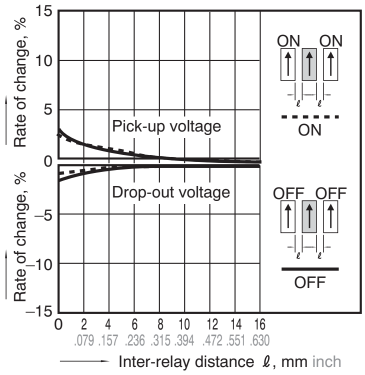
10. Thermal electromotive force

Tested sample: TXS2-4.5V, 6 pcs.



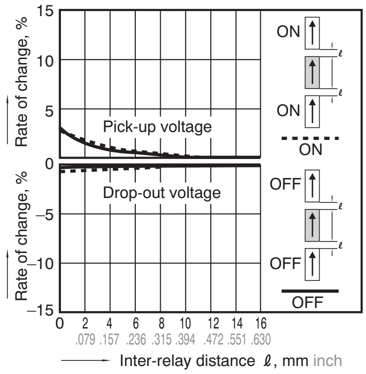
11-(1). Influence of adjacent mounting

Tested sample: TXS2-4.5V, 6 pcs.



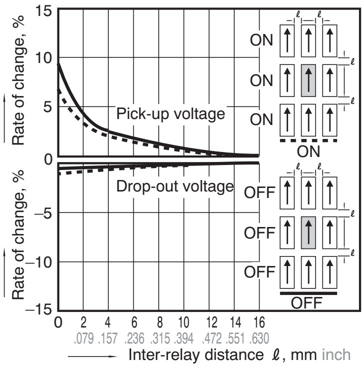
11-(2). Influence of adjacent mounting

Tested sample: TXS2-4.5V, 6 pcs.



11-(3). Influence of adjacent mounting

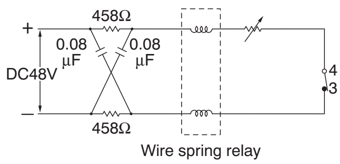
Tested sample: TXS2-4.5V, 6 pcs.



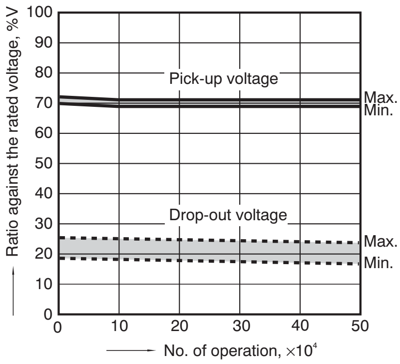
12. Pulse dialing test

(35 mA 48V DC wire spring relay load)

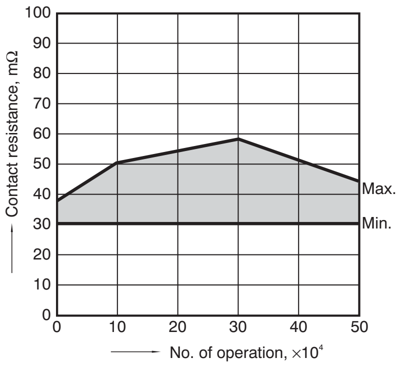
Tested sample: TXS2-4.5V, 6 pcs.



Change of pick-up and drop-out voltage



Change of contact resistance



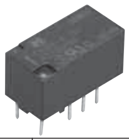
Note: Data of surface-mount type are the same as those of PC board terminal type.

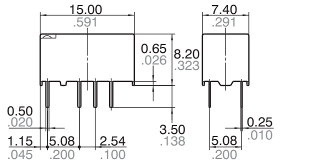
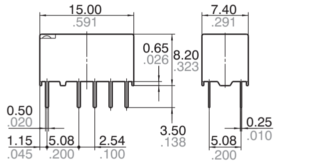
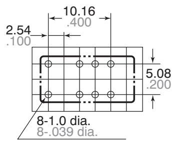
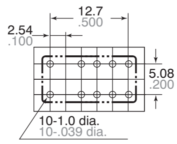
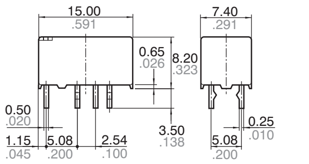
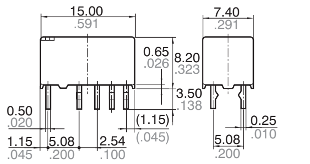
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. Standard PC board terminal and Self clinching terminal

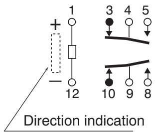
CAD Data



Type	External dimensions (General tolerance: ±0.3 ±.012)		PC board pattern (Bottom view) (Tolerance: ±0.1 ±.004)	
	Single side stable and 1 coil latching type	2 coil latching type (L2, LT)	Single side stable and 1 coil latching type	2 coil latching type (L2, LT)
Standard PC board terminal				
Self clinching terminal				

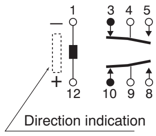
Schematic (Bottom view)

Single side stable



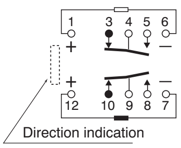
(Deenergized condition)

1 coil latching



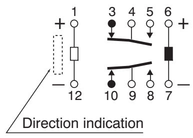
(Reset condition)

2 coil latching (L2)



(Reset condition)

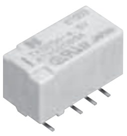
2 coil latching (LT)

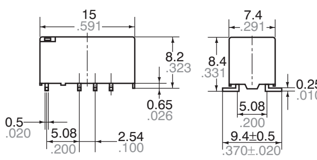
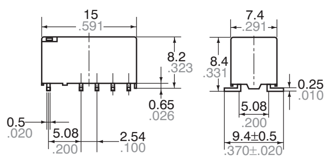
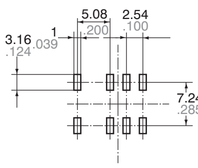
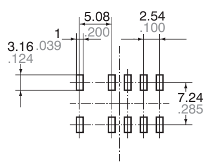
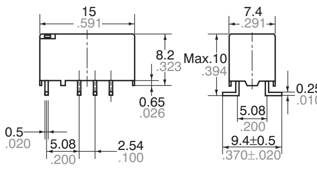
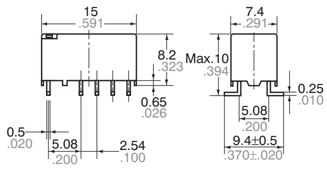
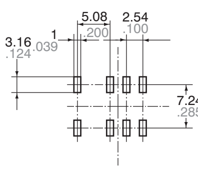
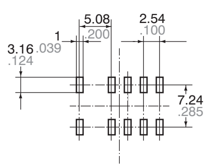
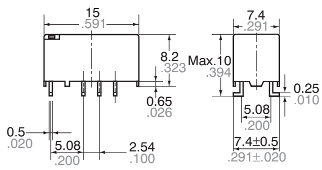
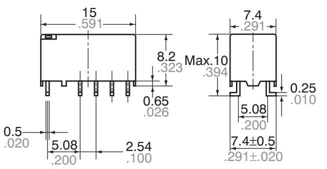
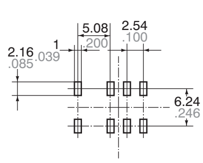
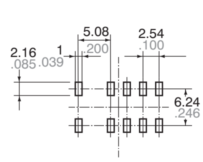


(Reset condition)

2. Surface-mount terminal

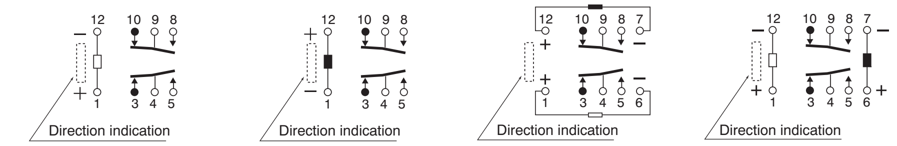
CAD Data



Type	External dimensions (General tolerance: ±0.3 ±.012)		Suggested mounting pad (Top view) (Tolerance: ±0.1 ±.004)	
	Single side stable and 1 coil latching type	2 coil latching type (L2, LT)	Single side stable and 1 coil latching type	2 coil latching type (L2, LT)
SA type				
SL type				
SS type				

Schematic (Top view)

Single side stable	1 coil latching	2 coil latching (L2)	2 coil latching (LT)

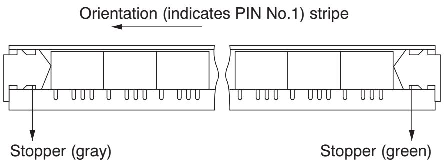


(Deenergized condition)	(Reset condition)	(Reset condition)	(Reset condition)

NOTES

1. Packing style

1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.

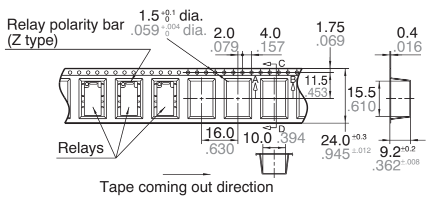


2) Tape and reel packing (surface-mount terminal type)

(1) Tape dimensions

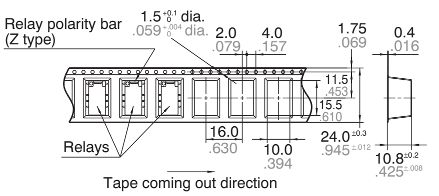
(i) SA type

mm inch



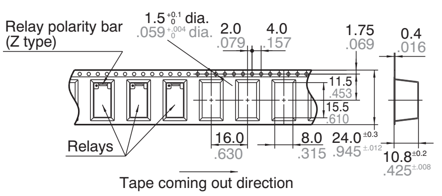
(ii) SL type

mm inch



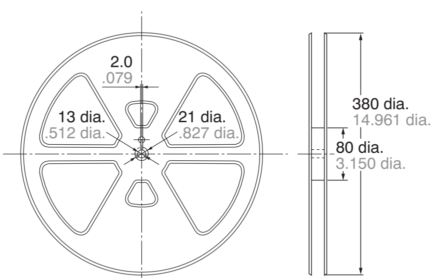
(iii) SS type

mm inch



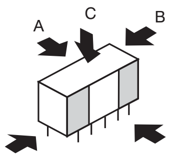
(2) Dimensions of plastic reel

mm inch



2. Automatic insertion

To maintain the internal function of the relay, the chucking pressure should not exceed the values below.
Chucking pressure in the direction A:
4.9 N {500gf} or less
Chucking pressure in the direction B:
9.8 N {1 kgf} or less
Chucking pressure in the direction C:
9.8 N {1 kgf} or less



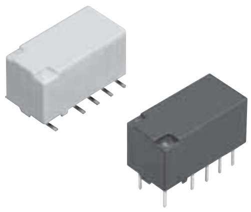
Please chuck the ▭ portion.
Avoid chucking the center of the relay.
In addition, excessive chucking pressure to the pinpoint of the relay should be avoided.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

Small size, controlled 7.5A inrush current possible

TX RELAYS TH types



FEATURES

1. **Small size, controlled 7.5A inrush current possible**
2. **2,000 V breakdown voltage between contact and coil**
   The body block construction of the coil that is sealed at formation offers a high breakdown voltage of 2,000 V between contact and coil, and 1,000 V between open contacts.
3. **Outstanding surge resistance**
   Surge breakdown voltage between open contacts:
   1,500 V 10×160μsec. (FCC part 68)
   Surge breakdown voltage between contact and coil:
   2,500 V 2×10μsec. (Bellcore)
4. **Nominal operating power: High sensitivity of 140mW**
   By using the highly efficient polar magnetic circuit “seesaw balance mechanism”, a nominal operating power of 140 mW (minimum operating power of 79 mW) has been achieved.
5. **High contact capacity: 2 A 30 V DC**
6. **Compact size**
   15.0(L) × 7.4(W) × 8.2(H) .591(L) × .291(W) × .323(H)
7. **Outstanding vibration and shock resistance**
   Functional shock resistance: 750 m/s^2
   Destructive shock resistance: 1,000 m/s^2
   Functional vibration resistance:
   10 to 55 Hz (at double amplitude of 3.3 mm .130 inch)
   Destructive vibration resistance:
   10 to 55 Hz (at double amplitude of 5 mm .197 inch)
8. **Sealed construction allows automatic washing.**
9. **A range of surface-mount types is also available**
   SA: Low-profile surface-mount terminal type
   SL: High connection reliability surface-mount terminal type
   SS: Space saving surface-mount terminal type

TYPICAL APPLICATIONS

1. **Air-conditioning control (solenoid load)**
2. **Others, High-capacity control etc.**

ORDERING INFORMATION

TX 2 [ ] - [ ] - [ ] - [ ] - TH - [ ]

Contact arrangement
2: 2 Form C

Surface-mount availability
Nil: Standard PC board terminal type or self-clinching terminal type
SA: SA type
SL: SL type
SS: SS type

Operating function
Nil: Single side stable
L: 1 coil latching
L2: 2 coil latching
LT: 2 coil latching

Terminal shape
Nil: Standard PC board terminal or surface-mount terminal
H: Self-clinching terminal

Nominal coil voltage (DC)*
1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V

Contact material
TH: Power type (Ag+Au clad/stationary, movable)

Packing style
Nil: Tube packing
X: Tape and reel (picked from 1/3/4/5-pin side)
Z: Tape and reel packing (picked from the 8/9/10/12-pin side)

Notes: 1. *48 V coil type: Single side stable only
2. In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

TYPES

1. Standard PC board terminal

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching (L2)	2 coil latching (LT)
		Part No.	Part No.	Part No.	Part No.
2 Form C	1.5V DC	TX2-1.5V-TH	TX2-L-1.5V-TH	TX2-L2-1.5V-TH	TX2-LT-1.5V-TH
	3V DC	TX2-3V-TH	TX2-L-3V-TH	TX2-L2-3V-TH	TX2-LT-3V-TH
	4.5V DC	TX2-4.5V-TH	TX2-L-4.5V-TH	TX2-L2-4.5V-TH	TX2-LT-4.5V-TH
	5V DC	TX2-5V-TH	TX2-L-5V-TH	TX2-L2-5V-TH	TX2-LT-5V-TH
	6V DC	TX2-6V-TH	TX2-L-6V-TH	TX2-L2-6V-TH	TX2-LT-6V-TH
	9V DC	TX2-9V-TH	TX2-L-9V-TH	TX2-L2-9V-TH	TX2-LT-9V-TH
	12V DC	TX2-12V-TH	TX2-L-12V-TH	TX2-L2-12V-TH	TX2-LT-12V-TH
	24V DC	TX2-24V-TH	TX2-L-24V-TH	TX2-L2-24V-TH	TX2-LT-24V-TH
	48V DC	TX2-48V-TH	—	—	—

Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.

Signal

2. Self-clinching terminal

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching (L2)	2 coil latching (LT)
		Part No.	Part No.	Part No.	Part No.
2 Fom C	1.5V DC	TX2-H-1.5V-TH	TX2-L-H-1.5V-TH	TX2-L2-H-1.5V-TH	TX2-LT-H-1.5V-TH
	3V DC	TX2-H-3V-TH	TX2-L-H-3V-TH	TX2-L2-H-3V-TH	TX2-LT-H-3V-TH
	4.5V DC	TX2-H-4.5V-TH	TX2-L-H-4.5V-TH	TX2-L2-H-4.5V-TH	TX2-LT-H-4.5V-TH
	5V DC	TX2-H-5V-TH	TX2-L-H-5V-TH	TX2-L2-H-5V-TH	TX2-LT-H-5V-TH
	6V DC	TX2-H-6V-TH	TX2-L-H-6V-TH	TX2-L2-H-6V-TH	TX2-LT-H-6V-TH
	9V DC	TX2-H-9V-TH	TX2-L-H-9V-TH	TX2-L2-H-9V-TH	TX2-LT-H-9V-TH
	12V DC	TX2-H-12V-TH	TX2-L-H-12V-TH	TX2-L2-H-12V-TH	TX2-LT-H-12V-TH
	24V DC	TX2-H-24V-TH	TX2-L-H-24V-TH	TX2-L2-H-24V-TH	TX2-LT-H-24V-TH
	48V DC	TX2-H-48V-TH	—	—	—

Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.

3. Surface-mount terminal

1) Tube packing

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching (L2)	2 coil latching (LT)
		Part No.	Part No.	Part No.	Part No.
2c	1.5V DC	TX2S❑-1.5V-TH	TX2S❑-L-1.5V-TH	TX2S❑-L2-1.5V-TH	TX2S❑-LT-1.5V-TH
	3V DC	TX2S❑-3V-TH	TX2S❑-L-3V-TH	TX2S❑-L2-3V-TH	TX2S❑-LT-3V-TH
	4.5V DC	TX2S❑-4.5V-TH	TX2S❑-L-4.5V-TH	TX2S❑-L2-4.5V-TH	TX2S❑-LT-4.5V-TH
	5V DC	TX2S❑-5V-TH	TX2S❑-L-5V-TH	TX2S❑-L2-5V-TH	TX2S❑-LT-5V-TH
	6V DC	TX2S❑-6V-TH	TX2S❑-L-6V-TH	TX2S❑-L2-6V-TH	TX2S❑-LT-6V-TH
	9V DC	TX2S❑-9V-TH	TX2S❑-L-9V-TH	TX2S❑-L2-9V-TH	TX2S❑-LT-9V-TH
	12V DC	TX2S❑-12V-TH	TX2S❑-L-12V-TH	TX2S❑-L2-12V-TH	TX2S❑-LT-12V-TH
	24V DC	TX2S❑-24V-TH	TX2S❑-L-24V-TH	TX2S❑-L2-24V-TH	TX2S❑-LT-24V-TH
	48V DC	TX2S❑-48V-TH	—	—	—

❑: For each surface-mounted terminal identification, input the following letter. SA type: A, SL type: L, SS type: S
Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.

2) Tape and reel packing

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching (L2)	2 coil latching (LT)
		Part No.	Part No.	Part No.	Part No.
2 Form C	1.5V DC	TX2S❑-1.5V-TH-Z	TX2S❑-L-1.5V-TH-Z	TX2S❑-L2-1.5V-TH-Z	TX2S❑-LT-1.5V-TH-Z
	3V DC	TX2S❑-3V-TH-Z	TX2S❑-L-3V-TH-Z	TX2S❑-L2-3V-TH-Z	TX2S❑-LT-3V-TH-Z
	4.5V DC	TX2S❑-4.5V-TH-Z	TX2S❑-L-4.5V-TH-Z	TX2S❑-L2-4.5V-TH-Z	TX2S❑-LT-4.5V-TH-Z
	5V DC	TX2S❑-5V-TH-Z	TX2S❑-L-5V-TH-Z	TX2S❑-L2-5V-TH-Z	TX2S❑-LT-5V-TH-Z
	6V DC	TX2S❑-6V-TH-Z	TX2S❑-L-6V-TH-Z	TX2S❑-L2-6V-TH-Z	TX2S❑-LT-6V-TH-Z
	9V DC	TX2S❑-9V-TH-Z	TX2S❑-L-9V-TH-Z	TX2S❑-L2-9V-TH-Z	TX2S❑-LT-9V-TH-Z
	12V DC	TX2S❑-12V-TH-Z	TX2S❑-L-12V-TH-Z	TX2S❑-L2-12V-TH-Z	TX2S❑-LT-12V-TH-Z
	24V DC	TX2S❑-24V-TH-Z	TX2S❑-L-24V-TH-Z	TX2S❑-L2-24V-TH-Z	TX2S❑-LT-24V-TH-Z
	48V DC	TX2S❑-48V-TH-Z	—	—	—

Standard packing: Tape and reel: 500 pcs.; Case: 1,000 pcs.
Note: Tape and reel packing symbol “-Z” is not marked on the relay. “X” type tape and reel packing (picked from 1/2/3/4-pin side) is also available.

RATING

1. Coil data

1) Single side stable

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC	75%V or less of nominal voltage* (Initial)	10%V or more of nominal voltage* (Initial)	93.8mA	16Ω	140mW	150%V of nominal voltage
3V DC			46.7mA	64.3Ω		
4.5V DC			31mA	145Ω		
5V DC			28.1mA	178Ω		
6V DC			23.3mA	257Ω		
9V DC			15.5mA	579Ω		
12V DC			11.7mA	1,028Ω		
24V DC			5.8mA	4,114Ω		
48V DC			5.6mA	8,533Ω	270mW	120%V of nominal voltage

2) 1 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
1.5V DC	75%V or less of nominal voltage* (Initial)	75%V or less of nominal voltage* (Initial)	66.7mA	22.5Ω	100mW	150%V of nominal voltage
3V DC			33.3mA	90Ω		
4.5V DC			22.2mA	202.5Ω		
5V DC			20mA	250Ω		
6V DC			16.7mA	360Ω		
9V DC			11.1mA	810Ω		
12V DC			8.3mA	1,440Ω		
24V DC			4.2mA	5,760Ω		

3) 2 coil latching (L2, LT)

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. applied voltage (at 20°C 68°F
			Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
1.5V DC	75%V or less of nominal voltage* (Initial)	75%V or less of nominal voltage* (Initial)	93.8mA	93.8mA	16Ω	16Ω	140mW	140mW	150%V of nominal voltage
3V DC			46.7mA	46.7mA	64.3Ω	64.3Ω			
4.5V DC			31mA	31mA	145Ω	145Ω			
5V DC			28.1mA	28.1mA	178Ω	178Ω			
6V DC			23.3mA	23.3mA	257Ω	257Ω			
9V DC			15.5mA	15.5mA	579Ω	579Ω			
12V DC			11.7mA	11.7mA	1,028Ω	1,028Ω			
24V DC			5.8mA	5.8mA	4,114Ω	4,114Ω			

*Pulse drive (JIS C 5442-1986)

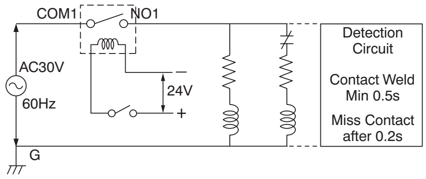
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		2 Form C
	Initial contact resistance, max.		Max. 100 mΩ (By voltage drop 6 V DC 1A)
	Contact material		Ag+Au plating
Rating	Nominal switching capacity		2 A 30 V DC, 0.5 A 125 V AC (resistive load)
	Max. switching power		60 W, 60 VA (resistive load)
	Max. switching voltage		220V DC, 250V AC
	Max. switching current		7.5 A (When used at 7.5 A. Regarding connection method, you must follow the precaution, below*.)
	Min. switching capacity (Reference value)[*1]		10μA 10mV DC
	Nominal operating power	Single side stable	140 mW (1.5 to 24 V DC), 270 mW (48 V DC)
		1 coil latching	100 mW (1.5 to 24 V DC)
		2 coil latching	140 mW (1.5 to 24 V DC)
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1min. (Detection current: 10mA)
		Between contact and coil	2,000 Vrms for 1min. (Detection current: 10mA)
		Between contact sets	1,000 Vrms for 1min. (Detection current: 10mA)
	Temperature rise (at 20°C 68°F)		Max. 50°C (By resistive method, nominal coil voltage applied to the coil; contact carrying current: 2A.)
	Surge breakdown voltage (Initial)	Between open contacts	1,500 V (10×160μs) (FCC Part 68)
		Between contacts and coil	2,500 V (2×10μs) (Telcordia)
	Operate time [Set time] (at 20°C 68°F)		Max. 4 ms [Max. 4 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.)
	Release time [Reset time] (at 20°C 68°F)		Max. 4 ms [Max. 4 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 750 m/s^2 (Half-wave pulse of sine wave: 6 ms; detection time: 10μs.)
		Destructive	Min. 1,000 m/s^2 (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3.3 mm (Detection time: 10μs.)
		Destructive	10 to 55 Hz at double amplitude of 5 mm
Expected life	Mechanical		Min. 10^8 (at 180 cpm)
	Electrical		Min. 10^5 (2 A 30 V DC resistive), 5×10^5 (1 A 30 V DC resistive), Min. 10^5 (0.5 A 125 V AC resistive) (at 20 cpm) Min. 2×10^5 (7.5 A inrush (250 ms)/1.5 A normal 30 V AC (cosϕ = 0.4)) (ON/OFF = 1s/9s)
Conditions	Conditions for operation, transport and storage[*2]		Ambient temperature: –40°C to +85°C (up to 24 V coil) –40°F to +185°F [–40°C to +70°C (48 V coil) –40°F to +158°F]; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed (at rated load)		20 cpm
Unit weight			Approx. 2 g .071 oz

*1This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

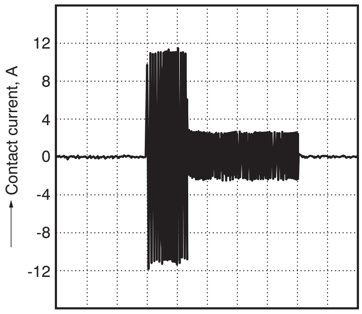
REFERENCE DATA

1. Electrical life (2 × 10^5 operation is possible)
Tested sample: TX2SA-24V-TH, 6 pcs.
Switching frequency: ON:OFF = 1s:9s
Ambient temperature: 25°C 77°F
Circuit



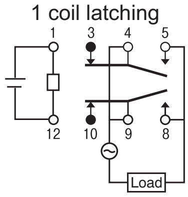
Condition: 30 V AC
Inrush current 7.5 A (execution value),
inrush time 250 ms
Normal current 1.5 A (execution value),
(inductive load cosϕ = 0.4)

Inrush current wave form vs time



***Precaution**
When using at 7.5 A, connection of NO (pin #5 and #8) and COM (pin #4 and #9) in the circuit is required.

Pin layout and schematic (BOTTOM VIEW)
1 coil latching



For general REFERENCE DATA, DIMENSIONS and NOTES, please refer to the TX Relay (page 99).

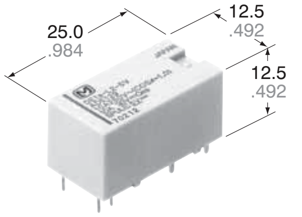
For Cautions for Use, see Relay Technical Information (page 582).

Polarized Power Relays

Panasonic
ideas for life

COMPACT
HIGH-INSULATION
POLARIZED POWER RELAY

DE RELAYS (ADE)



mm inch

FEATURES

- **Conforms to European safety standards (VDE0700 and VDE0631)**
  Insulating distance between coil and contacts:
  Clearance Min. 8mm .315 inch
  Creepage distance Min. 8mm .315 inch
- **Extensive product line-up**
- **Surge voltage between contact and coil 12 kV**
- **Low operating power**
  Nominal operating power at 200 mW (Single side stable, 2 coil latching)
- **Compact body saves space**
  Size: 12.5(W) × 25.0(L) × 12.5(H) mm
  .492(W) × .984(L) × .492(H) inch
- **UL/CSA, VDE approved**

SPECIFICATIONS

Contact

Arrangement		1 Form A	1 Form A 1 Form B	2 Form A
Contact material		$AgSnO_2$ type		
Initial contact resistance, max. (By voltage drop 6V DC 1A)		30mΩ		
Rating (resistive load)	Nominal switching capacity	10A 250V AC, 10A 30V DC	8A 250V AC, 8A 30V DC	8A 250V AC, 8A 30V DC
	Max. switching power	2,500 VA*, 300W	2,000 VA*, 240W	2,000 VA*, 240W
	Max. switching voltage	440V AC, 230V DC	440V AC, 230V DC	440V AC, 230V DC
	Max. switching current	10A (16A)*	8A (16A)*	8A (16A)*
	Min. switching capacity#1	100 mA, 5 V DC		
Expected life (min. operations)	Mechanical (at 300cpm)	10^7		
	Electrical (at 20 cpm) (resistive load)	10^5	10^5(AC) 5×10^4(DC)	
	Electrical (16A / 230 V AC resistive)*	25000	20000	

Coil (at 20°C, 68°F)

	Nominal operating power
Single side stable	200 mW
1 coil latching	100 mW
2 coil latching	200 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms
	Between contact sets	4,000 Vrms (2 Form A, 1 Form A 1 Form B)
	Between contact and coil	5,000 Vrms
Surge voltage between contact and coil*3		Min. 12,000 V (initial)
Operate time [Set time]*4		Max. 10ms (typ. 5ms) [Max. 10ms (typ. 4ms)] (at 20°C 68°F)
Release time (without diode) [Reset time]*4		Max. 5ms (typ. 2ms) [Max. 10ms (typ. 4ms)] (at 20°C 68°F)
Temperature rise (at 70°C)*5		Max. 50°C
Shock resistance	Functional*6	Min. 196 m/s^2\{20 G\}
	Destructive*7	Min. 980 m/s^2\{100 G\}
Vibration resistance	Functional*8	10 to 55 Hz at double amplitude of 2 mm
	Destructive	10 to 55 Hz at double amplitude of 3 mm
Conditions for operation, transport and storage*9 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to 70°C –40°F to 158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 7 g .25 oz

Remarks

* 16A possible for one contact set only with max. 4000 VA switching power.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Nominal operating voltage applied to the coil, excluding contact bounce time.
*5 By resistive method
*6 Half-wave pulse of sine wave: 11ms, detection time: 10ms.
*7 Half-wave pulse of sine wave: 6ms
*8 Detection time: 10ms
*9 Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

TYPICAL APPLICATIONS

- **Temperature controller**
- **Automatic meter reading**
- **OA equipment**
- **FA equipment**

ORDERING INFORMATION

Ex. DE — 1a — L — 3 V

Product name	Contact arrangement	Operating function	Coil voltage, V DC
DE	1a: 1 Form A 1a1b: 1 Form A 1 Form B 2a: 2 Form A	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48**

Notes: 1) Standard packing; Carton (tube package) 20 pcs. Case 500 pcs.
2) UL/CSA, VDE approved type is standard.

**just for single side stable

TYPES AND COIL DATA (at 20°C 68°F)

• Single side stable type

1 Form A, 1 Form A 1 Form B, 2 Form A

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
DE❑-1.5V	1.5	1.05	0.15	11.3	132.7	200	1.95
DE❑-3V	3	2.1	0.3	45	66.6	200	3.9
DE❑-4.5V	4.5	3.15	0.45	101	44.5	200	5.85
DE❑-5V	5	3.5	0.5	125	40	200	6.5
DE❑-6V	6	4.2	0.6	180	33.3	200	7.8
DE❑-9V	9	6.3	0.9	405	22.2	200	11.7
DE❑-12V	12	8.4	1.2	720	16.6	200	15.6
DE❑-24V	24	16.8	2.4	2,880	8.3	200	31.2
DE❑-48V	48	33.6	4.8	11,520	4.2	200	62.4

• 1 coil latching type

1 Form A

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (min.) (initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
DE❑-L-1.5V	1.5	1.05	1.05	22.5	66.6	100	1.95
DE❑-L-3V	3	2.1	2.1	90	33.3	100	3.9
DE❑-L-4.5V	4.5	3.15	3.15	202	22.3	100	5.85
DE❑-L-5V	5	3.5	3.5	250	20	100	6.5
DE❑-L-6V	6	4.2	4.2	360	16.7	100	7.8
DE❑-L-9V	9	6.3	6.3	812	11.1	100	11.7
DE❑-L-12V	12	8.4	8.4	1,440	8.3	100	15.6
DE❑-L-24V	24	16.8	16.8	5,760	4.2	100	31.2

• 2 coil latching type

1 Form A

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (min.) (initial)	Coil resistance, Ω (±10%)		Nominal operating current, mA (±10%)		Nominal operating power, mW		Max. allowable voltage, V DC
				Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
DE❑-L2-1.5V	1.5	1.05	1.05	11.3	11.3	66.6	66.6	200	200	1.95
DE❑-L2-3V	3	2.1	2.1	45	45	66.6	66.6	200	200	3.9
DE❑-L2-4.5V	4.5	3.15	3.15	101	101	44.5	44.5	200	200	5.85
DE❑-L2-5V	5	3.5	3.5	125	125	40	40	200	200	6.5
DE❑-L2-6V	6	4.2	4.2	180	180	33.3	33.3	200	200	7.8
DE❑-L2-9V	9	6.3	6.3	405	405	22.2	22.2	200	200	11.7
DE❑-L2-12V	12	8.4	8.4	720	720	16.6	16.6	200	200	15.6
DE❑-L2-24V	24	16.8	16.8	2,880	2,880	8.3	8.3	200	200	31.2

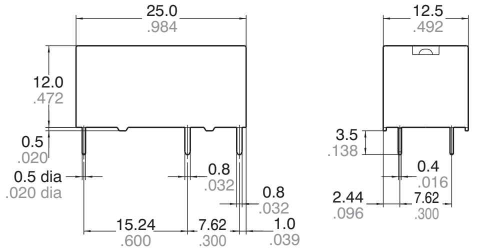
Note: Insert contact arrangement, e.g.1a, 1a1b, 2a, in ❑ for contact form required.

DIMENSIONS(mm inch)

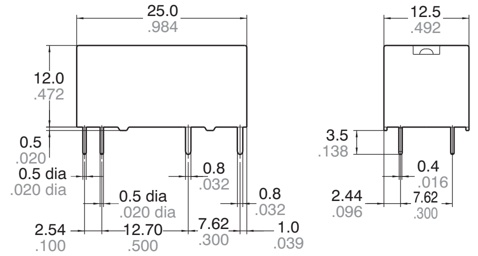
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data

Single side stable 1 coil latching type



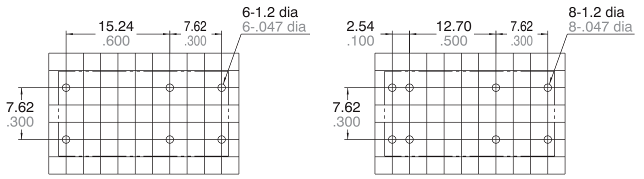
2 coil latching type



Tolerance: ±0.3 ±.012

PC board pattern (Bottom view)

Single side stable 1 coil latching type / 2 coil latching type

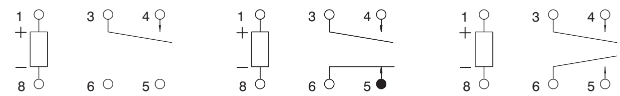


Tolerance : ±0.1 ±.004

Schematic (Bottom view)

Single side stable

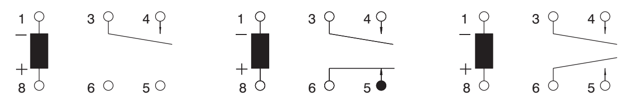
(1 Form A) (1 Form A 1 Form B) (2 Form A)



(5,6: dummy terminal) (Deenergized condition)

1coil latching type

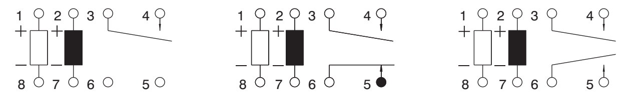
(1 Form A) (1 Form A 1 Form B) (2 Form A)



(5,6: dummy terminal) (Reset condition)

2coil latching type

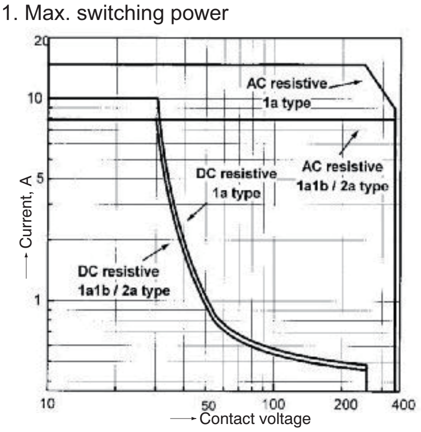
(1 Form A) (1 Form A 1 Form B) (2 Form A)



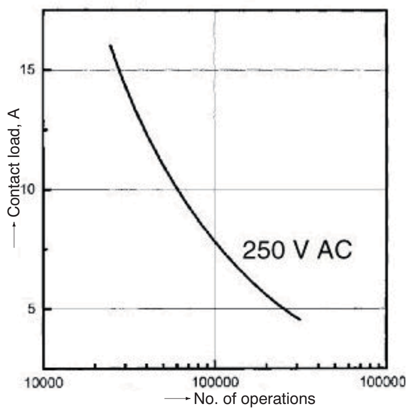
(5,6: dummy terminal) (Reset condition)

REFERENCE DATA

1. Max. switching power

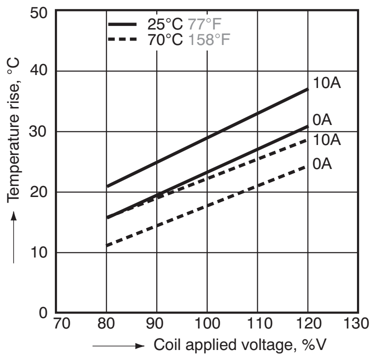


2. Life curve



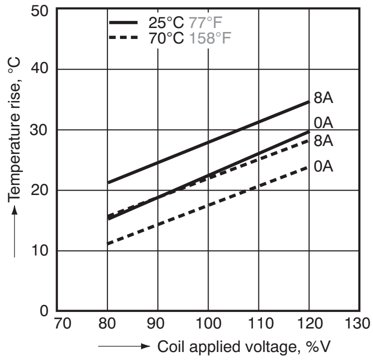
3.-(1) Coil temperature rise (1 Form A)

Tested sample: ADE109
Quantity: n=6
Ambient temperature: 25°C to 70°C 77°F to 158°F



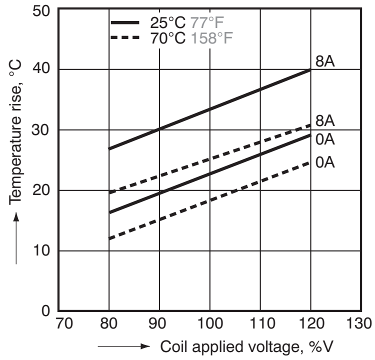
3.-(2) Coil temperature rise (1 Form A 1 Form B)

Tested sample: ADE309
Quantity: n=6
Ambient temperature: 25°C to 70°C 77°F to 158°F



3.-(3) Coil temperature rise (2 Form A)

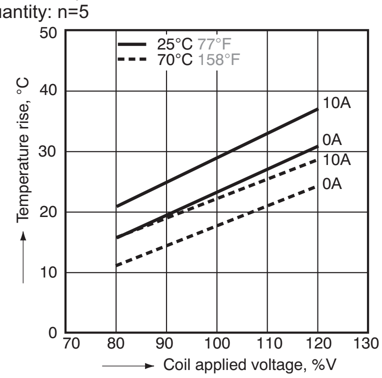
Tested sample: ADE209
Quantity: n=6
Ambient temperature: 25°C to 70°C 77°F to 158°F



Polarized Power

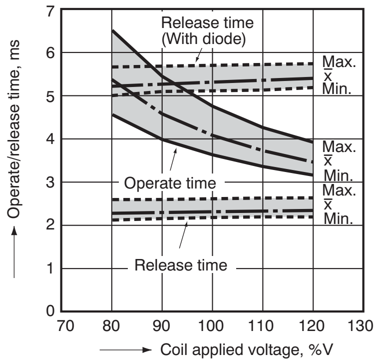
4-1. Operate/release time (1 Form A)

Tested sample: DE1a-5V
Quantity: n=5



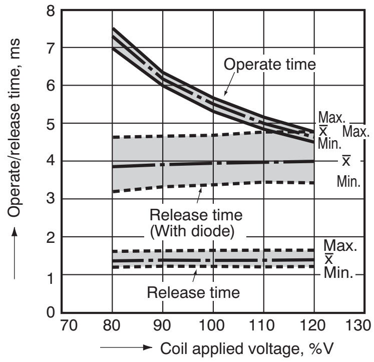
4-2. Operate/release time (1 Form A 1 Form B)

Tested sample: DE1a1b-5V, Quantity: n=5



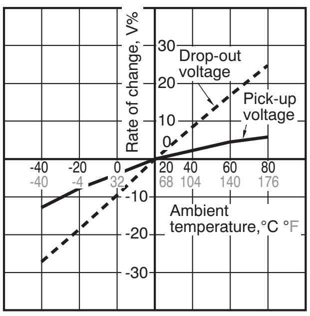
4-3. Operate/release time (2 Form A)

Tested sample: DE2a-5V, Quantity: n=5



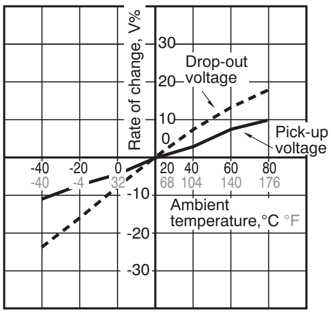
5-1. Ambient temperature characteristics (1 Form A)

Tested sample: DE1a-5V, Ambient temperature: –40°C to 80°C –40°F to 176°F, Quantity: n=6



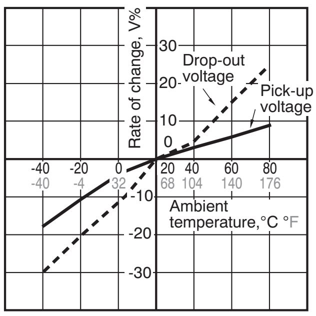
5-2. Ambient temperature characteristics (1 Form A 1 Form B)

Tested sample: DE1a1b-5V, Ambient temperature: –40°C to 80°C –40°F to 176°F, Quantity: n=6

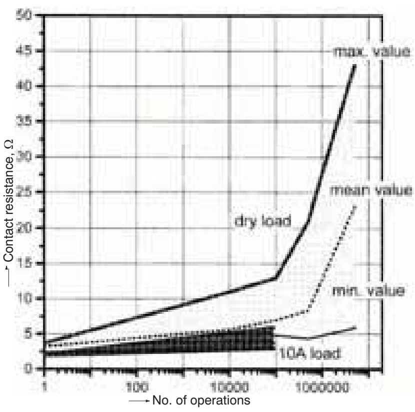


5-3. Ambient temperature characteristics (2 Form A)

Tested sample: DE2a-5V, Ambient temperature: –40°C to 80°C –40°F to 176°F, Quantity: n=6



6. Change of contact resistance



For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
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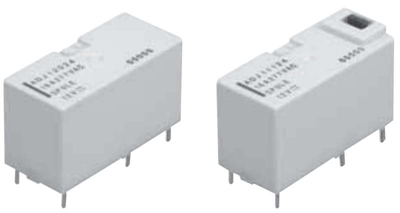
16A, COMPACT AND HIGH INSULATION POWER LATCHING RELAY

DJ RELAYS (ADJ)



Without test button   With test button

FEATURES

1. **Variety of contact arrangements**
   Wide lineup of 1 Form C, 1 Form A, 1 Form B, 2 Form C, 2 Form A, 2 Form B, 1 Form A 1 Form B.
2. **Latching operation**
   Latching via a polarized magnetic circuit structure allows remote operation and lower energy consumption
3. **Compact with high capacity**
   16A (1-pole type) contact rating in a compact 29×13×16.5 mm (L×W×H) size.
4. **Low power consumption**
   1 coil latching: 150mW
   2 coil latching, single side stable: 250mW
5. **High insulation**
   Both clearance and creepage distance between coil and contact are at 8 mm min.
6. **With operation verification function**
   A test button (manual lever) type to facilitate circuit checks is also available (1 Form C, 1 Form A, 1 Form B types only).

TYPICAL APPLICATIONS

1. **FA equipment (brake circuits of industrial machine and robots, etc.)**
2. **Electric power devices (remote surveillance devices, etc.)**
3. **Household appliance networks (Motor control and lighting control, etc.)**
4. **Time switches**

ORDERING INFORMATION

ADJ □ □ □ □□

Contact arrangement
1: 1 Form C
2: 1 Form A
3: 1 Form B
4: 1 Form A 1 Form B
5: 2 Form C
6: 2 Form A
7: 2 Form B

Operating function and protective construction
1: 1 coil latching, Flux-resistant type
2: 1 coil latching, Sealed type
3: 2 coil latching, Flux-resistant type
4: 2 coil latching, Sealed type
5: Single side stable, Flux-resistant type
6: Single side stable, Sealed type

Auxiliary function
0: Without a test button
1: With a test button

Coil voltage (DC)
05: 5 V, 06: 6 V, 12: 12 V, 24: 24 V, 48: 48 V

TYPES

1. Without a test button

1) Flux-resistant type

Contact arrangement	Nominal coil voltage	Single side stable type Part No.	1 coil latching type Part No.	2 coil latching type Part No.
1 Form C	5V DC	ADJ15005	ADJ11005	ADJ13005
	6V DC	ADJ15006	ADJ11006	ADJ13006
	12V DC	ADJ15012	ADJ11012	ADJ13012
	24V DC	ADJ15024	ADJ11024	ADJ13024
	48V DC	ADJ15048	ADJ11048	ADJ13048
1 Form A	5V DC	ADJ25005	ADJ21005	ADJ23005
	6V DC	ADJ25006	ADJ21006	ADJ23006
	12V DC	ADJ25012	ADJ21012	ADJ23012
	24V DC	ADJ25024	ADJ21024	ADJ23024
	48V DC	ADJ25048	ADJ21048	ADJ23048
1 Form B	5V DC	ADJ35005	Please use 1 Form A.	Please use 1 Form A.
	6V DC	ADJ35006		
	12V DC	ADJ35012		
	24V DC	ADJ35024		
	48V DC	ADJ35048		
1 Form A 1 Form B	5V DC	ADJ45005	ADJ41005	ADJ43005
	6V DC	ADJ45006	ADJ41006	ADJ43006
	12V DC	ADJ45012	ADJ41012	ADJ43012
	24V DC	ADJ45024	ADJ41024	ADJ43024
	48V DC	ADJ45048	ADJ41048	ADJ43048
2 Form C	5V DC	ADJ55005	ADJ51005	ADJ53005
	6V DC	ADJ55006	ADJ51006	ADJ53006
	12V DC	ADJ55012	ADJ51012	ADJ53012
	24V DC	ADJ55024	ADJ51024	ADJ53024
	48V DC	ADJ55048	ADJ51048	ADJ53048
2 Form A	5V DC	ADJ65005	ADJ61005	ADJ63005
	6V DC	ADJ65006	ADJ61006	ADJ63006
	12V DC	ADJ65012	ADJ61012	ADJ63012
	24V DC	ADJ65024	ADJ61024	ADJ63024
	48V DC	ADJ65048	ADJ61048	ADJ63048
2 Form B	5V DC	ADJ75005	Please use 2 Form A.	Please use 2 Form A.
	6V DC	ADJ75006		
	12V DC	ADJ75012		
	24V DC	ADJ75024		
	48V DC	ADJ75048		

Standard packing: Tube: 100 pcs.; Case: 500 pcs.

2) Sealed type

Contact arrangement	Nominal coil voltage	Single side stable type Part No.	1 coil latching type Part No.	2 coil latching type Part No.
1 Form C	5V DC	ADJ16005	ADJ12005	ADJ14005
	6V DC	ADJ16006	ADJ12006	ADJ14006
	12V DC	ADJ16012	ADJ12012	ADJ14012
	24V DC	ADJ16024	ADJ12024	ADJ14024
	48V DC	ADJ16048	ADJ12048	ADJ14048
1 Form A	5V DC	ADJ26005	ADJ22005	ADJ24005
	6V DC	ADJ26006	ADJ22006	ADJ24006
	12V DC	ADJ26012	ADJ22012	ADJ24012
	24V DC	ADJ26024	ADJ22024	ADJ24024
	48V DC	ADJ26048	ADJ22048	ADJ24048
1 Form B	5V DC	ADJ36005	Please use 1 Form A.	Please use 1 Form A.
	6V DC	ADJ36006		
	12V DC	ADJ36012		
	24V DC	ADJ36024		
	48V DC	ADJ36048		
1 Form A 1 Form B	5V DC	ADJ46005	ADJ42005	ADJ44005
	6V DC	ADJ46006	ADJ42006	ADJ44006
	12V DC	ADJ46012	ADJ42012	ADJ44012
	24V DC	ADJ46024	ADJ42024	ADJ44024
	48V DC	ADJ46048	ADJ42048	ADJ44048
2 Form C	5V DC	ADJ56005	ADJ52005	ADJ54005
	6V DC	ADJ56006	ADJ52006	ADJ54006
	12V DC	ADJ56012	ADJ52012	ADJ54012
	24V DC	ADJ56024	ADJ52024	ADJ54024
	48V DC	ADJ56048	ADJ52048	ADJ54048
2 Form A	5V DC	ADJ66005	ADJ62005	ADJ64005
	6V DC	ADJ66006	ADJ62006	ADJ64006
	12V DC	ADJ66012	ADJ62012	ADJ64012
	24V DC	ADJ66024	ADJ62024	ADJ64024
	48V DC	ADJ66048	ADJ62048	ADJ64048
2 Form B	5V DC	ADJ76005	Please use 2 Form A.	Please use 2 Form A.
	6V DC	ADJ76006		
	12V DC	ADJ76012		
	24V DC	ADJ76024		
	48V DC	ADJ76048		

Standard packing: Tube: 100 pcs.; Case: 500 pcs.

2. With a test button

Flux-resistant type

Contact arrangement	Nominal coil voltage	Single side stable type Part No.	1 coil latching type Part No.	2 coil latching type Part No.
1 Form C	5V DC	ADJ15105	ADJ11105	ADJ13105
	6V DC	ADJ15106	ADJ11106	ADJ13106
	12V DC	ADJ15112	ADJ11112	ADJ13112
	24V DC	ADJ15124	ADJ11124	ADJ13124
	48V DC	ADJ15148	ADJ11148	ADJ13148
1 Form A	5V DC	ADJ25105	ADJ21105	ADJ23105
	6V DC	ADJ25106	ADJ21106	ADJ23106
	12V DC	ADJ25112	ADJ21112	ADJ23112
	24V DC	ADJ25124	ADJ21124	ADJ23124
	48V DC	ADJ25148	ADJ21148	ADJ23148
1 Form B	5V DC	ADJ35105	Please use 1 Form A.	Please use 1 Form A.
	6V DC	ADJ35106		
	12V DC	ADJ35112		
	24V DC	ADJ35124		
	48V DC	ADJ35148		

Standard packing: Tube: 100 pcs.; Case: 500 pcs.

RATING

1. Coil data

1) Single side stable

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 20°C 68°F)
5V DC	75%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	100Ω	250mW	130%V of nominal voltage
6V DC			144Ω		
12V DC			576Ω		
24V DC			2,304Ω		
48V DC			9,216Ω		

2) 1 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 20°C 68°F)
5V DC	70%V or less of nominal voltage (Initial)	70%V or less of nominal voltage (Initial)	167Ω	150mW	130%V of nominal voltage
6V DC			240Ω		
12V DC			960Ω		
24V DC			3,840Ω		
48V DC			15,360Ω		

3) 2 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 20°C 68°F)
5V DC	70%V or less of nominal voltage (Initial)	70%V or less of nominal voltage (Initial)	100Ω	250mW	130%V of nominal voltage
6V DC			144Ω		
12V DC			576Ω		
24V DC			2,304Ω		
48V DC			9,216Ω		

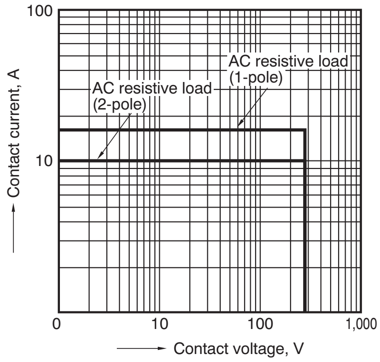
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form C, 1 Form A, 1 Form B, 1 Form A 1 Form B, 2 Form C, 2 Form A, 2 Form B
	Initial contact resistance, max.		Max. 100 mΩ (By voltage drop 6 V DC 1A)
	Contact material		$AgSnO_2$ type (1 Form C, 1 Form A, 1 Form B), Au-flashed $AgSnO_2$ type (1 Form A 1 Form B, 2 Form C, 2 Form A, 2 Form B)
Rating	Nominal switching capacity (resistive load)		16 A 250V AC (1 Form C, 1 Form A, 1 Form B), 10 A 250V AC (2 Form C, 2 Form A, 2 Form B, 1 Form A 1 Form B)
	Max. switching power (resistive load)		4,000 V A
	Max. switching voltage		250V AC
	Max. switching current		16 A (1 Form C, 1 Form A, 1 Form B), 10 A (1 Form A 1 Form B, 2 Form C, 2 Form A, 2 Form B)
	Nominal operating power		150mW (1 coil latching), 250mW (Single side stable, 2 coil latching)
	Min. switching capacity (Reference value)*1		100mA 5 V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1min. (Detection current: 10mA.)
		Between contact and coil	4,000 Vrms for 1min. (Detection current: 10mA.)
	Surge breakdown voltage*2	Between contact and coil	Min. 10,000 V (initial)
	Temperature rise (at 70°C 158°F)		Max. 55°C (By resistive method, nominal voltage applied to the coil, max. switching current.)
	Operate time [Set time] (at 20°C 68°F)		Max. 20 ms [20 ms] (Nominal voltage applied to the coil, excluding contact bounce time.)
	Release time [Reset time] (at 20°C 68°F)		Max. 20 ms [20 ms] (Nominal voltage applied to the coil, excluding contact bounce time.)
Mechanical characteristics	Shock resistance	Functional	Min. 200 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)
		Destructive	Min. 1,000 m/s² (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 2 mm (Detection time: 10μs.)
		Destructive	10 to 55 Hz at double amplitude of 3 mm
Expected life	Mechanical		Min. 5×10^6 (at 180 cpm)
	Electrical (Resistive load)*3 (at 20 cpm)		Min. 10^5 (at 16A 250V AC): 1 Form C, 1 Form A, 1 Form B Min. 10^5 (at 10A 250V AC): 2 Form C, 2 Form A, 2 Form B, 1 Form A 1 Form B
Conditions	Conditions for operation, transport and storage*4		Ambient temperature: –40°C to +70°C –40°F to +158°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
Unit weight			Approx. 14 g .49 oz

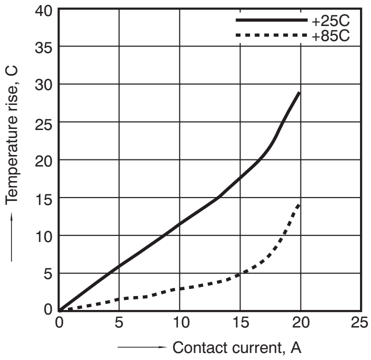
*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2 Wave is standard shock voltage of ±1.2×50μs according to JEC-212-1981
*3 With breathing holes open
*4 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

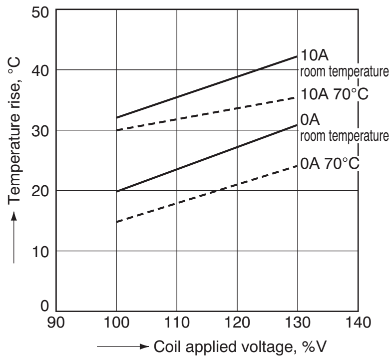
1. Max. switching capacity



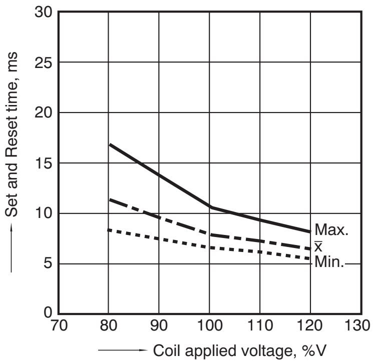
2. Temperature rise
Tested sample: ADJ12024, 6 pcs.
Coil applied voltage: 0%V, Contact current: 16 A, 20 A
Measured portion: Contact, Ambient temperature: 25°C 77°F, 85°C 185°F



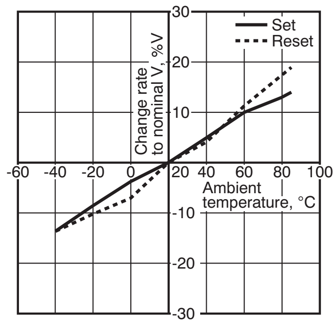
3. Coil temperature rise
Tested sample: ADJ56024, 6 pcs.
Coil applied voltage: 100%V, 130%V of rating
Contact current: 0 A, 10 A
Measured portion: Inside the coil, Ambient temperature: Room temperature, 70°C 158°F



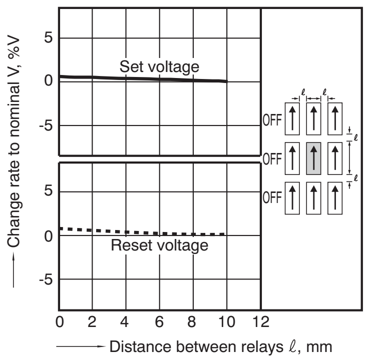
4. Set and Reset time
Tested sample: ADJ12024, 10 pcs
Coil applied voltage: 80%V, 100%V, 120%V of rating



5. Ambient temperature characteristics
Tested sample: ADJ12024, 6pcs
Ambient temperature: –40°C to 85°C –40°F to 185°F



6. Influence of adjacent mounting
Tested sample: ADJ12024, 6pcs
Ambient temperature: Room temperature

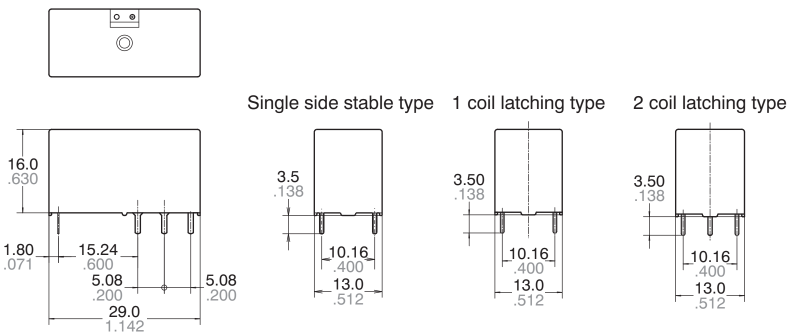


DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

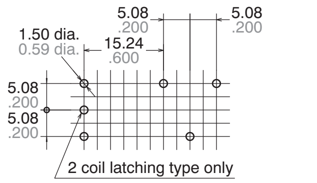
1. 1 Form C, without a test button

CAD Data External dimensions



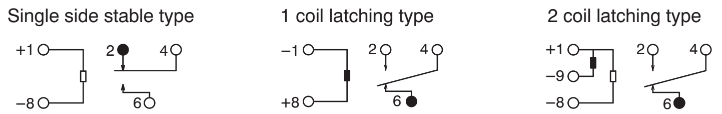
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



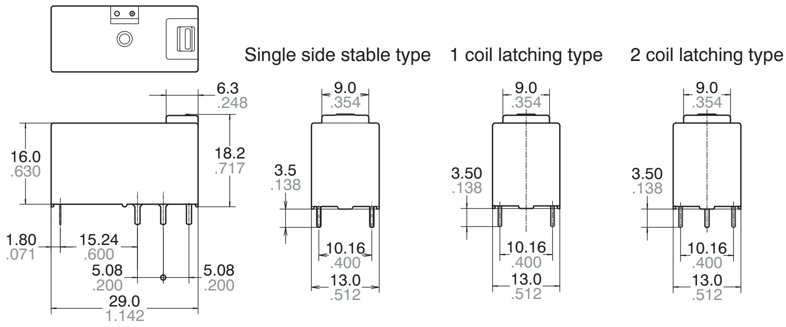
Tolerance: ±0.1 ±.004

Schematic (Bottom view)



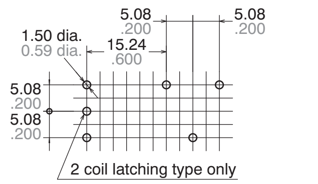
2. 1 Form C, with a test button

CAD Data External dimensions



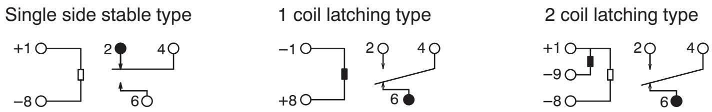
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



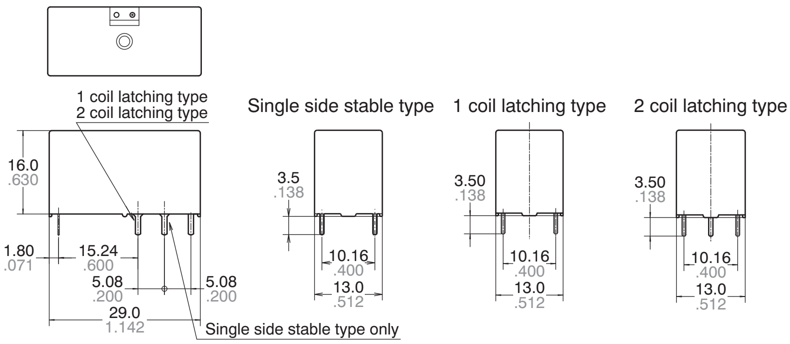
Tolerance: ±0.1 ±.004

Schematic (Bottom view)



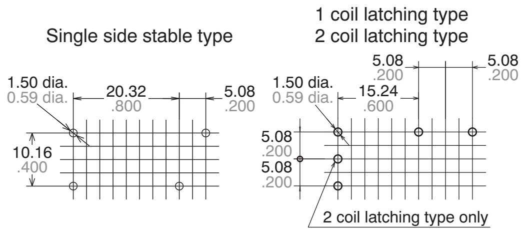
3. 1 Form A, without a test button

CAD Data External dimensions



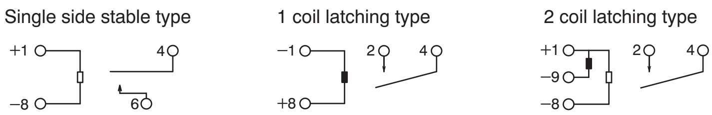
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



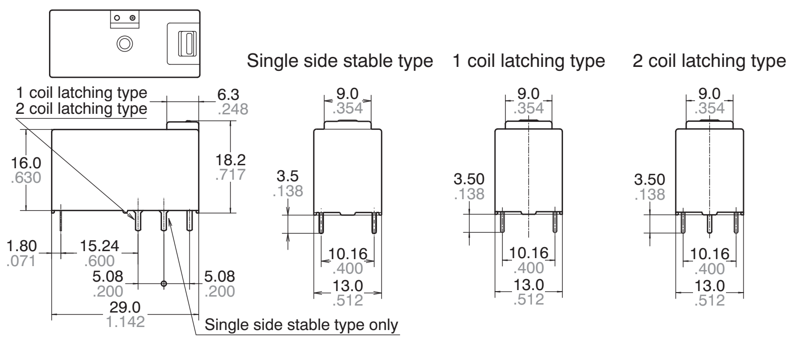
Tolerance: ±0.1 ±.004

Schematic (Bottom view)



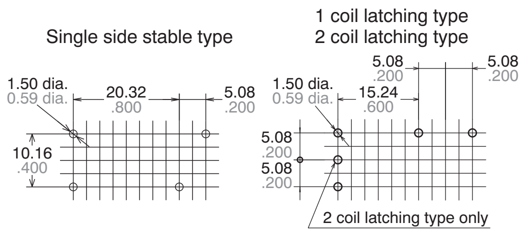
4. 1 Form A, with a test button

CAD Data External dimensions



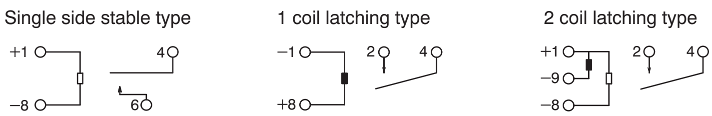
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



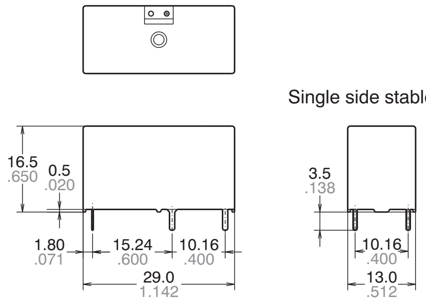
Tolerance: ±0.1 ±.004

Schematic (Bottom view)



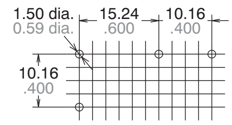
5. 1 Form B, without a test button

CAD Data External dimensions



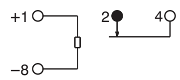
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



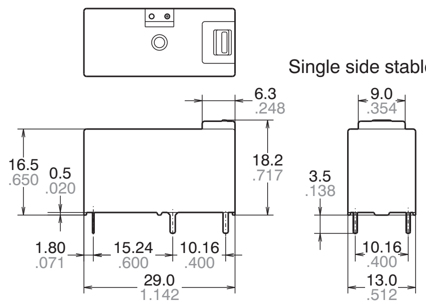
Tolerance: ±0.1 ±.004

Schematic (Bottom view)



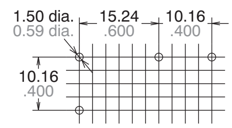
6. 1 Form B, with a test button

CAD Data External dimensions



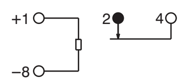
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



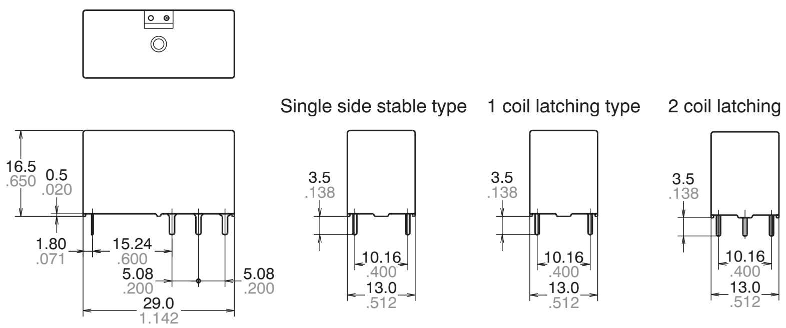
Tolerance: ±0.1 ±.004

Schematic (Bottom view)



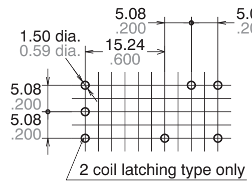
7. 1 Form A 1 Form B, without a test button

CAD Data External dimensions



General tolerance: ±0.3 ±.012

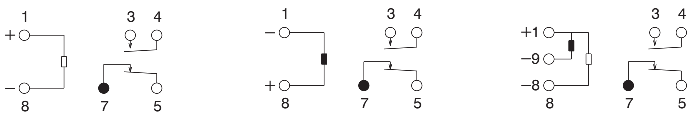
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

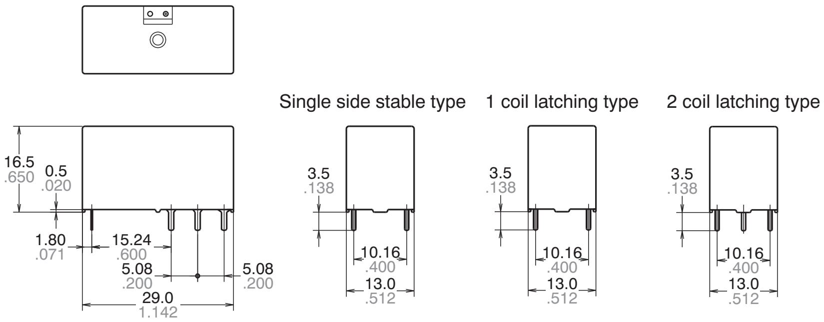
Schematic (Bottom view)

Single side stable type | 1 coil latching type | 2 coil latching type



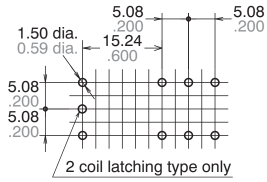
8. 2 Form C, without a test button

CAD Data External dimensions



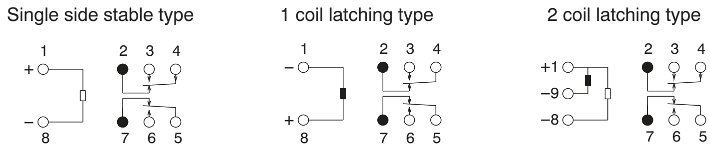
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



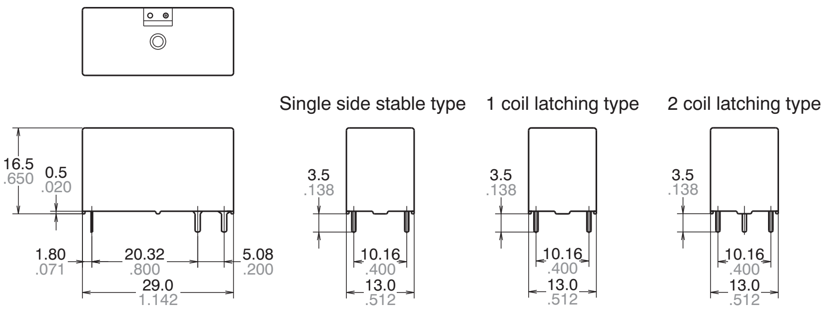
Tolerance: ±0.1 ±.004

Schematic (Bottom view)



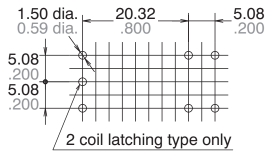
9. 2 Form A, without a test button

CAD Data External dimensions



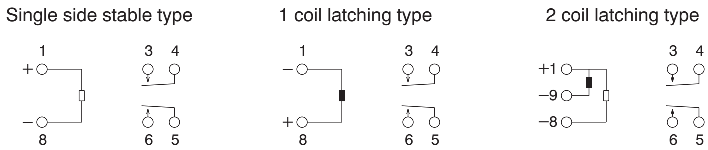
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



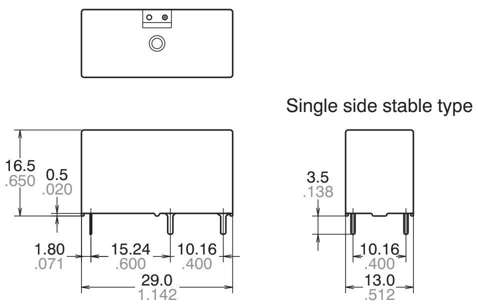
Tolerance: ±0.1 ±.004

Schematic (Bottom view)



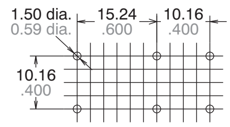
10. 2 Form B, without a test button

CAD Data External dimensions



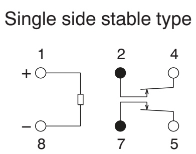
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



NOTES

1. Coil operating power

Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%. However, check it with the actual circuit since the characteristics may be slightly different.

2. Coil connection

When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction.

3. Soldering

We recommend the following soldering conditions

Soldering: 260°C±5°C 500°F±41°F, max. 6 s

4. Others

1) If the relay has been dropped, the appearance and characteristics should always be checked before use.

2) The cycle lifetime is defined under the standard test condition specified in the JIS* C 5442-1996 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 85%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.

Also, be especially careful of loads such as those listed below.

• When used for AC load-operating and the operating phase is synchronous. Rocking and fusing can easily occur due to contact shifting.

• High-frequency load-operating

When high-frequency opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.

Three countermeasures for these are listed here.

• Incorporate an arc-extinguishing circuit.
• Lower the operating frequency
• Lower the ambient humidity

3) For secure operations, the voltage applied to the coil should be nominal voltage. In addition, please note that pick-up and drop-out voltage will vary according to the ambient temperature and operation conditions.

4) Heat, smoke, and even a fire may occur if the relay is used in conditions outside of the allowable ranges for the coil ratings, contact ratings, operating cycle lifetime, and other specifications. Therefore, do not use the relay if these ratings are exceeded. Also, make sure that the relay is wired correctly.

5) Incorrect wiring may cause unexpected events or the generation of heat or flames.

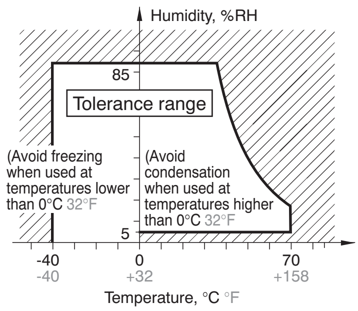
6) Check the ambient conditions when storing or transporting the relays and devices containing the relays. Freezing or condensation may occur in the relay, causing functional damage. Avoid subjecting the relays to heavy loads, or strong vibration and shocks.

5. Usage, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:

• Temperature:
–40 to +70°C –40 to +158°F

• Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.



• Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage

2) Condensation

Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.

3) Freezing

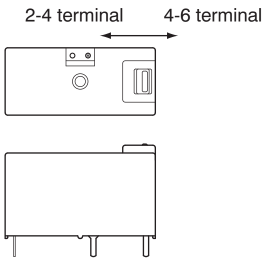
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.

4) Low temperature, low humidity environments

The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

6. Test button (manual lever) operation

The relay contacts switch over as follows:



For Cautions for Use, see Relay Technical Information (page 582).

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10 A MINIATURE POWER RELAY

DK RELAYS

FEATURES

1. Compact with high capacity
High capacity switching in a small package: 1 Form A, 10 A 250 V AC; 1 Form A 1 Form B and 2 Form A, 8 A 250 V AC.

2. High sensitivity: 200 mW nominal operating power

3. High breakdown voltage
Independent coil and the contact structure improves breakdown voltage.

Between contact and coil	Between open contacts
4,000 Vrms for 1 min. 10,000 V surge breakdown voltage	1,000 Vrms for 1 min. 1,500 V surge breakdown voltage

Conforms with FCC Part 68

4. Latching types available

5. Sealed construction allows automatic washing.

6. Sockets are also available

7. Complies with safety standards
Complies with Japan Electrical Appliance and Material Safety Law requirements for operating 200 V power supply circuits, and complies with UL, CSA, and TÜV safety standards.

TYPICAL APPLICATIONS

1. Switching power supply
2. Power switching for various OA equipment
3. Control or driving relays for industrial machines (robotics, numerical control machines, etc.)
4. Output relays for programmable logic controllers, temperature controllers, timers and so on.
5. Home appliances

About Cd-free contacts
We have introduced Cadmium free type products to reduce Environmental Hazardous Substances.
(The suffix “F” should be added to the part number)
(Note: The Suffix “F” is required only for 1 Form A contact type. The 2 Form A and 1 Form A 1 Form B contact type is originally Cadmium free, the suffix “F” is not required.)
Please replace parts containing Cadmium with Cadmium-free products and evaluate them with your actual application before use because the life of a relay depends on the contact material and load.

ORDERING INFORMATION

DK ☐ - ☐ - ☐ - ☐

Contact arrangement
1a: 1 Form A
2a: 2 Form A
1a1b: 1 Form A 1 Form B

Operating function
Nil: Single side stable
L2: 2 coil latching

Coil voltage (DC)
3, 5, 6, 9, 12, 24V

Contact material
F: 1 Form A ($AgSnO_2$ type)
Nil: 2 Form A, 1 FormA 1 Form B (Au-flashed AgNi type)

Notes: 1. UL/CSA, TÜV approved type is standard.
2. VDE approved type is available.
3. 1 coil latching type available

TYPES

Contact arrangement	Nominal coil voltage	Single side stable	2 coil latching
		Part No.	Part No.
1 Form A	3V DC	DK1a-3V-F	DK1a-L2-3V-F
	5V DC	DK1a-5V-F	DK1a-L2-5V-F
	6V DC	DK1a-6V-F	DK1a-L2-6V-F
	9V DC	DK1a-9V-F	DK1a-L2-9V-F
	12V DC	DK1a-12V-F	DK1a-L2-12V-F
	24V DC	DK1a-24V-F	DK1a-L2-24V-F
1 Form A 1 Form B	3V DC	DK1a1b-3V	DK1a1b-L2-3V
	5V DC	DK1a1b-5V	DK1a1b-L2-5V
	6V DC	DK1a1b-6V	DK1a1b-L2-6V
	9V DC	DK1a1b-9V	DK1a1b-L2-9V
	12V DC	DK1a1b-12V	DK1a1b-L2-12V
	24V DC	DK1a1b-24V	DK1a1b-L2-24V
2 Form A	3V DC	DK2a-3V	DK2a-L2-3V
	5V DC	DK2a-5V	DK2a-L2-5V
	6V DC	DK2a-6V	DK2a-L2-6V
	9V DC	DK2a-9V	DK2a-L2-9V
	12V DC	DK2a-12V	DK2a-L2-12V
	24V DC	DK2a-24V	DK2a-L2-24V

Standard packing: Tube: 50 pcs.; Case: 500 pcs.

RATING

1. Coil data

1) Single side stable

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 20°C 68°F)
3V DC	70%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	66.6mA	45Ω	200mW	130%V of nominal voltage
5V DC			40mA	125Ω		
6V DC			33.3mA	180Ω		
9V DC			22.2mA	405Ω		
12V DC			16.6mA	720Ω		
24V DC			8.3mA	2,880Ω		

2) 2 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. allowable voltage (at 20°C 68°F)
			Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
3V DC	70%V or less of nominal voltage (Initial)	70%V or less of nominal voltage (Initial)	66.6mA	66.6mA	45Ω	45Ω	200mW	200mW	130%V of nominal voltage
5V DC			40mA	40mA	125Ω	125Ω			
6V DC			33.3mA	33.3mA	180Ω	180Ω			
9V DC			22.2mA	22.2mA	405Ω	405Ω			
12V DC			16.6mA	16.6mA	720Ω	720Ω			
24V DC			8.3mA	8.3mA	2,880Ω	2,880Ω			

2. Specifications

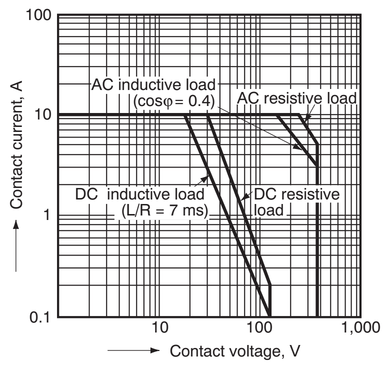
Characteristics	Item		Specifications		
Contact	Arrangement		1 Form A	1 Form A 1 Form B	2 Form A
	Initial contact resistance, max.		Max. 30 mΩ (By voltage drop 6 V DC 1A)		
	Contact material		Au-flashed $AgSnO_2$ type	Au-flashed AgNi type	
Rating	Nominal switching capacity (resistive load)		10 A 250 V AC, 10 A 30 V DC	8 A 250 V AC,8 A 30 V DC	8 A 250 V AC,8 A 30 V DC
	Max. switching power (resistive load)		2,500VA, 300 W	2,000 VA, 240 W	2,000 VA, 240 W
	Max. switching voltage		250 V AC, 125 V DC	250 V AC, 125 V DC	250 V AC, 125 V DC
	Max. switching current		10 A	8 A	8 A
	Nominal operating power		200 mW		
	Min. switching capacity (Reference value)*1		10m A 5 V DC		
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.		
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1min. (Detection current: 10mA.)		
		Between contact and coil	4,000 Vrms for 1min. (Detection current: 10mA.)		
	Surge breakdown voltage*2	Between contacts and coil	10,000 V (Initial)		
	Temperature rise (at 65°C 149°F)		Max. 40°C (By resistive method, nominal voltage applied to the coil; max. switching current)		
	Operate time [Set time] (at 20°C 68°F)		Max. 10 ms (Approx. 5 ms) [10 ms (Approx. 5 ms)] (Nominal voltage applied to the coil, excluding contact bounce time.)		
	Release time [Reset time] (at 20°C 68°F)		Max. 8 ms (Approx. 3 ms) [10 ms (Approx. 3 ms)] (Nominal voltage applied to the coil, excluding contact bounce time.) (without diode)		
Mechanical characteristics	Shock resistance	Functional	Min. 98 m/s^2 (Half-wave pulse of sine wave: 11 ms; detection time: 10µs.)		
		Destructive	Min. 980 m/s^2 (Half-wave pulse of sine wave: 6 ms.)		
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1.5 mm (Detection time: 10µs.)		
		Destructive	10 to 55 Hz at double amplitude of 3 mm		
Expected life	Mechanical		Min. 5×10^7 (at 300 cpm)		
	Electrical		Min. 10^5 (resistive load, at 20 cpm, at rated capacity)		
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –40°C to +65°C –40°F to +149°F, Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)		
	Max. operating speed (at rated load)		20 cpm		
Unit weight			Approx. 5 g .18 oz	Approx. 6 g .21 oz	Approx. 6 g .21 oz

Notes:

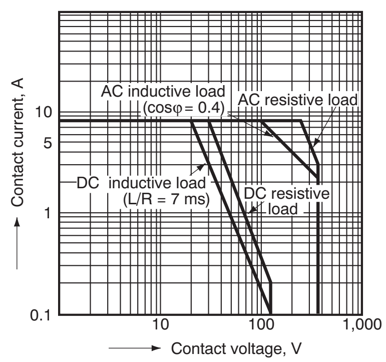
*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2 Wave is standard shock voltage of ±1.2×50µs according to JEC-212-1981.
*3 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

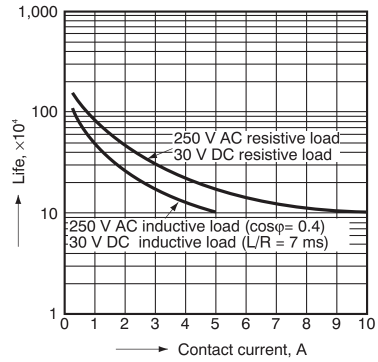
1-(1). Maximum operating power (1 Form A)



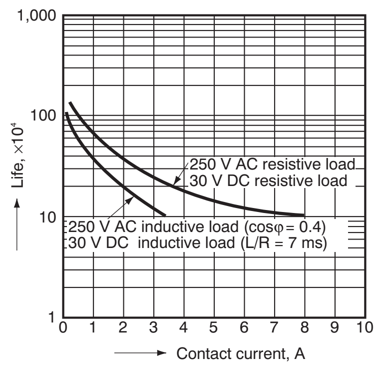
1-(2). Maximum operating power (1 Form A 1 Form B, 2 Form A)



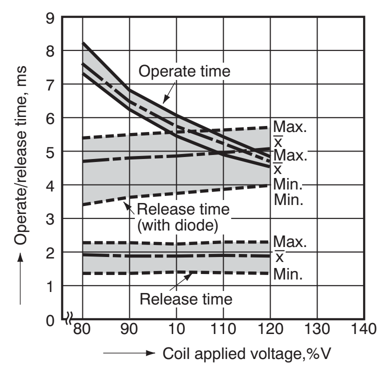
2-(1). Life curve (1 Form A)



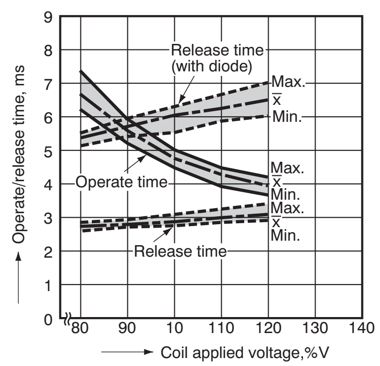
2-(2). Life curve (1 Form A 1 Form B, 2 Form A)



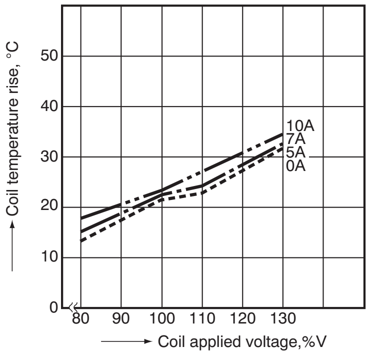
3-(1). Operate/Release time (1 Form A)
Tested sample: DK1a-24V, 5 pcs.



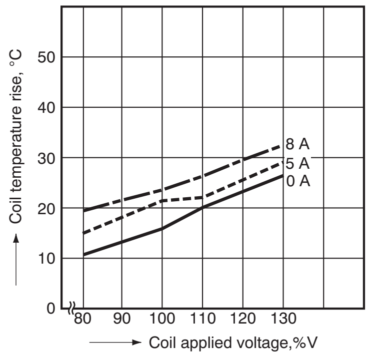
3-(2). Operate/Release time (1 Form A 1 Form B, 2 Form A)
Tested sample: DK1a1b-12V, 5 pcs.



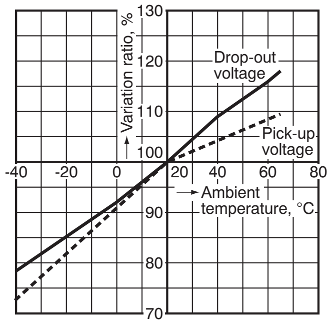
4-(1). Coil temperature rise (1 Form A)
Tested sample: DK1a-12V, 5 pcs.
Ambient temperature: 30°C 86°F



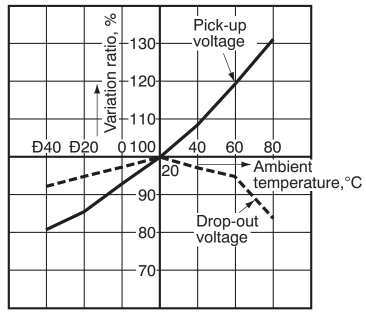
4-(2). Coil temperature rise
(1 Form A 1 Form B, 2 Form A)
Tested sample: DK1a1b-12V, 5 pcs.
Ambient temperature: 20°C 68°F



5-(1). Ambient temperature characteristics
(1 Form A)
Tested sample: DK1a-24V, 6 pcs
Ambient temperature: –40°C to +80°C
–40°F to +176°F



5-(2). Ambient temperature characteristics
(1 Form A 1 Form B, 2 Form A)



DIMENSIONS(mm inch)

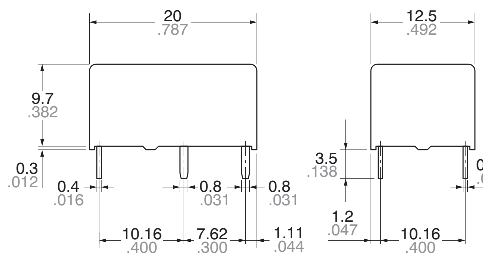
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. 1 Form A type

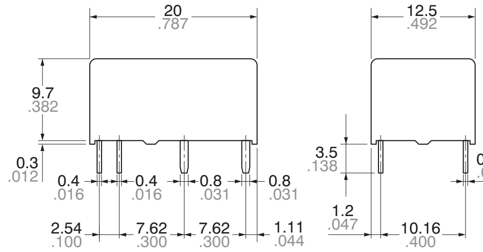
CAD Data

External dimensions

Single side stable type

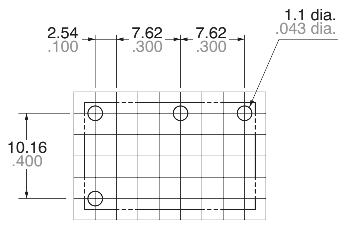


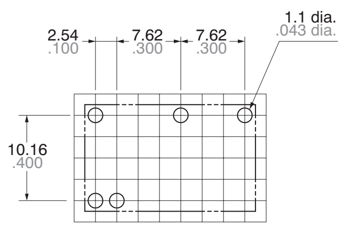
2 coil latching type



General tolerance: ±0.3 ±.012

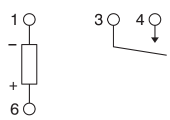
PC board pattern (Bottom view)





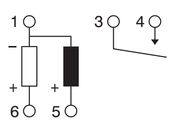
Tolerance: ±0.1 ±.004

Schematic
(Bottom view)
Single side stable



(Deenergized condition)

2 coil latching



(Reset condition)

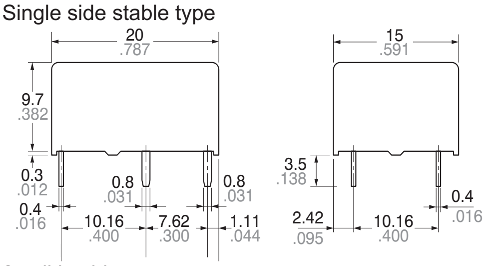
Since this is a polarized relay, the connection to the coil should be done according to the above schematic.

2. 1 Form A 1 Form B type, 2 Form A type

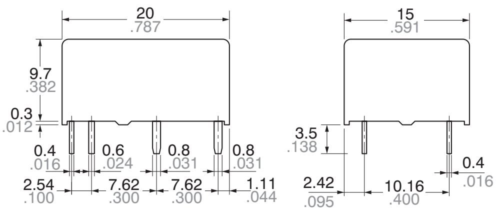
CAD Data

External dimensions

Single side stable type

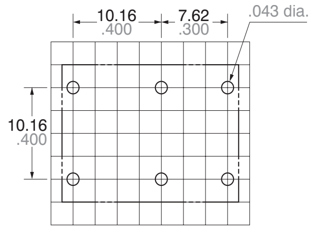


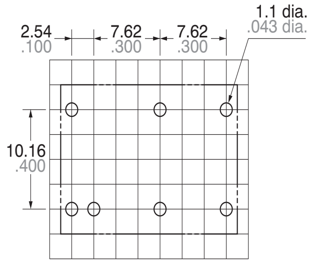
2 coil latching type



General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



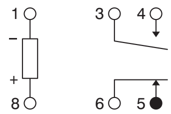


Tolerance: ±0.1 ±.004

Schematic (Bottom view)

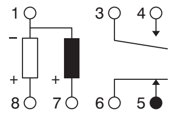
<1 Form A 1 Form B type>

Single side stable



(Deenergized condition)

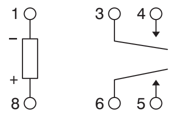
2 coil latching



(Reset condition)

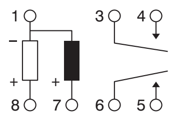
<2 Form A>

Single side stable



(Deenergized condition)

2 coil latching



(Reset condition)

Since this is a polarized relay, the connection to the coil should be done according to the above schematic.

Polarized Power

NOTES

1. Soldering should be done under the following conditions:

250°C 482°F within 10s
300°C 572°F within 5s
350°C 662°F within 3s
Soldering depth: 2/3 terminal pitch

2. External magnetic field

Since DK relays are highly sensitive polarized relays, their characteristics will be affected by a strong external magnetic field. Avoid using the relay under that condition.

3. When using, please be aware that the a contact and b contact sides of 1 Form A and 1 Form B types may go on simultaneously at operate time and release time.

For Cautions for Use, see Relay Technical Information (page 582).

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ACCESSORIES

DK RELAY SOCKET

FEATURES

DK relay sockets that can be used also for DY relay.

TYPES

Type		Part No.
1 Form A	Single side stable	DK1a-PS
	2 coil latching	DK1a-PSL2
1 Form A 1 Form B, 2 Form A*	Single side stable	DK2a-PS
	2 coil latching	DK2a-PSL2

Standard packing: Tube: 50 pcs.; Case: 500 pcs
Note: * 2 Form A type is DK relays only.

RELAY COMPATIBILITY

• When using the DK relays

Relay \ Socket		1 Form A		1 Form A 1 Form B, 2 Form A	
		Single side stable type	2 coil latching type	Single side stable type	2 coil latching type
1 Form A	Single side stable type	●	●	—	—
	2 coil latching type	—	●	—	—
1 Form A 1 Form B 2 Form A	Single side stable type	—	—	●	●
	2 coil latching type	—	—	—	●

• When using the DY relays

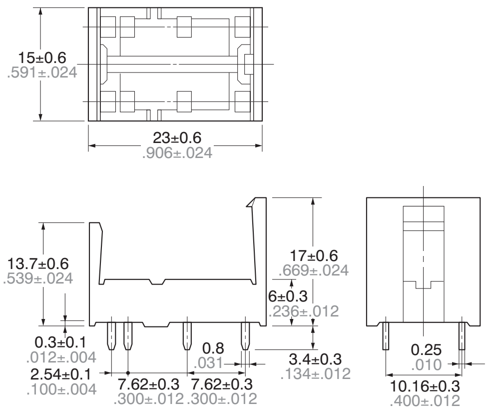
Relay \ Socket		1 Form A		1 Form A 1 Form B	
		Single side stable type	2 coil latching type	Single side stable type	2 coil latching type
1 Form A	Single side stable type	●	●	—	—
	2 coil latching type	—	●	—	—
1 Form A 1 Form B	Single side stable type	—	—	●	●
	2 coil latching type	—	—	—	●

SPECIFICATIONS

Item	Specifications
Breakdown voltage	4,000 Vrms (Detection current: 10 mA) (Except the portion between coil terminals)
Insulation resistance	Min. 1,000 mΩ (at 500 V DC)
Heat resistance	150°C (for 1 hour)
Max. continuous current	10 A (DK1a-PS, DK1a-PSL2), 8 A (DK2a-PS, DK2a-PSL2)

DIMENSIONS (Unit: mm inch)

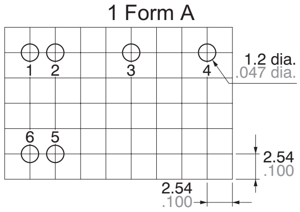
External dimensions



General tolerance: ±0.3 ±.012

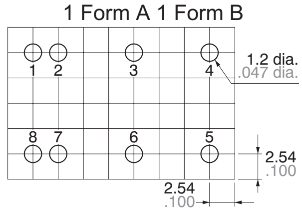
PC board pattern (Bottom view)

1 Form A



The above shows 2 coil latching type. No.2 and 5 terminal are eliminated on single side stable type.

1 Form A 1 Form B

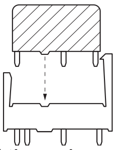


Tolerance: ±0.1 ±.004

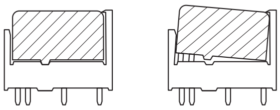
The above shows 2 coil latching type. No.2 and 7 terminal are eliminated on single side stable type.

FIXING AND REMOVAL METHOD

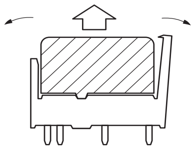
1. Match the direction of relay and socket.



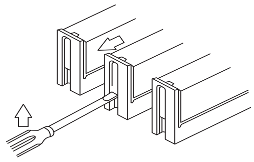
2. Both ends of the relay are to be secured firmly so that the socket hooks on the top surface of the relay.



3. Remove the relay, applying force in the direction shown below.



4. In case there is not enough space to grasp relay with fingers, use screwdrivers in the way shown below.



Notes: 1. Exercise care when removing relays. If greater than necessary force is applied at the socket hooks, deformation may alter the dimensions so that the hook will no longer catch, and other damage may also occur.
2. It is hazardous to use IC chip sockets.

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30A POWER LATCHING RELAY

DQ RELAYS (ADQ)

FEATURES

1. **30A capacity in small size**
2. **Latching type**
3. **High insulation**
   4,000V AC (between contacts and coil)
   Surge 10,000V (between contacts and coil)
4. **Cd-free, Pb-free**
5. **Sealed construction**
6. **UL/C-UL approved**

TYPICAL APPLICATIONS

1. **Time switches**
2. **Electric water heaters**
3. **Remote control of electric power meters**

ORDERING INFORMATION

ADQ [ ] **3** **Q** **0** [ ]

Operating function
1: 1 coil latching (1 Form A)
2: 2 coil latching (1 Form A)

Contact capacity
3: 30 A

Terminal shape
Q: 250 Faston terminal

Contact characteristics
0: Standard contact

Coil voltage (DC)
4H: 4.5 V, 06: 6 V, 09: 9 V, 12: 12 V, 24: 24 V

TYPES

Contact arrangement	Nominal coil voltage	1 coil latching Part No.	2 coil latching Part No.
1 Form A	4.5V DC	ADQ13Q04H	ADQ23Q04H
	6V DC	ADQ13Q006	ADQ23Q006
	9V DC	ADQ13Q009	ADQ23Q009
	12V DC	ADQ13Q012	ADQ23Q012
	24V DC	ADQ13Q024	ADQ23Q024

Standard packing: Tube: 20 pcs.; Case: 200 pcs.

RATING

1. Coil data

1) 1 coil latching

Nominal coil voltage	Set voltage* (at 20°C 68°F)	Reset voltage* (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 20°C 68°F)
4.5V DC	70%V or less of nominal voltage (Initial)	70%V or less of nominal voltage (Initial)	111.1mA	40.5Ω	500mW	130%V of nominal voltage
6V DC			83.3mA	72Ω		
9V DC			55.6mA	162Ω		
12V DC			41.7mA	288Ω		
24V DC			20.8mA	1,152Ω		

* Pulse, direction of measurement: Terminal is downward.

2) 2 coil latching

Nominal coil voltage	Set voltage* (at 20°C 68°F)	Reset voltage* (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. allowable voltage (at 20°C 68°F)
			Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
4.5V DC	70%V or less of nominal voltage (Initial)	70%V or less of nominal voltage (Initial)	221.7mA	221.7mA	20.3Ω	20.3Ω	1,000mW	1,000mW	130%V of nominal voltage
6V DC			166.7mA	166.7mA	36Ω	36Ω			
9V DC			111.1mA	111.1mA	81Ω	81Ω			
12V DC			83.3mA	83.3mA	144Ω	144Ω			
24V DC			41.7mA	41.7mA	576Ω	576Ω			

* Pulse, direction of measurement: Terminal is downward.

2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form A
	Initial contact resistance, max.		Max. 30 mΩ (By voltage drop 6 V DC 1A)
	Contact material		$AgSnO_2$ type
Rating	Nominal switching capacity (resistive load)		30 A 250V AC
	Max. switching power (resistive load)		7,500 V A
	Max. switching voltage		250V AC
	Max. switching current		30 A
	Nominal operating power		500mW (1 coil latching), 1,000mW (2 coil latching)
	Min. switching capacity (Reference value)*1		100mA 5 V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as "Initial breakdown voltage" section.
	Breakdown voltage (Initial)	Between open contacts	1,500 Vrms for 1min. (Detection current: 10mA.)
		Between contact and coil	4,000 Vrms for 1min. (Detection current: 10mA.)
	Surge breakdown voltage*2	Between contact and coil	Min. 10,000 V (initial)
	Temperature rise (at 65°C 149°F)		Max. 50°C (By resistive method, max. switching current) (Coil; de-energized)
	Set time (at 20°C 68°F)		Max. 20 ms (Nominal voltage applied to the coil, excluding contact bounce time.)
	Reset time (at 20°C 68°F)		Max. 20 ms (Nominal voltage applied to the coil, excluding contact bounce time.)
Mechanical characteristics	Shock resistance	Functional	Min. 200 m/s^2 (Half-wave pulse of sine wave: 11 ms; detection time: 10µs.)
		Destructive	Min. 1,000 m/s^2 (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1.5 mm (Detection time: 10µs.)
		Destructive	10 to 55 Hz at double amplitude of 2 mm
Expected life	Mechanical		Min. 10^6 (at 180 cpm)
	Electrical		Min. 10^4 (At nominal switching capacity, operating frequency: 3s ON, 3s OFF)
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –40°C to +65°C –40°F to +149°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed		10 cpm (at rated load)
Unit weight			Approx. 35 g 1.23 oz

Notes:

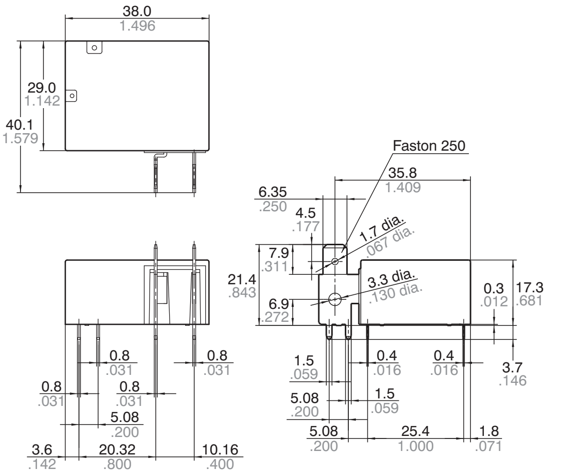
*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2 Wave is standard shock voltage of ±1.2×50µs according to JEC-212-1981.
*3 Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

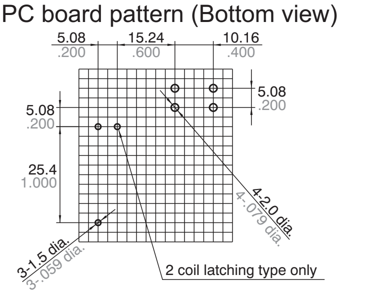
CAD Data

External dimensions



General tolerance: ±0.3 ±.012

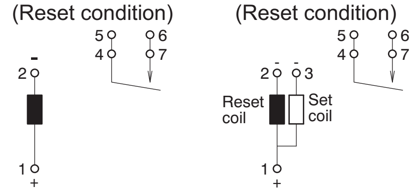
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

1 coil latching type



2 coil latching type

Polarized Power

NOTES

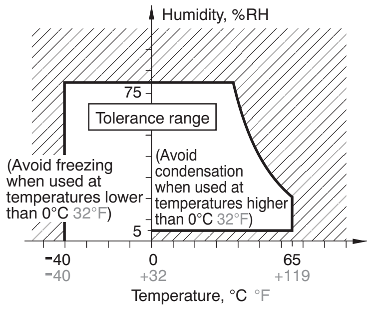
1. Coil operating power
Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%. However, check it with the actual circuit since the characteristics may be slightly different.

2. Coil connection
When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction.

3. Soldering and cleaning
1) When soldering the relays, ensure conformance with the conditions listed below.
[Automatic soldering]
(1) Preheating: less than 120°C 248°F (solder target surface of terminal) for less than 120 sec
(2) Soldering: less than 265°C 509°F (solder temperature) for less than 6 sec (soldering time)
[Manual soldering]
(1) Soldering tip temperature: less than 350°C 662°F
(2) Soldering iron: 60 W to 100 W
(3) Soldering time: less than 3 sec
Furthermore, because the type of PC board used and other factors may influence the relays, test that the relays function properly on the actual board on which they are mounted.
2) Ultrasonic cleaning has adverse effects on relay characteristics: never use ultrasonic cleaning. For liquid cleaning, use alcohol-based liquids.

4. Others
1) If the relay has been dropped, the appearance and characteristics should always be checked before use.
2) The cycle lifetime is defined under the standard test condition specified in the JIS* C 5442-1996 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.
Also, be especially careful of loads such as those listed below.
(1) When used for AC load-operating and the operating phase is synchronous.
Rocking and fusing can easily occur due to contact shifting.
(2) High-frequency load-operating
When high-frequency opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.
Three countermeasures for these are listed here.
1. Incorporate an arc-extinguishing circuit.
2. Lower the operating frequency
3. Lower the ambient humidity
3) For secure operations, the voltage applied to the coil should be nominal voltage. In addition, please note that pick-up and drop-out voltage will vary according to the ambient temperature and operation conditions.
4) Heat, smoke, and even a fire may occur if the relay is used in conditions outside of the allowable ranges for the coil ratings, contact ratings, operating cycle lifetime, and other specifications. Therefore, do not use the relay if these ratings are exceeded. Also, make sure that the relay is wired correctly.
5) Incorrect wiring may cause unexpected events or the generation of heat or flames.
6) Check the ambient conditions when storing or transporting the relays and devices containing the relays. Freezing or condensation may occur in the relay, causing functional damage. Avoid subjecting the relays to heavy loads, or strong vibration and shocks.
7) Relays are shipped in a ‘reset’ state. During shipping and handling, however, shocks may change the state to ‘set.’ Consequently, at time of use (at power on) it is recommended to ensure that circuits are returned to the desired state (‘set’ or ‘reset’).
8) If more than 20 A is delivered via the plug-in terminal connection, to prevent loosening of contacts loss long periods of operation, ensure that the plug-in terminal is soldered to the receptacle terminal.

5. Usage, transport and storage conditions
1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature:
–40 to +65°C –40 to +149°F
(2) Humidity: 5 to 75% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.



(3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage:
2) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
3) Freezing
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
4) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

For Cautions for Use, see Relay Technical Information (page 582).

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60A POWER LATCHING RELAY

DQ-M RELAYS (ADQM)

FEATURES

1. Miniature and high capacity
Miniature relay capable of high 60 A capacity control.
Size: 29.0(L)×38.0(W)×17.3(H) mm
1.142(L)×1.496(W)×.681(H) inch
Nominal switching capacity:
60A 250V AC

2. Latching type
Latching type contributes to device energy efficiency.
Nominal operating power
- 500mW (1 coil latching)
- 1W (2 coil latching)

3. High insulation
Between contact and coil
Breakdown voltage: 4,000 V AC
Surge breakdown voltage: 10,000 V

4. Cd-free, Pb-free

5. Flux-Resistant type

TYPICAL APPLICATIONS

1. Remote control of electric power meters

2. Time switches

ORDERING INFORMATION

ADQM [ ] 6 [ ] 0 [ ][ ]

DQ-M relays

Operating function
1: 1 coil latching (1 Form A)
2: 2 coil latching (1 Form A)

Contact capacity
6: 60 A

Terminal shape
Nil: M4 securing screw

Contact characteristics
0: Standard contact

Coil voltage (DC)
4H: 4.5 V, 06: 6 V, 09: 9 V, 12: 12 V, 24: 24 V

TYPES

Contact arrangement	Nominal coil voltage	Part No.	
		1 coil latching	2 coil latching
1 Form A	4.5V DC	ADQM1604H	ADQM2604H
	6V DC	ADQM16006	ADQM26006
	9V DC	ADQM16009	ADQM26009
	12V DC	ADQM16012	ADQM26012
	24V DC	ADQM16024	ADQM26024

Standard packing: Tube: 20 pcs.; Case: 200 pcs.

RATING

1. Coil data

1) 1 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 20°C 68°F)
4.5V DC	80%V or less of nominal voltage (Initial)	80%V or less of nominal voltage (Initial)	111.1mA	40.5Ω	500mW	130%V of nominal voltage
6V DC			83.3mA	72Ω		
9V DC			55.6mA	162Ω		
12V DC			41.7mA	288Ω		
24V DC			20.8mA	1,152Ω		

2) 2 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 20°C 68°F)
4.5V DC	80%V or less of nominal voltage (Initial)	80%V or less of nominal voltage (Initial)	221.7mA	20.3Ω	1,000mW	130%V of nominal voltage
6V DC			166.7mA	36Ω		
9V DC			111.1mA	81Ω		
12V DC			83.3mA	144Ω		
24V DC			41.7mA	576Ω		

2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form A
	Contact resistance (Initial)		Max. 30 mΩ (By voltage drop 6 V DC 1A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		60 A 250V AC
	Max. switching power (resistive load)		15,000 V A
	Max. switching voltage		250V AC
	Max. switching current		60 A
	Nominal operating power		500mW (1 coil latching), 1,000mW (2 coil latching)
	Min. switching capacity (Reference value)*1		100mA 5 V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as "Initial breakdown voltage" section.
	Breakdown voltage (Initial)	Between open contacts	1,500 Vrms for 1min. (Detection current: 10mA.)
		Between contact and coil	4,000 Vrms for 1min. (Detection current: 10mA.)
	Surge breakdown voltage*2	Between contact and coil	Min. 10,000 V (initial)
	Temperature rise (at 20°C 68°F)		Max. 50°C (By resistive method, max. switching current) (Coil; de-energized)
	Set time (at 20°C 68°F)		Max. 20 ms (Nominal voltage applied to the coil, excluding contact bounce time.)
	Reset time (at 20°C 68°F)		Max. 20 ms (Nominal voltage applied to the coil, excluding contact bounce time.)
Mechanical characteristics	Shock resistance	Functional	Min. 200 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10µs.)
		Destructive	Min. 1,000 m/s² (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1.5 mm (Detection time: 10µs.)
		Destructive	10 to 55 Hz at double amplitude of 2.0 mm
Expected life	Mechanical		Min. 10^6 (at 180 cpm)
	Electrical		60A 250V AC Min. 10^3 (resistive load, operating frequency: 15s ON, 45s OFF)
			50A 250V AC Min. 10^4 (resistive load, operating frequency: 15s ON, 45s OFF)
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –40°C to +70°C –40°F to +158°F Humidity: 5 to 75% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed		1 cpm (at rated load)
Unit weight			Approx. 35 g 1.23 oz

Notes:

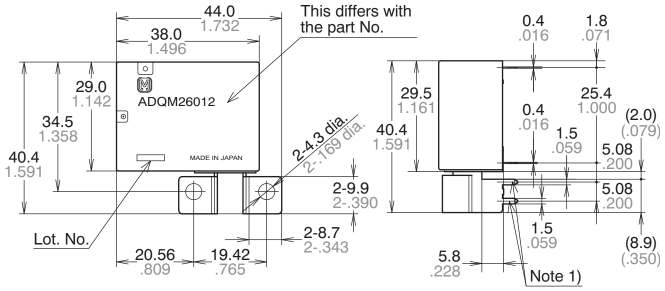
*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2 Wave is standard shock voltage of ±1.2×50µs according to JEC-212-1981
*3 The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

DIMENSIONS(mm inch)

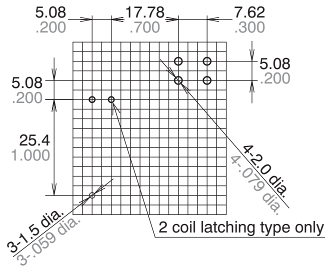
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data

External dimensions

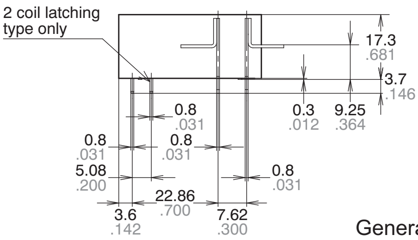


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

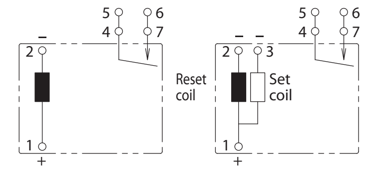
Note 1)
These are dummy terminals for the strength reinforcement for the M4 screw terminal connection. Fix or solder these to the PC board in case setting M4 screw. However, do not use the dummy terminals as wiring to the PC board. In case wiring of the dummy terminals, the conductor destruction may occur due to the high current.
Note 2)
No 3rd terminal on 1 coil latching type.



General tolerance: ±0.3 ±.012

Schematic (Bottom view)

1 coil latching type
2 coil latching type

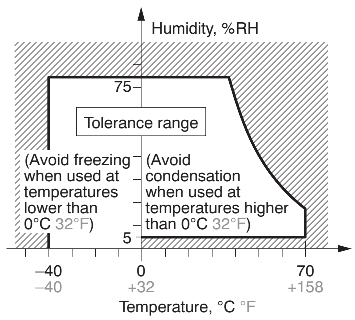


Polarized Power

NOTES

1. Coil operating power
Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%. However, check it with the actual circuit since the characteristics may be slightly different.
2. Coil connection
When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction.
3. Soldering and cleaning
1) When soldering the relays, ensure conformance with the conditions listed below.
[Automatic soldering]
(1) Preheating: less than 120°C 248°F (solder target surface of terminal) for less than 120 sec
(2) Soldering: less than 260±5°C 500±41°F (solder temperature) for less than 6 sec (soldering time)
[Manual soldering]
(1) Soldering tip temperature: less than 350°C 662°F
(2) Soldering iron: 60 W to 100 W
(3) Soldering time: less than 3 sec
Furthermore, because the type of PC board used and other factors may influence the relays, test that the relays function properly on the actual board on which they are mounted.
2) This relay is not sealed. Do not wash it. Also, make sure that any flux overflowing upward from the PC board does not get inside the relay.
4. Others
1) If the relay has been dropped, the appearance and characteristics should always be checked before use.
2) The cycle lifetime is defined under the standard test condition specified in the JIS C 5442-1996 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.
Also, be especially careful of loads such as those listed below.
(1) When used for AC load-operating and the operating phase is synchronous. Rocking and fusing can easily occur due to contact shifting.
(2) High-frequency load-operating
When high-frequency opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.
Three countermeasures for these are listed here.
1. Incorporate an arc-extinguishing circuit.
2. Lower the operating frequency
3. Lower the ambient humidity

3) For secure operations, the voltage applied to the coil should be nominal voltage. In addition, please note that pick-up and drop-out voltage will vary according to the ambient temperature and operation conditions.
4) Heat, smoke, and even a fire may occur if the relay is used in conditions outside of the allowable ranges for the coil ratings, contact ratings, operating cycle lifetime, and other specifications. Therefore, do not use the relay if these ratings are exceeded. Also, make sure that the relay is wired correctly.
5) Incorrect wiring may cause unexpected events or the generation of heat or flames.
6) Check the ambient conditions when storing or transporting the relays and devices containing the relays. Freezing or condensation may occur in the relay, causing functional damage. Avoid subjecting the relays to heavy loads, or strong vibration and shocks.
7) The minimum switching capacity is given as a guide to the lowest level that switching is possible when using minute loads. This value can change due to switching frequency, environmental conditions, and desired reliability level. Therefore, please conduct sufficient tests under actual conditions.
8) Relays are shipped in a 'reset' state. During shipping and handling, however, shocks may change the state to 'set.' Consequently, at time of use (at power on) it is recommended to ensure that circuits are returned to the desired state ('set' or 'reset').
9) Do not use parts that generate organic silicon. When present in the vicinity, conduction failure may occur.
10) This relay is designed to flux-resistant type. Malfunction and contact failure may result if small insects get inside the relay.
11) Installation of M4 securing screw
Do not apply excessive pressure on the terminals. This could adversely affect relay performance. Secure to the PC board a dummy terminal designed for reinforcement of the terminal and use a washer in order to prevent deformation. Keep the installation torque to within 1.2 and 1.4 N·m (12 to 14 kgf·cm). Also, use a spring washer to prevent it from loosening. Do not use the dummy terminals as wiring to the PC board. In case wiring of the dummy terminals, the conductor destruction may occur due to the high current.
5. Usage, transport and storage conditions
1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature:
–40 to +70°C –40 to +158°F
(2) Humidity: 5 to 75% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage:



2) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
3) Freezing
Condensation or other moisture may freeze on the relay when the temperature is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
4) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

For Cautions for Use, see Relay Technical Information (page 582).

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8 A MINIATURE POWER RELAY IN DS RELAY SERIES

DS-P RELAYS

FEATURES

1. Compact with high contact rating
Even with small 10 mm .394 inch (H) x 11 mm .433 inch (W) x 20 mm .787 inch (L) (dimensions, high capacity switching is provided: 1a, 8 A 250 V AC; 2a and 1a1b, 5 A 250 V AC.

2. High switching capability
High contact pressure, low contact bounce, and wiping operation improve resistance to weld bonding. Resistant against lamp load and dielectric loading: 1a achieves maximum switching capacity of 2,000 VA (8A 250 V AC).

3. High sensitivity
Using the same type of high-performance polar magnetic circuits as DS relays, by matching the spring load to the magnetic force of attraction, greater sensitivity has been achieved. The resultant pick up sensitivity of about 190 mW makes possible direct driving of transistors and chips.

4. High breakdown voltage
Breakdown voltage has been raised by keeping the coil and contacts separate.

Between contact and coil	Between contacts
3,000 Vrms for 1 min. 5,000 V surge breakdown voltage	1,000 Vrms for 1 min. 1,500 V surge breakdown voltage

Conforms with FCC Part 68

5. Latching types available

6. Wide variation
Three types of contact arrangement are offered: 1a, 2a, and 1a1b. In addition, each is available in standard and reversed polarity types.

7. Sealed construction allows automatic washing

8. Complies with safety standards
- Complies with Japan Electrical Appliance and Material Safety Law requirements for operating 200 V power supply circuits
- Complies with UL, CSA and TÜV safety standards
- Complies with EN 60335 / GWT (test report available)

TYPICAL APPLICATIONS

1. Office and industrial electronic devices
2. Terminal devices of information processing equipment, such as printer, data recorder.
3. Office equipment (copier, facsimile)
4. Measuring instruments
5. NC machines, temperature controllers and programmable logic controllers.

About Cd-free contacts
We have introduced cadmium-free type products to reduce environmentally hazardous substances. Please replace parts that contain cadmium with Cd-free products. Evaluate them with your actual application before use because the life of a relay depends on the contact material and load.

Polarized Power

ORDERING INFORMATION

DSP ☐ - ☐ - ☐ - ☐ - ☐

Contact arrangement
1a: 1 Form A
1: 1 Form A 1 Form B
2a: 2 Form A

Operating function
Nil: Single side stable
L: 1 coil latching
L2: 2 coil latching

Coil voltage
DC 3, 5, 6, 9, 12, 24 V

Polarity
Nil: Standard polarity
R: Reverse polarity

Contact material
● $AgSnO_2$ type
F: 1 Form A 1 Form B
Nil: 1 Form A, 2 Form A

Notes: 1. Reverse polarity types available (add suffix-R)
2. UL/CSA, TÜV approved type is standard.

TYPES

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching
		Part No.	Part No.	Part No.
1 Form A	3V DC	DSP1a-DC3V	DSP1a-L-DC3V	DSP1a-L2-DC3V
	5V DC	DSP1a-DC5V	DSP1a-L-DC5V	DSP1a-L2-DC5V
	6V DC	DSP1a-DC6V	DSP1a-L-DC6V	DSP1a-L2-DC6V
	9V DC	DSP1a-DC9V	DSP1a-L-DC9V	DSP1a-L2-DC9V
	12V DC	DSP1a-DC12V	DSP1a-L-DC12V	DSP1a-L2-DC12V
	24V DC	DSP1a-DC24V	DSP1a-L-DC24V	DSP1a-L2-DC24V
1 Form A 1 Form B	3V DC	DSP1-DC3V-F	DSP1-L-DC3V-F	DSP1-L2-DC3V-F
	5V DC	DSP1-DC5V-F	DSP1-L-DC5V-F	DSP1-L2-DC5V-F
	6V DC	DSP1-DC6V-F	DSP1-L-DC6V-F	DSP1-L2-DC6V-F
	9V DC	DSP1-DC9V-F	DSP1-L-DC9V-F	DSP1-L2-DC9V-F
	12V DC	DSP1-DC12V-F	DSP1-L-DC12V-F	DSP1-L2-DC12V-F
	24V DC	DSP1-DC24V-F	DSP1-L-DC24V-F	DSP1-L2-DC24V-F
2 Form A	3V DC	DSP2a-DC3V	DSP2a-L-DC3V	DSP2a-L2-DC3V
	5V DC	DSP2a-DC5V	DSP2a-L-DC5V	DSP2a-L2-DC5V
	6V DC	DSP2a-DC6V	DSP2a-L-DC6V	DSP2a-L2-DC6V
	9V DC	DSP2a-DC9V	DSP2a-L-DC9V	DSP2a-L2-DC9V
	12V DC	DSP2a-DC12V	DSP2a-L-DC12V	DSP2a-L2-DC12V
	24V DC	DSP2a-DC24V	DSP2a-L-DC24V	DSP2a-L2-DC24V

Standard packing: Carton: 50 pcs.; Case: 500 pcs.
Note: Reverse polarity type are manufactured by lot upon receipt of order. Self-clinching types are also available, please consult us.

RATING

1. Coil data

1) Single side stable

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 20°C 68°F)
3V DC	80%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	100mA	30Ω	300mW	130%V of nominal voltage
5V DC			60mA	83Ω		
6V DC			50mA	120Ω		
9V DC			33.3mA	270Ω		
12V DC			25mA	480Ω		
24V DC			12.5mA	1,920Ω		

2) 1 coil latching

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. allowable voltage (at 20°C 68°F)
			Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
3V DC	80%V or less of nominal voltage (Initial)	80%V or less of nominal voltage (Initial)	50mA	50mA	60Ω	60Ω	150mW	150mW	130%V of nominal voltage
5V DC			30mA	30mA	167Ω	167Ω			
6V DC			25mA	25mA	240Ω	240Ω			
9V DC			16.7mA	16.7mA	540Ω	540Ω			
12V DC			12.5mA	12.5mA	960Ω	960Ω			
24V DC			6.3mA	6.3mA	3,840Ω	3,840Ω			

3) 2 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. allowable voltage (at 20°C 68°F)
			Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
3V DC	80%V or less of nominal voltage (Initial)	80%V or less of nominal voltage (Initial)	100mA	100mA	30Ω	30Ω	300mW	300mW	130%V of nominal voltage
5V DC			60mA	60mA	83Ω	83Ω			
6V DC			50mA	50mA	120Ω	120Ω			
9V DC			33.3mA	33.3mA	270Ω	270Ω			
12V DC			25mA	25mA	480Ω	480Ω			
24V DC			12.5mA	12.5mA	1,920Ω	1,920Ω			

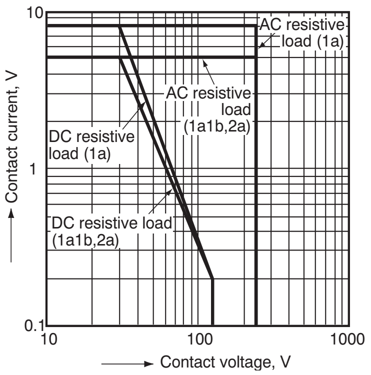
2. Specifications

Characteristics	Item		Specifications		
Contact	Arrangement		1 Form A	1 Form A 1 Form B	2 Form A
	Initial contact resistance, max.		Max. 30 mΩ (By voltage drop 6 V DC 1A)		
	Contact material		Au-flashed $AgSnO_2$ type		
Rating	Nominal switching capacity (resistive load)		8 A 250 V AC, 5A 30V DC	5 A 250 V AC, 5 A 30 V DC	
	Max. switching power (resistive load)		2,000 VA, 150 W	1,250 VA, 150 W	
	Max. switching voltage		380 V AC, 125 V DC		
	Max. switching current		8 A AC, 5 A DC	5 A AC, DC	
	Nominal operating power		Single side stable, 2 coil latching: 300 mW. 1 coil latching: 150mW		
	Min. switching capacity (Reference value)*1		10m A 5 V DC		
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.		
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1min. (Detection current: 10mA.)		
		Between contact sets	2,000 Vrms (1 Form A 1 Form B, 2 Form A) (Detection current: 10mA.)		
		Between contact and coil	3,000 Vrms for 1min. (Detection current: 10mA.)		
	Surge breakdown voltage*2	between contacts and coil	5,000 V		
	Temperature rise (at 65°C 149°F)		Max. 55°C	Max. 40°C	Max. 55°C
	Operate time [Set time] (at 20°C 68°F)		Max. 10 ms [10 ms] (Nominal voltage applied to the coil, excluding contact bounce time.)		
	Release time [Reset time] (at 20°C 68°F)		Max. 5 ms [10 ms] (Nominal voltage applied to the coil, excluding contact bounce time.) (without diode)		
Mechanical characteristics	Shock resistance	Functional	Min. 196 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10µs.)		
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 ms.)		
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 2 mm (Detection time: 10µs.)		
		Destructive	10 to 55 Hz at double amplitude of 3.5 mm		
Expected life	Mechanical		Min. 5×10^7 (at 180 cpm)		
	Electrical		Min. 10^5 (resistive load)		
Conditions	Conditions for operation, transport and storage*3 (Not freezing and condensing at low temperature)		Ambient temperature: –40°C to +60°C –40°F to +140°F	Ambient temperature: –40°C to +65°C –40°F to +149°F	Ambient temperature: –40°C to +60°C –40°F to +140°F
	Solder heating		250°C 482°F (10s), 300°C 572°F (5s), 350°C 662°F (3s) (Soldering depth: 2/3 terminal pitch)		
	Max. operating speed		3 cps		
Unit weight			Approx. 4.5 g .16 oz		

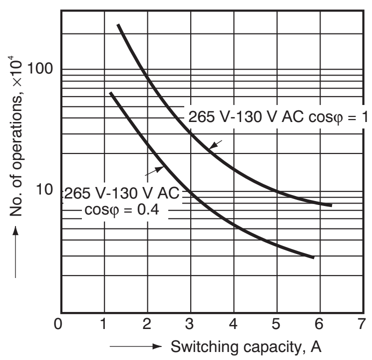
Notes:
*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2 Wave is standard shock voltage of ±1.2×50µs according to JEC-212-1981
*3 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

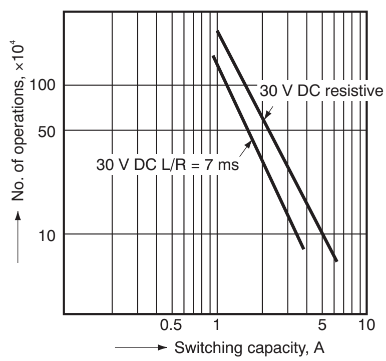
1. Max. switching capacity



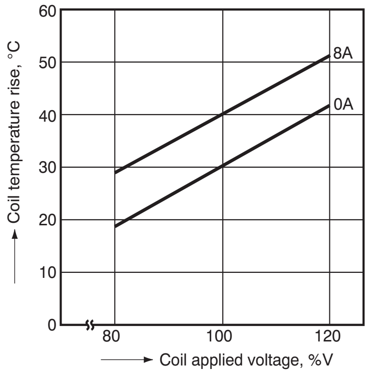
2.-(1) Life curve (1 Form A 1 Form B)



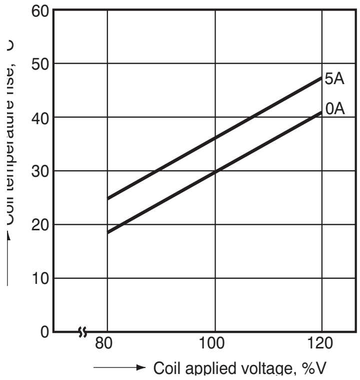
2.-(2) Life curve (1 Form A 1 Form B)



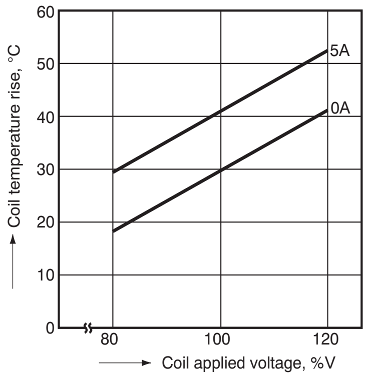
3.-(1) Coil temperature rise (1 Form A)
Tested sample: DSP1a-DC12V, 5 pcs.



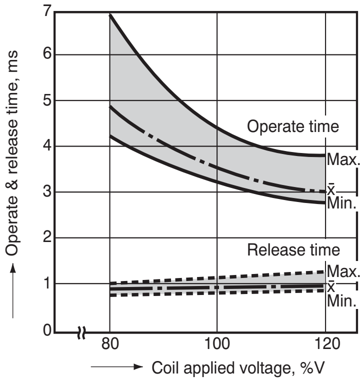
3.-(2) Coil temperature rise
(1 Form A 1 Form B)
Tested sample: DSP1-DC12V, 5 pcs.



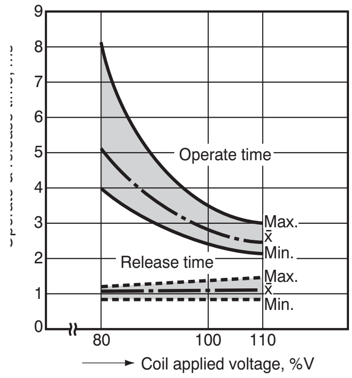
3.-(3) Coil temperature rise (2 Form A)
Tested sample: DSP2a-DC12V, 5 pcs.



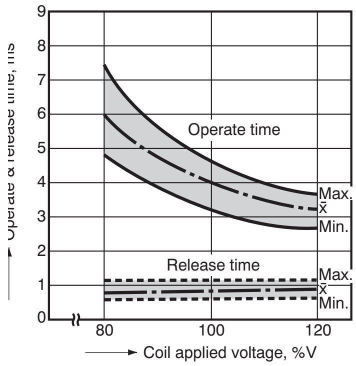
4.-(1) Operate & release time
(without diode, 1 Form A)
Tested sample: DSP1a-DC12V, 5 pcs.



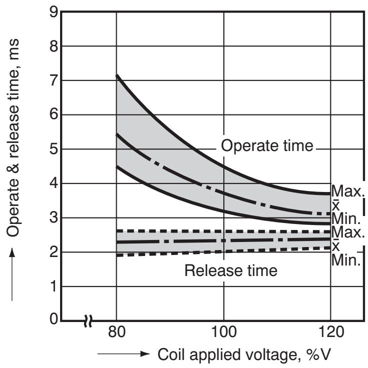
4.-(2) Operate & release time
(without diode, 1 Form A 1 Form B)
Tested sample: DSP1-DC12V, 5 pcs.



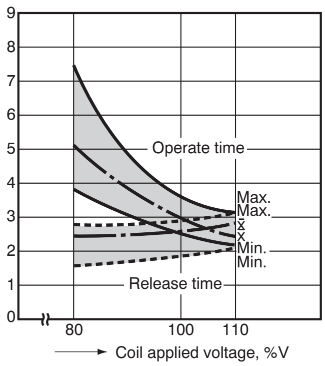
4.-(3) Operate & release time
(without diode, 2 Form A)
Tested sample: DSP2a-DC12V, 5 pcs.)



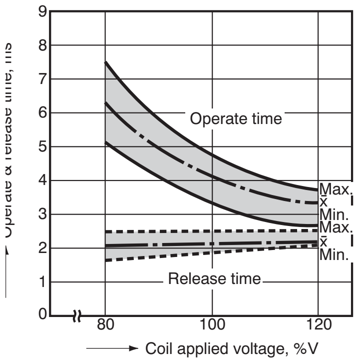
4.-(4) Operate & release time
(with diode, 1 Form A)
Tested sample: DSP1a-DC12V, 5 pcs.



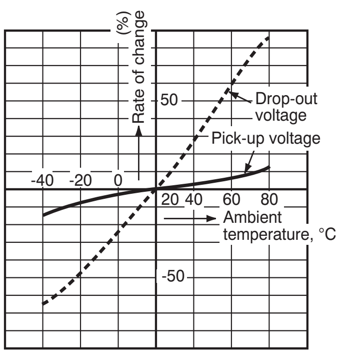
4.-(5) Operate & release time
(with diode, 1 Form A 1 Form B)
Tested sample: DSP1-DC12V, 5 pcs.



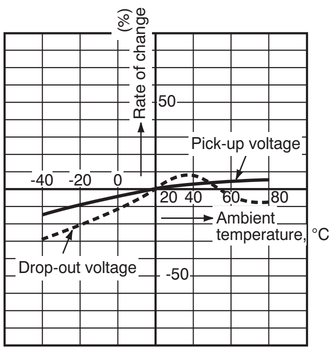
4.-(6) Operate & release time
(with diode, 2 Form A)
Tested sample: DSP2a-DC12V, 5 pcs.



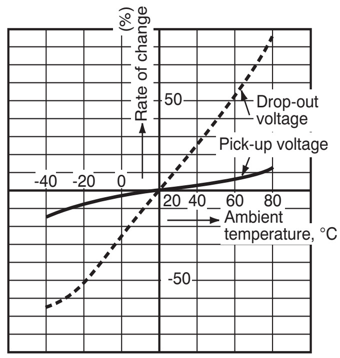
5.-(1) Change of pick-up and drop-out voltage
(1 Form A)
Tested sample: DSP1a-DC12V, 5 pcs.



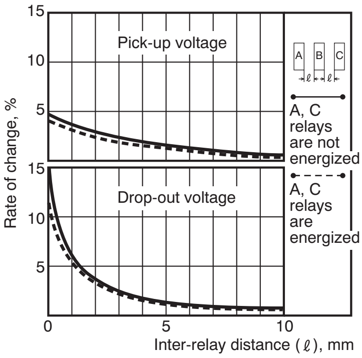
5.-(2) Change of pick-up and drop-out voltage
(1 Form A 1 Form B)
Tested sample: DSP1-DC12V, 5 pcs.



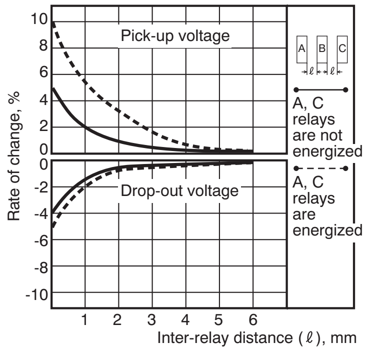
5.-(3) Change of pick-up and drop-out voltage
(2 Form A)
Tested sample: DSP2a-DC12V, 5 pcs.



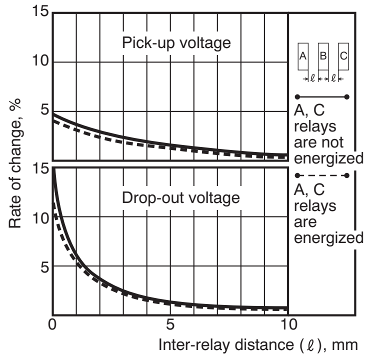
6.-(1) Influence of adjacent mounting (1 Form A)
Tested sample: DSP1a-DC12V, 5 pcs.



6.-(2) Influence of adjacent mounting (1 Form A 1 Form B)
Tested sample: DSP1-DC12V, 5 pcs.



6.-(3) Influence of adjacent mounting (2 Form A)
Tested sample: DSP2a-DC12V, 5 pcs.



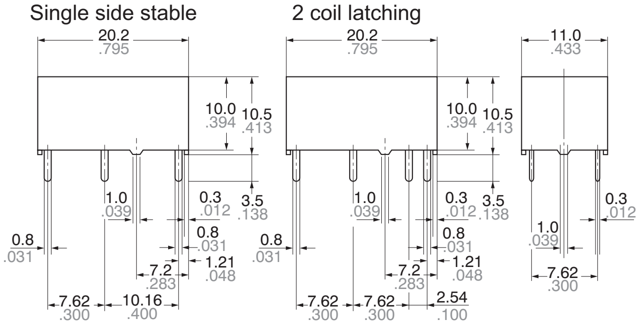
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. 1 Form A type

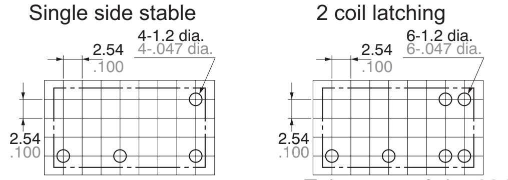
CAD Data

External dimensions



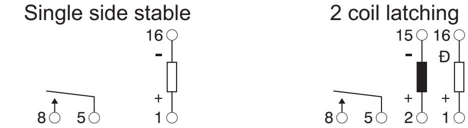
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



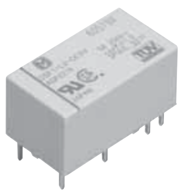
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

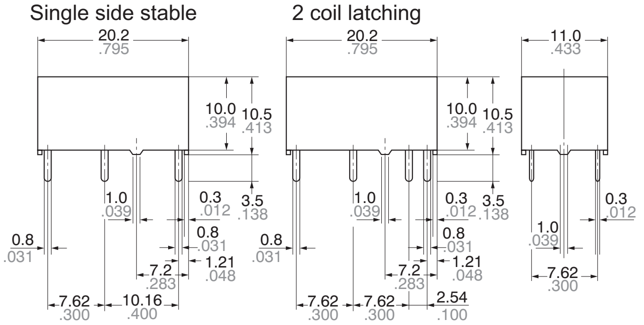


2. 1 Form A 1 Form B type

CAD Data

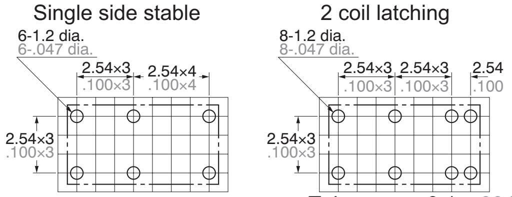


External dimensions



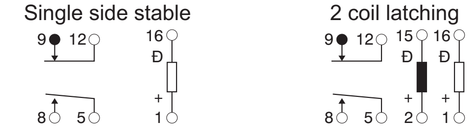
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



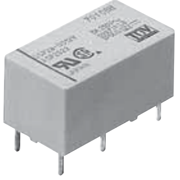
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

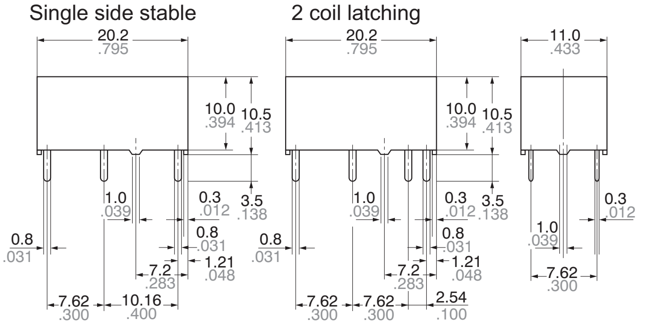


3. 2 Form A type

CAD Data

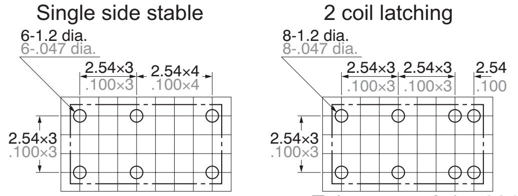


External dimensions



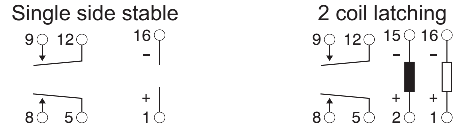
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



NOTES

1. Soldering should be done under the following conditions:
250°C 482°F within 10 s
300°C 572°F within 5 s
350°C 662°F within 3 s

2. Cleaning
For automatic cleaning, the boiling method is recommended. Avoid ultrasonic cleaning which subjects the relays to high frequency vibrations, which may cause the contacts to stick.
It is recommended that a fluorinated hydrocarbon or other alcoholic solvents be used.

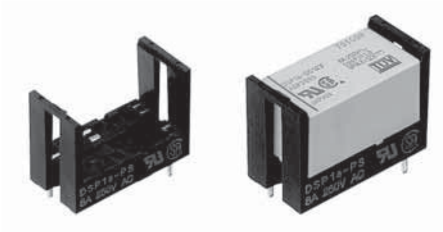
3. External magnetic field
Since DY relays are highly sensitive polarized relays, their characteristics will be affected by a strong external magnetic field. Avoid using the relay under that condition.

4. Coil operating power
Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%.
However, check it with the actual circuit since the characteristics may be slightly different.

5. When using, please be aware that the a contact and b contact sides of 1 Form A and 1 Form B types may go on simultaneously at operate time and release time.

For Cautions for Use, see Relay Technical Information (page 582).

SOCKETS FOR DS-P RELAYS



TYPES AND APPLICABLE RELAYS

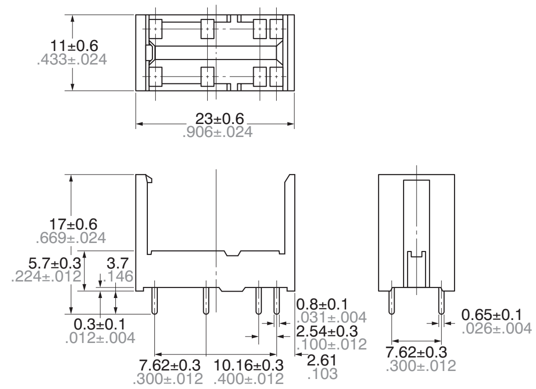
Applicable relays \ Type No.	For DSP1a		For DSP1a, DSP1, DSP2a	
	DSP1a-PS	DSP1a-PSL2	DSP2a-PS	DSP2a-PSL2
DSP1a relays	OK	OK	OK	OK
DSP1a-L2 relays		OK		OK
DSP1 relays			OK	OK
DSP1-L2 relays				OK
DSP2a relays			OK	OK
DSP2a-L2 relays				OK

SPECIFICATIONS

Item	Specifications
Breakdown voltage	3,000 Vrms between terminals (Except for the portion between coil terminals)
Insulation resistance	1,000 MΩ between terminals at 500 V
Heat resistance	150°C for 1 hour
Max. continuous current	8 A

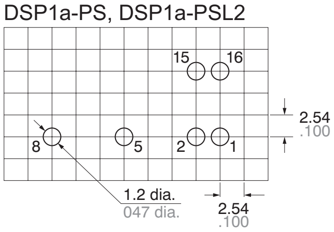
DIMENSIONS (Unit: mm inch)

External dimensions



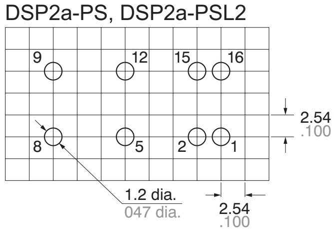
PC board pattern (Bottom view)

DSP1a-PS, DSP1a-PSL2



Terminal No.2 and 15 are for DSP1a-PSL2 only.

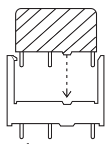
DSP2a-PS, DSP2a-PSL2



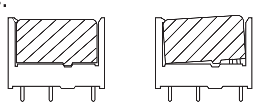
Terminal No.2 and 15 are for DSP2a-PSL2 only.

FIXING AND REMOVAL METHOD

1. Match the direction of relay and socket.

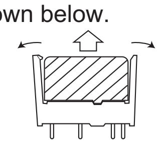


2. Both ends of relays are fixed so tightly that the socket hooks on the top surface of relays.

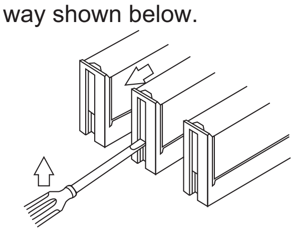


Good No good

3. Remove the relay, applying force in the direction shown below.



4. In case there is not enough space for finger to pick relay up, use screw drivers in the way shown below.



Notes: 1. Exercise care when removing relays. If greater than necessary force is applied at the socket hooks, deformation may alter the dimensions so that the hook will no longer catch, and other damage may also occur.
2. It is hazardous to use IC chip sockets.

Panasonic
ideas for life

10A MINIATURE POWER RELAY FOR INDUCTIVE LOADS

DY RELAYS (ADY)

FEATURES

1. Compact size:
   1 Form A (10A 250V AC),
   1 Form A 1 Form B (8A 250V AC)
2. Latching types available
3. Compliant with IEC EN61010-1. Reinforced insulation with 6 mm distance between input and output.
4. Electrical life of Min. 2×10^5 times (1 Form A type) realized with inductive load (cosφ=0.4, L/R=7ms, 5A 250V AC)
5. Socket also available.

Product name		Part No.
1 Form A	Single side stable type	DK1a-PS
	2 coil latching type	DK1a-PSL2
1 Form A 1 Form B	Single side stable type	DK2a-PS
	2 coil latching type	DK2a-PSL2

Please see “DK relay socket” for details.

TYPICAL APPLICATIONS

1. Control for industrial machines (machine tools, robotics)
2. Output relays for temperature controllers, PLCs, timers, sensors.
3. Measuring equipment
4. Security equipment

ORDERING INFORMATION

ADY □ □ □ □□

Contact arrangement
1: 1 Form A
3: 1 Form A 1 Form B

Operating function
0: Single side stable
2: 2 coil latching type

Auxiliary function
0: Plastic sealed/standard contact

Coil voltage (DC)
03: 3, 05: 5, 06: 6, 09: 9, 12: 12, 24: 24

Note: UL/CSA, TÜV approved type is standard.

TYPES

Contact arrangement	Nominal coil voltage	Single side stable	2 coil latching
		Part No.	Part No.
1 Form A	3V DC	ADY10003	ADY12003
	5V DC	ADY10005	ADY12005
	6V DC	ADY10006	ADY12006
	12V DC	ADY10012	ADY12012
	24V DC	ADY10024	ADY12024
1 Form A 1 Form B	3V DC	ADY30003	ADY32003
	5V DC	ADY30005	ADY32005
	6V DC	ADY30006	ADY32006
	12V DC	ADY30012	ADY32012
	24V DC	ADY30024	ADY32024

Standard packing: Tube: 50 pcs.; Case: 500 pcs.

RATING

1. Coil data

1) Single side stable

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 20°C 68°F)
3V DC	70%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	66.6mA	45Ω	200mW	130%V of nominal voltage
5V DC			40mA	125Ω		
6V DC			33.3mA	180Ω		
12V DC			16.6mA	720Ω		
24V DC			8.3mA	2,880Ω		

2) 2 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. allowable voltage (at 20°C 68°F)
			Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
3V DC	70%V or less of nominal voltage (Initial)	70%V or less of nominal voltage (Initial)	66.6mA	66.6mA	45Ω	45Ω	200mW	200mW	130%V of nominal voltage
5V DC			40mA	40mA	125Ω	125Ω			
6V DC			33.3mA	33.3mA	180Ω	180Ω			
12V DC			16.6mA	16.6mA	720Ω	720Ω			
24V DC			8.3mA	8.3mA	2,880Ω	2,880Ω			

2. Specifications

Characteristics	Item		Specifications	
Contact	Arrangement		1 Form A	1 Form A 1 Form B
	Initial contact resistance, max.		Max. 30 mΩ (By voltage drop 6 V DC 1A)	
	Contact material		Au-flashed $AgSnO_2$ type	
Rating	Nominal switching capacity	Resistive load	10A 250V AC, 10A 30V DC	8A 250V AC, 8A 30V DC
		Inductive load (cosϕ = 0.4, L/R = 7ms)	5A 250V AC	3.5A 250V AC
	Max. switching capacity (Reference value)	Resistive load	2,500V A, 300W	2,000V A, 240W
		Inductive load (cosϕ = 0.4, L/R = 7ms)	1,250V A	875V A
	Max. switching voltage		250V AC, 30V DC	
	Max. switching current		10 A	8 A
	Min. switching capacity (Reference value)*1		5V 10mA	
	Nominal operating power		200 mW	
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.	
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1 min. (Detection current: 10 mA)	
		Between contact and coil	4,000 Vrms for 1 min. (Detection current: 10 mA)	
	Surge breakdown voltage*2	Between contact and coil	10,000 V (initial)	
	Temperature rise (at70°C 158°F)		Max. 40°C (By resistive method, nominal voltage applied to the coil; max. switching current)	
	Operate time [Set time] (at 20°C 68°F)		Max. 10 ms [10 ms] (Nominal voltage applied to the coil, excluding contact bounce time.)	
	Release time [Reset time] (at 20°C 68°F)		Max. 8 ms [10 ms] (Nominal voltage applied to the coil, excluding contact bounce time.) (without diode)	
Mechanical characteristics	Shock resistance	Functional	Min. 98 m/s^2 (Half-wave pulse of sine wave: 11 ms; detection time: 10µs.)	
		Destructive	Min. 980 m/s^2 (Half-wave pulse of sine wave: 6 ms.)	
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1.5 mm (Detection time: 10µs.)	
		Destructive	10 to 55 Hz at double amplitude of 3 mm	
Expected life	Mechanical		Min. 5×10^7 (at 300 cpm)	
	Electrical		Min. 2×10^5: 1 Form A inductive load (at 20 cpm) (at rated load); Min. 10^5: 1 Form A resistive load,1 Form A 1 Form B resistive load,1 Form A 1 Form B inductive load (at 20 cpm) (at rated load)	
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –40°C to +70°C –40°F to +158°F; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)	
	Max. operating speed (at rated load)		20 cpm	
Unit weight			Approx. 6g .21oz	

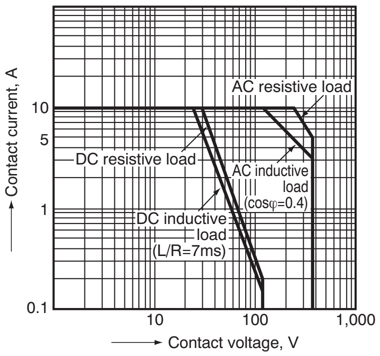
Notes

*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load
*2 Wave is standard shock voltage of ±1.2×50µs according to JEC-212-1981.
*3 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

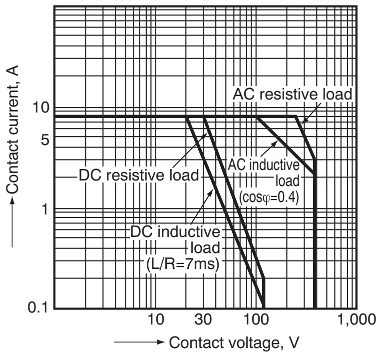
1-(1). Maximum switching capacity (1 Form A)

Tested sample: ADY10024



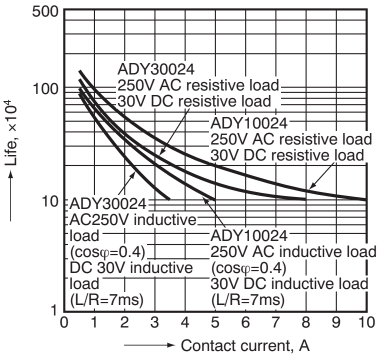
1-(2). Maximum switching capacity (1 Form A 1 Form B)

Tested sample: ADY30024



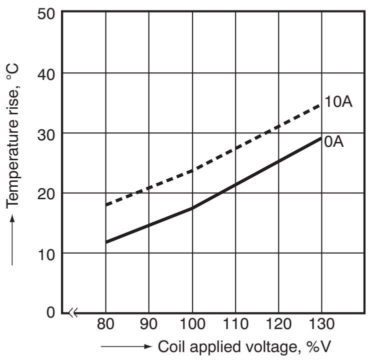
2. Life curve (1 Form A, 1 Form A 1 Form B)

Tested sample: ADY10024 (1 Form A),
ADY30024 (1 Form A 1 Form B)



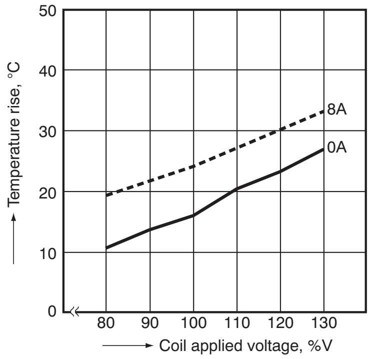
3-(1). Coil temperature rise (1 Form A)

Tested sample: ADY10024, 6 pcs.
Ambient temperature: 20°C, 68°F



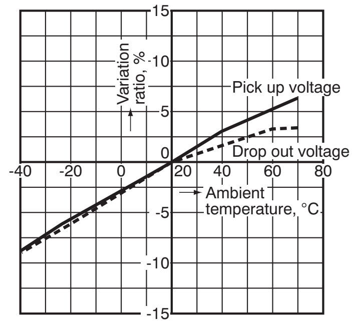
3-(2). Coil temperature rise (1 Form A 1 Form B)

Tested sample: ADY30024, 6 pcs.
Ambient temperature: 20°C, 68°F



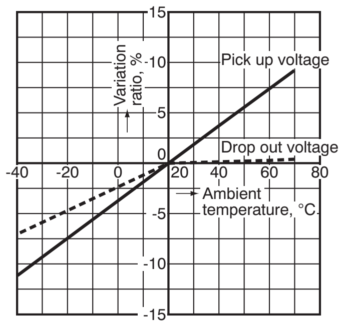
4-(1). Ambient temperature characteristics (1 Form A)

Tested sample: ADY10024, 6 pcs.
Ambient temperature: –40°C to 70°C –40°F to 158°F



4-(2). Ambient temperature characteristics (1 Form A 1 Form B)

Tested sample: ADY30024, 6 pcs.
Ambient temperature: –40°C to 70°C –40°F to 158°F

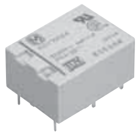


DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

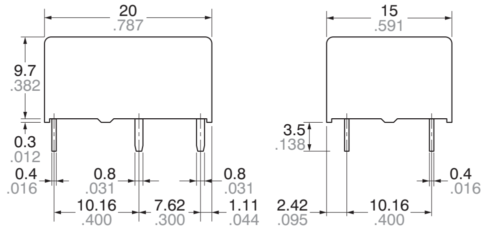
1. 1 Form A type

CAD Data



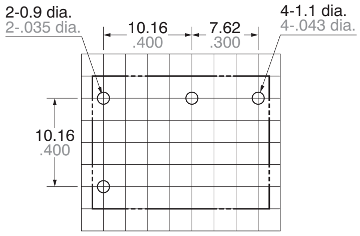
External dimensions

Single side stable type



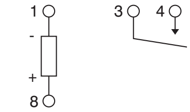
PC board pattern (BOTTOM VIEW)

Single side stable type



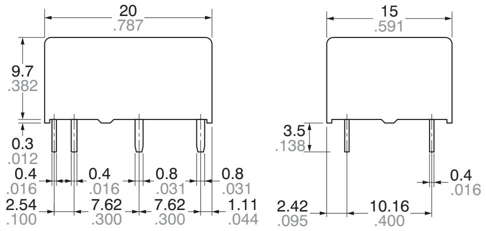
Schematic (BOTTOM VIEW)

Single side stable

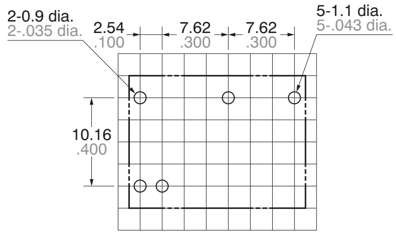


(Deenergized condition)

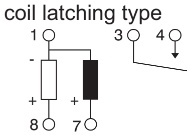
2 coil latching type



2 coil latching type



2 coil latching type



(Reset condition)

Since this is a polarized relay, the connection to the coil should be done according to the above schematic.

General tolerance: ±0.3 ±.012

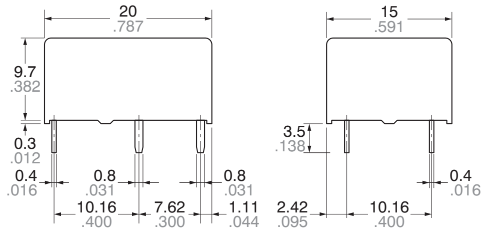
Tolerance: ±0.1 ±.004

2. 1 Form A 1 Form B type

CAD Data

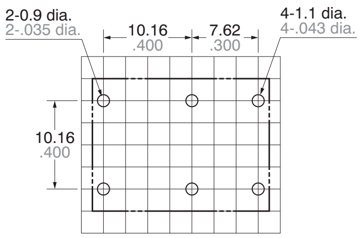
External dimensions

Single side stable type



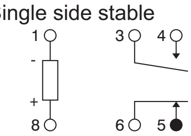
PC board pattern (BOTTOM VIEW)

Single side stable type



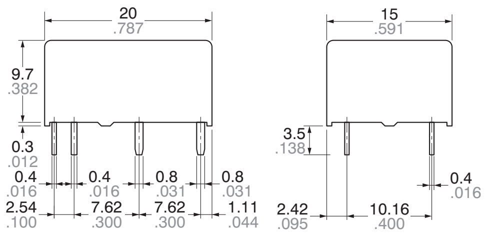
Schematic (BOTTOM VIEW)

Single side stable

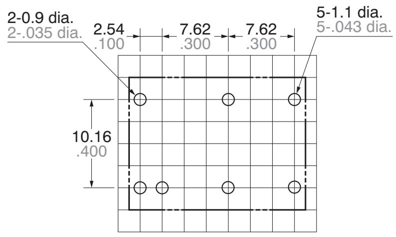


(Deenergized condition)

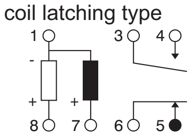
2 coil latching type



2 coil latching type



2 coil latching type



(Reset condition)

Since this is a polarized relay, the connection to the coil should be done according to the above schematic.

General tolerance: ±0.3 ±.012

Tolerance: ±0.1 ±.004

NOTES

1. Soldering should be done under the following conditions:
250°C 482°F within 10s
300°C 572°F within 5s
350°C 662°F within 3s
Soldering depth: 2/3 terminal pitch

2. External magnetic field
Since DY relays are highly sensitive polarized relays, their characteristics will be affected by a strong external magnetic field. Avoid using the relay under that condition.

3. When using, please be aware that the A contact and B contact sides of 1 Form A and 1 Form B types may go on simultaneously at operate time and release time.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

HIGH VOLTAGE AND CURRENT CUT-OFF CAPACITY IN A COMPACT PACKAGE

EP RELAYS

10A PC board type

10A TM type

60A Screw terminal type

80A Connector type

300A Connector type

FEATURES

1. High-voltage, high-current control capable
400V DC high-voltage switching cutoff has been achieved thanks to a sealed construction with mixed hydrogen gas and the magnetic arc motion through use of a permanent magnet.
2. Compact & Low Operating Sound
By using a capsule contact mechanism that is enclosed with hydrogen gas, high-capacity cutoff is possible even with a tiny contact gap. There is little operating sound, which does not change even when large currents are cut off.
3. Arc space unnecessary
The enclosure box can be made smaller thanks to an arc-space-free construction beyond which the arc will not go.
4. Safety
Since the contacts are enclosed in a sealed capsule structure, beyond which the arc will not go, safety is ensured.
5. High contact reliability
The contact part is hermetically sealed with H_2 mixed gas, hence the contact resistance remains stable regardless of the ambient conditions.
6. Mounting direction is not specified
The weight of the movable parts is light, and also the restoring force is large, hence the relay is relatively unaffected by gravity.
7. Wide selection of models available.
Types include PC board type, TM type (10A), screw terminal type (60A), and connector type (80A and 300A).
8. Standard compliance
The 60A type is UL and C-UL standard certified.

TYPICAL APPLICATIONS

1. Cogeneration systems
2. Battery inspection and testing equipment (charge and discharge control)
3. Construction machinery
4. AGV (Automatic guided vehicle) (Unmanned transport carts)
5. Welding equipment
6. Inverter control
7. Solar power generation systems
8. Elevator, etc.

ORDERING INFORMATION

AEP ☐ ☐ **0** ☐☐

EP Relay

Contact arrangement
1: 1 Form A
3: 1 Form A PC board type*
5: 1 Form A TM type*

Contact rating
1: 10A
6: 60A
8: 80A
9: 300A

Coil voltage
12: 12V DC
24: 24V DC
48: 48V DC*
X0: 100V DC*

Note: *10A type only

TYPES

Ttpe	Nominal coil voltage	Contact arrangement	Part No.	Packing quantity	
				Carton	Case
10A PC board type	12V DC	1 Form A	AEP31012	25pcs.	100pcs.
10A TM type			AEP51012	25pcs.	100pcs.
60A			AEP16012	1pc.	20pcs.
80A Connector type*			AEP18012	1pc.	20pcs.
300A Connector type*			AEP19012	1pc.	5pcs.
10A PC board type	24V DC		AEP31024	25pcs.	100pcs.
10A TM type			AEP51024	25pcs.	100pcs.
60A			AEP16024	1pc.	20pcs.
80A Connector type*			AEP18024	1pc.	20pcs.
300A Connector type*			AEP19024	1pc.	5pcs.
10A PC board type	48V DC		AEP31048	25pcs.	100pcs.
10A TM type			AEP51048	25pcs.	100pcs.
10A PC board type	100V DC		AEP310X0	25pcs.	100pcs.
10A TM type			AEP510X0	25pcs.	100pcs.

Notes: * One female connector lead wire for connecting is packaged with the 80A and 300A connector types.
-Specifications: Housing: Yazaki 7283-1020 (light gray); Lead wire: 0.5 mm² dia. and 300±10 mm length
Lead wire coating color: Pin No. 1: white; Pin No. 2: green

RATING

1. Coil data

Type	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal coil current [±10%] (at 20°C 68°F)	Nominal operating power (Nominal voltage applied to the coil, at 20°C 68°F)	Max. allowable voltage
10A	12V DC	75%V or less of nominal voltage (Initial)	8%V or more of nominal voltage (Initial)	0.103A	Max.1.4W	130%V of nominal voltage
60A				0.415A	Max. 5W	
80A				0.375A	Max. 5W	
300A				3.3A (during peak)	When input: 40 W max. (0.1 sec. from time of input) When retained: 4 W max.	
10A	24V DC			0.052A	Max.1.4W	
60A				0.208A	Max. 5W	
80A				0.188A	Max. 5W	
300A				1.85A (during peak)	When input: 45 W max. (0.1 sec. from time of input) When retained: 4 W max.	
10A	48V DC			0.026A	Max.1.4W	
10A	100V DC			0.012A		

*When using a DC power supply use one that has a leeway of at least 150% current capacity.

2. Specifications

Characteristics	Item		Specifications			
			10A type	60A type	80A type	300A type
Rating	Arrangement		1 Form A	1 Form A	1 Form A	1 Form A
	Nominal switching capacity (resistive load)		10A 400V DC	60A 400V DC	80A 400V DC	300A 400V DC
	Short term current		15A (2min), 30A (30s)	120A (15min) (harness wire: $15mm^2$)		400A (10min) (harness wire: $100mm^2$)
	Max. cut-off current		—	600A 300V DC (5 cycles)*1	800A 300V DC (1 cycle)*1	2,500A 300V DC (3 cycles)*2
	Overload opening/closing rating		30A 400V DC (Min. 50 cycles)*1	180A 400V DC (Min. 100 cycles)*1	120A 400V DC (Min. 50 cycles)*1	600A 400V DC (Min. 300 cycles)
	Reverse cut-off current		–10A 200V DC (Min. 2.5×10^4 cycles)*1	–60A 200V DC (Min. 1,000 cycles)*1	–120A 200V DC (Min. 50 cycles)*1	–300A 200V DC (Min. 100 cycles)
	Min. switching capacity		1A 6V DC	—	—	—
	Contact voltage drop		Max. 0.5V	Max. 0.1V	Max. 0.067V (By voltage drop 6V DC 20A)	Max. 0.06V
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.			
	Breakdown voltage (Initial)	Between open contacts	2,500 Vrms for 1min. (Detection current: 10mA.)			
		Between contact and coil	2,500 Vrms for 1min. (Detection current: 10mA.)			
	Operate time (at 20°C 68°F)		Max. 50ms (Nominal voltage applied to the coil, excluding contact bounce time.)			Max. 30ms (Nominal voltage applied to the coil, excluding contact bounce time.)
	Release time (at 20°C 68°F)		Max. 30ms (After the nominal operation voltage stops)			Max. 10ms (After the nominal operation voltage stops)
Mechanical characteristics	Shock resistance	Functional	Min. 196 m/s^2 (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)			
		Destructive	Min. 490 m/s^2 (Half-wave pulse of sine wave: 6 ms.)			
	Vibration resistance	Functional	10 to 200Hz, acceleration $43m/s^2$ constant (Detection time: 10μs.)			
		Destructive	10 to 200Hz, acceleration $43m/s^2$ constant (3 directions,each 4 hours)			
Expected life	Mechanical		Min. 10^5	Min. 2×10^5		
	Electrical		7.5×10^4 10A 400V DC*2 L/R ≦ 1ms	3×10^3 60A 400V DC*2 L/R ≦ 1ms	10^3 80A 400V DC*2 L/R ≦ 1ms	10^3 300A 400V DC L/R ≦ 1ms
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –40°C to +80°C –40°F to +176°F (Storage: Max. 85°C 185°F), Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)			
Unit weight			Approx. 80 g 2.820oz	Approx. 340 g 12.00oz	Approx. 400 g 14.11oz	Approx. 750 g 26.46oz

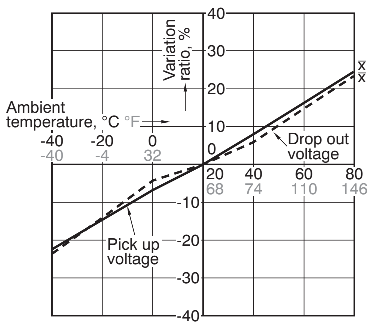
Notes

*1 Conditions: Varistor used for coil surge absorption. Note: If a diode is used the life will be lower.
*2 Condition: Switches rated number of 10 cycles each time there is a 2,500A cutoff.
*3 The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

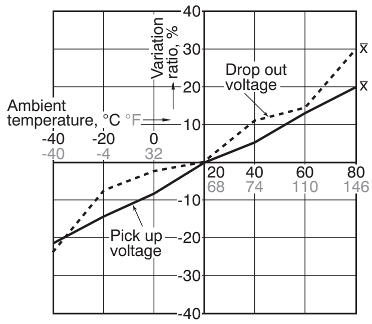
1.-(1) Ambient temperature characteristics (10A type)

Tested sample: 10A type EP relay, 3pcs



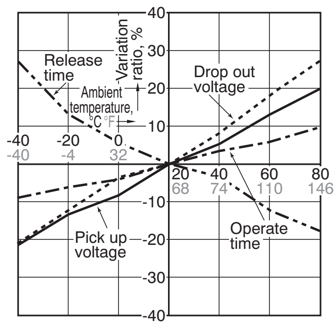
1.-(2) Ambient temperature characteristics (60A type)

Tested sample: 60A type EP relay, 3pcs



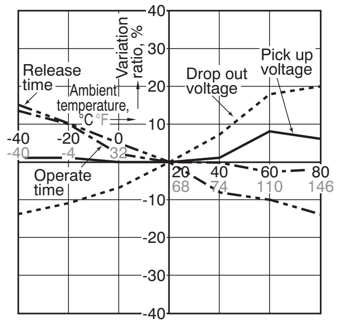
1.-(3) Ambient temperature characteristics (80A type)

Tested sample: 80A type EP relay, 3pcs

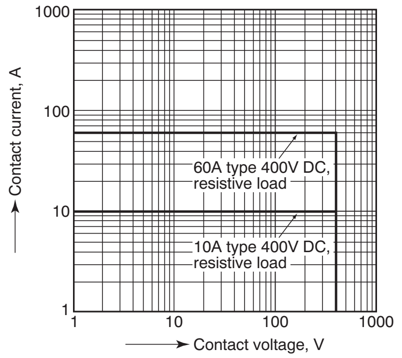


1.-(4) Ambient temperature characteristics (300A type)

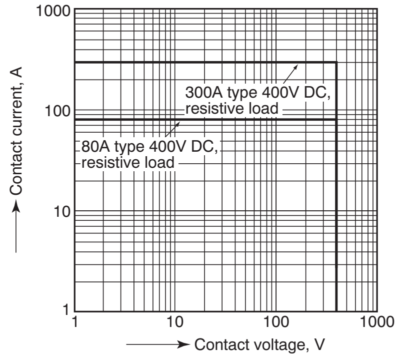
Tested sample: 300A type EP relay, 3pcs



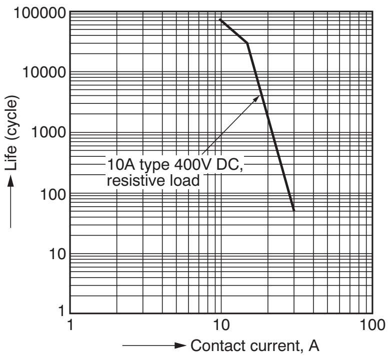
2.-(1) Max. value for switching capacity (10A and 60A types)



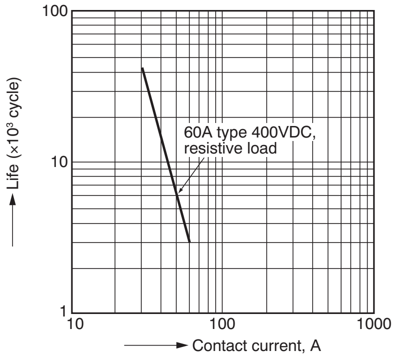
2.-(2) Max. value for switching capacity (80A and 300A types)



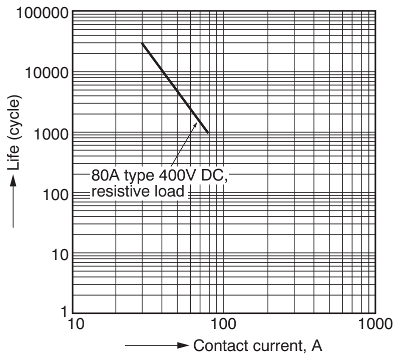
3.-(1) Switching life curve (10A type)



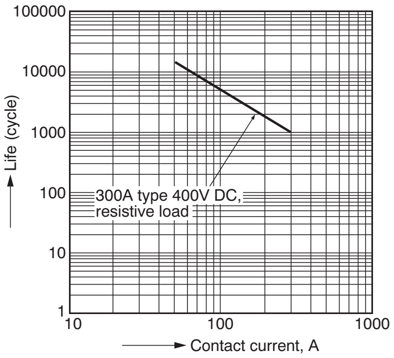
3.-(2) Switching life curve (60A type)



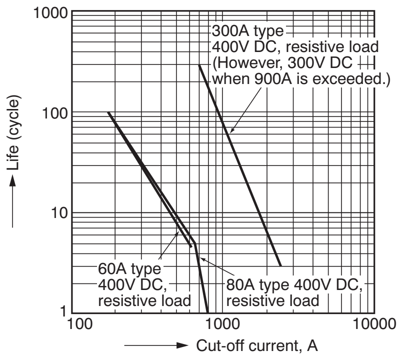
3.-(3) Switching life curve (80A type)



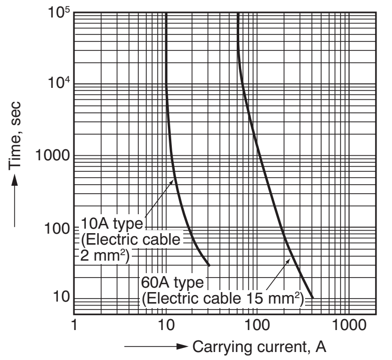
3.-(4) Switching life curve (300A type)



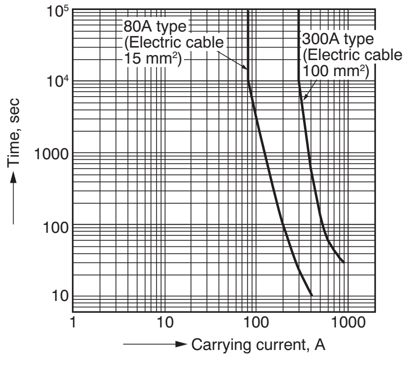
4. Cut-off curve (forward direction)



5.-(1) Carrying performance curve (80°C) (10A and 60A types)



5.-(2) Carrying performance curve (80°C) (80A and 300A types)

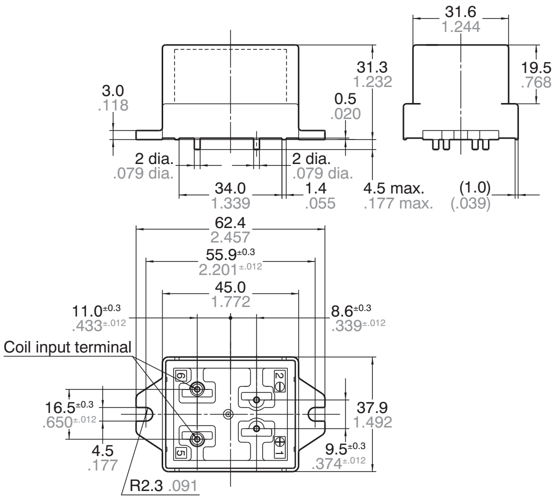


DIMENSIONS(mm inch)

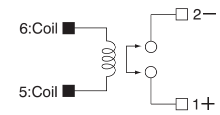
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. 10A PC board type

CAD Data External dimensions

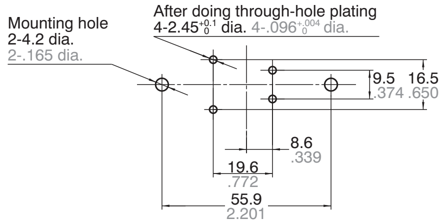


Schematic (Bottom view)



Load sides have polarities (+) and (−).

PC board pattern (Bottom view)

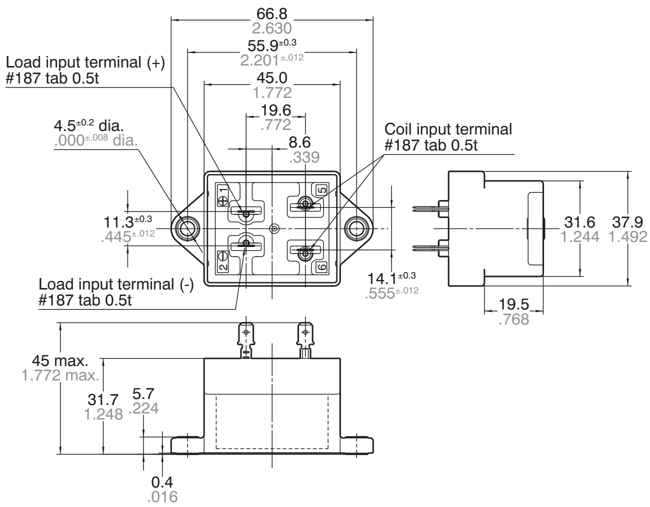


Notes: 1. We recommend through-hole plating with land on both sides.
2. Be careful of the insulation distance between land patterns with regards to the circuit voltage you will use.

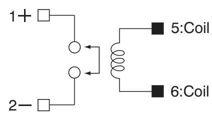
General tolerance:
Max. 10 .394 ±0.3 ±.012
10 .394 to 50 1.969 ±0.6 ±.024
Min. 50 1.969 ±1.0 ±.039

2. 10A TM type

CAD Data External dimensions

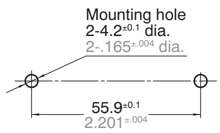


Schematic (Top view)



Load sides have polarities (+) and (−).

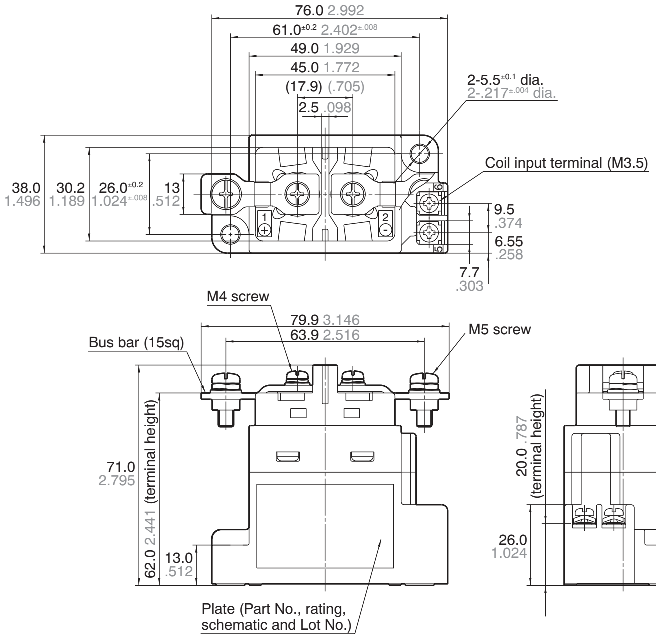
Panel cut-off



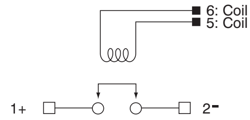
General tolerance:
Max. 10 .394 ±0.3 ±.012
10 .394 to 50 1.969 ±0.6 ±.024
Min. 50 1.969 ±1.0 ±.039

3. 60A type

CAD Data External dimensions

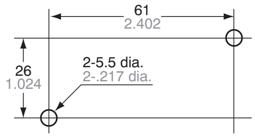


Schematic (Top view)



Load side has polarities (+) and (−).

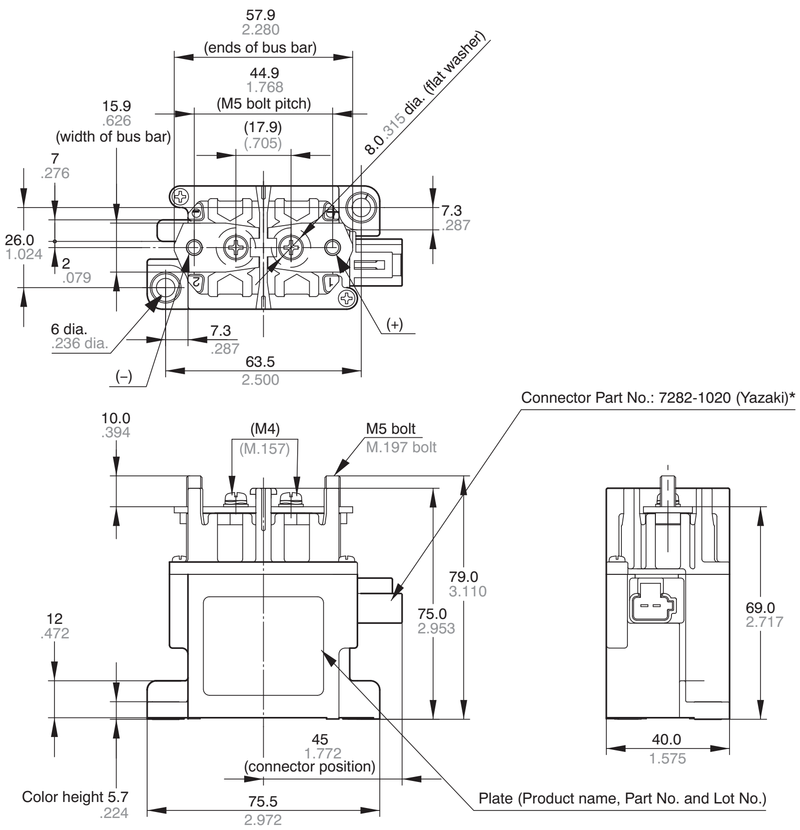
Panel cut-off



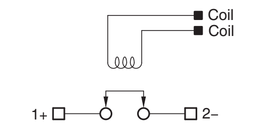
General tolerance:
Max. 10 .394 ±0.3 ±.012
10 .394 to 50 1.969 ±0.6 ±.024
Min. 50 1.969 ±1.0 ±.039

4. 80A type

CAD Data External dimensions

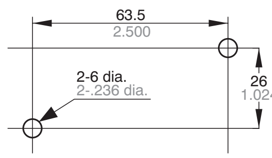


Schematic (Top view)

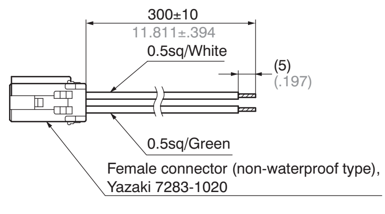


Load sides have polarities (+) and (–).

Panel cut-off



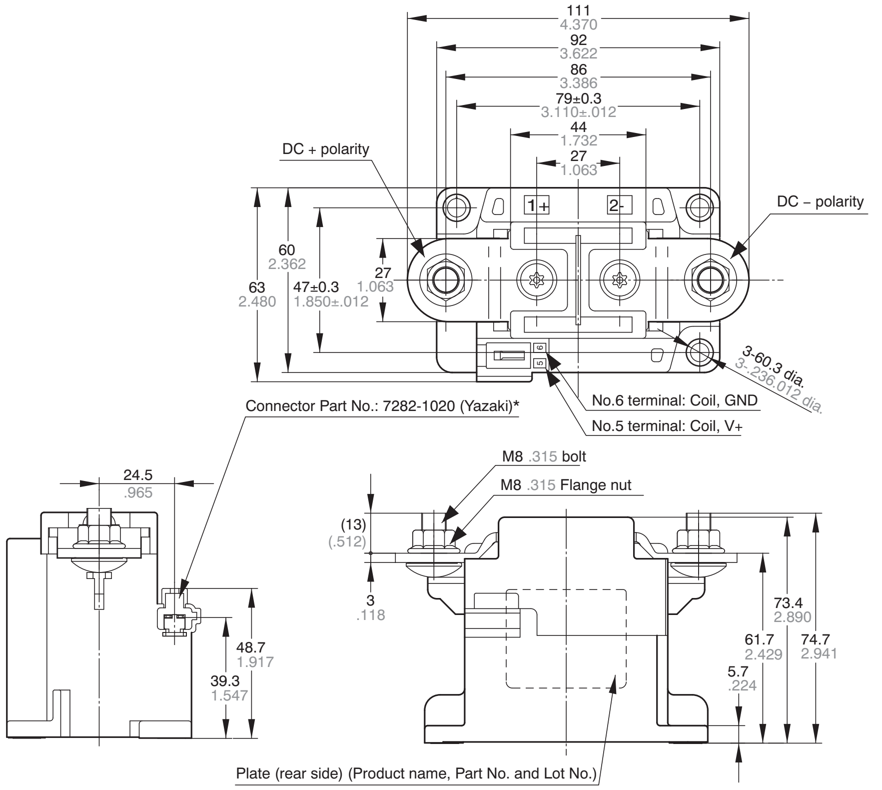
*Accessories (included)



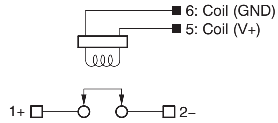
General tolerance:
Max. 10 .394: ±0.3 ±.012
10 .394 to 50 1.969: ±0.6 ±.024
Min. 50 1.969: ±1.0 ±.039

5. 300A type

CAD Data External dimensions

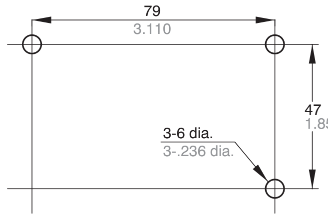


Schematic (Top view)

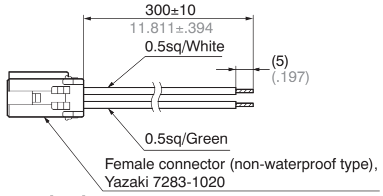


Input and load sides have polarities (+) and (−).

Panel cut-off



*Accessories (included)



General tolerance:
Max. 10 .394: ±0.3 ±.012
10 .394 to 50 1.969: ±0.6 ±.024
Min. 50 1.969: ±1.0 ±.039

Polarized Power

NOTES

1. When installing the relay, always use washers to prevent the screws from loosening.
Tighten each screw within the rated range given below. Exceeding the maximum torque may result in breakage. Mounting is possible in either direction.
- M5 screw (60A, 80A and 300A main unit mounting section): 3 to 4N·m
- M3.5 screw (60A input terminal): 0.84 to 1.2 N·m
- M4 screw (10A PC board type main unit mounting section): 0.98 to 1.2N·m (10A TM type main unit mounting section): 1.8 to 2.7N·m

Recommended securing torque on load side terminals
- 60A/M5 screw: 2.5 to 3.6 N·m
- 80A/M5 bolt: 3.5 to 6.5 N·m
- 300A/M8 bolt: 10 to 12 N·m

2. The contacts of the relay are polarized. Please follow instructions in the connection schematic when connecting the contacts.
We recommend installing a surge protector varistor (ZNR) for the 10A , 60A and 80A types. Avoid using a diode as this may result in decreased cut-off capability.

3. Do not use a relay if it has been dropped.

4. Avoid mounting the relay in strong magnetic fields (near a transformer or magnet) or close to an object that radiates heat.

5. Electrical life
This relay is a high-voltage direct-current switch. In its final breakdown mode, it may lose the ability to provide the proper cut-off. Therefore, do not exceed the indicated switching capacity and life. (Please treat the relay as a product with limited life and replace it when necessary.)
In the event that the relay loses cut-off ability, there is a possibility that burning may spread to surrounding parts, so configure the layout so that the power is turned off within one second and from the point of view of safety, consider installing a failsafe circuit in the device.
Also, in order to avoid increased contact resistance, do not operate when there is no switching load.

6. Permeation life of internal gas
This relay uses a hermetically encased contact (capsule contact) with gas inside. The gas has a permeation life that is affected by the temperature inside the capsule contact (ambient temperature + temperature rise due to flow of electrical current). For this reason, make sure the ambient operating temperature is between –40 and 80°C –40 and +176°F, and the ambient storage temperature is between –40 and 85°C –40 and +185°F.

7. Do not disassemble the relay. Please note that disassembling the relay will invalidate the warranty.

8. If the power is turned off and then immediately on after applying the rated voltage (current) continuously to the relay's coil and contact, the resistance of the coil will increase due to a rise in the coil temperature. This causes the pick-up voltage to rise, and possibly exceed the rated pick-up voltage. In these circumstances, take measures such as reducing the load current, limiting the duration of current flow, and applying a coil voltage higher than the rated operating voltage.

9. Coil operating power
Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%. However, check the actual circuit since the characteristics may be slightly different. The power supply waveform supplied to the coil should be rectangular.

10. Don't exceed maximum coil voltage. Exceeding maximum allowable coil voltage on continuous basis will damage the relay and could case failure.

11. Ensure that the rated contacts voltage and current values are not exceeded.

12. The rated control capacity and life are given as general guides.
The contact life is heavily influenced by the type of load and other related conditions, and these factors must be kept in consideration when using the relay.

13. Main contact ratings in the ratings apply to when there is a resistive load. If you are using an inductive load (L load) such that L/R > 1 ms, add surge protection in parallel with the inductive load. If this is not done, the electrical life will decrease and cut-off failure may occur.

14. Be careful that foreign matter and oils and fats kind don't stick to the main terminal parts because it is likely to cause terminal parts to give off unusual heat. Also, please use the following materials for connected harnesses and bus bars.
- 10A TM type: Faston terminal for #187 tab terminal, 0.5 mm board thickness (JIS C2809-1992 compliant, flat type connection terminal)
  Harness nominal cross-sectional area
  Load input terminal: min. 2.0 mm²
  Coil input terminal: min. 0.3 mm²
- 60A and 80A types: Min. 14mm² nominal cross sectional area
- 300A type: Min. 100mm² nominal cross sectional area

15. Use 40N to 70N of force as a guide to fasten the terminal connected to the 10A TM type. Please use caution when inserting or removing the terminal as the relay tab terminal may cause injuly.

16. Place the PC board mount type (10A PC board type) securely by hand soldering after attaching it using M4 screw. Don't submerge assembled board in cleaning solvent or water. Also, be careful not let flux overflow up from the PC board or adhere to the base of the relay.
Recommended hand soldering conditions
- Soldering iron: 30 to 60 W
- Tip temperature: 400°C 752°F
- Solder time: within approx. 5 seconds

17. Make sure the power is turned off when wiring.

18. Incorrect wiring may cause unexpected malfunction and failure.

19. Regarding AC cutoff, although there is no contact polarity, generally it is thought that the electrical life will shorten due to cutoff in the reverse direction, compared to DC cutoff. Confirm electrical life using actual load. In the case of DC cut-off, please note the contact polarity.

20. Lead-free solder (tin, silver and copper) is used as pre-solder for the terminals of the PC board mount type (10A PC board type).

21. The warranted tensile strength of the female connector lead wire used for connection that comes with the 80A and 300A connector type when attaching it to the relay body is 100N. Avoid excessive tension as this is a cause of broken wires and damage. Also, insert the female connector deeply and make sure the connection is secure.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

4 A CAPACITY, THE VARIETY OF CONTACT ARRANGEMENTS

S RELAYS

FEATURES

1. Compact with high sensitivity
The high-efficiency polarized electromagnetic circuits of the 4-gap balanced armature and our exclusive spring alignment method achieves, with high-sensitivity in a small package, a relay that can be directly controlled by a driver chip.

2. Strong resistance to vibration and shock
Use of 4G-BA technology realizes strong resistance to vibration and shock.

3. High reliability and long life
Our application of 4G-BA technology, along with almost perfectly complete twin contact, ensures minimal contact bounce and high reliability.

4. Ability to provide wide-ranging control
Use of 4G-BA technology with gold-clad silver alloy contacts in a twin contact structure enables control across a broad range from microcurrents of 100 μA 100 mV DC to 4 A 250 V AC.

5. Latching types available
With 4G-BA technology, as well as single side stable types, convenient 2 coil latching types for circuit memory applications are also available.

6. Wide variety of contact formations available
The compact size of the 4G-BA mechanism enables the provision of many kinds of package, including 2a2b, 3a1b, and 4a. These meet your needs across a broad range of applications.

7. Low thermal electromotive force relay
High sensitivity (low power consumption) is realized by 4G-BA technology. Separation of the coil and spring sections has resulted in a relay with extremely low levels of thermal electromotive force (approx. 0.3 μV).

8. DIL terminal array
Deployed to fit a 2.54 mm .100 inch grid, the terminals are presented in DIL arrays which match the printed circuit board terminal patterns commonly in international use.

9. Relays that push the boundaries of relay efficiency
High-density S relays take you close to the limits of relay efficiency.

TYPICAL APPLICATIONS

Telecommunications equipment, data processing equipment, facsimiles, alarm equipment, measuring equipment.

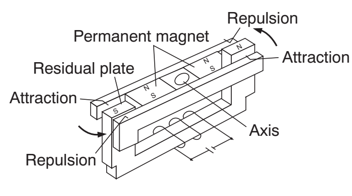
4-GAP BALANCED ARMATURE MECHANISM

1. Armature mechanism has excellent resistance to vibration and shock
The armature structure enables free rotation around the armature center of gravity. Because the mass is maintained in balance at the fulcrum of the axis of rotation, large rotational forces do not occur even if acceleration is applied along any vector. The mechanism has proven to have excellent resistance to vibration and shock. All our S relays are based on this balanced armature mechanism, which is able to further provide many other characteristics.

2. High sensitivity and reliability provided by 4-gap balanced armature mechanism
As a (polarized) balanced armature, the S relay armature itself has two permanent magnets. Presenting four interfaces, the armature has a 4-gap structure. As a result, the rotational axis at either end of the armature is symmetrical and, in an energized into a polarized state, the twin magnetic armature interfaces are subject to repulsion on one side and attraction on the other. This mechanism, exclusive to Panasonic Electric Works, provides a highly efficient polarized magnetic circuit structure that is both highly sensitive and has a small form factor. Moreover, suitability for provision with many types of contact array and other advantages promise to make it possible to provide many of the various characteristics that are coming to be demanded of relays.

HOW IT WORKS (single side stable type)

1) When current is passed through the coil, the yoke becomes magnetic and polarized.
2) At either pole of the armature, repulsion on one side and attraction on the other side is caused by the interaction of the poles and the permanent magnets of the armature.
3) At this time, opening and closing operates owing to the action of the simultaneously moulded balanced armature mechanism, so that when the force of the contact breaker spring closes the contact on one side, on the other side, the balanced armature opens the contact (2a2b).



ORDERING INFORMATION

S [ ] – [ ] – [ ]

Contact arrangement
2: 2 Form A 2 Form B
3: 3 Form A 1 Form B
4: 4 Form A

Operating function
Nil: Single side stable
L: 1 coil latching
L2: 2 coil latching

Coil voltage (DC)
3, 5, 6, 12, 24, 48 V

Note: UL/CSA approved type is standard.

TYPES

Contact arrangement	Nominal coil voltage	Single side stable	1 coil latching	2 coil latching
		Part No.	Part No.	Part No.
2 Form A 2 Form B	3V DC	S2-3V	S2-L-3V	S2-L2-3V
	5V DC	S2-5V	S2-L-5V	S2-L2-5V
	6V DC	S2-6V	S2-L-6V	S2-L2-6V
	12V DC	S2-12V	S2-L-12V	S2-L2-12V
	24V DC	S2-24V	S2-L-24V	S2-L2-24V
	48V DC	S2-48V	S2-L-48V	S2-L2-48V
3 Form A 1 Form B	3V DC	S3-3V	S3-L-3V	S3-L2-3V
	5V DC	S3-5V	S3-L-5V	S3-L2-5V
	6V DC	S3-6V	S3-L-6V	S3-L2-6V
	12V DC	S3-12V	S3-L-12V	S3-L2-12V
	24V DC	S3-24V	S3-L-24V	S3-L2-24V
	48V DC	S3-48V	S3-L-48V	S3-L2-48V
4 Form A	3V DC	S4-3V	S4-L-3V	S4-L2-3V
	5V DC	S4-5V	S4-L-5V	S4-L2-5V
	6V DC	S4-6V	S4-L-6V	S4-L2-6V
	12V DC	S4-12V	S4-L-12V	S4-L2-12V
	24V DC	S4-24V	S4-L-24V	S4-L2-24V
	48V DC	S4-48V	S4-L2-48V	S4-L2-48V

Standard packing: Tube: 50 pcs.; Case: 500 pcs.

RATING

1. Coil data

1) Single side stable

Type	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Coil inductance	Max. allowable voltage (at 40°C 104°F)
Standard	3V DC	70%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	66.7mA	45Ω	200mW	Approx. 23mH	5.5V DC
	5V DC			38.5mA	130Ω	192mW	Approx. 65mH	9.0V DC
	6V DC			33.3mA	180Ω	200mW	Approx. 93mH	11.0V DC
	12V DC			16.7mA	720Ω	200mW	Approx. 370mH	22.0V DC
	24V DC			8.4mA	2,850Ω	202mW	Approx. 1,427mH	44.0V DC
	48V DC			5.6mA	8,500Ω	271mW	Approx. 3,410mH	75.0V DC

2) 1 coil latching

Type	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Coil inductance	Max. allowable voltage (at 40°C 104°F)
Standard	3V DC	70%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	33mA	90Ω	99mW	Approx. 0.04mH	8.4V DC
	5V DC			16mA	300Ω	80mW	Approx. 0.14mH	15.3V DC
	6V DC			16mA	360Ω	96mW	Approx. 0.14mH	16.8V DC
	12V DC			8mA	1450Ω	96mW	Approx. 0.6mH	33.7V DC
	24V DC			4mA	5,700Ω	96mW	Approx. 2.05mH	66.7V DC
	48V DC			3mA	16,000Ω	144mW	Approx. 8.9mH	111V DC

3) 2 coil latching

Type	Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power (at 20°C 68°F)		Coil inductance		Max. allowable voltage (at 40°C 104°F)
				Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
Standard	3V DC	70%V or less of nominal voltage (Initial)	70%V or less of nominal voltage (Initial)	66.7mA	66.7mA	45Ω	45Ω	200mW	200mW	Approx. 10mH	Approx. 10mH	5.5V DC
	5V DC			38.5mA	38.5mA	130Ω	130Ω	192mW	192mW	Approx. 31mH	Approx. 31mH	9.0V DC
	6V DC			33.7mA	33.7mA	180Ω	180Ω	200mW	200mW	Approx. 40mH	Approx. 40mH	11.0V DC
	12V DC			16.7mA	16.7mA	720Ω	720Ω	200mW	200mW	Approx. 170mH	Approx. 170mH	22.0V DC
	24V DC			8.4mA	8.4mA	2,850Ω	2,850Ω	202mW	202mW	Approx. 680mH	Approx. 680mH	44.0V DC
	48V DC			7.4mA	7.4mA	6,500Ω	6,500Ω	355mW	355mW	Approx. 1,250mH	Approx. 1,250mH	65.0V DC

Polarized Power

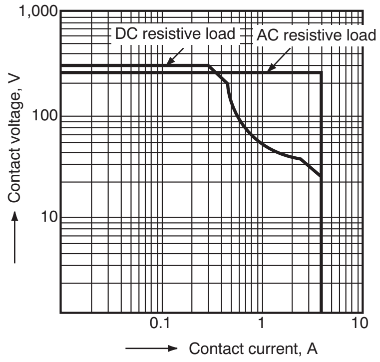
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		2 Form A 2 Form B, 3 Form A 1 Form B, 4 Form A
	Initial contact resistance, max.		Max. 50 mΩ (By voltage drop 6 V DC 1A)
	Electrostatic capacitance (initial)		Approx. 3pF
	Contact material		Au clad Ag alloy (Cd free)
	Thermal electromotive force (at nominal coil voltage) (initial)		Approx. 3μV
Rating	Nominal switching capacity (resistive load)		4 A 250 V AC, 3 A 30 V DC
	Max. switching power (resistive load)		1,000 VA, 90 W
	Max. switching voltage		250 V AC, 48 V DC (30 to 48 V DC at less than 0.5 A)
	Max. switching current		4 A (AC), 3 A (DC)
	Minimum operating power		100 mW (Single side stable, latching)
	Nominal operating power		200 mW (Single side stable, latching)
	Min. switching capacity (Reference value)*1		100μA 100 m V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 10,000MΩ (at 500V DC) Measurement at same location as "Initial breakdown voltage" section.
	Breakdown voltage (Initial)	Between open contacts	750 Vrms for 1min. (Detection current: 10mA.)
		Between contact sets	1,000 Vrms for 1min. (Detection current: 10mA.)
		Between contact and coil	1,500 Vrms for 1min. (Detection current: 10mA.)
	Temperature rise (at 20°C 68°F)		Max. 35°C (By resistive method, nominal voltage applied to the coil; contact carrying current: 4A.)
	Operate time [Set time] (at 20°C 68°F)		Max. 15 ms [15 ms] (Nominal voltage applied to the coil, excluding contact bounce time.)
	Release time [Reset time] (at 20°C 68°F)		Max. 10 ms [15 ms] (Nominal voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 490 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3 mm (Detection time: 10μs.)
		Destructive	10 to 55 Hz at double amplitude of 4 mm
Expected life	Mechanical		Min. 10^8 (at 50 cps)
	Electrical		Min. 10^5 (4 A 250 V AC), Min. 2×10^5 (3 A 30 V DC) (at 20 cpm)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –55°C to +65°C –67°F to +149°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed		20 cpm for maximum load, 50 cps for low-level load (1 mA 1 V DC)
Unit weight			Approx. 8 g .28 oz

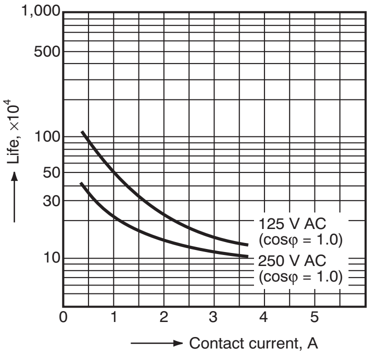
*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2 Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

1. Maximum switching power



2. Life curve

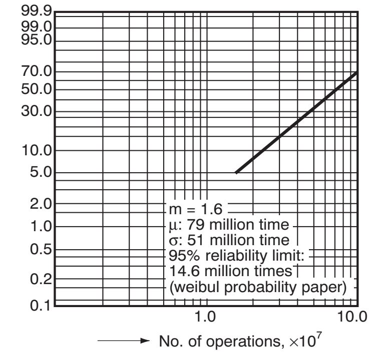


3. Contact reliability

Condition: 1V DC, 1mA

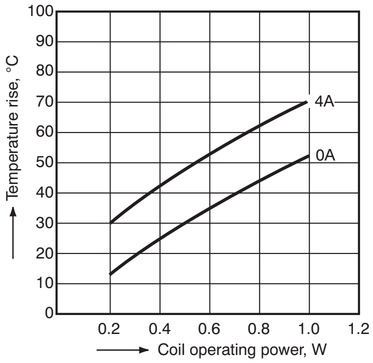
Detection level 10 Ω

Tasted Sample: S4-24V, 10pcs



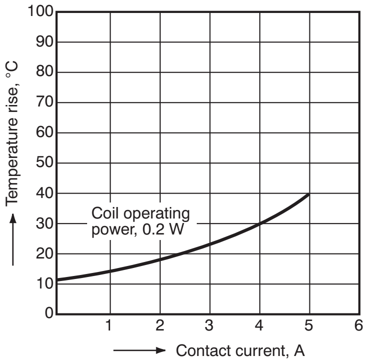
4.-(1) Coil temperature rise

Tested Sample: S4-24V, 4 Form A



4.-(2) Coil temperature rise

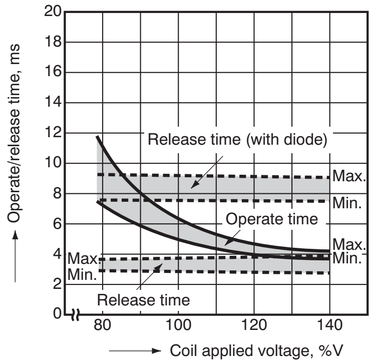
Tested Sample: S4-24V, 4 Form A



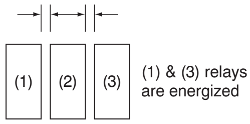
5. Operate and release time

(Single side stable type)

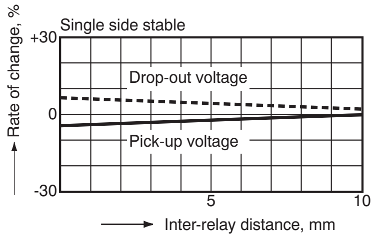
Tested Sample: S4-24V, 10pcs

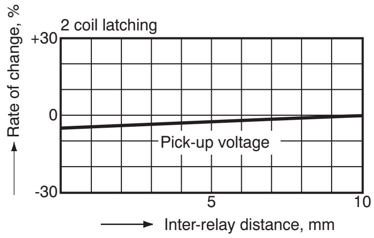


6. Influence of adjacent mounting

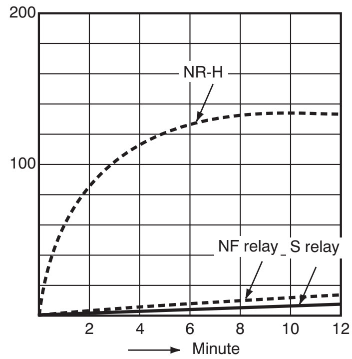


Note: When installing an S-relay near another, and there is no effect from an external magnetic field, be sure to leave at least 10 mm .394 inch between relays in order to achieve the performance listed in the catalog.

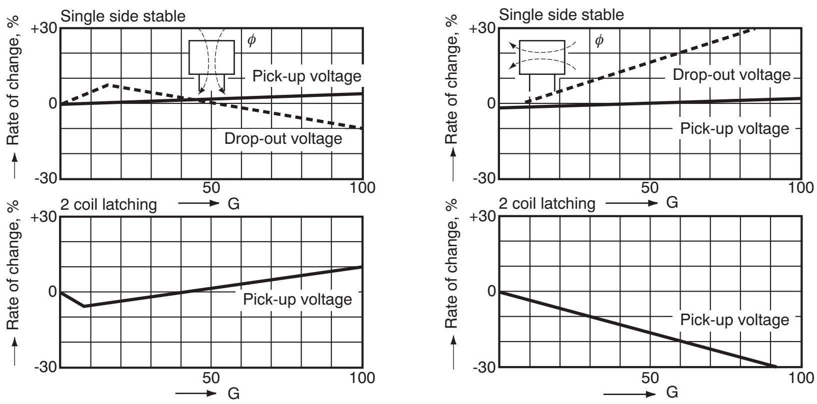




7. Thermal electromotive force



8. Effect from an external magnetic field

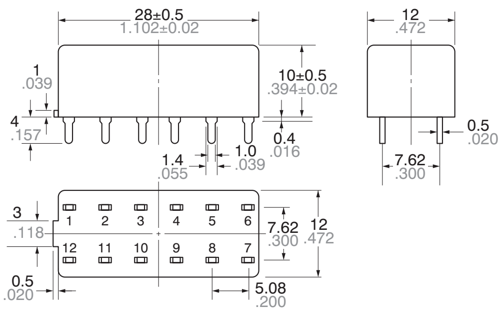


DIMENSIONS(mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

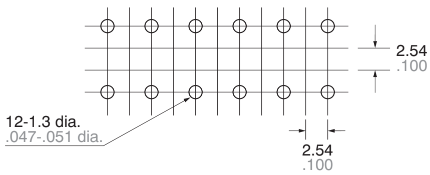
CAD Data

External dimensions



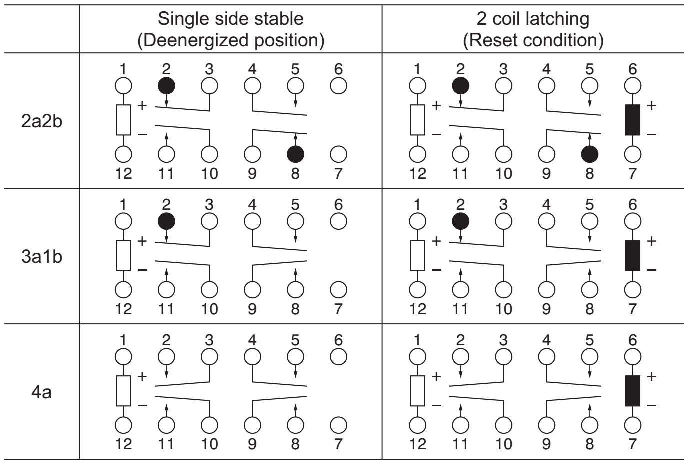
General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

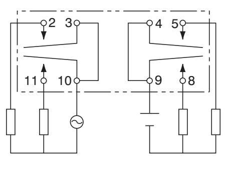
Schematic (Bottom view)



NOTES

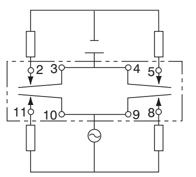
1. Based on regulations regarding insulation distance, there is a restriction on same-channel load connections between terminals No. 2, 3 and 4, 5, as well as between No. 8, 9 and 10, 11. See the figure below for an example.

2. Please note that when this relay (1 Form A 1 Form B types) operates and releases, contacts a and b may go ON at the same time.



- Between 2, 3 and 4, 5: different channels, therefore not possible
- Between 10, 11 and 8, 9: different channels, therefore not possible

No good



- Between 2, 3 and 4, 5: same channels, therefore possible
- Between 10, 11 and 8, 9: same channels, therefore possible

Good

For Cautions for Use, see Relay Technical Information (page 582).

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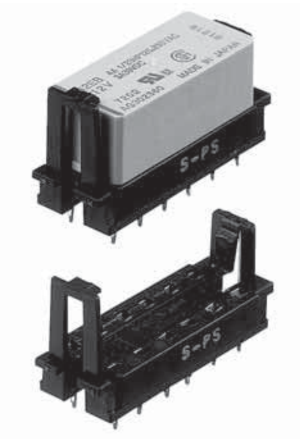
ACCESSORIES

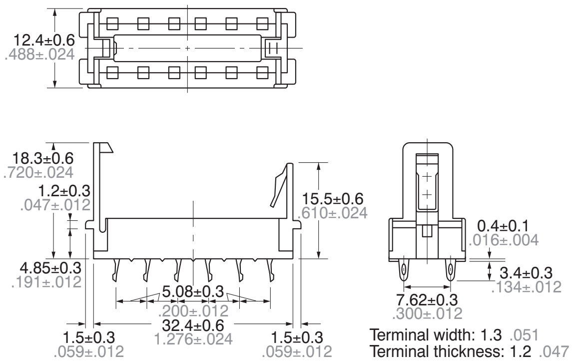
S RELAYS SOCKET



S-PS

DIMENSIONS (Unit: mm inch)

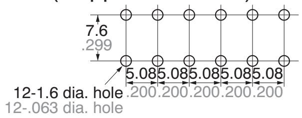
External dimensions



Terminal width: 1.3 .051
Terminal thickness: 1.2 .047

General tolerance: ±0.3 ±.012

PC board pattern
(Copper-side view)



Tolerance: ±0.1 ±.004

SPECIFICATIONS

Maximum continuous current	4 A Note: Don't insert or remove relays while in the energized condition.
Breakdown voltage	1,500 Vrms between terminals
Insulation resistance	More than 100 MΩ between terminals at 500 V DC Mega
Heat resistance	150 ±3°C (302 ±5.4°F) for 1 hour.

Inserting and removing method
Inserting method: Insert the relay as shown in Fig. 1 unit the rib of the relay snaps into the clip of the socket.

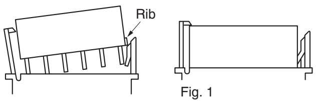


Fig. 1

Removing method:
(1) Remove the relay straight from the socket holding the shaded portion of the relay as shown in Fig. 2.

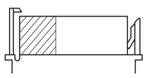


Fig. 2

(2) When sockets are mounted in close proximity, use a slotted screw driver as shown in Fig. 3.

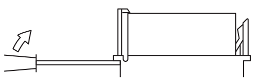


Fig. 3

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15A (2 Form C), 10A (4 Form C) COMPACT POWER RELAYS WITH HIGH SENSITIVITY

SP RELAYS

Taking advantage of the 4-gap balanced armature mechanism, S relays have met a number of relay needs and earned a reputation for the characteristics that they provide. Building on the same structure, the SP relay was introduced as a high-sensitivity power relay to provide nominal operating power of 300 mW and minimum operating power of 150 mW (single side stable and 2 coil latching types). Even so, with the nominal switching capacity for the 2 Form C at 15 A, and for the 4 Form C at 10 A, high-capacity switching is possible with small input. Moreover, taking full advantage of the excellence of the 4-gap balanced armature mechanism, we have realized a small, slim form factor that also has superior resistance to vibration and shock. This power relay is often chosen for NC machines and electrical power remote monitoring control panels, and for power supplies used in computers and other equipment. The SP also often provides power control for high-end business and industrial equipment.

FEATURES

1. Small, slim form factor
Facilitating the form factor reduction of devices, the overall height of the relay package is less than half that of our HP relay.

2. High sensitivity
The high-efficiency polarized electromagnetic mechanism in conjunction with our exclusive spring alignment method achieves levels of sensitivity higher than relays that have been available up to now. For both the 2 Form C and 4 Form C single side stable and 2 coil latching types, the 150 mW minimum operating power level allows direct driving by transistor or chip controllers.

3. High reliability and long life
With a structure that ensures almost perfectly complete twin contact and minimal contact bounce, you get greater reliability than has so far been provided by power relays.

4. Latching types also available
1 coil latching and 2 coil latching types are available. In cases where it was formerly unavoidable to use plural relays for large power memory, you can now use a single SP relay.

5. Strong resistance to vibration and shock
Our balanced armature technology well withstands vibration and shocks. It provides strong resistance to vibration and shock.

ORDERING INFORMATION

SP ☐ - ☐ - ☐ ☐

Contact arrangement
2: 2 Form C
4: 4 Form C

Terminal shape
Nil: Plug-in type
P: PC board type
Standard - 1.4 mm x 0.5 mm (without UL/CSA marking)
Optional - 2.0 mm x 0.5 mm (with UL/CSA marking)

Operating function
Nil: Single side stable
L: 1 coil latching
L2: 2 coil latching

Coil voltage
DC 3, 5, 6, 12, 24, 48 V

Notes: 1. PC board type and 1 coil latching type are manufactured by lot upon receipt of order.
2. UL/CSA and TÜV approved type is standard.

TYPES

Contact arrangement	Nominal coil voltage	Single side stable	2 coil latching
		Part No.	Part No.
2 Form C	3V DC	SP2-DC3V	SP2-L2-DC3V
	5V DC	SP2-DC5V	SP2-L2-DC5V
	6V DC	SP2-DC6V	SP2-L2-DC6V
	12V DC	SP2-DC12V	SP2-L2-DC12V
	24V DC	SP2-DC24V	SP2-L2-DC24V
	48V DC	SP2-DC48V	SP2-L2-DC48V
4 Form C	3V DC	SP4-DC3V	SP4-L2-DC3V
	5V DC	SP4-DC5V	SP4-L2-DC5V
	6V DC	SP4-DC6V	SP4-L2-DC6V
	12V DC	SP4-DC12V	SP4-L2-DC12V
	24V DC	SP4-DC24V	SP4-L2-DC24V
	48V DC	SP4-DC48V	SP4-L2-DC48V

Standard packing (2 Form C): Tube: 20 pcs.; Case: 200 pcs.
Standard packing (4 Form C): Tube: 10 pcs.; Case: 100 pcs.
Note: PC board type and 1 coil latching type are manufactured by lot upon receipt of order.

RATING

1. Coil data

1) Single side stable

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage
3V DC	70%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	100mA	30Ω	300mW	150%V of nominal voltage
5V DC			60.2mA	83Ω		
6V DC			50mA	120Ω		
12V DC			25mA	480Ω		
24V DC			12.5mA	1,920Ω		
48V DC			6.2mA	7,700Ω		

2) 2 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. allowable voltage
			Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
3V DC	70%V or less of nominal voltage (Initial)	70%V or less of nominal voltage (Initial)	100mA	100mA	30Ω	30Ω	300mW	300mW	150%V of nominal voltage
5V DC			60.2mA	60.2mA	83Ω	83Ω			
6V DC			50mA	50mA	120Ω	120Ω			
12V DC			25mA	25mA	480Ω	480Ω			
24V DC			12.5mA	12.5mA	1,920Ω	1,920Ω			
48V DC			6.2mA	6.2mA	7,680Ω	7,680Ω			

2. Specifications

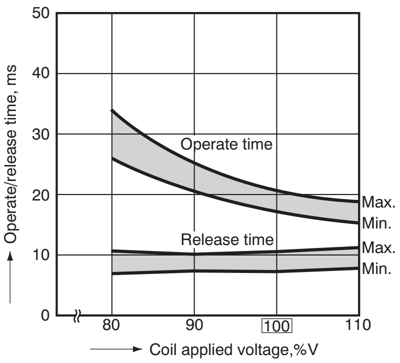
Characteristics	Item		Specifications
Contact	Initial contact pressure		2 Form C: Approx. 0.392 N (40 g 1.41 oz), 4 Form C: Approx. 0.196 N (20 g 0.71 oz)
	Arrangement		2 Form C, 4 Form C
	Initial contact resistance, max.		Max. 30 mΩ (By voltage drop 6 V DC 1A)
	Contact material		Stationary contact: Au flashed $AgSnO_2$ type, Movable contact: $AgSnO_2$ type
Rating	Nominal switching capacity (resistive load)		2 Form C: 15 A 250 V AC, 4 Form C: 10 A 250 V AC
	Max. switching power (resistive load)		2 Form C: 3,750 VA, 300 W, 4 Form C: 2,500 VA, 300 W
	Max. switching voltage		2 Form C, 4 Form C: 250 V AC, 30 V DC (48V DC: Max. 2A)
	Max. switching current		2 Form C: 15 A (AC) 10 A (DC), 4 Form C: 10 A
	Minimum operating power		150mW (Single side stable, 2 coil latching)
	Nominal operating power		300mW (Single side stable, 2 coil latching)
	Min. switching capacity (Reference value)*1		100 mA 5V DC
Electrical characteristics	Insulation resistance (Initial) (25°C, 50% relative humidity)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	1,500 Vrms for 1 min. (Detection current: 10 mA)
		Between contact and coil	3,000 Vrms for 1 min. (Detection current: 10 mA)
		Between contact sets	3,000 Vrms for 1 min. (Detection current: 10 mA)
	Operate time [Set time] (at 20°C 68°F)		Max. 30 ms [Max. 30 ms] (Nominal voltage applied to the coil, excluding contact bounce time.)
	Release time [Reset time] (at 20°C 68°F)		Max. 20 ms [Max. 30 ms] (Nominal voltage applied to the coil, excluding contact bounce time.) (without diode)
	Temperature rise (at 20°C 68°F)		Max. 40°C (By resistive method, nominal voltage applied to the coil; nominal switching capacity.)
Mechanical characteristics	Shock resistance	Functional	Min. 392 m/s^2 (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)
		Destructive	Min. 980 m/s^2 (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3 mm (Detection time: 10μs.)
		Destructive	10 to 55 Hz at double amplitude of 3 mm
Expected life	Mechanical		Min. 5×10^7 (at 180 cpm)
	Electrical (resistive load)		2 Form C: Min. 10^5 (15 A 250 V AC [at 20 cpm]), Min. 10^5 (10 A 30 V DC [at 20 cpm]) 4 Form C: Min. 10^5 (15 A 250 V AC [at 20 cpm]), Min. 10^5 (10 A 30 V DC [at 20 cpm])
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –50°C to +60°C –58°F to +140°F; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed		20 cpm (at rated load)
Unit weight			2 Form C: 50 g 1.76 oz; 4 Form C: 65 g 2.29 oz

*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

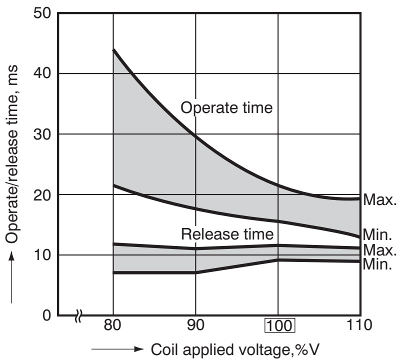
REFERENCE DATA

Operate and release time (Single side stable)

SP2



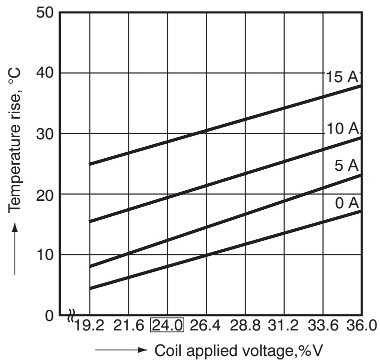
SP4



Coil temperature rise

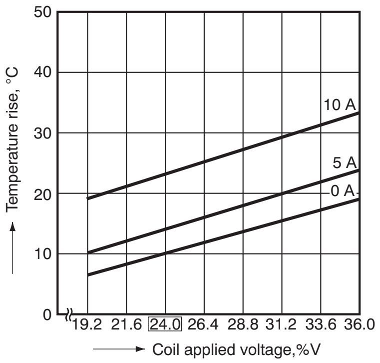
Tested sample: SP2-DC24V

Ambient temperature: 20 to 22°C 68 to 72°F



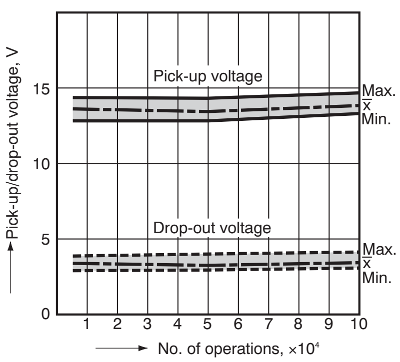
Tested sample: SP4-DC24V

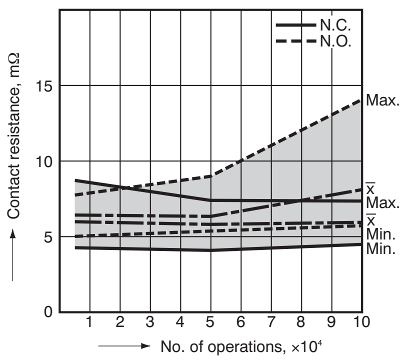
Ambient temperature: 27 to 29°C 81 to 84°F



Electrical life

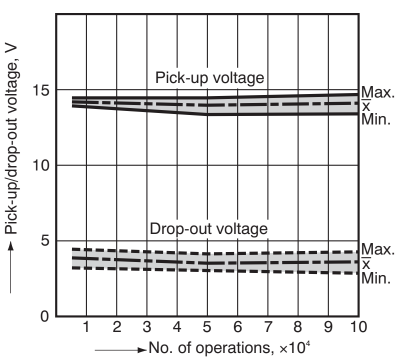
(SP2, 15 A 250 V AC resistive load)

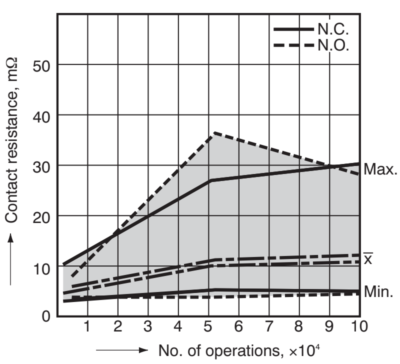




Electrical life

(SP4, 10 A 250 V AC resistive load)





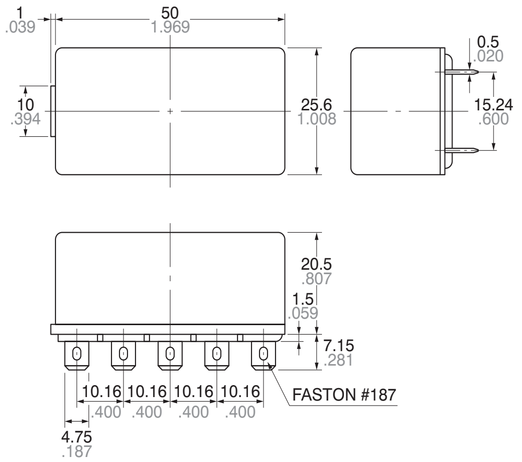
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

2 Form C

Plug-in terminal

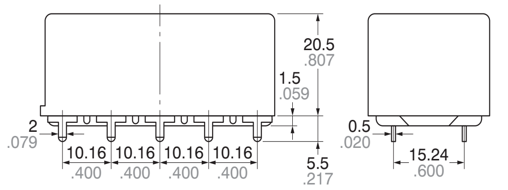
CAD Data External dimensions



General tolerance: ±0.3 ±.012

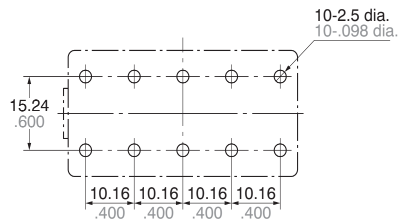
PC board type

CAD Data External dimensions



General tolerance: ±0.3 ±.012

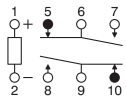
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

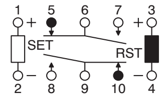
Schematic (Bottom view)

Single side stable



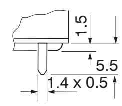
(Deenergized condition)

2 coil latching



(Reset condition)
Diagram shows the “reset” position when terminals 3 and 4 are energized. Energize terminals 1 and 2 to transfer contacts.

PC board terminal

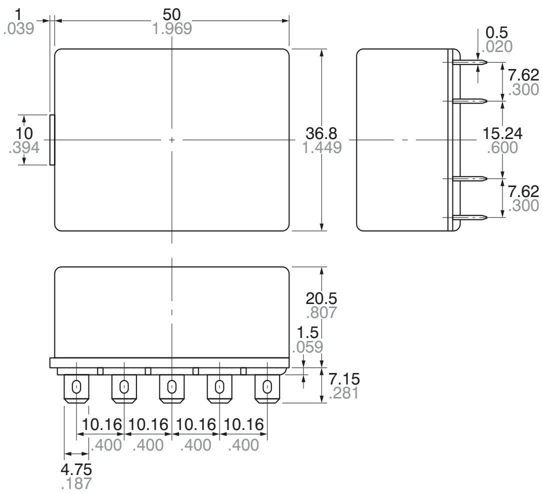


With UL/CSA approval:
pin 2 mm x 0.5 mm
standard type:
pin 1.4 mm x 0.5 mm

4 Form C

Plug-in terminal

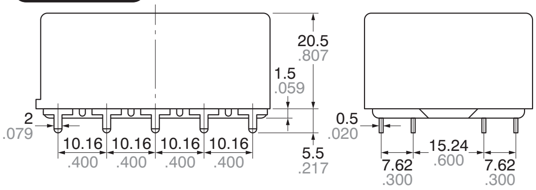
CAD Data External dimensions



General tolerance: ±0.3 ±.012

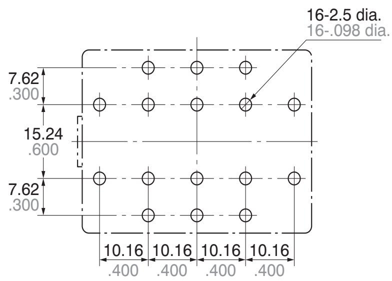
PC board type

CAD Data External dimensions



General tolerance: ±0.3 ±.012

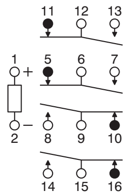
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

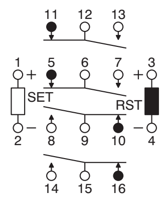
Schematic (Bottom view)

Single side stable



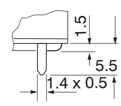
(Deenergized condition)

2 coil latching



(Reset condition)
Diagram shows the “reset” position when terminals 3 and 4 are energized. Energize terminals 1

PC board terminal



With UL/CSA approval:
pin 2 mm x 0.5 mm
standard type:
pin 1.4 mm x 0.5 mm

Polarized Power

For Cautions for Use, see Relay Technical Information (page 582).

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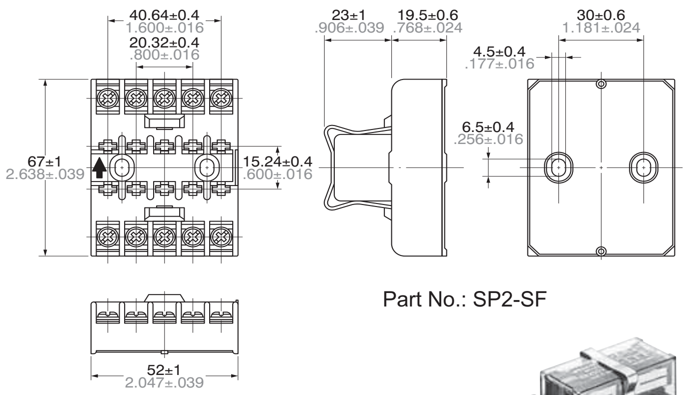
ACCESSORIES

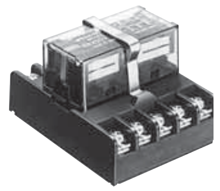
SP RELAYS
TERMINAL SOCKET

DIMENSIONS (Unit: mm inch)

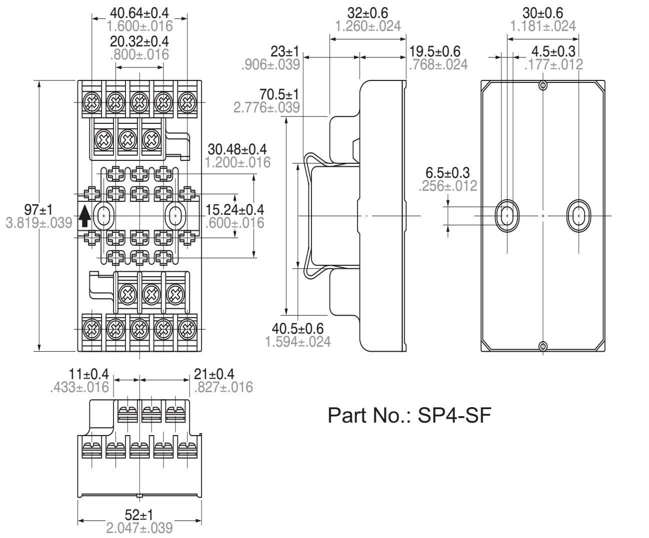
SP2-Terminal socket



Part No.: SP2-SF



SP4-Terminal socket

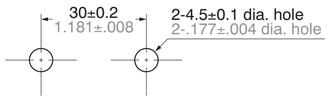


Part No.: SP4-SF

General tolerance: ±0.5 ±.020

Note: Terminal number marking is on the socket body. Please refer together with the SP relay schematic.

Mounting hole diagram

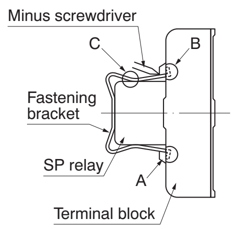


Notes:
(1) Mounting screws and the fastening bracket are included in the package.
(2) Mount the relay with the proper mounting direction — i.e. with the direction of the Ⓜ mark on top of the relay case matching the direction of the Ⓜ mark on the terminal block. (The ⇧ direction of the terminal block is the upward direction of the relay.)

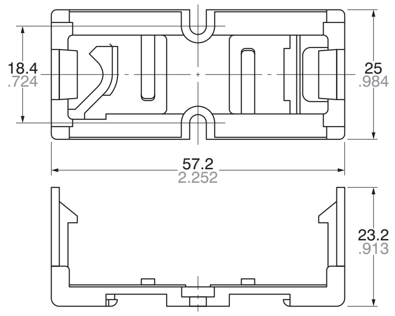
Fastening bracket mounting and removal

1. Mounting
Insert the A part of the fastening bracket into the mounting groove of the terminal block, and then fit the B part into groove, while pressing with the tip of a minus screwdriver.

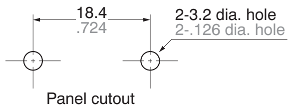
2. Removal
Slide the B part of the fastening bracket from the groove in the terminal block, while pressing with the tip of a minus screwdriver. While the bracket is in this position, keep pressing the C part of the bracket to the relay side with your finger, and lift up to the left side and remove from the groove, as in the diagram at right.



DIMENSIONS (Unit: mm inch)



Mounting hole diagram



Tolerance: ±0.1 ±.004

Part No.: SP-MA

Direct chassis mounting possible, and applicable to DIN rail.

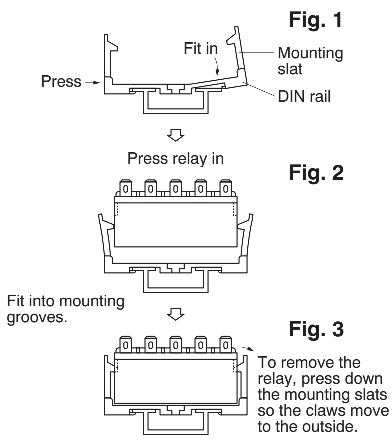
Use method

1. Both the SP relay 2 Form C and 4 Form C can be mounted to the mounting slats.
2. Use the mounting slats either by attaching them directly to the chassis, or by mounting with a DIN rail.

(A) When attaching directly to chassis
Use two M3 screws.
For the mounting pitch, refer to the specification diagram.

(B) When mounting on a DIN rail
Use a 35mm 1.378inch wide DIN rail (DIN46277).
The mounting method should be as indicated in the diagram at right.

Method for mounting on DIN rail



(1) First fit the arc shaped claw of the mounting slat into the DIN rail.
(2) Press on the side as shown in the diagram below.
(3) Fit in the claw part on the opposite side.

Precautions for use

When mounting to a DIN rail, use a commercially available fastening bracket if there is a need to stop sliding of the mounting slat in the rail direction.

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IC DRIVABLE PC BOARD RELAY FOR INDUCTIVE LOAD SWITCHING

ST RELAYS

FEATURES

1. **Even with small form factor, sensitive enough for direct IC-driving**
   The dimensions of this high-density 4-gap balanced armature are 31 mm × 14 mm × 11 mm 1.220 inch × .551 inch × .433 inch. Despite this small size, high sensitivity is achieved by a mechanism that incorporates high-efficiency polarized magnetic circuits along with our exclusive spring alignment method. With an minimum operating power of about 150 mW, nominal operating power of 240 mW, this relay can be directly driven by transistor or chip controllers.
2. **High switching capability**
   Strong against lamp inductive loads, maximum switching capacity has reached 3,040 VA (8A 380V AC).
3. **High breakdown voltage – Optimal for control in 250 V power circuits**
   High breakdown voltage has been achieved. Between contacts and coil of 3,750 Vrms; Surge breakdown voltage between coil and contact of 6,000 V, and between open contacts of 1,200 Vrms mean that these relays are suitable even for 250 V power circuit control.
4. **Improved stability**
   Conforms to all types of safety standards.
   Insulating distance of more than 3 mm secured. Complies with Japan Electrical Appliance and Material Safety Law requirements for operating 200 V power supply circuits, and conforms with UL, CSA and VDE standards.
5. **Latching types available**
   In addition to single side stable types, convenient 2 coil latching types with memory functions are also available. Moreover, we offer 2 Form A specifications which, with double pole switching for applications such as 250 V power circuit switching, can enable safer designs.
6. **Automatic cleaning possible**
   The sealed design means that these relays can undergo immersion in automatic washing systems and are suitable for automatic soldering. Even in difficult environments, the contacts remain reliable.
7. **Easy to design PC board patterns**
   Features 4/10 dual-in-line terminals. Because the lead spacing has a pitch greater than 7.54 mm .297 inch, designers can make easy adjustments with the width of the land size. This, along with the large insulation distance, simplifies the drawing of PC board patterns.
8. **To improve soldering efficiency, preapplication of solder to the terminals is recommended.**

About Cd-free contacts
We have introduced Cadmium free type products to reduce Environmental Hazardous Substances.
(The suffix “F” should be added to the part number)
Please replace parts containing Cadmium with Cadmium-free products and evaluate them with your actual application before use because the life of a relay depends on the contact material and load.

ORDERING INFORMATION

ST [ ] - [ ] - [ ] - F

Contact arrangement
1: 1 Form A 1 Form B
2: 2 Form A

Operating function
Nil: Single side stable
L2: 2 coil latching

Coil voltage
DC 3, 5, 6, 9, 12, 24, 48 V

Contact material
F: $AgSnO_2$ type contact

Note: UL/CSA, VDE, SEV type is standard.

TYPES

Contact arrangement	Nominal coil voltage	Single side stable	2 coil latching
		Part No.	Part No.
1 Form A 1 Form B	3V DC	ST1-DC3V-F	ST1-L2-DC3V-F
	5V DC	ST1-DC5V-F	ST1-L2-DC5V-F
	6V DC	ST1-DC6V-F	ST1-L2-DC6V-F
	9V DC	ST1-DC9V-F	ST1-L2-DC9V-F
	12V DC	ST1-DC12V-F	ST1-L2-DC12V-F
	24V DC	ST1-DC24V-F	ST1-L2-DC24V-F
	48V DC	ST1-DC48V-F	ST1-L2-DC48V-F
2 Form A	3V DC	ST2-DC3V-F	ST2-L2-DC3V-F
	5V DC	ST2-DC5V-F	ST2-L2-DC5V-F
	6V DC	ST2-DC6V-F	ST2-L2-DC6V-F
	9V DC	ST2-DC9V-F	ST2-L2-DC9V-F
	12V DC	ST2-DC12V-F	ST2-L2-DC12V-F
	24V DC	ST2-DC24V-F	ST2-L2-DC24V-F
	48V DC	ST2-DC48V-F	ST2-L2-DC48V-F

Standard packing: Tube: 50 pcs.; Case: 500 pcs.

RATING

1. Coil data

1) Single side stable

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 20°C 68°F)
3V DC	80%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	75mA	38Ω	240mW	150%V of nominal voltage
5V DC			47mA	105Ω		
6V DC			40mA	150Ω		
9V DC			25mA	360Ω		
12V DC			20mA	600Ω		
24V DC			10mA	2,400Ω		
48V DC			4.7mA	9,000Ω		

2) 2 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. allowable voltage (at 20°C 68°F)
			Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
3V DC	80%V or less of nominal voltage (Initial)	80%V or less of nominal voltage (Initial)	75mA	75mA	40Ω	40Ω	240mW	240mW	150%V of nominal voltage
5V DC			45mA	45mA	110Ω	110Ω			
6V DC			37.5mA	37.5mA	155Ω	155Ω			
9V DC			25mA	25mA	360Ω	360Ω			
12V DC			18.8mA	18.8mA	640Ω	640Ω			
24V DC			10mA	10mA	2,400Ω	2,400Ω			
48V DC			4.7mA	4.7mA	10,200Ω	10,200Ω			

2. Specifications

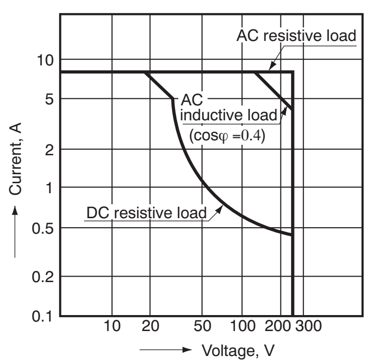
Characteristics	Item		Specifications
Contact	Arrangement		1 Form A 1 Form B, 2 Form A
	Contact material		Au-flashed $AgSnO_2$ type
	Initial contact resistance, max.		Max. 30 mΩ (By voltage drop 6 V DC 1A)
Rating	Max. switching power (resistive load)		3,040 VA, 150 W
	Max. switching voltage		380 V AC, 250 V DC
	Max. switching current		8 A
	Minimum operating power		150mW (Single side stable, 2 coil latching)
	Nominal operating power		240mW (Single side stable, 2 coil latching)
	Min. switching capacity (Reference value)*1		100 mA 5V DC
Electrical characteristics	Insulation resistance (Initial) (at 25°C, 50% relative humidity)		Min. 1,000MΩ (at 500V DC) Measurement at same location as "Initial breakdown voltage" section.
	Breakdown voltage (Initial)	Between open contacts	1,200 Vrms for 1 min. (Detection current: 10 mA)
		Between contact sets	2,000 Vrms for 1 min. (Detection current: 10 mA)
		Between contact and coil	3,750 Vrms for 1 min. (Detection current: 10 mA)
	Surge breakdown voltage (Initial)*2		6,000 V (Between contact and coil)
	Operate time [Set time] (at 20°C 68°F)		Max. 15 ms [Max. 15 ms] (Nominal voltage applied to the coil, excluding contact bounce time.)
	Release time [Reset time] (at 20°C 68°F)		Max. 10 ms [Max. 15 ms] (Nominal voltage applied to the coil, excluding contact bounce time.) (without diode)
	Temperature rise (at 60°C 140°F)		Max. 55°C (By resistive method, nominal voltage applied to the coil; contact carrying current: 8A.)
Mechanical characteristics	Shock resistance	Functional	Min. 196 m/s^2 (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)
		Destructive	Min. 980 m/s^2 (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 2 mm (Detection time: 10μs.)
		Destructive	10 to 55 Hz at double amplitude of 3 mm
Expected life	Mechanical		Min. 10^7 (at 180 cpm)
	Electrical		Min. 10^5 (8 A 250 V AC resistive) (ON : OFF = 1 s : 5 s)
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –40°C to +60°C –40°F to +140°F; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed		20 cpm*4
Unit weight			Approx. 10g .353 oz

*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2 Wave is standard shock voltage of ±1.2×50μs according to JEC-212-1981.
*3 Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

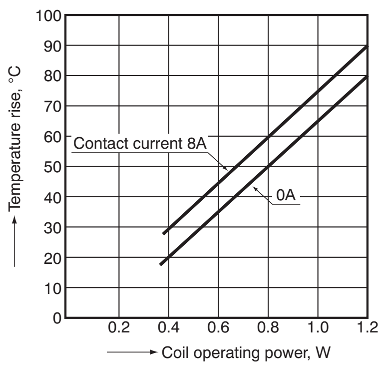
*4 The max. operating speed amounts to 30cps without load.

REFERENCE DATA

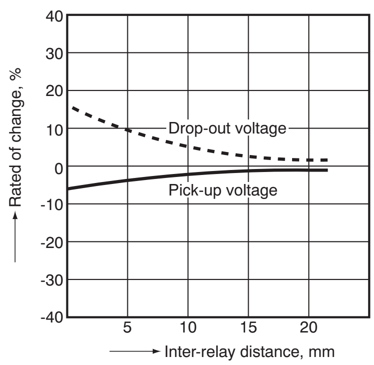
1. Max. switching power



2. Coil temperature rise



3. Influence of adjacent mounting

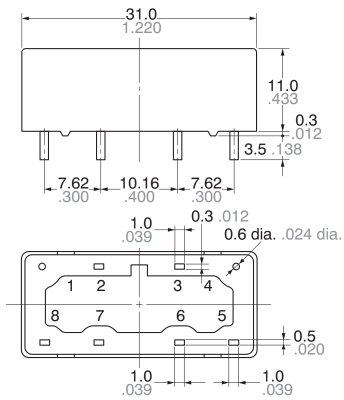


DIMENSIONS(mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

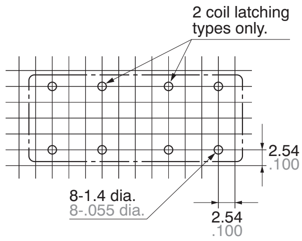
CAD Data

External dimensions



General tolerance: ±0.5 ±.020

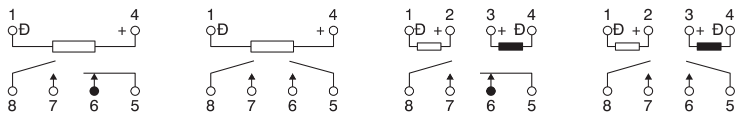
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Polarized Power

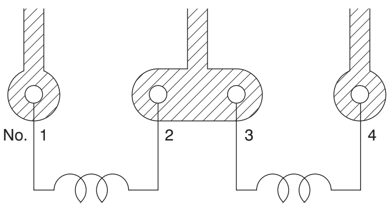
Schematic (Bottom view)



NOTES

1. PC board patterns for 2 coil latching types

When applying relays in power supply operation circuits for finished products regulated by the Electrical Appliance and Material Safety Law, use the pattern shown below.



2. Soldering should be done under the following conditions:

1)
250°C 482°F within 10s
300°C 572°F within 5s
350°C 662°F within 3s

2) For automatic cleaning, the boiling method is recommended. Avoid ultrasonic cleaning which subjects the relays to high frequency vibrations, which may cause the contacts to stick.
It is recommended that a fluorinated hydrocarbon or other alcoholic solvents be used.

3. When using, please be aware that the a contact and b contact sides of 1 Form A and 1 Form B types may go on simultaneously at operate time and release time.

For Cautions for Use, see Relay Technical Information (page 582).

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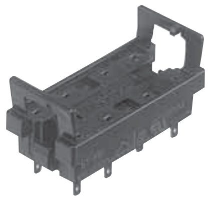
ACCESSORIES

ST RELAYS SOCKET

ST relay socket

ST-PS
PC board terminal socket



ST-SS
Solder terminal socket

FEATURES

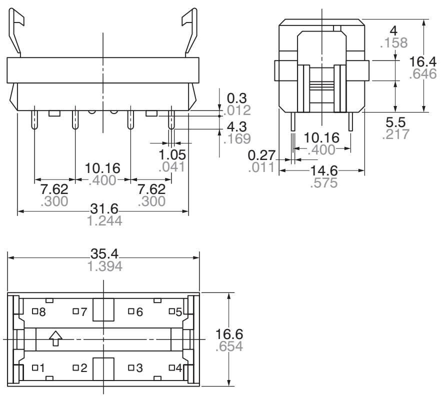
1. **Possible to fit or remove the chassis with one touch (t = 0.6 mm to 2.2 mm .024 inch to .087 inch)**
2. **Easy design of PC board pattern** (2.54 mm x 4 pitch DIL terminal array)
3. **Complies with Japan Electrical Appliance and Material Safety Law.** (UL and VDE certification)
4. **High breakdown voltage.**

SPECIFICATIONS

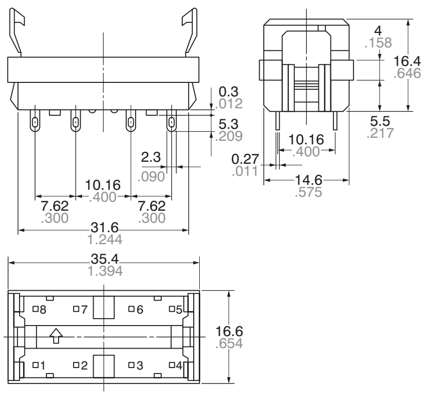
Item	Specifications
Breakdown voltage (Initial)	Between contact and coil: 4,000 Vrms for 1 min. (Detection current: 10 mA) Between contact and terminal: 2,000 Vrms for 1 min.
Insulation resistance (Initial)	Min. 1,000 MΩ between terminals (500V DC)
Heat resistance	150°C 302°F for 1 hr
Max. continuous current	10 A
Relay insertion life	15 times

DIMENSIONS (Unit: mm inch)

ST-PS



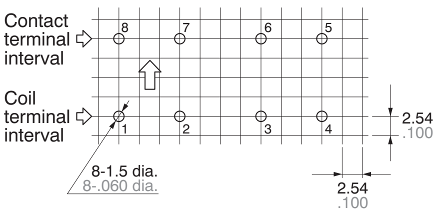
ST-SS



PRECAUTIONS FOR USE (SOCKET)

1. PC board mounting method

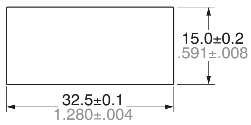
PC board pattern

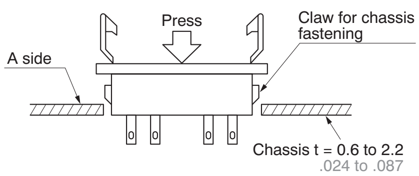


The terminal configuration is symmetrical on the left and right, so an arrow mark ⇧ is stamped on the socket to prevent mis-insertion. We recommend printing the same arrow mark ⇧ on the component mounting side (side opposite from pattern) of the PC board. In this case, the terminal configuration becomes the terminal nos. noted near the drilling holes.

2. Chassis cutout

Chassis cutting dimensions

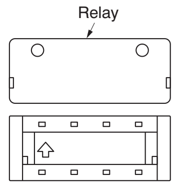




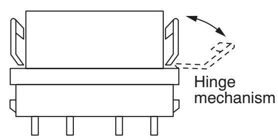
If the chassis hole is punched with a press, set so the release R on the front side (A side).
The range for chassis thickness is 0.6 to 2.2 mm .024 to .087 inch.

3. Relay mounting and removal

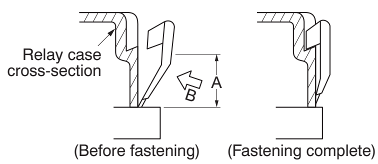
(1) Align the directions of the relay and socket.



(2) Insert the relay all the way in, so it is securely in place.



(3) Press the part indicated by A in the B direction, and fasten by placing the hook on the relay.



(4) When removing the relay, completely release the hooks on both sides and pull the relay out.

Non-Polarized Power Relays

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FROM SEQUENCE TO POWER CIRCUITS COMPATIBLE WORLDWIDE

HC RELAY PRODUCT TYPES

Standard type

Amber sealed type

Keep (Latching) relay

With diode type

FEATURES

1. Long track record means reliable quality.
2. Can provide switching across the range from low to high level power loads (100 µA to 10 A).
3. Rich lineup includes relays with LED, with diode, and high-capacity types.
4. UL, CSA approval is standard
Compliance also with Japanese Electrical Appliance and Material Control Law.

TYPICAL APPLICATIONS

Suitable for factory automation equipment and automotive devices
1. Control panels, power supply equipment, molding equipment, machine tools, welding equipment, agricultural equipment, etc.
2. Office equipment, automatic vending machines, telecommunications equipment, disaster prevention equipment, copiers, measuring devices, medical equipment, amusement devices, etc.
3. All types of household appliance

TYPES

HC Relay

Type	Contact arrangement	Contact arrangement	Plug-in terminal type		PC board terminal type		Top mounting type (TM type)	Remarks
			Without LED	With LED	Without LED	With LED		
Standard type	Single side stable	1 Form C	A	A	A	A	A	
		2 Form C	A	A	A	A	A	
		3 Form C	A	A	A	A	A	
		4 Form C	A	A	A	A	A	
	Bifurcated (Twin)	4 Form C	A	A	A	A	A	
Amber sealed type HC relay	Single side stable	1 Form C	A	A	A	A	A	
		2 Form C	A	A	A	A	A	
		4 Form C	A	A	A	A	A	
	Bifurcated (Twin)	4 Form C	A	A	A	A	A	
HC keep (latching) relay	Single side stable	2 Form C	A (With operating indication)	—	A (With operating indication)	—	—	
DC type with surge absorbing diode	Single side stable	1 Form C	A	A	—	—	—	Amber sealed type also available
		2 Form C	A	A	—	—	—	
		3 Form C	A	A	—	—	—	
		4 Form C	A	A	—	—	—	
	Bifurcated (Twin)	4 Form C	A	A	—	—	—	
AC type with surge absorbing CR circuit	Single side stable	1 Form C	A	A	—	—	—	17 mm higher than standard type
		2 Form C	A	A	—	—	—	
		3 Form C	A	A	—	—	—	
		4 Form C	A	A	—	—	—	
	Bifurcated (Twin)	4 Form C	A	A	—	—	—	

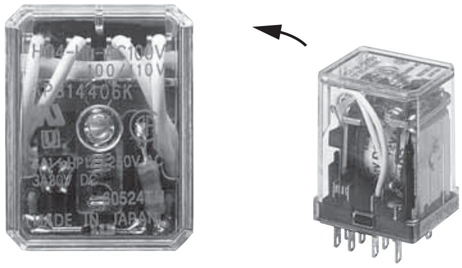
A: Available
Notes: 1. HC relays with ground terminals also available.
2. HC relays with 0.9 mm wide PC board terminals also available.

HC RELAY CONTACT ARRANGEMENT

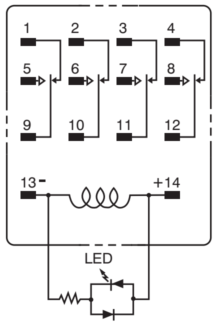
Type	Single side stable contact	4-pole bifurcated (twin) contact
Part number	HC□	HC4D
Features	Suitable for high-capacity load switching Standard type HC relays have high single-contact capacity; 1 Form C: 10 A 2 Form C and 3 Form C: 7 A 4 Form C: 5 A	Bifurcated (twin) contact ensures high contact reliability Suitable for low level loads Minimum switching capability: 100 μA 100m V DC (reference value)

LED INDICATION TYPE

Type	With LED indication type
Part number	HC□-HL
Features	LED lights up when relay is operating Inspection and detection of trouble is easy. LEDs are green for DC types and red for AC types. All types are available with LED indication.



• LED colors indicate the type of relay: red for AC type and green for DC type.



Protection diode (Bottom view)

HC RELAY SERIES PRODUCT TYPES

Type	Amber sealed type HC relay	HC keep (Latching) relay	HC relay with diode type (for DC)
Part number	HC□E	HC2K	HC□-□-□V-D
Features	Relay is completely sealed with resin. Provides high reliability in adverse surroundings. Suitable for use in dusty conditions or where organic gases are present	Magnetic latching relay Suitable for nominal operating power saving of operating circuits and for memory circuits Has operating indication (mechanical indicator).	Has built-in diode to absorb surge when the coil goes to the off state (for DC type). Suitable for protecting relay driver circuits and for noise suppression Diode characteristics: Reverse breakdown voltage 1,000 V, Forward current 1 A
Type	HC relay with CR circuit (for AC)	—	—
Part number	HC□-□-□V-R	—	—
Features	Has built-in CR circuit to absorb surge when the coil goes to the off state (for AC). Relay with CR circuit is 17 mm higher than standard type relay.	—	—

4-pole bifurcated (twin) type available
Relay with LED indication available

VDE
1c, 2c, 4c

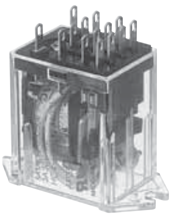
Panasonic
ideas for life

MINIATURE RELAY FOR WIDER APPLICATIONS

HC RELAYS

Plug-in type

PC board type



TM type

FEATURES

1. Long track record means reliable quality.
2. Can provide switching across the range from low to high level power loads (100 µA to 10 A).
3. Full range of types
Standard types include 1 Form C, 2 Form C, 3 Form C, 4 Form C, 4-pole bifurcated (twin), plug-in type, PC board type, and TM type.
4. HC relay with LED indication type also available
5. UL, CSA approval is standard
Compliance also with Japanese Electrical Appliance and Material Control Law.

TYPICAL APPLICATIONS

Suitable for factory automation equipment and automotive devices
1. Control panels, power supply equipment, molding equipment, machine tools, welding equipment, agricultural equipment, etc.
2. Office equipment, automatic vending machines, telecommunications equipment, disaster prevention equipment, copiers, measuring devices, medical equipment, amusement devices, etc.
3. All types of household appliance

About Cd-free contacts
We have introduced Cadmium free type products to reduce Environmental Hazardous Substances. (The suffix “F” should be added to the part number. The Suffix “F” is required only for 1 Form C, 2 Form C, 3 Form C contact type. The 4 Form C and 4 Form C bifurcated (twin) contact type is originally cadmium-free, the suffix “F” is not required.)
Please replace parts containing Cadmium with Cadmium-free products and evaluate them with your actual application before use because the life of a relay depends on the contact material and load.

ORDERING INFORMATION

HC ☐ - ☐ - ☐ - ☐

Contact arrangement
1: 1 Form C
2: 2 Form C
3: 3 Form C
4: 4 Form C
4D: Bifurcated contact (twin)

Terminal arrangement
H: Plug-in type
HL: Plug-in with LED indication
HP: PC board type
HPL: PC board with LED indication
HTM: TM type

Coil voltage
AC 6, 12, 24, 48, 100 (100/110), 120 (110/120), 200 (200/220), 240 (220/240) V
DC 6, 12, 24, 48, 100 (100/110) V

Contact material

Contact arrangement \ Contact material	Ag alloy (cadmium-free)	AgNi type
1 Form C	F	
2 Form C	F	
3 Form C	F	
4 Form C		Nil
Bifurcated contact (twin)		Nil

Notes: UL/CSA approved type is standard.
Please inquire about VDE (1 Form C, 2 Form C, and 4 Form C only) and TV-3 (1 Form C and 2 Form C only) approved products.

TYPES

1) Plug-in type

Coil voltage	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.	Part No.
6V AC	HC1-H-AC6V-F	HC2-H-AC6V-F	HC3-H-AC6V-F	HC4-H-AC6V	HC4D-H-AC6V
12V AC	HC1-H-AC12V-F	HC2-H-AC12V-F	HC3-H-AC12V-F	HC4-H-AC12V	HC4D-H-AC12V
24V AC	HC1-H-AC24V-F	HC2-H-AC24V-F	HC3-H-AC24V-F	HC4-H-AC24V	HC4D-H-AC24V
48V AC	HC1-H-AC48V-F	HC2-H-AC48V-F	HC3-H-AC48V-F	HC4-H-AC48V	HC4D-H-AC48V
100/110V AC	HC1-H-AC100V-F	HC2-H-AC100V-F	HC3-H-AC100V-F	HC4-H-AC100V	HC4D-H-AC100V
110/120V AC	HC1-H-AC120V-F	HC2-H-AC120V-F	HC3-H-AC120V-F	HC4-H-AC120V	HC4D-H-AC120V
200/220V AC	HC1-H-AC200V-F	HC2-H-AC200V-F	HC3-H-AC200V-F	HC4-H-AC200V	HC4D-H-AC200V
220/240V AC	HC1-H-AC240V-F	HC2-H-AC240V-F	HC3-H-AC240V-F	HC4-H-AC240V	HC4D-H-AC240V
6V DC	HC1-H-DC6V-F	HC2-H-DC6V-F	HC3-H-DC6V-F	HC4-H-DC6V	HC4D-H-DC6V
12V DC	HC1-H-DC12V-F	HC2-H-DC12V-F	HC3-H-DC12V-F	HC4-H-DC12V	HC4D-H-DC12V
24V DC	HC1-H-DC24V-F	HC2-H-DC24V-F	HC3-H-DC24V-F	HC4-H-DC24V	HC4D-H-DC24V
48V DC	HC1-H-DC48V-F	HC2-H-DC48V-F	HC3-H-DC48V-F	HC4-H-DC48V	HC4D-H-DC48V
100/110V DC	HC1-H-DC100V-F	HC2-H-DC100V-F	HC3-H-DC100V-F	HC4-H-DC100V	HC4D-H-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

2) Plug-in type (with LED indication)

Coil voltage	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.	Part No.
6V AC	HC1-HL-AC6V-F	HC2-HL-AC6V-F	HC3-HL-AC6V-F	HC4-HL-AC6V	HC4D-HL-AC6V
12V AC	HC1-HL-AC12V-F	HC2-HL-AC12V-F	HC3-HL-AC12V-F	HC4-HL-AC12V	HC4D-HL-AC12V
24V AC	HC1-HL-AC24V-F	HC2-HL-AC24V-F	HC3-HL-AC24V-F	HC4-HL-AC24V	HC4D-HL-AC24V
100/110V AC	HC1-HL-AC100V-F	HC2-HL-AC100V-F	HC3-HL-AC100V-F	HC4-HL-AC100V	HC4D-HL-AC100V
110/120V AC	HC1-HL-AC120V-F	HC2-HL-AC120V-F	HC3-HL-AC120V-F	HC4-HL-AC120V	HC4D-HL-AC120V
200/220V AC	HC1-HL-AC200V-F	HC2-HL-AC200V-F	HC3-HL-AC200V-F	HC4-HL-AC200V	HC4D-HL-AC200V
220/240V AC	HC1-HL-AC240V-F	HC2-HL-AC240V-F	HC3-HL-AC240V-F	HC4-HL-AC240V	HC4D-HL-AC240V
6V DC	HC1-HL-DC6V-F	HC2-HL-DC6V-F	HC3-HL-DC6V-F	HC4-HL-DC6V	HC4D-HL-DC6V
12V DC	HC1-HL-DC12V-F	HC2-HL-DC12V-F	HC3-HL-DC12V-F	HC4-HL-DC12V	HC4D-HL-DC12V
24V DC	HC1-HL-DC24V-F	HC2-HL-DC24V-F	HC3-HL-DC24V-F	HC4-HL-DC24V	HC4D-HL-DC24V
48V DC	HC1-HL-DC48V-F	HC2-HL-DC48V-F	HC3-HL-DC48V-F	HC4-HL-DC48V	HC4D-HL-DC48V
100/110V DC	HC1-HL-DC100V-F	HC2-HL-DC100V-F	HC3-HL-DC100V-F	HC4-HL-DC100V	HC4D-HL-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

3) PC board type

Coil voltage	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.	Part No.
6V AC	HC1-HP-AC6V-F	HC2-HP-AC6V-F	HC3-HP-AC6V-F	HC4-HP-AC6V	HC4D-HP-AC6V
12V AC	HC1-HP-AC12V-F	HC2-HP-AC12V-F	HC3-HP-AC12V-F	HC4-HP-AC12V	HC4D-HP-AC12V
24V AC	HC1-HP-AC24V-F	HC2-HP-AC24V-F	HC3-HP-AC24V-F	HC4-HP-AC24V	HC4D-HP-AC24V
48V AC	HC1-HP-AC48V-F	HC2-HP-AC48V-F	HC3-HP-AC48V-F	HC4-HP-AC48V	HC4D-HP-AC48V
100/110V AC	HC1-HP-AC100V-F	HC2-HP-AC100V-F	HC3-HP-AC100V-F	HC4-HP-AC100V	HC4D-HP-AC100V
110/120V AC	HC1-HP-AC120V-F	HC2-HP-AC120V-F	HC3-HP-AC120V-F	HC4-HP-AC120V	HC4D-HP-AC120V
200/220V AC	HC1-HP-AC200V-F	HC2-HP-AC200V-F	HC3-HP-AC200V-F	HC4-HP-AC200V	HC4D-HP-AC200V
220/240V AC	HC1-HP-AC240V-F	HC2-HP-AC240V-F	HC3-HP-AC240V-F	HC4-HP-AC240V	HC4D-HP-AC240V
6V DC	HC1-HP-DC6V-F	HC2-HP-DC6V-F	HC3-HP-DC6V-F	HC4-HP-DC6V	HC4D-HP-DC6V
12V DC	HC1-HP-DC12V-F	HC2-HP-DC12V-F	HC3-HP-DC12V-F	HC4-HP-DC12V	HC4D-HP-DC12V
24V DC	HC1-HP-DC24V-F	HC2-HP-DC24V-F	HC3-HP-DC24V-F	HC4-HP-DC24V	HC4D-HP-DC24V
48V DC	HC1-HP-DC48V-F	HC2-HP-DC48V-F	HC3-HP-DC48V-F	HC4-HP-DC48V	HC4D-HP-DC48V
100/110V DC	HC1-HP-DC100V-F	HC2-HP-DC100V-F	HC3-HP-DC100V-F	HC4-HP-DC100V	HC4D-HP-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.
Note: Please add “-31” before “-F” in the part number when ordering the PC board type 0.9 mm width terminal (ex) HC1-HP-AC6V-31-F.

4) PC board type (with LED indication)

Coil voltage	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.	Part No.
6V AC	HC1-HPL-AC6V-F	HC2-HPL-AC6V-F	HC3-HPL-AC6V-F	HC4-HPL-AC6V	HC4D-HPL-AC6V
12V AC	HC1-HPL-AC12V-F	HC2-HPL-AC12V-F	HC3-HPL-AC12V-F	HC4-HPL-AC12V	HC4D-HPL-AC12V
24V AC	HC1-HPL-AC24V-F	HC2-HPL-AC24V-F	HC3-HPL-AC24V-F	HC4-HPL-AC24V	HC4D-HPL-AC24V
100/110V AC	HC1-HPL-AC100V-F	HC2-HPL-AC100V-F	HC3-HPL-AC100V-F	HC4-HPL-AC100V	HC4D-HPL-AC100V
110/120V AC	HC1-HPL-AC120V-F	HC2-HPL-AC120V-F	HC3-HPL-AC120V-F	HC4-HPL-AC120V	HC4D-HPL-AC120V
200/220V AC	HC1-HPL-AC200V-F	HC2-HPL-AC200V-F	HC3-HPL-AC200V-F	HC4-HPL-AC200V	HC4D-HPL-AC200V
6V DC	HC1-HPL-DC6V-F	HC2-HPL-DC6V-F	HC3-HPL-DC6V-F	HC4-HPL-DC6V	HC4D-HPL-DC6V
12V DC	HC1-HPL-DC12V-F	HC2-HPL-DC12V-F	HC3-HPL-DC12V-F	HC4-HPL-DC12V	HC4D-HPL-DC12V
24V DC	HC1-HPL-DC24V-F	HC2-HPL-DC24V-F	HC3-HPL-DC24V-F	HC4-HPL-DC24V	HC4D-HPL-DC24V
48V DC	HC1-HPL-DC48V-F	HC2-HPL-DC48V-F	HC3-HPL-DC48V-F	HC4-HPL-DC48V	HC4D-HPL-DC48V
100/110V DC	HC1-HPL-DC100V-F	HC2-HPL-DC100V-F	HC3-HPL-DC100V-F	HC4-HPL-DC100V	HC4D-HPL-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.
Note: Please add "-31" before "-F" in the part number when ordering the PC board type 0.9 mm width terminal (ex) HC1-HPL-AC6V-31-F.

5) TM type

Coil voltage	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.	Part No.
6V AC	HC1-HTM-AC6V-F	HC2-HTM-AC6V-F	HC3-HTM-AC6V-F	HC4-HTM-AC6V	HC4D-HTM-AC6V
12V AC	HC1-HTM-AC12V-F	HC2-HTM-AC12V-F	HC3-HTM-AC12V-F	HC4-HTM-AC12V	HC4D-HTM-AC12V
24V AC	HC1-HTM-AC24V-F	HC2-HTM-AC24V-F	HC3-HTM-AC24V-F	HC4-HTM-AC24V	HC4D-HTM-AC24V
48V AC	HC1-HTM-AC48V-F	HC2-HTM-AC48V-F	HC3-HTM-AC48V-F	HC4-HTM-AC48V	HC4D-HTM-AC48V
100/110V AC	HC1-HTM-AC100V-F	HC2-HTM-AC100V-F	HC3-HTM-AC100V-F	HC4-HTM-AC100V	HC4D-HTM-AC100V
110/120V AC	HC1-HTM-AC120V-F	HC2-HTM-AC120V-F	HC3-HTM-AC120V-F	HC4-HTM-AC120V	HC4D-HTM-AC120V
200/220V AC	HC1-HTM-AC200V-F	HC2-HTM-AC200V-F	HC3-HTM-AC200V-F	HC4-HTM-AC200V	HC4D-HTM-AC200V
6V DC	HC1-HTM-DC6V-F	HC2-HTM-DC6V-F	HC3-HTM-DC6V-F	HC4-HTM-DC6V	HC4D-HTM-DC6V
12V DC	HC1-HTM-DC12V-F	HC2-HTM-DC12V-F	HC3-HTM-DC12V-F	HC4-HTM-DC12V	HC4D-HTM-DC12V
24V DC	HC1-HTM-DC24V-F	HC2-HTM-DC24V-F	HC3-HTM-DC24V-F	HC4-HTM-DC24V	HC4D-HTM-DC24V
48V DC	HC1-HTM-DC48V-F	HC2-HTM-DC48V-F	HC3-HTM-DC48V-F	HC4-HTM-DC48V	HC4D-HTM-DC48V
100/110V DC	HC1-HTM-DC100V-F	HC2-HTM-DC100V-F	HC3-HTM-DC100V-F	HC4-HTM-DC100V	HC4D-HTM-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

RATING

1. Coil data

1) AC coils (50/60Hz)

Type	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal coil current [±20%] (at 20°C 68°F)		Coil inductance		Nominal operating power		Max. allowable voltage (at 70°C 158°F)
				50Hz	60Hz	N.C. condition	N.O. condition	50Hz	60Hz	
Standard	6V AC	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	224mA	200mA	0.078H	0.074H	1.3VA	1.2VA	110%V of nominal voltage
	12V AC			111mA	100mA	0.312H	0.295H	1.3VA	1.2VA	
	24V AC			56mA	50mA	1.243H	1.181H	1.3VA	1.2VA	
	48V AC			28mA	25mA	4.974H	4.145H	1.3VA	1.2VA	
	100/110V AC			13.4/14.7mA	12/13.2mA	23.75H	20.63H	1.3VA	1.2VA	
	110/120V AC			12.2/13.5mA	10.9/11.9mA	27.19H	25.57H	1.3VA	1.2VA	
	200/220V AC			6.7/7.4mA	6/6.6mA	85.98H	81.76H	1.3VA	1.2VA	

Notes: 1. The relay operates in a range of 80% to 110% V of the voltage rating, but ideally, in consideration of temporary voltage fluctuations, it should be operated at the rated voltage. In particular, for AC operation, if the applied voltage drops to 80% V or more below the rated voltage, humming will occur and a large current will flow leading possibly to coil burnout.
2. The maximum allowable voltage is the maximum voltage fluctuation value for the coil power supply. This value is not a permissible value for continuous operation. (This value differs depending on the ambient temperature. Please contact us for details.

2) DC coils

Type	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal coil current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 70°C 158°F)
Standard	6V DC	80%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	150mA	40Ω	0.9W	110%V of nominal voltage
	12V DC			75mA	160Ω	0.9W	
	24V DC			37mA	650Ω	0.9W	
	48V DC			18.5mA	2,600Ω	0.9W	
	100/110V DC			10/11mA	10,000Ω	1.0W	

Notes: 1. The coil resistance for DC operation is the value measured when the coil temperature is 20°C 68°F. Compensate ±0.4% for every ±1°C change in temperature.
2. The relay operates in a range of 80% to 110% V of the voltage rating, but ideally, in consideration of temporary voltage fluctuations, it should be operated at the rated voltage.
3. For use with 200 V DC, connect a 10 KΩ (5W) resistor, in series, to the 100 V DC relay.
4. The maximum allowable impress voltage is the maximum voltage fluctuation value for the coil power supply. This value is not a permissible value for continuous operation. (This value differs depending on the ambient temperature. Please contact us for details.)

2. Specifications

Characteristics	Item		Specifications				
Contact	Arrangement		1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Contact pressure		Approx. 0.294N{30gf}	Approx. 0.147N{15gf}	Approx. 0.147N{15gf}	Approx. 0.098N{10gf}	Approx. 0.127N{13gf}
	Initial contact resistance, max		Max. 30 mΩ (By voltage drop 6 V DC 1A)				
	Contact material		Ag alloy (cd free) + Au flash			AgNi type + Au clad	
Rating	Nominal switching capacity (resistive load)		10A 250V AC	7A 250V AC	7A 250V AC	5A 250V AC	3A 250V AC
	Max. switching power (resistive load)		2,500VA	1,750VA	1,750VA	1,250VA	750VA
	Max. switching voltage		250VAC				
	Max. switching current		10A	7A	7A	5A	3A
	Nominal operating power		AC (50Hz): 1.3VA, AC (60Hz): 1.2VA, DC: 0.9 to 1.1W				
	Min. switching capacity (Reference value)*1		1mA 1V DC				100μA 1V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.				
	Breakdown voltage (Initial)	Between open contacts	700 Vrms for 1min. (Detection current: 10mA.)				
		Between contact sets	700 Vrms for 1min. (Detection current: 10mA.)				
		Between contact and coil	2,000 Vrms for 1min. (Detection current: 10mA.)				
	Temperature rise (at 70°C 158°F)		Max. 80°C (By resistive method, nominal voltage)				
	Operate time (at 20°C 68°F)*2		Max. 20ms (Nominal voltage applied to the coil, excluding contact bounce time.)				
	Release time (at 20°C 68°F)*2		Max. 20ms (Nominal voltage applied to the coil, excluding contact bounce time.) (without diode)				
Mechanical characteristics	Shock resistance	Functional	Min. 196 m/s^2 (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)				
		Destructive	Min. 980 m/s^2 (Half-wave pulse of sine wave: 6 ms.)				
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1 mm (Detection time: 10μs.)				
		Destructive	10 to 55 Hz at double amplitude of 2 mm				
Expected life	Mechanical		Min. 5×10^{7}: AC coil type (at 180 cpm); Min. 10^{8}: DC coil type (at 180 cpm)				
	Electrical (resistive load)		Min. 2×10^{5} (at 20 cpm)	Min. 2×10^{5} (at 20 cpm)	Min. 10^{5} (at 20 cpm)	Min. 2×10^{5} (at 20 cpm)	Min. 2×10^{5} (at 20 cpm)
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –50°C to +70°C –58°F to +158°F (without LED); –50°C to +60°C –58°F to +140°F (with LED) Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)				
	Max. Operating speed		20 cpm (at max. rating)				
Unit weight			Approx. 30g 1.06 oz				

Notes: In accordance with the Electrical Appliance and Material Safety Law, you cannot exceed a voltage of 150V AC when using the 4 Form C type. For more information, please inquire.

*1 This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.

*2 For the AC coil types, the operate/release time will differ depending on the phase.

*3The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

3. Switching capacity and expected life

1) Electrical (at 20 cpm)

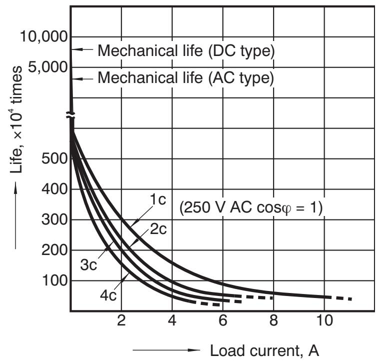
Load	AC				DC		Expected life
	Resistive (cos φ = 1)		Inductive (cos φ ≒ 0.4)		Resistive	Inductive	
Voltage	125V AC	250V AC	125V AC	250V AC	30V DC	30V DC	
1 Form C	10A	10A	5A	3A	—	—	Min. 2×10^{5}
	7A	7A	3A	2.5A	3A	1A	Min. 5×10^{5}
	5A	5A	2A	1.5A	—	—	Min. 10^{6}
2 Form C	7A	7A	3.5A	2A	—	—	Min. 2×10^{5}
	5A	5A	2.5A	1.5A	3A	0.6A	Min. 5×10^{5}
	3A	3A	1.5A	1A	—	—	Min. 10^{6}
3 Form C	7A	7A	—	—	—	—	Min. 10^{5}
	—	—	3.5A	2A	—	—	Min. 2×10^{5}
	5A	5A	—	—	3A	0.4A	Min. 5×10^{5}
4 Form C	5A	5A	2A	1A	—	—	Min. 2×10^{5}
	3A	3A	1A	0.8A	3A	0.4A	Min. 5×10^{5}
	2A	2A	0.5A	0.4A	—	—	Min. 10^{6}
4 Form C (twin)	3A	3A	1A	0.8A	3A	—	Min. 2×10^{5}

2) Mechanical (at 180 cpm)

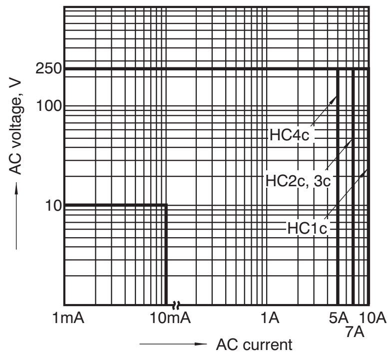
Min. 5×10^{7} (AC coil type); Min. 10^{8} (DC coil type)

REFERENCE DATA

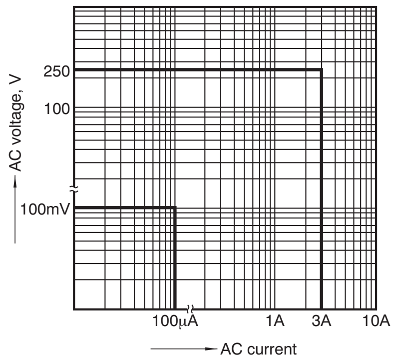
1. Life curve
Load: 250 V AC resistive load



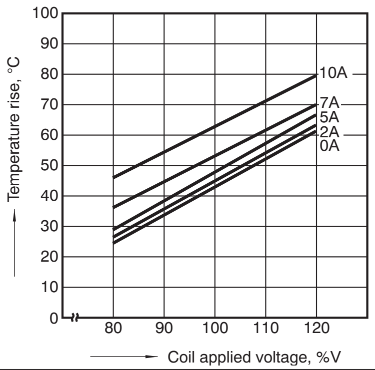
2.-(1) Switching capacity range
(single contact type)



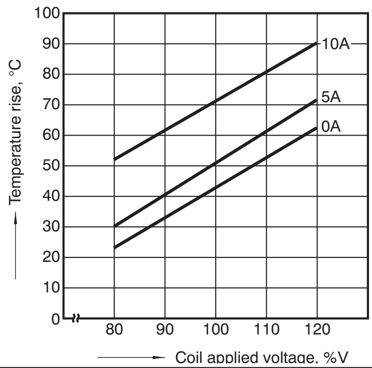
2.-(2) Switching capacity range
(4-pole bifurcated (twin))



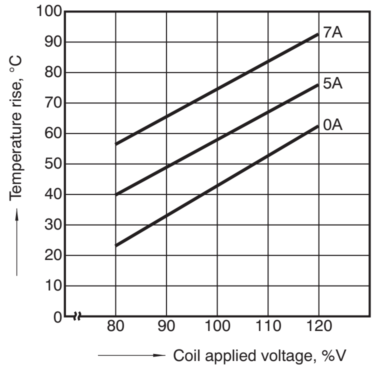
3.-(1) Coil temperature rise
(1 Form C, AC type)
Measured portion: Inside the coil
Ambient temperature: 25°C 77°F (See note.)



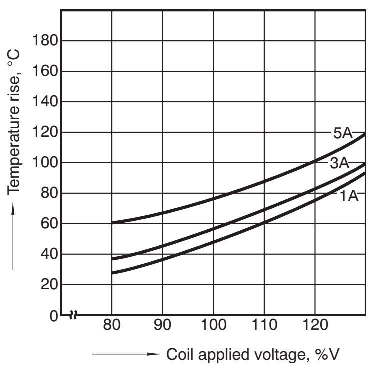
3.-(2) Coil temperature rise
(2 Form C, AC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F (See note.)



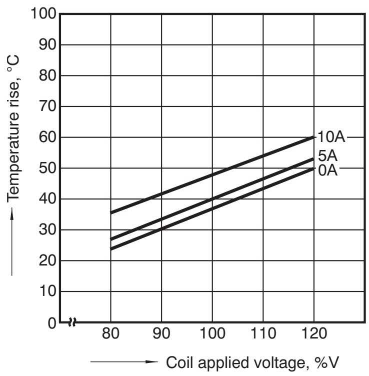
3.-(3) Coil temperature rise
(3 Form C, AC type)
Measured portion: Inside the coil
Ambient temperature: 18°C 64°F (See note.)



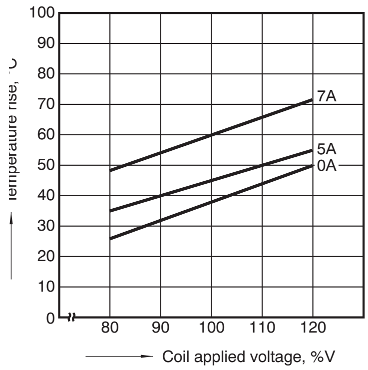
3.-(4) Coil temperature rise
(4 Form C, AC type)
Measured portion: Inside the coil
Ambient temperature: 15 to 21°C 59 to 70°F
(See note.)



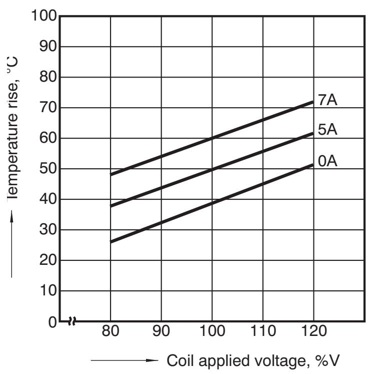
3.-(5) Coil temperature rise
(1 Form C, DC type)
Measured portion: Inside the coil
Ambient temperature: 29°C 84°F



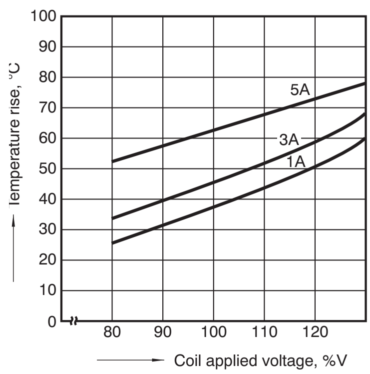
3.-(6) Coil temperature rise
(2 Form C, DC type)
Measured portion: Inside the coil
Ambient temperature: 29°C 84°F



3.-(7) Coil temperature rise
(3 Form C, DC type)
Measured portion: Inside the coil
Ambient temperature: 29°C 84°F



3.-(8) Coil temperature rise
(4 Form C, DC type)
Measured portion: Inside the coil
Ambient temperature: 17 to 18°C 62 to 64°F



When the nominal voltage is applied to AC 120 or 240 V coil types respectively, the figures of coil temperature rise increase by approx. 10 degrees to the ones shown on each graph.

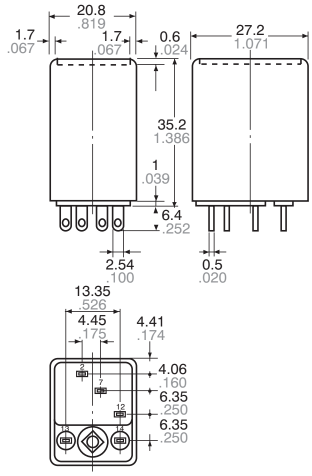
DIMENSIONS(mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. Plug-in type

CAD Data

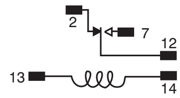
1 Form C type External dimensions



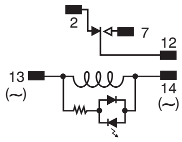
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

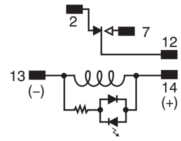
Standard type



LED AC type

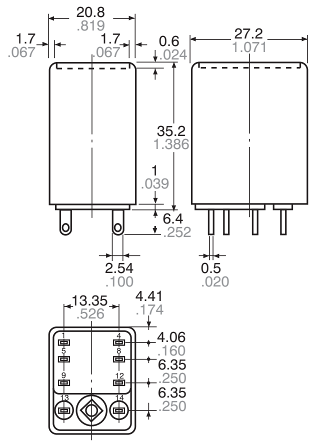


LED DC type



CAD Data

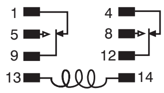
2 Form C type External dimensions



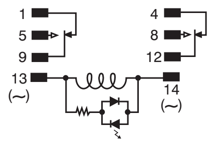
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

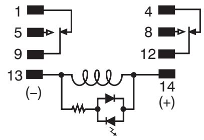
Standard type



LED AC type

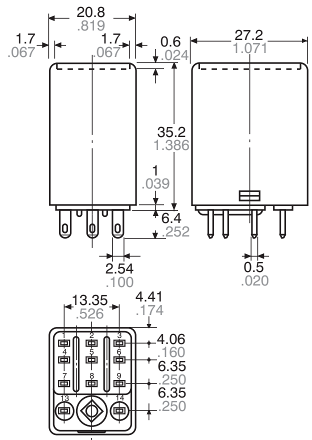


LED DC type



CAD Data

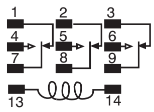
3 Form C type External dimensions



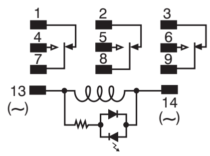
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

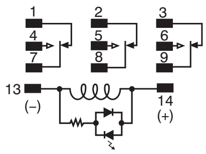
Standard type



LED AC type

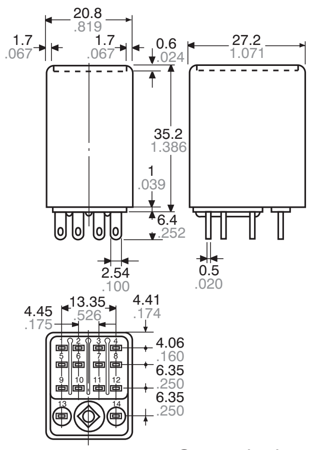


LED DC type



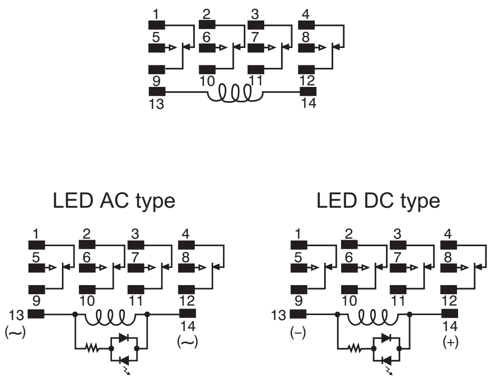
CAD Data

4 Form C and 4-pole bifurcated (twin) types
External dimensions



General tolerance: ±0.3 ±.012

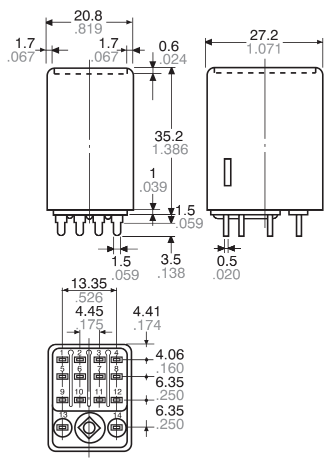
Schematic (Bottom view)



2. PC board type

CAD Data

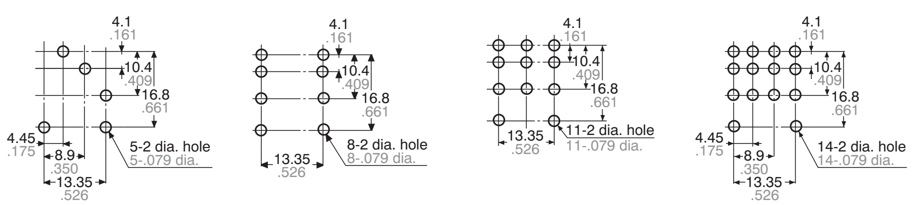
4 Form C type External dimensions



General tolerance: ±0.3 ±.012

The diagrams show the external dimensions of the 4 Form C and 4-pole bifurcated (twin) types. For 1 Form C, 2 Form C, and 3 Form C, see diagrams at plug-in types (only the terminals are different).
Types with 0.9 mm terminal width are also available.

PC board pattern



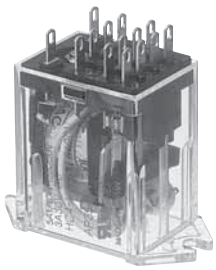
Tolerance: ±0.1 ±.004

Schematic

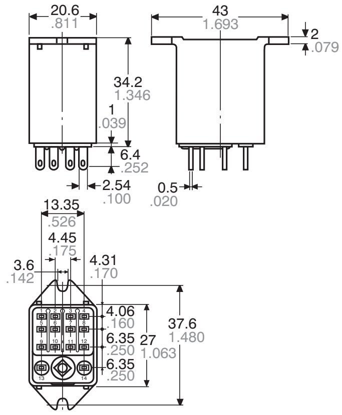
Same schematic as plug-in type HC relay

3. TM type

CAD Data



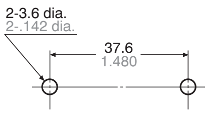
4 Form C type External dimensions



General tolerance: ±0.3 ±.012

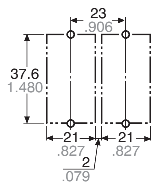
The diagrams show the external dimensions of the 4 Form C and 4-pole bifurcated (twin) types. For 1 Form C, 2 Form C, and 3 Form C, see diagrams at plug-in types (only the terminals are different).

Chassis (Panel) cutout



Tolerance: ±0.1 ±.004

Chassis (Panel) cutout in tandem mounting



Schematic

Same schematic as plug-in type HC relay
Be aware that there is no LED indicator with CR circuit and built-in diode types.

Notes: 1. In mounting, use M3 screws and M3 washers.
2. When mounting TM types, use washers to prevent damage or distortion to the polycarbonate cover.
3. When tightening fixing screws, the optimum torque range should be 0.294 to 0.49 N·m, (3 to 5 kgf·cm). Moreover, use washers to prevent loosening.

For Cautions for Use, see Relay Technical Information (page 584).

Power

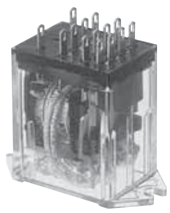
Panasonic
ideas for life

SEALED CONSTRUCTION
High reliability ensured in challenging environments.

HC RELAYS
AMBER SEALED TYPE


Plug-in type


PC board type


TM type

FEATURES

1. Even when left for long periods in challenging environments, resistance values for the contacts remain stable.
2. Compact yet compatible all over the world.
3. Can be used in a wide variety of applications.
4. With LED indication type also available
5. External dimensions and mounting dimensions same as for HC relays
Connection accessories (terminal sockets and sockets) also shared.
6. UL, CSA approval is standard
Compliance also with Japanese Electrical Appliance and Material Control Law.

TYPICAL APPLICATIONS

1. Where surrounding atmosphere is bad
Cotton mills, flour mills, chemical works, traffic signals, etc.
2. In situations where high reliability is required
Safety equipment, alarms, copiers, telecommunications devices, computers, etc.

About Cd-free contacts
We have introduced Cadmium free type products to reduce Environmental Hazardous Substances. (The suffix “F” should be added to the part number. The Suffix “F” is required only for 1 Form C, 2 Form C contact type. The 4 Form C and 4 Form C bifurcated (twin) contact type is originally cadmium-free, the suffix “F” is not required.)
Please replace parts containing Cadmium with Cadmium-free products and evaluate them with your actual application before use because the life of a relay depends on the contact material and load.

ORDERING INFORMATION

HC □ - □ - □ - □ - □

Contact arrangement
1: 1 Form C
2: 2 Form C
4: 4 Form C

E: Amber sealed type
ED: Amber sealed type bifurcated contact (twin) (Only 4 Form C)

Terminal arrangement
H: Plug-in type
L: Plug-in with LED indication
HP: PC board type
PL: PC board with LED indication
HTM: TM type

Coil voltage
AC 6, 12, 24, 48, 100 (100/110), 120 (110/120), 200 (200/220), 240 (220/240) V
DC 6, 12, 24, 48, 100 (100/110) V

Contact material

Contact arrangement \ Contact material	$AgSnO_2$ type	AgNi type
1 Form C	F	
2 Form C	F	
4 Form C		Nil
4-pole bifurcated (twin)		Nil

Note: UL/CSA approved type is standard.

TYPES

1) Plug-in type

Coil voltage	1 Form C	2 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.
6V AC	HC1E-H-AC6V-F	HC2E-H-AC6V-F	HC4E-H-AC6V	HC4ED-H-AC6V
12V AC	HC1E-H-AC12V-F	HC2E-H-AC12V-F	HC4E-H-AC12V	HC4ED-H-AC12V
24V AC	HC1E-H-AC24V-F	HC2E-H-AC24V-F	HC4E-H-AC24V	HC4ED-H-AC24V
48V AC	HC1E-H-AC48V-F	HC2E-H-AC48V-F	HC4E-H-AC48V	HC4ED-H-AC48V
100/110V AC	HC1E-H-AC100V-F	HC2E-H-AC100V-F	HC4E-H-AC100V	HC4ED-H-AC100V
110/120V AC	HC1E-H-AC120V-F	HC2E-H-AC120V-F	HC4E-H-AC120V	HC4ED-H-AC120V
200/220V AC	HC1E-H-AC200V-F	HC2E-H-AC200V-F	HC4E-H-AC200V	HC4ED-H-AC200V
220/240V AC	HC1E-H-AC240V-F	HC2E-H-AC240V-F	HC4E-H-AC240V	HC4ED-H-AC240V
6V DC	HC1E-H-DC6V-F	HC2E-H-DC6V-F	HC4E-H-DC6V	HC4ED-H-DC6V
12V DC	HC1E-H-DC12V-F	HC2E-H-DC12V-F	HC4E-H-DC12V	HC4ED-H-DC12V
24V DC	HC1E-H-DC24V-F	HC2E-H-DC24V-F	HC4E-H-DC24V	HC4ED-H-DC24V
48V DC	HC1E-H-DC48V-F	HC2E-H-DC48V-F	HC4E-H-DC48V	HC4ED-H-DC48V
100/110V DC	HC1E-H-DC100V-F	HC2E-H-DC100V-F	HC4E-H-DC100V	HC4ED-H-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

2) Plug-in type (With LED indication)

Coil voltage	1 Form C	2 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.
6V AC	HC1E-L-AC6V-F	HC2E-L-AC6V-F	HC4E-L-AC6V	HC4ED-L-AC6V
12V AC	HC1E-L-AC12V-F	HC2E-L-AC12V-F	HC4E-L-AC12V	HC4ED-L-AC12V
24V AC	HC1E-L-AC24V-F	HC2E-L-AC24V-F	HC4E-L-AC24V	HC4ED-L-AC24V
48V AC	HC1E-L-AC48V-F	HC2E-L-AC48V-F	HC4E-L-AC48V	HC4ED-L-AC48V
100/110V AC	HC1E-L-AC100V-F	HC2E-L-AC100V-F	HC4E-L-AC100V	HC4ED-L-AC100V
110/120V AC	HC1E-L-AC120V-F	HC2E-L-AC120V-F	HC4E-L-AC120V	HC4ED-L-AC120V
200/220V AC	HC1E-L-AC200V-F	HC2E-L-AC200V-F	HC4E-L-AC200V	HC4ED-L-AC200V
220/240V AC	HC1E-L-AC240V-F	HC2E-L-AC240V-F	HC4E-L-AC240V	HC4ED-L-AC240V
6V DC	HC1E-L-DC6V-F	HC2E-L-DC6V-F	HC4E-L-DC6V	HC4ED-L-DC6V
12V DC	HC1E-L-DC12V-F	HC2E-L-DC12V-F	HC4E-L-DC12V	HC4ED-L-DC12V
24V DC	HC1E-L-DC24V-F	HC2E-L-DC24V-F	HC4E-L-DC24V	HC4ED-L-DC24V
48V DC	HC1E-L-DC48V-F	HC2E-L-DC48V-F	HC4E-L-DC48V	HC4ED-L-DC48V
100/110V DC	HC1E-L-DC100V-F	HC2E-L-DC100V-F	HC4E-L-DC100V	HC4ED-L-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

3) PC board type

Coil voltage	1 Form C	2 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.
6V AC	HC1E-HP-AC6V-F	HC2E-HP-AC6V-F	HC4E-HP-AC6V	HC4ED-HP-AC6V
12V AC	HC1E-HP-AC12V-F	HC2E-HP-AC12V-F	HC4E-HP-AC12V	HC4ED-HP-AC12V
24V AC	HC1E-HP-AC24V-F	HC2E-HP-AC24V-F	HC4E-HP-AC24V	HC4ED-HP-AC24V
48V AC	HC1E-HP-AC48V-F	HC2E-HP-AC48V-F	HC4E-HP-AC48V	HC4ED-HP-AC48V
100/110V AC	HC1E-HP-AC100V-F	HC2E-HP-AC100V-F	HC4E-HP-AC100V	HC4ED-HP-AC100V
110/120V AC	HC1E-HP-AC120V-F	HC2E-HP-AC120V-F	HC4E-HP-AC120V	HC4ED-HP-AC120V
200/220V AC	HC1E-HP-AC200V-F	HC2E-HP-AC200V-F	HC4E-HP-AC200V	HC4ED-HP-AC200V
220/240V AC	HC1E-HP-AC240V-F	HC2E-HP-AC240V-F	HC4E-HP-AC240V	HC4ED-HP-AC240V
6V DC	HC1E-HP-DC6V-F	HC2E-HP-DC6V-F	HC4E-HP-DC6V	HC4ED-HP-DC6V
12V DC	HC1E-HP-DC12V-F	HC2E-HP-DC12V-F	HC4E-HP-DC12V	HC4ED-HP-DC12V
24V DC	HC1E-HP-DC24V-F	HC2E-HP-DC24V-F	HC4E-HP-DC24V	HC4ED-HP-DC24V
48V DC	HC1E-HP-DC48V-F	HC2E-HP-DC48V-F	HC4E-HP-DC48V	HC4ED-HP-DC48V
100/110V DC	HC1E-HP-DC100V-F	HC2E-HP-DC100V-F	HC4E-HP-DC100V	HC4ED-HP-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.
Note: The PC board 0.9 mm width terminal type is also available, please part number. suffix “31” is needed when ordering (4 Form C, 4 Form C (twin) only)

4) PC board type (With LED indication)

Coil voltage	1 Form C	2 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.
6V AC	HC1E-PL-AC6V-F	HC2E-PL-AC6V-F	HC4E-PL-AC6V	HC4ED-PL-AC6V
12V AC	HC1E-PL-AC12V-F	HC2E-PL-AC12V-F	HC4E-PL-AC12V	HC4ED-PL-AC12V
24V AC	HC1E-PL-AC24V-F	HC2E-PL-AC24V-F	HC4E-PL-AC24V	HC4ED-PL-AC24V
48V AC	HC1E-PL-AC48V-F	HC2E-PL-AC48V-F	HC4E-PL-AC48V	HC4ED-PL-AC48V
100/110V AC	HC1E-PL-AC100V-F	HC2E-PL-AC100V-F	HC4E-PL-AC100V	HC4ED-PL-AC100V
110/120V AC	HC1E-PL-AC120V-F	HC2E-PL-AC120V-F	HC4E-PL-AC120V	HC4ED-PL-AC120V
200/220V AC	HC1E-PL-AC200V-F	HC2E-PL-AC200V-F	HC4E-PL-AC200V	HC4ED-PL-AC200V
220/240V AC	HC1E-PL-AC240V-F	HC2E-PL-AC240V-F	HC4E-PL-AC240V	HC4ED-PL-AC240V
6V DC	HC1E-PL-DC6V-F	HC2E-PL-DC6V-F	HC4E-PL-DC6V	HC4ED-PL-DC6V
12V DC	HC1E-PL-DC12V-F	HC2E-PL-DC12V-F	HC4E-PL-DC12V	HC4ED-PL-DC12V
24V DC	HC1E-PL-DC24V-F	HC2E-PL-DC24V-F	HC4E-PL-DC24V	HC4ED-PL-DC24V
48V DC	HC1E-PL-DC48V-F	HC2E-PL-DC48V-F	HC4E-PL-DC48V	HC4ED-PL-DC48V
100/110V DC	HC1E-PL-DC100V-F	HC2E-PL-DC100V-F	HC4E-PL-DC100V	HC4ED-PL-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.
Note: The PC board 0.9 mm width terminal type is also available, please part number. suffix “31” is needed when ordering (4 Form C, 4 Form C (twin) only)

5) TM type

Coil voltage	1 Form C	2 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.
6V AC	HC1E-HTM-AC6V-F	HC2E-HTM-AC6V-F	HC4E-HTM-AC6V	HC4ED-HTM-AC6V
12V AC	HC1E-HTM-AC12V-F	HC2E-HTM-AC12V-F	HC4E-HTM-AC12V	HC4ED-HTM-AC12V
24V AC	HC1E-HTM-AC24V-F	HC2E-HTM-AC24V-F	HC4E-HTM-AC24V	HC4ED-HTM-AC24V
48V AC	HC1E-HTM-AC48V-F	HC2E-HTM-AC48V-F	HC4E-HTM-AC48V	HC4ED-HTM-AC48V
100/110V AC	HC1E-HTM-AC100V-F	HC2E-HTM-AC100V-F	HC4E-HTM-AC100V	HC4ED-HTM-AC100V
110/120V AC	HC1E-HTM-AC120V-F	HC2E-HTM-AC120V-F	HC4E-HTM-AC120V	HC4ED-HTM-AC120V
200/220V AC	HC1E-HTM-AC200V-F	HC2E-HTM-AC200V-F	HC4E-HTM-AC200V	HC4ED-HTM-AC200V
220/240V AC	HC1E-HTM-AC240V-F	HC2E-HTM-AC240V-F	HC4E-HTM-AC240V	HC4ED-HTM-AC240V
6V DC	HC1E-HTM-DC6V-F	HC2E-HTM-DC6V-F	HC4E-HTM-DC6V	HC4ED-HTM-DC6V
12V DC	HC1E-HTM-DC12V-F	HC2E-HTM-DC12V-F	HC4E-HTM-DC12V	HC4ED-HTM-DC12V
24V DC	HC1E-HTM-DC24V-F	HC2E-HTM-DC24V-F	HC4E-HTM-DC24V	HC4ED-HTM-DC24V
48V DC	HC1E-HTM-DC48V-F	HC2E-HTM-DC48V-F	HC4E-HTM-DC48V	HC4ED-HTM-DC48V
100/110V DC	HC1E-HTM-DC100V-F	HC2E-HTM-DC100V-F	HC4E-HTM-DC100V	HC4ED-HTM-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

RATING

1. Coil data (Common for standard types)

2. Specifications

Characteristics	Item	Specifications			
		1 Form C	2 Form C	4 Form C	4 Form C (twin)
Contact	Arrangement	1 Form C	2 Form C	4 Form C	4 Form C
Rating	Nominal switching capacity (resistive load)	5A 250V AC	3A 250V AC	2A 250V AC	1A 250V AC
	Max. switching power (resistive load)	1,250VA	700VA	500VA	250VA
	Max. switching voltage	250VAC	250VAC	250VAC	250VAC
	Max. switching current	5A	3A	2A	1A
	Min. switching capacity (Reference value)*1	1mA 100mV DC			100μA 100mV DC
Electrical characteristics	Temperature rise (at 60°C 140°F)	Max. 90°C (By resistive method, nominal voltage)			
Expected life	Electrical	Min. 2×10^5 resistive load (at 20 cpm)			
Conditions	Conditions for operation, transport and storage*2	Ambient temperature: –40°C to +60°C –40°F to +140°F; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)			
	Ambient air pressure	760mmHg±20% (1,013mb±20%)			

Notes:Other specifications are same as standard types.
*1This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.
*2The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value.Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).
.

3. Switching capacity and expected life

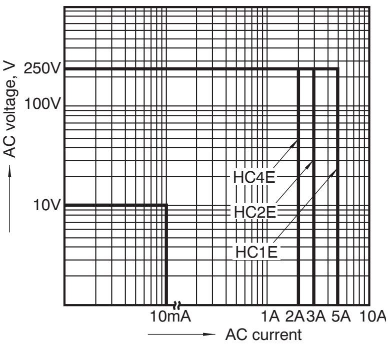
1) Electrical (at 20 cpm)

Load	AC				DC		Expected life
	Resistive (cos φ = 1)		Inductive (cos φ ≒ 0.4)		Resistive	Inductive	
Voltage	125V AC	250V AC	125V AC	250V AC	30V DC	30V DC	
HC1E	5A	5A	—	—	3A	1A	Min. 2×10^5
HC2E	3A	3A	—	—	2A	1.7A	Min. 2×10^5
HC4E	2A	2A	—	—	2A	0.6A	Min. 2×10^5
HC4ED (4 Form C twin)	1A	1A	—	—	—	—	Min. 2×10^5

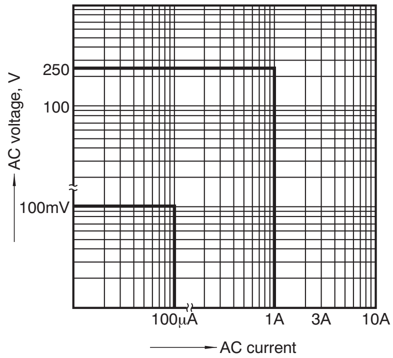
2) Mechanical (at 180 cpm)
Min. 5×10^7 (AC coil type); Min. 10^8 (DC coil type)

REFERENCE DATA

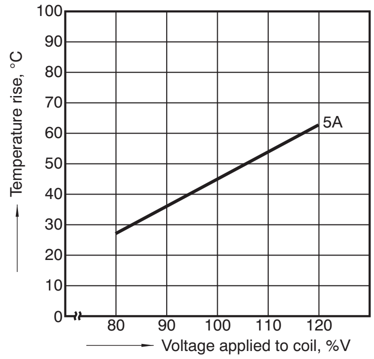
1.-(1) Switching capacity range
(single contact type)



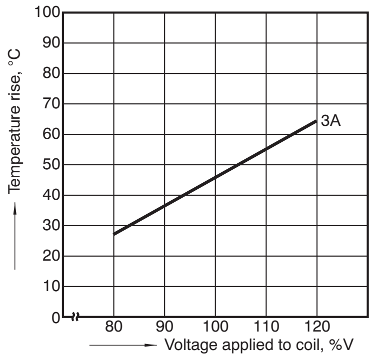
1.-(2) Switching capacity range
(4-pole bifurcated (twin))



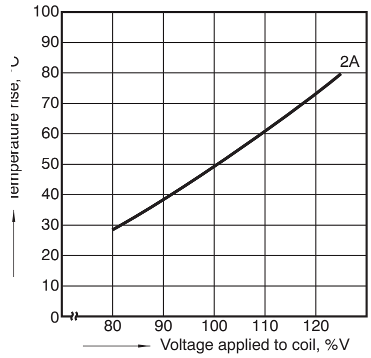
2.-(1) Coil temperature rise (1 Form C AC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



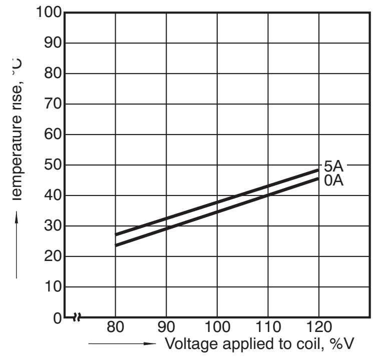
2.-(2) Coil temperature rise (2 Form C AC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



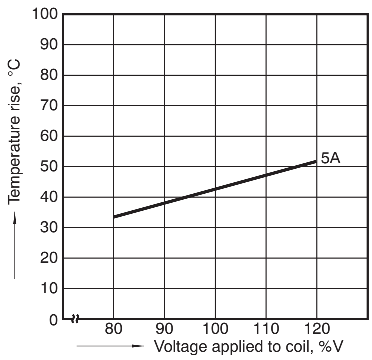
2.-(3) Coil temperature rise (4 Form C AC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



2.-(4) Coil temperature rise (1 Form C DC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



2.-(5) Coil temperature rise (2 Form C DC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



Note: Coil temperature rise

When the nominal voltage is applied to AC 120 or 240 V coil types respectively, the figures of coil temperature rise increase by approx. 10 degrees to the ones shown on each graph.

DIMENSIONS

HC relays are unified to standard sizes. Please refer to standard type information.

NOTES

When mounting TM types, use washers to prevent damage or distortion to the polycarbonate cover. When tightening fixing screws, the optimum torque range should be 0.294 to 0.49 N·m, (3 to 5 kgf·cm). If screws are over tightened, the cover may distort, resulting in poor sealing. Moreover, to prevent loosening, use washers.

For Cautions for Use, see Relay Technical Information (page 584).

Panasonic
ideas for life

MAGNETIC MEMORY TYPE
HC RELAY

HC LATCHING (KEEP) RELAYS

FEATURES

1. Energy-saving type
2. Wide range of applications in control circuits for industrial equipment and consumer devices.
3. Form factors same as for HC relays
4. With operation indicator
5. Can be used in a wide variety of applications.

About Cd-free contacts
We have introduced Cadmium free type products to reduce Environmental Hazardous Substances. (The suffix “F” should be added to the part number.) Please replace parts containing Cadmium with Cadmium-free products and evaluate them with your actual application before use because the life of a relay depends on the contact material and load.

TYPES

Plug-in type	PC board type
Part No.	Part No.
HC2K-AC6V-F	HC2K-P-AC6V-F
HC2K-AC12V-F	HC2K-P-AC12V-F
HC2K-AC24V-F	HC2K-P-AC24V-F
HC2K-AC48V-F	HC2K-P-AC48V-F
HC2K-AC100V-F	HC2K-P-AC100V-F
HC2K-DC6V-F	HC2K-P-DC6V-F
HC2K-DC12V-F	HC2K-P-DC12V-F
HC2K-DC24V-F	HC2K-P-DC24V-F
HC2K-DC48V-F	HC2K-P-DC48V-F
HC2K-DC100V-F	HC2K-P-DC100V-F

Standard packing: Carton: 20 pcs.; Case: 200 pcs.
Notes: 1. Some materials and price vary. Please inquire for details.
2. Please refer to the standards chart for information on compliance with international standards.

RATING

1. Coil data

1) AC coils (50/60Hz)

Contact arrangement	Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil inductance				Nominal operating power		Max. allowable voltage (at 50°C 122°F)
						Set coil		Reset coil				
				Set coil	Reset coil	N.C. codition	N.O. condition	N.C. codition	N.O. condition	Set coil	Reset coil	
2 Form C	6V AC	80%V or less of nominal voltage (Initial)	80%V or less of nominal voltage (Initial)	206mA	103mA	—	—	—	—	1.23VA	0.62VA	110%V of nominal voltage
	12V AC			100mA	52mA	—	—	—	—	1.20VA	0.62VA	
	24V AC			51mA	21.4mA	—	—	—	—	1.22VA	0.51VA	
	48V AC			25.2mA	18.5mA	—	—	—	—	1.20VA	0.88VA	
	100V AC			13.3mA	7.1mA	—	—	—	—	1.33VA	0.71VA	

2) DC coils

Contact arrangement	Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power		Max. allowable voltage (at 50°C 122°F)
				Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
2 Form C	6V DC	80%V or less of nominal voltage (Initial)	80%V or less of nominal voltage (Initial)	207mA	107mA	29Ω	56Ω	1.24W	0.64W	110%V of nominal voltage
	12V DC			100mA	52.2mA	120Ω	230Ω	1.20W	0.63W	
	24V DC			51.1mA	25.5mA	470Ω	941Ω	1.23W	0.61W	
	48V DC			25.3mA	13.7mA	1,897Ω	3,504Ω	1.21W	0.66W	
	100V DC			15.6mA	5.8mA	6,410Ω	17,241Ω	1.56W	0.58W	

Notes: 1. The allowable coil resistance range is ±10% when within 1,000Ω and ±15% when. 1,000Ω or higher.
2. The maximum allowable voltage is the maximum voltage fluctuation value for the coil power supply. This value is not a permissible value for continuous operation. (This value differs depending on the ambient temperature. Please contact us for details.)

2. Specifications

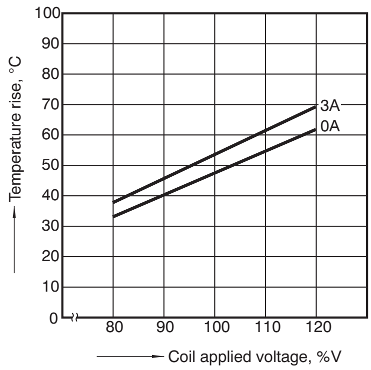
Characteristics	Item		Specifications
Contact	Contact pressure		Approx. 0.098N{10gf}
	Initial contact resistance, max		Max. 50 mΩ (By voltage drop 6 V DC 1A)
Rating	Nominal switching capacity (resistive load)		3A 250V AC
	Max. switching power (resistive load)		750VA
	Max. switching current		3A
	Nominal operating power		Set coil: 1.20VA to 1.33VA; Reset coil: 0.51VA to 0.88VA
	Min. switching capacity (Reference value)*1		100µA 100mV DC
Electrical characteristics	Breakdown voltage (Initial)	Between contact and coil	1,500 Vrms for 1min. (initial)
	Temperature rise		Set coil: Max. 80°C; Reset coil: Max. 50°C (at nominal voltage)
	Set time/Reset time (at 20°C 68°F)		Approx. 20ms/30ms (at nominal voltage)
Mechanical characteristics	Shock resistance	Functional	Min. 98m/s^2 (Half-wave pulse of sine wave: 11 ms; detection time: 10µs.)
Expected life	Mechanical		Min. 10^7 (at 180 cpm)
	Electrical		Min. 2×10^5 rated load (at 20 cpm)
Conditions	Ambient temperature		–40°C to +50°C –40°F to +122°F (Not freezing and condensing at low temperature)

Notes:*1This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.
2.Other specifications are same as standard types.

REFERENCE DATA

Coil temperature rise

Tested sample: HC2K-DC12V, 2 pcs
Measured portion: Inside the coil
Ambient temperature: 28°C 82.4°F



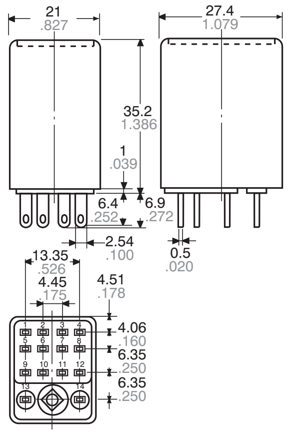
DIMENSIONS(mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

Plug-in type (2 Form C)

CAD Data

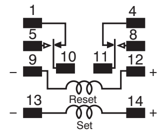
External dimensions



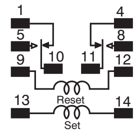
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

DC type



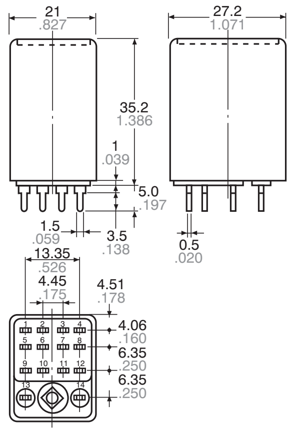
AC type



PC board type (2 Form C)

CAD Data

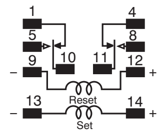
External dimensions



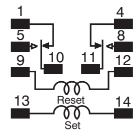
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

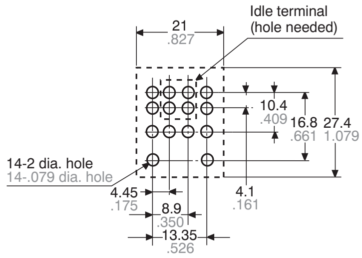
DC type



AC type



PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

MOUNTING METHOD

The mounting method and mounting holes can all be made the same as for the 4 Form C HC relay terminal socket.

NOTES

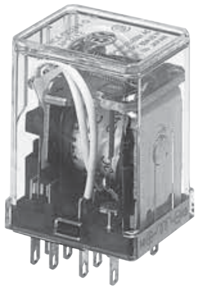
1. The schematic differs from that in the standard type 4 Form C HC relay. Follow the schematic on the cover sticker.
2. Conform with the schematic for the DC type, which has a polarized coil.
3. Because retention characteristics vary according to the waveform of the voltage applied to the coil, do your best to avoid capacitor driving.
In capacitor driving, use a capacitor of 300 μF or more.
4. Ensure that the minimum pulse width of voltage applied to coil is greater than 150 ms.

For Cautions for Use, see Relay Technical Information (page 584).

Panasonic
ideas for life

Has built-in diode to absorb surge
For use in semiconductor circuits

HC RELAY WITH DIODE



FEATURES

1. The built-in diode absorbs surge voltage arising when the coil goes to the off state (for DC type).
Diode characteristics;
Reverse breakdown voltage: 1,000V,
Forward current: 1A
2. With LED indicator type also available
3. UL, CSA approval is standard
Compliance also with Japanese Electrical Appliance and Material Control Law.

TYPICAL APPLICATIONS

Suitable for factory automation equipment and automotive devices
1. Control panels, power supply equipment, molding equipment, machine tools, welding equipment, agricultural equipment, etc.
2. Office equipment, automatic vending machines, telecommunications equipment, disaster prevention equipment, copiers, measuring devices, medical equipment, amusement devices, etc.
3. All types of household appliance
About Cd-free contacts

We have introduced Cadmium free type products to reduce Environmental Hazardous Substances. (The suffix “F” should be added to the part number. The Suffix “F” is required only for 1 Form C, 2 Form C, 3 Form C contact type. The 4 Form C and 4 Form C bifurcated (twin) contact type is originally cadmium-free, the suffix “F” is not required.)
Please replace parts containing Cadmium with Cadmium-free products and evaluate them with your actual application before use because the life of a relay depends on the contact material and load.

Power

TYPES

1) Plug-in type

Coil voltage	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.	Part No.
6V DC	HC1-DC6V-D-F	HC2-DC6V-D-F	HC3-DC6V-D-F	HC4-DC6V-D	HC4D-DC6V-D
12V DC	HC1-DC12V-D-F	HC2-DC12V-D-F	HC3-DC12V-D-F	HC4-DC12V-D	HC4D-DC12V-D
24V DC	HC1-DC24V-D-F	HC2-DC24V-D-F	HC3-DC24V-D-F	HC4-DC24V-D	HC4D-DC24V-D
48V DC	HC1-DC48V-D-F	HC2-DC48V-D-F	HC3-DC48V-D-F	HC4-DC48V-D	HC4D-DC48V-D
100/110V DC	HC1-DC100V-D-F	HC2-DC100V-D-F	HC3-DC100V-D-F	HC4-DC100V-D	HC4D-DC100V-D

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

2) Plug-in type (with LED indication)

Coil voltage	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.	Part No.
6V DC	HC1-L-DC6V-D-F	HC2-L-DC6V-D-F	HC3-L-DC6V-D-F	HC4-L-DC6V-D	HC4D-L-DC6V-D
12V DC	HC1-L-DC12V-D-F	HC2-L-DC12V-D-F	HC3-L-DC12V-D-F	HC4-L-DC12V-D	HC4D-L-DC12V-D
24V DC	HC1-L-DC24V-D-F	HC2-L-DC24V-D-F	HC3-L-DC24V-D-F	HC4-L-DC24V-D	HC4D-L-DC24V-D
48V DC	HC1-L-DC48V-D-F	HC2-L-DC48V-D-F	HC3-L-DC48V-D-F	HC4-L-DC48V-D	HC4D-L-DC48V-D
100/110V DC	HC1-L-DC100V-D-F	HC2-L-DC100V-D-F	HC3-L-DC100V-D-F	HC4-L-DC100V-D	HC4D-L-DC100V-D

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

RATING

1. Coil data (Common for standard DC coil types)

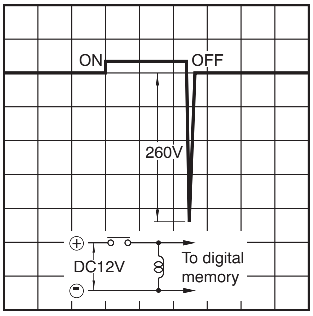
2. Specifications

Characteristics	Item	Specifications
Conditions	Conditions for operation, transport and storage*	Ambient temperature: –50°C to +60°C –58°F to +140°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)

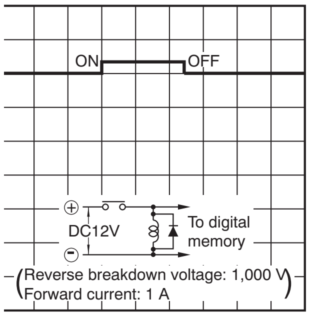
Notes: Other specifications are same as standard types.
*The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

1.-(1) DC coil surge voltage waveform (without diode)

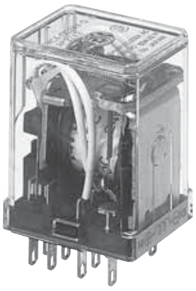


1.-(2) DC coil surge voltage waveform (with diode)
Diode characteristics;
Reverse breakdown voltage: 1,000V,
Forward current: 1A



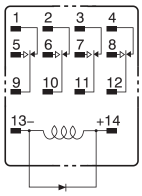
DIMENSIONS

Same dimensions as HC relay standard/ plug-in type



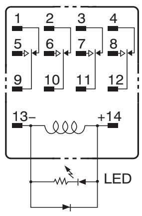
Schematic

Without LED indicator



Protection (surge-absorbing) diode

With LED indicator



Protection (surge-absorbing) diode

NOTES

1. Pay attention to the polarity.
2. Diode characteristics
Reverse breakdown voltage: 1,000V
Forward current: 1A

For Cautions for Use, see Relay Technical Information (page 584).

Panasonic
ideas for life

Able to absorb surge voltage in AC specification CR circuit is built-in

HC RELAYS WITH CR

FEATURES

1. With CR circuits built in, surge voltage arising in the AC type when the coil goes to the off state is absorbed.
2. HC relay with LED indication type also available
3. UL, CSA approval is standard
Compliance also with Japanese Electrical Appliance and Material Control Law.

TYPICAL APPLICATIONS

Suitable for factory automation equipment and automotive devices
1. Control panels, power supply equipment, molding equipment, machine tools, welding equipment, agricultural equipment, etc.
2. Office equipment, automatic vending machines, telecommunications equipment, disaster prevention equipment, copiers, measuring devices, medical equipment, amusement devices, etc.

About Cd-free contacts
We have introduced Cadmium free type products to reduce Environmental Hazardous Substances. (The suffix "F" should be added to the part number. The Suffix "F" is required only for 1 Form C, 2 Form C, 3 Form C contact type. The 4 Form C and 4 Form C bifurcated (twin) contact type is originally cadmium-free, the suffix "F" is not required.)
Please replace parts containing Cadmium with Cadmium-free products and evaluate them with your actual application before use because the life of a relay depends on the contact material and load.

Power

TYPES

1) Plug-in type

Coil voltage	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.	Part No.
100/110V AC	HC1-AC100V-R-F	HC2-AC100V-R-F	HC3-AC100V-R-F	HC4-AC100V-R	HC4D-AC100V-R
110/120V AC	HC1-AC120V-R-F	HC2-AC120V-R-F	HC3-AC120V-R-F	HC4-AC120V-R	HC4D-AC120V-R
200/220V AC	HC1-AC200V-R-F	HC2-AC200V-R-F	HC3-AC200V-R-F	HC4-AC200V-R	HC4D-AC200V-R
220/240V AC	HC1-AC240V-R-F	HC2-AC240V-R-F	HC3-AC240V-R-F	HC4-AC240V-R	HC4D-AC240V-R

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

2) Plug-in type (with LED indication)

Coil voltage	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.	Part No.
100/110V AC	HC1-L-AC100V-R-F	HC2-L-AC100V-R-F	HC3-L-AC100V-R-F	HC4-L-AC100V-R	HC4D-L-AC100V-R
110/120V AC	HC1-L-AC120V-R-F	HC2-L-AC120V-R-F	HC3-L-AC120V-R-F	HC4-L-AC120V-R	HC4D-L-AC120V-R
200/220V AC	HC1-L-AC200V-R-F	HC2-L-AC200V-R-F	HC3-L-AC200V-R-F	HC4-L-AC200V-R	HC4D-L-AC200V-R
220/240V AC	HC1-L-AC240V-R-F	HC2-L-AC240V-R-F	HC3-L-AC240V-R-F	HC4-L-AC240V-R	HC4D-L-AC240V-R

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

RATING

1. Coil data (Common for standard AC coil types)

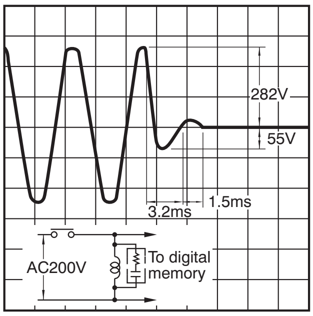
2. Specifications

Characteristics	Item	Specifications
Electrical characteristics	Temperature rise	Max. 90°C (By resistive method, nominal voltage, rated current at 60°C)
Conditions	Conditions for operation, transport and storage*	Ambient temperature: –50°C to +60°C –58°F to +140°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)

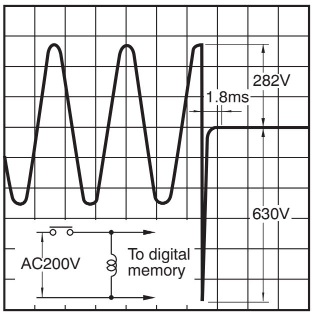
Notes: Other specifications are same as standard types.
*The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

1.-(1) AC coil surge voltage waveform (with CR circuit)
Tested sample: HC4-AC200V-R



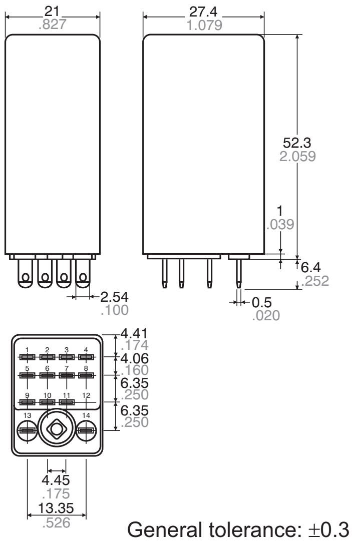
1.-(2) AC coil surge voltage waveform (without CR circuit)
Tested sample: HC4-AC200V



DIMENSIONS (Unit: mm inch)

Plug-in type

4 Form C External dimensions

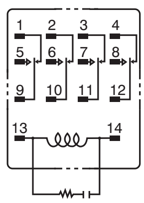


General tolerance: ±0.3 ±.012

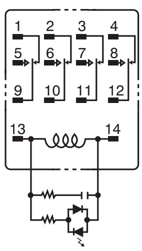
dimensions and schematic of the 4 Form C and 4-pole bifurcated (twin) types. For the 1 Form C, 2 Form C, and 3 Form C types, only the terminals differ. The dimensions of the terminal are the same as for standard type HC relays.

Schematic

Without LED indicator



With LED indicator



Diagrams show the external

Connection accessories

Connection accessories (terminal sockets and sockets) are the same as for standard type HC relays. To hold the relay in place, use the hold-down clip that is provided.

For Cautions for Use, see Relay Technical Information (page 584).

HC RELAY SOCKETS

1. Plug-in type sockets, PC board type sockets, and wrapping type sockets are available for HC relays.
2. In the table below, the socket suitable for each type of HC relay is indicated by a black dot.
3. UL/CSA approval is standard.
4. A hold-down clip is included in the package.

The fixing method is the same as for HC sockets, ordinary HC terminal sockets and HL sockets.

HC/HL-LEAF-SPRING-MK

SOCKET SELECTOR CHART

Type	No. of pole	Item	Part No.	Applicable HC relay (Plug-in type)									
				Standard/Bifurcated contact (DC)					Amber				Keep relay
				1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)	1 Form C	2 Form C	4 Form C	4 Form C (twin)	2 Form C
Plug-in	2-pole	HC2-socket	HC2-SS-K		●					●			
	1/2/4-pole (common)	HC4-socket	HC4-SS-K	●	●		●	●	●	●	●	●	●
PC board	1-pole	HC1-socket for PC board	HC1-PS-K	●					●				
	2-pole	HC2-socket for PC board	HC2-PS-K		●					●			
	3-pole	HC3-socket for PC board	HC3-PS-K		●	●				●			
	1/2/4-pole (common)	HC4-socket for PC board	HC4-PS-K	●	●		●	●	●	●	●	●	●
Wrapping	1/2/4-pole (common)	HC4-wrapping socket	HC4-WS-K	●	●		●	●	●	●	●	●	●

Notes: 1. Use the retainer that is shipped with the terminal socket.
2. UL/CSA approved type is standard (except for wrapping socket).

HC RELAY TERMINAL SOCKETS

1. Ordinary terminal sockets and terminal sockets for DIN rail assembly are available.
2. In the table below, the terminal socket suitable for each type of HC relay is indicated by a black dot.
3. UL/CSA approval is standard.
4. A hold-down clip is included in the package.

The fixing method is the same as for sockets.

HC/HL-LEAF-SPRING-MK

Ordinary terminal socket

The fixing method is the same as for the HC DIN rail terminal sockets and the HL DIN terminal sockets.

HC/HL-LEAF-SPRING-K

Terminal sockets for DIN rail assembly

Power

TERMINAL SOCKET SELECTOR CHART

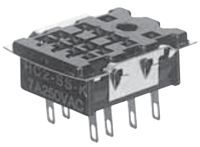
Type	No. of pole	Item	Part No.	Packing quantity		Applicable HC relay (Plug-in type)									
						Standard/Bifurcated contact (DC)					Amber				Keep relay
				Carton	Case	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)	1 Form C	2 Form C	4 Form C	4 Form C (twin)	2 Form C
For DIN rail	2-pole	HC2-slim type DIN terminal socket	HC2-SFD-S	20 pcs.	100 pcs.		●					●			
	2-pole	HC2-DIN	HC2-SFD-K	10 pcs.	100 pcs.		●					●			
	3-pole	HC3-DIN	HC3-SFD-K	5 pcs.	50 pcs.		●	●				●			
	1/2/4-pole (common)	HC4-DIN high terminal socket	HC4-SFD-K	10 pcs.	100 pcs.	●	●		●	●	●	●	●	●	●
For general	2-pole	HC2-terminal socket	HC2-SF-K	10 pcs.	100 pcs.		●					●			
	3-pole	HC3-high terminal socket	HC3-HSF-K	5 pcs.	50 pcs.		●	●				●			
	1/2/4-pole (common)	HC-high terminal socket	HC4-HSF-K	5 pcs.	50 pcs.	●	●		●	●	●	●	●	●	●

Notes: 1. Use the retainer that is shipped with the terminal socket.
2. UL/CSA approved type is standard (except for HC4-TSF-K).
3. In order to prevent breakage and disfiguring, the screw tightening torque for the terminal socket should be within the range of 0.49 to 0.69 N·m {5 to 7kgf·cm}.

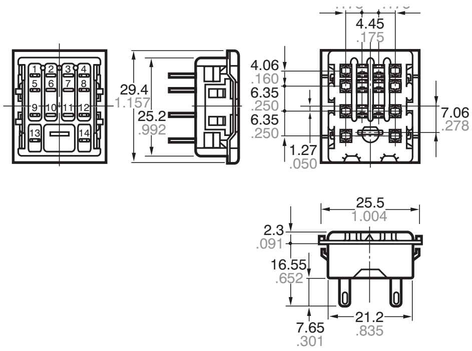
DIMENSIONS (Unit: mm inch)

1. Plug-in type sockets

HC2-Socket (HC2-SS-K)

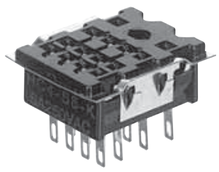


External dimensions

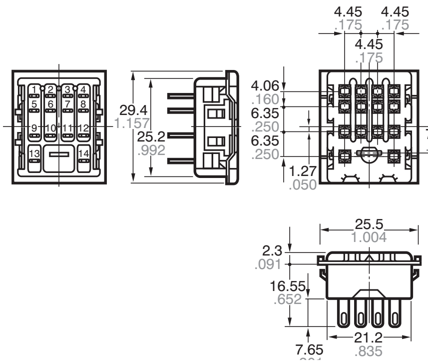


General tolerance: ±0.3 ±.012

HC4-Socket (HC4-SS-K)

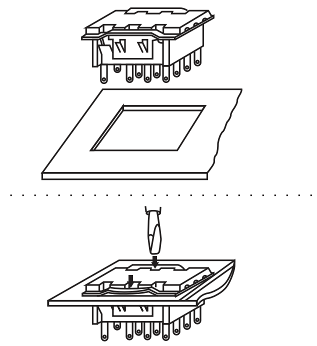


External dimensions

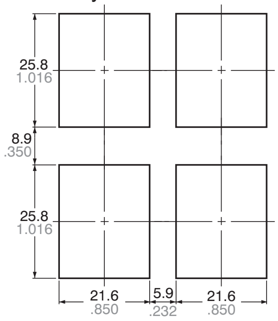


General tolerance: ±0.3 ±.012

Mounting hole diagram



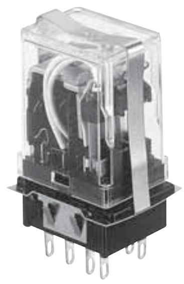
Side-by-side installation



General tolerance: ±0.2 ±.008

Notes: 1. Applicable chassis board thickness is 1.0 to 2.0 mm.
2. Installation is easy by inserting the socket from the top into the holes and by depressing the two down arrows on the retention fitting from the front.

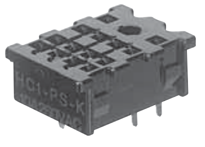
With a relay mounted (HC2-SS-K)



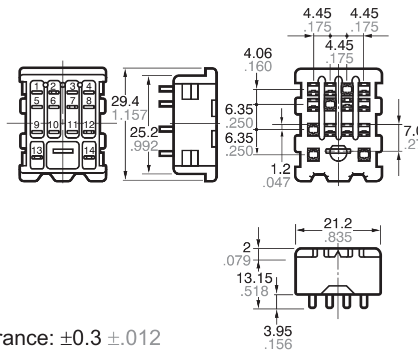
Hold-down clip is packaged with the socket.

2. PC board type sockets

HC1- PC board type socket (HC1-PS-K)

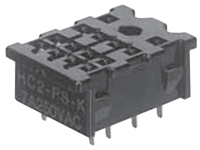


External dimensions

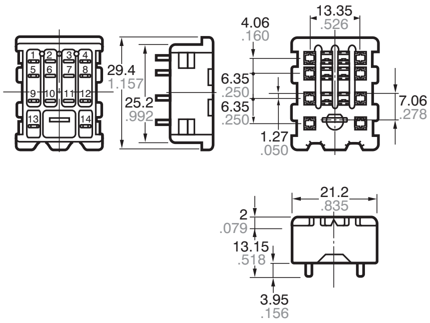


General tolerance: ±0.3 ±.012

HC2- PC board type socket (HC2-PS-K)

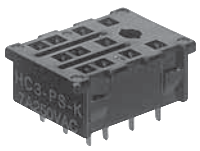


External dimensions

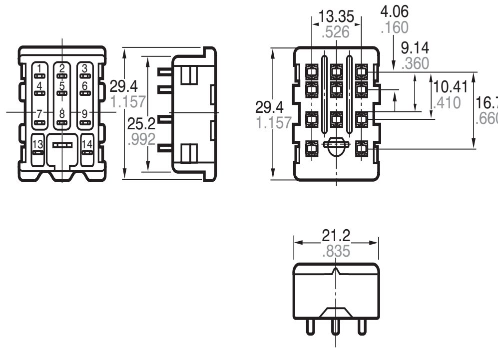


General tolerance: ±0.3 ±.012

HC3- PC board type socket (HC3-PS-K)

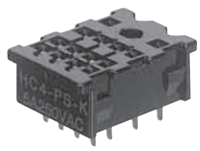


External dimensions

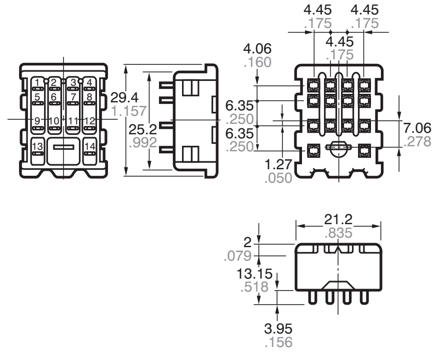


General tolerance: ±0.3 ±.012

HC4- PC board type socket (HC4-PS-K)

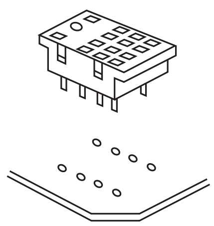


External dimensions



General tolerance: ±0.3 ±.012

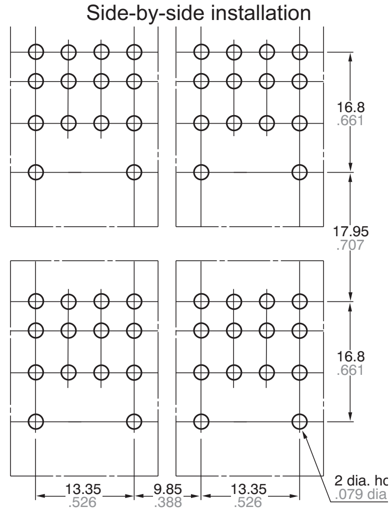
PC board pattern (Bottom view)



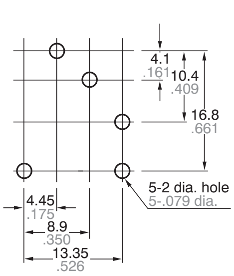
With a relay mounted

Hold-down clip is packaged with the socket.

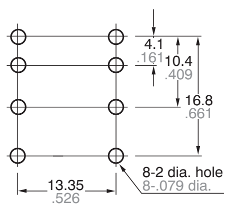
Side-by-side installation



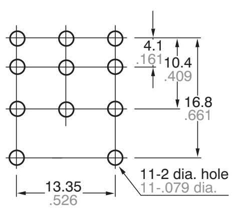
1 Form C



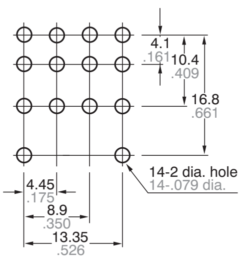
2 Form C



3 Form C



4 Form C

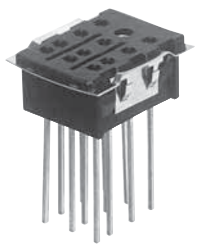


General tolerance: ±0.2 ±.008

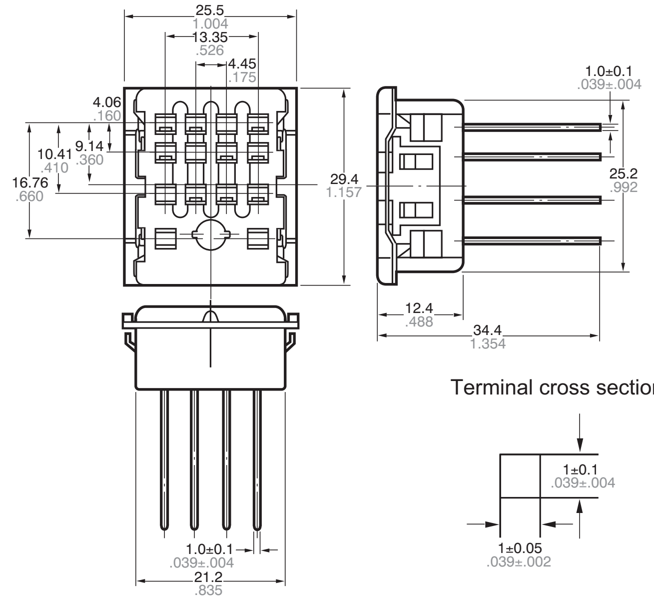
Power

3. Wrapping type sockets

Standard wrapping type sockets
(HC4-WS-K)



External dimensions



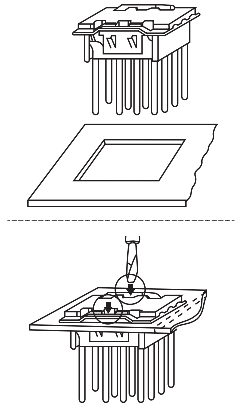
Hold-down clip

(Hold-down clip is packaged with the socket)

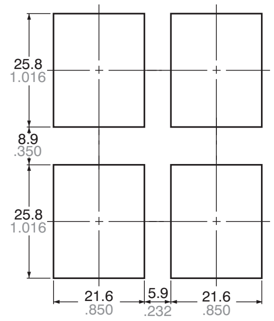
General tolerance: ±0.3 ±.012

Note: The external and mounting dimensions are the same for 1-pole (HC1-WS-K), 2-pole (HC2-WS-K), and 3-pole (HC3-WS-K) types.
Only the number of terminals varies.

Mounting hole diagram



Side-by-side installation

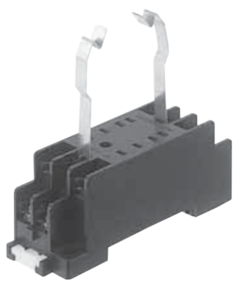


General tolerance: ±0.2 ±.008

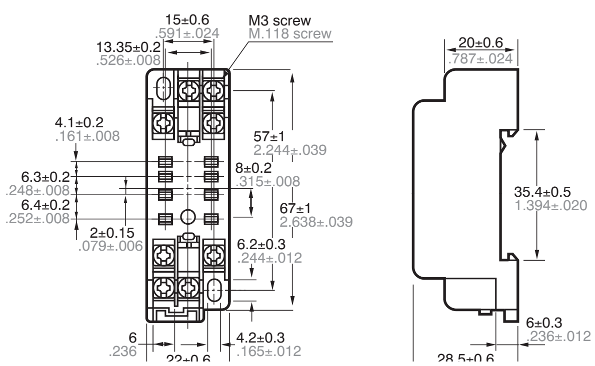
Notes: 1. Applicable chassis board thickness is 1.0 to 2.0 mm.
2. Installation is easy by inserting the socket from the top into the holes and by depressing the two down arrows on the retention fitting from the front.

4. Terminal sockets for DIN rail assembly

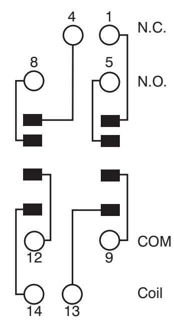
HC2-Slim type terminal sockets for DIN rail assembly (HC2-SFD-S)



External dimensions

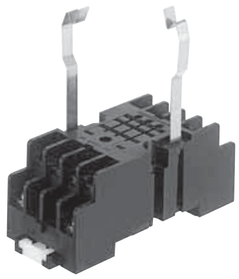


Schematic

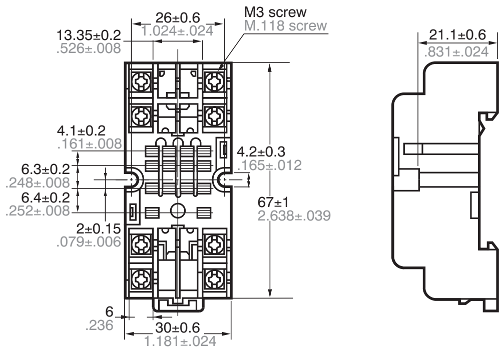


General tolerance: ±0.5 ±.020

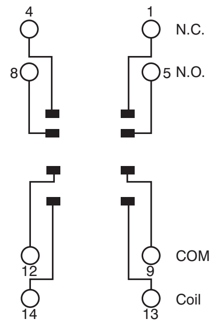
HC2-high terminal socket for DIN rail assembly (HC2-SFD-K)



External dimensions

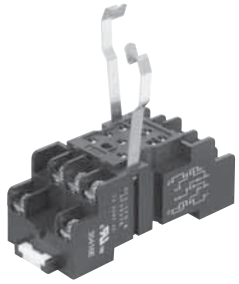


Schematic

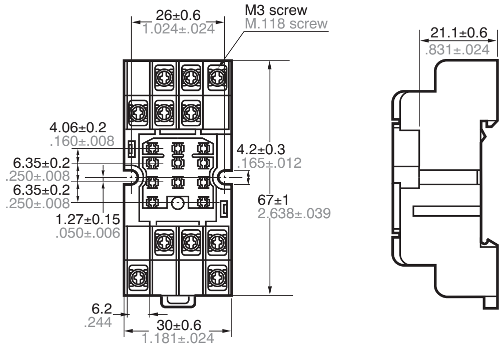


General tolerance: ±0.5 ±.020

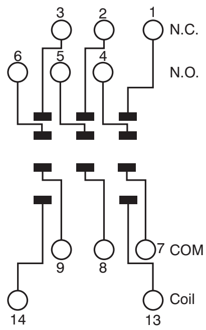
HC3-high terminal socket for DIN rail assembly (HC3-SFD-K)



External dimensions

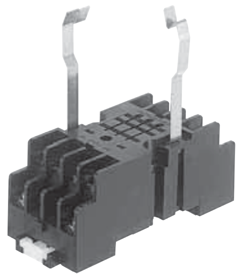


Schematic

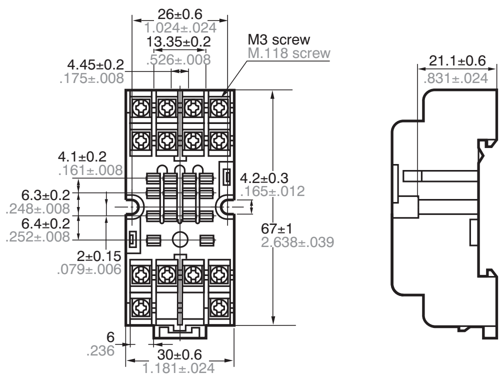


General tolerance: ±0.5 ±.020

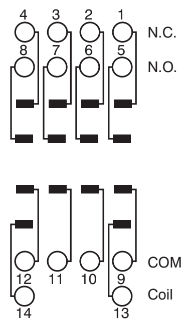
HC4-high terminal socket for DIN rail assembly (HC4-SFD-K)



External dimensions



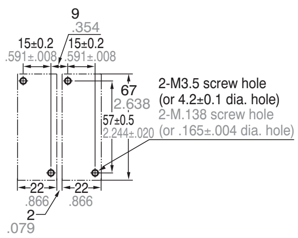
Schematic



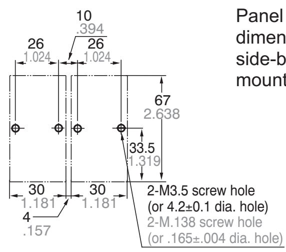
General tolerance: ±0.5 ±.020

Mounting hole diagram

HC2-Slim type

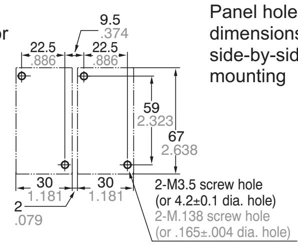


HC2, HC3 and HC4



Panel hole dimensions for side-by-side mounting

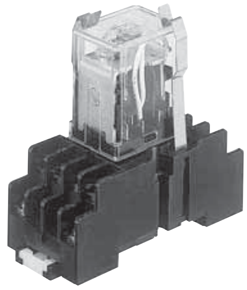
HC vertical type



Panel hole dimensions for side-by-side mounting

General tolerance: ±0.1 ±.004

With a relay mounted (HC4-SFD-K)

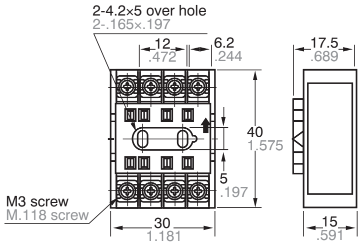


Hold-down clip is packaged with the terminal socket.

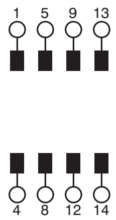
5. Ordinary terminal sockets

HC2-terminal socket (HC2-SF-K for HC2)

External dimensions

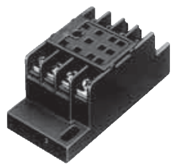


Schematic

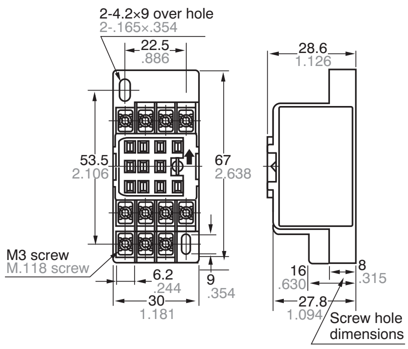


General tolerance: ±0.5 ±.020

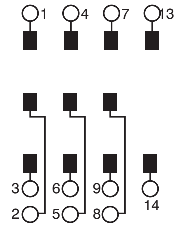
HC3-high terminal socket (HC3-HSF-K) suitable for both HC2 and HC3



External dimensions

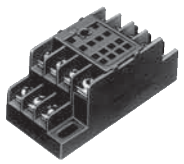


Schematic

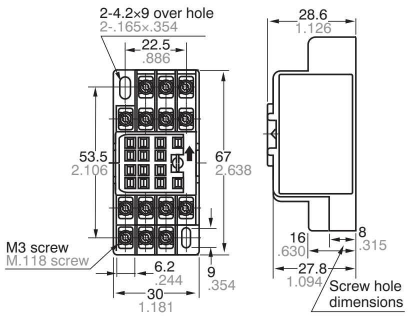


General tolerance: ±0.5 ±.020

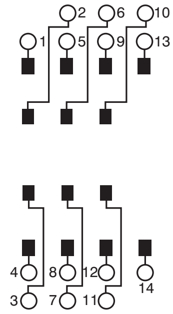
HC4-high terminal socket (HC4-HSF-K) suitable for HC 1, 2 and 4



External dimensions



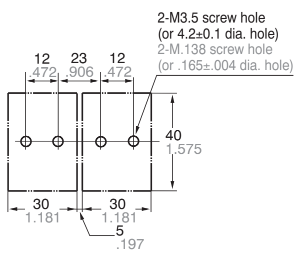
Schematic



General tolerance: ±0.5 ±.020

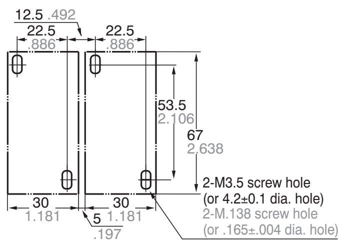
Mounting hole diagram

HC2-SF-K



Panel hole dimensions for side-by-side mounting

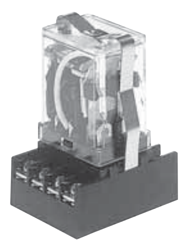
HC3-HSF-K and HC4-HSF-K



Panel hole dimensions for side-by-side mounting

General tolerance: ±0.1 ±.004

With a relay mounted (HC2-SF-K)

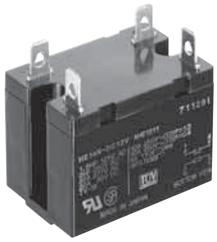


Hold-down clip is packaged with the terminal socket.

Panasonic
ideas for life

TV-15, 30 AMP (1 Form A) Power Relay

HE RELAYS



1 Form A Plug-in type

Form A type also available with
48A contact capacity
Refer to data sheet starting on page 233.

FEATURES

1. Excellent resistance to contact welding
Owing to the pre-tension and kick-off mechanism, the 1 Form A passes TV-15 and the 2 Form A passes TV-10.

2. High-capacity and long life

Contact arrangement	1 Form A type	2 Form A type
Contact capacity	30A	20A
Electrical life (at 20 cpm)	2×10^5	
Mechanical life (at 180 cpm)	DC type: 10^7, AC type: 5×10^6	

3. Excellent surge resistance
Between contacts and coil, the surge voltage is more than 10,000 V (when surge waveform accords with JEC-212-1981).

4. Compatible with all major safety standards
UL, CSA, VDE and TÜV certified

TYPICAL APPLICATIONS

1. Office equipment
Copiers, package air conditioners, automatic vending machines.

2. Industrial equipment
Machine tools, molding equipment, wrapping machines, food processing equipment, etc.

3. Home appliances
Air conditioners, microwave ovens, televisions, stereo systems, water heaters and air heating equipment.

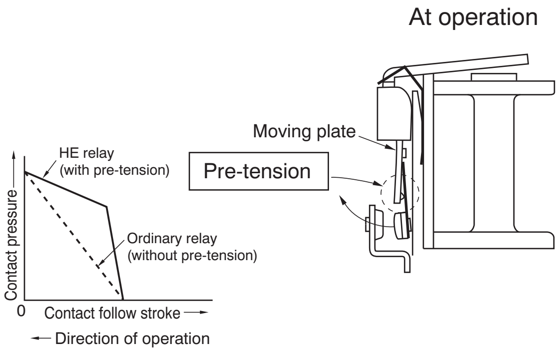
Type		Single side stable type	
		HE 1 Form A, 2 Form A	
Insulation gap		Min. 8 mm	
Distance between contacts*		1 Form A and 2 Form A: Min. 3 mm	PC board type: Min. 2.5 mm
Breakdown voltage	Between open contacts	2, 000 Vrms for 1 min.	
	Between contact and coil	5, 000 Vrms for 1 min.	

CLASSIFICATION

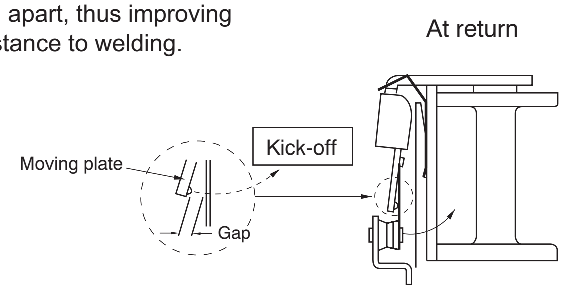
Type	PC board	Plug-in		TM		Screw terminal	
Operating funciton	Single side stable						
Contact arrangement	1 Form A	1 Form A	2 Form A	1 Form A	2 Form A	1 Form A	2 Form A

PRE-TENSION AND KICK-OFF MECHANISM

1. Pre-tension mechanism
Before operation, the moving spring is pre-tensioned by being held down by a moving plate. As a result, at the ON moment, with little follow, contact pressure is ensured with low bounce.



2. Kick-off mechanism
Even when contact welding has occurred, at the moment of return, the moving plate taps the moving spring (kick-off) and, in effect, works to tear the weld apart, thus improving resistance to welding.



	1 Form A	2 Form A
Electrical life	30 A 277 V AC, 10^5 30 A 250 V AC, 20^5	25 A 277 V AC, 10^5 20 A 250 V AC, 20^5
TV rating	TV-15	TV-10

ORDERING INFORMATION

HE [ ] [ ] – [ ] – [ ]

HE Relay

Contact arrangement
1a: 1 Form A (Single side stable type)
2a: 2 Form A (Single side stable type)

Pick-up voltage
N: 70% of nominal voltage

Terminals
Nil: Plug-in type
S: Screw terminal type
Q: TM type
P: PC board type

Coil voltage
DC 6, 12, 24, 48, 100, 110 V
AC 12, 24, 48, 100 (100/120), 200 (200/240) V

TYPES

1. PC board type (1 Form A, DC coil) (Single side stable)

Coil voltage	1 Form A	Packing quantity	
	Part No.	Carton	Case
6V DC	HE1aN-P-DC6V	25 pcs.	100 pcs.
12V DC	HE1aN-P-DC12V		
24V DC	HE1aN-P-DC24V		
48V DC	HE1aN-P-DC48V		
100V DC	HE1aN-P-DC100V		
110V DC	HE1aN-P-DC110V		

2. Plug-in type (Single side stable)

Type	Coil voltage	1 Form A	2 Form A	Packing quantity	
		Part No.	Part No.	Carton	Case
DC type	6V DC	HE1aN-DC6V	HE2aN-DC6V	20 pcs.	100 pcs.
	12V DC	HE1aN-DC12V	HE2aN-DC12V		
	24V DC	HE1aN-DC24V	HE2aN-DC24V		
	48V DC	HE1aN-DC48V	HE2aN-DC48V		
	100V DC	HE1aN-DC100V	HE2aN-DC100V		
	110V DC	HE1aN-DC110V	HE2aN-DC110V		
AC type	12V AC	HE1aN-AC12V	HE2aN-AC12V	20 pcs.	100 pcs.
	24V AC	HE1aN-AC24V	HE2aN-AC24V		
	48V AC	HE1aN-AC48V	HE2aN-AC48V		
	100/120V AC	HE1aN-AC100V	HE2aN-AC100V		
	200/240V AC	HE1aN-AC200V	HE2aN-AC200V		

3. TM type (Single side stable)

Type	Coil voltage	1 Form A	2 Form A	Packing quantity	
		Part No.	Part No.	Carton	Case
DC type	6V DC	HE1aN-Q-DC6V	HE2aN-Q-DC6V	20 pcs.	100 pcs.
	12V DC	HE1aN-Q-DC12V	HE2aN-Q-DC12V		
	24V DC	HE1aN-Q-DC24V	HE2aN-Q-DC24V		
	48V DC	HE1aN-Q-DC48V	HE2aN-Q-DC48V		
	100V DC	HE1aN-Q-DC100V	HE2aN-Q-DC100V		
	110V DC	HE1aN-Q-DC110V	HE2aN-Q-DC110V		
AC type	12V AC	HE1aN-Q-AC12V	HE2aN-Q-AC12V	20 pcs.	100 pcs.
	24V AC	HE1aN-Q-AC24V	HE2aN-Q-AC24V		
	48V AC	HE1aN-Q-AC48V	HE2aN-Q-AC48V		
	100/120V AC	HE1aN-Q-AC100V	HE2aN-Q-AC100V		
	200/240V AC	HE1aN-Q-AC200V	HE2aN-Q-AC200V		

4. Screw terminal type (Single side stable)

Type	Coil voltage	1 Form A	2 Form A	Packing quantity	
		Part No.	Part No.	Carton	Case
DC type	6V DC	HE1aN-S-DC6V	HE2aN-S-DC6V	10 pcs.	50 pcs.
	12V DC	HE1aN-S-DC12V	HE2aN-S-DC12V		
	24V DC	HE1aN-S-DC24V	HE2aN-S-DC24V		
	48V DC	HE1aN-S-DC48V	HE2aN-S-DC48V		
	100V DC	HE1aN-S-DC100V	HE2aN-S-DC100V		
	110V DC	HE1aN-S-DC110V	HE2aN-S-DC110V		
AC type	12V AC	HE1aN-S-AC12V	HE2aN-S-AC12V	10 pcs.	50 pcs.
	24V AC	HE1aN-S-AC24V	HE2aN-S-AC24V		
	48V AC	HE1aN-S-AC48V	HE2aN-S-AC48V		
	100/120V AC	HE1aN-S-AC100V	HE2aN-S-AC100V		
	200/240V AC	HE1aN-S-AC200V	HE2aN-S-AC200V		

Note: The TM type of the screw terminals are also available.

RATING

1. Coil data

1) AC coils

Coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 20°C 68°F)
12V AC	70%V or less of nominal voltage (Initial)	15%V or more of nominal voltage (Initial)	138mA	1.7VA	110%V of nominal voltage
24V AC			74mA	1.8VA	
48V AC			39mA	1.9VA	
100/120V AC			18.7 to 2.1mA	1.9 to 2.7VA	
200/240V AC			9.1 to 10.8mA	1.8 to 2.6VA	

2) DC coils

Coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 55°C 131°F)
6V DC	70%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	320mA	18.8Ω	1.92W	110%V of nominal voltage
12V DC			160mA	75Ω	1.92W	
24V DC			80mA	300Ω	1.92W	
48V DC			40mA	1,200Ω	1.92W	
100V DC			19mA	5,200Ω	1.92W	
110V DC			18mA	6,300Ω	1.92W	

2. Specifications

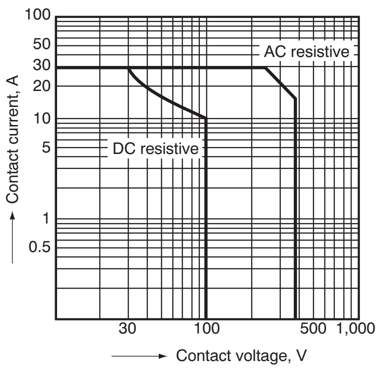
Characteristics	Item		Specifications	
Contact	Arrangement		1 Form A	2 Form A
	Initial contact resistance, max		Max. 100 mΩ (By voltage drop 6 V DC 1A)	
	Contact material		$AgSnO_2$ type	
Rating	Nominal switching capacity (resistive load)		30A 277V AC	25A 277V AC
	Max. switching power		8,310VA	6,925VA
	Max. switching voltage		277V AC, 30V DC	
	Max. switching current		30A	25A
	Nominal operating power		DC: 1.92W, AC: 1.7 to 2.7VA	
	Min. switching capacity (Reference value)*1		100mA 5V DC	
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.	
	Breakdown voltage (Initial)	Between open contacts	2,000 Vrms for 1min (Detection current: 10mA.)	
		Between contact sets	—	4,000 Vrms for 1min (Detection current: 10mA.)
		Between contact and coil	5,000 Vrms for 1min (Detection current: 10mA.)	
	Surge breakdown voltage*2 (between contact and coil)		Min. 10,000V (initial)	
	Temperature rise		DC: Max. 60°C (at 55°C) (By resistive method), AC: Max. 65°C (at 55°C) (By resistive method)	
	Operate time (at nominal voltage)		Max. 30ms (excluding contact bounce time)	
	Release time (at nominal voltage)		DC: Max.10ms (excluding contact bounce time, without diode), AC: Max. 30ms (excluding contact bounce time)	
Mechanical characteristics	Shock resistance	Functional	Min. 98 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10µs.)	
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 ms.)	
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1 mm (Detection time: 10µs.)	
		Destructive	10 to 55 Hz at double amplitude of 1.5 mm	
Expected life	Mechanical		DC: Min. 10^7 (at 180 cpm), AC: Min. 5×10^6 (at 180 cpm)	
	Electrical (resistive load) (at 20 cpm)		Min. 10^5 (30A 277V AC) Min. 2×10^5 (30A 250V AC)	Min. 10^5 (25A 277V AC) Min. 2×10^5 (20A 250V AC)
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –50°C to +55°C –58°F to +131°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature), Air pressure: 86 to 106kPa	
	Conditions for operation, transport and storage*3		20 cpm (at max. rating)	
Unit weight			PC board type: approx. 80g 2.82oz, Plug-in type/TM type: approx. 90g 3.17oz, Screw terminal type: approx. 120g 4.23oz	

*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2 Wave is standard shock voltage of ±1.2×50µs according to JEC-212-1981
*3 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

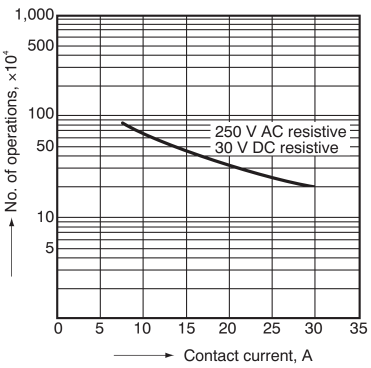
REFERENCE DATA

1 Form A Type

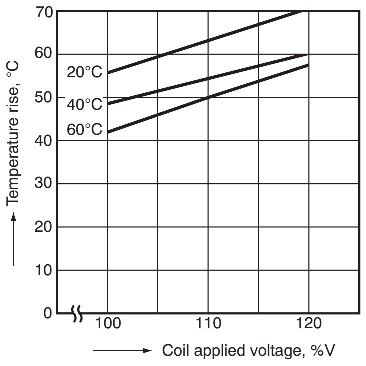
1. Maximum switching power



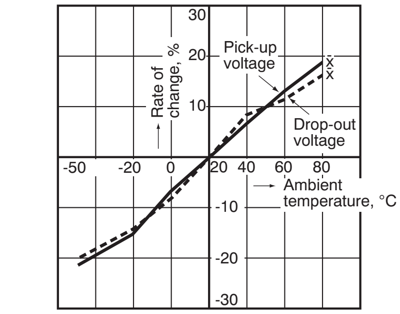
2. Life curve



3. Coil temperature rise (DC type)
Measured portion: Inside the coil
Contact current: 30 A

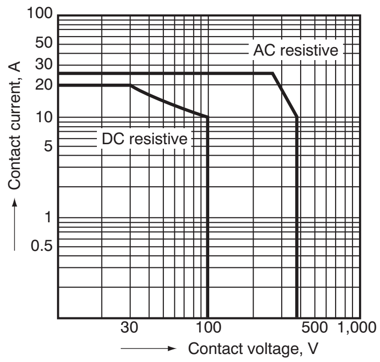


4. Ambient temperature characteristics
Tested sample: HE1aN-AC120V, 6 pcs.

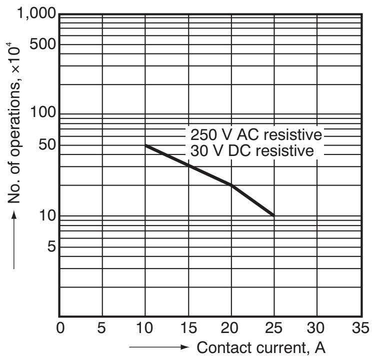


2 Form A Type

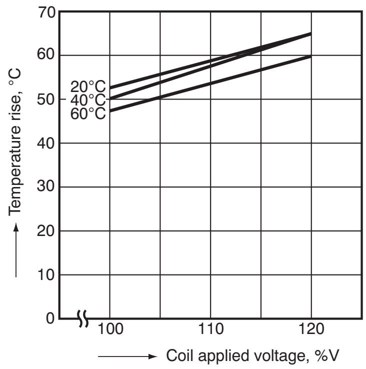
1. Maximum switching power



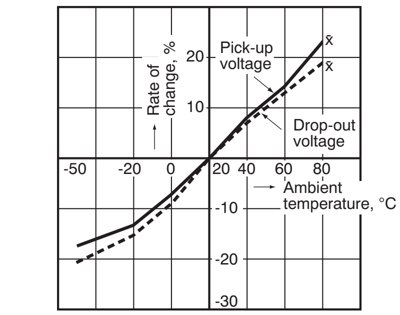
2. Life curve



3. Coil temperature rise (DC type)
Measured portion: Inside the coil
Contact current: 30 A



4. Ambient temperature characteristics
Tested sample: HE2aN-AC120V, 6 pcs.



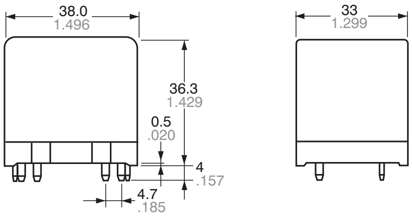
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. PC board type

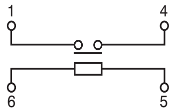
1 Form A

CAD Data External dimensions
Single side stable type

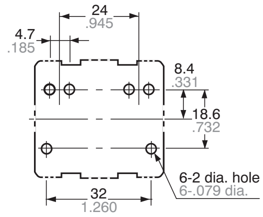


General tolerance: ±0.3 ±.012

Schematic (Bottom view)
Single side stable type



PC board pattern (Bottom view)



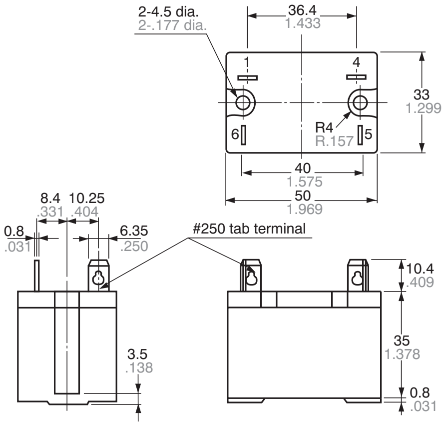
Tolerance: ±0.1 ±.004

2. Plug-in type

1 Form A

CAD Data External dimensions

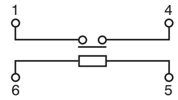
Single side stable type



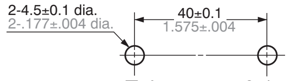
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

Single side stable type



Panel cutout

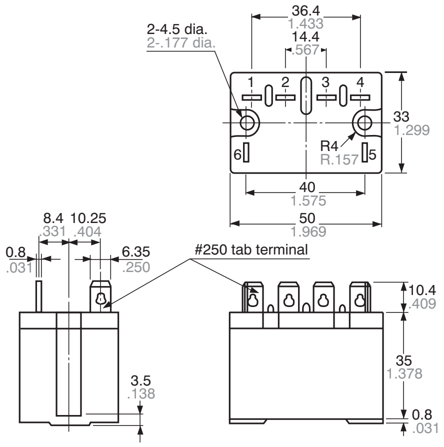


Tolerance: ±0.1 ±.004

2 Form A

CAD Data External dimensions

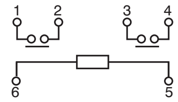
Single side stable type



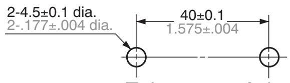
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

Single side stable type



Panel cutout

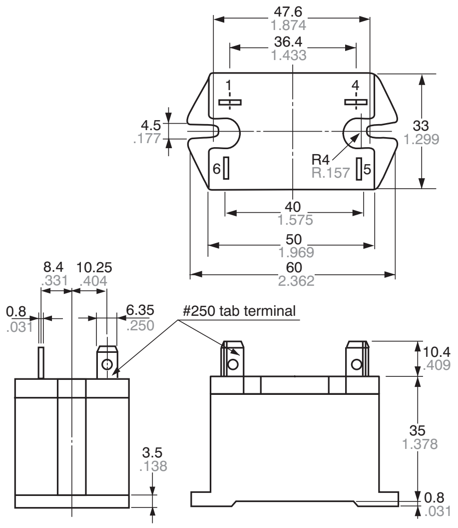


Tolerance: ±0.1 ±.004

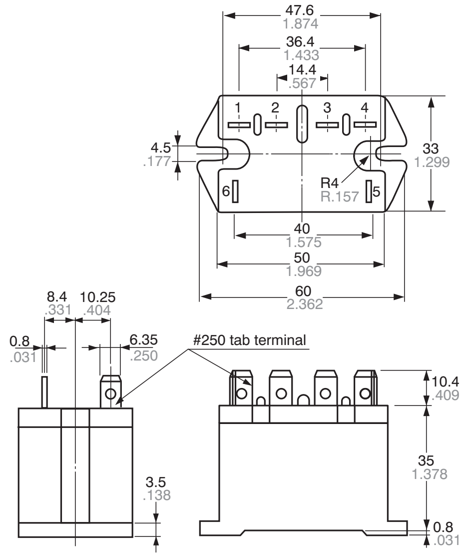
3. TM type

CAD Data External dimensions
Single side stable type

1 Form A



2 Form A

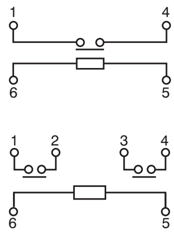


General tolerance: ±0.3 ±.012

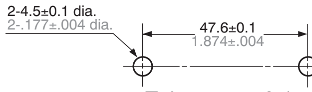
Schematic (Bottom view)
Single side stable type

1 Form A

2 Form A



Panel cutout

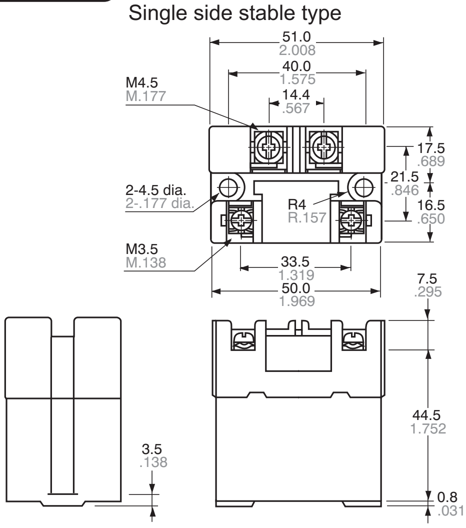


Tolerance: ±0.1 ±.004

4. Screw terminal type

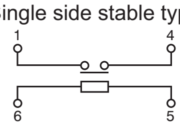
1 Form A

CAD Data External dimensions
Single side stable type

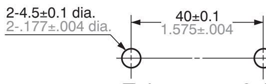


General tolerance: ±0.3 ±.012

Schematic (Bottom view)
Single side stable type



Panel cutout



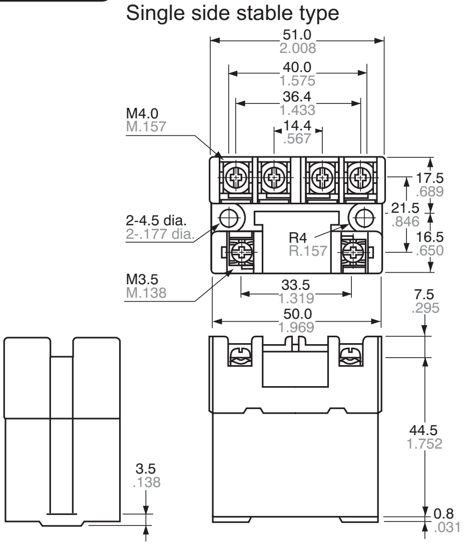
Tolerance: ±0.1 ±.004

Power

2 Form A

CAD Data External dimensions

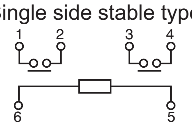
Single side stable type



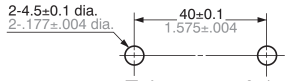
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

Single side stable type



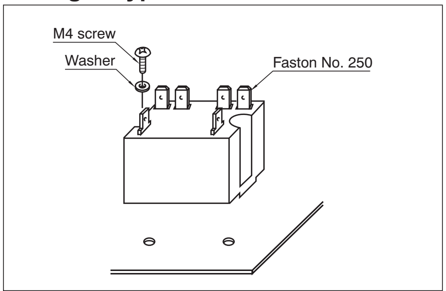
Panel cutout



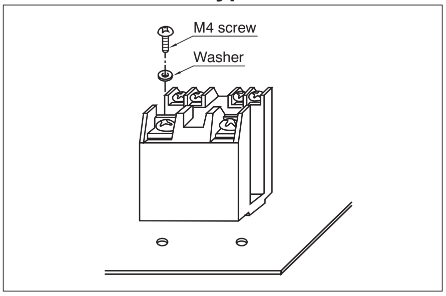
Tolerance: ±0.1 ±.004

MOUNTING METHOD

1. Plug-in type



2. Screw terminal type



3. Allowable installation wiring size for screw terminal types and terminal sockets

Due to the UP terminals, it is possible to either directly connect the wires or use crimped terminal.

NOTES

1. The dust cover should not be removed since doing so may alter the characteristics.
2. Avoid use under severe environmental conditions, such as high humidity, organic gas or in dust, oily locations and locations subjected to extremely frequent shock or vibrations.
3. When mounting, use spring washers. Optimum fastening torque ranges from 49 to 68.6 N·m (5 to 7 kgf·cm).
4. Firmly insert the receptacles so that there is no slack or looseness. To remove a receptacle, 19.6 to 39.2 N (2 to 4 kg) of pulling strength is required. Do not remove more than one receptacle at one time. Always remove one receptacle at a time and pull it straight outwards.
5. When using the AC type, the operate time due to the in-rush phase is 20 ms or more. Therefore, it is necessary for you to verify the characteristics for your actual circuit.
6. When using the push-on blocks for the screw terminal type, use crimped terminals and tighten the screw-down terminals to the torque below.

M4.5 screw:
147 to 166.6 N·cm (15 to 17 kgf·cm)
M4 screw:
117.6 to 137 N·cm (12 to 14 kgf·cm)
M3.5 screw:
78.4 to 98 N·cm (8 to 10 kgf·cm)

For Cautions for Use, see Relay Technical Information (page 582).

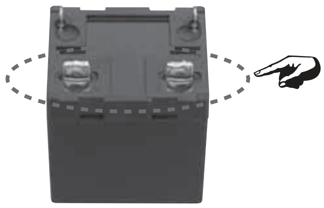
Panasonic
ideas for life

Ideal for Solar inverter
Compact size, 1 Form A 48A
Power Relay

HE RELAYS PV Type

FEATURES

• 48 A current at 250 V AC achieved in compact size (L: 33 × W: 38 × H: 36.3 mm L: 1.299 × W: 1.496 × H: 1.429 inch)
Due to improved conduction efficiency, wide terminal blades are used.



• Contact gap: 2.5 mm (VDE0126 compliant)
Compliant with European photovoltaic standard VDE0126
Compliant with EN61810-1 2.5 kV surge voltage (between contacts)

• Contributes to energy saving in devices thanks to reduced coil hold voltage
Coil hold voltage can be reduced down to 40% of the nominal coil voltage (ambient temperature 20°C 68°F). This equals to power consumption of approximately 310 mW.
*Coil hold voltage is the coil voltage after 100 ms following application of the nominal coil voltage.

• High insulation and 10,000 V surge breakdown voltage (between contacts and coil) achieved.

• Conforms to various safety standards
UL, C-UL and VDE

TYPICAL APPLICATIONS

• Photovoltaic power generation systems (Solar inverter)

Power

ORDERING INFORMATION

HE [1a] [N] - [P] - DC [ ] - [Y5]

Contact arrangement
1a: 1 Form A (Single side stable type)

Pick-up voltage
N: 70% of nominal voltage

Terminals
P: Blade terminal type

Coil voltage (DC)
6, 9, 12, 24V

Type, contact material and switching capacity
Y5: PV type, AgNi type and 1 Form A 48A

Note: UL/C-UL and VDE approved type is standard.

TYPES

Nominal coil voltage	Part No.
6V DC	HE1aN-P-DC6V-Y5
9V DC	HE1aN-P-DC9V-Y5
12V DC	HE1aN-P-DC12V-Y5
24V DC	HE1aN-P-DC24V-Y5

Standard packing: Carton: 20 pcs.; Case: 100 pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F) (Initial)	Drop-out voltage (at 20°C 68°F) (Initial)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
6V DC	70%V or less of nominal voltage	10%V or more of nominal voltage	320mA	18.8Ω	1,920mW	110%V of nominal voltage
9V DC			213mA	42.2Ω		
12V DC			160mA	75.0Ω		
24V DC			80mA	300.0Ω		

2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form A
	Contact resistance (Initial)		Max. 100 mΩ (By voltage drop 6 V DC 1A)
	Contact material		AgNi type
Rating	Nominal switching capacity		48 A 250 V AC (resistive load)
	Contact carring power		12,000 VA (resistive load)
	Max. switching voltage		250 V AC
	Max. switching current		48 A (AC)
	Nominal operating power		1,920 mW
	Min. switching capacity (Reference value)*1		100 mA 5 V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	2,000 Vrms for 1 min. (Detection current: 10 mA)
		Between contact and coil	5,000 Vrms for 1 min. (Detection current: 10 mA)
	Surge breakdown voltage*2 (Between contact and coil)		10,000 V (initial)
	Temperature rise		Max. 60°C 140°F (By resistive method, contact carrying current: 48A, 100%V of nominal coil voltage at 55°C 131°F.)
			Max. 30°C 86°F (By resistive method, contact carrying current: 48A, 60%V of nominal coil voltage at 85°C 185°F.)
	Coil hold voltage*3		40 to 100%V (Contact carrying current: 48A, at 20°C 68°F), 50 to 100%V (Contact carrying current: 48A, at 55°C 131°F), 50 to 60%V (Contact carrying current: 48A, at 85°C 185°F)
	Operate time (at 20°C 68°F)		Max. 30 ms (nominal coil voltage, excluding contact bounce time)
	Release time (at 20°C 68°F)*5		Max. 10 ms (nominal coil voltage, excluding contact bounce time) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 98 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10 μs.)
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1.0 mm (Detection time: 10 μs.)
		Destructive	10 to 55 Hz at double amplitude of 1.5 mm
Expected life	Mechanical		Min. 10^6 (at 180 cpm)
	Electrical	Resistive load	Min. 3×10^4 (48 A 250 V AC) (ON : OFF = 1s : 9s)
		Inductive load	Endurance: 48 A 250 V AC (cosϕ = 0.8), Min. 3×10^4 (ON : OFF = 0.1s : 10s) Overload: 72 A 250 V AC (cosϕ = 0.8), Min. 50 (ON : OFF = 0.1s : 10s)
Conditions	Conditions for operation, transport and storage*4		Ambient temperature: –50 to +55°C –58 to +131°F (When nominal coil voltage applied) –50 to +85°C –58 to +185°F (When applied coil hold voltage is 50% to 60% of nominal coil voltage) Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature); Atmospheric pressure: 86 to 106 kPa
	Max. operating speed		6 cpm (at nominal switching capacity ON : OFF = 1s : 9s)
Unit weight			Approx. 80 g 2.82 oz

Notes:

*1.This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

*2.Wave is standard shock voltage of ±1.2×50μs according to JEC-212-1981

*3.Coil hold voltage is the coil voltage after 100 ms following application of the nominal coil voltage.

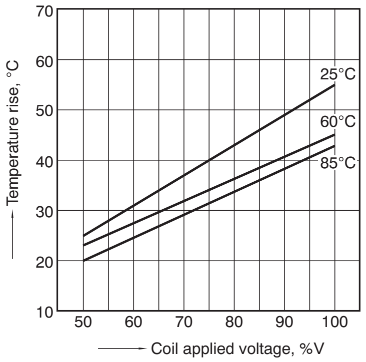
*4.The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to usage, transport and storage conditions in NOTES.

*5.Release time will lengthen if a diode, etc., is connected in parallel to the coil. Be sure to verify operation under actual conditions.

REFERENCE DATA

1. Coil temperature rise

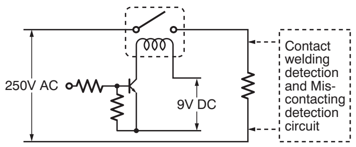
Sample: HE1aN-P-DC9V-Y5, 6 pcs.
Point measured: coil inside
Ambient temperature: 25°C 77°F, 60°C 140°F, 85°C 185°F
Contact carrying current: 48A



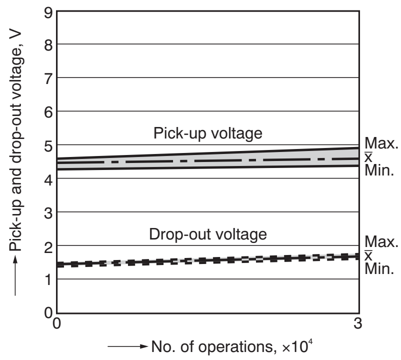
2. Electrical life test (Resistive load 250V AC, 48A at 85°C 185°F)

Sample: HE1aN-P-DC9V-Y5, 6 pcs.
Operation frequency: 6 times/min.
(ON/OFF = 1.0s : 9.0s)

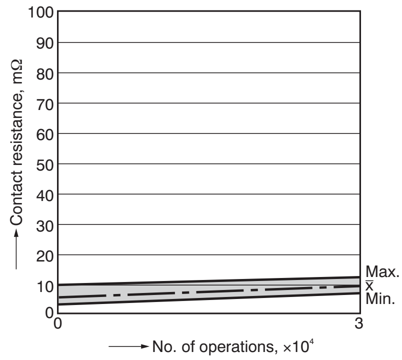
Circuit:



Change of pick-up and drop-out voltage

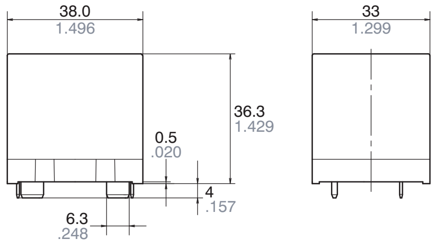


Change of contact resistance



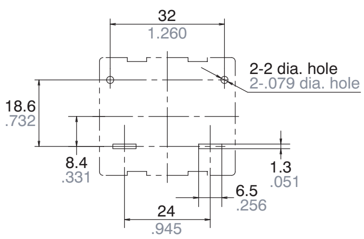
DIMENSIONS (Unit: mm inch)

External dimensions



General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

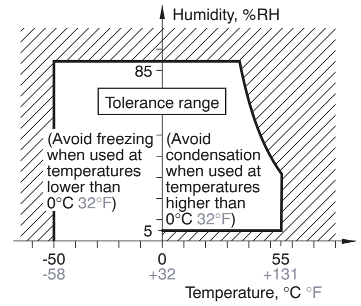
SAFETY STANDARDS

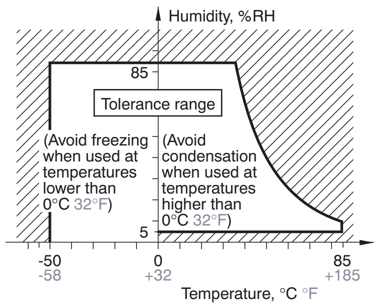
Certification authority	
C-UL	48 A 277 V AC (at 85°C 185°F)
VDE (VDE0435)	48 A 250 V AC cosϕ = 0.8 (at 85°C 185°F)

NOTES

■ Usage, transport and storage conditions

1) Temperature:
–50 to +55°C –58 to +131°F
–50 to +85°C –58 to +185°F (When applied coil hold voltage is 50% to 60% of nominal coil voltage)
2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage





* –50 to +85°C –58 to +185°F (When applied coil hold voltage is 50% to 60% of nominal coil voltage)

4) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
5) Freezing
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
6) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

■ Certification

This relay is C-UL certified.
48 A 277 V AC
This relay is certified by VDE as an electromagnetic relay that complies with VDE0435.
48 A 250 V AC cosϕ = 0.8

■ Others

1) For precautions regarding use and explanations of technical terminology, please refer to our web site. (panasonic-electric-works.net/ac)
2) To ensure good operation, please keep the voltage on the coil ends to ±5% (at 20°C 68°F) of the rated coil operation voltage. Also, please be aware that the pick-up voltage and drop-out voltage may change depending on the temperature and conditions of use.
3) Keep the ripple rate of the nominal coil voltage below 5%.
4) The cycle lifetime is defined under the standard test condition specified in the JIS C 5442 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 85%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.
Also, be especially careful of loads such as those listed below.
(1) When used for AC load-operating and the operating phase is synchronous.
Rocking and fusing can easily occur due to contact shifting.
(2) Highly frequent load-operating
When highly frequent opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.
Three countermeasures for these are listed here.
• Incorporate an arc-extinguishing circuit.
• Lower the operating frequency
• Lower the ambient humidity
5) This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
6) Heat, smoke, and even a fire may occur if the relay is used in conditions outside of the allowable ranges for the coil ratings, contact ratings, operating cycle lifetime, and other specifications. Therefore, do not use the relay if these ratings are exceeded.
7) If the relay has been dropped, the appearance and characteristics should always be checked before use.
8) Incorrect wiring may cause unexpected events or the generation of heat or flames.

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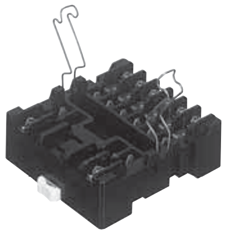
ACCESSORIES
(Terminal sockets)

HE RELAY ACCESSORIES



FEATURES

1. Snap-in mounting to DIN rails is possible.
Can be inserted into 35 mm wide DIN rails. Removal is easy, too.

2. Sure and easy wiring
The use of UP terminals makes wiring exceptionally easy and sure.

3. Hold-down clips can be stored in main unit
Because the hold-down clips can be stored in the main unit, there is no need to remove them when, for example, wiring is changed.

TYPES

No. of poles	Types	Part No.	Packing quantity	
			Carton	Case
For 1 Form A	Single side stable type	JH1-SF	10 pcs.	50 pcs.
For 2 Form A	Single side stable type	JH2-SF	10 pcs.	50 pcs.

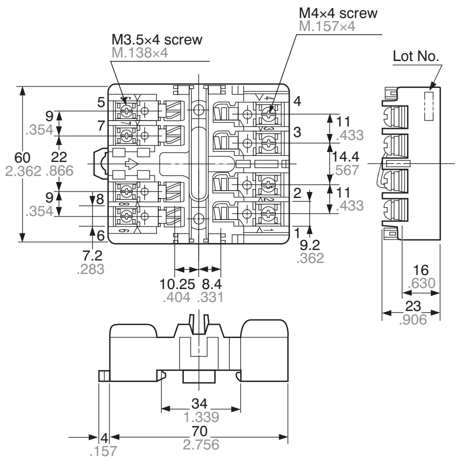
SPECIFICATIONS

Item	Specifications	
Arrangement	1 Form A	2 Form A
Max. continuous current	30A 250V AC	20A 250V AC
Breakdown voltage (initial)	2,000 Vrms for 1min (between terminals) (Detection current: 10mA.)	
Insulation resistance	Min. 100MΩ (between poles)	
Heat resistance	150°C ±3°C for 1 hour	

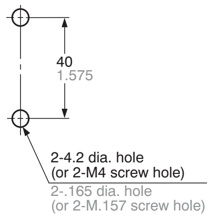
DIMENSIONS (Unit: mm inch)

1 Form A and 2 Form A types

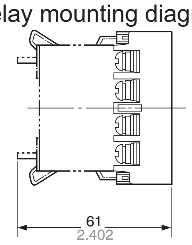
External dimensions



Panel cutout



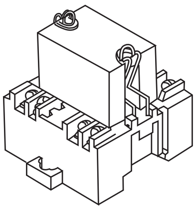
Relay mounting diagram



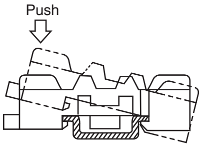
Note: The JH1-SF (1 Form A single side stable type) does not have receptacles (tooth rests) for numbers 2, 3, 7, and 8.
The JH2-SF (2 Form A single side stable type) does not have receptacles (tooth rests) for numbers 7 and 8.

MOUNTING METHOD

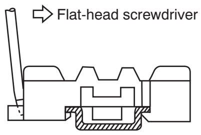
1. Relay mounting



2. Installing to a DIN rail



3. Removing from a DIN rail



NOTES

1. Be careful not to drop the relay. It is made of heat-hardened resin and may break.

2. Be sure to tighten the screw-down terminals firmly. Loose terminals may lead to the generation of heat.

3. When the 1 Form A is used in situations covered by the Japanese Electrical Appliance and Material Control Law, the use of 5.5 mm² cabling and 30 A current is not allowed. Consequently, the circuit should be less than 20 A.

4. When fixing the terminal socket with screws, to avoid torque damage and distortion, apply torque within the ranges shown below.

M3.5 screws:
0.784 to 0.98 N·m (8 to 10 kgf·cm)
M4 screws:
1.176 to 1.37 N·m (12 to 14 kgf·cm)

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20 AMP POWER RELAY

HG RELAYS

FEATURES

1. High-capacity and long life
The electrical life of this high capacity is 20A 100,000 operations (250 V AC). It can be used for 1.5kW (3-phase 200 V) motor control.
2. High breakdown voltage
Both between contacts, and between contacts and coil, high breakdown voltage is 2,000 V for 1 minute.
3. Easy mounting and wiring
The terminal arrangement is apparent at a glance and wiring is easy. Moreover, #250 series tab terminals can be used.
4. Socket and terminal sockets available
Lineup includes DIN terminal sockets that enable the use of DIN rails. The pole numbers of the terminal sockets are interchangeable and different terminal sockets can be used in combination.
5. UL/CSA approved

TYPICAL APPLICATIONS

HP relays enjoy wide use in various applications, particularly in automation controls and remote controls.
Applications include:
1. Industrial machinery
For controlling positioning, pressure, and temperature in molding equipment, boilers, pumps, charging pressure equipment, measuring and evaluation equipment, textile machines, etc.
2. Machine tools
Control of positioning and directional change in turning machines, lathes, borers, etc.
3. Food processing packing machines
Automatic control of packing equipment for milk and seafood, bottling, canning, and packaging
4. Office equipment
Control of copiers, time recorders, etc.
5. Coin operate machines
Control of food, cigarette, and other vending machines
6. Measuring devices and equipment
For repeating installation of control signals and in power amplifiers
7. Generators, transformers and power receiving equipment
Functional parts in protective equipment, functional assistance in automatic adjustment equipment, telemeters and other remote monitoring equipment
8. Control of conveyance equipment
Control panels for elevators, escalators, and other conveyance equipment, control of all kinds industrial transport equipment such as conveyors.
9. Amusement equipment
Control of equipment in amusement parks, etc., control of bowling alley equipment, control of fountains in public parks

About Cd-free contacts
We have introduced Cadmium free type products to reduce Environmental Hazardous Substances. (The suffix "F" should be added to the part number.) Please replace parts containing Cadmium with Cadmium-free products and evaluate them with your actual application before use because the life of a relay depends on the contact material and load.

Power

ORDERING INFORMATION

HG [ ] - [ ] - **F**

Contact arrangement
2: 2 Form C
3: 3 Form C
4: 4 Form C

Coil voltage
AC 24, 48, 100, (115), 200, (220), (240) V
DC 12, 24, 48, 100, (110), 200 V

Contact material
F: $AgSnO_2$ type

The voltage values in parentheses are for order-made products for export.
Note: UL/CSA approved type is standard.

TYPES

Coil voltage	2 Form C	3 Form C	4 Form C
	Part No.	Part No.	Part No.
24V AC	HG2-AC24V-F	HG3-AC24V-F	HG4-AC24V-F
48V AC	HG2-AC48V-F	HG3-AC48V-F	HG4-AC48V-F
100V AC	HG2-AC100V-F	HG3-AC100V-F	HG4-AC100V-F
115V AC	HG2-AC115V-F	HG3-AC115V-F	HG4-AC115V-F
200V AC	HG2-AC200V-F	HG3-AC200V-F	HG4-AC200V-F
220V AC	HG2-AC220V-F	HG3-AC220V-F	HG4-AC220V-F
240V AC	HG2-AC240V-F	HG3-AC240V-F	HG4-AC240V-F
12V DC	HG2-DC12V-F	HG3-DC12V-F	HG4-DC12V-F
24V DC	HG2-DC24V-F	HG3-DC24V-F	HG4-DC24V-F
48V DC	HG2-DC48V-F	HG3-DC48V-F	HG4-DC48V-F
100V DC	HG2-DC100V-F	HG3-DC100V-F	HG4-DC100V-F
110V DC	HG2-DC110V-F	HG3-DC110V-F	HG4-DC110V-F
200V DC	HG2-DC200V-F	HG3-DC200V-F	HG4-DC200V-F

Standard packing (2 Form C): Carton: 20 pcs.; Case: 100 pcs.
Standard packing (3 Form C, 4 Form C): Carton: 10 pcs.; Case: 50 pcs.
Note: Terminal sockets and sockets are not included. Please order these separately.

RATING

1. Coil data

1) AC coils

Contact arrangement	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±20%] (at 20°C 68°F)		Coil inductance		Nominal operating power		Max. allowable voltage (at 40°C 104°F)
				50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	
2 Form C	24V AC	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	167mA	150mA	0.441H	0.416H	4.2VA	3.6VA	110%V of nominal voltage
	48V AC			86mA	75mA	1.717H	1.660H			
	100V AC			42mA	36mA	7.457H	7.216H			
	115V AC			36mA	31.3mA	9.868H	9.531H			
	200V AC			21mA	18mA	30.39H	29.00H			
	220V AC			19mA	16.4mA	35.99H	34.82H			
	240V AC			18mA	15mA	42.06H	41.68H			
3 Form C	24V AC	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	250mA	216mA	0.299H	0.290H	6.0VA	5.2VA	110%V of nominal voltage
	48V AC			125mA	108mA	1.195H	1.163H			
	100V AC			61mA	52mA	5.174H	5.039H			
	115V AC			52.4mA	45.2mA	6.844H	6.648H			
	200V AC			30mA	26mA	20.71H	20.14H			
	220V AC			27.3mA	23.6mA	25.00H	24.27H			
	240V AC			25mA	21.6mA	29.97H	29.06H			
4 Form C	24V AC	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	367mA	316mA	0.204H	0.199H	8.8VA	7.6VA	110%V of nominal voltage
	48V AC			184mA	158mA	0.817H	0.795H			
	100V AC			88mA	76mA	3.540H	3.444H			
	115V AC			76.8mA	66.1mA	4.685H	4.557H			
	200V AC			44mA	38mA	14.16H	13.79H			
	220V AC			39mA	34mA	17.48H	16.89H			
	240V AC			36.6mA	31.6mA	20.48H	19.87H			

2) DC coils

Contact arrangement	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 40°C 104°F)
2 Form C	12V DC	80%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	119.6mA	100Ω	1.4W	110%V of nominal voltage
	24V DC			57.6mA	416Ω	1.4W	
	48V DC			30.3mA	1,585Ω	1.5W	
	100V DC			14.4mA	6,950Ω	1.4W	
	110V DC			14.4mA	7,650Ω	1.6W	
	200V DC			7.2mA	27,800Ω	1.4W	
3 Form C	12V DC	80%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	134mA	89.5Ω	1.6W	110%V of nominal voltage
	24V DC			66mA	364Ω	1.6W	
	48V DC			33.1mA	1,450Ω	1.6W	
	100V DC			16.5mA	6,060Ω	1.7W	
	110V DC			16.5mA	6,670Ω	1.8W	
	200V DC			8.4mA	23,800Ω	1.7W	
4 Form C	12V DC	80%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	168mA	71.4Ω	2.0W	110%V of nominal voltage
	24V DC			81.2mA	296Ω	1.9W	
	48V DC			45.7mA	1,050Ω	2.2W	
	100V DC			20.3mA	4,930Ω	2.0W	
	110V DC			20.3mA	5,420Ω	2.2W	
	200V DC			12.9mA	15,500Ω	2.6W	

Notes: 1. The rated current area is±15% (60Hz) [AC coils],. ±10% (20°C) [DC coils]
2. The coil resistance for DC operation is the value measured when the coil temperature is 20°C 68°F. Compensate ±0.4% for every ±1°C change in temperature.
3. The relay operates in a range of 80% to 110% V of the voltage rating, but ideally, in consideration of temporary voltage fluctuations, it should be operated at the rated voltage. In particular, for AC operation, if the impressed voltage drops to 80% V or more below the rated voltage, humming will occur and a large current will flow leading possibly to coil burnout.
4. As a general rule, only a pure DC voltage should be used for the coil drive.
However, a DC power supply that contains ripples has characteristics that differ from pure DC.
Therefore, please verify characteristics (operate voltage, release voltage, humming) using the actual circuit that will be used.

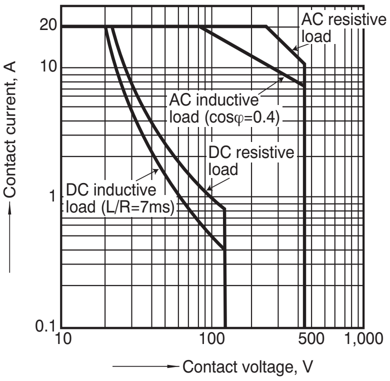
2. Specifications

Characteristics	Item		Specifications
Contact	Initial contact resistance, max		Max. 15 mΩ (By voltage drop 6 V DC 1A)
	Contact material		$AgSnO_2$ type
Rating	Nominal switching capacity		20A 250V AC (resistive load)
	Min. switching capacity (Reference value)*1		100mA 5V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	2,000 Vrms for 1min (Detection current: 10mA.)
		Between contact sets	2,000 Vrms for 1min (Detection current: 10mA.)
		Between contact and coil	2,000 Vrms for 1min (Detection current: 10mA.)
	Operate time*2		Max. 30ms (2 Form C), Max.40ms (3 Form C, 4 Form C) (Nominal voltage applied to the coil, excluding contact bounce time.)
	Release time*2		Max. 30ms (2 Form C), Max.40ms (3 Form C, 4 Form C) (Nominal voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 98 m/s^2 (Except for contact operating direction) (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)
		Destructive	Min. 980 m/s^2 (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1 mm (Detection time: 10μs.)
		Destructive	10 to 55 Hz at double amplitude of 2 mm
Expected life	Mechanical	AC coil	Min. 10^7 (at 180 cpm)
		DC coil	Min. 10^6 (at 180 cpm)
	Electrical		20A 250V AC resistive load (cosφ=1), Min. 10^5
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –50°C to +40°C –58°F to +104°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. Operating speed		20 cpm (at max. rating)
Unit weight			2 Form C: approx. 130g 4.59oz, 3 Form C: approx. 185g 6.53oz, 4 Form C: approx. 240g 8.47oz

Notes:
*1 This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.
*2 For the AC coil types, the operate/release time will differ depending on the phase.
*3 The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

1. Switching capacity range



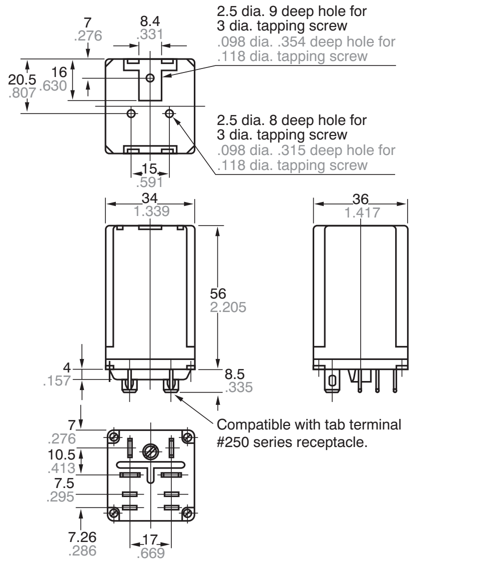
DIMENSIONS(mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

2 Form C

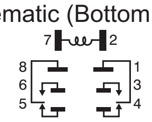
CAD Data

External dimensions



General tolerance: ±0.5 ±.020

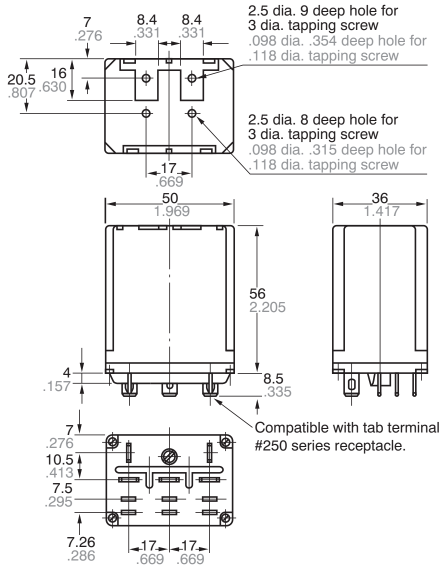
Schematic (Bottom view)



3 Form C

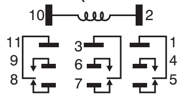
CAD Data

External dimensions



General tolerance: ±0.5 ±.020

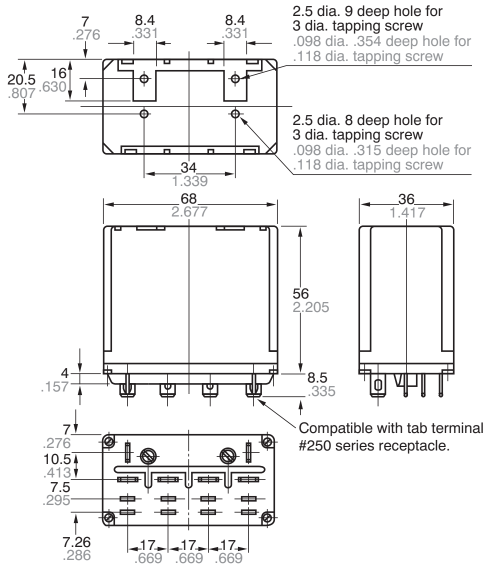
Schematic (Bottom view)



4 Form C

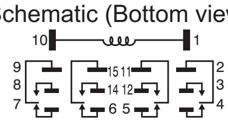
CAD Data

External dimensions



General tolerance: ±0.5 ±.020

Schematic (Bottom view)

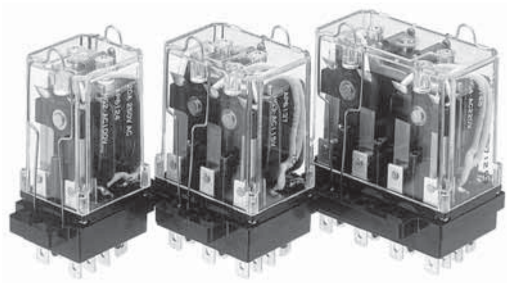


Power

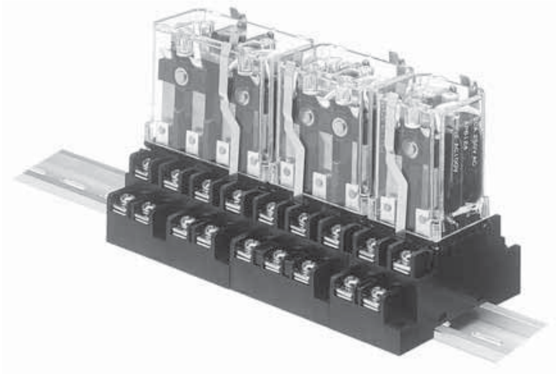
For Cautions for Use, see Relay Technical Information (page 582).

ACCESSORIES
(Sockets and
Terminal sockets)

HG RELAY ACCESSORIES



Socket



Terminal socket for DIN rail assembly

TYPES

1. For DIN rail terminal sockets, sockets and general terminal sockets hold-down clip included.
2. The terminal socket installation rail can be used also for the square plug-in terminal socket of the timer and the terminal socket of the HP relay.

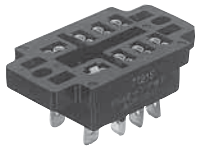
Type	No. of poles	Item	Part No.	Packing quantity	
				Carton	Case
Socket	2-pole	HG2-socket	HG2-SS	10 pcs.	50 pcs.
	3-pole	HG3-socket	HG3-SS	5 pcs.	25 pcs.
	4-pole	HG4-socket	HG4-SS	5 pcs.	25 pcs.
DIN rail terminal socket	2-pole	HG2-DIN terminal socket	HG2-SFD	10 pcs.	50 pcs.
	3-pole	HG3-DIN terminal socket	HG3-SFD	5 pcs.	25 pcs.

Note: For a 4-pole relay with DIN rail terminal socket, use two 2-pole types side by side.
Socket and terminal socket conform to UL, CSA as standard.

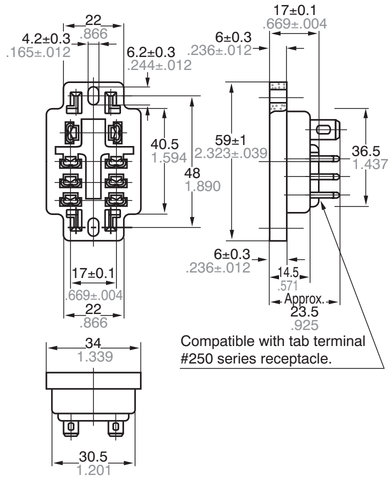
DIMENSIONS (Unit: mm inch)

1. Socket (with hold-down clip)

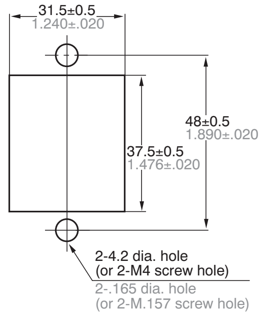
HG2-Socket (HG2-SS)



External dimensions



Mounting hole diagram



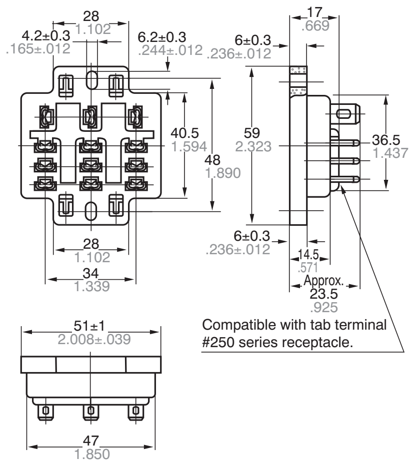
With a relay mounted

Note: Hold-down clip is packaged with the socket.

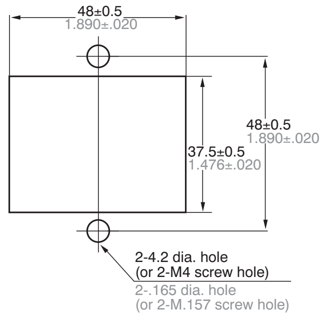
General tolerance: ±0.6 ±.024

HG3-Socket (HG3-SS)

External dimensions



Mounting hole diagram



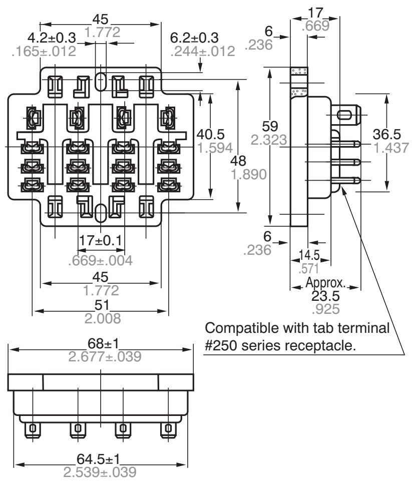
With a relay mounted

Note: Hold-down clip is packaged with the socket.

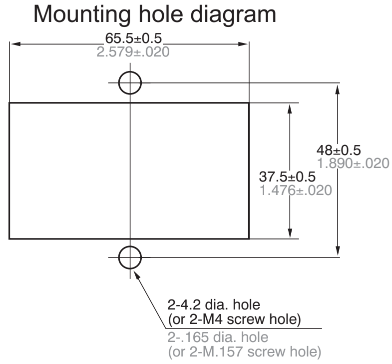
General tolerance: ±0.6 ±.024

HG4-Socket (HG4-SS)

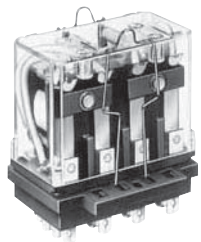
External dimensions



Mounting hole diagram



With a relay mounted



Note: Hold-down clip is packaged with the socket.

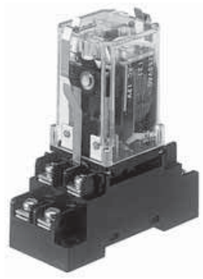
General tolerance: ±0.6 ±.024

Power

2. Terminal socket for DIN rail assembly (with hold-down clip and installation screw)

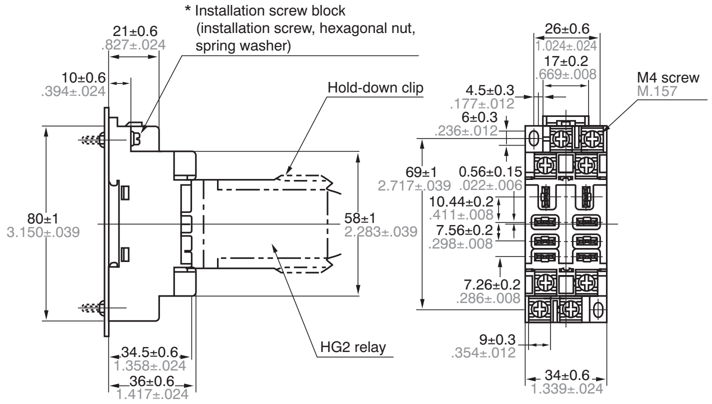
HG2-Terminal socket for DIN rail assembly (HG2-SFD)

With a relay mounted

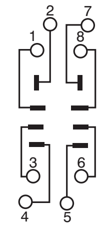


Note: Hold-down clip is packaged with the terminal socket.

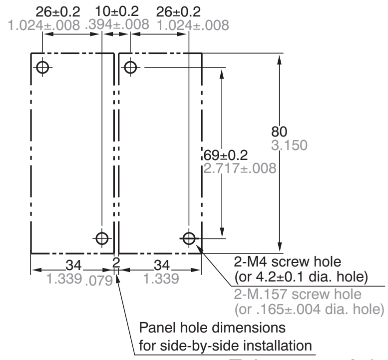
External dimensions



Schematic



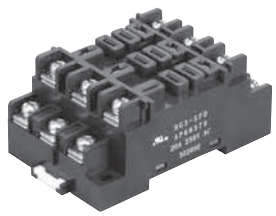
Mounting hole diagram



Tolerance: ±0.1 ±.004

*For direct mounting, use the included installation screw block.

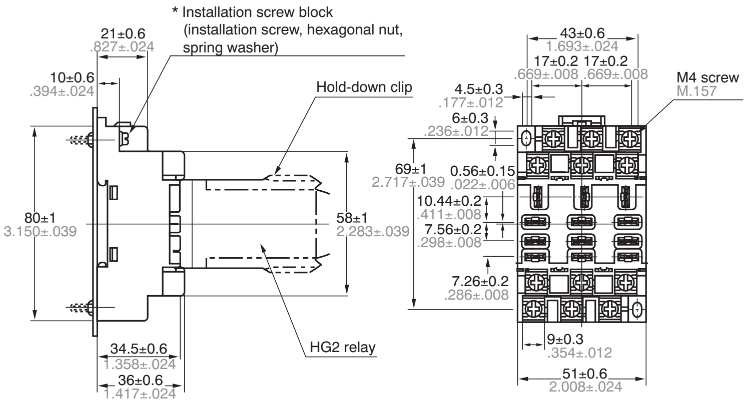
HG3-Terminal socket for DIN rail assembly (HG3-SFD)



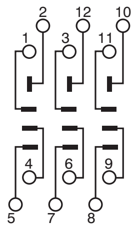
With a relay mounted

Note: Hold-down clip is packaged with the terminal socket.

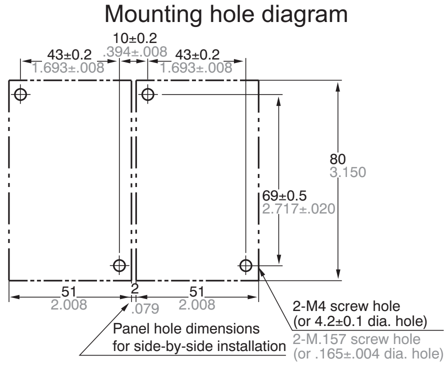
External dimensions



Schematic



Mounting hole diagram



Tolerance: ±0.1 ±.004

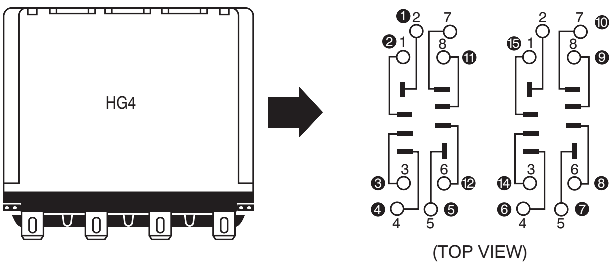
*For direct mounting, use the included installation screw block.

With 4-pole HG relays, use two HG2-Terminal sockets for DIN rail assembly side by side.

With a relay mounted

Note: Hold-down clip is packaged with the terminal socket.

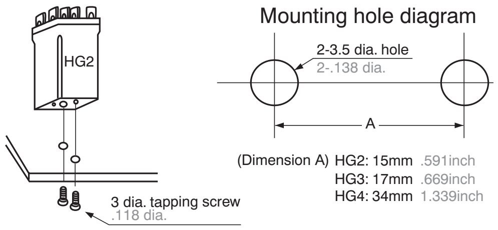
Schematic for terminal socket and relay



Note: The plain numbers denote the terminal socket terminal number. The white numbers in black circles denote the relay terminal number.

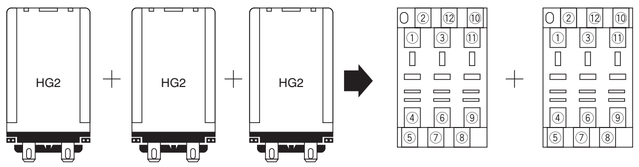
OTHER WAYS TO MOUNT RELAYS

With direct mounting by cover tapping
(Tab terminal connection)
Compatible with #250 series

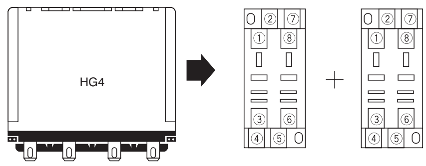


TERMINAL SOCKET (SOCKET) COMBINATION

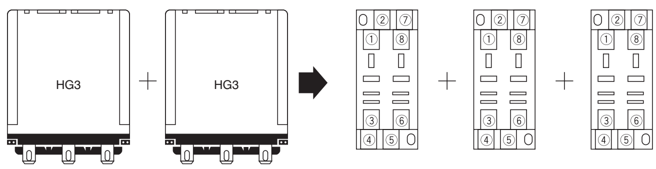
Because the pole numbers of the terminal sockets (sockets) are interchangeable, different terminal sockets (sockets) can be used in combination.



HG2 main unit + HG2 main unit + HG2 main unit → HG3 terminal socket + HG3 terminal socket



HG4 main unit → HG2 terminal socket + HG2 terminal socket



HG3 main unit + HG3 main unit → HG2 terminal socket + HG2 terminal socket + HG2 terminal socket

NOTES

1. Hold-down clip
Please use the hold-down clip whenever HG relays will be used in applications where strong vibrating or shock force occurs.

2. Mounting direction
There is no restriction on the mounting direction. However, if the mounted relay will be susceptible to strong vibrations or shocks, to avoid influence on switching operations, mount so that the direction of vibration and shock are not in line with the direction of contact switching. (In direction of contact switching operation, resistance to external shock is more than 98 m/s^2). Moreover, if the mounted relay is likely to be susceptible to strong vibrations or shocks, be sure to fit the hold-down clip.

3. Environment
Avoid use in adverse conditions, such as where there is exposure to harmful gas, or where ambient temperatures are high (more than 40°C).

4. Do not insert or remove relays into or out of live circuits.

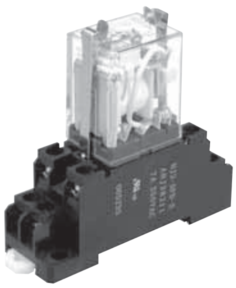
5. To prevent damage or distortion, when tightening fixing screws, the optimum torque range should be 1.176 to 1.37 N·m (12 to 14 kgf·cm).

For Cautions for Use, see Relay Technical Information (page 584).

Power

MINIATURE RELAY FOR WIDER APPLICATIONS

HJ RELAYS



FEATURES

1. Economical prices achieved

2. Useful for wide range of applications

Gold-plated contact types are capable of switching under low level (1mA: reference value) to powerful high level (7A: 2-pole) loads.

3. Wide range of types available

The lineup includes 2-pole and 4-pole products, relays with operating indicator lights, and push-button types. You will also find relays that absorb surge when the coil goes to the off state with diodes (for DC type) or CR circuits (for AC type). Moreover, the availability of a broad range of coil voltages meets a wide range of needs.

4. Cadmium-free contacts

To minimize environmental impact, cadmium-free contacts are used.

5. Coil cutoff detection

The LED that is fitted to AC coils goes off when the coil is inoperative and so provides a cutoff detection function.

6. Finger protection

Terminal sockets with finger protection, designed to prevent fingers from touching the terminals, are also available.

TYPICAL APPLICATIONS

Control panels
Power supply units
Molding machines
Machine tools
Welding equipment
Agricultural equipment
Office equipment
Vending machines
Communications equipment
Amusement machines

ORDERING INFORMATION

HJ ☐ - ☐ - ☐ - ☐ - ☐ - ☐

Contact arrangement
2: 2 Form C
4: 4 Form C

Operation indication
Nil: Without LED indication
L: With LED indication

Test button
Nil: Without a test button
T: With a test button

Coil voltage
DC 12, 24, 48, 100, 120, 200, 220/240 V
AC 12, 24, 48, 110 V

Surge suppression
Nil: Without
D: With diode
R: With CR circuit

Contact surface
Nil: Without Au plating
6: With Au plating

Note: HJ relays conform to UL, C-UL and TÜV as standard.

TYPES

[Au plating type]

1. Plug-in type

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-DC 12V-6	HJ4-DC 12V-6
24V DC	HJ2-DC 24V-6	HJ4-DC 24V-6
48V DC	HJ2-DC 48V-6	HJ4-DC 48V-6
100/110V DC	HJ2-DC110V-6	HJ4-DC110V-6
12V AC	HJ2-AC 12V-6	HJ4-AC 12V-6
24V AC	HJ2-AC 24V-6	HJ4-AC 24V-6
48V AC	HJ2-AC 48V-6	HJ4-AC 48V-6
100/110V AC	HJ2-AC100V-6	HJ4-AC100V-6
110/120V AC	HJ2-AC120V-6	HJ4-AC120V-6
200/220V AC	HJ2-AC200V-6	HJ4-AC200V-6
220/240V AC	HJ2-AC220/240V-6	HJ4-AC220/240V-6

Note: Packing quantity: 20pcs. (Carton), 200pcs. (Case)

2. Plug-in type (with LED indication)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-DC 12V-6	HJ4-L-DC 12V-6
24V DC	HJ2-L-DC 24V-6	HJ4-L-DC 24V-6
48V DC	HJ2-L-DC 48V-6	HJ4-L-DC 48V-6
100/110V DC	HJ2-L-DC110V-6	HJ4-L-DC110V-6
12V AC	HJ2-L-AC 12V-6	HJ4-L-AC 12V-6
24V AC	HJ2-L-AC 24V-6	HJ4-L-AC 24V-6
48V AC	HJ2-L-AC 48V-6	HJ4-L-AC 48V-6
100/110V AC	HJ2-L-AC100V-6	HJ4-L-AC100V-6
110/120V AC	HJ2-L-AC120V-6	HJ4-L-AC120V-6
200/220V AC	HJ2-L-AC200V-6	HJ4-L-AC200V-6
220/240V AC	HJ2-L-AC220/240V-6	HJ4-L-AC220/240V-6

Note: Packing quantity: 20pcs. (Carton), 200pcs. (Case)

3. Plug-in type (with diode)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-DC 12V-D-6	HJ4-DC 12V-D-6
24V DC	HJ2-DC 24V-D-6	HJ4-DC 24V-D-6
48V DC	HJ2-DC 48V-D-6	HJ4-DC 48V-D-6
100/110V DC	HJ2-DC110V-D-6	HJ4-DC110V-D-6

Note: Packing quantity: 20pcs. (Carton), 200pcs. (Case)

4. Plug-in type (with diode and LED indication)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-DC 12V-D-6	HJ4-L-DC 12V-D-6
24V DC	HJ2-L-DC 24V-D-6	HJ4-L-DC 24V-D-6
48V DC	HJ2-L-DC 48V-D-6	HJ4-L-DC 48V-D-6
100/110V DC	HJ2-L-DC110V-D-6	HJ4-L-DC110V-D-6

Note: Packing quantity: 20pcs. (Carton), 200pcs. (Case)

Power

5. Plug-in type (with CR)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
100/110V AC	HJ2-AC100V-R-6	HJ4-AC100V-R-6
110/120V AC	HJ2-AC120V-R-6	HJ4-AC120V-R-6
200/220V AC	HJ2-AC200V-R-6	HJ4-AC200V-R-6
220/240V AC	HJ2-AC220/240V-R-6	HJ4-AC220/240V-R-6

Note: Packing quantity: 20pcs. (Carton), 200pcs. (Case)

6. Plug-in type (with CR and LED indication)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
100/110V AC	HJ2-L-AC100V-R-6	HJ4-L-AC100V-R-6
110/120V AC	HJ2-L-AC120V-R-6	HJ4-L-AC120V-R-6
200/220V AC	HJ2-L-AC200V-R-6	HJ4-L-AC200V-R-6
220/240V AC	HJ2-L-AC220/240V-R-6	HJ4-L-AC220/240V-R-6

Note: Packing quantity: 20pcs. (Carton), 200pcs. (Case)

[Without Au plating type]

1. Plug-in type

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-DC 12V	HJ4-DC 12V
24V DC	HJ2-DC 24V	HJ4-DC 24V
48V DC	HJ2-DC 48V	HJ4-DC 48V
100/110V DC	HJ2-DC110V	HJ4-DC110V
12V AC	HJ2-AC 12V	HJ4-AC 12V
24V AC	HJ2-AC 24V	HJ4-AC 24V
48V AC	HJ2-AC 48V	HJ4-AC 48V
100/110V AC	HJ2-AC100V	HJ4-AC100V
110/120V AC	HJ2-AC120V	HJ4-AC120V
200/220V AC	HJ2-AC200V	HJ4-AC200V
220/240V AC	HJ2-AC220/240V	HJ4-AC220/240V

Note: Packing quantity: 20pcs. (Carton), 200pcs. (Case)

2. Plug-in type (with LED indication)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-DC 12V	HJ4-L-DC 12V
24V DC	HJ2-L-DC 24V	HJ4-L-DC 24V
48V DC	HJ2-L-DC 48V	HJ4-L-DC 48V
100/110V DC	HJ2-L-DC110V	HJ4-L-DC110V
12V AC	HJ2-L-AC 12V	HJ4-L-AC 12V
24V AC	HJ2-L-AC 24V	HJ4-L-AC 24V
48V AC	HJ2-L-AC 48V	HJ4-L-AC 48V
100/110V AC	HJ2-L-AC100V	HJ4-L-AC100V
110/120V AC	HJ2-L-AC120V	HJ4-L-AC120V
200/220V AC	HJ2-L-AC200V	HJ4-L-AC200V
220/240V AC	HJ2-L-AC220/240V	HJ4-L-AC220/240V

Note: Packing quantity: 20pcs. (Carton), 200pcs. (Case)

3. Plug-in type (with a test button)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-T-DC 12V	HJ4-T-DC 12V
24V DC	HJ2-T-DC 24V	HJ4-T-DC 24V
48V DC	HJ2-T-DC 48V	HJ4-T-DC 48V
100/110V DC	HJ2-T-DC110V	HJ4-T-DC110V
12V AC	HJ2-T-AC 12V	HJ4-T-AC 12V
24V AC	HJ2-T-AC 24V	HJ4-T-AC 24V
48V AC	HJ2-T-AC 48V	HJ4-T-AC 48V
100/110V AC	HJ2-T-AC100V	HJ4-T-AC100V
110/120V AC	HJ2-T-AC120V	HJ4-T-AC120V
200/220V AC	HJ2-T-AC200V	HJ4-T-AC200V
220/240V AC	HJ2-T-AC220/240V	HJ4-T-AC220/240V

Note: Packing quantity: 20pcs. (Carton), 200pcs. (Case)

4. Plug-in type (with LED indication and a test button)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-T-DC 12V	HJ4-L-T-DC 12V
24V DC	HJ2-L-T-DC 24V	HJ4-L-T-DC 24V
48V DC	HJ2-L-T-DC 48V	HJ4-L-T-DC 48V
100/110V DC	HJ2-L-T-DC110V	HJ4-L-T-DC110V
12V AC	HJ2-L-T-AC 12V	HJ4-L-T-AC 12V
24V AC	HJ2-L-T-AC 24V	HJ4-L-T-AC 24V
48V AC	HJ2-L-T-AC 48V	HJ4-L-T-AC 48V
100/110V AC	HJ2-L-T-AC100V	HJ4-L-T-AC100V
110/120V AC	HJ2-L-T-AC120V	HJ4-L-T-AC120V
200/220V AC	HJ2-L-T-AC200V	HJ4-L-T-AC200V
220/240V AC	HJ2-L-T-AC220/240V	HJ4-L-T-AC220/240V

Note: Packing quantity: 20pcs. (Carton), 200pcs. (Case)

5. Plug-in type (with diode)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-DC 12V-D	HJ4-DC 12V-D
24V DC	HJ2-DC 24V-D	HJ4-DC 24V-D
48V DC	HJ2-DC 48V-D	HJ4-DC 48V-D
100/110V DC	HJ2-DC110V-D	HJ4-DC110V-D

Note: Packing quantity: 20pcs. (Carton), 200pcs. (Case)

6. Plug-in type (with diode and LED indication)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-DC 12V-D	HJ4-L-DC 12V-D
24V DC	HJ2-L-DC 24V-D	HJ4-L-DC 24V-D
48V DC	HJ2-L-DC 48V-D	HJ4-L-DC 48V-D
100/110V DC	HJ2-L-DC110V-D	HJ4-L-DC110V-D

Note: Packing quantity: 20pcs. (Carton), 200pcs. (Case)

7. Plug-in type (with CR)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
100/110V AC	HJ2-AC100V-R	HJ4-AC100V-R
110/120V AC	HJ2-AC120V-R	HJ4-AC120V-R
200/220V AC	HJ2-AC200V-R	HJ4-AC200V-R
220/240V AC	HJ2-AC220/240V-R	HJ4-AC220/240V-R

Note: Packing quantity: 20pcs. (Carton), 200pcs. (Case)

8. Plug-in type (with CR and LED indication)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
100/110V AC	HJ2-L-AC100V-R	HJ4-L-AC100V-R
110/120V AC	HJ2-L-AC120V-R	HJ4-L-AC120V-R
200/220V AC	HJ2-L-AC200V-R	HJ4-L-AC200V-R
220/240V AC	HJ2-L-AC220/240V-R	HJ4-L-AC220/240V-R

Note: Packing quantity: 20pcs. (Carton), 200pcs. (Case)

9. Accessories

Type	No. of poles	Product name	Part No.
Terminal socket	2-pole	HJ2 terminal socket	HJ2-SFD
		HJ2 terminal socket (Finger protect type)	HJ2-SFD-S
	2/4-pole (common)	HJ4 terminal socket	HJ4-SFD
		HJ4 terminal socket (Finger protect type)	HJ4-SFD-S
Socket for plug-in	2-pole	HC2-socket (for HJ relay)	HC2-SS-K
	2/4-pole (common)	HC4-socket (for HJ relay)	HC4-SS-K
Socket for PC board	2-pole	HC2-PC board socket (for HJ relay)	HC2-PS-K
	2/4-pole (common)	HC4-PC board socket (for HJ relay)	HC4-PS-K

Notes: 1. Packing quantity: 10pcs. (Carton), 100pcs. (Case)
2. Use the hold-down clip that is shipped with the terminal socket or socket.
3. Terminal sockets conform to UL, CSA and TÜV, as standard.
Sockets conform to UL and CSA, as standard.
4. In order to prevent breakage and disfiguring, the screw tightening torque for the terminal socket should be within the range of 0.49 to 0.69 N·m (5 to 7 kgf·cm).
5. When attaching directly to a chassis, please use an M4 × 10 metric coarse screw thread, a spring washer, and a hexagonal nut.
6. For S1DX/S1DXM timer, use the leaf holding clip (Part No. ADX18012).
7. HC relay sockets/terminal sockets are not adaptive for HJ relays. Use dedicated sockets/terminal sockets.

RATING

1. Coil data

1) AC coils (50/60Hz)

Coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal coil current [±20%]		Nominal operating power		Max. allowable voltage (at 70°C 158°F)
			50Hz	60Hz	50Hz	60Hz	
12V AC	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	102.9mA	85.4mA	Approx. 1.2 to 1.5 V A	Approx. 1.0 to 1.3 V A	110%V of nominal voltage
24V AC			54.5mA	45.6mA			
48V AC			30.7mA	25.9mA			
100/110V AC			11.8mA/13.9mA	10.0mA/11.6mA			
110/120V AC			10.9mA/12.5mA	9.1mA/10.3mA			
200/220V AC			6.8mA/8.1mA	5.7mA/6.7mA			
220/240V AC			6.8mA/7.8mA	5.6mA/6.4mA			

2) DC coils

Coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal coil current	Coil resistance (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 70°C 158°F)
12V DC	80%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	75mA [±10%]	160Ω	0.9W	110%V of nominal voltage
24V DC			37mA [±10%]	650Ω	0.9W	
48V DC			18mA [±15%]	2,600Ω	0.9W	
100/110V DC			9.1mA/10mA [±15%]	11,000Ω	1.1W	

2. Specifications

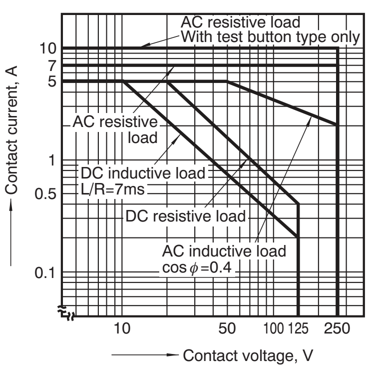
Characteristics	Item		Specifications	
Contact	Arrangement		2 Form C	4 Form C
	Initial contact resistance, max		Max. 50 mΩ (By voltage drop 6 V DC 1A)	
	Contact material		Au plating type: Au plating Ag Without Au plating type: Ag	
Rating	Nominal switching capacity (resistive load)		7 A 250V AC	5 A 250V AC
	Max. switching power (resistive load)		1,750 VA	1,250 VA
	Max. switching voltage		250V AC, 125V DC	
	Max. switching current		7 A	5 A
	Nominal operating power		0.9W 1.2 VA	
	Min. switching capacity (Reference value)*1	Au plating type	1mA 1V DC	
		Without Au plating type	1mA 5V DC	
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500V DC) Measurement at same location as "Initial breakdown voltage" section.	
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1min. (Detection current: 10mA.)	
		Between contact sets	2,000 Vrms for 1min. (Detection current: 10mA.)	
		Between contact and coil	2,000 Vrms for 1min. (Detection current: 10mA.)	
	Temperature rise (at 70°C 158°F)		Max. 60°C (By resistive method, nominal voltage)	
	Operate time*2		Max. 20ms (Nominal voltage applied to the coil, excluding contact bounce time.)	
	Release time*2		Max. 20ms (Nominal voltage applied to the coil, excluding contact bounce time.) (without diode)	
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s^2 (Half-wave pulse of sine wave: 11 ms; detection time: 10µs.)	
		Destructive	Min. 1,000 m/s^2 (Half-wave pulse of sine wave: 6 ms.)	
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1.0 mm (Detection time: 10µs.)	
		Destructive	10 to 55 Hz at double amplitude of 1.0 mm	
Expected life	Mechanical		Min. 2×10^7 (at 180 cpm)	
	Electrical (resistive load) (at 20 cpm)		Min. 10^5 (7A 250V AC) Min. 5×10^5 (5A 250V AC)	Min. 10^5 (5A 250V AC) Min. 2×10^5 (3A 250V AC)
Conditions	Conditions for operation, transport and storage*3 (Not freezing and condensing at low temperature)		Ambient temperature: –40°C to +70°C –40°F to +158°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)	
	Max. Operating speed		20 cpm (at rated load)	
Unit weight			Approx. 34g 1.20 oz	Approx. 34g 1.20 oz

Notes:
In accordance with the Electrical Appliance and Material Safety Law, you cannot exceed a voltage of 150V AC when using the 4 Form C type.
For more information, please inquire.
When using low level loads, contact instability may result depending on conditions of use (switching frequency and ambient conditions, etc.); therefore, please use the Au plating type.
*1 This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.
*2 For the AC coil types, the operate/release time will differ depending on the phase.
*3 The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

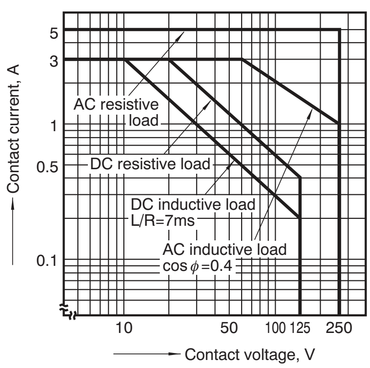
Power

REFERENCE DATA

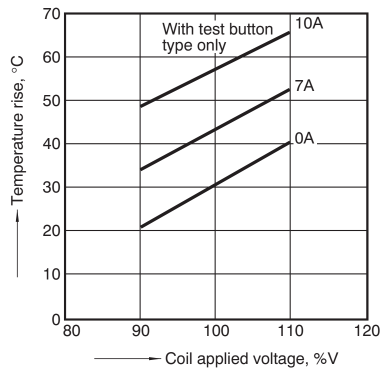
1-(1). Max. switching capacity (2 Form C type)



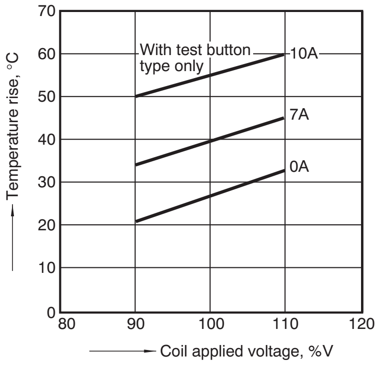
1-(2). Max. switching capacity (4 Form C type)



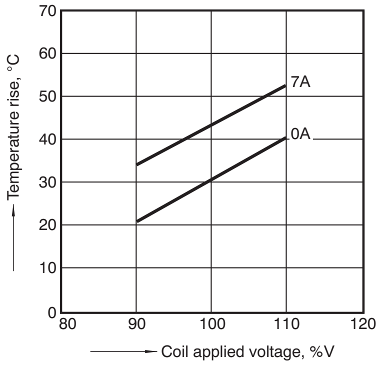
2-(1). Life curve (2 Form C)



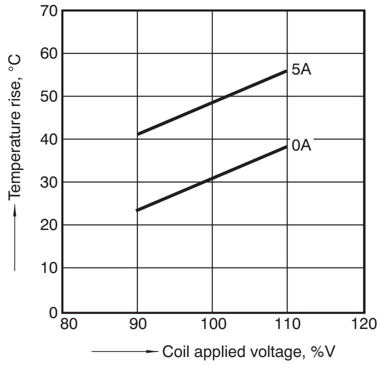
2-(2). Life curve (4 Form C)



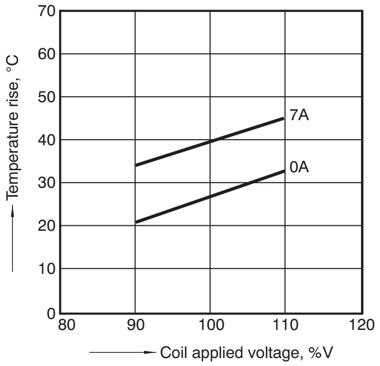
3-(1). Coil temperature rise (2 Form C/AC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



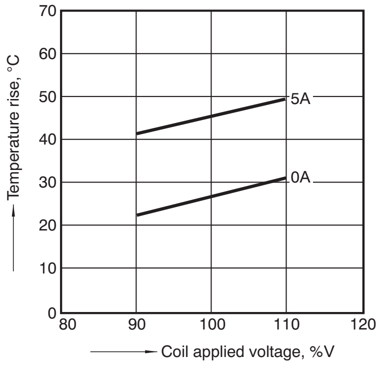
3-(2). Coil temperature rise (2 Form C/DC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



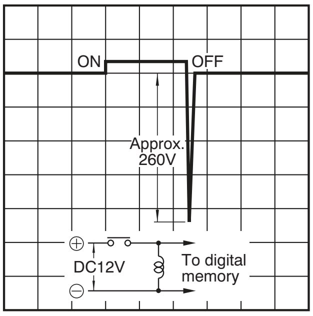
3-(3). Coil temperature rise (4 Form C/AC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



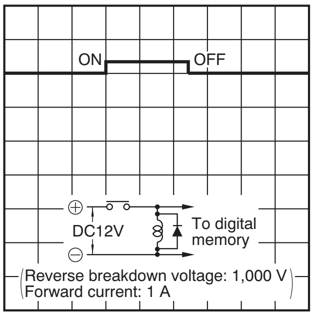
3-(4). Coil temperature rise (4 Form C/DC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



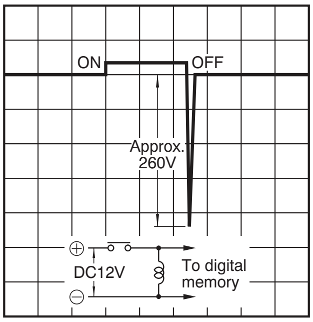
4-(1). AC coil surge voltage waveform
(With CR circuit)
Tested sample: HJ4-AC200V-R



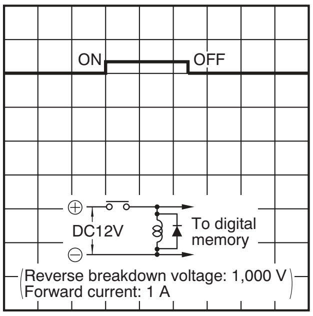
4-(2). AC coil surge voltage waveform
(Without CR circuit)
Tested sample: HJ4-AC200V



5-(1). DC coil surge voltage waveform
(Without diode)



5-(2). DC coil surge voltage waveform
(With diode)
Diode characteristics:
Reverse breakdown voltage: 1,000 V
Forward current: 1 A



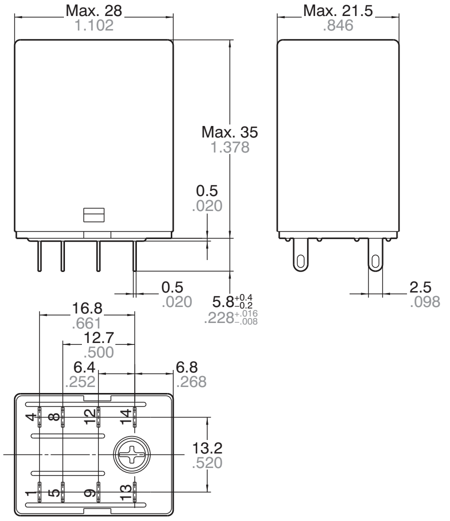
DIMENSIONS(mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

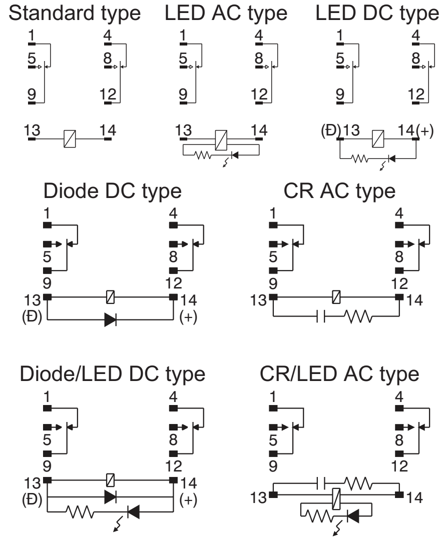
1. Plug-in type (2 Form C) (including diode/CR)

CAD Data

External dimensions



Schematic (Bottom view)

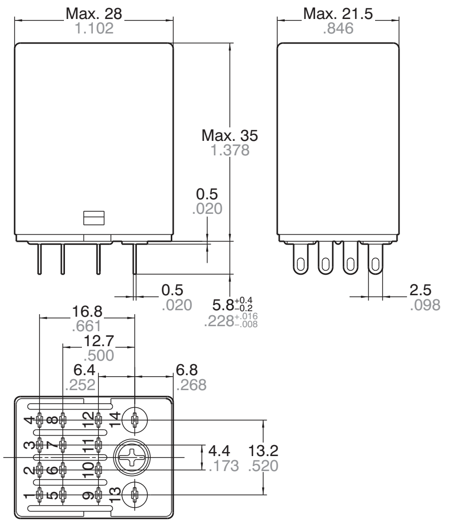


Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

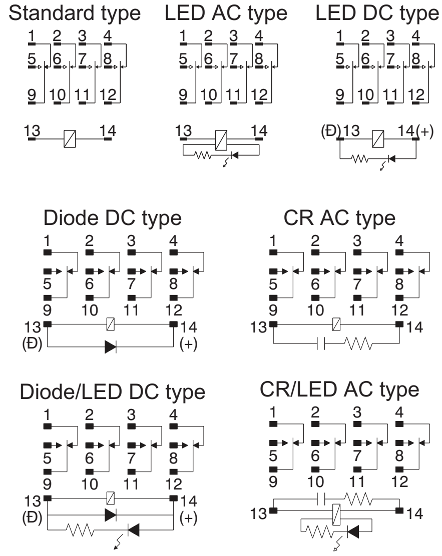
2. Plug-in type (4 Form C) (including diode/CR)

CAD Data

External dimensions



Schematic (Bottom view)



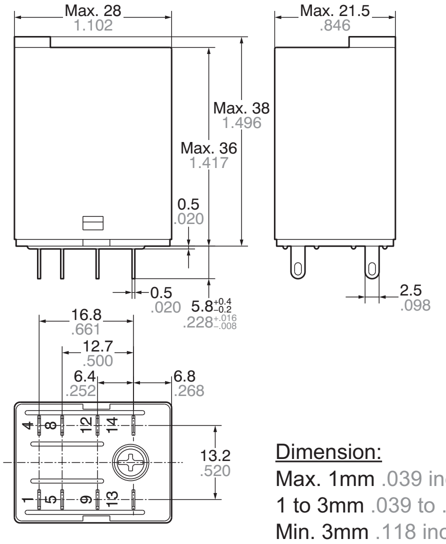
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Power

3. Plug-in type with a test button (2 Form C)

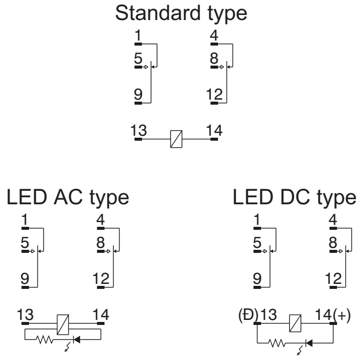
CAD Data

External dimensions



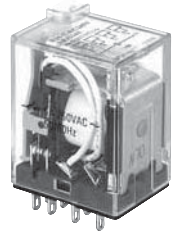
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

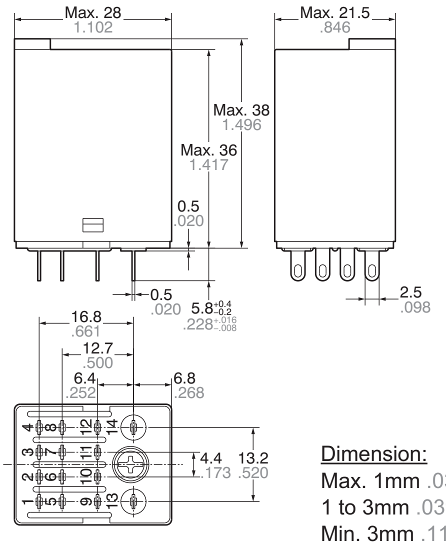


4. Plug-in type with a test button (4 Form C)

CAD Data

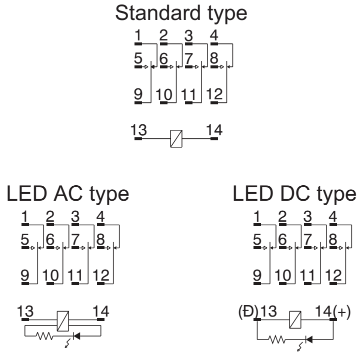


External dimensions



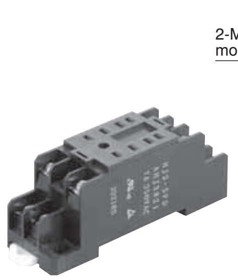
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

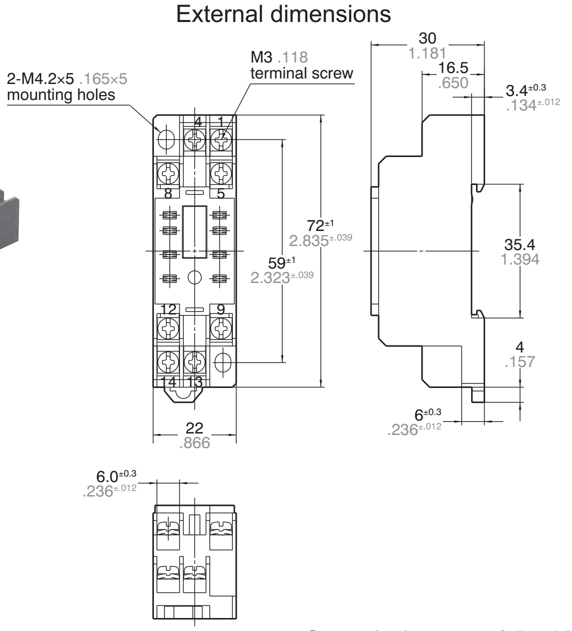


5. Terminal socket

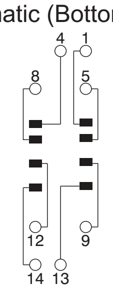
HJ2 terminal socket



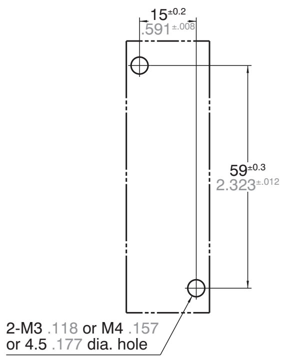
External dimensions



Schematic (Bottom view)

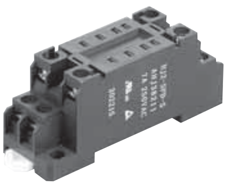


Mounting hole dimensions

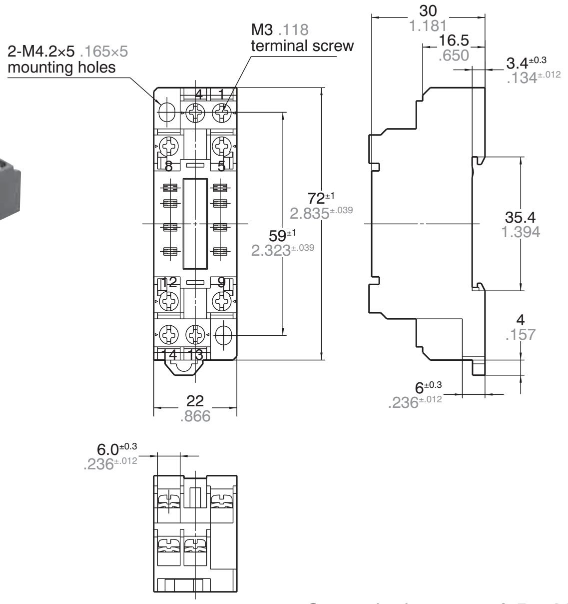


General tolerance: ±0.5 ±.020

HJ2 terminal socket (Finger protect type)

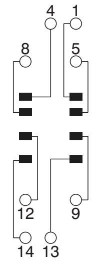


External dimensions

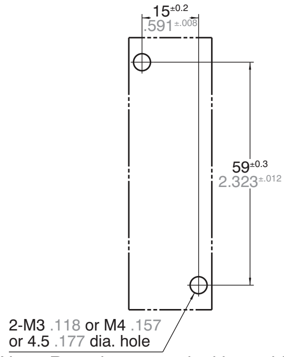


General tolerance: ±0.5 ±.020

Schematic (Bottom view)



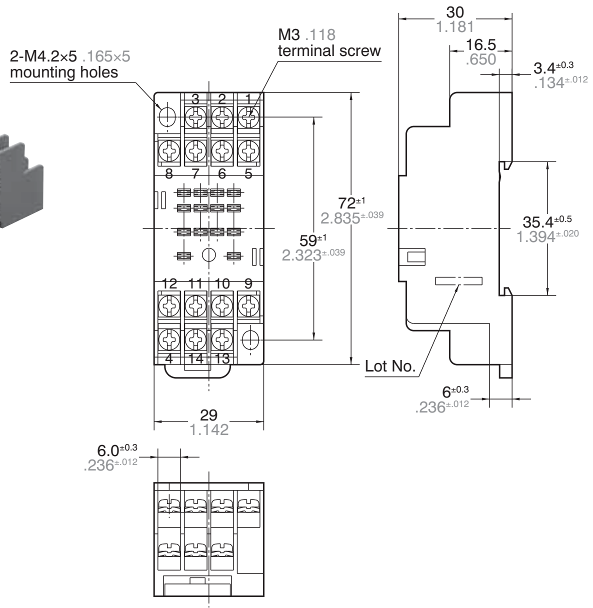
Mounting hole dimensions



Note: Round type terminal is unable to attach.

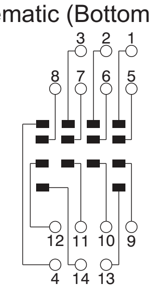
HJ4 terminal socket

External dimensions

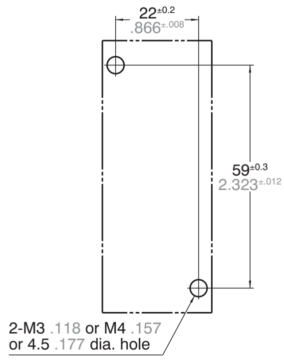


General tolerance: ±0.5 ±.020

Schematic (Bottom view)

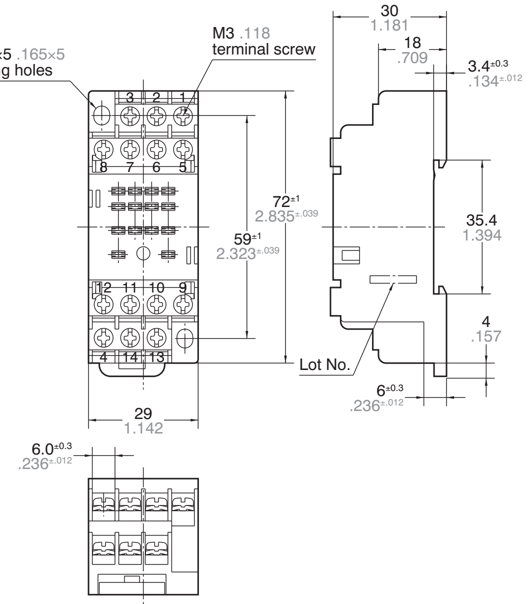


Mounting hole dimensions

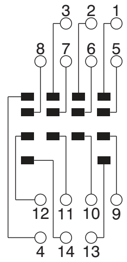


HJ4 terminal socket (Finger protect type)

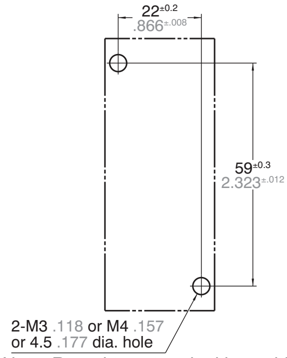
External dimensions



Schematic (Bottom view)



Mounting hole dimensions

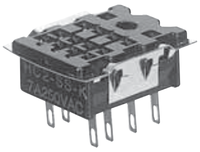


Note: Round type terminal is unable to attach.

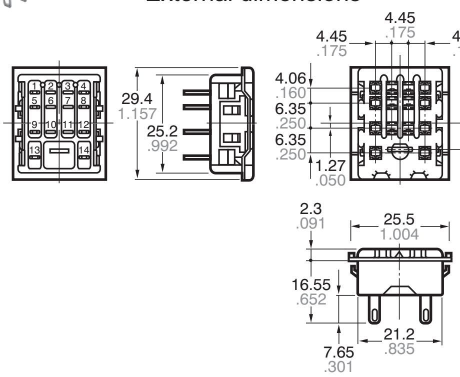
General tolerance: ±0.5 ±.020

6. Plug-in socket

HC2 - Socket for HJ relay (HC2-SS-K-H105)

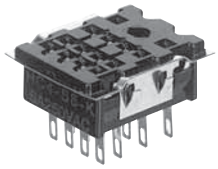


External dimensions

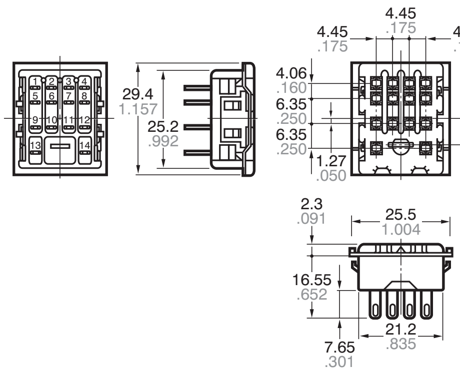


Tolerance: ±0.3 ±.012

HC4 - Socket for HJ relay (HC4-SS-K-H105)

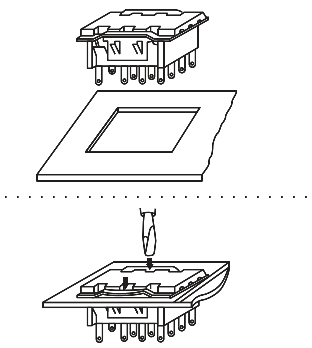


External dimensions

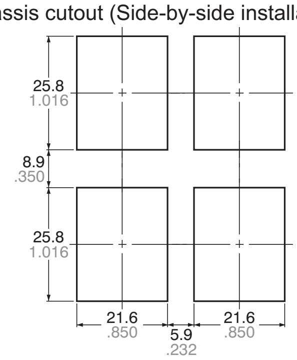


Tolerance: ±0.3 ±.012

Mounting hole diagram



Chassis cutout (Side-by-side installation)



Tolerance: ±0.2 ±.008

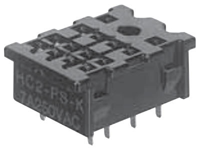
Notes: 1. Applicable chassis board thickness is 1.0 to 2.0 mm.
2. Installation is easy by inserting the socket from the top into the holes and by depressing the two down arrows on the retention fitting from the front.

With a relay mounted (HC2-SS-K-H105)

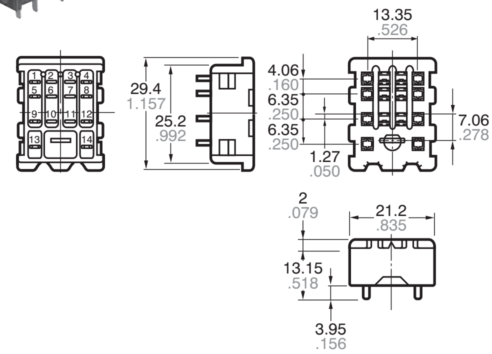
Hold-down clip is packaged with the socket. (Same product as plug-in socket (Part No.: HC2-SS-K) for HC relay except that hold-down clip shape is different.)

7. PC board socket

HC2 - PC board socket for HJ relay (HC2-PS-K-H105)

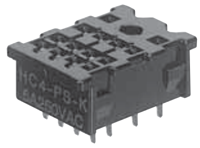


External dimensions

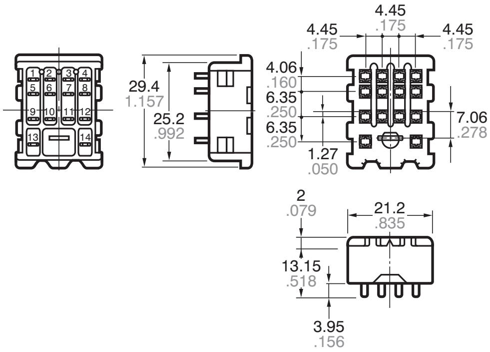


Tolerance: ±0.3 ±.012

HC4 - PC board socket for HJ relay (HC4-PS-K-H105)

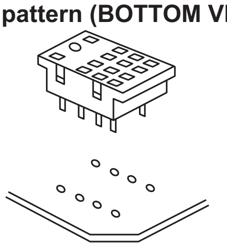


External dimensions

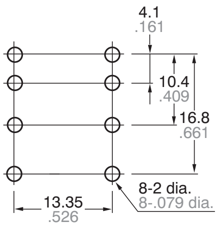


Tolerance: ±0.3 ±.012

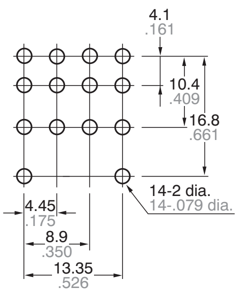
PC board pattern (BOTTOM VIEW)



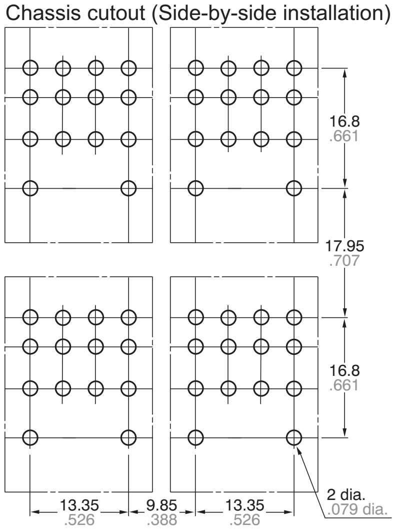
2 Form C



4 Form C



Chassis cutout (Side-by-side installation)



Tolerance: ±0.1 ±.004

With a relay mounted (HC2-PS-K-H105)

Hold-down clip is packaged with the socket. (Same product as PC board socket (Part No.: HC2-PS-K) for HC relay except that hold-down clip shape is different.)

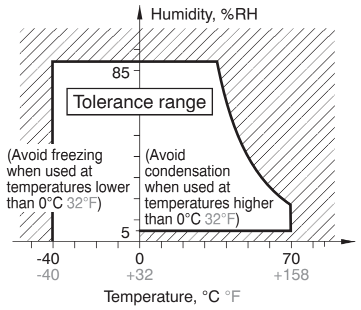
NOTES

1. Coil voltage
Please refer to “RATING” about coil input power supply.

2. LED display
Operation is displayed by the light emitted from the LED. The LED may remain briefly lit if voltage remains after the relay opens.

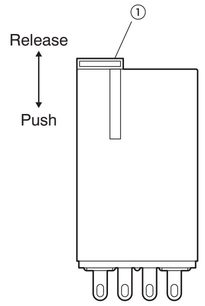
3. Switching lifetime
The switching lifetime is defined under the standard test condition specified in the JIS* C 5442 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase,ambient conditions and other factors.
Also, be especially careful of loads such as those listed below.
1) When used for AC load-operating and the operating phase is synchronous.
Rocking and fusing can easily occur due to contact shifting.
2) High-frequency load-operating
When high-frequency opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.
Three countermeasures for these are listed here.
(1) Incorporate an arc-extinguishing circuit.
(2) Lower the operating frequency
(3) Lower the ambient humidity

4. Usage, transport and storage conditions
1) Temperature, humidity and pressure during usage, storage and transport
(1) Temperature:
–40 to +70°C –40 to +158°F
(2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
Temperature and humidity range for usage, transport, and storage

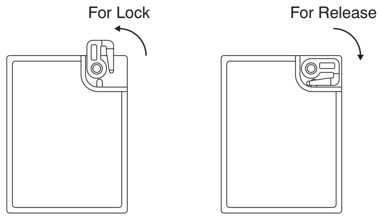


(3) Atmospheric pressure: 86 to 106 kPa
2) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
3) Freezing
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F.
This causes problems such as sticking of movable parts or operational time lags.
4) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

5. Operation method for test button
1) Push and release 1 gently to confirm relay switching.



2) To lock to one side turn 90° counter-clockwise while pushing lock and turn 90° clockwise to release.



3) Do not use the test button for anything other than testing, such as when checking the circuit.

6. Diode characteristics
1) Reverse breakdown voltage: 1,000 V
2) Forward current: 1 A

7. Diode and CR built-in type
Since the diode and CR inside the relay coil are designed to absorb the counter emf, the element may be damaged if a large surge, etc., is applied to the diode and CR. If there is the possibility of a large surge voltage from the outside, please implement measures to absorb it.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

15A (1C), 10 A (2C)
SPACE SAVING
POWER RELAY

HL RELAYS

FEATURES

1. Compact high-capacity control relay
In the same external dimensions as an HC relay, this compact power relay enables high-capacity control:
15 A for 1 Form C, 10 A for 2 Form C.
2. Designed for high reliability
High operational reliability is achieved by solder-less construction, in which all connections between lead wires and the contact springs and terminal plate are welded.
3. Various types provided in rich lineup. LED indicator type also available.
4. The terminals are compatible with #187 series tab terminals.
5. UL, CSA approval is standard

TYPICAL APPLICATIONS

Suitable for factory automation equipment and automotive devices
1. Control panels, power supply equipment, molding equipment, machine tools, welding equipment, agricultural equipment, etc.
2. Office equipment, automatic vending machines, telecommunications equipment, disaster prevention equipment, copiers, measuring devices, medical equipment, amusement devices, etc.
3. All types of household appliance

About Cd-free contacts
We have introduced Cadmium free type products to reduce Environmental Hazardous Substances. (The suffix “F” should be added to the part number.) Please replace parts containing Cadmium with Cadmium-free products and evaluate them with your actual application before use because the life of a relay depends on the contact material and load.

ORDERING INFORMATION

HL [ ] - [ ] - [ ] - F

Contact arrangement
1: 1 Form C
2: 2 Form C

Terminal arrangement
H: Plug-in type
L: Plug-in with LED indication
HP: PC board type
PL: PC board with LED indication
HTM: TM type

Coil voltage
AC 6, 12, 24, 48, 100 (100/110), 120 (110/120), 200 (200/220), 240 (220/240) V
DC 6, 12, 24, 48, 100 (100/110) V

Contact material
F: $AgSnO_2$ type

Notes: UL/CSA approved type is standard.
Please inquire about TV approved products.

TYPES

1. Plug-in type

Coil voltage	1 Form C	2 Form C
	Part No.	Part No.
6V AC	HL1-H-AC6V-F	HL2-H-AC6V-F
12V AC	HL1-H-AC12V-F	HL2-H-AC12V-F
24V AC	HL1-H-AC24V-F	HL2-H-AC24V-F
48V AC	HL1-H-AC48V-F	HL2-H-AC48V-F
100/110V AC	HL1-H-AC100V-F	HL2-H-AC100V-F
110/120V AC	HL1-H-AC120V-F	HL2-H-AC120V-F
200/220V AC	HL1-H-AC200V-F	HL2-H-AC200V-F
220/240V AC	HL1-H-AC240V-F	HL2-H-AC240V-F
6V DC	HL1-H-DC6V-F	HL2-H-DC6V-F
12V DC	HL1-H-DC12V-F	HL2-H-DC12V-F
24V DC	HL1-H-DC24V-F	HL2-H-DC24V-F
48V DC	HL1-H-DC48V-F	HL2-H-DC48V-F
100/110V DC	HL1-H-DC100V-F	HL2-H-DC100V-F

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

2. Plug-in type (with LED indication)

Coil voltage	1 Form C	2 Form C
	Part No.	Part No.
6V AC	HL1-L-AC6V-F	HL2-L-AC6V-F
12V AC	HL1-L-AC12V-F	HL2-L-AC12V-F
24V AC	HL1-L-AC24V-F	HL2-L-AC24V-F
48V AC	HL1-L-AC48V-F	HL2-L-AC48V-F
100/110V AC	HL1-L-AC100V-F	HL2-L-AC100V-F
110/120V AC	HL1-L-AC120V-F	HL2-L-AC120V-F
200/220V AC	HL1-L-AC200V-F	HL2-L-AC200V-F
220/240V AC	HL1-L-AC240V-F	HL2-L-AC240V-F
6V DC	HL1-L-DC6V-F	HL2-L-DC6V-F
12V DC	HL1-L-DC12V-F	HL2-L-DC12V-F
24V DC	HL1-L-DC24V-F	HL2-L-DC24V-F
48V DC	HL1-L-DC48V-F	HL2-L-DC48V-F
100/110V DC	HL1-L-DC100V-F	HL2-L-DC100V-F

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

3. PC board type

Coil voltage	1 Form C	2 Form C
	Part No.	Part No.
6V AC	HL1-HP-AC6V-F	HL2-HP-AC6V-F
12V AC	HL1-HP-AC12V-F	HL2-HP-AC12V-F
24V AC	HL1-HP-AC24V-F	HL2-HP-AC24V-F
48V AC	HL1-HP-AC48V-F	HL2-HP-AC48V-F
100/110V AC	HL1-HP-AC100V-F	HL2-HP-AC100V-F
110/120V AC	HL1-HP-AC120V-F	HL2-HP-AC120V-F
200/220V AC	HL1-HP-AC200V-F	HL2-HP-AC200V-F
220/240V AC	HL1-HP-AC240V-F	HL2-HP-AC240V-F
6V DC	HL1-HP-DC6V-F	HL2-HP-DC6V-F
12V DC	HL1-HP-DC12V-F	HL2-HP-DC12V-F
24V DC	HL1-HP-DC24V-F	HL2-HP-DC24V-F
48V DC	HL1-HP-DC48V-F	HL2-HP-DC48V-F
100/110V DC	HL1-HP-DC100V-F	HL2-HP-DC100V-F

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

4. PC board type (with LED indication)

Coil voltage	1 Form C	2 Form C
	Part No.	Part No.
6V AC	HL1-PL-AC6V-F	HL2-PL-AC6V-F
12V AC	HL1-PL-AC12V-F	HL2-PL-AC12V-F
24V AC	HL1-PL-AC24V-F	HL2-PL-AC24V-F
48V AC	HL1-PL-AC48V-F	HL2-PL-AC48V-F
100/110V AC	HL1-PL-AC100V-F	HL2-PL-AC100V-F
110/120V AC	HL1-PL-AC120V-F	HL2-PL-AC120V-F
200/220V AC	HL1-PL-AC200V-F	HL2-PL-AC200V-F
220/240V AC	HL1-PL-AC240V-F	HL2-PL-AC240V-F
6V DC	HL1-PL-DC6V-F	HL2-PL-DC6V-F
12V DC	HL1-PL-DC12V-F	HL2-PL-DC12V-F
24V DC	HL1-PL-DC24V-F	HL2-PL-DC24V-F
48V DC	HL1-PL-DC48V-F	HL2-PL-DC48V-F
100/110V DC	HL1-PL-DC100V-F	HL2-PL-DC100V-F

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

5. TM type

Coil voltage	1 Form C	2 Form C
	Part No.	Part No.
6V AC	HL1-HTM-AC6V-F	HL2-HTM-AC6V-F
12V AC	HL1-HTM-AC12V-F	HL2-HTM-AC12V-F
24V AC	HL1-HTM-AC24V-F	HL2-HTM-AC24V-F
48V AC	HL1-HTM-AC48V-F	HL2-HTM-AC48V-F
100/110V AC	HL1-HTM-AC100V-F	HL2-HTM-AC100V-F
110/120V AC	HL1-HTM-AC120V-F	HL2-HTM-AC120V-F
200/220V AC	HL1-HTM-AC200V-F	HL2-HTM-AC200V-F
220/240V AC	HL1-HTM-AC240V-F	HL2-HTM-AC240V-F
6V DC	HL1-HTM-DC6V-F	HL2-HTM-DC6V-F
12V DC	HL1-HTM-DC12V-F	HL2-HTM-DC12V-F
24V DC	HL1-HTM-DC24V-F	HL2-HTM-DC24V-F
48V DC	HL1-HTM-DC48V-F	HL2-HTM-DC48V-F
100/110V DC	HL1-HTM-DC100V-F	HL2-HTM-DC100V-F

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

RATING

1. Coil data

1) AC coils

Nominal coil voltage	Nominal coil current (mA)		Nominal operating power (VA)		Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Inductance (H)		Max. allowable voltage
	50Hz	60Hz	50Hz	60Hz			When drop-out	When operating	
6V AC	224	200	1.3	1.2	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	0.078	0.074	110%V of nominal voltage
12V AC	111	100	1.3	1.2			0.312	0.295	
24V AC	56	50	1.3	1.2			1.243	1.181	
48V AC	28	25	1.3	1.2			4.974	4.145	
100/110V AC	13.4/14.7	12/13.2	1.3	1.2			23.75	20.63	
110/120V AC	12.2/13.5	10.9/11.9	1.3	1.2			27.19	25.57	
200/220V AC	6.7/7.4	6/6.6	1.3	1.2			85.98	81.76	

Notes: 1. The relay operates in a range of 80% to 110% V of the voltage rating, but ideally, in consideration of temporary voltage fluctuations, it should be operated at the rated voltage.
In particular, for AC operation, if the applied voltage drops to 80% V or more below the rated voltage, humming will occur and a large current will flow leading possibly to coil burnout.
2. The maximum allowable voltage is the maximum voltage fluctuation value for the coil power supply. This value is not a permissible value for continuous operation. (This value differs depending on the ambient temperature. Please contact us for details.

2) DC coils (at 20°C 68°F)

Nominal coil voltage	Nominal coil current (mA)	Nominal operating power (W)	Coil resistance (Ω)	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Max. allowable voltage (at 70°C 158°F)
6V DC	150	0.9	40	80%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	110%V of nominal voltage
12V DC	75	0.9	160			
24V DC	37	0.9	650			
48V DC	18.5	0.9	2,600			
100/110V DC	10	1.0	10,000			

Notes: 1. The rated excitation current is ±10% (20°C 68°F).
2. The coil resistance for DC operation is the value measured when the coil temperature is 20°C 68°F. Compensate ±0.4% for every ±1°C change in temperature.
3. The relay operates in a range of 80% to 110% V of the voltage rating, but ideally, in consideration of temporary voltage fluctuations, it should be operated at the rated voltage.
4. For use with 200 V DC, connect a 10 KΩ (5W) resistor, in series, to the 100 V DC relay.
5. The maximum allowable voltage is the maximum voltage fluctuation value for the coil power supply. This value is not a permissible value for continuous operation. (This value differs depending on the ambient temperature. Please contact us for details.)

2. Specifications

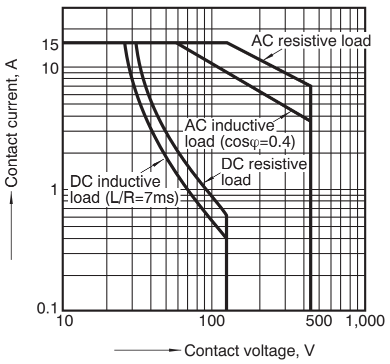
Characteristics	Item		Specifications
Contact	Initial contact resistance, max		Max. 50 mΩ (By voltage drop 6 V DC 1A)
	Contact material		$AgSnO_2$ type
Rating	Nominal switching capacity		1 Form C: 15A 125V AC, 10A 250V AC (resistive load) 2 Form C: 10A 125V AC (resistive load)
	Min. switching capacity (Reference value)*1		100mA 5V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500V DC) Measurement at same location as "Initial breakdown voltage" section.
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1min. (Detection current: 10mA.)
		Between contact sets	1,500 Vrms for 1min. (Detection current: 10mA.)
		Between contact and coil	2,000 Vrms for 1min. (Detection current: 10mA.)
	Temperature rise		Max. 80°C (By resistive method, nominal voltage)
	Operate time (at 20°C 68°F)*2		DC type/AC type: Max. 25ms (Nominal voltage applied to the coil, excluding contact bounce time.)
	Release time (at 20°C 68°F)*2		DC type/AC type: Max. 25ms (Nominal voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 196 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10µs.)
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1 mm (Detection time: 10µs.)
		Destructive	10 to 55 Hz at double amplitude of 2 mm
Expected life	Mechanical		AC type: 5×10^7 (at 180 cpm), DC type: 10^8 (at 180 cpm)
	Electrical	AC load	1 Form C: 15A 125V AC, 10A 250V AC resistive load (cosφ=1) Life switching cycle: Min. 5×10^5 2 Form C: 10A 250V AC resistive load (cosφ=1) Life switching cycle: Min. 3×10^5
		DC load	1 Form C: 3A 30V DC resistive load (cosφ=1) Life switching cycle: Min. 5×10^5 2 Form C: 3A 30V DC resistive load (cosφ=1) Life switching cycle: Min. 5×10^5
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –50°C to +70°C –58°F to +158°F (Without LED indication); –50°C to +60°C –58°F to +140°F (With LED indication) Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. Operating speed		20 cpm (at max. rating)
Unit weight			Approx. 35g 1.23 oz

Notes:
If integrating into electrical appliances that will be subject to compliance to the Electrical Appliance and Material Safety Law, please use in an ambient temperature between –50°C to +40°C –58°F to +104°F (AC type).

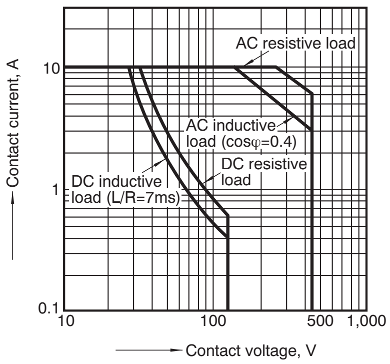
*1 This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.
*2 For the AC coil types, the operate/release time will differ depending on the phase.
*3 The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

Switching capacity range (1 Form C)



Switching capacity range (2 Form C)



DIMENSIONS (mm inch)

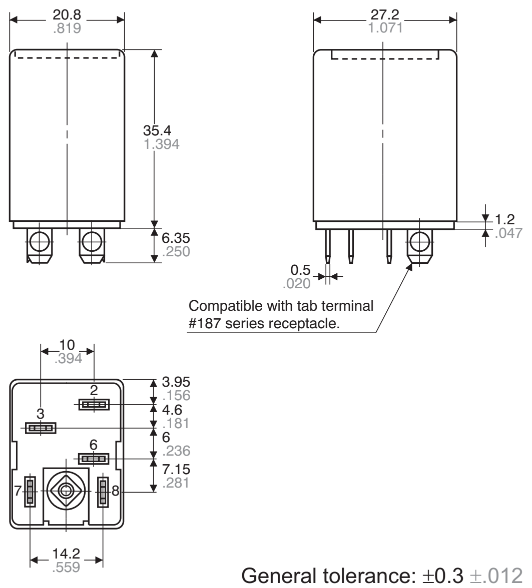
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. Plug-in type

1 Form C

CAD Data

External dimensions



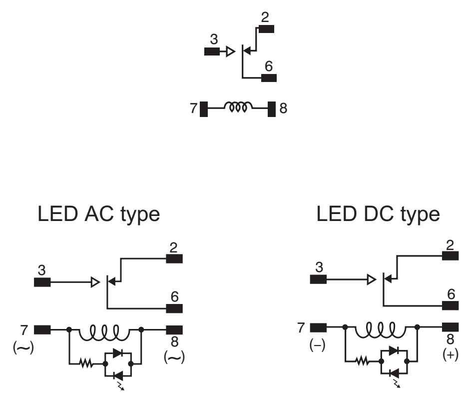
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

Standard type

LED AC type

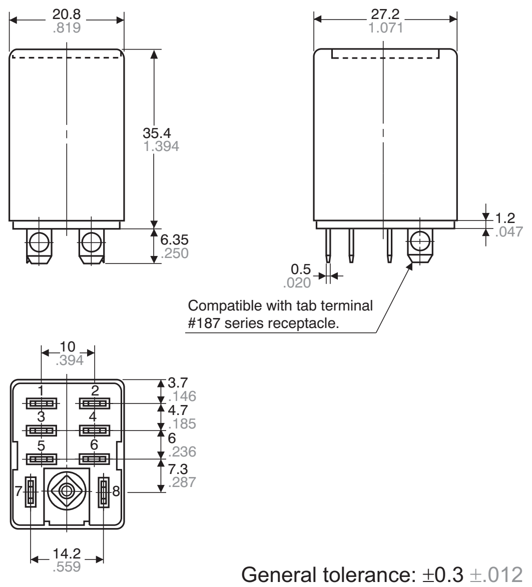
LED DC type



2 Form C

CAD Data

External dimensions



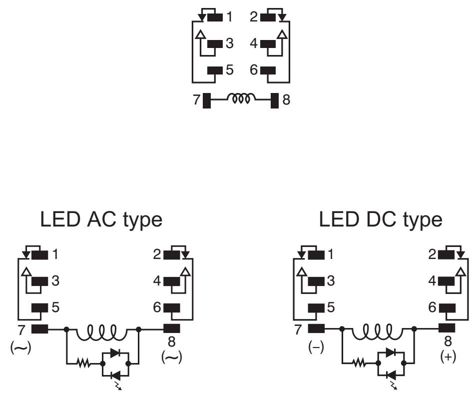
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

Standard type

LED AC type

LED DC type

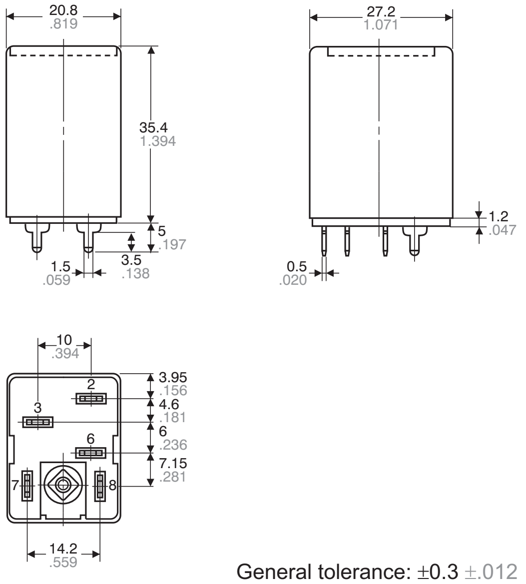


2. PC board type

1 Form C

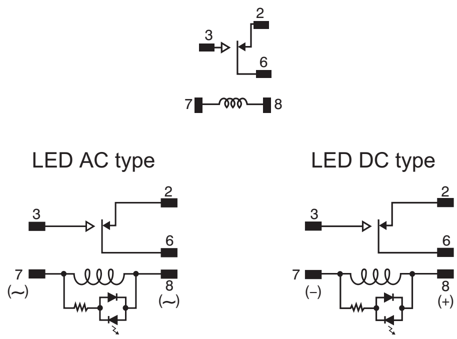
CAD Data

External dimensions

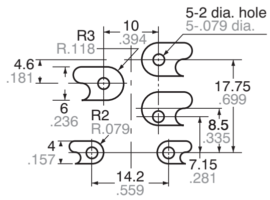


General tolerance: ±0.3 ±.012

Schematic (Bottom view)



PC board pattern (Bottom view)

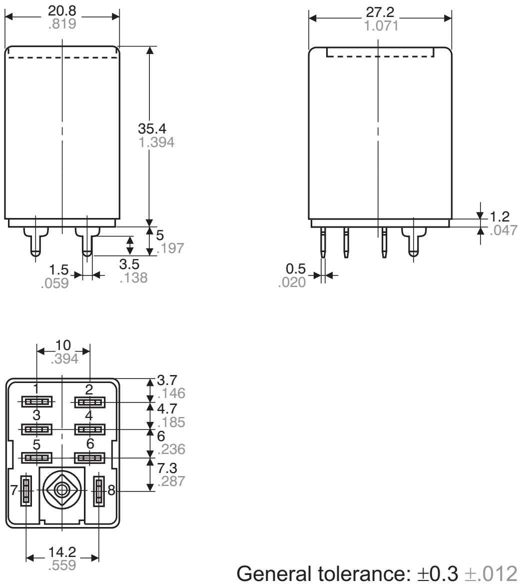


Tolerance: ±0.1 ±.004

2 Form C

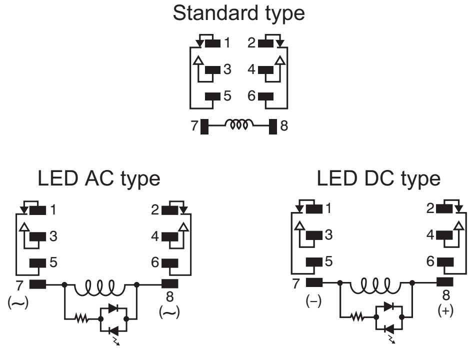
CAD Data

External dimensions

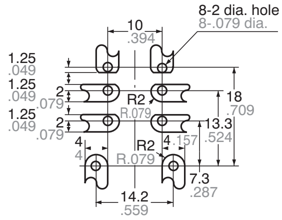


General tolerance: ±0.3 ±.012

Schematic (Bottom view)



PC board pattern (Bottom view)



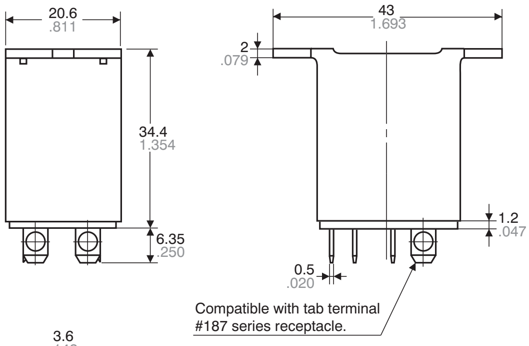
Tolerance: ±0.1 ±.004

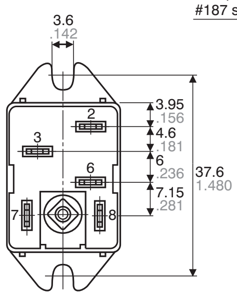
3. TM type

1 Form C

CAD Data

External dimensions

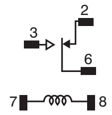




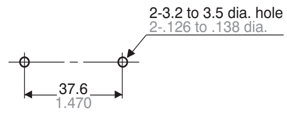
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

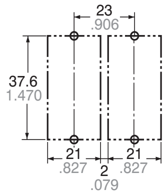
Standard type



Chassis (Panel) cutout



Chassis (Panel) cutout in tandem mounting



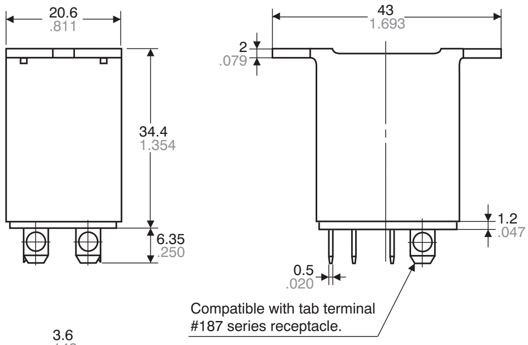
Tolerance: ±0.1 ±.004

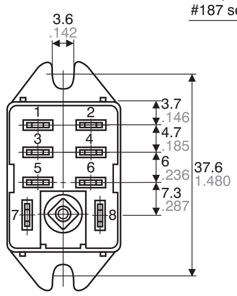
Notes: 1. If connecting to #187 series tab terminals, use AMP Faston #187 series or #187 tab terminals conforming to UL or CSA inch-standard dimensions.
2. In mounting, use M3 screws and M3 washers.
3. When mounting TM types, use washers to prevent damage or distortion to the polycarbonate cover.
4. When tightening fixing screws, the optimum torque range should be 0.294 to 0.49 N·m, (3 to 5 kgf·cm). Moreover, use washers to prevent loosening.

2 Form C

CAD Data

External dimensions

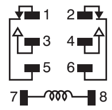




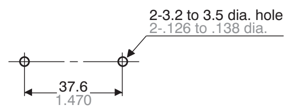
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

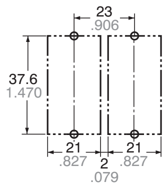
Standard type



Chassis (Panel) cutout



Chassis (Panel) cutout in tandem mounting



Tolerance: ±0.1 ±.004

Notes: 1. If connecting to #187 series tab terminals, use AMP Faston #187 series or #187 tab terminals conforming to UL or CSA inch-standard dimensions.
2. In mounting, use M3 screws and M3 washers.
3. When mounting TM types, use washers to prevent damage or distortion to the polycarbonate cover.
4. When tightening fixing screws, the optimum torque range should be 0.294 to 0.49 N·m, (3 to 5 kgf·cm). Moreover, use washers to prevent loosening.

For Cautions for Use, see Relay Technical Information (page 582).

TYPES

1. HL relay connection accessories include plug-in sockets, PC board sockets, and terminal socket for DIN rails.
2. UL/CSA approval is standard.

3. A hold-down clip is included in the package.

The fixing method is the same as for HL sockets, HC sockets and ordinary HC terminal sockets.

HC/HL-LEAF-SPRING-MK

The fixing method is the same as for the HL DIN rail terminal sockets and the HC DIN terminal sockets.

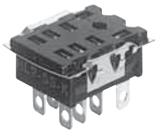
HC/HL-LEAF-SPRING-K

Type	No. of poles	Item	Part No.	Packing quantity	
				Carton	Case
Plug-in socket	1-pole	HL1 socket	HL1-SS-K	20 pcs.	200 pcs.
	2-pole	HL2 socket	HL2-SS-K		
PC board socket	1-pole	HL1 PC board socket	HL1-PS-K		
	2-pole	HL2 PC board socket	HL2-PS-K		
DIN rail terminal socket	1/2-pole (common)	HL2-DIN terminal socket	HL2-SFD-K	10 pcs.	100 pcs.

DIMENSIONS (Unit: mm inch)

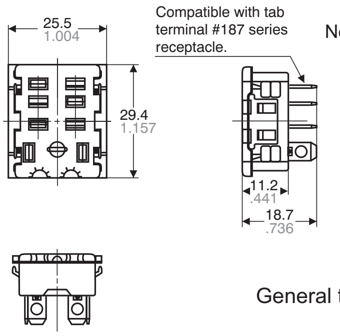
1. Plug-in type sockets

HL1 Socket (HL1-SS-K)



HL2 Socket (HL2-SS-K)

HL1 socket External dimensions



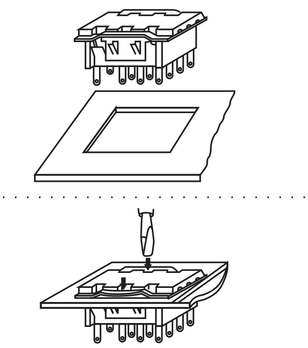
Note: The external and mounting dimensions of HL2 socket are the same for HL1 socket types. Only the number of terminals varies.

General tolerance: ±0.3 ±.012

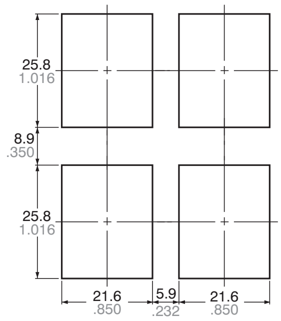
Hold-down clip

Hold-down clip is packaged with the socket.
(Applied to HC sockets and ordinary HC terminal sockets)

Mounting hole diagram



Side-by-side installation



Tolerance: ±0.1 ±.004

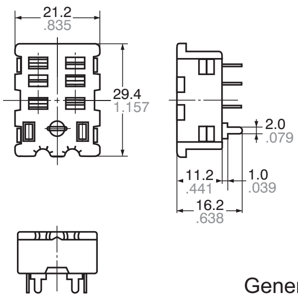
Notes: 1. Applicable chassis board thickness is 1.0 to 2.0 mm.
2. Installation is easy by inserting the socket from the top into the holes and by depressing the two down arrows on the retention fitting from the front.

2. PC board type sockets

HL1 PC board type socket
(HL1-PS-K)

HL2 PC board type socket
(HL2-PS-K)

HL2 PC board type socket
External dimensions



Note: The external and mounting dimensions of HL2 PC board type socket are the same for HL1 PC board type socket. Only the number of terminals varies.

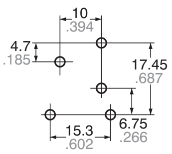
General tolerance: ±0.3 ±.012

Hold-down clip

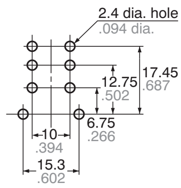
Hold-down clip is packaged with the socket.
(Applied to HC sockets and ordinary HC terminal sockets)

PC board pattern (Bottom view)

1 Form C

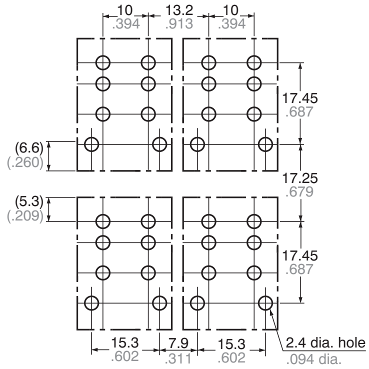


2 Form C



Tolerance: ±0.1 ±.004

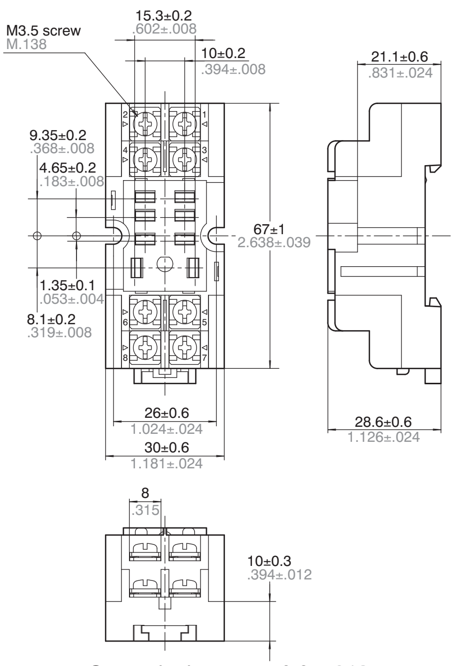
Side-by-side installation (For 2 Form C)



Tolerance: ±0.1 ±.004

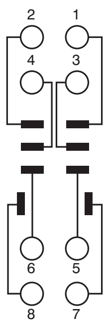
3. Terminal sockets for DIN rail assembly (HL2-SFD-K)

HL2-terminal sockets for DIN rail
External dimensions



General tolerance: ±0.3 ±.012

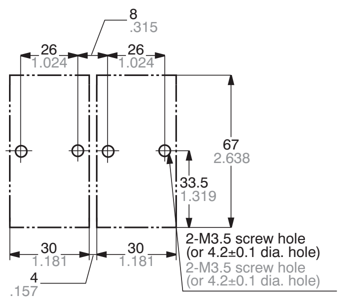
Schematic



With a relay mounted

Hold-down clip is packaged with the terminal socket. (Applied to HC DIN rail terminal sockets)

Mounting hole diagram



Tolerance: ±0.1 ±.004

Chassis (Panel) cutout in tandem (side-by-side) mounting

*To prevent damage or distortion, when tightening fixing screws, the optimum torque range should be 0.784 to 0.98 N·m, (8 to 10 kgf·cm).

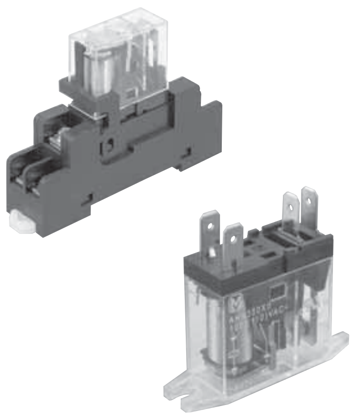
For Cautions for Use, see Relay Technical Information (page 584).

c UL us (TM type: under application) VDE

Panasonic
ideas for life

FLAT/VERTICAL TYPE
HIGH POWER BIFURCATED
CONTACT

HN RELAYS (AHN)



FEATURES

1. Slim and compact size
20% smaller (width and height) than existing model* (with the condition of screw terminal socket for DIN rail)
*Compared with our HC/HJ relay.

2. High-capacity and high reliability
Max. switching current:
16 A (for 1 Form C type at AC load)
Uses gold-flashed contacts for highly reliable contact (for 2 Form C type).

3. Environmentally friendly
Cadmium-free contacts and lead-free solder are used.

4. Slim screw terminal socket and PC board terminal socket
Utilizes relay-securing hook for easy relay removal.
One-touch relay removal possible.
Terminal sockets with finger protect function available.

5. Full lineup
We added a TM type that can be built into devices.

TYPICAL APPLICATIONS

Control panels
Power supply units
Molding machines
Machine tools
Welding equipment
Agricultural equipment
Office equipment
Vending machines
Communications equipment
Amusement machines, etc.

ORDERING INFORMATION

AHN ☐ ☐ ☐ ☐☐

HN relays

Contact arrangement
1: 1 Form C
2: 2 Form C
3: 1 Form A (TM type only)

Terminal arrangement
1: AC plug-in type
2: DC plug-in type
5: AC TM type
6: DC TM type

Type classification
0: Standard
1: With LED indication
2: With diode
3: With diode and LED indication

Coil voltage
05: 5 V, 06: 6 V, 12: 12 V, 24: 24 V, 48: 48 V
X0: 100/110 V AC, 100 V DC
X1: 110/120 V AC, 110 V DC
Y0: 200/220 V AC, Y2: 220/240 V AC

Note: Products conform to UL/C-UL and VDE, as standard.
(VDE under application for TM type.)

TYPES

1. Plug-in type

Coil voltage	1 Form C	2 Form C
	Part No.	Part No.
5V DC	AHN12005	AHN22005
6V DC	AHN12006	AHN22006
12V DC	AHN12012	AHN22012
24V DC	AHN12024	AHN22024
48V DC	AHN12048	AHN22048
100V DC	AHN120X0	AHN220X0
110V DC	AHN120X1	AHN220X1
12V AC	AHN11012	AHN21012
24V AC	AHN11024	AHN21024
100/110V AC	AHN110X0	AHN210X0
110/120V AC	AHN110X1	AHN210X1
200/220V AC	AHN110Y0	AHN210Y0
220/240V AC	AHN110Y2	AHN210Y2

Note: Packing quantity; Carton: 50 pcs, Case: 500 pcs.

2. Plug-in type (with LED indication)

Coil voltage	1 Form C	2 Form C
	Part No.	Part No.
5V DC	AHN12105	AHN22105
6V DC	AHN12106	AHN22106
12V DC	AHN12112	AHN22112
24V DC	AHN12124	AHN22124
48V DC	AHN12148	AHN22148
100V DC	AHN121X0	AHN221X0
110V DC	AHN121X1	AHN221X1
12V AC	AHN11112	AHN21112
24V AC	AHN11124	AHN21124
100/110V AC	AHN111X0	AHN211X0
110/120V AC	AHN111X1	AHN211X1
200/220V AC	AHN111Y0	AHN211Y0
220/240V AC	AHN111Y2	AHN211Y2

Note: Packing quantity; Carton: 50 pcs, Case: 500 pcs.

3. Plug-in type (with diode)

Coil voltage	1 Form C	2 Form C
	Part No.	Part No.
5V DC	AHN12205	AHN22205
6V DC	AHN12206	AHN22206
12V DC	AHN12212	AHN22212
24V DC	AHN12224	AHN22224
48V DC	AHN12248	AHN22248
100V DC	AHN122X0	AHN222X0
110V DC	AHN122X1	AHN222X1

Note: Packing quantity; Carton: 50 pcs, Case: 500 pcs.

4. Plug-in type (with diode and LED indication)

Coil voltage	1 Form C	2 Form C
	Part No.	Part No.
5V DC	AHN12305	AHN22305
6V DC	AHN12306	AHN22306
12V DC	AHN12312	AHN22312
24V DC	AHN12324	AHN22324
48V DC	AHN12348	AHN22348
100V DC	AHN123X0	AHN223X0
110V DC	AHN123X1	AHN223X1

Note: Packing quantity; Carton: 50 pcs, Case: 500 pcs.

5. TM type

Coil voltage	1 Form A
	Part No.
5V DC	AHN36005
6V DC	AHN36006
12V DC	AHN36012
24V DC	AHN36024
48V DC	AHN36048
100V DC	AHN360X0
110V DC	AHN360X1
12V AC	AHN35012
24V AC	AHN35024
100/110V AC	AHN350X0
110/120V AC	AHN350X1
200/220V AC	AHN350Y0
220/240V AC	AHN350Y2

Note: Packing quantity; Carton: 50 pcs, Case: 500 pcs.

6. Accessories

Type	No. of poles	Item	Part No.
Screw terminal socket	1-pole	HN1 screw terminal socket	AHNA11
		HN1 screw terminal socket (Finger protect type)	AHNA11P
	2-pole	HN2 screw terminal socket	AHNA21
		HN2 screw terminal socket (Finger protect type)	AHNA21P
PC board terminal socket	1-pole	HN1 PC board terminal socket	AHNA13
	2-pole	HN2 PC board terminal socket	AHNA23

Notes: 1. Packing quantity: 10pcs. (Carton), 100pcs. (Case)
2. Products conform to UL/C-UL, as standard.

• Specifications

Item		Performance					
Type		HN1 screw terminal socket	HN1 screw terminal socket (Finger protect type)	HN1 PC board terminal socket	HN2 screw terminal socket	HN2 screw terminal socket (Finger protect type)	HN2 PC board terminal socket
Contact arrangement		1 Form C			2 Form C		
Max. continuous current (Ambient temperature: –40 to +70°C –40 to +158°F)		16A*	10A	10A	5A	5A	5A
Initial breakdown voltage	Between open contacts	1, 000 Vrms for 1 min. (Detection current: 10mA)					
	Between contact sets	—			3, 000 Vrms for 1 min. (Detection current: 10mA)		
	Between contact and coil	5, 000 Vrms for 1 min. (Detection current: 10mA)					
Initial insulation resistance		1, 000 MΩ between each terminal (500V DC)					

* When using with current of 16 A (for HN1 screw terminal socket), the maximum ambient temperature is 50°C.
When using between 50°C and 70°C, please reduce by 0.1 A/°C.
Notes: 1. In order to prevent breakage and disfiguring, the screw tightening torque for the terminal socket should be within the range of 0.5 to 0.8 N·m.
2. When attaching the terminal socket directly to a chassis, please use the metric coarse thread screw.
- AHNA11 and AHNA21: M3 × 16, - AHNA11P and AHNA21P: M3 × 30

RATING

1. Coil data

1) DC coils

Coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal coil current [±20%]	Coil resistance (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 20°C 68°F)
5V DC	70%V or less of nominal voltage (Initial)	15%V or more of nominal voltage (Initial)	106.4mA	47Ω [±10%]	0.53W	170%V of nominal voltage
6V DC			88.2mA	68Ω [±10%]		
12V DC			44.4mA	270Ω [±10%]		
24V DC			22.0mA	1,090Ω [±10%]		
48V DC			11.0mA	4,350Ω [±10%]		
100V DC			5.3mA	18,870Ω [±10%]		
110V DC			4.8mA	22,830Ω [±10%]		

2) AC coils (50/60Hz)

Coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal coil current [±20%]		Nominal operating power		Max. Allowable voltage (at 20°C 68°F)
			50Hz	60Hz	50Hz	60Hz	
12V AC	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	93mA	75mA	Approx. 1.1 to 1.4 V A	Approx. 0.9 to 1.2 V A	140%V of nominal voltage
24V AC			46.5mA	37.5mA			
100/110V AC			11.0/13.0mA	9.0/10.6mA			
110/120V AC			10.0/11.8mA	8.2/9.7mA			
200/220V AC			5.5/6.5mA	4.5/5.3mA			
220/240V AC			5.0/5.9mA	4.1/4.8mA			

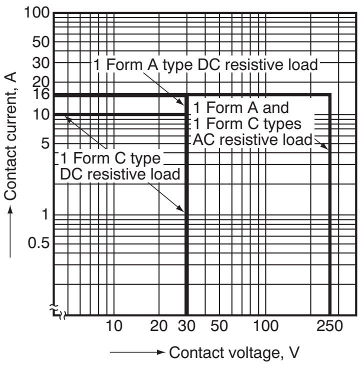
2. Specifications (Plug-in Standard type and TM type)

Characteristics	Item		Specifications		
Contact	Arrangement		1 Form C	2 Form C	1 Form A (TM type)
	Initial contact resistance, max		Max. 100 mΩ (By voltage drop 6 V DC 1A)	Max. 50 mΩ (By voltage drop 6 V DC 1A)	Max. 100 mΩ (By voltage drop 6 V DC 1A)
	Contact material		$AgSnO_2$ type	Au-flashed AgNi type	$AgSnO_2$ type
Rating	Nominal switching capacity (resistive load)		10A 250V AC, 10A 30V DC	5A 250V AC, 5A 30V DC	16A 250V AC, 16A 30V DC
	Max. switching power (resistive load)		4,000VA, 300W	1,250VA, 150W	4,000VA, 480W
	Max. switching voltage		250V AC, 30V DC		
	Max. switching current		16A (at AC load), 10A (at DC load)	5A	16A
	Nominal operating power		0.53W, 0.9VA		
	Min. switching capacity (Reference value)*1		100mA 5V DC	1mA 1V DC	100mA 5V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.		
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1min. (Detection current: 10mA.)		
		Between contact sets	—	3,000 Vrms for 1min. (Detection current: 10mA.)	—
		Between contact and coil	5,000 Vrms for 1min. (Detection current: 10mA.)		
	Temperature rise (at 70°C 158°F)		Max. 60°C (By resistive method, nominal voltage)		
	Operate time (at 20°C 68°F)*2		Max. 15ms (Nominal voltage applied to the coil, excluding contact bounce time.)		
	Release time (at 20°C 68°F)*2		Max. 5ms (Nominal voltage applied to the coil, excluding contact bounce time.) (without diode)/ Max. 20ms (with diode)		
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s^2 (Half-wave pulse of sine wave: 11 ms; detection time: 10µs.)		
		Destructive	Min. 1,000 m/s^2 (Half-wave pulse of sine wave: 6 ms.)		
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1.5 mm (Detection time: 10µs.)		
		Destructive	10 to 55 Hz at double amplitude of 1.5 mm		
Expected life	Mechanical		AC: Min. 10^7; DC: Min. 2×10^7 (at 300 cpm)		
	Electrical (resistive load)		Min. 10^5 (at 20 cpm)		Min. 10^5 (at 10 cpm)
Conditions	Conditions for operation, transport and storage*3 (Not freezing and condensing at low temperature)		Ambient temperature: –40°C to +70°C –40°F to +158°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)		
	Max. Operating speed		20 cpm (at rated load)		10 cpm (at rated load)
Unit weight			Approx. 19 g .67 oz	Approx. 17 g .60 oz	Approx. 19 g .67 oz

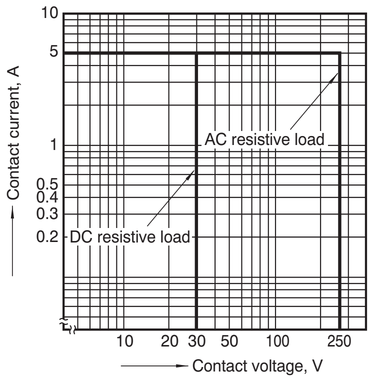
*1This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.
*2For the AC coil types, the operate/release time will differ depending on the phase.
*3Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

1-(1). Max. switching capacity (1 Form C and 1 Form A)

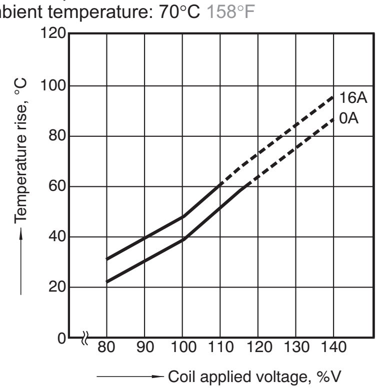


1-(2). Max. switching capacity (2 Form C)

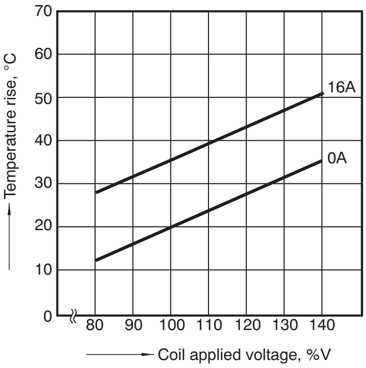


2-(1). Coil temperature rise (1 Form C/AC and 1 Form A/AC types)

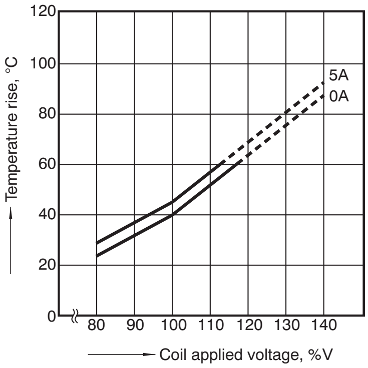
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



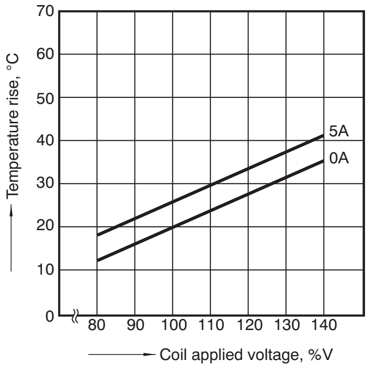
2-(2). Coil temperature rise (1 Form C/DC and 1 Form A/DC types)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



2-(3). Coil temperature rise (2 Form C/AC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



2-(4). Coil temperature rise (2 Form C/DC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



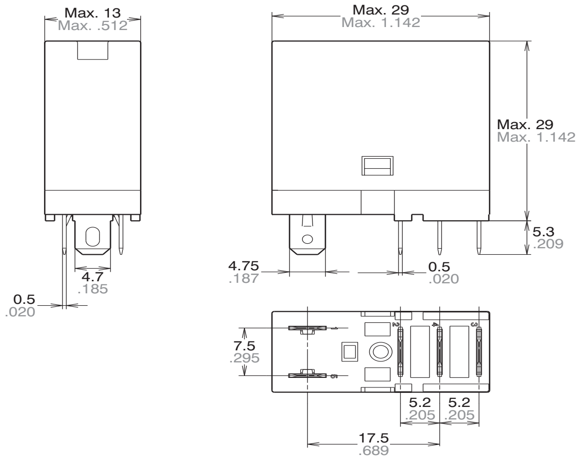
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

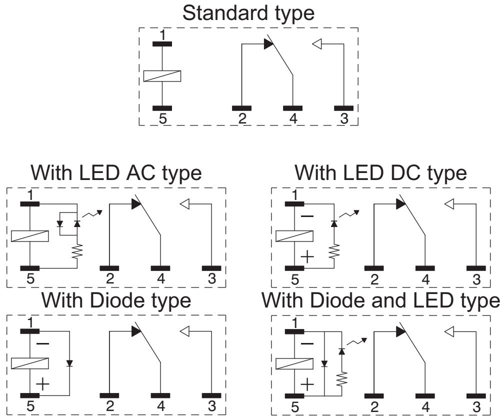
1. Plug-in type 1 Form C

CAD Data

External dimensions



Schematic (Bottom view)



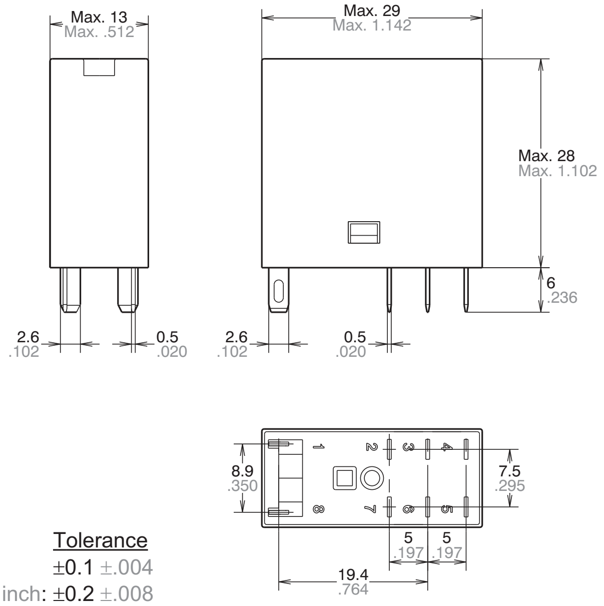
Dimension :	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Power

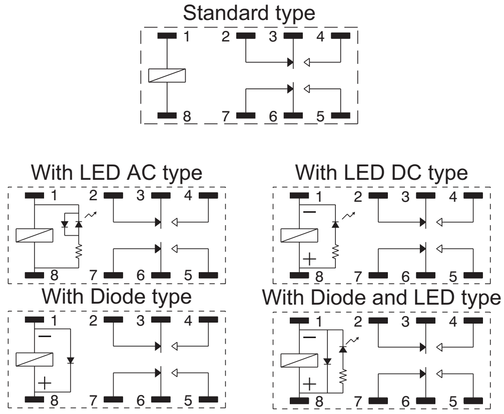
2. Plug-in type 2 Form C

CAD Data

External dimensions



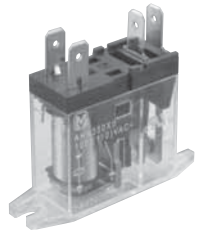
Schematic (Bottom view)



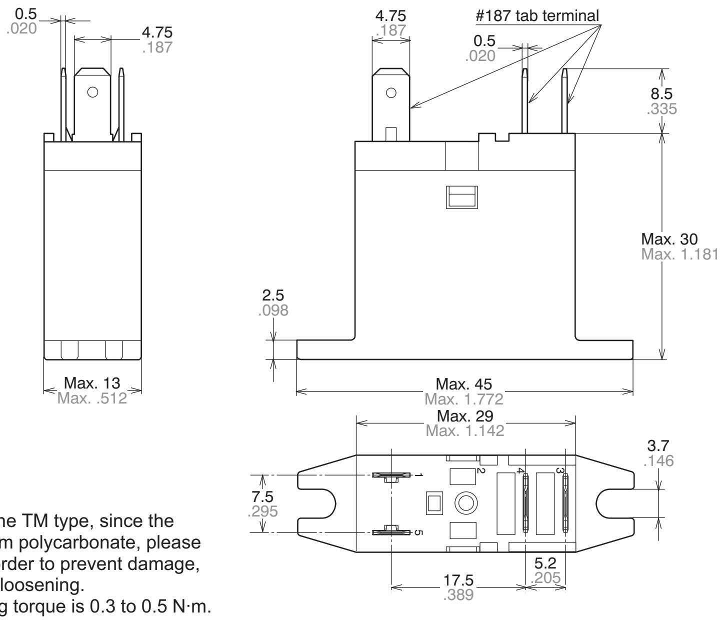
Dimension :	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

3. TM type 1 Form A

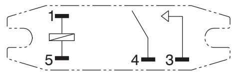
CAD Data



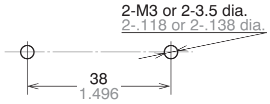
External dimensions



Schematic



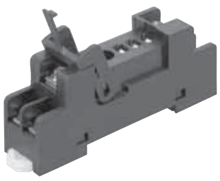
Mounting hole dimensions



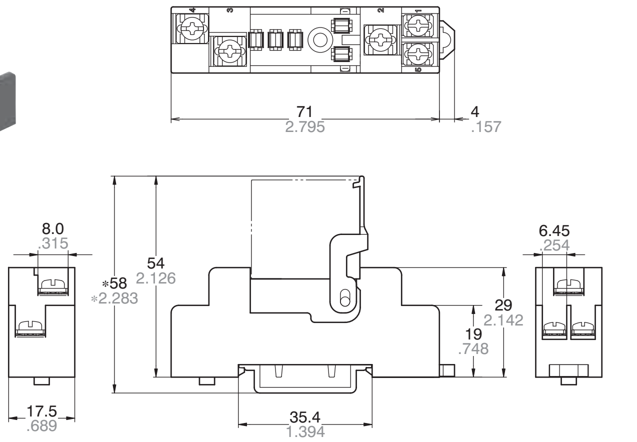
Dimension :	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Notes: 1. When mounting the TM type, since the cover is made from polycarbonate, please use a washer in order to prevent damage, deformation, and loosening.
2. Suitable tightening torque is 0.3 to 0.5 N·m.

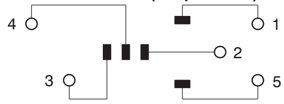
4. HN1 Screw terminal socket



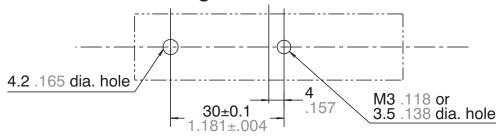
External dimensions



Schematic (Top view)

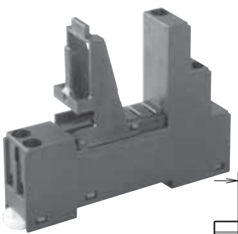


Mounting hole dimensions

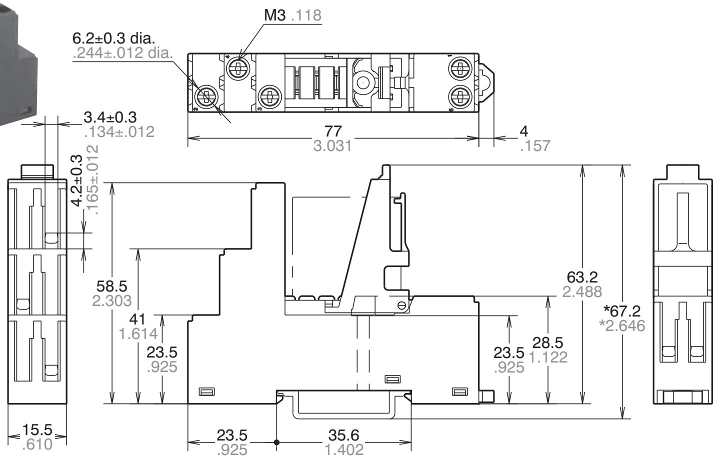


Tolerance: ±0.5 ±.020
* Reference in case of using DIN rail (ATA48011)

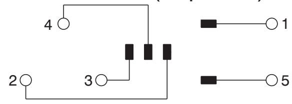
5. HN1 Screw terminal socket (Finger protect type)



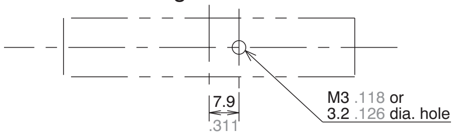
External dimensions



Schematic (Top view)



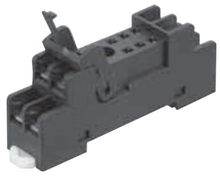
Mounting hole dimensions



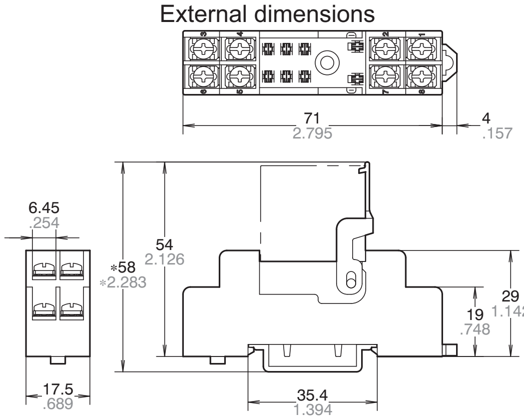
Tolerance: ±0.5 ±.020
* Reference in case of using DIN rail (ATA48011)

Note: Use rod or plate terminals, etc. (You cannot use Y-shape or round terminals.)

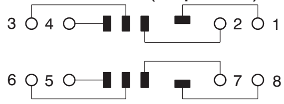
6. HN2 Screw terminal socket



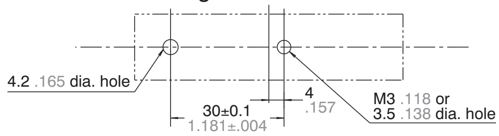
External dimensions



Schematic (Top view)



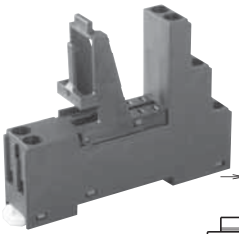
Mounting hole dimensions



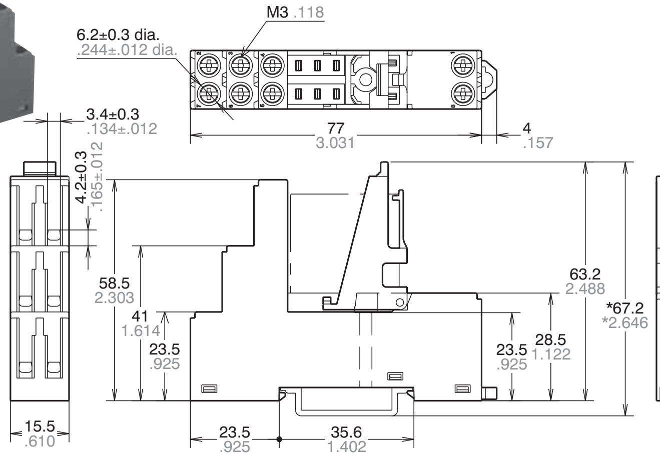
Tolerance: ±0.5 ±.020
* Reference in case of using DIN rail (ATA48011)

Power

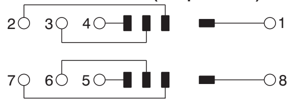
7. HN2 Screw terminal socket (Finger protect type)



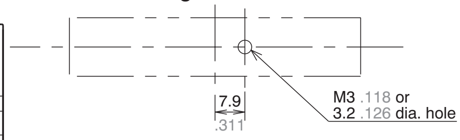
External dimensions



Schematic (Top view)



Mounting hole dimensions

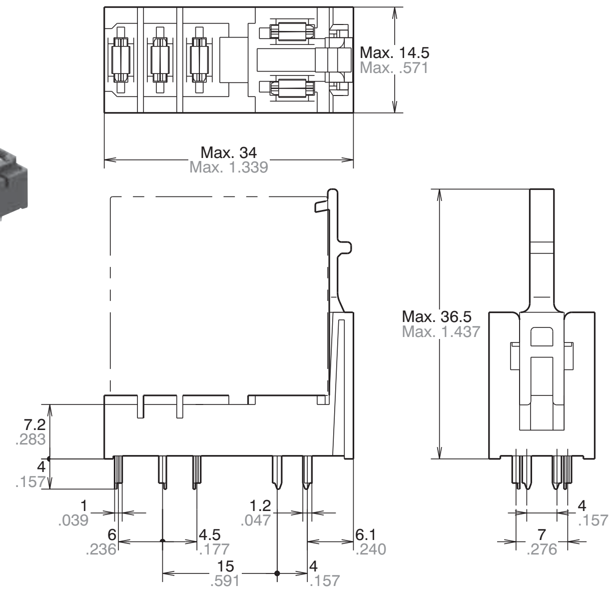


Tolerance: ±0.5 ±.020
* Reference in case of using DIN rail (ATA48011)

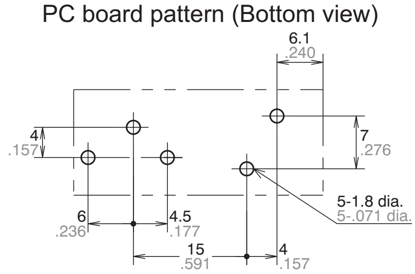
Note: Use rod or plate terminals, etc. (You cannot use Y-shape or round terminals.)

8. HN1 PC board terminal socket

External dimensions



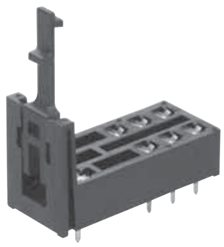
PC board pattern (Bottom view)



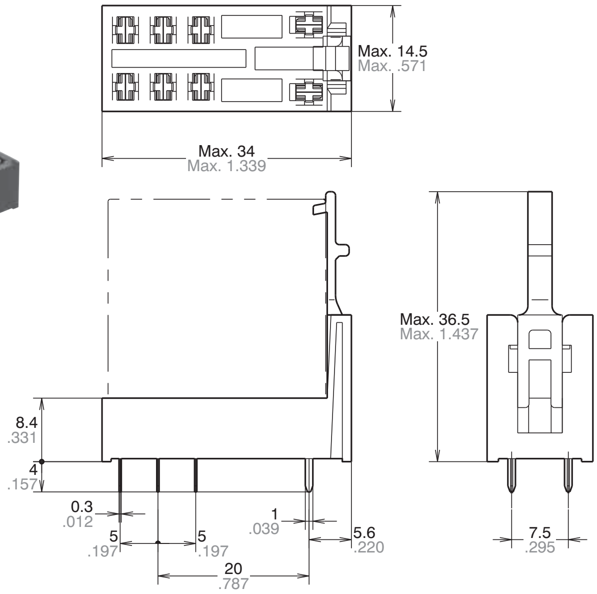
Tolerance: ±0.1 ±.004

Dimension :	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

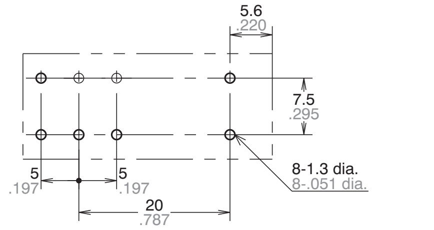
9. HN2 PC board terminal socket



External dimensions



PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Dimension :	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Power

NOTES

1. Coil operating power

To ensure proper operation, the voltage applied to both terminals of the coil should be ±5% (at 20°C 68°F) the rated operating voltage of the coil.

Also, be aware that the pick-up and drop-out voltages will fluctuate depending on the ambient temperature and operating conditions.

2. LED indications

The light of the light emitting diode is what displays operation. If voltage remains after relay dropout, the LED might illuminate briefly.

3. Switching lifetime

The switching lifetime is defined under the standard test condition specified in the JIS C 5442(*2) standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75% R.H.). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase,ambient conditions and other factors.

Also, be especially careful of loads such as those listed below.

1) When used for AC load-operating and the operating phase is synchronous.
Rocking and fusing can easily occur due to contact shifting.

2) High-frequency load-operating
When high-frequency opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.
Three countermeasures for these are listed here.

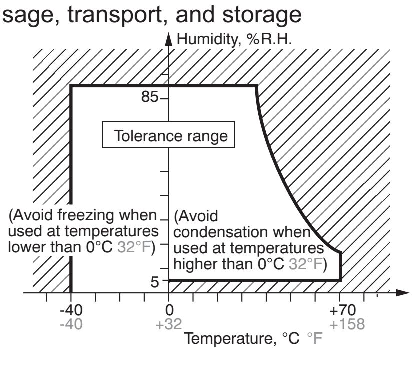
(1) Incorporate an arc-extinguishing circuit.
(2) Lower the operating frequency
(3) Lower the ambient humidity

4. Direct mount type (TM type)

If the current to the connection terminal will exceed 10 A, we recommend connecting with solder. If you are going to use a tab terminal when the current will exceed 10 A, make sure to verify the temperature rise on the receptacle side under actual conditions before using.

5. Conditions for operation, transport and storage

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature:
–40 to +70°C – 40 to +158° F
(2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
Temperature and humidity range for usage, transport, and storage



(3) Atmospheric pressure: 86 to 106 kPa

2) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.

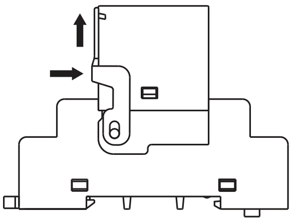
3) Freezing
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32° F.
This causes problems such as sticking of movable parts or operational time lags.

4) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

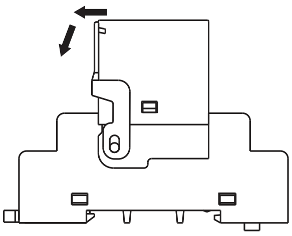
6. About the relay-securing hook

• Screw terminal socket

1) Installation of the securing hook is easily performed by pressing upward in the direction of the arrows.

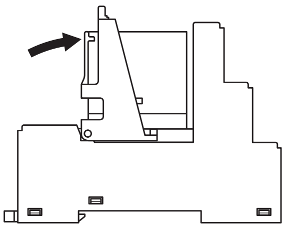


2) Removal of the securing hook is easily performed by releasing the hook and pressing down, as shown in the figure.

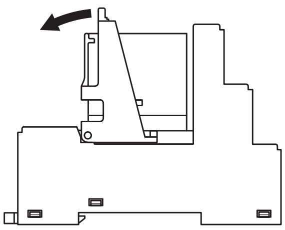


• Screw terminal socket
(Finger protect type)

1) Install the securing hook by pressing the parts with arrows after inserting the relay.

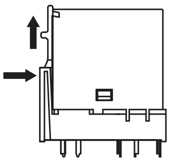


2) Removal of the relay is easily performed by pressing the parts with arrows.

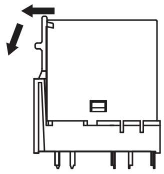


• PC board terminal socket

1) Installation of the securing hook is easily performed by pressing upward in the direction of the arrows.



2) Removal of the securing hook is easily performed by releasing the hook and pressing down, as shown in the figure.



* To prevent damage and deformity, please use the relay-securing hook at 10 N or less.

7. Diode characteristics

1) Reverse breakdown voltage:
Min. 1,000V (with diode type)
Min. 400V (with diode and LED indication type)

8. Diode type

Since the diode inside the relay coil are designed to absorb the counter emf, the element may be damaged if a large surge, etc., is applied to the diode.
If there is the possibility of a large surge voltage from the outside, please implement measures to absorb it.

9. Installation

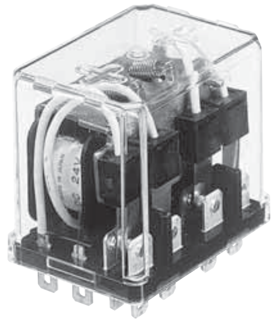
If you will be installing adjacent to other relays, please keep a distance of at least 5 mm from the relay.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

10 AMP POWER RELAY

HP RELAYS



FEATURES

1. High-capacity and long life
Mechanical life is more than 10 million operations and, with electrical life of more than 200,000 operations (resistive load 10 A; inductive load 7.5 A), the relay has excellent inductive load durability.
2. Easy mounting and wiring
The terminal arrangement is apparent at a glance and wiring is easy. Moreover, quick tab terminal is also possible.
3. Operation indicator option
Optional operation indicators are available for easy visual confirmation that relays are operating. They simplify maintenance.
4. UL/CSA approved
5. Wide range of sockets and terminal sockets
To enable use with DIN rails, DIN terminal sockets are also available.

TYPICAL APPLICATIONS

HP relays enjoy wide use in various applications, particularly in automation controls and remote controls.
Applications include:
1. Industrial machinery
For controlling positioning, pressure, and temperature in molding equipment, boilers, pumps, charging pressure equipment, measuring and evaluation equipment, textile machines, etc.
2. Machine tools
Control of positioning and directional change in turning machines, lathes, borers, etc.
3. Food processing packing machines
Automatic control of packing equipment for milk and seafood, bottling, canning, and packaging
4. Office equipment
Control of copiers, time recorders, etc.
5. Coin operate machines
Control of food, cigarette, and other vending machines
6. Measuring devices and equipment
For repeating installation of control signals and in power amplifiers
7. Generators, transformers and power receiving equipment.
Functional parts in protective equipment, functional assistance in automatic adjustment equipment, telemeters and other remote monitoring equipment
8. Control of conveyance equipment
Control panels for elevators, escalators, and other conveyance equipment, control of all kinds industrial transport equipment such as conveyors.
9. Amusement equipment
Control of equipment in amusement parks, etc., control of bowling alley equipment, control of fountains in public parks

About Cd-free contacts
We have introduced Cadmium free type products to reduce Environmental Hazardous Substances. (The suffix “F” should be added to the part number. The Suffix “F” is required only for 4 Form C contact type. The 2 Form C and 3 Form C contact type is originally cadmium-free, the suffix “F” is not required.)
Please replace parts containing Cadmium with Cadmium-free products and evaluate them with your actual application before use because the life of a relay depends on the contact material and load.

Power

ORDERING INFORMATION

HP ☐ - ☐ ☐ - ☐ - ☐

Contact arrangement
2: 2 Form C
3: 3 Form C
4: 4 Form C

Terminal arrangement
Nil: Standard plug-in terminal
TM: TM type (2 Form C only)
M: Direct mounting (3 Form C only)

Operation indication
Nil: Without indication
L: With indication

Coil voltage
AC 24, 48, 100, (115), 200, (220), (240) V
DC 12, 24, 48, 100, (110) V

Contact material
F: 4 Form C, Silver alloy (cadmium-free)
Nil: 2 Form C, 3 Form C (Silver)

With LED indicator type
Coil voltage: 12, 24 V AC 12, 24, 48 V DC
With neon lamp type
Coil voltage: 100, 115, 200, 220, 240 V AC 100, 110 V DC

TYPES

1. Plug-in type

Coil voltage	2 Form C	3 Form C	4 Form C
	Part No.	Part No.	Part No.
24V AC	HP2-AC24V	HP3-AC24V	HP4-AC24V-F
48V AC	HP2-AC48V	HP3-AC48V	HP4-AC48V-F
100V AC	HP2-AC100V	HP3-AC100V	HP4-AC100V-F
115V AC	HP2-AC115V	HP3-AC115V	HP4-AC115V-F
200V AC	HP2-AC200V	HP3-AC200V	HP4-AC200V-F
220V AC	HP2-AC220V	HP3-AC220V	HP4-AC220V-F
240V AC	HP2-AC240V	HP3-AC240V	HP4-AC240V-F
12V DC	HP2-DC12V	HP3-DC12V	HP4-DC12V-F
24V DC	HP2-DC24V	HP3-DC24V	HP4-DC24V-F
48V DC	HP2-DC48V	HP3-DC48V	HP4-DC48V-F
100V DC	HP2-DC100V	HP3-DC100V	HP4-DC100V-F
110V DC	HP2-DC110V	HP3-DC110V	HP4-DC110V-F

Standard packing (2 Form C): Carton: 20 pcs.; Case: 100 pcs.
Standard packing (3 Form C, 4 Form C): Carton: 10 pcs.; Case: 50 pcs.

2. Plug-in type (with LED indication)

	Coil voltage	2 Form C	3 Form C	4 Form C
		Part No.	Part No.	Part No.
With LED indication	24V AC	HP2-L-AC24V	HP3-L-AC24V	HP4-L-AC24V-F
With neon lamp	100V AC	HP2-L-AC100V	HP3-L-AC100V	HP4-L-AC100V-F
	115V AC	HP2-L-AC115V	HP3-L-AC115V	HP4-L-AC115V-F
	200V AC	HP2-L-AC200V	HP3-L-AC200V	HP4-L-AC200V-F
	220V AC	HP2-L-AC220V	HP3-L-AC220V	HP4-L-AC220V-F
	240V AC	HP2-L-AC240V	HP3-L-AC240V	HP4-L-AC240V-F
With LED indication	12V DC	HP2-L-DC12V	HP3-L-DC12V	HP4-L-DC12V-F
	24V DC	HP2-L-DC24V	HP3-L-DC24V	HP4-L-DC24V-F
	48V DC	HP2-L-DC48V	HP3-L-DC48V	HP4-L-DC48V-F
With neon lamp	100V DC	HP2-L-DC100V	HP3-L-DC100V	HP4-L-DC100V-F
	110V DC	HP2-L-DC110V	HP3-L-DC110V	HP4-L-DC110V-F

Standard packing (2 Form C): Carton: 20 pcs.; Case: 100 pcs.
Standard packing (3 Form C, 4 Form C): Carton: 10 pcs.; Case: 50 pcs.

3. TM type and Direct mount type

Coil voltage	2 Form C (TM type)	3 Form C (direct mount type)
	Part No.	Part No.
24V AC	HP2-TM-AC24V	HP3-M-AC24V
48V AC	HP2-TM-AC48V	HP3-M-AC48V
100V AC	HP2-TM-AC100V	HP3-M-AC100V
115V AC	HP2-TM-AC115V	HP3-M-AC115V
200V AC	HP2-TM-AC200V	HP3-M-AC200V
220V AC	HP2-TM-AC220V	HP3-M-AC220V
240V AC	HP2-TM-AC240V	HP3-M-AC240V
12V DC	HP2-TM-DC12V	HP3-M-DC12V
24V DC	HP2-TM-DC24V	HP3-M-DC24V
48V DC	HP2-TM-DC48V	HP3-M-DC48V
100V DC	HP2-TM-DC100V	HP3-M-DC100V
110V DC	HP2-TM-DC110V	HP3-M-DC110V

Standard packing: Carton: 10 pcs.; Case: 50 pcs.

4. Direct mount type (with LED indication)

	Coil voltage	3 Form C
		Part No.
With neon lamp	100V AC	HP3-ML-AC100V
	115V AC	HP3-ML-AC115V
	200V AC	HP3-ML-AC200V
	220V AC	HP3-ML-AC220V
	240V AC	HP3-ML-AC240V
	100V DC	HP3-ML-DC100V
	110V DC	HP3-ML-DC110V

Standard packing: Carton: 10 pcs.; Case: 50 pcs.
Notes: 1. Standard packaging is handled in units of inner cartons. Please specify if you require inner cartons to be boxed.
2. Sockets, terminal sockets and installation brackets are not included. Please order these separately.
3. For products compliant with international standards, please refer to the standards chart.

RATING

1. Coil data

1) AC coils

Contact arrangement	Nominal coil voltage	Nominal coil current (mA)		Nominal operating power (VA)		Inductance (H)		Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Max. allowable voltage (at 20°C 68°F)
		50Hz	60Hz	50Hz	60Hz	50Hz	60Hz			
2 Form C	24V AC	94mA	78mA	2.25VA	1.9VA	0.753	0.776	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	110%V of nominal voltage
	48V AC	46.5mA	39mA	2.23VA	1.9VA	3.055	3.106			
	100V AC	25.3mA	21mA	2.36VA	2.1VA	12.60	12.03			
	115V AC	23.1mA	18mA	2.31VA	2.1VA	16.70	15.83			
	200V AC	12.4mA	11mA	2.48VA	2.2VA	48.03	45.81			
	220V AC	10.6mA	9.5mA	2.34VA	2.1VA	61.28	57.90			
	240V AC	10.0mA	9.0mA	2.40VA	2.2VA	69.00	66.26			
3 Form C	24V AC	148.7mA	130mA	3.56VA	3.1VA	0.0494	0.475	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	110%V of nominal voltage
	48V AC	74.2mA	65mA	3.56VA	3.1VA	1.976	1.899			
	100V AC	36.4mA	32mA	3.64VA	3.2VA	8.500	8.038			
	115V AC	32.5mA	28.5mA	3.74VA	3.3VA	10.79	10.36			
	200V AC	18.2mA	16mA	3.65VA	3.2VA	33.53	32.10			
	220V AC	16.0mA	14.2mA	3.54VA	3.1VA	41.35	39.32			
	240V AC	15.8mA	13.9mA	3.79VA	3.3VA	45.94	44.05			
4 Form C	12V AC	456mA	400mA	5.47VA	4.8VA	0.080	0.077	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	110%V of nominal voltage
	24V AC	229mA	200mA	5.49VA	4.8VA	0.320	0.309			
	48V AC	108mA	95mA	5.18VA	4.6VA	1.348	1.292			
	100V AC	57.3mA	50mA	5.73VA	5.0VA	5.348	5.156			
	115V AC	47.6mA	42mA	5.47VA	4.8VA	7.264	6.953			
	200V AC	28.5mA	25mA	5.69VA	5.0VA	21.27	20.45			
	220V AC	23.8mA	21mA	5.24VA	4.6VA	27.75	26.57			
	240V AC	23.3mA	20.5mA	5.58VA	4.9VA	30.98	29.75			

2) DC coils (20°C 68°F)

Contact arrangement	Nominal coil voltage	Nominal coil current (mA)	Nominal operating power (W)	Coil resistance (Ω)	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Max. allowable voltage (at 20°C 68°F)
2 Form C	12V DC	109mA	1.3W	110Ω	80%V or less of nominal voltage (Initial)	15%V or more of nominal voltage (Initial)	110%V of nominal voltage
	24V DC	54.5mA	1.3W	440Ω			
	48V DC	26.7mA	1.3W	1,800Ω			
	100V DC	14.9mA	1.5W	6,700Ω			
	110V DC	15.0mA	1.7W	7,300Ω			
3 Form C	12V DC	120mA	1.4W	100Ω	80%V or less of nominal voltage (Initial)	15%V or more of nominal voltage (Initial)	110%V of nominal voltage
	24V DC	60mA	1.4W	400Ω			
	48V DC	31mA	1.5W	1,560Ω			
	100V DC	15.6mA	1.6W	6,400Ω			
	110V DC	14.9mA	1.6W	7,450Ω			
4 Form C	12V DC	127mA	1.5W	95Ω	80%V or less of nominal voltage (Initial)	15%V or more of nominal voltage (Initial)	110%V of nominal voltage
	24V DC	63mA	1.5W	380Ω			
	48V DC	32.0mA	1.5W	1,500Ω			
	100V DC	16.3mA	1.6W	5,950Ω			
	110V DC	15.7mA	1.7W	7,000Ω			

Notes: 1. The rated current area is ±15% (60Hz) [AC coils],. ±10% (20°C) [DC coils]
2. The coil resistance for DC operation is the value measured when the coil temperature is 20°C 68°F. Compensate ±0.4% for every ±1°C change in temperature.
3. The relay operates in a range of 80% to 110% V of the voltage rating, but ideally, in consideration of temporary voltage fluctuations, it should be operated at the rated voltage. In particular, for AC operation, if the impressed voltage drops to 80% V or more below the rated voltage, humming will occur and a large current will flow leading possibly to coil burnout.
4. For use with 200 V DC, connect a 6.7kΩ (10W) resistor, in series, to the 100 V DC relay [3 Form C type is .6.4kΩ (5W); 4 Form C type is .6.2kΩ (10W)].
5. As a general rule, only a pure DC voltage should be used for the coil drive.
However, a DC power supply that contains ripples has characteristics that differ from pure DC.
Therefore, please verify characteristics (operate voltage, release voltage, humming) using the actual circuit that will be used.

2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		2 Form C, 3 Form C, 4 Form C
	Initial contact resistance, max		Max. 15 mΩ (By voltage drop 6 V DC 1A)
	Contact material	2 Form C, 3 Form C	Ag
		4 Form C	Ag alloy (cd free)
Rating	Nominal switching capacity		10A 250V AC (resistive load)
	Min. switching capacity (Reference value)*1		100mA 5V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1min (2 Form C, 4 Form C). 2,000 Vrms for 1min (3 Form C) (Detection current: 10mA.)
		Between contact sets	1,500 Vrms for 1min (2 Form C, 4 Form C). 2,000 Vrms for 1min (3 Form C) (Detection current: 10mA.)
		Between contact and coil	1,500 Vrms for 1min (2 Form C, 4 Form C). 2,000 Vrms for 1min (3 Form C) (Detection current: 10mA.)
	Temperature rise		Max. 65°C (By temperature method, at 40°C, nominal current)
	Operate time*2		Max. 25ms (2 Form C), Max.30ms (3 Form C, 4 Form C) (Nominal voltage applied to the coil, excluding contact bounce time.)
	Release time*2		Max. 25ms (2 Form C), Max.30ms (3 Form C, 4 Form C) (Nominal voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 98 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1 mm (Detection time: 10μs.)
		Destructive	10 to 55 Hz at double amplitude of 2 mm
Expected life	Mechanical		Min. 10^7
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –50°C to +40°C –58°F to +104°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. Operating speed		20 cpm (at max. rating)
Unit weight			2 Form C: approx. 60g 2.12oz, 3 Form C: approx. 100g 3.53oz, 4 Form C: approx. 125g 4.41oz

*1 This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.
*2 For the AC coil types, the operate/release time will differ depending on the phase.
*3 The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

3. Electrical life

1) AC load

Voltage	125V AC		250V AC		Expected life
Load	Resistive (A) (cosφ=1)	Inductive (A) (cosφ=0.4)	Resistive (A) (cosφ=1)	Inductive (A) (cosφ=0.4)	
Current	—	—	10	7.5	Min. 2×10^5
	10	7.5	7.5	5	Min. 5×10^5
	5	3	3	2	Min. 10^6
	1	0.7	0.6	0.4	Min. 2×10^6

Note: When the electromagnet or exciting coil (Solenoid, etc.) is the load, the value of motor or lamp load is applicable.

2) DC load

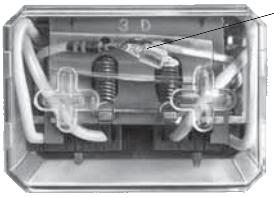
Voltage	24V DC		125V DC		Expected life
Load	Resistive (A)	Inductive (A)	Resistive (A)	Inductive (A)	
Current	—	7	—	—	Min. 2×10^5
	7.5	5	0.5	0.4	Min. 5×10^5
	5	3	0.3	0.2	Min. 10^6
	1	0.6	0.1	0.06	Min. 2×10^6

Notes:
1. For DC inductive loads, use an arc suppressing circuit.
2. Cautions at DC load use: when used under a DC load operating at high repetition rate with considerable arcing, corrosion of the contacts and/or the contact blades is likely to occur.

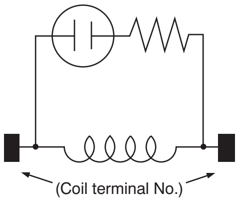
4. Life of LED and neon lamp (with operation indication)

	Continuous	Use rating (ON time) 50%
With neon lamp	25,000 hours (approx. 3 years)	Approx. 6 years
With LED indication	50,000 hours (approx. 5.5 years)	100,000 hours (approx. 11 years)

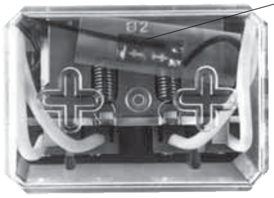
With neon lamp



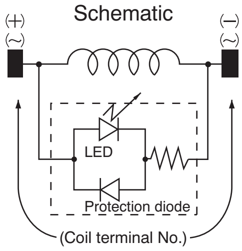
Schematic



With LED indication



Schematic

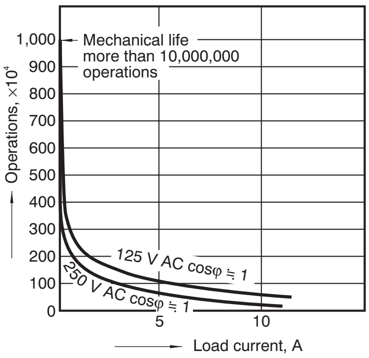


Coil terminal No. and polarity (DC type)

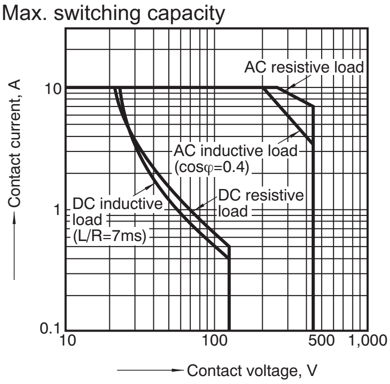
	Polarity	HP2	HP3	HP4
Terminal No.	(+)	7	10	10
	(–)	2	2	1

REFERENCE DATA

1. Life curve



2. Max. switching capacity



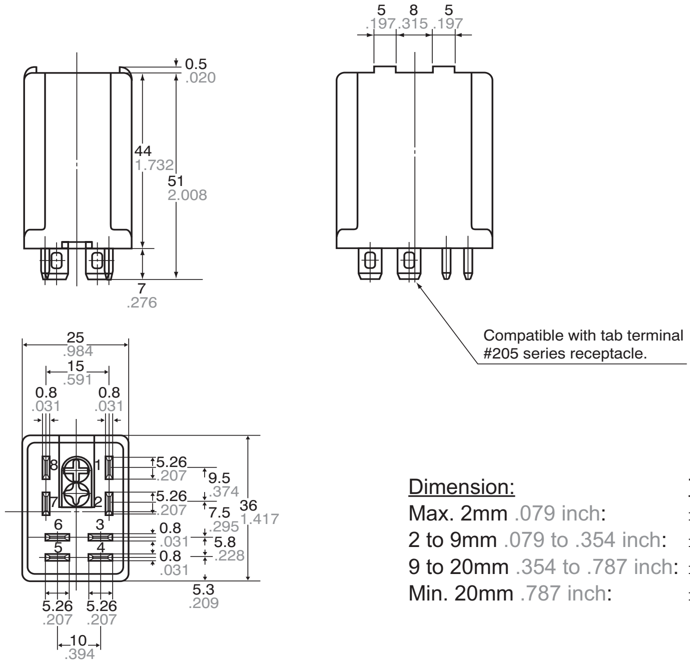
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

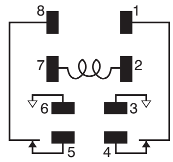
Plug-in type (2 Form C)

CAD Data

External dimensions



Schematic (Bottom view)

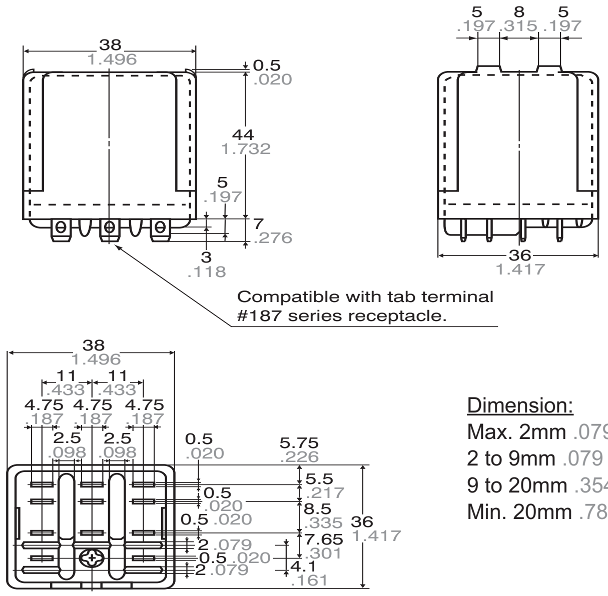


Dimension:	Tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

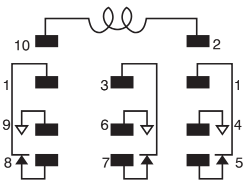
Plug-in type (3 Form C)

CAD Data

External dimensions



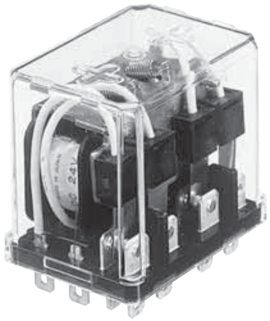
Schematic (Bottom view)



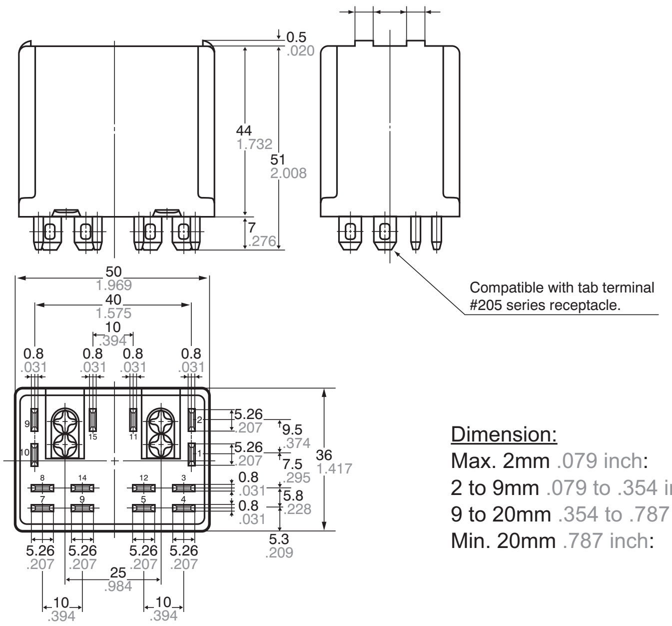
Dimension:	Tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

Plug-in type (4 Form C)

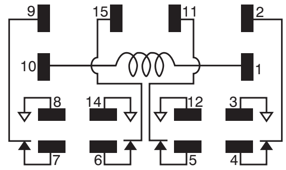
CAD Data



External dimensions



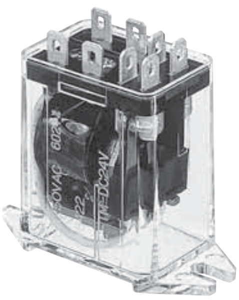
Schematic (Bottom view)



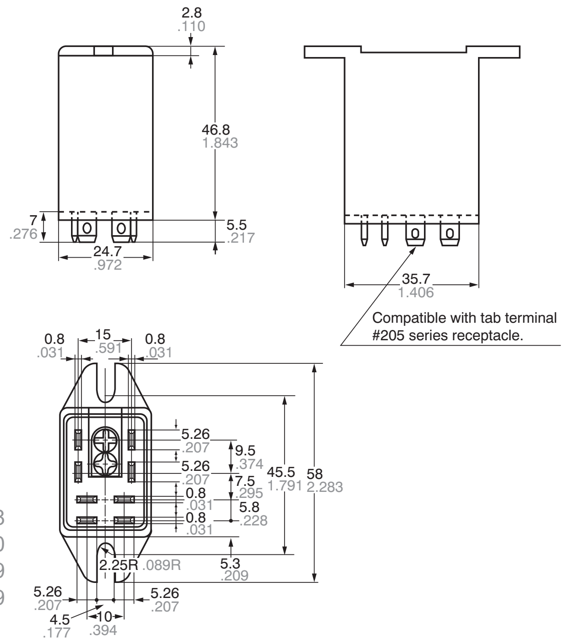
Dimension:	Tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

TM type (2 Form C)

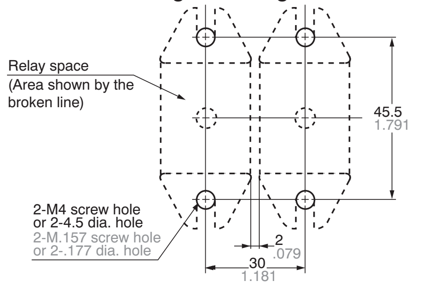
CAD Data



External dimensions



Mounting hole diagram

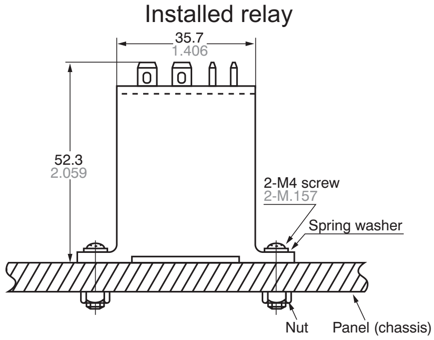


Tolerance: ±0.1 ±.004

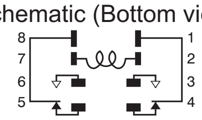
(Pitch for side-by-side mounting)

Dimension:	Tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

Installed relay



Schematic (Bottom view)

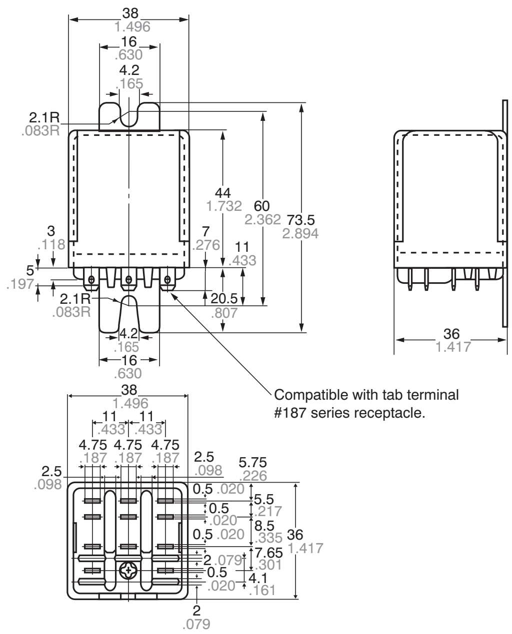


Power

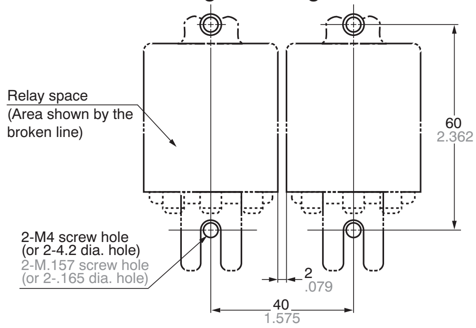
Direct mounting type
(3 Form C)

CAD Data

External dimensions



Mounting hole diagram

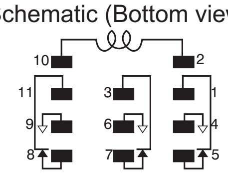


Tolerance: ±0.1 ±.004

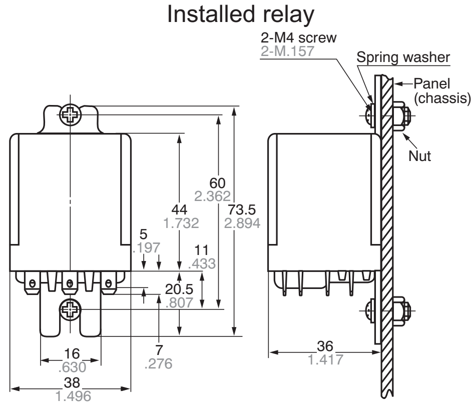
(Pitch for side-by-side mounting)

Dimension:	Tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

Schematic (Bottom view)



Installed relay

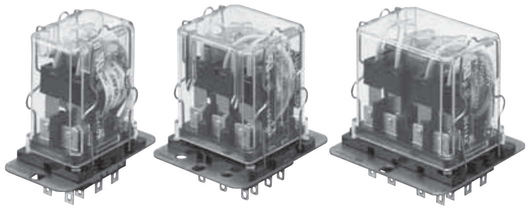


For Cautions for Use, see Relay Technical Information (page 582).

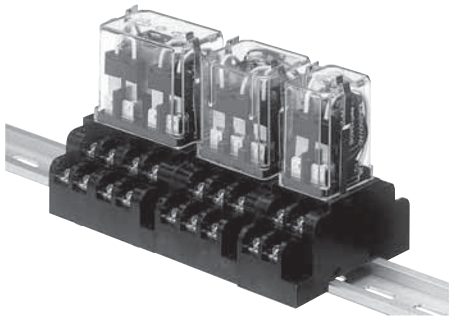
Panasonic
ideas for life

ACCESSORIES (Sockets and Terminal sockets)

HP RELAY ACCESSORIES



Socket for rectangular hold boring



Terminal socket for DIN rail assembly

TYPES

1. For DIN rail terminal sockets, hold-down clip included.
2. For square hole sockets, powerful hold-down clip included.

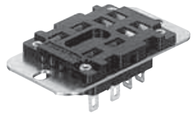
Type	No. of poles	Item	Part No.	Packing quantity	
				Carton	Case
Square hole socket	2-pole	HP2-square hole socket	HP2-SRS	20 pcs.	100 pcs.
	3-pole	HP3-square hole socket	HP3-SRS	10 pcs.	50 pcs.
	4-pole	HP4-square hole socket	HP4-SRS	10 pcs.	50 pcs.
DIN rail terminal socket	2-pole	HP2-DIN terminal socket	HP2-SFD	10 pcs.	50 pcs.
	3-pole	HP3-DIN terminal socket	HP3-SFD	10 pcs.	50 pcs.
	4-pole	HP4-DIN terminal socket	HP4-SFD	5 pcs.	25 pcs.
Common part	2/3/4-pole (common)	HP-hold down clip for socket	AW5806	—	50 pcs.

Note: Socket and terminal socket conform to UL, CSA as standard.

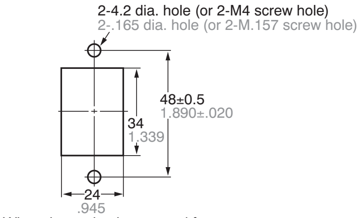
DIMENSIONS (Unit: mm inch)

1. Socket for rectangular hold boring (hold-down clip included)

HP2-Socket (HP2-SRS)



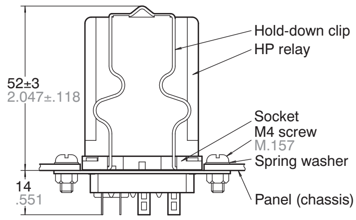
Front surface mounting



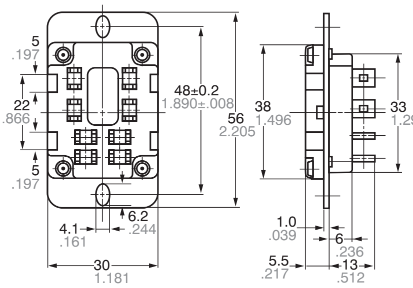
When the socket is mounted from the top of the panel (chassis).

Tolerance: ±0.1 ±.004

Mounting dimensions

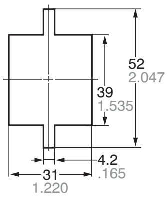


External dimensions



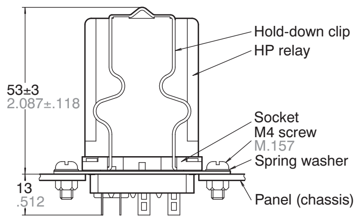
General tolerance: ±0.1 ±.004

Rear surface mounting



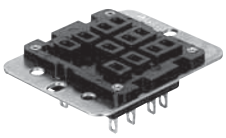
When the socket is mounted from below the panel (chassis).

Tolerance: ±0.1 ±.004

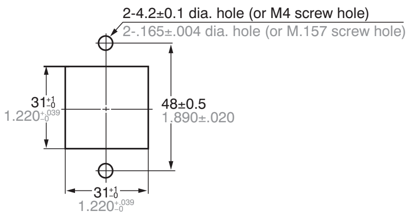


Notes: 1. Optimum space-saving panel cut-out.
2. Can be mounted from either the front or the rear of the panel.
3. Hold-down clip is included in package.

HP3-Socket (HP3-SRS)

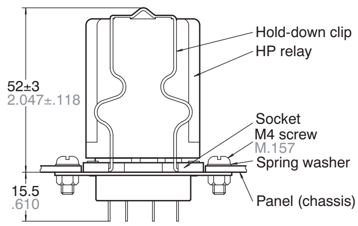


Front surface mounting

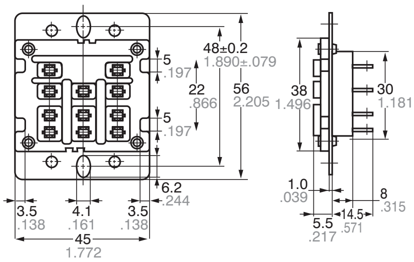


Tolerance: ±0.1 ±.004

Mounting dimensions

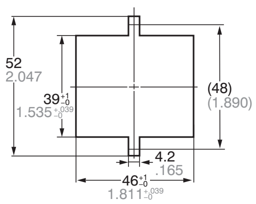


External dimensions

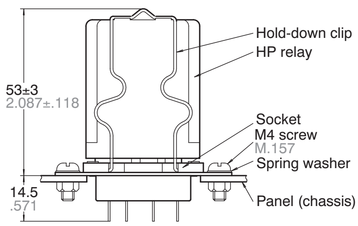


General tolerance: ±0.1 ±.004

Rear surface mounting

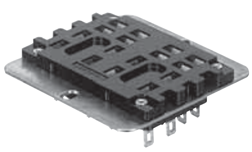


Tolerance: ±0.1 ±.004

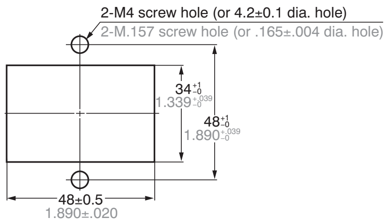


Notes: 1. Optimum space-saving panel cut-out.
2. Can be mounted from either the front or the rear of the panel.
3. Hold-down clip is included in package.

HP4-Socket (HP4-SRS)

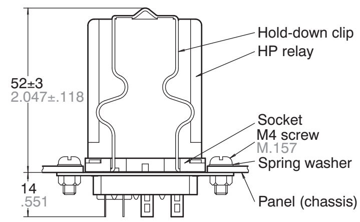


Front surface mounting

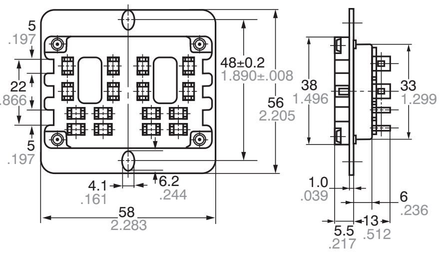


Tolerance: ±0.1 ±.004

Mounting dimensions

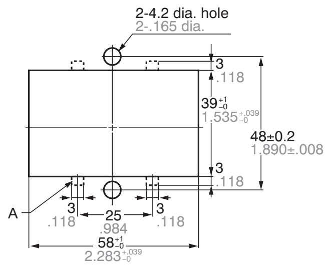


External dimensions



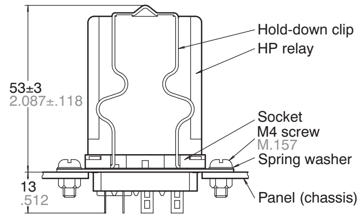
General tolerance: ±0.1 ±.004

Rear surface mounting



Tolerance: ±0.1 ±.004

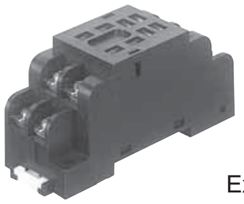
* When using the former hold-down clip, it is necessary to cut out the A section marked by the broken line (not necessary with the powerful hold-down clip).



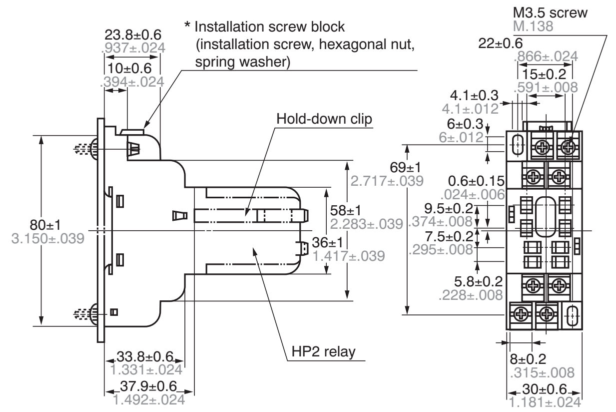
Notes: 1. Optimum space-saving panel cut-out.
2. Can be mounted from either the front or the rear of the panel.
3. Hold-down clip is included in package.

2. Terminal socket for DIN rail assembly (hold-down clip and installation screw included)

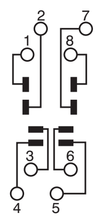
HP2-Terminal socket for DIN rail assembly (HP2-SFD)



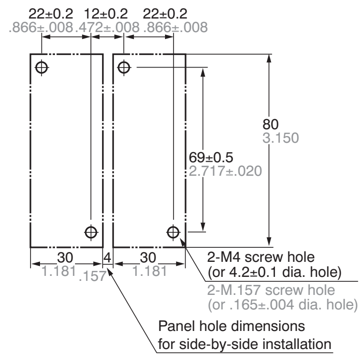
External dimensions



Schematic

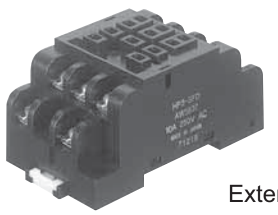


Mounting hole diagram

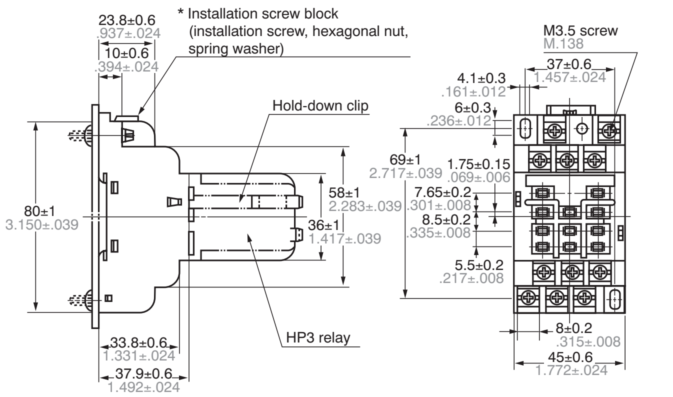


Notes: 1. For direct mounting, use the included installation screw block.
2. A hold-down clip is included with the terminal socket.

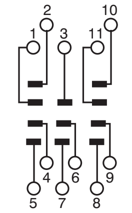
HP3-Terminal socket for DIN rail assembly (HP3-SFD)



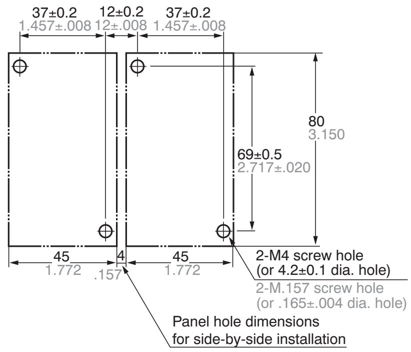
External dimensions



Schematic

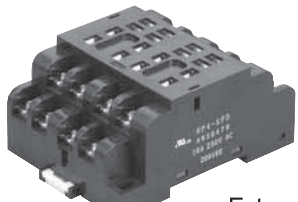


Mounting hole diagram

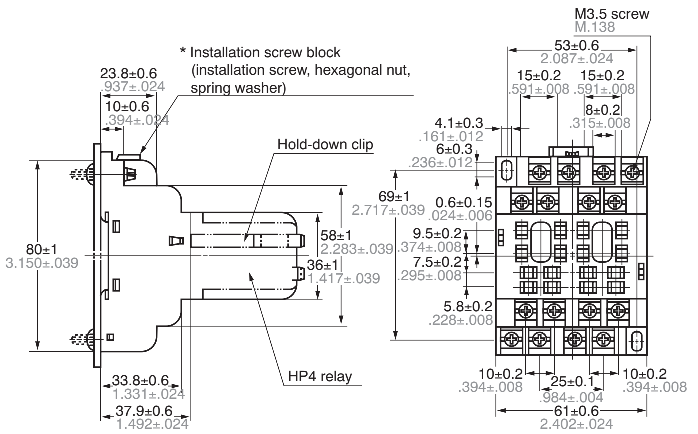


Notes: 1. For direct mounting, use the included installation screw block.
2. A hold-down clip is included with the terminal socket.

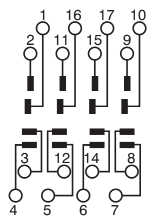
HP4-Terminal socket for DIN rail assembly (HP4-SFD)



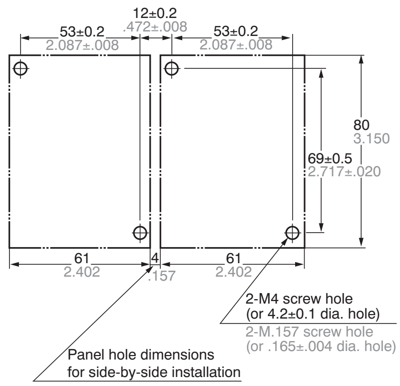
External dimensions



Schematic



Mounting hole diagram



Notes: 1. For direct mounting, use the included installation screw block.
2. A hold-down clip is included with the terminal socket.

NOTES

1. There are two types of HP relay: plug-in and direct mounting (HP2-TM and HP3-M only).
Avoid use of direct mounting types in sockets or terminal sockets.

Note: Mounting measurements for direct mounting types (HP2-TM and HP3-M) are shown in the drawing on page 283.

2. The terminals are compatible with tab terminals. Consequently, for direct mounting types, in addition to soldering, AMP terminals can be used.

Part number	Compatible tab terminal
HP2	#205 series
HP3	#187 series
HP4	#205 series

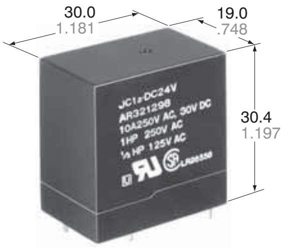
3. When tightening the fixing screws of direct mounting types, use washers to prevent damage or distortion.
The optimum torque range is 0.49 to 0.69 N·m, (5 to 7 kgf·cm).
To prevent loosening of direct mounting types, terminal sockets and sockets, etc., when fixing the screws, use spring washers, etc. Moreover, wiring (soldering), should be done with care while ensuring strong connections.
4. When tightening terminal socket fixing screws, to prevent damage, the optimum torque range should be 0.784 to 0.98 N·m, (8 to 10 kgf·cm).
5. Avoid use in adverse conditions, such as where the relay will be subjected to strong vibrations or shock, where there is exposure to harmful gas, or where ambient temperatures are high (more than 40°C).
6. Use in DC load
Abnormal wear of the contacts and contact springs will occur when the switching frequency is high and there are large arcs. In particular, if high-frequency operation in hot or humid conditions is intended, use arc-suppressing circuits.
7. There is no particular specification for HP relay mounting orientation.
8. Do not insert or remove relays into or out of live circuits.

For Cautions for Use, see Relay Technical Information (page 584).

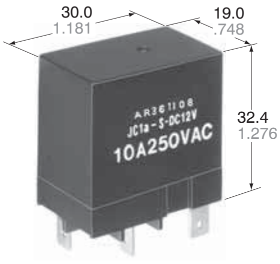
Panasonic
ideas for life

COMPACT POWER RELAYS

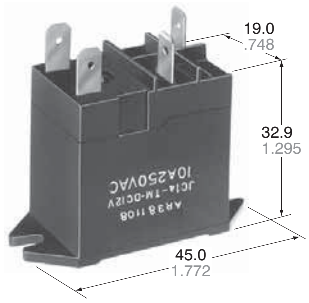
JC RELAYS



PC board type



Plug-in type



TM type

mm inch

FEATURES

- **High inrush current capability**
  1 Form A: 163 A inrush (TV-8)
  2 Form A: 111 A inrush (TV-5)
- **High dielectric withstanding for transient protection:**
  JC can withstand 10,000 V surge in μs between coil and contact.
- **Electrical life:**
  1 Form A: 10^5 ope. at 15 A 250 V AC resistive load
  2 Form A: 10^5 ope.
  at 10 A 250 V AC resistive load
- **UL/CSA, VDE, TÜV, SEMKO also approved.**

SPECIFICATIONS

Contact

			1 Form A	2 Form A
Arrangement			1 Form A	2 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			30 mΩ (Cd free type: 100 mΩ)	
Contact material			Silver alloy	
Contact force, min.			30 g	
Rating (resistive load)	Maximum switching power		3,750 VA	2,500 VA
	Maximum switching voltage		250 V AC	250 V AC
	Max. switching current		15 A	10 A
	Min. switching capacity#1		100 mA, 5 V DC	
Expected life (min. operation)	Mechanical		5×10^6	
	Electrical (resistive)	15 A 250 V AC	10^5	—
		10 A 250 V AC	—	10^5

Coil

Nominal operating power	900 mW	1,000 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement of same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

Characteristics

Maximum operating speed		20 cpm.
Initial insulation resistance*1		Min. 100 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	2,000 V rms for 1 min.
	Between contacts sets	2,000 Vrms for 1 min.
	Between contacts and coil	4,000 Vrms for 1 min.
Operate time*3 (at nominal voltage)		Max. 30 ms
Release time(without diode)*3 (at nominal voltage)		Max. 10 ms
Temperature rise (at nominal voltage)		Max. 55°C
Shock resistance	Functional*4	196 m/s² {20 G}
	Destructive*5	980 m/s² {100 G}
Vibration resistance	Functional*6	98 m/s² {10 G}, 10 to 55 Hz at double amplitude of 1.6 mm
	Destructive	117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–50°C to +60°C –58°F to +140°F
	Humidity	5 to 85%R.H.
Unit weight		Approx. 31 g 1.09 oz

TYPICAL APPLICATIONS

Automatic garage door openers
Microwave ovens
Dryers
Vending machines
Copiers
Air conditioners
Stereo equipment
TV sets

ORDERING INFORMATION

Ex. JC 1a F — TM — DC12V — F

Contact arrangement	Mounting classification	Coil voltage	Environmental support
1a: 1 Form A 2a: 2 Form A	Nil: PC board terminal S: Plug-in terminal TM: Top mounting	DC 5, 6, 12, 24, 48 V	F: RoHS Directive conforming type ($AgSnO_2$ type)

(Notes) 1. TV rated types available 1 Form A: TV-8; 2 Form A: TV-5.
2. Standard packing Carton: 50 pcs.; Case: 200 pcs.
3. UL/CSA, VDE, TÜV, and SEMKO certified products can also be supported. Please consult us.

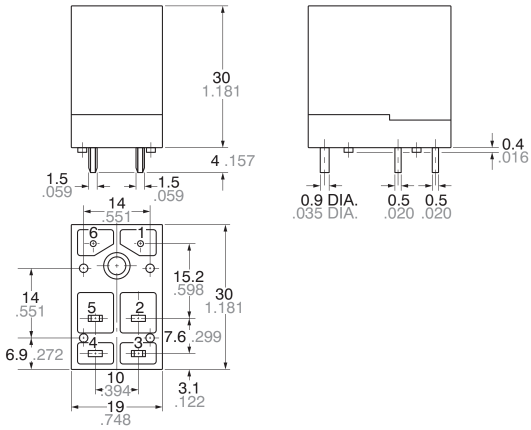
COIL DATA (at 20°C 68°F)

Contact arrangement	Nominal voltage. V DC	Pick-up voltage. V DC (max.)	Drop-out voltage. V DC (min.)	Coil resistance, Ω(±10%)	Nominal operating current, mA	Nominal operating power, W	Maximum allowable voltage, V DC (at 60°C)
1 Form A	6	4.8	0.6	40	150	0.9	6.6
	12	9.6	1.2	160	75	0.9	13.2
	24	19.2	2.4	640	37.5	0.9	26.4
	48	38.4	4.8	2,560	18.8	0.9	52.8
2 Form A	6	4.8	0.6	36	166.6	1.0	6.6
	12	9.6	1.2	144	83.3	1.0	13.2
	24	19.2	2.4	576	41.6	1.0	26.4
	48	38.4	4.8	2,304	20.8	1.0	52.8

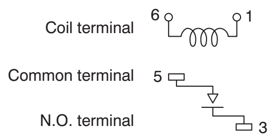
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

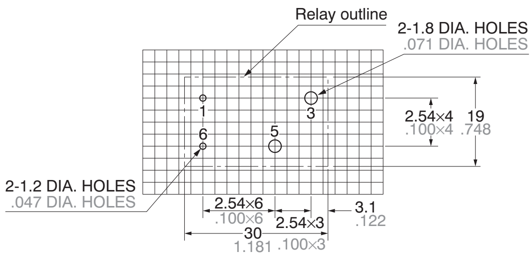
PC board type
JC1a
CAD Data



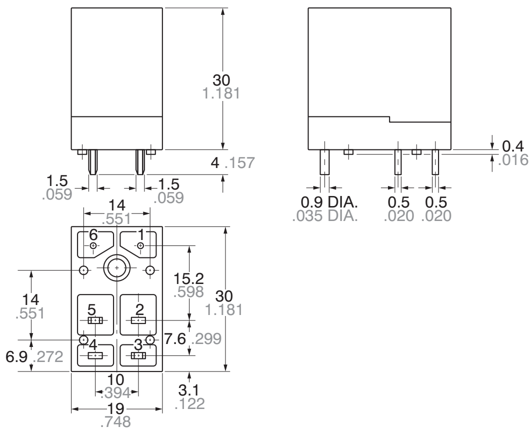
Schematic



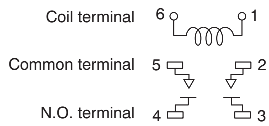
PC board pattern (Bottom view)



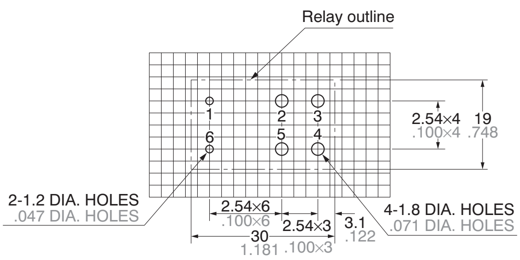
PC board type
JC2a
CAD Data



Schematic



PC board pattern (Bottom view)



General tolerance: ±0.3 ±.012

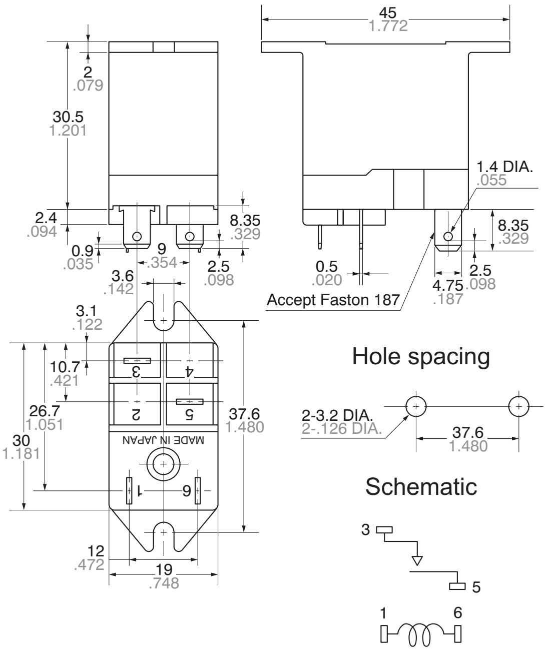
Tolerance: ±0.1 ±.004

Top mount type

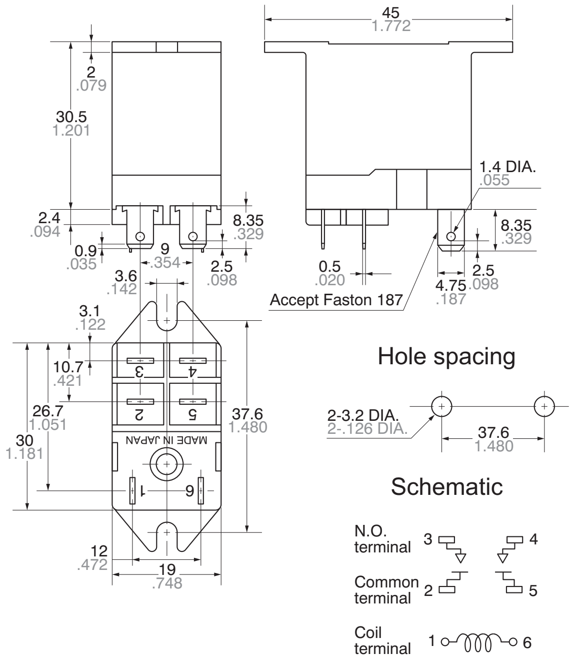
mm inch

CAD Data

1a



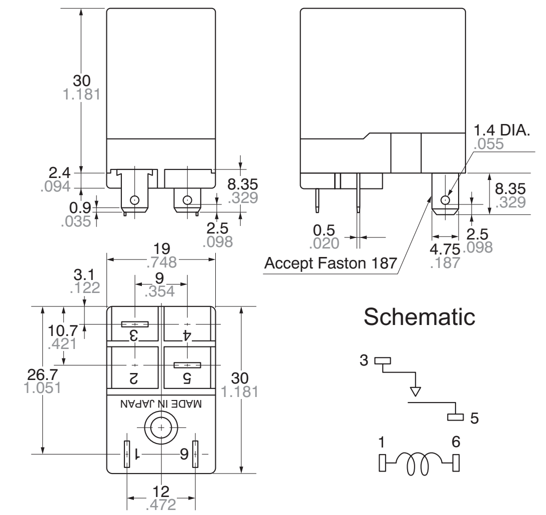
2a



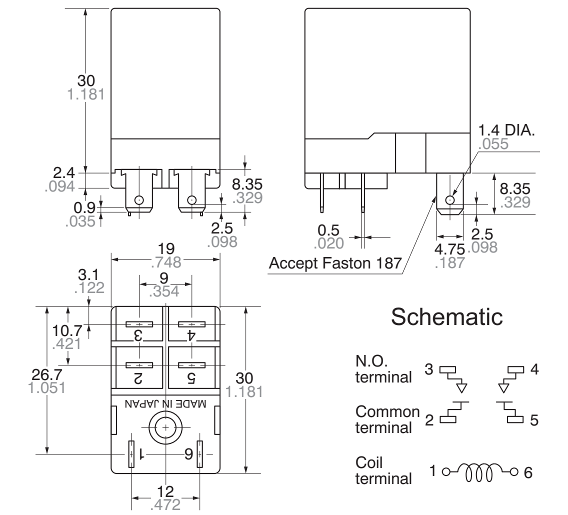
Plug-in type

CAD Data

1a



2a

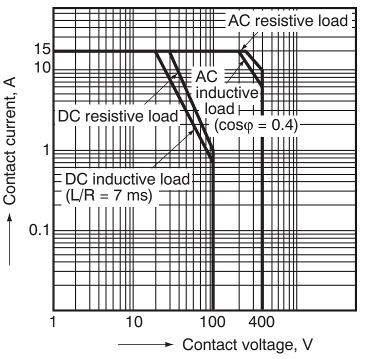


General tolerance: ±0.3 ±.012

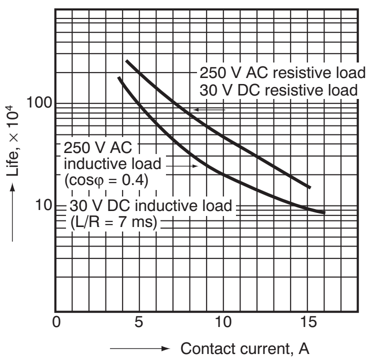
REFERENCE DATA

JC1a type

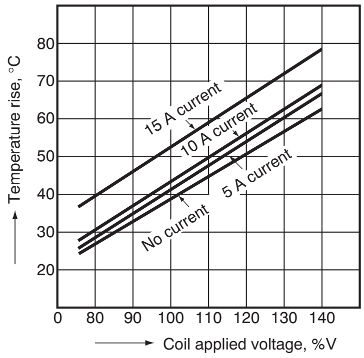
1. Maximum value for switching capacity



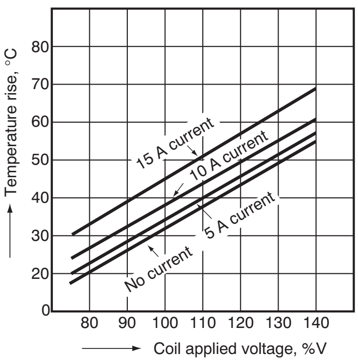
2. Life curve



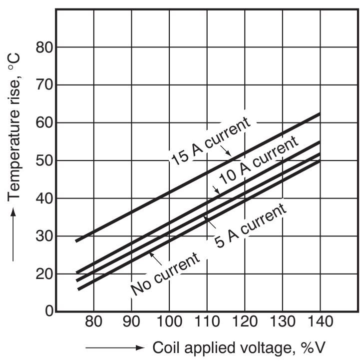
3.-(1) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 26°C 79°F



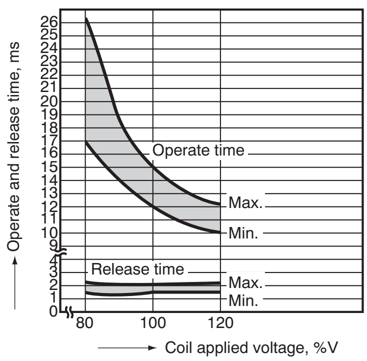
3.-(2) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 40°C 104°F



3.-(3) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 60°C 140°F

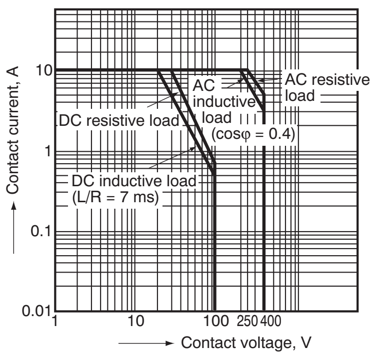


4. Operate / release time

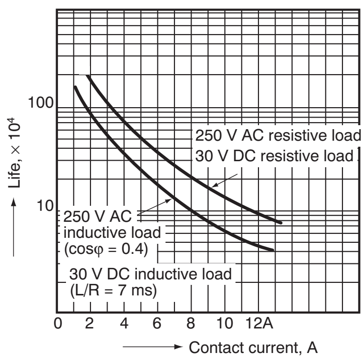


JC2a type

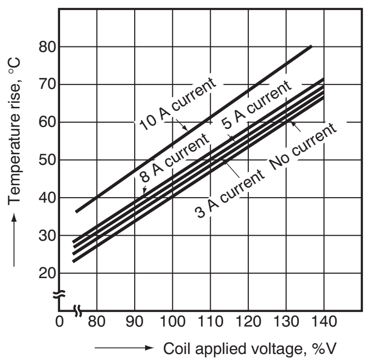
1. Maximum value for switching capacity



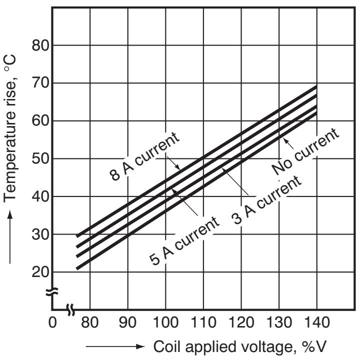
2. Life curve



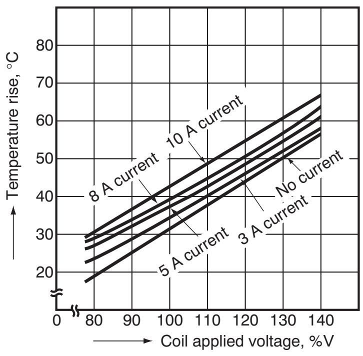
3.-(1) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 26°C 79°F



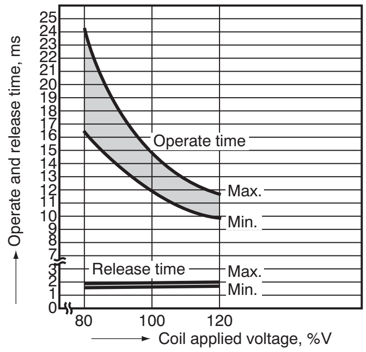
3.-(2) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 40°C 104°F



3.-(3) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 60°C 140°F



4. Operate / release time



For Cautions for Use, see Relay Technical Information (page 582).

ACCESSORIES


JC1-SS

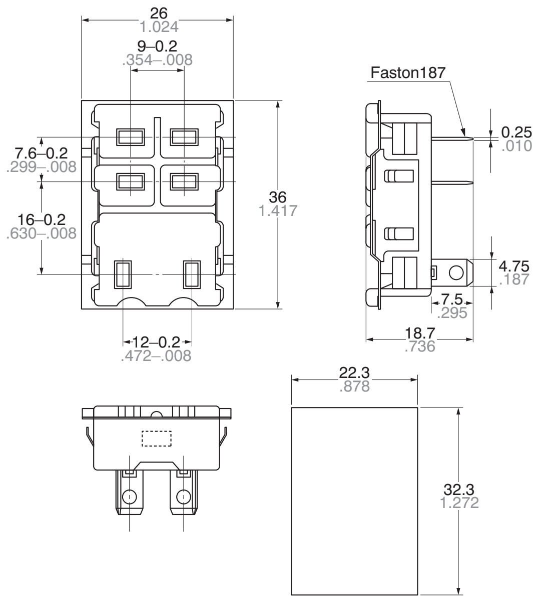

JC2-SS


JC1-PS

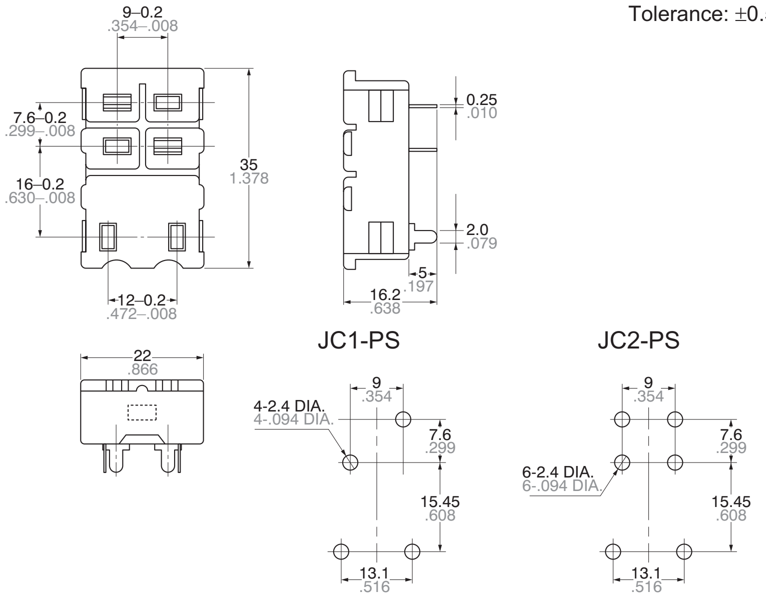

JC2-PS

mm inch

Tolerance: ±0.5 ±.020



Panel cutout
Tolerance: ±0.1 ±.004



PC board Pattern
Tolerance: ±0.1 ±.004

(Note)
Outward dimensions and chassis cutout dimensions for JC1-SS and JC1-PS are same as those of JC2-SS and JC2-PS respectively.
UL/CSA approved type is standard.

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COMPACT POWER RELAYS FOR HIGH DC LOADS

JC RELAYS
(Special Type)

Data sheet addition for JC Relay

- **Integrated arc-blowing magnet for high DC loads [H73 type]**
- **High switching capacity: 20A / 60V DC**
- **Clearance and creepage distance contact / coil: 8 mm**
- **Two contacts connected in series ensures even higher life expectancy**

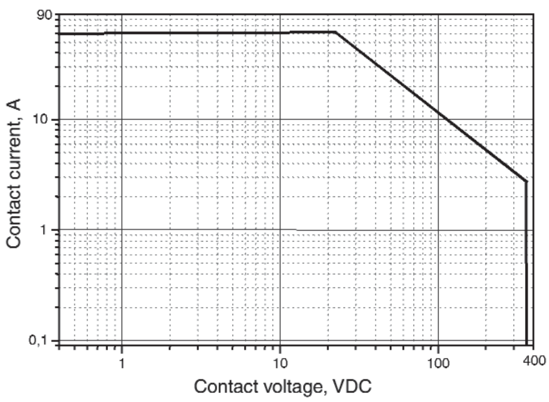
APPLICATIONS: Switching of DC loads in devices such as
- Control of Industrial DC motors
- Emergency power-off for DC loads

Power

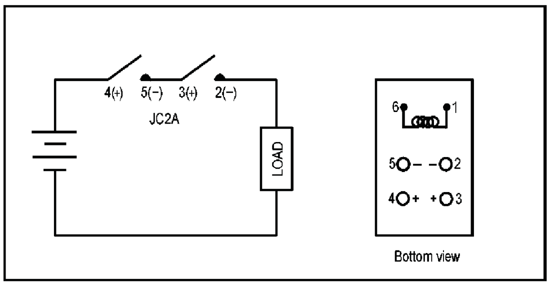
Arrangement		**2 Form A**	
Contact material		**$AgSnO_2$**	
Contact connection		one contact	two contacts in series
Rating (resistive) load	250VDC / 5A	1×10^4 ops.	2×10^4 ops.
	250VDC / 4A	3×10^4 ops.	4×10^4 ops.
Special loads test data (min. operations at 20°C)	220VDC / 1,6A; L/R = 14.6ms (1s On, 4s Off)	2×10^4	3×10^4
	220VDC / 1A; L/R = 17.4ms (1s On, 4s Off)	2×10^4	3×10^4
	60VDC / 20A; resistive load (30s On, 30s Off)	1×10^4	2×10^4

Mechanical, endurance and coil data according to JC-datasheet

Load limit curve for connection in series



Connection diagram



Attention: For the Blow-out effect, the polarity must be defined as: (-) at contacts: 2, 5
(+) at contacts: 3, 4

ORDERING AND TYPE INFORMATION (values at 20°C)

Type	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating power, W	Coil resistance, Ω (±10%)
JC2aF-DC5V-Y1-F-H73	5	4.0	0.5	1	25
JC2aF-DC6V-Y1-F-H73	6	4.8	0.6	1	36
JC2aF-DC12V-Y1-F-H73	12	9.6	1.2	1	144
JC2aF-DC24V-Y1-F-H73	24	19.2	2.4	1	576
JC2aF-DC48V-Y1-F-H73	48	38.4	4.8	1	2304

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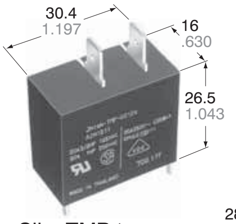
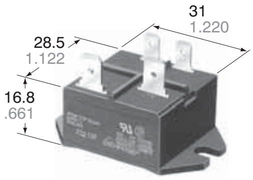
COMPACT POWER RELAY
FOR INDUCTIVE LOAD

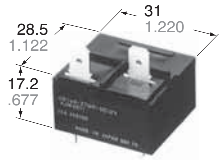
JM RELAYS



Slim TMP type



Flat TM type



Flat TMP type

mm inch

FEATURES

• Compact, high-capacity, and resistant to inductive loads
The relay is a compact 16×30.4×26.5 mm .630×1.197×1.043 inch. It can control an inductive load (cosφ = 0.7) with inrush current of 70 A and steady state current of 20 A.

• Excellent contact welding resistance
High contact pressure, a forced opening mechanism, and a forced wiping mechanism realizes an excellent contact welding resistance.

• High breakdown voltage and surge resistant relay
More than 6.4 mm .252 inch maintained for the insulation distance between contacts and coil, and the breakdown voltage between contacts and coil is 5,000 V for 1 minute. In addition, the surge resistance between contacts and coil is greater than 10,000 V.

• Resistant to external force
An absorber mechanism is used on the load terminals, giving a large improvement in characteristics variations caused by the external force during FASTON placement/removal.

• Flux resistance mechanism
The terminal area is plugged with resin to prevent flux seepage during PCB mounting. (TMP type)

• Conforms to the various safety standards
UL, CSA approved.
TÜV, VDE under application.

• The line up can support economical mounting methods.
The relay are equipped with a drive terminal (coil terminal) on one side for PCBs, and a load terminal (tab terminal #250) on the reverse side. The line up includes the TM type which can be attached directly to the PCB composing a drive circuit, and the TMP type which supports economical wiring. The TMP type can also be directly attached, and a high capacity load can be wired to the tab terminal.

COMMENTS ABOUT Cd FREE

We have introduced Cadmium free type products to reduce the material which is not good for our environment. (The suffix “F” should be added to the part number.) If you are still using Cadmium containing parts, which don’t have “F” on the suffix of the part number, please use Cadmium free parts from now on. The life of the Cadmium free parts may be shorter than the Cadmium containing parts based on the load condition, so please evaluate the Cadmium free parts with your actual application before use.

SPECIFICATIONS

Contact

Arrangement				1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)				30 mΩ
Contact material				$AgSnO_2$ type
Rating (resistive load)	Nominal switching capacity			20 A 250 V AC
	Max. switching power			5,000 VA
	Max. switching voltage			250 V AC
	Max. switching current			20 A
	Min. switching capacity#1			100 mA, 5 V DC
Expected life (min. ope.)	Mechanical (at 180 cpm)			10^6
	Electrical Life (at 20 cpm)	Resistive load 20 A, 250 V AC (cosφ = 1)		10^5
		Inductive load	Inrush 70 A, Steady 20 A (250 V AC cosφ = 0.7)	10^5
			Inrush 80 A, Cut-off 80 A (When the motor is locked) (250 V AC cosφ = 0.7)	1.5×10^3

Coil

Nominal operating power	900 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50µs according to JEC-212-1981
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 11ms; detection time: 10µs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10µs
*8 Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

Characteristics

Max. operating speed		180 cpm
Initial insulation resistance*1		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	5,000 Vrms for 1 min.
Surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage)(at 20°C)		Max. 20ms (Approx. 8 ms)
Release time (without diode)*4 (at nominal voltage)(at 20°C)		Max. 10ms (Approx. 3 ms)
Temperature rise (at 60°C)		Max. 55°C (Contact switching current: 20 A/voltage applied to coil: 100%V)
Shock resistance	Functional*5	Min. 98 m/s² {10 G}
	Destructive*6	Min. 980 m/s² {100 G}
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 1.6 mm
	Destructive	10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +60°C –40°F to +140°F
	Humidity	5 to 85% R.H.
Unit weight	Slim TMP	Approx. 28 g .99 oz
	Flat TMP	Approx. 32 g 1.13 oz
	Flat TM	Approx. 33 g 1.16 oz

Power

TYPICAL APPLICATIONS

- Compressor and heater control in air conditioners
- Power control in hot air type heaters
- Magnetron control in microwave ovens
- Lamp and motor control in OA equipment such as copiers and facsimiles.

ORDERING INFORMATION

Ex. JM 1a N — Z TMP — DC 24V — F

Contact arrangement	Pickup voltage	Classification of type	Mounting classification	Coil voltage	Environmental support
1a: 1 Form A	N: 70% of nominal voltage	Nil: Slim type Z: Flat type	TMP: TMP type TM: TM type (Flat type) P: PCB type(Slim type)	DC 5, 6, 9, 12, 24, 48 V	F: RoHS Directive conforming type ($AgSnO_2$ type) Nil: RoHS Directive non-conforming type (AgCdO type)

(Note) 1. Standard packing: Carton: 50pcs. Case: 200pcs.
UL/CSA, VDE approved type is standard.

TYPES AND COIL DATA (at 20°C 68°F)

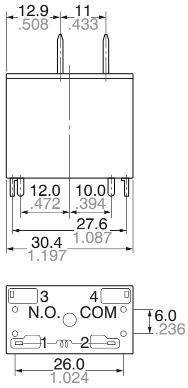
Part No.				Nominal voltage, V DC	Pick-up voltage	Drop-out voltage,	Nominal operating current, mA	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Slim		Flat								
TMP	PCB	TMP	TM							
JM1aN-TMP-DC5V-F	JM1aN-P-DC5V-F	JM1aN-ZTMP-DC5V-F	JM1aN-ZTM-DC5V-F	5	3.5	0.5	180	27.8	900	5.5
JM1aN-TMP-DC6V-F	JM1aN-P-DC6V-F	JM1aN-ZTMP-DC6V-F	JM1aN-ZTM-DC6V-F	6	4.2	0.6	150	40	900	6.6
JM1aN-TMP-DC9V-F	JM1aN-P-DC9V-F	JM1aN-ZTMP-DC9V-F	JM1aN-ZTM-DC9V-F	9	6.3	0.9	100	90	900	9.9
JM1aN-TMP-DC12V-F	JM1aN-P-DC12V-F	JM1aN-ZTMP-DC12V-F	JM1aN-ZTM-DC12V-F	12	8.4	1.2	75	160	900	13.2
JM1aN-TMP-DC24V-F	JM1aN-P-DC24V-F	JM1aN-ZTMP-DC24V-F	JM1aN-ZTM-DC24V-F	24	16.8	2.4	37.5	640	900	26.4
JM1aN-TMP-DC48V-F	JM1aN-P-DC48V-F	JM1aN-ZTMP-DC48V-F	JM1aN-ZTM-DC48V-F	48	33.6	4.8	18.75	2,560	900	52.8

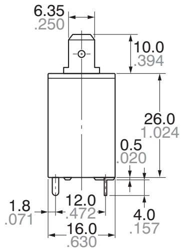
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

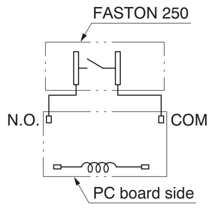
Slim TMP type

CAD Data



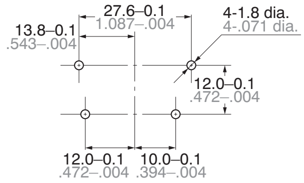


Schematic



PC board pattern

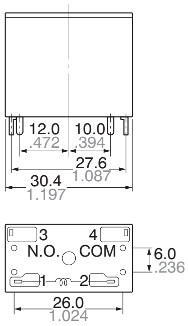
(Copper-side view)

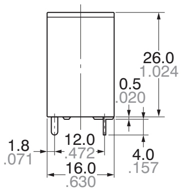


General tolerance: ±0.4 ±.016

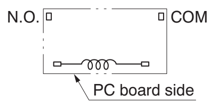
Slim PCB type

CAD Data



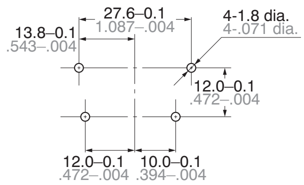


Schematic



PC board pattern

(Copper-side view)

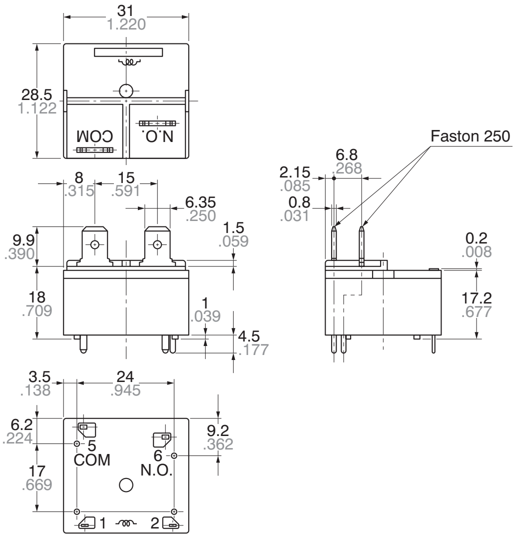


General tolerance: ±0.4 ±.016

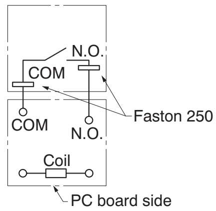
Tolerance: ±0.1 ±.004

Flat TMP type

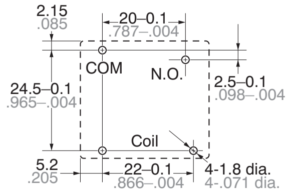
CAD Data



Schematic



PC board pattern (Bottom view)



General tolerance: ±0.4 ±.016

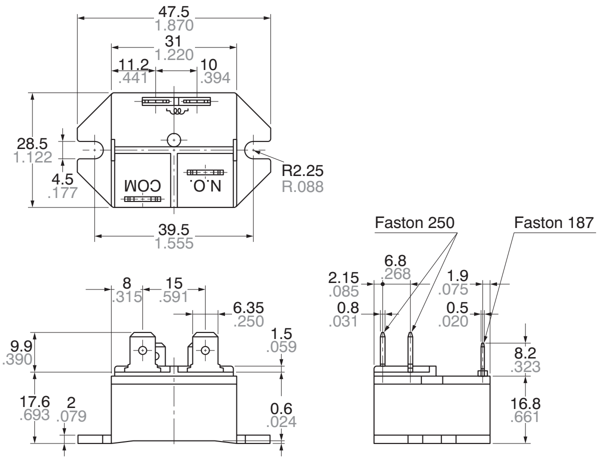
Tolerance: ±0.1 ±.004

Power

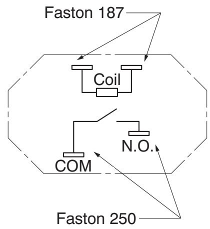
Flat TM type

mm inch

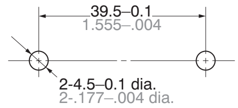
CAD Data



Schematic



Panel cutout

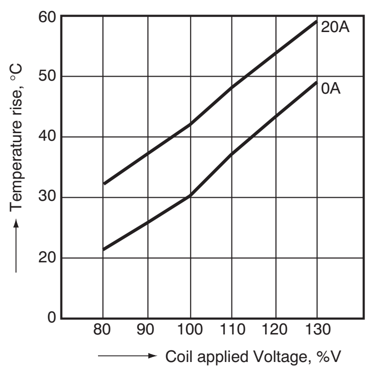


General tolerance: ±0.4 ±.016

REFERENCE DATA

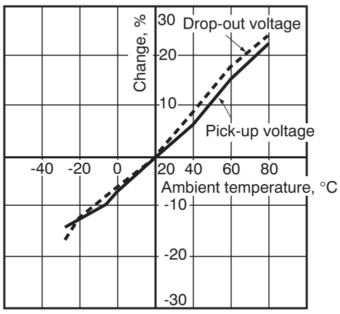
1. Coil temperature rise

Place to be measured: Inside of coil
Ambient temperature: 25°C 77°F



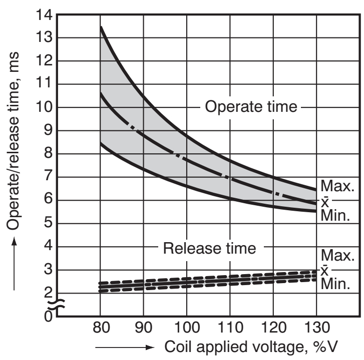
2. Ambient temperature characteristics

Sample: JM1aN-TMP-DC24V-F, 5 pcs.

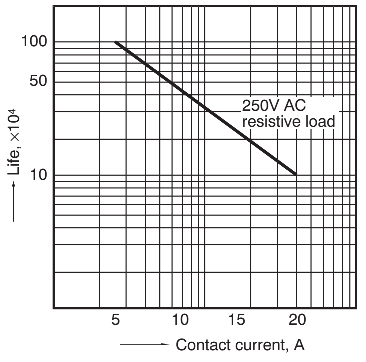


3. Operate/release time

Sample: JM1aN-TMP-DC24V-F, 5 pcs.



4. Life curve



For Cautions for Use, see Relay Technical Information (page 582).

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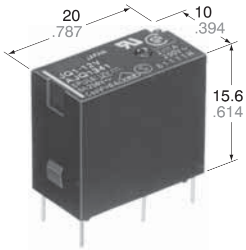
HIGH ELECTRICAL & MECHANICAL NOISE IMMUNITY RELAY

JQ RELAYS



mm inch

FEATURES

- **High electrical noise immunity**
- **High switching capacity in a compact package**
- **High sensitivity: 200 mW (1a), 400 mW (1c)**
- **High surge voltage: 8,000 V between contacts and coil**
- **UL, CSA, VDE, TÜV, SEMKO approved**
- **Class B coil insulation type available**

About Cd-free contacts
We have introduced cadmium-free type products to reduce environmentally hazardous substances. Please replace parts that contain cadmium with Cd-free products. Evaluate them with your actual application before use because the life of a relay depends on the contact material and load.

Power

SPECIFICATIONS

Contact

				Standard type	High capacity type
Arrangement				1 Form A, 1 Form C	
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)				100 mΩ	
Contact material				$AgSnO_2$ type	
Rating (resistive)	Nominal switching capacity	1a		5 A 125 V AC, 2 A 250 V AC, 5 A 30 V DC	10 A 125 V AC, 5 A 250 V AC, 5 A 30 V DC
		1c	N.O.	5 A 125 V AC, 2 A 250 V AC, 3 A 30 V AC	10 A 125 V AC, 5 A 250 V AC, 5 A 30 V DC
			N.C.	2 A 125 V AC, 1 A 250 V AC, 1 A 30 V DC	3 A 125 V AC, 2 A 250 V AC, 1 A 30 V DC
	Max. switching power	1a		625 VA, 150 W	1,250 VA, 150 W
		1c	N.O.	625 VA, 90 W	1,250 V AC, 150 W
			N.C.	250 VA, 30 W	500 V AC, 30 W
	Max. switching voltage			250 V AC, 110 V DC (0.3A)	
	Max. switching current			N.O.: 5 A N.C.: 2 A	N.O.: 10 A N.C.: 3 A
	Min. switching capacity[#1]			100 mA, 5 V DC	
Expected mechanical life (at 180 cpm)(min. operations)				10^7	

Expected electrical life (min. operations)

Type			Switching capacity	No. of operations
Standard type	1a		5 A 125 V AC 3 A 125 V AC 2 A 250 V AC 5 A 30 V DC	5×10^4 2×10^5 2×10^5 10^5
	1c	N.O.	5 A 125 V AC 2 A 250 V AC 3 A 30 V DC	5×10^4 2×10^5 10^5
		N.C.	2 A 125 V AC 1 A 250 V AC 1 A 30 V DC	2×10^5 2×10^5 10^5
High capacity type	1a		10 A 125 V AC 5 A 250 V AC 5 A 30 V DC	5×10^4 5×10^4 10^5
	1c	N.O.	10 A 125 V AC 5 A 250 V AC 5 A 30 V DC	5×10^4 5×10^4 10^5
		N.C.	3 A 125 V AC 2 A 250 V AC 1 A 30 V DC	2×10^5 2×10^5 10^5

Coil (at 20°C 68°F)

Nominal operating power	1a: 200 mW	1c: 400 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed		20 cpm
Initial insulation resistance*1		Min. 1,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	1a: 1,000 Vrms for 1 min. 1c: 750 Vrms for 1 min.
	Between contacts and coil	4,000 Vrms for 1 min.
Surge voltage between contact and coil*3		8,000 V
Operate time*4 (at nominal voltage)		Max. 20 ms
Release time*4 (at nominal voltage)(without diode)		Max. 10 ms
Temperature rise*5		Max. 45°C
Shock resistance	Functional*6	Min. 294 m/s^2 {30 G}
	Destructive*7	Min. 980 m/s^2 {100 G}
Vibration resistance	Functional*8	98 m/s^2 {10 G}, 10 to 55 Hz at double amplitude of 1.6 mm
	Destructive	117.6 m/s^2 {12 G}, 10 to 55 Hz at double amplitude of 2.0 mm
Conditions for operation, transport and storage*9 (Not freezing and condensing at low temperature)	Ambient temp.*10	–40°C to +85°C –40°F to +185°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 7 g .25 oz

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as “Initial breakdown voltage” section
*2 Detection current: 10 mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 Measured conditions

Standard type	Resistive, nominal voltage applied to the coil. Contact carrying current: 5 A, at 70°C 158°F
High capacity type	Resistive, nominal voltage applied to the coil. Contact carrying current: 10 A, at 70°C 158°F

*6 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*7 Half-wave pulse of sine wave: 6ms
*8 Detection time: 10μs
*9 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).
*10 When using relays in a high ambient temperature, consider the pick-up voltage rise due to the high temperature (a rise of approx. 0.4% V for each 1°C 33.8°F with 20°C 68°F as a reference) and use a coil impressed voltage that is within the maximum allowable voltage range.

TYPICAL APPLICATIONS

• Air conditioners
• Refrigerators
• Microwave ovens
• Heaters

ORDERING INFORMATION

Ex. JQ 1a P — B — 12 V — F

Contact arrangement	Contact capacity	Coil insulation class	Coil voltage (DC)	Contact material
1a: 1 Form A 1: 1 Form C	Nil: Standard P: High capacity	Nil: Class E coil insulation B: Class B coil insulation	5, 6, 9, 12, 18, 24, 48* V	F: AgSnO$_2$ type

UL/CSA, VDE, SEMKO approved type is standard.
* Available only for 1 Form C type

TYPES AND COIL DATA at 20°C 68°F

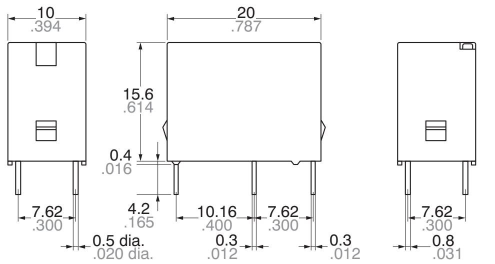
		Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (min.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA	Nominal operating power, mW	Coil resistance, Ω (±10%)	Max. allowable voltage, V DC
1 Form A	Standard type	JQ1a-5V-F	5	3.75	0.25	40	200	125	180% of nominal voltage (at 20°C 68°F)
		JQ1a-6V-F	6	4.5	0.3	33.3		180	
		JQ1a-9V-F	9	6.75	0.45	22.2		405	
		JQ1a-12V-F	12	9	0.6	16.7		720	
		JQ1a-18V-F	18	13.5	0.9	11.1		1,620	
		JQ1a-24V-F	24	18	1.2	8.3		2,880	
	High capacity type	JQ1aP-5V-F	5	4	0.25	40	200	125	130% of nominal voltage (at 85°C 185°F)
		JQ1aP-6V-F	6	4.8	0.3	33.3		180	
		JQ1aP-9V-F	9	7.2	0.45	22.2		405	
		JQ1aP-12V-F	12	9.6	0.6	16.7		720	
		JQ1aP-18V-F	18	14.4	0.9	11.1		1,620	
		JQ1aP-24V-F	24	19.2	1.2	8.3		2,880	
1 Form C	Standard type	JQ1-5V-F	5	3.75	0.25	80	400	62.5	150% of nominal voltage (at 20°C 68°F)
		JQ1-6V-F	6	4.5	0.3	66.7		90	
		JQ1-9V-F	9	6.75	0.45	44.4		202.5	
		JQ1-12V-F	12	9	0.6	33.3		360	
		JQ1-18V-F	18	13.5	0.9	22.2		810	
		JQ1-24V-F	24	18	1.2	16.7		1,440	
		JQ1-48V-F	48	36	2.4	8.3		5,760	
	High capacity type	JQ1P-5V-F	5	4	0.25	80	400	62.5	110% of nominal voltage (at 85°C 185°F)
		JQ1P-6V-F	6	4.8	0.3	66.7		90	
		JQ1P-9V-F	9	7.2	0.45	44.4		202.5	
		JQ1P-12V-F	12	9.6	0.6	33.3		360	
		JQ1P-18V-F	18	14.4	0.9	22.2		810	
		JQ1P-24V-F	24	19.2	1.2	16.7		1,440	
		JQ1P-48V-F	48	38.4	2.4	8.3		5,760	

DIMENSIONS (mm inch)

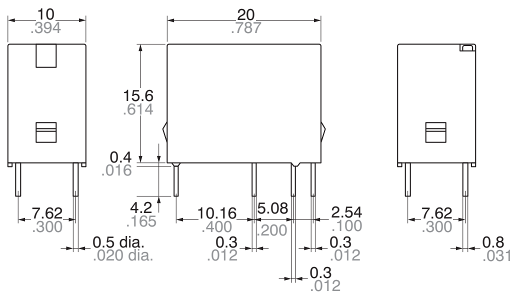
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data

1 Form A

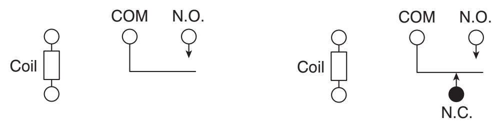


1 Form C



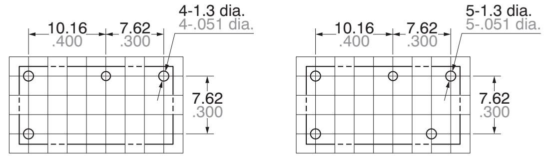
Schematic (Bottom view)

1 Form A 1 Form C



PC board pattern (Bottom view)

1 Form A 1FormC

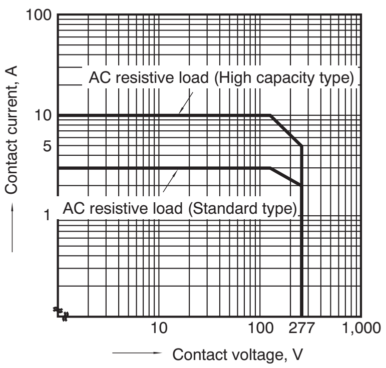


Tolerance: ±0.1 ±.004

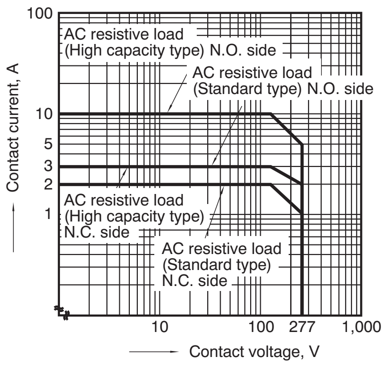
Dimension :	General tolerance
Max. 1mm .039 inch	±0.2 ±.008
1 to 5mm .039 to .118 inch	±0.3 ±.012
Min. 5mm .118 inch	±0.4 ±.016

REFERENCE DATA

Max. switching capacity (1 Form A type)

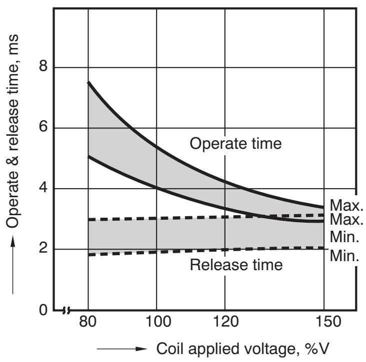


Max. switching capacity (1 Form C type)

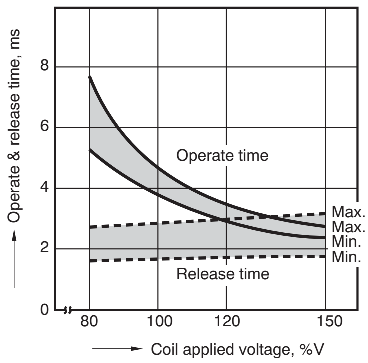


Standard type

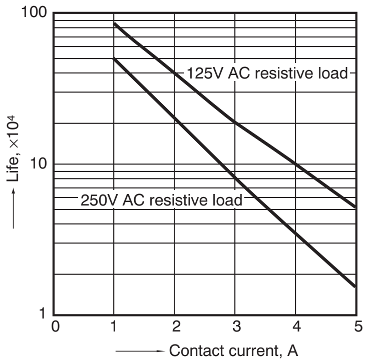
1-(1). Operate & release time (1 Form A type)
Tested sample: JQ1a-12V-F, 25 pcs.



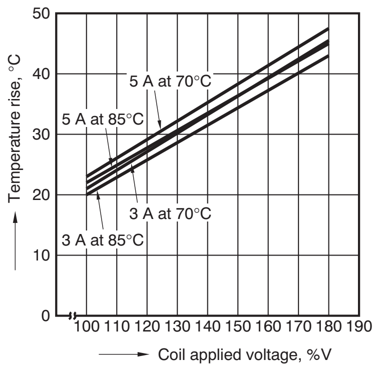
1-(2). Operate & release time (1 Form C type)
Tested sample: JQ1-24V-F, 25 pcs.



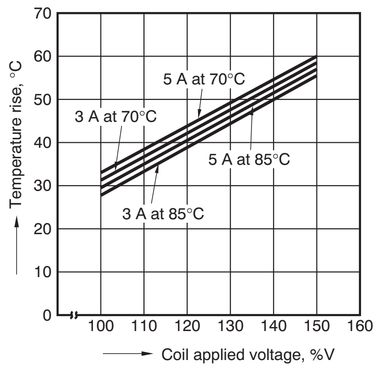
2. Life curve
Ambient temperature: room temperature



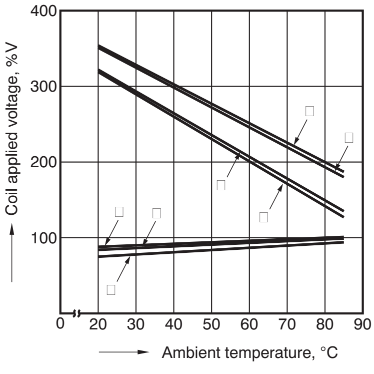
3-(1). Coil temperature rise (1 Form A type)
Contact carrying current: 3 A, 5 A
Measured portion: Inside the coil



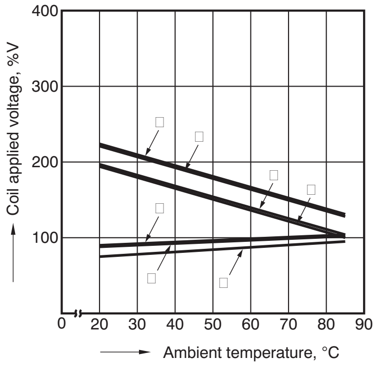
3-(2). Coil temperature rise (1 Form C type)
Contact carrying current: 3 A, 5 A
Measured portion: Inside the coil



4-(1). Ambient temperature characteristics (1 Form A type)
Tested sample: JQ1a-24V-F
Contact carrying current: 3 A, 5 A



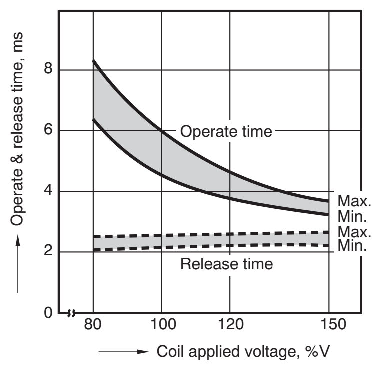
4-(2). Ambient temperature characteristics (1 Form C type)
Tested sample: JQ1-24V-F
Contact carrying current: 3 A, 5 A



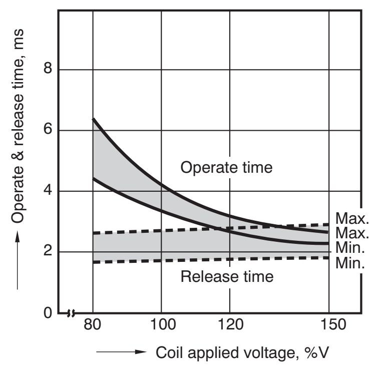
① Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 130°C 266°F) (Carrying current: 3 A)
② Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 130°C 266°F) (Carrying current: 5 A)
③ Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 115°C 239°F) (Carrying current: 3 A)
④ Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 115°C 239°F) (Carrying current: 5 A)
⑤ Pick-up voltage with a hot-start condition of 100%V on the coil (Carrying current: 5 A)
⑥ Pick-up voltage with a hot-start condition of 100%V on the coil (Carrying current: 3 A)
⑦ Pick-up voltage

High capacity type

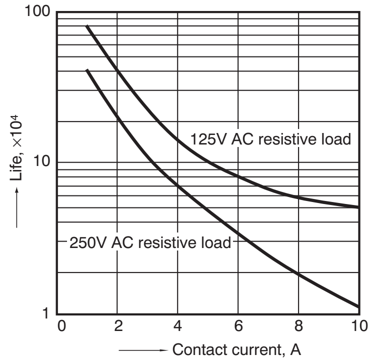
1-(1). Operate & release time (1 Form A type)
Tested sample: JQ1aP-12V-F, 25 pcs.



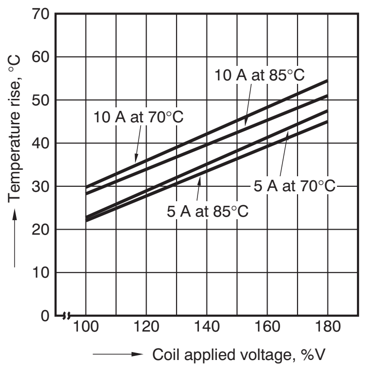
1-(2). Operate & release time (1 Form C type)
Tested sample: JQ1P-12V-F, 25 pcs.



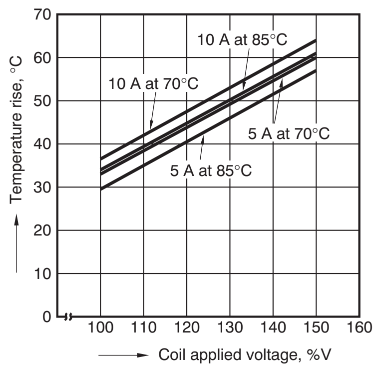
2. Life curve
Ambient temperature: room temperature



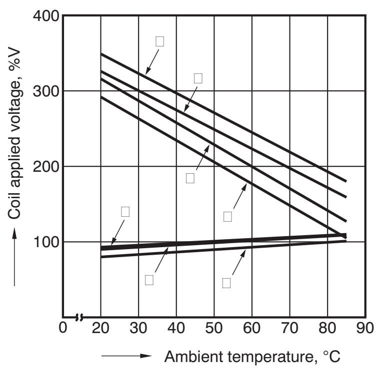
3-(1). Coil temperature rise (1 Form A type)
Contact carrying current: 5 A, 10 A
Measured portion: Inside the coil



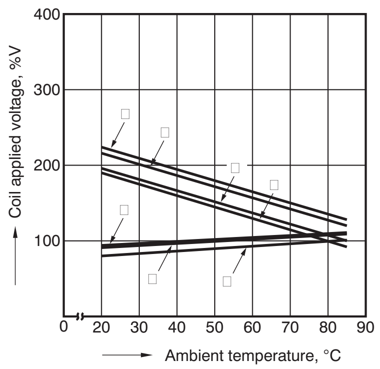
3-(2). Coil temperature rise (1 Form C type)
Contact carrying current: 5 A, 10 A
Measured portion: Inside the coil



4-(1). Ambient temperature characteristics (1 Form A type)
Tested sample: JQ1aP-24V-F
Contact carrying current: 5 A, 10 A



4-(2). Ambient temperature characteristics (1 Form C type)
Tested sample: JQ1P-24V-F
Contact carrying current: 5 A, 10 A



① Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 130°C 266°F) (Carrying current: 5 A)
② Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 130°C 266°F) (Carrying current: 10 A)
③ Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 115°C 239°F) (Carrying current: 5 A)
④ Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 115°C 239°F) (Carrying current: 10 A)
⑤ Pick-up voltage with a hot-start condition of 100%V on the coil (Carrying current: 10 A)
⑥ Pick-up voltage with a hot-start condition of 100%V on the coil (Carrying current: 5 A)
⑦ Pick-up voltage

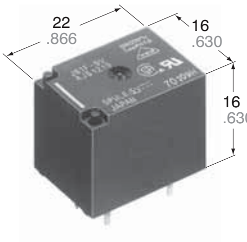
For Cautions for Use, see Relay Technical Information (page 582).

Power

Panasonic
ideas for life

MINIATURE PC BOARD TYPE POWER RELAY

JS RELAYS



mm inch

FEATURES

- **Miniature size with universal terminal footprint**
- **High contact capacity: 10 A**
- **TV-5 type available (Standard type)**
  1 Form A type → TV-5
  1 Form C type → TV-5 (N.O. side only)
- **VDE, TÜV also approved**
- **Sealed construction for automatic cleaning (Standard type)**
- **Class B and F coil insulation type also available.**
- **EN60335-1 GWT compliant (Tested by VDE) type available**
- **Surge voltage 6 kV type also available**

About Cd-free contacts
We have introduced Cadmium free type products to reduce Environmental Hazardous Substances.
(The suffix “F” should be added to the part number)
Please replace parts containing Cadmium with Cadmium-free products and evaluate them with your actual application before use because the life of a relay depends on the contact material and load.

SPECIFICATIONS

Contact

Types		Standard type	Long endurance type
Arrangement		1 Form A, 1 Form C	1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ	
Contact material		$AgSnO_2$ type	
Rating (resistive load)	Nominal switching capacity	10 A 250 V AC 10 A 125 V AC 6 A 277 V AC	10 A 250 V AC 10 A 125 V AC 10 A 277 V AC
	Max. switching power	2,500 VA	
	Max. switching voltage	250 V AC, 100 V DC	
	Max. switching current	10 A (AC), 5 A (DC)	
	Min. switching capacity#1	100 mA, 5 V DC	
Expected life (min. ope.)	Mechanical (at 180 cpm)	10^7	
	Electrical at 10 A 125 V AC, 6 A 277 V AC resistive (standard) 10 A 277 V AC resistive (High power)	1×10^5	2×10^5
	10 A 250 V AC resistive (Standard: at 20 cpm) (High power: at 20 cpm, 105°C 221°F)**	5×10^4 (No contact only)	1.2×10^5

** Holding voltage should be 60% V of nominal voltage

Coil

Nominal operating power	360 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
*1 Detection current: 10mA
*2 Excluding contact bounce time

Characteristics

Max. operating speed		20 cpm	
Types		Standard type	Long endurance type
Initial insulation resistance		Min. 100 MΩ (at 500 V DC)	
Initial breakdown voltage*1	Between open contacts	750 Vrms for 1 min.	
	Between contacts and coil	1,500 Vrms for 1 min.	
Operate time*2 (at nominal voltage)		Max. 10 ms	
Release time (without diode)*2 (at nominal voltage)		Max. 10 ms	
Temperature rise (at nominal voltage)		Max. 35°C, resistive, nominal voltage applied to coil. Contact carrying current: 10A, at 70°C 158°F	
Shock resistance	Functional*3	98 m/s^2 {10 G}	
	Destructive*4	980 m/s^2 {100 G}	
Vibration resistance	Functional*5	10 to 55 Hz at double amplitude of 1.6 mm	
	Destructive	10 to 55 Hz at double amplitude of 2 mm	
Conditions for operation, transport and storage*6 (Not freezing and condensing at low temperature)	Ambient temp.*7	–40°C to +85°C –40°F to +185°F	–40°C to +105°C –40°F to +221°F
	Humidity	5 to 85% R.H.	
Unit weight		Approx.12 g .423 oz	

*3 Half-wave pulse of sine wave: 11ms; detection time: 10µs
*4 Half-wave pulse of sine wave: 6ms
*5 Detection time: 10µs
*6 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).
*7 When using relays in a high ambient temperature, consider the pick-up voltage rise due to the high temperature (a rise of approx. 0.4% V for each 1°C 33.8°F with 20°C 68°F as a reference) and use a coil impressed voltage that is within the maximum allowable voltage range.

TYPICAL APPLICATIONS

1. Home appliances
   Air conditioner, heater, etc.
2. Automotive
   Power-window, car antenna, door-lock, etc.
3. Office machines
   PPC, facsimile, etc.
4. Vending machines

ORDERING INFORMATION

Ex. JS [1a] [F] — [B] — [12V] — [F][ ] — [ ][ ]

Contact arrangement	Protective construction	Coil insulation class	Coil voltage (DC)	Contact material	Flame resistance and tracking resistance	Surge voltage
1: 1 Form C (Standard) 1a: 1 Form A (Standard) 1aP: 1 Form A (Long endurance type)	Nil: Sealed type F: Flux-resistant type	Nil: Class E insulation B: Class B insulation F: Class F insulation	5, 6, 9, 12, 18, 24, 48 V	F: $AgSnO_2$ type	Nil: — TT: EN60335-1 (Conform)	6K: 6kV type

Standard: UL/CSA, VDE, TÜV (Standard type)
UL/CSA, VDE (Long endurance type and EN60335-1 GWT compliant type)
UL/CSA (Surge voltage 6kV type)

Notes: 1. Standard packing: Carton: 100 pcs. Case: 500 pcs.
2. When ordering TV rated (TV-5) types, add suffix -TV.
3. Contact arrangement 1aP type is Flux-resistant type only (Class B insulation only).

COIL DATA

Part No.					Nominal voltage, V DC	Pick-up voltage, V DC (max.) (at 20°C 68°F)	Drop-out voltage, V DC (min.) (at 20°C 68°F)	Coil resistance, Ω (±10%) (at 20°C 68°F)	Nominal operating current, mA (±10%) (at 20°C 68°F)	Nominal operating power, mW (at 20°C 68°F)	Max. allowable voltage (at 85°C 185°F)
Standard type				Long endurance type							
Sealed type		Flux-resistant type		Flux-resistant type							
1 Form A	1 Form C	1 Form A	1 Form C	1 Form A							
JS1a-5V-F	JS1-5V-F	JS1aF-5V-F	JS1F-5V-F	JS1aPF-B-5V-F	5	3.5	0.5	69.4	72		
JS1a-6V-F	JS1-6V-F	JS1aF-6V-F	JS1F-6V-F	JS1aPF-B-6V-F	6	4.2	0.6	100	60		
JS1a-9V-F	JS1-9V-F	JS1aF-9V-F	JS1F-9V-F	JS1aPF-B-9V-F	9	6.3	0.9	225	40		
JS1a-12V-F	JS1-12V-F	JS1aF-12V-F	JS1F-12V-F	JS1aPF-B-12V-F	12	8.4	1.2	400	30	360	130%V of nominal voltage
JS1a-18V-F	JS1-18V-F	JS1aF-18V-F	JS1F-18V-F	JS1aPF-B-18V-F	18	12.6	1.8	900	20		
JS1a-24V-F	JS1-24V-F	JS1aF-24V-F	JS1F-24V-F	JS1aPF-B-24V-F	24	16.8	2.4	1,600	15		
JS1a-48V-F	JS1-48V-F	JS1aF-48V-F	JS1F-48V-F	JS1aPF-B-48V-F	48	33.6	4.8	6,400	7.5		

Notes) 1. Class B and F coil insulation types available.
Ex) JS1aF-B-12V-F
JS1aF-F-12V-F
2. Surge voltage 6kV types available. When ordering, please add suffix "6K" (except for Long endurance type and EN60335-1 GWT compliant type).
Ex) JS1aF-B-12V-F-6K

EN60335-1 GWT compliant types. When ordering, please add suffix "TT", e.g. JS1aF-B-12V-FTT

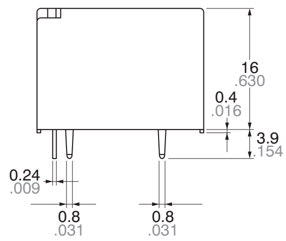
Part No.					Nominal voltage, V DC	Pick-up voltage, V DC (max.) (at 20°C 68°F)	Drop-out voltage, V DC (min.) (at 20°C 68°F)	Coil resistance, Ω (±10%) (at 20°C 68°F)	Nominal operating current, mA (±10%) (at 20°C 68°F)	Nominal operating power, mW (at 20°C 68°F)	Max. allowable voltage (at 85°C 185°F)
Standard type				Long endurance type							
Sealed type		Flux-resistant type		Flux-resistant type							
1 Form A	1 Form C	1 Form A	1 Form C	1 Form A							
JS1a-5V-FTT	JS1-5V-FTT	JS1aF-5V-FTT	JS1F-5V-FTT	JS1aPF-B-5V-FTT	5	3.5	0.5	69.4	72		
JS1a-6V-FTT	JS1-6V-FTT	JS1aF-6V-FTT	JS1F-6V-FTT	JS1aPF-B-6V-FTT	6	4.2	0.6	100	60		
JS1a-9V-FTT	JS1-9V-FTT	JS1aF-9V-FTT	JS1F-9V-FTT	JS1aPF-B-9V-FTT	9	6.3	0.9	225	40		
JS1a-12V-FTT	JS1-12V-FTT	JS1aF-12V-FTT	JS1F-12V-FTT	JS1aPF-B-12V-FTT	12	8.4	1.2	400	30	360	130%V of nominal voltage
JS1a-18V-FTT	JS1-18V-FTT	JS1aF-18V-FTT	JS1F-18V-FTT	JS1aPF-B-18V-FTT	18	12.6	1.8	900	20		
JS1a-24V-FTT	JS1-24V-FTT	JS1aF-24V-FTT	JS1F-24V-FTT	JS1aPF-B-24V-FTT	24	16.8	2.4	1,600	15		
JS1a-48V-FTT	JS1-48V-FTT	JS1aF-48V-FTT	JS1F-48V-FTT	JS1aPF-B-48V-FTT	48	33.6	4.8	6,400	7.5		

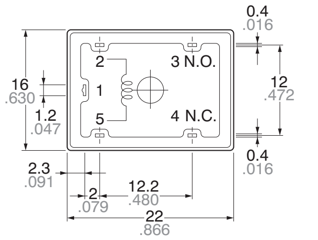
Notes) 1. Class B and F coil insulation types available.
Ex) JS1aF-B-12V-FTT
JS1aF-F-12V-FTT
2. Surge voltage 6kV types are not available for the EN60335-1 GWT compliant type.

DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data



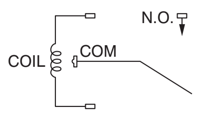


Note: Terminal No. 4 is only for Standard 1 Form C type

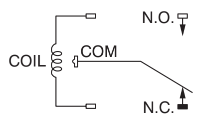
General tolerance: ±0.3 ±.012

Schematic
(Bottom view)

1a

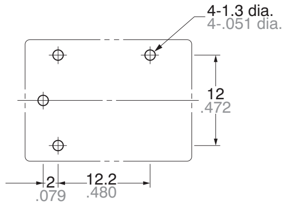


1c

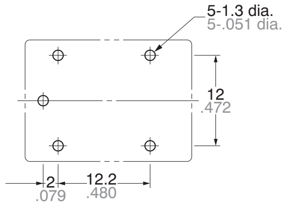


PC board pattern
(Bottom view)

1a
(Standard, High Power)



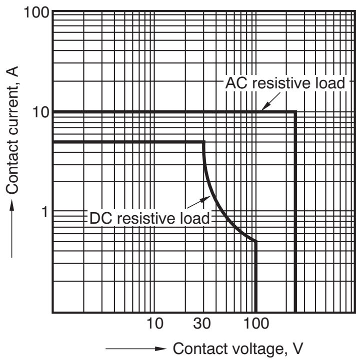
1c
(Standard)



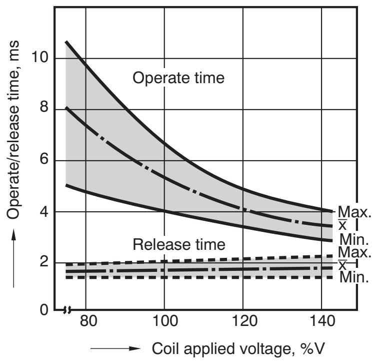
Tolerance: ±0.1 ±.004

REFERENCE DATA

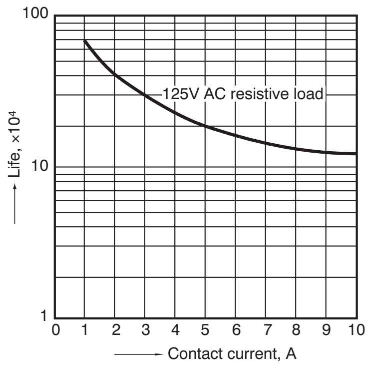
1. Maximum value for switching capacity



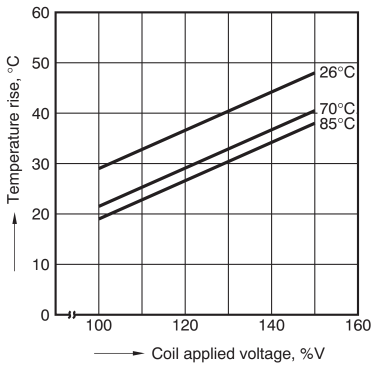
2. Operate/release time
Sample: 25 pcs., JS1-12V-F



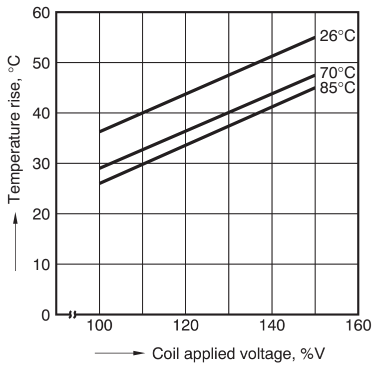
3. Life curve
Ambient temperature: Room temperature



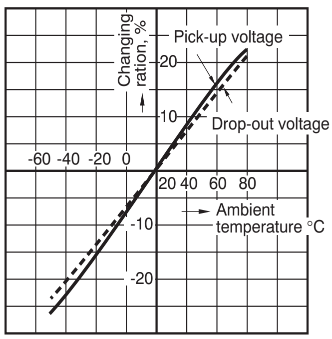
4-(1). Coil temperature rise
Sample: 5 pcs., JS1a-24V-F
Measured portion: Inside the coil
Contact current: 5 A



4-(2). Coil temperature rise
Sample: 5 pcs., JS1a-24V-F
Measured portion: Inside the coil
Contact current: 10 A



5. Ambient temperature characteristics
Sample: 6 pcs., JS1-12V-F



For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

SURGE VOLTAGE 6,000 V
30 AMP. RELAY

JT-V RELAYS

PCB type

TMP type

FEATURES

- **Surge withstand voltage: Min. 6,000 V**
- **High switching capacity — 30 A for 1 Form A**
- **2 contact arrangements — 1 Form A or 1 Form C**
- **"TMP" types available**
- **UL/C-UL recognized**
- **Class F types standard**

SPECIFICATIONS

Contacts

		PCB & TMP type	
Arrangement		1 Form A	1 Form C
Initial contact resistance, max. (By voltage drop method, 6 V DC 1 A)		50 mΩ	
Contact material		$AgSnO_2$ type	
Rating	Max. switching power	8310 VA	N.C.: 2770 VA N.O.: 5540 VA
	Max. switching voltage	277 V AC	
	Max. switching current	30 A	N.C.: 10 A N.O.: 20 A
	Min. switching capacity#1	100 mA, 5 V DC	
Expected life	Mechanical	Min. 1×10^7	
	Electrical (Resistive load)	20 A 277 V AC Min. 1×10^5*	N.O.: 20 A 277 V AC Min. 1×10^5* N.C.: 10 A 277 V AC Min. 1×10^5*

* The life is for open venting-hole condition.

Coil at 20°C 68°F

	PCB & TMP type
Nominal operating power	Approx. 1,000 mW

Characteristics

		PCB & TMP type
Initial insulation resistance*1		Min. 100 MΩ at 500 V DC
Initial breakdown voltage*2	Between contacts	1,200 Vrms
	Between contacts and coil	3,500 Vrms
Initial surge voltage between contact and coil		Min. 6,000 V*3
Operate time*4 (at nominal voltage)		Max. 15 ms
Release time (without diode)*4 (at nominal voltage)		Max. 10 ms
Shock resistance	Functional*5	Min. 98 m/s^2 {10 G}
	Destructive*6	Min. 980 m/s^2 {100 G}
Vibration resistance	Functional*7	Max. 88.2 m/s^2 {9 G}, 10 to 55 Hz at double amplitude of 1.5 mm
	Destructive	Max. 117.6 m/s^2 {12 G}, 10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–55°C to +85°C –67°F to +185°F
	Humidity	5 to 85% R.H.
Unit weight		PCB type: Approx. 25 g (.88 oz) TMP type: Approx. 30 g (1.06 oz)

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10 mA
*3 Ware is standard shock voltage of $\pm1.2 \times 50\mu s$ according to JEC-212-1981.
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 11ms; detection time: 10µs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10µs
*8 Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

TYPICAL APPLICATIONS

- Oven
- Heating & ventilation
- Home appliance

ORDERING INFORMATION

JT-V Relays (PCB and TMP type)

JTV [1a] — [S] — [TMP] — [12V]

Contact arrangement	Protective construction	Mounting classification	Coil voltage
1a: 1 Form A 1: 1 Form C	S: Sealed type G: Dust cover type	PA: PCB type TMP: TMP type	DC 12, 18, 24, 48 V

Notes: 1. UL/C-UL approved type is standard.
2. 5 V, 6 V, 9 V DC types are also available. Please contact us for details.
3. Standard packing: PCB type: Carton: 50 pcs. Case: 500 pcs.
TMP type: Carton: 50 pcs. Case: 300 pcs.

COIL DATA (at 20°C 68°F)

Nominal voltage, V DC	Pick-up voltage, V DC (max.) (Initial)	Drop-out voltage, V DC (min.) (Initial)	Coil resistance, Ω (±10%) PCB & TMP	Nominal operating power, mW PCB & TMP	Max. allowable voltage, V DC (at 70°C 158°F)
12	9.0	1.2	144	1000	14.4
18	13.5	1.8	324	1000	21.6
24	18.0	2.4	576	1000	28.8
48	36.0	4.8	2304	1000	57.6

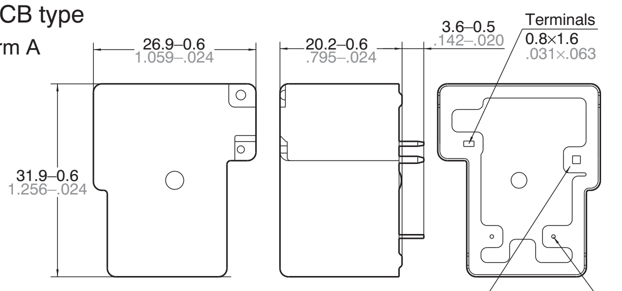
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

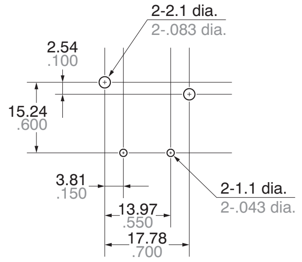
CAD Data

1. PCB type

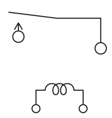
1 Form A



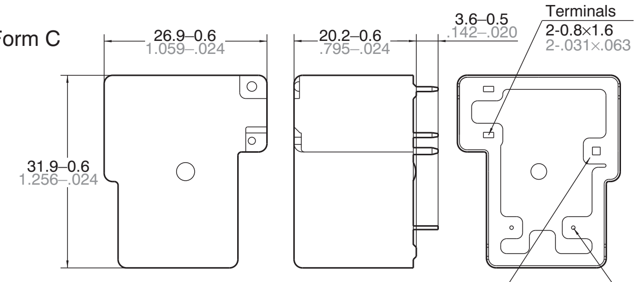
PC board pattern (Bottom view)



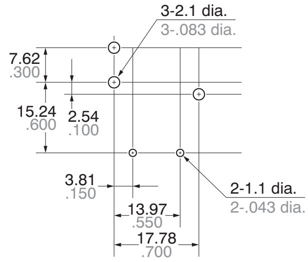
Schematic (Bottom view)



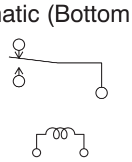
1 Form C



PC board pattern (Bottom view)



Schematic (Bottom view)

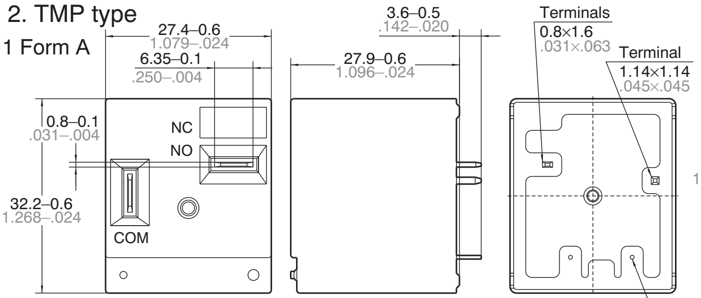


Tolerance: –0.1 –.004

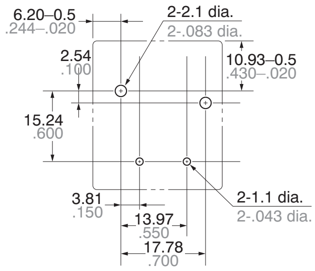
CAD Data

2. TMP type

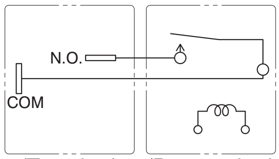
1 Form A



PC board pattern (Bottom view)

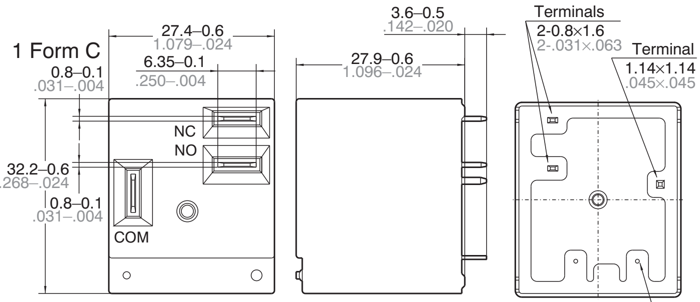


Schematic

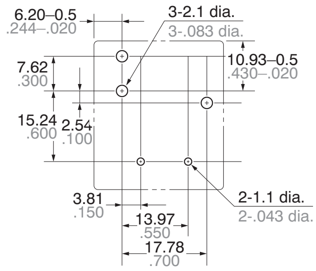


(Top view) (Bottom view)

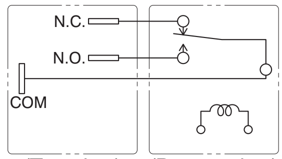
1 Form C



PC board pattern (Bottom view)



Schematic

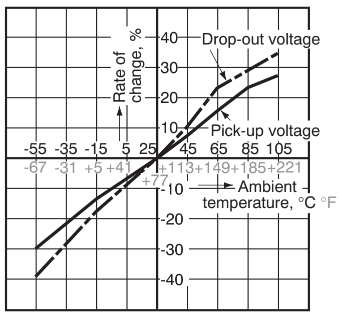


(Top view) (Bottom view)

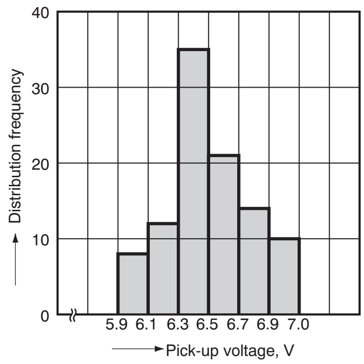
Tolerance: –0.1 –.004

REFERENCE DATA

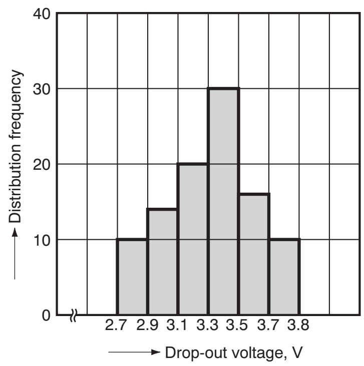
1. Change of rate of pick-up and drop-out voltage (at 20°C 68°F)
Sample: JTV1S-TMP-24V (6 pcs.)



2. Distribution frequency of pick-up voltage (at 20°C 68°F)
Sample: JTV1S-TMP-12V (100 pcs.)

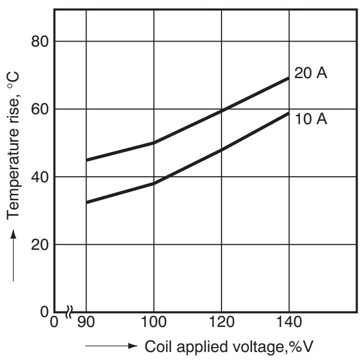


3. Distribution frequency of drop-out voltage (at 20°C 68°F)
Sample: JTV1S-TMP-12V (100 pcs.)

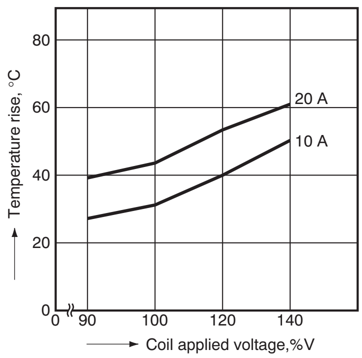


4.-(1) Coil temperature rise (TMP type)*

Ambient temperature: 25°C 77°F
Sample: JTV1aS-TMP-12V (6 pcs.)



Ambient temperature: 85°C 185°F
Sample: JTV1aS-TMP-12V (6 pcs.)



* Coil temperature rise of sealed types are same as data of the dust cover type.

For Cautions for Use, see Relay Technical Information (page 582).

Power

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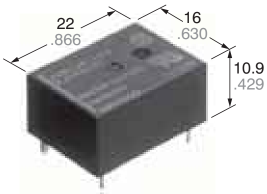
COMPACT FLAT POWER RELAY FOR HEATER LOADS

JV-N RELAYS



FEATURES

• High 16 A capacity
The contacts are high capacity 16A, 125 V AC.

• Compact, flat type with low 10.9 mm .429 inch height
Compact flat type with low surface area of 16 × 22 mm .630 × .866 inch and height of 10.9 mm .429 inch.

• High sensitivity at 200 mW
High sensitivity at 200 mW coil power consumption.

• Represses contact terminal heat
The contact terminals are larger and thicker compared to the existing JV relay. This limits the rise in temperature of the terminals when there is a large current flowing to approx. 28°C 62°F (normal current of 16 A).

• Conforms to the various safety standards
UL/CSA, TÜV approved.

COMMENTS ABOUT Cd FREE

We have introduced Cadmium free type products to reduce the material which is not good for our environment. (The suffix "F" should be added to the part number.) If you are still using Cadmium containing parts, which don't have "F" on the suffix of the part number, please use Cadmium free parts from now on. The life of the Cadmium free parts may be shorter than the Cadmium containing parts based on the load condition, so please evaluate the Cadmium free parts with your actual application before use.

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		Max. 100 mΩ
Contact material		$AgSnO_2$ type
Rating (resistive load)	Nominal switching capacity	16 A 125 V AC, 10 A 277 V AC 10 A 30 V DC, 10 A 125 V AC
	Max. switching power	2,770 VA, 300 W
	Max. switching voltage	277 V AC, 30 V DC
	Max. switching current	16 A (AC 125 V), 10 A (DC)
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. ope.) Mechanical (at 180 cpm)		2×10^7
Electrical at resistive load (at 20 cpm)	Sealed type 16 A 125 V AC, 10 A 30 V DC	10^5
	Flux-resistant type 10 A 125 V AC	3×10^5

Coil

Nominal operating power	200 mW (DC 4.5 to 48 V) 600 mW (DC 100 V)

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Excluding contact bounce time
*2 Excluding contact bounce time, without diode
*3 By resistive method; nominal voltage applied to the coil; contact carrying current: 16A, at 70°C 158°F
*4 Nominal voltage applied to the coil, at 60°C 140°F
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 µs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 µs
*8 Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

Characteristics

Max. operating speed		20 cpm
Operate time*1 (at nominal voltage)		Max. 12 ms (DC 4.5 V to 48 V) Max. 8 ms (DC 100 V)
Release time*2 (at nominal voltage)		Max. 5 ms
Initial insulation resistance		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage (Detection current: 10 mA	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	2,500 Vrms for 1 min.
Surge voltage between contact and coil		Min. 4,500 V
Temperature rise		Max. 45°C (DC 4.5 V to 48 V) *3 Max. 55°C (DC 100 V)*4
Conditions in case of operation, transport and storage*8		Ambient temperature –40 to 70°C –40 to 158°F (DC 4.5 to 48 V) –40 to 60°C –40 to 140°F (DC 100V) Humidity: 5 to 85 % R.H. (Note freezing and condensing at low temperature) Air pressure: 86 to 106 kPa
Shock resistance	Functional	Min. 200 m/s²{20G}*5
	Destructive	Min. 1,000 m/s²{100G}*6
Vibration resistance	Functional	10 to 55 Hz *7 at double amplitude of 1.6 mm
	Destructive	10 to 55 Hz at double amplitude of 2 mm
Unit weight		Approx. 8g .28 oz

TYPICAL APPLICATIONS

- AV equipment: TV’s, VTR’s, etc.
- OA equipment
- HA equipment

ORDERING INFORMATIONS

Ex. JVN | 1a | F — 4.5 V — F

Contact arrangement	Protective construction	Coil voltage (DC)	Contact material
1a: 1 Form A	Nil: Sealed type F: Flux-resistant type	4.5, 6, 9, 12,18, 24, 48, 100 V	F: $AgSnO_2$ type

UL/CSA, TÜV approved type is standard.
Please inquire about the previous products (Cadmium containing parts).

TYPES AND COIL DATA (at 20°C 68°F)

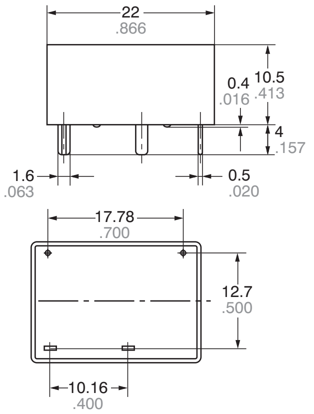
Part No.		Nominal voltage, V DC	Pick-up voltage V DC (max.)	Drop-out voltage V DC (min.)	Coil resistance, W (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Sealed type	Flux-resistant type							
JVN1a-4.5V-F	JVN1aF-4.5V-F	4.5	3.375	0.23	101	44.4	200	6.75
JVN1a-6V-F	JVN1aF-6V-F	6	4.5	0.3	180	33.3	200	9
JVN1a-9V-F	JVN1aF-9V-F	9	6.75	0.45	405	22.2	200	13.5
JVN1a-12V-F	JVN1aF-12V-F	12	9	0.6	720	16.7	200	18
JVN1a-18V-F	JVN1aF-18V-F	18	13.5	0.9	1,620	11.1	200	27
JVN1a-24V-F	JVN1aF-24V-F	24	18	1.2	2,880	8.3	200	36
JVN1a-48V-F	JVN1aF-48V-F	48	36	2.4	11,520	4.2	200	72
JVN1a-100V-F	JVN1aF-100V-F	100	60	4	16,600	6	600	110

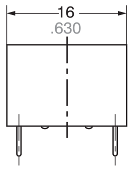
Power

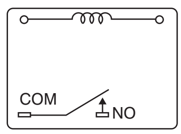
DIMENSIONS(mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

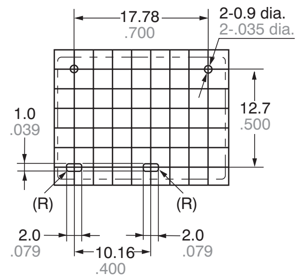
CAD Data







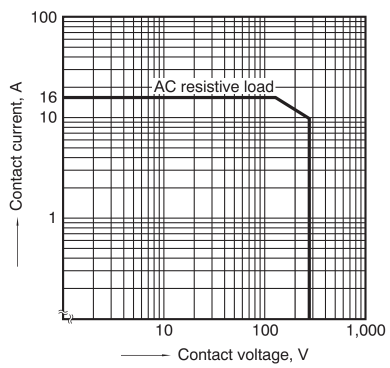
PC board pattern



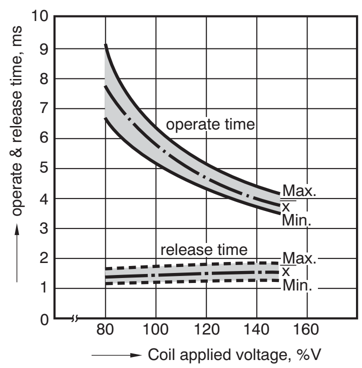
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.2 ±.008
1 to 5mm .039 to .197 inch:	±0.3 ±.012
Min. 5mm .197 inch:	±0.4 ±.016

REFERENCE DATA

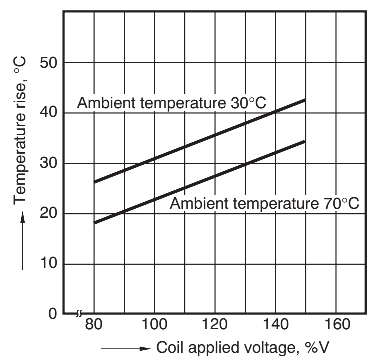
1. Max. switching power



2. Operate/release time
Sample: JVN1aF-12 V-F, 6 pcs.

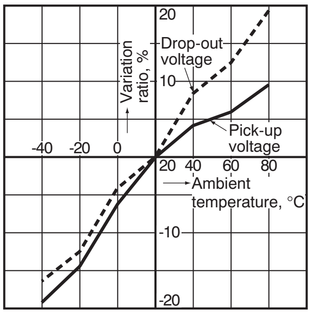


3. Coil temperature rise
Sample: JVN1aF-12 V-F, 6 pcs.
point measured: coil inside
Contact current: 16 A



4. Ambient temperature characteristics

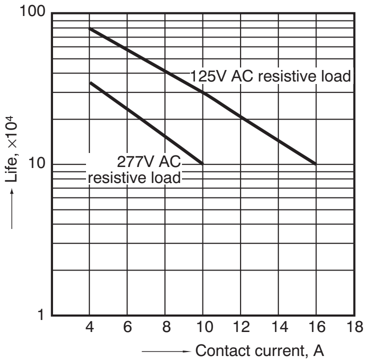
Sample: JVN1aF-12 V-F, 6 pcs.



5. Life curve

Operation frequency: 20 times/min.

Ambient temperature: room temperature

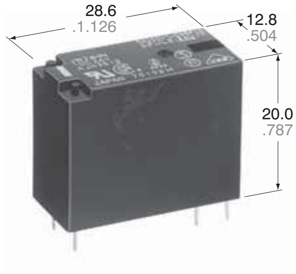


For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

COMPACT PC BOARD POWER RELAY

JW RELAYS



mm inch

FEATURES

- **Miniature package with universal terminal footprint**
- **High dielectric withstanding for transient protection: 10,000 V surge in μs between coil and contact**
- **Sealed construction**
- **Class B coil insulation types available**
- **TV rated (TV-5) types available (only for 1 Form A type)**
- **VDE, TÜV, SEMKO, SEV, FIMKO, TV-5 also approved**

About Cd-free contacts
We have introduced cadmium-free type products to reduce environmentally hazardous substances. Please replace parts that contain cadmium with Cd-free products. Evaluate them with your actual application before use because the life of a relay depends on the contact material and load.

Note: Add the suffix “F” to the part number for the 1 Form A contact type. The 1 Form C, 2 Form A and 2 Form C contact types were originally Cd-free, hence the suffix “F” is not required.

SPECIFICATIONS

Contact

		Standard type	High capacity type
Arrangement		1 Form A, 1 Form C, 2 Form A, 2 Form C	1 Form A, 1 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ	
Contact material		1a: $AgSnO_2$ type 1c, 2a, 2c: AgNi type	
Rating (resistive load)	Nominal switching capacity	5 A 250 V AC, 5 A 30 V DC	10 A 250 V AC, 10 A 30 V DC
	Max. switching power	1,250 VA, 150 W	2,500 VA, 300 W
	Max. switching voltage	250 V AC, 30 V DC	
	Max. switching current	5 A	10 A
	Min. switching capacity#1	100 mA, 5 V DC	
Expected life (min. ope.)	Mechanical (at 180 cpm)	5×10^6	
	Electrical (at 6 cpm) (Resistive load)	10^5	

Coil

Nominal operating power	530 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Detection current: 10mA
*2 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).
*8 When using relays in a high ambient temperature, consider the pick-up voltage rise due to the high temperature (a rise of approx. 0.4% V for each 1°C 33.8°F with 20°C 68°F as a reference) and use a coil impressed voltage that is within the maximum allowable voltage range.

Characteristics

		Standard type	High capacity type
Max. operating speed (at rated load)		6 cpm	
Initial insulation resistance		Min. 1,000 MΩ at 500 V DC	
Initial breakdown voltage*1	Between open contacts	1,000 Vrms for 1 min.	
	Between contacts and coil	5,000 Vrms for 1 min.	
	Between contact sets	3,000 Vrms for 1 min. (2 Form A, 2 Form C)	
Initial surge voltage between contacts and coil*2		Min. 10,000 V	
Operate time*3 (at nominal voltage)		Max. 15 ms	
Release time (without diode)*3 (at nominal voltage)		Max. 5 ms	
Temperature rise (at 20°C) (at nominal voltage) (with nominal coil voltage and at nominal switching capacity)		1a: max. 45°C 1c, 2a, 2c: max. 55°C (resistance method)	1a: max. 45°C 1c: max. 55°C (resistance method)
Shock resistance	Functional*4	Min. 98 m/s^2 {10 G}	
	Destructive*5	Min. 980 m/s^2 {100 G}	
Vibration resistance	Functional*6	10 to 55 Hz at double amplitude of 1.6 mm	
	Destructive	10 to 55 Hz at double amplitude of 2.0 mm	
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.*8	–40°C to +85°C –40°F to +185°F	
	Humidity	5 to 85% R.H.	
Unit weight		Approx. 13 g .46 oz	

TYPICAL APPLICATIONS

1. Home appliances
   TV sets, VCR, Microwave ovens
2. Office machines
   Photocopiers, Vending machines
3. Industrial equipment
   NC machines, Robots, Temperature controllers

ORDERING INFORMATION

Ex. JW [1] [F] [S] [N] – [B] – [DC5V] – [ ]

Contact arrangement	Contact capacity	Protective construction	Pick-up voltage	Coil insulation class	Coil voltage	Contact material
1: 1 Form C 1a: 1 Form A 2: 2 Form C 2a: 2 Form A	Nil: Standard (5 A) F: High capacity (10 A)*	S: Sealed type	N: 70% of nominal voltage	Nil: Class E insulation B: Class B insulation	DC 5, 6, 9, 12, 18, 24, 48 V	F: $AgSnO_2$ type (1a) Nil: AgNi type (1c, 2a, 2c)

*Only for 1 Form A and 1 Form C type
UL/CSA, VDE, SEMKO, FIMKO, SEV approved type is standard.
Notes: 1. When ordering TV rated (TV-5) types, add suffix-TV (available only for 1 Form A type).
2. Standard packing: Carton: 100 pcs. Case: 500 pcs.
3. Please inquire about the previous products (Cadmium containing parts).

TYPES

Standard (5A) types

Contact arrangement	Coil voltage, V DC	Part No.	Contact arrangement	Coil voltage, V DC	Part No.
1 Form A	5	JW1aSN-DC5V-F	2 Form A	5	JW2aSN-DC5V
	6	JW1aSN-DC6V-F		6	JW2aSN-DC6V
	9	JW1aSN-DC9V-F		9	JW2aSN-DC9V
	12	JW1aSN-DC12V-F		12	JW2aSN-DC12V
	18	JW1aSN-DC18V-F		18	JW2aSN-DC18V
	24	JW1aSN-DC24V-F		24	JW2aSN-DC24V
	48	JW1aSN-DC48V-F		48	JW2aSN-DC48V
1 Form C	5	JW1SN-DC5V	2 Form C	5	JW2SN-DC5V
	6	JW1SN-DC6V		6	JW2SN-DC6V
	9	JW1SN-DC9V		9	JW2SN-DC9V
	12	JW1SN-DC12V		12	JW2SN-DC12V
	18	JW1SN-DC18V		18	JW2SN-DC18V
	24	JW1SN-DC24V		24	JW2SN-DC24V
	48	JW1SN-DC48V		48	JW2SN-DC48V

High capacity (10 A) types

Contact arrangement	Coil voltage, V DC	Part No.	Contact arrangement	Coil voltage, V DC	Part No.
1 Form A	5	JW1aFSN-DC5V-F	1 Form C	5	JW1FSN-DC5V
	6	JW1aFSN-DC6V-F		6	JW1FSN-DC6V
	9	JW1aFSN-DC9V-F		9	JW1FSN-DC9V
	12	JW1aFSN-DC12V-F		12	JW1FSN-DC12V
	18	JW1aFSN-DC18V-F		18	JW1FSN-DC18V
	24	JW1aFSN-DC24V-F		24	JW1FSN-DC24V
	48	JW1aFSN-DC48V-F		48	JW1FSN-DC48V

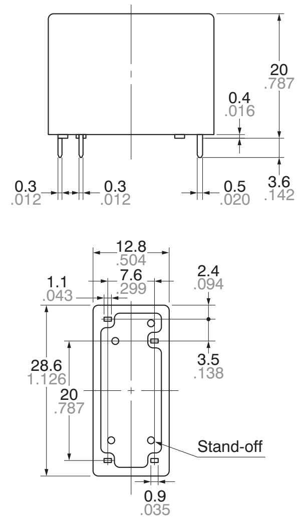
COIL DATA (at 20°C 68°F)

Nominal voltage, V DC	Pick-up voltage, V DC (max.) (Initial)	Drop-out voltage, V DC (min.) (Initial)	Nominal operating current, mA (±10%)	Coil resistance, W (±10%)	Nominal operating power, mW	Max. allowable voltage
5	3.5	0.5	106	47	530	130% V of Nominal Voltage (at 60°C 140°F) 120% V of Nominal Voltage (at 85°C 185°F)
6	4.2	0.6	88	68		
9	6.3	0.9	58	155		
12	8.4	1.2	44	270		
18	12.6	1.8	29	611		
24	16.8	2.4	22	1,100		
48	33.6	4.8	11	4,400		

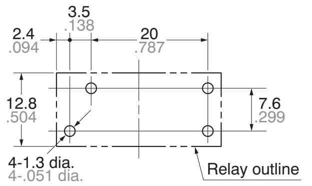
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data 1 Form A

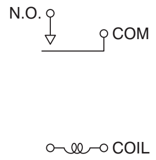


PC board pattern (Copper-side view)



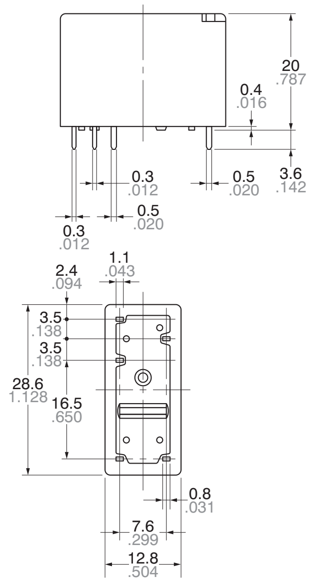
Tolerance: ±0.1 ±.004

Wiring diagram (Bottom view)

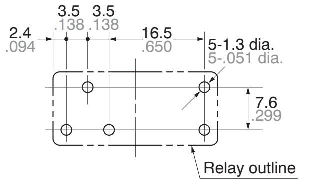


Dimension :	General tolerance
Max. 1mm .039 inch	±0.1 ±.004
1 to 3mm .039 to .118 inch	±0.2 ±.008
Min. 3mm .118 inch	±0.3 ±.012

CAD Data 1 Form C

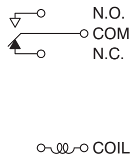


PC board pattern (Copper-side view)

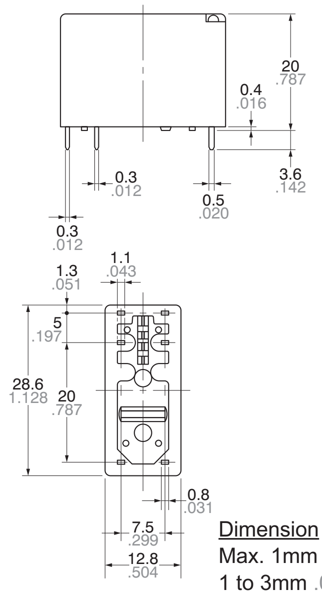


Tolerance: ±0.1 ±.004

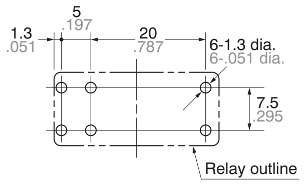
Wiring diagram (Bottom view)



CAD Data 2 Form A

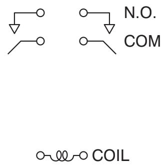


PC board pattern (Copper-side view)



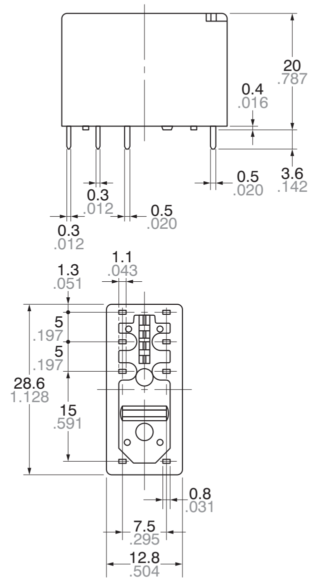
Tolerance: ±0.1 ±.004

Wiring diagram (Bottom view)

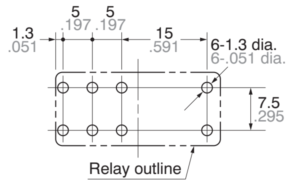


Dimension :	General tolerance
Max. 1mm .039 inch	±0.1 ±.004
1 to 3mm .039 to .118 inch	±0.2 ±.008
Min. 3mm .118 inch	±0.3 ±.012

CAD Data 2 Form C

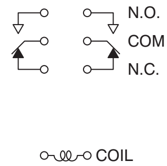


PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

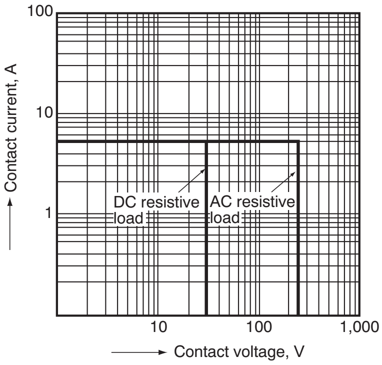
Wiring diagram (Bottom view)



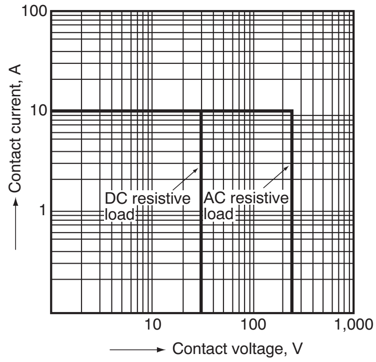
Power

REFERENCE DATA

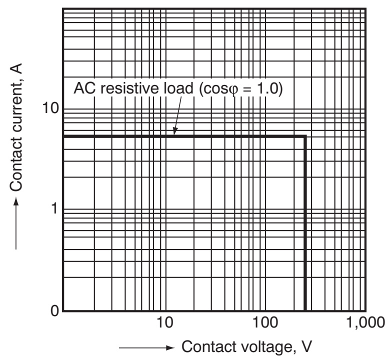
1-(1). Maximum operating power
1 Form A Standard (5 A) type



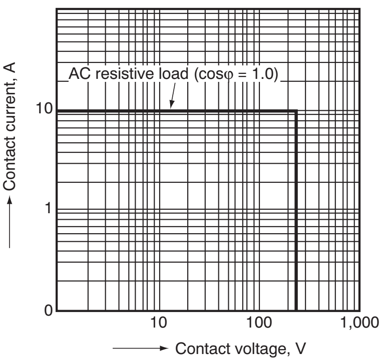
1-(2). Maximum operating power
1 Form A High Capacity (10 A) type



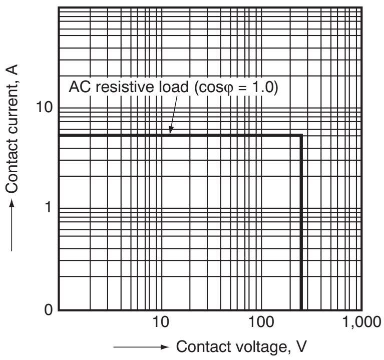
1-(3). Maximum operating power
1 Form C Standard (5 A) type



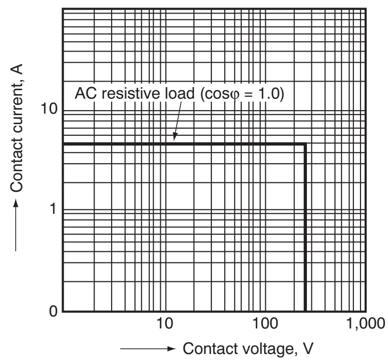
1-(4). Maximum operating power
1 Form C High Capacity (10 A) type



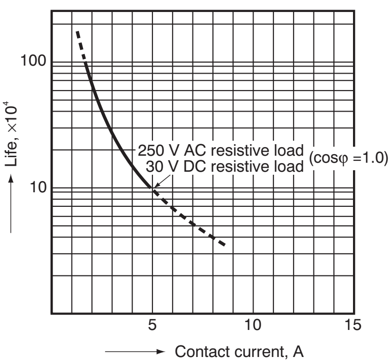
1-(5). Maximum operating power
2 Form A Standard (5 A) type



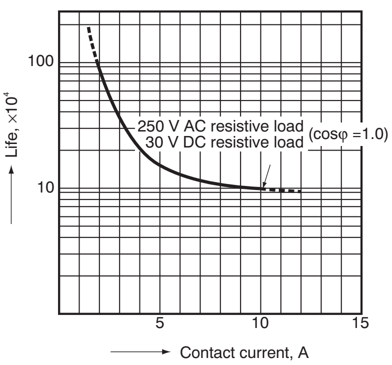
1-(6). Maximum operating power
2 Form C Standard (5 A) type



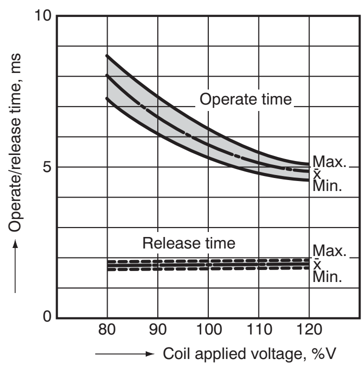
2-(1). Life curve
1 Form A Standard (5 A) type



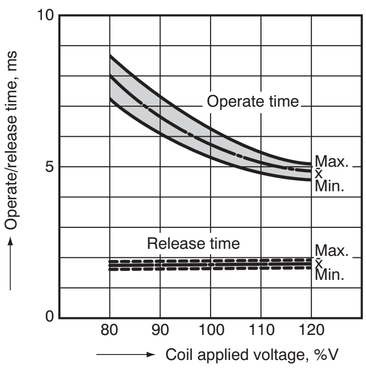
2-(2). Life curve
1 Form A High Capacity (10 A) type



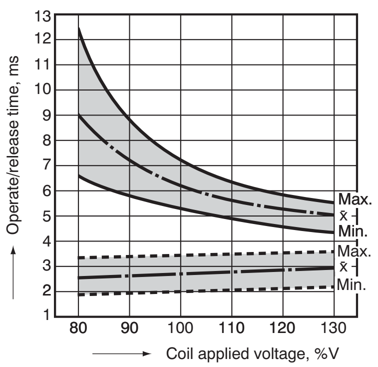
3-(1). Operate/release time
Sample: JW1aSN-DC12V-F, 10 pcs.
Ambient temperature: 20°C 68°F



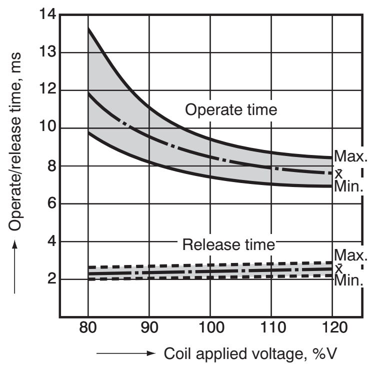
3-(2). Operate/release time
Sample: JW1aFSN-DC12V, 10 pcs.
Ambient temperature: 20°C 68°F



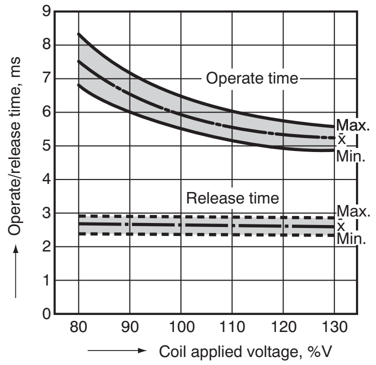
3-(3). Operate/release time
Sample: JW1SN-DC12V-F, 6 pcs.
Ambient temperature: 20°C 68°F



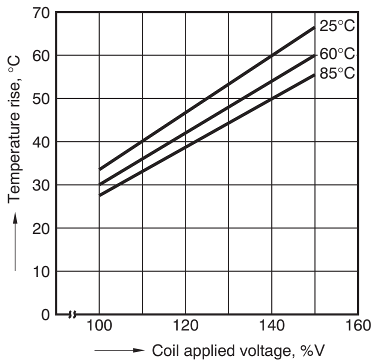
3-(4). Operate/release time
Sample: JW2aSN-DC24V-F, 6 pcs.
Ambient temperature: 20°C 68°F



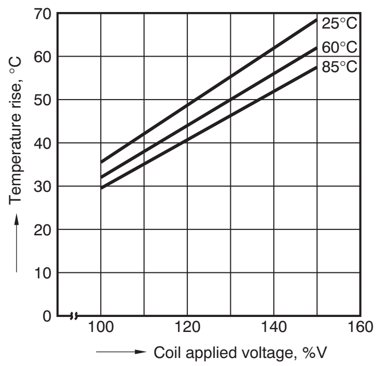
3-(5). Operate/release time
Sample: JW2SN-DC12V-F, 6 pcs.
Ambient temperature: 20°C 68°F



4-(1). Coil temperature rise
(Contact carrying current: 5A)
Sample JW1aFSN-DC12V-F, 6 pcs.
Point measured: Inside the coil



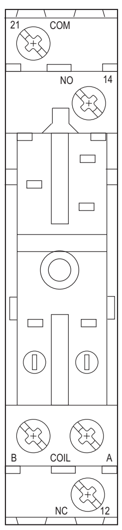
4-(2). Coil temperature rise
(Contact carrying current: 10 A)
Sample: JW1aFSN-DC12V-F, 6 pcs.
Point measured: Inside the coil



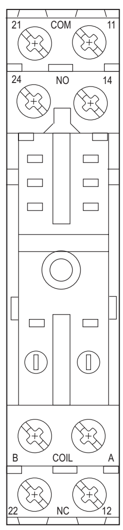
ACCESSORIES

DIN terminal sockets

JW1SI

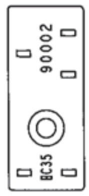


JW2SI

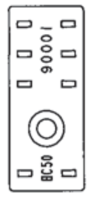


PCB sockets

JW1PI

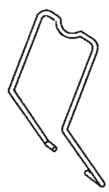


JW2PI

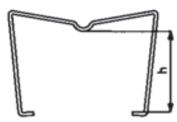


Retaining springs

JWHFSI



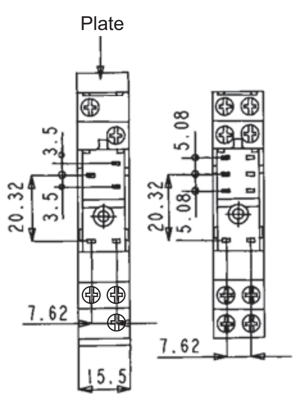
JWHFI

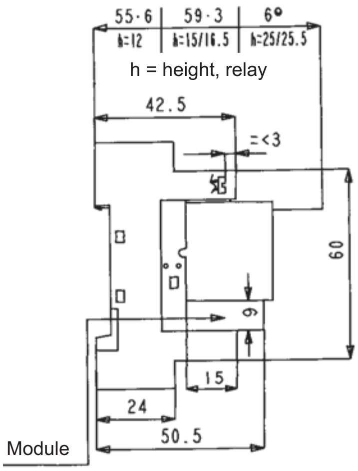


h (relay height) = 20.4 mm

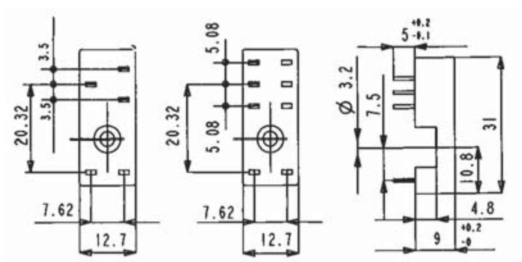
DIMENSIONS

JW1SI
JW2SI





JW1PI **JW2PI**



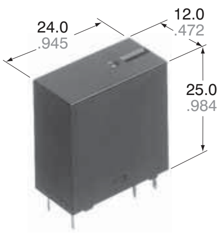
For Cautions for Use, see Relay Technical Information (page 582).

Power

Panasonic
ideas for life

2 FORM A SLIM POWER RELAY

LA RELAYS (ALA)



mm inch

FEATURES

1. 2 Form A slim type
24(L) × 12(W) × 25(H) mm
.945(L)×.472(W)×.984(H) inch

2. 3A type and 5A TV type
3A type: Contact reliability and break performance best suited for protecting and switching speakers.
5A TV type: Tough against inrush current and optimal for turning on and off the power supply. Rated TV-4 (UL/CSA).

3. High insulation resistance
• Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch (In compliance with IEC65)
• Surge withstand voltage between contact and coil: 10,000 V or more.

4. High noise immunity realized by the card separation structure between contact and coil

5. Conforms to the various safety standards
• UL/CSA, VDE, TÜV, SEMKO, SEV approved

TYPICAL APPLICATIONS

- **Audio devices**
- **Monitor**
- **Automatic vending machine**

SPECIFICATIONS

Contact

Type		3A rated	5A TV rated
Arrangement		2 Form A	
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		Max. 50 mΩ	Max. 100 mΩ
Contact material		Gold-clad AgNi type	$AgSnO_2$ type
Rating (resistive load)	Nominal switching capacity	3 A 125 V AC	5 A 277 V AC
	Max. switching power	625 VA	1,385 V A
	Max. switching voltage	125 V AC	277 V AC
	Max. switching current	5 A (AC)	
	Min. switching capacity#1	100 mA, 5 V DC	
Expected life (min. operations)	Mechanical (at 180 cpm)	10^6	
	Electrical (at 20 cpm) (at rated load)	5×10^4 (ON: OFF=1.5s: 1.5s)	

Coil

Nominal operating power	530 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as “Initial breakdown voltage” section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50ms according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

Characteristics

Type		3A rated	5A TV rated
Max. operating speed		20 cpm	
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)	
Initial breakdown voltage*2	Between contact sets	1,000 Vrms for 1 min.	
	Between open contacts	1,000 Vrms for 1 min.	
	Between contact and coil	4,000 Vrms for 1 min.	
Surge voltage between contact and coil*3		Min. 10,000 V	
Operate time*4 (at nominal voltage)		Max. 15ms (at 20°C 68°F)	
Release time (with diode)*4 (at nominal voltage)		Max. 15ms (at 20°C 68°F)	
Temperature rise (at 70°C)		Max. 45°C with nominal coil voltage and at 3 A contact carrying current	Max. 45°C with nominal coil voltage and at 5 A contact carrying current
Shock resistance	Functional*5	Min. 200 m/s^2{approx. 20 G}	
	Destructive*6	Min. 1,000 m/s^2{approx. 100 G}	
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm	
	Destructive	10 to 55Hz at double amplitude of 1.5mm	
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F	
	Humidity	5 to 85% R.H.	
	Air pressure	86 to 106 kPa	
Unit weight		Approx. 13 g .46 oz	

ORDERING INFORMATION

Ex. | A | LA | 2 | P | F | 12

Product name	Contact arrangement	Contact capacity	Protective construction	Coil voltage(V DC)
LA	2: 2 Form A	Nil: 3A P: 5A TV-4	F: Flux-resistant type	12, 24

UL/CSA, VDE, TÜV, SEMKO, TV-4 approved type is standard.
Notes: 1. Standard packing Carton: 100 pcs. Case: 500 pcs.
2. 4.5V, 5V, 9V and 18V DC types are also available. Please consult us for details.

TYPES AND COIL DATA (at 20°C 68°F)

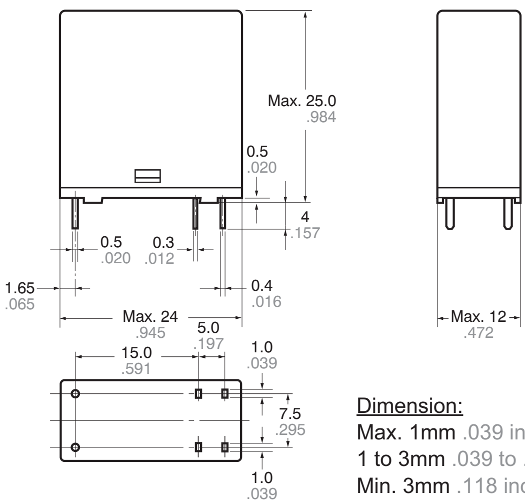
Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Maximum allowable voltage, V DC
3 A type	5A TV type							
ALA2F12	ALA2PF12	12	(Initial) 9	(Initial) 0.6	272	44.2	530	15.6
ALA2F24	ALA2PF24	24	(Initial) 18	(Initial) 1.2	1,087	22.1	530	31.2

DIMENSIONS(mm inch)

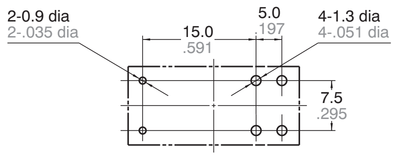
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

Power

CAD Data



PC board pattern (Bottom view)



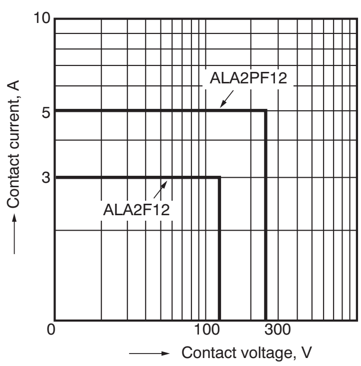
Tolerance : ±0.1 ±.004

Schematic (Bottom view)

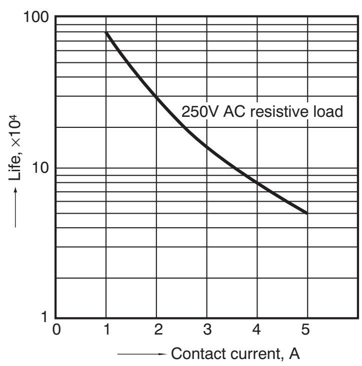
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

REFERENCE DATA

1. Max. switching power (AC resistive load)

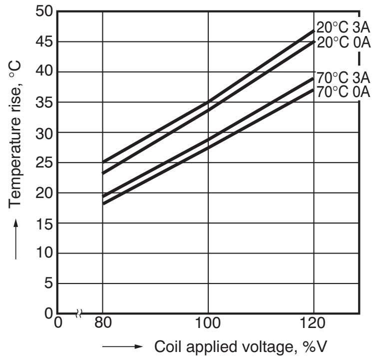


2. Life curve (250 V AC resistive load)



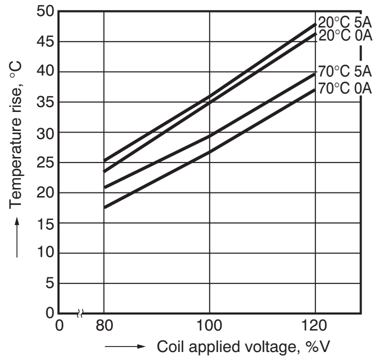
3-(1). Coil temperature rise

Sample: ALA2F12, 6 pcs.
Measured portion: coil inside
Contact current: 0 A, 3A



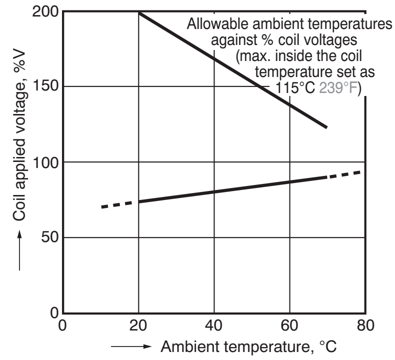
3-(2). Coil temperature rise

Sample: ALA2PF12, 6 pcs.
Measured portion: coil inside
Contact current: 0 A, 5A



4. Ambient temperature characteristics and coil applied voltage

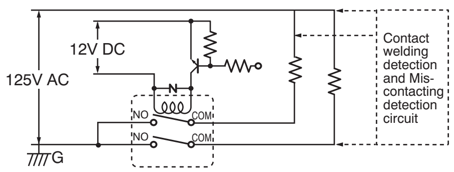
Contact current: ALA2F=3A
ALA2PF=5A



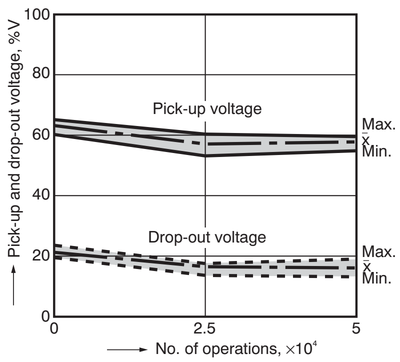
5-(1). Electrical life test (3 A 125 V AC, resistive load)

Sample: ALA2F12, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 20°C 68°F

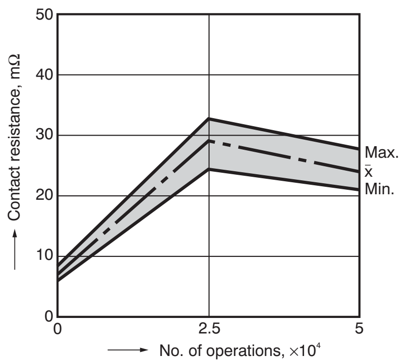
Circuit:



Change of pick-up and drop-out voltage



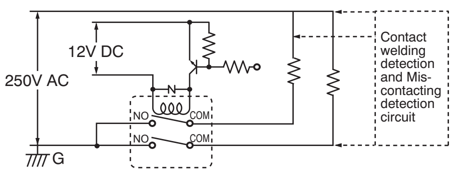
Change of contact resistance



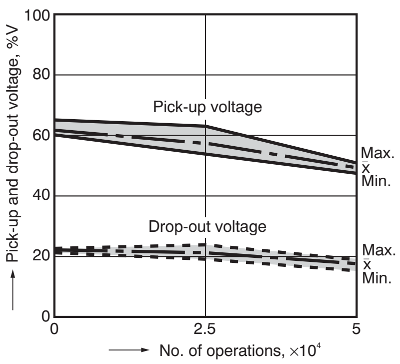
5-(2). Electrical life test (5 A 250 V AC, resistive load)

Sample: ALA2PF12, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 20°C 68°F

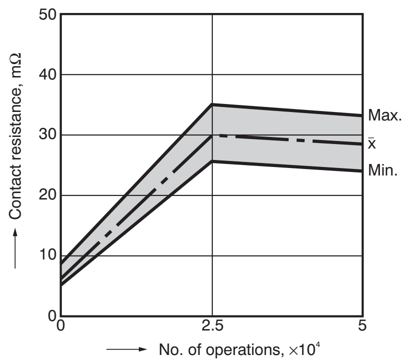
Circuit:



Change of pick-up and drop-out voltage



Change of contact resistance

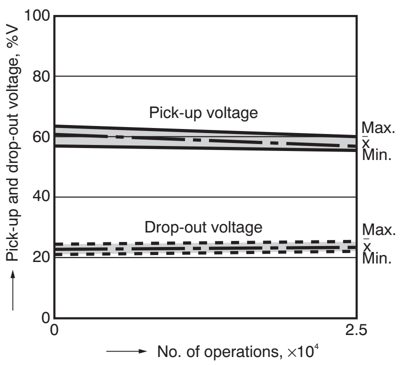


5-(3). Electrical life test (UL lamp load test TV-4)

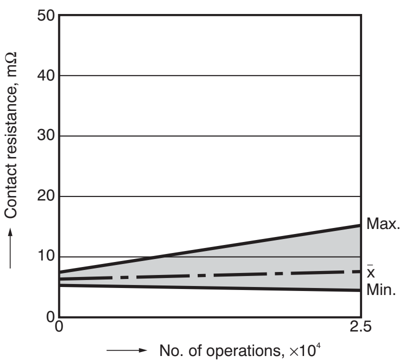
Tested sample: ALA2PF12, 6 pcs.

- Overload test
  Load: 6.0 A 120 V AC (60 Hz),
  Inrush: 91 A
  Operation frequency: 10 times/min
  (ON: OFF = 1 s: 5 s)
  No. of operations: 50 ope.
- Endurance test
  Load: 4A 120 V AC (60 Hz),
  Inrush: 65 A
  Operation frequency: 10 times/min
  (ON: OFF = 1 s: 5 s)
  No. of operations: 25,000 ope.

Change of pick-up and drop-out voltage



Change of contact resistance

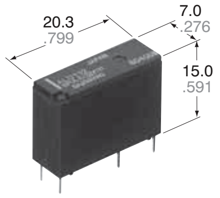


For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

1 FORM A SLIM POWER RELAY

LD RELAYS (ALD)



mm inch

FEATURES

1. Slim type: Width 7 mm .276 inch.
20.3(L)×7.0(W)×15.0(H) mm
.799(L)×.276(W)×.591(H) inch

2. Perfect for small load switching of home appliances
10^5 switching operations possible with a 3A 250V AC resistive load.

3. Low operating power
Compact size, nominal operating power as low as 200mW.

4. High shock resistance
The relay withstands a functional shock resistance of 300m/s^2 [approx. 30 G more]

5. High insulation resistance
• Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch
• Surge withstand voltage between contact and coil: 10,000 V or more.

6. UL/CSA, VDE, TÜV approved.

TYPICAL APPLICATIONS

- **Air conditioner**
- **Refrigerator**
- **Hot water units**
- **Microwave ovens**
- **Fan heaters**

Power

SPECIFICATIONS

Contact

Arrangement			1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			Max. 100 mΩ
Contact material			$AgSnO_2$ type
Rating (resistive load)	Nominal switching capacity		3 A 277 V AC, 3 A 30V DC
	Max. switching power		831 V A (AC), 90W (DC)
	Max. switching voltage		277 V AC, 30 V DC
	Max. switching current		3 A
	Min. switching capacity#1		100 mA, 5 V DC
Expected life (min.operations)	Mechanical (at 180 cpm)		5×10^6
	Electrical (at 20 cpm) (at rated load)	3A 125V AC, 3A 30V DC	2×10^5
		3A 250V AC	10^5
		5A 250V AC	5×10^4

Coil

Nominal operating power	200 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as “Initial breakdown voltage” section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2×50ms according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 µs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 µs
*8 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

Characteristics

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial*2 breakdown voltage	Between open contacts	750 Vrms for 1 min.
	Between contact and coil	4,000 Vrms for 1 min.
Initial surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Max. 10ms (at 20°C 68°F)
Release time (with diode)*4 (at nominal voltage)		Max. 10ms (at 20°C 68°F)
Temperature rise (at 70°C 158°F)		Max. 45°C with nominal coil voltage and at 3 A contact carrying current (resistance method)
Shock resistance	Functional*5	Min. 300 m/s^2{approx. 30 G}
	Destructive*6	Min. 1,000 m/s^2{approx. 100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 4 g .14 oz

ORDERING INFORMATION

Ex. A LD 1 12 W

Product name	Contact arrangement	Coil voltage (V DC)	Packing style
LD	1: 1 Form A	4H: 4.5, 09: 9 , 24: 24 05: 5, 12: 12 06: 6, 18: 18	Nil: Tube packing W: Carton packing

UL/CSA, TÜV, VDE approved type is standard.
Note: Tube packing: Tube: 50pcs, Case: 1,000pcs
Carton packing: Carton: 100pcs, Case: 500pcs

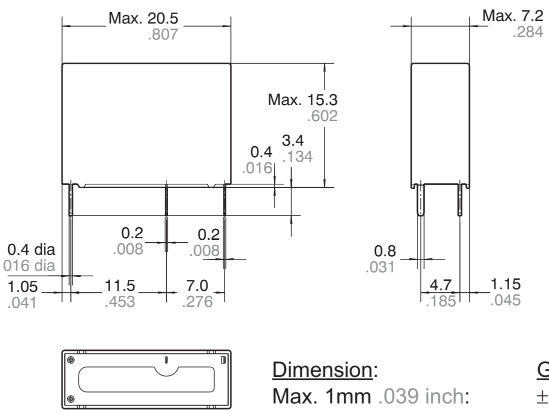
TYPES AND COIL DATA (at 20°C 68°F)

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (Initial)	Drop-out voltage, V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Maximum allowable voltage, V DC (at 20°C 68°F)
ALD14H	4.5	3.38	0.22	101	44.6	200	5.85
ALD105	5	3.75	0.25	125	40.0	200	6.5
ALD106	6	4.5	0.3	180	33.3	200	7.8
ALD109	9	6.75	0.45	405	22.2	200	11.7
ALD112	12	9	0.6	720	16.7	200	15.6
ALD118	18	13.5	0.9	1,620	11.1	200	23.4
ALD124	24	18	1.2	2,880	8.3	200	31.2

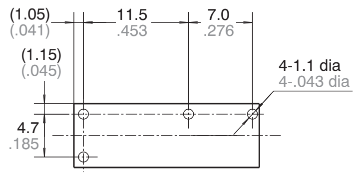
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data

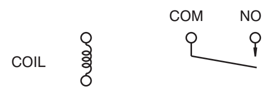


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

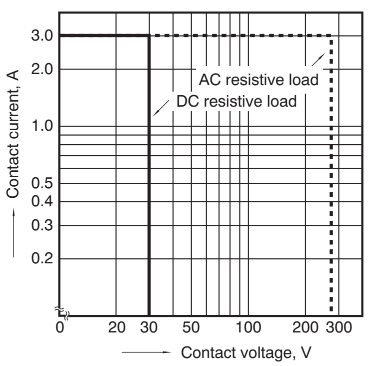
Schematic (Bottom view)



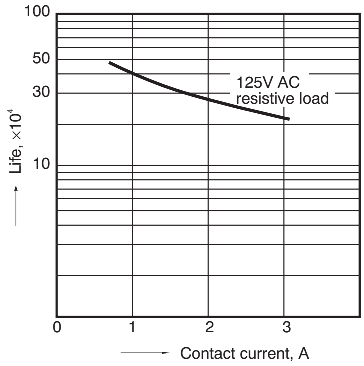
Dimension: General tolerance
Max. 1mm .039 inch: ±0.1 ±.004
1 to 3mm .039 to .118 inch: ±0.2 ±.008
Min. 3mm .118 inch: ±0.3 ±.012

REFERENCE DATA

1. Max. switching power

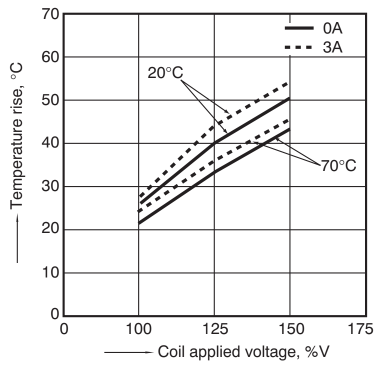


2. Life curve

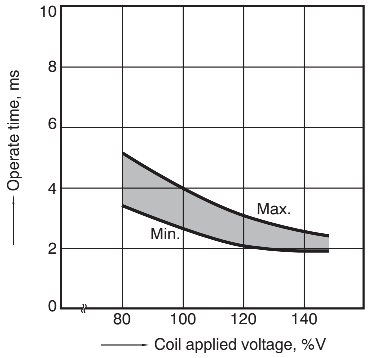


3. Coil temperature rise

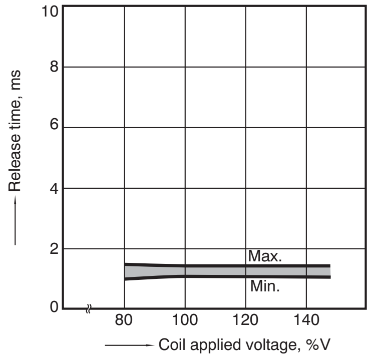
Sample: ALD112, 6 pcs.
Point measured: inside the coil
Contact current: 0 A, 3 A



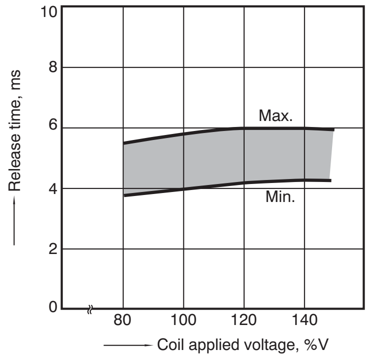
4-(1). Operate time
Sample: ALD112, 6 pcs.



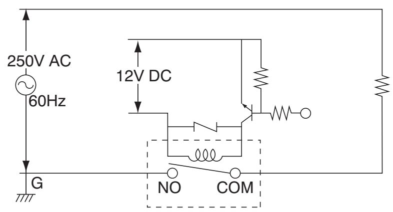
4-(2). Release time (without diode)
Sample: ALD112, 6 pcs.



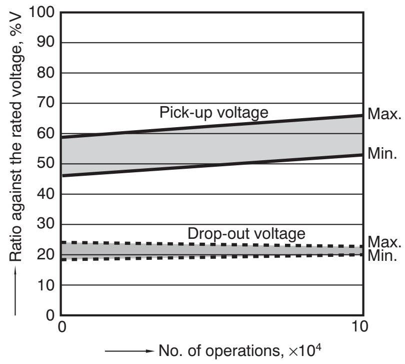
4-(3). Release time (with diode)
Sample: ALD112, 6 pcs.



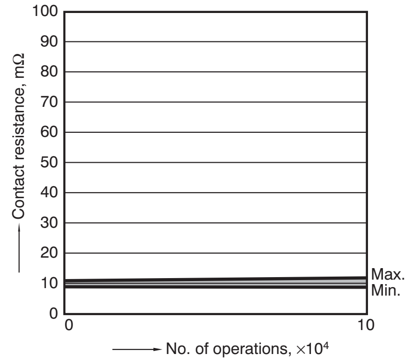
5-(1). Electrical life test
(3 A 250 V AC, resistive load)
Sample: ALD112, 6 pcs.
Operating speed: 20 cpm
Ambient temperature: room temperature
circuit:



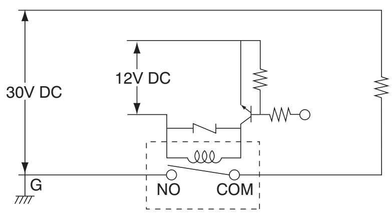
Change of pick-up and drop-out voltage



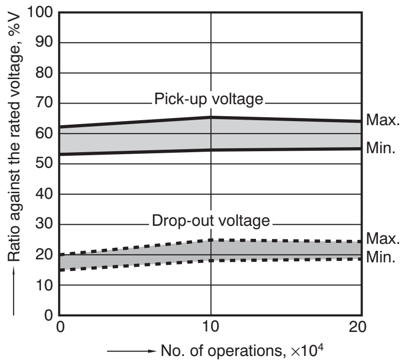
Change of contact resistance



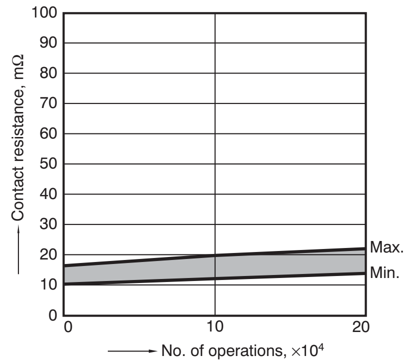
5-(2). Electrical life test
(3 A 30 V DC, resistive load)
Sample: ALD112, 6 pcs.
Operating speed: 20 cpm
Ambient temperature: room temperature
circuit:



Change of pick-up and drop-out voltage



Change of contact resistance



SAFETY STANDARDS

UL/C-UL (Recognized)		CSA (Certified)		VDE (Certified)		TÜV (Certified)	
File No.	Contact rating	File No.	Contact rating	File No.	Contact rating	File No.	Rating
E43028	3A 277V AC 3A 30V DC	LR26550 etc.	3A 277V AC 3A 30V DC	40014384	3A 250V AC (cos° = 1.0) 3A 30V DC (0ms)	B 10 02 13461 274	3A 250V AC (cosϕ = 1.0) 3A 30V DC (0ms)

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

1 Form A 5A Slim size (7 mm) Power Relay

LD-P RELAYS (ALDP)

Protective construction: Sealed type

FEATURES

1. Nominal switching capacity:
5A 277V AC

2. Ambient temperature:
–40°C to +85°C –40°F to +185°F

3. Excellent heat resistance and tracking performance:
EN60695 (GWT2-11, GWFI2-12, GWIT2-13) data available
(Please consult us for details.)

4. Slim type:
20.3 (L) × 7.0 (W) × 15 (H) mm .799 (L) × .276 (W) × .591 (H) inch

5. High insulation resistance:
• Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch (In compliance with IEC65)
• Surge withstand voltage between contact and coil: 10,000 V or more.

TYPICAL APPLICATIONS

- **Boilers**
- **Air conditioner**
- **Refrigerator**
- **Hot water units**
- **Microwave ovens**
- **Fan heaters**

ORDERING INFORMATION

ALDP [1] [ ] [ ]

LD-P relay

Contact arrangement
1: 1 Form A

Coil voltage (DC)
05: 5V, 06: 6V, 09: 9V, 12: 12V, 18: 18V, 24: 24V

Packing style
Nil: Tube packing
W: Carton packing

Note: UL, C-UL and VDE approved type is standard.

TYPES

Contact arrangement	Nominal coil voltage	Part No.
1 Form A	5V DC	ALDP105
	6V DC	ALDP106
	9V DC	ALDP109
	12V DC	ALDP112
	18V DC	ALDP118
	24V DC	ALDP124

Packing quantity: inner 100 pieces, outer 500 pieces

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 20°C 68°F)
5V DC	75%V or less of nominal voltage (Initial)	5%V or more of nominal voltage (Initial)	40.0mA	125Ω	200mW	130%V of nominal voltage
6V DC			33.3mA	180Ω		
9V DC			22.2mA	405Ω		
12V DC			16.7mA	720Ω		
18V DC			11.1mA	1,620Ω		
24V DC			8.3mA	2,880Ω		

2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form A
	Contact resistance (Initial)		Max. 100 mΩ (By voltage drop 6 V DC 1A)
	Contact material		AgNi type
Rating	Nominal switching capacity (resistive load)		5A 277V AC
	Max. switching power (resistive load)		1,385VA
	Max. switching voltage		277V AC
	Max. switching current		5A
	Min. switching capacity (reference value)*1		100mA 5V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	750 Vrms for 1 min. (Detection current: 10 mA)
		Between contact and coil	4,000 Vrms for 1 min. (Detection current: 10 mA)
	Surge breakdown voltage*2 (Between contact and coil)		10,000 V (initial)
	Temperature rise		Max. 30°C 86°F (By resistive method, nominal coil voltage applied to the coil; contact carrying current: 5A, at 85°C 185°F)
	Operate time (at nominal voltage) (at 20°C 68°F)		Max. 10 ms (excluding contact bounce time.)
	Release time (at nominal voltage) (at 20°C 68°F)		Max. 10 ms (excluding contact bounce time) (With diode)
Mechanical characteristics	Shock resistance	Functional	Min. 300 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10µs.)
		Destructive	Min. 1,000 m/s² (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1.5 mm (Detection time: 10µs.)
		Destructive	10 to 55 Hz at double amplitude of 1.5 mm
Expected life	Mechanical (at 180 cpm)		Min. 5×10^6
	Electrical (at 20 cpm)		Min. 2×10^5 (5A 125V AC at rated load), Min. 10^5 (5A 250V AC at rated load)
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –40°C to +85°C –40°F to +185°F; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed (at nominal switching capacity)		20 cpm
Unit weight			Approx. 4 g .14 oz

Notes:

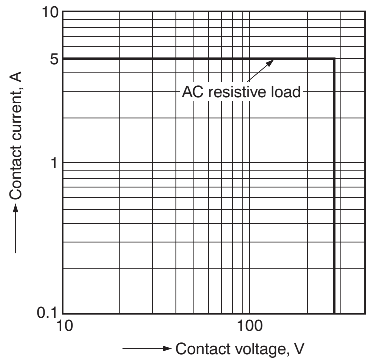
*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

*2 Wave is standard shock voltage of $\pm1.2\times50\mu s$ according to JEC-212-1981

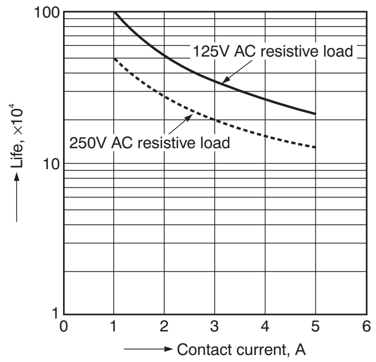
*3 The upper limit of the ambient temperature is the maximum temperature that can satisfy the coil temperature rise value. Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

1. Max. switching power

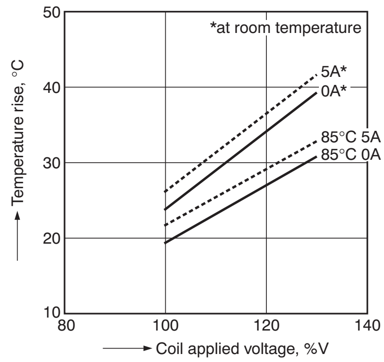


2. Life curve



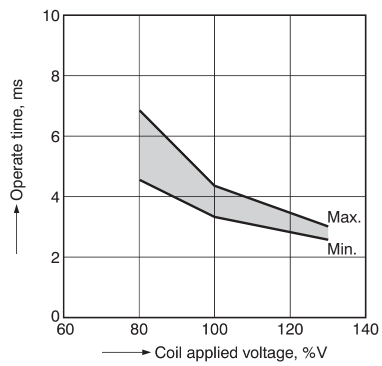
3. Coil temperature rise

Sample: ALDP112, 6 pcs.
Point measured: inside the coil
Contact current: 0 A, 5 A



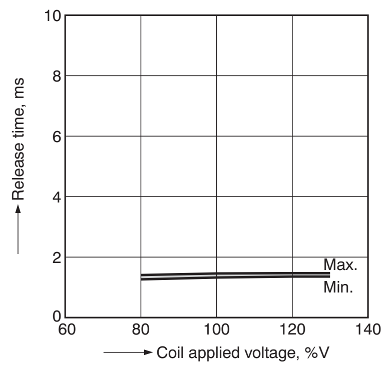
4-(1). Operate time

Sample: ALDP112, 30 pcs.



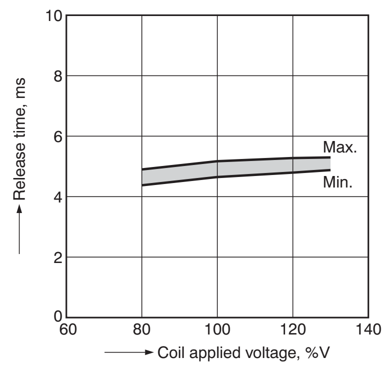
4-(2). Release time (without diode)

Sample: ALDP112, 30 pcs.



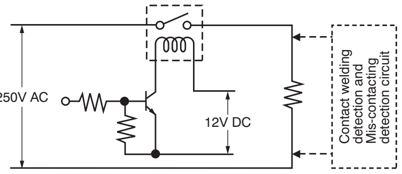
4-(3). Release time (with diode)

Sample: ALDP112, 30 pcs.

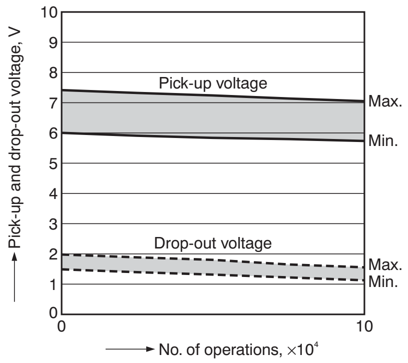


5. Electrical life test
(5A 250V AC Resistive load)
Sample: ALDP112, 6 pcs.
Operation frequency: 20 times/min.
(ON:OFF = 1.5s:1.5s)

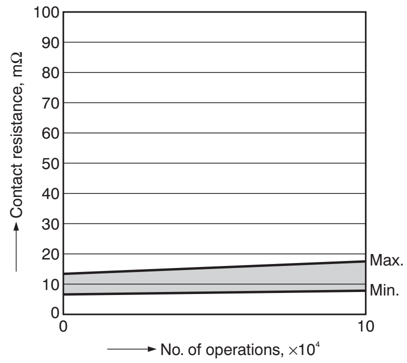
Circuit:



Change of pick-up and drop-out voltage



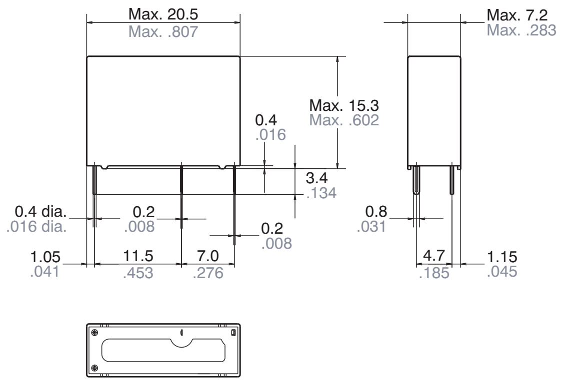
Change of contact resistance



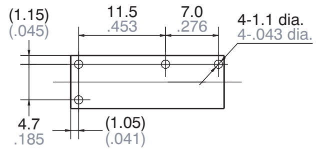
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data

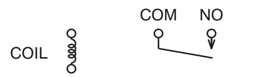


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

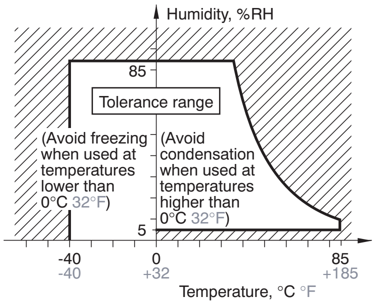
SAFETY STANDARDS

Certification authority	
UL, C-UL	5A 277V AC 70°C 5A 30V DC
VDE	5A 250V AC cos° = 1.0 70°C 5A 30V DC 0ms

NOTES

■ Usage, transport and storage conditions

1) Temperature:
–40 to +85°C –40 to +185°F
2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage



4) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
5) Freezing
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
6) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

■ Solder and cleaning conditions

1) Please obey the following conditions when soldering automatically.
(1) Preheating: Within 120°C 248°F (solder surface terminal portion) and within 120 seconds
(2) Soldering iron: 260°C±5°C 500°F±41°F (solder temperature) and within 6 seconds (soldering time)
2) Do not use ultrasonic cleaning. This will adversely affect the relay characteristics. Also, it is recommended that alcoholic solvents be used.

■ Certification

1) This relay is UL and C-UL certified.
UL and C-UL standards:
5 A 277 V AC 70°C
5 A 30 V DC
2) This relay is certified by VDE.
VDE standards:
5 A 250 V AC cos° = 1.0 70°C
5 A 30 V DC 0ms
3) UL, C-UL and VDE certified ratings are displayed on the packaging box.
(On the relay, only the certification marks are shown and not the certified ratings. Please refer to the product specification diagrams to see what is stamped.)

■ Part number display

The “W” at the end of the part number only appears on the inner and outer packaging. It does not appear on the relay itself.

■ Others

1) To ensure good operation, please keep the voltage on the coil ends to ±5% (at 20°C 68°F) of the rated coil operation voltage. Also, please be aware that the pick-up voltage and drop-out voltage may change depending on the temperature and conditions of use.
2) Keep the ripple rate of the nominal coil voltage below 5%.
3) The cycle lifetime is defined under the standard test condition specified in the JIS C 5442 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%R.H.). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.
Also, be especially careful of loads such as those listed below.
(1) When used for AC load-operating and the operating phase is synchronous. Rocking and fusing can easily occur due to contact shifting.
(2) Highly frequent load-operating
When highly frequent opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.
Three countermeasures for these are listed here.
• Incorporate an arc-extinguishing circuit.
• Lower the operating frequency
• Lower the ambient humidity
4) Minimum switching capacity is a guideline as to the lowest possible level at which it will be possible for a low level load to allow switching. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
5) Heat, smoke, and even a fire may occur if the relay is used in conditions outside of the allowable ranges for the coil ratings, contact ratings, operating cycle lifetime, and other specifications. Therefore, do not use the relay if these ratings are exceeded.
6) If the relay has been dropped, the appearance and characteristics should always be checked before use.
7) Incorrect wiring may cause unexpected events or the generation of heat or flames.
8) Creepage distance and clearances between contact and coil: Min. 6 mm

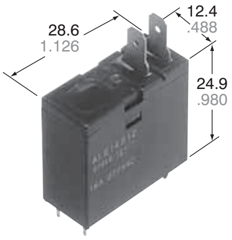
Power

For Cautions for Use, see Relay Technical Information (page 582).

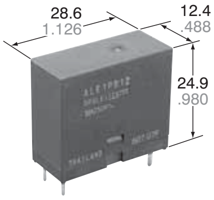
Panasonic
ideas for life

16A POWER RELAY FOR MICRO WAVE OVEN

LE RELAYS (ALE)



TMP type



PCB type

FEATURES

1. Supports magnetron and heater loads.
Capable for switching magnetron and heater loads found in microwave ovens.
2. Excellent heat resistance
Ambient temperature: up to 85°C 185°F
Certified UL coil insulation class B and class F
3. High insulation resistance
Creepage distance and clearances between contact and coil:
Min. 8 mm .315 inch
Surge withstand voltage: 10,000V
4. Low operating power
Nominal operating power: 400mW/ 200mW (High sensitive type)
5. A wide variety of types
Product line consists of 4 types with different shapes and pins
6. Conforms to the various safety standards:
UL/CSA, TÜV, VDE approved and SEMKO available (TMP type)
UL/CSA, VDE approved (PCB type)

TYPICAL APPLICATIONS

- **Microwave ovens**
- **Refrigerators**
- **OA equipment**

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ
Contact material		AgSnO$_2$ type
Rating (resistive load)	Nominal switching capacity	16 A 277 V AC
	Max. switching power	4,432 V A
	Max. switching voltage	277 V AC
	Max. switching current	16 A
	Min. switching capacity#1 (Reference value)	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	2×10^6
	Electrical (at 20 cpm) (Resistive load)	10^5

Coil

Type	Standard	High sensitive
Nominal operating power	400 mW	200 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as “Initial breakdown voltage” section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50µs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 µs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 µs
*8 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

Characteristics

Max. operating speed (at rated load)		20 cpm
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	4,000 Vrms for 1 min.
Initial surge voltage between contact and coil*3		10,000 V
Operate time*4 (at nominal voltage) (at 20°C 68°F)		Max. 20ms
Release time (with diode)*4 (at nominal voltage) (at 20°C 68°F)		Max. 20ms Max. 25ms (200 mW type)
Temperature rise (at nominal voltage) (resistance method, contact current 16 A, 20°C 68°F)		Max. 55°C Max. 45°C (200 mW type)
Shock resistance	Functional*5	200 m/s^2{20 G}
	Destructive*6	1,000 m/s^2{100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +85°C –40°F to +185°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 17 g .60 oz Approx. 15 g .53 oz (PCB type)

ORDERING INFORMATION

Ex. A | LE | 1 | 2 | B | 12

Product name	Contact arrangement	Terminal shape	Coil insulation class	Coil voltage, V DC
LE	1: 1 Form A (400 mW) 7: 1 Form A (200 mW)	2: TMP type/PCB side three terminals (includes one dummy terminal) 3: TMP type/PCB side three terminals 4: TMP type/PCB side four terminals P: PCB type (No tab terminals)	B: Class B insulation F: Class F insulation	05: 5 18: 18 06: 6 24: 24 09: 9 48: 48 12: 12

UL/CSA, TÜV, VDE approved type is standard (TMP type). SEMKO approved types are also available, please consult us.
UL/CSA, VDE approved type is standard (PCB type).
Note: Standard packing; Carton: 100 pcs. Case 500 pcs.

TYPES

1. Standard type

Contact arrangement	Coil voltage, V DC	TMP type/PCB side three terminals (includes one dummy terminal)	TMP type/PCB side three terminals	TMP type/PCB side four terminals	PCB type (No tab terminals)
		Part No.	Part No.	Part No.	Part No.
1 Form A	5	ALE12❍05	ALE13❍05	ALE14❍05	ALE1P❍05
	6	ALE12❍06	ALE13❍06	ALE14❍06	ALE1P❍06
	9	ALE12❍09	ALE13❍09	ALE14❍09	ALE1P❍09
	12	ALE12❍12	ALE13❍12	ALE14❍12	ALE1P❍12
	18	ALE12❍18	ALE13❍18	ALE14❍18	ALE1P❍18
	24	ALE12❍24	ALE13❍24	ALE14❍24	ALE1P❍24
	48	ALE12❍48	ALE13❍48	ALE14❍48	ALE1P❍48

❍: Input the following letter. Class B: B, Class F: F

Power

2. High sensitive type

Contact arrangement	Coil voltage, V DC	TMP type/PCB side three terminals (includes one dummy terminal)	TMP type/PCB side three terminals	TMP type/PCB side four terminals
		Part No.	Part No.	Part No.
1 Form A (High sensitivity: 200mW)	5	ALE72❍05	ALE73❍05	ALE74❍05
	6	ALE72❍06	ALE73❍06	ALE74❍06
	9	ALE72❍09	ALE73❍09	ALE74❍09
	12	ALE72❍12	ALE73❍12	ALE74❍12
	18	ALE72❍18	ALE73❍18	ALE74❍18
	24	ALE72❍24	ALE73❍24	ALE74❍24
	48	ALE72❍48	ALE73❍48	ALE74❍48

❍: Input the following letter. Class B: B, Class F: F

COIL DATA (at 20°C 68°F)

1. Standard type

Nominal voltage, V DC	Pick-up voltage, V DC (max.) (at 20°C 68°F)	Drop-out voltage, V DC (min.) (at 20°C 68°F)	Coil resistance, Ω (±10%) (at 20°C 68°F)	Nominal operating current, mA (±10%) (at 20°C 68°F)	Nominal operating power, mW (at 20°C 68°F)	Maximum allowable voltage, V DC (at 20°C 68°F)
5	3.75	0.25	63	80	400	7.25
6	4.5	0.3	90	66.7		8.7
9	6.75	0.45	203	44.4		13.05
12	9	0.6	360	33.3		17.4
18	13.5	0.9	810	22.2		26.1
24	18	1.2	1,440	16.7		34.8
48	36	2.4	5,760	8.3		69.6

2. High sensitive type

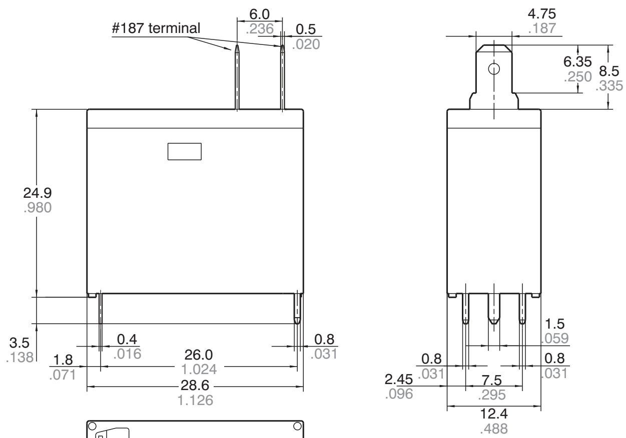
Nominal voltage, V DC	Pick-up voltage, V DC (max.) (at 20°C 68°F)	Drop-out voltage, V DC (min.) (at 20°C 68°F)	Coil resistance, Ω (±10%) (at 20°C 68°F)	Nominal operating current, mA (±10%) (at 20°C 68°F)	Nominal operating power, mW (at 20°C 68°F)	Maximum allowable voltage, V DC (at 20°C 68°F)
5	3.75	0.25	125	40		7.25
6	4.5	0.3	180	33.3		8.7
9	6.75	0.45	405	22.2		13.05
12	9	0.6	720	16.7	200	17.4
18	13.5	0.9	1,620	11.1		26.1
24	18	1.2	2,880	8.3		34.8
48	36	2.4	11,520	4.2		69.6

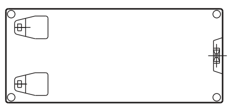
DIMENSIONS(mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. TMP type

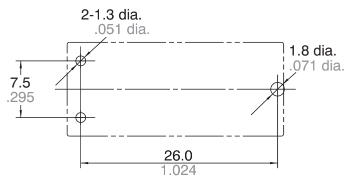
PCB side three terminals
(includes one dummy terminal)
CAD Data





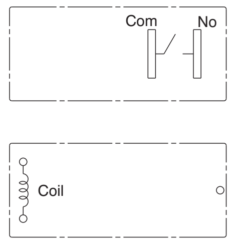
Dimension: | Tolerance
Max. 1mm .039 inch: ±0.1 ±.004
1 to 3mm .039 to .118 inch: ±0.2 ±.008
Min. 3mm .118 inch: ±0.3 ±.012

PC board pattern (Bottom view)

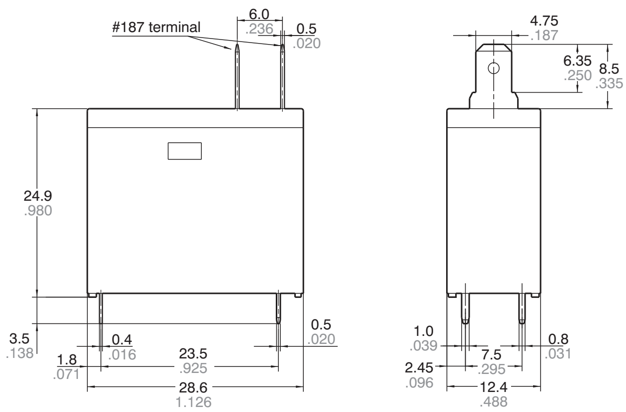


Tolerance : ±0.1 ±.004

Schematic (Bottom view)

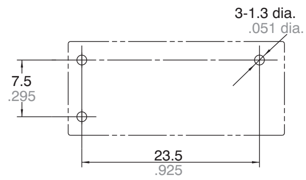


PCB side three terminals



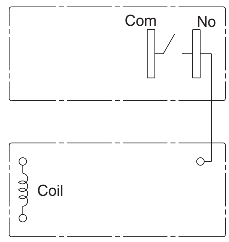
Dimension: | Tolerance
Max. 1mm .039 inch: ±0.1 ±.004
1 to 3mm .039 to .118 inch: ±0.2 ±.008
Min. 3mm .118 inch: ±0.3 ±.012

PC board pattern (Bottom view)



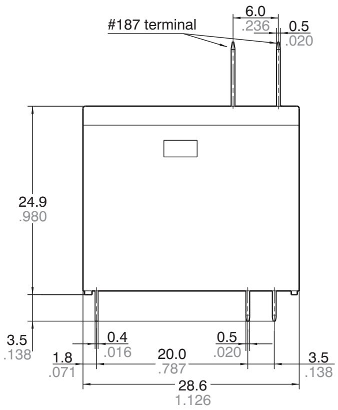
Tolerance : ±0.1 ±.004

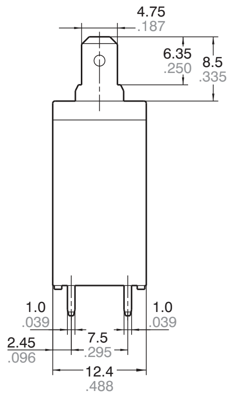
Schematic (Bottom view)

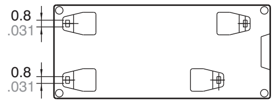


PCB side four terminals

mm inch

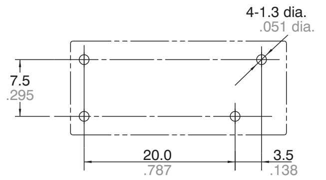






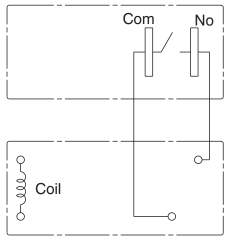
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



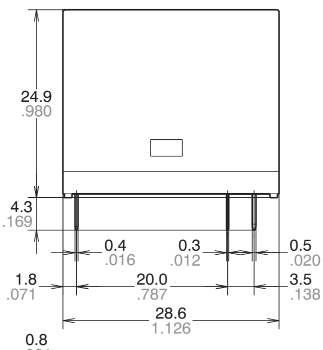
Tolerance : ±0.1 ±.004

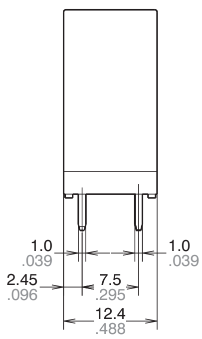
Schematic (Bottom view)

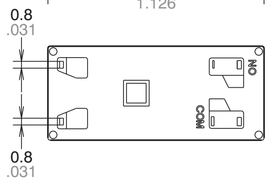


2. PCB type
(No tab terminals)

CAD Data

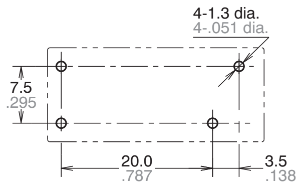






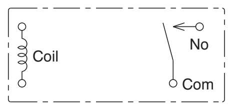
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

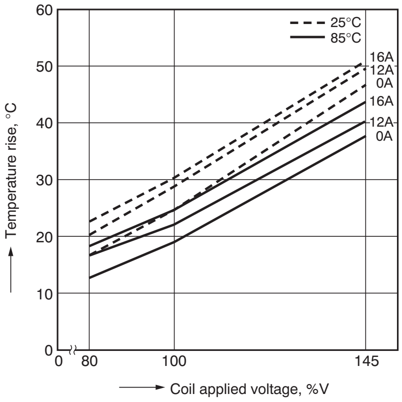
Schematic (Bottom view)



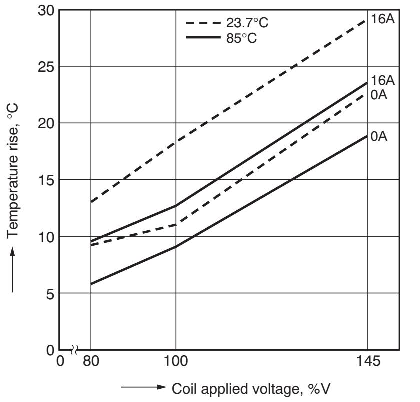
Power

REFERENCE DATA

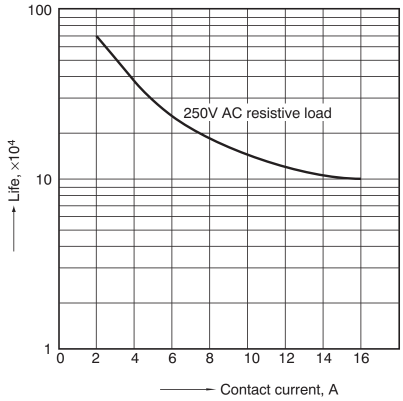
1-1. Coil temperature rise (400mW type)
Sample: ALE14B12, 6 pcs.
Point measured: coil inside
Ambient temperature: 25°C 77°F, 85°C 185°F



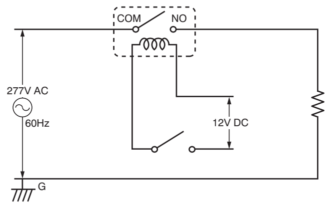
1-2. Coil temperature rise (200mW type)
Sample: ALE74B12, 6 pcs.
Point measured: coil inside
Ambient temperature: 23.7°C 74.66°F, 85°C 185°F

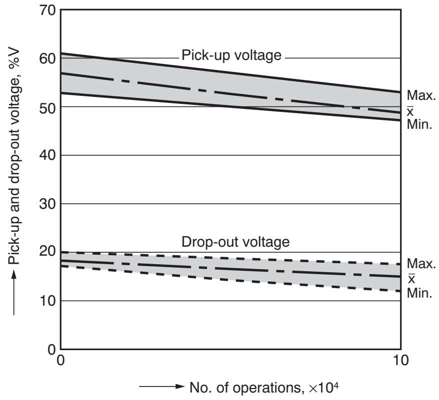


2. Life curve



3. Electrical life test (16 A 277 V AC, resistive load)
Sample: ALE14B12, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: Room temperature
Circuit:





For Cautions for Use, see Relay Technical Information (page 582).

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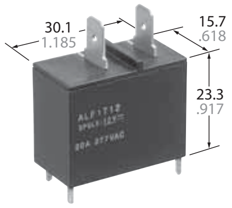
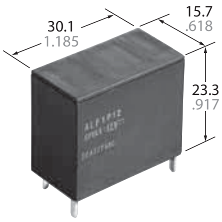
ideas for life

20A POWER RELAY FOR HOME APPLIANCES

LF RELAYS (ALF)



TMP type



PCB type

mm inch

FEATURES

1. Ideal for compressor and inverter loads
1) Compressor load: 20A 250V AC
2) Inverter load: 20A 100V AC,
10A 200V AC

2. High insulation resistance
- Creepage distance and clearances between contact and coil;
  Creepage Min. 9.5mm .374inch/
  Clearance Min. 8mm .315inch
- Surge withstand voltage: Min. 10,000V

3. "PCB" and "TMP" types available

4. Conforms to the various safety standards:
UL/CSA, TÜV, VDE approved

Power

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ
Contact material		$AgSnO_2$ type
Rating (resistive load)	Nominal switching capacity	20 A 250V AC
	Max. switching power	6,250 V A
	Max. switching voltage	250V AC
	Max. switching current	25 A
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	2×10^6
	Electrical (at 20 cpm) (Resistive load)	10^5

Coil

Nominal operating power	900 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

Characteristics

Max. operating speed (at rated load)		20 cpm
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	5,000 Vrms for 1 min.
Surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Max. 20 ms (at 20°C 68°F)
Release time (without diode)*4 (at nominal voltage)		Max. 15 ms (at 20°C 68°F)
Temperature rise (at nominal voltage)		Max. 45°C (resistance method, contact current 20 A, rated coil voltage, 60°C 140°F)
Shock resistance	Functional*5	Min. 100 m/s²{10 G}
	Destructive*6	Min. 1,000 m/s²{100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +60°C –40°F to +140°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 23 g .81 oz

TYPICAL APPLICATIONS

- **Air conditioner**
- **Refrigerators**
- **OA equipment**

ORDERING INFORMATION

Ex. A | LF | 1 | T | 12

Product Name	Contact arrangement	Terminal shape	Coil voltage, V DC
LF	1: 1 Form A	T: TMP type P: PCB type	05: 5 12: 12 06: 6 18: 18 09: 9 24: 24

Note: Standard packing; Carton: 50 pcs. Case 200 pcs.
UL/CSA,VDE, TÜV approved type is standard.

TYPES

Contact arrangement	Coil voltage, V DC	TMP type	PCB type
1 Form A	5	ALF1T05	ALF1P05
	6	ALF1T06	ALF1P06
	9	ALF1T09	ALF1P09
	12	ALF1T12	ALF1P12
	18	ALF1T18	ALF1P18
	24	ALF1T24	ALF1P24

COIL DATA

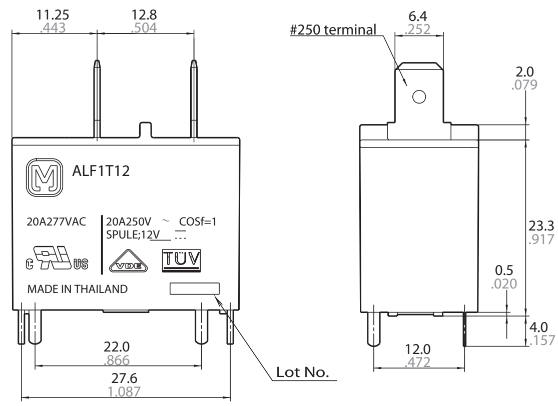
Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance, Ω(±10%)	Nominal operating current, mA (±10%)	Nominal operating power, W	Maximum allowable voltage, V DC
5	3.5	0.5	27.8	180	0.9	5.5
6	4.2	0.6	40	150		6.6
9	6.3	0.9	90	100		9.9
12	8.4	1.2	160	75		13.2
18	12.6	1.8	360	50		19.8
24	16.8	2.4	640	37.5		26.4

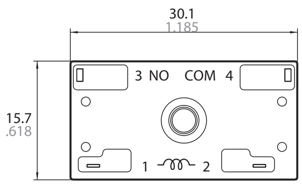
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. TMP type

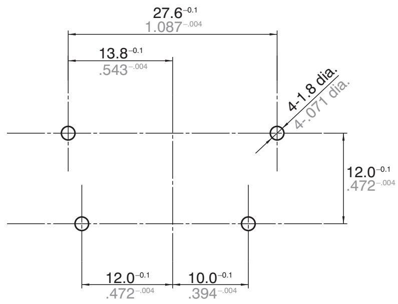
CAD Data





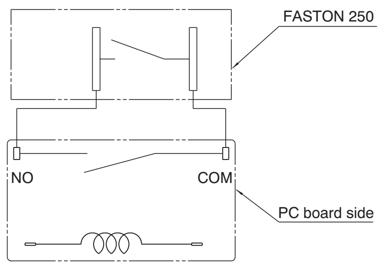
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



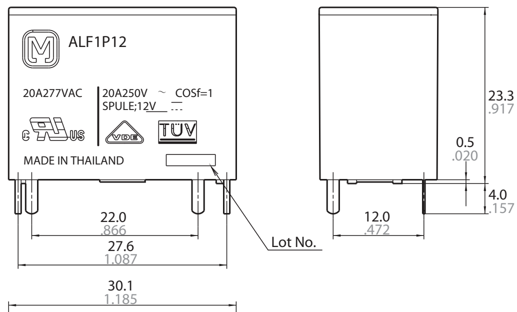
Tolerance: ±0.1 ±.004

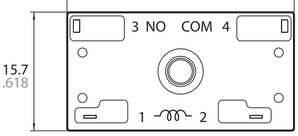
Schematic (Bottom view)



2. PCB type

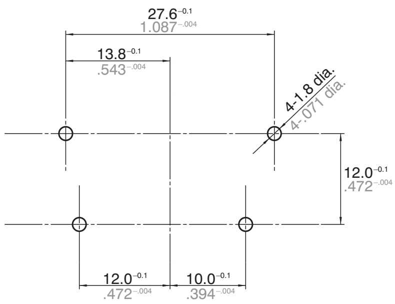
CAD Data





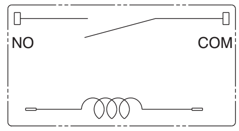
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

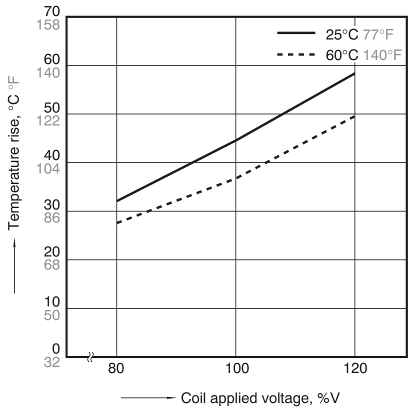
Schematic (Bottom view)



REFERENCE DATA

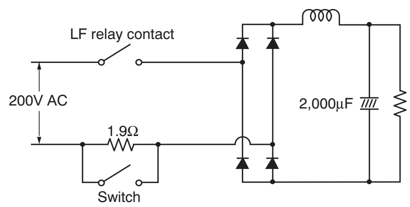
1. Coil temperature rise

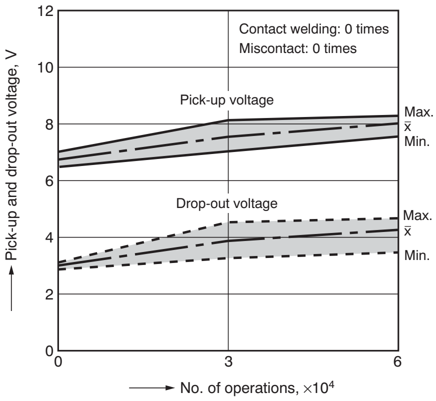
Sample: ALF1T12, 6 pcs.
Point measured: coil inside
Contact current: 20A
Ambient temperature: 25°C 77°F, 60°C 140°F



2-(1). 200V AC electrical life test
(200V AC, inverter load)

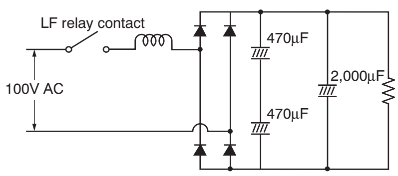
Sample: ALF1T12, 6 pcs.
Load: Inrush 102A (wave peak value),
Steady 14.4A (wave peak value)
Inverter dummy 200V AC
Switching frequency: ON 1s, OFF 5s
Circuit:

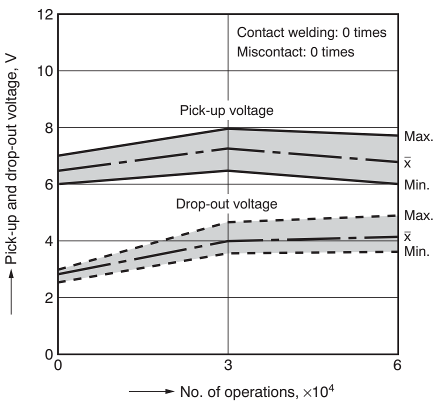




2-(2). 100V AC electrical life test
(100V AC, inverter load)

Sample: ALF1T12, 6 pcs.
Load: Inrush 224A (wave peak value),
Steady 30.5A (wave peak value)
Inverter dummy 100V AC
Switching frequency: ON 1s, OFF 5s
Circuit:

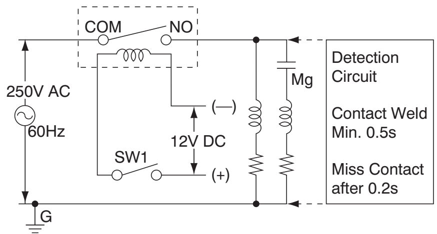


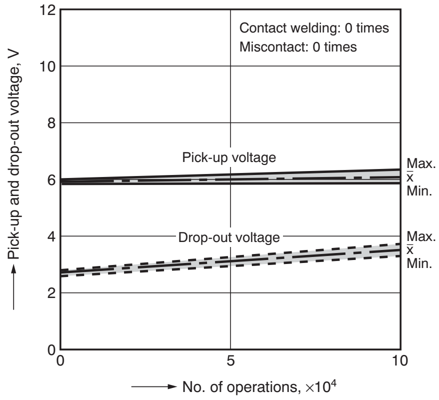


Power

2-(3). Inrush 70.7A, Steady 20A, 250V AC electrical life test (Compressor dummy load)

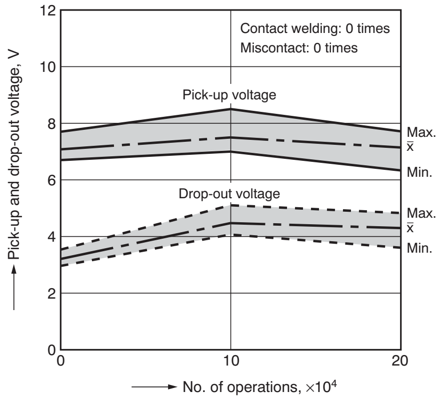
Sample: ALF1T12, 3 pcs.
Load: Inrush 70.7A, cosϕ = 0.7
Steady 20A, cosϕ 0.9
250V AC compressor dummy
Switching frequency: ON 1.5s, OFF 1.5s
Circuit:





2-(4). Electrical life test (20A 250V AC, resistive load)

Sample: ALF1T12, 6 pcs.
Switching frequency: ON 1.5s, OFF 1.5s



For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

Ideal for Solar inverter Compact size, 1 Form A 22A/31A Power Relay

LF-G RELAYS (ALFG)

FEATURES

• High capacity
High capacity control possible at 22A/31A (High capacity type) 250V AC rating in compact size (L: 15.7 × W: 30.1 × H: 23.3 mm L: .618 × W: 1.185 × H: .917 inch)

• Contact gap: 1.5 mm .059 inch
Compliant with European photovoltaic standard (VDE0126).
EN61810-1 certified: 2.5 kV surge breakdown voltage (between contacts)

• Coil holding voltage contributes to saving energy of equipment
The coil holding voltage can be reduced up to 35%V of the nominal coil voltage (Ambient temperature: 20°C 68°F).
Power consumption at the lowest coil holding voltage: 170 mW equivalent
*Coil holding voltage is the coil voltage after 100 ms from the applied nominal coil voltage.
*When the ambient temperature during use is 85°C 185°F, make the coil holding voltage between 45% and 80%V of the nominal coil voltage.

• High insulation resistance
Creepage distance between contact and coil terminal: Min. 9.5 mm .354 inch
Clearance distance between contact and coil terminal: Min. 6.5 mm .256 inch
Surge breakdown voltage: 6 kV

• Conforms to various safety standards
UL, C-UL and VDE approved

TYPICAL APPLICATIONS

- **Photovoltaic power generation systems (Solar inverter)**
- **Uninterruptible Power Supplies (UPS)**
- **Home appliances**
- **Office equipment**

Power

ORDERING INFORMATION

ALFG [ ] **P** **F** [ ][ ]

LF-G relay

Contact arrangement
1: 1 Form A Standard type (22A)
2: 1 Form A High capacity type (31A)

Terminal shape
P: PCB type

Coil insulation class
F: UL Class F

Nominal coil voltage (DC)
09: 9V, 12: 12V, 18: 18V, 24: 24V

Note: UL, C-UL and VDE approved type is standard.

TYPES

Contact arrangement	Nominal coil voltage	Part No.	
		Standard type	High capacity type
1 Form A	9V DC	ALFG1PF09	ALFG2PF09
	12V DC	ALFG1PF12	ALFG2PF12
	18V DC	ALFG1PF18	ALFG2PF18
	24V DC	ALFG1PF24	ALFG2PF24

Standard packing: Carton: 50 pcs.; Case: 200 pcs.

RATING

■ Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F) (Initial)	Drop-out voltage (at 20°C 68°F) (Initial)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 20°C 68°F)
9V DC	70%V or less of nominal voltage	10%V or more of nominal voltage	115mA	58Ω	1,400mW	120%V of nominal voltage
12V DC			117mA	103Ω		
18V DC			78mA	230Ω		
24V DC			59mA	410Ω		

■ Specifications

Characteristics	Item		Specifications	
			Standard type	High capacity type
Contact	Arrangement		1 Form A	
	Contact resistance (Initial)		Max. 100 mΩ (By voltage drop 6 V DC 1A)	
	Contact material		$AgSnO_2$ type	
Rating	Nominal switching capacity		22A 250V AC	31A 250V AC
	Max. switching power		5,500VA	7,750VA
	Max. switching voltage		250V AC	
	Max. switching current		22A (AC)	31A (AC)
	Nominal operating power		1,400mW	
	Min. switching capacity (Reference value)*1		100mA 5V DC	
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Breakdown voltage” section.	
	Breakdown voltage (Initial)	Between open contacts	2,500 Vrms for 1 min. (Detection current: 10 mA)	
		Between contact and coil	4,000 Vrms for 1 min. (Detection current: 10 mA)	
	Surge breakdown voltage*2 (Between contact and coil)		6,000 V (initial)	
	Temperature rise*3		Max. 95°C 203°F (By resistive method, nominal coil voltage applied to the coil; contact carrying current: 22A, at 60°C 140°F) Max. 70°C 158°F (By resistive method, 80%V of nominal coil voltage applied to the coil; contact carrying current: 22A, at 85°C 185°F)	Max. 95°C 203°F (By resistive method, nominal coil voltage applied to the coil; contact carrying current: 31A, at 60°C 140°F) Max. 70°C 158°F (By resistive method, 80%V of nominal coil voltage applied to the coil; contact carrying current: 31A, at 85°C 185°F)
	Coil holding voltage*4		35 to 120%V (contact carrying current: 22A, at 20°C 68°F) 45 to 80%V (contact carrying current: 22A, at 85°C 185°F)	35 to 120%V (contact carrying current: 31A, at 20°C 68°F) 45 to 80%V (contact carrying current: 31A, at 85°C 185°F)
	Operate time (at 20°C 68°F)		Max. 20 ms (at nominal coil voltage excluding contact bounce time.)	
	Release time (at 20°C 68°F)		Max. 10 ms (at nominal coil voltage excluding contact bounce time, without diode)	
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s^2 (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)	
		Destructive	Min. 1,000 m/s^2 (Half-wave pulse of sine wave: 6 ms.)	
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1.5 mm (Detection time: 10μs.)	
		Destructive	10 to 55 Hz at double amplitude of 1.5 mm	
Expected life	Mechanical		Min. 10^6 (at 180 cpm)	
	Electrical	Resistive load	22A 250V AC, Min. 3×10^4 (at 20 cpm)	—
		Inductive load	Destructive: 22A 250V AC (cosϕ = 0.8), Min. 3×10^4 (on:off = 0.1s:10s) Over load: 35A 250V AC (cosϕ = 0.8), Min. 50 (on:off = 0.1s:10s)	Destructive: 31A 250V AC (cosϕ = 0.8), Min. 3×10^4 (on:off = 0.1s:10s) Over load: 47A 250V AC (cosϕ = 0.8), Min. 50 (on:off = 0.1s:10s)
Conditions	Conditions for operation, transport and storage*5		Ambient temperature: –40°C to +60°C –40°F to +140°F (When nominal coil voltage applied) –40°C to +85°C –40°F to +185°F (Coil holding voltage is when 45 to 80%V of nominal coil voltage is applied.) Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature) Air pressure: 86 to 106 kPa	
Unit weight			Approx. 23 g .81 oz	

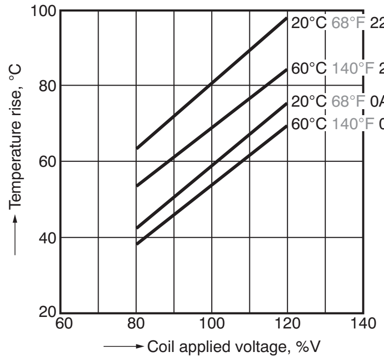
Notes: *1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2 Wave is standard shock voltage of ±1.2×50μs according to JEC-212-1981
*3 In accordance with UL class-F
*4 Coil holding voltage is the coil voltage after 100 ms from the applied nominal coil voltage.
*5 The upper limit of the ambient temperature is the maximum temperature that can satisfy the coil temperature rise value. Refer to 1. Usage, transport and storage conditions in NOTES.

REFERENCE DATA

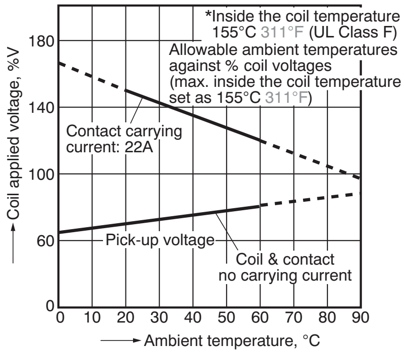
■ Standard type

1. Coil temperature rise

Sample: ALFG1PF09, 6 pcs.
Point measured: coil inside
Ambient temperature: 20°C 68°F, 60°C 140°F
Contact carrying current: 22A



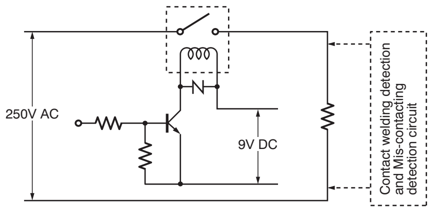
2. Ambient temperature characteristics and coil applied voltage



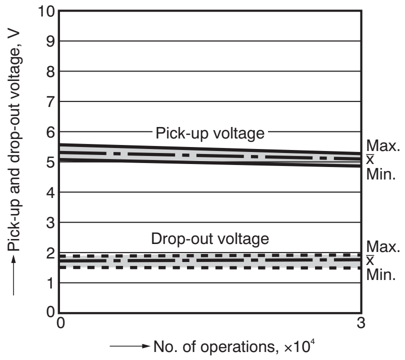
3. Electrical life test
(22A 250V AC Resistive load)

Sample: ALFG1PF09, 6 pcs.
Operation frequency: ON:OFF = 1.5s:1.5s
Ambient temperature: 85°C 185°F

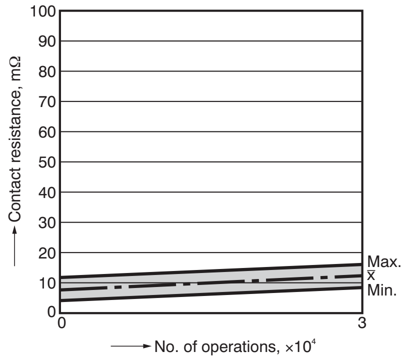
Circuit:



Change of pick-up and drop-out voltage



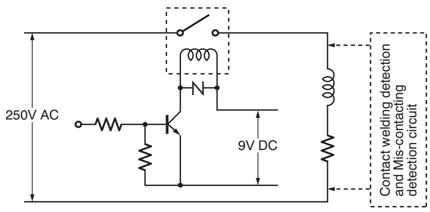
Change of contact resistance



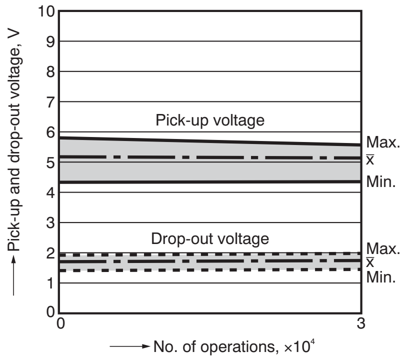
4. Electrical life test
(22A 250V AC cosϕ = 0.8 Inductive load)

Sample: ALFG1PF09, 6 pcs.
Operation frequency: ON:OFF = 0.1s:10s
Ambient temperature: 85°C 185°F

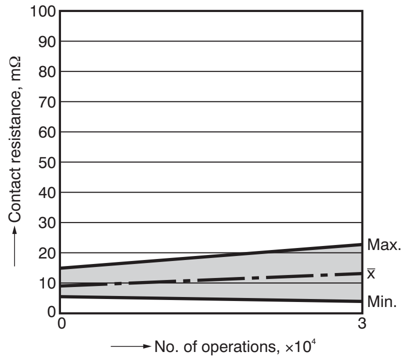
Circuit:



Change of pick-up and drop-out voltage



Change of contact resistance

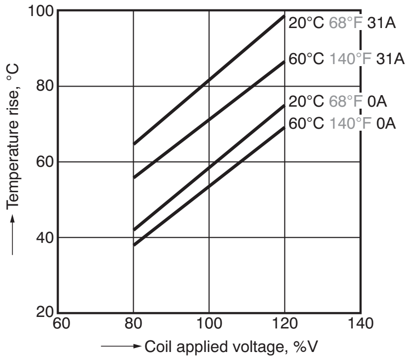


Power

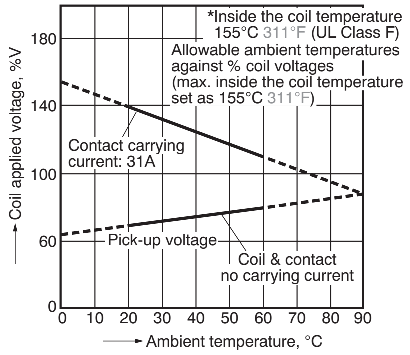
■ High capacity type

1. Coil temperature rise

Sample: ALFG2PF09, 6 pcs.
Point measured: coil inside
Ambient temperature: 20°C 68°F, 60°C 140°F
Contact carrying current: 31A



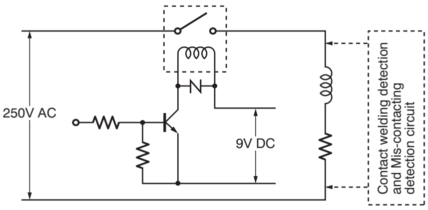
2. Ambient temperature characteristics and coil applied voltage



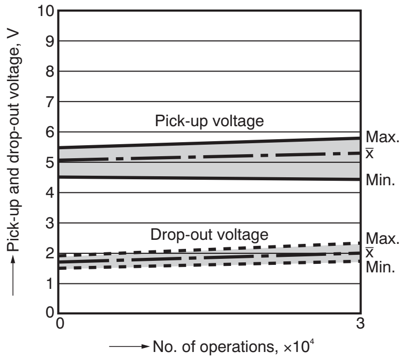
3. Electrical life test
(31A 250V AC cosϕ = 0.8 Inductive load)

Sample: ALFG2PF09, 6 pcs.
Operation frequency: ON:OFF = 0.1s:10s
Ambient temperature: 85°C 185°F

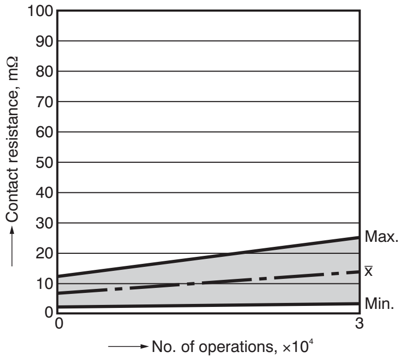
Circuit:



Change of pick-up and drop-out voltage



Change of contact resistance

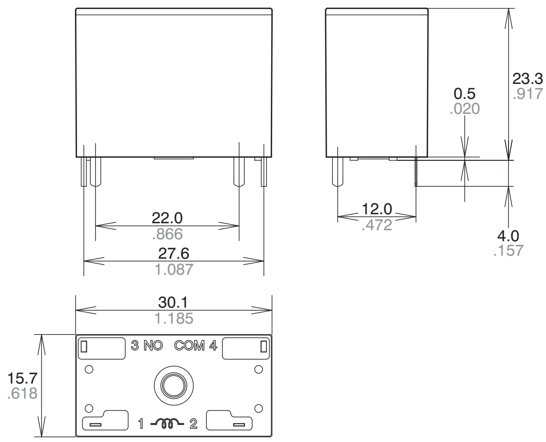


DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

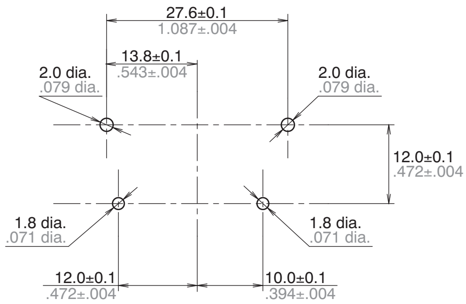
CAD Data

External dimensions



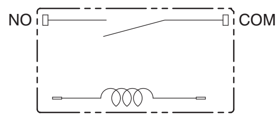
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



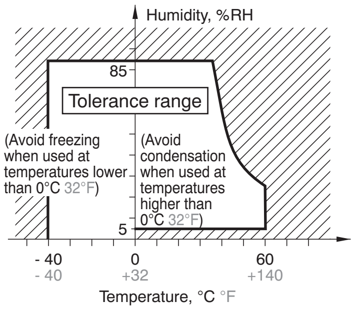
SAFETY STANDARDS

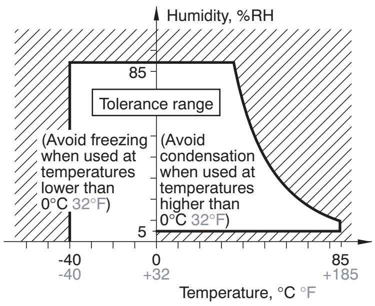
Certification authority	Standard type	High capacity type
UL, C-UL	22A 277V AC General Use (at 85°C 185°F)	31A 277V AC General Use (at 85°C 185°F)
VDE (VDE0435)	22A 250V AC cosϕ = 0.8 (at 85°C 185°F)	31A 250V AC cosϕ = 0.8 (at 85°C 185°F)

NOTES

■ Usage, transport and storage conditions

1) Temperature:
–40 to +60°C –40 to +140°F (When nominal coil voltage applied)
–40 to +85°C –40 to +185°F (When coil holding voltage is 45% to 80% of the nominal coil voltage)
2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage





* –40 to +85°C –40 to +185°F (When 45% to 80%V of coil holding voltage)

4) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
5) Freezing
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
6) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

■ Solder and cleaning conditions

1) Please obey the following conditions when soldering automatically.
(1) Preheating: Within 120°C 248°F (solder surface terminal portion) and within 120 seconds
(2) Soldering iron: 260°C±5°C 500°F±41°F (solder temperature) and within 6 seconds (soldering time)
2) Since this is not a sealed type relay, do not clean it as is. Also, be careful not to allow flux to overflow above the PC board or enter the inside of the relay.

■ Certification

1) This relay is UL, C-UL certified.
UL, C-UL;
Standard type:
22A 277V AC General Use
High capacity type:
31A 277V AC General Use
2) This relay is certified by VDE (VDE0435).
VDE;
Standard type:
22A 250V AC cosϕ = 0.8
High capacity type:
31A 250V AC cosϕ = 0.8

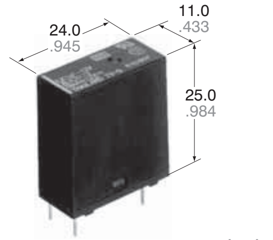
■ Cautions for use

1) For precautions regarding use and explanations of technical terminology, please refer to our web site. (panasonic-electric-works.net/ac)
2) To ensure good operation, please keep the voltage on the coil ends to ±5% (at 20°C 68°F) of the rated coil operation voltage. Also, please be aware that the pick-up voltage and drop-out voltage may change depending on the temperature and conditions of use.
3) Keep the ripple rate of the nominal coil voltage below 5%.
4) Please test with actual device when using the coil holding voltage with PWM control.
5) The cycle lifetime is defined under the standard test condition specified in the JIS C5442 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors. Also, be especially careful of loads such as those listed below.
(1) When used for AC load-operating and the operating phase is synchronous. Rocking and fusing can easily occur due to contact shifting.
(2) Highly frequent load-operating
When highly frequent opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.
Three countermeasures for these are listed here.
• Incorporate an arc-extinguishing circuit.
• Lower the operating frequency
• Lower the ambient humidity
6) This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
7) Heat, smoke, and even a fire may occur if the relay is used in conditions outside of the allowable ranges for the coil ratings, contact ratings, operating cycle lifetime, and other specifications. Therefore, do not use the relay if these ratings are exceeded.
8) If the relay has been dropped, the appearance and characteristics should always be checked before use.
9) Incorrect wiring may cause unexpected events or the generation of heat or flames.
10) If complying with the Electrical Appliance and Material Safety Law (300V AC), please use with a nominal current no higher than 10A.
11) In order to reduce the occurrence of solder cracking due to thermal stress on the PC board, please use a double-face through hole PC board.

Panasonic
ideas for life

SLIM POWER RELAY WITH HIGH INRUSH CURRENT CAPABILITY

LK RELAYS



mm inch

FEATURES

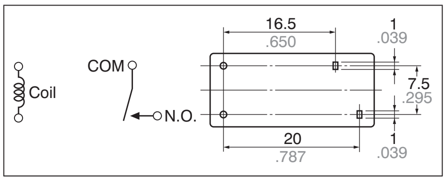
1. High inrush current capability
1) Operating load capability:
inrush 100 A, steady 5 A
2) UL/CSA, TV-5

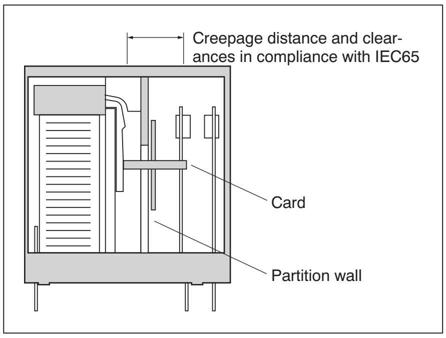
2. High insulation resistance between contact and coil
1) Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch (In compliance with IEC65)
2) Surge withstand voltage between contact and coil: 10,000 V or more

3. High noise immunity realized by the card separation structure between contact and coil

4. Popular terminal pitch in AV equipment field

mm inch





5. Space-saving slim type
Base area: Width 11 × Length 24 mm
Width .433 × Length .945 inch

6. Conforms to the various safety standards
UL, CSA, VDE, TÜV, SEMKO, SEV, BSI approved

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		Max. 100 mΩ
Contact material		$AgSnO_2$ type
Rating (resistive load)	Nominal switching capacity	5 A 277 V AC, 5 A 30 V DC
	Max. switching power	1,385 VA, 150 W
	Max. switching voltage	277 V AC, 30 V DC
	Max. switching current	5A (AC), 5 A (DC)
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. ope.)	Mechanical (at 180 cpm)	2×10^6
	Electrical (at 20 cpm) (at rated load)	10^5

Coil

Nominal operating power	530 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

Characteristics

Max. operating speed		20 cpm
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min
	Between contacts and coil	4,000 Vrms for 1 min
Initial surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Max. 15 ms (at 20°C 68°F)
Release time (without diode)*4 (at nominal voltage)		Max. 5 ms (at 20°C 68°F)
Temperature rise (at 70°C)		Max. 35°C with nominal coil voltage at 5A contact carrying current (resistance method)
Shock resistance	Functional*5	Min. 200 m/s²
	Destructive*6	Min. 1,000 m/s²
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 1.5 mm
	Destructive	10 to 55 Hz at double amplitude of 1.5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40 to +70°C –40 to +158°F
	Humidity	5 to 85%R.H.
	Air pressure	86 to 106 kPa
Unit weight		Approx. 12 g .42 oz

TYPICAL APPLICATIONS

- AV equipment: TV's, VTR's, etc.
- OA equipment
- HA equipment

ORDERING INFORMATION

Ex. LK 1a F — 24V

Contact arrangement	Protective construction	Coil voltage (DC)
1a: 1 Form A	F: Flux-resistant type	5, 6, 9, 12, 18, 24 V

UL/CSA, TÜV, SEMKO, TV-5 approved type is standard.
(Note) Standard packing Carton: 100 pcs. Case: 500 pcs.

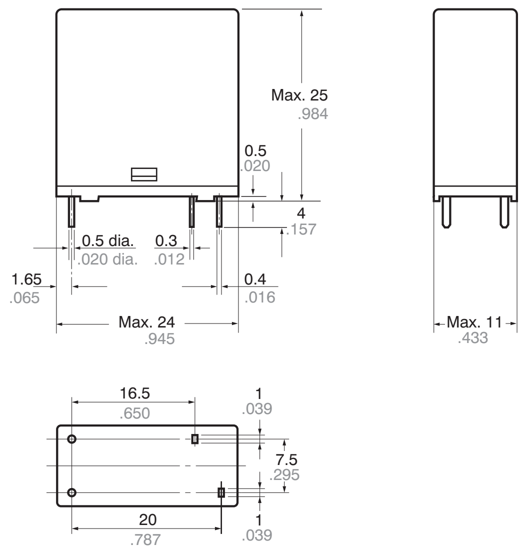
TYPES AND COIL DATA (at 20°C 68°F)

Part No.	Nominal voltage, V DC	Pick-up voltage V DC (max.) (Initial)	Drop-out voltage V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 20°C 68°F)
LK1aF-5V	5	3.5	0.5	47	106.4	530	6.5
LK1aF-6V	6	4.2	0.6	68	88.3	530	7.8
LK1aF-9V	9	6.3	0.9	153	58.8	530	11.7
LK1aF-12V	12	8.4	1.2	272	44.2	530	15.6
LK1aF-18V	18	12.6	1.8	611	29.5	530	23.4
LK1aF-24V	24	16.8	2.4	1,087	22.1	530	31.2

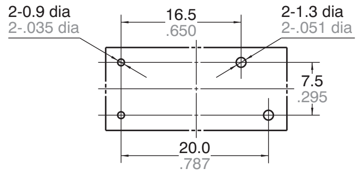
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data



PC board pattern (Bottom view)



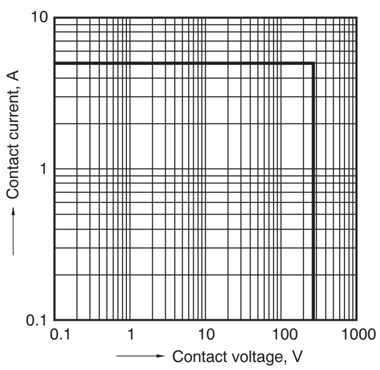
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

Dimension :	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

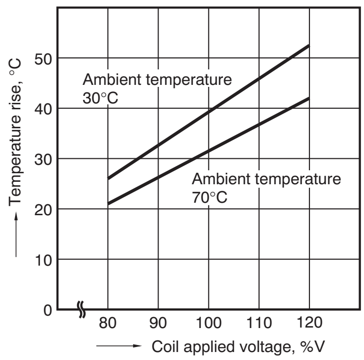
REFERENCE DATA

1. Max. switching power (AC resistive load)



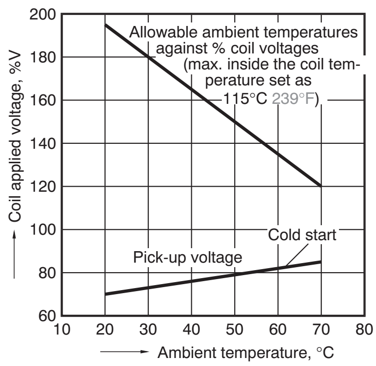
2. Coil temperature rise

Sample: LK1aF-12V, 6 pcs.
Point measured: coil inside
Contact current: 5 A



3. Ambient temperature characteristics

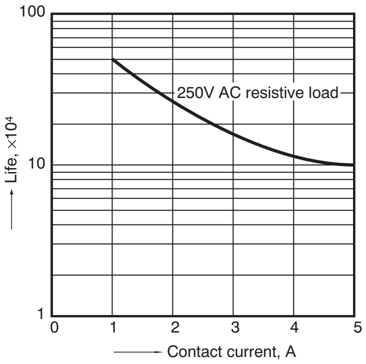
Contact current: 5 A



Power

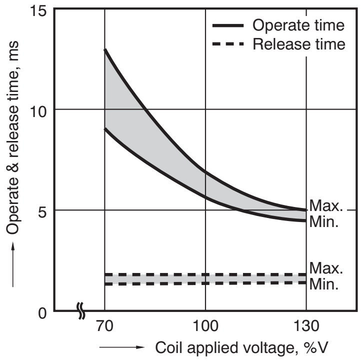
4. Life curve

Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: room temperature



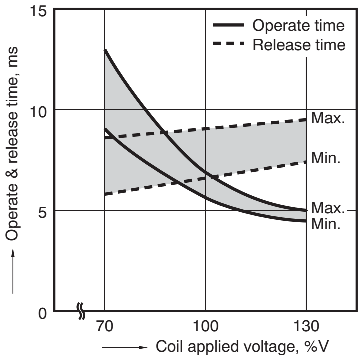
5-1. Operate & release time (without diode)

Sample: LK1aF-12V, 20 pcs.



5-2. Operate & release time (with diode)

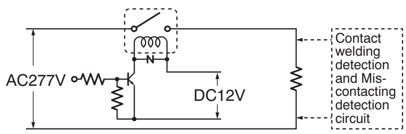
Sample: LK1aF-12V, 20 pcs.



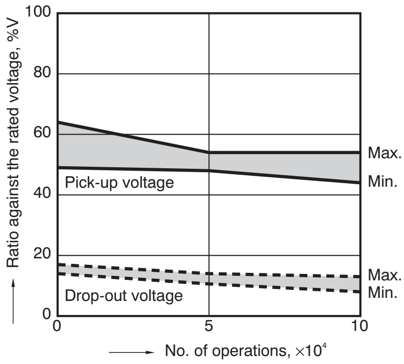
6-1. Electrical life test
(5 A 277 V AC, resistive load)

Sample: LK1aF-12V, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 26°C 79°F

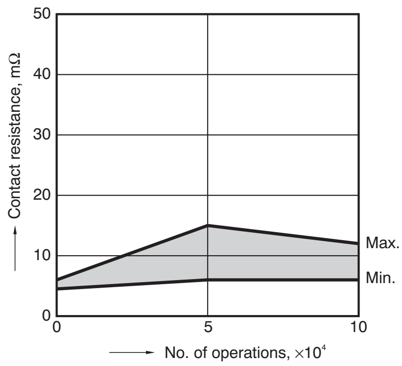
Circuit:



Change of pick-up and drop-out voltage



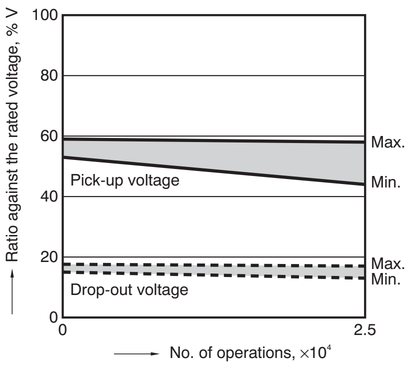
Change of contact resistance



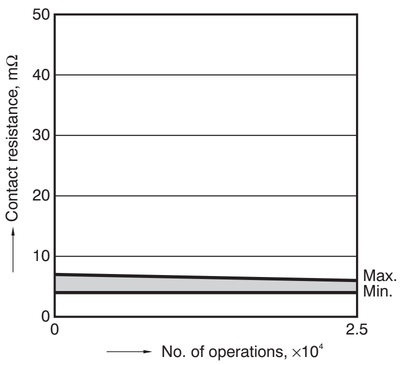
6-2. Electrical life test
(UL lamp load test TV-5)

Tested sample: LK1aF-12V, 6 pcs.
- Overload test
  Load: 7.5 A 120 V AC (60 Hz),
  Inrush: 111 A
  Operation frequency: 10 times/min
  (ON: OFF = 1 s: 5 s)
  No. of operations: 50 ope.
- Endurance test
  Load: 5A 120 V AC (60 Hz),
  Inrush: 78 A
  Operation frequency: 10 times/min
  (ON: OFF = 1 s: 5 s)
  No. of operations: 25,000 ope.

Change of pick-up and drop-out voltage



Change of contact resistance



NOTES

1. Cleaning

This relay is not the sealed type, so it cannot be immersion cleaned. Be careful that flux does not overflow onto the PC board or penetrate inside the relay.

2. Soldering

We recommend the following soldering conditions.

1) Automatic soldering
* Preheating: 100°C 212°F, within 2 mins (PC board solder surface)
* Soldering: 260°C 500°F, within 5 s

2) Hand soldering
* Iron tip temperature: 280 to 300°C 536 to 571°F
* Soldering iron: 30 to 60W
* Soldering time: Within 3 s

For Cautions for Use, see Relay Technical Information (page 582).

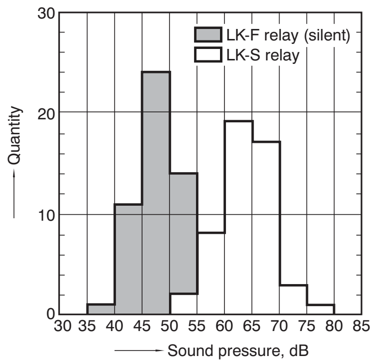
Panasonic
ideas for life

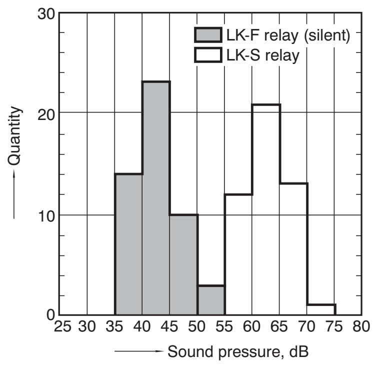
Low Profile (10 mm)
TV-5 and TV-8 Compatible
Flat Power Relay

LK-F RELAYS

- **TV standards compatible: TV-5 and TV-8**
- TV-5 type: 78 A inrush current and switching possible at 5 A rated current.
- TV-8 type: 118 A inrush current and switching possible at 8 A rated current.
- **Line up includes silent type**

Approx. 10 dB less sound pressure than LK-S relay.

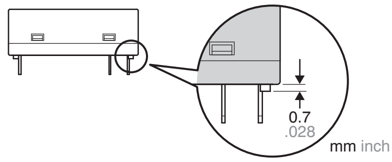




- **High sensitivity: 250mW**

Ideal for device power reduction

- **0.7 mm .028 inch stand off height**



- **Conforms to various safety standards**

UL, C-UL, TÜV and SEMKO

TYPICAL APPLICATIONS

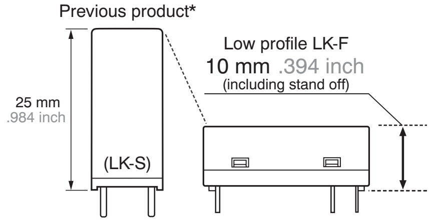
- **Flat-panel TVs**
- **Audio visual equipment**
- **Other slim profile devices**

Power

FEATURES

- **Low profile (10 mm height)**

Height reduced 60% compared with previous product*.



*Previous product: LK-S relay

- **Nominal switching capacity: 5A, 8A 277V AC**

ORDERING INFORMATION

LKF | 1a | M | | - | 1 | 2 | V | - 1 - | 5

Contact arrangement
1a: 1 Form A

Nominal operating power
M: 250mW

Operation noise
Nil: Standard type
Q: Silent type

Coil voltage (DC)
5, 9, 12, 24V

TV standard
5: TV-5
8: TV-8

Note: UL/C-UL, T†V, SEMKO approved type is standard.

TYPES

Contact arrangement	Nominal coil voltage	Part No.			
		TV-5 type		TV-8 type	
		Standard type	Silent type	Standard type	Silent type
1 Form A	5V DC	LKF1aM-5V-1-5	LKF1aMQ-5V-1-5	LKF1aM-5V-1-8	LKF1aMQ-5V-1-8
	9V DC	LKF1aM-9V-1-5	LKF1aMQ-9V-1-5	LKF1aM-9V-1-8	LKF1aMQ-9V-1-8
	12V DC	LKF1aM-12V-1-5	LKF1aMQ-12V-1-5	LKF1aM-12V-1-8	LKF1aMQ-12V-1-8
	24V DC	LKF1aM-24V-1-5	LKF1aMQ-24V-1-5	LKF1aM-24V-1-8	LKF1aMQ-24V-1-8

Standard packing: Tube: 50 pcs.; Case: 500 pcs.
*Operation noise standard type is available, please contact us.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F) (JIS C 5442* pulse drive.)		Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
	Standard type	Silent type					
5V DC	70%V or less of nominal voltage (Initial)	80%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	50 mA	100Ω	250mW	130%V of nominal voltage
9V DC				27.8mA	324Ω		
12V DC				20.8mA	576Ω		
24V DC				10.4mA	2,304Ω		

*JIS C 5442: JIS C 5442-1986 test method for miniature electromagnetic relays used for control applications.

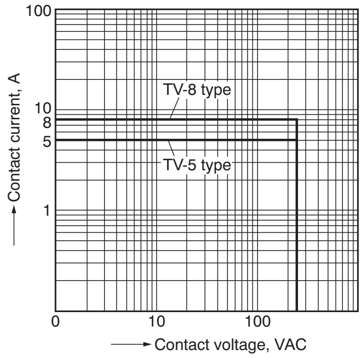
2. Specifications

Characteristics	Item		Specifications	
			TV-5 type	TV-8 type
Contact	Arrangement		1 Form A	
	Contact resistance (Initial)		Max. 100 mΩ (By voltage drop 6 V DC 1A)	
	Contact material		$AgSnO_2$ type	
Rating	Nominal switching capacity (resistive load)		5 A 277 V AC	8 A 277 V AC
	Contact carring power		1,385 VA	2,216 VA
	Max. switching voltage		277 V AC	
	Max. switching current		5 A (AC)	8 A (AC)
	Min. switching capacity (Reference value)*1		100 mA 5 V DC	
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as "Breakdown voltage" section.	
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1 min. (Detection current: 10 mA)	
		Between contact and coil	4,000 Vrms for 1 min. (Detection current: 10 mA)	
	Surge breakdown voltage*2	Between contact and coil	10,000 V (initial)	
	Temperature rise (at 20°C 68°F)		Max. 45°C 113°F (By resistive method, nominal voltage applied to the coil; contact carrying current: 5 A at 70°C 158°F.)	Max. 45°C 113°F (By resistive method, nominal voltage applied to the coil; contact carrying current: 8 A at 70°C 158°F.)
	Operate time (at 20°C 68°F)		Max. 15 ms (nominal coil voltage, excluding contact bounce time)	
	Release time (at 20°C 68°F)		Max. 5 ms (nominal coil voltage, excluding contact bounce time) (without diode)	
Mechanical characteristics	Shock resistance	Functional	Min. 200 m/s^2 (Half-wave pulse of sine wave: 11 ms; detection time: 10 µs.)	
		Destructive	Min. 1,000 m/s^2 (Half-wave pulse of sine wave: 6 ms.)	
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1.5 mm (Detection time: 10 µs.)	
		Destructive	10 to 55 Hz at double amplitude of 1.5 mm	
Expected life	Mechanical		Min. 10^6 (at 180 cpm)	
	Electrical		Min. 10^5 (at 20 cpm)	Min. 5×10^4 (at 20 cpm)
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –40°C to +70°C –40°F to +158°F; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature); Atmospheric pressure: 86 to 106 kPa	
	Max. operating speed		20 cpm (at nominal switching capacity)	
Unit weight			Approx. 12 g .42 oz	

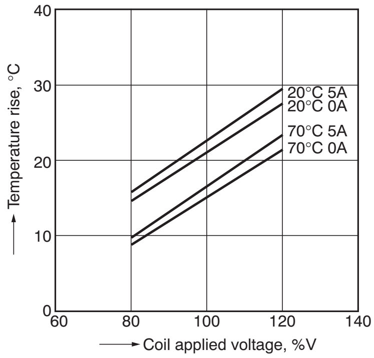
*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2 Wave is standard shock voltage of $\pm1.2\times50\mu s$ according to JEC-212-1981
*3 The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value.
Refer to 1. Usage, transport and storage conditions in NOTES.
Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

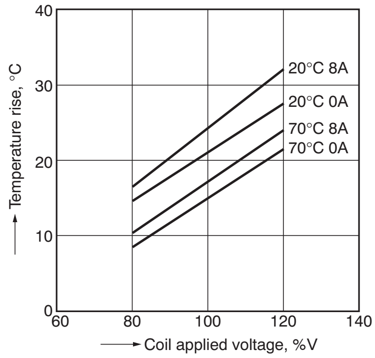
1. Max. switching power (AC resistive load)



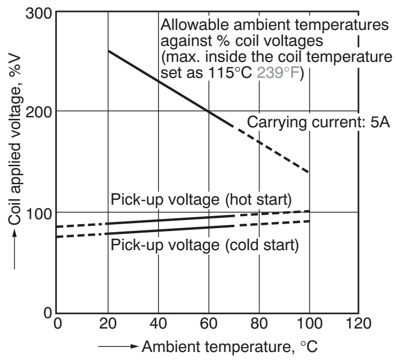
2-(1). Coil temperature rise (TV-5 type)
Sample: LKF1aMQ-12V-1-5, 6 pcs.
Point measured: coil inside
Contact current: 0A, 5A



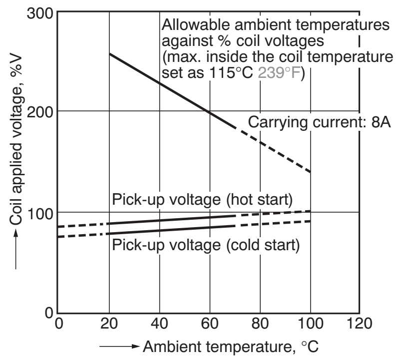
2-(2). Coil temperature rise (TV-8 type)
Sample: LKF1aMQ-12V-1-8, 6 pcs.
Point measured: coil inside
Contact current: 0A, 8A



3-(1). Ambient temperature characteristics and coil applied voltage (TV-5 type)

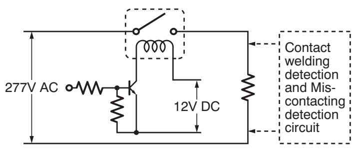


3-(2). Ambient temperature characteristics and coil applied voltage (TV-8 type)

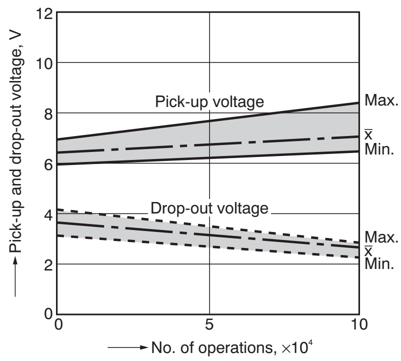


4-(1). Electrical life test
(5A 277V AC, resistive load)
Sample: LKF1aMQ-12V-1-5, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 20°C 68°F

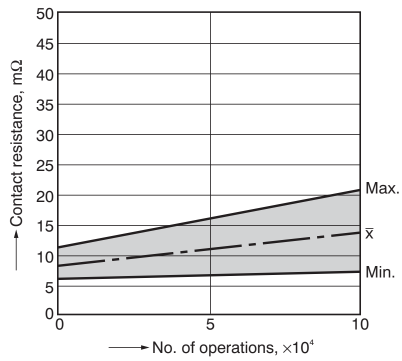
Circuit:



Change of pick-up and drop-out voltage

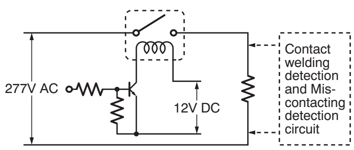


Change of contact resistance

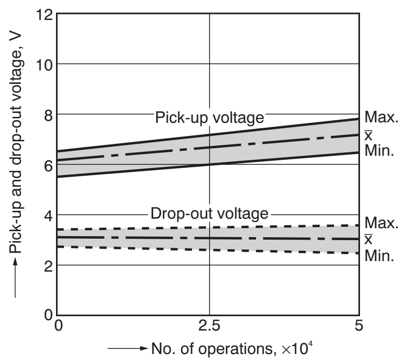


4-(2). Electrical life test
(8A 277V AC, resistive load)
Sample: LKF1aMQ-12V-1-8, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 20°C 68°F

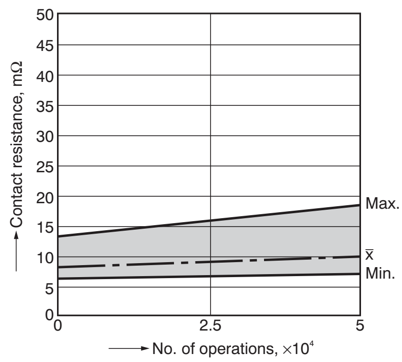
Circuit:



Change of pick-up and drop-out voltage

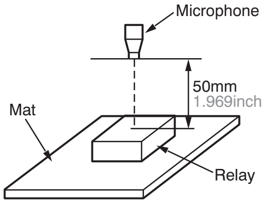


Change of contact resistance

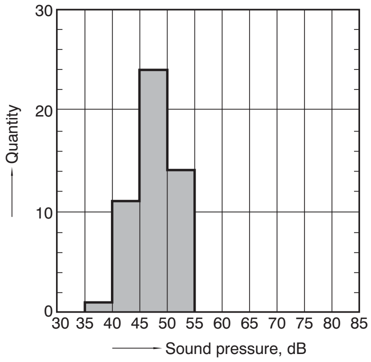


Power

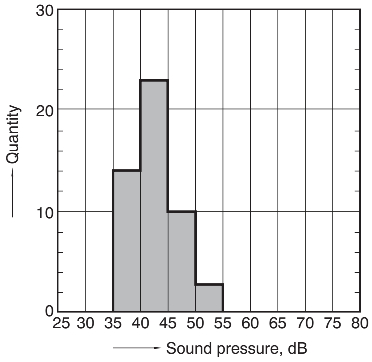
5-(1). Operation noise distribution
LK-F (Height: 10 mm, Silent)
Measuring conditions
Sample: LKF1aMQ-12V-1-5, 50pcs
Background noise: approx. 20dB
Coil voltage: 12V DC
Equipment setting: “A” weighted
Single part (refer to figure below)
With diode



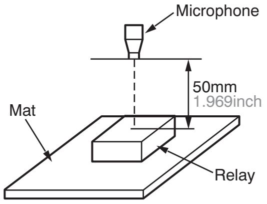
When operate



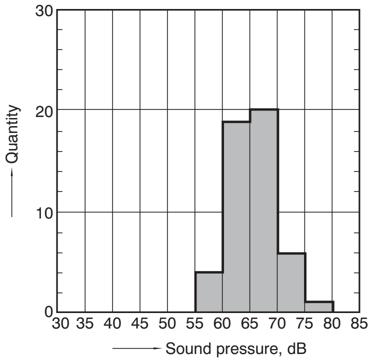
When release



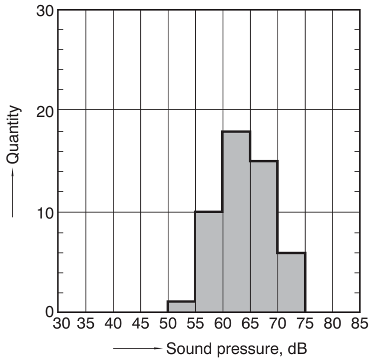
5-(2). Operation noise distribution
LK-F (Height: 10 mm, Standard)
Measuring conditions
Sample: LKF1aM-12V-1-5, 50pcs
Background noise: approx. 20dB
Coil voltage: 12V DC
Equipment setting: “A” weighted
Single part (refer to figure below)
With diode



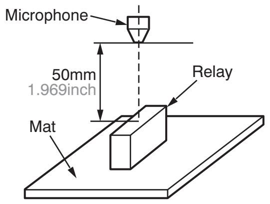
When operate



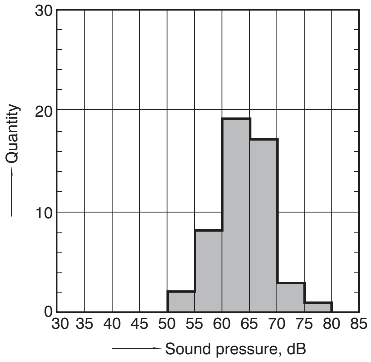
When release



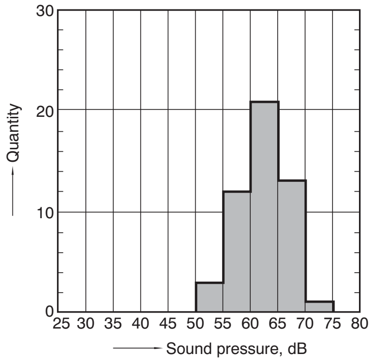
5-(3). Operation noise distribution
LK-S (Height: 25 mm) Refer to comparison
Measuring conditions
Sample: LKS1aF-12V, 50pcs
Background noise: approx. 20dB
Coil voltage: 12V DC
Equipment setting: “A” weighted
Single part (refer to figure below)
With diode



When operate



When release

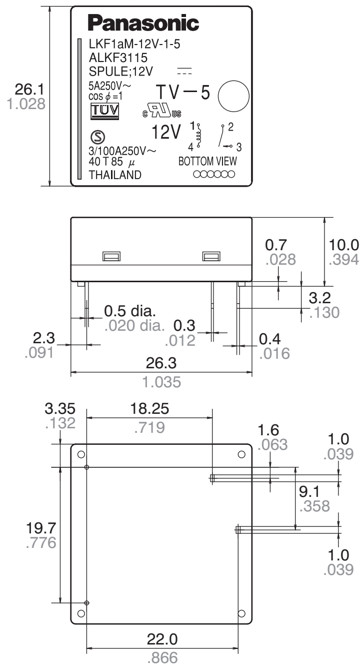


DIMENSIONS (mm inch)

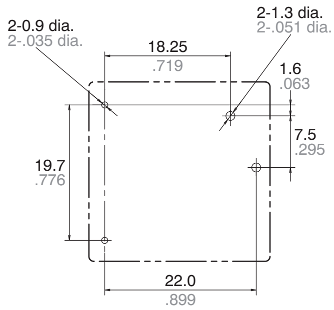
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data

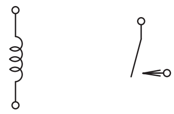
External dimensions



PC board pattern (Bottom view)



Schematic (Bottom view)



Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

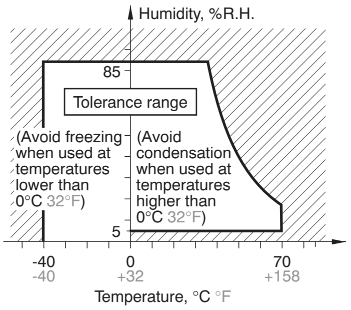
SAFETY STANDARDS

Certification authority	TV-5 type	TV-8 type
UL, C-UL	TV-5 5 A 277 V AC	TV-8 8 A 277 V AC
SEMKO	3/100 A 250 V AC 40T85 μ	
TÜV	EN61810-1 5 A 250 V AC (cosϕ = 1.0)	EN61810-1 8 A 250 V AC (cosϕ = 1.0)

NOTES

■ **Usage, transport and storage conditions**

1) Temperature:
–40 to +70°C –40 to +158°F
2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage



4) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
5) Freezing
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
6) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

■ **Solder and cleaning conditions**

1) Please obey the following conditions when soldering automatically.
(1) Preheating: Within 120°C 248°F (solder surface terminal portion) and within 120 seconds
(2) Soldering iron: 260°C±5°C 500°F±41°F (solder temperature) and within 6 seconds (soldering time)
2) Since this is not a sealed type relay, do not clean it as is. Also, be careful not to allow flux to overflow above the PC board or enter the inside of the relay.

■ **Certification**

1) This relay is UL and C-UL certified.
UL and C-UL standards:
TV-5 5 A 277 V AC
TV-8 8 A 277 V AC
2) This relay is certified by TÜV as an electromagnetic relay that complies with EN61810-1.
TÜV standards:
TV-5 type 5 A 250 V~ cosϕ = 1.0
TV-8 type 8 A 250 V~ cosϕ = 1.0
3) This relay is certified by SEMKO.
3/100 A 250 V AC 40T85 μ
Steady-state current: 3A/Inrush current: 100 A, Load voltage: 250 V AC
Ambient temperature: –40 to +85°C –40 to +185°F, Micro-gap

■ **Others**

1) For precautions regarding use and explanations of technical terminology, please refer to our web site. (panasonic-electric-works.net/ac)
2) To ensure good operation, please keep the voltage on the coil ends to ±5% (at 20°C 68°F) of the rated coil operation voltage. Also, please be aware that the pick-up voltage and drop-out voltage may change depending on the temperature and conditions of use.
3) Keep the ripple rate of the nominal coil voltage below 5%.
4) The cycle lifetime is defined under the standard test condition specified in the JIS C 5442 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.
Also, be especially careful of loads such as those listed below.
(1) When used for AC load-operating and the operating phase is synchronous.
Rocking and fusing can easily occur due to contact shifting.
(2) Highly frequent load-operating
When highly frequent opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.
Three countermeasures for these are listed here.
• Incorporate an arc-extinguishing circuit.
• Lower the operating frequency
• Lower the ambient humidity
5) This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
6) Heat, smoke, and even a fire may occur if the relay is used in conditions outside of the allowable ranges for the coil ratings, contact ratings, operating cycle lifetime, and other specifications. Therefore, do not use the relay if these ratings are exceeded.
7) If the relay has been dropped, the appearance and characteristics should always be checked before use.
8) Incorrect wiring may cause unexpected events or the generation of heat or flames.
9) The amount of relay operation noise will vary depending on the substrate used for mounting. Please use after verifying with the relay mounted on the substrate.
10) There are no restrictions as to how this relay should be oriented during installation. However, due to gravitation there may be slight differences in pick-up/drop-out voltage and operate/release time, etc., depending on the orientation. Therefore, when evaluating the relay, please do so with the relay installed with the actual orientation.

For Cautions for Use, see Relay Technical Information (page 582).

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1 mm CONTACT GAP. 1 FORM A 10A/16A POWER RELAY

LK-G RELAYS

FEATURES

1. Contact gap: 1 mm **.039 inch**
2. Wide lineup of 3 types available
1) 10A, 1 mm contact gap type
2) 16A, 1 mm contact gap type
3) 16 A standard type
3. High insulation resistance
1) Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch (In compliance with IEC65)
2) Surge withstand voltage between contact and coil: 10,000 V or more
4. High noise immunity
High noise immunity realized by the card separation structure between contact and coil
5. Conforms to the various safety standards
UL, C-UL and TÜV approved

TYPICAL APPLICATIONS

1. Audio visual equipment
2. HA equipment
3. Home appliances
4. Office equipment

Power

ORDERING INFORMATION

LKG | 1a | F | - | □ | - | □ | - | □

LK-G relay

Contact arrangement
1a: 1 Form A

Protective construction
F: Flux-resistant type

Coil voltage (DC)
5V, 9V, 12V, 24V

Contact capacity
10: 10A
16: 16A

Contact gap
Nil: Standard
1: 1 mm

TYPES

Contact arrangement	Nominal coil voltage	Part No.		
		10A, 1 mm contact gap type	16A, 1 mm contact gap type	16 A standard type
1 Form A	5V DC	LKG1aF-5V-10-1	LKG1aF-5V-16-1	LKG1aF-5V-16
	9V DC	LKG1aF-9V-10-1	LKG1aF-9V-16-1	LKG1aF-9V-16
	12V DC	LKG1aF-12V-10-1	LKG1aF-12V-16-1	LKG1aF-12V-16
	24V DC	LKG1aF-24V-10-1	LKG1aF-24V-16-1	LKG1aF-24V-16

Standard packing: Carton: 100 pcs.; Case: 500 pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 20°C 68°F)
5V DC	75%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	106.4mA	47Ω	530mW	130%V of nominal voltage
9V DC			58.8mA	153Ω		
12V DC			44.2mA	272Ω		
24V DC			22.1mA	1,087Ω		

2. Specifications

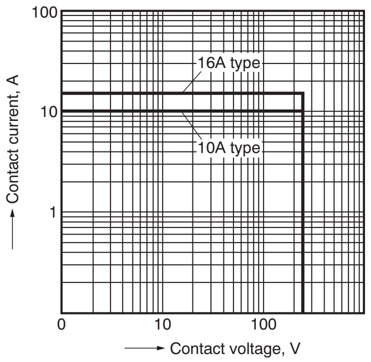
Characteristics	Item		Specifications		
			10A, 1 mm contact gap type	16A, 1 mm contact gap type	16 A standard type
Contact	Arrangement		1 Form A		
	Initial contact resistance, max.		Max. 100 mΩ (By voltage drop 6 V DC 1A)		
	Contact material		$AgSnO_2$ type		
Rating	Nominal switching capacity (resistive load)		10A 277V AC	16A 277V AC	
	Max. switching power (resistive load)		2,770VA	4,432VA	
	Max. switching voltage		277V AC	277V AC	
	Max. switching current		10A (AC)	16A (AC)	
	Min. switching capacity*1		100mA 5V DC		
Electrical characteristics	Contact gap		Min. 1 mm .039 inch		
	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC)		
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1 min. (Detection current: 10 mA)		
		Between contact and coil	4,000 Vrms for 1 min. (Detection current: 10 mA)		
	Temperature rise		Max. 45°C 113°F (By resistive method, nominal voltage applied to the coil; contact carrying current: 10A, at 70°C 158°F)	Max. 45°C 113°F (By resistive method, nominal voltage applied to the coil; contact carrying current: 16A, at 70°C 158°F)	
	Surge breakdown voltage*2 (Between contact and coil)		10,000 V (initial)		
	Operate time (at nominal voltage) (at 20°C 68°F)		Max. 15 ms (excluding contact bounce time.)		
	Release time (at nominal voltage) (at 20°C 68°F)		Max. 20 ms (excluding contact bounce time.) (with diode)		
Mechanical characteristics	Shock resistance	Functional	Min. 200 m/s^2 (Half-wave pulse of sine wave: 11 ms; detection time: 10µs.)		
		Destructive	Min. 1,000 m/s^2 (Half-wave pulse of sine wave: 6 ms.)		
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1.5 mm (Detection time: 10µs.)		
		Destructive	10 to 55 Hz at double amplitude of 1.5 mm		
Expected life	Mechanical		Min. 2×10^6 (at 180 cpm)		
	Electrical		Min. 10×10^4 (at 6 cpm) (with diode)	Min. 5×10^4 (at 6 cpm) (with diode)	
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –40°C to +70°C –40°F to +158°F; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature); Air pressure: 86 to 106 kPa		
	Max. operating speed		6 cpm (at rated load)		
Unit weight			Approx. 12 g .42 oz		

Notes:

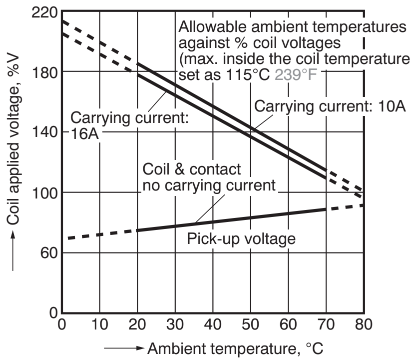
*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2 Wave is standard shock voltage of ±1.2×50µs according to JEC-212-1981
*3 The upper limit of the ambient temperature is the maximum temperature that can satisfy the coil temperature rise value. Refer to 1. Usage, transport and storage conditions in NOTES on page 356.

REFERENCE DATA

1. Max. switching power (AC resistive load)



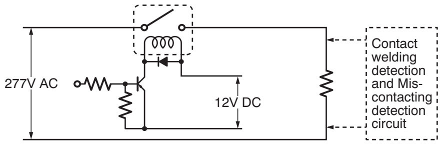
2. Ambient temperature characteristics and coil applied voltage



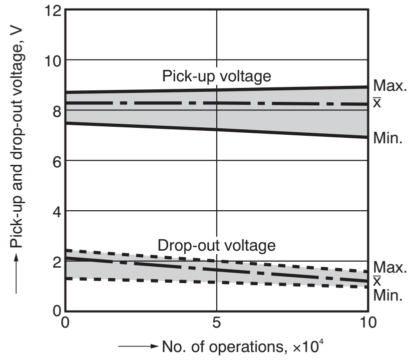
3-(1). Electrical life test (10A type)

Sample: LKG1aF-12V-10-1, 6 pcs.
Operation frequency: 6 times/min.
(ON/OFF = 1s: 9s)
Ambient temperature: 20°C 68°F

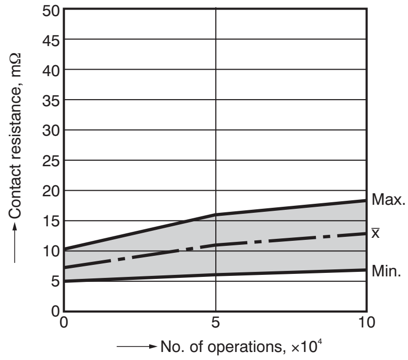
Circuit:



Change of pick-up and drop-out voltage



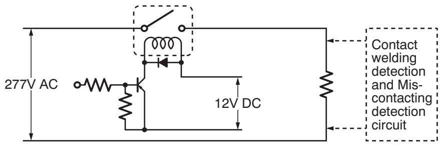
Change of contact resistance



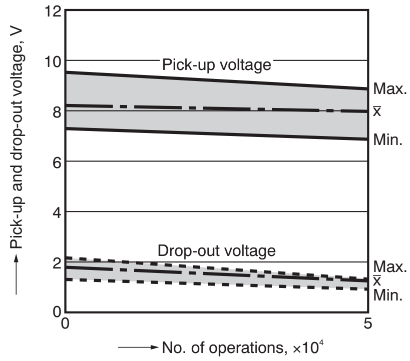
3-(2). Electrical life test (16A type)

Sample: LKG1aF-12V-16-1, 6 pcs.
Operation frequency: 6 times/min.
(ON/OFF = 1s: 9s)
Ambient temperature: 20°C 68°F

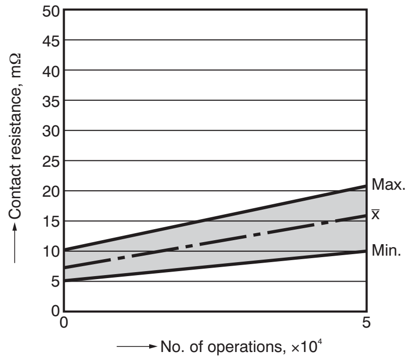
Circuit:



Change of pick-up and drop-out voltage



Change of contact resistance

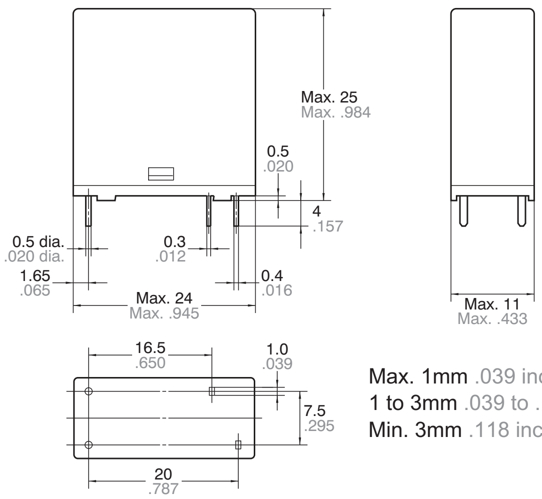


DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

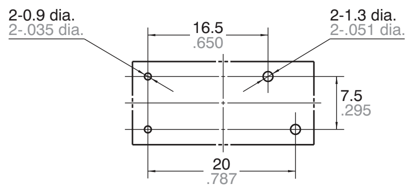
CAD Data

External dimensions



Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



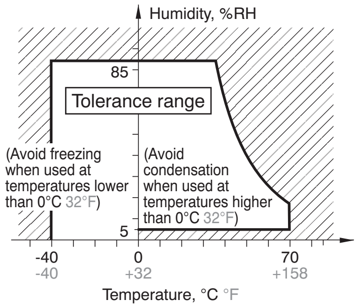
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

NOTES

1. Usage, transport and storage conditions

1) Temperature:
–40 to +70°C –40 to +158°F
2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage



4) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
5) Freezing
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
6) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

2. Solder and cleaning conditions

1) Please obey the following conditions when soldering automatically.
(1) Preheating: Within 120°C 248°F (solder surface terminal portion) and within 120 seconds
(2) Soldering iron: 260°C±5°C 500°F±41°F (solder temperature) and within 6 seconds (soldering time)
2) Since this is not a sealed type relay, do not clean it as is. Also, be careful not to allow flux to overflow above the PC board or enter the inside of the relay.

3. Certification

1) This relay is UL and C-UL certified.
2) This relay is certified by TÜV as an electromagnetic relay that complies with VDE0435.
The terminals of this relay can only be connected with solder.

4. Others

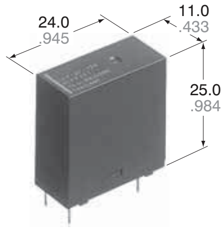
1) For precautions regarding use and explanations of technical terminology, please refer to “Relay Technical Information”.
2) To ensure good operation, please keep the voltage on the coil ends to ±5% (at 20°C 68°F) of the rated coil operation voltage. Also, please be aware that the pick-up voltage and drop-out voltage may change depending on the temperature and conditions of use.
3) Keep the ripple rate of the nominal coil voltage below 5%.
4) The cycle lifetime is defined under the standard test condition specified in the JIS C 5442 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%).
The cycle life time is based on the condition that a diode is connected in parallel with the coil. The cycle life time may be different if no diode was connected to the coil.
Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.
Also, be especially careful of loads such as those listed below.
(1) When used for AC load-operating and the operating phase is synchronous.
Rocking and fusing can easily occur due to contact shifting.
(2) Highly frequent load-operating
When highly frequent opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.
Three countermeasures for these are listed here.
• Incorporate an arc-extinguishing circuit.
• Lower the operating frequency
• Lower the ambient humidity
5) Heat, smoke, and even a fire may occur if the relay is used in conditions outside of the allowable ranges for the coil ratings, contact ratings, operating cycle lifetime, and other specifications. Therefore, do not use the relay if these ratings are exceeded.
6) If the relay has been dropped, the appearance and characteristics should always be checked before use.
7) Incorrect wiring may cause unexpected events or the generation of heat or flames.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

10 A SLIM POWER RELAY

LK-P RELAYS



mm inch

FEATURES

1. High switching capacity: 10 A 277V AC

2. High insulation resistance between contact and coil

1) Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch (In compliance with IEC65)

2) Surge withstand voltage between contact and coil: 10,000 V or more

3. High noise immunity realized by the card separation structure between contact and coil

4. Popular terminal pitch in AV equipment field

5. Space-saving slim type

Base area: Width 11 × Length 24 mm
Width .433 × Length .945 inch

6. Conforms to the various safety standards

UL/CSA, VDE, TÜV and SEMKO, SEV approved

Power

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		Max. 100 mΩ
Contact material		$AgSnO_2$ type
Rating (resistive load)	Nominal switching capacity	10 A 277 V AC, 5 A 30V DC
	Max. switching power	2,770 V A, 150W
	Max. switching voltage	277 V AC, 30 V DC
	Max. switching current	10 A (AC), 5A (DC)
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	2×10^6
	Electrical (at 20 cpm) (at rated load)	10^5

Coil

Nominal operating power	530 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

Characteristics

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial *2 breakdown voltage	Between open contacts	1,000 Vrms for 1 min.
	Between contact and coil	4,000 Vrms for 1 min.
Initial surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Max. 15 ms (at 20°C 68°F)
Release time (without diode)*4 (at nominal voltage)		Max. 5 ms (at 20°C 68°F)
Temperature rise (at 70°C)		Max. 45°C with nominal coil voltage and at 10 A contact carrying current (resistance method)
Shock resistance	Functional*5	Min. 200 m/s^2{approx. 20 G}
	Destructive*6	Min. 1,000 m/s^2{approx. 100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
	Air pressure	86 to 106 kPa
Unit weight		Approx. 12 g .42 oz

TYPICAL APPLICATIONS

- Audio visual equipment
  TVs, VTRs
- Office equipment
  LBP, CRT
- Home appliances
  Refrigerator, Air conditioner

ORDERING INFORMATION

Ex. LKP 1a F — 12V

Contact arrangement	Protective construction	Coil voltage(DC)
1a: 1 Form A	F: Flux-resistant type	5, 6, 9, 12, 18, 24V

UL/CSA, TÜV, SEMKO, TV-5 approved type is standard.
Notes 1. Standard packing Carton: 100 pcs. Case: 500 pcs.
2. 5 V, 9 V, 18 V DC types are also available. Please consult us for details.

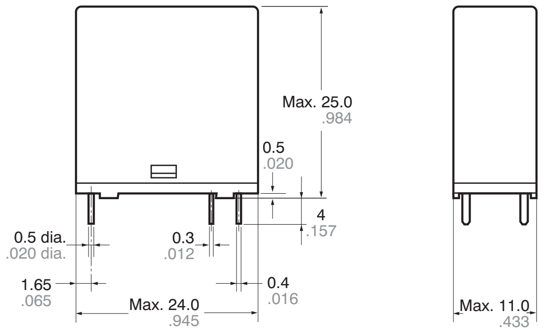
TYPES AND COIL DATA (at 20°C 68°F)

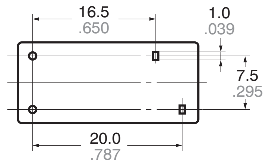
Part No.	Nominal voltage, V DC	Pick-up voltage V DC (max.) (Initial)	Drop-out voltage V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 20°C 68°F)
LKP1aF-5V	5	3.5	0.5	47	106.4	530	6.5
LKP1aF-6V	6	4.2	0.6	68	88.3	530	7.8
LKP1aF-9V	9	6.3	0.9	153	58.8	530	11.7
LKP1aF-12V	12	8.4	1.2	272	44.2	530	15.6
LKP1aF-18V	18	12.6	1.8	611	29.5	530	23.4
LKP1aF-24V	24	16.8	2.4	1,087	22.1	530	31.2

DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

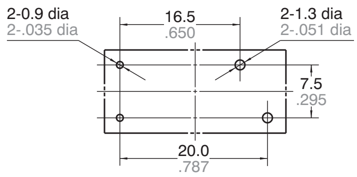
CAD Data





Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)

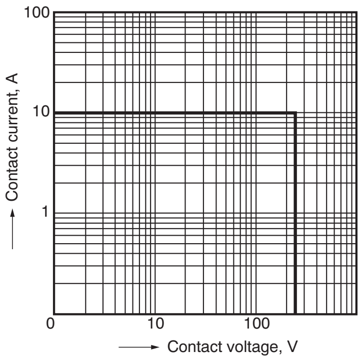


Tolerance: ±0.1 ±.004

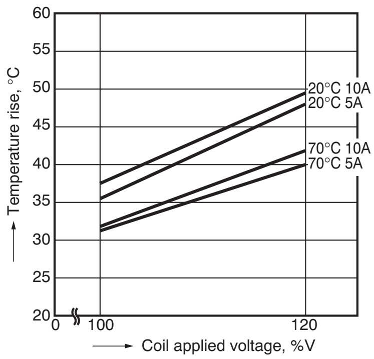
Schematic (Bottom view)

REFERENCE DATA

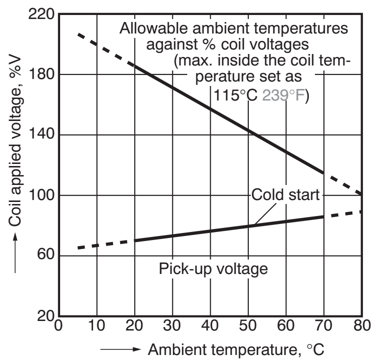
1. Max. switching power



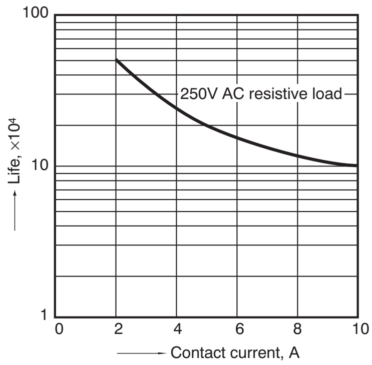
2. Coil temperature rise
Sample: LKP1aF-12V, 6 pcs.
Point measured: coil inside
Contact current: 5 A, 10 A



3. Ambient temperature characteristics and coil applied voltage
Contact current: 10 A

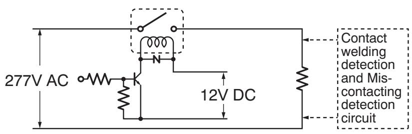


4. Life curve
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: room temperature

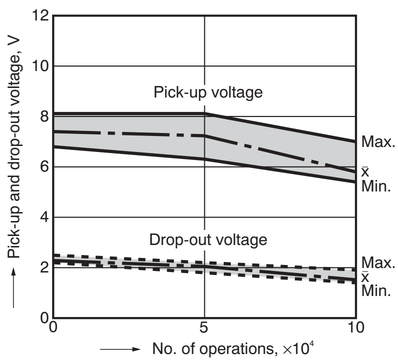


5. Electrical life test
(10 A 277 V AC, resistive load)
Sample: LKP1aF-12V, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 20°C 68°F

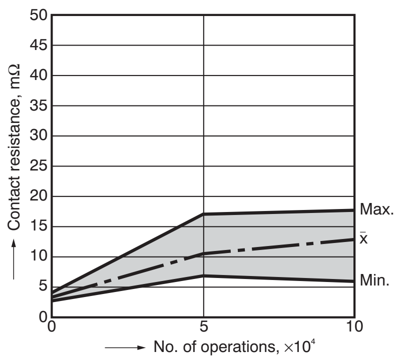
Circuit:



Change of pick-up and drop-out voltage



Change of contact resistance



Power

For Cautions for Use, see Relay Technical Information (page 582).

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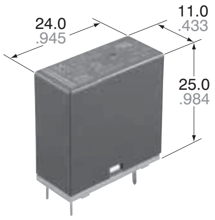
QUIET TYPE, HIGH SENSITIVITY 250mW, SLIM POWER RELAY

LK-Q RELAYS



mm inch

FEATURES

1. High sensitivity
The power-saving relay is highly sensitive at the nominal operating power of 250 mW.
2. Quiet
Approx. 10 dB less sound pressure than previous LK series relay
3. High inrush current capability
Switching capability;
- TV-5 type: inrush 100A, steady: 5A
- TV-8 type: inrush 118A, steady: 8A

4. High insulation resistance
1) Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch (In compliance with IEC65)
2) Surge withstand voltage between contact and coil: 10,000 V or more
5. High noise immunity realized by the card separation structure between contact and coil
6. Conforms to the various safety standards
UL, C-UL, TÜV, and SEMKO approved

TYPICAL APPLICATIONS

- Flat-panel TVs
- Audio visual equipment

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		Max. 100 mΩ
Contact material		$AgSnO_2$ type
Rating (resistive load)	Nominal switching capacity	TV-5 type: 5A 277V AC TV-8 type: 8A 277V AC
	Max. switching power	TV-5 type: 1,385 VA TV-8 type: 2,216 VA
	Max. switching voltage	277 V AC
	Max. switching current	TV-5 type: 5A (AC) TV-8 type: 8A (AC)
	Min. switching capacity#1 (Reference value)	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	10^6
	Electrical (at 20 cpm) (at rated load)	TV-5 type: 10^5 TV-8 type: 5×10^4

Coil

Nominal operating power	250 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50µs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 µs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 µs
*8 The upper limit of the ambient temperature is the maximum temperature that can satisfy the coil temperature rise value. Refer to 1. Usage, transport and storage conditions in NOTES on page 363.

Characteristics

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial *2 breakdown voltage	Between open contacts	1,000 Vrms for 1 min.
	Between contact and coil	4,000 Vrms for 1 min.
Initial surge voltage between contact and coil*3		10,000 V
Operate time*4 (at nominal voltage)		Max. 15 ms (at 20°C 68°F)
Release time (without diode)*4 (at nominal voltage)		Max. 5 ms (at 20°C 68°F)
Temperature rise (at 70°C)		TV-5 type: Max. 35°C with nominal coil voltage and at 5 A contact carrying current (resistance method) TV-8 type: Max. 35°C with nominal coil voltage and at 8 A contact carrying current (resistance method)
Shock resistance	Functional*5	200 m/s²{approx. 20 G}
	Destructive*6	1,000 m/s²{approx. 100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
	Air pressure	86 to 106 kPa
Unit weight		Approx. 12 g .42 oz

ORDERING INFORMATION

Ex. LKQ | 1a | F | — | 12V | — | TV5

Contact arrangement	Protective construction	Coil voltage(DC)	TV standard
1a: 1 Form A	F: Flux-resistant type	5, 9, 12, 24V	TV-5: TV5, TV-8: TV8

UL/C-UL, TÜV, SEMKO approved type is standard.
Note: Standard packing Carton: 100 pcs. Case: 500 pcs.

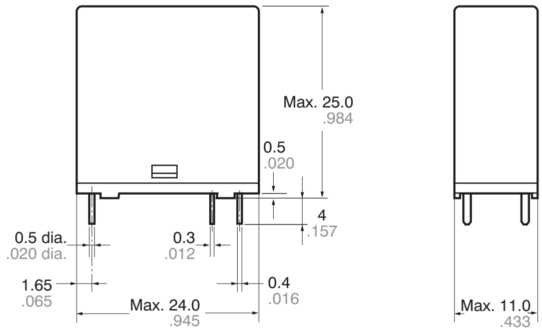
TYPES AND COIL DATA (at 20°C 68°F)

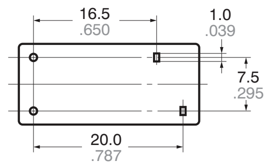
Part No.		Nominal voltage, V DC	Pick-up voltage V DC (max.) (Initial)	Drop-out voltage V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 20°C 68°F)
TV-5 type	TV-8 type							
LKQ1aF-5V-TV5	LKQ1aF-5V-TV8	5	4.0	0.5	100	50	250	6.5
LKQ1aF-9V-TV5	LKQ1aF-9V-TV8	9	7.2	0.9	324	27.8	250	11.7
LKQ1aF-12V-TV5	LKQ1aF-12V-TV8	12	9.6	1.2	576	20.8	250	15.6
LKQ1aF-24V-TV5	LKQ1aF-24V-TV8	24	19.2	2.4	2,304	10.4	250	31.2

DIMENSIONS (mm inch)

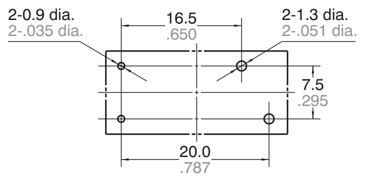
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data





PC board pattern (Bottom view)



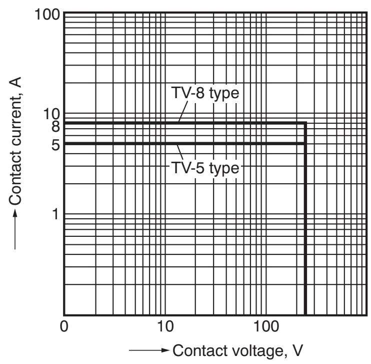
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

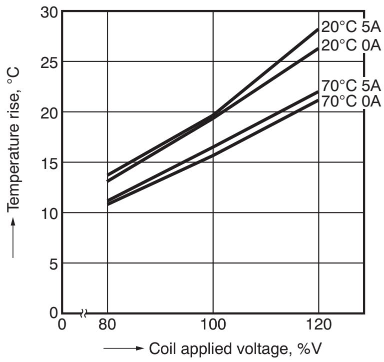
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

REFERENCE DATA

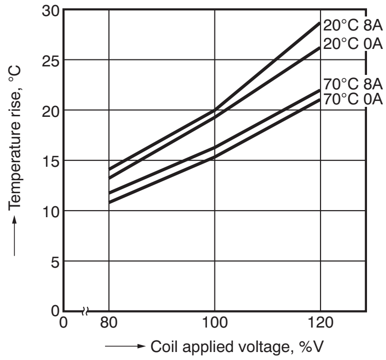
1. Max. switching power (AC resistive load)



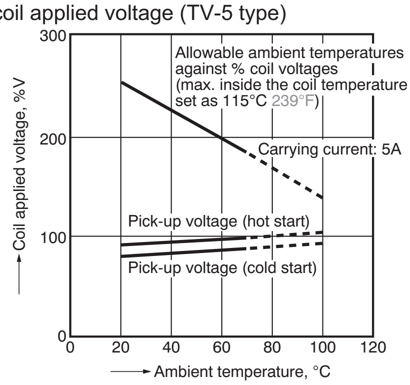
2-(1). Coil temperature rise (TV-5 type)
Sample: LKQ1aF-12V-TV5, 6 pcs.
Point measured: coil inside
Contact current: 0A, 5A



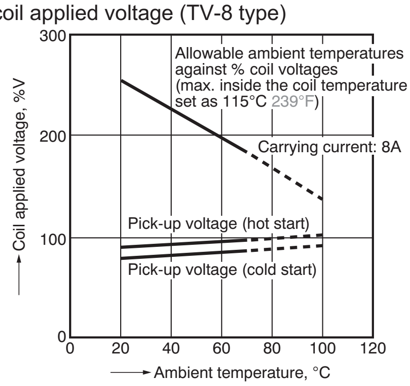
2-(2). Coil temperature rise (TV-8 type)
Sample: LKQ1aF-12V-TV8, 6 pcs.
Point measured: coil inside
Contact current: 0A, 8A



3-(1). Ambient temperature characteristics and coil applied voltage (TV-5 type)

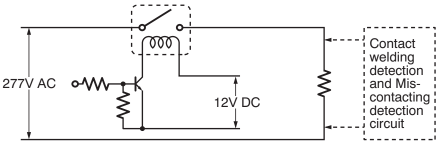


3-(2). Ambient temperature characteristics and coil applied voltage (TV-8 type)

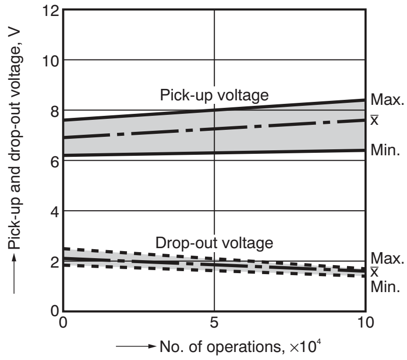


4-(1). Electrical life test (TV-5 type)
(5A 277V AC, resistive load)
Sample: LKQ1aF-12V-TV5, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 20°C 68°F

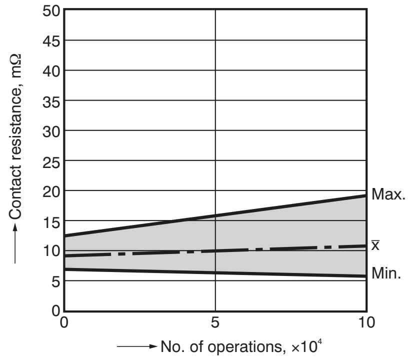
Circuit:



Change of pick-up and drop-out voltage

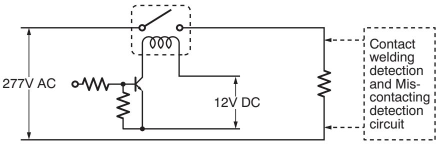


Change of contact resistance

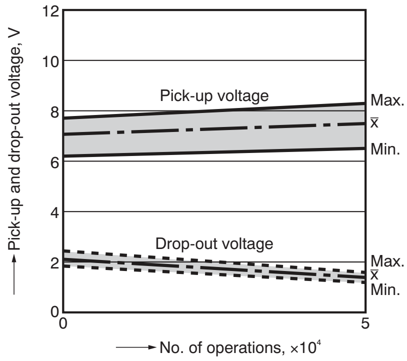


4-(2). Electrical life test (TV-8 type)
(8A 277V AC, resistive load)
Sample: LKQ1aF-12V-TV8, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 20°C 68°F

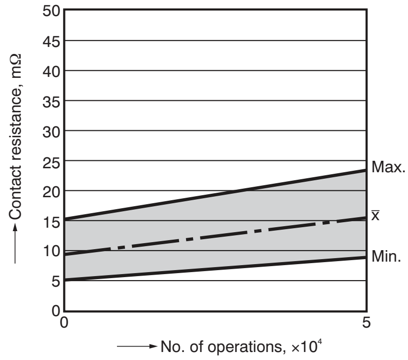
Circuit:



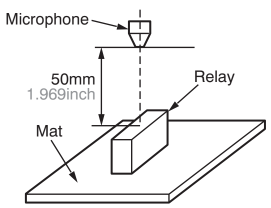
Change of pick-up and drop-out voltage



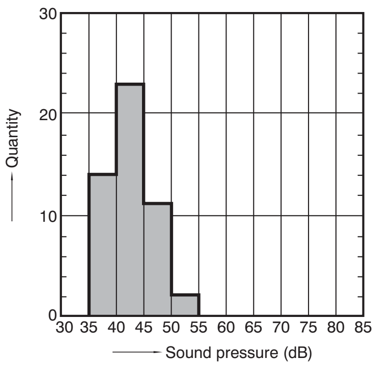
Change of contact resistance



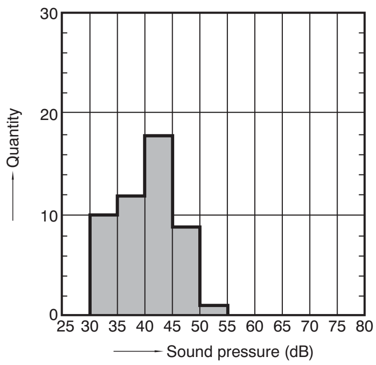
5-(1). Operation noise distribution
Measuring conditions
Sample: LKQ1aF-12V-TV5, 50pcs
Background noise: approx. 20dB
Coil voltage: 12V DC
Equipment setting: “A” weighted
Single part (refer to figure below)
With diode



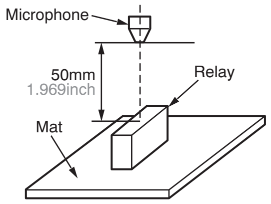
When operate



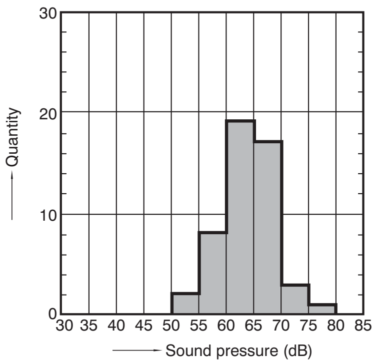
When release



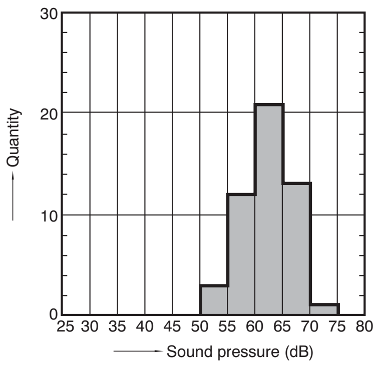
5-(2). Operation noise distribution
(refer to comparison)
Measuring conditions
Sample: LKS1aF-12V, 50pcs
Background noise: approx. 20dB
Coil voltage: 12V DC
Equipment setting: “A” weighted
Single part (refer to figure below)
With diode



When operate



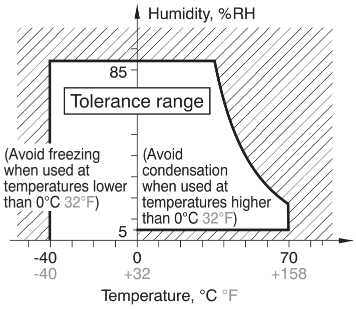
When release



NOTES

1. Usage, transport and storage conditions

1) Temperature:
–40 to +70°C –40 to +158°F
2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage



4) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
5) Freezing
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
6) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

2. Solder and cleaning conditions

1) Please obey the following conditions when soldering automatically.
(1) Preheating: Within 120°C 248°F (solder surface terminal portion) and within 120 seconds
(2) Soldering iron: 260°C±5°C 500°F±41°F (solder temperature) and within 6 seconds (soldering time)
2) Since this is not a sealed type relay, do not clean it as is. Also, be careful not to allow flux to overflow above the PC board or enter the inside of the relay.

3. Certification

1) This relay is UL and C-UL certified.
2) This relay is certified by TÜV as an electromagnetic relay that complies with VDE0435.
The terminals of this relay can only be connected with solder.
3) This relay is certified by SEMKO.

4. Others

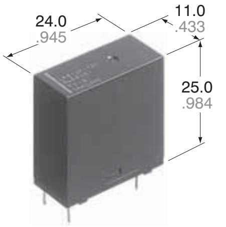
1) For precautions regarding use and explanations of technical terminology, please refer to “Relay Technical Data Book”.
2) To ensure good operation, please keep the voltage on the coil ends to ±5% (at 20°C 68°F) of the rated coil operation voltage. Also, please be aware that the pick-up voltage and drop-out voltage may change depending on the temperature and conditions of use.
3) Keep the ripple rate of the nominal coil voltage below 5%.
4) The cycle lifetime is defined under the standard test condition specified in the JIS C 5442 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase,ambient conditions and other factors.
Also, be especially careful of loads such as those listed below.
(1) When used for AC load-operating and the operating phase is synchronous. Rocking and fusing can easily occur due to contact shifting.
(2) Highly frequent load-operating
When highly frequent opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.
Three countermeasures for these are listed here.
• Incorporate an arc-extinguishing circuit.
• Lower the operating frequency
• Lower the ambient humidity
5) Heat, smoke, and even a fire may occur if the relay is used in conditions outside of the allowable ranges for the coil ratings, contact ratings, operating cycle lifetime, and other specifications. Therefore, do not use the relay if these ratings are exceeded.
6) If the relay has been dropped, the appearance and characteristics should always be checked before use.
7) Incorrect wiring may cause unexpected events or the generation of heat or flames.
8) The amount of relay operation noise will vary depending on the substrate used for mounting. Please use after verifying with the relay mounted on the substrate.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

250 mW
SLIM POWER RELAY

LK-S RELAYS



mm inch

FEATURES

1. High sensitivity: 250mW
The power-saving relay is highly sensitive at the nominal operating power of 250 mW (530 mW power consumption on LK relays).

2. High insulation resistance between contact and coil
1) Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch (In compliance with IEC65)
2) Surge withstand voltage between contact and coil: 10,000 V or more

3. High noise immunity realized by the card separation structure between contact and coil

4. Popular terminal pitch in AV equipment field

5. Space-saving slim type
Base area: Width 11 × Length 24 mm
Width .433 × Length .945 inch

6. Conforms to the various safety standards
UL/CSA, VDE, TÜV and SEMKO SEV approved

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		Max. 100 mΩ
Contact material		$AgSnO_2$ type
Rating (resistive load)	Nominal switching capacity	5 A 277 V AC
	Max. switching power	1,385 V A
	Max. switching voltage	277 V AC
	Max. switching current	5 A (AC)
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	10^6
	Electrical (at 20 cpm) (at rated load)	10^5

Coil

Nominal operating power	250 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50µs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 µs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 µs
*8 Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

Characteristics

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial *2 breakdown voltage	Between open contacts	1,000 Vrms for 1 min.
	Between contact and coil	4,000 Vrms for 1 min.
Initial surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Max. 15 ms (at 20°C 68°F)
Release time (without diode)*4 (at nominal voltage)		Max. 5 ms (at 20°C 68°F)
Temperature rise (at 70°C)		Max. 35°C with nominal coil voltage and at 5 A contact carrying current (resistance method)
Shock resistance	Functional*5	Min. 200 m/s²{approx. 20 G}
	Destructive*6	Min. 1,000 m/s²{approx. 100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
	Air pressure	86 to 106 kPa
Unit weight		Approx. 12 g .42 oz

TYPICAL APPLICATIONS

• Audio visual equipment
• Office equipment
• Home appliances

ORDERING INFORMATION

Ex. LKS 1a F — 12V

Contact arrangement	Protective construction	Coil voltage(DC)
1a: 1 Form A	F: Flux-resistant type	5, 6, 9, 12, 18, 24V

UL/CSA, TÜV, SEMKO, TV-5 approved type is standard.
Notes 1. Standard packing Carton: 100 pcs. Case: 500 pcs.
2. 6 V, 18 V DC types are also available. Please consult us for details.

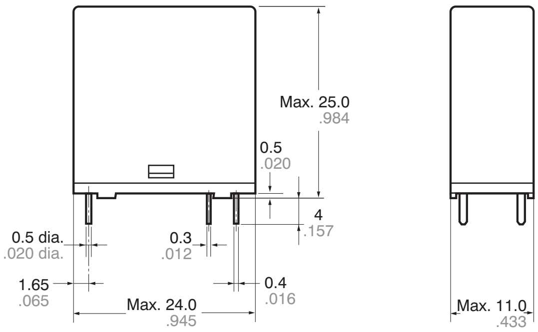
TYPES AND COIL DATA (at 20°C 68°F)

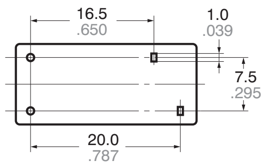
Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (Initial)	Drop-out voltage, V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Maximum allowable voltage, V DC (at 20°C 68°F)
LKS1aF-5V	5	3.5	0.5	100	50	250	6.5
LKS1aF-6V	6	4.2	0.6	144	41.7	250	7.8
LKS1aF-9V	9	6.3	0.9	324	27.8	250	11.7
LKS1aF-12V	12	8.4	1.2	576	20.8	250	15.6
LKS1aF-18V	18	12.6	1.8	1,296	13.9	250	23.4
LKS1aF-24V	24	16.8	2.4	2,304	10.4	250	31.2

DIMENSIONS (mm inch)

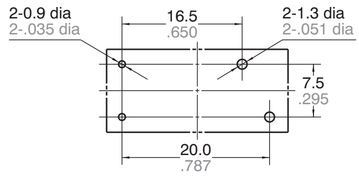
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data





PC board pattern (Bottom view)



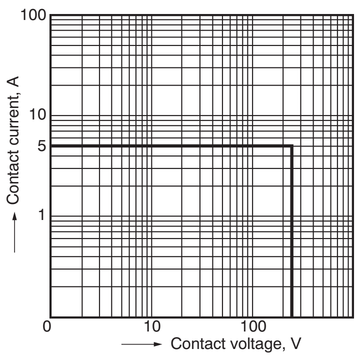
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

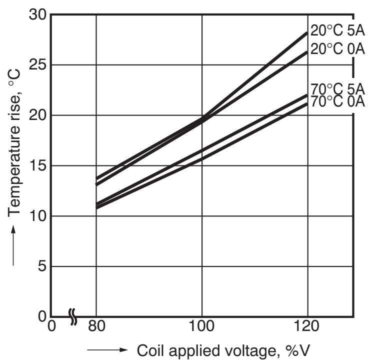
REFERENCE DATA

1. Max. switching power (AC resistive load)



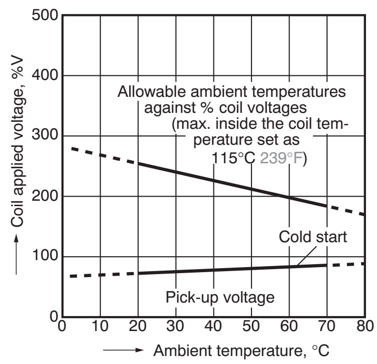
2. Coil temperature rise

Sample: LKS1aF-12V, 6 pcs.
Point measured: coil inside
Contact current: 0 A, 5A



3. Ambient temperature characteristics and coil applied voltage

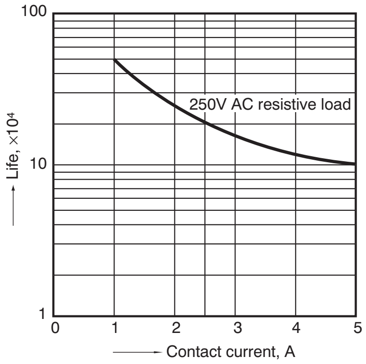
Contact current: 5 A



Power

4. Life curve

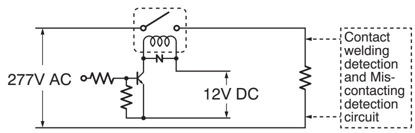
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: Room temperature



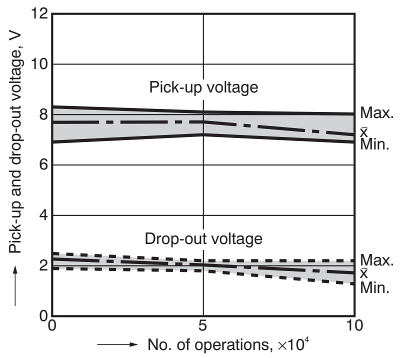
5-(1). Electrical life test
(5 A 277 V AC, resistive load)

Sample: LKS1aF-12V, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 20°C 68°F

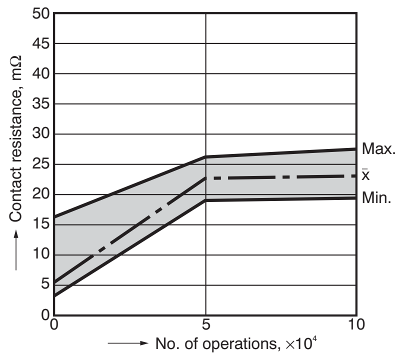
Circuit:



Change of pick-up and drop-out voltage



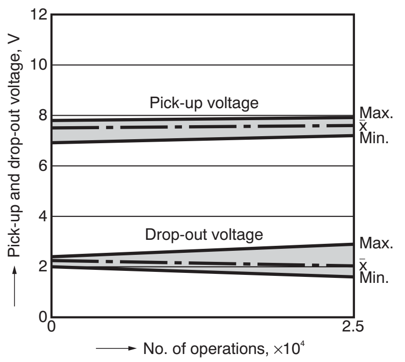
Change of contact resistance



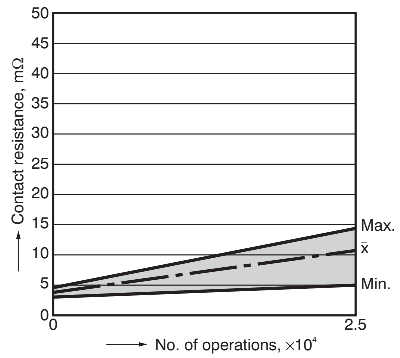
5-(2). Electrical life test
(UL lamp load test TV-5)

Tested sample: LKS1aF-12V, 6 pcs.
- Overload test
  Load: 7.5 A 120 V AC (60 Hz),
  Inrush: 111 A
  Operation frequency: 10 times/min
  (ON: OFF = 1 s: 5 s)
  No. of operations: 50 ope.
- Endurance test
  Load: 5A 120 V AC (60 Hz),
  Inrush: 78 A
  Operation frequency: 10 times/min
  (ON: OFF = 1 s: 5 s)
  No. of operations: 25,000 ope.

Change of pick-up and drop-out voltage



Change of contact resistance

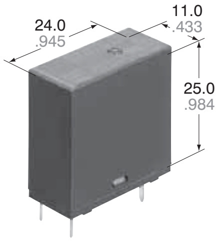


For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

SLIM POWER RELAY WITH HIGH INRUSH CURRENT CAPABILITY TV-8 CERTIFIED

LK-T RELAYS



FEATURES

1. High inrush current capability
1) Operating load capability:
inrush 118 A, steady 8 A
2) UL/C-UL TV-8 approved
2. High insulation resistance
1) Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch (In compliance with IEC65)
2) Surge withstand voltage between contact and coil: 10,000 V or more

3. High noise immunity realized by the card separation structure between contact and coil
4. Conforms to the various safety standards
UL, C-UL, TÜV, and SEMKO approved

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance (By voltage drop 6 V DC 1 A)		Max. 100 mΩ
Contact material		$AgSnO_2$ type
Rating (resistive load)	Nominal switching capacity	5 A 277 V AC
	Max. switching power	1,385 V A
	Max. switching voltage	277 V AC
	Max. switching current	8 A (120V AC)
	Min. switching capacity#1 (Reference value)	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	10^6
	Electrical (at 20 cpm) (at rated load)	10^5

Coil

Nominal operating power	250 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
*1 Measurement at same location as “Initial breakdown voltage” section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to 1. Usage, transport and storage conditions in NOTES on page 370.

Characteristics

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial *2 breakdown voltage	Between open contacts	1,000 Vrms for 1 min.
	Between contact and coil	4,000 Vrms for 1 min.
Initial surge voltage between contact and coil*3		10,000 V
Operate time*4 (at nominal voltage)		Max. 15ms (at 20°C 68°F)
Release time (without diode)*4 (at nominal voltage)		Max. 5ms (at 20°C 68°F)
Temperature rise (at 70°C)		Max. 35°C with nominal coil voltage and at 5 A contact carrying current (resistance method)
Shock resistance	Functional*5	200 m/s²{approx. 20 G}
	Destructive*6	1,000 m/s²{approx. 100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
	Air pressure	86 to 106 kPa
Unit weight		Approx. 12 g .42 oz

TYPICAL APPLICATIONS

- Audio visual equipment
- Flat TVs and audio equipment, etc.
- Office equipment
- Home appliances

ORDERING INFORMATION

Ex. LKT 1a F — 12V

Contact arrangement	Protective construction	Coil voltage(DC)
1a: 1 Form A	F: Flux-resistant type	5, 9, 12, 24V

UL/C-UL, TÜV, SEMKO, TV-8 approved type is standard.
Notes: 1. Standard packing Carton: 100 pcs. Case: 500 pcs.
2. 3 V, 6 V, and 18 V DC types are also available. Please consult us for details.

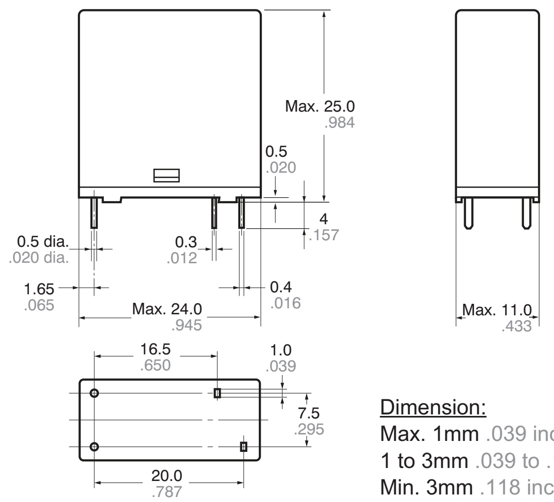
TYPES AND COIL DATA (at 20°C 68°F)

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (Initial)	Drop-out voltage, V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Maximum allowable voltage, V DC (at 20°C 68°F)
LKT1aF-5V	5	(Initial) 3.5	(Initial) 0.5	100	50	250	6.5
LKT1aF-9V	9	(Initial) 6.3	(Initial) 0.9	324	27.8	250	11.7
LKT1aF-12V	12	(Initial) 8.4	(Initial) 1.2	576	20.8	250	15.6
LKT1aF-24V	24	(Initial) 16.8	(Initial) 2.4	2,304	10.4	250	31.2

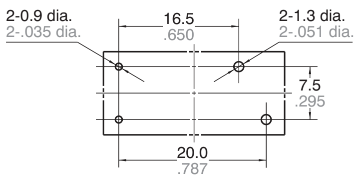
DIMENSIONS(mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data



PC board pattern (Bottom view)



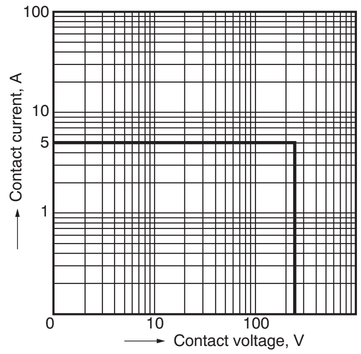
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

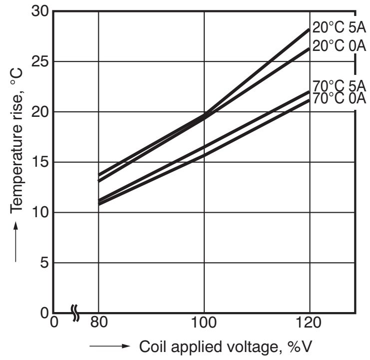
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

REFERENCE DATA

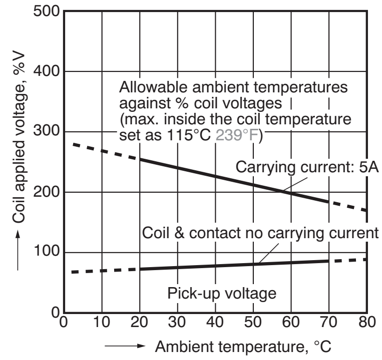
1. Max. switching power (AC resistive load)



2. Coil temperature rise
Sample: LKT1aF-12V, 6 pcs.
Point measured: coil inside
Contact current: 0 A, 5A

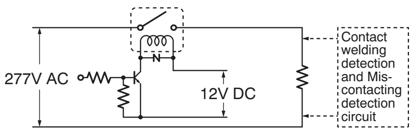


3. Ambient temperature characteristics and coil applied voltage

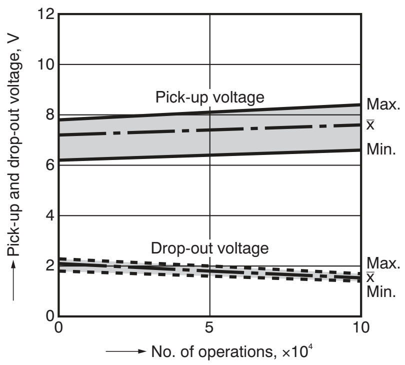


4-(1). Electrical life test
(5 A 277 V AC, resistive load)
Sample: LKT1aF-12V, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 20°C 68°F

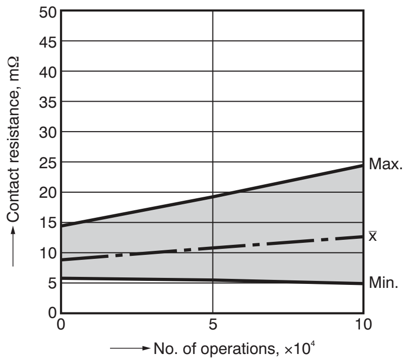
Circuit:



Change of pick-up and drop-out voltage

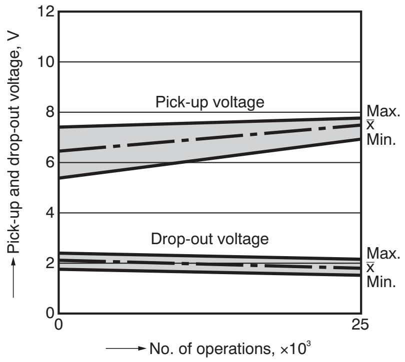


Change of contact resistance

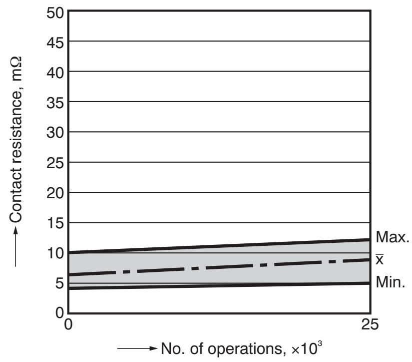


4-(2). Electrical life test
(UL508 TV-8 rating test)
Sample: LKT1aF-12V, 6 pcs.
- Overload test
  Load: 12 A 120 V AC (60 Hz),
  Inductive load (cosϕ = 0.75)
  Operation frequency: 6 times/min
  (ON : OFF = 1 s : 9 s)
  No. of operations: 50 ope.
- Endurance test
  Load: 8A 120 V AC (960 W lamp load),
  (Inrush: 118 A)
  Operation frequency: 1 times/min
  (ON: OFF = 1 s: 59 s)
  No. of operations: 25,000 ope.

Change of pick-up and drop-out voltage

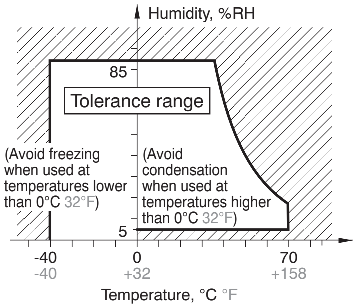


Change of contact resistance



NOTES

1. Usage, transport and storage conditions
1) Temperature:
–40 to +70°C –40 to +158°F
2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage



4) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
5) Freezing
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
6) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

2. Solder and cleaning conditions
1) Please obey the following conditions when soldering automatically.
(1) Preheating: Within 120°C 248°F (solder surface terminal portion) and within 120 seconds
(2) Soldering iron: 260°C±5°C 500°F±41°F (solder temperature) and within 6 seconds (soldering time)
2) Since this is not a sealed type relay, do not clean it as is. Also, be careful not to allow flux to overflow above the PC board or enter the inside of the relay.

3. Certification
1) This relay is UL and C-UL certified (File No. E43149).
UL, C-UL rating: TV-8
2) This relay is certified by TUV as an electromagnetic relay that complies with VDE0435 (File No. B040413461035).
(1) TUV rating: 8A, 250 V to COSϕ = 1.0
(2) The terminals of this relay can only be connected with solder.
(3) This relay is certified by SEMKO (File No. 400968).
SEMKO rating: 3/100A 250 V AC, 5/40A 250 V AC

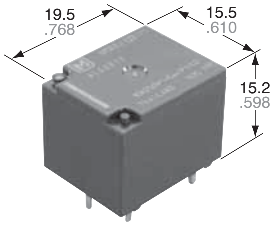
4. Others
1) For precautions regarding use and explanations of technical terminology, please refer to “Relay Technical Information”.
2) To ensure good operation, please keep the voltage on the coil ends to ±5% (at 20°C 68°F) of the rated coil operation voltage. Also, please be aware that the pick-up voltage and drop-out voltage may change depending on the temperature and conditions of use.
3) Keep the ripple rate of the nominal coil voltage below 5%.
4) The cycle lifetime is defined under the standard test condition specified in the JIS* C 5442 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase,ambient conditions and other factors.
Also, be especially careful of loads such as those listed below.
(1) When used for AC load-operating and the operating phase is synchronous. Rocking and fusing can easily occur due to contact shifting.
(2) High-frequency load-operating
When high-frequency opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.
Three countermeasures for these are listed here.
• Incorporate an arc-extinguishing circuit.
• Lower the operating frequency
• Lower the ambient humidity
5) Heat, smoke, and even a fire may occur if the relay is used in conditions outside of the allowable ranges for the coil ratings, contact ratings, operating cycle lifetime, and other specifications. Therefore, do not use the relay if these ratings are exceeded.
6) If the relay has been dropped, the appearance and characteristics should always be checked before use.
7) Incorrect wiring may cause unexpected events or the generation of heat or flames.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

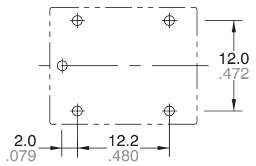
10A COMPACT CUBE TYPE POWER RELAY

LS RELAYS (ALS)



FEATURES

1. Universal terminal footprint
Same terminal pitch as our JS relay



2. Space-saving and Compact cube type
19.5 (L) × 15.5 (W) × 15.2 (H) mm
.768 (L) × .610 (W) × .598 (H) inch
Comparison with our JS relay:
• PCB mount area: 86%

3. Excellent heat resistance and tracking performance
• 85°C 185°F ambient operating temperature (UL Class B)
• Compatibility available for UL Class F
• Uses PTI250 material
• EN60335-1 GWT compliant (Tested by VDE)

4. Supports all safety standards
• UL, C-UL and VDE certified

TYPICAL APPLICATIONS

1. Household appliances
Refrigerator, Heater, Washing machine, Dishwasher, Rice cooker, etc.
2. Office automation equipment, Home appliances, etc.
3. Game machines, etc.

Power

SPECIFICATIONS

Contact

Arrangement		1 Form A, 1 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ
Contact material		AgNi/$AgSnO_2$ type
Rating	Nominal switching capacity (resistive load)	10 A 277 V AC (N.O.) 6 A 277 V AC (N.C.)
	Max. switching power (resistive load)	2,770 VA
	Max. switching voltage	277 V AC
	Max. switching current	10 A (AC)
	Min. switching capacity#1 (Reference value)	100 mA, 5 V DC
Expected life (min. ope.)	Mechanical (at 180 cpm)	10^7
	Electrical at 20°C 68°F (resistive load)	10 A 250 V AC: 5 × 10^4 (N.O.) 6 A 250 V AC: 10^5 (N.O.) 6 A 250 V AC: 5 × 10^4 (N.C.)

Coil

Nominal operating power	360 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed		20 cpm
Initial insulation resistance		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*1	Between open contacts	750 Vrms for 1 min.
	Between contacts and coil	1,500 Vrms for 1 min.
Operate time*2 (at nominal voltage)		Max. 10 ms
Release time(without diode)*2 (at nominal voltage)		Max. 10 ms
Temperature rise (at nominal voltage)		Max. 45°C, resistive, nominal voltage applied to coil. Contact carrying current: 10A, at 85°C 185°F
Shock resistance	Functional*3	98 m/s² {10 G}
	Destructive*4	980 m/s² {100 G}
Vibration resistance	Functional*5	10 to 55 Hz at double amplitude of 1.6 mm
	Destructive	10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*6 (Not freezing and condensing at low temperature)	Ambient temp.*7	–40°C to +85°C –40°F to +185°F
	Humidity	5 to 85% R.H.
Unit weight		Approx.10 g .35 oz

Remarks

*1 Detection current: 10mA
*2 Excluding contact bounce time
*3 Half-wave pulse of sine wave: 11ms; detection time: 10µs
*4 Half-wave pulse of sine wave: 6ms
*5 Detection time: 10µs
*6 The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value.
*7 Pick-up and drop-out voltages increase approximately 0.4% for each 1°C 33.8°F where the standard temperature is 20°C 68°F. Therefore, when using the relay where the ambient temperature is high, please take into consideration the rise in pick-up voltage due to ambient temperature and determine a coil nominal voltage that is within the maximum allowable voltage range.

ORDERING INFORMATION

Ex. A LS 1 B 1 2 T W

Product name	Contact arrangement and Protective construction	Coil insulation class	Coil nominal voltage (DC)	Flame resistance and tracking resistance	Packing style
LS	1: 1 Form C, Flux-resistant type 2: 1 Form C, Sealed type 3: 1 Form A, Flux-resistant type 4: 1 Form A, Sealed type	B: Class B insulation F: Class F insulation	05: 5 V 06: 6 V 09: 9 V 12: 12 V 18: 18 V 24: 24 V 48: 48 V	T: EN60335-1 (Conform)	W: Carton packing

Note: UL, C-UL, VDE approved type is standard.

TYPES

Contact arrangement	Nominal voltage, V DC	Part No.	
		Sealed type	Flux-resistant type
1 Form A	5	ALS4❍05TW	ALS3❍05TW
	6	ALS4❍06TW	ALS3❍06TW
	9	ALS4❍09TW	ALS3❍09TW
	12	ALS4❍12TW	ALS3❍12TW
	18	ALS4❍18TW	ALS3❍18TW
	24	ALS4❍24TW	ALS3❍24TW
	48	ALS4❍48TW	ALS3❍48TW
1 Form C	5	ALS2❍05TW	ALS1❍05TW
	6	ALS2❍06TW	ALS1❍06TW
	9	ALS2❍09TW	ALS1❍09TW
	12	ALS2❍12TW	ALS1❍12TW
	18	ALS2❍18TW	ALS1❍18TW
	24	ALS2❍24TW	ALS1❍24TW
	48	ALS2❍48TW	ALS1❍48TW

Packing quantity: inner 100 pieces, outer 500 pieces
Notes: 1. ❍: Input the following letter. Class B insulation: B, Class F insulation: F
2. Carton packing symbol “W” is not marked on the relay.
3. Please consult with our sales office on a tube packing type.

COIL DATA

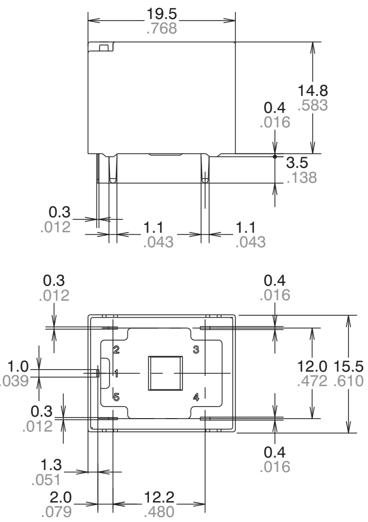
Nominal voltage, V DC	Pick-up voltage, V DC (max.) (at 20°C 68°F)	Drop-out voltage, V DC (min.) (at 20°C 68°F)	Nominal operating current, mA (±10%) (at 20°C 68°F)	Coil resistance, Ω (±10%) (at 20°C 68°F)	Nominal operating power, mW (at 20°C 68°F)	Maximum allowable voltage (at 85°C 185°F)
5	3.75	0.5	72	69.4	360	130%V of nominal voltage*[1]
6	4.5	0.6	60	100	360	
9	6.75	0.9	40	225	360	
12	9	1.2	30	400	360	
18	13.5	1.8	20	900	360	
24	18	2.4	15	1,600	360	
48	36	4.8	7.5	6,400	360	

*[1] Pick-up and drop-out voltages increase approximately 0.4% for each 1°C 33.8°F where the standard temperature is 20°C 68°F. Therefore, when using the relay where the ambient temperature is high, please take into consideration the rise in pick-up voltage due to ambient temperature and determine a coil nominal voltage that is within the maximum allowable voltage range.

DIMENSIONS(mm inch)

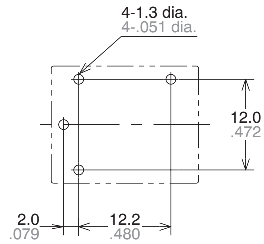
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data

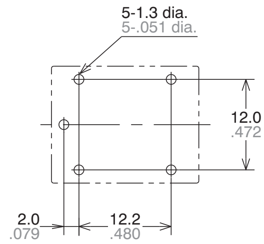


PC board pattern (Bottom view)

1 Form A



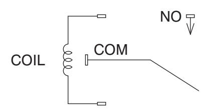
1 Form C



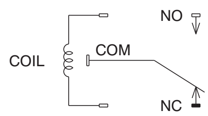
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

1 Form A



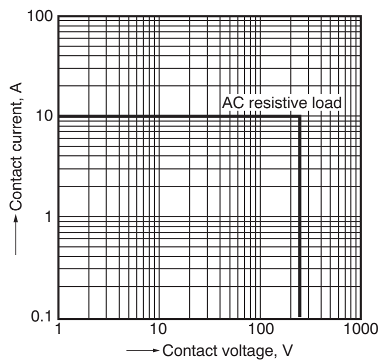
1 Form C



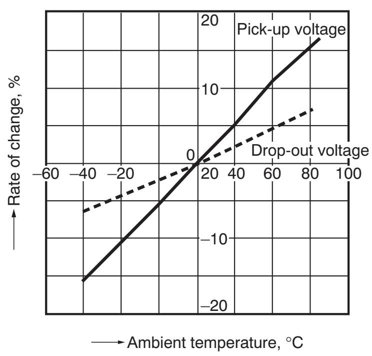
Power

REFERENCE DATA

1. Maximum switching capacity

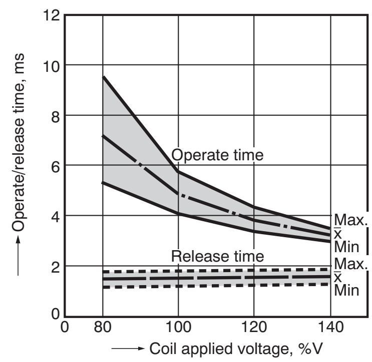


2. Ambient temperature characteristics
Sample: 6 pcs., ALS2B12TW



* Rate of change: for nominal voltage

3. Operate/release time
Sample: 25 pcs., ALS2B12TW



For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
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16A LOW PROFILE
POWER RELAY

LZ RELAYS (ALZ)

FEATURES

1. Low profile type with height of 15.7 mm
Slim, low profile type with dimensions of 28.8 (L) × 12.5 (W) × 15.7 (H) mm
1.134 (L) × .492 (W) × .618 (H) inch.

2. High insulation resistance
Superior insulation characteristics have been achieved by maintaining an insulation distance between coil and contacts of at least 10 mm for both creepage distance and clearances. Furthermore, anti-surge voltage is 10 kV and higher. (Supports European reinforced insulation requirement.)

3. Superior heat resistance
Can be used in ambient temperatures up to 85°C 185°F for the class B and 105°C 221°F for the class F.

4. Low operating power
Power saved with a nominal operating power of only 400 mW.

5. Conforms to the various safety standards:
UL, C-UL, VDE approved.

6. Superior heat resistance and tracking resistance
EN60335-1 GWT compliant (Tested by VDE) type available.

TYPICAL APPLICATIONS

1) Household electrical appliances
TV, CATV, Audio equipment, Microwave ovens, and Heaters, etc.

2) Office equipment
Copy machines, Packaged air conditioners, and Vending machines

3) Industrial equipment
Machine tools, Robots, and Temperature controllers

ORDERING INFORMATION

ALZ ☐ ☐ ☐ ☐☐ ☐ ☐

LZ relays

Contact arrangement
1: 1 Form C
5: 1 Form A (New PC board terminal)

Protective construction
1: Flux-resistant type
2: Sealed type

Coil insulation class
B: Class B insulation
F: Class F insulation

Coil voltage (DC)
05: 5 V   18: 18 V
09: 9 V   24: 24 V
12: 12 V   48: 48 V

Flame resistance and tracking resistance
Nil: —
T: EN60335-1 (Conform)

Packing style
Nil: Tube packing
W: Carton packing

Note: UL, C-UL, VDE approved type is standard.

TYPES

1. Flux-resistant type

Contact arrangement	Coil voltage	Flux-resistant type		Packing style			
		Class B insulation	Class F insulation	Tube packing		Carton packing	
		Part No.	Part No.	Inner carton	Case	Inner carton	Case
1 Form C	5 V DC	ALZ11B05W	ALZ11F05W	20 pcs.	800 pcs.	100 pcs.	500 pcs.
	9 V DC	ALZ11B09W	ALZ11F09W				
	12 V DC	ALZ11B12W	ALZ11F12W				
	18 V DC	ALZ11B18W	ALZ11F18W				
	24 V DC	ALZ11B24W	ALZ11F24W				
	48 V DC	ALZ11B48W	ALZ11F48W				
1 Form A (New PC board terminal)	5 V DC	ALZ51B05W	ALZ51F05W				
	9 V DC	ALZ51B09W	ALZ51F09W				
	12 V DC	ALZ51B12W	ALZ51F12W				
	18 V DC	ALZ51B18W	ALZ51F18W				
	24 V DC	ALZ51B24W	ALZ51F24W				
	48 V DC	ALZ51B48W	ALZ51F48W				

2. Sealed type

Contact arrangement	Coil voltage	Sealed type		Packing style			
		Class B insulation	Class F insulation	Tube packing		Carton packing	
		Part No.	Part No.	Inner carton	Case	Inner carton	Case
1 Form C	5 V DC	ALZ12B05W	ALZ12F05W	20 pcs.	800 pcs.	100 pcs.	500 pcs.
	9 V DC	ALZ12B09W	ALZ12F09W				
	12 V DC	ALZ12B12W	ALZ12F12W				
	18 V DC	ALZ12B18W	ALZ12F18W				
	24 V DC	ALZ12B24W	ALZ12F24W				
	48 V DC	ALZ12B48W	ALZ12F48W				
1 Form A (New PC board terminal)	5 V DC	ALZ52B05W	ALZ52F05W				
	9 V DC	ALZ52B09W	ALZ52F09W				
	12 V DC	ALZ52B12W	ALZ52F12W				
	18 V DC	ALZ52B18W	ALZ52F18W				
	24 V DC	ALZ52B24W	ALZ52F24W				
	48 V DC	ALZ52B48W	ALZ52F48W				

Notes: 1. If you desire tube packaging, please order without adding the packaging symbol “W” to the end of the part number.
2. Carton packing symbol “W” is not marked on the relay.
3. EN60335-1 GWT compliant types available. When ordering, please add suffix “T”.
Ex. ALZ51B12T, ALZ51F12TW

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Max. applied voltage (at 20°C 68°F)
5 V DC	Max. 70%V nominal voltage (Initial)	Min. 10%V nominal voltage (Initial)	80 mA	63Ω	400 mW	130%V of nominal voltage
9 V DC			44.4 mA	203Ω		
12 V DC			33.3 mA	360Ω		
18 V DC			22.2 mA	810Ω		
24 V DC			16.7 mA	1,440Ω		
48 V DC			8.3 mA	5,760Ω		

Power

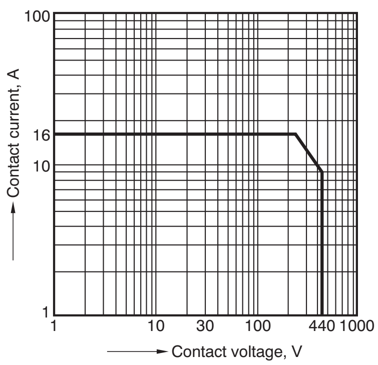
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form C, 1 Form A
	Contact resistance (Initial)		Max. 100 mΩ (By voltage drop 6V DC 1A)
	Contact material		$AgSnO_2$ type
Rating	Nominal switching capacity (resistive load)		16A 250V AC
	Max. switching power (resistive load)		4,000V A
	Max. switching voltage		440V AC
	Max. switching current		16A
	Nominal operating power		400mW
	Min. switching capacity*1		100mA 5V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC)
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1min. (Detection current: 10mA)
		Between contact and coil	5,000 Vrms for 1min. (Detection current: 10mA)
	Temperature rise (at 20°C 68°F)		Max. 55°C 131°F [with nominal coil voltage and at 16A contact carrying current (resistance method) at 20°C 68°F]
	Surge breakdown voltage*2 (Between contacts and coil)		10,000 V (Initial)
	Operate time (at nominal voltage) (at 20°C 68°F)		Max. 15ms (excluding contact bounce time)
	Release time (at nominal voltage) (at 20°C 68°F)		Max. 5ms (excluding contact bounce time, without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s^2 {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs.)
		Destructive	Min. 1,000 m/s^2 {100G} (Half-wave pulse of sine wave: 6ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1.5mm (Detection time: 10μs.) (Only the N.C. side of 1 Form C is 0.8mm)
		Destructive	10 to 55 Hz at double amplitude of 1.5mm
Expected life	Mechanical (at 180 cpm)		Min. 10^7
	Electrical (at 20 cpm)		N.O.: Min. 10^5, N.C.: Min. 5×10^4
Conditions	Conditions for operation, transport and storage*3, *4		Ambient temperature: –40°C to +85°C –40°F to +185°F (Class B) Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed		20 cpm (at nominal switching capacity)
Unit weight			Approx. 12 g .42 oz

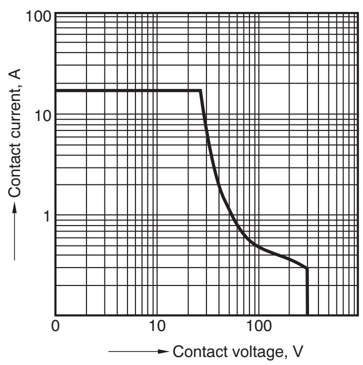
*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*3 Class F type is ambient temperature 105°C +221°F.
*4 The upper limit of the ambient temperature is the maximum temperature that can satisfy the coil temperature rise value. Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).
*Please note that some of the specifications listed above may not comply with overseas standards.

REFERENCE DATA

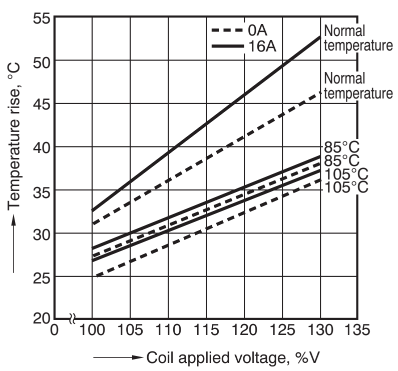
1. Max. switching power (AC resistive load)



2. Max. switching power (DC resistive load)



3. Coil temperature rise
Sample: ALZ11F12, 5pcs.
Measured portion: coil inside
Contact current: 0 A, 16 A

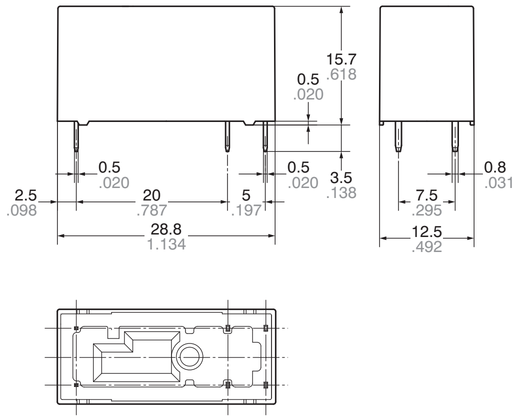


DIMENSIONS (mm inch)

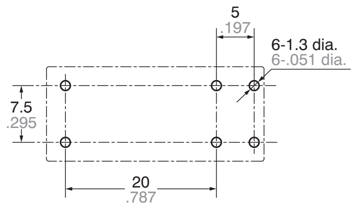
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. 1 Form A type (New PC board terminal)

CAD Data

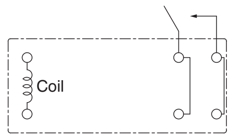


PC board pattern



Tolerance: ±0.1 ±.004

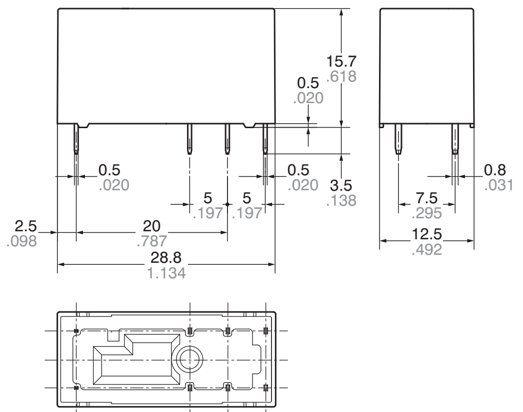
Schematic (Bottom view)



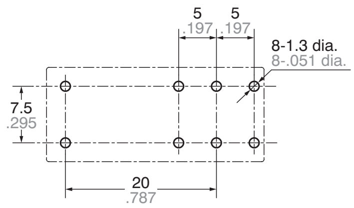
Dimension:	Tolerance
Less than 1 mm.039inch:	±0.1±.004
Min. 1 mm.039inch less than 3 mm.118inch:	±0.2±.008
Min. 3 mm.118inch:	±0.3±.012

2. 1 Form C type

CAD Data

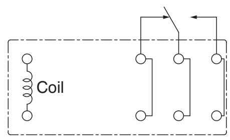


PC board pattern



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



Dimension:	Tolerance
Less than 1 mm.039inch:	±0.1±.004
Min. 1 mm.039inch less than 3 mm.118inch:	±0.2±.008
Min. 3 mm.118inch:	±0.3±.012

For Cautions for Use, see Relay Technical Information (page 582).

Power

Panasonic
ideas for life

THE SLIM POWER RELAY

PA RELAYS

FEATURES

1. Slim size (width 5 mm .197 inch, height 12.5 mm .492 inch) permits higher density mounting
Despite the slim 5 mm width, the 20 mm length is still compact and the 12.5 mm profile is low. Even when a socket is used, the height is still only 18 mm. Suitable for high-density mounting, these relays enable device size smaller.
2. Nominal operating power: High sensitivity of 120mW
Enables smaller power supplies, facilitates energy saving applications, and contributes to device size smaller.
3. Control from low level loads to 5 A
Use of gold-clad twin contacts enables control of low level loads down to 100 mV 100 µA and up to 5 A 250 V AC and 30 V DC.
4. Reinforced according to IEC1131-2 (TÜV)
PAD type: 3.1 mm clearance
3.6 mm creepage distance
5. High surge breakdown voltage (4000 V) and high breakdown voltage (2000 V)
Between contacts and coil of 2,000 V and surge resistance of 4,000 V work to prevent controller malfunctions caused by noise and surges.
6. Outstanding vibration and shock resistance.
Functional shock resistance: 147 m/s²
Functional vibration resistance:
10 to 55 Hz (at double amplitude of 2.5 mm .098 inch)
Keeps equipment from miss-operation due to vibration and shock.
Can be used as mounted on control panel doors.
7. Sealed construction allows automatic washing.
8. SIL (single in line) terminal layout
9. Complies with safety standards
Complies with Japanese Electrical Appliance and Material Safety Law, and certified by UL, CSA, and TÜV.
10. Sockets are also available

TYPICAL APPLICATIONS

1. Industrial equipment, office equipment
2. Measuring devices and test equipment
3. Interface relays for programmable controllers
4. Output relays in small devices such as timers, counters, sensors, and temperature controllers.

ORDERING INFORMATION

PA(D) 1a - [ ]

Contact arrangement
1a: 1 Form A (Bifurcated)

Coil voltage (DC)
5, 6, 9, 12, 18, 24V

Notes: 1) The PAD type offers sloghtly higher clearance (3.1 mm) and creepage distance (3.6 mm).
2) UL/CSA, TÜV approved type is standard.

TYPES

Contact arrangement	Nominal coil voltage	Part No.
1 Form A	5V DC	PA(D)1a-5V
	6V DC	PA1a-6V
	9V DC	PA1a-9V
	12V DC	PA(D)1a-12V
	18V DC	PA(D)1a-18V
	24V DC	PA(D)1a-24V

Standard packing: Carton: 25 pcs.; Case: 1,000 pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 20°C 68°F)
5V DC	70%V or less of nominal voltage *1 (Initial)	5%V or more of nominal voltage*1 (Initial)	24mA	208Ω	120mW	120%V of nominal voltage
6V DC			20mA	300Ω		
9V DC			13.3mA	675Ω		
12V DC			10mA	1,200Ω		
18V DC			6.7mA	2,700Ω		
24V DC			7.5mA	3,200Ω	180mW*2	

Notes: *1 Pulse drive (JIS C 5442)
*2 24V DC, 120mW type are also available, please consult us.

2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form A
	Initial contact resistance, max.		Max. 30 mΩ (By voltage drop 6 V DC 1A)
	Contact material		Au-clad AgNi type
Rating	Nominal switching capacity (resistive load)		5 A 250 V AC, 5 A 30 V DC
	Max. switching power (resistive load)		1,250 VA, 150 W
	Max. switching voltage		250 V (AC), 110 V (DC)
	Max. switching current		5 A
	Nominal operating power		120 mW (5 to 18 V DC), 180 mW (24 V DC)
	Min. switching capacity (Reference value)*1		100μA 100mV DC
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1min. (Detection current: 10mA.)
		Between contact and coil	2,000 Vrms for 1min. (Detection current: 10mA.)
	Surge breakdown voltage (Initial)	Between contacts and coil*2	4,000 V
	Temperature rise (at 20°C 68°F)		Max. 45°C (By resistive method, nominal voltage applied to the coil, nominal switching capacity.)
	Operate time (at nominal voltage) (at 20°C 68°F)		Max. 10 ms
	Release time (at nominal voltage) (at 20°C 68°F)		Max. 5 ms
Mechanical characteristics	Shock resistance	Functional	Min. 147 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 2.5 mm (Detection time: 10μs.)
		Destructive	10 to 55 Hz at double amplitude of 3.5 mm
Expected life	Mechanical		Min. 2×10^7 (at 180 cpm)
	Electrical		Min. 10^5 (3 A 250 V AC, 30 V DC, resistive load) Min. 5×10^4 (5 A 250 V AC, 30 V DC, resistive load) (at 20 cpm)
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –40°C to 70°C –40°F to 158°F; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed (at rated load)		20 cpm
Unit weight			Approx. 3 g .15 oz

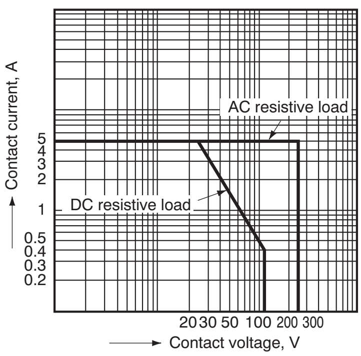
Notes:

*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2 Wave is standard shock voltage of ±1.2×50μs according to JEC-212-1981.
*3 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

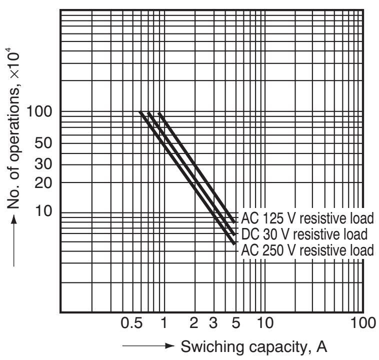
Power

REFERENCE DATA

1. Max. switching capacity

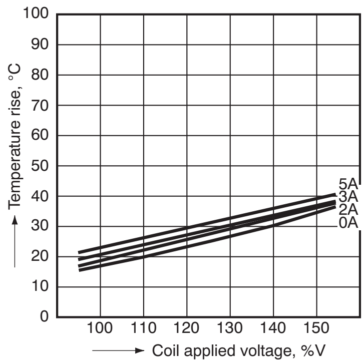


2. Life curve



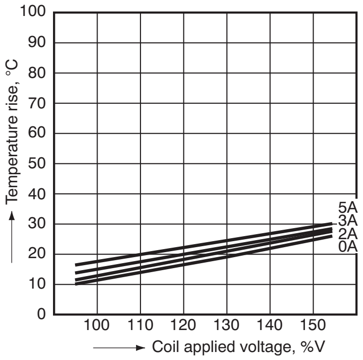
3.-(1) Coil temperature rise (120 mW)

Tested sample: PA1a-12V
Measured portion: Inside the coil
Ambient temperature: 20°C 68°F

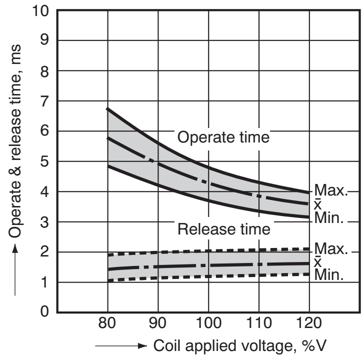


3.-(2) Coil temperature rise (180 mW)

Tested sample: PA1a-24V
Measured portion: Inside the coil
Ambient temperature: 20°C 68°F

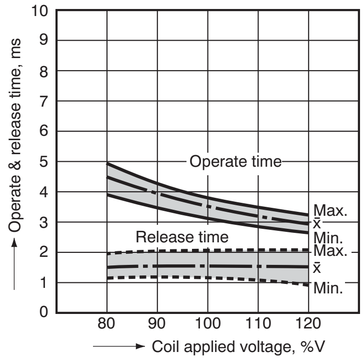


Tested sample: PA1a-12V, 20 pcs.



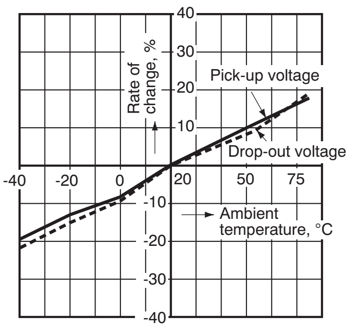
4.-(2) Operate & release time (180 mW)

Tested sample: PA1a-24V, 20 pcs.



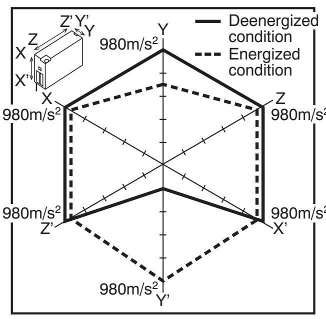
5. Ambient temperature characteristics

Tested sample: PA1a-12V, 6 pcs.



6. Malfunctional shock

Tested sample: PA1a-12V, 6 pcs.



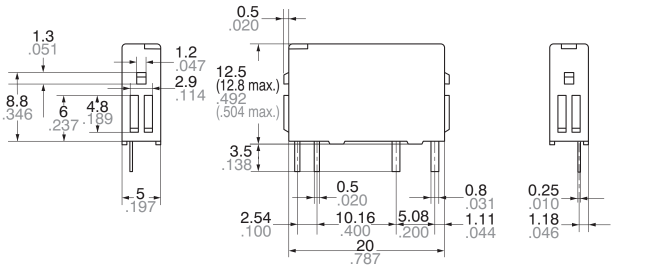
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

Relay

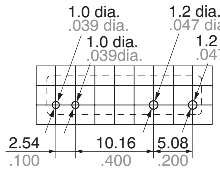
CAD Data

External dimensions



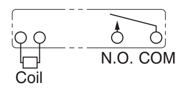
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



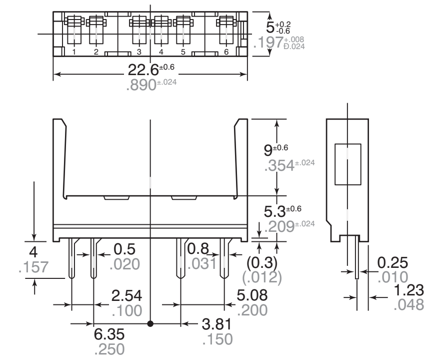
PA Socket

CAD Data

PA1a-PS

1. Standard type (PA1a-PS)

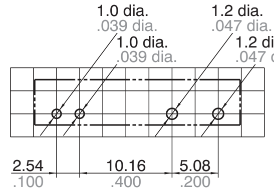
External dimensions



General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)

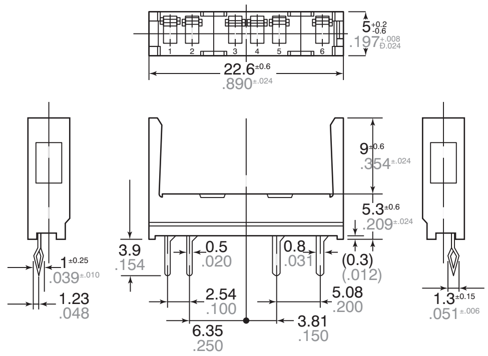
PA1a-PS



Tolerance: ±0.1 ±.004

2. Self clinching type (PA1a-PS-H)

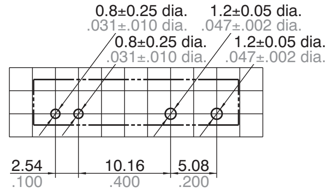
External dimensions



General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)

PA1a-PS-H

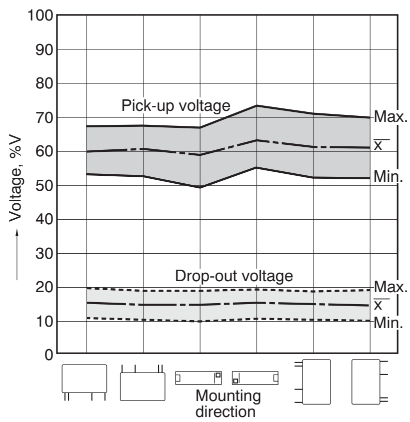


Tolerance: ±0.1 ±.004

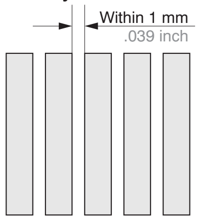
Power

NOTES

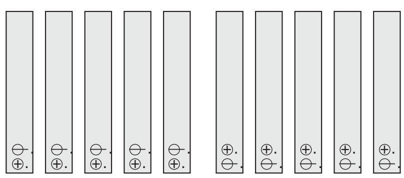
1. If it includes ripple, the ripple factor should be less than 5%.
2. Specification values for pick-up and drop-out voltages are for the relay mounting with its terminals below.



3. When mounting the relays within 1 mm .039 inch, please notice the condition below.
1) Mount the relays in the same direction.

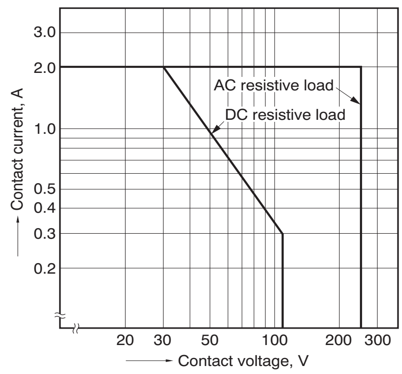


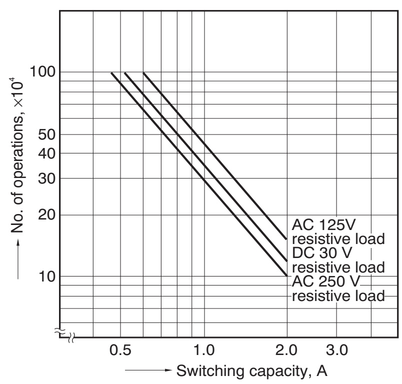
2) Coil terminals (Terminal No. 1 & 2) polarity should be arranged in the same direction.



3) Allowable contact current is 2 A.

4) About the electrical life for close mounting, please refer to data below.



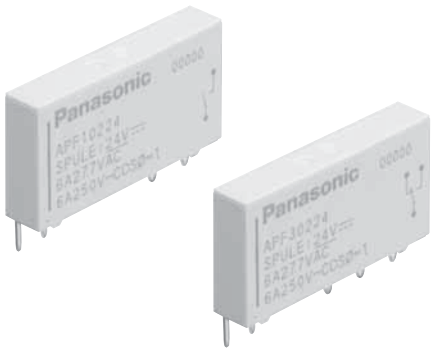


For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

Compliant with European standards (reinforced insulation)
1 Form A/1 Form C 6A
Slim power relays

PF RELAYS (APF)



FEATURES

1. High density mounting with 5 mm .197 inch width
Space saved with 5 mm .197 inch slim type with 28 mm 1.102 inch length. Allows high density mounting and use in compact devices.
2. Satisfies reinforced insulation standard (EN/IEC 61810-1).
3. High switching capacity
Supports 6A 250 V AC nominal switching capacity (resistive load) and AC15 and DC13 (inductive load).
4. 1 Form A and 1 Form C contact arrangements with options for a variety of applications.
5. 4,000 V high breakdown voltage and 6,000 V high surge breakdown voltage.
Controller protection against surges and noise with a breakdown voltage of 4,000 Vrms for 1 min. between contacts and coil, and 6,000 V surge breakdown voltage between contacts and coil.
6. Resistance to heat and fire; EN60335-1, clause 30 (GWT) approved.
7. Sealed construction allows automatic washing.
8. Complies with all safety standards.
UL, C-UL, VDE certified.

TYPICAL APPLICATIONS

1. Interface relays for programmable controllers
2. Output relays for measuring equipment, timers, counters and temperature controllers
3. Industrial equipment, office equipment
4. Household appliances for Europe

ORDERING INFORMATION

APF [ ] **0** [ ] [ ][ ]

Contact arrangement
1: 1 Form A
3: 1 Form C

Contact type
0: Single contact

Contact material
2: AgNi type
3: AgNi type/Au-plated

Coil voltage (DC)
4H: 4.5 V   05: 5 V   06: 6 V   09: 9 V   12: 12 V   18: 18 V
24: 24 V   48: 48 V   60: 60 V

Note: UL/C-UL/VDE approved type is standard.

ds_61C16_en_pf: 120510D

TYPES

Contact arrangement	Nominal coil voltage	Part No.	Contact arrangement	Nominal coil voltage	Part No.
1 Form A (AgNi type)	4.5V DC	APF1024H	1 Form C (AgNi type)	4.5V DC	APF3024H
	5V DC	APF10205		5V DC	APF30205
	6V DC	APF10206		6V DC	APF30206
	9V DC	APF10209		9V DC	APF30209
	12V DC	APF10212		12V DC	APF30212
	18V DC	APF10218		18V DC	APF30218
	24V DC	APF10224		24V DC	APF30224
	48V DC	APF10248		48V DC	APF30248
	60V DC	APF10260		60V DC	APF30260
1 Form A (AgNi type/Au-plated)	4.5V DC	APF1034H	1 Form C (AgNi type/Au-plated)	4.5V DC	APF3034H
	5V DC	APF10305		5V DC	APF30305
	6V DC	APF10306		6V DC	APF30306
	9V DC	APF10309		9V DC	APF30309
	12V DC	APF10312		12V DC	APF30312
	18V DC	APF10318		18V DC	APF30318
	24V DC	APF10324		24V DC	APF30324
	48V DC	APF10348		48V DC	APF30348
	60V DC	APF10360		60V DC	APF30360

Standard packing: Tube: 20 pcs.; Case: 1,000 pcs.

Power

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 20°C 68°F)
4.5V DC	Max. 70%V nominal voltage (Initial)	Min. 5%V nominal voltage (Initial)	37.8mA	119Ω	170mW	120%V of nominal voltage
5V DC			34.0mA	147Ω		
6V DC			28.3mA	212Ω		
9V DC			18.9mA	476Ω		
12V DC			14.2mA	847Ω		
18V DC			9.4mA	1,906Ω		
24V DC			7.1mA	3,388Ω		
48V DC			4.5mA	10,618Ω	217mW	
60V DC			2.9mA	20,570Ω	175mW	

2. Specifications

Characteristic	Item		Specifications	
Contact	Arrangement		1 Form A	1 Form C
	Contact resistance (Initial)		Max. 100 mΩ (By voltage drop 6 V DC 1A)	
	Contact material		AgNi type, AgNi type/Au-plated	
Rating	Nominal switching capacity (resistive load)		6 A 250 V AC	
	Max. switching power (resistive load)		1,500 VA	
	Max. switching voltage		250V AC	
	Max. switching current		6 A (AC)	
	Nominal operating power		170 mW (5 to 24 V DC), 217 mW (48 V DC), 175 mW (60 V DC)	
	Min. switching capacity (Reference value)*1		100 mA 5 V DC (without Au-plated), 1 mA 1 V DC (with Au-plated)	
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.	
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1 min. (Detection current: 10 mA)	
		Between contact and coil	4,000 Vrms for 1 min. (Detection current: 10 mA)	
	Surge breakdown voltage (Between contact and coil)*2		6,000 V (initial)	
	Temperature rise (at 20°C 68°F)		Max. 45°C 113°F (By resistive method, nominal coil voltage applied to the coil; contact carrying current: 6A.)	
	Operate time (at 20°C 68°F)		Max. 8 ms (Nominal coil voltage applied to the coil, excluding contact bounce time.)	
	Release time (at 20°C 68°F)		Max. 4 ms (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)	
Mechanical characteristics	Shock resistance	Functional	Min. 98 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs)	Min. 49 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs)
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 11 ms.)	
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1 mm (Detection time: 10μs.)	
		Destructive	10 to 55 Hz at double amplitude of 1.5 mm	
Expected life	Mechanical		Min. 5×10⁶ (at 180 cpm)	
	Electrical*3		N.O.: Min. 5×10⁴ (at resistive load, 6 cpm and nominal switching capacity)	N.O.: Min. 5×10⁴, N.C.: Min. 3×10⁴ (at resistive load, 6 cpm and nominal switching capacity)
Conditions	Conditions for operation, transport and storage*4		Ambient temperature: –40°C to +85°C –40°F to +185°F; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)	
Unit weight			Approx. 5 g .18 oz	

*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2 Wave is standard shock voltage of ±1.2×50μs according to JEC-212-1981
*3 For cycle lifetime, refer to “Cautions for Use 4)” in NOTES (page 386)
*4 The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

1. Electrical life

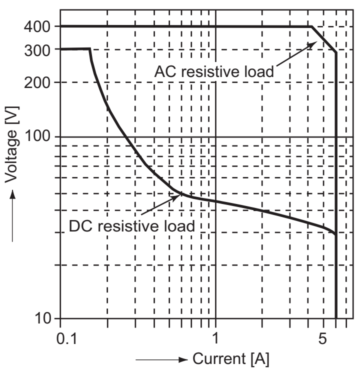
Tested sample: APF30224

Load type		Voltage	Current	Ambient temperature	No. of ops.
Resistive load		250V AC	6 A	85°C 185°F	30,000
Inductive load	AC 15	250V AC	3 A	25°C 77°F	20,000
	DC 13	24V DC	2 A	25°C 77°F	6,000

Notes: 1. Switch contacts are all on N.O. side.
2. AC 15 and DC 13 comply with IEC-60947-5-1 testing conditions.

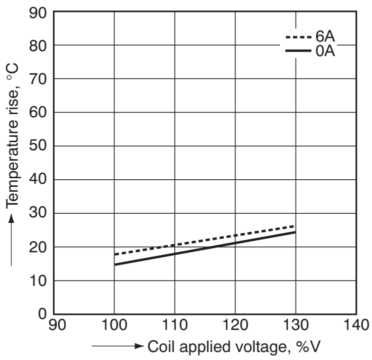
2. Max. switching capacity

Load Limit Curve



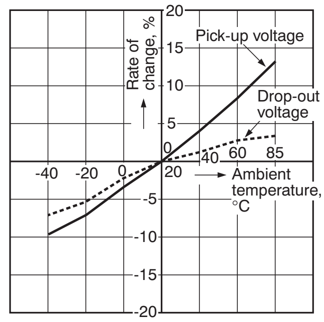
3. Coil temperature rise

Tested sample: APF30224
Measured portion: Inside the coil
Ambient temperature: 28°C 82°F



4. Ambient temperature characteristics

Tested sample: APF30224, 6 pcs.



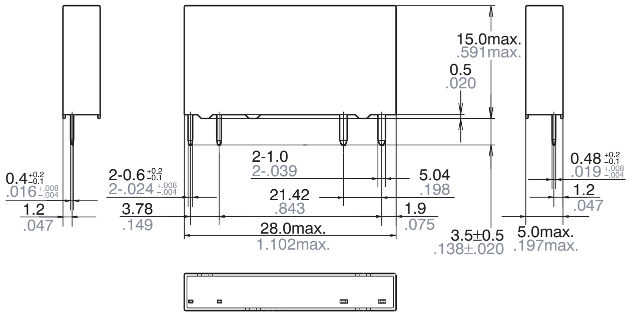
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. 1 Form A type

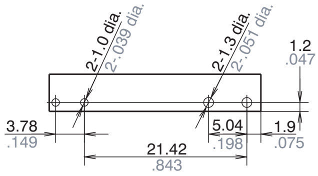
CAD Data

External dimensions



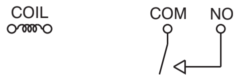
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

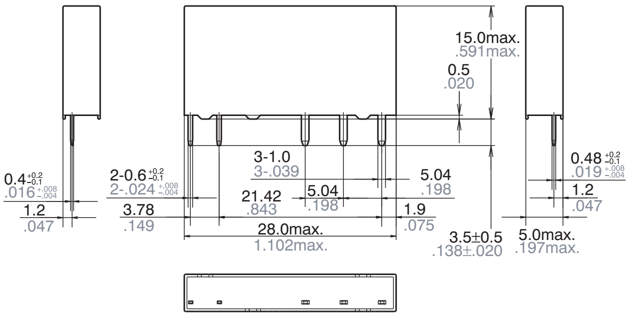
Schematic (Bottom view)



2. 1 Form C type

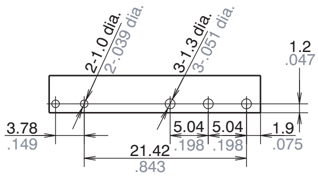
CAD Data

External dimensions



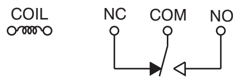
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



SAFETY STANDARDS

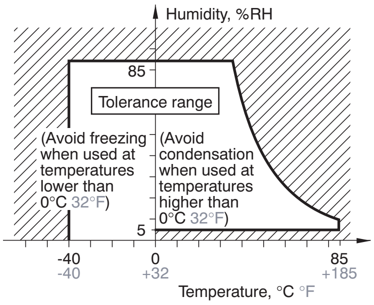
Certification authority	File No.	Applicable standard	Rating	Remarks
UL, C-UL	E120782	UL508, CSA C22.2 No.14 UL1604 (class I, Division 2, Group A, B, C, D)	277V AC 8A, General use, 24V DC 6A, General use, B300, R300 (Pilot Duty)	
VDE	40027672	EN/IEC 61810-1	250V AC 6A (cos° = 1.0) 85°C 185°F N.O. side, N.C. side 250V AC 8A (cosϕ = 1.0) 25°C 77°F N.O. side	Insulation: Reinforced insulation between contact and coil. Resistance to heat and fire; EN60335-1, clause 30 (GWT) approved.

Power

NOTES

■ Usage, transport and storage conditions

1) Temperature:
–40 to +85°C –40 to +185°F
2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage



4) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
5) Freezing
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
6) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

■ Solder and cleaning conditions

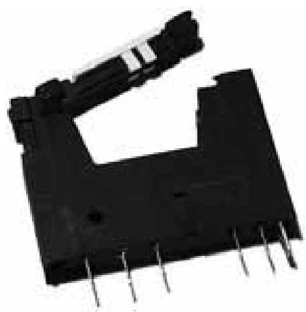
1) Please obey the following conditions when soldering automatically.
(1) Preheating: Within 120°C 248°F (solder surface terminal portion) and within 120 seconds
(2) Soldering iron: 260°C±5°C 500°F±41°F (solder temperature) and within 6 seconds (soldering time)
2) Please obey the following conditions when soldering manually.
Thoroughly clean the iron tip.
(1) Soldering iron: 30 to 60 W
(2) Soldering iron tip temperature: 350°C 662°F
(3) Soldering time: within approx. 3 seconds
3) Since this is not a sealed type relay, do not clean it as is. Also, be careful not to allow flux to overflow above the PC board or enter the inside of the relay.

■ Cautions for use

1) For precautions regarding use and explanations of technical terminology, please refer to our web site. (panasonic-electric-works.net/ac)
2) To ensure good operation, please keep the voltage on the coil ends to ±5% (at 20°C 68°F) of the rated coil operation voltage. Also, please be aware that the pick-up voltage and drop-out voltage may change depending on the temperature and conditions of use.
3) Keep the ripple rate of the nominal coil voltage below 5%.
4) The cycle lifetime is defined under the standard test condition specified in the JIS C 5442 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.
Also, be especially careful of loads such as those listed below.
(1) When used for AC load-operating and the operating phase is synchronous.
Rocking and fusing can easily occur due to contact shifting.
(2) Highly frequent load-operating
When highly frequent opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.
Three countermeasures for these are listed here.
• Incorporate an arc-extinguishing circuit.
• Lower the operating frequency
• Lower the ambient humidity
5) Minimum switching capacity provides a guideline for low level load switching. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
6) Heat, smoke, and even a fire may occur if the relay is used in conditions outside of the allowable ranges for the coil ratings, contact ratings, operating cycle lifetime, and other specifications. Therefore, do not use the relay if these ratings are exceeded.
7) If the relay has been dropped, the appearance and characteristics should always be checked before use.
8) Incorrect wiring may cause unexpected events or the generation of heat or flames.
9) The amount of relay operation noise will vary depending on the substrate used for mounting. Please use after verifying with the relay mounted on the substrate.

For Cautions for Use, see Relay Technical Information (page 582).

PF (APF) relay socket



APF1-PS-GD

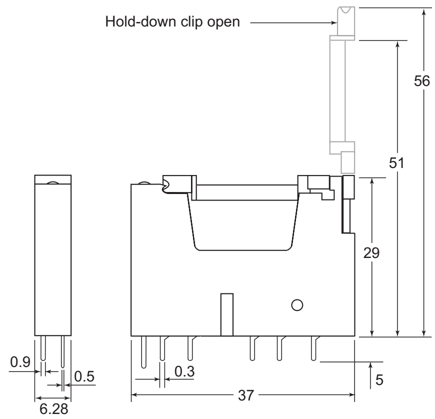
FEATURES

1. Socket incorporates LED-indication
2. It is equipped with a hold-down clip and an integrated casting mechanism
3. Suitable for PCB-mounting

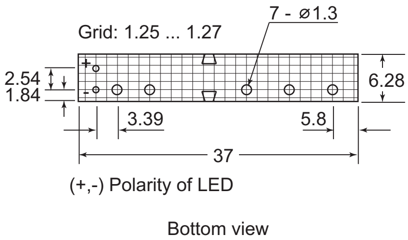
SPECIFICATIONS

Item	Specifications
LED	
Nominal voltage	24 V DC
Nominal current	appr. 4.2 mA
Diameter	3 mm
Color	green*

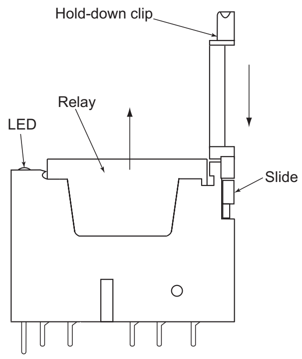
DIMENSIONS



PIN LAYOUT



HANDLING



Push down the hold-down clip in order to cast the relay.

NOTE: The PF relay approvals do not apply to the PF relay socket.

Panasonic
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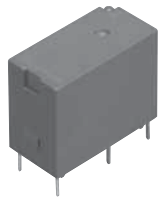
HIGH ELECTRICAL & MECHANICAL NOISE IMMUNITY RELAY

PQ RELAYS



FEATURES

1. **Compact and slim**
   20 mm (L) × 10 mm (W) × 16 mm (H)
   .787 inch (L) × .394 inch (W) × .630 inch (H) slim type
2. **Twin contact structure**
   Gold-clad twin contacts provide high reliability.
3. **High capacity and small size**
   This small package can provide high 5 A capacity.
4. **High sensitivity with 200 mW nominal operating power**
5. **8,000 V surge breakdown voltage**
   Despite the compact size, between contact and coil surge resistance of 8,000 V has been achieved. The relay has low susceptibility to noise.
6. **Outstanding shock resistance.**
   Functional shock resistance:
   294 m/s² {Min. 30 G}
7. **Most suitable for sequencer output and internal device output relays.**
8. **Sealed type**

TYPICAL APPLICATIONS

1. **Programmable controllers**
2. **Interface relays for Factory Automation and Communication equipment**
3. **Output relays for measuring equipment, timers, counters and temperature controllers**

ORDERING INFORMATION

PQ 1a - [ ]

Contact arrangement
1a: 1 Form A (Bifurcated)

Coil voltage (DC)
3, 5, 6, 9, 12, 18, 24 V

Notes: 1. UL/CSA, VDE, SEMKO approved type is standard.
2. TÜV approved type is available.

TYPES

Contact arrangement	Nominal coil voltage	Part No.
1 Form A (Bifurcated)	3V DC	PQ1a-3V
	5V DC	PQ1a-5V
	6V DC	PQ1a-6V
	9V DC	PQ1a-9V
	12V DC	PQ1a-12V
	18V DC	PQ1a-18V
	24V DC	PQ1a-24V

Standard packing: Tube: 100 pcs.; Case: 500 pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage
3V DC	75%V or less of nominal voltage (Initial)	5%V or more of nominal voltage (Initial)	66.7mA	45Ω	200mW	180%V of nominal voltage (at 20°C 68°F) 130%V of nominal voltage (at 70°C 158°F)
5V DC			40mA	125Ω		
6V DC			33.3mA	180Ω		
9V DC			22.2mA	405Ω		
12V DC			16.7mA	720Ω		
18V DC			11.1mA	1,620Ω		
24V DC			8.3mA	2,880Ω		

2. Specifications

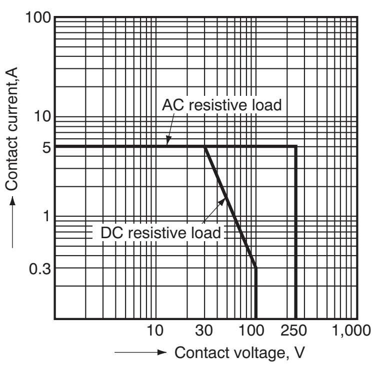
Characteristics	Item		Specifications
Contact	Arrangement		1 Form A (Bifurcated)
	Initial contact resistance, max.		Max. 50 mΩ (By voltage drop 6 V DC 1A)
	Contact material		Au-clad AgNi type
Rating	Nominal switching capacity (resistive load)		5 A 250 V AC, 5 A 30 V DC
	Max. switching power (resistive load)		1,250 VA, 150 W
	Max. switching voltage		250 V AC, 110 V DC (0.3 A)
	Max. switching current		5 A
	Nominal operating power		200 mW
	Min. switching capacity (Reference value)*1		100μA 100mV DC
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Initial breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1min. (Detection current: 10mA.)
		Between contact and coil	4,000 Vrms for 1min. (Detection current: 10mA.)
	Surge breakdown voltage (Initial)*2	Between contacts and coil	8,000 V
	Temperature rise		Max. 45°C (By resistive method, nominal voltage applied to the coil, contact carrying current: 5 A, at 70°C)
	Operate time (at 20°C 68°F)		Max. 20 ms (Nominal voltage applied to the coil, excluding contact bounce time.)
	Release time (at 20°C 68°F)		Max. 10 ms (Nominal voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 294 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 ms.)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 2.0 mm (Detection time: 10μs.)
		Destructive	10 to 55 Hz at double amplitude of 3.5 mm
Expected life	Mechanical		Min. 2×10^7 (at 180 cpm)
	Electrical (at 20 cpm)		Min. 2×10^5 (5 A 125 V AC), Min. 10^5 (5 A 250 V AC), Min. 10^5 (5 A 30 V DC)
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –40°C to 70°C –40°F to 158°F; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed (at rated load)		20 cpm
Unit weight			Approx. 7 g .25 oz

Notes:

*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2 Wave is standard shock voltage of ±1.2×50μs according to JEC-212-1981.
*3 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

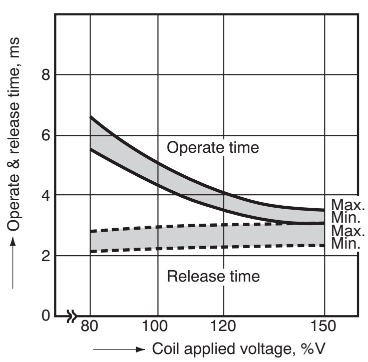
REFERENCE DATA

1. Max. switching capacity



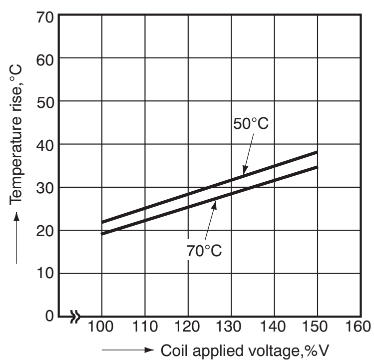
2. Operate & release time

Tested sample: PQ1a-24V, 25 pcs.

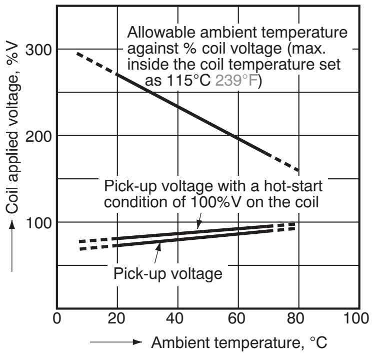


3. Coil temperature rise

Measured portion: Inside the coil
Contact carrying current: 5 A



4. Ambient temperature characteristics
Tested sample: PQ1a-24V
Contact carrying current: 5 A

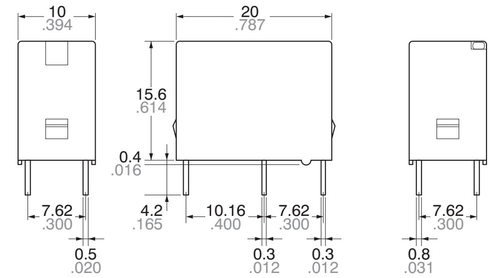


DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

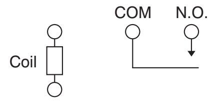
CAD Data

External dimensions

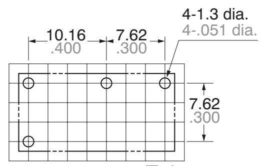


Dimension :	General tolerance
Max. 1mm .039 inch	±0.2 ±.008
1 to 5mm .039 to .118 inch	±0.3 ±.012
Min. 5mm .118 inch	±0.4 ±.016

Schematic (Bottom view)



PC board pattern
(Bottom view)



Tolerance: ±0.1 ±.004

For Cautions for Use, see Relay Technical Information (page 582).

High-Frequency Relays

Panasonic
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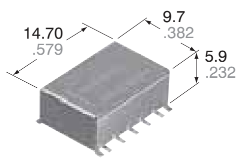
1.0GHz 2 Form C RELAY

RA RELAYS (ARA)



mm inch

FEATURES

1. High frequency characteristics (Impedance 50Ω, ~1.0GHz)
- Insertion loss; Max. 0.3dB
- Isolation; Min. 20dB
  (Between open contacts)
  Min. 30dB
  (Between contact sets)
- V.S.W.R.; Max. 1.2

2. Surface mount terminal
This relay is a surface-mounted model with excellent high-frequency properties. In addition, it can use a microstrip line in the base circuit design which spares the labor of machining the base.

3. Low profile small type
9.7(W)×14.7(L)×5.9(H) mm
.382(W)×.579(L)×.232(H) inch

4. High sensitivity: 140 mW nominal operating power

5. High contact reliability
Electrical life: Min. 10^7 (10mA 10V DC)

TYPICAL APPLICATIONS

- **Measurement instruments**
  Oscilloscope attenuator circuit

SPECIFICATIONS

Contact

Arrangement			2 Form C
Contact material	Stationary		AgPd + Au clad
	Movable		AgPd
Initial contact resistance (By voltage 6V DC 1A)			Max. 75m¾
Rating	Contact rating (resistive)		10mA 10 V DC 1A 30 V DC
	Contact carrying power		Max. 3W (at 1.0GHz, impedance 50¾, V.S.W.R. max.1.2)
	Max. switching voltage		30 V DC
	Max. switching current		1A
High frequency characteristics (~1GHz, Impedance 50¾) (Initial)	Isolation	Between open contacts	Min. 20dB
		Between contact sets	Min. 30dB
	Insertion loss		Max. 0.3dB
	V.S.W.R.		Max. 1.2
	Input power		Max. 3W (at 1.0GHz, impedance 50¾, V.S.W.R. max.1.2)
Nominal operating power	Single side stable		140mW (1.5 to 12V) 200mW (24V) 300mW (48V)
	1 coil latching		70 mW (1.5 to 12V) 100mW (24V)
	2 coil latching		140mW (1.5 to 12V) 200mW (24V)
Expected life (min. operation)	Mechanical (at 180 cpm)		10^8
	Electrical (at 20 cpm)	10mA 10 V DC (resistive load)	10^7
		1A 30 V DC (resistive load)	10^5

Characteristics

Initial insulation resistance *1		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage *2	Between open contacts	750 Vrms for 1 min.
	Between contact sets	1,000 Vrms for 1 min.
	Between contact and coil	1,000 Vrms for 1 min.
	Between contact and earth terminal	1,000 Vrms for 1 min.
Operate time [Set time] *3 (at 20°C)		Max. 4ms (Approx. 2ms) [Max. 4ms (Approx. 2ms)]
Release time (without diode) [Reset time] *3 (at 20°C)		Max. 4ms (Approx. 1ms) [Max. 4ms (Approx. 2ms)]
Temperature rise (at 20°C) *4		Max. 60°C
Shock resistance	Functional *5	Min. 500 m/s²
	Destructive *6	Min. 1,000 m/s²
Vibration resistance	Functional *7	10 to 55 Hz at double amplitude of 3mm
	Destructive	10 to 55 Hz at double amplitude of 5mm
Conditions for operation, transport and storage *8 (Not freezing and condensing at low temperature)	Ambient temp	–40°C to +85°C –40°F to +185°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 2g .07oz

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Nominal operating voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil: 3W contact carrying power: at 1.0GHz, Impedance 50Ω, V.S.W.R. Max.1.2
*5 Half-wave pulse of sine wave: 11ms, detection time: 10μs.
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage conditions in NOTES (Page 396).

ORDERING INFORMATION

Ex. A RA 2 0 0 A 03 [ ]

Product name	Contact arrangement	Operating function	Type of operation	Terminal shape	Coil voltage, V DC	Packing style
RA	2: 2 Form C	0: Single side stable 1: 1 coil latching 2: 2 coil latching	0: Standard type (B.B.M)	A: Surface-mount terminal	1H: 1.5 09: 9 03: 3 12: 12 4H: 4.5 24: 24 05: 5 48: 48 06: 6	Nil: Tube packing X: Tape and reel packing (picked from 1/2/3 pin side) Z: Tape and reel packing (picked from 8/9/10 pin side)

Note: Packing style; Nil: Tube packing 40 pcs. in an inner package, 1,000 pcs. in an outer package
Z: Tape and reel packing 500 pcs. in an inner package, 1,000 pcs. in an outer package

TYPES AND COIL DATA (at 20°C 68°F)

• Single side stable type

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
ARA200A1H(Z)	1.5	1.125	0.15	16	93.8	140	2.25
ARA200A03(Z)	3	2.25	0.3	64.3	46.7	140	4.5
ARA200A4H(Z)	4.5	3.375	0.45	145	31	140	6.75
ARA200A05(Z)	5	3.75	0.5	178	28.1	140	7.5
ARA200A06(Z)	6	4.5	0.6	257	23.3	140	9
ARA200A09(Z)	9	6.75	0.9	579	15.5	140	13.5
ARA200A12(Z)	12	9	1.2	1,028	11.7	140	18
ARA200A24(Z)	24	18	2.4	2,880	8.3	200	36
ARA200A48(Z)	48	36	4.8	7,680	6.3	300	57.6

• 1 coil latching type

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
ARA210A1H(Z)	1.5	1.125	1.125	32	46.9	70	2.25
ARA210A03(Z)	3	2.25	2.25	128.6	23.3	70	4.5
ARA210A4H(Z)	4.5	3.375	3.375	289.3	15.6	70	6.75
ARA210A05(Z)	5	3.75	3.75	357	14	70	7.5
ARA210A06(Z)	6	4.5	4.5	514	11.7	70	9
ARA210A09(Z)	9	6.75	6.75	1,157	7.8	70	13.5
ARA210A12(Z)	12	9	9	2,057	5.8	70	18
ARA210A24(Z)	24	18	18	5,760	4.2	100	36

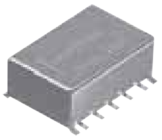
• 2 coil latching type

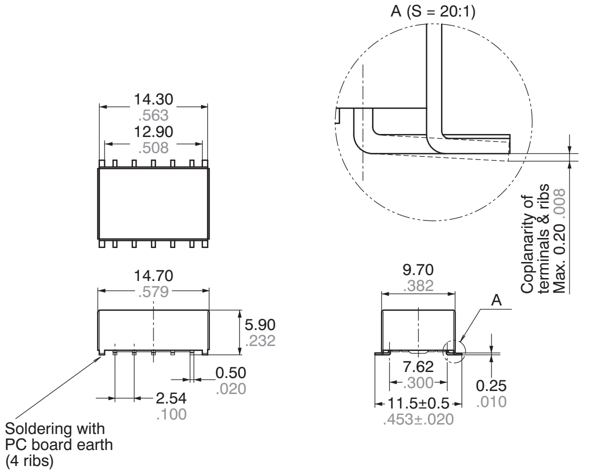
Part No.	Nominal voltage, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
ARA220A1H(Z)	1.5	1.125	1.125	16	93.8	140	2.25
ARA220A03(Z)	3	2.25	2.25	64.3	46.7	140	4.5
ARA220A4H(Z)	4.5	3.375	3.375	145	31	140	6.75
ARA220A05(Z)	5	3.75	3.75	178	28.1	140	7.5
ARA220A06(Z)	6	4.5	4.5	257	23.3	140	9
ARA220A09(Z)	9	6.75	6.75	579	15.5	140	13.5
ARA220A12(Z)	12	9	9	1,028	11.7	140	18
ARA220A24(Z)	24	18	18	2,880	8.3	200	36

DIMENSIONS mm inch

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data

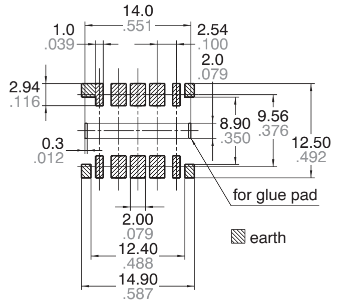




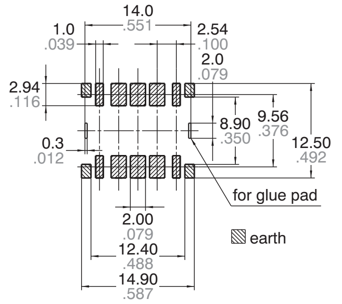
Tolerance: ±0.3 ±.012

Suggested Mounting Pads (Top view)

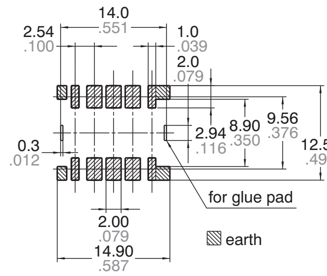
Single side stable



1 coil latching



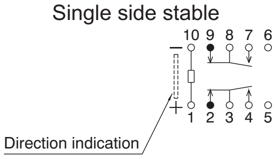
2 coil latching



Tolerance: ±0.1 ±.004

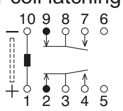
Schematic (Top view)

Single side stable



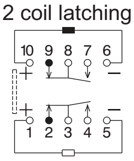
(Deenergized condition)

1 coil latching



(Reset condition)

2 coil latching



(Reset condition)

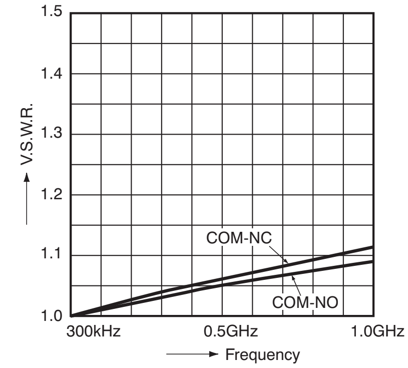
REFERENCE DATA

1-(1). High frequency characteristics (Impedance 50Ω)

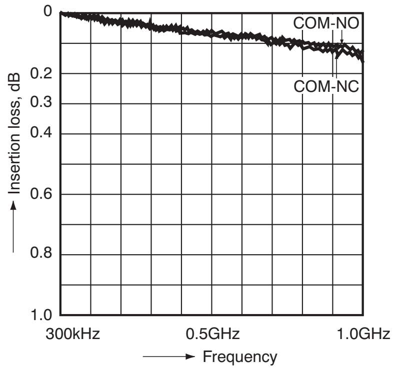
Sample: ARA200A12

Measuring method: Measured with HP network analyzer (HP8753C).

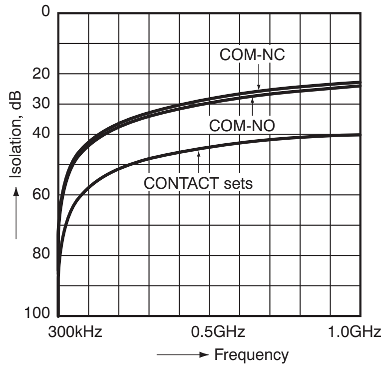
• V.S.W.R.



• Insertion loss



• Isolation

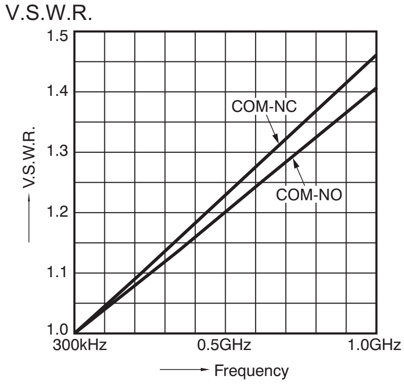


1-(2). High frequency characteristics (Impedance 75Ω

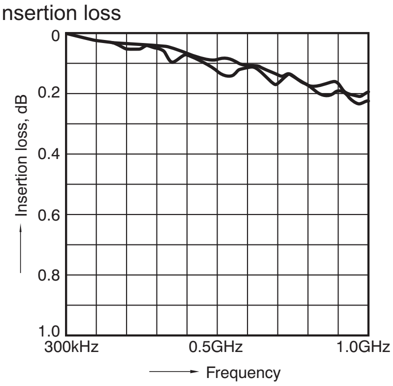
Sample: ARA200A12

Measuring method: Measured with HP network analyzer (HP8753C).

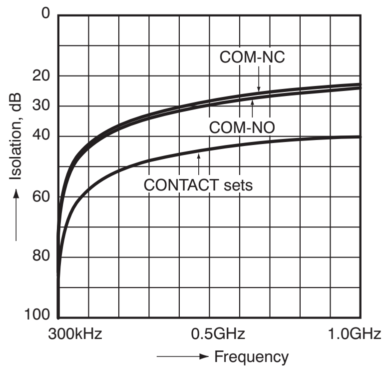
• V.S.W.R.



• Insertion loss



• Isolation



High-Frequency

NOTES

1. Coil operating power
Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%.
However, check it with the actual circuit since the characteristics may be slightly different. The nominal operating voltage should be applied to the coil for more than 10 ms to set/reset the latching type relay.

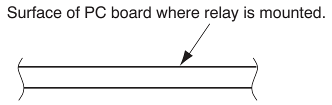
2. Coil connection
When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction.

3. External magnetic field
Since RA relays are highly sensitive polarized relays, their characteristics will be affected by a strong external magnetic field. Avoid using the relay under that condition.

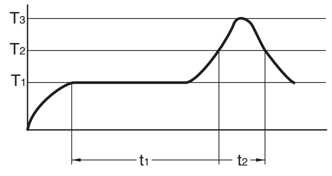
4. Cleaning
For automatic cleaning, the boiling method is recommended. Avoid ultrasonic cleaning which subjects the relays to high frequency vibrations, which may cause the contacts to stick.
It is recommended that alcoholic solvents be used.

5. Soldering
Manual soldering shall be performed under following condition.
Tip temperature: 280°C to 300°C 536°F to 572°F.
Wattage: 30 to 60W
Soldering time: within 5s
In case of automatic soldering, the following conditions should be observed

1) Position of measuring temperature



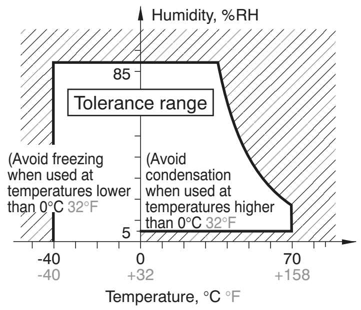
2) IR (infrared reflow) soldering method



T_1 = 150 to 180C 302 to 356F
T_2 = 230C 446F and higher
T_3 = Within 250C 482F
t_1 = 60 to 120 sec.
t_2 = Within 30 sec.

Temperature rise of relay itself may vary according to the mounting level or the heating method of reflow equipment. Therefore, please set the temperature of soldering portion of relay terminal and the top surface of the relay case not to exceed the above mentioned soldering condition.
It is recommended to check the temperature rise of each portion under actual mounting condition before use.
The soldering earth shall be performed by manual soldering.

6. Conditions for operation, transport and storage conditions
1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature:
–40 to +70°C –40 to +158°F
(2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage:



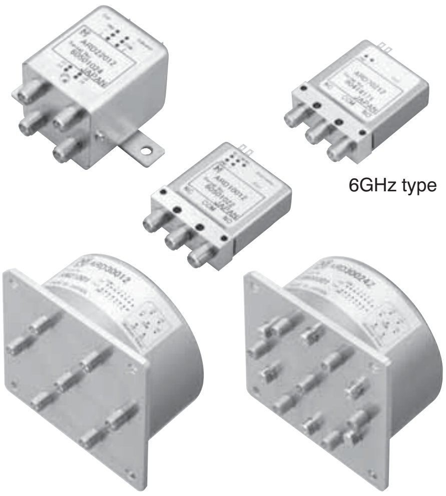
2) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
3) Freezing
Condensation or other moisture may freeze on the relay when the temperature is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
4) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

Addition of 6GHz High Reliability RD Coaxial Switch (SPDT) for Communications Market

RD COAXIAL SWITCHES (ARD)


6GHz type

FEATURES

1. Excellent high frequency characteristics (50Ω, to 26.5Ghz)
2. SPDT, Transfer and SP6T types are available.
3. High sensitivity
Nominal operating power:
840 mW (SPDT/SP6T, Fail-safe type, with indicator)
1,540 mW (Transfer, Fail-safe type, with indicator)
*Without 24V type
4. Long-lasting life: min. 5 × 10^6
5. With termination type is added. (SP6T)
Thanks to the addition of termination, steady high frequency characteristics can be maintained when contacts are either open or closed and this contributes to increase system reliability.
6. + COM type is available.

TYPICAL APPLICATIONS

Wireless and mobile communication
• Cellular phone base station
• Amplifier switching
Digital broadcasting
• Broadcasting relay station
• Broadcasting equipment
Measuring instrument
All types of inspection equipment

Please inquire beforehand if you are thinking of using this product in applications that involve low level load or high frequency of switching.

High-Frequency

HIGH FREQUENCY CHARACTERISTICS (Impedance 50Ω)

Frequency	to 1 GHz	1 to 4 GHz	4 to 8 GHz*1	8 to 12.4 GHz	12.4 to 18 GHz	18 to 26.5 GHz*2
V.S.W.R. (max.)	1.1	1.15	1.25	1.35	1.5	1.7
V.S.W.R. (SP6T With termination) (max.)	1.20		1.40	1.50	—	—
Insertion loss (dB. max.)	0.2		0.3	0.4	0.5	0.8
Isolation (dB. min.)	85	80	70	65	60	55

Notes:
*1The 6GHz type only has the above characteristics up to 6GHz.
*218 to 26.5GHz characteristics can be applied 26.5GHz type only (SPDT, Transfer)

ORDERING INFORMATION

ARD ☐ ☐☐ ☐☐ ☐ ☐ ☐

RD coaxial switches

Frequency
1: to 18GHz (SPDT)
2: to 18GHz (Transfer)
3: to 13GHz (SP6T)
5: to 26.5GHz (SPDT)
6: to 26.5GHz (Transfer)
7: to 6GHz (SPDT)

Operating function
00: Fail-safe (with indicator)
20: Latching (with indicator)
51: Latching with TTL driver (SPDT, Transfer) (with self cut-off function) (with indicator)
02: Fail-safe (without indicator)
22: Latching (without indicator)
53: Latching with TTL driver (SPDT) (with self cut-off function) (without indicator)

Nominal operating voltage, V DC
4H: 4.5 (Fail-safe, Latching type only)
05: 5 (Latching with TTL driver type only)
12: 12
24: 24

Operation terminal
Nil: Solder terminal
C: Connector cable (SPDT type only)

Termination (SP6T type only)
Nil: No termination
Z: With termination

HF data attached
Nil: No HF test data attached
Q: HF test data attached

Note: Sealed types also available, please consult us (SPDT only)

RD (ARD)

TYPES

1. SPDT

1) Solder terminal

Operating function	Nominal operating voltage, V DC	6GHz type	18GHz type		26.5GHz type	
		No HF datasheet attached	No HF datasheet attached	HF datasheet attached	No HF datasheet attached	HF datasheet attached
Fail-safe (with indicator)	4.5	ARD7004H	ARD1004H	ARD1004HQ	ARD5004H	ARD5004HQ
	12	ARD70012	ARD10012	ARD10012Q	ARD50012	ARD50012Q
	24	ARD70024	ARD10024	ARD10024Q	ARD50024	ARD50024Q
Latching (with indicator)	4.5	ARD7204H	ARD1204H	ARD1204HQ	ARD5204H	ARD5204HQ
	12	ARD72012	ARD12012	ARD12012Q	ARD52012	ARD52012Q
	24	ARD72024	ARD12024	ARD12024Q	ARD52024	ARD52024Q
Latching with TTL driver (with self cut-off function) (with indicator)	5	ARD75105	ARD15105	ARD15105Q	ARD55105	ARD55105Q
	12	ARD75112	ARD15112	ARD15112Q	ARD55112	ARD55112Q
	24	ARD75124	ARD15124	ARD15124Q	ARD55124	ARD55124Q
Fail-safe (without indicator)	4.5	ARD7024H	—	—	—	—
	12	ARD70212				
	24	ARD70224				
Latching (without indicator)	4.5	ARD7224H	—	—	—	—
	12	ARD72212				
	24	ARD72224				
Latching with TTL driver (with self cut-off function) (without indicator)	5	ARD75305	—	—	—	—
	12	ARD75312				
	24	ARD75324				

Note: Standard packing; Carton: 1 pc. Case: 20 pcs.

2) Connector cable

Operating function	Nominal operating voltage, V DC	18GHz type		26.5GHz type	
		No HF datasheet attached	HF datasheet attached	No HF datasheet attached	HF datasheet attached
Fail-safe	4.5	ARD1004HC	ARD1004HCQ	ARD5004HC	ARD5004HCQ
	12	ARD10012C	ARD10012CQ	ARD50012C	ARD50012CQ
	24	ARD10024C	ARD10024CQ	ARD50024C	ARD50024CQ
Latching	4.5	ARD1204HC	ARD1204HCQ	ARD5204HC	ARD5204HCQ
	12	ARD12012C	ARD12012CQ	ARD52012C	ARD52012CQ
	24	ARD12024C	ARD12024CQ	ARD52024C	ARD52024CQ
Latching with TTL driver (with self cut-off function)	5	ARD15105C	ARD15105CQ	ARD55105C	ARD55105CQ
	12	ARD15112C	ARD15112CQ	ARD55112C	ARD55112CQ
	24	ARD15124C	ARD15124CQ	ARD55124C	ARD55124CQ

Note: Standard packing; Carton: 1 pc. Case: 10 pcs.

2. Transfer

Operating function	Nominal operating voltage, V DC	18GHz type		26.5GHz type	
		No HF datasheet attached	HF datasheet attached	No HF datasheet attached	HF datasheet attached
Fail-safe	4.5	ARD2004H	ARD2004HQ	ARD6004H	ARD6004HQ
	12	ARD20012	ARD20012Q	ARD60012	ARD60012Q
	24	ARD20024	ARD20024Q	ARD60024	ARD60024Q
Latching	4.5	ARD2204H	ARD2204HQ	ARD6204H	ARD6204HQ
	12	ARD22012	ARD22012Q	ARD62012	ARD62012Q
	24	ARD22024	ARD22024Q	ARD62024	ARD62024Q
Latching with TTL driver (with self cut-off function)	5	ARD25105	ARD25105Q	ARD65105	ARD65105Q
	12	ARD25112	ARD25112Q	ARD65112	ARD65112Q
	24	ARD25124	ARD25124Q	ARD65124	ARD65124Q

Note: Standard packing; Carton: 1 pc. Case: 10 pcs.

3. SP6T

Operating function	Nominal operating voltage, V DC	13GHz type	
		No HF datasheet attached	HF datasheet attached
Fail-safe	4.5	ARD3004H	ARD3004HQ
	12	ARD30012	ARD30012Q
	24	ARD30024	ARD30024Q
Latching	4.5	ARD3204H	ARD3204HQ
	12	ARD32012	ARD32012Q
	24	ARD32024	ARD32024Q

Note: Standard packing; Carton: 1 pc. Case: 5 pcs.

4. SP6T (with termination)

Operating function	Nominal operating voltage, V DC	13GHz type	
		No HF datasheet attached	HF datasheet attached
Fail-safe	4.5	ARD3004HZ	ARD3004HZQ
	12	ARD30012Z	ARD30012ZQ
	24	ARD30024Z	ARD30024ZQ
Latching	4.5	ARD3204HZ	ARD3204HZQ
	12	ARD32012Z	ARD32012ZQ
	24	ARD32024Z	ARD32024ZQ

Note: Standard packing; Carton: 1 pc. Case: 5 pcs.

RATING

1. Coil data

(1) SPDT

1) Fail-safe type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%) (at 20°C 68°F)		Nominal power consumption, mW	
	With indicator	Without indicator	With indicator	Without indicator
4.5	186.7	155.6	840	700
12	70.0	58.3		
24	40.4	29.2	970	

2) Latching type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%) (at 20°C 68°F)		Nominal power consumption, mW	
	With indicator	Without indicator	With indicator	Without indicator
4.5	155.6	111.1	700	500
12	62.5	41.7	750	
24	37.5	16.7	900	

3) Latching with TTL driver type

Nominal operating voltage, V DC	TTL logic level (see TTL logic level range)		Electronic self cut-off	Switching frequency
	ON	OFF		
5	2.4 to 5.5V	0 to 0.5V	Available	Max. 180 cpm (ON time : OFF time = 1 : 1)
12				
24				

(2) Transfer

1) Fail-safe type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%) (at 20°C 68°F)	Nominal power consumption, mW
4.5	342.2	1540
12	128.3	
24	69.6	1670

2) Latching type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%) (at 20°C 68°F)	Nominal power consumption, mW
4.5	266.7	1200
12	104.2	1250
24	58.3	1400

3) Latching with TTL driver type (with self cut-off function)

Nominal operating voltage, V DC	TTL logic level (see TTL logic level range)		Electronic self cut-off	Switching frequency
	ON	OFF		
5	2.4 to 5.5V	0 to 0.5V	Available	Max. 180 cpm (ON time : OFF time = 1 : 1)
12				
24				

(3) SP6T and SP6T (with termination type)

1) Fail-safe type

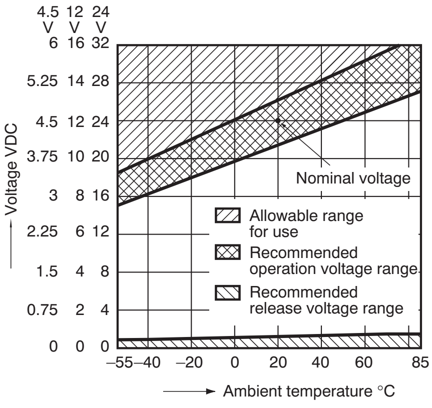
Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%) (at 20°C 68°F)	Nominal power consumption, mW
4.5	186.7	840
12	70.0	
24	40.4	970

2) Latching type

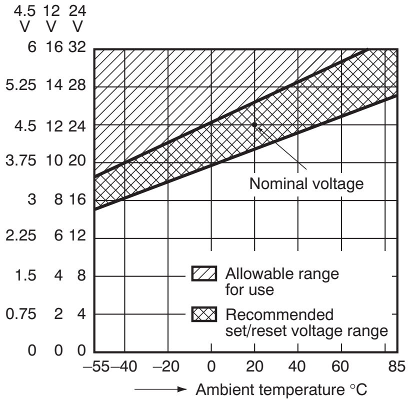
Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%) (at 20°C 68°F)	Nominal power consumption, mW
4.5	SET: 155.6 / RESET (ALL): 933.6	SET: 700 / RESET (ALL): 4,200
12	SET: 62.5 / RESET (ALL): 375.0	SET: 750 / RESET (ALL): 4,500
24	SET: 37.5 / RESET (ALL): 225.0	SET: 900 / RESET (ALL): 5,400

• Operating voltage range

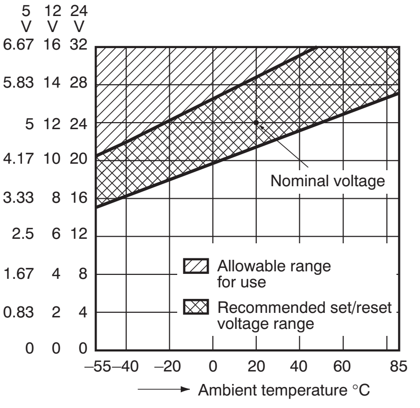
1) Fail-safe type



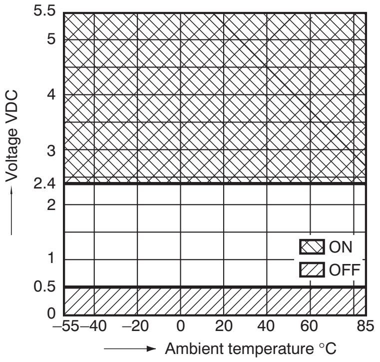
2) Latching type



3) Latching with TTL driver type (with self cut-off function)



4) TTL Logic level range



Note: Please consult us for use that is outside this range.

2. Specifications

1) SPDT/Transfer

Characteristics	Item		Specifications (SPDT)	Specifications (Transfer)
Contact	Arrangement		SPDT	Transfer
	Contact material		Gold plating	
	Initial contact resistance		Max. 100mΩ (By voltage drop 6V DC 1A)	
Rating	Contact input power		120W (at 3GHz) (V.S.W.R. 1.15 or less, no contact switching, ambient temperature 40°C 104°F [SPDT], 25°C 77°F [Transfer])*1	
	Nominal operating power	Fail-safe	840mW (4.5V, 12V DC), 970mW (24V DC)	1,540mW (4.5V, 12V DC), 1,670mW (24V DC)
		Latching	700mW (4.5V DC), 750mW (12V DC), 900mW (24V DC)	1,200mW (4.5V DC), 1,250mW (12V DC), 1,400mW (24V DC)
Indicator rating (with indicator type only)	Contact rating		Max. 30V 100mA	
	Initial contact resistance		Max. 1Ω (Measured by 5V 100mA)	
	Min. switching capacity (Reference value)		3V DC, 0.1mA (5 × 10^6, Reliability level: 10% (3kΩ))	

High frequency characteristics (Impedance 50Ω)	to 1 GHz	1 to 4 GHz	4 to 8 GHz*2	8 to 12.4 GHz	12.4 to 18 GHz	18 to 26.5 GHz*3
V.S.W.R. (max.)	1.1	1.15	1.25	1.35	1.5	1.7
Insertion loss (dB, max.)	0.2		0.3	0.4	0.5	0.8
Isolation (dB, min.)	85	80	70	65	60	55

Characteristics	Item		Specifications (SPDT)	Specifications (Transfer)
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000 MΩ (at 500 V DC) Measurement at same location as “breakdown voltage (Initial)” section.	
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)	
		Between contact and coil	500 Vrms for 1 min. (Detection current: 10mA)	
		Between contact and earth terminal	500 Vrms for 1 min. (Detection current: 10mA)	
		Between coil and earth terminal	500 Vrms for 1 min. (Detection current: 10mA)	
Time characteristics (at 20°C 68°F)	Operate time		Max. 15ms (Nominal operating voltage applied to the coil, excluding contact bounce time.)	Max. 20ms (Nominal operating voltage applied to the coil, excluding contact bounce time.)
Mechanical characteristics	Shock resistance	Functional	Min. 500 m/s^2 (Half-wave pulse of sine wave: 11ms, detection time: 10µs.)	
		Destructive	Min. 1,000 m/s^2 (Half-wave pulse of sine wave: 11ms.)	
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3mm (Detection time: 10µs.)	
		Destructive	10 to 55 Hz at double amplitude of 5mm	
Expected life	Mechanical		6GHz type: Min. 10^6 18 and 26.5GHz type: Min. 5 × 10^6 (All types, at 180 cpm)	Min. 5 × 10^6 (at 180 cpm)
	Electrical	High frequency contact (Hot switch)	6GHz type: Min. 10^6 18 and 26.5GHz type: Min. 5 × 10^6 (All types, 5W to 3GHz, impedance 50Ω, V.S.W.R.; max. 1.2) (at 20 cpm)	Min. 5 × 10^6 (5W to 3GHz, impedance 50Ω, V.S.W.R.; max. 1.2) (at 20 cpm)
		Indicator (with indicator type only)	5 V DC, 10 mA, Min. 10^6 (at 20 cpm)	
Conditions	Conditions for operation, transport and storage*4		Ambient temperature: –55°C to +85°C –67°F to +185°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)	
Unit weight			Approx. 50g 1.76oz	Approx. 110g 3.88oz

*1 Factors such as heating of the connected connector influence the high frequency characteristics; therefore, please verify under actual conditions of use.
*2 The 6GHz type only has the above characteristics up to 6GHz.
*3 18 to 26.5GHz characteristics can be applied 26.5GHz type only (SPDT, Transfer)
*4 The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

High-Frequency

2) SP6T

Characteristics	Item		Specifications			
Contact	Arrangement		SP6T			
	Contact material		Gold plating			
	Initial contact resistance		Max. 100mΩ (By voltage drop 6V DC 1A)			
Rating	Contact input power	No termination	120 W (at 3GHz) (V.S.W.R. 1.15 or less, no contact switching, ambient temperature 25°C 77°F)*1			
		With termination	2W (at 3GHz) (V.S.W.R. 1.15 or less, no contact switching, ambient temperature 25°C 77°F)*1			
	Nominal operating power	Fail-safe	840mW (4.5V, 12V DC), 970mW (24V DC)			
		Latching	700mW (4.5V DC), 750mW (12V DC), 900mW (24V DC)			
Indicator rating	Contact rating		Max. 30V 100mA			
	Initial contact resistance		Max. 1Ω (Measured by 5V 100mA)			
	Min. switching capacity (Reference value)		3V DC, 0.1mA (5 × 10^6, Reliability level: 10% (3kΩ))			
High frequency characteristics (Impedance 50Ω)			to 1 GHz	1 to 4 GHz	4 to 8 GHz	8 to 13 GHz
	V.S.W.R. (max.)	No termination	1.1	1.15	1.25	1.35
		With termination	1.20		1.40	1.50
	Insertion loss (dB, max.)		0.2		0.3	0.4
	Isolation (dB, min.)		85	80	70	65
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000 MΩ (at 500 V DC) Measurement at same location as “breakdown voltage (Initial)” section.			
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)			
		Between contact and coil	500 Vrms for 1 min. (Detection current: 10mA)			
		Between contact and earth terminal	500 Vrms for 1 min. (Detection current: 10mA)			
		Between coil and earth terminal	500 Vrms for 1 min. (Detection current: 10mA)			
Time characteristics (at 20°C 68°F)	Operate time		Max. 20ms (Nominal operating voltage applied to the coil, excluding contact bounce time.)			
Mechanical characteristics	Shock resistance	Functional	Min. 500 m/s² (Half-wave pulse of sine wave: 11ms, detection time: 10μs.)			
		Destructive	Min. 1,000 m/s² (Half-wave pulse of sine wave: 11ms.)			
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3mm (Detection time: 10μs.)			
		Destructive	10 to 55 Hz at double amplitude of 5mm			
Expected life	Mechanical		Min. 5 × 10^6 (at 180 cpm)			
	Electrical	High frequency contact (Hot switch)	No termination	Min. 5 × 10^6 (5W to 3GHz, impedance 50¾, V.S.W.R.; max. 1.2) (at 20 cpm)		
			With termination	Min. 5 × 10^6 (2W to 3GHz, impedance 50¾, V.S.W.R.; max. 1.2) (at 20 cpm)		
		Indicator (with indicator type only)	5 VDC, 10 mA, Min. 10^6 (at 20 cpm)			
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –55°C to +85°C –67°F to +185°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)			
Unit weight			Approx. 320g 11.29oz			

*1 Factors such as heating of the connected connector influence the high frequency characteristics; therefore, please verify under actual conditions of use.
*2 The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

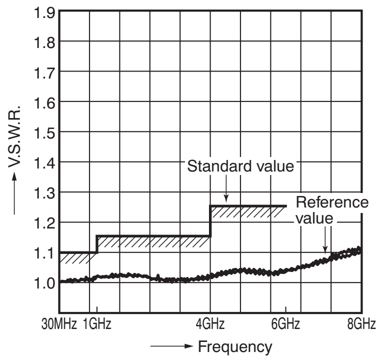
REFERENCE DATA

1-(1). High frequency characteristics (SPDT) 6GHz type

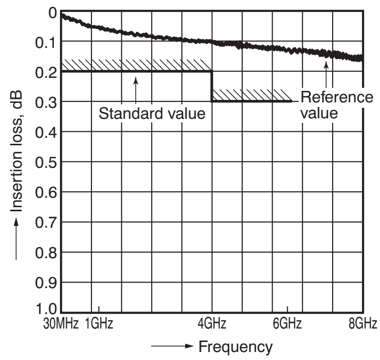
Sample: ARD70012

Measuring method: Measured with Agilent Technologies network analyzer (E8363B).

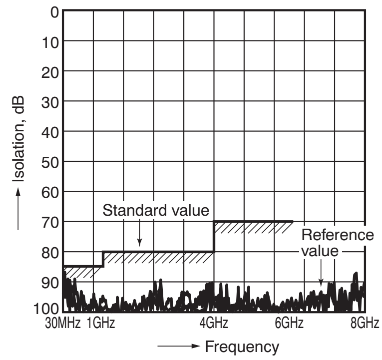
• V.S.W.R.



• Insertion loss



• Isolation

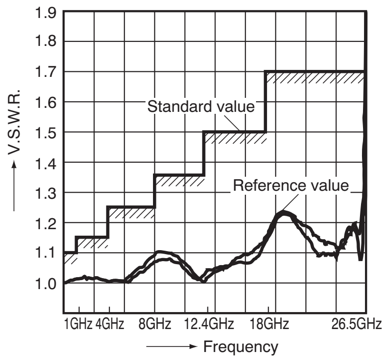


1-(2). High frequency characteristics (SPDT) 18, 26.5GHz type

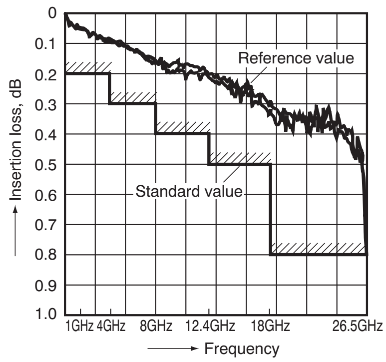
Sample: ARD10012

Measuring method: Measured with Agilent Technologies network analyzer (HP8510).

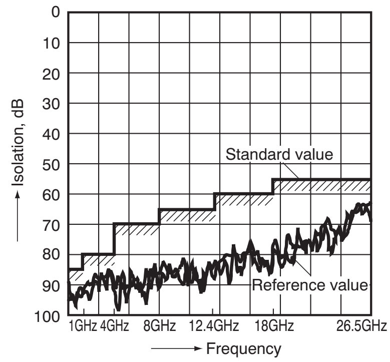
• V.S.W.R.



• Insertion loss



• Isolation

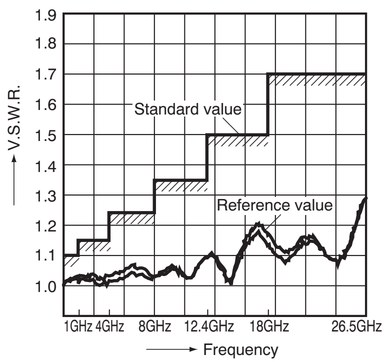


1-(3). High frequency characteristics (Transfer)

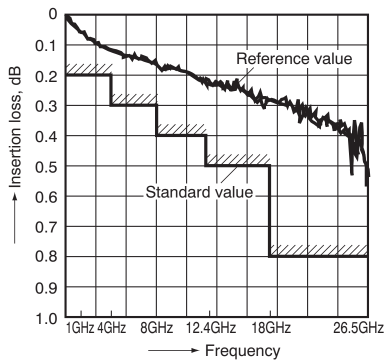
Sample: ARD60012

Measuring method: Measured with Agilent Technologies network analyzer (HP8510).

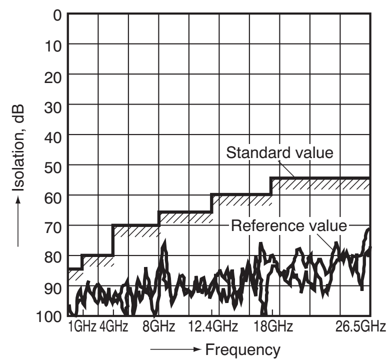
• V.S.W.R.



• Insertion loss



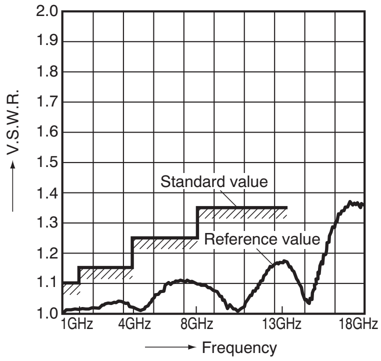
• Isolation



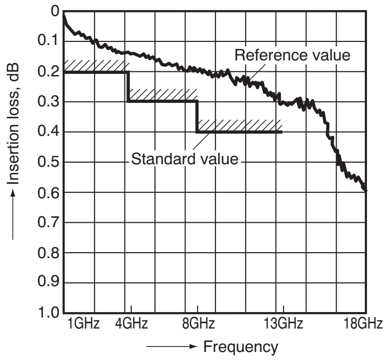
RD (ARD)

1-(4). High frequency characteristics (SP6T)
Sample: ARD30012
Measuring method: Measured with Agilent Technologies network analyzer (HP8510).

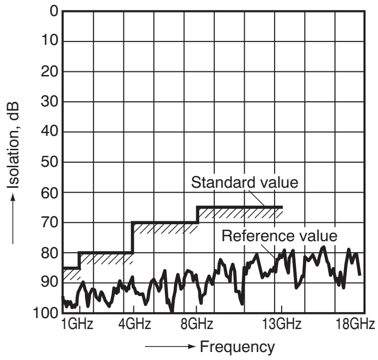
• V.S.W.R.



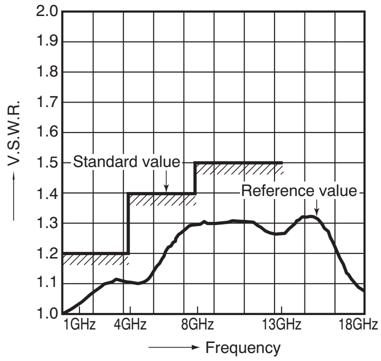
• Insertion loss



• Isolation



• Termination characteristics



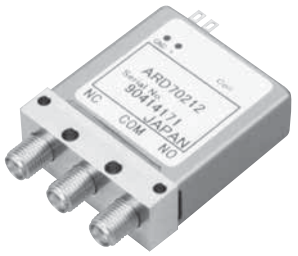
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. SPDT

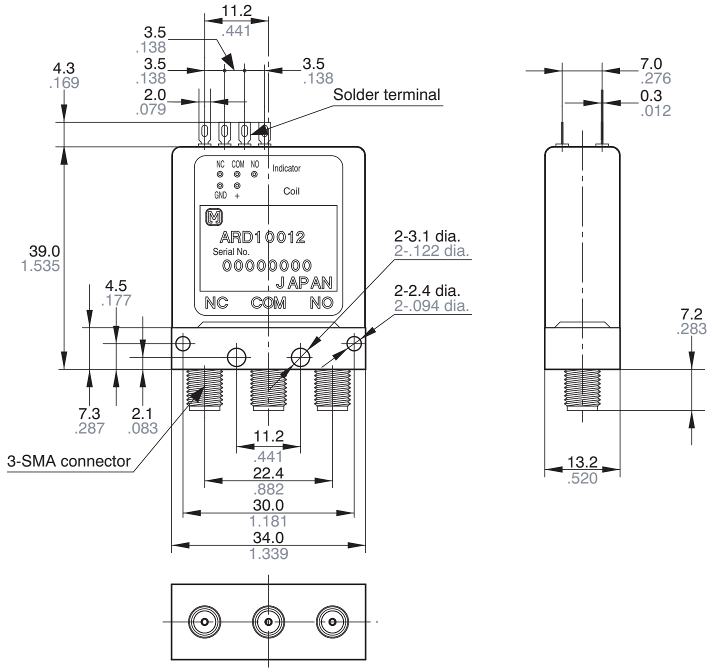
CAD Data

1) Solder terminal



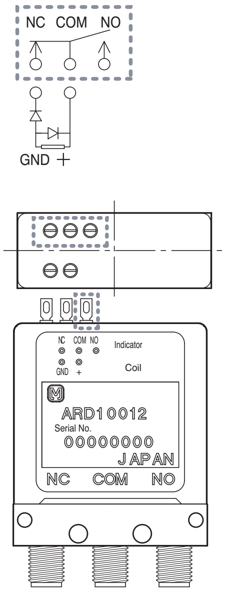
6GHz type

18 and 26.5GHz types

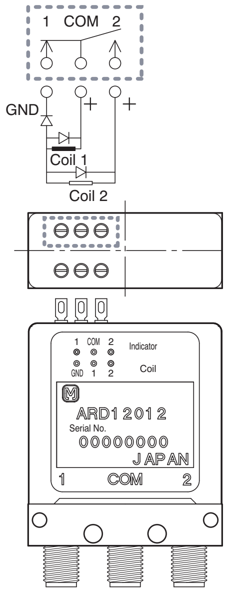


Tolerance: ±0.3 ±.012

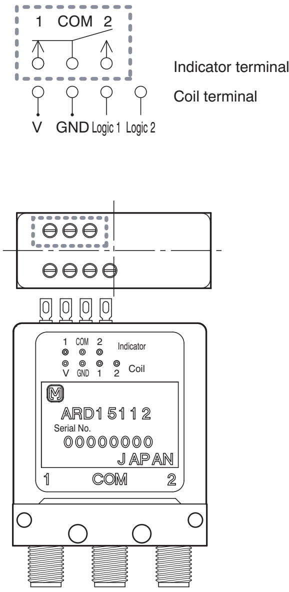
Fail-safe



Latching



Latching with TTL driver
(with self cut-off function)

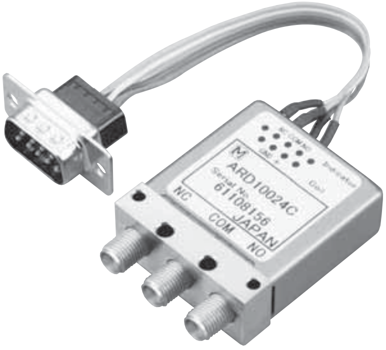


⁎ + COM type is available

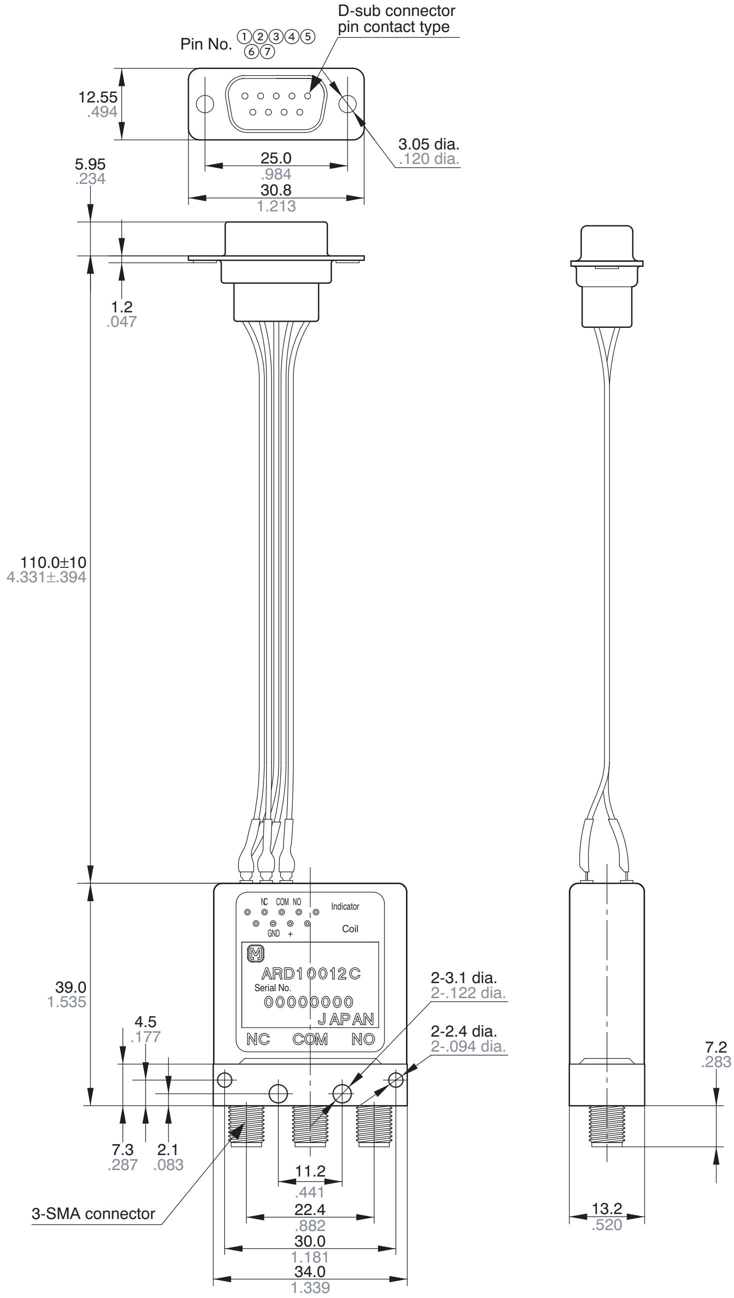
* The type without indicator terminals will not have the indicator terminals that are marked with the dotted box.

High-Frequency

2) Connector cable

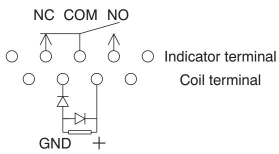


	Indicator					Coil			
Pin No.	1	2	3	4	5	6	7	8	9
Fail-safe	–	NC	COM	NO	–	–	GND	+	–
Latching	–	1	COM	2	–	–	GND	1	2
Latching with TTL driver	–	1	COM	2	–	V	GND	Logic 1	Logic 2

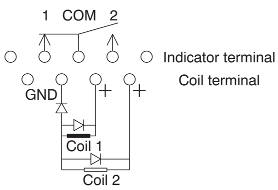


Tolerance: ±0.3 ±.012

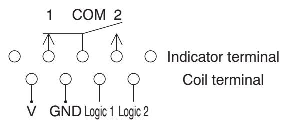
Fail-safe



Latching



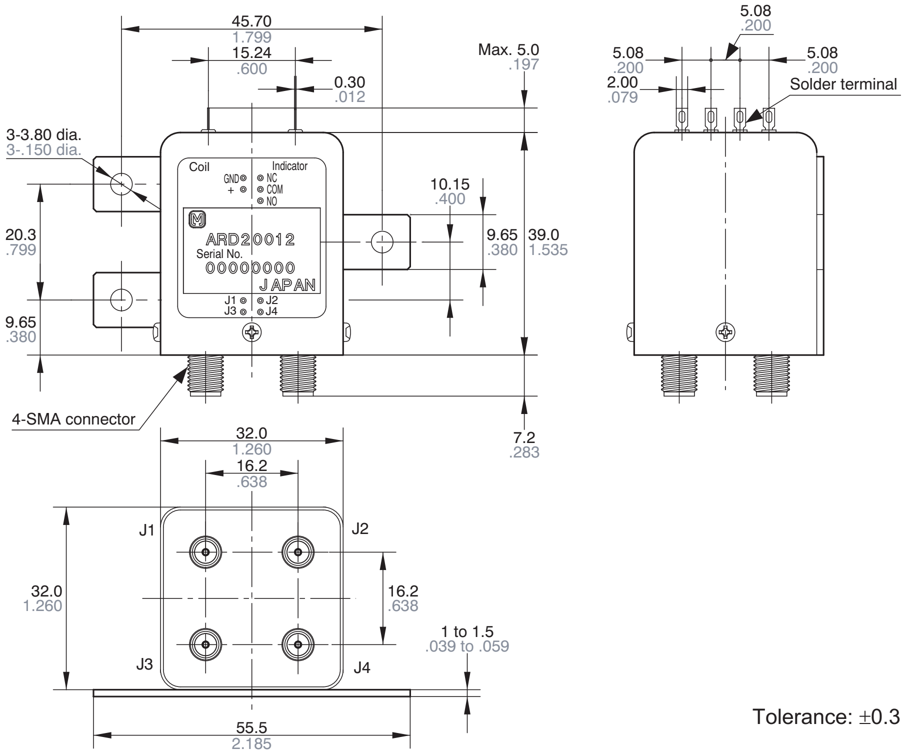
Latching with TTL driver
(with self cut-off function)



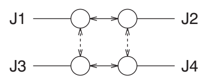
∗ + COM type is available

2. Transfer

CAD Data

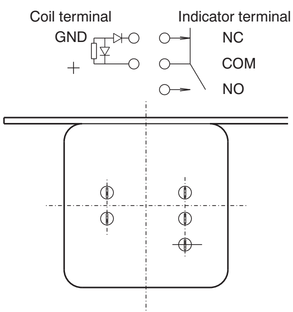


Tolerance: ±0.3 ±.012

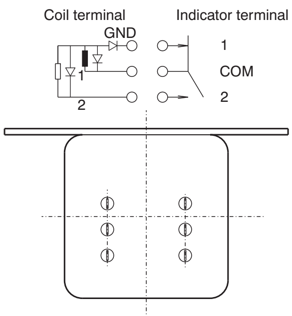


Fail-safe	NC: J1-J2, J3-J4 NO: J1-J3, J2-J4
Latching	POS1: J1-J2, J3-J4 POS2: J1-J3, J2-J4
Latching with TTL driver	POS1: J1-J2, J3-J4 POS2: J1-J3, J2-J4

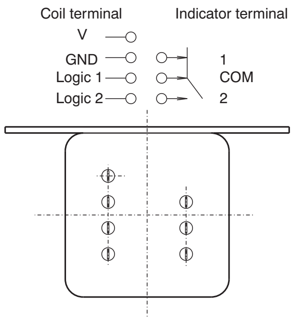
Fail-safe



Latching



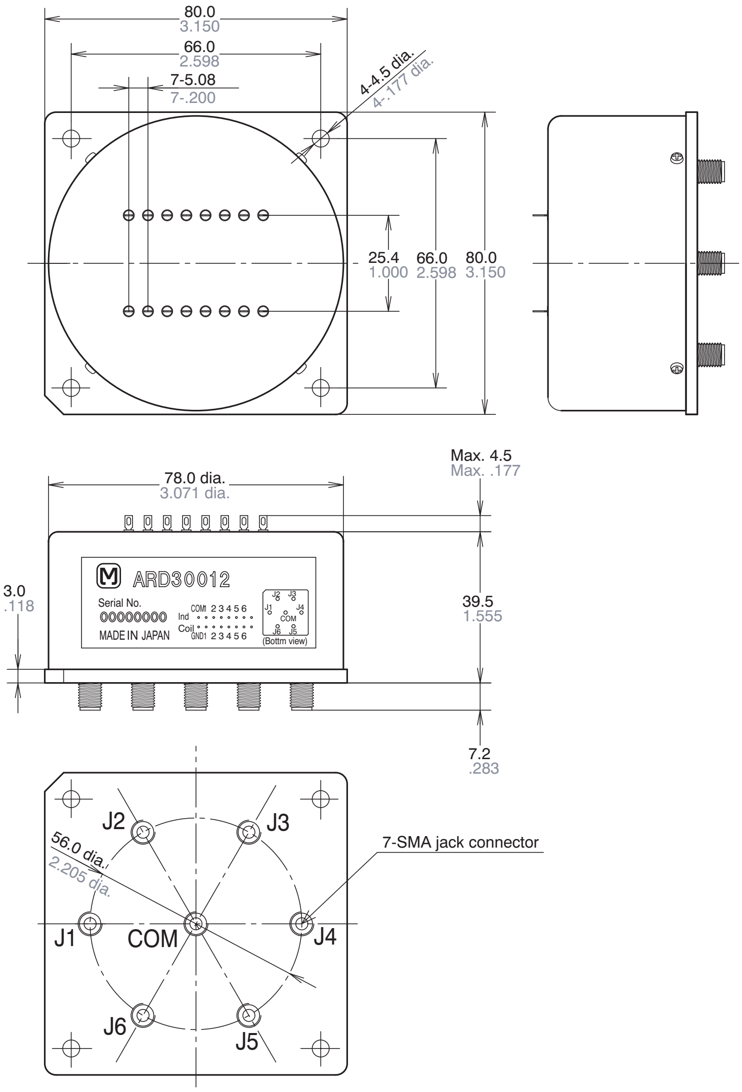
Latching with TTL driver
(with self cut-off function)



* + COM type is available

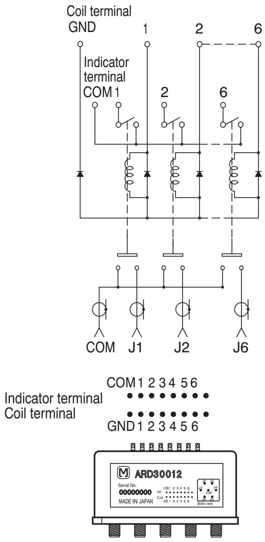
3. SP6T

CAD Data

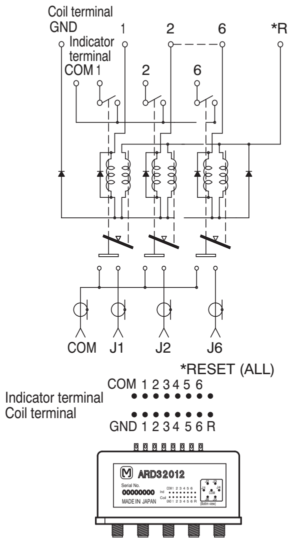


Tolerance: ±0.3 ±.012

Fail-safe type



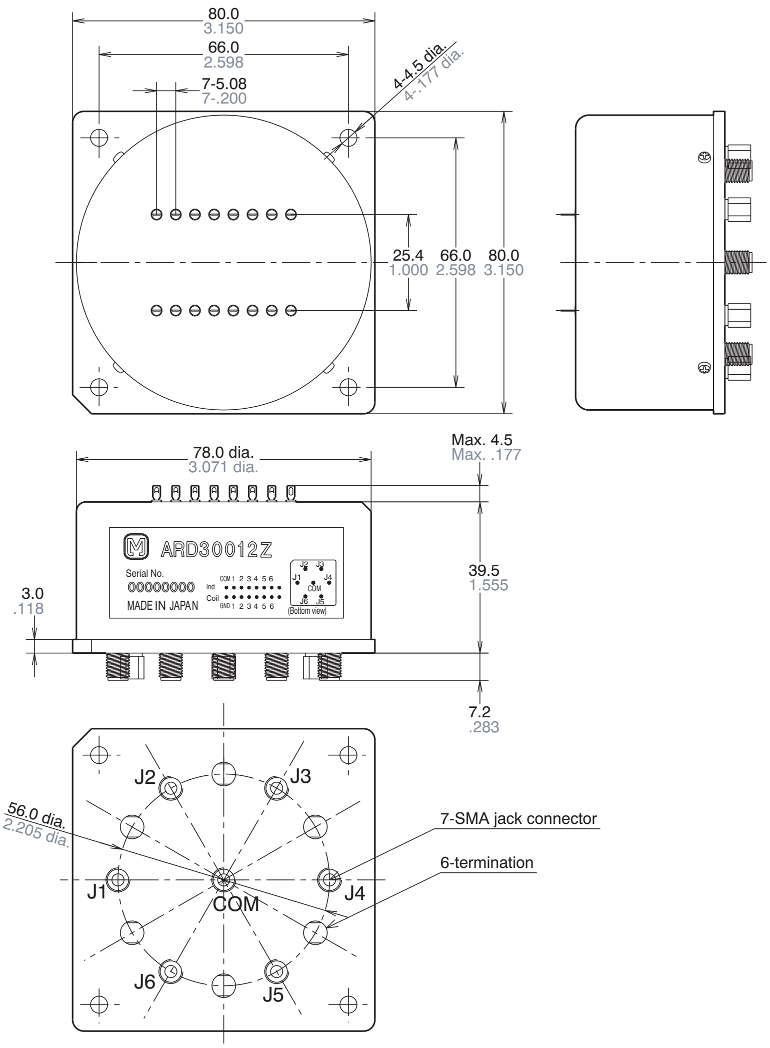
Latching type



∗ + COM type is available.

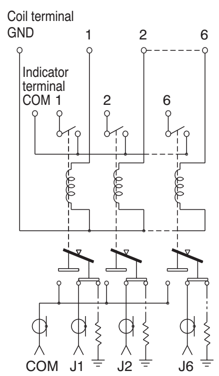
4. SP6T (with termination)

CAD Data

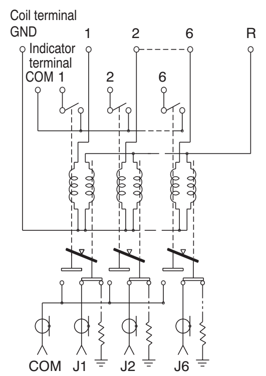


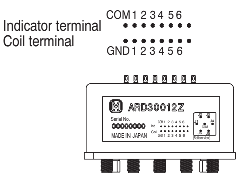
Tolerance: ±0.3 ±.012

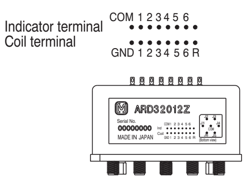
Fail-safe type



Latching type







NOTES

1. For general cautions for use, please refer to the “General Application Guidelines”.

2. Coil operating power

Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%.

However, check it with the actual circuit since the characteristics may be slightly different. The nominal operating voltage should be applied to the coil for more than 50 ms to set/reset the latching type relay.

Please use the latching type for circuits that are continually powered for long periods of time.

3. Coil connection

When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction.

4. Connection of coil indicator and washing conditions

1) The connection of coil indicator terminal shall be done by soldering.

Soldering conditions

Max. 260°C 500°F (solder temp) within 10sec (soldering time)

Max. 350°C 662°F (solder temp) within 3sec (soldering time)

2) This product is not sealed type, therefore washing is not allowed.

5. Conditions for operation, transport and storage conditions

1) Temperature:

–55 to +85°C –67 to +185°F

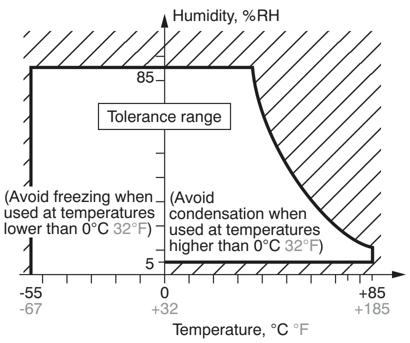
2) Humidity: 5 to 85% RH

(Avoid freezing and condensation.)

The humidity range varies with the temperature. Use within the range indicated in the graph below.

3) Atmospheric pressure: 86 to 106 kPa

Temperature and humidity range for usage, transport, and storage:



4) Condensation

Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.

5) Freezing

Condensation or other moisture may freeze on the relay when the temperature is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.

6) Low temperature, low humidity environments.

The plastic may become brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

6. Other handling precautions

1) The relay’s on/off service life is based on standard test conditions (temperature: 15 to 35°C 59 to 95°F, humidity: 25 to 75%) specified in JIS C5442-1996. Life will depend on many factors of your system: coil drive circuit, type of load, switching intervals, switching phase, ambient conditions, to name a few.

2) Use the relay within specifications such as coil rating, contact rating and on/off service life. If used beyond limits, the relay may overheat, generate smoke or catch fire.

3) Be careful not to drop the relay. If accidentally dropped, carefully check its appearance and characteristics before use.

4) Be careful to wire the relay correctly. Otherwise, malfunction, overheat, fire or other trouble may occur.

5) The latching type relay is shipped in the reset position. But jolts during transport or impacts during installation can move it to the set position. It is, therefore, advisable to build a circuit in which the relay can be initialized (set and reset) just after turning on the power.

6) If a relay stays on in a circuit for many months or years at a time without being activated, circuit design should be reviewed so that the relay can remain non-excited. A coil that receives current all the time heats, which degrades insulation earlier than expected. A latching type relay is recommended for such circuits.

7) For SMA connectors, we recommend a torque of 0.90±0.1 N·m for installation, which falls within the prescribed torque of MIL-C-39012. Please be aware that conditions might be different depending on the connector materials and how it interacts with surrounding materials.

8) Please do not use silicon based substances such as silicon rubber, silicon oil, silicon coatings and silicon fillings, in the vicinity of the relay. Doing so may cause volatile silicon gas to form which may lead to contact failure due to the adherence of silicon on the contacts when they open and close in this atmosphere.

9) Please note that when switching contacts (latching type only), you must apply reset (ALL) voltage and release all contacts first. (SP6T type)

10) Do not use multiple contacts simultaneously. (SP6T type)

11) The indicator terminal is the terminal that indicates the operation status of the MAIN contact.

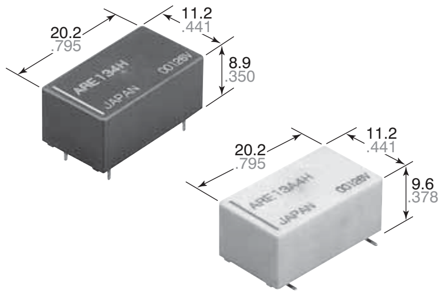
12) For details about the drive method of the latching with TTL driver type, please refer to the RD coaxial switch catalog on the website.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

2.6 GHz SMALL MICROWAVE RELAYS

RE RELAYS (ARE)



mm inch

FEATURES

• Excellent high frequency characteristics (to 2.6GHz)

Type	Frequency	900MHz	2.6GHz
Imped-ance 50Ω	V.S.W.R. (Max.)	1.3	1.7
	Insertion loss (dB, Max.)	0.2	0.7
	Isolation (dB, Min.)	60	30
Imped-ance 75Ω	V.S.W.R. (Max.)	1.2	1.5
	Insertion loss (dB, Max.)	0.2	0.5
	Isolation (dB, Min.)	60	30

• Surface-mount type also available

• Compact and slim size

Size: 20.2(L) × 11.2(W) × 8.9(H)* mm
.795(L) × .441(W) × .350(H) inch
*The height of Surface-mount type is 9.6 mm .378 inch size.

TYPICAL APPLICATIONS

1. Broadcasting and video markets.
- Digital broadcasting market
- STB/tuner market, etc.

2. Communications market
- Antennae switching
- All types of wireless devices

SPECIFICATIONS

Contact

Arrangement			1 Form C
Contact material			Gold plating
Initial contact resistance (By voltage drop 10V DC 10mA)			Max. 100mΩ
Rating	Contact rating		1W (at 2.6 GHz [Impedance 75 Ω, V.S.W.R. Max.1.5] [Impedance 50 Ω, V.S.W.R. Max.1.7]) 10mA 24V DC (resistive load)
	Contact carrying power		10W (at 2.6GHz [Impedance 75 Ω, V.S.W.R. Max.1.5] [Impedance 50 Ω, V.S.W.R. Max.1.7])
	Max. switching voltage		30 V DC
	Max. switching current		0.5 A DC
High frequency characteristics (Impedance 75Ω) (Initial)	V.S.W.R.		Max. 1.2 (to 900MHz) Max. 1.5 (to 2.6GHz)
	Insertion loss		Max. 0.2dB (to 900MHz) Max. 0.5dB (to 2.6GHz)
	Isolation		Min. 60dB (to 900MHz) Min. 30dB (to 2.6GHz)
High frequency characteristics (Impedance 50Ω) (Initial)	V.S.W.R.		Max. 1.3 (to 900MHz) Max. 1.7 (to 2.6GHz)
	Insertion loss		Max. 0.2dB (to 900MHz) Max. 0.7dB (to 2.6GHz)
	Isolation		Min. 60dB (to 900MHz) Min. 30dB (to 2.6GHz)
Expected life (min. operations)	Mechanical (at 180 cpm)		10^6
	Electri-cal	1W, 2.6GHz, [Impedance 50Ω, V.S.W.R. & 1.7] [Impedance 75Ω, V.S.W.R. & 1.5]	3×10^5
		10mA 24V DC (resistive load) (at 20cpm)	3×10^5

Coil (at 20°C, 68°F)

Nominal operating power	200 mW

Characteristics

Initial insulation resistance*1		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	500 Vrms
	Between contact and coil	1,000 Vrms
	Between contact and ground terminal	500 Vrms
Operate time*3 (at 20°C)		Max. 10ms
Release time (without diode)*3 (at 20°C)		Max. 5ms
Temperature rise (at 20°C)*4		Max. 60°C
Shock resistance	Functional*5	Min. 500 m/s²{50 G}
	Destructive*6	Min. 1,000 m/s²{100 G}
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to 70°C –40°F to 158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 5 g .18 oz

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Nominal operating voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil: Contact carrying power: 10W, at 2.6GHz, [Impedance 75Ω, V.S.W.R. & 1.5] [Impedance 50Ω, V.S.W.R. & 1.7]
*5 Half-wave pulse of sine wave: 11ms, detection time: 10µs.
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10µs
*8 Refer to 5. Conditions for operation, transport and storage conditions in NOTES (Page 414).

ORDERING INFORMATION

Ex. ARE [1] [ ] [ ] [ ][ ] [ ]

Contact arrangement	Operating function	Terminal shape	Coil voltage (DC)	Packing style
1: 1 Form C	0: Single side stable type (Impedance 50Ω) 3: Single side stable type (Impedance 75Ω)	Nil: Standard PC board terminal A: Surface-mount terminal	03: 3 V 4H: 4.5 V 06: 6 V 09: 9 V 12: 12 V 24: 24 V	Nil: Carton packing (Standard PC board terminal only) Tube packing (Surface-mount terminal only) Z: Tape and reel packing (picked from 12/13/14 pin side)

Note: Tape and reel packing symbol "-Z" is not marked on the relay.
"X" type tape and reel packing (picked from 8/9/10/11/12/13/14-pin side) is also available.
Suffix "X" instead of "Z".

TYPES AND COIL DATA (at 20°C 68°F)

• Single side stable type (Impedance 50Ω)
• Packing of standard PC board terminal: 50 pcs. in an inner package (carton); 500 pcs. in an outer package.
• Packing of surface-mount terminal: 25 pcs. in an inner package (tube); 200 pcs. in an outer package.
• Packing of surface-mount terminal: 400 pcs. in an inner package (tape and reel); 800 pcs. in an outer package.

Standard PC board terminal	Surface-mount terminal	Nominal coil voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C 140°F)
ARE1003	ARE10A03	3	2.25	0.3	45	66.7	200	3.3
ARE104H	ARE10A4H	4.5	3.375	0.45	101	44.4	200	4.95
ARE1006	ARE10A06	6	4.5	0.6	180	33.3	200	6.6
ARE1009	ARE10A09	9	6.75	0.9	405	22.2	200	9.9
ARE1012	ARE10A12	12	9	1.2	720	16.7	200	13.2
ARE1024	ARE10A24	24	18	2.4	2,880	8.3	200	26.4

• Single side stable type (Impedance 75Ω)
• Packing of standard PC board terminal: 50 pcs. in an inner package (carton); 500 pcs. in an outer package.
• Packing of surface-mount terminal: 25 pcs. in an inner package (tube); 200 pcs. in an outer package.
• Packing of surface-mount terminal: 400 pcs. in an inner package (tape and reel); 800 pcs. in an outer package.

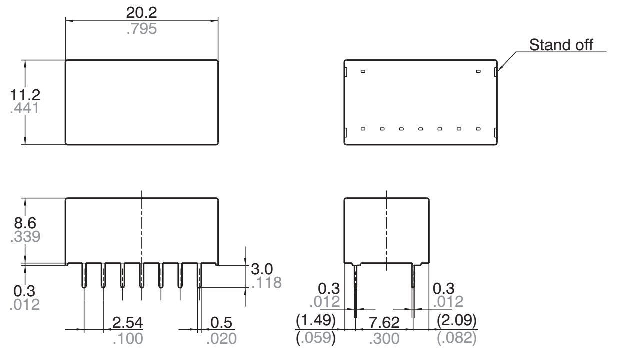
Standard PC board terminal	Surface-mount terminal	Nominal coil voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C 140°F)
ARE1303	ARE13A03	3	2.25	0.3	45	66.7	200	3.3
ARE134H	ARE13A4H	4.5	3.375	0.45	101	44.4	200	4.95
ARE1306	ARE13A06	6	4.5	0.6	180	33.3	200	6.6
ARE1309	ARE13A09	9	6.75	0.9	405	22.2	200	9.9
ARE1312	ARE13A12	12	9	1.2	720	16.7	200	13.2
ARE1324	ARE13A24	24	18	2.4	2,880	8.3	200	26.4

DIMENSIONS mm inch

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

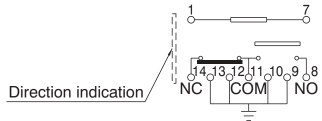
1. Standard PC board terminal (50Ω , 75Ω type)

CAD Data



General tolerance: ±0.3 ±.012

Schematic (Bottom view)



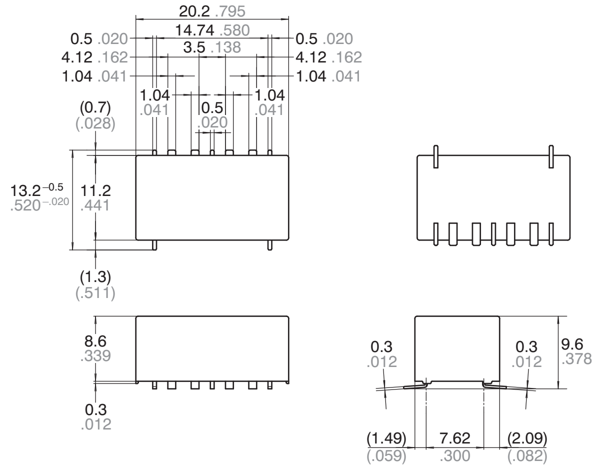
(Deenergized condition)

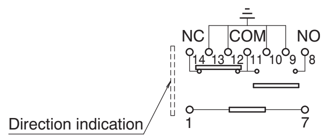
2. Surface mount terminal

mm inch

CAD Data

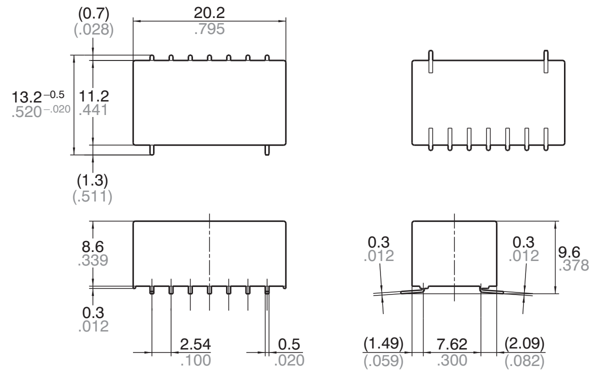
• 50Ω type

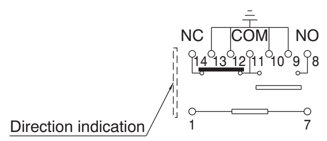




General tolerance: ±0.3 ±.012

• 75Ω type



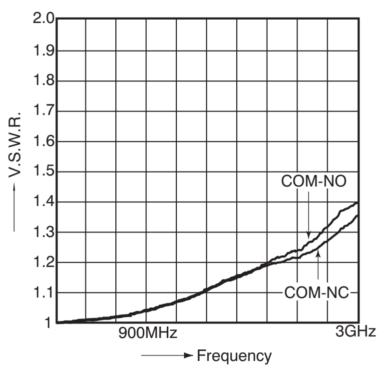


General tolerance: ±0.3 ±.012

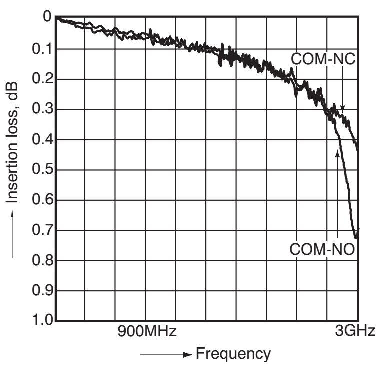
REFERENCE DATA

1-(1). High frequency characteristics (Impedance 75Ω) (Standard PC board terminal)

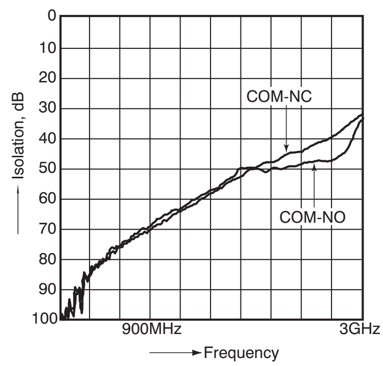
• V.S.W.R. characteristics



• Insertion loss characteristics



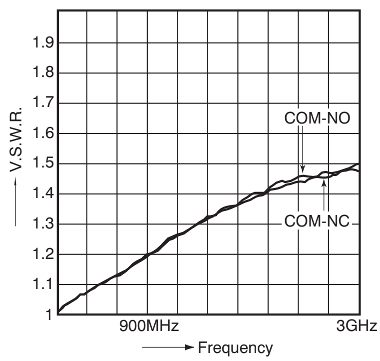
• Isolation characteristics



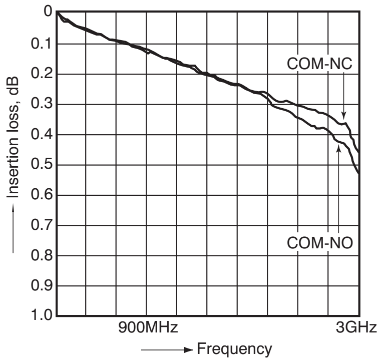
High-Frequency

1-(2). High frequency characteristics (Impedance 50Ω) (Standard PC board terminal)

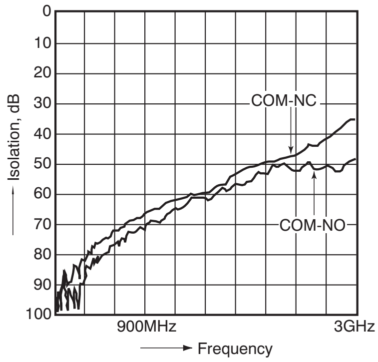
• V.S.W.R. characteristics



• Insertion loss characteristics



• Isolation characteristics



NOTES

1. Coil operating power

Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%.
However, check it with the actual circuit since the characteristics may be slightly different.

2. Cleaning

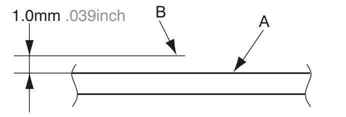
For automatic cleaning, the boiling method is recommended. Avoid ultrasonic cleaning which subjects the relays to high frequency vibrations, which may cause the contacts to stick.
It is recommended that alcoholic solvents be used.

3. Soldering

1) The manual soldering shall be performed under following condition.
Max. 260°C 500°F 10s
Max. 350°C 662°F 3s
The affect of the PCB on the relay will differ depending on the type of PCB used. Please verify the type of PCB to be used.
Preheat according to the following conditions.

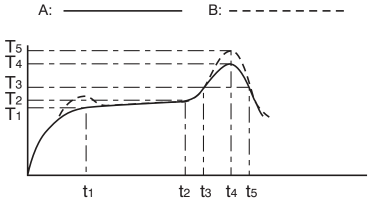
Temperature	120°C 248°F or less
Time	Within 2 minute

Soldering should be done at 260±5°C 500±9°F within 6 s.
2) In case of automatic soldering, the following conditions should be observed (Surface-mount terminal)
(1) Position of measuring temperature



A: Surface of PC board where relay is mounted.
B: Above the PC board surface.

(2) IR (infrared reflow) soldering method



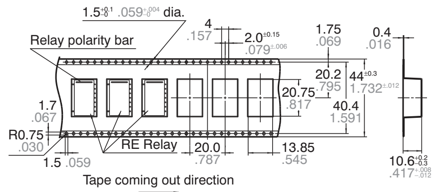
T_1=150°C 302°F
T_2=160°C 320°F
T_3=183°C 361°F
T_4=245°C 473°F
T_5=270°C 518°F

$t_2 - t_1$ = 80 to 120 s
$t_5 - t_3$ = 30 to 40 s
t_4 = 170 to 190 s

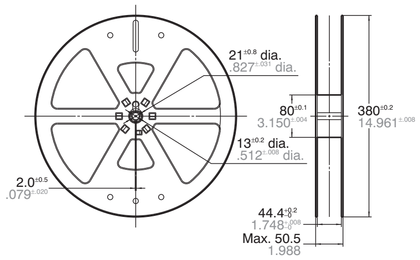
Temperature rise of relay itself may vary according to the mounting level or the heating method of reflow equipment. Therefore, please set the temperature of soldering portion of relay terminal and the top surface of the relay case not to exceed the above mentioned soldering condition.
It is recommended to check the temperature rise of each portion under actual mounting condition before use.

4. Packing style

1) Tape dimensions

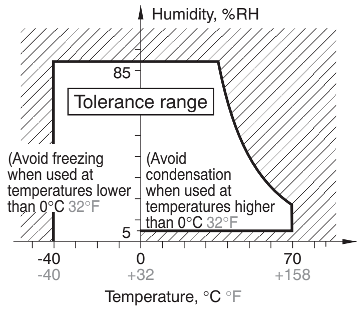


2) Dimensions of plastic reel



5. Conditions for operation, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature:
–40 to +70°C –40 to +158°F
(2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage:



2) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
3) Freezing
Condensation or other moisture may freeze on the relay when the temperature is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
4) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

Panasonic
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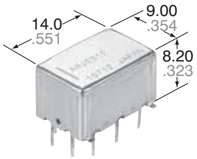
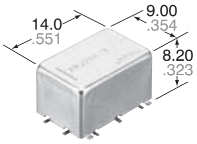
UP TO 8GHz
SMALL MICROWAVE
RELAYS

RJ RELAYS (ARJ)





FEATURES

- **Excellent high frequency characteristics (50Ω, at 5GHz)**
V.S.W.R.: Max. 1.25
Insertion loss: Max. 0.5dB
Isolation: Min. 35dB
(Between open contacts)
Min. 30dB
(Between contact sets)
- **Surface mount terminal**
Surface mount terminals are now standard so there is much less work in designing PC boards.
- **Small size**
Size: 14.00 (L)×9.00 (W)×8.20 (H) mm
.551 (L)×.354 (W)×.323 (H) inch

TYPICAL APPLICATIONS

Measuring equipment market
Attenuator circuits, spectrum analyzer, oscilloscope
Mobile telecommunication market
IMT2000, microwave communication
Medical instrument market

SPECIFICATIONS

Contact

Arrangement			2 Form C
Contact material			Gold plating
Initial contact resistance (By voltage drop 10V DC 10mA)			Max. 150mΩ
Rating	Contact rating		1W (at 5 GHz, Impedance 50 Ω, V.S.W.R. &1.25) 10mA 10V DC (resistive load)
	Contact carrying power		1W (at 5 GHz, Impedance 50 Ω, V.S.W.R. &1.25)
	Max. switching voltage		30 V DC
	Max. switching current		0.3 A DC
High frequency characteristics (Initial) (~5GHz, Impedance 50Ω)	V.S.W.R.		Max. 1.25
	Insertion loss (without D.U.T. board's loss)		Max. 0.5dB
	Isolation	Between open contacts	Min. 35dB
		Between contact sets	Min. 30dB
	Input power		1W (at 5GHz, impedance 50Ω, V.S.W.R. &1.25, at 20°C)
Expected life (min. operations)	Mechanical (at 180 cpm)		10^7
	Electrical (at 20cpm)	1W, at 5GHz, V.S.W.R. & 1.25	10^6
		10mA 10V DC (resistive load)	10^6

Coil (at 20°C, 68°F)

	Nominal operating power
Single side stable	200 mW
2 coil latching	150 mW

Characteristics

Initial insulation resistance*1		Min. 500 MΩ (at 500 V DC)
Initial breakdown voltage*2 for 1 min.	Between open contacts	500 Vrms
	Between contact sets	500 Vrms
	Between contact and coil	500 Vrms
	Between coil and earth terminal	500 Vrms
	Between contact and earth terminal	500 Vrms
Operate time [Set time]*3 (at 20°C)		Max. 5ms [Max. 5 ms]
Release time (without diode)[Reset time]*3 (at 20°C)		Max. 5ms [Max. 5 ms]
Temperature rise (at 20°C)*4		Max. 50°C
Shock resistance	Functional*5	Min. 500 m/s²
	Destructive*6	Min. 1,000 m/s²
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–30°C to 70°C –22°F to 158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 3 g .11 oz

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Nominal operating voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil, 5GHz, V.S.W.R. & 1.25
*5 Half-wave pulse of sine wave: 6ms, detection time: 10µs.
*6 Pulse of sine wave: 11ms.
*7 Detection time: 10µs
*8 Refer to 6. Conditions for operation, transport and storage conditions in NOTES (Page 418).

ORDERING INFORMATION

Ex. ARJ 2 ☐ ☐ ☐ ☐

Contact arrangement	Operating function	Terminal shape	Coil voltage (DC)	Packing style
2: 2 Form C	0: Single side stable 2: 2 coil latching	Nil: Standard PC board terminal A: Surface-mount terminal	03 : 3V 4H: 4.5V 12 : 12V 24 : 24V	Nil: Carton packing X: Tape end reel packing (picked from 1/2/3-pin side) Z: Tape and reel packing (picked from 6/7/8-pin side)

Note: Tape and reel packing symbol "-Z" is not marked on the relay. "X" type tape and reel packing (picked from 1/2/3-pin side) is also available. Suffix "X" instead of "Z".

TYPES AND COIL DATA (at 20°C 68°F)

1. Standard PC board terminal

• Packing of standard PC board terminal: 50 pcs. in an inner package (carton); 500 pcs. in an outer package

Operating function	Coil Rating, V DC	Part No. Standard PC board terminal	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 70°C 158°F)
Single side stable	3	ARJ2003	2.25	0.3	66.6	45	200	3.3
	4.5	ARJ204H	3.375	0.45	44.4	101.2	200	4.95
	12	ARJ2012	9	1.2	16.6	720	200	13.2
	24	ARJ2024	18	2.4	8.3	2,880	200	26.4

Operating function	Coil Rating, V DC	Part No. Standard PC board terminal	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 70°C 158°F)
2 coil latching	3	ARJ2203	2.25	2.25	50	60	150	3.3
	4.5	ARJ224H	3.375	3.375	33.3	135	150	4.95
	12	ARJ2212	9	9	12.5	960	150	13.2
	24	ARJ2224	18	18	6.3	3,840	150	26.4

2. Surface-mount terminal

• Packing of surface-mount terminal: 50 pcs. in an inner package (carton); 500 pcs. in an outer package
• Packing of surface-mount terminal: 500 pcs. in an inner package (tape and reel); 500 pcs. in an outer package

Operating function	Coil Rating, V DC	Part No. Carton packing	Part No. Tape and reel packing	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 70°C 158°F)
Single side stable	3	ARJ20A03	ARJ20A03Z	2.25	0.3	66.6	45	200	3.3
	4.5	ARJ20A4H	ARJ20A4HZ	3.375	0.45	44.4	101.2	200	4.95
	12	ARJ20A12	ARJ20A12Z	9	1.2	16.6	720	200	13.2
	24	ARJ20A24	ARJ20A24Z	18	2.4	8.3	2,880	200	26.4

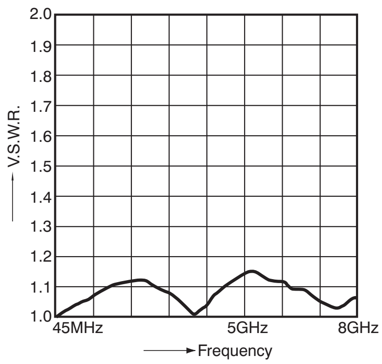
Operating function	Coil Rating, V DC	Part No. Carton packing	Part No. Tape and reel packing	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 70°C 158°F)
2 coil latching	3	ARJ22A03	ARJ22A03Z	2.25	2.25	50	60	150	3.3
	4.5	ARJ22A4H	ARJ22A4HZ	3.375	3.375	33.3	135	150	4.95
	12	ARJ22A12	ARJ22A12Z	9	9	12.5	960	150	13.2
	24	ARJ22A24	ARJ22A24Z	18	18	6.3	3,840	150	26.4

REFERENCE DATA

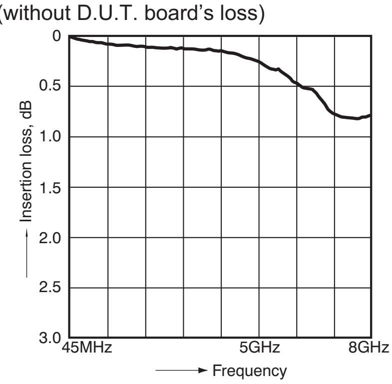
1. High frequency characteristics

Sample: ARJ20A12
Measuring method: Measured with MEW PC board by HP network analyzer (HP8510C).

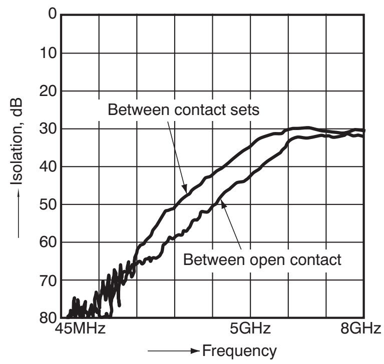
• V.S.W.R. characteristics



• Insertion loss characteristics (without D.U.T. board's loss)



• Isolation characteristics

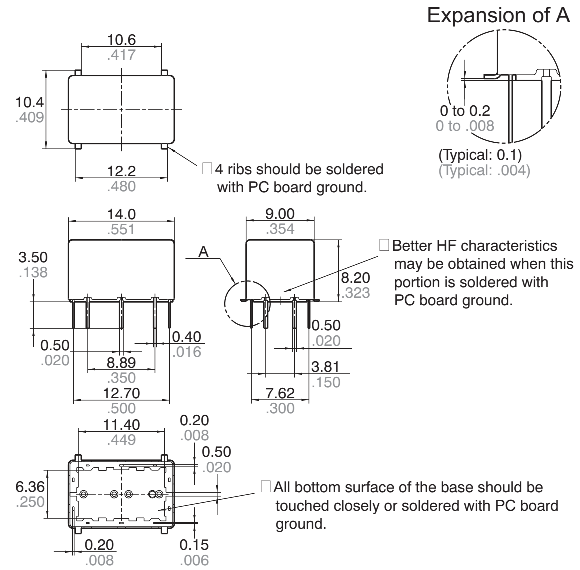


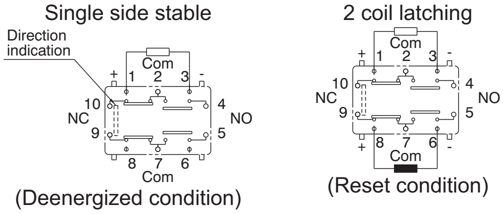
DIMENSIONS mm inch

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. Standard PC board terminal

CAD Data

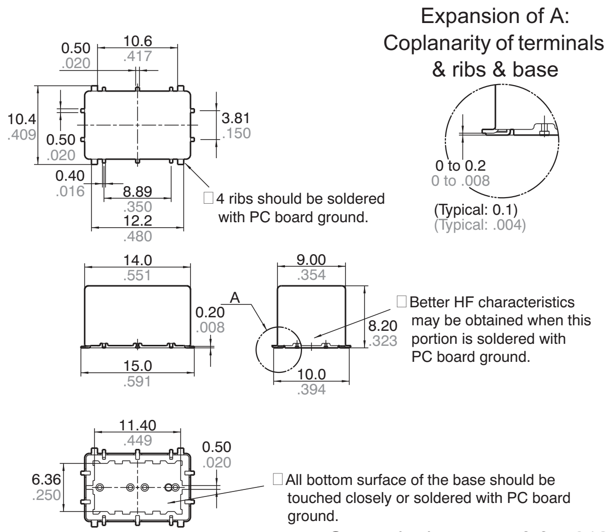


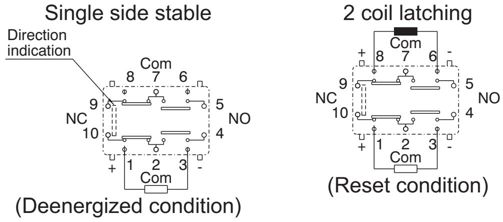


General tolerance: ±0.3 ±.012

2. Surface mount terminal

CAD Data





General tolerance: ±0.3 ±.012

High-Frequency

NOTES

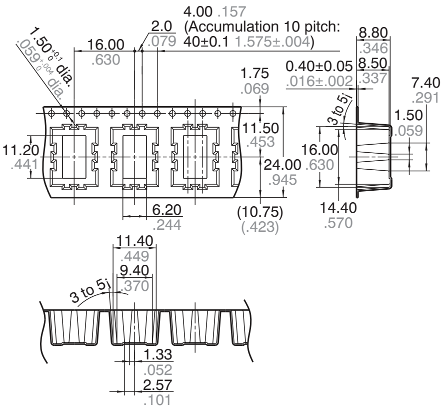
1. Coil operating power
Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%.
However, check it with the actual circuit since the characteristics may be slightly different. The nominal operating voltage should be applied to the coil for more than 20 ms to set/reset the latching type relay.

2. Coil connection
When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction.

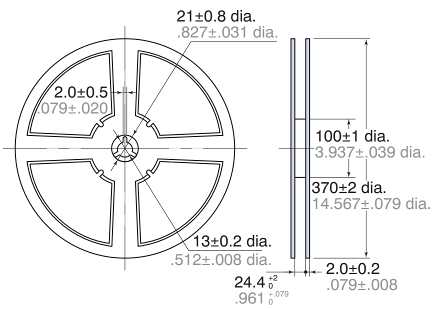
3. External magnetic field
Since RJ relays are highly sensitive polarized relays, their characteristics will be affected by a strong external magnetic field. Avoid using the relay under that condition.

4. Cleaning
For automatic cleaning, the boiling method is recommended. Avoid ultrasonic cleaning which subjects the relays to high frequency vibrations, which may cause the contacts to stick.
It is recommended that alcoholic solvents be used.

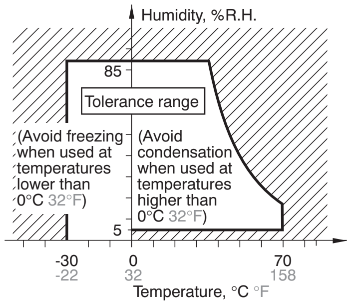
5. Tape and reel packing
1) Tape dimensions



2) Dimensions of plastic reel

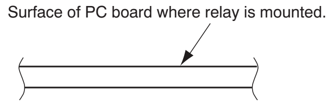


6. Conditions for operation, transport and storage conditions
1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature:
–30 to +70°C –22 to +158°F
(However, tolerance range is –30 to +60°C –22 to +140°F if package is carried as is.)
(2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage:

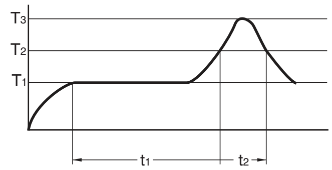


2) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
3) Freezing
Condensation or other moisture may freeze on the relay when the temperature is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
4) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.
5) Storage procedures for surface-mount terminal types
Since the relay is very sensitive to humidity, it is packed in humidity-free, hermetically sealed packaging. When storing the relay, be careful of the following points:
(1) Be sure to use the relay immediately after removing it from its sealed package.
(2) When storing the relay for long periods of time after removing it from its sealed package, we recommend using a humidity-free bag with silica gel to prevent subjecting the relay to humidity. Furthermore, if the relay is solder mounted when it has been subjected to excessive humidity, cracks and leaks can occur. Be sure to mount the relay under the required mounting conditions.

7. Soldering
1) Surface-mount terminal
In case of automatic soldering, the following conditions should be observed
(1) Position of measuring temperature



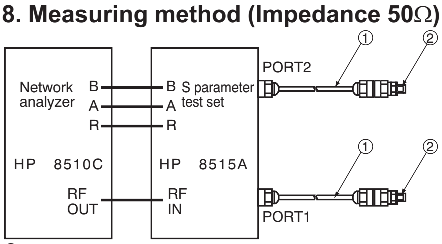
(2) IR (infrared reflow) soldering method



T_1 = 150 to 180C 302 to 356F
T_2 = 230C 446F and higher
T_3 = Within 250C 482F
t_1 = 60 to 120 sec.
t_2 = Within 30 sec.

Temperature rise of relay itself may vary according to the mounting level or the heating method of reflow equipment. Therefore, please set the temperature of soldering portion of relay terminal and the top surface of the relay case not to exceed the above mentioned soldering condition.
It is recommended to check the temperature rise of each portion under actual mounting condition before use.
2) Standard PC board terminal
Please meet the following conditions if this relay is to be automatically soldered.
(1) Preheating: Max. 120°C 248°F (terminal solder surface) for max. 120 seconds
(2) Soldering: Max. 260±5°C 500±9°F for max. 6 seconds
The effect on the relay depends on the actual substrate used. Please verify the substrate to be used.
Moisture-proof packaging enables RJ relay’s standard PCB type capable for reflow soldering.
Please contact us in the case of reflow soldering considerations.
3) Hand soldering
Please meet the following conditions if this relay is to be soldered by hand.
(1) Wattage: 30 to 60 W
(2) Tip temperature/time: 280 to 300°C 536 to 572°F for max. 5 seconds
The effect on the relay depends on the actual substrate used. Please verify the substrate to be used.
4) Avoid high frequency cleaning since this may adversely affect relay characteristics. Use alcohol-based cleaning solutions when cleaning relays.

8. Measuring method (Impedance 50Ω)



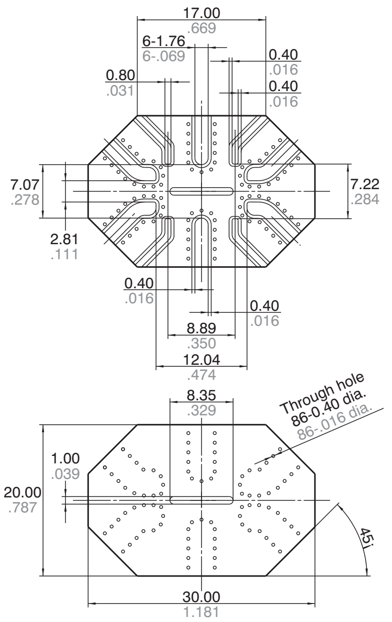
Connector

No.	Product name	Contents
1	HP 85131-60013	3.5 mm testport, Extension cable
2	HP 83059	3.5 mm coaxial adaptor

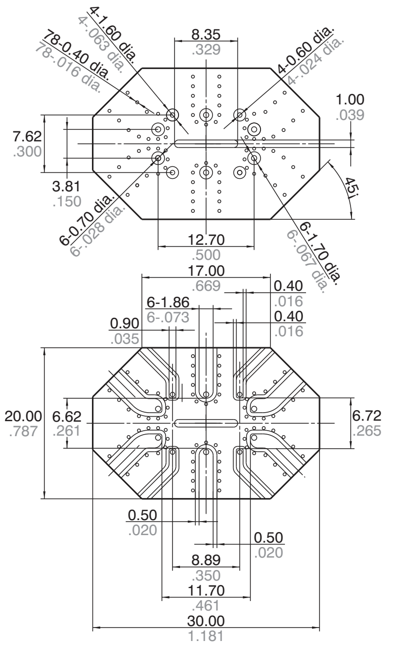
(Step 1) Calibrate the test system with HP calibration kit [HP85052B]
(Step 2) After calibration, connect the D.U.T. board and measure. Connect 50 Ω terminals on connectors other than those for measurement.

Notes)
1. All bottom surface of the base should be touched closely or soldered with PC board ground.
2. 4 ribs should be soldered with PC board ground.

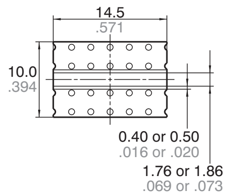
Measuring board
1) Dimensions
<Surface mount terminal>



<Standard PC board terminal>



<Calibration board>



2) Material: Glass PTFE double-sided through hole PC board R-4737 (Matsushita Electric Works)
3) Board thickness: t = 0.8 mm
4) Copper plating: 18μm
• Connector (SMA type receptacle)
Product name: R125 510 (RADIALL)
Insertion loss compensation
The insertion loss of relay itself is given by subtracting the insertion loss of short-circuit the Com and the NC (or NO). (signal path and two connectors)

9. Others

1) The switching lifetime is defined under the standard test condition specified in the JIS* C 5442-1996 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.
Also, be especially careful of loads such as those listed below.
• When used for AC load-operating and the operating phase is synchronous.
Rocking and fusing can easily occur due to contact shifting.
• High-frequency load-operating
When high-frequency opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.
Three countermeasures for these are listed here.
(1) Incorporate an arc-extinguishing circuit.
(2) Lower the operating frequency
(3) Lower the ambient humidity
2) Use the relay within specifications such as coil rating, contact rating and on/off service life. If used beyond limits, the relay may overheat, generate smoke or catch fire.
3) Be careful not to drop the relay. If accidentally dropped, carefully check its appearance and characteristics before use.
4) Be careful to wire the relay correctly. Otherwise, malfunction, overheat, fire or other trouble may occur.
5) If a relay stays on in a circuit for many months or years at a time without being activated, circuit design should be reviewed so that the relay can remain non-excited. A coil that receives current all the time heats, which degrades insulation earlier than expected. A latching type relay is recommended for such circuits.
6) The latching type relay is shipped in the reset position. But jolts during transport or impacts during installation can change the reset position. It is, therefore, advisable to build a circuit in which the relay can be initialized (set and reset) just after turning on the power.
7) If silicone materials (e.g., silicone rubbers, silicone oils, silicone coating agents, silicone sealers) are used in the vicinity of the relay, the gas emitted from the silicone may adhere to the contacts of the relay during opening and closing and lead to improper contact. If this is the case, use a material other than silicone.
8) We recommend latching type when using in applications which involve lengthy duty cycles.
* Japanese Industrial Standards

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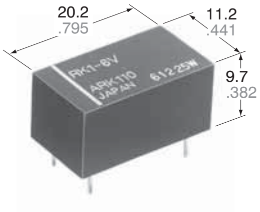
1.5 GHz MICROWAVE RELAYS

RK RELAYS



mm inch

FEATURES

1.Excellent high frequency characteristics

Impedance 50Ω (Initial)	V.S.W.R. (Max.)	1.5 (at 900 MHz)
	Insertion loss (dB. Max.)	0.3 (at 900 MHz)
	Isolation (dB. Min.)	60 (at 1.5 GHz)
Impedance 75Ω (Initial)	V.S.W.R. (Max.)	1.2 (at 900 MHz)
	Insertion loss (dB. Max.)	0.2 (at 900 MHz)
	Isolation (dB. Min.)	60 (at 1.5 GHz)

2.High sensitivity in small size
Size: 20.2 × 11.2 × 9.7 mm
.795 × .441 × .382 inch
Nominal power consumption:
200 mW (single side stable type)

3.Sealed construction for automatic cleaning

4.Reversed contact types and latching types are also available

TYPICAL APPLICATIONS

- **Audio visual equipment**
  Broadcast satellite tuners VCRs, CATVs, TVs
- **Communication equipment**
  Automobile telephones, maritime telephones, emergency and disaster prevention communications, PCM switches
- **Instrumentation**
  Testing equipment, measuring equipment

SPECIFICATIONS

Contact

Arrangement			1 Form C
Contact material	Stationary		Gold plating
	Movable		Gold clad
Initial contact resistance, max. (By voltage drop 10V DC 10mA)			100 mΩ
Rating	Max. switching power		10 W
	Max. switching voltage		30 V DC
	Max. switching current		0.5 A
	Nominal switching capacity		0.01 A 24 V DC 10 W (at 1.2 GHz, Impedance 50Ω)
High frequency characteristics (Impedance 50Ω) (Initial)	V.S.W.R.		Max. 1.5 (at 900 MHz)
	Insertion loss		Max. 0.3 dB (at 900 MHz)
	Isolation		Min. 60 dB (at 1.5 GHz)
High frequency characteristics (Impedance 75Ω) (Initial)	V.S.W.R.		Max. 1.2 (at 900 MHz)
	Insertion loss		Max. 0.2 dB (at 900 MHz)
	Isolation		Min. 60 dB (at 1.5 GHz)
Expected life (min. operations)	Mechanical		5×10^6
	Electrical	0.01 A 24 V DC	3×10^5
		10 W 1.2 GHz	10^5

Coil (at 25°C, 68°F)

	Nominal operating power
Single side stable	200 mW
1 coil latching	200 mW
2 coil latching	400 mW

Characteristics

Initial insulation resistance*1		Min. 100 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	500 Vrms
	Between contact and coil	1,000 Vrms
	Between contact and earth terminal	500 Vrms
Operate time [Set time]*3 (at nominal voltage)		Max. 10 ms (Approx. 6 ms) [Max. 10 ms [Approx. 5ms]]
Release time (without diode) [Reset time]*3 (at nominal voltage)*2		Max. 6 ms (Approx. 3 ms) [Max. 10 ms [Approx. 5ms]]
Temperature rise		Max. 60°C with nominal coil voltage across coil and at nominal switching capacity
Shock resistance	Functional*4	Min. 196 m/s² {20 G}
	Destructive*5	Min. 980 m/s² {100 G}
Vibration resistance	Functional*6	10 to 55 Hz at double amplitude of 3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to 70°C –40°F to 158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 4.4 g .155 oz

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms, detection time: 10µs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10µs
*7 Refer to 5. Conditions for operation, transport and storage conditions in NOTES (Page 424).

ORDERING INFORMATION

Ex. RK [1] — [L2] — [24V]

Contact arrangement	Operating function	Coil voltage, DC
1: Standard contact type 1R: Reversed contact type (See Schematic on next page.)	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	3, 4.5, 5, 6, 9, 12, 24 V

Note: No part number distinguishment on impedance in RK relays.
Standard packing; Carton: 50 pcs. Case 500 pcs.

TYPES AND COIL DATA (at 20°C 68°F)

• Single side stable type

• 50 pcs. in an inner package (carton); 500 pcs. in an outer package

Part No.		Nominal coil voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Maximum. allowable voltage, V DC (at 60°C 140°F)
Standard type	Reversed type							
RK1-3V	RK1R-3V	3	2.25	0.3	45	66.7	200	3.3
RK1-4.5V	RK1R-4.5V	4.5	3.38	0.45	101	44.4	200	4.95
RK1-5V	RK1R-5V	5	3.75	0.5	125	40.7	200	5.5
RK1-6V	RK1R-6V	6	4.5	0.6	180	33.3	200	6.6
RK1-9V	RK1R-9V	9	6.75	0.9	405	22.2	200	9.9
RK1-12V	RK1R-12V	12	9	1.2	720	16.7	200	13.2
RK1-24V	RK1R-24V	24	18	2.4	2,880	8.3	200	26.4

• 1 coil latching type

• 50 pcs. in an inner package (carton); 500 pcs. in an outer package

Part No.		Nominal coil voltage, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Maximum. allowable voltage, V DC (at 60°C 140°F)
Standard type	Reversed type							
RK1-L-3V	RK1R-L-3V	3	2.25	2.25	45	66.7	200	3.3
RK1-L-4.5V	RK1R-L-4.5V	4.5	3.38	3.38	101	44.4	200	4.95
RK1-L-5V	RK1R-L-5V	5	3.75	3.75	125	40	200	5.5
RK1-L-6V	RK1R-L-6V	6	4.5	4.5	180	33.3	200	6.6
RK1-L-9V	RK1R-L-9V	9	6.75	6.75	405	22.2	200	9.9
RK1-L-12V	RK1R-L-12V	12	9	9	720	16.7	200	13.2
RK1-L-24V	RK1R-L-24V	24	18	18	2,880	8.3	200	26.4

• 2 coil latching type

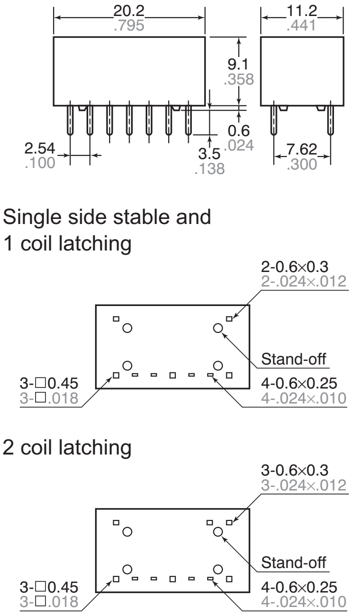
• 50 pcs. in an inner package (carton); 500 pcs. in an outer package

Part No.		Nominal coil voltage, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Maximum. allowable voltage, V DC (at 60°C 140°F)
Standard type	Reversed type							
RK1-L2-3V	RK1R-L2-3V	3	2.25	2.25	22.5	133.3	400	3.3
RK1-L2-4.5V	RK1R-L2-4.5V	4.5	3.38	3.38	50.6	88.9	400	4.95
RK1-L2-5V	RK1R-L2-5V	5	3.75	3.75	62.5	80	400	5.5
RK1-L2-6V	RK1R-L2-6V	6	4.5	4.5	90	66.7	400	6.6
RK1-L2-9V	RK1R-L2-9V	9	6.75	6.75	202.5	44.4	400	9.9
RK1-L2-12V	RK1R-L2-12V	12	9	9	360	33.3	400	13.2
RK1-L2-24V	RK1R-L2-24V	24	18	18	1,440	16.7	400	26.4

DIMENSIONS mm inch

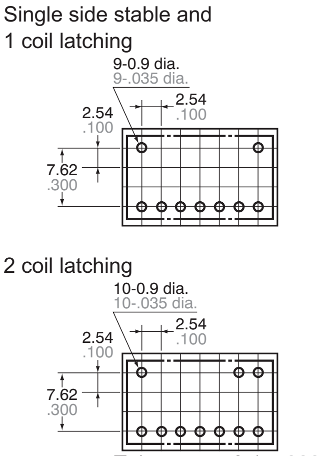
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data



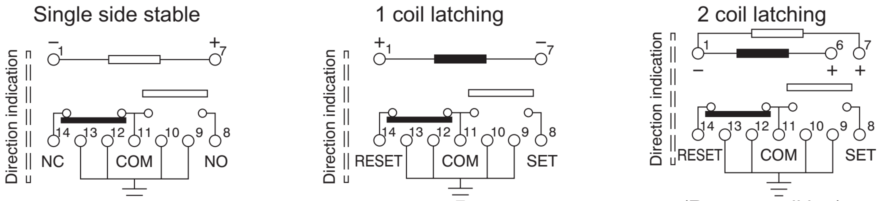
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.003

Schematic (Bottom view)



(Deenergized condition) (Reset condition) (Reset condition)

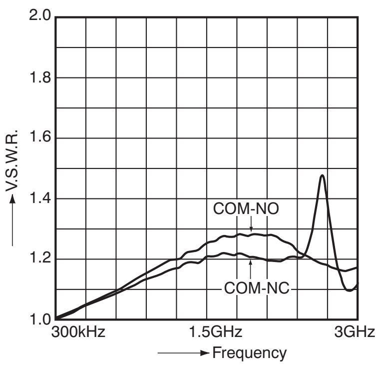
REFERENCE DATA

1.-(1) High frequency characteristics (Impedance 75Ω)

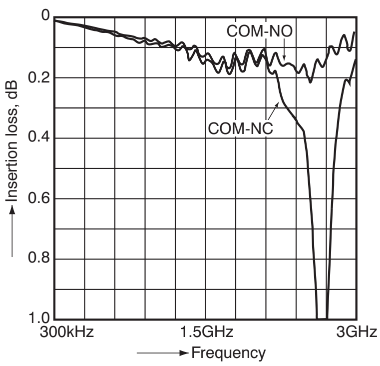
Sample: RK1-12V

Measuring method: Measured with HP network analyzer (HP8753C)

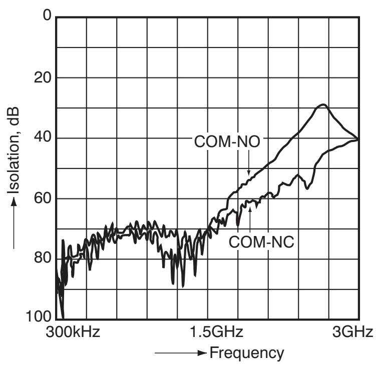
• V.S.W.R. characteristics



• Insertion loss characteristics



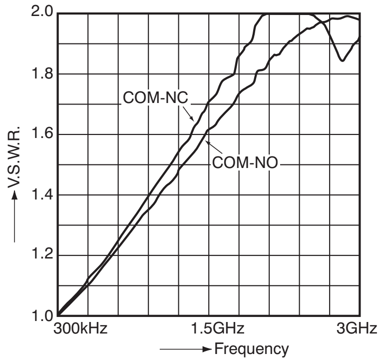
• Isolation characteristics



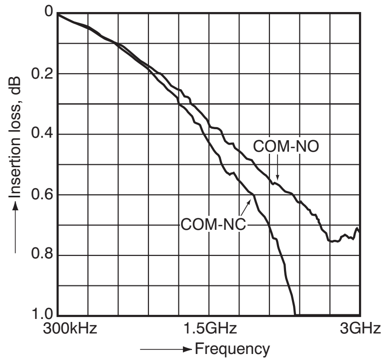
1.-(2) High frequency characteristics (Impedance 50Ω)

Sample: RK1-5V
Measuring method: Measured with HP network analyzer (HP8753C)

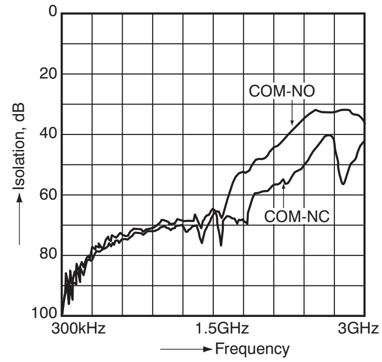
• V.S.W.R. characteristics



• Insertion loss characteristics

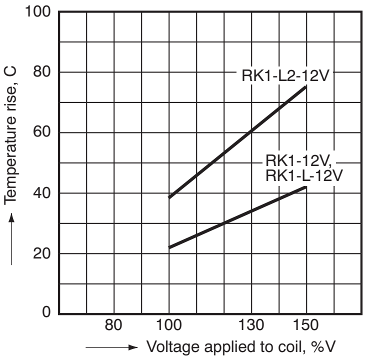


• Isolation characteristics



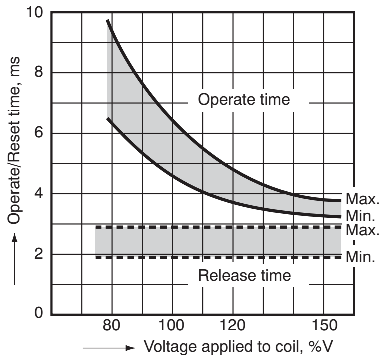
2. Coil temperature rise

Sample: RK1-12V, RK1-L-12V, RK1-L2-12V
No. of samples: n = 6
Carrying current: 10 mA
Ambient temperature: 25°C 77°F



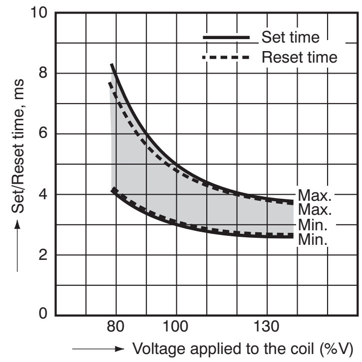
3.-(1) Operate/Release time (Single side stable)

Sample: RK1-12V; No. of samples: n = 6



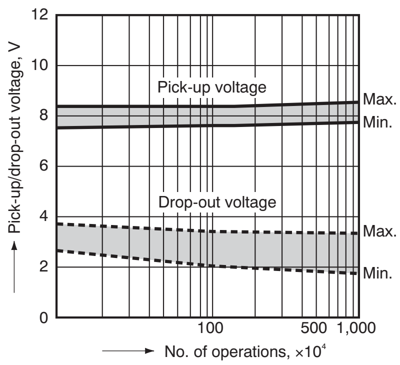
3.-(2) Set/Reset time (Latching)

Sample: RK1-L-12V, RK1-L2-12V
No. of samples: n = 12



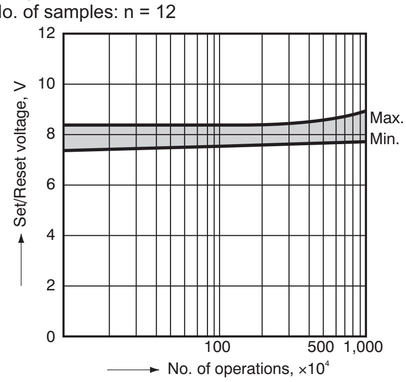
4.-(1) Mechanical life test (Single side stable)

Sample: RK1-12V; No. of samples: n = 12



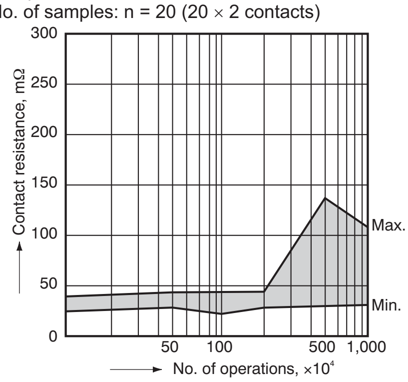
4.-(2) Mechanical life test (Latching)

Sample: RK1-L2-12V
No. of samples: n = 12



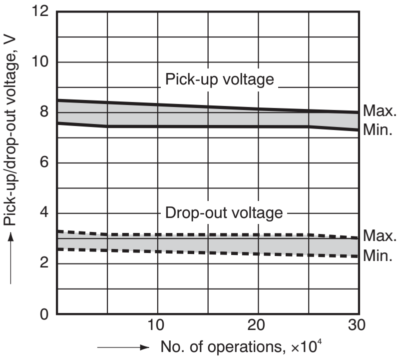
4.-(3) Mechanical life test

Sample: RK1-12V
No. of samples: n = 20 (20 × 2 contacts)

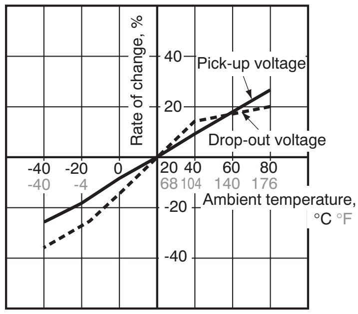


High-Frequency

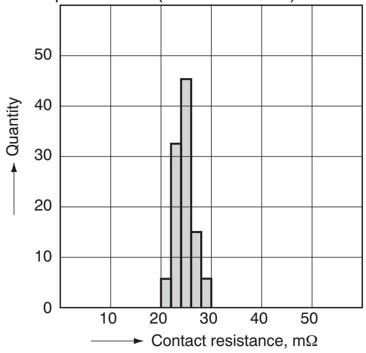
5. Electrical life test (0.01 A 24 V DC)
Sample: RK1-12V; No. of samples: n = 6



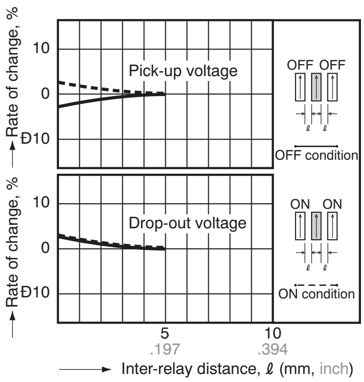
6. Ambient temperature characteristics
Sample: RK1-12V; No. of samples: n = 6



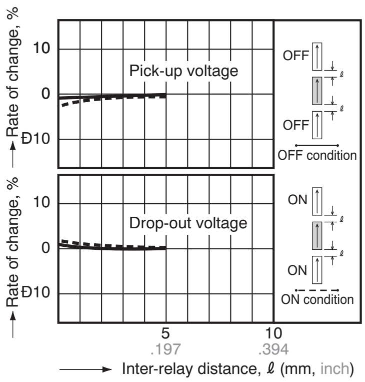
7. Contact resistance distribution (initial)
Sample: RK1-12V
No. of samples: n = 50 (50 × 2 contacts)



8.-(1) Influence of adjacent mounting
Sample: RK1-12V; No. of sample: n = 10



8.-(2) Influence of adjacent mounting
Sample: RK1-12V; No. of samples: n = 10



NOTES

1. Coil operating power
Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%.
However, check it with the actual circuit since the characteristics may be slightly different. The nominal operating voltage should be applied to the coil for more than 20 ms to set/reset the latching type relay.

2. Coil connection
When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction.

3. External magnetic field
Since RK relays are highly sensitive polarized relays, their characteristics will be affected by a strong external magnetic field. Avoid using the relay under that condition.

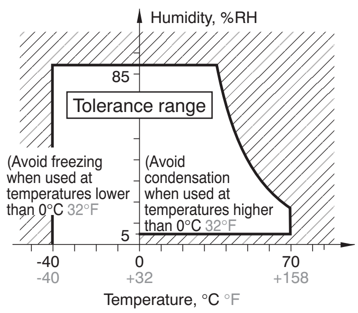
4. Soldering and cleaning
1) Perform manual soldering under the conditions below.
• Within 10 s at 260°C 500°F
• Within 3 s at 350°C 662°F
Preheat according to the following conditions.

Temperature	120°C 248°F or less
Time	Within 2 minute

Soldering should be done at 260±5°C 500±9°F within 6 s.

2) For automatic cleaning, the boiling method is recommended. Avoid ultrasonic cleaning which subjects the relays to high frequency vibrations, which may cause the contacts to stick. It is recommended that alcoholic solvents be used.

5. Conditions for operation, transport and storage conditions
1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature:
–40 to +70°C –40 to +158°F
(2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage:



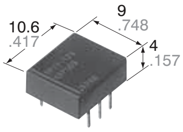
2) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
3) Freezing
Condensation or other moisture may freeze on the relay when the temperature is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
4) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

6. Latching relay
In order to assure proper operating regardless of changes in the ambient usage temperature and usage conditions, nominal operating voltage should be applied to the coil for more than 30 ms to set/reset the latching type relay.

Panasonic
ideas for life

LOW PROFILE
HIGH FREQUENCY RELAY

RP RELAYS



mm inch

FEATURES

1. High frequency relay with the low profile of 4 mm .157 inch
2. Excellent high frequency characteristics
- Isolation: Min. 10dB (at 1.8 GHz)
- Insertion loss: Max. 1.0dB (at 1.8 GHz)
- V.S.W.R.: Max. 1.3 (at 1.8 GHz)

3. High sensitivity in small size
Size: 10.6 × 9 × 4 mm
.417 × .354 × .157 inch
Nominal operating power: 140 mW

4. Utilizes tube package for automatic mounting.
5. Self-clinching terminal also available

TYPICAL APPLICATIONS

- Antenna switching of mobile phone
- Switching signal of measuring equipment
- All types of compact wireless devices

SPECIFICATIONS

Contact

Arrangement		1 Form C
Contact material	Stationary	Ag + Au clad
	Movable	AgPd
Initial contact resistance, max. (By voltage drop 6 V DC 0.1 A)		50 mΩ
Rating	Nominal switching capacity	0.1 A 30 V DC Contact switching power: 1 W (Max. 1.8 GHz); Contact carrying power: 3 W (Max. 1.2 GHz) 1 W (Max. 1.8 GHz)
High frequency characteristics (Impedance 50Ω) (Initial)	V.S.W.R.	Max. 1.2 (at 1 GHz) Max. 1.3 (at 1.8 GHz)
	Insertion loss	Max. 0.5 dB (at 1 GHz) Max. 1 dB (at 1.8 GHz)
	Isolation	Min. 15 dB (at 1 GHz) Min. 10 dB (at 1.8 GHz)
Expected life (min. operations)	Mechanical (at 180 cpm)	5×10⁶
	Electrical (at 20 cpm)	10⁵ (0.1 A 30 V DC resistive load)
		10⁵ (1 W at 1.8 GHz; V.S.W.R.: max. 1.3)

Coil (at 25C, 68F)

Voltage type	Nominal operating power
1.5 to 12 V DC	140 mW
24 V DC	270 mW

Characteristics

Max. operating speed (at rated load)		20 cpm
Initial insulation resistance*1		Min. 1,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	750 Vrms for 1 min.
	Between contacts and coil	1,500 Vrms for 1 min.
Operate time*3 (at nominal voltage)		Max. 3 ms (Approx. 1.5 ms)
Release time(without diode)*3 (at nominal voltage)		Max. 2 ms (Approx. 1 ms)
Temperature rise		Max. 50Cwith nominal coil voltage across coil and at nominal switching capacity
Shock resistance	Functional*4	Min. 500 m/s² {50 G}
	Destructive*5	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*6	10 to 55 Hz at double amplitude of 3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	Ð40C to 70C Ð40F to 158F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 1 g .04 oz

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as ÒInitial breakdown voltageÓ section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms, detection time: 10µs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10µs
*7 Refer to 7. Conditions for operation, transport and storage conditions in NOTES at the back of this data sheet.

ORDERING INFORMATION

Ex. RP 1 — □ — □ — □

Contact arrangement	Operating function	Terminal shape	Coil voltage (DC)
1: 1 Form C	Nil: Single side stable	Nil: Standard PC board terminal H: Self-clinching terminal	1.5, 3, 4.5, 5, 6, 9, 12, 24 V

Note: Standard packing; Carton: 50 pcs. Case 1,000 pcs.

TYPES ANE COIL DATA (at 20°C 68°F)

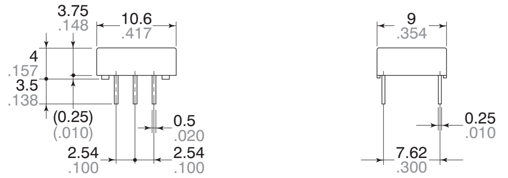
Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Maximum. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
RP1-1.5V	RP1-H-1.5V	1.5	1.125	0.15	93.8	16	140	2.25
RP1-3V	RP1-H-3V	3	2.25	0.3	46.7	64.3	140	4.5
RP1-4.5V	RP1-H-4.5V	4.5	3.375	0.45	31.1	145	140	6.75
RP1-5V	RP1-H-5V	5	3.75	0.5	28	178	140	7.5
RP1-6V	RP1-H-6V	6	4.5	0.6	23.3	257	140	9
RP1-9V	RP1-H-9V	9	6.75	0.9	15.6	579	140	13.5
RP1-12V	RP1-H-12V	12	9	1.2	11.7	1,028	140	18
RP1-24V	RP1-H-24V	24	18	2.4	11.3	2,133	270	28.8

DIMENSIONS mm inch

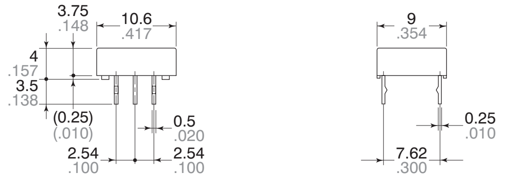
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data

Standard PC board terminal

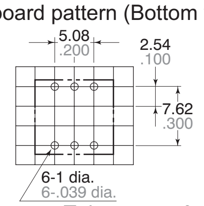


Self-clinching terminal



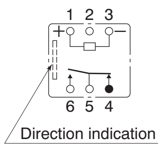
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

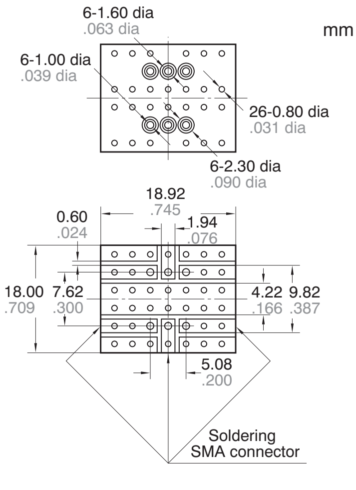


Deenergized condition

REFERENCE DATA

1. High frequency characteristics

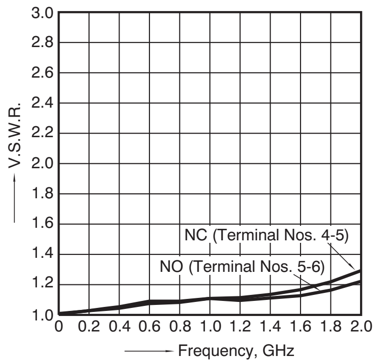
Sample: RP1-6V
Measuring method: Impedance 50¾
Measuring tool:



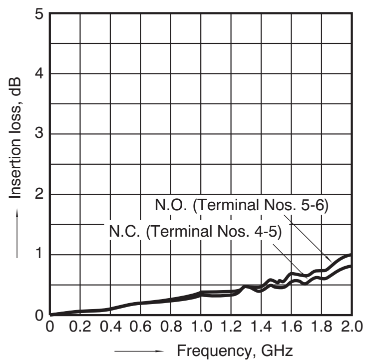
mm inch

PC board
- Double-sided through hole
- Material: Glass-epoxy resin
- t = 1.0mm .039 inch
- Copper plated thickness: 35 μm

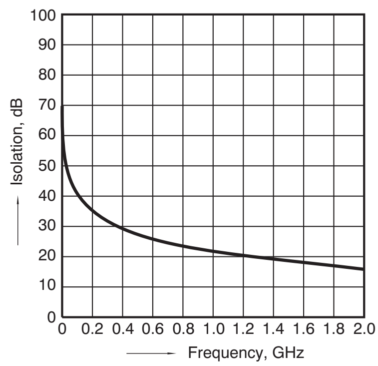
• V.S.W.R



• Insertion loss

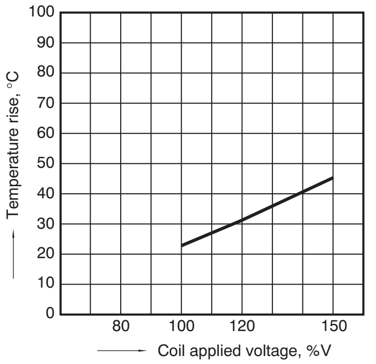


• Isolation



2. Coil temperature rise

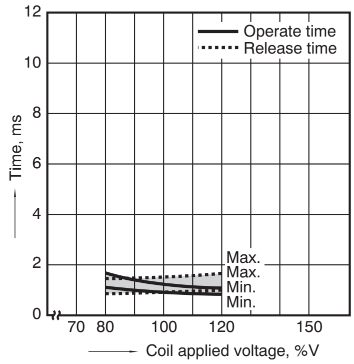
Sample: RP1-6V; No. of samples: n = 5
Carrying current: 0.1 A
Ambient temperature: 25°C 77°F



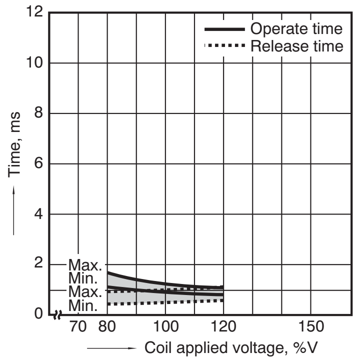
3. Operate/release time

Sample: RP1-9V; No. of samples: n = 50

• With diode



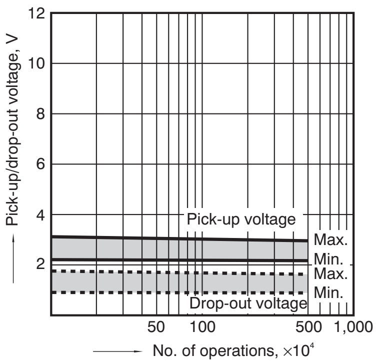
• Without diode



4. Mechanical life

Sample: RP1-5V; No. of samples: n = 8

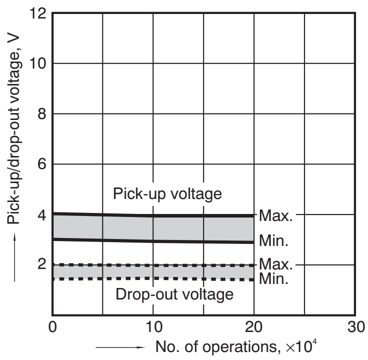
• Change of pick-up, drop-out voltage



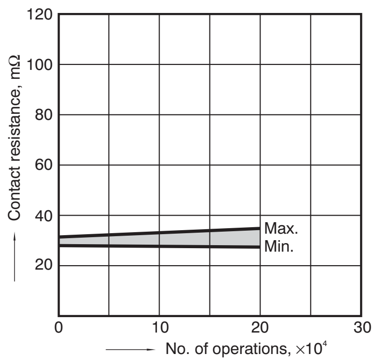
5. Electrical life (0.1 A 30 V DC)

Sample: RP1-6V; No. of samples: n = 6

• Change of pick-up/drop-out voltage

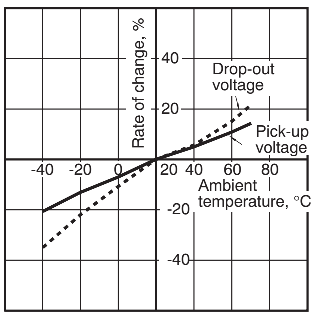


• Change of contact resistance



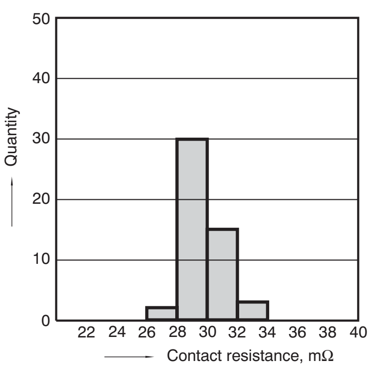
6. Ambient temperature characteristics

Sample: RP1-6V; No. of samples: n = 5

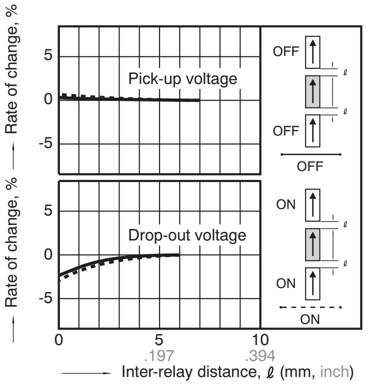


7. Contact resistance distribution (initial)

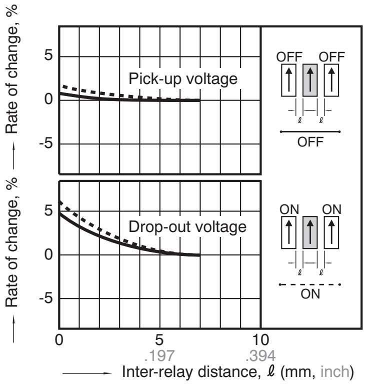
Sample: RP1-12V; No. of samples: n = 25



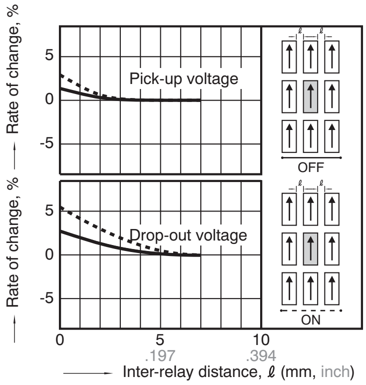
8.-(1) Influence of adjacent mounting
Sample: RP1-12V; No. of samples: n = 6



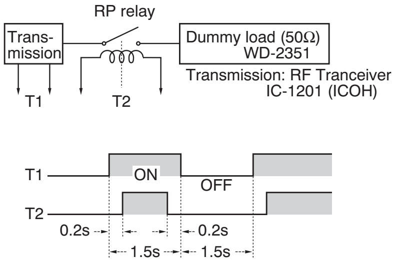
8.-(2) Influence of adjacent mounting
Sample: RP1-12V; No. of samples: n = 6



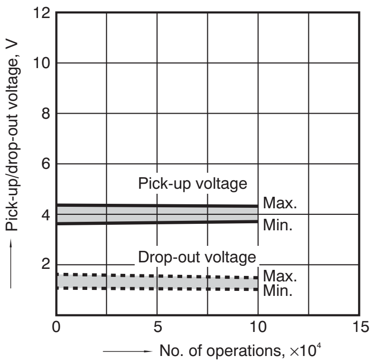
8.-(3) Influence of adjacent mounting
Sample: RP1-12V; No. of samples: n = 6



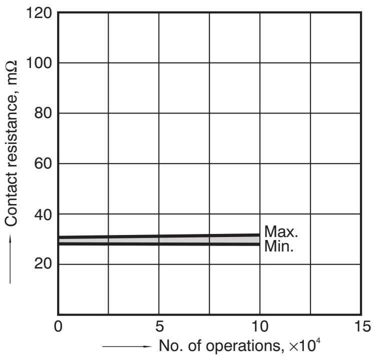
9. High frequency switching test (1.2 GHz, 1 W)
Sample: RP1-6V; No. of samples: n = 6
Ambient temperature: 20°C 68°F



• Change of pick-up/drop-out voltage



• Change of contact resistance



NOTES

1. Coil operating power

Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%.

However, check it with the actual circuit since the characteristics may be slightly different. The nominal operating voltage should be applied to the coil for more than 20 ms to set/reset the latching type relay.

2. Coil connection

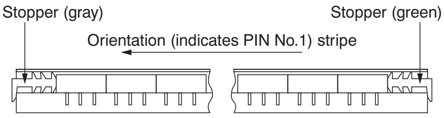
When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction.

3. External magnetic field

Since RP relays are highly sensitive polarized relays, their characteristics will be affected by a strong external magnetic field. Avoid using the relay under that condition.

4. Packing direction

Relays are packed in a tube with the orientation stripe (PIN NO. 1) toward the green stopper.



5. Automatic mounting

To maintain the internal function of the relay, the chucking pressure should not exceed the values below.

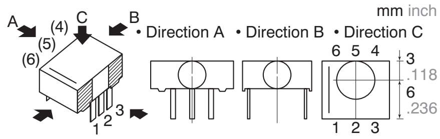
Chucking pressure* in the direction A:
4.9 N {500 gf} or less

Chucking pressure* in the direction B:
9.8 N {1 kgf} or less

Chucking pressure* in the direction C:
9.8 N {1 kgf} or less

Please chuck the portion.

Avoid chucking the center of the relay. In addition, excessive chucking pressure to the pinpoint of the relay should be avoided.



*Value of chucking pressure is shown by the value of weight pressed on the portion (4 mm .157 inch dia.).

6. Soldering

Preheat according to the following conditions.

Temperature	120°C 248°F or less
Time	Within 2 minute

Soldering should be done at 260±5°C 500±9°F within 6 s.

1) Perform manual soldering under the conditions below.

• Within 10 s at 260°C 500°F
• Within 3 s at 350°C 662°F

7. Conditions for operation, transport and storage conditions

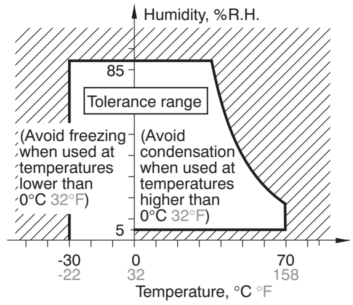
1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:

(1) Temperature:
–40 to +70°C –40 to +158°F

(2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.

(3) Atmospheric pressure: 86 to 106 kPa

Temperature and humidity range for usage, transport, and storage:



2) Condensation

Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.

3) Freezing

Condensation or other moisture may freeze on the relay when the temperature is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.

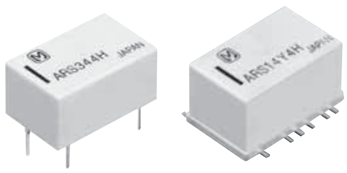
4) Low temperature, low humidity environments

The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

Panasonic
ideas for life

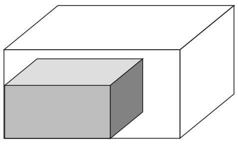
3 GHz MICROWAVE RELAYS
Miniature size
Lineup includes
50/75Ω type

RS RELAYS (ARS)



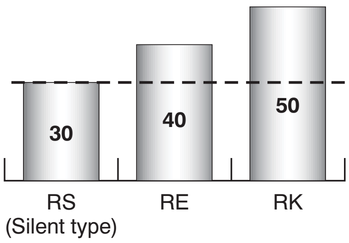
FEATURES

1. Super miniature design
14 × 8.6 × 7.2 mm .551 × .339 × .283 inch
(standard PC board terminal)



60% OFF in volume
(Compared to
RK relay)

2. Lineup includes silent type.
(75Ω type only)
Operation noise (Unit: dB)



3. Excellent high frequency characteristics

• Impedance: 50Ω
(Standard PC board terminal)

Frequency	to 900 MHz	to 3 GHz
V. S. W. R. (Max.)	1.20	1.40
Insertion loss (dB, Max.)	0.10	0.35
Isolation (dB, Min.)	60	35

• Impedance: 75Ω
(Standard PC board terminal)

Frequency	to 900 MHz	to 3 GHz
V. S. W. R. (Max.)	1.15	1.40
Insertion loss (dB, Max.)	0.10	0.30
Isolation (dB, Min.)	60	30

• Impedance: 50Ω
(Surface-mount terminal)

Frequency	to 900 MHz	to 3 GHz
V. S. W. R. (Max.)	1.20	1.40
Insertion loss (dB, Max.)	0.20	0.40
Isolation (dB, Min.)	55	30

• Impedance: 75Ω
(Surface-mount terminal)

Frequency	to 900 MHz	to 3 GHz
V. S. W. R. (Max.)	1.20	1.50
Insertion loss (dB, Max.)	0.20	0.50
Isolation (dB, Min.)	55	30

4. Lineup includes surface-mount terminal type
E and Y layouts available.

5. Lineup includes reversed contact type
Great design freedom is possible using reversed contact type in which the positions of the N.O. and N.C. contacts are switched.

TYPICAL APPLICATIONS

1. Broadcasting and video equipment markets
• Digital broadcasting equipment
• STB/tuner, etc.

2. Mobile phone base stations

3. Communications market
• Antenna switching
• All types of wireless devices

4. Measurement equipment market
• Spectrum analyzer and oscilloscope, etc.

ORDERING INFORMATION

ARS ☐ ☐ ☐ ☐☐ ☐

RS relays

Contact arrangement
1: Standard contact type (1 Form C)
3: Reversed contact type (1 Form C)

Operating function
0: Single side stable standard type (Impedance: 75Ω)
1: 1 coil latching type (Impedance: 75Ω)
2: 2 coil latching type (Impedance: 75Ω)
3: Single side stable silent type (Impedance: 75Ω)
4: Single side stable type (Impedance: 50Ω)
5: 1 coil latching type (Impedance: 50Ω)
6: 2 coil latching type (Impedance: 50Ω)

Nil: Standard PC board terminal
A: Surface-mount terminal, E layout
Y: Surface-mount terminal, Y layout

Coil voltage, DC
03: 3 V 4H: 4.5 V 09: 9 V 12: 12 V 24: 24 V

Packing style
Nil: Carton packing (Standard PC board terminal only)
Tube packing (Surface-mount terminal only)
X: Tape and reel packing (picked from 2-pin side) (Surface-mount terminal only)
Z: Tape and reel packing (picked from 18-pin side) (Surface-mount terminal only)

TYPES

1. Standard PC board terminal and standard contact type

Impedance	Nominal coil voltage	Part No.		
		Single side stable type	1 coil latching type	2 coil latching type
50Ω	3 V DC	ARS1403	ARS1503	ARS1603
	4.5 V DC	ARS144H	ARS154H	ARS164H
	9 V DC	ARS1409	ARS1509	ARS1609
	12 V DC	ARS1412	ARS1512	ARS1612
	24 V DC	ARS1424	ARS1524	ARS1624

Impedance	Nominal coil voltage	Part No.			
		Standard type			Silent type
		Single side stable type	1 coil latching type	2 coil latching type	Single side stable type
75Ω	3 V DC	ARS1003	ARS1103	ARS1203	ARS1303
	4.5 V DC	ARS104H	ARS114H	ARS124H	ARS134H
	9 V DC	ARS1009	ARS1109	ARS1209	ARS1309
	12 V DC	ARS1012	ARS1112	ARS1212	ARS1312
	24 V DC	ARS1024	ARS1124	ARS1224	ARS1324

Standard packing: 50 pcs. in an inner package; 500 pcs. in an outer package

2. Standard PC board terminal and reversed contact type

Impedance	Nominal coil voltage	Part No.		
		Single side stable type	1 coil latching type	2 coil latching type
50Ω	3 V DC	ARS3403	ARS3503	ARS3603
	4.5 V DC	ARS344H	ARS354H	ARS364H
	9 V DC	ARS3409	ARS3509	ARS3609
	12 V DC	ARS3412	ARS3512	ARS3612
	24 V DC	ARS3424	ARS3524	ARS3624

Impedance	Nominal coil voltage	Part No.			
		Standard type			Silent type
		Single side stable type	1 coil latching type	2 coil latching type	Single side stable type
75Ω	3 V DC	ARS3003	ARS3103	ARS3203	ARS3303
	4.5 V DC	ARS304H	ARS314H	ARS324H	ARS334H
	9 V DC	ARS3009	ARS3109	ARS3209	ARS3309
	12 V DC	ARS3012	ARS3112	ARS3212	ARS3312
	24 V DC	ARS3024	ARS3124	ARS3224	ARS3324

Standard packing: 50 pcs. in an inner package; 500 pcs. in an outer package

3. Surface-mount terminal and standard contact type, E layout

Impedance	Nominal coil voltage	Part No.		
		Single side stable type	1 coil latching type	2 coil latching type
50Ω	3 V DC	ARS14A03❑	ARS15A03❑	ARS16A03❑
	4.5 V DC	ARS14A4H❑	ARS15A4H❑	ARS16A4H❑
	9 V DC	ARS14A09❑	ARS15A09❑	ARS16A09❑
	12 V DC	ARS14A12❑	ARS15A12❑	ARS16A12❑
	24 V DC	ARS14A24❑	ARS15A24❑	ARS16A24❑
75Ω	3 V DC	ARS10A03❑	ARS11A03❑	ARS12A03❑
	4.5 V DC	ARS10A4H❑	ARS11A4H❑	ARS12A4H❑
	9 V DC	ARS10A09❑	ARS11A09❑	ARS12A09❑
	12 V DC	ARS10A12❑	ARS11A12❑	ARS12A12❑
	24 V DC	ARS10A24❑	ARS11A24❑	ARS12A24❑

Standard packing: 40 pcs. in an inner package (tube); 1,000 pcs. in an outer package
Standard packing: 500 pcs. in an inner package (tape and reel); 500 pcs. in an outer package
Note: The box at the end of a part number shows where packing type is indicated. If there is no indication, tube packing will be used.
If “X” or “Z” is added, tape and reel packing will be used. Example: ARS14A03 (tube packing), ARS14A03X (tape and reel packing)

4. Surface-mount terminal and standard contact type, Y layout

Impedance	Nominal coil voltage	Part No.		
		Single side stable type	1 coil latching type	2 coil latching type
50Ω	3 V DC	ARS14Y03❑	ARS15Y03❑	ARS16Y03❑
	4.5 V DC	ARS14Y4H❑	ARS15Y4H❑	ARS16Y4H❑
	9 V DC	ARS14Y09❑	ARS15Y09❑	ARS16Y09❑
	12 V DC	ARS14Y12❑	ARS15Y12❑	ARS16Y12❑
	24 V DC	ARS14Y24❑	ARS15Y24❑	ARS16Y24❑
75Ω	3 V DC	ARS10Y03❑	ARS11Y03❑	ARS12Y03❑
	4.5 V DC	ARS10Y4H❑	ARS11Y4H❑	ARS12Y4H❑
	9 V DC	ARS10Y09❑	ARS11Y09❑	ARS12Y09❑
	12 V DC	ARS10Y12❑	ARS11Y12❑	ARS12Y12❑
	24 V DC	ARS10Y24❑	ARS11Y24❑	ARS12Y24❑

Standard packing: 40 pcs. in an inner package (tube); 1,000 pcs. in an outer package
Standard packing: 500 pcs. in an inner package (tape and reel); 500 pcs. in an outer package
Note: The box at the end of a part number shows where packing type is indicated. If there is no indication, tube packing will be used.
If “X” or “Z” is added, tape and reel packing will be used. Example: ARS14Y03 (tube packing), ARS14Y03X (tape and reel packing)

5. Surface-mount terminal and reversed contact type, E layout

Impedance	Nominal coil voltage	Part No.		
		Single side stable type	1 coil latching type	2 coil latching type
50Ω	3 V DC	ARS34A03❑	ARS35A03❑	ARS36A03❑
	4.5 V DC	ARS34A4H❑	ARS35A4H❑	ARS36A4H❑
	9 V DC	ARS34A09❑	ARS35A09❑	ARS36A09❑
	12 V DC	ARS34A12❑	ARS35A12❑	ARS36A12❑
	24 V DC	ARS34A24❑	ARS35A24❑	ARS36A24❑
75Ω	3 V DC	ARS30A03❑	ARS31A03❑	ARS32A03❑
	4.5 V DC	ARS30A4H❑	ARS31A4H❑	ARS32A4H❑
	9 V DC	ARS30A09❑	ARS31A09❑	ARS32A09❑
	12 V DC	ARS30A12❑	ARS31A12❑	ARS32A12❑
	24 V DC	ARS30A24❑	ARS31A24❑	ARS32A24❑

Standard packing: 40 pcs. in an inner package (tube); 1,000 pcs. in an outer package
Standard packing: 500 pcs. in an inner package (tape and reel); 500 pcs. in an outer package
Note: The box at the end of a part number shows where packing type is indicated. If there is no indication, tube packing will be used.
If “X” or “Z” is added, tape and reel packing will be used. Example: ARS34A03 (tube packing), ARS34A03X (tape and reel packing)

6. Surface-mount terminal and reversed contact type, Y layout

Impedance	Nominal coil voltage	Part No.		
		Single side stable type	1 coil latching type	2 coil latching type
50Ω	3 V DC	ARS34Y03❑	ARS35Y03❑	ARS36Y03❑
	4.5 V DC	ARS34Y4H❑	ARS35Y4H❑	ARS36Y4H❑
	9 V DC	ARS34Y09❑	ARS35Y09❑	ARS36Y09❑
	12 V DC	ARS34Y12❑	ARS35Y12❑	ARS36Y12❑
	24 V DC	ARS34Y24❑	ARS35Y24❑	ARS36Y24❑
75Ω	3 V DC	ARS30Y03❑	ARS31Y03❑	ARS32Y03❑
	4.5 V DC	ARS30Y4H❑	ARS31Y4H❑	ARS32Y4H❑
	9 V DC	ARS30Y09❑	ARS31Y09❑	ARS32Y09❑
	12 V DC	ARS30Y12❑	ARS31Y12❑	ARS32Y12❑
	24 V DC	ARS30Y24❑	ARS31Y24❑	ARS32Y24❑

Standard packing: 40 pcs. in an inner package (tube); 1,000 pcs. in an outer package
Standard packing: 500 pcs. in an inner package (tape and reel); 500 pcs. in an outer package
Note: The box at the end of a part number shows where packing type is indicated. If there is no indication, tube packing will be used.
If “X” or “Z” is added, tape and reel packing will be used. Example: ARS34Y03 (tube packing), ARS34Y03X (tape and reel packing)

RATING

1. Coil data

1) Single side stable type

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 60°C 140°F)
3 V DC	75%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	66.7 mA	45 Ω	200 mW	110%V or less of nominal voltage
4.5 V DC			44.4 mA	101.3Ω		
9 V DC			22.2 mA	405 Ω		
12 V DC			16.7 mA	720 Ω		
24 V DC			8.3 mA	2,880 Ω		

2) 1 coil latching type

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 60°C 140°F)
3 V DC	75%V or less of nominal voltage (Initial)	75%V or less of nominal voltage (Initial)	66.7 mA	45 Ω	200 mW	110%V or less of nominal voltage
4.5 V DC			44.4 mA	101.3Ω		
9 V DC			22.2 mA	405 Ω		
12 V DC			16.7 mA	720 Ω		
24 V DC			8.3 mA	2,880 Ω		

3) 2 coil latching type

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 60°C 140°F)
3 V DC	75%V or less of nominal voltage (Initial)	75%V or less of nominal voltage (Initial)	133.3 mA	22.5Ω	400 mW	110%V or less of nominal voltage
4.5 V DC			88.9 mA	50.6Ω		
9 V DC			44.4 mA	202.5Ω		
12 V DC			33.3 mA	360 Ω		
24 V DC			16.7 mA	1,440 Ω		

2. Specifications

Item			Specifications
Contact	Arrangement		1 Form C
	Contact material		Gold plating
	Contact resistance (Initial)		Max. 100 mΩ (By voltage drop 10 V AC 10mA)
Rating	Nominal switching capacity		1W (at 3 GHz, Impedance: 50/75Ω, V.S.W.R.: Max. 1.4), 10 mA 24 V DC (resistive load)
	Contact carrying power		Max. 10W (at 3GHz, Impedance: 50/75Ω, V.S.W.R.: Max. 1.4)
	Max. switching voltage		30 V DC
	Max. switching current		0.5 A DC
	Nominal operating power	Single side stable type	200mW
		1 coil latching type	200mW
		2 coil latching type	400mW
High frequency characteristics, Impedance: 50Ω (Initial)	V.S.W.R.		Max. 1.20/900MHz, Max. 1.40/3GHz (Standard PC board terminal) Max. 1.20/900MHz, Max. 1.40/3GHz (Surface-mount terminal)
	Insertion loss (without D.U.T. board's loss)		Max. 0.10dB/900MHz, Max. 0.35dB/3GHz (Standard PC board terminal) Max. 0.20dB/900MHz, Max. 0.40dB/3GHz (Surface-mount terminal)
	Isolation		Min. 60dB/900MHz, Min. 35dB/3GHz (Standard PC board terminal) Min. 55dB/900MHz, Min. 30dB/3GHz (Surface-mount terminal)
High frequency characteristics, Impedance: 75Ω (Initial)	V.S.W.R.		Max. 1.15/900MHz, Max. 1.40/3GHz (Standard PC board terminal) Max. 1.20/900MHz, Max. 1.50/3GHz (Surface-mount terminal)
	Insertion loss (without D.U.T. board's loss)		Max. 0.10dB/900MHz, Max. 0.30dB/3GHz (Standard PC board terminal) Max. 0.20dB/900MHz, Max. 0.50dB/3GHz (Surface-mount terminal)
	Isolation		Min. 60dB/900MHz, Min. 30dB/3GHz (Standard PC board terminal) Min. 55dB/900MHz, Min. 30dB/3GHz (Surface-mount terminal)
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500V DC, Measurement at same location as "Breakdown voltage" section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1min. (Detection current: 10mA)
		Between contact and earth terminal	500 Vrms for 1min. (Detection current: 10mA)
		Between contact and coil	1,000 Vrms for 1min. (Detection current: 10mA)
	Temperature rise (at 20°C 68°F)		Max. 60°C 140°F (By resistive method, nominal voltage applied to the coil, contact carrying current: 10mA)
	Operate time (at 20°C 68°F)		Max. 10 ms (Nominal voltage applied to the coil, excluding contact bounce time)
	Release time (at 20°C 68°F)		Max. 6 ms (Nominal voltage applied to the coil, excluding contact bounce time) (without diode)
	Set time and Reset time (at 20°C 68°F)		Max. 10 ms (Nominal voltage applied to the coil, excluding contact bounce time)
Mechanical characteristics	Shock resistance	Functional	Min. 196 m/s^2 (Half-wave pulse of sine wave: 11 ms, detection time: 10μs)
		Destructive	Min. 980 m/s^2 (Half-wave pulse of sine wave: 6 ms)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3 mm (Detection time: 10μs)
		Destructive	10 to 55 Hz at double amplitude of 5 mm
Operation noise*	Standard type		Approx. 40dB
	Silent type (75Ω, PC board terminal type only)		Approx. 30dB
Expected life	Mechanical life	Single side stable standard type	Min. 5×10^{6} (at 180 cpm)
		Single side stable silent type	Min. 10^{6} (at 180 cpm)
		Latching type	Min. 10^{6} (at 180 cpm)
	Electrical life	50Ω type	Min. 10^{6} (Standard PC board terminal), Min. 3×10^{5} (Surface-mount terminal) (10V DC 10mA resistive load)/Min. 3×10^{5} (24V DC 10mA resistive load) Min. 10^{6} (Standard PC board terminal), Min. 3×10^{5} (Surface-mount terminal) (1W, at 3GHz, Impedance: 50Ω, V.S.W.R: Max. 1.4) (at 20 cpm)
		75Ω type	Min. 3×10^{5} (10mA 24V DC resistive load) Min. 3×10^{5} (1W, at 3GHz, Impedance: 75Ω, V.S.W.R: Max. 1.4) (at 20 cpm)
Conditions	Conditions for operation, transport and storage		Ambient temperature: –40 to 70°C –40°F to 158°F (Single side stable standard and Latching type) Ambient temperature: –40 to 60°C –40°F to 140°F (Single side stable silent type) Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
Unit weight			Approx. 2 g .071 oz

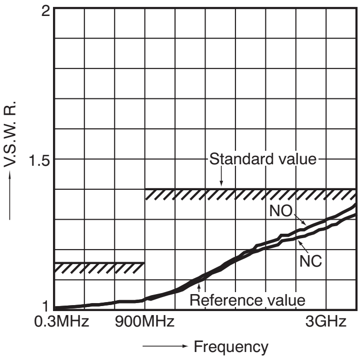
* Measured the operation noise of the relay alone (with diodes at both ends of the coil) 30cm away from top side, by the A-weighted, FAST method while applying the rated voltage.
(Reference) Operation noise of RK relay (existing model): Approx. 50dB

REFERENCE DATA

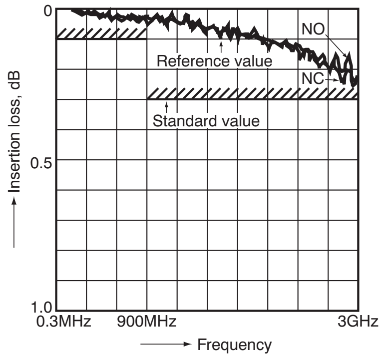
1.-(1) High frequency characteristics (Impedance: 50Ω, Standard PC board terminal)

Sample: ARS144H; Measuring method: Measured with Agilent Technologies network analyzer (E8363B). *For details see No. 7 under "NOTES".

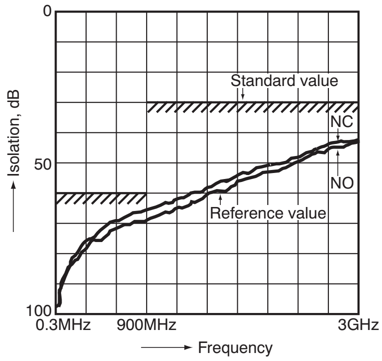
• V.S.W.R. characteristics



• Insertion loss characteristics (without D.U.T. board's loss)



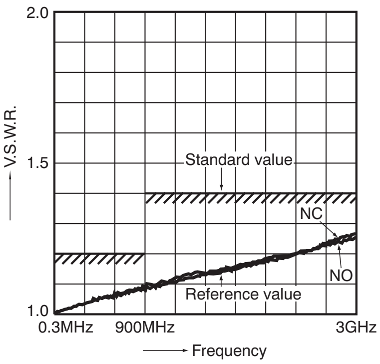
• Isolation characteristics



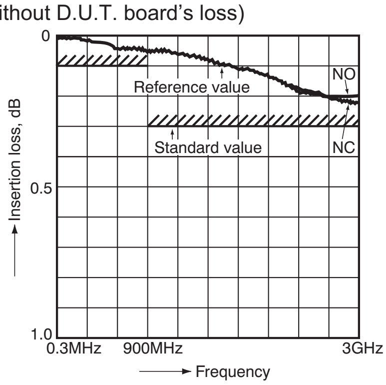
1.-(2) High frequency characteristics (Impedance: 75Ω, Standard PC board terminal)

Sample: ARS104H; Measuring method: Measured with Agilent Technologies network analyzer (E8363B). *For details see No. 7 under "NOTES".

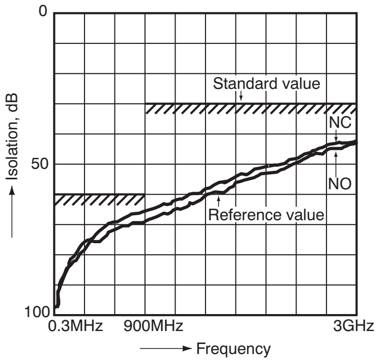
• V.S.W.R. characteristics



• Insertion loss characteristics (without D.U.T. board's loss)



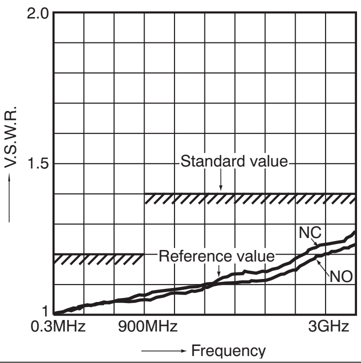
• Isolation characteristics



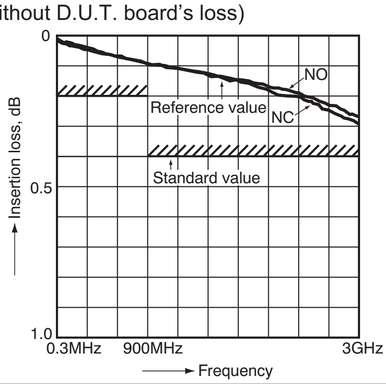
1.-(3) High frequency characteristics (Impedance: 50Ω, Surface-mount terminal)

Sample: ARS14A4H; Measuring method: Measured with Agilent Technologies network analyzer (E8363B). *For details see No. 7 under "NOTES".

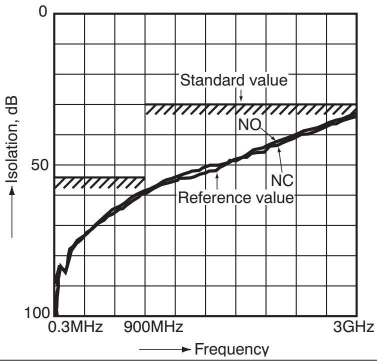
• V.S.W.R. characteristics



• Insertion loss characteristics (without D.U.T. board's loss)



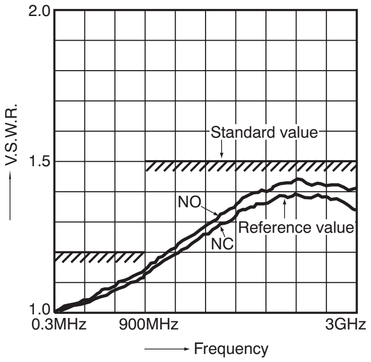
• Isolation characteristics



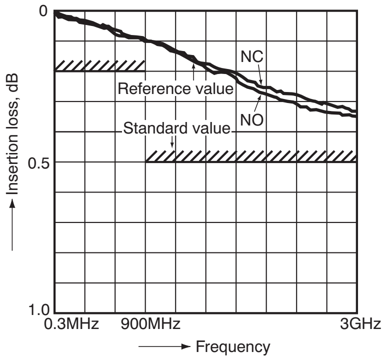
1.-(4) High frequency characteristics (Impedance: 75Ω, Surface-mount terminal)

Sample: ARS10A4H; Measuring method: Measured with Agilent Technologies network analyzer (E8363B). *For details see No. 7 under "NOTES".

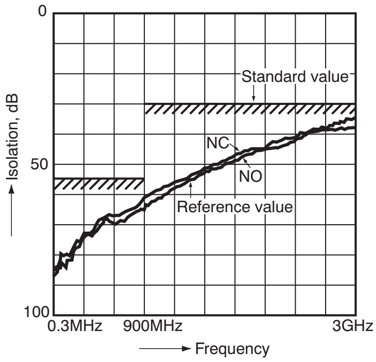
• V.S.W.R. characteristics



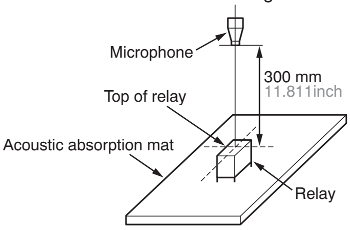
• Insertion loss characteristics (without D.U.T. board's loss)



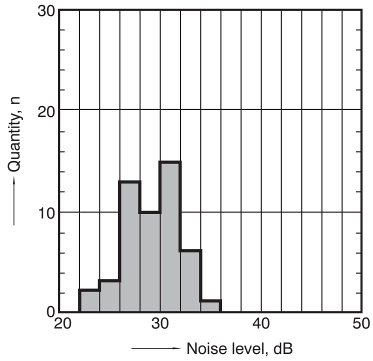
• Isolation characteristics



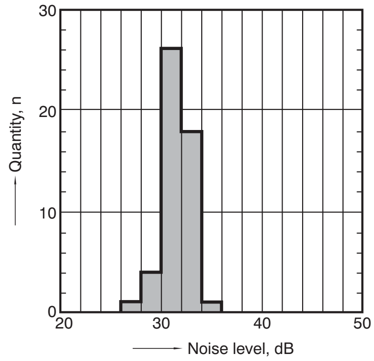
2.-(1) Operation noise distribution
Sample: ARS134H (single side stable silent type), 50 pcs.
Coil voltage: rated voltage applied (with diode)
Equipment setting: A weighted sound pressure level, FAST.
Background noise: approx. 20 dB
Method of measurement: See figure below.



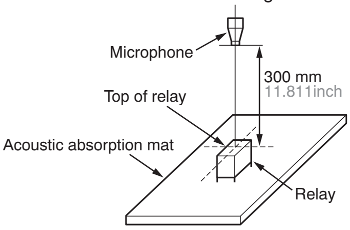
When operated



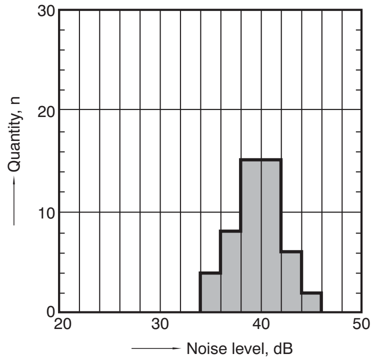
When released



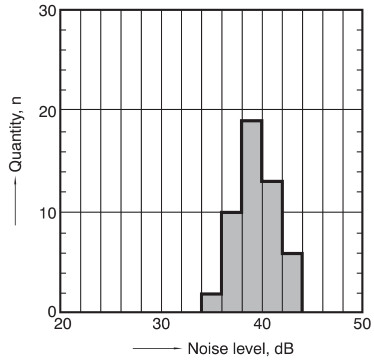
2.-(2) Operation noise distribution
Sample: ARS104H (single side stable standard type), 50 pcs.
Coil voltage: rated voltage applied (with diode)
Equipment setting: A weighted sound pressure level, FAST.
Background noise: approx. 20 dB
Method of measurement: See figure below.



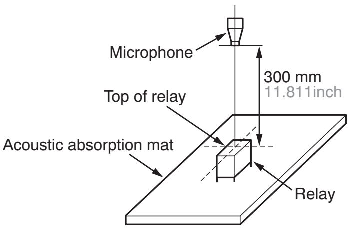
When operated



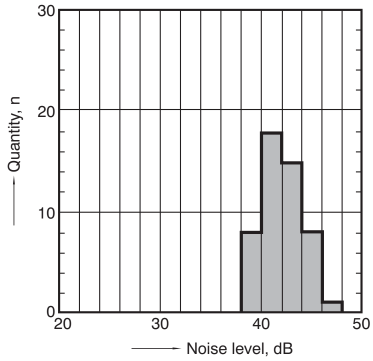
When released



2.-(3) Operation noise distribution
Sample: ARS114H (latching type), 50 pcs.
Coil voltage: rated voltage applied (with diode)
Equipment setting: A weighted sound pressure level, FAST.
Background noise: approx. 20 dB
Method of measurement: See figure below.



When set and reset



DIMENSIONS (mm inch)

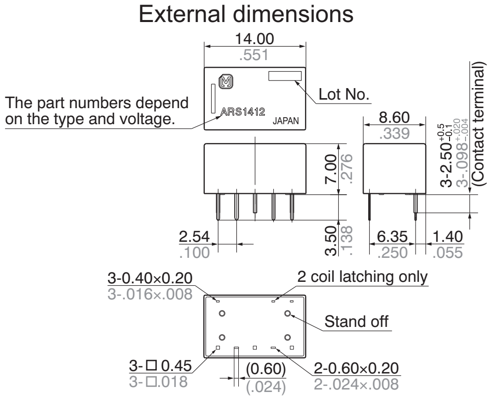
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

<Standard PC board terminal>

1. 50Ω type

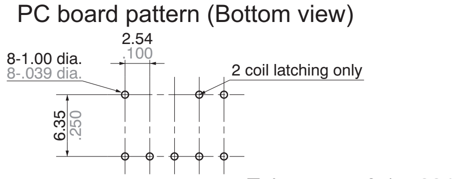
CAD Data

External dimensions



Tolerance: ±0.3 ±.012

PC board pattern (Bottom view)

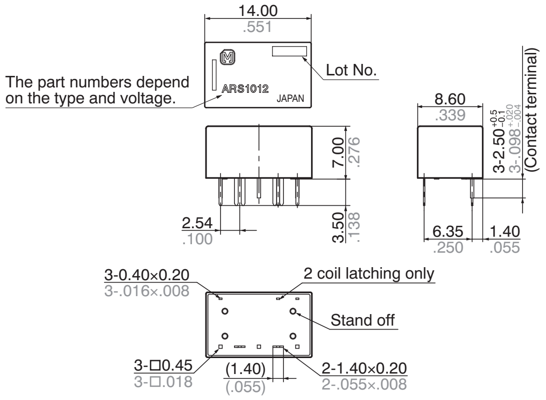


Tolerance: ±0.1 ±.004

2. 75Ω type

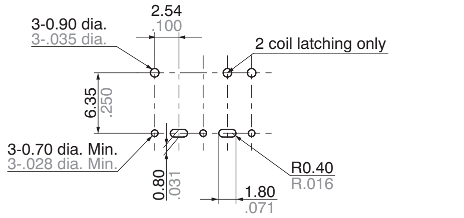
CAD Data

External dimensions



Tolerance: ±0.3 ±.012

PC board pattern (Bottom view)

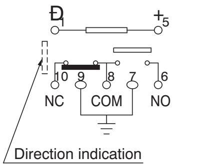


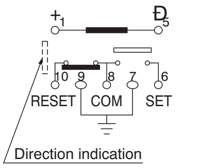
Tolerance: ±0.1 ±.004

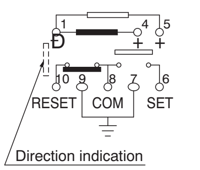
Schematic (Bottom view)

1. Standard contact type

Single side stable type (Deenergized condition)	1 coil latching type (Reset condition)	2 coil latching type (Reset condition)

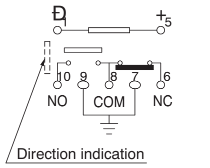


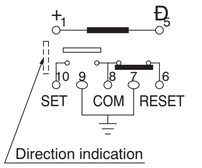


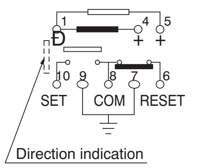


2. Reversed contact type

Single side stable type (Deenergized condition)	1 coil latching type (Reset condition)	2 coil latching type (Reset condition)







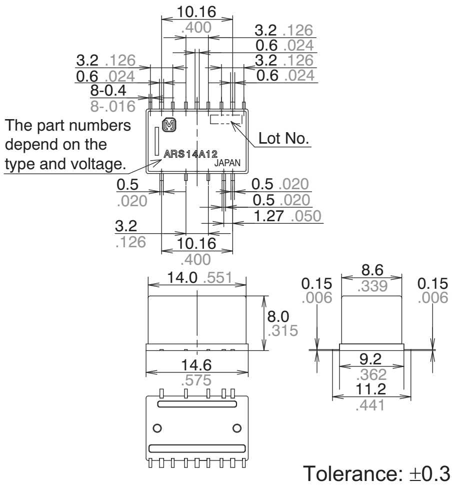
<Surface-mount terminal>

1. Impedance: 50Ω type

1) E layout

CAD Data

External dimensions

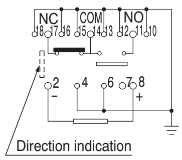


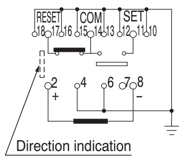
Tolerance: ±0.3 ±.012

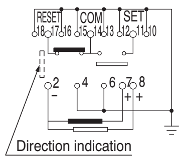
Schematic (Top view)

<Standard contact type>

Single side stable type (Deenergized condition)	1 coil latching type (Reset condition)	2-coil latching type (Reset condition)

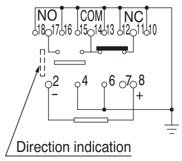


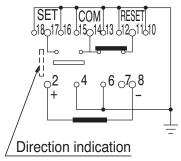


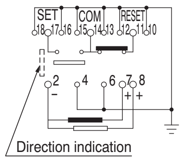


<Reversed contact type>

Single side stable type (Deenergized condition)	1 coil latching type (Reset condition)	2-coil latching type (Reset condition)





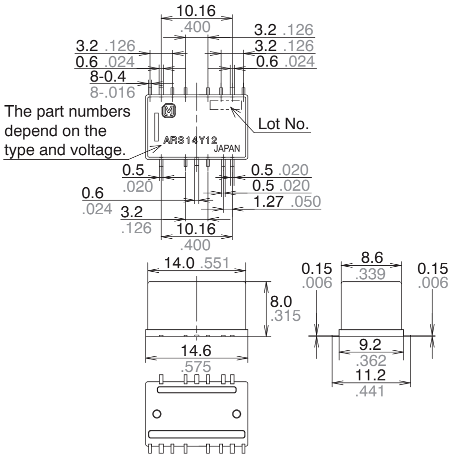


2) Y layout

External dimensions

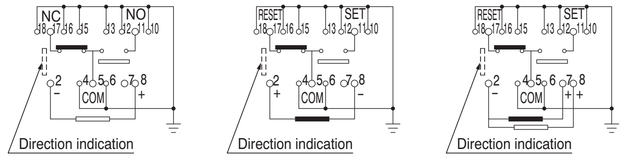
Schematic (Top view)

CAD Data



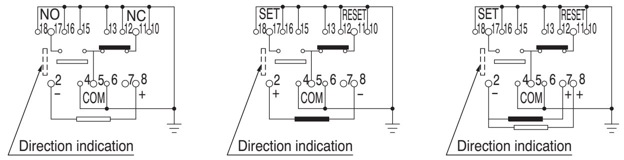
<Standard contact type>

Single side stable type (Deenergized condition) | 1 coil latching type (Reset condition) | 2-coil latching type (Reset condition)



<Reversed contact type>

Single side stable type (Deenergized condition) | 1 coil latching type (Reset condition) | 2-coil latching type (Reset condition)



Tolerance: ±0.3 ±.012

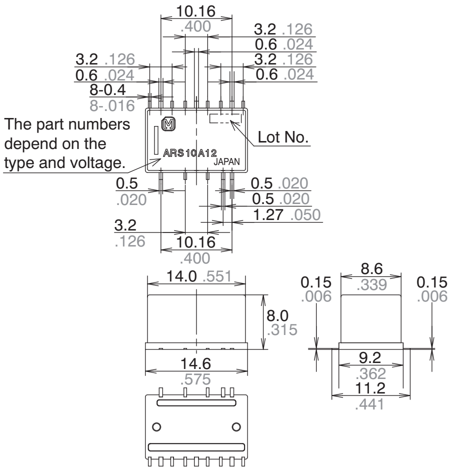
2. Impedance: 75Ω type

1) E layout

External dimensions

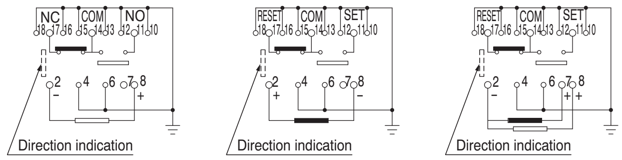
Schematic (Top view)

CAD Data



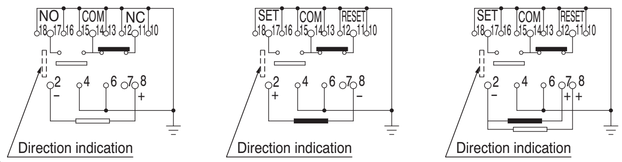
<Standard contact type>

Single side stable type (Deenergized condition) | 1 coil latching type (Reset condition) | 2-coil latching type (Reset condition)



<Reversed contact type>

Single side stable type (Deenergized condition) | 1 coil latching type (Reset condition) | 2-coil latching type (Reset condition)



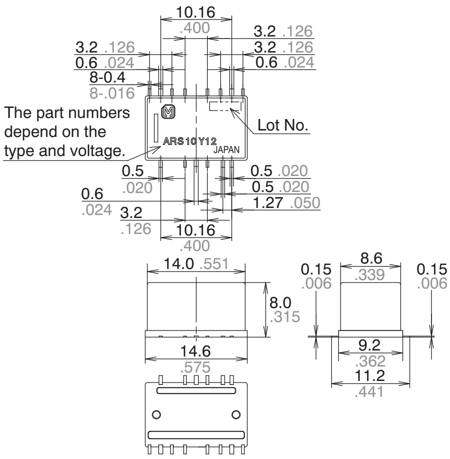
Tolerance: ±0.3 ±.012

2) Y layout

External dimensions

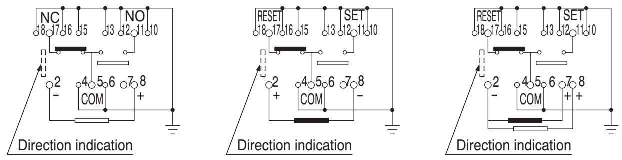
Schematic (Top view)

CAD Data



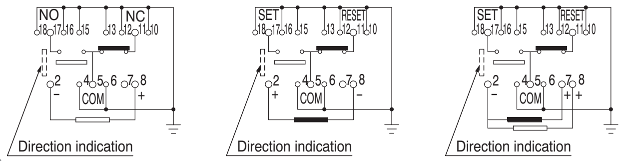
<Standard contact type>

Single side stable type (Deenergized condition) | 1 coil latching type (Reset condition) | 2-coil latching type (Reset condition)



<Reversed contact type>

Single side stable type (Deenergized condition) | 1 coil latching type (Reset condition) | 2-coil latching type (Reset condition)



Tolerance: ±0.3 ±.012

High-Frequency

NOTES

1. Coil operating power
Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%.
However, check it with the actual circuit since the characteristics may be slightly different. The nominal operating voltage should be applied to the coil for more than 30 ms to set/reset the latching type relay.

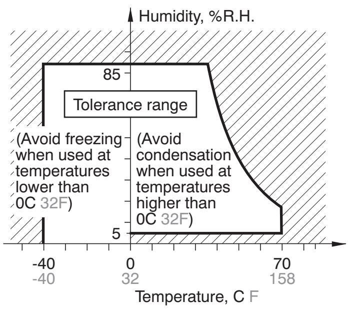
2. Coil connection
When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction.

3. External magnetic field
Since RS relays are highly sensitive polarized relays, their characteristics will be affected by a strong external magnetic field. Avoid using the relay under that condition.

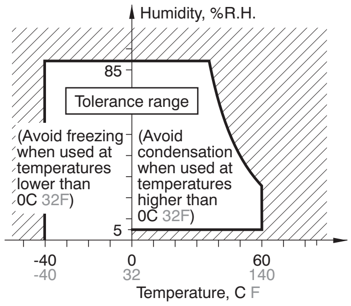
4. Cleaning
For automatic cleaning, the boiling method is recommended. Avoid ultrasonic cleaning which subjects the relays to high frequency vibrations, which may cause the contacts to stick.
It is recommended that alcoholic solvents be used.

5. Conditions for operation, transport and storage conditions
1) Temperature
- Single side stable standard and latching type: –40 to 70°C –40 to 158°F
- Single side stable silent type: –40 to 60°C –40 to 140°F

2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage:
Single side stable standard
and latching type



Single side stable silent type

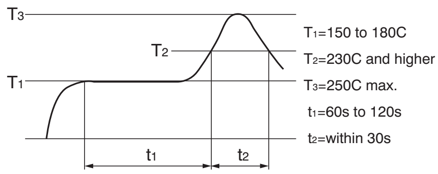


4) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
5) Freezing
Condensation or other moisture may freeze on the relay when the temperature is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
6) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.
7) Storage requirements
Since the relay is sensitive to humidity, the surface-mount type is packaged with tightly sealed anti-humidity packaging. However, when storing, please be careful of the following.
(1) Please use promptly once the anti-humidity pack is opened.
If relays are left as is after unpacking, they will absorb moisture which will result in loss of air tightness as a result of case expansion due to thermal stress when reflow soldering during the mounting process. (within one day, 30°C and 60%R.H or less)
(2) When storing for a log period after opening the anti-humidity pack, storage in anti-humidity packaging with an anti-humidity bag to which silica gel has been added, is recommended.
*Furthermore, if the relay is solder mounted when it has been subjected to excessive humidity, cracks and leaks can occur. Be sure to mount the relay under the required mounting conditions.

6. Soldering
1) Please meet the following conditions if this relay is to be automatically soldered.
(1) Preheating: Max. 120°C 248°F (terminal solder surface) for max. 120 seconds
(2) Soldering: Max. 260±5°C 500±9°F for max. 6 seconds
*Relays are influenced by the type of PC board used. Please confirm with the actual PC board you plan to use.
*Please avoid reflow soldering.
2) Surface-mount terminal
In case of automatic soldering, the following conditions should be observed
(1) Position of measuring temperature

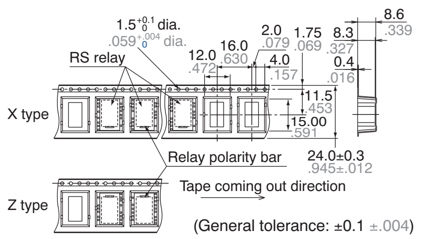
A: Surface of PC board where relay is mounted.

(2) IR (infrared reflow) soldering method

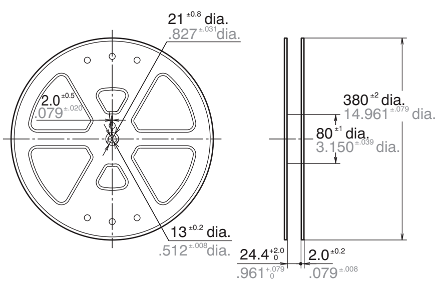


• Mounting cautions
Rise in relay temperature depends greatly on the component mix on a given PC board and the heating method of the reflow equipment. Therefore, please test beforehand using actual equipment to ensure that the temperature where the relay terminals are soldered and the temperature at the top of the relay case are within the conditions given above.
3) Please meet the following conditions if this relay is to be soldered by hand.
(1) 260°C 500°F for max. 10 seconds
(2) 350°C 662°F for max. 3 seconds
The effect on the relay depends on the actual substrate used. Please verify the substrate to be used.
(3) Avoid ultrasonic cleaning. Doing so will adversely affect relay characteristics. Please use alcohol-based cleaning solvents when cleaning relays.

7. Tape and reel packing
1) Tape dimensions

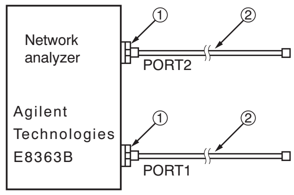


2) Dimensions of plastic reel



8. Measuring method

1) 50Ω type



Connect connectors 1 and 2 respectively to PORT 1 and PORT 2. Perform calibration using the 3.5 mm calibration kit (HP85052B).

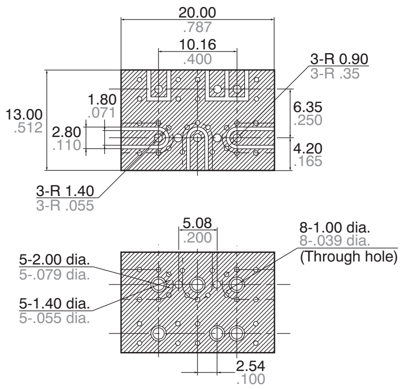
No.	Product name	Contents
1	Agilent 85130-60011	Adapter 2.4mm-3.5mm female .095inch-.138inch female
2	SUHNER SUCOFLEX104	Cable 3.5mm-3.5mm male .138inch-.138inch male

After calibration, connect the D.U.T. board and measure. However, connectors other than those for measurement should be connected with a 50¾ termination resistor.

<Standard PC board terminal>

PC board

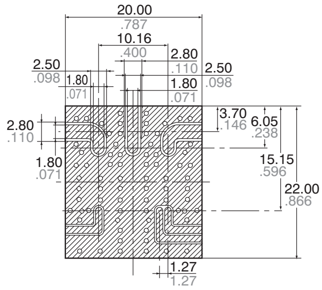
Dimensions (mm inch)



<Surface-mount terminal and E layout>

PC board

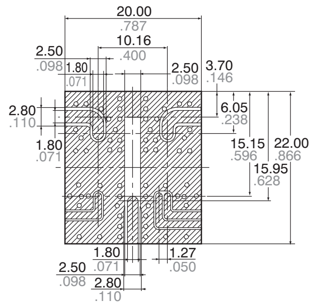
Dimensions (mm inch)



<Surface-mount terminal and Y layout>

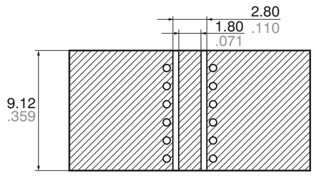
PC board

Dimensions (mm inch)



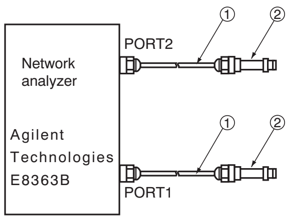
PC board for correction

Dimensions (mm inch)



Material: Glass PTFE double-sided through hole PC board R-4737 (Matsushita Electric Works)
Board thickness: t = 0.8 mm .031 inch
Copper plating: 18 μm
Connector (SMA type receptacle)
Product name: 01K1808-00 (Waka Manufacturing Co., Ltd.)
Insertion loss compensation
The insertion loss of relay itself is given by subtracting the insertion loss of shortcircuit the Com and the NC (or NO). (signal path and two connectors)

2) 75Ω type



Connect connectors 1 and 2 respectively to PORT 1 and PORT 2, and then perform calibration using the 75Ω F type.

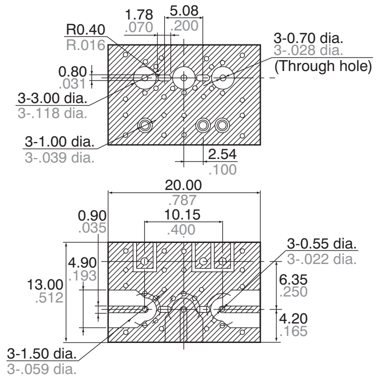
No.	Product name	Contents
1	85134-60003	Test port cable
2	11852B	Conversion adapter; 50Ω N type (female) to 75Ω N type (male)
2	85039-60011	Conversion adapter; 75Ω N type (female) to 75Ω F type (male)

After calibration, connect the D.U.T. board and measure. However, connectors other than those for measurement should be connected with a 75Ω termination resistor.

<Standard PC board terminal>

PC board

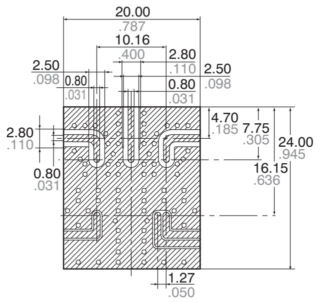
Dimensions (mm inch)



<Surface-mount terminal and E layout>

PC board

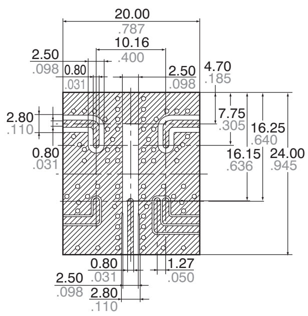
Dimensions (mm inch)



<Surface-mount terminal and Y layout>

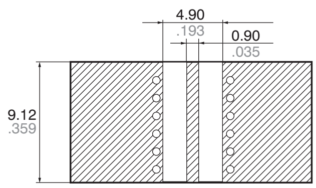
PC board

Dimensions (mm inch)



PC board for correction

Dimensions (mm inch)



Material: Glass PTFE double-sided through hole PC board R-4737 (Matsushita Electric Works)
Board thickness: t = 0.8 mm .031 inch
Copper plating: 18μm
Connector (F type receptacle)
Product name: C05-0236 (Komine Musen Electric Corporation)

Insertion loss compensation
The insertion loss of relay itself is given by subtracting the insertion loss of shortcircuit the COM and the NC (or NO). (signal path and two connectors)

9. Others

1) The switching lifetime is defined under the standard test condition specified in the JIS* C 5442 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.
Also, be especially careful of loads such as those listed below.
• When used for AC load-operating and the operating phase is synchronous, rocking and fusing can easily occur due to contact shifting.
• When high-frequency opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.
Three countermeasures for these are listed here.
(1) Incorporate an arc-extinguishing circuit.
(2) Lower the operating frequency
(3) Lower the ambient humidity
2) Use the relay within specifications such as coil rating, contact rating and on/off service life. If used beyond limits, the relay may overheat, generate smoke or catch fire.
3) Be careful not to drop the relay. If accidentally dropped, carefully check its appearance and characteristics before use.
4) Be careful to wire the relay correctly. Otherwise, malfunction, overheat, fire or other trouble may occur.
5) If a relay stays on in a circuit for many months or years at a time without being activated, circuit design should be reviewed so that the relay can remain non-excited. A coil that receives current all the time heats, which degrades insulation earlier than expected. A latching type relay is recommended for such circuits.
6) To ensure accurate operation of the latching type amidst surrounding temperature changes and other factors that might affect the set and reset pulse times, we recommend a coil impress set and reset pulse width of at least 30 ms at the rated operation voltage.
7) The latching type relay is shipped in the reset position. But jolts during transport or impacts during installation can change the reset position. It is, therefore, advisable to build a circuit in which the relay can be initialized (set and reset) just after turning on the power.
8) If silicone materials (e.g., silicone rubbers, silicone oils, silicone coating agents, silicone sealers) are used in the vicinity of the relay, the gas emitted from the silicone may adhere to the contacts of the relay during opening and closing and lead to improper contact. If this is the case, use a material other than silicone.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

8, 18 and 26.5GHz, Compact size COAXIAL SWITCH

RV COAXIAL SWITCHES (ARV)

PIN type

SMA type

FEATURES

1. Compact size (Approx. 85% less volume compared to previous product.*)
PIN type size: L 15.9 × W 15.9 × H 11.2 mm L .626 × W .626 × H .441 inch
2. Excellent high frequency characteristics (to 8, 18, 26.5GHz, 50Ω)
3. Terminal shape options available (PIN and SMA)**
4. Contact arrangement: SPDT
5. Failsafe type and latching type (2-coil latching type) that reduces operating power are now available.

*Compared to previous product (RD coaxial switch) and PIN type RV coaxial switch.
**For SMP connector type, please contact us.

TYPICAL APPLICATIONS

Compact wireless devices
Compact measuring instrument
All types of inspection equipment
Digital broadcasting
- Broadcasting relay station
- Broadcasting equipment

Mobile communication
- Cellular phone base station

1) If you consider using applications requiring frequent switching or high number of operations, please contact us.
2) If you consider using applications with low level load, please contact us.

HIGH FREQUENCY CHARACTERISTICS (Impedance 50Ω, Initial)

1. PIN type

Frequency	to 4 GHz	4 to 8 GHz	8 to 12.4 GHz*	12.4 to 18 GHz*
V.S.W.R. (max.)	1.3	1.4	1.5	1.7
Insertion loss (dB. max.)	0.3	0.4	0.5	0.7
Isolation (dB. min.)	70	60	50	40

Note: *8 to 18GHz characteristics can be applied 18GHz type only.

2. SMA type

Frequency	to 8 GHz	8 to 12.4 GHz*	12.4 to 18 GHz*	18 to 26.5 GHz**
V.S.W.R. (max.)	1.35	1.6	1.7	1.8
Insertion loss (dB. max.)	0.3	0.5	0.7	0.8
Isolation (dB. min.)	70	60	60	50

Note: *8 to 18GHz characteristics can be applied 18GHz type and 26.5GHz type only.
**18 to 26.5GHz characteristics can be applied 26.5GHz type only.

ORDERING INFORMATION

ARV ☐ ☐ ☐ ☐☐ ☐ ☐

Frequency
1: to 8GHz
2: to 18GHz
3: to 26.5GHz (SMA type only)

Operating function
0: Failsafe type/Standard contact
2: Latching type/Standard contact
3: Failsafe type/Reverse contact

Terminal shape
N: PIN type
A: SMA type

Nominal operating voltage
4H: 4.5 V DC
12: 12 V DC
24: 24 V DC

Operation terminal
Nil: Solder terminal

HF data attached
Nil: No HF test data attached
Q: HF test data attached (Displayed only on inner and outer packaging)

*Please inquire regarding use with nominal operating voltage of 28 V DC.

TYPES

SPDT

Operating function	Contact terminal shape	Nominal operating voltage	to 8 GHz type		to 18 GHz type		to 26.5 GHz type	
			No HF datasheet attached	HF datasheet attached	No HF datasheet attached	HF datasheet attached	No HF datasheet attached	HF datasheet attached
Failsafe type/ Standard contact	PIN type	4.5 V DC	ARV10N4H	ARV10N4HQ	ARV20N4H	ARV20N4HQ	–	–
		12 V DC	ARV10N12	ARV10N12Q	ARV20N12	ARV20N12Q	–	–
		24 V DC	ARV10N24	ARV10N24Q	ARV20N24	ARV20N24Q	–	–
	SMA type	4.5 V DC	ARV10A4H	ARV10A4HQ	ARV20A4H	ARV20A4HQ	ARV30A4H	ARV30A4HQ
		12 V DC	ARV10A12	ARV10A12Q	ARV20A12	ARV20A12Q	ARV30A12	ARV30A12Q
		24 V DC	ARV10A24	ARV10A24Q	ARV20A24	ARV20A24Q	ARV30A24	ARV30A24Q
Latching type/ Standard contact	PIN type	4.5 V DC	ARV12N4H	ARV12N4HQ	ARV22N4H	ARV22N4HQ	–	–
		12 V DC	ARV12N12	ARV12N12Q	ARV22N12	ARV22N12Q	–	–
		24 V DC	ARV12N24	ARV12N24Q	ARV22N24	ARV22N24Q	–	–
	SMA type	4.5 V DC	ARV12A4H	ARV12A4HQ	ARV22A4H	ARV22A4HQ	ARV32A4H	ARV32A4HQ
		12 V DC	ARV12A12	ARV12A12Q	ARV22A12	ARV22A12Q	ARV32A12	ARV32A12Q
		24 V DC	ARV12A24	ARV12A24Q	ARV22A24	ARV22A24Q	ARV32A24	ARV32A24Q
Failsafe type/ Reverse contact	PIN type	4.5 V DC	ARV13N4H	ARV13N4HQ	ARV23N4H	ARV23N4HQ	–	–
		12 V DC	ARV13N12	ARV13N12Q	ARV23N12	ARV23N12Q	–	–
		24 V DC	ARV13N24	ARV13N24Q	ARV23N24	ARV23N24Q	–	–
	SMA type	4.5 V DC	ARV13A4H	ARV13A4HQ	ARV23A4H	ARV23A4HQ	ARV33A4H	ARV33A4HQ
		12 V DC	ARV13A12	ARV13A12Q	ARV23A12	ARV23A12Q	ARV33A12	ARV33A12Q
		24 V DC	ARV13A24	ARV13A24Q	ARV23A24	ARV23A24Q	ARV33A24	ARV33A24Q

Standard packing: Carton: 5 pcs. Case: 50 pcs.

RATING

1. Coil data

1) Failsafe type (Standard contact and Reverse contact)

Nominal operating voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 85°C 185°F)
4.5 V DC	75%V or less of nominal voltage*1 (Initial)	10%V or more of nominal voltage*1 (Initial)	155.7mA	28.9Ω	700mW	110%V of nominal voltage
12 V DC			58.3mA	205.7Ω		
24 V DC			29.2mA	822.9Ω		

2) Latching type (Standard contact)

Nominal operating voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 85°C 185°F)
4.5 V DC	75%V or less of nominal voltage*1 (Initial)	75%V or less of nominal voltage*1 (Initial)	155.7mA	28.9Ω	700mW	110%V of nominal voltage
12 V DC			58.3mA	205.7Ω		
24 V DC			29.2mA	822.9Ω		

Notes: *1. Pulse drive (JIS C5442)
*2. Please inquire regarding use with nominal operating voltage of 28 V DC.

2. Specifications

Characteristics	Item		Specifications							
Contact	Arrangement		SPDT							
	Contact material		Gold plating							
	Contact resistance (Initial)		Max. 100mΩ (By voltage drop 10V AC 10mA)							
Rating	Contact input power (CW)		Max. 50W (at 3GHz) (V.S.W.R. 1.3 or less, no contact switching, ambient temperature 20°C 68°F)*1							
	Nominal operating power		700mW							
High frequency characteristics (Impedance 50Ω)			PIN type*2				SMA type			
	Frequency		to 4 GHz	4 to 8 GHz	8 to 12.4 GHz*3	12.4 to 18 GHz*3	to 8 GHz	8 to 12.4 GHz*4	12.4 to 18 GHz*4	18 to 26.5 GHz*5
	V.S.W.R. (max.)		1.3	1.4	1.5	1.7	1.35	1.6	1.7	1.8
	Insertion loss (dB, max.)		0.3	0.4	0.5	0.7	0.3	0.5	0.7	0.8
	Isolation (dB, min.)		70	60	50	40	70	60	60	50
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000 MΩ (at 500 V DC) Measurement at same location as “breakdown voltage (Initial)” section.							
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)							
		Between contact and earth terminal	500 Vrms for 1 min. (Detection current: 10mA)							
		Between contact and coil	500 Vrms for 1 min. (Detection current: 10mA)							
		Between coil and earth terminal	500 Vrms for 1 min. (Detection current: 10mA)							
Time characteristics (at 20°C 68°F)	Operate time (Set time)		Max. 15ms (approx. 5ms) (Nominal operating voltage applied to the coil, excluding contact bounce time.)							
	Release time (Reset time)		Max. 15ms (approx. 5ms) (Nominal operating voltage applied to the coil, excluding contact bounce time.) (without diode, only for Release time)							
Mechanical characteristics	Shock resistance	Functional	Min. 500 m/s² (Half-wave pulse of sine wave: 11ms, detection time: 10μs.)							
		Destructive	Min. 1,000 m/s² (Half-wave pulse of sine wave: 6ms.)							
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3mm (Detection time: 10μs.)							
		Destructive	10 to 55 Hz at double amplitude of 5mm/15 to 2,000 Hz [W0 = 2.94 (m/s²)²/Hz]							
Expected life	Mechanical		Min. 10^6 (at 180 cpm)							
	Electrical (Hot switch)		Min. 3×10^5 (1W High frequency load, at 3GHz, impedance 50Ω, V.S.W.R.; max. 1.3) (at 20 cpm)							
Conditions	Conditions for operation, transport and storage*6		Ambient temperature: –55°C to +85°C –67°F to +185°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature) Air pressure: 86 to 106 kPa							
Unit weight			PIN type: Approx. 12g .42oz				SMA type: Approx. 20g .71oz			

Notes: *1. Factors such as heating of the connected terminal influence the high frequency characteristics; therefore, please verify under actual conditions of use.
*2. Measuring method: After installing on dedicated inspection equipment
*3. 8 to 18GHz characteristics can be applied 18GHz type only.
*4. 8 to 18GHz characteristics can be applied 18GHz and 26.5GHz types only.
*5. 18 to 26.5GHz characteristics can be applied 26.5GHz type only.
*6. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “NOTES” on page 446.

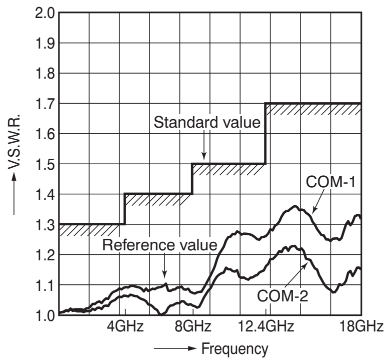
REFERENCE DATA

1-(1). High frequency characteristics (PIN type)

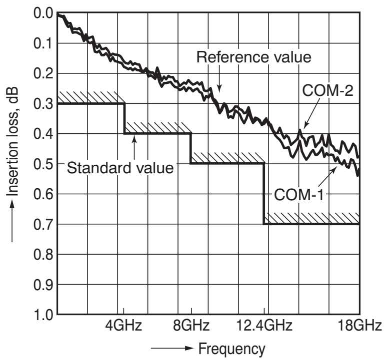
Sample: ARV22N12

Measuring method: Measured with Agilent Technologies network analyzer (E8363B) after installing on dedicated inspection equipment.

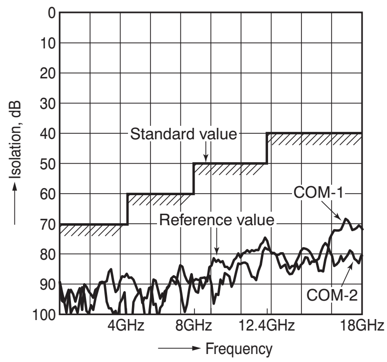
• V.S.W.R.



• Insertion loss



• Isolation

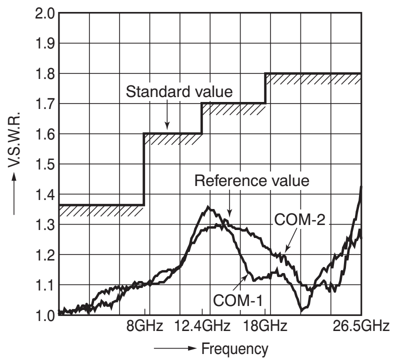


1-(2). High frequency characteristics (SMA type)

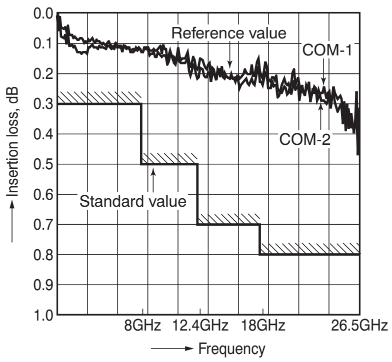
Sample: ARV32A12

Measuring method: Measured with Agilent Technologies network analyzer (E8363B).

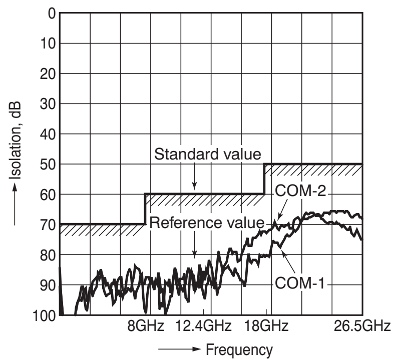
• V.S.W.R.



• Insertion loss



• Isolation

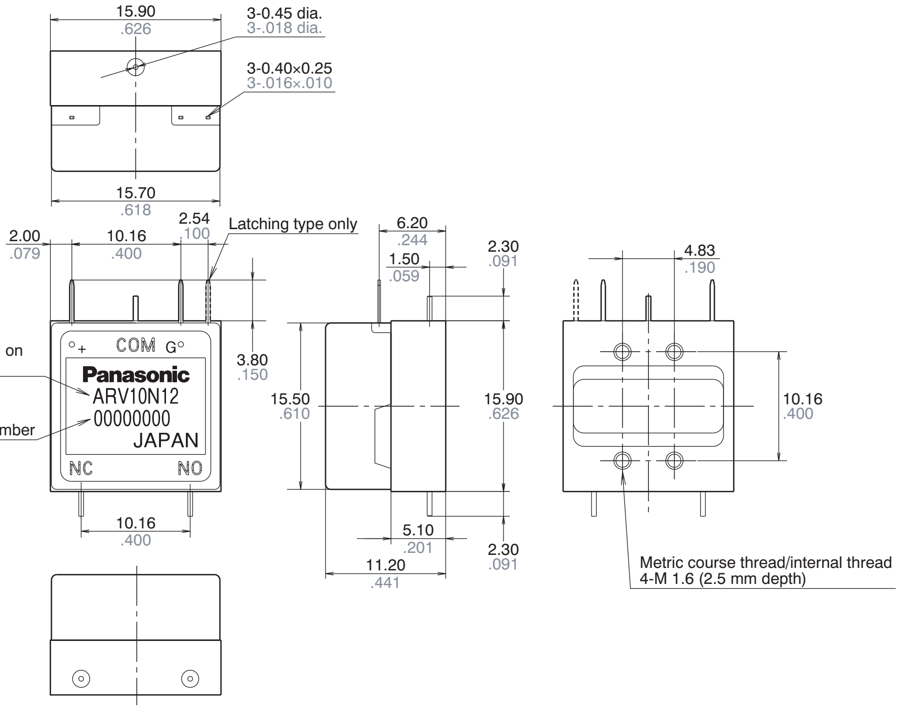


DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

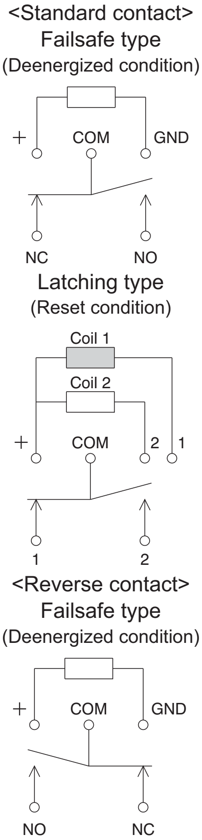
1. PIN type

CAD Data



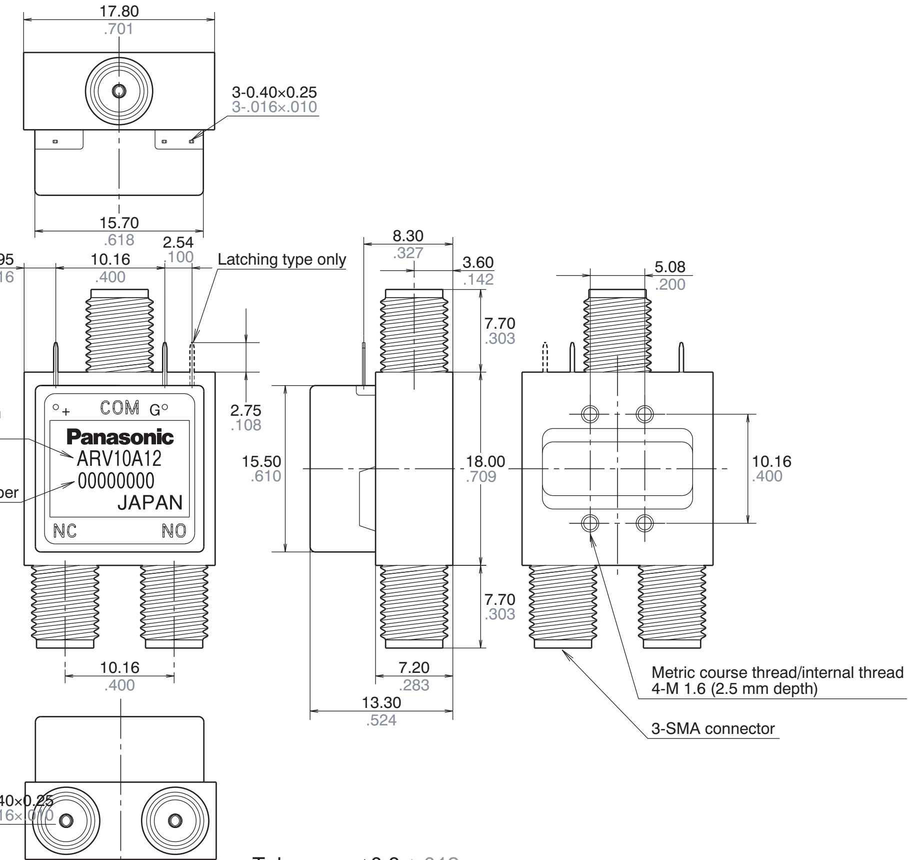
Tolerance: ±0.3 ±.012

Schematic (Top view)



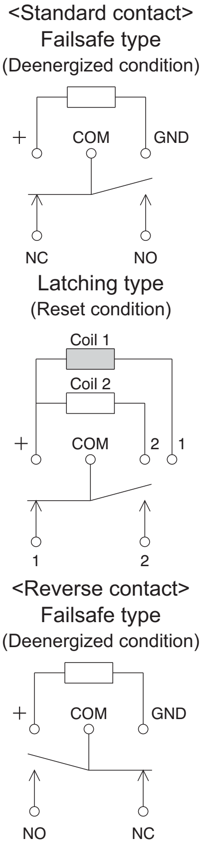
2. SMA type

CAD Data



Tolerance: ±0.3 ±.012

Schematic (Top view)



*For SMP connector type, please consult us.

NOTES

1. For general cautions for use, please refer to the “Cautions for Use” in the “Relay Technical Information”.

2. Coil operating power

Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%.
However, check it with the actual circuit since the characteristics may be slightly different. The nominal operating voltage should be applied to the coil for more than 50 ms to set/reset the latching type.
Please use the latching type for circuits that are continually powered for long periods of time.

3. Coil connection

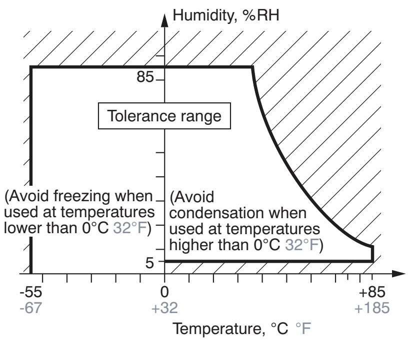
Since this product is polarized, please be aware of the plus/minus polarity of the coil.

4. Connection and washing conditions for coil and PIN type contact terminals

1) The connection of coil and PIN type contact terminals shall be done by soldering.
Soldering conditions
Max. 260°C 500°F (solder temp) within 10sec (soldering time)
Max. 350°C 662°F (solder temp) within 3sec (soldering time)
2) This product is not sealed type, therefore washing is not allowed.

5. Conditions for operation, transport and storage conditions

1) Temperature:
–55 to +85°C –67 to +185°F
2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage:



4) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of coaxial switch insulation.
5) Freezing
Condensation or other moisture may freeze on coaxial switch when the temperature is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
6) Low temperature, low humidity environments.
The plastic may become brittle if coaxial switch is exposed to a low temperature, low humidity environment for long periods of time.

6. Other handling precautions.

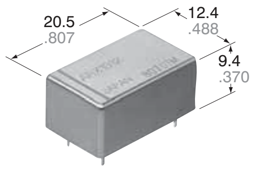
1) Coaxial switch’s on/off service life is based on standard test conditions (temperature: 15 to 35°C 59 to 95°F, humidity: 25 to 75%) specified in JIS C5442-1996. Life will depend on many factors of your system: coil drive circuit, type of load, switching intervals, switching phase, ambient conditions, to name a few.
2) Use coaxial switch within specifications such as coil rating, contact rating and on/off service life. If used beyond limits, coaxial switch may overheat, generate smoke or catch fire.
3) Be careful not to drop coaxial switch. If accidentally dropped, carefully check its appearance and characteristics before use.
4) Be careful to wire coaxial switch correctly. Otherwise, malfunction, overheat, fire or other trouble may occur.
5) The latching type product is shipped in the reset position. But jolts during transport or impacts during installation can move it to the set position. It is, therefore, advisable to build a circuit in which coaxial switch can be initialized (set and reset) just after turning on the power.
6) If coaxial switch stays on in a circuit for many months or years at a time without being activated, circuit design should be reviewed so that the coaxial switch can remain deenergized. A coil that receives current all the time heats, which degrades insulation earlier than expected. A latching type is recommended for such circuits.
7) For SMA connectors (SMA type only), we recommend a torque of 0.90±0.1 N·m for installation, which falls within the prescribed torque of MIL-C-39012.
Please be aware that conditions might be different depending on the connector materials and how it interacts with surrounding materials.
8) Please do not use silicon based substances such as silicon rubber, silicon oil, silicon coatings and silicon fillings, in the vicinity of the coaxial switch. Doing so may cause volatile silicon gas to form which may lead to contact failure due to the adherence of silicon on the contacts when they open and close in this atmosphere.
9) In order to ensure stable signal communication on contact, it is recommended that the monitoring of contact signal should be started from Min. 100 ms after coil rated voltage is applied.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

3 GHz SMALL MICROWAVE RELAY

RX RELAYS (ARX)

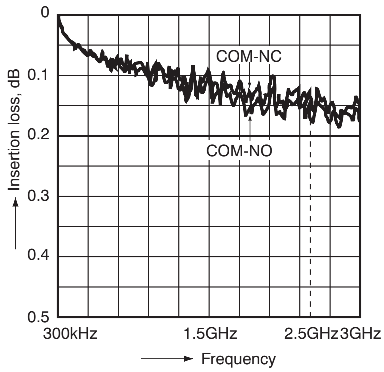


mm inch

FEATURES

1. Excellent high frequency characteristics (~2.5GHz, Impedance 50Ω)

Frequency	to 2.5GHz
V.S.W.R. (Max.)	1.2
Insertion loss (dB, Max.)	0.2
Isolation (dB, Min.)	60



2. Small size

- Size: 20.5(L) × 12.4(W) × 9.4(H) mm
  .807(L) × .488(W) × .370(H) inch

3. High sensitivity

- Nominal operating power: 200 mW

*Also available for unit support (contact us for more details).

TYPICAL APPLICATIONS

- Cellular phone base station (W-CDMA, FPLMTS, IMT-2000, PCS, DCS)
- Cellular phone-related measurement devices (SP3T/SP4T switches, etc)
- Wireless LAN
- Wireless Local Loop

SPECIFICATIONS

Contact

Arrangement			1 Form C
Contact material	Stationary		Gold plating
	Movable		Gold clad
Initial contact resistance (By voltage drop 10 V DC 10 mA)			Max. 100 mΩ
Rating	Contact rating		10W (2.5 GHz, Impedance 50 Ω, V.S.W.R.&1.2) 10mA 24V DC (resistive load)
	Contact carrying power		Max. 20W (at 40°C, V.S.W.R.&1.2, Average)
	Max. switching voltage		30 V DC
	Max. switching current		0.5 A DC
High frequency characteristics (Initial) (~2.5GHz, Impedance 50¾)	V.S.W.R. (Return loss)		Max. 1.2 (Min. 20.8dB)
	Insertion loss		Max. 0.2 dB
	Isolation		Min. 60 dB
	Input power		Max. 20W (at 40°C, V.S.W.R.&1.2, Average)
Expected life (min. operations)	Mechanical (at 180 cpm)		5×10^6
	Electrical	10mA 24 V DC (resistive load)	3×10^5
		10W 2.5 GHz, Impedance 50Ω, V.S.W.R.&1.2	10^5

Coil (at 20°C, 68°F)

	Nominal operating power
Single side stable	200 mW
1 coil latching	200 mW
2 coil latching	400 mW

Characteristics

Initial insulation resistance*1		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	500 Vrms for 1 min.
	Between contact and coil	1,000 Vrms for 1 min.
	Between contact and earth terminal	500 Vrms for 1 min.
Operate time [Set time]*3 (at 20°C)		Max. 10ms (Approx. 6ms) [Max. 10ms (Approx. 5ms)]
Release time (without diode) [Reset time]*3		Max. 6ms (Approx. 3ms) [Max. 10ms (Approx. 5ms)]
Temperature rise (at 20°C)*4		Max. 60°C
Shock resistance	Functional*5	Min. 200 m/s² {20 G}
	Destructive*6	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to 70°C –40°F to 158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 5 g .18 oz

Remarks

*1 Measurement at same location as “Initial breakdown voltage” section.
*2 Detection current: 10mA
*3 Nominal operating voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil: Contact carrying power: 20W, at 2.5GHz, Impedance 50Ω, V.S.W.R.&1.2
*5 Half-wave pulse of sine wave: 11ms, detection time: 10µs.
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10µs
*8 Refer to 6. Conditions for operation, transport and storage conditions in NOTES (Page 450).

ORDERING INFORMATION

Ex. A RX 1 0 12

Product name	Contact arrangement	Operating function	Coil voltage, V DC
RX	1: 1 Form C	0: Single side stable 1: 1 coil latching 2: 2 coil latching	03: 3 09: 9 4H: 4.5 12: 12 06: 6 24: 24

Note: Standard packing; Carton: 50 pcs. Case 500 pcs.

TYPES AND COIL DATA (at 20°C 68°F)

• Single side stable type

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)(initial)	Drop-out voltage, V DC (min.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C 140°F)
ARX1003	3	2.25	0.3	45	66.7	200	3.3
ARX104H	4.5	3.375	0.45	101	44.4	200	4.95
ARX1006	6	4.5	0.6	180	33.3	200	6.6
ARX1009	9	6.75	0.9	405	22.2	200	9.9
ARX1012	12	9	1.2	720	16.7	200	13.2
ARX1024	24	18	2.4	2,880	8.3	200	26.4

• 1 coil latching type

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)(initial)	Reset voltage, V DC (max.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C 140°F)
ARX1103	3	2.25	2.25	45	66.7	200	3.3
ARX114H	4.5	3.375	3.375	101	44.4	200	4.95
ARX1106	6	4.5	4.5	180	33.3	200	6.6
ARX1109	9	6.75	6.75	405	22.2	200	9.9
ARX1112	12	9	9	720	16.7	200	13.2
ARX1124	24	18	18	2,880	8.3	200	26.4

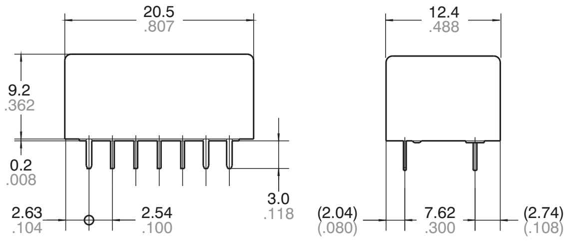
• 2 coil latching type

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)(initial)	Reset voltage, V DC (max.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C 140°F)
ARX1203	3	2.25	2.25	22.5	133.3	400	3.3
ARX124H	4.5	3.375	3.375	50.6	88.9	400	4.95
ARX1206	6	4.5	4.5	90	66.7	400	6.6
ARX1209	9	6.75	6.75	202.5	44.4	400	9.9
ARX1212	12	9	9	360	33.3	400	13.2
ARX1224	24	18	18	1,440	16.7	400	26.4

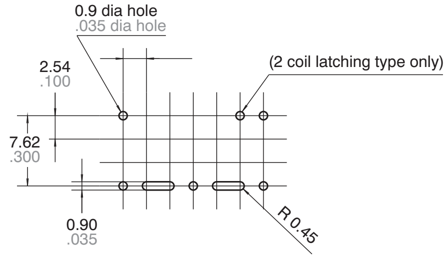
DIMENSIONS mm inch

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

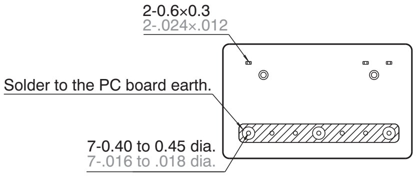
CAD Data



PC board pattern (Bottom view)



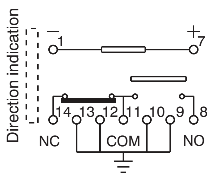
Tolerance: 0.1 .004



General tolerance: 0.3 .012

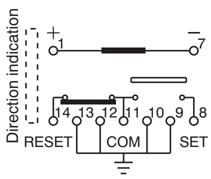
Schematic (Bottom view)

Single side stable



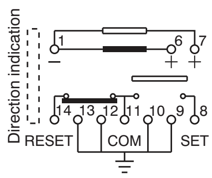
(Deenergized condition)

1 coil latching



(Reset condition)

2 coil latching



(Reset condition)

REFERENCE DATA

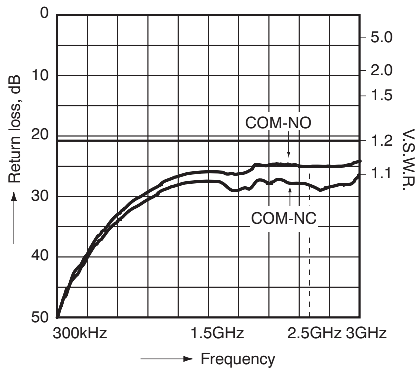
1. High frequency characteristics

Sample: ARX1012

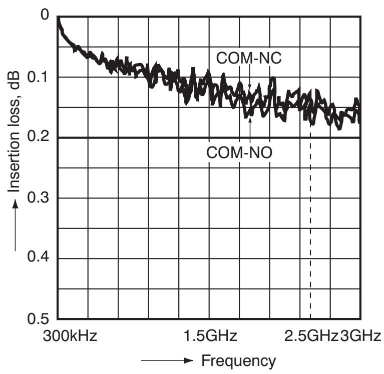
Measuring method: Measured with HP network analyzer (HP8753C).

The details for the high frequency characteristics and the measurement procedures and conditions are listed in the RX relay test report.

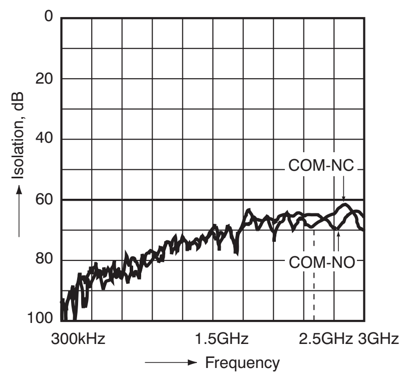
• V.S.W.R. (Return loss)



• Insertion loss



• Isolation



NOTES

1. Coil operating power
Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%.
However, check it with the actual circuit since the characteristics may be slightly different. The nominal operating voltage should be applied to the coil for more than 30 ms to set/reset the latching type relay.

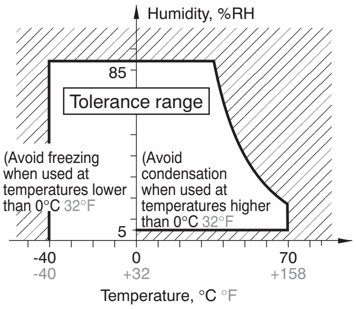
2. Coil connection
When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction.

3. External magnetic field
Since RX relays are highly sensitive polarized relays, their characteristics will be affected by a strong external magnetic field. Avoid using the relay under that condition.

4. Cleaning
For automatic cleaning, the boiling method is recommended. Avoid ultrasonic cleaning which subjects the relays to high frequency vibrations, which may cause the contacts to stick.
It is recommended that a fluorinated hydrocarbon or other alcoholic solvents be used.

5. Soldering
The manual soldering shall be performed under following condition.
Max. 260°C 500°F 10s
Max. 350°C 662°F 3s
In addition, when soldering the case to the PC board, the plating may swell depending on the soldering conditions.

6. Conditions for operation, transport and storage conditions
1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature:
–40 to +70°C –40 to +158°F
(2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage:



2) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
3) Freezing
Condensation or other moisture may freeze on the relay when the temperature is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
4) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

7. Latching relay
In order to assure proper operating regardless of changes in the ambient usage temperature and usage conditions, nominal operating voltage should be applied to the coil for more than 30 ms to set/reset the latching type relay.

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2.5 GHz MICROWAVE RELAY WITH 60 W CARRYING POWER	RX-P RELAYS (ARXP)

FEATURES

1. 60 W contact carrying power realized

• Three times the contact carrying power achieved compared to previous 20 W RX relay.

• Nominal switching capacity (when switching) also improved to 40W.

2. Excellent high frequency characteristics

• High frequency characteristics
(to 2.5GHz, Impedance: 50Ω, Initial)

Insertion loss (Max.)	0.2dB
Isolation (Min.)	60dB
V. S. W. R. (Max.) (Return loss) (Min.)	1.2 or less (20.8dB)
Contact carrying power	Max. 60W (at 20°C 68°F, V.S.W.R. ≦ 1.2, Average)

3. Small size

L: 20.5, W: 12.4, H: 9.4 mm
L: .807, W: .488, H: .370 inch

4. High sensitivity

Nominal operating power: 200mW (Single side stable type and 1 coil latching type)

TYPICAL APPLICATIONS

1. Base stations (mobile phones, terrestrial digital, etc.)

Used for redundant circuit construction in transmitter section.

2. Other applications

High-frequency amp switching in wireless devices, etc.

High-Frequency

ORDERING INFORMATION

ARXP 1 [ ] [ ][ ]

RX-P relays

Contact arrangement
1: 1 Form C

Operating function
0: Single side stable type
1: 1 coil latching type
2: 2 coil latching type

Coil voltage, DC
03: 3 V 4H: 4.5 V 06: 6 V 09: 9 V 12: 12 V 24: 24 V

TYPES

Nominal coil voltage	Part No.		
	Single side stable type	1 coil latching type	2 coil latching type
3 V DC	ARXP1003	ARXP1103	ARXP1203
4.5 V DC	ARXP104H	ARXP114H	ARXP124H
6 V DC	ARXP1006	ARXP1106	ARXP1206
9 V DC	ARXP1009	ARXP1109	ARXP1209
12 V DC	ARXP1012	ARXP1112	ARXP1212
24 V DC	ARXP1024	ARXP1124	ARXP1224

Standard packing: 50 pcs. in an inner package; 500 pcs. in an outer package

RATING

1. Coil data

1) Single side stable type

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage
3 V DC	75%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	66.7 mA	45 Ω	200 mW	110%V or less of nominal voltage (at 60°C 140°F) 150%V or less of nominal voltage (at 20°C 68°F)
4.5 V DC			44.4 mA	101 Ω		
6 V DC			33.3 mA	180 Ω		
9 V DC			22.2 mA	405 Ω		
12 V DC			16.7 mA	720 Ω		
24 V DC			8.3 mA	2,880 Ω		

2) 1 coil latching type

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage
3 V DC	75%V or less of nominal voltage (Initial)	75%V or less of nominal voltage (Initial)	66.7 mA	45 Ω	200 mW	110%V or less of nominal voltage (at 60°C 140°F) 150%V or less of nominal voltage (at 20°C 68°F)
4.5 V DC			44.4 mA	101 Ω		
6 V DC			33.3 mA	180 Ω		
9 V DC			22.2 mA	405 Ω		
12 V DC			16.7 mA	720 Ω		
24 V DC			8.3 mA	2,880 Ω		

3) 2 coil latching type

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage
3 V DC	75%V or less of nominal voltage (Initial)	75%V or less of nominal voltage (Initial)	133.3 mA	22.5Ω	400 mW	110%V or less of nominal voltage (at 60°C 140°F) 150%V or less of nominal voltage (at 20°C 68°F)
4.5 V DC			88.9 mA	50.6Ω		
6 V DC			66.7 mA	90 Ω		
9 V DC			44.4 mA	202.5Ω		
12 V DC			33.3 mA	360 Ω		
24 V DC			16.7 mA	1,440 Ω		

2. Specifications

Item			Specifications
Contact	Arrangement		1 Form C
	Contact material		Fixed: Au plating Movable: Au clad
	Contact resistance (Initial)		Max. 100 mΩ (By voltage drop 10 V AC 10mA)
Rating	Nominal switching capacity		40W (at 2.5GHz, Impedance: 50Ω, V.S.W.R.: Max. 1.2)
	Contact carrying power		Max. 60W (at 2.5GHz, Impedance: 50Ω, V.S.W.R.: Max. 1.2)
	Max. switching voltage		30 V DC
	Max. switching current		0.5 A DC
	Nominal operating power	Single side stable type	200mW
		1 coil latching type	200mW
		2 coil latching type	400mW
High frequency characteristics, Impedance: 50Ω (to 2.5GHz) (Initial)	V.S.W.R. (Return loss)		Max. 1.2 (Min. 20.8dB)
	Insertion loss		Max. 0.2dB
	Isolation		Min. 60dB
	Contact carrying power		Max. 60W (at 20°C 68°F, V.S.W.R. ≦ 1.2, Average)
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1min. (Detection current: 10mA)
		Between contact and coil	1,000 Vrms for 1min. (Detection current: 10mA)
		Between contact and earth terminal	500 Vrms for 1min. (Detection current: 10mA)
	Temperature rise (at 20°C 68°F)		Max. 60°C 140°F (By resistive method, nominal voltage applied to the coil, contact carrying power: 20W at 2.5GHz, 50Ω, V.S.W.R. ≦ 1.2)
	Operate time (at nominal voltage, at 20°C 68°F)	Single side stable type	Max. 10 ms (Approx. 6 ms) (Nominal voltage applied to the coil, excluding contact bounce time)
		1 coil latching type 2 coil latching type	Max. 10 ms (Approx. 5 ms) (Nominal voltage applied to the coil, excluding contact bounce time)
	Release time (at nominal voltage, at 20°C 68°F)	Single side stable type*1	Max. 6 ms (Approx. 3 ms) (Nominal voltage applied to the coil, excluding contact bounce time) (without diode)
		1 coil latching type 2 coil latching type	Max. 10 ms (Approx. 5 ms) (Nominal voltage applied to the coil, excluding contact bounce time)
Mechanical characteristics	Shock resistance	Functional	Min. 200 m/s² (Half-wave pulse of sine wave: 11 ms, detection time: 10µs)
		Destructive	Min. 1,000 m/s² (Half-wave pulse of sine wave: 6 ms)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3 mm (Detection time: 10µs)
		Destructive	10 to 55 Hz at double amplitude of 5 mm
Expected life	Mechanical life		Min. 10^4 (at 180 cpm)
	Electrical life		Min. 10^4 (40W, at 2.5GHz, Impedance: 50Ω, V.S.W.R: Max. 1.2) (at 20 cpm)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40 to 70°C –40°F to 158°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
Unit weight			Approx. 5 g .18 oz

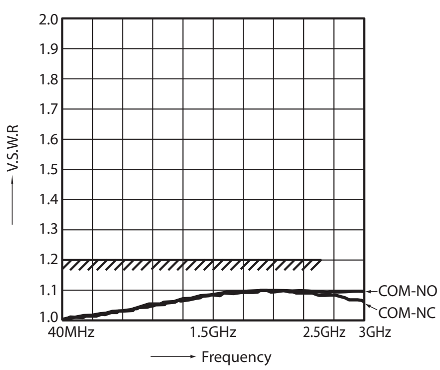
Notes:*
*1 Release time will lengthen if a diode, etc., is connected in parallel to the coil. Be sure to verify operation under actual conditions.
*2 The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

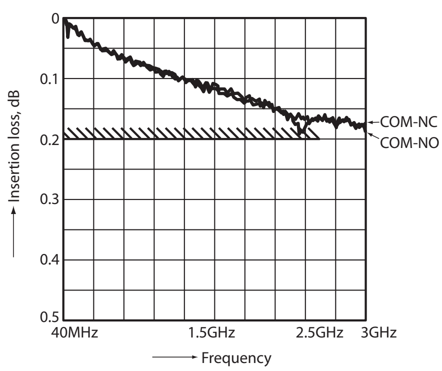
1. High frequency characteristics

Sample: ARXP1012; Measuring method: Measured with Agilent Technologies network analyzer (E8363B). *For details see No. 8 under “NOTES”.

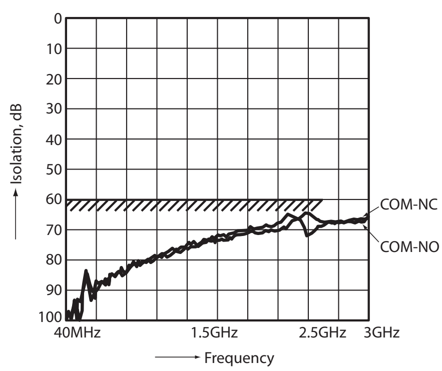
• V.S.W.R. characteristics



• Insertion loss characteristics (without D.U.T. board’s loss)



• Isolation characteristics

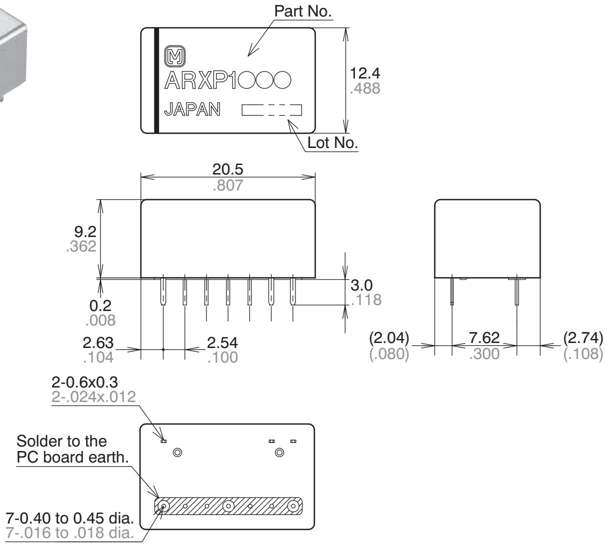


DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

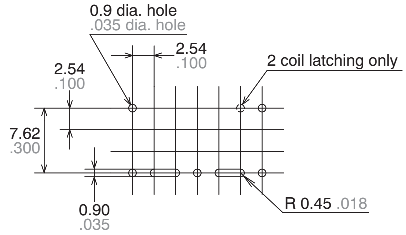
CAD Data

External dimensions



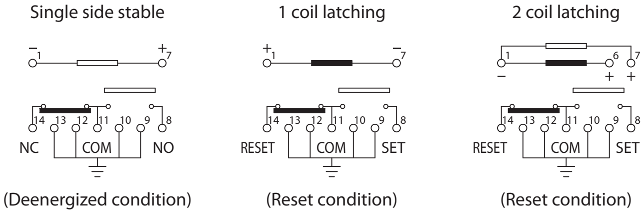
Tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



NOTES

1. Coil operating power

Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%.

However, check it with the actual circuit since the characteristics may be slightly different.

2. Coil connection

When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction.

To ensure accurate operation, the voltage on both sides of the coil should be ±5% (at 20°C 68°F) of the nominal coil voltage.

Also, please note that the pick-up and drop-out voltages (set and reset voltages) will change depending on operation temperature and conditions of use.

Keep the coil allowable voltage ripple ratio to no more than 5%.

3. External magnetic field

Since RX-P relays are highly sensitive polarized relays, their characteristics will be affected by a strong external magnetic field. Avoid using the relay under that condition.

4. Cleaning

For automatic cleaning, the boiling method is recommended. Avoid ultrasonic cleaning which subjects the relays to high frequency vibrations, which may cause the contacts to stick.

It is recommended that alcoholic solvents be used.

5. Soldering

1) Please meet the following conditions if this relay is to be automatically soldered.

(1) Preheating: Max. 120°C 248°F (terminal solder surface) for max. 120 seconds

(2) Soldering: Max. 260±5°C 500±41°F for max. 6 seconds

2) Please meet the following conditions if this relay is to be soldered by hand.

(1) 260°C 500°F for max. 10 seconds

(2) 350°C 662°F for max. 3 seconds

*In addition, when soldering the case to the PC board, the plating may swell depending on the soldering conditions.

6. Conditions for operation, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:

(1) Temperature:

–40 to +70°C –40 to +158°F (However, when 60 to 70°C 140 to 158°F, the pulse time is 1 second maximum and ON time is 10% maximum.)

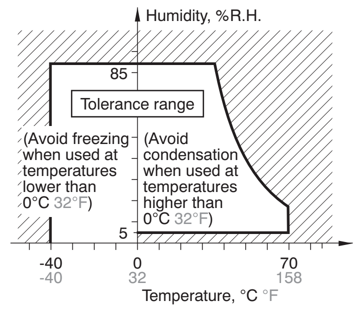
(2) Humidity: 5 to 85% RH

(Avoid freezing and condensation.)

The humidity range varies with the temperature. Use within the range indicated in the graph below.

(3) Atmospheric pressure: 86 to 106 kPa

Temperature and humidity range for usage, transport, and storage:



2) Condensation

Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.

3) Freezing

Condensation or other moisture may freeze on the relay when the temperature is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.

4) Low temperature, low humidity environments

The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

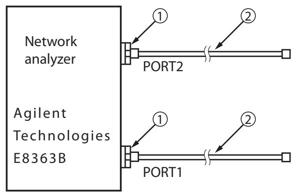
7. Latching relay

1) To ensure accurate operation of the latching type amidst surrounding temperature changes and other factors that might affect the set and reset pulse times, we recommend a coil impress set and reset pulse width of at least 30 ms at the rated operation voltage.

2) The latching type relay is shipped in the reset position. But jolts during transport or impacts during installation can change the reset position. It is, therefore, advisable to build a circuit in which the relay can be initialized (set and reset) just after turning on the power.

8. Measuring method

50Ω type

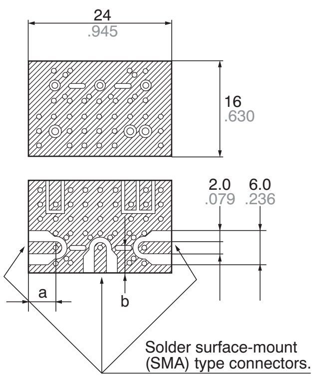


Connect connectors 1 and 2 respectively to PORT 1 and PORT 2. Perform calibration using the 3.5 mm calibration kit (HP85052B).

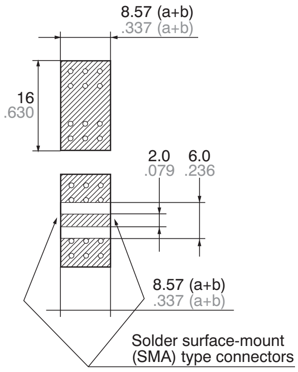
No.	Product name	Contents
1	Agilent 85130-60011	Adapter 2.4mm-3.5mm female .095inch-.138inch female
2	SUHNER SUCOFLEX104	Cable 3.5mm-3.5mm male .138inch-.138inch male

After calibration, connect the D.U.T. board and measure. However, connectors other than those for measurement should be connected with a 50¾ termination resistor.

PC board
Dimensions (mm inch)



PC board for correction
Dimensions (mm inch)



Material: Glass PTFE double-sided through hole PC board R-4737 (Matsushita Electric Works)
Board thickness: t = 0.8 mm .031 inch
Copper plating: 18 µm
Connector (SMA type receptacle)
Product name: 01K1808-00 (Waka Manufacturing Co., Ltd.)
Value has compensation PC board subtracted only for insertion loss. (Eliminate loss of connector and PC board.)

9. Others

1) The switching lifetime is defined under the standard test condition specified in the JIS C 5442 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 85%R.H.). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.

Also, be especially careful of loads such as those listed below.

• When used for AC load-operating and the operating phase is synchronous, rocking and fusing can easily occur due to contact shifting.

• When high-frequency opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.

Three countermeasures for these are listed here.

(1) Incorporate an arc-extinguishing circuit.
(2) Lower the operating frequency
(3) Lower the ambient humidity

2) Use the relay within specifications such as coil rating, contact rating and on/off service life. If used beyond limits, the relay may overheat, generate smoke or catch fire.

3) Be careful not to drop the relay. If accidentally dropped, carefully check its appearance and characteristics before use.

4) Be careful to wire the relay correctly. Otherwise, malfunction, overheat, fire or other trouble may occur.

5) If a relay stays on in a circuit for many months or years at a time without being activated, circuit design should be reviewed so that the relay can remain non-excited. A coil that receives current all the time heats, which degrades insulation earlier than expected. A latching type relay is recommended for such circuits.

6) If silicone materials (e.g., silicone rubbers, silicone oils, silicone coating agents, silicone sealers) are used in the vicinity of the relay, the gas emitted from the silicone may adhere to the contacts of the relay during opening and closing and lead to improper contact. If this is the case, use a material other than silicone.

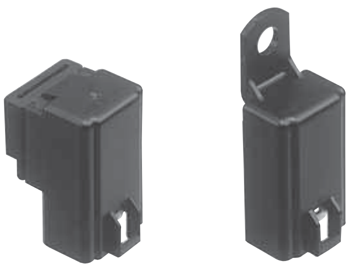
For Cautions for Use, see Relay Technical Information (page 582).

Automotive Relays

Panasonic
ideas for life

AUTOMOTIVE POWER RELAYS — SMALL SIZE, LIGHT WEIGHT

CA RELAYS



FEATURES

1. Small size and light weight
For space saving, the outside dimensions of the main body are reduced to be 21.5 mm (length) × 14.4 mm (width) × 37 mm (height) (.846 × .567 × 1.457 inch) and the weight is also reduced to be approx. 19 g .67 oz (direct coupling 1 Form A, 1 Form B type)

2. Low operating power (1.4W) type is available (1 Form A, 1 Form B)

3. Since the terminal arrangement complies with JIS D5011 B4-M1, commercial connectors are available for these types of relays.

SPECIFICATIONS

Contact

Type			12 V DC			24 V DC
Arrangement			1 Form A	1 Form B	1 Form C	1 Form C
Initial contact resistance (By voltage drop 6 V DC 1A)			Max. 50 mΩ			
Contact material			$AgSnO_2$ type			
Contact voltage drop			Max. 0.3 V After electrical life test, by voltage drop 12 V DC 20 A (1.4 W type), 12 V DC 30 A (1.8 W type)	Max. 0.3 V After electrical life test, by voltage drop 12 V DC 20 A	Max. 0.4 V After electrical life test, by voltage drop 12 V DC 20 A	Max. 0.4 V After electrical life test, by voltage drop 24 V DC 10 A
Rating	Nominal switching capacity (resistive load)		20 A 12 V DC (1.4 W type) 30 A 12 V DC (1.8 W type)	20 A 12 V DC		10 A 24 V DC (ON: 2s, OFF: 2s)
	Max. switching voltage		16 V		15 V	30 V
	Max. switching current		120 A (1.4 W type) 150 A (1.8 W type)	120 A	100 A	50 A (Inrush current)
	Max. carrying current		20 A continuous (1.4 W type) 30 A for 1 min (1.8 W type)	20 A continuous	20 A continuous	10 A continuous
	Min. switching capacity#1		1 A 12 V DC			1 A 24 V DC
Nominal operating power			1.4 W / 1.8 W		1.8 W	
Expected life (min. operations)	Mechanical (at 120 cpm)		10^6		5×10^5	
	Electrical	20 A (1.4 W, 1.8 W type)	10^5 (ON: 2s, OFF: 2s)	10^5 (ON 2s, OFF 2s)		10^5 (ON 2s, OFF 2s)
		30 A (1.8 W type)	2×10^4 (ON: 3s, OFF: 15s)			

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics (at 20°C 68°F)

Item		12 V DC		24 V DC
Type		12 V DC		24 V DC
Max. operating speed		15 cpm (1.4 W type: at nominal load / 1.8 W type: at 20 A)		15 cpm (at nominal load)
Initial insulation resistance		Min. 10 MΩ at 500 V DC		
Initial breakdown voltage*1	Between open contacts	500 V rms for 1 min.		
	Between contacts and coil	500 V rms for 1 min.		
Operate time*2 (at nominal voltage)		Max. 10 ms at 20°C (initial)		Max. 10 ms (initial)
Release time (without diode)*2 (at nominal voltage)		Max. 10 ms at 20°C (initial)		Max. 10 ms (initial)
Shock resistance	Functional*3	Min. 200 m/s² {20 G}	Min. 100 m/s² {10 G}	Min. 100 m/s² {10 G}
	Destructive*4	Min. 1,000 m/s² {100 G}		
Vibration resistance	Functional*5	Rubber bracket A type: Min. 100 m/s² {10 G}, 50 Hz to 500 Hz Direct coupling type or Screw-mounting type: Min. 44.1 m/s² {4.5 G}, 33Hz		Min. 44.1 m/s² {4.5 G}, 33 Hz
	Destructive*6	Rubber bracket A type: Min. 100m/s² {10 G}, 50 Hz to 500 Hz Direct coupling type or Screw-mounting type: Min. 44.1 m/s² {4.5 G}, 33Hz		Min. 44.1 m/s² {4.5 G}, 33 Hz
Conditions for operation, transport and storage*7 (Not freezing and condensing low temperature)	Ambient temp.	–30°C to +80°C –22°F to +176°F		
	Humidity	5% R.H. to 85% R.H.		
Water-proof standard		Plastic sealed type: JIS DO203S2, Dust cover type: JIS DO203R2		JIS DO203S2
Mass		Rubber bracket A type: 23 g .81 oz Direct coupling type or Screw-mounting type: 19 g .67 oz	31 g 1.09 oz	

Electrical life (min. operation)

	Nominal coil voltage, V DC	Motor load (operating frequency ON: 2 s, OFF: 2 s)	Halogen lamp load (operating frequency ON: 1 s, OFF: 14 s)
1 Form A, 1 Form B	12	10^5, 20 A 12 V DC	10^5, 20 A 12 V DC
1 Form C	12	10^5, 20 A 12 V DC	10^5, 20 A 12 V DC
	24	10^5, 10 A 24 V DC	10^5, 6 A 24 V DC

Remarks

*1 Detection current: 10 mA
*2 Excluding contact bounce time
*3 Half-wave pulse of sine wave: 11ms; detection time: 10µs
*4 Half-wave pulse of sine wave: 6ms
*5 Detection time: 10µs
*6 Time of vibration for each direction; X, Y, direction: 2 hours, Z direction: 4 hours
*7 Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

ORDERING INFORMATION

CA 1a F S — 12 V — A — 5

Contact arrangement	Protective construction	Nominal operating power	Coil voltage (DC)	Mounting method	Classification by type
1a: 1 Form A 1b: 1 Form B 1 : 1 Form C	Nil: Plastic sealed type F: Dust cover type	Nil: Standard type (1.8 W) S: Low operating power type (1.4 W) (1 Form A, 1 Form B)	12 V 24 V (1 Form C only)	A: Rubber bracket A type (1 Form A, 1 Form B) N: Screw mounting type C: Direct coupling type	Nil: 1 Form C 5: 1 Form A or 1 Form B

Notes: 1. Type with resistor/diode inside are available as options. Please consult our sales office.
2. Standard packing: Carton: 20 pcs. Case: 200 pcs.

COIL DATA

1) Standard type

Contact arrangement	Mounting type	Plastic sealed type	Dust cover type	Nominal voltage, V DC	Pick-up voltage, V DC (at 20°C 68°F)	Drop-out voltage, V DC (at 20°C 68°F)	Nominal operating current, mA (at 20°C 68°F)	Coil resistance, Ω (at 20°C 68°F)	Nominal operating power, W (at 20°C 68°F)	Usable voltage range, V DC
1 Form A	Rubber bracket A	CA1a-12V-A-5	CA1aF-12V-A-5	12	Max. 8	Min. 0.6 to 6	150±10%	80±10%	1.8	10 to 16
	Screw-mounting	CA1a-12V-N-5	CA1aF-12V-N-5	12	Max. 8	Min. 0.6 to 6	150±10%	80±10%	1.8	10 to 16
	Direct coupling	CA1a-12V-C-5	CA1aF-12V-C-5	12	Max. 8	Min. 0.6 to 6	150±10%	80±10%	1.8	10 to 16
1 Form B	Rubber bracket A	CA1b-12V-A-5	CA1bF-12V-A-5	12	Max. 8	Min. 0.6 to 6	150±10%	80±10%	1.8	10 to 16
	Screw-mounting	CA1b-12V-N-5	CA1bF-12V-N-5	12	Max. 8	Min. 0.6 to 6	150±10%	80±10%	1.8	10 to 16
	Direct coupling	CA1b-12V-C-5	CA1bF-12V-C-5	12	Max. 8	Min. 0.6 to 6	150±10%	80±10%	1.8	10 to 16
1 Form C	Screw-mounting	CA1-DC12V-N	–	12	Max. 8	Min. 0.6	150±10%	80±10%	1.8	10 to 15
	Direct coupling	CA1-DC12V-C	–	12	Max. 8	Min. 0.6	150±10%	80±10%	1.8	10 to 15
	Screw-mounting	CA1-DC24V-N	–	24	Max. 16	Min. 1.2	75±10%	320±10%	1.8	20 to 30
	Direct coupling	CA1-DC24V-C	–	24	Max. 16	Min. 1.2	75±10%	320±10%	1.8	20 to 30

2) Low operating power type

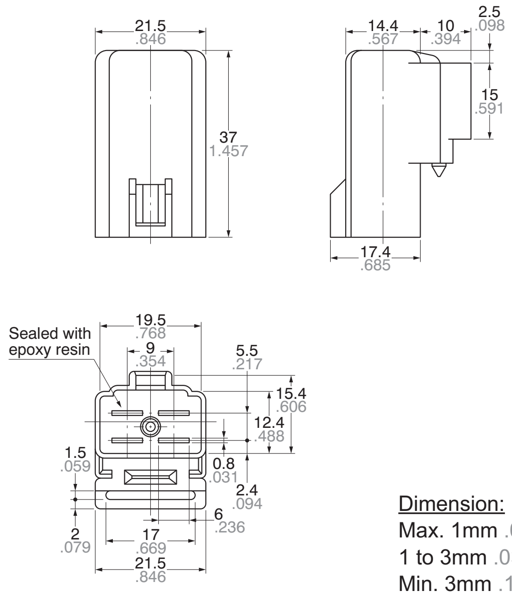
Contact arrangement	Mounting type	Plastic sealed type	Dust cover type	Nominal voltage, V DC	Pick-up voltage, V DC (at 20°C 68°F)	Drop-out voltage, V DC (at 20°C 68°F)	Nominal operating current, mA (at 20°C 68°F)	Coil resistance, Ω (at 20°C 68°F)	Nominal operating power, W (at 20°C 68°F)	Usable voltage range, V DC
1 Form A	Rubber bracket A	CA1aS-12V-A-5	CA1aFS-12V-A-5	12	Max. 8	Min. 0.6 to 6	120±10%	100±10%	1.4	10 to 16
	Screw-mounting	CA1aS-12V-N-5	CA1aFS-12V-N-5	12	Max. 8	Min. 0.6 to 6	120±10%	100±10%	1.4	10 to 16
	Direct coupling	CA1aS-12V-C-5	CA1aFS-12V-C-5	12	Max. 8	Min. 0.6 to 6	120±10%	100±10%	1.4	10 to 16
1 Form B	Rubber bracket A	CA1bS-12V-A-5	CA1bFS-12V-A-5	12	Max. 8	Min. 0.6 to 6	120±10%	100±10%	1.4	10 to 16
	Screw-mounting	CA1bS-12V-N-5	CA1bFS-12V-N-5	12	Max. 8	Min. 0.6 to 6	120±10%	100±10%	1.4	10 to 16
	Direct coupling	CA1bS-12V-C-5	CA1bFS-12V-C-5	12	Max. 8	Min. 0.6 to 6	120±10%	100±10%	1.4	10 to 16

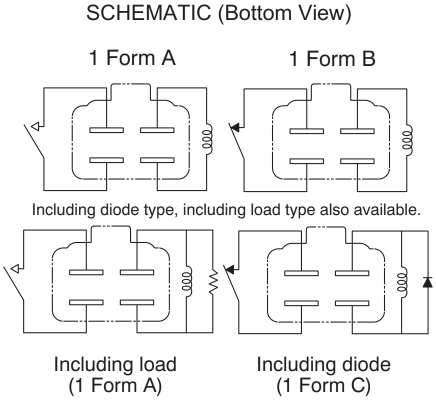
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. 1 Form A/1 Form B
Rubber bracket A type

CAD Data

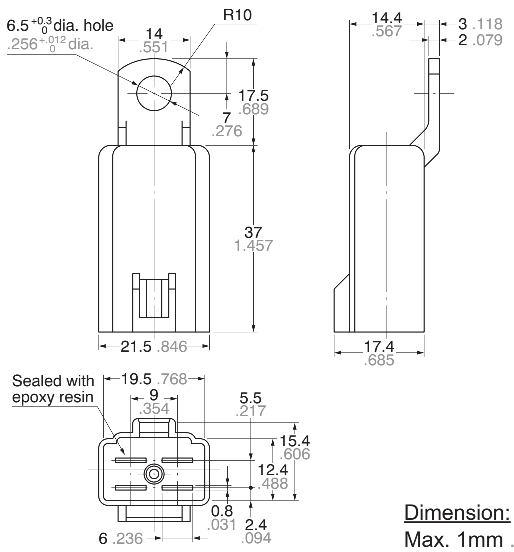


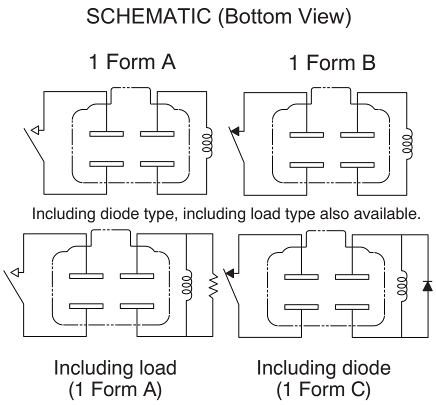


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

2. 1 Form A/1 Form B
Screw-mounting type

CAD Data





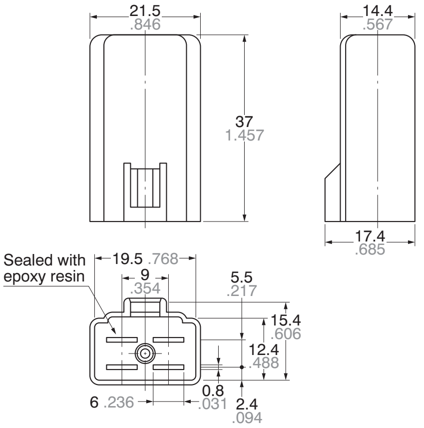
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

3. 1 Form A/1 Form B

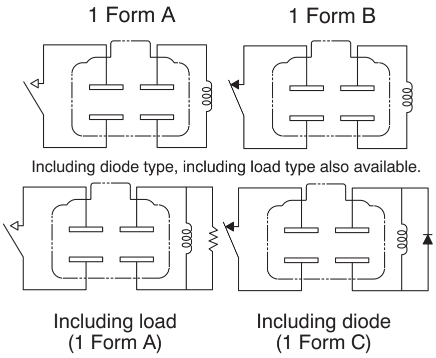
Direct coupling type

CAD Data

mm inch



SCHEMATIC (Bottom View)

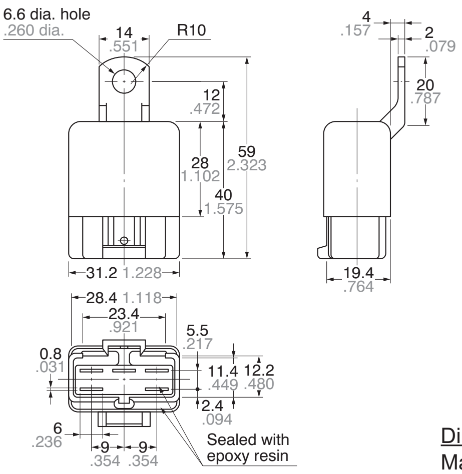


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

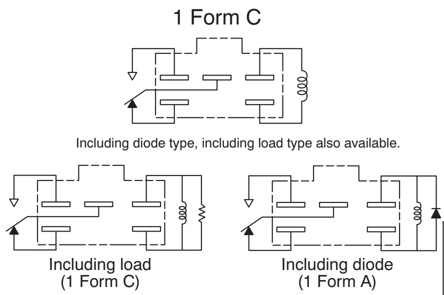
4. 1 Form C

Screw-mounting type

CAD Data



SCHEMATIC (Bottom View)

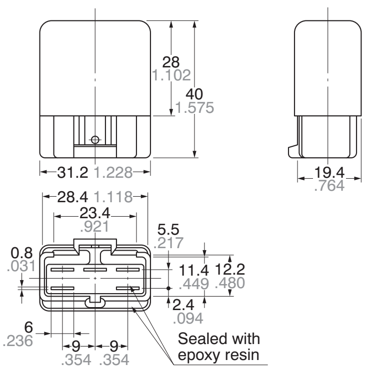


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

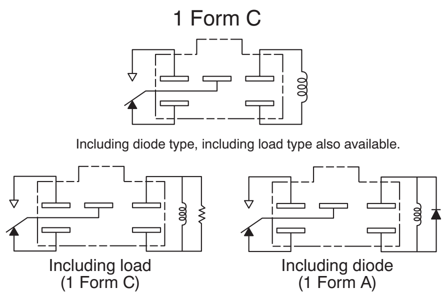
5. 1 Form C

Direct coupling type

CAD Data



SCHEMATIC (Bottom View)

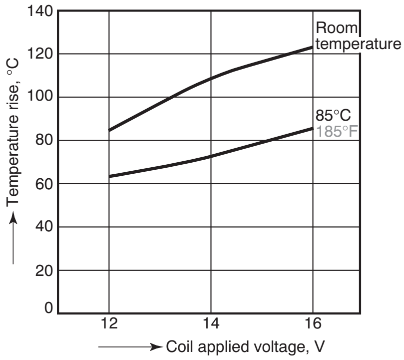


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

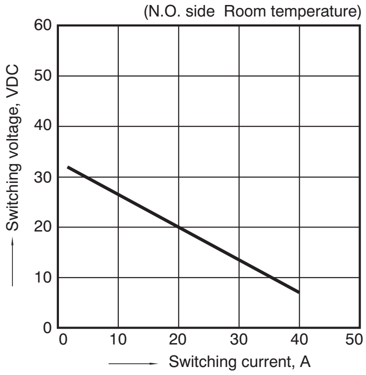
REFERENCE DATA

1. Coil temperature rise

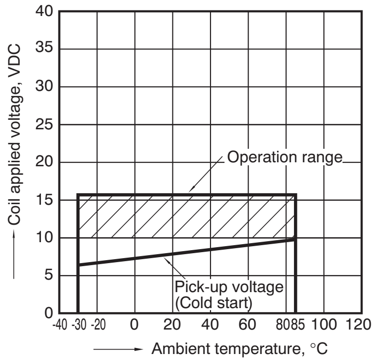
Samples: CA1aS-12V-N-5, 5pcs.
Measured portion: Inside the coil
Contact carrying current: 20A
Ambient temperature: Room temperature, 85°C
185°F



2. Max. switching capability (Resistive load)

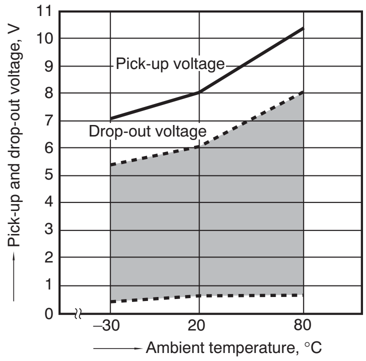


3. Ambient temperature and operating temperature range



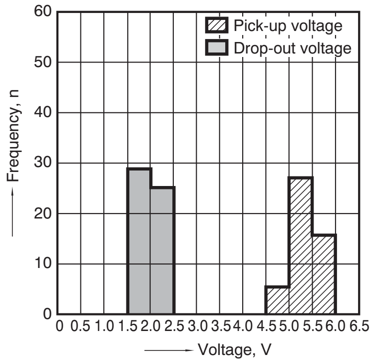
4. Ambient temperature characteristics (Cold start)

Samples: CA1bS-12V-N-5



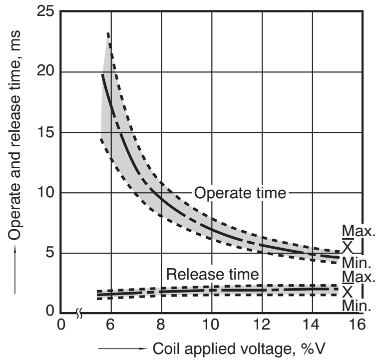
5. Distribution of pick-up and drop-out voltage

Quantity: 50pcs.



6. Distribution of operate and release time

Sample: CA1a-12V-N-5, 10pcs.

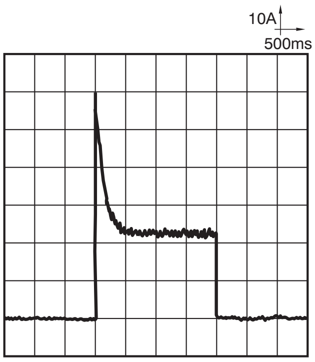


7-(1). Electrical life test (Motor load)

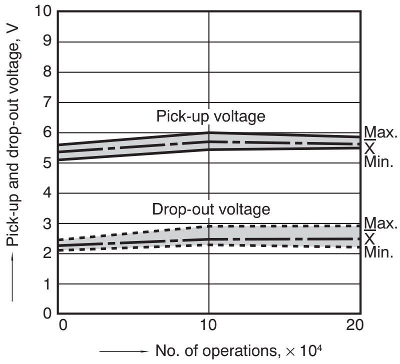
Sample: CA1a-12V-C, 3pcs.
Load: Inrush current: 63A, steady current: 23A
Blower fan motor actual load (motor free)
Switching frequency: (ON:OFF = 2s:2s)
Ambient temperature: Room temperature

Load current waveform

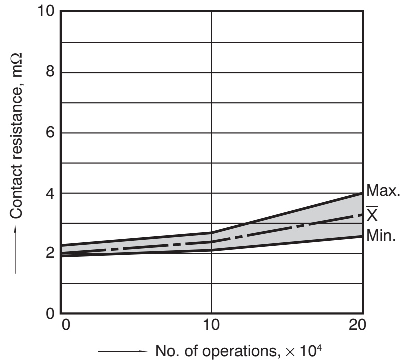
Load: Inrush current: 63A, steady current: 23A,



Change of pick-up and drop-out voltage

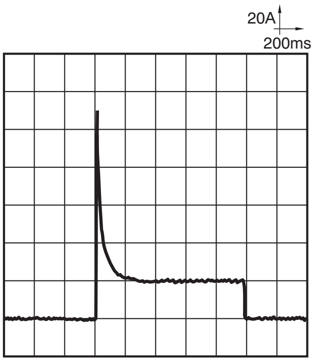


Change of contact resistance

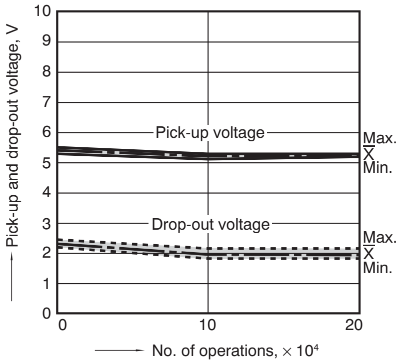


7-(2). Electrical life test (Lamp load)
Sample: CA1a-12V-C, 3pcs.
Load: 60Wx4, Inrush current: 110A, steady current: 20A
Halogen lamp actual load
Switching frequency: (ON:OFF = 1s:14s)
Ambient temperature: Room temperature

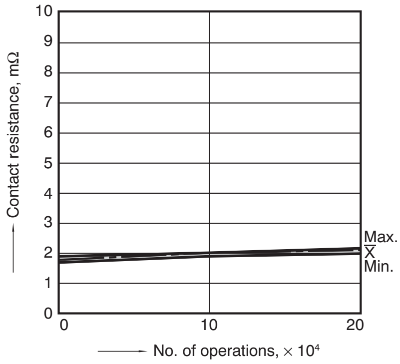
Load current waveform
Load: Inrush current: 110A, steady current: 20A,



Change of pick-up and drop-out voltage



Change of contact resistance



Cautions regarding the protection element

1. Part numbers without protection elements

1) 12 V models

When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 24 V or higher, or a resistor (680Ω to 1,000Ω). When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2) 24 V models

When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 48 V or higher, or a resistor (2,800Ω to 4,700Ω).
When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2. Part numbers with diodes

These relays use a diode in the coil surge protection element. Therefore, the release time is slower and the working life might be shorter compared to part numbers without protection elements and part numbers with resistors.
Be sure to use only after evaluating under actual load conditions.

3. Part numbers with resistors

This part number employs a resistor in the coil surge protection circuit; therefore, an external surge protection element is not required. In particular, when a diode is connected in parallel with a coil, the revert time becomes slower which could adversely affect working life. Please check the circuit and make sure that a diode is not connected in parallel with the coil drive circuit.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

AUTOMOTIVE RELAY WITH ISO TERMINAL ARRANGEMENT

CB RELAYS

FEATURES

1. This relay has an ISO (International Organization for Standardization) terminal arrangement.
Terminals are all solder plated.
*35 A type: Terminal is the plug-in type (no plating).

2. Relay is compact and high capacity (40 A).
Compact form factor realized with space saving 22 × 26 mm .866 × 1.024 inch small base area thanks to integrated bobbin and base construction. Features high switching capacity of 40 A

3. Features high thermal resistance of 125°C 257°F (heat resistant type).
Heat resistant type is available that can withstand use near engines. (40 A switching capacity)

4. Sealed type available for resisting adverse environments.

5. Surge absorbing built-in diode type that works when the relay coil is off and an internal resistor type are available. (Please inquire.)

6. Protective element type is also available.

7. For only plug-in types, types with nominal switching capacities of 35 A (12 V) and 15 A (24 V) are available.

TYPICAL APPLICATIONS

1. Automobiles
Headlights, Cell motors, Air conditioners, ABS, EPS, etc.

2. Construction equipment

3. Agricultural equipment, Conveyor, etc.

ORDERING INFORMATION

CB [ ] [ ] [ ] - [ ] [ ] - [ ] - [ ]

Contact arrangement
1a: 1 Form A
1: 1 Form C

Contact rating
Nil: Standard type
H: High contact capacity type
V: 35 A type

Protective construction
Nil: Sealed type
F: Flux-resistant type

Heat resistant of types
Nil: Standard type
T: Heat resistant type

Protective element
Nil: None
D: with diode inside
R: with resistor inside

Mounting classification
Nil: Plug-in type
P: PC board type
M: Bracket type

Coil voltage (DC)
12V, 24 V

TYPES

1. Standard type

Contact arrangement	Mounting classification	Nominal coil voltage	Sealed type	Flux-resistant type
			Part No.	Part No.
1 Form A	PC board type	12V DC	CB1a-P-12V	CB1aF-P-12V
		24V DC	CB1a-P-24V	CB1aF-P-24V
	Plug-in type	12V DC	CB1a-12V	CB1aF-12V
		24V DC	CB1a-24V	CB1aF-24V
	Bracket type	12V DC	CB1a-M-12V	CB1aF-M-12V
		24V DC	CB1a-M-24V	CB1aF-M-24V
1 Form C	PC board type	12V DC	CB1-P-12V	CB1F-P-12V
		24V DC	CB1-P-24V	CB1F-P-24V
	Plug-in type	12V DC	CB1-12V	CB1F-12V
		24V DC	CB1-24V	CB1F-24V
	Bracket type	12V DC	CB1-M-12V	CB1F-M-12V
		24V DC	CB1-M-24V	CB1F-M-24V
High contact capacity (1 Form A)	PC board type*	12V DC	CB1aH-P-12V	CB1aHF-P-12V
		24V DC	CB1aH-P-24V	CB1aHF-P-24V
	Plug-in type	12V DC	CB1aH-12V	CB1aHF-12V
		24V DC	CB1aH-24V	CB1aHF-24V
	Bracket type	12V DC	CB1aH-M-12V	CB1aHF-M-12V
		24V DC	CB1aH-M-24V	CB1aHF-M-24V

Packing quantity; Carton: 50 pcs. Case: 200 pcs.
Notes: 1. Please use “CB∗∗∗R∗∗” to order built-in resistor type and “CB∗∗∗D∗∗” to order built-in diode type. (Asterisks “∗” should be filled in from parts table.)
2. *Regarding solder, this product is not MIL (Military Standard) compliant. Please evaluate solder mounting by the actual equipment before using.

2. Heat resistant type

Contact arrangement	Mounting classification	Nominal coil voltage	Sealed type	Flux-resistant type
			Part No.	Part No.
1 Form A	PC board type	12V DC	CB1a-T-P-12V	CB1aF-T-P-12V
		24V DC	CB1a-T-P-24V	CB1aF-T-P-24V
	Plug-in type	12V DC	CB1a-T-12V	CB1aF-T-12V
		24V DC	CB1a-T-24V	CB1aF-T-24V
	Bracket type	12V DC	CB1a-T-M-12V	CB1aF-T-M-12V
		24V DC	CB1a-T-M-24V	CB1aF-T-M-24V
1 Form C	PC board type	12V DC	CB1-T-P-12V	CB1F-T-P-12V
		24V DC	CB1-T-P-24V	CB1F-T-P-24V
	Plug-in type	12V DC	CB1-T-12V	CB1F-T-12V
		24V DC	CB1-T-24V	CB1F-T-24V
	Bracket type	12V DC	CB1-T-M-12V	CB1F-T-M-12V
		24V DC	CB1-T-M-24V	CB1F-T-M-24V
High contact capacity (1 Form A)	PC board type*	12V DC	CB1aH-T-P-12V	CB1aHF-T-P-12V
		24V DC	CB1aH-T-P-24V	CB1aHF-T-P-24V
	Plug-in type	12V DC	CB1aH-T-12V	CB1aHF-T-12V
		24V DC	CB1aH-T-24V	CB1aHF-T-24V
	Bracket type	12V DC	CB1aH-T-M-12V	CB1aHF-T-M-12V
		24V DC	CB1aH-T-M-24V	CB1aHF-T-M-24V

Packing quantity; Carton: 50 pcs. Case: 200 pcs.
Notes: 1. Please use “CB∗∗∗R∗∗” to order built-in resistor type and “CB∗∗∗D∗∗” to order built-in diode type. (Asterisks “∗” should be filled in from parts table.)
2. *Regarding solder, this product is not MIL (Military Standard) compliant. Please evaluate solder mounting by the actual equipment before using.

3. 35 A type (*Terminals are all of the plug-in type.)

Contact arrangement	Nominal coil voltage	Sealed type	Flux-resistant type
		Part No.	Part No.
1 Form A	12V DC	CB1aV-12V	CB1aVF-12V
	24V DC	CB1aV-24V	CB1aVF-24V
1 Form C	12V DC	CB1V-12V	CB1VF-12V
	24V DC	CB1V-24V	CB1VF-24V
1 Form A with resistor inside	12V DC	CB1aV-R-12V	CB1aVF-R-12V
	24V DC	CB1aV-R-24V	CB1aVF-R-24V
1 Form C with resistor inside	12V DC	CB1V-R-12V	CB1VF-R-12V
	24V DC	CB1V-R-24V	CB1VF-R-24V
1 Form A with diode inside	12V DC	CB1aV-D-12V	CB1aVF-D-12V
	24V DC	CB1aV-D-24V	CB1aVF-D-24V
1 Form C with diode inside	12V DC	CB1V-D-12V	CB1VF-D-12V
	24V DC	CB1V-D-24V	CB1VF-D-24V

Packing quantity; Carton: 50 pcs. Case: 200 pcs.

RATING

1. Coil data

1) 1. No protective element and with diode inside

Contact arrangement	Nominal coil voltage	Pick-up voltage (Initial, at 20°C 68°F)	Drop-out voltage (Initial, at 20°C 68°F)	Nominal operating current (at 20°C 68°F)	Coil resistance (±10%) (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
1 Form A, 1 Form C	12V DC	3 to 7V DC	1.2 to 4.2V DC	117mA	103Ω	1.4W	10 to 16V DC
	24V DC	6 to 14V DC	2.4 to 8.4V DC	75mA	320Ω	1.8W	20 to 32V DC
High contact capacity (1 Form A)	12V DC	3 to 7V DC	1.2 to 4.2V DC	117mA	103Ω	1.4W (PC board type)	10 to 16V DC
				150mA	80Ω	1.8W	
	24V DC	6 to 14V DC	2.4 to 8.4V DC	58mA	411Ω	1.4W (PC board type)	20 to 32V DC
				75mA	320Ω	1.8W	

Note: Other pick-up voltage types are also available. Please contact us for details.

2) With resistor inside

Contact arrangement	Nominal coil voltage	Pick-up voltage (Initial, at 20°C 68°F)	Drop-out voltage (Initial, at 20°C 68°F)	Nominal operating current (at 20°C 68°F)	Combined resistance (±10%) (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
1 Form A, 1 Form C	12V DC	3 to 7V DC	1.2 to 4.2V DC	134mA	89.5Ω	1.6W	10 to 16V DC
	24V DC	6 to 14V DC	2.4 to 8.4V DC	84mA	287.2Ω	2.0W	20 to 32V DC

2. Specifications

1) Standard type (12 V coil voltage)

Characteristics	Item		Specifications		
Contact	Arrangement		1 Form A	1 Form C	High contact capacity (1 Form A)
	Contact resistance (Initial)		Typ2mΩ (By voltage drop 6 V DC 1 A)		
	Contact material		Ag alloy (Cadmium free)		
Rating	Nominal switching capacity (Initial)		40A 14V DC	N.O.: 40A 14V DC N.C.: 30A 14V DC	70A 14V DC (at 20°C 68°F) 50A 14V DC (at 85°C 185°F)
	Max. carrying current (Initial) (14V DC, at 85°C 185°F, continuous)		N.O.: 40A	N.O.: 40A, N.C.: 30A	N.O.: 40A
	Nominal operating power		1.4W	1.4W	1.8W (1.4W: PC board type)
	Min. switching capacity*1		1A 12V DC (12V DC), 1A 24V DC (24V DC)		
Electrical characteristics	Initial insulation resistance		Min. 20 MΩ (at 500 V DC)		
	Initial breakdown voltage	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)		
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)		
	Operate time (at nominal voltage) (at 20°C 68°F)		Max. 15ms (at 20°C 68°F, excluding contact bounce time) (Initial)		
	Release time (at nominal voltage) (at 20°C 68°F)		Max. 15ms (at 20°C 68°F, excluding contact bounce time, without diode) (Initial)		
Mechanical characteristics	Shock resistance	Functional	Min. 200 m/s² {20G}		
		Destructive	Min. 1,000 m/s² {100G}		
	Vibration resistance	Functional	10 Hz to 500 Hz, Min. 44.1m/s² {4.5G}		
		Destructive	10 Hz to 2,000 Hz, Min. 44.1m/s² {4.5G} Time of vibration for each direction; X. Y. Z direction: 4 hours		
Expected life	Electrical (at nominal switching capacity)		Flux-resistant type: Min. 10^5, Sealed type: Min. 5×10^4 (Operating frequency: 2s ON, 2s OFF)		
	Mechanical		Min. 10^6 (at 120 cpm)		
Conditions	Conditions for operation, transport and storage*2		Standard type; Ambient temp: –40 to +85°C –40 to +185°F, Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)		
			Heat resistant type; Ambient temp: –40 to +125°C –40 to +257°F, Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)		
	Max. operating speed		15 cpm (At nominal switching capacity)		
Unit weight			Approx. 33 g 1.16 oz		

Notes:

*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

*2 The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

2) Standard type (24 V coil voltage)

Characteristics	Item	Specifications		
Contact	Arrangement	1 Form A	1 Form C	High contact capacity (1 Form A)
	Contact resistance (Initial)	Max. 15mΩ (By voltage drop 6 V DC 1 A)		
	Contact material	Ag alloy (Cadmium free)		
Rating	Nominal switching capacity (Initial)	20A 28V DC	N.O.: 20A 28V DC N.C.: 10A 28V DC	20A 28V DC
	Max. carrying current (Initial) (28V DC, at 85°C 185°F, continuous)	20A	N.O.: 20A, N.C.: 10A	20A
	Nominal operating power	1.8W	1.8W	1.8W, 1.4W (PC board type)

Note: All other specifications are the same as those of standard type (12 V coil voltage)

3) Heat resistant type (12 V and 24 V coil voltage)

Characteristics	Item	Specifications						
		12V				24V		
Contact	Arrangement	1 Form A	1 Form C	High contact capacity (1 Form A)		1 Form A	1 Form C	High contact capacity (1 Form A)
	Contact resistance (Initial)	Max. 15mΩ (By voltage drop 6 V DC 1 A)						
	Contact material	Ag alloy (Cadmium free)						
Rating	Nominal switching capacity (Initial)	40A 14V DC	N.O.: 40A 14V DC N.C.: 30A 14V DC	40A 14V DC		20A 28V DC	N.O.: 20A 28V DC N.C.: 10A 28V DC	20A 28V DC
	Max. carrying current (Initial) (at 85°C 185°F, continuous)*	50A 14V DC	N.O.: 50A 14V DC N.C.: 30A 14V DC	45A 14V DC	50A 14V DC	25A 28V DC	N.O.: 25A 28V DC N.C.: 10A 28V DC	25A 28V DC
	Nominal operating power	1.4W	1.4W	1.8W	1.4W (PC board type)	1.8W	1.8W	1.8W, 1.4W (PC board type)

Notes: 1. All other specifications are the same as those of standard type (12 V coil voltage)
2. *Current value in which carry current is possible when the coil temperature is 180°C 356°F

4) 35 A type (12 V coil voltage)

Characteristics	Item		Specifications	
Contact	Arrangement		1 Form A	1 Form C
	Contact resistance (Initial)		Typ2mΩ (By voltage drop 6 V DC 1 A)	
	Contact material		Ag alloy (Cadmium free)	
Rating	Nominal switching capacity (Resistive load)		35A 14V DC	N.O.: 35A 14V DC, N.C.: 25A 14V DC
	Max. carrying current (Initial) (14V DC, at 85°C 185°F, continuous)		N.O.: 35A	N.O.: 35A, N.C.: 25A
	Nominal operating power		1.4W, 1.6W (with resistor inside)	
	Min. switching capacity (Reference value)*		1A 12V DC (12V DC), 1A 24V DC (24V DC)	
Electrical characteristics	Initial insulation resistance		Min. 20 MΩ (at 500 V DC)	
	Initial breakdown voltage	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)	
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)	
	Operate time (at nominal voltage)		Max. 15ms (excluding contact bounce time) (Initial)	
	Release time (at nominal voltage)		Max. 15ms (excluding contact bounce time, without diode) (Initial)	
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s^2 {10G} (Half-wave pulse of sine wave: 11ms; detection: 10µs)	
		Destructive	Min. 1,000 m/s^2 {100G} (Half-wave pulse of sine wave: 6ms)	
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1m/s^2 {4.5G} (Detection time: 10µs)	
		Destructive	10 Hz to 2,000 Hz, Min. 44.1m/s^2 {4.5G} Time of vibration for each direction; X. Y. Z direction: 4 hours	
Expected life	Electrical (at nominal switching capacity)		Flux-resistant type: Min. 10^5, Sealed type: Min. 5×10^4 (Operating frequency: 2s ON, 2s OFF) With diode inside: Min. 5×10^4 (Operating frequency: 2s ON, 2s OFF)	
	Mechanical		Min. 10^6 (at 120 cpm)	
Conditions	Conditions for operation, transport and storage		Ambient temp: –40°C to +85°C –40°F to +185°F Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature)	
	Max. operating speed		15 cpm (At nominal switching capacity)	
Unit weight			Approx. 26 g .92 oz, Approx. 28 g .99 oz (with diode inside)	

Note: * This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

5) 35 A type (24 V coil voltage)

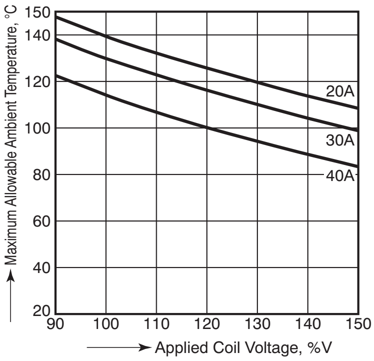
Characteristics	Item	Specifications	
Contact	Arrangement	1 Form A	1 Form C
Rating	Nominal switching capacity (Resistive load)	15A 28V DC	N.O.: 15A 28V DC, N.C.: 8A 28V DC
	Max. carrying current (14V DC, at 85°C 185°F, continuous)	N.O.: 15A	N.O.: 15A, N.C.: 8A
	Nominal operating power	1.8W, 2.0W (with resistor inside)	

Note: All other specifications are the same as those of 35 A type (12 V coil voltage).

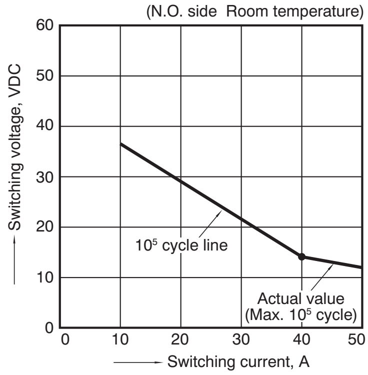
REFERENCE DATA

CB RELAYS (Standard type)

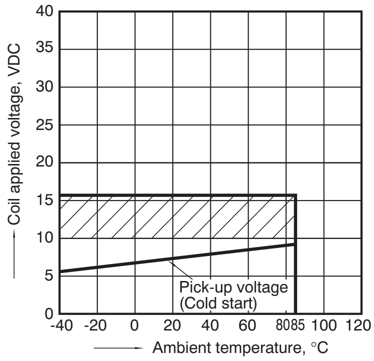
1. Allowable ambient temperature



2. Max. switching capability (Resistive load)
(Standard type)

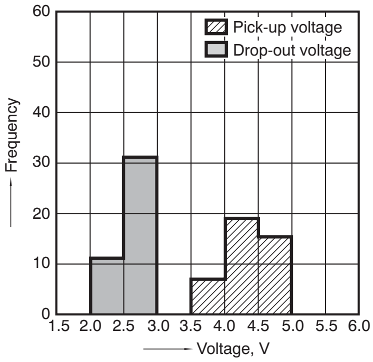


3. Ambient temperature and operating voltage range
(Standard type)

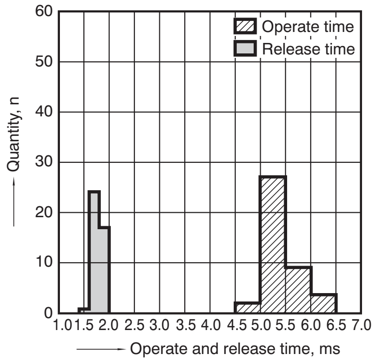


Asssumption:
• Maximum mean coil temperature: 180°C
• Curves are based on 1.4W (Nominal power consumption of the unsupprressed coil at nominal voltage)

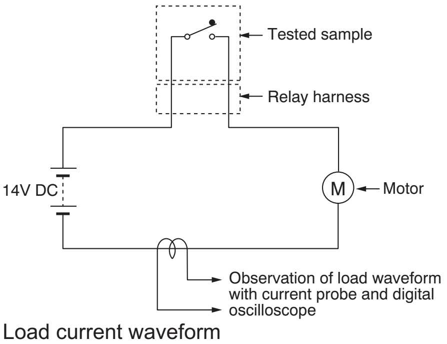
4. Distribution of pick-up and drop-out voltage
Sample: CB1-P-12V, 42pcs.



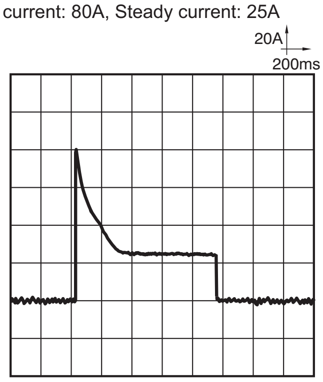
5. Distribution of operate and release time
Sample: CB1-P-24V, 42pcs.
* Without diode



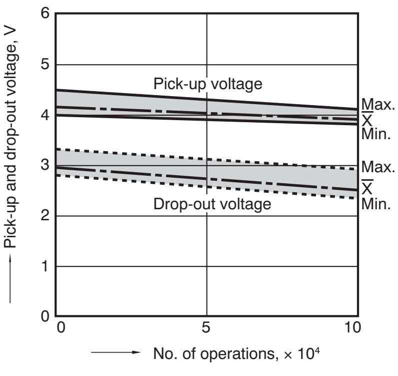
6-(1). Electrical life test (Motor free)
Sample: CB1F-12V, 5pcs.
Load: 25A 14V DC, motor free actual load
Switching frequency: (ON:OFF = 1s:9s)
Ambient temperature: Room temperature
Circuit



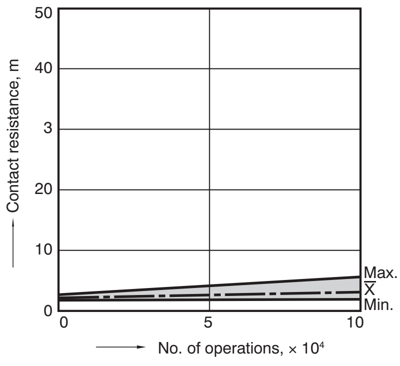
Load current waveform
Inrush current: 80A, Steady current: 25A



Change of pick-up and drop-out voltage



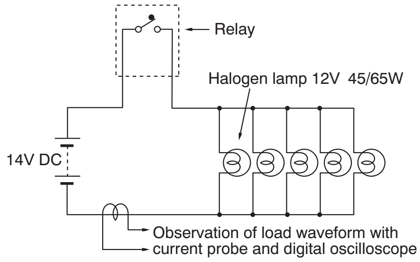
Change of contact resistance



6-(2). Electrical life test (Lamp load)

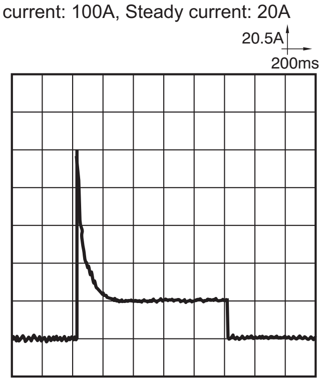
Sample: CB1F-12V, 5pcs.
Load: 45/65Wx5 parallel, 14V DC, halogen lamp actual load
Switching frequency: (ON:OFF = 1s:8s)
Ambient temperature: Room temperature

Circuit

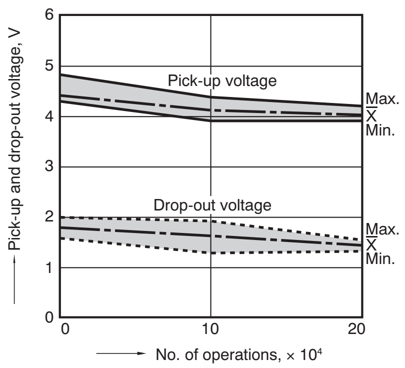


Load current waveform

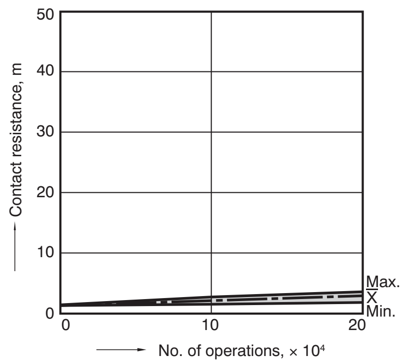
Inrush current: 100A, Steady current: 20A



Change of pick-up and drop-out voltage

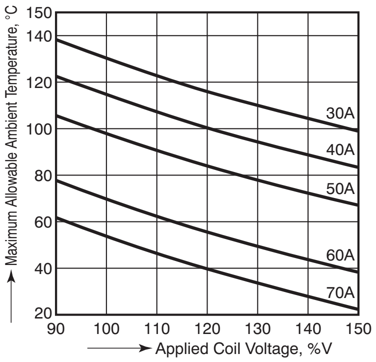


Change of contact resistance



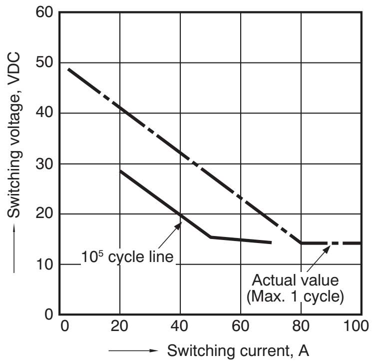
CB RELAYS (High contact capacity type)

1. Allowable ambient temperature



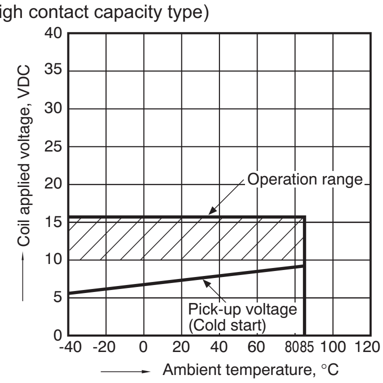
2. Max. switching capability

(High contact capacity type)



3. Ambient temperature and operating voltage range

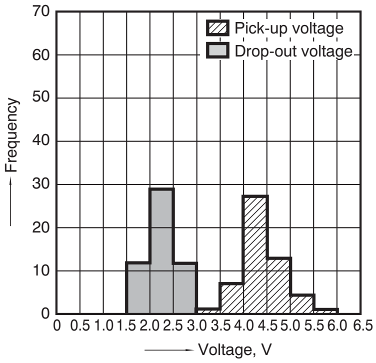
(High contact capacity type)



Asssumption:
• Maximum mean coil temperature: 180°C
• Curves are based on 1.4W (Nominal power consumption of the unsupprressed coil at nominal voltage)

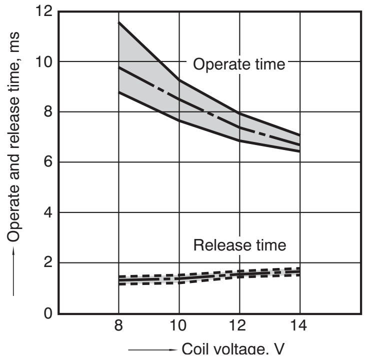
4. Distribution of pick-up and drop-out voltage

Sample: CB1aHF-12V, 53pcs.



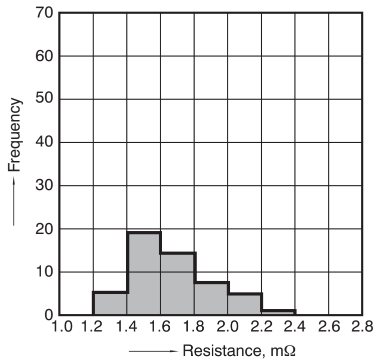
5. Distribution of operate and release time

Sample: CB1aHF-12V, 53pcs.



6. Contact resistance

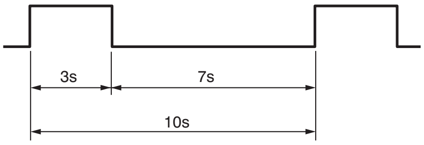
Sample: CB1aHF-12V, 53pcs.
(By voltage drop 6V DC 1A)

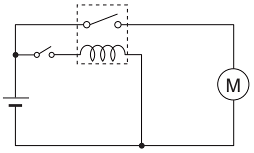


7-(1). Electrical life test (Motor free)

Sample: CB1aH-12V, 3pcs.
Load: Inrush current: 64A/Steady current: 35A
Fan motor actual load (motor free) 12V DC
Switching frequency: (ON:OFF = 3s:7s)
Ambient temperature: Room temperature

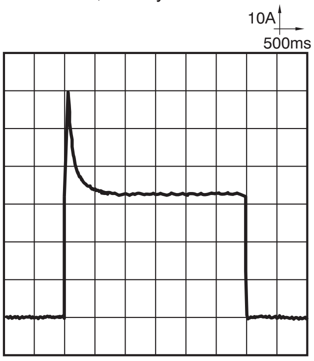
Circuit



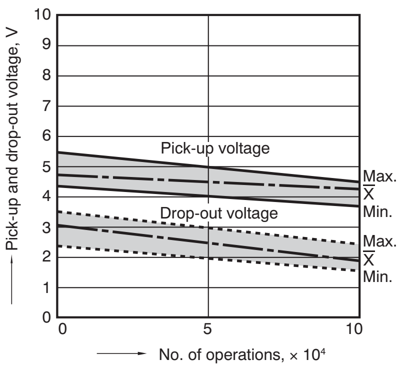


Load current waveform

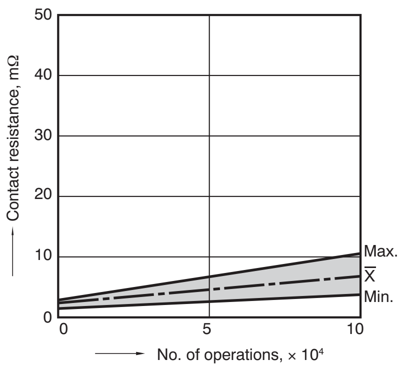
Inrush current: 64A, Steady current: 35A



Change of pick-up and drop-out voltage



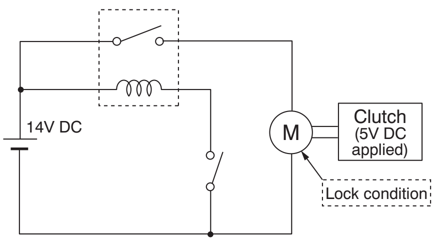
Change of contact resistance



7-(2). Electrical life test (Motor lock)

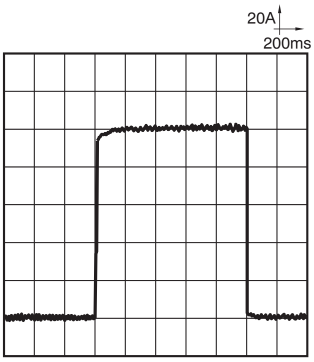
Sample: CB1aH-12V, 5pcs.
Load: 100A 14V DC
Magnet clutch actual load (lock condition)
Switching frequency: (ON:OFF = 1s:9s)
Ambient temperature: Room temperature

Circuit

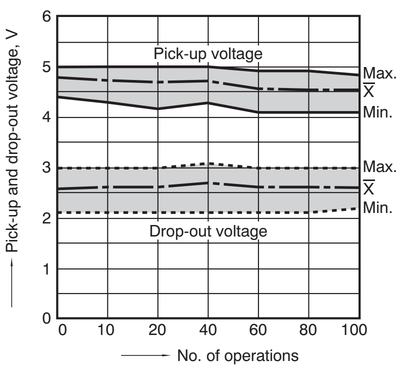


Load current waveform

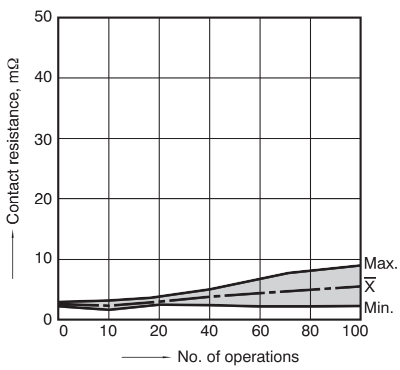
100A 14V DC



Change of pick-up and drop-out voltage

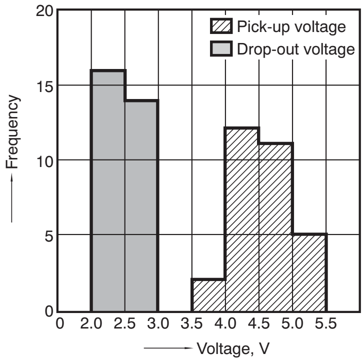


Change of contact resistance

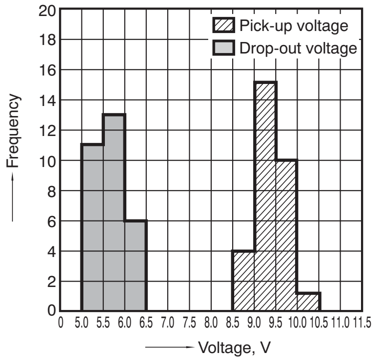


CB RELAY (35 A type)

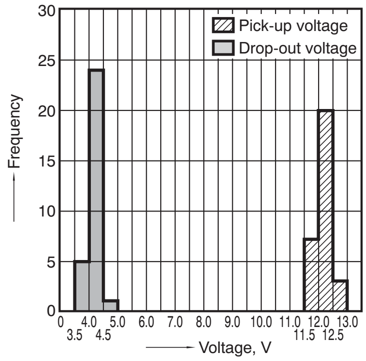
1-(1). Distribution of pick-up and drop-out voltage
Sample: CB1aV-12V, 30pcs.



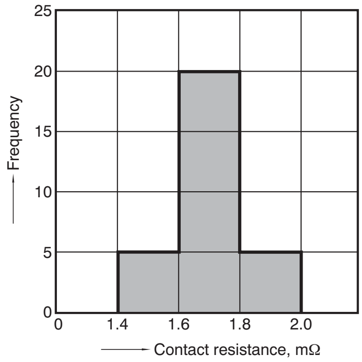
1-(2). Distribution of pick-up and drop-out voltage
Sample: CB1aV-24V, 30pcs.



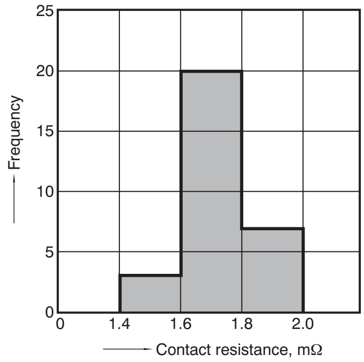
1-(3). Distribution of pick-up and drop-out voltage
Sample: CB1V-24V, 30pcs.



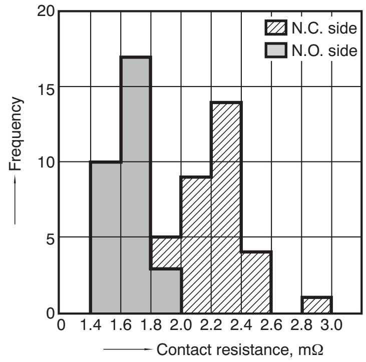
2.-(1) Contact resistance
Sample: CB1aV-12V, 30pcs.
(By voltage drop 12 V DC 1A)



2.-(2) Contact resistance
Sample: CB1aV-24V, 30pcs.
(By voltage drop 24 V DC 1A)

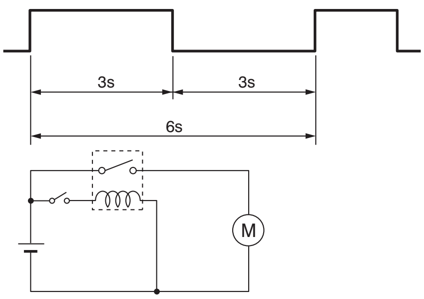


2.-(3) Contact resistance
Sample: CB1V-24V, 30pcs.
(By voltage drop 24 V DC 1A)

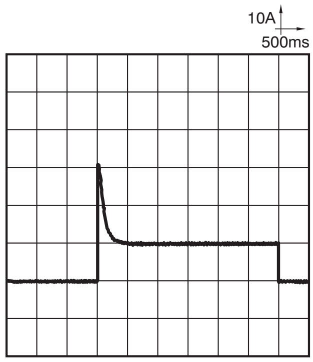


3. Electrical life test (Blower fan)
Sample: CB1aV-D-24V, 3pcs.
Load: Blower fan load 28 V DC
Inrush current: 30 A/Steady current: 10 A
Switching frequency: (ON:OFF = 3s:3s)
Switching cycle: 10^5
Ambient temperature: 85°C
Coil protective element: Diode

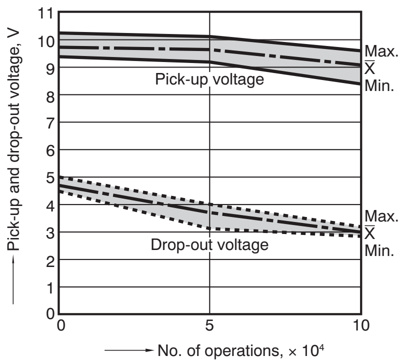
Circuit



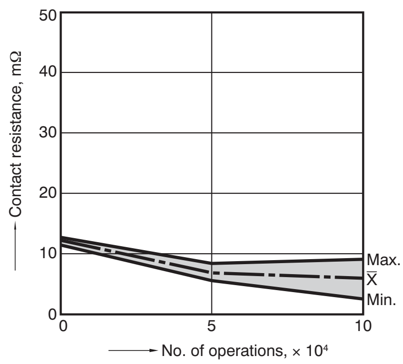
Load current waveform
Inrush current: 30 A, Steady current: 10 A



Change of pick-up and drop-out voltage



Change of contact resistance



Automotive

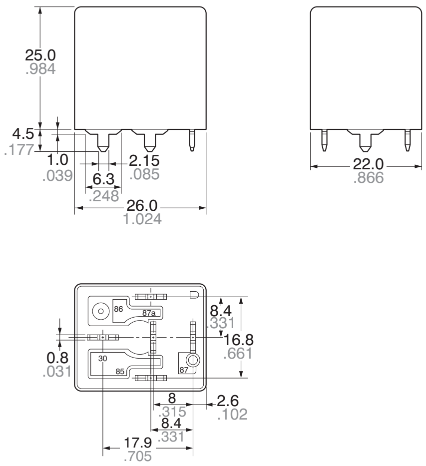
DIMENSIONS(mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

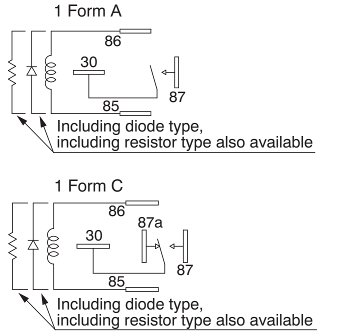
1. PC board type

CAD Data

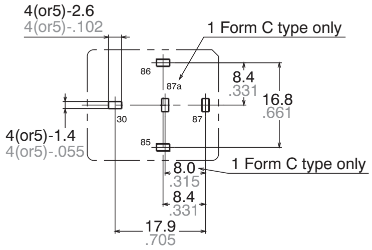
External dimensions



Schematic (Bottom view)



PC board pattern (Bottom view)



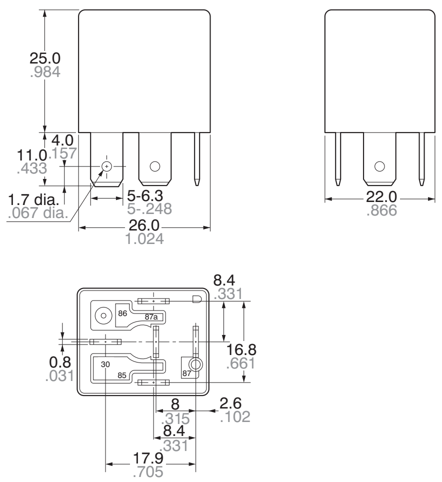
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

2. Plug-in type

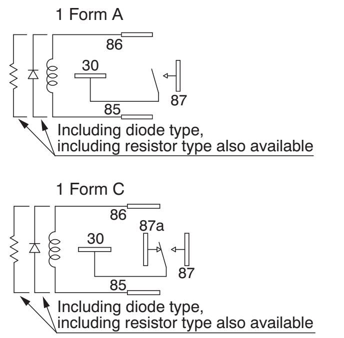
* The dimensions are the same as those of 35A type.

CAD Data

External dimensions



Schematic (Bottom view)

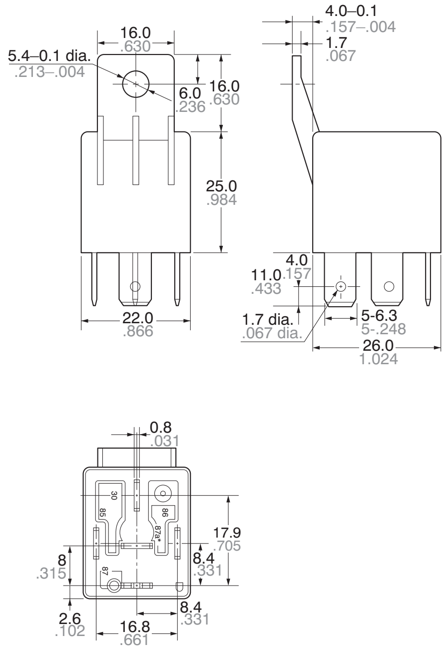


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

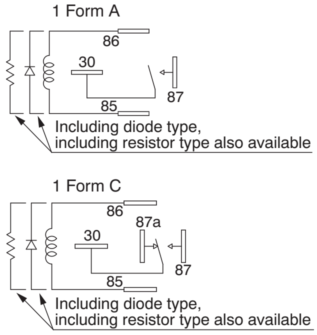
3. Bracket type

CAD Data

External dimensions



Schematic (Bottom view)

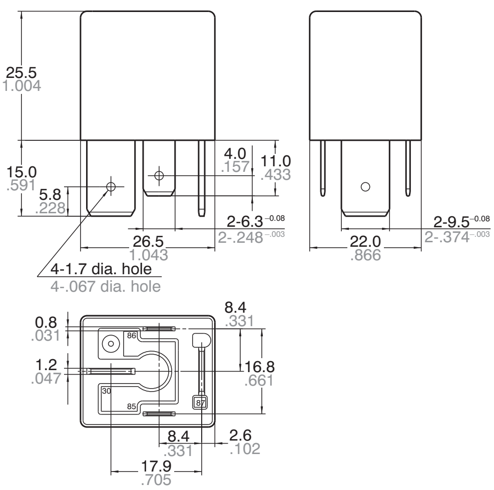


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

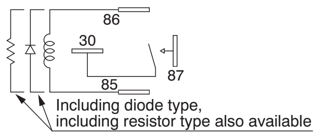
4. High contact capacity (1 Form A) (Plug-in type)

CAD Data

External dimensions



Schematic (Bottom view)



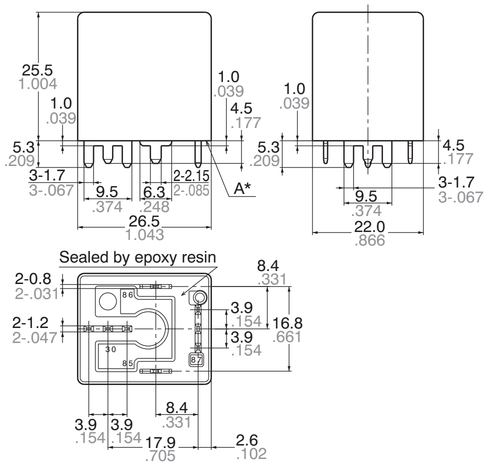
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Automotive

5. High contact capacity (1 Form A) (PC board type)

CAD Data

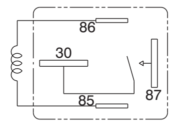
External dimensions



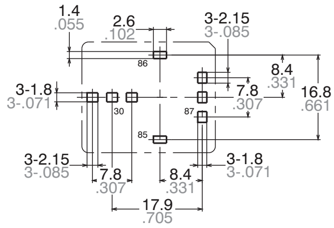
* Intervals between terminals is measured at A surface level.

Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)



PC board pattern (Bottom view)



Cautions regarding the protection element

1. Part numbers without protection elements

1) 12 V models

When connecting a coil surge protection circuit to these relays, we recommend a zener diode with a zener voltage of 24 V or higher, or a resistor (680Ω to 1,000Ω).

When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2) 24 V models

When connecting a coil surge protection circuit to these relays, we recommend a zener diode with a zener voltage of 48 V or higher, or a resistor (2,800Ω to 4,700Ω).

When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2. Part numbers with diodes

These relays use a diode in the coil surge protection element. Therefore, the release time is slower and the working life might be shorter compared to part numbers without protection elements and part numbers with resistors.

Be sure to use only after evaluating under actual load conditions.

3. Part numbers with resistors

This part number employs a resistor in the coil surge protection circuit; therefore, an external surge protection element is not required. In particular, when a diode is connected in parallel with a coil, the release time becomes slower which could adversely affect working life.

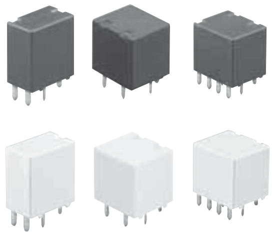
Please check the circuit and make sure that a diode is not connected in parallel with the coil drive circuit.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

SUPER MINIATURE PC BOARD TYPE AUTOMOTIVE RELAY

CJ RELAYS (ACJ)



FEATURES

1. Smallest in its class, it is extremely compact at approx. 2/3 the size of previous products.
Compared to our previous miniature type CT relay, the 1 Form C as well as the 10-pin and 8-pin twin types take up approx. two-thirds the space and volume.
2. High-capacity 25 A load switching
High capacity control capable of motor lock load switching at 25 A, 14 V DC is possible despite contact size.
3. Pin in Paste (PiP)* compatible model added
Models compatible with the recently increasingly popular PiP technique (reflow solder mounting) have been added.
PiP compatible models are the flux tight type.
* The PiP method may sometimes be referred to as THR (Through-Hole Reflow).
4. Environmental protection specifications
Cadmium-free contacts and use of lead-free solder are standard. Environmental pollutants are not used.

TYPICAL APPLICATIONS

- **Power windows**
- **Automatic door locks**
- **Power mirrors**
- **Power sunroofs**
- **Power seats**
- **Lift gates**
- **Smart junction box related products, etc.**

Automotive

ORDERING INFORMATION

Ex. A CJ 1 1 12 P

Product name	Contact arrangement	Pick-up voltage (V DC)	Coil voltage (V DC)	Coil voltage (V DC)
CJ	1: 1 Form C 2: 1 Form C × 2 (8 terminals type) 5: 1 Form C × 2 (10 terminals type)	1: Max. 6.5 V DC 2: Max. 7.2 V DC	12: 12	Nil: Standard type P : Pin in Paste type

Standard packing:
1 Form C: Tube: 70 pcs.; Outer carton: 2,800 pcs.
1 Form C × 2, 8 terminals: Tube: 40 pcs.; Outer carton: 1,000 pcs.
1 Form C × 2, 10 terminals: Tube: 35 pcs.; Outer carton: 1,400 pcs.

TYPES

Contact arrangement	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Part No.	
			Standard type	Pin in Paste type
1 Form C	12 V DC	Max.6.5 V DC (Initial)	ACJ1112	ACJ1112P
		Max.7.2 V DC (Initial)	ACJ1212	ACJ1212P
1 Form C × 2 (8 terminal)		Max.6.5 V DC (Initial)	ACJ2112	ACJ2112P
		Max.7.2 V DC (Initial)	ACJ2212	ACJ2212P
1 Form C × 2 (10 terminal)		Max.6.5V DC (Initial)	ACJ5112	ACJ5112P
		Max.7.2 V DC (Initial)	ACJ5212	ACJ5212P

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Max. continuous voltage*
12 V DC	Max. 7.2 V DC (Initial)	Min. 1.0 V DC (Initial)	53.3 mA	225Ω	640 mW	10 to 16 V DC
	Max. 6.5 V DC (Initial)	Min. 0.8 V DC (Initial)	66.7 mA	180Ω	800 mW	9 to 16 V DC

* Other usable voltage range types are also available. Please contact us for details.

2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form C, 1 Form C×2
	Initial contact resistance (Initial)		N.O.: Typ7mΩ, N.C.: Typ10mΩ (By voltage drop 6 V DC 1 A)
	Contact material		Ag alloy (Cadmium free)
Protective construction			Standard type: Sealed type Pin in Paste type: Flux tight type
Rating	Nominal switching capacity		N.O.: 20A 14V DC, N.C.: 10A 14V DC
	Max. carrying current (14V DC)		N.O.: 20 A for 1 hour, 30 A for 2 minutes (at 20°C 68°F)
	Nominal operating power		640 mW (for pick-up voltage max. 7.2 V DC), 800 mW (for pick-up voltage max. 6.5 V DC)
	Min. switching capacity*1		1A 12V DC
Electrical characteristics	Initial insulation resistance		Min. 100 MΩ (at 500 V DC)
	Initial breakdown voltage	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68° F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68° F, excluding contact bounce time) (Initial)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s^2 {10G} (Half-wave pulse of sine wave: 11ms; detection: 10µs)
		Destructive	Min. 1,000 m/s^2 {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1m/s^2 {4.5G} (Detection time: 10µs)
		Destructive	10 Hz to 500 Hz, Min. 44.1m/s^2 {4.5G} Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical		**[Standard type]** <Resistive load> Min. 10^5 (At nominal switching capacity, operating frequency: 1s ON, 9s OFF) <Motor load> N.O. side: Min. 2×10^5: at 25 A (inrush), 5 A (steady), 14 V DC; Min. 10^5: at 25 A 14 V DC (Motor lock) N.C. side: Min. 2×10^5: at 20 A 14 V DC (brake) (Operating frequency: 0.5s ON, 9.5s OFF) **[Pin in Paste type]** <Resistive load> Min. 10^5 (At nominal switching capacity, operating frequency: 1s ON, 9s OFF) <Motor load> N.O. side: Min. 10^5: at 25 A (inrush), 5 A (steady), 14 V DC; Min. 5×10^4: at 25 A 14 V DC (Motor lock) N.C. side: Min. 10^5: at 20 A 14 V DC (brake) (Operating frequency: 0.5s ON, 9.5s OFF)
Conditions	Conditions for operation, transport and storage*2		Ambient temp: –40°C to +85°C –40°F to +185°F Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed		6 cpm (At nominal switching capacity)
Unit weight			1 Form C type: approx. 3.5 g .12 oz Twin type: approx. 6.5 g .23 oz

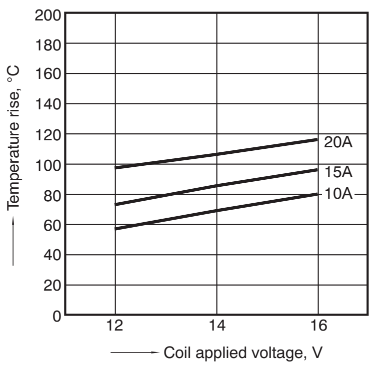
Notes:

*1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2 Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

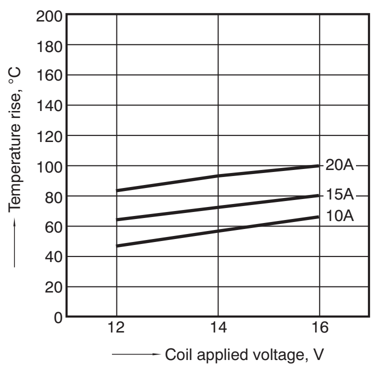
1-(1). Coil temperature rise (at room temperature)

Sample: ACJ1212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: 25°C 77°F



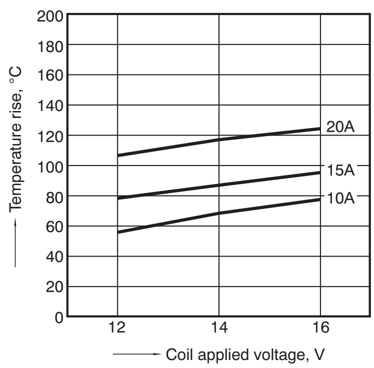
1-(2). Coil temperature rise (at 85°C 185°F)

Sample: ACJ1212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: 85°C 185°F



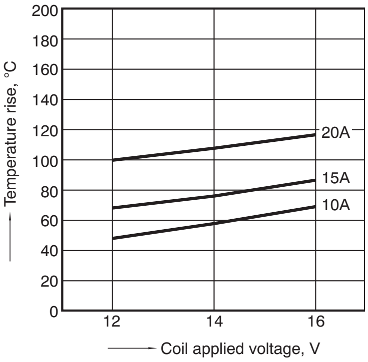
1-(3). Coil temperature rise (at room temperature)

Sample: ACJ2212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: 25°C 77°F



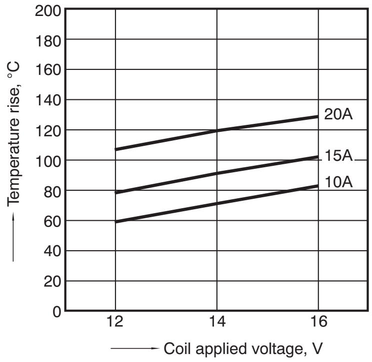
1-(4). Coil temperature rise (at 85°C 185°F)

Sample: ACJ2212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: 85°C 185°F



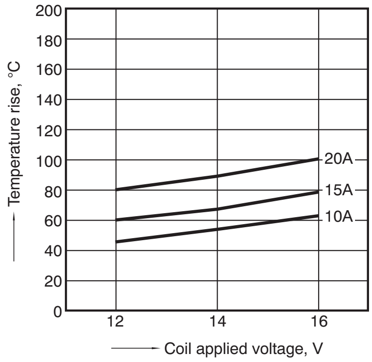
1-(5). Coil temperature rise (at room temperature)

Sample: ACJ5212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: 25°C 77°F



1-(6). Coil temperature rise (at 85°C 185°F)

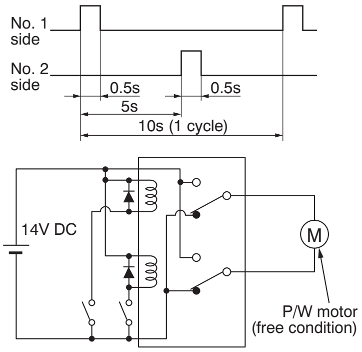
Sample: ACJ5212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: 85°C 185°F



2-(1). Electrical life test (Motor free)

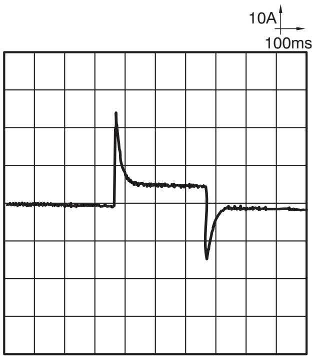
Sample: ACJ2212, 3pcs; Load: Inrush current: 25A/ Steady current: 5A, Power window motor actual load (free condition); Tested voltage: 14V DC; Switching frequency: (ON:OFF = 0.5s:9.5s); Switching cycle: 2×10^5; Ambient temperature: Room temperature

Circuit

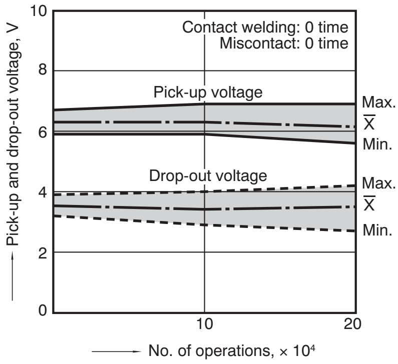


Load current waveform

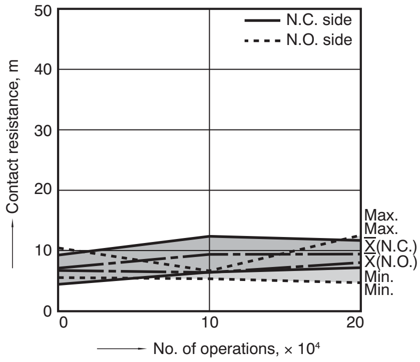
Inrush current: 25A, Steady current: 6A, Brake current: 13A



Change of pick-up and drop-out voltage



Change of contact resistance

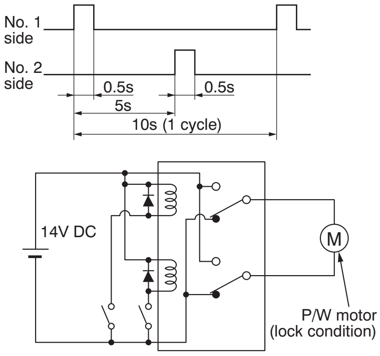


Automotive

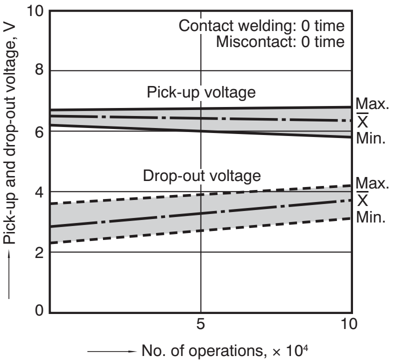
2-(2). Electrical life test (Motor lock)

Sample: ACJ2212, 3pcs; Load: Steady current: 25A, Power window motor actual load (lock condition); Tested voltage: 14V DC; Switching frequency: (ON:OFF = 0.5s:9.5s); Switching cycle: 10^5; Ambient temperature: Room temperature

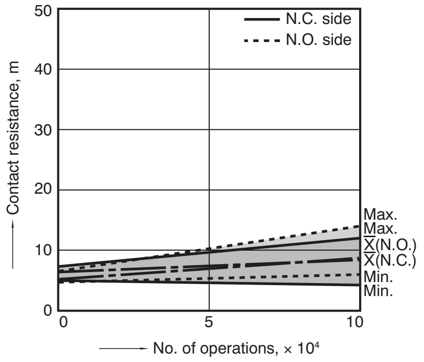
Circuit



Change of pick-up and drop-out voltage

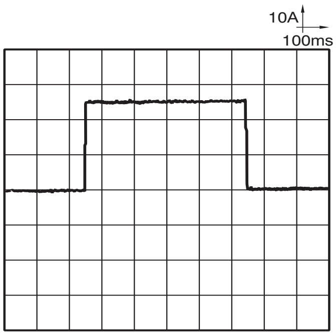


Change of contact resistance



Load current waveform

Current value: 25A

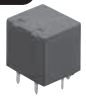


DIMENSIONS (mm inch)

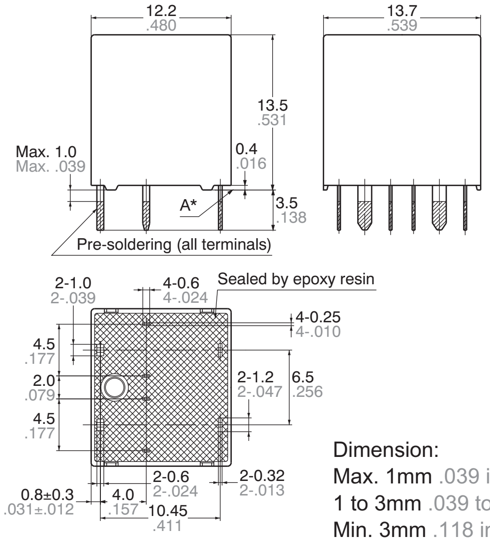
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. Twin type (8-pin)
Standard type

CAD Data

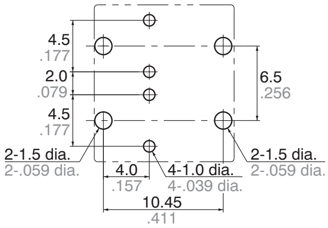


External dimensions



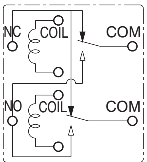
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

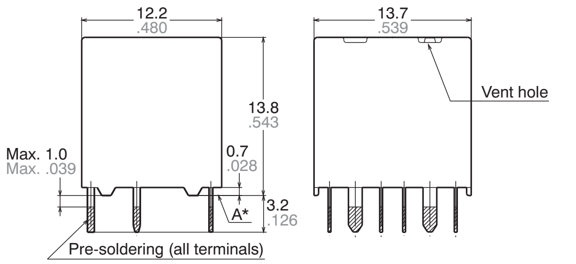


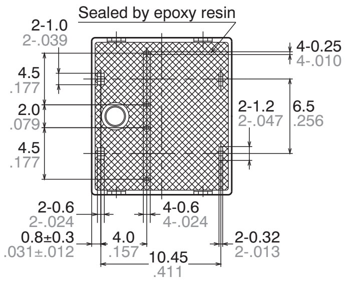
* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

2. Twin type (8-pin) Pin in Paste type

CAD Data

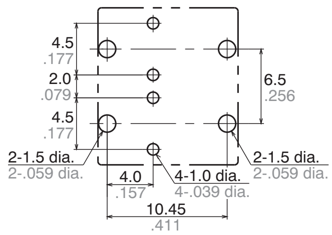
External dimensions





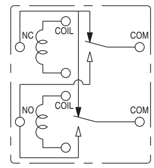
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

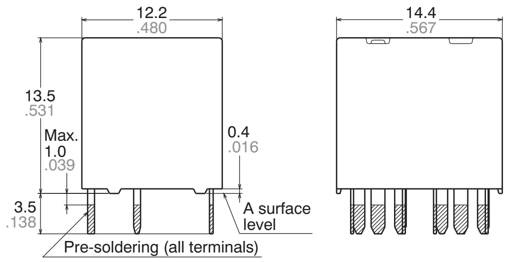


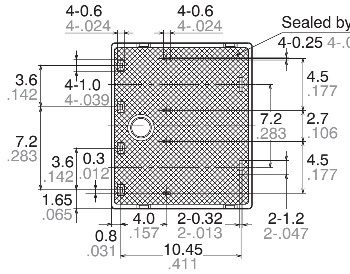
* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

3. Twin type (10-pin) Standard type

CAD Data

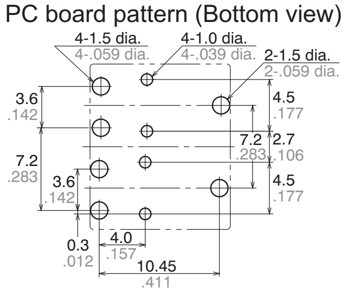
External dimensions





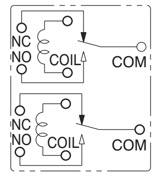
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

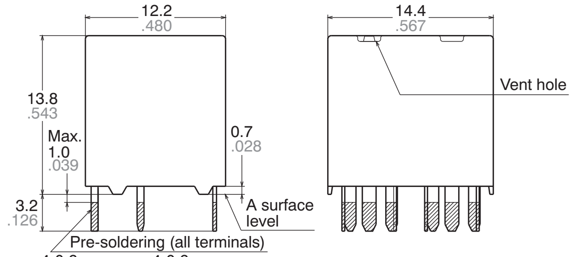
Schematic (Bottom view)

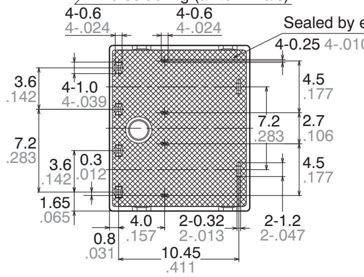


4. Twin type (10-pin) Pin in Paste type

CAD Data

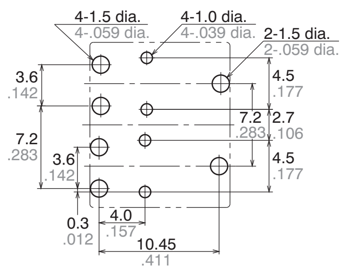
External dimensions





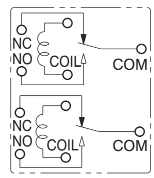
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

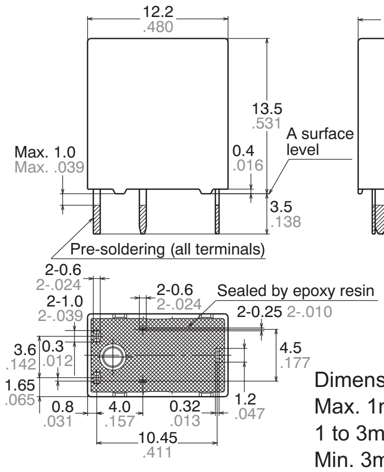


Automotive

5. Slim 1 Form C
Standard type

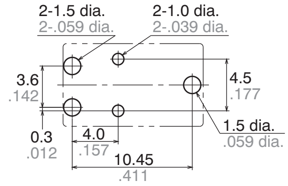
CAD Data

External dimensions



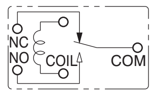
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

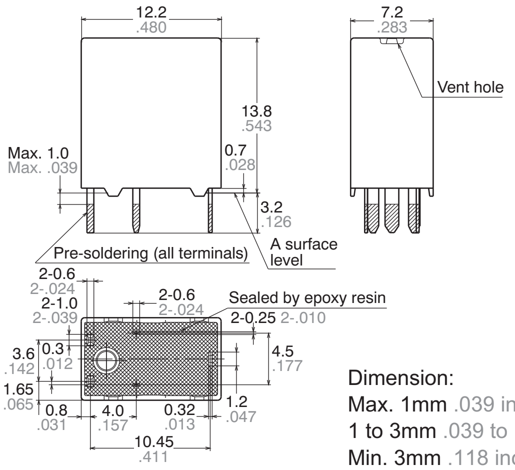
Schematic (Bottom view)



6. Slim 1 Form C
Pin in Paste type

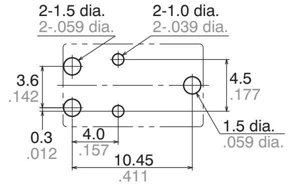
CAD Data

External dimensions



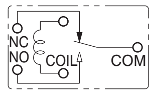
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



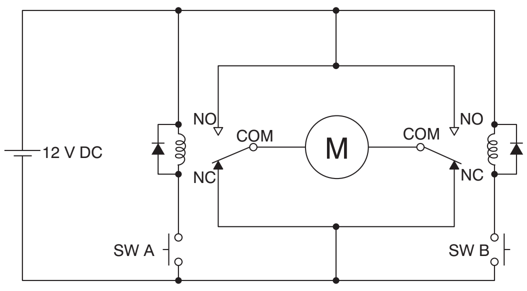
Tolerance: ±0.1 ±.004

Schematic (Bottom view)



EXAMPLE OF CIRCUIT

Forward/reverse control circuits of DC motor (for 1 Form C × 2 (8 terminal) type)



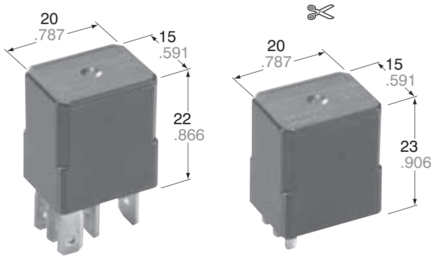
Ⓜ : Power window motor

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

AUTOMOTIVE MICRO-ISO RELAY

CM RELAYS



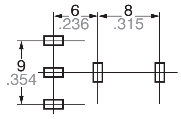
mm inch

✂ Products to be discontinued.

FEATURES

- **Micro-ISO type terminals**
- **Small size:**
20 mm(L)×15 mm(W)×22 mm(H)
.787 inch(L)×.591 inch(L)×.866 inch(H)
- **Wide line-up**
PC board and Plug-in type, Resistor and diode inside type.
24V DC type is also available.
- **Compact and high-capacity 35A load switching**
N.O.: 35A 14V DC, N.C.: 20A 14V DC (Sealed type)
Min. 5×10^4
N.O.: 35A 14V DC, N.C.: 20A 14V DC (Flux-resistant type)
Min. 10^5 *12V DC type
- **Uses international standard ISO terminal arrangement.**
The ISO international standard terminal arrangement is used.

(plug-in type)



TYPICAL APPLICATIONS

- Fan motor
- Heater
- Head lamp
- Air Compressor
- EPS
- ABS
- Blower fan
- Defogger, etc.

SPECIFICATIONS

Contact

Type		12 V coil voltage	24 V coil voltage
Arrangement		1 Form A, 1 Form C	
Contact material		Ag alloy (Cadmium free)	
Initial contact resistance (Initial) (By voltage drop 6 V DC 1 A)		Typ. 2 mΩ	
Contact voltage drop		Max. N.O.: 0.5 V (at 35 A 14 V DC) Max. N.C.: 0.3 V (at 20 A 14 V DC)	Max. N.O.: 0.3 V (at 15 A 28 V DC) Max. N.C.: 0.2 V (at 8 A 28 V DC)
Rating (resistive load)	Nominal switching capacity	N.O.: 35 A 14 V DC N.C.: 20 A 14 V DC	N.O.: 15 A 28 V DC N.C.: 8 A 28 V DC
	Max. carrying current	N.O.: 20 A (14 V DC, at 85°C 185°F) N.C.: 10 A (14 V DC, at 85°C 185°F)	N.O.: 15 A (28 V DC, at 85°C 185°F) N.C.: 8 A (28 V DC, at 85°C 185°F)
	Min. switching capacity#1	1 A 12 V DC	1 A 24 V DC
Expected life	Mechanical (at 120 cpm)	Min. 10^6	
	Electrical (at rated load)	Flux-resistant type: Min. 10^5*1 Sealed type: Min. 5×10^4	

Coil

	12 V coil voltage	24 V coil voltage
Nominal operating power	1.5 W 1.7 W (with resistor inside type)	1.8 W 2.0 W (with resistor inside type)

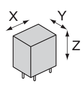
#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Type		24V coil type	12V coil type
Max. operating speed (at nominal switching capacity)		15 cpm	
Initial insulation resistance*2		Min. 20 MΩ (at 500 V DC)	
Initial breakdown voltage*3	Between open contacts	500 Vrms for 1 min.	
	Between contacts and coil	500 Vrms for 1 min.	
Operate time*4 (at nominal voltage) (at 20°C 85°F)		Max. 10 ms (initial)	
Release time*4 (at nominal voltage) (at 20°C 85°F)		Max. 10 ms Max. 15 ms (with diode) (initial)	
Shock resistance	Functional*5	Min. 200 m/s² {20G}	
	Destructive*6	Min. 1,000m/s² {100G}	
Vibration resistance	Functional	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5 G}	
	Destructive*7	10 Hz to 2,000 Hz, Min. 44.1 m/s² {4.5 G}	
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to + 85°C –40°F to + 185°F	
	Humidity	5% R.H. to 85% R.H.	
Mass		Approx. 20g .71oz	

Remarks

*1 At nominal switching capacity, operating frequency: 2s ON, 2s OFF
*2 Measurement at same location as “Initial breakdown voltage” section.
*3 Detection current: 10mA
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Time of vibration for each direction; X, Y, Z direction: 4 hours



*8 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).
Please inquire if you will be using the relay in a high temperature atmosphere.

Automotive

ORDERING INFORMATION

CM 1 F — R — P — 12V

Contact arrangement	Protective construction	Classification of types	Mounting classification	Coil voltage (DC)
1a: 1 Form A 1: 1 Form C	Nil: Sealed type F: Flux-resistant type	Nil: Standard type D: with diode inside R: with resistor inside	Nil: Plug-in type P: PC board type	12 V 24 V

Note: Bulk package: 50 pcs.; Case: 200 pcs.

TYPES

Packing quantity: Inner 50pcs, Outer 200pcs.

Contact arrangement	Part No.	Coil voltage	Mounting classification	Protective construction
1 Form A	CM1a-12V	12 V DC	Plug-in type	Sealed type
	CM1aF-12V			Flux-resistant type
	✂ CM1a-P-12V		PC board type	Sealed type
	✂ CM1aF-P-12V			Flux-resistant type
1 Form C	CM1-12V		Plug-in type	Sealed type
	CM1F-12V			Flux-resistant type
	✂ CM1-P-12V		PC board type	Sealed type
	✂ CM1F-P-12V			Flux-resistant type

Contact arrangement	Part No.	Coil voltage	Mounting classification	Protective construction
1 Form A	CM1a-24V	24 V DC	Plug-in type	Sealed type
	CM1aF-24V			Flux-resistant type
	✂ CM1a-P-24V		PC board type	Sealed type
	✂ CM1aF-P-24V			Flux-resistant type
1 Form C	CM1-24V		Plug-in type	Sealed type
	CM1F-24V			Flux-resistant type
	✂ CM1-P-24V		PC board type	Sealed type
	✂ CM1F-P-24V			Flux-resistant type

COIL DATA (at 20°C 68°F)

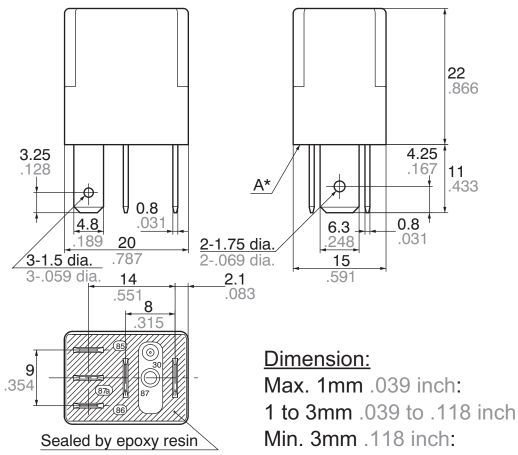
Nominal voltage, V DC	Pick-up voltage, V DC	Drop-out voltage, V DC	Nominal current, mA	Coil resistance, ohm	Nominal operating power, W	Usable voltage range, V DC
12	3 to 7	1.2 to 4.2	125±10%	96±10%	1.5	10 to 16
24	6 to 14	2.4 to 8.4	75±10%	320±10%	1.8	20 to 32

DIMENSIONS (mm inch)

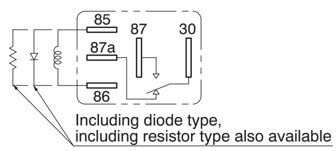
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. Micro-ISO Plug-in type (1 Form C)

CAD Data



Schematic (Bottom view)



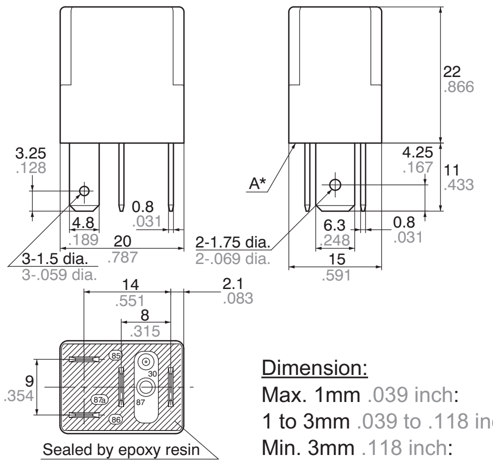
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Intervals between terminals is measured at A surface level.

2. Micro-ISO Plug-in type (1 Form A)

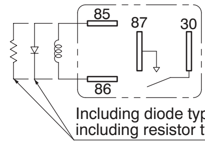
mm inch

CAD Data



Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

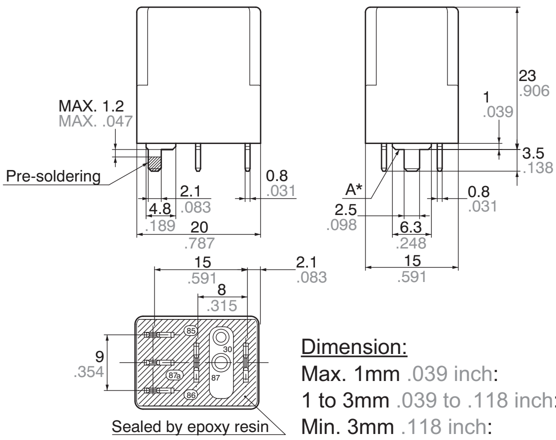


Including diode type, including resistor type also available

* Intervals between terminals is measured at A surface level.

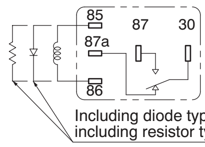
3. Micro-ISO PC board type (1 Form C)

CAD Data



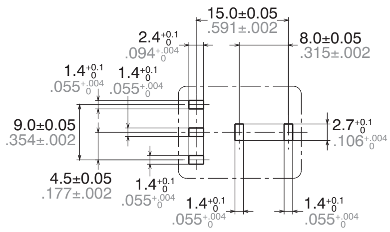
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)



Including diode type, including resistor type also available

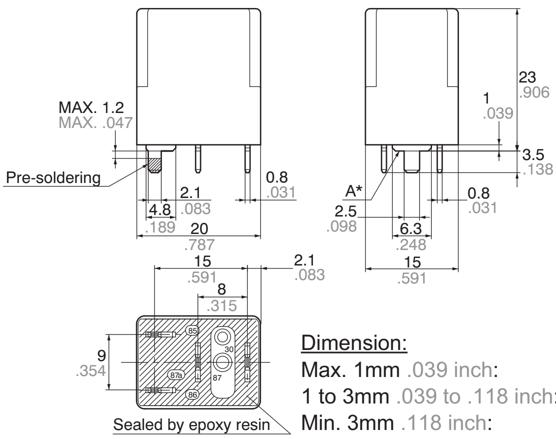
PC board pattern (Bottom view)



* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

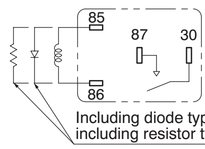
4. Micro-ISO PC board type (1 Form A)

CAD Data



Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)



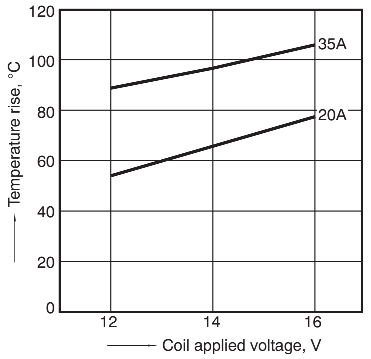
Including diode type, including resistor type also available

* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

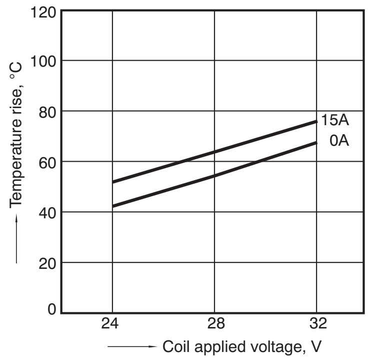
Automotive

REFERENCE DATA

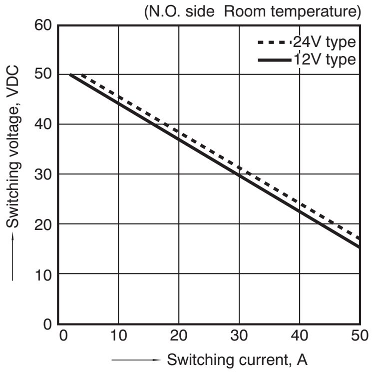
1-(1). Coil temperature rise (12V type)
Sample: CM1F-12V, 3 pcs.
Measured portion: Inside the coil
Contact carrying current: 20A, 35A
Ambient temperature: 85°C 185°F



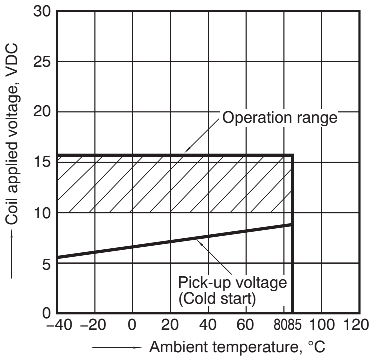
1-(2). Coil temperature rise (24V type)
Sample: CM1F-24V, 4 pcs.
Measured portion: Inside the coil
Contact carrying current: 0A, 15A
Ambient temperature: 85°C 185°F



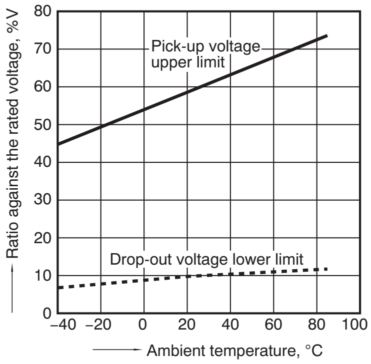
2. Max. switching capability (Resistive load, initial)



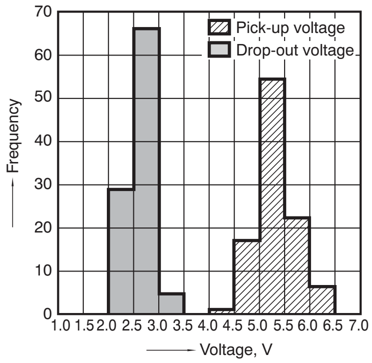
3. Ambient temperature and operating temperature range (12V type)



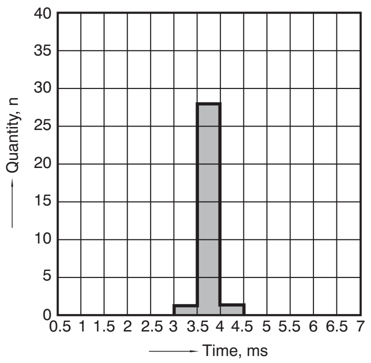
4. Ambient temperature characteristics (Cold/initial)



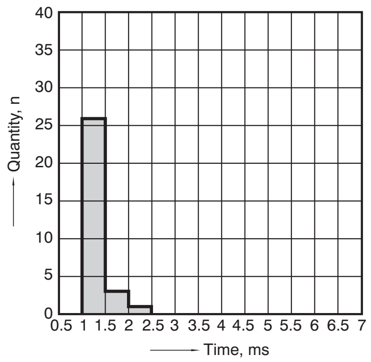
5. Distribution of pick-up and drop-out voltage
Sample: CM1F-12V, 100pcs.



6. Distribution of operate time
Sample: CM1F-12V, 30pcs.
* Max. 10ms standard (excluding contact bounce)

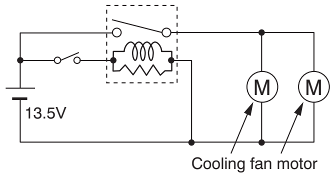


7. Distribution of release time
Sample: CM1F-12V, 30pcs.
* Max. 10ms standard (excluding contact bounce)
Without diode

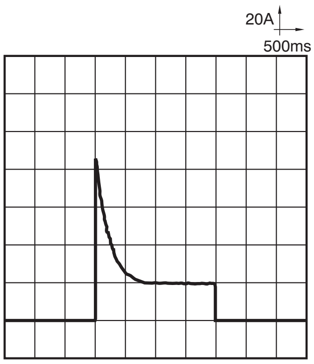


8-(1). Electrical life test (Motor free)
Sample: CM1aF-R-12V, 6pcs.
Load: 16 A 13.5 V DC
Cooling fan motor actual load (free condition)
Switching frequency: (ON:OFF = 2s:6s)
Ambient temperature: Room temperature

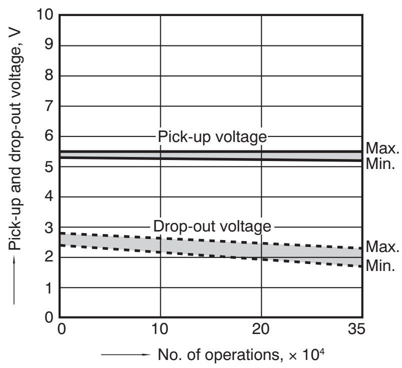
Circuit



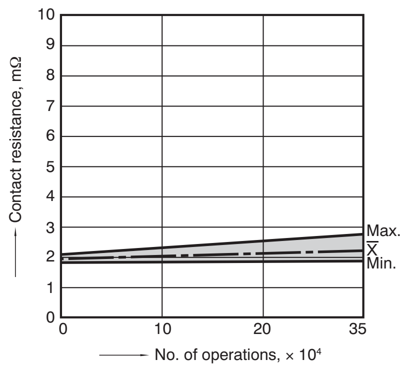
Load current waveform
Inrush current: 85A, Steady current: 18A,



Change of pick-up and drop-out voltage

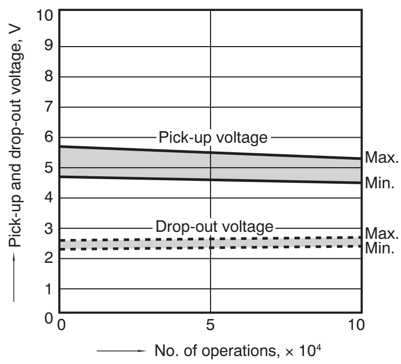


Change of contact resistance

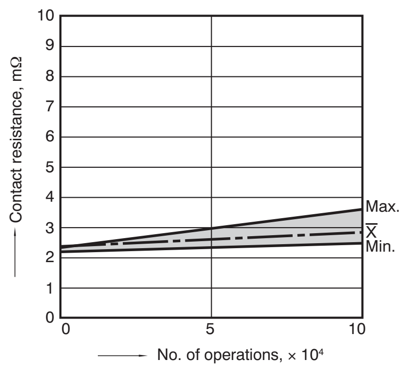


8-(2). Electrical life test (Halogen lamp load)
Sample: CM1aF-R-12V, 6pcs.
Load: 20A 13.5V DC
Switching frequency: (ON:OFF = 1s:14s)
Ambient temperature: Room temperature

Change of pick-up and drop-out voltage



Change of contact resistance



Cautions regarding the protection element

1. Part numbers without protection elements
1) 12 V models
When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 24 V or higher, or a resistor (680Ω to 1,000Ω).
When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.
2) 24 V models
When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 48 V or higher, or a resistor (2,800Ω to 4,700Ω).
When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.
2. Part numbers with diodes
These relays use a diode in the coil surge protection element. Therefore, the release time is slower and the working life might be shorter compared to part numbers without protection elements and part numbers with resistors.
Be sure to use only after evaluating under actual load conditions.
3. Part numbers with resistors
This part number employs a resistor in the coil surge protection circuit; therefore, an external surge protection element is not required. In particular, when a diode is connected in parallel with a coil, the revert time becomes slower which could adversely affect working life. Please check the circuit and make sure that a diode is not connected in parallel with the coil drive circuit.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

HIGH LOAD RELAY
FOR SMART J/B

CN-H RELAYS (ACNH)

FEATURES

1. Best space savings in its class.
2. Large capacity switching despite small size. Can replace micro ISO terminal type relays.
3. Terminals for PC board pattern designs are easily allocated.
4. Sealed type

TYPICAL APPLICATIONS

Headlamp, Fog lamp, Fan motor, EPS, Defogger, Seat heater, etc.

ORDERING INFORMATION

ACNH ☐ ☐ ☐

CN-H relay

Contact arrangement
3: 1 Form A

Pick-up voltage
1: Max. 5.5V DC
2: Max. 6.5V DC

Coil voltage (DC)
12: 12V

TYPES

Contact arrangement	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Part No.
1 Form A	12V DC	Max. 6.5 V DC (Initial)	ACNH3212
		Max. 5.5 V DC (Initial)	ACNH3112

Standard packing; Carton (tube): 50 pcs.; Case: 1,000 pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12 V DC	Max. 6.5 V DC (Initial)	Min. 1.0 V DC (Initial)	37.5 mA	320Ω	450 mW	10 to 16 V DC
	Max. 5.5 V DC (Initial)	Min. 0.8 V DC (Initial)	53.3 mA	225Ω	640 mW	

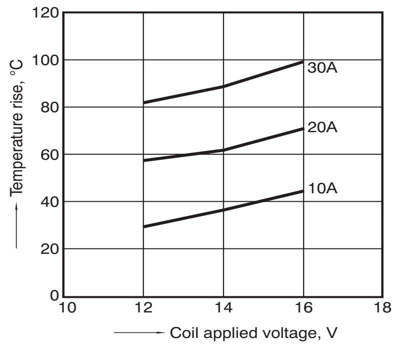
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form A
	Initial contact resistance (Initial)		Typ5mΩ (By voltage drop 6 V DC 1 A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		30A 14V DC
	Max. carrying current		<450mW> 35A/1 h, 45A/2 min. at 20°C 68°F 30A/1 h, 40A/2 min. at 85°C 185°F 25A/1 h, 35A/2 min. at 110°C 230°F <640mW> 30A/1 h, 40A/2 min. at 20°C 68°F 25A/1 h, 35A/2 min. at 85°C 185°F 20A/1 h, 30A/2 min. at 110°C 230°F
	Continuous carrying current		20A 14V DC (450mW) at 110°C 230°F, 15A 14V DC (640mW) at 110°C 230°F
	Nominal operating power		450 mW (for pick-up voltage max. 6.5 V DC), 640 mW (for pick-up voltage max. 5.5 V DC)
	Min. switching capacity (resistive load)		1A 12V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500 V DC)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F) (Initial) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s^2 {10G} (Half-wave pulse of sine wave: 11ms; detection: 10µs)
		Destructive	Min. 1,000 m/s^2 {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1m/s^2 {4.5G} (Detection time: 10µs)
		Destructive	10 Hz to 500 Hz, Min. 44.1m/s^2 {4.5G} Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical		<Resistive load> Min. 10^5 (At nominal switching capacity, operating frequency: 1s ON, 1s OFF) <Motor load> Min. 3×10^5: at 84 A (inrush), 18 A (steady), 14 V DC (Operating frequency: 2s ON, 5s OFF) <Lamp load> Min. 2×10^5: at 84 A (inrush), 12 A (steady), 14 V DC (Operating frequency: 1s ON, 14s OFF)
Conditions	Conditions for operation, transport and storage		Ambient temp: –40°C to +110°C –40°F to +230°F Humidity: 2% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
Unit weight			Approx. 9 g .32 oz

REFERENCE DATA

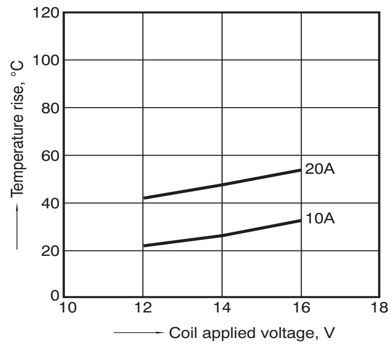
1-(1). Coil temperature rise

Sample: ACNH3212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 20A, 30A
Ambient temperature: 25°C 77°F

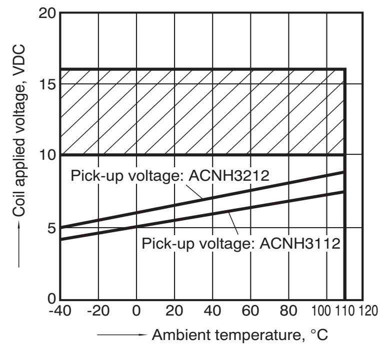


1-(2). Coil temperature rise

Sample: ACNH3212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 20A
Ambient temperature: 110°C 230°F

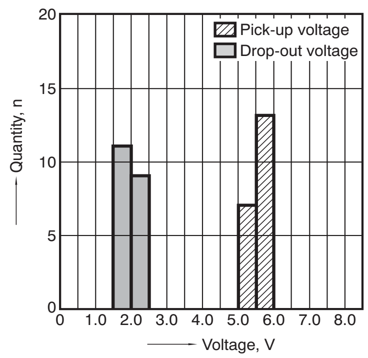


2. Ambient temperature and operating voltage range



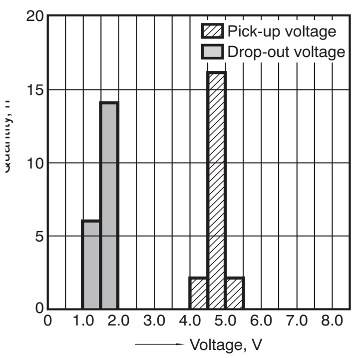
3-(1). Distribution of pick-up and drop-out voltage

Sample: ACNH3212, 20pcs.



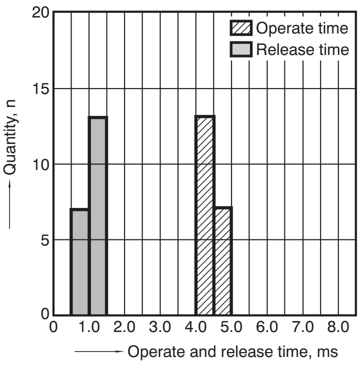
3-(2). Distribution of pick-up and drop-out voltage

Sample: ACNH3112, 20pcs.



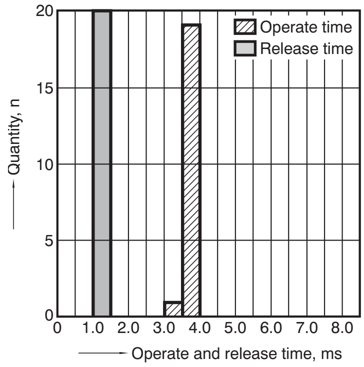
4-(1). Distribution of operate and release time

Sample: ACNH3212, 20pcs.



4-(2). Distribution of operate and release time

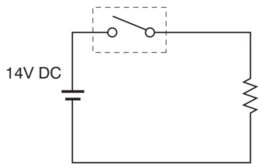
Sample: ACNH3112, 20pcs.



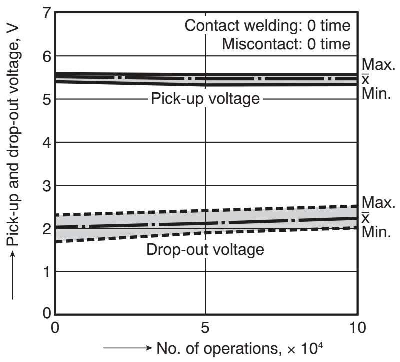
5. Electrical life test (Resistive load)

Sample: ACNH3212, 6pcs.
Load: Resistive load (NO side: 30A 14V DC)
Operating frequency: (ON:OFF = 1s:1s)
Ambient temperature: Room temperature

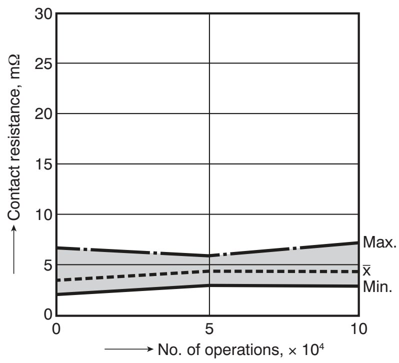
Circuit:



Change of pick-up and drop-out voltage



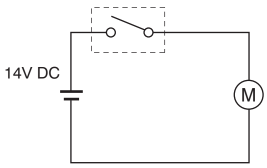
Change of contact resistance



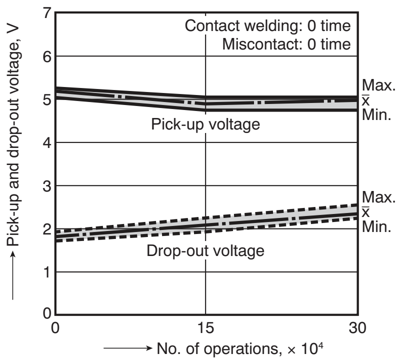
6-(1). Electrical life test (Motor load)

Sample: ACNH3212, 3pcs.
Load: inrush: 84A/steady: 18A,
radiator fan actual load (motor free)
Switching frequency: (ON:OFF = 2s:5s)
Ambient temperature: 110°C 230°F

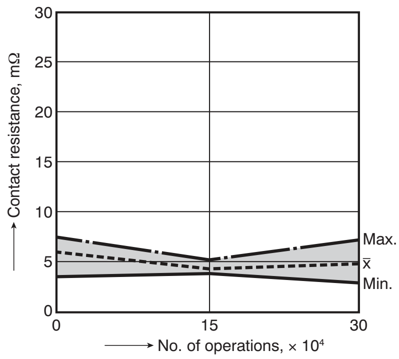
Circuit:



Change of pick-up and drop-out voltage



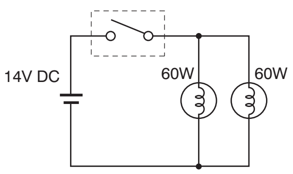
Change of contact resistance



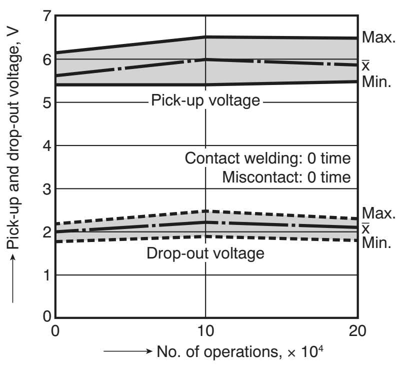
6-(2). Electrical life test (Lamp load)

Sample: ACNH3212, 6pcs.
Load: 60W×2, inrush: 84A/steady: 12A
Switching frequency: (ON:OFF = 1s:14s)
Ambient temperature: Room temperature

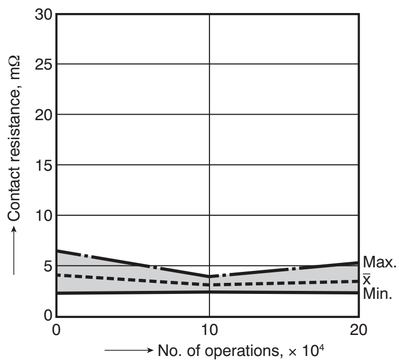
Circuit:



Change of pick-up and drop-out voltage



Change of contact resistance

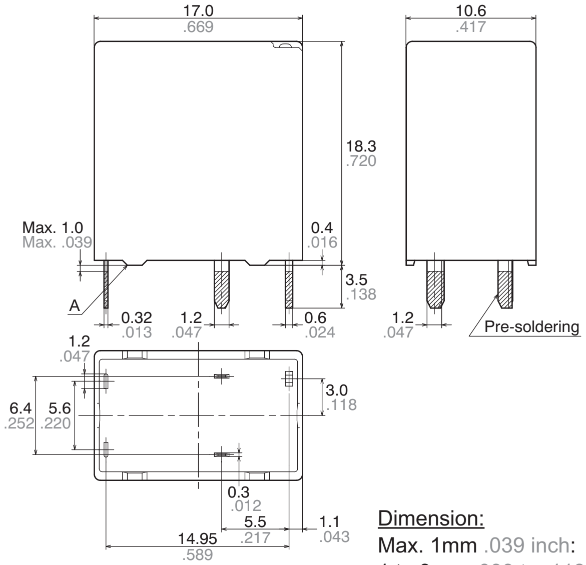


DIMENSIONS(mm inch)

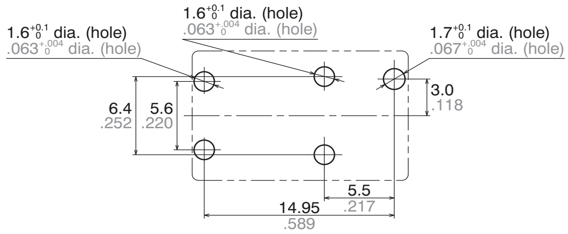
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data

External dimensions

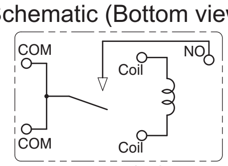


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

NOTES

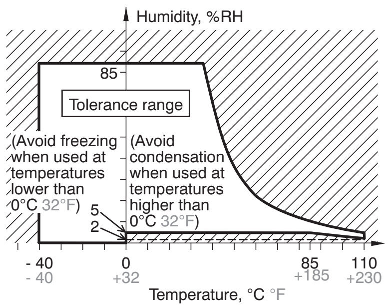
1. Coil operating power
Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%. However, check it with the actual circuit since the characteristics may be slightly different.

2. Coil applied voltage
To ensure proper operation, the voltage applied to the coil should be the rated operating voltage of the coil. Also, be aware that the pick-up and drop-out voltages will fluctuate depending on the ambient temperature and operating conditions.

3. Cycle lifetime
Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.

4. Soldering
When soldering the relays, ensure conformance with the conditions listed below.
1) Automatic soldering
• Preheating: less than 100°C 212°F (solder target surface of PC board) for less than 120 sec
• Soldering: less than 260°C 500°F (solder temperature) for less than 5 sec (soldering time)
2) Manual soldering
• Soldering tip temperature: less than 280 to 300°C 536 to 572°F
• Soldering iron: 30 W to 60 W
• Soldering time: less than 5 sec

5. Usage, transport and storage conditions
1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature:
–40 to +110°C –40 to +230°F
(2) Humidity: 2 to 85% RH
(Avoid freezing and condensation.)
(3) Atmospheric pressure: 86 to 106 kPa
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(Temperature and humidity range for usage, transport, and storage)



2) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
3) Freezing
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
4) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

6. Others
If the relay has been dropped, the appearance and characteristics should always be checked before use.

Automotive

For Cautions for Use, see Relay Technical Information (page 582).

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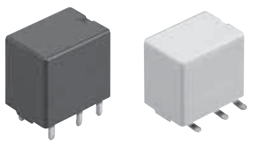
MIDDLE LOAD RELAY FOR SMART J/B

CN-M RELAYS (ACNM)



FEATURES

1. Best space savings in its class.
2. Compact and high-capacity 30A load switching.
3. Full line up (High heat-resistant type and SMD type)
4. Terminals for PC board pattern designs are easily allocated.

TYPICAL APPLICATIONS

Defogger, Seat heater, Head lamp, Fog lamp, Fan motor, etc.

ORDERING INFORMATION

ACNM □ □ □ □ □

CN-M relay

Contact arrangement*1
1: 1 Form C
3: 1 Form A
5: 1 Form C high heat-resistant type
7: 1 Form A high heat-resistant type

Pick-up voltage
1: Max. 7.2V DC

Coil voltage (DC)
12: 12V

Terminal shape
Nil: PC board terminal
SA: Surface-mount terminal

Packing style*2
Nil: Tube packing
X: Tape and reel packing
(Reverse NO terminal direction in pull-out direction)
Z: Tape and reel packing
(Normal NO terminal direction in pull-out direction)

Notes: *1. Surface-mount terminal type is available in high heat-resistant type only.
*2. Tube packing: PC board terminal type only
Tape and reel packing: Surface-mount type only

TYPES

1. PC board terminal type

Contact arrangement	Nominal coil voltage	Part No.	
		Standard type	High heat-resistant type
1 Form A	12V DC	ACNM3112	ACNM7112
1 Form C		ACNM1112	ACNM5112

Standard packing; Carton (tube): 50 pcs.; Case: 1,500 pcs.

2. Surface-mount terminal type

Contact arrangement	Nominal coil voltage	Part No.
		High heat-resistant type
1 Form A	12V DC	ACNM7112SAX
		ACNM7112SAZ
1 Form C		ACNM5112SAX
		ACNM5112SAZ

Standard packing; Carton (tape and reel): 200 pcs.; Case: 600 pcs.
Notes: *1.Surface-mount terminal type is available in high heat-resistant type only.
*2.An “X” at the end of the part number indicates, for tape and reel packing, reverse NO terminal direction in pull-out direction.
A “Z” at the end of the part number indicates, for tape and reel packing, normal NO terminal direction in pull-out direction.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12 V DC	Max. 7.2 V DC (Initial)	Min. 1.0 V DC (Initial)	53.3 mA	225Ω	640 mW	10 to 16 V DC

2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form A, 1 Form C
	Contact resistance (Initial)		Typical 5mΩ (By voltage drop 6 V DC 1 A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		N.O.: 30A 14V DC, N.C.: 15A 14V DC
	Max. carrying current (at 14V DC)		N.O. 30A/1 h, 40A/2 min. at 20°C 68°F 25A/1 h, 35A/2 min. at 85°C 185°F 20A/1 h, 30A/2 min. at 110°C 230°F (High heat-resistant type) N.C. 25A/1 h, 30A/2 min. at 20°C 68°F 20A/1 h, 25A/2 min. at 85°C 185°F 15A/1 h, 20A/2 min. at 110°C 230°F (High heat-resistant type)
	Nominal operating power		640 mW
	Min. switching capacity (resistive load)*		1A 12V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500 V DC)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s^2 {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10µs)
		Destructive	Min. 1,000 m/s^2 {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1m/s^2 {4.5G} (Detection time: 10µs)
		Destructive	10 Hz to 500 Hz, Min. 44.1m/s^2 {4.5G} Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical		<Resistive load> Min. 10^5 (At nominal switching capacity, operating frequency: 1s ON, 2s OFF)
			<Motor load> Min. 2×10^5: at 80 A (inrush), 16 A (steady), 14 V DC (Operating frequency: 2s ON, 6s OFF)
			<Lamp load> Min. 10^5: at 84 A (inrush), 12 A (steady), 14 V DC (Operating frequency: 1s ON, 14s OFF)
Conditions	Conditions for operation, transport and storage		Standard type; Ambient temp: –40°C to +85°C –40°F to +185°F, Humidity: 5 to 85% R.H. High heat-resistant type; Ambient temp: –40°C to +110°C –40°F to +230°F, Humidity: 2 to 85% R.H. (Not freezing and condensing at low temperature)
Unit weight			Approx. 5.5 g .19 oz

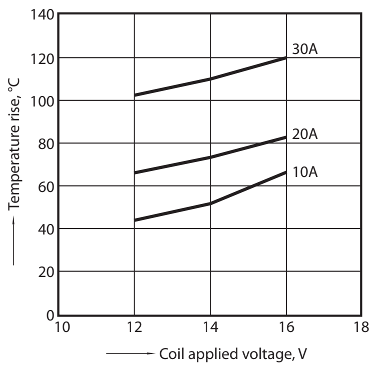
Note: *This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Automotive

REFERENCE DATA

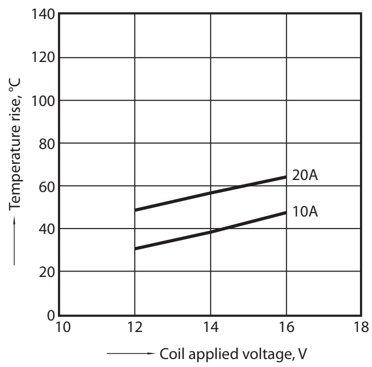
1-(1). Coil temperature rise

Sample: ACNM1112, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 20A, 30A
Ambient temperature: 26°C 78.8°F

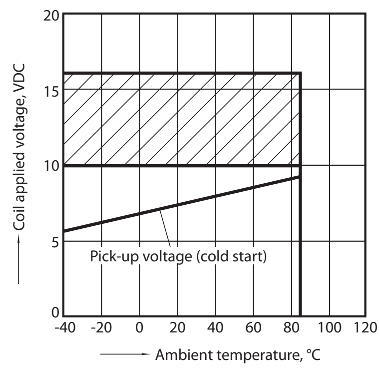


1-(2). Coil temperature rise

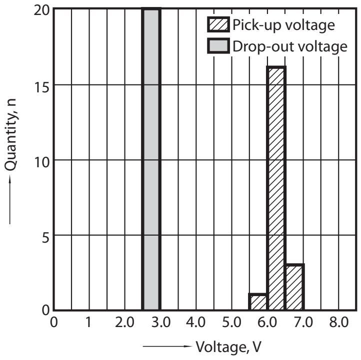
Sample: ACNM7112, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 20A
Ambient temperature: 110°C 230°F



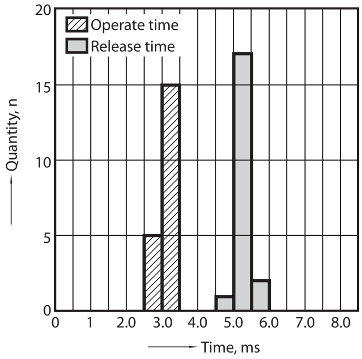
2. Ambient temperature and operating voltage range



3. Distribution of pick-up and drop-out voltage
Sample: ACNM1112, 20pcs.

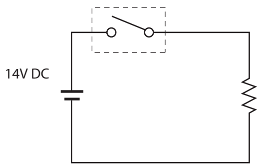


4. Distribution of operate and release time
Sample: ACNM1112, 20pcs.

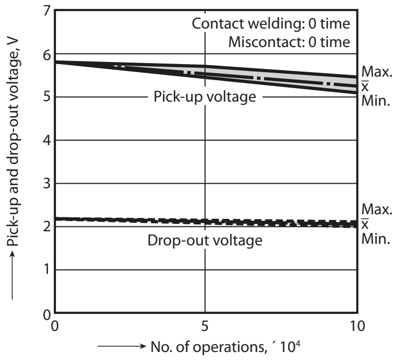


5-(1). Electrical life test (Resistive load)
Sample: ACNM1112, 3pcs.
Load: Resistive load (NO side: 30A 14V DC)
Operating frequency: (ON:OFF = 1s:1s)
Ambient temperature: Room temperature

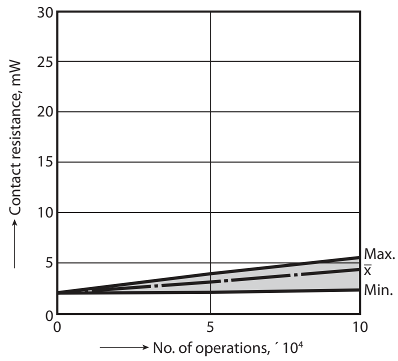
Circuit:



Change of pick-up and drop-out voltage

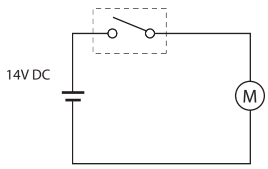


Change of contact resistance

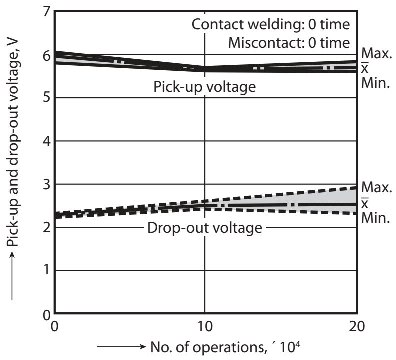


5-(2). Electrical life test (Motor load)
Sample: ACNM7112, 3pcs.
Load: inrush: 80A/steady: 16A,
radiator fan actual load (motor free)
Switching frequency: (ON:OFF = 2s:6s)
Ambient temperature: 110°C 230°F

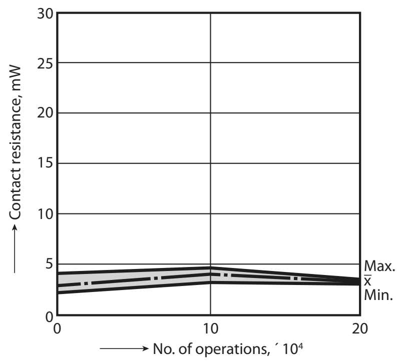
Circuit:



Change of pick-up and drop-out voltage

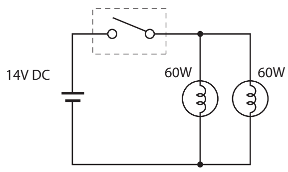


Change of contact resistance

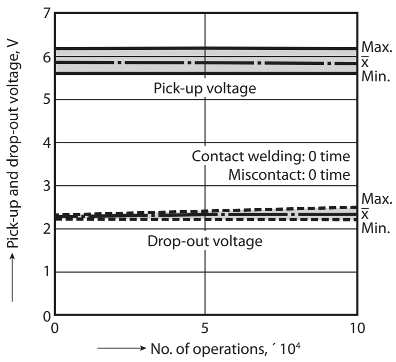


5-(3). Electrical life test (Lamp load)
Sample: ACNM3112, 3pcs.
Load: inrush: 84A/steady: 12A
Switching frequency: (ON:OFF = 1s:14s)
Ambient temperature: Room temperature

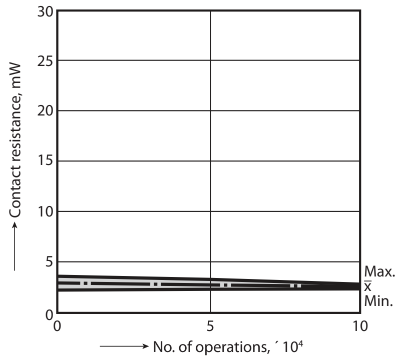
Circuit:



Change of pick-up and drop-out voltage



Change of contact resistance

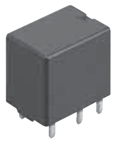


DIMENSIONS(mm inch)

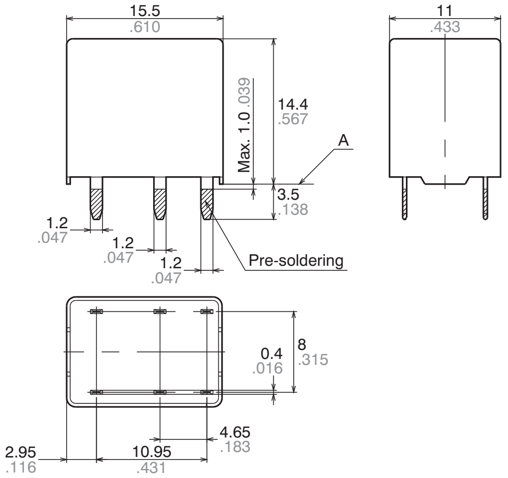
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. PC board terminal type

CAD Data



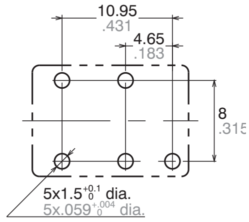
External dimensions



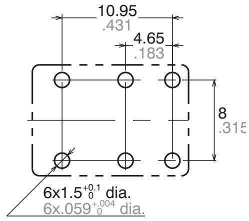
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)

1 Form A

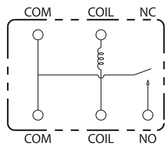


1 Form C

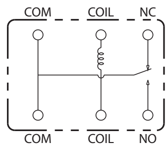


Schematic (Bottom view)

1 Form A



1 Form C



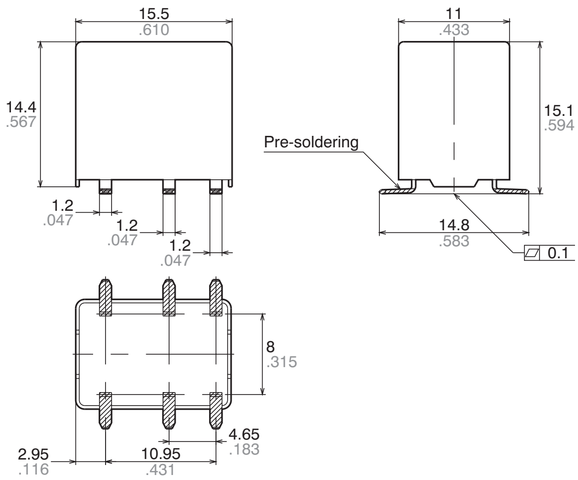
* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

Tolerance: ±0.1 ±.004

2. Surface-mount terminal type

CAD Data

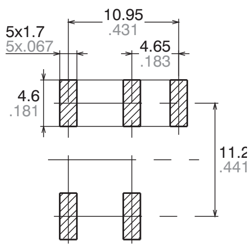
External dimensions



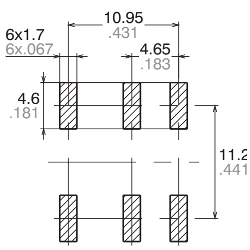
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Recommended mounting pad (Top view)

1 Form A

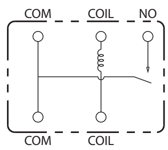


1 Form C

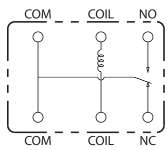


Schematic (Top view)

1 Form A



1 Form C



Tolerance: ±0.1 ±.004

Automotive

NOTES

1. Coil operating power
Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%. However, check it with the actual circuit since the characteristics may be slightly different.

2. Coil applied voltage
To ensure proper operation, the voltage applied to the coil should be the rated operating voltage of the coil. Also, be aware that the pick-up and drop-out voltages will fluctuate depending on the ambient temperature and operating conditions.

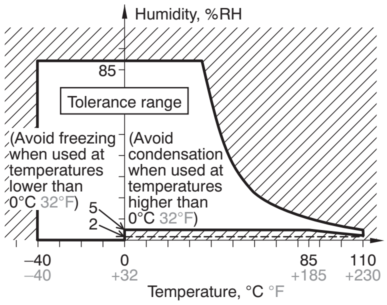
3. Cycle lifetime
Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.

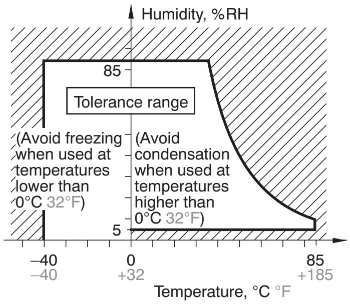
4. Soldering
When soldering the relays, ensure conformance with the conditions listed below.

1) Automatic soldering
• Preheating: less than 100°C 212°F (solder target surface of PC board) for less than 120 sec
• Soldering: less than 260°C 500°F (solder temperature) for less than 5 sec (soldering time)

2) Manual soldering
• Soldering tip temperature: less than 280 to 300°C 536 to 572°F
• Soldering iron: 30 to 60 W
• Soldering time: less than 5 sec

5. Usage, transport and storage conditions
1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature:
–40 to +85°C –40 to +185°F
(Standard type)
–40 to +110°C –40 to +230°F
(High heat-resistant type)
(2) Humidity: 2 to 85% RH
(Avoid freezing and condensation.)
(3) Atmospheric pressure: 86 to 106 kPa
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(Temperature and humidity range for usage, transport, and storage)





2) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.

3) Freezing
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.

4) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

6. Others
If the relay has been dropped, the appearance and characteristics should always be checked before use.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

COMPACT FLAT SIZE PC BOARD RELAY FOR AUTOMOTIVE

CP RELAYS

FEATURES

1. Compact flat type
Flat size enables it to be built-in switch units.
<Height>
PC board terminal type:
9.5 mm .374 inch
Surface-mount terminal type:
10.5mm .413inch

2. High capacity
CP Relay provides low profile spacesaving advantages while offering high continuous current of 25A (1 hour).

3. Simple footprint pattern enables ease of PC board layout
Arrangement of coil and contact terminals designed to withstand large capacity which ensures leeway and facilitates PC board design.

4. Sealed construction
Sealed construction suitable for harsh environments

5. "PC board terminal" and "Surface mount terminal" types available
SMD automatic mounting is possible for surface mount terminal types because tape and reel packaging is used.

6. Model available for wiper load.

TYPICAL APPLICATIONS

For automotive system
Power windows, Auto door lock, Power sunroof, Memory seat, Wiper, Defogger, Blower fan, EPS, ABS etc.

ORDERING INFORMATION

CP [ ] [ ] - [ ] - [ ]

Contact arrangement
1: 1 Form C
1a: 1 Form A
1W: 1 Form C for wiper load

Mounting classification
Nil: PC board terminal/wiper load
SA: Surface-mount terminal*1

Coil voltage (DC)
12 V

Packing style*2
Nil: Tube packing
X: Tape and reel packing (picked from the NC terminal side)
Z: Tape and reel packing (picked from the coil terminal side)

TYPES

1. PC board terminal type

Contact arrangement	Coil voltage	Part No.
1 Form A	12V DC	CP1a-12V
1 Form C		CP1-12V
1 Form C for wiper load		CP1W-12V

Standard packing; Carton (tube): 40 pcs.; Case: 1,000 pcs.

2. Surface mount terminal type

Contact arrangement	Coil voltage	Part No.
1 Form C	12V DC	CP1SA-12V-X
		CP1SA-12V-Z

Standard packing; Carton (tape and reel): 300 pcs.; Case: 900 pcs.
Notes: *1. Surface-mount terminal type is available only for 1 form C contact arrangement.
*2. Surface mount terminal type is only supplied in tape and reel packaging. Tube packaging is only available for PC board type.
Tape and reel packing symbol "-z" or "-x" are not marked on the relay.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range (at 85°C 185°F)
12V DC	Max. 7.2V DC (Initial)	Min. 1.0V DC (Initial)	53.3 mA	225Ω	640 mW	10 to 16V DC

Note: Other pick-up voltage types are also available. Please contact us for details.

2. Specifications

1) Standard CP relay

Characteristics	Item		Specifications	
Contact	Arrangement		1 Form A	1 Form C
	Initial contact resistance (Initial)		N.O.: Typ6mΩ, N.C.: Typ8mΩ (By voltage drop 6V DC 1A)	
	Contact material		Ag alloy (Cadmium free)	
Rating	Nominal switching capacity (resistive load)		20A 14V DC	N.O.: 20A 14V DC, N.C.: 10A 14V DC
	Max. carrying current (12V DC initial)*3		N.O.: 40A for 2 minutes, 30A for 1 hour (at 20°C 68°F) 35A for 2 minutes, 25A for 1 hour (at 85°C 185°F)	
	Nominal operating power		640 mW	
	Min. switching capacity (resistive load)*1		1A 12V DC	
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC)	
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)	
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)	
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)	
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)	
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s^2 {10G} (Half-wave pulse of sine wave: 11ms; detection: 10μs)	
		Destructive	Min. 1,000 m/s^2 {100G} (Half-wave pulse of sine wave: 6ms)	
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s^2 {4.5G} (Detection time: 10μs)	
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s^2 {4.5G} Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours	
Expected life	Mechanical		Min. 10^7 (at 120 cpm)	
	Electrical *Motor load does not apply to wiper load applications.		<Resistive load> Min. 10^5 (At nominal switching capacity, operating frequency: 1s ON, 9s OFF) <Motor load*> Min. 2×105 (N.O. side, Inrush 25A, steady 5A at 14V DC) Min. 105 (N.O. side, 20A 14V DC at motor lock) Min. 2×105 (N.C. side, 20A 14V DC at brake current) (Operating frequency: 0.5s ON, 9.5s OFF)	
Conditions	Conditions for operation, transport and storage*2		Ambient temp: –40°C to +85°C –40°F to +185°F Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature)	
	Max. operating speed		6 cpm (at rated load)	
Mass			Approx. 4g .14 oz	

Notes:
*1.This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2.Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
*3.Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.

2) For wiper load

Anything outside of that given below complies with standard CP relays.

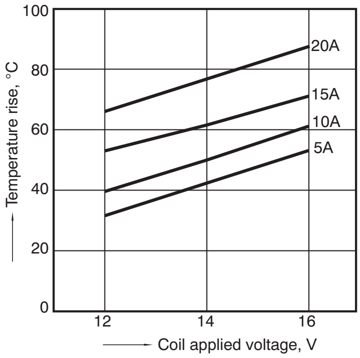
Characteristics	Item	Specifications
Rating	Max. carrying current (12V DC initial)	N.O.: 25A for 1 minutes, 15A for 1 hour (at 20°C 68°F)
Expected life	Electrical	<Wiper motor load (L = Approx. 1mH)> N.O. side: Min. 5×10^5 (Inrush 25A, steady 6A at 14V DC) N.C. side: Min. 5×10^5 (12A 14V DC at brake current) (Operating frequency: 1s ON, 9s OFF)

Note:*1. Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.

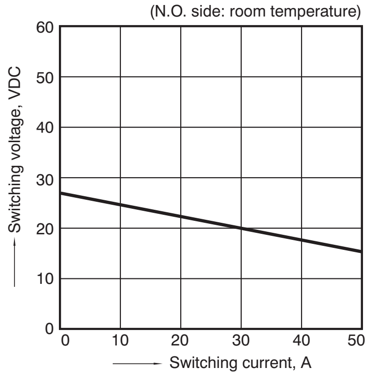
REFERENCE DATA

1. Coil temperature rise

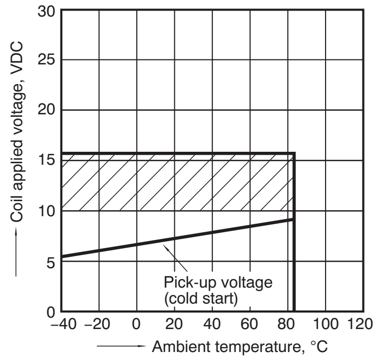
Sample: CP1-12V, 6pcs
Point measured: Inside the coil
Contact carrying current, 5A, 10A, 15A, 20A
Resistance method, ambient temperature 85°C 185°F



2. Max. switching capability (Resistive load)

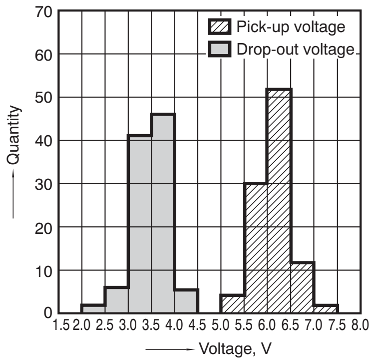


3. Ambient temperature and operating voltage range



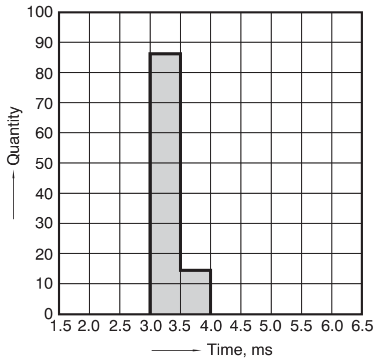
4. Distribution of pick-up and drop-out voltage

Sample: CP1-12V, 100pcs
Ambient temperature: 20°C 68°F



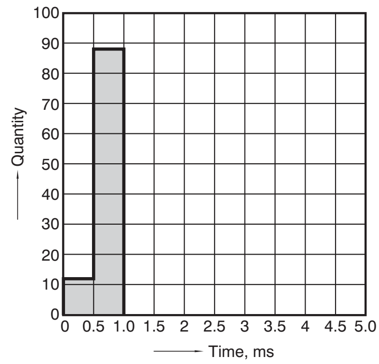
5. Distribution of operate time

Sample: CP1-12V, 100pcs
Ambient temperature: 20°C 68°F



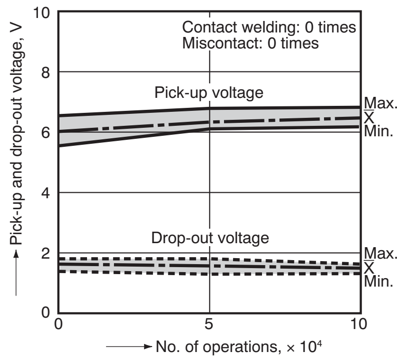
6. Distribution of release time

Sample: CP1-12V, 100pcs
Ambient temperature: 20°C 68°F
* Without diode



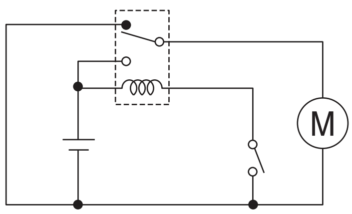
7.-(1) Electrical life test (at resistive load)

Sample: CP1-12V
Quantity: n = 4 (N.C. = 2, N.O. = 2)
Load: Resistive load (N.C. side: 10A 14V DC, N.O. side: 20A 14V DC)
Operating frequency: ON 1s, OFF 9s
Ambient temperature: Room temperature

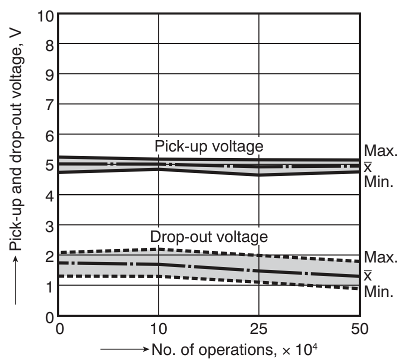


7.-(2) Electrical life test for wiper load (motor free)

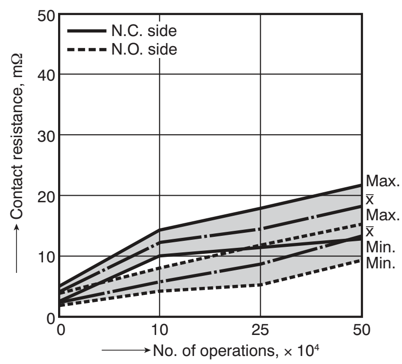
Sample: CP1W-12V
Quantity: n = 5
Load: N.O. side: Inrush 25A, steady 6A 14V DC
Load: N.C. side: Brake current 12A 14V DC
Operating frequency: ON 1s, OFF 9s
Ambient temperature: Room temperature
Circuit



Change of pick-up and drop-out voltage



Change of contact resistance



Automotive

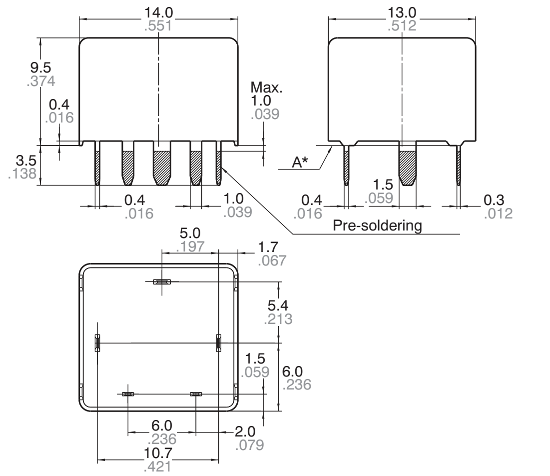
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. PC board terminal type

CAD Data

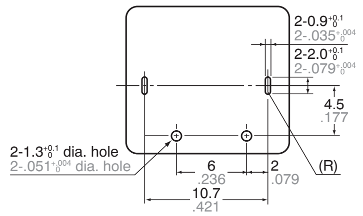
External dimensions



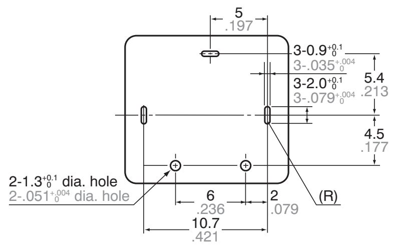
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)

1 Form A

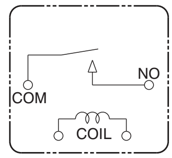


1 Form C

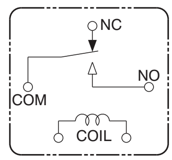


Schematic (Bottom view)

1 Form A



1 Form C

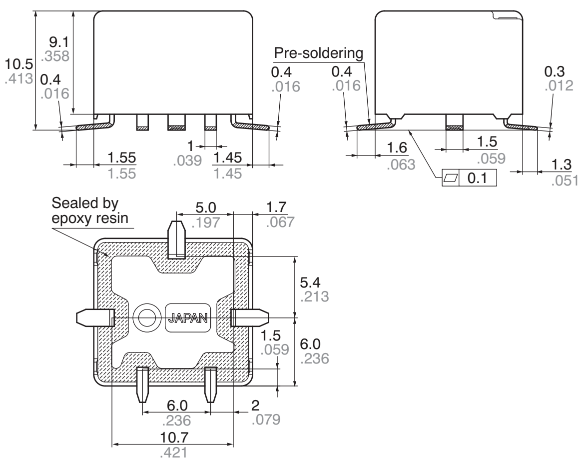


* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

2. Surface mount terminal type

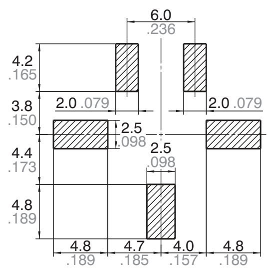
CAD Data

External dimensions

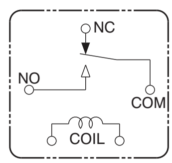


Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Recommendable mounting pad (Top view)



Schematic (Top view)

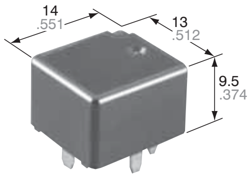


For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

POWER TYPE
MINIATURE LOW PROFILE
AUTOMOTIVE RELAY

CP RELAYS
<POWER TYPE>



FEATURES

• Compact flat type
We successfully developed a power type that is the same size as our CP relay (14 mm (L) x 13 mm (W) x 9.5 mm (H) .551 inch (L) x .512 inch (W) x .374 inch (H)).

• 35A maximum carrying current
Current carrying of 35 A/1h and 45 A/2 min. at 20°C
(450 W type, 16 V applied) is possible due to use of N.O. double pin terminals and COM terminal width expansion.

• Supports capacitor loads required for power supply applications
Inrush current: 60A, steady-state current: 1A and 10^5 switching times possible.

• Plastic sealed type
This plastic sealed type can be automatically cleaned.

TYPICAL APPLICATIONS

For automotive system
Defoggers, Ignitions, Heaters, Accessories, Power windows, EPS and ABS etc.

SPECIFICATIONS

Contact

Arrangement			1 Form A, 1 Form C
Contact material			Ag alloy (Cadmium free)
Initial contact resistance (Initial) (By voltage drop 6V DC 1A)			Typ. 3 mΩ (N.O.) Typ. 4 mΩ (N.C.)
Rating	Nominal switching capacity		20A 14V DC (N.O.) 10A 14V DC (N.C.)
	Max. carrying current (16V DC)		N.O.: For 450mW 45A/2 minutes, 35A/1 hour at 20°C 68°F 40A/2 minutes, 30A/1 hour at 85°C 185°F 35A/2 minutes, 25A/1 hour at 110°C 230°F For 640mW 40A/2 minutes, 30A/1 hour at 20°C 68°F 35A/2 minutes, 25A/1 hour at 85°C 185°F 30A/2 minutes, 20A/1 hour at 110°C 230°F
	Min. switching capacity#1		1A 12V DC
Expected life (min. operations)	Mechanical (at 120cpm)		Min. 10^7
	Electrical (at 6cpm)	Resistive load	Min. 10^5*1
		Capacitor load	Min. 10^5*2

Coil

Nominal operating power	450 mW for pick-up voltage 7.2V DC 640 mW for pick-up voltage 6.5V DC

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed (at nominal switching capacity)		6cpm
Initial insulation resistance		Min. 100MΩ (at 500 V DC)
Initial breakdown voltage*3	Between open contacts	500 Vrms for 1min.
	Between contact and coil	500 Vrms for 1min.
Operate time*4 (at nominal voltage) (Initial)		Max. 10ms (at 20°C 68°F)
Release time*4 (at nominal voltage) (Initial)		Max. 10ms (at 20°C 68°F)
Shock resistance	Functional 5	Min. 100 m/s²{10 G}
	Destructive*6	Min. 1,000 m/s²{100 G}
Vibration resistance	Functional*7	10 Hz to 100 Hz, Min.44.1 m/s² {4.5 G}
	Destructive*8	10 Hz to 500 Hz, Min.44.1 m/s² {4.5 G}
Conditions in case of operation, transport and storage*9 (Not freezing and condensing at low temperature)	Ambient temp	–40°C to +85°C –40 to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 4.5g .16 oz

Remarks
*1 At nominal switching capacity, operating frequency: 1s ON, 9s OFF
*2 At 1A (steady), 60A (inrush), 14V DC, operating frequency: 1s ON, 9s OFF
*3 Detection current: 10mA
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Time of vibration for each direction;
- X, Y direction: 2 hours
- Z direction: 4 hours
*9 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).

ORDERING INFORMATION

Ex. CP [ ] – [ ] – [ ]

Contact arrangement	Pick-up voltage	Coil voltage (DC)
1H: 1 Form C Powr type 1aH: 1 Form A Powr type	Nil: Max. 7.2 V DC N: Max. 6.5 V DC	12 V

Note: Tube packing: Carton (Tube): 40 pcs.; Case: 1,000 pcs.

TYPES

Contact arrangement	Coil voltage	Pick-up voltage, V DC (Initial) (at 20°C 68°F)	Part No.
1 Form C	12 V DC	Max. 7.2	CP1H-12V
		Max. 6.5	CP1H-N-12V
1 Form A		Max. 7.2	CP1aH-12V
		Max. 6.5	CP1aH-N-12V

Note: THD type only

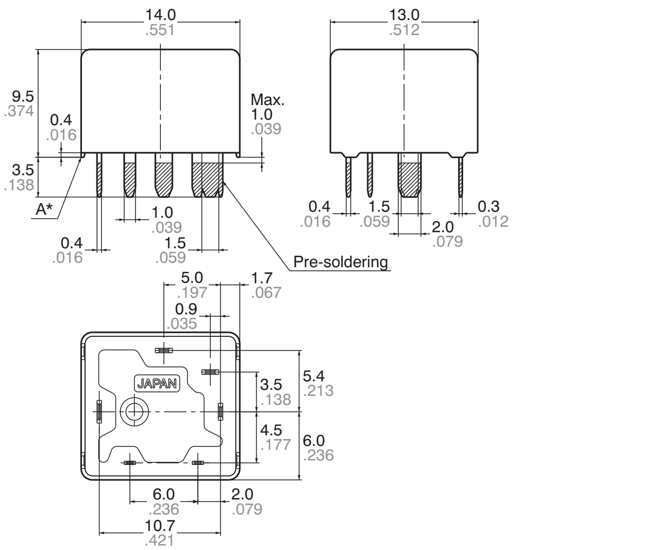
COIL DATA (at 20°C 68°F)

Nominal voltage, V DC (at 20°C 68°F)	Pick-up voltage, V DC (Initial) (at 20°C 68°F)	Drop-out voltage, V DC (Initial) (at 20°C 68°F)	Coil resistance Ω (at 20°C 68°F)	Nominal operating current mA (at 20°C 68°F)	Nominal operating power mW (at 20°C 68°F)	Usable voltage range, V DC (at 85°C 185°F)
12	Max. 7.2	Min. 1.0	320±10%	37.5±10%	450	10 to 16
	Max. 6.5		225±10%	53.3±10%	640	9 to 16

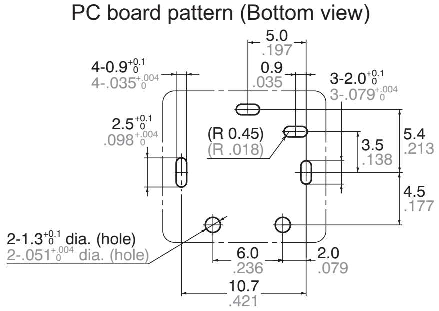
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data

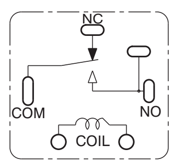


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



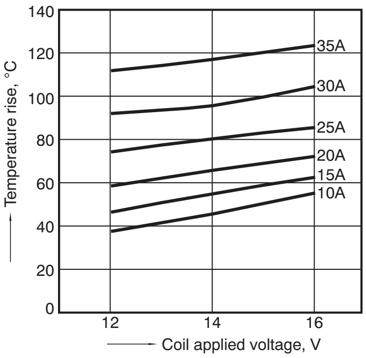
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

*Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

REFERENCE DATA

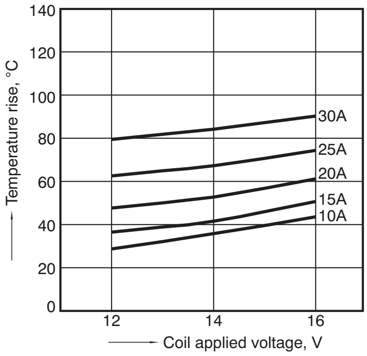
1-(1). Coil temperature rise

Sample : CP1H-12V, 3pcs
Point measured : Inside the coil
Ambient temperature: 27°C 81°F

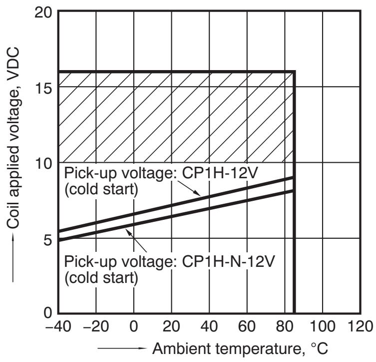


1-(2). Coil temperature rise

Sample : CP1H-12V, 3pcs
Point measured : Inside the coil
Ambient temperature: 85°C 185°F

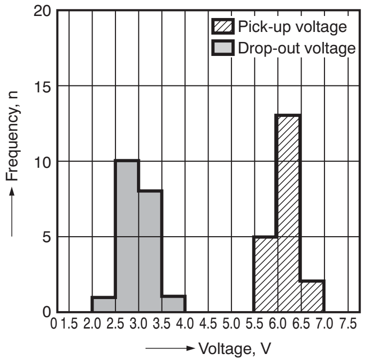


2. Ambient temperature and operating voltage range



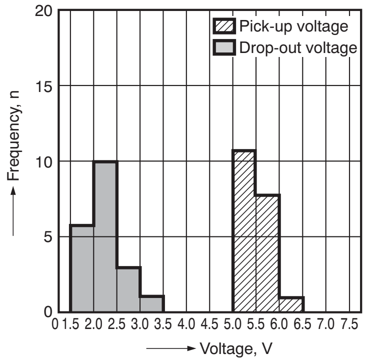
3-(1). Distribution of pick-up and drop-out voltage

Sample : CP1H-12V



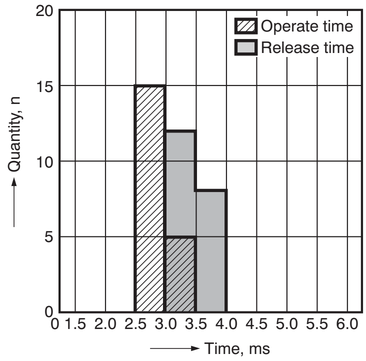
3-(2). Distribution of pick-up and drop-out voltage

Sample : CP1H-N-12V



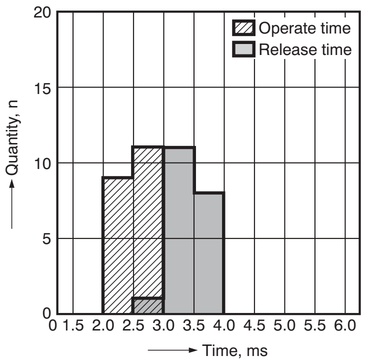
4-(1). Distribution of operate and release time

Sample : CP1H-12V



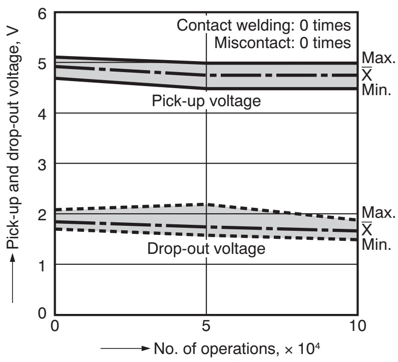
4-(2). Distribution of operate and release time

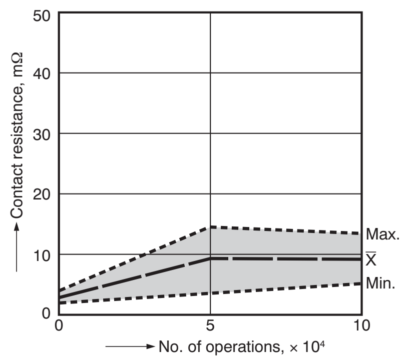
Sample : CP1H-N-12V



5-(1). Electrical life test (at rated load)

Sample : CP1H-12V
Quantity : n = 6
Load : Resistive load (NO side : 20 A 14 V DC)
Operating frequency : ON 1s, OFF 9s
Ambient temperature : Room temperature



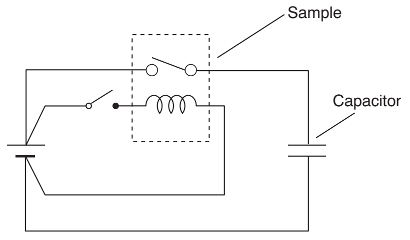


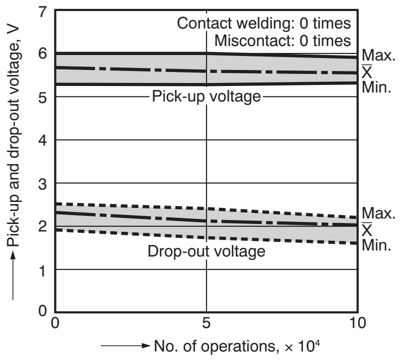
Automotive

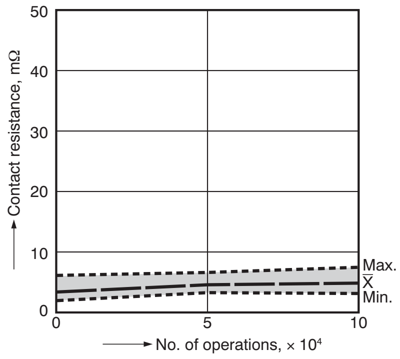
5-(2). Electrical life test (at capacitor load)

Sample : CP1H-12V, 6pcs.
Load : Inrush 60A/steady 1A
Operating frequency : (ON : OFF = 1s : 9s)
Ambient temperature : Room temperature

Circuit :







For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

1 FORM C AUTOMOTIVE SILENT RELAY

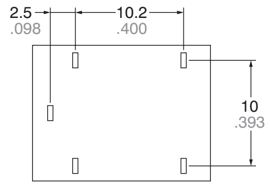
CQ RELAYS

FEATURES

1. Silent
Noise has been reduced by approximately 20 dB, using our own silencing design.

2. Less space required
Measuring only 17(L) × 13(W) mm .669(L) × .512(W) inches, this product ranks first among automotive quiet relays in terms of saving space.

3. Next-generation standard terminal pitch employed
The terminal array used is identical to that used in JJM relays.



4. Sealed construction

5. Model available for wiper load

TYPICAL APPLICATIONS

Intermittent wiper, Cruise control, Power windows, Auto door lock, Power supply of car stereo and car air-conditioner, Electrically powered seats, Electrically powered sunroof, etc.

TYPES

Contact arrangement	Coil voltage	Model No.	Part No.
1 Form C	12V DC	ACQ131	CQ1-12V
1 Form C for wiper load		ACQW131	CQ1W-12V

Standard packing; Carton (tube): 40 pcs.; Case: 800 pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 7.2V DC (Initial)	Min. 1.0V DC (Initial)	53.3 mA	225Ω	640 mW	10 to 16V DC

Note: Other pick-up voltage types are also available. Please contact us for details.

2. Specifications

1) Standard CQ relay

Characteristics	Item		Specifications
Contact	Arrangement		1 Form C
	Initial contact resistance (Initial)		N.O.: Typ7mΩ, N.C.: Typ8mΩ (By voltage drop 6V DC 1A)
	Contact voltage drop		Max. 0.2V (at 10 A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		N.O.: 20A 14V DC, N.C.: 10A 14V DC
	Max. carrying current (12V DC initial)*1		N.O.: 35A for 2 minutes, 25A for 1 hour (at 20°C 68°F) 30A for 2 minutes, 20A for 1 hour (at 85°C 185°F)
	Nominal operating power		640 mW
	Min. switching capacity (resistive load)*2		1A 12V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s^2 {10G} (Half-wave pulse of sine wave: 11ms; detection: 10μs)
		Destructive	Min. 1,000 m/s^2 {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s^2 {4.5G} (Detection time: 10μs)
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s^2 {4.5G} Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical *Motor load does not apply to wiper load applications.		<Resistive load> Min. 10^5 (At nominal switching capacity, operating frequency: 1s ON, 9s OFF) <Motor load*> Min. 3×10^5 (Inrush 30A, steady 5A, 20A 14V DC at brake current) (Operating frequency: 1s ON, 2s OFF)
Conditions	Conditions for operation, transport and storage*3		Ambient temp: –40°C to +85°C –40°F to +185°F Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed		6 cpm (at rated load)
Mass			Approx. 6.5g .23 oz

*1Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.
*2This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*3Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

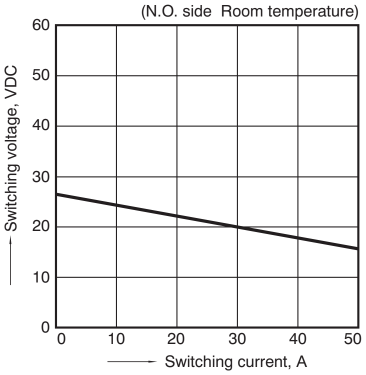
2) For wiper load
Anything outside of that given below complies with standard CQ relays.

Characteristics	Item	Specifications
Rating	Max. carrying current (12V DC initial)	N.O.: 25A for 1 minutes, 15A for 1 hour (at 20°C 68°F)
Expected life	Electrical	<Wiper motor load (L = Approx. 1mH)> N.O. side: Min. 5×10^5 (Inrush 25A, steady 6A at 14V DC) N.C. side: Min. 5×10^5 (12A 14V DC at brake current) (Operating frequency: 1s ON, 9s OFF)

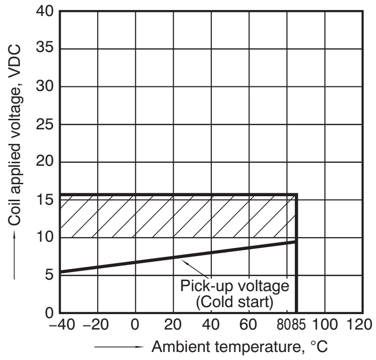
Note:*1. Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.

REFERENCE DATA

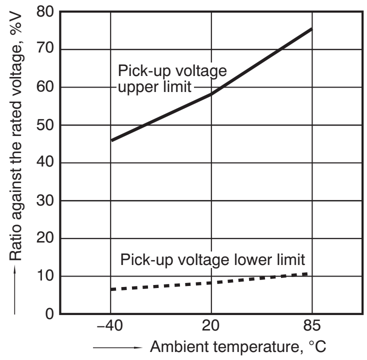
1. Max. switching capability (Resistive load, initial)



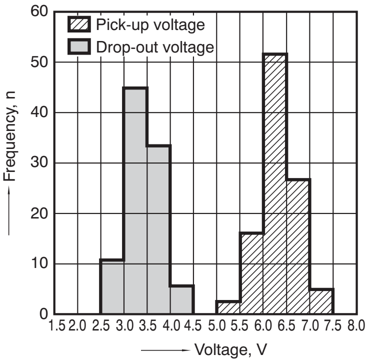
2. Ambient temperature and operating temperature range



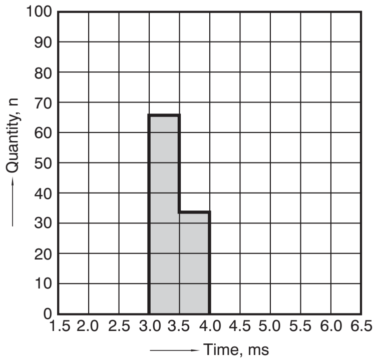
3. Ambient temperature characteristics



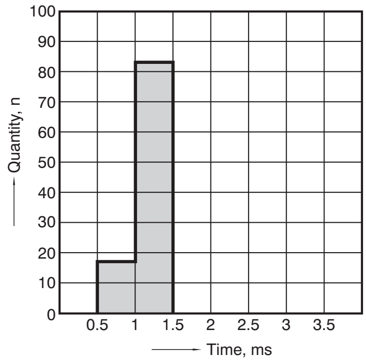
4. Distribution of pick-up and drop-out voltage
Sample: CQ1-12V, 100pcs



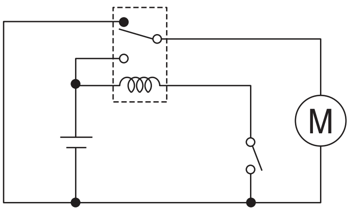
5. Distribution of operate time
Sample: CQ1-12V, 100pcs



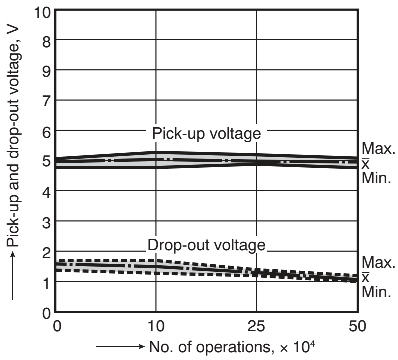
6. Distribution of release time
Sample: CQ1-12V, 100pcs
* Without diode



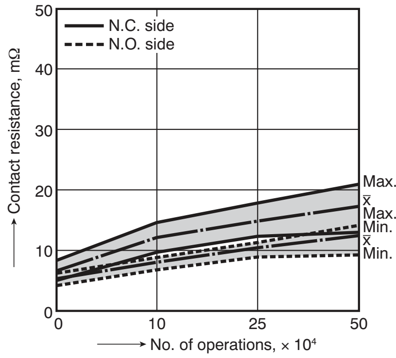
7. Electrical life test for wiper load (motor free)
Sample: CQ1W-12V
Quantity: n = 3
Load: N.O. side: Inrush 25A, steady 6A 14V DC
Load: N.C. side: Brake current 12A 14V DC
Operating frequency: ON 1s, OFF 9s
Ambient temperature: Room temperature
Circuit



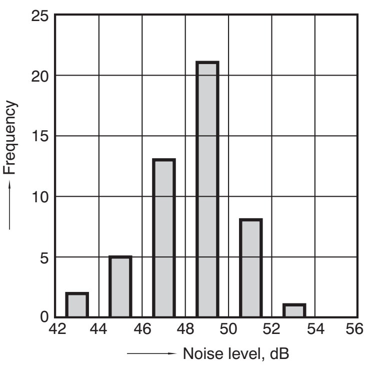
Change of pick-up and drop-out voltage



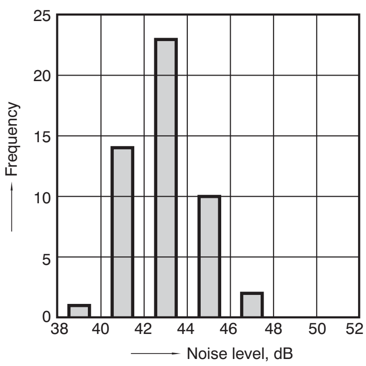
Change of contact resistance



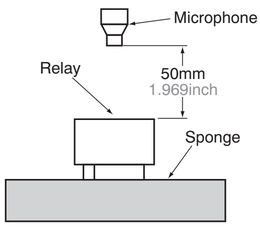
8.-(1) Operation noise distribution
When operate



8.-(2) Operation noise distribution
When release



Measuring conditions
Sample: CQ1-12 V, 50 pcs.
Equipment setting: “A” weighted, Fast, Max. hold
Coil voltage: 12V DC
Coil connection device: Diode
Background noise: Approx. 20dB



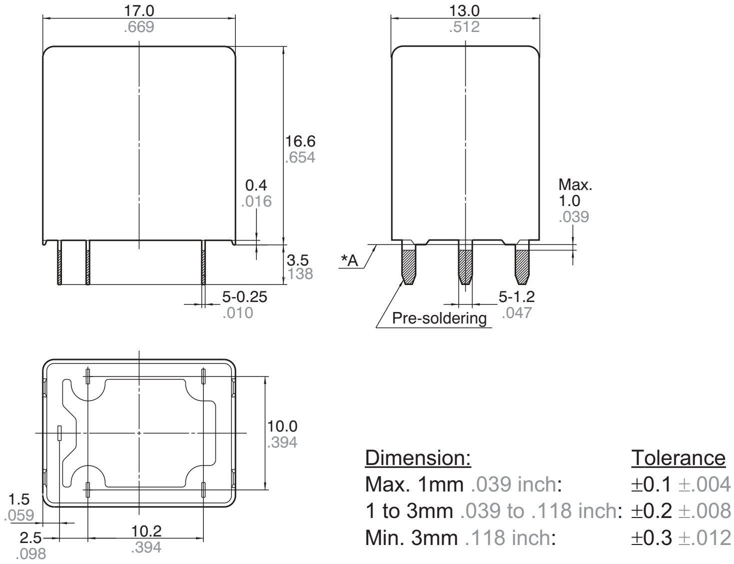
Automotive

DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

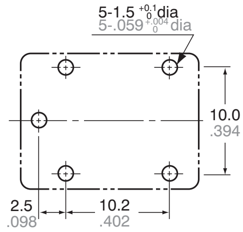
CAD Data

External dimensions



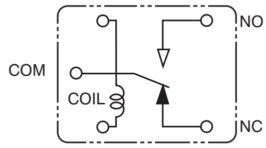
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

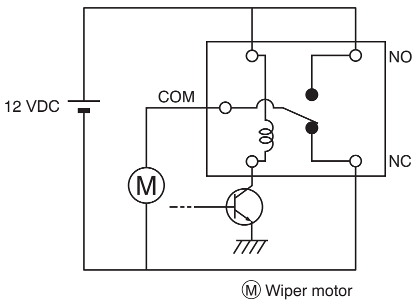
Schematic (Bottom view)



* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

EXAMPLE OF CIRCUIT

Control circuit for intermittent wiper motor

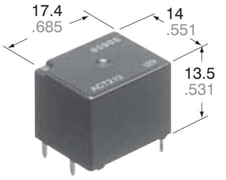


For Cautions for Use, see Relay Technical Information (page 582).

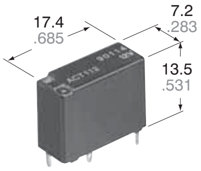
Panasonic
ideas for life

SUPER MINIATURE TWIN TYPE AUTOMOTIVE RELAY

CT RELAYS (ACT)



Twin type (8 terminals)



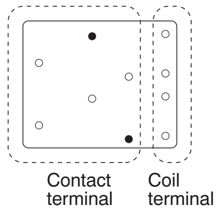
mm inch

Slim 1c type

FEATURES

- **Small & slim size**
  Twin type: 17.4(L)×14.0(W)×13.5(H)mm
  .685(L)×.551(W)×.531(H)inch
  Slim 1c type: 17.4(L)×7.2(W)×13.5(H)mm
  .685(L)×.283(W)×.531(H)inch
- **Twin (1 Form C × 2)**
  Forward/reverse motor control is possible with a single relay.
- **Simple footprint enables ease of PC board layout**

※10 terminals layout



○ = 8 terminals

TYPICAL APPLICATIONS

- Power windows
- Auto door lock
- Power sunroof
- Electrically powered mirrors
- Powered seats
- Lift gates
- Slide door closers, etc.
  (for DC motor forward/reverse control circuits)

SPECIFICATIONS

Contact

Arrangement			1 Form C×2, 1 Form C
Contact material			Ag alloy (Cadmium free)
Initial contact resistance (Initial) (By voltage drop 6 V DC 1 A)			Typ. 7 mΩ (N.O.) Typ. 10 mΩ (N.C.)
Rating	Nominal switching capacity		N.O.: 20 A 14 V DC N.C.: 10 A 14 V DC
	Max. carrying current (N.O.)		35 A for 2 minutes, 25 A for 1 hour (14 V, at 20°C 68°F) 30 A for 2 minutes, 20 A for 1 hour (14 V, at 85°C 185°F)
	Min. switching capacity#1		1 A 12 V DC
Expected life (min. operation)	Mechanical (at 120 cpm)		Min. 10^7
	Electrical	Resistive load	Min. 10^5*1
		Motor load	Min. $2×10^5$*2 (free)
			Min. 10^5*3 (lock)

Coil

Nominal operating power	800 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

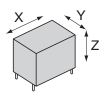
Remarks

*1 At nominal switching capacity, operating frequency: 1s ON, 9s OFF
*2 N.O.: at 5 A (steady), 25 A (inrush)/N.C.: at 20 A (brake) 14 V DC, operating frequency: 0.5s ON, 9.5s OFF
*3 At 25A 14 V DC (Motor lock), operating frequency: 0.5s ON, 9.5s OFF
*4 Measurement at same location as “Initial breakdown voltage” section
*5 Detection current: 10mA
*6 Excluding contact bounce time
*7 Half-wave pulse of sine wave: 11ms; detection: 10µs
*8 Half-wave pulse of sine wave: 6ms
*9 Detection time: 10µs

Characteristics

Max. operating speed (at nominal switching capacity)		6 cpm
Initial insulation resistance*4		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*5	Between open contacts	500 Vrms for 1 min.
	Between contacts and coil	500 Vrms for 1 min.
Operate time*6 (at nominal voltage) (at 20°C 68° F)		Max. 10ms (Initial)
Release time*6 (at nominal voltage) (at 20°C 68° F)		Max. 10ms (Initial)
Shock resistance	Functional*7	Min. 100 m/s² {10G}
	Destructive*8	Min. 1,000 m/s² {100G}
Vibration resistance	Functional*9	10 Hz to 100 Hz, Min. 44.1m/s² {4.5G}
	Destructive*10	10 Hz to 500 Hz, Min. 44.1m/s² {4.5G}
Conditions for operation, transport and storage*11 (Not freezing and condensing at low temperature)	Ambient temp	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 8.0g .28oz (Twin type) Approx. 4.0g .14oz (Slim 1c type)

*10 Time of vibration for each direction;
X, Y, direction: 2 hours
Z direction: 4 hours



*11 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
* If the relay is used continuously for long periods of time with coils on both sides in an energized condition, breakdown might occur due to abnormal heating depending on the carrying condition. Therefore, please inquire when using with a circuit that causes an energized condition on both sides simultaneously.

ORDERING INFORMATION

Ex. A CT 1 12

Product name	Contact arrangement	Coil voltage (V DC)
CT	1: 1 Form C 2: 1 Form C × 2 (8 terminals type) 5: 1 Form C × 2 (10 terminals type)	12: 12

Standard packing; 1 Form C: Carton(tube package) 30pcs. Case 1,500pcs.
1 Form C × 2: Carton(tube package) 30pcs. Case 900pcs.

TYPES AND COIL DATA (at 20°C 68°F)

Contact arrangement	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance, Ω	Nominal operating current, mA	Nominal operating power, mW	Usable voltage range, V DC
1c	ACT112	12	Max. 7.2	Min. 1.0	180±10%	66.7±10%	800	10 to 16
1c × 2 (8 terminals type)	ACT212	12	Max. 7.2	Min. 1.0	180±10%	66.7±10%	800	10 to 16
1c × 2 (10 terminals type)	ACT512	12	Max. 7.2	Min. 1.0	180±10%	66.7±10%	800	10 to 16

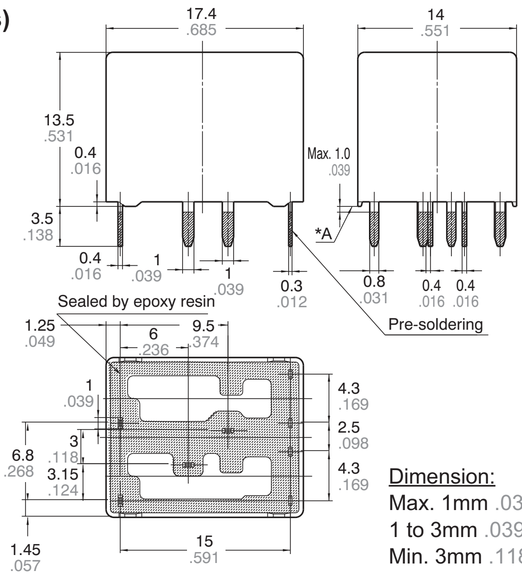
* Other pick-up voltage types are also available. Please contact us for details.

DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

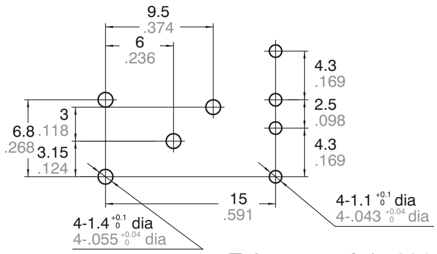
1. Twin type (8 terminals)

CAD Data



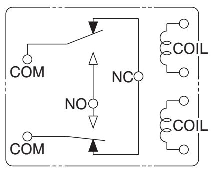
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1±.004

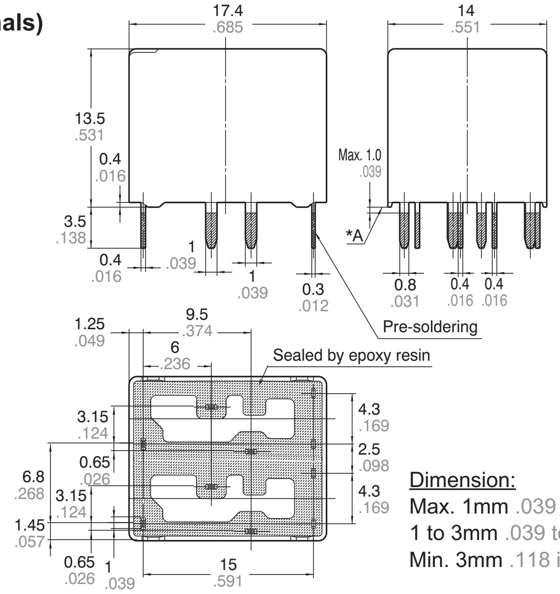
Schematic (Bottom view)



* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

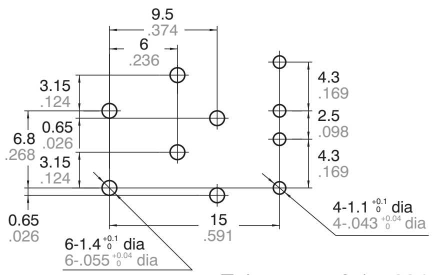
2. Twin type (10 terminals)

CAD Data



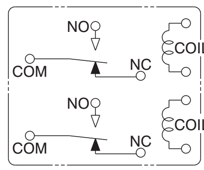
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

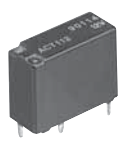


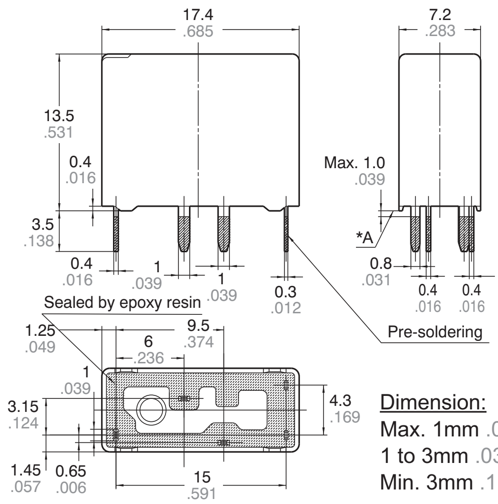
* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

3. Slim 1c type

CAD Data

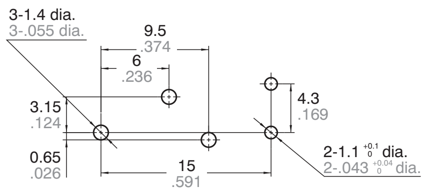
mm inch





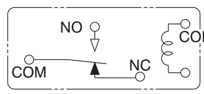
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1±.004

Schematic (Bottom view)

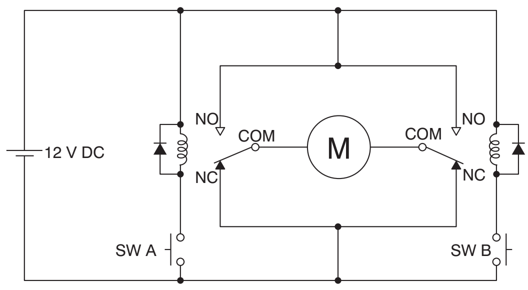


* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

Automotive

EXAMPLE OF CIRCUIT

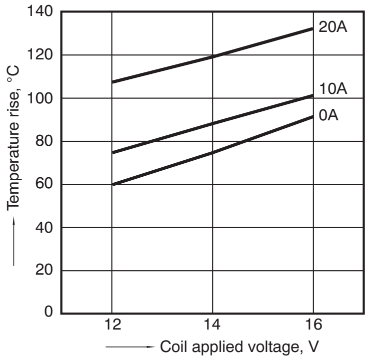
Forward/reverse control circuits of DC motor for power windows



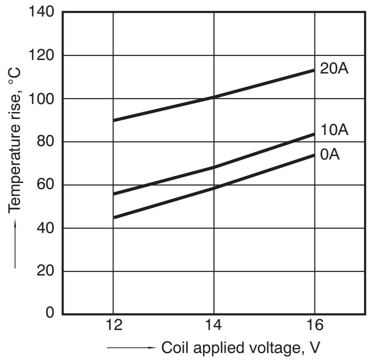
Ⓜ : Power window motor

REFERENCE DATA

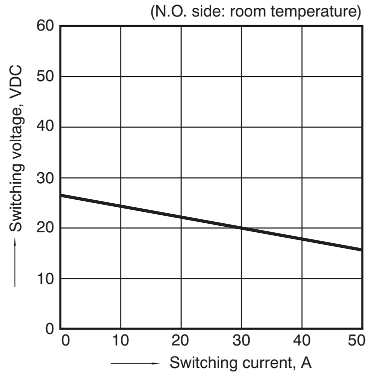
1-(1). Coil temperature rise (at room temperature
Sample: ACT212, 3pcs.
Contact carrying current: 0A, 10A, 20A



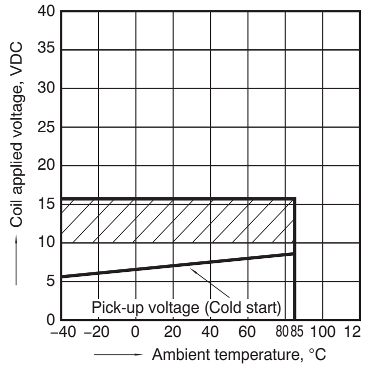
1-(2). Coil temperature rise (at 85°C 185°F)
Sample: ACT212, 3pcs.
Contact carrying current: 0A, 10A, 20A



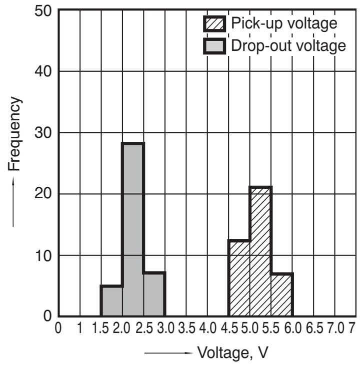
2. Max. switching capability (Resistive load, initial)



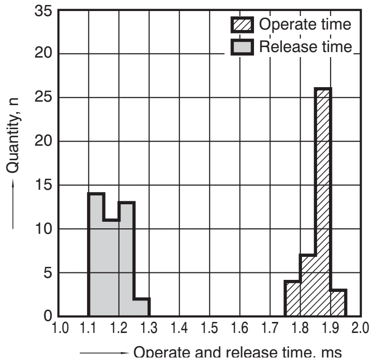
3. Ambient temperature and operating voltage range



4. Distribution of pick-up and drop-out voltage
Sample: ACT212, 40pcs.



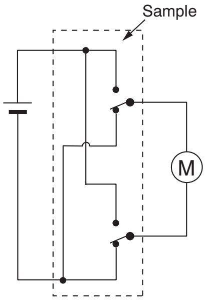
5. Distribution of operate and release time
Sample: ACT212, 40pcs.
* Without diode



6-(1). Electrical life test (Motor free)

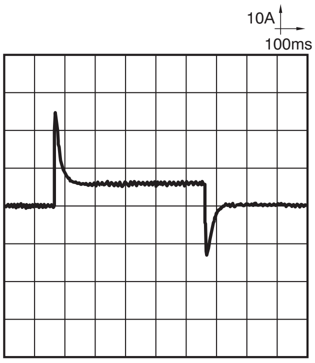
Sample: ACT212, 3pcs.
Load: 5A steady, Inrush 25A, 14V DC
Brake current: 13A 14V DC,
Power window motor actual load (free condition)
Operating frequency: (ON : OFF = 0.5s : 9.5s)
Ambient temperature: Room temperature

Circuit:

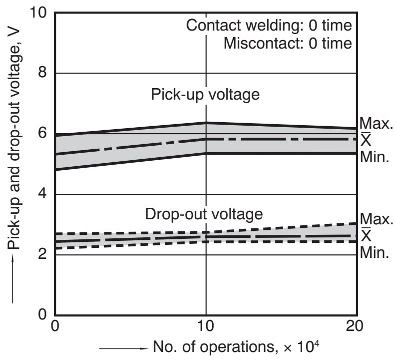


Load current waveform

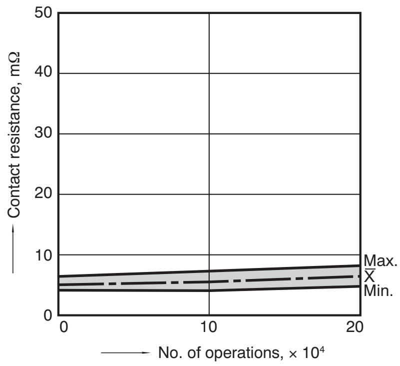
Inrush current: 25A, Steady current: 6A
Brake current: 13A



Change of pick-up and drop-out voltage



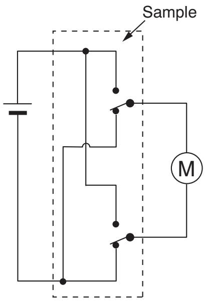
Change of contact resistance



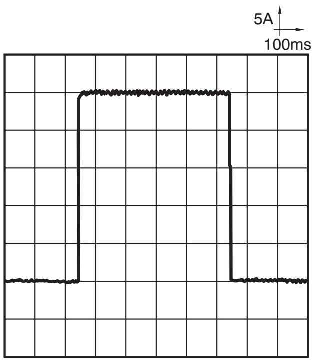
6-(2). Electrical life test (Motor lock)

Sample: ACT212, 3pcs.
Load: 25A 14V DC
Switching frequency: (ON : OFF = 0.5s : 9.5s)
Ambient temperature: Room temperature

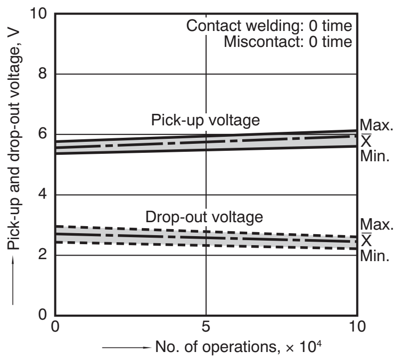
Circuit:



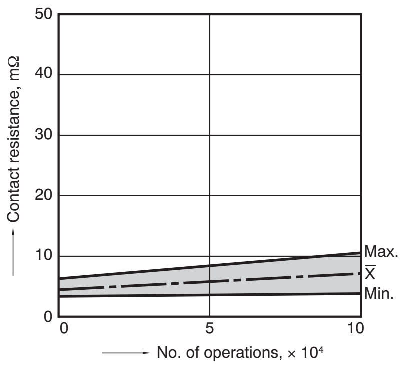
Load current waveform



Change of pick-up and drop-out voltage



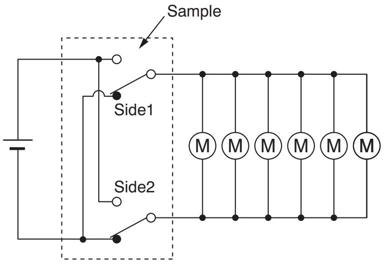
Change of contact resistance



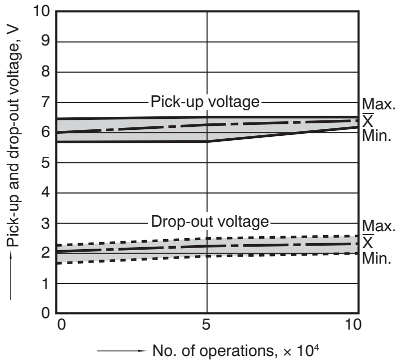
Automotive

6-(3). Electrical life test (Motor lock)
Sample: ACT212, 3pcs.
Load: 20A 14V DC,
door lock motor actual load (Lock condition)
Switching frequency: (ON : OFF = 0.3s : 19.7s)
Ambient temperature: Room temperature

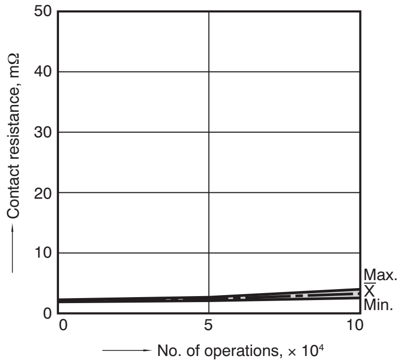
Circuit:

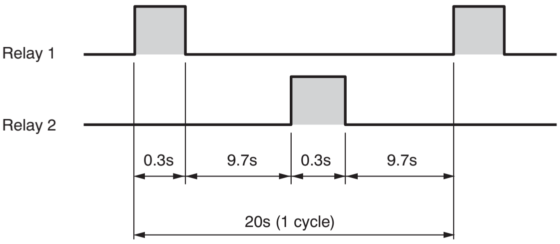


Change of pick-up and drop-out voltage

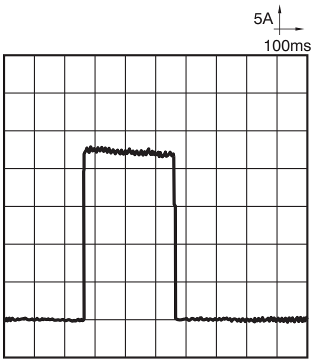


Change of contact resistance





Load current waveform

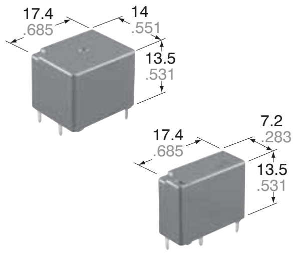


For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

POWER TYPE
SMALL & SLIM
AUTOMOTIVE RELAY

CT RELAYS
<POWER TYPE>



FEATURES

1. Compact type for automotives
We successfully developed a power type that is the same size as our CT relay.

2. 30 A maximum switching capacity
Switching of 30 A motor loads is possible due to change of COM spring material and other improvements.

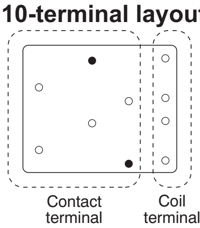
3. Still top-of-its-class for silent operation
Maintains equally silent operation as our CT relay (ACT).

4. Sealed type
Sealed type makes automatic cleaning possible.

APPLICATIONS

Power windows, Powered seats, Auto door lock, Slide door closers, Power sunroof, etc.

10-terminal layout



*8-terminal type has no ● terminals.

SPECIFICATIONS

Contact

Arrangement			1 Form C×2, 1 Form C
Contact material			Ag alloy (Cadmium free)
Initial contact resistance (Initial) (By voltage drop 6 V DC 1 A)			Typ. 7 mΩ (N.O.) Typ. 10 mΩ (N.C.)
Rating	Nominal switching capacity		N.O.: 30 A 14 V DC N.C.: 10 A 14 V DC
	Max. carrying current (N.O.)		40 A for 2 minutes, 25 A for 1 hour (at 20°C 68°F) 35 A for 2 minutes, 20 A for 1 hour (at 85°C 185°F)
	Min. switching capacity#1		1 A 12 V DC
Expected life (min. operation)	Mechanical (at 120 cpm)		Min. 10^6
	Electrical	Resistive load	Min. 5×10^4*1
		Motor load	Min. 10^5*2 (free)
			Min. 5×10^4*3 (lock)

Coil

Nominal operating power	1,000 mW

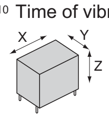
#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed (at nominal switching capacity)		6 cpm
Initial insulation resistance*4		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*5	Between open contacts	500 Vrms for 1 min.
	Between contacts and coil	500 Vrms for 1 min.
Operate time*6 (at nominal voltage) (at 20°C 68°F)		Max. 10ms (Initial)
Release time*6 (at nominal voltage) (at 20°C 68°F)		Max. 10ms (Initial)
Shock resistance	Functional*7	Min. 100 m/s² {10G}
	Destructive*8	Min. 1,000 m/s² {100G}
Vibration resistance	Functional*9	10 Hz to 100 Hz, Min. 44.1m/s² {4.5G}
	Destructive*10	10 Hz to 500 Hz, Min. 44.1m/s² {4.5G}
Conditions for operation, transport and storage*11 (Not freezing and condensing at low temperature)	Ambient temp	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Twin type: approx. 8.0g .28oz 1 Form C type: approx. 4.0g .14oz

Remarks

*1 At nominal switching capacity, operating frequency: 1s ON, 9s OFF
*2 N.O.: at 7 A (steady), 30 A (inrush)/N.C.: at 15 A (brake) 14 V DC, operating frequency: 0.5s ON, 9.5s OFF
*3 At 30A 14 V DC (Motor lock), operating frequency: 0.5s ON, 9.5s OFF
*4 Measurement at same location as “Initial breakdown voltage” section
*5 Detection current: 10mA
*6 Excluding contact bounce time
*7 Half-wave pulse of sine wave: 11ms; detection: 10μs
*8 Half-wave pulse of sine wave: 6ms
*9 Detection time: 10μs
*10 Time of vibration for each direction;



X, Y, direction: 2 hours
Z direction: 4 hours

*11 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
* If the relay is used continuously for long periods of time with coils on both sides in an energized condition, breakdown might occur due to abnormal heating depending on the carrying condition. Therefore, please inquire when using with a circuit that causes an energized condition on both sides simultaneously.

TYPES AND COIL DATA (at 20°C 68°F)

Standard packing; 1 Form C: Carton(tube package) 30pcs. Case 1,500pcs.
1 Form C × 2: Carton(tube package) 30pcs. Case 900pcs.

Contact arrangement	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance, Ω	Nominal operating current, mA	Nominal operating power, mW	Usable voltage range, V DC
1 Form C	ACTP112	12	Max. 7.2	Min. 1.0	144±10%	83.3±10%	1,000	10 to 16
1 Form C × 2 (8 terminals type)	ACTP212	12	Max. 7.2	Min. 1.0	144±10%	83.3±10%	1,000	10 to 16
1 Form C × 2 (10 terminals type)	ACTP512	12	Max. 7.2	Min. 1.0	144±10%	83.3±10%	1,000	10 to 16

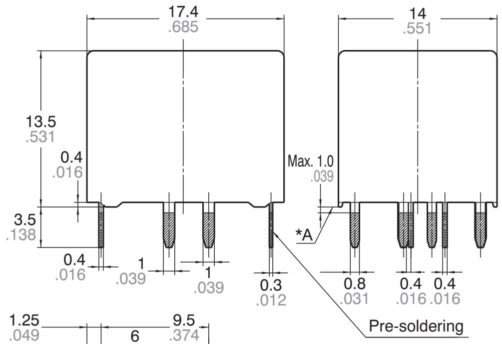
* Other pick-up voltage types are also available. Please contact us for details.

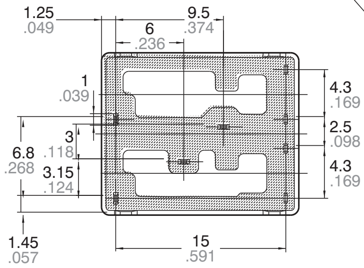
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. Twin type (8 terminals)

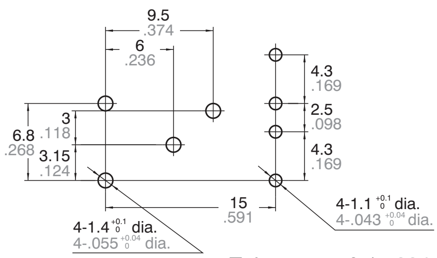
CAD Data





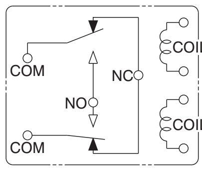
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

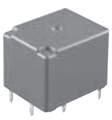
Schematic (Bottom view)

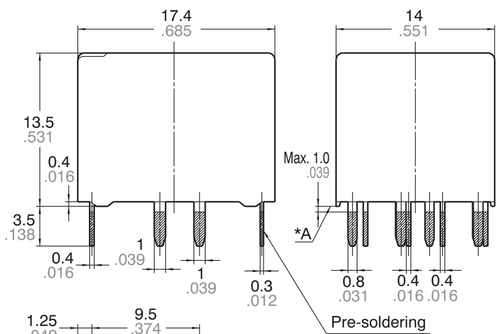


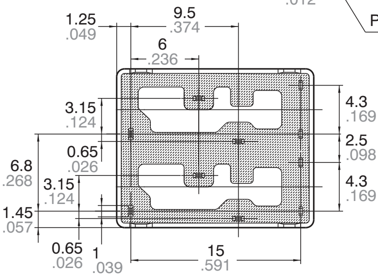
* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

2. Twin type (10 terminals)

CAD Data

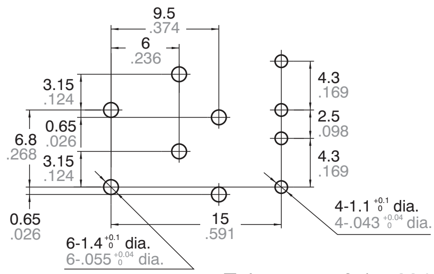






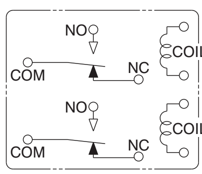
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

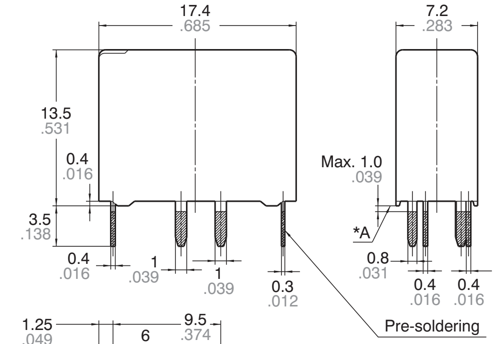


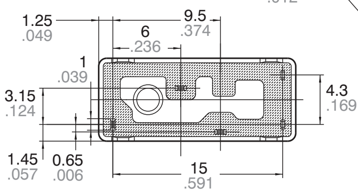
* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

3. Single type (1 Form C)

CAD Data

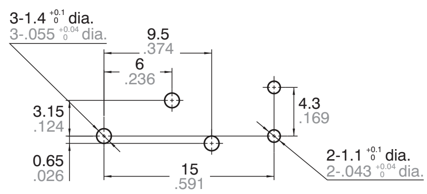
mm inch





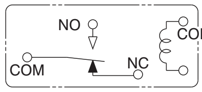
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1±.004

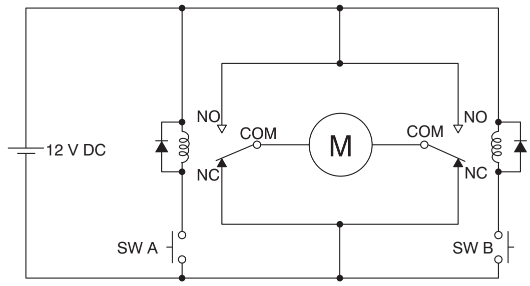
Schematic (Bottom view)



* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

EXAMPLE OF CIRCUIT

Forward/reverse control circuits of DC motor for power windows

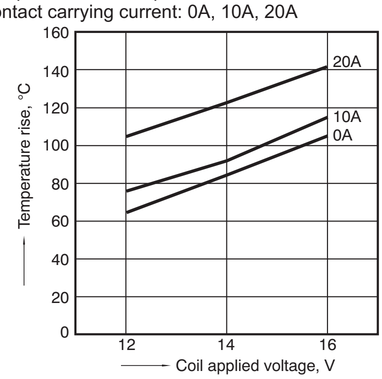


Ⓜ : Power window motor

REFERENCE DATA

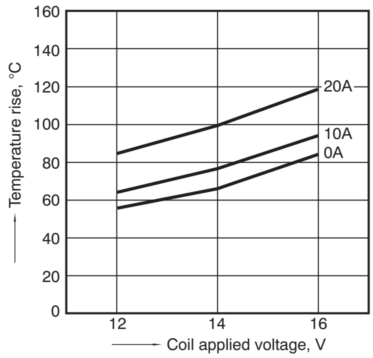
1-(1). Coil temperature rise (at room temperature)

Sample: ACTP212, 3pcs.
Contact carrying current: 0A, 10A, 20A

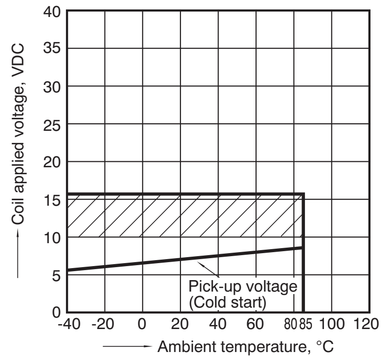


1-(2). Coil temperature rise (at 85°C 185°F)

Sample: ACTP212, 3pcs.
Contact carrying current: 0A, 10A, 20A

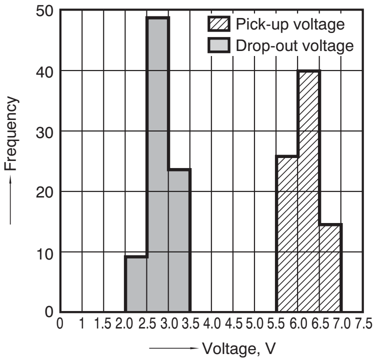


2. Ambient temperature and operating voltage range

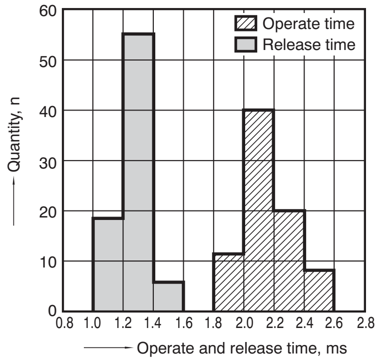


Automotive

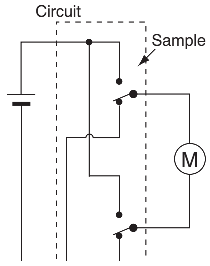
3. Distribution of pick-up and drop-out voltage
Sample: ACTP212, 40pcs.



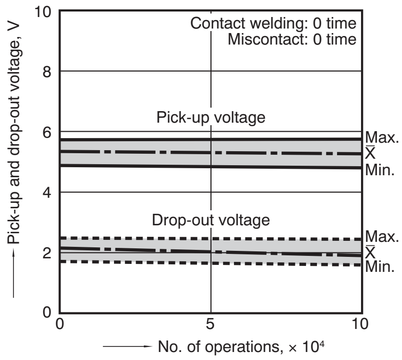
4. Distribution of operate and release time
Sample: ACTP212, 40pcs.
* Without diode



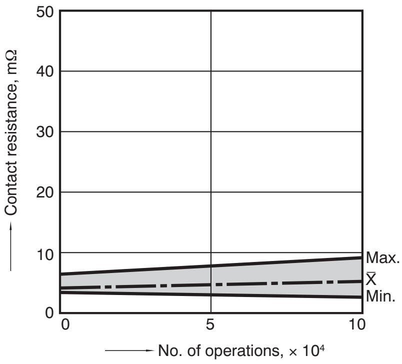
5. Electrical life test (Motor free)
Sample: ACTP212, 3pcs.
Load: 7A steady, Inrush 30A
Brake current: 15A 14V DC,
Power window motor actual load (free condition)
Operating frequency: (ON : OFF = 0.5s : 9.5s)
Ambient temperature: Room temperature
Circuit:



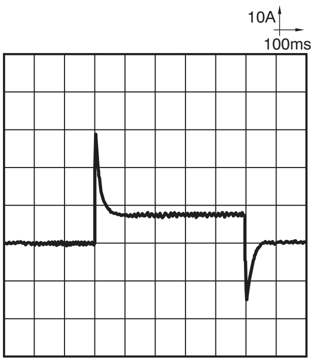
Change of pick-up and drop-out voltage



Change of contact resistance

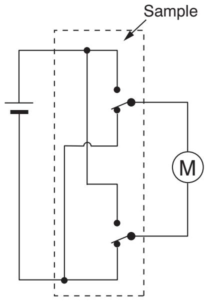


Load current waveform
Inrush current: 30A, Steady current: 7A
Brake current: 15A

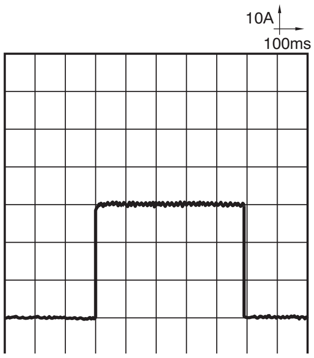


6. Electrical life test (Motor lock)
Sample: ACTP212, 3pcs.
Load: 30A 14V DC
Switching frequency: (ON : OFF = 0.5s : 9.5s)
Ambient temperature: Room temperature

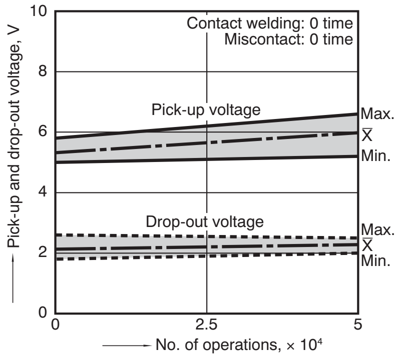
Circuit:



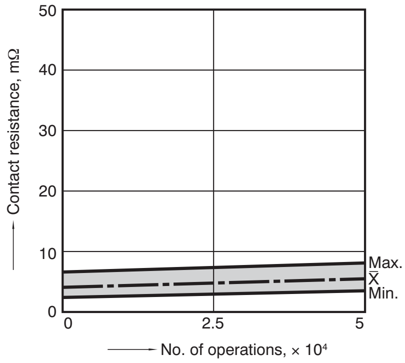
Load current waveform



Change of pick-up and drop-out voltage



Change of contact resistance



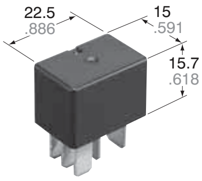
For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

AUTOMOTIVE LOW PROFILE MICRO-ISO/MICRO-280 RELAY

CV RELAYS (ACV)

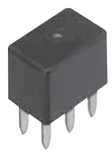
mm inch



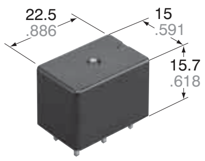
Micro ISO 1c type


Micro ISO 1a type

✂


Micro 280 plug-in type

✂



Micro 280 PCB type

✂ Products to be discontinued.

FEATURES

- **Low profile:**
  22.5 mm(L)×15 mm(W)×15.7 mm(H)
  .886 inch(L)×.591 inch(W)×.618 inch(H)
- **Low temperature rise**
  Terminal temperature has been reduced compared with using our conventional product
- **Low sound pressure level**
  Noise level has been reduced approx.10dB compared with using our conventional product.
- **Wide line-up**
  Micro ISO/Micro 280 terminal types and resistor and diode inside type, PCB terminal type (Micro 280 only).
- **Plastic sealed type**
  Plastically sealed for automatic cleaning.
- **Compact and high-capacity 20A load switching**
  N.O.: 20A 14V DC, N.C.: 10A 14V DC
  (Max. carrying current: at 85°C 185°F)

TYPICAL APPLICATIONS

- Headlights
- Magnetic clutches
- Radiator fans
- Blowers
- Fog lamps
- Tail lights
- Heaters
- Defoggers
- Horns
- Condenser fans, etc.

SPECIFICATIONS

Contact

Arrangement		1 Form A	1 Form C
Contact material		Ag alloy (Cadmium free)	
Initial contact resistance (Initial) (By voltage drop 6 V DC 1 A)		Typ. 3 mΩ	
Contact voltage drop		N.O.: Max. 0.2 V (at 20 A)	N.O.: Max. 0.2 V (at 20 A switching) N.C.: Max. 0.5 V (at 10 A switching)
Rating	Nominal switching capacity	N.O.: 20 A 14 V DC	N.O.: 20 A 14 V DC N.C.: 10 A 14 V DC
	Max. carrying current (Continuous, at 85°C 185°F)	N.O.: 20 A 12 V DC	N.O.: 20 A 12 V DC N.C.: 10 A 12 V DC
	Min. switching capacity#1	1 A 12 V DC	
Expected life (min. operation)	Mechanical (at 120 cpm)	Min. 10^6	
	Electrical (at rated load)	Min. 10^5*1	

Coil

Nominal operating power	0.8 W, 1.0 W (with resistor inside type)

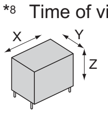
#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed (at nominal switching capacity)		15cpm
Initial insulation resistance*2		Min. 20MΩ (at 500 V DC)
Initial breakdown voltage*3	Between open contacts	500 Vrms for 1min.
	Between contacts and coil	500 Vrms for 1min.
Operate time*4 (at nominal voltage) (at 20°C 68°F)		Max. 10ms (initial)
Release time*4 (at nominal voltage) (at 20°C 68°F)		Max. 10ms (initial) Max. 15ms (initial) (with diode inside type)
Shock resistance	Functional*5	Min. 100 m/s²{10 G}
	Destructive*6	Min. 1,000 m/s²{100 G}
Vibration resistance	Functional*7	10 Hz to 100 Hz, Min.44.1 m/s² {4.5 G}
	Destructive*8	10 Hz to 500 Hz, Min.44.1 m/s² {4.5 G}
Conditions in case of operation, transport and storage*9 (Not freezing and condensing at low temperature)	Ambient temp	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 15.0g .53 oz

Remarks

*1 At nominal switching capacity, operating frequency: 2s ON, 2s OFF
*2 Measurement at same location as “Initial breakdown voltage” section.
*3 Detection current: 10mA
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 µs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 µs
*8 Time of vibration for each direction;
X, Y, Z direction: 4 hours



*9 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 18).
Please inquire if you will be using the relay in a high temperature atmosphere.

ORDERING INFORMATION

Ex. | A | CV | | | | 12

Product name	Contact arrangement	Mounting classification	Type classification	Coil voltage, V DC
CV	1: 1 Form C 3: 1 Form A	1: Micro ISO plug-in type 2: Micro 280 plug-in type 3: Micro 280 PC board type	0: Standard type 1: With diode inside 2: With resistor inside	12: 12

Note: Standard packing; Carton (Tube): 50 pcs.; Case: 200 pcs.

TYPES

Coil voltage (DC)	Contact arrangement	Mounting classification	Type classification	Part No.
12 V	1 Form A	Sealed type	Micro ISO plug-in type	ACV31012
			Micro 280 plug-in type	ACV32012
			Micro 280 PC board type	ACV33012
	1 Form C		Micro ISO plug-in type	ACV11012
			Micro 280 plug-in type	ACV12012
			Micro 280 PC board type	ACV13012

COIL DATA (at 20°C 68°F)

Nominal voltage, V DC	Pick-up voltage, * V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance, W	Nominal operating current, mA	Nominal operating power, W	Usable voltage range, V DC (at 85°C 185°F)
12	Max. 7.0	Min. 0.6	180±10% 142.3±10% (with resistor)	67±10% 84±10% (with resistor)	0.8 1.0 (with resistor)	10 to 16

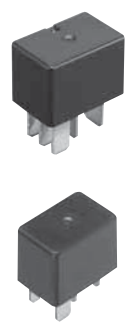
* Other pick-up voltage types are also available. Please contact us for details.

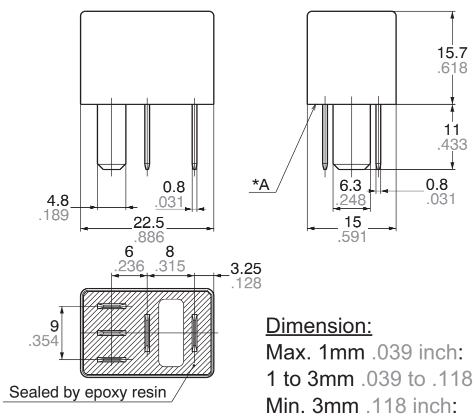
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. Micro ISO terminal type

CAD Data

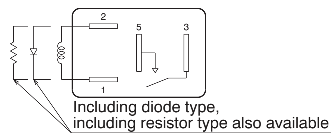




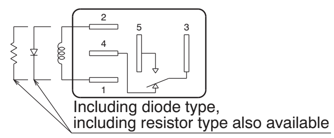
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

1 Form A



1 Form C



Automotive

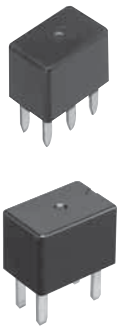
* Intervals between terminals is measured at A surface level.

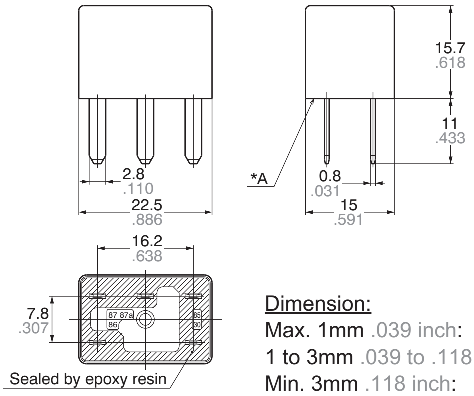
2. Micro 280 terminal type

mm inch

CAD Data

1). Plug-in type

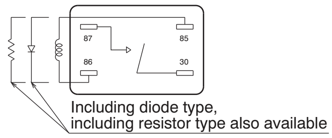




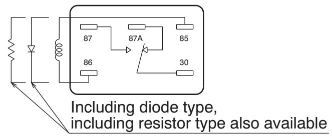
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

1 Form A

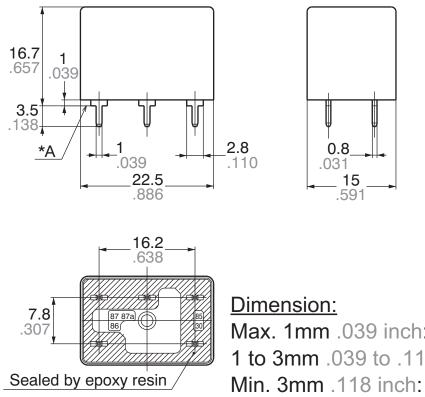


1 Form C



* Intervals between terminals is measured at A surface level.

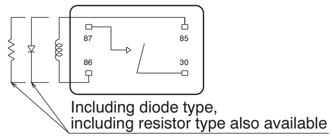
2). PC board type



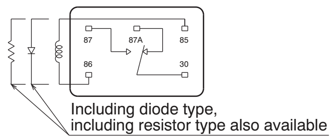
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

1 Form A



1 Form C

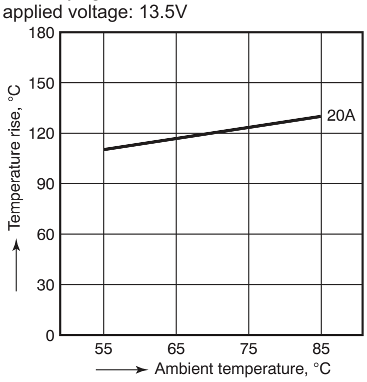


* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

REFERENCE DATA

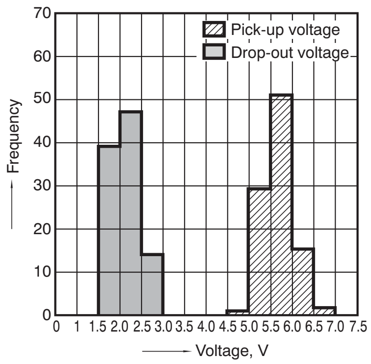
1. Coil temperature rise (20A)

Point measured: Inside the coil
Contact carrying current: 20A
Coli applied voltage: 13.5V



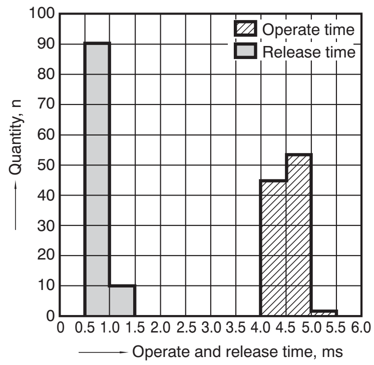
2. Distribution of pick-up and drop-out voltage

Sample: ACV11012, 100pcs



3. Distribution of operate and release time

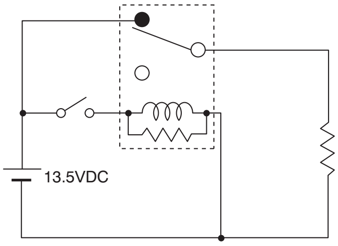
Sample: ACV11012, 100pcs.



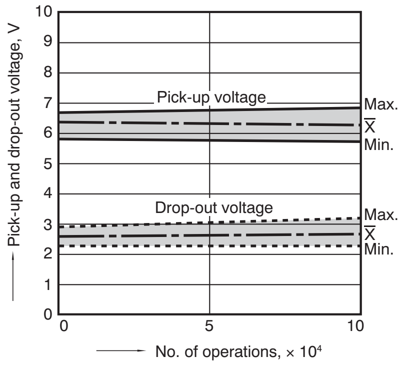
4-(1). Electrical life test (Resistive load)

Sample: ACV12212, 3pcs.
Load: Resistive load (NC switching) 11A
Switching frequency: (ON : OFF = 1s : 1s)
Ambient temperature: Room temperature

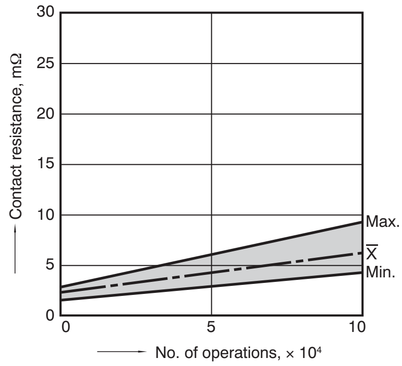
Circuit



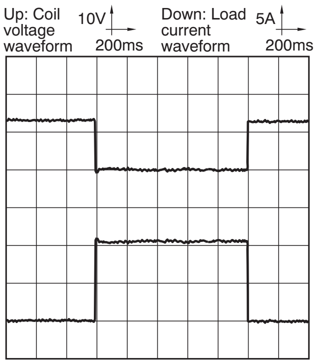
Change of pick-up and drop-out voltage



Change of contact resistance



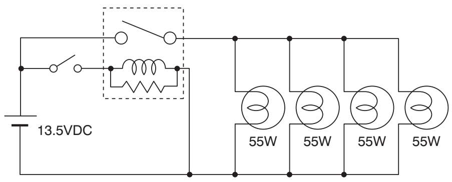
Load current waveform



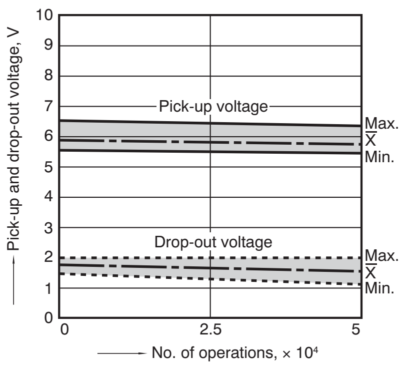
4-(2). Electrical life test (Lamp load)

Sample: ACV12212, 3pcs.
Load: 55Wx4, inrush: 90A/steady: 20A, lamp actual load
Switching frequency: (ON : OFF = 1s : 14s)
Ambient temperature: Room temperature

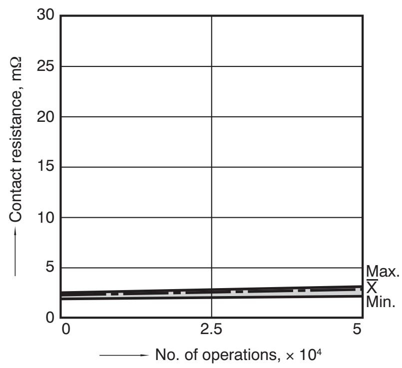
Circuit



Change of pick-up and drop-out voltage

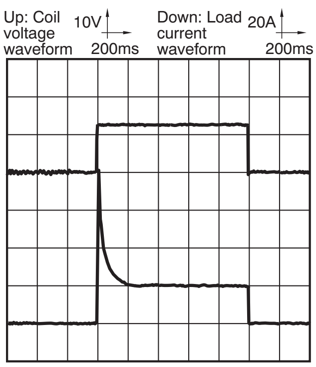


Change of contact resistance



Load current waveform

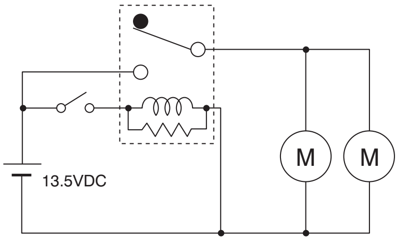
Inrush current: 90A, steady current: 20A



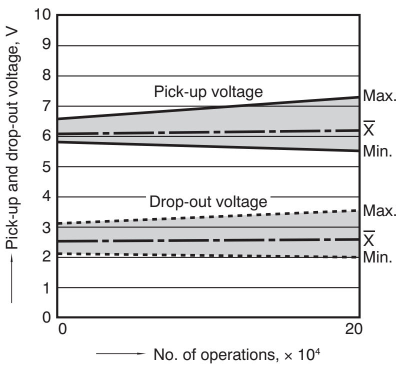
Automotive

4-(3). Electrical life test (Motor load)
Sample: ACV12212, 3pcs.
Load: inrush: 80A/steady: 18A,
radiator fan actual load (motor free)
Switching frequency: (ON : OFF = 2s : 6s)
Ambient temperature: Room temperature

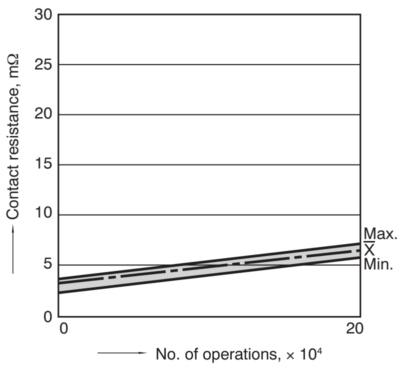
Circuit



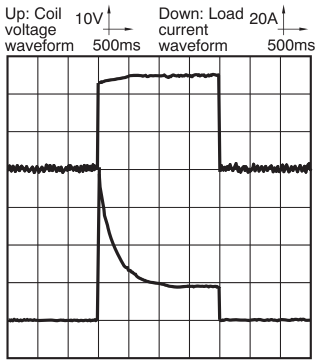
Change of pick-up and drop-out voltage



Change of contact resistance



Load current waveform
Inrush current: 80A, steady current: 18A



Cautions regarding the protection element

1. Part numbers without protection elements
• 12 V models
When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 24 V or higher, or a resistor (680Ω to 1,000Ω). When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2. Part numbers with diodes
These relays use a diode in the coil surge protection element. Therefore, the release time is slower and the working life might be shorter compared to part numbers without protection elements and part numbers with resistors.
Be sure to use only after evaluating under actual load conditions.

3. Part numbers with resistors
This part number employs a resistor in the coil surge protection circuit; therefore, an external surge protection element is not required. In particular, when a diode is connected in parallel with a coil, the revert time becomes slower which could adversely affect working life. Please check the circuit and make sure that a diode is not connected in parallel with the coil drive circuit.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
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AUTOMOTIVE RELAY FOR FAILSAFE CIRCUITS IN HIGH OUTPUT MOTORS (EPS)

CW RELAYS (ACW)

FEATURES

- **Ideal relay for high output 3-phase motors (EPS)**
  2-path cut-off (2 Form A) using single coil for 3-phase motors
- **High cut-off current capability**
  High cut-off current performance (12V) using 2-point cut-off configuration
- **High carrying current performance**
  High capacity achieved through use of high conductivity material
- **Highly heat resistance properties**
  High heat resistance (at 125°C 257°F) through use of high heat resistance plastic

TYPICAL APPLICATIONS

- **To 3-phase motor EPS unit (for failsafe circuit)**

ORDERING INFORMATION

ACW [2] [ ]

Contact arrangement
2: 2 Form A

Coil voltage (DC)
12: 12 V

TYPES

Contact arrangement	Coil voltage	Part No.
2 Form A	12 V DC	ACW212

Standard packing; Carton: 40 pcs.; Case: 160 pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 6.2 V DC (Initial)	Min. 0.5 V DC (Initial)	117 mA	103Ω	1.4 W	10 to 16V DC

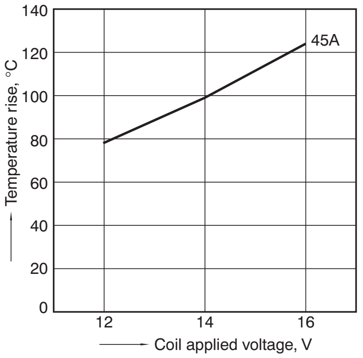
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		2 Form A
	Contact resistance (Initial)		Max. 50 mΩ (By voltage drop 6V DC 1A)
	Contact material		Ag alloy (Cadmium free)
Rating	Max. carrying current (14V DC)		120 A for 5 seconds (at 20°C 68°F) 70 A for 1 minute (at 85°C 185°F) 45 A for continuous (at 85°C 185°F)
	Nominal operating power		1.4 W
	Min. switching capacity (resistive load)		1 A 14V DC (at 20°C 68°F)
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 20ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 20ms (at 20°C 68°F) (Initial) (without protective element)
Mechanical characteristics	Shock resistance	Functional	Min. 200 m/s² {approx. 20G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs) (12 V DC applied to the coil, at 20°C 68°F)
		Destructive	Min. 1,000 m/s² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 500 Hz, Min. 44.1 m/s² {approx. 4.5G} (Detection time: 10μs) (12 V DC applied to the coil, at 20°C 68°F)
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {approx. 4.5G}, Time of vibration for each direction; X, Y, Z direction: 4 hours
Expected life	Mechanical		Min. 2 × 10^5 (at 60 cpm)
	Electrical (at cut off only)		200 A 14V DC (resistive load), Min. 3 times (without diode)
Conditions	Conditions for operation, transport and storage*		Ambient temperature: –40°C to +125°C –40°F to +257°F, Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
Mass			Approx. 26 g .92 oz

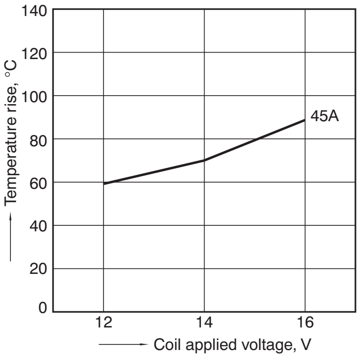
Note:
* The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

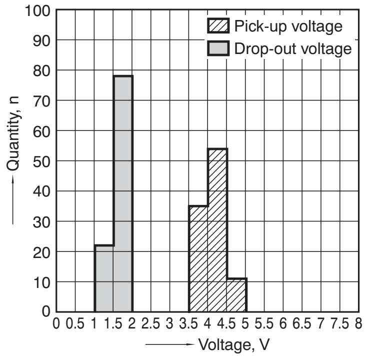
1.-(1) Coil temperature rise (25°C 77°F)
Sample: ACW212, 3pcs
Point measured: Inside the coil
Contact carrying current: 45A
Ambient temperature: 25°C 77°F



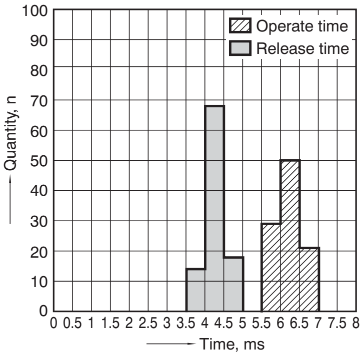
1.-(1) Coil temperature rise (85°C 185°F)
Sample: ACW212, 3pcs
Point measured: Inside the coil
Contact carrying current: 45A
Ambient temperature: 85°C 185°F



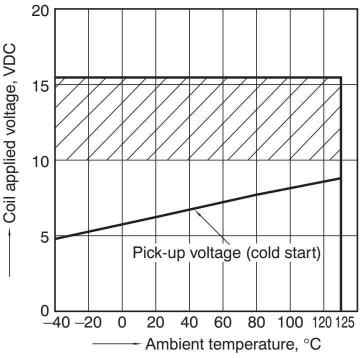
2. Distribution of pick-up and drop-out voltage
Sample: ACW212, 100pcs



3. Distribution of operate and release time
Sample: ACW212, 100pcs.



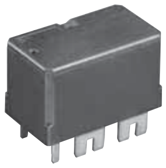
4. Ambient temperature and operating voltage range



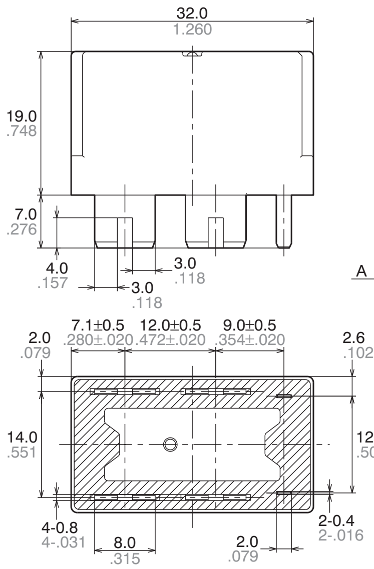
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

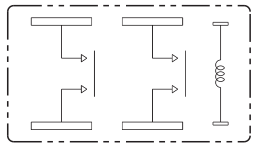
CAD Data



External dimensions



Schematic (Bottom view)



Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

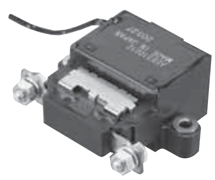
* Intervals between terminals is measured at A surface level.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

COMPACT BUT CUT OFF DC POWER CURRENT, POWER CAPSULE CONTACT RELAY

EB RELAYS (AEB)



(100A type)

FEATURES

• Compact and high capacity using double contacts in series and permanent magnet installed.
(1,000A/3 times) cut-off possible
(EB Relay 100A type)
• Compact and lightweight for space savings and improved gas mileage.

TYPICAL APPLICATIONS

Equipment requiring high capacity cutoff such as main power supplies for 42 V vehicles, motor assisters, quick recharging power supplies for AGVs (automatic guided vehicle), and motor controls for forklifts, etc.

ORDERING INFORMATION

AEB [3] [1] [0] [0] [ ]

Contact arrangement
3: 1 Form A

Contact rating / Relay shape
1: 100 A / Flat

Heat resistance grade / protective element
0: Standard / no protective element

Terminal shape
0: Screw terminal

Coil voltage (DC)
12: 12 V
24: 24 V
36: 36 V

TYPES

Contact arrangement	Coil voltage	Protective costruction	Terminal shape	Part No.
1 Form A	12 V DC	Dust cover	Screw terminal	AEB310012
	24 V DC			AEB310024
	36 V DC			AEB310036

RATING

1. Coil data

Type	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
100 A	12V DC	Max. 9.0 V DC	Min. 1.0 V DC	410 mA	29.0Ω	5.0 W	10 to 16V DC
	24V DC	Max. 18.0 V DC	Min. 2.0 V DC	208 mA	115Ω	5.0 W	20 to 32V DC
	36V DC	Max. 27.0 V DC	Min. 3.0 V DC	139 mA	260Ω	5.0 W	30 to 48V DC

2. Specifications

Characteristics	Item		Specifications
			100 A type
Contact rating	Arrangement		1 Form A
	Between terminal voltage drop (Initial)		Max. 0.15 V (at 100 A), Max. 0.05 V (at 10 A), Max. 0.01 V (at 1 A)
	Contact material		Ag alloy (Cadmium free)
	Nominal switching capacity (resistive load)		100 A 42V DC
	Max. carrying current		1,000A (0.1s)
	Min. switching capacity (resistive load)*1		1 A 12V DC
	Max. cut-off current		1,000A 42V DC/3 cycle*3
	Overload opening/closing rating		400A 55V DC/10 cycle
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC)
	Breakdown voltage (Initial)	Between open contacts	1,500 Vrms for 1 min.
		Between contacts and coil	2,500 Vrms for 1 min.
	Operate time (at nominal voltage)		Max. 30ms (at nominal coil voltage, excluding contact bounce time, at 20°C 68°F)
	Release time (at nominal voltage)		Max. 15ms (at nominal coil voltage, at 20°C 68°F)
Mechanical characteristics	Shock resistance	Functional	Min. 196 m/s² {20.0G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs) (Nominal coil voltage applied to the coil)
		Destructive	Min. 980 m/s² {100G} (Half-wave pulse of sine wave: 6ms) (Nominal coil voltage applied to the coil or deenergized)
	Vibration resistance	Functional	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G} (Nominal coil voltage applied to the coil)
		Destructive	10 Hz to 200 Hz, Min. 44.1 m/s² {4.5G}, (Nominal coil voltage applied to the coil or deenergized)
Expected life	Mechanical		Min. 10^6
	Electrical		Min. 10^4 (at 100 A 42V DC) (resistive load, operating frequency: 1s ON, 9s OFF, room temperature)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +85°C –40°F to +185°F
Mass			Approx. 300 g 10.58 oz

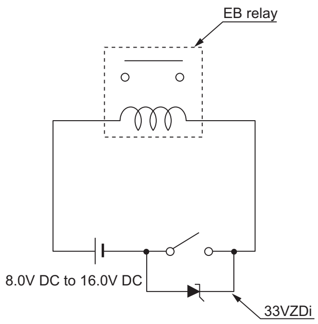
Notes:*
1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2.The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).
*3.Condition: Nominal switching 100cycles, each cut off 1,000A
* When using a surge absorbing element for the relay coil drive circuit, please use with a surge absorbing element with a clamp voltage of "Rating voltage x1.5: 18V/36V/54V" or more. When the coil is connected in parallel with a diode, resistor or capacitor, the revert time will delay which might lead to degradation in shutoff performance and electrical working life.
Contact terminals have polarity; therefore, please obey the wiring diagram when connecting contacts.
The electrical load performance value applies when a varistor is connected in parallel with the coil.

Automotive

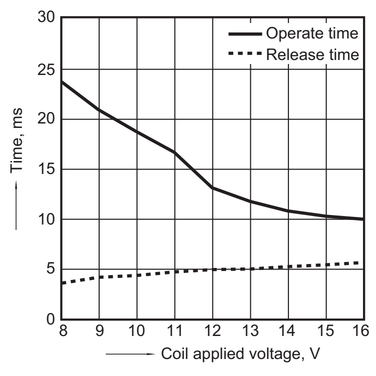
REFERENCE DATA

1. Operate and release time characteristics

Sample: AEB310012
*nominal coil voltage 12V type, 1pcs
Load: Coil applied voltage; 8.0 to 16.0V DC, coil surge protection elements; with zener diode (33V)
Ambient temperature: 25°C 77°F
Circuit:



Coil applied voltage vs operate and release time

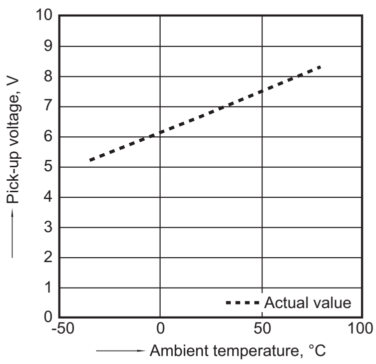


2. Ambient temperature characteristics (Cold start)

Sample: AEB310012
*nominal coil voltage 12V type
5pcs

Ambient temperature (°C)	–35	20	80
Standard value (V)	—	9.0	—
Actual value (V)	5.4	6.7	8.3

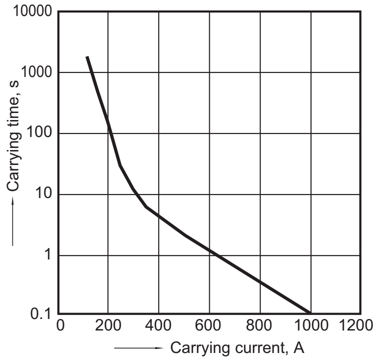
Ambient temperature vs pick-up voltage (Cold start)



3. Carrying current limit (error assumed)

Sample: AEB310012
*nominal coil voltage 12V type
1pcs
Connection electric wire: 40mm²
Ambient temperature: 85°C 185°F
Standard for judgment: Relay contacts off when carrying finished.

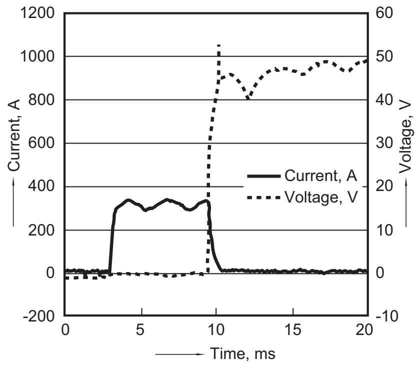
Carrying current and carrying time



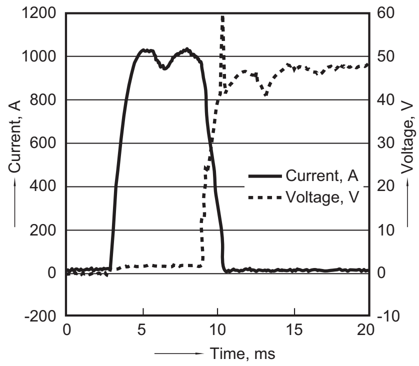
4. Cut-off characteristics

Sample: AEB310012
*nominal coil voltage 12V type
2pcs
Load: Coil applied voltage; 14V DC
Ambient temperature: Room temperature
Max. cut-off current:
(1) 300A (42V DC: resistive load)
(2) 1,000A (42V DC: resistive load)
Operating cycle:
(1) 300A/10 cycles
(2) 1.000A/3 cycles

(1) Cut off current/voltage: 300A/42V DC (resistive load)



(2) Cut-off current/voltage: 1,000A/42V DC (resistive load)

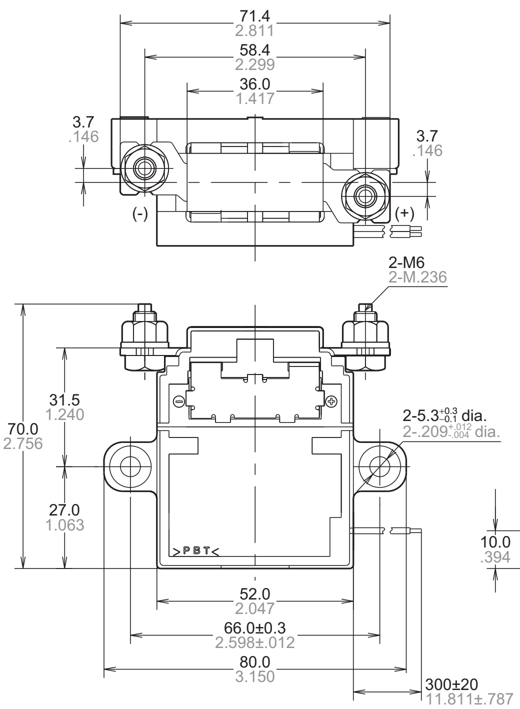


DIMENSIONS (mm inch)

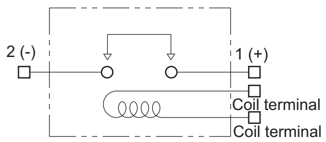
CAD Data

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

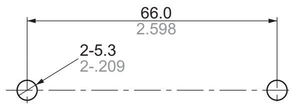
External dimensions



Schematic (TOP VIEW)



Mounting hole pattern (TOP VIEW)



Tolerance: ±0.1 ±.004

General tolerance;
less than 10 .394: ±0.3 ±.012
10 to 50 .394 to 1.969: ±0.6 ±.024
more than 50 1.969: ±1.0 ±.039

Notes: 1. Please be warned that contact terminals have polarity. There is no polarity in the coil input line.
2. We will make separate consideration if a coil lead wire connector is desired.
3. M6 tighten torque: 6.0 N·m to 8.0 N·m

NOTES

1. For general cautions for use, please refer to the "CAUTIONS FOR USE OF AUTOMOTIVE RELAYS".

2. To ensure proper operation, the voltage applied to the coil should be the rated operating voltage of the coil. Also, be aware that the pick-up and drop-out voltages will fluctuate depending on the ambient temperature and operating conditions.

3. Heat, smoke, and even a fire may occur if the relay is used in conditions outside of the allowable ranges for the coil ratings, contact ratings, operating cycle lifetime, and other specifications. Therefore, do not use the relay if these ratings are exceeded.

4. If the relay has been dropped, the appearance and characteristics should always be checked before use.

5. When using this relay for AC load switching, caution is required. Please contact us.

6. Make sure that the relay is wired correctly. Incorrect wiring may cause unexpected events or the generation of heat or flames.

7. We recommend you use a surge absorbing element with a clamp voltage of "Rating voltate x1.5: 18V/36V/54V" or more for the relay coil drive circuit as a means for relay coil surge absorption. Please avoid the use of diodes, capacitors and resistors because they lead to degradation in cut-off performance.

8. Avoid mounting the relay in strong magnetic fields (near a transformer or magnet) or close to an object that radiates heat.

9. Electrical life
This relay is a high-voltage direct-current switch. In its final breakdown mode, it may lose the ability to provide the proper cut-off. Therefore, do not exceed the indicated switching capacity and life. (Please treat the relay as a product with limited life and replace it when necessary.)
In the event that the relay loses cut-off ability, there is a possibility that burning may spread to surrounding parts, so configure the layout so that the power is turned off within one second.

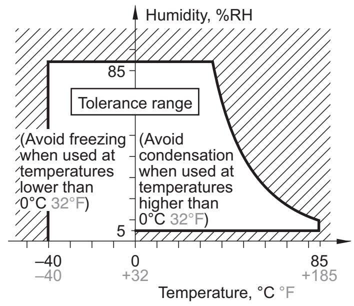
10. If the power is turned off and then immediately on after applying the rated voltage (current) continuously to the relay's coil and contact, the resistance of the coil will increase due to a rise in the coil temperature. This causes the pick-up voltage to rise, and possibly exceed the rated pick-up voltage. In these circumstances, take measures such as reducing the load current, limiting the duration of current flow, and applying a coil voltage higher than the rated operating voltage (quick start).

11. If you are using an inductive load (L load) such that L/R > 1 ms, add surge protection in parallel with the inductive load. If this is not done, the electrical life will decrease and cut-off failure may occur.

12. Be careful that foreign matter and oils and fats kind doesn't stick to the main terminal part because it is likely to cause a terminal part to give off unusual heat.

13. Avoid excessive load applied to the terminal in case of installing such as a bus bar etc., because it might give bad influence to the opening and closing performance.
Tighten each of the screws within the rated ranges given below.
Main terminal (M6 screw):
6.0N·m to 8.0N·m
Main unit mounting (M5 screw):
2.5N·m to 3.6N·m

14. Usage, transport and storage conditions
Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
1) Temperature: –40 to +85°C –40 to +185°F
2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
3) Atmospheric pressure: 85 to 106 kPa
Temperature and humidity range for usage, transport, and storage:



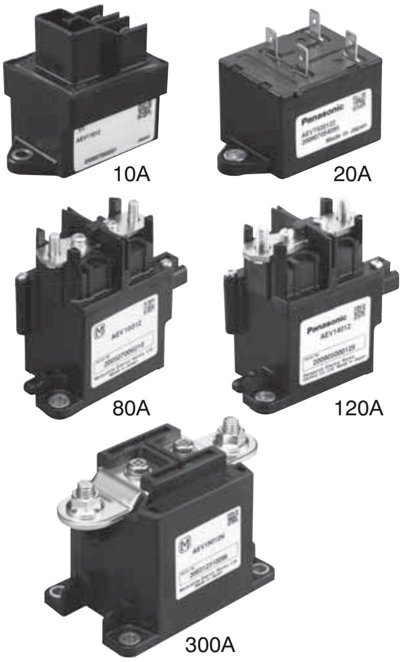
4) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
5) Freezing
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
6) Low temperature, low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

Automotive

For Cautions for Use, see Relay Technical Information (page 582).

EV RELAYS (AEV)

Capsule contact Mechanism and High-capacity Cut-off Compact Relay



FEATURES

1. Compact and lightweight
Charged with hydrogen gas for high arc cooling capacity, short gap cutoff has been achieved at high DC voltages.

2. Safety
High safety achieved with construction that prevents explosions by keeping the arc from leaking.

3. High contact reliability
Since the contact portion is sealed in hydrogen gas, there is no contact oxidation. The relay is also dustproof.

TYPICAL APPLICATIONS

High DC voltage applications such as
- **Electric vehicle**
- **Hybrid vehicle**
- **Fuel-cell vehicle**
- **Battery charge and discharge systems**
- **Construction equipment**

ORDERING INFORMATION

AEV ☐ ☐ **0** ☐ ☐

EV relays

Contact arrangement
1: 1 Form A (Screw terminal or TM with terminal protection cover)
5: 1 Form A (TM type)

Contact rating
1: 10 A
2: 20 A
8: 80 A
9: 300 A
4: 120 A

Coil voltage
12: 12V DC
24: 24V DC

Coil terminal structure
Nil: Plug-in (Faston) (for 20 A type), Connector (for 80 A, 120 A and 300 A)
2: Plug-in (Faston) (for 10 A type with terminal protection cover)

TYPES

Type	Nominal coil voltage	Contact arrangement	Part number
10 A	12 V DC	1 Form A	AEV110122
20 A			AEV52012
80 A			AEV18012
120 A			AEV14012
300 A			AEV19012
10 A	24 V DC	1 Form A	AEV110242
80 A			AEV18024
120 A			AEV14024
300 A			AEV19024

Packing quantity:
Inner 25pcs. Outer 100pcs (for 10 A type)
Inner 25pcs. Outer 50pcs (for 20 A type)
Inner 1pc. Outer 20pcs (for 80 A type)
Inner 1pc. Outer 20pcs (for 120 A type)
Inner 1pc. Outer 5pcs (for 300 A type)

RATING

1. Coil data

Type	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Max. allowable voltage
10 A	12 V DC	Max. 9 V DC	Min. 1 V DC	0.103 A	1.24 W	16 V DC
20 A		Max. 9 V DC	Min. 0.5 V DC	0.327 A	3.9 W	
80 A		Max. 9 V DC	Min. 1 V DC	0.353 A	4.2 W	
120 A		Max. 9 V DC	Min. 1 V DC	0.353 A	4.2 W	
300 A		Max. 9 V DC	Min. 2 V DC	3.2 A (Inrush)	37.9 W (Inrush, approx. 0.1 sec.) 3.6 W (Stable)	
10 A	24 V DC	Max. 18 V DC	Min. 2 V DC	0.052 A	1.24 W	32 V DC
80 A		Max. 18 V DC	Min. 2 V DC	0.176 A	4.2 W	
120 A		Max. 18 V DC	Min. 2 V DC	0.176 A	4.2 W	
300 A		Max. 18 V DC	Min. 4 V DC	1.85 A (Inrush)	44.4 W (Inrush, approx. 0.1 sec.) 3.8 W (Stable)	

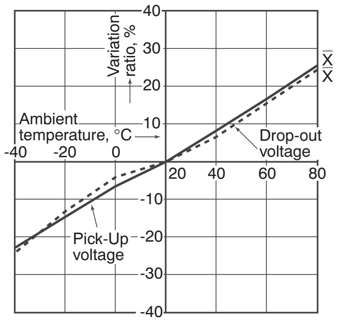
2. Specifications

Characteristics	Item		Specifications				
			10A type	20A type	80A type	120 A type	300 A type
Contact rating	Contact arrangement		1 Form A				
	Nominal switching capacity (resistive load)		10A 400V DC	20A 400V DC	80A 400V DC	120A 400V DC (Carry current)	300A 400V DC
	Short term current		15A 2min, 30A 30sec (2mm^2)	40A 10min, 60A 1min (3mm^2)	120A 15min, 180A 2min (15mm^2)	225A 3min, 400A 30sec. (38mm^2)	400A 10 min, 600A 1 min. (100mm^2)
	Min. switching capacity (resistive load)*1		1A 12V DC	1A 12V DC	1A 12V DC	1A 12V DC	1A 24V DC
	Max. cut-off current*5		—	—	800A 300V DC (Min. 1 cycles)*2	1,200A 300V DC (Min. 1 cycle)*2	2,500A 300V DC (Min. 3 cycles)*3
	Overload opening/closing rating*5		30A 400V DC (Min. 50 cycles)*2	60A 400V DC (Min. 50 cycles)*2	120A 400V DC (Min. 50 cycles)*2	800A 300V DC (Min. 5 cycles)*2 120A 400V DC (Min. 50 cycles)*2	600A 400V DC (Min. 300 cycles)
	Reverse direction cut-off*5		—	—	–120A 200V DC (Min. 50 cycle)*2	–120A 200V DC (Min. 50 cycle)*2	–300A 200V DC (Min. 100 cycles)
	Contact voltage drop (Initial)		Max. 0.5V (By voltage drop 6 V DC 10A)	Max. 0.2V (By voltage drop 6 V DC 20A)	Max. 0.067 V (By voltage drop 6 V DC 20A)	Max. 0.03V (By voltage drop 6 V DC 20A)	Max. 0.06V (300 A Carry current)
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500 V DC, Measurement at same location as "Initial breakdown voltage" section.)				
	Breakdown voltage (Initial)	Between open contacts	2,500Vrms/min. (Detection current: 10mA)				
		Between contact and coil	2,500Vrms/min. (Detection current: 10mA)				
	Operate time (at 20°C 68°F)		Max. 50ms (Nominal coil voltage applied to the coil, excluding contact bounce time.)				Max. 30ms (Nominal coil voltage applied to the coil, excluding contact bounce time.)
	Release time (at 20°C 68°F)		Max. 30ms (Nominal coil voltage applied to the coil, without diode.)				Max. 10ms (Nominal coil voltage applied to the coil, without diode.)
Mechanical characteristics	Shock resistance	Functional	Min. 196m/s^2 {20 G} (Half-wave pulse of sine wave: 11ms; detection time: 10µs)	For ON: Min. 196m/s^2 {20 G} (Half-wave pulse of sine wave: 11ms; detection time: 10µs) For OFF: Min. 98m/s^2 {10 G} (Half-wave pulse of sine wave: 11ms; detection time: 10µs)			
		Destructive	Min. 490 m/s^2 {50 G} (Half-wave pulse of sine wave: 6ms)				
	Vibration resistance	Functional	10 to 200 Hz, Min.43 m/s^2 {4.4 G} (Detection time: 10µs)				10 to 200 Hz, Min.44 m/s^2 {4.5 G} (Detection time: 10µs)
		Destructive	10 to 200 Hz, Min.43 m/s^2 {4.4 G} (Time of vibration for each direction; X, Y, Z direction: 4 hours)				10 to 200 Hz, Min.44 m/s^2 {4.5 G} (Time of vibration for each direction; X, Y, Z direction: 4 hours)
Expected life	Mechanical		Min. 10^5	Min. 2×10^5			
	Electrical (resistive load)		10A 400V DC Min. 75,000*2	20A 400V DC Min. 3,000*2	80A 400V DC Min. 1,000*2	30A 400V DC Min. 3,000*2	300A 400V DC Min. 1,000
Conditions*6	Conditions for operation, transport and storage		Ambient temperature: –40 to +80°C –40 to +176°F (Storage: Max. 85°C 185°F), Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)				Ambient temperature: –40 to +85°C –40 to +185°F (Storage: Max.85°C 185°F), Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
Unit weight (Approx.)			90 g 3.17 oz	180 g 6.35 oz	400 g 14.11 oz	400 g 14.11 oz	750 g 26.46 oz

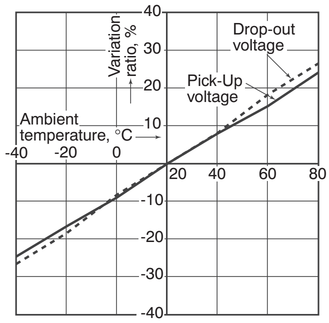
Notes:
*1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2. The electrical load performance value for the 10A, 20A, 80A and 120 A types applies when a varistor is connected in parallel to the coil. Please be warned that working life will be reduced when a diode is used.
*3. Condition: Nominal switching 10 cycles, each cut-off 2,500 A
*4. The coil voltage 12 V DC type and 24 V DC type have the same specifications.
*5. at L/R ≤ 1ms
*6. Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

REFERENCE DATA

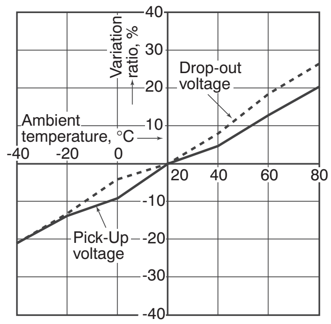
1.-(1) Ambient temperature characteristics (10 A type)
Sample: EV relay 10 A, 3 pcs.



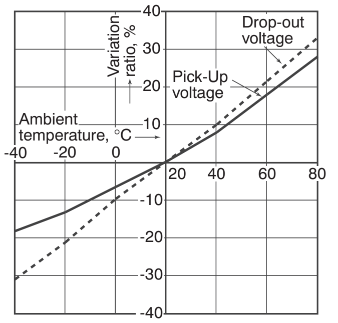
1.-(2) Ambient temperature characteristics (20 A type)
Sample: EV relay 20 A, 3 pcs.



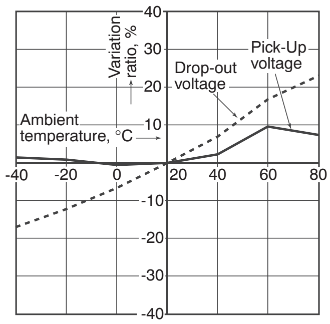
1.-(3) Ambient temperature characteristics (80 A type)
Sample: EV relay 80 A, 3 pcs.



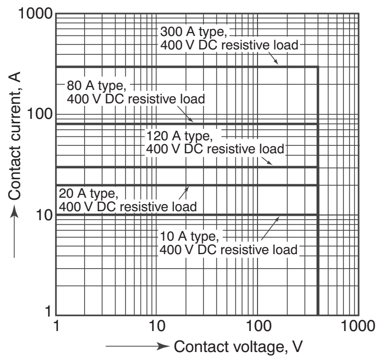
1.-(4) Ambient temperature characteristics (120 A type)
Sample: EV relay 120 A, 3 pcs.



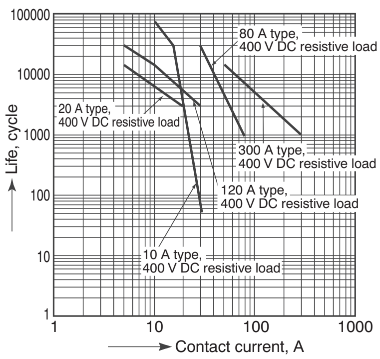
1.-(5) Ambient temperature characteristics (300 A type)
Sample: EV relay 300 A, 3 pcs.



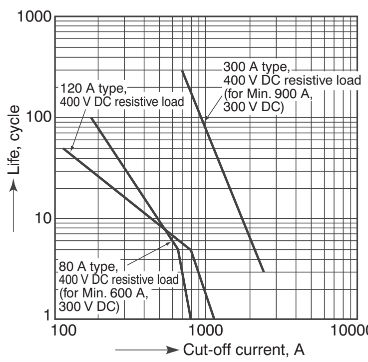
2. Max. value for switching capacity



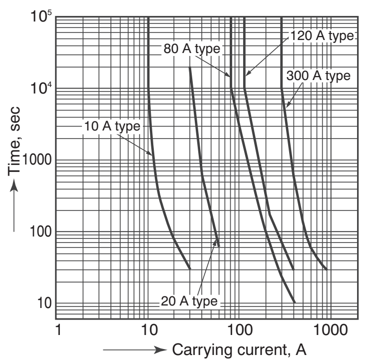
3. Switching life curve



4. Cut-off life curve



5. Carrying performance curve (80°C 176°F)
*For 300 A, at 85°C 185°F

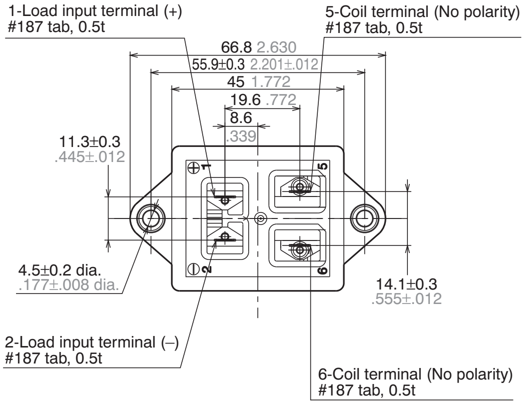


DIMENSIONS (mm inch)

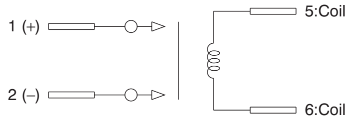
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

1. 10 A type

CAD Data

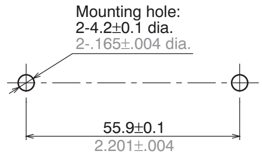


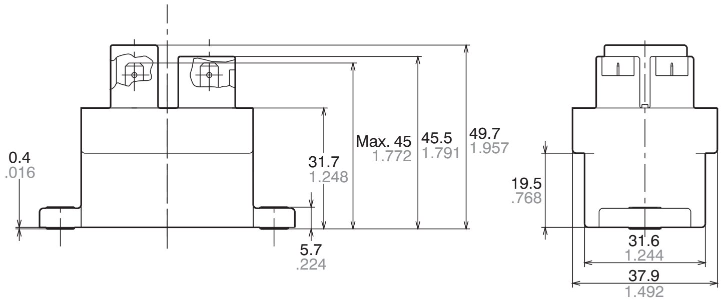
Schematic (TOP VIEW)



Load side has polarities (+) and (–)

Mounting dimensions



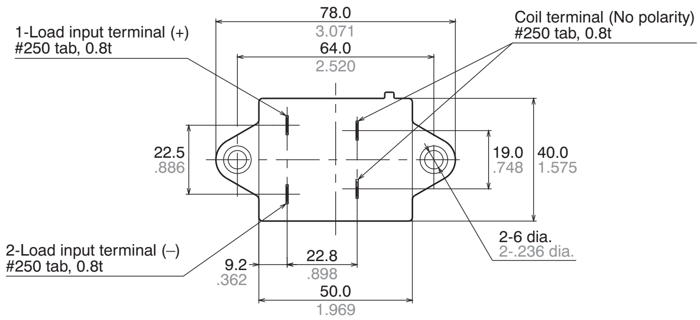


General tolerance;

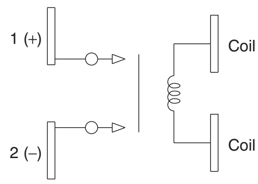
less than 10 .394:	±0.3 ±.012
10 to 50 .394 to 1.969:	±0.6 ±.024
more than 50 1.969:	±1.0 ±.039

2. 20 A type

CAD Data

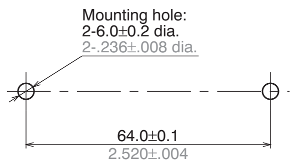


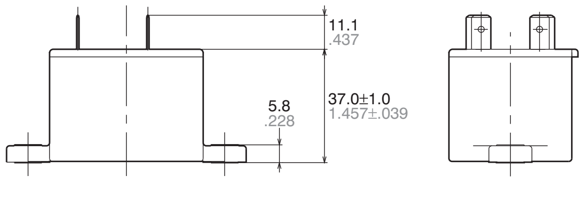
Schematic (TOP VIEW)



Load side has polarities (+) and (–)

Mounting dimensions



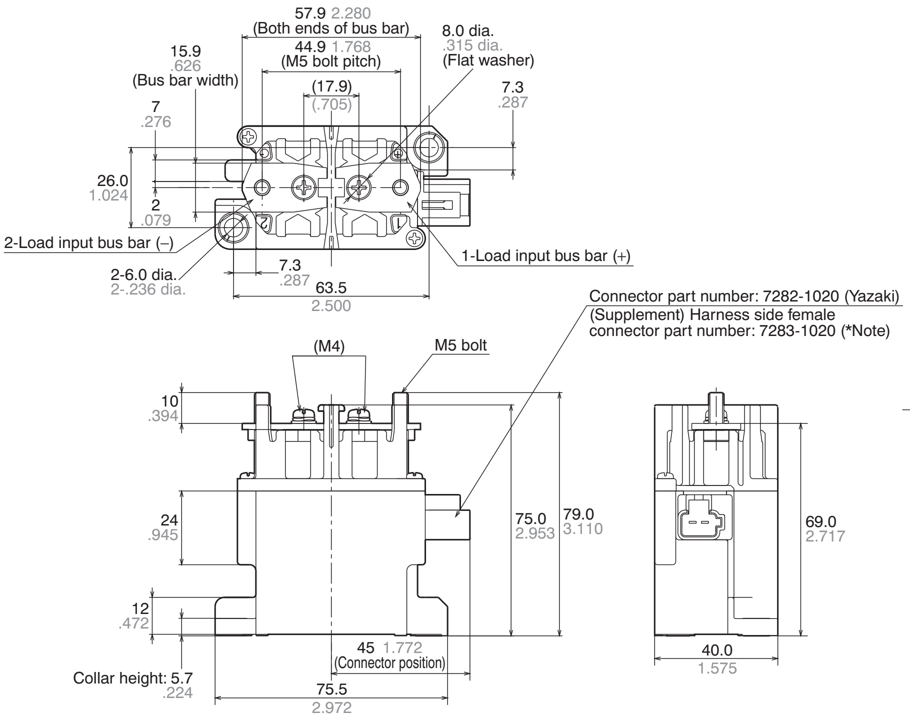


General tolerance;

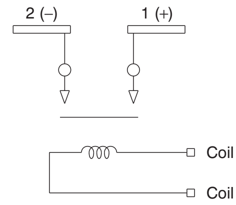
less than 10 .394:	±0.3 ±.012
10 to 50 .394 to 1.969:	±0.6 ±.024
more than 50 1.969:	±1.0 ±.039

3. 80 A type

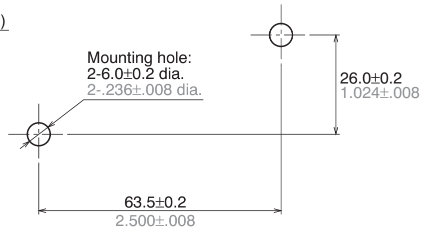
CAD Data



Schematic (TOP VIEW)



Mounting dimensions



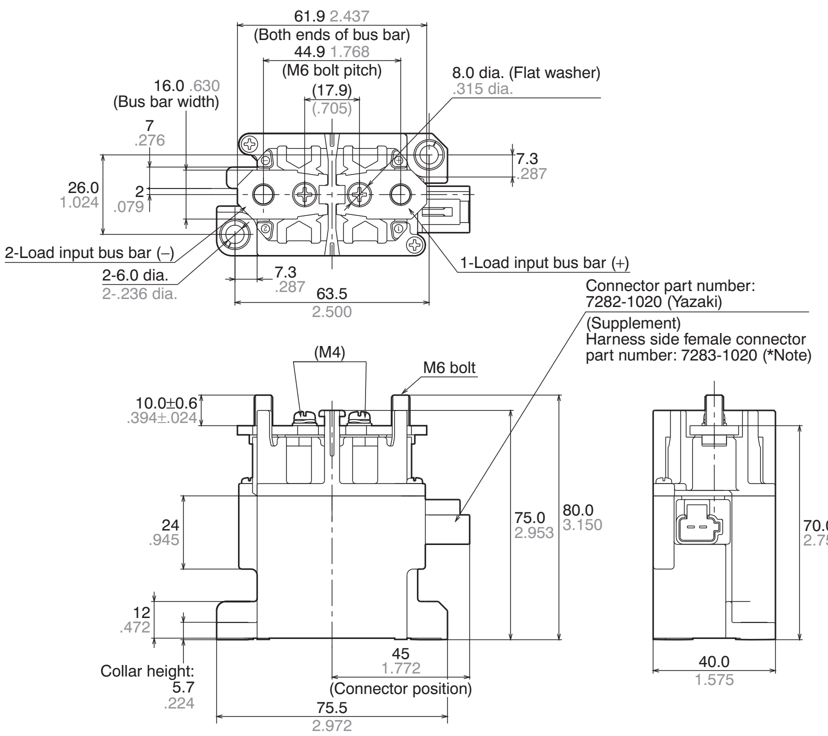
General tolerance:

less than 10 .394:	±0.3 ±.012
10 to 50 .394 to 1.969:	±0.6 ±.024
more than 50 1.969:	±1.0 ±.039

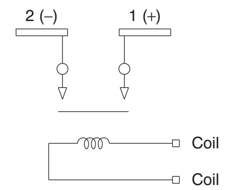
*Note: Separate connection of the terminal and lead wire is required.

4. 120 A type

CAD Data

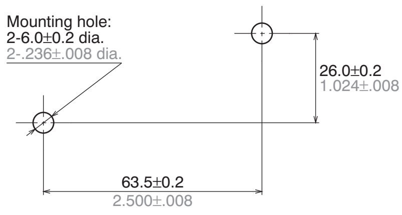


Schematic (TOP VIEW)



Load side has polarities (+) and (–)

Mounting dimensions



General tolerance:

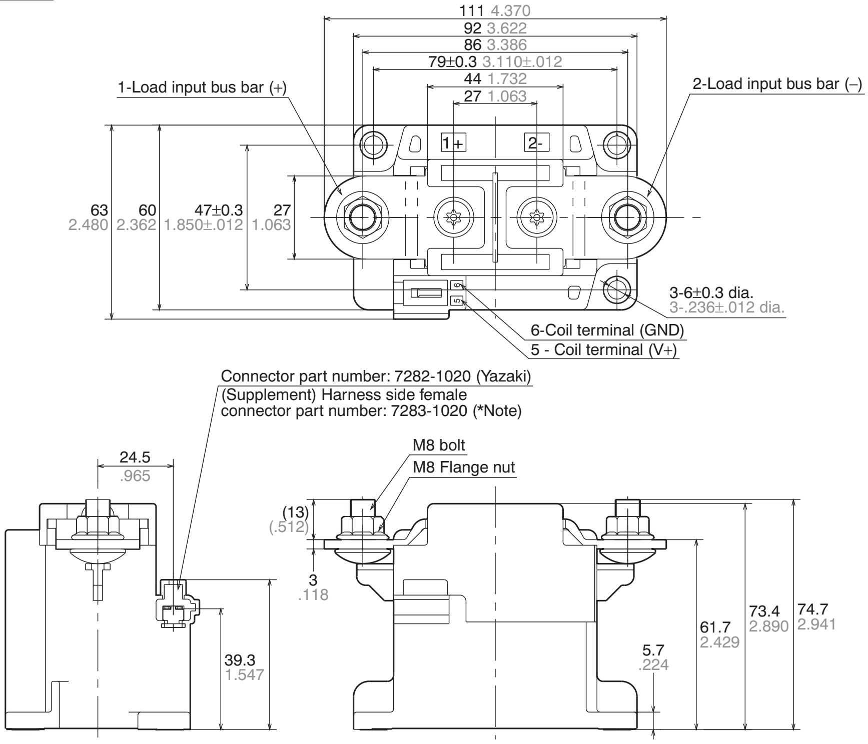
less than 10 .394:	±0.3 ±.012
10 to 50 .394 to 1.969:	±0.6 ±.024
more than 50 1.969:	±1.0 ±.039

*Note: Separate connection of the terminal and lead wire is required.

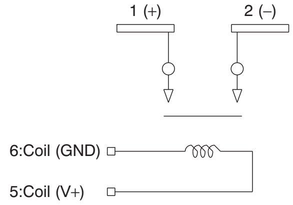
Automotive

5. 300 A type

CAD Data

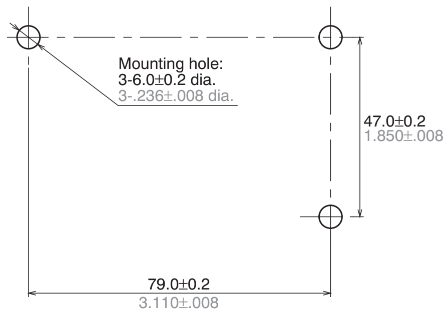


Schematic (TOP VIEW)



Load side has polarities (+) and (–)

Mounting dimensions



General tolerance;

less than 10 .394:	±0.3 ±.012
10 to 50 .394 to 1.969:	±0.6 ±.024
more than 50 1.969:	±1.0 ±.039
more than 100 3.937:	±1.6 ±.063

*Note: Separate connection of the terminal and lead wire is required.

NOTES

1. When installing the relay, always use washers to prevent the screws from loosening.
Tighten each screw within the rated range given below. Exceeding the maximum torque may result in breakage. Mounting is possible in either direction.
<Relay installing section>
• M4 screw (for 10A type): 1.8 to 2.7 N·m
• M5 screw (for 20A, 80A, 120A and 300A types): 3 to 4 N·m
<Main terminal installing section>
• M5 nut (for 80A type): 3 to 4 N·m
• M6 nut (for 120A type): 6 to 8 N·m
• M8 nut (for 300A type): 10 to 12 N·m

2. The coils (300 A type) and contacts (all type) of the relay are polarized, so follow the connection schematic when connecting the coils and contacts.
Type 300 A contains a reverse surge voltage absorption circuit; therefore a surge protector is not needed. We recommend installing a surge protector varistor (ZNR) for the 10A, 20A, 80A and 120A types.
<Recommend varistor>
Amount of proof energy: Min. 1 J
Varistor voltage: 1.5 to 2.0 times of nominal voltage
Avoid using a diode as this may result in decreased cut-off capability.

3. As a general rule, do not use a relay if it has been dropped.

4. Avoid mounting the relay in strong magnetic fields (near a transformer or magnet) or close to an object that radiates heat.

5. Electrical life
This relay is a high-voltage direct-current switch. In its final breakdown mode, it may lose the ability to provide the proper cut-off. Therefore, do not exceed the indicated switching capacity and life. (Please treat the relay as a product with limited life and replace it when necessary.)
In the event that the relay loses cut-off ability, there is a possibility that burning may spread to surrounding parts, so configure the layout so that the power is turned off within one second.

6. Permeation life of internal gas
This relay uses a hermetically encased contact (capsule contact) with gas inside. The gas has a permeation life that is affected by the temperature inside the capsule contact (ambient temperature + temperature rise due to flow of electrical current). For this reason, make sure the ambient operating temperature is between –40 and 80°C –40 and +176°F (300A type is Max. 85°C 185°F), and the ambient storage temperature is between –40 and 85°C –40 and +185°F.

7. If the power is turned off and then immediately on after applying the rated voltage (current) continuously to the relay's coil and contact, the resistance of the coil will increase due to a rise in the coil temperature.
This causes the pick-up voltage to rise, and possibly exceed the rated pick-up voltage. In these circumstances, take measures such as reducing the load current, limiting the duration of current flow, and applying a coil voltage higher than the rated operating voltage.

8. Main contact ratings in the ratings apply to when there is a resistive load. If you are using an inductive load (L load) such that L/R > 1 ms, add surge protection in parallel with the inductive load.
If this is not done, the electrical life will decrease and cut-off failure may occur.

9. For the 300 A type, drive the coil with a quick startup.
(Built-in one-shot pulse generator circuit)

10. Be careful that foreign matter and oils and fats kind don't stick to the main terminal parts because it is likely to cause terminal parts to give off unusual heat.
Also, please use the following materials for connected harnesses and bus bars.
10A type:
Min. 2 mm² nominal cross-sectional area
20A type:
Min. 3 mm² nominal cross-sectional area
80A type:
Min. 15 mm² nominal cross-sectional area
120A type:
Min. 38 mm² nominal cross-sectional area
300A type:
Min. 100 mm² nominal cross-sectional area

11. As a guide, the insertion strength of the plug-in terminal into the relay tab terminal should be 40 to 70N (10A type), 40 to 80N (20A type). Please select a plug-in terminal (flat connection terminal) which comply with JIS C2809-1992.
10A type: for plate thickness 0.5mm and #187 tab terminal
20A type: for plate thickness 0.8mm and #250 tab terminal

12. Avoid excessive load applied to the terminal in case of installing such as a bus bar etc., Because it might adversely affect the opening and closing performance.

13. Use the specified connector for the connector terminal connection (80A, 120A and 300A)
Yazaki Corporation 7283 – 1020 or equivalent

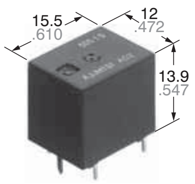
14. After the ON signal enters the 300A type, automatic coil current switching occurs after approximately 0.1 seconds. Do not repeatedly turn it OFF within that 0.1 seconds interval, as doing so may damage the relay.

For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

COMPACT SIZE AUTOMOTIVE RELAY

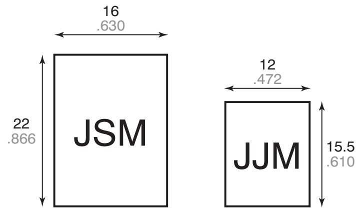
JJ-M RELAYS



mm inch

FEATURES

• Compact (half-size).
The base area is approximately half the size of conventional (JS-M) relays. The controller unit can be made more compact.
Base area has been reduced by one half



• Perfect for automobile electrical systems.
Over 2 × 10^5 openings possible with a 14 V DC motor load, an inrush current of 25 A, and steady state current of 5 A. (N.O. side)

• Standard terminal pitch employed
The terminal array used is identical to that used in small automotive relays.

• Plastic sealed type.
Plastically sealed for automatic cleaning.

• Line-up of 1 Form A and 1 Form C.

TYPICAL APPLICATIONS

• Power windows
• Auto door lock
• Electrically powered sun roof
• Electrically powered mirror
• Cornerring lamp, etc.

SPECIFICATIONS

Contact

Arrangement			1 Form A	1 Form C
Contact material			Ag alloy (Cadmium free)	
Initial contact resistance (Initial) (By voltage drop 6V DC 1A)			Typ. 5 mΩ	
Rating (resistive load)	Nominal switching capacity		20 A 14 V DC	20 A 14 V DC (N.O.) 10 A 14 V DC (N.C.)
	Min. switching capacity#1		1 A 12 V DC	
	Max. carrying current		N.O.: 35 A (12V, at 20°C 68°F for 2 minutes) 25 A (12V, at 20°C 68°F for 1 hour) 30 A (12V, at 85°C 185°F for 2 minutes) 20 A (12V, at 85°C 185°F for 1 hour)	
Expected life (min. operations)	Mechanical (at 120cpm)		10^7	
	Electrical (at rated load)	Resistive	10^5 *1	10^5 (N.O.)*2 10^5 (N.C.)*3
		Motor load	2×10^5 *4 5×10^4 *5	2×10^5 (N.O.)*6 5×10^4 (N.O.)*7 2×10^5 (N.C.)*8

Coil

Nominal operating power	640 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
*1 at 20 A 14 V DC, at 20 cpm, operating frequency: 1s ON, 9s OFF
*2 at 20 A 14 V DC, operating frequency: 1s ON, 9s OFF
*3 at 10 A 14 V DC, at 20 cpm, operating frequency: 1s ON, 9s OFF
*4 at 5 A (steady), 25 A (inrush) 14 V DC
*5 at 20 A 14 V DC (Motor lock), operating frequency: 0.5 s ON, 9.5 s OFF
*6 at 5A (steady), 25 A (inrush) 14 V DC

Characteristics

Max. operating speed (at rated load)		6 cpm
Initial insulation resistance*9		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*10	Between open contacts	500 Vrms for 1min.
	Between contact and coil	500 Vrms for 1min.
Operate time*11 (at nominal voltage)		Max. 10 ms (at 20°C 68°F)
Release time (without diode)*11 (at nominal voltage) (Initial)		Max. 10 ms (at 20°C 68°F)
Shock resistance	Functional*12	Min. 100 m/s² {10 G}
	Destructive*13	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*14	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5 G}
	Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5 G}
Conditions in case of operation, transport and storage*15 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 5 g .176 oz

*7 at 20 A 14 V DC (Motor lock)
*8 at peak 20 A 14 V DC (Braking current) operating frequency: 0.5 s ON, 9.5 s OFF
*9 Measurement at same location as “Initial break down voltage” section.
*10 Detection current: 10mA
*11 Excluding contact bounce time.
*12 Half-wave pulse of sine wave: 11 ms; detection time: 10 µs
*13 Half-wave pulse of sine wave: 6 ms
*14 Detection time: 10 µs
*15 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).

ORDERING INFORMATION

Ex. JJM [ ] — [ ]

Contact arrangement	Coil voltage(DC)
1a: 1 Form A 1: 1 Form C	12 V

(Note) Standard packing: Carton: 50 pcs.; Case: 1,000 pcs.

TYPES AND COIL DATA (at 20°C 68°F)

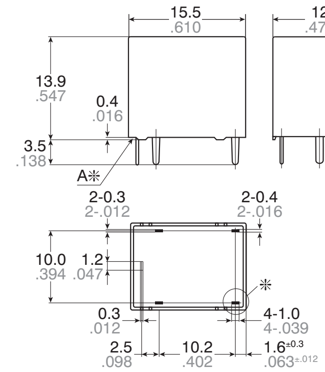
Contact arrangement	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance Ω	Nominal operating current mA	Nominal operating power mW	Usable voltage range, V DC
1 Form A	JJM1a-12 V	12	Max. 7.2	Min. 1.0	225±10%	53.3±10%	640	10 to 16
1 Form C	JJM1-12 V	12	Max. 7.2	Min. 1.0	225±10%	53.3±10%	640	10 to 16

* Other pick-up voltage types are also available. Please contact us for details.

DIMENSIONS (mm inch)

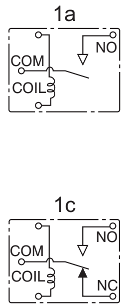
Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data

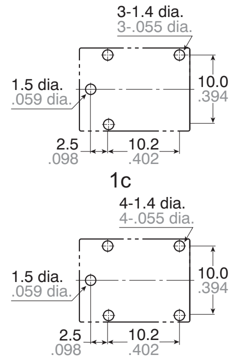


Note: ❊Marked terminal is only for 1Form C type

Schematic (Bottom view)



PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

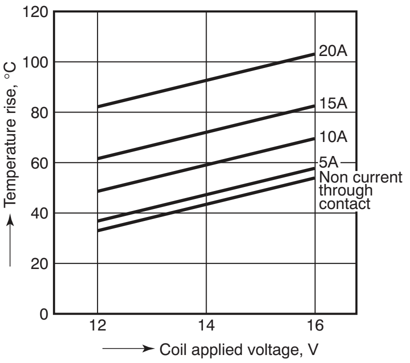
Automotive

* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
  Intervals between terminals is measured at A surface level.

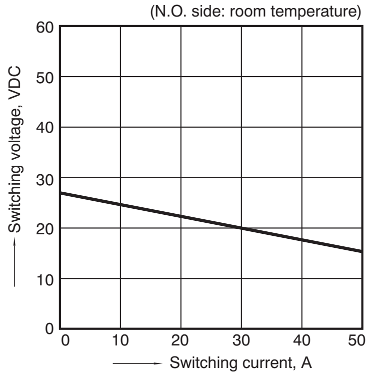
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

REFERENCE DATA

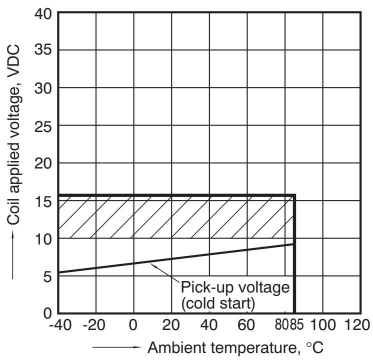
1. Coil temperature rise
Sample: JJM1-12V, 6pcs
Point measured: Inside the coil
Contact current: Now current through contact, 5A, 10A, 15A, 20A
Resistance method, ambient temperature 85°C 185°F



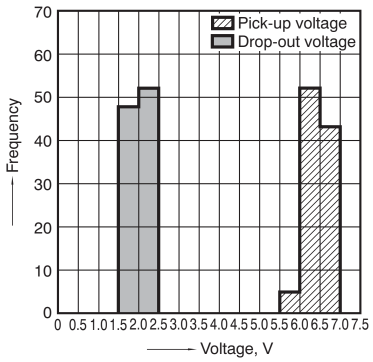
2. Max. switching capability (Resistive load)



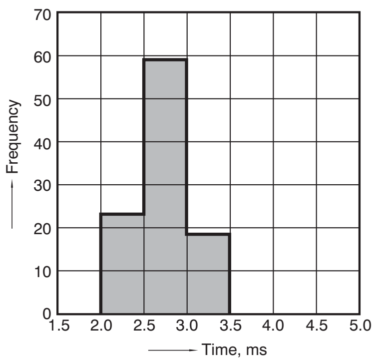
3. Ambient temperature and operating voltage range



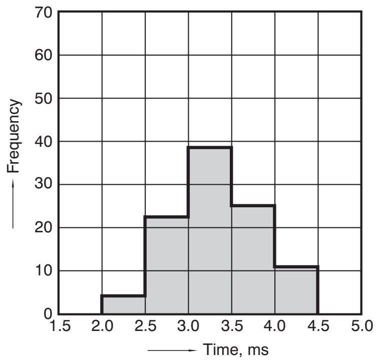
4. Distribution of pick-up and drop-out voltage
Sample: JJM1-12V, 100pcs



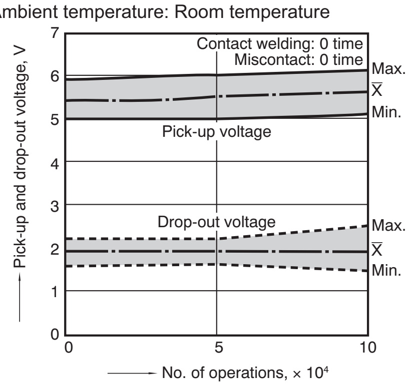
5. Distribution of operate time
Sample: JJM1-12V, 100pcs



6. Distribution of release time
Sample: JJM1-12V, 100pcs
* With diode



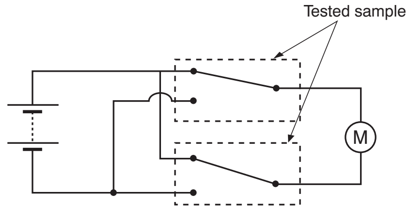
7-(1). Electrical life test (at rated load)
Sample: JJM1-12V
Quantity: n = 6 (NC = 3, NO = 3)
Load: Resisitive load (NC side: 10A 14 V DC, NO side: 20 A 14 V DC); Operating frequency: ON 1s, OFF 9s
Ambient temperature: Room temperature



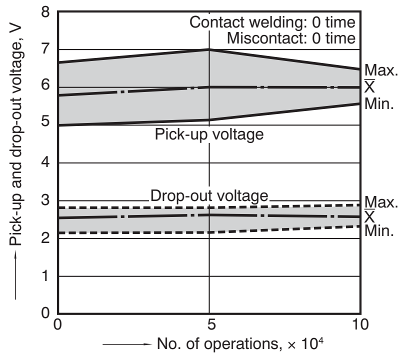
7-(2). Electrical life test (Motor free)

Sample: JJM1-12V, 6pcs.
Load: 5A, Inrush 25A, Brake current 18A 14V DC,
Power window motor load (Free condition).
Operating frequency: (ON : OFF = 0.5s : 9.5s)
Ambient temperature: Room temperature

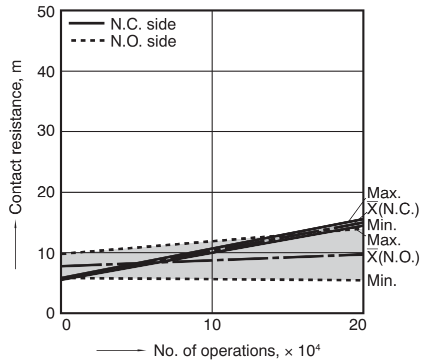
Circuit :



Change of pick-up and drop-out voltage



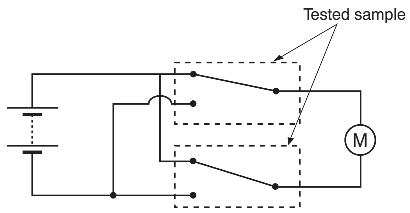
Change of contact resistance



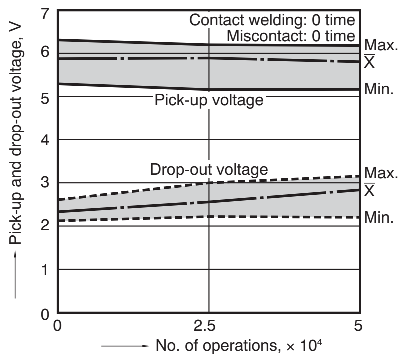
7-(3). Electrical life test (Motor lock)

Sample: JJM1-12V, 6pcs.
Load: 20A, 14VDC,
Power window motor actual load (lock condition).
Operating frequency: (ON : OFF = 1s : 5s)
Ambient temperature: Room temperature

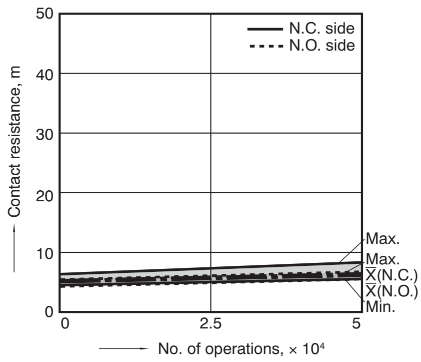
Circuit :



Change of pick-up and drop-out voltage



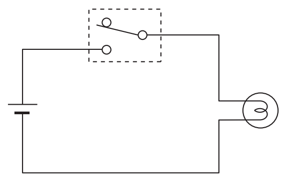
Change of contact resistance



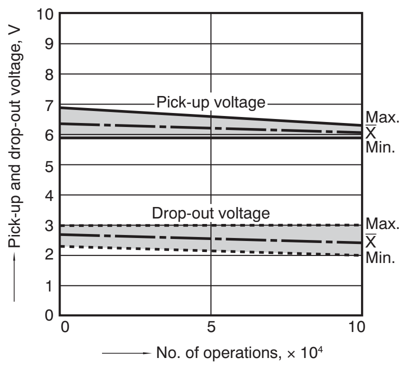
7-(4). Electrical life test (Lamp load)

Sample: JJM1-12V, 6pcs.
Load: 27W+21W, min. 4A (steady), Lamp actual load
Operating frequency: ON 2s, OFF 13s
Ambient temperature: Room temperature

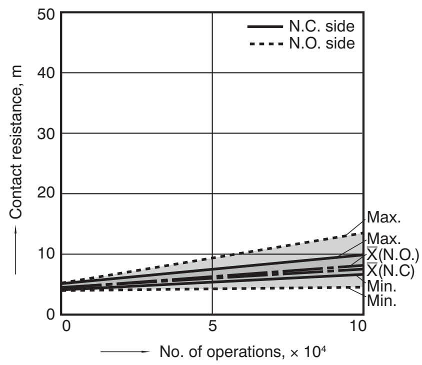
Circuit :



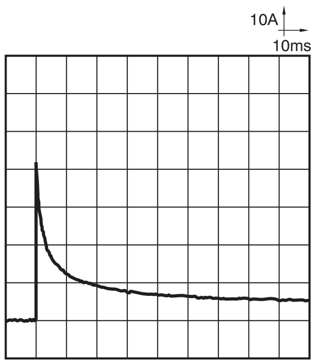
Change of pick-up and drop-out voltage



Change of contact resistance



Inrush current: 42A, Steady current: 4.4A

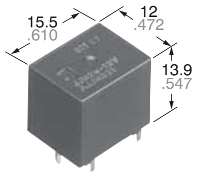


For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

DOUBLE MAKE CONTACT AUTOMOTIVE RELAY

JJ-M RELAYS
(Double make type)



mm inch

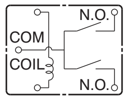
FEATURES

• Small size
The smallest double make type relay
12.0(W)×15.5(L)×13.9(H) mm
.472(W)×.610(L)×.547(H) inch

• Pattern design simplification
Simplified pattern design is possible because, while double make construction is employed, the external COM terminal is single.

• Standard terminal pitch employed
The terminal array used is identical to that used in JJM relays(1c type).

• Plastic sealed type
Plastically sealed for automotive cleaning.



<Schematic>

SPECIFICATIONS

Contact

Arrangement		Double make contact
Contact material		Ag alloy (Cadmium free)
Initial contact resistance (Initial) (By voltage drop 6V DC 1A)		Typ. 10 mΩ
Contact voltage drop		Max. 0.25V (at 2 × 6A)
Rating	Nominal switching capacity	12A 14V DC (at 2 × 6A, lamp load)
	Max. carrying current	2 × 6A (12V, at 20°C 68°F), 2 × 4A (12V, at 85°C 185°F)
	Min. switching capacity#1	1A 12V DC
Expected life (min. operations)	Mechanical (at 120cpm)	Min. 10^7
	Electrical (lamp load)	Min. 10^5*1

Coil

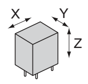
Nominal operating power	1,000 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed (at nominal switching capacity)		4 cpm
Initial insulation resistance*2		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*3	Between open contacts	500 Vrms for 1min.
	Between contact and coil	500 Vrms for 1min.
Operate time*4 (at nominal voltage)(at 20°C 68°F)		Max. 10 ms (Initial)
Release time (without diode)*4 (at nominal voltage)(at 20°C 68°F)		Max. 10 ms (Initial)
Shock resistance	Functional*5	Min. 100 m/s² {10 G}
	Destructive*6	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*7	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5 G}
	Destructive*8	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5 G}
Conditions in case of operation, transport and storage*9 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 5 g .176 oz

Remarks
*1 At 12A 14V DC (lamp), operating frequency: 1s ON, 14s OFF
*2 Measurement at same location as “initial breakdown voltage” section.
*3 Detection current: 10mA
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 µs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 µs
*8 Time of vibration for each direction; X, Y direction: 2 hours Z direction: 4 hours



*9 Refer to “6. Usage, Storage and Transport Conditions” in AMBIENT ENVIRONMENT (page 599).
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).

TYPICAL APPLICATIONS

Car alarm system flashing lamp etc.

ORDERING INFORMATION

Ex. JJM 2w 12V

Contact arrangement	Coil voltage (DC)
Double make contact	12V

Standard packing: Carton(tube package) 50pcs. Case: 1,000pcs.

TYPES AND COIL DATA (at 20°C 68°F)

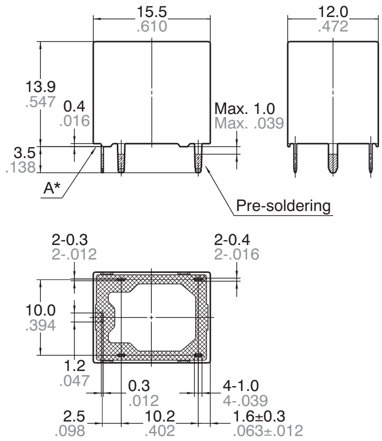
• Single side stable type

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance Ω	Nominal operating current, mA	Nominal operating power, mW	Usable voltage range, V DC
JJM2w-12V	12	Max. 6.9	Min. 1.0	144±10%	83.3±10%	1,000	10 to 16

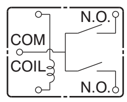
DIMENSIONS(mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

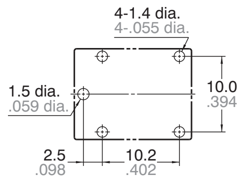
CAD Data



Schematic (Bottom view)



PC board pattern (Bottom view)



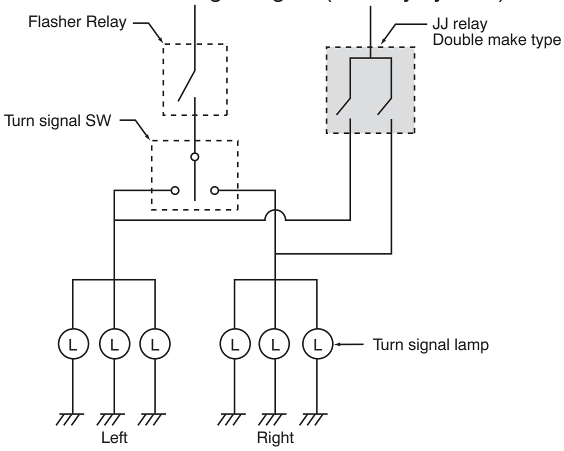
Tolerance: ±0.1 ±.004

Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

EXAMPLE OF CIRCUIT

Control circuit for signal lights (security system)

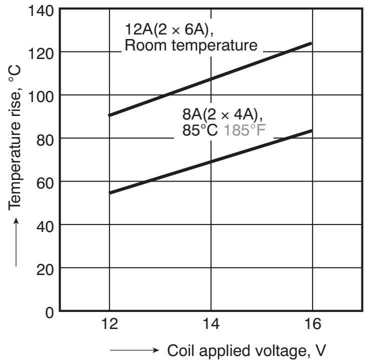


Automotive

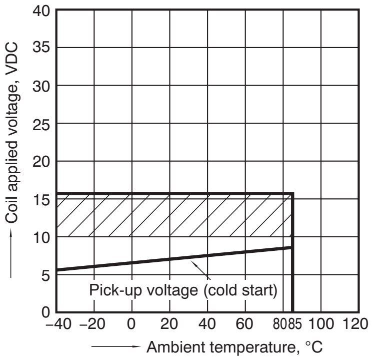
REFERENCE DATA

1. Coil temperature rise

Sample: JJM2w-12V, 6pcs.
Point measured: Inside the coil
Contact carrying current: 2 × 6A, 2 × 4A
Ambient temperature: Room temperature, 85°C 185°F

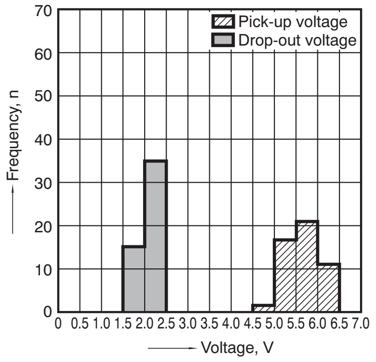


2. Ambient temperature and operating voltage range



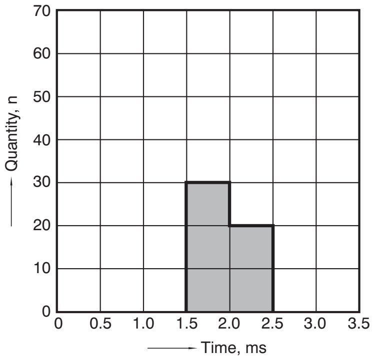
3. Distribution of pick-up and drop-out voltage

Sample: JJM2W-12V, 50pcs.



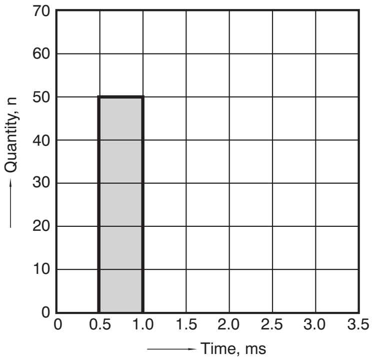
4. Distribution of operate time

Sample: JJM2W-12V, 50pcs.



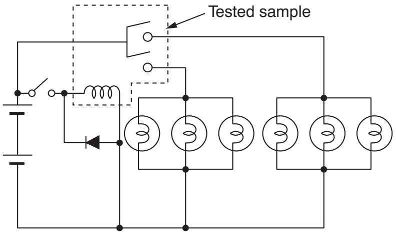
5. Distribution of release time

Sample: JJM2W-12V, 50pcs.
* Without diode

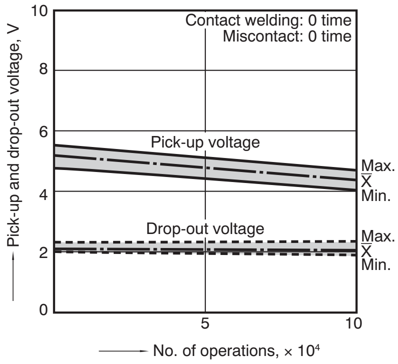


6. Electrical life test (Lamp load)
Sample: JJM2w-12V, 6pcs.
Load: 5.5A, inrush 48A, 6 × 21W
Operating frequency: (ON : OFF = 1s : 14s)
Ambient temperature: Room temperature

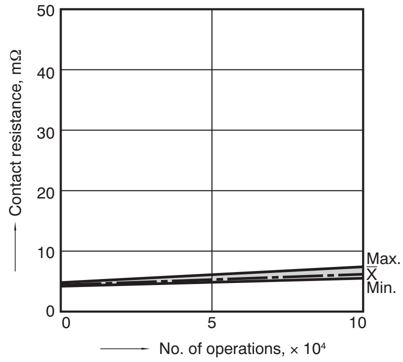
Circuit:



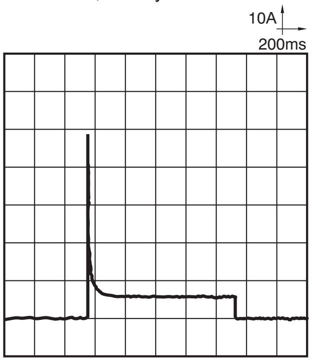
Change of pick-up and drop-out voltage



Change of contact resistance



Load current waveform
Current value per contact on one side
Inrush current: 48A, Steady current: 5.5A



For Cautions for Use, see Relay Technical Information (page 582).

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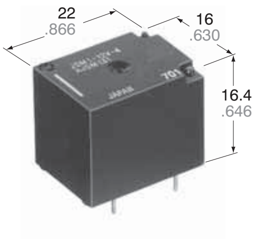
GLOBAL STANDARD TERMINAL PITCH AUTOMOTIVE POWER RELAY

JS-M RELAYS



mm inch

FEATURES

- **Low pick-up voltage for high ambient use**
- **Sealed construction**
- **Global standard terminal pitch**
- **Usable at high temperature: 85°C 185°F**

TYPICAL APPLICATIONS

- Power-window
- Car antenna
- Door lock
- Intermittent wiper
- Interior lighting
- Power seat
- Power sunroof
- Car stereo
- Horn
- Lift gate, etc.

SPECIFICATIONS

Contact

			Standard type	High capacity type
Arrangement			1 Form A, 1 Form C	
Contact material			Ag alloy (Cadmium free)	
Initial contact resistance (By voltage drop 6 V DC 1 A)			*Max. 100 mΩ	*Max. 100 mΩ
Contact voltage drop			Max. 0.2 V DC (at 10 A 12 V DC)	
Rating	Nominal switching capacity		10 A 16 V DC (resistive)	15 A 16 V DC (resistive)
	Max. carrying current		25 A (at 20°C 68°F for 2 minutes) 15 A (at 20°C 68°F for 1 hour) 20 A (at 85°C 185°F for 2 minutes) 10 A (at 85°C 185°F for 1 hour)	
	Max. switching power		160 W	
	Max. switching voltage		16 V DC	
	Max. switching current		10 A	15 A (10 A max. at 85°C)
	Min. switching capacity#1		1 A 12 V DC	
Expected life (min. ope.)	Mechanical life (at 180 cpm)		10^7	
	Electrical (at 15 cpm)	Resistive	10^5	N.O.: 10^5 N.C.: 5×10^4

* Measured after operating 5 times at the rated load

Coil

Nominal operating power	640 mW

Contact rating

Load	Standard type			High capacity type		
	Form A	Form C		Form A	Form C	
		N.O.	N.C.		N.O.	N.C.
Max. carry current	15 A	15 A	15 A	15 A	15 A	15 A
Max. make current	25 A	25 A	10 A	50 A	50 A	15 A
Max. break current	10 A	10 A	10 A	15 A	15 A	15 A

Characteristics

Max. operating speed (at rated load)		15 cps.
Initial insulation resistance*1		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	750 Vrms for 1 min.
	Between contacts and coil	1,500 Vrms for 1 min.
Operate time*3 (at nominal voltage)		Max. 10 ms
Release time (without diode)*3 (at nominal voltage)		Max. 10 ms
Shock resistance	Functional*4	Min. 98 m/s² {10 G}
	Destructive*5	Min. 980 m/s² {100 G}
Vibration resistance	Functional*6	10 Hz to 55 Hz at double amplitude of 1.6 mm
	Destructive	10 Hz to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 12 g .423 oz

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

ORDERING INFORMATION

Ex. JSM [ ] [ ] — 12V — [ ]

Contact arrangement	Protective construction	Coil voltage (DC)	Contact material
1a: 1 Form A 1: 1 Form C	Nil: Sealed construction F: Flux-resistant type	12 V	4: Standard type (10 A) 5: High capacity type (15 A)

Note: Standard packing: Carton: 100 pcs. Case: 500 pcs.

TYPES AND COIL DATA (at 20°C 68°F)

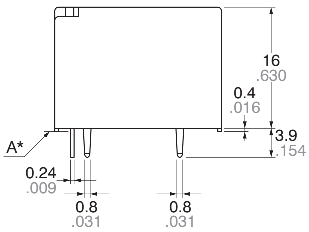
Contact arrangement	Coil voltage, V DC	Standard type (10 A)		High capacity type (15 A)		Nominal voltage, V DC	Pick-up voltage, V DC	Drop-out voltage, V DC	Coil resistance Ω	Nominal operating current, mA	Nominal operating power, mW	Max. allowable voltage, V DC (at 80°C 176°F)
		Sealed type	Flux-resistant type	Sealed type	Flux-resistant type							
1 Form A	12	JSM1a-12V-4	JSM1aF-12V-4	JSM1a-12V-5	JSM1aF-12V-5	12	Max. 6.3	Min. 0.9	225±10%	53.3±10%	640	10 to 16
1 Form C	12	JSM1-12V-4	JSM1F-12V-4	JSM1-12V-5	JSM1F-12V-5	12	Max. 6.3	Min. 0.9	225±10%	53.3±10%	640	10 to 16

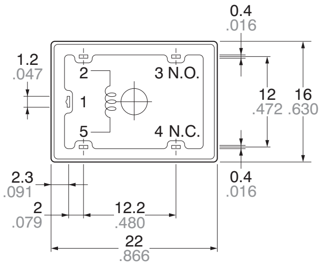
* Other pick-up voltage types are also available. Please contact us for details.

DIMENSIONS(mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

CAD Data



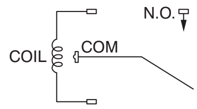


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

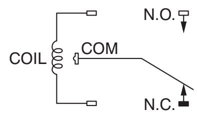
* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

Schematic (Bottom view)

1a

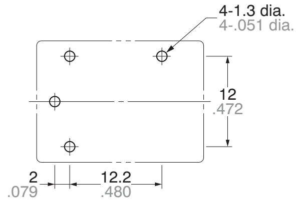


1c

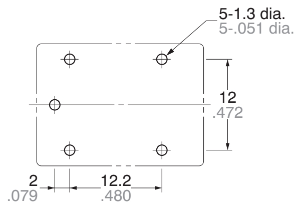


PC board pattern (Bottom view)

1a



1c



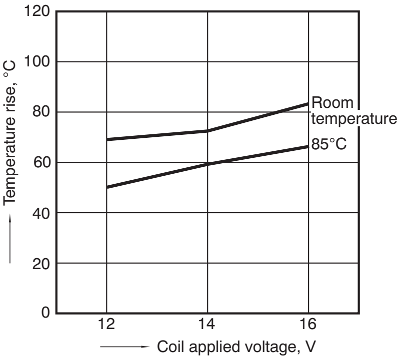
Tolerance: ±0.1 ±.004

Automotive

REFERENCE DATA

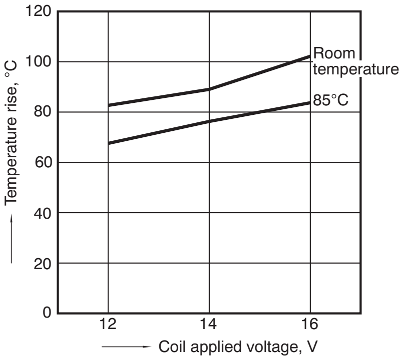
1-(1). Coil temperature rise (10A)

Measured portion: Inside the coil
Contact carrying current, 10A
Ambient temperature: Room temperature, 85°C
185°F

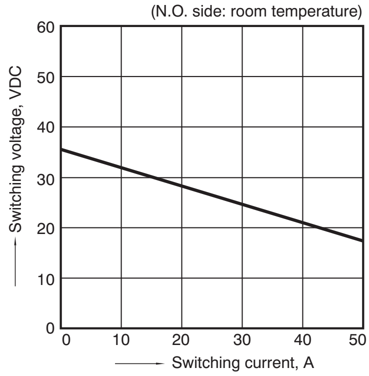


1-(2). Coil temperature rise (15A)

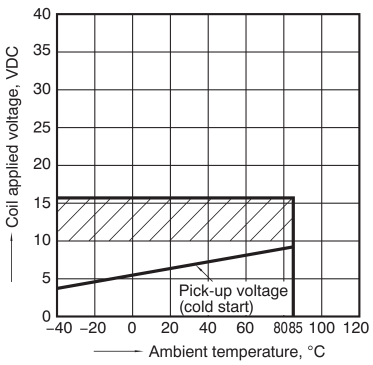
Measured portion: Inside the coil
Contact carrying current, 15A
Ambient temperature: Room temperature, 85°C
185°F



2. Max. switching capability (Resistive load, initial)

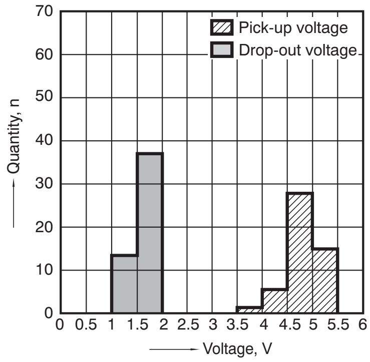


3. Ambient temperature and oprating voltage range



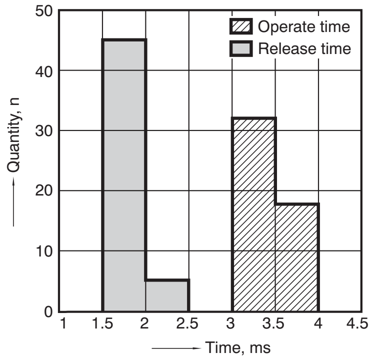
4. Distribution of pick-up and drop-out voltage

Sample: JSM1-12V-5, 50pcs.



5. Distribution of operate and release time

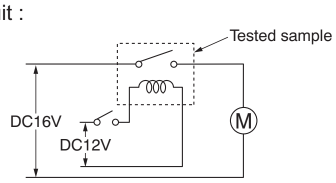
Sample: JSM1-12V-5, 50pcs.
Coil both side without diode

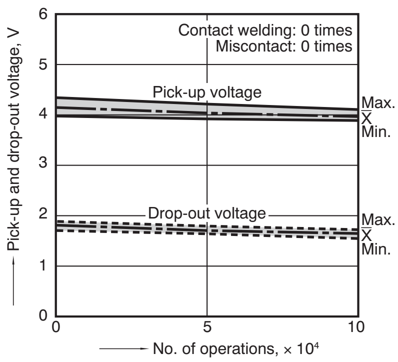


6-(1). Electrical life test (Motor load)

Sample: JSM1-12V-5, 3pcs.
Load: 50A (Inrush), 10A 16V DC (Steady)
Switching frequency: (ON : OFF = 1s : 9s)

Circuit :

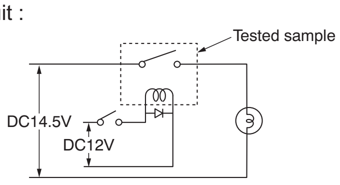


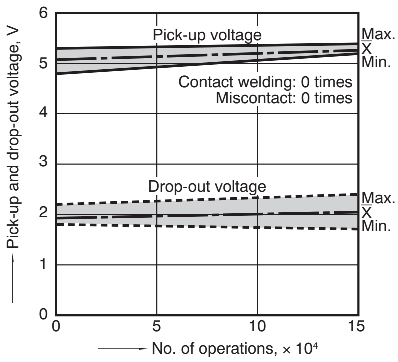


6-(2). Electrical life test (Lamp load)

Sample: JSM1-12V-5, 4pcs.
Load: 55.2A (Inrush), 9.6A 14.5V DC (Steady)
Switching frequency: (ON : OFF = 1s : 3s)

Circuit :





For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

COMPACT ECONOMICAL
30 AMP. RELAY

JT-N RELAYS

PCB type

TMP type

FEATURES

- **High switching capacity — 30 A for 1 Form A**
- **2 contact arrangements — 1 Form A or 1 Form C**
- **"TMP" types available**
- **UL/CSA recognized**
- **Class F types standard**

SPECIFICATIONS

Contacts

		PCB & TMP type	
Arrangement		1 Form A	1 Form C
Initial contact resistance, max. (By voltage drop method, 6 V DC 1 A)		50 mΩ	
Contact material		$AgSnO_2$ type	
Rating	Max. switching power	8310 VA	N.C.: 2770 VA N.O.: 5540 VA
	Max. switching voltage	277 V AC	
	Max. switching current	30 A	N.C.: 10 A N.O.: 20 A
	Min. switching capacity#1	100 mA, 5 V DC	
Expected life	Mechanical	Min. 1×10^7	
	Electrical (Resistive load)	20 A 277 V AC Min. 1×10^5*	N.O.: 20 A 277 V AC Min. 1×10^5* N.C.: 10 A 277 V AC Min. 1×10^5*

* The life is for open venting-hole condition.

Coil at 20°C 68°F

Nominal operating power	Approx. 800 mW

Characteristics

		PCB & TMP type
Initial insulation resistance*1		Min. 100 MΩ at 500 V DC
Initial breakdown voltage*2	Between contacts	1,200 Vrms
	Between contacts and coil	2,500 Vrms
Operate time*3 (at nominal voltage)		Max. 20 ms
Release time (without diode)*3 (at nominal voltage)		Max. 10 ms
Shock resistance	Functional*4	Min. 98 m/s^2 {10 G}
	Destructive*5	Min. 980 m/s^2 {100 G}
Vibration resistance	Functional*6	Max. 88.2 m/s^2 {9 G}, 10 to 55 Hz at double amplitude of 1.5 mm
	Destructive	Max. 117.6 m/s^2 {12 G}, 10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–55°C to +85°C –67°F to +185°F
	Humidity	5 to 85% R.H.
Unit weight		PCB type: Approx. 25 g (.88 oz) TMP type: Approx. 30 g (1.06 oz)

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10 mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10µs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10µs
*7 Refer to "6. Usage, Storage and Transport Conditions" in AMBIENT ENVIRONMENT (page 599).

Automotive

TYPICAL APPLICATIONS

- Automotive
- Air conditioner
- Heating & ventilation
- Home appliance

ORDERING INFORMATION

JT-N Relays (PCB and TMP type)

JTN | 1a | S | — TMP | — F | — DC12V

Contact arrangement	Protective construction	Mounting classification	Coil insulation	Coil voltage
1a: 1 Form A 1: 1 Form C	S: Sealed type	PA: PCB type TMP: TMP type	F: Class F	DC 5, 6, 9, 12, 15, 18, 24 V

Notes: 1. UL/CSA approved type is standard.
2. Standard packing: PCB type: Carton: 50 pcs. Case: 500 pcs.
TMP type: Carton: 50 pcs. Case: 300 pcs.

COIL DATA (at 20°C 68°F)

Nominal voltage, V DC	Pick-up voltage, V DC (max.) (Initial)	Drop-out voltage, V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 70°C 158°F)
			PCB & TMP	PCB & TMP	
5	3.75	0.5	31	800	6
6	4.5	0.6	45	800	7.2
9	6.75	0.9	101	800	10.8
12	9.0	1.2	180	800	14.4
15	11.25	1.5	281	800	18
18	13.5	1.8	405	800	21.6
24	18.0	2.4	720	800	28.8

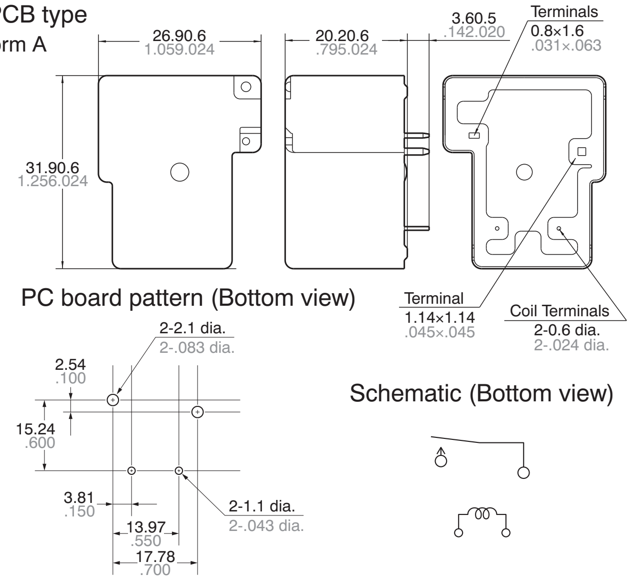
DIMENSIONS (mm inch)

Interested in CAD data? You can obtain CAD data for all products with a CAD Data mark from your local Panasonic Electric Works representative.

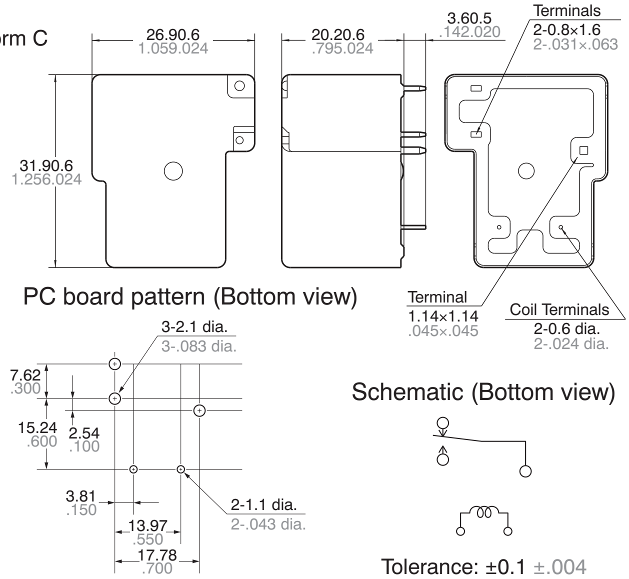
CAD Data

1. PCB type

1 Form A



1 Form C

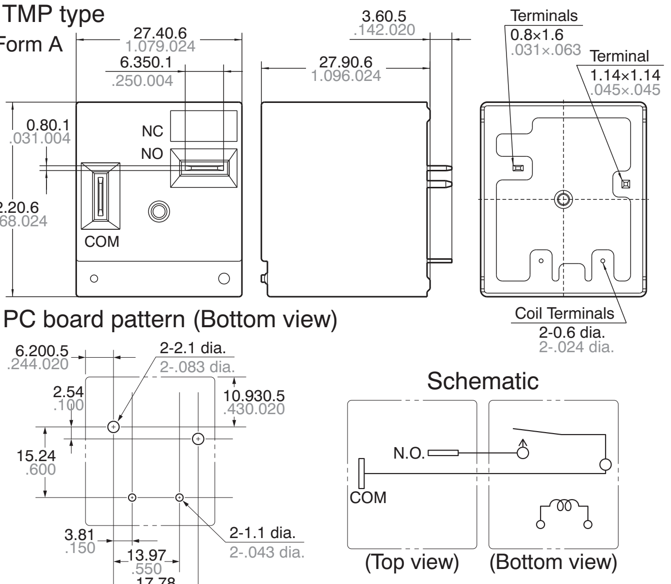


Tolerance: ±0.1 ±.004

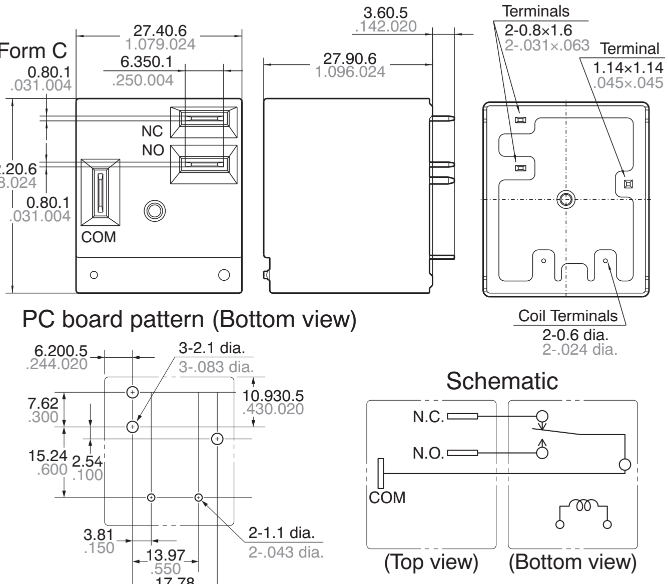
CAD Data

2. TMP type

1 Form A



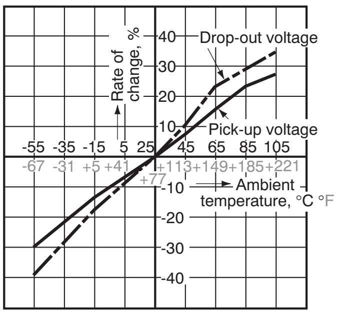
1 Form C



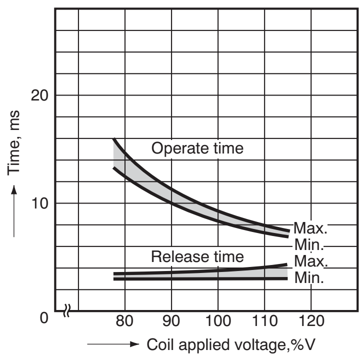
Tolerance: ±0.1 ±.004

REFERENCE DATA

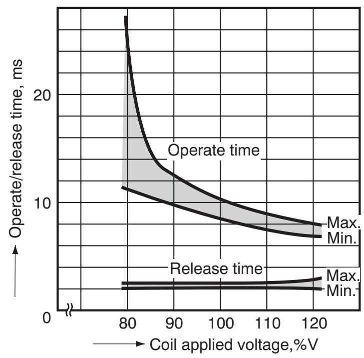
1. Change of rate of pick-up and drop-out voltage (at 20°C 68°F)
Sample: JTN1S-TMP-F-DC24V (6 pcs.)



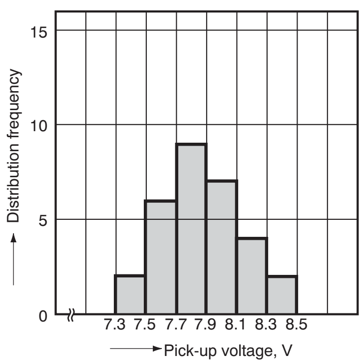
2. Operate & release time (at 20°C 68°F)
Sample: JTN1S-TMP-F-DC24V (6 pcs.)



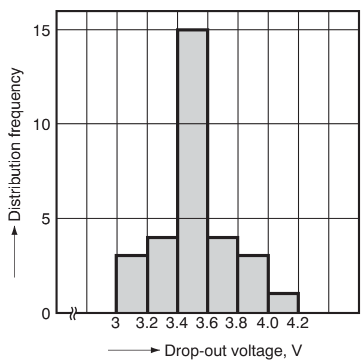
3. Operate & release time (at 20°C 68°F)
Sample: JTN1aS-PA-F-DC24V (6 pcs.)



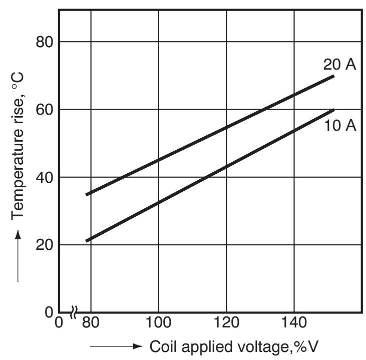
4. Distribution frequency of pick-up voltage (at 20°C 68°F)
Sample: JTN1S-TMP-F-DC12V (30 pcs.)



5. Distribution frequency of drop-out voltage (at 20°C 68°F)
Sample: JTN1S-TMP-F-DC12V (30 pcs.)



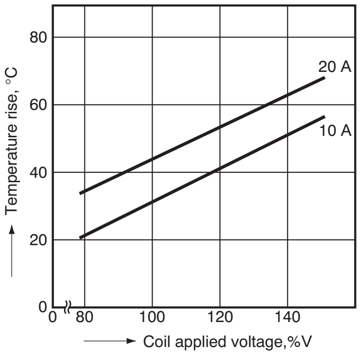
6.-(1) Coil temperature rise (TMP type)*
Ambient temperature: 20°C 68°F
Sample: JTN1aS-TMP-F-DC12V (6 pcs.)



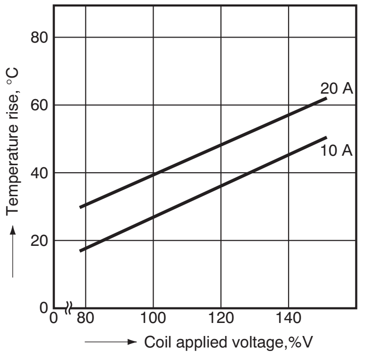
* Coil temperature rise of sealed types are same as data of the dust cover type.

Automotive

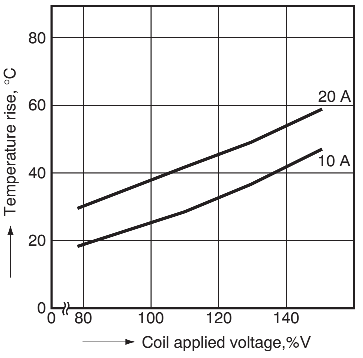
Ambient temperature: 55°C 131°F
Sample: JTN1aS-TMP-F-DC12V (6 pcs.)



Ambient temperature: 85°C 185°F
Sample: JTN1aS-TMP-F-DC12V (6 pcs.)



Ambient temperature: 105°C 221°F
Sample: JTN1aS-TMP-F-DC12V (6 pcs.)



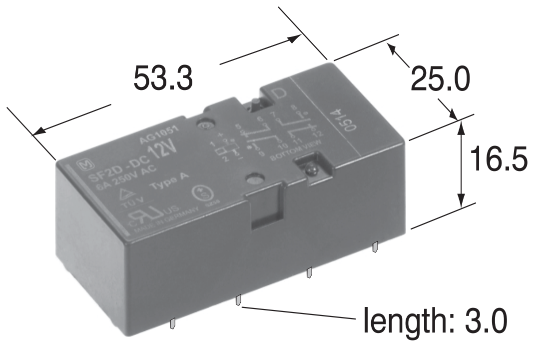
For Cautions for Use, see Relay Technical Information (page 582).

Safety Relays

Panasonic
ideas for life

POLARIZED, MONOSTABLE SAFETY RELAY WITH FORCIBLY GUIDED DOUBLE CONTACTS

SF2D RELAY



Tolerance ± 0.3mm
Weight approx. 47g

Features

- **Relay complies with EN 50205, Type A**
- **Overvoltage category as per IEC 60664-1 III / 4kV**
- **Rated voltage as per IEC 60664-1 basic insulation**

	Polution degree		
	2 inside	2 outside	3 inside
Coil-contact	400V	400V	250V
Contact-contact	400V	400V	400V

- **Relay complies with IEC/EN 60335-1 (GWT)**
- **For applications according to EN 50155***
  *For details, please contact your local Panasonic Electric Works representative.

SPECIFICATIONS

Contact

Contact configuration (a = normally open / NO, b = normally closed / NC)	2a2b
Contact material	$AgSnO_2$, with Au flash
Contact resistance (initial at 6V DC, 1A)	30mΩ
Making and breaking capacities (breathing hole open)*1	6A 250V / 3A 24V
Max. switching voltage	400V
Min. switching voltage / min. switching current	10V / 10mA
Pick-up / drop-out / bounce time (approx. values at $U_{nominal}$)	17.5 / 7 / 2ms
Mechanical life	10^7ops

Coil

Operate / release voltage (% of $U_{nominal}$ at 20°C)	75% / 10%
Pick-up/nominal power consumption at 20°C	280 / 500mW

Remarks

*1 According to EN 60947-5-1: 1997, table 4 AC15 / DC13
*2 Contact interruption <10µs
*3 Breathing hole open

Characteristics

Max. switching frequency (without load)	10Hz
Permissible ambient temperature at nominal power consumption	-40°C to +70°C
Upper temperature limit	105°C
Test voltage: open contact / contact-contact / contact-coil	2500 / 2500 / 2500V_{rms}
Insulation resistance at 500V DC (initial)	$10^9\Omega$
Shock resistance (11ms) NO/NC*2	30G
Vibration resistance 10 – 200 Hz (10 – 55 Hz, amplitude 2 mm)*2	10G
Degree of protection	IP67 / IP30*3
Unit weight	37g

Important: Relay characteristics may be influenced by:

- strong external magnetic fields
- magnetic conductive materials near the relay
- narrow top-to-top mounting (printed surface to printed surface)

Note:

Suitable for most common washing methods except ultrasonic cleaning.

ORDERING INFORMATION

Ex. SF2D — DC12 V

Coil voltage (DC)
5, 9, 12, 18, 21 24, 36, 48, 60

Note: Standard packing; Carton: 20 pcs. Case 200 pcs.

COIL DATA

Part number	Coil nominal voltage V DC	Operate voltage V DC	Release voltage V DC	Coil resistance Ω (±10%, 20°C)	Coil inductance (mH)
SF2D-DC5V	5	3.75	0.5	50	47
SF2D-DC9V	9	6.75	0.9	162	145
SF2D-DC12V	12	9.00	1.2	288	252
SF2D-DC18V	18	13.50	1.8	648	551
SF2D-DC21V	21	15.75	2.1	882	742
SF2D-DC24V	24	18.00	2.4	1152	959
SF2D-DC36V	36	27.00	3.6	2592	2097
SF2D-DC48V	48	36.00	4.8	4608	3654
SF2D-DC60V	60	45.00	6.0	7200	5612

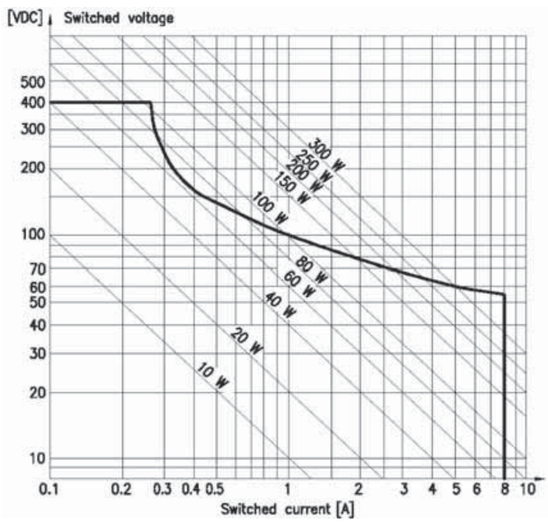
ELECTRICAL LIFE

Voltage	Current	Load type	Frequency	Duty cycle	No. of contacts	No. of ops.
230V AC	8A	AC 1	0.25Hz	25%	2*2	85,000*5
250V AC	6A	AC 1	0.33Hz	50%	4*2	100,000*5
230V AC	6A	AC 1	0.33Hz	10%	2*3	200,000*4,*5
230V AC	30 / 3A	AC 15*1	0.33Hz	10%	1*3	150,000*4,*5
24V DC	8A	DC 1	0.33Hz	10%	2*3	200,000*4,*5
24V DC	3A	DC 13*1	0.33Hz	10%	1*3	50,000*4,*5
24V DC	3A	L/R = 40ms	0.33Hz	10%	1*3	100,000*4,*5

*1 EN 60947-5-1: 1997; table C.1
*2 Breathing hole closed
*3 Breathing hole open
*4 Ambient temperature +70°C
*5 Dielectric strength according to EN61810-1:2004.

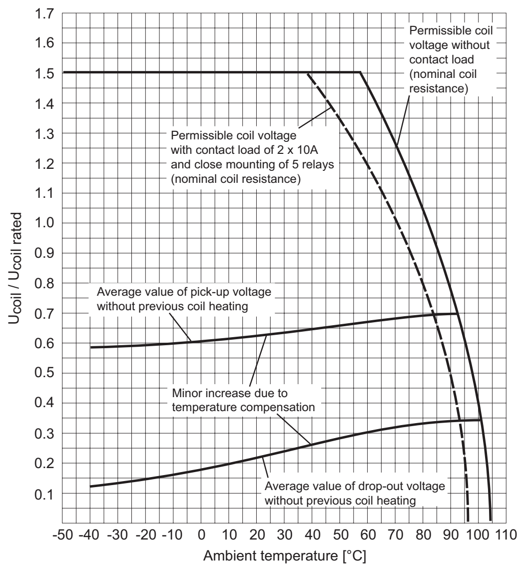
REFERENCE DATA

Load limit curve



Loads in the range under the curve can be switched safely.
The arc will extinguish before the opposite contact makes.

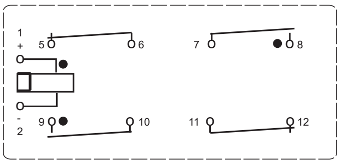
Coil voltage characteristics



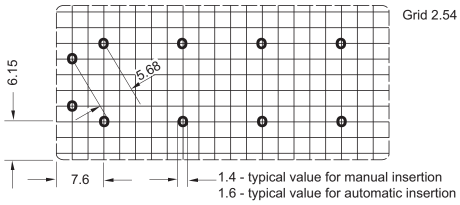
Permissable coil voltages and pick-up and drop-out characteristics at various ambient temperatures.

Safety

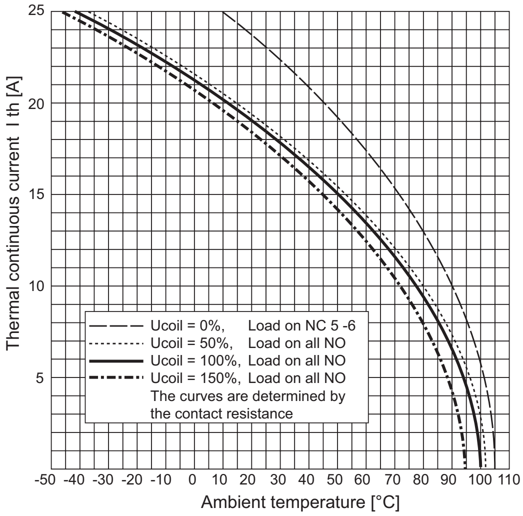
Connection diagram and pcb bore hole data



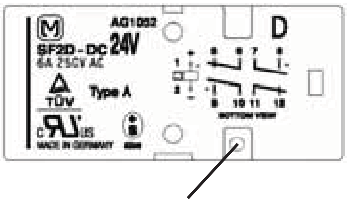
Bottom view
The contacts are shown in the deenergized condition.



Contact current characteristics



APPLICATION NOTES



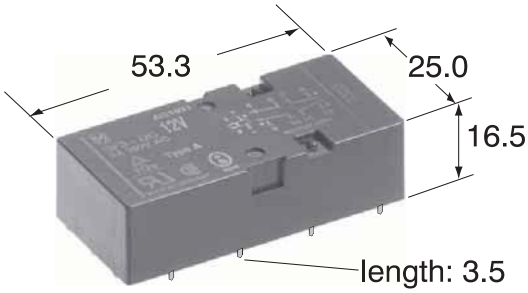
Nipple

If required a breathing hole can be made in the cover by removing the nipple.
However be aware that the degree of protection will be reduced from IP67 to IP30!

For Cautions for Use, see Relay Technical Information (page 582).

POLARIZED, MONOSTABLE SAFETY RELAY WITH FORCIBLY GUIDED CONTACTS

SF3 RELAY



Tolerance ± 0.3mm
Weight approx. 47g

FEATURES

- **Relay complies with EN 50205, Type A**
- **Overvoltage category as per IEC 60664-1 III / 4kV**
- **Rated voltage as per IEC 60664-1 basic insulation**

	Polution degree		
	2 inside	2 outside	3 outside
Coil-contact	400V	400V	250V
Contact-contact	400V	400V	400V

- **Relay complies with IEC/EN 60335-1 (GWT)**
- **For applications according to EN 50155***
  *For details, please contact your local Panasonic Electric Works representative.

SPECIFICATIONS

Contact

Contact configuration (a = normally open / NO, b = normally closed / NC)	3a1b
Contact material	$AgSnO_2$, with Au flash
Contact resistance (initial at 6V DC, 1A)	≤30mΩ
Making and breaking capacities (breathing hole open)*1, *3	6A 250V / 3A 24V
Max. switching voltage	400V
Min. switching voltage / min. switching current	10V / 10mA
Pick-up / drop-out / bounce time (approx. values at $U_{nominal}$)	16.5 / 7 / 3ms
Mechanical life	10^7ops

Coil

Operate / release voltage (% of $U_{nominal}$ at 20°C)	75% / 10%
Pick-up/nominal power consumption at 20°C	280 / 500mW

Remarks

*1 According to EN 60947-5-1: 1997, table 4 AC15 / DC13
*2 Contact interruption <10µs
*3 Breathing hole open

Characteristics

Max. switching frequency (without load)	10Hz
Permissible ambient temperature at nominal power consumption	-40°C to +70°C
Upper temperature limit	105°C
Test voltage: open contact / contact-contact / contact-coil	2500 / 2500 / 2500V_{rms}
Insulation resistance at 500V DC (initial)	$10^9\Omega$
Shock resistance (11ms) NO/NC*2	30G
Vibration resistance 10 – 200 Hz (10 – 55 Hz, amplitude 2 mm)*2	10G
Solder bath temperature, maximum duration	260°C, 5s
Degree of protection	IP67 / IP30*3
Unit weight	37g

Important: Relay characteristics may be influenced by:

- strong external magnetic fields
- magnetic conductive materials near the relay
- narrow top-to-top mounting (printed surface to printed surface)

Note:

Suitable for most common washing methods except ultrasonic cleaning.

ORDERING INFORMATION

Ex. SF3 — DC12 V

Coil voltage (DC)
5, 9, 12, 18, 21 24, 36, 48, 60

Note: Standard packing; Carton: 20 pcs. Case 200 pcs.

Safety

COIL DATA

Part number	Coil nominal voltage V DC	Operate voltage V DC	Release voltage V DC	Coil resistance Ω (±10%, 20°C)	Coil inductance (mH)
SF3-5V	5	3.75	0.5	50	47
SF3-9V	9	6.75	0.9	162	145
SF3-12V	12	9.00	1.2	288	252
SF3-18V	18	13.50	1.8	648	551
SF3-21V	21	15.75	2.1	882	742
SF3-24V	24	18.00	2.4	1152	959
SF3-36V	36	27.00	3.6	2592	2097
SF3-48V	48	36.00	4.8	4608	3654
SF3-60V	60	45.00	6.0	7200	5612

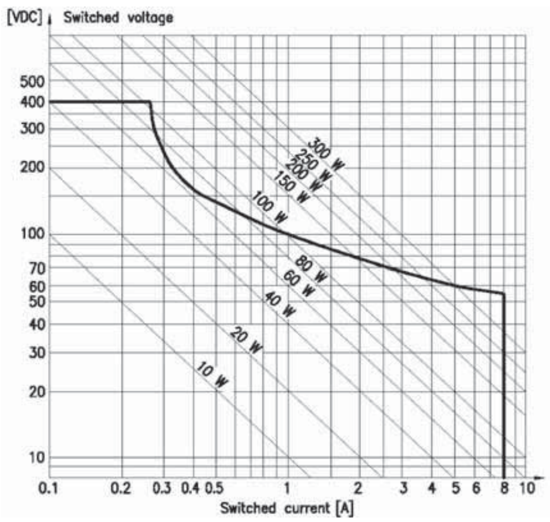
ELECTRICAL LIFE

Voltage	Current	Load type	Frequency	Duty cycle	No. of contacts	No. of ops.
250V AC	8A	cos φ = 1	0.33Hz	50%	2*2,*6	30,000*4,*5
250V AC	6A	cos φ = 1	0.33Hz	50%	4*2	100,000*4,*5
250V AC	2A	cos φ = 1	0.33Hz	50%	4*2	500,000*4,*5
220V AC	30 / 3A	AC 15*1	0.10Hz	10%	1*3	200,000*4,*5
220V AC	5.10A	cos φ = 0.60	0.20Hz	10%	1*3	100,000*4,*5
220V AC	4.43A	cos φ = 0.35	0.20Hz	50%	1*3	100,000*4,*5
220V AC	1.45A	cos φ = 0.35	0.20Hz	50%	1*3	300,000*4,*5
24V DC	6A	resistive	0.33Hz	50%	4*2	400,000*4,*5
24V DC	2A	resistive	0.50Hz	50%	4*2	2,000,000*4,*5
24V DC	3A	DC 13*1	0.33Hz	10%	1*3	50,000*4,*5
24V DC	3A	L/R = 40ms	0.33Hz	10%	1*3	100,000*4,*5

*1 EN 60947-5-1: 1997; table C.1
*2 Breathing hole closed
*3 Breathing hole open
*4 Ambient temperature +70°C
*5 Dielectric strength according to EN61810-1:2004.
*6 Normally open contacts

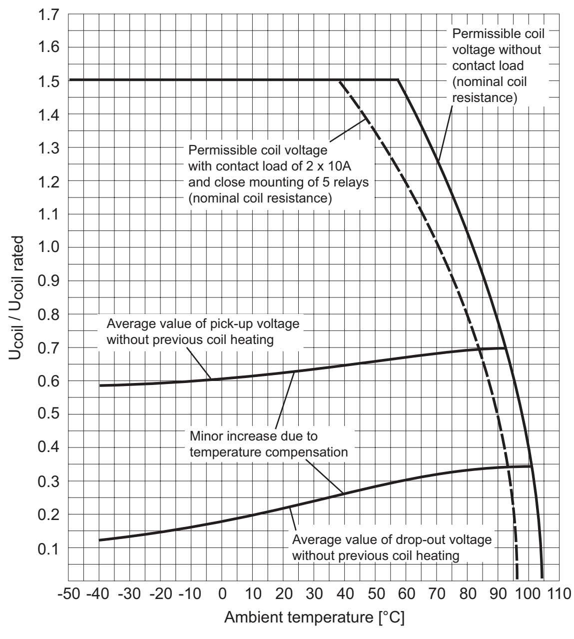
REFERENCE DATA

Load limit curve



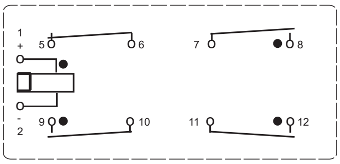
Loads in the range under the curve can be switched safely.
The arc will extinguish before the opposite contact makes.

Coil voltage characteristics

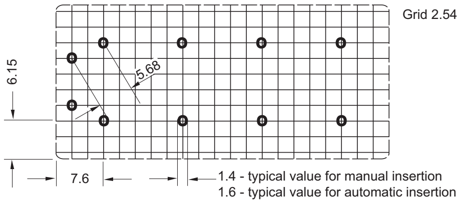


Permissable coil voltages and pick-up and drop-out characteristics at various ambient temperatures.

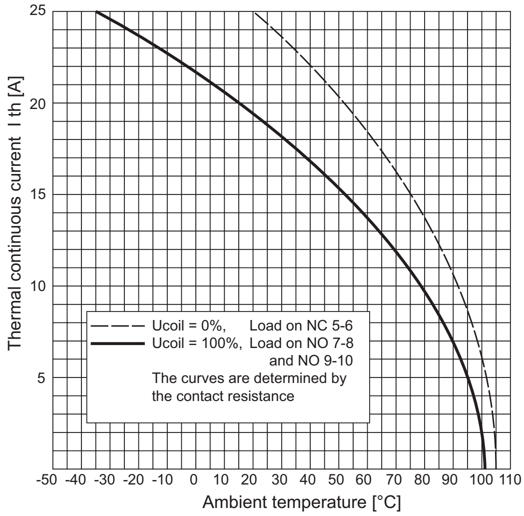
Connection diagram and pcb bore hole data



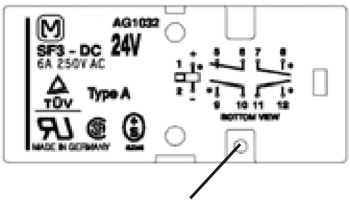
Bottom view
The contacts are shown in the deenergized condition.



Contact current characteristics



APPLICATION NOTES



If required a breathing hole can be made in the cover by removing the nipple.
However be aware that the degree of protection will reduce from IP67 to IP30!

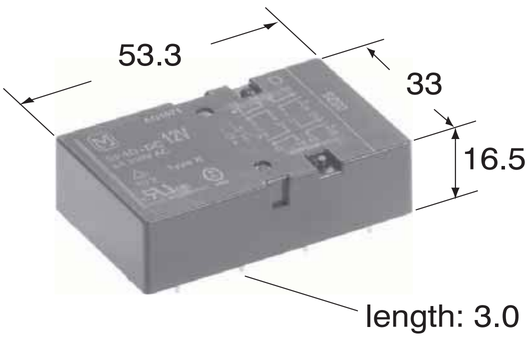
For Cautions for Use, see Relay Technical Information (page 582).

Safety

Panasonic
ideas for life

POLARIZED, MONOSTABLE SAFETY RELAY WITH FORCIBLY GUIDED DOUBLE CONTACTS

SF4D RELAY



Tolerance± 0.3mm
Weight approx. 47g

Features

- **Relay complies with EN 50205, Type B**
- **Overvoltage category as per IEC 60664-1 III / 4kV**
- **Rated voltage as per IEC 60664-1 basic insulation**

		Polution degree 2 inside	Polution degree 2 outside	Polution degree 3 inside
Coil-contact		400V	400V	250V
Contact-contact	forcibly linked pair only	250V	250V	250V
	all other contacts	400V	400V	400V

SPECIFICATIONS

Contact

Contact configuration (a = normally open / NO, b = normally closed / NC)	4a4b
Contact material	$AgSnO_2$, with Au flash
Contact resistance (initial at 6V DC, 1A)	≤30mΩ
Making and breaking capacities (breathing hole open)*1	6A 250V / 3A 24V
Max. switching voltage	400V
Min. switching voltage / min. switching current	10V / 10mA
Pick-up / drop-out / bounce time (approx. values at $U_{nominal}$)	18.5 / 7.5 / 3ms
Mechanical life	10^7ops

Coil

Operate / release voltage (% of $U_{nominal}$ at 20°C)	75% / 15%
Pick-up/nominal power consumption at 20°C	280 / 500mW

Remarks

*1 According to EN 60947-5-1: 1997, table 4 AC15 / DC13
*2 Contact interruption <10µs
*3 Breathing hole open

Characteristics

Max. switching frequency (without load)	10Hz
Permissible ambient temperature at nominal power consumption	-40°C to +70°C
Upper temperature limit	105°C
Test voltage: open contact / contact-contact / contact-coil	2500 / 2500 / 2500V_{rms}
Insulation resistance at 500V DC (initial)	$10^9\Omega$
Shock resistance (11ms) NO/NC*2	30G
Vibration resistance 10 – 200 Hz (10 – 55 Hz, amplitude 2 mm)*2	10G
Degree of protection	IP67 / IP30*3
Unit weight	47g

Important: Relay characteristics may be influenced by:

- strong external magnetic fields
- magnetic conductive materials near the relay
- narrow top-to-top mounting (printed surface to printed surface)

Note:

Suitable for most common washing methods except ultrasonic cleaning.

ORDERING INFORMATION

Ex. SF4D — DC12 V

Coil voltage (DC)
5, 9, 12, 18, 21 24, 36, 48, 60

Note: Standard packing; Carton: 20 pcs. Case 200 pcs.

COIL DATA

Part number	Coil nominal voltage V DC	Operate voltage V DC	Release voltage V DC	Coil resistance Ω (±10%, 20°C)	Coil inductance (mH)
SF4D-DC5V	5	3.75	0.75	50	47
SF4D-DC9V	9	6.75	1.35	162	145
SF4D-DC12V	12	9.00	1.80	288	252
SF4D-DC18V	18	13.50	2.70	648	551
SF4D-DC21V	21	15.75	3.15	882	742
SF4D-DC24V	24	18.00	3.60	1152	959
SF4D-DC36V	36	27.00	5.40	2592	2097
SF4D-DC48V	48	36.00	7.20	4608	3654
SF4D-DC60V	60	45.00	9.00	7200	5612

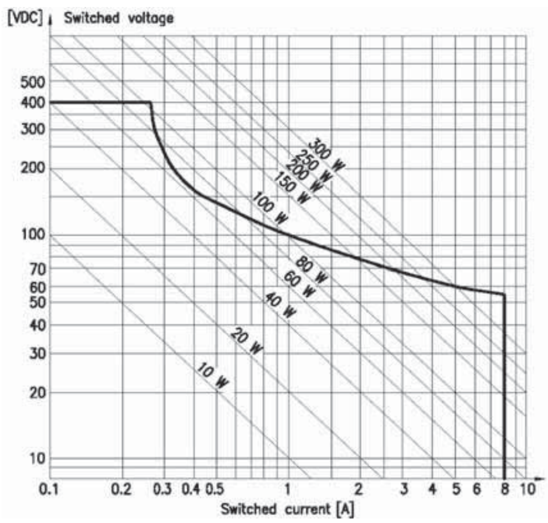
ELECTRICAL LIFE

Voltage	Current	Load type	Frequency	Duty cycle	No. of contacts	No. of ops.
230V AC	8A	AC 1	0.25Hz	25%	4*2	85,000*5
250V AC	6A	AC 1	0.33Hz	50%	4*2 / 8*3	100,000*5
230V AC	6A	AC 1	0.33Hz	10%	2*3	200,000*4,*5
230V AC	30 / 3A	AC 15*1	0.33Hz	10%	1*3	200,000*4,*5
24V DC	8A	DC 1	0.33Hz	10%	2*3	200,000*4,*5
24V DC	3A	DC 13*1	0.33Hz	10%	1*3	50,000*4,*5
24V DC	3A	L/R = 40ms	0.33Hz	10%	1*3	100,000*4,*5

*1 EN 60947-5-1: 1997; table C.1
*2 Breathing hole closed
*3 Breathing hole open
*4 Ambient temperature +70°C
*5 Dielectric strength according to EN61810-1:2004.

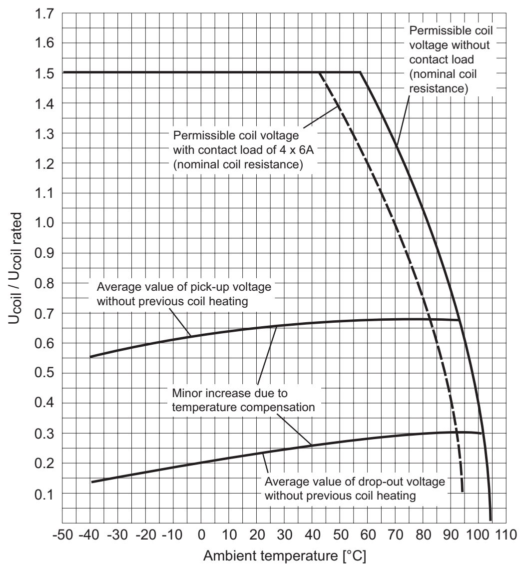
REFERENCE DATA

Load limit curve



Loads in the range under the curve can be switched safely. The arc will extinguish before the opposite contact makes.

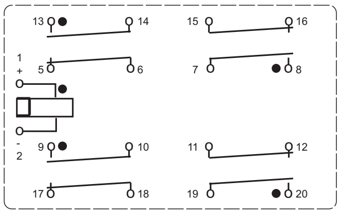
Coil voltage characteristics



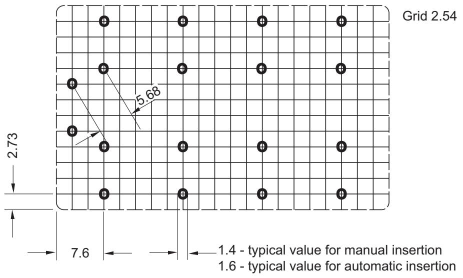
Permissable coil voltages and pick-up and drop-out characteristics at various ambient temperatures.

Safety

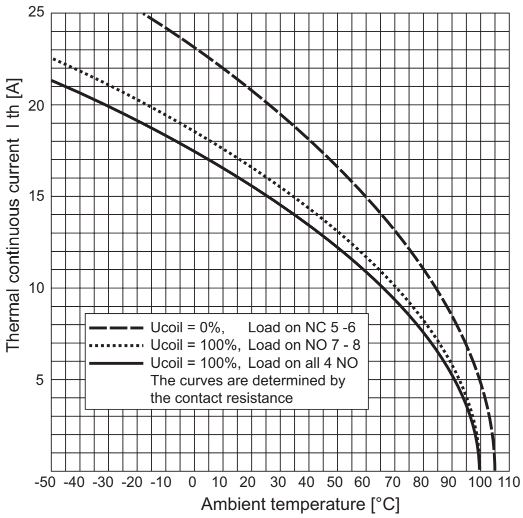
Connection diagram and pcb bore hole data



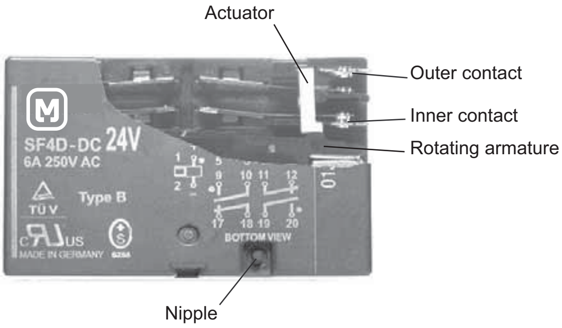
Bottom view
The contacts are shown in the deenergized condition.



Contact current characteristics



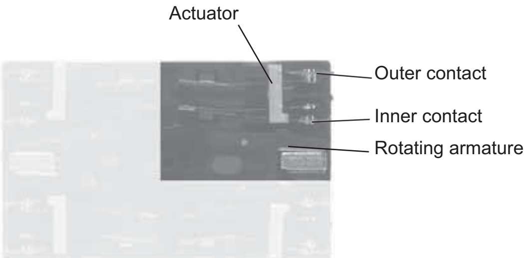
APPLICATION NOTES



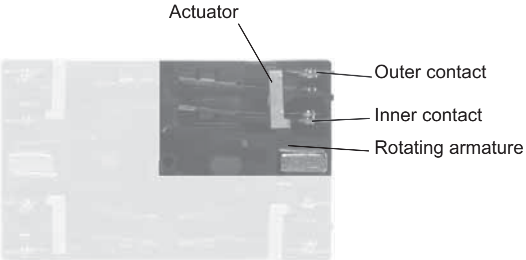
If required a breathing hole can be made in the cover by removing the nipple.
However be aware that the degree of protection will reduce from IP67 to IP30!

Operation of forcibly guided contacts, Type B

If an outer contact should weld, then the forced operated inner contacts driven by the actuator remain open.
The rotating armature remains free to move.
The unaffected contact pairs can operate normally, i.e. their function to make or break remains unaffected.



If an inner contact should weld, then the movement of the rotating armature is blocked via the actuator.
Open contacts of all four contact pairs remain open.
This arrangement corresponds to a conventional forcibly guided contact operation.



For Cautions for Use, see Relay Technical Information (page 582).

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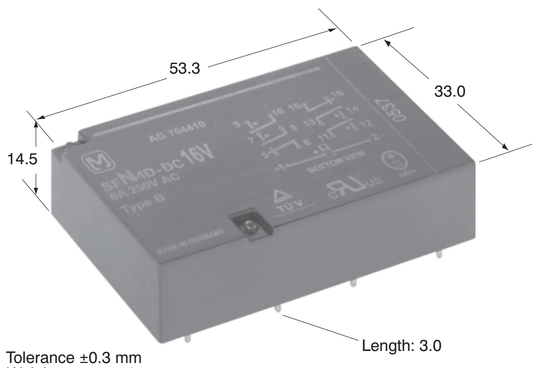
LOW PROFILE SAFETY RELAY WITH FORCIBLY GUIDED DOUBLE CONTACTS

SFN4D RELAY



Tolerance ±0.3 mm
Weight approx. 42 g

Features

- **Relay complies with EN 50205, Type B**
- **Polarized magnet system with snap action function**
- **Extremely small total power loss**
  - Nominal coil power consumption of 390mW
  - Double contacts with low contact resistance,
  e.g. $[(6A)^2 \times 2.5m\Omega] \times 4NO = 360mW$
- **Relay height, 14.5mm**
- **Reinforced insulation according to EN 50178**
  - between coil-contacts and contacts-contacts
  - rated voltage of the circuits 230 / 400V or 277 / 480Vrms
  - rated impulse voltage of 6kV → clearance ≥ 5.5 mm
  - pollution degree 2 → creepage distance ≥ 5.5mm

SPECIFICATIONS

Contact

Contact configuration (a = normally open / NO, b = normally closed / NC)	4a2b
Contact material	$AgSnO_2$, with Au flash
Contact resistance (initial at 6V DC, 1A) Typical contact resistance	≤30mΩ 2.5mΩ
Max. switching capacity	6A/8A*1 250V AC
Max. switching voltage	500V AC / DC
Min. switching voltage / min. switching current	Reference 10V / 10mA
Pick-up / drop-out / bounce time (approx. values at $U_{nominal}$)	23 / 6*2 / 2ms
Mechanical life	10^7ops

Coil

Operate / release and holding at 20°C (% of $U_{nominal}$)*3	75% / 25% min. 48%
Pick-up/nominal power consumption	219-236 / 390-420mW

Characteristics

Max. switching frequency (without load)	5Hz
Permissible ambient temperature at nominal power consumption*3	-25°C to 92°C
Upper temperature limit	105°C
Test voltage: open contact / contact-contact / contact-coil	2500 / 4000 / 5000V_{rms}
Insulation resistance at 500V DC (initial)	$10^9\Omega$
Shock resistance (11ms) NO/NC*4	20 / 15G
Vibration resistance 10 – 200 Hz (10 – 55 Hz, amplitude 2 mm)*4	10G
Degree of protection	RT III*5
Unit weight	42g

Important: Relay characteristics may be influenced by:

- strong external magnetic fields
- magnetic conductive materials near the relay
- narrow top-to-top mounting (printed surface to printed surface)

*1 See "ELECTRICAL LIFE (Reference Data)*1" on page 564.
*2 Without diode
*3 See also "REFERENCE DATA" on page 565.
*4 Contact interruption <10µs
*5 According to EN 61810-1: 2004, table 2

ORDERING INFORMATION

Ex. SFN4D — DC12 V

Coil voltage (DC)
5, 9, 12, 16, 18, 21 24, 36, 48, 60

Notes: 1) Standard packing; Tube: 10 pcs. Case 100 pcs.
2) Other coil voltage available upon request

Safety

COIL DATA (at 20°C)

Part number	Coil nominal voltage V DC	Operate voltage*1 V DC	Release voltage*1 V DC	Coil resistance Ω (±10%, 20°C)
SFN4D-DC5V	5	3.75	1.25	64.1
SFN4D-DC9V	9	6.75	2.25	207.7
SFN4D-DC12V	12	9.00	3.00	369.2
SFN4D-DC16V	16	12.00	4.00	656.4
SFN4D-DC18V	18	13.5	4.50	830.8
SFN4D-DC21V	21	15.75	5.25	1130.8
SFN4D-DC24V	24	18.00	6.00	1476.9
SFN4D-DC36V	36	27.00	9.00	3085.7
SFN4D-DC48V	48	36.00	12.00	5485.7
SFN4D-DC60V	60	45.00	15.00	8571.4

*1 Operate and release voltage at different temperatures, see "REFERENCE DATA" on page 565, coil voltage characteristics.

SWITCHING CAPABILITY

- Making / breaking capacities according to EN 60947-5-1: 2000, table 4 / 5; AC15: 6A 230V AC / DC13: 6A 24V DC
- Endurance / overload test according to UL 508 16 edition, sections 42 / 43; 6A 250V AC / 6A 24V DC; B300 / R300; File E120782

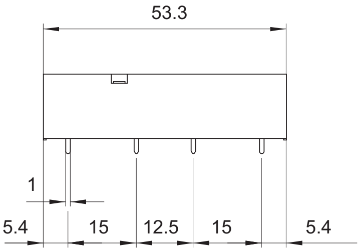
ELECTRICAL LIFE (Reference Data)*1

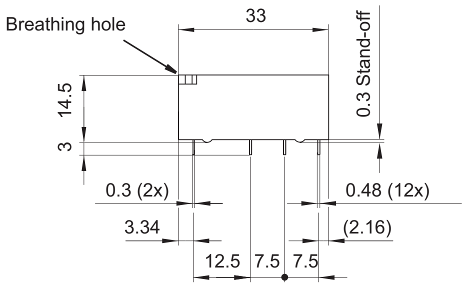
Voltage	Current (A)	Load type	Frequency	Duty cycle	No. of contacts	No. of ops.
230V AC	8	AC 1	0.25Hz	25%	4	85,000
230V AC	6	AC 1	0.25Hz	25%	4	200,000
230V AC	2.5	AC 1	0.25Hz	25%	4	1,500,000
230V AC	60 / 6	AC 15	0.20Hz	20%	3	40,000
24V DC	6	DC 1	0.25Hz	25%	4	2,000,000
250V DC	0.27	DC 13	0.10Hz	10%	4	>1,000,000*2

*1 Test conditions: Room temperature, breathing hole closed, dielectric strength according to EN61810-1:2004.
*2 Has to be confirmed

DIMENSIONS

Outer dimensions

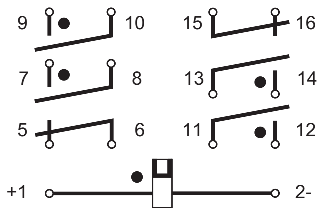




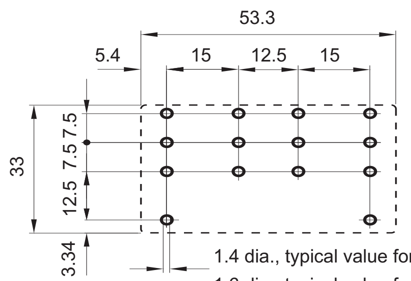
General tolerance: ±0.3

Projection mode:

Schematic (Bottom view)



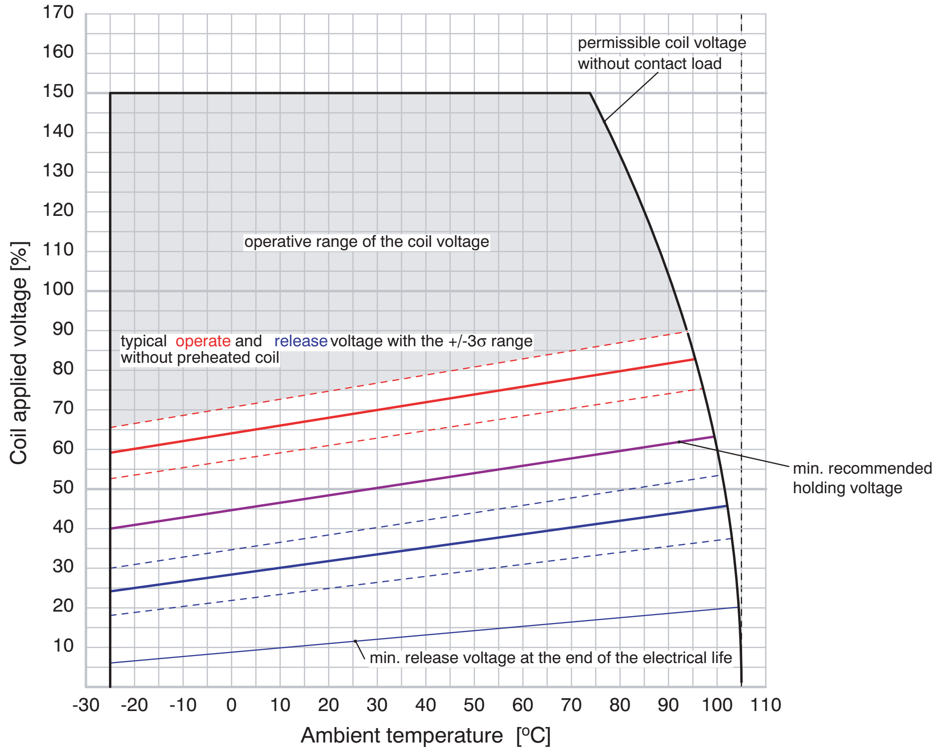
PC board pattern (Bottom view)



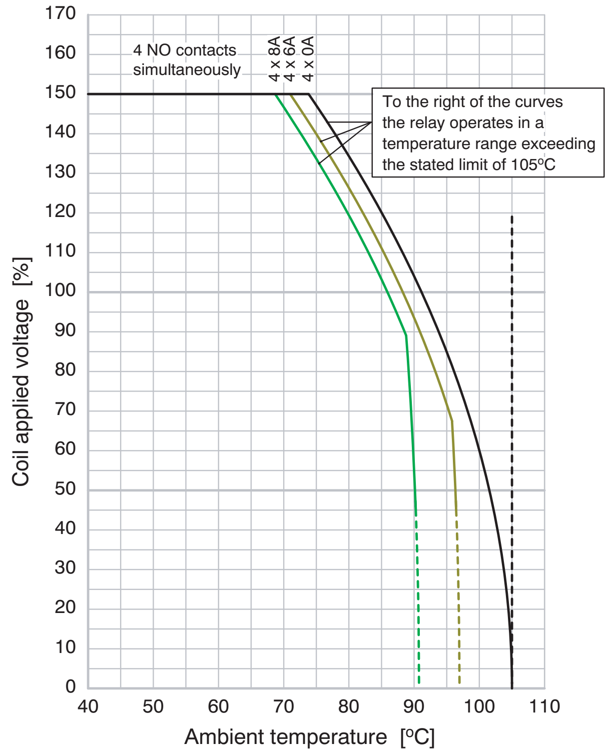
1.4 dia., typical value for manual insertion
1.6 dia., typical value for automatic insertion

REFERENCE DATA

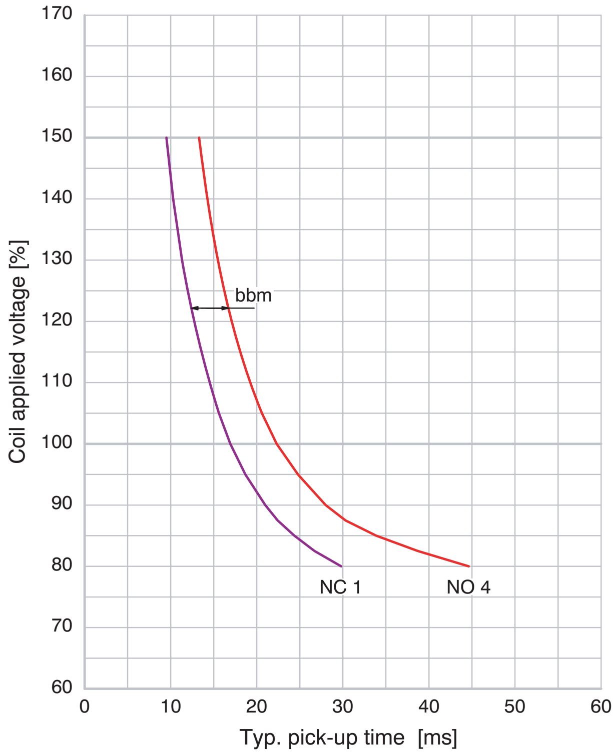
Coil voltage characteristics



Thermic operating range



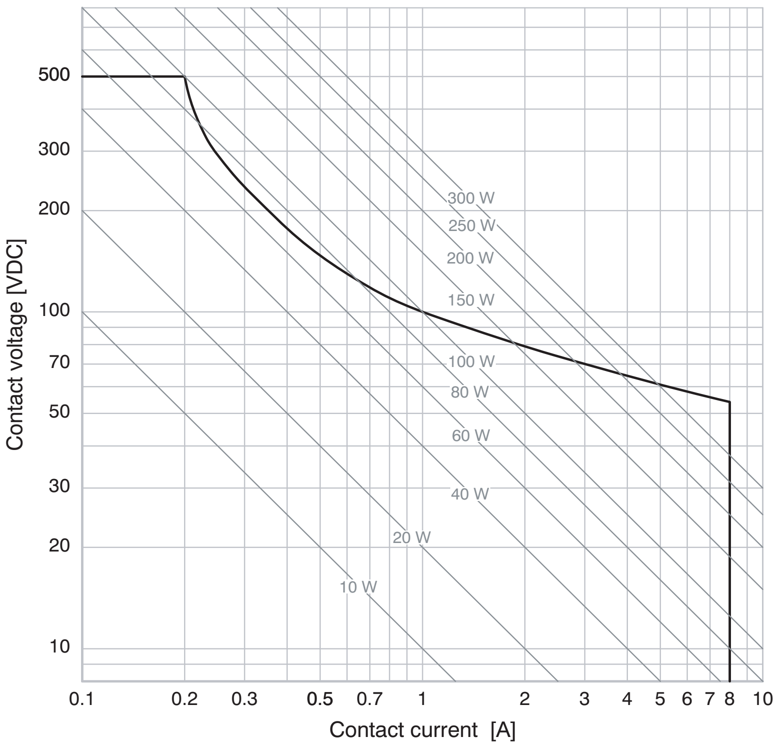
Switching time in relation to coil excitement at 20°C



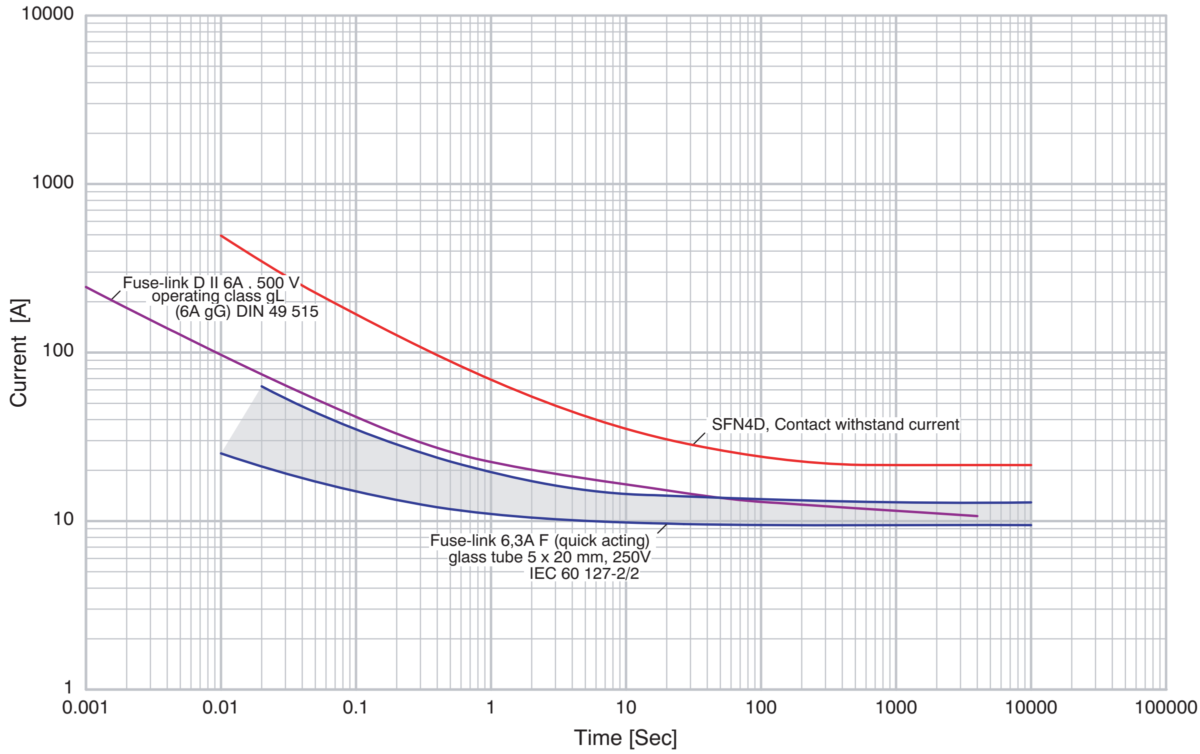
Safety

REFERENCE DATA, continued

Load limit curve

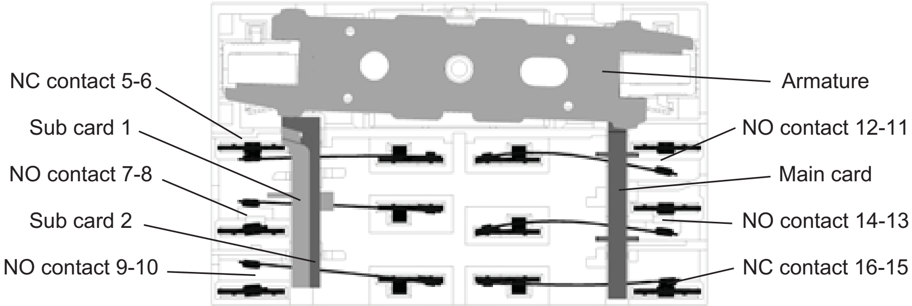


Time / current characteristic

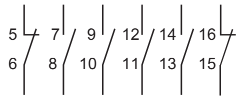


APPLICATION NOTES

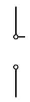
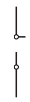
The SFN4D Safety Relay



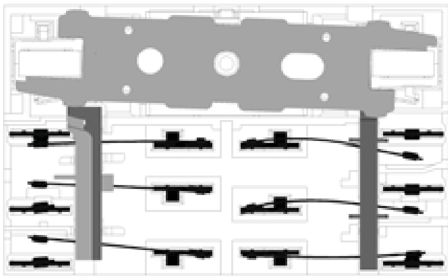
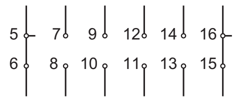
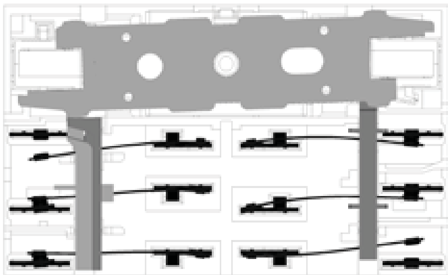
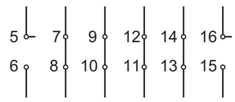
Remark:
Only NC 5-6 monitors all NO contacts!



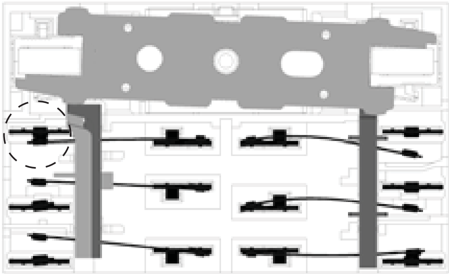
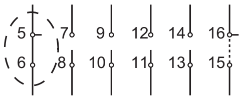
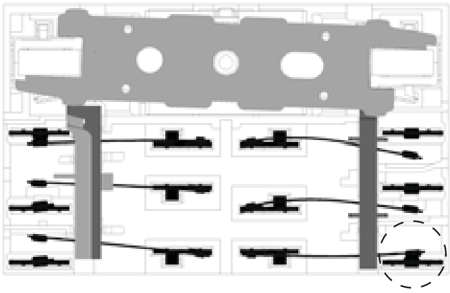
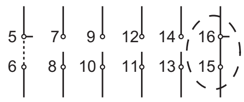
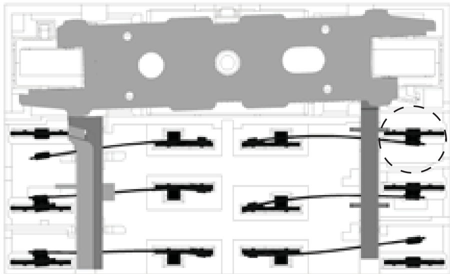
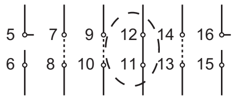
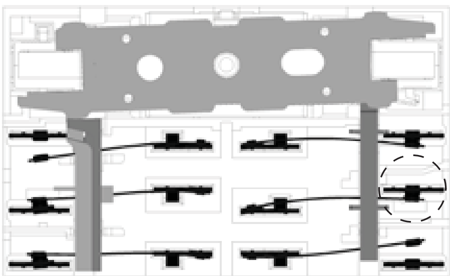
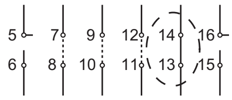
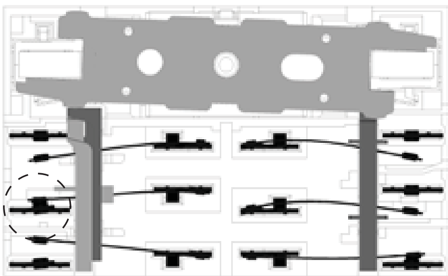
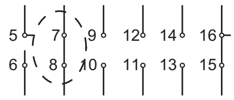
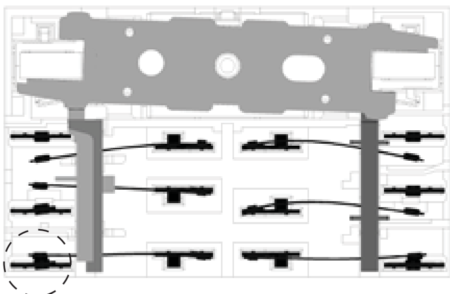
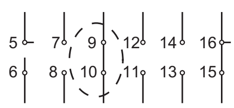
Legend for interpreting contact conditions

Contact	NC (Normally Closed)				NO (Normally Open)			
Condition	Closed	Fully open	Open	Open or closed	Closed	Fully open	Open	Open or closed
Symbol								
Contact gap	0	Maximum (~1.5mm)	>0.5mm (forcibly guided)	Not defined	0	Maximum (~1.5mm)	>0.5mm (forcibly guided)	Not defined

The SFN4D under normal operating conditions

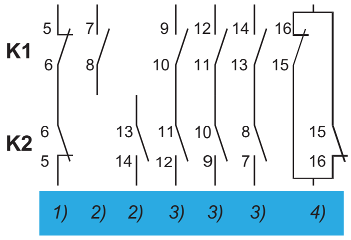
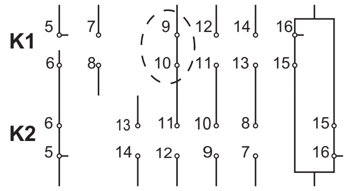
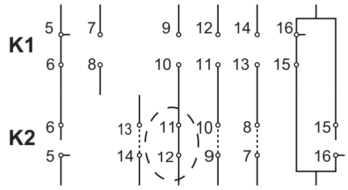
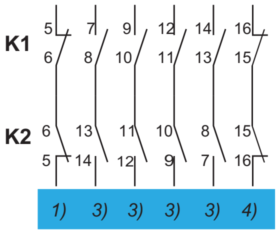
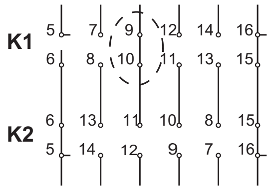
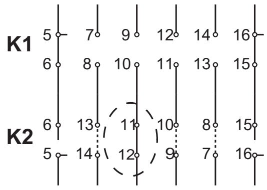
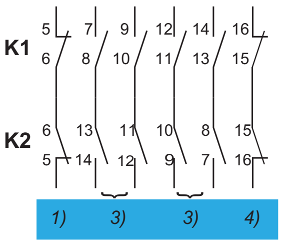
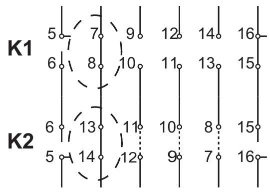
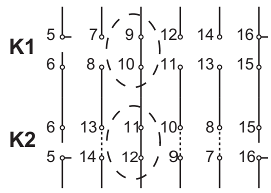
Condition	Illustration of Relay State	Condition of Contacts
- Coil deenergized. - Armature in deenergized position. - NC contacts closed. - NO contacts have a contact gap of approx. 1.5mm.		
- Coil energized. - Armature in energized position. - NO contacts closed. - NC contacts have a contact gap of approx. 1.5mm.		

The SFN4D safety relay with welded contacts

Condition	Illustration of Relay State	Condition of Contacts
- NC 5-6 welded. - Coil energized. - Armature nearly in deenergized position.		 - All NO contacts are forcibly guided. - The NO contact gaps are min. 0.5mm. - For NC 16-15, the contact condition is not defined.
- NC 16-15 welded. - Coil energized. - Armature nearly in deenergized position.		 - All NO contacts are forcibly guided. - The NO contact gaps are min. 0.5mm. - For NC 5-6, the contact condition is not defined.
- NO 12-11 welded. - Coil deenergized. - Armature nearly in energized position.		 - All (both) NC contacts are forcibly guided. - The NC contact gaps are min. 0.5mm. - For all NO contacts, the contact condition is not defined.
- NO 14-13 welded. - Coil deenergized. - Armature in nearly energized position.		 - All (both) NC contacts are forcibly guided. - The NC contact gaps are min. 0.5mm. - For all NO contacts, the contact condition is not defined.
- NO 7-8 welded. - Coil deenergized. - Armature in deenergized position.		 **- NC 16-15 is closed!!** **- All non-welded NO contacts show their max. contact gap.** - NC 5-6 forcibly guided to the welded contact by sub card 1. The contact gap is min. 0.5mm.
- NO 9-10 welded. - Coil deenergized. - Armature in deenergized position.		 **- NC 16-15 is closed!!** **- All non-welded NO contacts show their max. contact gap.** - NC 5-6 forcibly guided to the welded contact by sub card 2. The contact gap is min. 0.5mm.

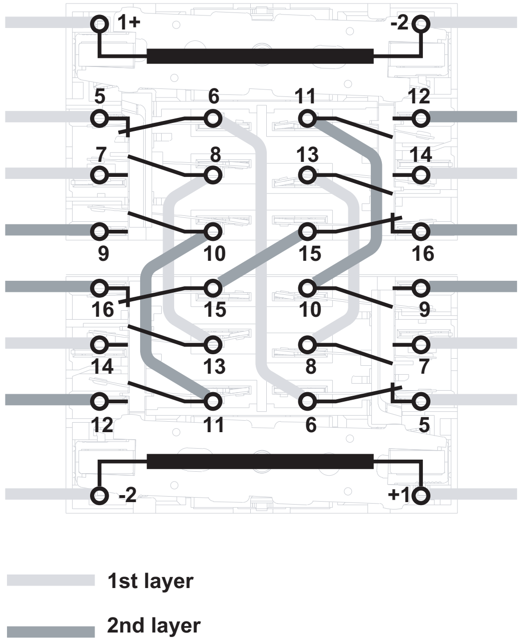
Failure modes, application examples

1) Feedback loop, 2) Self-holding circuit, 3) Safety circuit, 4) Auxilliary contacts

1. Self-holding circuit, three safety circuits 	One contact welded, e.g. NO 9-10 of K1.	Condition of contacts at deenergized coil 
	One contact welded, e.g. NO 12-11 of K2.	Condition of contacts at deenergized coil 
2.1. Four safety circuits  (see wiring example, p. 570)	One contact welded, e.g. NO 9-10 of K1.	Condition of contacts at deenergized coil 
	One contact welded, e.g. NO 12-11 of K2.	Condition of contacts at deenergized coil 
2.2. Two safety circuits  (see wiring example, p. 570)	Both contacts of one path are welded, e.g. NO 7-8 and NO 14-13. A safety circuit needs two paths in this failure mode. The contacts 9-10, 12-11, and 14-13 of K1 interrupt the load.	Condition of contacts at deenergized coil 
	Both contacts of one path are welded, e.g. NO 9-10 and NO 12-11. A safety circuit needs two paths in this failure mode. The contacts 7-8, 12-11, and 14-13 of K1 interrupt the load.	Condition of contacts at deenergized coil 

Safety

Wiring for application examples 2.1 and 2.2

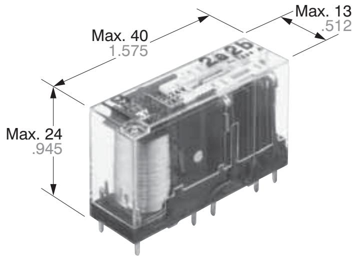


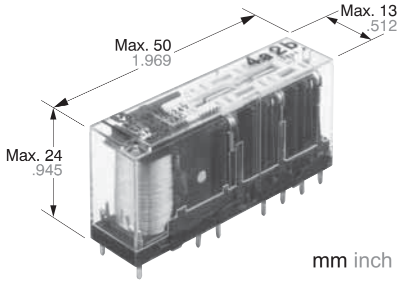
For Cautions for Use, see Relay Technical Information (page 582).

Panasonic
ideas for life

SLIM COMPACT SAFETY RELAY

SF-RELAYS
Slim type





mm inch

FEATURES

- **Forcibly guide contact structure**
  (EN50205 ClassA TÜV recognized)
- **Slim profile (mm inch)**
  Compact size with slim profile relay reduces substrate size.
  [4-pole type]40 (L)×13 (W)×24 (H)
  1.575 (L)×.512 (W)×.945 (H)
  [6-pole type]50 (L)×13 (W)×24 (H)
  1.969 (L)×.512 (W)×.945 (H)
- **Built-in LED indication type available**
  Built-in LED eliminates need for design and mounting of separate LED circuit. This cuts costs and saves labor.
- **Fast response time is achieved (8 ms or less).**
  Circuit is quickly opened to ensure safety.
- **High shock resistance (Functional: Min. 200m/s²)**
  Improved anti-shock properties meaning that the relay can be safely used in high shock and vibration environments such as in machine tools and other factory equipment.
- **PC board sockets also available (4 and 6-poles)**
- **Lineup also includes DIN terminal socket with finger protect construction. (4 and 6-poles)**

TYPICAL APPLICATIONS

- **Machine tools**
- **Robots**
- **Safety PLCs**
- **Circuits with stringent safety standard requirements such as those in motor vehicle production equipment.**

SPECIFICATIONS

Contact

Item		4 poles	6 poles
Contact arrangement		2 Form A/2 Form B 3 Form A/1 Form B	4 Form A/2 Form B 5 Form A/1 Form B 3 Form A/3 Form B
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ	
Contact material		Gold-flashed $AgSnO_2$ type	
Rating (resistive load)	Nominal switching capacity	6 A 250 V AC, 6 A 30 V DC	
	Max. switching power	1,500 VA, 180 W	
	Max. switching voltage	250 V AC, 30 V DC	
	Max. switching current	6 A (Reduce by 0.1 A/°C for temperatures 70 to 85°C.)	
	Min. switching capacity (Reference value) #1	1 mA 5 V DC	
Expected life (min. operations)	Mechanical (at 180 cpm)	10^7	
	Electrical	250 V AC 6 A resistive load: 10^5 (at 20 cpm)	
		30 V DC 6 A resistive load: 10^5 (at 20 cpm)	
		250 V AC 1 A resistive load: 5×10^5 (at 30 cpm)	
		30 V DC 1 A resistive load: 5×10^5 (at 30 cpm)	
		[AC 15] 240 V AC 2 A inductive load: 10^5 (at 20 cpm, $\cos\phi = 0.3$)	
		[DC 13] 24 V DC 1 A inductive load: 10^5 (at 20 cpm, L/R = 48 ms)	

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Coil

	4 poles	6poles
	2 Form A/2 Form B 3 Form A/1 Form B	4 Form A/2 Form B 5 Form A/1 Form B 3 Form A/3 Form B
Nominal operating power	360 mW	500 mW

Characteristics (at 20°C 68°F)

Item		4 poles	6 poles
		2 Form A/2 Form B 3 Form A/1 Form B	4 Form A/2 Form B 5 Form A/1 Form B 3 Form A/3 Form B
Max. operating speed		20 cpm (at nominal voltage)	
Initial insulation resistance*[1]		Min. 1,000 MΩ at 500 V DC	
Initial breakdown voltage*[2]	Between open contacts	1,500 Vrms for 1 min.	
	Between contact sets	2,500 Vrms for 1 min.: 7-8/9-10 between open contacts	2,500 Vrms for 1 min.: 7-8/11-12 between open contacts 9-10/13-14 between open contacts 11-12/13-14 between open contacts
		4,000 Vrms for 1 min.: 3-4/5-6 between open contacts 3-4/7-8 between open contacts 5-6/9-10 between open contacts	4,000 Vrms for 1 min.: 3-4/5-6 between open contacts 3-4/7-8 between open contacts 5-6/9-10 between open contacts 7-8/9-10 between open contacts
	Between contact and coil	4,000 Vrms for 1 min.	
Operate time (at nominal voltage)		Max. 20 ms*[3]	
Response time*[4] (without diode) (at nominal voltage)		Max. 8 ms*[3]	
Release time (without diode) (at nominal voltage)		Max. 20 ms*[3]	
Shock resistance	Functional*[5]	Min. 200 m/s^2	
	Destructive*[6]	Min. 1,000 m/s^2	
Vibration resistance	Functional*[7]	10 to 55 Hz at double amplitude of 1.5 mm	
	Destructive	10 to 55 Hz at double amplitude of 1.5 mm	
Conditions for operation, transport and storage*[8] (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +85°C –40°F to +185°F	
	Humidity	5 to 85% R.H.	
Unit weight		Approx. 20 g Approx. .71 oz	Approx. 23 g Approx. .81 oz

• Outline of performance [Socket for PC board/DIN terminal socket]

Max. carrying current	6 A (Reduce by 0.1 A/°C for temperatures 70 to 85°C.)
Initial breakdown voltage	Between each terminal: 2,500 Vrms for 1 min. (Detection current: 10mA)
Initial insulation resistance*[1]	Min. 1,000 MΩ at 500V DC

*[1] Measurement at same location as “Initial breakdown voltage” section

Remarks

*[1] Measurement at same location as “Initial breakdown voltage” section
*[2] Detection current: 10mA
*[3] Excluding contact bounce time
*[4] Response time is the time after the coil voltage turns off until the time when “a” contact turns off.
*[5] Half-wave pulse of sine wave: 11ms; detection time: 10µs
*[6] Half-wave pulse of sine wave: 6ms
*[7] Detection time: 10µs
*[8] Refer to “NOTES” on page 579, 7. Usage, transport and storage conditions.

ORDERING INFORMATION

Ex. SF S [ ] – [ ] – [ ]

Product name	Contact arrangement	Operation indication	Coil voltage
Slim type	2: 2 Form A/2 Form B 3: 3 Form A/1 Form B 4: 4 Form A/2 Form B 5: 5 Form A/1 Form B 6: 3 Form A/3 Form B	Nil: Without LED indication L: With LED indication	DC12, 16, 18, 21, 24, 48V

Note: Standard packing: Carton 50 pcs. Case 200 pcs. (Accessories: Carton 10 pcs. Case 100 pcs.)
Please inquire about other coil voltages.

TYPES

1. Relay

Contact arrangement		Nominal voltage	Without LED indication	With LED indication
			Part No.	Part No.
4 poles	2 Form A/2 Form B	12 V DC	SFS2-DC12V	SFS2-L-DC12V
		16 V DC	SFS2-DC16V	SFS2-L-DC16V
		18 V DC	SFS2-DC18V	SFS2-L-DC18V
		21 V DC	SFS2-DC21V	SFS2-L-DC21V
		24 V DC	SFS2-DC24V	SFS2-L-DC24V
		48 V DC	SFS2-DC48V	SFS2-L-DC48V
	3 Form A/1 Form B	12 V DC	SFS3-DC12V	SFS3-L-DC12V
		16 V DC	SFS3-DC16V	SFS3-L-DC16V
		18 V DC	SFS3-DC18V	SFS3-L-DC18V
		21 V DC	SFS3-DC21V	SFS3-L-DC21V
		24 V DC	SFS3-DC24V	SFS3-L-DC24V
		48 V DC	SFS3-DC48V	SFS3-L-DC48V
6 poles	4 Form A/2 Form B	12 V DC	SFS4-DC12V	SFS4-L-DC12V
		16 V DC	SFS4-DC16V	SFS4-L-DC16V
		18 V DC	SFS4-DC18V	SFS4-L-DC18V
		21 V DC	SFS4-DC21V	SFS4-L-DC21V
		24 V DC	SFS4-DC24V	SFS4-L-DC24V
		48 V DC	SFS4-DC48V	SFS4-L-DC48V
	5 Form A/1 Form B	12 V DC	SFS5-DC12V	SFS5-L-DC12V
		16 V DC	SFS5-DC16V	SFS5-L-DC16V
		18 V DC	SFS5-DC18V	SFS5-L-DC18V
		21 V DC	SFS5-DC21V	SFS5-L-DC21V
		24 V DC	SFS5-DC24V	SFS5-L-DC24V
		48 V DC	SFS5-DC48V	SFS5-L-DC48V
	3 Form A/3 Form B	12 V DC	SFS6-DC12V	SFS6-L-DC12V
		16 V DC	SFS6-DC16V	SFS6-L-DC16V
		18 V DC	SFS6-DC18V	SFS6-L-DC18V
		21 V DC	SFS6-DC21V	SFS6-L-DC21V
		24 V DC	SFS6-DC24V	SFS6-L-DC24V
		48 V DC	SFS6-DC48V	SFS6-L-DC48V

2. Accessories

Type	No. of poles	Part No.
PC board sockets	4 poles	SFS4-PS
	6 poles	SFS6-PS
DIN terminal socket	4 poles	SFS4-SFD
	6 poles	SFS6-SFD

COIL DATA (at 20°C 68°F)

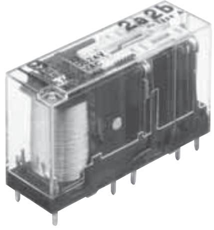
Contact arrangement		Nominal voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
4 poles	2 Form A/2 Form B	12	9	1.2	30	400	Approx. 360	13.2
		16	12	1.6	22.5	711		17.6
		18	13.5	1.8	20	900		19.8
		21	15.75	2.1	17.1	1,225		23.1
		24	18	2.4	15	1,600		26.4
		48	36	4.8	7.5	6,400		52.8
	3 Form A/1 Form B	12	9	1.2	30	400		13.2
		16	12	1.6	22.5	711		17.6
		18	13.5	1.8	20	900		19.8
		21	15.75	2.1	17.1	1,225		23.1
		24	18	2.4	15	1,600		26.4
		48	36	4.8	7.5	6,400		52.8
6 poles	4 Form A/2 Form B	12	9	1.2	41.7	288	Approx. 500	13.2
		16	12	1.6	31.3	512		17.6
		18	13.5	1.8	27.8	648		19.8
		21	15.75	2.1	23.8	882		23.1
		24	18	2.4	20.8	1,152		26.4
		48	36	4.8	10.4	4,608		52.8
	5 Form A/1 Form B	12	9	1.2	41.7	288		13.2
		16	12	1.6	31.3	512		17.6
		18	13.5	1.8	27.8	648		19.8
		21	15.75	2.1	23.8	882		23.1
		24	18	2.4	20.8	1,152		26.4
		48	36	4.8	10.4	4,608		52.8
	3 Form A/3 Form B	12	9	1.2	41.7	288		13.2
		16	12	1.6	31.3	512		17.6
		18	13.5	1.8	27.8	648		19.8
		21	15.75	2.1	23.8	882		23.1
		24	18	2.4	20.8	1,152		26.4
		48	36	4.8	10.4	4,608		52.8

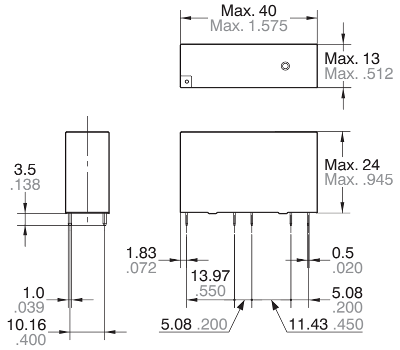
Note: The nominal operating current of the LED indication type increases approximately 2 mA because of the light emitting diode display.

DIMENSIONS

mm inch

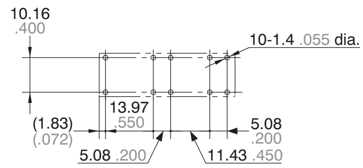
1. 4 poles (2 Form A/2 Form B, 3 FormA/1 Form B)





General tolerance: ±0.3 ±.012

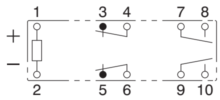
PC board pattern (Bottom view)



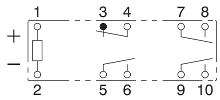
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

Standard

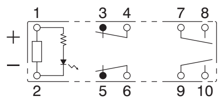


(2 FormA/2 Form B)

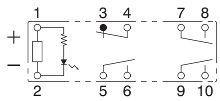


(3 FormA/1 Form B)

With LED indication

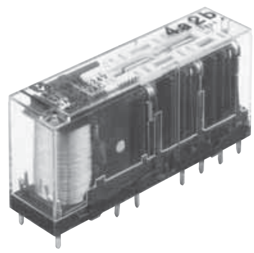


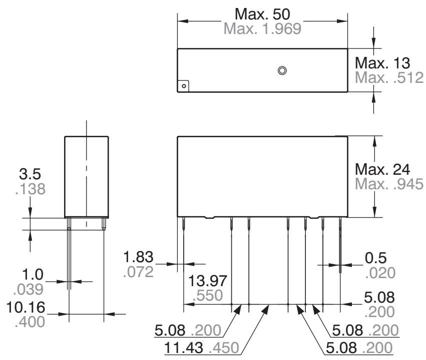
(2 FormA/2 Form B)



(3 FormA/1 Form B)

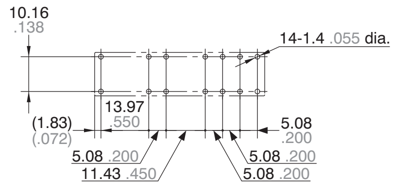
2. 6 poles (4 Form A/2 Form B, 5 FormA/1 Form B, 3 Form A/3 Form B)





General tolerance: ±0.3 ±.012

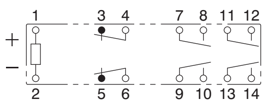
PC board pattern (Bottom view)



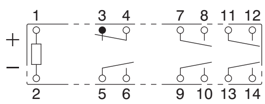
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

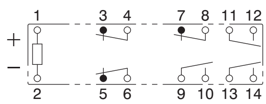
Standard



(4 Form A/2 Form B)

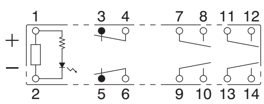


(5 FormA/1 Form B)

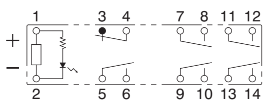


(3 Form A/3 Form B)

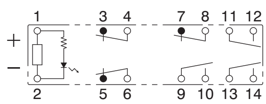
With LED indication



(4 Form A/2 Form B)



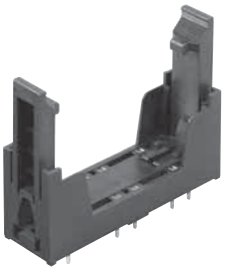
(5 FormA/1 Form B)

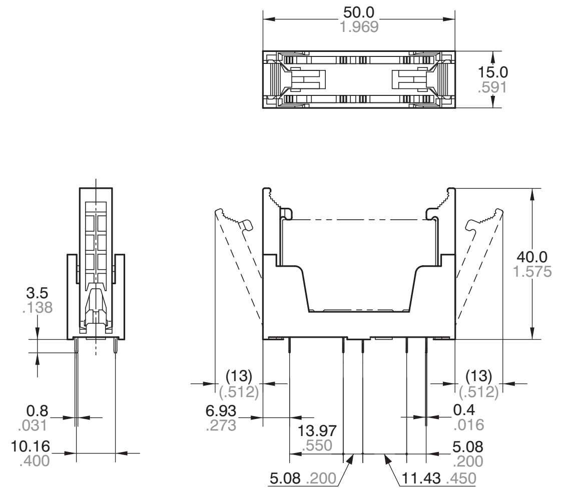


(3 Form A/3 Form B)

3. PC board sockets (4 poles)

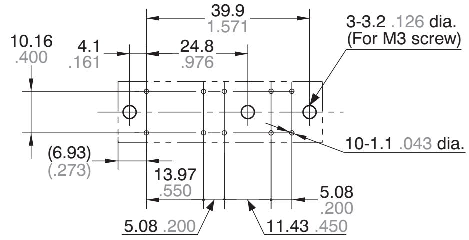
mm inch





General tolerance: ±0.3 ±.012

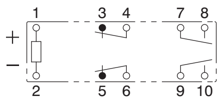
PC board pattern (Bottom view)



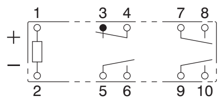
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

Standard

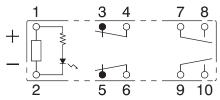


(When 2 FormA/2 Form B mounted)

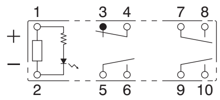


(When 3 FormA/1 Form B mounted)

With LED indication

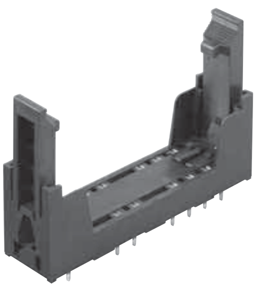


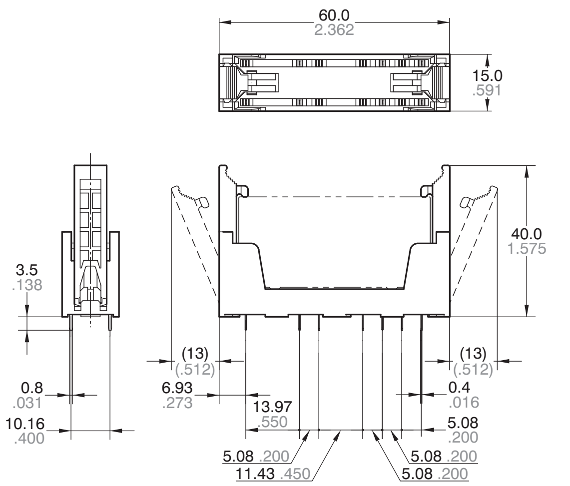
(When 2 FormA/2 Form B mounted)



(When 3 FormA/1 Form B mounted)

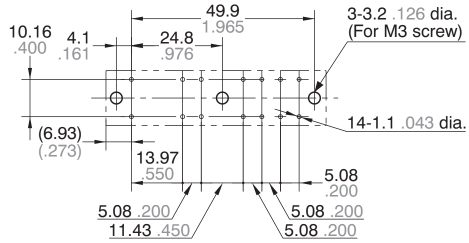
4. PC board sockets (6 poles)





General tolerance: ±0.3 ±.012

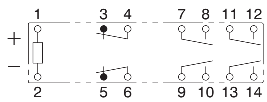
PC board pattern (Bottom view)



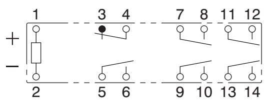
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

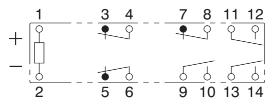
Standard



(When 4 Form A/2 Form B mounted)

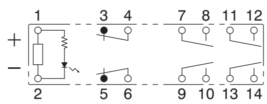


(When 5 FormA/1 Form B mounted)

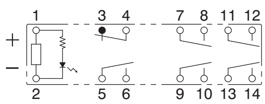


(When 3 Form A/3 Form B mounted)

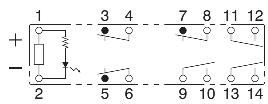
With LED indication



(When 4 Form A/2 Form B mounted)



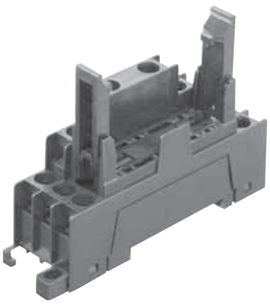
(When 5 FormA/1 Form B mounted)

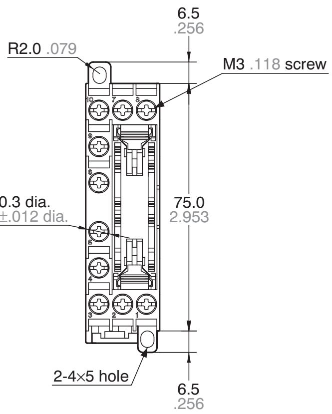


(When 3 Form A/3 Form B mounted)

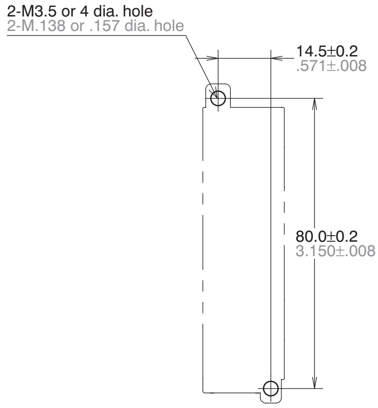
5. DIN terminal socket (4 poles)

mm inch

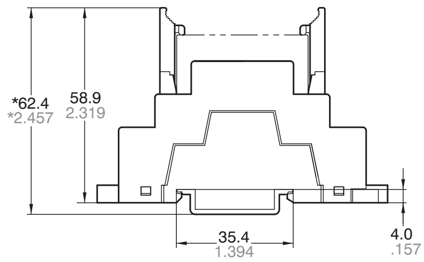


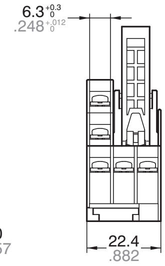


Mounting hole dimensions



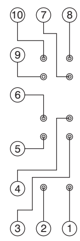
Tolerance: ±0.1 ±.004





General tolerance: ±0.5 ±.020

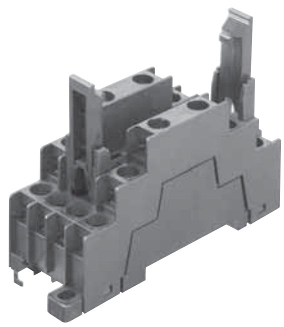
Schematic (Top view)

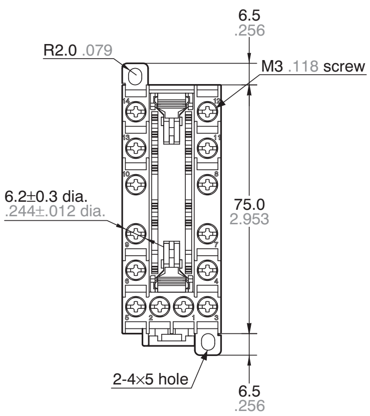


* Reference value (when using DIN rail ATA48011)

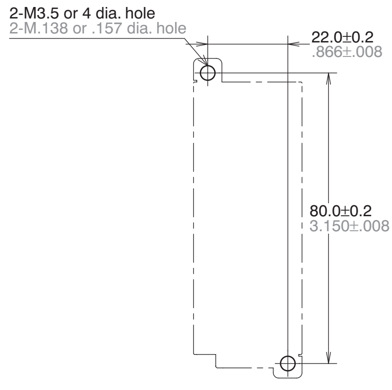
Note: Round terminals cannot be used with DIN terminal sockets.

6. DIN terminal socket (6 poles)

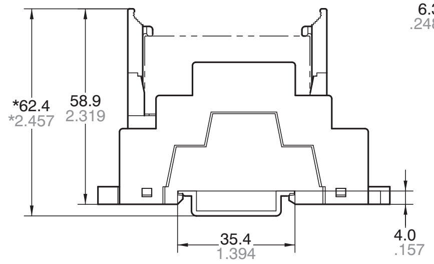


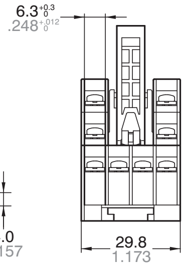


Mounting hole dimensions



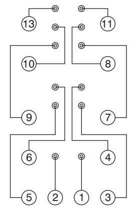
Tolerance: ±0.1 ±.004





General tolerance: ±0.5 ±.020

Schematic (Top view)



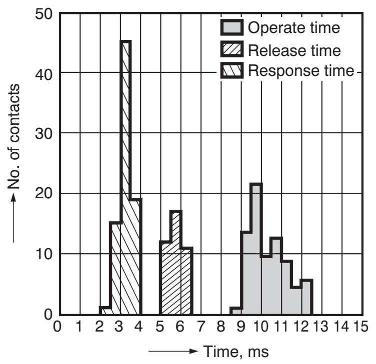
* Reference value (when using DIN rail ATA48011)

Note: Round terminals cannot be used with DIN terminal sockets.

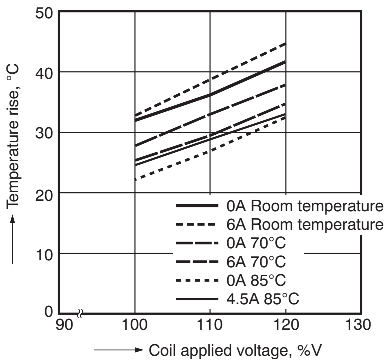
Safety

REFERENCE DATA

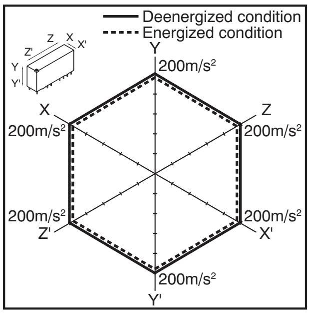
1. Operate/response/release time
Sample: SFS4-DC24V (4 Form A/2 Form B)
Quantity: n = 20 (a contacts: 80, b contacts: 40)



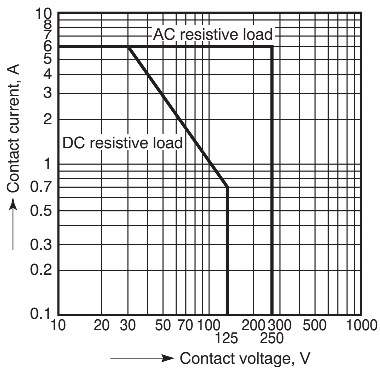
2. Coil temperature rise
Sample: SFS4-DC24V (4 Form A/2 Form B)
Quantity: n = 3
Measured portion: Inside the coil
Ambient temperature: Room temperature
(27°C 80.6°F), 70°C 158°F, 85°C 185°F



3. Malfunctional shock
Sample: SFS4-DC24V (4 Form A/2 Form B)
Quantity: n = 3



4. Max, switching capacity
(2 Form A/2 Form B type)



Other contact gaps when contacts are welded

Sample: SFS4-DC24V (4 Form A/2 Form B)
The table below shows the state of the other contacts.
In case of form “NO” contact weld the coil applied voltage is 0 V.
In case of form “NC” contact weld the coil applied voltage is nominal.

		State of other contacts					
		3-4 (NC)	5-6 (NC)	7-8 (NO)	9-10 (NO)	11-12 (NO)	13-14 (NO)
Welded contact No.	3-4 (NC)			>0.5	>0.5	>0.5	>0.5
	5-6 (NC)			>0.5	>0.5	>0.5	>0.5
	7-8 (NO)	>0.5	>0.5				
	9-10 (NO)	>0.5	>0.5				
	11-12 (NO)	>0.5	>0.5				
	13-14 (NO)	>0.5	>0.5				

>0.5: contact gap is kept at min. 0.5 mm .020inch
Empty cells: either ON or OFF
Note: Contact gaps are shown at the initial state.
If the contact transfer is caused by load switching, it is necessary to check the actual loading.

NOTES

1. Coil operating power
Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%. However, check it with the actual circuit since the characteristics may be slightly different.

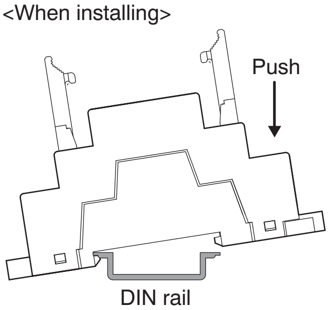
2. Coil connection
When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction.

3. Cleaning
This relay is not sealed, therefore, immersion may cause failure. Be careful that flux does not overflow onto the PC board or penetrate inside the relay.

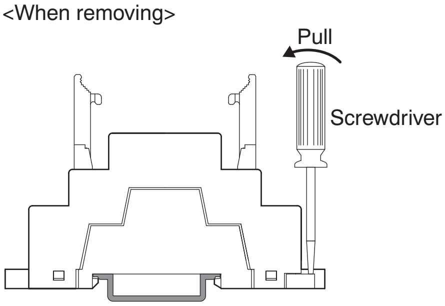
4. Soldering
When using automatic soldering, the following conditions are recommended
1) Preheating: 120°C 248°F, within 120 s max (PC board solder surface).
2) Soldering: 260°C±5°C 500°F±41°F, within 6 s max.

5. Attach directly to the chassis or use a DIN rail.
(1) When attaching directly to chassis
• Use a M3.5 screw, spring washer, and hex nut.
• For the mounting pitch, refer to the dimensions.
(2) When installing on a DIN rail
• Use a 35 mm 1.378 inch wide DIN rail (DIN46277).
• Install and remove as shown in the figures below.

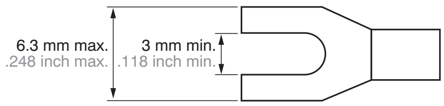
<When installing>



<When removing>



2) Refer to the figure below for applicable wire-pressed terminals.
(You cannot use round type wire-pressed terminals.)

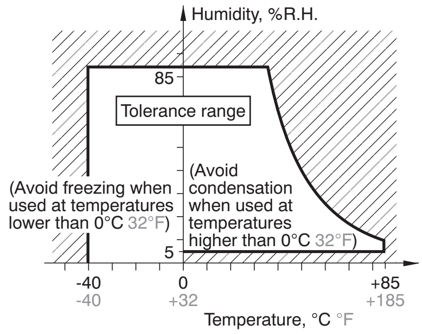


6. Other
1) If the relay has been dropped, the appearance and characteristics should always be checked before use.
2) The switching lifetime is defined under the standard test condition specified in the JIS* C 5442-1996 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%). Check this with the actual product as it is affected by the coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.
Also, be especially careful with loads such as those listed below.
(1) When used for AC load-operation and the operating phase is synchronous.
Rocking and fusing can easily occur due to contact shifting.
(2) During high frequency on/off operation with certain loads, arcing may occur at the contacts. This can cause fusion to Oxygen and Nitrogen gas in the air creating Nitric Acid (HNO_3) which can cause corrosion to the contacts.
Please see the following countermeasure examples:

1. Incorporate an arc-extinguishing circuit.
2. Lower the operating frequency
3. Lower the ambient humidity

3) For secure operations, nominal coil voltage should be applied. In addition, please note that pick-up and drop-out voltage will vary according to the ambient temperature and operating conditions.
4) Heat, smoke, and/or fire may occur if the relay is used outside the allowable ranges for the coil ratings, contact ratings, operating cycle lifetime, and other specifications. Therefore, do not use the relay if these ratings are exceeded. Also, make sure that the relay is wired correctly.
5) Incorrect wiring may cause false operation or generate heat or flames.
6) Check the ambient conditions when storing or transporting the relays and devices containing the relays. Freezing or condensation may occur in the relay causing damage. Avoid exposing the relays to heavy loads, or strong shock and vibration.

7. Usage, transport and storage conditions
1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature:
–40 to +85°C –40 to +185°F
(When the temperature is 70 to 80°C, reduce the 6 A max. switching current by 0.1 A/°C.)
(2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.



(3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage
2) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
3) Freezing
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
4) At low temperature, low humidity environments, the plastic becomes brittle. Please note corrections.

For Cautions for Use, see Relay Technical Information (page 582).

Relay Technical Information

CONFIGURATION AND CONSTRUCTION

PROTECTIVE CONSTRUCTION

1. Dust Cover Type

To protect from dust, these types are covered, for example, with a plastic case. We recommend hand soldering, because these relays are not constructed to prevent flux and cleaning fluid from entering during automatic soldering.

2. Flux-Resistant Type

The relay is constructed so that flux will not enter inside the relay during automatic soldering. However, cleaning is not possible.

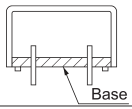
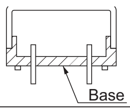
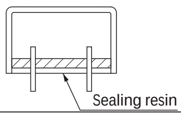
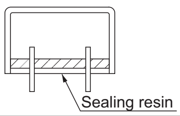
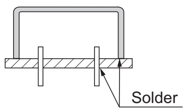
3. Sealed Type

Construction is designed to prevent seeping of flux when soldering and cleaning fluid when cleaning. Harmful substances on the contacts are removed by gas purging before sealing with.

4. Sealed capsule type

This type is hermetically sealed with ceramic and metal plating. No harmful gas or humidity will ever reach the contacts. This type cannot be washed.

CONSTRUCTION AND CHARACTERISTIC

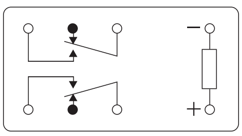
Type	Construction	Characteristics	Automatic Soldering	Automatic Cleaning	Dust Resistance	Harmful Gas Resistance
Dust Cover Type		Most basic construction where the case and base (or body) are fitted together.	Take care	No	Take care	No
Flux-Resistant Type		Terminals are sealed or molded simultaneously. The joint between the case and base is higher than the surface of the PC board.	Yes	No	Take care	No
		Terminals, case, and base are filled with sealing resin.	Yes	No	Take care	No
Sealed Type		Sealed construction with terminals, case and base sealed shut with sealing resin.	Yes	Yes	Yes	Yes*
Sealed capsule type (EP and EV relays only)		Hermetically sealed construction by sealing the metal case and plate, and the terminal and ceramic part, with solder.	No	No	Yes	Yes

*Since the plastic breathes, please do not use in an atmosphere that contains silicone.

OPERATIONAL FUNCTION

1. Single Side Stable Type

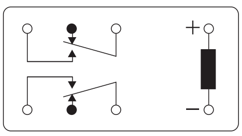
Relay which turns on when the coil is energized and turns off when de-energized.



(Schematic example: DS relay)

2. 1 Coil Latching Type

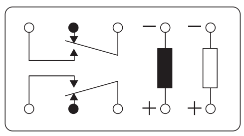
Relay with latching construction that can maintain the on or off state with a pulse input. With one coil, the relay is set or reset by applying signals of opposite polarities.



(Schematic example: DS relay)

3. 2 Coil Latching Type

Relay with latching construction composed of 2 coils: set coil and reset coil. The relay is set or reset by alternately applying pulse signals of the same polarity. The HC latching (keep) relay also has the same function.



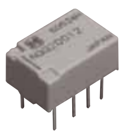
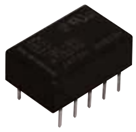
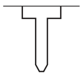
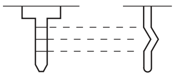
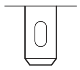
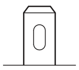
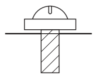
Schematic example: DS relay

4. Operation Indication

Indicates the set and reset states either electrically or mechanically for easy maintenance. An LED type (HC relay with LED), lamp type (HP relay with lamp), and a mechanical display type (HC latching (keep) relay) in which the display panel moves using the movement of the armature, are available.

LED type, HC relay

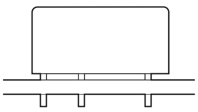
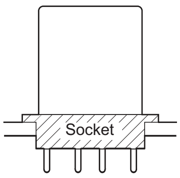
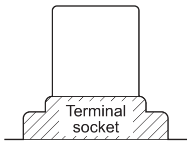
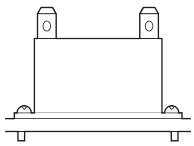
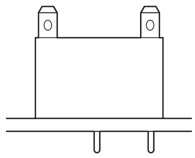
TERMINAL CONFIGURATION

Type	PC board through hole terminal	PC board self-clinching terminal	Plug-in terminal	Quick connect terminal	Screw terminal
Typical relay					
Terminal configuration					
Typical relay type	GQ(AGQ), TX, DS relay	TQ, TX, TN relay	HJ, HN, HP relay	JC, JM relay	HE, EP relay

Note:

A plug-in solder dual type (HG relay) is also available.

MOUNTING METHOD

Type	Insertion mount	Socket mount	Terminal socket mount	TM type	TMP type
Mounting configuration					
Typical relay type	TQ, DS, S relay	NC, HC relay	SP-, HC-, HJ-, HL-, HP-, HG-, JW-, SFS-Relays	HC, JC relay	LE, LF relay

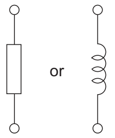
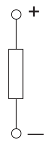
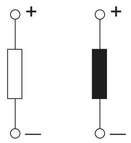
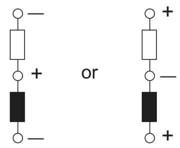
Notes:

- Sockets are available for certain PC board relays (S relay, ST relay).
- M type (solder type) for direct screw mounting of case is also available. (HG relay)

DEFINITION OF RELAY TERMINOLOGY

COIL (also referred to as primary or input)

1. Coil Designation

Single side stable type		1 coil latching type	2 coil latching type	
Non-polarized	Polarized		4-terminal	3-terminal
				

A black coil represents the energized state. For latching relays, schematic diagrams generally show the coil in its reset state. Therefore, the coil symbol is also shown for the reset coil in its reset state.

2. Nominal Coil Voltage

(Rated Coil Voltage)

A single value (or narrow range) of source voltage intended by design to be applied to the coil or input.

3. Nominal Operating Current

The value of current flow in the coil when nominal voltage is impressed on the coil.

4. Nominal Operating Power

The value of power used by the coil at nominal voltage. For DC coils expressed in watts; AC expressed as volt amperes. Nominal Power (W or VA) = Nominal Voltage × Nominal Current.

5. Coil Resistance

This is the DC resistance of the coil in DC type relays for the temperature conditions listed in the catalog. (Note that for certain types of relays, the DC resistance may be for temperatures other than the standard 20°C 68°F.)

6. Pick-Up Voltage

(Pull-In Voltage or Must Operate Voltage)

As the voltage on an unoperated relay is increased, the value at or below which all contacts must function (transfer).

7. Drop-Out Voltage

(Release or Must Release Voltage)

As the voltage on an operated relay is decreased, the value at or above which all contacts must revert to their unoperated position.

8. Maximum Continuous Voltage

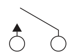
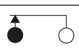
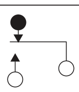
The maximum voltage that can be applied continuously to the coil without causing damage. Short duration spikes of a higher voltage may be tolerable, but this should not be assumed without first checking with the manufacturer.

CONTACTS (secondary or output)

1. Contact Forms

Denotes the contact mechanism and number of contacts in the contact circuit.

2. Contact Symbols

Form A contacts (normally open contacts)	
Form B contacts (normally closed contacts)	
Form C contacts (changeover contacts)	

Form A contacts are also called N.O. contacts or make contacts.

Form B contacts are also called N.C. contacts or break contacts.

Form C contacts are also called changeover contacts or transfer contacts.

3. MBB Contacts

Abbreviation for make-before-break contacts. Contact mechanism where Form A contacts (normally open contacts) close before Form B contacts open (normally closed contacts).

4. Rated Switching Power

The design value in watts (DC) or volt amperes (AC) which can safely be switched by the contacts. This value is the product of switching voltage x switching current, and will be lower than the maximum voltage and maximum current product.

5. Maximum Switching Voltage

The maximum open circuit voltage which can safely be switched by the contacts. AC and DC voltage maximums will differ in most cases.

6. Maximum Switching Current

The maximum current which can safely be switched by the contacts. AC and DC current maximums may differ.

7. Maximum Switching Power

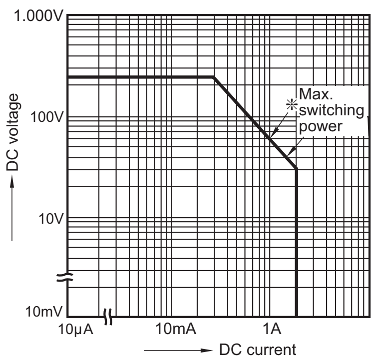
The upper limit of power which can be switched by the contacts. Care should be taken not to exceed this value.

8. Maximum Switching Capacity

This is listed in the data column for each type of relay as the maximum value of the contact capacity and is an interrelationship of the maximum switching power, maximum switching voltage, and maximum switching current. The switching current and switching voltage can be obtained from this graph.

For example, if the switching voltage is fixed in a certain application, the maximum switching current can be obtained from the intersection between the voltage on the axis and the maximum switching power.

Maximum switching capacity



Example: Using TX relay at a switching voltage of 60V DC, the maximum switching current is 1A.

(*Maximum switching capacity is given for a resistive load. Be sure to carefully check the actual load before use.)

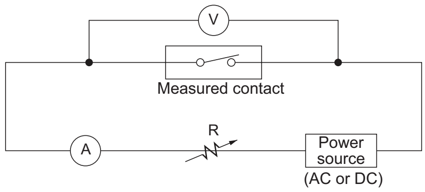
9. Minimum switching capability

This value is a guideline as to the lowest possible level at which it will be possible for a low level load to allow switching. The level of reliability of this value depends on switching frequency, ambient conditions, change in the desired contact resistance, and the absolute value. Please use a relay with AgPd contacts if your needs analog low level loads, control, or a contact resistance of 100 mΩ or less.

We recommend that you verify with one of our sales offices regarding usage.

10.Contact Resistance

This value is the combined resistance of the resistance when the contacts are touching each other, the resistance of the terminals and contact spring. The contact resistance is measured using the voltage-drop method as shown below. The measuring currents are designated.



Ⓐ:Ammeter Ⓥ: Voltmeter Ⓡ:Variable resistor

Test Currents

Rated Contact Current or Switching Current (A)	Test Current (mA)
Less than 0.01	1
0.01 or more and less than 0.1	10
0.1 or more and less than 1	100
1 or more	1,000

The resistance can be measured with reasonable accuracy on a YHP 4328A milliohmmeter.

In general, for relays with a contact rating of 1A or more, measure using the voltage-drop method at 1A 6V DC.

11.Maximum Carrying Current

The maximum current which after closing or prior to opening, the contacts can safely pass without being subject to temperature rise in excess of their design limit, or the design limit of other temperature sensitive components in the relay (coil, springs, insulation, etc.). This value is usually in excess of the maximum switching current.

12.Capacitance

This value is measured between the terminals at 1kHz and 20°C 68°F

ELECTRICAL PERFORMANCE

1. Insulation Resistance

The resistance value between all mutually isolated conducting sections of the relay, i.e. between coil and contacts, across open contacts and between coil or contacts to any core or frame at ground potential. This value is usually expressed as “initial insulation resistance” and may decrease with time, due to material degradation and the accumulation of contaminants.

- Between coil and contacts
- Between open contacts
- Between contact sets
- Between set coil and reset coil

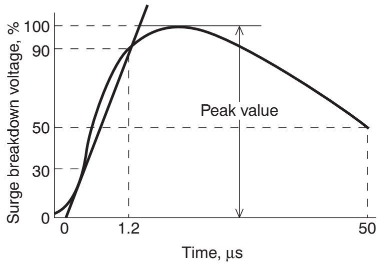
2. Breakdown Voltage

(Hi-Pot or Dielectric Strength)

The maximum voltage which can be tolerated by the relay without damage for a specified period of time, usually measured at the same points as insulation resistance. Usually the stated value is in VAC (RMS) for one minute duration.

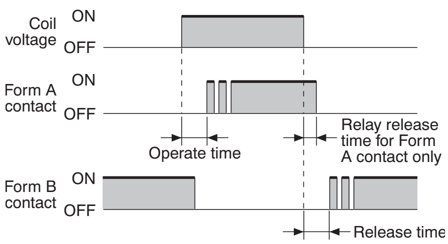
3. Surge Breakdown Voltage

The ability of the device to withstand an abnormal externally produced power surge, as in a lightning strike, or other phenomenon. An impulse test waveform is usually specified, indicating rise time, peak value and fall time.



4. Operate Time (Set Time)

The elapsed time from the initial application of power to the coil, until the closure of the Form A (normally open) contacts. (With multiple pole devices the time until the last contact closes.) This time does not include any bounce time.



5. Release Time (Reset Time)

The elapsed time from the initial removal of coil power until the reclosure of the Form B (normally closed) contacts (last contact with multi-pole). This time does not include any bounce time.

6. Contact Bounce (Time)

Generally expressed in time (ms), this refers to the intermittent switching phenomenon of the contacts which occurs due to the collision between the movable metal parts or contacts, when the relay is operated or released.

Definition of Relay Terminology

MECHANICAL PERFORMANCE AND LIFE

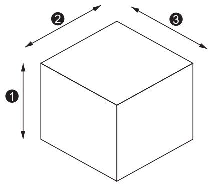
1. Shock Resistance

1) Functional

The acceleration which can be tolerated by the relay during service without causing the closed contacts to open for more than the specified time.
(usually 10 μs)

2) Destructive

The acceleration which can be withstood by the relay during shipping or installation without it suffering damage, and without causing a change in its operating characteristics. Usually expressed in “G”s. However, test was performed a total of 18 times, six times each in three-axis directions.



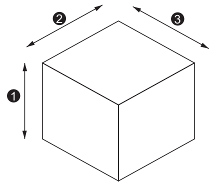
2. Vibration Resistance

1) Functional

The vibration which can be tolerated by the relay during service, without causing the closed contacts to open for more than the specified time.

2) Destructive

The vibration which can be withstood by the relay during shipping, installation or use without it suffering damage, and without causing a change in its operating characteristics. Expressed as an acceleration in G’s or displacement, and frequency range. However, test was performed a total of six hours, two hours each in three-axis directions.



3. Mechanical Life

The minimum number of times the relay can be operated under nominal conditions (coil voltage, temperature, humidity, etc.) with no load on the contacts.

4. Electrical Life

The minimum number of times the relay can be operated under nominal conditions with a specific load being switched by the contacts.

5. Maximum Switching Frequency

This refers to the maximum switching frequency which satisfies the mechanical life or electrical life under repeated operations by applying a pulse train at the rated voltage to the operating coil.

6. Life Curve

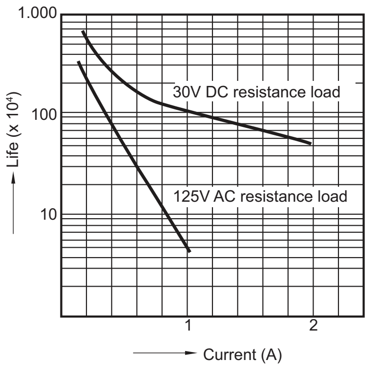
This is listed in the data column for each type of relay. The life (number of operations) can be estimated from the switching voltage and switching current. For example, for a DS relay operating at:

Switching voltage = 125V AC

Switching current = 0.6A

The life expectancy is 300,000 operations. However, this value is for a resistive load. Be sure to carefully check the actual load before use.

Life Curve



HIGH FREQUENCY CHARACTERISTICS

1. Isolation

High frequency signals leak through the stray capacitance across contacts even if the contacts are separated. This leak is called isolation. The symbol dB (decibel) is used to express the magnitude of the leak signal. This is expressed as the logarithm of the magnitude ratio of the signal generated by the leak with respect to the input signal. The larger the magnitude, the better the isolation.

2. Insertion Loss

At the high frequency region, signal disturbance occurs from self-induction, resistance, and dielectric loss as well as from reflection due to impedance mismatching in circuits. Loss due to any of these types of disturbances is called insertion loss. Therefore, this refers to the magnitude of loss of the input signal. The smaller the magnitude, the better the relay.

3. V.S.W.R.

(Voltage Standing Wave Ratio)

High frequency resonance is generated from the interference between the input signal and reflected (wave) signal.

V.S.W.R. refers to the ratio of the maximum value to minimum value of the waveform. The V.S.W.R. is 1 when there is no reflected wave. It usually becomes greater than 1.

Notes:

1. Except where otherwise specified, the tests above are conducted under standard temperature and humidity (15°C to 35°C 59°F to 95°F, 25 to 75%).
2. The coil impressed voltage in the switching tests is a rectangular wave at the rated voltage.
3. The phase of the AC load operation is random.

GENERAL APPLICATION GUIDELINES

A relay may encounter a variety of ambient conditions during actual use resulting in unexpected failure. Therefore, testing over a practical range under actual operating conditions is necessary. Application considerations should be reviewed and determined for proper use of the relay.

SAFETY PRECAUTIONS

- Use that exceeds the specification ranges such as the coil rating, contact rating and switching life should be absolutely avoided. Doing so may lead to abnormal heating, smoke, and fire.
- Never touch live parts when power is applied to the relay. Doing so may cause electrical shock. When installing, maintaining, or troubleshooting a relay (including connecting parts such as terminals and sockets) be sure that the power is turned off.
- When connecting terminals, please follow the internal connection diagrams in the catalog to ensure that connections are done correctly. Be warned that an incorrect connection may lead to unexpected operation error, abnormal heating, and fire.
- If the possibility exists that faulty adhesion or contact could endanger assets or human life, take double safety precautions and make sure that operation is foolproof.

[1] METHOD OF DETERMINING SPECIFICATIONS

In order to use the relays properly, the characteristics of the selected relay should be well known, and the conditions of use of the relay should be investigated to determine whether they are matched to the environmental conditions, and at the same time, the coil conditions, contact conditions, and the ambient conditions for the relay that is actually used must be sufficiently known in advance. In the table below, a summary has been made of the points of consideration for relay selection. It may be used as a reference for investigation of items and points of caution.

Specification item		Consideration points regarding selection
Coil	a) Rating b) Pick-up voltage/current c) Drop-out voltage/current d) Maximum continuous voltage/current e) Coil resistance f) Impedance g) Temperature rise	1) Select relay with consideration for power source ripple. 2) Give sufficient consideration to ambient temperature, for the coil temperature rise and hot start. 3) When used in conjunction with semiconductors, additional attention to the application should be taken. Be careful of voltage drops when starting up.
Contacts	a) Contact arrangement b) Contact rating c) Contact material d) Life e) Contact resistance	1) It is desirable to use a standard product with more than the required number of contacts. 2) It is beneficial to have the relay life balanced with the life of the device it is used in. 3) Is the contact material matched to the type of load? It is necessary to take care particularly with low level usage. 4) The rated life may become reduced when used at high temperatures. Life should be verified in the actual atmosphere used. 5) Depending on the circuit, the relay drive may synchronize with the AC load. As this will cause a drastic shortening of life should be verified with the actual machine.
Operate time	a) Operate time b) Release time c) Bounce time d) Switching frequency	1) It is beneficial to make the bounce time short for sound circuits and similar applications.
Mechanical characteristics	a) Vibration resistance b) Shock resistance c) Ambient temperature d) Life	1) Give consideration to performance under vibration and shock in the use location. 2) In particular, when used in high temperature applications, relay with class B or class F coil insulation may be required.
Other items	a) Breakdown voltage b) Mounting method c) Size d) Protective construction	1) Selection can be made for connection method with plug-in type, PC board type, soldering, tab terminals, and screw fastening type. 2) For use in an adverse atmosphere, sealed construction type should be selected. 3) When used in adverse environments, use the sealed type. 4) Are there any special conditions?

BASICS ON RELAY HANDLING

- To maintain initial performance, care should be taken to avoid dropping or hitting the relay.
- Under normal use, the relay is designed so that the case will not detach. To maintain initial performance, the case should not be removed. Relay characteristics cannot be guaranteed if the case is removed.
- Use of the relay in an atmosphere at standard temperature and humidity with minimal amounts of dust, SO_2, H_2S, or organic gases is recommended.
  For installation in adverse environments, one of the sealed types should be considered.
  Please avoid the use of silicone-based resins near the relay, because doing so may result in contact failure. (This applies to plastic sealed type relays, too.)
- Care should be taken to observe correct coil polarity (+, –) for polarized relays.
- Proper usage requires that the rated voltage be impressed on the coil. Use rectangular waves for DC coils and sine waves for AC coils.
- Be sure the coil impressed voltage does not continuously exceed the maximum allowable voltage.
- The rated switching power and life are given only as guides. The physical phenomena at the contacts and contact life greatly vary depending on the type of load and the operating conditions. Therefore, be sure to carefully check the type of load and operating conditions before use.
- Do not exceed the usable ambient temperature values listed in the catalog.
- Use the flux-resistant type or sealed type if automatic soldering is to be used.
- Use alcohol based cleaning solvents when cleaning is to be performed using a sealed type relay. Avoid ultrasonic cleaning of all types of relays.
- As a guide, use a Faston mounting pressure of 40 to 70N {4 to 7kgf} for relays with tab terminals.
- Avoid bending terminals, because it may cause malfunction.
- For proper use, read the main text for details.

[2] PRECAUTIONS REGARDING COIL INPUT

Application of the rated voltage is the most basic requirement for accurate relay operation. Although the relay will work if the voltage applied exceeds the pick-up voltage, it is required that only the rated voltage be applied to the coil out of consideration for changes in coil resistance, etc., due to differences in power supply type, voltage fluctuations, and rises in temperature. Also, caution is required, because problems such as layer shorts and burnout in the coil may occur if the voltage applied exceeds the maximum that can be applied continuously. The following section contains precautions regarding coil input. Please refer to it in order to avoid problems.

1. Basic Precautions Regarding Coil

• AC operation type

For the operation of AC relays, the power source is almost always a commercial frequency (50 or 60Hz) with standard voltages of 6, 12, 24, 48, 115, 120, 230 and 240V AC. Because of this, when the voltage is other than the standard voltage, the product is a special order item, and the factors of price, delivery, and stability of characteristics may create inconveniences. To the extent that it is possible, the standard voltages should be selected.

Also, in the AC type, shading coil resistance loss, magnetic circuit eddy current loss, and hysteresis loss exit, and because of lower coil efficiency, it is normal for the temperature rise to be greater than that for the DC type.

Furthermore, because humming occurs when below the pick-up voltage and when above the rated voltage, care is required with regard to power source voltage fluctuations.

For example, in the case of motor starting, if the power source voltage drops, and during the humming of the relay, if it reverts to the restored condition, the contacts suffer a burn damage and welding, with the occurrence of a false operation self-maintaining condition.

For the AC type, there is an inrush current during the operation time (for the separated condition of the armature, the impedance is low and a current greater than rated current flows; for the adhered condition of the armature, the impedance is high and the rated value of current flows), and because of this, for the case of several relays being used in parallel connection, it is necessary to give consideration to power consumption.

• DC operation type

For the operation of DC relays, standards exist for power source voltage and current, with DC voltage standards set at 5, 6, 12, 24, 48, and 100V, but with regard to current, the values as expressed in catalogs in milliamperes of pick-up current.

However, because this value of pick-up current is nothing more than a guarantee of just barely moving the armature, the variation in energizing voltage and resistance values, and the increase in coil resistance due to temperature rise, must be given consideration for the worst possible condition of relay operation, making it necessary to consider the current value as 1.5 to 2 times the pick-up current. Also, because of the extensive use of relays as limit devices in place of meters for both voltage and current, and because of the gradual increase or decrease of current impressed on the coil causing possible delay in movement of the contacts, there is the possibility that the designated control capacity may not be satisfied. Thus it is necessary to exercise care. The DC type relay coil resistance varies due to ambient temperature as well as to its own heat generation to the extent of about 0.4%/°C, and accordingly, if the temperature increases, because of the increase in pic k-up and drop-out voltages, care is required.

(However, for some polarized relays, this rate of change is considerably smaller.)

2. Power Source for Coil Input

• Energizing voltage of AC coil

In order to have stable operation of the relay, the energizing voltage should be basically within the range of +10%/-15% of the rated voltage. However, it is necessary that the waveform of the voltage impressed on the coil be a sine wave. There is no problem if the power source is commercially provided power, but when a stabilized AC power source is used, there is a waveform distortion due to that equipment, and there is the possibility of abnormal overheating. By means of a shading coil for the AC coil, humming is stopped, but with a distorted waveform, that function is not displayed. Figure 1 shows an example of waveform distortion.

If the power source for the relay operating circuit is connected to the same line as motors, solenoids, transformers, and other loads, when these loads operate, the line voltage drops, and because of this the relay contacts suffer the effect of vibration and subsequent burn damage. In particular, if a small type transformer is used and its capacity has no margin of safety, when there is long wiring, or in the case of household used or small sales shop use where the wiring is slender, it is necessary to take precautions because of the normal voltage fluctuations combined with these other factors. When trouble develops, a survey of the voltage situation should be made using a synchroscope or similar means, and the necessary counter-measures should be taken, and together with this determine whether a special relay with suitable excitation characteristics should be used, or make a change in the DC circuit as shown in Figure 2 in which a capacitor is inserted to absorb the voltage fluctuations.

In particular, when a magnetic switch is being used, because the load becomes like that of a motor, depending upon the application, separation of the operating circuit and power circuit should be tried and investigated.

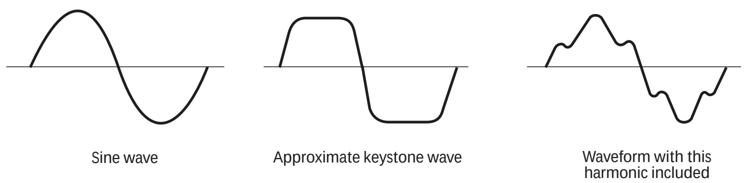


Figure 1 Distortion in an AC stabilized power source

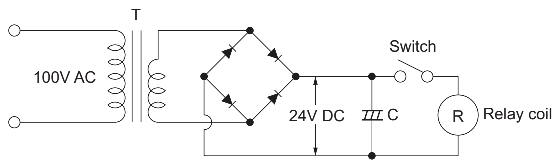


Figure 2 Voltage fluctuation absorbing circuit using a condenser

• Power source for DC input

We recommend that the voltage applied to both ends of the coil in DC type relays be within ±5% of the rated coil voltage.

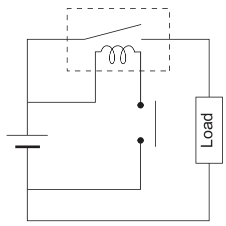
As a power source for the DC type relay, a battery or either a half wave or full wave rectifier circuit with a smoothing capacitor is used. The characteristics with regard to the pick-up voltage of the relay will change depending upon the type of power source, and because of this, in order to display stable characteristics, the most desirable method is perfect DC.

In the case of ripple included in the DC power source, particularly in the case of half wave rectifier circuit with a smoothing capacitor, if the capacity of the capacitor is too small, due to the influence of the ripple, humming develops and an unsatisfactory condition is produced. With the actual circuit to be used, it is absolutely necessary to confirm the characteristics.

It is necessary to give consideration to the use of a DC power source with less than a 5% ripple. Also ordinarily the following must be given thought.

- It is desirable to have less than a 5% ripple for the reed type relay.
- For the hinge type relay, a half wave rectifier cannot be used, alone unless you use a smoothing capacitor. The ripple and the characteristics must be evaluated for proper usage.
- For the hinge type relay, there are certain applications that may or maynot use the full wave rectifier on it’s own. Please check specifications with the original manufacture.
- Coil applied voltage and the drop in voltage
  Shown following is a circuit driven by the same power supply (battery, etc.) for both the coil and contact.
  Electrical life will be affected by the drop in voltage in the coil when load is turned on.

Please verify that the actual voltage is applied to the coil at the actual load.



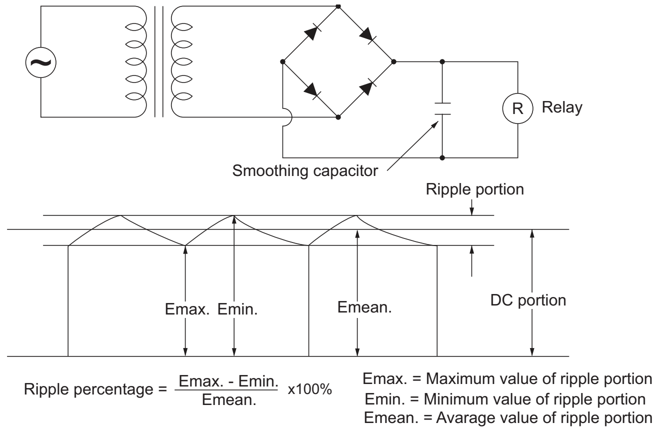


Figure 3

3. Maximum Continuous Voltage and Temperature Rise

Proper usage requires that the rated voltage be impressed on the coil. Note, however, that if a voltage greater than or equal to the maximum continuous voltage is impressed on the coil, the coil may burn or its layers short due to the temperature rise. Furthermore, do not exceed the usable ambient temperature range listed in the catalog.

- **Maximum continuous voltage**

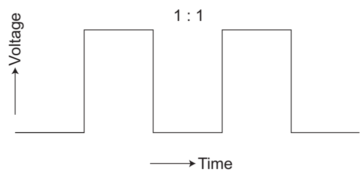
In addition to being a requirement for relay operation stability, the maximum continuous voltage is an important constraint for the prevention of such problems as thermal deterioration or deformity of the insulation material, or the occurrence of fire hazards.

In actual use with E-type insulation, when the ambient temperature is 40°C 104°F, a temperature rise limit of 80°C 176°F is thought to be reasonable according to the resistance method. However, when complying with the Electrical Appliance and Material Safety Law, this becomes 75°C 167°F.

- **Temperature rise due to pulse voltage**

When a pulse voltage with ON time of less than 2 minutes is used, the coil temperature rise bares no relationship to the ON time. This varies with the ratio of ON time to OFF time, and compared with continuous current passage, it is rather small. The various relays are essentially the same in this respect.

Current passage time	%
For continuous passage	Temperature rise value is 100%
ON : OFF = 3 : 1	About 80%
ON : OFF = 1 : 1	About 50%
ON : OFF = 1 : 3	About 35%



- **Pick-up voltage change due to coil temperature rise (hot start)**

In DC relays, after continuous passage of current in the coil, if the current is turned OFF, then immediately turned ON again, due to the temperature rise in the coil, the pick-up voltage will become somewhat higher. Also, it will be the same as using it in a higher temperature atmosphere. The resistance/temperature relationship for copper wire is about 0.4% for 1°C, and with this ratio the coil resistance increases. That is, in order to operate of the relay, it is necessary that the voltage be higher than the pick-up voltage and the pick-up voltage rises in accordance with the increase in the resistance value. However, for some polarized relays, this rate of change is considerably smaller.

4. Coil Applied Voltage and Operate Time

In the case of AC operation, there is extensive variation in operate time depending upon the point in the phase at which the switch is turned ON for coil excitation, and it is expressed as a certain range, but for miniature types it is for the most part 1/2 cycle. However, for the somewhat large type relay where bounce is large, the operate time is 7 to 16ms, with release time in the order of 9 to 18ms. Also, in the case of DC operation, to the extent of large coil input, the operating time is rapid, but if it is too rapid, the “Form A” contact bounce time is extended.

Please be warned that load conditions (in particular when inrush current is large or load is close to the load rating) may cause the working life to shorten and slight welding.

5. Stray Circuits (Bypass Circuits)

In the case of sequence circuit construction, because of bypass flow or alternate routing, it is necessary to take care not to have erroneous operation or abnormal operation. To understand this condition while preparing sequence circuits, as shown in Figure 4, with 2 lines written as the power source lines, the upper line is always ⊕ and the lower line ⊖ (when the circuit is AC, the same thinking applies). Accordingly the ⊕ side is necessarily the side for making contact connections (contacts for relays, timers and limit switches, etc.), and the ⊖ side is the load circuit side (relay coil, timer coil, magnet coil, solenoid coil, motor, lamp, etc.).

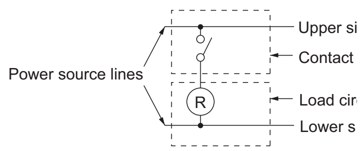


Figure 4 Example of a vertically written sequence circuit

Figure 5 shows an example of stray circuits. In Figure 5 (a), with contacts A, B, and C closed, after relays R_1, R_2, and R_3 operate, if contacts B and C open, there is a series circuit through A, R_1, R_2, and R_3, and the relays will hum and sometimes not be restored to the drop out condition.

The connections shown in Figure 5 (b) are correctly made. In addition, with regard to the DC circuit, because it is simple by means of a diode to prevent stray circuits, proper application should be made.

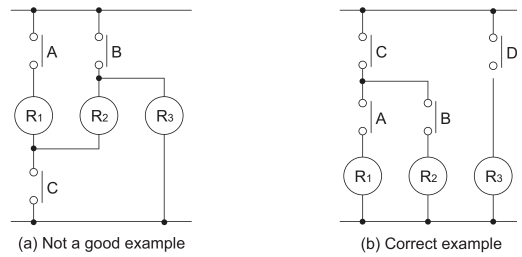


Figure 5 Stray circuits

6. Gradual Increase of Coil Impressed Voltage and Suicide Circuit

When the voltage impressed on the coil is increased slowly, the relay transferring operation is unstable, the contact pressure drops, contact bounce increases, and an unstable condition of contact occurs. This method of applying voltage to the coil should not be used, and consideration should be given to the method of impressing voltage on the coil (use of switching circuit). Also, in the case of latching relays, using self "Form B" contacts, the method of self coil circuit for complete interruption is used, but because of the possibility of trouble developing, care should be taken.

The circuit shown in Figure 6 causes a timing and sequential operation using a reed type relay, but this is not a good example with mixture of gradual increase of impressed voltage for the coil and a sucide circuit. In the timing portion for relay R_1, when the timing times out, chattering occurs causing trouble. In the initial test (trial production), it shows favorable operation, but as the number of operations increases, contact blackening (carbonization) plus the chattering of the relay creates instability in performance.

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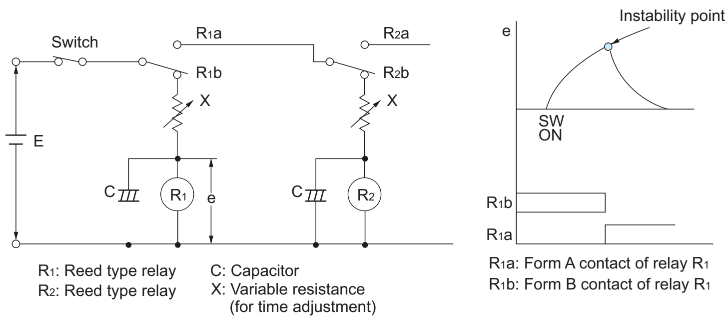


Figure 6 "Not a good example": A timing and sequential operation using a reed type relay

7. Phase Synchronization in AC Load Switching

If switching of the relay contacts is synchronized with the phase of the AC power, reduced electrical life, welded contacts, or a locking phenomenon (incomplete release) due to contact material transfer may occur. Therefore, check the relay while it is operating in the actual system. When driving relays with timers, micro computers and thyristors, etc., there may be synchronization with the power supply phase.

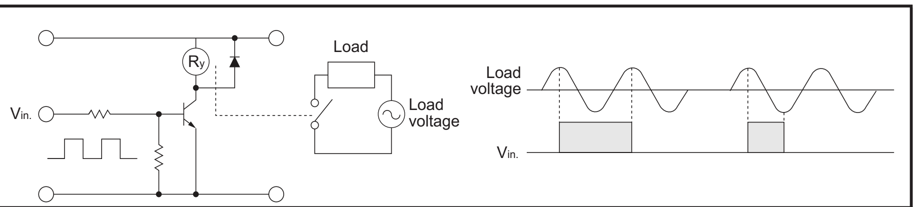


Figure 7

8. Erroneous Operation due to Inductive Interference

For long wire runs, when the line for the control circuit and the line for electric power use a single conduit, induction voltage, caused by induction from the power line, will be applied to the operation coil regardless of whether or not the control signal is off. In this case the relay and timer may not revert. Therefore, when wiring spans a long distance please remember that along with inductive interference, connection failure may be caused by a problem with distribution capacity or the device might break down due to the influence of externally caused surges, such as that caused by lightning.

9. Long Term Current Carrying

A circuit designed for non-excitation when left running is desirable for circuits (circuits for emergency lamps, alarm devices and error inspection that, for example, revert only during malfunction and output warnings with form B contacts) that will be carrying a current continuously for long periods without relay switching operation.

Continuous, long-term current to the coil will facilitate deterioration of coil insulation and characteristics due to heating of the coil itself.

For circuits such as these, please use a magnetic-hold type latching relay. If you must use a single stable relay, use a sealed type relay that is not easily affected by ambient conditions and provide a failsafe circuit design that considers the possibility of contact failure or disconnection.

10.Usage with Infrequent Switching

Please carry out periodic contact conductivity inspections when the frequency of switching is once or fewer times per month. When no switching of the contacts occurs for long periods, organic membrane may form on the contact surfaces and lead to contact instability.

11.Regarding Electrolytic Corrosion of Coils

n the case of comparatively high voltage coil circuits, when such relays are used in high temperature and high humidity atmospheres or with continuous passage of current, the corrosion can be said to be the result of the occurrence of electrolytic corrosion. Because of the possibility of open circuits occurring, attention should be given to the following points.

- The ⊕ side of the power source should be connected to the chassis. (Refer to Figure 8) (Common to all relays)

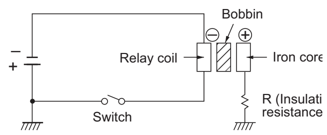


Figure 8 Judgement: Good

- In the case where unavoidably the ⊕ side is grounded, or in the case where grounding is not possible.
  - Insert the contacts (or switch) in the ⊕ side of the power source. (Refer to Figure 9) (Common to all relays)

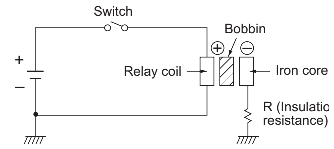


Figure 9 Judgement: Good

  - When a grounding is not required, connect the ground terminal to the ⊕ side of the coil. (Refer to Figure 10) (NF and NR with ground terminal)

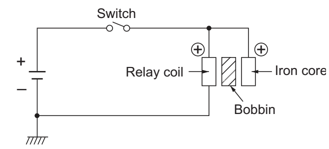


Figure 10 Judgement: Good

- When the ⊕ side of the power source is grounded, always avoid interting the contacts (and switches) in the ⊕ side. (Refer to Figure 11) (Common to all relays)

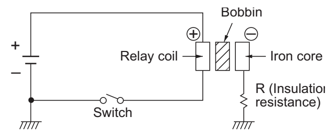


Figure 11 Judgement: No good

- In the case of relays provided with a ground terminal, when the ground terminal is not considered effective, not making a connection to ground plays an important role as a method for preventing electrolytic corrosion.

Note: The designation on the drawing indicates the insertion of insulation between the iron core and the chassis. In relays where a ground terminal is provided, the iron core can be grounded directly to the chassis, but in consideration of electrolytic corrosion, it is more expedient not to make the connection.

[3] PRECAUTIONS REGARDING CONTACT

- **Contact**

The contacts are the most important elements of relay construction. Contact performance conspicuously influenced by contact material, and voltage and current values applied to the contacts (in particular, the voltage and current waveforms at the time of application and release), the type of load, frequency of switching, ambient atmosphere, form of contact, contact switching speed, and of bounce.

Because of contact transfer, welding, abnormal wear, increase in contact resistance, and the various other damages which bring about unsuitable operation, the following items require full investigation.

*We recommend that you verify with one of our sales offices

1. Basic Precautions Regarding Contact

- **Voltage, AC and DC**

When there is inductance included in the circuit, a rather high counter emf is generated as a contact circuit voltage, and since, to the extent of the value of that voltage, the energy applied to the contacts causes damage with consequent wear of the contacts, and transfer of the contacts, it is necessary to exercise care with regard to control capacity. In the case of DC, there is no zero current point such as there is with AC, and accordingly, once a cathode arc has been generated, because it is difficult to quench that arc, the extended time of the arc is a major cause. In addition, due to the direction of the current being fixed, the phenomenon of contact shift, as noted separately below, occurs in relation to the contact wear. Ordinarily, the approximate control capacity is mentioned in catalogs or similar data sheets, but this alone is not sufficient. With special contact circuits, for the individual case, the maker either estimates from the past experience or makes test on each occasion. Also, in catalogs and similar data sheets, the control capacity that is mentioned is limited to resistive load, but there is a broad meaning indicated for that class of relay, and ordinarily it is proper to think of current capacity as that for 125V AC circuits.

Minimum applicable loads are given in the catalog; however, these are only provided as a guide to the lower limit that the relay is able to switch and are not guaranteed values. The level of reliability of these values depends on switching frequency, ambient conditions, change in the desired contact resistance, and the absolute value. Please use relays with AgPd contacts when minute analog load control or contact resistance no higher than 100 mΩ is desired (for measurement and wireless applications, etc.).

- **Current**

The current at both the closing and opening time of the contact circuit exerts important influence. For example, when the load is either a motor or a lamp, to the extent of the inrush current at the time of closing the circuit, wear of the contacts, and the amount of contact transfer increase, and contact welding and contact transfer make contact separation impossible.

2. Characteristics of Common Contact Materials

Characteristics of contact materials are given below. Refer to them when selecting a relay.

Contact Material	Ag (silver)	Electrical conductivity and thermal conductivity are the highest of all metals. Exhibits low contact resistance, is inexpensive and widely used. A disadvantage is it easily develops a sulfide film in a sulfide atmosphere. Care is required at low voltage and low current levels.
	$AgSnO_2$ (silver-tin)	Exhibits superior welding resistance characteristics equal or better than AgCdO. Like silver, it easily develops a sulfide film in a sulfide atmosphere.
	AgW (silver-tungsten)	Hardness and melting point are high, arc resistance is excellent, and it is highly resistant to material transfer. However, high contact pressure is required. Furthermore, contact resistance is relatively high and resistance to corrosion is poor. Also, there are constraints on processing and mounting to contact springs.
	AgNi (silver-nickel)	Equals the electrical conductivity of silver. Excellent arc resistance.
	AgPd (silver-palladium)	At standard temperature, good corrosion resistance and good sulfidation resistance. However, in dry circuits, organic gases adhere and it easily develops a polymer. Gold clad is used to prevent polymer buildup. Expensive.
Surface Finish	Rh plating (rhodium)	Combines perfect corrosion resistance and hardness. As plated contacts, used for relatively light loads. In an organic gas atmosphere, care is required as polymers may develop. Therefore, it is used in hermetic sealed relays (reed relays, etc.) . Expensive.
	Au clad (gold clad)	Au with its excellent corrosion resistance is pressure welded onto a base metal. Special characteristics are uniform thickness and the nonexistence of pinholes. Greatly effective especially for low level loads under relatively adverse atmospheres. Often difficult to implement clad contacts in existing relays due to design and installation.
	Au plating (gold plating)	Similar effect to Au clad. Depending on the plating process used, supervision is important as there is the possibility of pinholes and cracks. Relatively easy to implement gold plating in existing relays.
	Au flash plating (gold thin-film plating) 0.1 to 0.5μm	Purpose is to protect the contact base metal during storage of the switch or device with built-in switch. However, a certain degree of contact stability can be obtained even when switching loads.

3. Contact Protection

- **Counter EMF**

When switching inductive loads with a DC relay such as relay sequence circuits, DC motors, DC clutches, and DC solenoids, it is always important to absorb surges (e.g. with a diode) to protect the contacts.

When these inductive loads are switched off, a counter emf of several hundred to several thousand volts develops which can severely damage contacts and greatly shorten life. If the current in these loads is relatively small at around 1A or less, the counter emf will cause the ignition of a glow or arc discharge. The discharge decomposes organic matter contained in the air and causes black deposits (oxides, carbides) to develop on the contacts. This may result in contact failure.

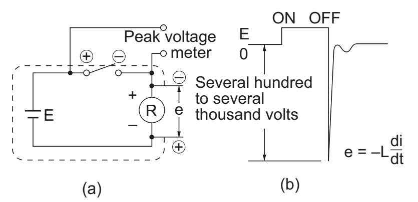


Figure 12 Example of counter emf and actual measurement

In Figure 12 (a), a counter emf ($e = -L\,di/dt$) with a steep waveform is generated across the coil with the polarity shown in Figure 12 (b) at the instant the inductive load is switched off. The counter emf passes through the power supply line and reaches both contacts.

Generally, the critical dielectric breakdown voltage at standard temperature and pressure in air is about 200 to 300 volts. Therefore, if the counter emf exceeds this, discharge occurs at the contacts to dissipate the energy ($\frac{1}{2}Li^2$) stored in the coil. For this reason, it is desirable to absorb the counter emf so that it is 200V or less.

- **Material transfer phenomenon**

Material transfer of contacts occurs when one contact melts or boils and the contact material transfers to the other contact. As the number of switching operations increases, uneven contact surfaces develop such as those shown in Figure 13. After a while, the uneven contacts lock as if they were welded together. This often occurs in circuits where sparks are produced at the moment the contacts “make” such as when the DC current is large for DC inductive or capacitive loads or when the inrush current is large (several amperes or several tens of amperes).

Contact protection circuits and contact materials resistant to material transfer such as $AgSnO_2$, AgW or AgCu are used as countermeasures. Generally, a concave formation appears on the cathode and a convex formation appears on the anode. For DC capacitive loads (several amperes to several tens of amperes), it is always necessary to conduct actual confirmation tests.

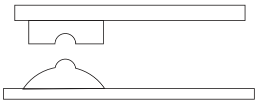
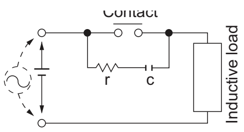
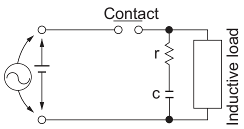
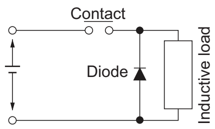
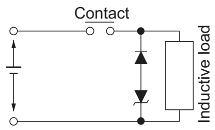
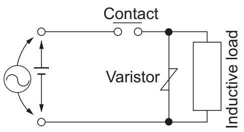


Figure 13 Material transfer of contacts

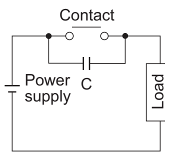
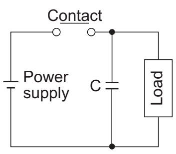
- **Contact protection circuit**

Use of contact protective devices or protection circuits can suppress the counter emf to a low level. However, note that incorrect use will result in an adverse effect. Typical contact protection circuits are given in the table below.

(G: Good, NG: No Good, C: Conditional)

Circuit		Application AC	Application DC	Features/Others	Devices Selection
CR circuit		C*	G	If the load is a timer, leakage current flows through the CR circuit causing faulty operation. * If used with AC voltage, be sure the impedance of the load is sufficiently smaller than that of the CR circuit	As a guide in selecting c and r, c: 0.5 to 1μF per 1A contact current r: 0.5 to 1Ω per 1V contact voltage Values vary depending on the properties of the load and variations in relay characteristics. Capacitor “c” acts to suppress the discharge the moment the contacts open. Resistor “r” acts to limit the current when the power is turned on the next time. Test to confirm. Use a capacitor “c” with a breakdown voltage of 200 to 300V. Use AC type capacitors (non-polarized) for AC circuits.
		G	G	If the load is a relay or solenoid, the release time lengthens. Effective when connected to both contacts if the power supply voltage is 24 or 48V and the voltage across the load is 100 to 200V.	
Diode circuit		NG	G	The diode connected in parallel causes the energy stored in the coil to flow to the coil in the form of current and dissipates it as joule heat at the resistance component of the inductive load. This circuit further delays the release time compared to the CR circuit. (2 to 5 times the release time listed in the catalog)	Use a diode with a reverse breakdown voltage at least 10 times the circuit voltage and a forward current at least as large as the load current. In electronic circuits where the circuit voltages are not so high, a diode can be used with a reverse breakdown voltage of about 2 to 3 times the power supply voltage.
Diode and zener diode circuit		NG	G	Effective when the release time in the diode circuit is too long.	Use a zener diode with a zener voltage about the same as the power supply voltage.
Varistor circuit		G	G	Using the stable voltage characteristics of the varistor, this circuit prevents excessively high voltages from being applied across the contacts. This circuit also slightly delays the release time. Effective when connected to both contacts if the power supply voltage is 24 to 48V and the voltage across the load is 100 to 200V.	–

- Avoid using the protection circuits shown in the figures on the right.
  Although DC inductive loads are usually more difficult to switch than resistive loads, use of the proper protection circuit will raise the characteristics to that for resistive loads.

No good 	No good 
Although extremely effective in arc suppression as the contacts open, the contacts are susceptible to welding since energy is stored in “C” when the contacts open and short-circuit current flows from “C” when the contacts close.	Although extremely effective in arc suppression as the contacts open, the contacts are susceptible to welding since charging current flows to “C” when the contacts close.

- **Mounting the protective device**

In the actual circuit, it is necessary to locate the protective device (diode, resistor, capacitor, varistor, etc.) in the immediate vicinity of the load or contact. If located too far away, the effectiveness of the protective device may diminish. As a guide, the distance should be within 50cm.

- **Abnormal corrosion during high frequency switching of DC loads (spark generation)**

If, for example, a DC valve or clutch is switched at a high frequency, a blue-green corrosion may develop. This occurs from the reaction with nitrogen and oxygen in the air when sparks (arc discharge) are generated during switching. Therefore, care is required in circuits where sparks are generated at a high frequency.

4. Cautions on Use Related to Contacts

- **Connection of load and contacts**

Connect the load to one side of the power supply as shown in Figure 14 (a). Connect the contacts to the other side. This prevents high voltages from developing between contacts. If contacts are connected to both side of the power supply as shown in Figure 14 (b), there is a risk of shorting the power supply when relatively close contacts short.

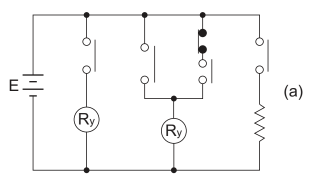


Figure 14

- **Dummy Resistor**

Since voltage levels at the contacts used in low current circuits (dry circuits) are low, poor conduction is often the result. One method to increase reliability is to add a dummy resistor in parallel with the load to intentionally raise the load current reaching the contacts.

- **Avoid circuits where shorts occur between Form A and B contacts**

1) The clearance between form A and B contacts in compact control components is small. The occurrence of shorts due to arcing must be assumed.

2) Even if the three N.C., N.O., and COM contacts are connected so that they short, a circuit must never be designed to allow the possibility of burning or generating an overcurrent.

3) A forward and reverse motor rotation circuit using switching of form A and B contacts must never be designed.

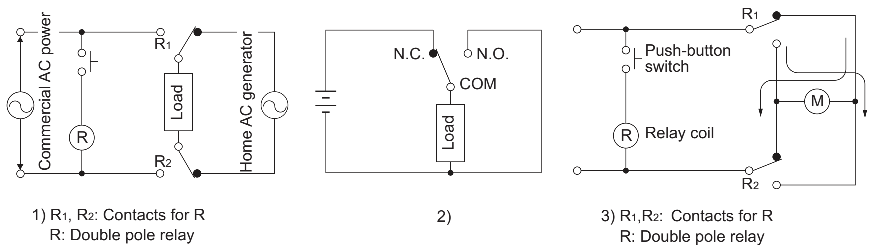


Figure 15 Bad example of Form A and B use

- **Shorts between different electrodes**

Although there is a tendency to select miniature control components because of the trend toward miniaturizing electrical control units, care must be taken when selecting the type of relay in circuits where different voltages are applied between electrodes in a multi-pole relay, especially when switching two different power supply circuits. This is not a problem that can be determined from sequence circuit diagrams. The construction of the control component itself must be examined and sufficient margin of safety must be provided especially in creepage between electrodes, space distance, presence of barrier, etc.

General Application Guidelines

- **Type of load and inrush current**

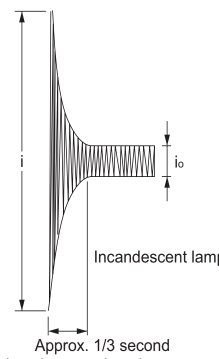
The type of load and its inrush current characteristics, together with the switching frequency, are important factors which cause contact welding. Particularly for loads with inrush currents, measure the steady state and inrush current. Then select a relay which provides an ample margin of safety. The table on the right shows the relationship between typical loads and their inrush currents.

Also, verify the actual polarity used since, depending on the relay, electrical life is affected by the polarity of COM and NO.

Type of load	Inrush current
Resistive load	Steady state current
Solenoid load	10 to 20 times the steady state current
Motor load	5 to 10 times the steady state current
Incandescent lamp load	10 to 15 times the steady state current
Mercury lamp load	Approx. 3 times the steady state current
Sodium vapor lamp load	1 to 3 times the steady state current
Capacitive load	20 to 40 times the steady state current
Transformer load	5 to 15 times the steady state current

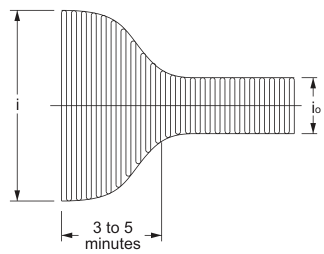
Load Inrush Current Wave and Time

(1) Incandescent Lamp Load

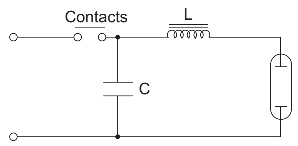


Inrush current/rated current:
i/io] 10 to 15 times

(2) Mercury Lamp Load
i/io approx. 3 times

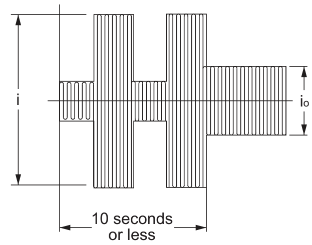


The discharge tube, transformer, choke coil, capacitor, etc., are combined in common discharge lamp circuits. Note that the inrush current may be 20 to 40 times, especially if the power supply impedance is low in the high power factor type.

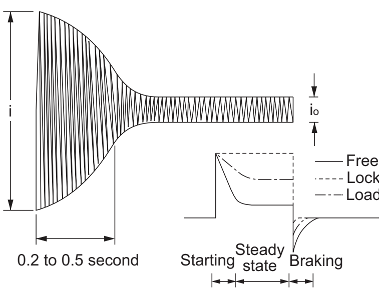


(for high power factor type)

(3) Fluorescent Lamp Load
i/io approx. 5 to 10 times

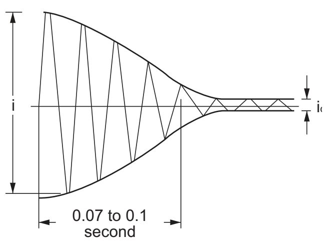


(4) Motor Load i/io approx. 5 to 10 times



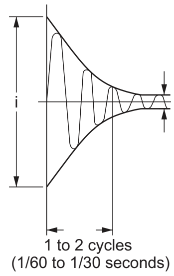
- Conditions become more harsh if plugging or inching i performed since state transitions are repeated.
- When using a relay to control a DC motor and brake, the on time inrush current, steady state current and of time brake current differ depending on whether the load to the motor is free or locked. In particular, with non-polarized relays, when using from B contact of from contact for the DC motor brake, mechanical life might be affected by the brake current. Therefore, please verify current at the actual load.

(5) Solenoid Load
i/io approx.10 to 20 times

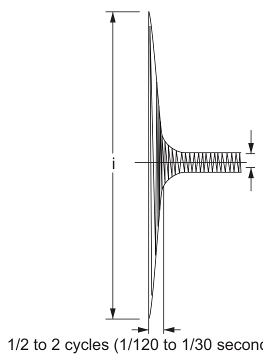


Note that since inductance is great, the arc lasts longer when power is cut. The contact may beome easily worn.

(6) Electromagnetic Contact Load
i/io approx. 3 to 10 times

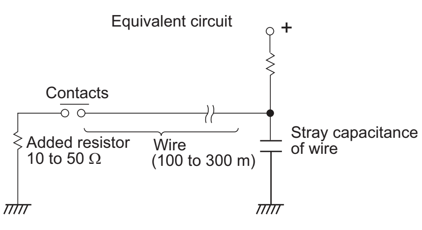


(7) Capacitive Load
i/io approx. 20 to 40 times



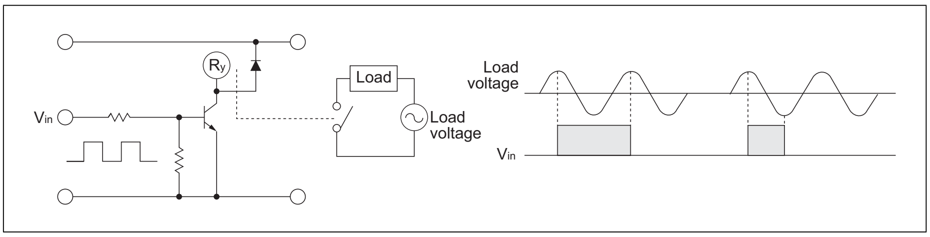
- **When using long wires**

If long wires (100 to 300m) are to be used in a relay contact circuit, inrush current may become a problem due to the stray capacitance existing between wires. Add a resistor (approx. 10 to 50Ω) in series with the contacts.



- **Phase synchronization in switching AC loads**

If switching of the relay contacts is synchronized with the phase of the AC power, reduced electrical life, welded contacts, or a locking phenomenon (incomplete release) due to contact material transfer may occur. Therefore, check the relay while it is operating in the actual system. When driving relays with timers, micro computers and thyristors, etc., there may be synchronization with the power supply phase.



- **Electrical life at high temperatures**

Verify at the actual load since electrical life may be affected by use at high temperatures.

[4] PRECAUTIONS REGARDING LATCHING RELAYS

- Latching relays are shipped from the factory in the reset state. A shock to the relay during shipping or installation may cause it to change to the set state. Therefore, it is recommended that the relay be used in a circuit which initializes the relay to the required state (set or reset) whenever the power is turned on.
- Avoid impressing voltages to the set coil and reset coil at the same time.
- Connect a diode as shown since latching may be compromised when the relay is used in the following circuits.
  - If set coils or reset coils are to be connected together in parallel, connect a diode in series to each coil. Figure 16 (a), (b)
  - Also, if the set coil of a relay and the reset coil of another relay are connected in parallel, connect a diode to the coils in series. Figure 16 (c)
  - If the set coil or reset coil is to be connected in parallel with an inductive load (e.g. another electromagnetic relay coil, motor, transformer, etc.), connect a diode to the set coil or reset coil in series. Figure 16 (d)

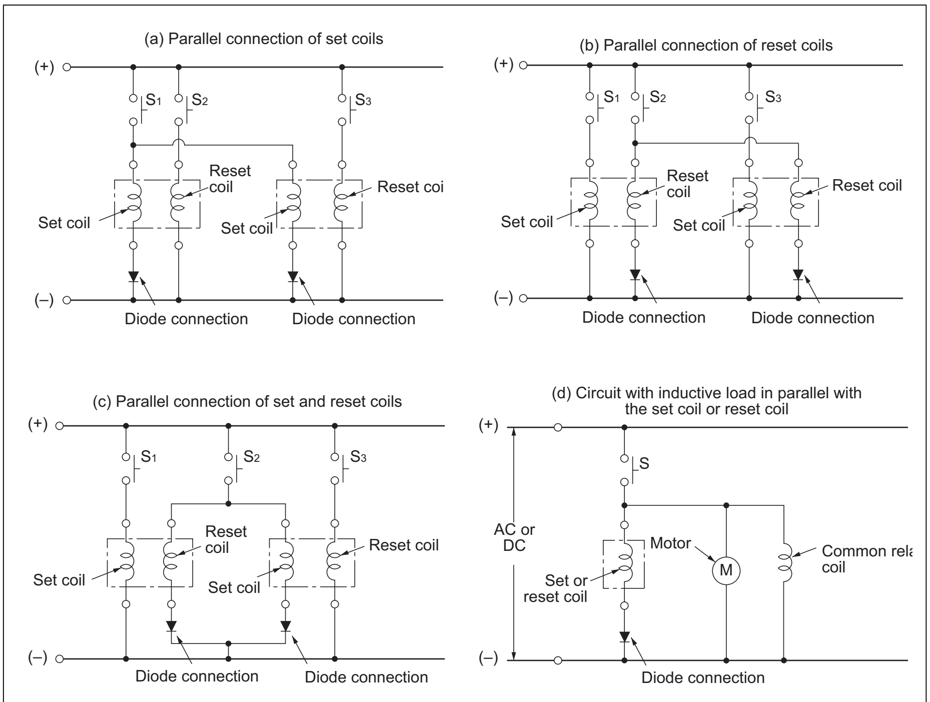
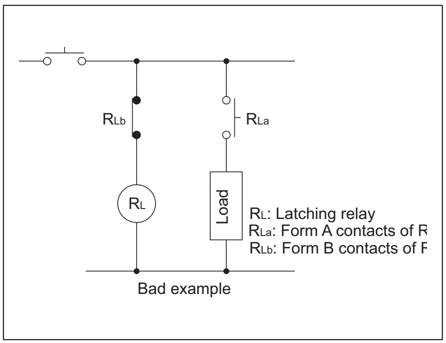


Figure 16

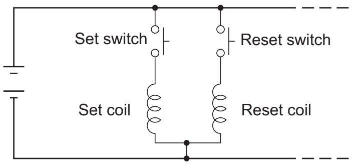
- Use a diode having an ample margin of safety for repeated DC reverse voltage and peak reverse voltage applications and having an average rectified current greater than or equal to the coil current.
- Avoid applications in which conditions include frequent surges to the power supply.
- Avoid using the following circuit since self-excitation at the contacts will inhibit

the normal keep state.



- Four-terminal latching relay

In the 2-coil latching type circuit as shown below, one terminal at one end of the set coil and one terminal at one end of the reset coil are connected in common and voltages of the same polarity are applied to the other side for the set and reset operations. In this type of circuit, short 2 terminals of the relay as noted in the right table. This helps to keep the insulation high between the two winding.



- Minimum pulse width

As a guide, make the minimum pulse width in order to set or reset a latching relay at least 5 times the set time or reset time of each product and apply a rectangular-wave rated voltage. Also, please verify operation. Please inquire if you cannot obtain a pulse width of at least 5 times the set (reset) time. Also, please inquire regarding capacitor drive.

Relay Type		Terminal Nos.
DS	1c	—
	2c	15 & 16
	4c	*
NC	Flat	5 & 6
	Slim	3 & 4
ST		*
SP		2 & 4

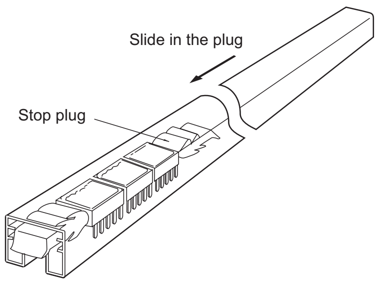
Notes:
1. DS4c and ST relays are constructed so that the set coil and reset coil are separated for high insulation resistance.
2. DSP, TQ, TN, S relays are not applicable due to polarity.

- Two Coil Latch Induction Voltage

Each coil in a 2-coil latch relay is wound with a set coil and a reset coil on the same iron cores. Accordingly, induction voltage is generated on the reverse side coil when voltage is applied and shut off to each coil. Although the amount of induction voltage is about the same as the rated relay voltage, you must be careful of the reverse bias voltage when driving transistors.

[5] HANDLING CAUTIONS FOR TUBE PACKAGING

Some types of relays are supplied in tube packaging. If you remove any relays from the tube packaging, be sure to slide the stop plug at one end to hold the remaining relays firmly together so they would not move in the tube. Failing to do this may lead to the appearance and/or performance being damaged.



[6] AMBIENT ENVIRONMENT

1. Ambient Temperature and Atmosphere

Be sure the ambient temperature at the installation does not exceed the value listed in the catalog. Furthermore, environmentally sealed types (plastic sealed type) should be considered for applications in an atmosphere with dust, sulfur gases (SO_2, H_2S), or organic gases.

2. Silicone Atmosphere

Silicone-based substances (silicone rubber, silicone oil, silicone-based coating material, silicone caulking compound, etc.) emit volatile silicone gas. Note that when silicone is used near relay, switching the contacts in the presence of its gas causes silicone to adhere to the contacts and may result in contact failure (in plastic sealed types, too).

In this case, use a substitute that is not silicone-based.

3. NOx Generation

When a relay is used in an atmosphere high in humidity to switch a load which easily produces an arc, the NOx created by the arc and the water absorbed from outside the relay combine to produce nitric acid. This corrodes the internal metal parts and adversely affects operation.

Avoid use at an ambient humidity of 85%RH or higher (at 20°C 68°F). If use at high humidity is unavoidable, consult us.

4. Vibration and Shock

If a relay and magnetic switch are mounted next to each other on a single plate, the relay contacts may separate momentarily from the shock produced when the magnetic switch is operated and result in faulty operation. Countermeasures include mounting them on separate plates, using a rubber sheet to absorb the shock, and changing the direction of the shock to a perpendicular angle.

Also, if the relay will be subject to continual vibration (trains, etc.), do not use it with a socket. We recommend that you solder directly to the relay terminals.

5. Influence of External Magnetic Fields

Permanent magnets are used in reed relays and polarized relays, and their movable parts are constructed of ferrous materials. For this reason, when a magnet or permanent magnet in any other large relay, transformer, or speaker is located nearby, the relay characteristics may change and faulty operations may result. The influence depends on the strength of the magnetic field and it should be checked at the installation.

6. Usage, Storage, and Transport Conditions

During usage, storage, or transportation, avoid locations subject to direct sunlight and maintain normal temperature, humidity, and pressure conditions.

The allowable specifications for environments suitable for usage, storage, and transportation are given below.

- **Temperature**

The allowable temperature range differs for each relay, so refer to the relay's individual specifications.

In addition, when transporting or storing relays while they are tube packaged, there are cases when the temperature may differ from the allowable range.

In this situation, be sure to consult the individual specifications.

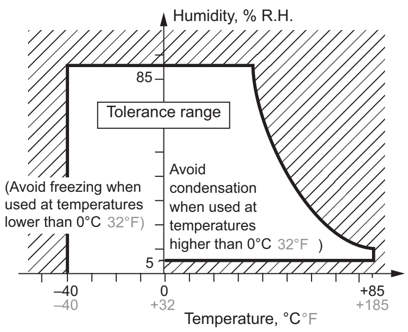
- **Humidity**

5 to 85 % R.H.

- **Pressure**

86 to 106 kPa

The humidity range varies with the temperature. Use within the range indicated in the graph.



(The allowable temperature depends on the switch.)

- Condensation will occur inside the switch if there is a sudden change in ambient temperature when used in an atmosphere of high temperature and high humidity. This is particularly likely to happen when being transported by ship, so please be careful of the atmosphere when shipping. Condensation is the phenomenon whereby steam condenses to cause water droplets that adhere to the switch when an atmosphere of high temperature and humidity rapidly changes from a high to low temperature or when the switch is quickly moved from a low humidity location to one of high temperature and humidity. Please be careful because condensation can cause adverse conditions such as deterioration of insulation, coil cutoff, and rust.
- Condensation or other moisture may freeze on the switch when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
- The plastic becomes brittle if the switch is exposed to a low temperature, low humidity environment for long periods of time.
- Storage for extended periods of time (including transportation periods) at high temperatures or high humidity levels or in atmospheres with organic gases or sulfide gases may cause a sulfide film or oxide film to form on the surfaces of the contacts and/or it may interfere with the functions. Check out the atmosphere in which the units are to be stored and transported.
- In terms of the packing format used, make every effort to keep the effects of moisture, organic gases and sulfide gases to the absolute minimum.
- Since the SMD type is sensitive to humidity it is packaged with tightly sealed anti-humidity packaging. However, when storing, please be careful of the following.
  - Please use promptly once the anti-humidity pack is opened (Signal relay: with in 3 days, Max. 30°C 86°F/60%RH). If left with the pack open, the relay will absorb moisture which will cause thermal stress when reflow mounting and thus cause the case to expand. As a result, the seal may break.
  - When storing for a long period after opening the anti-humidity pack, you must take measures to prevent humidity, for example, by storing in the open location of a promptly re-sealed anti-humidity pack after it is used or in a humidity-controlled desicator. You may also store it in an anti-humidity bag to which silica gel has been added.
  - To avoid incorrect handling of our moisture-sensitive products, Panasonic affixes a cautionary label to the vacuum-sealed bag in which the products are delivered.

- **Note:**
  Please note that the products must be mounted within the time limit specified on the bag. The time limit given on the bag varies for the different kinds of surface-mount terminal type products.

7. Vibration, Impact and Pressure when Shipping

When shipping, if strong vibration, impact or heavy weight is applied to a device in which a relay is installed, functional damage may occur. Therefore, please package in a way, using shock absorbing material, etc., so that the allowable range for vibration and impact is not exceeded.

[7] ENVIRONMENTALLY SEALED TYPE RELAYS

Sealed type (plastic sealed type, etc.) relays are available. They are effective when problems arise during PC board mounting (e.g. automatic soldering and cleaning). They also, of course, feature excellent corrosion resistance. Note the cautions below regarding the features and use of environmentally sealed type relays to avoid problems when using them in applications.

1. Operating Environment

Plastic sealed type relays are not suited for use in environments that especially require air tightness. Although there is no problem if they are used at sea level, avoid atmospheric pressures beyond 96±10kPa. Also avoid using them in an atmosphere containing flammable or explosive gases.

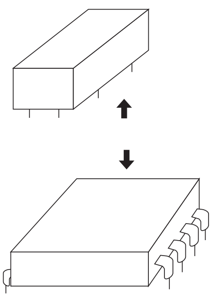
2. Cleaning

When cleaning a printed circuit board after soldering, we recommend using alcohol based cleaning fluids. Please avoid ultrasonic cleaning. The ultrasonic energy from this type of cleaning may cause coil line breakage and light sticking of contacts.

[8] MOUNTING CONSIDERATIONS

1. Top View and Bottom View

Relays used for PC boards, especially the flat type relays, have their top or bottom surface indicated in the terminal wiring diagrams.



Relay with terminals viewed from the bottom (terminals cannot be seen from the top)

Relay with terminals viewed from the top (all terminals can be seen from the top)
Note during PC board pattern design (NL, NC)

2. Mounting Direction

Mounting direction is important for optimum relay characteristics.

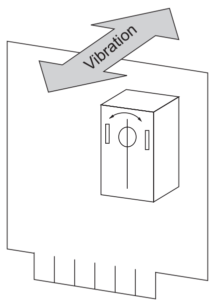
- **Shock resistance**

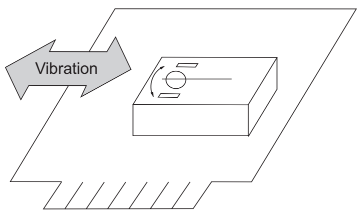
It is ideal to mount the relay so that the movement of the contacts and movable parts is perpendicular to the direction of vibration or shock. Especially note that the vibration and shock resistance of Form B contacts while the coil is not excited is greatly affected by the mounting direction of the relay.

- **Contact reliability**

Mounting the relay so the surfaces of its contacts (fixed contacts or movable contacts) are vertical prevents dirt and dust as well as scattered contact material (produced due to large loads from which arcs are generated) and powdered metal from adhering to them.

Furthermore, it is not desirable to switch both a large load and a low level load with a single relay. The scattered contact material produced when switching the large load adheres to the contacts when switching the low level load and may cause contact failure. Therefore, avoid mounting the relay with its low level load contacts located below the large load contacts.





3. Adjacent Mounting

When many relays are mounted close together, abnormally high temperatures may result from the combined heat generated. Mount relays with sufficient spacing between them to prevent heat buildup.

This also applies when a large number of boards mounted with relays are installed as in a card rack. Be sure the ambient temperature of the relay does not exceed the value listed in the catalog.

- **Influence of adjacent mounting of polarized relays**

When polarized relays are mounted close together, their characteristics change. Since the affect of adjacent mounting differs according to the type of relay, refer to the data for the particular type.

4. Panel Mounting

- Do not remove the cover. It has a special function. (It will not come off under normal handling.)
- When installing please use washers to prevent damage and deformation. Please keep the tightening torque to within 0.49 to 68.6 N·m (5 to 7 kgf·cm). Also, please use a spring washer to prevent it from coming loose.

5. Tab Terminals

As a guide, use a quick connect mounting pressure of 40 to 70N {4 to 7 kgf} for relays with tab terminals.

[9] METHOD OF MOUNTING AND LEAD WIRES CONNECTION

1. Mounting Method

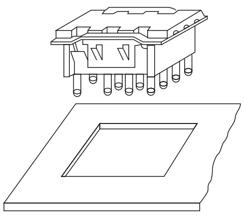
The direction of mounting is not specifically designated, but to the extent possible, the direction of contact movement should be such that vibration and shock will not be applied.

When a terminal socket is used

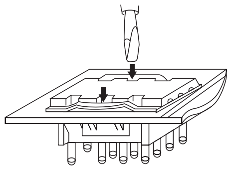
After drilling the mounting holes, the terminal socket should be mounted making certain the mounting screws are not loose. DIN standard sockets are available for one-touch mounting on DIN rail of 35mm 1.378 inch width.

When reversible terminal sockets are used

- The reversible terminal sockets (HC, HL socket) are for one-touch mounting. (A panel thickness of 1 to 2mm .039 to .079 inch should be used.)



- The socket should be pushed through the opening in the mounting panel until the projections on the side of the mounting bracket extend out over the back surface.



- When all four of the projections are visible from the back side of the mounting panel, the mounting is completed and the socket is fastened.
- To remove the socket, the projections on the side of the mounting bracket should be pushed inward and at the same time the body of the socket should be pushed lightly from the back side. The socket can then be removed from the panel.

2. Connection of Lead Wires

- When making the connections, depending upon the size of load, the wire cross-section should be at least as large as the values shown in the table below.

Permissible current (A)	Cross-section (mm^2)
2	0.2
3	0.3
5	0.5
7.5	0.75
12.5	1.25
15	2
20	2
30	3.5

- When the terminal socket uses screw fastening connections, either pressure terminals or other means should be used to make secure fastening of the wire.
- To prevent damage and deformity, please use a torque within the following range when tightening the push screw block of the terminal socket.

Screw	Torque
M4.5	1.47 to 1.666 N·m (15 to 17 kgf·cm)
M4	1.176 to 1.37 N·m (12 to 14 kgf·cm)
M3.5	0.784 to 0.98 N·m (8 to 10 kgf·cm)
M3	0.49 to 0.69 N·m(5 to 7 kgf·cm)

[10]CAUTIONS FOR USE–CHECK LIST

Item	To check
Coil Drive Input	1) Is the correct rated voltage applied? 2) Is the applied coil voltage within the allowable continuous voltage limit? 3) Is the ripple in the coil voltage within the allowable level? 4) For voltage applied to a polarized coil, is polarity observed? 5) When hot start is required, is the increase in coil resistance resulting from coil temperature rise taken into account in setting coil voltage? 6) Is the coil voltage free from momentary drop caused by load current? (Pay special attention for self-holding relays.) 7) Is supply voltage fluctuation taken into account when setting the rated coil voltage? 8) The relay status may become unstable if the coil voltage (current) is gradually increased or decreased. Was the relay tested in a real circuit or with a real load? 9) When driving with transistors, did you consider voltage drops?

General Application Guidelines

Item	To check
Load (Relay contacts)	1) Is the load rated within the contact ratings? 2) Does the load exceed the contacts' minimum switching capacity? 3) Special attention is required for contact welding when the load is a lamp, motor, solenoid, or electromagnetic contractor. Was the relay tested with a real load? 4) A DC load may cause contact lock-up due to large contact transfer. Was the relay tested with a real load? 5) For an inductive load, is a surge absorber used across the contacts? 6) When an inductive load causes heavy arc discharge across the relay contacts, the contacts may be corroded by chemical reaction with nitrogen in the atmosphere. Was the relay tested with a real load? 7) Platinum contacts may generate brown powder due to a catalyzer effect or vibration energy. Was the relay tested with a real load? 8) Is the contact switching frequency below the specification? 9) When there are more than two sets of contacts (2T) in a relay, metallic powder shed from one set of contacts may cause a contact failure on the other set (particularly for light loads). Was the relay tested in a real load? 10) A delay capacitor used across relay contacts may cause contact welding. Was the relay tested with a real load? 11) For an AC relay, a large contact bounce may cause contact welding. Was the relay tested in a real circuit or with a real load? 12) A high voltage may be induced at transformer load. Was the relay tested with a real load?
Circuit Design	1) Does circuit design take into account electrolytic corrosion of the coil? 2) Are transistors and other circuit components protected rom counter electromotive force that develops across the relay coil? 3) Is the circuit designed so the relay coil is left deenergized while the relay is inactive for long period of time? 4) Is the relay operated within the ratings approved by the relevant international standard (if compliance is required)? 5) Is the circuit protected from malfunction when the relay's activation and/or deactivation time varies considerably? 6) Is the circuit protected from malfunctions that might result from relay contact bounce? 7) Is the circuit protected from malfunction when a high-sensitivity latching type relay is to be used? 8) When there are two or more sets of contacts (2T) in a relay, arc discharges from load switching may cause short circuits across the two or more sets of contacts. Is the circuit designed to suppress such arc discharges? 9) Item 8 above also requires special attention when loads are supplied from separate power sources. 10) Does the post-installation insulation distance comply with the requirement of the relevant international standard or the Electrical Appliance and Material Control Law? 11) Is the circuit protected from malfunction when the relay is to be driven by transistors? 12) When the SCR is used for on/off control, the relay activation tends to synchronize with the line frequency, resulting in an extremely shortened life. Was the relay tested in a real circuit or with a real load? 13) Does the PC board design take into account use of on-board relay? 14) RF signals may leak across relay's open contacts. Check for adequate contact isolation and use RF relays as needed
Operating Environment	1) Is the ambient temperature in the allowable operating temperature range? 2) Is the humidity in the allowable humidity range? 3) Is the operating atmosphere free from organic and sulfide gases? 4) Is the operating atmosphere free from silicone gas? Depending on the load type, silicone gas may cause a black substance to from on the contacts, leading to contact failure. 5) Is the operating atmosphere free from excessive airborne dust? 6) Is the relay protected from oil and water splashes? 7) Is the relay protected from vibration and impact which may cause poor contact with the socket? 8) Is ambient vibration and impact below the level allowable for the relay? 9) Is the relay free from mechanical resonance after it is installed in position? 10) Is insulation coating applied to the relay along with the PC board? Depending on the load type, a black substance may form to cause contact failure.

Item	To check
Installation and Connection	1) Is the relay protected from solder chips and flux when it is manually soldered? 2) Are preparations for flux application and automatic soldering complete? 3) Is the PC board cleaning process designed to minimize adverse affects to the relays? 4) Are adequate separations provided between polarized or reed relays to prevent magnetic coupling? 5) Are the relay terminals free from stress in the socket? 6) Polarized relay’s characteristics may be affected by strong external magnetic field. Are the relays installed away from such fields? 7) If very long leads (100 to 300 meters) are used to connect the load, the stray capacity existing across the leads may cause the inrush current. Was the relay tested with a real load? 8) Unless otherwise specified, all relay terminals should be soldered at 250°C 482°F within 5 sec. or at 350°C 662°F within 3 sec. 9) A badly warped PC board can cause stress to the relay terminals which may lead to degraded relay characteristics. 10) Glass shot should not be used to clean the PC board of solder flux. This may cause relay malfunction due to glass powder becoming lodged in the relay’s internal structure. 11) Relays should always be used with their plastic shields installed, or degraded relay performance may result. 12) Do not cut away any relay terminal as the stress may cause degraded relay performance.
Storage and Transport	1) Is the relay subject to freezing or condensation (especially when shipping)? 2) Is the temperature in the allowable temperature range? 3) Is the humidity in the allowable humidity range? 4) Is the storing atmosphere free from organic and sulfide gases? 5) Is the storing atmosphere free from excessive airborne dust? 6) Is the relay protected from oil and water splashes? 7) Is the relay subject to the application of heavy weight? 8) When shipping does vibration and impact exceed the allowable range?

RELIABILITY

[1] WHAT IS RELIABILITY?

1. Reliability in a Narrow Sense of the Term

In the industrial world, reliability is an index of how long a particular product serves without failure.

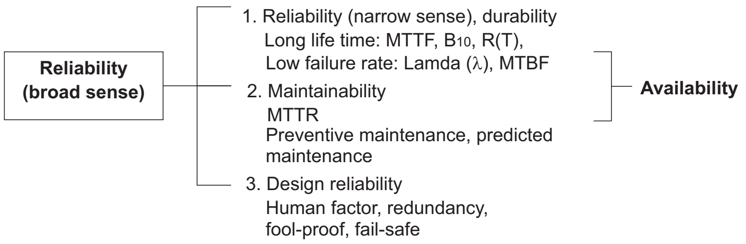
2. Reliability in a Broad Sense of the Term

Every product has a finite service lifetime. This means that no product can continue normal service infinitely. When a product has broken down, the user may throw it away or repair it. The reliability of repairable products is recognized as “reliability in a broad sense of the term”. For repairable products, their serviceability or maintainability is another problem. In addition, reliability of product design is becoming a serious concern for the manufacturing industry. In short, reliability has three senses: i.e. reliability of the product itself, serviceability of the product, and reliability of product design.

3. Intrinsic Reliability and Reliability of Use

Reliability is “built” into products. This is referred to as intrinsic reliability which consists mainly of reliability in the narrow sense.

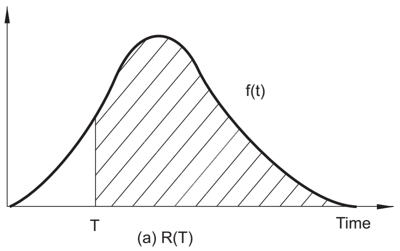
Product reliability at the user’s site is called “reliability of use”, which consists mainly of reliability in the broad sense. In the relay industry, reliability of use has a significance in aspects of servicing.



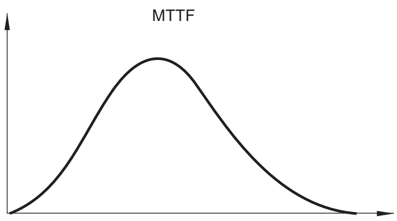
[2] RELIABILITY MEASURES

The following list contains some of the most popular reliability measures:

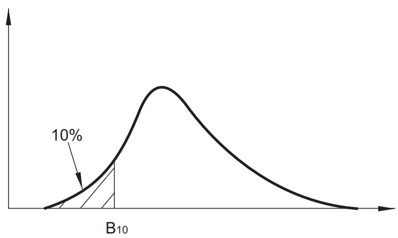
Reliability measure	Sample representation
Degree of reliability R(T)	99.9%
MTBF	100 hours
MTTF	100 hours
Failure rate λ	20 fit, 1%/hour
Safe life B_{10}	50 hours



(a) R(T)



(b) MTTF



(c) Safe life

1. Degree of Reliability

Degree of reliability represents percentage ratio of reliability. For example, if none of 10 light bulbs has failed for 100 hours, the degree of reliability defined in, 100 hours of time is 10/10 = 100%. If only three bulbs remained alive, the degree of reliability is 3/10 = 30%.

The JIS Z8115 standard defines the degree of reliability as follows:

The probability at which a system, equipment, or part provides the specified functions over the intended duration under the specified conditions.

2. MTBF

MTBF is an acronym of mean time between failures. It indicates the mean time period in which a system, equipment, or part operates normally between two incidences of repair. MTBF only applies to repairable products.

MTBF tells how long a product can be used without the need for repair.

Sometimes MTBF is used to represent the service lifetime before failure.

3. MTTF

MTTF is an acronym of mean time to failure. It indicates the mean time period until a product becomes faulty MTTF normally applies to unrepairable products such as parts and materials.

The relay is one of such objective of MTTF.

4. Failure Rate

Failure rate includes mean failure rate and momentary failure rate.

Mean failure rate is defined as follows:

Mean failure rate = Total failure count/ total operating hours

In general, failure rate refers to momentary failure rate. This represents the probability at which a system, equipment, or part, which has continued normal operation to a certain point of time, becomes faulty in the subsequent specified time period.

Failure rate is often represented in the unit of percent/hours. For parts with low failure rates, “failure unit (Fit) = 10^{-9} / hour” is often used instead of failure rate. Percent/count is normally used for relays.

5. Safe Life

Safe life is an inverse of degree of reliability. It is given as value B which makes the following equation true:

1 – R(B) = *t* %

In general, "B[1 – R(B)] = 10%" is more often used. In some cases this represents a more practical value of reliability than MTTF.

[3] FAILURE

1. What is Failure?

Failure is defined as a state of system, equipment, or component in which part of all of its functions are impaired or lost.

2. Bathtub Curve

Product's failure rate throughout its lifetime is depicted as a bathtub curve, as shown below. Failure rate is high at the beginning and end of its service lifetime.

(I) Initial failure period

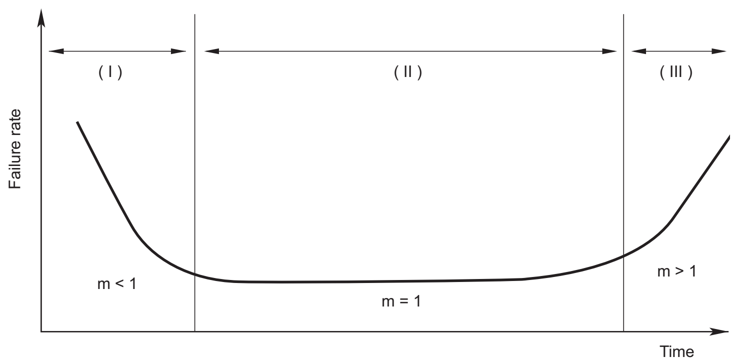
The high failure rate in the initial failure period is derived from latent design errors, process errors, and many other causes. Initial failures are screened at manufacturer's site through burn-in process. This process is called debugging, performing aging or screening.

(II) Accidental failure period

The initial failure period is followed by a long period with low, stable failure rate. In this period, called accidental failure period, failures occurs at random along the time axis. While zero accidental failure rate is desirable, this is actually not practical in the real world.

(III) Wear-out failure period

In the final stage of the product's service lifetime comes the wear-out failure period, in which the life of the product expires due to wear of fatigue. Preventive maintenance is effective for this type of failure. The timing of a relay's wear-out failure can be predicted with a certain accuracy from the past record of uses. The use of a relay is intended only in the accidental failure period, and this period virtually represents the service lifetime of the relay.



3. Weibull Analysis

Weibull analysis is often used for classifying a product's failure patterns and to determine its lifetime. Weibull distribution is expressed by the following equation:

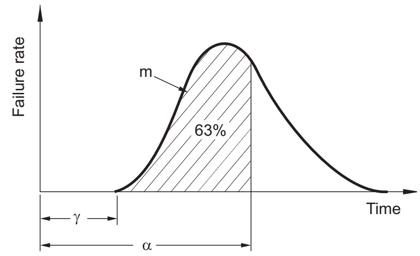
$$f(x) = \frac{m}{\alpha}(\chi-\gamma)^{m-1}e-\frac{(\chi-\gamma)^m}{\alpha}$$

m : Figure parameter

α : Measurement parameter

γ : Position parameter

Weibull distribution can be adopted to the actual failure rate distribution if the three variables above are estimated.



The Weibull probability chart is a simpler alternative of complex calculation formulas. The chart provides the following advantages:

- The Weibull distribution has the closest proximity to the actual lifetime distribution.
- The Weibull probability chart is easy to use.
- Different types of failures can be identified on the chart.

The following describes the correlation with the bathtub curve. The value of the figure parameter "m" represents the type of the failure.

- When *m* < 1: Initial failures
- When *m* = 1: Accidental failures
- When *m* > 1: Wear-out failures

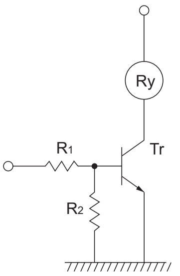
APPLICATIONS OF RELAYS IN ELECTRONIC CIRCUITS

[1] RELAY DRIVE BY MEANS OF A TRANSISTOR

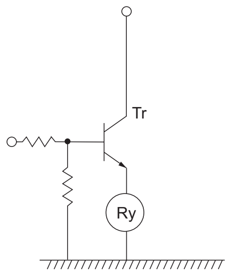
1. Connection Method

If the relay is transistor driven, we recommend using it with a collector connection.

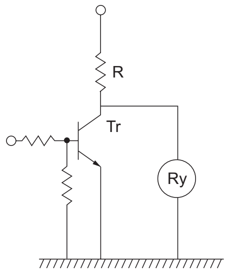
The voltage impressed on the relay is always full rated voltage, and in the OFF time, the voltage is completely zero for avoidance of trouble in use.



(Good) Collector connection
With this most common connection, operation is stable.



(Care) Emitter connection
When the circumstances make the use of this connection unavoidable, if the voltage is not completely impressed on the relay, the transistor does not conduct completely and operation is uncertain.



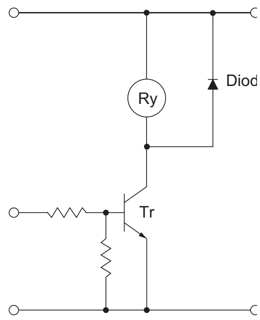
(Care) Parallel connection
When the power consumed by the complete circuit becomes large, consideration of the relay voltage is necessary.

2. Countermeasures for Surge Breakdown Voltage of Relay Control Transistor

If the coil current is suddenly interrupted, a sudden high voltage pulse is developed in the coil. If this voltage exceeds the breakdown voltage of the transistor, the transistor will be degraded, and this will lead to damage. It is absolutely necessary to connect a diode in the circuit as a means of preventing damage from the counter emf.

As suitable ratings for this diode, the current should be equivalent to the average rectified current to the coil, and the reverse blocking voltage should be about 3 times the value of the power source voltage.

Connection of a diode is an excellent way to prevent voltage surges, but there will be a considerable time delay when the relay is open. If you need to reduce this time delay you can connect between the transistor's collector and emitter a Zener diode that will make the Zener voltage somewhat higher than the supply voltage.

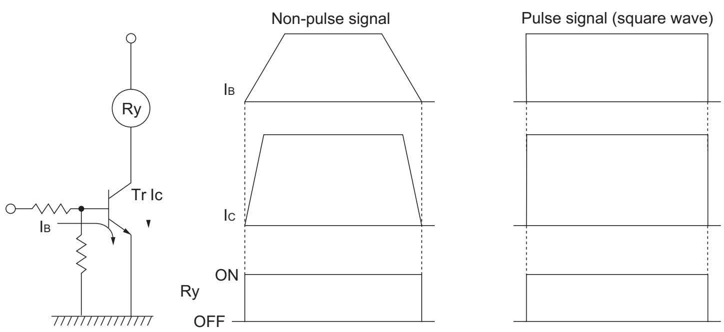


Take care of the "Area of Safe Operat
(ASO)"

3. Snap Action

(Characteristic of relay with voltage rise and fall of voltage)

Unlike the characteristic when voltage is impressed slowly on the relay coil, this is the case where it is necessary to impress the rated voltage in a short time and also to drop the voltage in a short time.



(No Good) Without snap action

(Good) Snap action

4. Schmidt Circuit (Snap Action Circuit)

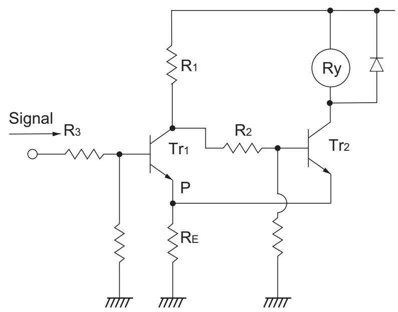
(Wave rectifying circuit)

When the input signal does not produce a snap action, ordinarily a Schmidt circuit is used to produce safe snap action.

Characteristic points

- The common emitter resistor R_E must have a value sufficiently small compared with the resistance of the relay coil.

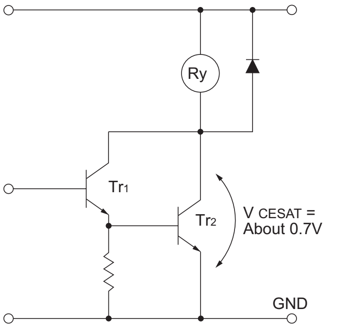
- Due to the relay coil current, the difference in the voltage at point P when Tr_2 is conducting and at point P when Tr_1 is conducting creates hysteresis in the detection capability of Schmidt circuit, and care must be taken in setting the values.
- When there is chattering in the input signal because of waveform oscillation, an CR time constant circuit should be inserted in the stage before the Schmidt trigger circuit. (However, the response speed drops.)



5. Avoid Darlington Connections.

(High amplification)

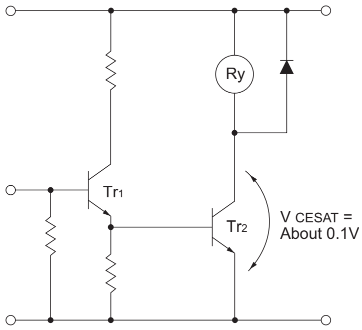
This circuit is a trap into which it is easy to fall when dealing with high circuit technology. This does not mean that it is immediately connected to the defect, but it is linked to troubles that occur after long periods of use and with many units in operation.



(No good) Darlington connection

(Due to excessive consumption of power, heat is generated.)

(A strong Tr_1 is necessary)



(Good) Emitter connection

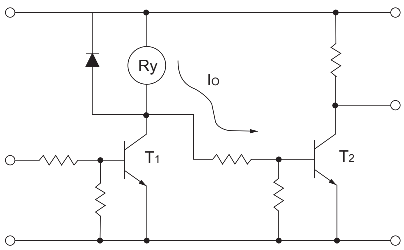
(Tr_2 conducts completely.)

(Tr_1 is sufficient for signal use.)

6. Residual Coil Voltage

In switching applications where a semiconductor (transistor, UJT, etc.) is connected to the coil, a residual voltage is retained at the relay coil which may cause incomplete restoration and faulty operation. By using DC coils, there may be a reduction in; the danger of incomplete restoration, the contact pressure, and the vibration resistance. This is because the drop-out voltage is 10% or more of the rated voltage, a low value compared to that for AC coil, and also there is a tendency to increase the life by lowering the drop-out voltage. When the signal from the transistor’s collector is taken and used to drive another circuit as shown in the figure on the right, a minute dark current flows to the relay even if the transistor is off. This may cause the problems described above.

Connection to the next stage through collector

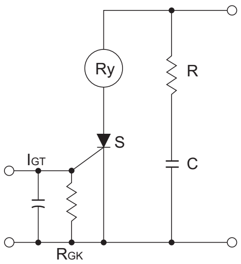


I_O: dark current (No good)

[2] RELAY DRIVE BY MEANS OF SCR

1. Ordinary Drive Method

For SCR drive, it is necessary to take particular care with regard to gate sensitivity and erroneous operation due to noise.



I_{GT} : There is no problem even with more then 3 ti the related current.

R_{GK} : 1K Ω must be connected.

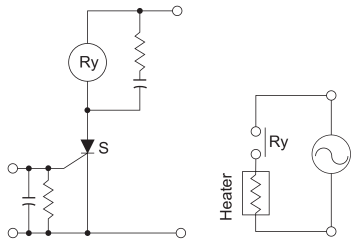
R,C : This is for prevention of ignition error due to a sudden rise in the power source or to noise. (dv/dt countermeasure)

2. Caution points regarding ON/OFF control circuits

(When used for temperature or similar control circuits)

When the relay contacts close simultaneously with an AC single phase power source, because the electrical life of the contacts suffers extreme shortening, care is necessary.

- When the relay is turned ON and OFF using a SCR, the SCR serves as a half wave power source as it is, and there are ample cases where the SCR is easily restored.
- In this manner the relay operation and restoration timing are easily synchronized with the power source frequency, and the timing of the load switching also is easily synchronized.
- When the load for the temperature control is a high current load such as a heater, the switching can occur only at peak values and it can occur only at zero phase values as a phenomenon of this type of control. (Depending upon the sensitivity and response speed of the relay)
- Accordingly, either an extremely long life or an extremely short life results with wide variation, and it is necessary to take care with the initial device quality check.

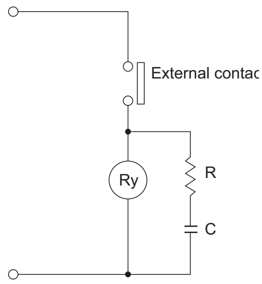


[3] RELAY DRIVE FROM EXTERNAL CONTACTS

Relays for PC board use have high sensitivity and high speed response characteristics, and because they respond sufficiently to chattering and bouncing, it is necessary to take care in their drive.

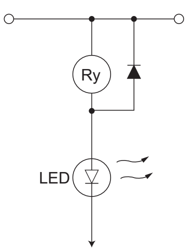
When the frequency of use is low, with the delay in response time caused by a condenser, it is possible to absorb the chattering and bouncing.

(However, it is not possible to use only a condenser. A resistor should also be used with the capacitor.)



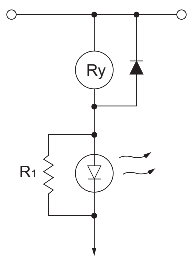
[4] LED SERIES AND PARALLEL CONNECTIONS

1) In series with relay



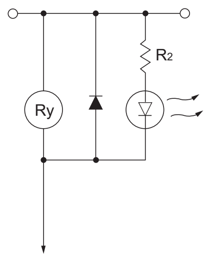
Power consuption:
In common with relay (Good)
Defective LED:
Relay does not operate (No Good)
Low voltage circuit:
With LED, 1.5V down (No good)
No. of parts: (Good)

2) R in parallel with LED



Power consuption:
In common with relay (Good)
Defective LED:
Relay operate (Good)
Low voltage cicuit:
With LED, 1.5V down (No good)
No. of parts: R_1 (Care)

3) In parallel connection with relay

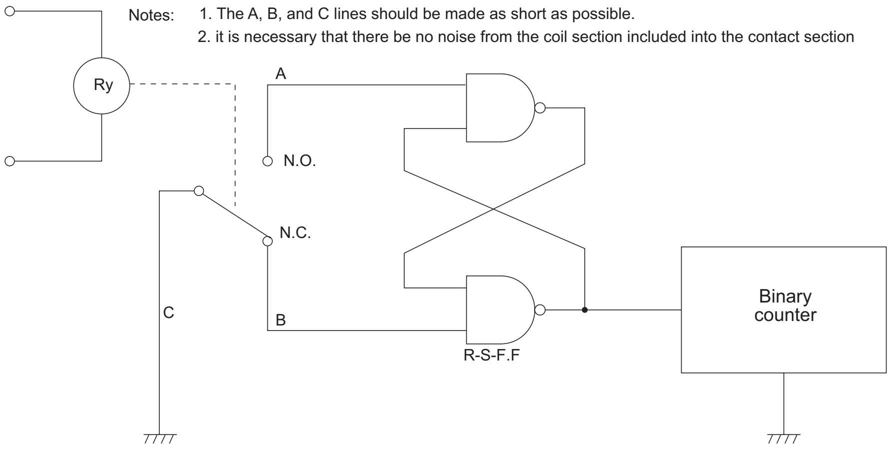


Power consumption:
Current limiting resistor R_2 (Care)
Defective LED:
Relay operate stable (Good)
Low voltage circuit: (Good)
No. of parts: R_2 (Care)

[5] ELECTRONIC CIRCUIT DRIVE BY MEANS OF A RELAY

1. Chatterless Electronic Circuit

Even though a chatterless characteristic is a feature of relays, this is to the fullest extent a chatterless electrical circuit, much the same as a mercury relay. To meet the requirement for such circuits as the input to a binary counter, there is an electronic chatterless method in which chattering is absolutely not permissible. Even if chattering develops on one side, either the N.O. side contacts or the N.C. side contacts, the flip flop does not reverse, and the counter circuit can be fed pulsed without a miss. (However, bouncing from the N.O. side to N.C. side must be absolutely avoided.)

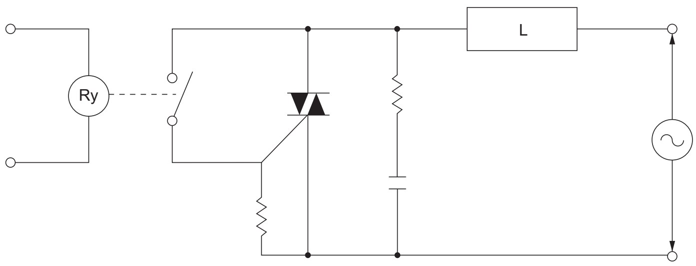


2. Triac Drive

When an electronic circuit using a direct drive from a triac, the electronic circuit will not be isolated from the power circuit, and because of this, troubles due to erroneous operation and damage can develop easily. The introduction of a relay drive is the most economical and most effective solution. (Photo coupler and pulse transformer circuits are complicated.)

Also, compared to switching a direct load with a relay, long life and reduced arc noise can be achieved.

When a zero cross switching characteristic is necessary, a solid state relay (SSR) should be used.



[6] POWER SOURCE CIRCUIT

1. Constant Voltage Circuit

In general, electronic circuits are extremely vulnerable to such phenomena as power supply ripples and voltage fluctuations. Although relay power supplies are not as vulnerable as electronic circuits, please keep both ripples and the regulation within the specification.

If power supply voltage fluctuations are large, please connect a stabilized circuit or constant-voltage circuit as shown in Figure 17

If the relay power consumption is great, satisfactory results can be achieved by implementing a circuit configuration as shown in Figure 18.

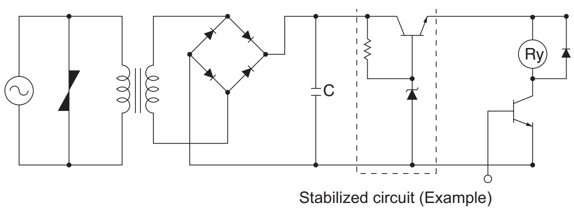


Figure 17

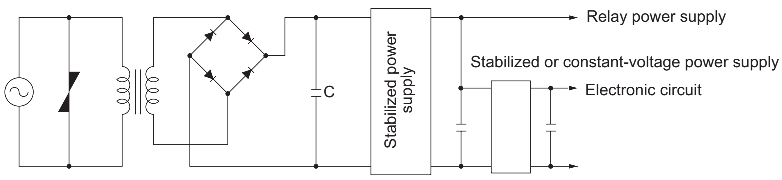


Figure 18

2. Prevention of Voltage Drop Due to Rush Current

In the circuit shown in Figure 19, rush current flows from the lamp or capacitor. The instant the contacts close, the voltage drops and the relay releases or chatters.

In this case it is necessary to raise the transformer's capacity or add a smoothing circuit.

Figure 20 shows an example of the modified circuit.

Figure 21 shows a battery-powered version.

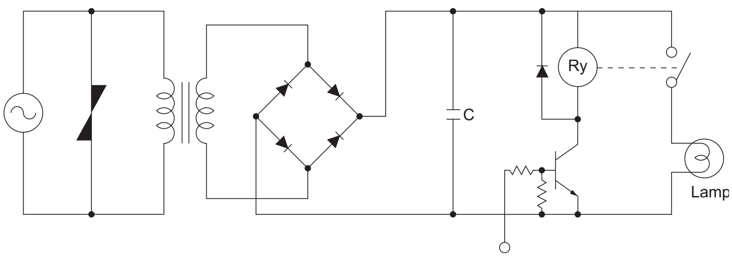


Figure 19

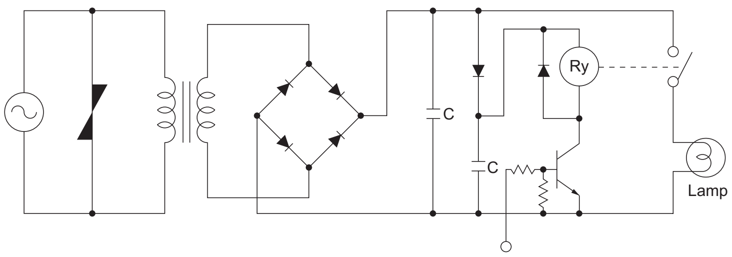


Figure 20

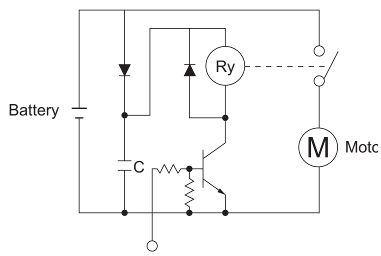


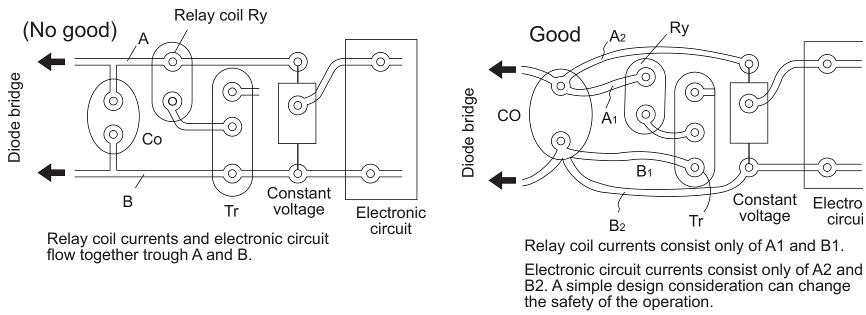
Figure 21

[7] PC BOARD DESIGN CONSIDERATIONS

1. Pattern Layout for Relays

Since relays affect electronic circuits by generating noise, the following points should be noted.

Keep relays away from semiconductor devices. Design the pattern traces for shortest lengths. Place the surge absorber (diode, etc.) near the relay coil. Avoid routing pattern traces susceptible to noise (such as for audio signals) underneath the relay coil section. Avoid through-holes in places which cannot be seen from the top (e.g. at the base of the relay). Solder flowing up through such a hole may cause damage such as a broken seal. Even for the same circuit, pattern design considerations which minimize the influence of the on/off operations of the relay coil and lamp on other electronic circuits are necessary.



2. Hole and land diameter

The hole diameter and land are made with the hole slightly larger than the lead wire so that the component may be inserted easily. Also, when soldering, the solder will build up in an eyelet condition, increasing the mounting strength.

The standard dimensions for the hole diameter and land are shown in the table.

Standard dimensions for hole and land diameter mm inch

Standard hole diameter	Tolerance	Land diameter
0.8 .031	±0.1 ±.039	2.0 to 3.0 .079 to .118
1.0 .039		
1.2 .047		3.5 to 4.5 .138 to .177
1.6 .063		

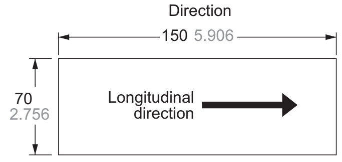
Remarks

1. The hole diameter is made 0.2 to 0.5mm .008 to .020inch larger than the lead diameter. However, if the jet method (wave type, jet type) of soldering is used, because of the fear of solder passing through to the component side, it is more suitable to make the hole diameter equal to the lead diameter +0.2mm.
2. The land diameter should be 2 to 3 times the hole diameter.
3. Do not put more than 1 lead in one hole.

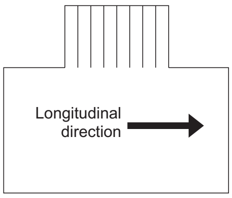
3. Expansion and shrinkage of copperclad laminates

Because copperclad laminates have a longitudinal and lateral direction, the manner of punching fabrication and layout must be observed with care. The expansion and shrinkage in the longitudinal direction due to heat is 1/15 to 1/2 that in the lateral, and accordingly, after the punching fabrication, the distortion in the longitudinal direction will be 1/15 to 1/2 that of the lateral direction. The mechanical strength in the longitudinal direction is 10 to 15% greater than that in the lateral direction. Because of this difference between the longitudinal and lateral directions, when products having long configurations are to be fabricated, the lengthwise direction of the configuration should be made in the longitudinal direction, and PC boards having a connector section should be made with the connector along the longitudinal side.

Example: As shown is the drawing below, the 150mm 5.906 inch direction is taken as the longitudinal direction

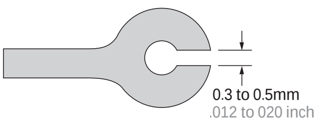


Also, as shown in the drawing below, when the pattern has a connector section, the direction is taken as shown by the arrow in the longitudinal direction



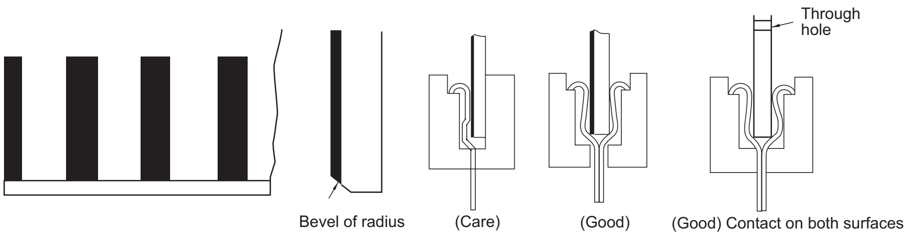
4. When it is necessary to use hand soldering for one part of a component after dip soldering has been done

By providing a narrow slot in the circular part of the foil pattern, the slot will prevent the hole from being plugged with solder.



5. When the PC board itself is used as a connector

- The edge should be beveled. (This prevents peeling of the foil when the board is inserted into its socket.)
- When only a single side is used as the connector blade, if there is distortion in the PC board, contact will be defective.
- Care should be taken.



6. PC Board Reference Data

This data has been derived from samples of this company's products. Use this data as a reference when designing PC boards.

• Conductor width

The allowable current for the conductor was determined from the safety aspect and the effect on the performance of the conductor due to the rise in saturation temperature when current is flowing. (The narrower the conductor width and the thinner the copper foil, the larger the temperature rise.) For example, too high a rise in temperature causes degradation of the characteristic and color changes of the laminate. In general, the allowable current of the conductor is determined so that the rise is temperature is less than 10°C. It is necessary to design the conductor width from this allowable conductor current.

Figure 22, Figure 23, Figure 24 show the relationship between the current and the conductor width for each rise in temperature for different copper foils. It is also necessary to give consideration to preventing abnormal currents from exceeding the destruction current of the conductor.

Figure 25 shows the relationship between the conductor width and the destruction current.

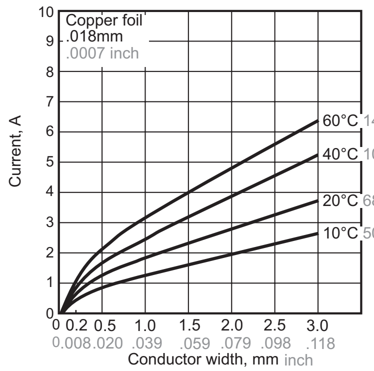


Figure 22

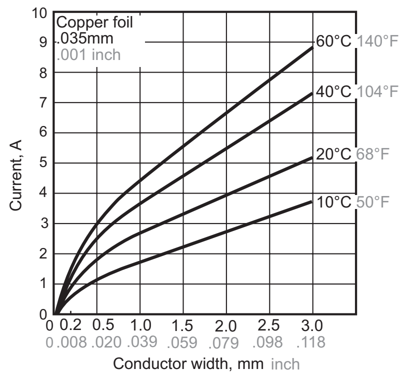


Figure 23

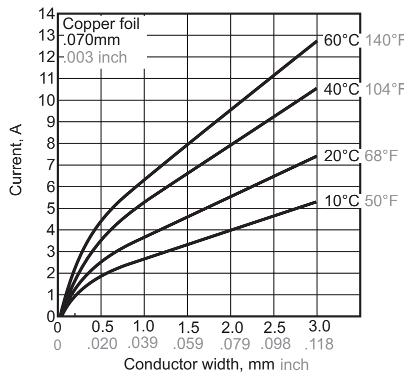


Figure 24

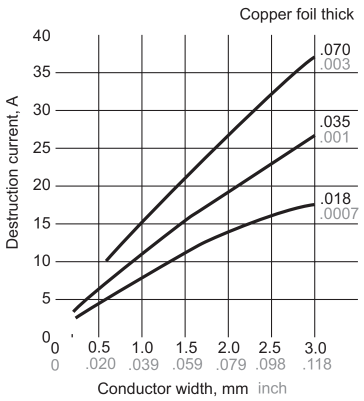


Figure 25

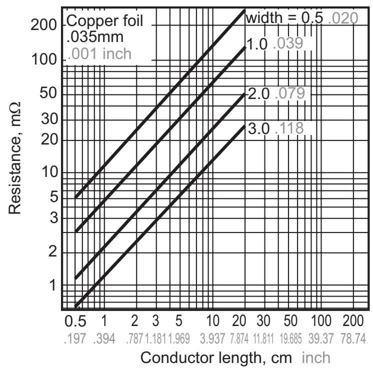


Figure 26

• Space between conductors

Figure 27 shows the relationship between the spacing between conductors and the destruction voltage. This destruction voltage is not the destruction voltage of the PC board; it is the flash over voltage (insulation breakdown voltage of the space between circuits.) Coating the surface of the conductor with an insulating resin such as a solder resist increases the flash over voltage, but because of the pin holes of the solder resist, it is necessary to consider the conductor destruction voltage without the solder resist. In fact, it is necessary to add an ample safety factor when determining the spacing between conductors. Table shows an example of a design for the spacing between conductors. (Taken from the JIS C5010 standards.) However, when the product is covered by the electrical products control law, UL standards or other safety standards, it is necessary to conform to the regulations.

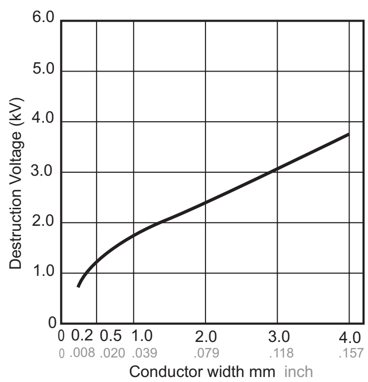


Figure 27

Example of conductor spacing design

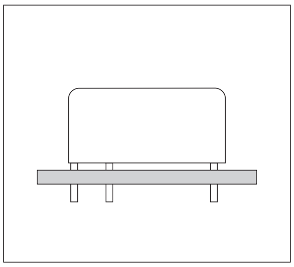
Maximum DC and AC Voltage Between Conductors (V)	Minimum Conductor Spacing (mm inch)
0 to 50	0.381 .015
51 to 150	0.635 .025
151 to 300	1.27 .050
301 to 500	2.54 .100
500 or more	Calculated at 0.00508 mm/V

RELAY SOLDERING AND CLEANING GUIDELINES

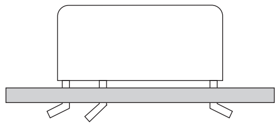
In keeping with making devices compact, it is becoming more common to weld the relay to a PC board along with the semiconductors instead of using the previous plug-in type in which relays were plugged into sockets. With this style, loss of function may occur because of seepage into the relay of flux, which is applied to the PC board. Therefore, the following precautions are provided for soldering a relay onto a PC board. Please refer to them during installation in order to avoid problems.

The type of protective structure will determine suitability for automatic soldering or automatic cleaning. Please review the parts on construction and characteristics. See “Configuration and Construction” on page 582.

1. Mounting of relay

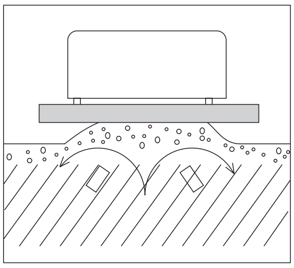


- Avoid bending the terminals to make the relay self-clinching. Relay performance cannot be guaranteed if the terminals are bent. Self-clinching terminal types are available depending on the type of relay.
- Correctly drill the PC board according to the given PC board pattern illustration.
- Stick packaging is also available for automatic mounting, depending on the type of relay. (Be sure that the relays don’t rattle.) Interference may occur internally if the gripping force of the tab of the surface mounting machine is too great. This could impair relay performance.

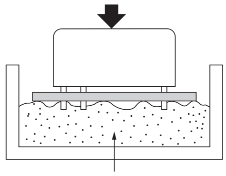


Bad example

2. Flux application

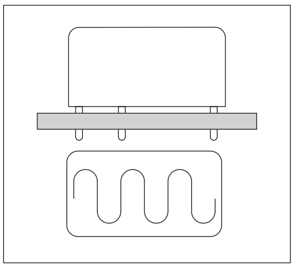


- Adjust the position of the PC board so that flux does not overflow onto the top of it. This must be observed especially for dust-cover type relays.
- Use rosin-based non-corrosive flux.
- If the PC board is pressed down into a flux-soaked sponge as shown on the right, the flux can easily penetrate a dust-cover type relay. Never use this method. Note that if the PC board is pressed down hard enough, flux may even penetrate a flux-resistant type relay.



Bad example

3. Preheating

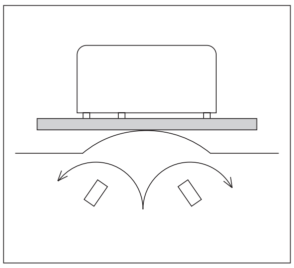


- Be sure to preheat before using automatic soldering. For dust-cover type relays and flux-resistant type relays, preheating acts to prevent the penetration of flux into the relay when soldering. Solderability also improves.
- Preheat according to the following conditions.

Temperature	120°C 248°F or less
Time	Within approx. 2 minutes

- Note that long exposure to high temperatures (e.g. due to a malfunctioning unit) may affect relay characteristics.

4. Soldering



- **Automatic soldering**
- Flow solder is the optimum method for soldering.
- Adjust the level of solder so that it does not overflow onto the top of the PC board.
- Unless otherwise specified, solder under the following conditions depending on the type of relay.

Solder temperature	260°C±5°C 500°F±41°F
Soldering time	Within approx. 6 seconds

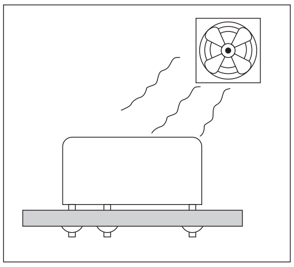
- Please take caution with multi-layer boards. Relay performance may degrade due to the high thermal capacity of these boards.

- **Hand soldering**

Keep the tip of the soldering iron clean.

Soldering Iron	30W to 60W
Iron Tip Temperature	350°C 662°F
Soldering Time	Within approx. 3 seconds

5. Cooling

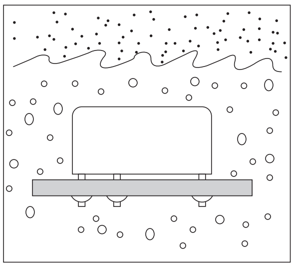


- **Automatic soldering**
- Immediate air cooling is recommend to prevent deterioration of the relay and surrounding parts due of soldering heat.
- Although the environmentally sealed type relay (plastic sealed type, etc.) can be cleaned, avoid immersing the relay into cold liquid (such as cleaning solvent) immediately after soldering. Doing so may deteriorate the sealing performance.

- **Hand soldering**

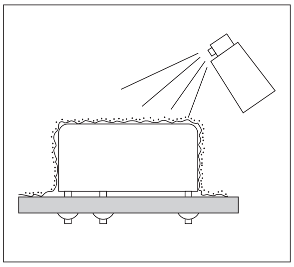
—

6. Cleaning



- Do not clean dust-cover type relays and flux-resistant type relays by immersion. Even if only the bottom surface of the PC board is cleaned (e.g. with a brush), careless cleaning may cause cleaning solvent to penetrate the relay.
- Plastic sealed type relays can be cleaned by immersion. Use a Freon- or alcohol-based cleaning solvent. Use of other cleaning solvents (e.g. Trichlene, chloroethene, thinner, benzyl alcohol, gasoline) may damage the relay case.
- Cleaning with the boiling method is recommended. Avoid ultrasonic cleaning on relays. Use of ultrasonic cleaning may cause breaks in the coil or slight sticking of the contacts due to the ultrasonic energy.
- Do not cut the terminals. When terminals are cut, breaking of coil wire and slight sticking of the contacts may occur due to vibration of the cutter.

7. Coating



- If the PC board is to be coated to prevent the insulation of the PC board from deteriorating due to corrosive gases and high temperatures, note the following.
- Do not coat dust-cover type relays and flux-resistant type relays, since the coating material may penetrate the relay and cause contact failure. Or, mount the relay after coating.
- If the relay and all components (e.g. ICs) are to be coated, be sure to carefully check the flexibility of the coating material. The solder may peel off from thermal stress.
- Depending on the type, some coating materials may have an adverse affect on relays. Furthermore, solvents (e.g. xylene, toluene, MEK, I.P.A.) may damage the case or chemically dissolve the epoxy and break the seal. Select coating materials carefully.
- If the relay and all components (e.g. ICs) are to be coated, be sure to carefully check the flexibility of the coating material. The solder may peel off from thermal stress.

Type	Suitability for Relays	Features
Epoxy-base	Good	• Good electrical insulation. • Although slightly difficult to apply, does not affect relay contacts.
Urethane-base	Care	• Good electrical insulation, easy to apply. • Solvent may damage case. Check before use.
Silicone-base	No Good	• Silicone gas becomes the cause of contact failure. Do not use the silicone-base type.

SMT SOLDERING GUIDELINES

CAUTIONS FOR SURFACE MOUNT RELAY INSTALLATION

To meet the market demand for downsizing to smaller, lighter, and thinner products, PC boards also need to proceed from Insertion mounting to surface mounting technology. To meet this need, we offer a line of surface mount relays. The following describes some cautions required for surface mount relay installation to prevent malfunction and incorrect operation.

[1] What is a Surface Mount Relay?

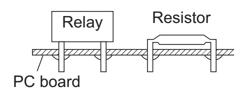
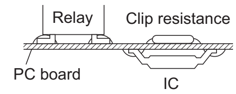
1. From IMT to SMT

Conventional insertion mount technology (IMT) with some 30 years of history is now being replaced with surface mount technology (SMT).

Solid-state components such as resistors, ICs, and diodes can withstand high heat stresses from reflow soldering because they use no mechanical parts. In contrast, the conventional electro-mechanical relays consisting of solenoid coils, springs, and armatures are very sensitive to thermal stress from reflow soldering.

We applied the experience gained from our advanced relay technologies to produce high-performance electromagnetic relays compatible with surface mount technologies such as IRS and VPS.

•Insertion Mount Technology (IMT) vs. Surface Mount Technology (SMT)

Insertion Mounting Technology (IMT)	Components' leads are inserted into lead holes drilled into the PC board and are soldered to copper pads on the other side of the board using flow-soldering techniques.	
Surface Mount Technology (SMT)	Components are placed on copper pads precoated with paste solder and the board assembly is heated to solder the components on the pads (reflow soldering).	

2. Features and Effects

Features	Effects
• Allows high density mounting • Components can be installed on both sides of a board • Ceramic PC boards can be used	System downsizing
• Compatible with automatic placement by robots • Drilling for lead holes is not required • Compact system designs are possible due to high density mounting	Overall cost reduction
• High heat resistance • Anti-gas measures	High reliability

The surface mount relay is manufactured with the following advanced technologies:

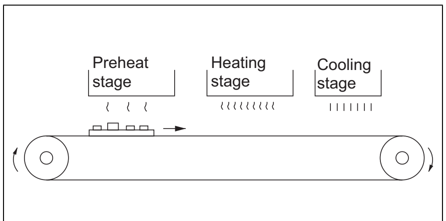
- Heat-resistance encapsulation technique
- Gas analysis
- Reliability assessment
- Precision molding technique for heat-resistant materials

3. Examples of SMT Applications

The following describes some examples of typical SMT applications:

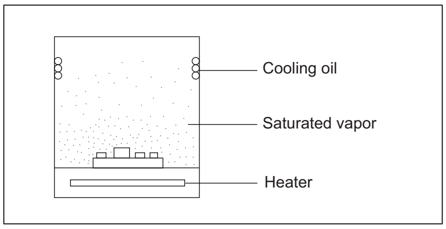
- Infrared Reflow Soldering (IRS)

IRS is the most popular reflow soldering technology now available for surface mounting. It uses a sheath heater or infrared lamp as its heat source. PC board assemblies are continuously soldered as they are transferred through a tunnel furnace comprised of a preheating, heating, and cooling-stages.



- Vapor Phase Soldering (VPS)

With VPS technology, PCB assemblies are carried through a special inactive solvent, such as Fluorinert FC-70, that has been heated to a vapor state. As the saturated vapor condenses on the PC board surface, the resulting evaporation heat provides the energy for reflow soldering.



- Belt conveyer reflow furnace

As PCB assemblies are transferred on a thin, heat-resistant belt conveyer, they are soldered by the heat from hotplates placed begeath the conveyer belt.

- Double Wave Soldering (DWS)

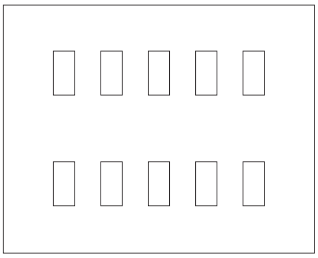
Components are glued to the PC board surface. The board assembly is transferred through a molten solder fountain (with the component side facing down), and the components are soldered to the board.

- Other Technologies

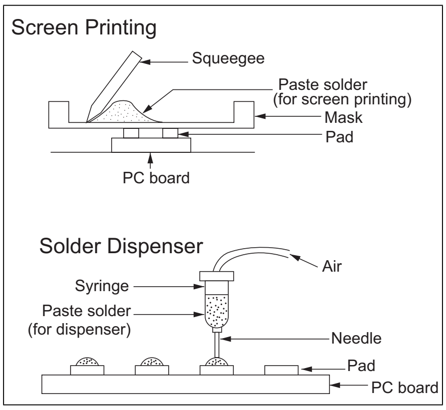
Other reflow soldering technologies include those utilizing lasers, hot air, and pulse heaters.

[2] Cautions for installation

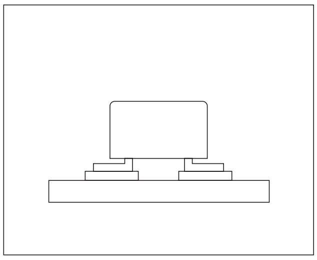
1. Paste Soldering



- Mounting pads on PC boards must be designed to absorb placement errors while taking account of solderability and insulation. Refer to the suggested mounting pad layout in the application data for the required relay product.
- Paste solder may be applied on the board with screen printing or dispenser techniques. For either method, the paste solder must be coated to appropriate thickness and shapes to achieve good solder wetting and adequate insulation.

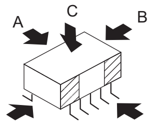


2. Relay Installation



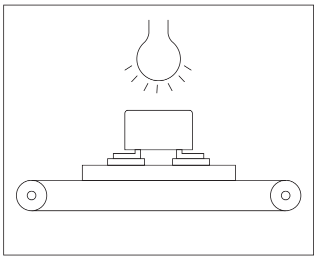
- For small, lightweight components such as chip components, a self-alignment effect can be expected if small placement errors exist. However, this effect is not as expected for electro-mechanical components such as relays, and they require precise positioning on their soldering pads.
- If SMT relays sustain excessive mechanical stress from the placement machine's pickup head, their performance cannot be guaranteed.
- Our SMT relays are supplied in stick packaging compatible with automatic placement processes. We also offer tape packaging at customer request.

Holding Pressure
Direction A: Less than 9.8 N (less than 1,000 gf)
Direction B: Less than 9.8 N (less than 1,000 gf)
Direction C: Less than 9.8 N (less than 1,000 gf)



(ex. TQ-SMD Relay)

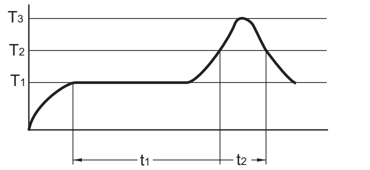
3. Reflow



Reflow soldering under inadequate soldering conditions may result in unreliable relay performance or even physical damage to the relay (even if the relay is of surface mount type with high heat resistance).

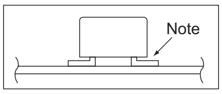
Example of Recommended Soldering Condition for Surface Mount Relays.

- IRS technique



T_1 = 150 to 180°C 302 to 356°F
T_2 = 230°C 446°F or more
T_3 = Less than 250°C 482°F

t_1 = 60 to 120 sec.
t_2 = Less than 30 sec.



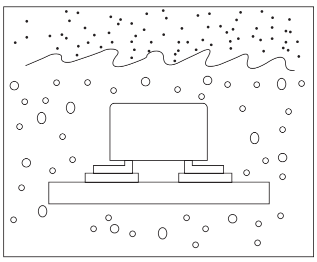
- It is recommended that the soldered pad be immediately cooled to prevent thermal damage to the relay and its associated components.
- While surface mount relays are solvent washable, do not immerse the relay in cold cleaning solvent immediately after soldering.

- Manual soldering
  - Soldering iron tip temperature: 350°C 662°F
  - Soldering iron wattage: 30 to 60 watts
  - Soldering time: Less than 3 sec.
- Others
  When a soldering technique other than above is to be used (hot air, hotplate, laser, or pulse heater technique), carefully investigate the suitability of the technique.

Note:

The soldering temperature profile indicates the pad temperature. In some cases, the ambient temperature may be greatly increased. Check for the specific mounting condition.

4. Cleaning



- The surface mount relays are solvent washable. Use alcohol or an equivalent solvent for cleaning.
- Boiled cleaning is approved for surface mount relays. Ultrasonic cleaning may cause coil damage or light contact sticking.

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