

Panasonic
ideas for life

SP/WL/VZ SERIES

PaPIRs MOTION SENSOR



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MOTION SENSOR
(Passive Infrared Type)

((PaPIRS)) Motion Sensor
SP Series



PE (Polyethylene) lens



Si (Silicon) lens

APPLICATIONS

Security & Wireless Devices

- Security sensors and cameras
- Wireless occupancy sensors driven by photovoltaic cells or battery to extend battery life.

Housing & Commercial equipment

- Lighting fixtures and wiring devices
- Video intercoms, HA control panels
- Vending machines etc.

Home appliances (Energy savings)

- Television and PC monitors
- PC, Air-Conditioners
- Air Purifiers
- Wireless and Battery operated monitoring sensing devices

1. Low profile achieved with fitted lens and embedded sensing circuit.

The low profile sensor (Polyethylene: 9.7mm, Silicon-lens: 6mm) is possible using Panasonic's proprietary and high-density electronic component mounting. This technology is achieved by simply embedding the sensing circuits inside the actual sensor. (See "Block Diagram" below)

With Silicon-lens sensor, the lens is incorporated in the outer package to become a pyroelectric sensor module. This makes it easy to mount the sensor on thin or compact products with limited space.

2. Motion detection with 3mm diameter miniature flat lens

A 3 mm diameter flat surface lens is possible using Panasonic's unique Lens Formation Technology for silicon substrates, making the lens operating substantially small compared to other conventional sensors.

3. 1µA low current consumption possible based on Panasonic's proprietary design

The development of a specialized circuit allows the reduction of current consumption to 1 µA (*). After motion is detected, the sensor will shift to "stand-by" mode.

Reduction of Current consumption allows battery life to be extended for battery driven products. These include wireless based or energy sensitive devices.

(Note: Product lineup includes: 1µA, 2µA, and 6µA sensors.)

4. Robust design against false detection

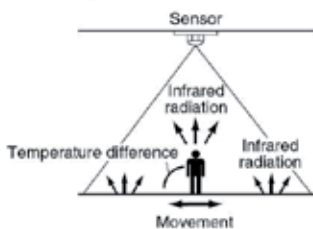
Panasonic PaPIRS sensing circuits are enclosed in a metallic case which helps minimize the adverse effects of external electro magnetic fields. (i.e.: radiated noise caused by cellular phones)

Since the sensors have a high S/N ratio, they are less sensitive to false starts when operated under different environmental surroundings.

What is passive infrared type?

This sensor detects changes in infrared radiation which occur when there is movement by a person (or object) which is different in temperature from the surroundings.

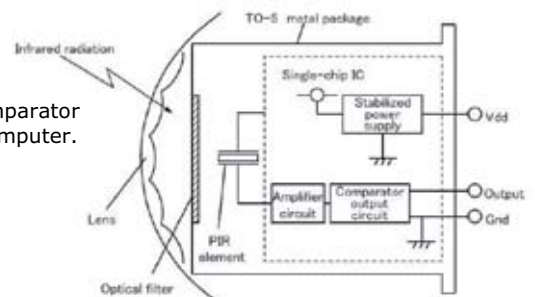
- ① As this sensor detects temperature differences, it is well suited to detecting the motion of people by their body temperature.
- ② Wide sensing area.



Compliance with RoHS Directive

Block Diagram (digital output circuit)

Has a built-in amplifier and comparator connected directly to a microcomputer.



ORDERING INFORMATION

EKMA



Output: 1: Digital

Current Consumption: 1: 1µA 2: 2µA 3: 6µA

Detection Range: 01: 5m 02: 3m

Lens Color:
0: No Lens 1: White 2: Black

Lens Material: 1: Polyethylene 2: Silicon

Mounting: 1: TO-5

PRODUCT TYPES

Lens type	Current Consumption	Lens color	Model No.	Inner Package	Outer Package
Si-lens type (Silicon)	1 μ A	—	EKMA1102120	50pcs.	1000pcs.
	2 μ A	—	EKMA1202120		
	6 μ A	—	EKMA1302120		
PE-lens type (Polyethylene)	1 μ A	White	EKMA1101111		
		Black	EKMA1101112		
	2 μ A	White	EKMA1201111		
		Black	EKMA1201112		
	6 μ A	White	EKMA1301111		
		Black	EKMA1301112		

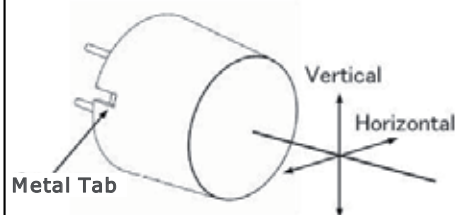
PERFORMANCE

1. Detection Performance

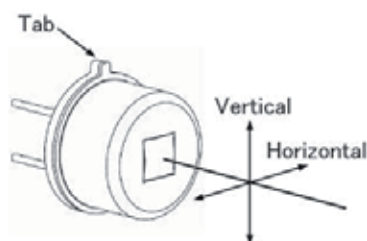
Items	PE-lens type	Si-lens type	Conditions concerning the target	
Detection Range *1)	Max. 5m	Max. 3m	1. The temperature difference between the target and the surroundings should be superior to 4°C.(7.2°F) 2. Movement speed: 1.0m/s 3. Target concept is human body (Size: Around 700 × 250mm)	
Detection Area	Horizontal *2)	94° (±47°)		58° (±29°)
	Vertical *2)	82° (±41°)		34° (±12°)
	Detection Zones *3)	64 zones		4 zones

*1) Depending on the target's speed and its temperature difference with the surroundings, detection can occur at a range superior to the above value. However, please use this sensor according to the specifications.

*2) Definitions for "Horizontal" and "Vertical"



(Polyethylene lens-type)



(Silicon lens-type)

*3) Refer to the "detection area" diagram on P6

2. Maximum Rated Values (Common for both PE-lens type, and Si-lens type)

Items	Specified value
Power Supply Voltage	-0.3~7V DC
Usable Ambient Temperature	-20~+60°C (-4~+140°F) Do not use in a freezing or condensation environment
Storage Temperature	-20~+70°C (-4~+158°F)

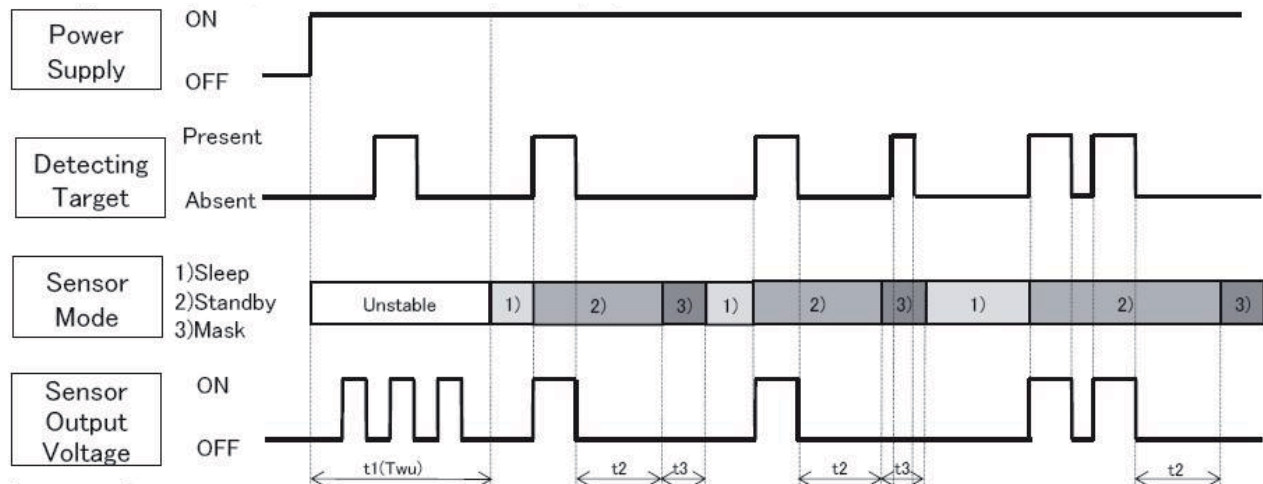
3. Electrical Characteristic (Conditions for Measuring: Ambient temperature: 25° C (77° F))

Items		Symbol	1 μ A type	2 μ A type	6 μ A type	Measured Conditions
Operating Voltage	Min.	V _{dd}	2.3V DC	2.3V DC	2.3V	—
	Max.		6.0V DC	6.0V DC	6.0V	
Electrical Current Consumption (Sleep mode) ^(*4)	Min	I _w	1.0 μ A	—	—	I _{out} =0
	Max		1.6 μ A			
Electrical Current Consumption (Standby mode) ^(*5)	Avg.	I _w	1.9 μ A	1.9 μ A	6.0 μ A	I _{out} =0
	Max.		3.0 μ A	3.0 μ A	12.0 μ A	
Output Current	Max.	I _{out}	100 μ A	100 μ A	100 μ A	V _{out} \geq V _{dd} - 0.5
Output Voltage	Min.	V _{out}	V _{dd} - 0.5V DC	V _{dd} - 0.5V DC	V _{dd} - 0.5V DC	—
Circuit Stability Time (when voltage is applied)	Avg.	T _{wu}	25s	25s	—	—
	Max.		210s	210s	30s	

(*4) (*5): "Sleep mode" or "Standby mode" is for current consumption 1 μ A type. Please refer to "TIMING CHART".

TIMING CHART

1. Digital Output (For current consumption 1 μ A)



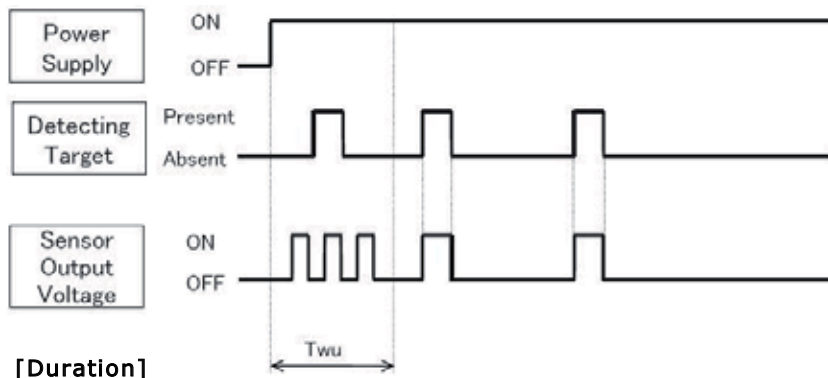
[Mode]

- 1) Sleep Mode : When the output is OFF. The electrical current consumption is around 1 μ A.
- 2) Standby Mode : After the sensor's output reached ON status, the sensor switches to standby mode. The electrical current consumption gets close to 1.9 μ A . When the sensor's output returns to its OFF value after expiration of the "hold time", the sensor switches again to sleep mode.
- 3) Mask Mode : Time during which the output is forced to OFF after the end of the standby mode. (No detection is possible during this period.)

[Duration]

- t₁(T_{wu}) : Circuit Stability Time: About 25s. (typ.)
During this stage, the output's status is undefined (ON/OFF) and detection is therefore not guaranteed.
- t₂ : Standby Hold Time : About 2.6s (typ.)
Depending on the number of output happening during standby mode, the hold time can differ.
- t₃ : Mask Time : About 1.3s (typ.)
During this stage, even if the sensor detects something, output will not switch to ON.

2. Digital Output (For current consumption 2μA and 6μA)



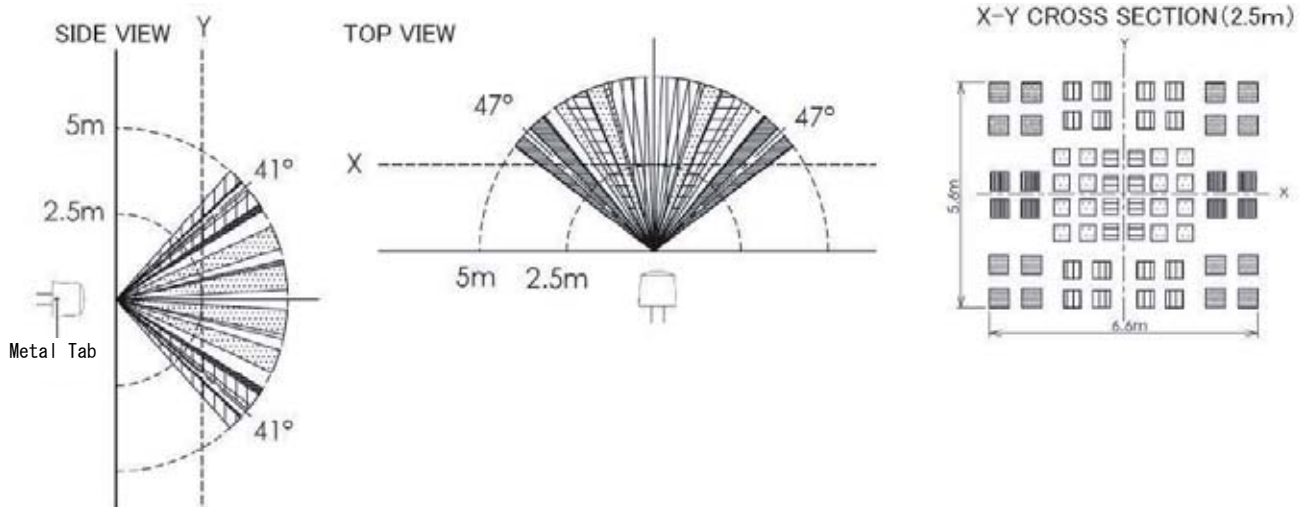
[Duration]

T_{wu} : Circuit Stability Time : About 25s. (typ.) (For 2 μ A)
About 30s. (Max.) (For 6 μ A)

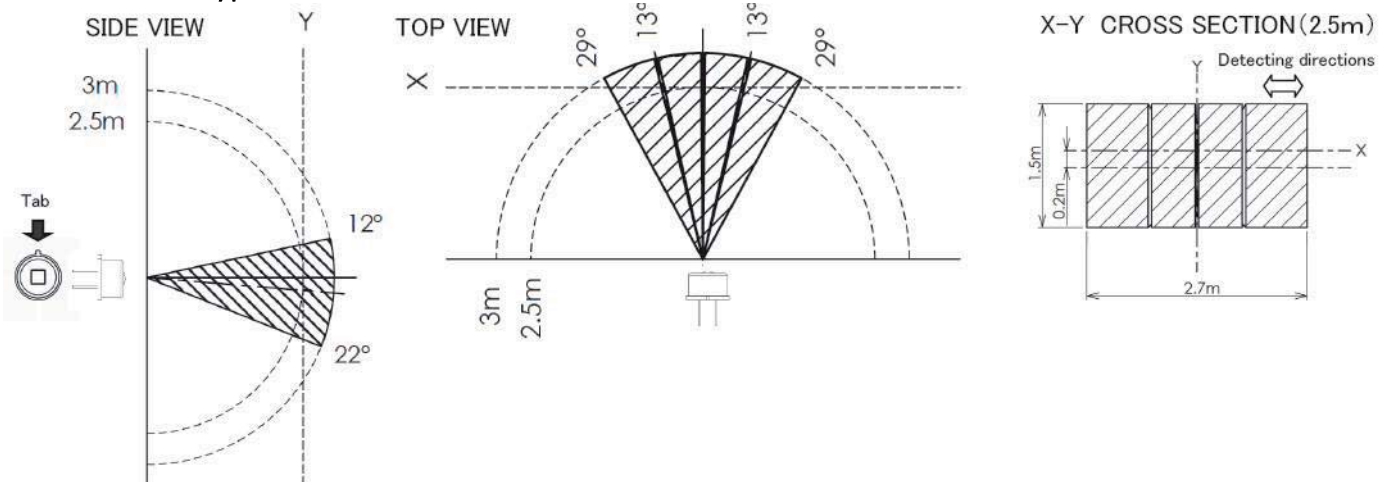
During this stage, the output's status is undefined (ON/OFF) and detection is therefore not guaranteed.

DETECTION PERFORMANCE

1. Polyethylene-lens type

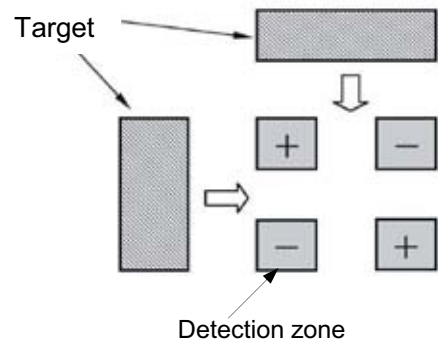


2. Silicon-lens type



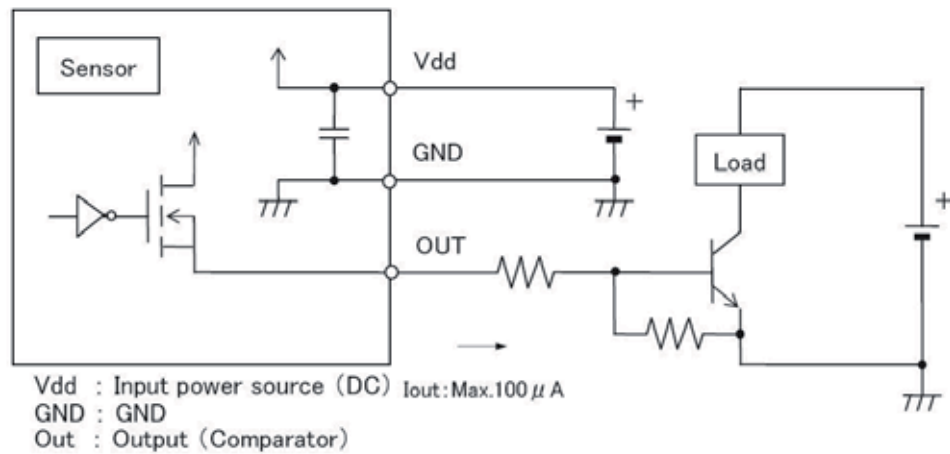
3. Notes Regarding the Detection Zone

As shown on the diagram, the detection zone is polarized. If a target enters the detection zones + and - at the same time, the signals are respectively cancelled and cannot be detected. (Please refer to the detection area diagram for details on P.4.)



HOW TO USE

1. Wiring Diagram (Digital Output)

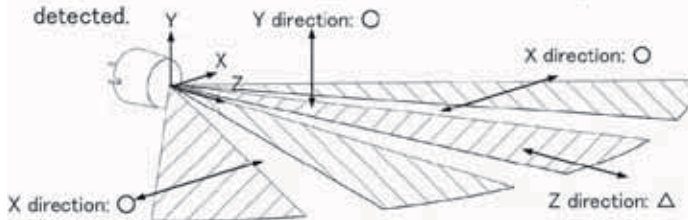


2. Moving Direction Concept

1) Polyethylene-lens type

As detailed on the diagram, please install the sensor so that the expected trespassing direction corresponds to the axis X.,Y.

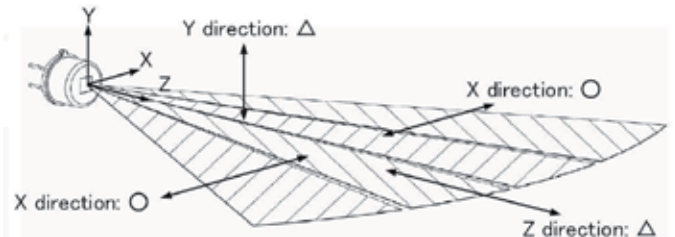
In some cases, intrusions that occur parallel to the axis Z in every detection zone, closing toward the sensor, may not be detected.



2) Silicon-lens type

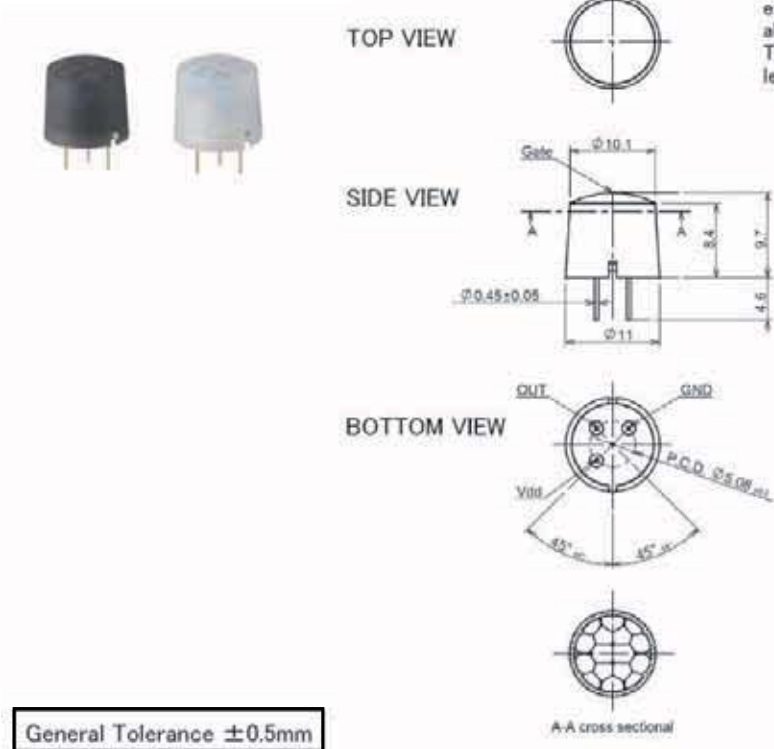
As detailed on the diagram, please install the sensor so that people will be entering from the X direction.

If there will be people coming close towards the sensor from the Y or Z directions, there will be cases which people may not be detected.



DIMENSIONS

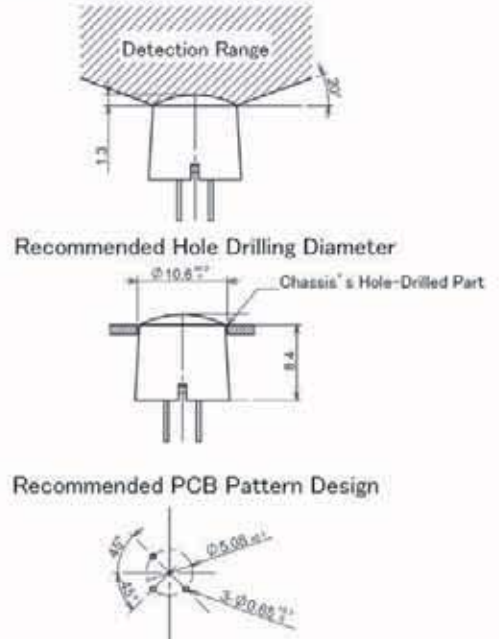
1) Polyethylene-lens type



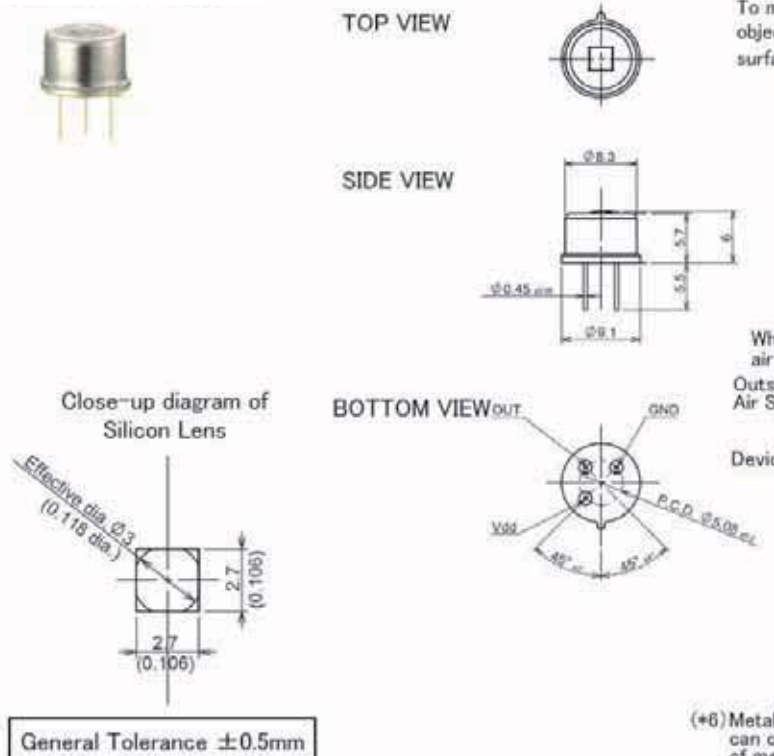
General Tolerance $\pm 0.5\text{mm}$

When designing your products

To maintain specified detection capability, please place and expose the sensor so that tip of lens will be more than 1.3mm above the chassis. The hole of the chassis should have a taper depending on the lens shape, or have a bigger hole.



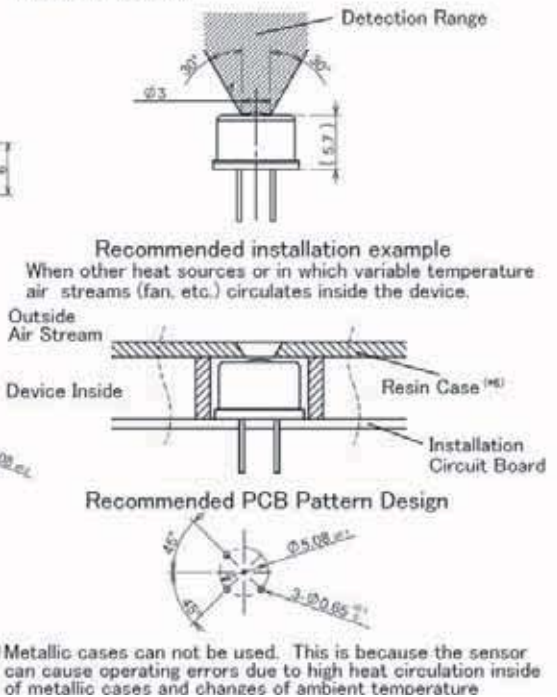
2) Silicon-lens type



General Tolerance $\pm 0.5\text{mm}$

When designing your products

To maintain the detection performance, please avoid to place objects in the detection area of 30° left to right from the surface of the CAN.



(*6) Metallic cases can not be used. This is because the sensor can cause operating errors due to high heat circulation inside of metallic cases and changes of ambient temperature

NOTES

1. Basic Principles

The PaPIRs Motion Sensor is a pyroelectric infrared sensor that detects variations in infrared rays. However it may not detect in the following cases: lack of movement, no temperature change in the heat source. In addition it can also detect the presence of heat sources other than a human body. Efficiency and reliability of the system may vary depending on actual operating conditions:

- 1) Detecting heat sources other than the human body, such as:
 - a) small animals entering the detection area,
 - b) white light source (sunlight, car headlights, etc.) directly hitting the sensor,
 - c) sudden temperature changes in the detection area caused by humidifier water vapor emission, or air conditioning system hot/cold air emissions.
- 2) Difficulty in sensing the heat source
 - a) Glass, acrylic or similar materials standing between the target and the sensor may not allow a correct transmissions of infrared rays.
 - b) Non-movement or quick movements of the heat source inside the detection area.
- 3) Expansion of the detection area

In case of considerable difference in the ambient temperature and the human body temperature, detection area may be wider than from the configured detection area.

3. Ambient Environmental Conditions

- 1) Temperature:
 - Ambient Temperature -20°C~+60°C (-4°F ~+140°F)
 - (Do not use in a freezing or condensation environment)
 - Storage Temperature -20°C~+70°C(-4°F~+158°F)
- 2) Humidity Level: 15~85% Rh
(Avoid condensation or freezing of this product)
- 3) Pressure: 86~106kPa
- 4) Operating temperatures and humidity level are suggested to prolong usage. However, they do not guarantee durability or environmental resistance. Generally, high temperatures or high humidity levels will accelerate the deterioration of electrical components. Please consider both the planned usage and environment to determine the expected reliability and length of life of the product.
- 5) This sensor is not waterproof or dustproof. Avoid use in environments subject to excessive moisture, condensation, frost, or containing salt air or dust. If a sensor is used with a cover installed, the initial detection performance specifications may not be able to be met. Confirm the operation under the actual operating conditions.
- 6) Overheating, oscillations, shocks can cause the sensor to malfunction.

2. Other Handling Cautions

- 1) Deterioration of detecting performance will happen if dirt and dust adhere to the lens. For silicone type lenses, please take into consideration that dirt and dust may adhere to the lens.
- 2) The lens of the Polyethylene lens type is made of soft materials (Polyethylene). If any loads or shocks are applied to the lens, due to deformities, and damages, this will lead to malfunction, or deterioration of performance. On occasion of commodity structure design for the Silicon-lens type, please consider to point of protecting lens.
- 3) The sensor may be damaged by ± 200 volts of static electricity. Avoid direct hand contact with the pins and be very careful when operating the product.
- 4) When soldering the lead wire, hand-solder the sensor using the soldering iron below 350°C, and within 3 seconds. Please avoid soldering using solder tank, this can lead to deterioration of performance. Also, please avoid bending the lead wire to mount the sensor onto the circuit board temporarily. This will damage the sensor.
- 5) Do not use liquids to wash the sensor. If washing fluid gets through the lens, it can reduce performance.
- 6) When wiring the product, always use shielded cables and minimize the wiring length to prevent noise disturbances.

4. External surge voltages

The inner circuit board can be destroyed by a voltage surge.

Use of surge absorption elements is highly recommended.

- Surge resistance: below the power supply voltage value indicated in the maximum rated values section.

5. Power supply-superimposed noise

- 1) Please use a stabilized power supply. Power supply noise can cause operating errors.
 - Noise resistance : $\pm 20V$ or less
(Square waves with a width of 50ns or 1 μ s)
- 2) To reduce the effect of power supply noise, install a capacitor on the sensor's power supply pin.

6. Drop damage

After the sensor had been dropped on the floor, damage can occur resulting in incorrect operation. Therefore, be sure not to use sensors that have been dropped.



Safety Precautions

Head the following precautions to prevent injury or accidents.

- Do not use these sensors under any circumstances in which the range of their ratings, environment conditions or other specifications are exceeded. Using the sensors in any way which causes their specifications to be exceeded may generate abnormally high levels of heat, emit smoke, etc., resulting in damage to the circuitry and possibly causing an accident.
- Before connecting, check the pin layout by referring to the connector wiring diagram, specifications diagram, etc., to verify that the connector is connected properly. Connection errors may cause unforeseen problems in operation, generate abnormally high levels of heat, emit smoke, etc., resulting in damage to the circuitry.
- Do not use any motion sensor which has been disassembled or remodeled.
- Failure modes of sensors include short-circuiting, open-circuiting and rises in temperature. If this sensor is to be used in equipment where safety is a prime consideration, examine the possible effects of these failures on the equipment concerned and ensure safety by providing protection circuits or protection devices.
Example:
 - Safety equipment and devices
 - Traffic signals
 - Burglar and disaster prevention

PaPIRs

Panasonic

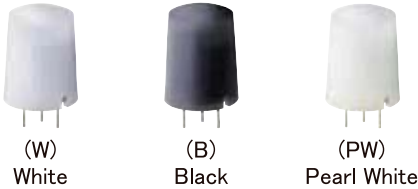
ideas for life

MOTION SENSOR (Passive Infrared Type)

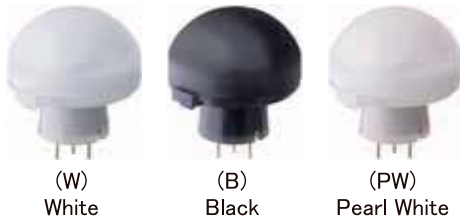
(((PaPIRs))) Motion Sensor WL Series

PaPIRs WL series

(Standard detection type)



(Long distance detection type)



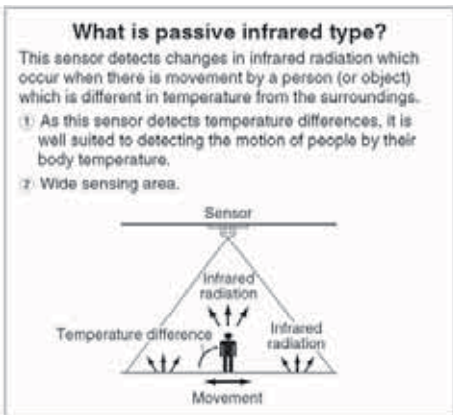
APPLICATIONS

Security Equipment:

- Wireless security sensors, and cameras.

Wireless Devices / Mobile Equipment:

- Wireless occupancy sensors (powered by PV cells or battery)
- PC and smart phone



Compliance with RoHS Directive

1. 1μA low current consumption with Panasonic's proprietary design

Development of a specialized circuit allows the reduction of current consumption to 1 μA (during sleep mode). When motion is detected, the sensor will shift to "stand-by" mode.

Reduction of current consumption allows battery life to be extended for battery driven products, including wireless based and low power consumption devices. (Product lineup includes 1 μA, 2 μA, and 6 μA sensors.)

2. Simplified circuitry with fully integrated sensor design

Panasonic's proprietary high-density embedded circuit design eliminates external sensing circuits. Advantages include reduced development and design schedules.

3. Lead-free pyroelectric elements

PaPIRs sensing elements contain lithium tantalate and are lead-free. Typical PIR sensing elements are ferroelectric ceramic (PZT) containing lead.

4. Low curvature lens for product designs

Panasonic's lens formation technology achieves a semi-flat lens with a smooth surface and minimum protrusion from the device (lens diameter: φ9.5mm).

In addition to white and black lens options, pearl white is offered for design aesthetics.

(※Refer to "Dimensions" on page 5)

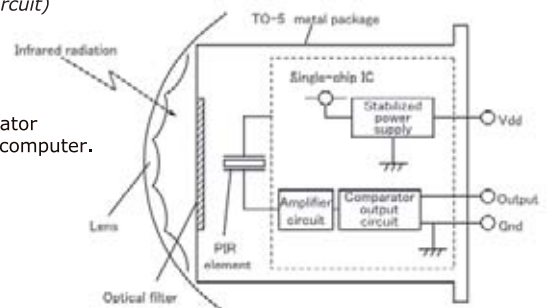
5. Robust design prevents false detection

PaPIRs sensing circuits are enclosed in a metallic can to minimize adverse effects of external electromagnetic fields. Examples include radiated noise caused by cellular phones.

A high S/N ratio minimizes sensitivity to false tripping when operated under various environmental conditions.

Block Diagram (Digital output circuit)

Built-in amplifier and comparator connected directly to a microcomputer.



ORDERING INFORMATION

EKMB

Output: 1: Digital

Current Consumption: 1: 1 μA, 2: 2 μA, 3: 6 μA

Detection Performance: 01: Standard detection type
03: Long distance detection type

Lens Color:
1: White 2: Black 3: Pearl White

Lens Material: 1: Polyethylene

Mounting: 1: TO-5

PRODUCT TYPES

Detection Performance	Current Consumption	Lens Color	Model No.	Inner Package	Outer Package
Standard detection type	1 μ A	White	EKMB1101111	50pcs	1000pcs
		Black	EKMB1101112		
		Pearl White	EKMB1101113		
	2 μ A	White	EKMB1201111		
		Black	EKMB1201112		
		Pearl White	EKMB1201113		
	6 μ A	White	EKMB1301111		
		Black	EKMB1301112		
		Pearl White	EKMB1301113		
Long Distance detection type	1 μ A	White	EKMB1103111	50pcs	1000pcs
		Black	EKMB1103112		
		Pearl White	EKMB1103113		
	2 μ A	White	EKMB1203111		
		Black	EKMB1203112		
		Pearl White	EKMB1203113		
	6 μ A	White	EKMB1303111		
		Black	EKMB1303112		
		Pearl White	EKMB1303113		

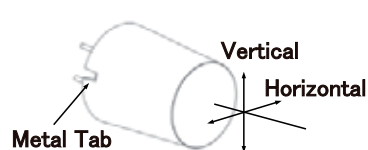
PRODUCT TYPES

1. Detection Performance [Conditions for measuring: Ambient temperature:25°C(77°F) Operating voltage:3VDC]

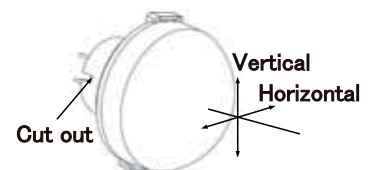
Items		Standard Detection type	Long Distance Detection type	Conditions concerning target
Detection Range *1)		Max. 5m	Max. 12m	1. The temperature difference between the target and the surroundings should be superior to 4°C (7.2°F). 2. Movement speed: 1.0m/s 3. Target concept is human body (Size: 700 × 250mm)
Detection Area	Horizontal *2)	94° (±47°)	102° (±51°)	
	Vertical *2)	82° (±41°)	92° (±46°)	
	Detection Zone *3)	64 zones	92 zones	

*1) Depending on the target's speed and temperature difference compared to the surroundings, detection can occur at a range superior to the above value. Please use this sensor according to the specifications for guaranteed performance.

*2) Definitions for "Horizontal" and "Vertical"



Standard detection type



Long Distance detection type

*3) Refer to the "detection area" diagram on P.14

2. Maximum Rated Values

Items	Specified value
Power Supply Voltage	-0.3~4.5V DC
Usable Ambient Temperature	-20~+60°C (-4~+140°F) Do not use in a freezing or condensation environment.
Storage Temperature	-20~+70°C (-4~+158°F)

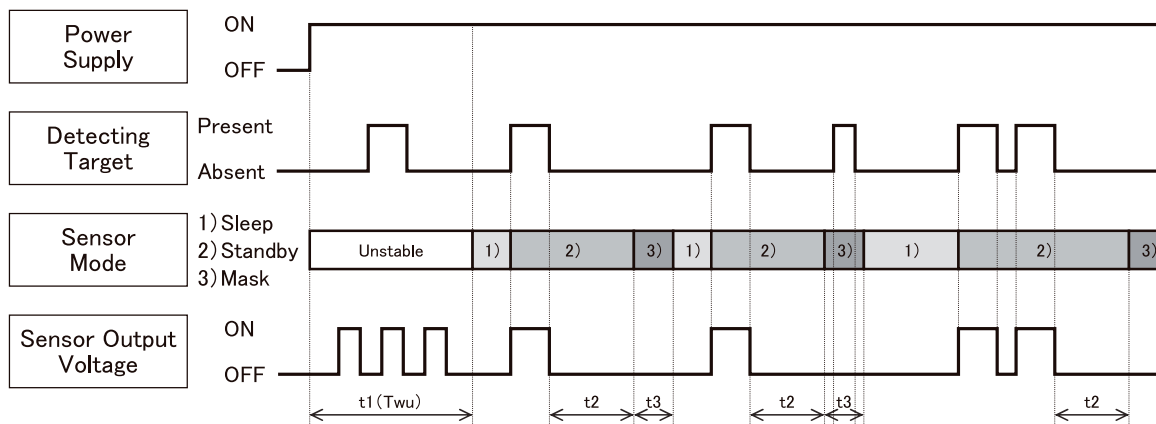
3. Electrical Characteristic [Conditions for Measuring: Ambient temperature 25°C(77°F)]

Items	Symbol	1 μ A type	2 μ A type	6 μ A type	Measured Conditions	
Operating Voltage	Min.	Vdd	2.3V DC	2.3V DC	2.3V DC	—
	Max.	Vdd	4.0V DC	4.0V DC	4.0V DC	—
Electrical Current Consumption (Sleep mode) (*4)	Avg.	Iw	1.0 μ A	—	—	Iout=0
	Max.	Iw	1.6 μ A	—	—	
Electrical Current Consumption (Standby mode) (*4)	Avg.	Iw	1.9 μ A	1.9 μ A	6.0 μ A	Iout=0
	Max.	Iw	3.0 μ A	3.0 μ A	12.0 μ A	
Output Current	Max.	Iout	100 μ A	100 μ A	100 μ A	Vout \geq Vdd-0.5
Output Voltage	Min.	Vout	Vdd-0.5VDC	Vdd-0.5VDC	Vdd-0.5VDC	—
Circuit Stability Time (When voltage is applied)	Avg.	T _{wu}	25s	25s	—	—
	Max.		210s	210s	30s	

(*4)(*5): "Sleep mode" or "Standby mode" is for 1 μ A current consumption version. Please refer to "TIMING CHART" below.

TIMING CHART

1. Digital output (1 μ A current consumption)



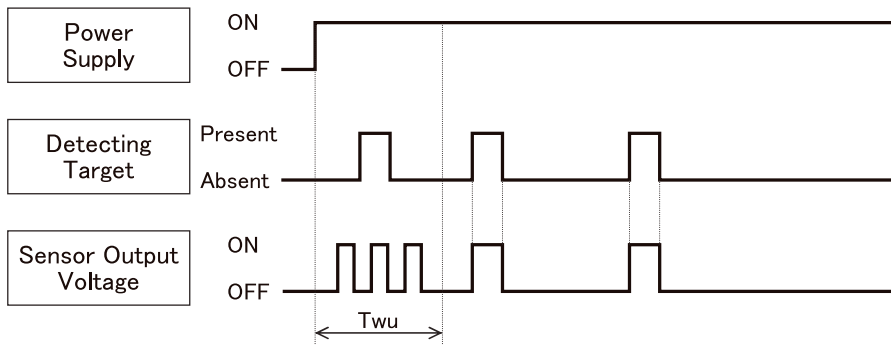
[Modes]

- 1) Sleep Mode : When the output is OFF. The electrical current consumption is approximately 1 μ A.
- 2) Standby Mode : After the sensor's output reaches ON status, the sensor switches to standby mode. The electrical current consumption is ~ 1.9 μ A. When the sensor's output returns to an OFF value after expiration of the "hold time", the sensor switches again to sleep mode.
- 3) Mask Mode : Time during which the output is forced to OFF after the end of the standby mode. (no detection is possible during this period.)

[Durations]

- t1(T_{wu}): Circuit Stability Time: ~ 25s (typ.)
During this stage, the output's status is undefined (ON/OFF) and detection is not guaranteed.
- t2 : Standby Hold Time: ~ 2.6s (typ.)
Depending on the number of output occurrences during standby mode, the hold time can differ (※1)
- t3 : Mask Time ~ 1.3s (typ.)
During this stage, even if the sensor detects something, output will not switch ON.(※2)

2. Digital Output ($2\mu A$ and $6\mu A$ current consumption)

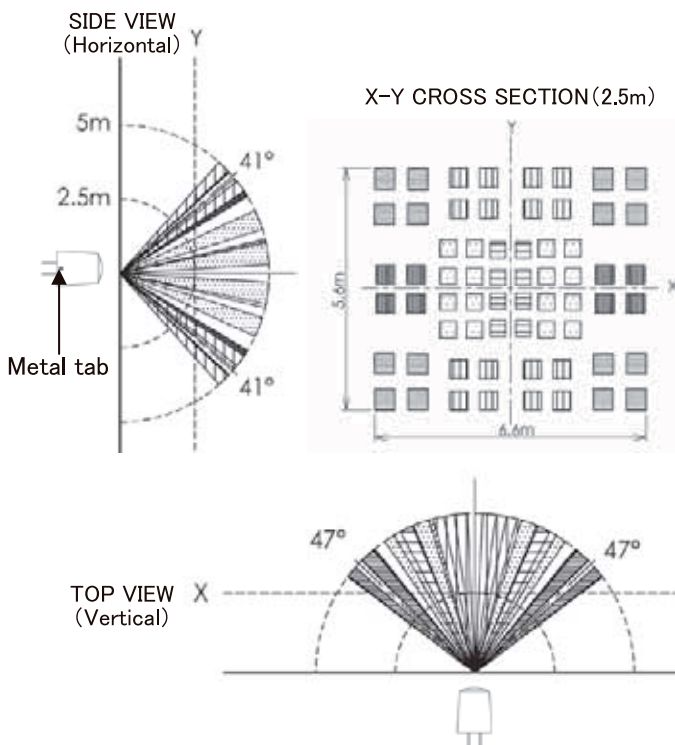


[Durations]

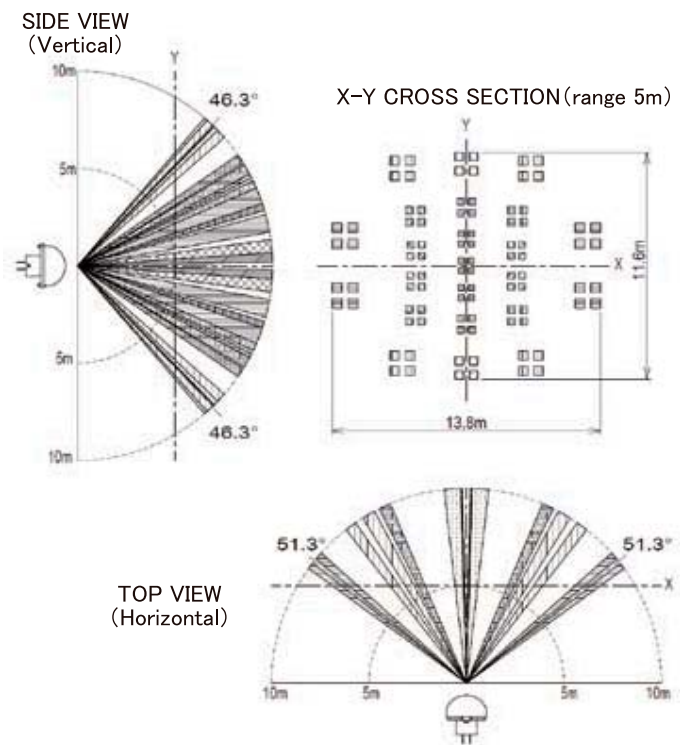
T_{wu} : Circuit Stability Time ($2\mu A$): $\sim 25s$ (typ.)
 Circuit Stability Time ($6\mu A$): $\sim 30s$ (max.)
 During this stage, output status is undefined (ON/OFF) and detection is not guaranteed.

DETECTION PERFORMANCE

1) Standard detection type

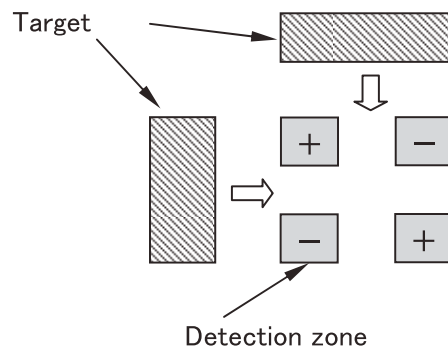


2) Long Distance detection type



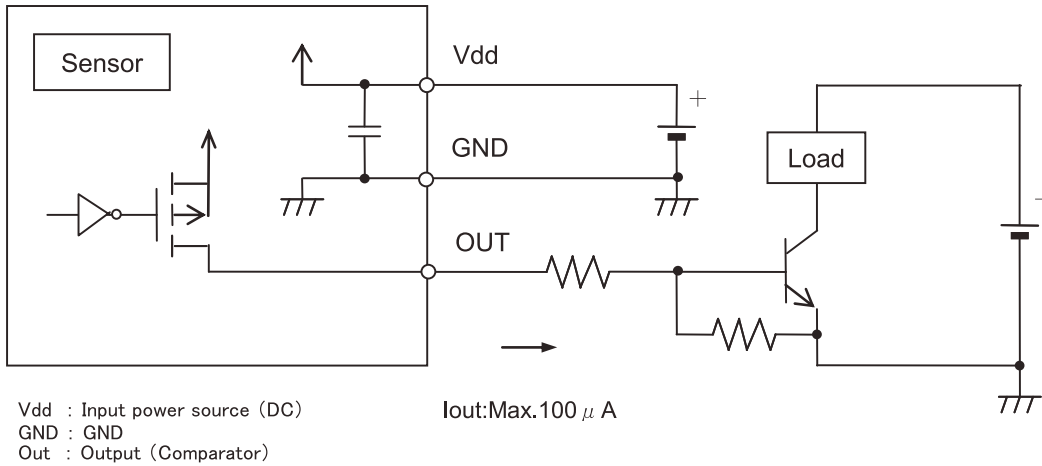
2. Detection Zone Notes

As shown on the diagram, the detection zone is polarized. If a target enters the detection zones + and - at the same time, the signals are respectively cancelled and detection could become impossible at maximum detection range. (Please refer to the detection area diagram for details)



HOW TO USE

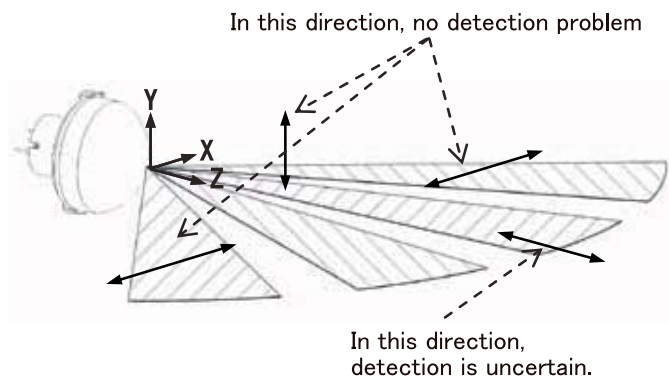
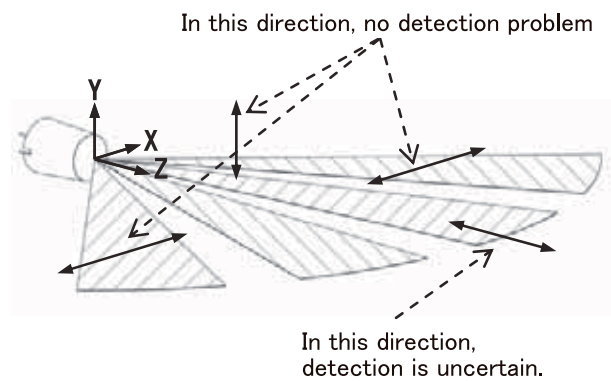
1. Wiring Diagram (Digital Output)



2. Moving Direction

As detailed on the diagram, please install the sensor so that the expected trespassing direction corresponds to the axis X or axis Y.

In some cases, intrusions that occur parallel to the axis Z in every detection zone, closing toward the sensor, may not be detected.



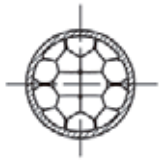
DIMENSION

1) Standard Detection type



White Black Pearl White

A-A Cross Sectional

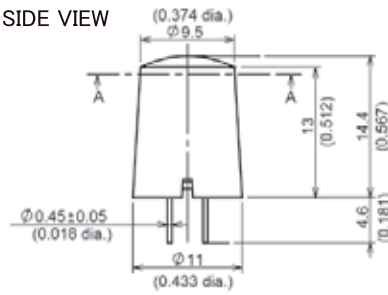


Dimensions

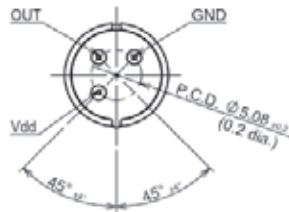
TOP VIEW



SIDE VIEW



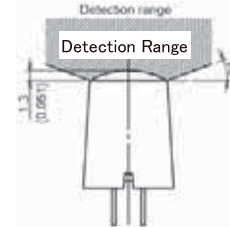
BOTTOM VIEW



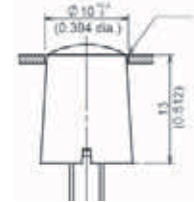
When designing your products

To maintain specified detection capability, position the sensor so that the lens tip is a minimum 1.3mm above the chassis.

The chassis hole requires a taper according to the lens shape, or a larger hole.



Recommended Hole Drilling Diameter



Chassis's Hole-Drilled Part

Recommended PCB Pattern Design

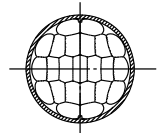


2) Long Distance Detection type



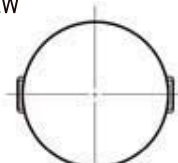
White Black Pearl White

A-A Cross Sectional

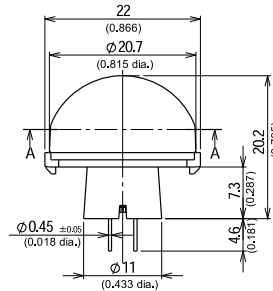


Dimensions

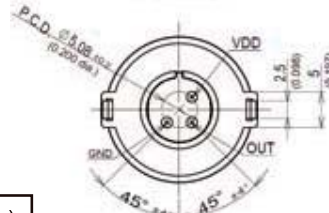
TOP VIEW



SIDE VIEW



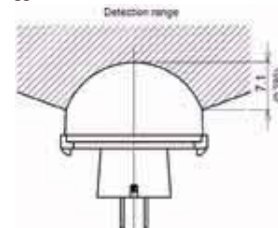
BOTTOM VIEW



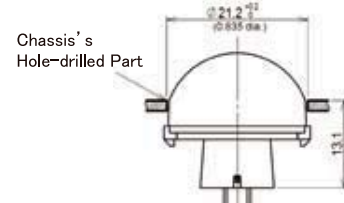
When designing your products

To maintain specified detection capability, please place and expose the sensor so that tip of lens will be more than 7.1mm above the chassis.

The hole of the chassis should have a taper depending on the lens shape, or have a bigger hole.

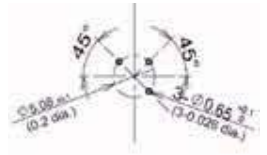


Recommended Hole Drilling Diameter



Chassis's Hole-drilled Part

Recommended PCB Pattern Design



General Tolerance $\pm 0.5\text{mm}$ ($\pm 0.020\text{inch}$)

NOTES

1. Basic Principles

The PaPIRs Motion Sensor is a pyroelectric infrared sensor that detects variations in infrared rays. However it may not detect in the following cases: lack of movement, no temperature change in the heat source. Besides, it could also detect the presence of heat sources other than a human body. Efficiency and reliability of the system may vary depending on actual operating conditions:

- 1) Detecting heat sources other than the human body, such as:
 - a) small animals entering the detection area.
 - b) white light source (sunlight, car headlights, etc.) directly hitting the sensor.
 - c) sudden temperature changes in the detection area caused by humidifier water vapor emission, or air conditioning system hot/cold air emissions.
- 2) Difficulty in sensing the heat source
 - a) Glass, acrylic or similar materials standing between the target and the sensor may not allow a correct transmission of infrared rays.
 - b) Non-movement or quick movements of the heat source inside the detection area.
- 3) Expansion of the detection area

In case of considerable difference in the ambient temperature and the human body temperature, detection area may be wider apart from the configured detection area.

2. Other handling cautions

- 1) Deterioration of detecting performance will happen if dirt and dust adhere to the lens.
- 2) The lens of the Polyethylene lens type is made of soft materials (Polyethylene). If any loads or shocks are applied to the lens, due to deformities, and damages, this will lead to malfunction, or deterioration of performance.
- 3) The sensor may be damaged by ± 200 volts of static electricity. Avoid direct hand contact with the pins and be very careful when operating the product
- 4) When soldering the lead wire, hand solder the sensor using the soldering iron below 350°C , and within 3 seconds. Please avoid soldering using solder tank, this can lead to deterioration of performance. Also please avoid bending the lead wire to mount the sensor on to the circuit board temporarily. This will damage the sensor.
- 5) Do not use liquids to wash the sensor. If washing fluid gets through the lens, it can reduce performance.
- 6) When wiring the product, always use shielded cables and minimize the wiring length to prevent noise disturbances.

3. Ambient Environmental Conditions

- 1) Temperature: Ambient temperature $-20^{\circ}\text{C} \sim +60^{\circ}\text{C}$ ($-4^{\circ}\text{F} \sim +140^{\circ}\text{F}$)
(Do not use in a freezing or condensation environment)
Storage Temperature $-20^{\circ}\text{C} \sim +70^{\circ}\text{C}$ ($-4^{\circ}\text{F} \sim +158^{\circ}\text{F}$)
- 2) Humidity Degree: 15~85% Rh (Avoid condensation or freezing of this product)
- 3) Pressure : 86~106kPa
- 4) Operating "temperatures" and "humidity level" are suggested to prolong usage. However, they do not guarantee durability or environmental resistance. Generally, high temperatures or high humidity levels will accelerate the deterioration of electrical components. Please consider both the planned usage and environment to determine the expected reliability and length of life of the product.
- 5) This sensor is not waterproof or dustproof. Avoid use in environments subject to excessive moisture, condensation, frost, containing salt air or dust. If a sensor is used with a cover installed, the initial detection performance specifications may not be able to be met. Confirm the operation under the actual operating conditions.
- 6) Overheating, oscillations, shocks can cause the sensor to malfunction.

4. External surge voltages

The inner circuit board could be destroyed by a voltage surge. Use of surge absorption elements is highly recommended.
> Surge resistance : below the power supply voltage value indicated in the maximum rated values section.

5. Power supply-superimposed noise

- 1) Please use a stabilized power supply. Power supply noise can cause operating errors.
> Noise resistance : $\pm 20\text{V}$ or less (Square waves with a width of 50ns or 1 μs)
- 2) To reduce the effect of power supply noise, install a capacitor on the sensor's power supply pin.

6. Drop damage

After the sensor had been dropped on the floor, the damage can occur resulting in incorrect operation. Therefore, be sure not to use those sensors.



Safety Precautions

Head the following precautions to prevent injury or accidents.

- 1) Do not use these sensors under any circumstance in which the range of their ratings, environment conditions or other specifications are exceeded. Using the sensors in any way which causes their specifications to be exceeded may generate abnormally high levels of heat, emit smoke, etc., resulting in damage to the circuitry and possibly causing an accident.
- 2) Our company is committed to making products of the highest quality and reliability. Nevertheless, all electrical components are subject to natural deterioration, and durability of a product will depend on the operating environment and conditions of use. Continued use after such deterioration could lead to overheating, smoke or fire. Always use the product in conjunction with proper fire-prevention, safety and maintenance measures to avoid accidents, reduction in product life expectancy or break-down.
- 3) Before connecting, check the pin layout by referring to the connector wiring diagram, specifications diagram, etc., to verify that the connector is connected properly. Mistakes made in connection may cause unforeseen problems in operation, generate abnormally high levels of heat, emit smoke, etc., resulting in damage to the circuitry.
- 4) Do not use any motion sensor which has been disassembled or remodeled.
- 5) Failure modes of sensors include short-circuiting, open-circuiting and temperature rises. If this sensor is to be used in equipment where safety is a prime consideration, examine the possible effects of these failures on the equipment concerned, and ensure safety by providing protection circuits or protection devices.
Example :
 - Safety equipments and devices
 - Traffic signals
 - Burglar and disaster prevention

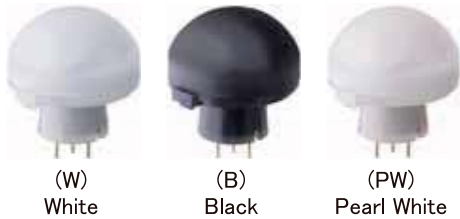
(((PaPIRs)))

PaPIRs VZ series

(Standard detection type)



(Long distance detection type)



APPLICATIONS

Commercial / Residential Equipment

- Lighting fixtures, Sensor switches,
- Video intercoms, Vending machines,
- Home automation control panels

Home Appliances (Energy Savings)

- Television and PC monitor
- Air conditioners, Air purifiers

1. Simplified circuitry with fully integrated sensor design

Panasonic's proprietary high-density embedded circuit design eliminates external sensing circuits. Advantages include reduced development and design schedules.

2. Low curvature lens for product designs

Panasonic's lens formation technology achieves a semi-flat lens with a smooth surface and minimum protrusion from the device. In addition to white and black lens options, pearl white is offered for design aesthetics. (※Refer to "Dimensions" on page 5)

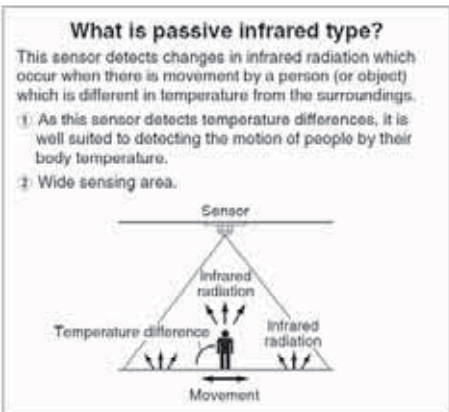
3. Robust design prevents false detection

PaPIRs sensing circuits are enclosed in a metallic can to minimize adverse effects of external electromagnetic fields. Examples include irradiated noise caused by cellular phones.

A high S/N ratio minimizes sensitivity to false tripping when operated under various environmental conditions.

4. Lead-free pyroelectric elements

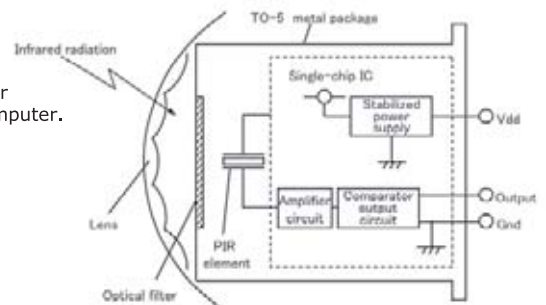
PaPIRs sensing elements contain lithium tantalate and are lead-free. Typical PIR sensing elements are ferroelectric ceramic (PZT) containing lead.



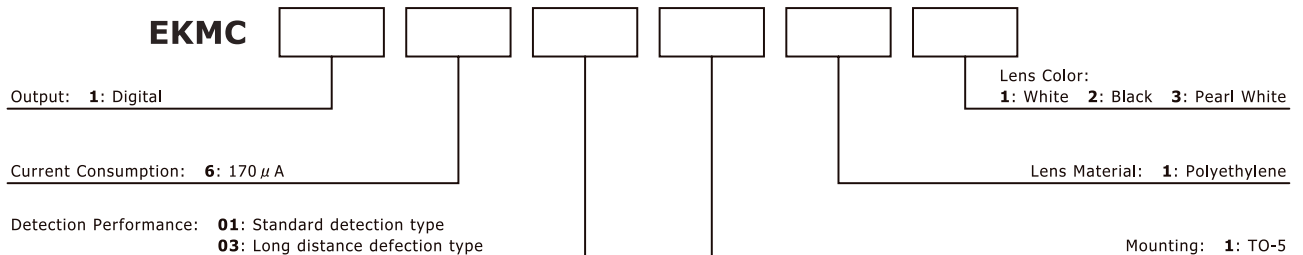
Compliance with RoHS Directive

Block Diagram (Digital output circuit)

Built-in amplifier and comparator connected directly to a microcomputer.



ORDERING INFORMATION



PRODUCT TYPES

Detection Performance	Current Consumption	Lens Color	Model No.	Inner Package	Outer Package
Standard detection type	170 μ A	White	EKMC1601111	50pcs	1000pcs
		Black	EKMC1601112		
		Pearl White	EKMC1601113		
Long Distance detection type	170 μ A	White	EKMC1603111	50pcs	1000pcs
		Black	EKMC1603112		
		Pearl White	EKMC1603113		

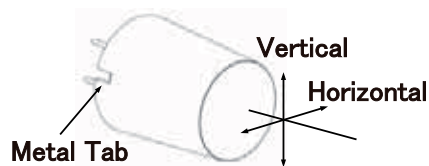
PRODUCT TYPES

1. Detection Performance [Conditions for measuring: Ambient temperature:25°C(77°F) Operating voltage:5VDC]

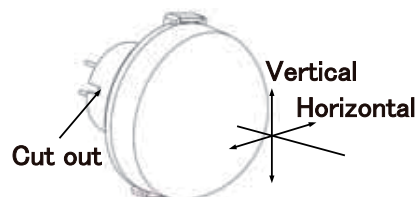
Items		Standard Detection type	Long Distance Detection type	Conditions concerning target
Detection Range *1)		Max. 5m	Max. 12m	1. The temperature difference between the target and the surroundings should be superior to 4°C (7.2°F). 2. Movement speed: 1.0m/s 3. Target concept is human body (Size: 700 × 250mm)
Detection Area	Horizontal *2)	94° (±47°)	102° (±51°)	
	Vertical *2)	82° (±41°)	92° (±46°)	
Detection Zone *3)		64 zones	92 zones	

*1) Depending on the target's speed and its temperature difference with the surroundings, detection can occur at a range superior to the above value. However, please use this sensor according to the specifications.

*2) Definitions for "Horizontal" and "Vertical"



Standard detection type



Long Distance detection type

*3) Refer to the "detection area" diagram on P. 21

2. Maximum Rated Values

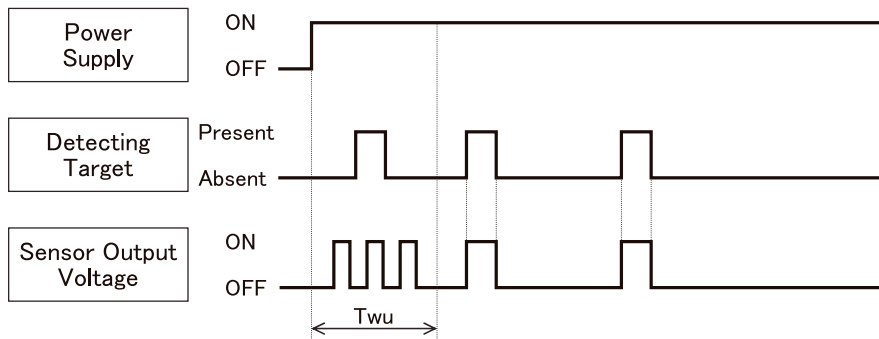
Items	Specified value
Power Supply Voltage	-0.3~7.0V DC
Usable Ambient Temperature	-20~+60°C (-4~+140°F) Do not use in a freezing or condensation environment.
Storage Temperature	-20~+70°C (-4~+158°F)

3. Electrical Characteristic [Conditions for Measuring: Ambient temperature 25°C(77°F)]

Items		Symbol	VZ series	Measured Conditions
Operating Voltage	Min.	Vdd	3.0V DC	—
	Max.		6.0V DC	—
Electrical Current Consumption	Avg.	Iw	170 μ A	Iout=0
	Max.		300 μ A	
Output Current	Max.	Iout	100 μ A	Vout \geq Vdd-0.5
Output Voltage	Min.	Vout	Vdd-0.5VDC	—
Circuit Stability Time (When voltage is applied)	Avg.	T _{wu}	—	—
	Max.		30s	

TIMING CHART

1. Digital Output

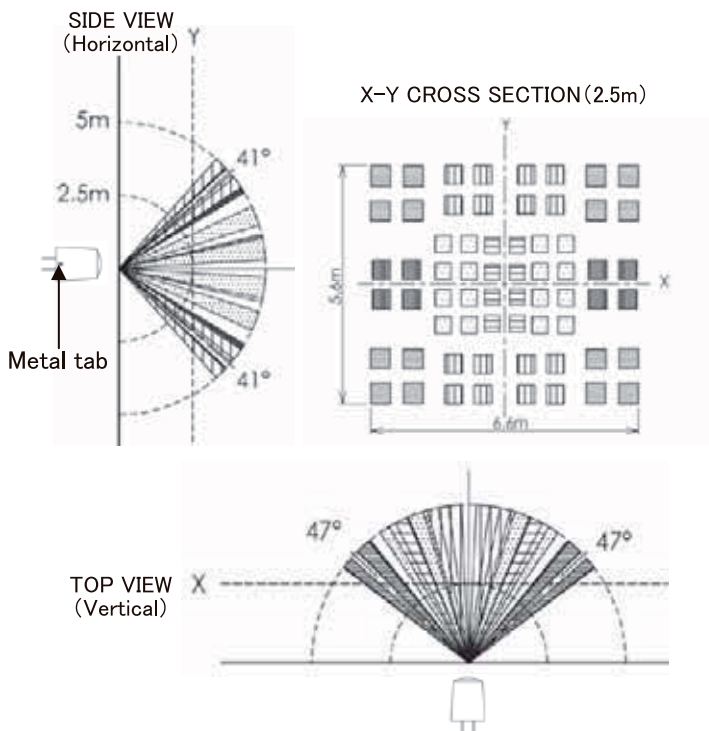


[Durations]

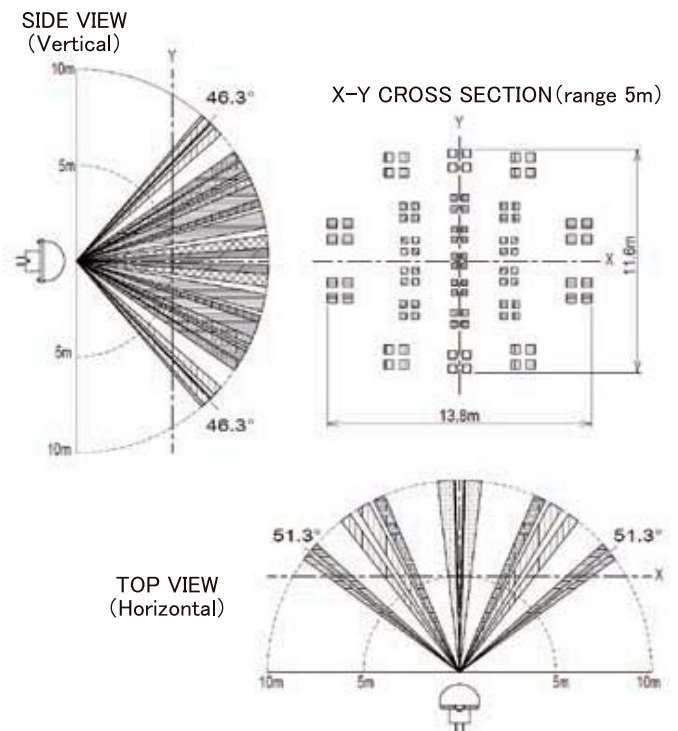
T_{wu} : Circuit Stability Time: About 30s. (Max.)
During this stage, the output's status is undefined (ON/OFF) and detection is therefore not guaranteed.

DETECTION PERFORMANCE

1) Standard detection type

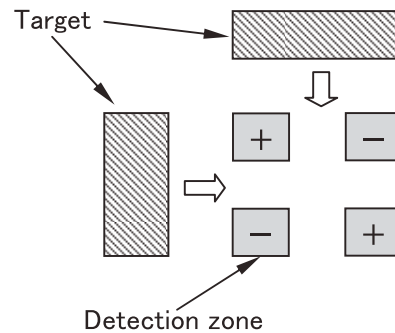


2) Long Distance detection type



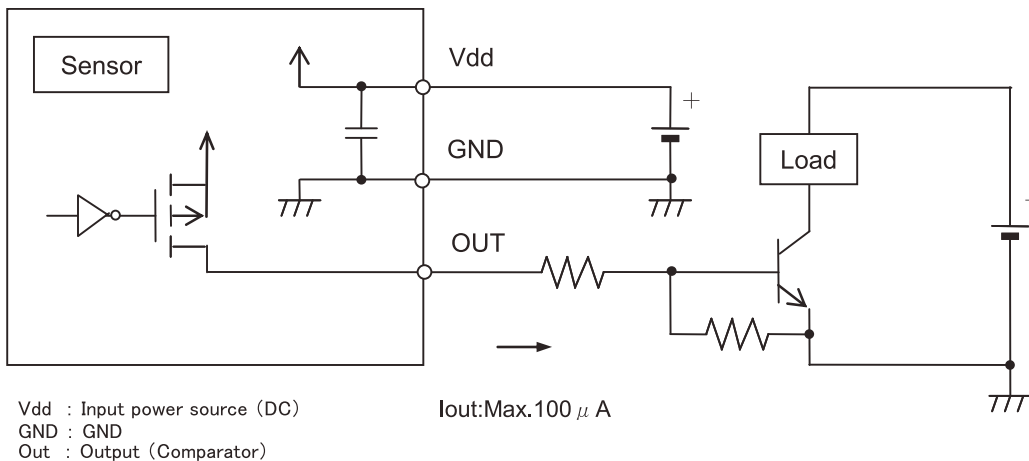
2. Notes Regarding the Detection Zone

As shown on the diagram, the detection zone is polarized.
If a target enters the detection zones + and - at the same time, the signals are respectively cancelled and detection could become impossible at maximum detection range.
(Please refer to the detection area diagram for details)



HOW TO USE

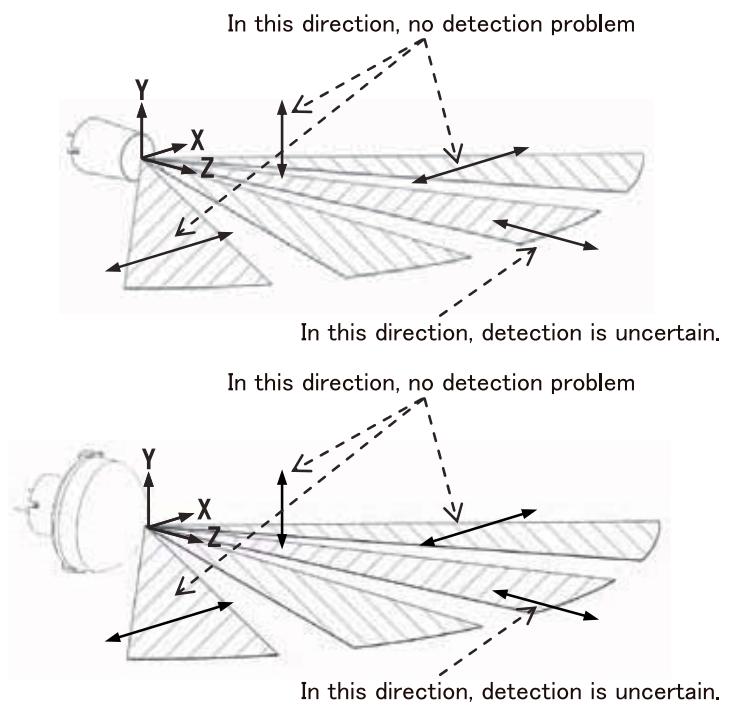
1. Wiring Diagram (Digital Output)



2. Moving Direction Concept

As detailed on the diagram, please install the sensor so that the expected trespassing direction corresponds to the axis X or axis Y.

In some cases, intrusions that occur parallel to the axis Z in every detection zone, closing toward the sensor, may not be detected.



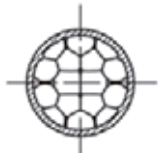
DIMENSION

1) Standard Detection type

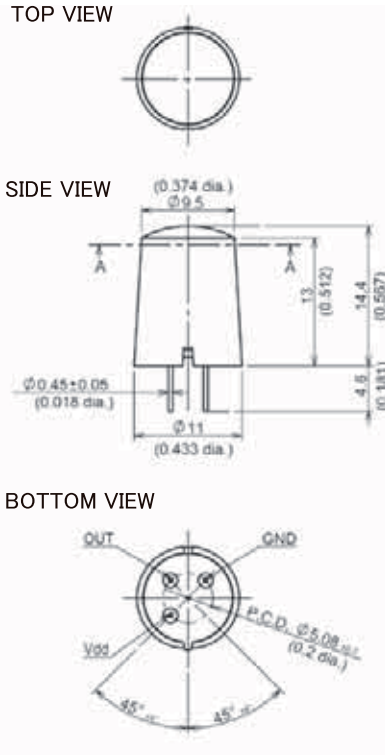


White Black Pearl White

A-A Cross Sectional



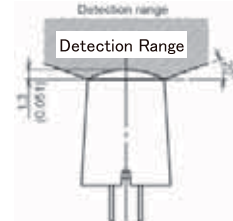
Dimensions



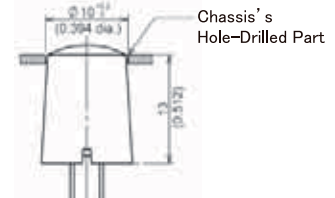
When designing your products

To maintain specified detection capability, please place and expose the sensor so that tip of lens will be more than 1.3mm above the chassis.

The hole of the chassis should have a taper depending on the lens shape, or have a bigger hole.



Recommended Hole Drilling Diameter



Recommended PCB Pattern Design

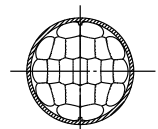


2) Long Distance Detection type

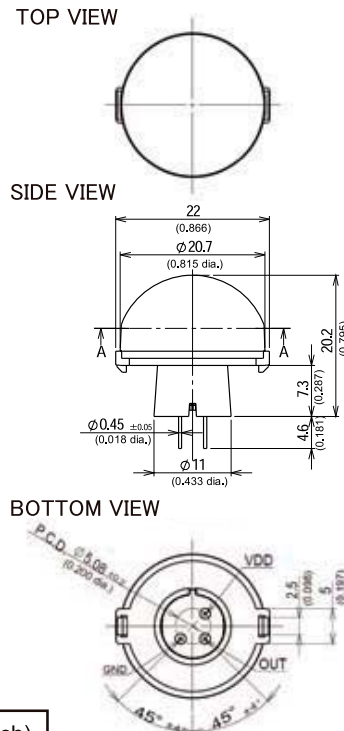


White Black Pearl White

A-A Cross Sectional



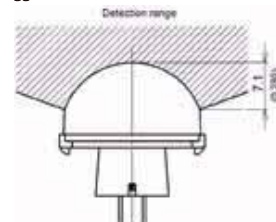
Dimensions



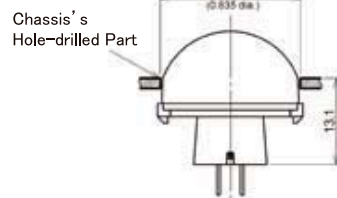
When designing your products

To maintain specified detection capability, please place and expose the sensor so that tip of lens will be more than 7.1mm above the chassis.

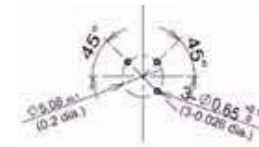
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Recommended Hole Drilling Diameter



Recommended PCB Pattern Design



General Tolerance $\pm 0.5\text{mm}$ ($\pm 0.020\text{inch}$)

NOTES

1. Basic Principles

The PaPIRs Motion Sensor is a pyroelectric infrared sensor that detects variations in infrared rays. However it may not detect in the following cases: lack of movement, no temperature change in the heat source. Besides, it could also detect the presence of heat sources other than a human body. Efficiency and reliability of the system may vary depending on actual operating conditions:

- 1) Detecting heat sources other than the human body, such as:
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 - a) Glass, acrylic or similar materials standing between the target and the sensor may not allow a correct transmission of infrared rays.
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- 1) Temperature: Ambient temperature $-20^{\circ}\text{C} \sim +60^{\circ}\text{C}$ ($-4^{\circ}\text{F} \sim +140^{\circ}\text{F}$)
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- 6) Overheating, oscillations, shocks can cause the sensor to malfunction.

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- 1) Deterioration of detecting performance will happen if dirt and dust adhere to the lens.
- 2) The lens of the Polyethylene lens type is made of soft materials (Polyethylene). If any loads or shocks are applied to the lens, due to deformities, and damages, this will lead to malfunction, or deterioration of performance.
- 3) The sensor may be damaged by ± 200 volts of static electricity. Avoid direct hand contact with the pins and be very careful when operating the product
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- 5) Do not use liquids to wash the sensor. If washing fluid gets through the lens, it can reduce performance.
- 6) When wiring the product, always use shielded cables and minimize the wiring length to prevent noise disturbances.

4. External surge voltages

The inner circuit board could be destroyed by a voltage surge. Use of surge absorption elements is highly recommended.
>Surge resistance : below the power supply voltage value indicated in the maximum rated values section.

5. Power supply-superimposed noise

- 1) Please use a stabilized power supply. Power supply noise can cause operating errors.
>Noise resistance : $\pm 20\text{V}$ or less (Square waves with a width of 50ns or $1\mu\text{s}$)
- 2) To reduce the effect of power supply noise, install a capacitor on the sensor's power supply pin.

6. Drop damage

After the sensor had been dropped on the floor, the damage can occur resulting in incorrect operation. Therefore, be sure not to use those sensors.



Safety Precautions

Head the following precautions to prevent injury or accidents.

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- 2) Our company is committed to making products of the highest quality and reliability. Nevertheless, all electrical components are subject to natural deterioration, and durability of a product will depend on the operating environment and conditions of use. Continued use after such deterioration could lead to overheating, smoke or fire. Always use the product in conjunction with proper fire-prevention, safety and maintenance measures to avoid accidents, reduction in product life expectancy or break-down.
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- 4) Do not use any motion sensor which has been disassembled or remodeled.
- 5) Failure modes of sensors include short-circuiting, open-circuiting and temperature rises. If this sensor is to be used in equipment where safety is a prime consideration, examine the possible effects of these failures on the equipment concerned, and ensure safety by providing protection circuits or protection devices.
Example :
 - Safety equipments and devices
 - Traffic signals
 - Burglar and disaster prevention

Product information in this document is as of Dec. 2010.

PRODUCT RANGE



Equipment sensors for improved comfort and convenience, safety and energy conservation

Acceleration

Acceleration Sensors

Acceleration Sensor

Made possible by leading-edge MEMS technology, this acceleration sensor is ideal for automotive and mobile devices




Product name	Acceleration detection range	Characteristics
2-axis GS2  1-axis GS1 	$\pm 2g$ $\pm 1.5g$	<ul style="list-style-type: none"> High precision and high sensitivity. High reliability: Detection errors due to temperature fluctuation reduced to a minimum. Product lineup covers range of operating voltage and acceleration detection.

Brightness

Light Sensors

Light Sensor

Making us more comfortable with energy efficient devices...Environmentally friendly, cadmium-free





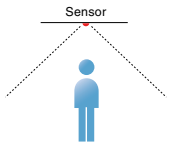





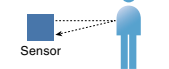
Product name	Peak sensitivity wave length	Characteristics
Light Sensor NaPiCa    <small>Chip type SMD type Through-hole type</small>	$580nm$ $560nm$ (Chip type)	<ul style="list-style-type: none"> Cadmium-free. Built-in optical filter for spectral response similar to that of the human eye. Photocurrent is proportional to illumination. (linear output). Chip type that achieves miniaturization.

Motion

Motion Sensors

Motion Sensor

Motion sensors that always detect your slightest movement

Product name	Detection method	Type	Characteristics					
MP Motion Sensor NaPiOn   <small>Standard type Slight motion detection type</small>   <small>Spot type 10m detection type</small>	Detecting the heat (infrared rays) of the human body and other objects. 	Standard type Black lens White lens	<ul style="list-style-type: none"> Built-in amplifier for easy use. Detects even slight motion of a person. Digital output and analog output (with adjustable sensitivity) are available. Ideal for battery driven devices, a low current consumption type ($46\mu A$ typ.) has also been added to the lineup. <p style="text-align: right;">*Digital output type only.</p>					
		Slight motion detection type Black lens White lens						
		Spot type Black lens White lens						
		10m detection type Black lens White lens						
		MA Motion Sensor    <small>Thin short type (V type) Short type (H type) Middle type (H type)</small>   <small>Long type (H type) Long type (V type)</small>			Detecting the presence of the human body (or another object) by the reflected beam of LED light from the sensor itself. 	Built-in oscillation circuit type Detection distance 5 to 200cm	<ul style="list-style-type: none"> The sensors are ready for immediate use by simply connecting to a DC power supply. The built-in oscillation circuit removes the need to input a start signal. Can be used with a number of different supply voltages. <ol style="list-style-type: none"> 5V DC type Free-ranging type (6.5 to 27V DC) 	
		External trigger type Detection distance 5 to 200cm		<ul style="list-style-type: none"> These sensors can be used in adjacent positions and can save energy. Can be used with a number of different supply voltages. <ol style="list-style-type: none"> 5V DC type Free-ranging type (6.5 to 27V DC) 				










PRODUCT RANGE

Pressure

Pressure Sensors

Pressure Sensors

A wide range of rated pressure, including minute pressures

Product name	Pressure medium	Type (*Without glass base type)		Terminal direction	Pressure inlet hole length	Characteristics
PS-A Pressure Sensor 	Air	Rated pressure		 Opposite the pressure inlet direction	 3mm	<ul style="list-style-type: none"> • Compact pressure sensor with built-in amplification and temperature compensation circuit
		±100, -100, 25, 50, 100, 200, 500, 1,000 *40kPa			 5mm	
PS-A Pressure Sensor (Direct water pressure detection type) 	Air Water	-19.6 to 49kPa		 8mm 6mm dia.	<ul style="list-style-type: none"> • Not only air, now water pressure can be detected directly. 	
		<Low pressure type> 6kPa				 5mm 3mm dia.
PS Pressure Sensor PF Pressure Sensor 	Air	Rated pressure	Bridge resistance	 Opposite the pressure inlet direction	—	<ul style="list-style-type: none"> • Ultra-miniature Base area 7.2 (W) x 7.2 (D) mm • A wide range of rated pressure, including a minute pressure.
4.9, 14.7, 34.3, *49.0, 98.1, 196.1, 343.2, 490.3, 833.6, 980.7 kPa		5kΩ				
*40kPa 98.1, 980.7kPa (PS only)	3.3kΩ					

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