

FEATURES

- Low $V_{CE(sat)}$ Device
- 10 μ s Short Circuit Withstand
- High Thermal Cycling Capability
- High Current Density Enhanced DMOS SPT
- Isolated AISiC Base with AlN Substrates

APPLICATIONS

- High Reliability Inverters
- Motor Controllers
- Traction Drives
- Choppers

The Powerline range of high power modules includes half bridge, chopper, dual, single and bi-directional switch configurations covering voltages from 1200V to 6500V and currents up to 2400A.

The DIM1000ECM33-TL000 is a Low $V_{CE(sat)}$ 3300V, soft punch through n-channel enhancement mode, insulated gate bipolar transistor (IGBT) chopper module. The IGBT has a wide reverse bias safe operating area (RBSOA) plus 10 μ s short circuit withstand. This device is optimised for traction drives and other applications requiring high thermal cycling capability.

The module incorporates an electrically isolated base plate and low inductance construction enabling circuit designers to optimise circuit layouts and utilise grounded heat sinks for safety.

ORDERING INFORMATION

Order As:

DIM1000ECM33-TL000

Note: When ordering, please use the complete part number

KEY PARAMETERS

V_{CES}	3300V
$V_{CE(sat)}$ * (typ)	2.0V
I_C (max)	1000A
$I_{C(PK)}$ (max)	2000A

* Measured at the auxiliary terminals

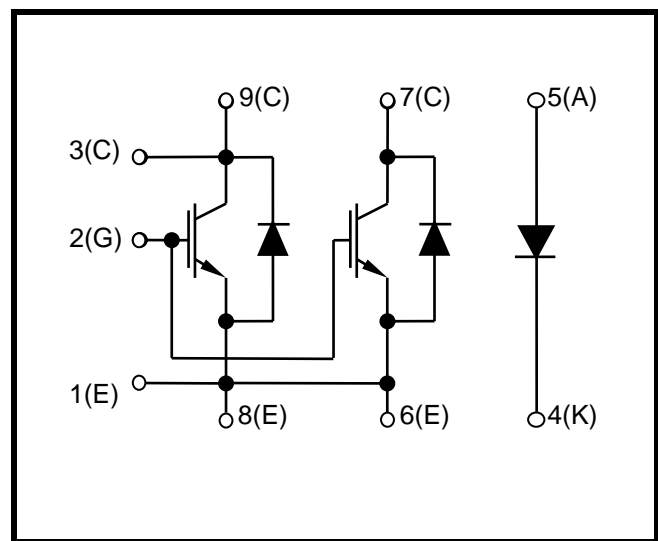


Fig. 1 Circuit configuration



Outline type code: E

(See Fig. 11 for further information)

Fig. 2 Package

ABSOLUTE MAXIMUM RATINGS

Stresses above those listed under 'Absolute Maximum Ratings' may cause permanent damage to the device. In extreme conditions, as with all semiconductors, this may include potentially hazardous rupture of the package. Appropriate safety precautions should always be followed. Exposure to Absolute Maximum Ratings may affect device reliability.

$T_{\text{case}} = 25^{\circ}\text{C}$ unless stated otherwise

Symbol	Parameter	Test Conditions	Max.	Units
V_{CES}	Collector-emitter voltage	$V_{\text{GE}} = 0\text{V}$	3300	V
V_{GES}	Gate-emitter voltage		± 20	V
I_{C}	Continuous collector current	$T_{\text{case}} = 115^{\circ}\text{C}$	1000	A
$I_{\text{C(PK)}}$	Peak collector current	1ms, $T_{\text{case}} = 140^{\circ}\text{C}$	2000	A
P_{max}	Max. transistor power dissipation	$T_{\text{case}} = 25^{\circ}\text{C}$, $T_{\text{j}} = 150^{\circ}\text{C}$	10.4	kW
I^2t	Diode I^2t value (IGBT arm)	$V_{\text{R}} = 0$, $t_{\text{p}} = 10\text{ms}$, $T_{\text{j}} = 125^{\circ}\text{C}$	320	kA^2s
	Diode I^2t value (Diode arm)		320	kA^2s
V_{isol}	Isolation voltage – per module	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	6000	V
Q_{PD}	Partial discharge – per module	IEC1287, $V_1 = 3500\text{V}$, $V_2 = 2600\text{V}$, 50Hz RMS	10	pC

THERMAL AND MECHANICAL RATINGS

Internal insulation material:	AlN
Baseplate material:	AlSiC
Creepage distance:	31mm
Clearance:	20mm
CTI (Comparative Tracking Index):	>600

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$R_{\text{th(j-c)}}$	Thermal resistance – transistor	Continuous dissipation – junction to case	-	-	12	$^{\circ}\text{C}/\text{kW}$
$R_{\text{th(j-c)}}$	Thermal resistance – diode (IGBT arm)	Continuous dissipation – junction to case	-	-	24	$^{\circ}\text{C}/\text{kW}$
$R_{\text{th(j-c)}}$	Thermal resistance – diode (Diode arm)	Continuous dissipation – junction to case	-	-	24	$^{\circ}\text{C}/\text{kW}$
$R_{\text{th(c-h)}}$	Thermal resistance – case to heatsink (per module)	Mounting torque 5Nm (with mounting grease)	-	-	6	$^{\circ}\text{C}/\text{kW}$
T_{j}	Junction temperature	Transistor	-	-	150	$^{\circ}\text{C}$
		Diode	-	-	150	$^{\circ}\text{C}$
T_{stg}	Storage temperature range	-	-40	-	125	$^{\circ}\text{C}$
	Screw torque	Mounting – M6	-	-	5	Nm
		Electrical connections – M4	-	-	2	Nm
		Electrical connections – M8	-	-	10	Nm

ELECTRICAL CHARACTERISTICS
 $T_{case} = 25^{\circ}\text{C}$ unless stated otherwise.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I_{CES}	Collector cut-off current	$V_{GE} = 0V, V_{CE} = V_{CES}$			4	mA
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{case} = 125^{\circ}\text{C}$			60	mA
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{case} = 150^{\circ}\text{C}$			100	mA
I_{GES}	Gate leakage current	$V_{GE} = \pm 20V, V_{CE} = 0V$			1	μA
$V_{GE(TH)}$	Gate threshold voltage	$I_C = 80\text{mA}, V_{GE} = V_{CE}$		5.7		V
$V_{CE(sat)}^{\dagger}$	Collector-emitter saturation voltage	$V_{GE} = 15V, I_C = 1000A$		2.0		V
		$V_{GE} = 15V, I_C = 1000A, T_j = 125^{\circ}\text{C}$		2.6		V
		$V_{GE} = 15V, I_C = 1000A, T_j = 150^{\circ}\text{C}$		2.8		V
I_F	Diode forward current	DC		1000		A
I_{FM}	Diode maximum forward current	$t_p = 1\text{ms}$		2000		A
V_F^{\dagger}	Diode forward voltage (IGBT & Diode arm)	$I_F = 1000A$		2.4		V
		$I_F = 1000A, T_j = 125^{\circ}\text{C}$		2.5		V
		$I_F = 1000A, T_j = 150^{\circ}\text{C}$		2.4		V
C_{ies}	Input capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 1\text{MHz}$		170		nF
Q_g	Gate charge	$\pm 15V$ Including external C_{ge}		17		μC
C_{res}	Reverse transfer capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 1\text{MHz}$		4		nF
L_M	Module inductance	IGBT		15		nH
		Diode		25		
R_{INT}	Internal resistance	IGBT		135		
		Diode		270		$\mu\Omega$
SC_{Data}	Short circuit current, I_{SC}	$T_j = 150^{\circ}\text{C}, V_{CC} = 2500V$ $t_p \leq 10\mu\text{s}, V_{GE} \leq 15V$ $V_{CE(max)} = V_{CES} - L^* \times di/dt$ IEC 60747-9		3700		A

Note:
 \dagger Measured at the auxiliary terminals

 $*$ L is the circuit inductance + L_M

ELECTRICAL CHARACTERISTICS

$T_{\text{case}} = 25^{\circ}\text{C}$ unless stated otherwise

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$t_{d(\text{off})}$	Turn-off delay time	$I_C = 1000\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 1800\text{V}$ $R_{G(\text{ON})} = 2.7\Omega$ $R_{G(\text{OFF})} = 2.2\Omega$ $C_{ge} = 220\text{nF}$ $L_S \sim 100\text{nH}$		2700		ns
t_f	Fall time			610		ns
E_{OFF}	Turn-off energy loss			2500		mJ
$t_{d(\text{on})}$	Turn-on delay time			960		ns
t_r	Rise time			430		ns
E_{ON}	Turn-on energy loss			1600		mJ
Q_{rr}	Diode reverse recovery charge	$I_F = 1000\text{A}$ $V_{CE} = 1800\text{V}$ $dI_F/dt = 2700\text{A}/\mu\text{s}$		570		μC
I_{rr}	Diode reverse recovery current			620		A
E_{rec}	Diode reverse recovery energy			670		mJ

$T_{\text{case}} = 125^{\circ}\text{C}$ unless stated otherwise

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$t_{d(\text{off})}$	Turn-off delay time	$I_C = 1000\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 1800\text{V}$ $R_{G(\text{ON})} = 2.7\Omega$ $R_{G(\text{OFF})} = 2.2\Omega$ $C_{ge} = 220\text{nF}$ $L_S \sim 100\text{nH}$		2750		ns
t_f	Fall time			590		ns
E_{OFF}	Turn-off energy loss			2700		mJ
$t_{d(\text{on})}$	Turn-on delay time			1000		ns
t_r	Rise time			460		ns
E_{ON}	Turn-on energy loss			2050		mJ
Q_{rr}	Diode reverse recovery charge	$I_F = 1000\text{A}$ $V_{CE} = 1800\text{V}$ $dI_F/dt = 2700\text{A}/\mu\text{s}$		930		μC
I_{rr}	Diode reverse recovery current			775		A
E_{rec}	Diode reverse recovery energy			1150		mJ

$T_{\text{case}} = 150^{\circ}\text{C}$ unless stated otherwise

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$t_{d(\text{off})}$	Turn-off delay time	$I_C = 1000\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 1800\text{V}$ $R_{G(\text{ON})} = 2.7\Omega$ $R_{G(\text{OFF})} = 2.2\Omega$ $C_{ge} = 220\text{nF}$ $L_S \sim 100\text{nH}$		2760		ns
t_f	Fall time			590		ns
E_{OFF}	Turn-off energy loss			2950		mJ
$t_{d(\text{on})}$	Turn-on delay time			940		ns
t_r	Rise time			460		ns
E_{ON}	Turn-on energy loss			2250		mJ
Q_{rr}	Diode reverse recovery charge	$I_F = 1000\text{A}$ $V_{CE} = 1800\text{V}$ $dI_F/dt = 2700\text{A}/\mu\text{s}$		1070		μC
I_{rr}	Diode reverse recovery current			800		A
E_{rec}	Diode reverse recovery energy			1300		mJ

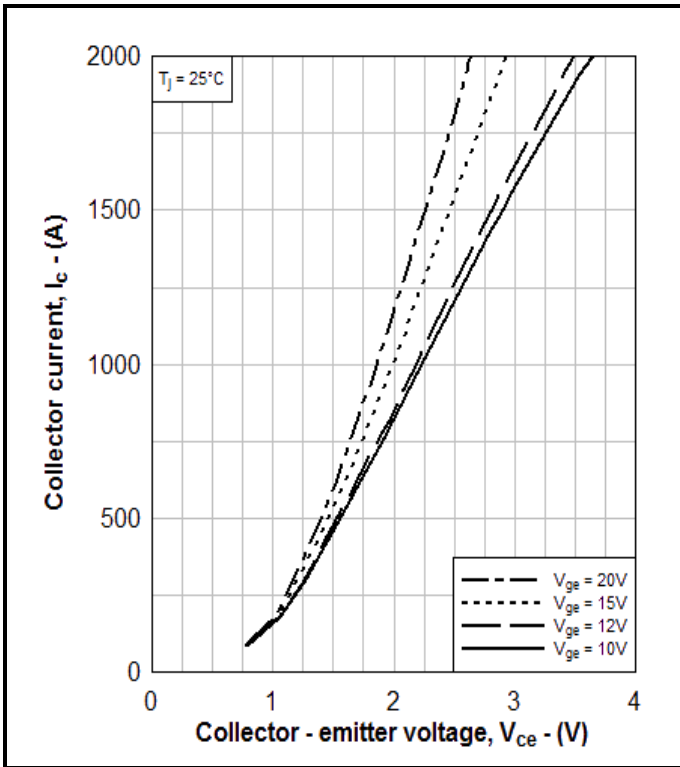


Fig. 3 Typical output characteristics

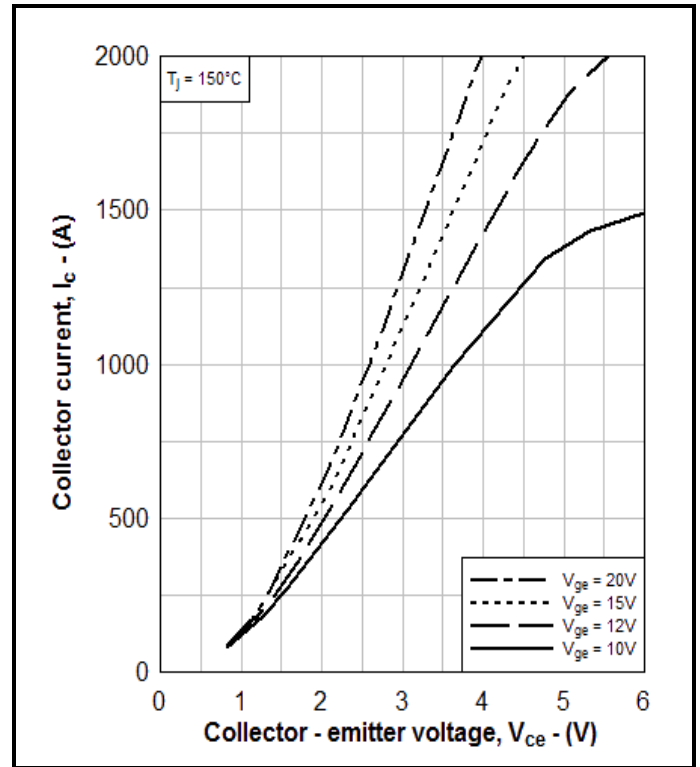


Fig. 4 Typical output characteristics

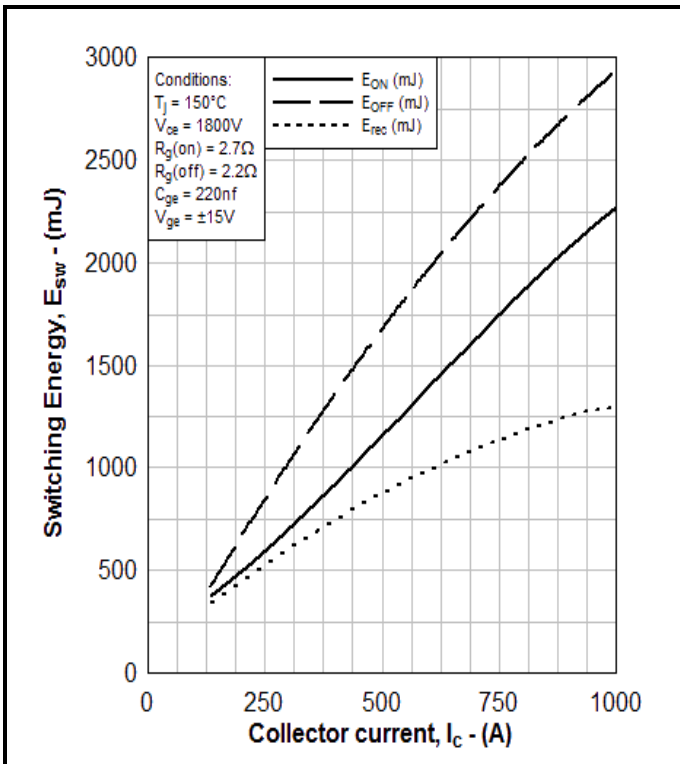


Fig. 5 Typical switching energy vs collector current

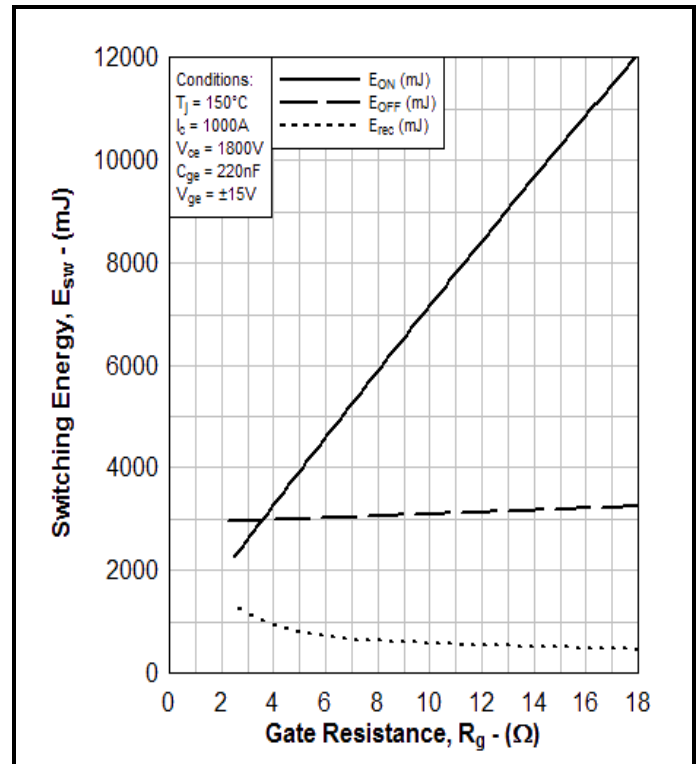


Fig. 6 Typical switching energy vs gate resistance

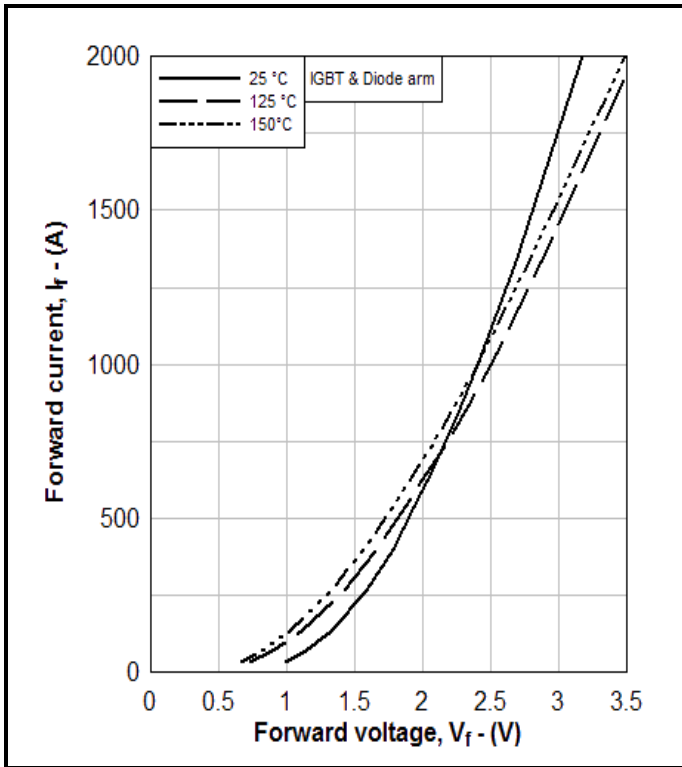


Fig. 7 Diode typical forward characteristics

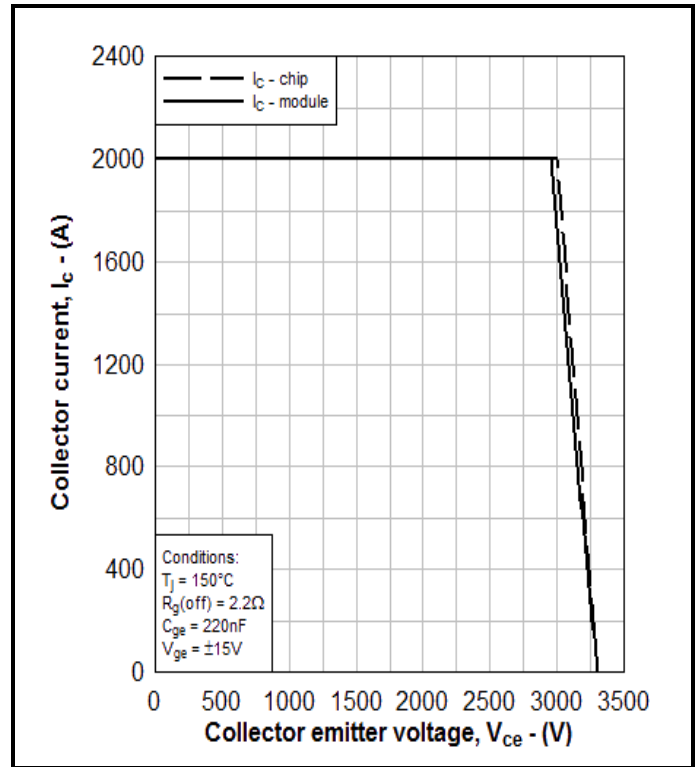


Fig. 8 Reverse bias safe operating area

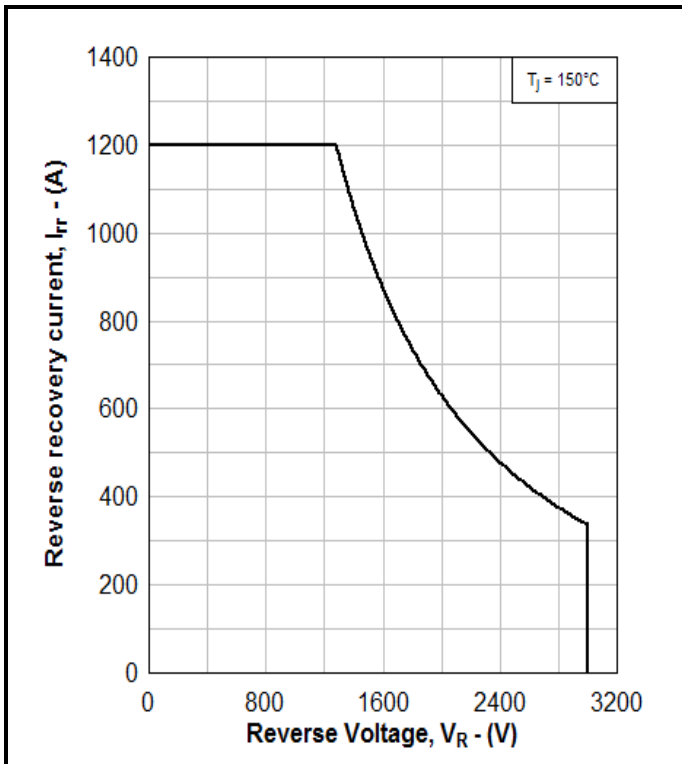


Fig. 9 Diode reverse bias safe operating area

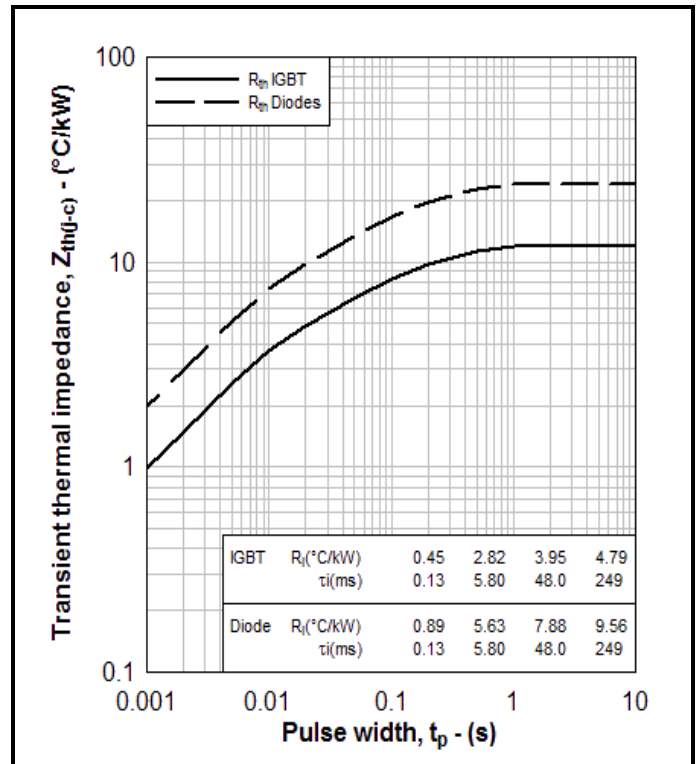
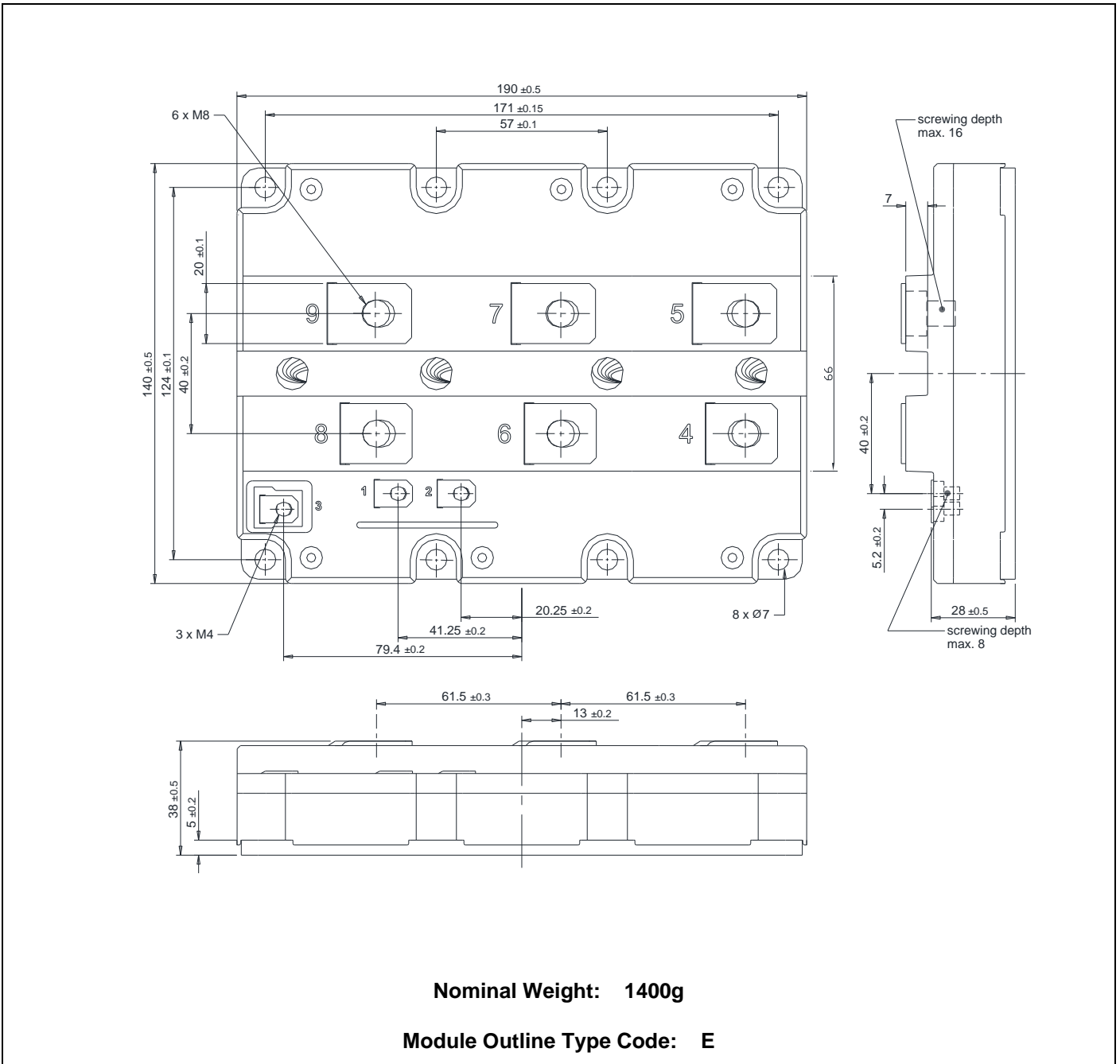


Fig. 10 Transient thermal impedance

PACKAGE DETAILS

For further package information, please visit our website or contact Customer Services.
 All dimensions in mm, unless stated otherwise.
DO NOT SCALE.



Nominal Weight: 1400g

Module Outline Type Code: E

Fig. 11 Module outline drawing

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