

FEATURES

- Low $V_{CE(sat)}$ Device
- 10 μ s Short Circuit Withstand
- High Thermal Cycling Capability
- High Current Density Enhanced DMOS SPT
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- 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 DIM1500ESM33-TL000 is a Low $V_{CE(sat)}$ single switch 3300V, n-channel enhancement mode, insulated gate bipolar transistor (IGBT) 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:

DIM1500ESM33-TL000

Note: When ordering, please use the complete part number

KEY PARAMETERS

V_{CES}	3300V
$V_{CE(sat)}^*$ (typ)	2.0V
I_C (max)	1500A
$I_{C(PK)}$ (max)	3000A

* Measured at the auxiliary terminals

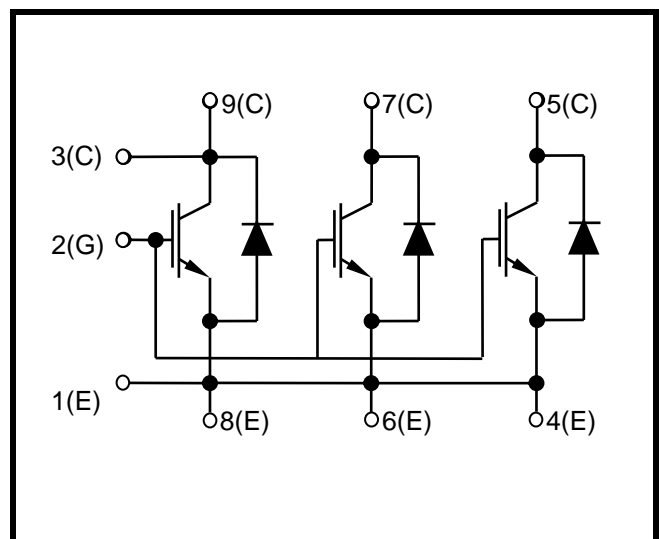
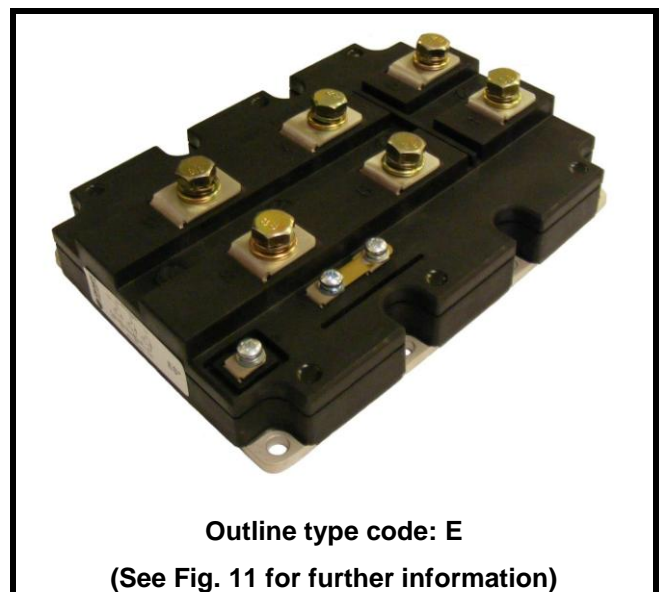


Fig. 1 Circuit configuration



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.

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

Symbol	Parameter	Test Conditions	Max.	Units
V_{CES}	Collector-emitter voltage	$V_{GE} = 0V$	3300	V
V_{GES}	Gate-emitter voltage		± 20	V
I_C	Continuous collector current	$T_{case} = 115^{\circ}\text{C}$	1500	A
$I_{C(PK)}$	Peak collector current	1ms, $T_{case} = 140^{\circ}\text{C}$	3000	A
P_{max}	Max. transistor power dissipation	$T_{case} = 25^{\circ}\text{C}$, $T_j = 150^{\circ}\text{C}$	15.6	kW
I^2t	Diode I^2t value	$V_R = 0$, $t_p = 10\text{ms}$, $T_j = 150^{\circ}\text{C}$	720	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, $V_1 = 3500V$, $V_2 = 2600V$, 50Hz RMS	10	pC

THERMAL AND MECHANICAL RATINGS

Internal insulation material:	AlN
Baseplate material:	AlSiC
Creepage distance:	33mm
Clearance:	20mm
CTI (Comparative Tracking Index):	>600

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$R_{th(j-c)}$	Thermal resistance – transistor	Continuous dissipation - junction to case	-	-	8	$^{\circ}\text{C}/\text{kW}$
$R_{th(j-c)}$	Thermal resistance – diode	Continuous dissipation - junction to case	-	-	16	$^{\circ}\text{C}/\text{kW}$
$R_{th(c-h)}$	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	$V_{GE} = 0\text{V}, V_{CE} = V_{CES}$			5	mA
		$V_{GE} = 0\text{V}, V_{CE} = V_{CES}, T_{case} = 125^{\circ}\text{C}$			90	mA
		$V_{GE} = 0\text{V}, V_{CE} = V_{CES}, T_{case} = 150^{\circ}\text{C}$			150	mA
I_{GES}	Gate leakage current	$V_{GE} = \pm 20\text{V}, V_{CE} = 0\text{V}$			1	μA
$V_{GE(TH)}$	Gate threshold voltage	$I_C = 120\text{mA}, V_{GE} = V_{CE}$		5.7		V
$V_{CE(sat)}^{\dagger}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{V}, I_C = 1500\text{A}$		2.0		V
		$V_{GE} = 15\text{V}, I_C = 1500\text{A}, T_j = 125^{\circ}\text{C}$		2.6		V
		$V_{GE} = 15\text{V}, I_C = 1500\text{A}, T_j = 150^{\circ}\text{C}$		2.8		V
I_F	Diode forward current	DC		1500		A
I_{FM}	Diode maximum forward current	$t_p = 1\text{ms}$		3000		A
V_F^{\dagger}	Diode forward voltage	$I_F = 1500\text{A}$		2.4		V
		$I_F = 1500\text{A}, T_j = 125^{\circ}\text{C}$		2.5		V
		$I_F = 1500\text{A}, T_j = 150^{\circ}\text{C}$		2.4		V
C_{ies}	Input capacitance	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		260		nF
Q_g	Gate charge	$\pm 15\text{V}$ Including external C_{ge}		25		μC
C_{res}	Reverse transfer capacitance	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		6		nF
L_M	Module inductance			10		nH
R_{INT}	Internal transistor resistance			90		$\mu\Omega$
SC_{Data}	Short circuit current, I_{SC}	$T_j = 150^{\circ}\text{C}, V_{CC} = 2500\text{V}$ $t_p \leq 10\mu\text{s}, V_{GE} \leq 15\text{V}$ $V_{CE(max)} = V_{CES} - L^* \times dl/dt$ IEC 60747-9		5500		A

Note:
 \dagger Measured at the auxiliary terminals

 $*$ L is the circuit inductance + L_M

ELECTRICAL CHARACTERISTICS

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

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$t_{d(off)}$	Turn-off delay time	$I_C = 1500\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 1800\text{V}$ $R_{g(ON)} = 1.65\Omega$ $R_{g(OFF)} = 1.5\Omega$ $C_{GE} = 330\text{nF}$ $L_S \sim 150\text{nH}$		2700		ns
t_f	Fall time			610		ns
E_{OFF}	Turn-off energy loss			3750		mJ
$t_{d(on)}$	Turn-on delay time			960		ns
t_r	Rise time			430		ns
E_{ON}	Turn-on energy loss			2400		mJ
Q_{rr}	Diode reverse recovery charge	$I_F = 1500\text{A}$ $V_{CE} = 1800\text{V}$ $dI_F/dt = 4000\text{A}/\mu\text{s}$		850		μC
I_{rr}	Diode reverse recovery current			920		A
E_{rec}	Diode reverse recovery energy			1000		mJ

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

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$t_{d(off)}$	Turn-off delay time	$I_C = 1500\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 1800\text{V}$ $R_{g(ON)} = 1.65\Omega$ $R_{g(OFF)} = 1.5\Omega$ $C_{GE} = 330\text{nF}$ $L_S \sim 150\text{nH}$		2750		ns
t_f	Fall time			590		ns
E_{OFF}	Turn-off energy loss			4050		mJ
$t_{d(on)}$	Turn-on delay time			1000		ns
t_r	Rise time			460		ns
E_{ON}	Turn-on energy loss			3100		mJ
Q_{rr}	Diode reverse recovery charge	$I_F = 1500\text{A}$ $V_{CE} = 1800\text{V}$ $dI_F/dt = 4000\text{A}/\mu\text{s}$		1400		μC
I_{rr}	Diode reverse recovery current			1160		A
E_{rec}	Diode reverse recovery energy			1700		mJ

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

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$t_{d(off)}$	Turn-off delay time	$I_C = 1500\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 1800\text{V}$ $R_{g(ON)} = 1.65\Omega$ $R_{g(OFF)} = 1.5\Omega$ $C_{GE} = 330\text{nF}$ $L_S \sim 150\text{nH}$		2760		ns
t_f	Fall time			590		ns
E_{OFF}	Turn-off energy loss			4400		mJ
$t_{d(on)}$	Turn-on delay time			940		ns
t_r	Rise time			460		ns
E_{ON}	Turn-on energy loss			3400		mJ
Q_{rr}	Diode reverse recovery charge	$I_F = 1500\text{A}$ $V_{CE} = 1800\text{V}$ $dI_F/dt = 4000\text{A}/\mu\text{s}$		1600		μC
I_{rr}	Diode reverse recovery current			1200		A
E_{rec}	Diode reverse recovery energy			1950		mJ

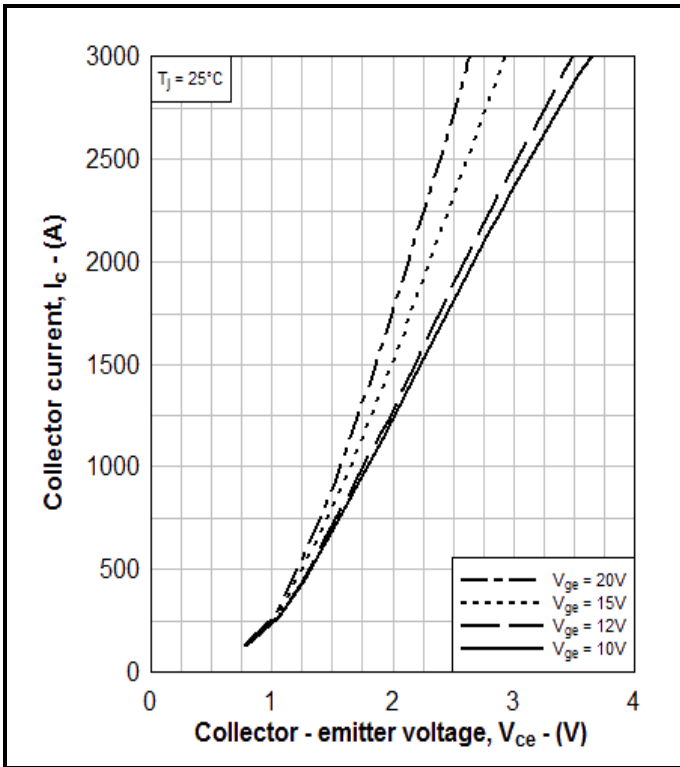


Fig. 3 Typical output characteristics

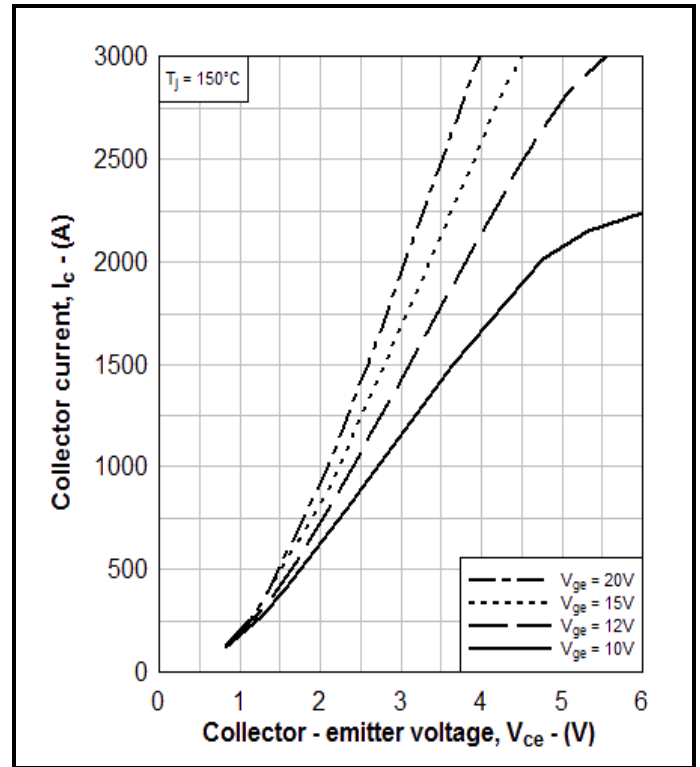


Fig. 4 Typical output characteristics

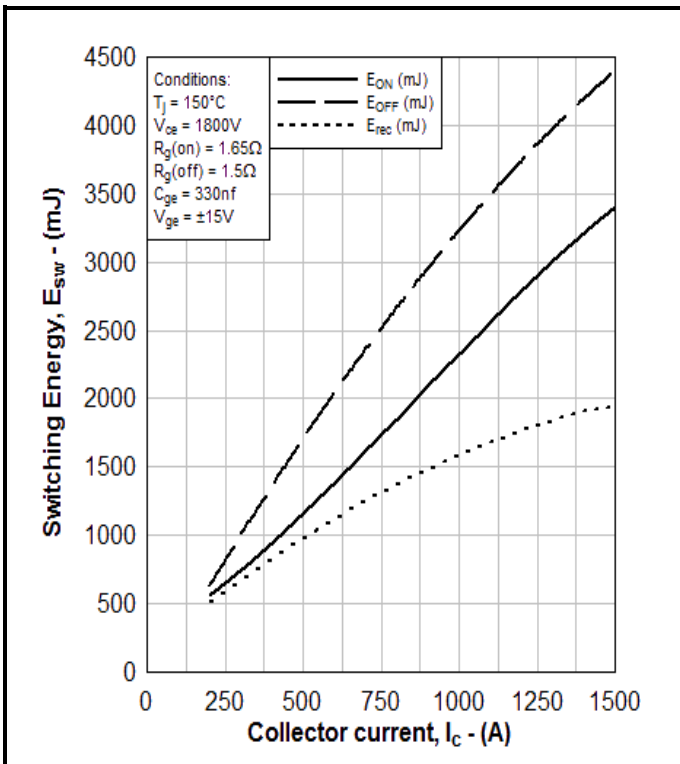


Fig. 5 Typical switching energy vs collector current

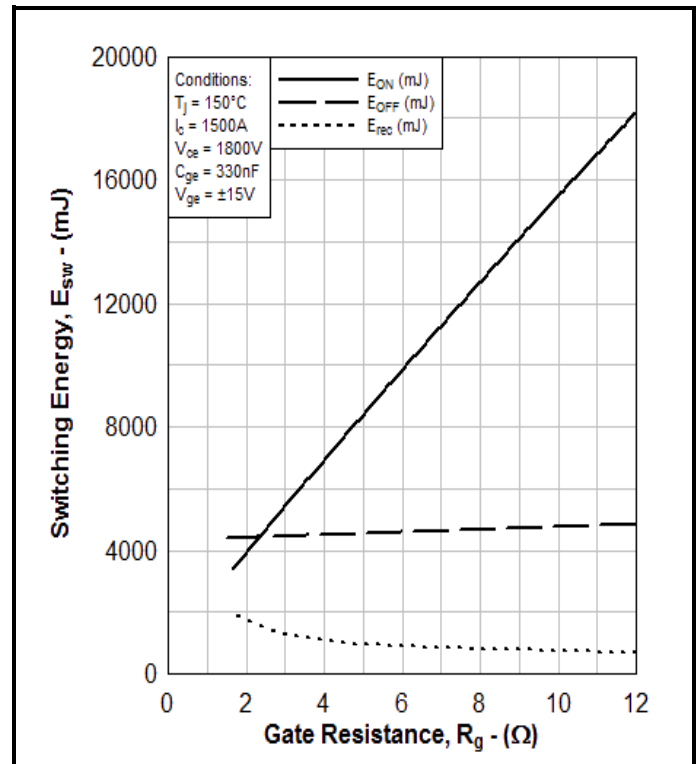


Fig. 6 Typical switching energy vs gate resistance

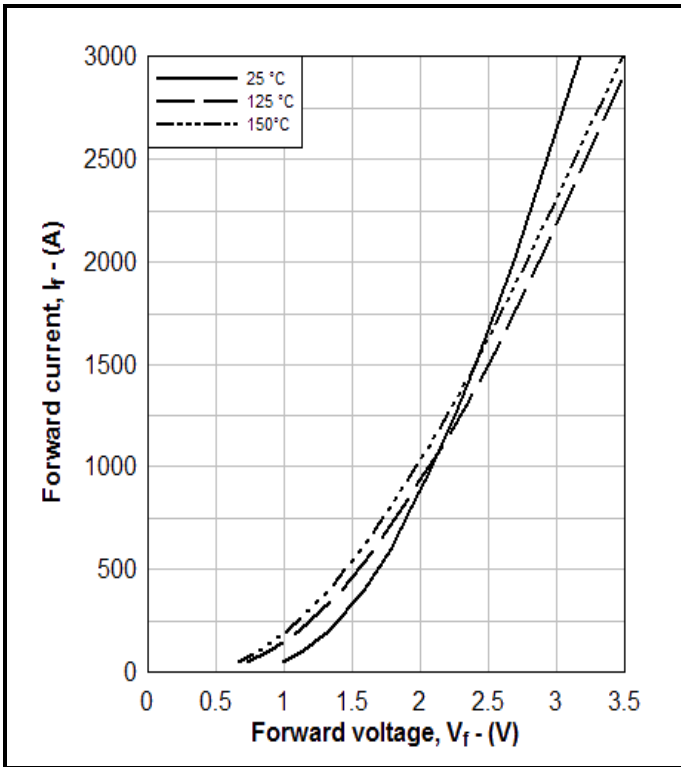


Fig. 7 Diode typical forward characteristics

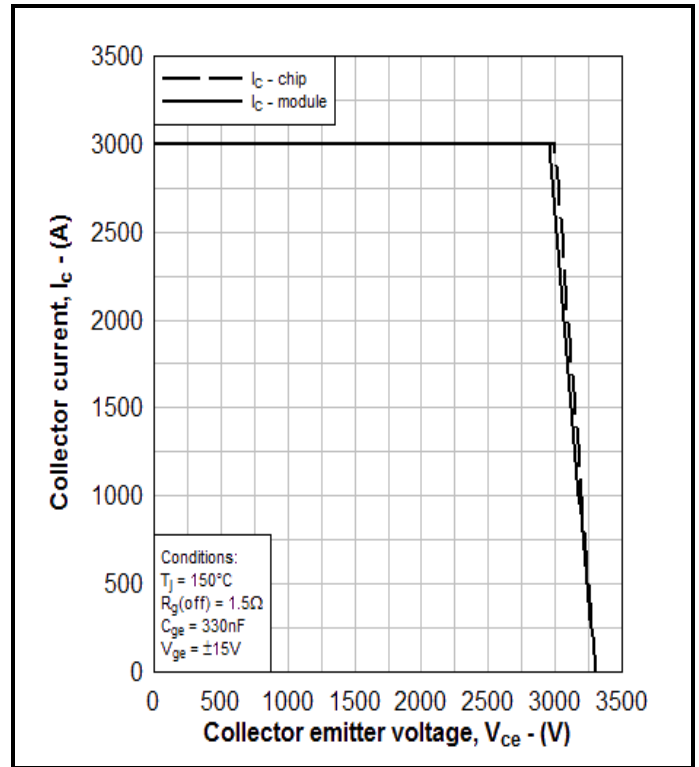


Fig. 8 Reverse bias safe operating area

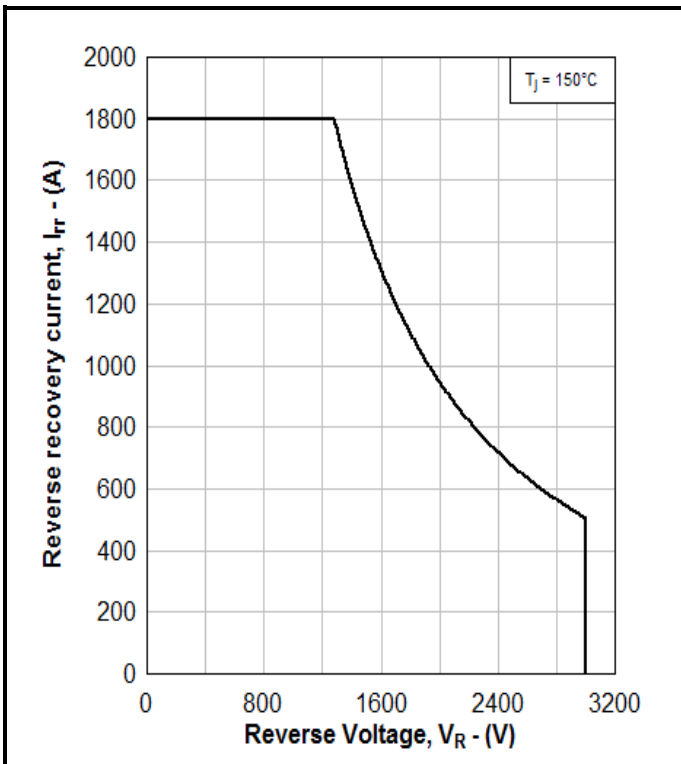


Fig. 9 Diode reverse bias safe operating area

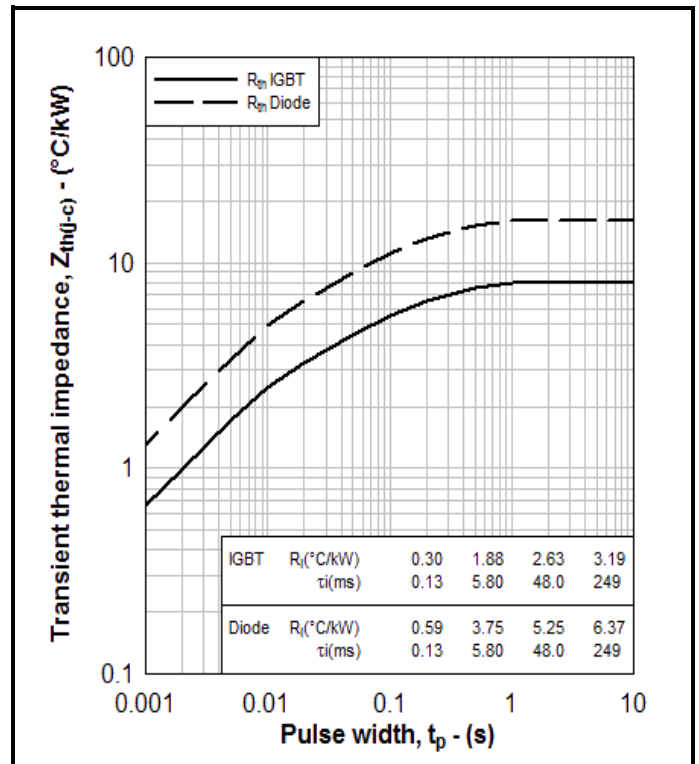


Fig. 10 Transient thermal impedance

PACKAGE DETAILS

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

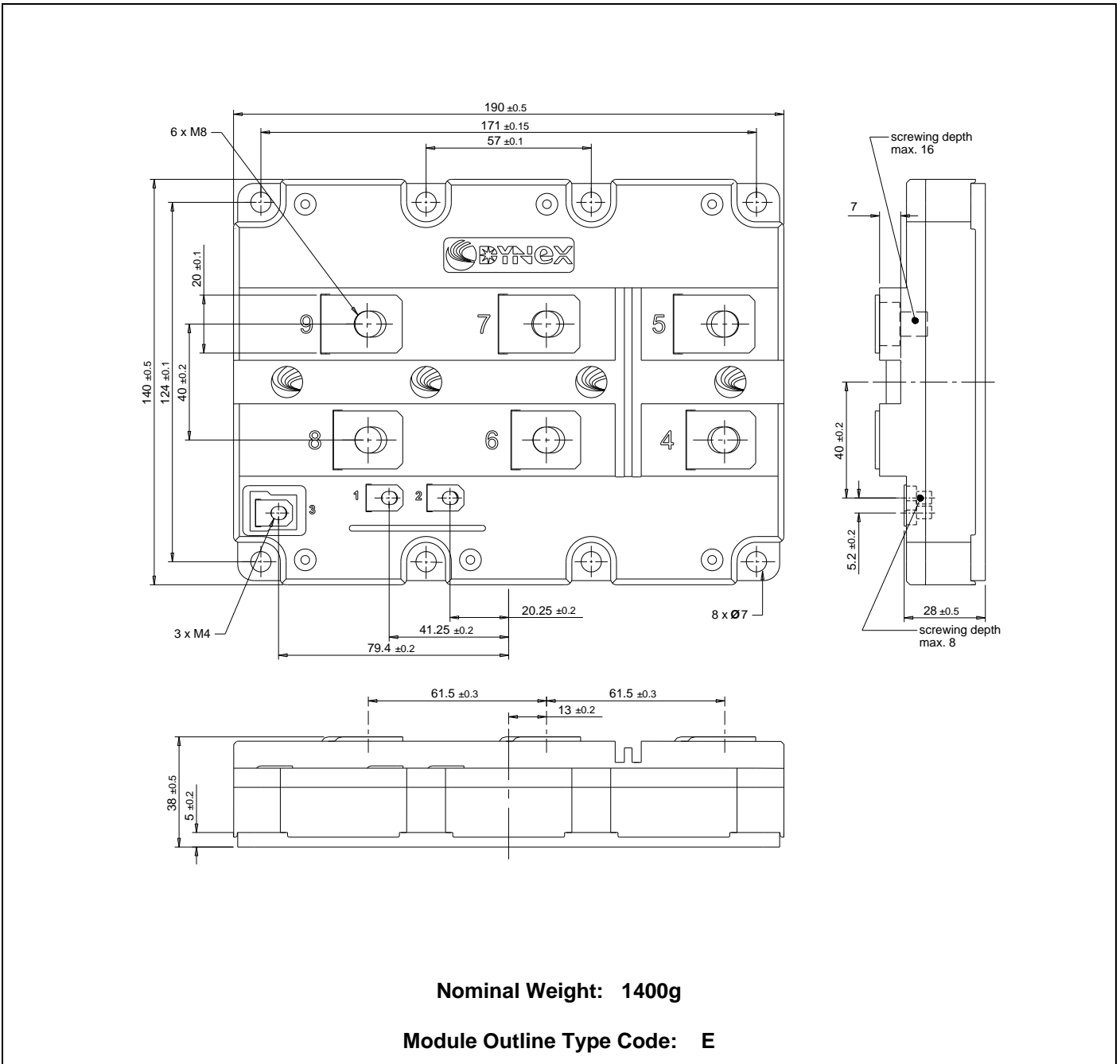


Fig. 11 Module outline drawing

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