

### FEATURES

- 10.2kV Isolation
- 10µs 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 DIM400XCM45-TS001 is a single switch 4500V, n-channel enhancement mode, insulated gate bipolar transistor (IGBT) chopper module. The IGBT has a wide reverse bias safe operating area (RBSOA) plus 10µs 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:

### DIM400XCM45-TS001

Note: When ordering, please use the complete part number

### KEY PARAMETERS

$V_{CES}$	<b>4500V</b>
$V_{CE(sat)}$ * (typ)	<b>2.7V</b>
$I_C$ (max)	<b>400A</b>
$I_{C(PK)}$ (max)	<b>800A</b>

\* Measured at the auxiliary terminals

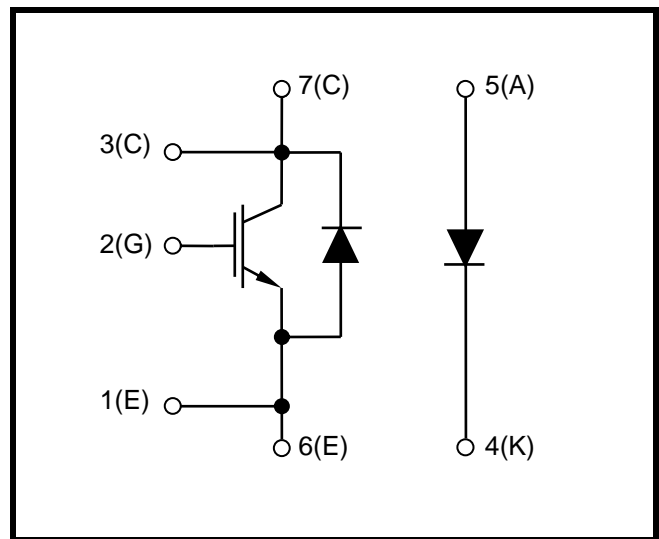
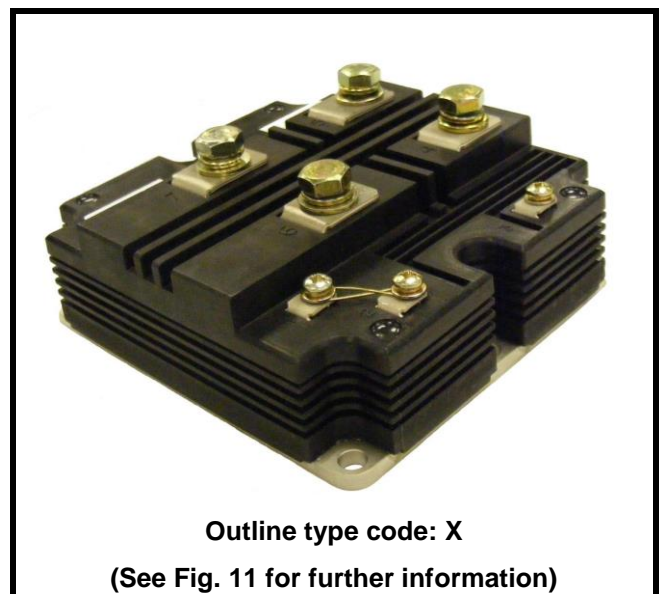


Fig. 1 Circuit configuration



Outline type code: X  
(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	$V_{GE} = 0\text{V}$	4500	V
$V_{GES}$	Gate-emitter voltage		$\pm 20$	V
$I_C$	Continuous collector current	$T_{case} = 90^{\circ}\text{C}$	400	A
$I_{C(PK)}$	Peak collector current	1ms, $T_{case} = 115^{\circ}\text{C}$	800	A
$P_{max}$	Max. transistor power dissipation	$T_{case} = 25^{\circ}\text{C}$ , $T_j = 125^{\circ}\text{C}$	4.16	kW
$I^2t$	Diode $I^2t$ value	$V_R = 0$ , $t_p = 10\text{ms}$ , $T_j = 125^{\circ}\text{C}$	50	$\text{kA}^2\text{s}$
$V_{isol}$	Isolation voltage – per module	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	10.2	kV
$Q_{PD}$	Partial discharge – per module	IEC1287, $V_1 = 6900\text{V}$ , $V_2 = 5100\text{V}$ , 50Hz RMS	10	pC

## THERMAL AND MECHANICAL RATINGS

Internal insulation material:	AlN
Baseplate material:	AlSiC
Creepage distance:	56mm
Clearance:	26mm
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	-	-	24	$^{\circ}\text{C}/\text{kW}$
$R_{th(j-c)}$	Thermal resistance – diode (IGBT arm)	Continuous dissipation - junction to case	-	-	48	$^{\circ}\text{C}/\text{kW}$
$R_{th(j-c)}$	Thermal resistance – diode (Diode arm)		-	-	48	$^{\circ}\text{C}/\text{kW}$
$R_{th(c-h)}$	Thermal resistance – case to heatsink (per module)	Mounting torque 5Nm (with mounting grease)	-	-	8	$^{\circ}\text{C}/\text{kW}$
$T_j$	Junction temperature	Transistor	-	-	125	$^{\circ}\text{C}$
		Diode	-	-	125	$^{\circ}\text{C}$
$T_{stg}$	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<sub>case</sub> = 25°C unless stated otherwise.**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I <sub>CES</sub>	Collector cut-off current	V <sub>GE</sub> = 0V, V <sub>CE</sub> = V <sub>CES</sub>			1	mA
		V <sub>GE</sub> = 0V, V <sub>CE</sub> = V <sub>CES</sub> , T <sub>case</sub> = 125°C			20	mA
I <sub>GES</sub>	Gate leakage current	V <sub>GE</sub> = ± 20V, V <sub>CE</sub> = 0V			1	μA
V <sub>GE(TH)</sub>	Gate threshold voltage	I <sub>C</sub> = 40mA, V <sub>GE</sub> = V <sub>CE</sub>		5.8		V
V <sub>CE(sat)</sub>	Collector-emitter saturation voltage	V <sub>GE</sub> = 15V, I <sub>C</sub> = 400A		2.7		V
		V <sub>GE</sub> = 15V, I <sub>C</sub> = 400A, T <sub>j</sub> = 125°C		3.5		V
I <sub>F</sub>	Diode forward current	DC		400		A
I <sub>FM</sub>	Diode maximum forward current	t <sub>p</sub> = 1ms		800		A
V <sub>F</sub>	Diode forward voltage	I <sub>F</sub> = 400A		2.8		V
		I <sub>F</sub> = 400A, T <sub>j</sub> = 125°C		3.2		V
C <sub>ies</sub>	Input capacitance	V <sub>CE</sub> = 25V, V <sub>GE</sub> = 0V, f = 1MHz		50		nF
Q <sub>g</sub>	Gate charge	±15V		7.5		μC
C <sub>res</sub>	Reverse transfer capacitance	V <sub>CE</sub> = 25V, V <sub>GE</sub> = 0V, f = 1MHz		TBC		nF
L <sub>M</sub>	Module inductance – per arm			30		nH
R <sub>INT</sub>	Internal resistance – per arm			260		μΩ
SC <sub>Data</sub>	Short circuit current, I <sub>SC</sub>	T <sub>j</sub> = 125°C, V <sub>CC</sub> = 3400V t <sub>p</sub> ≤ 10μs, V <sub>GE</sub> ≤ 15V V <sub>CE(max)</sub> = V <sub>CES</sub> – L* x dl/dt IEC 60747-9		1200		A

**Note:**

 \* L is the circuit inductance + L<sub>M</sub>

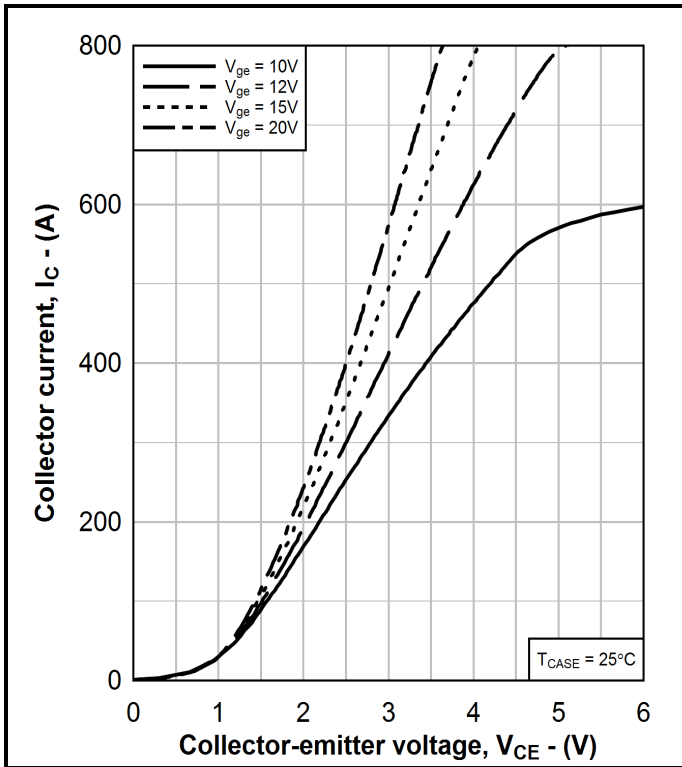
## ELECTRICAL CHARACTERISTICS

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

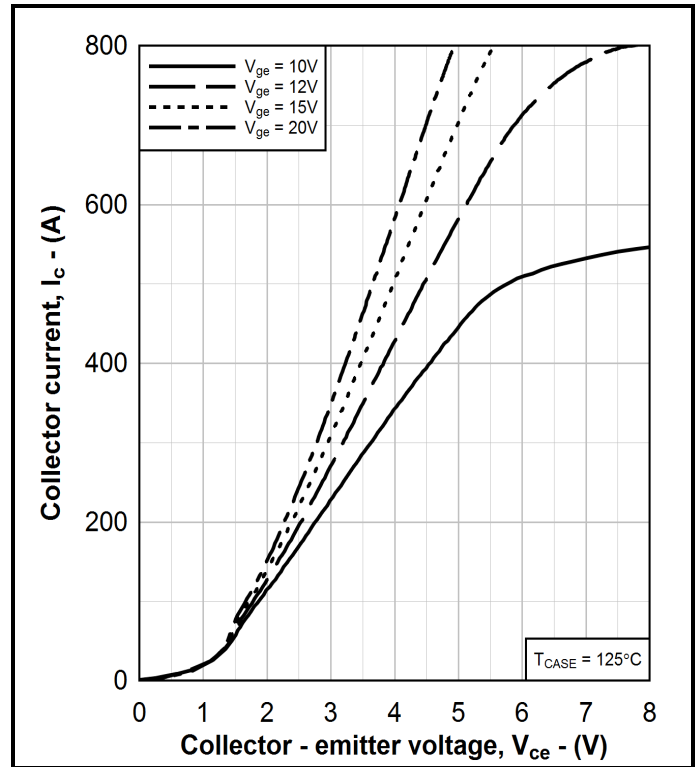
Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$t_{d(\text{off})}$	Turn-off delay time	$I_C = 400\text{A}$ $V_{\text{GE}} = \pm 15\text{V}$ $V_{\text{CE}} = 2800\text{V}$ $R_{\text{G(ON)}} = 8.2\Omega$ $R_{\text{G(OFF)}} = 8.2\Omega$ $C_{\text{ge}} = 68\text{nF}$ $L_S \sim 165\text{nH}$		3000		ns
$t_f$	Fall time			600		ns
$E_{\text{OFF}}$	Turn-off energy loss			1500		mJ
$t_{d(\text{on})}$	Turn-on delay time			900		ns
$t_r$	Rise time			350		ns
$E_{\text{ON}}$	Turn-on energy loss			1600		mJ
$Q_{\text{rr}}$	Diode reverse recovery charge	$I_F = 400\text{A}$ $V_{\text{CE}} = 2800\text{V}$ $dI_F/dt = 1000\text{A}/\mu\text{s}$		450		$\mu\text{C}$
$I_{\text{rr}}$	Diode reverse recovery current			350		A
$E_{\text{rec}}$	Diode reverse recovery energy			750		mJ

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

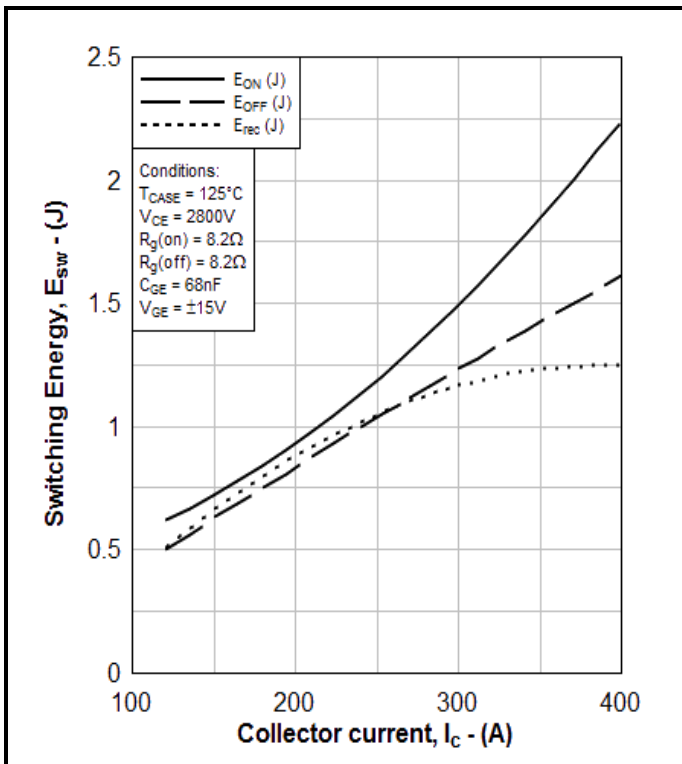
Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$t_{d(\text{off})}$	Turn-off delay time	$I_C = 400\text{A}$ $V_{\text{GE}} = \pm 15\text{V}$ $V_{\text{CE}} = 2800\text{V}$ $R_{\text{G(ON)}} = 8.2\Omega$ $R_{\text{G(OFF)}} = 8.2\Omega$ $C_{\text{ge}} = 68\text{nF}$ $L_S \sim 165\text{nH}$		3100		ns
$t_f$	Fall time			560		ns
$E_{\text{OFF}}$	Turn-off energy loss			1600		mJ
$t_{d(\text{on})}$	Turn-on delay time			900		ns
$t_r$	Rise time			360		ns
$E_{\text{ON}}$	Turn-on energy loss			2200		mJ
$Q_{\text{rr}}$	Diode reverse recovery charge	$I_F = 400\text{A}$ $V_{\text{CE}} = 2800\text{V}$ $dI_F/dt = 1000\text{A}/\mu\text{s}$		750		$\mu\text{C}$
$I_{\text{rr}}$	Diode reverse recovery current			380		A
$E_{\text{rec}}$	Diode reverse recovery energy			1250		mJ



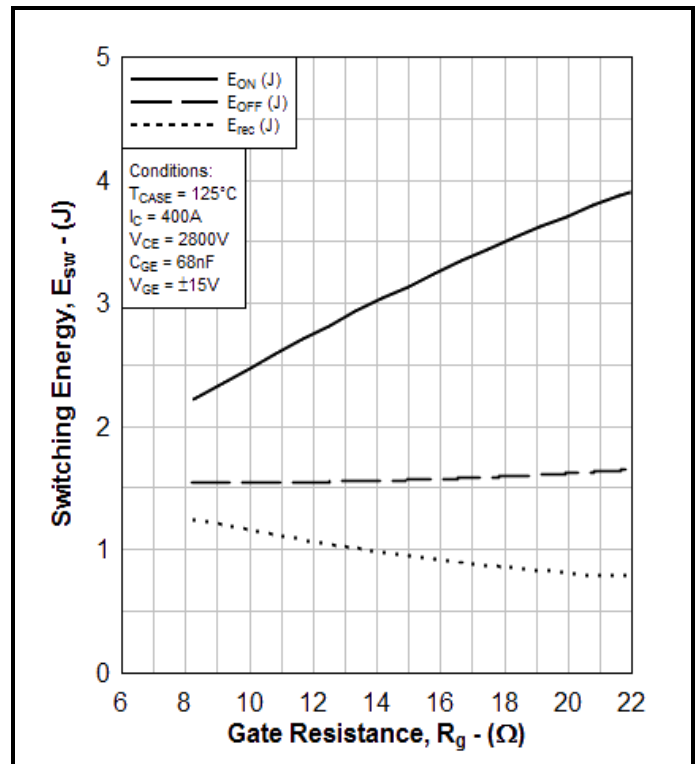
**Fig. 3 Typical output characteristics**



**Fig. 4 Typical output characteristics**



**Fig. 5 Typical switching energy vs collector current**



**Fig. 6 Typical switching energy vs gate resistance**

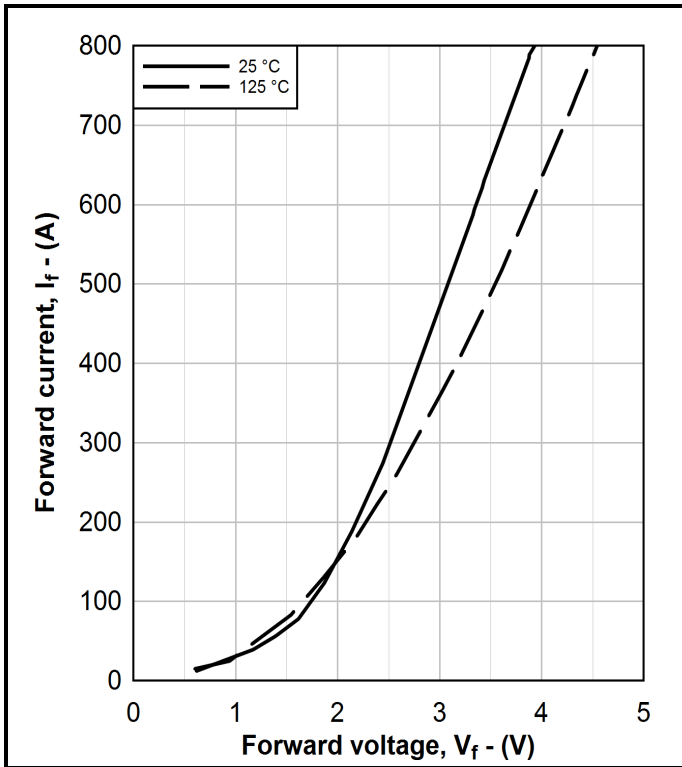


Fig. 7 Diode typical forward characteristics

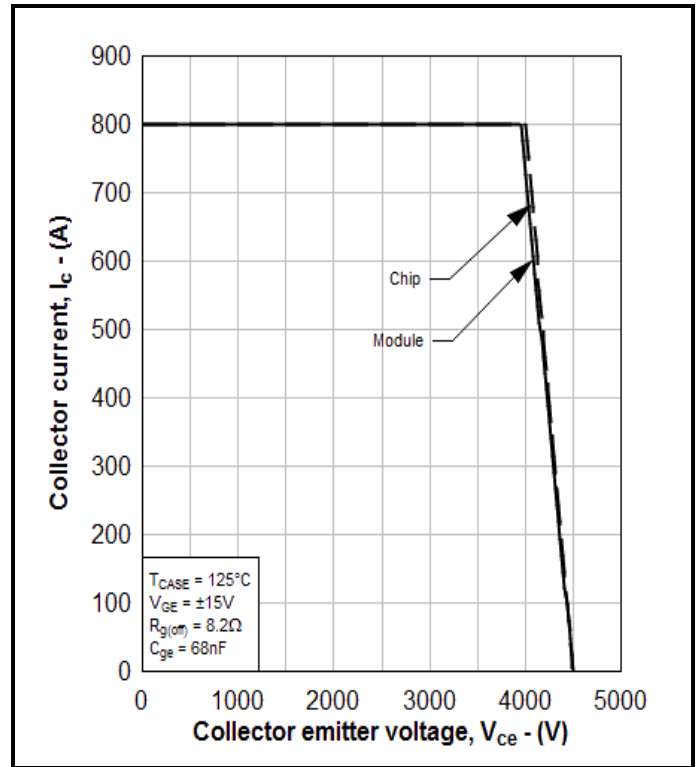


Fig. 8 Reverse bias safe operating area

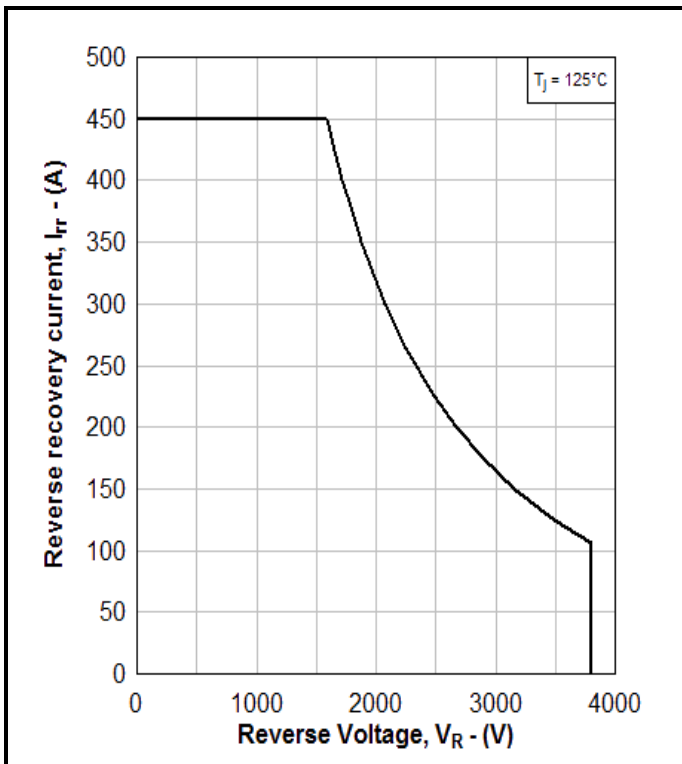


Fig. 9 Diode reverse bias safe operating area

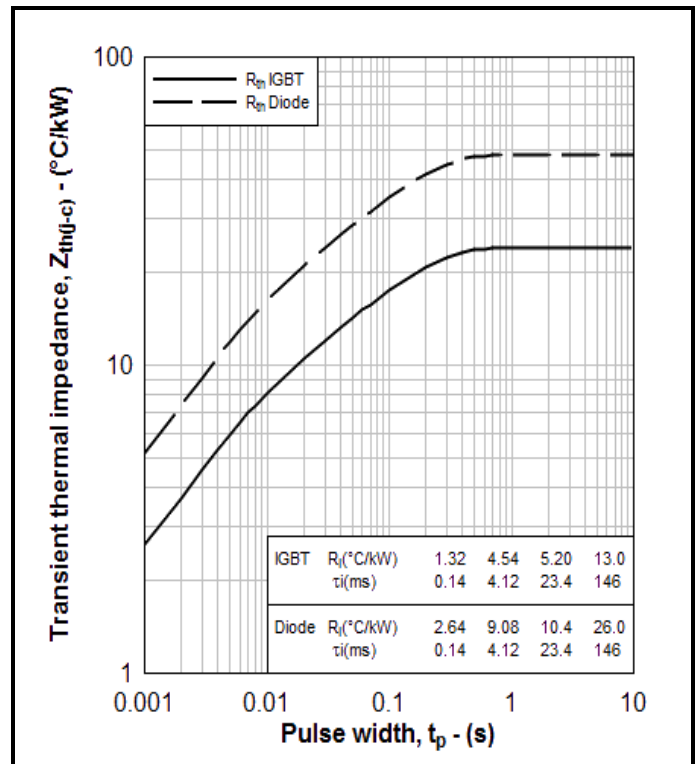
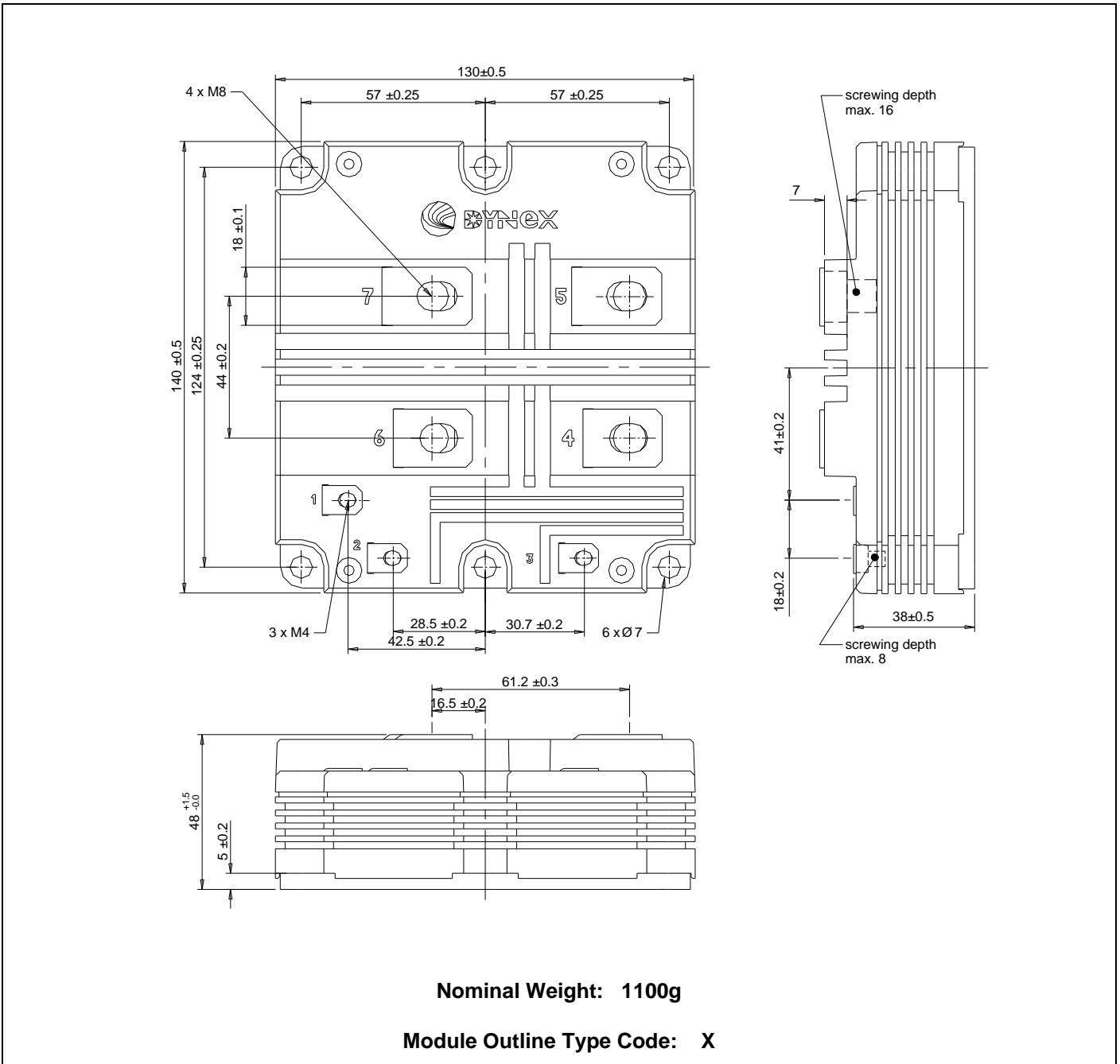


Fig. 10 Transient thermal impedance

**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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