

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 DIM400XSM45-TS001 is a single switch 4500V, n-channel enhancement mode, insulated gate bipolar transistor (IGBT) 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:

DIM400XSM45-TS001

Note: When ordering, please use the complete part number

KEY PARAMETERS

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

* Measured at the auxiliary terminals

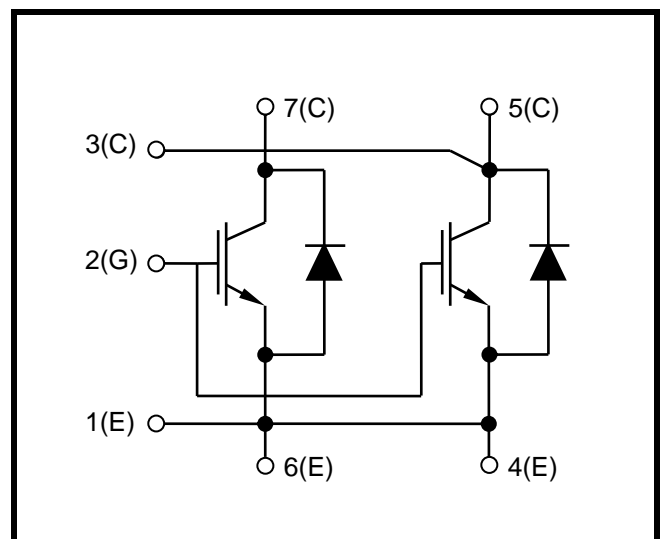
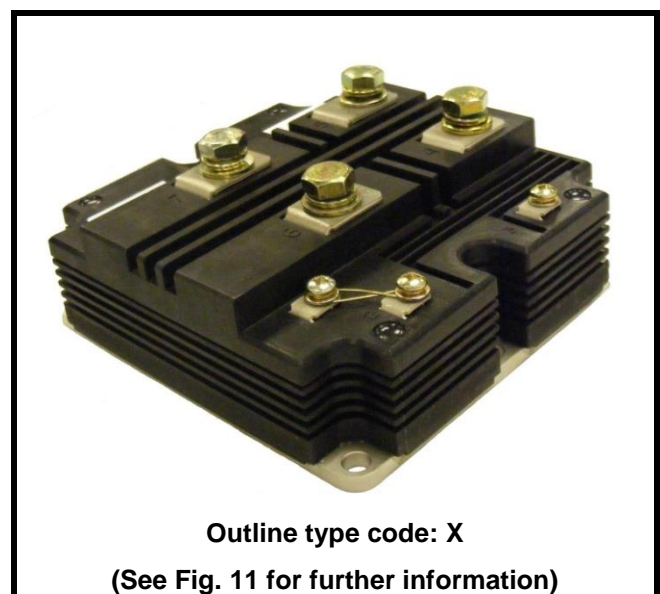


Fig. 1 Circuit configuration



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	$V_{GE} = 0V$	4500	V
V_{GES}	Gate-emitter voltage		± 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	$T_{case} = 25^{\circ}\text{C}$, $T_j = 125^{\circ}\text{C}$	4.2	kW
I^2t	Diode I^2t value	$V_R = 0$, $t_p = 10\text{ms}$, $T_j = 125^{\circ}\text{C}$	50	kA^2s
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, $V_1 = 6900V$, $V_2 = 5100V$, 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	Continuous dissipation - junction to case	-	-	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
 $T_{case} = 25^{\circ}C$ unless stated otherwise.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I_{CES}	Collector cut-off current	$V_{GE} = 0V, V_{CE} = V_{CES}$			1	mA
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{case} = 125^{\circ}C$			20	mA
I_{GES}	Gate leakage current	$V_{GE} = \pm 20V, V_{CE} = 0V$			1	μA
$V_{GE(TH)}$	Gate threshold voltage	$I_C = 40mA, V_{GE} = V_{CE}$		5.8		V
$V_{CE(sat)}^{\dagger}$	Collector-emitter saturation voltage	$V_{GE} = 15V, I_C = 400A$		2.7		V
		$V_{GE} = 15V, I_C = 400A, T_j = 125^{\circ}C$		3.5		V
I_F	Diode forward current	DC		400		A
I_{FM}	Diode maximum forward current	$t_p = 1ms$		800		A
V_F^{\dagger}	Diode forward voltage	$I_F = 400A$		2.8		V
		$I_F = 400A, T_j = 125^{\circ}C$		3.2		V
C_{ies}	Input capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$		50		nF
Q_g	Gate charge	$\pm 15V$ Including external C_{ge}		5		μC
C_{res}	Reverse transfer capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$		4		nF
L_M	Module inductance			15		nH
R_{INT}	Internal transistor resistance			TBC		$\mu\Omega$
SC_{Data}	Short circuit current, I_{SC}	$T_j = 125^{\circ}C, V_{CC} = 3400V$ $t_p \leq 10\mu s, V_{GE} \leq 15V$ $V_{CE(max)} = V_{CES} - L^* \times dl/dt$ IEC 60747-9		1600		A

Note:
 \dagger Measured at the power busbars, not 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	$I_C = 400\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 2800\text{V}$ $R_{G(ON)} = 8.2\ \Omega$ $R_{G(OFF)} = 8.2\ \Omega$ $C_{ge} = 68\text{nF}$ $L_S \sim 190\text{nH}$		3000		ns
t_f	Fall time			600		ns
E_{OFF}	Turn-off energy loss			1500		mJ
$t_{d(on)}$	Turn-on delay time			900		ns
t_r	Rise time			350		ns
E_{ON}	Turn-on energy loss			1600		mJ
Q_{rr}	Diode reverse recovery charge	$I_F = 400\text{A}$ $V_{CE} = 2800\text{V}$ $dI_F/dt = 1000\text{A}/\mu\text{s}$		450		μC
I_{rr}	Diode reverse recovery current			350		A
E_{rec}	Diode reverse recovery energy			750		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	$I_C = 400\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 2800\text{V}$ $R_{G(ON)} = 8.2\ \Omega$ $R_{G(OFF)} = 8.2\ \Omega$ $C_{ge} = 68\text{nF}$ $L_S \sim 190\text{nH}$		3100		ns
t_f	Fall time			560		ns
E_{OFF}	Turn-off energy loss			1600		mJ
$t_{d(on)}$	Turn-on delay time			900		ns
t_r	Rise time			360		ns
E_{ON}	Turn-on energy loss			2200		mJ
Q_{rr}	Diode reverse recovery charge	$I_F = 400\text{A}$ $V_{CE} = 2800\text{V}$ $dI_F/dt = 1000\text{A}/\mu\text{s}$		750		μC
I_{rr}	Diode reverse recovery current			380		A
E_{rec}	Diode reverse recovery energy			1250		mJ

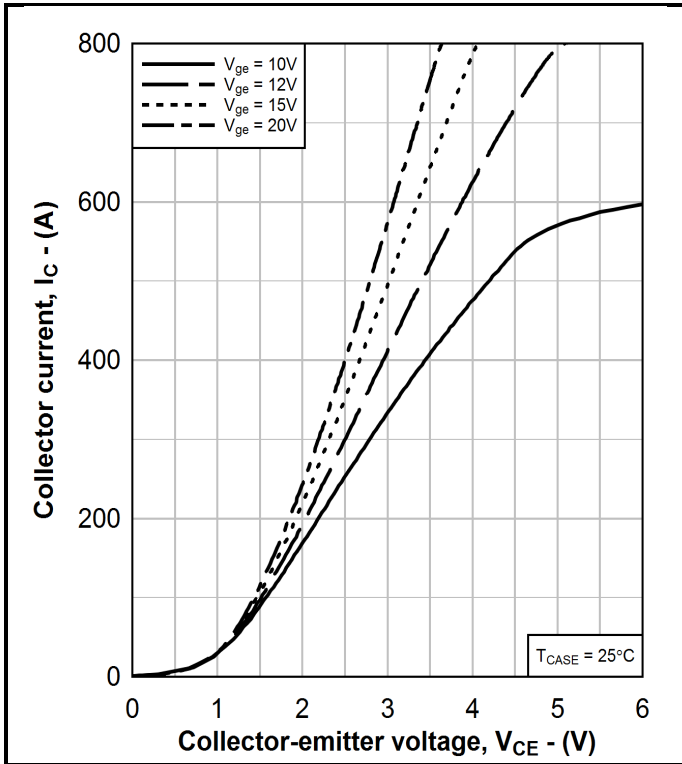


Fig. 3 Typical output characteristics

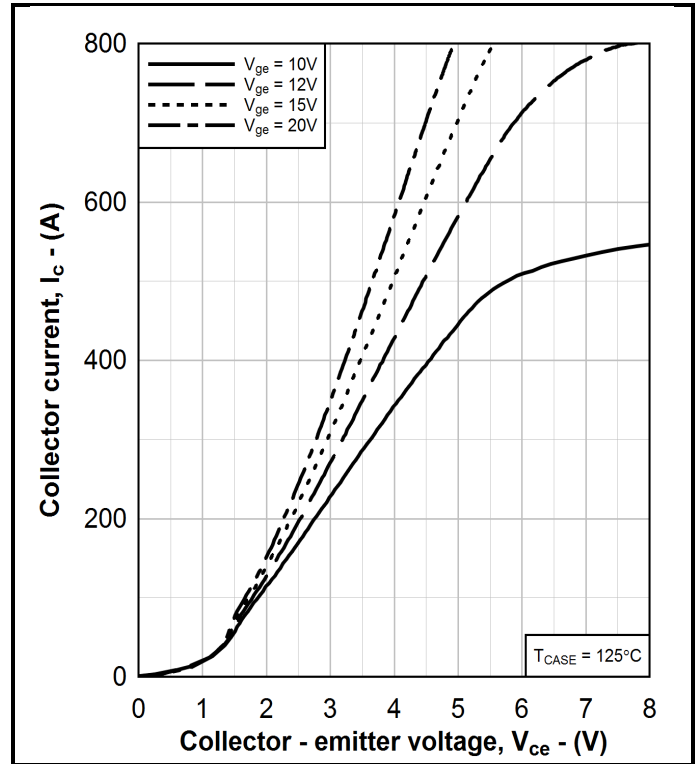


Fig. 4 Typical output characteristics

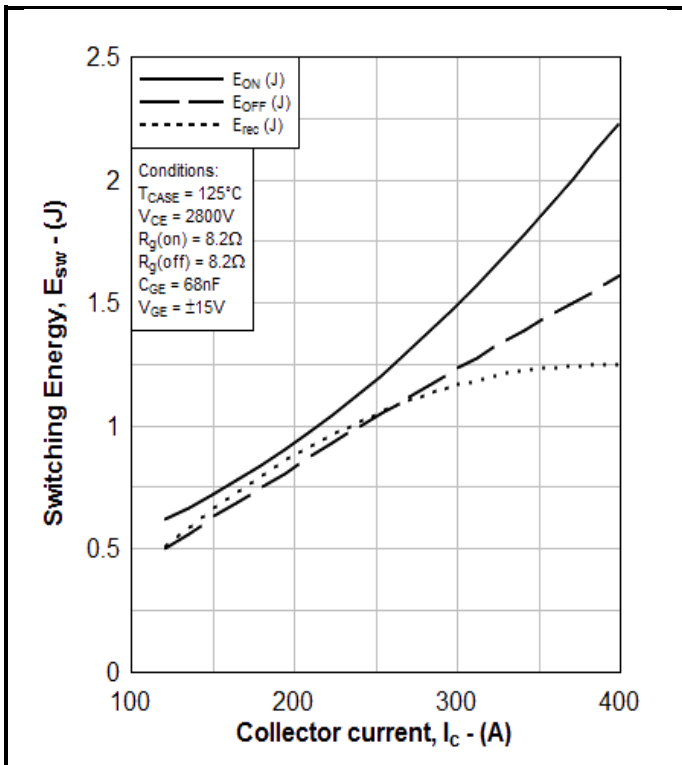


Fig. 5 Typical switching energy vs collector current

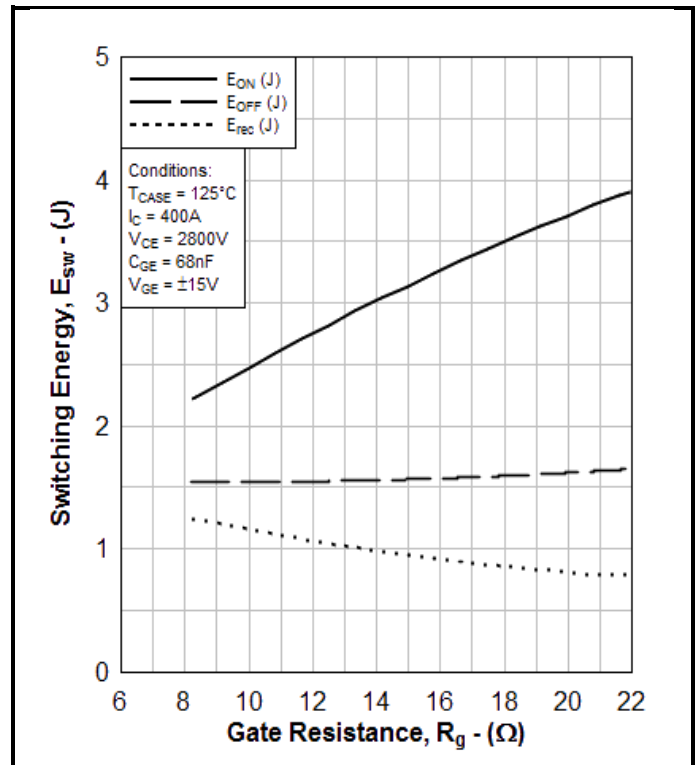


Fig. 6 Typical switching energy vs gate resistance

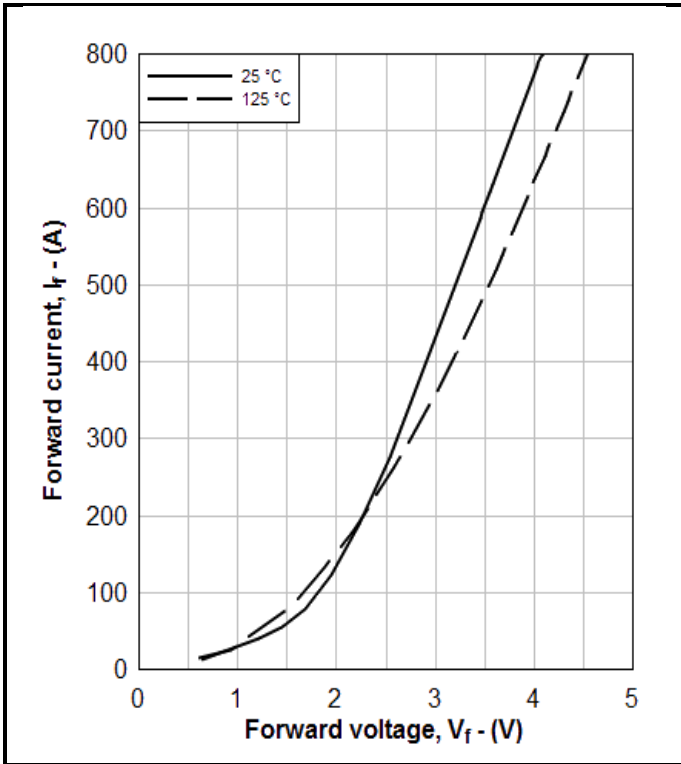


Fig. 7 Diode typical forward characteristics

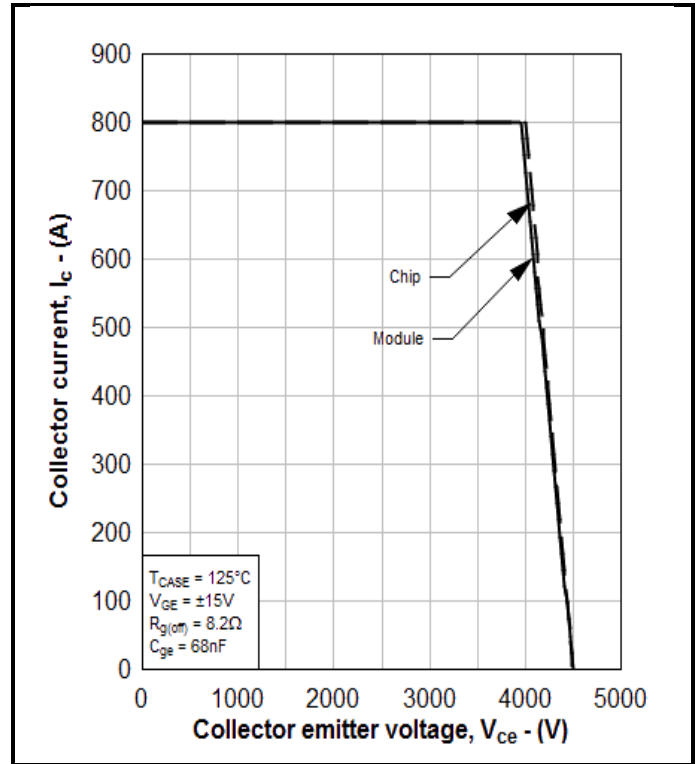


Fig. 8 Reverse bias safe operating area

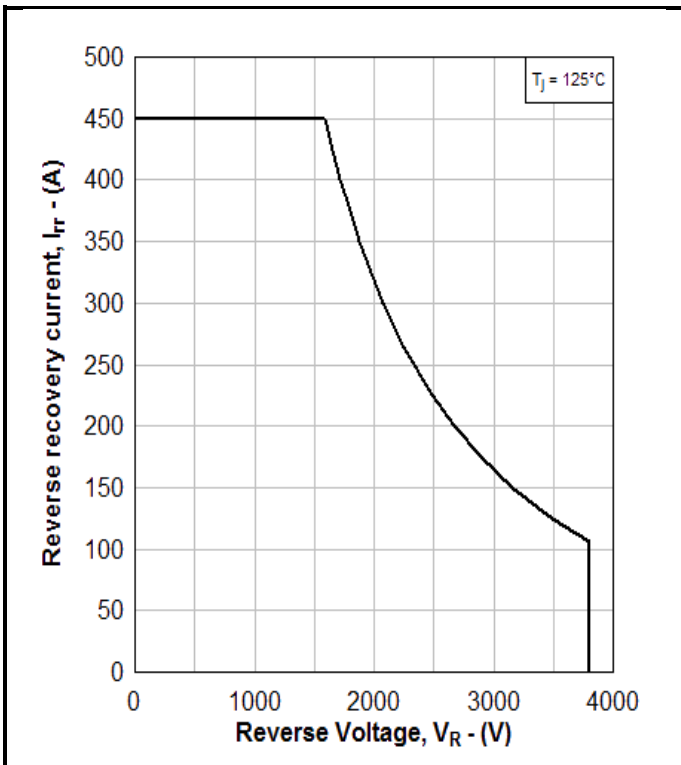


Fig. 9 Diode reverse bias safe operating area

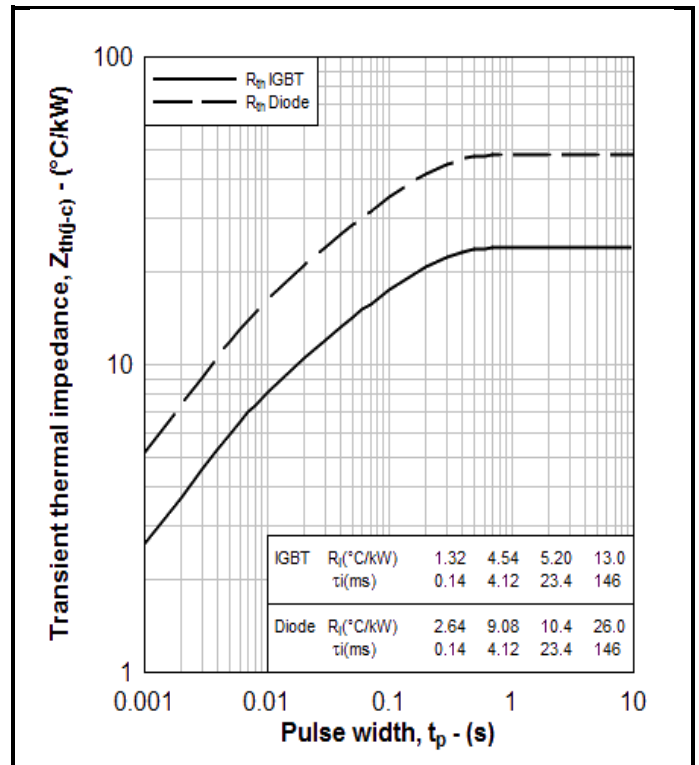


Fig. 10 Transient thermal impedance

PACKAGE DETAILS

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

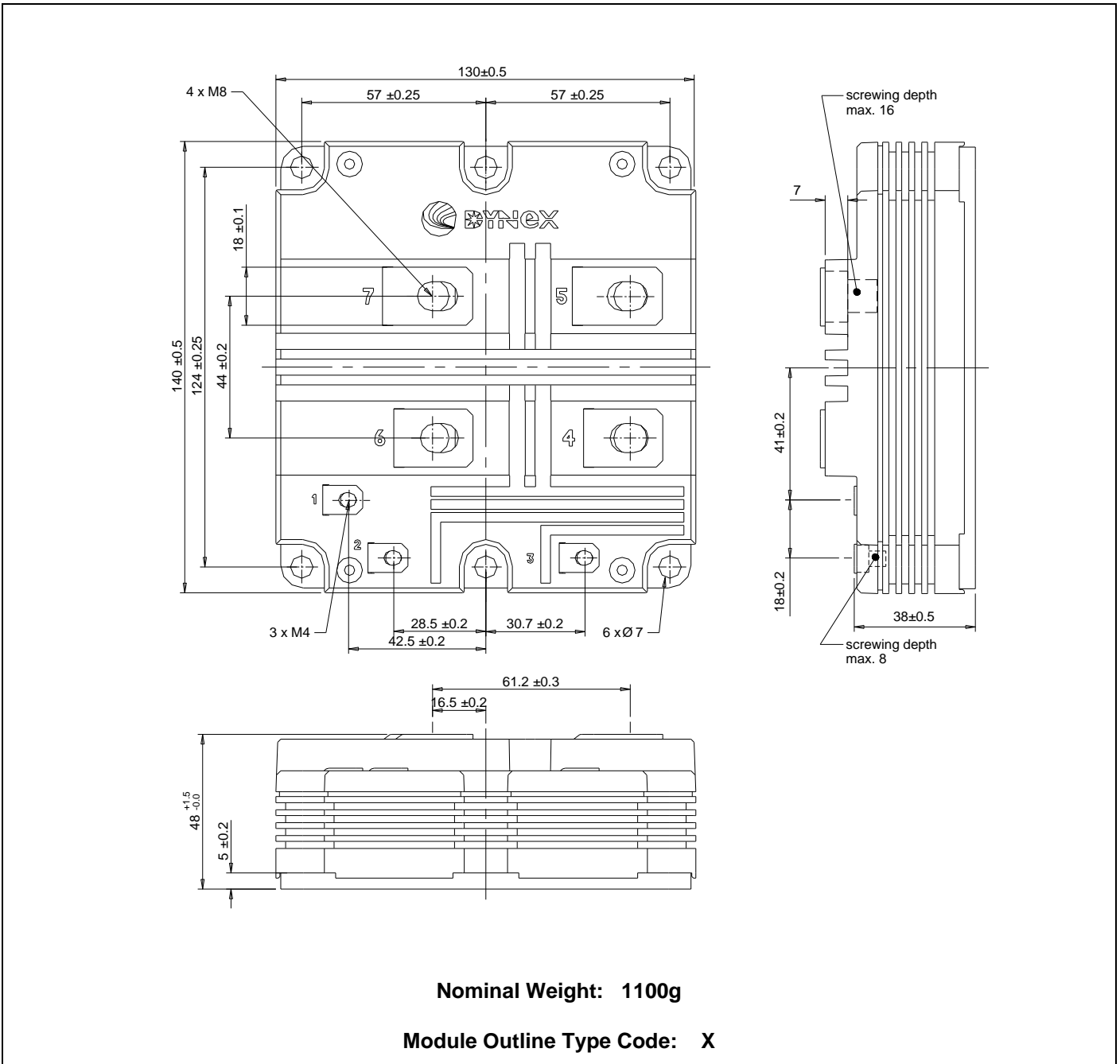


Fig. 11 Module outline drawing

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