IGBT Chopper Module

Replaces DS6111-1

DS6111-2 January 2014 (LN31266)

FEATURES

- 10µs Short Circuit Withstand
- High Thermal Cycling Capability
- High Current Density Enhanced DMOS SPT
- Isolated AlSiC 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-TS000 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-TS000

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

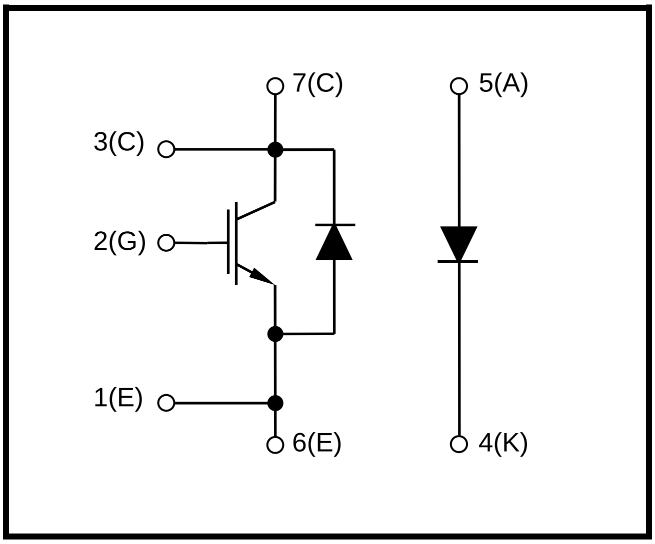
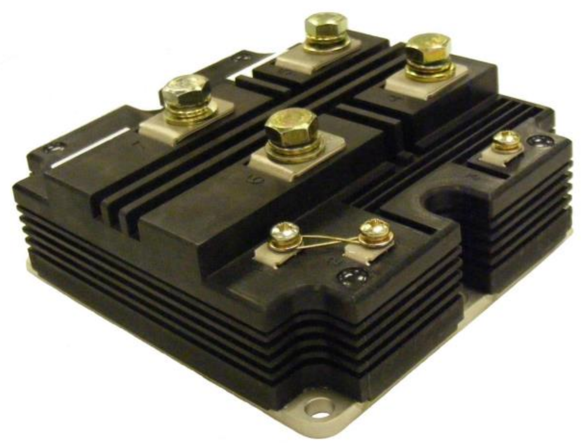


Fig. 1 Circuit configuration



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°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°C	400	A
$I_{C(PK)}$	Peak collector current	1ms, T_{case} = 120°C	800	A
P_{max}	Max. transistor power dissipation	T_{case} = 25°C, T_j = 125°C	4.16	kW
I^2t	Diode I^2t value	V_R = 0, t_p = 10ms, T_j = 125ºC	50	kA^2s
V_{isol}	Isolation voltage – per module	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	7.4	kV
Q_{PD}	Partial discharge – per module	IEC1287, V_1 = 4800V, V_2 = 3500V, 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	°C/kW
$R_{th(j-c)}$	Thermal resistance – diode (IGBT arm)	Continuous dissipation - junction to case	-	-	48	°C/kW
$R_{th(j-c)}$	Thermal resistance – diode (Diode arm)		-	-	48	°C/kW
$R_{th(c-h)}$	Thermal resistance – case to heatsink (per module)	Mounting torque 5Nm (with mounting grease)	-	-	8	°C/kW
T_j	Junction temperature	Transistor	-	-	125	°C
		Diode	-	-	125	°C
T_{stg}	Storage temperature range	-	-40	-	125	°C
	Screw torque	Mounting – M6	-	-	5	Nm
		Electrical connections – M4	-	-	2	Nm
		Electrical connections – M8	-	-	10	Nm

ELECTRICAL CHARACTERISTICS

T_{case} = 25°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°C			20	mA
I_{GES}	Gate leakage current	V_{GE} = ± 20V, V_{CE} = 0V			1	μA
$V_{GE(TH)}$	Gate threshold voltage	I_C = 40mA, V_{GE} = V_{CE}		5.8		V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 400A		2.7		V
		V_{GE} = 15V, I_C = 400A, T_j = 125°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	Diode forward voltage	I_F = 400A		2.8		V
		I_F = 400A, T_j = 125°C		3.2		V
C_{ies}	Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		50		nF
Q_g	Gate charge	±15V		7.5		μC
C_{res}	Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		TBC		nF
L_M	Module inductance – per arm			30		nH
R_{INT}	Internal resistance – per arm			260		μΩ
SC_{Data}	Short circuit current, I_{SC}	T_j = 125°C, V_{CC} = 3400V t_p ≤ 10μs, V_{GE} ≤ 15V $V_{CE\ (max)} = V_{CES} - L^* \times dI/dt$ IEC 60747-9		1200		A

Note:

* L is the circuit inductance + L_M

ELECTRICAL CHARACTERISTICS

T_{case} = 25°C unless stated otherwise

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$t_{d(off)}$	Turn-off delay time	I_C = 400A V_{GE} = ±15V V_{CE} = 2800V $R_{G(ON)}$ = 8.2Ω $R_{G(OFF)}$ = 8.2Ω C_{ge} = 68nF L_S ~ 165nH		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 = 400A V_{CE} = 2800V dI_F/dt = 1000A/μs		450		μC
I_{rr}	Diode reverse recovery current			350		A
E_{rec}	Diode reverse recovery energy			750		mJ

T_{case} = 125°C unless stated otherwise

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$t_{d(off)}$	Turn-off delay time	I_C = 400A V_{GE} = ±15V V_{CE} = 2800V $R_{G(ON)}$ = 8.2Ω $R_{G(OFF)}$ = 8.2Ω C_{ge} = 68nF L_S ~ 165nH		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 = 400A V_{CE} = 2800V dI_F/dt = 1000A/μs		750		μC
I_{rr}	Diode reverse recovery current			380		A
E_{rec}	Diode reverse recovery energy			1250		mJ

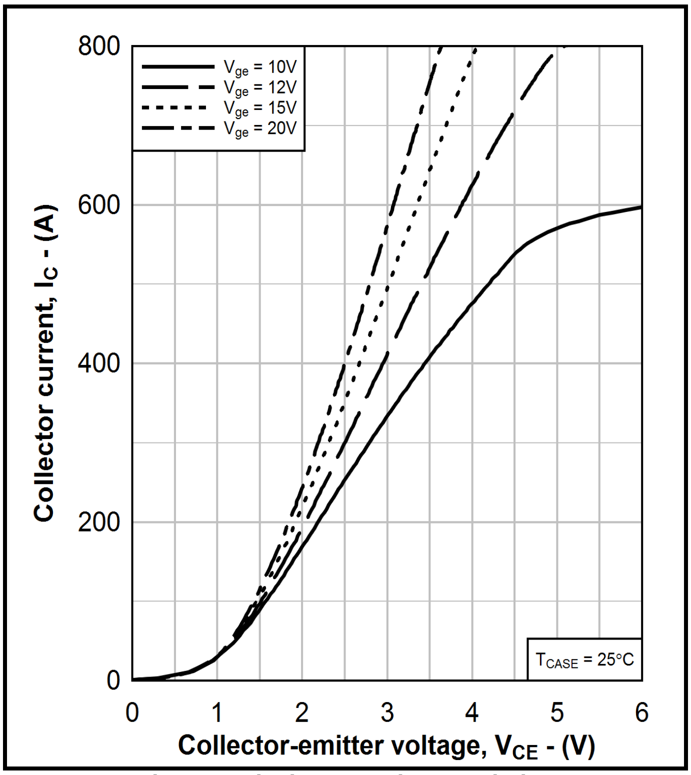


Fig. 3 Typical output characteristics

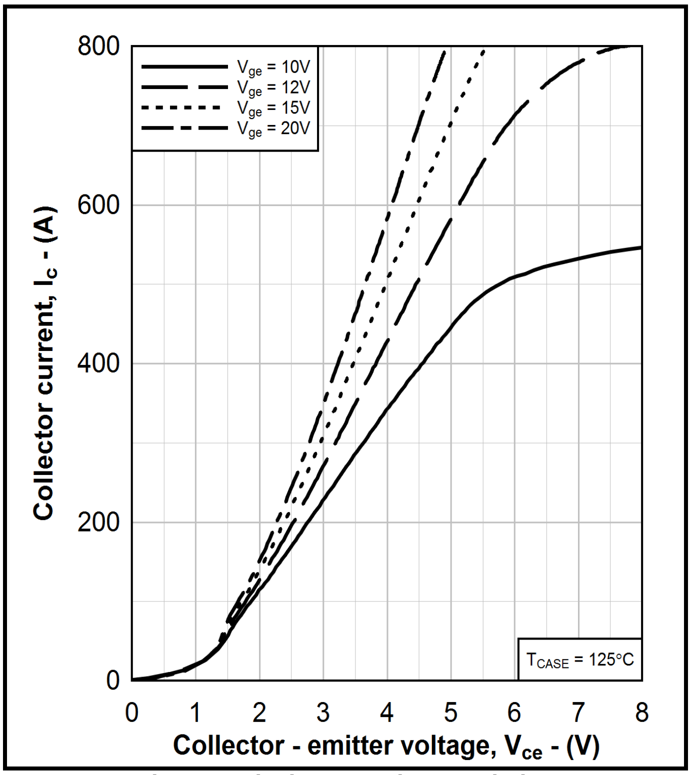


Fig. 4 Typical output characteristics

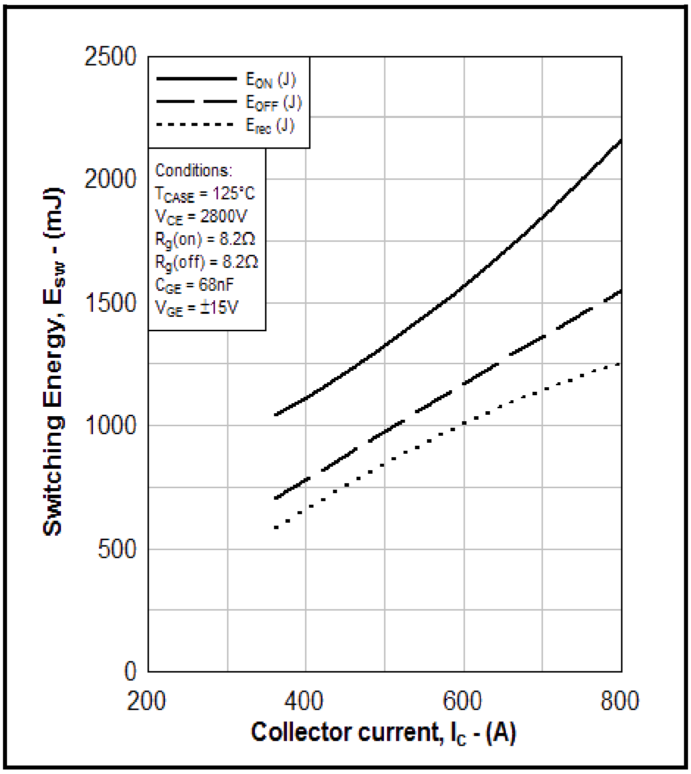


Fig. 5 Typical switching energy vs collector current

TBD

Fig. 6 Typical switching energy vs gate resistance

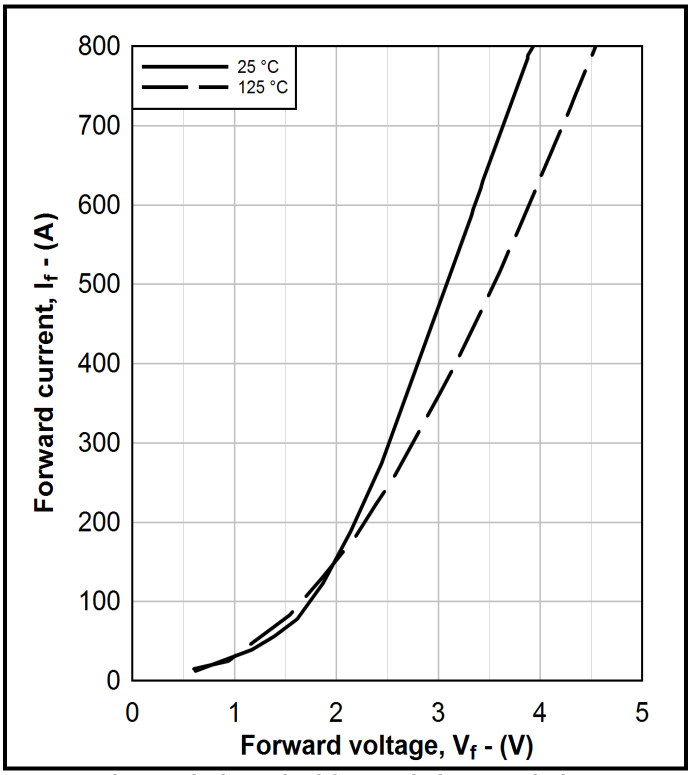


Fig. 7 Diode typical forward characteristics

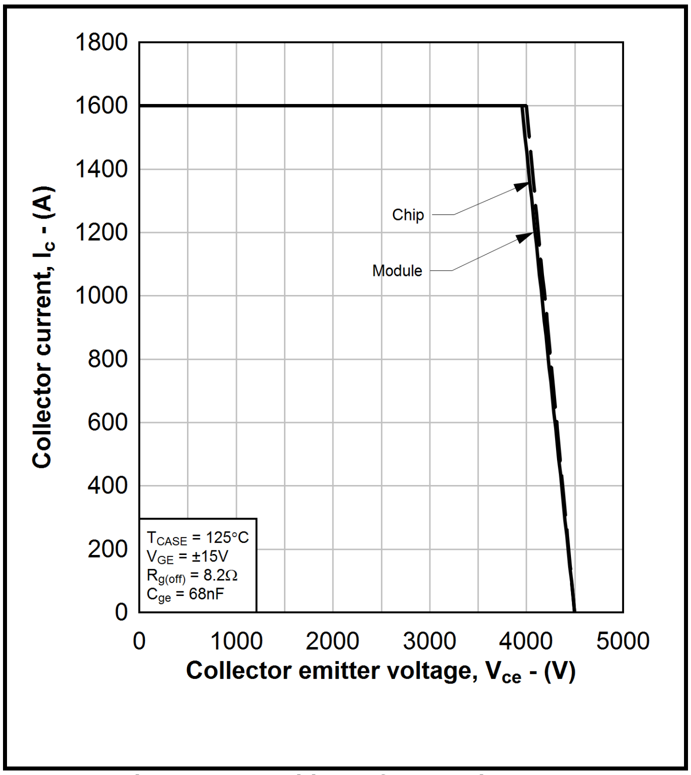


Fig. 8 Reverse bias safe operating area

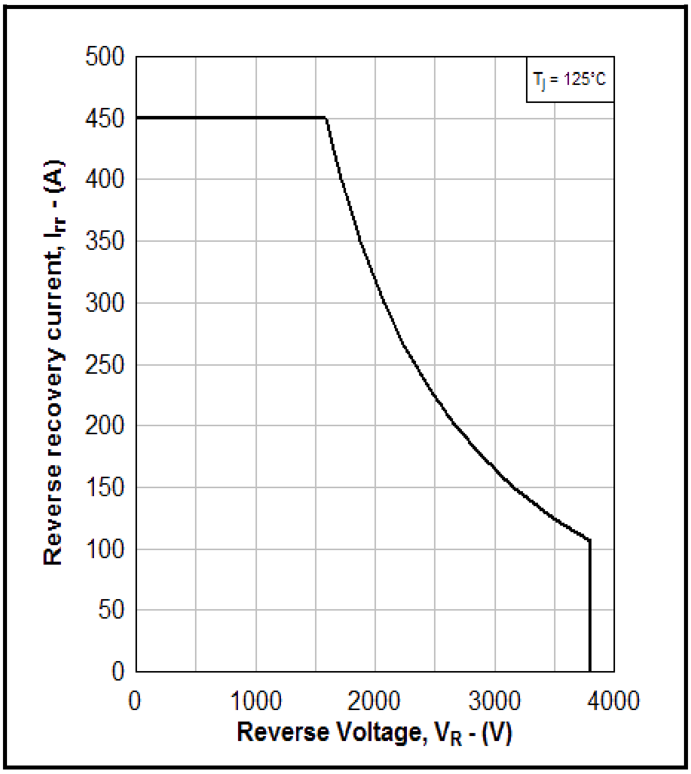


Fig. 9 Diode reverse bias safe operating area

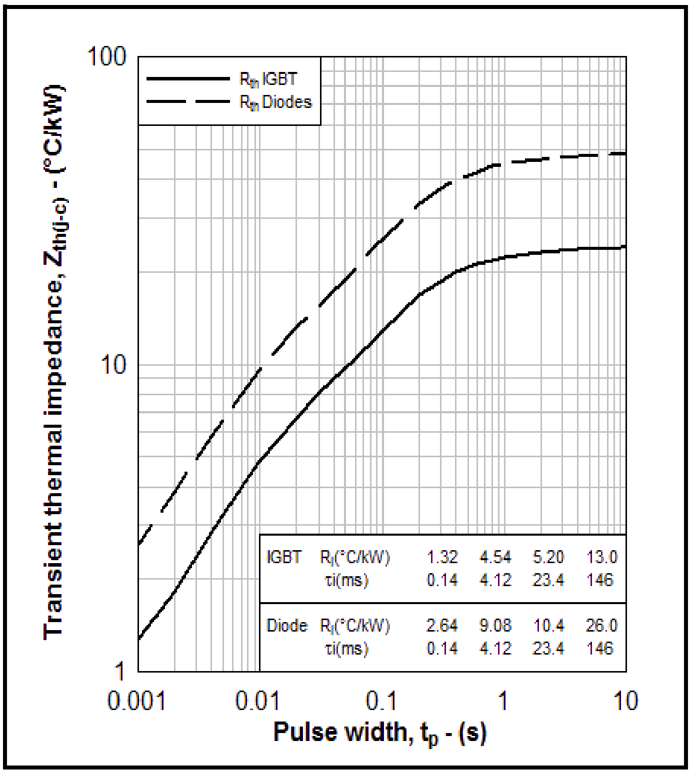
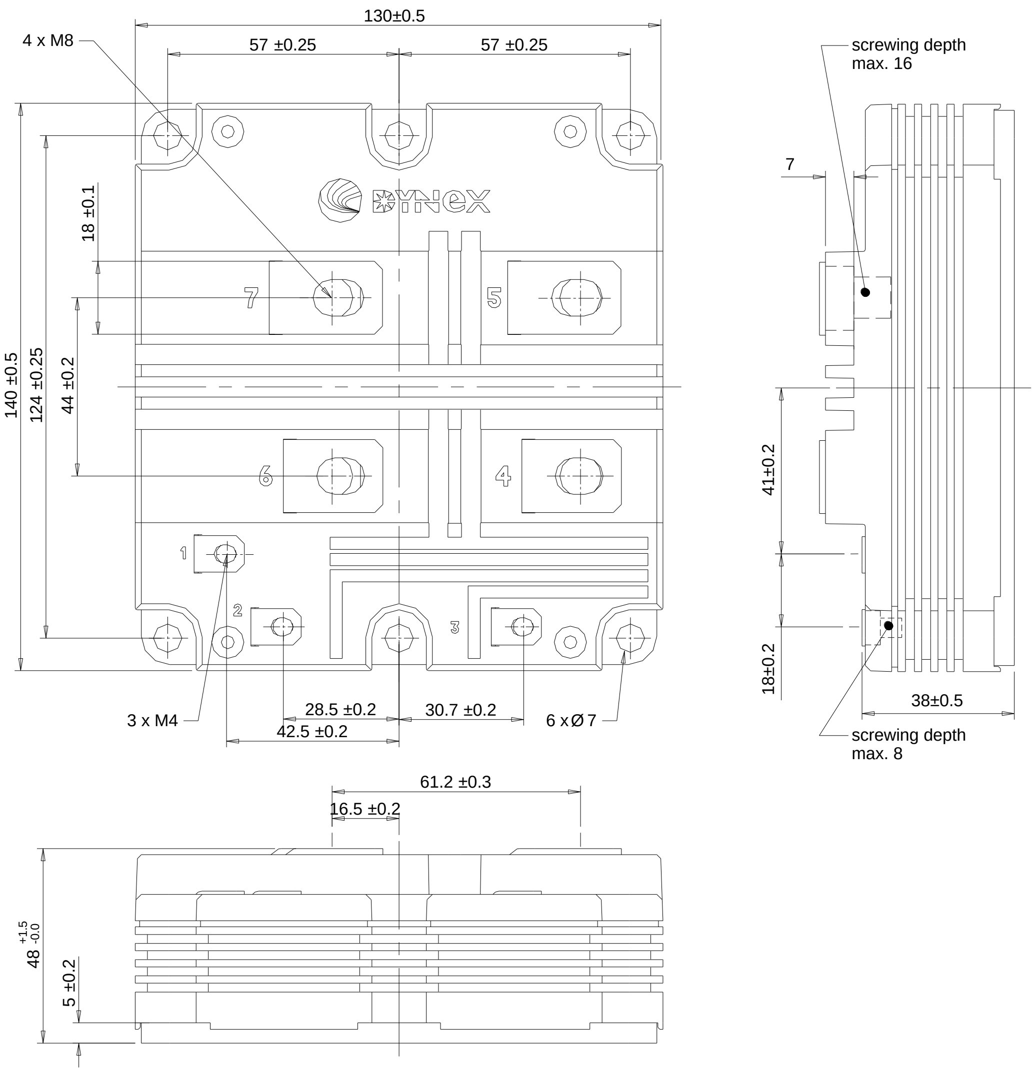


Fig. 10 Transient thermal impedance

Caution: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.

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: 1100g

Module Outline Type Code: X

Fig. 11 Module outline drawing

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