

IGBT Chopper Module

DS5938-1.0 February 2009(LN26594)

FEATURES

- Soft Punch Through Silicon
- Isolated MMC Base with AlN Substrates
- High Thermal Cycling Capability
- 10µs Short Circuit Withstand
- Lead Free construction
- High Isolation module

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 3600A.

The DIM400XCM33-F000 is a 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 10us 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:

DIM400XCM33-F000

Note: When ordering, please use the complete part number

KEY PARAMETERS

V_{CES}		3300V
$V_{CE(sat)}$ *	(typ)	2.8 V
I_C	(max)	400A
$I_{C(PK)}$	(max)	800A

*(measured at the auxiliary terminals)

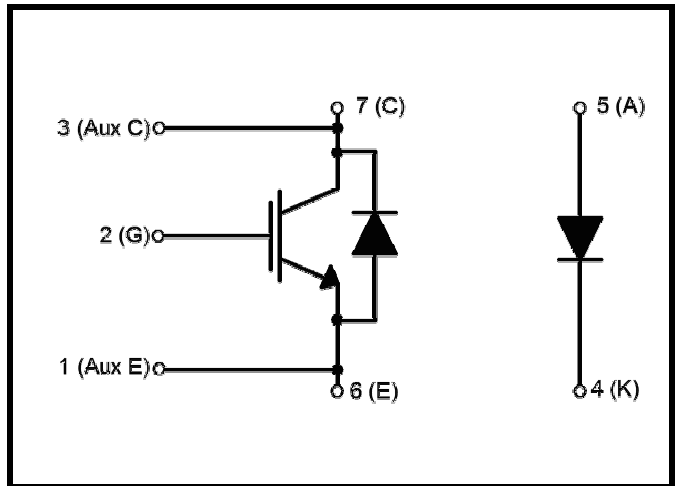


Fig. 1 Circuit configuration

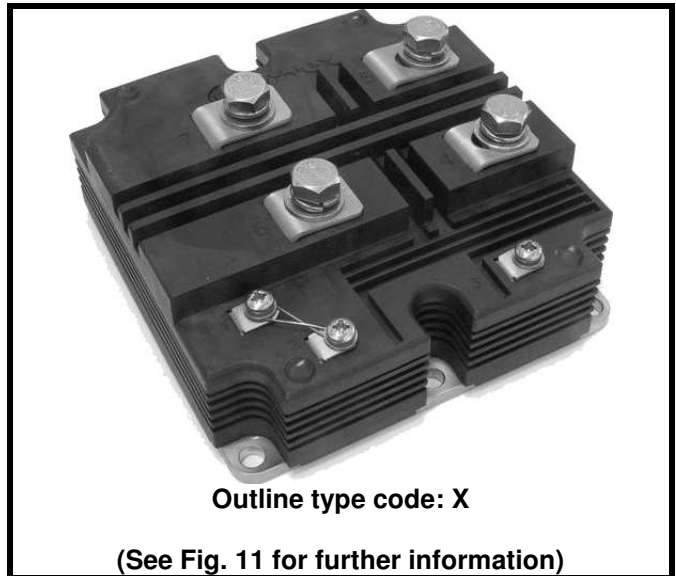


Fig. 2 Package

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.

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

Symbol	Parameter	Test Conditions	Max.	Units
V_{CES}	Collector-emitter voltage	$V_{GE} = 0 V$	3300	V
V_{GES}	Gate-emitter voltage		± 20	V
I_C	Continuous collector current	$T_{case} = 90^{\circ}C$	400	A
$I_{C(PK)}$	Peak collector current	1ms, $T_{case} = 115^{\circ}C$	800	A
P_{max}	Max. transistor power dissipation	$T_{case} = 25^{\circ}C, T_j = 150^{\circ}C$	5.2	kW
I^2t	Diode I^2t value	$V_R = 0 V, t_p = 10ms, T_j = 125^{\circ}C$	80	kA^2s
V_{isol}	Isolation voltage	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	10.2	kV
Q_{PD}	Partial discharge	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 (Critical Tracking Index): >600

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$R_{th(j-c)}$	Thermal resistance -transistor	Continuous dissipation - junction to case			24	$^{\circ}C/kW$
$R_{th(j-c)}$	Thermal resistance -diode	Continuous dissipation - junction to case			48	$^{\circ}C/kW$
$R_{th(c-h)}$	Thermal resistance -case to heatsink	Mounting torque **Nm (with mounting grease)			8	$^{\circ}C/kW$
T_j	Junction temperature	Transistor			150	$^{\circ}C$
		Diode			125	$^{\circ}C$
T_{stg}	Storage temperature range		-40		125	$^{\circ}C$
	Screw torque	Mounting – M6			5	Nm
		Electrical connections – M4			2	Nm
		Electrical connections – M8			10	Nm

2/8: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.

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} = 0 V, V _{CE} = V _{CES}			2	mA	
		V _{GE} = 0 V, V _{ce} = V _{ces} , T _{case} = 125 ° C			30	mA	
I _{GES}	Gate leakage current	V _{GE} = ±15 V, V _{CE} = 0 V			1	μA	
V _{GE(TH)}	Gate threshold voltage	I _C = 40mA, V _{GE} = V _{CE}	5.5	6.5	7.0	V	
V _{CE(sat)} [†]	Collector-emitter saturation voltage	V _{GE} = 15V, I _C = 400 A		2.8		V	
		V _{GE} = 15V, I _C = 400 A, T _{VJ} = 125 ° C		3.6		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 = 400 A		2.9		V	
		I _F = 400 A, T _{VJ} = 125 ° C		3.0		V	
C _{ies}	Input capacitance	V _{CE} = 25V, V _{GE} = 0V, f = 1MHz		72		nF	
C _{res}	Reverse transfer capacitance	V _{CE} = 25V, V _{GE} = 0V, f = 1MHz		1.1		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} = 2500 V V _{GE} ≤ 15V, t _p ≤ 10μs, V _{CE(max)} = V _{CES} - L* x di/dt IEC 6074-9	I ₁		2000		A
			I ₂		1850		A

Note:
[†] Measured at the auxiliary terminals

^{*} L is the circuit inductance + L_M

ELECTRICAL CHARACTERISTICS

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

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units	
$t_{d(off)}$	Turn-off delay time	$I_C = 400 A$ $V_{GE} = \pm 15 V$ $V_{CE} = 1800 V$ $R_{G(ON)} = R_{G(OFF)} = 8.2 \Omega$ $C_{ge} = 110 nF$ $L \sim 100 nH$		2100		ns	
t_f	Fall time			210		ns	
E_{OFF}	Turn-off energy loss				520		mJ
$t_{d(on)}$	Turn-on delay time				1130		ns
t_r	Rise time				245		ns
Q_g	Gate charge				10		μC
E_{ON}	Turn-on energy loss		$I_C = 400A, V_{GE} = \pm 15 V, V_{CE} = 1800 V$ $R_{G(ON)} = 5.6 \Omega, C_{ge} = 110 nF, L \sim 100nH$		620		mJ
Q_{rr}	Diode reverse recovery charge	$I_F = 400 A$ $V_{CE} = 1800 V$ $di_F/dt = 2000 A/\mu s$		160		μC	
I_{rr}	Diode reverse recovery current			330		A	
E_{rec}	Diode reverse recovery energy				150		mJ

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

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units	
$t_{d(off)}$	Turn-off delay time	$I_C = 400 A$ $V_{GE} = \pm 15 V$ $V_{CE} = 1800V$ $R_{G(ON)} = R_{G(OFF)} = 8.2 \Omega$ $C_{ge} = 110 nF, L \sim 100 nH$		2150		ns	
t_f	Fall time			220		ns	
E_{OFF}	Turn-off energy loss				600		mJ
$t_{d(on)}$	Turn-on delay time				1160		ns
t_r	Rise time				285		ns
E_{ON}	Turn-on energy loss		$I_C = 400A, V_{GE} = \pm 15 V, V_{CE} = 1800 V$ $R_{G(ON)} = 5.6 \Omega, C_{ge} = 110 nF, L \sim 100nH$		870		mJ
Q_{rr}	Diode reverse recovery charge		$I_F = 400 A$ $V_{CE} = 1800 V$ $di_F/dt = 2000 A/\mu s$		300		μC
I_{rr}	Diode reverse recovery current			400		A	
E_{rec}	Diode reverse recovery energy				300		mJ

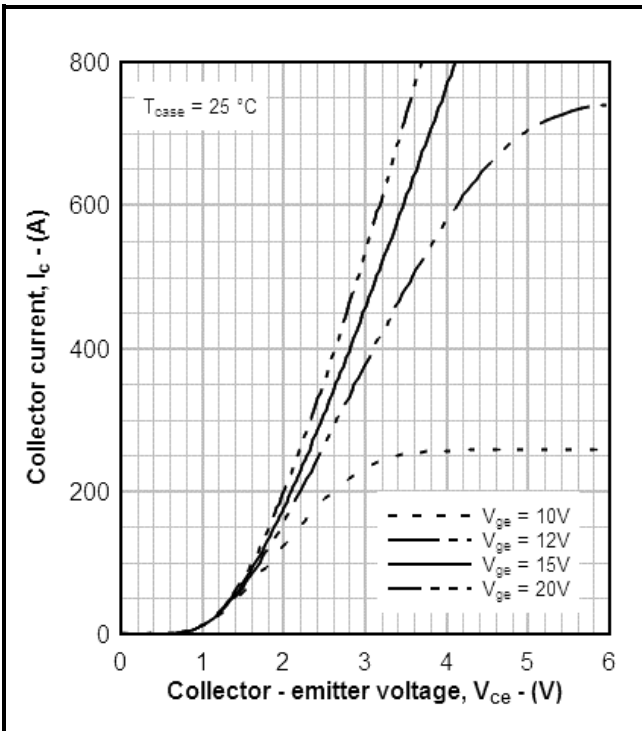


Fig. 3 Typical output characteristics

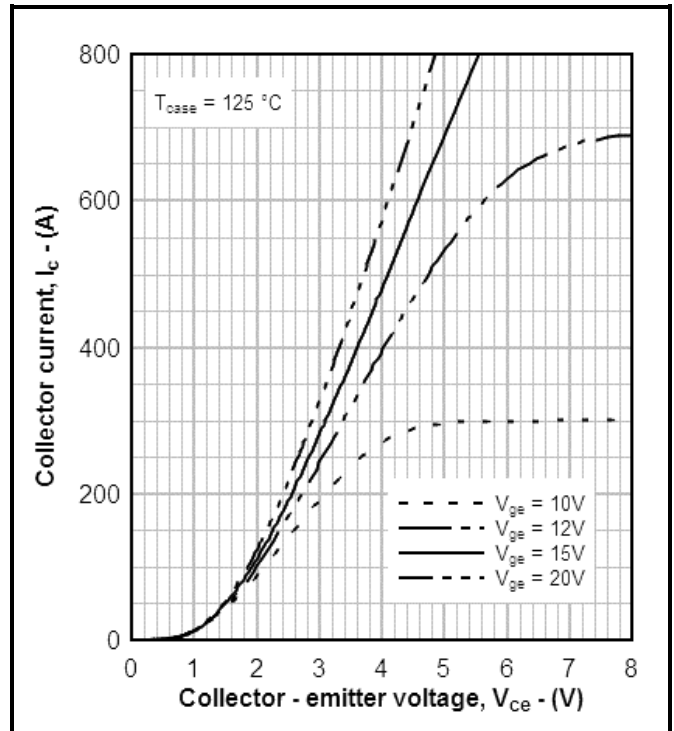


Fig. 4 Typical output characteristics

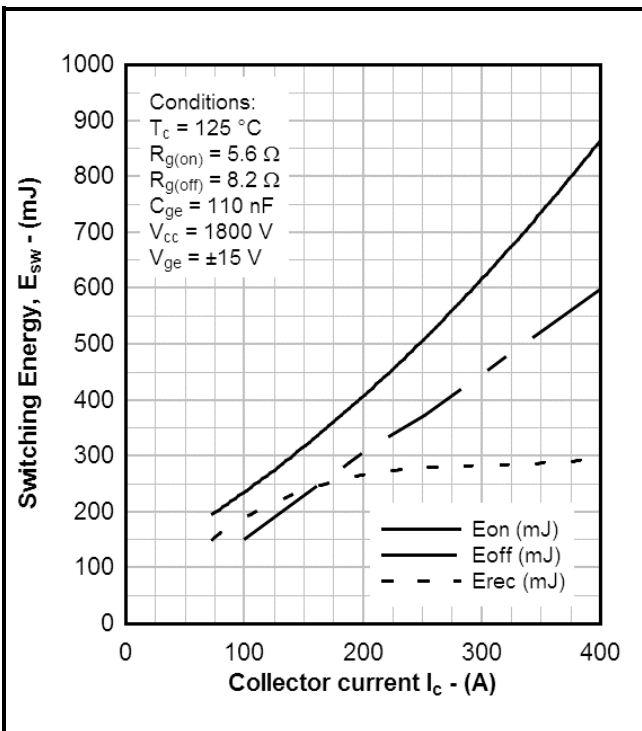


Fig.5 Typical switching energy vs collector current

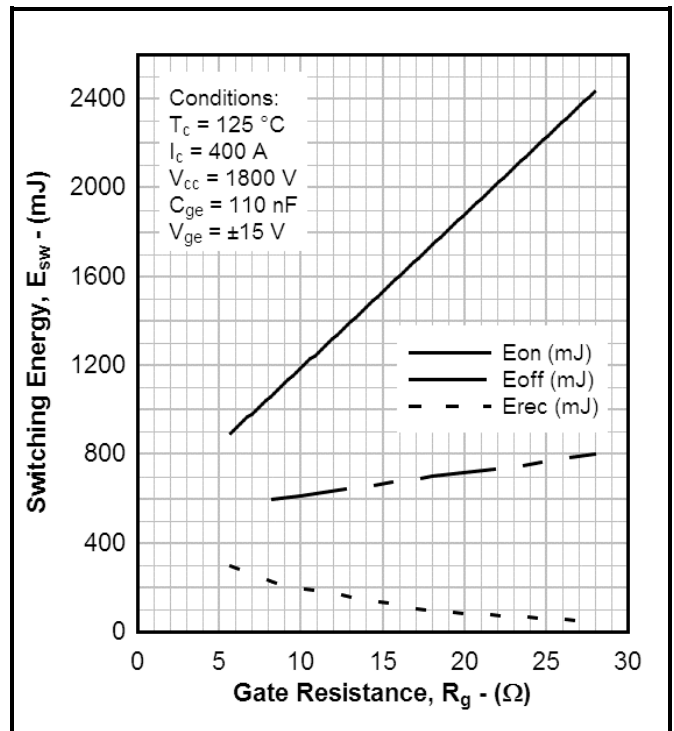


Fig. 6 Typical switching energy vs gate resistance

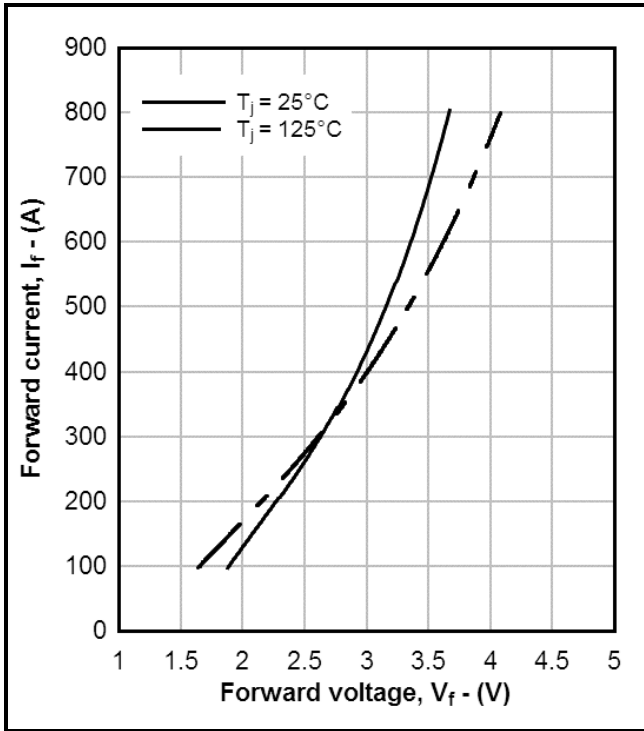


Fig. 7 Diode typical forward characteristics

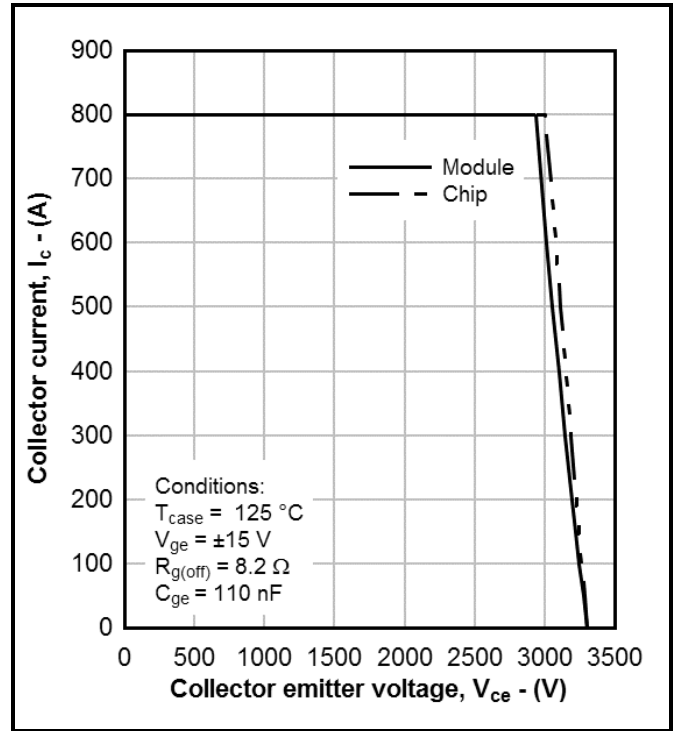


Fig. 8 Reverse bias safe operating area

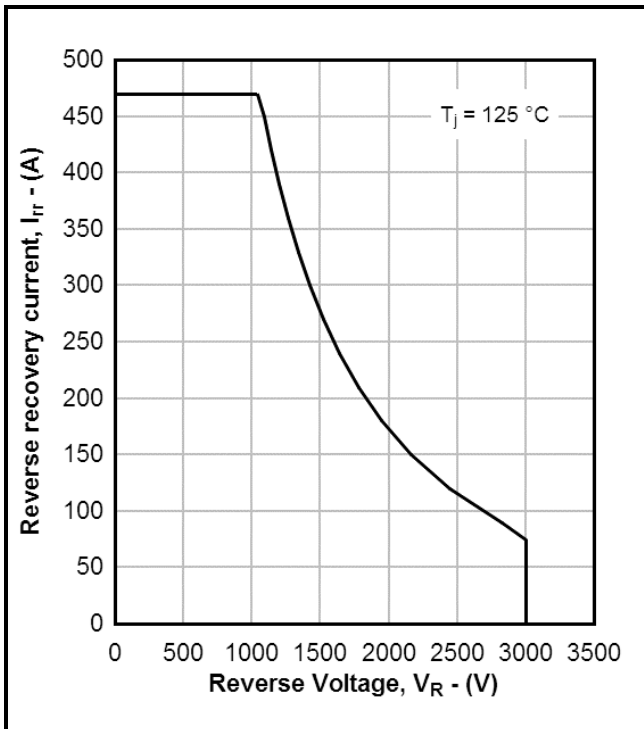


Fig. 9 Diode reverse bias safe operating area

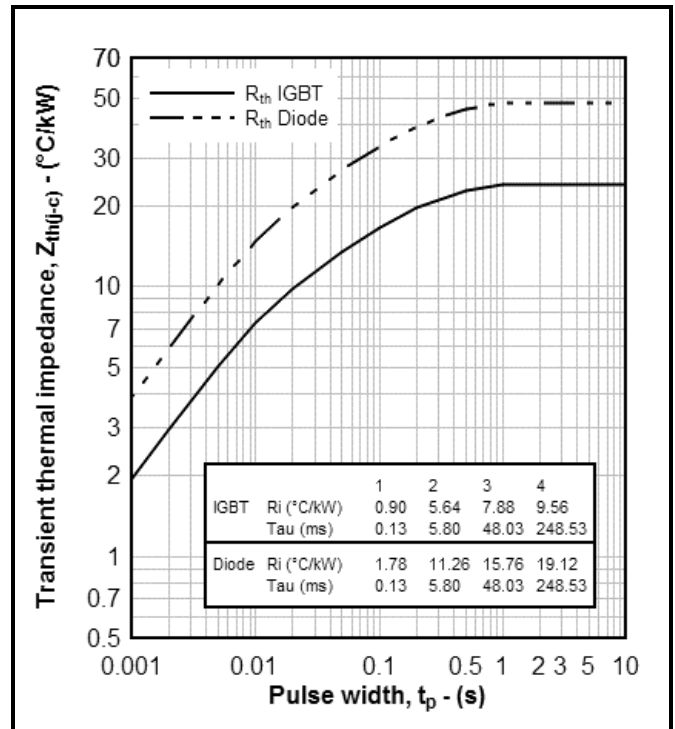
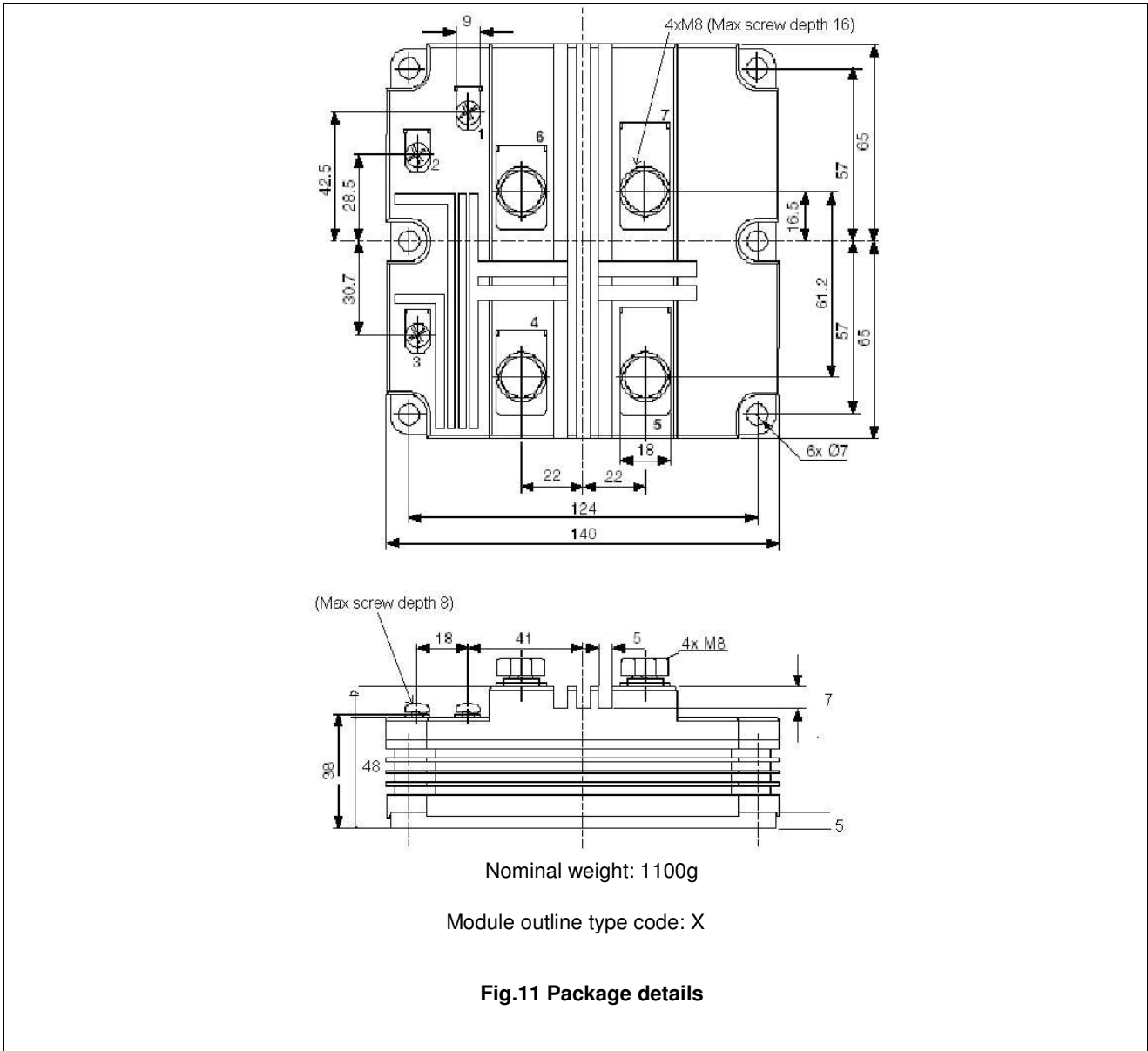


Fig. 10 Transient thermal impedance

PACKAGE DETAILS

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



POWER ASSEMBLY CAPABILITY

The Power Assembly group was set up to provide a support service for those customers requiring more than the basic semiconductor, and has developed a flexible range of heatsink and clamping systems in line with advances in device voltages and current capability of our semiconductors.

We offer an extensive range of air and liquid cooled assemblies covering the full range of circuit designs in general use today. The Assembly group offers high quality engineering support dedicated to designing new units to satisfy the growing needs of our customers.

Using the latest CAD methods our team of design and applications engineers aim to provide the Power Assembly Complete Solution (PACs).

HEATSINKS

The Power Assembly group has its own proprietary range of extruded aluminium heatsinks which have been designed to optimise the performance of Dynex semiconductors. Data with respect to air natural, forced air and liquid cooling (with flow rates) is available on request.

For further information on device clamps, heatsinks and assemblies, please contact your nearest sales representative or Customer Services.



<http://www.dynexsemi.com>

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8/8: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.