

IGBT Chopper Module

DS5918- 1.3 February 2009(LN26586)

FEATURES

- Soft Punch Through Silicon
- Isolated AISiC Base with AlN Substrates
- High Thermal Cycling Capability
- 10µs Short Circuit Withstand
- Lead Free construction
- 10.2kV isolation

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 DIM300XCM45-F000 is a 4500V, 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 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:

DIM300XCM45-F000

Note: When ordering, please use the complete part number

KEY PARAMETERS

| | | |
|-----------------|--------------|--------------|
| V_{CES} | | 4500V |
| $V_{CE(sat)}$ * | (typ) | 2.9V |
| I_C | (max) | 300A |
| $I_{C(PK)}$ | (max) | 600A |

*(measured at the auxiliary terminals)

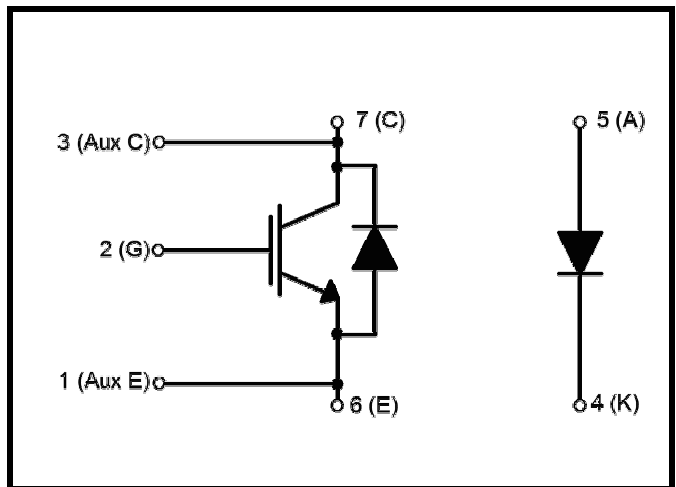


Fig. 1 Circuit configuration



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.

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

| Symbol | Parameter | Test Conditions | Max. | Units |
|-------------|-----------------------------------|----------------------------------------------------------|----------|---------|
| V_{CES} | Collector-emitter voltage | $V_{GE} = 0V, T_j = -25^{\circ}C$ | 4500 | V |
| V_{GES} | Gate-emitter voltage | | ± 20 | V |
| I_C | Continuous collector current | $T_{case} = 100^{\circ}C$ | 300 | A |
| $I_{C(PK)}$ | Peak collector current | 1ms, $T_{case} = 115^{\circ}C$ | 600 | 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 | $V_R = 0V, t_p = 10ms, T_j = 125^{\circ}C$ | 51 | 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 (per switch) | Continuous dissipation - junction to case | | | 48 | $^{\circ}C/kW$ |
| $R_{th(c-h)}$ | Thermal resistance - case to heatsink (per module) | Mounting torque 5Nm (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} = 0V, V _{CE} = V _{CES} | | | 2 | mA | |
| | | V _{GE} = 0V, V = V, T _{case} = 125° C | | | 60 | mA | |
| I _{GES} | Gate leakage current | V _{GE} = ±15V, V _{CE} = 0V | | | 4 | 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 = 300A | | 2.9 | | V | |
| | | V _{GE} = 15V, I _C = 300A, T _J = 125° C | | 3.5 | | V | |
| I _F | Diode forward current | DC | | 300 | | A | |
| I _{FM} | Diode maximum forward current | t _p = 1ms | | 600 | | A | |
| V _F [†] | Diode forward voltage | I _F = 300A | | 3.0 | | V | |
| | | I _F = 300A, T _J = 125° C | | 3.1 | | V | |
| C _{ies} | Input capacitance | V _{CE} = 25V, V _{GE} = 0V, f = 1MHz | | 65 | | nF | |
| C _{res} | Reverse transfer capacitance | V _{CE} = 25V, V _{GE} = 0V, f = 1MHz | | 0.9 | | nF | |
| L _M | Module inductance – per arm | | | 30 | | nH | |
| R _{INT} | Internal resistance | | | 270 | | μΩ | |
| SC _{Data} | Short circuit current, I _{SC} | T _J = 125° C, V _{CC} ≤ 3000V V _{GE} ≤ 15V, t _p ≤ 10μs, V _{CE(max)} = V _{CES} - L* x di/dt IEC 6074-9 | I ₁ | | 1400 | | A |
| | | | I ₂ | | 1250 | | 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 | $I_C = 300A$ | | 5.0 | | μs |
| t_f | Fall time | $V_{GE} = \pm 15V$ | | 250 | | ns |
| E_{OFF} | Turn-off energy loss | $V_{CE} = 2250V$ | | 750 | | mJ |
| $t_{d(on)}$ | Turn-on delay time | $R_{G(ON)} = 10\Omega$ | | 850 | | ns |
| t_r | Rise time | $R_{G(OFF)} = 22\Omega$ | | 220 | | ns |
| E_{ON} | Turn-on energy loss | $C_{ge} = 55nF$ | | 900 | | mJ |
| Q_g | Gate charge | $L \sim 200nH$ | | 10 | | μC |
| Q_{rr} | Diode reverse recovery charge | $I_F = 300A$ | | 240 | | μC |
| I_{rr} | Diode reverse recovery current | $V_{CE} = 2250V$ | | 350 | | A |
| E_{rec} | Diode reverse recovery energy | $di_F/dt = 1500A/\mu s$ | | 300 | | mJ |

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

| Symbol | Parameter | Test Conditions | Min | Typ. | Max | Units |
|--------------|--------------------------------|-----------------------------------------------|-----|------|-----|---------|
| $t_{d(off)}$ | Turn-off delay time | $I_C = 300A$ | | 5.2 | | μs |
| t_f | Fall time | $V_{GE} = \pm 15V$ | | 250 | | ns |
| E_{OFF} | Turn-off energy loss | $V_{CE} = 2250V$ | | 850 | | mJ |
| $t_{d(on)}$ | Turn-on delay time | $R_{G(ON)} = 10\Omega, R_{G(OFF)} = 22\Omega$ | | 800 | | ns |
| t_r | Rise time | $C_{ge} = 55nF$ | | 220 | | ns |
| E_{ON} | Turn-on energy loss | $L \sim 200nH$ | | 1350 | | mJ |
| Q_{rr} | Diode reverse recovery charge | $I_F = 300A$ | | 430 | | μC |
| I_{rr} | Diode reverse recovery current | $V_{CE} = 2250V$ | | 410 | | A |
| E_{rec} | Diode reverse recovery energy | $di_F/dt = 1500A/\mu s$ | | 530 | | mJ |

4/8: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.

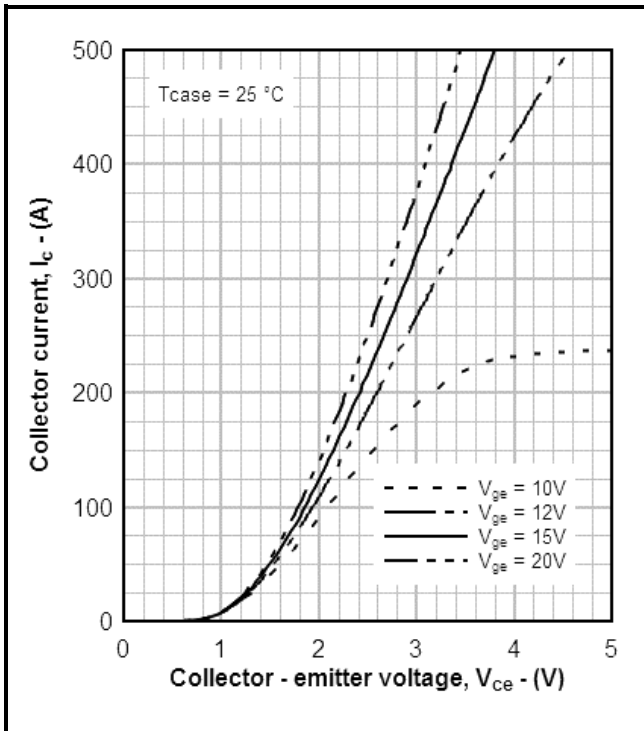


Fig. 3 Typical output characteristics

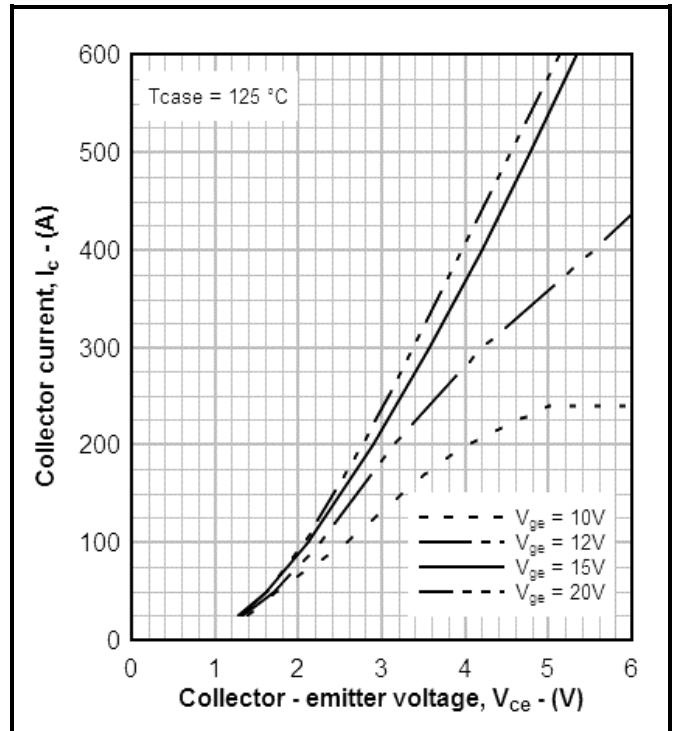


Fig. 4 Typical output characteristics

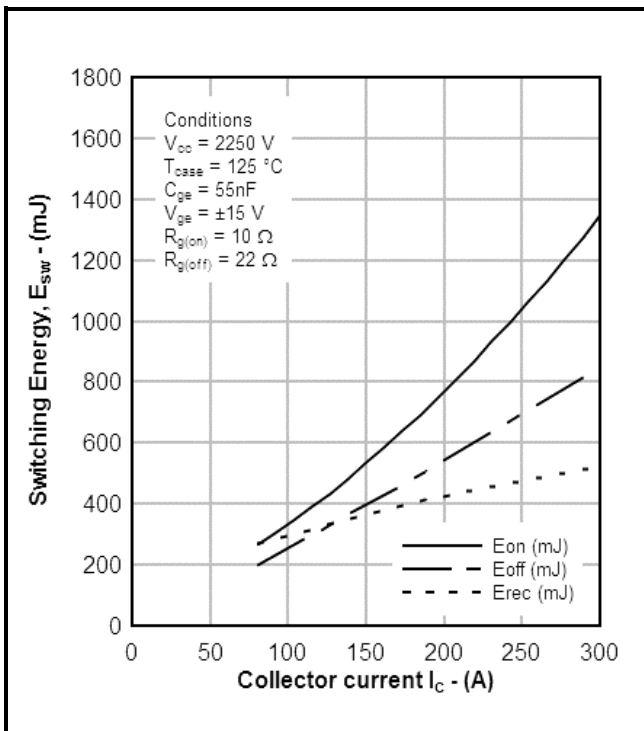


Fig.5 Typical switching energy vs collector current

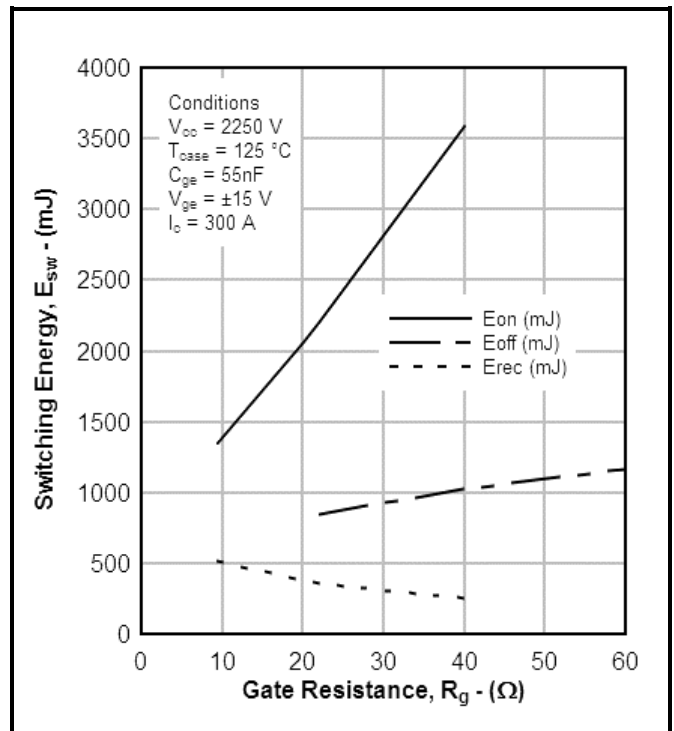


Fig. 6 Typical switching energy vs gate resistance

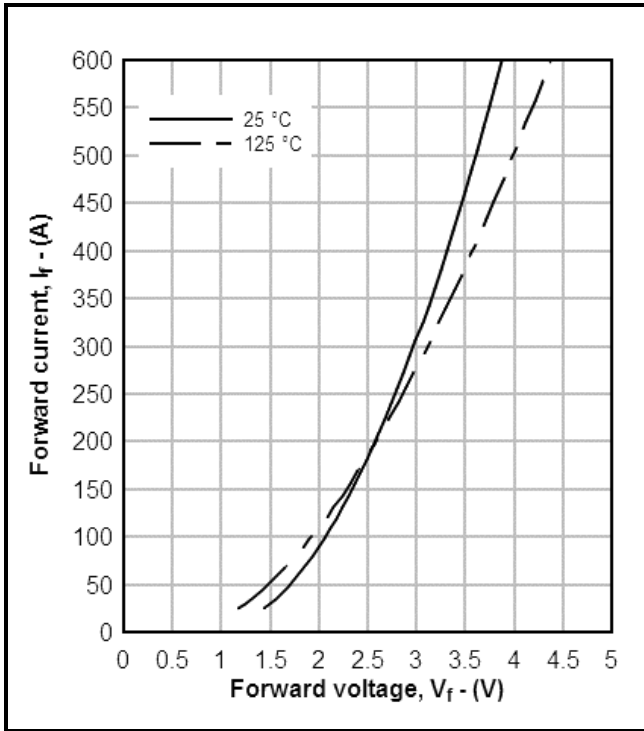


Fig. 7 Diode typical forward characteristics

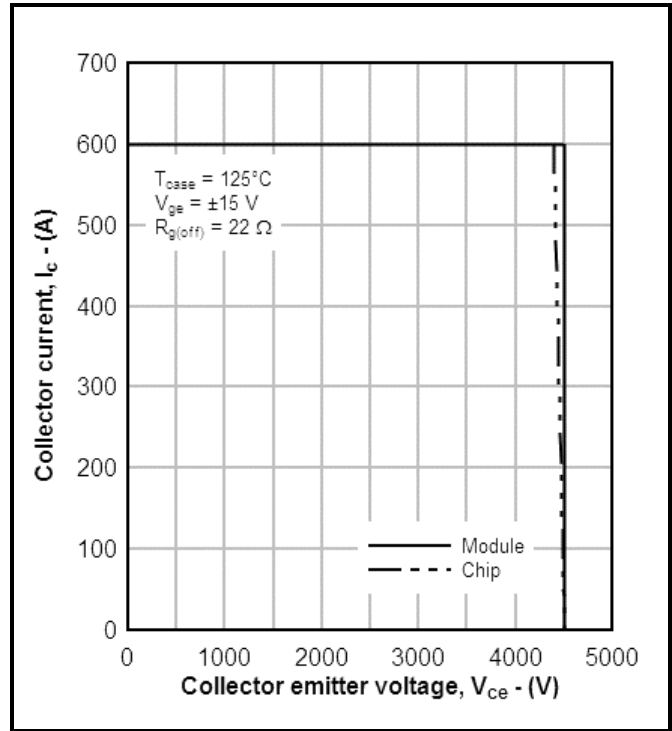


Fig. 8 Reverse bias safe operating area

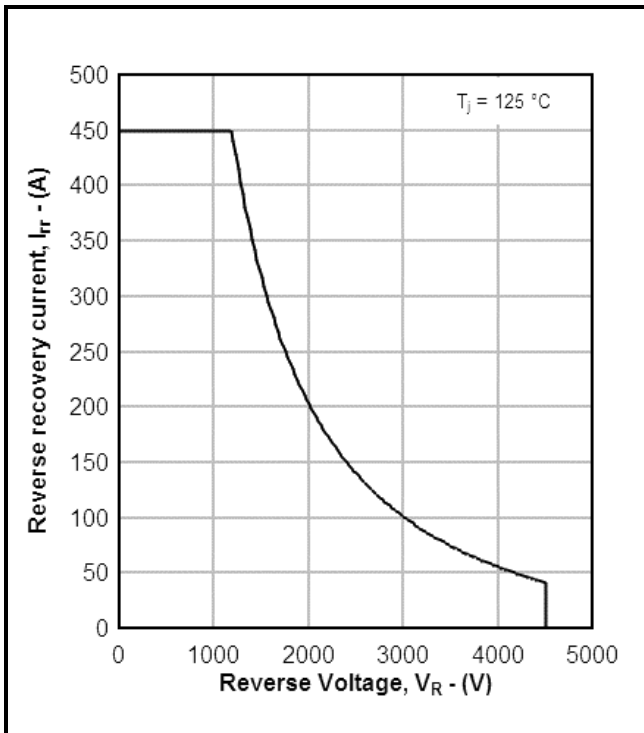


Fig. 9 Diode reverse bias safe operating area

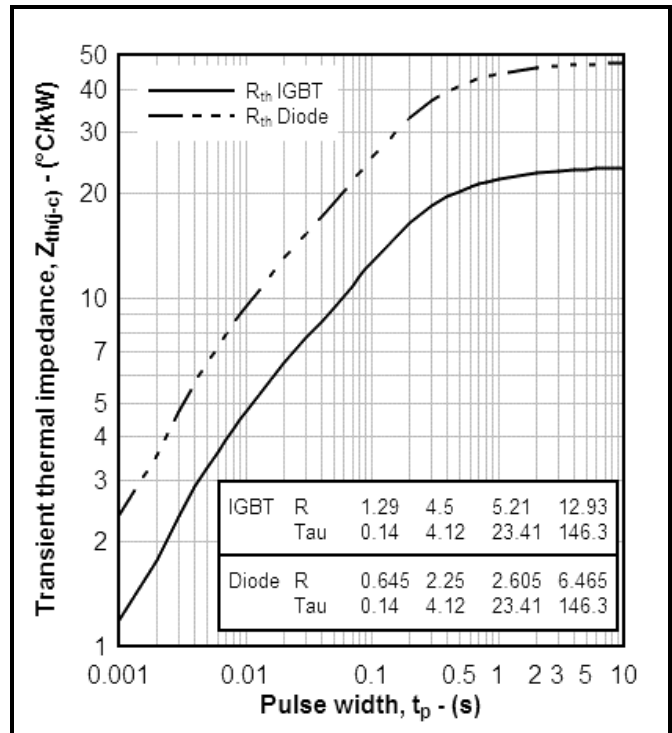
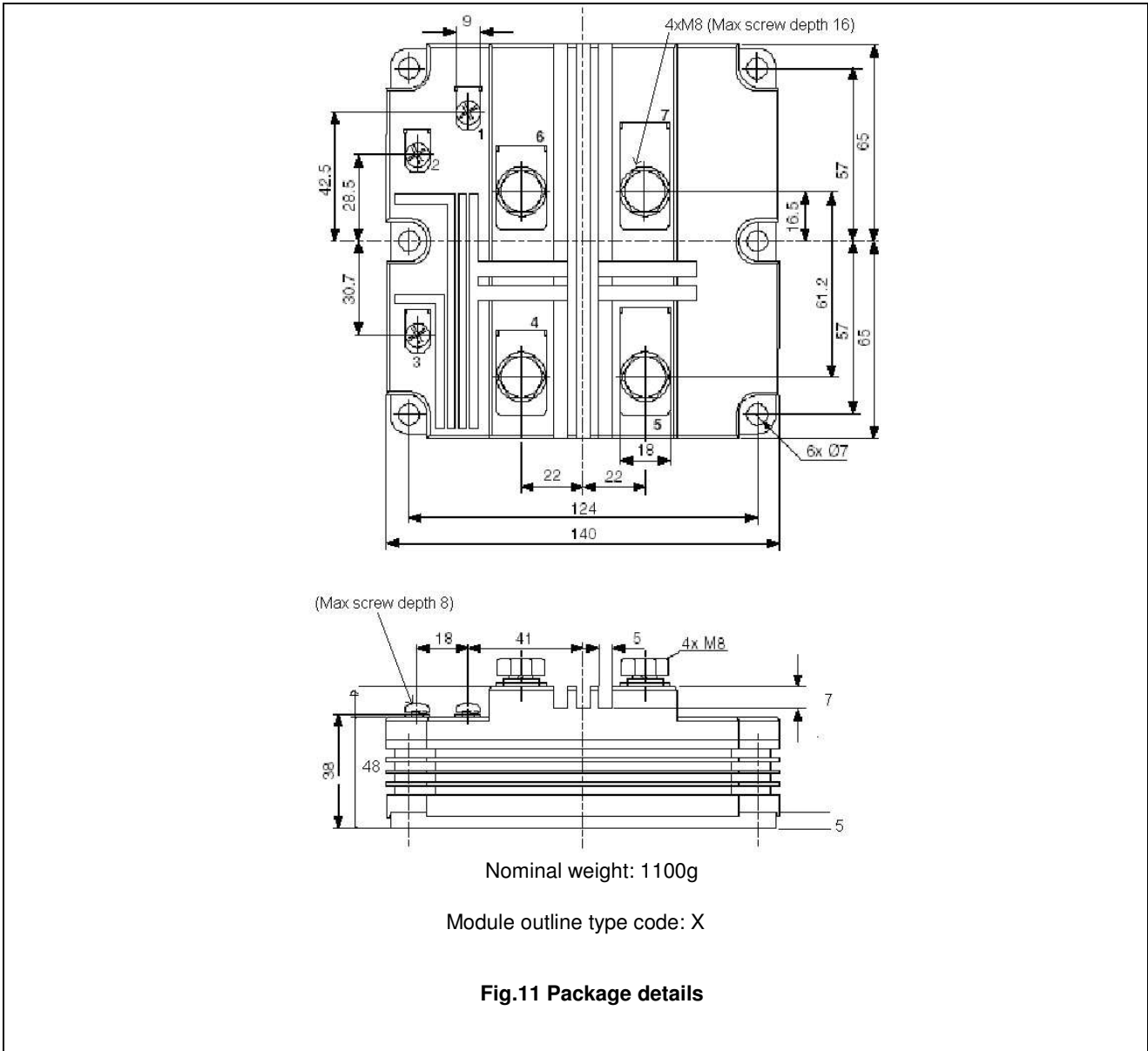


Fig. 10 Transient thermal impedance

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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