# DIM500GCM33-TL000

## IGBT Chopper Module

Replaces DS6114-1

DS6114-2 January 2014 (LN31264)

## FEATURES

- Low $V_{CE(sat)}$ Device
- 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 DIM500GCM33-TL000 is a Low $V_{CE(sat)}$ 3300V, 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:

**DIM500GCM33-TL000**

Note: When ordering, please use the complete part number

## KEY PARAMETERS

| | | |
|---|---|---|
| $V_{CES}$ | | **3300V** |
| $V_{CE(sat)}$ * | **(typ)** | **2.0V** |
| $I_C$ | **(max)** | **500A** |
| $I_{C(PK)}$ | **(max)** | **1000A** |

* Measured at the auxiliary terminals

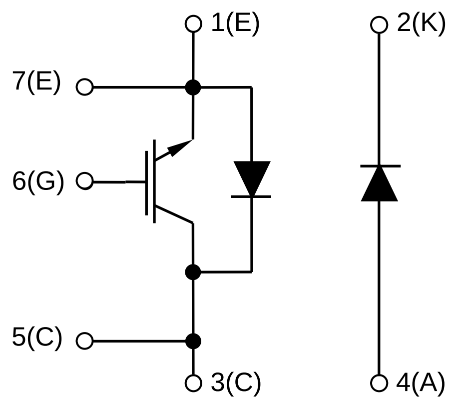



**Fig. 1 Circuit configuration**


**Outline type code: G**

**(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 | 3300 | V |
| $V_{GES}$ | Gate-emitter voltage | | ±20 | V |
| $I_C$ | Continuous collector current | $T_{case}$ = 115°C | 500 | A |
| $I_{C(PK)}$ | Peak collector current | 1ms, $T_{case}$ = 140°C | 1000 | A |
| $P_{max}$ | Max. transistor power dissipation | $T_{case}$ = 25°C, $T_j$ = 150°C | 5.2 | kW |
| $I^2t$ | Diode $I^2t$ value (IGBT arm) | $V_R$ = 0, $t_p$ = 10ms, $T_j$ = 125ºC | 80 | $kA^2s$ |
| | Diode $I^2t$ value (Diode arm) | | 80 | $kA^2s$ |
| $V_{isol}$ | Isolation voltage – per module | Commoned terminals to base plate.<br>AC RMS, 1 min, 50Hz | 6000 | V |
| $Q_{PD}$ | Partial discharge – per module | IEC1287, $V_1$ = 3500V, $V_2$ = 2600V, 50Hz RMS | 10 | pC |

## THERMAL AND MECHANICAL RATINGS

| | |
|---|---|
| Internal insulation material: | AlN |
| Baseplate material: | AlSiC |
| Creepage distance: | 33mm |
| Clearance: | 20mm |
| CTI (Comparative Tracking Index): | >600 |

| Symbol | Parameter | Test Conditions | Min | Typ. | Max | Units |
|---|---|---|---|---|---|---|
| $R_{th(j-c)}$ | Thermal resistance – transistor (per arm) | 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 |
| | 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 | - | - | 150 | °C |
| | | Diode | - | - | 150 | °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, $V_{CE}$ = $V_{CES}$ | | | 2 | mA |
| | | $V_{GE}$ = 0V, $V_{CE}$ = $V_{CES}$, $T_{case}$ = 125°C | | | 30 | mA |
| | | $V_{GE}$ = 0V, $V_{CE}$ = $V_{CES}$, $T_{case}$ = 150°C | | | 50 | mA |
| $I_{GES}$ | Gate leakage current | $V_{GE}$ = ± 20V, $V_{CE}$ = 0V | | | 1 | µA |
| $V_{GE(TH)}$ | Gate threshold voltage | $I_C$ = 40mA, $V_{GE}$ = $V_{CE}$ | | 5.7 | | V |
| $V_{CE(sat)}$ | Collector-emitter saturation voltage | $V_{GE}$ = 15V, $I_C$ = 500A | | 2.0 | | V |
| | | $V_{GE}$ = 15V, $I_C$ = 500A, $T_j$ = 125°C | | 2.6 | | V |
| | | $V_{GE}$ = 15V, $I_C$ = 500A, $T_j$ = 150°C | | 2.8 | | V |
| $I_F$ | Diode forward current | DC | | 500 | | A |
| $I_{FM}$ | Diode maximum forward current | $t_p$ = 1ms | | 1000 | | A |
| $V_F$ † | Diode forward voltage (IGBT arm) | $I_F$ = 500A | | 2.4 | | V |
| | Diode forward voltage (Diode arm) | | | 2.4 | | V |
| | Diode forward voltage (IGBT arm) | $I_F$ = 500A, $T_j$ = 125°C | | 2.5 | | V |
| | Diode forward voltage (Diode arm) | | | 2.5 | | V |
| | Diode forward voltage (IGBT arm) | $I_F$ = 500A, $T_j$ = 150°C | | 2.4 | | V |
| | Diode forward voltage (Diode arm) | | | 2.4 | | V |
| $C_{ies}$ | Input capacitance | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | | 90 | | nF |
| $Q_g$ | Gate charge | ±15V Including external $C_{ge}$ | | 9 | | µC |
| $C_{res}$ | Reverse transfer capacitance | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | | 2 | | nF |
| $L_M$ | Module inductance – per arm | | | 25 | | nH |
| $R_{INT}$ | Internal resistance – per arm | | | 260 | | µΩ |
| $SC_{Data}$ | Short circuit current, $I_{SC}$ | $T_j$ = 150°C, $V_{CC}$ = 2500V<br>$t_p$ ≤ 10µs, $V_{GE}$ ≤ 15V<br>$V_{CE\,(max)}$ = $V_{CES}$ – $L^*$ x dI/dt<br>IEC 60747-9 | | 1900 | | A |

**Note:**
† Measured at the power busbars, not the auxiliary terminals
* 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 | $I_C$ = 500A<br>$V_{GE}$ = ±15V<br>$V_{CE}$ = 1800V<br>$R_{G(ON)}$ = 4.7Ω<br>$R_{G(OFF)}$ = 4.7Ω<br>$C_{ge}$ = 100nF<br>$L_S$ ~ 100nH | | 2700 | | ns |
| $t_f$ | Fall time | | | 610 | | ns |
| $E_{OFF}$ | Turn-off energy loss | | | 1250 | | mJ |
| $t_{d(on)}$ | Turn-on delay time | | | 960 | | ns |
| $t_r$ | Rise time | | | 430 | | ns |
| $E_{ON}$ | Turn-on energy loss | | | 800 | | mJ |
| $Q_{rr}$ | Diode reverse recovery charge | $I_F$ = 500A<br>$V_{CE}$ = 1800V<br>$dI_F/dt$ = 1400A/μs | | 280 | | μC |
| $I_{rr}$ | Diode reverse recovery current | | | 310 | | A |
| $E_{rec}$ | Diode reverse recovery energy | | | 350 | | mJ |

### $T_{case}$ = 125°C unless stated otherwise

| Symbol | Parameter | Test Conditions | Min | Typ. | Max | Units |
|---|---|---|---|---|---|---|
| $t_{d(off)}$ | Turn-off delay time | $I_C$ = 500A<br>$V_{GE}$ = ±15V<br>$V_{CE}$ = 1800V<br>$R_{G(ON)}$ = 4.7Ω<br>$R_{G(OFF)}$ = 4.7Ω<br>$C_{ge}$ = 100nF<br>$L_S$ ~ 100nH | | 2750 | | ns |
| $t_f$ | Fall time | | | 590 | | ns |
| $E_{OFF}$ | Turn-off energy loss | | | 1350 | | mJ |
| $t_{d(on)}$ | Turn-on delay time | | | 1000 | | ns |
| $t_r$ | Rise time | | | 460 | | ns |
| $E_{ON}$ | Turn-on energy loss | | | 1050 | | mJ |
| $Q_{rr}$ | Diode reverse recovery charge | $I_F$ = 500A<br>$V_{CE}$ = 1800V<br>$dI_F/dt$ = 1400A/μs | | 470 | | μC |
| $I_{rr}$ | Diode reverse recovery current | | | 390 | | A |
| $E_{rec}$ | Diode reverse recovery energy | | | 600 | | mJ |

### $T_{case}$ = 150°C unless stated otherwise

| Symbol | Parameter | Test Conditions | Min | Typ. | Max | Units |
|---|---|---|---|---|---|---|
| $t_{d(off)}$ | Turn-off delay time | $I_C$ = 500A<br>$V_{GE}$ = ±15V<br>$V_{CE}$ = 1800V<br>$R_{G(ON)}$ = 4.7Ω<br>$R_{G(OFF)}$ = 4.7Ω<br>$C_{ge}$ = 100nF<br>$L_S$ ~ 100nH | | 2760 | | ns |
| $t_f$ | Fall time | | | 590 | | ns |
| $E_{OFF}$ | Turn-off energy loss | | | 1500 | | mJ |
| $t_{d(on)}$ | Turn-on delay time | | | 940 | | ns |
| $t_r$ | Rise time | | | 460 | | ns |
| $E_{ON}$ | Turn-on energy loss | | | 1150 | | mJ |
| $Q_{rr}$ | Diode reverse recovery charge | $I_F$ = 500A<br>$V_{CE}$ = 1800V<br>$dI_F/dt$ = 1400A/μs | | 530 | | μC |
| $I_{rr}$ | Diode reverse recovery current | | | 400 | | A |
| $E_{rec}$ | Diode reverse recovery energy | | | 650 | | mJ |

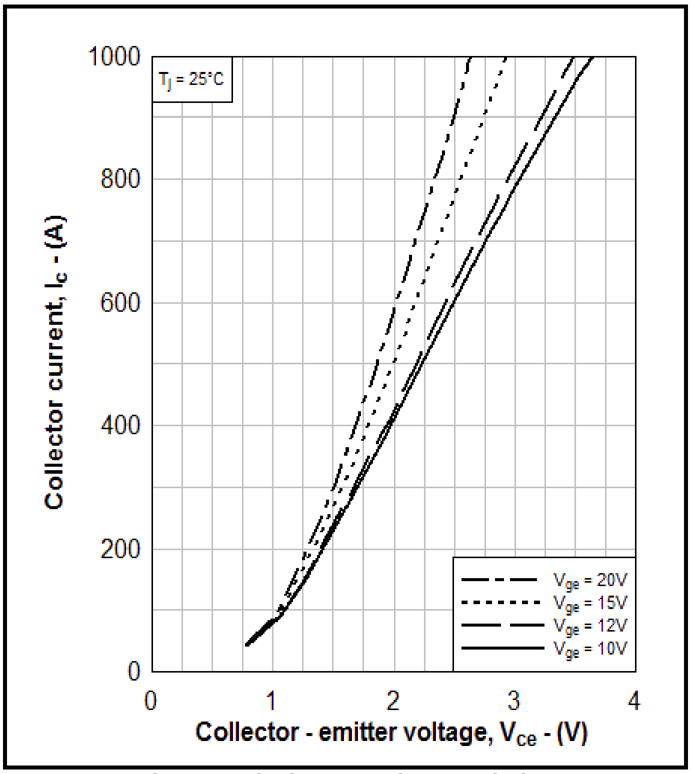



Fig. 3 Typical output characteristics

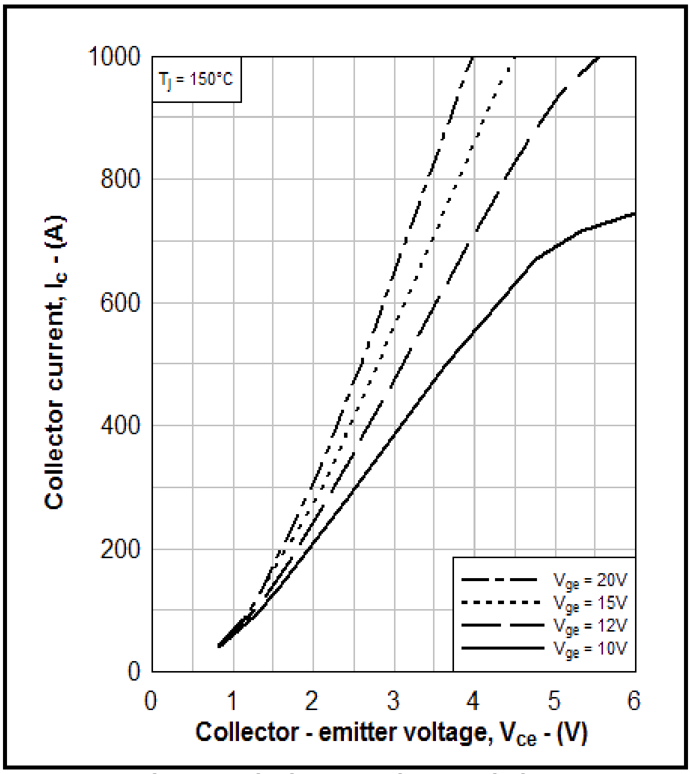



Fig. 4 Typical output characteristics

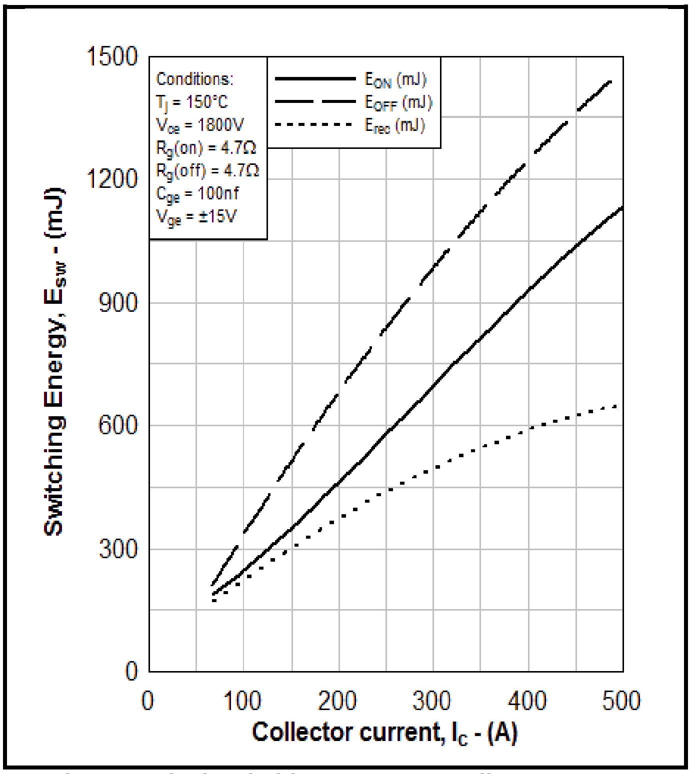



Fig. 5 Typical switching energy vs collector current

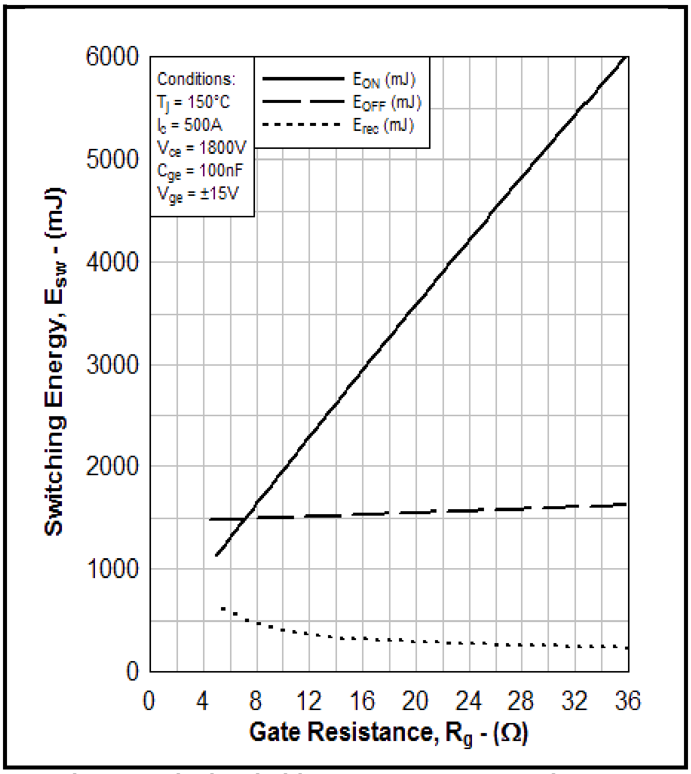



Fig. 6 Typical switching energy vs gate resistance

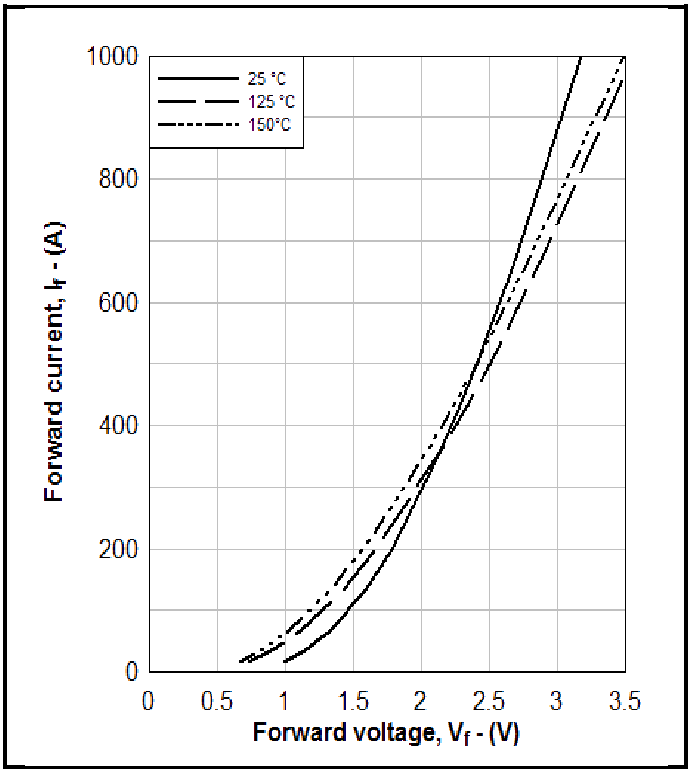



**Fig. 7 Diode typical forward characteristics**

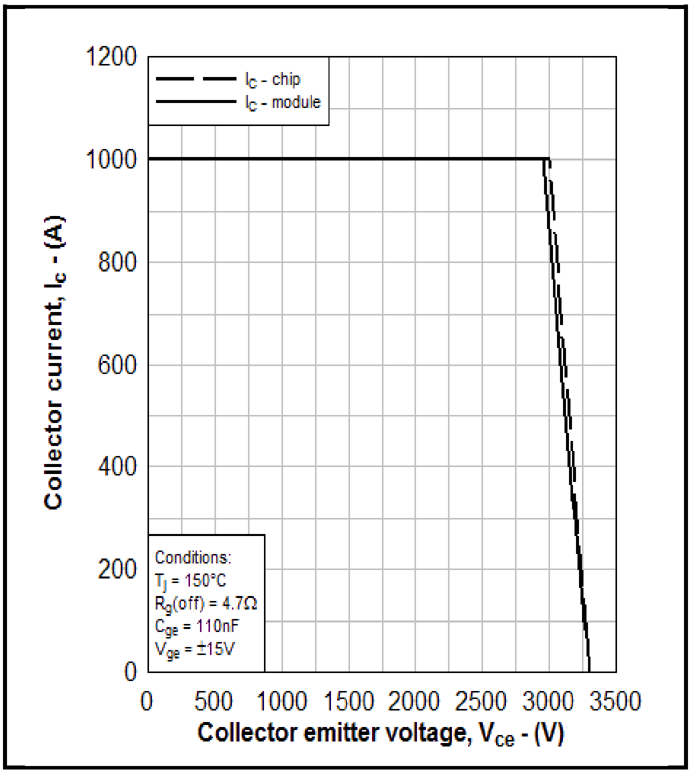



**Fig. 8 Reverse bias safe operating area**

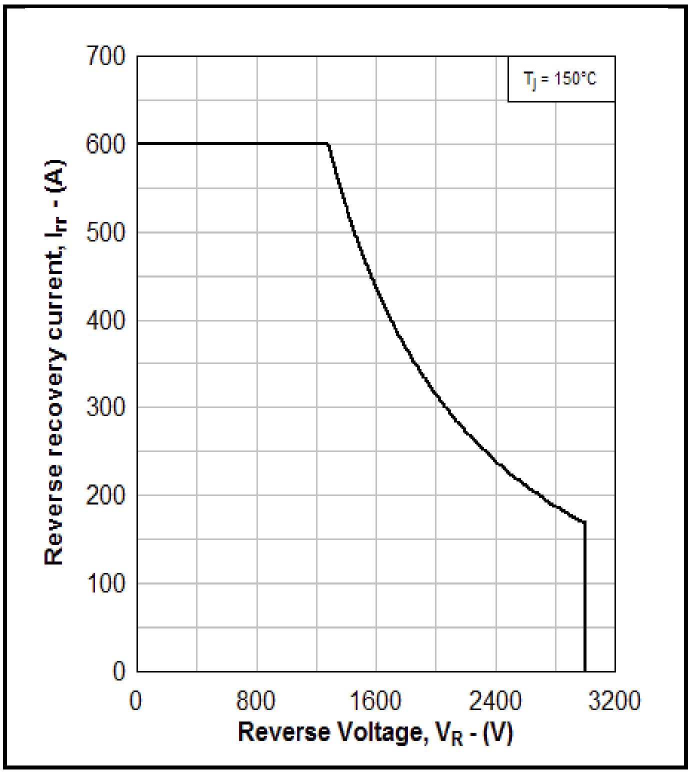



**Fig. 9 Diode reverse bias safe operating area**

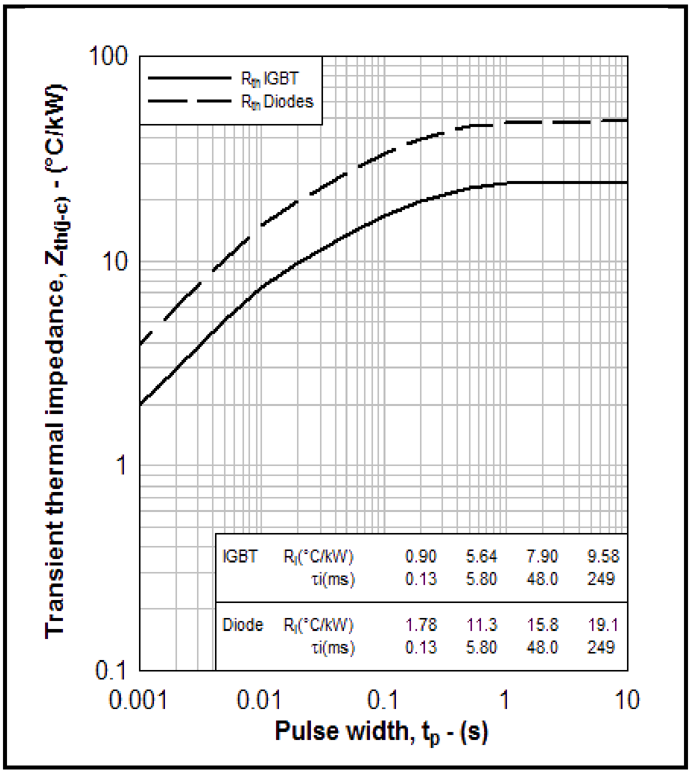


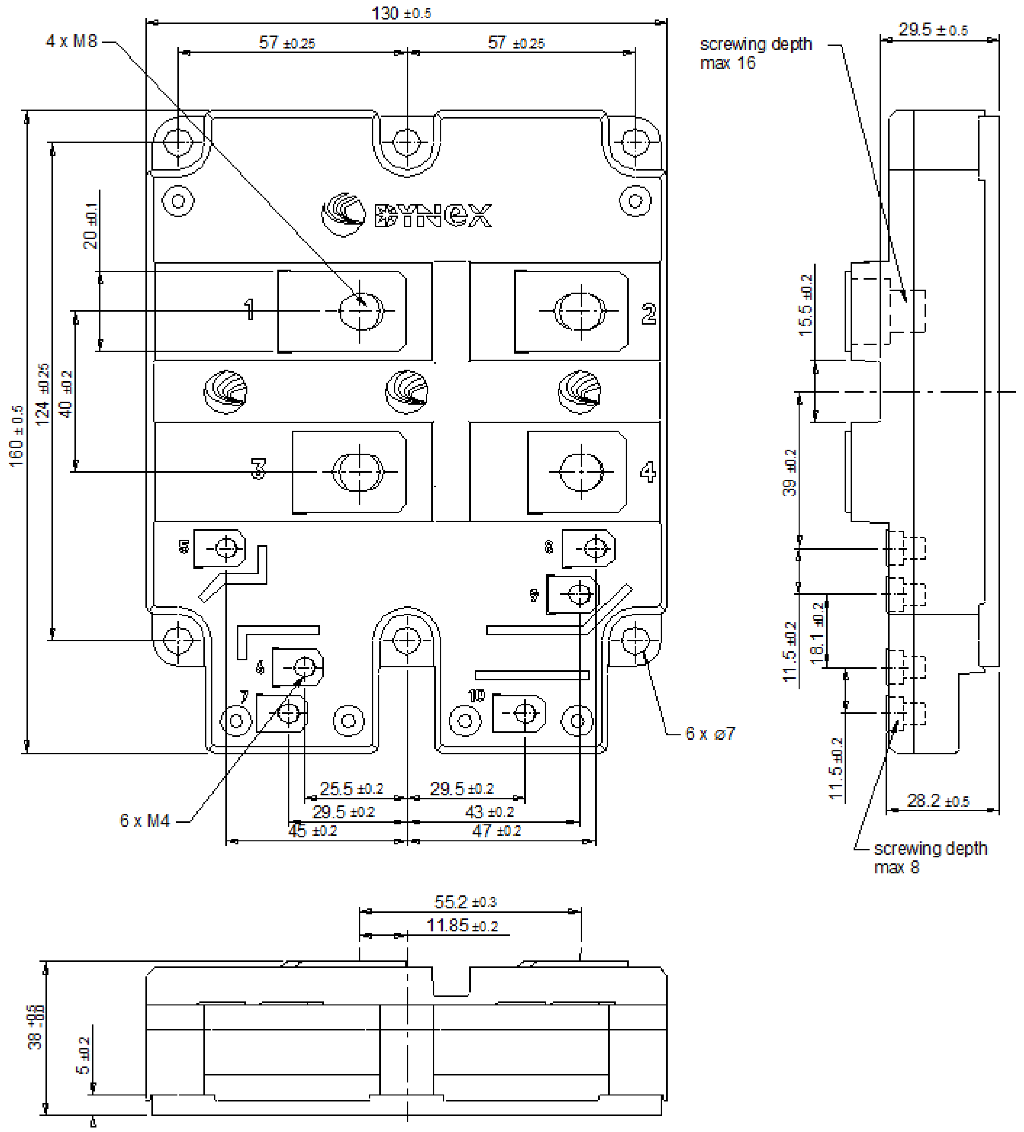

**Fig. 10 Transient thermal impedance**



**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: 1050g**

**Module Outline Type Code: G**

**Fig. 11 Module outline drawing**

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