

FEATURES

- Low $V_{CE(sat)}$ Device
- 10 μ s 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 DIM1000ECM33-TL000 is a Low $V_{CE(sat)}$ 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 10 μ s 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:

DIM1000ECM33-TL000

Note: When ordering, please use the complete part number

KEY PARAMETERS

| | |
|-----------------------|--------------|
| V_{CES} | 3300V |
| $V_{CE(sat)}$ * (typ) | 2.0V |
| I_C (max) | 1000A |
| $I_{C(PK)}$ (max) | 2000A |

* Measured at the auxiliary terminals

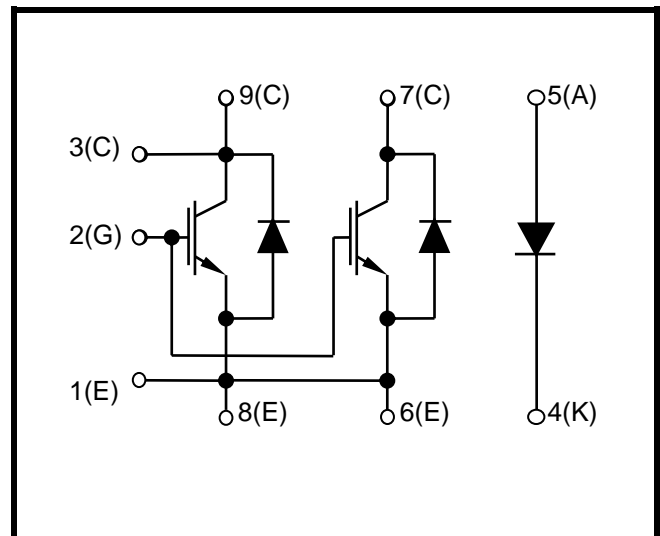


Fig. 1 Circuit configuration



Outline type code: E

(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 | 1000 | A |
| I _{C(PK)} | Peak collector current | 1ms, T _{case} = 140°C | 2000 | A |
| P _{max} | Max. transistor power dissipation | T _{case} = 25°C, T _j = 150°C | 10.4 | kW |
| I ² t | Diode I ² t value (IGBT arm) | V _R = 0, t _p = 10ms, T _j = 125°C | 320 | kA ² s |
| | Diode I ² t value (Diode arm) | | 320 | kA ² s |
| V _{isol} | Isolation voltage – per module | Commoned terminals to base plate. 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: | 31mm |
| Clearance: | 20mm |
| 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 | - | - | 12 | °C/kW |
| R _{th(j-c)} | Thermal resistance – diode (IGBT arm) | Continuous dissipation – junction to case | - | - | 24 | °C/kW |
| R _{th(j-c)} | Thermal resistance – diode (Diode arm) | Continuous dissipation – junction to case | - | - | 24 | °C/kW |
| R _{th(c-h)} | Thermal resistance – case to heatsink (per module) | Mounting torque 5Nm (with mounting grease) | - | - | 6 | °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

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

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|-------------------------|--|--|-----|------|-----|-------------|
| I_{CES} | Collector cut-off current | $V_{GE} = 0V, V_{CE} = V_{CES}$ | | | 4 | mA |
| | | $V_{GE} = 0V, V_{CE} = V_{CES}, T_{case} = 125^{\circ}C$ | | | 60 | mA |
| | | $V_{GE} = 0V, V_{CE} = V_{CES}, T_{case} = 150^{\circ}C$ | | | 100 | mA |
| I_{GES} | Gate leakage current | $V_{GE} = \pm 20V, V_{CE} = 0V$ | | | 1 | μA |
| $V_{GE(TH)}$ | Gate threshold voltage | $I_C = 80mA, V_{GE} = V_{CE}$ | | 5.7 | | V |
| $V_{CE(sat)}^{\dagger}$ | Collector-emitter saturation voltage | $V_{GE} = 15V, I_C = 1000A$ | | 2.0 | | V |
| | | $V_{GE} = 15V, I_C = 1000A, T_j = 125^{\circ}C$ | | 2.6 | | V |
| | | $V_{GE} = 15V, I_C = 1000A, T_j = 150^{\circ}C$ | | 2.8 | | V |
| I_F | Diode forward current | DC | | 1000 | | A |
| I_{FM} | Diode maximum forward current | $t_p = 1ms$ | | 2000 | | A |
| V_F^{\dagger} | Diode forward voltage (IGBT & Diode arm) | $I_F = 1000A$ | | 2.4 | | V |
| | | $I_F = 1000A, T_j = 125^{\circ}C$ | | 2.5 | | V |
| | | $I_F = 1000A, T_j = 150^{\circ}C$ | | 2.4 | | V |
| C_{ies} | Input capacitance | $V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$ | | 170 | | nF |
| Q_g | Gate charge | $\pm 15V$ Including external C_{ge} | | 17 | | μC |
| C_{res} | Reverse transfer capacitance | $V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$ | | 4 | | nF |
| L_M | Module inductance | IGBT | | 15 | | nH |
| | | Diode | | 25 | | |
| R_{INT} | Internal resistance | IGBT | | 135 | | |
| | | Diode | | 270 | | $\mu\Omega$ |
| SC_{Data} | Short circuit current, I_{SC} | $T_j = 150^{\circ}C, V_{CC} = 2500V$ $t_p \leq 10\mu s, V_{GE} \leq 15V$ $V_{CE(max)} = V_{CES} - L^* \times di/dt$ IEC 60747-9 | | 3700 | | A |

Note:

\dagger Measured at 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 = 1000A V _{GE} = ±15V V _{CE} = 1800V R _{G(ON)} = 2.7Ω R _{G(OFF)} = 2.2Ω C _{ge} = 220nF L _S ~ 100nH | | 2700 | | ns |
| t _f | Fall time | | | 610 | | ns |
| E _{OFF} | Turn-off energy loss | | | 2500 | | mJ |
| t _{d(on)} | Turn-on delay time | | | 960 | | ns |
| t _r | Rise time | | | 430 | | ns |
| E _{ON} | Turn-on energy loss | | | 1600 | | mJ |
| Q _{rr} | Diode reverse recovery charge | I _F = 1000A V _{CE} = 1800V dI _F /dt = 2700A/μs | | 570 | | μC |
| I _{rr} | Diode reverse recovery current | | | 620 | | A |
| E _{rec} | Diode reverse recovery energy | | | 670 | | 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 = 1000A V _{GE} = ±15V V _{CE} = 1800V R _{G(ON)} = 2.7Ω R _{G(OFF)} = 2.2Ω C _{ge} = 220nF L _S ~ 100nH | | 2750 | | ns |
| t _f | Fall time | | | 590 | | ns |
| E _{OFF} | Turn-off energy loss | | | 2700 | | mJ |
| t _{d(on)} | Turn-on delay time | | | 1000 | | ns |
| t _r | Rise time | | | 460 | | ns |
| E _{ON} | Turn-on energy loss | | | 2050 | | mJ |
| Q _{rr} | Diode reverse recovery charge | I _F = 1000A V _{CE} = 1800V dI _F /dt = 2700A/μs | | 930 | | μC |
| I _{rr} | Diode reverse recovery current | | | 775 | | A |
| E _{rec} | Diode reverse recovery energy | | | 1150 | | 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 = 1000A V _{GE} = ±15V V _{CE} = 1800V R _{G(ON)} = 2.7Ω R _{G(OFF)} = 2.2Ω C _{ge} = 220nF L _S ~ 100nH | | 2760 | | ns |
| t _f | Fall time | | | 590 | | ns |
| E _{OFF} | Turn-off energy loss | | | 2950 | | mJ |
| t _{d(on)} | Turn-on delay time | | | 940 | | ns |
| t _r | Rise time | | | 460 | | ns |
| E _{ON} | Turn-on energy loss | | | 2250 | | mJ |
| Q _{rr} | Diode reverse recovery charge | I _F = 1000A V _{CE} = 1800V dI _F /dt = 2700A/μs | | 1070 | | μC |
| I _{rr} | Diode reverse recovery current | | | 800 | | A |
| E _{rec} | Diode reverse recovery energy | | | 1300 | | mJ |

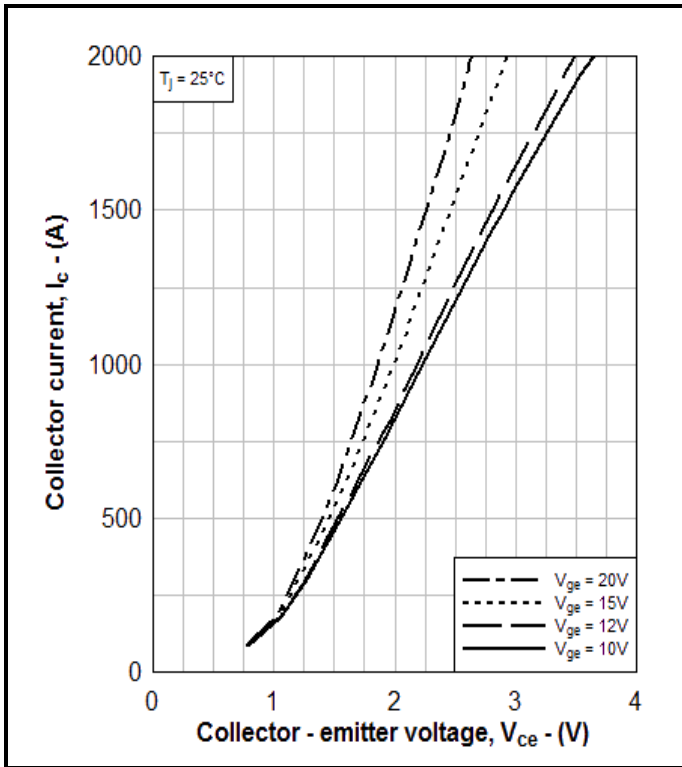


Fig. 3 Typical output characteristics

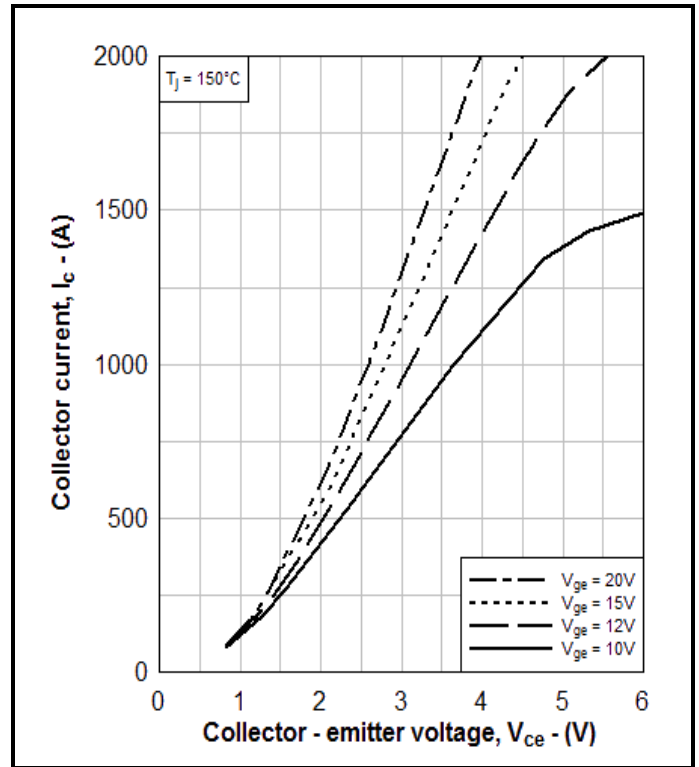


Fig. 4 Typical output characteristics

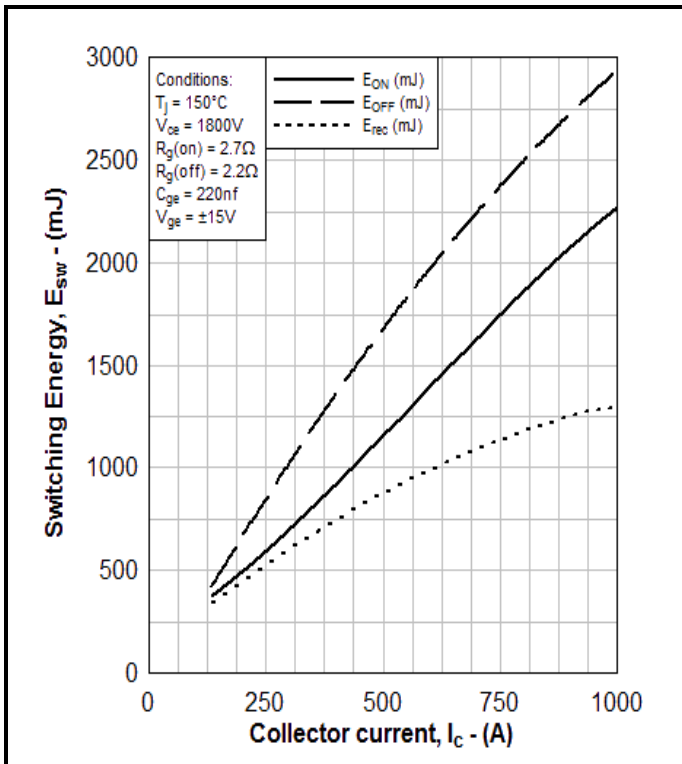


Fig. 5 Typical switching energy vs collector current

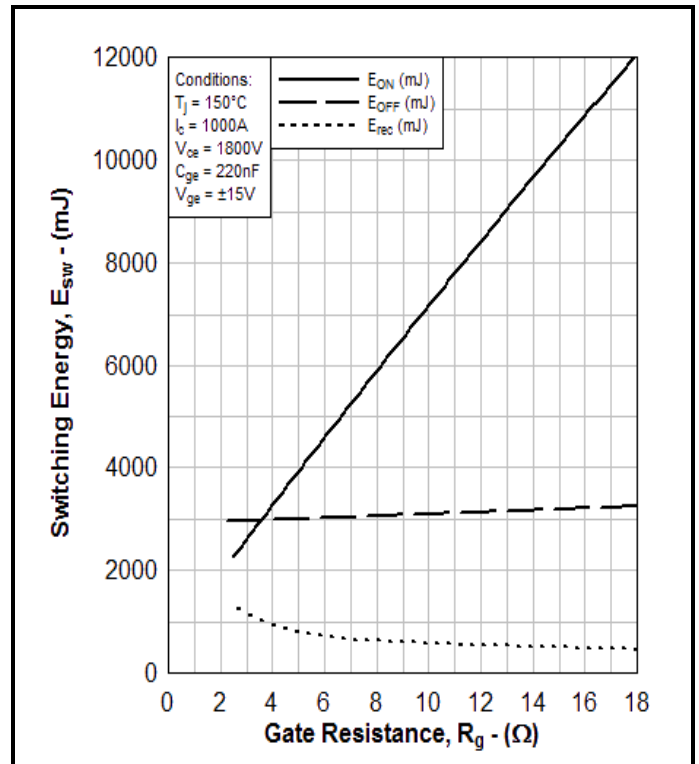


Fig. 6 Typical switching energy vs gate resistance

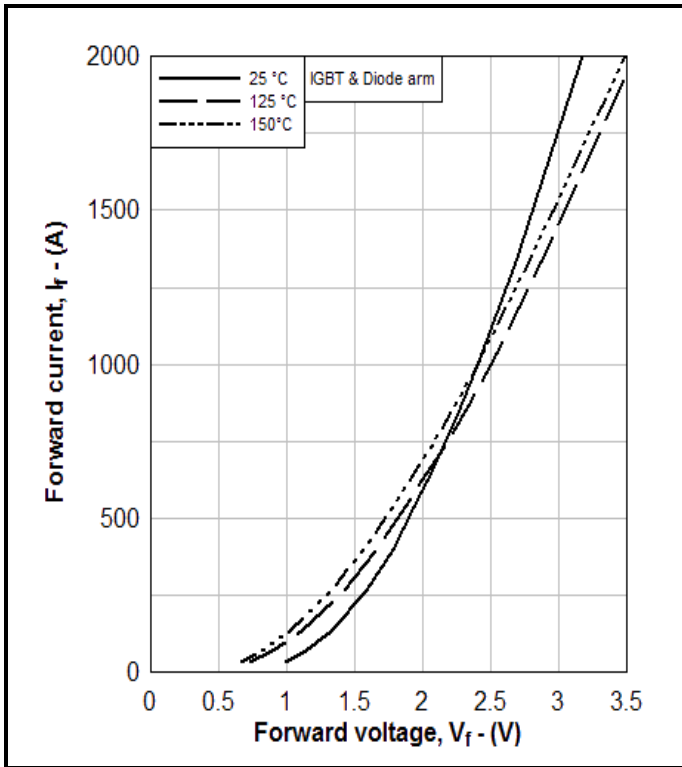


Fig. 7 Diode typical forward characteristics

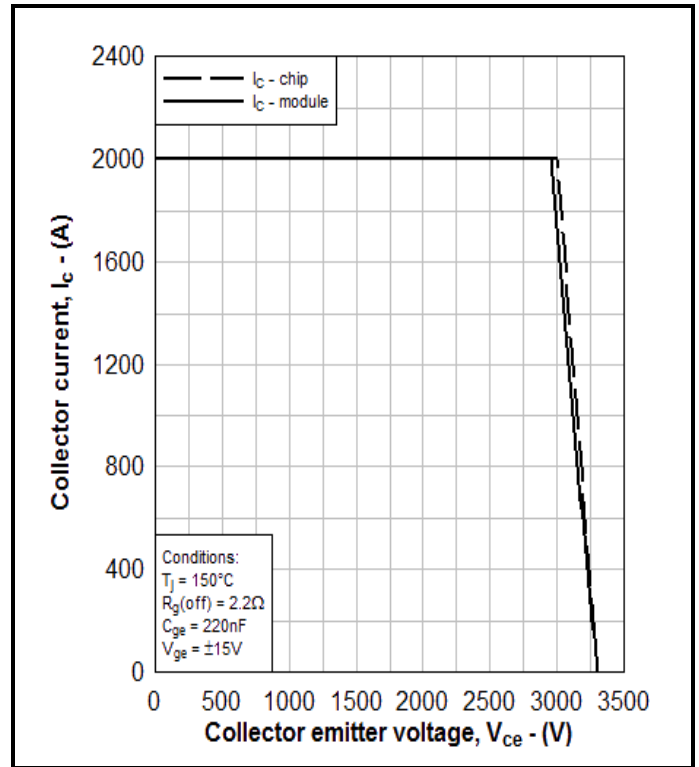


Fig. 8 Reverse bias safe operating area

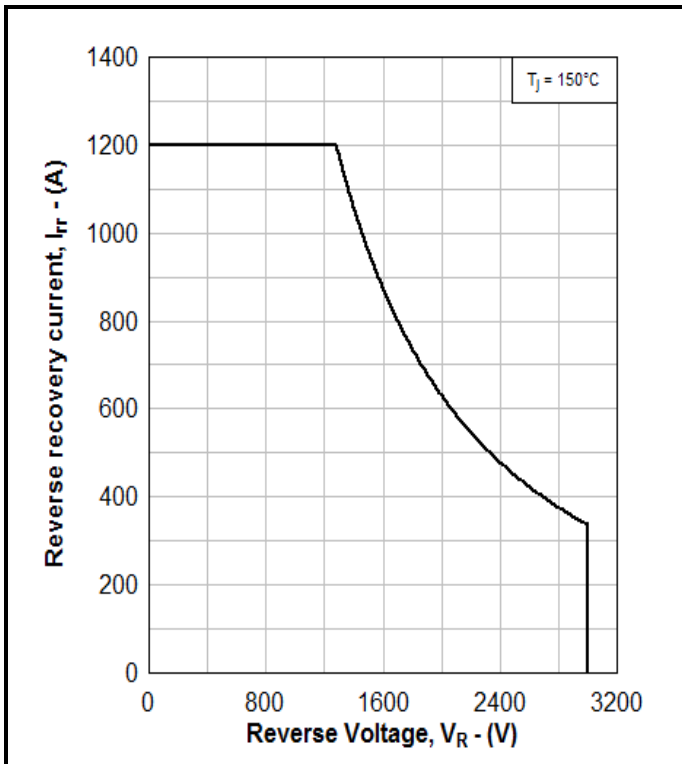


Fig. 9 Diode reverse bias safe operating area

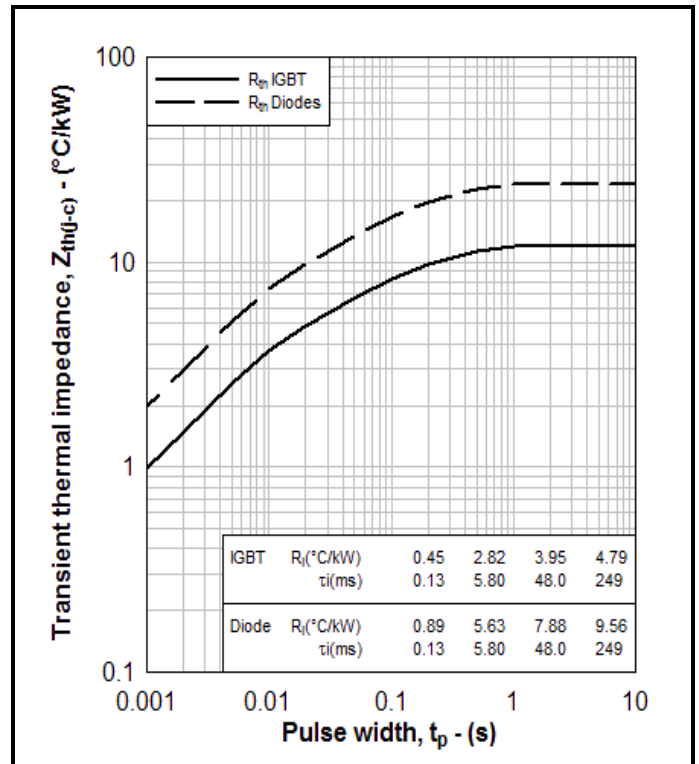


Fig. 10 Transient thermal impedance

PACKAGE DETAILS

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

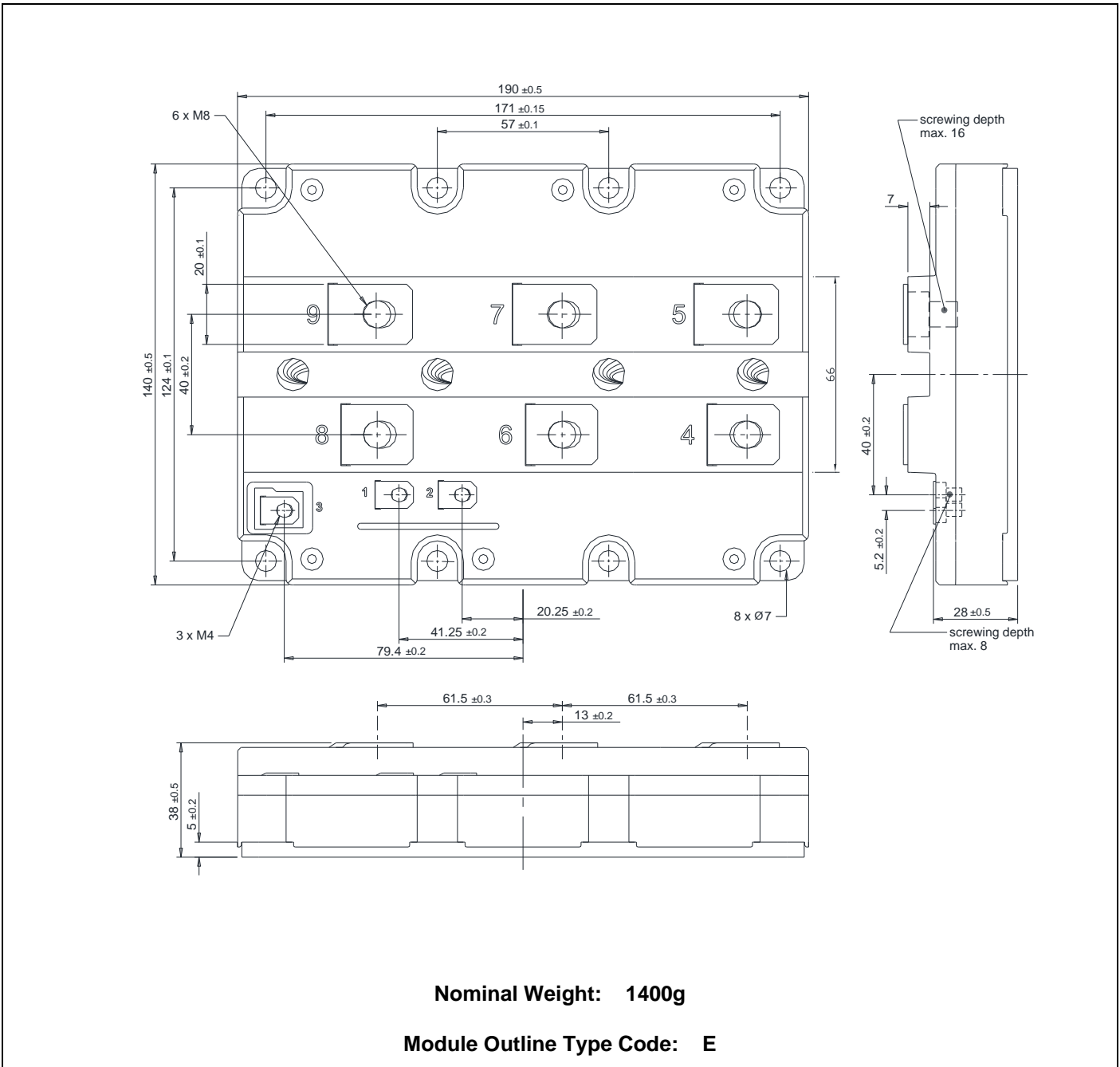


Fig. 11 Module outline drawing

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