

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

- Choppers
- Motor Controllers
- Power Supplies
- Traction Auxiliaries

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 DIM250PKM33-TL000 is a Low $V_{CE(sat)}$ 3300V, n-channel enhancement mode, insulated gate bipolar transistor (IGBT) chopper module configured with the upper arm of the bridge controlled. The IGBT has a wide reverse bias safe operating area (RBSOA). 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:

DIM250PKM33-TL000

Note: When ordering, please use the complete part number

KEY PARAMETERS

| | |
|-----------------------|--------------|
| V_{CES} | 3300V |
| $V_{CE(sat)}$ * (typ) | 2.0V |
| I_C (max) | 250A |
| $I_{C(PK)}$ (max) | 500A |

* Measured at the auxiliary terminals

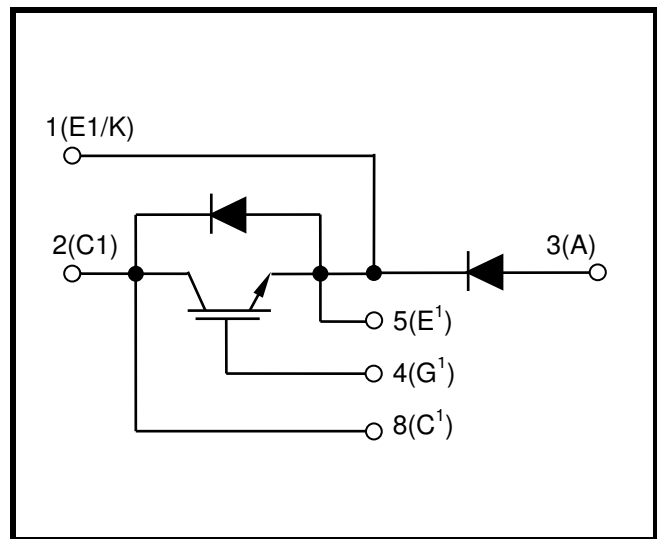
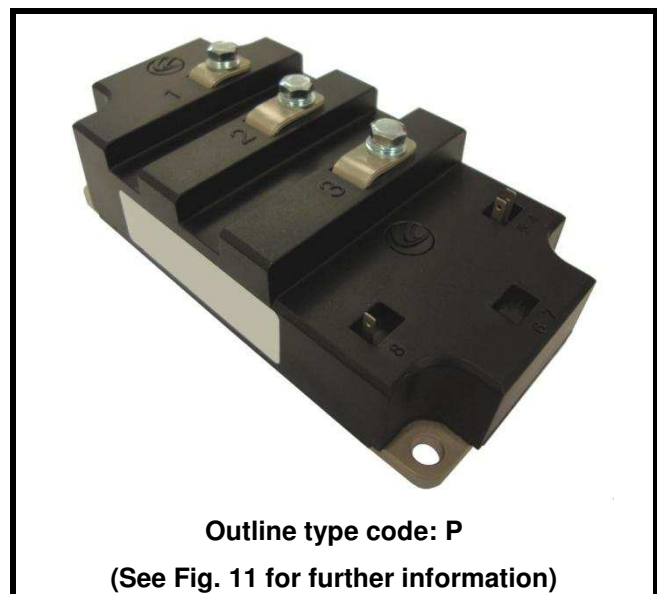


Fig. 1 Circuit configuration



Outline type code: P

(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.

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

| Symbol | Parameter | Test Conditions | Max. | Units |
|-------------|-----------------------------------|-----------------------------------------------------------------|----------|-----------------------|
| V_{CES} | Collector-emitter voltage | $V_{GE} = 0\text{V}$ | 3300 | V |
| V_{GES} | Gate-emitter voltage | | ± 20 | V |
| I_C | Continuous collector current | $T_{case} = 115^{\circ}\text{C}$ | 250 | A |
| $I_{C(PK)}$ | Peak collector current | 1ms, $T_{case} = 140^{\circ}\text{C}$ | 500 | A |
| P_{max} | Max. transistor power dissipation | $T_{case} = 25^{\circ}\text{C}$, $T_j = 150^{\circ}\text{C}$ | 2.6 | kW |
| I^2t | Diode I^2t value – IGBT Arm | $V_R = 0$, $t_p = 10\text{ms}$, $T_j = 150^{\circ}\text{C}$ | 20 | kA^2s |
| | Diode I^2t value – Diode Arm | | 20 | kA^2s |
| 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, $V_1 = 3500\text{V}$, $V_2 = 2600\text{V}$, 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 | Continuous dissipation - junction to case | - | - | 48 | $^{\circ}\text{C}/\text{kW}$ |
| $R_{th(j-c)}$ | Thermal resistance – diode (IGBT Arm) | Continuous dissipation - junction to case | - | - | 96 | $^{\circ}\text{C}/\text{kW}$ |
| | Thermal resistance – diode (Diode Arm) | | - | - | 96 | $^{\circ}\text{C}/\text{kW}$ |
| $R_{th(c-h)}$ | Thermal resistance – case to heatsink (per module) | Mounting torque 5Nm (with mounting grease) | - | - | 16 | $^{\circ}\text{C}/\text{kW}$ |
| T_j | Junction temperature | Transistor | - | - | 150 | $^{\circ}\text{C}$ |
| | | Diode | - | - | 150 | $^{\circ}\text{C}$ |
| T_{stg} | Storage temperature range | - | -40 | - | 125 | $^{\circ}\text{C}$ |
| | Screw torque | Mounting – M6 | - | - | 5 | Nm |
| | | Electrical connections – M5 | - | - | 4 | Nm |

ELECTRICAL CHARACTERISTICS
 $T_{case} = 25^{\circ}\text{C}$ 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 |
| | | $V_{GE} = 0V, V_{CE} = V_{CES}, T_{case} = 125^{\circ}\text{C}$ | | | 15 | mA |
| | | $V_{GE} = 0V, V_{CE} = V_{CES}, T_{case} = 150^{\circ}\text{C}$ | | | 25 | mA |
| I_{GES} | Gate leakage current | $V_{GE} = \pm 20V, V_{CE} = 0V$ | | | 1 | μA |
| $V_{GE(TH)}$ | Gate threshold voltage | $I_C = 20\text{mA}, V_{GE} = V_{CE}$ | | 5.7 | | V |
| $V_{CE(sat)}^{\dagger}$ | Collector-emitter saturation voltage | $V_{GE} = 15V, I_C = 250A$ | | 2.0 | | V |
| | | $V_{GE} = 15V, I_C = 250A, T_j = 125^{\circ}\text{C}$ | | 2.6 | | V |
| | | $V_{GE} = 15V, I_C = 250A, T_j = 150^{\circ}\text{C}$ | | 2.8 | | V |
| I_F | Diode forward current | DC | | 250 | | A |
| I_{FM} | Diode maximum forward current | $t_p = 1\text{ms}$ | | 500 | | A |
| V_F | Diode forward voltage † (IGBT arm) | $I_F = 250A$ | | 2.4 | | V |
| | Diode forward voltage ‡ (Diode arm) | | | 2.5 | | V |
| | Diode forward voltage † (IGBT arm) | $I_F = 250A, T_j = 125^{\circ}\text{C}$ | | 2.5 | | V |
| | Diode forward voltage ‡ (Diode arm) | | | 2.6 | | V |
| | Diode forward voltage † (IGBT arm) | $I_F = 250A, T_j = 150^{\circ}\text{C}$ | | 2.4 | | V |
| | Diode forward voltage ‡ (Diode arm) | | | 2.5 | | V |
| C_{ies} | Input capacitance | $V_{CE} = 25V, V_{GE} = 0V, f = 1\text{MHz}$ | | 45 | | nF |
| Q_g | Gate charge | $\pm 15V$ Including external C_{ge} | | 5 | | μC |
| C_{res} | Reverse transfer capacitance | $V_{CE} = 25V, V_{GE} = 0V, f = 1\text{MHz}$ | | 1 | | nF |
| L_M | Module inductance | | | 40 | | nH |
| R_{INT} | Internal transistor resistance | | | 500 | | $\mu\Omega$ |
| SC_{Data} | Short circuit current, I_{SC} | $T_j = 150^{\circ}\text{C}, V_{CC} = 2500V$ $t_p \leq 10\mu\text{s}, V_{GE} \leq 15V$ $V_{CE(max)} = V_{CES} - L^* \times dl/dt$ IEC 60747-9 | | 950 | | A |

Note:
 † Measured at the auxiliary terminals

 ‡ Measured at the power busbars

 $*$ L is the circuit inductance + L_M

ELECTRICAL CHARACTERISTICS

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

| Symbol | Parameter | Test Conditions | Min | Typ. | Max | Units |
|---------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|-----|---------------|
| $t_{d(\text{off})}$ | Turn-off delay time | $I_C = 250\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 1800\text{V}$ $R_{g(\text{ON})} = 10\Omega$ $R_{g(\text{OFF})} = 10\Omega$ $C_{GE} = 56\text{nF}$ $L_S \sim 150\text{nH}$ | | 2700 | | ns |
| t_f | Fall time | | | 610 | | ns |
| E_{OFF} | Turn-off energy loss | | | 650 | | mJ |
| $t_{d(\text{on})}$ | Turn-on delay time | | | 960 | | ns |
| t_r | Rise time | | | 430 | | ns |
| E_{ON} | Turn-on energy loss | | | 400 | | mJ |
| Q_{rr} | Diode reverse recovery charge | $I_F = 250\text{A}$ $V_{CE} = 1800\text{V}$ $di_F/dt = 700\text{A}/\mu\text{s}$ | | 140 | | μC |
| I_{rr} | Diode reverse recovery current | | | 150 | | A |
| E_{rec} | Diode reverse recovery energy | | | 170 | | mJ |

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

| Symbol | Parameter | Test Conditions | Min | Typ. | Max | Units |
|---------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|-----|---------------|
| $t_{d(\text{off})}$ | Turn-off delay time | $I_C = 250\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 1800\text{V}$ $R_{g(\text{ON})} = 10\Omega$ $R_{g(\text{OFF})} = 10\Omega$ $C_{GE} = 56\text{nF}$ $L_S \sim 150\text{nH}$ | | 2750 | | ns |
| t_f | Fall time | | | 590 | | ns |
| E_{OFF} | Turn-off energy loss | | | 680 | | mJ |
| $t_{d(\text{on})}$ | Turn-on delay time | | | 1000 | | ns |
| t_r | Rise time | | | 460 | | ns |
| E_{ON} | Turn-on energy loss | | | 520 | | mJ |
| Q_{rr} | Diode reverse recovery charge | $I_F = 250\text{A}$ $V_{CE} = 1800\text{V}$ $di_F/dt = 700\text{A}/\mu\text{s}$ | | 230 | | μC |
| I_{rr} | Diode reverse recovery current | | | 190 | | A |
| E_{rec} | Diode reverse recovery energy | | | 280 | | mJ |

 $T_{\text{case}} = 150^{\circ}\text{C}$ unless stated otherwise

| Symbol | Parameter | Test Conditions | Min | Typ. | Max | Units |
|---------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|-----|---------------|
| $t_{d(\text{off})}$ | Turn-off delay time | $I_C = 250\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 1800\text{V}$ $R_{g(\text{ON})} = 10\Omega$ $R_{g(\text{OFF})} = 10\Omega$ $C_{GE} = 56\text{nF}$ $L_S \sim 150\text{nH}$ | | 2760 | | ns |
| t_f | Fall time | | | 590 | | ns |
| E_{OFF} | Turn-off energy loss | | | 750 | | mJ |
| $t_{d(\text{on})}$ | Turn-on delay time | | | 940 | | ns |
| t_r | Rise time | | | 460 | | ns |
| E_{ON} | Turn-on energy loss | | | 550 | | mJ |
| Q_{rr} | Diode reverse recovery charge | $I_F = 250\text{A}$ $V_{CE} = 1800\text{V}$ $di_F/dt = 700\text{A}/\mu\text{s}$ | | 270 | | μC |
| I_{rr} | Diode reverse recovery current | | | 200 | | A |
| E_{rec} | Diode reverse recovery energy | | | 330 | | mJ |

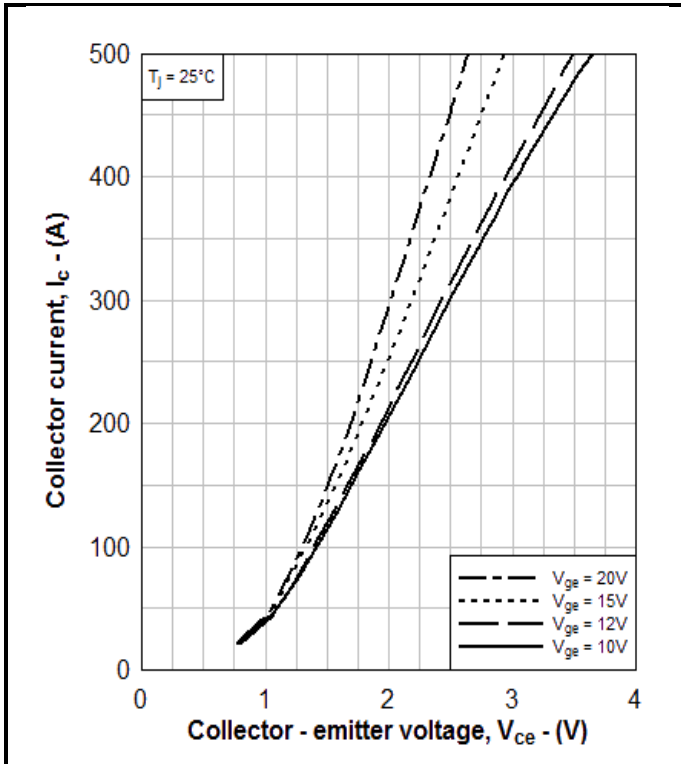


Fig. 3 Typical output characteristics

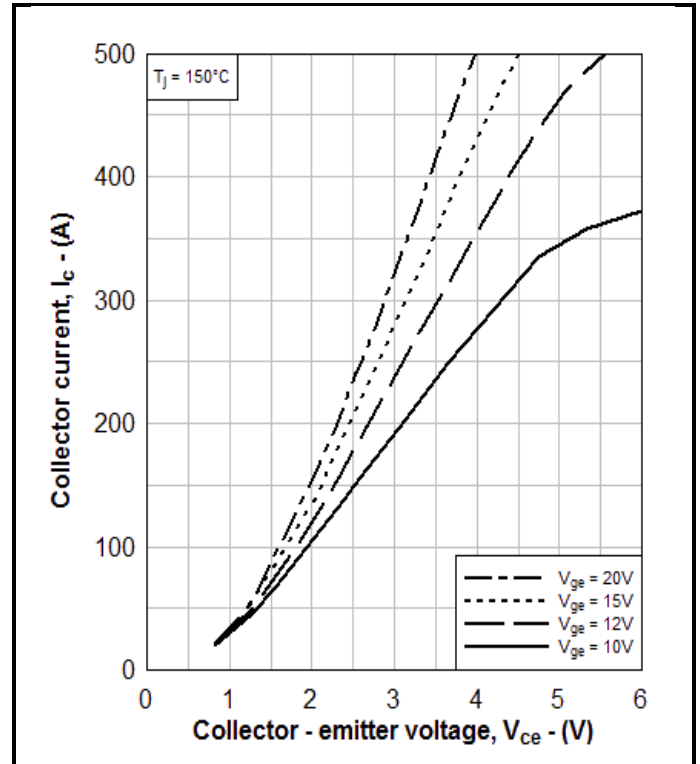


Fig. 4 Typical output characteristics

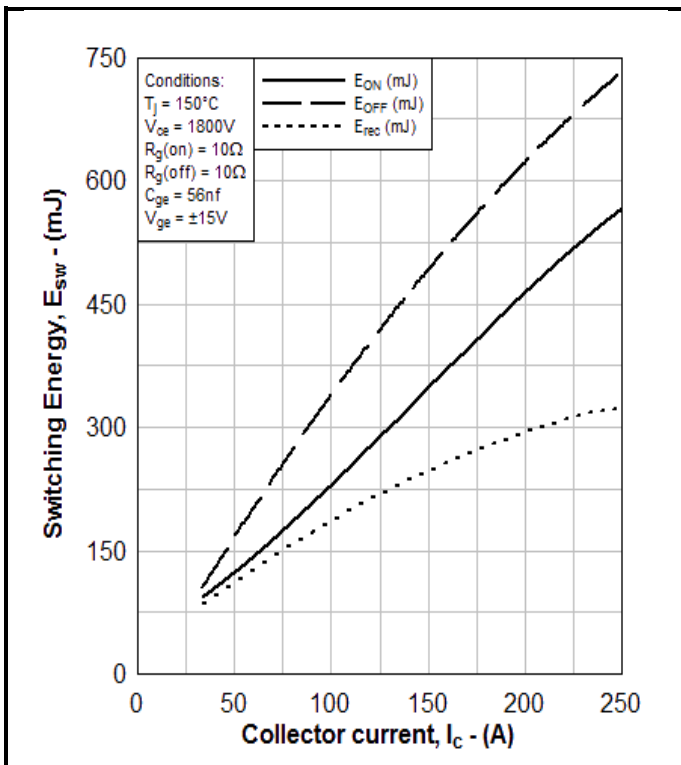


Fig. 5 Typical switching energy vs collector current

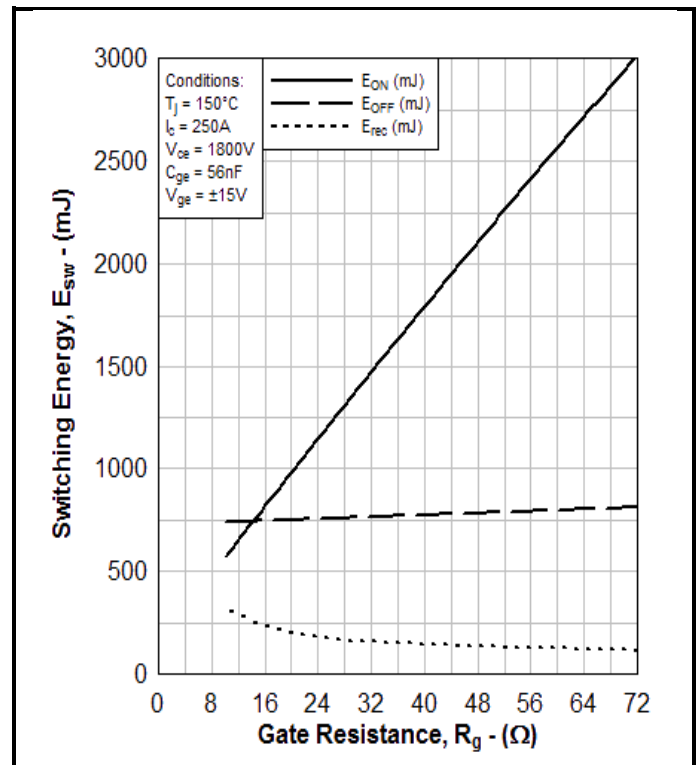


Fig. 6 Typical switching energy vs gate resistance

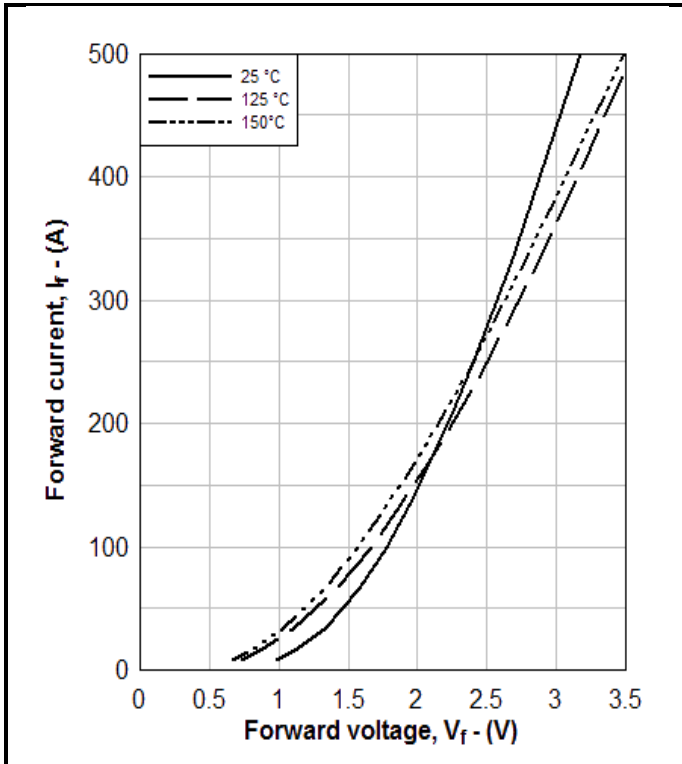


Fig. 7 Diode typical forward characteristics

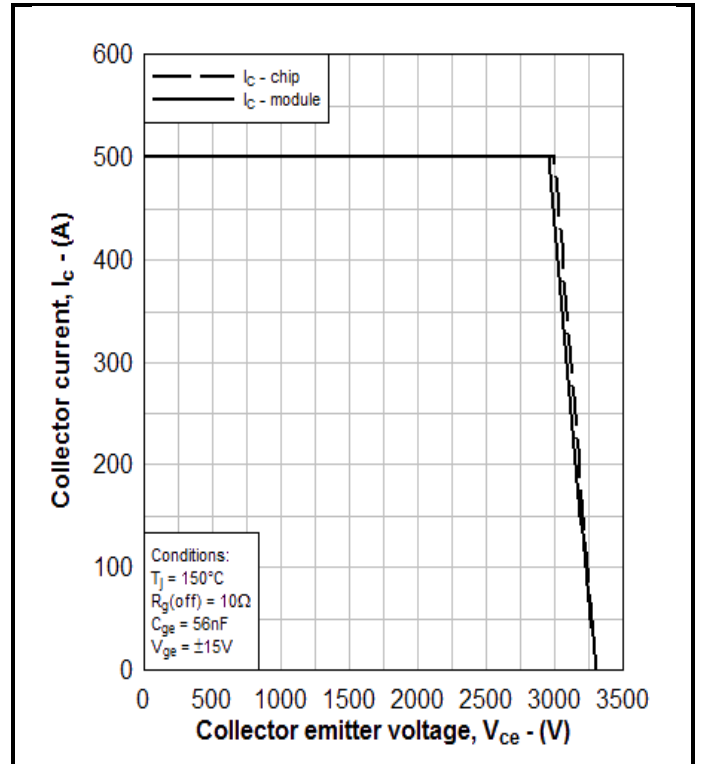


Fig. 8 Reverse bias safe operating area

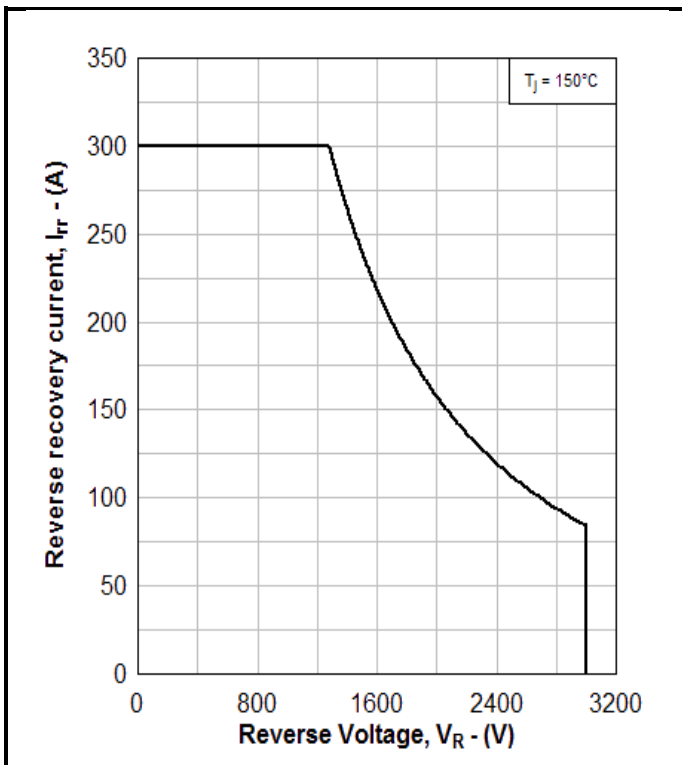


Fig. 9 Diode reverse bias safe operating area

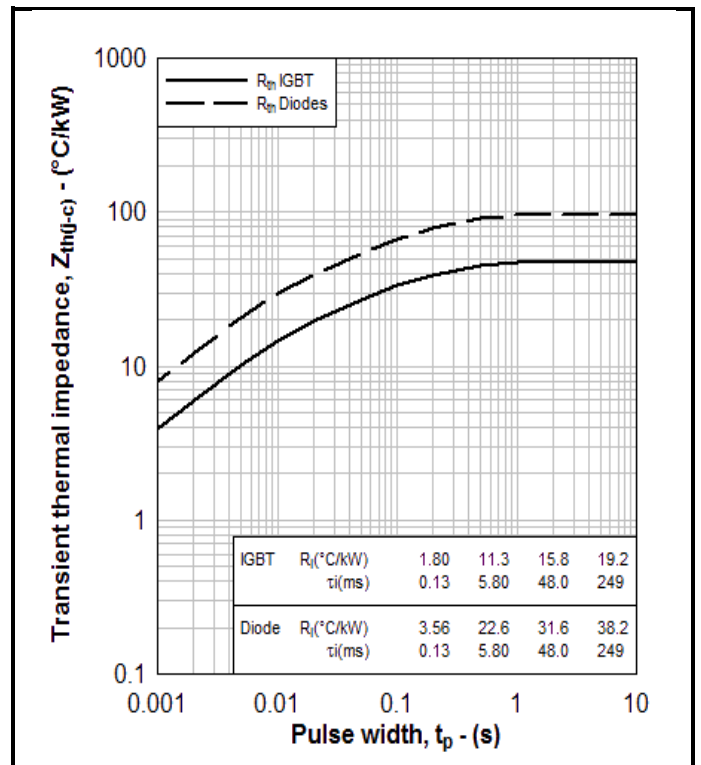
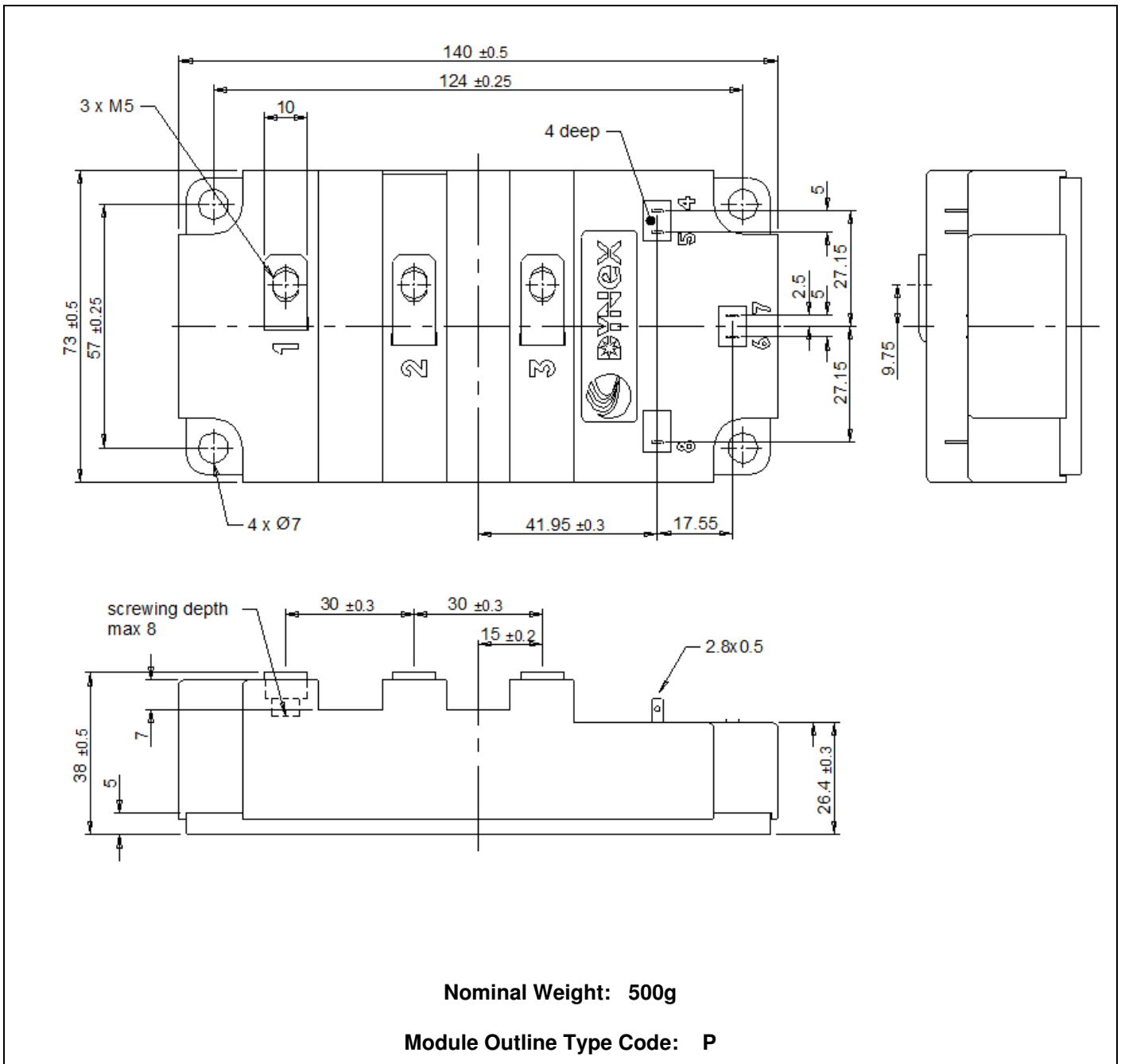


Fig. 10 Transient thermal impedance

PACKAGE DETAILS

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



Nominal Weight: 500g

Module Outline Type Code: P

Fig. 11 Module outline drawing

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