# GP400DDM12

## Dual Switch IGBT Module

Advance Information

DS5503-1.0 October 2001

## FEATURES

- High Thermal Cycling Capability
- 400A Per Switch
- Non Punch Through Silicon
- Isolated MMC Base with AIN Substrates

## APPLICATIONS

- High Reliability Inverters
- Motor Controllers
- Traction Drives
- Resonant Converters

## KEY PARAMETERS

| | | |
|---|---|---|
| $V_{CES}$ | | 1200V |
| $V_{CE(sat)}$ | (typ) | 2.7V |
| $I_C$ | (max) | 400A |
| $I_{C(PK)}$ | (max) | 800A |

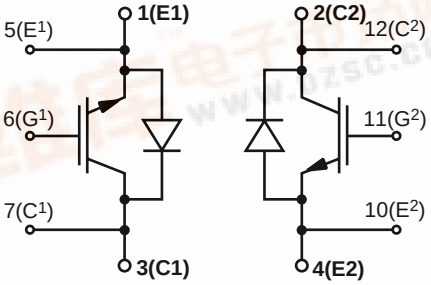
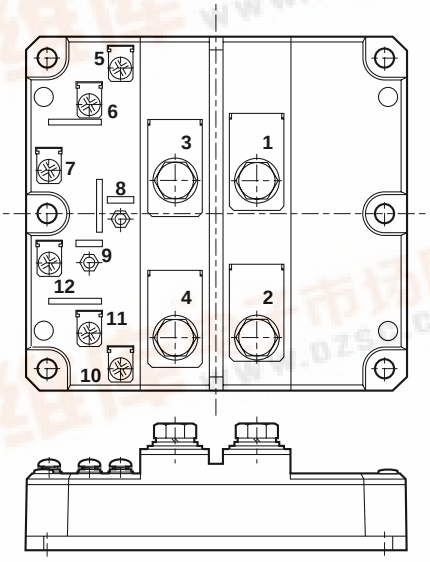



**Fig. 1 Dual switch circuit diagram**




**Outline type code:** D

(See package details for further information)

**Fig. 2 Electrical connections - (not to scale)**

The Powerline range of high power modules includes half bridge, dual, chopper and single switch configurations covering voltages from 600V to 3300V and currents up to 2400A.

The GP400DDM12 is a dual switch 1200V, n channel enhancement mode, insulated gate bipolar transistor (IGBT) module. The IGBT has a wide reverse bias safe operating area (RBSOA) ensuring reliability in demanding applications. This device is optimised for traction drives and other applications requiring high thermal cycling capability or very high reliability.

The module incorporates an electrically isolated base plate and low inductance construction enabling circuit designers to optimise circuit layouts and utilise earthed heat sinks for safety.

## ORDERING INFORMATION

Order As:

**GP400DDM12**

Note: When ordering, please use the whole part number.

## ABSOLUTE MAXIMUM RATINGS - PER ARM

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 | 1200 | V |
| $V_{GES}$ | Gate-emitter voltage | - | ±20 | V |
| $I_C$ | Continuous collector current | $T_{case}$ = 80˚C | 400 | A |
| $I_{C(PK)}$ | Peak collector current | 1ms, $T_{case}$ = 105˚C | 800 | A |
| $P_{max}$ | Max. transistor power dissipation | $T_{case}$ = 25˚C, $T_j$ = 150˚C | 3470 | W |
| $V_{isol}$ | Isolation voltage | Commoned terminals to base plate. AC RMS, 1 min, 50Hz | 4000 | V |

## THERMAL AND MECHANICAL RATINGS

| Symbol | Parameter | Test Conditions | Min. | Max. | Units |
|---|---|---|---|---|---|
| $R_{th(j-c)}$ | Thermal resistance - transistor (per arm) | Continuous dissipation - junction to case | - | 36 | ˚C/kW |
| $R_{th(j-c)}$ | Thermal resistance - diode (per arm) | Continuous dissipation - junction to case | - | 80 | ˚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 | - | 125 | ˚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, $V_{CE}$ = $V_{CES}$ | - | - | 1 | mA |
| | | $V_{GE}$ = 0V, $V_{CE}$ = $V_{CES}$, $T_{case}$ = 125˚C | - | - | 20 | mA |
| $I_{GES}$ | Gate leakage current | $V_{GE}$ = ±20V, $V_{CE}$ = 0V | - | - | ±2 | µA |
| $V_{GE(TH)}$ | Gate threshold voltage | $I_C$ = 120mA, $V_{GE}$ = $V_{CE}$ | 4.5 | 5.5 | 7.5 | V |
| $V_{CE(sat)}$ | Collector-emitter saturation voltage | $V_{GE}$ = 15V, $I_C$ = 800A | - | 2.7 | 3.5 | V |
| | | $V_{GE}$ = 15V, $I_C$ = 800A, , $T_{case}$ = 125˚C | - | 3.2 | 4 | V |
| $I_F$ | Diode forward current | DC, $T_{case}$ = 50˚C | - | - | 400 | A |
| $I_{FM}$ | Diode maximum forward current | $t_p$ = 1ms | - | - | 800 | A |
| $V_F$ | Diode forward voltage | $I_F$ = 800A | - | 2.2 | 2.5 | V |
| | | $I_F$ = 800A, $T_{case}$ = 125˚C | - | 2.3 | 2.5 | V |
| $C_{ies}$ | Input capacitance | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | - | 45 | - | nF |
| $L_M$ | Module inductance | - | - | 20 | - | nH |

## ELECTRICAL CHARACTERISTICS

**$T_{case}$ = 25˚C unless stated otherwise**

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $t_{d(off)}$ | Turn-off delay time | $I_C$ = 400A | - | 800 | - | ns |
| $t_f$ | Fall time | $V_{GE}$ = ±15V | - | 110 | - | ns |
| $E_{OFF}$ | Turn-off energy loss | $V_{CE}$ = 600V | - | 65 | - | mJ |
| $t_{d(on)}$ | Turn-on delay time | $R_{G(ON)}$ = $R_{G(OFF)}$ = 4.7Ω | - | 700 | - | ns |
| $t_r$ | Rise time | L ~ 100nH | - | 170 | - | ns |
| $E_{ON}$ | Turn-on energy loss | | - | 45 | - | mJ |
| $Q_{rr}$ | Diode reverse recovery charge | $I_F$ = 400A, $V_R$ = 50% $V_{CES}$, $dI_F/dt$ = 2000A/µs | - | 30 | - | µC |

**$T_{case}$ = 125˚C unless stated otherwise**

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $t_{d(off)}$ | Turn-off delay time | $I_C$ = 400A | - | 1000 | - | ns |
| $t_f$ | Fall time | $V_{GE}$ = ±15V | - | 150 | - | ns |
| $E_{OFF}$ | Turn-off energy loss | $V_{CE}$ = 600V | - | 80 | - | mJ |
| $t_{d(on)}$ | Turn-on delay time | $R_{G(ON)}$ = $R_{G(OFF)}$ = 4.7Ω | - | 800 | - | ns |
| $t_r$ | Rise time | L ~ 100nH | - | 300 | - | ns |
| $E_{ON}$ | Turn-on energy loss | | - | 75 | - | mJ |
| $Q_{rr}$ | Diode reverse recovery charge | $I_F$ = 400A, $V_R$ = 50% $V_{CES}$, $dI_F/dt$ = 2000A/µs | - | 65 | - | µC |

## TYPICAL CHARACTERISTICS

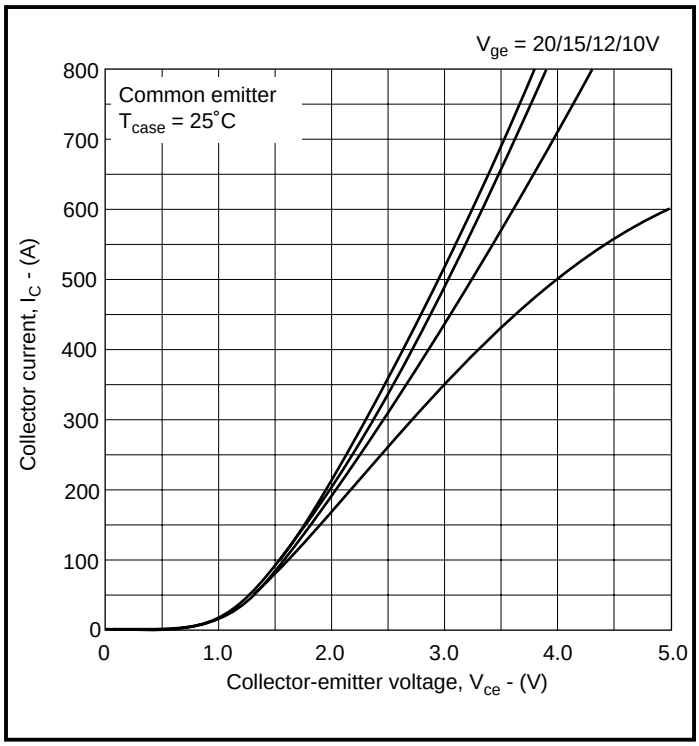



**Fig. 3 Typical output characteristics**

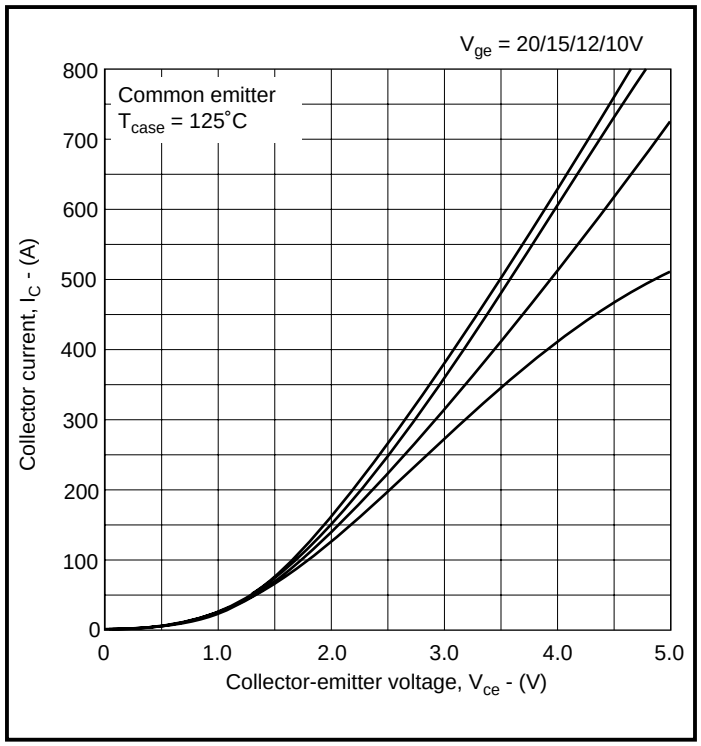



**Fig. 4 Typical output characteristics**

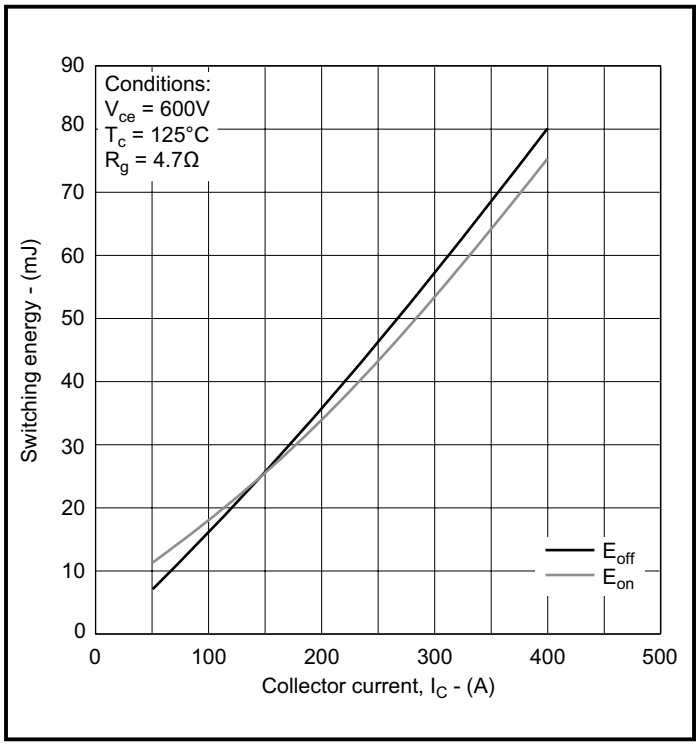



**Fig. 5 Typical switching energy vs collector current**

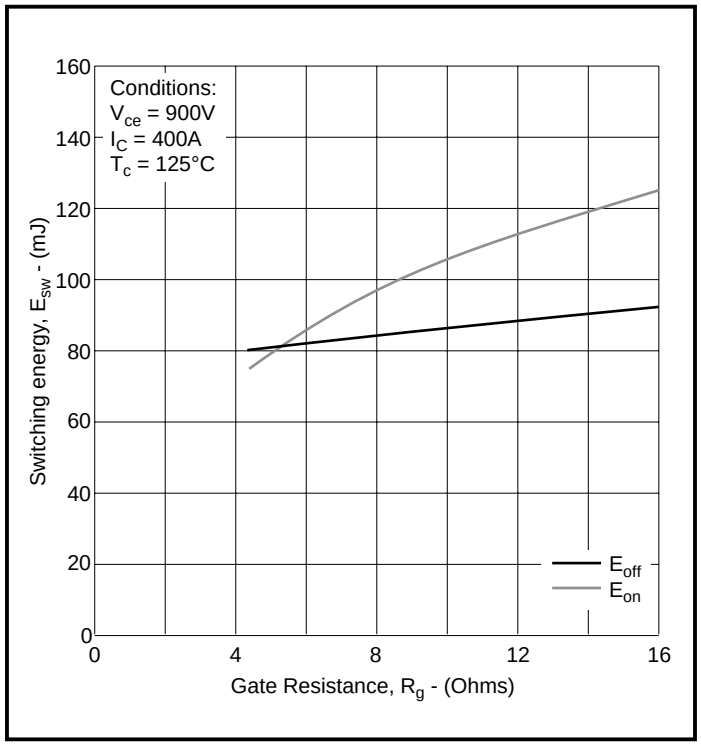



**Fig. 6 Typical switching energy vs gate resistance**

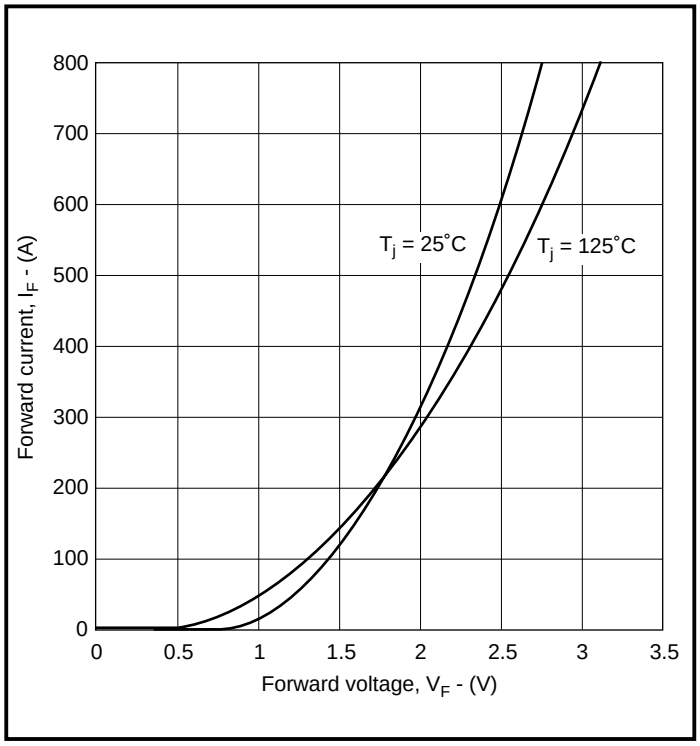



**Fig.7 Diode typical forward characteristics**

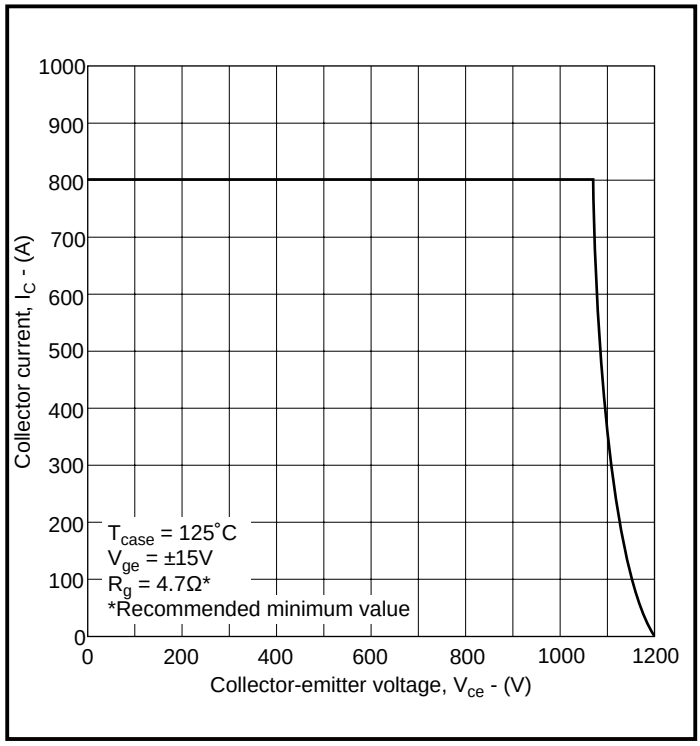



**Fig.8 Reverse bias safe operating area**

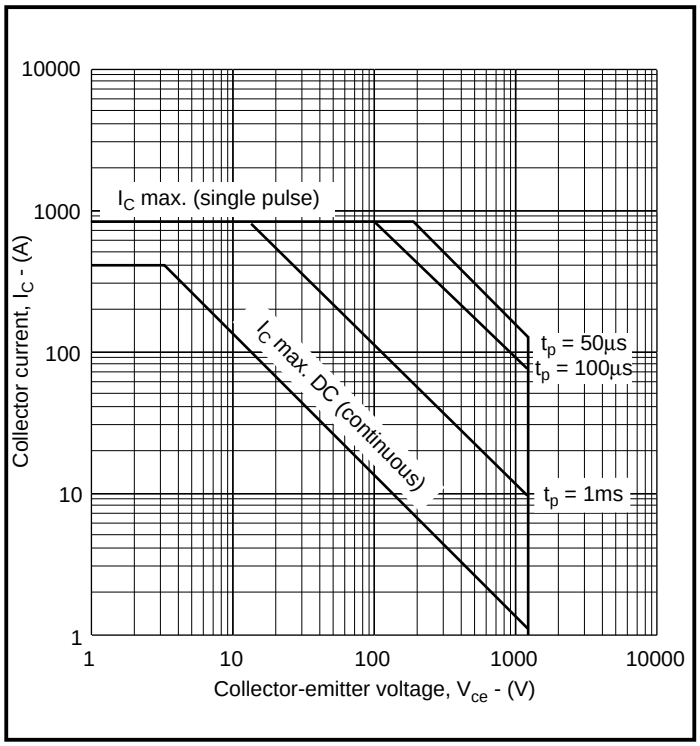



**Fig.9 Forward bias safe operating area**

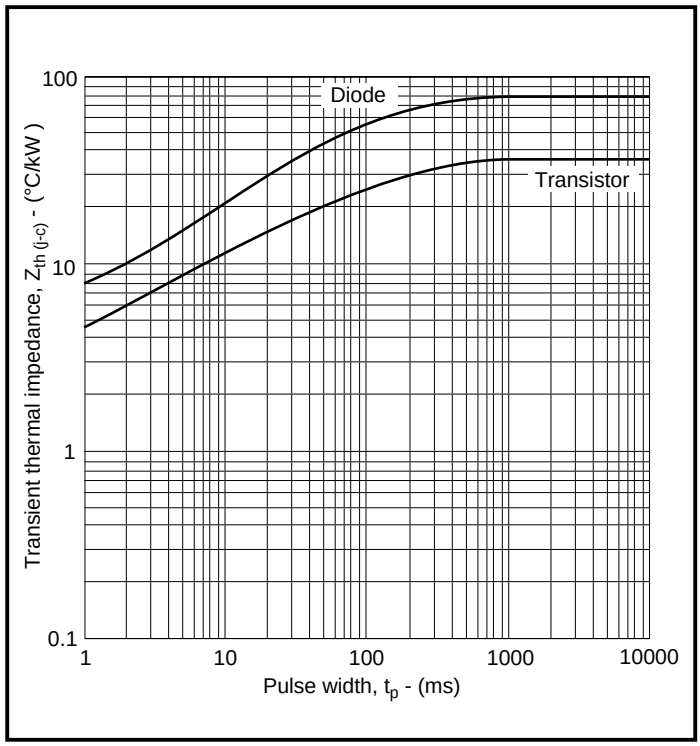



**Fig.10 Transient thermal impedance**

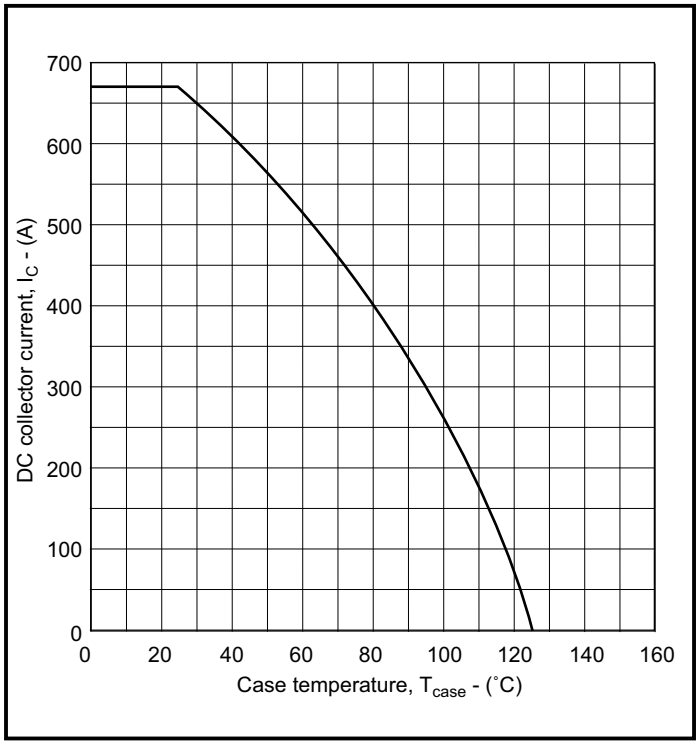
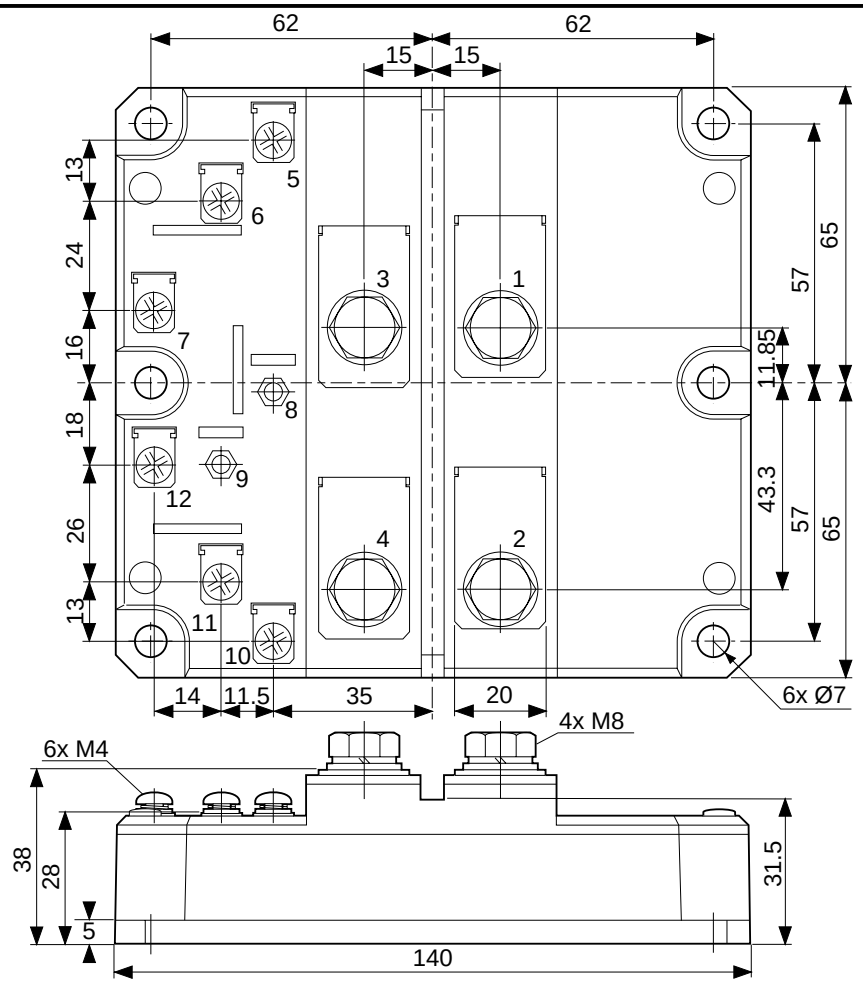



**Fig.11 DC current rating vs case temperature**

## PACKAGE DETAILS

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




Main Terminal screw plastic hole depth (M8) = 16.8 ± 0.3
Auxiliary and Gate pin plastic hole depth (M4) = 9□± 0.3

Copper terminal thickness, Main Terminal pins = 1.5 ± 0.1
Copper terminal thickness, Auxiliary and Gate pin = 0.9 ± 0.1

Nominal weight: 1050g

**Module outline type code: D**

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