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 AlN Substrates

APPLICATIONS

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

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.

KEY PARAMETERS

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

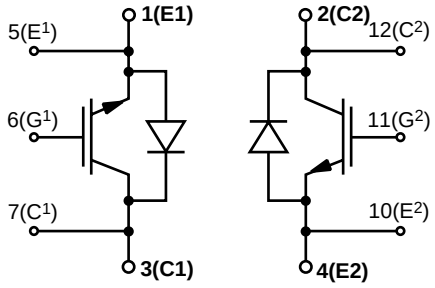
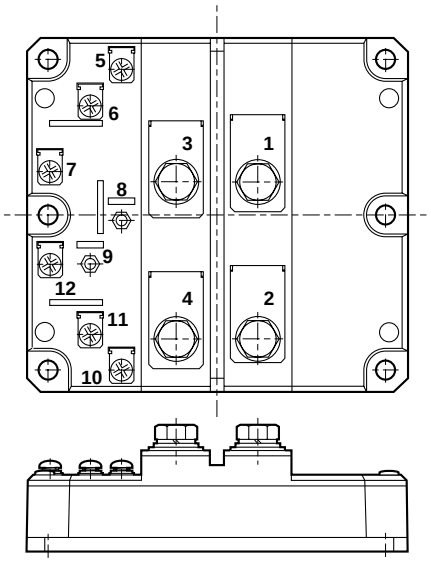


Fig. 1 Dual switch circuit diagram



Outline type code: D

(See package details for further information)

Fig. 2 Electrical connections - (not to scale)

Caution: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.

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

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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

Caution: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.

TYPICAL CHARACTERISTICS

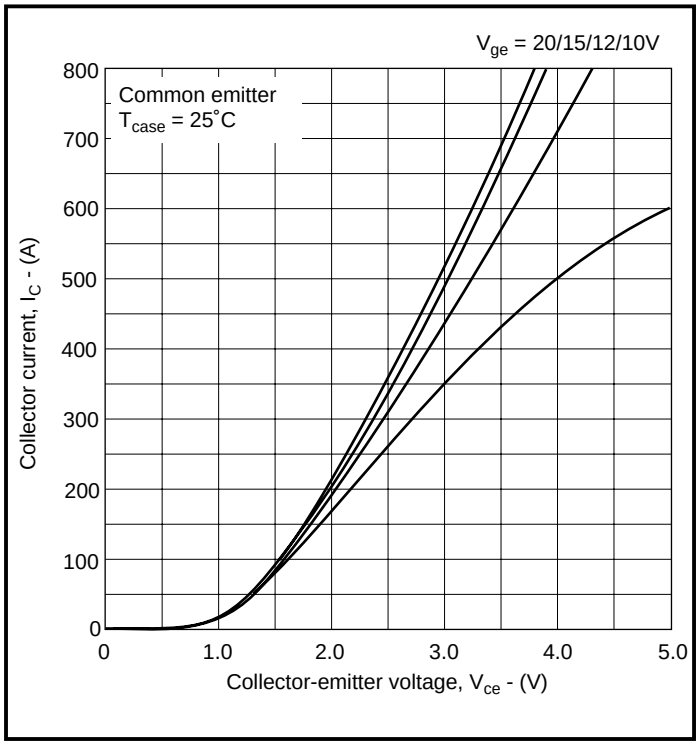


Fig. 3 Typical output characteristics

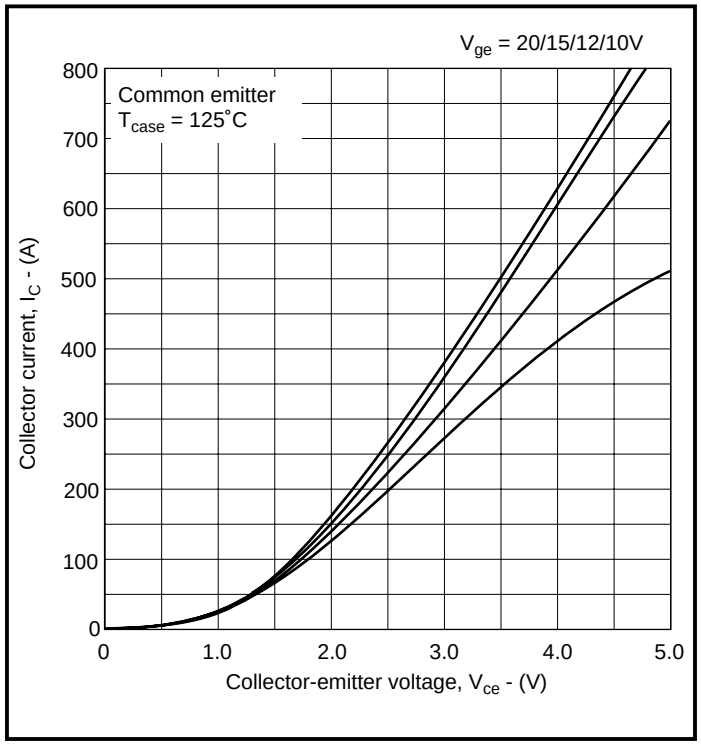


Fig. 4 Typical output characteristics

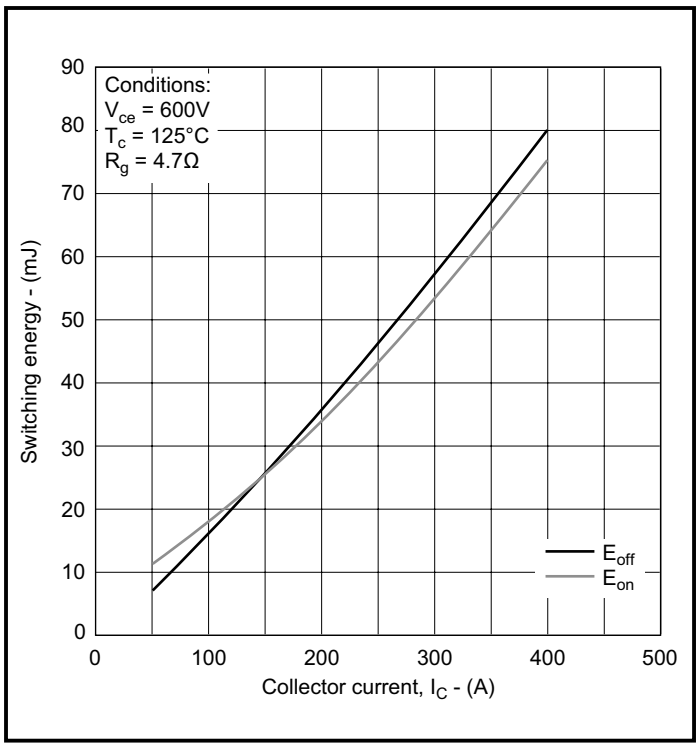


Fig. 5 Typical switching energy vs collector current

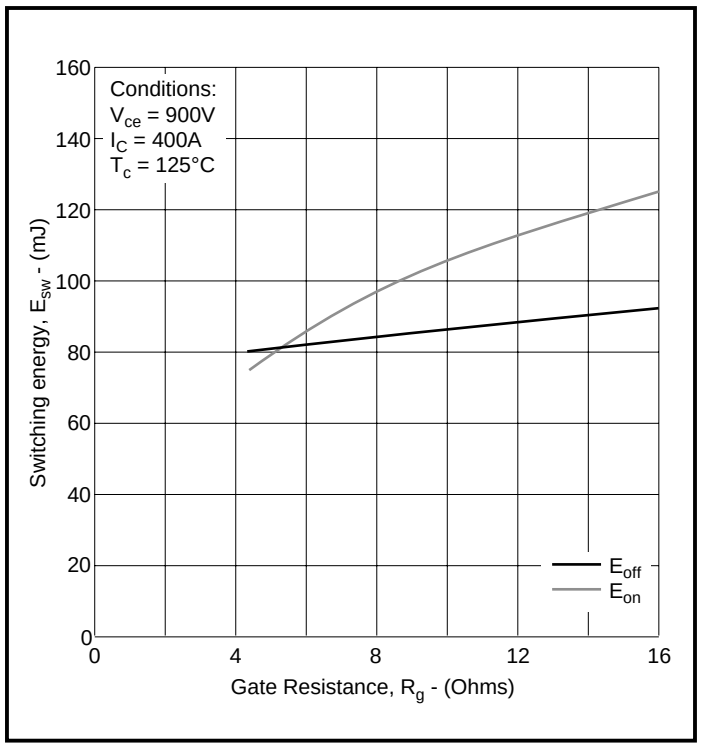


Fig. 6 Typical switching energy vs gate resistance

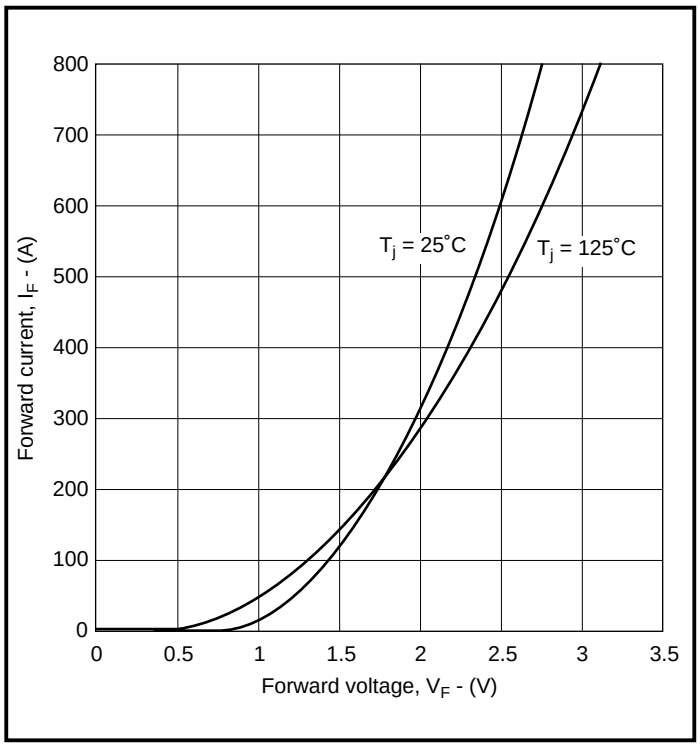


Fig.7 Diode typical forward characteristics

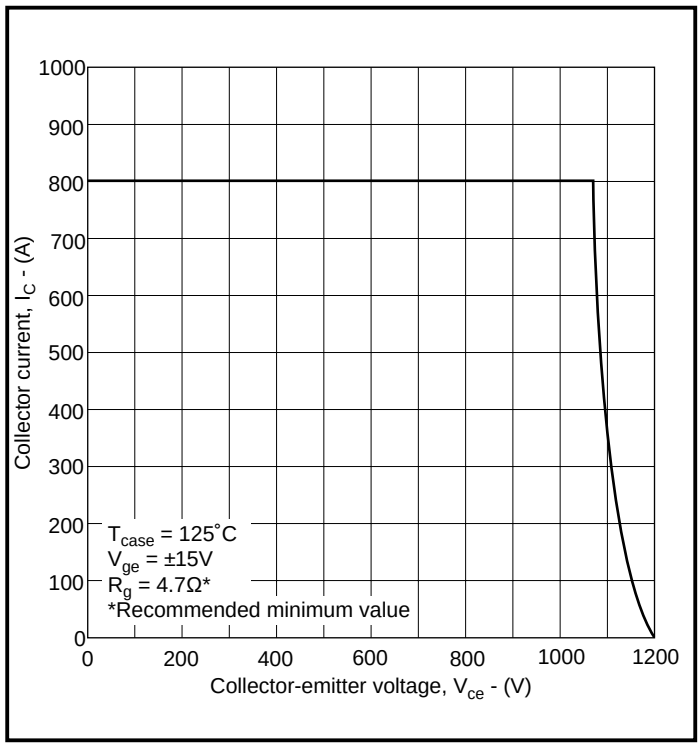


Fig.8 Reverse bias safe operating area

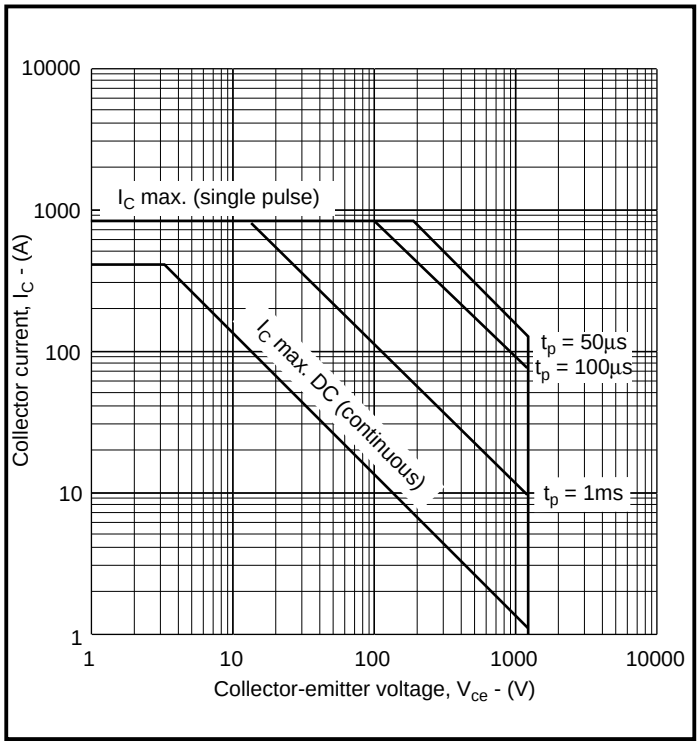


Fig.9 Forward bias safe operating area

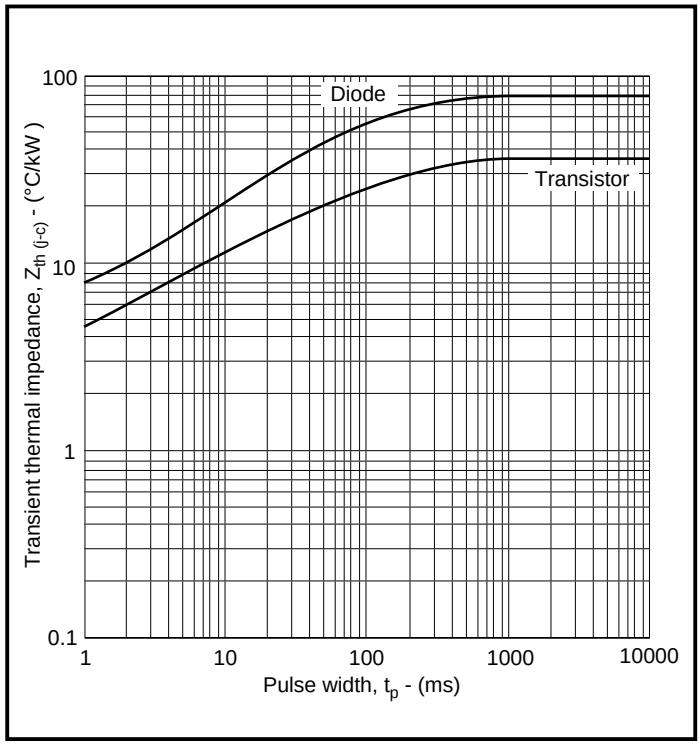


Fig.10 Transient thermal impedance

Caution: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.

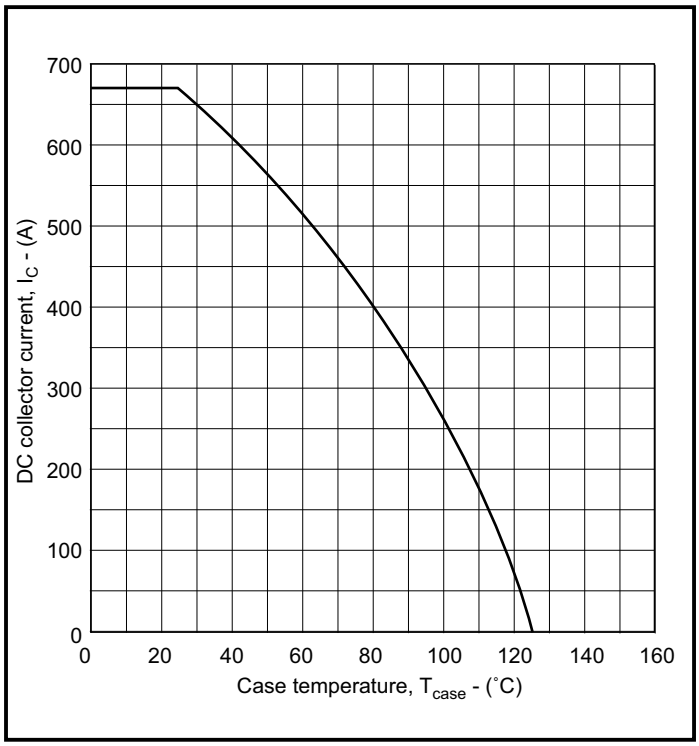
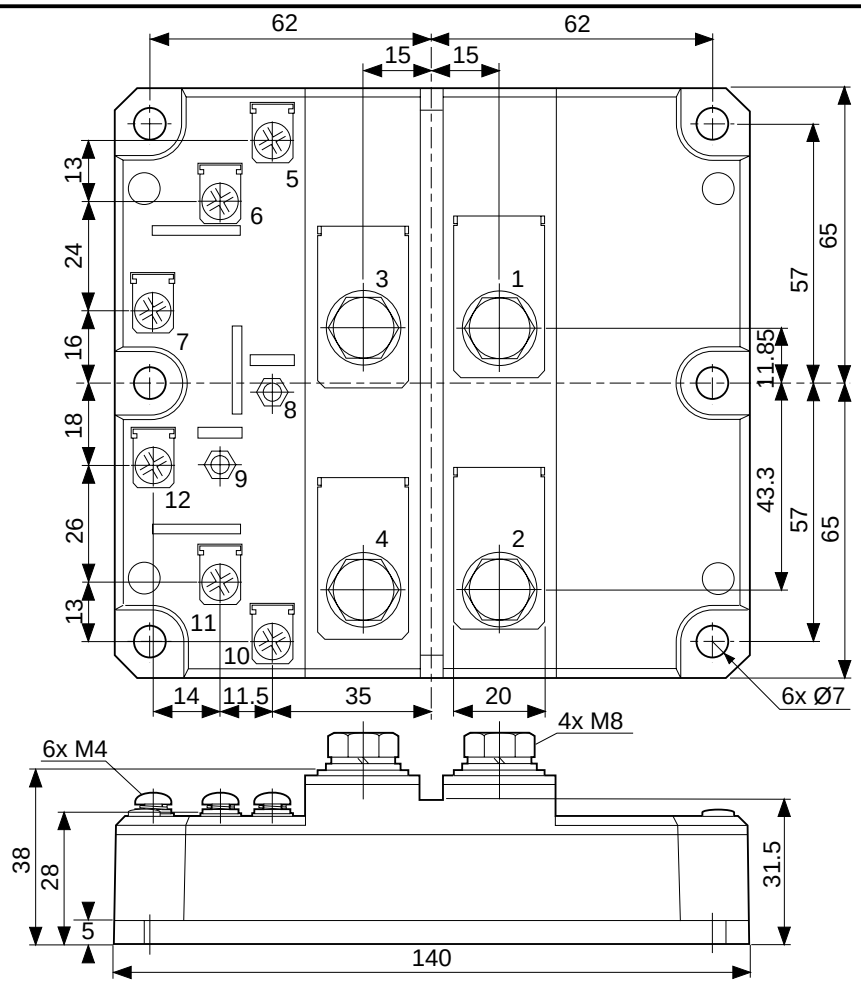


Fig.11 DC current rating vs case temperature

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

Caution: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.

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Target Information: This is the most tentative form of information and represents a very preliminary specification. No actual design work on the product has been started.

Preliminary Information: The product is in design and development. The datasheet represents the product as it is understood but details may change.

Advance Information: The product design is complete and final characterisation for volume production is well in hand.

No Annotation: The product parameters are fixed and the product is available to datasheet specification.

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