SEMICONDUCTOR

DIM400PBM17-A000

IGBT Bi-Directional Switch Module

Preliminary Information

DS5524-1.2 March 2002

FEATURES

- 10µs Short Circuit Withstand
- High Thermal Cycling Capability
- Non Punch Through Silicon
- Isolated MMC Base with AlN Substrates

APPLICATIONS

- Matrix Converters
- Brushless Motor Controllers
- Frequency Converters

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

The DIM400PBM17-A000 is a bi-directional 1700V, n channel enhancement mode, insulated gate bipolar transistor (IGBT) switch. The IGBT has a wide reverse bias safe operating area (RBSOA) plus full 10µs short circuit withstand. This module is optimised for 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:

DIM400PBM17-A000

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

KEY PARAMETERS

V_{DRM}		**±1700V**
V_T	**(typ)**	**4.9V**
I_C	**(max)**	**400A**
$I_{C(PK)}$	**(max)**	**800A**

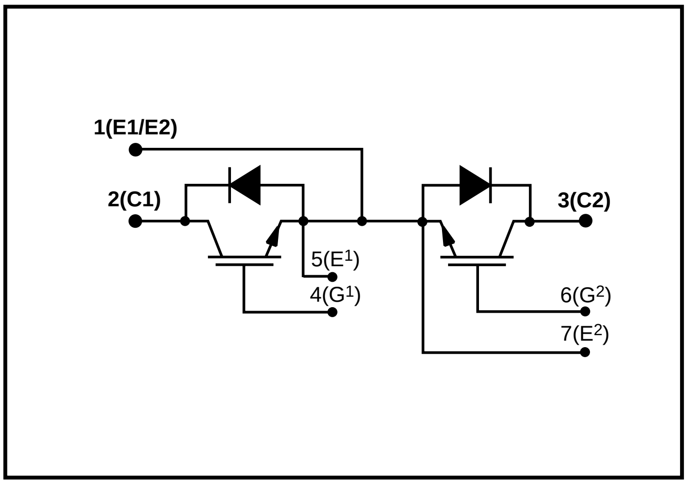
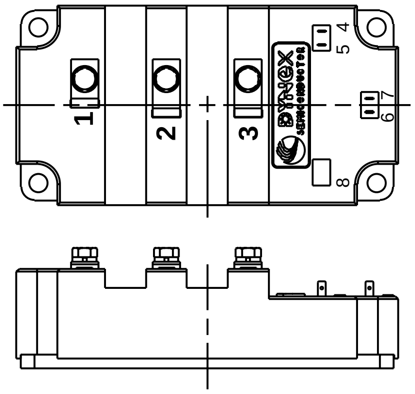


Fig. 1 Bi-directional switch circuit diagram



Outline type code: P

(See package details for further information)

Fig. 2 Electrical connections - (not to scale)

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_{DRM}	Off-state repetitive maximum voltage (measured across terminals 2 and 3)	V_{GE} = 0V	±1700	V
V_{GES}	Gate-emitter voltage	-	±20	V
I_C	Continuous collector current	T_{case} = 75˚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
I^2t	Diode I^2t value	V_R = 0, t_p = 10ms, T_{vj} = 125˚C	30	kA^2s
V_{isol}	Isolation voltage - per module	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	4000	V
Q_{PD}	Partial discharge - per module	IEC1287. V_1 = 1500V, V_2 = 1100V, 50Hz RMS	10	PC

THERMAL AND MECHANICAL RATINGS

Internal insulation material:	AlN
Baseplate material:	AlSiC
Creepage distance:	20mm
Clearance:	10mm
CTI (Critical Tracking Index):	175

Symbol	Parameter	Test Conditions	Min.	Typ.	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		-	-	12	mA
I_{GES}	Gate leakage current	V_{GE} = ±20V, V_{CE} = 0V		-	-	2	µA
$V_{GE(TH)}$	Gate threshold voltage	I_C = 20mA, V_{GE} = V_{CE}		4.5	5.5	6.5	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 400A		-	2.7	3.2	V
		V_{GE} = 15V, I_C = 400A, T_{case} = 125°C		-	3.4	4.0	V
V_T	On-state voltage	V_{GE} = 15V, I_C = 400A		-	4.9	-	V
	(measured across terminals 2 and 3)	V_{GE} = 15V, I_C = 400A, T_{case} = 125°C		-	5.7	-	V
I_F	Diode forward current	DC		-	-	400	A
I_{FM}	Diode maximum forward current	t_p = 1ms		-	-	800	A
V_F	Diode forward voltage	I_F = 400A		-	2.2	2.5	V
		I_F = 400A, T_{case} = 125°C		-	2.3	2.6	V
C_{ies}	Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		-	30	-	nF
L_M	Module inductance - per arm	-		-	20	-	nH
R_{INT}	Internal transistor resistance - per arm	-		-	0.27	-	mΩ
SC_{Data}	Short circuit. I_{SC}	T_j = 125°C, V_{CC} = 1000V,	I_1	-	1850	-	A
		t_p ≤ 10µs, $V_{CE(max)}$ = V_{CES} – L*. di/dt IEC 60747-9	I_2	-	1600	-	A

Note:
L* is the circuit inductance + L_M

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

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	-	1150	-	ns
t_f	Fall time	V_{GE} = ±15V	-	100	-	ns
E_{OFF}	Turn-off energy loss	V_{CE} = 900V	-	120	-	mJ
$t_{d(on)}$	Turn-on delay time	$R_{G(ON)} = R_{G(OFF)} = 4.7\Omega$	-	250	-	ns
t_r	Rise time	L ~ 100nH	-	250	-	ns
E_{ON}	Turn-on energy loss		-	150	-	mJ
Q_g	Gate charge		-	4.5	-	µC
Q_{rr}	Diode reverse recovery charge	I_F = 400A, V_R = 900V,	-	100	-	µC
I_{rr}	Diode reverse current	dI_F/dt = 3000A/µs	-	230	-	A
E_{REC}	Diode reverse recovery energy		-	70	-	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 = 400A	-	1400	-	ns
t_f	Fall time	V_{GE} = ±15V	-	130	-	ns
E_{OFF}	Turn-off energy loss	V_{CE} = 900V	-	180	-	mJ
$t_{d(on)}$	Turn-on delay time	$R_{G(ON)} = R_{G(OFF)} = 4.7\Omega$	-	400	-	ns
t_r	Rise time	L ~ 100nH	-	250	-	ns
E_{ON}	Turn-on energy loss		-	170	-	mJ
Q_{rr}	Diode reverse recovery charge	I_F = 400A, V_R = 900V,	-	170	-	µC
I_{rr}	Diode reverse current	dI_F/dt = 2500A/µs	-	270	-	A
E_{REC}	Diode reverse recovery energy		-	100	-	mJ

TYPICAL CHARACTERISTICS

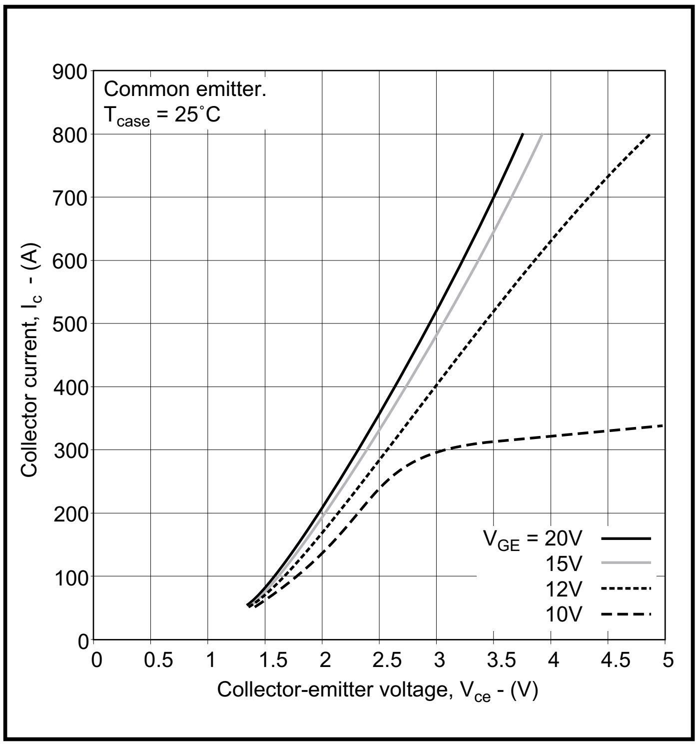


Fig. 3 Typical output characteristics

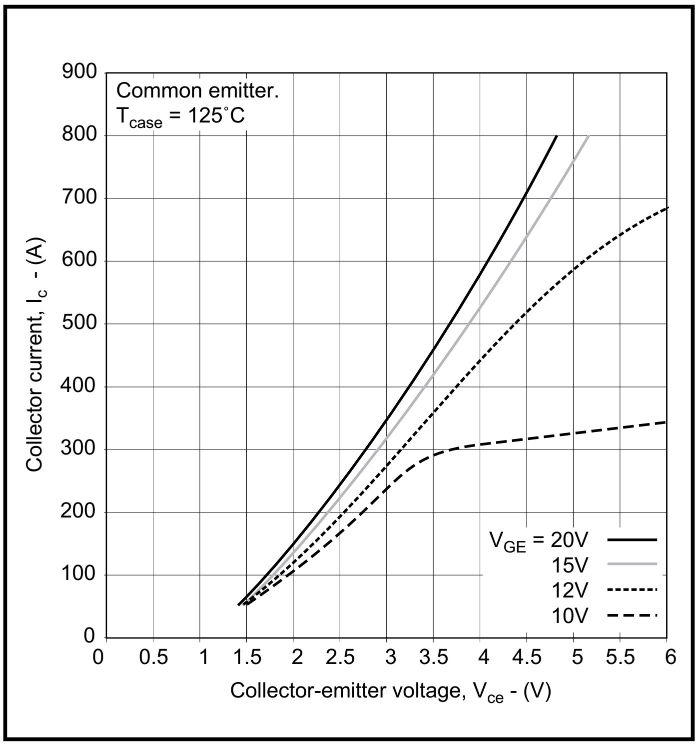


Fig. 4 Typical output characteristics

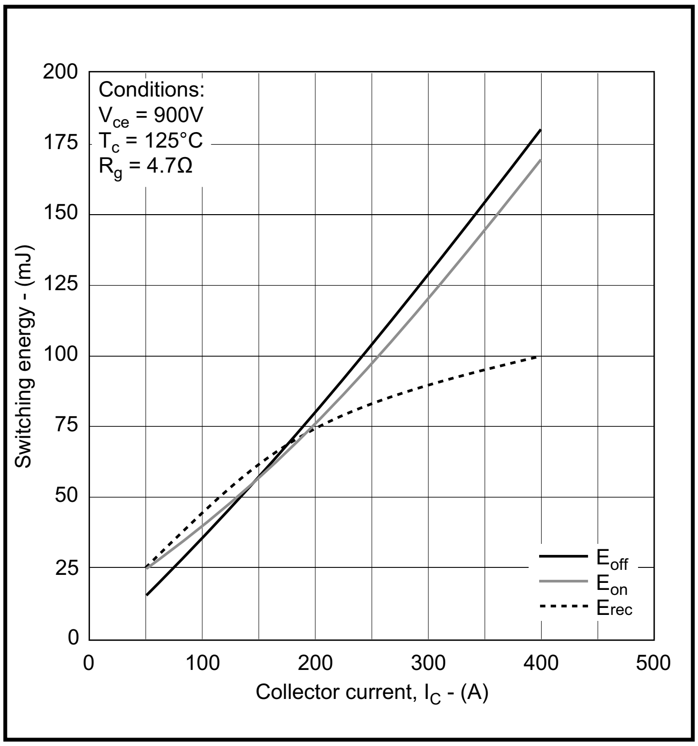


Fig. 5 Typical switching energy vs collector current

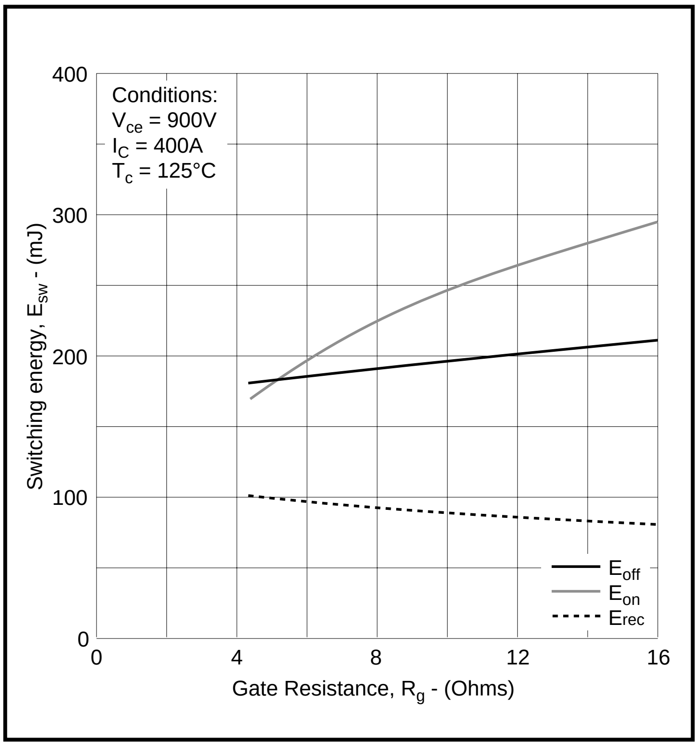


Fig. 6 Typical switching energy vs gate resistance

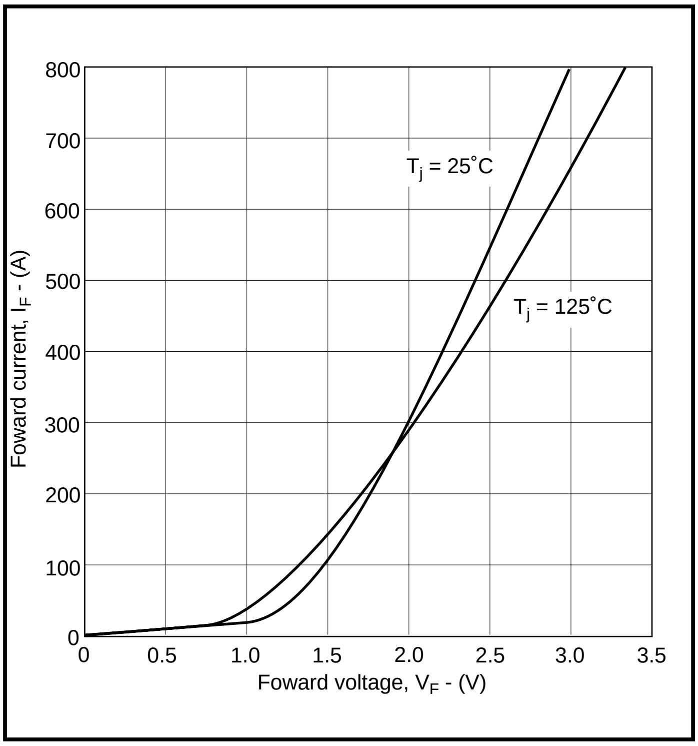


Fig. 7 Diode typical forward characteristics

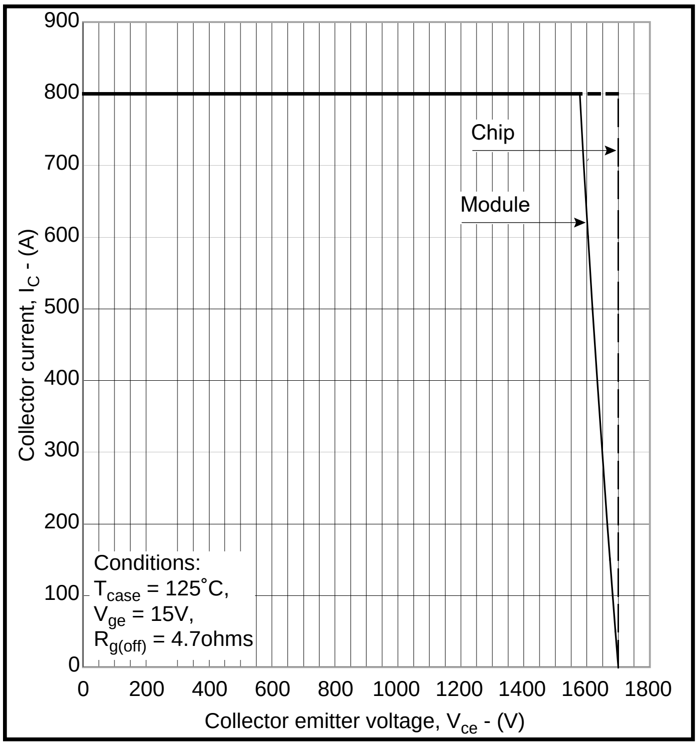


Fig. 8 Reverse bias safe operating area

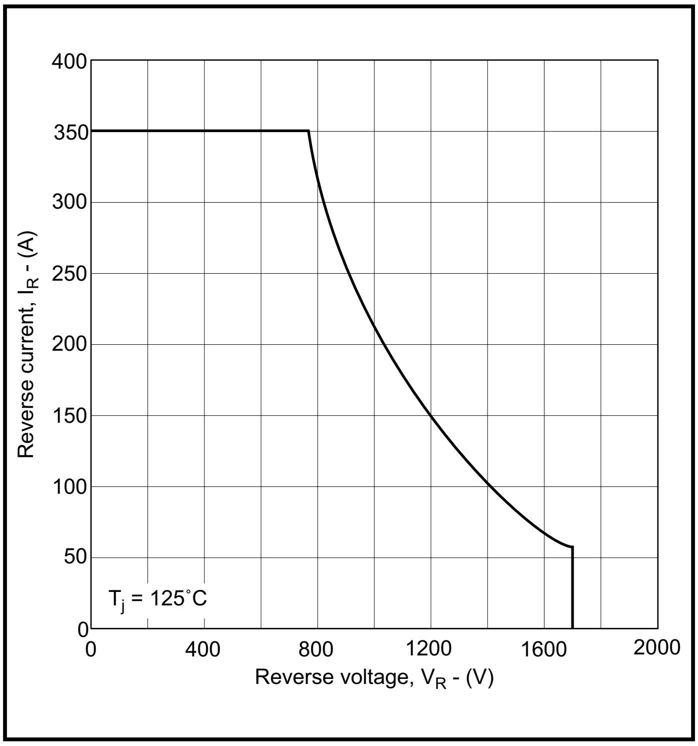


Fig. 9 Diode reverse bias safe operating area

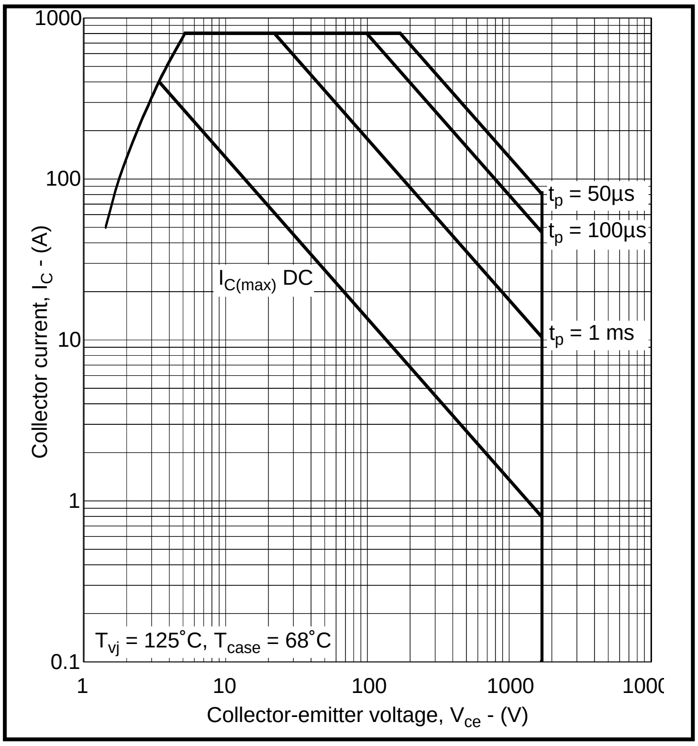
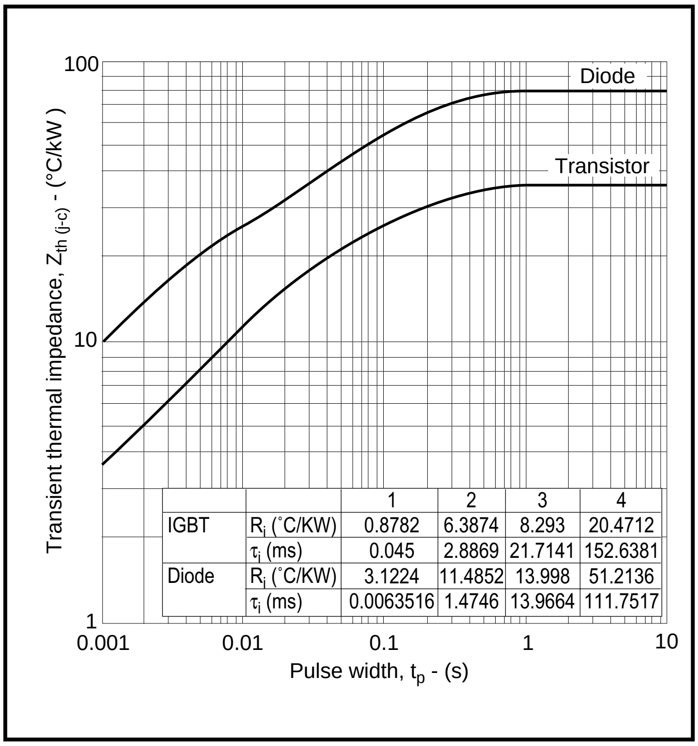


Fig. 10 Forward bias safe operating area



		1	2	3	4
IGBT	R_i (˚C/KW)	0.8782	6.3874	8.293	20.4712
	τ_i (ms)	0.045	2.8869	21.7141	152.6381
Diode	R_i (˚C/KW)	3.1224	11.4852	13.998	51.2136
	τ_i (ms)	0.0063516	1.4746	13.9664	111.7517

Fig. 13 Transient thermal impedance

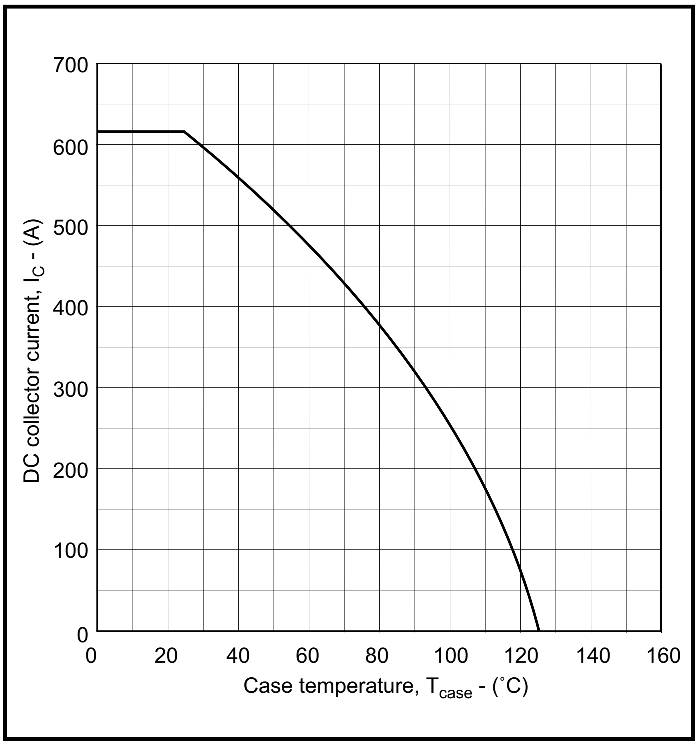
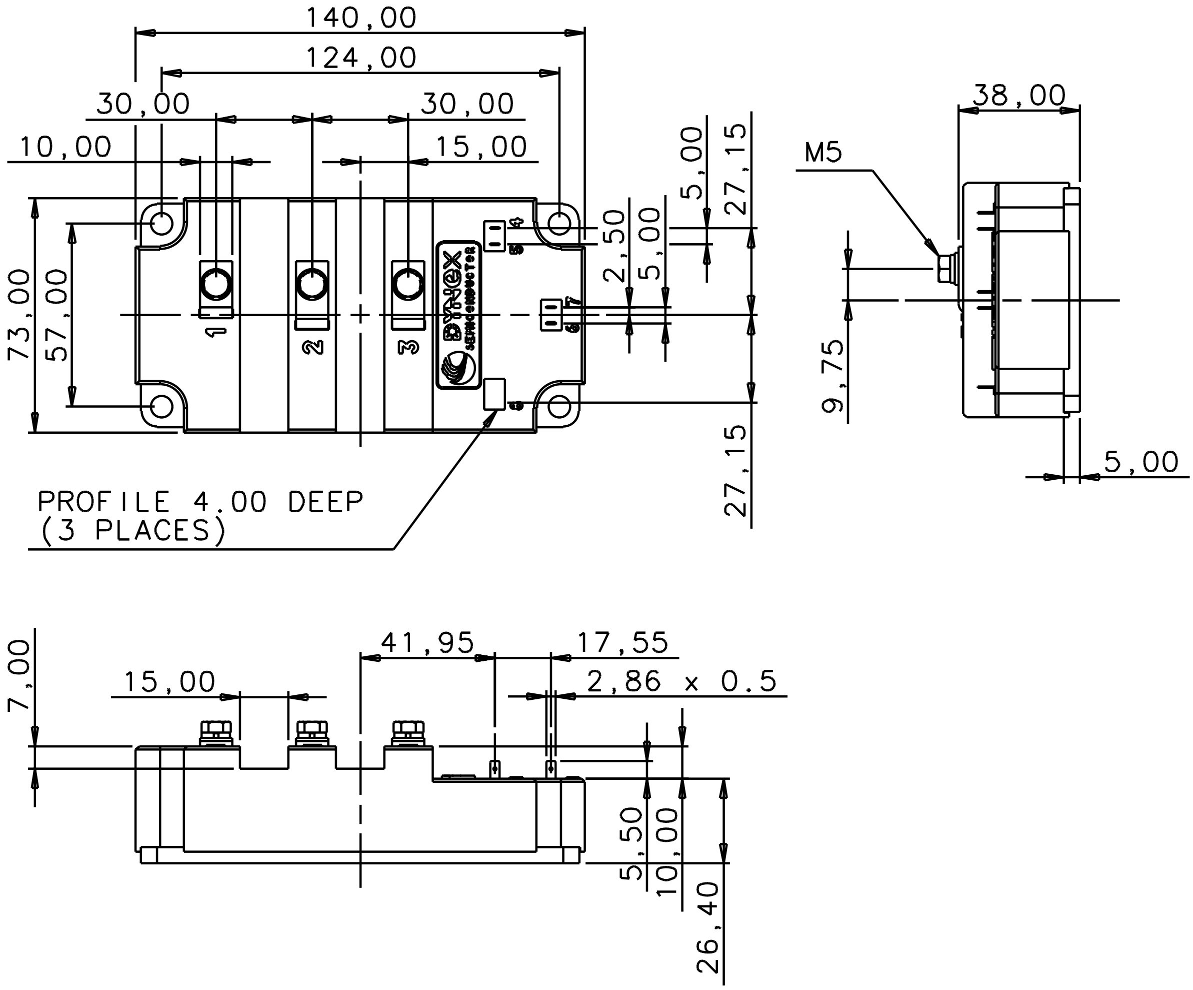


Fig. 14 DC current rating vs case temperature

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.



Nominal weight: 750g

Module outline type code: P

http://www.dynexsemi.com

e-mail: power_solutions@dynexsemi.com

HEADQUARTERS OPERATIONS
DYNEX SEMICONDUCTOR LTD
Doddington Road, Lincoln.
Lincolnshire. LN6 3LF. United Kingdom.
Tel: 00-44-(0)1522-500500
Fax: 00-44-(0)1522-500550

SALES OFFICES
North America Tel: (613) 723-7035. Fax: (613) 723-1518. Toll Free: 1.888.33.DYNEX (39639) /
Tel: (949) 733-3005. Fax: (949) 733-2986.
Rest Of World Tel: +44 (0)1522 502753/502901. Fax: +44 (0)1522 500020

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