DIM400DCM17-A000

IGBT Chopper Module

Replaces September 2001, version DS5490-1.1

DS5490-2.0 March 2002

FEATURES

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

APPLICATIONS

- Power Supplies
- Motor Controllers
- Traction Drives

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

The DIM400DCM17-A000 is a 1700V, n channel enhancement mode, insulated gate bipolar transistor (IGBT) chopper 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.

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:

DIM400DCM17-A000

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

KEY PARAMETERS

V_{CES}		**1700V**
$V_{CE(sat)}$*	**(typ)**	**2.7V**
I_C	**(max)**	**400A**
$I_{C(PK)}$	**(max)**	**800A**

*(measured at the power busbars and not the auxiliary terminals)

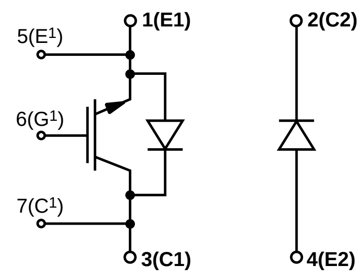
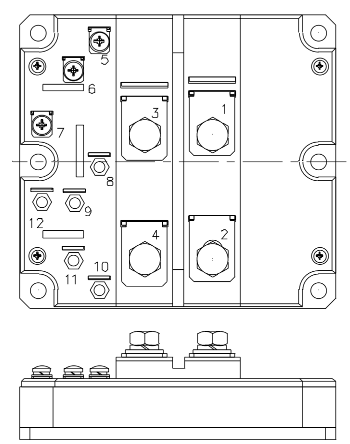


Fig. 1 Chopper circuit diagram



Outline type code: D

(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_{CES}	Collector-emitter voltage	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 (IGBT arm)	V_R = 0, t_p = 10ms, T_{vj} = 125˚C	30	kA^2s
	Diode I^2t value (Diode arm)		120	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 (IGBT arm)	Continuous dissipation - junction to case	-	-	80	°C/kW
	Thermal resistance - diode (Diode arm)		-	-	40	°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
I_F	Diode forward current	DC		-	-	400	A
I_{FM}	Diode maximum forward current	t_p = 1ms		-	-	800	A
V_F †	Diode forward voltage (IGBT arm)	I_F = 400A		-	2.2	2.5	V
	Diode forward voltage (Diode arm)			-	1.8	2.1	V
	Diode forward voltage (IGBT arm)	I_F = 400A, T_{case} = 125˚C		-	2.3	2.6	V
	Diode forward voltage (Diode arm)			-	1.8	2.1	V
C_{ies}	Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		-	30	-	nF
C_{res}	Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		-	2.5	-	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	I_2	-	1600	-	A
		IEC 60747-9					

Note:
† Measured at the power busbars and not the auxiliary terminals)
* 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	Diode arm	I_F = 400A,	-	250	-	µC
		IGBT arm	V_R = 50% V_{CES},	-	100	-	µC
I_{rr}	Diode reverse recovery current	Diode arm	dI_F/dt = 2000A/µs	-	530	-	A
		IGBT arm		-	230	-	A
E_{rec}	Diode reverse recovery energy	Diode arm		-	160	-	mJ
		IGBT arm		-	70	-	mJ

ELECTRICAL CHARACTERISTICS

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	Diode arm	I_F = 400A,	-	425	-	µC
		IGBT arm	$V_R = 50\%\ V_{CES}$,	-	170	-	µC
I_{rr}	Diode reverse recovery current	Diode arm	dI_F/dt = 2000A/µs	-	600	-	A
		IGBT arm		-	270	-	A
E_{rec}	Diode reverse recovery energy	Diode arm		-	250	-	mJ
		IGBT arm		-	100	-	mJ

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TYPICAL CHARACTERISTICS

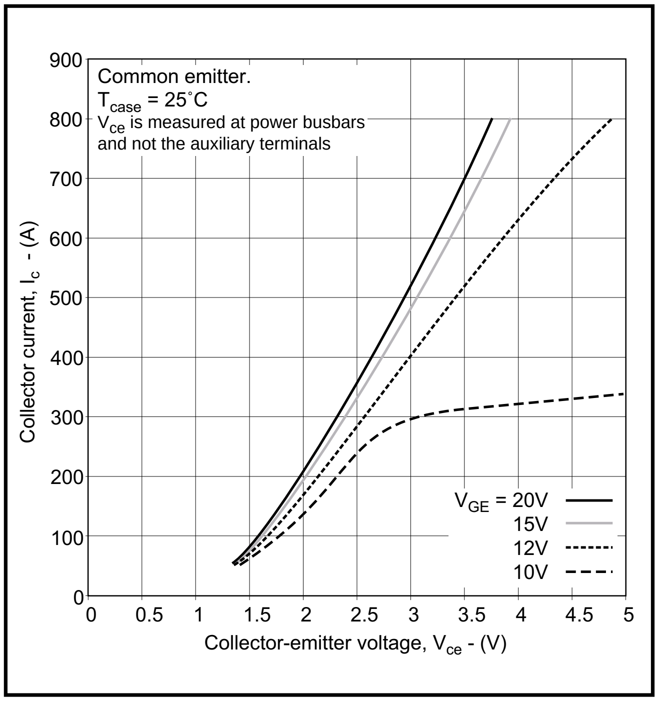


Fig. 3 Typical output characteristics

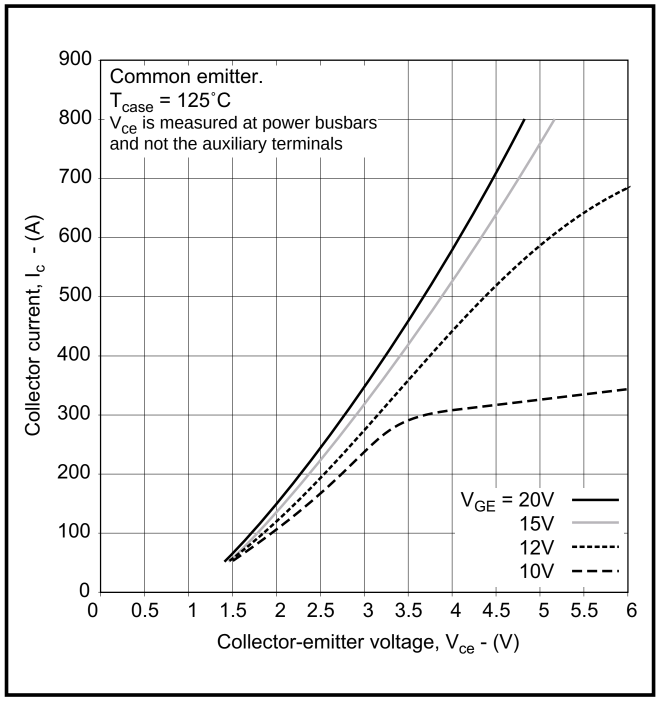


Fig. 4 Typical output characteristics

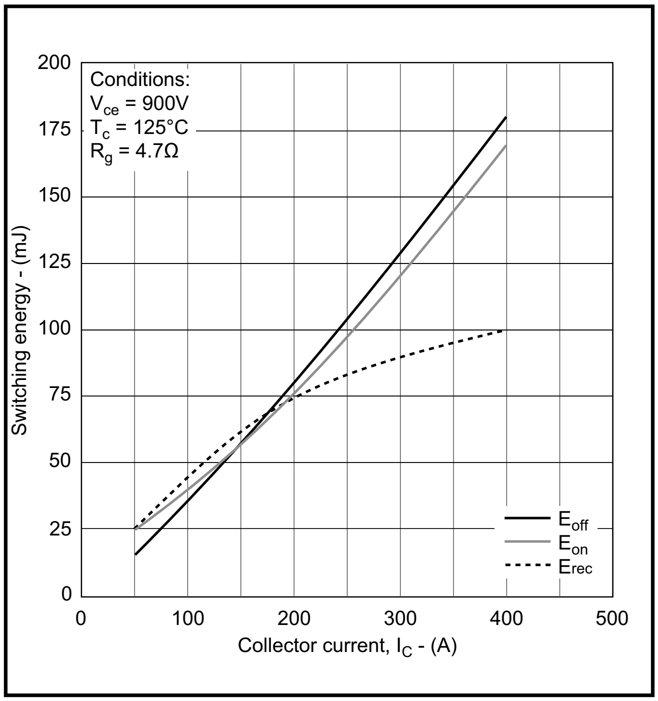


Fig. 5 Typical switching energy vs collector current

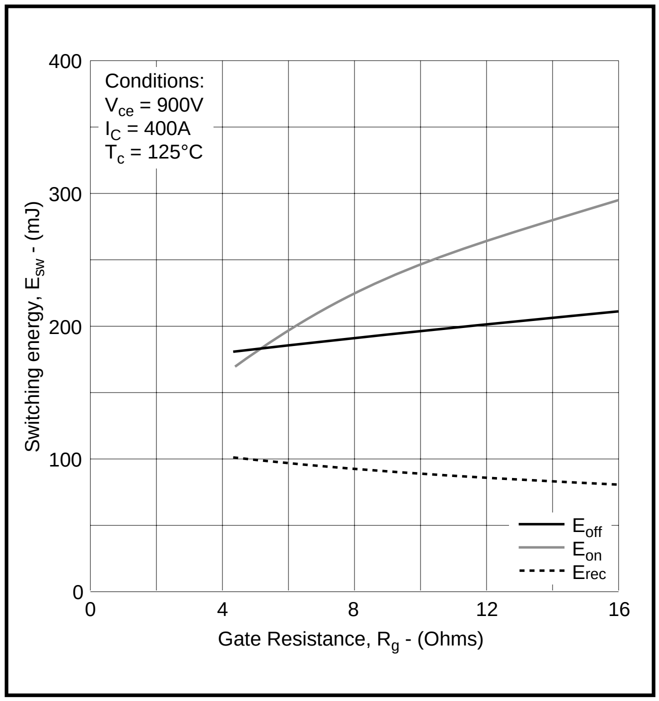


Fig. 6 Typical switching energy vs gate resistance

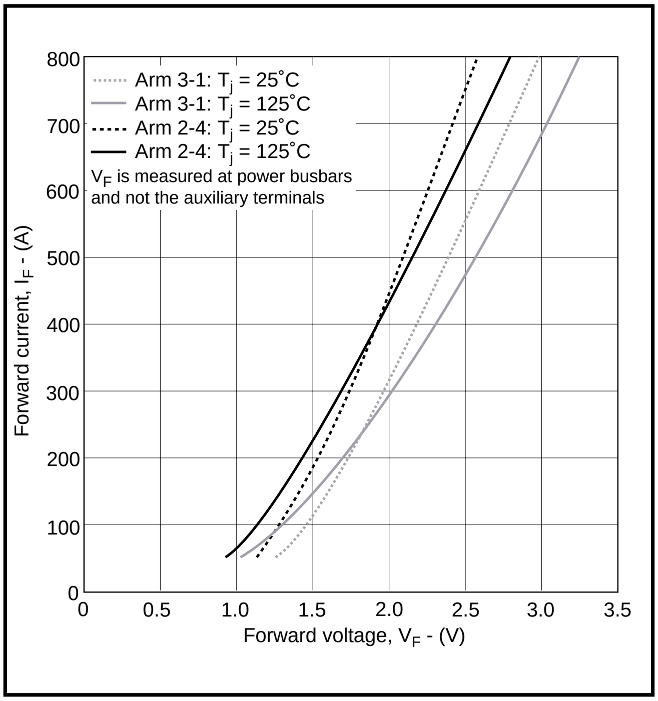


Fig. 7 Diode typical forward characteristics

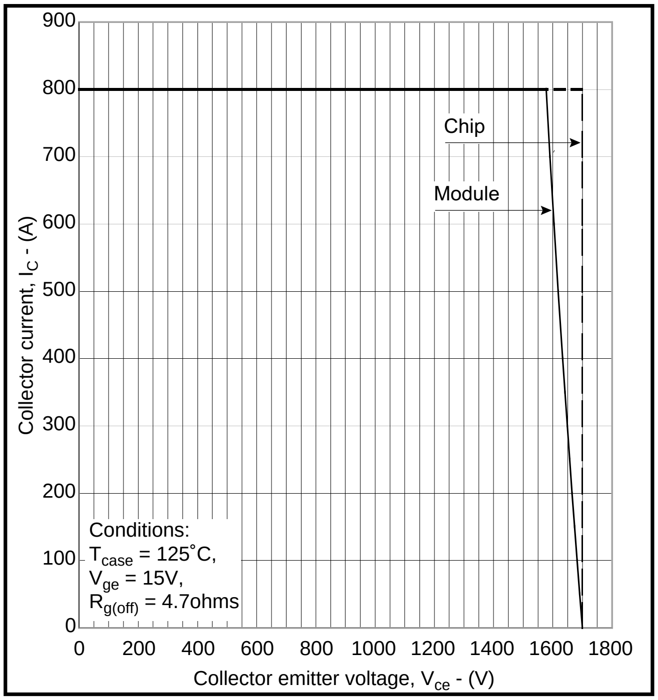


Fig. 8 Reverse bias safe operating area

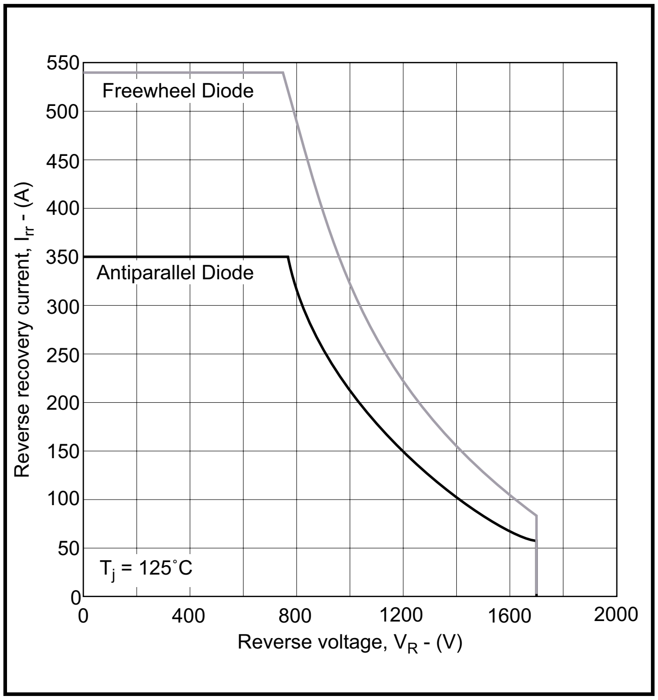


Fig. 9 Diode reverse bias safe operating area

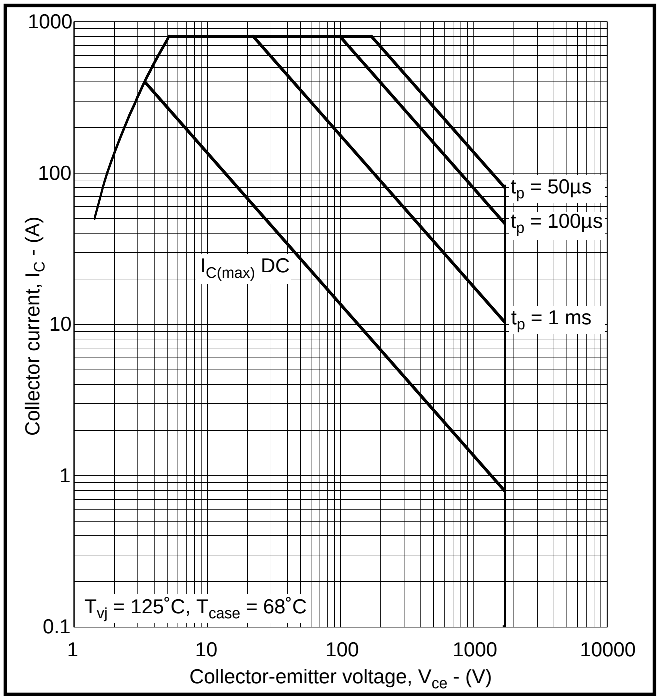
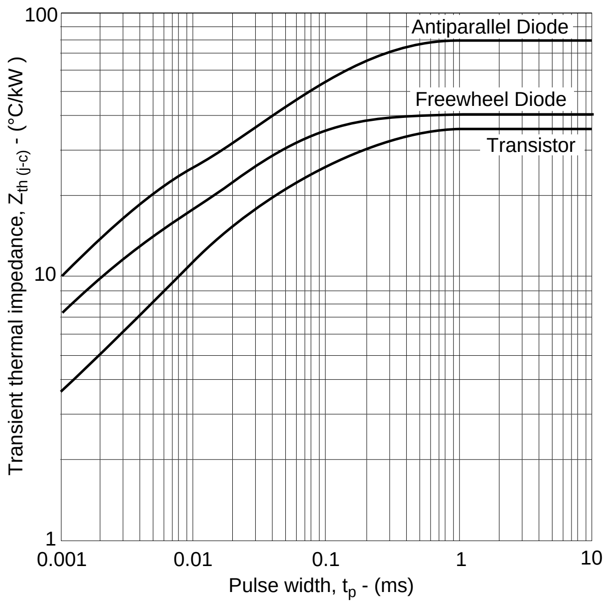


Fig. 10 Forward bias safe operating area

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



		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
Antiparallel Diode	R_i (˚C/KW)	3.1224	11.4852	13.998	51.2136
	τ_i (ms)	0.0063516	1.4746	13.9664	111.7517
Freewheel Diode	R_i (˚C/KW)	1.5612	5.7426	6.999	25.6068
	τ_i (ms)	0.0063516	1.4746	13.9664	111.7517

Fig. 11 Transient thermal impedance

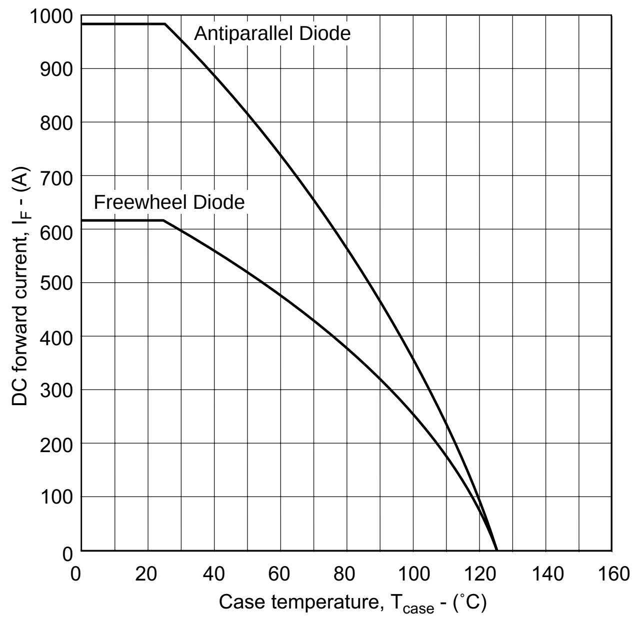
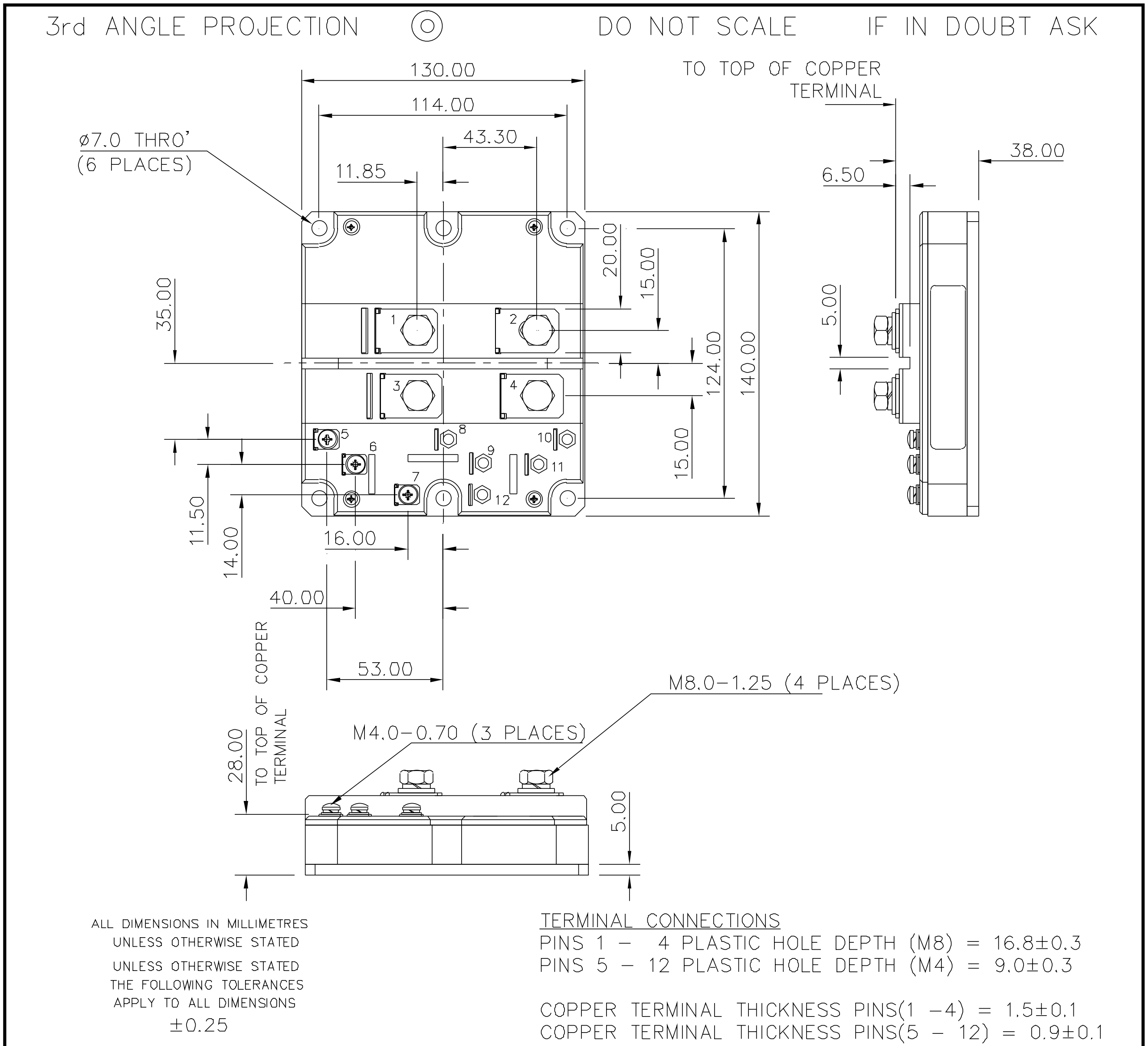


Fig. 12 DC current rating vs case temperature

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: 1050g

Module outine type code: D

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

POWER ASSEMBLY CAPABILITY

The Power Assembly group was set up to provide a support service for those customers requiring more than the basic semiconductor, and has developed a flexible range of heatsink and clamping systems in line with advances in device voltages and current capability of our semiconductors.

We offer an extensive range of air and liquid cooled assemblies covering the full range of circuit designs in general use today. The Assembly group continues to offer high quality engineering support dedicated to designing new units to satisfy the growing needs of our customers.

Using the latest CAD methods our team of design and applications engineers aim to provide the Power Assembly Complete Solution (PACs).

HEATSINKS

The Power Assembly group has its own proprietary range of extruded aluminium heatsinks. They have been designed to optimise the performance of Dynex semiconductors. Data with respect to air natural, forced air and liquid cooling (with flow rates) is available on request.

For further information on device clamps, heatsinks and assemblies, please contact your nearest sales representative or customer service office.

DYNEX SEMICONDUCTOR

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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.