DIM400GCM33-F000

IGBT Chopper Module

DS5863- 1.1 April 2006 (LN24542)

FEATURES

- 10µs Short Circuit Withstand
- Soft Punch Through Silicon
- Isolated AlSiC Base with AlN substrates
- High thermal cycling capability

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 600V to 3300V and currents up to 2400A.

The DIM400GCM33-F000 is a 3300V, n channel enhancement mode, insulated gate bipolar transistor (IGBT) chopper module. The IGBT has a wide reverse bias safe operating area (RBSOA) plus full 10µs short circuit withstand. 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:

DIM400GCM33-F000

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

KEY PARAMETERS

V_{CES}		**3300V**
$V_{CE\ (sat)}$*	**(typ)**	**2.8V**
I_C	**(max)**	**400A**
$I_{C(PK)}$	**(max)**	**800A**

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

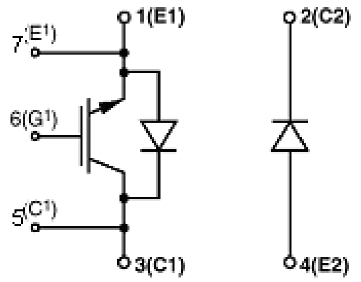


Fig. 1 Chopper circuit diagram

Outline type code: G

(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.

Tcase = 25°C unless stated otherwise

Symbol	Parameter	Test Conditions	Max.	Units
V_{CES}	Collector-emitter voltage	V_{GE} = 0V	3300	V
V_{GES}	Gate-emitter voltage		±20	V
I_C	Continuous collector current	T_{case} = 90°C	400	A
$I_{C(PK)}$	Peak collector current	1ms, T_{case} =115°C	800	A
P_{max}	Max. transistor power dissipation	T_{case} = 25°C, T_j = 150°C	5200	W
I^2t	Diode I^2t value (IGBT arm)	V_R = 0, t_P = 10ms, T_{vj} = 125°C	80	kA^2S
	Diode I^2t value (Diode arm)		80	
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 = 3500V, V_2 = 2600V, 50Hz RMS	10	pC

THERMAL AND MECHANICAL RATINGS

Internal insulation material: AIN
Baseplate material: AlSiC
Creepage distance: 33mm
Clearance: 20mm
CTI (Critical Tracking Index): 175

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$R_{th(j-c)}$	Thermal resistance - transistor	Continuous dissipation – junction to case	-	-	24	°C/kW
$R_{th(j-c)}$	Thermal resistance – diode (IGBT arm) Thermal resistance- diode (Diode arm)	Continuous dissipation – junction to case	-	-	48 48	°C/kW °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}		-	-	2	mA
		V_{GE} = 0V, V_{CE} = V_{CES}, T_{case} = 125°C		-	-	30	mA
I_{ces}	Gate leakage current	V_{GE} = ±20V, V_{CE} = 0V		-	-	1	µA
$V_{GE(TH)}$	Gate threshold voltage	I_C = 40mA, V_{GE} = V_{CE}		5.5	6.5	7.0	V
$V_{CE(sat)}^{\dagger}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 400A		-	2.8	-	V
		V_{GE} = 15V, I_C = 400A, T_{case} = 125°C		-	3.6	-	V
I_F	Diode forward current	DC		-	-	400	A
I_{FM}	Diode maximum forward current	t_p = 1ms		-	-	800	A
$V_F^{\dagger}$	Diode forward voltage (IGBT arm) Diode forward voltage (Diode arm)	I_F = 400A		-	2.9 2.9	- -	V
	Diode forward voltage (IGBT arm) Diode forward voltage (Diode arm)	I_F = 400A, T_{case} = 125°C		-	3.0 3.0	- -	V
C_{ies}	Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		-	72	-	nF
L_M	Module inductance – per arm	-		-	25	-	nH
R_{INT}	Internal resistance – per arm	-		-	0.26	-	mΩ
SC_{Data}	Short circuit. I_{sc}	T_j = 125°C, V_{cc} = 2500V,	I_1	-	2000	-	A
		t_p ≤ 10µs, $V_{CE(max)}$ = V_{CES} - L*×di/dt IEC 60747-9	I_2	-	1850	-	A

Note:

† Measured at the power busbars and not the auxiliary terminals

* L is the circuit inductance + L_M

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	-	2100	-	ns
t_f	Fall time	V_{GE} = ±15V	-	210	-	ns
E_{OFF}	Turn-off energy loss	V_{CE} = 1800V	-	520	-	mJ
$t_{d(on)}$	Turn-on delay time	$R_{G(ON)}$ = $R_{G(OFF)}$ = 8.2Ω	-	1130	-	ns
t_r	Rise time	L ~ 100nH	-	245	-	ns
Q_g	Gate charge	C_{ge} = 110nF	-	10	-	µC
E_{ON}	Turn-on energy loss	$R_{G(ON)}$ = 5.6Ω	-	620	-	mJ
Q_{rr}	Diode reverse recovery charge	I_F = 400A, V_R = 1800V,	-	160	-	µC
I_{rr}	Diode reverse current	dI_F/dt = 2000A/µs	-	330	-	A
E_{REC}	Diode reverse recovery energy	Diode arm	-	150	-	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	-	2150	-	ns
t_f	Fall time	V_{GE} = ±15V	-	220	-	ns
E_{OFF}	Turn-off energy loss	V_{CE} = 1800V	-	600	-	mJ
$t_{d(on)}$	Turn-on delay time	$R_{G(ON)}$ = $R_{G(OFF)}$ = 8.2Ω	-	1160	-	ns
t_r	Rise time	L ~ 100nH, C_{ge} = 110nF	-	285	-	ns
E_{ON}	Turn-on energy loss	$R_{G(ON)}$ = 5.6Ω	-	870	-	mJ
Q_{rr}	Diode reverse recovery charge	I_F = 400A, V_R = 1800V,	-	300	-	µC
I_{rr}	Diode reverse current	dI_F/dt = 4000A/µs	-	400	-	A
E_{REC}	Diode reverse recovery energy	Diode arm	-	300	-	mJ

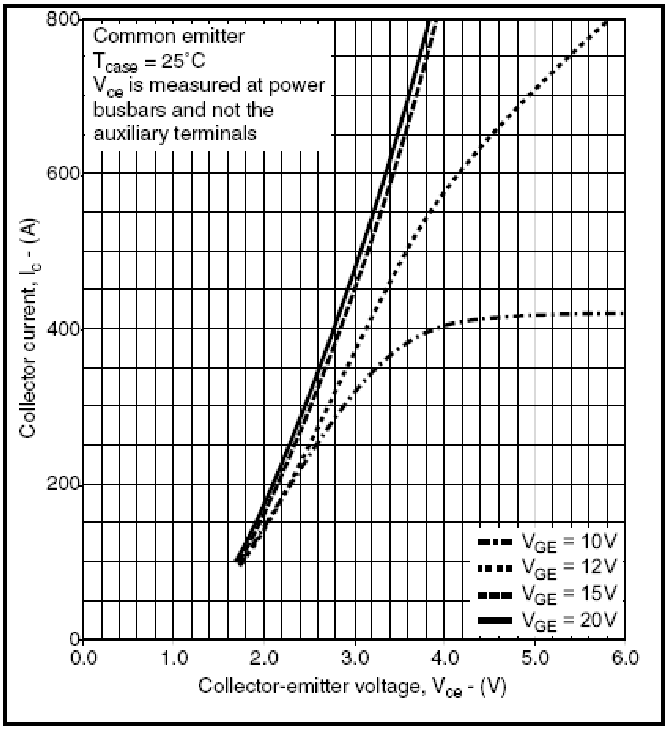


Fig.3 Typical output characteristics

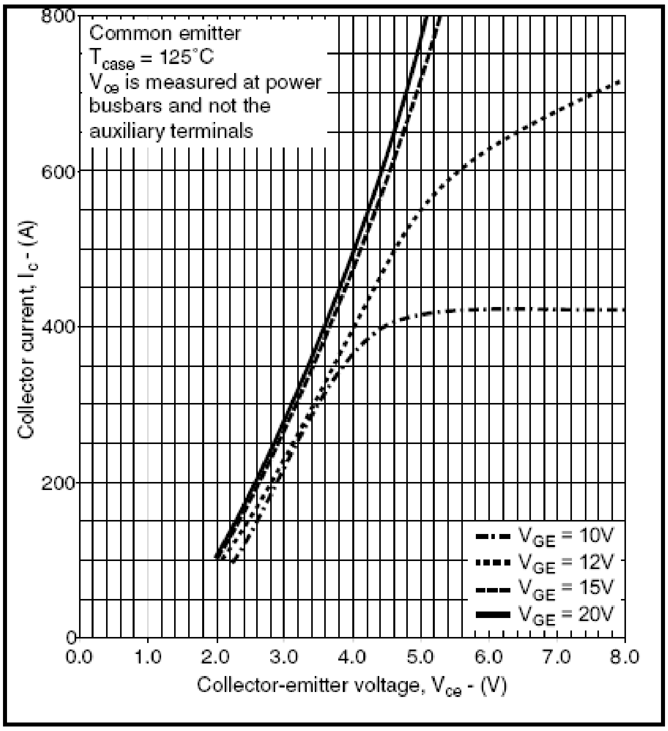


Fig.4 Typical output characteristics

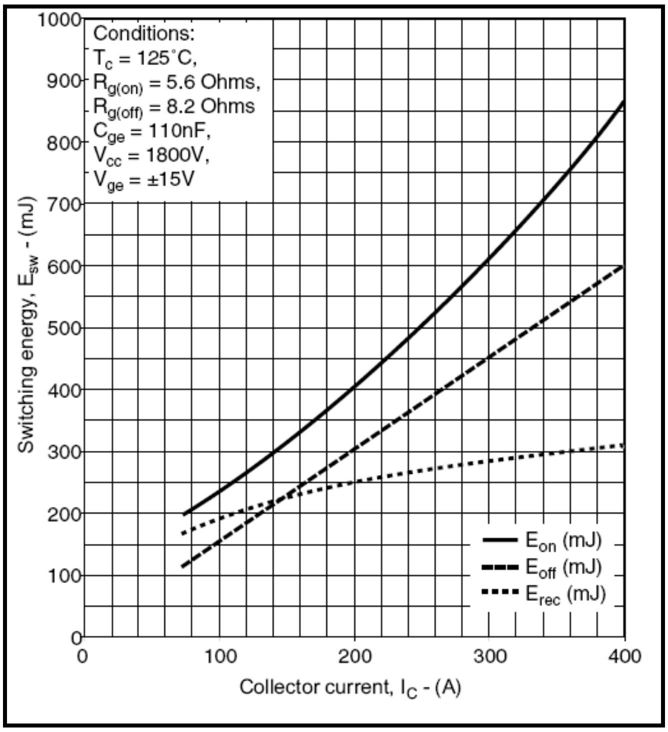


Fig.5 Typical switching energy vs collector current

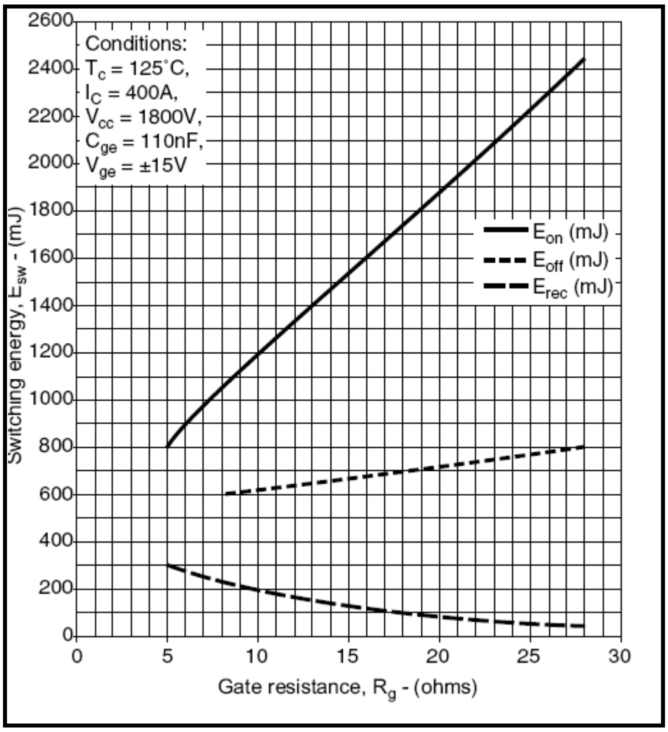


Fig.6 Typical switching energy vs gate resistance

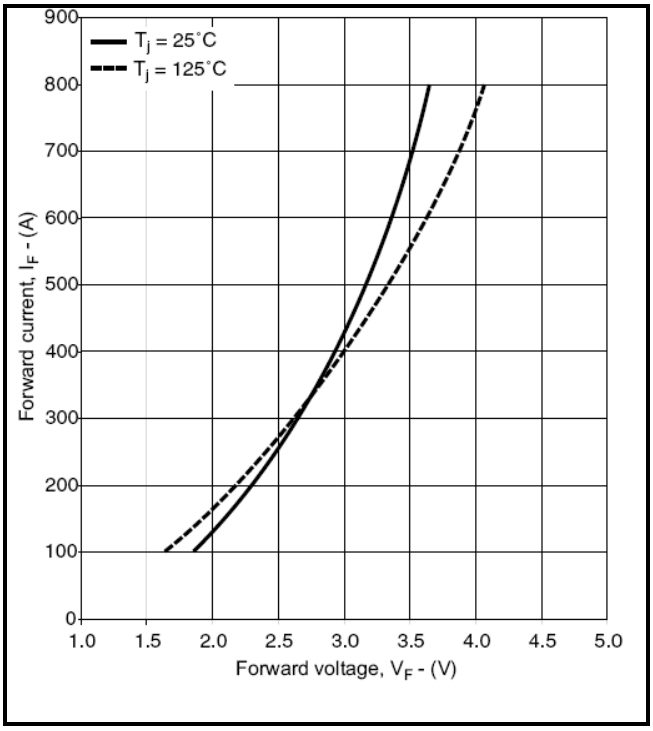


Fig.7 Diode typical forward characteristics

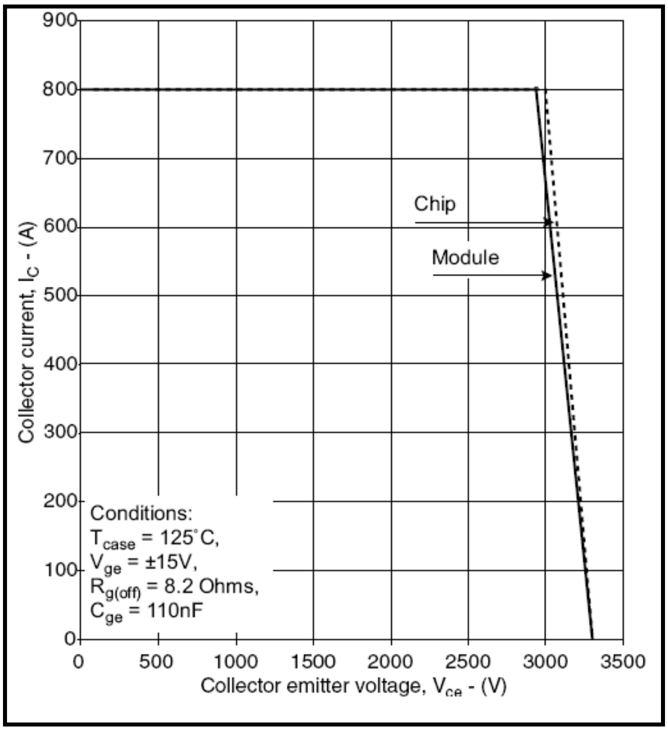


Fig.8 Reverse bias safe operating area

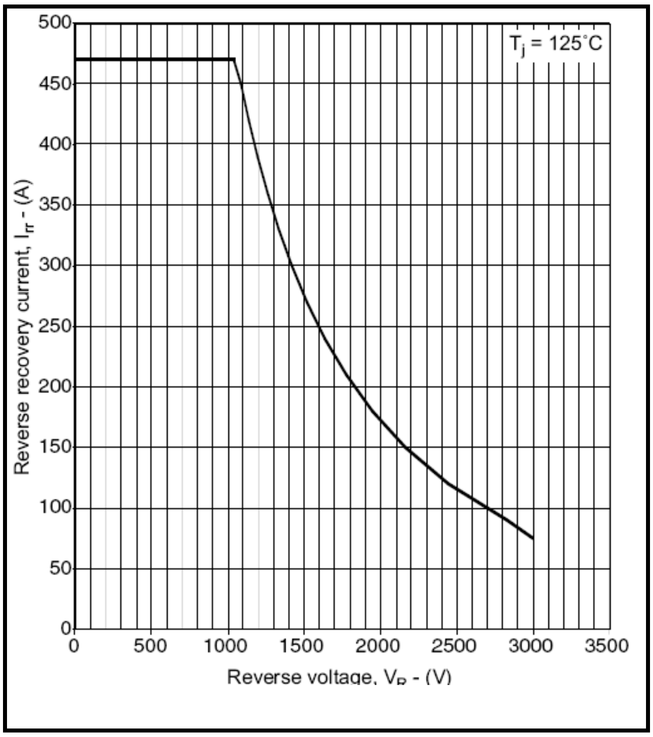
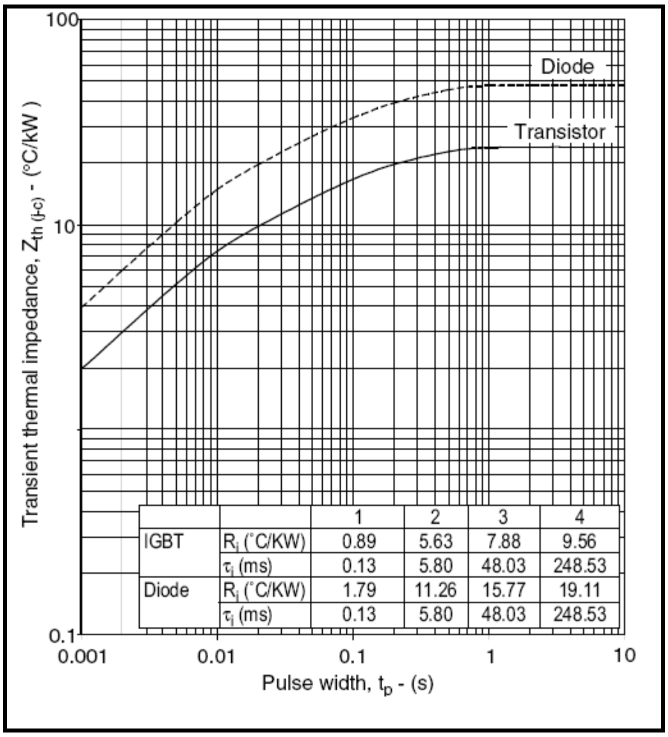


Fig.9 Diode reverse bias safe operating area

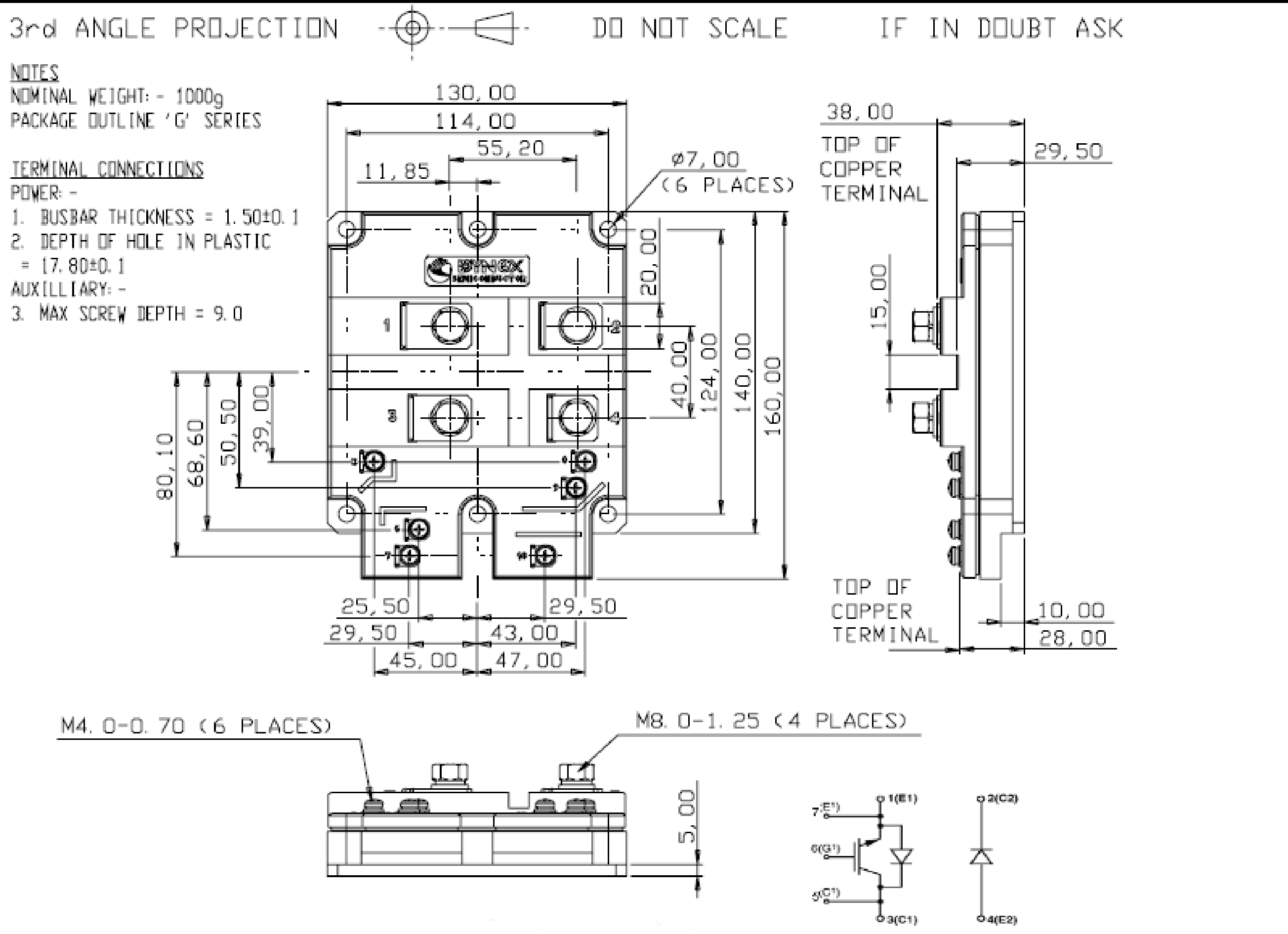


		1	2	3	4
IGBT	R_i (˚C/KW)	0.89	5.63	7.88	9.56
	τ_i (ms)	0.13	5.80	48.03	248.53
Diode	R_i (˚C/KW)	1.79	11.26	15.77	19.11
	τ_i (ms)	0.13	5.80	48.03	248.53

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: 1050 gms

Module outline type code: G

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 offers 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 which 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 Services.

http://www.dynexsemi.com

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Dynex Semiconductor annotate datasheets in the top right hand corner of the front page, to indicate product status. The annotations are as follows:-

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.