DIM600NSM45-F000

Single Switch IGBT Module

DS5873-1.2 August 2006 (LN24760)

FEATURES

- 10µs Short Circuit Withstand
- Soft Punch Through Silicon
- Lead Free construction
- Isolated MMC Base with AlN Substrates
- High Thermal Cycling Capability

APPLICATIONS

- High Reliability Inverters
- Motor Controllers
- Traction Drives
- Choppers

The Powerline range of high power modules includes half bridge, chopper, dual, single and bi-directional switch configurations covering voltages from 600V to 6500V and currents up to 3600A.

The DIM600NSM45-F000 is a single switch 4500V, soft punch through n-channel enhancement mode, insulated gate bipolar transistor (IGBT) module. The IGBT has a wide reverse bias safe operating area (RBSOA) plus 10us 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:

DIM600NSM45-F000

Note: When ordering, please use the complete part number

KEY PARAMETERS

V_{CES}		**4500V**
$V_{CE(sat)}$ *	**(typ)**	**2.9 V**
I_C	**(max)**	**600A**
$I_{C(PK)}$	**(max)**	**1200A**

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

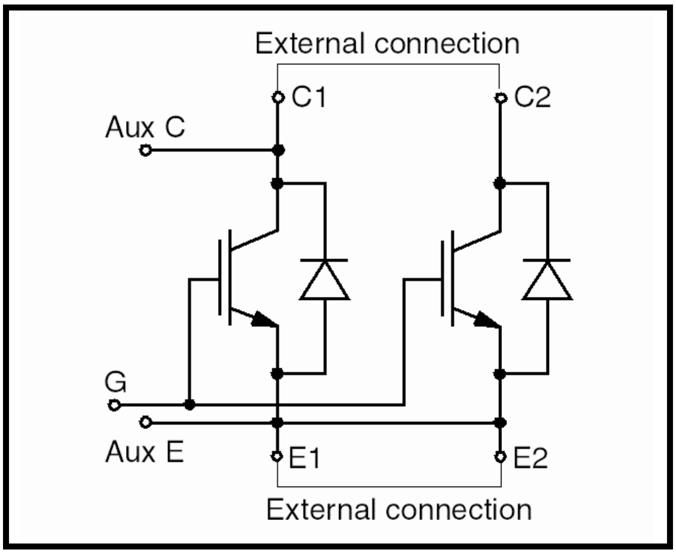
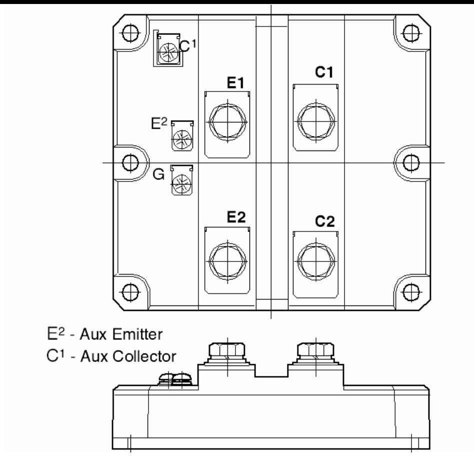


Fig. 1 Single switch circuit diagram



Outline type code: N

(See package details for further information)

Fig. 2 Electrical connections - (not to scale)

ABSOLUTE MAXIMUM RATINGS

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℃ unless stated otherwise

Symbol	Parameter	Test Conditions	Max.	Units
V_{CES}	Collector-emitter voltage	V_{GE} =0V	4500	V
V_{GES}	Gate-emitter voltage		±20	V
I_C	Continuous collector current	T_{case} =100 ℃	600	A
$I_{C(PK)}$	Peak collector current	1ms, T_{case}=115 ℃	1200	A
P_{max}	Max.transistor power dissipation	T_{case} =25 ℃, T_j =150 ℃	10.4	kW
V_{isol}	Isolation voltage-per module	Commoned terminals to base plate. AC RMS,1 min,50Hz	6000	kV
Q_{PD}	Partial discharge-per module	IEC1287.V_1 =3750V, V_2 =2750V, 50Hz RMS	10	pC

THERMAL AND MECHANICAL RATINGS

Internal insulation material: AlN

Baseplate material: AlSiC

Creepage distance: 29mm

Clearance: 20mm

CTI (Critical Tracking Index) 175

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$R_{th(j-c)}$	Thermal resistance -transistor (per switch)	Continuous dissipation - junction to case		-	12	℃/kW
$R_{th(j-c)}$	Thermal resistance -diode (per switch)	Continuous dissipation - junction to case		-	24	℃/kW
$R_{th(c-h)}$	Thermal resistance -case to heatsink (per module)	Mounting torque 5Nm (with mounting grease)		-	8	℃/kW
T_j	Junction temperature	Transistor	-	-	150	℃
		Diode	-	-	125	℃
T_{stg}	Storage temperature range	-	-40	-	125	℃
	Screw torque	Mounting M6	-	-	5	Nm
		Electrical connections - M4	-	-	2	Nm
		Electrical connections - M8	-	-	10	Nm

 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
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			60	mA
I_{GES}	Gate leakage current	V_{GE} = 20V, V_{CE} =0V			8	uA
$V_{GE(TH)}$	Gate threshold voltage	I_C =80mA, V_{GE} = V_{CE}	5.5	6.5	7.0	V
$V_{CE(sat)}$ †	Collector-emitter saturation voltage	V_{GE} =15V, I_C =600A		2.9		V
		V_{GE} =15V, I_C =600A, T_{VJ} =125 °C		3.5		V
I_F	Diode forward current	DC			600	A
I_{FM}	Diode maximum forward current	t_p =1ms			1200	A
V_F	Diode forward voltage	I_F =600A		3.0		V
		I_F =600A, T_{VJ} =125 °C		3.1		V
C_{ies}	Input capacitance	V_{CE} =25V, V_{GE} =0V, f =1MHz		132		nF
C_{res}	Reverse transfer capacitance	V_{CE} =25V, V_{GE} =0V, f =1MHz		1.8		nF
L_M	Module inductance			15		nH
R_{INT}	Internal transistor resistance			135		μΩ
SC_{Data}	Short circuit. I SC	T_j ≤125 °C, V_{CC} ≤3000V, I_1		2800		A
		t_p =10 us, I_2 $V_{CE(max)}$ = V_{CES} – L*.di/dt IEC 60747-9		2500		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 =600A		5.0		us
t_f	Fall time	V_{GE} =±15V		250		ns
E_{OFF}	Turn-off energy loss	V_{CE} =2250V		1500		mJ
$t_{d(on)}$	Turn-on delay time	$R_{G(ON)}$ =4.7Ω $R_{G(OFF)}$=11Ω		850		ns
t_r	Rise time	C_{ge} =110nF		220		ns
E_{ON}	Turn-on energy loss	L ~200nH		1800		mJ
Q_g	Gate charge			20		uC
Q_{rr}	Diode reverse recovery charge	I_F =600A,V_{CE} =2250V,		475		uC
I_{rr}	Diode reverse recovery current	dI_F/dt =3000A/us		700		A
E_{rec}	Diode reverse recovery energy			600		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 =600A		5.2		us
t_f	Fall time	V_{GE} =±15V		250		ns
E_{OFF}	Turn-off energy loss	V_{CE} =2250V		1700		mJ
$t_{d(on)}$	Turn-on delay time	$R_{G(ON)}$ =4.7Ω $R_{G(OFF)}$=11Ω		800		ns
t_r	Rise time	C_{ge} =110nF		220		ns
E_{ON}	Turn-on energy loss	L ~200nH		2700		mJ
Q_{rr}	Diode reverse recovery charge	I_F =600A,V_{CE} =2250V,		850		uC
I_{rr}	Diode reverse recovery current	dI_F/dt =3000A/us		820		A
E_{rec}	Diode reverse recovery energy			1050		mJ

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

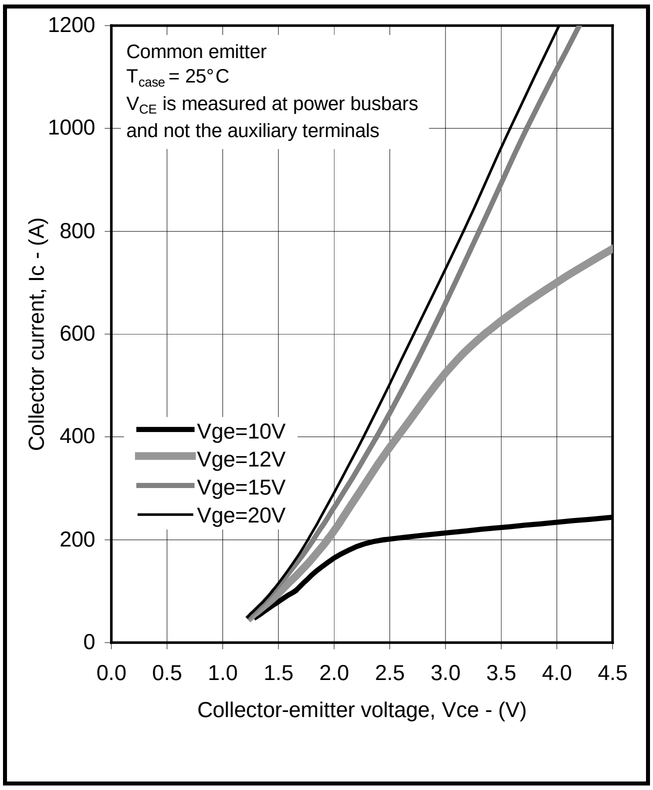


Fig. 3 Typical output characteristics

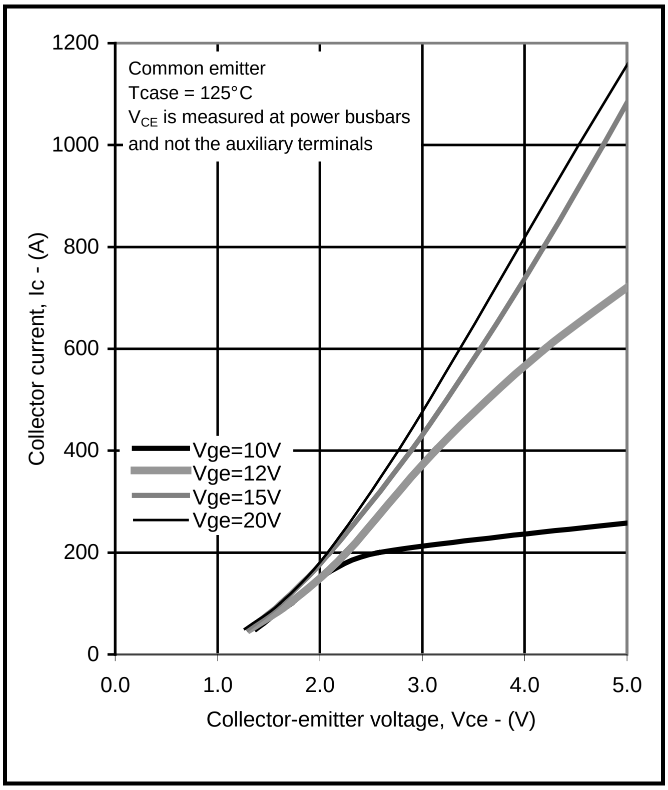


Fig. 4 Typical output characteristics

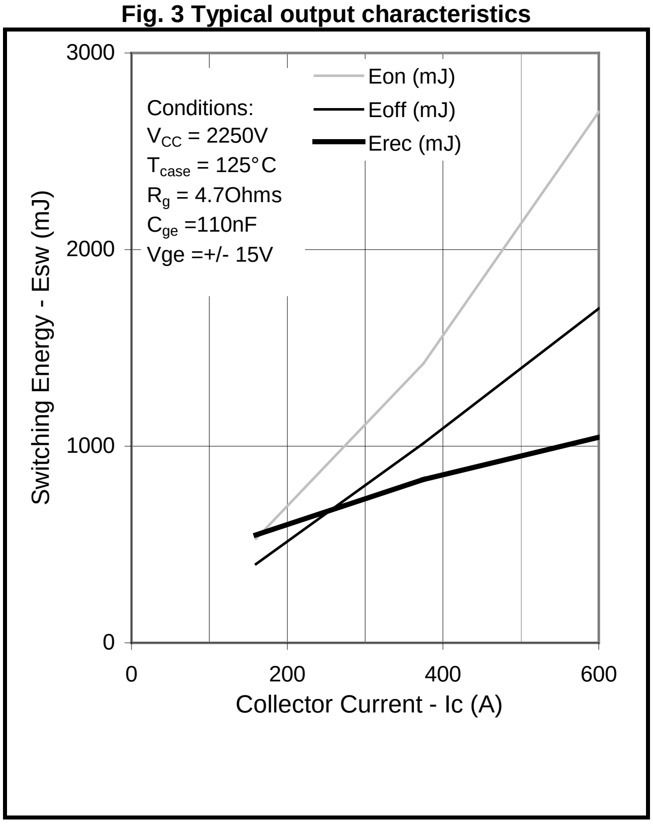


Fig.5 Typical switching energy vs collector current

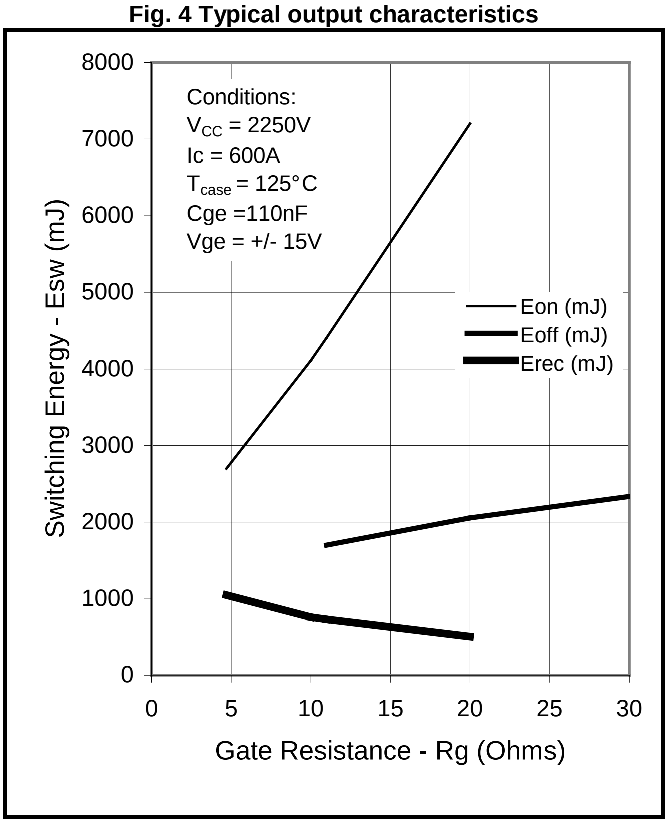


Fig. 6 Typical switching energy vs gate resistance

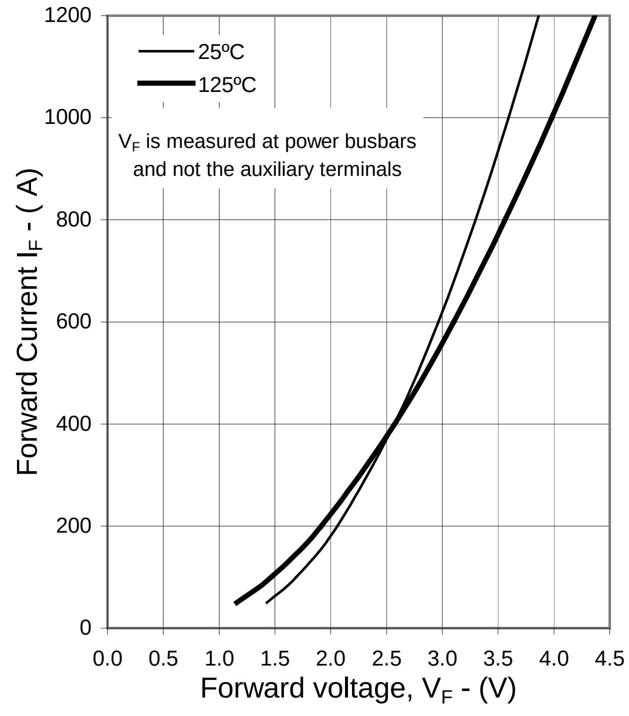


Fig. 7 Diode typical forward characteristics

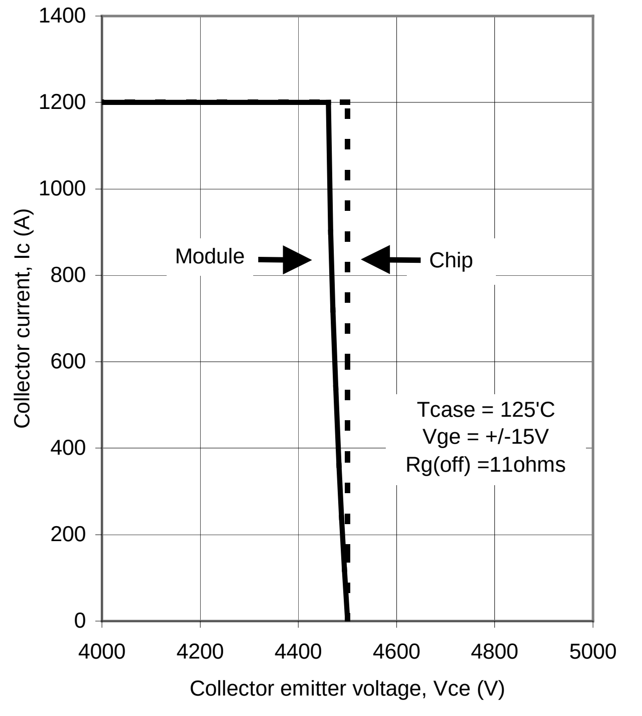


Fig. 8 Reverse bias safe operating area

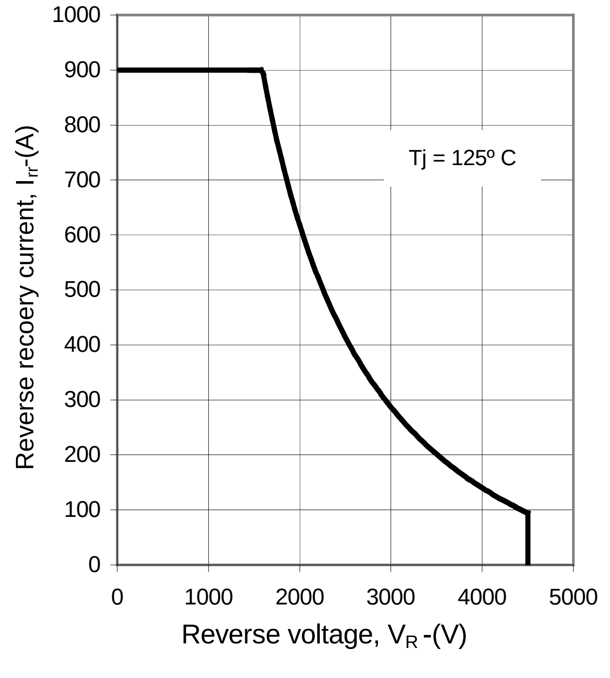
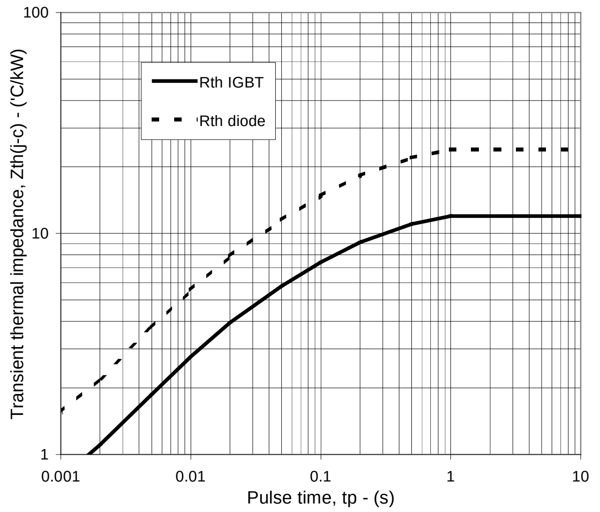


Fig. 9 Diode reverse bias safe operating area



		1	2	3	4
IGBT	Ri (℃/kW)	0.46	2.10	3.64	5.86
	t_i (ms)	0.17	8.08	51.92	280.5
Diode	Ri (℃/kW)	0.90	4.22	7.28	11.71
	t_i (ms)	0.17	8.08	51.92	280.5

Fig. 10 Transient thermal impedance

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

PACKAGE DETAILS

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

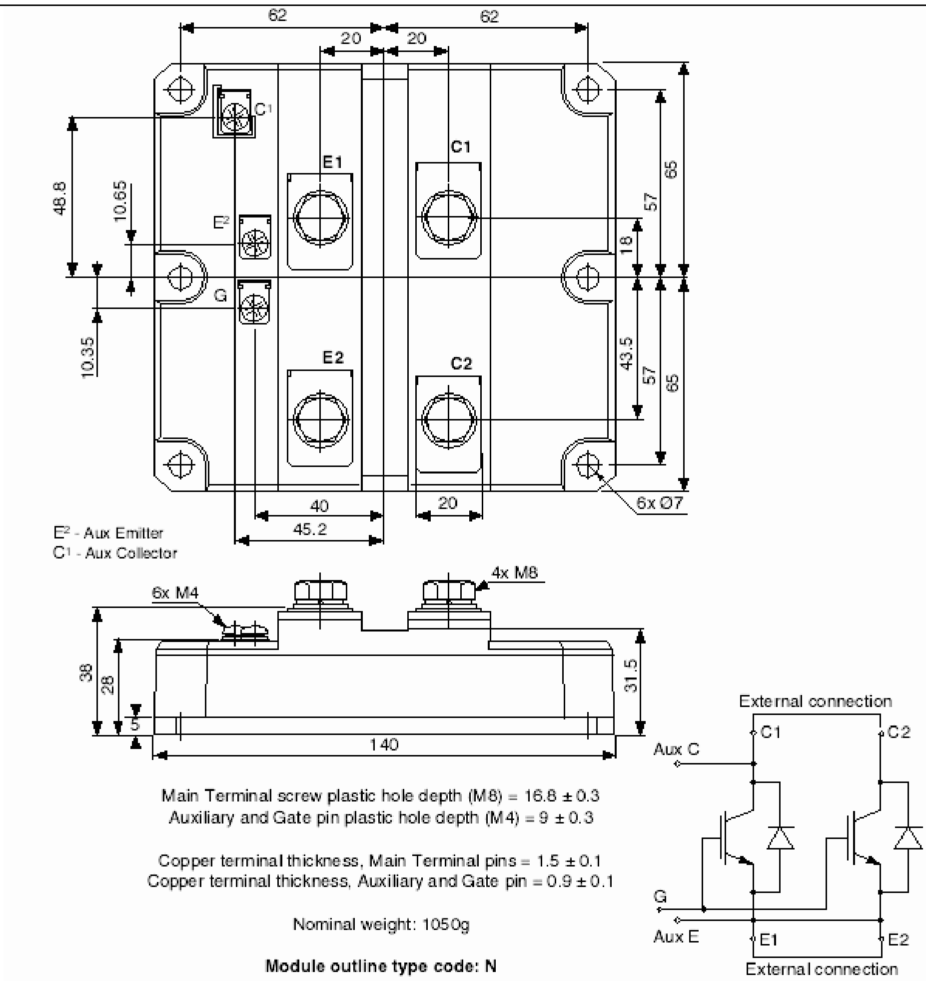


Fig. 11 Module outline drawing

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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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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