SEMICONDUCTOR

GP2400ESM18

Hi-Reliability Single Switch IGBT Module

DS5406-1.1 January 2001

FEATURES

- High Thermal Cycling Capability
- Non Punch Through Silicon
- Isolated MMC Base with AlN Substrates
- 2400A Per Module

KEY PARAMETERS

V_{CES}		1800V
$V_{CE(sat)}$	(typ)	3.5V
I_C	(max)	2400A
$I_{C(PK)}$	(max)	4800A

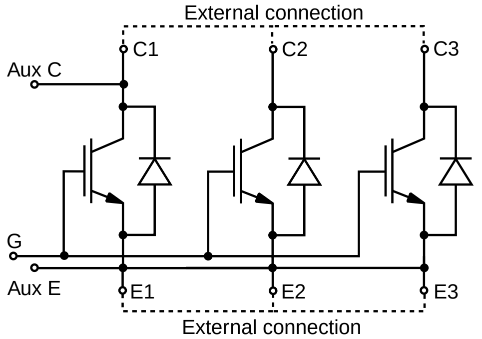


Fig. 1 Single switch circuit diagram

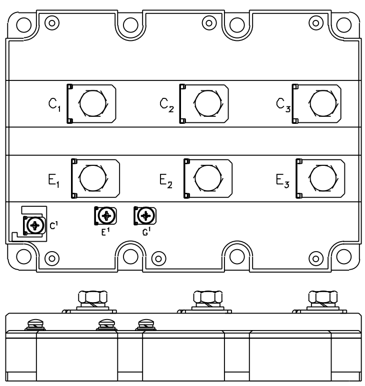
APPLICATIONS

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

The powerline range of high power modules includes dual and single switch configurations covering voltages from 600V to 3300V and currents up to 4800A.

The GP2400ESM18 is a single switch 1800V, 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.



Outline type code: E

(See package details for further information)

Fig. 2 Electrical connections - (not to scale)

ORDERING INFORMATION

Order As:

GP2400ESM18

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

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

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˚C unless stated otherwise

Symbol	Parameter	Test Conditions	Max.	Units
V_{CES}	Collector-emitter voltage	V_{GE} = 0V	1800	V
V_{GES}	Gate-emitter voltage	-	±20	V
I_C	Continuous collector current	T_{case} = 65˚C	2400	A
$I_{C(PK)}$	Peak collector current	1ms, T_{case} = 110˚C	4800	A
P_{max}	Max. transistor power dissipation	T_{case} = 25˚C, T_{vj} = 150˚C	20.8	kW
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	Continuous dissipation - junction to case	-	6	˚C/kW
$R_{th(j-c)}$	Thermal resistance - diode	Continuous dissipation - junction to case	-	14	˚C/kW
$R_{th(c-h)}$	Thermal resistance - case to heatsink (per module)	Mounting torque 5Nm (with mounting grease)	-	6	˚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}	-	-	3	mA
		V_{GE} = 0V, V_{CE} = V_{CES}, T_{case} = 125˚C	-	-	100	mA
I_{GES}	Gate leakage current	V_{GE} = ±20V, V_{CE} = 0V	-	-	12	µA
$V_{GE(TH)}$	Gate threshold voltage	I_C = 120mA, V_{GE} = V_{CE}	4.5	5.5	6.5	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 2400A	-	3.5	4	V
		V_{GE} = 15V, I_C = 2400A, T_{case} = 125˚C	-	4.3	5	V
I_F	Diode forward current	DC, T_{vj} = 125˚C	-	-	2400	A
I_{FM}	Diode maximum forward current	t_p = 1ms	-	-	4800	A
V_F	Diode forward voltage	I_F = 2400A	-	2.2	2.5	V
		I_F = 2400A, T_{case} = 125˚C	-	2.3	2.6	V
C_{ies}	Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz	-	270	-	nF
L_M	Module inductance	-	-	10	-	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 = 2400A	-	2050	2300	ns
t_f	Fall time	V_{GE} = ±15V	-	250	350	ns
E_{OFF}	Turn-off energy loss	V_{CE} = 900V	-	1100	1350	mJ
$t_{d(on)}$	Turn-on delay time	$R_{G(ON)} = R_{G(OFF)} = 2.2\Omega$	-	500	750	ns
t_r	Rise time	L ~ 50nH	-	400	600	ns
E_{ON}	Turn-on energy loss		-	850	1000	mJ
Q_{rr}	Diode reverse recovery charge	I_F = 2400A, V_R = 50% V_{CES},	-	500	650	µC
I_{rr}	Diode reverse current	dI_F/dt = 6000A/µs	-	1000	-	A
E_{REC}	Diode reverse recovery energy		-	350	-	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 = 2400A	-	2250	2600	ns
t_f	Fall time	V_{GE} = ±15V	-	250	350	ns
E_{OFF}	Turn-off energy loss	V_{CE} = 900V	-	1350	1650	mJ
$t_{d(on)}$	Turn-on delay time	$R_{G(ON)} = R_{G(OFF)} = 2.2\Omega$	-	600	850	ns
t_r	Rise time	L ~ 50nH	-	450	700	ns
E_{ON}	Turn-on energy loss		-	1300	1500	mJ
Q_{rr}	Diode reverse recovery charge	I_F = 2400A, V_R = 50% V_{CES},	-	850	1000	µC
I_{rr}	Diode reverse current	dI_F/dt = 5000A/µs	-	1200	-	A
E_{REC}	Diode reverse recovery energy		-	500	-	mJ

TYPICAL CHARACTERISTICS

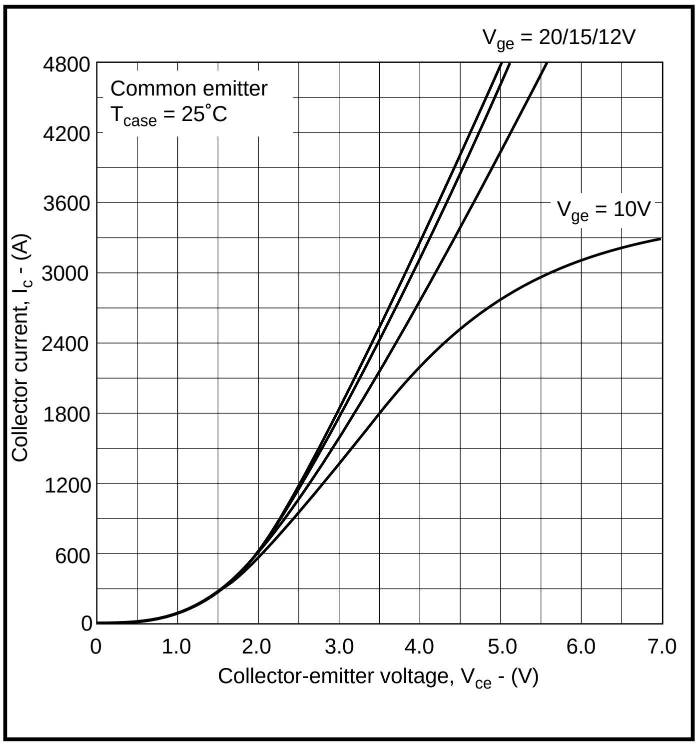

Fig. 3 Typical output characteristics

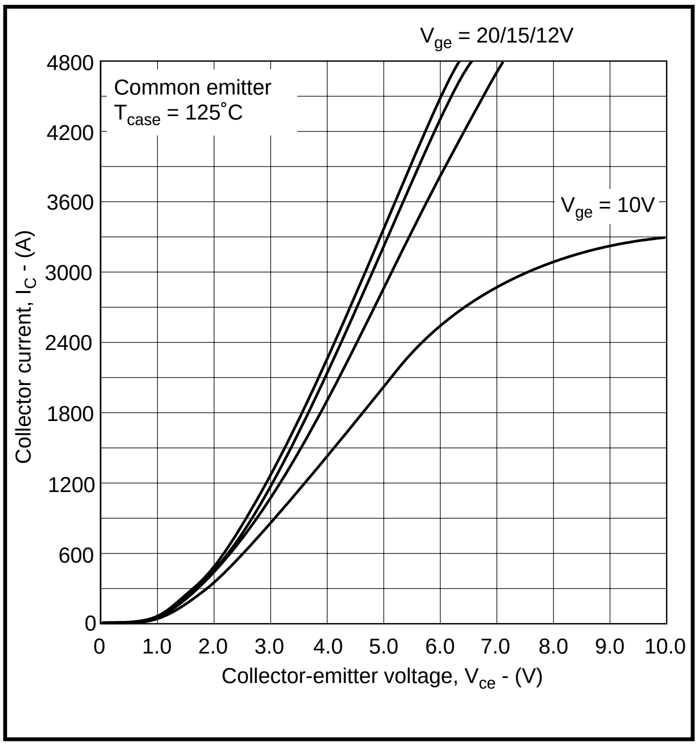

Fig. 4 Typical output characteristics

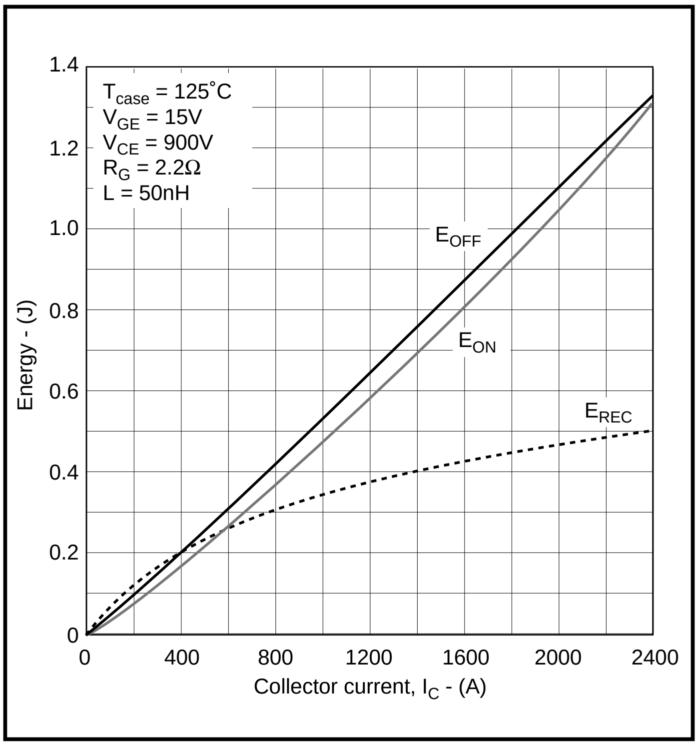

Fig. 5 Typical switching energy vs collector current

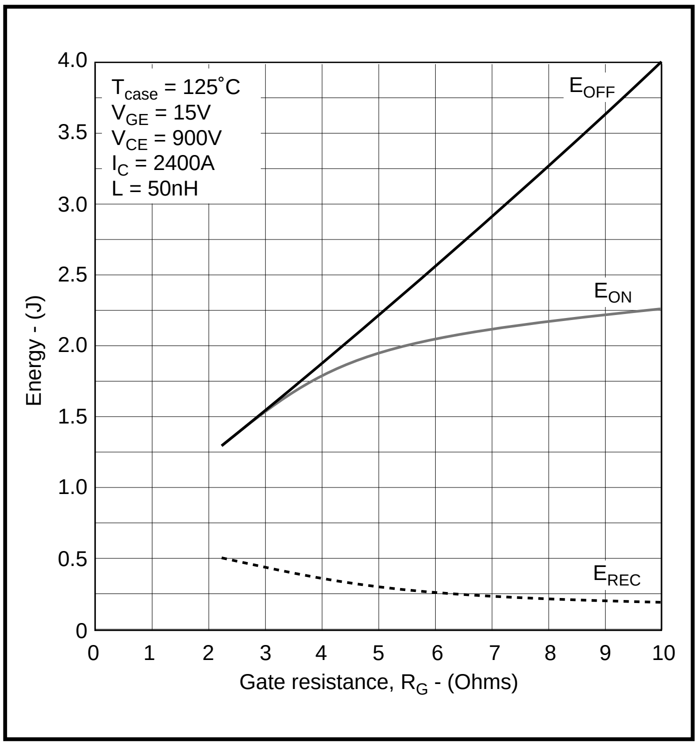

Fig. 6 Typical switching energy vs gate resistance

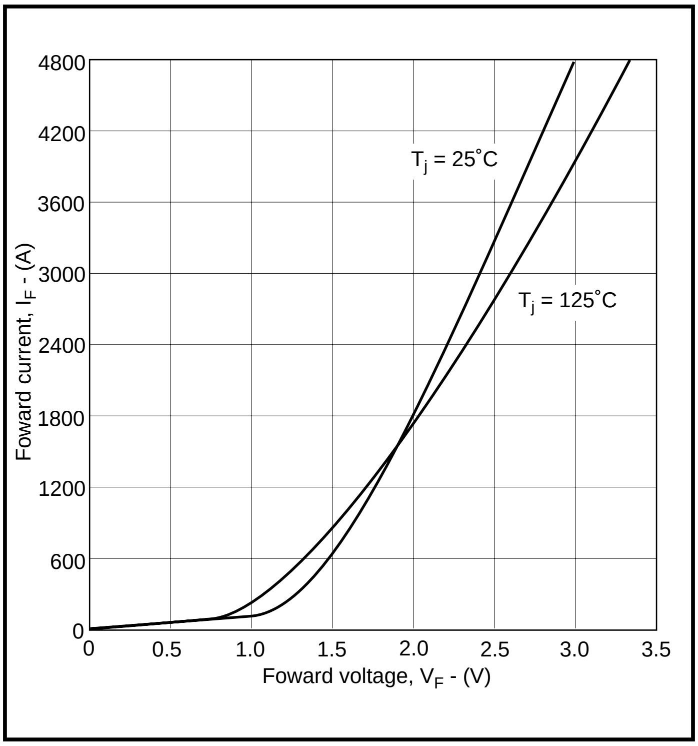

Fig. 7 Diode typical forward characteristics

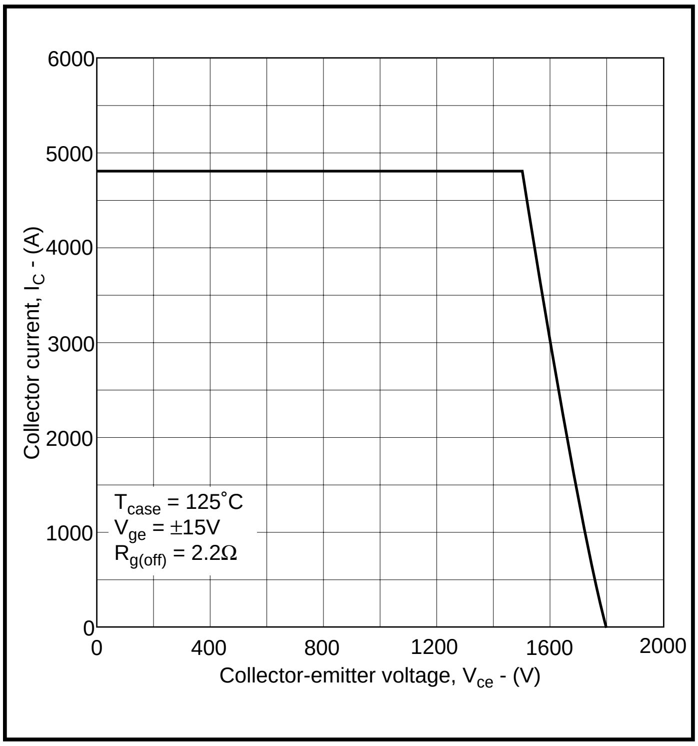

Fig. 8 Reverse bias safe operating area

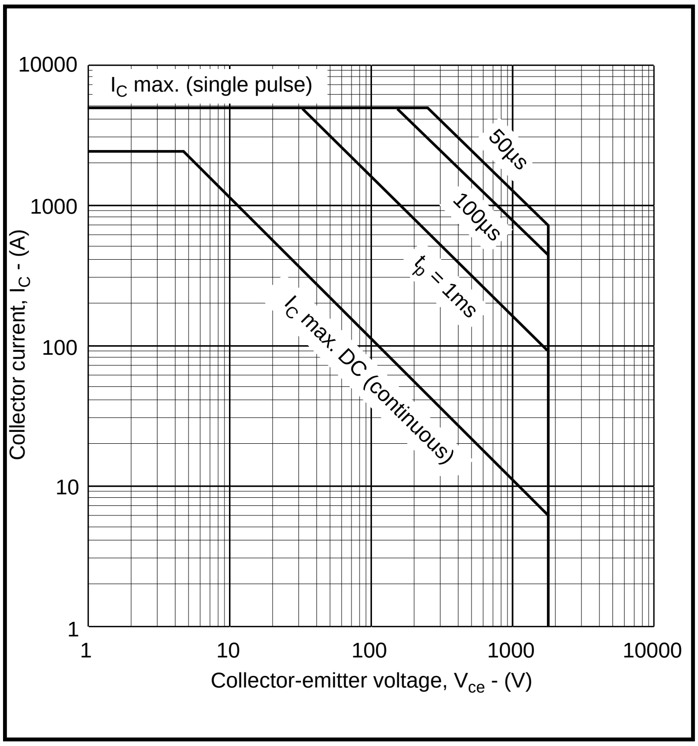

Fig. 9 Forward bias safe operating area

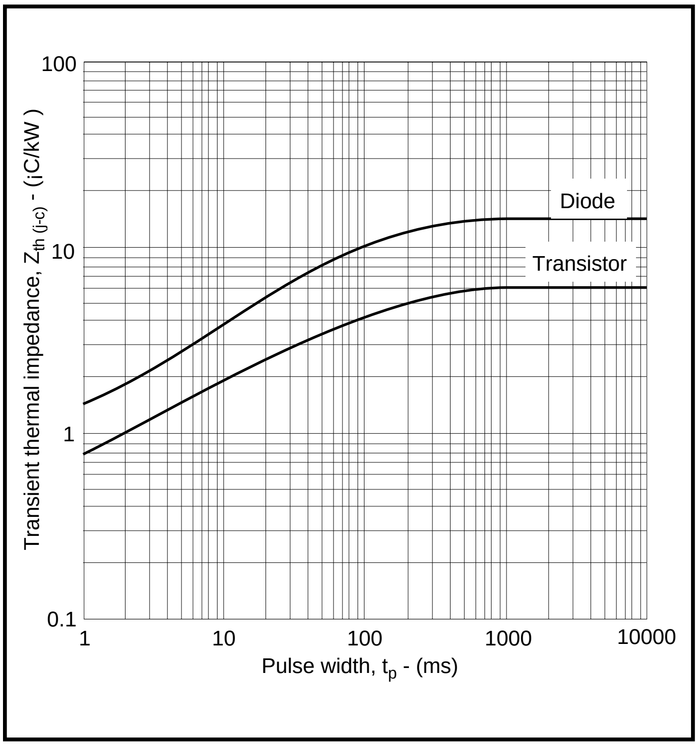

Fig. 10 Transient thermal impedance

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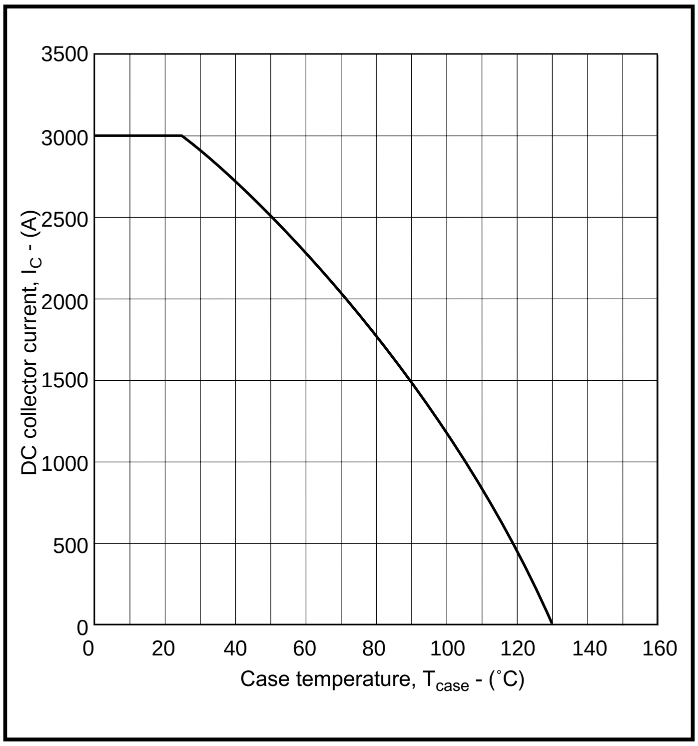
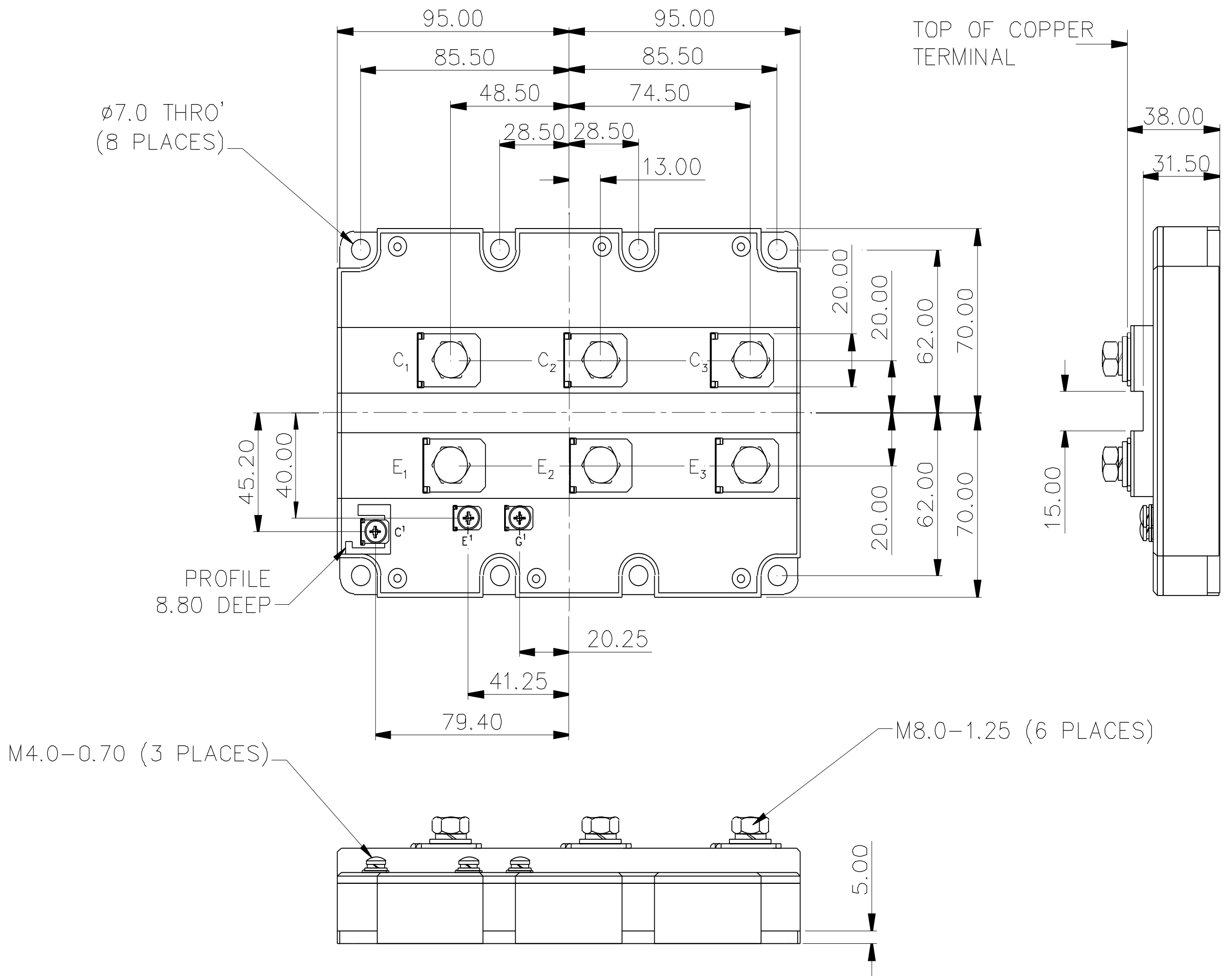


Fig. 11 DC current rating vs case temperature

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.



TERMINAL CONNECTIONS
POWER: –
1. BUSBAR THICKNESS = 1.50±0.1
2. DEPTH OF HOLE IN PLASTIC = 16.80±0.1
AUXILLIARY: –
3. MAX SCREW DEPTH = 8.0

Nominal weight: 1700g

Module outline type code: E

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ASSOCIATED PUBLICATIONS

Title	Application Note Number
Electrostatic handling precautions	AN4502
An introduction to IGBTs	AN4503
IGBT ratings and characteristics	AN4504
Heatsink requirements for IGBT modules	AN4505
Calculating the junction temperature of power semiconductors	AN4506
Gate drive considerations to maximise IGBT efficiency	AN4507
Parallel operation of IGBTs – punch through vs non-punch through characteristics	AN4508
Guidance notes for formulating technical enquiries	AN4869
Principle of rating parallel connected IGBT modules	AN5000
Short circuit withstand capability in IGBTs	AN5167
Driving Dynex Semincoductor IGBT modules with Concept gate drivers	AN5384

POWER ASSEMBLY CAPABILITY

The Power Assembly group provides support for those customers requiring more than the basic semiconductor switch. Using CAD design tools the group has developed a flexible range of heatsink / clamping systems in line with advances in device types and the voltage and current capability of Dynex semiconductors.

An extensive range of air and liquid cooled assemblies is available covering the range of circuit designs in general use today.

HEATSINKS

The Power Assembly group has a proprietary range of extruded aluminium heatsinks. These were 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.

http://www.dynexsemi.com

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Datasheet Annotations:

Dynex Semiconductor annotate datasheets in the top right hard 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.

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