



GP400DDM12

Dual Switch IGBT Module

Advance Information

DS5503-1.0 October 2001

FEATURES

- High Thermal Cycling Capability
- 400A Per Switch
- Non Punch Through Silicon
- Isolated MMC Base with AlN Substrates

APPLICATIONS

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

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

The GP400DDM12 is a dual switch 1200V, 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.

ORDERING INFORMATION

Order As:

GP400DDM12

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

KEY PARAMETERS

V_{CES}		1200V
$V_{CE(sat)}$	(typ)	2.7V
I_C	(max)	400A
$I_{C(PK)}$	(max)	800A

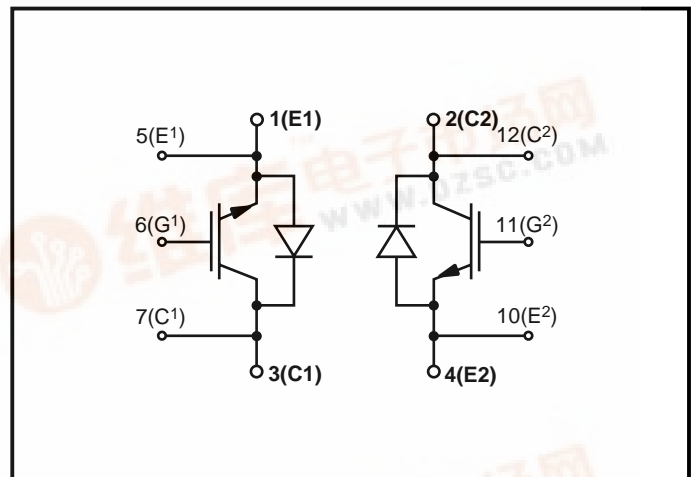


Fig. 1 Dual switch circuit diagram

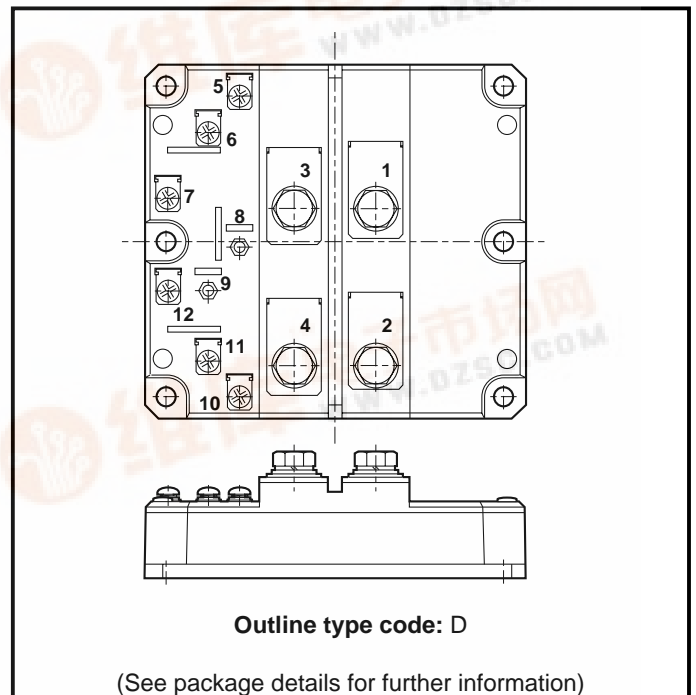


Fig. 2 Electrical connections - (not to scale)

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.

$T_{case} = 25^{\circ}\text{C}$ unless stated otherwise

Symbol	Parameter	Test Conditions	Max.	Units
V_{CES}	Collector-emitter voltage	$V_{GE} = 0\text{V}$	1200	V
V_{GES}	Gate-emitter voltage	-	± 20	V
I_C	Continuous collector current	$T_{case} = 80^{\circ}\text{C}$	400	A
$I_{C(PK)}$	Peak collector current	1ms, $T_{case} = 105^{\circ}\text{C}$	800	A
P_{max}	Max. transistor power dissipation	$T_{case} = 25^{\circ}\text{C}$, $T_j = 150^{\circ}\text{C}$	3470	W
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 (per arm)	Continuous dissipation - junction to case	-	36	$^{\circ}\text{C/kW}$
$R_{th(j-d)}$	Thermal resistance - diode (per arm)	Continuous dissipation - junction to case	-	80	$^{\circ}\text{C/kW}$
$R_{th(c-h)}$	Thermal resistance - case to heatsink (per module)	Mounting torque 5Nm (with mounting grease)	-	8	$^{\circ}\text{C/kW}$
T_j	Junction temperature	Transistor	-	150	$^{\circ}\text{C}$
		Diode	-	125	$^{\circ}\text{C}$
T_{stg}	Storage temperature range	-	-40	125	$^{\circ}\text{C}$
-	Screw torque	Mounting - M6	-	5	Nm
		Electrical connections - M4	-	2	Nm
		Electrical connections - M8	-	10	Nm

ELECTRICAL CHARACTERISTICS

$T_{case} = 25^{\circ}\text{C}$ 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
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{case} = 125^{\circ}\text{C}$	-	-	20	mA
I_{GES}	Gate leakage current	$V_{GE} = \pm 20V, V_{CE} = 0V$	-	-	± 2	μA
$V_{GE(TH)}$	Gate threshold voltage	$I_C = 120\text{mA}, V_{GE} = V_{CE}$	4.5	5.5	7.5	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15V, I_C = 800\text{A}$	-	2.7	3.5	V
		$V_{GE} = 15V, I_C = 800\text{A}, T_{case} = 125^{\circ}\text{C}$	-	3.2	4	V
I_F	Diode forward current	DC, $T_{case} = 50^{\circ}\text{C}$	-	-	400	A
I_{FM}	Diode maximum forward current	$t_p = 1\text{ms}$	-	-	800	A
V_F	Diode forward voltage	$I_F = 800\text{A}$	-	2.2	2.5	V
		$I_F = 800\text{A}, T_{case} = 125^{\circ}\text{C}$	-	2.3	2.5	V
C_{ies}	Input capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 1\text{MHz}$	-	45	-	nF
L_M	Module inductance	-	-	20	-	nH

ELECTRICAL CHARACTERISTICS

 $T_{\text{case}} = 25^{\circ}\text{C}$ unless stated otherwise

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(\text{off})}$	Turn-off delay time	$I_C = 400\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 600\text{V}$ $R_{G(\text{ON})} = R_{G(\text{OFF})} = 4.7\Omega$ $L \sim 100\text{nH}$	-	800	-	ns
t_f	Fall time		-	110	-	ns
E_{OFF}	Turn-off energy loss		-	65	-	mJ
$t_{d(\text{on})}$	Turn-on delay time		-	700	-	ns
t_r	Rise time		-	170	-	ns
E_{ON}	Turn-on energy loss		-	45	-	mJ
Q_{rr}	Diode reverse recovery charge	$I_F = 400\text{A}, V_R = 50\% V_{CES},$ $dI_F/dt = 2000\text{A}/\mu\text{s}$	-	30	-	μC

 $T_{\text{case}} = 125^{\circ}\text{C}$ unless stated otherwise

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(\text{off})}$	Turn-off delay time	$I_C = 400\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 600\text{V}$ $R_{G(\text{ON})} = R_{G(\text{OFF})} = 4.7\Omega$ $L \sim 100\text{nH}$	-	1000	-	ns
t_f	Fall time		-	150	-	ns
E_{OFF}	Turn-off energy loss		-	80	-	mJ
$t_{d(\text{on})}$	Turn-on delay time		-	800	-	ns
t_r	Rise time		-	300	-	ns
E_{ON}	Turn-on energy loss		-	75	-	mJ
Q_{rr}	Diode reverse recovery charge	$I_F = 400\text{A}, V_R = 50\% V_{CES},$ $dI_F/dt = 2000\text{A}/\mu\text{s}$	-	65	-	μC

TYPICAL CHARACTERISTICS

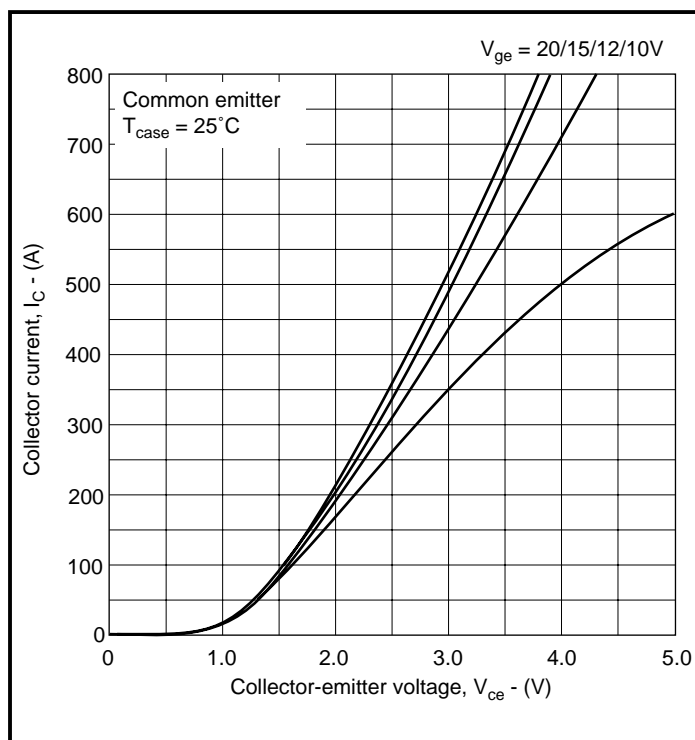


Fig. 3 Typical output characteristics

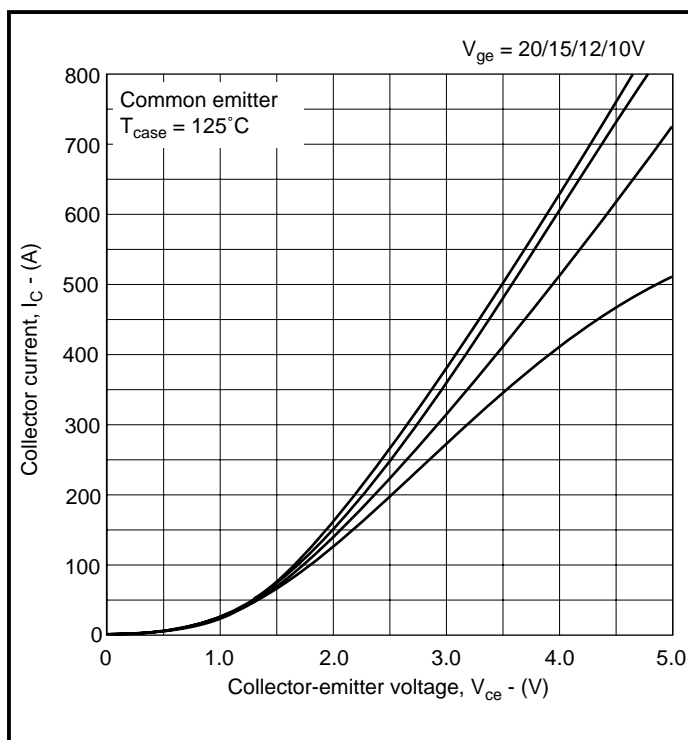


Fig. 4 Typical output characteristics

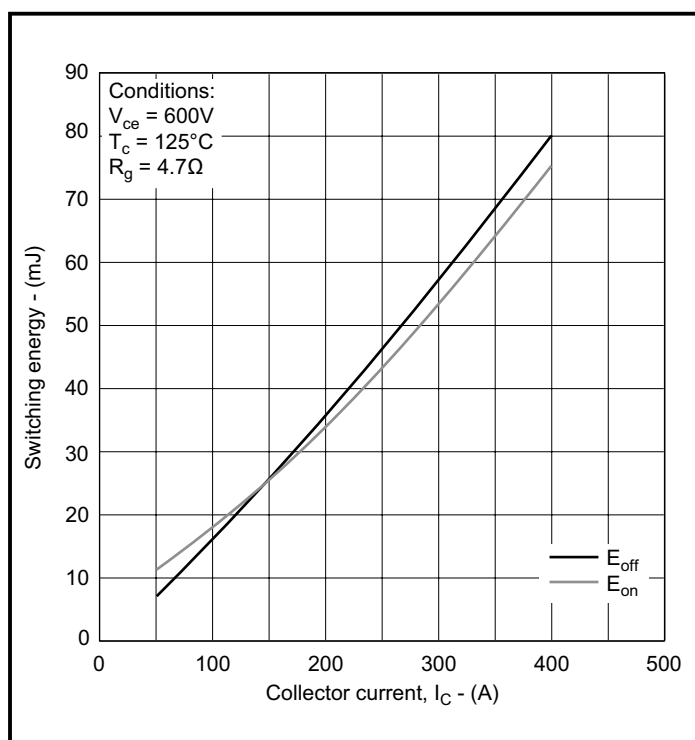


Fig. 5 Typical switching energy vs collector current

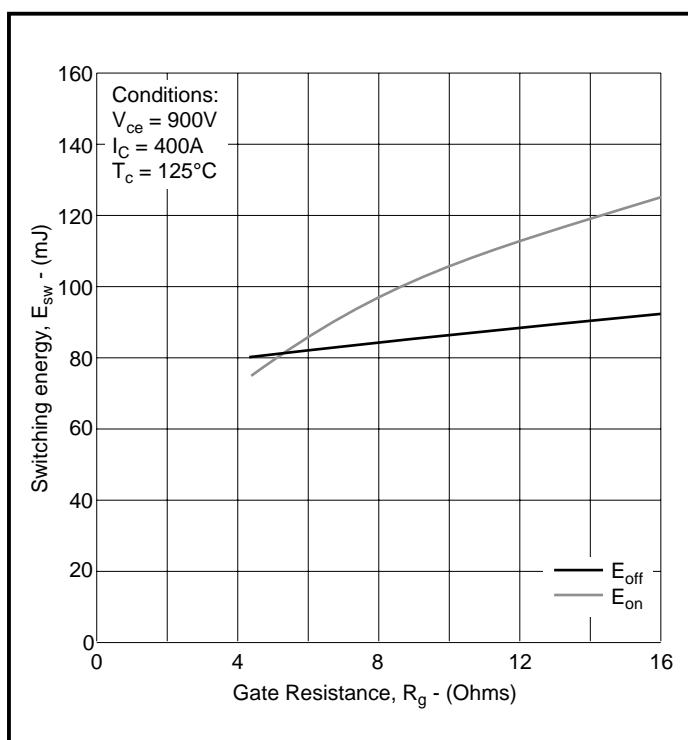


Fig. 6 Typical switching energy vs gate resistance

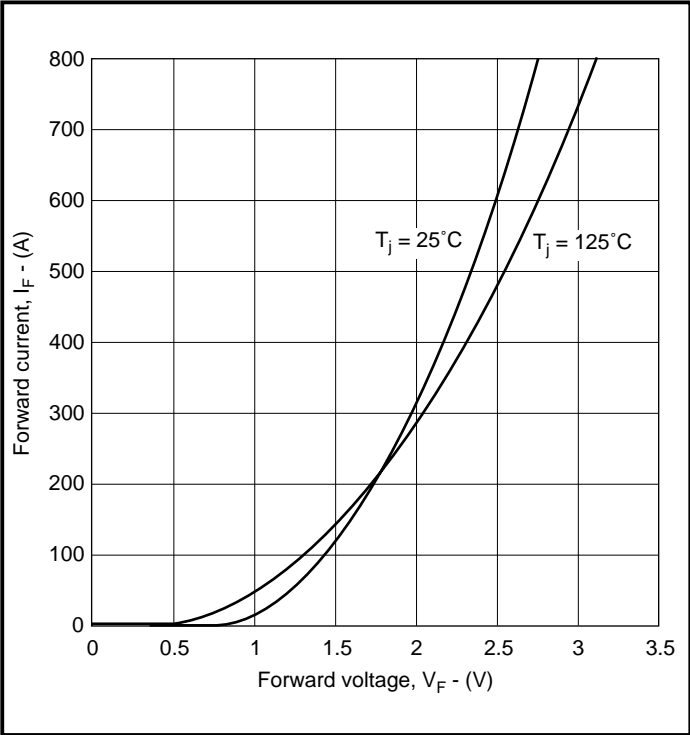


Fig.7 Diode typical forward characteristics

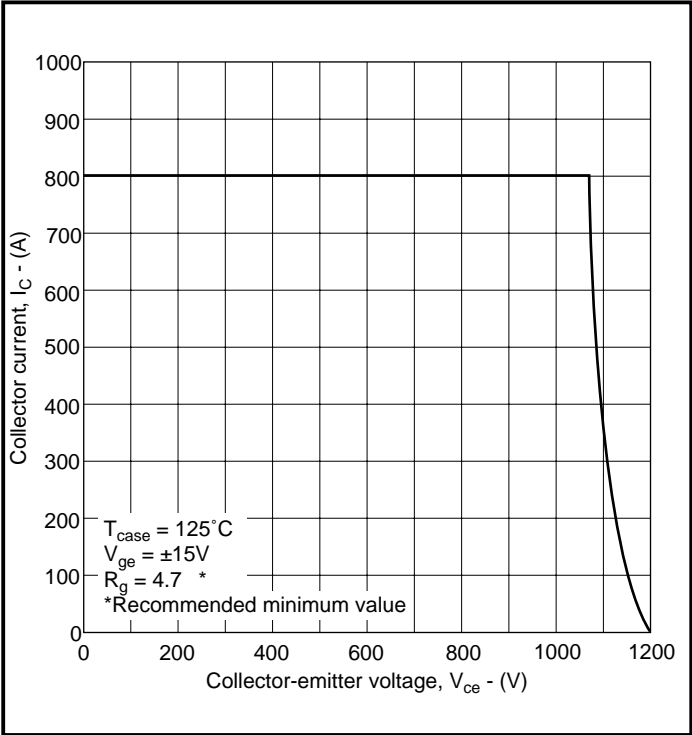


Fig.8 Reverse bias safe operating area

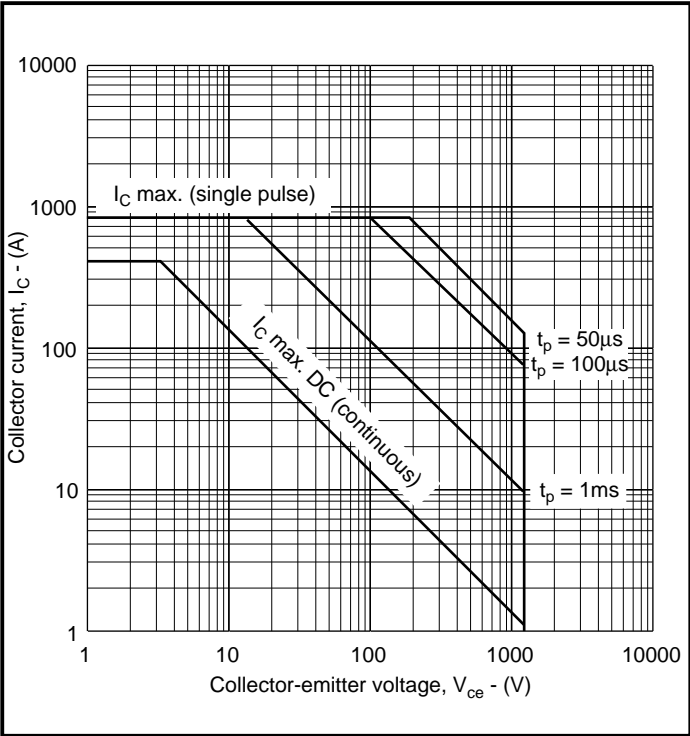


Fig.9 Forward bias safe operating area

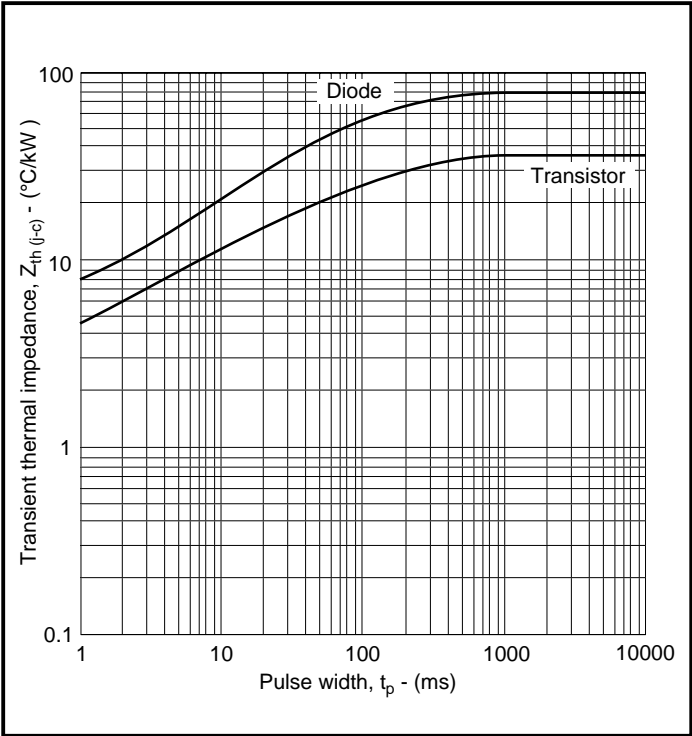


Fig.10 Transient thermal impedance

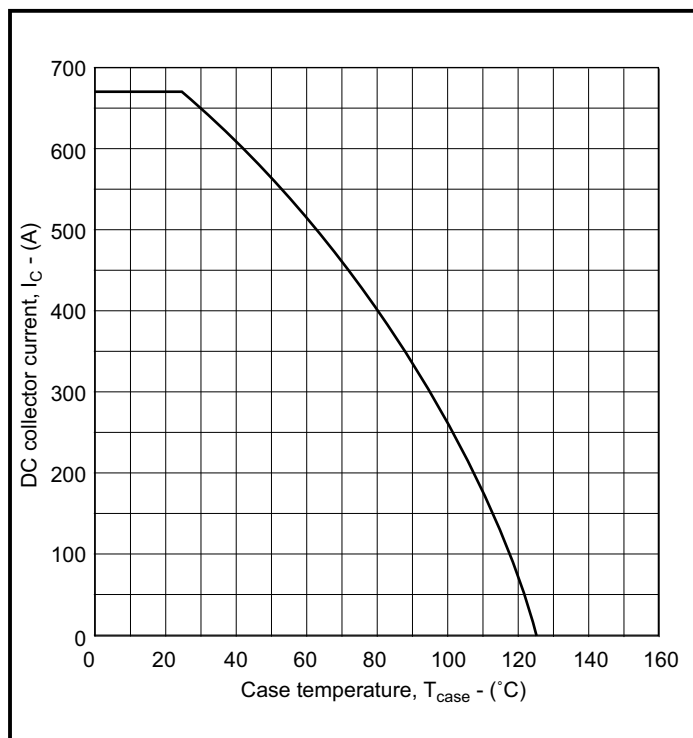
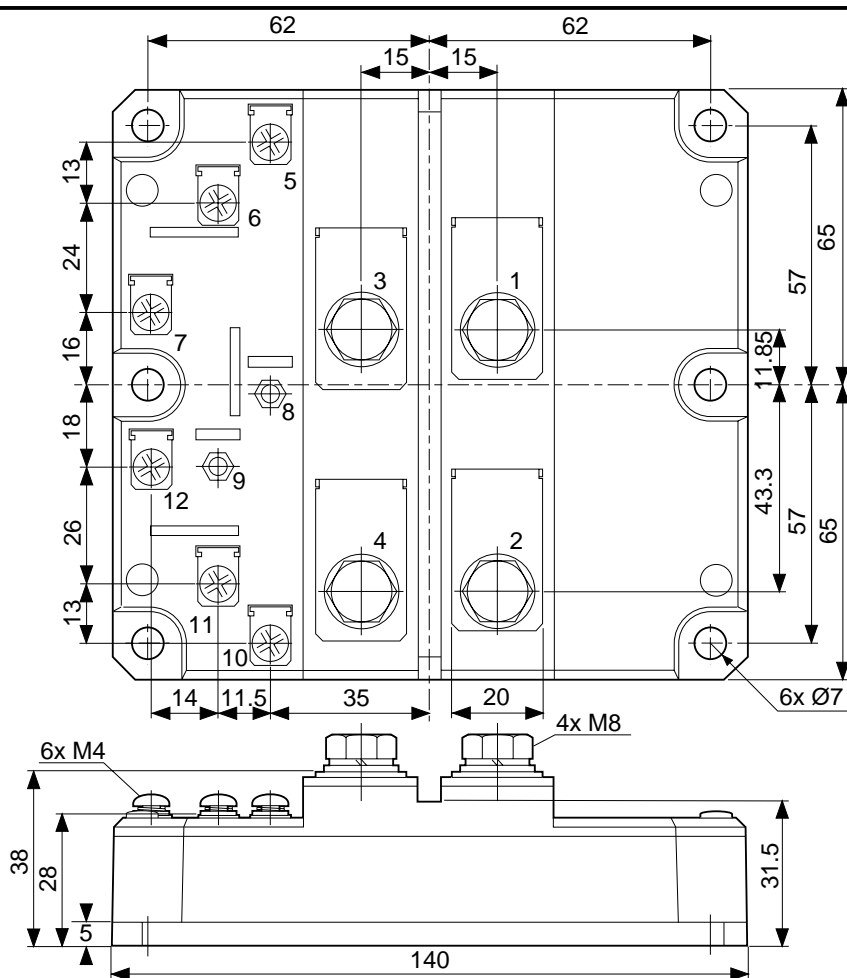


Fig.11 DC current rating vs case temperature

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.



Main Terminal screw plastic hole depth (M8) = 16.8 ± 0.3

Auxiliary and Gate pin plastic hole depth (M4) = 9 ± 0.3

Copper terminal thickness, Main Terminal pins = 1.5 ± 0.1

Copper terminal thickness, Auxiliary and Gate pin = 0.9 ± 0.1

Nominal weight: 1050g

Module outline type code: D



<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

DYNEX POWER INC.
99 Bank Street, Suite 410,
Ottawa, Ontario, Canada, K1P 6B9
Tel: 613.723.7035
Fax: 613.723.1518
Toll Free: 1.888.33.DYNEX (39639)

CUSTOMER SERVICE CENTRES
Mainland Europe Tel: +33 (0)1 58 04 91 00. Fax: +33 (0)1 46 38 51 33
North America Tel: (613) 723-7035. Fax: (613) 723-1518.
UK, Scandinavia & Rest Of World Tel: +44 (0)1522 500500. Fax: +44 (0)1522 500020

SALES OFFICES
Mainland Europe Tel: +33 (0)1 58 04 91 00. Fax: +33 (0)1 46 38 51 33
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.
UK, Scandinavia & Rest Of World Tel: +44 (0)1522 500500. Fax: +44 (0)1522 500020

These offices are supported by Representatives and Distributors in many countries world-wide.
© Dynex Semiconductor 2001 Publication No. DS5503-1 Issue No. 1.0 October 2001
TECHNICAL DOCUMENTATION – NOT FOR RESALE. PRINTED IN UNITED KINGDOM

Datasheet Annotations:

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.

This publication is issued to provide information only which (unless agreed by the Company in writing) may not be used, applied or reproduced for any purpose nor form part of any order or contract nor to be regarded as a representation relating to the products or services concerned. No warranty or guarantee express or implied is made regarding the capability, performance or suitability of any product or service. The Company reserves the right to alter without prior notice the specification, design or price of any product or service. Information concerning possible methods of use is provided as a guide only and does not constitute any guarantee that such methods of use will be satisfactory in a specific piece of equipment. It is the user's responsibility to fully determine the performance and suitability of any equipment using such information and to ensure that any publication or data used is up to date and has not been superseded. These products are not suitable for use in any medical products whose failure to perform may result in significant injury or death to the user. All products and materials are sold and services provided subject to the Company's conditions of sale, which are available on request.

All brand names and product names used in this publication are trademarks, registered trademarks or trade names of their respective owners.