Single Switch IGBT Module

Advance Information

DS5451-1.2 October 2001

FEATURES

- High Thermal Cycling Capability
- 1600A Per Module
- 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, chopper, dual and single switch configurations covering voltages from 600V to 3300V and currents up to 2400A.

The GP1600FSM12 is a singlel 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:

GP1600FSM12

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

KEY PARAMETERS

V_{CES}		**1200V**
$V_{CE(sat)}$	**(typ)**	**2.7V**
I_C	**(max)**	**1600A**
$I_{C(PK)}$	**(max)**	**3200A**

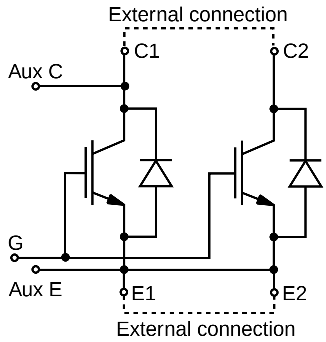
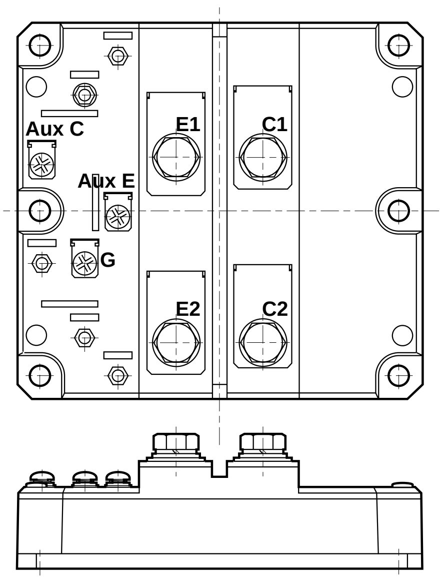


Fig.1 Single switch circuit diagram



Outline type code: F

(See package details for further information)

Fig. 2 Electrical connections - (not to scale)

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	1200	V
V_{GES}	Gate-emitter voltage	-	±20	V
I_C	Collector current	DC, T_{case} = 82°C	1600	A
I_{CM}		1ms, T_{case} = 112°C	3200	A
P_{max}	Maximum power dissipation	T_{case} = 25°C (Transistor)	13.9	kW
V_{isol}	Isolation voltage	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	2500	V

THERMAL AND MECHANICAL RATINGS

Symbol	Parameter	Conditions	Min.	Max.	Units
$R_{th(j-c)}$	Thermal resistance - transistor	DC junction to case	-	9	°C/kW
$R_{th(j-c)}$	Thermal resistance - diode	DC junction to case -	-	20	°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	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	-	-	75	mA
I_{GES}	Gate leakage current	V_{GE} = ±20V, V_{CE} = 0V	-	-	8	μA
$V_{GE(TH)}$	Gate threshold voltage	I_C = 120mA, V_{GE} = V_{CE}	4.5	-	6.5	V
$V_{CE(SAT)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C =1600A	-	2.7	3.5	V
		V_{GE} = 15V, I_C = 1600A, T_{case} = 125˚C	-	3.2	4.0	V
I_F	Diode forward current	DC	-	-	1600	A
I_{FM}	Diode maximum forward current	t_p = 1ms	-	-	3200	A
V_F	Diode forward voltage	I_F =1600A	-	2.2	2.4	V
		I_F =1600A, T_{case} = 125˚C	-	2.3	2.5	V
C_{ies}	Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz	-	180	-	nF
L_M	Module inductance	-	-	15	-	nH

INDUCTIVE SWITCHING CHARACTERISTICS

T_{case} = 25°C unless stated otherwise

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
$t_{d(off)}$	Turn-off delay time	I_C = 1600A V_{GE} = ±15V V_{CE} = 600 $R_{G(ON)}$ = $R_{G(OFF)}$ = 3.3Ω L ~ 100nH	-	1650	1800	ns
t_f	Fall time		-	200	250	ns
E_{OFF}	Turn-off energy loss		-	350	450	mJ
$t_{d(on)}$	Turn-on delay time		-	1600	1750	ns
t_r	Rise time		-	450	550	ns
E_{ON}	Turn-on energy loss		-	160	200	mJ
Q_{rr}	Diode reverse recovery charge	I_F = 1600A V_R = 50%V_{CES}, dI_F/dt = 2000A/μs	-	100	130	μC

T_{case} = 125°C unless stated otherwise.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
$t_{d(off)}$	Turn-off delay time	I_C = 1600A V_{GE} = ±15V V_{CE} = 600 $R_{G(ON)}$ = $R_{G(OFF)}$ = 3.3Ω L ~ 100nH	-	1900	2100	ns
t_f	Fall time		-	250	300	ns
E_{OFF}	Turn-off energy loss		-	400	500	mJ
$t_{d(on)}$	Turn-on delay time		-	1750	2000	ns
t_r	Rise time		-	500	550	ns
E_{ON}	Turn-on energy loss		-	250	350	mJ
Q_{rr}	Diode reverse recovery charge	I_F = 1600A V_R = 50%V_{CES}, dI_F/dt = 2000A/μs	-	250	350	μC

CURVES

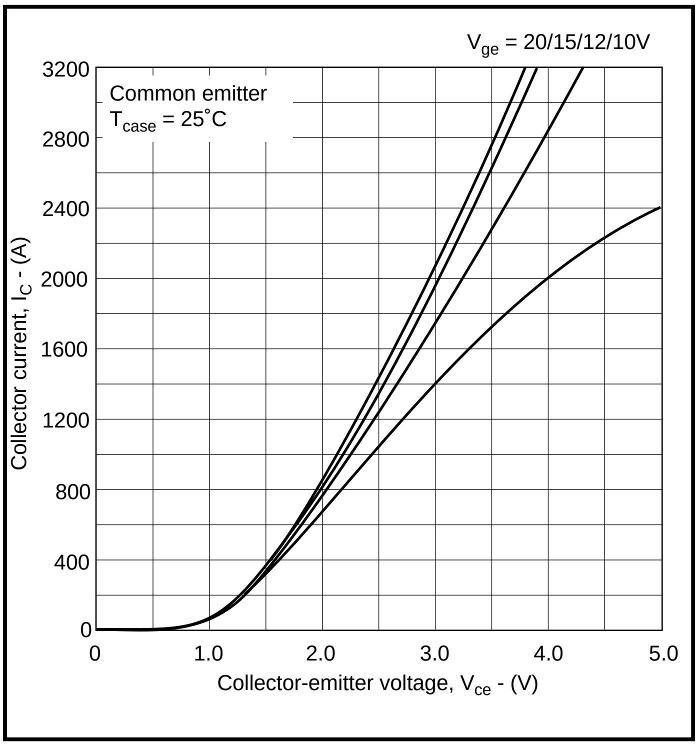


Fig.5 Typical output characteristics

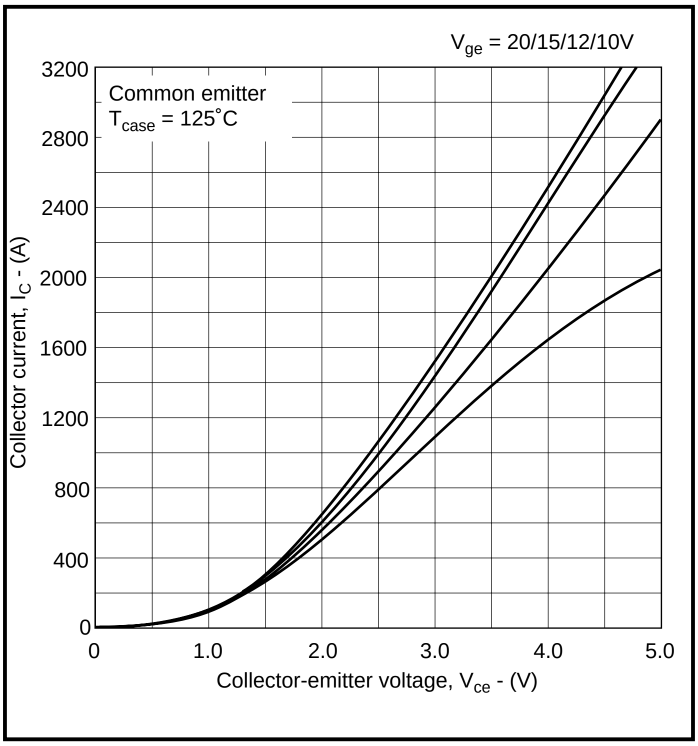


Fig.6 Typical output characteristics

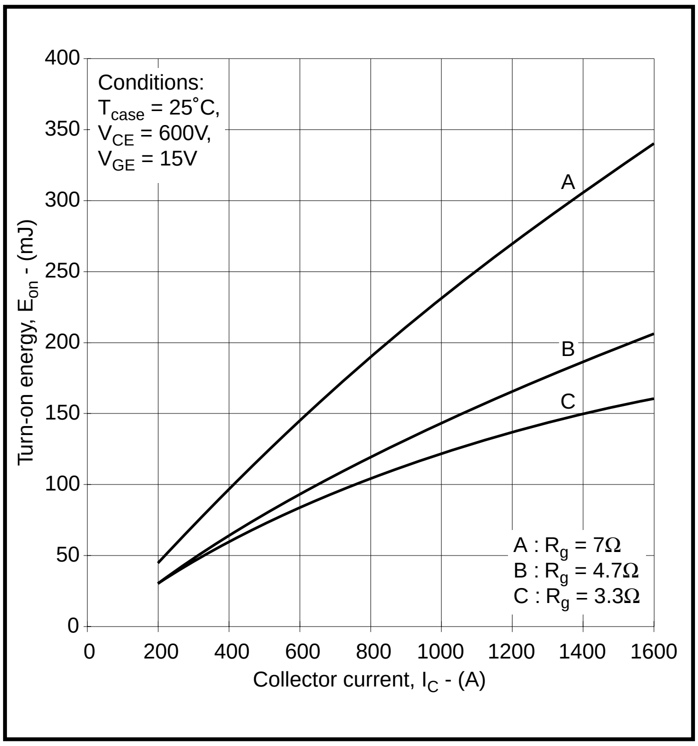


Fig.7 Typical turn-on energy vs collector current

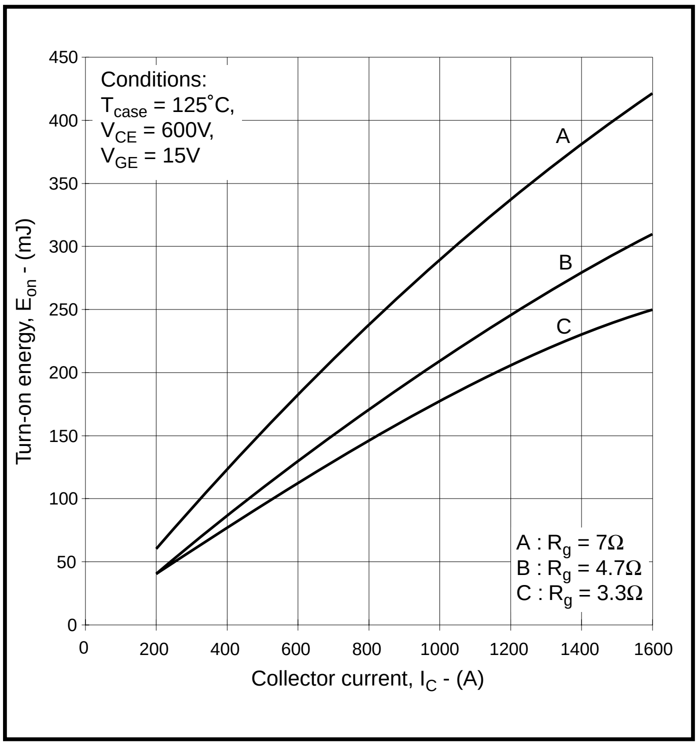


Fig.8 Typical turn-on energy vs collector current

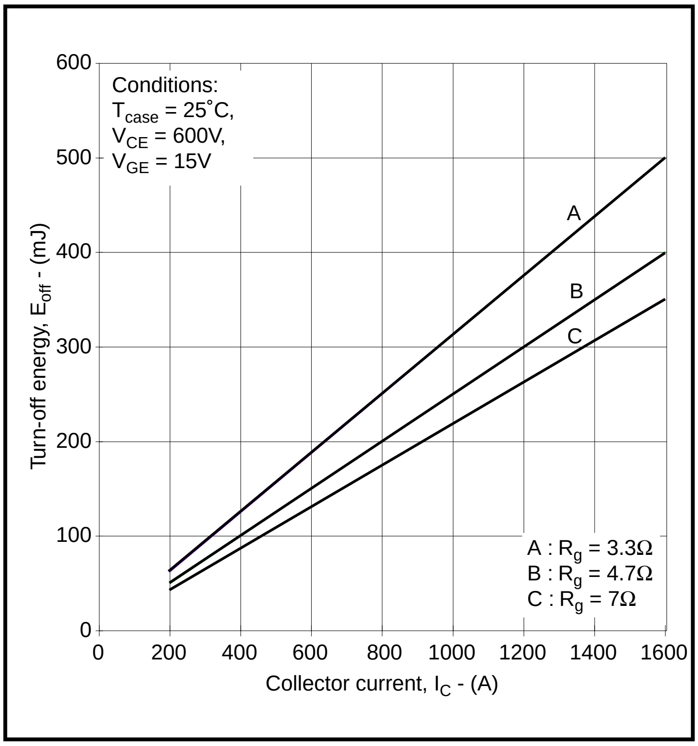


Fig.9 Typical turn-off energy vs collector current

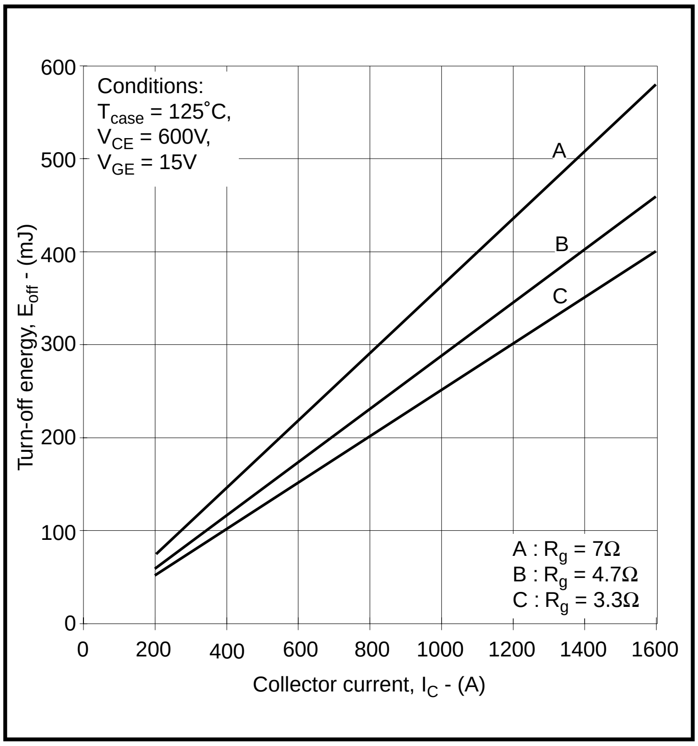


Fig.10 Typical turn-off energy vs collector current

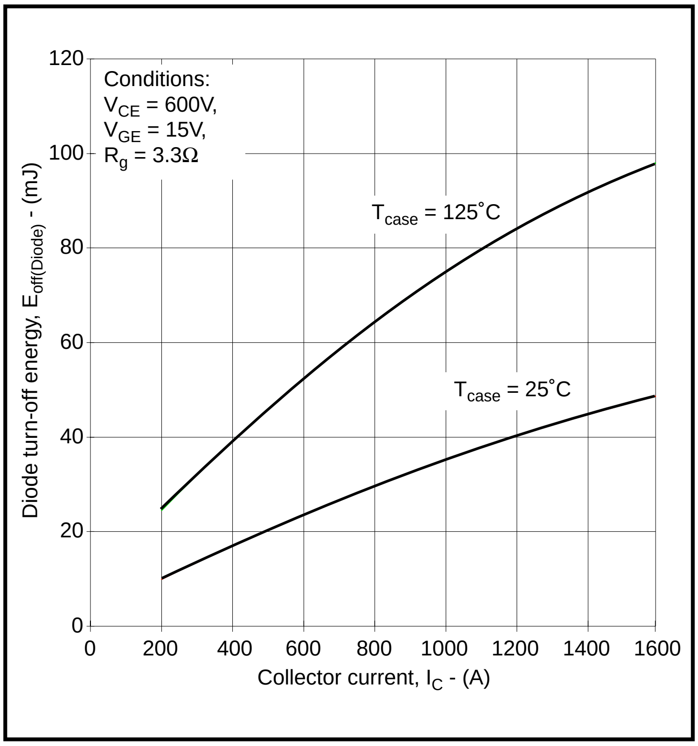


Fig.11 Typical diode turn-off energy vs collector current

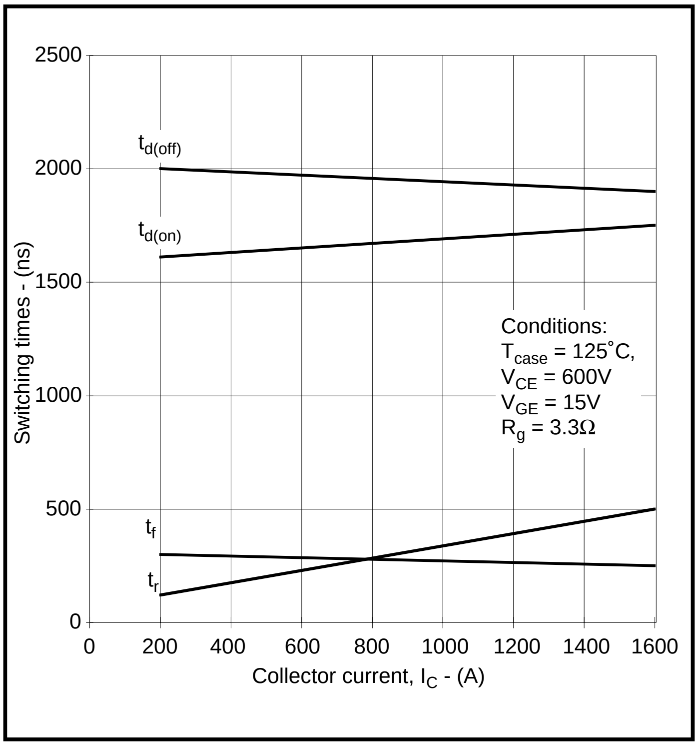


Fig.12 Typical switching times

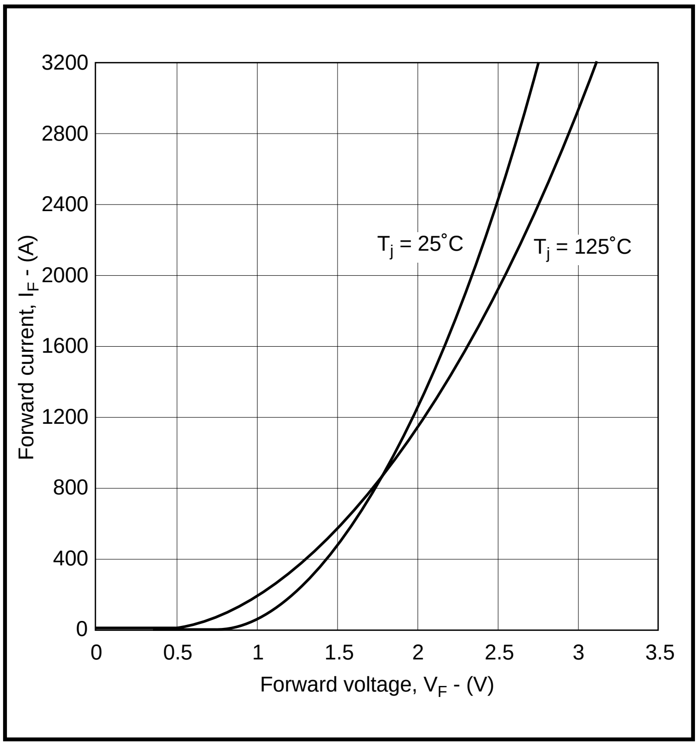


Fig.13 Diode typical forward characteristics

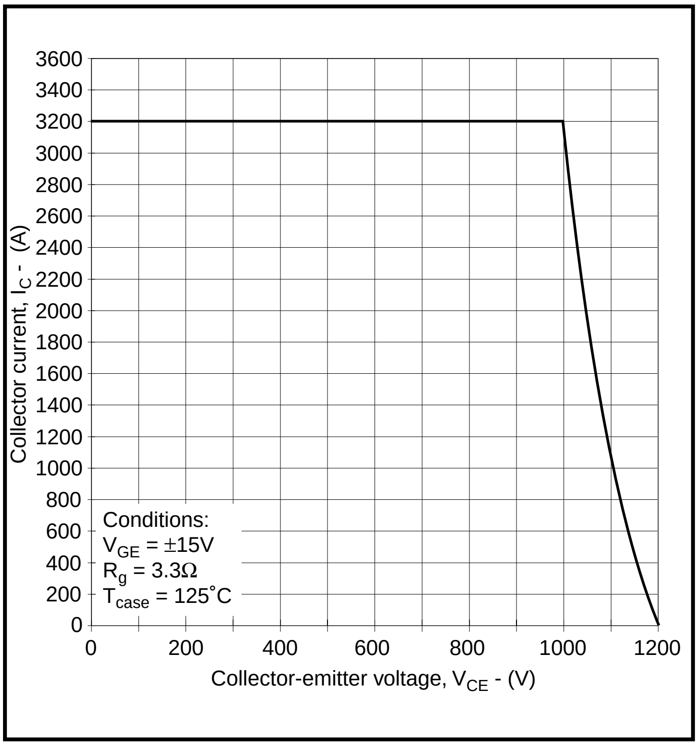


Fig.14 Reverse bias safe operating area

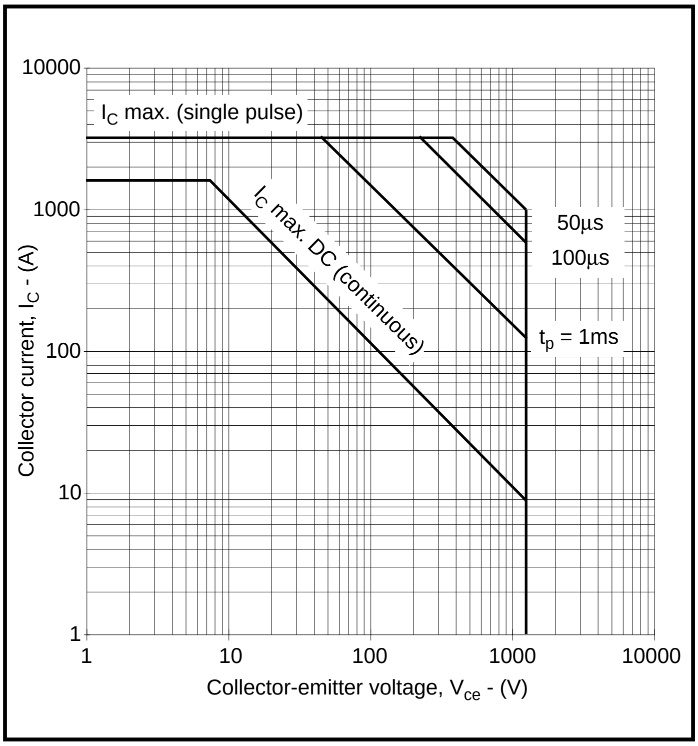


Fig.15 Forward bias safe operating area

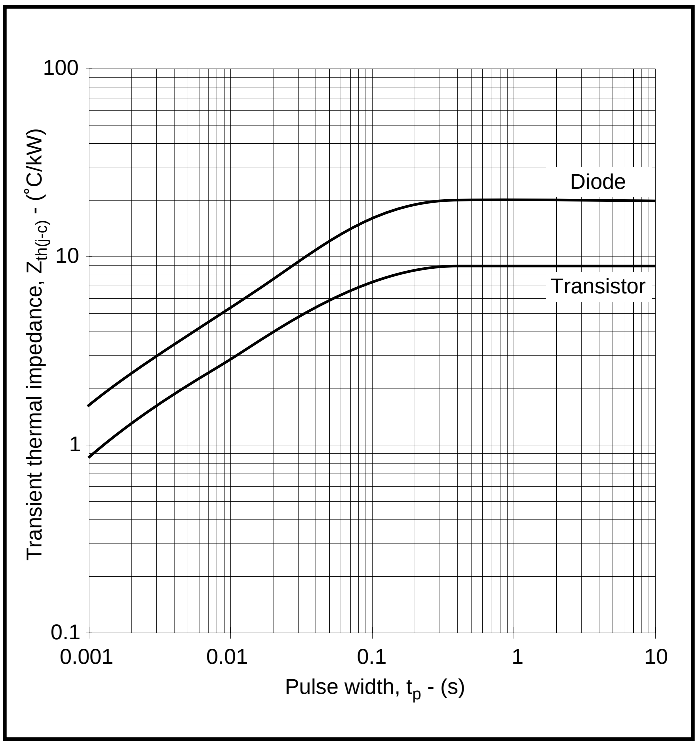


Fig.16 Transient thermal impedance

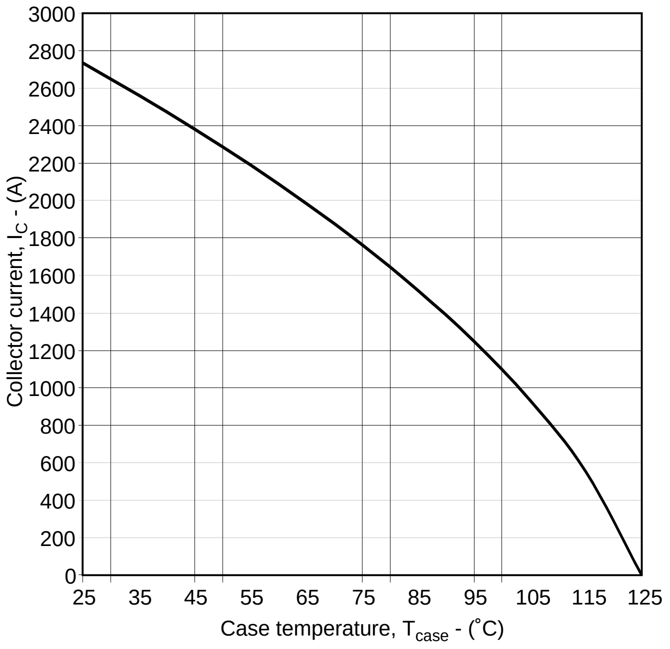
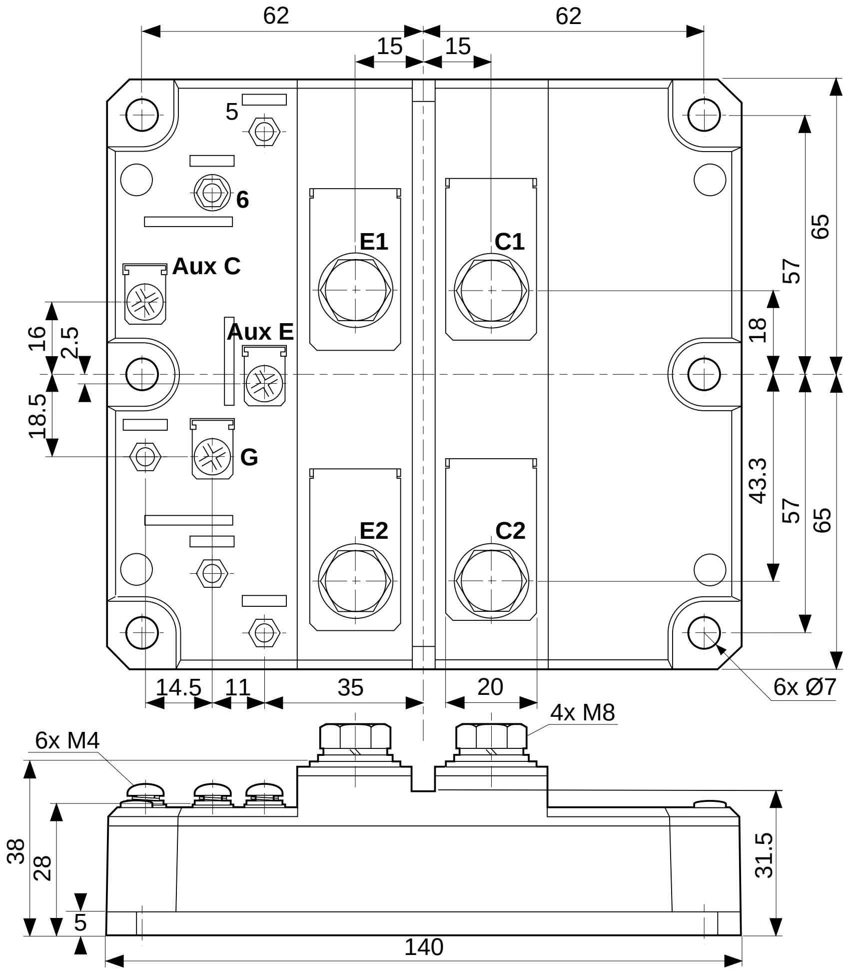


Fig.17 DC current rating vs case temperature

PACKAGE DETAILS

For further package information, please 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: F

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 / clamping systems in line with advances in device types and the voltage 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 up to date CAD methods our team of design and applications engineers aim to provide the Power Assembly Complete solution (PACs).

HEATSINKS

Power Assembly has it's own proprietary range of extruded aluminium heatsinks. They have been designed to optimise the performance or our 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 the factory.

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 502901 / 502753. 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 502901 / 502753. Fax: +44 (0)1522 500020

These offices are supported by Representatives and Distributors in many countries world-wide.

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.

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