DIM800WHS12-PF500

Half Bridge IGBT Module

Replaces DS6406-1

DS6406-2 May 2023 (LN42575)

FEATURES

- Cu Base with Al_2O_3 Substrates
- High Thermal Cycling capacity
- High Power Density

APPLICATIONS

- Motor Drives
- High Power Converters
- Wind Turbines
- UPS Systems

The Powerline range of high power modules includes half bridge, chopper, dual, single and bi-directional switch configurations covering voltages from 1200V to 6500V and currents up to 2400A.

The DIM800WHS12-PF500 is a Half Bridge 1200V, trench gate, insulated gate bipolar transistor (IGBT) module with enhanced field stop and implantation technology. The IGBT has a wide reverse bias safe operating area (RBSOA) plus 8μs short circuit withstand. This device is optimised for motor 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:

DIM800WHS12-PF500

Note: When ordering, please use the complete part number

KEY PARAMETERS

V_{CES}		**1200V**
$V_{CE(sat)}$ *	(typ)	**1.5V**
I_C	(max)	**800A**
$I_{C(PK)}$	(max)	**1600A**

* Measured at the auxiliary terminals

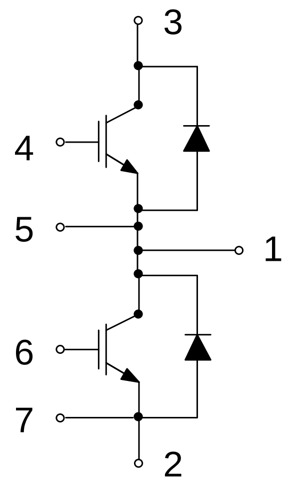


Fig. 1 Circuit configuration

Outline type code: W

(See Fig. 18 for further information)

Fig. 2 Package

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, T_C = 25°C	1200	V
V_{GES}	Gate-emitter voltage	T_C = 25°C	±20	V
I_C	Continuous collector current	T_C = 90°C, T_{vj} = 175°C	800	A
$I_{C(PK)}$	Peak collector current	t_P = 1ms	1600	A
P_{max}	Max. transistor power dissipation	T_C = 25°C, T_{vj} = 175°C	3.09	kW
I^2t	Diode I^2t value	V_R = 0, t_p = 10ms, T_{vj} = 150°C	64.8	kA^2s
V_{isol}	Isolation voltage – per module	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	4000	V

THERMAL AND MECHANICAL RATINGS

Internal insulation material:	Al_2O_3
Baseplate material:	Cu
Creepage distance – Terminal to heatsink:	29mm
Creepage distance – Terminal to terminal:	23mm
Clearance – Terminal to heatsink:	23mm
Clearance – Terminal to terminal:	11mm
CTI (Comparative Tracking Index):	>400

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$R_{th(j-c)}$	Thermal resistance – IGBT	Continuous dissipation - junction to case	-	-	48.5	°C/kW
$R_{th(j-c)}$	Thermal resistance – diode		-	-	81.1	°C/kW
$R_{th(c-h)}$	Thermal resistance – case to heatsink (IGBT)	Mounting torque 3.5Nm (with mounting grease 1W/m °C)	-	22.6	-	°C/kW
$R_{th(c-h)}$	Thermal resistance – case to heatsink (Diode)		-	25.0	-	°C/kW
T_j	Junction temperature	IGBT	-40	-	150	°C
		Diode	-40	-	150	°C
T_{stg}	Storage temperature range	-	-40	-	125	°C
	Screw torque	Mounting – M6	3	-	6	Nm
		Electrical connections – M6	2.5		5	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}				1	mA
		V_{GE} = 0V, V_{CE} = V_{CES}, T_C = 125°C				10	mA
		V_{GE} = 0V, V_{CE} = V_{CES}, T_C = 150°C				20	mA
I_{GES}	Gate leakage current	V_{GE} = ± 20V, V_{CE} = 0V				0.5	µA
$V_{GE(TH)}$	Gate threshold voltage	I_C = 20mA, V_{GE} = V_{CE}		5.3	5.9	6.5	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 800A			1.50	1.90	V
		V_{GE} = 15V, I_C = 800A, T_j = 125°C			1.70		V
		V_{GE} = 15V, I_C = 800A, T_j = 150°C			1.75		V
I_F	Diode forward current	DC			800		A
I_{FM}	Diode peak forward current	t_p = 1ms			1600		A
VF	Diode forward voltage	IF = 800A			1.65	2.05	V
		IF = 800A, Tj = 125°C			1.80		V
		IF = 800A, Tj = 150°C			1.80		V
Cies	Input capacitance	VCE = 25V, VGE = 0V, f = 100kHz			106		nF
Q_g	Gate charge	±15V			6.4		µC
C_{res}	Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz			0.5		nF
L_{sCE}	Module inductance				20		nH
$R_{CC'+EE'}$	Module lead resistance, Terminal - chip	Per switch			0.4		mΩ
R_{INT}	Internal transistor resistance				1.8		Ω
SC_{Data}	Short circuit current, I_{SC}	V_{CC} = 800V V_{GE} ≤ 15V $V_{CE\ (max)}$ = V_{CES} – L^* x di/dt IEC 60747-9	T_j = 150°C, t_p ≤ 8µs,		4100		A
			T_j = 175°C, t_p ≤ 6µs,		3900		A

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 = 800A V_{CE} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 3.3Ω $R_{G(ON)}$ = 1.8Ω L_S ~ 45nH	*dv/dt* = 4000V/µs		840		ns
t_f	Fall time				110		ns
E_{OFF}	Turn-off energy loss				106.5		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 7300A/µs		400		ns
t_r	Rise time				100		ns
E_{ON}	Turn-on energy loss				50		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 800A V_{CE} = 600V *di/dt* = 7300A/µs			77.5		µC
I_{rr}	Diode reverse recovery current				560		A
E_{rec}	Diode reverse recovery energy				42		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 = 800A V_{CE} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 3.3Ω $R_{G(ON)}$ = 1.8Ω L_S ~ 45nH	*dv/dt* = 4000V/µs		900		ns
t_f	Fall time				240		ns
E_{OFF}	Turn-off energy loss				137		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 7300A/µs		420		ns
t_r	Rise time				110		ns
E_{ON}	Turn-on energy loss				68		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 800A V_{CE} = 600V *di/dt* = 7300A/µs			134.5		µC
I_{rr}	Diode reverse recovery current				760		A
E_{rec}	Diode reverse recovery energy				70		mJ

T_{case} = 150°C unless stated otherwise

Symbol	Parameter	Test Conditions		Min	Typ.	Max	Units
$t_{d(off)}$	Turn-off delay time	I_C = 800A V_{CE} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 3.3Ω $R_{G(ON)}$ = 1.8Ω L_S ~ 45nH	*dv/dt* = 4000V/µs		940		ns
t_f	Fall time				270		ns
E_{OFF}	Turn-off energy loss				142.5		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 7300A/µs		420		ns
t_r	Rise time				110		ns
E_{ON}	Turn-on energy loss				79		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 800A V_{CE} = 600V *di/dt* = 7300A/µs			151		µC
I_{rr}	Diode reverse recovery current				780		A
E_{rec}	Diode reverse recovery energy				79.6		mJ

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

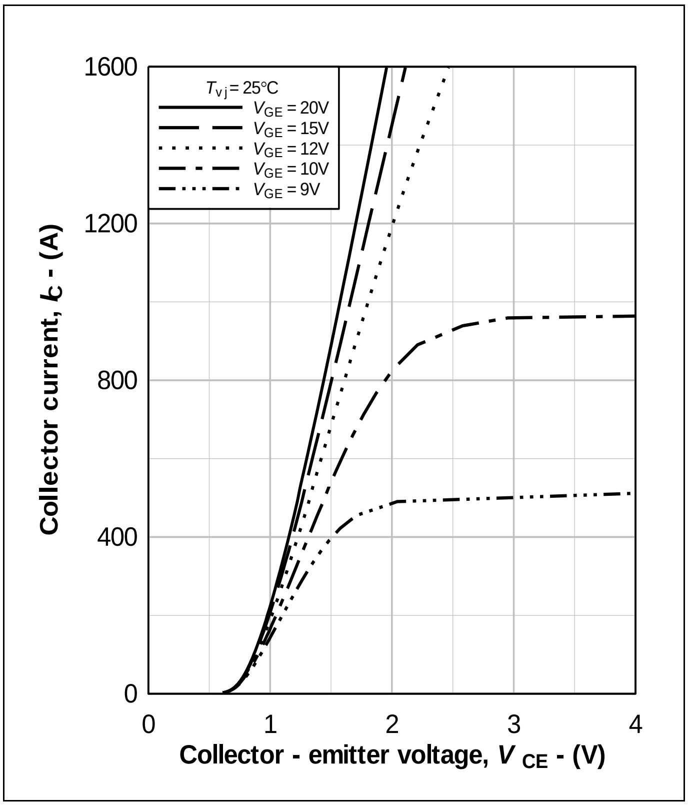


Fig. 3 Typical IGBT output characteristics, I_C = f (V_{CE})

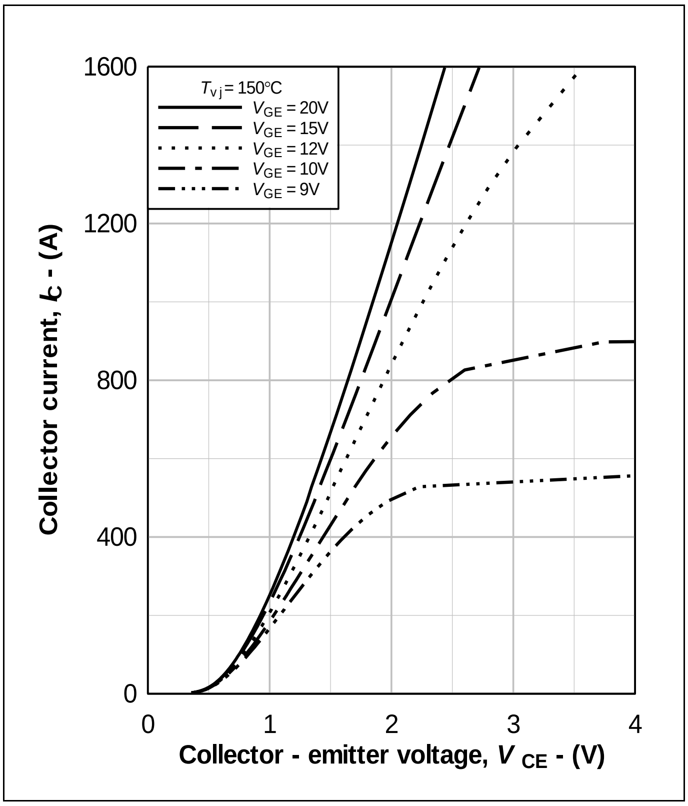


Fig. 4 Typical IGBT output characteristics, I_C = f (V_{CE})

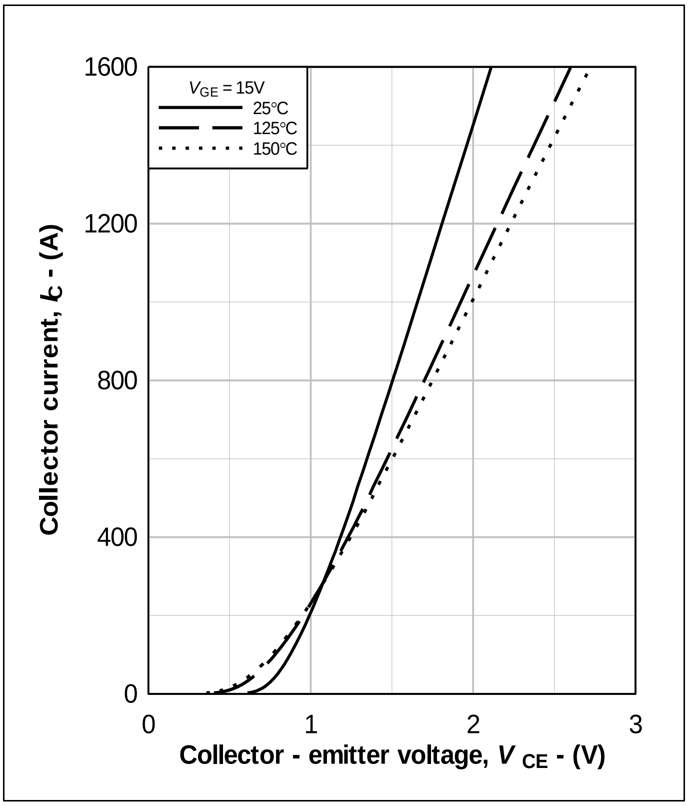


Fig. 5 Typical IGBT output characteristics, I_C = f (V_{CE})

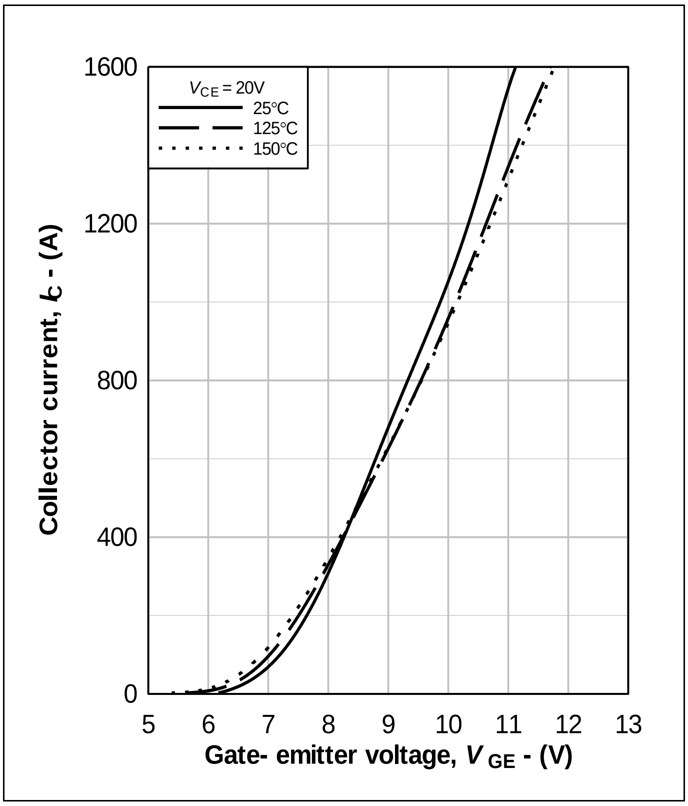


Fig. 6 Typical IGBT transfer characteristics, I_C = f (V_{GE})

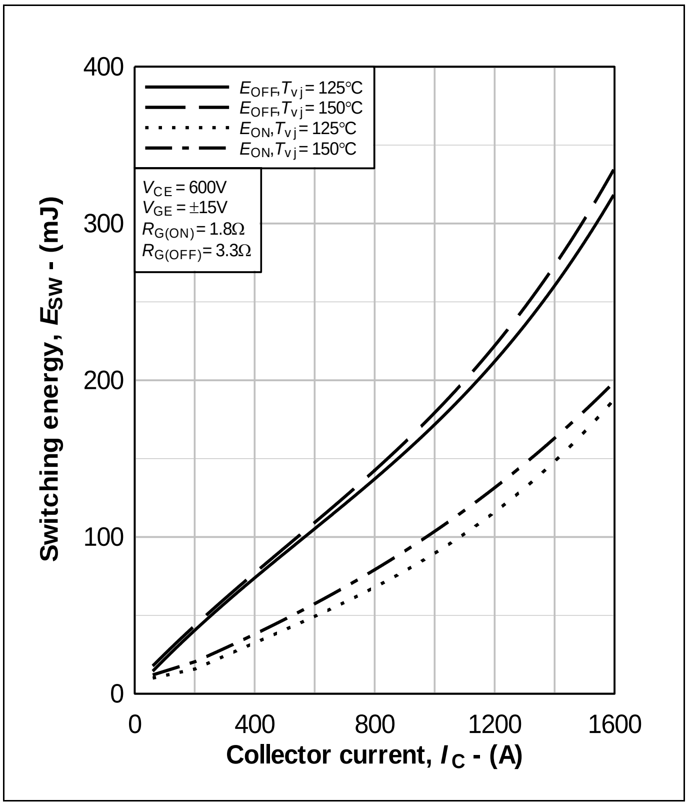


Fig. 7 Typical IGBT switching energy,
E_{ON} = f(I_C), E_{OFF} = f (I_C)

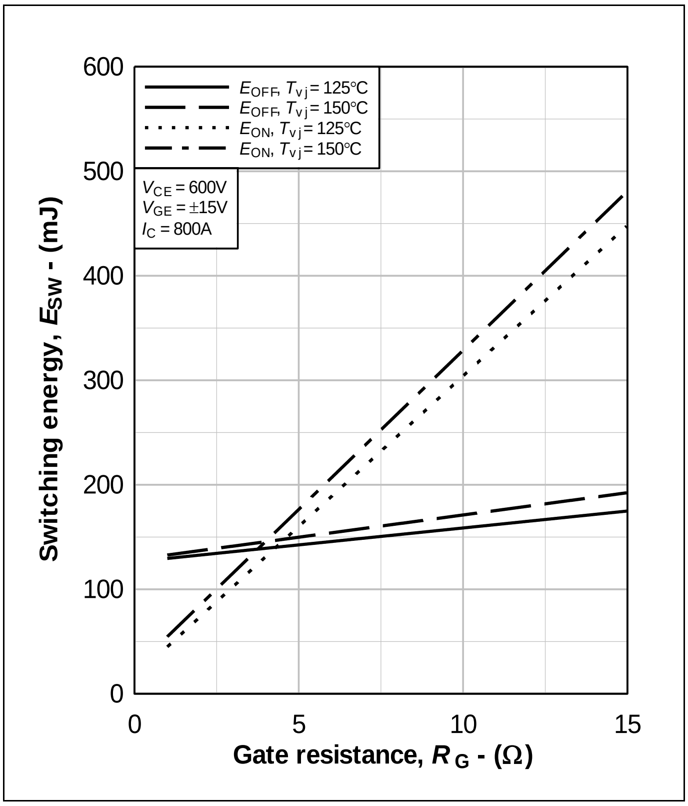


Fig. 8 Typical IGBT switching energy,
E_{ON} = f(R_G), E_{OFF} = f (R_G)

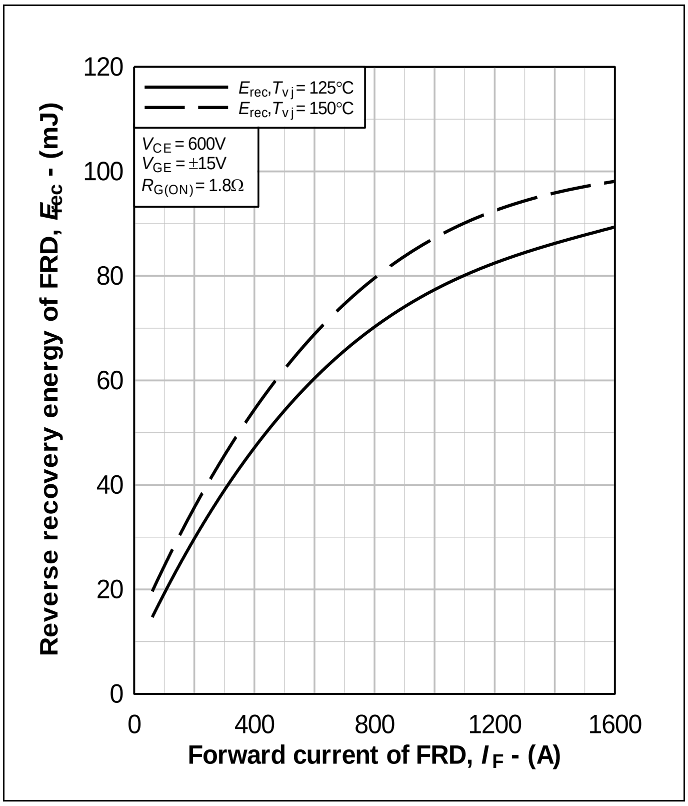


Fig. 9 Typical FRD E_{rec}, E_{rec} = f (I_F)

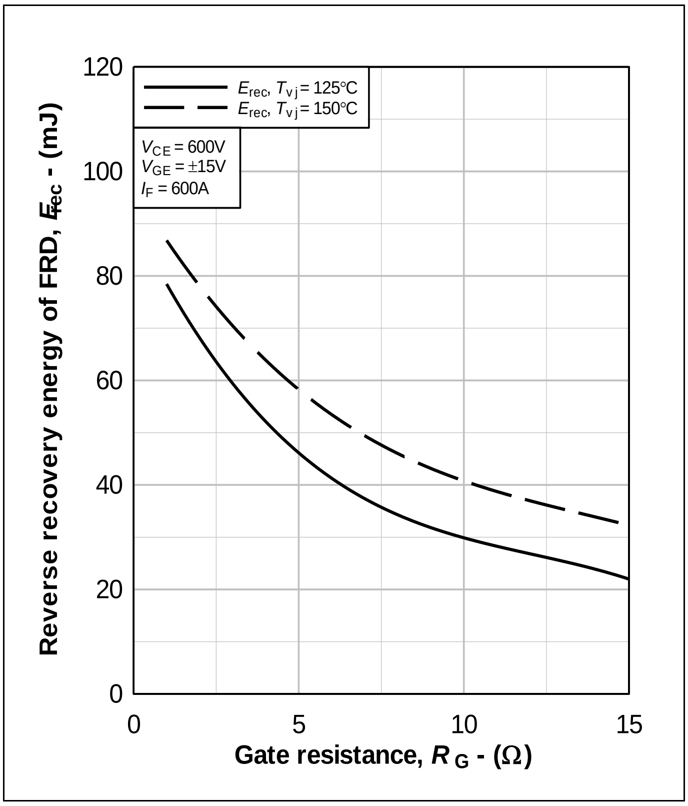


Fig. 10 Typical FRD E_{rec}, E_{rec} = f (R_G)

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

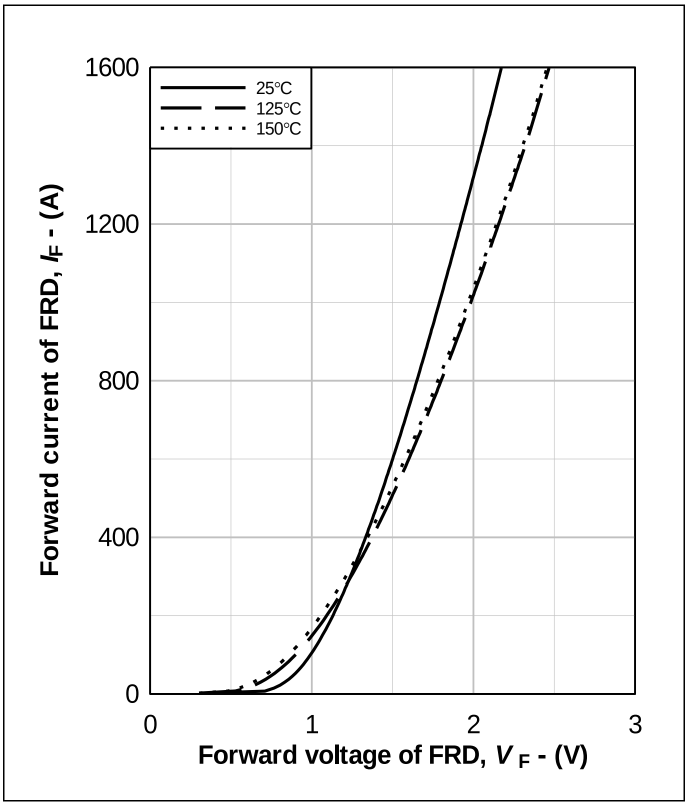


Fig. 11 Diode typical forward characteristics, I_F = f (V_F)

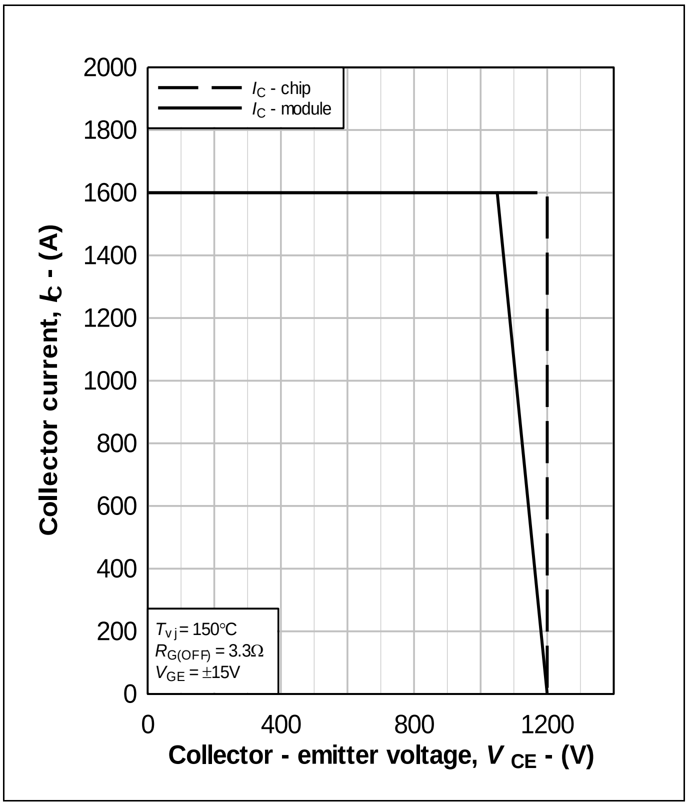


Fig. 12 Reverse bias safe operating area of IGBT,
I_C = f (V_{CE})

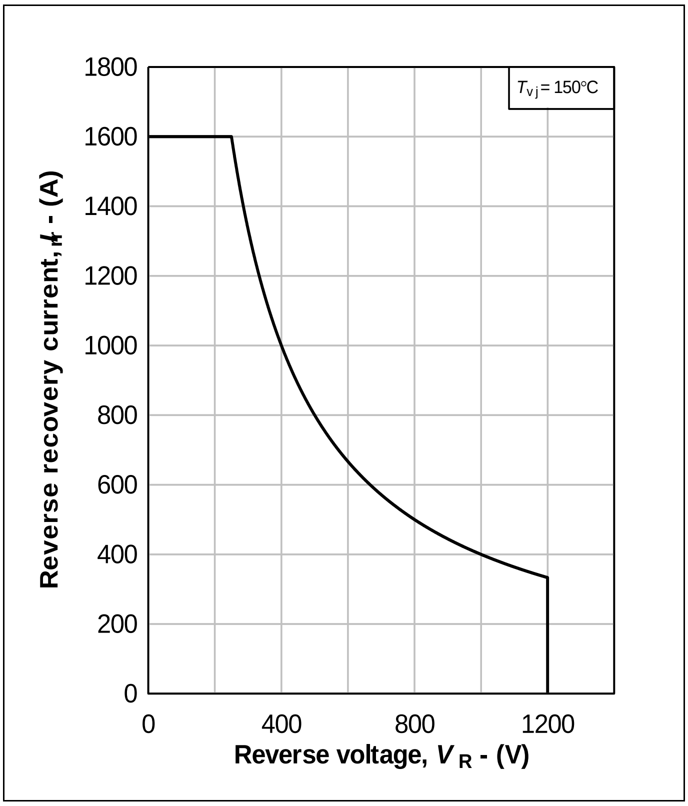


Fig. 13 Reverse bias safe operating area of FRD,
I_{rr} = f (V_R)

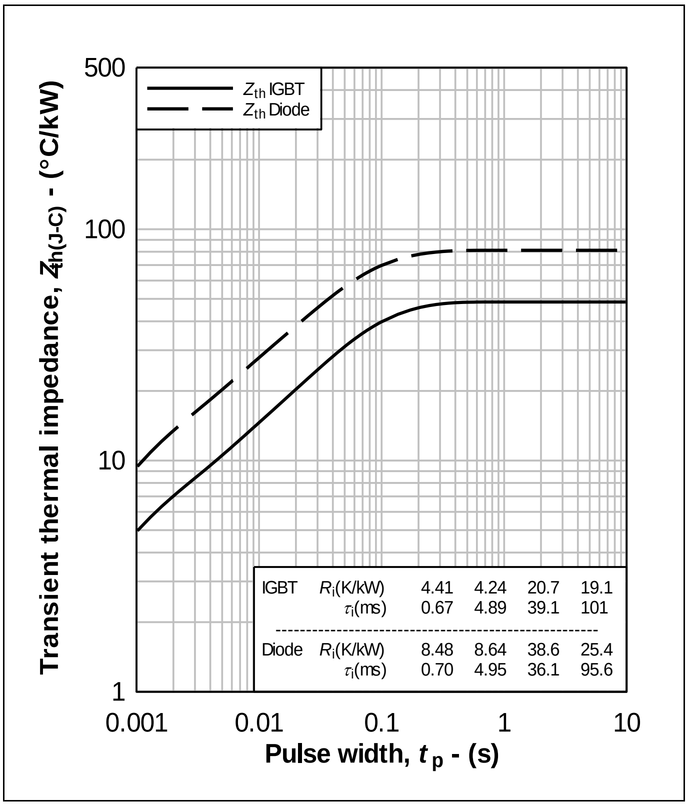


Fig. 14 Transient thermal impedance, $Z_{th(J-C)}$ = f (t_p)

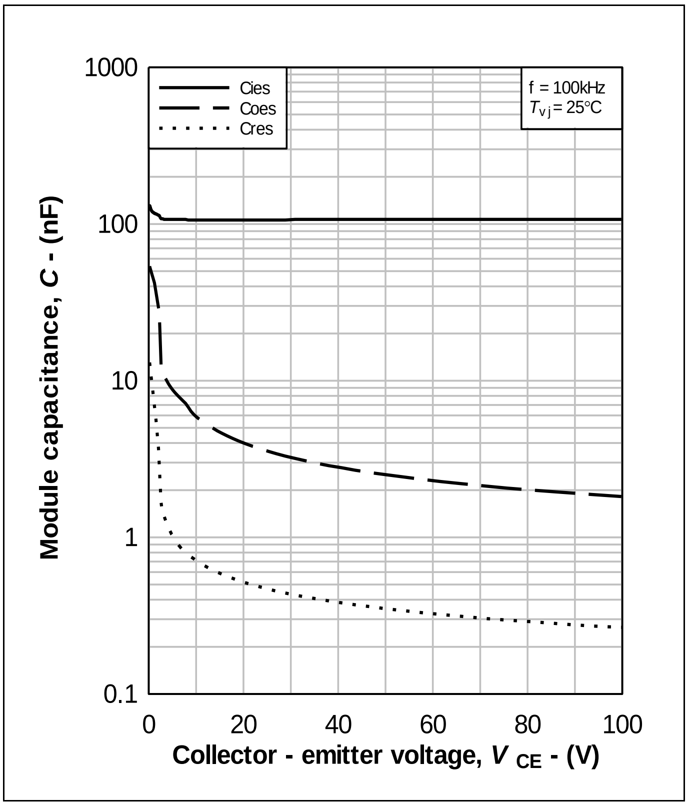


Fig. 15 Typical capacitor characteristic, $C = f(V_{CE})$

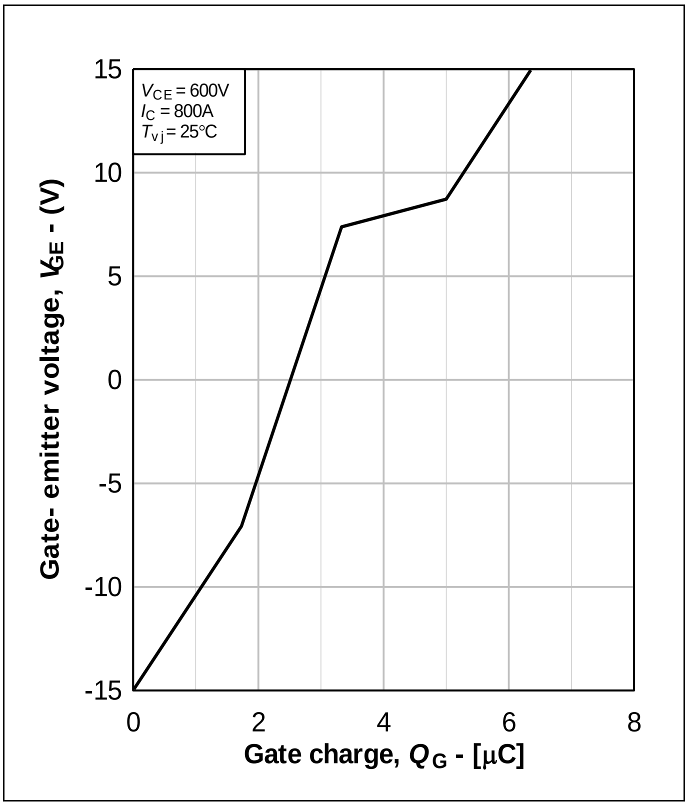
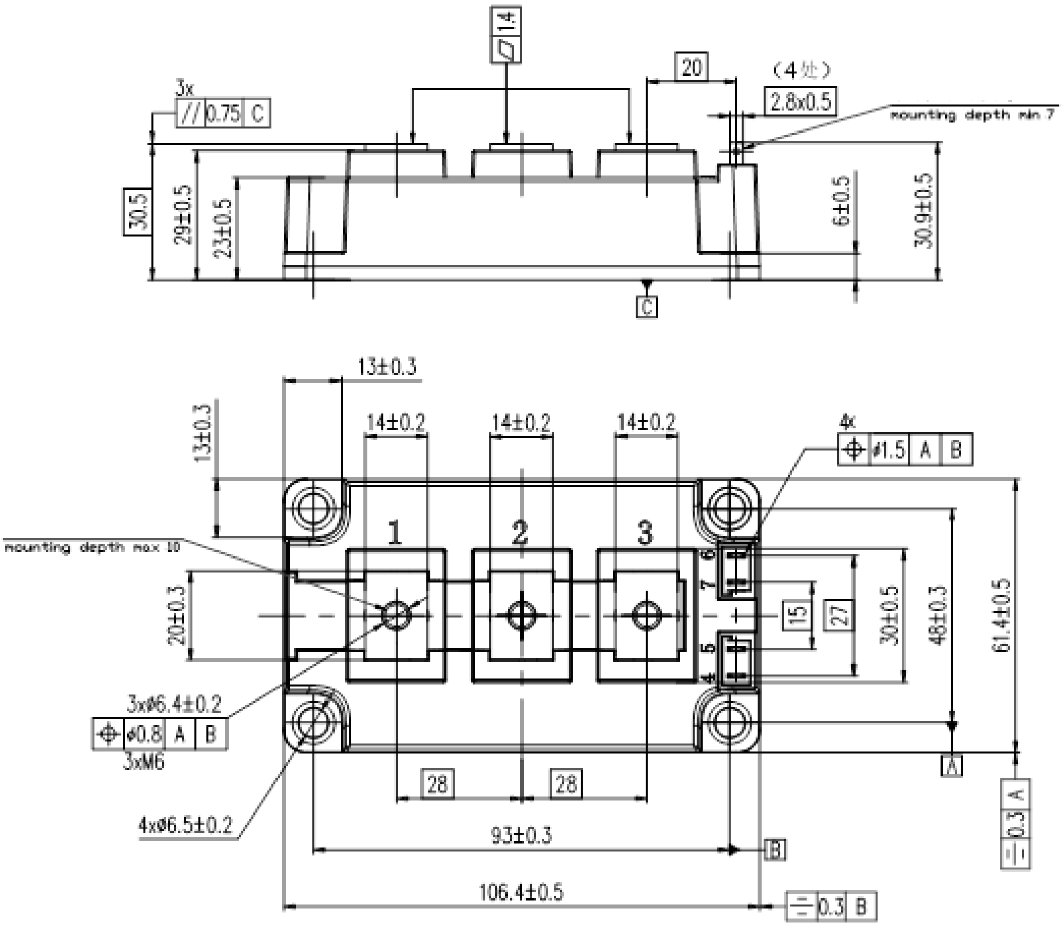


Fig. 16 Typical gate charge characteristic, $V_{GE} = f(Q_G)$

Caution: 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.



Nominal Weight: 335g

Module Outline Type Code: W

Fig. 17 Module outline drawing

IMPORTANT INFORMATION:

This publication is provided for information only and not for resale.

The products and information in this publication are intended for use by appropriately trained technical personnel.

Due to the diversity of product applications, the information contained herein is provided as a general guide only and does not constitute any guarantee of suitability for use in a specific application. The user must evaluate the suitability of the product and the completeness of the product data for the application. The user is responsible for product selection and ensuring all safety and any warning requirements are met. Should additional product information be needed please contact Customer Service.

Although we have endeavoured to carefully compile the information in this publication it may contain inaccuracies or typographical errors. The information is provided without any warranty or guarantee of any kind.

This publication is an uncontrolled document and is subject to change without notice. When referring to it please ensure that it is the most up to date version and has not been superseded.

The products are not intended for use in applications where a failure or malfunction may cause loss of life, injury or damage to property. The user must ensure that appropriate safety precautions are taken to prevent or mitigate the consequences of a product failure or malfunction.

The products must not be touched when operating because there is a danger of electrocution or severe burning. Always use protective safety equipment such as appropriate shields for the product and wear safety glasses. Even when disconnected any electric charge remaining in the product must be discharged and allowed to cool before safe handling using protective gloves.

Extended exposure to conditions outside the product ratings may affect reliability leading to premature product failure. Use outside the product ratings is likely to cause permanent damage to the product. In extreme conditions, as with all semiconductors, this may include potentially hazardous rupture, a large current to flow or high voltage arcing, resulting in fire or explosion. Appropriate application design and safety precautions should always be followed to protect persons and property.

Product Status & Product Ordering:
We annotate datasheets in the top right hand corner of the front page, to indicate product status if it is not yet fully approved for production. 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 design is complete and final characterisation for volume production is in progress. The datasheet represents the product as it is now understood but details may change.
No Annotation:	The product has been approved for production and unless otherwise notified by Dynex any product ordered will be supplied to the **current version of the data sheet prevailing at the time of our order acknowledgement.**

All products and materials are sold and services provided subject to Dynex's conditions of sale, which are available on request.

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

HEADQUARTERS OPERATIONS

DYNEX SEMICONDUCTOR LTD
Doddington Road, Lincoln, Lincolnshire, LN6 3LF,
United Kingdom
Tel: +44(0)1522 500500
Web: http://www.dynexsemi.com

CUSTOMER SERVICE

DYNEX SEMICONDUCTOR LTD
Doddington Road, Lincoln, Lincolnshire, LN6 3LF,
United Kingdom
Tel: +44(0)1522 502753 / 502901
Email: powersolutions@dynexsemi.com