DIM600WHS12-PC500

Half Bridge IGBT Module

DS6407-1 October 2022 (LN42136)

FEATURES

- Cu Base with Al_2O_3 Substrates
- High Thermal Cycling Capability
- 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 DIM600WHS12-PC500 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 10µs 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:

DIM600WHS12-PC500

Note: When ordering, please use the complete part number

KEY PARAMETERS

V_{CES}		**1200V**
$V_{CE(sat)}$ *	**(typ)**	**1.75V**
I_C	**(max)**	**600A**
$I_{C(PK)}$	**(max)**	**1200A**

* Measured at the auxiliary terminals

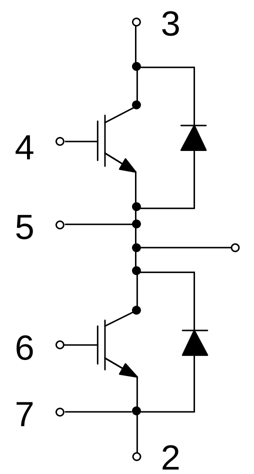


Fig. 1 Circuit configuration

Outline type code: W1

(See Fig. 17 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 = 100°C, T_{vj} max = 175°C	600	A
$I_{C(PK)}$	Peak collector current	t_P = 1ms	1200	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} = 150ºC	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

Caution: 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_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}	5.50	6.10	6.70	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 600A		1.75	2.15	V
		V_{GE} = 15V, I_C = 600A, T_j = 125°C		2.10		V
		V_{GE} = 15V, I_C = 600A, T_j = 150°C		2.20		V
I_F	Diode forward current	DC		600		A
I_{FRM}	Diode peak forward current	t_p = 1ms		1200		A
V_F	Diode forward voltage	I_F = 600A		1.50	1.90	V
		I_F = 600A, T_j = 125°C		1.55		V
		I_F = 600A, T_j = 150°C		1.55		V
C_{ies}	Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		90.3		nF
Q_g	Gate charge	±15V		6.9		μC
C_{res}	Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		1.0		nF
L_M	Module inductance			20		nH
$R_{CC'+EE'}$	Module lead resistance, terminal-chip			0.4		mΩ
R_{Gint}	Internal transistor resistance			1.1		Ω
SC_{Data}	Short circuit current, I_{SC}	T_j = 150°C, V_{CC} = 800V t_p ≤ 10μs, V_{GE} ≤ 15V $V_{CE\,(max)}$ = V_{CES} – L^* x di/dt IEC 60747-9		2800		A

Note:

* 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 V_{CE} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 2.2Ω $R_{G(ON)}$ = 2.2Ω L_S ~ 45nH	*dv/dt* = 5300V/µs		700		ns
t_f	Fall time				120		ns
E_{OFF}	Turn-off energy loss				74		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 7400A/µs		290		ns
t_r	Rise time				100		ns
E_{ON}	Turn-on energy loss				22		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 600A V_{CE} = 600V *di/dt* = 7400A/µs			82.4		µC
I_{rr}	Diode reverse recovery current				600		A
E_{rec}	Diode reverse recovery energy				48		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 V_{CE} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 2.2Ω $R_{G(ON)}$ = 2.2Ω L_S ~ 45nH	*dv/dt* = 5300V/µs		740		ns
t_f	Fall time				300		ns
E_{OFF}	Turn-off energy loss				90		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 7400A/µs		290		ns
t_r	Rise time				110		ns
E_{ON}	Turn-on energy loss				38.7		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 600A V_{CE} = 600V *di/dt* = 7400A/µs			113.4		µC
I_{rr}	Diode reverse recovery current				640		A
E_{rec}	Diode reverse recovery energy				61		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 = 600A V_{CE} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 2.2Ω $R_{G(ON)}$ = 2.2Ω L_S ~ 45nH	*dv/dt* = 5300V/µs		760		ns
t_f	Fall time				310		ns
E_{OFF}	Turn-off energy loss				94		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 7400A/µs		290		ns
t_r	Rise time				110		ns
E_{ON}	Turn-on energy loss				47.5		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 600A V_{CE} = 600V *di/dt* = 7400A/µs			134		µC
I_{rr}	Diode reverse recovery current				680		A
E_{rec}	Diode reverse recovery energy				68		mJ

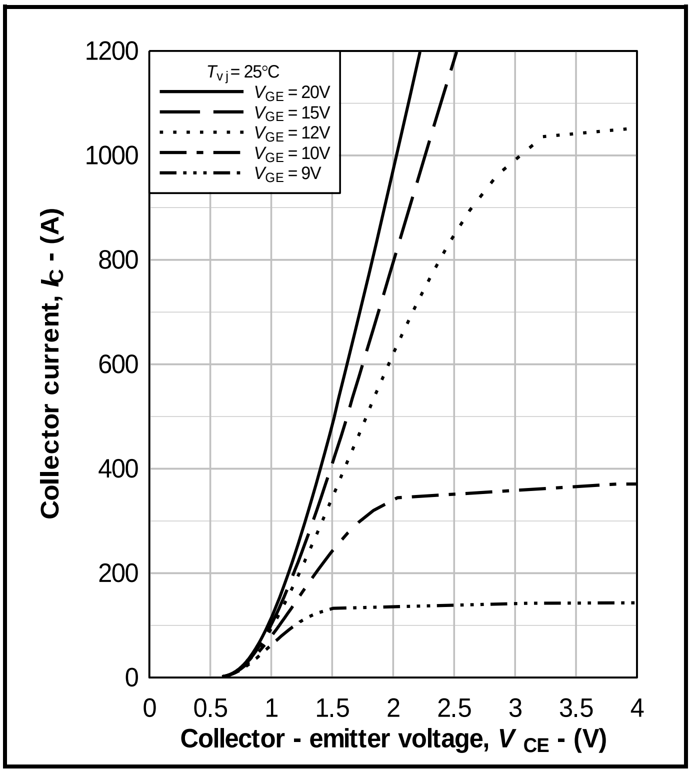


Fig. 3 Typical IGBT output characteristics, I_C = f(V_{CE})

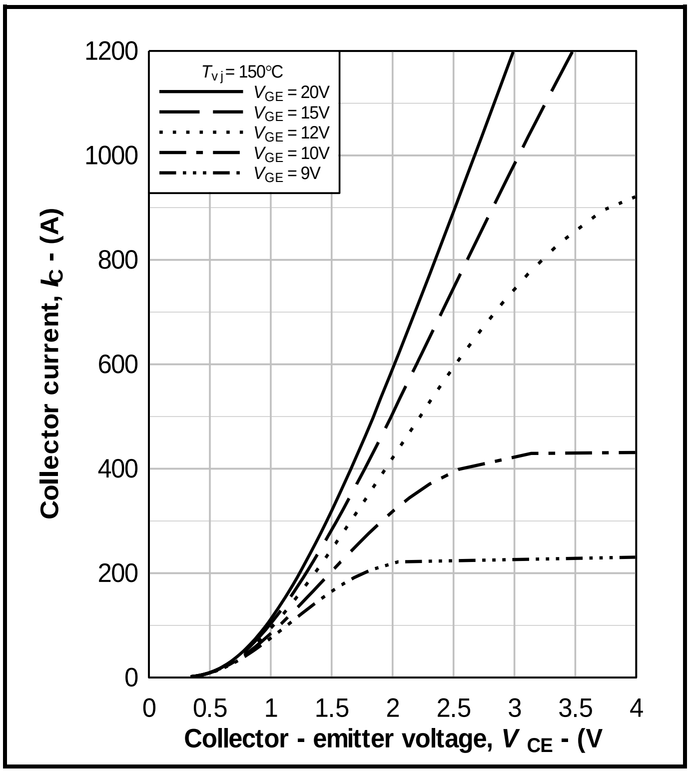


Fig. 4 Typical IGBT output characteristics, I_C = f(V_{CE})

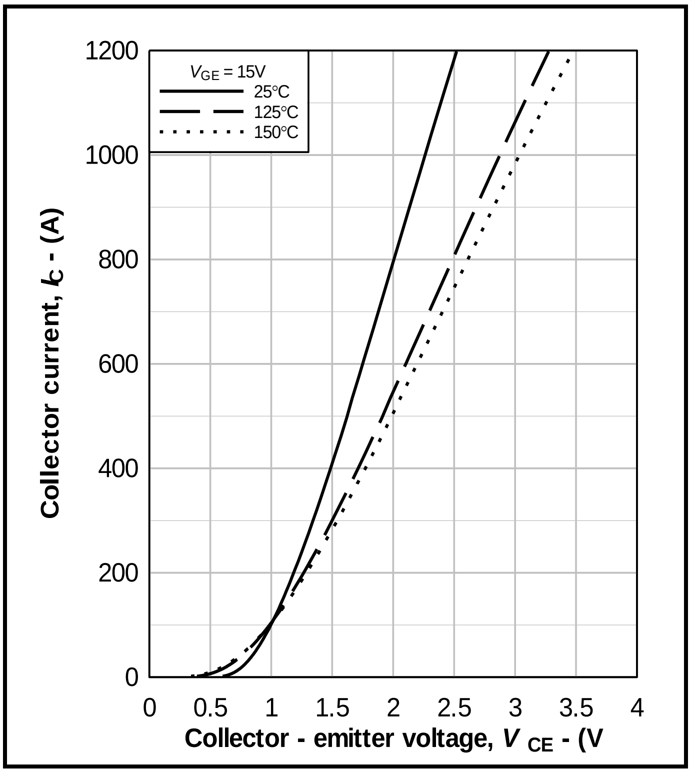


Fig. 5 Typical IGBT output characteristics, I_C = f(V_{CE})

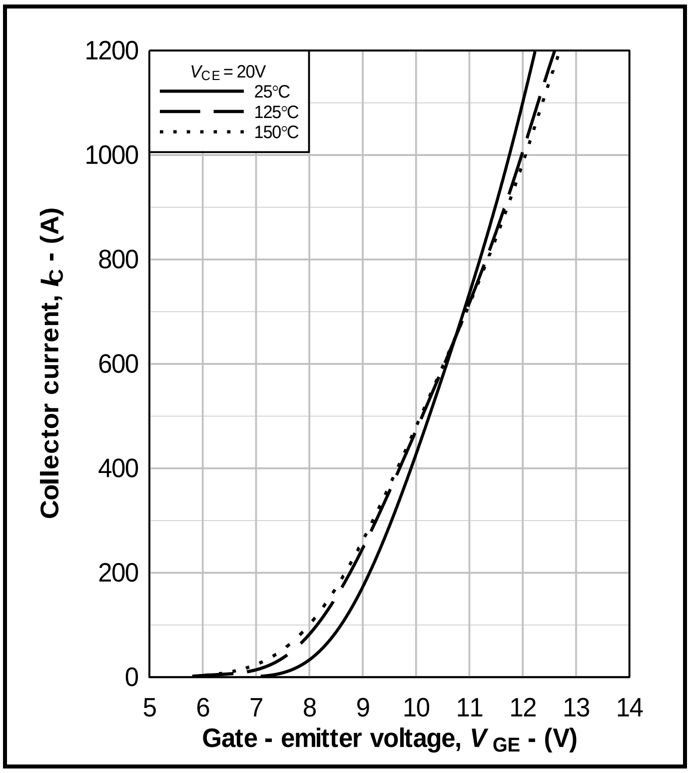


Fig. 6 Typical IGBT transfer characteristics, I_C = f(V_{GE})

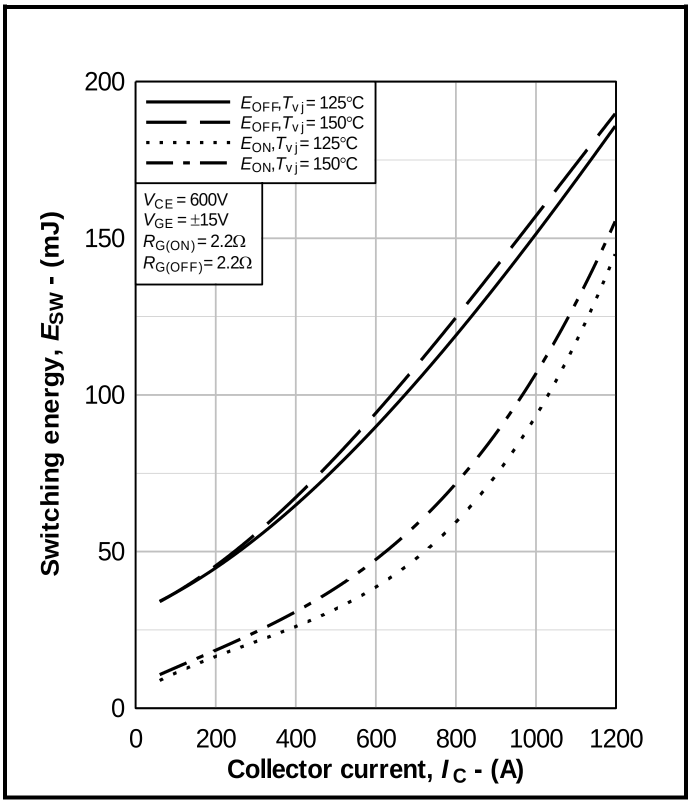


Fig. 7 Typical IGBT switching energy, E_{ON} = f(I_C), E_{OFF} = f(I_C)

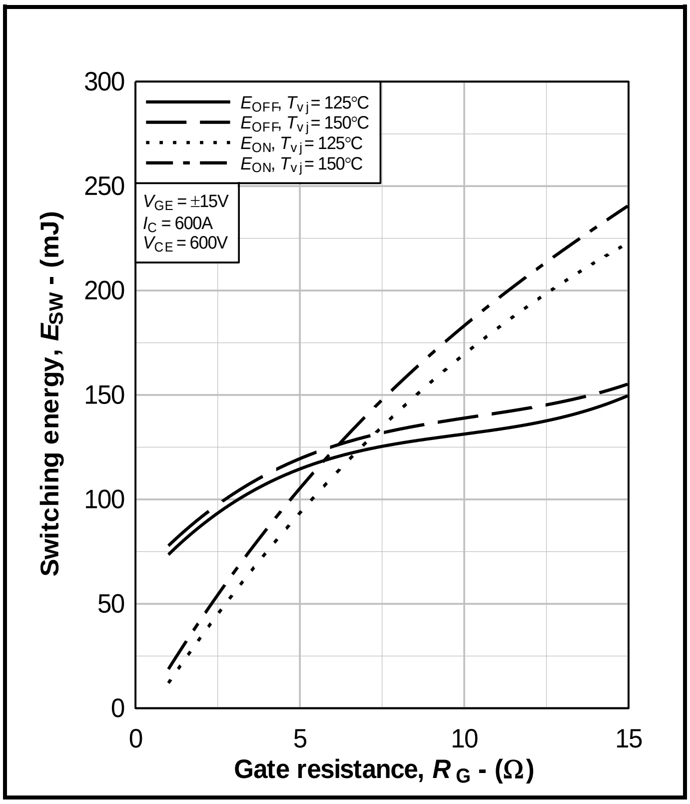


Fig. 8 **Typical IGBT switching energy, E_{ON} = f(R_G), E_{OFF} = f (R_G)**

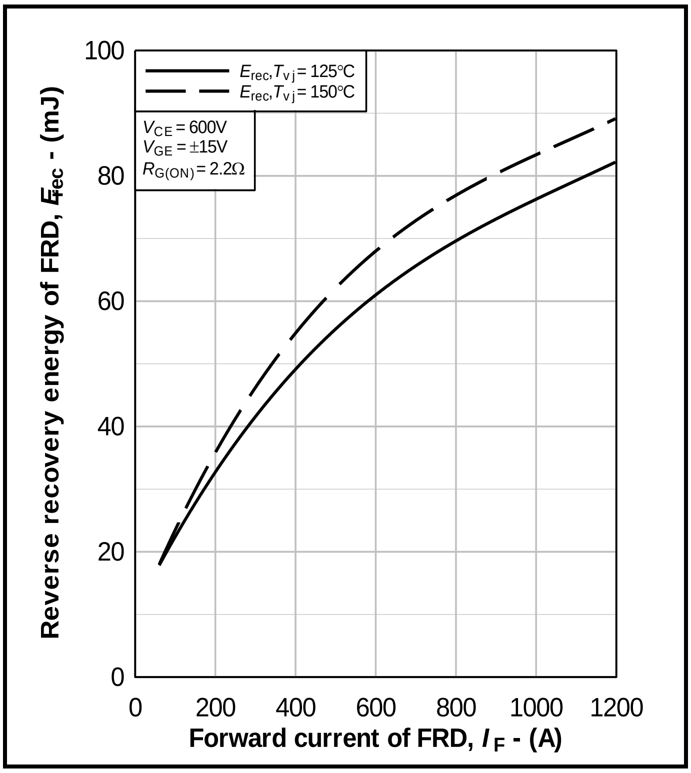


Fig. 9 Typical FRD E_{rec}, E_{rec} = f(I_F)

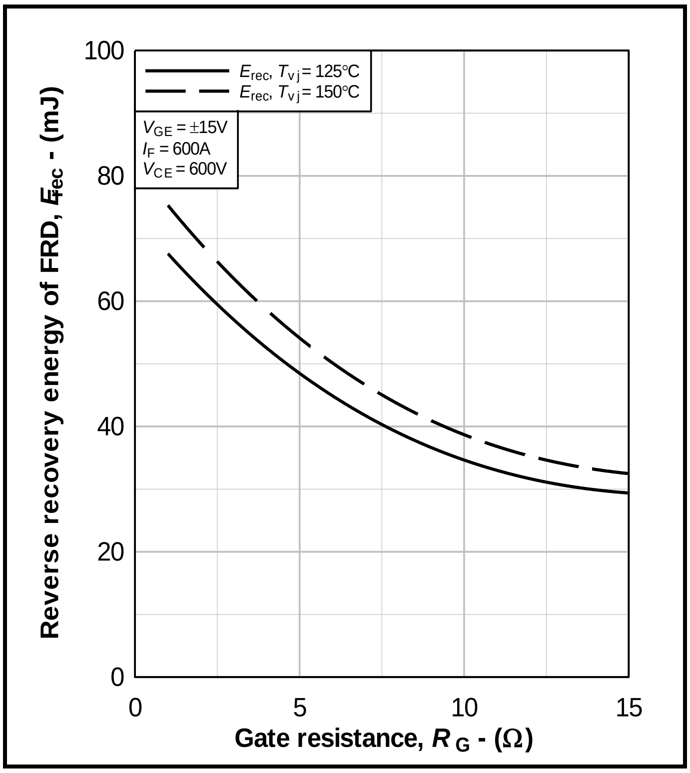


Fig. 10 Typical FRD E_{rec}, E_{rec} = f (R_G)

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

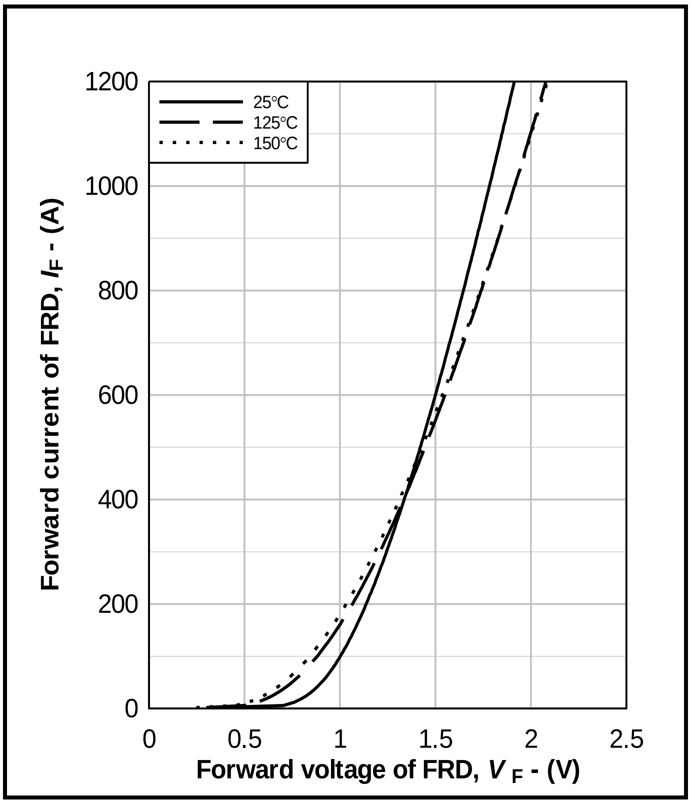


Fig. 11 Diode typical forward characteristics, $I_F = f(V_F)$

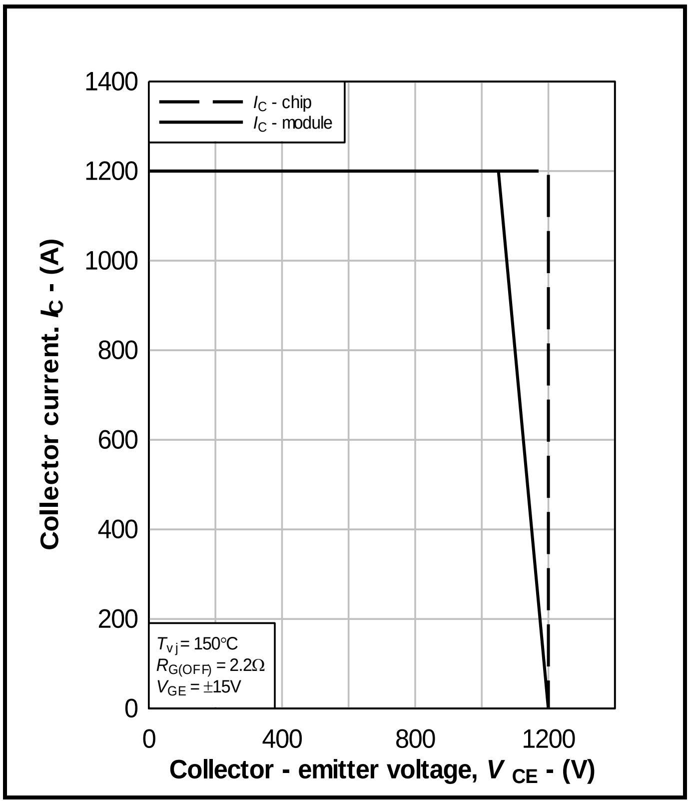


Fig. 12 Reverse bias safe operating area of IGBT, $I_C = f(V_{CE})$

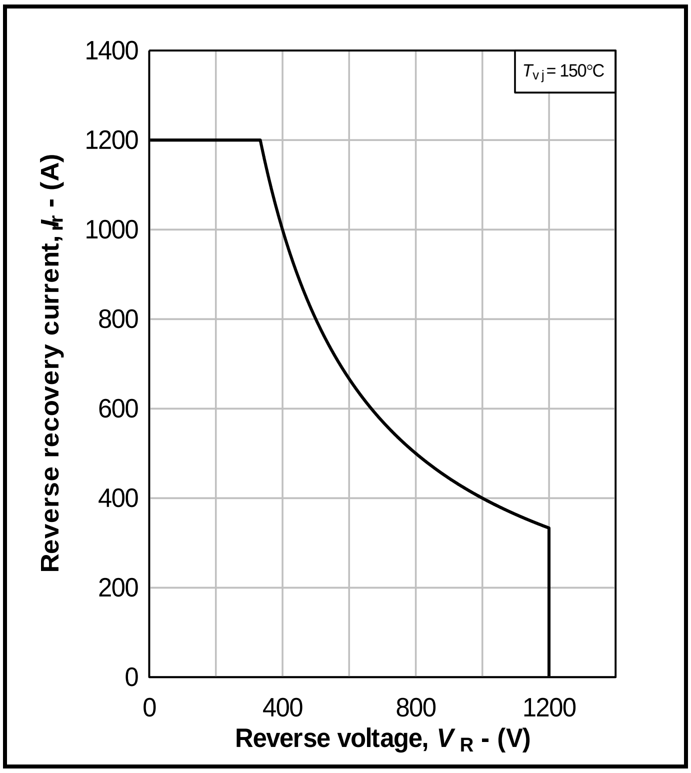


Fig. 13 Reverse bias safe operating area of FRD, $I_{rr} = f(V_R)$

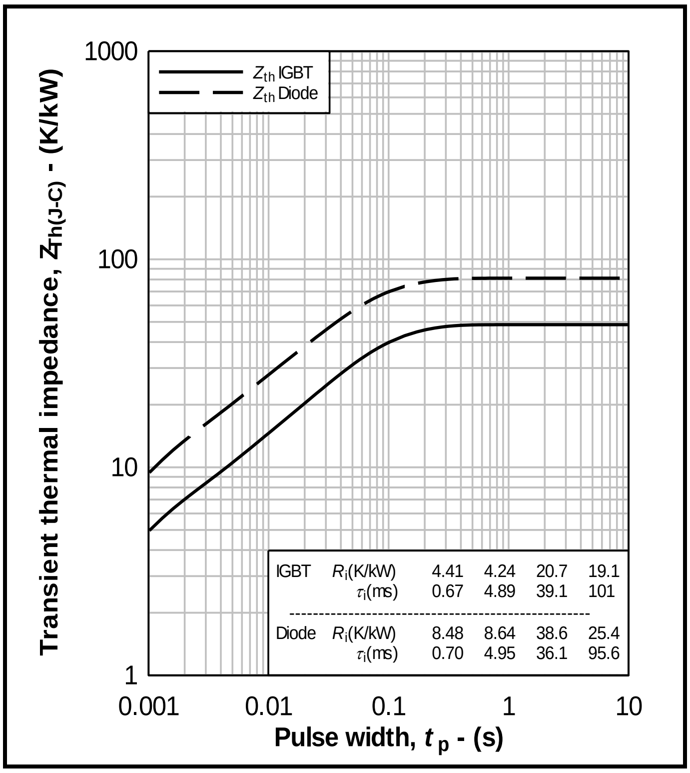


Fig. 14 Transient thermal impedance, $Z_{th(J-C)} = f(t_p)$

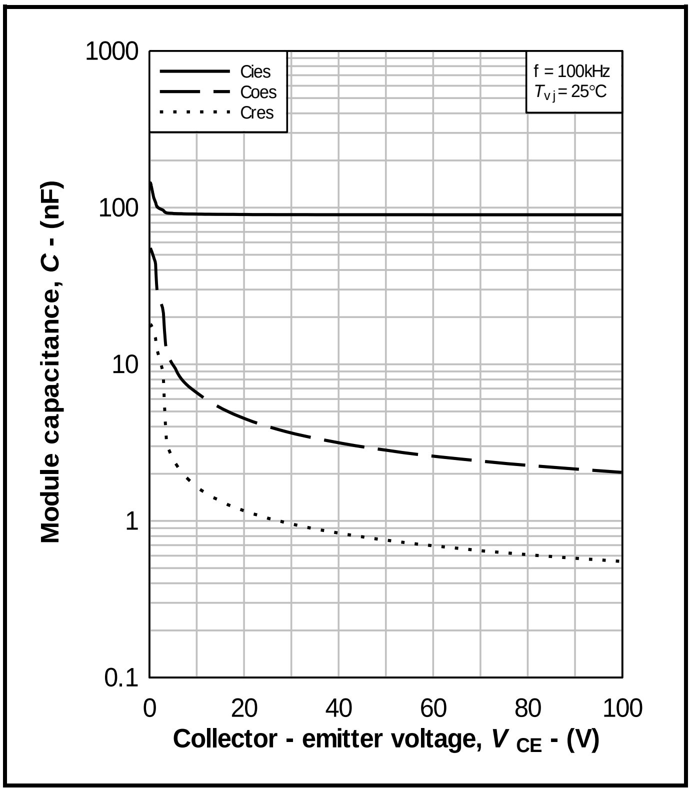


Fig. 15 Typical capacitor characteristic, $C = f(V_{CE})$

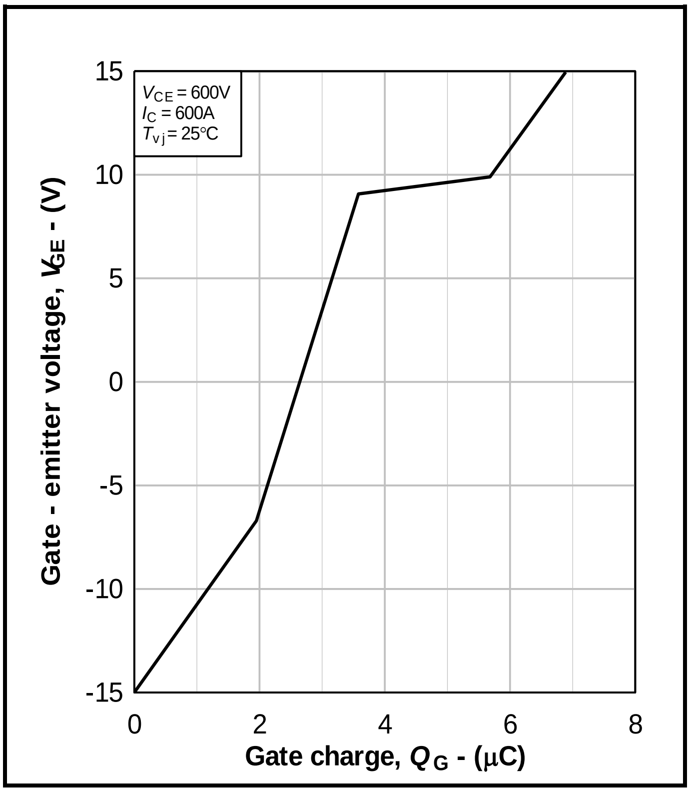
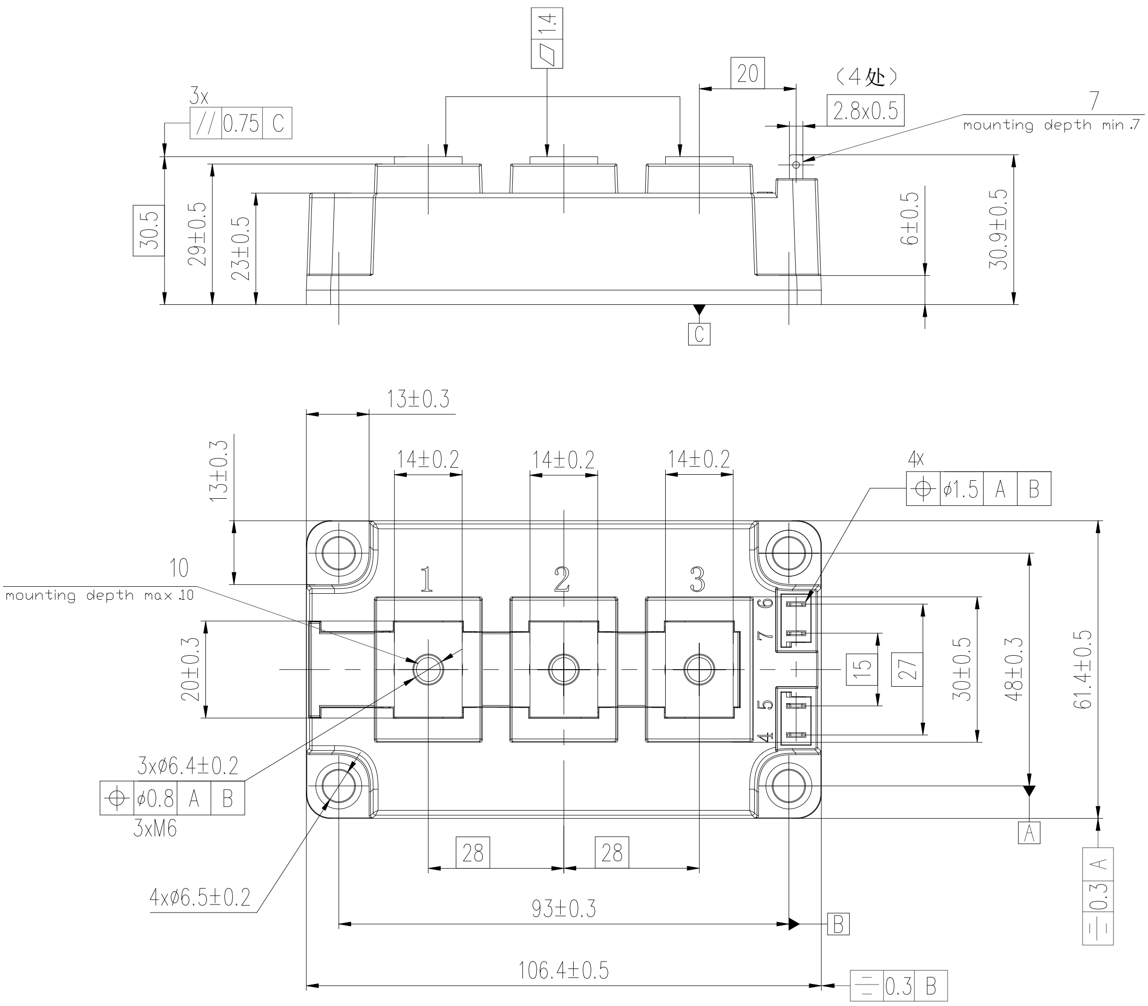


Fig. 16 Typical gate charge characteristic, $V_{GE} = f(Q_G)$

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

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