DIM300WHS12-PA500

Half Bridge IGBT Module

DS6424-1 June 2023 (LN42614)

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 DIM300WHS12-PA500 is a Half Bridge 1200V, n-channel enhancement mode, insulated gate bipolar transistor (IGBT) module. The IGBT has a wide reverse bias safe operating area (RBSOA) plus 10µs short circuit withstand. This device is optimised for 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:

DIM300WHS12-PA500

Note: When ordering, please use the complete part number

KEY PARAMETERS

V_{CES}		**1200V**
$V_{CE(sat)}$ *	(typ)	**1.75V**
I_C	(max)	**300A**
$I_{C(PK)}$	(max)	**600A**

* Measured at the auxiliary terminals

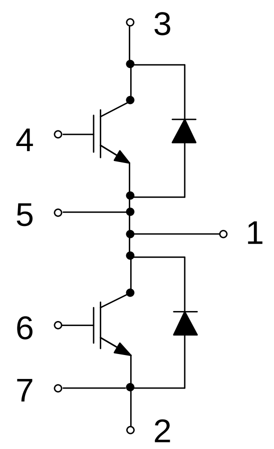


Fig. 1 Circuit configuration

Outline type code: W

(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} = 175°C	300	A
$I_{C(PK)}$	Peak collector current	t_P = 1ms	600	A
P_{max}	Max. transistor power dissipation	T_C = 25°C, T_{vj} = 175°C	1.55	kW
I^2t	Diode I^2t value	V_R = 0, t_p = 10ms, T_{vj} = 150°C	16.2	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:	29.0mm
Creepage distance – Terminal to terminal:	23.0mm
Clearance – Terminal to heatsink:	23.0mm
Clearance – Terminal to terminal:	11.0mm
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	-	-	97	°C/kW
$R_{th(j-c)}$	Thermal resistance – diode	Continuous dissipation - junction to case	-	-	162.2	°C/kW
$R_{th(c-h)}$ IGBT	Thermal resistance – case to heatsink (IGBT)	Mounting torque 3.5Nm (with mounting grease 1W/mK)	-	34	-	°C/kW
$R_{th(c-h)}$ Diode	Thermal resistance – case to heatsink (Diode)	Mounting torque 3.5Nm (with mounting grease 1W/mK)	-	37.5	-	°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			5	mA
		V_{GE} = 0V, V_{CE} = V_{CES}, T_C = 150°C			10	mA
I_{GES}	Gate leakage current	V_{GE} = ± 20V, V_{CE} = 0V			0.5	µA
$V_{GE(TH)}$	Gate threshold voltage	I_C = 10mA, V_{GE} = V_{CE}	5.5	6.1	6.7	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 300A		1.75	2.15	V
		V_{GE} = 15V, I_C = 300A, T_j = 125°C		2.1		V
		V_{GE} = 15V, I_C = 300A, T_j = 150°C		2.2		V
I_F	Diode forward current	DC		300		A
I_{FM}	Diode maximum forward current	t_p = 1ms		600		A
VF	Diode forward voltage	IF = 300A		1.5	1.9	V
		IF = 300A, Tj = 125°C		1.55		V
		IF = 300A, Tj = 150°C		1.55		V
Cies	Input capacitance	VCE = 25V, VGE = 0V, f = 100kHz		44.7		nF
Q_g	Gate charge	±15V		3.7		µC
C_{res}	Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		0.6		nF
L_{sCE}	Module inductance			20		nH
$R_{CC'+EE'}$	Module lead resistance, Terminal - chip	Per switch		0.4		mΩ
R_{INT}	Internal gate resistance			2.1		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		1400		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 = 300A V_{CE} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 3.3Ω $R_{G(ON)}$ = 3.3Ω L_S ~ 45nH	*dv/dt* = 5200V/µs		550		ns
t_f	Fall time				240		ns
E_{OFF}	Turn-off energy loss				27		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 4800A/µs		270		ns
t_r	Rise time				80		ns
E_{ON}	Turn-on energy loss				20.5		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 300A V_{CE} = 600V *di/dt* = 4800A/µs			20		µC
I_{rr}	Diode reverse recovery current				320		A
E_{rec}	Diode reverse recovery energy				7		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 = 300A V_{CE} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 3.3Ω $R_{G(ON)}$ = 3.3Ω L_S ~ 45nH	*dv/dt* = 5200V/µs		600		ns
t_f	Fall time				350		ns
E_{OFF}	Turn-off energy loss				34.5		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 4800A/µs		280		ns
t_r	Rise time				90		ns
E_{ON}	Turn-on energy loss				27		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 300A V_{CE} = 600V *di/dt* = 4800A/µs			41.5		µC
I_{rr}	Diode reverse recovery current				360		A
E_{rec}	Diode reverse recovery energy				16		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 = 300A V_{CE} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 3.3Ω $R_{G(ON)}$ = 3.3Ω L_S ~ 45nH	*dv/dt* = 5200V/µs		620		ns
t_f	Fall time				360		ns
E_{OFF}	Turn-off energy loss				37		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 4800A/µs		280		ns
t_r	Rise time				90		ns
E_{ON}	Turn-on energy loss				30.5		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 300A V_{CE} = 600V *di/dt* = 4800A/µs			49.5		µC
I_{rr}	Diode reverse recovery current				380		A
E_{rec}	Diode reverse recovery energy				18.5		mJ

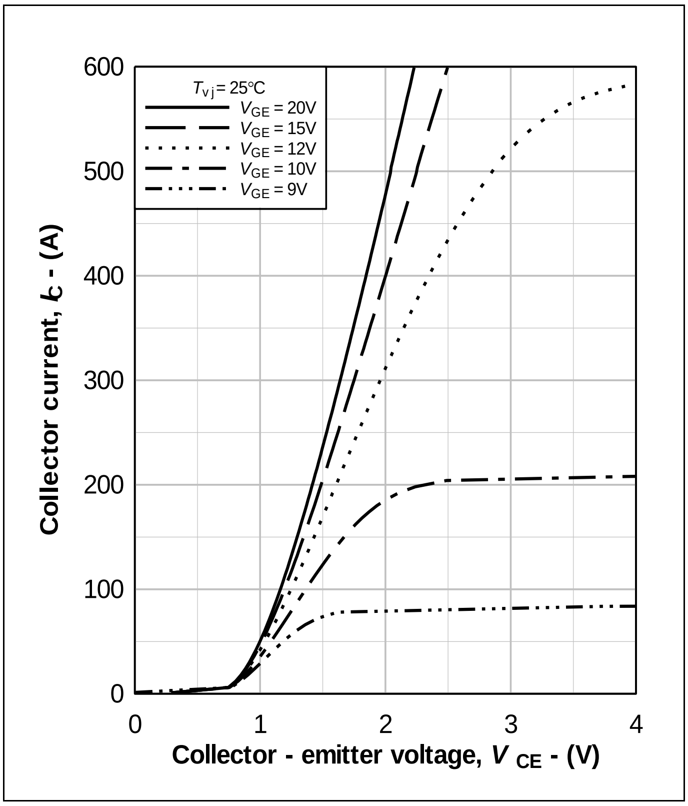


Fig. 3 Typical IGBT output characteristics, I_C = f (V_{CE})

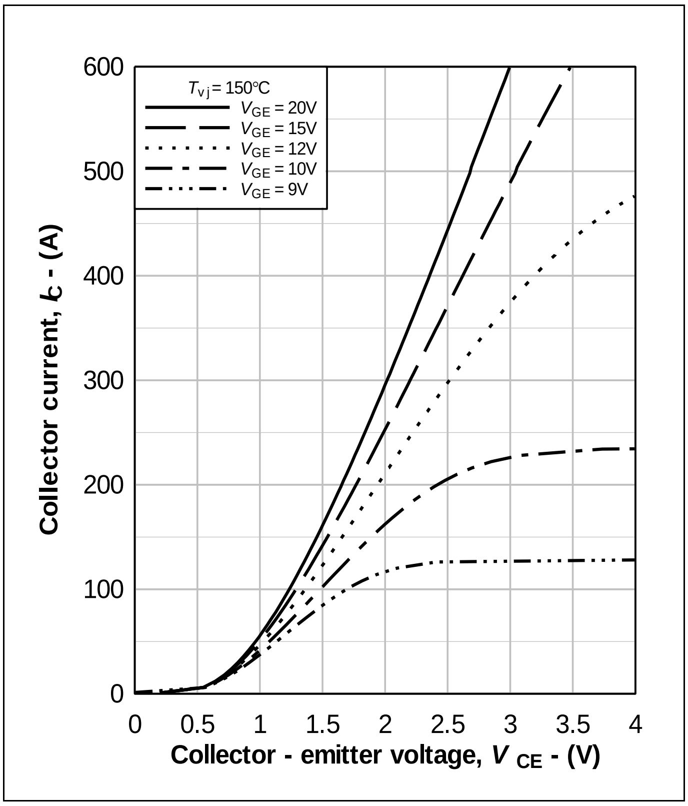


Fig. 4 Typical IGBT output characteristics, I_C = f (V_{CE})

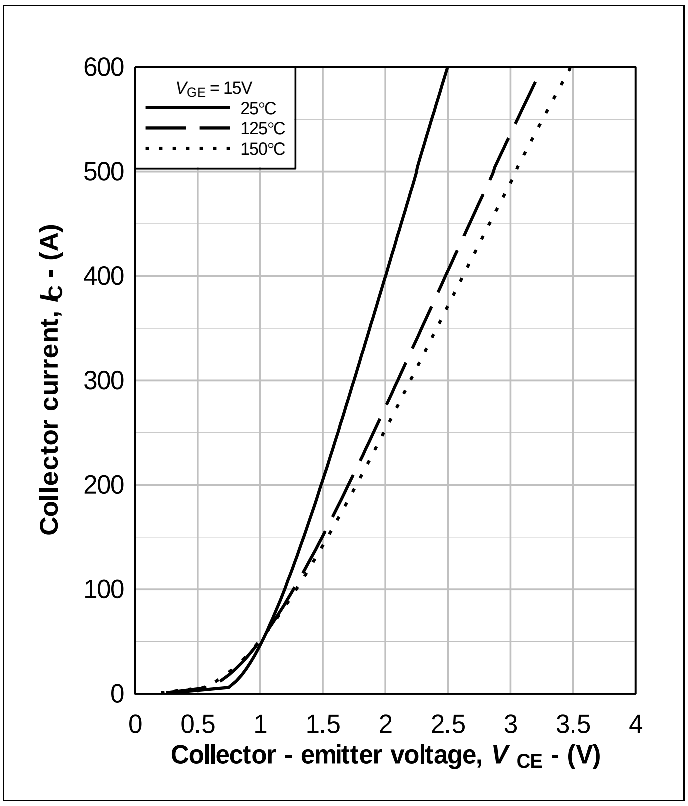


Fig. 5 Typical IGBT output characteristics, I_C = f (V_{CE})

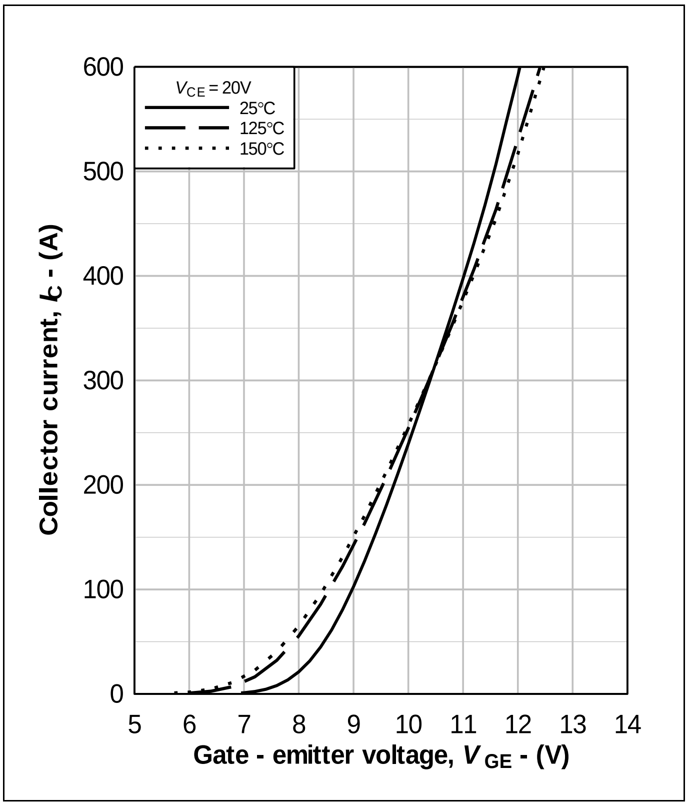


Fig. 6 Typical IGBT transfer characteristics, I_C = f (V_{GE})

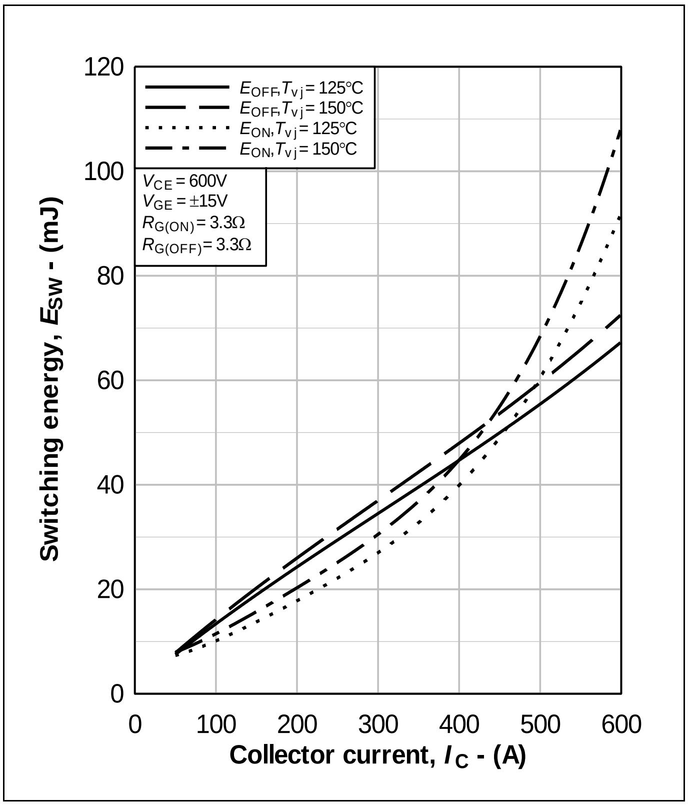


Fig. 7 Typical IGBT switching energy,
E_{ON} = f(I_C), E_{OFF} = f (I_C)

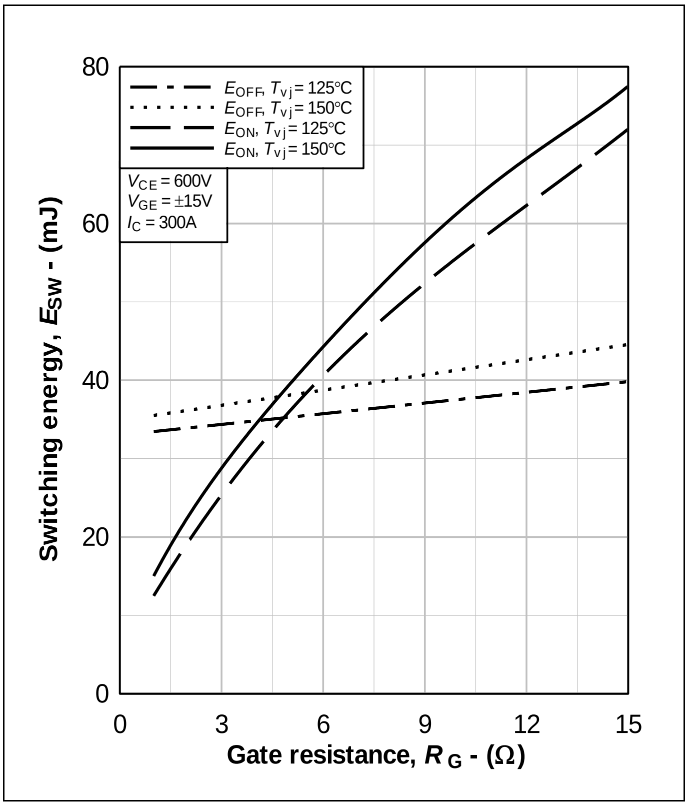


Fig. 8 Typical IGBT switching energy,
E_{ON} = f(R_G), E_{OFF} = f (R_G)

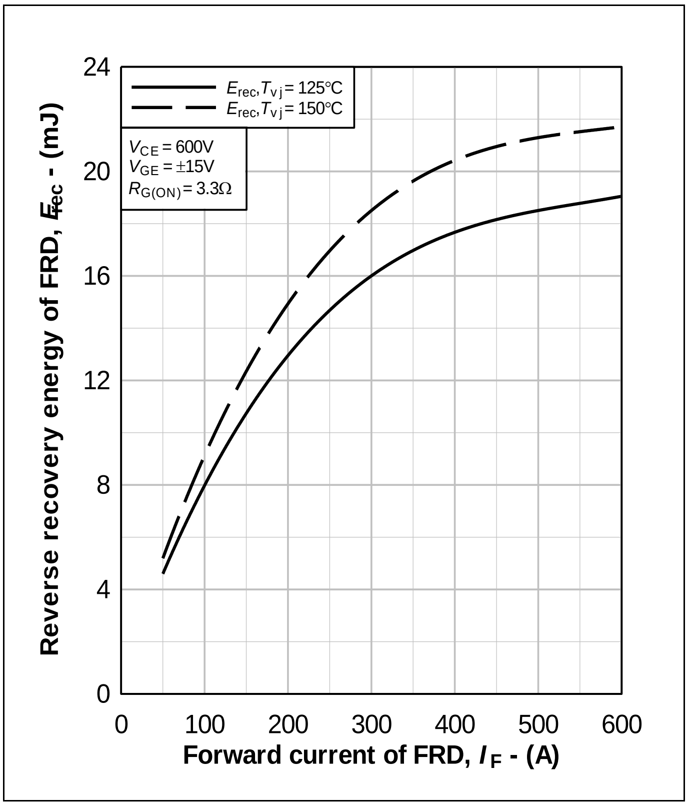


Fig. 9 Typical FRD E_{rec}, E_{rec} = f (I_F)

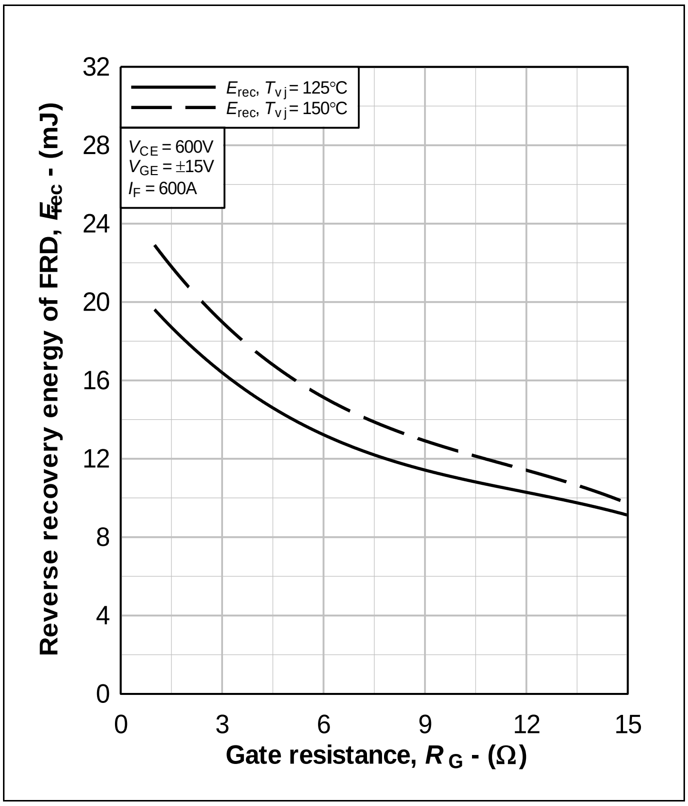


Fig. 10 Typical FRD E_{rec}, E_{rec} = f (R_G)

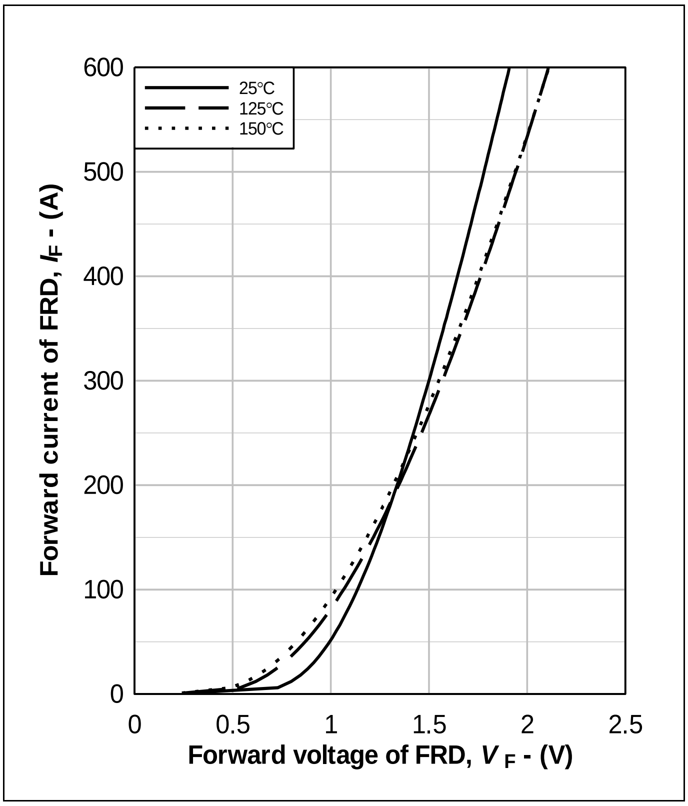


Fig. 11 Diode typical forward characteristics, I_F = f (V_F)

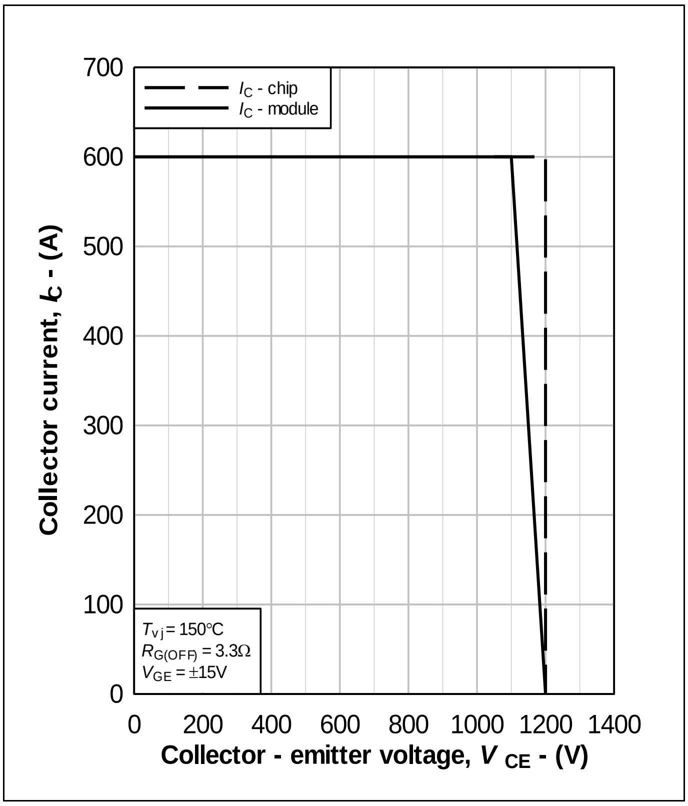


Fig. 12 Reverse bias safe operating area of IGBT,
I_C = f (V_{CE})

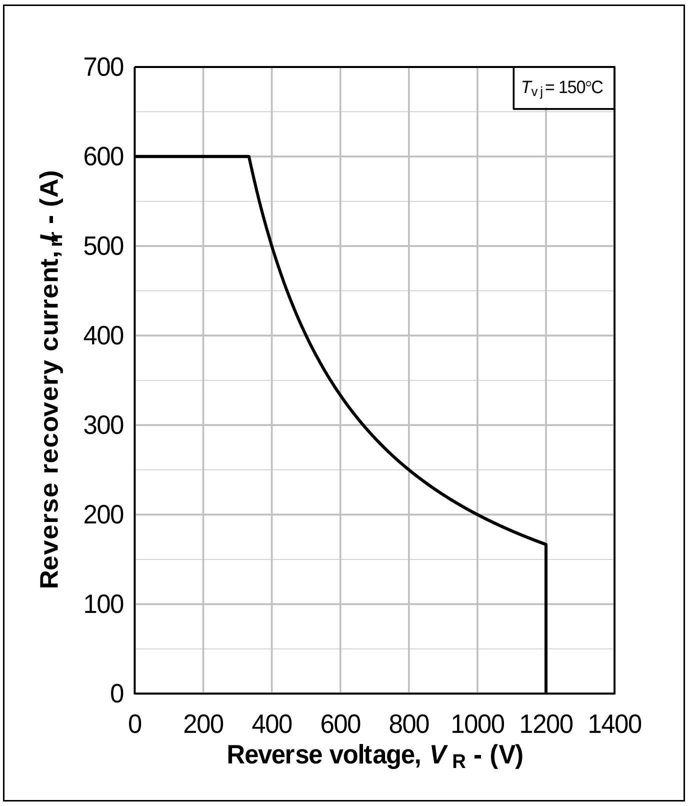


Fig. 13 Reverse bias safe operating area of FRD,
I_{rr} = f (V_R)

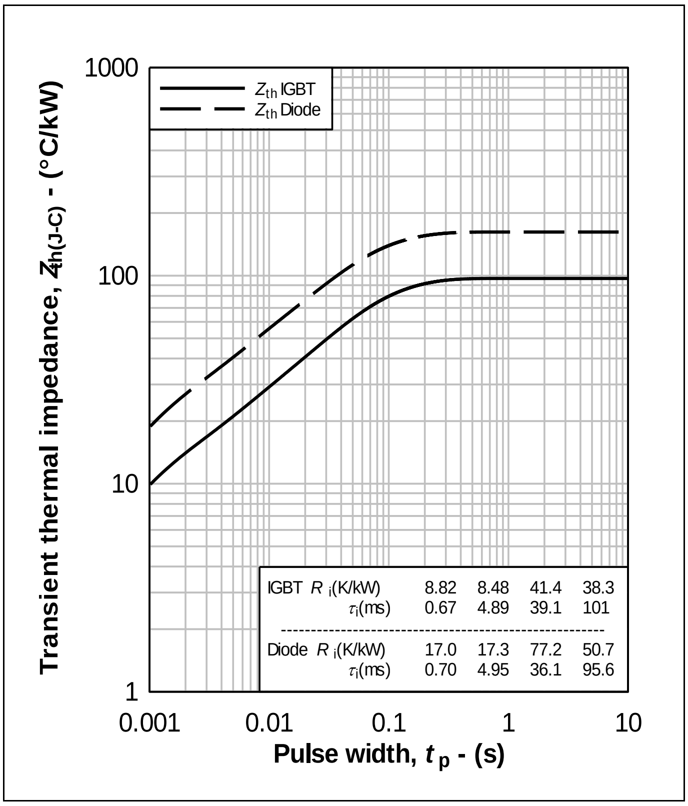


Fig. 14 Transient thermal impedance, $Z_{th(J-C)}$ = f (t_p)

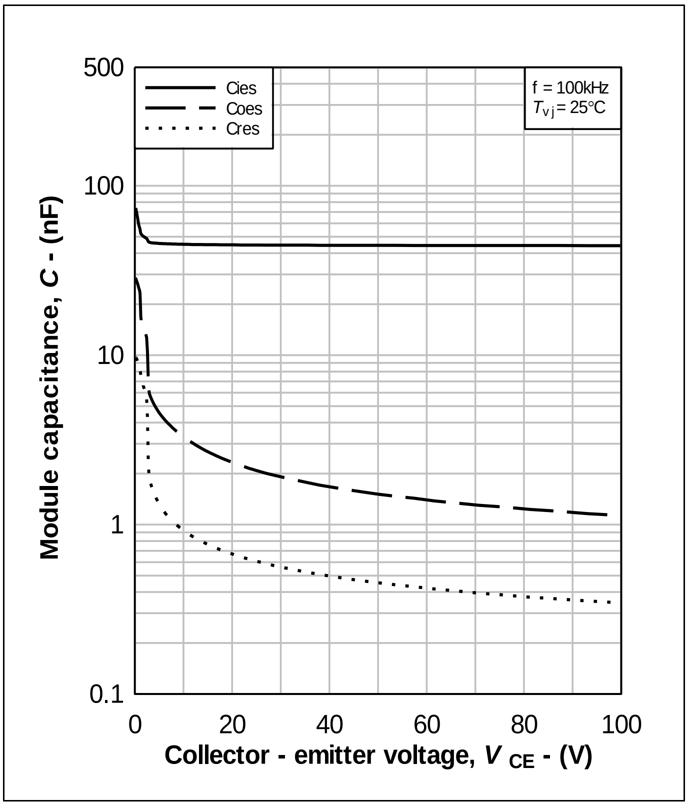


Fig. 15 Typical capacitor characteristic, $C = f(V_{CE})$

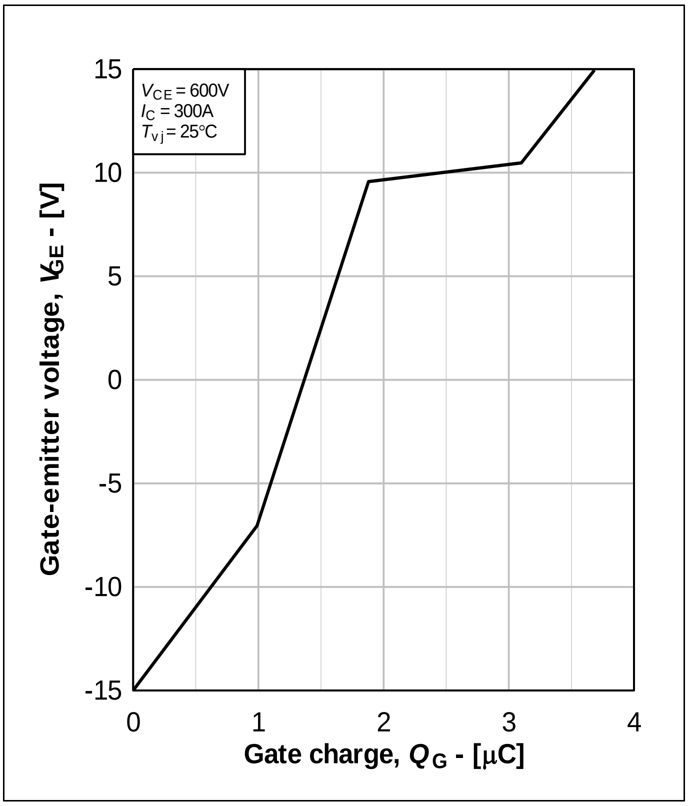
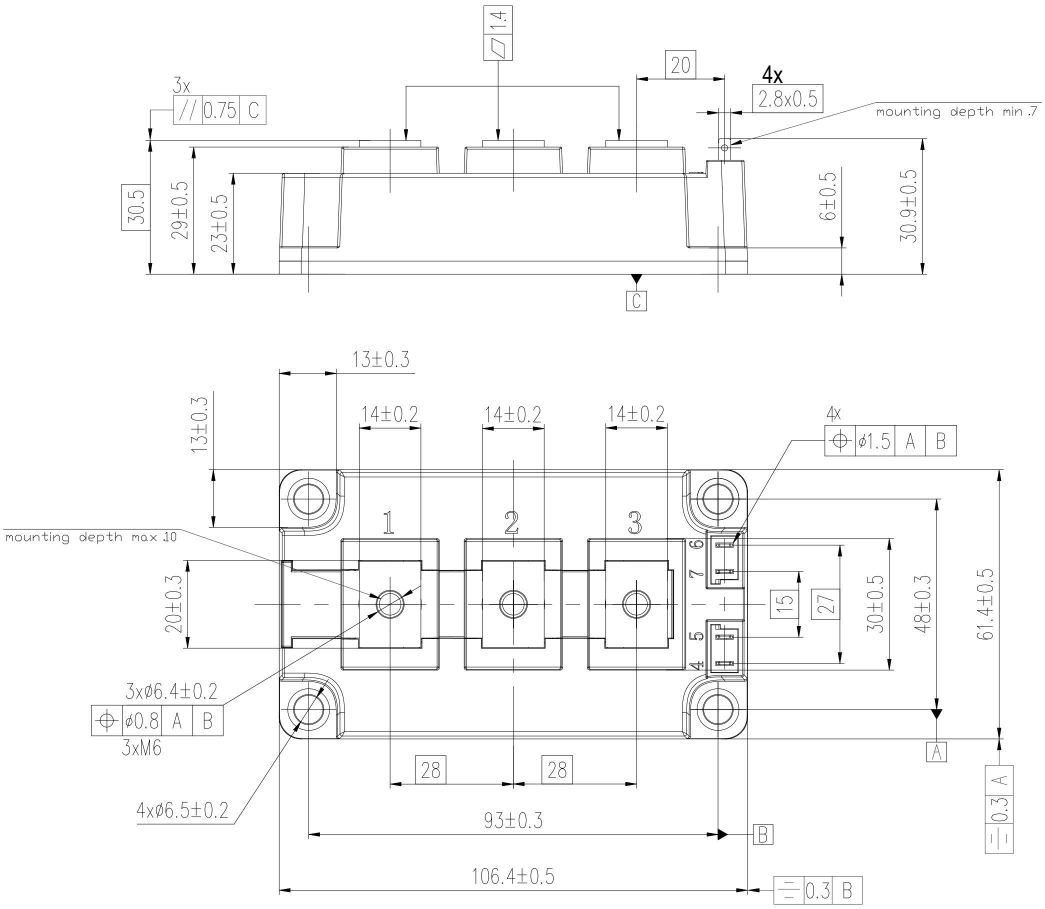


Fig. 16 Typical gate charge characteristic, $V_{GE} = f(Q_G)$

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: 325g

Module Outline Type Code: W

Fig. 17 Module outline drawing

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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.

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