DIM900M1HS12-PG500

Half Bridge IGBT Module

Replaces DS6404-2

DS6404-3 April 2024 (LN43277)

FEATURES

- Ultra-fine Trench Gate IGBT
- Cu Base with Enhanced Al_2O_3 Substrates
- High Thermal Cycling Capability

APPLICATIONS

- Motor Drives
- Power Charging Equipment
- Solar Power
- Electric Vehicles

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 DIM900M1HS12-PG500 is a half bridge 1200V, trench gate, insulated gate bipolar transistor (IGBT) module with enhanced field stop. The IGBT has a wide reverse bias safe operating area (RBSOA) plus 8μs short circuit withstand.

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:

DIM900M1HS12-PG500

Note: When ordering, please use the complete part number

KEY PARAMETERS

V_{CES}		**1200V**
$V_{CE(sat)}$ *	(typ)	**1.45V**
I_C	(max)	**900A**
$I_{C(PK)}$	(max)	**1800A**

* Measured at the auxiliary terminals

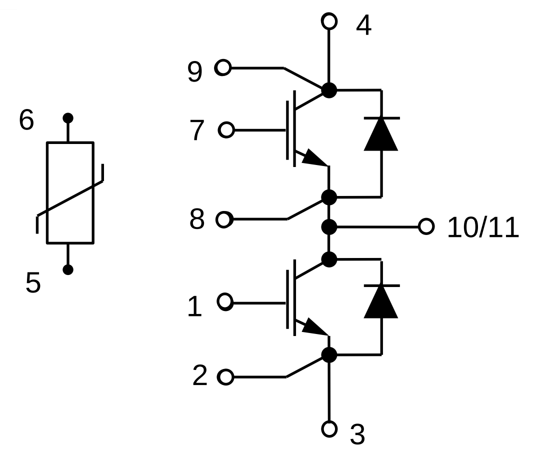


Fig. 1 Circuit configuration

Outline type code: M1

(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 = 80°C, T_{vj} = 175°C	900	A
$I_{C(PK)}$	Peak collector current	t_P = 1ms	1800	A
P_{max}	Max. transistor power dissipation	T_C = 25°C, T_{vj} = 175°C	2.9	kW
I^2t	Diode I^2t value	V_R = 0, t_p = 10ms, T_{vj} = 150°C	27	kA^2s
V_{isol}	Isolation voltage – per module	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	3400	V

THERMAL AND MECHANICAL RATINGS

Internal insulation material: Al_2O_3

Baseplate material: Cu

Creepage distance – Terminal to heatsink: 14.5mm

Creepage distance – Terminal to terminal: 13.0mm

Clearance – Terminal to heatsink: 12.5mm

Clearance – Terminal to terminal: 10mm

CTI (Comparative Tracking Index): >200

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$R_{th(j-c)}$	Thermal resistance – IGBT	Continuous dissipation – junction to case	-	-	52	°C/kW
$R_{th(j-c)}$	Thermal resistance – diode		-	-	75	°C/kW
$R_{th(c-h)}$	Thermal resistance – case to heatsink (IGBT)	Mounting torque 5Nm (with mounting grease 1W/m °C)	-	31	-	°C/kW
$R_{th(c-h)}$	Thermal resistance – case to heatsink (Diode)		-	32	-	°C/kW
T_j	Junction temperature – under switching conditions	IGBT	-40	-	175	°C
		Diode	-40	-	175	°C
T_{stg}	Storage temperature range	-	-40	-	125	°C
	Screw torque	Mounting – M5	3	-	6	Nm
		Electrical connections – M6	3	-	6	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 = 150°C			20	mA
		V_{GE} = 0V, V_{CE} = V_{CES}, T_C = 175°C			30	mA
I_{GES}	Gate leakage current	V_{GE} = ± 20V, V_{CE} = 0V			0.5	μA
$V_{GE(TH)}$	Gate threshold voltage	I_C = 15mA, V_{GE} = V_{CE}	5.40	6.00	6.60	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 900A		1.45	1.85	V
		V_{GE} = 15V, I_C = 900A, T_j = 150°C		1.80		V
		V_{GE} = 15V, I_C = 900A, T_j = 175°C		1.80		V
I_F	Diode forward current	DC		900		A
I_{FM}	Diode maximum forward current	t_p = 1ms		1800		A
V_F	Diode forward voltage	I_F = 900A		1.90	2.30	V
		I_F = 900A, T_j = 150°C		2.05		V
		I_F = 900A, T_j = 175°C		2.10		V
C_{ies}	Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		169		nF
Q_g	Gate charge	±15V		8.1		μC
C_{res}	Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		0.28		nF
L_M	Module inductance			28		nH
$R_{CC'+EE'}$	Module lead resistance, Terminal - chip			1		mΩ
R_{Gint}	Internal gate resistor			0.9		Ω
SC_{Data}	Short circuit current, I_{SC}	T_j = 150°C, V_{CC} = 800V t_p ≤ 8μs, V_{GE} ≤ 15V $V_{CE\,(max)}$ = V_{CES} – L^* x di/dt IEC 60747-9		3200		A

Note:
* L is the circuit inductance + L_M

NTC-Thermistor Data

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
R_{25}	Rated resistance	T_C = 25°C		5		kΩ
$\Delta R/R$	Deviation of R100	T_C = 100°C, R_{100} = 493Ω	-5		5	%
P_{25}	Power dissipation	T_C = 25°C			20	mW
$B_{25/50}$	B-value	$R_2 = R_{25}\exp[B_{25/50}(1/T2 - 1/(298.15K))]$		3375		K
$B_{25/80}$		$R_2 = R_{25}\exp[B_{25/80}(1/T2 - 1/(298.15K))]$		3411		K
$B_{25/100}$		$R_2 = R_{25}\exp[B_{25/100}(1/T2 - 1/(298.15K))]$		3433		K

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 = 900A V_{CE} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 3.3Ω $R_{G(ON)}$ = 1.0Ω L_S = 35nH	*dv/dt* = 4200V/µs		800		ns
t_f	Fall time				80		ns
E_{OFF}	Turn-off energy loss				85		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 5500A/µs		340		ns
t_r	Rise time				110		ns
E_{ON}	Turn-on energy loss				80		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 900A V_{CE} = 600V *di/dt* = 5500A/µs			78		µC
I_{rr}	Diode reverse recovery current				320		A
E_{rec}	Diode reverse recovery energy				24		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 = 900A V_{CE} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 3.3Ω $R_{G(ON)}$ = 1.0Ω L_S = 35nH	*dv/dt* = 4200V/µs		850		ns
t_f	Fall time				140		ns
E_{OFF}	Turn-off energy loss				105		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 5500A/µs		390		ns
t_r	Rise time				130		ns
E_{ON}	Turn-on energy loss				150		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 900A V_{CE} = 600V *di/dt* = 5500A/µs			115		µC
I_{rr}	Diode reverse recovery current				340		A
E_{rec}	Diode reverse recovery energy				42		mJ

T_{case} = 175°C unless stated otherwise

Symbol	Parameter	Test Conditions		Min	Typ.	Max	Units
$t_{d(off)}$	Turn-off delay time	I_C = 900A V_{CE} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 3.3Ω $R_{G(ON)}$ = 1.0Ω L_S = 35nH	*dv/dt* = 4200V/µs		875		ns
t_f	Fall time				155		ns
E_{OFF}	Turn-off energy loss				116		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 5500A/µs		390		ns
t_r	Rise time				140		ns
E_{ON}	Turn-on energy loss				165		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 900A V_{CE} = 600V *di/dt* = 5500A/µs			121		µC
I_{rr}	Diode reverse recovery current				360		A
E_{rec}	Diode reverse recovery energy				46		mJ

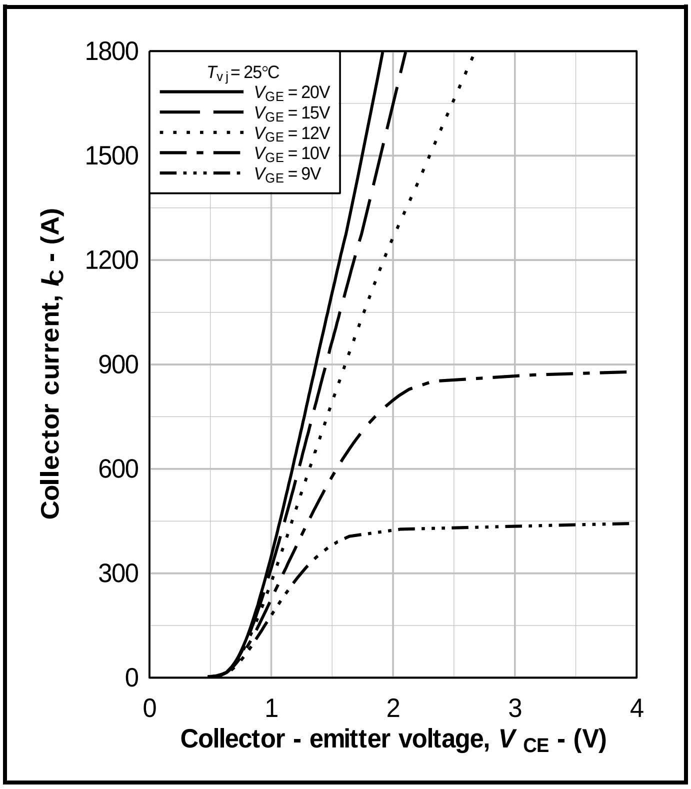


Fig. 3 Typical IGBT output characteristics, I_C = f (V_{CE})

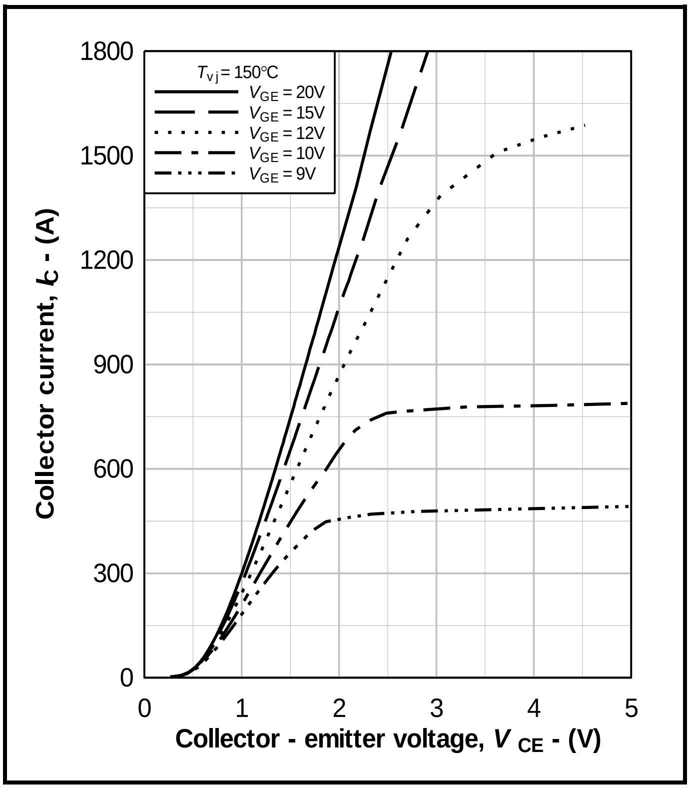


Fig. 4 Typical IGBT output characteristics, I_C = f (V_{CE})

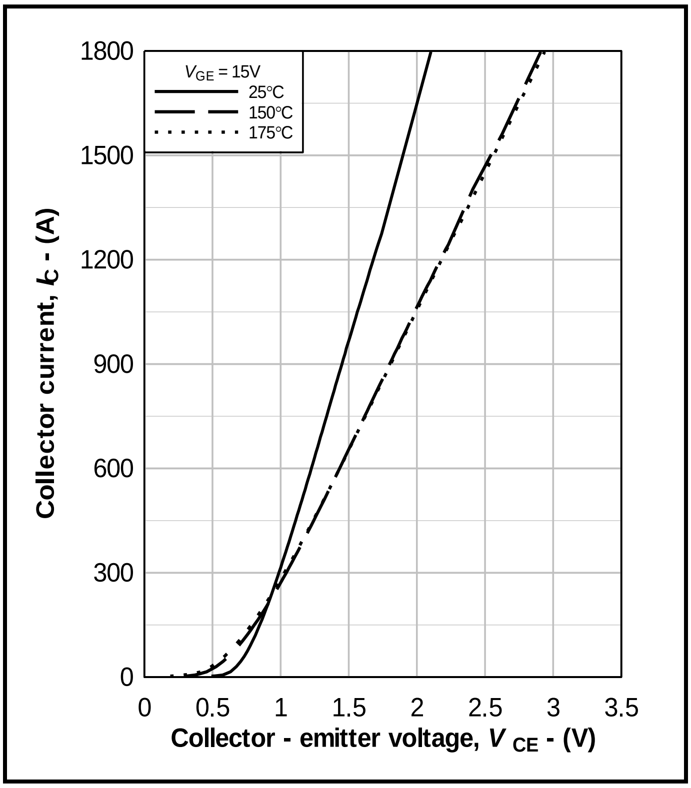


Fig. 5 Typical IGBT output characteristics, I_C = f (V_{CE})

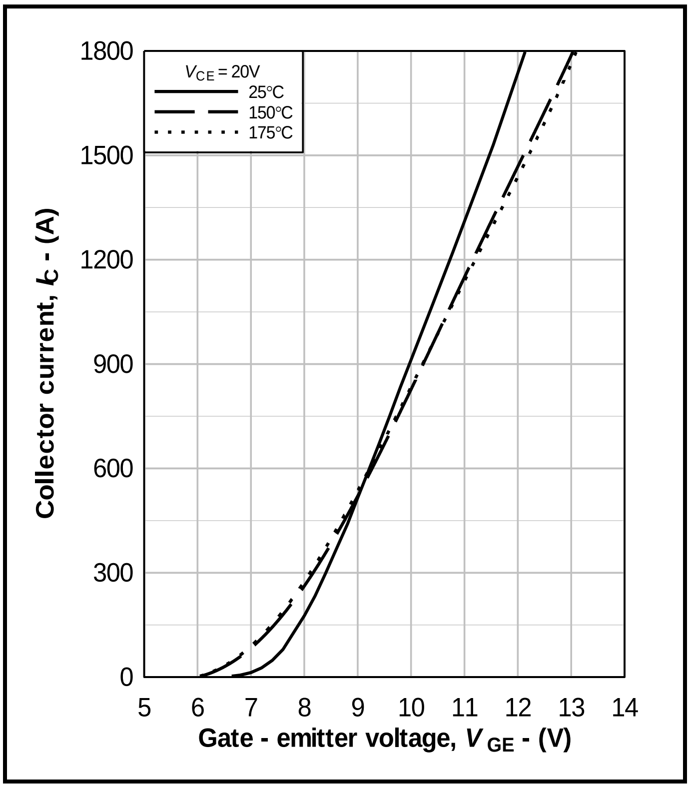


Fig. 6 Typical IGBT transfer characteristics, I_C = f (V_{GE})

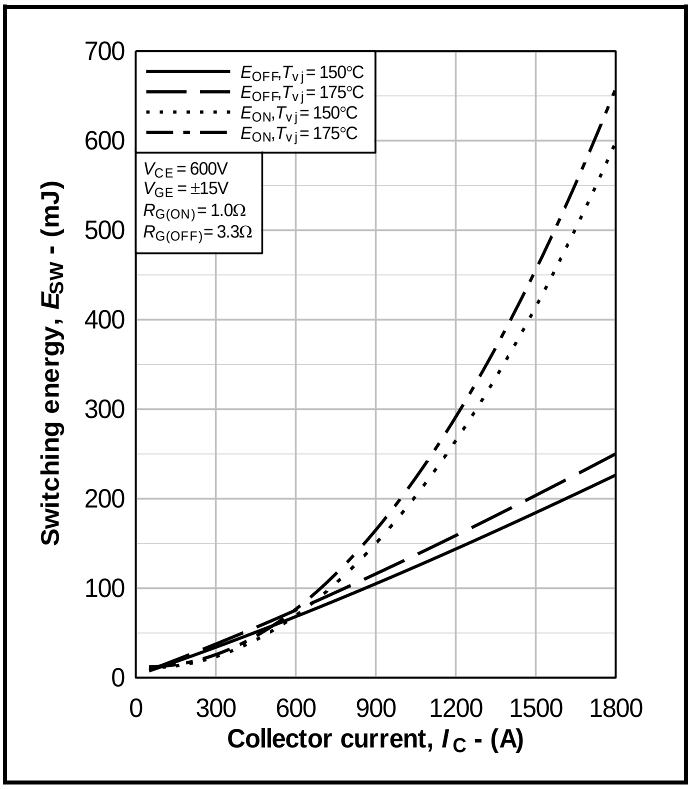


Fig. 7 Typical IGBT switching energy, E_{ON} = f(I_C), E_{OFF} = f (I_C)

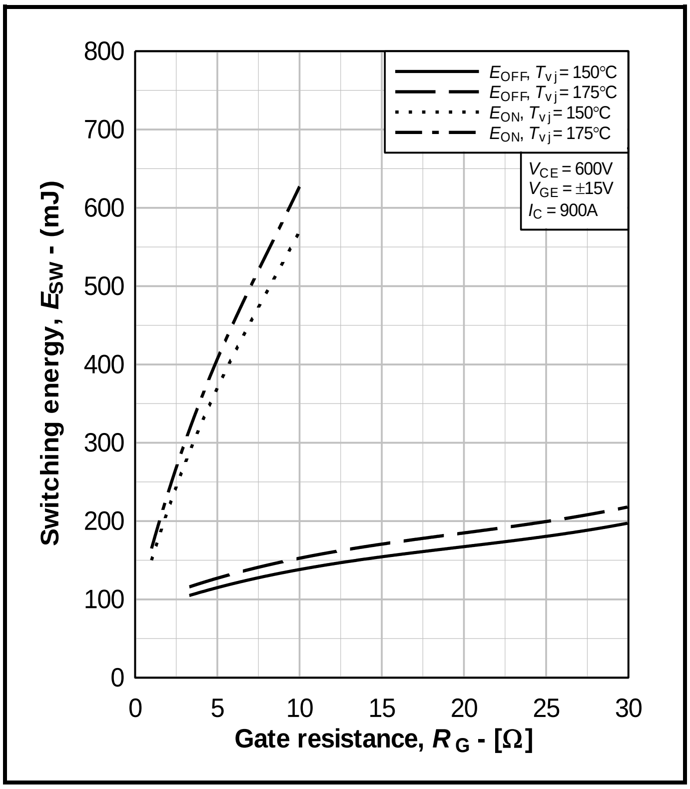


Fig. 8 Typical IGBT switching energy, E_{ON} = f(R_G), E_{OFF} = f (R_G)

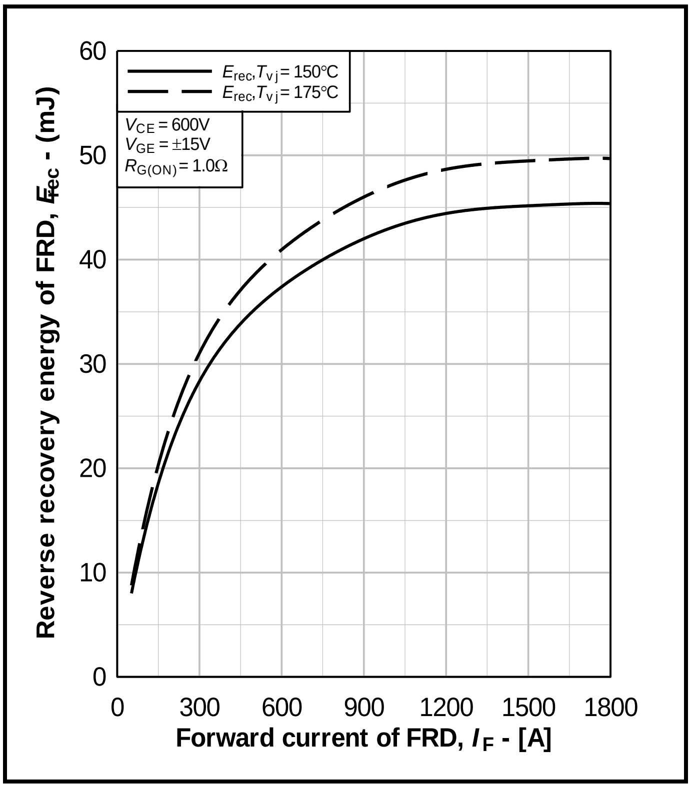


Fig. 9 Typical FRD E_{rec}, E_{rec} = f (I_F)

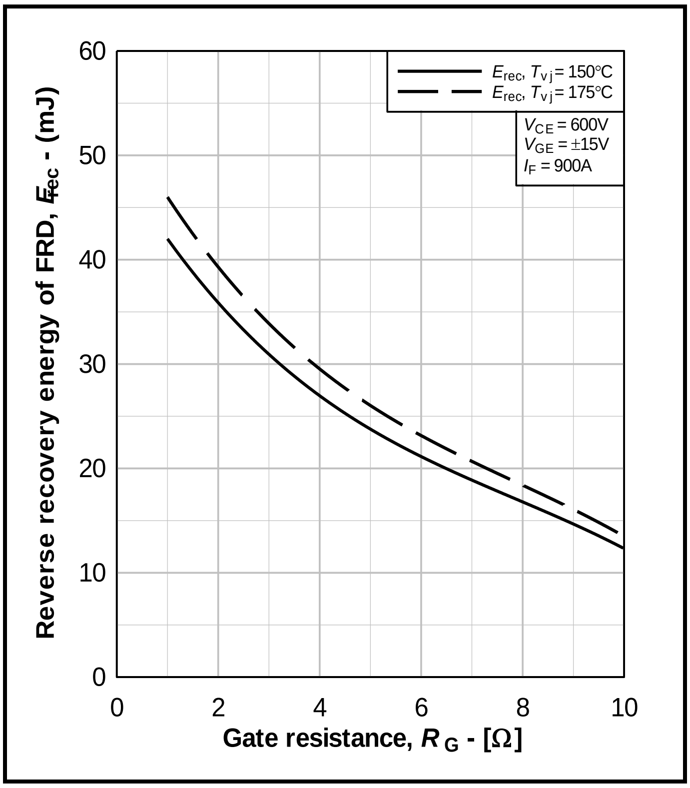


Fig. 10 Typical FRD E_{rec}, E_{rec} = f (R_G)

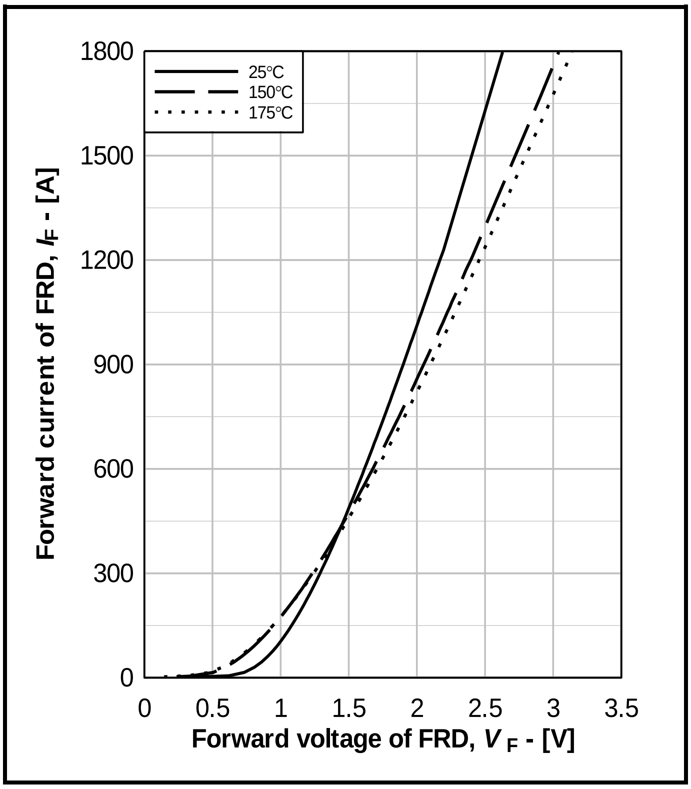


Fig. 11 Diode typical forward characteristics, I_F = f (V_F)

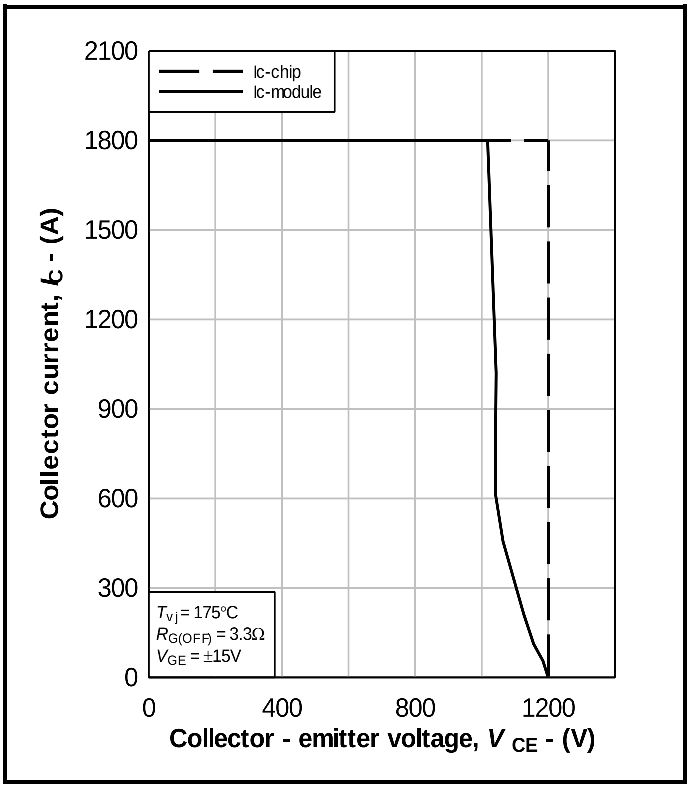


Fig. 12 Reverse bias safe operating area of IGBT, I_C = f (V_{CE})

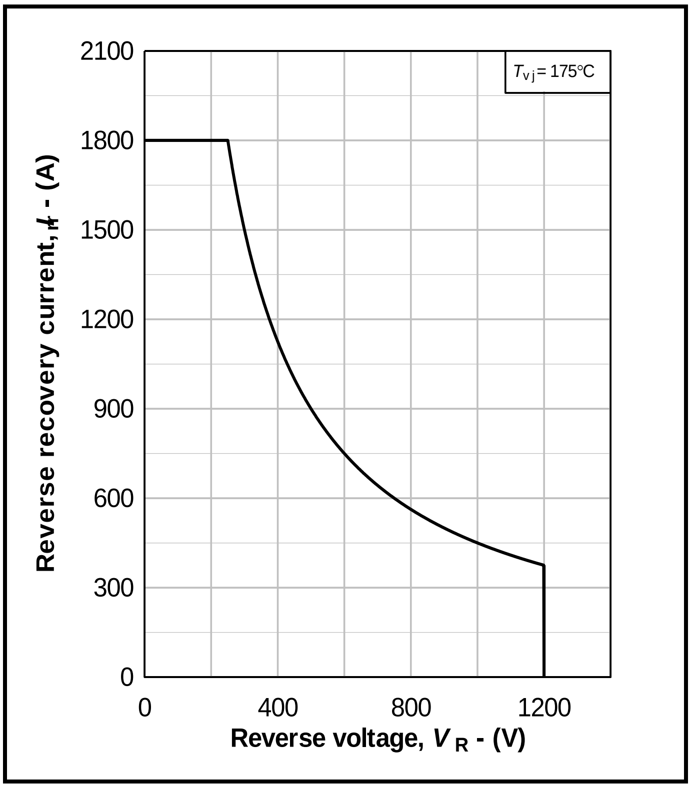


Fig. 13 Reverse bias safe operating area of FRD, I_{rr} = f (V_R)

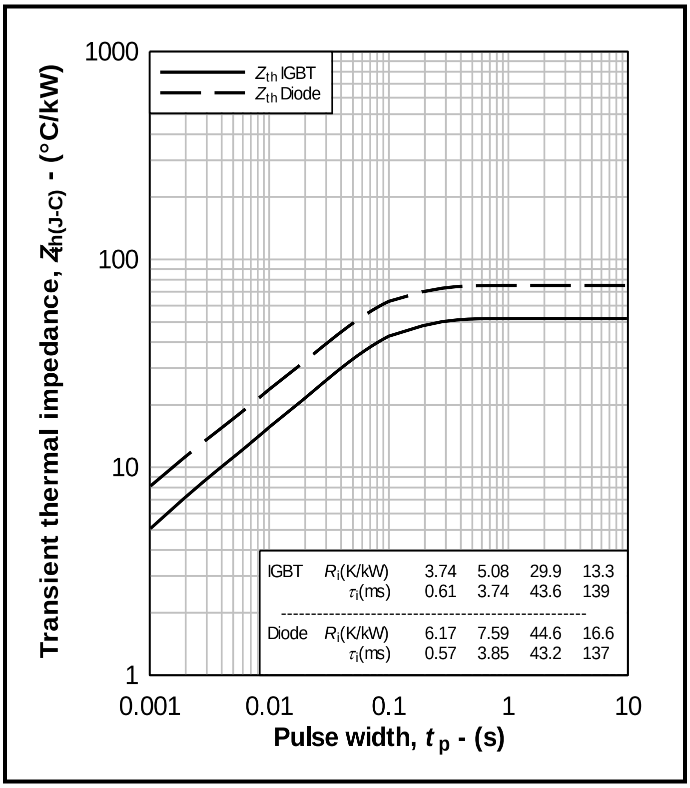


Fig. 14 Transient thermal impedance, $Z_{th(J-C)}$ = f (t_p)

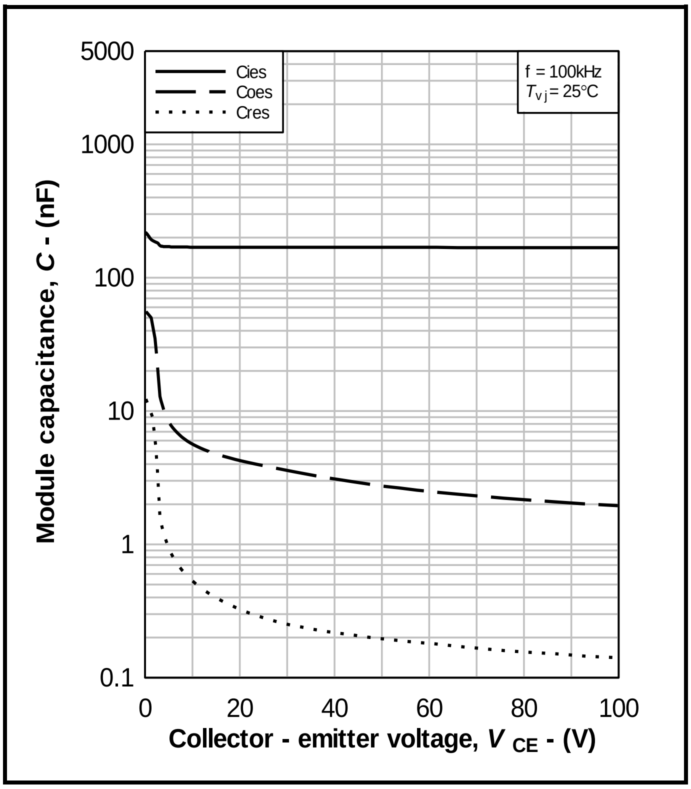


Fig. 15 Typical capacitor characteristic, $C = f(V_{CE})$

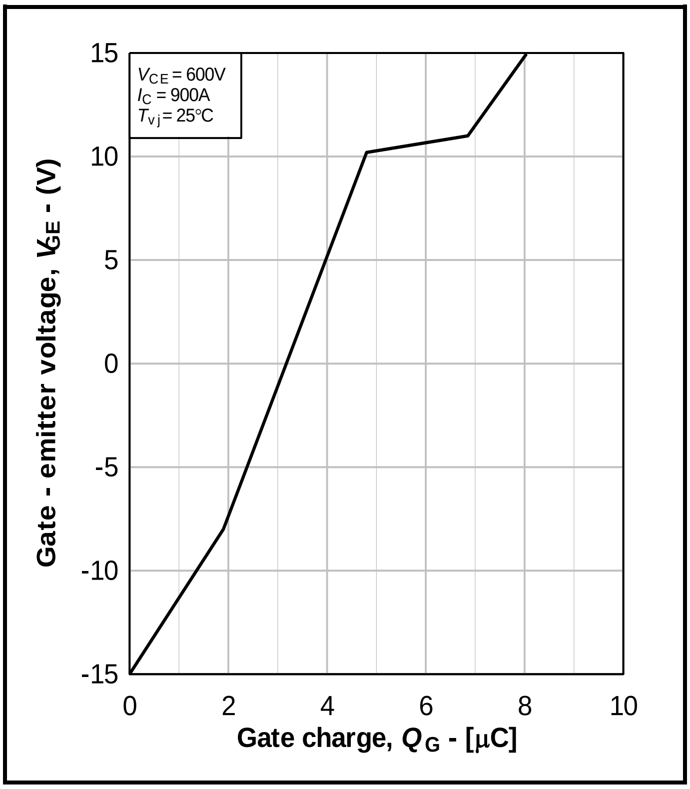


Fig. 16 Typical gate charge characteristic, $V_{GE} = f(Q_G)$

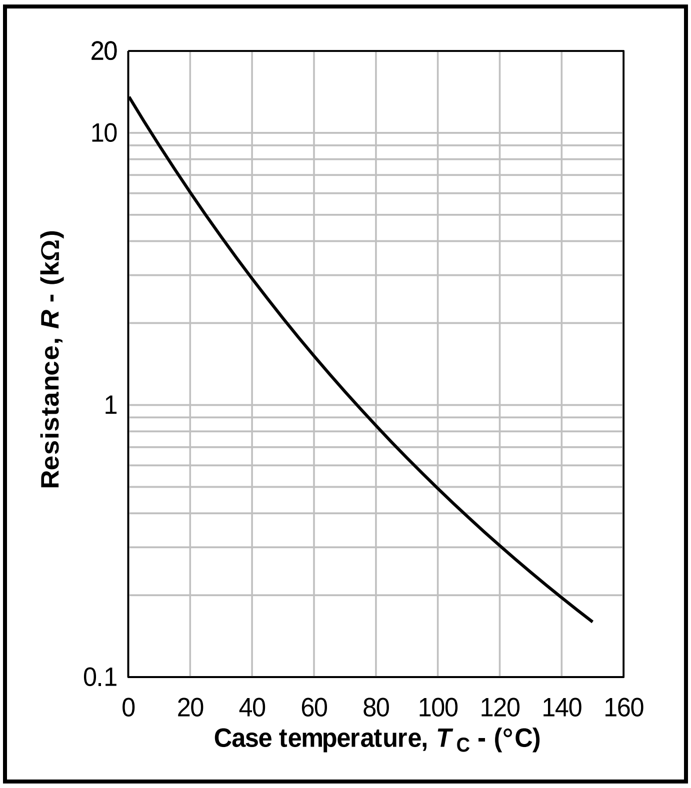
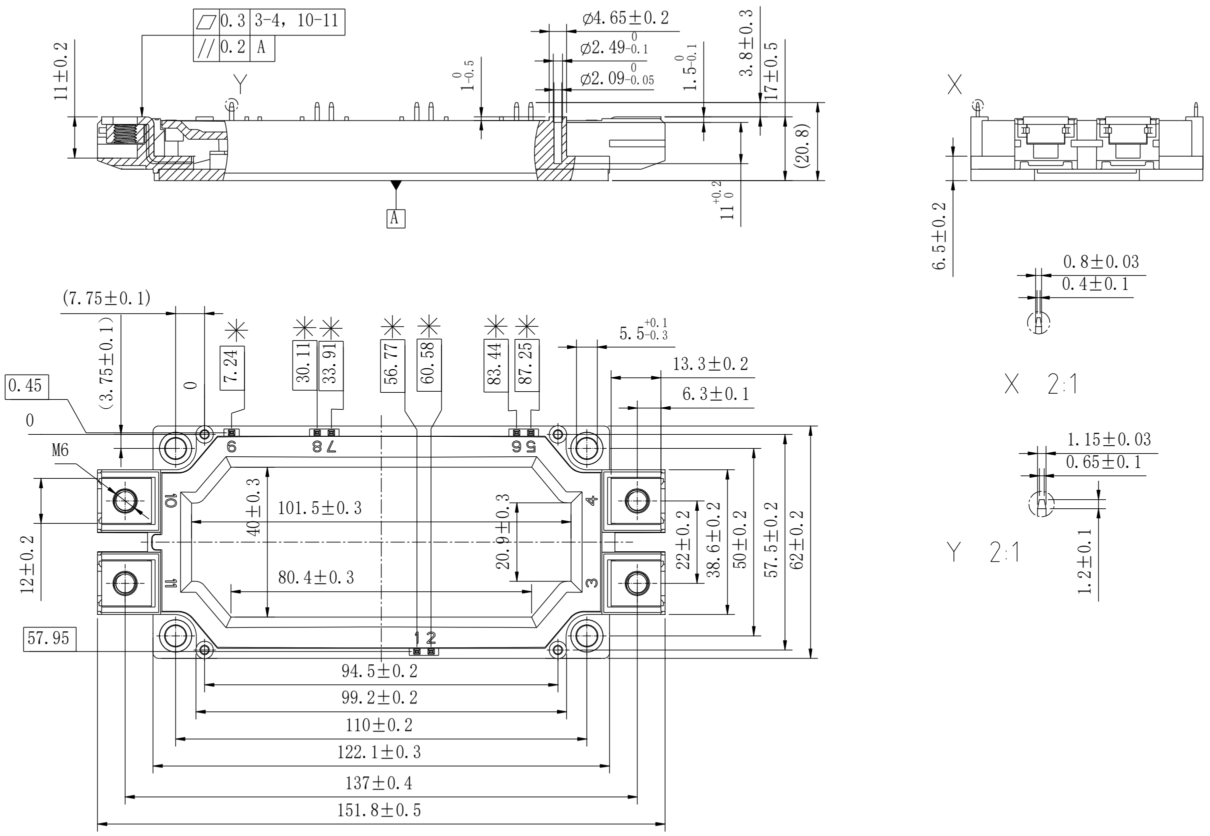


Fig. 17 Typical NTC thermistor characteristic, $R = f(T_C)$

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: 345g

Module Outline Type Code: M1

Fig. 18 Module outline drawing

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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.

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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.
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