DIM600M1HS12-PC500

Half Bridge IGBT Module

TRENCH
Gen5 TMOS

Replaces DS6315-2

DS6315-3 October 2021 (LN41266)

FEATURES

- Trench Gate IGBT
- Cu Base with Enhanced Al_2O_3 Substrates
- High Thermal Cycling Capability
- 10µs Short Circuit Withstand
- Low E_{ON} E_{OFF} Variant
- IGBT T_{vj}(max) = 175°C

APPLICATIONS

- Motor Drives
- Power Charging Equipment
- Renewable Energy Power Conversion
- 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 DIM600M1HS12-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 traction 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:

DIM600M1HS12-PC500

Note: When ordering, please use the complete part number

KEY PARAMETERS

V_{CES}		**1200V**
$V_{CE(sat)}$ *	**(typ)**	**1.85V**
I_C	**(max)**	**600A**
$I_{C(PK)}$	**(max)**	**1200A**

* Measured at the auxiliary terminals

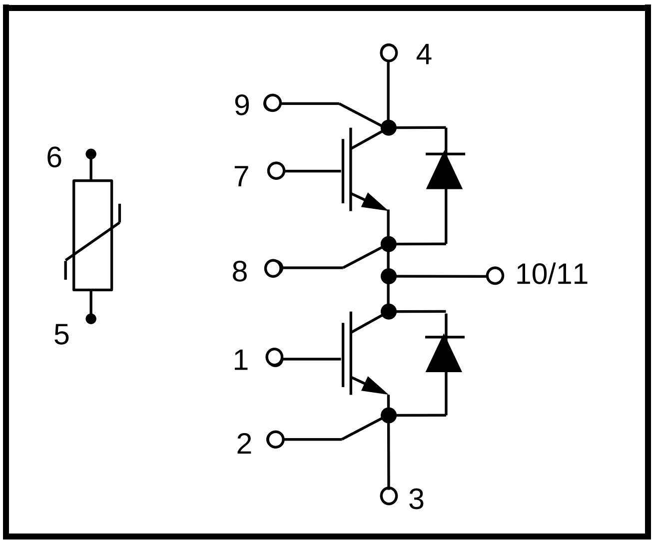


Fig. 1 Circuit configuration

Outline type code: M1

(See Fig. 15 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, T_C = 133°C	1200	A
P_{max}	Max. transistor power dissipation	T_C = 25°C, T_{vj} = 175°C	3.0	kW
I^2t	Diode I^2t value	V_R = 0, t_p = 10ms, T_{vj} = 150ºC	21.6	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	-	-	49	°C/kW
$R_{th(j-c)}$	Thermal resistance – diode		-	-	77	°C/kW
$R_{th(c-h)}$	Thermal resistance – case to heatsink (IGBT)	Mounting torque 5Nm (with mounting grease 1W/m °C)	-	-	34	°C/kW
$R_{th(c-h)}$	Thermal resistance – case to heatsink (Diode)		-	-	40	°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 – 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 = 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 = 15mA, V_{GE} = V_{CE}	5.50	6.10	6.70	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 600A		1.85	2.25	V
		V_{GE} = 15V, I_C = 600A, T_j = 125°C		2.15	2.55	V
		V_{GE} = 15V, I_C = 600A, T_j = 150°C		2.25	2.65	V
I_F	Diode forward current	DC		600		A
I_{FM}	Diode maximum forward current	t_p = 1ms		1200		A
V_F	Diode forward voltage	I_F = 600A		1.9	2.3	V
		I_F = 600A, T_j = 125°C		2.1	2.5	V
		I_F = 600A, T_j = 150°C		2.1	2.5	V
C_{ies}	Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		93		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			22		nH
R_{INT}	Internal transistor resistance			1		mΩ
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

NTC-Thermistor Data

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
R_{25}	Rated resistance	T_C = 25°C		5		kΩ
Δ*R*/R	Deviation of R100	T_C = 100°C, R_{100} = 493Ω	-5		5	%
P_{25}	Power dissipation	T_C = 25°C			20	m/W
$B_{25/50}$	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 = 600A V_{CE} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 1.5Ω $R_{G(ON)}$ = 1.5Ω L_S ~ 60nH	*dv/dt* = 5000V/µs		725		ns
t_f	Fall time				120		ns
E_{OFF}	Turn-off energy loss				66		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 6100A/µs		310		ns
t_r	Rise time				110		ns
E_{ON}	Turn-on energy loss				22		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 600A V_{CE} = 600V *di/dt* = 6100A/µs			62		µC
I_{rr}	Diode reverse recovery current				405		A
E_{rec}	Diode reverse recovery energy				34		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 $R_{G(OFF)}$ = 1.5Ω $R_{G(ON)}$ = 1.5Ω L_S ~ 60nH	*dv/dt* = 5000V/µs		770		ns
t_f	Fall time				205		ns
E_{OFF}	Turn-off energy loss				80		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 6100A/µs		330		ns
t_r	Rise time				115		ns
E_{ON}	Turn-on energy loss				29		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 600A V_{CE} = 600V *di/dt* = 6100A/µs			95		µC
I_{rr}	Diode reverse recovery current				460		A
E_{rec}	Diode reverse recovery energy				48		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 $R_{G(OFF)}$ = 1.5Ω $R_{G(ON)}$ = 1.5Ω L_S ~ 60nH	*dv/dt* = 5000V/µs		785		ns
t_f	Fall time				225		ns
E_{OFF}	Turn-off energy loss				84		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 6100A/µs		335		ns
t_r	Rise time				115		ns
E_{ON}	Turn-on energy loss				31		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 600A V_{CE} = 600V *di/dt* = 6100A/µs			110		µC
I_{rr}	Diode reverse recovery current				490		A
E_{rec}	Diode reverse recovery energy				56		mJ

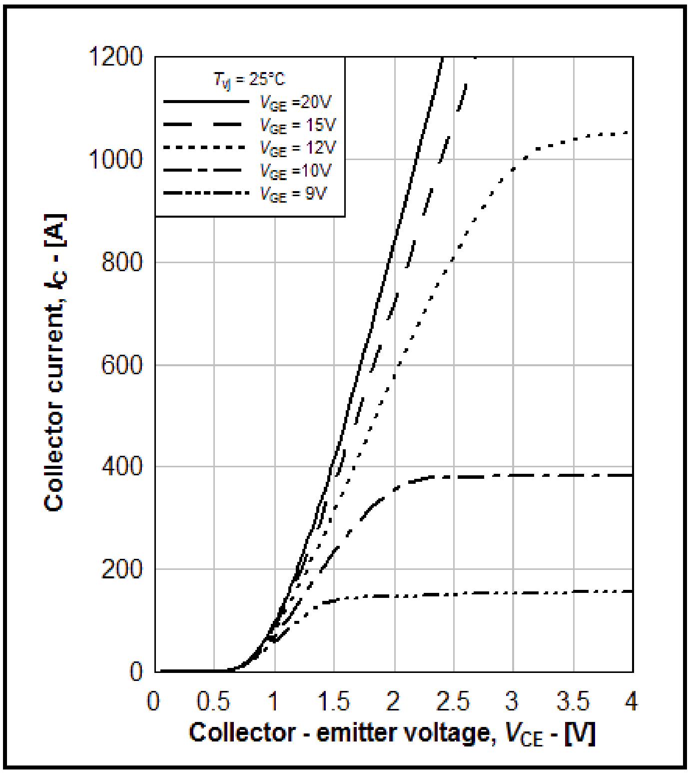


Fig. 3 Typical IGBT output characteristics, $I_C = f(V_{CE})$

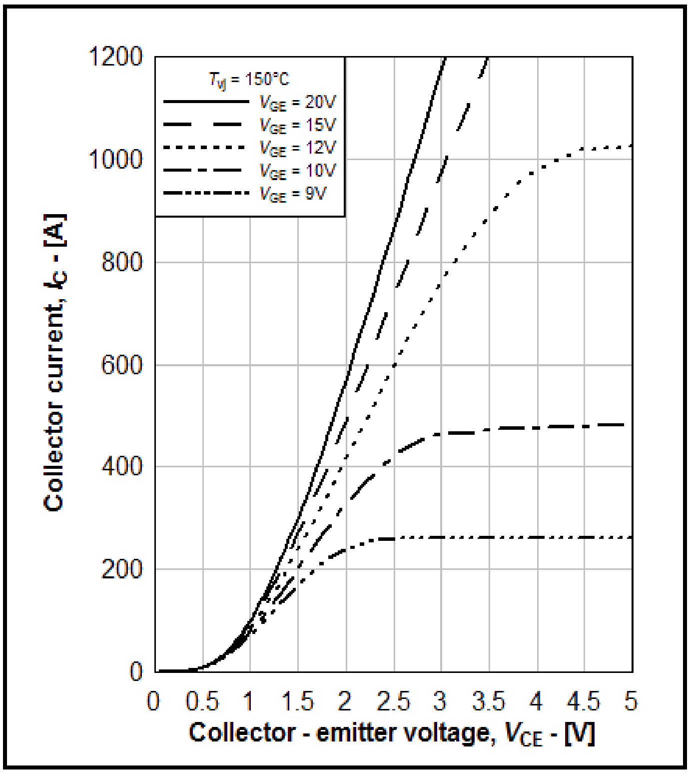


Fig. 4 Typical IGBT output characteristics, $I_C = f(V_{CE})$

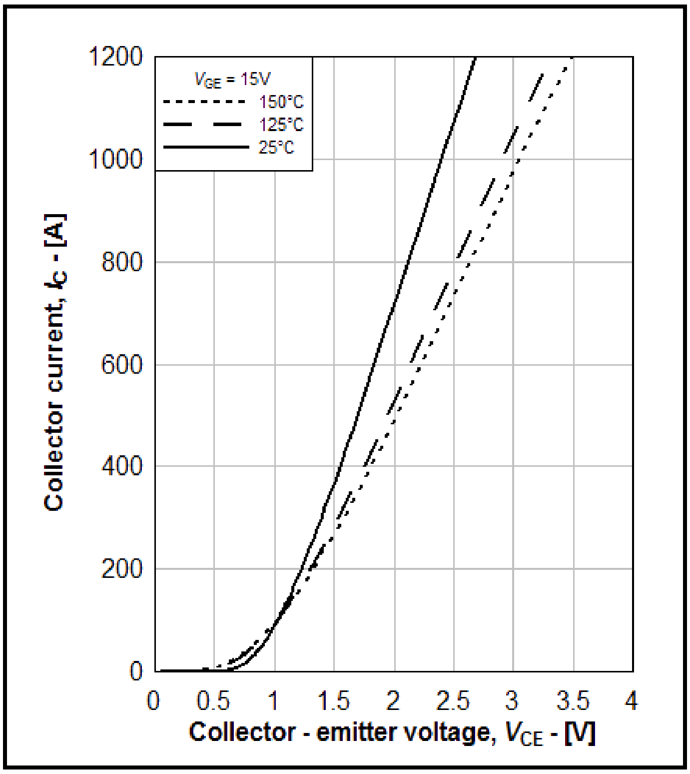


Fig. 5 Typical IGBT output characteristics, $I_C = f(V_{CE})$

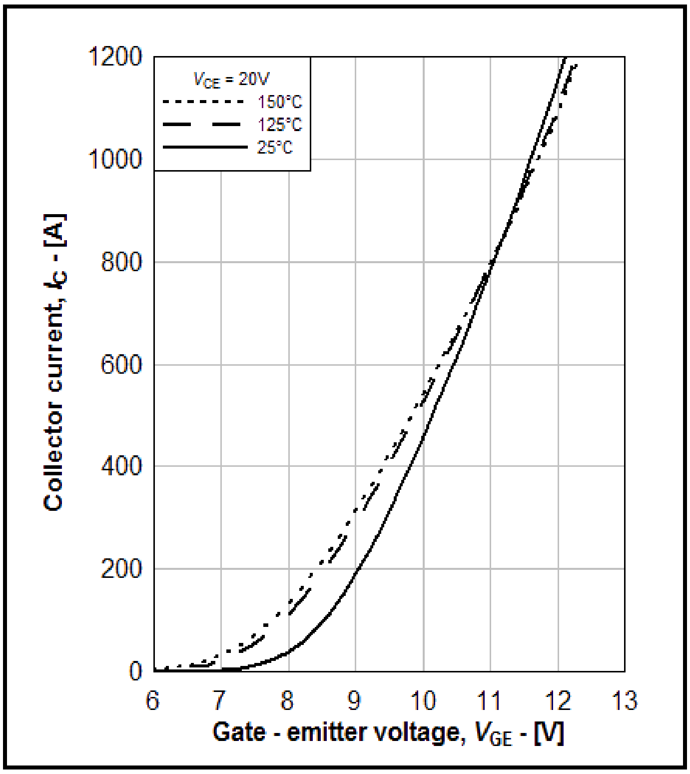


Fig. 6 Typical IGBT transfer characteristics, $I_C = f(V_{GE})$

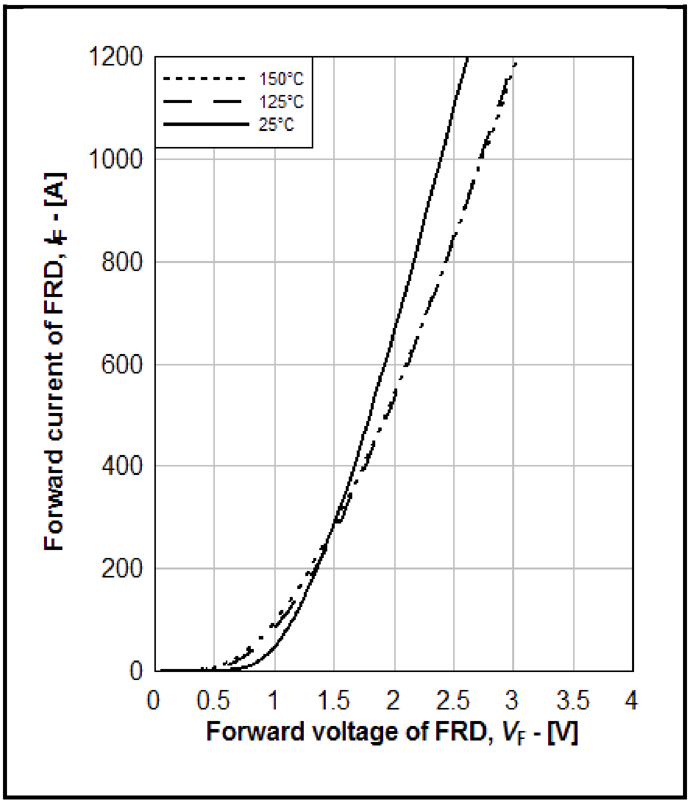


Fig. 7 Diode typical forward characteristics, I_F = f(V_F)

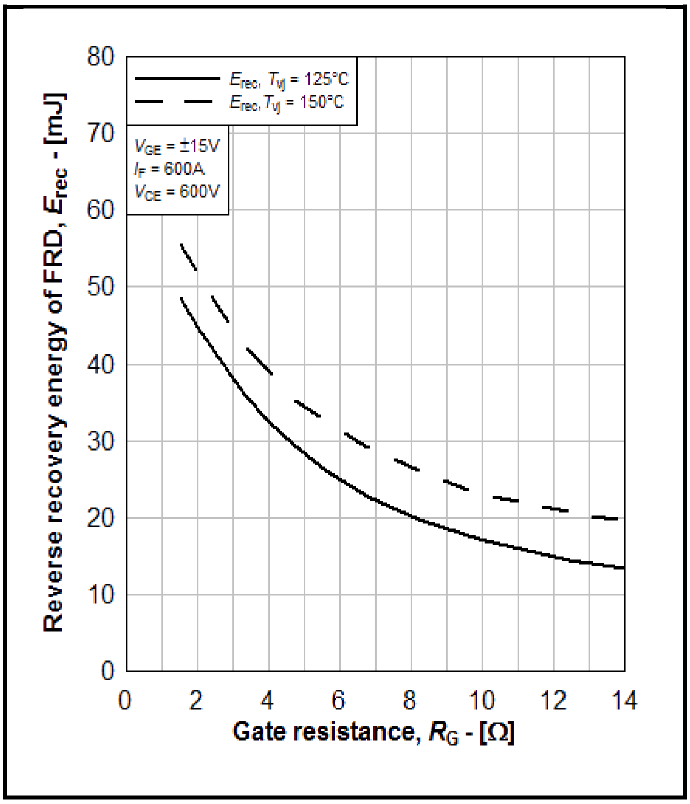


Fig. 8 Typical FRD E_{rec}, E_{rec} = f(R_G)

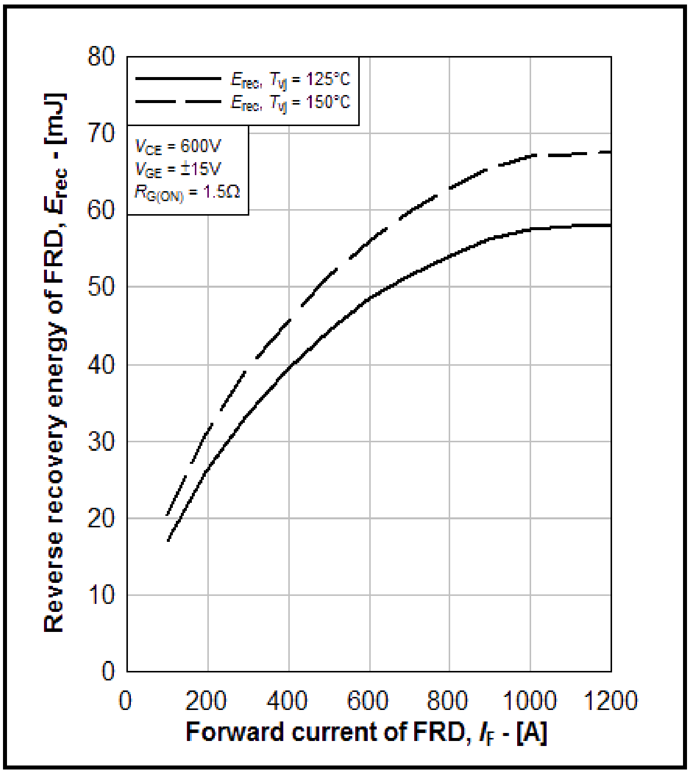


Fig. 9 Typical FRD E_{rec}, E_{rec} = f(I_F)

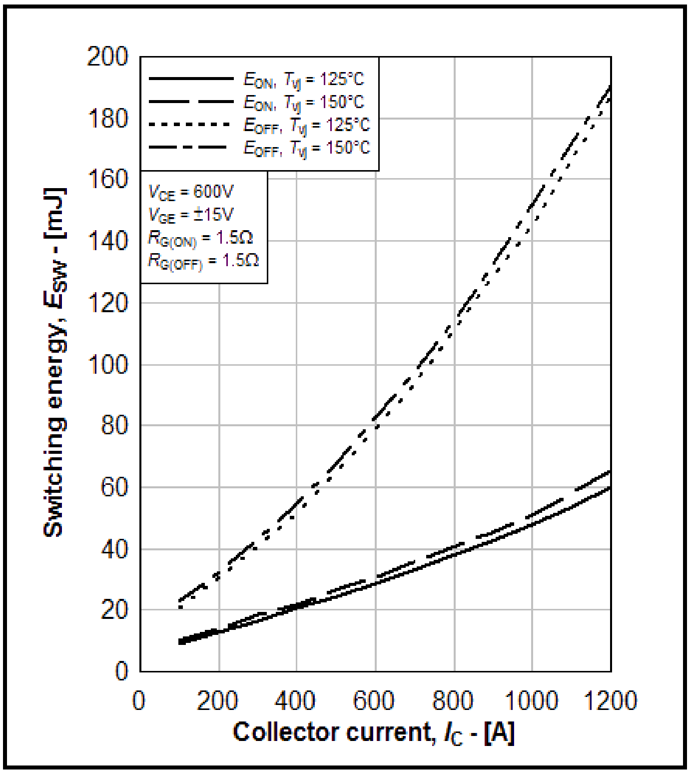


Fig. 10 Typical IGBT switching energy,
E_{ON} = f(I_C), E_{OFF} = f(I_C)

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

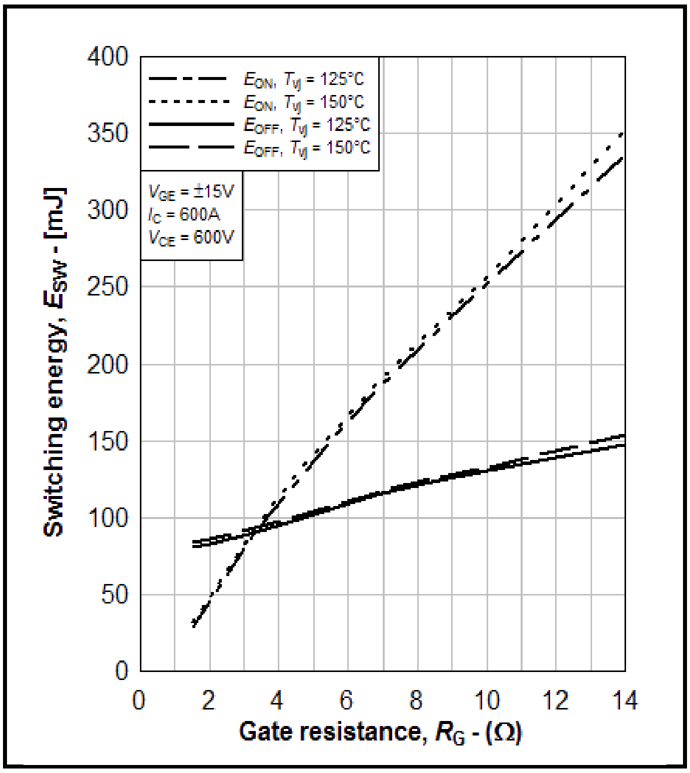


Fig. 11 Typical IGBT switching energy
E_{ON} = f(R_G), E_{OFF} = fR_G)

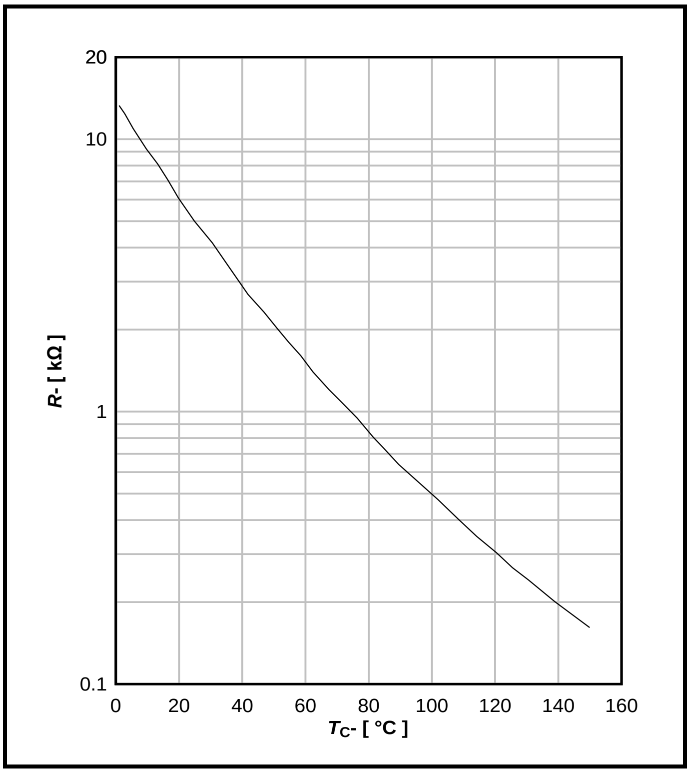


Fig. 12 Typical NTC thermistor characteristic, R = f(T_C)

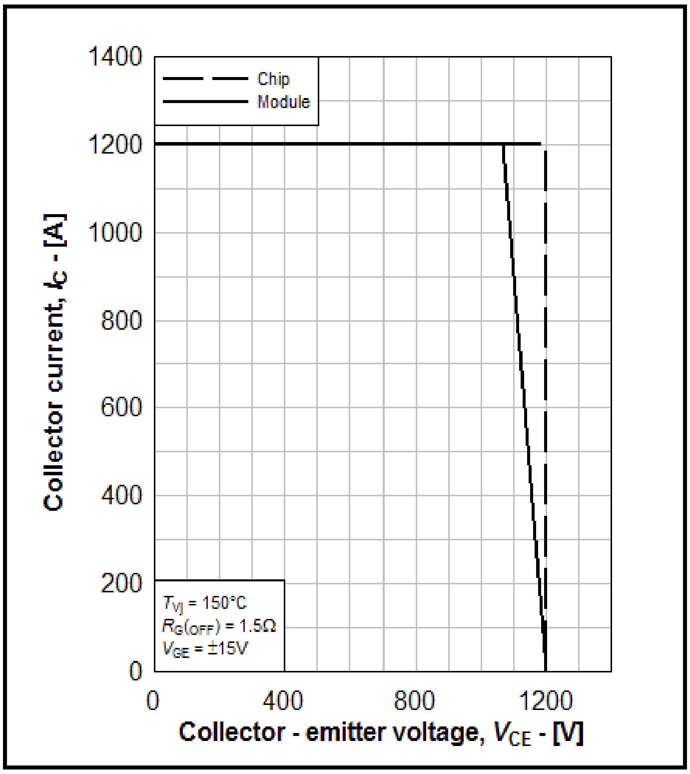


Fig. 13 Reverse bias safe operating area of IGBT,
I_C = f(V_{CE})

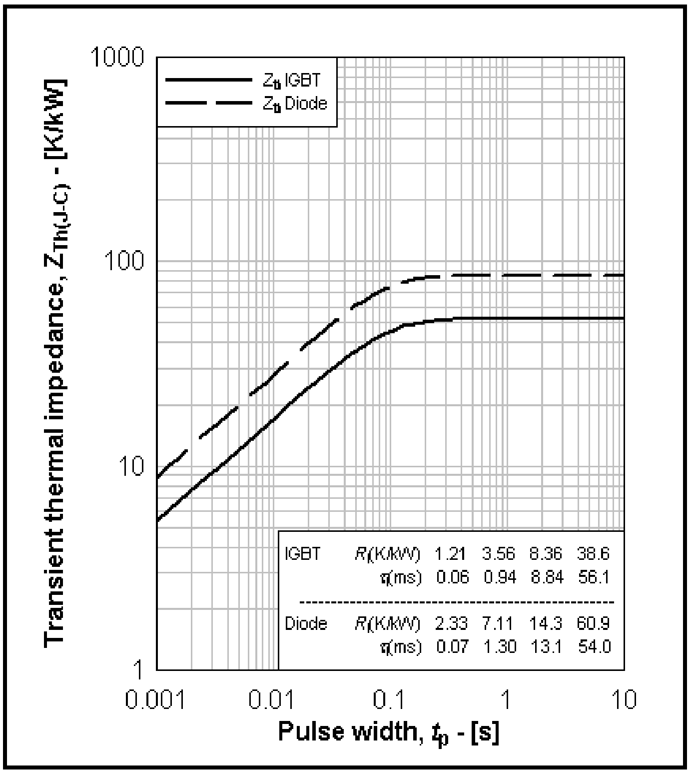
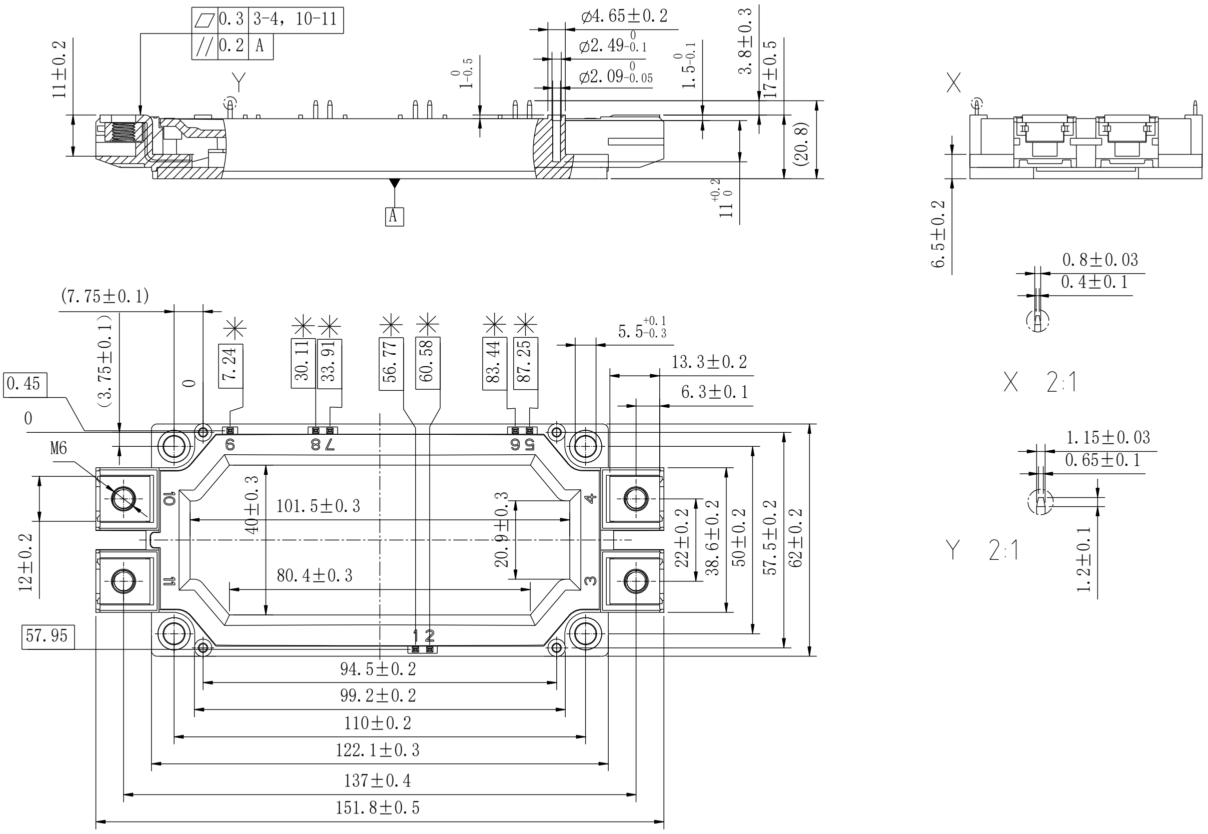


Fig. 14 Transient thermal impedance, Z_{th}(J-C) = f(t)

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. 15 Module outline drawing

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