TRENCH
Gen5 TMOS

DIM450M1HS17-PA500

Half Bridge IGBT Module

Replaces DS6253-1

DS6253-2 February 2020 (LN39616)

FEATURES

- Trench Gate IGBT
- Cu Base with Enhanced Al_2O_3 Substrates
- 10µs Short Circuit Withstand

KEY PARAMETERS

V_{CES}		1700V
$V_{CE(sat)}$ *	(typ)	1.80V
I_C	(max)	450A
$I_{C(RM)}$	(max)	900A

* Measured at the auxiliary terminals

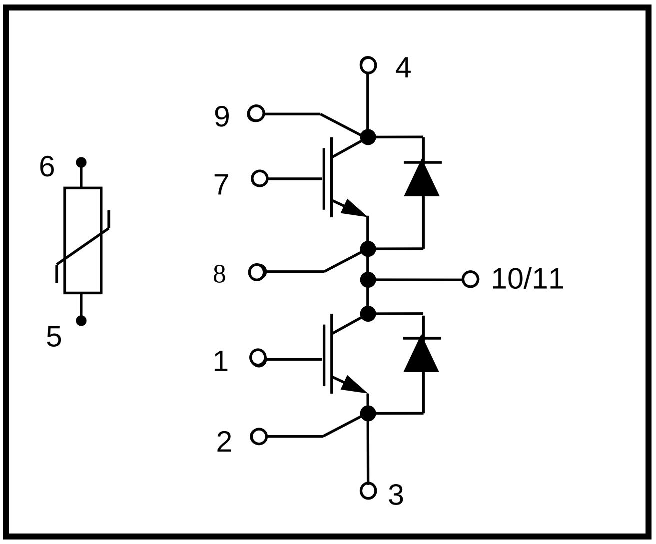


Fig. 1 Circuit configuration

APPLICATIONS

- Motor Drives
- Power Charging Equipment
- Reactive Compensation
- High Reliability Inverters

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 DIM450M1HS17-PA500 is a half bridge 1700V, 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.

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.

Outline type code: M1

(See Fig. 15 for further information)

Fig. 2 Package

ORDERING INFORMATION

Order As:

DIM450M1HS17-PA500

Note: When ordering, please use the complete part number

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	1700	V
V_{GES}	Gate-emitter voltage	T_C = 25°C	±20	V
I_C	Continuous collector current	T_C = 95°C	450	A
$I_{C(PK)}$	Peak collector current	t_P = 1ms, T_C = 125°C	900	A
P_{max}	Max. transistor power dissipation	T_C = 25°C, T_{vj} = 150°C	2270	W
I^2t	Diode I^2t value	V_R = 0, t_p = 10ms, T_{vj} = 150ºC	16.2	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	-	-	55	°C/kW
$R_{th(j-c)}$	Thermal resistance – diode		-	-	95	°C/kW
$R_{th(c-h)}$	Thermal resistance – case to heatsink (IGBT)	Mounting torque 3Nm (with mounting grease 1W/m °C)	-	-	28	°C/kW
$R_{th(c-h)}$	Thermal resistance – case to heatsink (Diode)		-	-	48	°C/kW
T_j	Junction temperature	IGBT	-40	-	150	°C
		Diode	-40	-	150	°C
T_{stg}	Storage temperature range	-	-40	-	150	°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}	5.0	6.0	7.0	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 450A		1.8	2.2	V
		V_{GE} = 15V, I_C = 450A, T_j = 125°C		2.1	2.5	V
		V_{GE} = 15V, I_C = 450A, T_j = 150°C		2.2	2.6	V
I_F	Diode forward current	DC		450		A
I_{FM}	Diode maximum forward current	t_p = 1ms		900		A
V_F	Diode forward voltage	I_F = 450A		2.1	2.4	V
		I_F = 450A, T_j = 125°C		2.2	2.6	V
		I_F = 450A, T_j = 150°C		2.2	2.6	V
C_{ies}	Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		42		nF
Q_g	Gate charge	±15V		4.4		μC
C_{res}	Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		1.2		nF
L_M	Module inductance			20		nH
R_{INT}	Internal transistor resistance			0.9		mΩ
SC_{Data}	Short circuit current, I_{SC}	T_j = 150°C, V_{CC} = 1000V t_p ≤ 10μs, V_{GE} ≤ 15V $V_{CE\ (max)}$ = V_{CES} – L^* x dI/dt IEC 60747-9		2000		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	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 = 450A V_{CE} = 900V V_{GE} = ±15V $R_{G(OFF)}$ = 2.7Ω $R_{G(ON)}$ = 2.7Ω L_S ~ 40nH	*dv/dt* = 4500V/µs		890		ns
t_f	Fall time				560		ns
E_{OFF}	Turn-off energy loss				155		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 6400A/µs		165		ns
t_r	Rise time				65		ns
E_{ON}	Turn-on energy loss				53		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 450A V_{CE} = 900V *di/dt* = 6400A/µs			85		µC
I_{rr}	Diode reverse recovery current				425		A
E_{rec}	Diode reverse recovery energy				65		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 = 450A V_{CE} = 900V V_{GE} = ±15V $R_{G(OFF)}$ = 2.7Ω $R_{G(ON)}$ = 2.7Ω L_S ~ 40nH	*dv/dt* = 4500V/µs		940		ns
t_f	Fall time				730		ns
E_{OFF}	Turn-off energy loss				185		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 6400A/µs		155		ns
t_r	Rise time				75		ns
E_{ON}	Turn-on energy loss				80		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 450A V_{CE} = 900V *di/dt* = 6400A/µs			125		µC
I_{rr}	Diode reverse recovery current				436		A
E_{rec}	Diode reverse recovery energy				94		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 = 450A V_{CE} = 900V V_{GE} = ±15V $R_{G(OFF)}$ = 2.7Ω $R_{G(ON)}$ = 2.7Ω L_S ~ 40nH	*dv/dt* = 4500V/µs		960		ns
t_f	Fall time				760		ns
E_{OFF}	Turn-off energy loss				190		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 6400A/µs		150		ns
t_r	Rise time				75		ns
E_{ON}	Turn-on energy loss				86		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 450A V_{CE} = 900V *di/dt* = 6400A/µs			145		µC
I_{rr}	Diode reverse recovery current				455		A
E_{rec}	Diode reverse recovery energy				105		mJ

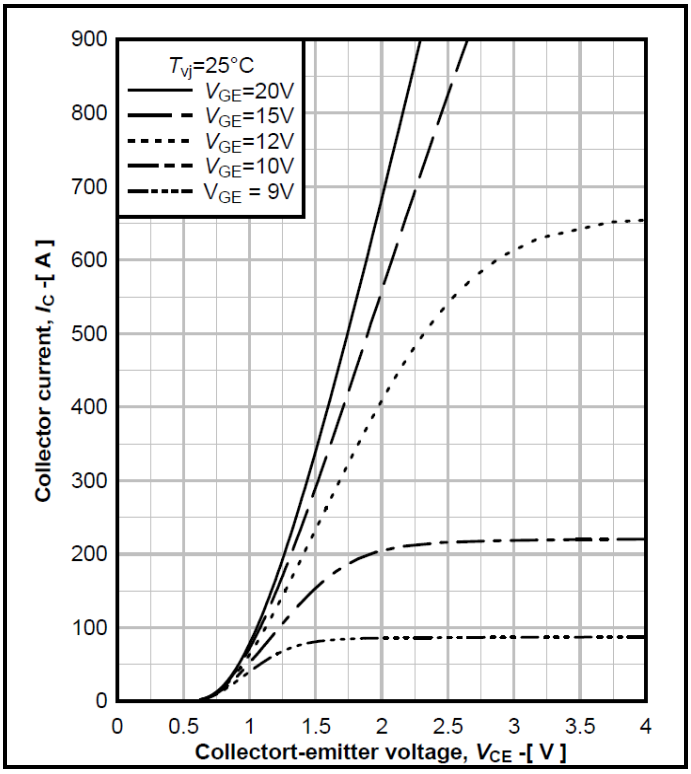


Fig. 3 Typical IGBT output characteristics, I_C = f(V_{CE})

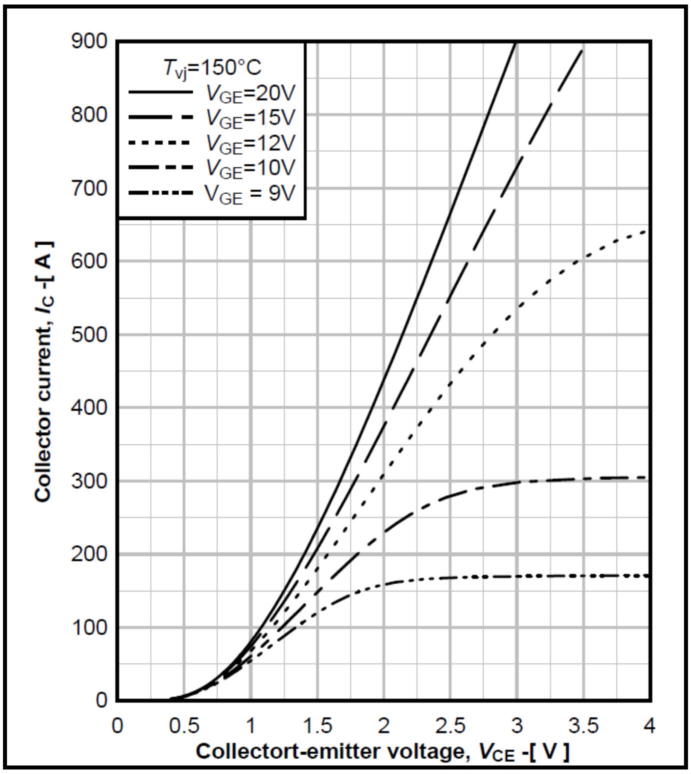


Fig. 4 Typical IGBT output characteristics, I_C = f(V_{CE})

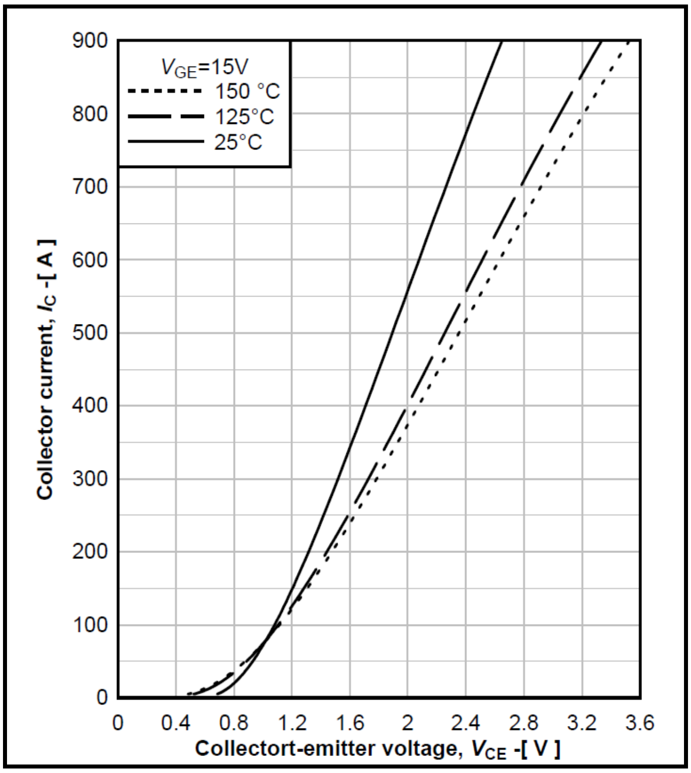


Fig. 5 Typical IGBT output characteristics, I_C = f(V_{CE})

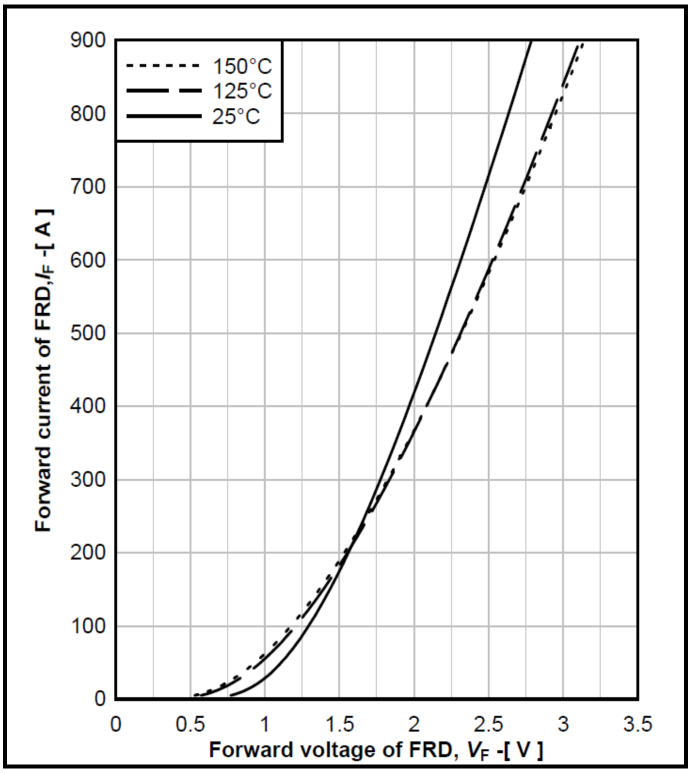


Fig. 6 Diode typical forward characteristics, I_F = f(V_F)

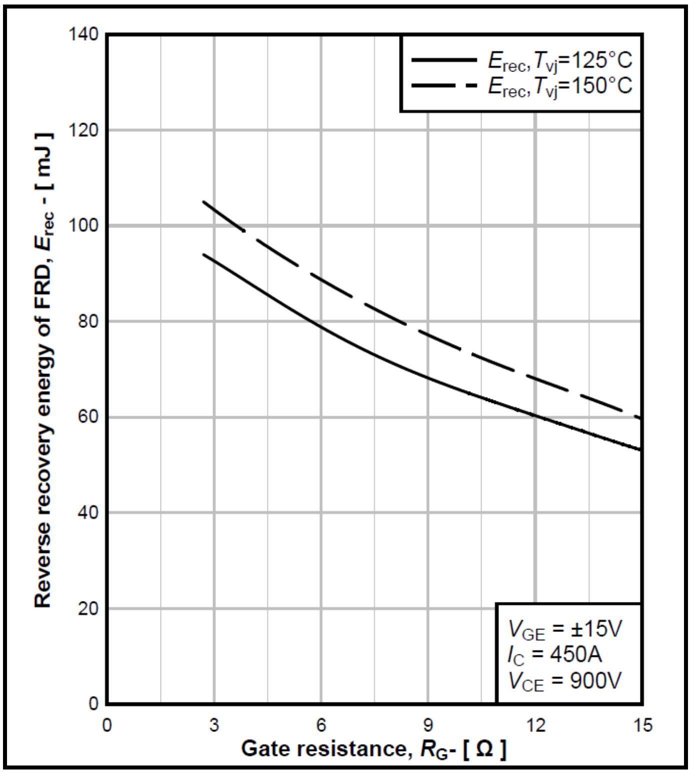


Fig. 7 Typical FRD E_{rec}, E_{rec} = f(R_G)

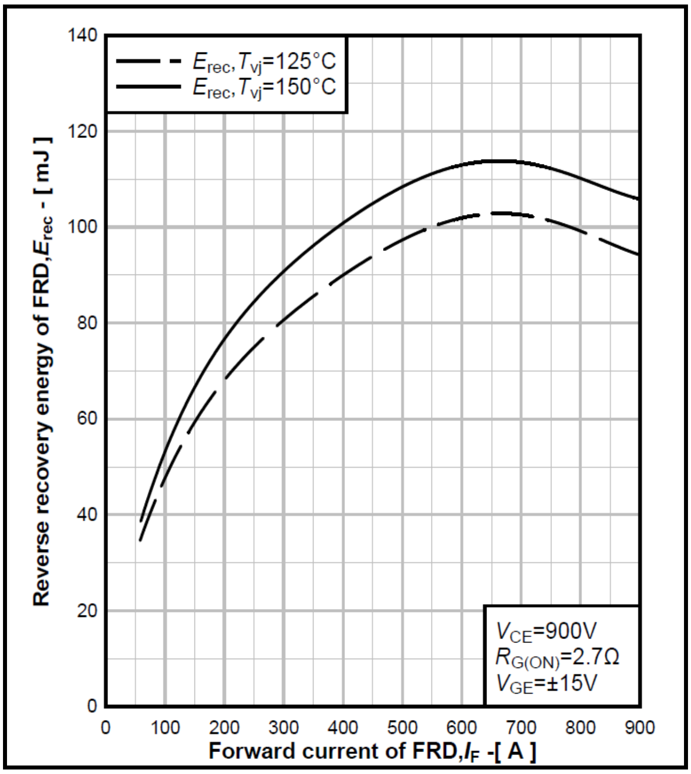


Fig. 8 Typical FRD E_{rec}, E_{rec} = f(I_F)

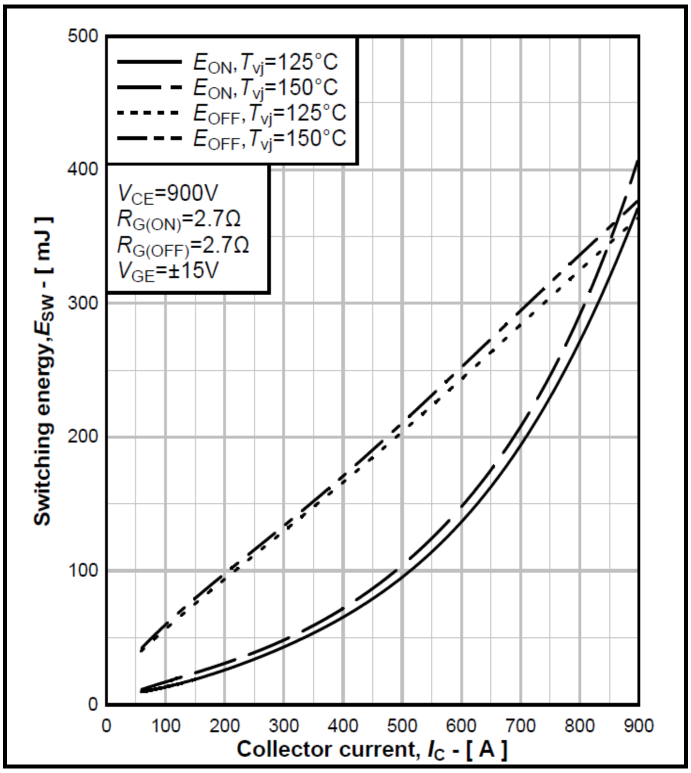


Fig. 9 Typical IGBT switching energy,
E_{ON} = f(I_C), E_{OFF} = f(I_C)

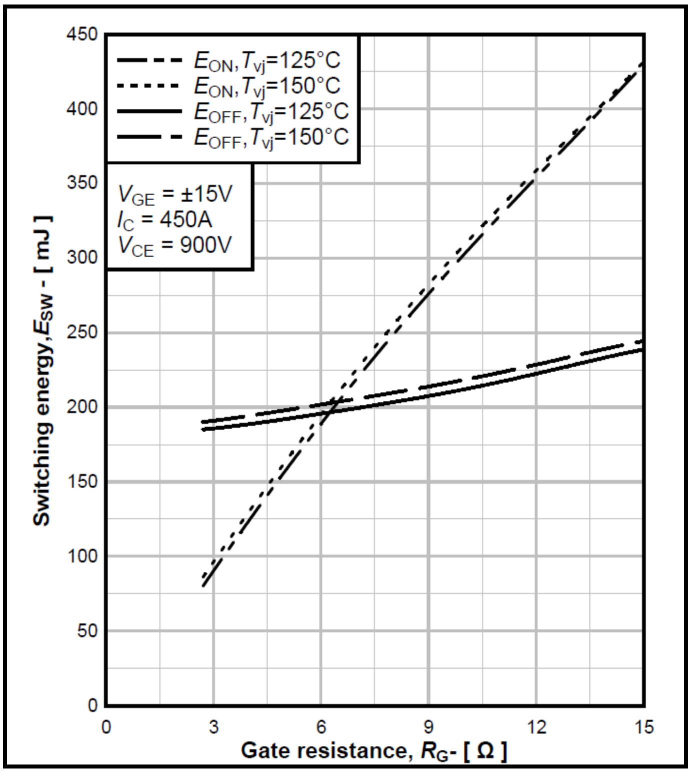


Fig. 10 Typical IGBT switching energy
E_{ON} = f(R_G), E_{OFF} = fR_G)

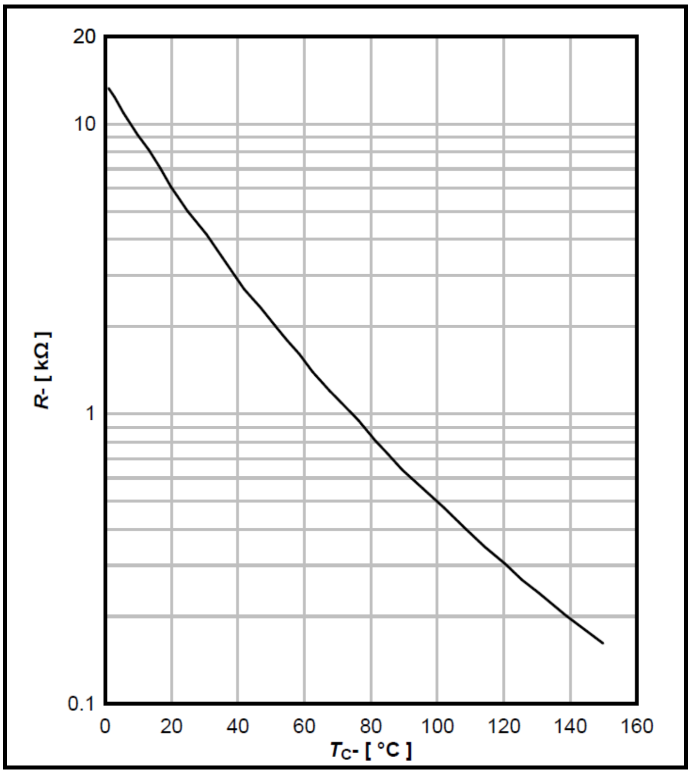


Fig. 11 Typical NTC thermistor characteristic, R = f(T_C)

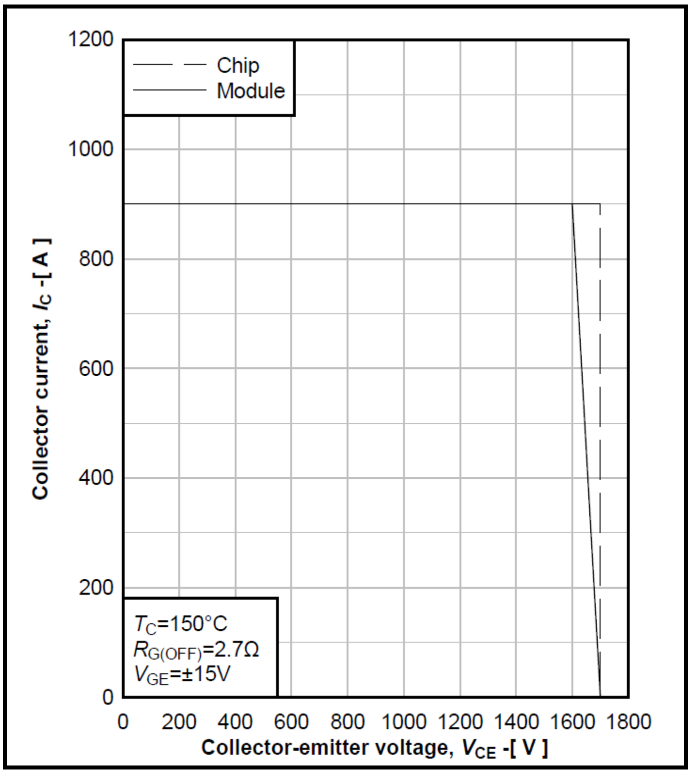


Fig. 12 Reverse bias safe operating area of IGBT, I_C = f(V_{CE})

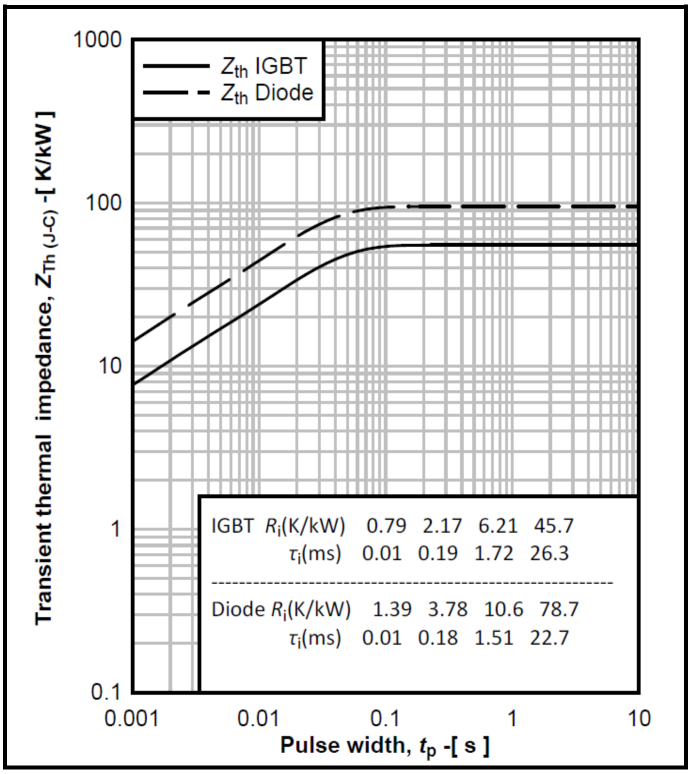
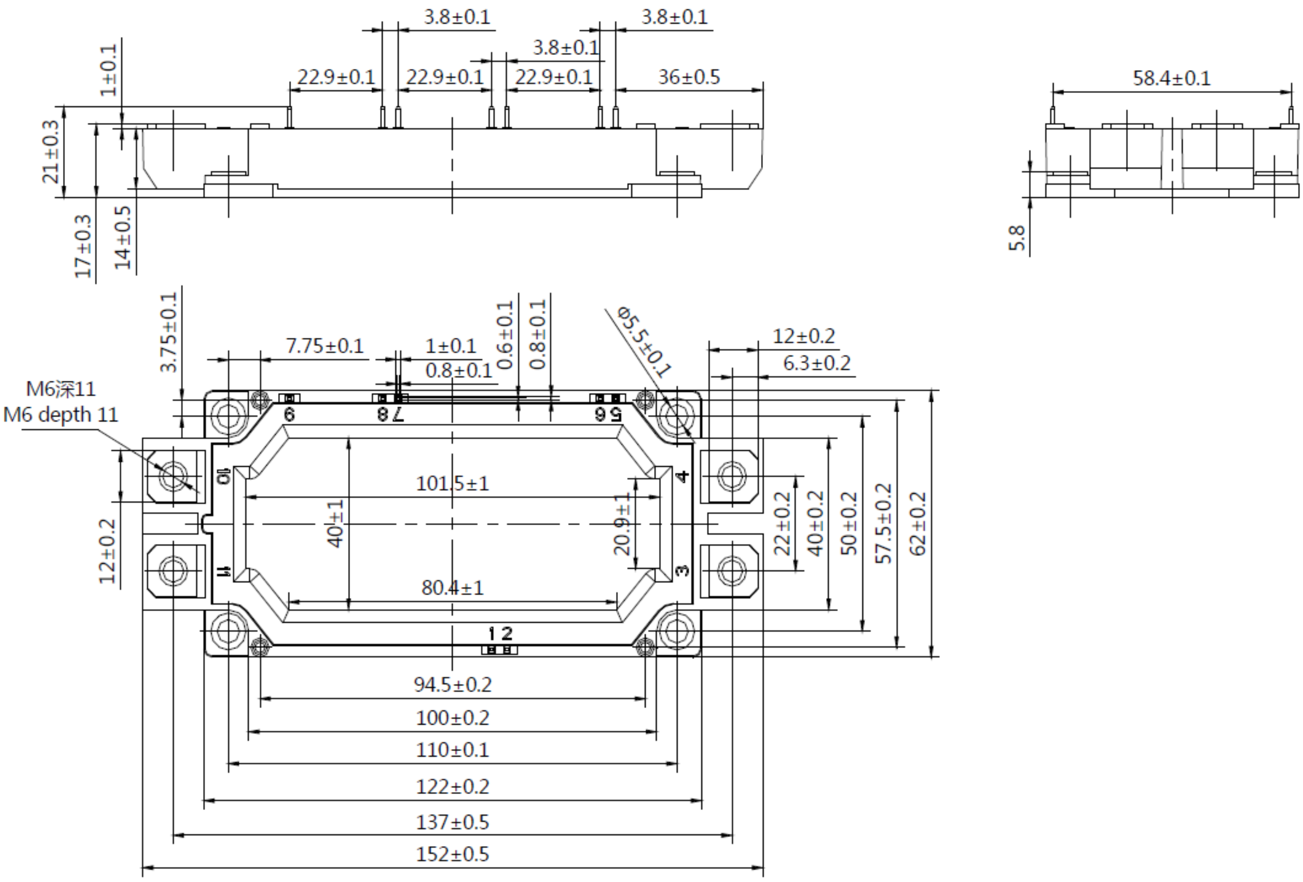


Fig. 13 Transient thermal impedance, $Z_{th(J-C)}$ = f(t)

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. 14 Module outline drawing

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

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