DYNEX
Power through Innovation

TRENCH
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STMOS

Preliminary Information

DIM1800H1HS17-PH500

Half Bridge IGBT Module

DS6405-1 October 2022 (LN42123)

FEATURES

- Ultra-fine Trench Gate IGBT
- Cu Base with Enhanced Al_2O_3 Substrates
- High Thermal Cycling capacity
- Low $V_{CE(sat)}$ Device
- Low Switching Losses

APPLICATIONS

- Motor Drives
- High Power Converters
- Wind Turbines
- 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 DIM1800H1HS17-PH500 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. 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:

DIM1800H1HS17-PH500

Note: When ordering, please use the complete part number

KEY PARAMETERS

V_{CES}		**1700V**
$V_{CE(sat)}$ *	**(typ)**	**1.70V**
I_C	**(max)**	**1800A**
$I_{C(PK)}$	**(max)**	**3600A**

* Measured at the auxiliary terminals

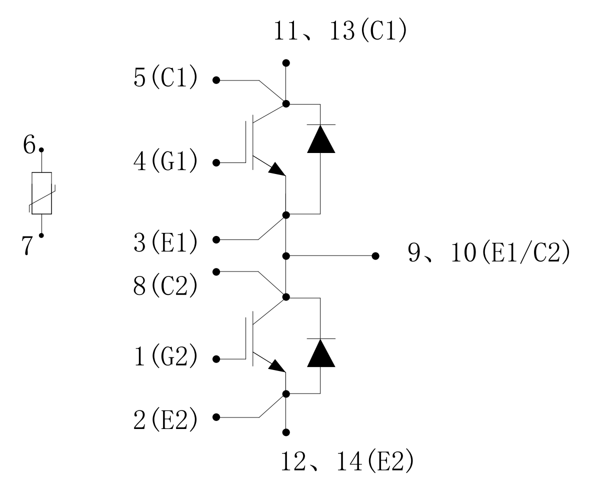


Fig. 1 Circuit configuration

Outline type code: H1

(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	1700	V
V_{GES}	Gate-emitter voltage	T_C = 25°C	±20	V
I_C	Continuous collector current	T_C = 85°C, T_{vj} = 175°C	1800	A
$I_{C(PK)}$	Peak collector current	t_P = 1ms	3600	A
P_{max}	Max. transistor power dissipation	T_C = 25°C, T_{vj} = 175°C	9.38	kW
I^2t	Diode I^2t value	V_R = 0, t_p = 10ms, T_{vj} = 150°C	551	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:	36.0mm
Creepage distance – Terminal to terminal:	28.0mm
Clearance – Terminal to heatsink:	21.0mm
Clearance – Terminal to terminal:	19.0mm
CTI (Comparative Tracking Index):	>400

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$R_{th(j-c)}$	Thermal resistance – transistor	Continuous dissipation - junction to case	-	-	16	°C/kW
$R_{th(j-c)}$	Thermal resistance – diode	Continuous dissipation - junction to case	-	-	33	°C/kW
$R_{th(c-h)}$ IGBT	Thermal resistance – case to heatsink (IGBT)	Mounting torque 5Nm (with mounting grease: 1W/mK)	-	14	-	°C/kW
$R_{th(c-h)}$ Diode	Thermal resistance – case to heatsink (Diode)	Mounting torque 5Nm (with mounting grease: 1W/mK)	-	17	-	°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 – M4	1.8		2.1	Nm
		Electrical connections – M8	8	-	10	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			40	mA
		V_{GE} = 0V, V_{CE} = V_{CES}, T_C = 150°C			60	mA
I_{GES}	Gate leakage current	V_{GE} = ± 20V, V_{CE} = 0V			0.5	μA
$V_{GE(TH)}$	Gate threshold voltage	I_C = 60mA, V_{GE} = V_{CE}	5.1	5.7	6.3	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 1800A		1.70		V
		V_{GE} = 15V, I_C = 1800A, T_j = 150°C		2.10		V
		V_{GE} = 15V, I_C = 1800A, T_j = 175°C		2.15		V
I_F	Diode forward current	DC		1800		A
I_{FM}	Diode maximum forward current	t_p = 1ms		3600		A
V_F	Diode forward voltage	I_F = 1800A		1.60		V
		I_F = 1800A, T_j = 150°C		1.75		V
		I_F = 1800A, T_j = 175°C		1.75		V
C_{ies}	Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		542		nF
Q_g	Gate charge	±15V		23.6		μC
C_{res}	Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		0.28		nF
L_{sCE}	Module inductance			8.4		nH
$R_{CC'+EE'}$	Module lead resistance, Terminal - chip	Per switch		0.2		mΩ
R_{INT}	Internal transistor resistance			1		Ω
SC_{Data}	Short circuit current, I_{SC}	T_j = 175°C, V_{CC} = 1000V t_p ≤ 10μs, V_{GE} ≤ 15V $V_{CE\ (max)}$ = V_{CES} – L^* x di/dt IEC 60747-9		7400		A

Note:
* L is the circuit inductance + L_{sCE}

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 = 1800A V_{CE} = 900V V_{GE} = ±15V $R_{G(OFF)}$ = 0.5Ω $R_{G(ON)}$ = 0.5Ω L_S ~ 25nH	*dv/dt* = 3800V/µs		1000		ns
t_f	Fall time				245		ns
E_{OFF}	Turn-off energy loss				425		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 8500A/µs		985		ns
t_r	Rise time				135		ns
E_{ON}	Turn-on energy loss				405		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 1800A V_{CE} = 900V *di/dt* = 7200A/µs			420		µC
I_{rr}	Diode reverse recovery current				1330		A
E_{rec}	Diode reverse recovery energy				265		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 = 1800A V_{CE} = 900V V_{GE} = ±15V $R_{G(OFF)}$ = 0.5Ω $R_{G(ON)}$ = 0.5Ω L_S ~ 25nH	*dv/dt* = 3800V/µs		1200		ns
t_f	Fall time				420		ns
E_{OFF}	Turn-off energy loss				600		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 8500A/µs		1065		ns
t_r	Rise time				205		ns
E_{ON}	Turn-on energy loss				790		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 1800A V_{CE} = 900V *di/dt* = 7200A/µs			695		µC
I_{rr}	Diode reverse recovery current				1120		A
E_{rec}	Diode reverse recovery energy				400		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 = 1800A V_{CE} = 900V V_{GE} = ±15V $R_{G(OFF)}$ = 0.5Ω $R_{G(ON)}$ = 0.5Ω L_S ~ 25nH	*dv/dt* = 3800V/µs		1250		ns
t_f	Fall time				485		ns
E_{OFF}	Turn-off energy loss				615		mJ
$t_{d(on)}$	Turn-on delay time		*di/dt* = 8500A/µs		1070		ns
t_r	Rise time				210		ns
E_{ON}	Turn-on energy loss				800		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 1800A V_{CE} = 900V *di/dt* = 8500A/µs			710		µC
I_{rr}	Diode reverse recovery current				1100		A
E_{rec}	Diode reverse recovery energy				420		mJ

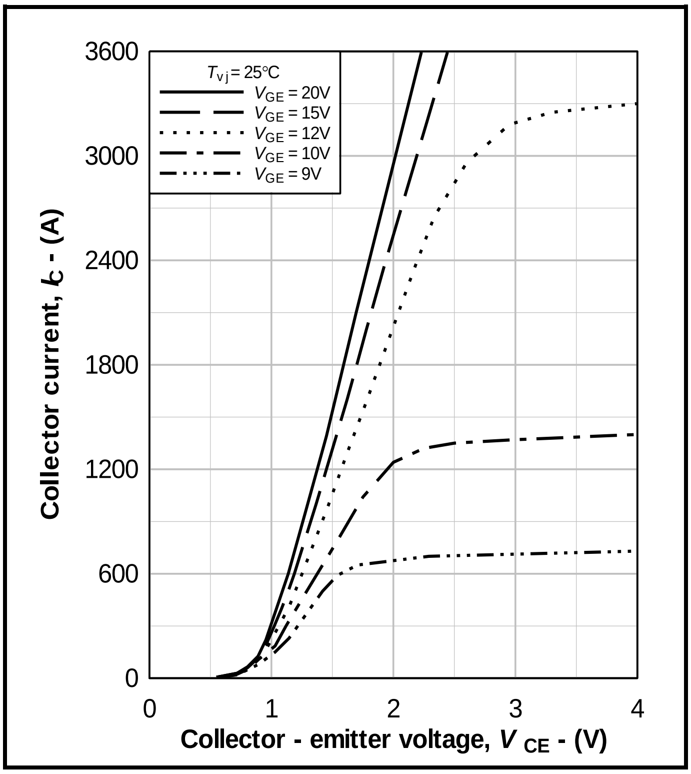


Fig. 3 Typical IGBT output characteristics, I_C = f (V_{CE})

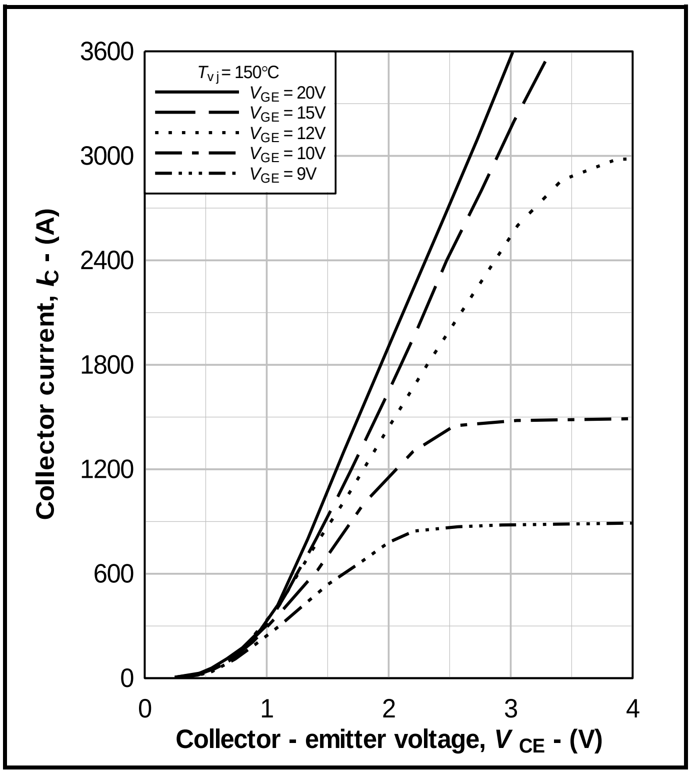


Fig. 4 Typical IGBT output characteristics, I_C = f (V_{CE})

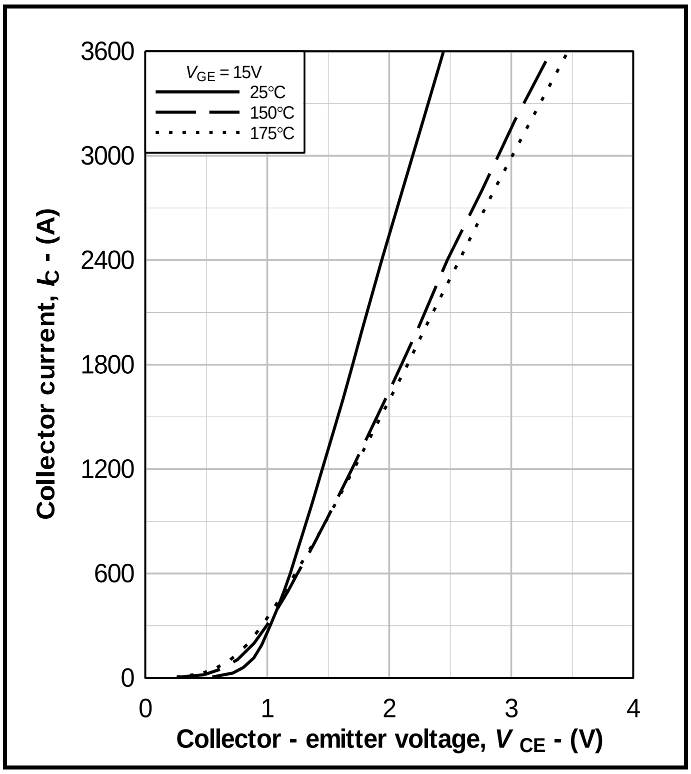


Fig. 5 Typical IGBT output characteristics, I_C = f (V_{CE})

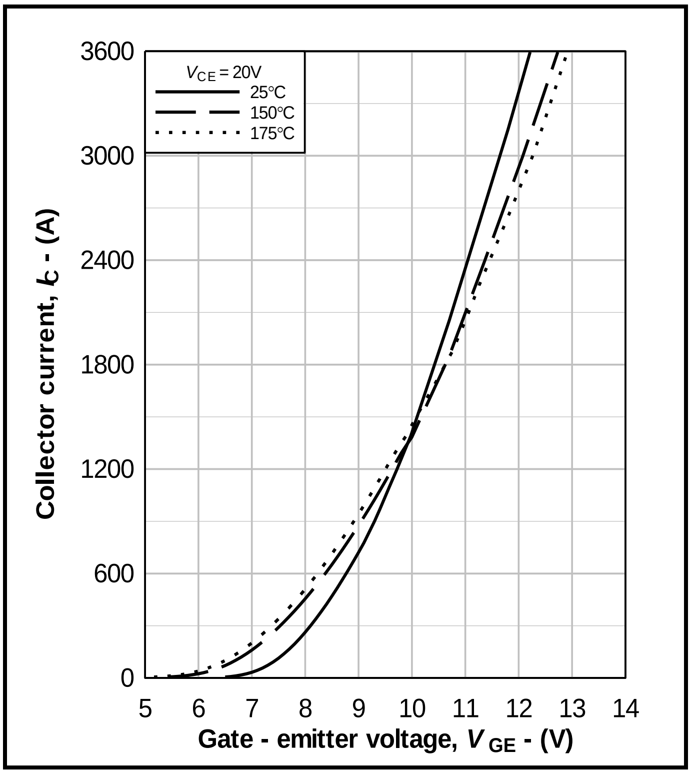


Fig. 6 Typical IGBT transfer characteristics, I_C = f (V_{GE})

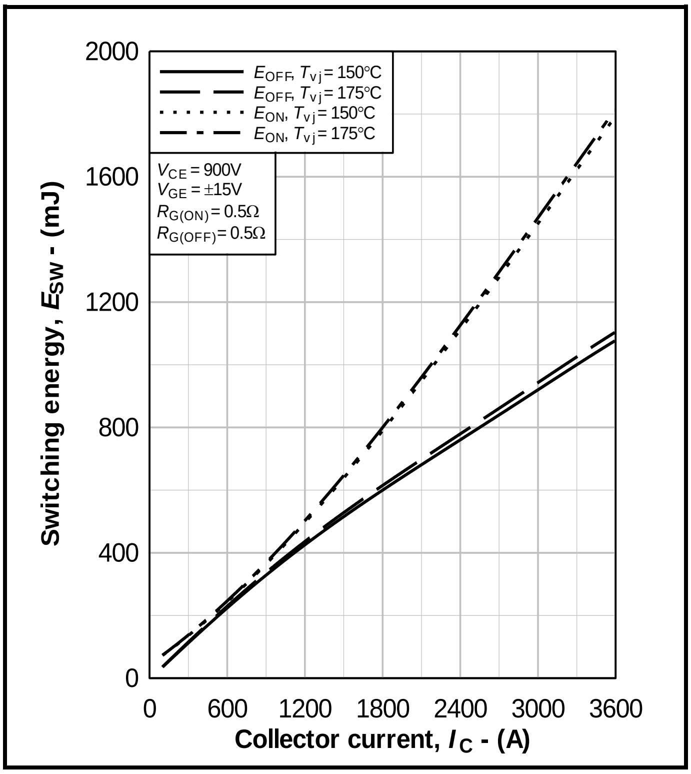


Fig. 7 Typical IGBT switching energy, E_{ON} = f(I_C), E_{OFF} = f (I_C)

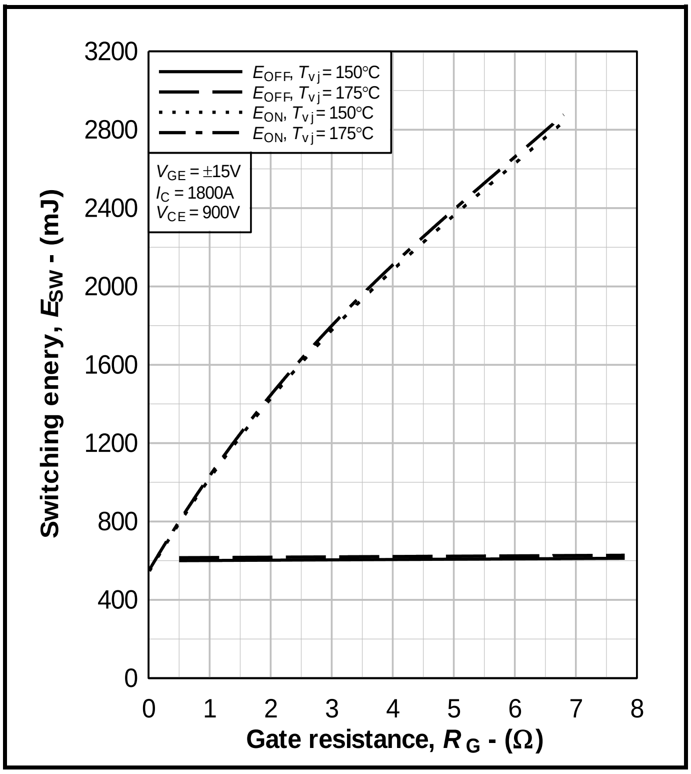


Fig. 8 Typical IGBT switching energy, E_{ON} = f(R_G), E_{OFF} = f (R_G)

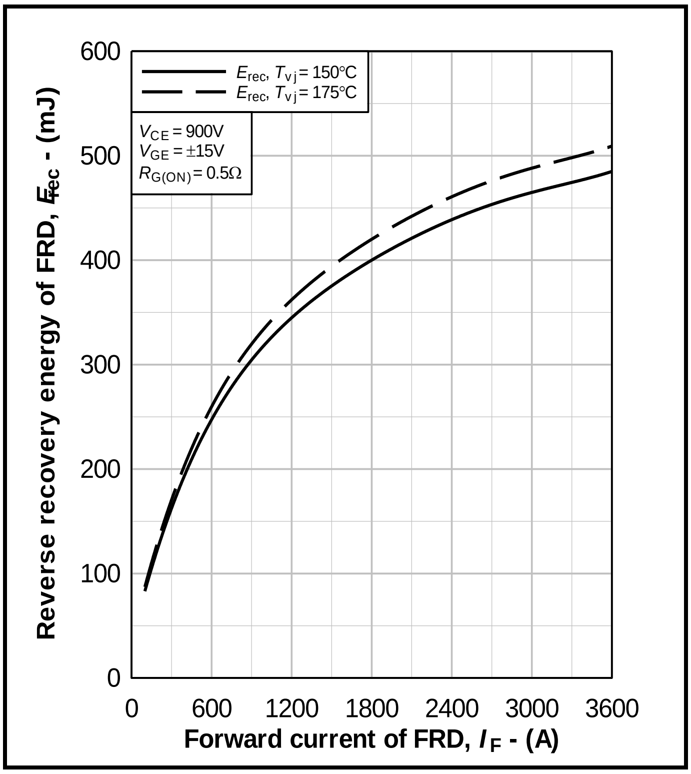


Fig. 9 Typical FRD E_{rec}, E_{rec} = f (I_F)

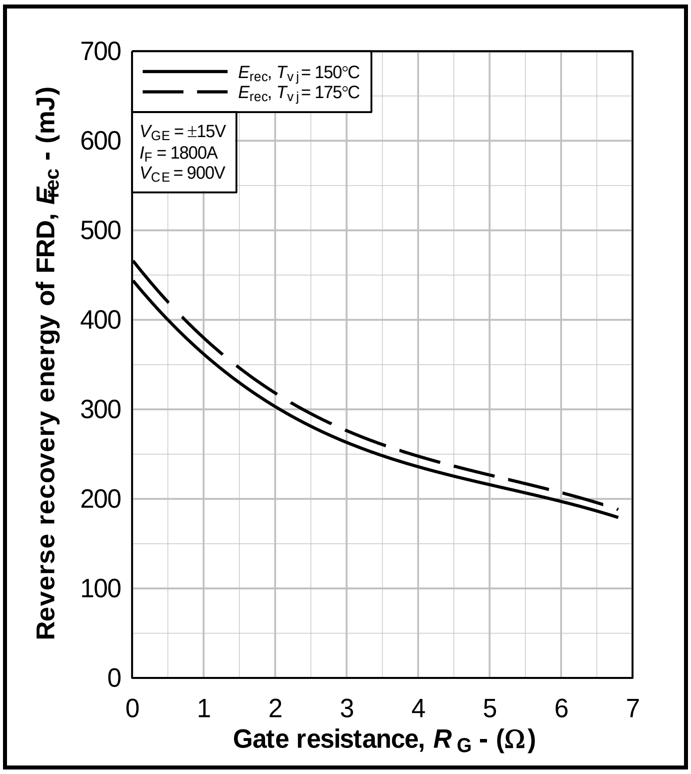


Fig. 10 Typical FRD E_{rec}, E_{rec} = f (R_G)

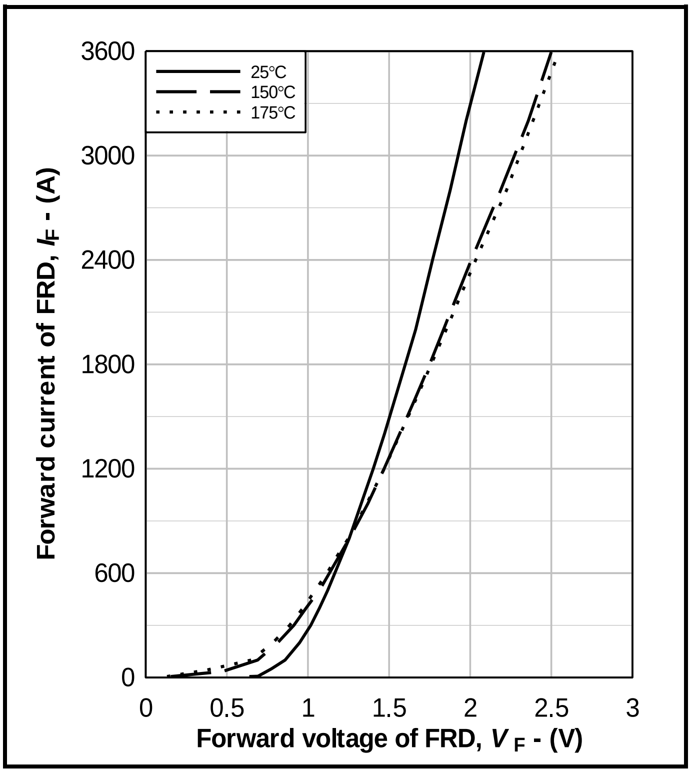


Fig. 11 Diode typical forward characteristics, I_F = f (V_F)

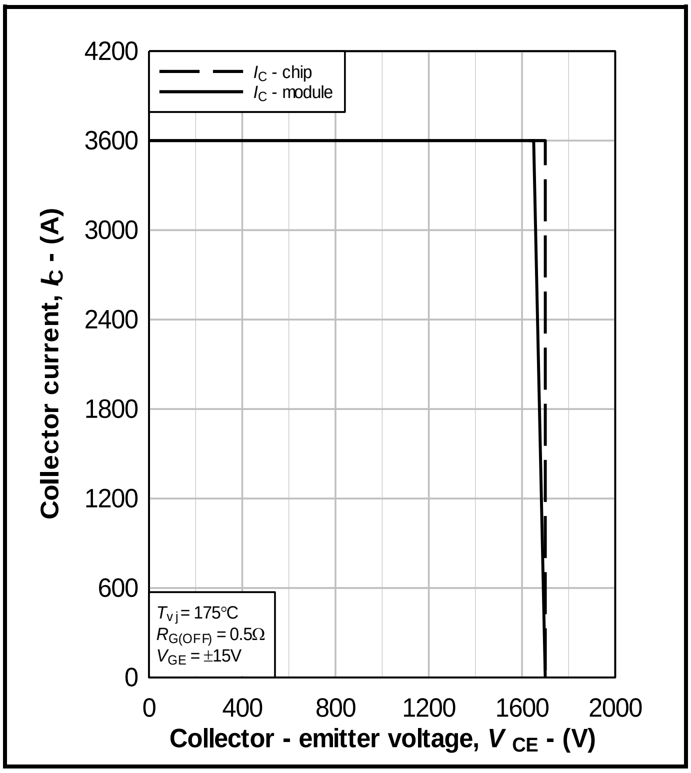


Fig. 12 Reverse bias safe operating area of IGBT, I_C = f (V_{CE})

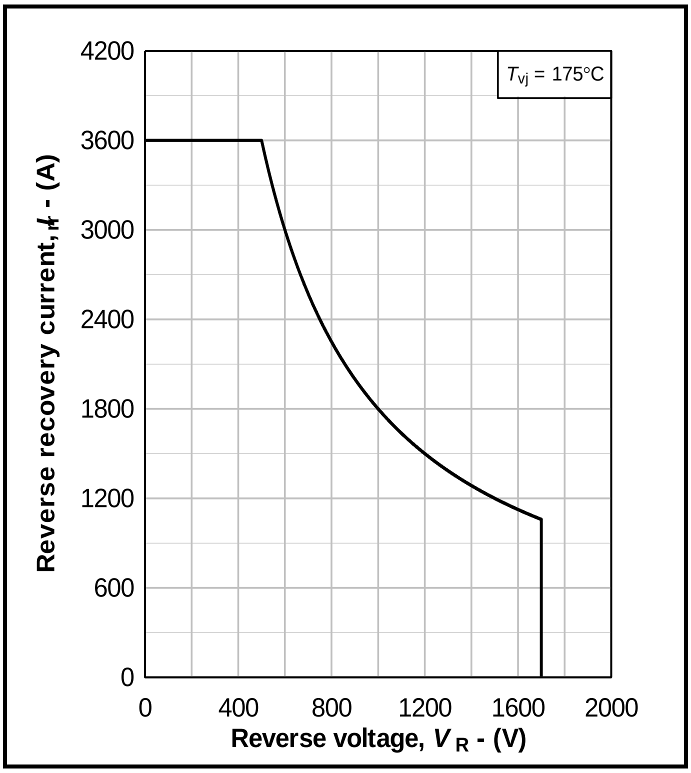


Fig. 13 Reverse bias safe operating area of FRD, I_{rr} = f (V_R)

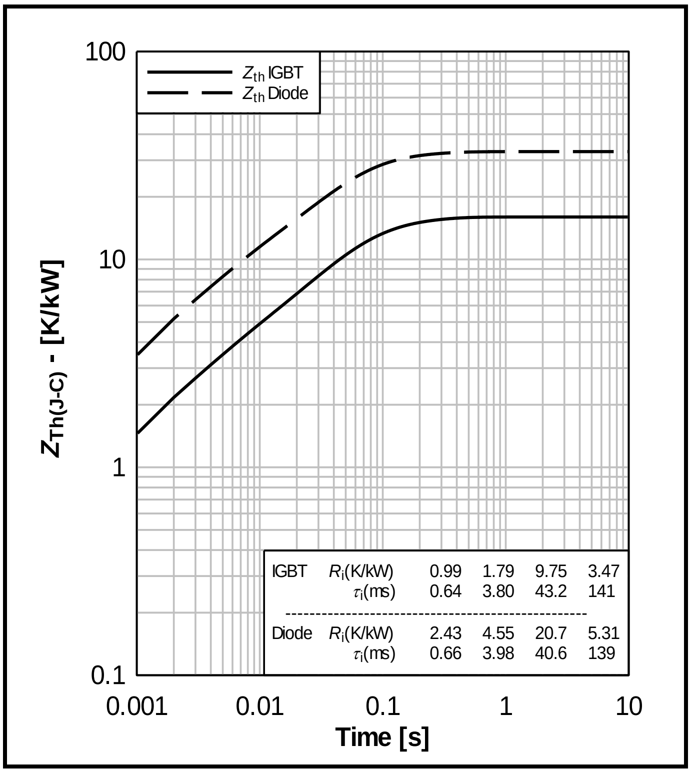


Fig. 14 Transient thermal impedance, $Z_{th(J-C)}$ = f (t_p)

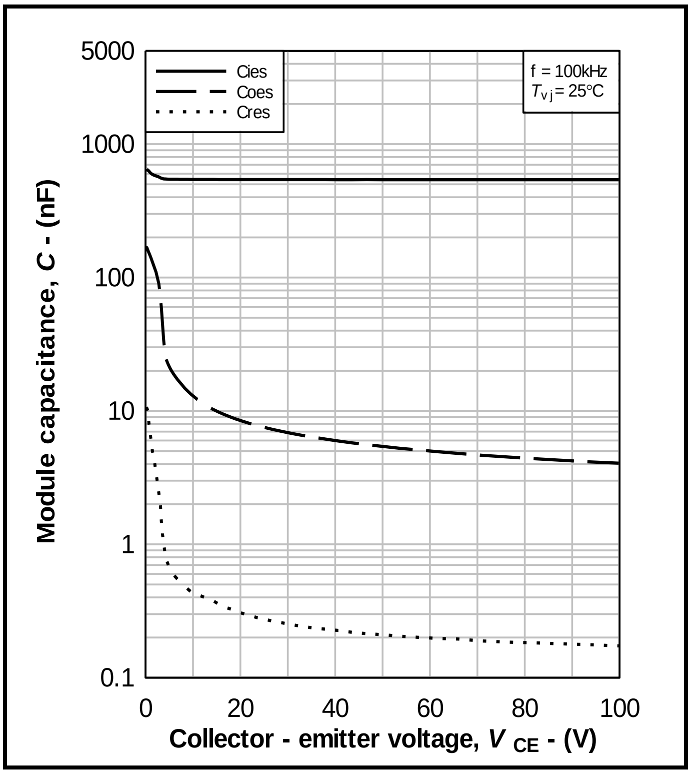


Fig. 15 Typical capacitor characteristic, $C = f(V_{CE})$

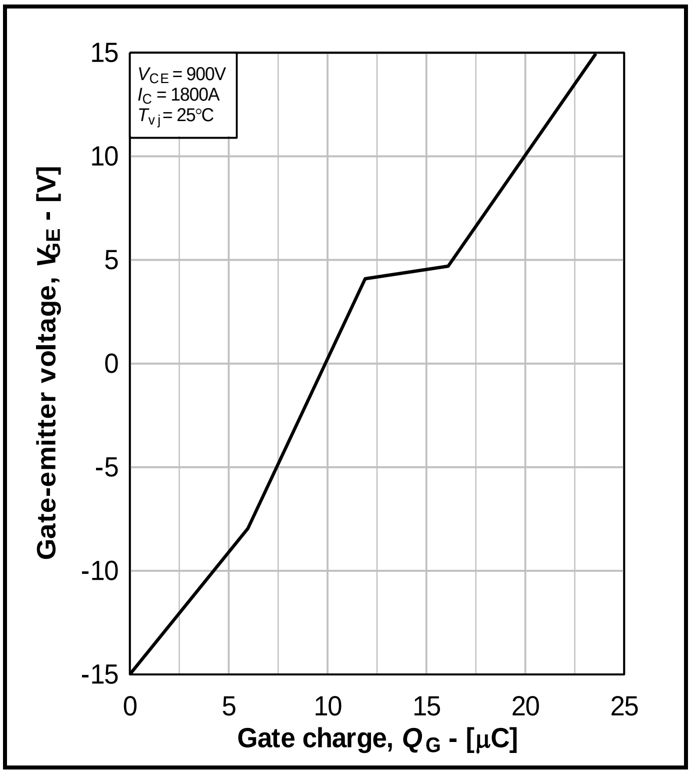


Fig. 16 Typical gate charge characteristic, $V_{GE} = f(Q_G)$

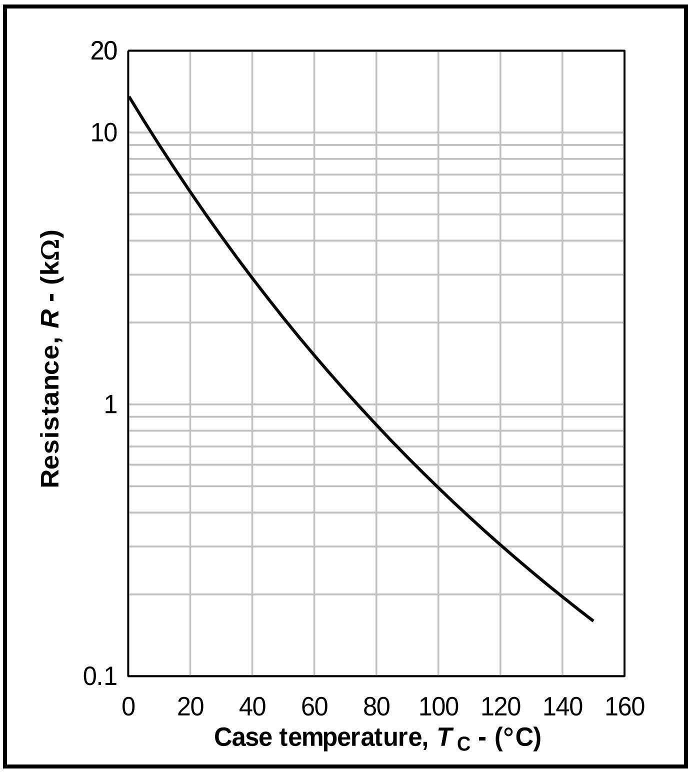
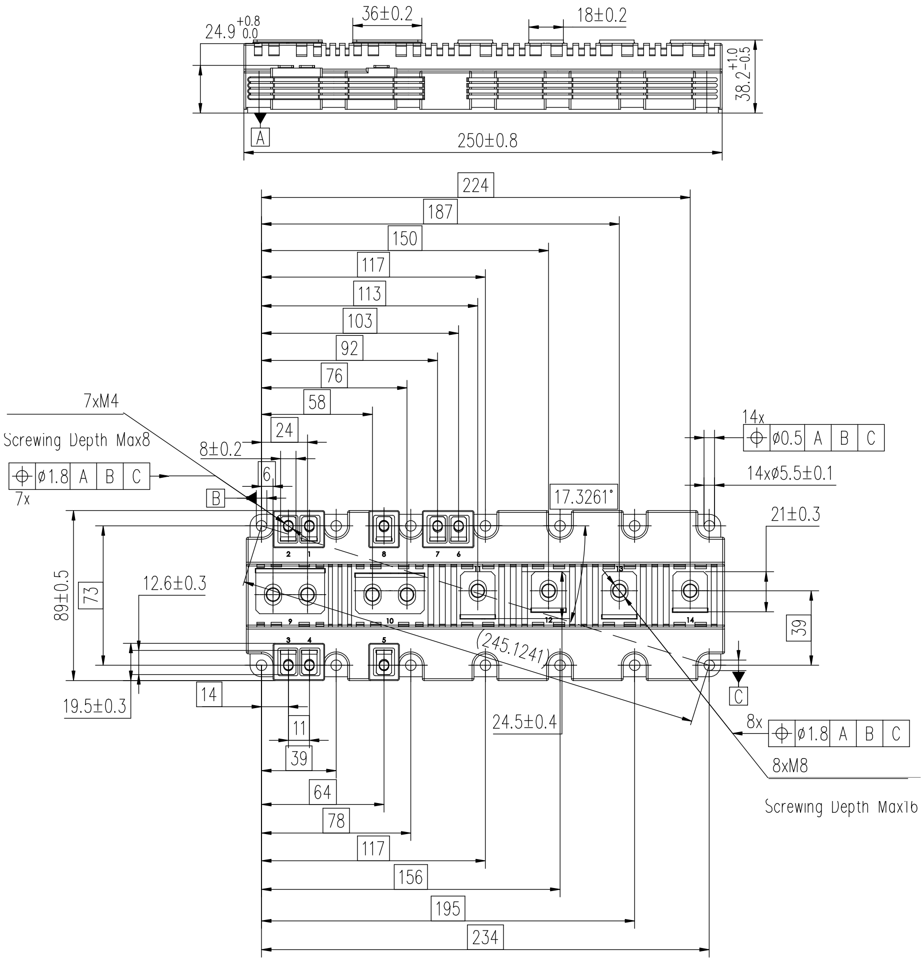


Fig. 17 Typical NTC thermistor characteristic, $R = f(T_C)$

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.



NOTES:
1. TOLERANCE UNLESS OTHERWISE SPECIFIAL REFER TO GRADE m IN GB/T 1804:
(a) X<6 ±0.1 (b) 6≤X<30 ±0.2;
(c) 30≤X<120 ±0.3 (d) 120≤X< 400 ±0.5。

Nominal Weight: 1200g

Module Outline Type Code: H1

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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