

关键参数 Key Parameters

V_{CES}		1200	V
$V_{CE(sat)}$	Typ.	1.85	V
I_C	Max.	600	A
$I_{C(RM)}$	Max.	1200	A

典型应用 Typical Applications

● 电机驱动	Motor Drives
● 充电装置	Power Charging Equipment
● 光伏发电	Solar Power
● 电动汽车	Electric Vehicle

特点 Features

● 铜基板	Cu Baseplate
● 增强型氧化铝衬板	Enhanced Al_2O_3 Substrates
● 高热循环能力	High Thermal Cycling Capability
● 10 μ s 短路承受能力	10 μ s Short Circuit Withstand

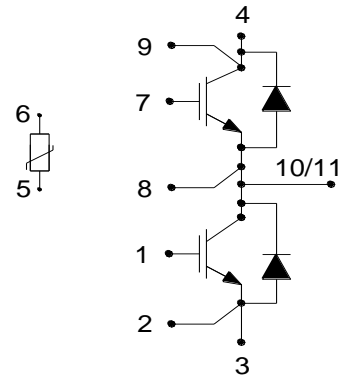
电路结构 Circuit Configuration


图 1. 电路结构

Fig. 1 Circuit configuration

模块外形 Module Appearance


图 2. 模块外形

Fig. 2 Module appearance

模块标签说明

Module Label Code Instruction

数据位置 Data position	数据内容 Content of data
1--8	模块批次号 Module batch number
9--12	模块序列号 Module serial number

最大额定值
Absolute Maximum Ratings

符号 Symbol	参数名称 Parameter	测试条件 Test Conditions	数值 Value	单位 Unit
V_{CES}	集电极-发射极电压 Collector-emitter voltage	$V_{GE} = 0V, T_C = 25\text{ }^\circ\text{C}$	1200	V
V_{GES}	栅极-发射极电压 Gate-emitter voltage	$T_C = 25\text{ }^\circ\text{C}$	± 20	V
I_C	集电极电流 Collector-emitter current	$T_C = 100\text{ }^\circ\text{C}, T_{vj} \text{ max} = 175\text{ }^\circ\text{C}$	600	A
$I_{C(PK)}$	集电极峰值电流 Peak collector current	$t_P = 1\text{ms}$	1200	A
P_{max}	晶体管部分最大损耗 Max. transistor power dissipation	$T_{vj} = 175\text{ }^\circ\text{C}, T_C = 25\text{ }^\circ\text{C}$	3.0	kW
t_t	二极管 t_t 值 Diode t_t	$V_R = 0V, t_P = 10\text{ms}, T_{vj} = 150\text{ }^\circ\text{C}$	21.6	kA^2s
V_{isol}	绝缘电压(模块) Isolation voltage – per module	短接所有端子, 端子与基板间施加电压 (Commoned terminals to base plate), AC RMS, 1 min, 50Hz, $T_C = 25\text{ }^\circ\text{C}$	2500	V

热和机械数据
Thermal & Mechanical Data

参数 Symbol	说明 Explanation	值 Value	单位 Unit
爬电距离 Creepage distance	端子-散热器 Terminal to heatsink	14.5	mm
	端子-端子 Terminal to terminal	13.0	mm
绝缘间隙 Clearance	端子-散热器 Terminal to heatsink	12.5	mm
	端子-端子 Terminal to terminal	10.0	mm
相对漏电起痕指数 CTI (Comparative Tracking Index)		>200	

热和机械数据
Thermal & Mechanical Data

符号 Symbol	参数名称 Parameter	测试条件 Test Conditions	最小值 Min.	最大值 Max.	单位 Unit
$R_{th(J-C)}$ IGBT	IGBT 结壳热阻 Thermal resistance – IGBT			49	K / kW
$R_{th(J-C)}$ Diode	二极管结壳热阻 Thermal resistance – Diode			77	K / kW
$R_{th(C-H)}$ IGBT	接触热阻(IGBT) Thermal resistance – case to heatsink (IGBT)	安装力矩 5Nm, 导热脂 1W/m·°C Mounting torque 5Nm, with mounting grease 1W/m·°C		34	K / kW
$R_{th(C-H)}$ Diode	接触热阻(Diode) Thermal resistance – case to heatsink (Diode)	安装力矩 5Nm, 导热脂 1W/m·°C Mounting torque 5Nm, with mounting grease 1W/m·°C		40	K / kW
$T_{vj\ op}$	工作结温 Operating junction temperature	IGBT 部分 (IGBT)	-40	150	°C
		二极管部分(Diode)	-40	150	°C
T_{stg}	存储温度 Storage temperature range		-40	125	°C
M	安装力矩 Screw torque	安装紧固用 - M5 Mounting - M5	3	6	Nm
		电路互连用 – M6 Electrical connections - M6	3	6	Nm

热敏电阻数据
NTC-Thermistor Data

符号 Symbol	参数名称 Parameter	测试条件 Test Conditions	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
R_{25}	额定电阻值 Rated resistance	$T_C = 25\ ^\circ\text{C}$		5		kΩ
$\Delta R/R$	R100 偏差 Deviation of R100	$T_C = 100\ ^\circ\text{C}, R_{100}=493\ \Omega$	-5		5	%
P_{25}	耗散功率 Power dissipation	$T_C = 25\ ^\circ\text{C}$			20	mW
$B_{25/50}$	B-值 B-value	$R_2 = R_{25}\exp [B_{25/50}(1/T_2 - 1/(298.15\ \text{K}))]$		3375		K
$B_{25/80}$	B-值 B-value	$R_2 = R_{25}\exp [B_{25/80}(1/T_2 - 1/(298.15\ \text{K}))]$		3411		K
$B_{25/100}$	B-值 B-value	$R_2 = R_{25}\exp [B_{25/100}(1/T_2 - 1/(298.15\ \text{K}))]$		3433		K

电特性值
Electrical Characteristics

 除非特别声明, 否则 $T_C = 25\text{ }^\circ\text{C}$
 $T_C = 25\text{ }^\circ\text{C}$ unless otherwise stated

符号 Symbol	参数名称 Parameter	条件 Test Conditions	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
I_{CES}	集电极截止电流 Collector cut-off current	$V_{GE} = 0V, V_{CE} = V_{CES}$			1	mA
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_C = 125\text{ }^\circ\text{C}$			10	mA
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_C = 150\text{ }^\circ\text{C}$			20	mA
I_{GES}	栅极漏电流 Gate leakage current	$V_{GE} = \pm 20V, V_{CE} = 0V$			0.5	μA
$V_{GE(TH)}$	栅极-发射极阈值电压 Gate threshold voltage	$I_C = 15\text{mA}, V_{GE} = V_{CE}$	5.50	6.10	6.70	V
$V_{CE(sat)}^{(*1)}$	集电极-发射极饱和电压 Collector-emitter saturation voltage	$V_{GE} = 15V, I_C = 600A$		1.85	2.25	V
		$V_{GE} = 15V, I_C = 600A, T_{vj} = 125\text{ }^\circ\text{C}$		2.15	2.55	V
		$V_{GE} = 15V, I_C = 600A, T_{vj} = 150\text{ }^\circ\text{C}$		2.25	2.65	V
I_F	二极管正向直流电流 Diode forward current	DC		600		A
I_{FRM}	二极管正向重复峰值电流 Diode peak forward current	$t_p = 1\text{ms}$		1200		A
$V_F^{(*1)}$	二极管正向电压 Diode forward voltage	$I_F = 600A, V_{GE} = 0$		1.90	2.30	V
		$I_F = 600A, V_{GE} = 0, T_{vj} = 125\text{ }^\circ\text{C}$		2.10	2.50	V
		$I_F = 600A, V_{GE} = 0, T_{vj} = 150\text{ }^\circ\text{C}$		2.10	2.50	V
I_{SC}	短路电流 Short circuit current	$T_{vj} = 150\text{ }^\circ\text{C}, V_{CC} = 800V,$ $V_{GE} \leq 15V, t_p \leq 10\mu\text{s},$ $V_{CE(max)} = V_{CES} - L^{(*2)} \times di/dt,$ IEC 6074-9		2800		A

注意: 1.(*1) 表示该参数的测试点为辅助母排端子 (*1 indicates it is measured at the auxiliary busbar terminal),

Note: 2.(*2) 表示 L 是电路杂散电感加上 L_M (*2) indicates L is the circuit stray inductance plus L_M).

电特性值
Electrical Characteristics

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 $T_C = 25\text{ }^\circ\text{C}$ unless otherwise stated

符号 Symbol	参数名称 Parameter	条件 Test Conditions	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
C_{ies}	输入电容 Input capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$		93		nF
Q_g	栅极电荷 Gate charge	$\pm 15V$		6.9		μC
C_{res}	反向传输电容 Reverse transfer capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$		1.0		nF
L_M	模块电感 Module inductance			22		nH
R_{INT}	内阻 Internal transistor resistance			1		m Ω

电特性值
Electrical Characteristics

符号 Symbol	参数名称 Parameter	测试条件 Test Conditions	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
$t_{d(off)}$	关断延迟时间 Turn-off delay time	$I_C = 600A,$ $V_{CE} = 600V,$ $V_{GE} = \pm 15V,$ $R_{G(OFF)} = 1.5\Omega,$ $L_S = 60nH,$ $dv/dt = 5000V/us$ ($T_{vj} = 150^\circ C$).	$T_{vj} = 25^\circ C$		725	ns
			$T_{vj} = 125^\circ C$		770	
			$T_{vj} = 150^\circ C$		785	
t_f	下降时间 Fall time		$T_{vj} = 25^\circ C$		120	ns
			$T_{vj} = 125^\circ C$		205	
			$T_{vj} = 150^\circ C$		225	
E_{OFF}	关断损耗 Turn-off energy loss		$T_{vj} = 25^\circ C$		66	mJ
			$T_{vj} = 125^\circ C$		80	
			$T_{vj} = 150^\circ C$		84	
$t_{d(on)}$	开通延迟时间 Turn-on delay time	$I_C = 600A,$ $V_{CE} = 600V,$ $V_{GE} = \pm 15V,$ $R_{G(ON)} = 1.5\Omega,$ $L_S = 60nH,$ $di/dt = 6100A/us$ ($T_{vj} = 150^\circ C$).	$T_{vj} = 25^\circ C$		310	ns
			$T_{vj} = 125^\circ C$		330	
			$T_{vj} = 150^\circ C$		335	
t_r	上升时间 Rise time		$T_{vj} = 25^\circ C$		110	ns
			$T_{vj} = 125^\circ C$		115	
			$T_{vj} = 150^\circ C$		115	
E_{ON}	开通损耗 Turn-on energy loss		$T_{vj} = 25^\circ C$		22	mJ
			$T_{vj} = 125^\circ C$		29	
			$T_{vj} = 150^\circ C$		31	
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	$T_{vj} = 25^\circ C$		62	μC	
		$T_{vj} = 125^\circ C$		95		
		$T_{vj} = 150^\circ C$		110		
I_{rr}	二极管反向恢复电流 Diode reverse recovery current	$T_{vj} = 25^\circ C$		405	A	
		$T_{vj} = 125^\circ C$		460		
		$T_{vj} = 150^\circ C$		490		
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy	$T_{vj} = 25^\circ C$		34	mJ	
		$T_{vj} = 125^\circ C$		48		
		$T_{vj} = 150^\circ C$		56		

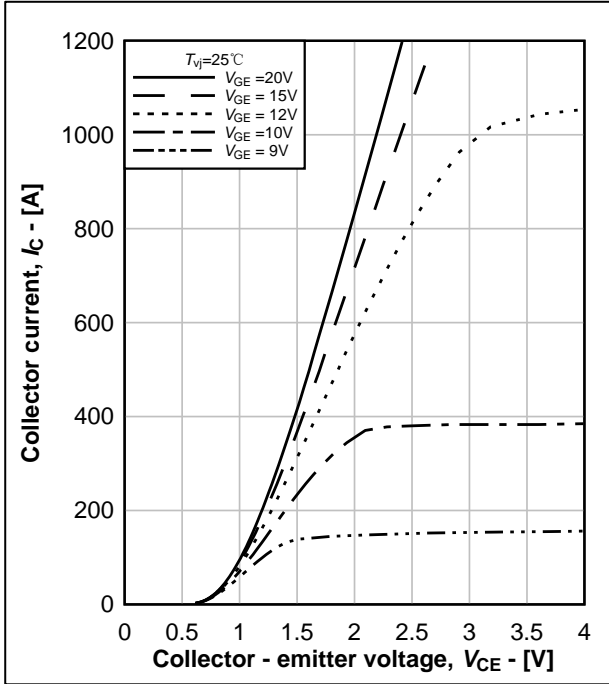

 图 3. IGBT 输出特性典型曲线, $I_C = f(V_{CE})$

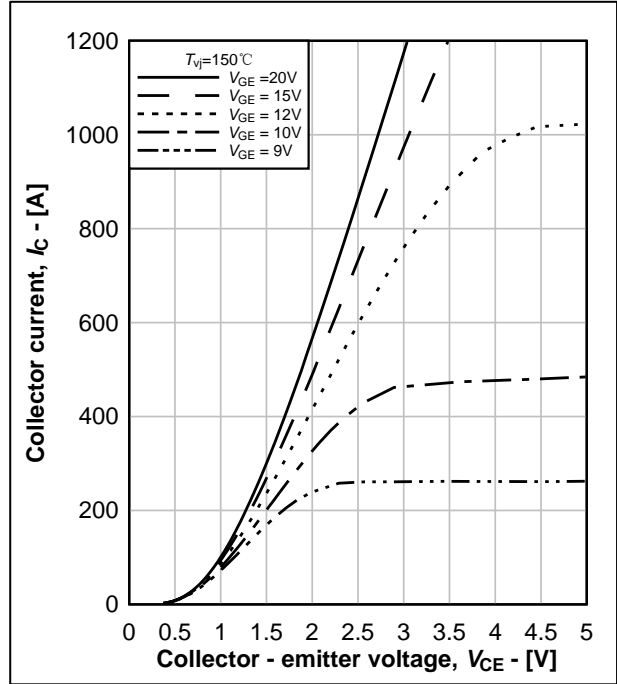
 Fig.3 Typical IGBT output characteristics, $I_C = f(V_{CE})$

 图 4. IGBT 输出特性典型曲线, $I_C = f(V_{CE})$

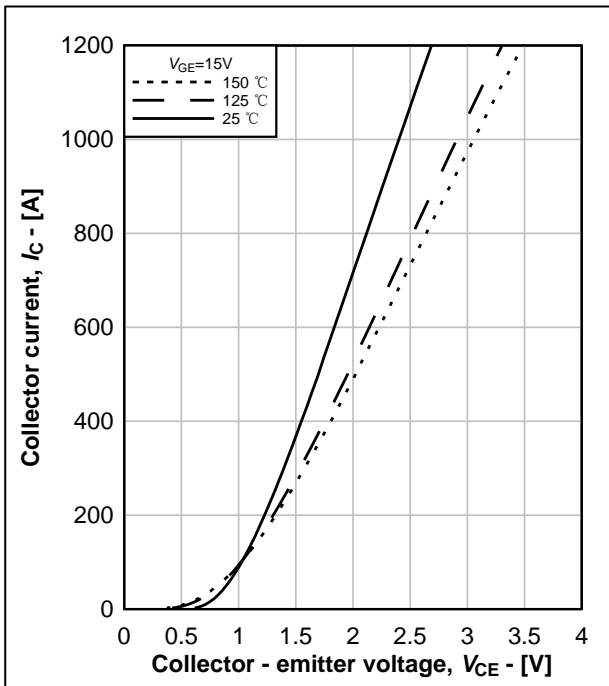
 Fig.4 Typical IGBT output characteristics, $I_C = f(V_{CE})$

 图 5. IGBT 输出特性典型曲线, $I_C = f(V_{CE})$

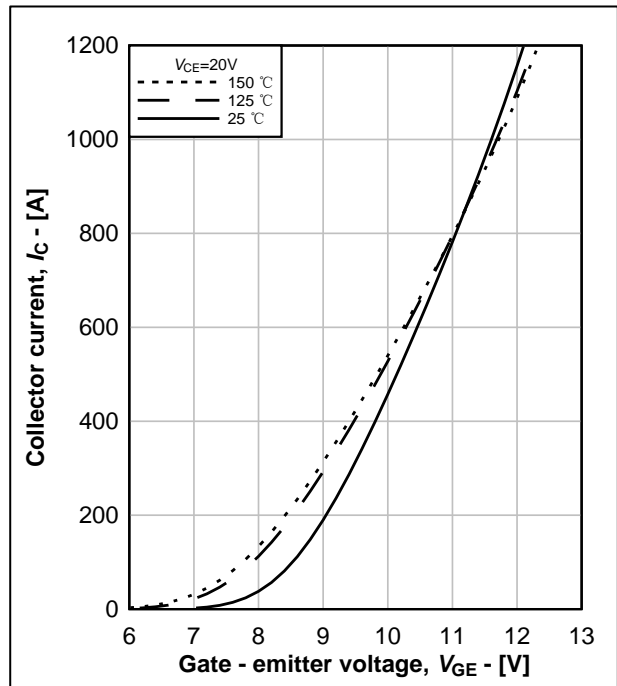
 Fig.5 Typical IGBT output characteristics, $I_C = f(V_{CE})$

 图 6. IGBT 传输特性典型曲线, $I_C = f(V_{GE})$

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

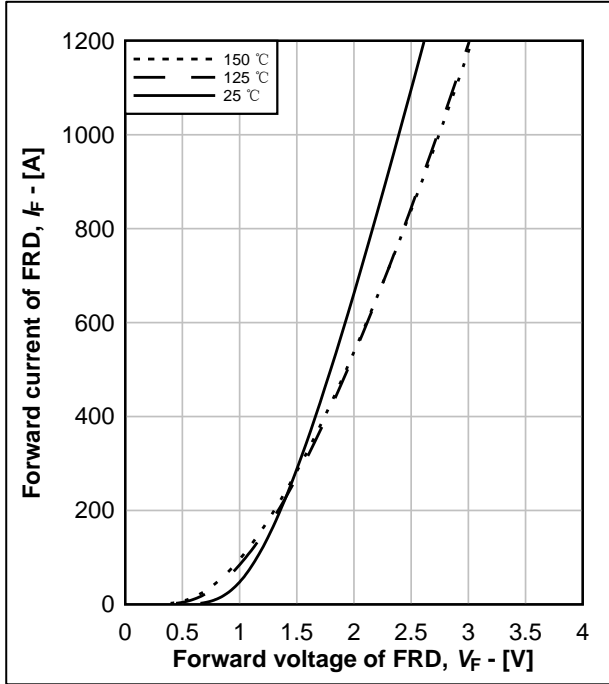

 图 7. FRD 输出特性典型曲线, $I_F = f(V_F)$

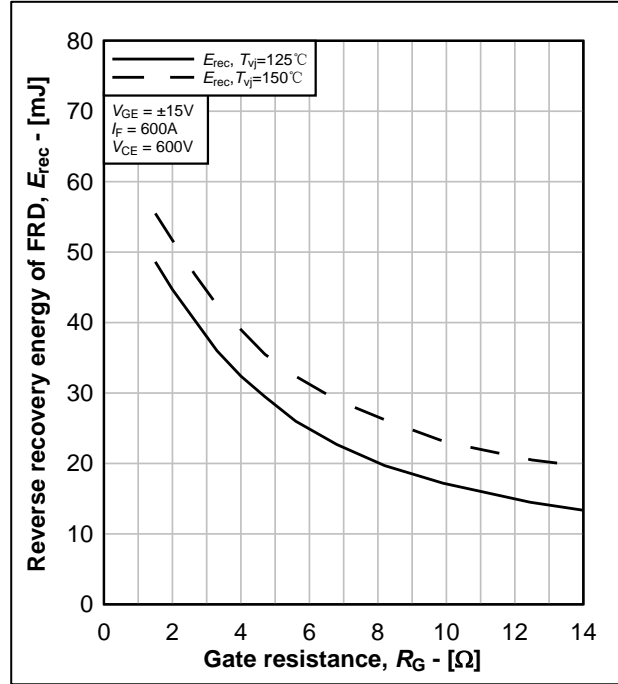
 Fig.7 Typical FRD output characteristics, $I_F = f(V_F)$

 图 8. FRD 反向恢复能耗典型曲线, $E_{rec} = f(R_G)$

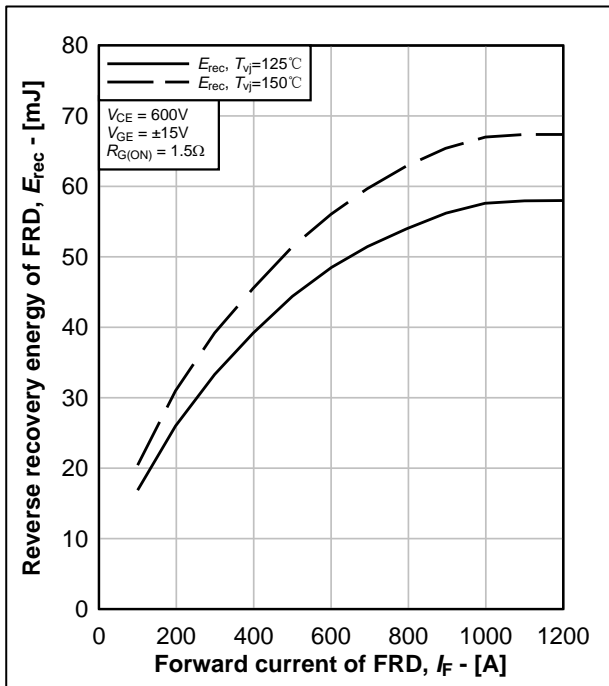
 Fig.8 Typical FRD E_{rec} , $E_{rec} = f(R_G)$

 图 9. FRD 反向恢复能耗典型曲线, $E_{rec} = f(I_F)$

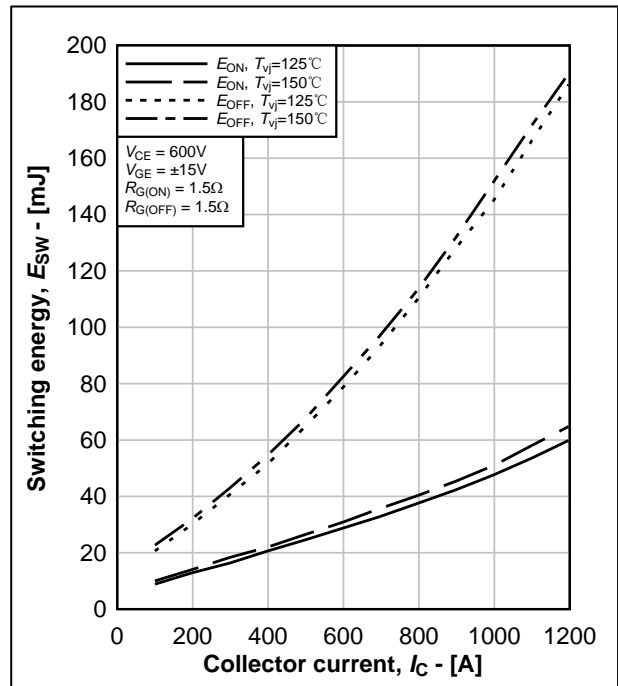
 Fig.9 Typical FRD E_{rec} , $E_{rec} = f(I_F)$

 图 10. IGBT 开关能耗典型曲线, $E_{ON} = f(I_C)$, $E_{OFF} = f(I_C)$

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

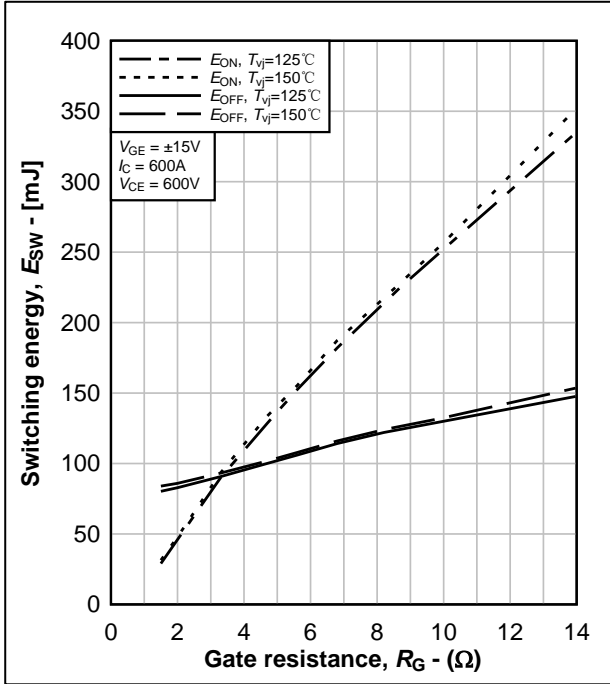

 图 11. IGBT 开关能耗典型曲线, $E_{ON} = f(R_G)$, $E_{OFF} = f(R_G)$

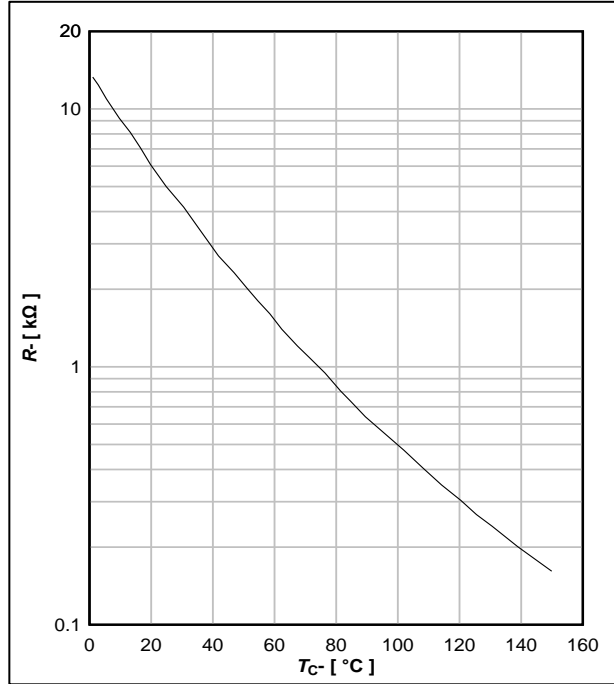
 Fig.11 Typical IGBT switching energy,
 $E_{ON} = f(R_G)$, $E_{OFF} = f(R_G)$

 图 12. 热敏电阻典型特性曲线, $R = f(T_C)$

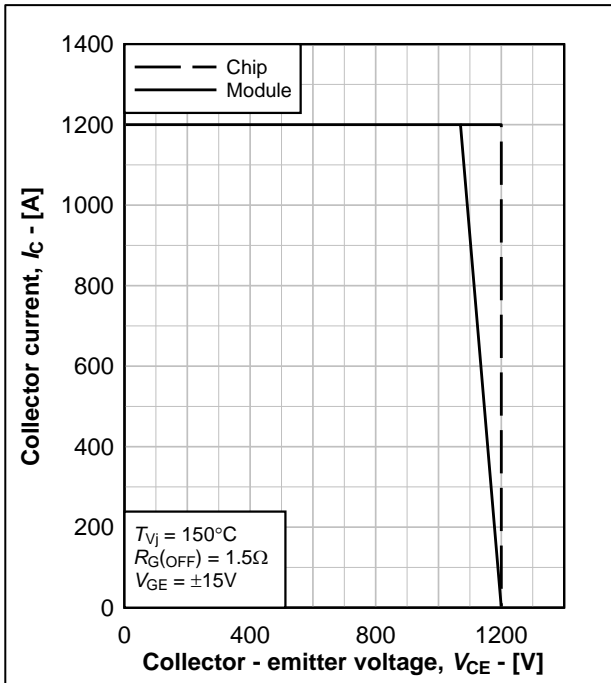
 Fig.12 Typical NTC thermistor characteristic, $R = f(T_C)$

 图 13. IGBT 反偏安全工作区, $I_C = f(V_{CE})$

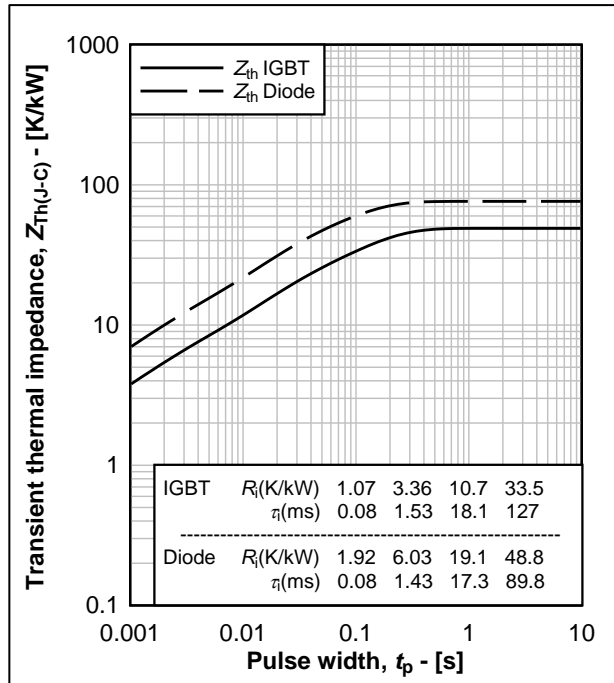
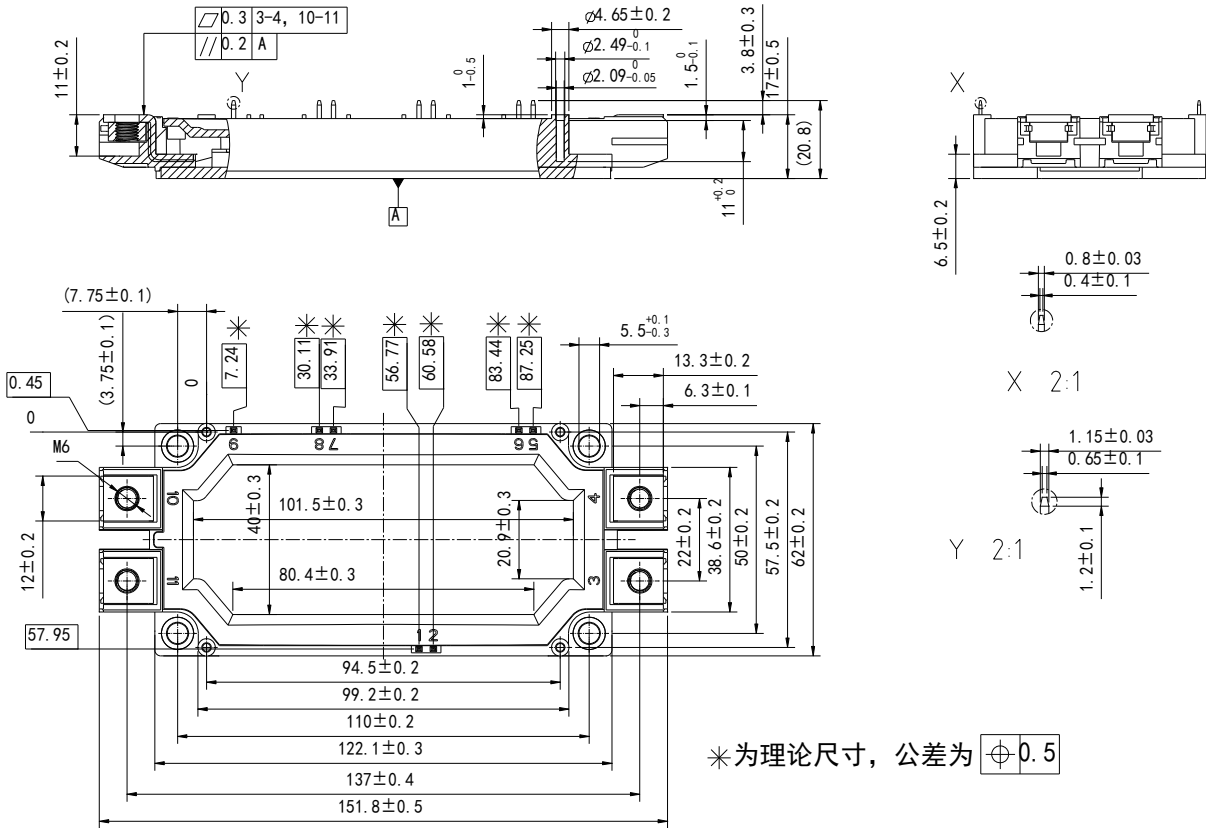
 Fig.13 Reverse bias safe operating area of IGBT,
 $I_C = f(V_{CE})$

 图 14. 瞬态热阻抗曲线, $Z_{Th(J-C)} = f(t_p)$

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



重量 Weight: 345g 模块外观类型 Module outline code: M1

图 15. 模块外观尺寸

Fig. 15 Module outlines

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