

关键参数
Key Parameters

V_{CES}		1700	V
$V_{CE(sat)}$	Typ.	1.70	V
I_C	Max.	600	A
$I_{C(RM)}$	Max.	1200	A

典型应用
Typical Applications

- 风力发电 Wind Turbines
- 充电装置 Power Charging Equipment
- 智能电网 Smart Grid
- 高可靠性逆变器 High Reliability Inverter

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

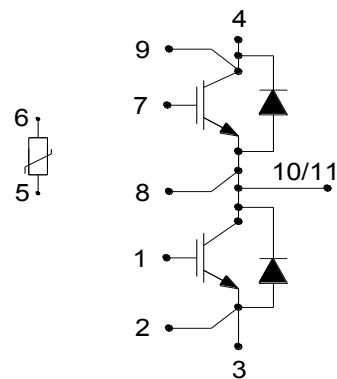
电路结构
Circuit Configuration


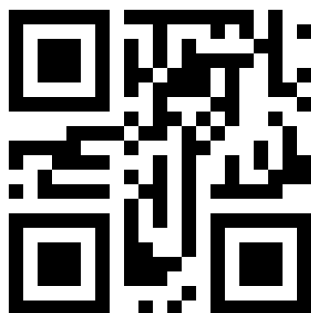
图 1.电路结构

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
13--17	模块型号代码 Module type code
18--19	模块生产周数 Module production weeks

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	$V_{GE} = 0V, T_C = 25\text{ }^{\circ}\text{C}$	1700	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	$T_C = 100\text{ }^{\circ}\text{C}, T_{vjmax} = 175\text{ }^{\circ}\text{C}$	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	$T_{vj} = 175\text{ }^{\circ}\text{C}, T_C = 25\text{ }^{\circ}\text{C}$	3.26	kW
I^2t	二极管 I^2t 值 Diode I^2t	$V_R = 0V, t_P = 10\text{ms}, T_{vj} = 150\text{ }^{\circ}\text{C}$	41.5	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 (Connected terminals to base plate), AC RMS, 1 min, 50Hz, $T_C = 25\text{ }^{\circ}\text{C}$	4000	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	15.0	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.	典型值 Typ.	最大值 Max.	单位 Unit
$R_{th(J-C)}$ IGBT	IGBT 结壳热阻 Thermal resistance – IGBT				46	K / kW
$R_{th(J-C)}$ Diode	二极管结壳热阻 Thermal resistance – Diode				80	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·K Mounting torque 5Nm, with mounting grease 1W/m·K		33		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·K Mounting torque 5Nm, with mounting grease 1W/m·K		38		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
$\Delta R/R$	R_{100} 偏差 Deviation of R_{100}	$T_C = 100\ ^\circ\text{C}$, $R_{100}=493\Omega$	-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
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{vj} = 125\text{ }^{\circ}\text{C}$			15	mA
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{vj} = 150\text{ }^{\circ}\text{C}$			30	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	$I_C = 15\text{mA}, V_{GE} = V_{CE}$	5.60	6.20	6.80	V
$V_{CE(sat)}^{(*1)}$	集电极-发射极饱和电压 Collector-emitter saturation voltage	$V_{GE} = 15V, I_C = 600A$		1.70	2.10	V
		$V_{GE} = 15V, I_C = 600A, T_{vj} = 125\text{ }^{\circ}\text{C}$		2.10		V
		$V_{GE} = 15V, I_C = 600A, T_{vj} = 150\text{ }^{\circ}\text{C}$		2.15		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	$I_F = 600A, V_{GE} = 0$		1.75	2.15	V
		$I_F = 600A, V_{GE} = 0, T_{vj} = 125\text{ }^{\circ}\text{C}$		2.00		V
		$I_F = 600A, V_{GE} = 0, T_{vj} = 150\text{ }^{\circ}\text{C}$		2.00		V
I_{SC}	短路电流 Short circuit current	$T_{vj} = 150\text{ }^{\circ}\text{C}, V_{CC} = 1000V,$ $V_{GE} \leq 15V, t_p \leq 10\mu\text{s},$ $V_{CE(max)} = V_{CES} - L^{(*2)} \times di/dt,$ IEC 60747-9		2400		A

注意: 1. (*1) 表示该参数基于芯片水平给出 (*1) indicates it is given at chip level),

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

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
C_{ies}	输入电容 Input capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$		96		nF
Q_g	栅极电荷 Gate charge	$\pm 15V$		6.1		μC
C_{res}	反向传输电容 Reverse transfer capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$		0.7		nF
L_M	模块电感 Module inductance			20		nH
$R_{CC'+EE'}$	模块引线电阻，端子-芯片 Module lead resistance, terminal-chip			1		m Ω
R_{Gint}	内部栅极电阻 Internal gate resistor			1.0		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} = 900V, V_{GE} = $\pm 15V$, $R_{G(OFF)}$ = 1 Ω , L_S = 45nH, dv/dt =5400V/ μ s (T_{vj} = 150 $^{\circ}$ C).	T_{vj} = 25 $^{\circ}$ C		500		ns
			T_{vj} = 125 $^{\circ}$ C		575		
			T_{vj} = 150 $^{\circ}$ C		595		
t_f	下降时间 Fall time		T_{vj} = 25 $^{\circ}$ C		305		ns
			T_{vj} = 125 $^{\circ}$ C		395		
			T_{vj} = 150 $^{\circ}$ C		400		
E_{OFF}	关断损耗 Turn-off energy loss		T_{vj} = 25 $^{\circ}$ C		124		mJ
			T_{vj} = 125 $^{\circ}$ C		154		
			T_{vj} = 150 $^{\circ}$ C		166		
$t_{d(on)}$	开通延迟时间 Turn-on delay time	T_{vj} = 25 $^{\circ}$ C		285		ns	
		T_{vj} = 125 $^{\circ}$ C		300			
		T_{vj} = 150 $^{\circ}$ C		305			
t_r	上升时间 Rise time	T_{vj} = 25 $^{\circ}$ C		90		ns	
		T_{vj} = 125 $^{\circ}$ C		95			
		T_{vj} = 150 $^{\circ}$ C		100			
E_{ON}	开通损耗 Turn-on energy loss	T_{vj} = 25 $^{\circ}$ C		168		mJ	
		T_{vj} = 125 $^{\circ}$ C		208			
		T_{vj} = 150 $^{\circ}$ C		235			
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	T_{vj} = 25 $^{\circ}$ C		125		μ C	
		T_{vj} = 125 $^{\circ}$ C		205			
		T_{vj} = 150 $^{\circ}$ C		230			
I_{rr}	二极管反向恢复电流 Diode reverse recovery current	T_{vj} = 25 $^{\circ}$ C		470		A	
		T_{vj} = 125 $^{\circ}$ C		500			
		T_{vj} = 150 $^{\circ}$ C		510			
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy	T_{vj} = 25 $^{\circ}$ C		70		mJ	
		T_{vj} = 125 $^{\circ}$ C		121			
		T_{vj} = 150 $^{\circ}$ C		136			

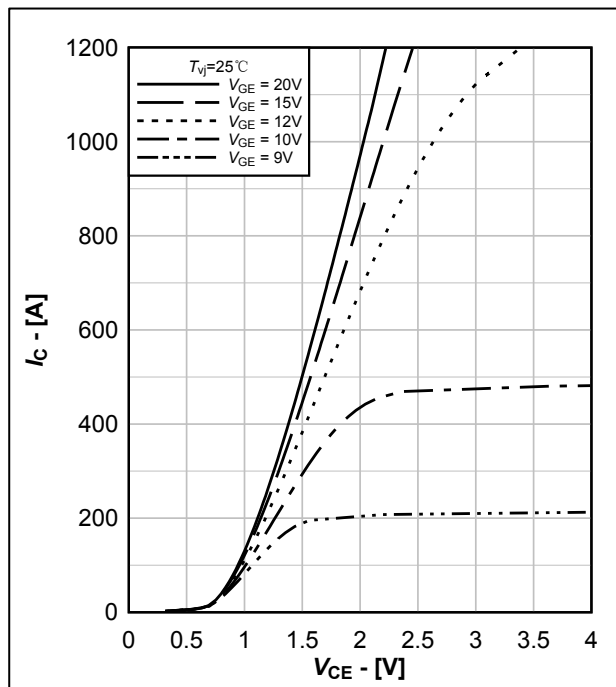

图 3. IGBT 输出特性典型曲线, $I_C = f(V_{CE})$

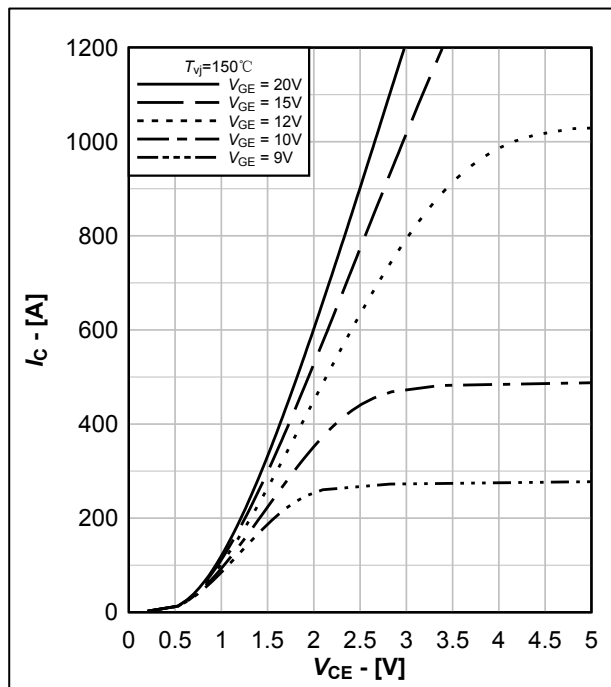
Fig.3 Typical IGBT output characteristics, $I_C = f(V_{CE})$

图 4. IGBT 输出特性典型曲线, $I_C = f(V_{CE})$

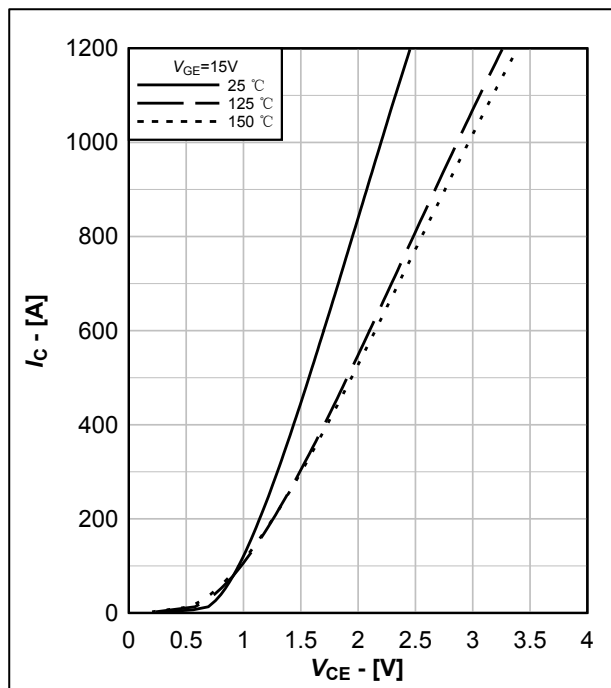
Fig.4 Typical IGBT output characteristics, $I_C = f(V_{CE})$

图 5. IGBT 输出特性典型曲线, $I_C = f(V_{CE})$

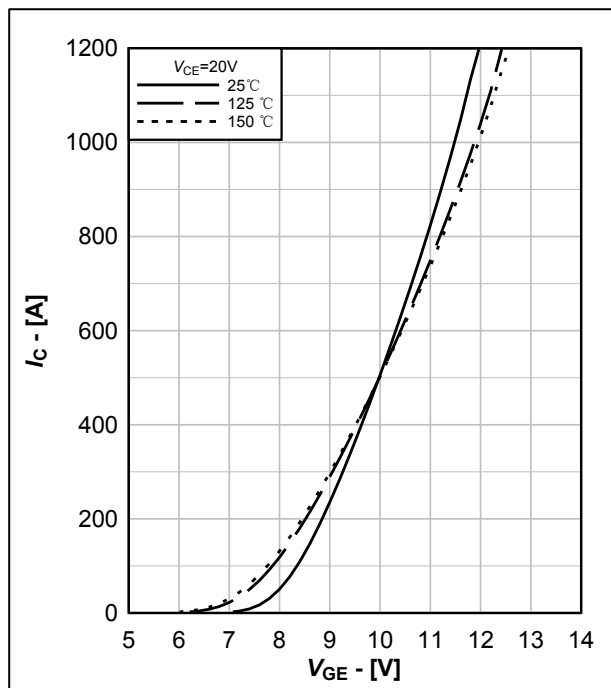
Fig.5 Typical IGBT output characteristics, $I_C = f(V_{CE})$

图 6. IGBT 传输特性典型曲线, $I_C = f(V_{GE})$

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

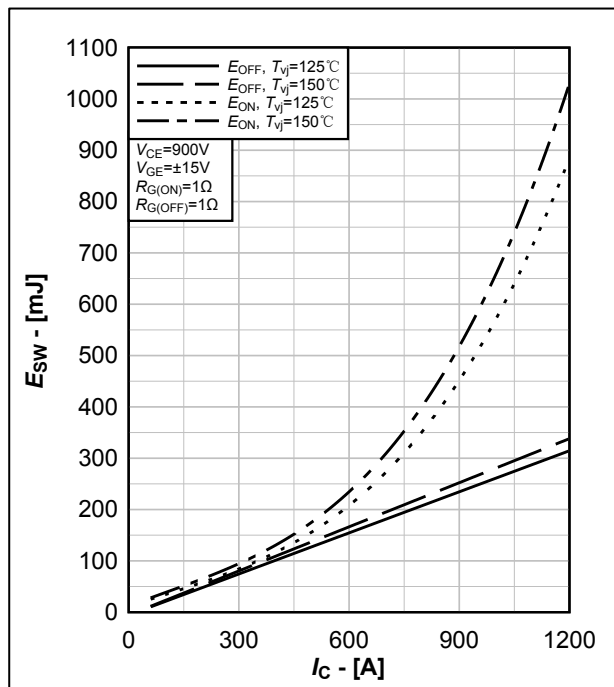

图 7. IGBT 开关损耗典型曲线, $E_{on} = f(I_C)$, $E_{off} = f(I_C)$

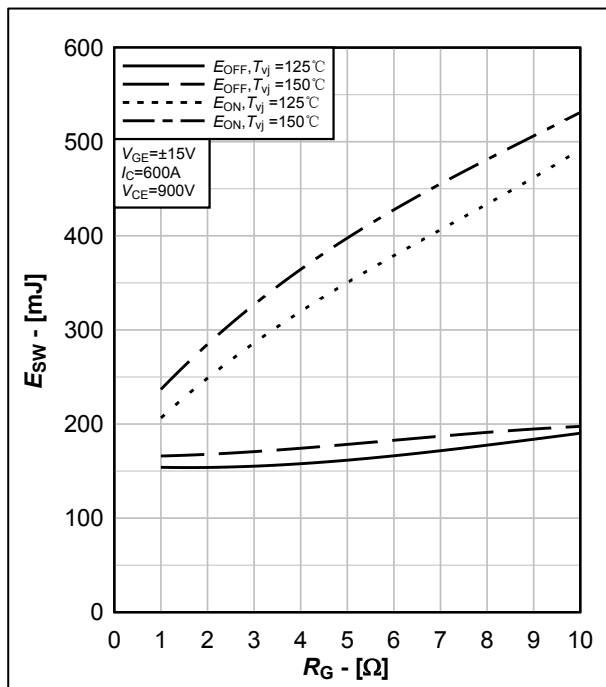
Fig.7 Typical IGBT switching energy, $E_{on} = f(I_C)$, $E_{off} = f(I_C)$

图 8. IGBT 开关损耗典型曲线, $E_{on} = f(R_G)$, $E_{off} = f(R_G)$

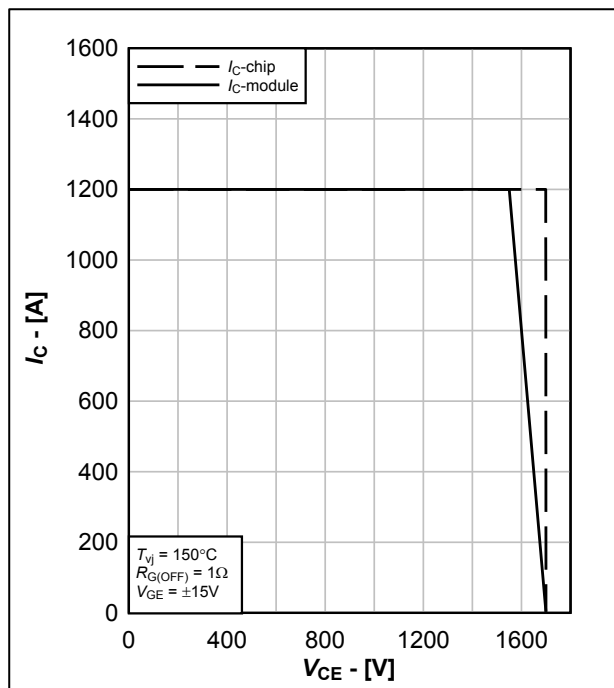
Fig.8 Typical IGBT switching energy, $E_{on} = f(R_G)$, $E_{off} = f(R_G)$

图 9. IGBT 反偏安全工作区, $I_C = f(V_{CE})$

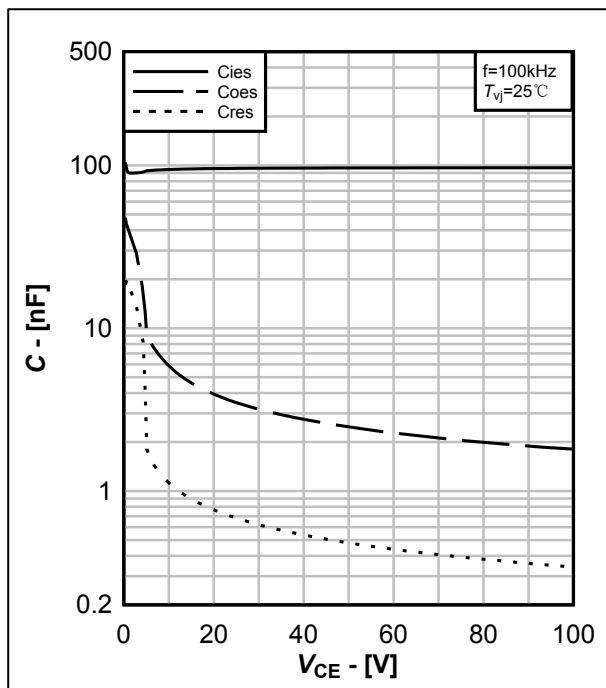
Fig.9 Reverse bias safe operating area of IGBT, $I_C = f(V_{CE})$

图 10. 电容特性典型曲线, $C = f(V_{CE})$

Fig.10 Typical capacity characteristic, $C = f(V_{CE})$

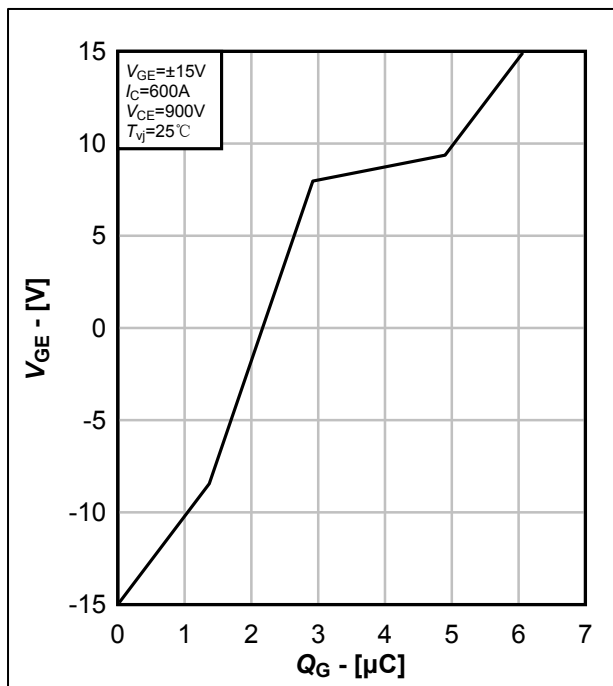

图 11. 栅极电荷特性典型曲线, $V_{GE} = f(Q_G)$

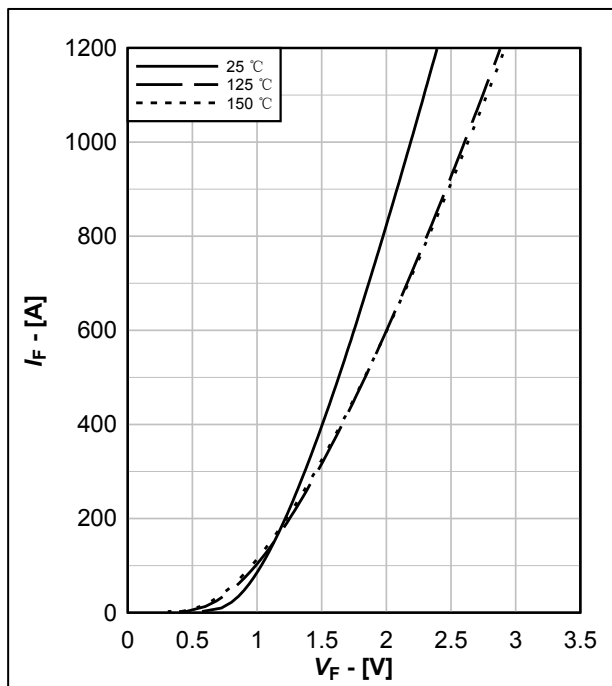
Fig.11 Typical gate charge characteristic, $V_{GE} = f(Q_G)$

图 12. FRD 输出特性典型曲线, $I_F = f(V_F)$

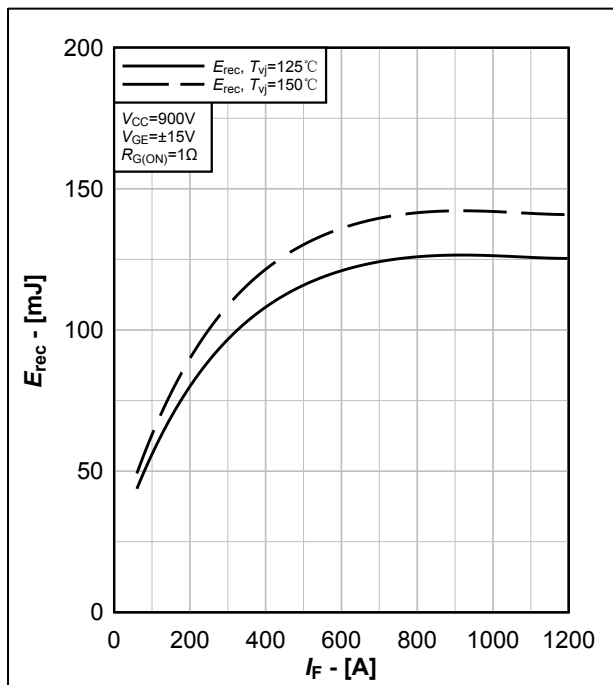
Fig.12 Typical FRD output characteristic, $I_F = f(V_F)$

图 13. FRD 反向恢复损耗典型曲线, $E_{rec} = f(I_F)$

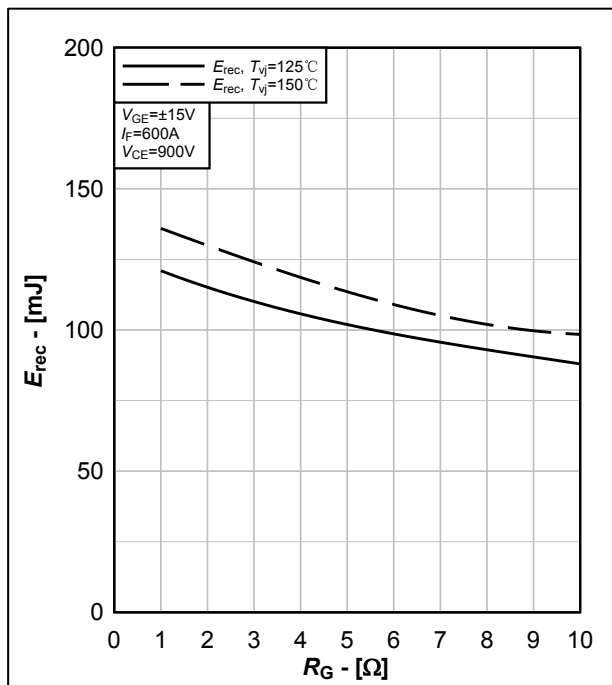
Fig.13 Typical FRD switching loss E_{rec} , $E_{rec} = f(I_F)$

图 14. FRD 反向恢复损耗典型曲线, $E_{rec} = f(R_G)$

Fig.14 Typical FRD switching loss E_{rec} , $E_{rec} = f(R_G)$

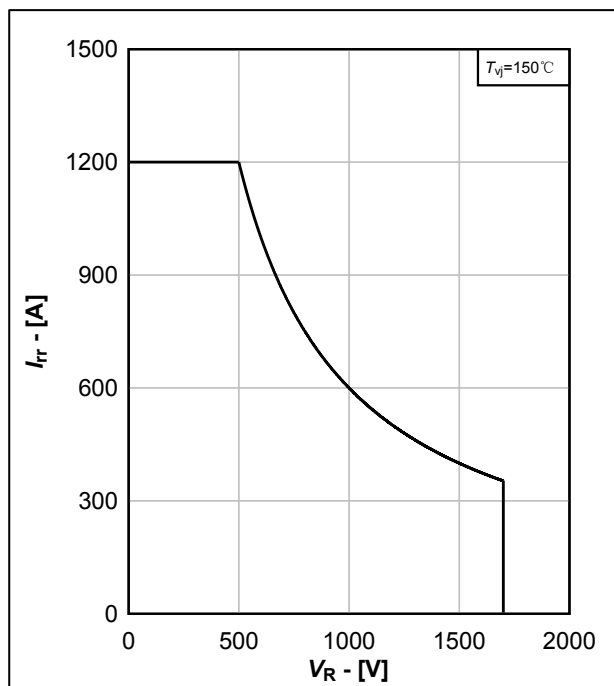


图 15. FRD 反偏安全工作区, $I_{rr} = f(V_R)$

Fig.15 Reverse bias safe operating area of FRD, $I_{rr} = f(V_R)$

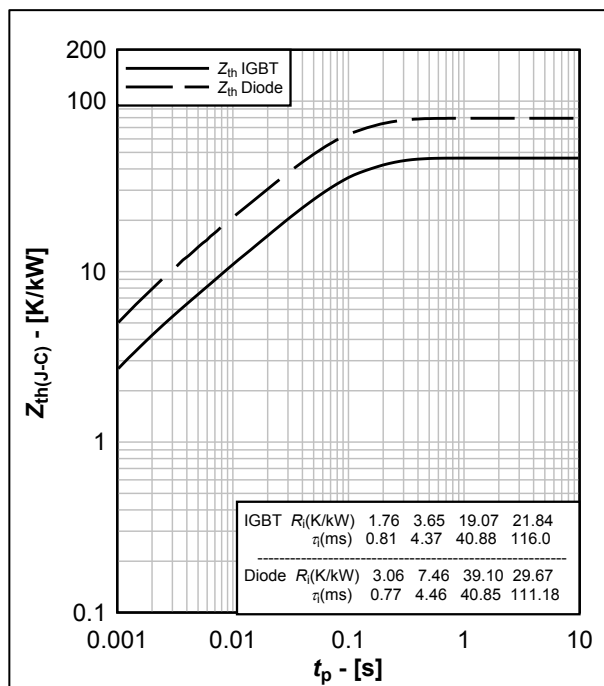


图 16. 瞬态热阻抗曲线, $Z_{th(j-c)} = f(t_p)$

Fig.16 Transient thermal impedance, $Z_{th(j-c)} = f(t_p)$

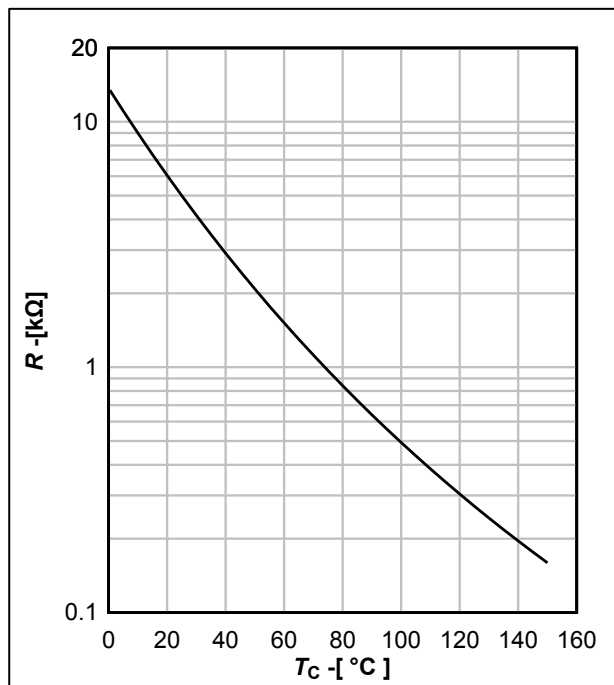
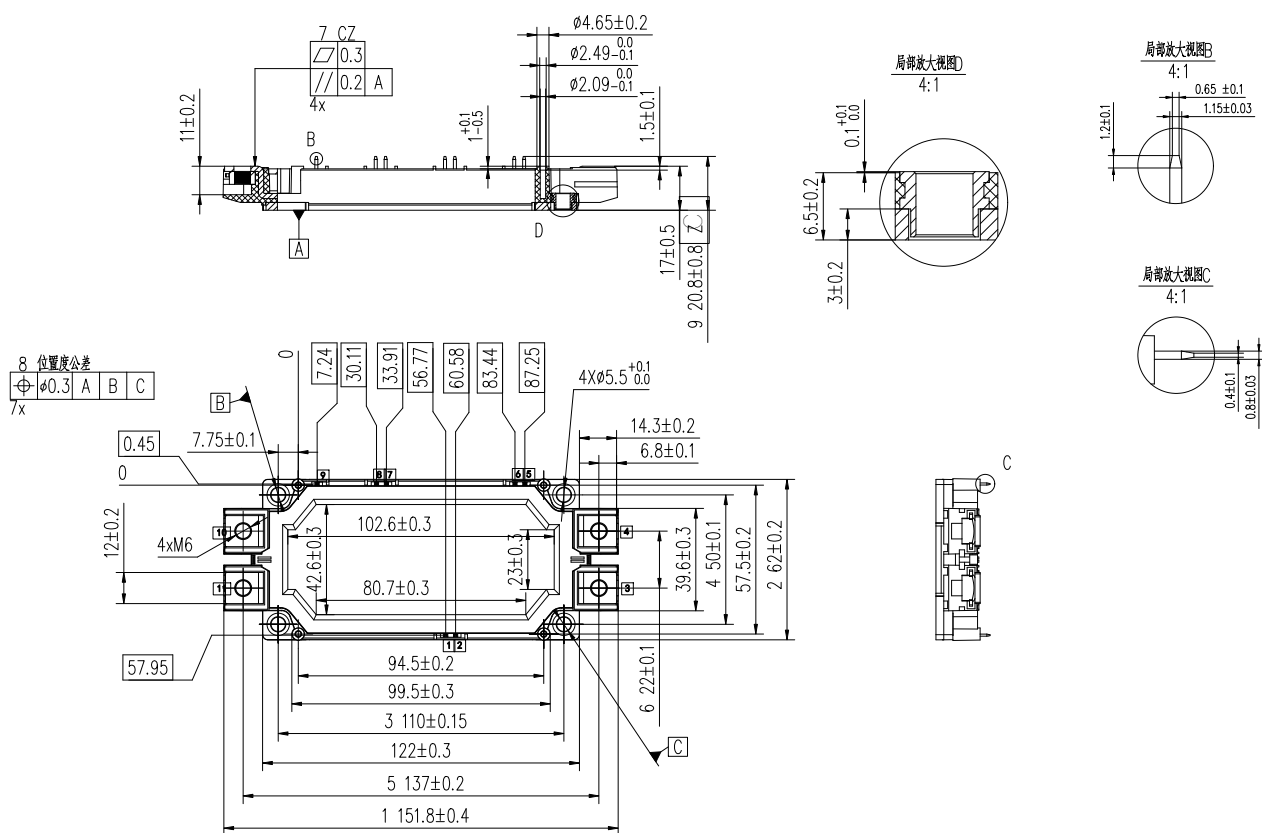


图 17. 热敏电阻典型特性曲线, $R = f(T_c)$

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



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

图 18. 模块外观尺寸

Fig. 18 Module outlines

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