

关键参数
Key Parameters

V_{CES}		1700	V
$V_{CE(sat)}$	Typ.	1.85	V
I_C	Max.	500	A
$I_{C(RM)}$	Max.	1000	A

典型应用
Typical Applications

● 风力发电	Wind Turbines
● 充电装置	Power Charging Equipment
● 无功补偿	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
● 高浪涌电流	High Surge Current
● 10 μ s 短路承受能力	10 μ s Short Circuit Withstand

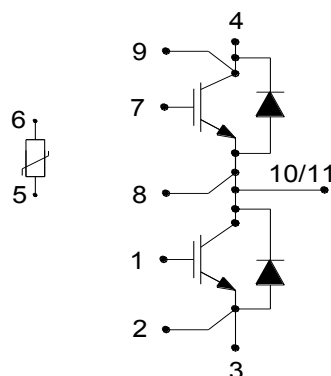
电路结构
Circuit Configuration


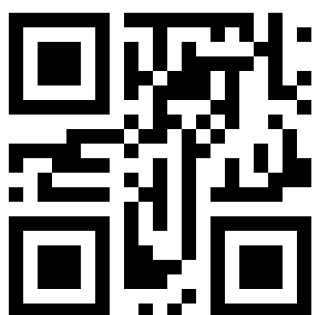
图 1. 电路结构

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	$T_C = 100\text{ }^{\circ}\text{C}, T_{vjmax} = 175\text{ }^{\circ}\text{C}$	500	A
$I_{C(PK)}$	集电极峰值电流 Peak collector current	$t_P = 1\text{ms}$	1000	A
P_{max}	晶体管部分最大损耗 Max. transistor power dissipation	$T_{vj} = 175\text{ }^{\circ}\text{C}, T_C = 25\text{ }^{\circ}\text{C}$	2.5	kW
ρ_t	二极管 ρ_t 值 Diode ρ_t	$V_R = 0V, t_P = 10\text{ms}, T_{vj} = 150\text{ }^{\circ}\text{C}$	51.2	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			56.9	60	K / kW
$R_{th(J-C)}$ Diode	二极管结壳热阻 Thermal resistance – Diode			75.9	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		28		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		48		K / kW
$T_{vj\ op}$	工作结温 Operating junction temperature	IGBT 芯片 (IGBT)	-40		150	°C
		二极管芯片(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
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{vj} = 125\text{ }^{\circ}\text{C}$			10	mA
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{vj} = 150\text{ }^{\circ}\text{C}$			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	$I_C = 15\text{mA}, V_{GE} = V_{CE}$	5.60	6.10	6.70	V
$V_{CE(sat)}^{(*1)}$	集电极-发射极饱和电压 Collector-emitter saturation voltage	$V_{GE} = 15V, I_C = 500A$		1.85	2.25	V
		$V_{GE} = 15V, I_C = 500A, T_{vj} = 125\text{ }^{\circ}\text{C}$		2.25		V
		$V_{GE} = 15V, I_C = 500A, T_{vj} = 150\text{ }^{\circ}\text{C}$		2.35		V
I_F	二极管正向直流电流 Diode forward current	DC		500		A
I_{FRM}	二极管正向重复峰值电流 Diode peak forward current	$t_P = 1\text{ms}$		1000		A
$V_F^{(*1)}$	二极管正向电压 Diode forward voltage	$I_F = 500A, V_{GE} = 0V$		1.70	2.10	V
		$I_F = 500A, V_{GE} = 0V, T_{vj} = 125\text{ }^{\circ}\text{C}$		1.80		V
		$I_F = 500A, V_{GE} = 0V, T_{vj} = 150\text{ }^{\circ}\text{C}$		1.80		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		1800		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_{sCE} (*2) indicates L is the circuit stray inductance plus L_{sCE}).

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	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 100\text{kHz}$		74		nF
Q_g	栅极电荷 Gate charge	$\pm 15\text{V}$		5		μC
C_{res}	反向传输电容 Reverse transfer capacitance	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 100\text{kHz}$		0.52		nF
L_{sCE}	模块杂散电感 Module stray inductance			20		nH
$R_{CC'+EE'}$	模块引线电阻，端子-芯片 Module lead resistance, terminal-chip			0.9		m Ω
R_{Gint}	内部栅极电阻 Internal gate resistor			1.3		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	$I_C = 500A$, $V_{CE} = 900V$, $V_{GE} = \pm 15V$, $R_{G(OFF)} = 1.8\Omega$, $L_S = 60nH$, $dv/dt = 4800V/\mu s$ ($T_{vj} = 150^\circ C$).	$T_{vj} = 25^\circ C$		740		ns
			$T_{vj} = 125^\circ C$		830		
			$T_{vj} = 150^\circ C$		850		
t_f	下降时间 Fall time		$T_{vj} = 25^\circ C$		360		ns
			$T_{vj} = 125^\circ C$		510		
			$T_{vj} = 150^\circ C$		550		
E_{OFF}	关断损耗 Turn-off energy loss		$T_{vj} = 25^\circ C$		110		mJ
			$T_{vj} = 125^\circ C$		144		
			$T_{vj} = 150^\circ C$		155		
$t_{d(on)}$	开通延迟时间 Turn-on delay time	$T_{vj} = 25^\circ C$		210		ns	
		$T_{vj} = 125^\circ C$		220			
		$T_{vj} = 150^\circ C$		220			
t_r	上升时间 Rise time	$T_{vj} = 25^\circ C$		70		ns	
		$T_{vj} = 125^\circ C$		80			
		$T_{vj} = 150^\circ C$		80			
E_{ON}	开通损耗 Turn-on energy loss	$T_{vj} = 25^\circ C$		42		mJ	
		$T_{vj} = 125^\circ C$		68			
		$T_{vj} = 150^\circ C$		80			
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	$T_{vj} = 25^\circ C$		135		μC	
		$T_{vj} = 125^\circ C$		215			
		$T_{vj} = 150^\circ C$		235			
I_{rr}	二极管反向恢复电流 Diode reverse recovery current	$T_{vj} = 25^\circ C$		685		A	
		$T_{vj} = 125^\circ C$		745			
		$T_{vj} = 150^\circ C$		770			
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy	$T_{vj} = 25^\circ C$		105		mJ	
		$T_{vj} = 125^\circ C$		160			
		$T_{vj} = 150^\circ C$		175			

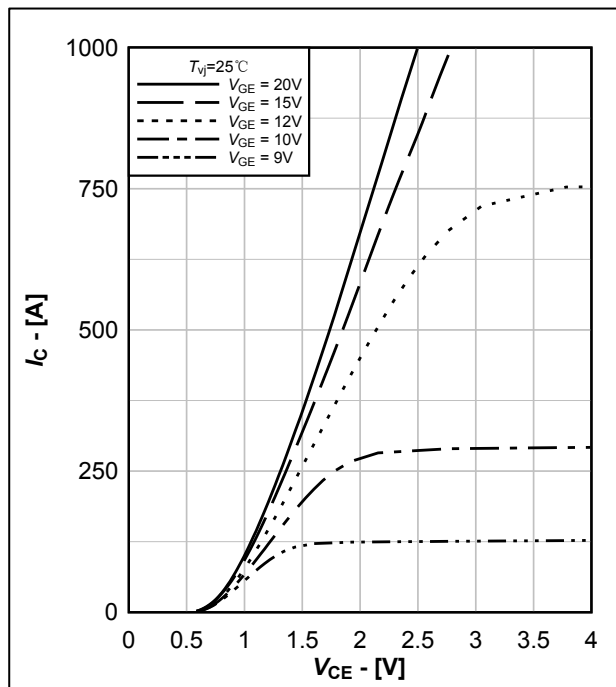

 图 3. IGBT 输出特性典型曲线, $I_C = f(V_{CE})$

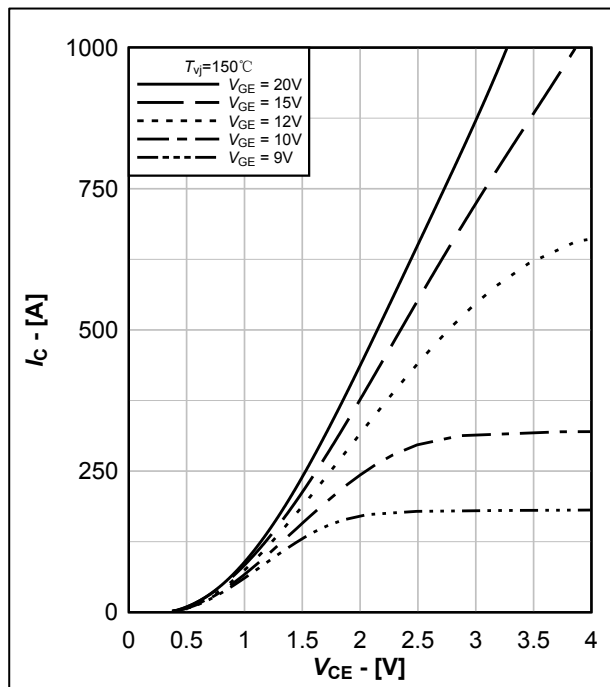
 Fig.3 Typical IGBT output characteristic, $I_C = f(V_{CE})$

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

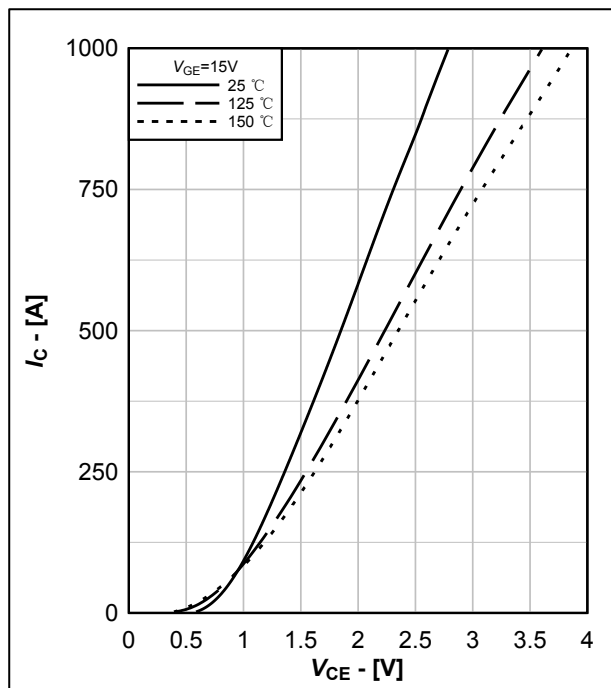
 Fig.4 Typical IGBT output characteristic, $I_C = f(V_{CE})$

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

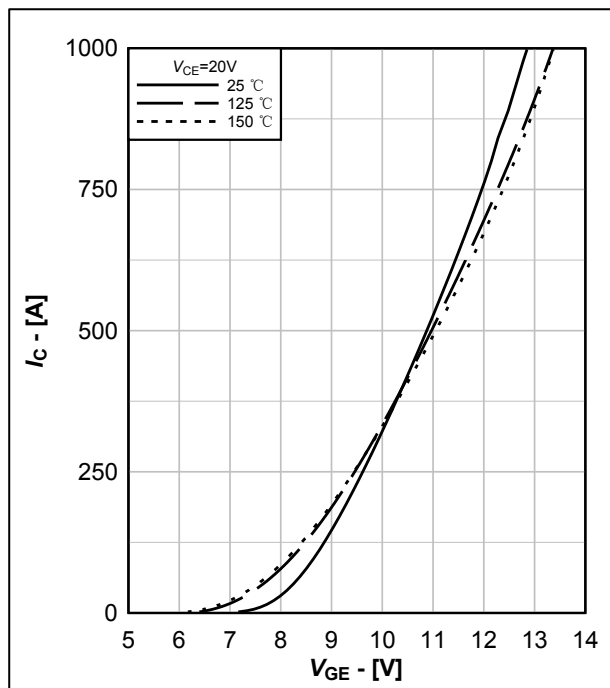
 Fig.5 Typical IGBT output characteristic, $I_C = f(V_{CE})$

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

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

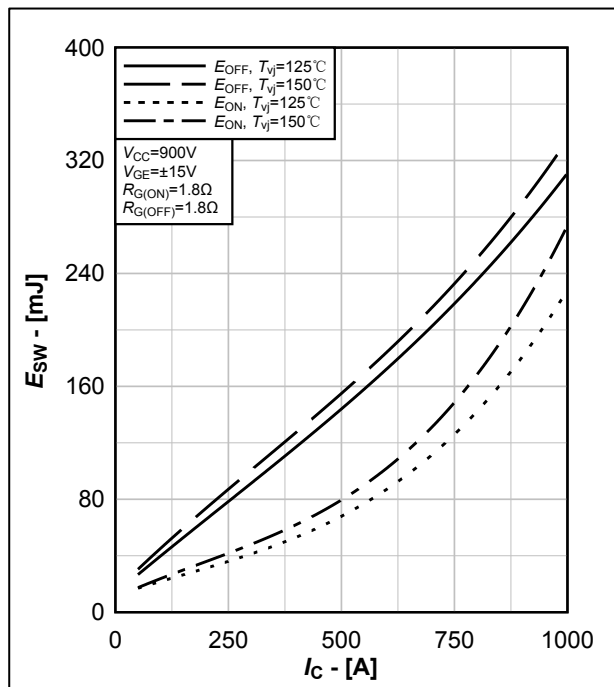

 图 7. IGBT 开关损耗典型曲线, $E_{on}=f(I_C)$, $E_{off}=f(I_C)$

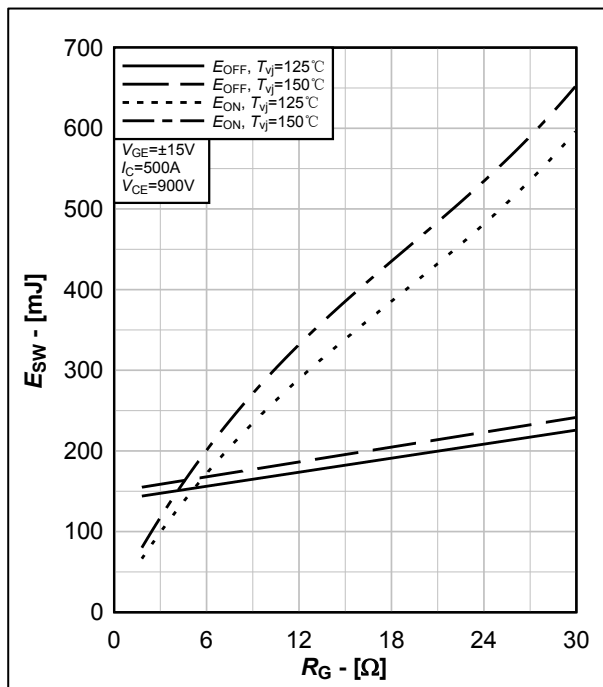
 Fig.7 Typical IGBT switching energy, $E_{on}=f(I_C)$, $E_{off}=f(I_C)$

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

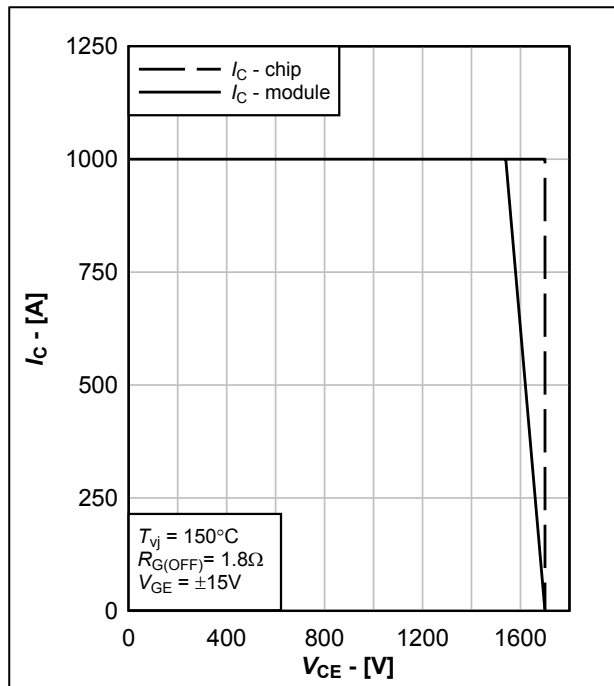
 Fig.8 Typical IGBT switching energy, $E_{on}=f(R_G)$, $E_{off}=f(R_G)$

 图 9. IGBT 反偏安全工作区, $I_C=f(V_{CE})$

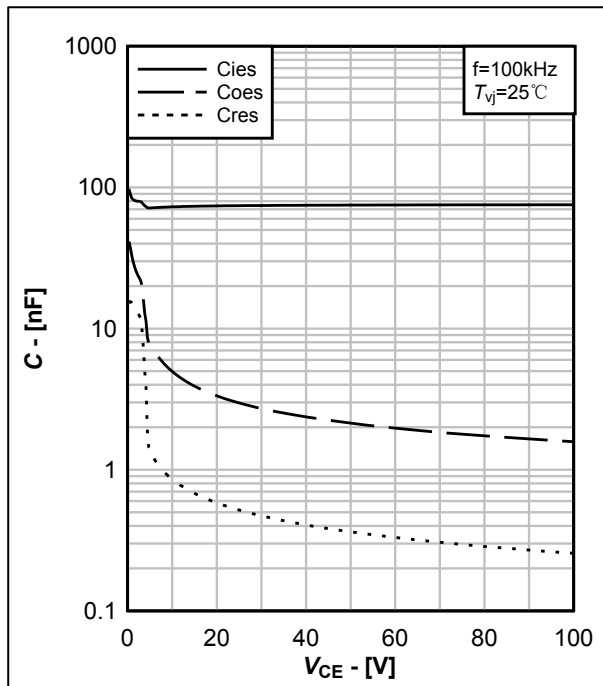
 Fig.9 Reverse bias safe operating area of IGBT, $I_C=f(V_{CE})$

 图 10. 电容特性典型曲线, $C=f(V_{CE})$

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

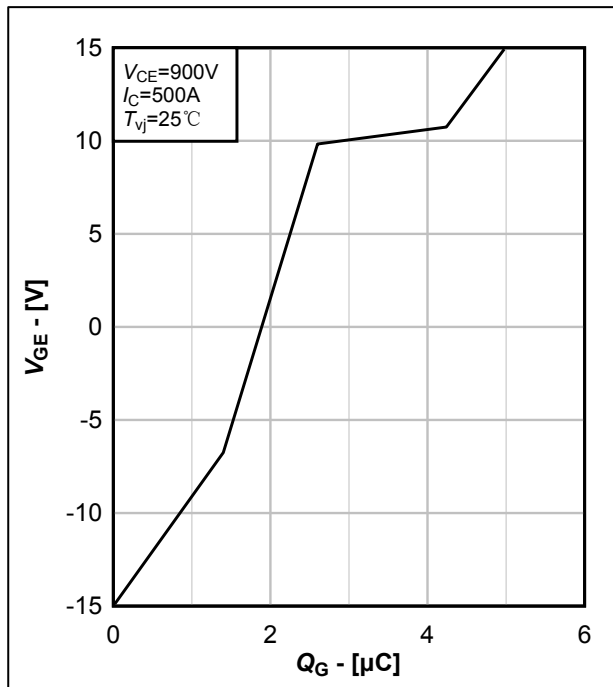

图 11. 栅极电荷特性典型曲线, $V_{GE} = f(Q_G)$

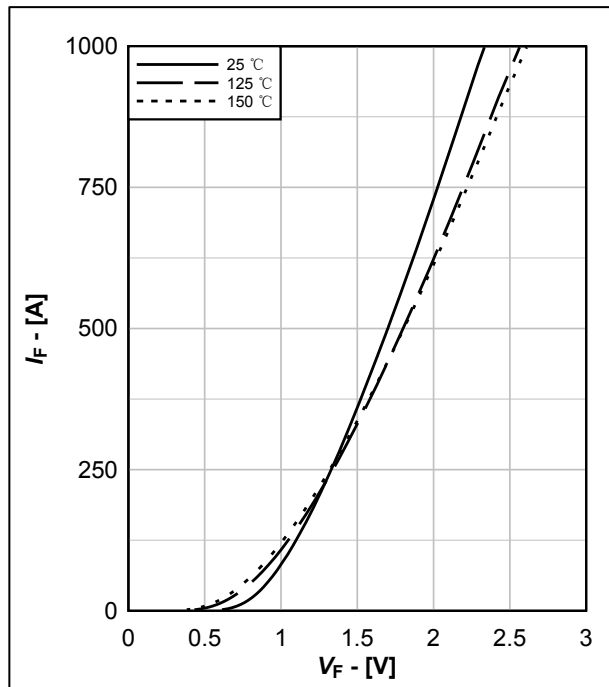
Fig.11 Typical gate charge characteristic, $V_{GE} = f(Q_G)$

图 12. FRD 输出特性典型曲线, $I_F = f(V_F)$

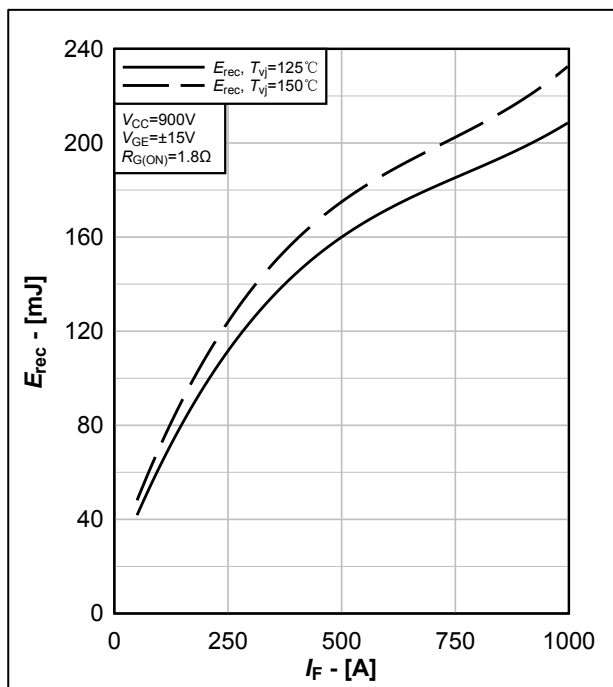
Fig.12 Typical FRD output characteristic, $I_F = f(V_F)$

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

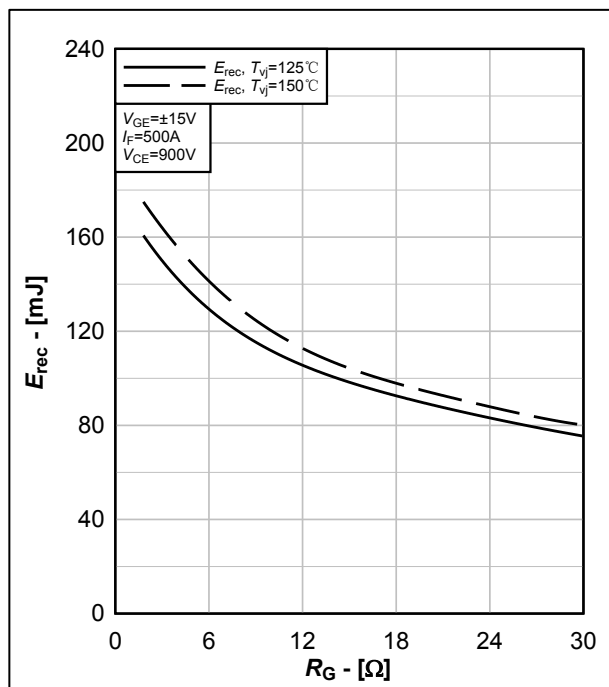
Fig.13 Typical FRD switching loss E_{rec} , $E_{rec} = f(I_F)$

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} , $E_{rec} = f(R_G)$

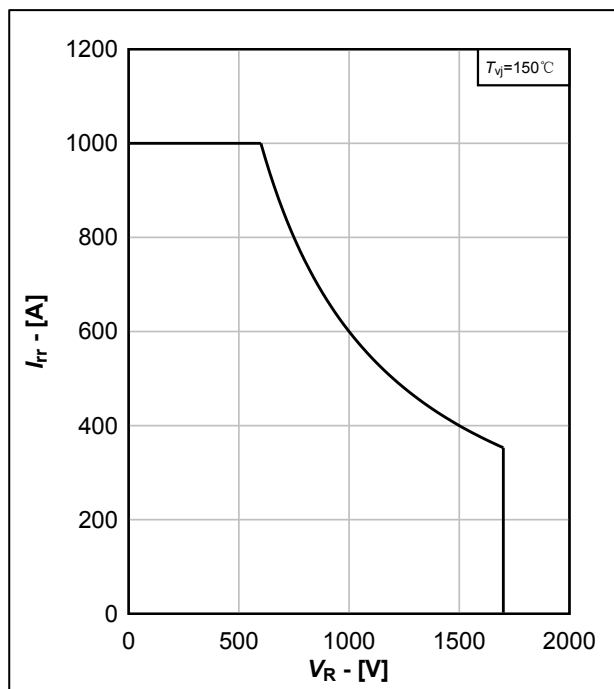

 图 15. FRD 反偏安全工作区, $I_{rr} = f(V_R)$

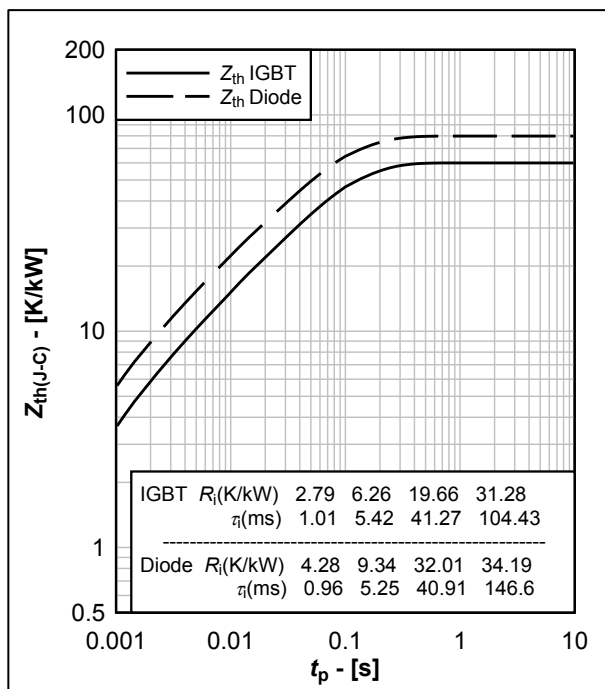
 Fig.15 Reverse bias safe operating area of FRD, $I_{rr} = f(V_R)$

 图 16. 瞬态热阻抗曲线, $Z_{th(j-c)} = f(t_p)$

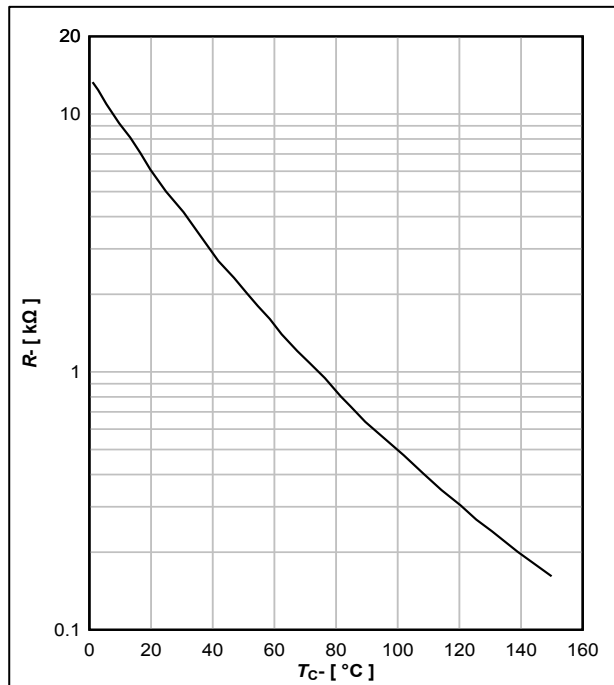
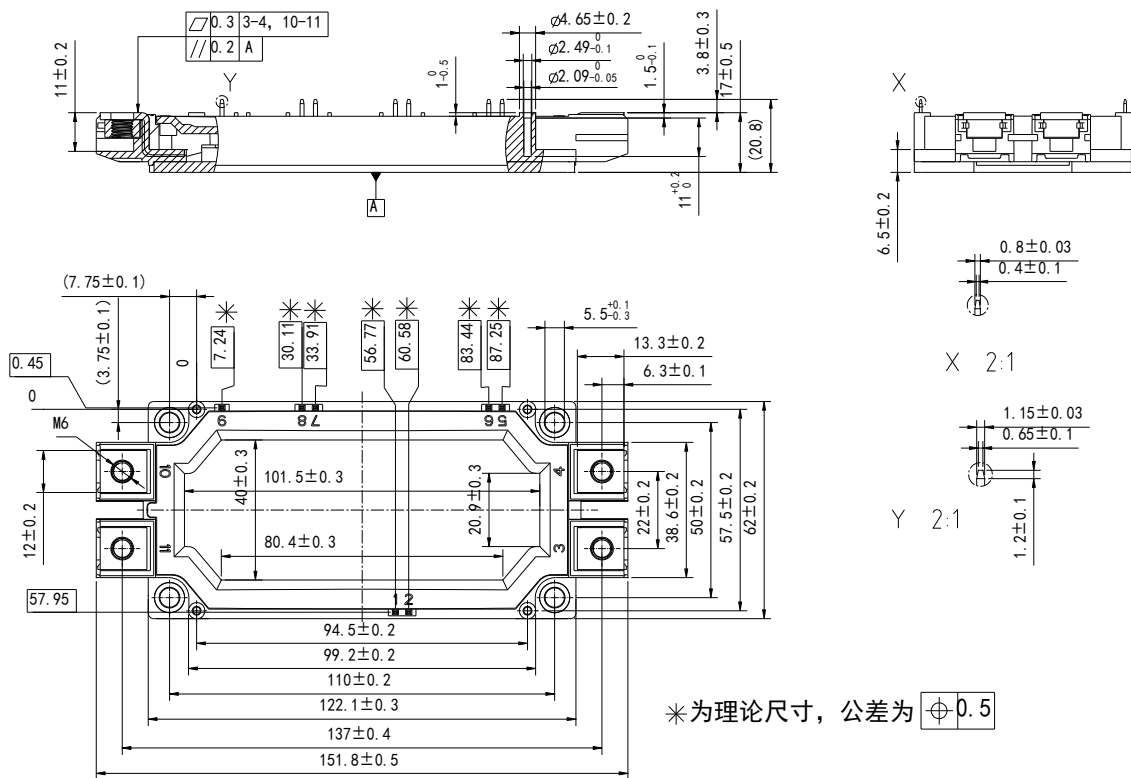
 Fig.16 Transient thermal impedance, $Z_{th(j-c)} = f(t_p)$

 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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