

关键参数

Key Parameters

V_{CES}		1200	V
$V_{CE(sat)}$	Typ.	1.80	V
I_C	Max.	1400	A
$I_{C(RM)}$	Max.	2800	A

典型应用

Typical Applications

- | | |
|-----------|----------------------------|
| ● 马达驱动 | Motor Drives |
| ● 大功率变流器 | High Power Converters |
| ● 风力发电 | Wind Turbines |
| ● 高可靠性逆变器 | High Reliability Inverters |

特点

Features

- | | |
|---------------------|------------------------------------|
| ● 铜基板 | Cu Baseplate |
| ● 氧化铝衬板 | 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

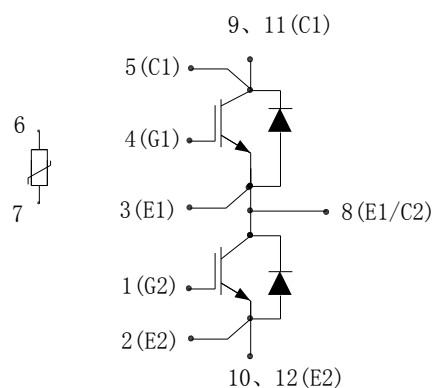


图 1. 电路结构

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	$T_C = 100\text{ }^{\circ}\text{C}, T_{vj\text{ max}}=175\text{ }^{\circ}\text{C}$	1400	A
$I_{C(PK)}$	集电极峰值电流 Peak collector current	$t_P=1\text{ms}$	2800	A
P_{max}	晶体管部分最大损耗 Max. transistor power dissipation	$T_C = 25\text{ }^{\circ}\text{C}, T_{vj\text{ max}}=175\text{ }^{\circ}\text{C}$	7.5	kW
t_t	二极管 t_t 值 Diode t_t	$V_R=0V, t_P = 10\text{ms}, T_{vj} = 150\text{ }^{\circ}\text{C}$	172	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	33.0	mm
	端子-端子 Terminal to terminal	33.0	mm
绝缘间隙 Clearance	端子-散热器 Terminal to heatsink	19.0	mm
	端子-端子 Terminal to terminal	19.0	mm
相对漏电起痕指数 CTI (Comparative Tracking Index)		>400	

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
$R_{th(J-F)} \text{ IGBT}$	IGBT 结壳热阻 Thermal resistance – IGBT				20	K / kW
$R_{th(J-F)} \text{ Diode}$	二极管结壳热阻 Thermal resistance – Diode				35.5	K / kW
$R_{th(C-H)} \text{ IGBT}$	接触热阻(IGBT) Thermal resistance – case to heatsink (IGBT)	导热脂 1W/m·K Mounting grease 1W/m·K		9.5		K / kW
$R_{th(C-H)} \text{ Diode}$	接触热阻(Diode) Thermal resistance – case to heatsink (Diode)	导热脂 1W/m·K Mounting grease 1W/m·K		17		K / kW
$T_{vj \text{ op}}$	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		150	°C
M	安装力矩 Screw torque	安装紧固用– M5 Mounting - M5	3		6	Nm
		电路互连用– M4 Electrical connections - M4	1.8		2.1	Nm
		电路互连用 - M8 Electrical connections - M8	8		10	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	$T_C = 25\text{ °C}$		5		kΩ
$\Delta R/R$	R100 偏差 Deviation of R100	$T_C = 100\text{ °C}, R_{100}=493\Omega$	-5		5	%
P_{25}	耗散功率 Power dissipation	$T_C = 25\text{ °C}$			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	$I_C = 60\text{mA}, V_{GE} = V_{CE}$	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	$V_{GE} = 15V, I_C = 1400\text{A}$		1.80	2.20	V
		$V_{GE} = 15V, I_C = 1400\text{A}, T_{vj} = 125\text{ }^{\circ}\text{C}$		2.15		V
		$V_{GE} = 15V, I_C = 1400\text{A}, T_{vj} = 150\text{ }^{\circ}\text{C}$		2.25		V
I_F	二极管正向直流电流 Diode forward current	DC		1400		A
I_{FRM}	二极管正向重复峰值电流 Diode peak forward current	$t_p = 1\text{ms}$		2800		A
$V_F^{(*1)}$	二极管正向电压 Diode forward voltage	$I_F = 1400\text{A}, V_{GE} = 0V$		1.90	2.30	V
		$I_F = 1400\text{A}, V_{GE} = 0V, T_{vj} = 125\text{ }^{\circ}\text{C}$		2.10		V
		$I_F = 1400\text{A}, V_{GE} = 0V, T_{vj} = 150\text{ }^{\circ}\text{C}$		2.10		V
I_{SC}	短路电流 Short circuit current	$T_{vj} = 150\text{ }^{\circ}\text{C}, V_{CC} = 800\text{V},$ $V_{GE} \leq 15\text{V}, t_p \leq 10\mu\text{s},$ $V_{CE(max)} = V_{CES} - L^{(*2)} \times di/dt,$ IEC 60747-9		5800		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}).



产品数据手册 Product Datasheet 版本 Ver 21.10

TG1400HF12H1-S300
半桥型 IGBT 模块 Half Bridge IGBT

电特性值

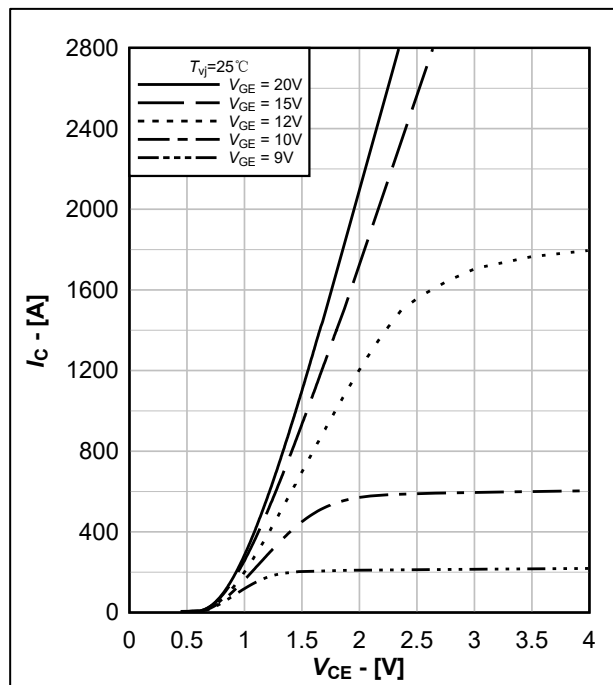
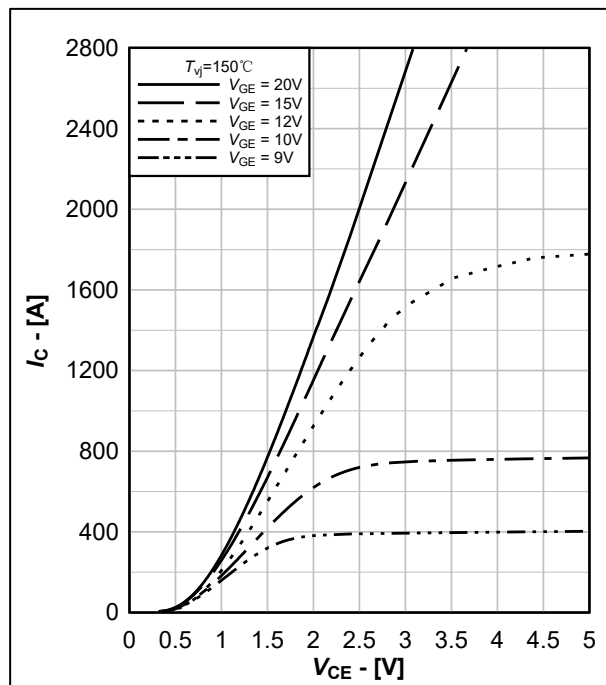
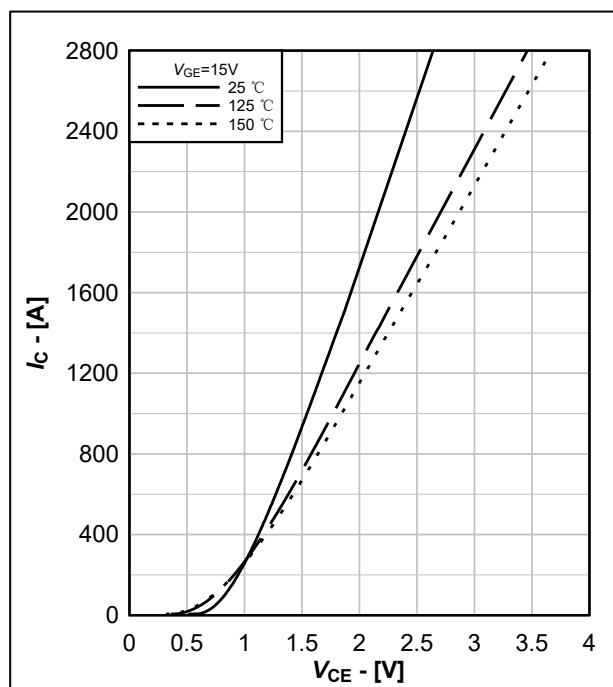
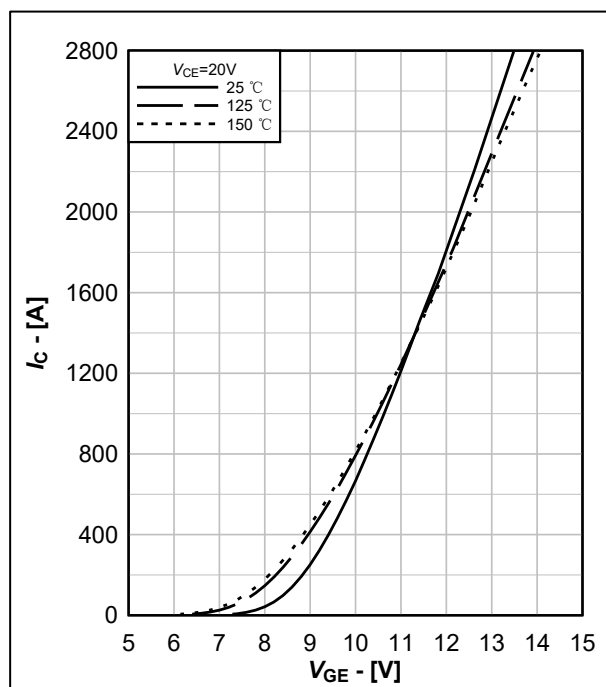
Electrical Characteristics

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	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$		187		nF
Q_g	栅极电荷 Gate charge	$\pm 15V$		13.4		μC
C_{res}	反向传输电容 Reverse transfer capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$		1.6		nF
L_{sCE}	模块电感 Module inductance			10		nH
$R_{CC'+EE'}$	模块引线电阻, 端子-芯片 Module lead resistance, terminal-chip			0.2		m Ω
R_{Gint}	内部栅极电阻 Internal gate resistor			1.2		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	$I_C = 1400A$, $V_{CE} = 600V$, $V_{GE} = \pm 15V$, $R_{G(OFF)} = 1.0\Omega$, $L_S = 50nH$, $dv/dt = 3400V/\mu s$ ($T_{vj} = 150\text{ }^{\circ}C$).	$T_{vj} = 25\text{ }^{\circ}C$		1265		ns
			$T_{vj} = 125\text{ }^{\circ}C$		1325		
			$T_{vj} = 150\text{ }^{\circ}C$		1330		
t_f	下降时间 Fall time		$T_{vj} = 25\text{ }^{\circ}C$		150		ns
			$T_{vj} = 125\text{ }^{\circ}C$		180		
			$T_{vj} = 150\text{ }^{\circ}C$		185		
E_{OFF}	关断损耗 Turn-off energy loss		$T_{vj} = 25\text{ }^{\circ}C$		234		mJ
			$T_{vj} = 125\text{ }^{\circ}C$		272		
			$T_{vj} = 150\text{ }^{\circ}C$		277		
$t_{d(on)}$	开通延迟时间 Turn-on delay time	$T_{vj} = 25\text{ }^{\circ}C$		700		ns	
		$T_{vj} = 125\text{ }^{\circ}C$		690			
		$T_{vj} = 150\text{ }^{\circ}C$		675			
t_r	上升时间 Rise time	$T_{vj} = 25\text{ }^{\circ}C$		170		ns	
		$T_{vj} = 125\text{ }^{\circ}C$		175			
		$T_{vj} = 150\text{ }^{\circ}C$		175			
E_{ON}	开通损耗 Turn-on energy loss	$T_{vj} = 25\text{ }^{\circ}C$		60		mJ	
		$T_{vj} = 125\text{ }^{\circ}C$		81			
		$T_{vj} = 150\text{ }^{\circ}C$		84			
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	$T_{vj} = 25\text{ }^{\circ}C$		125		μC	
		$T_{vj} = 125\text{ }^{\circ}C$		230			
		$T_{vj} = 150\text{ }^{\circ}C$		250			
I_{rr}	二极管反向恢复电流 Diode reverse recovery current	$T_{vj} = 25\text{ }^{\circ}C$		730		A	
		$T_{vj} = 125\text{ }^{\circ}C$		860			
		$T_{vj} = 150\text{ }^{\circ}C$		890			
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy	$T_{vj} = 25\text{ }^{\circ}C$		63		mJ	
		$T_{vj} = 125\text{ }^{\circ}C$		112			
		$T_{vj} = 150\text{ }^{\circ}C$		125			

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, $I_C = f(V_{GE})$

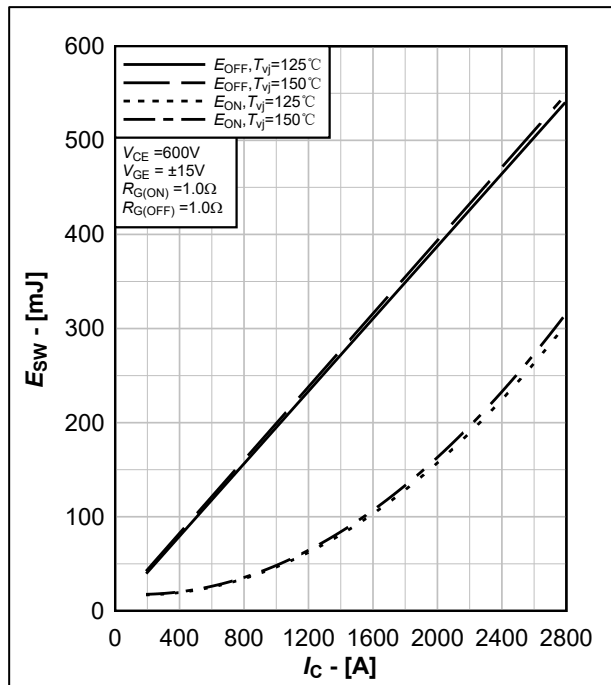

 图 7. IGBT 开关损耗典型曲线, $E_{on}=f(I_C)$, $E_{off}=f(I_C)$

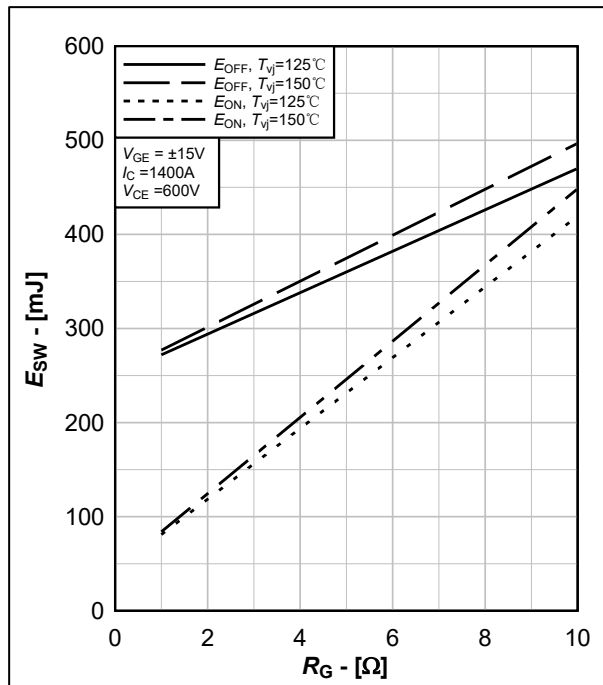
 Fig.7 Typical IGBT switching energy, $E_{on}=f(I_C)$, $E_{off}=f(I_C)$

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

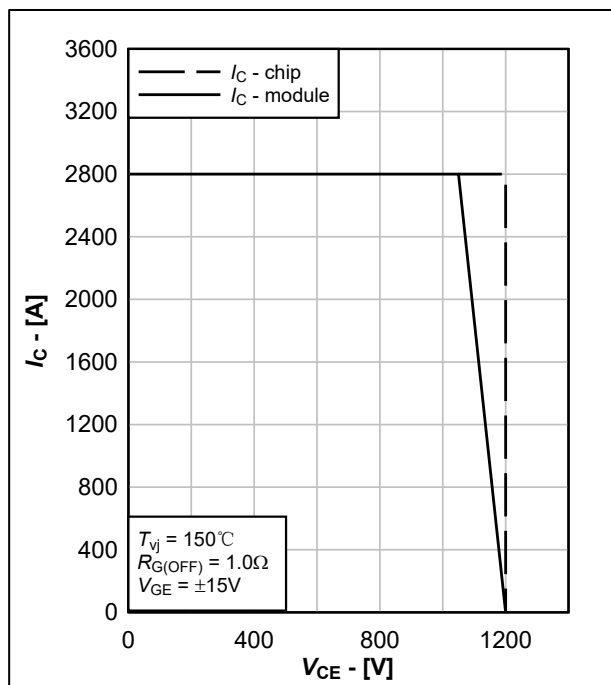
 Fig.8 Typical IGBT switching energy, $E_{on}=f(R_G)$, $E_{off}=f(R_G)$

 图 9. IGBT 反偏安全工作区, $I_C=f(V_{CE})$

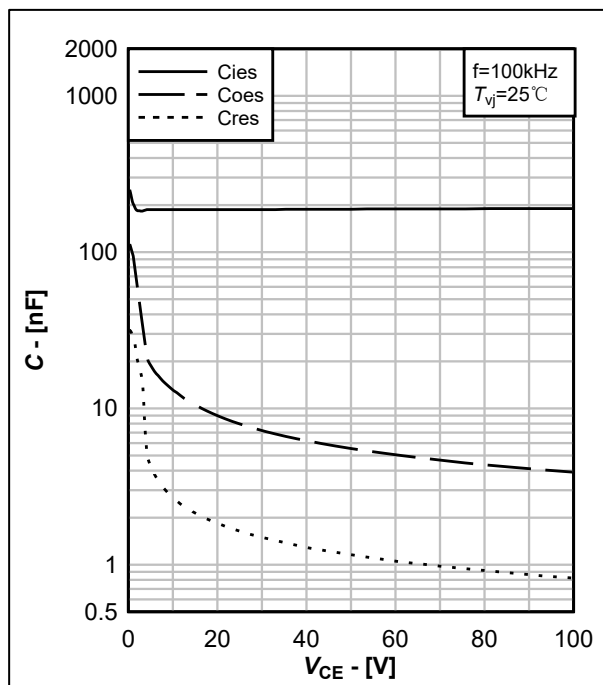
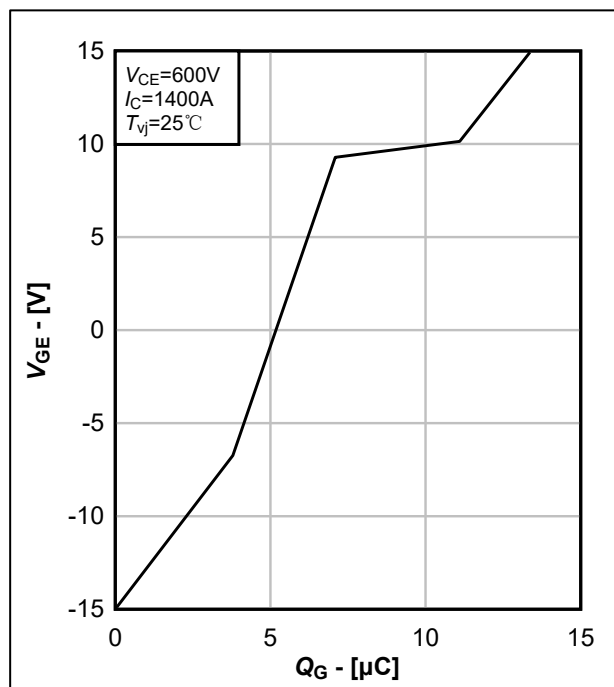
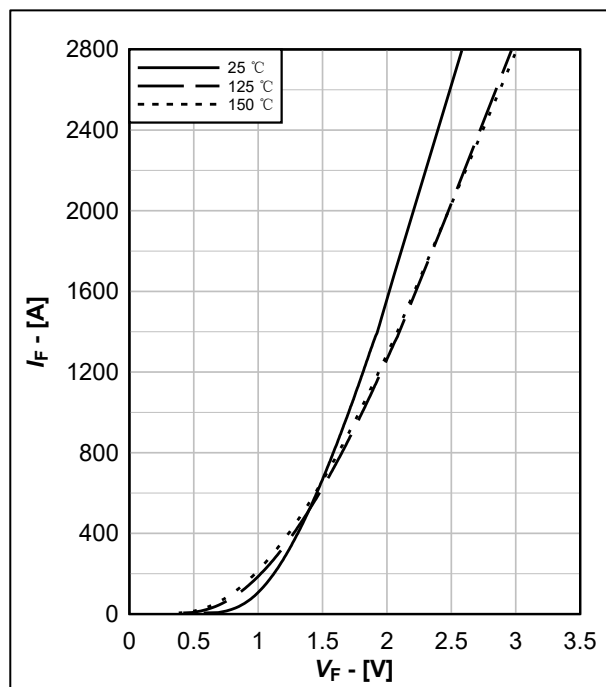
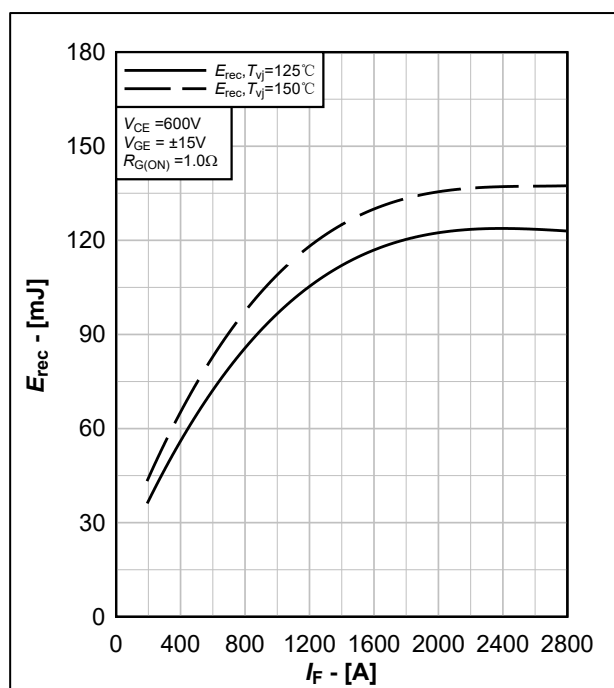
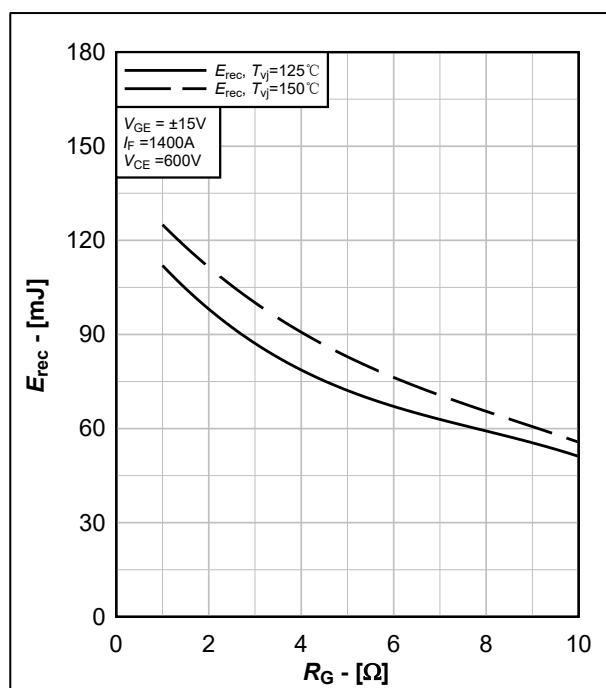
 Fig.9 Reverse bias safe operating area of IGBT, $I_C=f(V_{CE})$

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

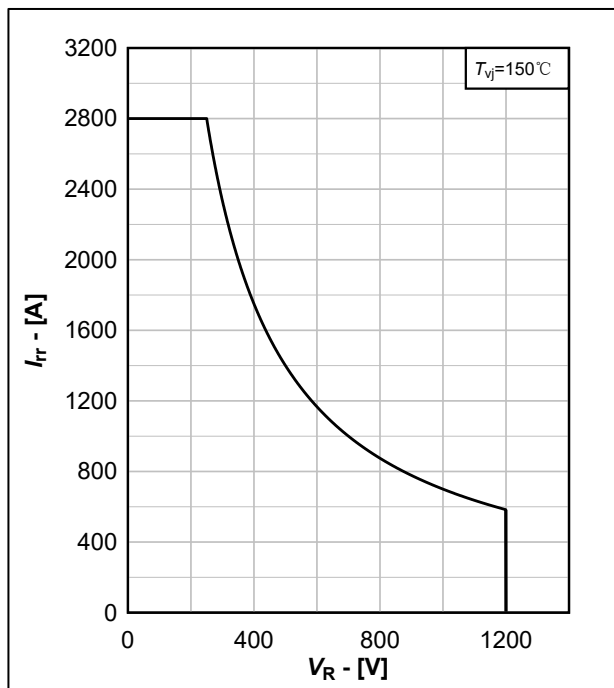

 图 15. FRD 反偏安全工作区, $I_{rr} = f(V_R)$

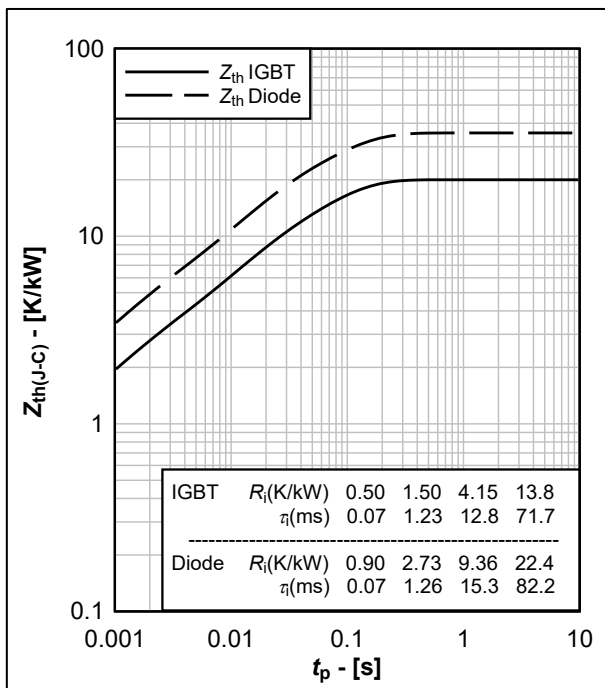
 Fig.15 Reverse bias safe operating area of FRD, $I_{rr} = f(V_R)$

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

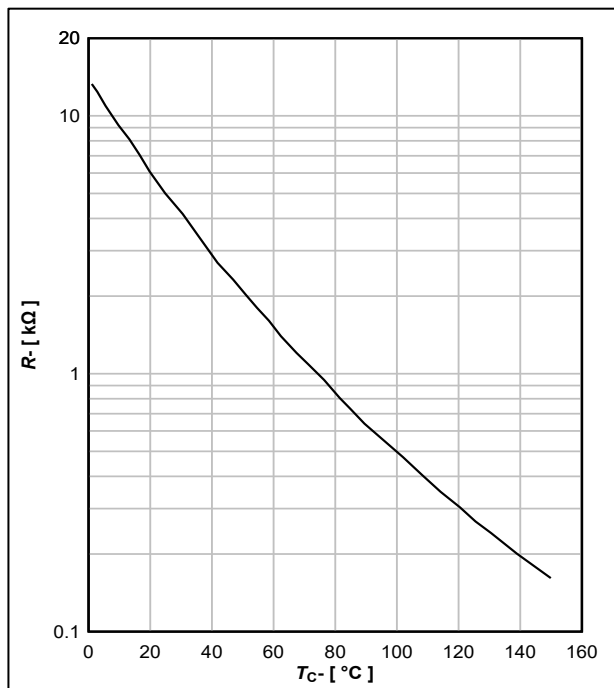
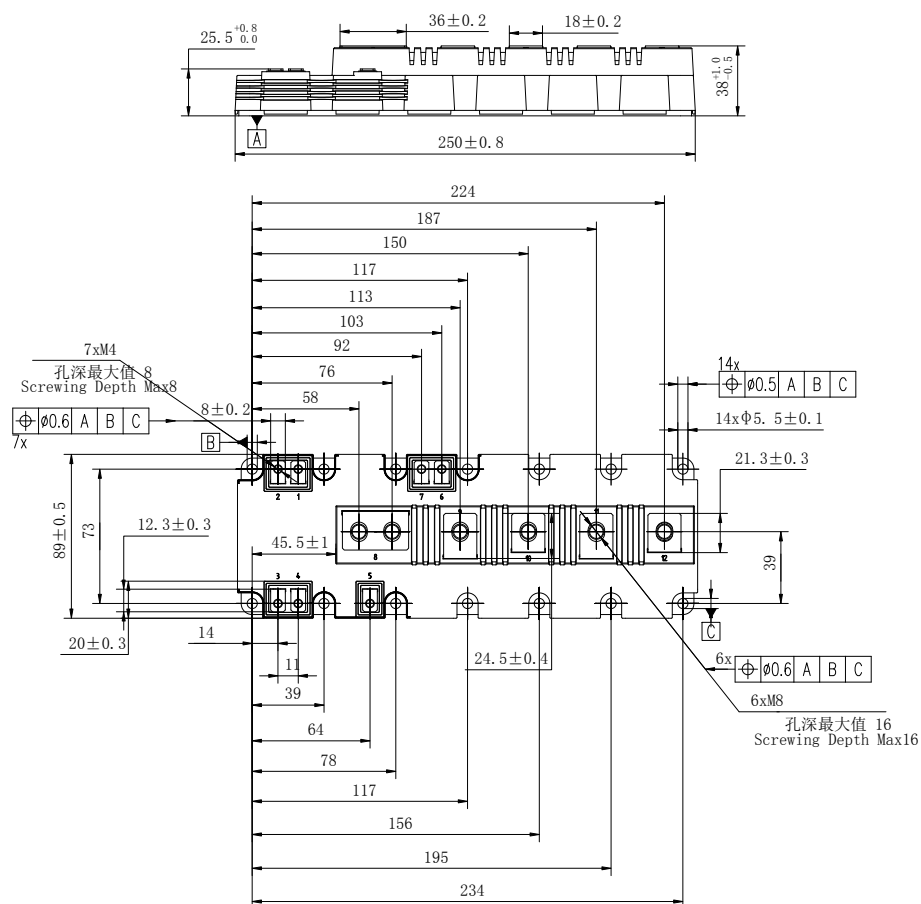
 Fig.16 Transient thermal impedance, $Z_{th(j-F)} = f(t_p)$

 图 17. 热敏电阻典型特性曲线, $R = f(T_C)$

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



技术要求

1、未注公差尺寸按照GB/T 1804-m级执行，参照如下：

(a) $X < 6 \pm 0.1$ (b) $6 \leq X < 30 \pm 0.2$;

(c) $30 \leq X < 120 \pm 0.3$ (d) $120 \leq X < 400 \pm 0.5$ 。

重量 Weight: 1200g 模块外观类型 Module outline code: H1

图 18. 模块外观尺寸

Fig. 18 Module outlines

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(4) During the application, if the working conditions are beyond the limitation of temperature, voltage, current or safe operating area of the product defined in the product datasheet, our company cannot guarantee the reliability of the product.

(5) When the products are in use, it is strictly prohibited to touch. After power off, to ensure that there is no residual charge and the products have been cooled before they can be touched. And all operations must be under ESD protection measures.

(6) We annotate datasheet in the top right hand corner of the front page, to indicate product status. The annotation “Preliminary” indicates the product design is complete and final characterization for volume production is in progress, the product information in the datasheet is currently can be referenced, but some details may change in the future. There is no annotation indicates the product is capable to produce in batch quantity.