



产品数据手册 Product Datasheet 版本 Ver 22.08

TG450HF12W1-S300

半桥型 IGBT 模块 Half Bridge IGBT Module

初版 Preliminary

关键参数

Key Parameters

V_{CES}		1200	V
$V_{CE(sat)}$	Typ.	1.75	V
I_C	Max.	450	A
$I_{C(RM)}$	Max.	900	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
● UPS 系统	UPS Systems

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
● 高功率密度	High Power Density

电路结构

Circuit Configuration

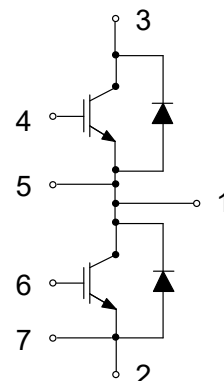


图 1. 电路结构

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	$T_C = 90\text{ }^{\circ}\text{C}, T_{vj\text{ max}}=175^{\circ}\text{C}$	450	A
$I_{C(PK)}$	集电极峰值电流 Peak collector current	$t_P=1\text{ms}$	900	A
P_{max}	晶体管部分最大损耗 Max. transistor power dissipation	$T_C = 25\text{ }^{\circ}\text{C}, T_{vj\text{ max}}=175^{\circ}\text{C}$	2.06	kW
t_t	二极管 t_t 值 Diode t_t	$V_R=0V, t_P = 10\text{ms}, T_{vj} = 150\text{ }^{\circ}\text{C}$	28.8	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	29.0	mm
	端子-端子 Terminal to terminal	23.0	mm
绝缘间隙 Clearance	端子-散热器 Terminal to heatsink	23.0	mm
	端子-端子 Terminal to terminal	11.0	mm
相对漏电起痕指数 CTI (Comparative Tracking Index)		>400	



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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				60	K / kW
$R_{th(J-C)}$ Diode	二极管结壳热阻 Thermal resistance – Diode				105	K / kW
$R_{th(C-H)}$ IGBT	接触热阻(IGBT) Thermal resistance – case to heatsink (IGBT)	安装力矩 3.5Nm, 导热脂 1W/m·K Mounting torque 3.5Nm, with mounting grease 1W/m·K		30		K / kW
$R_{th(C-H)}$ Diode	接触热阻(Diode) Thermal resistance – case to heatsink (Diode)	安装力矩 3.5Nm, 导热脂 1W/m·K Mounting torque 3.5Nm, with mounting grease 1W/m·K		55		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– M6 Mounting – M6	3		6	Nm
		电路互连用 – M6 Electrical connections – M6	2.5		5.0	Nm

Caution: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.

注意: 该器件对静电敏感, 用户须采取 ESD 防护措施。

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
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{vj} = 125\text{ }^{\circ}\text{C}$			5	mA
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{vj} = 150\text{ }^{\circ}\text{C}$			10	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	$I_C = 20\text{mA}, V_{GE} = V_{CE}$	5.10	5.70	6.30	V
$V_{CE(sat)}^{(*1)}$	集电极-发射极饱和电压 Collector-emitter saturation voltage	$V_{GE} = 15V, I_C = 450A$		1.75		V
		$V_{GE} = 15V, I_C = 450A, T_{vj} = 125\text{ }^{\circ}\text{C}$		2.10		V
		$V_{GE} = 15V, I_C = 450A, T_{vj} = 150\text{ }^{\circ}\text{C}$		2.20		V
I_F	二极管正向直流电流 Diode forward current	DC		450		A
I_{FRM}	二极管正向重复峰值电流 Diode peak forward current	$t_P = 1\text{ms}$		900		A
$V_F^{(*1)}$	二极管正向电压 Diode forward voltage	$I_F = 450A, V_{GE} = 0V$		1.60		V
		$I_F = 450A, V_{GE} = 0V, T_{vj} = 125\text{ }^{\circ}\text{C}$		1.75		V
		$I_F = 450A, V_{GE} = 0V, T_{vj} = 150\text{ }^{\circ}\text{C}$		1.75		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 60747-9		2100		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}).



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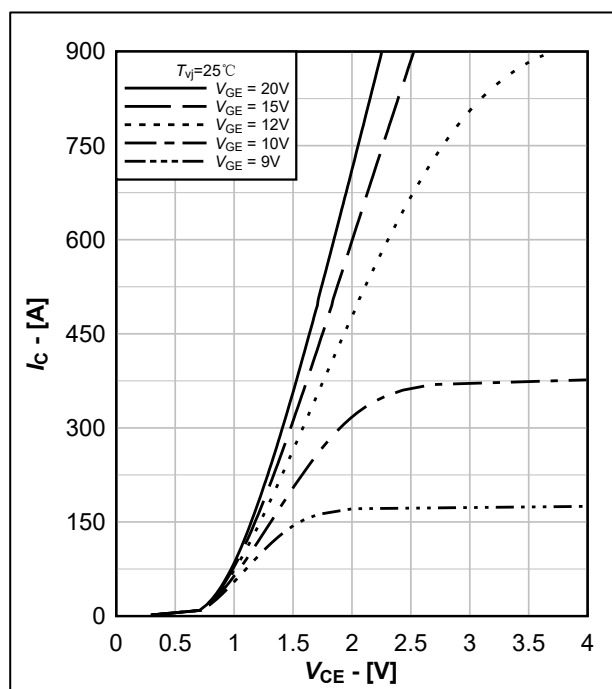
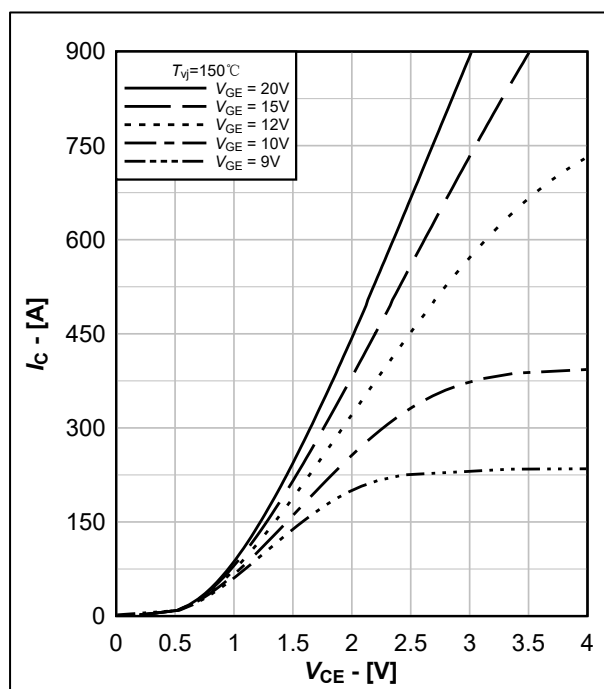
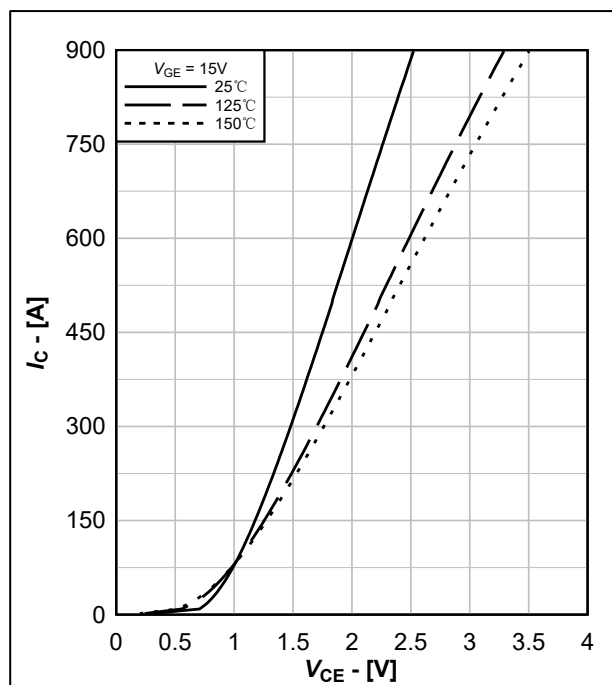
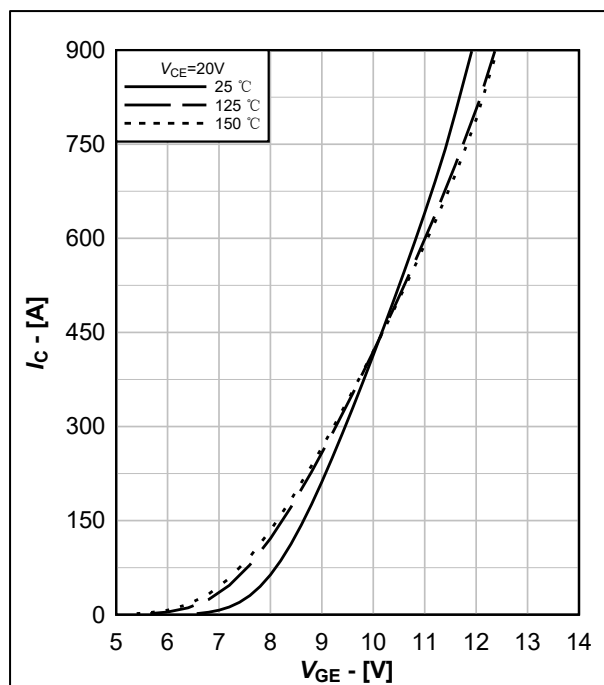
符号 Symbol	参数名称 Parameter	条件 Test Conditions	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
C_{ies}	输入电容 Input capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$		71.6		nF
Q_g	栅极电荷 Gate charge	$\pm 15V$		4.5		μC
C_{res}	反向传输电容 Reverse transfer capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$		0.7		nF
L_{sCE}	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			0.42		m Ω
R_{Gint}	内部栅极电阻 Internal gate resistor			1.2		Ω

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注意: 该器件对静电敏感, 用户须采取 ESD 防护措施。

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 =450A, V_{CE} = 600V, V_{GE} = $\pm 15V$, $R_{G(ON)} = 2.2\Omega$, $L_S = 45nH$, dv/dt =5400V/ μs (T_{vj} = 150 °C).	T_{vj} = 25 °C		410		ns
			T_{vj} = 125 °C		440		
			T_{vj} = 150 °C		450		
t_f	下降时间 Fall time		T_{vj} = 25 °C		120		ns
			T_{vj} = 125 °C		210		
			T_{vj} = 150 °C		230		
E_{OFF}	关断损耗 Turn-off energy loss		T_{vj} = 25 °C		33.0		mJ
			T_{vj} = 125 °C		41.0		
			T_{vj} = 150 °C		43.5		
$t_{d(on)}$	开通延迟时间 Turn-on delay time	T_{vj} = 25 °C		150		ns	
		T_{vj} = 125 °C		160			
		T_{vj} = 150 °C		160			
t_r	上升时间 Rise time	T_{vj} = 25 °C		70		ns	
		T_{vj} = 125 °C		70			
		T_{vj} = 150 °C		70			
E_{ON}	开通损耗 Turn-on energy loss	T_{vj} = 25 °C		14.0		mJ	
		T_{vj} = 125 °C		21.0			
		T_{vj} = 150 °C		24.0			
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	T_{vj} = 25 °C		48.0		μC	
		T_{vj} = 125 °C		74.5			
		T_{vj} = 150 °C		84.5			
I_{rr}	二极管反向恢复电流 Diode reverse recovery current	T_{vj} = 25 °C		450		A	
		T_{vj} = 125 °C		510			
		T_{vj} = 150 °C		525			
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy	T_{vj} = 25 °C		23.0		mJ	
		T_{vj} = 125 °C		35.0			
		T_{vj} = 150 °C		37.5			

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

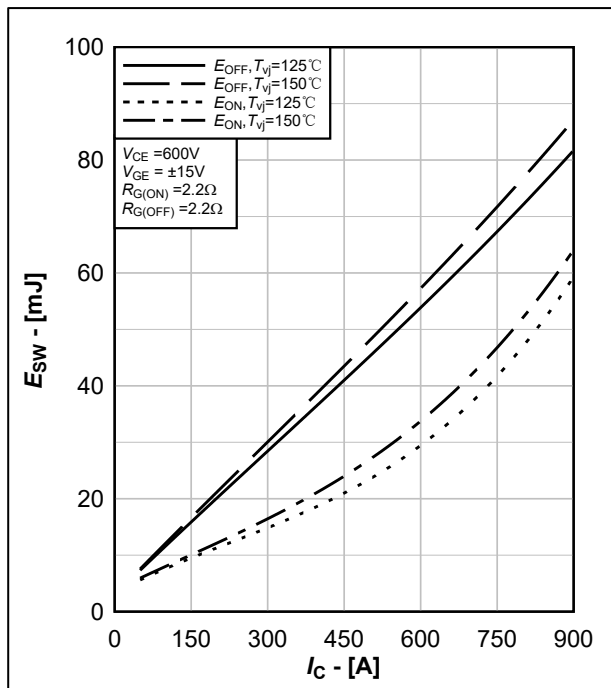

 图 7. IGBT 开关损耗典型曲线, $E_{on}=f(I_C)$, $E_{off}=f(I_C)$

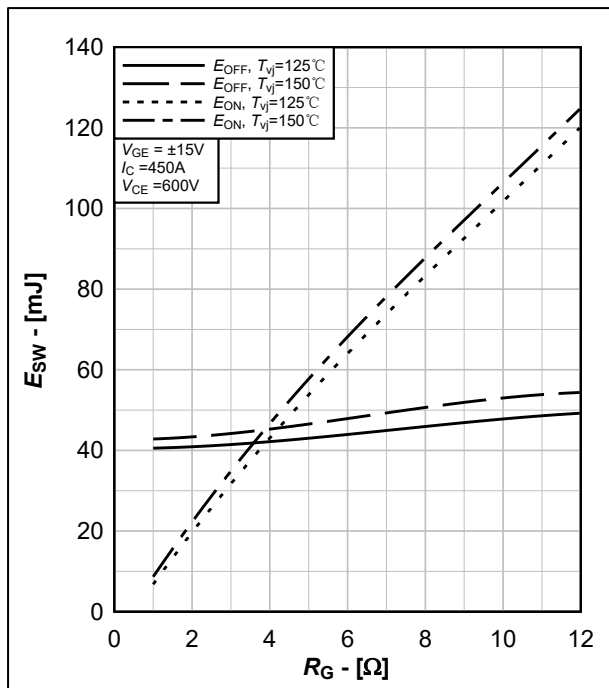
 Fig.7 Typical IGBT switching energy, $E_{on}=f(I_C)$, $E_{off}=f(I_C)$

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

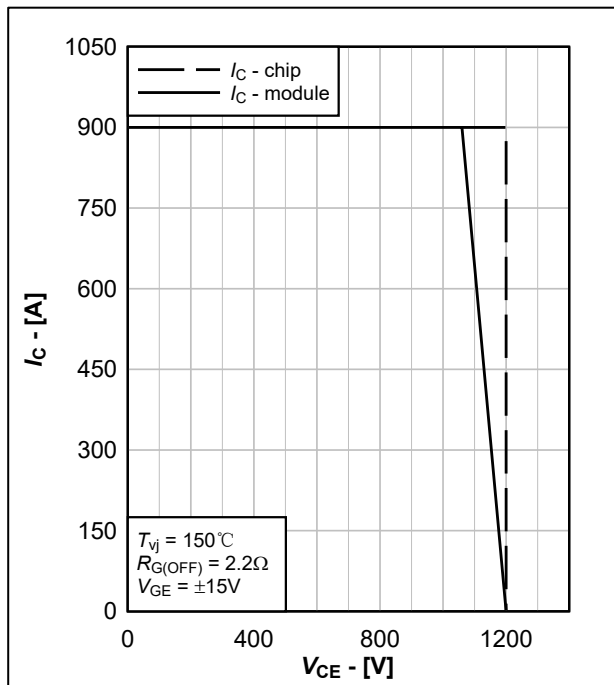
 Fig.8 Typical IGBT switching energy, $E_{on}=f(R_G)$, $E_{off}=f(R_G)$

 图 9. IGBT 反偏安全工作区, $I_C=f(V_{CE})$

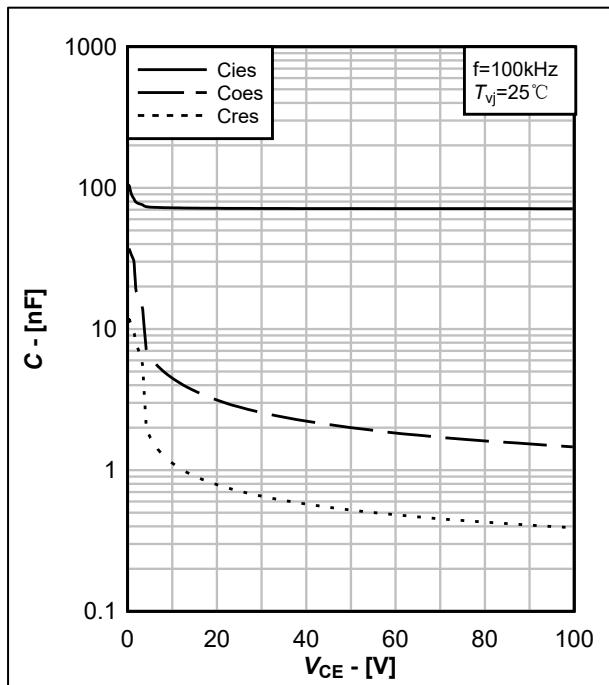
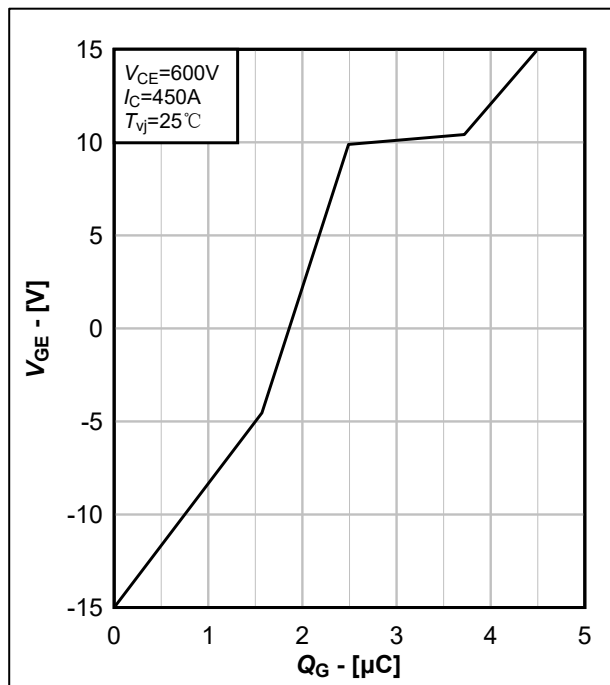
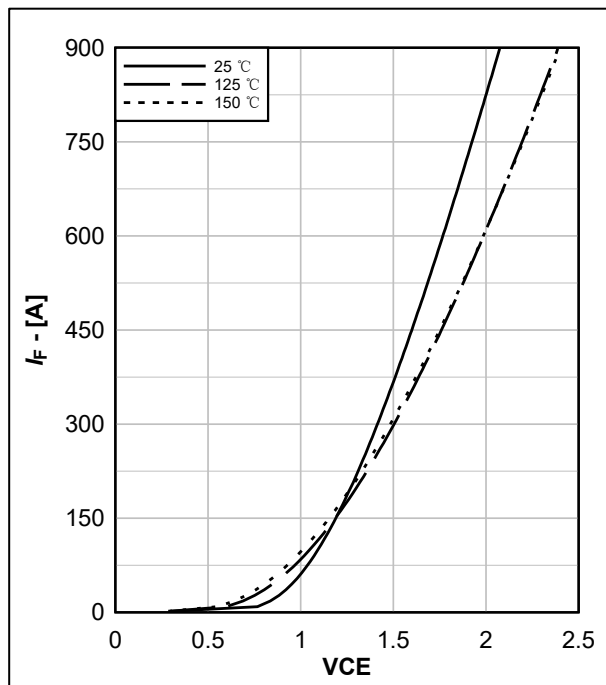
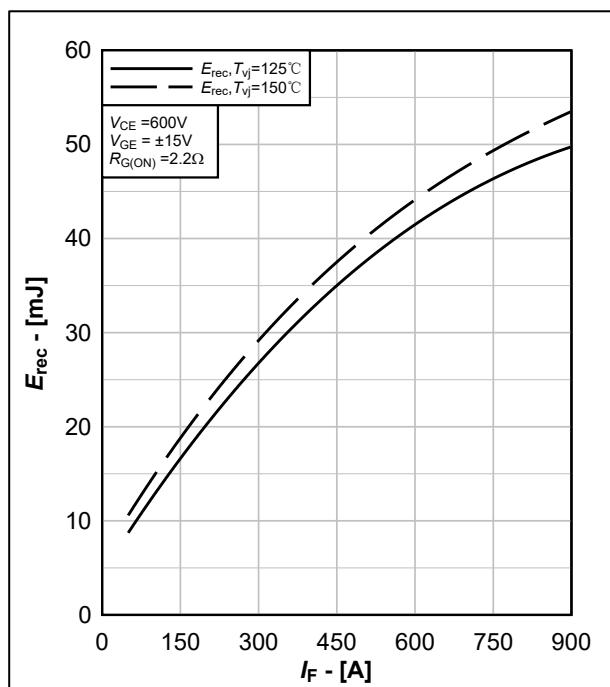
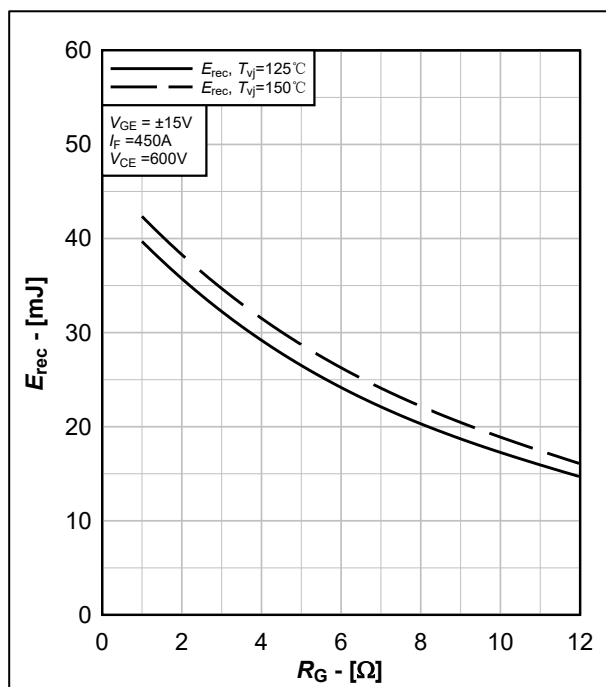
 Fig.9 Reverse bias safe operating area of IGBT, $I_C=f(V_{CE})$

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

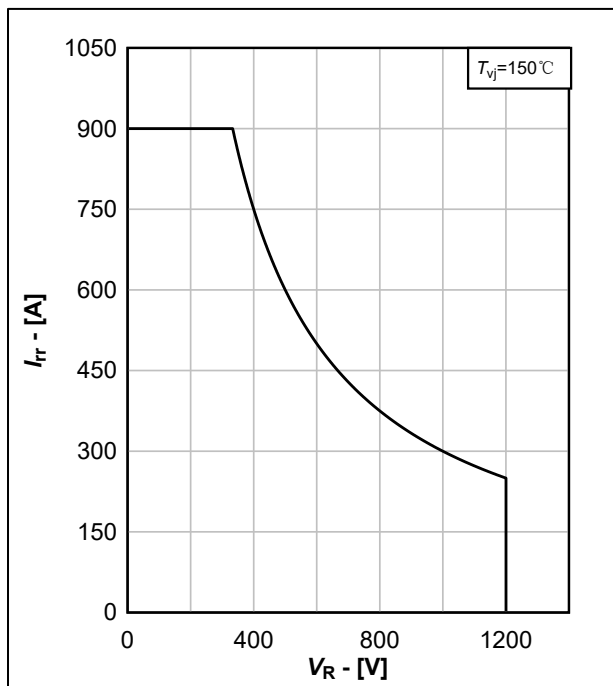


图 15. FRD 反偏安全工作区, $I_{rr} = f(V_R)$

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

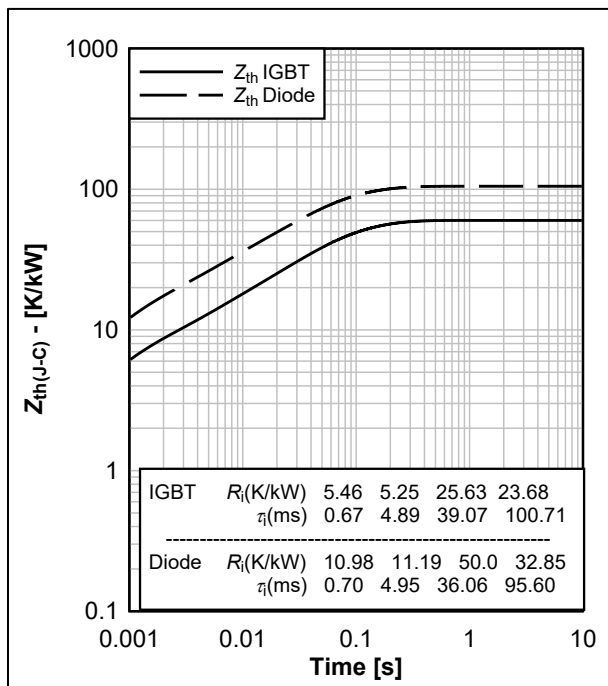
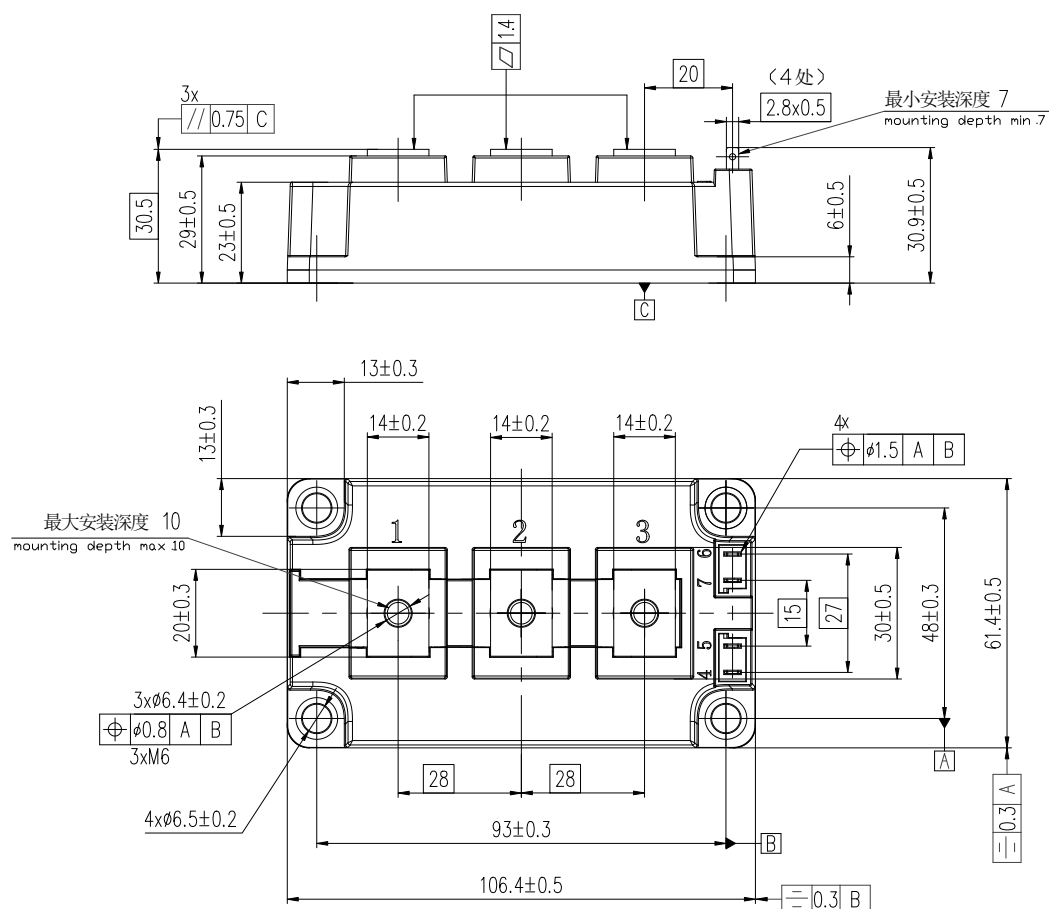


图 16. 瞬态热阻抗曲线, $Z_{th(J-C)} = f(t_p)$

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



重量 Weight: 325g 模块外观类型 Module outline code: W1

图 17. 模块外观尺寸

Fig. 17 Module outlines

株洲中车时代半导体有限公司

ZHUSHOU CRRC TIMES SEMICONDUCTOR CO., LTD

地 址 Address

湖南省株洲市石峰区田心工业园

Tianxin Industrial Park, Shifeng District,
ZhuZhou City, Hunan Province, China

邮 编 Zipcode

412001

电 话 Telephone

+86 (0)731-28498268, 28498238, 28493472

传 真 Fax

+86 (0)731-28498851, 28498494

电子邮箱 Email

sbu@crzcic.cc

网 址 Web Site

http://www.sbu.crzcic.cc

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