

关键参数

Key Parameters

V_{CES}		6500	V
$V_{CE(sat)}$	Typ.	3.2	V
I_C	Max.	250	A
$I_{C(RM)}$	Max.	500	A

典型应用

Typical Applications

● 牵引传动	Traction Drives
● 电机控制	Motor Controllers
● 智能电网	Smart Grid
● 高可靠性逆变器	High Reliability Inverter

特点

Features

● AISiC 基板	AlSiC Baseplate
● AlN 衬板	AlN 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

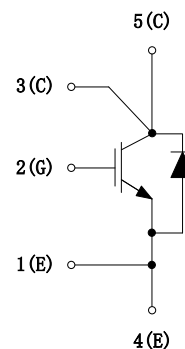


图 1. 电路结构

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



ab1234567890

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	$V_{GE} = 0V, T_C = 25\text{ }^{\circ}\text{C}$	6500	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	$T_C = 80\text{ }^{\circ}\text{C}$	250	A
$I_{C(PK)}$	集电极峰值电流 Peak collector current	$t_P = 1\text{ms}$	500	A
P_{max}	晶体管部分最大损耗 Max. transistor power dissipation	$T_{vj} = 125^{\circ}\text{C}, T_C = 25\text{ }^{\circ}\text{C}$	3800	W
t_t	二极管 t_t 值 Diode t_t	$V_R = 0V, t_P = 10\text{ms}, T_{vj} = 125\text{ }^{\circ}\text{C}$	51	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, $T_C = 25\text{ }^{\circ}\text{C}$	10.2	kV
Q_{PD}	局部放电电荷(模块) Partial discharge – per module	IEC1287. $V_1=6900V, V_2=5100V, 50\text{Hz RMS}$	10	pC

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	56.0	mm
	端子-端子 Terminal to terminal	56.0	mm
绝缘间隙 Clearance	端子-散热器 Terminal to heatsink	26.0	mm
	端子-端子 Terminal to terminal	26.0	mm
相对漏电起痕指数 CTI (Comparative Tracking Index)		>600	



TIM250P2SM65-PSA011

单管型 IGBT 模块 Single Switch IGBT Module

产品数据手册 Product Datasheet 版本 Ver 22.05

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				26	K / kW
$R_{th(J-C) Diode}$	二极管结壳热阻 Thermal resistance – Diode				50	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		27		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		54		K / kW
$T_{vj op}$	工作结温 Operating junction temperature	IGBT 芯片 (IGBT)	-40		125	°C
		二极管芯片(Diode)	-40		125	°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			5	Nm
		电路互连用 - M8 Electrical connections – M8			10	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
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_C = 125\text{ }^{\circ}\text{C}$			30	mA
I_{GES}	栅极漏电流 Gate leakage current	$V_{GE} = \pm 20V, V_{CE} = 0V$			1	μA
$V_{GE(th)}$	栅极-发射极阈值电压 Gate threshold voltage	$I_C = 40\text{mA}, V_{GE} = V_{CE}$	5.00	6.00	7.00	V
$V_{CE(sat)}^{(*1)}$	集电极-发射极饱和电压 Collector-emitter saturation voltage	$V_{GE} = 15V, I_C = 250A$		3.2	3.5	V
		$V_{GE} = 15V, I_C = 250A, T_{vj} = 125\text{ }^{\circ}\text{C}$		4.1		V
I_F	二极管正向直流电流 Diode forward current	DC		250		A
I_{FRM}	二极管正向重复峰值电流 Diode peak forward current	$t_P = 1\text{ms}$		500		A
$V_F^{(*1)}$	二极管正向电压 Diode forward voltage	$I_F = 250A, V_{GE} = 0$		2.45	2.80	V
		$I_F = 250A, V_{GE} = 0, T_{vj} = 125\text{ }^{\circ}\text{C}$		2.80		V
I_{SC}	短路电流 Short circuit current	$T_{vj} = 125\text{ }^{\circ}\text{C}, V_{CC} = 4500V,$ $V_{GE} \leq 15V, t_p \leq 10\mu\text{s},$ $V_{CE(max)} = V_{CES} - L^{(*2)} \times di/dt,$ IEC 60747-9		950		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_M).



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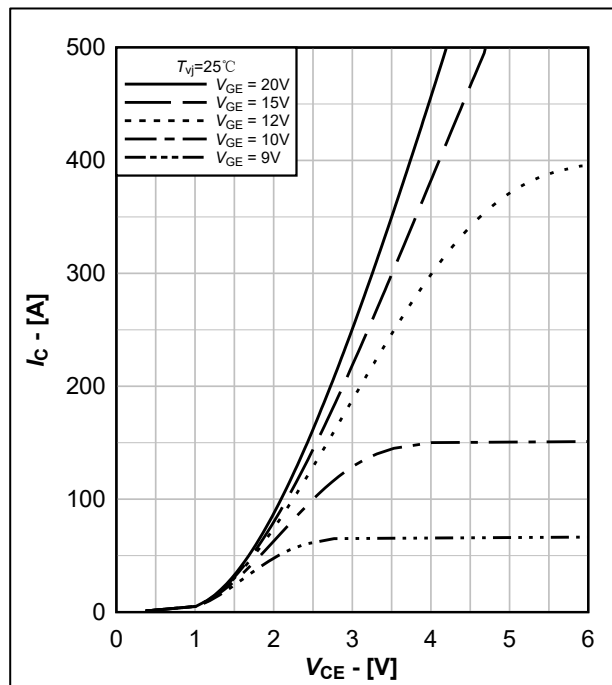
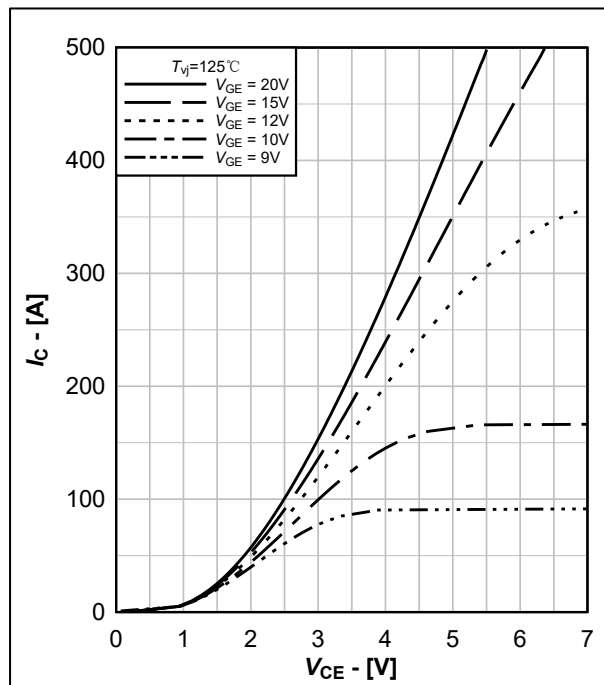
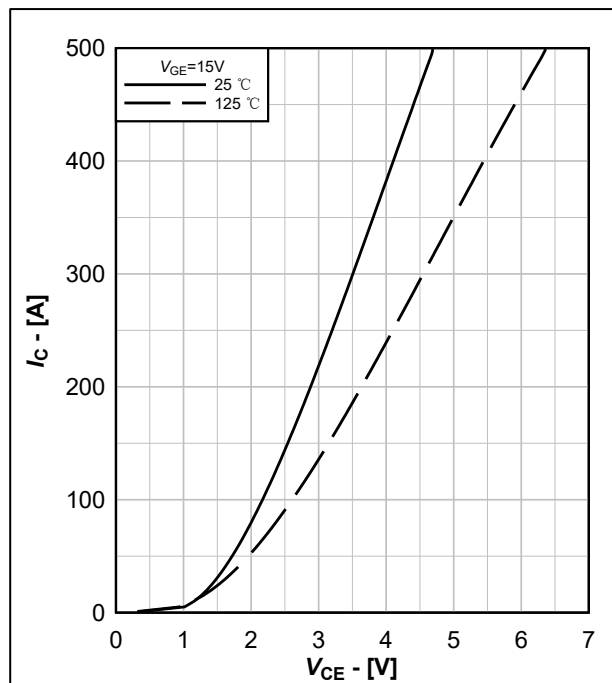
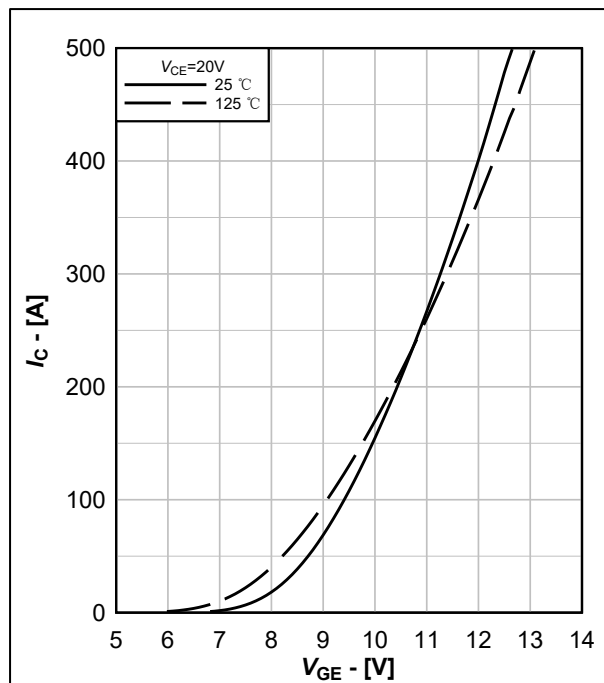
符号 Symbol	参数名称 Parameter	条件 Test Conditions	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
C_{ies}	输入电容 Input capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$		42		nF
Q_g	栅极电荷 Gate charge	$\pm 15V$		3.2		μC
C_{res}	反向传输电容 Reverse transfer capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$		0.9		nF
L_{sCE}	模块电感 Module inductance			30		nH
$R_{CC'+EE'}$	模块引线电阻, 端子-芯片 Module lead resistance, terminal-chip			250		$\mu\Omega$
R_{Gint}	内部栅极电阻 Internal gate resistor			5.7		Ω

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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 =250A, V_{CE} = 3600V, V_{GE} = ±15V, $R_{G(Off)}$ = 6.8Ω, C_{GE} = 56nF, L_S = 280nH,	T_{vj} = 25 °C		1200		ns
			T_{vj} = 125 °C		1300		
t_f	下降时间 Fall time		T_{vj} = 25 °C		2930		ns
			T_{vj} = 125 °C		3670		
E_{OFF}	关断损耗 Turn-off energy loss		T_{vj} = 25 °C		1000		mJ
			T_{vj} = 125 °C		1120		
$t_{d(on)}$	开通延迟时间 Turn-on delay time	I_C =250A, V_{CE} = 3600V, V_{GE} = ±15V, $R_{G(On)}$ = 4.7Ω, C_{GE} = 56nF, L_S = 280nH,	T_{vj} = 25 °C		780		ns
			T_{vj} = 125 °C		760		
t_r	上升时间 Rise time		T_{vj} = 25 °C		250		ns
			T_{vj} = 125 °C		280		
E_{ON}	开通损耗 Turn-on energy loss		T_{vj} = 25 °C		1940		mJ
			T_{vj} = 125 °C		2500		
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	I_F =250A, V_{CE} = 3600V, - di_F/dt = 1000A/us, (T_{vj} = 125°C).	T_{vj} = 25 °C		490		μC
			T_{vj} = 125 °C		700		
I_{rr}	二极管反向恢复电流 Diode reverse recovery current		T_{vj} = 25 °C		470		A
			T_{vj} = 125 °C		475		
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy		T_{vj} = 25 °C		850		mJ
			T_{vj} = 125 °C		1270		

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

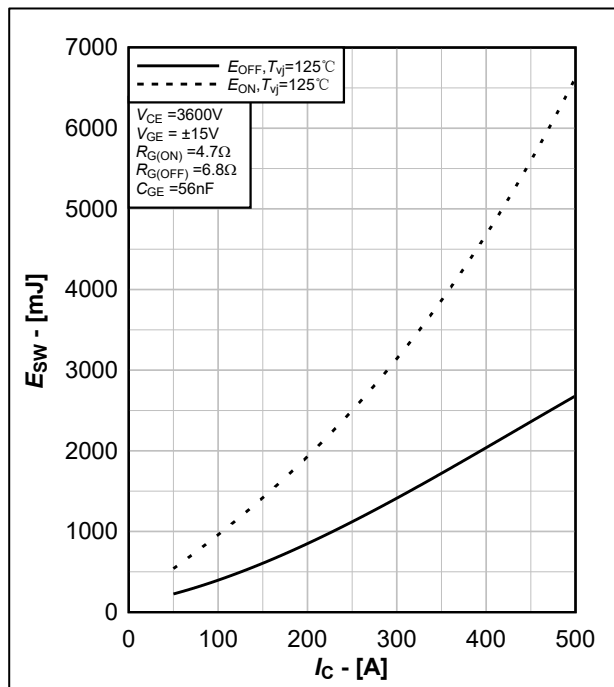

 图 7. IGBT 开关损耗典型曲线, $E_{on}=f(I_c)$, $E_{off}=f(I_c)$

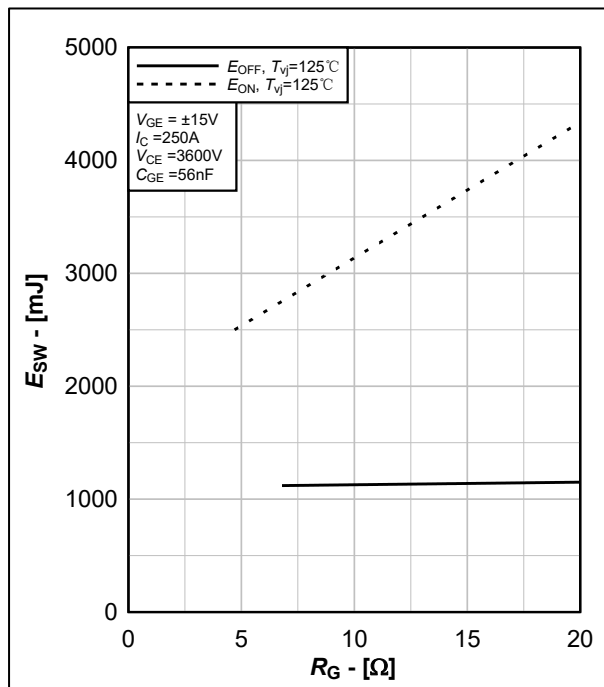
 Fig.7 Typical IGBT switching energy, $E_{on}=f(I_c)$, $E_{off}=f(I_c)$

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

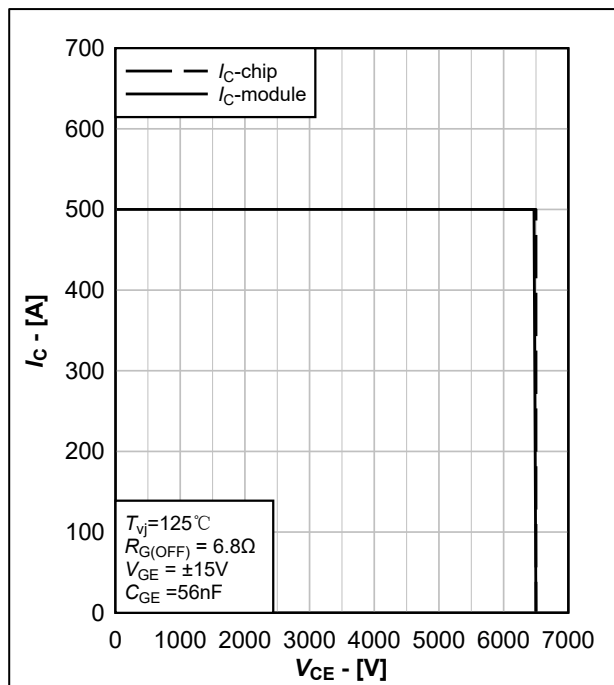
 Fig.8 Typical IGBT switching energy, $E_{on}=f(R_g)$, $E_{off}=f(R_g)$

 图 9. IGBT 反偏安全工作区, $I_c=f(V_{ce})$

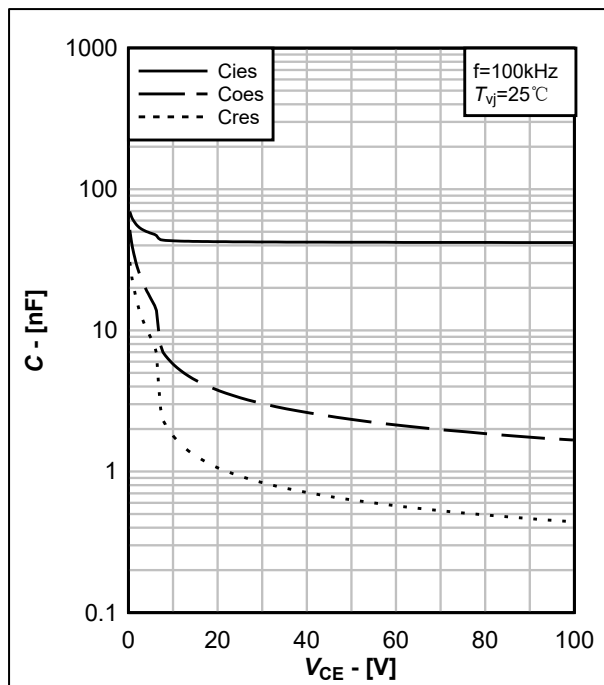
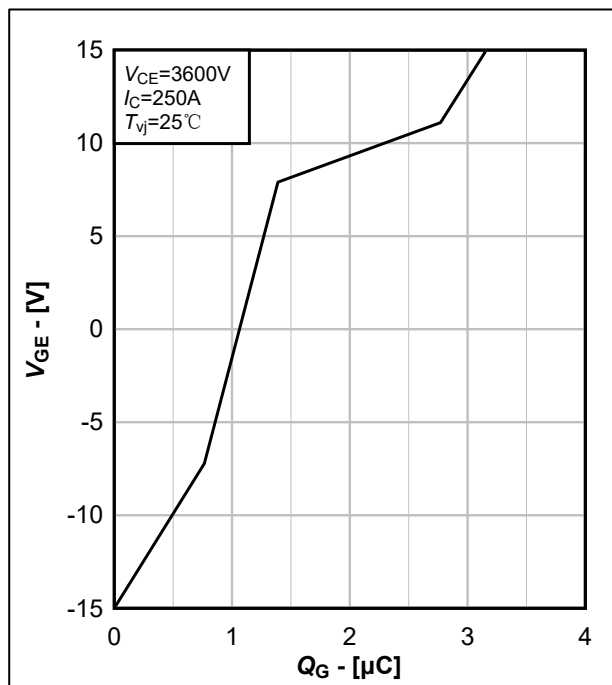
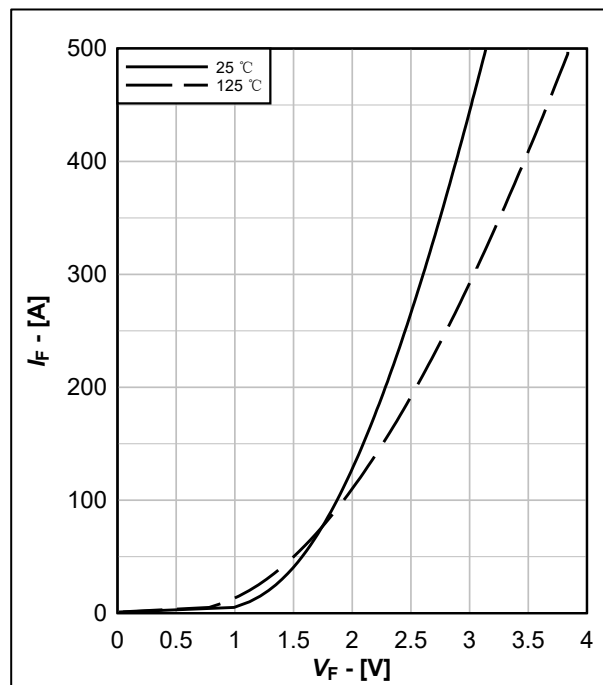
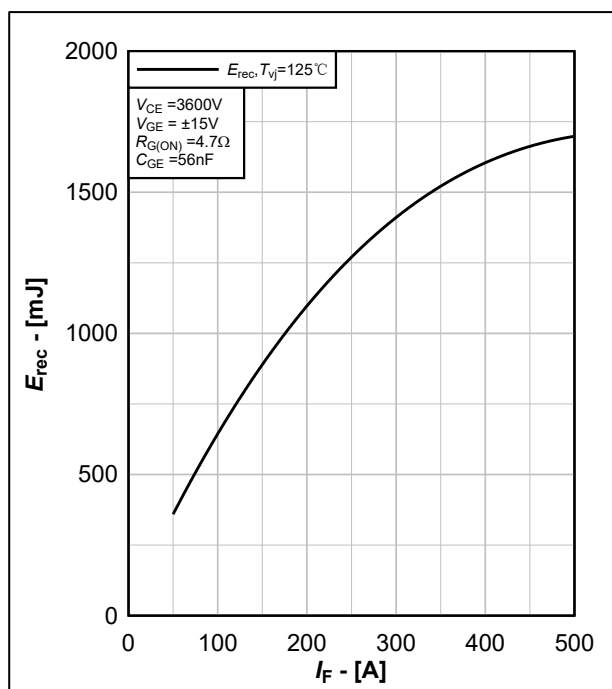
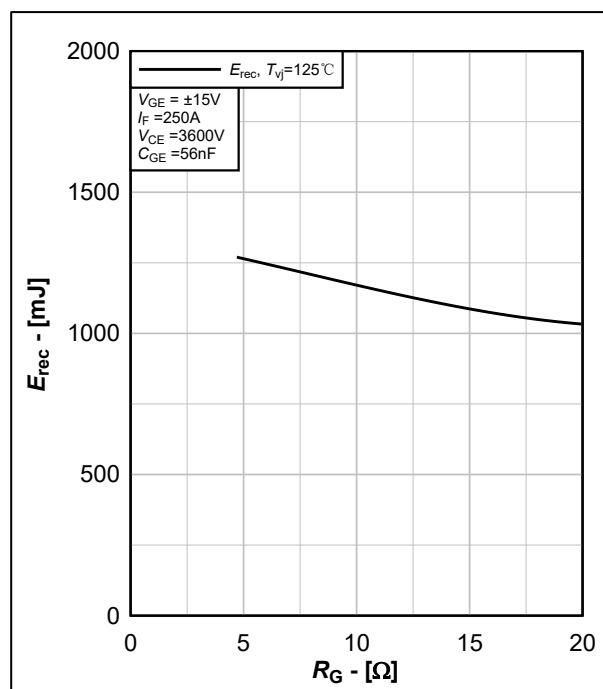
 Fig.9 Reverse bias safe operating area of IGBT, $I_c=f(V_{ce})$

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

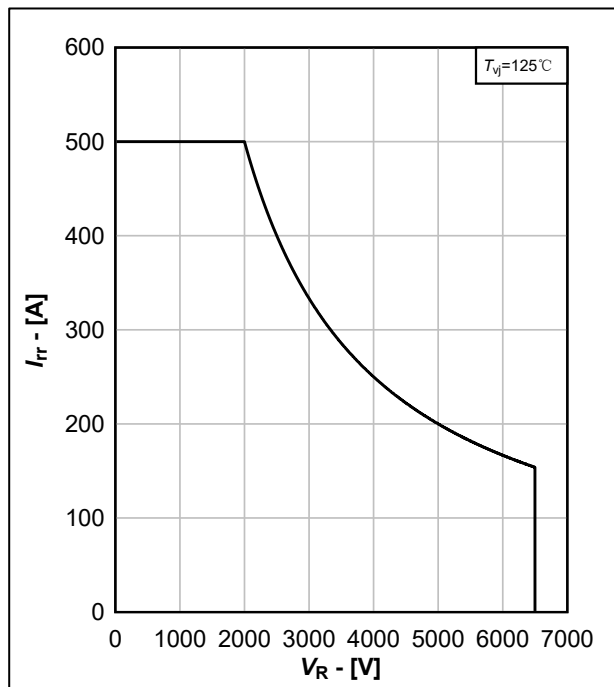


图 15. FRD 反偏安全工作区, $I_{rr} = f(V_R)$

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

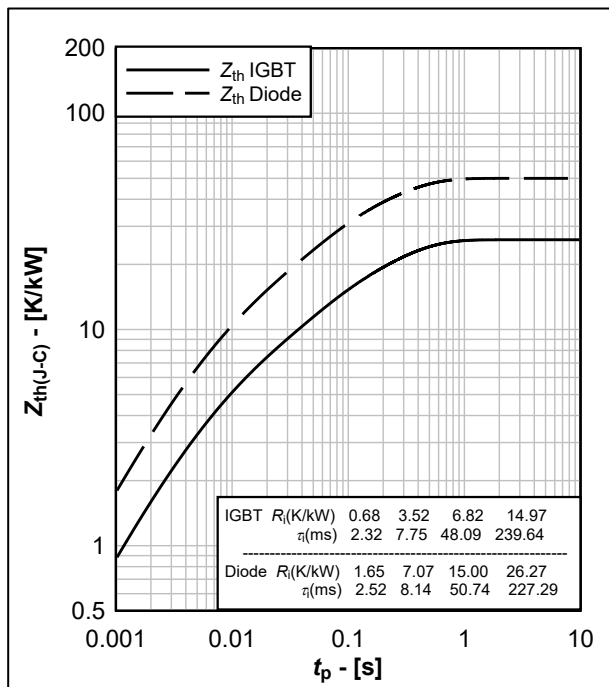
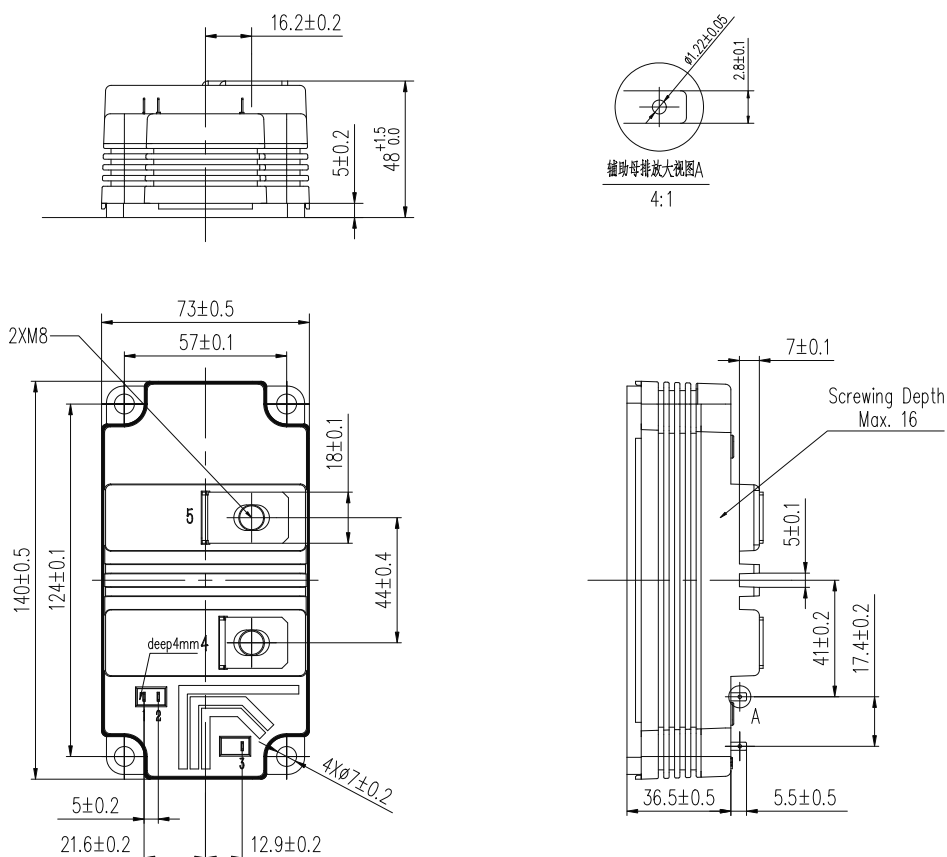


图 16. 瞬态热阻抗曲线, $Z_{th(J-C)} = f(t_p)$

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



重量 Weight: 600g 模块外观类型 Module outline code: P2

图 17. 模块外观尺寸

Fig. 17 Module outlines

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