

关键参数

Key Parameters

V_{CES}		1700	V
$V_{CE(sat)}$	Typ.	1.95	V
I_C	Max.	2400	A
$I_{C(RM)}$	Max.	4800	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 Inverters

特点

Features

● AISiC 基板	AISiC Baseplate
● AIN 衬板	AIN 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

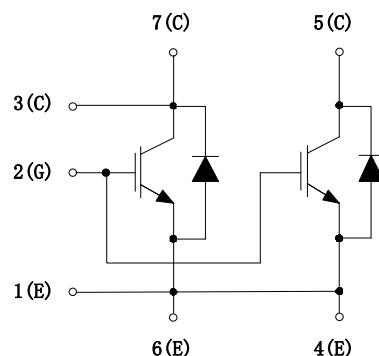


图 1. 电路结构

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	$V_{GE} = 0V, T_C = 25^\circ C$	1700	V
V_{GES}	栅极-发射极电压 Gate-emitter voltage	$T_C = 25^\circ C$	± 20	V
I_C	集电极电流 Collector-emitter current	$T_C = 95^\circ C, T_{vj} \text{ max} = 175^\circ C$	2400	A
$I_{C(RM)}$	集电极峰值电流 Peak collector current	$t_P = 1ms$	4800	A
P_{max}	晶体管部分最大损耗 Max. transistor power dissipation	$T_{vj} = 175^\circ C, T_C = 25^\circ C$	14.4	kW
t_t	二极管 t_t 值 Diode t_t	$V_R = 0V, t_P = 10ms, T_{vj} = 150^\circ C$	980	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, $T_C = 25^\circ C$	4000	V
Q_{PD}	局部放电电荷(模块) Partial discharge – per module	IEC1287. $V_1 = 1800V, V_2 = 1300V, 50Hz \text{ RMS}$	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	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	20.0	mm
	端子-端子 Terminal to terminal	20.0	mm
相对漏电起痕指数 CTI (Comparative Tracking Index)		>600	



TIM2400N2SM17-TSA000

单管型 IGBT 模块 Single Switch IGBT Module

产品数据手册 Product Datasheet 版本 Ver 21.10

初版 Preliminary

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				10.4	K / kW
$R_{th(J-C)} Diode$	二极管结壳热阻 Thermal resistance – Diode				13.7	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		9.7		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		10.5		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		150	°C
M	安装力矩 Screw torque	安装紧固用 – M6 Mounting – M6			5	Nm
		电路互连用 – M4 Electrical connections – M4			2	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
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{vj} = 125\text{ }^{\circ}\text{C}$			40	mA
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{vj} = 150\text{ }^{\circ}\text{C}$			70	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	$I_C = 80\text{mA}, V_{GE} = V_{CE}$	5.5	6.1	6.7	V
$V_{CE(sat)}^{(*1)}$	集电极-发射极饱和电压 Collector-emitter saturation voltage	$V_{GE} = 15V, I_C = 2400A$		1.95		V
		$V_{GE} = 15V, I_C = 2400A, T_{vj} = 125\text{ }^{\circ}\text{C}$		2.20		V
		$V_{GE} = 15V, I_C = 2400A, T_{vj} = 150\text{ }^{\circ}\text{C}$		2.25		V
I_F	二极管正向直流电流 Diode forward current	DC		2400		A
I_{FRM}	二极管正向重复峰值电流 Diode peak forward current	$t_p = 1\text{ms}$		4800		A
$V_F^{(*1)}$	二极管正向电压 Diode forward voltage	$I_F = 2400A, V_{GE} = 0V$		1.80		V
		$I_F = 2400A, V_{GE} = 0V, T_{vj} = 125\text{ }^{\circ}\text{C}$		1.85		V
		$I_F = 2400A, V_{GE} = 0V, T_{vj} = 150\text{ }^{\circ}\text{C}$		1.85		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		9600		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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TIM2400N2SM17-TSA000

单管型 IGBT 模块 Single Switch IGBT Module

初版 Preliminary

电特性值

Electrical Characteristics

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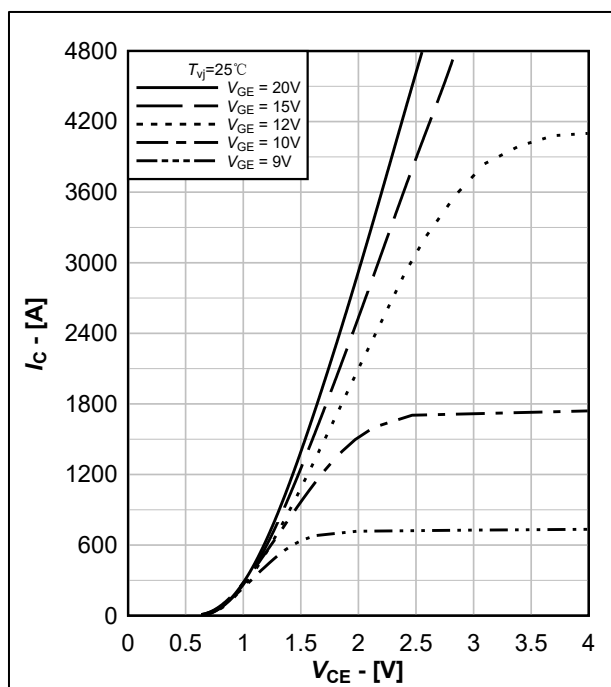
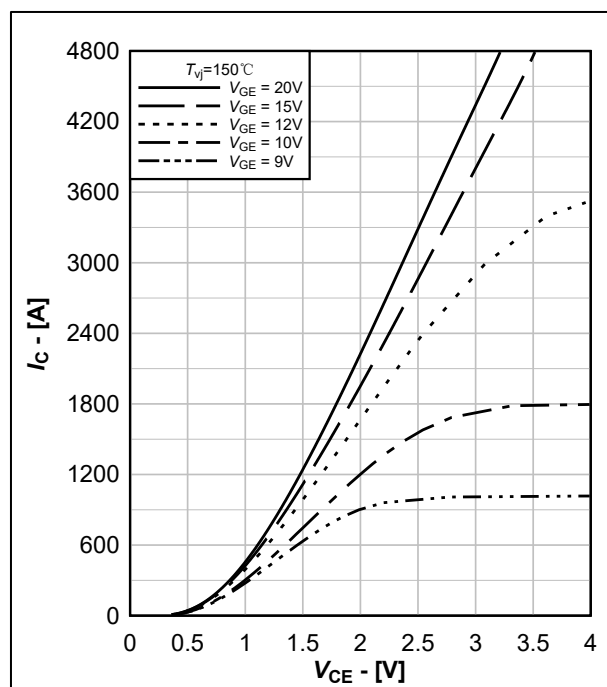
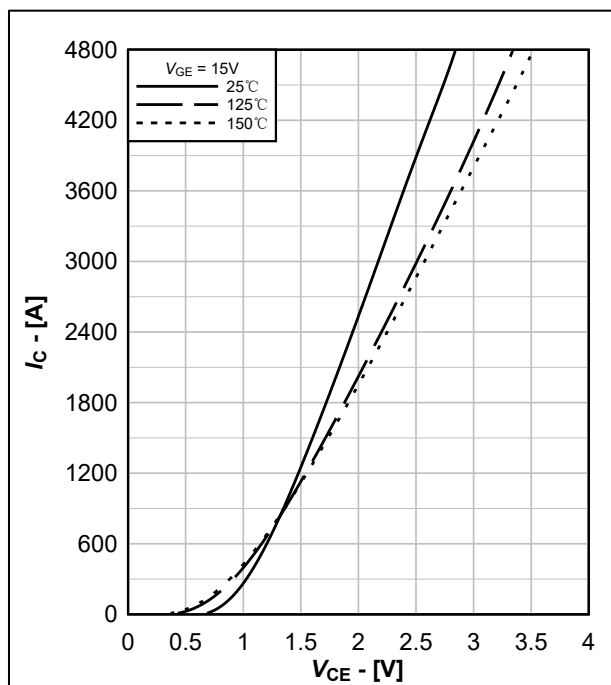
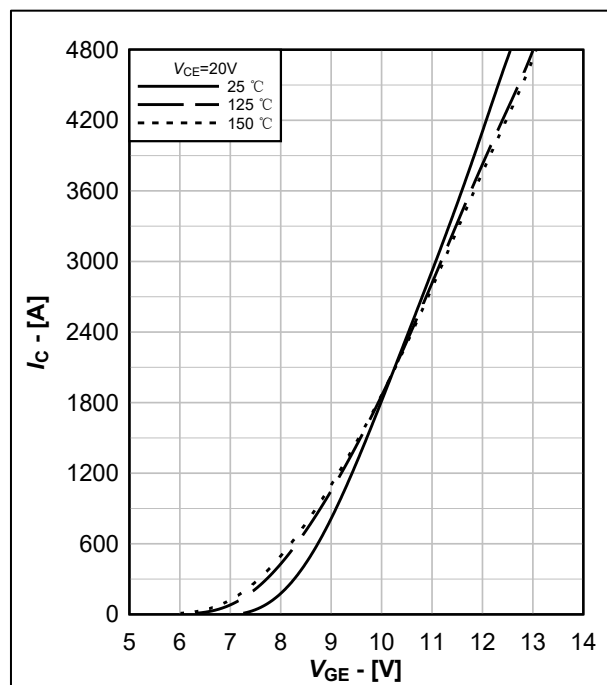
符号 Symbol	参数名称 Parameter	条件 Test Conditions	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
C_{ies}	输入电容 Input capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$		366		nF
Q_g	栅极电荷 Gate charge	$\pm 15V$		23		μC
C_{res}	反向传输电容 Reverse transfer capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$		1.2		nF
L_{sCE}	模块杂散电感 Module stray inductance			9		nH
$R_{CC'+EE'}$	模块引线电阻，端子-芯片 Module lead resistance, terminal-chip			127.5		$\mu\Omega$

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

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 =2400A, V_{CE} =900V, V_{GE} = ±15V, $R_{G(OFF)}$ = 0.5Ω, L_S = 60 nH, dv/dt =4200V/μs (T_{vj} = 150 °C)	T_{vj} = 25 °C		1635		ns
			T_{vj} = 125 °C		1760		
			T_{vj} = 150 °C		1780		
t_f	下降时间 Fall time		T_{vj} = 25 °C		245		ns
			T_{vj} = 125 °C		295		
			T_{vj} = 150 °C		310		
E_{OFF}	关断损耗 Turn-off energy loss		T_{vj} = 25 °C		890		mJ
			T_{vj} = 125 °C		1010		
			T_{vj} = 150 °C		1025		
$t_{d(on)}$	开通延迟时间 Turn-on delay time	T_{vj} = 25 °C		830		ns	
		T_{vj} = 125 °C		910			
		T_{vj} = 150 °C		915			
t_r	上升时间 Rise time	T_{vj} = 25 °C		220		ns	
		T_{vj} = 125 °C		225			
		T_{vj} = 150 °C		230			
E_{ON}	开通损耗 Turn-on energy loss	T_{vj} = 25 °C		100		mJ	
		T_{vj} = 125 °C		195			
		T_{vj} = 150 °C		210			
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	T_{vj} = 25 °C		615		μC	
		T_{vj} = 125 °C		980			
		T_{vj} = 150 °C		1090			
I_{rr}	二极管反向恢复电流 Diode reverse recovery current	T_{vj} = 25 °C		1575		A	
		T_{vj} = 125 °C		1880			
		T_{vj} = 150 °C		1990			
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy	T_{vj} = 25 °C		485		mJ	
		T_{vj} = 125 °C		755			
		T_{vj} = 150 °C		835			

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

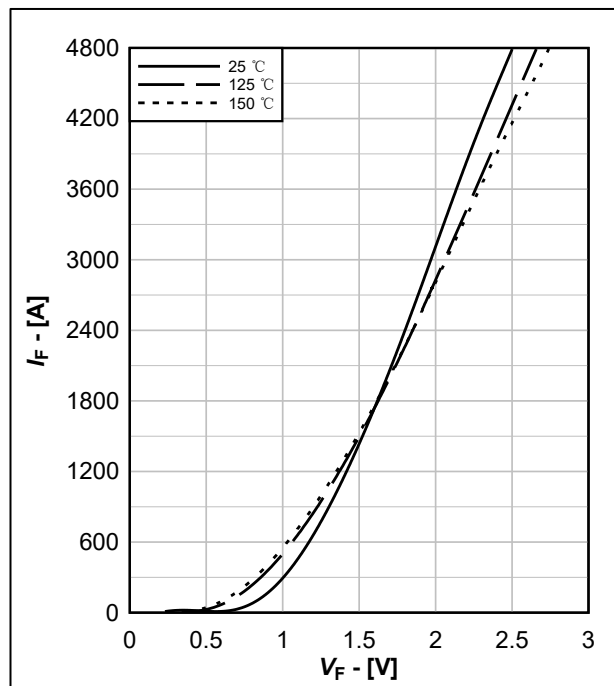

 图 7. FRD 输出特性典型曲线, $I_F = f(V_F)$

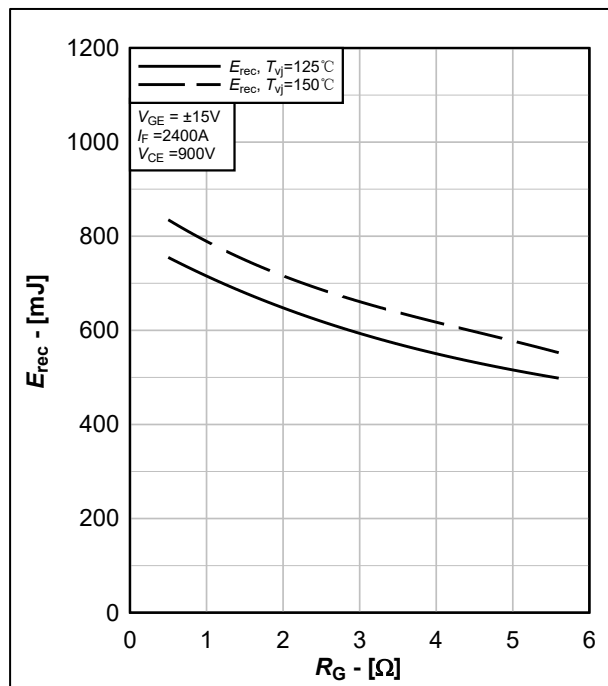
 Fig.7 Typical FRD output characteristics, $I_F = f(V_F)$

 图 8. FRD 反向恢复损耗典型曲线, $E_{rec} = f(R_G)$

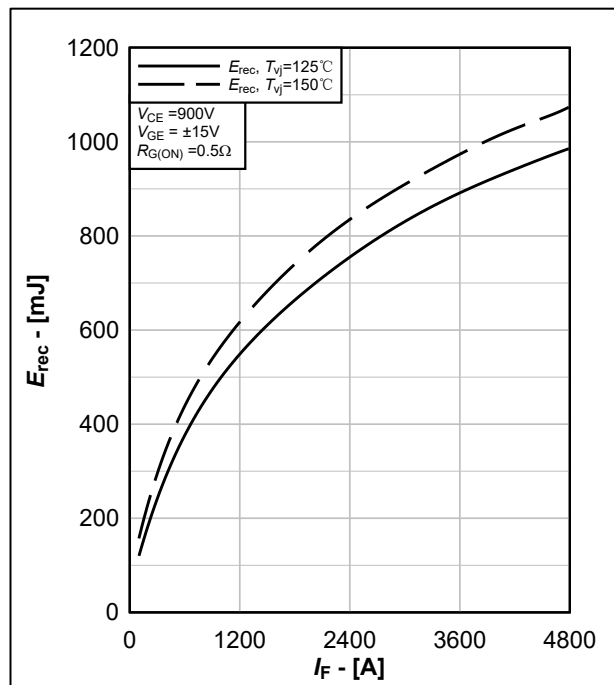
 Fig.8 Typical FRD switching loss E_{rec} , $E_{rec} = f(R_G)$

 图 9. FRD 反向恢复损耗典型曲线, $E_{rec} = f(I_F)$

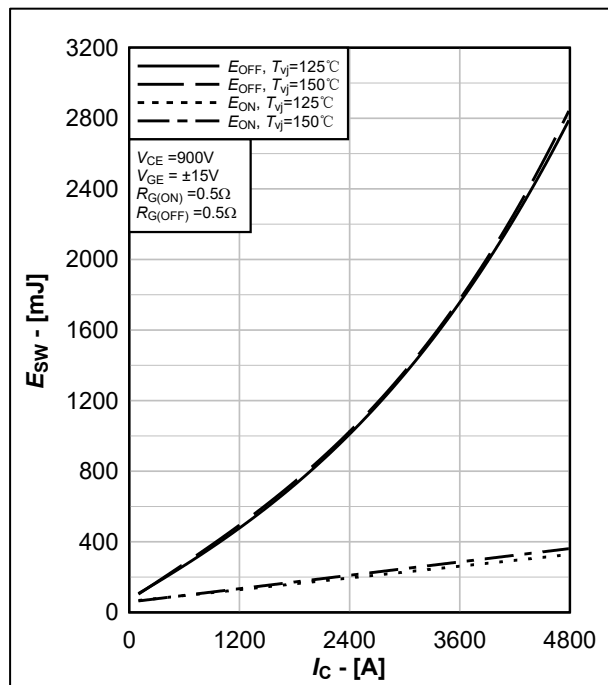
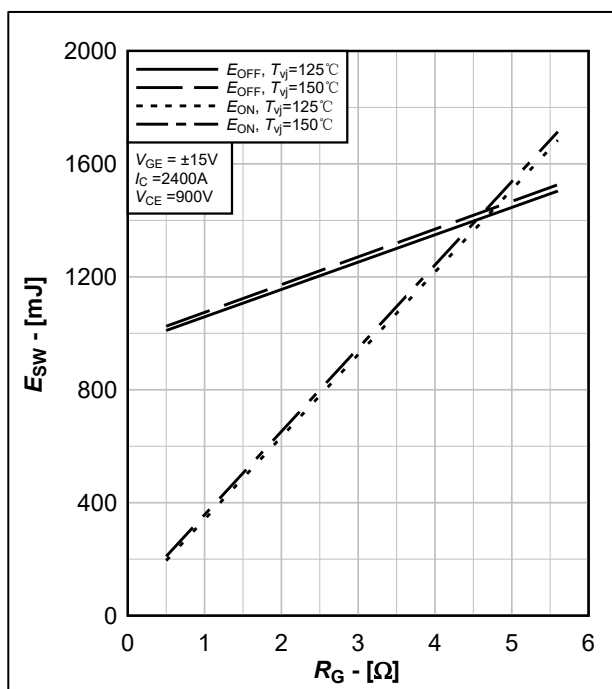
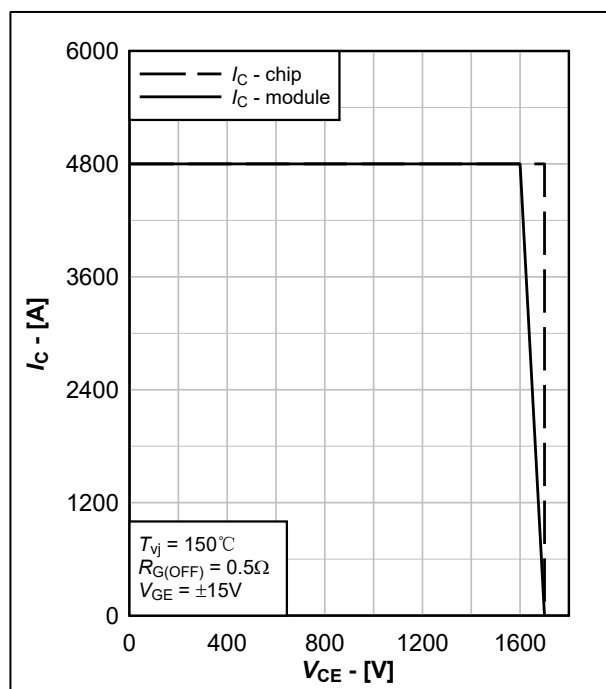
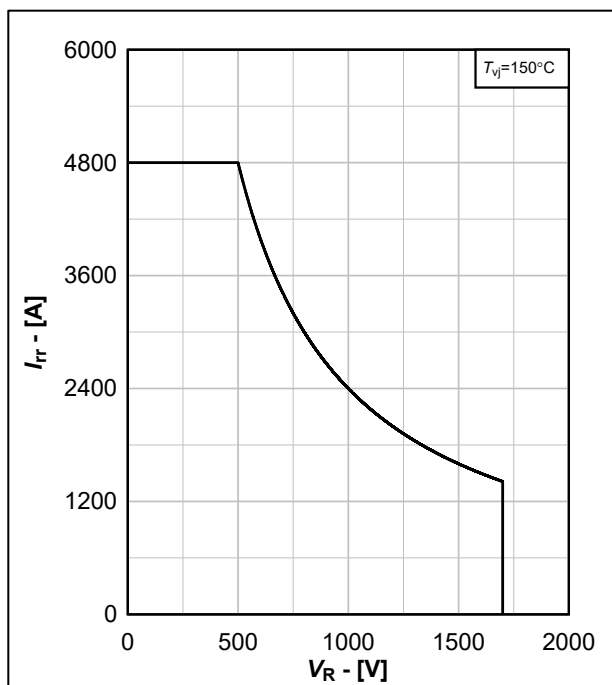
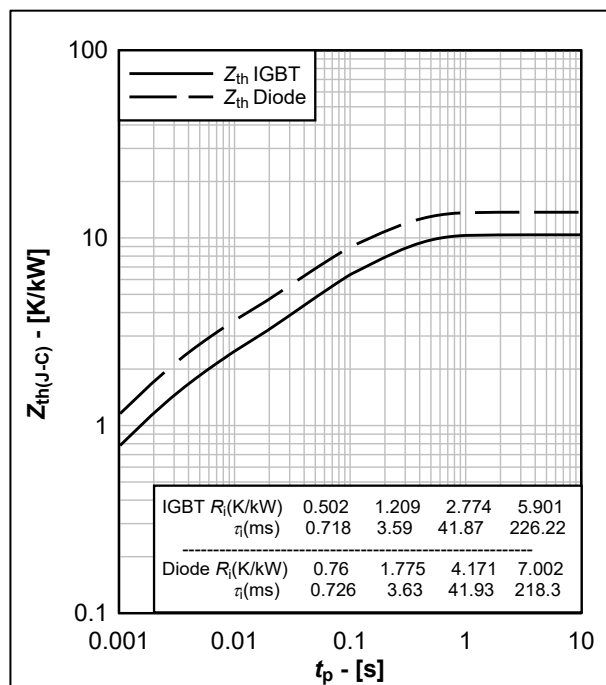
 Fig.9 Typical FRD switching loss E_{rec} , $E_{rec} = f(I_F)$

 图 10. IGBT 开关损耗典型曲线, $E_{on} = f(I_C)$, $E_{off} = f(I_C)$

 Fig.10 Typical IGBT switching energy, $E_{on} = f(I_C)$, $E_{off} = f(I_C)$

图 11. IGBT 开关损耗典型曲线, $E_{on} = f(R_G)$, $E_{off} = f(R_G)$ Fig.11 Typical IGBT switching energy, $E_{on} = f(R_G)$, $E_{off} = f(R_G)$ 图 12. IGBT 反偏安全工作区, $I_C = f(V_{CE})$ Fig.12 Reverse bias safe operating area of IGBT, $I_C = f(V_{CE})$ 图 13. FRD 反偏安全工作区, $I_{rr} = f(V_R)$ Fig.13 Reverse bias safe operating area of FRD, $I_{rr} = f(V_R)$ 图 14. 瞬态热阻抗曲线, $Z_{th(J-C)} = f(t_p)$ Fig.14 Transient thermal impedance, $Z_{th(J-C)} = f(t_p)$

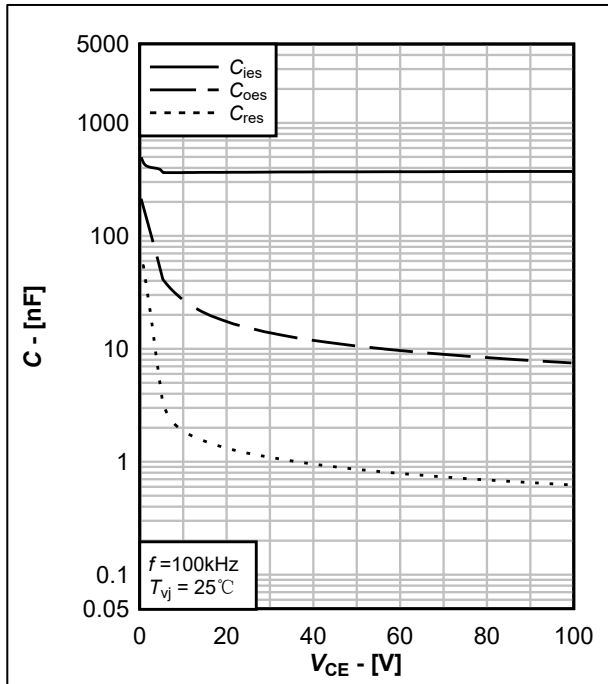


图 15. 电容特性典型曲线, $C = f(V_{CE})$

Fig.15 Typical capacity characteristic, $C = f(V_{CE})$

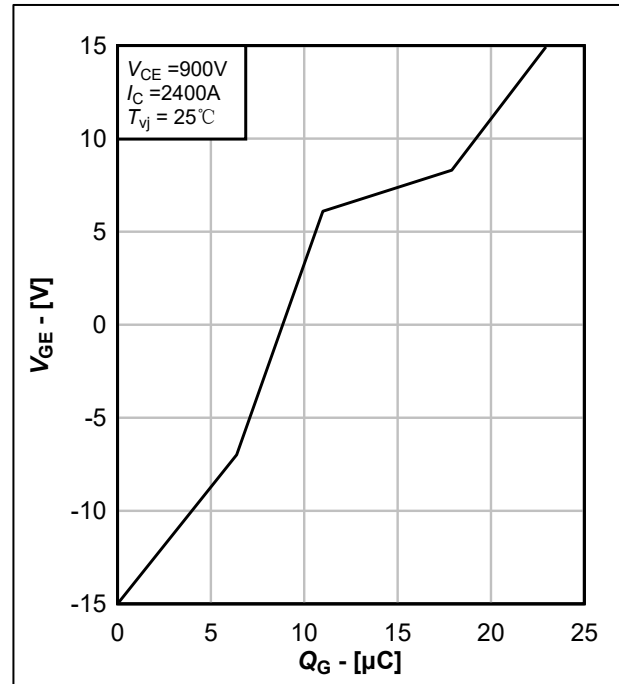
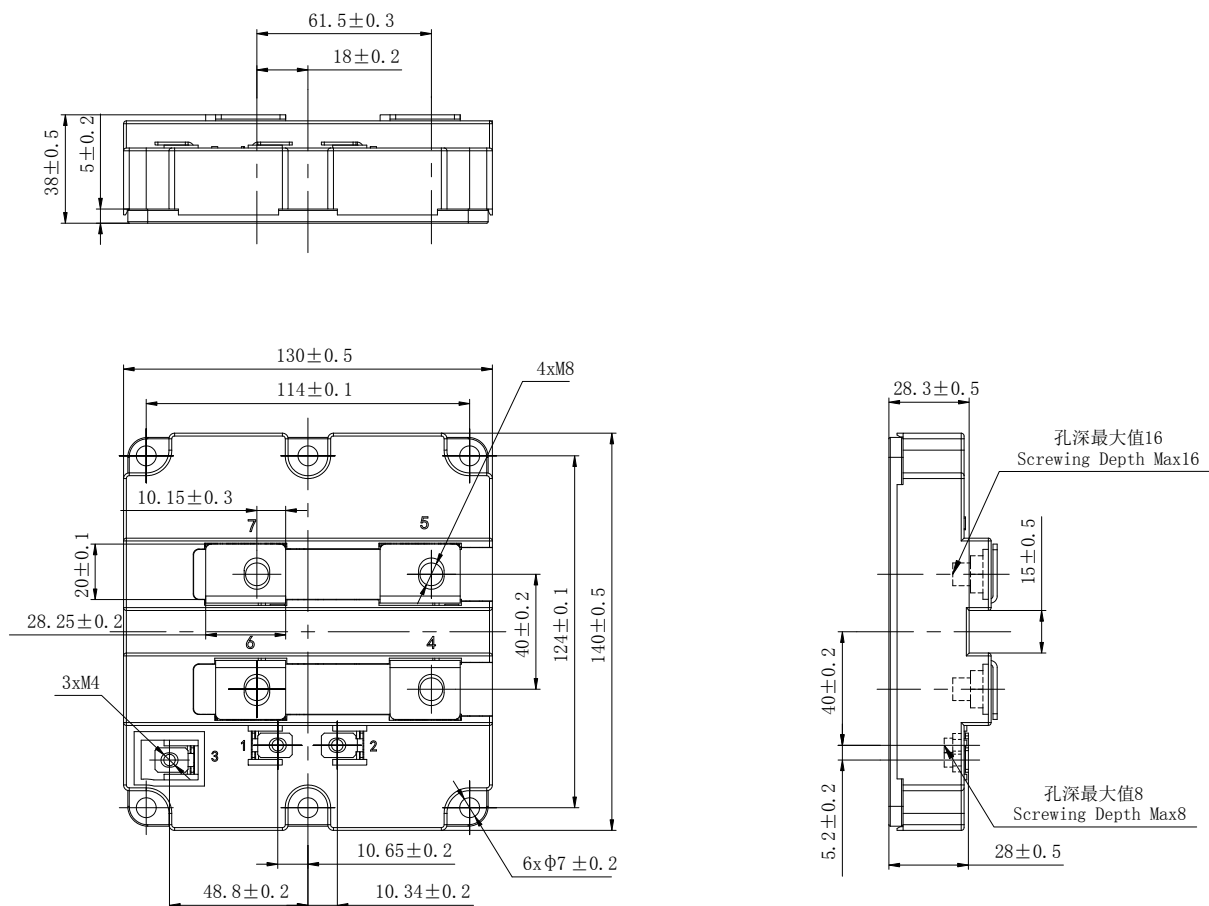


图 16. 栅极电荷特性典型曲线, $V_{GE} = f(Q_G)$

Fig.16 Typical gate charge characteristic, $V_{GE} = f(Q_G)$



重量 Weight: 745g 模块外观类型 Module outline code: N2

图 17. 模块外观尺寸

Fig. 17 Module outlines

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