

**关键参数 Key Parameters**

$V_{CES}$		3300	V
$V_{CE(sat)}$	Typ.	2.5	V
$I_C$	Max.	250	A
$I_{C(RM)}$	Max.	500	A

**典型应用 Typical Applications**

- 牵引辅变 Traction Auxiliaries
- 电机控制 Motor Controllers
- 斩波 Choppers
- 高可靠性逆变器 High Reliability Inverter

**特点 Features**

- AISiC 基板 AISiC Baseplate
- AIN 衬板 AIN Substrates
- 高热循环能力 High Thermal Cycling Capability
- 10 $\mu$ s 短路承受能力 10 $\mu$ s Short Circuit Withstand

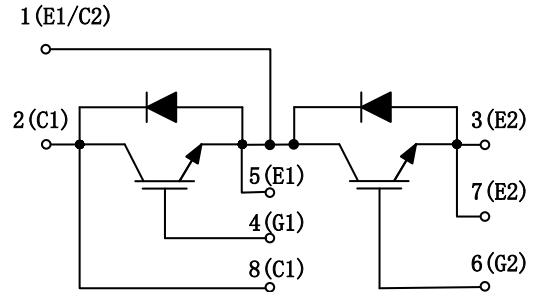
**电路结构 Circuit Configuration**


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	$V_{GE} = 0V, T_C = 25\text{ }^\circ\text{C}$	3300	V
$V_{GES}$	栅极-发射极电压 Gate-emitter voltage	$T_C = 25\text{ }^\circ\text{C}$	$\pm 20$	V
$I_C$	集电极电流 Collector-emitter current	$T_C = 100\text{ }^\circ\text{C}$	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	$T_{vj} = 150\text{ }^\circ\text{C}, T_C = 25\text{ }^\circ\text{C}$	2.6	kW
$\rho_t$	二极管 $\rho_t$ 值 Diode $\rho_t$	$V_R = 0V, t_P = 10\text{ms}, T_{vj} = 150\text{ }^\circ\text{C}$	20	$\text{kA}^2\text{s}$
$V_{isol}$	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 baseplate), AC RMS, 1 min, 50Hz, $T_C = 25\text{ }^\circ\text{C}$	6	kV
$Q_{PD}$	局部放电电荷(模块) Partial discharge – per module	IEC1287. $V_1 = 3500V, V_2 = 2600V, 50\text{Hz RMS}$	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	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	

**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.	最大值 Max.	单位 Unit
$R_{th(J-C)}$ IGBT	IGBT 结壳热阻 Thermal resistance – IGBT			48	K / kW
$R_{th(J-C)}$ Diode	二极管结壳热阻 Thermal resistance – Diode			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·°C Mounting torque 5Nm, with mounting grease 1W/m·°C		18	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·°C Mounting torque 5Nm, with mounting grease 1W/m·°C		36	K / kW
$T_{vj\ op}$	工作结温 Operating junction temperature	IGBT 部分 ( IGBT )	-40	150	°C
		二极管部分( 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 – M5 Electrical connections – M5		4	Nm

**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
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_C = 125\text{ }^\circ\text{C}$			15	mA
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_C = 150\text{ }^\circ\text{C}$			25	mA
$I_{GES}$	栅极漏电流 Gate leakage current	$V_{GE} = \pm 20V, V_{CE} = 0V$			1	$\mu\text{A}$
$V_{GE(TH)}$	栅极-发射极阈值电压 Gate threshold voltage	$I_C = 20\text{mA}, V_{GE} = V_{CE}$	5.5	6.1	7.0	V
$V_{CE(sat)}^{(*1)}$	集电极-发射极饱和电压 Collector-emitter saturation voltage	$V_{GE} = 15V, I_C = 250A$		2.50	2.80	V
		$V_{GE} = 15V, I_C = 250A, T_{vj} = 125\text{ }^\circ\text{C}$		3.15	3.45	V
		$V_{GE} = 15V, I_C = 250A, T_{vj} = 150\text{ }^\circ\text{C}$		3.30	3.60	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	$I_F = 250A, V_{GE} = 0$		2.10	2.40	V
		$I_F = 250A, V_{GE} = 0, T_{vj} = 125\text{ }^\circ\text{C}$		2.25	2.55	V
		$I_F = 250A, V_{GE} = 0, T_{vj} = 150\text{ }^\circ\text{C}$		2.25	2.55	V
$I_{SC}$	短路电流 Short circuit current	$T_{vj} = 150\text{ }^\circ\text{C}, V_{CC} = 2500V,$ $V_{GE} \leq 15V, t_p \leq 10\mu\text{s},$ $V_{CE(max)} = V_{CES} - L^{(*2)} \times di/dt,$ IEC 60747-9		900		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  $L_M$  (\*2) indicates  $L$  is the circuit stray inductance plus  $L_M$ ).

**电特性值**
**Electrical Characteristics**

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 $T_C = 25\text{ }^\circ\text{C}$  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	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$		27		nF
$Q_g$	栅极电荷 Gate charge	$\pm 15V$		2.6		$\mu\text{C}$
$C_{res}$	反向传输电容 Reverse transfer capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$		0.9		nF
$L_M$	模块电感 Module inductance			40		nH
$R_{CC+EE}$	模块引线电阻, 端子-芯片 Module lead resistance, terminal-chip			0.5		m $\Omega$

## 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	$I_C = 250A,$ $V_{CE} = 1800V,$ $V_{GE} = \pm 15V,$ $R_{G(OFF)} = 9.0\Omega,$ $C_{GE} = 56nF,$ $L_S = 150nH,$	$T_{vj} = 25\text{ }^\circ\text{C}$		1480	ns
			$T_{vj} = 125\text{ }^\circ\text{C}$		1550	
			$T_{vj} = 150\text{ }^\circ\text{C}$		1570	
$t_f$	下降时间 Fall time		$T_{vj} = 25\text{ }^\circ\text{C}$		1280	ns
			$T_{vj} = 125\text{ }^\circ\text{C}$		1920	
			$T_{vj} = 150\text{ }^\circ\text{C}$		2120	
$E_{OFF}$	关断损耗 Turn-off energy loss		$T_{vj} = 25\text{ }^\circ\text{C}$		300	mJ
			$T_{vj} = 125\text{ }^\circ\text{C}$		380	
			$T_{vj} = 150\text{ }^\circ\text{C}$		400	
$t_{d(on)}$	开通延迟时间 Turn-on delay time	$T_{vj} = 25\text{ }^\circ\text{C}$		640	ns	
		$T_{vj} = 125\text{ }^\circ\text{C}$		650		
		$T_{vj} = 150\text{ }^\circ\text{C}$		650		
$t_r$	上升时间 Rise time	$T_{vj} = 25\text{ }^\circ\text{C}$		220	ns	
		$T_{vj} = 125\text{ }^\circ\text{C}$		235		
		$T_{vj} = 150\text{ }^\circ\text{C}$		238		
$E_{ON}$	开通损耗 Turn-on energy loss	$T_{vj} = 25\text{ }^\circ\text{C}$		395	mJ	
		$T_{vj} = 125\text{ }^\circ\text{C}$		510		
		$T_{vj} = 150\text{ }^\circ\text{C}$		565		
$Q_{rr}$	二极管反向恢复电荷 Diode reverse recovery charge	$T_{vj} = 25\text{ }^\circ\text{C}$		190	$\mu\text{C}$	
		$T_{vj} = 125\text{ }^\circ\text{C}$		295		
		$T_{vj} = 150\text{ }^\circ\text{C}$		335		
$I_{rr}$	二极管反向恢复电流 Diode reverse recovery current	$T_{vj} = 25\text{ }^\circ\text{C}$		185	A	
		$T_{vj} = 125\text{ }^\circ\text{C}$		210		
		$T_{vj} = 150\text{ }^\circ\text{C}$		216		
$E_{rec}$	二极管反向恢复损耗 Diode reverse recovery energy	$T_{vj} = 25\text{ }^\circ\text{C}$		223	mJ	
		$T_{vj} = 125\text{ }^\circ\text{C}$		360		
		$T_{vj} = 150\text{ }^\circ\text{C}$		410		

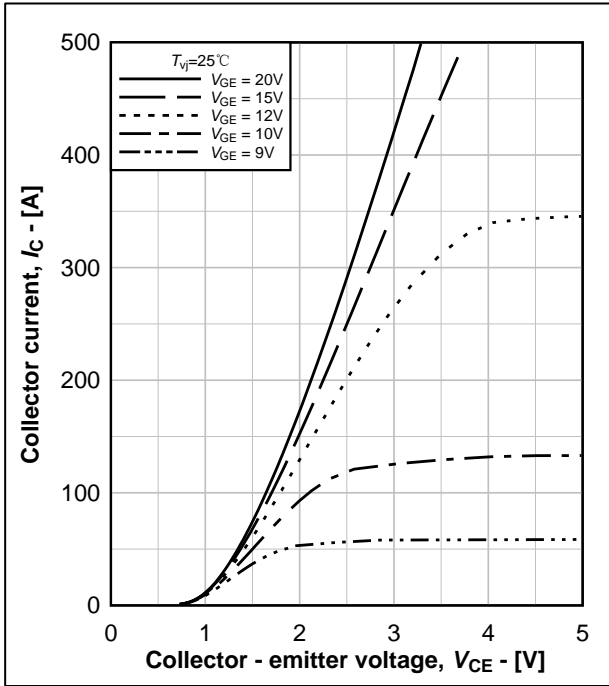


图 3. IGBT 输出特性典型曲线,  $I_C = f(V_{CE})$

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

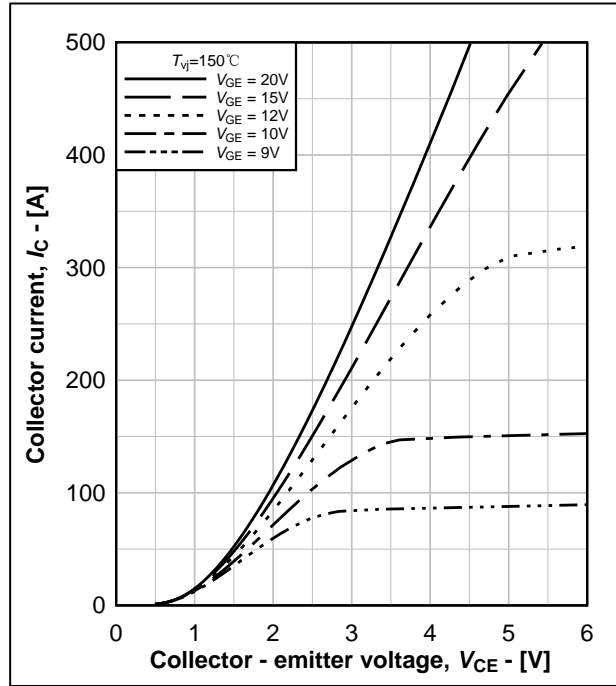


图 4. IGBT 输出特性典型曲线,  $I_C = f(V_{CE})$

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

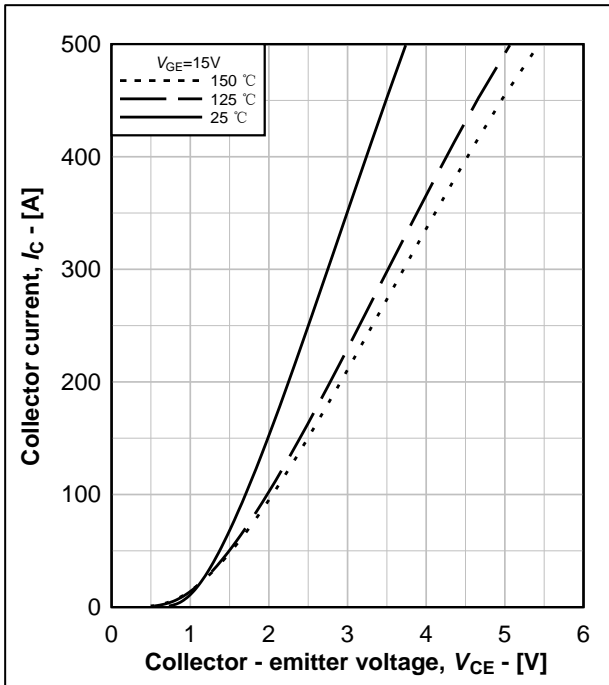


图 5. IGBT 输出特性典型曲线,  $I_C = f(V_{CE})$

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

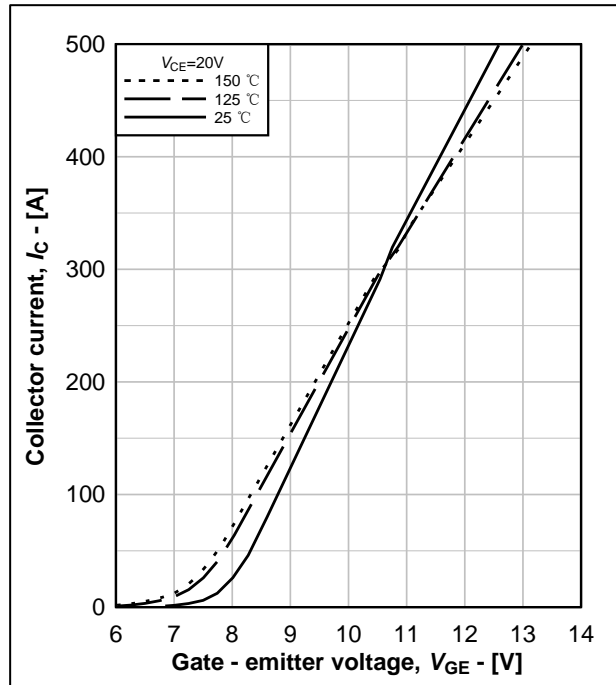


图 6. IGBT 传输特性典型曲线,  $I_C = f(V_{GE})$

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

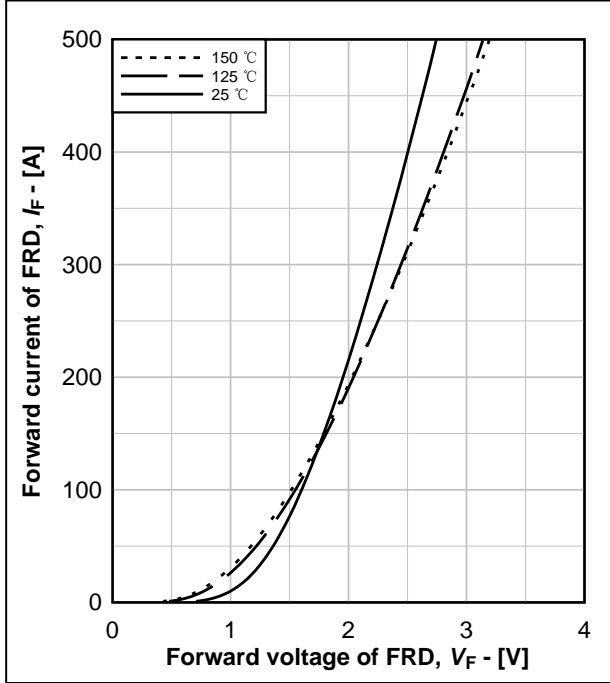

 图 7. FRD 输出特性典型曲线,  $I_F = f(V_F)$ 

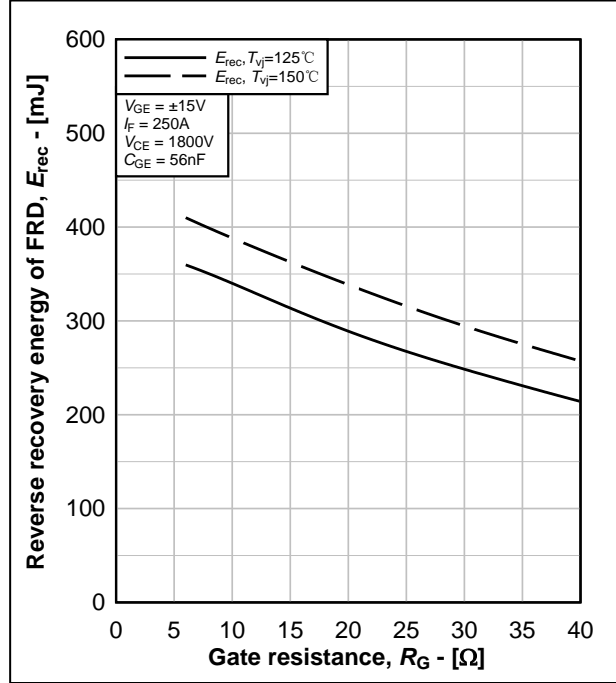
 Fig.7 Typical FRD output characteristics,  $I_F = f(V_F)$ 

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

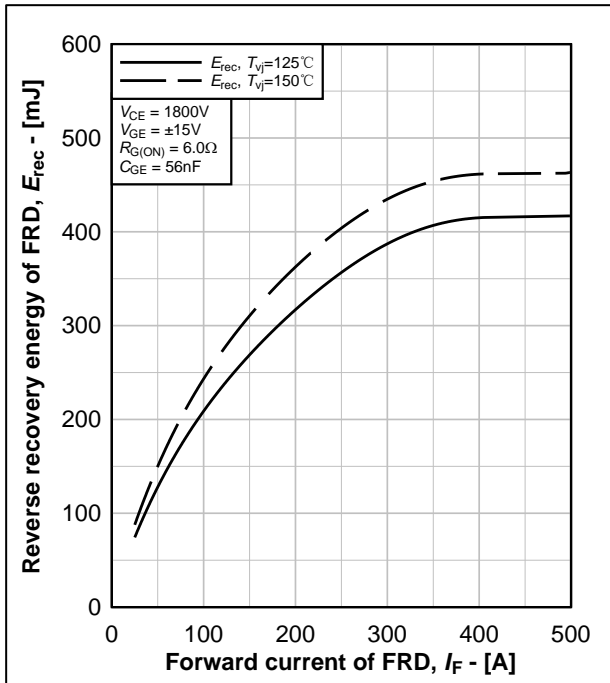
 Fig.8 Typical FRD  $E_{rec}$   $E_{rec} = f(R_G)$ 

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

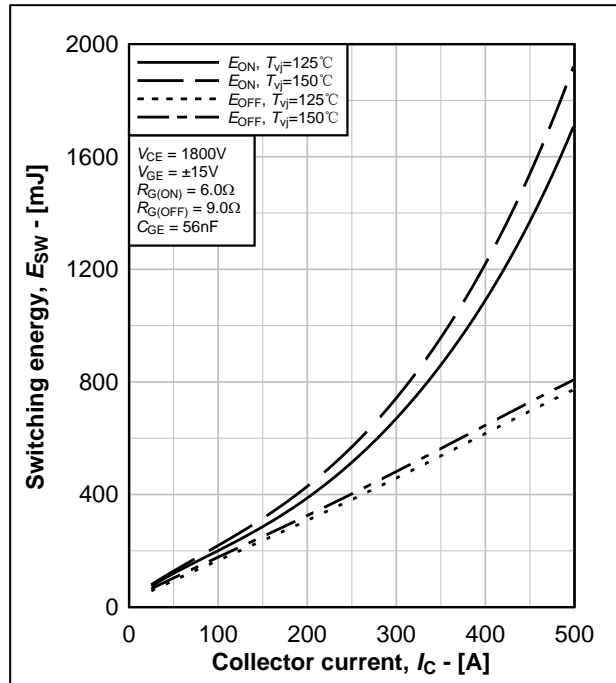
 Fig.9 Typical FRD  $E_{rec}$   $E_{rec} = f(I_F)$ 

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

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



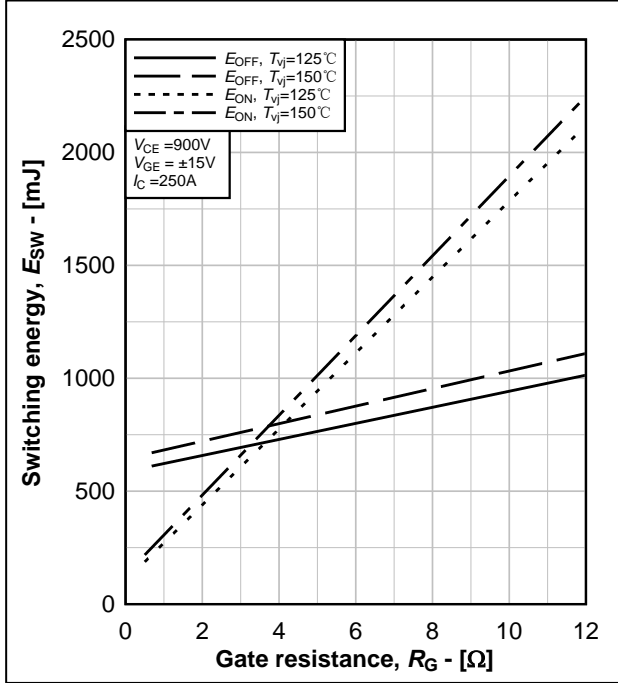


图 11. IGBT 开关能耗典型曲线,  $E_{on} = f(R_G)$ ,  $E_{off} = f(R_G)$

Fig.11 Typical IGBT switching energy,  $E_{on} = f(R_G)$ ,  $E_{off} = f(R_G)$

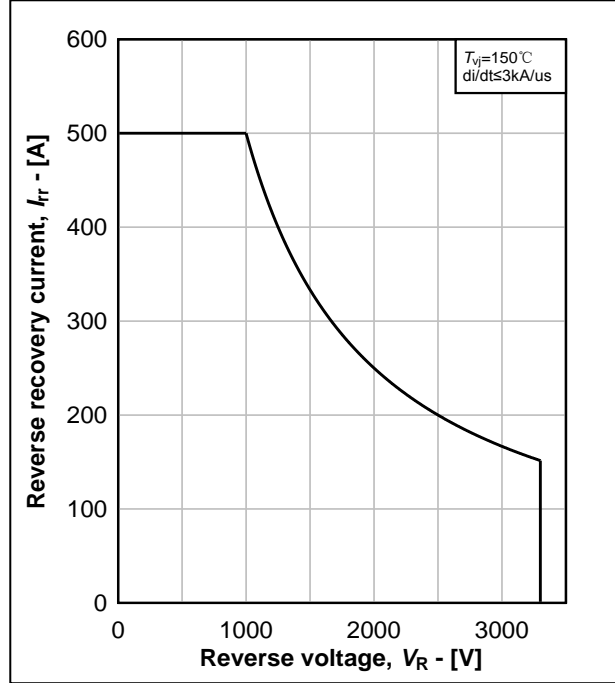


图 12. 二极管反偏安全工作区,  $I_{rr} = f(V_R)$

Fig.12 Diode reverse bias safe operating area,  $I_{rr} = f(V_R)$

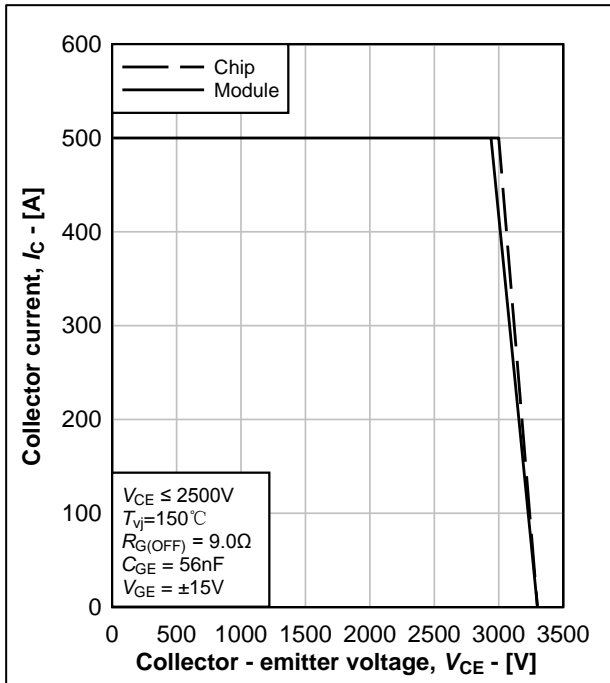


图 13. IGBT 反偏安全工作区,  $I_C = f(V_{CE})$

Fig.13 Reverse bias safe operating area of IGBT,  $I_C = f(V_{CE})$

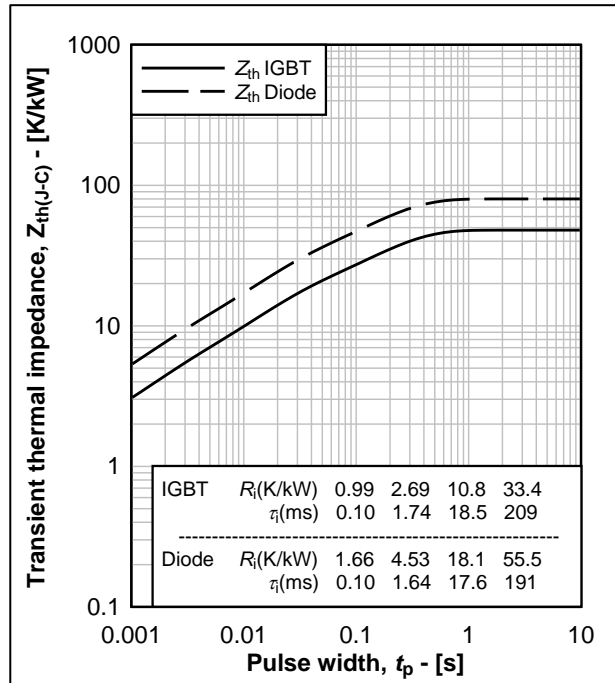
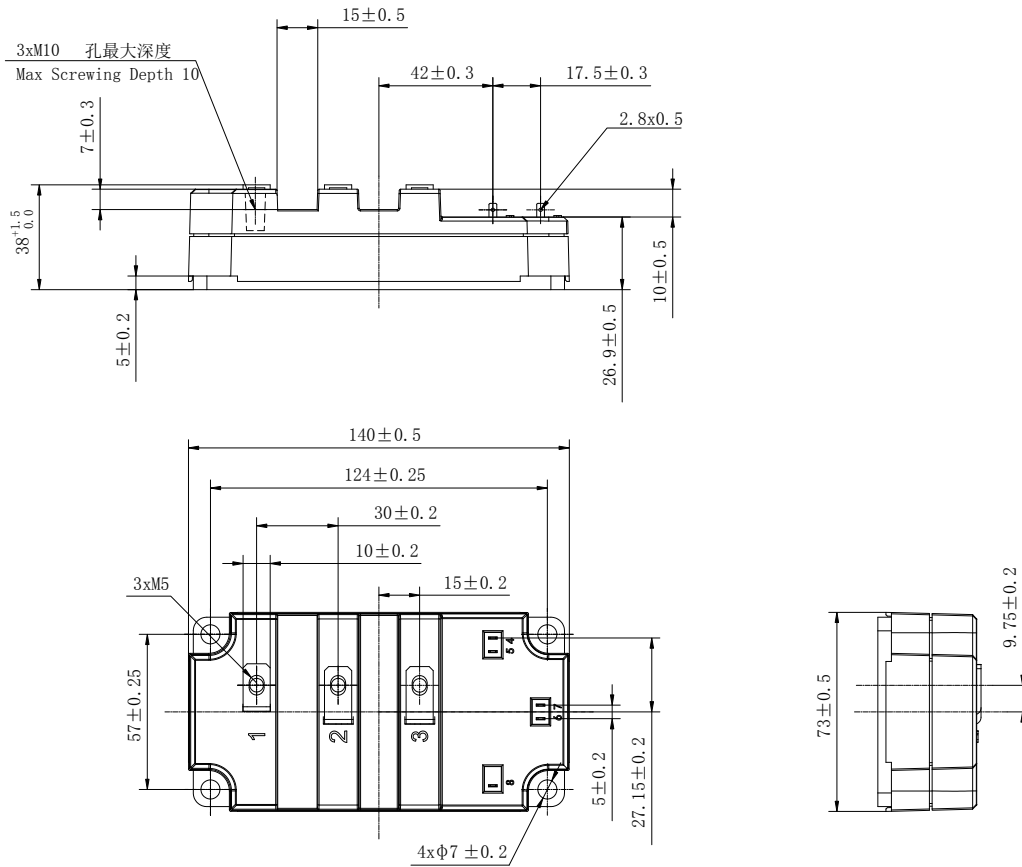


图 14. 瞬态热阻抗曲线,  $Z_{th(j-c)} = f(t_p)$

Fig.14 Transient thermal impedance,  $Z_{th(j-c)} = f(t_p)$



重量 Weight: 750g      模块外观类型 Module outline code: P

图 15 模块外观尺寸

Fig. 15 Module outlines

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