

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
● 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

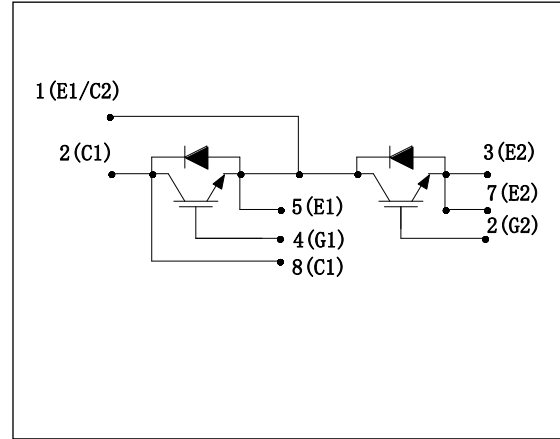
电路结构 Circuit Configuration


图 1. 电路结构

Fig. 1 Circuit configuration

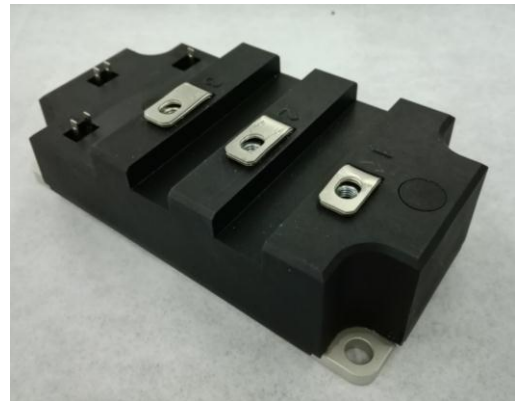
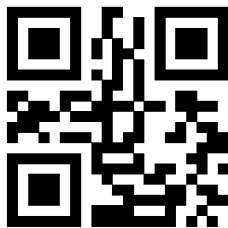
模块外形 Module Appearance


图 2. 模块外形

Fig. 2 Module appearance

模块标签说明

Module Label Code Instruction

数据位置 Data position	数据内容 Content of data
1--4	模块生产年周 Production year and week
5--12	模块批次号 Module batch number
13--16	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	$T_C = 25\text{ }^\circ\text{C}$	± 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
ρ_t	二极管 ρ_t 值 Diode ρ_t	$V_R = 0V, t_P = 10\text{ms}, T_{vj} = 150\text{ }^\circ\text{C}$	20	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 (Commoned 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. $V_1 = 6900V, V_2 = 5100V, 50\text{Hz RMS}$	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	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

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
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_C = 125\text{ }^\circ\text{C}$			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	μA
$V_{GE(TH)}$	栅极-发射极阈值电压 Gate threshold voltage	$I_C = 20\text{mA}, V_{GE} = V_{CE}$	5.5	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
		$V_{GE} = 15V, I_C = 250A, T_{vj} = 125\text{ }^\circ\text{C}$		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 6074-9		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

 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	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$		27		nF
Q_g	栅极电荷 Gate charge	$\pm 15V$		2.6		μC
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_{INT}	内阻 Internal transistor resistance			0.5		m 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	$I_C = 250A,$ $V_{CE} = 1800V,$ $V_{GE} = \pm 15V,$ $R_{G(OFF)} = 9.0\Omega,$ $C_{GE} = 56nF,$ $L_S = 150nH,$	$T_{vj} = 25\text{ }^\circ\text{C}$	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		μC	
		$T_{vj} = 125\text{ }^\circ\text{C}$		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			

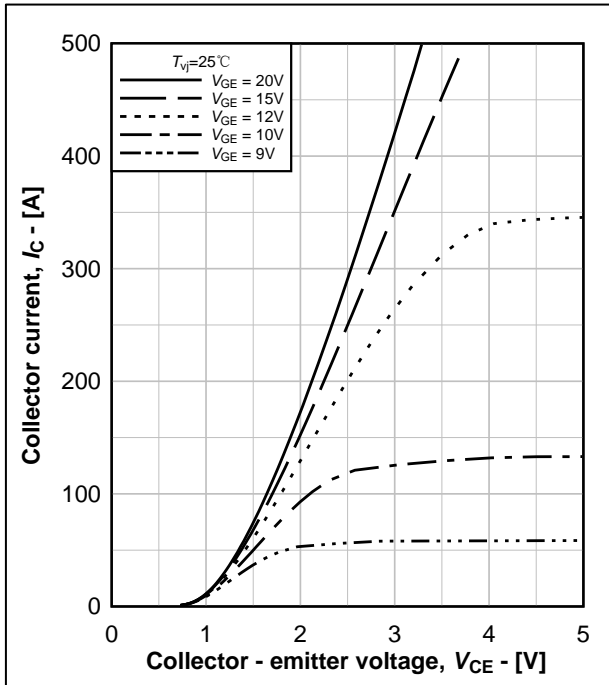

 图 3. IGBT 输出特性典型曲线, $I_C = f(V_{CE})$

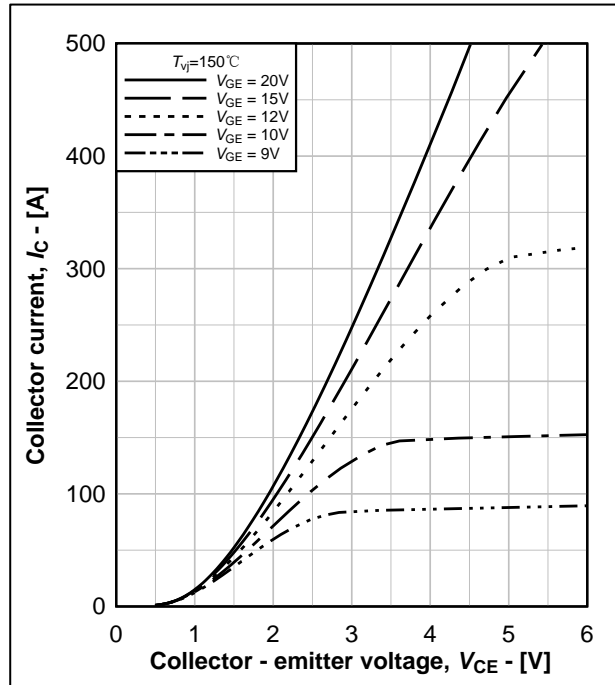
 Fig.3 Typical IGBT output characteristics, $I_C = f(V_{CE})$

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

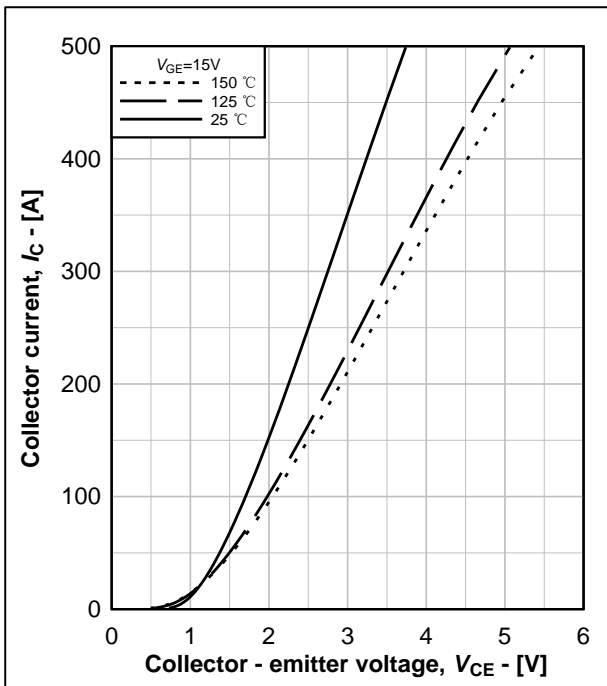
 Fig.4 Typical IGBT output characteristics, $I_C = f(V_{CE})$

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

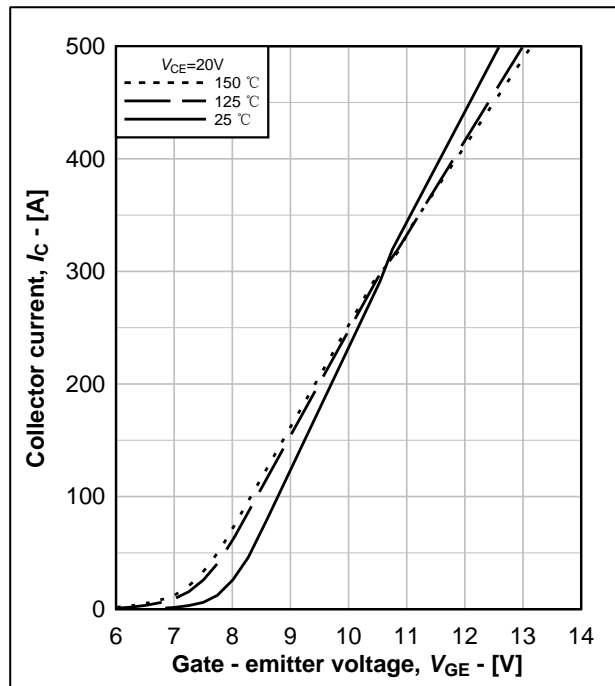
 Fig.5 Typical IGBT output characteristics, $I_C = f(V_{CE})$

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

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

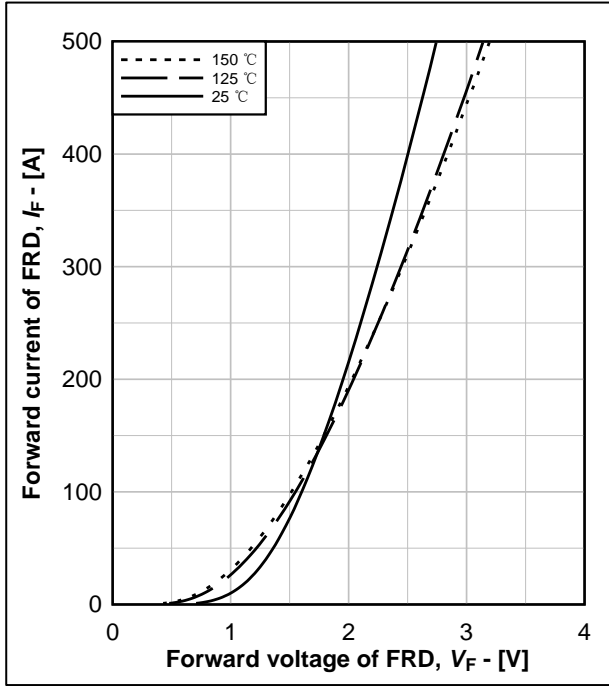


图 7. FRD 输出特性典型曲线, $I_F = f(V_F)$ Fig.7
Typical FRD output characteristics, $I_F = f(V_F)$

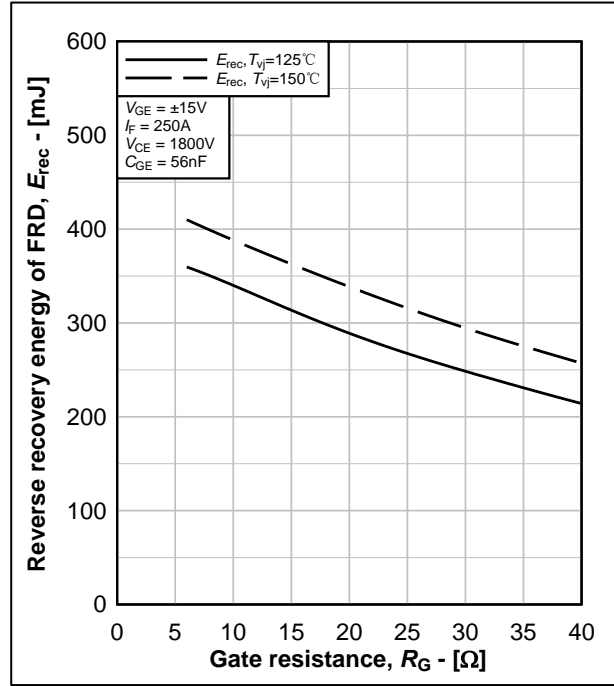


图 8. FRD 反向恢复能耗典型曲线, $E_{rec} = f(R_G)$ Fig.8
Typical FRD E_{rec} , $E_{rec} = f(R_G)$

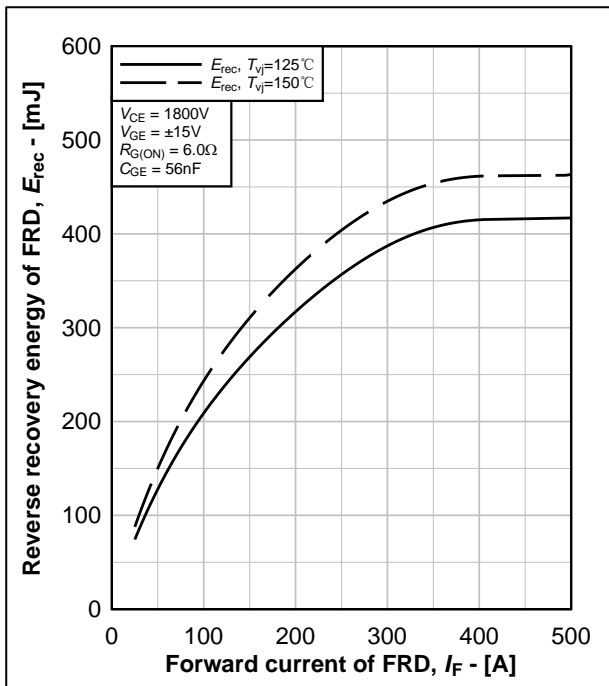


图 9. FRD 反向恢复能耗典型曲线, $E_{rec} = f(I_F)$ Fig.9
Typical FRD E_{rec} , $E_{rec} = f(I_F)$

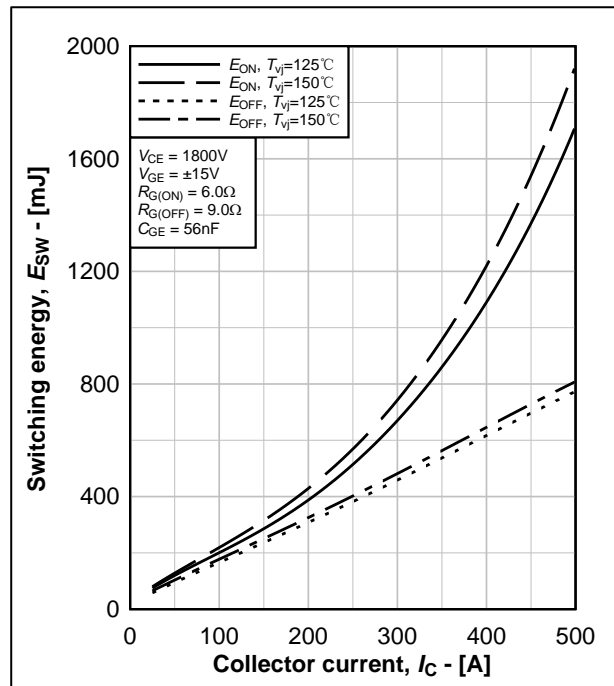


图 10. IGBT 开关能耗典型曲线, $E_{on} = f(I_C)$, $E_{off} = f(I_C)$ Fig.10
Typical IGBT switching energy, $E_{on} = f(I_C)$, $E_{off} = f(I_C)$

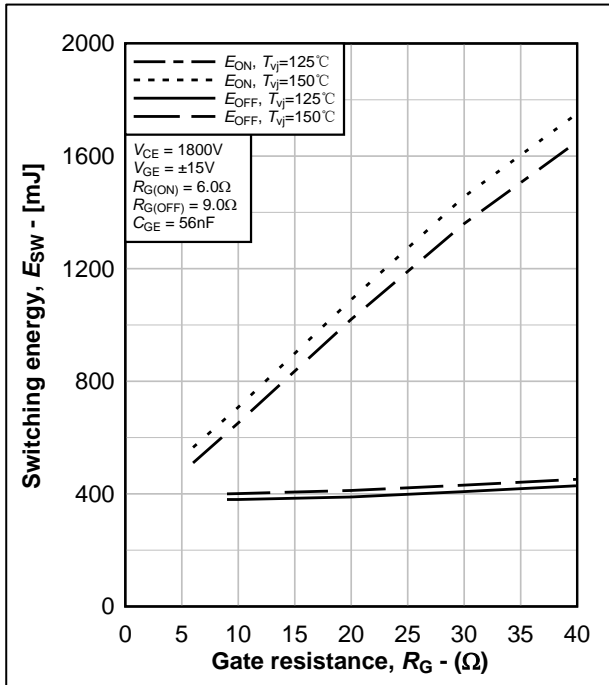

 图 11. IGBT 开关能耗典型曲线, $E_{on} = f(R_G)$, $E_{off} = f(R_G)$

Fig.11 Typical IGBT switching energy,

$$E_{on} = f(R_G), E_{off} = f(R_G)$$

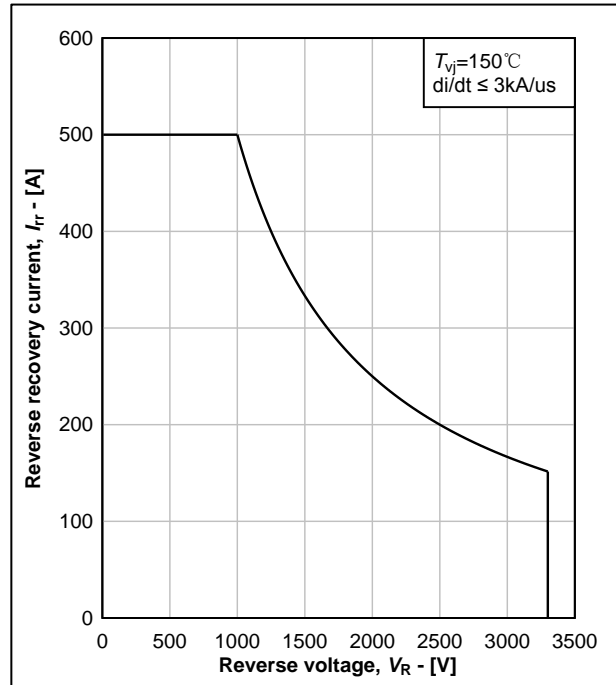


图 12. 二极管反偏安全工作区

Fig.12 Diode reverse bias safe operating area

$$I_{rr} = f(V_R)$$

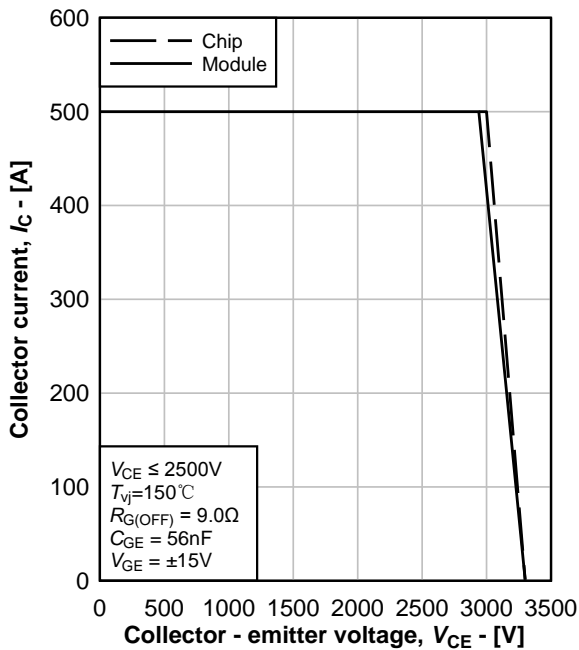

 图 13. IGBT 反偏安全工作区, $I_c = f(V_{CE})$

Fig.13 Reverse bias safe operating area of IGBT,

$$I_c = f(V_{CE})$$

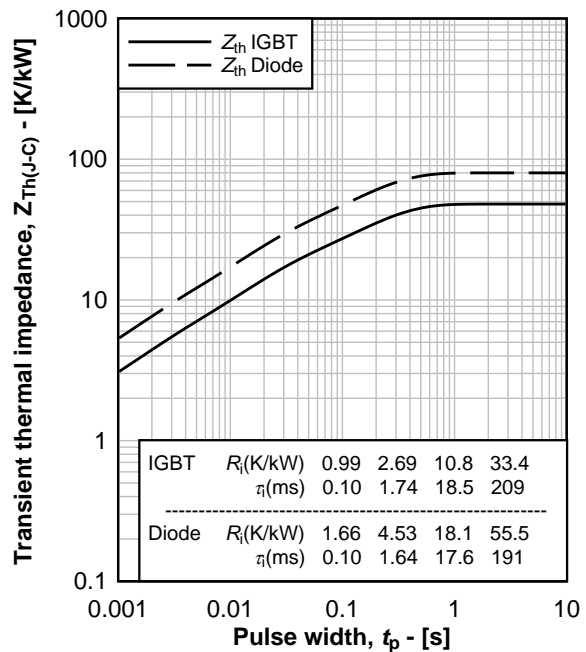
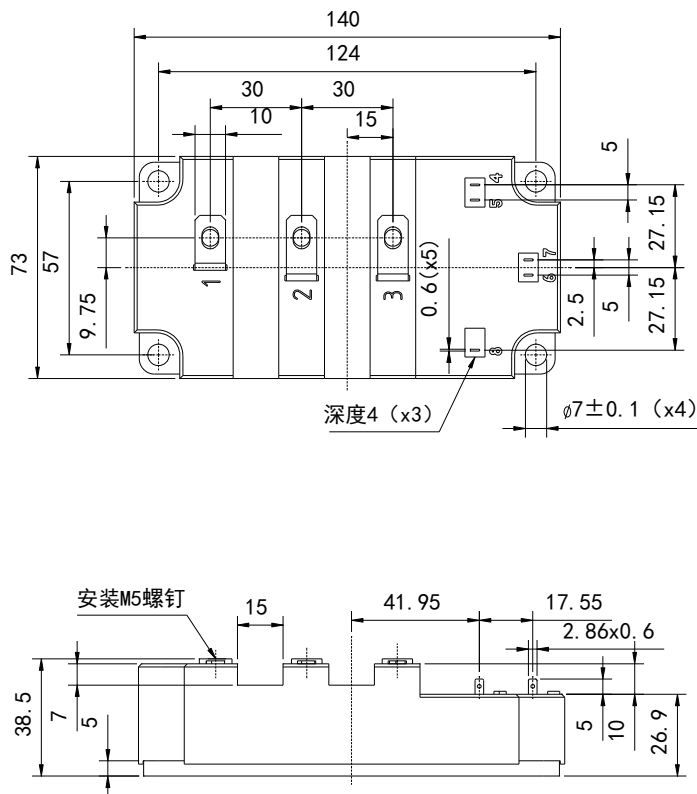

 图 14. 瞬态热阻抗曲线, $Z_{Th(J-C)} = f(t)$

 Fig.14 Transient thermal impedance, $Z_{Th(J-C)} = f(t)$



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

图 14. 模块外观尺寸

Fig. 14 Module outlines

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