



产品数据手册 Product Datasheet 版本 Ver 22.01

TG650PC17H2-S300

斩波管型 IGBT 模块 Chopper Switch IGBT

关键参数

Key Parameters

V_{CES}		1700	V
$V_{CE(sat)}$	Typ.	1.85	V
I_C	Max.	650	A
$I_{C(RM)}$	Max.	1300	A

典型应用

Typical Applications

● 马达驱动	Motor Drives
● 大功率变流器	High Power Converters
● 风力发电机	Wind Turbines
● 高可靠性逆变器	High Reliability Inverter

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
● 高电流密度	High Current Density

电路结构

Circuit Configuration

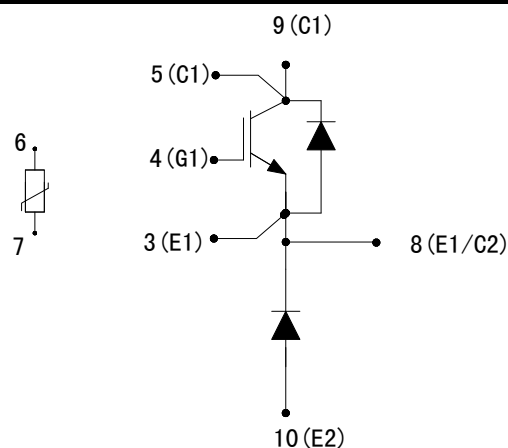


图 1. 电路结构

Fig. 1 Circuit configuration

模块外形

Module Appearance



图 2. 模块外形

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	$V_{GE} = 0V, T_C = 25\text{ }^{\circ}\text{C}$	1700	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	$T_C = 95\text{ }^{\circ}\text{C}$	650	A
$I_{C(PK)}$	集电极峰值电流 Peak collector current	$t_P = 1\text{ms}$	1300	A
P_{max}	晶体管部分最大损耗 Max. transistor power dissipation	$T_{vj} = 150\text{ }^{\circ}\text{C}, T_C = 25\text{ }^{\circ}\text{C}$	4.16	kW
f_t	二极管 f_t 值 Diode f_t	$V_R = 0V, t_P = 10\text{ms}, T_{vj} = 150\text{ }^{\circ}\text{C}$	64	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	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	19.0	mm
	端子-端子 Terminal to terminal	19.0	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				30	K / kW
$R_{th(J-C)} Diode$	二极管结壳热阻 Thermal resistance – Diode				54	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		19.5		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		35		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 - M5 Mounting - M5	3		6	Nm
		电路互连用- M4 Electrical connections - M4	1.8		2.1	Nm
		电路互连用 - M8 Electrical connections - M8	8		10	Nm

热敏电阻数据

NTC-Thermistor 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_{25}	额定电阻值 Rated resistance	$T_C = 25\text{ }^{\circ}\text{C}$		5		kΩ
$\Delta R/R$	R100 偏差 Deviation of R100	$T_C = 100\text{ }^{\circ}\text{C}$, $R_{100}=493\Omega$	-5		5	%
P_{25}	耗散功率 Power dissipation	$T_C = 25\text{ }^{\circ}\text{C}$			20	mW
$B_{25/50}$	B-值 B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15\text{ K}))]$		3375		K
$B_{25/80}$	B-值 B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298.15\text{ K}))]$		3411		K
$B_{25/100}$	B-值 B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298.15\text{ K}))]$		3433		K

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
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{vj} = 125\text{ }^{\circ}\text{C}$			15	mA
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{vj} = 150\text{ }^{\circ}\text{C}$			20	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	$I_C = 40\text{mA}, V_{GE} = V_{CE}$	5.70	6.30	6.90	V
$V_{CE(sat)}^{(*1)}$	集电极-发射极饱和电压 Collector-emitter saturation voltage	$V_{GE} = 15V, I_C = 650A$		1.85	2.25	V
		$V_{GE} = 15V, I_C = 650A, T_{vj} = 125\text{ }^{\circ}\text{C}$		2.20		V
		$V_{GE} = 15V, I_C = 650A, T_{vj} = 150\text{ }^{\circ}\text{C}$		2.30		V
I_F	二极管正向直流电流 Diode forward current	DC		650		A
I_{FRM}	二极管正向重复峰值电流 Diode peak forward current	$t_P = 1\text{ms}$		1300		A
$V_F^{(*1)}$	二极管正向电压 Diode forward voltage	$I_F = 650A, V_{GE} = 0$		1.80	2.20	V
		$I_F = 650A, V_{GE} = 0, T_{vj} = 125\text{ }^{\circ}\text{C}$		1.90		V
		$I_F = 650A, V_{GE} = 0, T_{vj} = 150\text{ }^{\circ}\text{C}$		1.90		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		3300		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).



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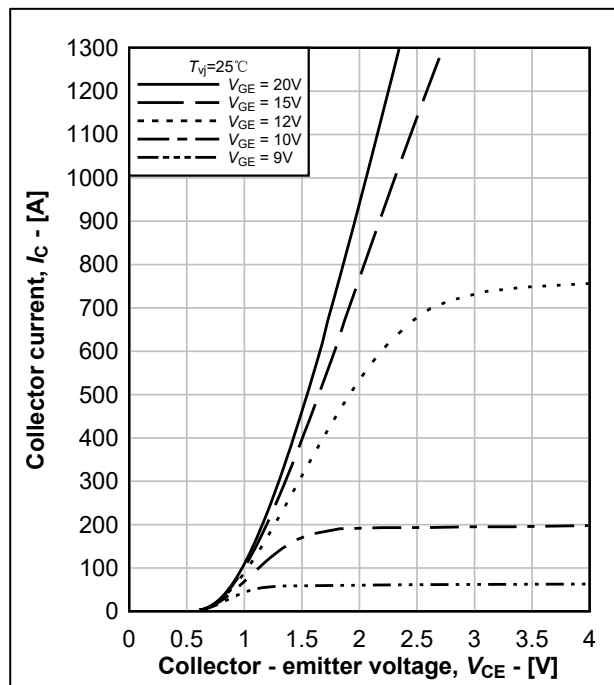
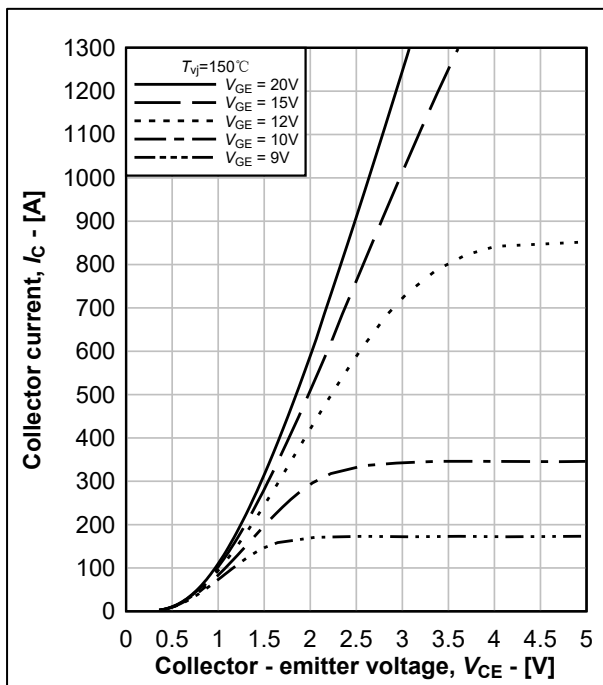
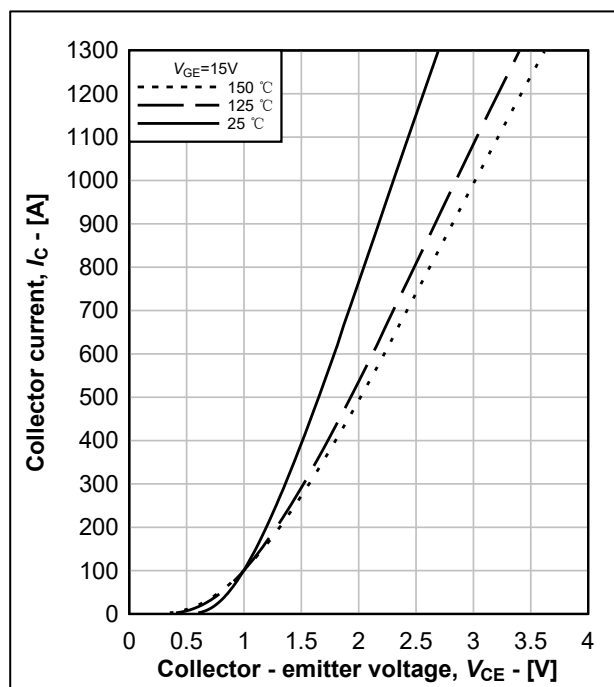
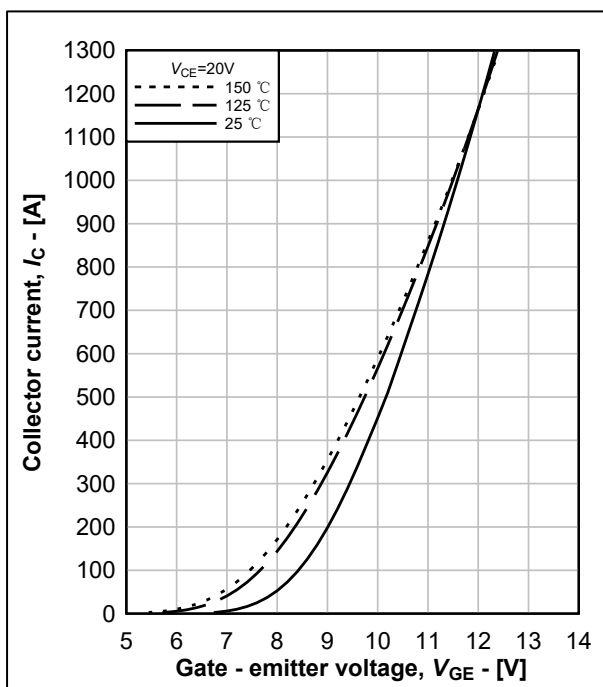
符号 Symbol	参数名称 Parameter	条件 Test Conditions	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
C_{ies}	输入电容 Input capacitance	$V_{CE} = 25V, V_{GE} = 0V,$ $f = 100kHz$		83		nF
Q_g	栅极电荷 Gate charge	$\pm 15V$		7.7		μC
C_{res}	反向传输电容 Reverse transfer capacitance	$V_{CE} = 25V, V_{GE} = 0V,$ $f = 100kHz$		1.0		nF
L_M	模块电感 Module inductance			18		nH
$R_{CC'+EE'}$	模块引线电阻, 端子-芯片 Module lead resistance, terminal-chip			0.3		m 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 =650A, V_{CE} = 900V, V_{GE} = ± 15V, $R_{G(OFF)}$ = 2.7Ω, L_S = 70nH, dv/dt =4500V/μs (T_{vj} = 150 °C).	T_{vj} = 25 °C		1055		ns
			T_{vj} = 125 °C		1145		
			T_{vj} = 150°C		1170		
t_f	下降时间 Fall time		T_{vj} = 25 °C		360		ns
			T_{vj} = 125 °C		450		
			T_{vj} = 150°C		550		
E_{OFF}	关断损耗 Turn-off energy loss		T_{vj} = 25 °C		155		mJ
			T_{vj} = 125 °C		200		
			T_{vj} = 150°C		210		
$t_{d(on)}$	开通延迟时间 Turn-on delay time	T_{vj} = 25 °C		495		ns	
		T_{vj} = 125 °C		485			
		T_{vj} = 150°C		480			
t_r	上升时间 Rise time	T_{vj} = 25 °C		170		ns	
		T_{vj} = 125 °C		170			
		T_{vj} = 150°C		160			
E_{ON}	开通损耗 Turn-on energy loss	T_{vj} = 25 °C		165		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		155		μC	
		T_{vj} = 125 °C		250			
		T_{vj} = 150°C		280			
I_{rr}	二极管反向恢复电流 Diode reverse recovery current	T_{vj} = 25 °C		610		A	
		T_{vj} = 125 °C		700			
		T_{vj} = 150°C		780			
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy	T_{vj} = 25 °C		100		mJ	
		T_{vj} = 125 °C		165			
		T_{vj} = 150°C		190			

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

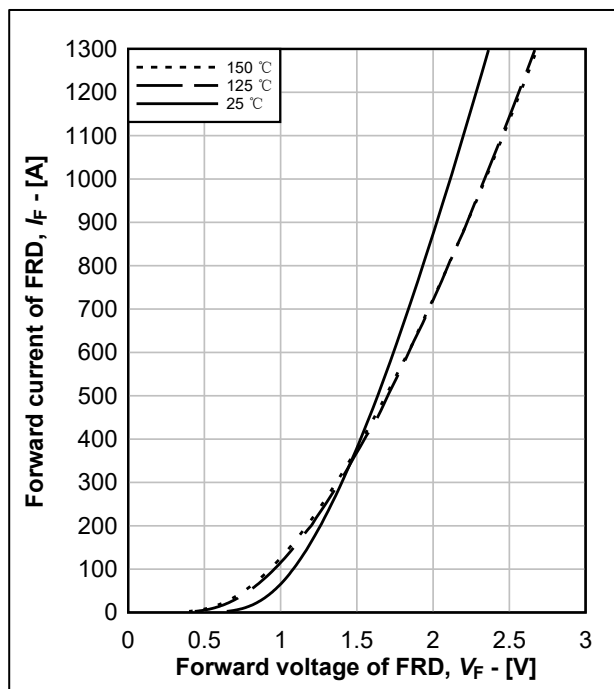

图 7. FRD 输出特性典型曲线, $I_F = f(V_F)$

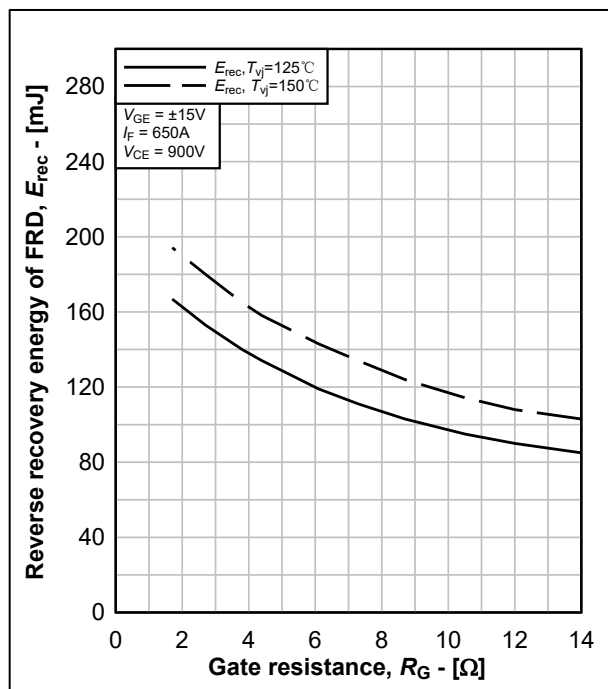
Fig.7 Typical FRD output characteristics, $I_F = f(V_F)$

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

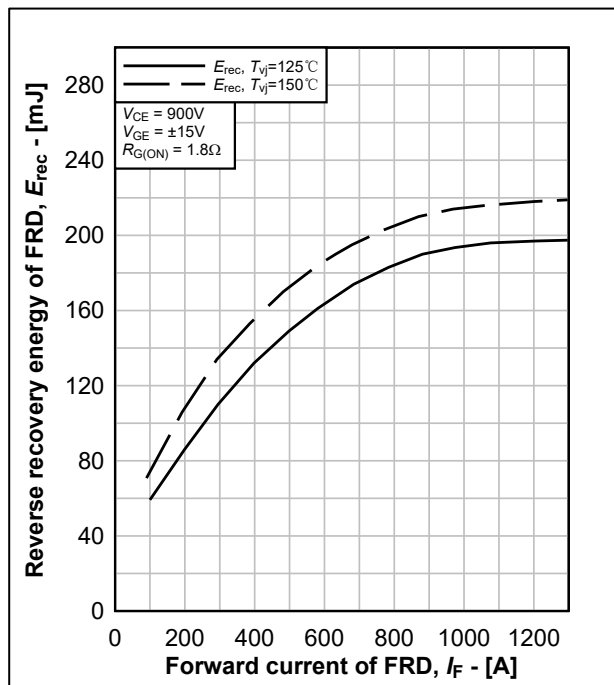
Fig.8 Typical FRD E_{rec} , $E_{rec} = f(R_G)$

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

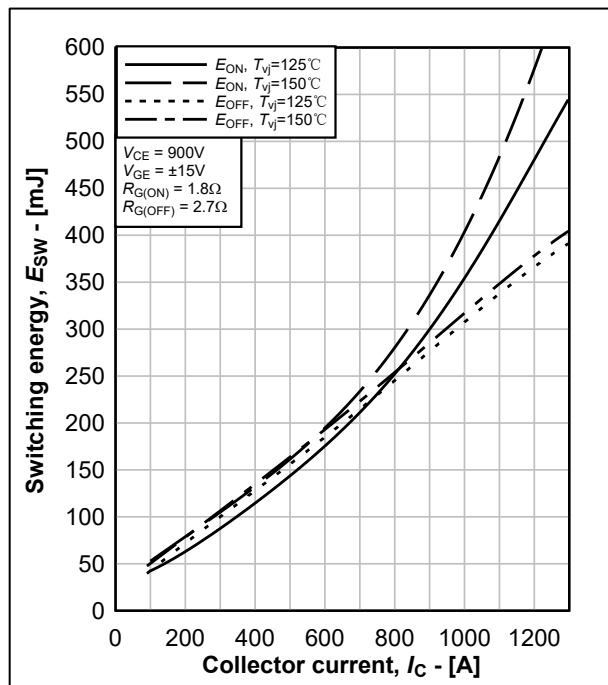
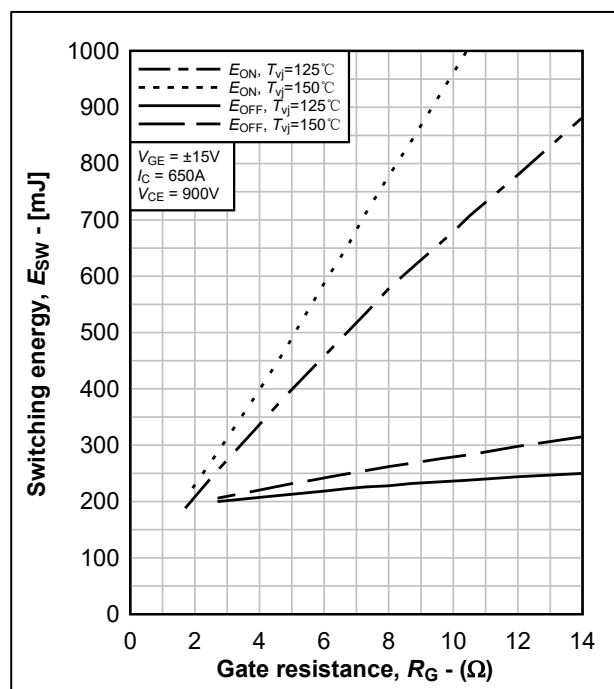
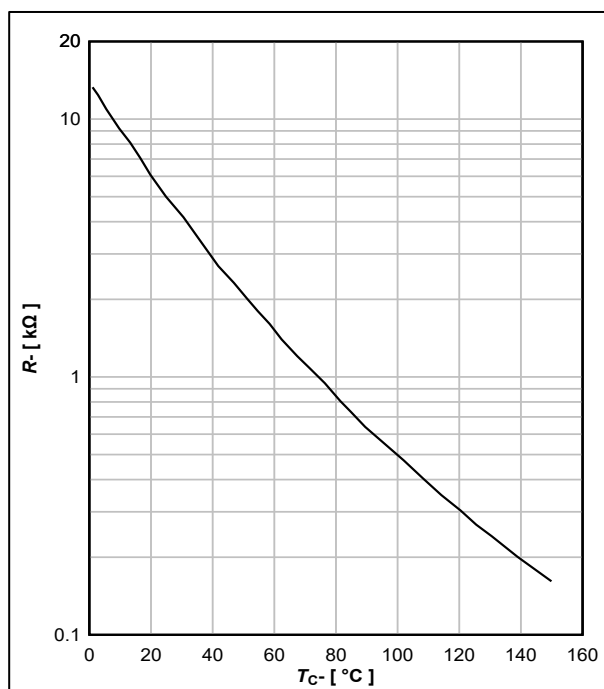
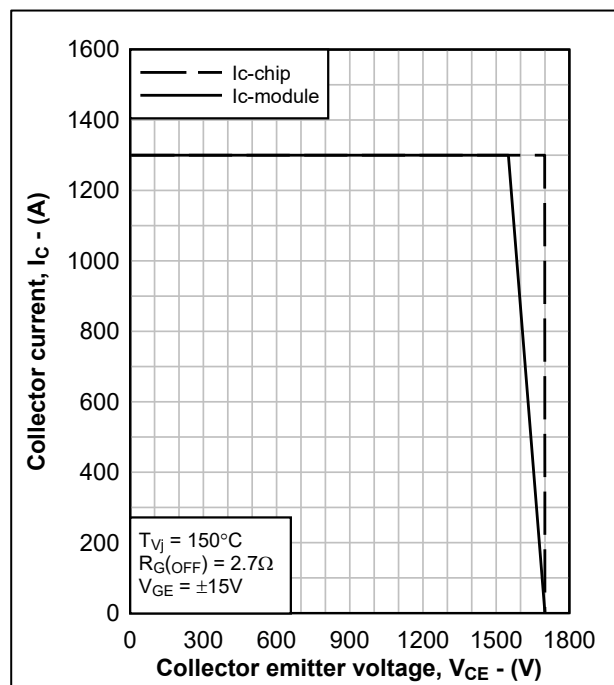
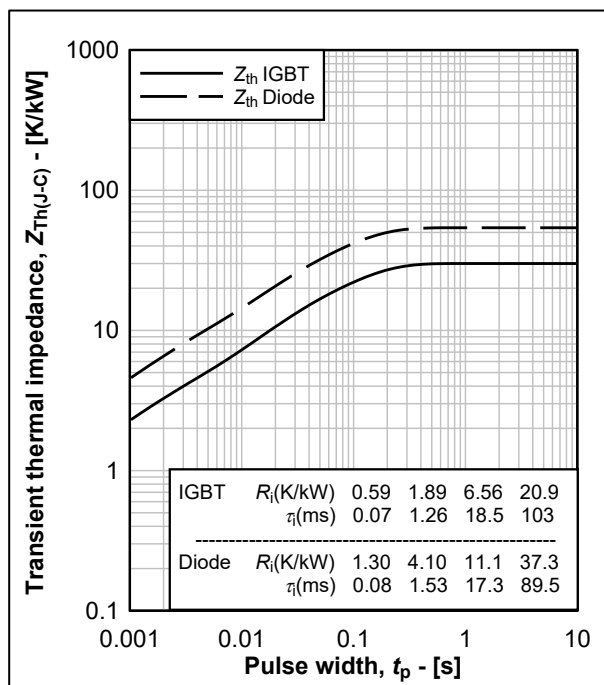
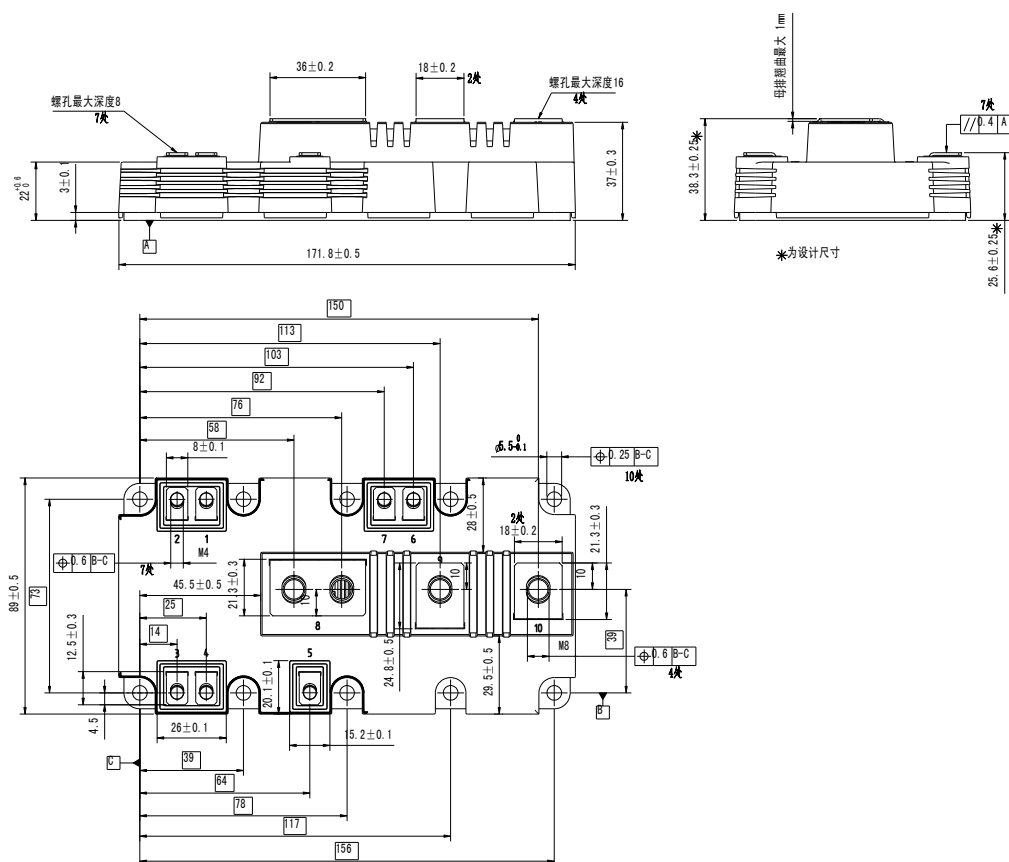
Fig.9 Typical FRD E_{rec} , $E_{rec} = f(I_F)$

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. 热敏电阻典型特性曲线, $R = f(T_C)$ Fig.12 Typical NTC thermistor characteristic, $R = f(T_C)$ 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: 900g 模块外观类型 Module outline code: H2

图 15. 模块外观尺寸

Fig. 15 Module outlines

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