

关键参数		Key Parameters	
V_{CES}		4500	V
$V_{CE(sat)}$	Typ.	2.50	V
I_C	Max.	5000	A
$I_{C(RM)}$	Max.	10000	A

典型应用	Typical Applications
● 柔直换流阀	MMC-HVDC Valve
● 直流断路器	DC Breaker
● 海上风电	Off-shore Wind Power
● 大型工业传动	Large-scale Industrial Drive

特点	Features
● 双面散热	Double-side Cooling
● 失效短路	Short-circuit Failure Mode
● 高热循环能力	High Thermal Cycling Capability
● 低杂散电感	Low Stray Inductance

电路结构	Circuit Configuration
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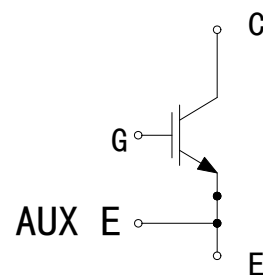


图 1. 电路结构

Fig. 1 Circuit configuration

模块外形	Module Appearance
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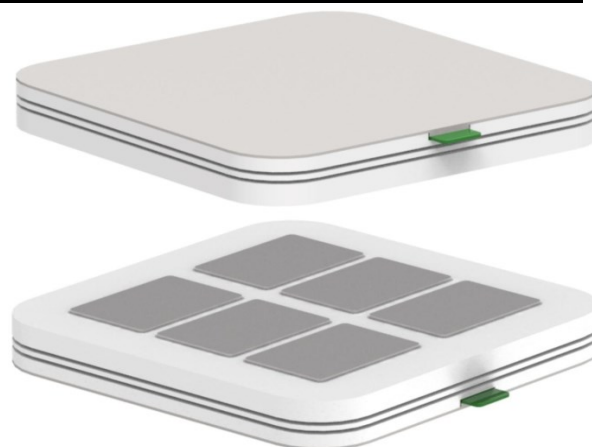


图 2. 模块外形

Fig. 2 Module appearance

模块标签说明
Module Label Code Instruction

 18BC00670027	数据位置	数据内容
	Data position	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	$V_{GE} = 0V, T_C = 25\text{ }^{\circ}\text{C}$	4500	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	$T_C = 90\text{ }^{\circ}\text{C}$	5000	A
$I_{C(PK)}$	集电极峰值电流 Peak collector current	$t_P = 1\text{ms}$	10000	A
P_{max}	晶体管部分最大损耗 Max. transistor power dissipation	$T_{vj} = 135^{\circ}\text{C}, T_C = 25\text{ }^{\circ}\text{C}$	61.1	kW

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
$R_{th(J-C)} \text{ IGBT}$	IGBT 结壳热阻 Thermal resistance – IGBT	双面散热 Double-side cooling			1.8	K / kW
$R_{th(C-H)} \text{ IGBT}$	接触热阻(IGBT) Thermal resistance – case to heatsink (IGBT)	压装力 85kN Clamping Force 85kN		0.5		K / kW
T_{vj}	工作结温 Operating junction temperature				135	°C
T_{stg}	存储温度 Storage temperature range		-40		125	°C
M	压装力 Clamping Force		85		100	kN

电特性值
Electrical Characteristics

 除非特别声明, 否则 $T_C = 25^\circ\text{C}$
 $T_C = 25^\circ\text{C}$ 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
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_C = 135^\circ\text{C}$		50	100	mA
I_{GES}	栅极漏电流 Gate leakage current	$V_{GE} = \pm 20V, V_{CE} = 0V$			500	nA
$V_{GE(th)}$	栅极-发射极阈值电压 Gate threshold voltage	$I_C = 500mA, V_{GE} = V_{CE}$	5.5	6.0	6.5	V
$V_{CE(sat)}$	集电极-发射极饱和电压 Collector-emitter saturation voltage	$V_{GE} = 15V, I_C = 5000A$		2.50	2.80	V
		$V_{GE} = 15V, I_C = 5000A, T_{vj} = 135^\circ\text{C}$		3.20	3.65	V
I_{SC}	短路电流 Short circuit current	$T_{vj} = 135^\circ\text{C}, V_{CC} = 3600V,$ $V_{GE} \leq 15V, t_p \leq 10\mu s,$ $V_{CE(max)} = V_{CES} - L \times di/dt,$ IEC 60747-9		16200		A

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	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$		871		nF
Q_g	栅极电荷 Gate charge	$\pm 15V$		49		μC
C_{res}	反向传输电容 Reverse transfer capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$		11.0		nF
C_{oes}	输出电容 Output capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$		31		nF
L_{sCE}	模块杂散电感 Module stray inductance			1.5		nH
$R_{CC'+EE'}$	模块引线电阻, 端子-芯片 Module lead resistance, terminal-chip			10.8		$\mu\Omega$
R_{Gint}	内部栅极电阻 Internal gate resistor			0.56		Ω

电特性值
Electrical Characteristics

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
$t_{d(off)}$	关断延迟时间 Turn-off delay time	$I_C = 5000A,$ $V_{CE} = 2800V,$ $V_{GE} = \pm 15V,$ $R_{G(OFF)} = 10\Omega,$ $C_{GE} = 330nF,$ $L_S = 150nH,$ $dV/dt = 625V/\mu s,$ ($T_{vj} = 135^\circ C$)	$T_{vj} = 25^\circ C$		14679		ns
			$T_{vj} = 135^\circ C$		15474		
t_f	下降时间 Fall time		$T_{vj} = 25^\circ C$		1458		ns
			$T_{vj} = 135^\circ C$		2375		
E_{OFF}	关断损耗 Turn-off energy loss		$T_{vj} = 25^\circ C$		43.9		J
			$T_{vj} = 135^\circ C$		50.2		
$t_{d(on)}$	开通延迟时间 Turn-on delay time	$I_C = 5000A,$ $V_{CE} = 2800V,$ $V_{GE} = \pm 15V,$ $R_{G(ON)} = 0.43\Omega,$ $C_{GE} = 330nF,$ $L_S = 150nH,$ $di/dt = 5820A/\mu s,$ ($T_{vj} = 135^\circ C$)	$T_{vj} = 25^\circ C$		1402		ns
			$T_{vj} = 135^\circ C$		1456		
t_r	上升时间 Rise time		$T_{vj} = 25^\circ C$		673		ns
			$T_{vj} = 135^\circ C$		713		
E_{ON}	开通损耗 Turn-on energy loss		$T_{vj} = 25^\circ C$		18.6		J
			$T_{vj} = 135^\circ C$		26.3		

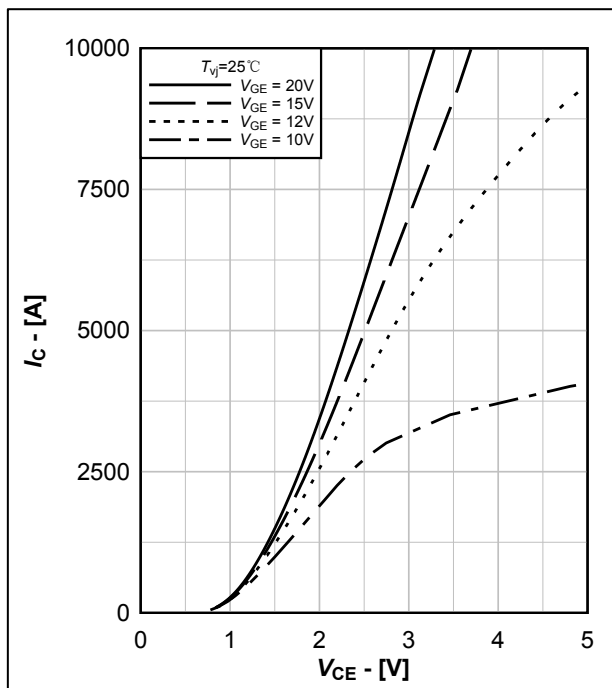

 图 3. IGBT 输出特性典型曲线, $I_c = f(V_{ce})$

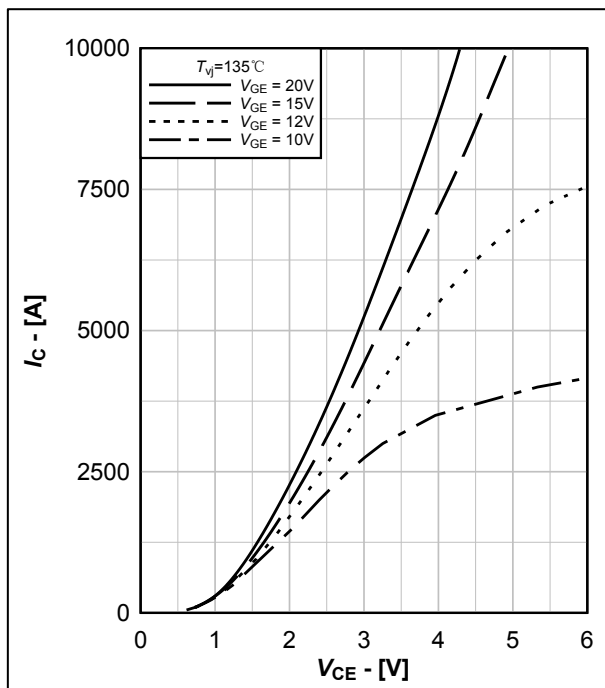
 Fig.3 Typical IGBT output characteristics, $I_c = f(V_{ce})$

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

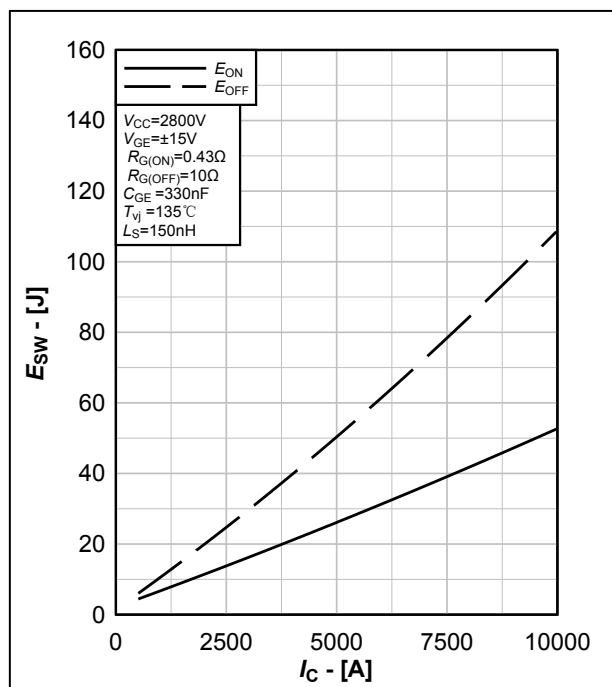
 Fig.4 Typical IGBT output characteristics, $I_c = f(V_{ce})$

 图 5. IGBT 开关能耗典型曲线, $E_{on} = f(I_c)$, $E_{off} = f(I_c)$

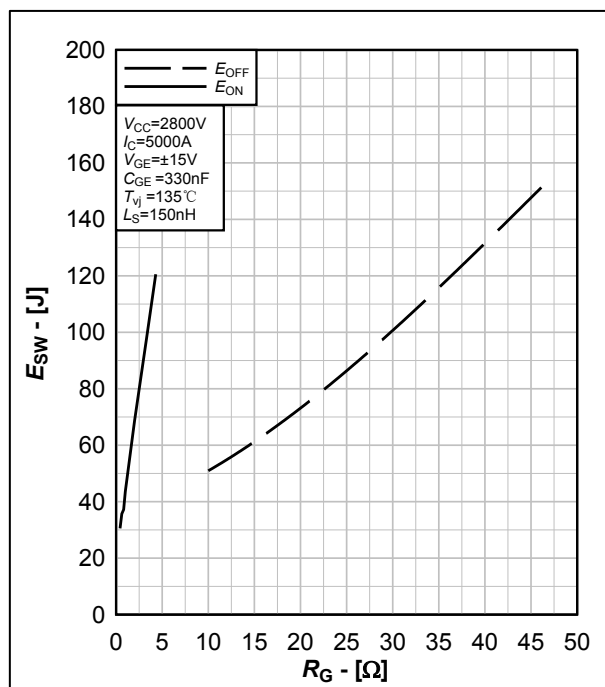
 Fig.5 Typical IGBT switching energy, $E_{on} = f(I_c)$, $E_{off} = f(I_c)$

 图 6. IGBT 开关能耗典型曲线, $E_{on} = f(R_g)$, $E_{off} = f(R_g)$

 Fig.6 Typical IGBT switching energy, $E_{on} = f(R_g)$, $E_{off} = f(R_g)$

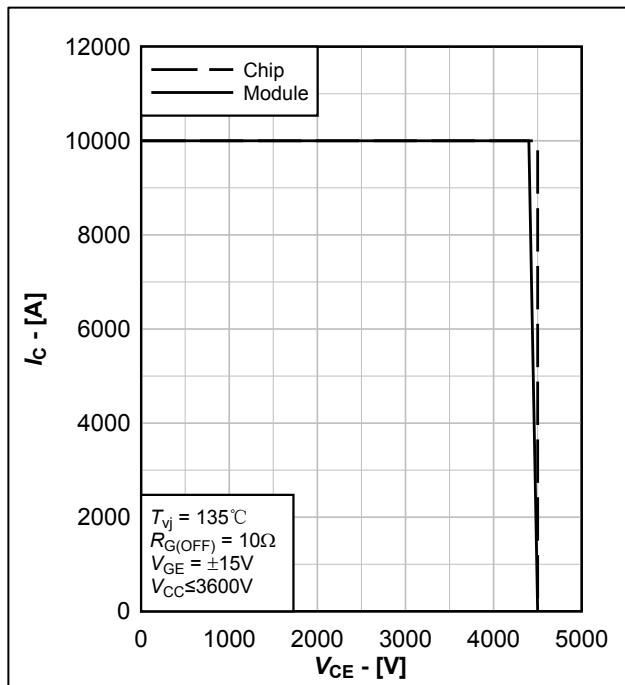


图 7. IGBT 反偏安全工作区, $I_C = f(V_{CE})$

Fig.7 Reverse bias safe operating area of IGBT, $I_C = f(V_{CE})$

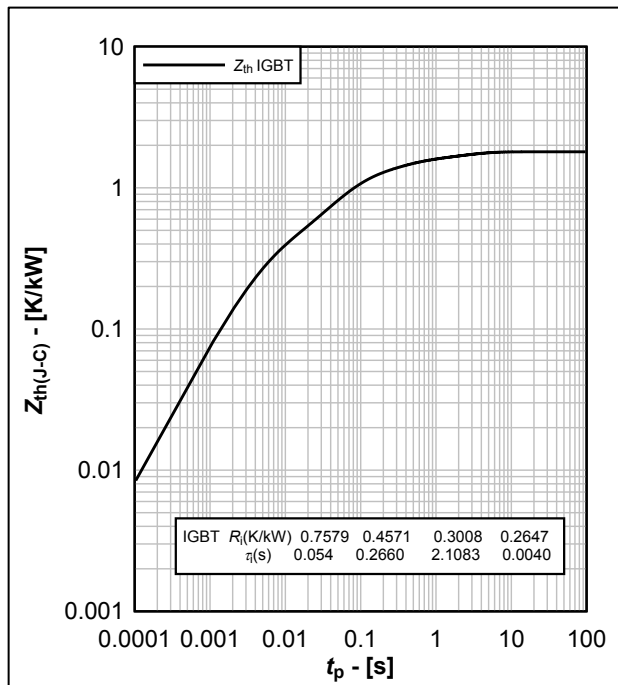
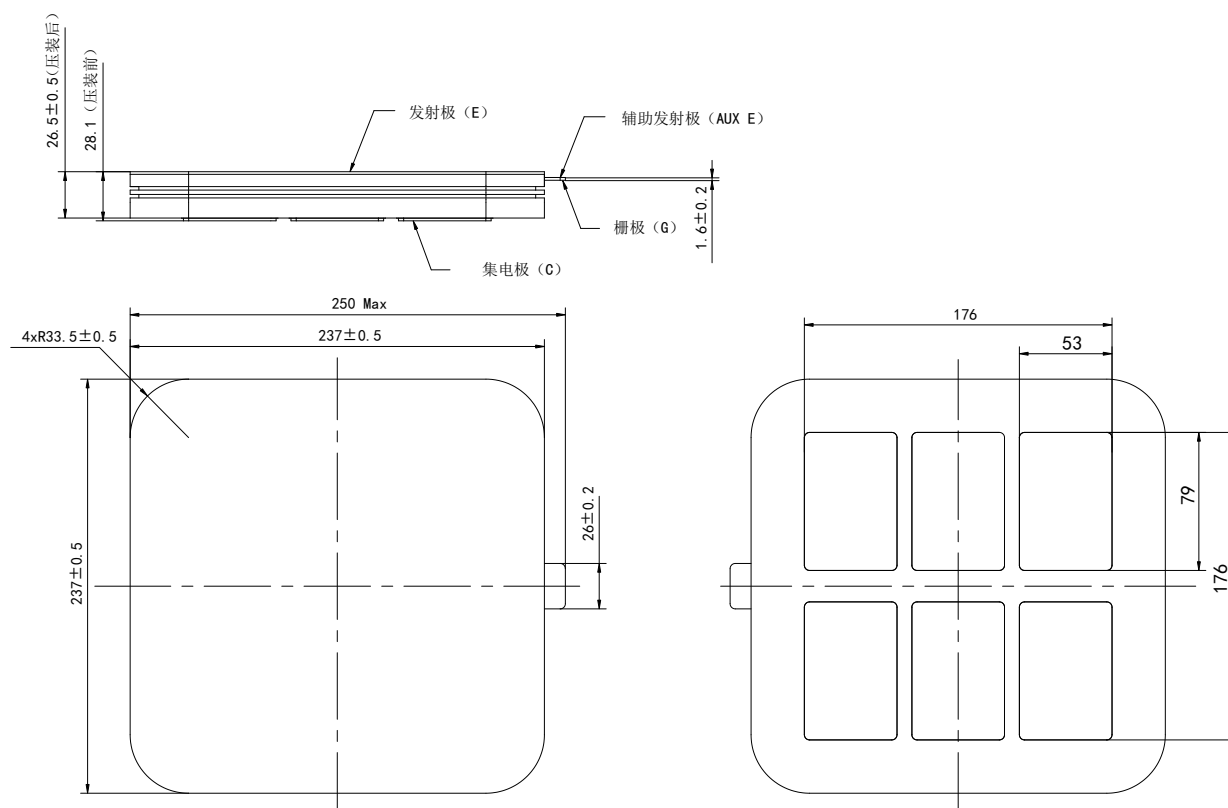


图 8. 瞬态热阻抗曲线, $Z_{th(J-C)} = f(t_p)$

Fig.8 Transient thermal impedance, $Z_{th(J-C)} = f(t_p)$



- 1、压接式IGBT单管，功率等级为4500V/5000A；
- 2、管壳材质为聚酯树脂+玻纤复合材料，CTI ≥ 600；
- 3、CE最小爬电距离40mm，CE最小电气间隙21mm；
- 4、使用压力范围85~100kN。

重量 Weight: 4750g

模块外观类型 Module outline code: ZF

图 9. 模块外观尺寸

Fig. 9 Module outlines

株洲中车时代半导体有限公司

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