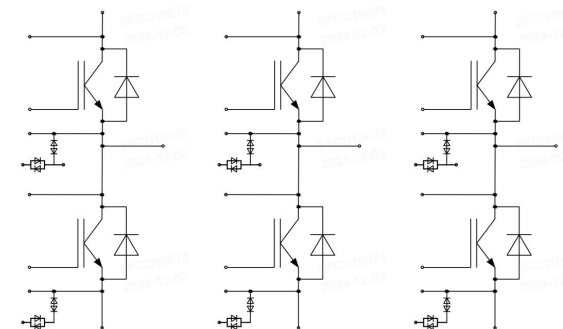


Six-Pack IGBT Module

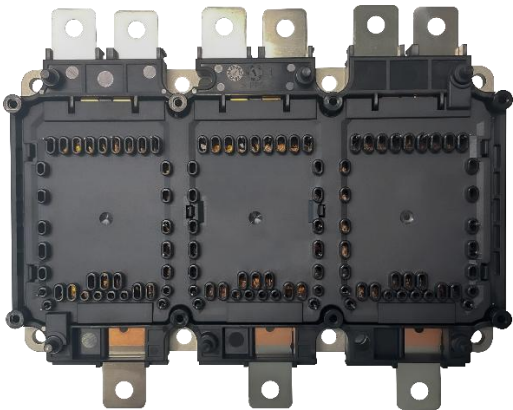
电气特性:

- 低开关损耗
Low switching losses
- Vcesat 正温度系数
Vcesat with positive temperature coefficient
- 芯片集成温敏二极管
Integrated on-chip temperature sensor



典型应用:

- 电动汽车
- 混合动力/纯电汽车
- 电机驱动



V_{CES} =1200V, I_{C nom} =800A / I_{CRM} =1600A

IGBT, 逆变器 / IGBT, Inverter

最大额定值 / Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
集电极-发射极电压 Collector-Emitter voltage	T _{vj} =25°C	V _{CES}	1200	V
连续集电极直流电流 Continuous DC collector current	T _f =65°C, T _{vj max} =175°C	I _{C nom}	800	A
集电极重复峰值电流 Repetitive peak collector current	t _p =1 ms	I _{CRM}	1600	A
总功率损耗 Total power dissipation	T _f = 65°C, T _{vj max} = 175°C	P _{tot}	1600	W
栅极-发射极电压 Gate emitter voltage		V _{GE}	+/-20	V

特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
集电极-发射极饱和电压 Collector-Emitter saturation voltage	$V_{GE}=15V, I_C=800A$ $V_{GE}=15V, I_C=800A$ $V_{GE}=15V, I_C=800A$	$T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=175^{\circ}C$	V_{CESat}	1.80 2.20 2.40	2.20	V
栅极-发射极阈值电压 Gate-Emitter threshold voltage	$I_C=10mA, V_{GE}=V_{CE}$	$T_{vj}=25^{\circ}C$	$V_{GE(th)}$	5.2	5.8	6.4
栅电荷 Gate charge	$V_{GE}=-15V \dots +15V$		Q_G	7.2		μC
内部栅极电阻 Internal gate resistor	$T_{vj}=25^{\circ}C$		R_{Gint}	0.85		Ω
输入电容 Input capacitance	$f=100KHz$	$T_{vj}=25^{\circ}C$	C_{ies}	87.8		nF
反向传输电容 Reverse transfer capacitance	$V_{CE}=30V, V_{GE}=0V$		C_{res}	2.2		
集电极-发射极截止电流 Collector-emitter cut-off current	$V_{CE}=1200V, V_{GE}=0V$	$T_{vj}=25^{\circ}C$	I_{CES}		1	mA
栅极-发射极漏电流 Gate-emitter leakage current	$V_{CE}=0V, V_{GE}=20V$	$T_{vj}=25^{\circ}C$	I_{GES}		500	nA
开通延迟时间 Turn-on delay time	$I_C=800A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_{Gon}=2.5\Omega$ (电感负载)/(inductive load)	$T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=175^{\circ}C$	t_{don}	348 364 374		ns
上升时间 Rise time	$I_C=800A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_{Gon}=2.5\Omega$ (电感负载)/(inductive load)	$T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=175^{\circ}C$	t_r	103 127 143		
关断延迟时间 Turn-off delay time	$I_C=800A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_{Goff}=5\Omega$ (电感负载)/(inductive load)	$T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=175^{\circ}C$	t_{doff}	662 695 712		
下降时间 Fall time	$I_C=800A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_{Goff}=5\Omega$ (电感负载)/(inductive load)	$T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=175^{\circ}C$	t_f	109 162 177		
开通损耗能量（每脉冲） Turn-on energy loss per pulse	$I_C=800A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_{Gon}=2.5\Omega$ $di/dt=4500A/\mu s(T_{vj}=175^{\circ}C)$ (电感负载)/(inductive load)	$T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=175^{\circ}C$	E_{on}	74.6 109.1 128.0		
关断损耗能量（每脉冲） Turn-off energy loss per pulse	$I_C=800A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_{Goff}=5\Omega$ $dv/dt=4800V/\mu s(T_{vj}=175^{\circ}C)$ (电感负载)/(inductive load)	$T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=175^{\circ}C$	E_{off}	64.2 79.7 87.6		mJ
短路数据 SC data	$V_{GE} \leq 15V, V_{CC}=800V$ $V_{CEmax}=V_{CES}-L_{sCE} \cdot di/dt, t_p \leq 4\mu s,$ $T_{vj}=150^{\circ}C$		I_{SC}	2800		A
结-散热器热阻 Thermal resistance, junction to cooling fluid	Fluid = 50% water / 50% ethylene glycol, $V/\Delta t = 20 dm^3/min, T_f = 65^{\circ}C$		$R_{th, j-f}$		0.068	K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj op}$	-40	175	$^{\circ}C$

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二极管，逆变器 / Diode, Inverter

最大额定值 / Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
反向重复峰值电压 Repetitive peak reverse voltage	$T_{vj}=25^{\circ}\text{C}$	V_{RRM}	1200	V
连续正向直流电流 Continuous DC forward current		$I_{F,nom}$	800	A
正向重复峰值电流 Repetitive peak forward current	$t_p=1\text{ms}$	I_{FRM}	1600	A
I^2t 值 $I^2t\text{-value}$	$t_p=10\text{ms}$, $\sin 180^{\circ}$, $T_{vj}=125^{\circ}\text{C}$	I^2t	25000	A^2s

特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward voltage	$I_F=800\text{A}$, $V_{GE}=0\text{V}$ $I_F=800\text{A}$, $V_{GE}=0\text{V}$ $I_F=800\text{A}$, $V_{GE}=0\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	V_F		1.80 2.00 2.10	2.30	V
反向恢复峰值电流 Peak reverse recovery current	$I_F=800\text{A}$, $-di_F/dt=5400\text{A}/\mu\text{s}(T_{vj}=175^{\circ}\text{C})$ $V_R=600\text{V}$, $V_{GE}=-15\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	I_{RM}		681 633 599		A
恢复电荷 Recovered charge	$I_F=800\text{A}$, $-di_F/dt=5400\text{A}/\mu\text{s}(T_{vj}=175^{\circ}\text{C})$ $V_R=600\text{V}$, $V_{GE}=-15\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	Q_r		138 176 198		μC
反向恢复损耗（每脉冲） Reverse recovered energy	$I_F=800\text{A}$, $-di_F/dt=5400\text{A}/\mu\text{s}(T_{vj}=175^{\circ}\text{C})$ $V_R=600\text{V}$, $V_{GE}=-15\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	E_{rec}		59.5 73.7 80.9		mJ
在开关状态下温度 Temperature under switching conditions		$T_{vj\text{ op}}$	-40		175	$^{\circ}\text{C}$

温敏二极管 / Temperature sense diode

特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward voltage	$T_c=25^{\circ}\text{C}$, $I_{TS}=200\mu\text{A}$	V_{TS}		1.4		V
温度系数 Temperature coefficient	$I_{TS}=200\mu\text{A}$	α		-3.55		mv/ °C

模块 / Module

Parameter	Conditions	Symbol	Value			Unit
绝缘测试电压 Isolation test voltag	RMS, f=50Hz, t=1min	V_{ISOL}	4200			V
内部绝缘 Internal isolation	Basic insulation (class 1, IEC 61140)		Si_3N_4			
储存温度 Storage temperature		T_{stg}	-40		125	°C
模块安装的扭矩 Mounting torque for modul mounting		M	1.8	2.0	2.2	Nm
重量 Weight		W		672		g

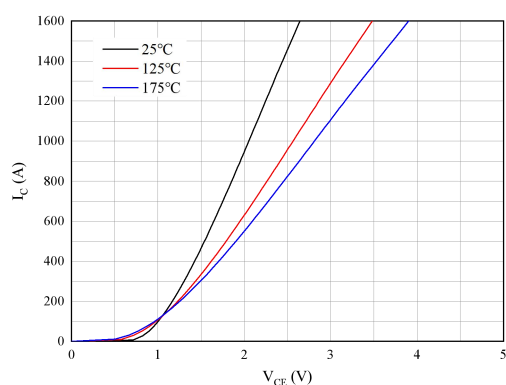
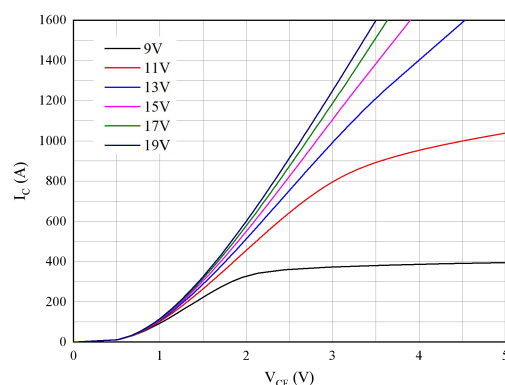
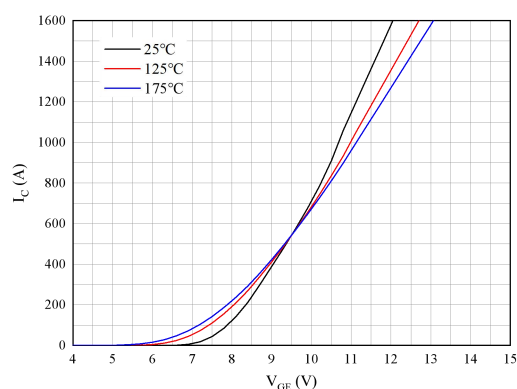
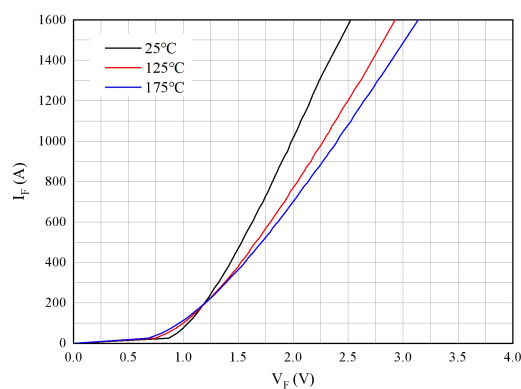
图 1. 典型输出特性 ($V_{GE}=15V$)Figure 1. Typical output characteristics ($V_{GE}=15V$)图 2. 典型输出特性 ($T_{vj}=175^{\circ}C$)Figure 2. Typical output characteristics ($T_{vj}=175^{\circ}C$)图 3. 典型传输特性($V_{CE}=20V$)Figure 3. Typical transfer characteristics ($V_{CE}=20V$)

图 4. 正向偏压特性 二极管

Figure 4. Forward characteristics of Diode

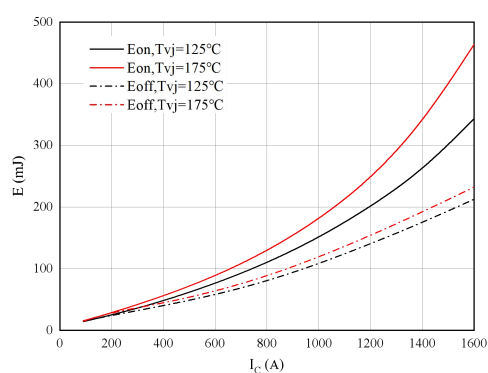


图 5. 开关损耗 逆变器

Figure 5. Switching losses of IGBT

$V_{GE}=\pm 15V$, $R_{Gon}=2.5\Omega$, $R_{Goff}=5\Omega$, $V_{CE}=600V$

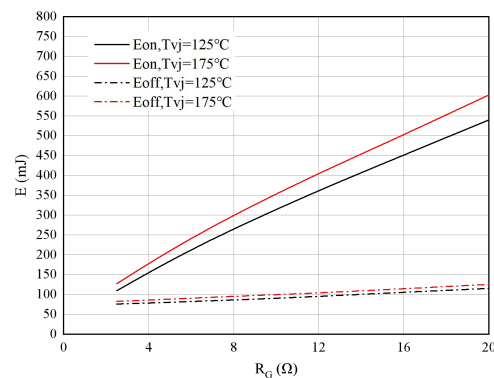


图 6. 开关损耗 逆变器

Figure 6. Switching losses of IGBT

$V_{GE}=\pm 15V$, $I_C=800A$, $V_{CE}=600V$

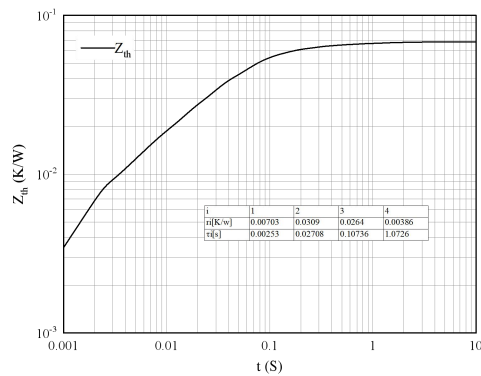


图 7. 瞬态热阻抗 IGBT 逆变器

Figure 7. Transient thermal impedance IGBT, Inverter

$$Z_{th}=f(t)$$

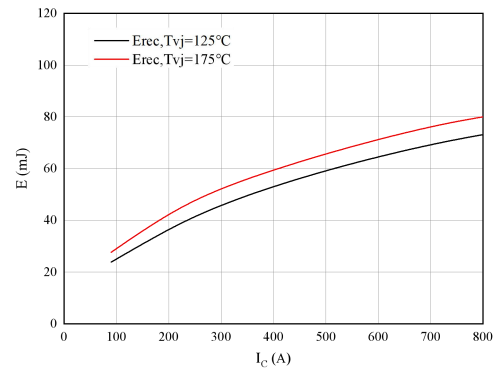


图 8. 开关损耗 二极管

Figure 8. Switching losses of Diode

$$R_{Gon}=2.5\Omega, V_{CE}=600V$$

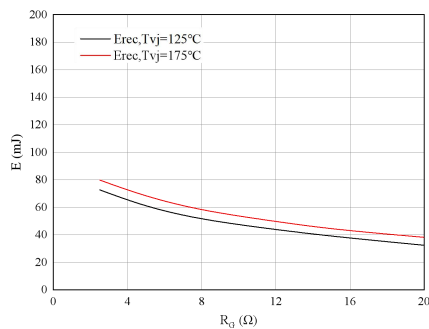


图 9. 开关损耗 二极管

Figure 9. Switching losses of Diode

$$I_F=800A, V_{CE}=600V$$

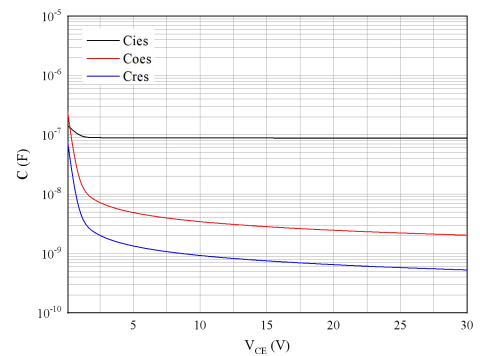


图 10. 电容特性

Figure 10. Capacitance characteristics

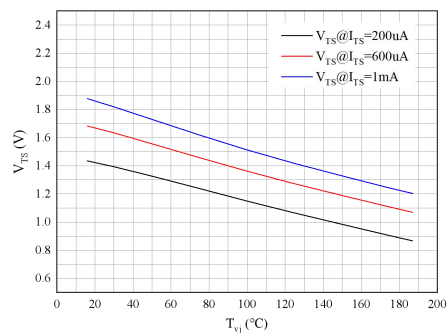
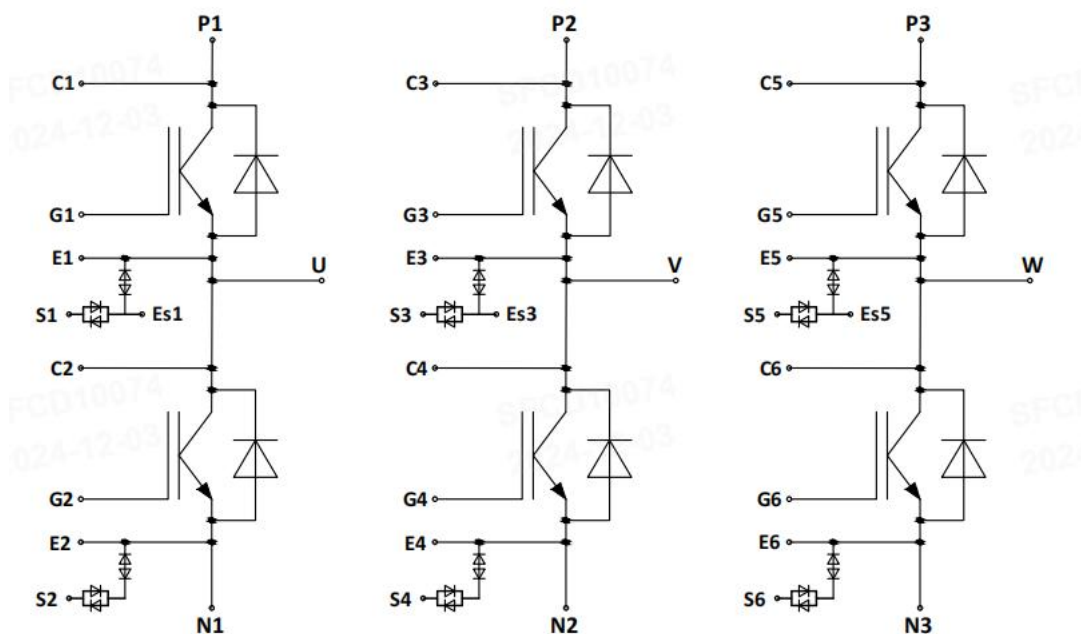


图 11. 温度特性 温敏二极管

Figure 11. Temperature sensor characteristics

接线图 / Circuit diagram

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封装尺寸 / Package outlines

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