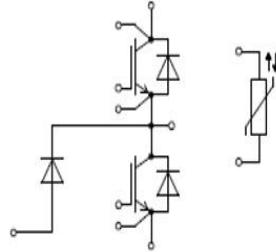


### 3-Level IGBT Module

电气特性:

- 1200V 沟槽栅/场终止工艺  
1200V trench gate/field termination process
- 低开关损耗  
Low switching losses
- Vcesat 正温度系数  
Vcesat has a positive temperature coefficient



典型应用:

- 三电平应用  
3-Level-Applications
  - 储能  
Energy storage inverter
  - APF  
Annual Performance Factor
  - UPS  
UPS Systems
- $V_{CES} = 1200V$ ,  $I_{C\ nom} = 450A$  /  $I_{CRM} = 900A$



### 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	$T_{vj}=25^\circ C$	$V_{CES}$	1200	V
连续集电极直流电流 Continuous DC collector current	$T_C=100^\circ C$ , $T_{vj\ max}=175^\circ C$	$I_{C\ nom}$	450	A
集电极重复峰值电流 Repetitive peak collector current	$t_p = 1\ ms$	$I_{CRM}$	900	A
总功率损耗 Total power dissipation	$T_C = 25^\circ C$ , $T_{vj\ max} = 175^\circ C$	$P_{tot}$	1250	W
栅极-发射极电压 Gate emitter voltage	$t_p \leq 0.5\ \mu s$ , $D < 0.001$	$V_{GE}$	$\pm 20$ 30	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 <sub>GE</sub> =15V, I <sub>C</sub> =450A V <sub>GE</sub> =15V, I <sub>C</sub> =450A V <sub>GE</sub> =15V, I <sub>C</sub> =450A	T <sub>vj</sub> =25°C T <sub>vj</sub> =125°C T <sub>vj</sub> =150°C	V <sub>CE sat</sub>	1.61	2.1	V
栅极-发射极阈值电压 Gate-Emitter threshold voltage	I <sub>C</sub> =17mA, V <sub>GE</sub> = V <sub>CE</sub>	T <sub>vj</sub> =25°C		1.89	1.96	
栅电荷 Gate charge	V <sub>GE</sub> =-15V...+15V			Q <sub>G</sub>	3.12	μC
内部栅极电阻 Internal gate resistor	T <sub>vj</sub> =25°C		R <sub>Gint</sub>	1.9		Ω
输入电容 Input capacitance	f=100kHz, V <sub>CE</sub> =25V, V <sub>GE</sub> =0 V	T <sub>vj</sub> =25°C	C <sub>ies</sub>	35.1		nF
反向传输电容 Reverse transfer capacitance			C <sub>res</sub>	1.4		
集电极-发射极截止电流 Collector-emitter cut-off current	V <sub>CE</sub> =1200V , V <sub>GE</sub> = 0 V	T <sub>vj</sub> =25°C	I <sub>CES</sub>		2	mA
栅极-发射极漏电流 Gate-emitter leakage current	V <sub>CE</sub> =0 V, V <sub>GE</sub> = 20 V	T <sub>vj</sub> =25°C	I <sub>GES</sub>		200	nA
开通延迟时间 Turn-on delay time	I <sub>C</sub> =450 A, V <sub>CE</sub> =600 V V <sub>GE</sub> =±15 V, R <sub>G</sub> =2.0Ω (电感负载) / (inductive load)	T <sub>vj</sub> =25°C T <sub>vj</sub> =125°C T <sub>vj</sub> =150°C	t <sub>d on</sub>	200		ns
上升时间 Rise time	I <sub>C</sub> =450 A, V <sub>CE</sub> =600 V V <sub>GE</sub> =±15 V, R <sub>G</sub> =2.0Ω (电感负载) / (inductive load)	T <sub>vj</sub> =25°C T <sub>vj</sub> =125°C T <sub>vj</sub> =150°C	t <sub>r</sub>	238		
关断延迟时间 Turn-off delay time	I <sub>C</sub> =450 A, V <sub>CE</sub> =600 V V <sub>GE</sub> =±15 V, R <sub>G</sub> =2.0Ω (电感负载) / (inductive load)	T <sub>vj</sub> =25°C T <sub>vj</sub> =125°C T <sub>vj</sub> =150°C	t <sub>d off</sub>	251		
下降时间 Fall time	I <sub>C</sub> =450 A, V <sub>CE</sub> =600 V V <sub>GE</sub> =±15 V, R <sub>G</sub> =2.0Ω (电感负载) / (inductive load)	T <sub>vj</sub> =25°C T <sub>vj</sub> =125°C T <sub>vj</sub> =150°C	t <sub>f</sub>	230		ns
开通损耗能量 (每脉冲) Turn-on energy loss per pulse	I <sub>C</sub> =450A,V <sub>CE</sub> =600V, V <sub>GE</sub> =±15V, R <sub>G</sub> =2.0Ω, di/dt=3300A/us(Tvj =150°C) (电感负载) / (inductive load)	T <sub>vj</sub> =25°C T <sub>vj</sub> =125°C T <sub>vj</sub> =150°C	E <sub>on</sub>	490		
关断损耗能量 (每脉冲) Turn-off energy loss per pulse	I <sub>C</sub> =450A,V <sub>CE</sub> =600V, V <sub>GE</sub> =±15V, R <sub>G</sub> =2.0Ω, du/dt=3700V/us(Tvj =150°C) (电感负载) / (inductive load)	T <sub>vj</sub> =25°C T <sub>vj</sub> =125°C T <sub>vj</sub> =150°C		502		
短路数据 SC data	V <sub>GE</sub> ≤15V, V <sub>CC</sub> =800V V <sub>CEmax</sub> =V <sub>CES</sub> ·L <sub>sCE</sub> ·di/dt   t <sub>p</sub> ≤10us, T <sub>vj</sub> =150°C			104		A
结-外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT		R <sub>thJC</sub>	1700	0.12	K/W
在开关状态下温度 Temperature under switching conditions			T <sub>vj op</sub>	-40	150	°C

二极管, 逆变&三电平 / Diode, Inverter&3-Level**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		$I_F$	450	A
正向重复峰值电流 Repetitive peak forward current	$t_p=1\text{ms}$	$I_{FRM}$	900	A
I <sub>2t</sub> -值 I <sub>2t</sub> -value	$V_R = 0\text{V}, t_p=10\text{ms}, T_{vj}=125^{\circ}\text{C}$	$I_{2t}$	33000	$\text{A}^2\text{s}$

**特征值 / Characteristic Values**

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward voltage	$I_F=450\text{A}, V_{GE}=0\text{V}$	$V_F$		1.99	2.50	V
	$I_F=450\text{A}, V_{GE}=0\text{V}$			1.81		
	$I_F=450\text{A}, V_{GE}=0\text{V}$			1.76		
反向恢复峰值电流 Peak reverse recovery current	$I_F=450\text{A}, V_R=600\text{V},$	$I_{RM}$		67		A
	$V_{GE}=-15\text{V}, R_G=2.0\Omega,$			115		
	$-\text{d}iF/\text{dt}=3300\text{A/us}(T_{vj}=150^{\circ}\text{C})$			124		
恢复电荷 Recovered charge	$I_F=450\text{A}, V_R=600\text{V},$	$Q_r$		25.65		$\mu\text{C}$
	$V_{GE}=-15\text{V}, R_G=2.0\Omega,$			70.72		
	$-\text{d}iF/\text{dt}=3300\text{A/us}(T_{vj}=150^{\circ}\text{C})$			82.98		
反向恢复损耗 (每脉冲) Reverse recovered energy	$I_F=450\text{A}, V_R=600\text{V},$	$E_{rec}$		7.78		mJ
	$V_{GE}=-15\text{V}, R_G=2.0\Omega,$			22.99		
	$-\text{d}iF/\text{dt}=3300\text{A/us}(T_{vj}=150^{\circ}\text{C})$			27.48		
结-外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode	$R_{thJC}$			0.20	K/W
在开关状态下温度 Temperature under switching conditions		$T_{vj op}$	-40		150	$^{\circ}\text{C}$

负温度系数热敏电阻 / NTC-Thermistor**特征值 / Characteristic Values**

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
额定电阻值 Rated resistances	$T_c=25^{\circ}\text{C}, \pm 5\%$	$R_{25}$		5.0		$\text{K}\Omega$
B-值 B-value	$\pm 2\%$	$B_{25/50}$		3375		K

**模块 / Module**

Parameter	Conditions	Symbol	Value		Unit
绝缘测试电压 Isolation test voltage	RMS, f=50Hz, t=1min	V <sub>ISOL</sub>	2500		V
内部绝缘 Internal isolation			Al <sub>2</sub> O <sub>3</sub>		
储存温度 Storage temperature		T <sub>stg</sub>	-40	125	°C
模块安装的扭矩 Mounting torque for modul mounting		M	3.0	6.0	Nm
端子联接扭距 Terminal connection torque		M	3.0	6.0	Nm
重量 Weight		W	340		g

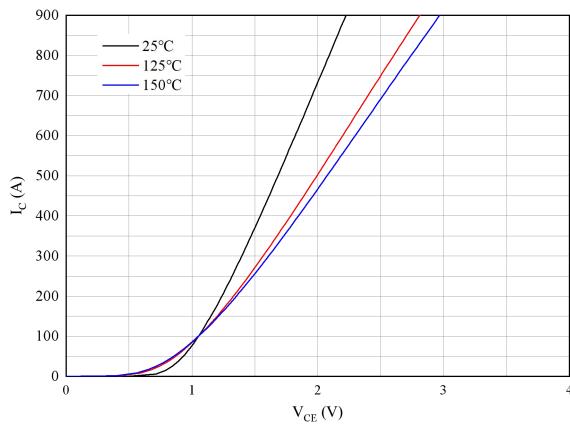
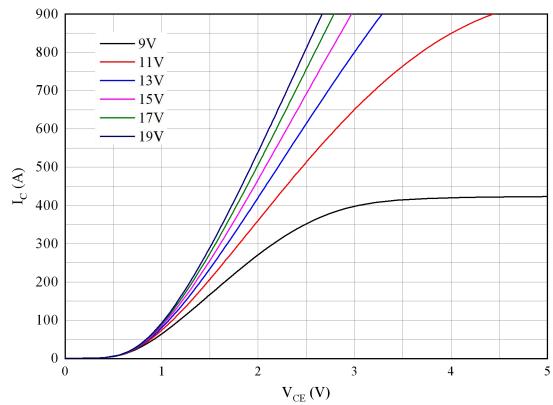
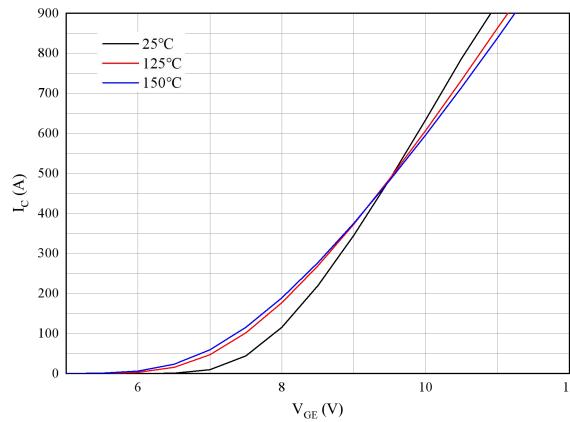
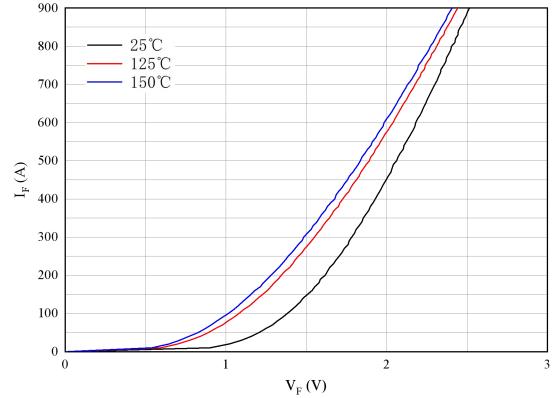
图 1. 典型输出特性 ( $V_{GE}=15V$ )Figure 1. Typical output characteristics ( $V_{GE}=15V$ )图 2. 典型输出特性 ( $T_{vj}=150^{\circ}C$ )Figure 2. Typical output characteristics ( $T_{vj}=150^{\circ}C$ )图 3. 典型传输特性 ( $V_{CE}=20V$ )Figure 3. Typical transfer characteristic( $V_{CE}=20V$ )

图 4. 正向偏压特性 二极管

Figure 4. Forward characteristic of Diode

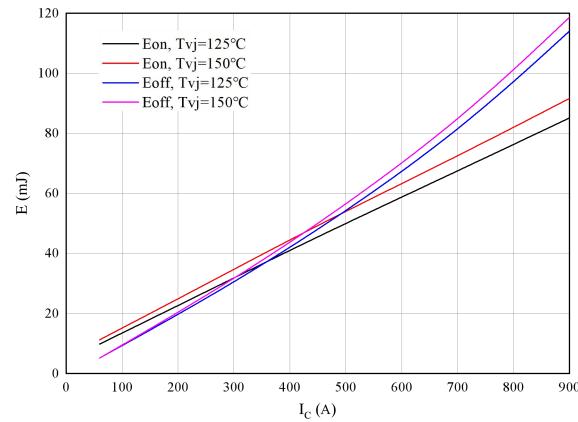


图 5. 开关损耗 逆变器

Figure 5. Switching losses of IGBT

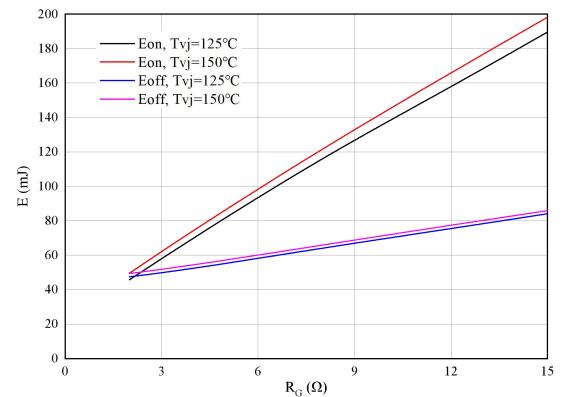
 $V_{GE}=\pm 15V$ ,  $R_{Gon}=2.0\Omega$ ,  $R_{Goff}=2.0\Omega$ ,  $V_{CE}=600V$ 

图 6. 开关损耗 逆变器

Figure 6. Switching losses of IGBT

 $V_{GE}=\pm 15V$ ,  $I_C=450A$ ,  $V_{CE}=600V$

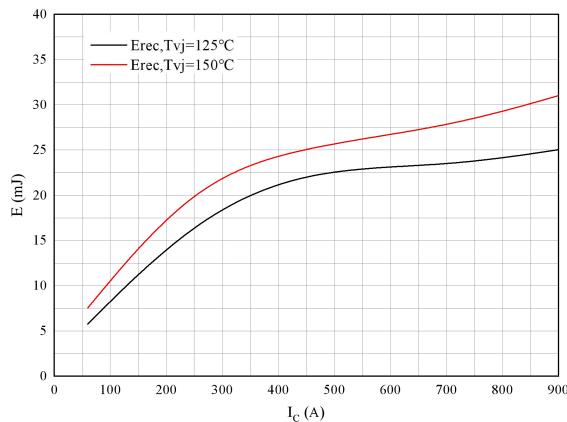


图 7. 开关损耗 二极管

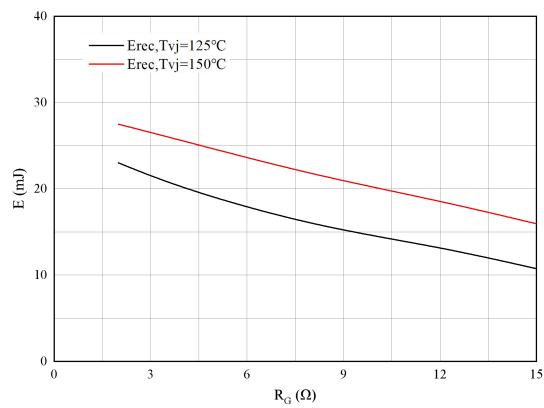
Figure 7. Switching losses of Diode  
RGon=2.0Ω, V<sub>CE</sub>=600V

图 8. 开关损耗 二极管

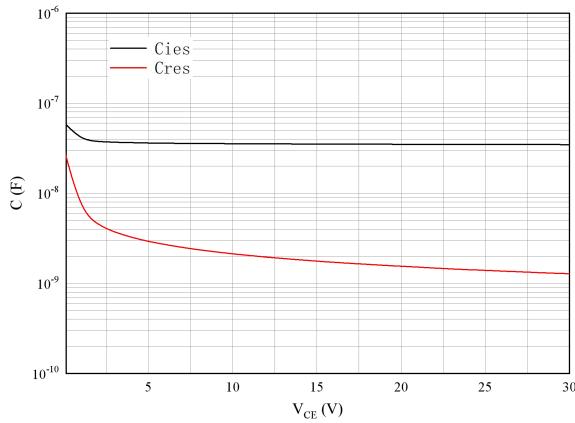
Figure 8. Switching losses of Diode  
I<sub>c</sub>=450A, V<sub>CE</sub>=600V

图 9. 电容特性

Figure 9. Capacitance characteristic

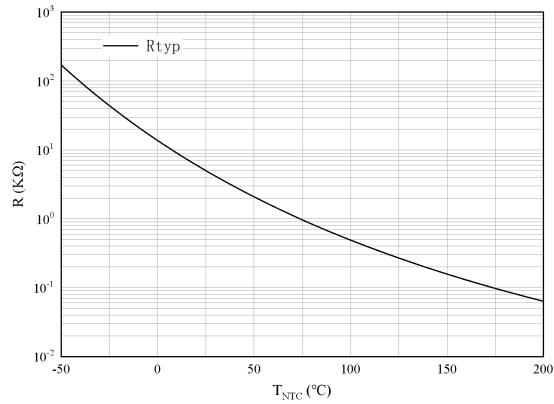


图 10. 负温系数热敏电阻 温度特性

Figure10. NTC-Thermistor-temperaturecharacteristic

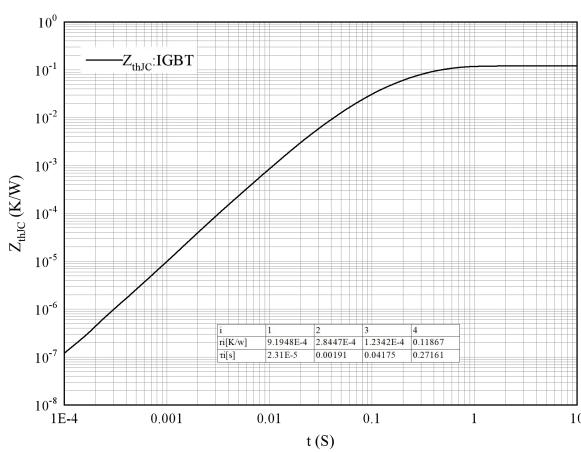


图 11. 瞬态热阻抗 IGBT 逆变器

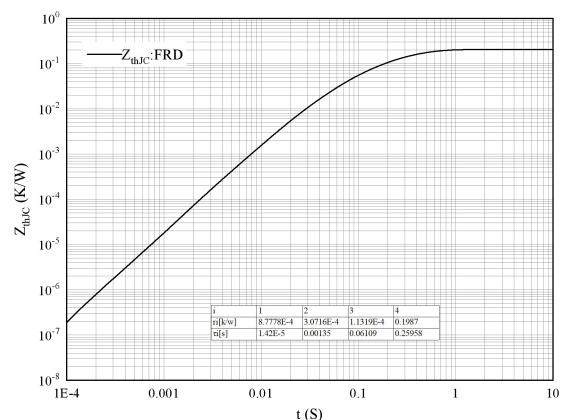
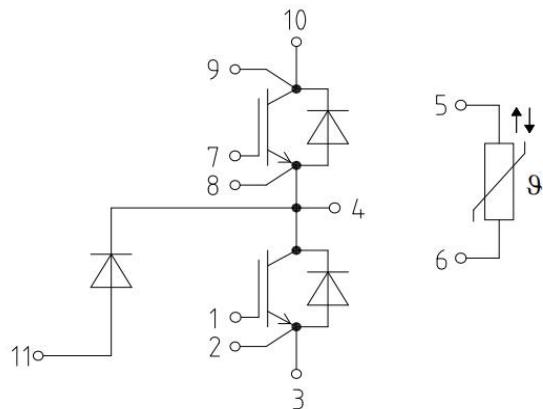
Figure11. Transient thermal impedance IGBT,Inverter  
Z<sub>thJC</sub>=f(t)

图 12. 瞬态热阻抗 FRD 逆变器

Figure12. Transient thermal impedance FRD ,Inverter  
Z<sub>thJC</sub>=f(t)

## 接线图 / Circuit diagram



## 封装尺寸 / Package outlines

