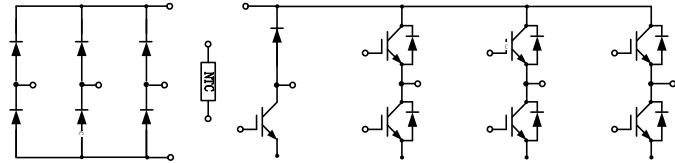


## PIM IGBT Module

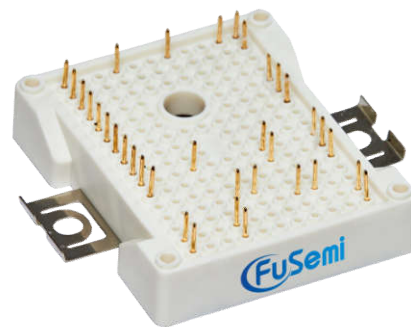
### 电气特性:

- 1200V 沟槽栅/场终止工艺
- 低开关损耗
- 正温度系数



### 典型应用:

- 变频器
- 伺服
- 逆变器



$V_{CES} = 1200V, I_{C\ nom} = 25A / I_{CRM} = 50A$

## 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	$T_C = 100^{\circ}C, T_{vj\ max} = 175^{\circ}C$	$I_{C\ nom}$	25	A
集电极重复峰值电流 Repetitive peak collector current	$t_p = 1\ ms$	$I_{CRM}$	50	A
总功率损耗 Total power dissipation	$T_C = 25^{\circ}C, T_{vj\ max} = 175^{\circ}C$	$P_{tot}$	175	W
栅极-发射极电压 Gate emitter voltage		$V_{GE}$	$\pm 20$	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	$V_{GE} = 15V, I_C = 25A$ $V_{GE} = 15V, I_C = 25A$ $V_{GE} = 15V, I_C = 25A$	$T_{vj} = 25^{\circ}C$ $T_{vj} = 125^{\circ}C$ $T_{vj} = 150^{\circ}C$	$V_{CEsat}$	1.98 2.41 2.51	2.40	V
栅极-发射极阈值电压	$I_C = 0.8mA, V_{GE} = V_{CE}$	$T_{vj} = 25^{\circ}C$	$V_{GE(th)}$	5.20 5.80	6.40	

Gate-Emitter threshold voltage						
内部栅极电阻 Internal gate resistor		$R_{Gint}$		None		$\Omega$
输入电容 Input capacitance	$f=1\text{MHz}, V_{CE}=25\text{V}, V_{GE}=0\text{V}$ $T_{vj}=25^\circ\text{C}$	$C_{ies}$		1.48		nF
反向传输电容 Reverse transfer capacitance		$C_{res}$		0.07		
集电极-发射极截止电流 Collector-emitter cut-off current	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}$ $T_{vj}=25^\circ\text{C}$	$I_{CES}$			1	mA
栅极-发射极漏电流 Gate-emitter leakage current	$V_{CE}=0\text{V}, V_{GE}=20\text{V}$ $T_{vj}=25^\circ\text{C}$	$I_{GES}$			100	nA
开通延迟时间 Turn-on delay time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=37\Omega$ (电感负载) / (inductive load) $T_{vj}=25^\circ\text{C}$ $T_{vj}=125^\circ\text{C}$ $T_{vj}=150^\circ\text{C}$	$t_{don}$		48		ns
上升时间 Rise time				62		
				64		
关断延迟时间 Turn-off delay time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=37\Omega$ (电感负载) / (inductive load) $T_{vj}=25^\circ\text{C}$ $T_{vj}=125^\circ\text{C}$ $T_{vj}=150^\circ\text{C}$	$t_{doff}$		202		ns
				241		
				251		
下降时间 Fall time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=37\Omega$ (电感负载) / (inductive load) $T_{vj}=25^\circ\text{C}$ $T_{vj}=125^\circ\text{C}$ $T_{vj}=150^\circ\text{C}$	$t_f$		245		ns
				326		
				354		
开通损耗能量 (每脉冲) Turn-on energy loss per pulse	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=37\Omega$ (电感负载) / (inductive load) $T_{vj}=25^\circ\text{C}$ $T_{vj}=125^\circ\text{C}$ $T_{vj}=150^\circ\text{C}$	$E_{on}$		1.70		mJ
				3.50		
				4.25		
关断损耗能量 (每脉冲) Turn-off energy loss per pulse	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=37\Omega$ (电感负载) / (inductive load) $T_{vj}=25^\circ\text{C}$ $T_{vj}=125^\circ\text{C}$ $T_{vj}=150^\circ\text{C}$	$E_{off}$		1.80		mJ
				2.47		
				2.68		
短路数据 SC data	$V_{GE}\leq 15\text{V}, V_{CC}=800\text{V}$ $V_{CEmax}=V_{CES}-L_{sCE}\cdot di/dt$ $t_p\leq 10\mu\text{s}, T_{vj}=150^\circ\text{C}$	$I_{SC}$		81		A
结-外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT	$R_{thJC}$			0.85	K/W
在开关状态下温度 Temperature under switching conditions		$T_{vj op}$	-40		150	$^\circ\text{C}$

## 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		$I_F$	25	A
正向重复峰值电流 Repetitive peak forward current	$t_p=1\text{ms}$	$I_{FRM}$	50	A
$I^2t$ 值	$t_p=10\text{ms}, \sin 180^\circ, T_j=125^\circ\text{C}$	$I^2t$	90	$\text{A}^2\text{s}$

I <sup>2</sup> t-value				
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## 特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward voltage	I <sub>F</sub> =25A, V <sub>GE</sub> =0V I <sub>F</sub> =25A, V <sub>GE</sub> =0V I <sub>F</sub> =25A, V <sub>GE</sub> =0V	T <sub>vj</sub> =25°C T <sub>vj</sub> =125°C T <sub>vj</sub> =150°C	V <sub>F</sub>	2.14 1.74 1.65	2.55	V
反向恢复峰值电流 Peak reverse recovery current	I <sub>F</sub> =25A, -di <sub>F</sub> /dt=710A/μs(T <sub>vj</sub> =150°C) V <sub>R</sub> =600V, V <sub>GE</sub> =-15V	T <sub>vj</sub> =25°C T <sub>vj</sub> =125°C T <sub>vj</sub> =150°C	I <sub>RM</sub>	26 31 32		A
恢复电荷 Recovered charge	I <sub>F</sub> =25A, -di <sub>F</sub> /dt=710A/μs(T <sub>vj</sub> =150°C) V <sub>R</sub> =600V, V <sub>GE</sub> =-15V	T <sub>vj</sub> =25°C T <sub>vj</sub> =125°C T <sub>vj</sub> =150°C	Q <sub>r</sub>	1.65 4.23 5.48		μC
反向恢复损耗（每脉冲） Reverse recovered energy	I <sub>F</sub> =25A, -di <sub>F</sub> /dt=710A/μs(T <sub>vj</sub> =150°C) V <sub>R</sub> =600V, V <sub>GE</sub> =-15V	T <sub>vj</sub> =25°C T <sub>vj</sub> =125°C T <sub>vj</sub> =150°C	E <sub>rec</sub>	0.44 1.19 1.57		mJ
结-外壳热阻 Thermal resistance, junction to case	每个 Diode / per diode				1.20	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，整流器 / Diode, Rectifier

### 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 <sub>vj</sub> =25°C	V <sub>RRM</sub>	1600	V
反向不重复峰值电压 Non-Repetitive peak reverse voltage	T <sub>vj</sub> =25°C	V <sub>RSM</sub>	1800	V
最大正向平均电流 Maximum Average Forward Current		I <sub>F(AV)</sub>	25	A
正向浪涌电流 Surge forward current	t <sub>p</sub> =10ms, sin180°, T <sub>vj</sub> =25°C	I <sub>FSM</sub>	320	A
I <sup>2</sup> t 值 I <sup>2</sup> t-value	t <sub>p</sub> =10ms, sin180°, T <sub>vj</sub> =25°C	I <sup>2</sup> t	512	A <sup>2</sup> s

## 特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward voltage	I <sub>F</sub> =25A, T <sub>vj</sub> =25°C	V <sub>F</sub>			1.1	V
反向电流 Reverse current	V <sub>R</sub> =V <sub>RRM</sub> T <sub>vj</sub> =25°C	I <sub>R</sub>			5	μA

在开关状态下温度 Temperature under switching conditions		$T_{vj\ op}$	-40		150	°C
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## IGBT, 制动-斩波器 / IGBT, Brake-Chopper

### 最大额定值 / Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
集电极-发射极电压 Collector-Emitter voltage	$T_{vj}=25^{\circ}\text{C}$	$V_{CES}$	1200	V
连续集电极直流电流 Continuous DC collector current	$T_C=100^{\circ}\text{C}, T_{vj\ max}=175^{\circ}\text{C}$	$I_{C\ nom}$	25	A
集电极重复峰值电流 Repetitive peak collector current	$t_p=1\ ms$	$I_{CRM}$	50	A
总功率损耗 Total power dissipation	$T_C = 25^{\circ}\text{C}, T_{vj\ max} = 175^{\circ}\text{C}$	$P_{tot}$	125	W
栅极-发射极电压 Gate emitter voltage		$V_{GE}$	$\pm 20$	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	$V_{GE}=15\text{V}, I_C=25\text{A}$ $V_{GE}=15\text{V}, I_C=25\text{A}$ $V_{GE}=15\text{V}, I_C=25\text{A}$	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$V_{CESat}$	1.99 2.39 2.51	2.40	V
栅极-发射极阈值电压 Gate-Emitter threshold voltage	$I_C=0.8\text{mA}, V_{GE}=V_{CE}$	$T_{vj}=25^{\circ}\text{C}$	$V_{GE(th)}$	5.20	5.80	6.40
内部栅极电阻 Internal gate resistor			$R_{Gint}$	None		$\Omega$
输入电容 Input capacitance	$f=1\text{MHz}, V_{CE}=25\text{V}, V_{GE}=0\text{V}$	$T_{vj}=25^{\circ}\text{C}$		$C_{ies}$	1.49	nF
反向传输电容 Reverse transfer capacitance				$C_{res}$	0.06	
集电极-发射极截止电流 Collector-emitter cut-off current	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}$	$T_{vj}=25^{\circ}\text{C}$	$I_{CES}$		1	mA
栅极-发射极漏电流 Gate-emitter leakage current	$V_{CE}=0\text{V}, V_{GE}=20\text{V}$	$T_{vj}=25^{\circ}\text{C}$	$I_{GES}$		100	nA
开通延迟时间 Turn-on delay time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=68\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_{don}$	50 70 72		ns
上升时间 Rise time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=68\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_r$	43 63 66		
关断延迟时间 Turn-off delay time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=68\Omega$	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$	$t_{doff}$	214 333		

	(电感负载) / (inductive load)	$T_{vj}=150^{\circ}\text{C}$			345		
下降时间 Fall time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=68\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_f$		225 314 332		
开通损耗能量 (每脉冲) Turn-on energy loss per pulse	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=68\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$E_{on}$		1.80 3.59 3.95		mJ
关断损耗能量 (每脉冲) Turn-off energy loss per pulse	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=68\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$E_{off}$		1.80 2.47 2.61		
短路数据 SC data	$V_{GE}\leq 15\text{V}, V_{CC}=800\text{V}$ $V_{CEmax}=V_{CES}-L_{sCE}\cdot di/dt \quad t_p\leq 10\mu\text{s}, T_{vj}=150^{\circ}\text{C}$		$I_{SC}$		82		A
结-外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT		$R_{thJC}$			1.2	K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj op}$	-40		150	$^{\circ}\text{C}$

## 二极管, 制动-斩波器 / Diode, Brake-Chopper

### 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		$I_F$	25	A
正向重复峰值电流 Repetitive peak forward current	$t_p=1\text{ms}$	$I_{FRM}$	50	A
$I^2t$ 值 $I^2t$ -value	$t_p=10\text{ms}, \sin 180^{\circ}, T_{vj}=125^{\circ}\text{C}$	$I^2t$	24	$\text{A}^2\text{s}$

### 特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward voltage	$I_F=25\text{A}, V_{GE}=0\text{V}$ $I_F=25\text{A}, V_{GE}=0\text{V}$ $I_F=25\text{A}, V_{GE}=0\text{V}$	$V_F$		2.34 1.94 1.83	2.85	V
反向恢复峰值电流 Peak reverse recovery current	$I_F=25\text{A},$ $-di_F/dt=411\text{A}/\mu\text{s}(T_{vj}=150^{\circ}\text{C})$ $V_R=600\text{V}, V_{GE}=-15\text{V}$	$I_{RM}$		19 24 25		A
恢复电荷 Recovered charge	$I_F=25\text{A},$ $-di_F/dt=411\text{A}/\mu\text{s}(T_{vj}=150^{\circ}\text{C})$ $V_R=600\text{V}, V_{GE}=-15\text{V}$	$Q_r$		1.39 3.23 3.80		$\mu\text{C}$
反向恢复损耗 (每脉冲) Reverse recovered energy	$I_F=25\text{A},$ $-di_F/dt=411\text{A}/\mu\text{s}(T_{vj}=150^{\circ}\text{C})$ $V_R=600\text{V}, V_{GE}=-15\text{V}$	$E_{rec}$		0.39 1.01 1.20		mJ

结-外壳热阻 Thermal resistance, junction to case	每个 Diode / per diode	$R_{thJC}$			1.90	K/W
在开关状态下温度 Temperature under switching conditions		$T_{vj op}$	-40		150	°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		K $\Omega$
B-值 B-value	$\pm 1\%$	$B_{25/50}$		3380		K

## 模块 / Module

Parameter	Conditions	Symbol	Value			Unit
绝缘测试电压 Isolation test voltage	RMS, f=50Hz, t=1min	$V_{ISOL}$		2500		V
内部绝缘 Internal isolation				$\text{Al}_2\text{O}_3$		
储存温度 Storage temperature		$T_{stg}$	-40		125	°C
模块安装的扭矩 Mounting torque for modul mounting		M	3.0		6.0	Nm
重量 Weight		W		41		g

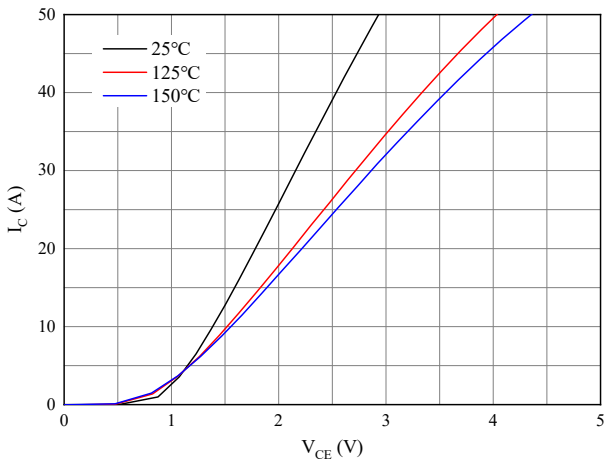


图 1. 典型输出特性 ( $V_{GE}=15V$ )

Figure 1. Typical output characteristics ( $V_{GE}=15V$ )

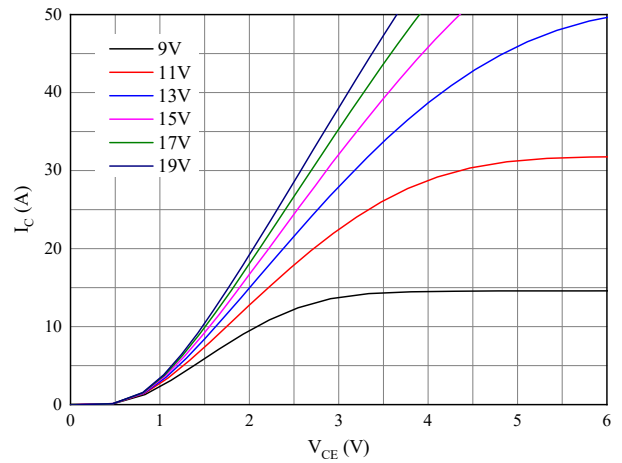


图 2. 典型输出特性 ( $T_{vj}=150^{\circ}C$ )

Figure 2. Typical output characteristics ( $T_{vj}=150^{\circ}C$ )

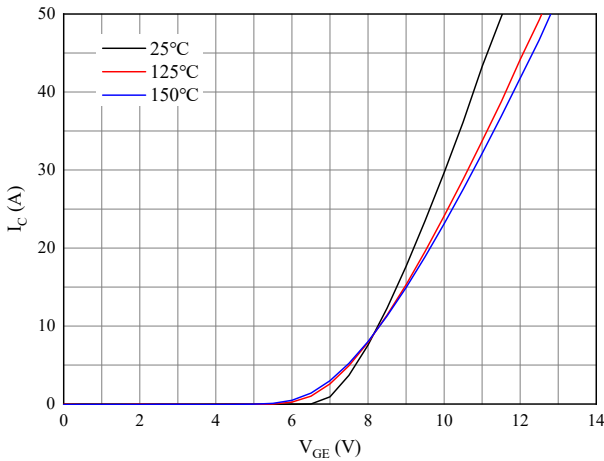


图 3. 典型传输特性 ( $V_{CE}=20V$ )

Figure 3. Typical transfer characteristic ( $V_{CE}=20V$ )

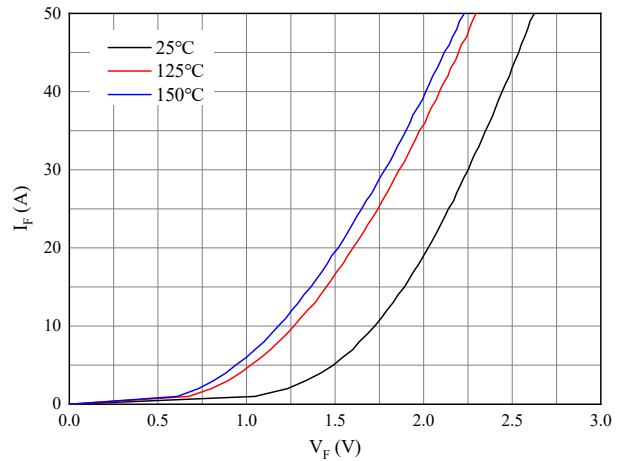


图 4. 正向偏压特性 二极管

Figure 4. Forward characteristic of Diode

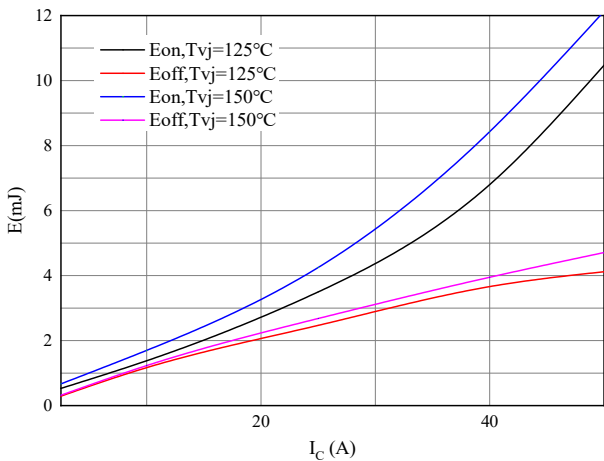


图 5. 开关损耗 逆变器

Figure 5. Switching losses of IGBT  
 $V_{GE}=\pm 15V, R_{Gon}=37\Omega, R_{Goff}=37\Omega, V_{CE}=600V$

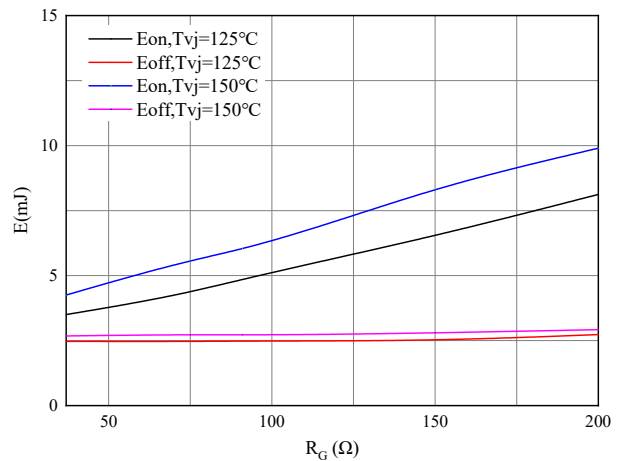


图 6. 开关损耗 逆变器

Figure 6. Switching losses of IGBT  
 $V_{GE}=\pm 15V, I_C=25A, V_{CE}=600V$

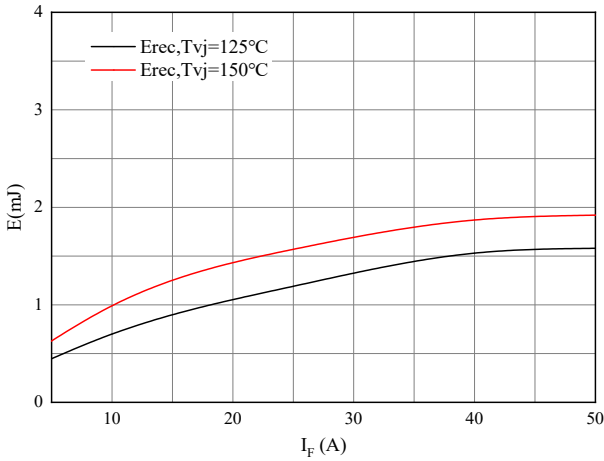


图 7. 开关损耗 二极管

Figure 7. Switching losses of Diode

$R_{Gon}=37\ \Omega, V_{CE}=600V$

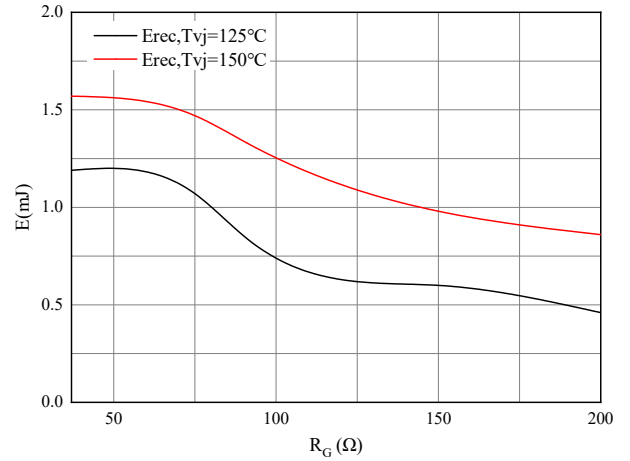


图 8. 开关损耗 二极管

Figure 8. Switching losses of Diode

$I_F=25A, V_{CE}=600V$

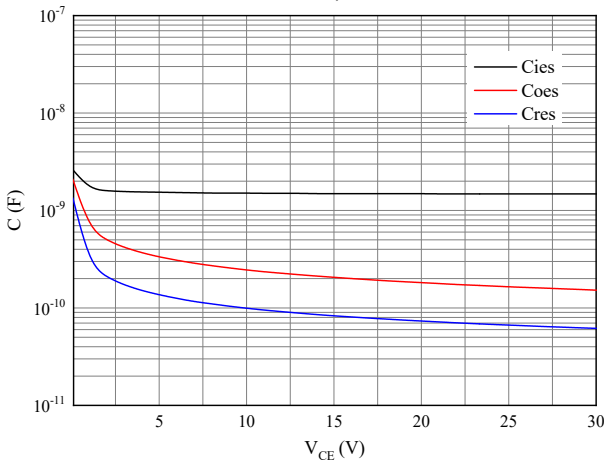


图 9. 电容特性

Figure 9. Capacitance characteristic

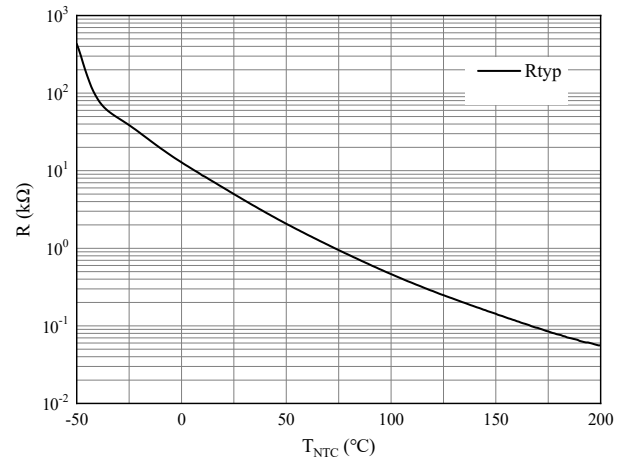
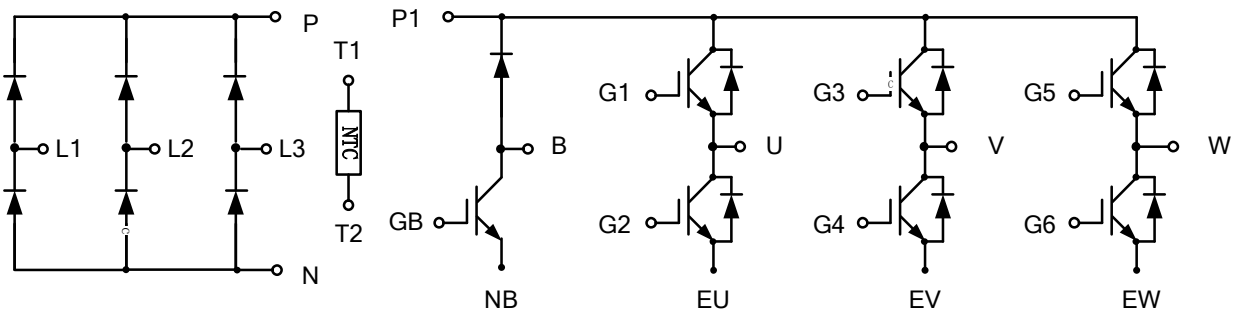


图 10. 负温系数热敏电阻 温度特性

Figure 10. NTC-Thermistor-temperature characteristic



接线图 / Circuit diagram



封装尺寸 / Package outlines

