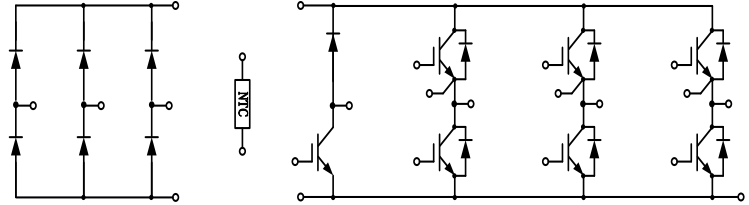


## PIM IGBT Module

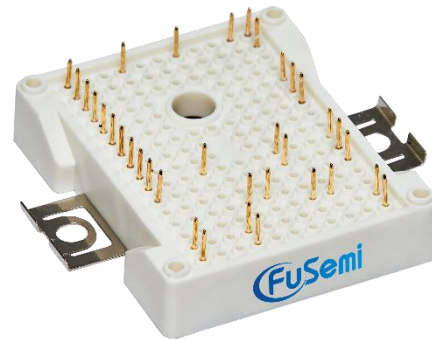
### 电气特性:

- 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	$V_{GE} = 15V, I_C = 25A$ $V_{GE} = 15V, I_C = 25A$ $V_{GE} = 15V, I_C = 25A$	$T_{vj} = 25^{\circ}C$ $T_{vj} = 125^{\circ}C$ $T_{vj} = 150^{\circ}C$	$V_{CEsat}$	1.65 1.95 2.00	2.00	V

栅极-发射极阈值电压 Gate-Emitter threshold voltage	$I_C=0.8\text{mA}, V_{GE}=V_{CE}$	$T_{vj}=25^\circ\text{C}$	$V_{GE(th)}$	5.2	5.85	6.4	
内部栅极电阻 Internal gate resistor			$R_{Gint}$		None		$\Omega$
输入电容 Input capacitance	$f=1\text{MHz}, V_{CE}=25\text{V}, V_{GE}=0\text{V}$	$T_{vj}=25^\circ\text{C}$	$C_{ies}$		1.67		nF
反向传输电容 Reverse transfer capacitance			$C_{res}$		0.08		
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	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ\text{C}$	$t_{don}$		63		
		$T_{vj}=125^\circ\text{C}$			58		
		$T_{vj}=150^\circ\text{C}$			54		
上升时间 Rise time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ\text{C}$	$t_r$		48		ns
		$T_{vj}=125^\circ\text{C}$			55		
		$T_{vj}=150^\circ\text{C}$			56		
关断延迟时间 Turn-off delay time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ\text{C}$	$t_{doff}$		314		
		$T_{vj}=125^\circ\text{C}$			351		
		$T_{vj}=150^\circ\text{C}$			362		
下降时间 Fall time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ\text{C}$	$t_f$		191		
		$T_{vj}=125^\circ\text{C}$			301		
		$T_{vj}=150^\circ\text{C}$			313		
开通损耗能量 (每脉冲) Turn-on energy loss per pulse	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ\text{C}$	$E_{on}$		2.88		mJ
		$T_{vj}=125^\circ\text{C}$			4.44		
		$T_{vj}=150^\circ\text{C}$			4.74		
关断损耗能量 (每脉冲) Turn-off energy loss per pulse	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ\text{C}$	$E_{off}$		1.66		
		$T_{vj}=125^\circ\text{C}$			2.14		
		$T_{vj}=150^\circ\text{C}$			2.31		
短路数据 SC data	$V_{GE}\leq 15\text{V}, V_{cc}=800\text{V}$		$I_{sc}$		117		A
	$V_{CEmax}=V_{CES}-L_{sCE}\cdot di/dt \quad t_p\leq 8\mu\text{s}, T_{vj}=150^\circ\text{C}$						
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 <sup>2</sup> t 值 I <sup>2</sup> t-value	t <sub>p</sub> =10ms, sin180°, T <sub>j</sub> =125°C	I <sup>2</sup> t	500	A <sup>2</sup> s
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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>	1.77 1.48 1.41	2.3	V
反向恢复峰值电流 Peak reverse recovery current	I <sub>F</sub> =25A, -di <sub>F</sub> /dt=333A/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>	15 24 26		A
恢复电荷 Recovered charge	I <sub>F</sub> =25A, -di <sub>F</sub> /dt=333A/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>	1.97 5.28 6.32		μC
反向恢复损耗（每脉冲） Reverse recovered energy	I <sub>F</sub> =25A, -di <sub>F</sub> /dt=333A/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>	0.64 1.75 2.12		mJ
结-外壳热阻 Thermal resistance, junction to case	每个 Diode / per diode	R <sub>thJC</sub>			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> =125°C	I <sup>2</sup> t	850	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	$V_R=V_{RRM}$	$T_{vj}=25^{\circ}\text{C}$	$I_R$			5	$\mu\text{A}$
在开关状态下温度 Temperature under switching conditions			$T_{vj\ op}$	-40		150	$^{\circ}\text{C}$

## 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	$V_{GE}=15\text{V}, I_C=25\text{A}$ $V_{GE}=15\text{V}, I_C=25\text{A}$ $V_{GE}=15\text{V}, I_C=25\text{A}$	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$V_{CEsat}$	1.80 2.08 2.15	2.20	V
栅极-发射极阈值电压 Gate-Emitter threshold voltage	$I_C=1\text{mA}, V_{GE}=V_{CE}$	$T_{vj}=25^{\circ}\text{C}$	$V_{GE(th)}$	5.2	5.85	6.4
内部栅极电阻 Internal gate resistor			$R_{Gint}$	None		$\Omega$
输入电容 Input capacitance	$f=1\text{MHz}, V_{CE}=25\text{V}, V_{GE}=0\text{V}$	$T_{vj}=25^{\circ}\text{C}$	$C_{ies}$	1.66		nF
反向传输电容 Reverse transfer capacitance			$C_{res}$	0.08		
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	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_{d\ on}$	65 60 56		ns
上升时间 Rise time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_r$	87 90 92		

关断延迟时间 Turn-off delay time	$I_C=25A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$t_{d\ off}$		301 350 355		
下降时间 Fall time	$I_C=25A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$t_f$		231 302 290		
开通损耗能量 (每脉冲) Turn-on energy loss per pulse	$I_C=25A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$E_{on}$		2.34 2.73 2.90		mJ
关断损耗能量 (每脉冲) Turn-off energy loss per pulse	$I_C=25A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$E_{off}$		1.66 2.16 2.30		
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	$^\circ C$

## 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	$T_{vj}=25^\circ C$	$V_{RRM}$	1200	V
连续正向直流电流 Continuous DC forward current		$I_F$	8	A
正向重复峰值电流 Repetitive peak forward current	$t_p=1ms$	$I_{FRM}$	16	A
$I^2t$ 值 $I^2t$ -value	$V_R=0V, t_p=10ms, T_{vj}=125^\circ C$	$I^2t$	30	$A^2s$

### 特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward voltage	$I_F=8A, V_{GE}=0V$ $I_F=8A, V_{GE}=0V$ $I_F=8A, V_{GE}=0V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$V_F$		2.03 1.70 1.63	2.50 V
反向恢复峰值电流 Peak reverse recovery current	$I_F=8A,$ $-di_f/dt=217A/\mu s(T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$I_{RM}$		8 10 11	A
恢复电荷 Recovered charge	$I_F=8A,$ $-di_f/dt=217A/\mu s(T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$Q_f$		0.74 1.33 1.61	$\mu C$
反向恢复损耗 (每脉冲) Reverse recovered energy	$I_F=8A,$ $-di_f/dt=217A/\mu s(T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$E_{rec}$		0.27 0.45 0.56	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, $f=50\text{Hz}$ , $t=1\text{min}$	$V_{ISOL}$	2500			V
内部绝缘 Internal isolation			Al <sub>2</sub> O <sub>3</sub>			
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		170		g

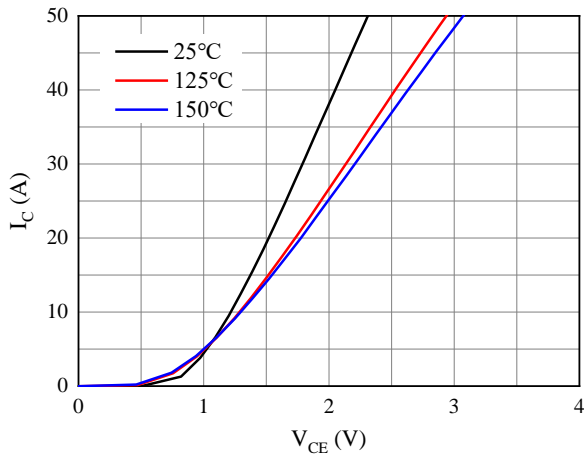


图 1. 典型输出特性 ( $V_{GE}=15V$ )

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

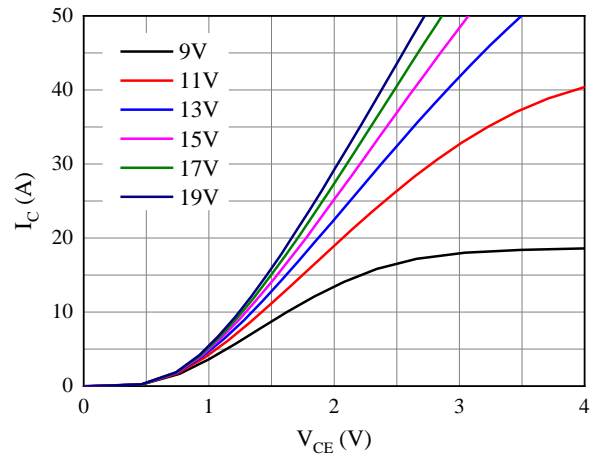
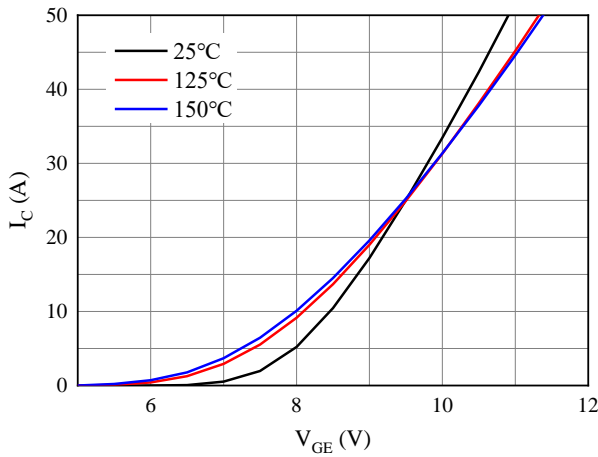


图 2. 典型输出特性 ( $T_{vj}=150^{\circ}C$ )

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



3. 典型传输特性( $V_{CE}=20V$ )

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

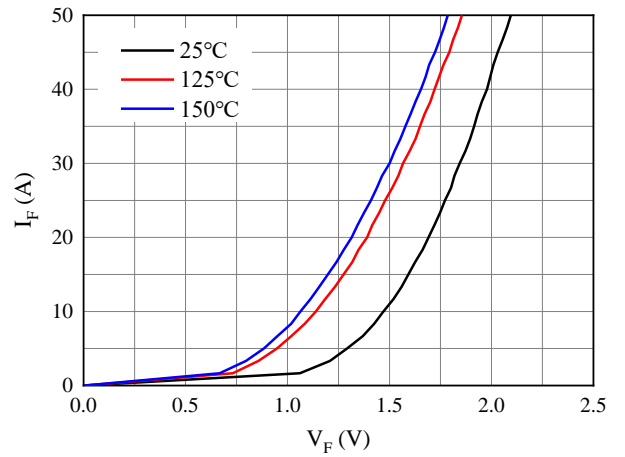


图 4. 正向偏压特性 二极管

Figure 4. Forward characteristic of Diode

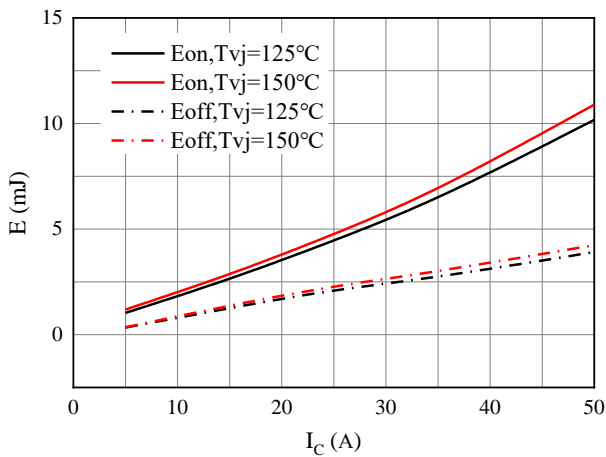


图 5. 开关损耗 逆变器

Figure 5. Switching losses of IGBT  
 $V_{GE}=\pm 15V, R_{Gon}=40\Omega, R_{Goff}=40\Omega, V_{CE}=600V$

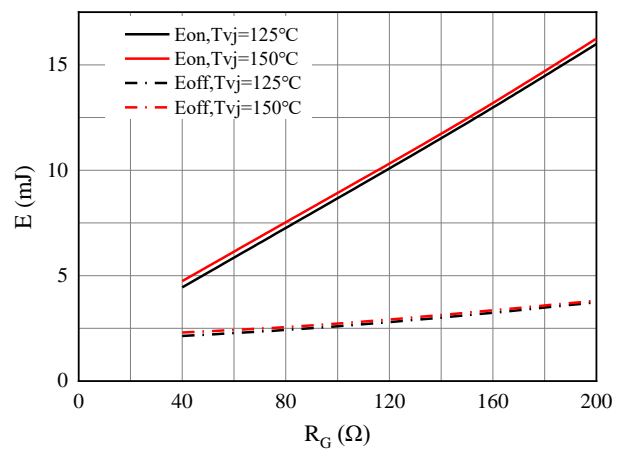


图 6. 开关损耗 逆变器

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

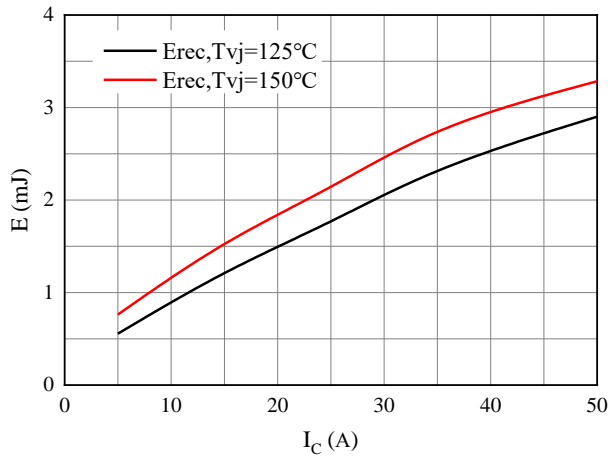


图 7. 开关损耗 二极管

Figure 7. Switching losses of Diode

$R_{Gon}=40\Omega, V_{CE}=600V$

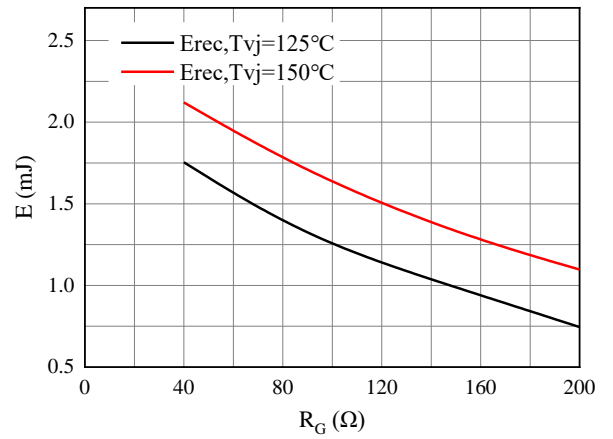


图 8. 开关损耗 二极管

Figure 8. Switching losses of Diode

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

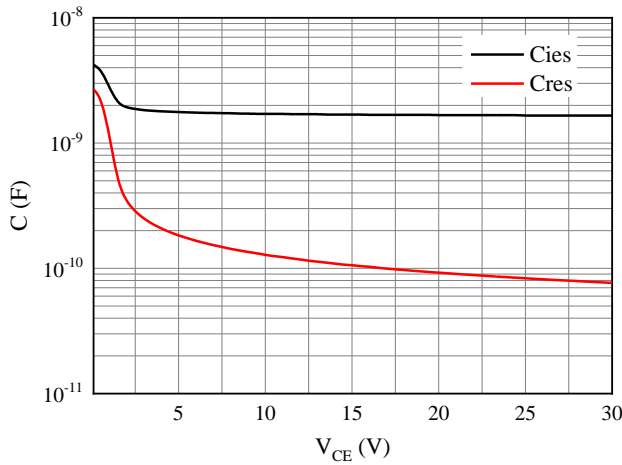


图 9. 电容特性

Figure 9. Capacitance characteristic

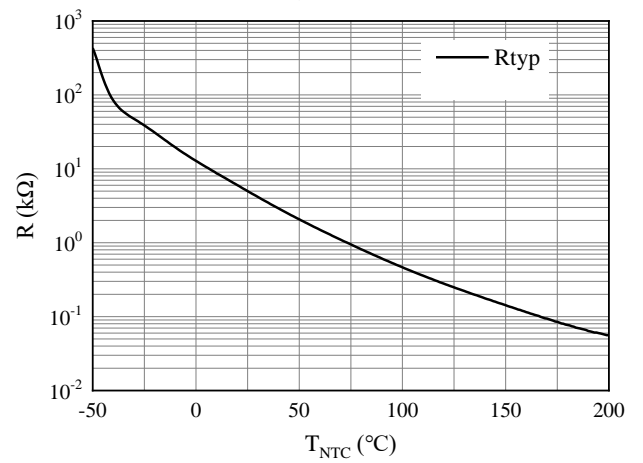
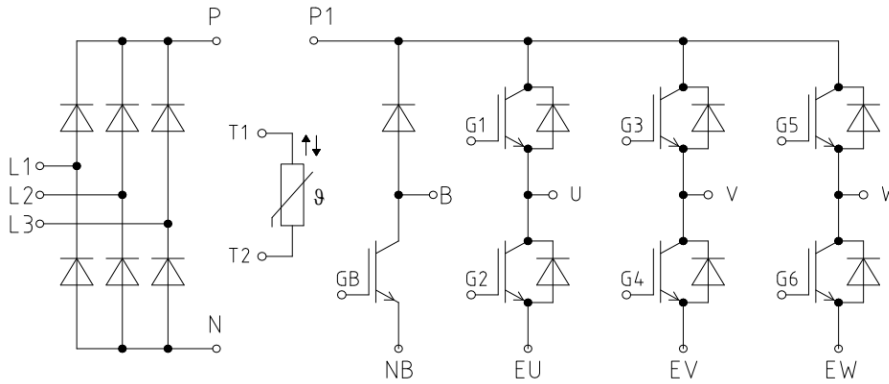


图 10. 负温系数热敏电阻 温度特性

Figure 10. NTC-Themistor-temperature characteristic



## 接线图 / Circuit diagram



## 封装尺寸 / Package outlines

