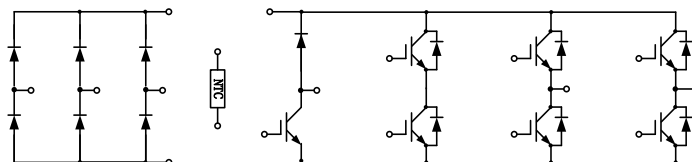


## PIM IGBT Module

## 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



$V_{CES} = 1200V$ ,  $I_{C\ nom} = 10A$  /  $I_{CRM} = 20A$

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	$T_C = 100^{\circ}C$ , $T_{vj\ max} = 175^{\circ}C$	$I_{C\ nom}$	10	A
集电极重复峰值电流 Repetitive peak collector current	$t_p = 1\ ms$	$I_{CRM}$	20	A
总功率损耗 Total power dissipation	$T_C = 25^{\circ}C$ , $T_{vj\ max} = 175^{\circ}C$	$P_{tot}$	105	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	$V_{GE} = 15V$ , $I_C = 10A$ $V_{GE} = 15V$ , $I_C = 10A$ $V_{GE} = 15V$ , $I_C = 10A$	$T_{vj} = 25^{\circ}C$ $T_{vj} = 125^{\circ}C$ $T_{vj} = 150^{\circ}C$	$V_{CESat}$	1.71 1.97 2.05	2.10	V
栅极-发射极阈值电压 Gate-Emitter threshold voltage	$I_C = 0.30mA$ , $V_{GE} = V_{CE}$	$T_{vj} = 25^{\circ}C$	$V_{GE(th)}$	5.0	5.6	6.2
内部栅极电阻 Internal gate resistor			$R_{Gint}$	None		$\Omega$

栅电荷 Gate charge	$V_{GE}=-15V...+15V$	$Q_G$		0.10		$\mu C$
输入电容 Input capacitance	$f=1MHz, V_{CE}=25V, V_{GE}=0V \quad T_{vj}=25^\circ C$	$C_{ies}$		0.88		nF
反向传输电容 Reverse transfer capacitance		$C_{res}$		0.04		
集电极-发射极截止电流 Collector-emitter cut-off current	$V_{CE}=1200V, V_{GE}=0V \quad T_{vj}=25^\circ C$	$I_{CES}$			1	mA
栅极-发射极漏电流 Gate-emitter leakage current	$V_{CE}=0V, V_{GE}=20V \quad T_{vj}=25^\circ C$	$I_{GES}$			100	nA
开通延迟时间 Turn-on delay time	$I_C=10A, V_{CE}=600V \quad T_{vj}=25^\circ C$ $V_{GE}=\pm 15V, R_G=40\Omega \quad T_{vj}=125^\circ C$ (电感负载) / (inductive load) $T_{vj}=150^\circ C$	$t_{don}$		48		
				45		
				44		
上升时间 Rise time	$I_C=10A, V_{CE}=600V \quad T_{vj}=25^\circ C$ $V_{GE}=\pm 15V, R_G=40\Omega \quad T_{vj}=125^\circ C$ (电感负载) / (inductive load) $T_{vj}=150^\circ C$	$t_r$		34		
				36		
				37		
关断延迟时间 Turn-off delay time	$I_C=10A, V_{CE}=600V \quad T_{vj}=25^\circ C$ $V_{GE}=\pm 15V, R_G=40\Omega \quad T_{vj}=125^\circ C$ (电感负载) / (inductive load) $T_{vj}=150^\circ C$	$t_{doff}$		240		ns
				283		
				294		
下降时间 Fall time	$I_C=10A, V_{CE}=600V \quad T_{vj}=25^\circ C$ $V_{GE}=\pm 15V, R_G=40\Omega \quad T_{vj}=125^\circ C$ (电感负载) / (inductive load) $T_{vj}=150^\circ C$	$t_f$		175		
				202		
				276		
开通损耗能量（每脉冲） Turn-on energy loss per pulse	$I_C=10A, V_{CE}=600V \quad T_{vj}=25^\circ C$ $V_{GE}=\pm 15V, R_G=40\Omega \quad T_{vj}=125^\circ C$ (电感负载) / (inductive load) $T_{vj}=150^\circ C$	$E_{on}$		0.87		mJ
				1.27		
				1.40		
关断损耗能量（每脉冲） Turn-off energy loss per pulse	$I_C=10A, V_{CE}=600V \quad T_{vj}=25^\circ C$ $V_{GE}=\pm 15V, R_G=40\Omega \quad T_{vj}=125^\circ C$ (电感负载) / (inductive load) $T_{vj}=150^\circ C$	$E_{off}$		0.67		
				0.85		
				0.89		
短路数据 SC data	$V_{GE} \leq 15V, V_{CC}=800V$ $V_{CEmax}=V_{CES}-L_{sCE} \cdot di/dt \quad t_p \leq 10\mu s, T_{vj}=150^\circ C$	$I_{sc}$		59		A
结-外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT	$R_{thJC}$		1.25	1.40	K/W
在开关状态下温度 Temperature under switching conditions		$T_{vj op}$	-40		150	$^\circ C$

## 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	$T_{vj}=25^\circ C$	$V_{RRM}$	1200	V
连续正向直流电流 Continuous DC forward current		$I_F$	10	A
正向重复峰值电流 Repetitive peak forward current	$t_p=1ms$	$I_{FRM}$	20	A
$I^2t$ 值 $I^2t$ -value	$t_p=10ms, \sin 180^\circ, T_{vj}=125^\circ C$	$I^2t$	24	$A^2s$

## 特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward voltage	$I_F=10A, V_{GE}=0V$ $T_{vj}=25^{\circ}C$ $I_F=10A, V_{GE}=0V$ $T_{vj}=125^{\circ}C$ $I_F=10A, V_{GE}=0V$ $T_{vj}=150^{\circ}C$	$V_F$		1.47 1.48 1.69	2.0	V
反向恢复峰值电流 Peak reverse recovery current	$I_F=10A,$ $-di_F/dt=298A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$ $T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$	$I_{RM}$		15 16 18		A
恢复电荷 Recovered charge	$I_F=10A,$ $-di_F/dt=298A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$ $T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$	$Q_r$		1.5 2.6 3.1		$\mu C$
反向恢复损耗（每脉冲） Reverse recovered energy	$I_F=10A,$ $-di_F/dt=298A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$ $T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$	$E_{rec}$		0.50 0.88 1.03		mJ
结-外壳热阻 Thermal resistance, junction to case	每个 Diode / per diode	$R_{thJC}$		1.75	1.90	K/W
在开关状态下温度 Temperature under switching conditions		$T_{vj op}$	-40		150	$^{\circ}C$

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	$T_{vj}=25^{\circ}C$	$V_{RRM}$	1600	V
反向不重复峰值电压 Non-Repetitive peak reverse voltage	$T_{vj}=25^{\circ}C$	$V_{RSM}$	1800	V
最大正向平均电流 Maximum Average Forward Current		$I_{F(AV)}$	16	A
正向浪涌电流 Surge forward current	$t_p=10ms, \sin 180^{\circ}, T_{vj}=25^{\circ}C$	$I_{FSM}$	190	A
$I^2t$ 值 $I^2t$ -value	$t_p=10ms, \sin 180^{\circ}, T_{vj}=125^{\circ}C$	$I^2t$	360	$A^2s$

## 特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward voltage	$I_F=16A, T_j=25^{\circ}C$	$V_F$		0.95		V
反向电流 Reverse current	$V_R=V_{RRM}$ $T_{vj}=25^{\circ}C$	$I_R$			5	$\mu A$

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	$T_C=100^{\circ}\text{C}, T_{vj\ max}=175^{\circ}\text{C}$	$I_{C\ nom}$	10	A
集电极重复峰值电流 Repetitive peak collector current	$t_p=1\ ms$	$I_{CRM}$	20	A
总功率损耗 Total power dissipation	$T_C = 25^{\circ}\text{C}, T_{vj\ max} = 175^{\circ}\text{C}$	$P_{tot}$	105	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	$V_{GE}=15\text{V}, I_C=10\text{A}$ $V_{GE}=15\text{V}, I_C=10\text{A}$ $V_{GE}=15\text{V}, I_C=10\text{A}$	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$V_{Cesat}$	1.68 1.88 1.92	2.10	V
栅极-发射极阈值电压 Gate-Emitter threshold voltage	$I_C=0.30\text{mA}, V_{GE}=V_{CE}$	$T_{vj}=25^{\circ}\text{C}$	$V_{GE(th)}$	5.65		
栅电荷 Gate charge	$V_{GE}=-15\text{V}\dots+15\text{V}$		$Q_G$	0.11		$\mu\text{C}$
内部栅极电阻 Internal gate resistor			$R_{Gint}$	None		$\Omega$
输入电容 Input capacitance	$f=1\text{MHz}, V_{CE}=25\text{V}, V_{GE}=0\text{V}$	$T_{vj}=25^{\circ}\text{C}$	$C_{ies}$	0.86		nF
反向传输电容 Reverse transfer capacitance			$C_{res}$	0.02		
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	$I_C=10\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_{d\ on}$	49 47 43		ns
上升时间 Rise time	$I_C=10\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_r$	38 39 40		
关断延迟时间 Turn-off delay time	$I_C=10\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_{d\ off}$	239 283 295		

下降时间 Fall time	$I_C=10A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$t_f$		162 259 241		
开通损耗能量 (每脉冲) Turn-on energy loss per pulse	$I_C=10A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$E_{on}$		0.62 0.81 0.87		mJ
关断损耗能量 (每脉冲) Turn-off energy loss per pulse	$I_C=10A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$E_{off}$		0.68 0.88 0.93		
结-外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT		$R_{thJC}$		1.25	1.40	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	$V_R=0V, t_p=10ms, T_{vj}=125^\circ C$	$I^2t$	24	$A^2t$

### 特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward voltage	$I_F=8A, V_{GE}=0V$ $I_F=8A, V_{GE}=0V$ $I_F=8A, V_{GE}=0V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$V_F$	1.88 1.96 1.90	2.3	V
反向恢复峰值电流 Peak reverse recovery current	$I_F=8A,$ $-di_F/dt=203A/\mu s(T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$I_{RM}$	6 7 8		A
恢复电荷 Recovered charge	$I_F=8A,$ $-di_F/dt=203A/\mu s(T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$Q_F$	0.8 1.2 1.3		$\mu C$
反向恢复损耗 (每脉冲) Reverse recovered energy	$I_F=8A,$ $-di_F/dt=203A/\mu s(T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$E_{rec}$	0.27 0.49 0.53		mJ
结-外壳热阻 Thermal resistance, junction to case	每个 Diode / per diode		$R_{thJC}$	1.75	1.90	K/W
在开关状态下温度 Temperature under switching			$T_{vj op}$	-40	150	$^\circ C$

conditions

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	$\pm 1\%$	$B_{25/50}$		3380		K

模块 / Module

Parameter	Conditions	Symbol	Value			Unit
绝缘测试电压 Isolation test voltage	RMS, $f=50\text{Hz}$ , $t=1\text{min}$	$V_{\text{ISOL}}$	2500			V
内部绝缘 Internal isolation			$\text{Al}_2\text{O}_3$			
储存温度 Storage temperature		$T_{\text{stg}}$	-40		125	$^{\circ}\text{C}$
模块安装的扭矩 Mounting torque for modul mounting		M	3.0		6.0	Nm
重量 Weight		W		23		g

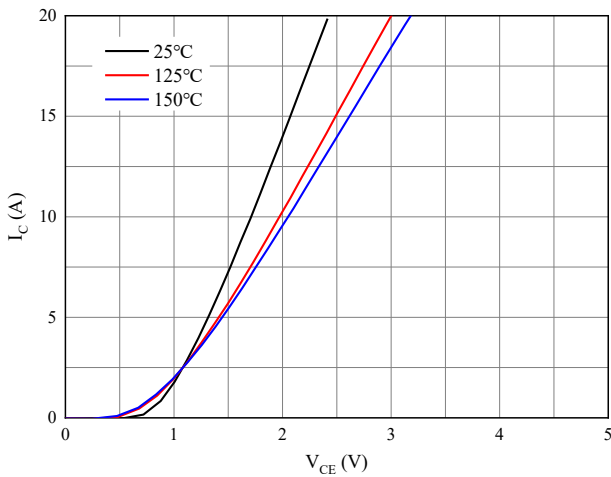


图 1. 典型输出特性 ( $V_{GE}=15V$ )  
Figure 1. Typical output characteristics ( $V_{GE}=15V$ )

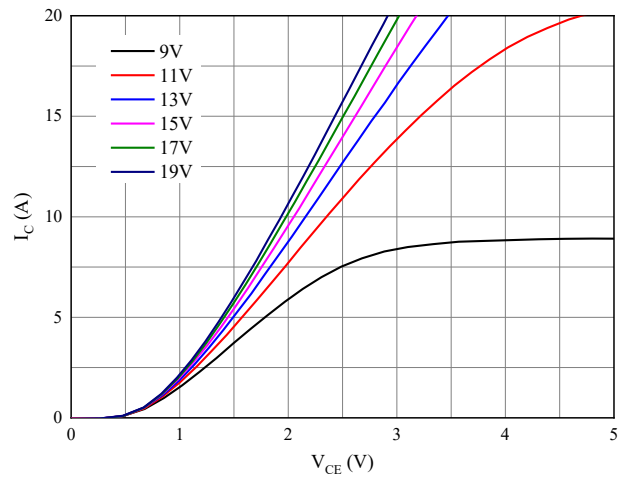


图 2. 典型输出特性 ( $T_{vj}=150^{\circ}C$ )  
Figure 2. Typical output characteristics ( $T_{vj}=150^{\circ}C$ )

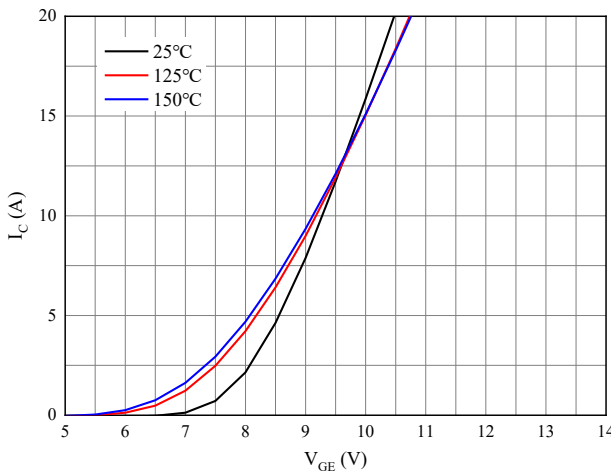


图 3. 典型传输特性 ( $V_{CE}=20V$ )  
Figure 3. Typical transfer characteristic ( $V_{CE}=20V$ )

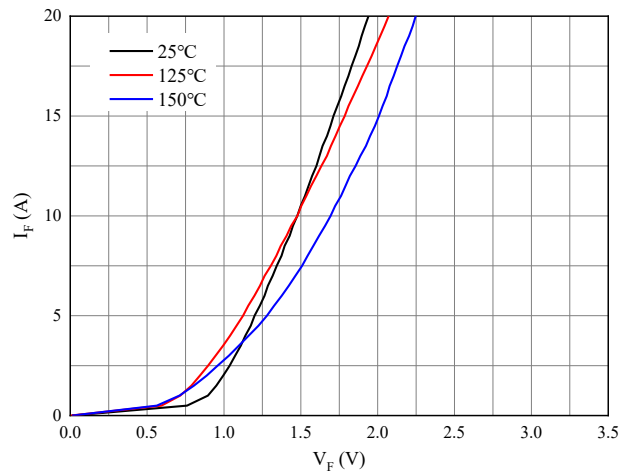


图 4. 正向偏压特性 二极管  
Figure 4. Forward characteristic of Diode

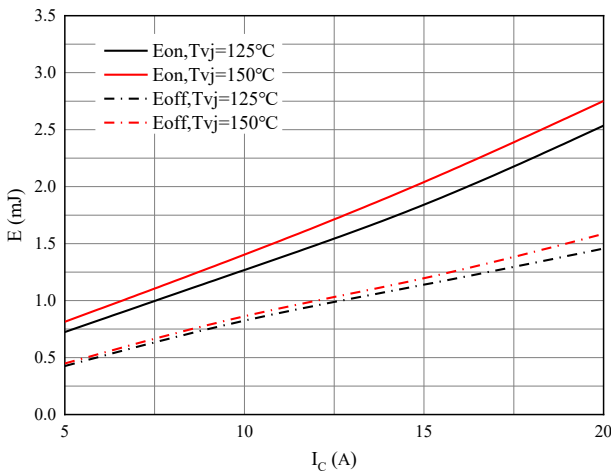


图 5. 开关损耗 逆变器  
Figure 5. Switching losses of IGBT  
 $V_{GE}=\pm 15V, R_{Gon}=40\Omega, R_{Goff}=40\Omega, V_{CE}=600V$

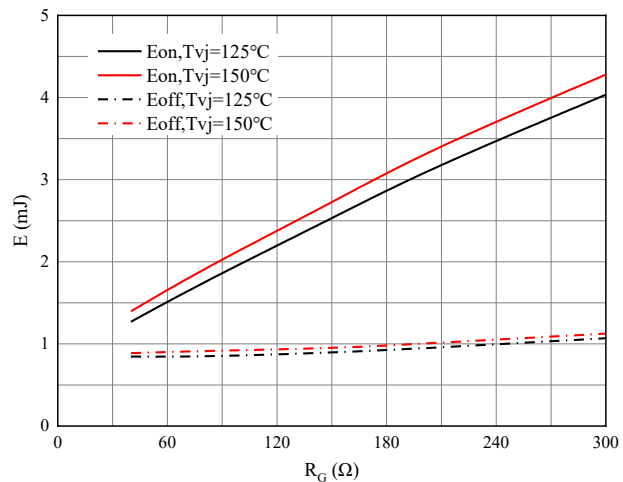


图 6. 开关损耗 逆变器  
Figure 6. Switching losses of IGBT  
 $V_{GE}=\pm 15V, I_C=10A, V_{CE}=600V$

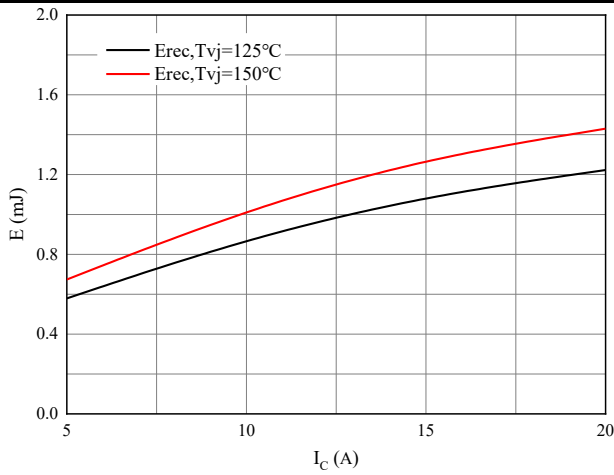


图 7. 开关损耗 二极管

Figure 7. Switching losses of Diode

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

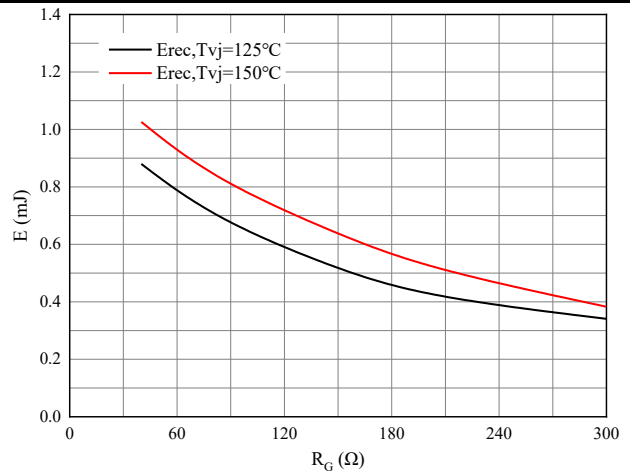


图 8. 开关损耗 二极管

Figure 8. Switching losses of Diode

$I_F=10A, V_{CE}=600V$

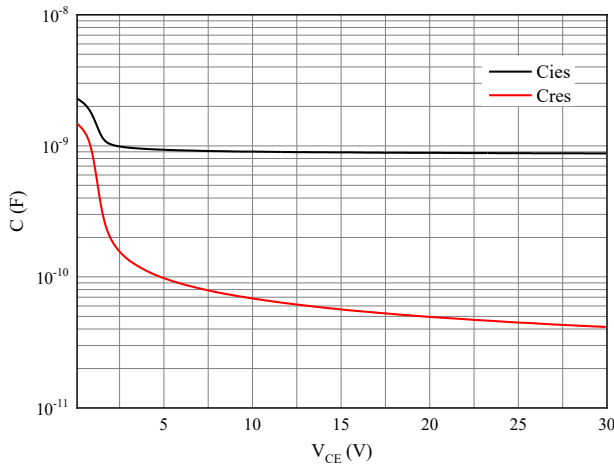


图 9. 电容特性

Figure 9. Capacitance characteristic

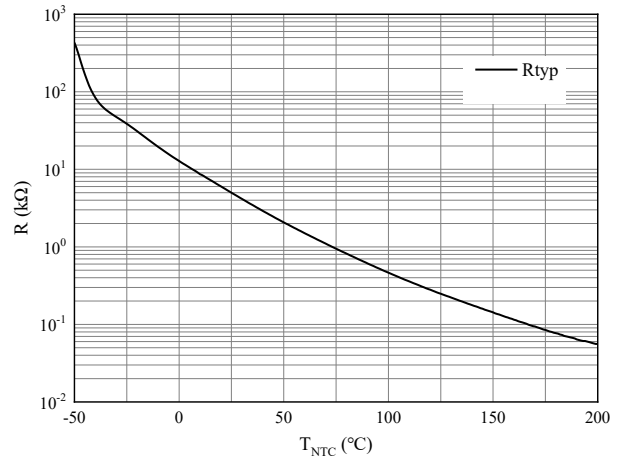
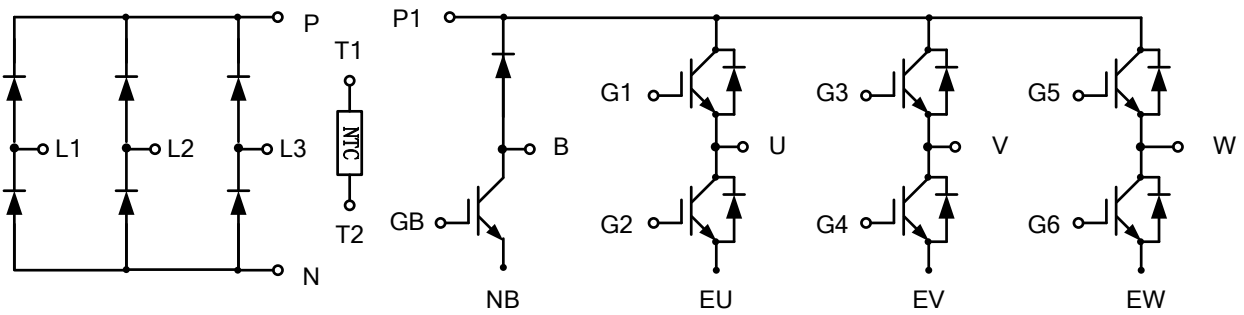


图 10. 负温系数热敏电阻 温度特性

Figure 10. NTC-Themistor-temperature characteristic



接线图 / Circuit diagram



封装尺寸 / Package outlines

