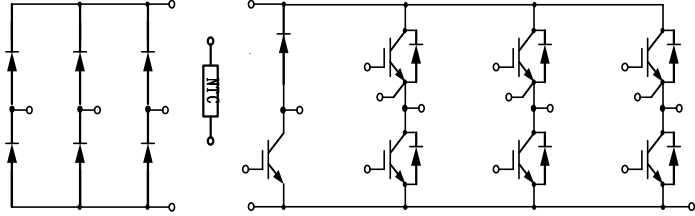


## PIM IGBT Module

### 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



$V_{CES} = 1200V$ ,  $I_{C\ nom} = 40A$  /  $I_{CRM} = 80A$

## 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	$T_C = 100^{\circ}C$ , $T_{vj\ max} = 175^{\circ}C$	$I_{C\ nom}$	40	A
集电极重复峰值电流 Repetitive peak collector current	$t_p = 1\ ms$	$I_{CRM}$	80	A
总功率损耗 Total power dissipation	$T_C = 25^{\circ}C$ , $T_{vj\ max} = 175^{\circ}C$	$P_{tot}$	250	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	$V_{GE} = 15V$ , $I_C = 40A$ $V_{GE} = 15V$ , $I_C = 40A$ $V_{GE} = 15V$ , $I_C = 40A$	$T_{vj} = 25^{\circ}C$ $T_{vj} = 125^{\circ}C$ $T_{vj} = 150^{\circ}C$	$V_{CEsat}$	1.71 2.02 2.09	2.0	V
栅极-发射极阈值电压 Gate-Emitter threshold voltage	$I_C = 1.5mA$ , $V_{GE} = V_{CE}$	$T_{vj} = 25^{\circ}C$	$V_{GE(th)}$	5.0 5.6	6.2	

内部栅极电阻 Internal gate resistor		$R_{Gint}$		None		$\Omega$
输入电容 Input capacitance	$f=1\text{MHz}, V_{CE}=25\text{V}, V_{GE}=0\text{V}$ $T_{vj}=25^\circ\text{C}$	$C_{ies}$		2.71		nF
反向传输电容 Reverse transfer capacitance		$C_{res}$		0.13		
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	$I_C=40\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=30\Omega$ (电感负载) / (inductive load) $T_{vj}=25^\circ\text{C}$ $T_{vj}=125^\circ\text{C}$ $T_{vj}=150^\circ\text{C}$	$t_{don}$		72		ns
上升时间 Rise time			$t_r$	58		
关断延迟时间 Turn-off delay time			$t_{doff}$	356		
下降时间 Fall time	$I_C=40\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=30\Omega$ (电感负载) / (inductive load) $T_{vj}=25^\circ\text{C}$ $T_{vj}=125^\circ\text{C}$ $T_{vj}=150^\circ\text{C}$	$t_f$		196		ns
开通损耗能量 (每脉冲) Turn-on energy loss per pulse			$E_{on}$	4.33		
关断损耗能量 (每脉冲) Turn-off energy loss per pulse			$E_{off}$	2.65		
短路数据 SC data	$V_{GE}\leq 15\text{V}, V_{CC}=800\text{V}$ $V_{CEmax}=V_{CES}-L_{sCE}\cdot di/dt$ $t_p\leq 8\mu\text{s}, T_{vj}=150^\circ\text{C}$	$I_{sc}$		208		A
结-外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT	$R_{thJC}$			0.60	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		$I_F$	30	A
正向重复峰值电流 Repetitive peak forward current	$t_p=1\text{ms}$	$I_{FRM}$	60	A
$I^2t$ 值 $I^2t$ -value	$t_p=10\text{ms}, \sin 180^\circ, T_j=125^\circ\text{C}$	$I^2t$	365	$\text{A}^2\text{s}$

## 特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward voltage	$I_F=30A, V_{GE}=0V$ $I_F=30A, V_{GE}=0V$ $I_F=30A, V_{GE}=0V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$V_F$	2.03 1.67 1.59	2.55	V
反向恢复峰值电流 Peak reverse recovery current	$I_F=30A,$ $-di_F/dt=480A/\mu s(T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$I_{RM}$	18 29 31		A
恢复电荷 Recovered charge	$I_F=30A,$ $-di_F/dt=480A/\mu s(T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$Q_F$	2.25 5.43 6.34		$\mu C$
反向恢复损耗（每脉冲） Reverse recovered energy	$I_F=30A,$ $-di_F/dt=480A/\mu s(T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$E_{rec}$	0.68 1.69 2.00		mJ
结-外壳热阻 Thermal resistance, junction to case	每个 Diode / per diode		$R_{thJC}$		0.95	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	$T_{vj}=25^\circ C, I_{RRM}=0.05mA$	$V_{RRM}$	1600	V
反向不重复峰值电压 Non-Repetitive peak reverse voltage	$T_{vj}=25^\circ C, I_{RRM}=0.05mA$	$V_{RSM}$	1800	V
最大正向平均电流 Maximum Average Forward Current	$T_S=80^\circ C, T_{vj}=25^\circ C$	$I_{F(AV)}$	35	A
正向浪涌电流 Surge forward current	$t_p=10ms, \sin 180^\circ, T_{vj}=25^\circ C$	$I_{FSM}$	420	A
$I^2t$ 值 $I^2t$ -value	$t_p=10ms, \sin 180^\circ, T_{vj}=25^\circ C$	$I^2t$	880	$A^2s$

## 特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward voltage	$I_F=5A, T_{vj}=25^\circ C$	$V_F$		0.9	1	V
反向电流 Reverse current	$V_R=V_{RRM}$ $T_{vj}=25^\circ C$	$I_R$			50	$\mu A$
在开关状态下温度 Temperature under switching		$T_{vj op}$	-40		150	$^\circ C$

conditions

## 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	$T_C=100^{\circ}\text{C}, T_{vj\max}=175^{\circ}\text{C}$	$I_{C\text{nom}}$	25	A
集电极重复峰值电流 Repetitive peak collector current	$t_p=1\text{ms}$	$I_{CRM}$	50	A
总功率损耗 Total power dissipation	$T_C=25^{\circ}\text{C}, T_{vj\max}=175^{\circ}\text{C}$	$P_{\text{tot}}$	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	$V_{GE}=15\text{V}, I_C=25\text{A}$ $V_{GE}=15\text{V}, I_C=25\text{A}$ $V_{GE}=15\text{V}, I_C=25\text{A}$	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$V_{CESat}$	2.16 2.69 2.82	2.5	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 5.75	6.4	
内部栅极电阻 Internal gate resistor			$R_{Gint}$	None		$\Omega$
输入电容 Input capacitance	$f=1\text{MHz}, V_{CE}=25\text{V}, V_{GE}=0\text{V}$	$T_{vj}=25^{\circ}\text{C}$	$C_{ies}$	1.46		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	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=75\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_{don}$	106 95 93		ns
上升时间 Rise time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=75\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_r$	54 54 53		
关断延迟时间 Turn-off delay time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=75\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_{doff}$	285 325 328		
下降时间 Fall time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=75\Omega$	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$	$t_f$	214 281		

	(电感负载) / (inductive load)	$T_{vj}=150^{\circ}\text{C}$			272		
开通损耗能量 (每脉冲) Turn-on energy loss per pulse	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=75\Omega$ (电感负载)	$T_{vj}=25^{\circ}\text{C}$	$E_{on}$		2.26		mJ
		$T_{vj}=125^{\circ}\text{C}$			3.02		
		$T_{vj}=150^{\circ}\text{C}$			3.37		
关断损耗能量 (每脉冲) Turn-off energy loss per pulse	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=75\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^{\circ}\text{C}$	$E_{off}$		1.56		
		$T_{vj}=125^{\circ}\text{C}$			2.02		
		$T_{vj}=150^{\circ}\text{C}$			2.19		
结-外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT		$R_{thJC}$			1.20	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		$I_F$	8	A
正向重复峰值电流 Repetitive peak forward current	$t_p=1\text{ms}$	$I_{FRM}$	16	A
$I^2t$ 值 $I^2t$ -value	$V_R=0\text{V}, t_p=10\text{ms}, T_{vj}=125^{\circ}\text{C}$	$I^2t$	32	$\text{A}^2\text{s}$

### 特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit	
			Min.	Typ.	Max.		
正向电压 Forward voltage	$I_F=8\text{A}, V_{GE}=0\text{V}$	$V_F$		$T_{vj}=25^{\circ}\text{C}$	1.57	2.00	V
				$T_{vj}=125^{\circ}\text{C}$	1.74		
				$T_{vj}=150^{\circ}\text{C}$	1.67		
反向恢复峰值电流 Peak reverse recovery current	$I_F=8\text{A},$ $-di_F/dt=322\text{A}/\mu\text{s}(T_{vj}=150^{\circ}\text{C})$ $V_R=600\text{V}, V_{GE}=-15\text{V}$	$I_{RM}$		$T_{vj}=25^{\circ}\text{C}$	8		A
				$T_{vj}=125^{\circ}\text{C}$	13		
				$T_{vj}=150^{\circ}\text{C}$	14		
恢复电荷 Recovered charge	$I_F=8\text{A},$ $-di_F/dt=322\text{A}/\mu\text{s}(T_{vj}=150^{\circ}\text{C})$ $V_R=600\text{V}, V_{GE}=-15\text{V}$	$Q_f$		$T_{vj}=25^{\circ}\text{C}$	0.30		$\mu\text{C}$
				$T_{vj}=125^{\circ}\text{C}$	1.30		
				$T_{vj}=150^{\circ}\text{C}$	1.41		
反向恢复损耗 (每脉冲) Reverse recovered energy	$I_F=8\text{A},$ $-di_F/dt=322\text{A}/\mu\text{s}(T_{vj}=150^{\circ}\text{C})$ $V_R=600\text{V}, V_{GE}=-15\text{V}$	$E_{rec}$		$T_{vj}=25^{\circ}\text{C}$	0.06		mJ
				$T_{vj}=125^{\circ}\text{C}$	0.33		
				$T_{vj}=150^{\circ}\text{C}$	0.37		
结-外壳热阻 Thermal resistance, junction to case	每个 Diode / per diode		$R_{thJC}$			2.30	K/W

在开关状态下温度 Temperature under switching conditions		$T_{vj\ op}$	-40		150	°C
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## 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, $f=50\text{Hz}$ , $t=1\text{min}$	$V_{\text{ISOL}}$	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	°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

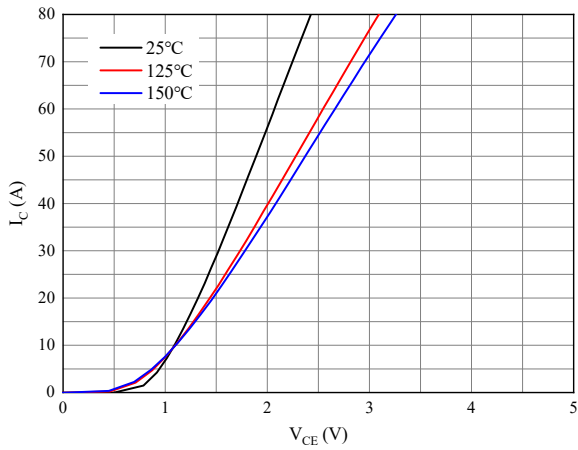


图 1. 典型输出特性 ( $V_{GE}=15V$ )

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

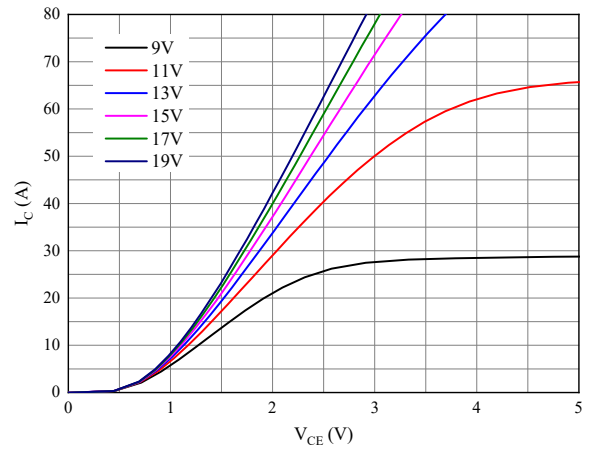


图 2. 典型输出特性 ( $T_{vj}=150^{\circ}C$ )

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

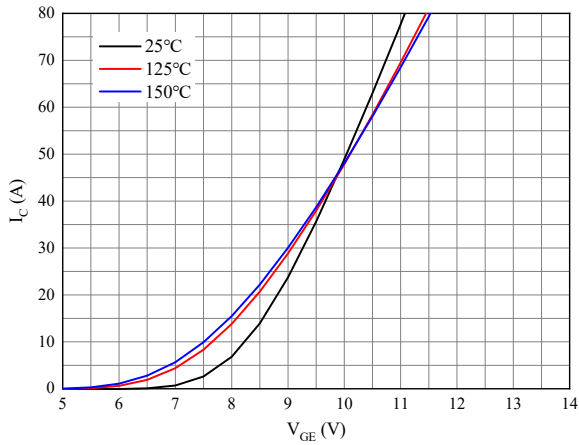


图 3. 典型传输特性 ( $V_{CE}=20V$ )

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

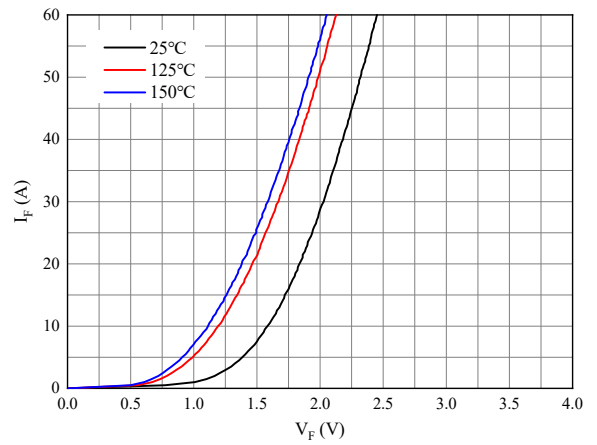


图 4. 正向偏压特性 二极管

Figure 4. Forward characteristic of Diode

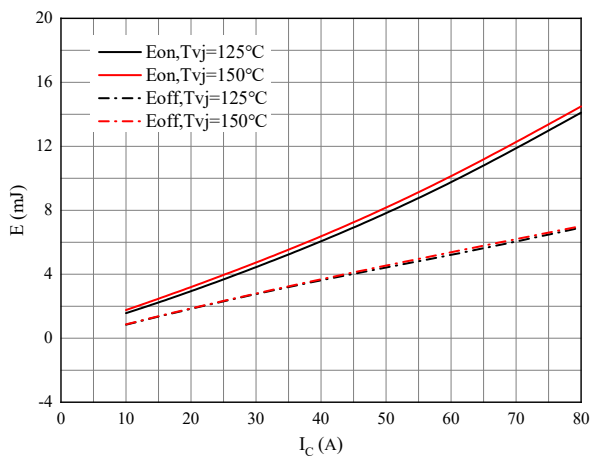


图 5. 开关损耗 逆变器

Figure 5. Switching losses of IGBT  
 $V_{GE}=\pm 15V, R_{Gon}=30\Omega, R_{Goff}=30\Omega, V_{CE}=600V$

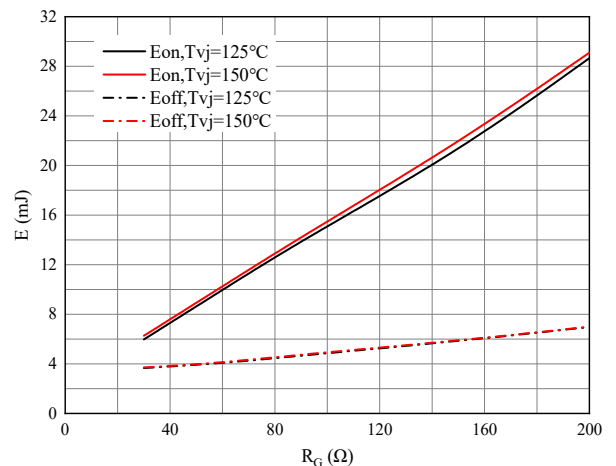


图 6. 开关损耗 逆变器

Figure 6. Switching losses of IGBT  
 $V_{GE}=\pm 15V, I_C=40A, V_{CE}=600V$

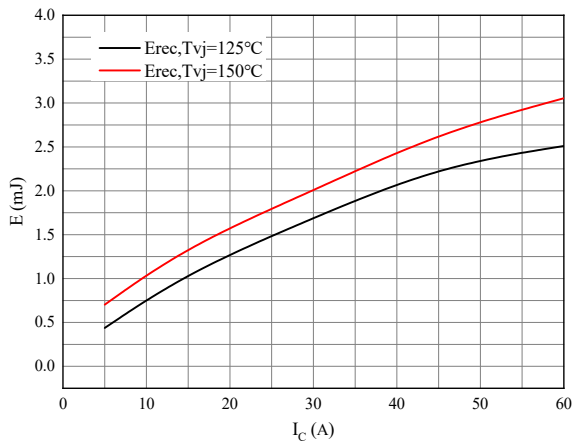


图 7. 开关损耗 二极管  
Figure 7. Switching losses of Diode  
 $R_{Gon}=30\Omega, V_{CE}=600V$

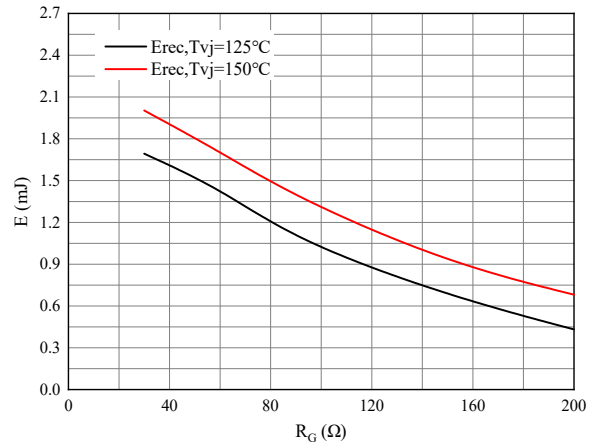


图 8. 开关损耗 二极管  
Figure 8. Switching losses of Diode  
 $I_F=40A, V_{CE}=600V$

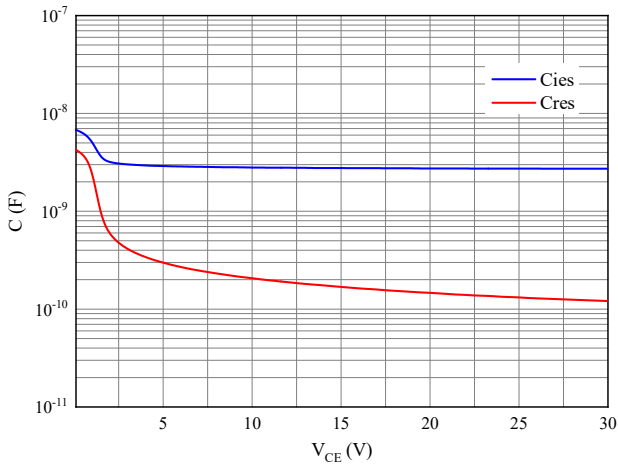


图 9. 电容特性  
Figure 9. Capacitance characteristic

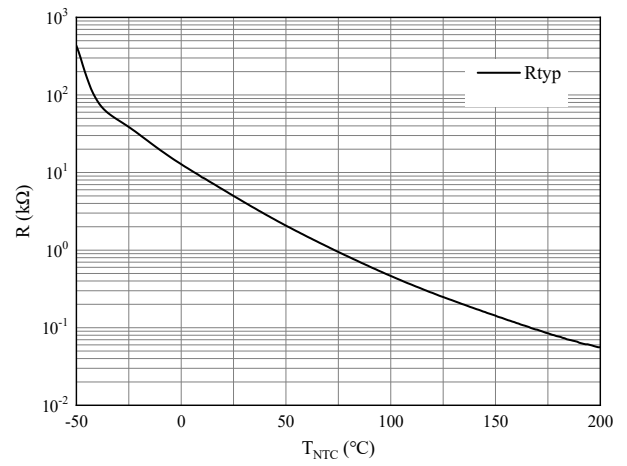
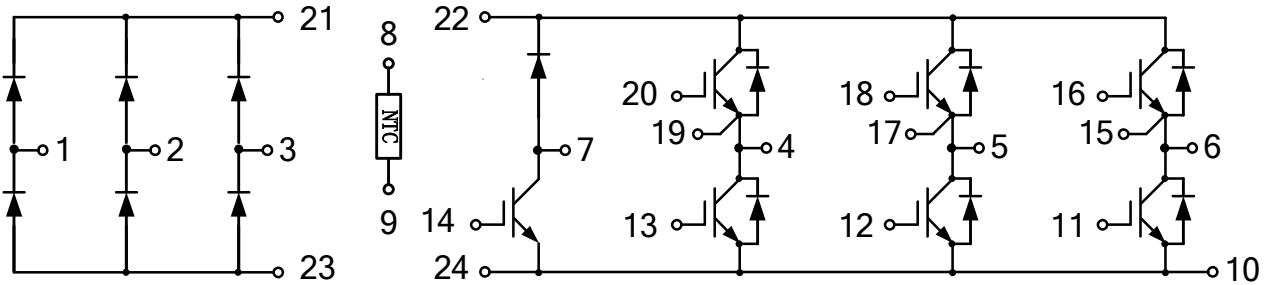


图 10. 负温系数热敏电阻 温度特性  
Figure 10. NTC-Themistor-temperature characteristic



接线图 / Circuit diagram



封装尺寸 / Package outlines

