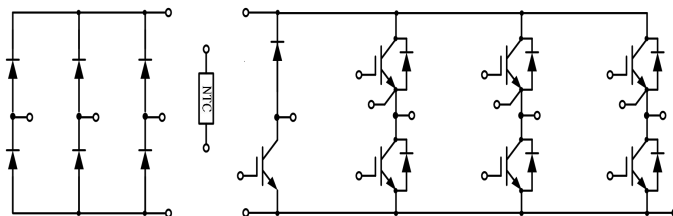


PIM IGBT Module

电气特性:

- 1200V 沟槽栅/场终止工艺
- 低开关损耗
- V_{CESat} 正温度系数



典型应用:

- 变频器
- 伺服
- 逆变器



$V_{CES} = 1200V$, $I_{C\ nom} = 75A$ / $I_{CRM} = 150A$

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	$T_C = 100^{\circ}C$, $T_{vj\ max} = 175^{\circ}C$	$I_{C\ nom}$	75	A
集电极重复峰值电流 Repetitive peak collector current	$t_p = 1\ ms$	I_{CRM}	150	A
栅极-发射极电压 Gate emitter voltage		V_{GE}	± 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	$V_{GE} = 15V$, $I_C = 75A$ $V_{GE} = 15V$, $I_C = 75A$ $V_{GE} = 15V$, $I_C = 75A$	$T_{vj} = 25^{\circ}C$ $T_{vj} = 125^{\circ}C$ $T_{vj} = 150^{\circ}C$	V_{CESat}	1.72 2.04 2.12	2.10	V
栅极-发射极阈值电压 Gate-Emitter threshold voltage	$I_C = 2.4mA$, $V_{GE} = V_{CE}$	$T_{vj} = 25^{\circ}C$	$V_{GE(th)}$	5.10 5.60	6.20	
栅电荷 Gate charge	$V_{GE} = -15V \dots +15V$		Q_G	0.58		μC

内部栅极电阻 Internal gate resistor		R_{Gint}		6.24		Ω
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}	5.24		nF
反向传输电容 Reverse transfer capacitance			C_{res}	0.24		
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}		1.0	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	$I_C=75\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=1\Omega$ (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}		85	
					95	
					96	
上升时间 Rise time	$I_C=75\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=1\Omega$ (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		31	ns
					34	
					37	
关断延迟时间 Turn-off delay time	$I_C=75\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=1\Omega$ (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}		256	
					309	
					323	
下降时间 Fall time	$I_C=75\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=1\Omega$ (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		186	
					178	
					167	
开通损耗能量 (每脉冲) Turn-on energy loss per pulse	$I_C=75\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=1\Omega$ $di/dt=1600\text{A}/\mu\text{s}$ ($T_{vj}=150^\circ\text{C}$) (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}		4.34	mJ
					7.86	
					8.90	
关断损耗能量 (每脉冲) Turn-off energy loss per pulse	$I_C=75\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=1\Omega$ $dv/dt=4100\text{V}/\mu\text{s}$ ($T_{vj}=150^\circ\text{C}$) (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}		5.58	
					6.87	
					7.06	
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}		398	A
在开关状态下温度 Temperature under switching conditions			T_{vjop}	-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	60	A
正向重复峰值电流 Repetitive peak forward current	$t_p=1\text{ms}$	I_{FRM}	120	A
I^2t 值 I^2t -value	$t_p=10\text{ms}, \sin 180^\circ, T_j=125^\circ\text{C}$	I^2t	960	A^2s

特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward voltage	$I_F=60A, V_{GE}=0V$ $I_F=60A, V_{GE}=0V$ $I_F=60A, V_{GE}=0V$	$T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$	V_F		2.12 1.72 1.64	2.50 V
反向恢复峰值电流 Peak reverse recovery current	$I_F=60A,$ $-di_F/dt=1700A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$	I_{RM}		64 98 107	A
恢复电荷 Recovered charge	$I_F=60A,$ $-di_F/dt=1700A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$	Q_F		4.74 10.79 12.65	μC
反向恢复损耗（每脉冲） Reverse recovered energy	$I_F=60A,$ $-di_F/dt=1700A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$	E_{rec}		1.75 3.87 4.86	mJ
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}	1800	V
反向不重复峰值电压 Non-Repetitive peak reverse voltage	$T_{vj}=25^{\circ}C, I_{RRM}=10\mu A$	V_{RSM}	2000	V
最大正向平均电流 Maximum Average Forward Current		$I_{F(AV)}$	70	A
正向浪涌电流 Surge forward current	$t_p=10ms, \sin 180^{\circ}, T_{vj}=25^{\circ}C$	I_{FSM}	840	A
I^2t 值 I^2t -value	$t_p=10ms, \sin 180^{\circ}, T_{vj}=25^{\circ}C$	I^2t	3528	A^2s

特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward voltage	$I_F=70A, T_{vj}=25^{\circ}C$	V_F		1.10	1.20	V
反向电流 Reverse current	$V_R=V_{RRM}$ $T_{vj}=25^{\circ}C$	I_R			10	μA
在开关状态下温度 Temperature under switching conditions			$T_{vj op}$	-40		150 $^{\circ}C$

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	$T_C=100^{\circ}\text{C}$, $T_{vj\max}=175^{\circ}\text{C}$	$I_{C\text{nom}}$	50	A
集电极重复峰值电流 Repetitive peak collector current	$t_p=1\text{ ms}$	I_{CRM}	100	A
总功率损耗 Total power dissipation	$T_C = 25^{\circ}\text{C}$, $T_{vj\max} = 175^{\circ}\text{C}$	P_{tot}	270	W
栅极-发射极电压 Gate emitter voltage		V_{GE}	± 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	$V_{GE}=15\text{V}$, $I_C=50\text{A}$ $V_{GE}=15\text{V}$, $I_C=50\text{A}$ $V_{GE}=15\text{V}$, $I_C=50\text{A}$	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$V_{CE\text{sat}}$	2.27 2.78 2.91	2.60	V	
栅极-发射极阈值电压 Gate-Emitter threshold voltage	$I_C=1.6\text{mA}$, $V_{GE}=V_{CE}$	$T_{vj}=25^{\circ}\text{C}$	$V_{GE(\text{th})}$	5.20	5.90	6.40	
栅电荷 Gate charge	$V_{GE}=-15\text{V}\dots+15\text{V}$		Q_G	0.26		μC	
内部栅极电阻 Internal gate resistor			$R_{G\text{int}}$	2.66		Ω	
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}	3.03		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	$I_C=50\text{A}$, $V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}$, $R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_{d\text{on}}$	127 110 108		ns	
上升时间 Rise time	$I_C=50\text{A}$, $V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}$, $R_G=40\Omega$ (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	55 67 68			
关断延迟时间 Turn-off delay time	$I_C=50\text{A}$, $V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}$, $R_G=40\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_{d\text{off}}$	347 383 391			
下降时间 Fall time	$I_C=50\text{A}$, $V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}$, $R_G=40\Omega$ (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_f	94 125 134			

开通损耗能量（每脉冲） Turn-on energy loss per pulse	$I_C=50A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=40\Omega$ $di/dt=570A/\mu s$ ($T_{vj}=150^\circ C$) (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	E_{on}		7.09 9.49 10.22		mJ
关断损耗能量（每脉冲） Turn-off energy loss per pulse	$I_C=50A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=40\Omega$ $dv/dt=5200V/\mu s$ ($T_{vj}=150^\circ C$) (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	E_{off}		2.58 3.35 3.61		
短路数据 SC data	$V_{GE}\leq 15V, V_{CC}=800V$ $V_{CEmax}=V_{CES}-L_{sCE}\cdot di/dt$ $t_p\leq 10\mu s, T_{vj}=150^\circ C$		I_{sc}		190		A
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	30	A
正向重复峰值电流 Repetitive peak forward current	$t_p=1ms$	I_{FRM}	60	A
I^2t 值 I^2t -value	$t_p=10ms, \sin 180^\circ, T_{vj}=125^\circ C$	I^2t	90	A^2s

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	1.94 1.60 1.53	2.40	V
反向恢复峰值电流 Peak reverse recovery current	$I_F=30A,$ $-di_F/dt=600A/\mu s$ ($T_{vj}=150^\circ C$) $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	I_{RM}	18 26 28		A
恢复电荷 Recovered charge	$I_F=30A,$ $-di_F/dt=600A/\mu s$ ($T_{vj}=150^\circ C$) $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	Q_r	2.44 5.65 7.17		μC
反向恢复损耗（每脉冲） Reverse recovered energy	$I_F=30A,$ $-di_F/dt=600A/\mu s$ ($T_{vj}=150^\circ C$) $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	E_{rec}	0.77 1.85 2.43		mJ
在开关状态下温度 Temperature under switching conditions			$T_{vj op}$	-40	150	$^\circ C$

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 Ω
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, $f=50\text{Hz}$, $t=1\text{min}$	V_{ISOL}		2500		V
内部绝缘 Internal isolation				Al_2O_3		
储存温度 Storage temperature		T_{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		300		g

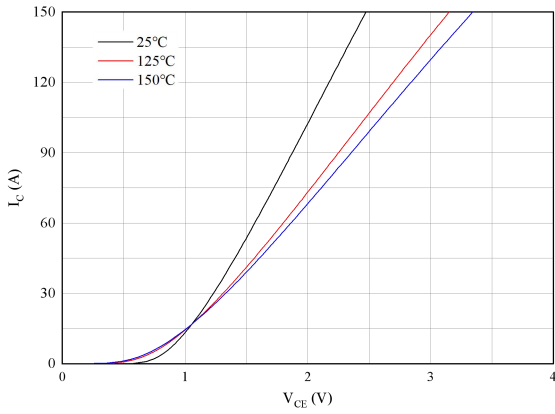


图 1. 典型输出特性 ($V_{GE}=15V$)
Figure 1. Typical output characteristics ($V_{GE}=15V$)

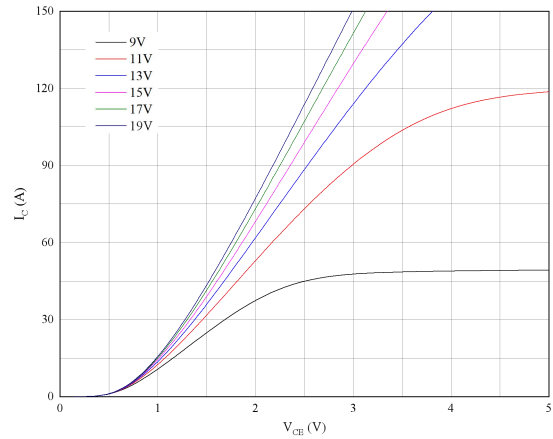


图 2. 典型输出特性 ($T_{vj}=150^{\circ}C$)
Figure 2. Typical output characteristics ($T_{vj}=150^{\circ}C$)

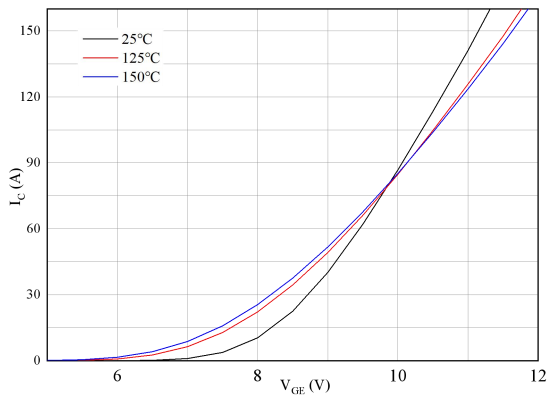


图 3. 典型传输特性 ($V_{CE}=20V$)
Figure 3. Typical transfer characteristic ($V_{CE}=20V$)

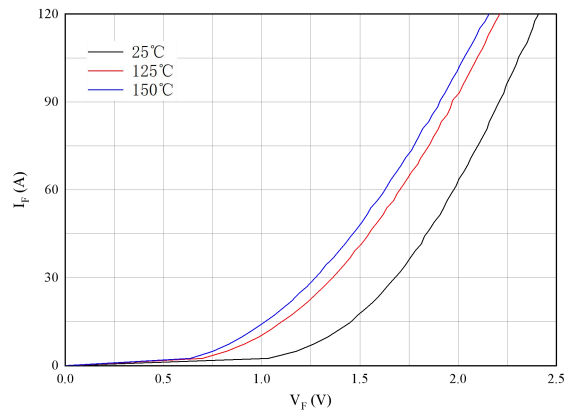


图 4. 正向偏压特性 二极管
Figure 4. Forward characteristic of Diode

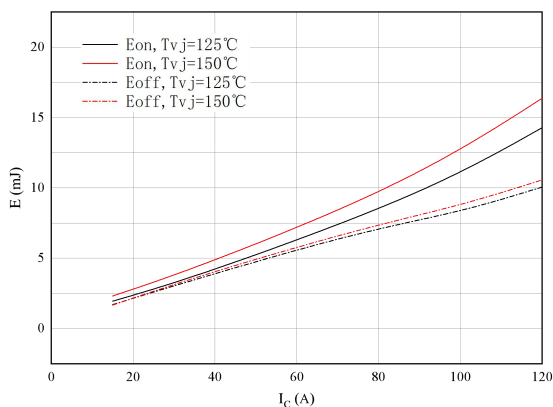


图 5. 开关损耗 逆变器
Figure 5. Switching losses of IGBT
 $V_{GE}=\pm 15V, R_{gon}=1\Omega, R_{goff}=1\Omega, V_{CE}=600V$

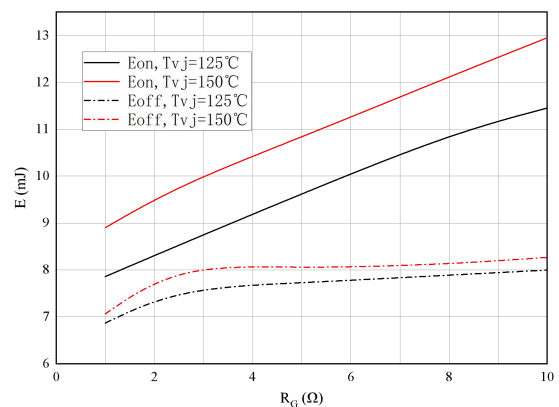


图 6. 开关损耗 逆变器
Figure 6. Switching losses of IGBT
 $V_{GE}=\pm 15V, I_C=75A, V_{CE}=600V$

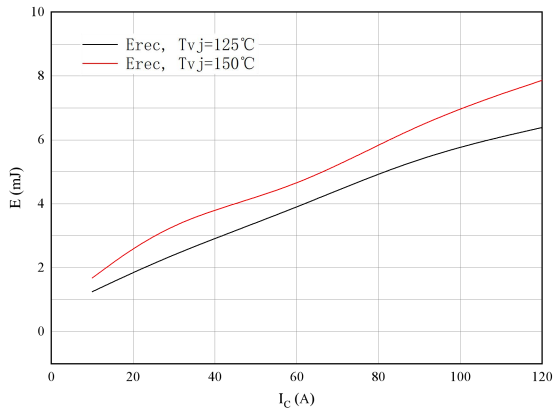


图 7. 开关损耗 二极管

Figure 7. Switching losses of Diode
Rgon=1Ω, VCE=600V

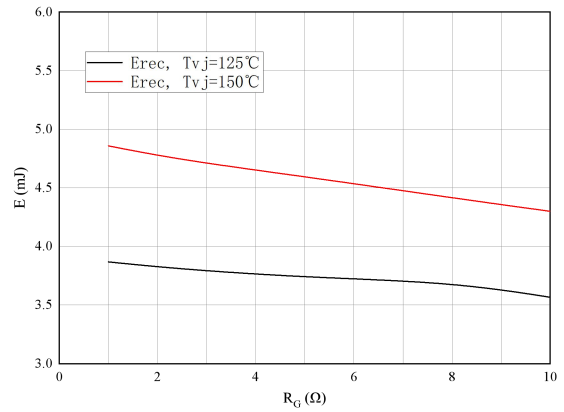


图 8. 开关损耗 二极管

Figure 8. Switching losses of Diode
IF=60A, VCE=600V

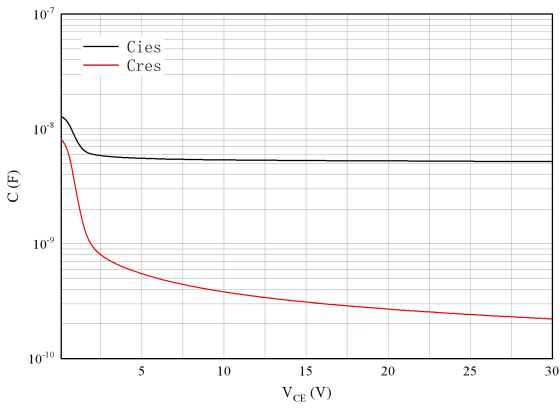


图 9. 电容特性

Figure 9. Capacitance characteristic

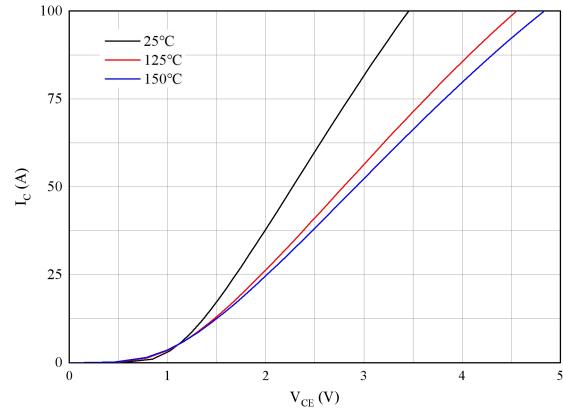


图 10. 典型输出特性 斩波(VGE=15V)

Figure 10. Typical output characteristics (VGE=15V)

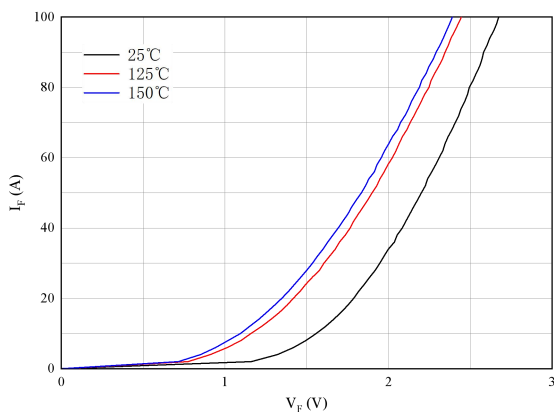


图 11. 正向偏压特性 斩波二极管

Figure 11. Forward characteristic of Diode

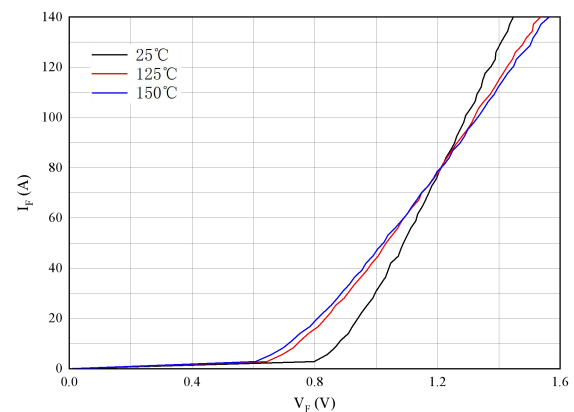


图 12. 正向偏压特性 整流二极管

Figure 12. Forward characteristic of Diode

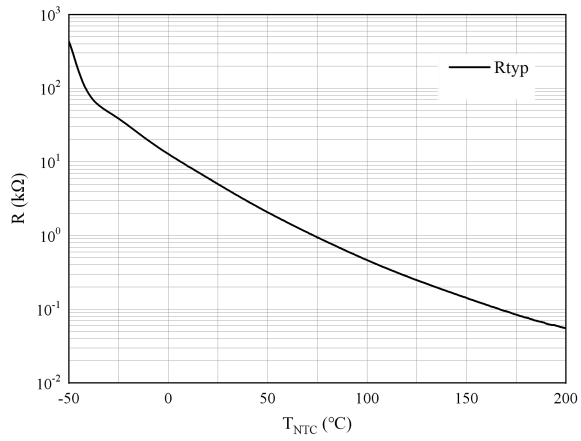
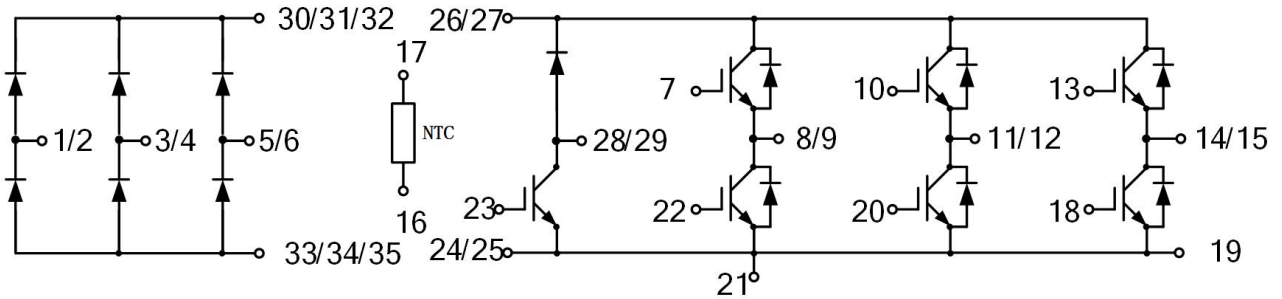


图 13. 负温系数热敏电阻 温度特性

Figure 13.NTC-Themistor-temperature characteristic

接线图 / Circuit diagram



封装尺寸 / Package outlines

