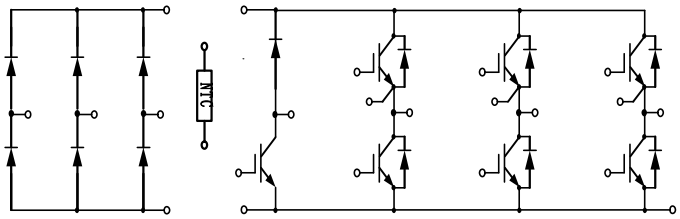
PIM IGBT Module

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，$I_{C\ nom}$ =100A / I_{CRM} =200A

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°C	V_{CES}	1200	V
连续集电极直流电流 Continuous DC collector current	T_C=100°C, $T_{vj\ max}$=175°C	$I_{C\ nom}$	100	A
集电极重复峰值电流 Repetitive peak collector current	t_P=1 ms	I_{CRM}	200	A
总功率损耗 Total power dissipation	T_C = 25°C, $T_{vj\ max}$ = 175°C	P_{tot}	515	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}=15V, I_C=100A V_{GE}=15V, I_C=100A V_{GE}=15V, I_C=100A	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	V_{CEsat}		2.03 2.29 2.41	2.50	V
栅极-发射极阈值电压 Gate-Emitter threshold voltage	I_C=3.8mA, V_{GE}= V_{CE}	T_{vj}=25°C	$V_{GE(th)}$	5.20	5.80	6.40	

Edited by Semi-Future Technologies, Edition 1.4
Publication: 2021-10-16

栅电荷 Gate charge	V_{GE}=-15V…+15V		Q_G		0.47		µC
内部栅极电阻 Internal gate resistor			R_{Gint}		5.86		Ω
输入电容 Input capacitance	f=1MHz, V_{CE}=25 V, V_{GE}=0 V	T_{vj}=25°C	C_{ies}		7.47		nF
反向传输电容 Reverse transfer capacitance			C_{res}		0.28		
集电极-发射极截止电流 Collector-emitter cut-off current	V_{CE}=1200V , V_{GE}= 0 V	T_{vj}=25°C	I_{CES}			1	mA
栅极-发射极漏电流 Gate-emitter leakage current	V_{CE}=0 V, V_{GE}= 20 V	T_{vj}=25°C	I_{GES}			100	nA
开通延迟时间 Turn-on delay time	I_C=100A, V_{CE}=600 V V_{GE}=±15 V, R_G=2Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	$t_{d\,on}$		109 115 118		ns
上升时间 Rise time	I_C=100A, V_{CE}=600 V V_{GE}=±15 V, R_G=2Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	t_r		25 29 30		
关断延迟时间 Turn-off delay time	I_C=100A, V_{CE}=600 V V_{GE}=±15 V, R_G=2Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	$t_{d\,off}$		215 273 285		
下降时间 Fall time	I_C=100A, V_{CE}=600 V V_{GE}=±15 V, R_G=2Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	t_f		154 233 239		
开通损耗能量（每脉冲） Turn-on energy loss per pulse	I_C=100A, V_{CE}=600 V V_{GE}=±15 V, R_G=2Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	E_{on}		3.64 5.91 6.80		mJ
关断损耗能量（每脉冲） Turn-off energy loss per pulse	I_C=100A, V_{CE}=600 V V_{GE}=±15 V, R_G=2Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	E_{off}		6.11 8.64 9.14		
短路数据 SC data	V_{GE}≤15V, Vcc=800V V_{CEmax}=V_{CES}-L_{sCE}·di/dt	t_P≤10us, T_{vj}=150°C	I_{SC}		329		A
结-外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT		R_{thJC}			0.29	K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\,op}$	-40		150	°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°C	V_{RRM}	1200	V
连续正向直流电流 Continuous DC forward current		I_F	100	A
正向重复峰值电流 Repetitive peak forward current	t_p=1ms	I_{FRM}	200	A

I^2t 值 I^2t-value	t_p=10ms，sin180°，T_j=125°C	I^2t	1680	A^2s

特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward voltage	I_F=100A, V_{GE}=0V T_{vj}=25°C I_F=100A, V_{GE}=0V T_{vj}=125°C I_F=100A, V_{GE}=0V T_{vj}=150°C	V_F		2.40 2.40 2.32	2.80	V
反向恢复峰值电流 Peak reverse recovery current	I_F=100A, T_{vj}=25°C -di$_F$/dt=2430A/μs(T_{vj}=150°C) T_{vj}=125°C V_R=600V, V_{GE}=-15V T_{vj}=150°C	I_{RM}		73 82 91		A
恢复电荷 Recovered charge	I_F=100A, T_{vj}=25°C -di$_F$/dt=2430A/μs(T_{vj}=150°C) T_{vj}=125°C V_R=600V, V_{GE}=-15V T_{vj}=150°C	Q_r		5.44 10.71 14.18		μC
反向恢复损耗（每脉冲） Reverse recovered energy	I_F=100A, T_{vj}=25°C -di$_F$/dt=2430A/μs(T_{vj}=150°C) T_{vj}=125°C V_R=600V, V_{GE}=-15V T_{vj}=150°C	E_{rec}		1.87 3.91 5.32		mJ
结-外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode	R_{thJC}			0.50	K/W
在开关状态下温度 Temperature under switching conditions		$T_{vj\ op}$	-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_{vj}=25°C，I_{RRM}=5μA	V_{RRM}	1800	V
反向不重复峰值电压 Non-Repetitive peak reverse voltage	T_{vj}=25°C，I_{RRM}=5μA	V_{RSM}	2000	V
最大正向平均电流 Maximum Average Forward Current		$I_{F(AV)}$	80	A
正向浪涌电流 Surge forward current	t_p=10ms，sin180°，T_j=25°C	I_{FSM}	960	A
I^2t 值 I^2t-value	t_p=10ms，sin180°，T_j=25°C	I^2t	4600	A^2s

特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward voltage	I_F=80A, T_j=25°C	V_F		1	1.2	V
反向电流 Reverse current	V_R=V_{RRM} T_{vj}=25°C	I_R			10	μA

在开关状态下温度 Temperature under switching conditions		$T_{vj\ op}$	-40		150	°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°C	V_{CES}	1200	V
连续集电极直流电流 Continuous DC collector curren	T_C=100°C, $T_{vj\ max}$=175°C	$I_{C\ nom}$	50	A
集电极重复峰值电流 Repetitive peak collector current	t_P=1 ms	I_{CRM}	100	A
总功率损耗 Total power dissipation	T_C = 25°C, $T_{vj\ max}$ = 175°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}=15V, I_C=50A V_{GE}=15V, I_C=50A V_{GE}=15V, I_C=50A	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	V_{CEsat}		2.52 3.30 3.52	2.90	V
栅极-发射极阈值电压 Gate-Emitter threshold voltage	I_C=1.6mA, V_{GE}= V_{CE}	T_{vj}=25°C	$V_{GE(th)}$	5.20	5.90	6.40	
栅电荷 Gate charge	V_{GE}=-15V…+15V		Q_G		0.25		µC
内部栅极电阻 Internal gate resistor			R_{Gint}		3.10		Ω
输入电容 Input capacitance	f=1MHz, V_{CE}=25 V, V_{GE}=0 V	T_{vj}=25°C	C_{ies}		3.84		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}=1200V , V_{GE}= 0 V	T_{vj}=25°C	I_{CES}			1	mA
栅极-发射极漏电流 Gate-emitter leakage current	V_{CE}=0 V, V_{GE}= 20 V	T_{vj}=25°C	I_{GES}			100	nA
开通延迟时间 Turn-on delay time	I_C=50A, V_{CE}=600 V V_{GE}=±15 V, R_G=15Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	$t_{d\ on}$		62 63 63		ns
上升时间 Rise time	I_C=50A, V_{CE}=600 V V_{GE}=±15 V, R_G=15Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	t_r		47 50 52		
关断延迟时间 Turn-off delay time	I_C=50A, V_{CE}=600 V V_{GE}=±15 V, R_G=15Ω	T_{vj}=25°C T_{vj}=125°C	$t_{d\ off}$		198 246		

	(电感负载) / (inductive load)	T_{vj}=150°C			257		
下降时间 Fall time	I_C=50A, V_{CE}=600 V V_{GE}=±15 V, R_G=15Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	t_f		184 261 284		
开通损耗能量（每脉冲） Turn-on energy loss per pulse	I_C=50A, V_{CE}=600 V V_{GE}=±15 V, R_G=15Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	E_{on}		4.60 7.18 7.71		mJ
关断损耗能量（每脉冲） Turn-off energy loss per pulse	I_C=50A, V_{CE}=600 V V_{GE}=±15 V, R_G=15Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	E_{off}		3.04 4.47 4.80		
短路数据 SC data	V_{GE}≤15V, Vcc=800V V_{CEmax}=V_{CES}-L_{sCE}·di/dt	t_P≤10us, T_{vj}=150°C	I_{SC}		157		A
结-外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT		R_{thJC}			0.54	K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\ op}$	-40		150	°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°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, sin180°，T_{vj}=125°C	I^2t	120	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°C T_{vj}=125°C T_{vj}=150°C	V_F		2.86 2.66 2.59	3.40	V
反向恢复峰值电流 Peak reverse recovery current	I_F=30A, -di$_F$/dt=771A/μs(T_{vj}=150°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	I_{RM}		20 29 31		A
恢复电荷 Recovered charge	I_F=30A, -di$_F$/dt=771A/μs(T_{vj}=150°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	Q_r		2.64 5.66 6.49		μC
反向恢复损耗（每脉冲） Reverse recovered energy	I_F=30A, -di$_F$/dt=771A/μs(T_{vj}=150°C)	T_{vj}=25°C T_{vj}=125°C	E_{rec}		0.95 2.01		mJ

	V_R=600V, V_{GE}=-15V T_{vj}=150°C			2.28		
结-外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode	R_{thJC}			1.35	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°C，±5%	R_{25}		5.0		KΩ
B-值 B-value	±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				Al_2O_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		300		g

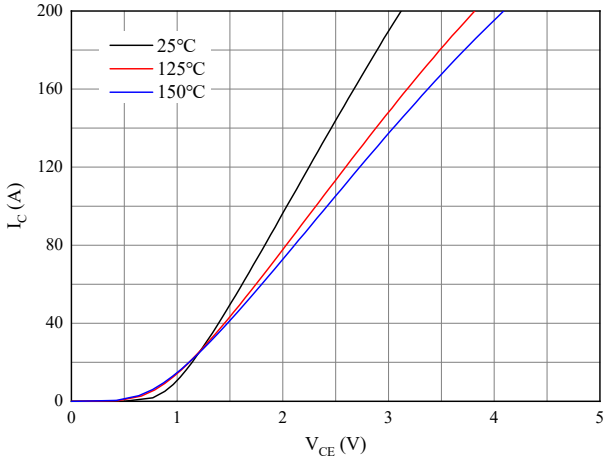


图 1. 典型输出特性 (V_{GE}=15V)

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

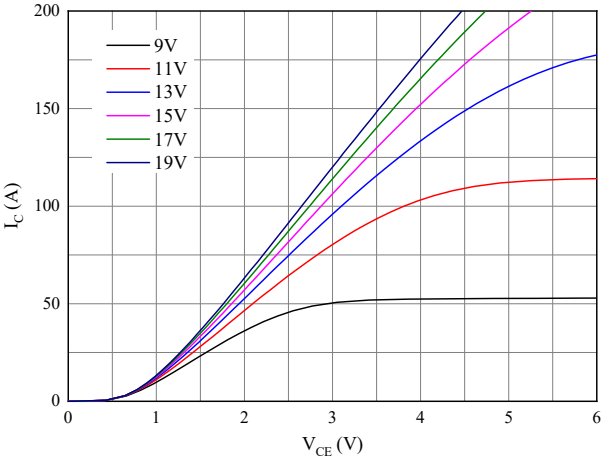


图 2. 典型输出特性 (T_{vj}=150℃)

Figure 2. Typical output characteristics (T_{vj}=150℃)

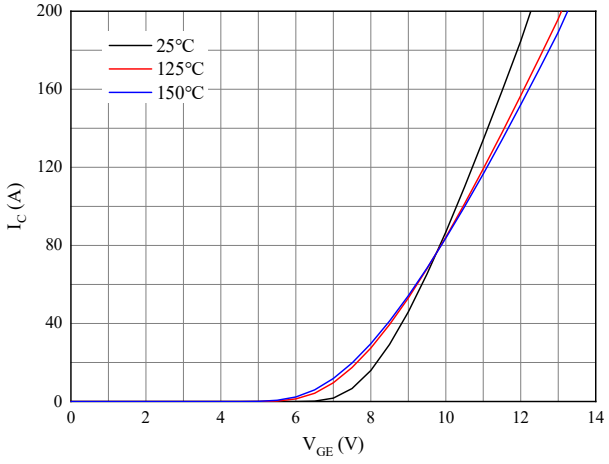


图 3. 典型传输特性(V_{CE}=20V)

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

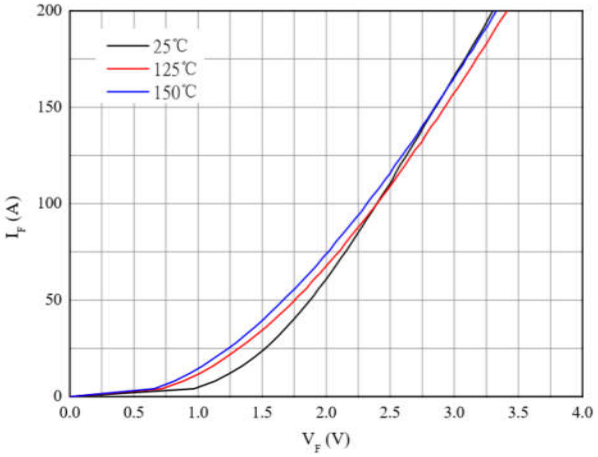


图 4. 正向偏压特性 二极管

Figure 4. Forward characteristic of Diode

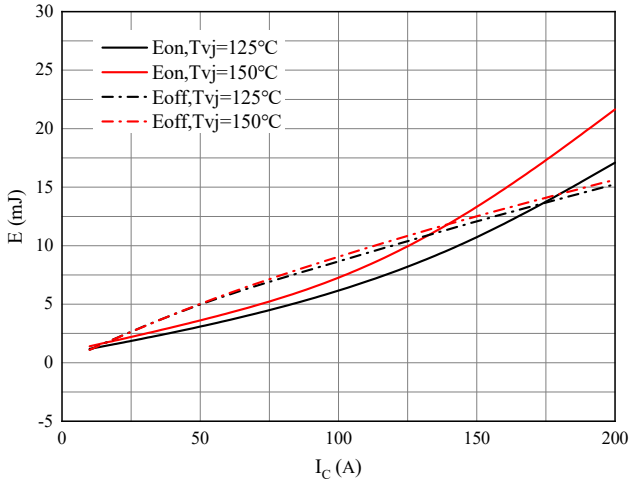


图 5. 开关损耗 逆变器

Figure 5. Switching losses of IGBT

VGE=±15V, RGon=2Ω, RGoff=2Ω, VCE=600V

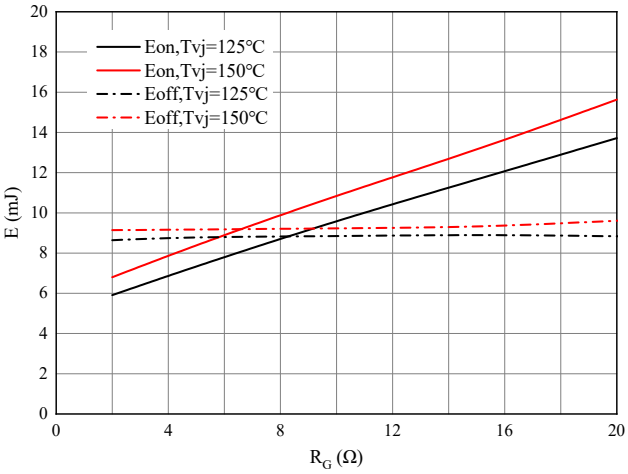


图 6. 开关损耗 逆变器

Figure 6. Switching losses of IGBT

VGE=±15V, IC=100A, VCE=600V

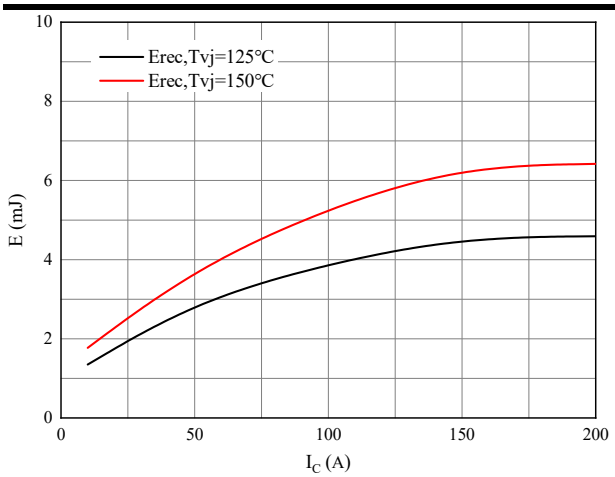


图 7. 开关损耗 二极管

Figure 7. Switching losses of Diode

RGon=2 Ω , VCE=600V

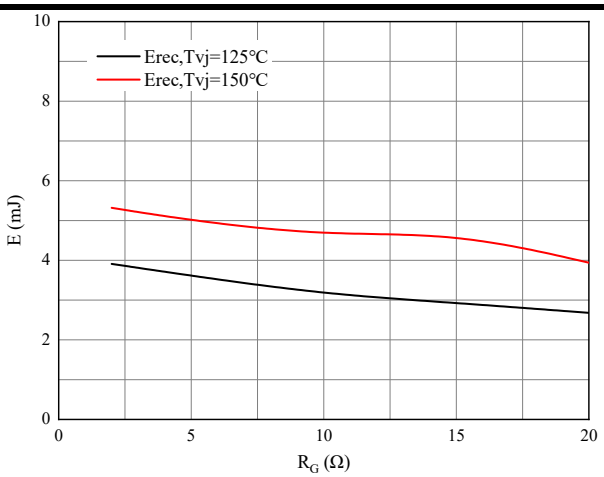


图 8. 开关损耗 二极管

Figure 8. Switching losses of Diode

IF=100A, VCE=600V

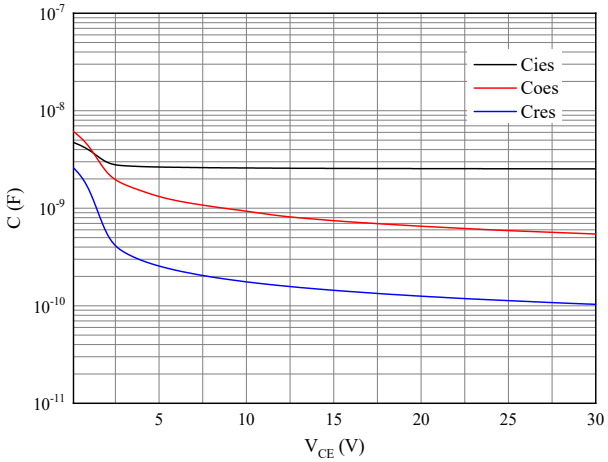


图 9. 电容特性

Figure 9. Capacitance characteristic

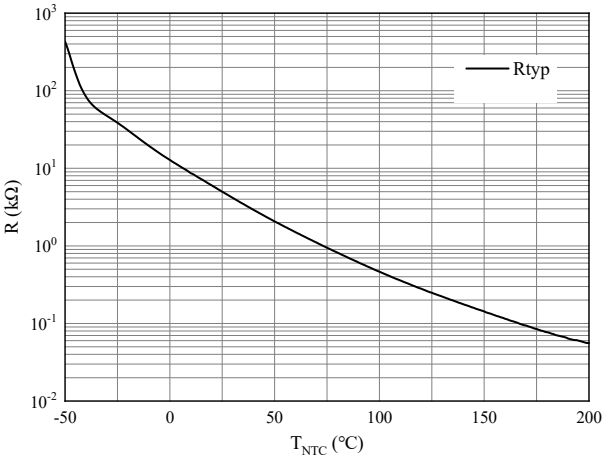
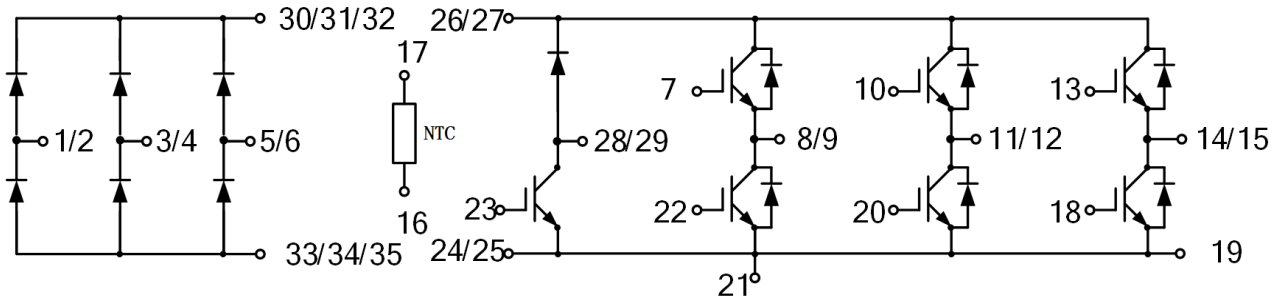


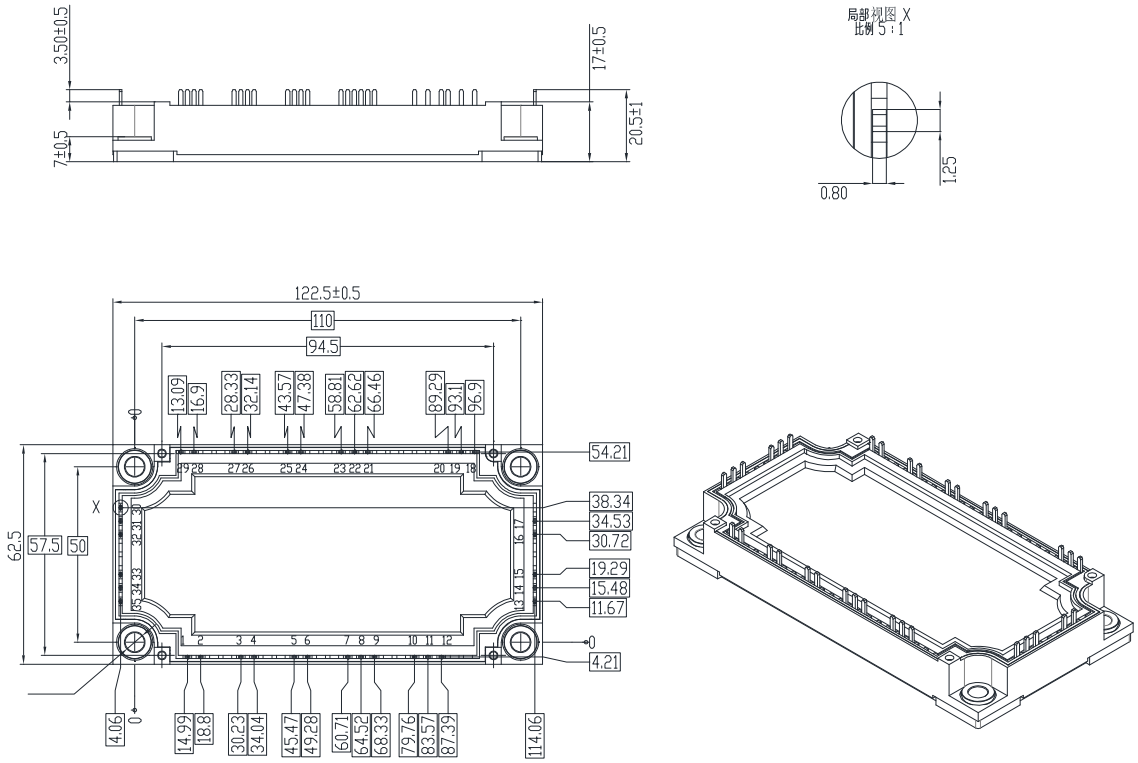
图 10. 负温系数热敏电阻 温度特性

Figure 10. NTC-Themistor-temperature characteristic

接线图 / Circuit diagram



封装尺寸 / Package outlines



Edited by Semi-Future Technologies, Edition 1.4
Publication: 2021-10-16