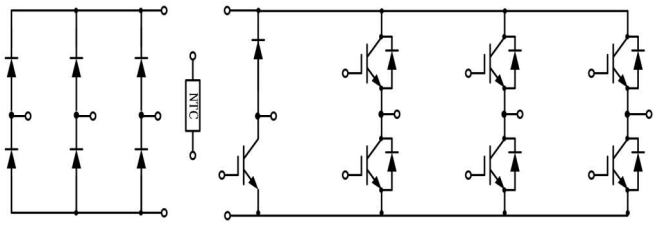
DONGGUAN NANJING ELECTRONICS LTD.,

Insulated Gate Bipolar Transistor Module

SP40R12H6B PIM IGBT Module

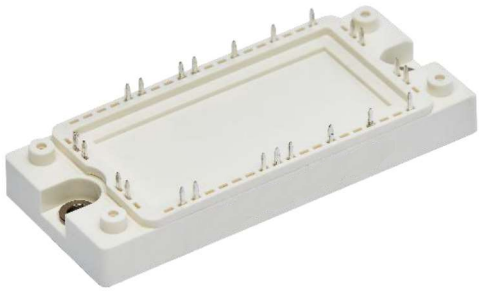
电气特性 / Features and Benefits:

- 1200V 沟槽栅/场终止工艺
1200V Trench Gate / Field Termination Process
- 低开关损耗
Low Switching Losses
- 正温度系数
Positive Temperature Coefficient



典型应用 / Application:

- 变频器
Frequency Converter
- 伺服
Servo
- 逆变器
Inverter



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°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	$I_{C\,nom}$	40	A
集电极重复峰值电流 Repetitive peak collector current	t_P=1 ms	I_{CRM}	80	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=40A V_{GE}=15V, I_C=40A V_{GE}=15V, I_C=40A	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	V_{CEsat}		1.78 2.11 2.17	2.3	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°C	$V_{GE(th)}$	5.3	5.8	6.4	
内部栅极电阻 Internal gate resistor			R_{Gint}		None		Ω

输入电容 Input capacitance	f=100KHz, V_{CE}=25 V, V_{GE}=0 V T_{vj}=25°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}=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=40A, V_{CE}=600 V T_{vj}=25°C V_{GE}=±15 V, R_G=30Ω T_{vj}=125°C (电感负载) / (inductive load) T_{vj}=150°C	$t_{d\,on}$		67 60 56		ns
上升时间 Rise time	I_C=40A, V_{CE}=600 V T_{vj}=25°C V_{GE}=±15 V, R_G=30Ω T_{vj}=125°C (电感负载) / (inductive load) T_{vj}=150°C	t_r		52 53 55		
关断延迟时间 Turn-off delay time	I_C=40A, V_{CE}=600 V T_{vj}=25°C V_{GE}=±15 V, R_G=30Ω T_{vj}=125°C (电感负载) / (inductive load) T_{vj}=150°C	$t_{d\,off}$		326 370 379		
下降时间 Fall time	I_C=40A, V_{CE}=600 V T_{vj}=25°C V_{GE}=±15 V, R_G=30Ω T_{vj}=125°C (电感负载) / (inductive load) T_{vj}=150°C	t_f		127 219 258		
开通损耗能量（每脉冲） Turn-on energy loss per pulse	I_C=40A, V_{CE}=600 V V_{GE}=±15 V, R_G=30Ω T_{vj}=25°C di/dt=550A/μs(Tvj=150°C) T_{vj}=125°C (电感负载) / (inductive load) T_{vj}=150°C	E_{on}		4.39 6.28 6.89		mJ
关断损耗能量（每脉冲） Turn-off energy loss per pulse	I_C=40A, V_{CE}=600 V V_{GE}=±15 V, R_G=30Ω T_{vj}=25°C du/dt=4700V/μs(Tvj=150°C) T_{vj}=125°C (电感负载) / (inductive load) T_{vj}=150°C	E_{off}		2.00 3.01 3.30		
短路数据 SC data	V_{GE}≤15V, Vcc=650V V_{CEmax}=V_{CES}-L_{sCE}·di/dt t_P≤10us, T_{vj}=150°C	I_{SC}		190		A
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	40	A
正向重复峰值电流 Repetitive peak forward current	t_p=1ms	I_{FRM}	80	A
I^2t 值 I^2t-value	t_p=10ms，sin180°，T_j=125°C	I^2t	680	A^2s

特征值 / Characteristic Values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
正向电压 Forward voltage	I_F=40A, V_{GE}=0V I_F=40A, V_{GE}=0V I_F=40A, V_{GE}=0V	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	V_F		2.11 1.77 1.70	2.55	V
反向恢复峰值电流 Peak reverse recovery current	I_F=40A, -di$_F$/dt=550A/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}		24 40 43		A
恢复电荷 Recovered charge	I_F=40A, -di$_F$/dt=550A/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		0.97 6.37 7.70		μC
反向恢复损耗（每脉冲） Reverse recovered energy	I_F=40A, -di$_F$/dt=550A/μs(T_{vj}=150°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	E_{rec}		0.08 1.89 2.35		mJ
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}=0.05mA	V_{RRM}	1600	V
反向不重复峰值电压 Non-Repetitive peak reverse voltage	T_{vj}=25°C，I_{RRM}=0.05mA	V_{RSM}	1800	V
最大正向平均电流 Maximum Average Forward Current	Ts=80°C，T_{vj}=25°C	$I_{F(AV)}$	35	A
正向浪涌电流 Surge forward current	t_p=10ms，sin180°，T_{vj}=125°C	I_{FSM}	530	A
I^2t 值 I^2t-value	t_p=10ms，sin180°，T_{vj}=125°C	I^2t	1400	A^2s

特征值 / Characteristic Values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
正向电压 Forward voltage	I_F=40A, T_{vj}=25°C		V_F		1.16	1.40	V
反向电流 Reverse current	V_R=V_{RRM}	T_{vj}=25°C	I_R			100	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 current	T_C=100°C, $T_{vj\,max}$=175°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
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=25A V_{GE}=15V, I_C=25A V_{GE}=15V, I_C=25A	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	V_{CEsat}		1.81 2.11 2.20	2.50	V
栅极-发射极阈值电压 Gate-Emitter threshold voltage	I_C=1mA, V_{GE}= V_{CE}	T_{vj}=25°C	$V_{GE(th)}$	5.2	5.8	6.4	
内部栅极电阻 Internal gate resistor			R_{Gint}		None		Ω
输入电容 Input capacitance	f=100KHz, V_{CE}=25 V, V_{GE}=0 V	T_{vj}=25°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}=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=25A, V_{CE}=600 V V_{GE}=±15 V, R_G=40Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	$t_{d\,on}$		72 60 58		ns
上升时间 Rise time	I_C=25A, V_{CE}=600 V V_{GE}=±15 V, R_G=40Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	t_r		57 62 63		
关断延迟时间 Turn-off delay time	I_C=25A, V_{CE}=600 V V_{GE}=±15 V, R_G=40Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	$t_{d\,off}$		283 324 335		
下降时间 Fall time	I_C=25A, V_{CE}=600 V V_{GE}=±15 V, R_G=40Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	t_f		171 238 250		
开通损耗能量（每脉冲） Turn-on energy loss per pulse	I_C=25A, V_{CE}=600 V V_{GE}= ± 15V,R_G=40 Ω di/dt=370A/μs(Tvj=150°C) (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	E_{on}		2.66 3.55 3.89		mJ

关断损耗能量（每脉冲） Turn-off energy loss per pulse	I_C=25A, V_{CE}=600 V V_{GE}=±15 V, R_G=40Ω du/dt=4800V/μs(Tvj=150°C) (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	E_{off}		1.37 1.87 2.02		
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	15	A
正向重复峰值电流 Repetitive peak forward current	t_p=1ms	I_{FRM}	30	A
I^2t 值 I^2t-value	V_R=0V, t_p=10ms, T_{vj}=125 °C	I^2t	50	A^2s

特征值 / Characteristic Values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
正向电压 Forward voltage	I_F=15A, V_{GE}=0V I_F=15A, V_{GE}=0V I_F=15A, V_{GE}=0V	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	V_F		2.05 1.67 1.60	2.70	V
反向恢复峰值电流 Peak reverse recovery current	I_F=15A, -di_F/dt=370A/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}		4 10 13		A
恢复电荷 Recovered charge	I_F=15A, -di_F/dt=370A/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		0.26 1.02 1.31		μC
反向恢复损耗（每脉冲） Reverse recovered energy	I_F=15A, -di_F/dt=370A/μs(T_{vj}=150°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	E_{rec}		0.05 0.25 0.35		mJ
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		170		g

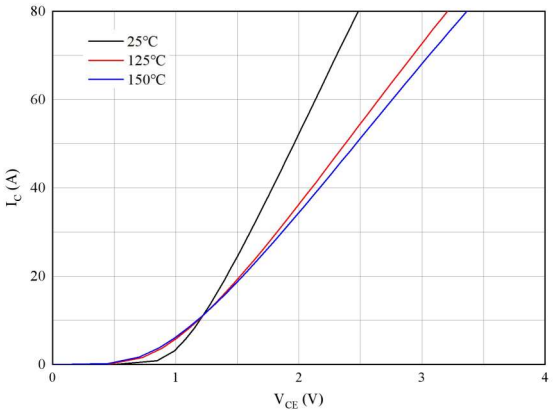


图 1. 典型输出特性(V_{GE}=15V)

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

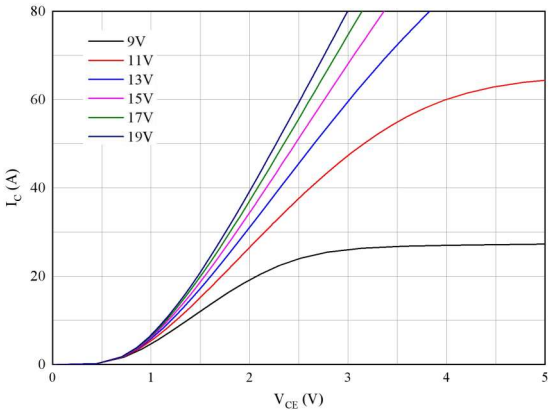


图 2. 典型输出特性 (T_{vj}=150℃)

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

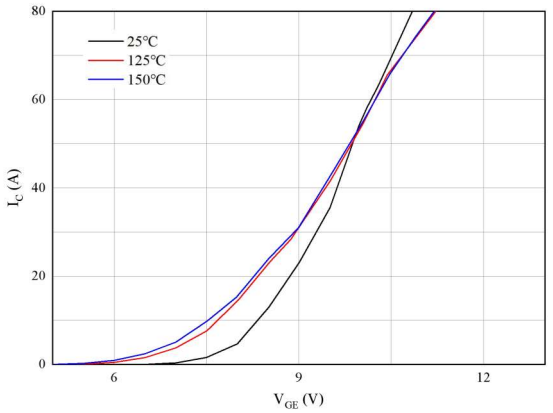


图 3. 典型传输特性(V_{CE}=20V)

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

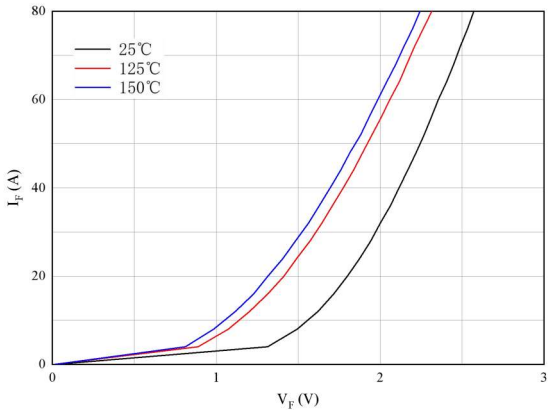


图 4. 正向偏压特性 二极管

Figure 4. Forward characteristic of Diode

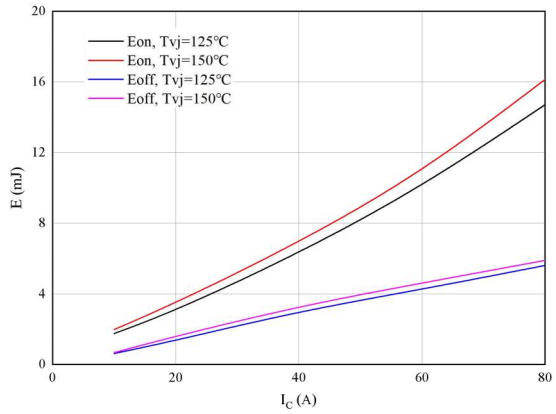


图 5. 开关损耗 逆变器

Figure 1. Switching losses of IGBT

VGE=±15V, Rgon=30Ω, Rgoff=30Ω, VCE=600V

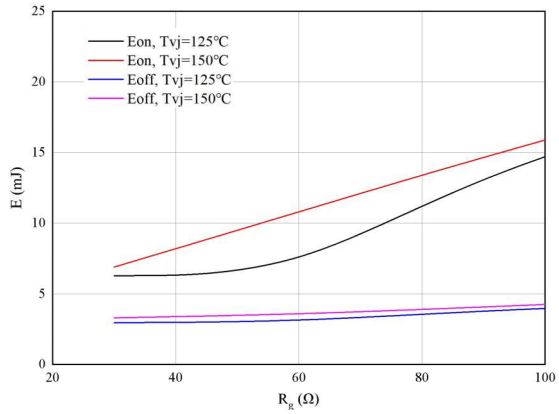


图 6. 开关损耗 逆变器

Figure 2. Switching losses of IGBT

VGE=±15V, IC=40A, VCE=600V

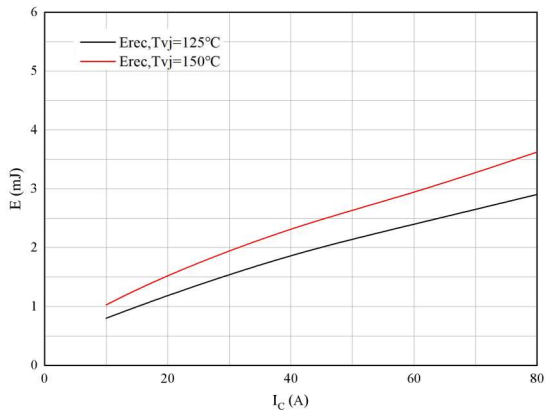


图 7. 开关损耗 二极管

Figure 3. Switching losses of Diode

Rgon=30Ω, VCE=600V

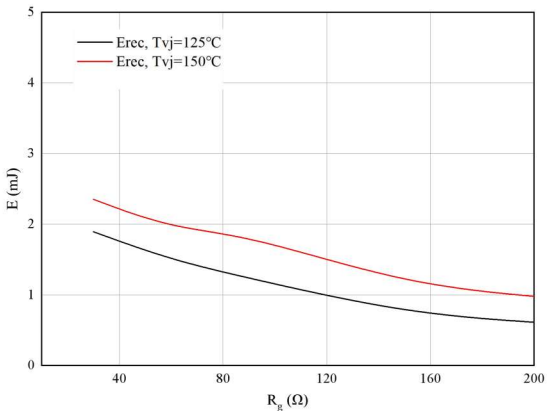


图 8. 开关损耗 二极管

Figure 4. Switching losses of Diode

IF=40A, VCE=600V

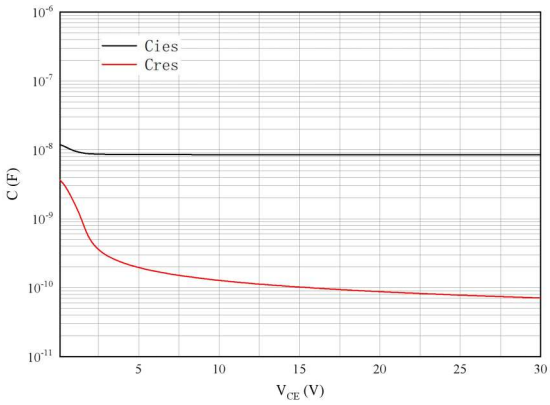


图 9. 电容特性

Figure 9. Capacitance characteristic

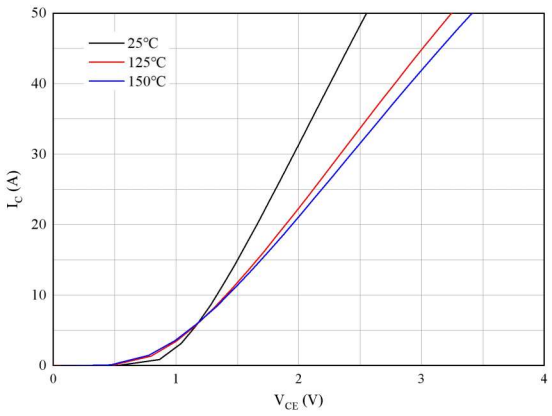


图 10. 典型输出特性 斩波(V_{GE}=15V)

Figure10. Typical output characteristics (V_{GE}=15V)

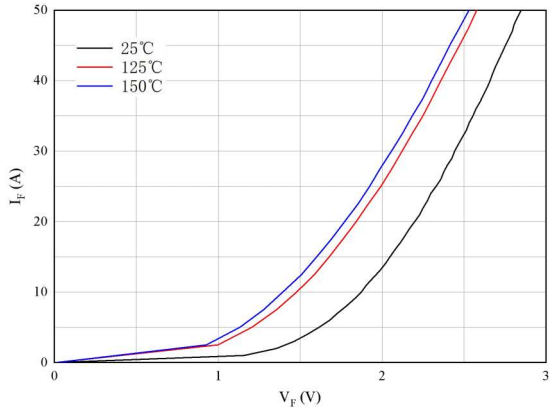


图 11. 正向偏压特性 斩波二极管

Figure 11.Forward characteristic of Diode

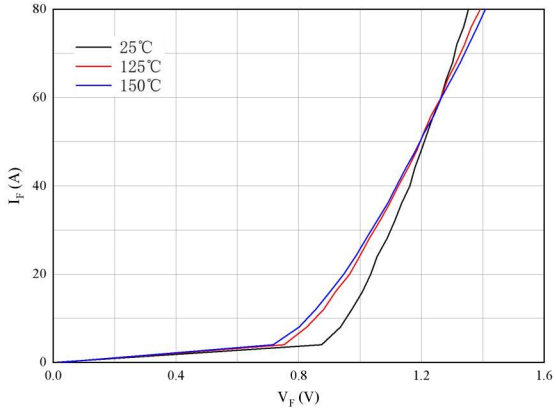


图 12. 正向偏压特性 整流二极管

Figure 12.Forward characteristic of Diode

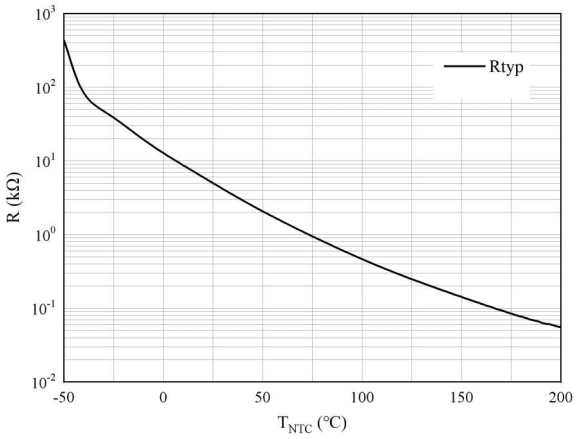
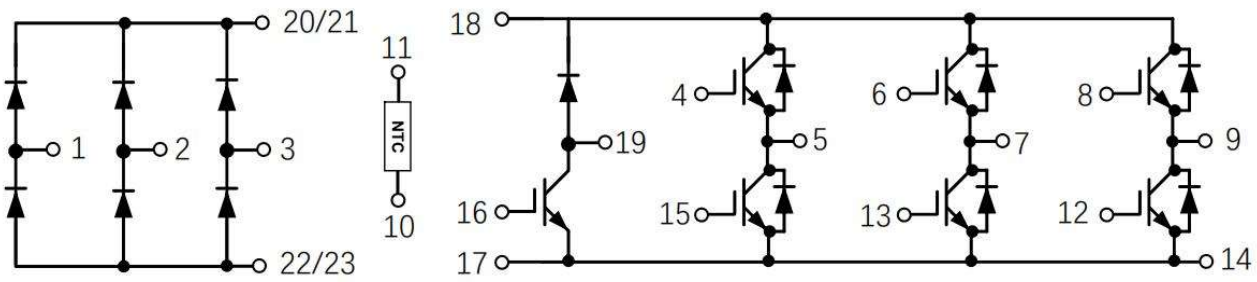


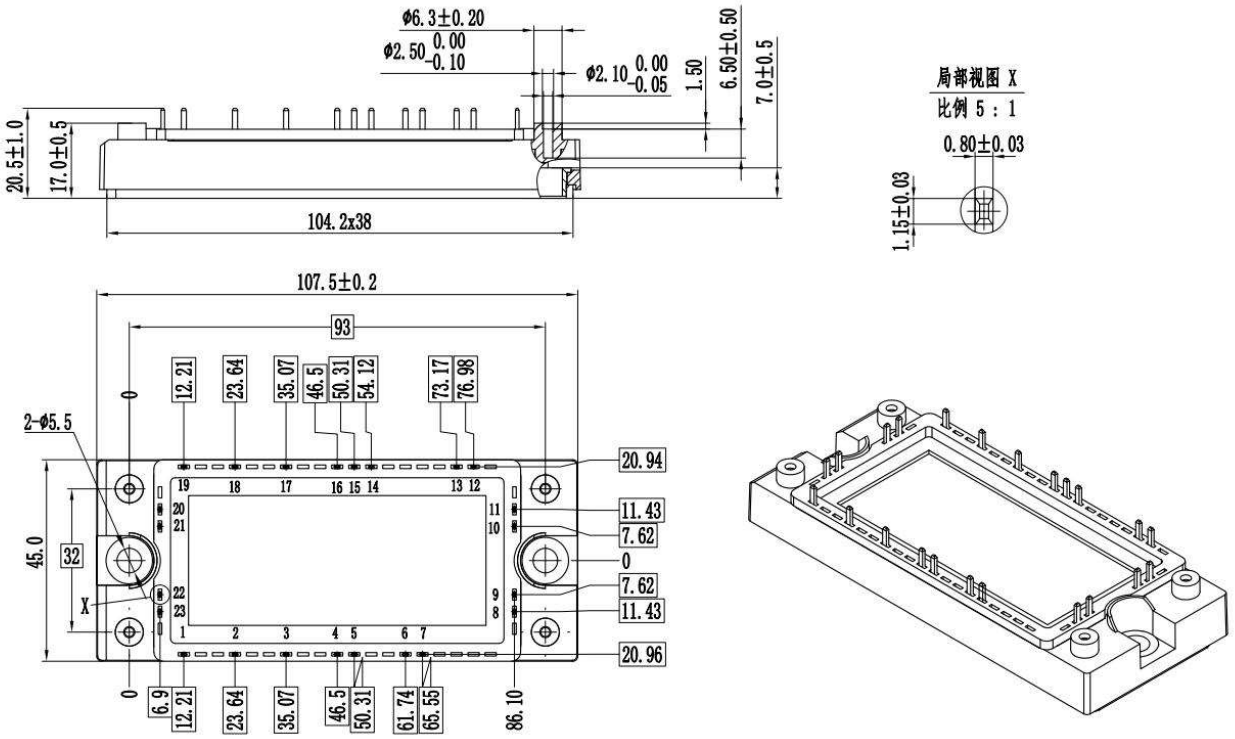
图 13. 负温系数热敏电阻 温度特性

Figure 13.NTC-Themistor-temperature characteristic

接线图 / Circuit diagram



封装尺寸 / Package outlines



Dimensions in (mm)