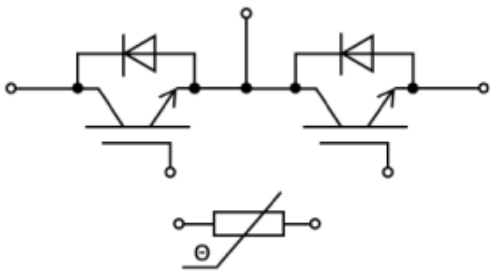
HCG450FH120D3K4

1200V 450A IGBT 模块, E6封装, 内置续流二极管及NTC
1200V 450A IGBT Module, E6 Package, with FWD and NTC

特点 Features

- 1200V 沟槽栅及场截止结构
  1200V Trench Gate & Field Stop Structure
- 高短路耐量
  High Short Circuit Capability
- 低开关损耗
  Low Switching Loss
- 高可靠性
  High Reliability
- 正温度系数
  Positive Temperature Coefficient

应用 Applications



- 光伏逆变器
  Solar Inverter
- 不间断电源UPS
  Uninterrupted Power Supply
- 伺服驱动
  Servo Driver
- 电机驱动
  Motor Driver

最大额定值 Maximum Ratings

参数 Parameter	符号 Symbol	数□ Value	□位 Unit
集□极-□射极□□ Collector-Emitter Voltage	V_{CES}	1200	V
集□极□流 DC Collector Current, T_c=100℃	I_C	450	A
集□极峰□□ 流 Peak Collector Current, t_p=1ms	I_{CM}	900	A
□极-□射极□□ Gate-Emitter Voltage	V_{GES}	±20	V
二极管正向□流 Diode Forward Current	I_F	450	A
二极管正向峰□□ 流 Diode Peak Forward Current, t_p=1ms	I_{FRM}	900	A
IGBT最大功耗 IGBT Maximum Power Dissipation	P_D	2080	W
IGBT短路耐量 IGBT Short Circuit Withstand Time	t_{sc}	10	μs
最高□温 Maximum Junction Temperature	$T_{vj, max}$	175	℃
工作□温 Operating Junction Temperature	$T_{vj, op}$	-40~150	℃
存□温度范□ Storage Temperature Range	T_{stg}	-40~125	℃

IGBT特征值 IGBT Characteristics Values*1 (T_{vj}=25℃ unless otherwise noted)

参数 Parameter	符号 Symbol	条件 Condition		数□ Value Min	Typ.	Max	□位 Unit
集□极-□射极□和□□ Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=450A	T_{vj}=25℃		1.75	2.10	V
			T_{vj}=125℃		2.15		V
			T_{vj}=150℃		2.25		V
□极-□射极开启□□ Gate-Emitter Threshold Voltage	$V_{GE(th)}$	I_C=17mA, V_{CE}=V_{GE}			5.9		V
集□极-□射极截止□流 Collector-Emitter Cut-off Current	I_{CES}	V_{CE}=1200V, V_{GE}=0V				5	mA
□极-□射极漏□流 Gate-Emitter Leakage Current	I_{GES}	V_{CE}=0V, V_{GE}=±20V		-400		400	nA
内置□极□阻 Internal Gate Resistance	R_{Gint}	T_{vj}=25℃			1.50		Ω
□极□荷 Gate Charge	Q_G	V_{GE}=-15V~+15V			7.4		μC
□入□容 Input Capacitance	C_{ies}	V_{CE}=25V, V_{GE}=0V, f=1MHz			133.0		nF
反向□□□ 容 Reverse Transfer Capacitance	C_{res}				1.5		nF
开通延□□□ Turn-on Delay Time	$t_{d(on)}$	I_C=450A V_{CE}=600V V_{GE}=±15V R_{Gon}=1.3Ω R_{Goff}=1.3Ω L_S=25nH Inductive Load	T_{vj}=25℃		370		ns
			T_{vj}=125℃		380		ns
			T_{vj}=150℃		290		ns
上升□□ Rise Time	t_r		T_{vj}=25℃		160		ns
			T_{vj}=125℃		180		ns
			T_{vj}=150℃		190		ns
关断延□□□ Turn-off Delay Time	$t_{d(off)}$		T_{vj}=25℃		510		ns
			T_{vj}=125℃		550		ns
			T_{vj}=150℃		560		ns
下降□□ Fall Time	t_f		T_{vj}=25℃		90		ns
			T_{vj}=125℃		120		ns
			T_{vj}=150℃		130		ns
开通□耗 Turn-on Energy Loss	E_{on}		T_{vj}=25℃		52.0		mJ
			T_{vj}=125℃		72.5		mJ
			T_{vj}=150℃		75.5		mJ
关断□耗 Turn-off Energy Loss	E_{off}		T_{vj}=25℃		39.0		mJ
			T_{vj}=125℃		49.5		mJ
			T_{vj}=150℃		53.5		mJ
短路□流 Short Circuit Current	I_{SC}	V_{GE}≤15V, t_p≤10us, V_{CC}=800V, T_{vj}=150℃ $V_{CE,max}$=V_{CES}-$L_{s,CE}$ x di/dt			1800		A

*1 IGBT特征值遵从IEC 60747-9。

二极管特征值 Diode Characteristics Values*2

参数 Parameter	符号 Symbol	条件 Condition		数□ Value			□位 Unit
				Min	Typ.	Max	
正向□□ Forward Voltage	V_F	I_F=450A	T_{vj}=25℃		2.25		V
			T_{vj}=125℃		2.35		V
			T_{vj}=150℃		2.35		V
反向恢复□□ Reverse Recovery Time	t_{rr}	I_F=450A, V_R=600V, V_{GE}=-15V di_F/dt=-1700A/μs (T_{vj}=150℃)	T_{vj}=25℃		230		ns
			T_{vj}=125℃		445		ns
			T_{vj}=150℃		580		ns
反向恢复□流 Reverse Recovery Current	I_{rr}		T_{vj}=25℃		120		A
			T_{vj}=125℃		155		A
			T_{vj}=150℃		180		A
反向恢复□荷 Reverse Recovery Charge	Q_{rr}		T_{vj}=25℃		14.5		μC
			T_{vj}=125℃		35.5		μC
			T_{vj}=150℃		53.5		μC
反向恢复□耗 Reverse Recovery Energy Loss	E_{rec}		T_{vj}=25℃		4.5		mJ
			T_{vj}=125℃		13.0		mJ
			T_{vj}=150℃		20.5		mJ

*2 二极管特征值遵从IEC 60747-2。

负温度系数热敏电阻 NTC-Thermistor

参数 Parameter	符号 Symbol	条件 Condition	Min	Typ.	Max	□位 Unit
□定□阻 Rated resistance	R_{25}	Tc=25℃		5.00		KΩ
功耗 Power dissipation	P_{25}				10	mW
B-□ B-value	$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298,15K))]$		3380		K

封装特性 Package Properties*3

参数 Parameter	符号 Symbol	条件 Condition	数□ Value			□位 Unit
			Min	Typ.	Max	
IGBT □-壳□阻 IGBT Thermal Resistance: Junction to Case	$R_{th(J-C)}$	每个IGBT/per IGBT			0.0721	K/W
二极管 □-壳□阻 Diode Thermal Resistance: Junction to Case	$R_{th(J-C)}$	每个二极管/per Diode			0.0908	K/W
IGBT接触□阻 IGBT Thermal Resistance: Case to Heatsink	$R_{th(C-H)}$	每个IGBT/per IGBT 硅脂□□ 系数λ_{grease}=1W/(m•K)		0.038		K/W
二极管接触□阻 Diode Thermal Resistance: Case to Heatsink	$R_{th(C-H)}$	每个二极管/per Diode 硅脂□□ 系数λ_{grease}=1W/(m•K)		0.074		K/W
□□ 耐□ Isolation Voltage	V_{isol}	RMS, f=50Hz, t=60s	2500			V
爬□距离 Creepage Distance	d_{cr}	端子到散□器 Terminal to Heatsink	14.5			mm
		端子到端子 Terminal to Terminal	13			mm
□□□ 隙 Clearance Distance	d_{cl}	端子到散□器 Terminal to Heatsink	12.5			mm
		端子到端子 Terminal to Terminal	10			mm
相□漏□起痕指数 Comparative Tracking Index	CTI		>200			
模□寄生□感 Module Stray Inductance	$L_{s,\ CE}$	每个□臂/per Switch		20		nH
模□引□内阻 Module lead Resistance, Terminal to Chip	$R_{CC'+EE'}$	每个□臂/per Switch, T_C=25℃		0.80		mΩ
安装扭矩 Mounting Torques	M	基板至散□器, Baseplate to Heatsink, M5	3		6	Nm
		功率端子安装, Power Terminal, M6	3		6	Nm
模□重量 Module Weight	G			350		g

*3 封装特性遵从IEC 60747-15

典型特性曲线 Typical Characteristic Curve

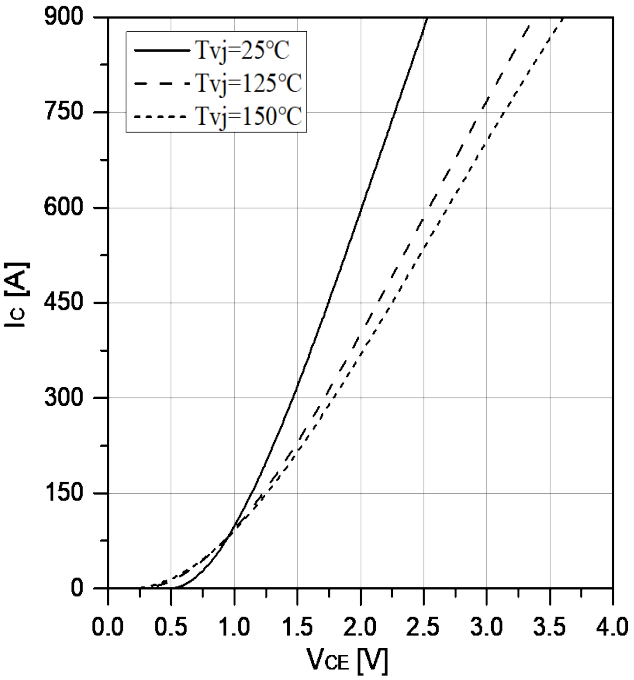


图1 IGBT输出特性
Fig.1 IGBT Output Characteristic
I_C vs V_{CE}, V_{GE}=15V

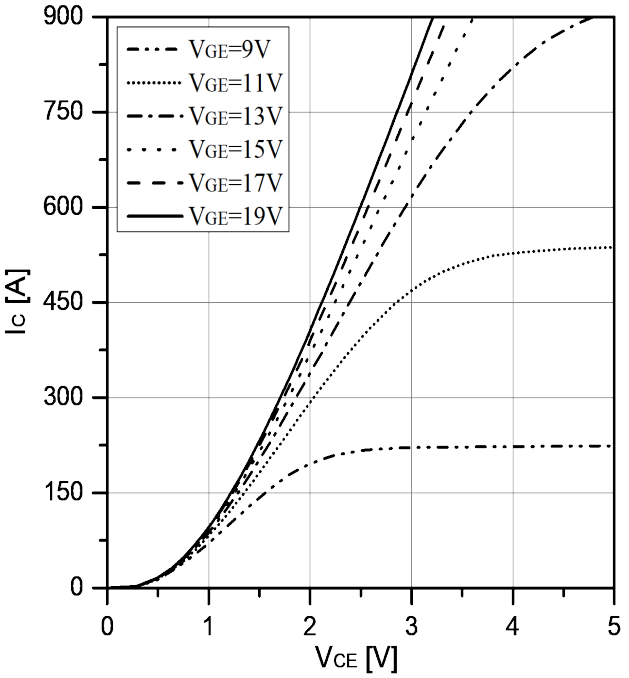


图2 IGBT输出特性
Fig.2 IGBT Output Characteristic
I_C vs V_{CE}, T_{vj}=150℃

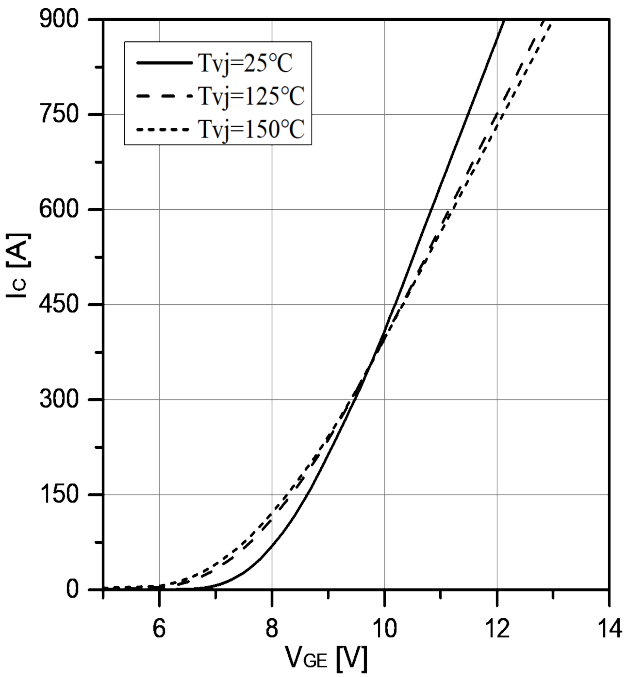


图3 IGBT转移特性
Fig.3 IGBT Transfer Characteristic
I_C vs V_{GE}, V_{CE}=20V

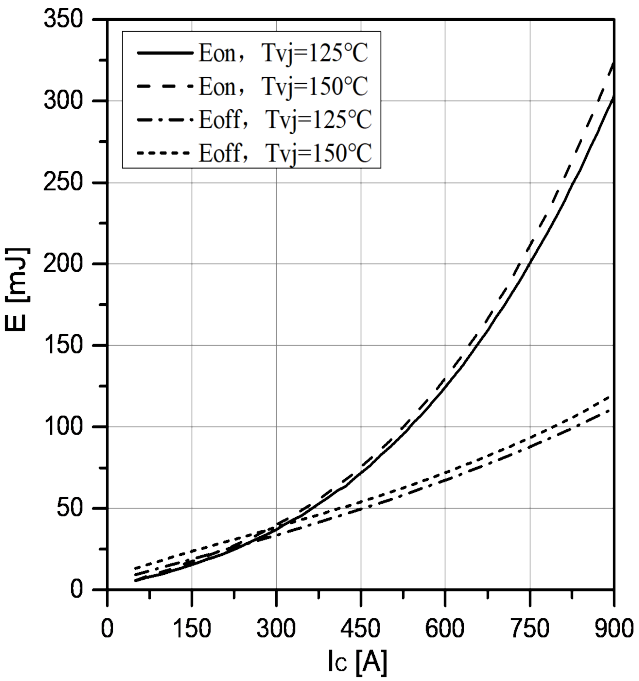


图4 IGBT开关损耗,
Fig.4 IGBT Switching Energy Loss
E_{on}, E_{off} vs I_C, V_{CE}=600V, V_{GE}=±15V, R_G=1.3Ω

典型特性曲线 Typical Characteristic Curve

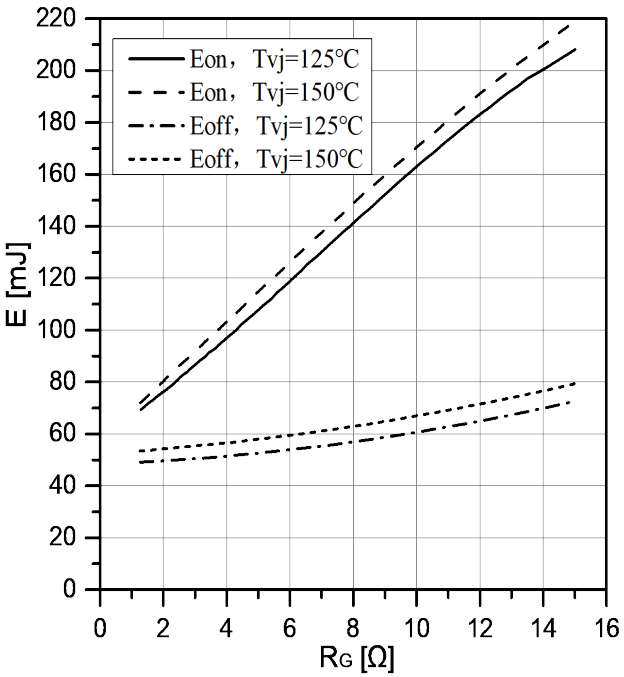


图5 IGBT开关损耗
Fig.5 IGBT Switching Energy Loss
E_{on}, E_{off} vs R_G, I_C=450A, V_{CE}=600V, V_{GE}=±15V

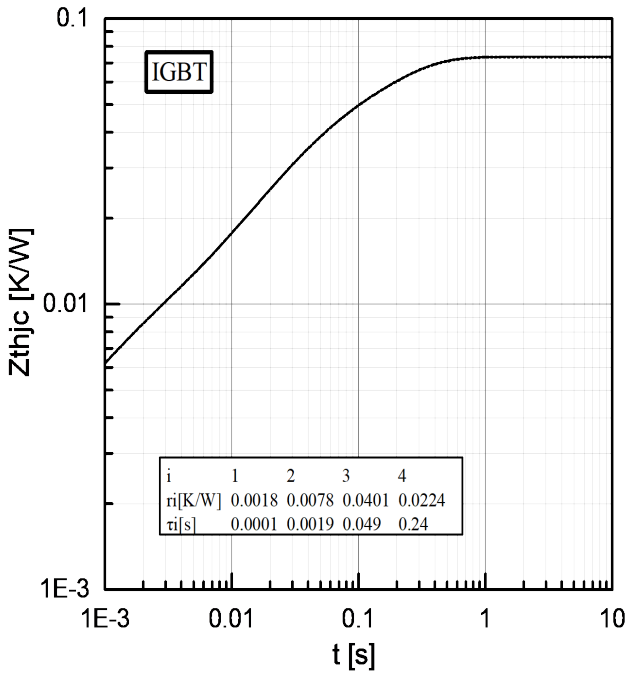


图6 IGBT瞬态热阻抗
Fig.6 Transient Thermal Impedance IGBT
Z_{thJC} vs t

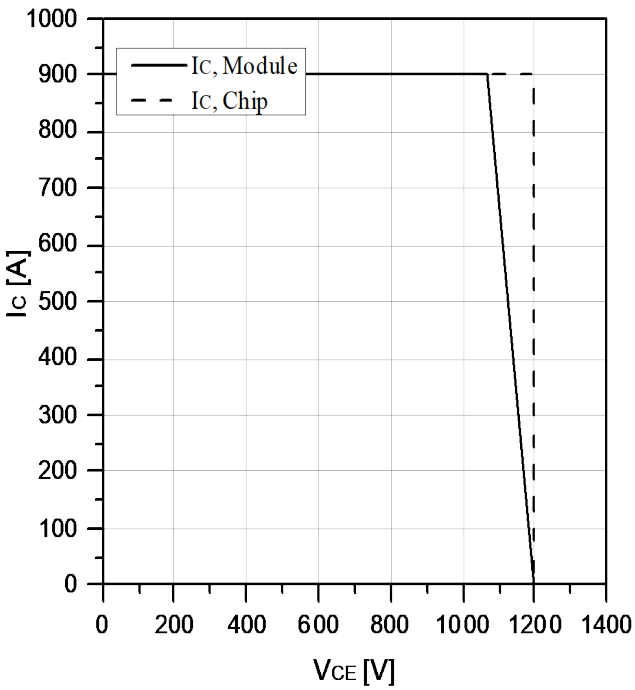


图7 IGBT反偏安全工作区（RBSOA）
Fig.7 Reverse Bias Safe Operating Area IGBT(RBSOA)
I_C vs V_{CE}, V_{GE}=±15V, R_G=1.3Ω, Tvj=150℃

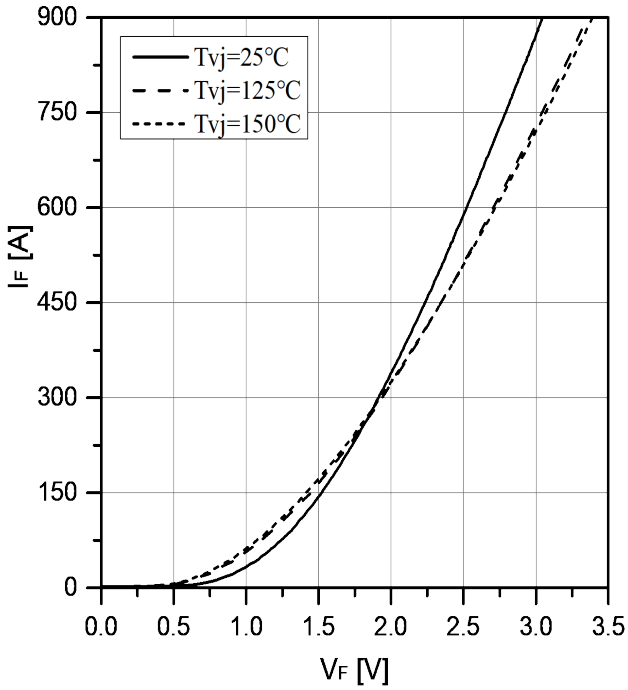


图8 二极管正向特性
Fig.8 Diode Forward Characteristic
I_F vs V_F

典型特性曲线 Typical Characteristic Curve

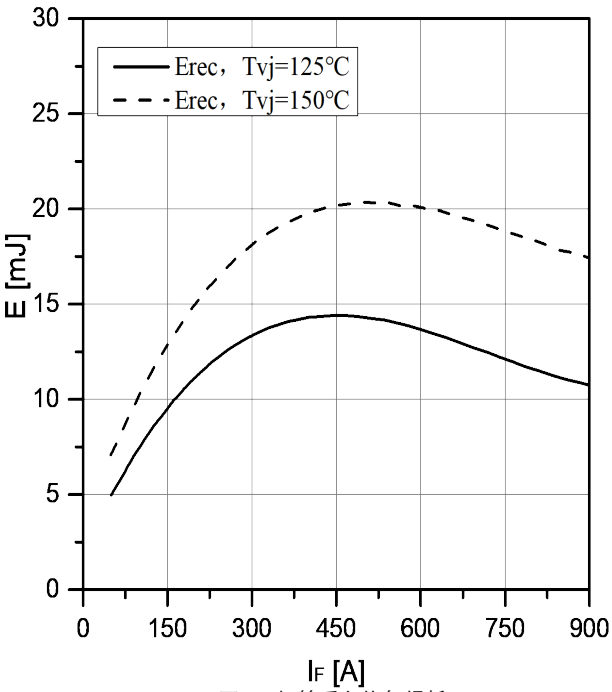


图9 二极管反向恢复损耗
Fig.9 Diode Reverse Recovery Energy Loss
E_{rec} vs I_F, V_R=600V, R_G=1.3Ω

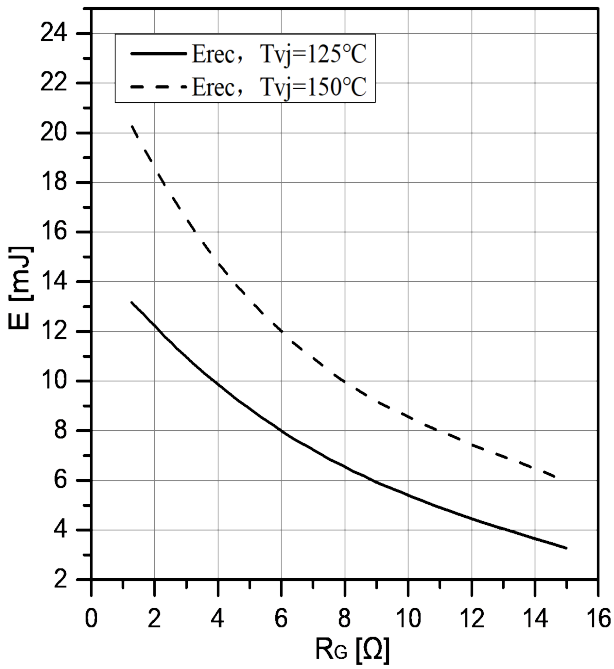


图10 二极管反向恢复损耗
Fig.10 Diode Reverse Recovery Energy Loss
E_{rec} vs R_G, V_R=600V, I_F=450A

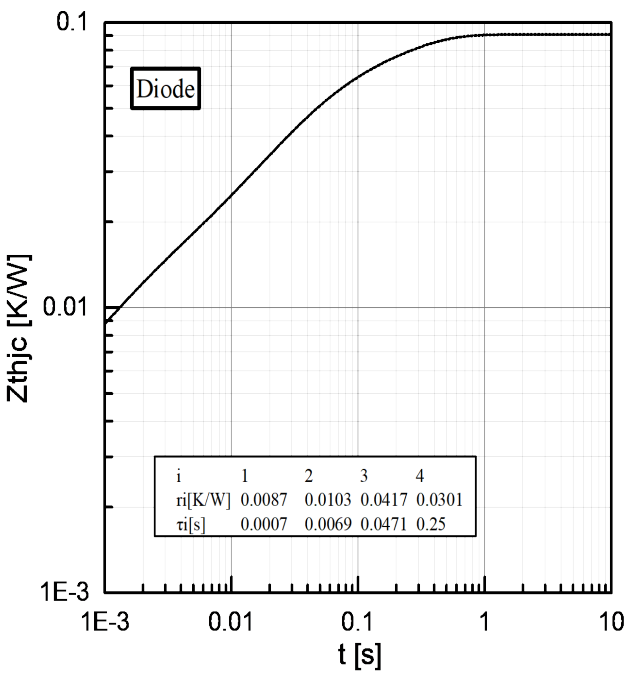


图11 二极管瞬态热阻抗
Fig.11 Transient Thermal Impedance Diode
Z_{thJC} vs t

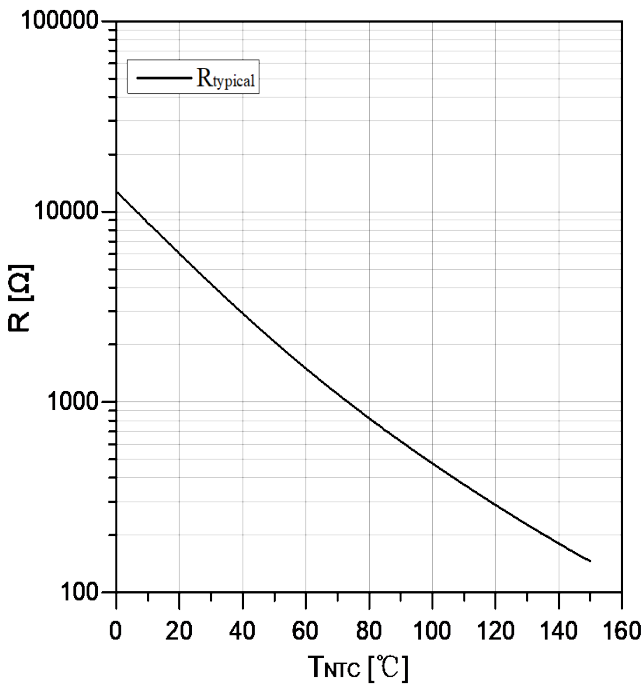
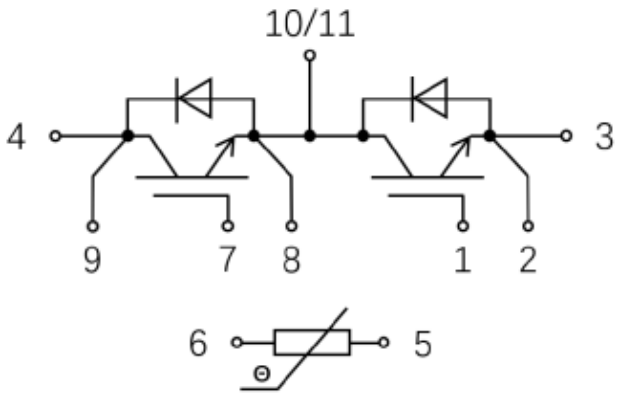
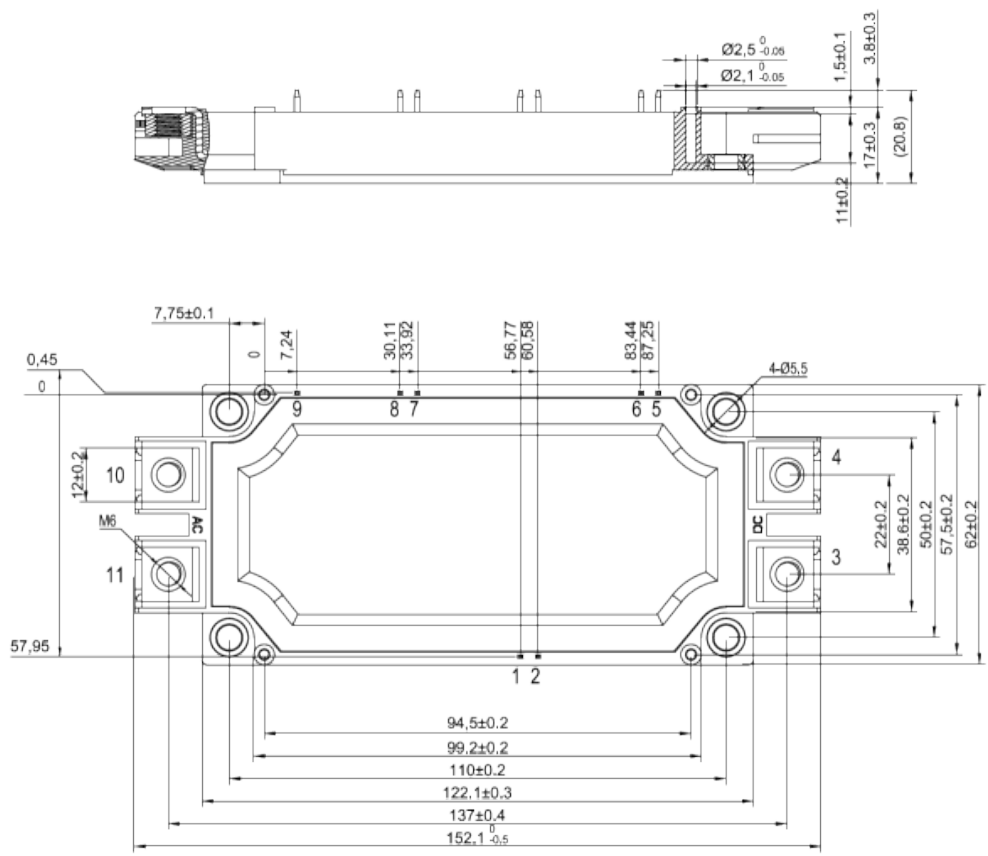


图12 NTC温度特性（典型值）
Fig.12 NTC Temperature Characteristic (typical)
R vs T

电路图 Circuit Diagram



外形尺寸 Outline Drawing



修订记录 Revision History

版本 Version	日期 Date	描述 Description
A1	2022-01-22	初版 Preliminary Version
A2	2022-04-16	正式版
A3	2024-01-24	徽口口 更