

NI450B12E6K4

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

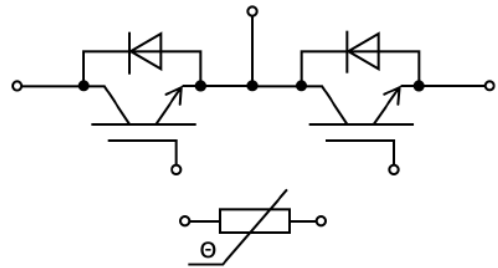
特点 Features

- 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	数值 Value	单位 Unit
集电极-发射极电压 Collector-Emitter Voltage	V_{CES}	1200	V
集电极电流 DC Collector Current, $T_c=100^\circ\text{C}$	I_C	450	A
集电极峰值电流 Peak Collector Current, $t_p=1\text{ms}$	I_{CM}	900	A
栅极-发射极电压 Gate-Emitter Voltage	V_{GES}	± 20	V
二极管正向电流 Diode Forward Current	I_F	450	A
二极管正向峰值电流 Diode Peak Forward Current, $t_p=1\text{ms}$	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
最高结温 Maximum Junction Temperature	$T_{vj, max}$	175	$^\circ\text{C}$
工作结温 Operating Junction Temperature	$T_{vj, op}$	-40~150	$^\circ\text{C}$
存储温度范围 Storage Temperature Range	T_{stg}	-40~125	$^\circ\text{C}$

IGBT特征值 IGBT Characteristics Values*1 ($T_{vj}=25^{\circ}\text{C}$ unless otherwise noted)

参数 Parameter	符号 Symbol	条件 Condition	数值 Value			单位 Unit	
			Min	Typ.	Max		
集电极-发射极饱和电压 Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C=450\text{A}$	$T_{vj}=25^{\circ}\text{C}$		1.75	2.10	V
			$T_{vj}=125^{\circ}\text{C}$		2.15		V
			$T_{vj}=150^{\circ}\text{C}$		2.25		V
栅极-发射极开启电压 Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$I_C=17\text{mA}, V_{CE}=V_{GE}$		5.9		V	
集电极-发射极截止电流 Collector-Emitter Cut-off Current	I_{CES}	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}$			5	mA	
栅极-发射极漏电流 Gate-Emitter Leakage Current	I_{GES}	$V_{CE}=0\text{V}, V_{GE}=\pm 20\text{V}$	-400		400	nA	
内置栅极电阻 Internal Gate Resistance	R_{Gint}	$T_{vj}=25^{\circ}\text{C}$		1.50		Ω	
栅极电荷 Gate Charge	Q_G	$V_{GE}=-15\text{V}\sim+15\text{V}$		7.4		μC	
输入电容 Input Capacitance	C_{ies}	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$		133.0		nF	
反向传输电容 Reverse Transfer Capacitance	C_{res}			1.5		nF	
开通延迟时间 Turn-on Delay Time	$t_{d(on)}$	$I_C=450\text{A}$ $V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}$ $R_{Gon}=1.3\Omega$ $R_{Goff}=1.3\Omega$ $L_S=25\text{nH}$ Inductive Load	$T_{vj}=25^{\circ}\text{C}$		370		ns
			$T_{vj}=125^{\circ}\text{C}$		380		ns
			$T_{vj}=150^{\circ}\text{C}$		290		ns
上升时间 Rise Time	t_r		$T_{vj}=25^{\circ}\text{C}$		160		ns
			$T_{vj}=125^{\circ}\text{C}$		180		ns
			$T_{vj}=150^{\circ}\text{C}$		190		ns
关断延迟时间 Turn-off Delay Time	$t_{d(off)}$		$T_{vj}=25^{\circ}\text{C}$		510		ns
			$T_{vj}=125^{\circ}\text{C}$		550		ns
			$T_{vj}=150^{\circ}\text{C}$		560		ns
下降时间 Fall Time	t_f		$T_{vj}=25^{\circ}\text{C}$		90		ns
			$T_{vj}=125^{\circ}\text{C}$		120		ns
			$T_{vj}=150^{\circ}\text{C}$		130		ns
开通损耗 Turn-on Energy Loss	E_{on}		$T_{vj}=25^{\circ}\text{C}$		52.0		mJ
			$T_{vj}=125^{\circ}\text{C}$		72.5		mJ
			$T_{vj}=150^{\circ}\text{C}$		75.5		mJ
关断损耗 Turn-off Energy Loss	E_{off}	$T_{vj}=25^{\circ}\text{C}$		39.0		mJ	
		$T_{vj}=125^{\circ}\text{C}$		49.5		mJ	
		$T_{vj}=150^{\circ}\text{C}$		53.5		mJ	
短路电流 Short Circuit Current	I_{SC}	$V_{GE}\leq 15\text{V}, t_p\leq 10\mu\text{s}, V_{CC}=800\text{V}, T_{vj}=150^{\circ}\text{C}$ $V_{CE,max}=V_{CES}-L_S \cdot CE \times di/dt$		1800		A	

*1 IGBT特征值遵从IEC 60747-9; $V_{CE(sat)}$ 为芯片值。

二极管特征值 Diode Characteristics Values*2

参数 Parameter	符号 Symbol	条件 Condition	数值 Value			单位 Unit
			Min	Typ.	Max	
正向电压 Forward Voltage	V_F	$I_F=450A$	$T_{vj}=25^{\circ}C$		2.25	V
			$T_{vj}=125^{\circ}C$		2.35	V
			$T_{vj}=150^{\circ}C$		2.35	V
反向恢复时间 Reverse Recovery Time	t_{rr}		$T_{vj}=25^{\circ}C$		230	ns
			$T_{vj}=125^{\circ}C$		445	ns
			$T_{vj}=150^{\circ}C$		580	ns
反向恢复电流 Reverse Recovery Current	I_{rr}	$I_F=450A,$ $V_R=600V,$ $V_{GE}=-15V$ $di_F/dt=-1700A/\mu s$ ($T_{vj}=150^{\circ}C$)	$T_{vj}=25^{\circ}C$		120	A
			$T_{vj}=125^{\circ}C$		155	A
			$T_{vj}=150^{\circ}C$		180	A
反向恢复电荷 Reverse Recovery Charge	Q_{rr}		$T_{vj}=25^{\circ}C$		14.5	μC
			$T_{vj}=125^{\circ}C$		35.5	μC
			$T_{vj}=150^{\circ}C$		53.5	μC
反向恢复损耗 Reverse Recovery Energy Loss	E_{rec}		$T_{vj}=25^{\circ}C$		4.5	mJ
			$T_{vj}=125^{\circ}C$		13.0	mJ
			$T_{vj}=150^{\circ}C$		20.5	mJ

*2 二极管特征值遵从IEC 60747-2; V_F 为芯片值。

负温度系数热敏电阻 NTC-Thermistor

参数 Parameter	符号 Symbol	条件 Condition	Min	Typ.	Max	单位 Unit
额定电阻 Rated resistance	R_{25}	$T_c=25^{\circ}C$		5.00		K Ω
功耗 Power dissipation	P_{25}				10	mW
B-值 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	数值 Value			单位 Unit
			Min	Typ.	Max	
IGBT 结-壳热阻 IGBT Thermal Resistance: Junction to Case	$R_{th(J-C)}$	每个IGBT/per IGBT			0.0721	K/W
二极管 结-壳热阻 Diode Thermal Resistance: Junction to Case	$R_{th(J-C)}$	每个二极管/per Diode			0.0908	K/W
IGBT接触热阻 IGBT Thermal Resistance: Case to Heatsink	$R_{th(C-H)}$	每个IGBT/per IGBT 硅脂导热系数 $\lambda_{grease}=1W/(m\cdot K)$		0.038		K/W
二极管接触热阻 Diode Thermal Resistance: Case to Heatsink	$R_{th(C-H)}$	每个二极管/per Diode 硅脂导热系数 $\lambda_{grease}=1W/(m\cdot K)$		0.074		K/W
绝缘耐压 Isolation Voltage	V_{isol}	RMS, f=50Hz, t=60s	2500			V
爬电距离 Creepage Distance	d_{cr}	端子到散热器 Terminal to Heatsink	14.5			mm
		端子到端子 Terminal to Terminal	13			mm
绝缘间隙 Clearance Distance	d_{cl}	端子到散热器 Terminal to Heatsink	12.5			mm
		端子到端子 Terminal to Terminal	10			mm
相对漏电起痕指数 Comparative Tracking Index	CTI		>200			
模块寄生电感 Module Stray Inductance	$L_{s, CE}$	每个桥臂/per Switch		20		nH
模块引线内阻 Module lead Resistance, Terminal to Chip	R_{CC+EE}	每个桥臂/per Switch, $T_c=25^\circ C$		0.80		m Ω
安装扭矩 Mounting Torques	M	基板至散热器, Baseplate to Heatsink, M5	3		6	Nm
		功率端子安装, Power Terminal, M6	3		6	Nm
模块重量 Module Weight	G			350		g

*3 封装特性遵从IEC 60747-15

典型特性曲线 Typical Characteristic Curve

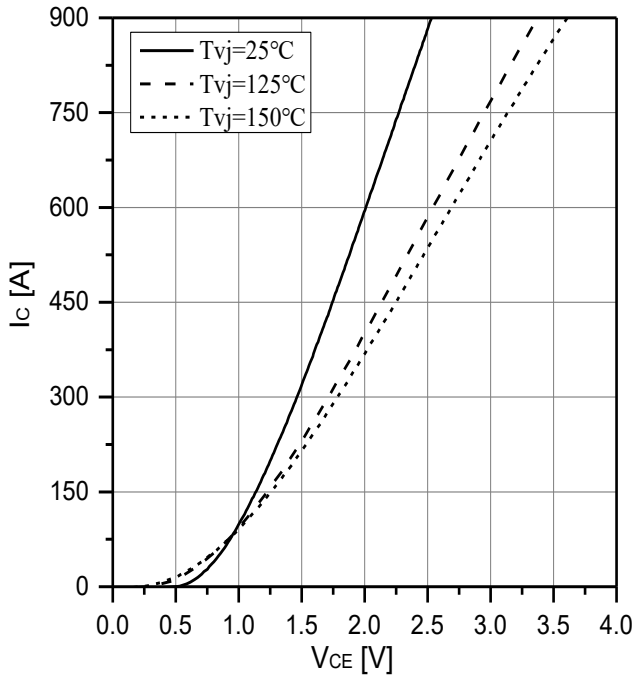


图1 IGBT输出特性
Fig.1 IGBT Output Characteristic
 I_c vs V_{CE} , $V_{GE}=15V$

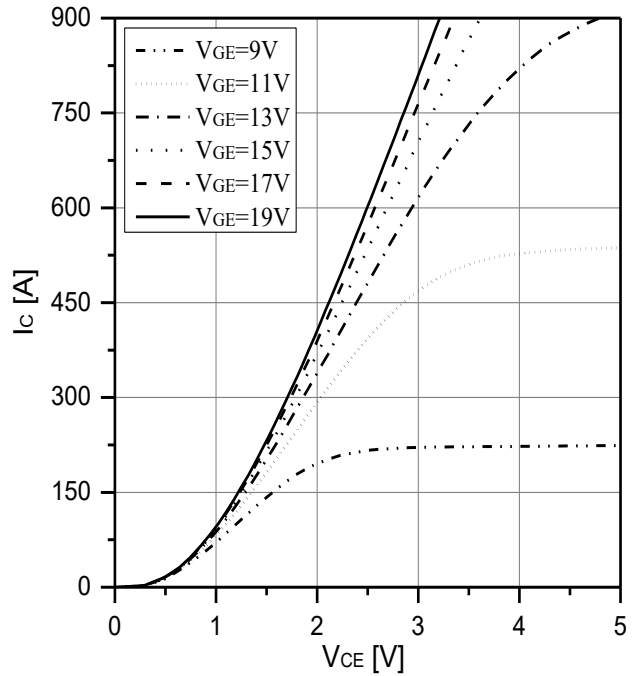


图2 IGBT输出特性
Fig.2 IGBT Output Characteristic
 I_c vs V_{CE} , $T_{vj}=150^{\circ}C$

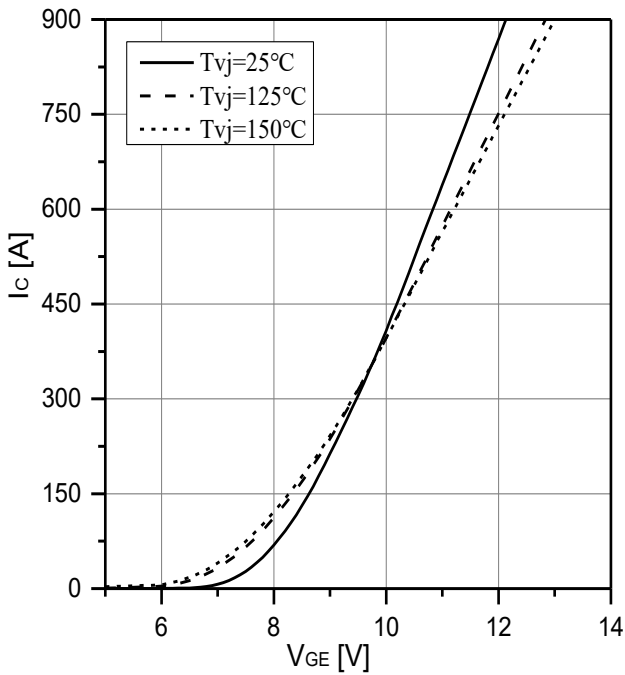


图3 IGBT转移特性
Fig.3 IGBT Transfer Characteristic
 I_c vs V_{GE} , $V_{CE}=20V$

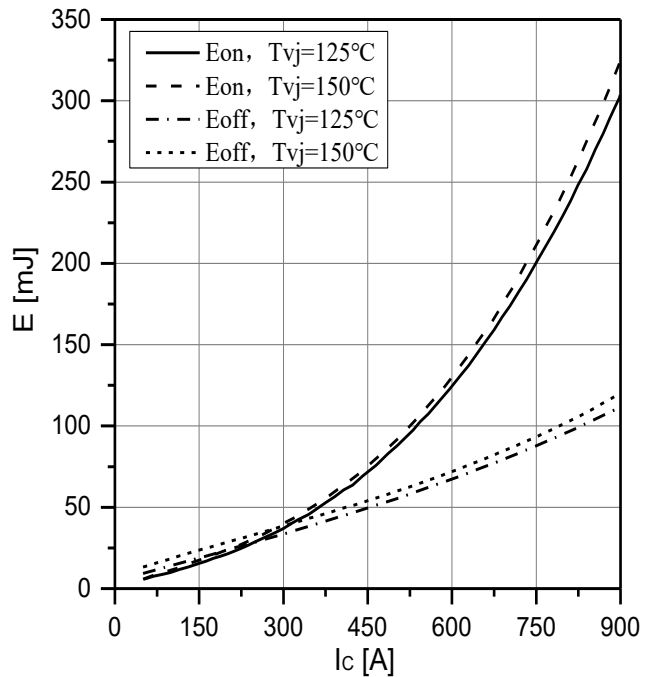


图4 IGBT开关损耗,
Fig.4 IGBT Switching Energy Loss
 E_{on} , E_{off} vs I_c , $V_{CE}=600V$, $V_{GE}=\pm 15V$, $R_G=1.3\Omega$

典型特性曲线 Typical Characteristic Curve

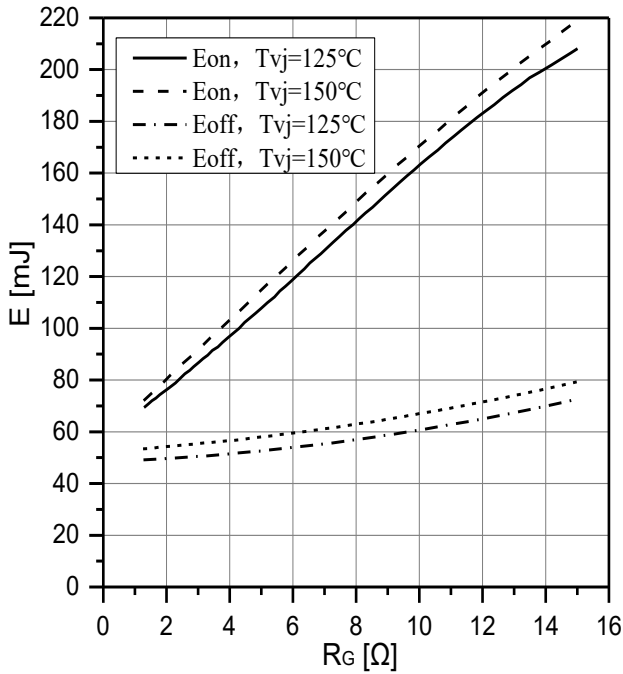


图5 IGBT开关损耗
Fig.5 IGBT Switching Energy Loss
 E_{on}, E_{off} vs R_G , $I_C=450A$, $V_{CE}=600V$, $V_{GE}=\pm 15V$

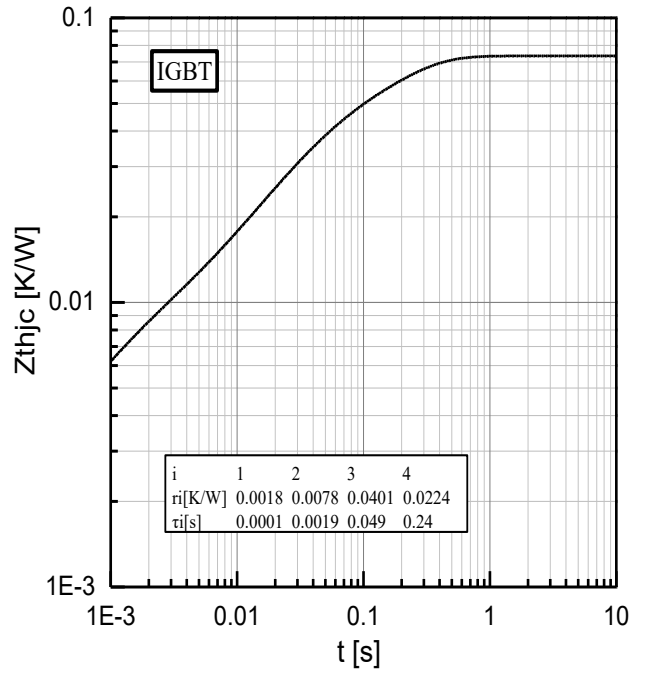


图6 IGBT瞬态热阻抗
Fig.6 Transient Thermal Impedance IGBT
 Z_{thjc} vs t

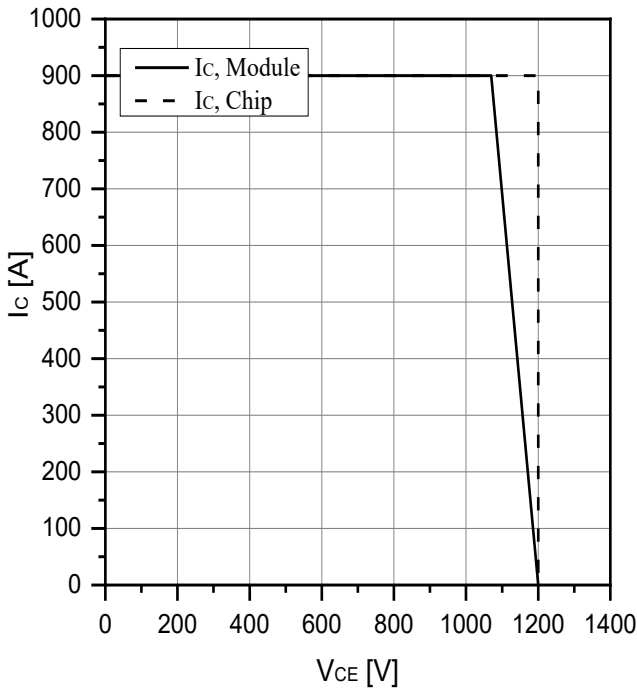


图7 IGBT反偏安全工作区 (RBSOA)
Fig.7 Reverse Bias Safe Operating Area IGBT(RBSOA)
 I_C vs V_{CE} , $V_{GE}=\pm 15V$, $R_G=1.3\Omega$, $T_{vj}=150^\circ C$

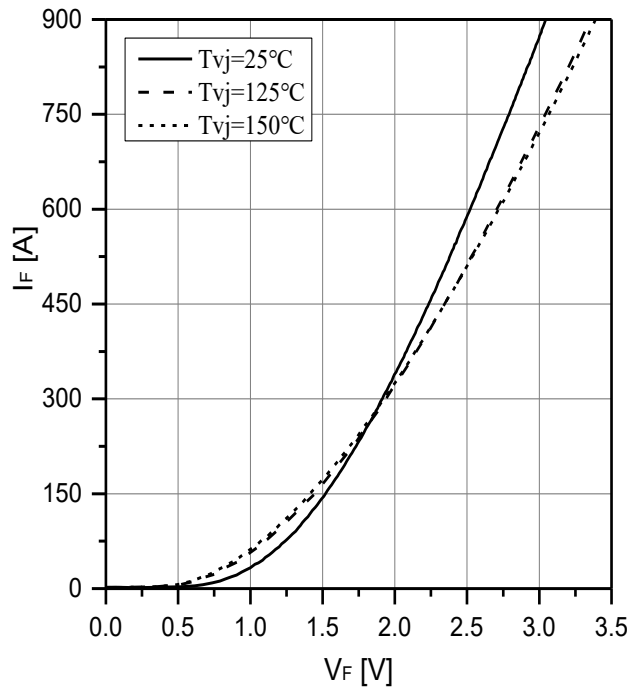


图8 二极管正向特性
Fig.8 Diode Forward Characteristic
 I_F vs V_F

典型特性曲线 Typical Characteristic Curve

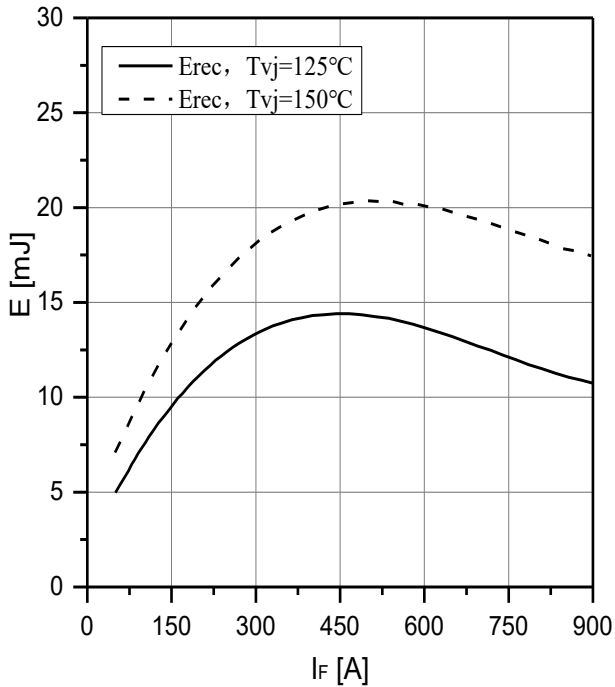


图9 二极管反向恢复损耗
Fig.9 Diode Reverse Recovery Energy Loss
 E_{rec} vs I_F , $V_R=600V$, $R_G=1.3\Omega$

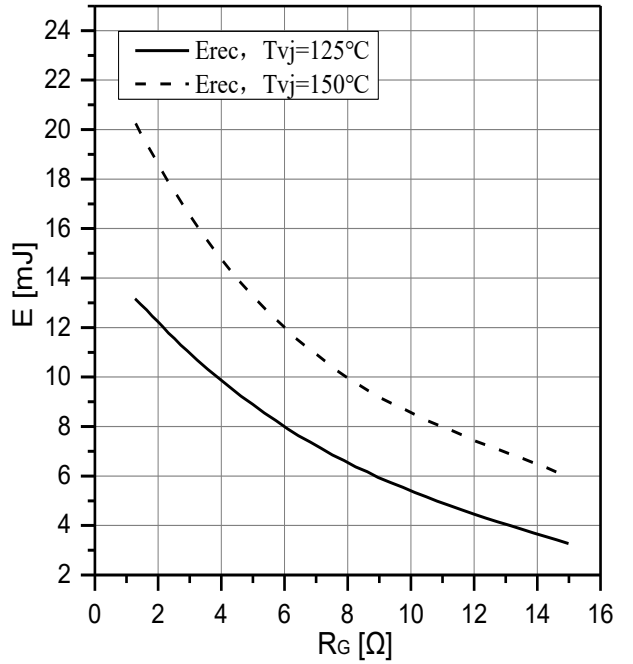


图10 二极管反向恢复损耗
Fig.10 Diode Reverse Recovery Energy Loss
 E_{rec} vs R_G , $V_R=600V$, $I_F=450A$

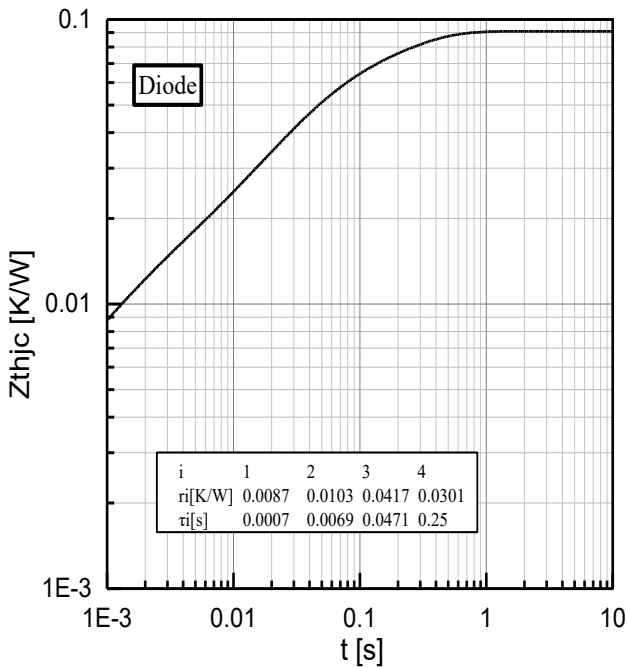


图11 二极管瞬态热阻抗
Fig.11 Transient Thermal Impedance Diode
 Z_{thjc} vs t

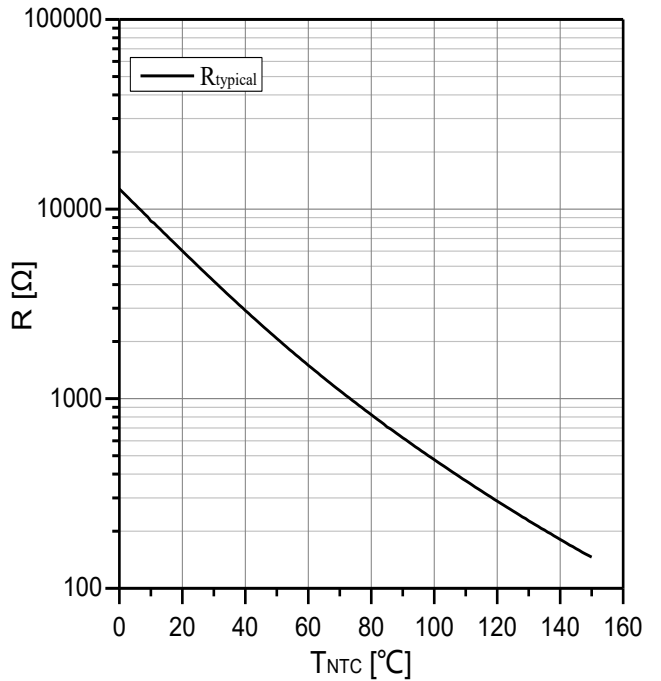
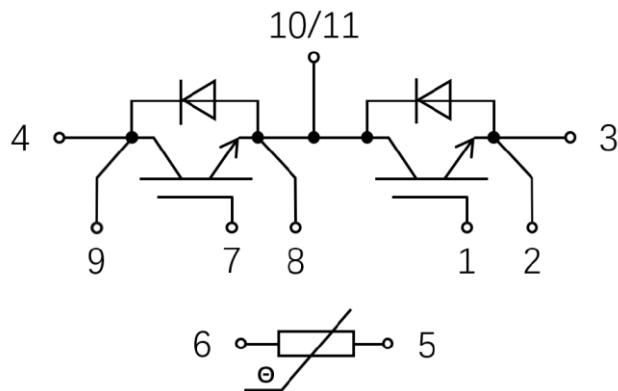
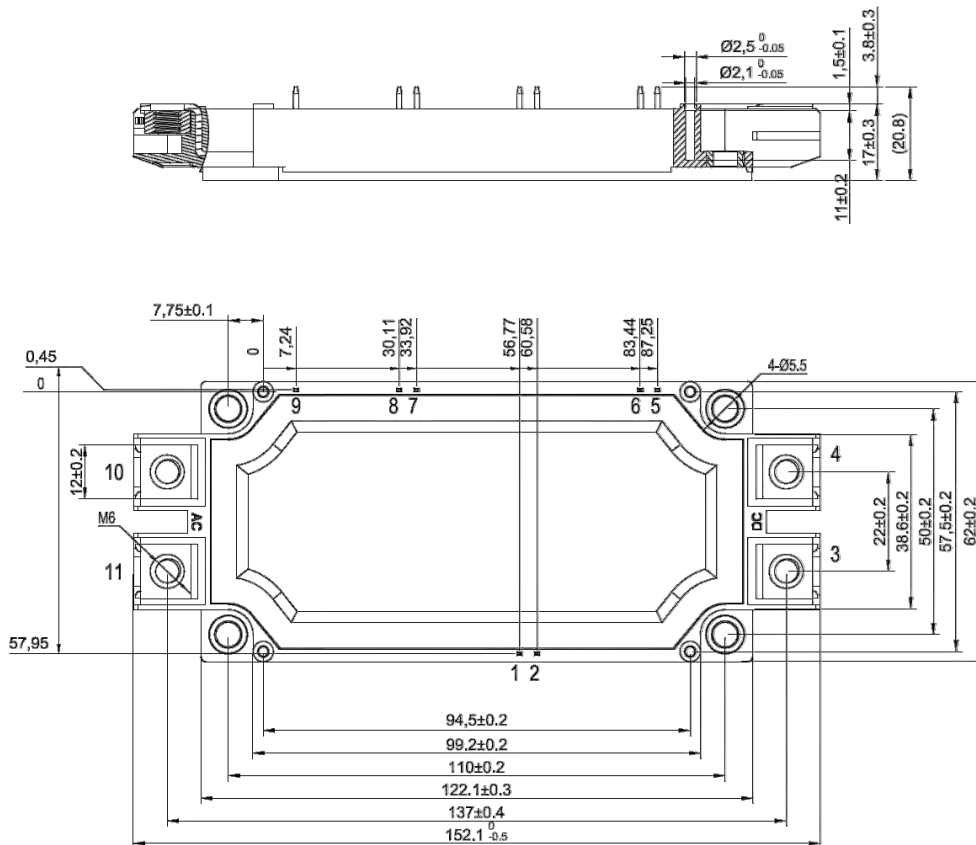


图12 NTC温度特性 (典型值)
Fig.12 NTC Temperature Characteristic (typical)
 R vs T

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
v1.0	2022-01-22	初版 Preliminary Version
v2.0	2022-04-16	正式版