

HCG450FH170D3K4

1700V 450A IGBT 模块, E6 封装, 内置续流二极管及NTC
1700V 450A IGBT Module, E6 Package, with FWD and NTC

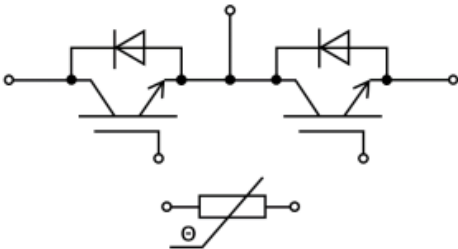
特点 Features

- 1700V 沟槽栅及场截止结构
1700V 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

- 风电变流器
Wind Converters
- 电机传动
Motor Drives
- 伺服驱动器
Servo Drives
- UPS 系统
UPS Systems



IGBT,逆变器/IGBT, Inverter
最大额定值/ Maximum Rated Values

参数 Parameter	符号 Symbol	数值 Value	单位 Unit
集电极-发射极电压 Collector-Emitter Voltage, $T_{vj}=25^{\circ}\text{C}$	V_{CES}	1700	V
集电极直流电流 DC Collector Current, $T_c=105^{\circ}\text{C}$, $T_{vj,max}=175^{\circ}\text{C}$	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
IGBT最大功耗 IGBT Maximum Power Dissipation, $T_c=25^{\circ}\text{C}$, $T_{vj,max}=175^{\circ}\text{C}$	P_D	2500	W
IGBT短路耐受时间 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电特性 IGBT Electrical Characteristics (T_{vj}=25°C unless otherwise noted)

参数 Parameter	符号 Symbol	条件 Condition		数□ Value			□位 Unit
				Min	Typ.	Max	
集□极-□射极□和□□ Collector-Emitter Saturation Voltage	V _{CE(sat)}	I _C =450A, V _{GE} =15V	T _{vj} =25℃		1.8	2.2	V
			T _{vj} =125℃		2.0		
			T _{vj} =150℃		2.2		
□极-□射极□□□□ Gate-Emitter Threshold Voltage	V _{GE(th)}	I _C =18mA, V _{CE} =V _{GE}		5.2	5.9	6.4	V
集□极-□射极截止□流 Collector-Emitter Cut-off Current	I _{CES}	V _{CE} =1700V, V _{GE} =0V				3	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}				1.2		Ω
□极□荷 Gate Charge	Q _G	V _{GE} =-15V~+15V			5.2		μC
□入□容 Input Capacitance	C _{ies}	f=1MHz, V _{GE} =0V, V _{CE} =25V			72		nF
□出□容 Output Capacitance	C _{oes}				2.9		nF
反向□□□容 Reverse Transfer Capacitance	C _{res}				0.6		nF
开通延□□□ Turn-on Delay Time	t _{d(on)}	I _C =450A, V _{CE} =900V, V _{GE} =±15V R _{Gon} =3.3Ω R _{Goff} =3.3Ω Inductive Load	T _{vj} =25℃		260		ns
			T _{vj} =125℃		280		
			T _{vj} =150℃		280		
上升□□ Rise Time	t _r		T _{vj} =25℃		140		ns
			T _{vj} =125℃		160		
			T _{vj} =150℃		160		
关断延□□□ Turn-off Delay Time	t _{d(off)}		T _{vj} =25℃		640		ns
			T _{vj} =125℃		700		
			T _{vj} =150℃		715		
下降□□ Fall Time	t _f		T _{vj} =25℃		405		ns
			T _{vj} =125℃		590		
			T _{vj} =150℃		590		
开通□耗 Turn-on Energy Loss	E _{on}		T _{vj} =25℃		75		mJ
			T _{vj} =125℃		110		
			T _{vj} =150℃		130		
关断□耗 Turn-off Energy Loss	E _{off}		T _{vj} =25℃		105		mJ
			T _{vj} =125℃		130		
			T _{vj} =150℃		130		
短路□流 Short Circuit Current	I _{SC}	V _{GE} ≤15V, V _{CC} =1000V, V _{CE,max} =V _{CES} -L _{s(CE)} · di/dt , T _{vj} =150℃ t _p ≤10us			2296		A

二极管,逆变器/Diode, Inverter

最大额定值/Maximum Rated Values ($T_{vj}=25^{\circ}\text{C}$ unless otherwise noted)

反向重复峰□□ Repetitive peak reverse voltage		V_{RRM}	1700	V
□□ 正向直流□流 Continuous DC forward current		I_F	450	A
正向重复峰□□流 Repetitive peak forward current	$t_p=1\text{ms}$	I_{FRM}	900	A
I^2t -□ I^2t -value	$V_R=0\text{V}, t_p=10\text{ms}, T_{vj}=125^{\circ}\text{C}$	I^2t	20000	A^2s

特征值/Characteristic Values

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℃		2.0	2.4	V
			T _{vj} =125℃		2.2		
			T _{vj} =150℃		2.2		
反向恢复峰□□流 Peak reverse recovery current	I _{RM}	I _F =450A, V _R =900V, di _F /dt=-2800A/μs V _{GE} =-15V Inductive Load	T _{vj} =25℃		245		A
			T _{vj} =125℃		265		
			T _{vj} =150℃		280		
反向恢复□荷 Reverse recovery charge	Q _{rr}		T _{vj} =25℃		60		uC
			T _{vj} =125℃		100		
			T _{vj} =150℃		120		
反向恢复□耗 Reverse recovery energy loss	E _{rec}		T _{vj} =25℃		40		mJ
			T _{vj} =125℃		60		
			T _{vj} =150℃		70		

NTC- Thermistor

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

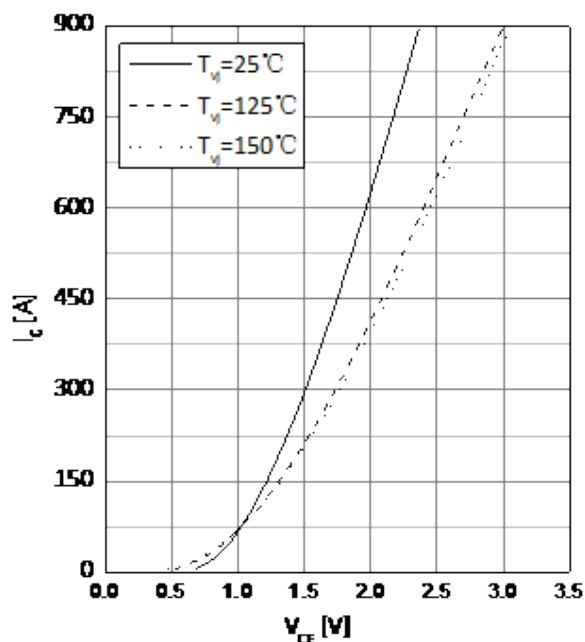
封装特性 Package Properties

参数 Parameter	符号 Symbol	条件 Condition	数值 Value			单位 Unit
			Min	Typ.	Max	
IGBT 结-壳电阻 IGBT Thermal Resistance: Junction to Case	$R_{th(J-C)}$	每个IGBT/per IGBT			0.06	K/W
二极管 结-壳电阻 Diode Thermal Resistance: Junction to Case	$R_{th(J-C)}$	每个二极管/per Diode			0.1	K/W
IGBT接触面电阻 IGBT Thermal Resistance: Case to Heatsink	$R_{th(C-H)}$	每个IGBT/per IGBT 硅脂接触系数 $\lambda_{grease}=1W/(m\cdot K)$			0.029	K/W
二极管接触面电阻 Diode Thermal Resistance: Case to Heatsink	$R_{th(C-H)}$	每个二极管/per Diode 硅脂接触系数 $\lambda_{grease}=1W/(m\cdot K)$			0.048	K/W
绝缘耐压 Isolation Voltage	V_{isol}	RMS, f=50Hz, t=60s	3.4			kV
爬电距离 Creepage Distance	d_{cr}	端子到散热器 Terminal to Heatsink	14			mm
		端子到端子 Terminal to Terminal	13.5			mm
电气间隙 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
相间漏起痕指数 Comparative Tracking Index	CTI		>200			
模块寄生电感 Module Stray Inductance	$L_{s, CE}$	每个臂/per Switch		20		nH
模块引脚内阻 Module lead Resistance, Terminal to Chip	R_{CC+EE}	每个臂/per Switch, $T_C=25^{\circ}C$		1.1		mΩ
安装扭矩 Mounting Torques	M	基板至散热器, Baseplate to Heatsink, M5	3.0		6.0	Nm
		功率端子安装, Power Terminal, M6	3.0		6.0	Nm
模块重量 Module Weight	G			345		g

输出特性 IGBT

Output characteristic IGBT

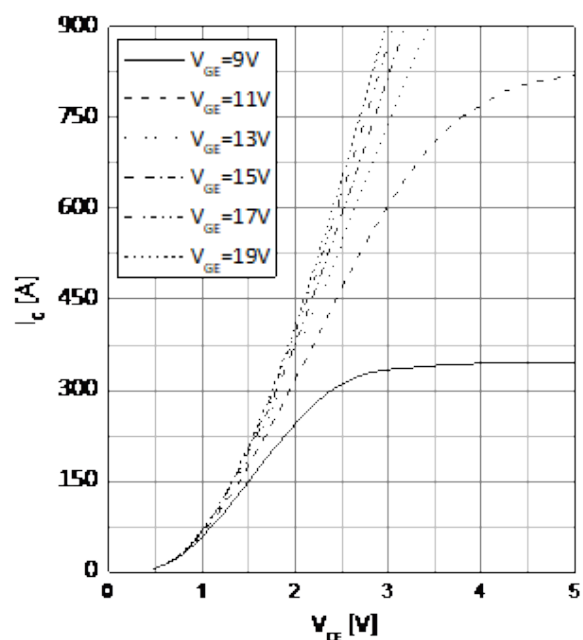
$$I_c = f(V_{CE}), V_{GE} = 15V$$



输出特性 IGBT

Output characteristic IGBT

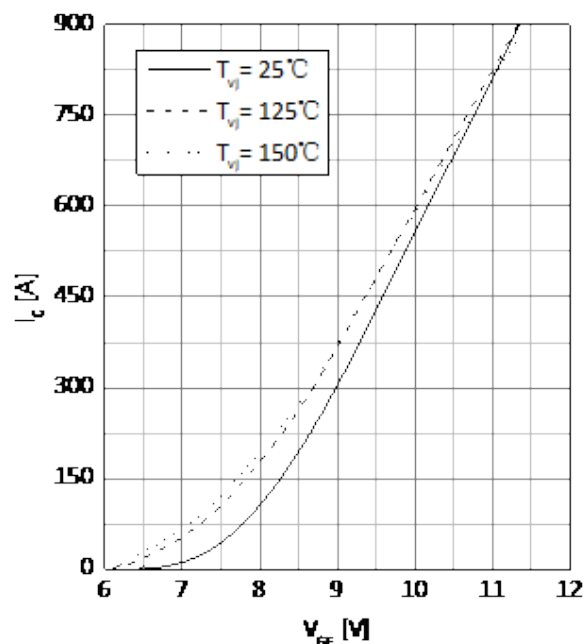
$$I_c = f(V_{CE}), T_{vj} = 150^\circ C$$



传输特性 IGBT

Transfer characteristic IGBT

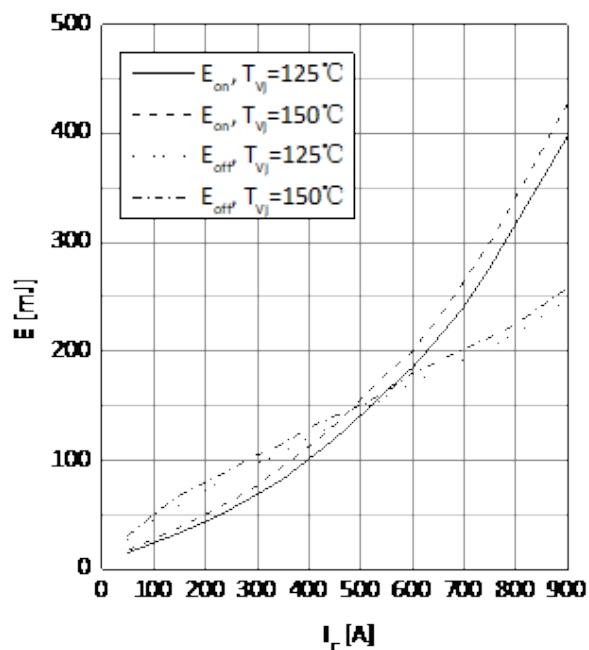
$$I_c = f(V_{GE}), V_{CE} = 20V$$



开关损耗 IGBT

Switching losses IGBT

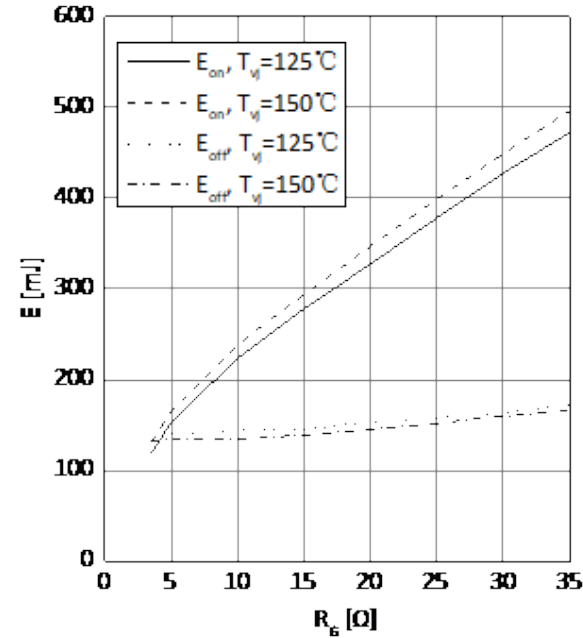
$$E = f(I_c), V_{GE} = \pm 15V, R_{Gon} = R_{Goff} = 3.3\Omega, V_{CE} = 900V$$



开关损耗 IGBT

Switching losses IGBT

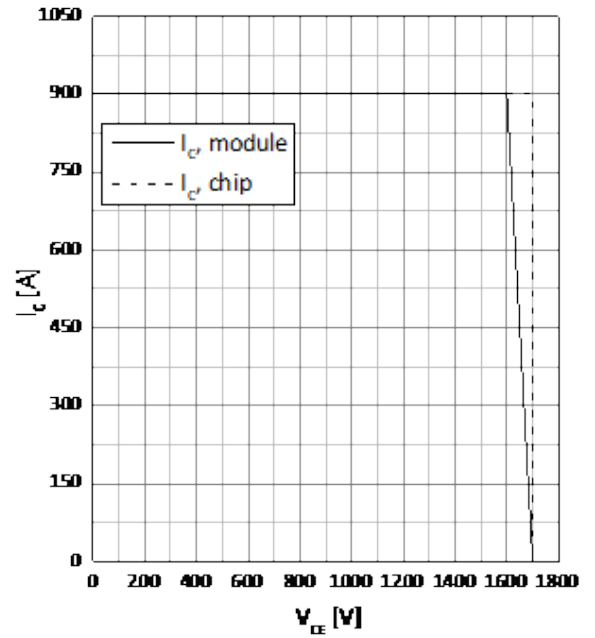
$V_{GE} = \pm 15V, I_C = 450A, V_{CE} = 900V$



反偏安全工作区 IGBT

Reverse bias safe operating area IGBT

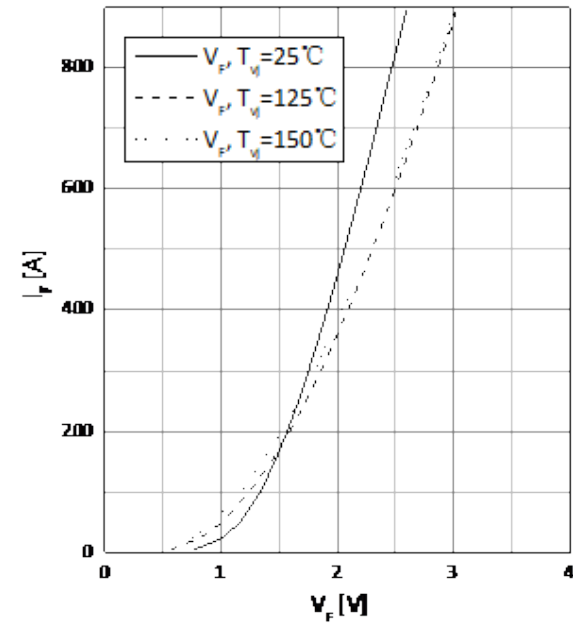
$V_{GE} = \pm 15V, R_{Goff} = 3.3\Omega, T_{vj} = 150^\circ C$



正向特性 Diode

Forward characteristic Diode

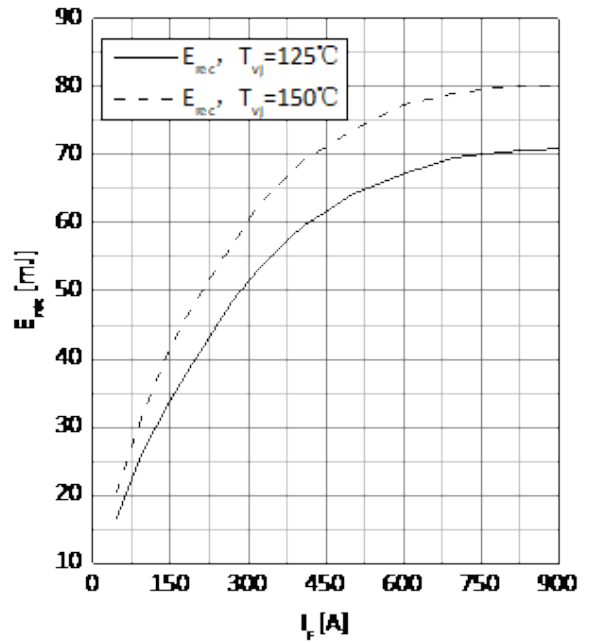
$I_F = f(V_F)$



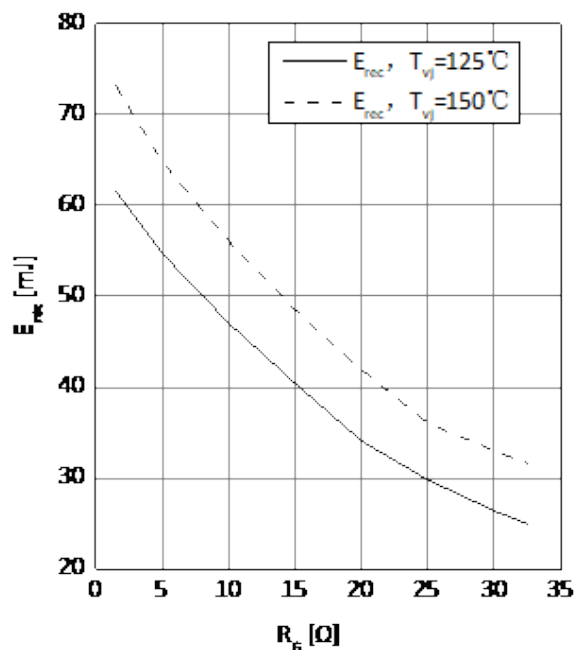
开关损耗 Diode

Switching losses Diode

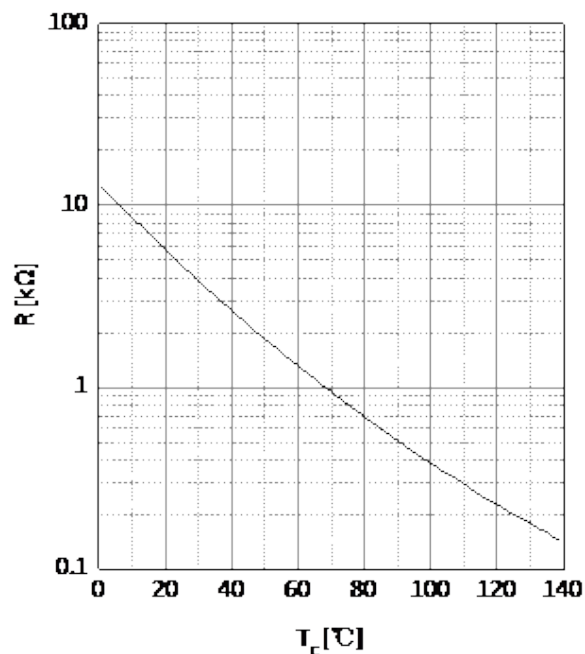
$E_{rec} = f(I_F), R_{Gon} = 3.3\Omega, V_{CE} = 900V$



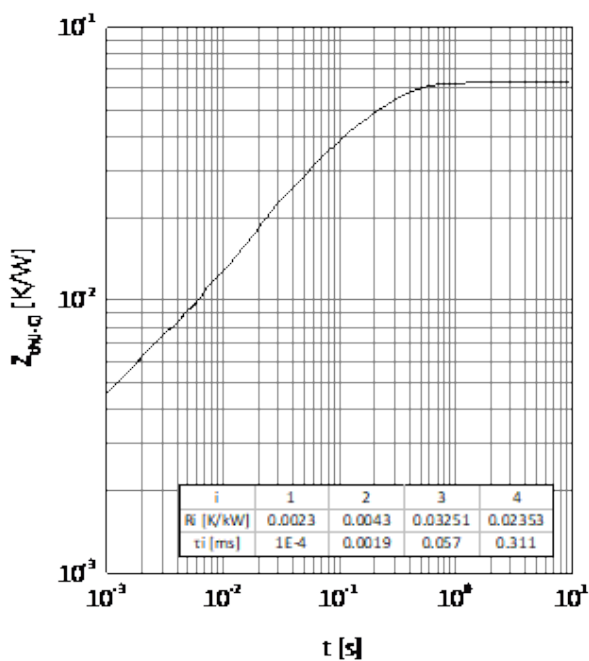
开关损耗Diode
Switching losses Diode
 $E_{rec}=f(R_g), V_{CE}=900V$



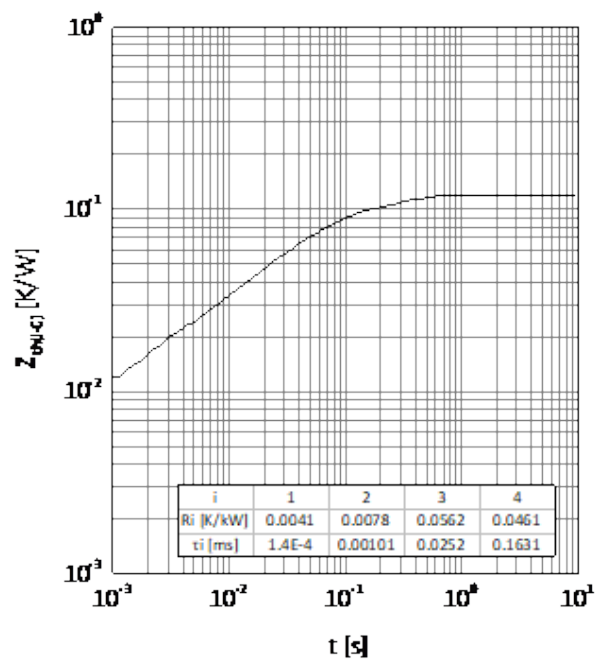
热敏电阻温度特性曲线
NTC temperature characteristic



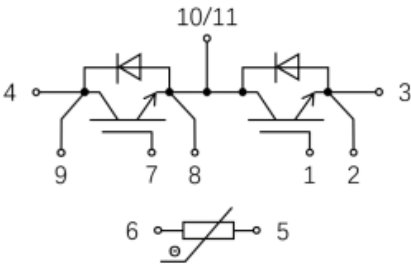
瞬态热阻抗 IGBT
Transient thermal impedance IGBT
 $Z_{th(j-c)} = f(t)$



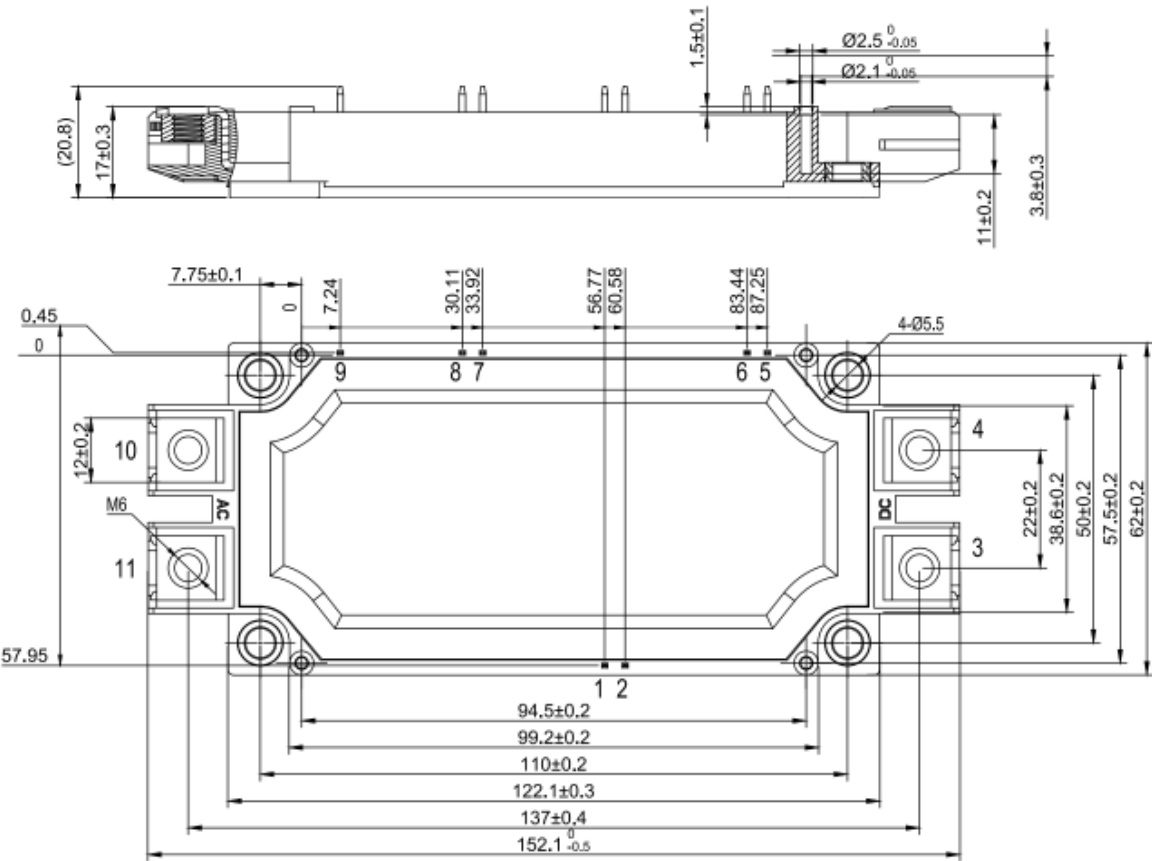
瞬态热阻抗 Diode
Transient thermal impedance Diode
 $Z_{th(j-c)} = f(t)$



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	2021-10-19	初版 Preliminary Version
A2	2022-02-25	量口版
A3	2024-01-24	徽口口更