

HCG600FH120D3K4D2

1200V 600A IGBT 模块, E6封装, 内置续流二极管及NTC
1200V 600A IGBT Module, E6 Package, with FWD and NTC

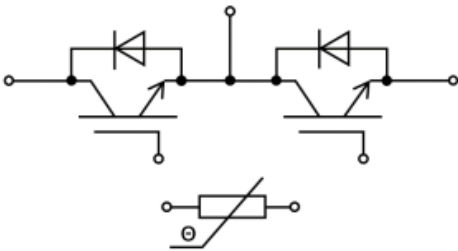
特点 Features

- 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 Drives
- 电机驱动
Motor Drives



最大额定值 Maximum Rated Values

参数 Parameter	符号 Symbol	条件 Condition	数口 Value	口位 Unit
集口极-口射极口口 Collector-emitter voltage	V_{CES}	$V_{GE}=0V, T_{vj}=25^{\circ}C$	1200	V
集口极口流 DC collector current	I_C	$T_c=115^{\circ}C, T_{vj,max}=175^{\circ}C$	600	A
集口极峰口口流 Peak collector current	I_{CM}	$t_p=1ms$	1200	A
口极-口射极峰口口 Gate-emitter peak voltage	V_{GES}		± 20	V
口功率口耗 Total power dissipation	P_{tot}	$T_c=25^{\circ}C, T_{vj,max}=175^{\circ}C$	3950	W
反向重复峰口口口 Repetitive peak reverse voltage	V_{RRM}	$T_{vj}=25^{\circ}C$	1200	V
口口正向直流口流 Continuous DC forward current	I_F		600	A
正向重复峰口口流 Repetitive peak forward current	I_{FRM}	$t_p=1ms$	1200	A
I^2t -口 I^2t -value	I^2t	$V_R=0V, t_p=10ms, T_{vj}=125^{\circ}C$	51000	A^2s
IGBT短路耐量 IGBT short circuit withstand time	t_{psc}		10	μs
最高口温 Maximum junction temperature	$T_{vj\ max}$		175	$^{\circ}C$
工作口温 Operating junction temperature	$T_{vj\ op}$		-40~150	$^{\circ}C$
存口温度 Storage temperature	T_{st}		-40~125	$^{\circ}C$

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□ Value			□位 Unit
				Min.	Typ.	Max.	
集□极-□射极□和□□ Collector-emitter saturation voltage	V _{CE sat}	I _C =600A, V _{GE} =15V	T _{vj} =25°C		1.75	2.15	V
			T _{vj} =125°C		2.20		
			T _{vj} =150°C		2.25		
□极-□射极□□□□ Gate-emitter threshold voltage	V _{GE th}	I _C =23mA, V _{CE} =V _{GE}		5.20	5.80	6.40	V
集□极-□射极截止□流 Collector-emitter cut-off current	I _{CES}	V _{CE} =1200V, V _{GE} =0V				1	mA
□极-□射极漏□流 Gate-emitter leakage current	I _{GES}	V _{CE} =0V, V _{GE} =±20V		-100		100	nA
内置□极□阻 Internal gate resistance	R _{G int}				1.2		Ω
□极□荷 Gate charge	Q _G	V _{GE} =-15V~+15V			9.7		μC
□入□容 Input capacitance	C _{ies}	f=1MHz, T _{vj} =25°C, V _{CE} =25V, V _{GE} =0V			128		nF
反向□□□容 Reverse transfer capacitance	C _{res}				1.47		nF
开通延□□□（□感□□） Turn-on delay time, inductive load	t _{d on}	I _C =600A, V _{CE} =600V, V _{GE} =±15V, R _{Gon} =1.5Ω, R _{Goff} =1.5Ω, Inductive Load	T _{vj} =25°C		435		ns
			T _{vj} =125°C		450		
			T _{vj} =150°C		450		
上升□□（□感□□） Rise time, inductive load	t _r		T _{vj} =25°C		115		ns
			T _{vj} =125°C		160		
			T _{vj} =150°C		170		
关断延□□□（□感□□） Turn-off delay time, inductive load	t _{d off}		T _{vj} =25°C		625		ns
			T _{vj} =125°C		680		
			T _{vj} =150°C		700		
下降□□（□感□□） Fall time, inductive load	t _f		T _{vj} =25°C		90		ns
			T _{vj} =125°C		200		
			T _{vj} =150°C		235		
开通□耗（每脉冲） Turn-on energy loss per pulse	E _{on}		T _{vj} =25°C		55		mJ
			T _{vj} =125°C		100		
			T _{vj} =150°C		110		
关断□耗（每脉冲） Turn-off energy loss per pulse	E _{off}		T _{vj} =25°C		35		mJ
			T _{vj} =125°C		50		
			T _{vj} =150°C		60		
短路□流 Short circuit current	I _{SC}	V _{GE} ≤15V, t _{psc} ≤10us, V _{CC} =800V, T _{vj} =150°C V _{CE,max} =V _{CES} -L _{sCE} ·di/dt			2650		A

*1 IGBT特征值遵从IEC 60747-9。

*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 =600A	T _{vj} =25°C		1.75	2.15	V
			T _{vj} =125°C		1.90		
			T _{vj} =150°C		1.90		
反向恢复峰□□ 流 Peak reverse recovery current	I _{RM}	I _F =600A, V _R =600V, V _{GE} =-15V -di _F /dt=2700A/μs (T _{vj} =150°C)	T _{vj} =25°C		460		A
			T _{vj} =125°C		450		
			T _{vj} =150°C		445		
反向□ 荷 Reverse charge	Q _{rr}		T _{vj} =25°C		50		uC
			T _{vj} =125°C		95		
			T _{vj} =150°C		105		
反向恢复□ 耗 Reverse recovery energy loss	E _{rec}		T _{vj} =25°C		12		mJ
			T _{vj} =125°C		25		
			T _{vj} =150°C		30		

*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	数值 Value			单位 Unit
			Min.	Typ.	Max.	
额定阻值 Rated resistance	R_{25}	$T_{NTC}=25^{\circ}C$		5.00		k Ω
耗散功率 Power dissipation	P_{25}	$T_{NTC}=25^{\circ}C$			10	mW
B-值 B-value	$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298,15K))]$		3375		K

封装特性 Package Properties*3

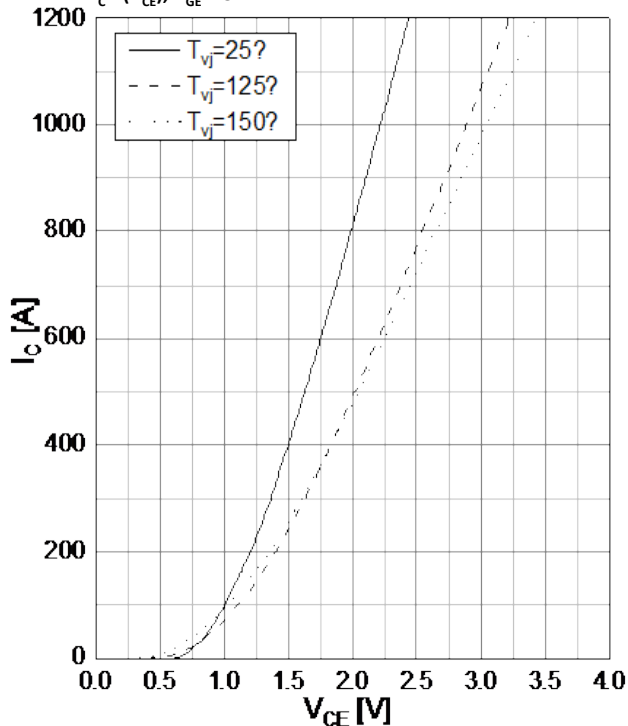
参数 Parameter	符号 Symbol	条件 Condition	数值 Value			单位 Unit
			Min.	Typ.	Max.	
IGBT 结-壳电阻 IGBT thermal resistance: junction to case	R_{thJC}	每个IGBT/per IGBT		0.038		K/W
二极管 结-壳电阻 Diode thermal resistance: junction to case	R_{thJC}	每个二极管/per diode		0.063		K/W
IGBT接触电阻 IGBT thermal resistance: case to heatsink	R_{thCH}	每个IGBT/per IGBT 硅脂系数 $\lambda_{grease}=1W/(m\cdot K)$		0.029		K/W
二极管接触电阻 Diode thermal resistance: case to heatsink	R_{thCH}	每个二极管/per diode 硅脂系数 $\lambda_{grease}=1W/(m\cdot K)$		0.048		K/W
绝缘电压 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
相漏起痕指数 Comparative tracking index	CTI		>200			
模块寄生电感 Module stray inductance	L_{sCE}	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

*3 封装特性遵从IEC 60747-15

输出特性 IGBT

Output characteristic IGBT

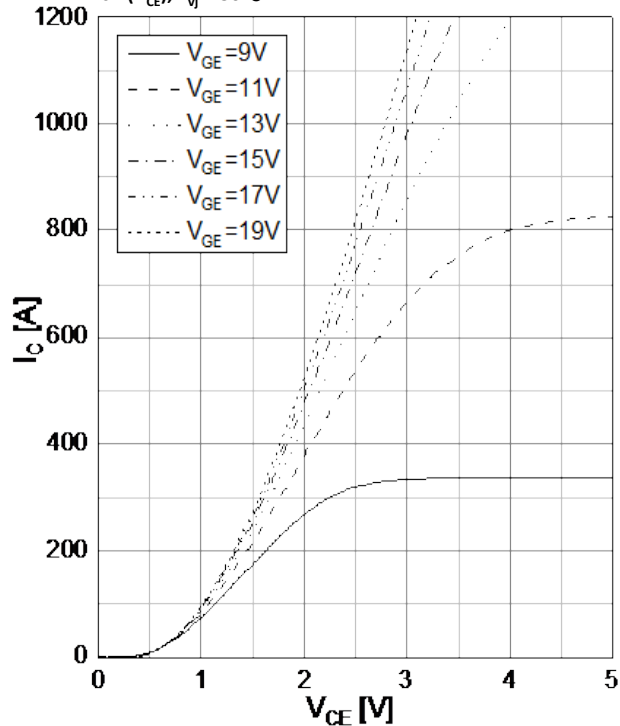
$I_c = f(V_{CE}), V_{GE} = 15V$



输出特性 IGBT

Output characteristic IGBT

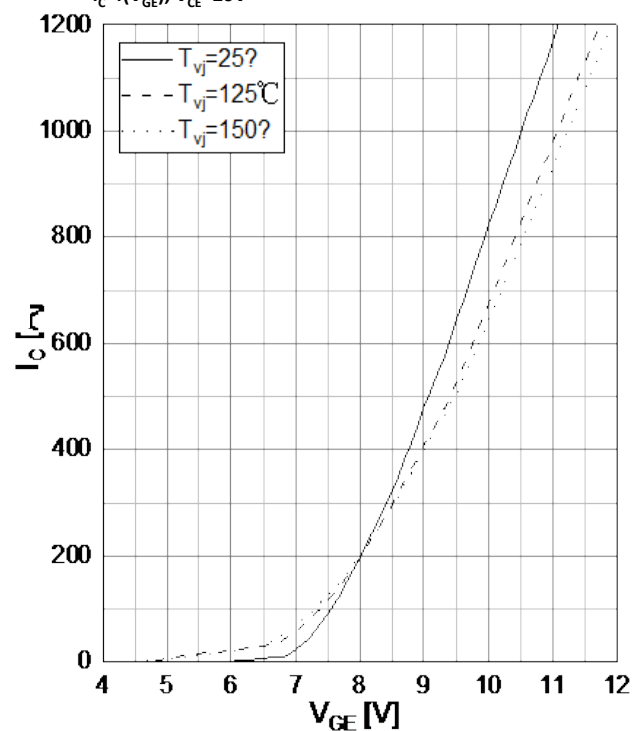
$I_c = f(V_{CE}), T_{vj} = 150^\circ C$



传输特性 IGBT

Transfer characteristic IGBT

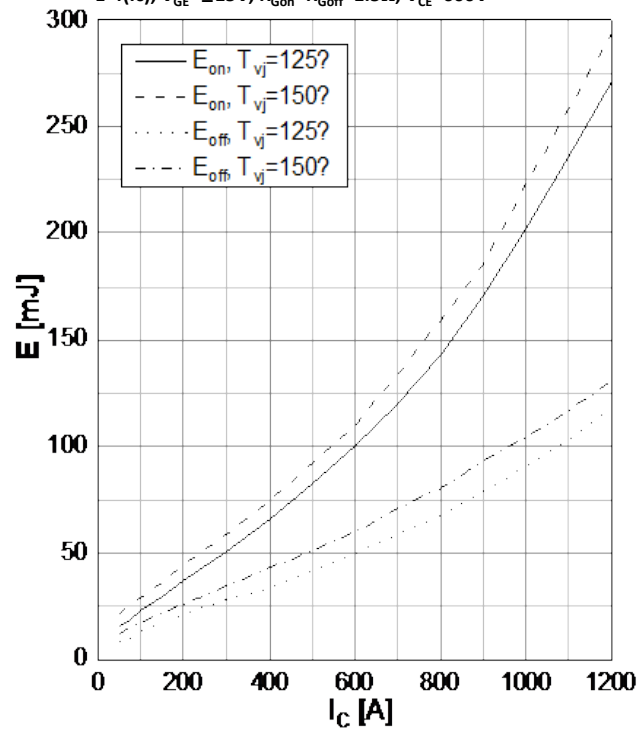
$I_c = f(V_{GE}), V_{CE} = 20V$



开关损耗 IGBT

Switching losses IGBT

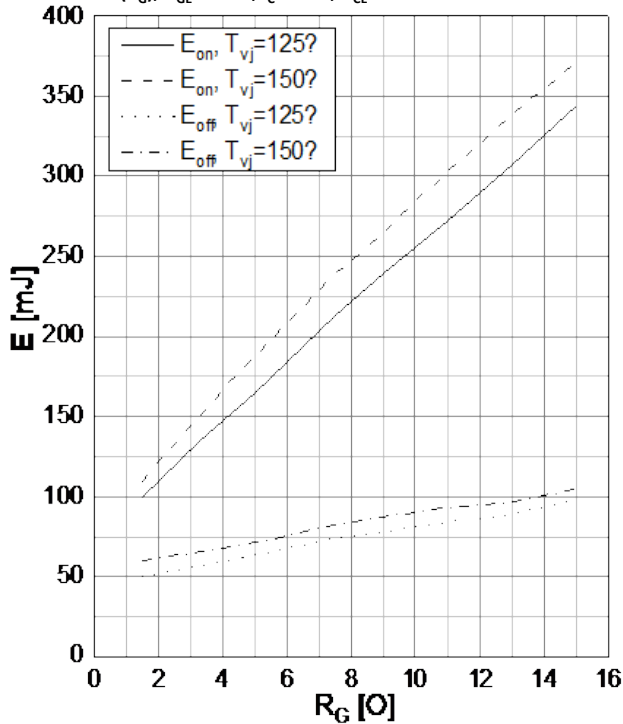
$E = f(I_c), V_{GE} = \pm 15V, R_{Gon} = R_{Goff} = 1.5\Omega, V_{CE} = 600V$



开关损耗IGBT

Switching losses IGBT

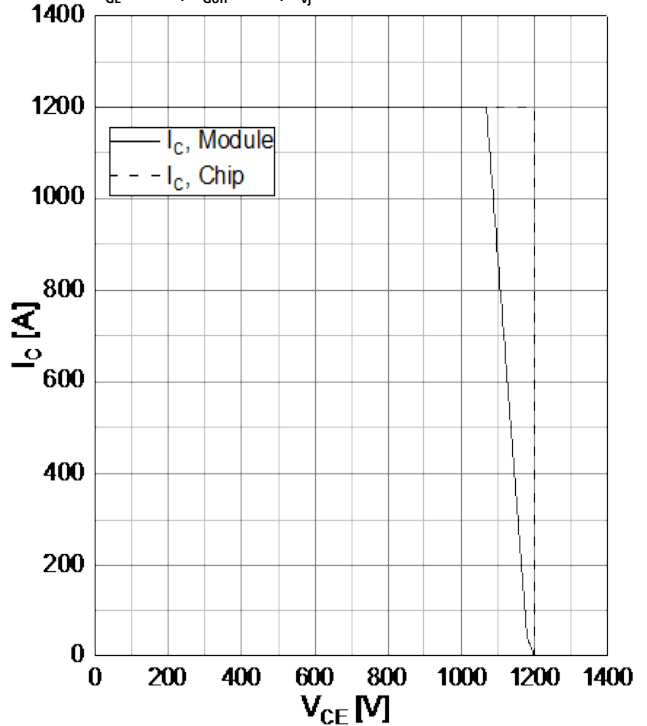
$E=f(R_G), V_{GE}=\pm 15V, I_C=600A, V_{CE}=600V$



反偏安全工作区 IGBT

Reverse bias safe operating area IGBT

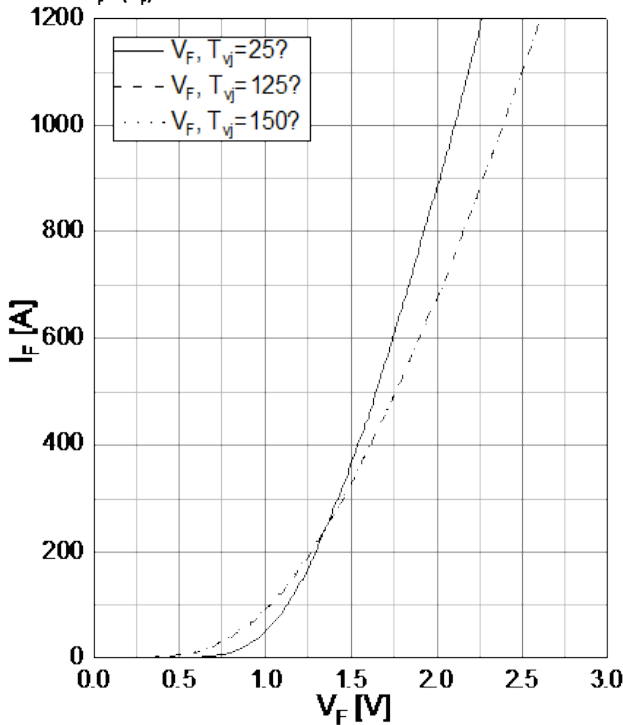
$V_{GE}=\pm 15V, R_{Goff}=1.5\Omega, T_{vj}=150^\circ C$



正向特性Diode

Forward characteristic Diode

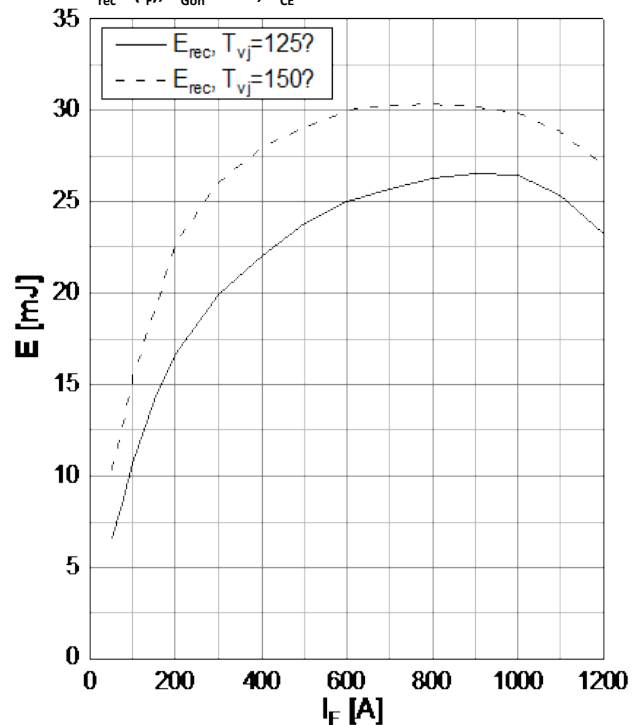
$I_F=f(V_F)$



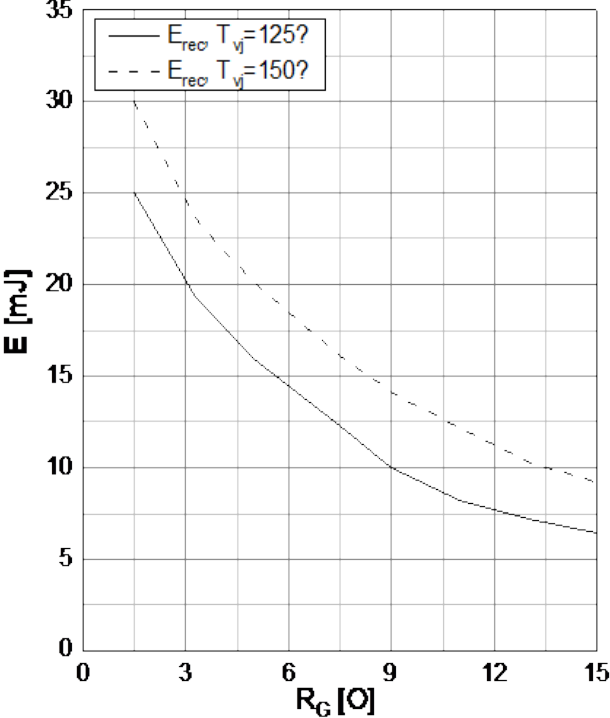
开关损耗 Diode

Switching losses Diode

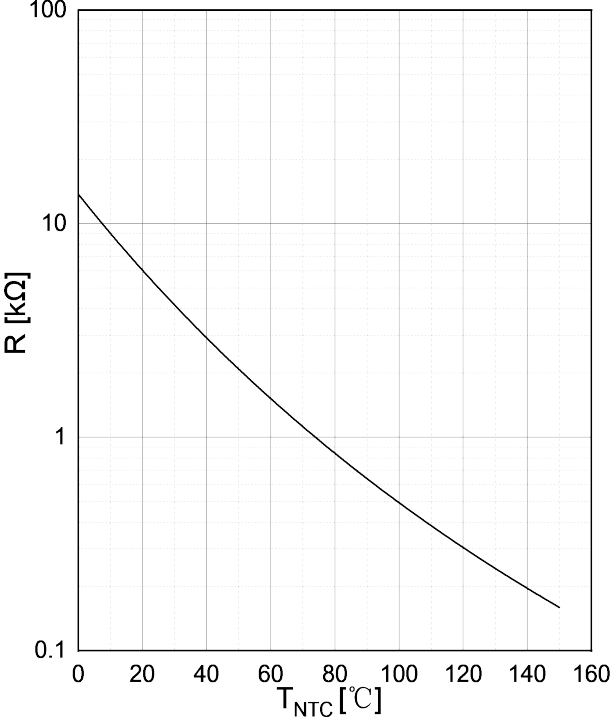
$E_{rec}=f(I_F), R_{Gon}=1.5\Omega, V_{CE}=600V$



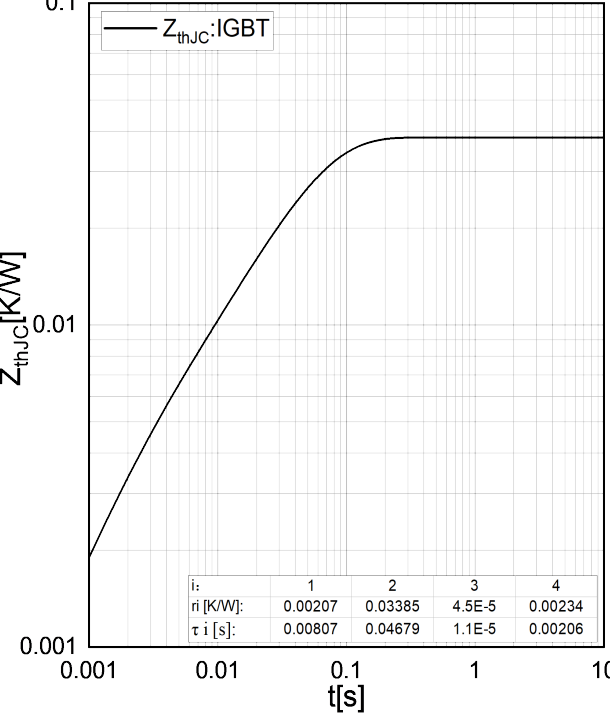
开关损耗Diode
Switching losses Diode
 $E_{rec}=f(R_G), V_{CE}=600V$



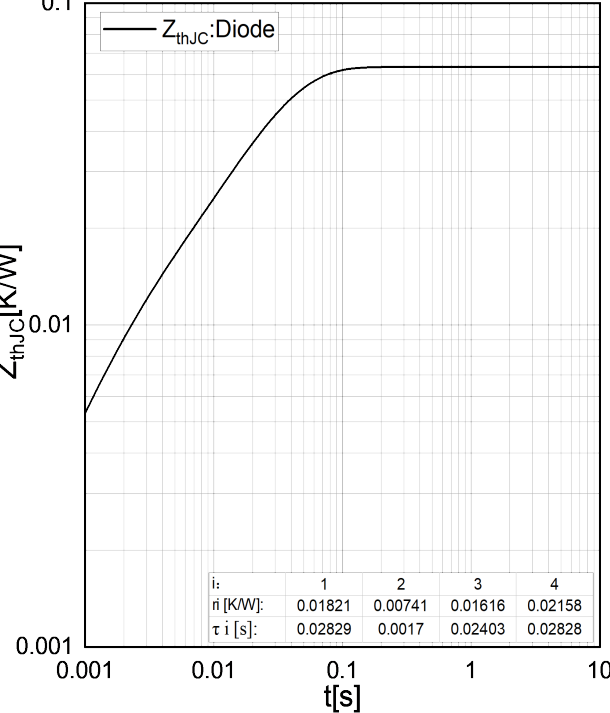
热敏电阻温度特性曲线
NTC temperature characteristic



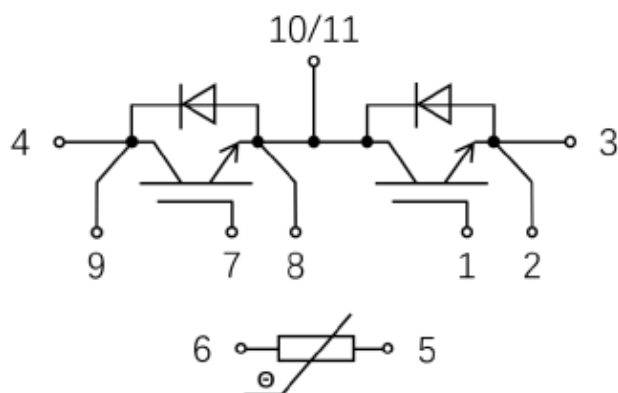
瞬态热阻抗 IGBT
Transient Thermal Impedance IGBT
 $Z_{thJC}=f(t)$



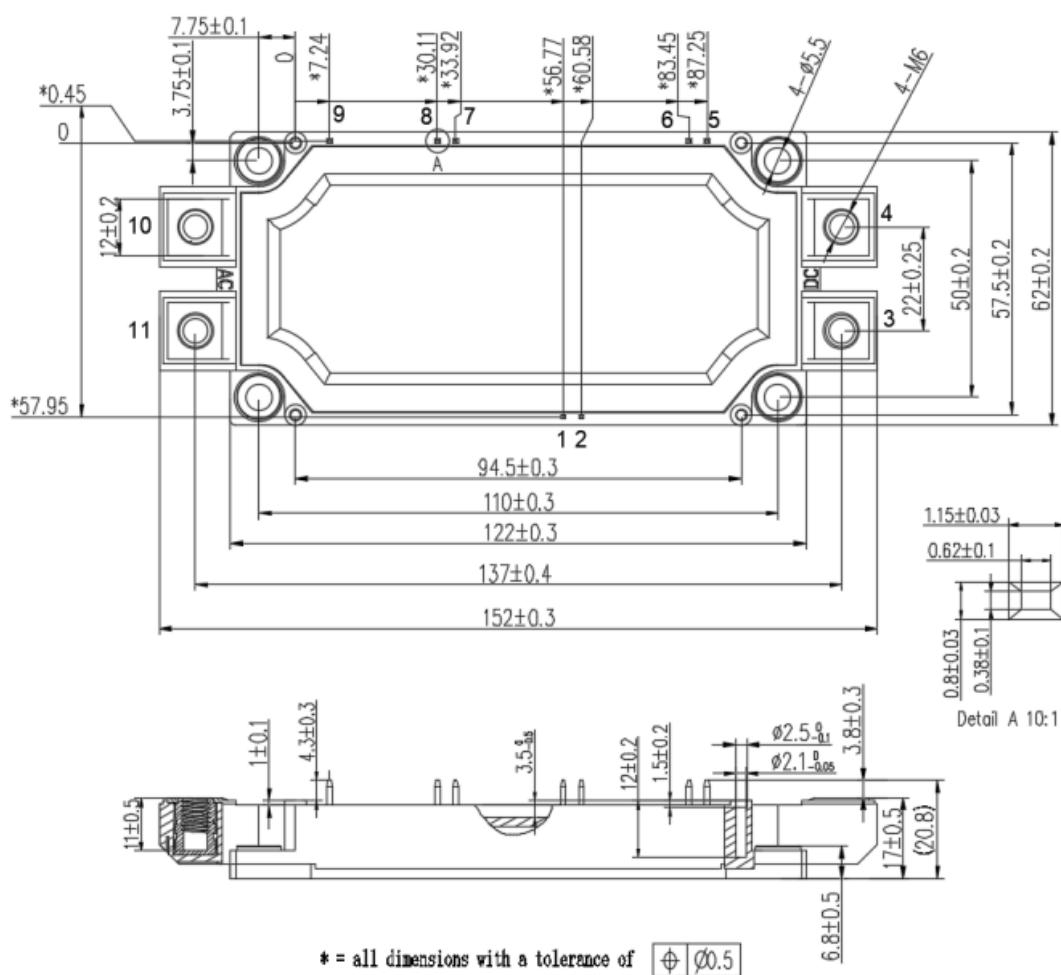
瞬态热阻抗 二极管
Transient Thermal Impedance Diode
 $Z_{thJC}=f(t)$



电路图 Circuit Diagram



外形尺寸 Outline Drawing



修订记录 Revision History

日期 Date	描述 Description
2025-4-8	正式版

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