

HCG1200FC170D3K5

1700V 1200A IGBT 模块, 斩波结构, E6封装, 内置续流二极管及NTC
1700V 1200A IGBT Module, Chopper, E6 Package, with FWD and NTC

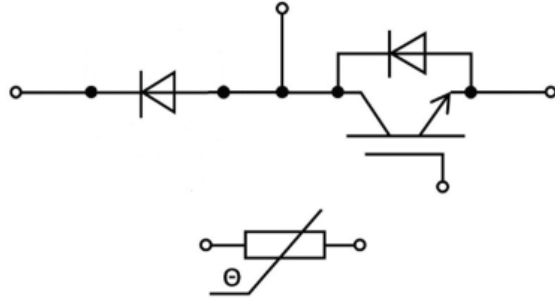
特点 Features

- 1700V 沟槽栅及场截止结构
1700V Trench Gate & Field Stop Structure
- 高可靠性
High Reliability
- 正温度系数
Positive Temperature Coefficient



应用 Applications

- 斩波应用
Chopper Applications
- 风电变流器
Wind Power Converter



最大额定值 Maximum Rated Values

参数 Parameter	符号 Symbol	条件 Condition	数值 Value	单位 Unit
集电极-发射极电压 Collector-emitter voltage	V_{CES}	$V_{GE}=0V, T_{vj}=25^{\circ}C$	1700	V
集电极直流 DC collector current	I_C	$T_C=95^{\circ}C, T_{vj,max}=175^{\circ}C$	1200	A
集电极峰值流 Peak collector current	I_{CM}	$t_p=1ms$	2400	A
栅极-发射极峰值电压 Gate-emitter peak voltage	V_{GES}		± 20	V
IGBT最大功耗 IGBT maximum power dissipation	P_{tot}	$T_C=25^{\circ}C, T_{vj,max}=175^{\circ}C$	5555	W
反向重复峰值电压 Repetitive peak reverse voltage	V_{RRM}	$T_{vj}=25^{\circ}C$	1700	V
正向直流流 Continuous DC forward current	二极管 Diode,brake-chopper	I_F	600	A
	反向二极管 Diode,reverse		200	A
正向重复峰值流 Repetitive peak forward current	二极管 Diode,brake-chopper	I_{FRM}	1200	A
	反向二极管 Diode,reverse		400	A
I^2t -Value	二极管 Diode,brake-chopper	I^2t	58650	A^2s
	反向二极管 Diode,reverse		6615	A^2s
最高结温 Maximum junction temperature	$T_{vj,max}$		175	$^{\circ}C$
工作结温 Operating junction temperature	$T_{vj,op}$		-40~150	$^{\circ}C$
存贮温度 Storage temperature	T_{slg}		-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	$V_{CE\ sat}$	$I_C=1200\text{A}$, $V_{GE}=15\text{V}$	$T_{vj}=25^{\circ}\text{C}$		1.70		V
			$T_{vj}=150^{\circ}\text{C}$		1.95	2.45	
栅极-发射极开启电压 Gate-emitter threshold voltage	$V_{GE\ th}$	$I_C=48\text{mA}$, $V_{CE}=V_{GE}$		5.4	5.9	6.4	V
集电极-发射极截止电流 Collector-emitter cut-off current	I_{CES}	$V_{CE}=1700\text{V}$, $V_{GE}=0\text{V}$				1	mA
栅极-发射极漏电流 Gate-emitter leakage current	I_{GES}	$V_{CE}=0\text{V}$, $V_{GE}=\pm 20\text{V}$		-100		100	nA
内置栅极电阻 Internal gate resistance	$R_{G\ int}$				1.0		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}	$f=1\text{MHz}$, $T_{vj}=25^{\circ}\text{C}$, $V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$			97.5		nF
反向转移电容 Reverse transfer capacitance	C_{res}				1.60		nF
开通延迟时间 (感性负载) Turn-on delay time, inductive load	$t_{d\ on}$	$I_C=1200\text{A}$, $V_{CE}=1100\text{V}$, $V_{GE}=\pm 15\text{V}$, $R_{Gon}=5.1\Omega$, $R_{Goff}=15\Omega$, 开通 $di/dt=8190\text{A}/\mu\text{s}$ ($T_{vj}=150^{\circ}\text{C}$) 关断 $dv/dt=1020\text{V}/\mu\text{s}$ ($T_{vj}=150^{\circ}\text{C}$) Inductive Load	$T_{vj}=25^{\circ}\text{C}$		1030		ns
			$T_{vj}=150^{\circ}\text{C}$		995		
上升时间 (感性负载) Rise time, inductive load	t_r		$T_{vj}=25^{\circ}\text{C}$		115		ns
			$T_{vj}=150^{\circ}\text{C}$		125		
关断延迟时间 (感性负载) Turn-off delay time, inductive load	$t_{d\ off}$		$T_{vj}=25^{\circ}\text{C}$		6150		ns
			$T_{vj}=150^{\circ}\text{C}$		6655		
下降时间 (感性负载) Fall time, inductive load	t_f		$T_{vj}=25^{\circ}\text{C}$		3420		ns
			$T_{vj}=150^{\circ}\text{C}$		3550		
开通损耗 (每脉冲) Turn-on energy loss per pulse	E_{on}		$T_{vj}=25^{\circ}\text{C}$		230		mJ
			$T_{vj}=150^{\circ}\text{C}$		270		
关断损耗 (每脉冲) Turn-off energy loss per pulse	E_{off}		$T_{vj}=25^{\circ}\text{C}$		685		mJ
			$T_{vj}=150^{\circ}\text{C}$		840		

*1 IGBT特征值遵从IEC 60747-9。

斩波器二极管特征值 Diode,Brake-Chopper Characteristic 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		1.92		V
			T _{vj} = 150°C		2.14		
		I _F = 1200 A	T _{vj} = 25°C		2.50		
			T _{vj} = 150°C		2.90		
反向恢复峰□□ 流 Peak reverse recovery current	I _{RM}	I _F =600A, V _R =1100V, V _{GE} =-15V -di _p /dt=7360A/μs (T _{vj} =150°C) Inductive Load	T _{vj} = 25°C		890		A
			T _{vj} = 150°C		955		
恢复□ 荷 Recovered charge	Q _{rr}		T _{vj} = 25°C		142		μC
			T _{vj} = 150°C		182		
反向恢复□ 耗 Reverse recovery energy loss	E _{rec}		T _{vj} = 25°C		100		mJ
			T _{vj} = 150°C		130		

*2 二极管特征值遵从IEC 60747-2。

反向二极管特征值 Diode,Reverse Characteristic 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 = 200 A	T _{vj} = 25°C		1.95		V
			T _{vj} = 150°C		2.20		

*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.	
额定电阻 Rated resistance	R ₂₅	T _{NTC} =25°C		5		KΩ
功耗 Power dissipation	P ₂₅	T _{NTC} =25°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

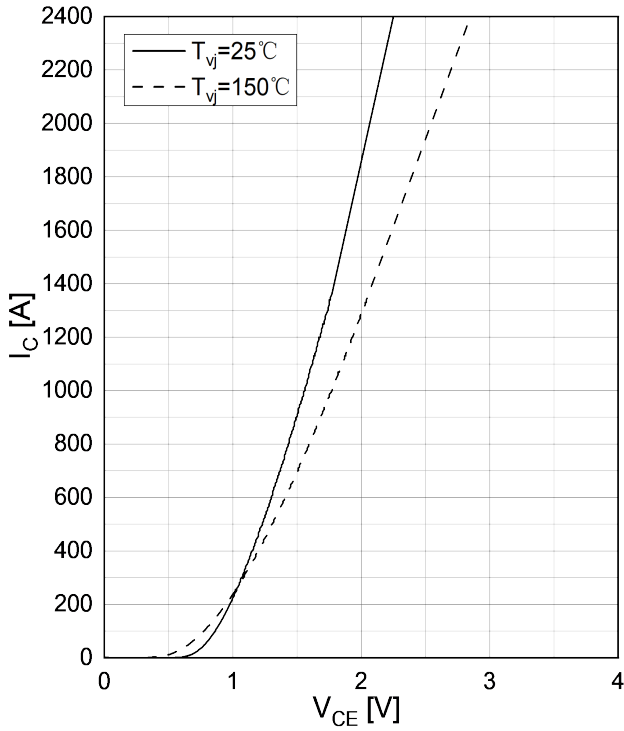
封装特性 Package Properties*3

参数 Parameter	符号 Symbol	条件 Condition	数值 Value			单位 Unit
			Min.	Typ.	Max.	
IGBT 壳-壳阻 IGBT thermal resistance: junction to case	R_{thJC}	每个IGBT/per IGBT		0.027		K/W
二极管 壳-壳阻 Transient thermal impedance diode,brake-chopper	R_{thJC}	每个二极管/per diode		0.099		K/W
反并二极管 壳-壳阻 Transient thermal impedance diode, reverse	R_{thJC}	每个二极管/per diode		0.300		K/W
IGBT接触阻 IGBT thermal resistance: case to heatsink	R_{thCH}	每个IGBT/per IGBT 硅脂系数 $\lambda_{grease} = 1W/(m \cdot K)$		0.024		K/W
二极管接触阻 Chopper diode resistance: case to heatsink	R_{thCH}	每个二极管/per diode 硅脂系数 $\lambda_{grease} = 1W/(m \cdot K)$		0.039		K/W
反并二极管接触阻 Antiparallel diode resistance: case to heatsink	R_{thCH}	每个二极管/per diode 硅脂系数 $\lambda_{grease} = 1W/(m \cdot K)$		0.120		K/W
耐压 Isolation voltage	V_{isol}	RMS, f=50Hz, t=60s	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
气隙 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			
模寄生电感 Module stray inductance	L_{sCE}	每个臂/per switch		20		nH
模引脚内阻 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

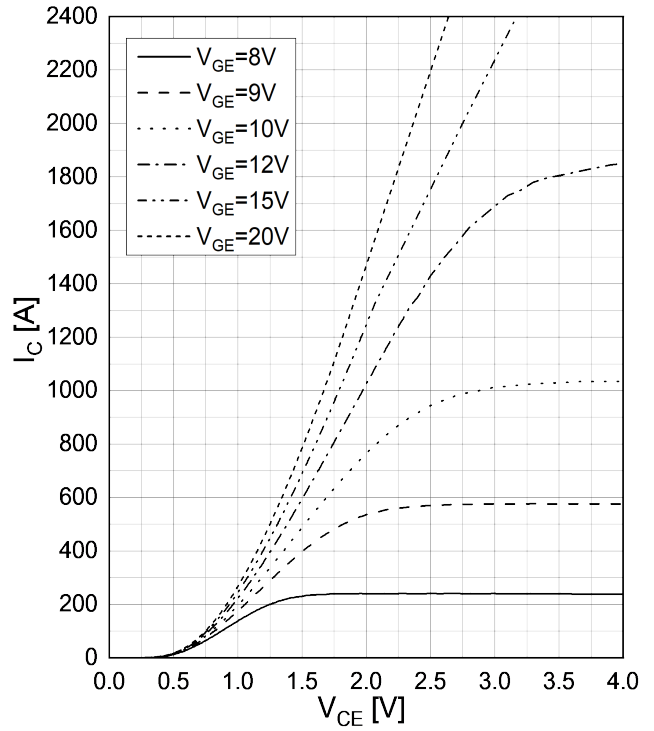
$$I_C = f(V_{CE}), V_{GE} = 15V$$



输出特性 IGBT

Output characteristic IGBT

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

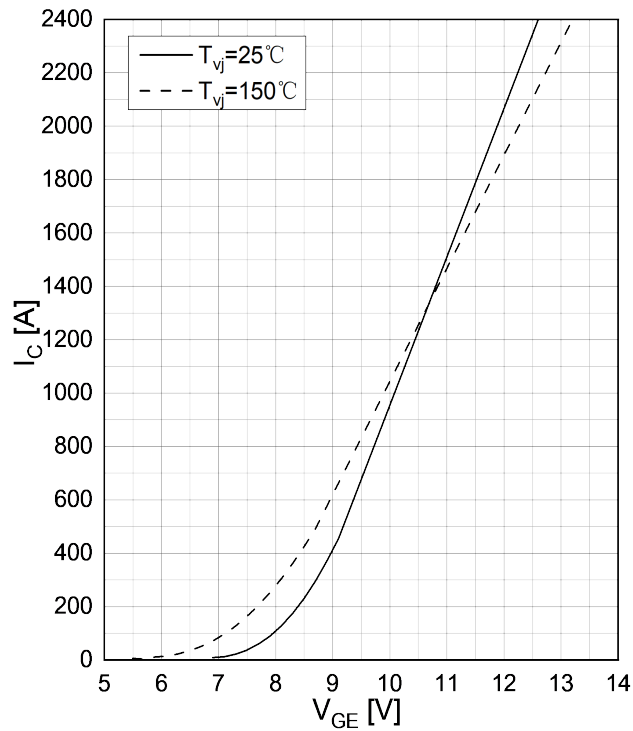


传输特性 IGBT

Transfer characteristic IGBT

$$I_C = f(V_{GE})$$

$$V_{CE} = 20V$$

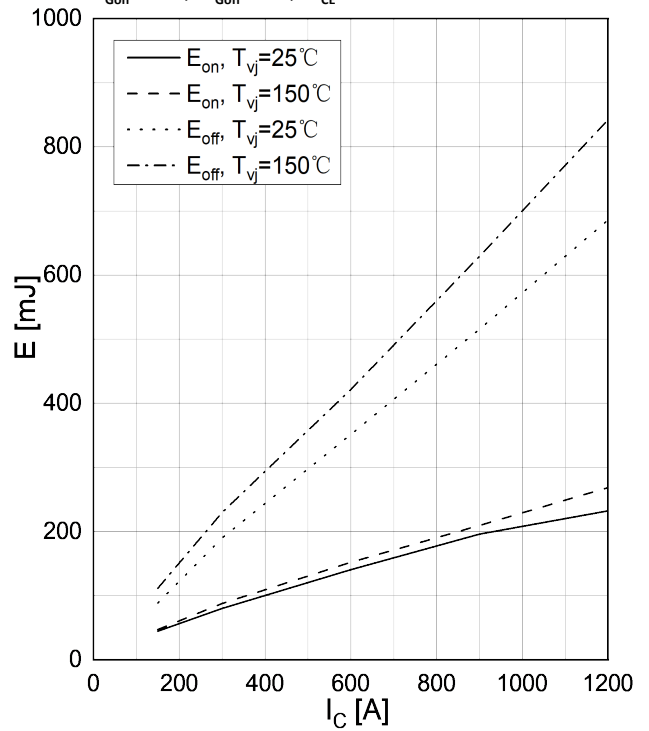


开关损耗 IGBT

Switching losses IGBT

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

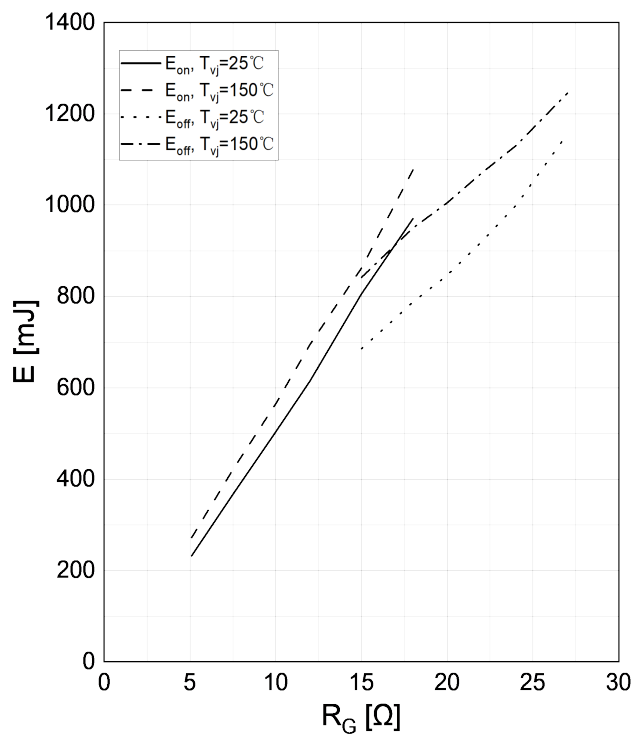
$$R_{Gon} = 5.1\Omega, R_{Goff} = 15\Omega, V_{CE} = 1100V$$



开关损耗 IGBT

Switching losses IGBT

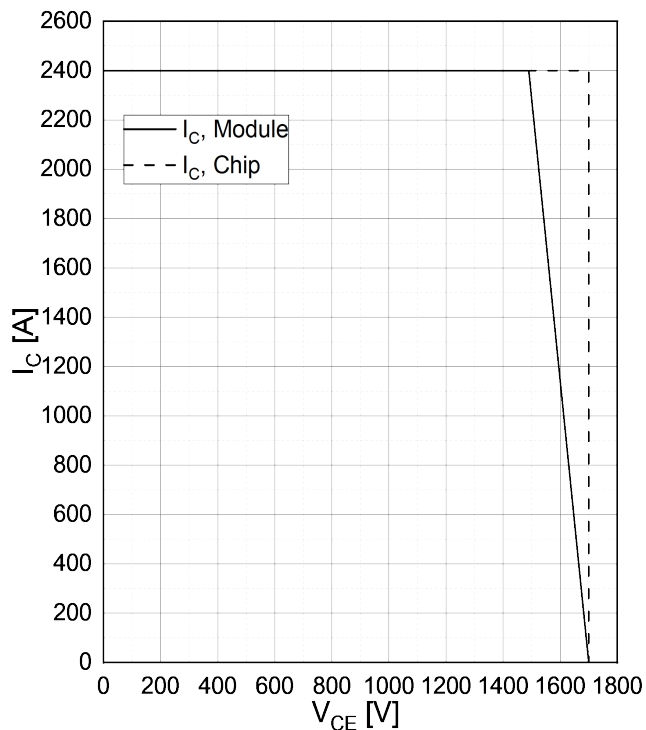
$E=f(R_G), V_{GE}=\pm 15V, I_C=1200A, V_{CE}=1100V$



反偏安全工作区 IGBT

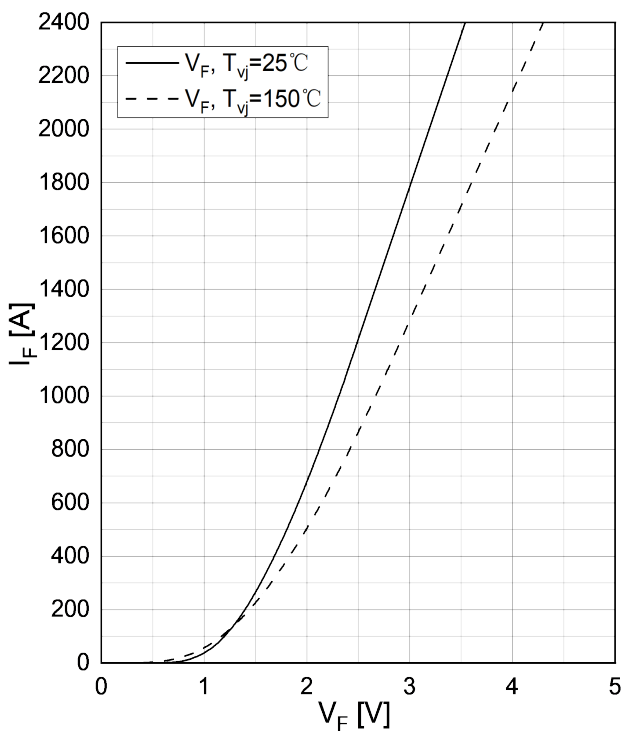
Reverse bias safe operating area IGBT (RBSOA)

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



正向偏压特性 斩波器二极管

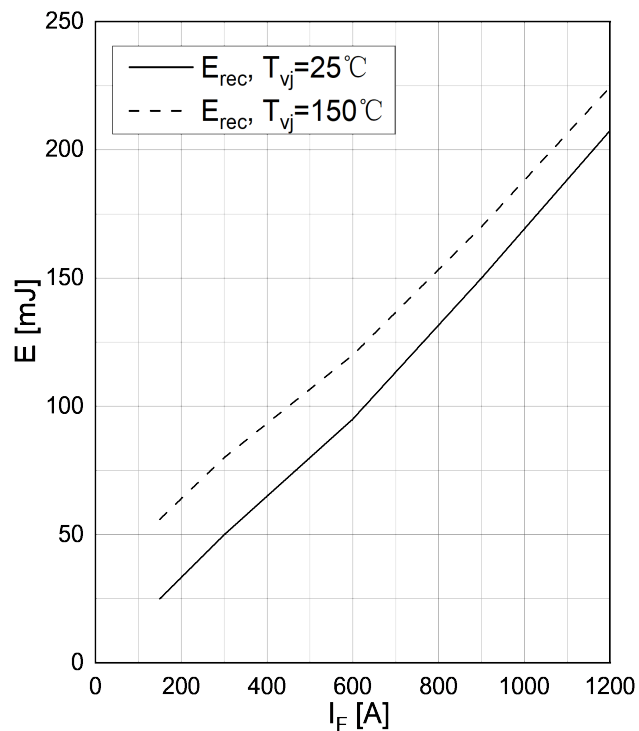
Forward characteristic of diode, brake-chopper (typical) $I_F=f(V_F)$



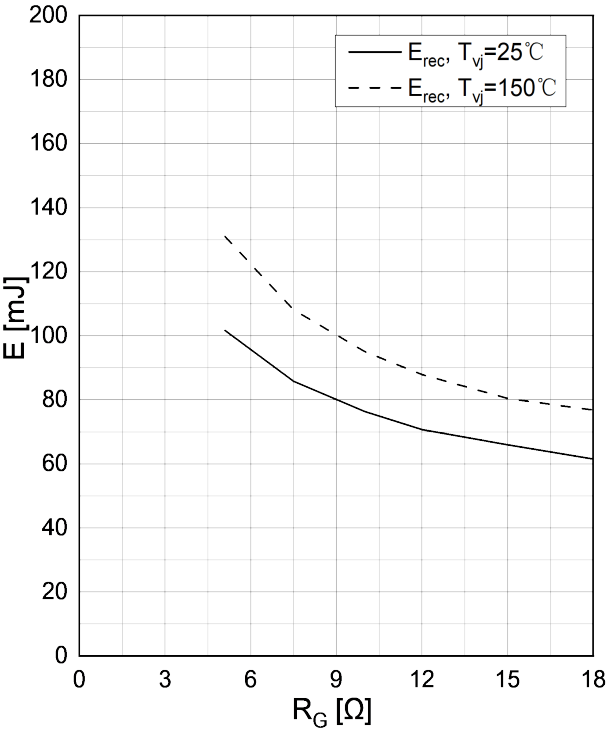
开关损耗 斩波器二极管

Switching losses、diode, brake-chopper

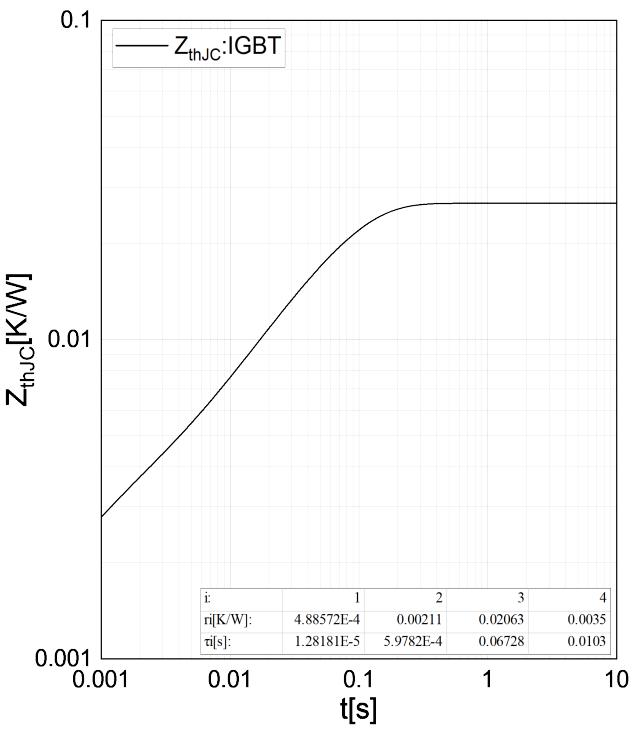
$E_{rec}=f(I_F), R_{Gon}=5.1\Omega, V_{CE}=1100V$



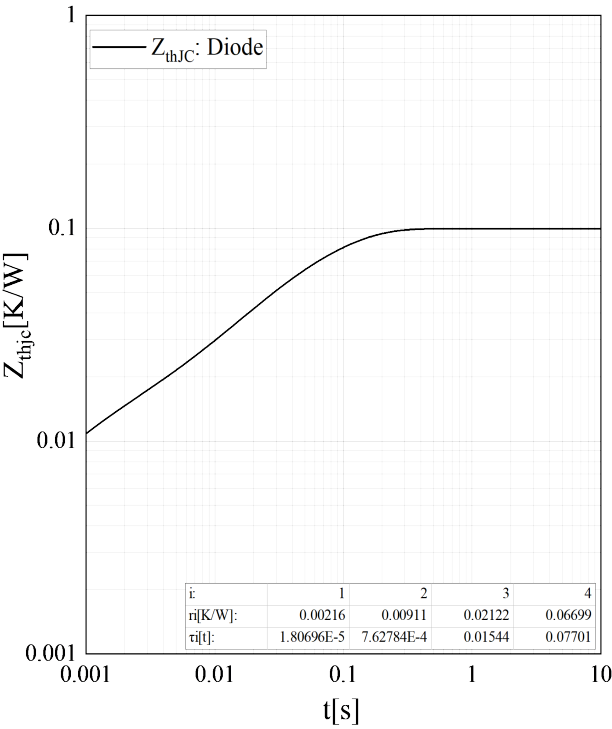
开关损耗 斩波器二极管
Switching losses diode,brake-chopper
 $E_{rec}=f(R_G)$,
 $I_F=600A,V_{CE}=1100V$



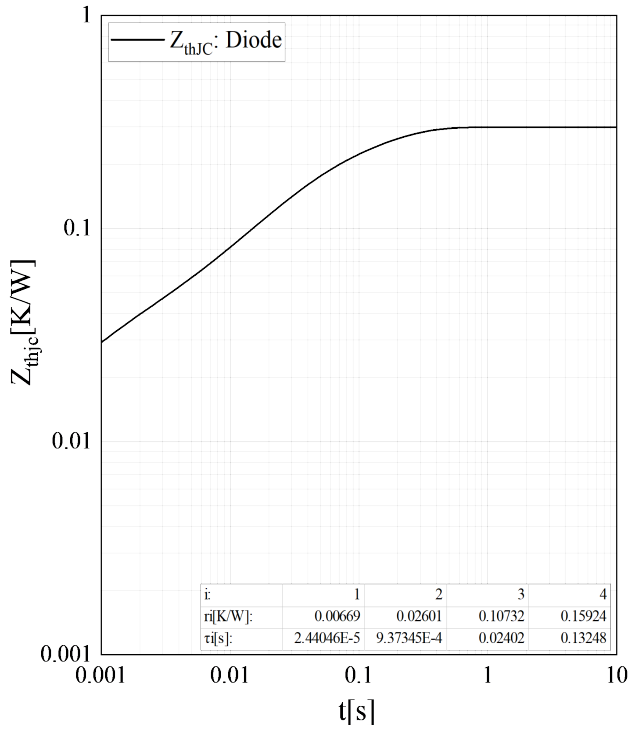
瞬态热阻抗 IGBT
Transient thermal impedance IGBT
 $Z_{thJC}=f(t)$



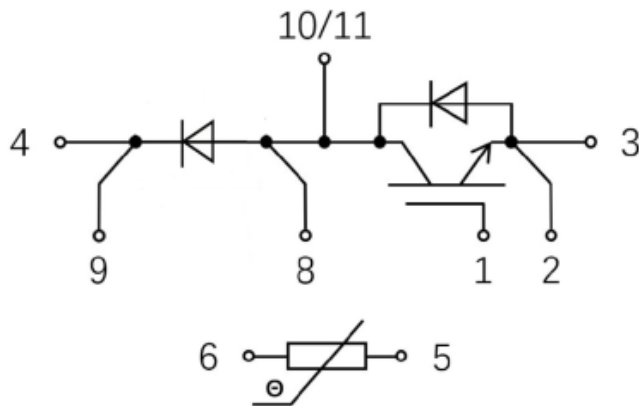
瞬态热阻抗 斩波器二极管
Transient thermal impedance diode,brake-chopper
 $Z_{thJC}=f(t)$



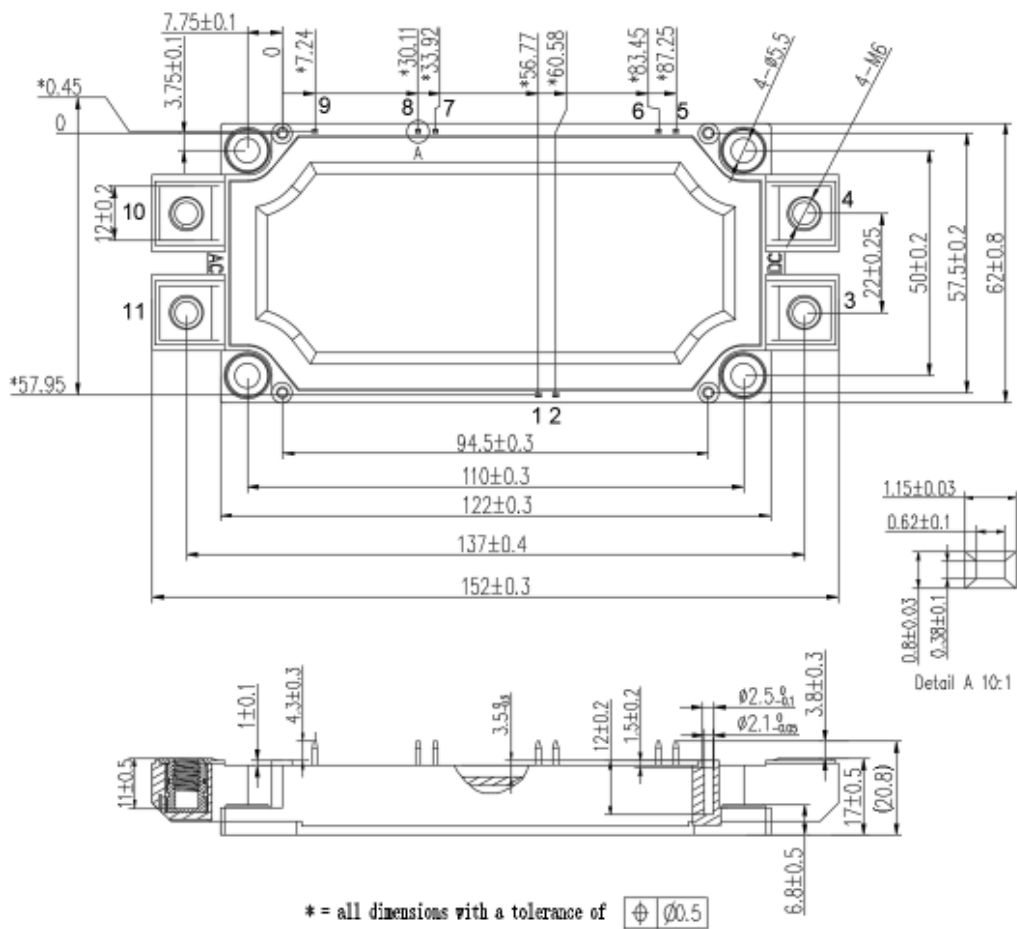
瞬态热阻抗 反向二极管
Transient thermal impedance diode,reverse
 $Z_{thJC}=f(t)$



电路图 Circuit Diagram



外形尺寸 Outline Drawing



修订记录 Revision History

日期 Date	描述 Description
2025-7-10	初版

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