

HCG450FH120D3RB 1200V/450A IGBT Module

特性

Features

- 1200V沟槽栅/场终止工艺
1200V Trench Gate/Field-Stop Process
- 低电磁干扰
Low EMI
- V_{CEsat} 带正温度系数
 V_{CEsat} with Positive Temperature Coefficient
- 集成温度传感器
Integrated Temperature Sensor
- 低热阻三氧化二铝 (Al_2O_3) 衬底
 Al_2O_3 Substrate with Low Thermal Resistance

应用

Application

- 电机驱动/Motor Drives
- 储能变流器/Power Control System
- 光伏发电/Photovoltaic Power Generation
- 风力发电/Wind Power Generation
- 不间断电源/UPS Systems
- 伺服驱动器/Servo Drives

关键参数

Key Parameters

Parameter		Symbol	Value	Unit
集电极—发射极电压 Collector-emitter voltage		V _{CES}	1200	V
连续集电极直流电流 Continuous DC collector current		I _{Cnom}	450	A
集电极重复峰值电流 Repetitive peak collector current		I _{CRM}	900	A
集电极—发射极饱和电压 Collector-Emitter saturation voltage	T _{vj} =25℃	V _{CEsat}	1.90	V
	T _{vj} =150℃		2.28	
IGBT结—散热器热阻 IGBT thermal resistance		R _{thJH}	0.115	K/W
二极管结—散热器热阻 Diode thermal resistance		R _{thJH}	0.155	K/W
开通损耗能量 Turn-on energy	T _{vj} =25℃	E _{on}	17.5	mJ
	T _{vj} =150℃		34.2	
关断损耗能量 Turn-off energy	T _{vj} =25℃	E _{off}	26.1	
	T _{vj} =150℃		38.8	

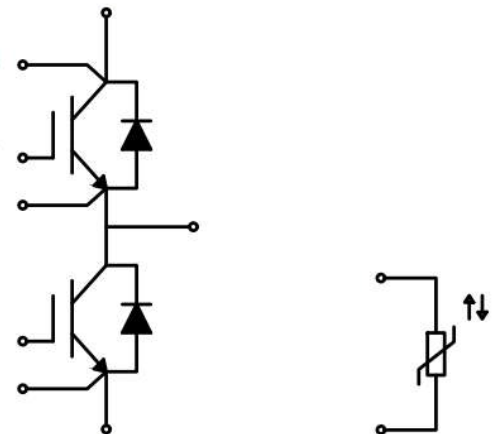
模块外观

Module Appearance



电路拓扑

Circuit Topology



HCG450FH120D3RB 1200V/450A IGBT Module

目录/Table of Contents

封装/ Package	3
IGBT	4
Diode	6
负温度系数热敏电阻/ NTC - Thermistor	7
特征参数表/ Characteristics Diagrams	8
电路拓扑图/ Circuit Diagram	11
封装尺寸/ Package Outlines	12
模块标签信息/ Module Marking Information	13

HCG450FH120D3RB

1200V/450A IGBT Module

封装/Package

表 1 绝缘参数/Insulation coordination

Parameter	Conditions	Symbol	Value	Unit
绝缘测试电压 Isolation test voltage	RMS, f = 50Hz, t =60s	V_{ISOL}	3	kV
模块基板材料 Material of module baseplate			Cu	
内部绝缘 Internal isolation	基本绝缘 (class 1, IEC 61140) Basic insulation (class 1, IEC 61140)		Al ₂ O ₃	
爬电距离 Creepage distance	端子至散热器 Terminal to heatsink	d_{Creep}	14.5	mm
爬电距离 Creepage distance	端子至端子 Terminal to terminal	d_{Creep}	13.0	mm
电气间隙 Clearance	端子至散热器 Terminal to heatsink	d_{Clear}	12.5	mm
电气间隙 Clearance	端子至端子 Terminal to terminal	d_{Clear}	10.0	mm
相对电痕指数 Comparative tracking index		CTI	>200	

表 2 特征值/Characteristic values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
杂散电感, 模块 Stray inductance module		L_{sCE}		20		nH
模块引线电阻, 端子—芯片 Module lead resistance, terminals - chip	$T_F = 25\text{ }^{\circ}\text{C}$, per switch	$R_{CC'+EE'}$		0.8		mΩ
储存温度 Storage temperature		T_{stg}	-40		125	°C
模块安装的安装扭矩 Mounting torque for module mounting	根据相应的应用手册进行安装 Mounting according to valid application note	M5, 螺丝 M5, Screw	M	3	6	Nm
端子安装扭矩 Terminal connection torque	根据相应的应用手册进行安装 Mounting according to valid application note	M6, 螺丝 M6, Screw	M	3	6	Nm
重量 Weight		G		345		g

HCG450FH120D3RB 1200V/450A IGBT Module

IGBT

表 3 最大标定值/Maximum rated values

Parameter	Conditions	Symbol	Value	Unit
集电极—发射极电压 Collector-emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	V_{CES}	1200	V
连续直流集电极电流 Continuous DC collector current	$T_H = 85^{\circ}\text{C}$, $T_{vj\max} = 175^{\circ}\text{C}$	I_{CDC}	450	A
集电极重复峰值电流 Repetitive peak collector current	$t_p = 1\text{ ms}$	I_{CRM}	900	A
总功率耗散 Total power dissipation	$T_H = 85^{\circ}\text{C}$, $T_{vj\max} = 175^{\circ}\text{C}$	P_{tot}	783	W
栅极—发射极电压 Gate-emitter peak voltage		V_{GES}	± 20	V

表 4 特征值/Characteristic values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
集电极-发射极饱和电压 Collector-emitter saturation voltage	$I_C = 450\text{ A}$, $V_{GE} = 15\text{ V}$, $T_{vj} = 25^{\circ}\text{C}$	$V_{CE\text{ sat}}$		1.90		V
	$I_C = 450\text{ A}$, $V_{GE} = 15\text{ V}$, $T_{vj} = 125^{\circ}\text{C}$			2.20		
	$I_C = 450\text{ A}$, $V_{GE} = 15\text{ V}$, $T_{vj} = 150^{\circ}\text{C}$			2.28		
栅极阈值电压 Gate threshold voltage	$I_C = 17\text{ mA}$, $V_{GE} = V_{CE}$, $T_{vj} = 25^{\circ}\text{C}$	V_{GEth}	5.0	5.9	6.8	V
栅极电荷 Gate charge	$V_{GE} = \pm 15\text{ V}$, $V_{CE} = 600\text{ V}$	Q_G		0.94		μC
内部栅极电阻 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$	R_{Gint}		2.0		Ω
输入电容 Input capacitance	$f = 1\text{ MHz}$, $T_{vj} = 25^{\circ}\text{C}$, $V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$	C_{ies}		38		nF
输出电容 Output capacitance	$f = 1\text{ MHz}$, $T_{vj} = 25^{\circ}\text{C}$, $V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$	C_{oes}		TBD		nF
反向传输电容 Reverse transfer capacitance	$f = 1\text{ MHz}$, $T_{vj} = 25^{\circ}\text{C}$, $V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$	C_{res}		1.4		nF
集电极—发射极截止电流 Collector-emitter cut-off current	$V_{CE} = 1200\text{ V}$, $V_{GE} = 0\text{ V}$, $T_{vj} = 25^{\circ}\text{C}$	I_{CES}			500	μA
栅极—发射极漏电流 Gate-emitter leakage current	$V_{CE} = 0\text{ V}$, $V_{GE} = 20\text{ V}$, $T_{vj} = 25^{\circ}\text{C}$	I_{GES}			1500	nA
开通延迟时间（感性负载） Turn-on delay time (inductive load)	$V_{CE} = 600\text{ V}$ $I_C = 450\text{ A}$ $V_{GE} = \pm 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$	t_{don}	116		ns
		$T_{vj} = 125^{\circ}\text{C}$		128		
		$T_{vj} = 150^{\circ}\text{C}$		133		
上升时间（感性负载） Rise time (inductive load)	$R_{Gon} = 0.5\Omega$ $R_{Goff} = 0.5\Omega$ $L_S = 30\text{ nH}$	$T_{vj} = 25^{\circ}\text{C}$	t_r	45		ns
		$T_{vj} = 125^{\circ}\text{C}$		51		
		$T_{vj} = 150^{\circ}\text{C}$		54		

HCG450FH120D3RB 1200V/450A IGBT Module

表 5 （续）特征值/ Characteristic values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
关断延迟时间（感性负载） Turn-off delay time (inductive load)		$T_{vj} = 25^{\circ}\text{C}$	t_{doff}		255		ns
		$T_{vj} = 125^{\circ}\text{C}$			298		
		$T_{vj} = 150^{\circ}\text{C}$			312		
下降时间（感性负载） Fall time (inductive load)	$V_{CE} = 600\text{V}$ $I_C = 450\text{A}$ $V_{GE} = \pm 15\text{V}$	$T_{vj} = 25^{\circ}\text{C}$	t_f		87		ns
		$T_{vj} = 125^{\circ}\text{C}$			142		
		$T_{vj} = 150^{\circ}\text{C}$			154		
开通损耗能量（每脉冲） Turn-on energy loss per pulse	$R_{Gon} = 0.5\Omega$ $R_{Goff} = 0.5\Omega$ $L_S = 30\text{nH}$	$T_{vj} = 25^{\circ}\text{C}$	E_{on}		17.5		mJ
		$T_{vj} = 125^{\circ}\text{C}$			29.5		
		$T_{vj} = 150^{\circ}\text{C}$			34.2		
关断损耗能量（每脉冲） Turn-off energy loss per pulse		$T_{vj} = 25^{\circ}\text{C}$	E_{off}		26.1		mJ
		$T_{vj} = 125^{\circ}\text{C}$			36.1		
		$T_{vj} = 150^{\circ}\text{C}$			38.8		
短路数据 SC data	$V_{CC} = 600\text{V}, V_{GE} = 15\text{V}$ $T_{vj} = 25^{\circ}\text{C}, t_p \leq 10\mu\text{s}$ $T_{vj} = 150^{\circ}\text{C}, t_p \leq 8\mu\text{s}$	$T_{vj} = 25^{\circ}\text{C}$	I_{SC}		2485		A
		$T_{vj} = 150^{\circ}\text{C}$			2150		
结—散热器热阻 Thermal resistance, junction to heatsink	每个IGBT, $\lambda_{grease} = 3.4\text{W}/(\text{m}^{\circ}\text{K})$ Per IGBT, $\lambda_{grease} = 3.4\text{W}/(\text{m}^{\circ}\text{K})$		R_{thJH}		0.115		K/W
最高结温 $T_{vj\max}$			$T_{vj\max}$	175			$^{\circ}\text{C}$

HCG450FH120D3RB 1200V/450A IGBT Module

二极管/ Diode

表 6 最大标定值/Maximum rated values

Parameter	Conditions	Symbol	Value	Unit
反向重复峰值电压 Repetitive peak reverse voltage	$T_{vj} = 25^{\circ}\text{C}$	V_{RRM}	1200	V
连续正向直流电流 Continuous DC forward current		I_F	450	A
正向重复峰值电流 Repetitive peak forward current	$t_p = 1 \text{ ms}$	I_{FRM}	900	A

表 7 特征值/Characteristic values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
正向电压 Forward voltage	$I_F=450\text{ A}, V_{GE}=0\text{ V}, T_{vj}=25^{\circ}\text{C}$		V_F		1.83		V
	$I_F=450\text{ A}, V_{GE}=0\text{ V}, T_{vj}=125^{\circ}\text{C}$				1.99		
	$I_F=450\text{ A}, V_{GE}=0\text{ V}, T_{vj}=150^{\circ}\text{C}$				1.99		
反向恢复峰值电流 Peak reverse recovery current	$V_R=600\text{ V}$	$T_{vj}=25^{\circ}\text{C}$	I_{RM}		428		A
		$T_{vj}=125^{\circ}\text{C}$			454		
		$T_{vj}=150^{\circ}\text{C}$			464		
反向恢复电荷 Recovered charge	$I_F=450\text{ A}$	$T_{vj}=25^{\circ}\text{C}$	Q_r		44		μC
	$V_{GE}=-15\text{ V}$	$T_{vj}=125^{\circ}\text{C}$			70		
	$R_{Gon}=0.5\Omega$	$T_{vj}=150^{\circ}\text{C}$			80		
反向恢复损耗（每脉冲） Reverse recovery energy	$L_s=30\text{ nH}$	$T_{vj}=25^{\circ}\text{C}$	E_{rec}		21.4		mJ
		$T_{vj}=125^{\circ}\text{C}$			32.7		
		$T_{vj}=150^{\circ}\text{C}$			36.7		
结—散热器热阻 Thermal resistance, junction to heatsink	每个二极管, $\lambda_{grease}=3.4\text{ W}/(\text{m}^2\text{K})$ Per diode, $\lambda_{grease}=3.4\text{ W}/(\text{m}^2\text{K})$		R_{thJH}		0.155		K/W
最高结温 $T_{vj\text{ max}}$			$T_{vj\text{ max}}$	175			$^{\circ}\text{C}$

HCG450FH120D3RB
1200V/450A IGBT Module

负温度系数热敏电阻/NTC-Thermistor

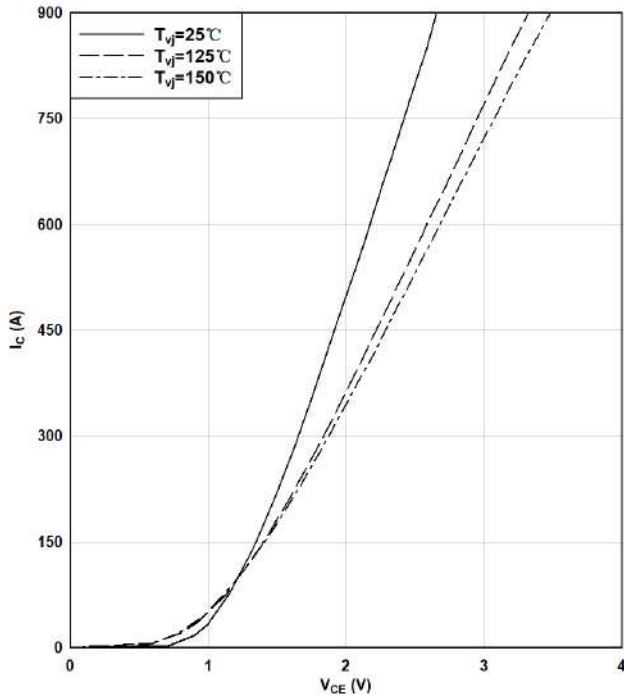
表 8 特征值/Characteristic values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
额定电阻值 Rated resistance	$T_{NTC} = 25\text{ }^{\circ}\text{C}$	R_{25}		5		kΩ
R ₁₀₀ 偏差 Deviation of R ₁₀₀	$T_{NTC} = 100\text{ }^{\circ}\text{C}, R_{100} = 493\text{ }\Omega$	$\Delta R/R$	-5		5	%
耗散功率 Power dissipation	$T_{NTC} = 25\text{ }^{\circ}\text{C}$	P_{25}			20	mW
B-值 B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15\text{ K}))]$	$B_{25/50}$		3375		K
B-值 B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15\text{ K}))]$	$B_{25/80}$		3411		K
B-值 B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15\text{ K}))]$	$B_{25/100}$		3433		K

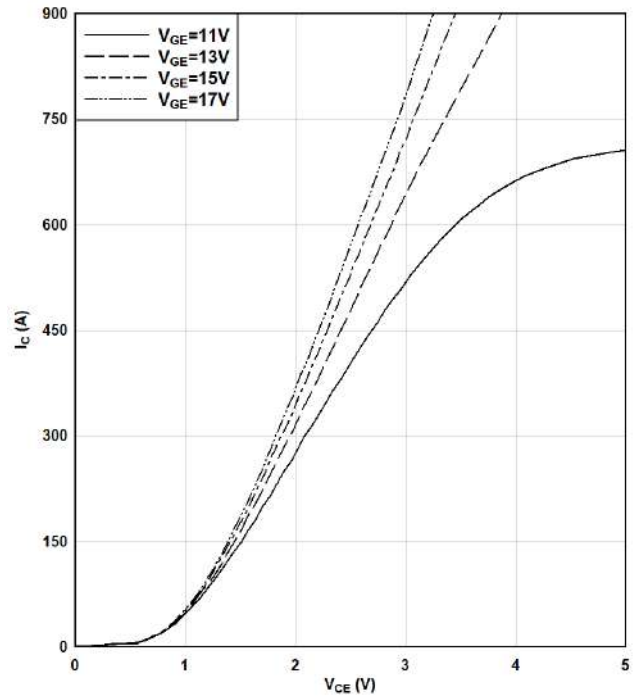
HCG450FH120D3RB 1200V/450A IGBT Module

特征参数图表/Characteristics Diagrams

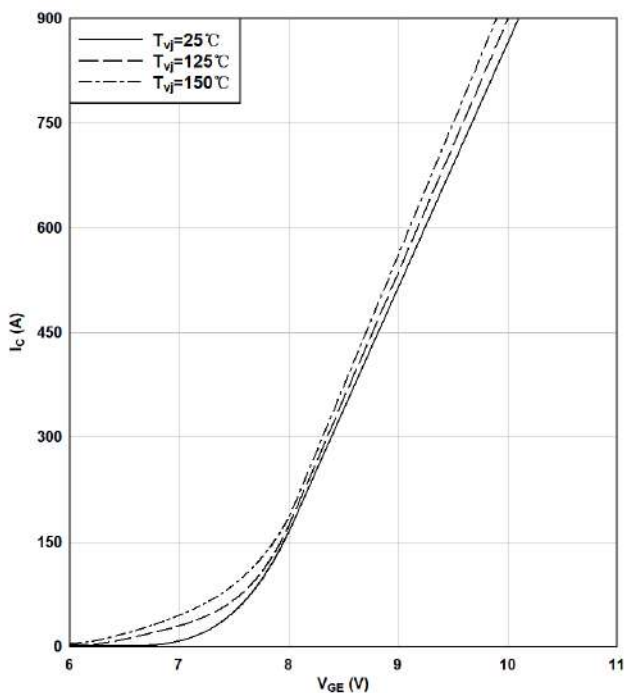
输出特性（典型），IGBT，逆变器
Output characteristic (typical), IGBT, Inverter
 $I_C = f(V_{CE})$
 $V_{GE} = 15V$



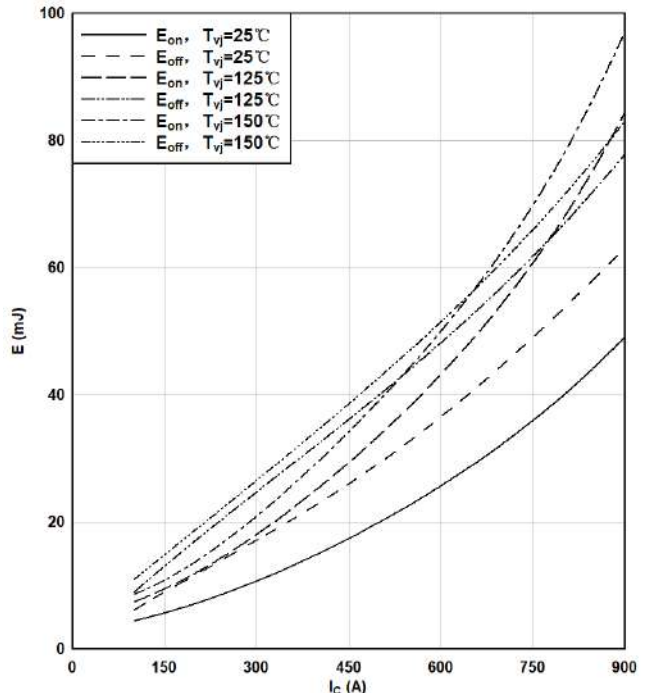
输出特性（典型），IGBT，逆变器
Output characteristic (typical), IGBT, Inverter
 $I_C = f(V_{CE})$
 $T_{vj} = 150^\circ C$



传输特性（典型），IGBT，逆变器
Transfer characteristic (typical), IGBT, Inverter
 $I_C = f(V_{GE})$
 $V_{CE} = 20V$



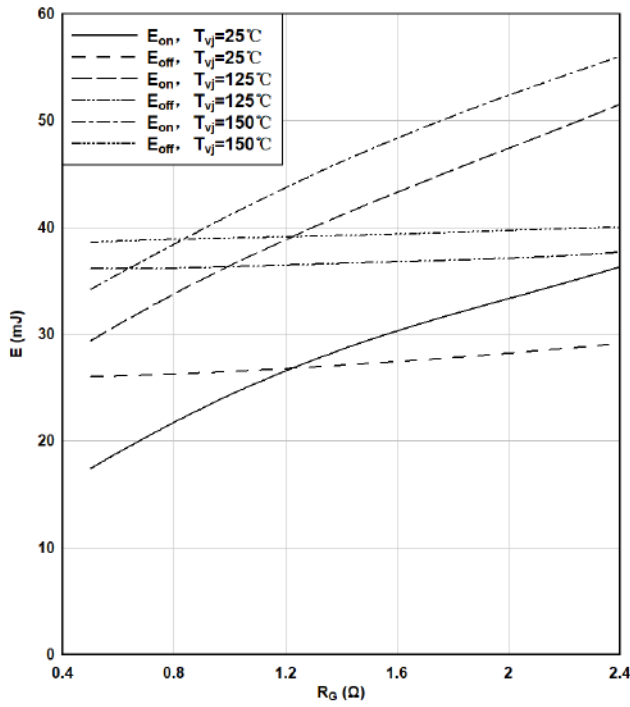
开关损耗（典型），IGBT，逆变器
Switching losses (typical), IGBT, Inverter
 $E = f(I_C)$
 $V_{CE} = 600V$, $R_{Gon} = 0.5\Omega$, $R_{Goff} = 0.5\Omega$, $V_{GE} = \pm 15V$



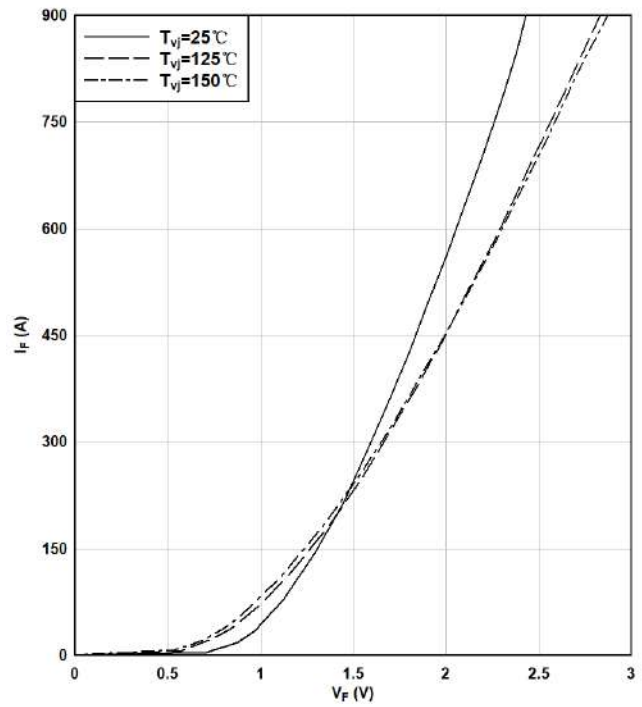
HCG450FH120D3RB 1200V/450A IGBT Module

(续) 特征参数图表/Characteristics Diagrams

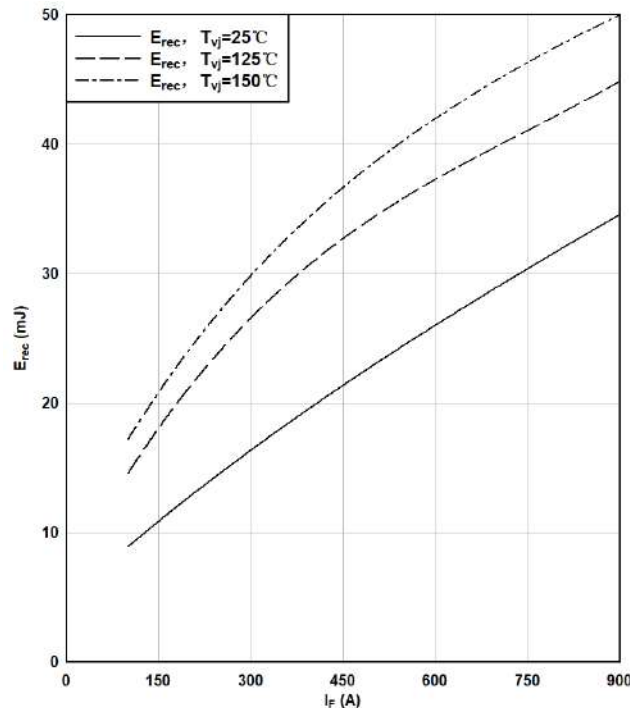
开关损耗 (典型), IGBT, 逆变器
Switching losses (typical), IGBT, Inverter
 $E = f(R_G)$
 $I_C = 600A$, $V_{CE} = 600V$, $V_{GE} = \pm 15V$



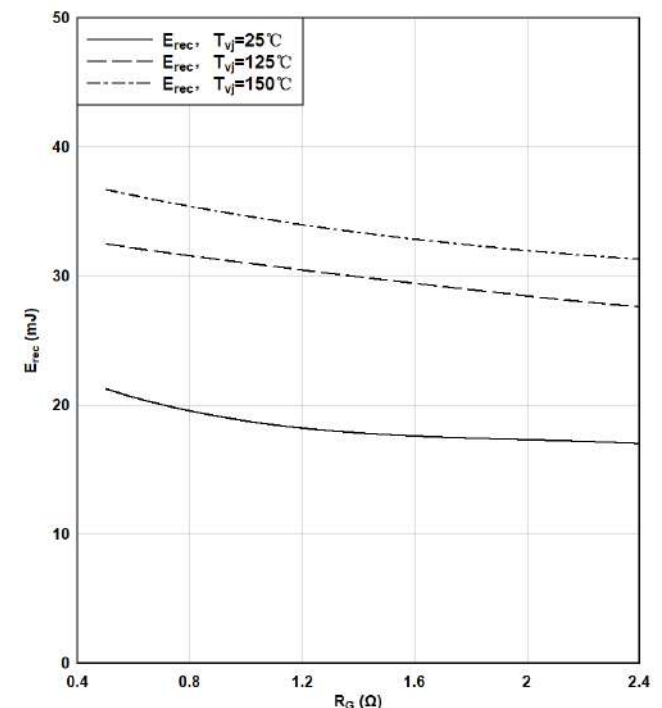
正向特性 (典型), 二极管
Forward characteristic (typical), Diode
 $I_F = f(V_F)$



开关损耗 (典型), 二极管
Switching losses (typical), Diode
 $E_{rec} = f(I_F)$
 $V_{CE} = 600V$, $R_{Gon} = 0.5\Omega$



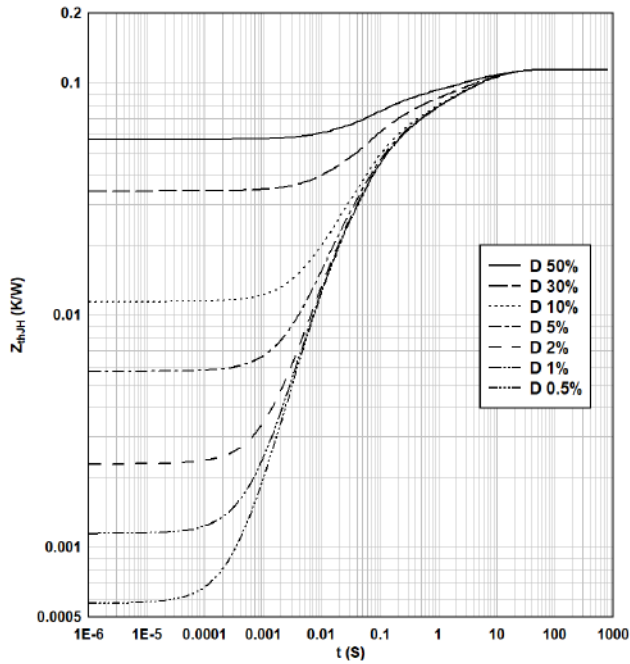
开关损耗 (典型), 二极管
Switching losses (typical), Diode
 $E_{rec} = f(R_G)$
 $I_F = 600A$, $V_{CE} = 600V$



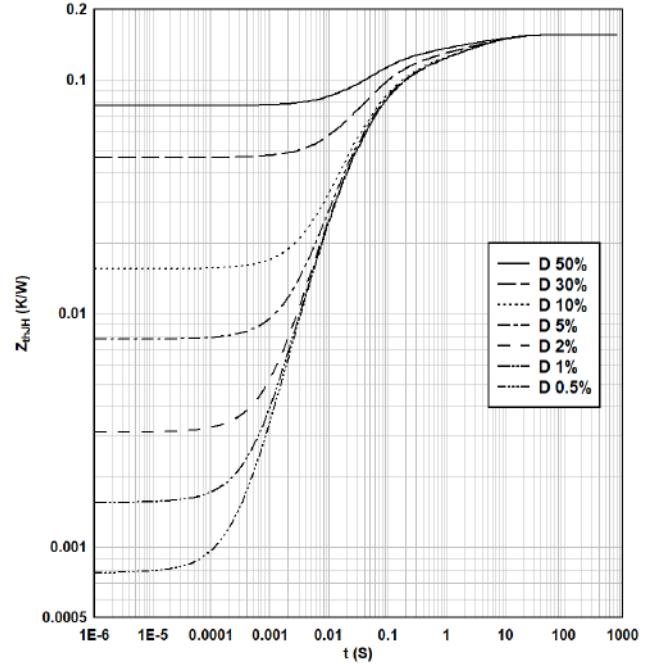
HCG450FH120D3RB 1200V/450A IGBT Module

(续) 特征参数图表/Characteristics Diagrams

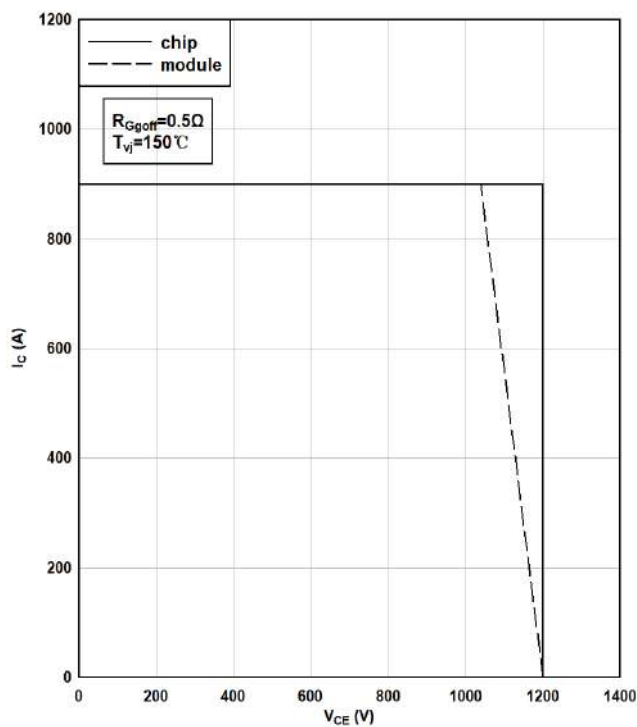
瞬态热阻抗, IGBT
Transient thermal impedance, IGBT
 $Z_{thJH} = f(t)$



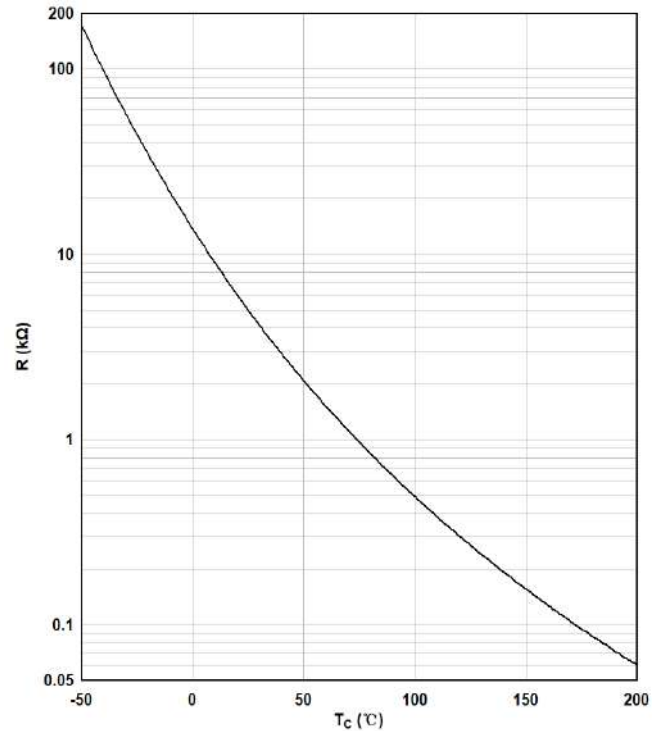
瞬态热阻抗, FRD
Transient thermal impedance, FRD
 $Z_{thJH} = f(t)$



反偏安全工作区 IGBT, 逆变器
Reverse bias safe operating area IGBT, Inverter
 $I_C = f(V_{CE})$

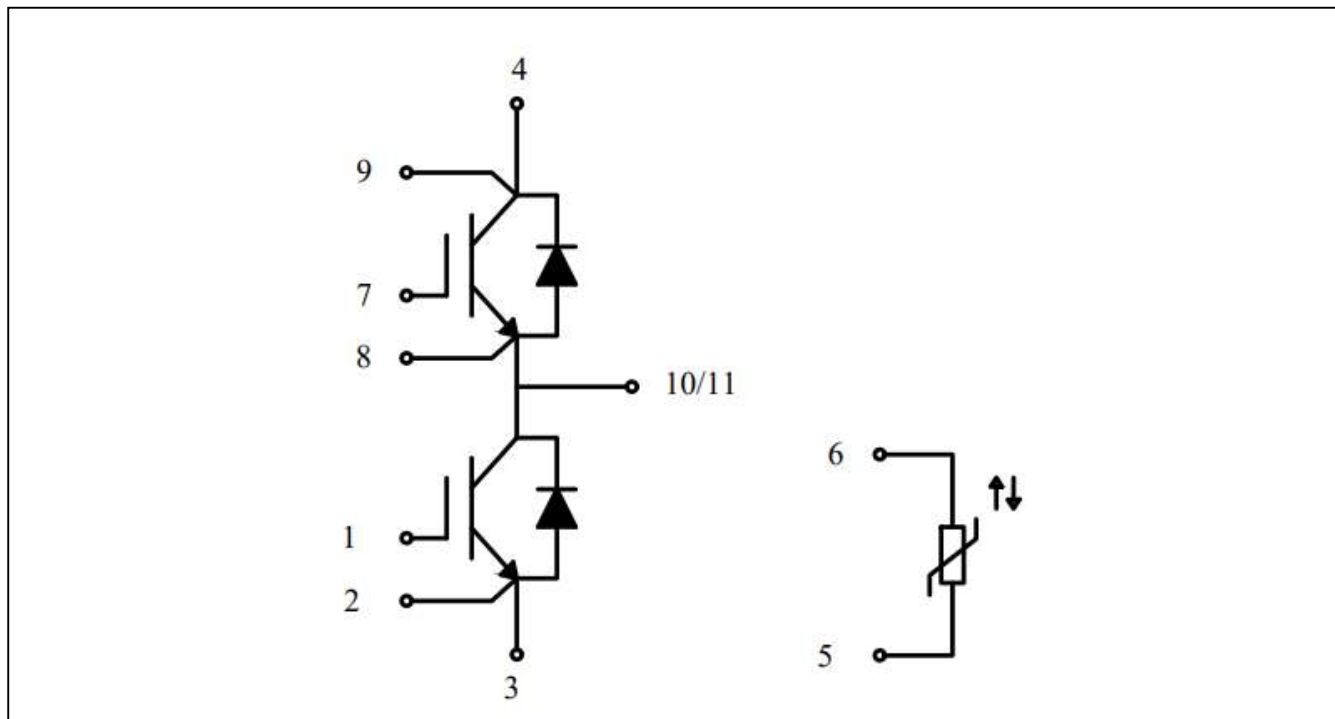


负温度系数热敏电阻温度特性
NTC-Thermistor-temperature characteristic(typical)
 $R = f(T_C)$



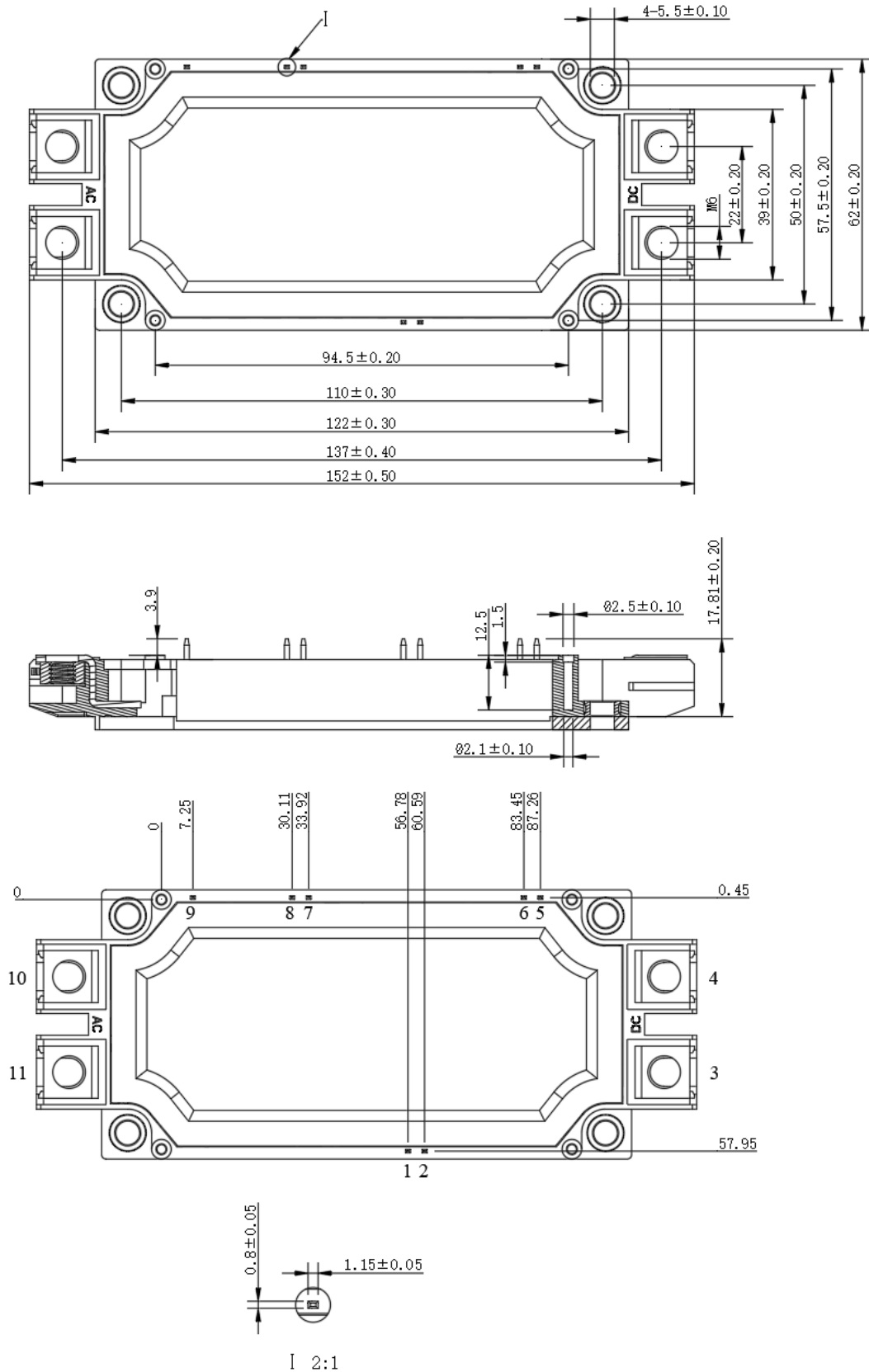
HCG450FH120D3RB 1200V/450A IGBT Module

电路拓扑图 / Circuit Diagram



HCG450FH120D3RB 1200V/450A IGBT Module

封装尺寸 / Package Outlines



HCG450FH120D3RB 1200V/450A IGBT Module

模块标签信息/ Module Marking Information

HCG450FH120D3RB = Specific Device Code
E1CQ23050010001 = Case Code
ACE = Package Type

声明与使用条件:

1. HIITIO 保留手册的更改权;

HIITIO reserves the right to change the manual;

2. 本手册中提供的数据一部分为产品的典型值, 实际出厂测试的数据与典型值略有差异, 但我司保证这些差异不会影响产品的正常使用, 如果产品信息发生变更, 我司会及时更新手册, 请随时关注;
Part of the data provided in this manual is the typical value of the product, the actual factory test data and the typical value are slightly different, but our company guarantees that these differences will not affect the normal use of the product, if the product information changes, our company will update the manual in time, please pay attention at any time;

3. 在应用我司产品时请不要超过产品的最大额定值, 否则我司无法保证产品应用的可靠性;

When applying our products, please do not exceed the maximum rating of the product, otherwise our company can not guarantee the reliability of the product application;

4. 产品在使用时, 严禁触碰, 断电后确认无残余电荷且产品已完全冷却后, 才可以在有静电防护措施下触碰产品;

When the product is in use, it is strictly forbidden to touch the product. After power off, it is confirmed that there is no residual charge and the product has been completely cooled, and it can only be touched under electrostatic protection measures;

5. 购买产品时请认准我司商标, 如有疑问请与本司联系。

Please look for our trademark when purchasing products. If you have any questions, please contact us.