

PrimePACK™3+ 模块 采用第五代沟槽栅/场终止IGBT5和第五代发射极控制二极管 带有温度检测NTC
 PrimePACK™3+ module with Trench/Fieldstop IGBT5, Emitter Controlled 5 diode and NTC



潜在应用

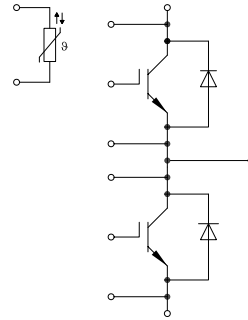
- 大功率变流器
- 牵引变流器
- 电机传动
- 风力发电机

电气特性

- $T_{vj\,op} = 175^{\circ}\text{C}$
- 低 V_{CEsat}
- 低开关损耗
- 提高工作结温 $T_{vj\,op}$
- 高电流密度

机械特性

- 封装的 CTI > 400
- 高功率密度
- 高功率循环和温度循环能力
- 高爬电距离和电气间隙



$$V_{CES} = 1700\text{V}$$

$$I_{C\,nom} = 1500\text{A} / I_{CRM} = 3000\text{A}$$

Potential Applications

- High power converters
- Traction drives
- Motor drives
- Wind turbines

Electrical Features

- $T_{vj\,op} = 175^{\circ}\text{C}$
- Low V_{CEsat}
- Low switching losses
- Extended operating temperature $T_{vj\,op}$
- High current density

Mechanical Features

- Package with CTI > 400
- High power density
- High power and thermal cycling capability
- High creepage and clearance distances

Module Label Code

Barcode Code 128



DMX - Code



Content of the Code

Content of the Code	Digit
Module Serial Number	1 - 5
Module Material Number	6 - 11
Production Order Number	12 - 19
Datecode (Production Year)	20 - 21
Datecode (Production Week)	22 - 23

IGBT, 逆变器 / IGBT, Inverter

最大额定值 / Maximum Rated Values

集电极 - 发射极电压 Collector-emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	V_{CES}	1700	V
连续集电极直流电流 Continuous DC collector current	$T_C = 90^{\circ}\text{C}, T_{vj\text{ max}} = 175^{\circ}\text{C}$	$I_{C\text{ nom}}$	1500	A
集电极重复峰值电流 Repetitive peak collector current	$t_P = 1\text{ ms}$	I_{CRM}	3000	A
栅极 - 发射极峰值电压 Gate-emitter peak voltage		V_{GES}	+/-20	V

特征值 / Characteristic Values

			min.	typ.	max.	
集电极 - 发射极饱和电压 Collector-emitter saturation voltage	$I_C = 1500\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 1500\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 1500\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$V_{CE\text{ sat}}$	1,75 2,10 2,30	2,20 2,65 2,90	V V V
栅极阈值电压 Gate threshold voltage	$I_C = 54,0\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		V_{GEth}	5,35	5,80	6,25 V
栅极电荷 Gate charge	$V_{GE} = -15\text{ V} \dots +15\text{ V}, V_{CE} = 900\text{ V}$		Q_G	7,50		μC
内部栅极电阻 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		R_{Gint}	1,0		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}	88,0		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}	2,70		nF
集电极-发射极截止电流 Collector-emitter cut-off current	$V_{CE} = 1700\text{ V}, V_{GE} = 0\text{ V}, T_{vj} = 25^{\circ}\text{C}$		I_{CES}		5,0	mA
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}		400	nA
开通延迟时间(电感负载) Turn-on delay time, inductive load	$I_C = 1500\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 0,51\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	t_{don}	0,30 0,31 0,32		μs μs μs
上升时间(电感负载) Rise time, inductive load	$I_C = 1500\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 0,51\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	t_r	0,15 0,16 0,16		μs μs μs
关断延迟时间(电感负载) Turn-off delay time, inductive load	$I_C = 1500\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 0,82\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$t_{d\text{ off}}$	0,66 0,74 0,80		μs μs μs
下降时间(电感负载) Fall time, inductive load	$I_C = 1500\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 0,82\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	t_f	0,11 0,16 0,17		μs μs μs
开通损耗能量(每脉冲) Turn-on energy loss per pulse	$I_C = 1500\text{ A}, V_{CE} = 900\text{ V}, L_S = 30\text{ nH}$ $V_{GE} = \pm 15\text{ V}, di/dt = 8550\text{ A}/\mu\text{s} (T_{vj} = 175^{\circ}\text{C})$ $R_{Gon} = 0,51\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	E_{on}	335 500 595		mJ mJ mJ
关断损耗能量(每脉冲) Turn-off energy loss per pulse	$I_C = 1500\text{ A}, V_{CE} = 900\text{ V}, L_S = 30\text{ nH}$ $V_{GE} = \pm 15\text{ V}, du/dt = 2750\text{ V}/\mu\text{s} (T_{vj} = 175^{\circ}\text{C})$ $R_{Goff} = 0,82\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	E_{off}	330 465 545		mJ mJ mJ
短路数据 SC data	$V_{GE} \leq 15\text{ V}, V_{CC} = 1000\text{ V}$ $V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$	$t_P \leq 10\ \mu\text{s}, T_{vj} = 175^{\circ}\text{C}$	I_{SC}	6000		A
结 - 外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT		R_{thJC}		19,0	K/kW
外壳 - 散热器热阻 Thermal resistance, case to heatsink	每个 IGBT / per IGBT $\lambda_{\text{Paste}} = 1\text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{\text{grease}} = 1\text{ W}/(\text{m}\cdot\text{K})$		R_{thCH}	15,5		K/kW
在开关状态下温度 Temperature under switching conditions			$T_{vj\text{ op}}$	-40	175	$^{\circ}\text{C}$

二极管, 逆变器 / Diode, Inverter

最大额定值 / Maximum Rated Values

反向重复峰值电压 Repetitive peak reverse voltage	$T_{vj} = 25^{\circ}\text{C}$	V_{RRM}	1700	V
连续正向直流电流 Continuous DC forward current		I_F	1500	A
正向重复峰值电流 Repetitive peak forward current	$t_P = 1\text{ ms}$	I_{FRM}	3000	A
I^2t -值 I^2t - value	$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 175^{\circ}\text{C}$	I^2t	580 485	kA^2s kA^2s
最大损耗功率 Maximum power dissipation	$T_{vj} = 175^{\circ}\text{C}$	P_{RQM}	1500	kW

特征值 / Characteristic Values

			min.	typ.	max.	
正向电压 Forward voltage	$I_F = 1500\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 1500\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 1500\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	V_F		1,75 1,70 1,70	2,10 2,05 2,05 V
反向恢复峰值电流 Peak reverse recovery current	$I_F = 1500\text{ A}, -di_F/dt = 8550\text{ A}/\mu\text{s} (T_{vj}=175^{\circ}\text{C})$ $V_R = 900\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	I_{RM}		1250 1450 1550	A A A
恢复电荷 Recovered charge	$I_F = 1500\text{ A}, -di_F/dt = 8550\text{ A}/\mu\text{s} (T_{vj}=175^{\circ}\text{C})$ $V_R = 900\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	Q_r		325 550 700	μC μC μC
反向恢复损耗 (每脉冲) Reverse recovery energy	$I_F = 1500\text{ A}, -di_F/dt = 8550\text{ A}/\mu\text{s} (T_{vj}=175^{\circ}\text{C})$ $V_R = 900\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	E_{rec}		185 325 425	mJ mJ mJ
结 - 外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode		R_{thJC}			35,0 K/kW
外壳 - 散热器热阻 Thermal resistance, case to heatsink	每个二极管 / per diode $\lambda_{\text{Paste}} = 1\text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{\text{grease}} = 1\text{ W}/(\text{m}\cdot\text{K})$		R_{thCH}		18,5	K/kW
在开关状态下温度 Temperature under switching conditions			$T_{vj\text{ op}}$	-40		175 $^{\circ}\text{C}$

负温度系数热敏电阻 / NTC-Thermistor

特征值 / Characteristic Values

			min.	typ.	max.	
额定电阻值 Rated resistance	$T_{NTC} = 25^{\circ}\text{C}$	R_{25}		5,00		k Ω
R100 偏差 Deviation of R100	$T_{NTC} = 100^{\circ}\text{C}, R_{100} = 493\text{ }\Omega$	$\Delta R/R$	-5		5	%
耗散功率 Power dissipation	$T_{NTC} = 25^{\circ}\text{C}$	P_{25}			20,0	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

根据应用手册标定

Specification according to the valid application note.

模块 / Module

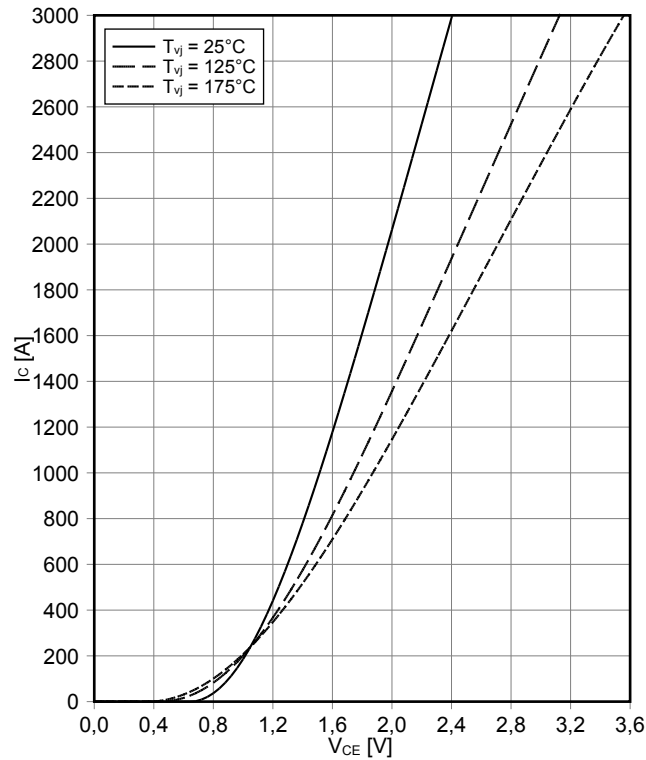
绝缘测试电压 Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V _{ISOL}	4,0		kV
模块基板材料 Material of module baseplate			Cu		
爬电距离 Creepage distance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal		33,0 33,0		mm
电气间隙 Clearance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal		19,0 19,0		mm
相对电痕指数 Comperative tracking index		CTI	> 400		
			min.	typ.	max.
杂散电感, 模块 Stray inductance module		L _{sCE}		10	nH
模块引线电阻, 端子-芯片 Module lead resistance, terminals - chip	T _c = 25°C, 每个开关 / per switch	R _{CC'+EE'} R _{AA'+CC'}		0,10 0,09	mΩ
储存温度 Storage temperature		T _{stg}	-40		150 °C
模块安装的安装扭矩 Mounting torque for modul mounting	螺丝 M5 根据相应的应用手册进行安装 Screw M5 - Mounting according to valid application note	M	3,00		6,00 Nm
端子联接扭矩 Terminal connection torque	螺丝 M4 根据相应的应用手册进行安装 Screw M4 - Mounting according to valid application note	M	1,8	-	2,1 Nm
	螺丝 M8 根据相应的应用手册进行安装 Screw M8 - Mounting according to valid application note		8,0	-	10 Nm
重量 Weight		G		1400	g

Höchstzulässige Bodenplattenbetriebstemperatur T_{BPmax} = 150°C
 Maximum baseplate operation temperature T_{BPmax} = 150°C

输出特性 IGBT, 逆变器 (典型)

output characteristic IGBT, Inverter (typical)

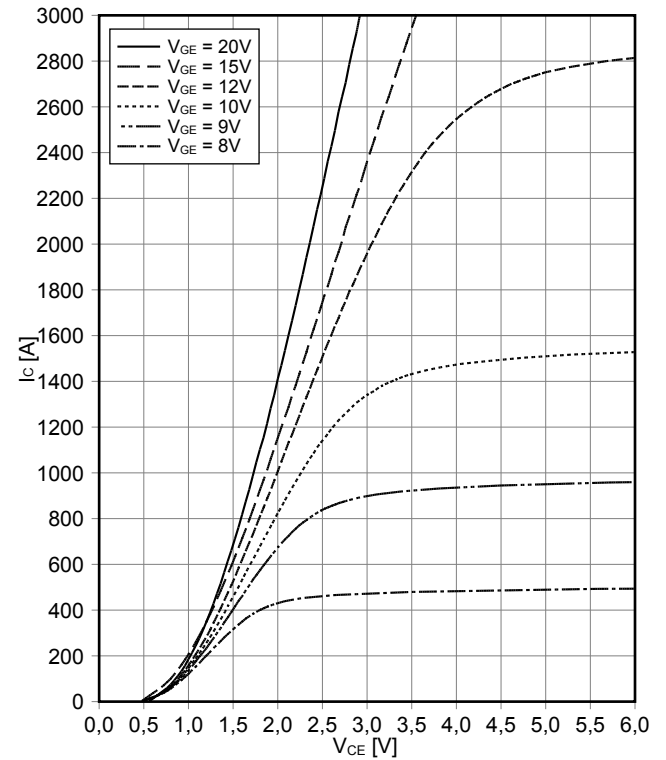
$I_C = f(V_{CE})$
 $V_{GE} = 15 \text{ V}$



输出特性 IGBT, 逆变器 (典型)

output characteristic IGBT, Inverter (typical)

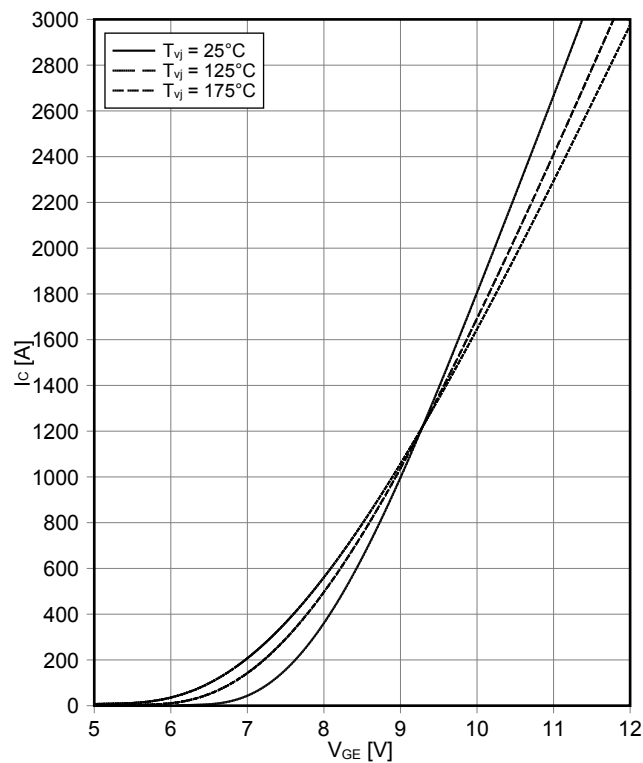
$I_C = f(V_{CE})$
 $T_{vj} = 175^\circ\text{C}$



传输特性 IGBT, 逆变器 (典型)

transfer characteristic IGBT, Inverter (typical)

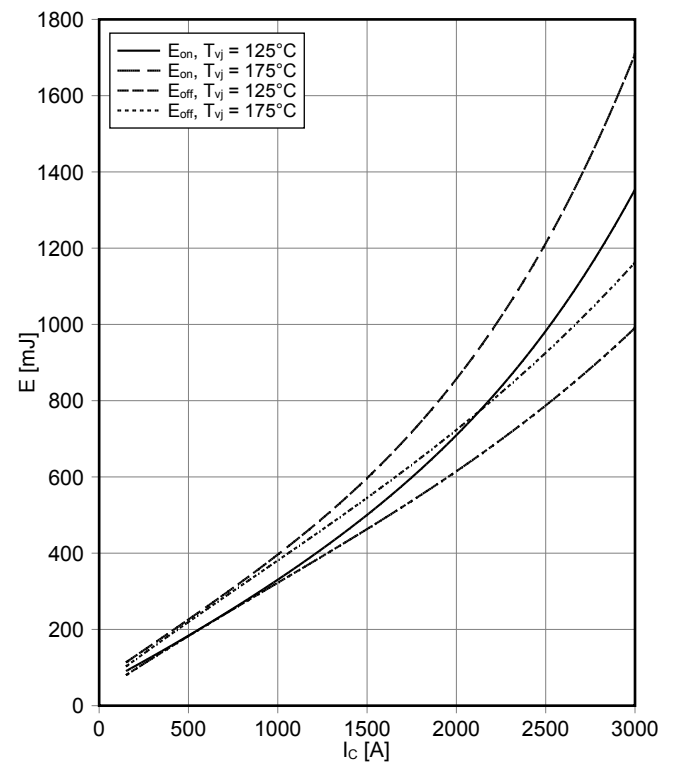
$I_C = f(V_{GE})$
 $V_{CE} = 20 \text{ V}$



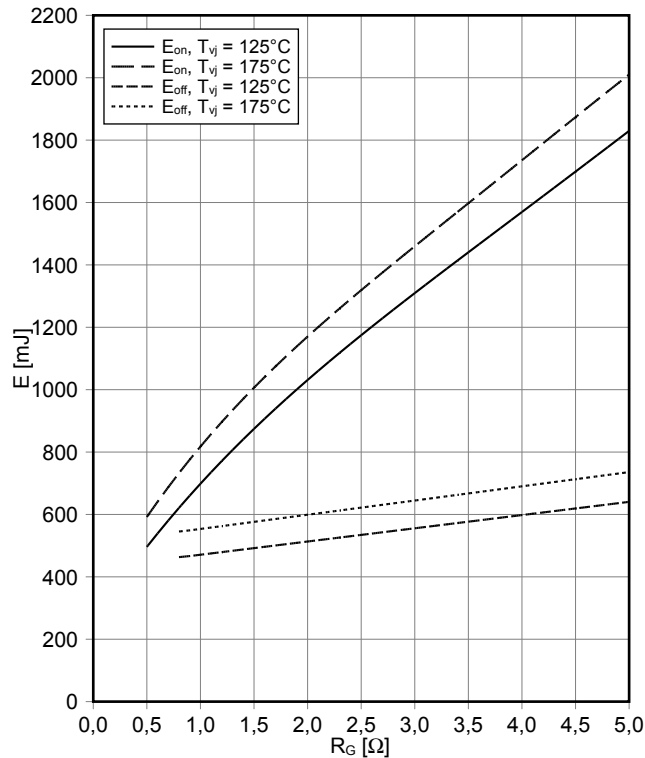
开关损耗 IGBT, 逆变器 (典型)

switching losses IGBT, Inverter (typical)

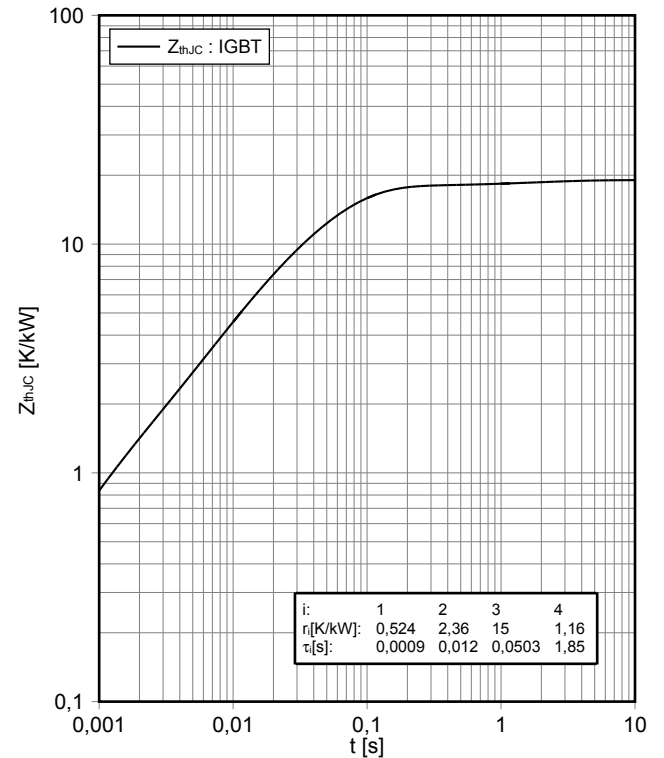
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
 $V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 0.51 \Omega$, $R_{Goff} = 0.82 \Omega$, $V_{CE} = 900 \text{ V}$



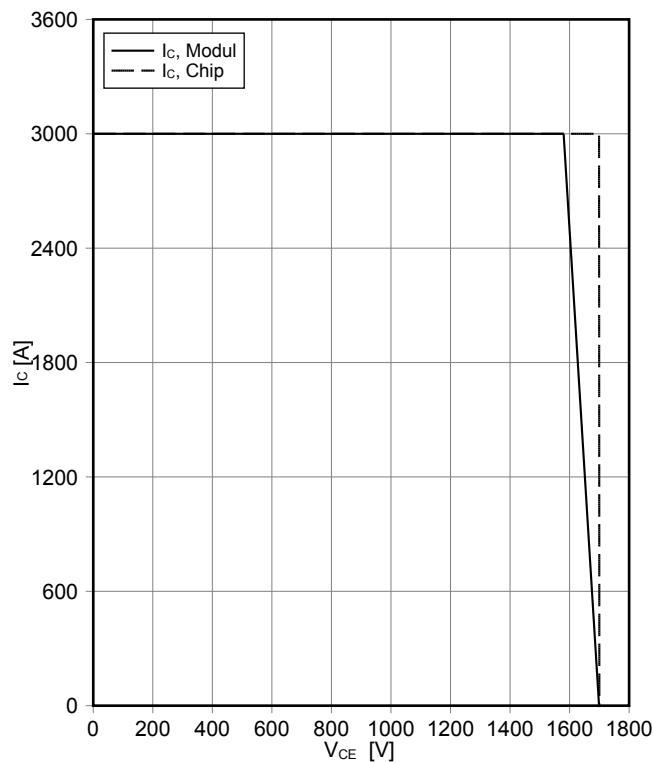
开关损耗 IGBT, 逆变器 (典型)
switching losses IGBT, Inverter (typical)
 $E_{on} = f(R_G)$, $E_{off} = f(R_G)$
 $V_{GE} = \pm 15 \text{ V}$, $I_C = 1500 \text{ A}$, $V_{CE} = 900 \text{ V}$



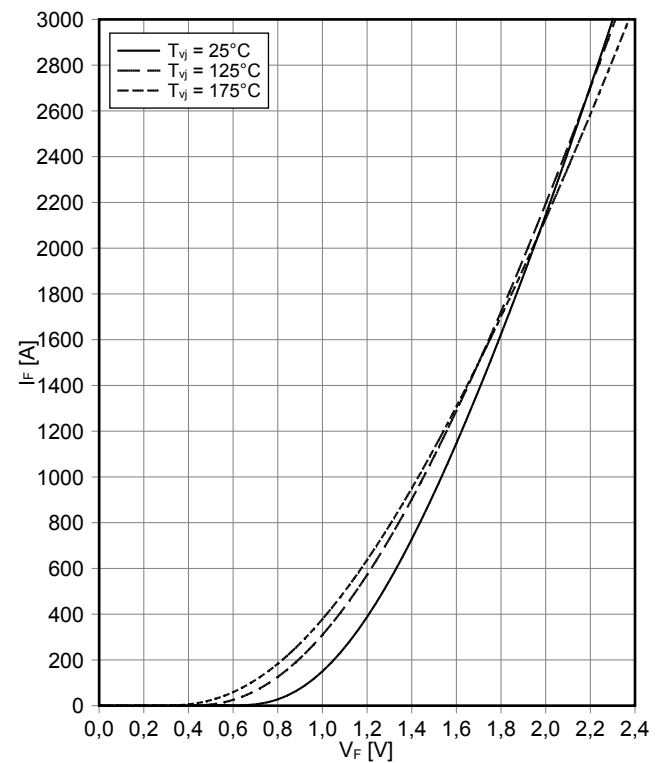
瞬态热阻抗 IGBT, 逆变器
transient thermal impedance IGBT, Inverter
 $Z_{thJC} = f(t)$



反偏安全工作区 IGBT, 逆变器 (RBSOA)
reverse bias safe operating area IGBT, Inverter (RBSOA)
 $I_C = f(V_{CE})$
 $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 0.82 \Omega$, $T_{vj} = 175^\circ\text{C}$

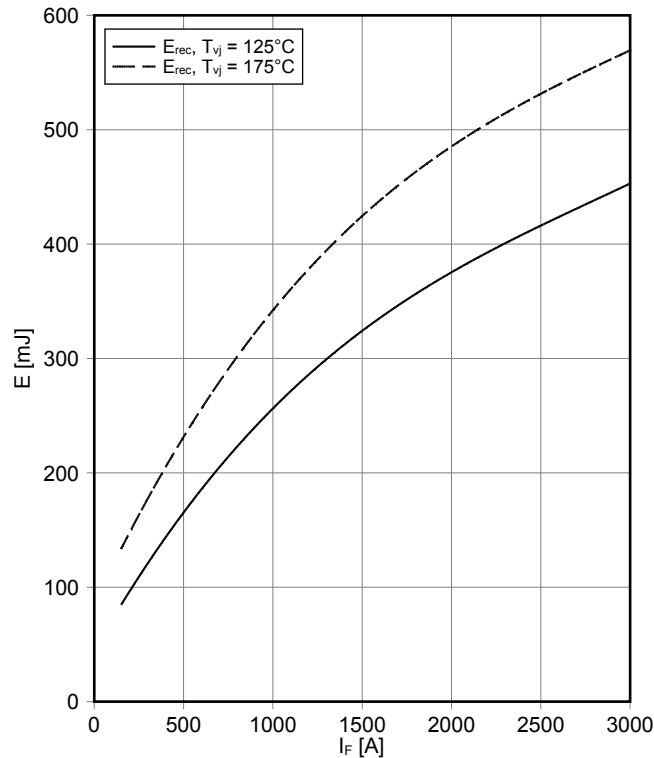


正向偏压特性 二极管, 逆变器 (典型)
forward characteristic of Diode, Inverter (typical)
 $I_F = f(V_F)$



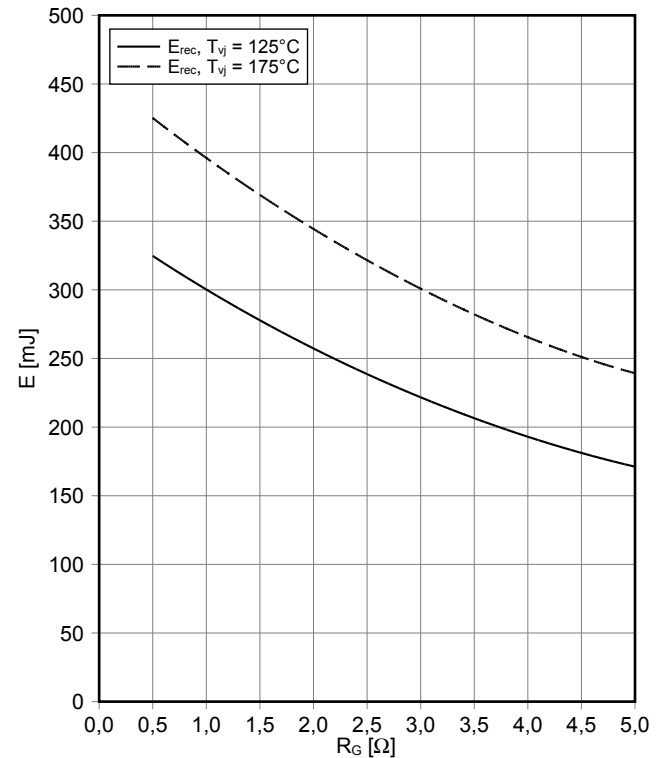
开关损耗 二极管,逆变器 (典型)

switching losses Diode, Inverter (typical)

 $E_{rec} = f(I_F)$ $R_{Gon} = 0.51 \Omega, V_{CE} = 900 V$ 

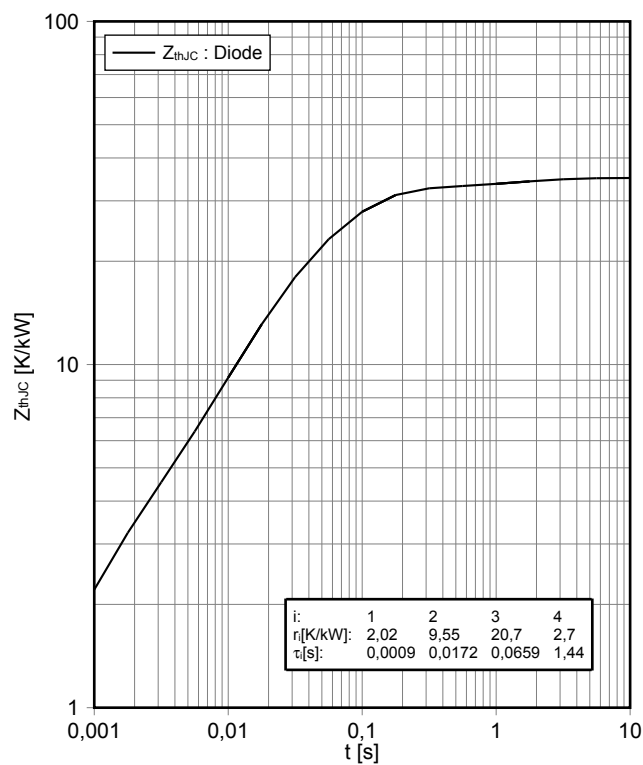
开关损耗 二极管,逆变器 (典型)

switching losses Diode, Inverter (typical)

 $E_{rec} = f(R_G)$ $I_F = 1500 A, V_{CE} = 900 V$ 

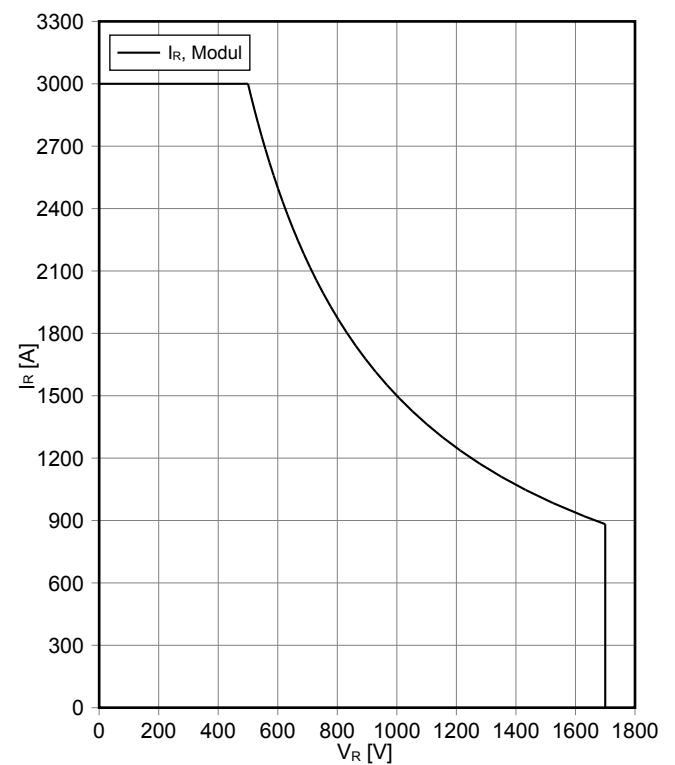
瞬态热阻抗 二极管,逆变器

transient thermal impedance Diode, Inverter

 $Z_{thJC} = f(t)$ 

安全工作区 二极管,逆变器 (SOA)

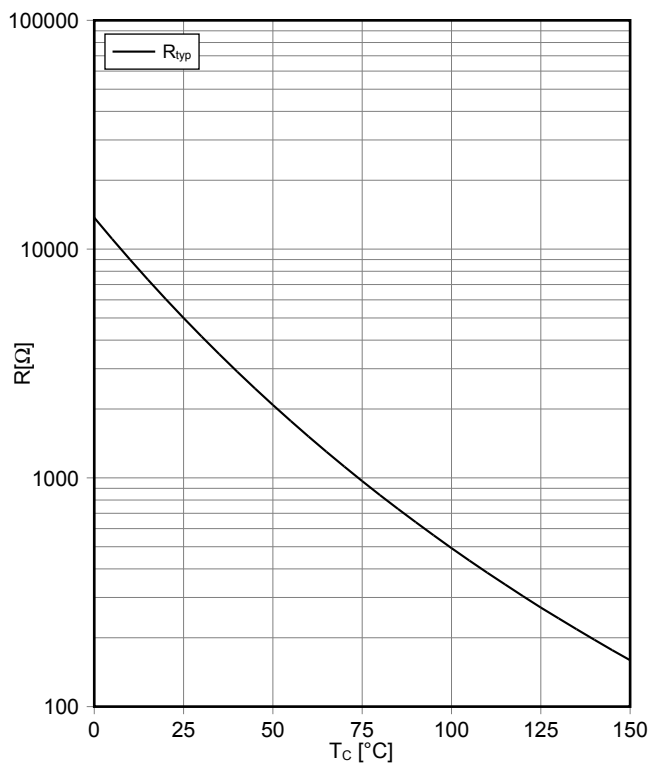
safe operation area Diode, Inverter (SOA)

 $I_R = f(V_R)$ $T_{vj} = 175^\circ C$ 

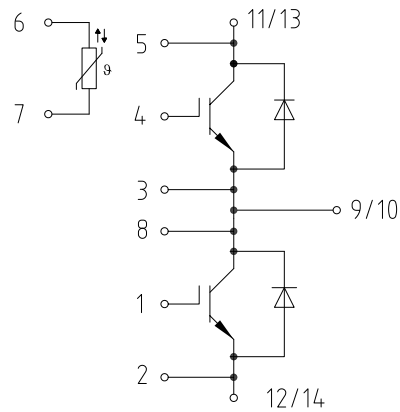
负温度系数热敏电阻 温度特性

NTC-Thermistor-temperature characteristic (typical)

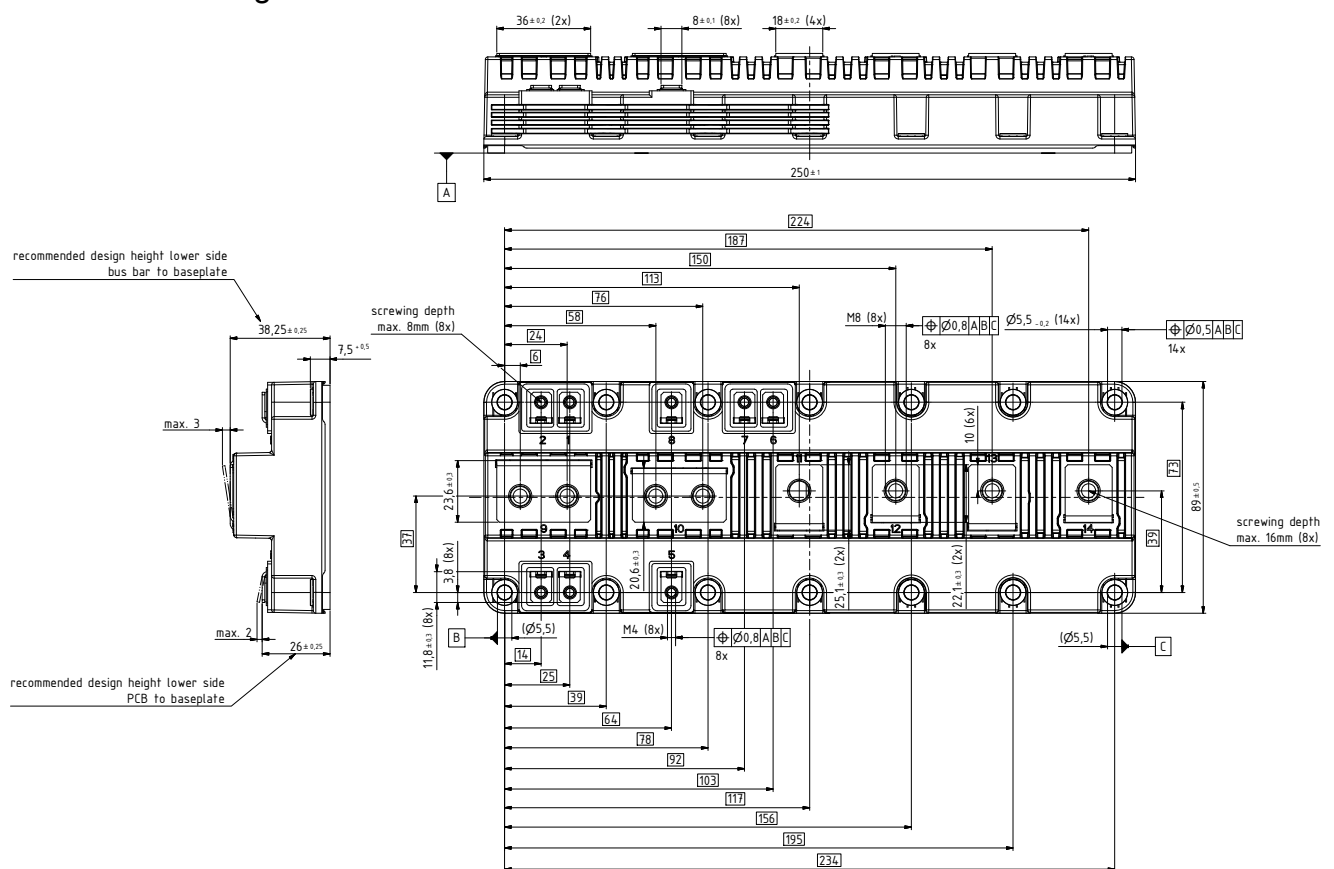
$R = f(T)$



接线图 / Circuit diagram



封装尺寸 / Package outlines



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