

Preliminary

EasyPIM™ 模块采用第七代沟槽栅/场终止 IGBT7 和第七代发射极控制二极管 带有 **pressfit** 压接管脚和温度检测 NTC

特性

- 电气特性
 - $V_{CES} = 1200\text{ V}$
 - $I_{C\text{ nom}} = 100\text{ A} / I_{CRM} = 200\text{ A}$
 - 沟槽栅 IGBT7
 - 低 V_{CESat}
 - 过载操作达 175°C
- 机械特性
 - 高功率密度
 - 紧凑型设计
 - 低热阻的三氧化二铝 Al_2O_3 衬底
 - 2.5 kV 交流 1 分钟 绝缘
 - PressFIT 压接技术



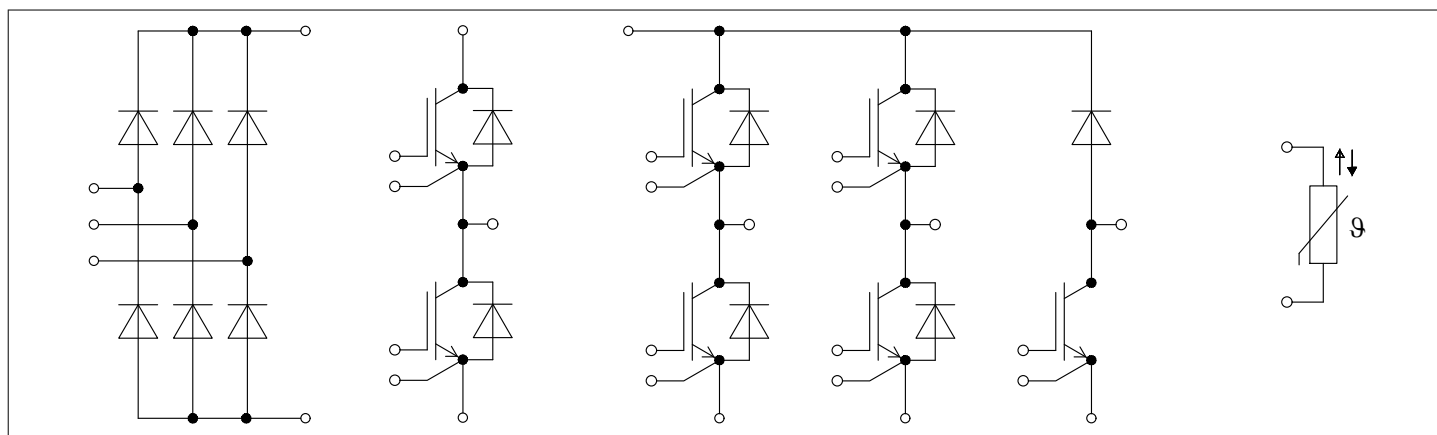
可选应用

- 空调
- 辅助逆变器
- 电机传动
- 伺服驱动器
- UPS 系统

Product validation

- 根据 IEC 60747、60749 和 60068 标准的相关测试，符合工业应用的要求。

描述





内容

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1 Package

1 Package

表 1 绝缘协调

特征参数	代号	标注或测试条件	数值	单位
绝缘测试电压	V_{ISOL}	RMS, $f = 50 \text{ Hz}$, $t = 1 \text{ min}$	2.5	kV
内部绝缘		基本绝缘 (class 1, IEC 61140)	Al_2O_3	
爬电距离	d_{Creep}	端子至散热器	11.2	mm
爬电距离	d_{Creep}	端子至端子	6.8	mm
电气间隙	d_{Clear}	端子至散热器	9.4	mm
电气间隙	d_{Clear}	端子至端子	5.5	mm
相对电痕指数	CTI		> 400	
相对温度指数 (电)	RTI	住房	140	°C

表 2 特征值

特征参数	代号	标注或测试条件	数值			单位
			最小值	典型值	最大值	
杂散电感, 模块	L_{sCE}			35		nH
模块引线电阻, 端子-芯片	$R_{AA'+CC'}$	$T_H = 25^\circ\text{C}$, 每个开关		2.8		mΩ
模块引线电阻, 端子-芯片	$R_{CC'+EE'}$	$T_H = 25^\circ\text{C}$, 每个开关		2.2		mΩ
储存温度	T_{stg}		-40		125	°C
模块安装的安装扭矩	M	根据相应的应用手册进行安装 M5, 螺丝	1.3		1.5	Nm
重量	G			78		g

注: The current under continuous operation is limited to 25 A rms per connector pin.

2 IGBT, 逆变器

表 3 最大标定值

特征参数	代号	标注或测试条件	数值	单位
集电极-发射极电压	V_{CES}	$T_{vj} = 25^\circ\text{C}$	1200	V
连续集电极直流电流	I_{CDC}	$T_{vj \max} = 175^\circ\text{C}$ $T_H = 65^\circ\text{C}$	100	A
集电极重复峰值电流	I_{CRM}	$t_p = 1 \text{ ms}$	200	A
栅极-发射极峰值电压	V_{GES}		±20	V

表 4 特征值

特征参数	代号	标注或测试条件	数值			单位
			最小值	典型值	最大值	
集电极-发射极饱和电压	$V_{CE\ sat}$	$I_C = 100\ A,$ $V_{GE} = 15\ V$ $T_{vj} = 25\ ^\circ C$ $T_{vj} = 125\ ^\circ C$ $T_{vj} = 175\ ^\circ C$		1.50	TBD	V
				1.64		
				1.72		
栅极阈值电压	V_{GEth}	$I_C = 2.5\ mA,$ $V_{CE} = V_{GE},$ $T_{vj} = 25\ ^\circ C$	5.15	5.80	6.45	V
栅极电荷	Q_G	$V_{GE} = \pm 15\ V,$ $V_{CE} = 600\ V$		1.8		μC
内部栅极电阻	R_{Gint}	$T_{vj} = 25\ ^\circ C$		1.5		Ω
输入电容	C_{ies}	$f = 100\ kHz,$ $T_{vj} = 25\ ^\circ C,$ $V_{CE} = 25\ V,$ $V_{GE} = 0\ V$		21.7		nF
反向传输电容	C_{res}	$f = 100\ kHz,$ $T_{vj} = 25\ ^\circ C,$ $V_{CE} = 25\ V,$ $V_{GE} = 0\ V$		0.076		nF
集电极-发射极截止电流	I_{CES}	$V_{CE} = 1200\ V,$ $V_{GE} = 0\ V$ $T_{vj} = 125\ ^\circ C$			0.009	mA
栅极-发射极漏电流	I_{GES}	$V_{CE} = 0\ V,$ $V_{GE} = 20\ V,$ $T_{vj} = 25\ ^\circ C$			100	nA
开通延迟时间(感性负载)	t_{don}	$I_C = 100\ A,$ $V_{CE} = 600\ V,$ $V_{GE} = \pm 15\ V,$ $R_{Gon} = 3.3\ \Omega$ $T_{vj} = 25\ ^\circ C$ $T_{vj} = 125\ ^\circ C$ $T_{vj} = 175\ ^\circ C$		0.163		μs
				0.184		
				0.193		
上升时间(感性负载)	t_r	$I_C = 100\ A,$ $V_{CE} = 600\ V,$ $V_{GE} = \pm 15\ V,$ $R_{Gon} = 3.3\ \Omega$ $T_{vj} = 25\ ^\circ C$ $T_{vj} = 125\ ^\circ C$ $T_{vj} = 175\ ^\circ C$		0.054		μs
				0.056		
				0.057		

表 4 特征值 (continued)

特征参数	代号	标注或测试条件	数值			单位
			最小值	典型值	最大值	
关断延迟时间(感性负载)	t_{doff}	$I_C = 100 \text{ A},$ $V_{\text{CE}} = 600 \text{ V},$ $V_{\text{GE}} = \pm 15 \text{ V},$ $R_{\text{Goff}} = 3.3 \Omega$		0.328		μs
				0.410		
				0.459		
下降时间(感性负载)	t_f	$I_C = 100 \text{ A},$ $V_{\text{CE}} = 600 \text{ V},$ $V_{\text{GE}} = \pm 15 \text{ V},$ $R_{\text{Goff}} = 3.3 \Omega$		0.114		μs
				0.197		
				0.258		
开通损耗能量(每脉冲)	E_{on}	$I_C = 100 \text{ A},$ $V_{\text{CE}} = 600 \text{ V},$ $L_\sigma = 35 \text{ nH},$ $di/dt = 1900 \text{ A}/\mu\text{s} (T_{\text{vj}} = 175^\circ\text{C}),$ $V_{\text{GE}} = \pm 15 \text{ V},$ $R_{\text{Gon}} = 3.3 \Omega$		9.5		mJ
				12.6		
				14.3		
关断损耗能量(每脉冲)	E_{off}	$I_C = 100 \text{ A},$ $V_{\text{CE}} = 600 \text{ V},$ $L_\sigma = 35 \text{ nH},$ $du/dt = 3000 \text{ V}/\mu\text{s} (T_{\text{vj}} = 175^\circ\text{C}),$ $V_{\text{GE}} = \pm 15 \text{ V},$ $R_{\text{Goff}} = 3.3 \Omega$		6.85		mJ
				10.3		
				12.6		
短路数据	I_{SC}	$V_{\text{CC}} = 800 \text{ V},$ $V_{\text{CEmax}} = V_{\text{CES}} - L_{\text{sCE}} * di/dt$		370		A
				350		
结-散热器热阻	R_{thJH}	每个 IGBT, $\lambda_{\text{grease}} = 3.3 \text{ W}/(\text{m}^2\text{K})$		0.510		K/W
在开关状态下温度	$T_{\text{vj op}}$		-40		175	$^\circ\text{C}$

注: $T_{\text{vj op}} > 150^\circ\text{C}$ is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.

3 二极管,逆变器

表 5 最大标定值

特征参数	代号	标注或测试条件	数值	单位
反向重复峰值电压	V_{RRM}	$T_{vj} = 25\text{ °C}$	1200	V
连续正向直流电流	I_F		100	A
正向重复峰值电流	I_{FRM}	$t_p = 1\text{ ms}$	200	A
I2t-值	I^2t	$V_R = 0\text{ V},$ $T_{vj} = 125\text{ °C}$	970	A^2s
		$t_p = 10\text{ ms}$ $T_{vj} = 175\text{ °C}$	860	

表 6 特征值

特征参数	代号	标注或测试条件	数值			单位
			最小值	典型值	最大值	
正向电压	V_F	$I_F = 100\text{ A},$ $V_{GE} = 0\text{ V}$		$T_{vj} = 25\text{ °C}$ 1.72	TBD	V
				$T_{vj} = 125\text{ °C}$ 1.59		
				$T_{vj} = 175\text{ °C}$ 1.52		
反向恢复峰值电流	I_{RM}	$V_R = 600\text{ V},$ $V_{GE} = -15\text{ V},$ $-di_F/dt = 1900\text{ A}/\mu\text{s}$ ($T_{vj} = 175\text{ °C}$)		$T_{vj} = 25\text{ °C}$ 68.3		A
				$T_{vj} = 125\text{ °C}$ 84.6		
				$T_{vj} = 175\text{ °C}$ 92.8		
恢复电荷	Q_r	$V_R = 600\text{ V},$ $V_{GE} = -15\text{ V},$ $-di_F/dt = 1900\text{ A}/\mu\text{s}$ ($T_{vj} = 175\text{ °C}$)		$T_{vj} = 25\text{ °C}$ 9.38		μC
				$T_{vj} = 125\text{ °C}$ 14.9		
				$T_{vj} = 175\text{ °C}$ 19.1		
反向恢复损耗（每脉冲）	E_{rec}	$V_R = 600\text{ V},$ $V_{GE} = -15\text{ V},$ $-di_F/dt = 1900\text{ A}/\mu\text{s}$ ($T_{vj} = 175\text{ °C}$)		$T_{vj} = 25\text{ °C}$ 3.02		mJ
				$T_{vj} = 125\text{ °C}$ 5.18		
				$T_{vj} = 175\text{ °C}$ 6.5		
结—散热器热阻	R_{thJH}	每个二极管, $\lambda_{grease} = 3.3\text{ W}/(\text{m}^2\text{K})$		0.870		K/W
在开关状态下温度	$T_{vj\text{ op}}$		-40		175	°C

注: $T_{vj\text{ op}} > 150\text{ °C}$ is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.

4 二极管,整流器

4 二极管,整流器

表 7 最大标定值

特征参数	代号	标注或测试条件	数值	单位
反向重复峰值电压	V_{RRM}	$T_{vj} = 25\text{ °C}$	1600	V
最大正向均方根电流(每芯片)	I_{FRMSM}	$T_H = 100\text{ °C}$	100	A
最大整流器输出均方根电流	I_{RMSM}	$T_H = 100\text{ °C}$	100	A
正向浪涌电流	I_{FSM}	$t_p = 10\text{ ms}$ $T_{vj} = 25\text{ °C}$	1150	A
		$T_{vj} = 150\text{ °C}$	880	
I2t-值	I^2t	$t_p = 10\text{ ms}$ $T_{vj} = 25\text{ °C}$	6610	A ² s
		$T_{vj} = 150\text{ °C}$	3870	

表 8 特征值

特征参数	代号	标注或测试条件	数值			单位
			最小值	典型值	最大值	
正向电压	V_F	$T_{vj} = 150\text{ °C}$, $I_F = 100\text{ A}$		1.02		V
反向电流	I_r	$T_{vj} = 150\text{ °C}$, $V_R = 1600\text{ V}$		1		mA
结-散热器热阻	R_{thJH}	每个二极管, $\lambda_{grease} = 3.3\text{ W/(m}^2\text{K)}$		0.700		K/W
在开关状态下温度	$T_{vj, op}$		-40		150	°C

5 IGBT, 制动-斩波器

表 9 最大标定值

特征参数	代号	标注或测试条件	数值	单位
集电极-发射极电压	V_{CES}	$T_{vj} = 25\text{ °C}$	1200	V
连续集电极直流电流	I_{CDC}	$T_{vj\text{ max}} = 175\text{ °C}$ $T_H = 80\text{ °C}$	50	A
集电极重复峰值电流	I_{CRM}	$t_p = 1\text{ ms}$	100	A
栅极-发射极峰值电压	V_{GES}		±20	V

表 10 特征值

特征参数	代号	标注或测试条件	数值			单位
			最小值	典型值	最大值	
集电极-发射极饱和电压	$V_{CE\ sat}$	$I_C = 50\ A,$ $V_{GE} = 15\ V$ $T_{vj} = 25\ ^\circ C$ $T_{vj} = 125\ ^\circ C$ $T_{vj} = 175\ ^\circ C$		1.50	TBD	V
				1.64		
				1.72		
栅极阈值电压	V_{GEth}	$I_C = 1.28\ mA,$ $V_{CE} = V_{GE},$ $T_{vj} = 25\ ^\circ C$	5.15	5.80	6.45	V
栅极电荷	Q_G	$V_{GE} = \pm 15\ V,$ $V_{CE} = 600\ V$		0.92		μC
内部栅极电阻	R_{Gint}	$T_{vj} = 25\ ^\circ C$		0		Ω
输入电容	C_{ies}	$f = 100\ kHz,$ $T_{vj} = 25\ ^\circ C,$ $V_{CE} = 25\ V,$ $V_{GE} = 0\ V$		11.1		nF
反向传输电容	C_{res}	$f = 100\ kHz,$ $T_{vj} = 25\ ^\circ C,$ $V_{CE} = 25\ V,$ $V_{GE} = 0\ V$		0.039		nF
集电极-发射极截止电流	I_{CES}	$V_{CE} = 1200\ V$ $T_{vj} = 25\ ^\circ C$			1	mA
栅极-发射极漏电流	I_{GES}	$V_{CE} = 0\ V,$ $V_{GE} = 20\ V,$ $T_{vj} = 25\ ^\circ C$			100	nA
开通延迟时间(感性负载)	t_{don}	$I_C = 50\ A,$ $V_{CE} = 600\ V,$ $V_{GE} = \pm 15\ V,$ $R_{Gon} = 5.1\ \Omega$ $T_{vj} = 25\ ^\circ C$ $T_{vj} = 125\ ^\circ C$ $T_{vj} = 175\ ^\circ C$		0.045		μs
				0.047		
				0.048		
上升时间(感性负载)	t_r	$I_C = 50\ A,$ $V_{CE} = 600\ V,$ $V_{GE} = \pm 15\ V,$ $R_{Gon} = 5.1\ \Omega$ $T_{vj} = 25\ ^\circ C$ $T_{vj} = 125\ ^\circ C$ $T_{vj} = 175\ ^\circ C$		0.031		μs
				0.034		
				0.035		
关断延迟时间(感性负载)	t_{doff}	$I_C = 50\ A,$ $V_{CE} = 600\ V,$ $V_{GE} = \pm 15\ V,$ $R_{Goff} = 5.1\ \Omega$ $T_{vj} = 25\ ^\circ C$ $T_{vj} = 125\ ^\circ C$ $T_{vj} = 175\ ^\circ C$		0.255		μs
				0.340		
				0.382		

表 10 特征值 (continued)

特征参数	代号	标注或测试条件	数值			单位
			最小值	典型值	最大值	
下降时间(感性负载)	t_f	$I_C = 50 \text{ A},$ $V_{CE} = 600 \text{ V},$ $V_{GE} = \pm 15 \text{ V},$ $R_{Goff} = 5.1 \Omega$		0.107		μs
				0.195		
				0.255		
开通损耗能量 (每脉冲)	E_{on}	$I_C = 50 \text{ A},$ $V_{CE} = 600 \text{ V},$ $L_\sigma = 35 \text{ nH},$ $di/dt = 1200 \text{ A}/\mu\text{s} (T_{vj} = 175^\circ\text{C}),$ $V_{GE} = \pm 15 \text{ V},$ $R_{Gon} = 5.1 \Omega$		3.21		mJ
				4.03		
				4.46		
关断损耗能量 (每脉冲)	E_{off}	$I_C = 50 \text{ A},$ $V_{CE} = 600 \text{ V},$ $L_\sigma = 35 \text{ nH},$ $du/dt = 2900 \text{ V}/\mu\text{s} (T_{vj} = 175^\circ\text{C}),$ $V_{GE} = \pm 15 \text{ V},$ $R_{Goff} = 5.1 \Omega$		3.23		mJ
				5.22		
				6.45		
短路数据	I_{SC}	$V_{CC} = 800 \text{ V},$ $V_{CEmax} = V_{CES} - L_{sCE} * di/dt$		190		A
				180		
结-散热器热阻	R_{thJH}	每个 IGBT, $\lambda_{grease} = 3.3 \text{ W}/(\text{m}^2\text{K})$		0.850		K/W
在开关状态下温度	$T_{vj op}$		-40		175	$^\circ\text{C}$

注: $T_{vj op} > 150^\circ\text{C}$ is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.

6 二极管，制动-斩波器

表 11 最大标定值

特征参数	代号	标注或测试条件	数值	单位
反向重复峰值电压	V_{RRM}	$T_{vj} = 25^\circ\text{C}$	1200	V

表 11 最大标定值 (continued)

特征参数	代号	标注或测试条件	数值	单位
连续正向直流电流	I_F		25	A
正向重复峰值电流	I_{FRM}	$t_p = 1 \text{ ms}$	50	A
I2t-值	I^2t	$V_R = 0 \text{ V},$ $T_{vj} = 125 \text{ }^\circ\text{C}$	72.5	A^2s
		$t_p = 10 \text{ ms}$ $T_{vj} = 175 \text{ }^\circ\text{C}$	63	

表 12 特征值

特征参数	代号	标注或测试条件	数值			单位
			最小值	典型值	最大值	
正向电压	V_F	$I_F = 25 \text{ A},$ $V_{GE} = 0 \text{ V}$		$T_{vj} = 25 \text{ }^\circ\text{C}$ 1.83		V
				$T_{vj} = 125 \text{ }^\circ\text{C}$ 1.70		
				$T_{vj} = 175 \text{ }^\circ\text{C}$ 1.63		
反向恢复峰值电流	I_{RM}	$V_R = 600 \text{ V},$ $V_{GE} = -15 \text{ V},$ $-di_F/dt = 1100 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ }^\circ\text{C})$		$T_{vj} = 25 \text{ }^\circ\text{C}$ 27.4		A
				$T_{vj} = 125 \text{ }^\circ\text{C}$ 31.2		
				$T_{vj} = 175 \text{ }^\circ\text{C}$ 34.1		
恢复电荷	Q_r	$V_R = 600 \text{ V},$ $V_{GE} = -15 \text{ V},$ $-di_F/dt = 1100 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ }^\circ\text{C})$		$T_{vj} = 25 \text{ }^\circ\text{C}$ 1.93		μC
				$T_{vj} = 125 \text{ }^\circ\text{C}$ 3.51		
				$T_{vj} = 175 \text{ }^\circ\text{C}$ 4.51		
反向恢复损耗 (每脉冲)	E_{rec}	$V_R = 600 \text{ V},$ $V_{GE} = -15 \text{ V},$ $-di_F/dt = 1100 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ }^\circ\text{C})$		$T_{vj} = 25 \text{ }^\circ\text{C}$ 0.74		mJ
				$T_{vj} = 125 \text{ }^\circ\text{C}$ 1.42		
				$T_{vj} = 175 \text{ }^\circ\text{C}$ 1.85		
结-散热器热阻	R_{thJH}	每个二极管, $\lambda_{grease} = 3.3 \text{ W}/(\text{m}^2\text{K})$		1.86		K/W
在开关状态下温度	$T_{vj op}$		-40		175	$^\circ\text{C}$

注: $T_{vj op} > 150^\circ\text{C}$ is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.

7 负温度系数热敏电阻

7 负温度系数热敏电阻

表 13 特征值

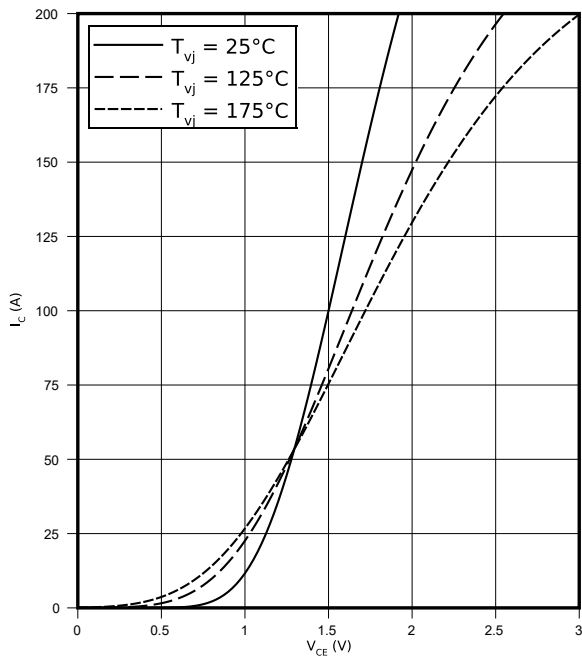
特征参数	代号	标注或测试条件	数值			单位
			最小值	典型值	最大值	
额定电阻值	R_{25}	$T_{NTC} = 25\text{ °C}$		5		kΩ
R_{100} 偏差	$\Delta R/R$	$T_{NTC} = 100\text{ °C},$ $R_{100} = 493\text{ Ω}$	-5		5	%
耗散功率	P_{25}	$T_{NTC} = 25\text{ °C}$			20	mW
B-值	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298,15\text{ K}))]$		3375		K
B-值	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298,15\text{ K}))]$		3411		K
B-值	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298,15\text{ K}))]$		3433		K

注: 根据应用手册标定

8 特征参数图表

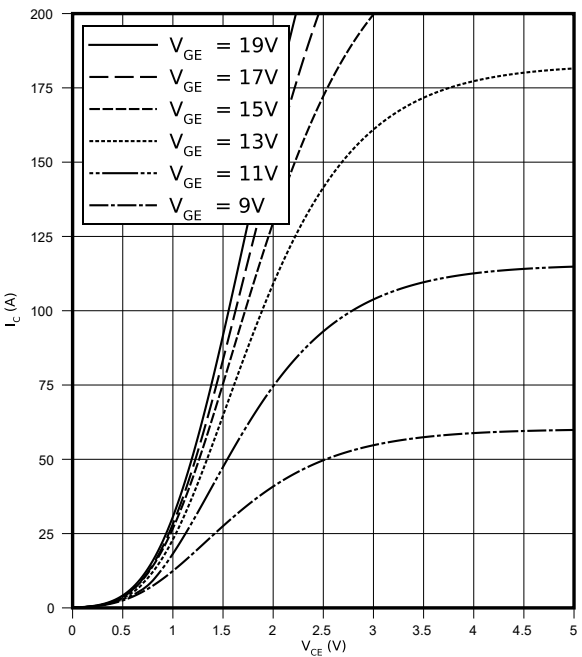
输出特性（典型）, IGBT, 逆变器

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



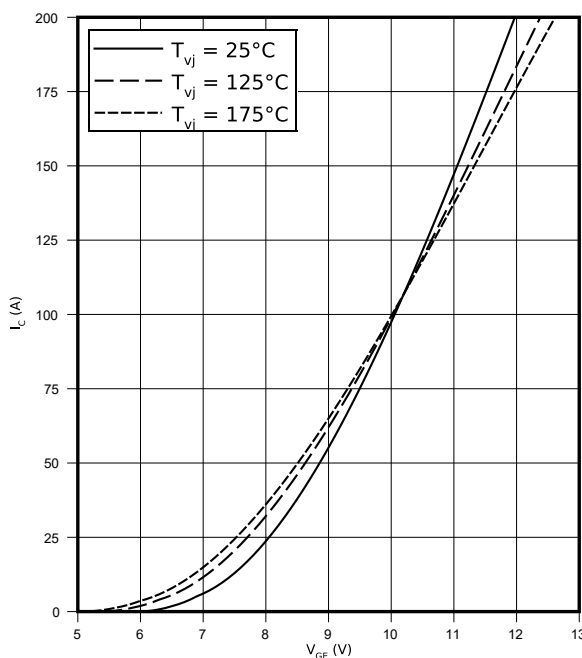
输出特性（典型）, IGBT, 逆变器

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



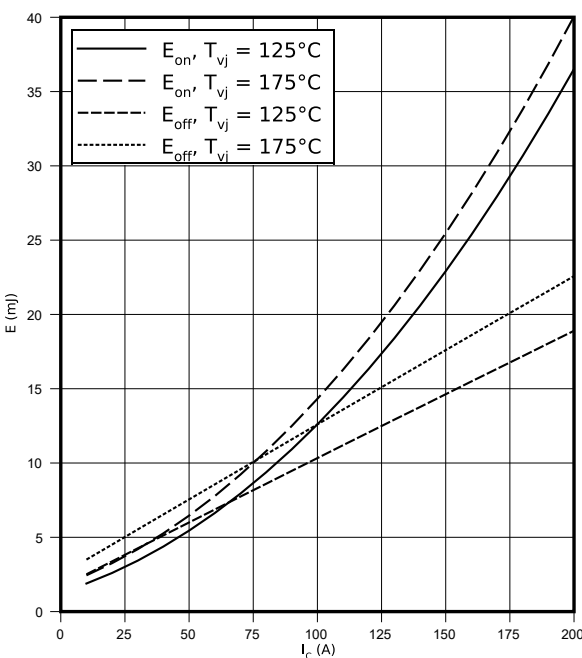
传输特性（典型）, IGBT, 逆变器

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



开关损耗（典型）, IGBT, 逆变器

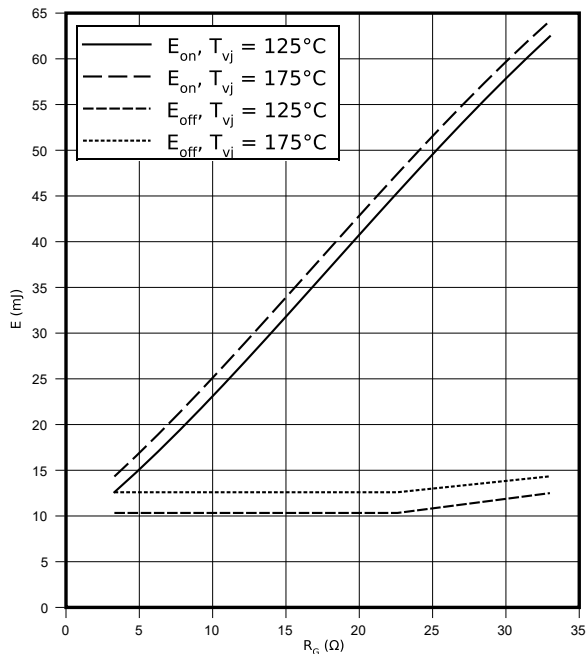
$E = f(I_C)$
 $R_{Goff} = 3.3\text{ }\Omega$, $R_{Gon} = 3.3\text{ }\Omega$, $V_{CE} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$



8 特征参数图表

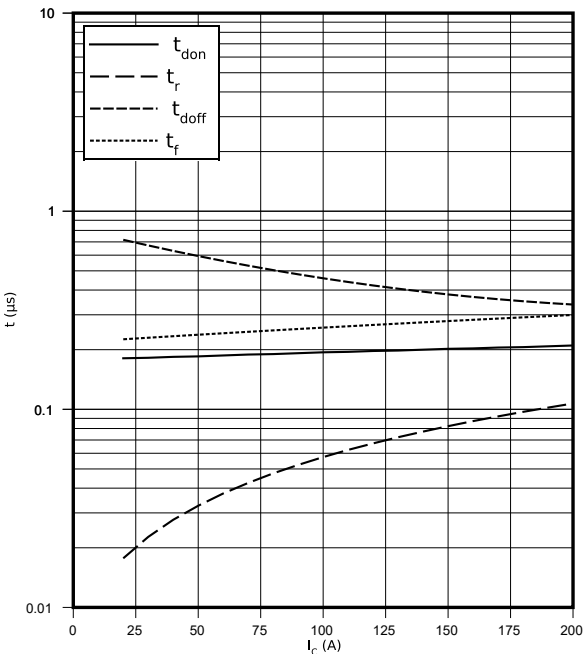
开关损耗（典型）, IGBT, 逆变器

$E = f(R_G)$
 $I_C = 100\text{ A}$, $V_{CE} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$



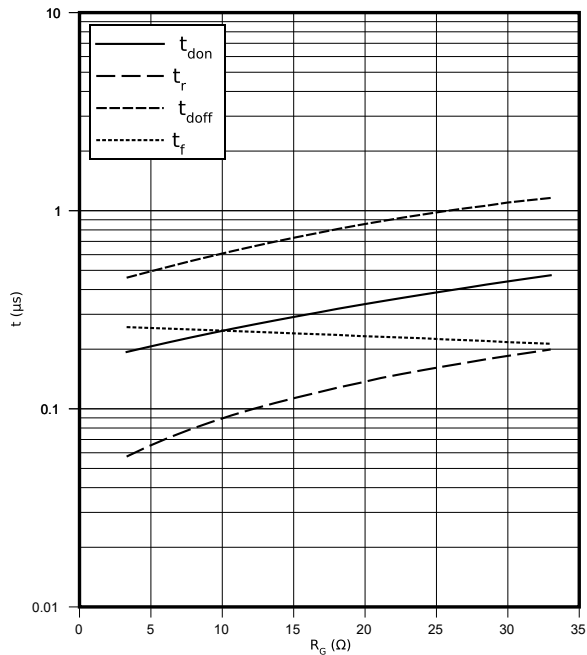
???（典型）, IGBT, 逆变器

$t = f(I_C)$
 $R_{Goff} = 3.3\text{ }\Omega$, $R_{Gon} = 3.3\text{ }\Omega$, $V_{CE} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $T_{vj} = 175\text{ }^\circ\text{C}$



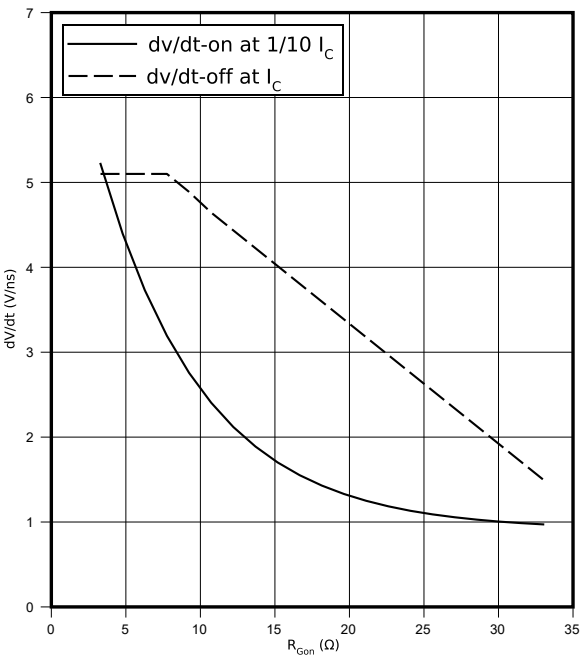
???（典型）, IGBT, 逆变器

$t = f(R_G)$
 $I_C = 100\text{ A}$, $V_{CE} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $T_{vj} = 175\text{ }^\circ\text{C}$



dv/dt（典型）, IGBT, 逆变器

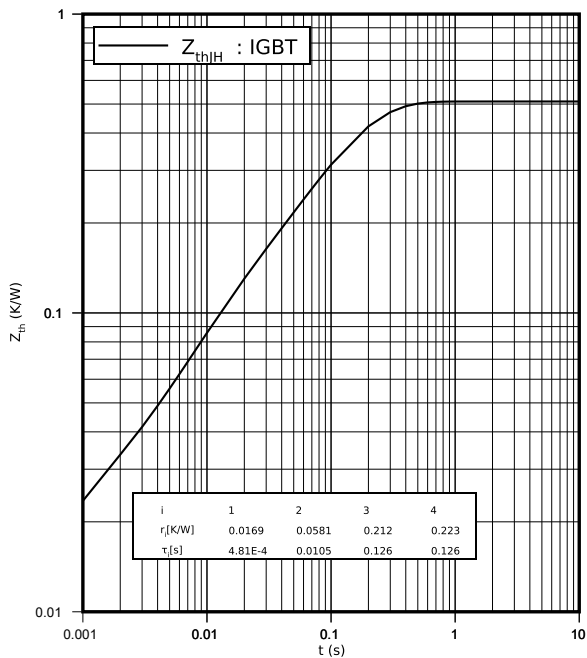
$dv/dt = f(R_{Gon})$
 $I_C = 100\text{ A}$, $V_{CE} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $T_{vj} = 25\text{ }^\circ\text{C}$



8 特征参数图表

瞬态热阻抗 , IGBT, 逆变器

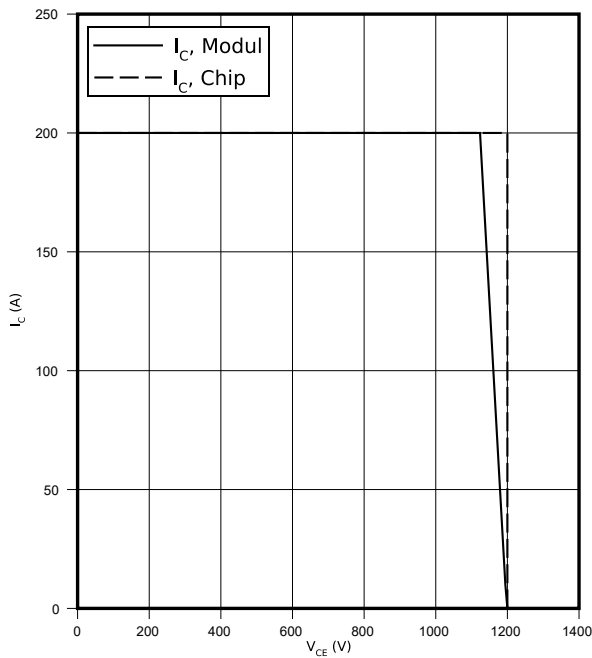
$Z_{th} = f(t)$



反偏安全工作区 (RBSOA) , IGBT, 逆变器

$I_C = f(V_{CE})$

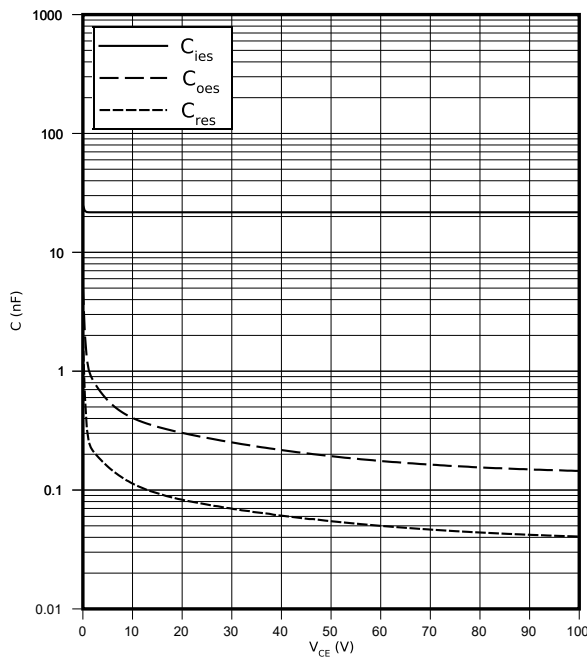
$R_{Goff} = 3.3 \Omega, V_{GE} = \pm 15.0 V, T_{vj} = 175^\circ C$



电容特性 (典型), IGBT, 逆变器

$C = f(V_{CE})$

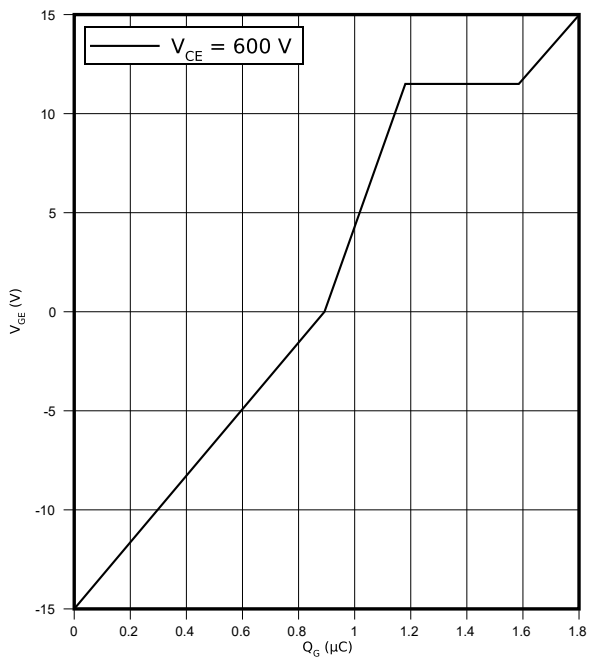
$f = 100 \text{ kHz}, V_{GE} = 0 V, T_{vj} = 25^\circ C$



栅极电荷特性 (典型), IGBT, 逆变器

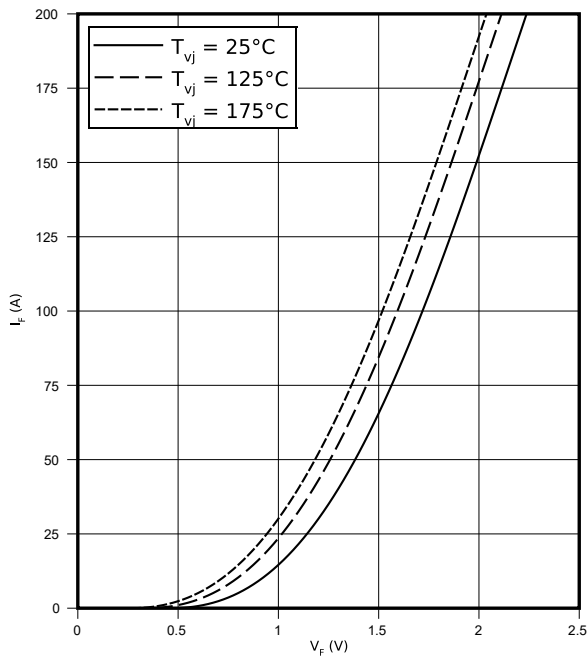
$V_{GE} = f(Q_G)$

$I_C = 100 A, T_{vj} = 25^\circ C$

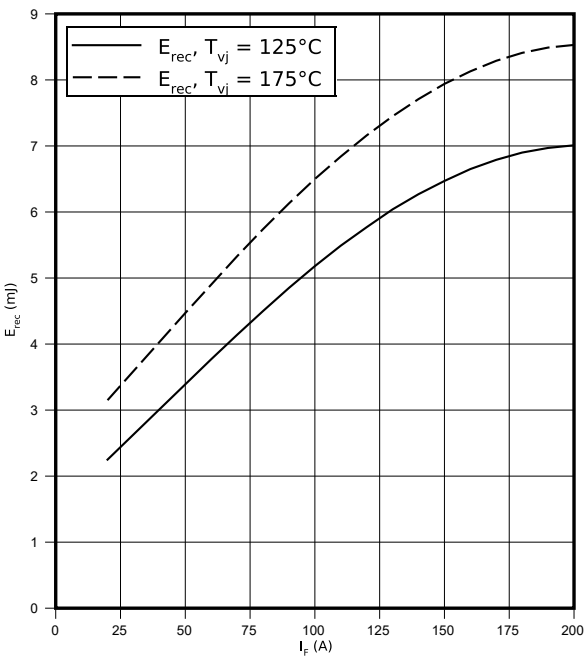


8 特征参数图表

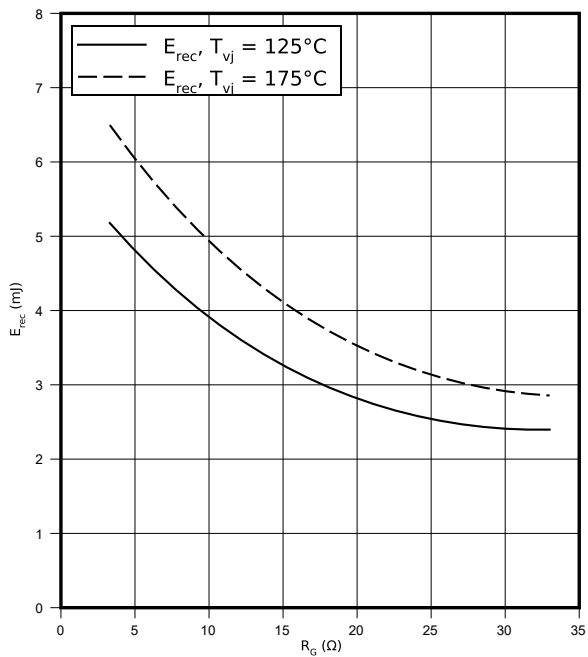
正向偏压特性（典型), 二极管, 逆变器
 $I_F = f(V_F)$



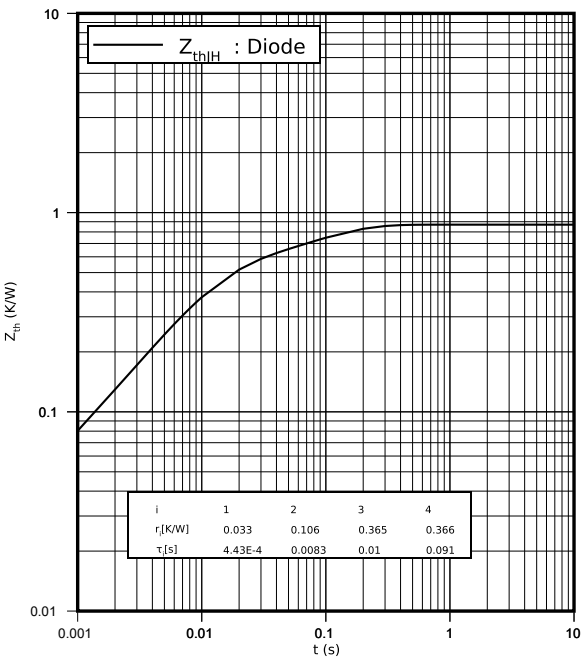
开关损耗（典型), 二极管, 逆变器
 $E_{rec} = f(I_F)$
 $V_{CE} = 600\text{ V}$, $R_{Gon} = R_{Gon}(IGBT)$



开关损耗（典型), 二极管, 逆变器
 $E_{rec} = f(R_G)$
 $V_{CE} = 600\text{ V}$, $I_F = 100\text{ A}$

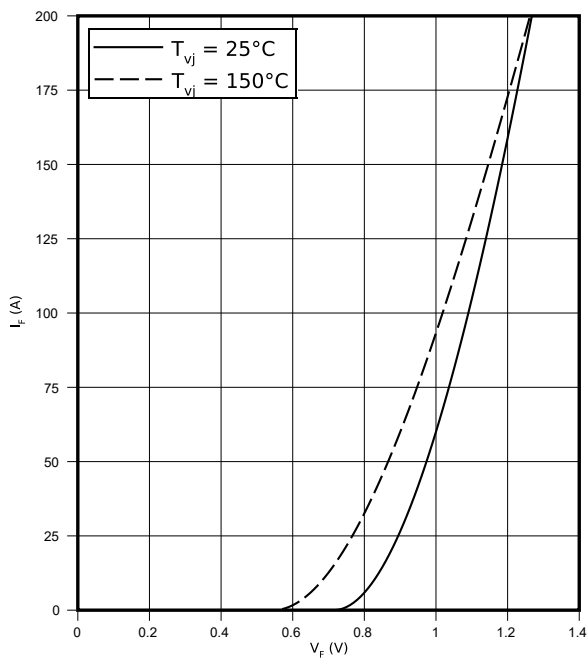


瞬态热阻抗，二极管, 逆变器
 $Z_{th} = f(t)$

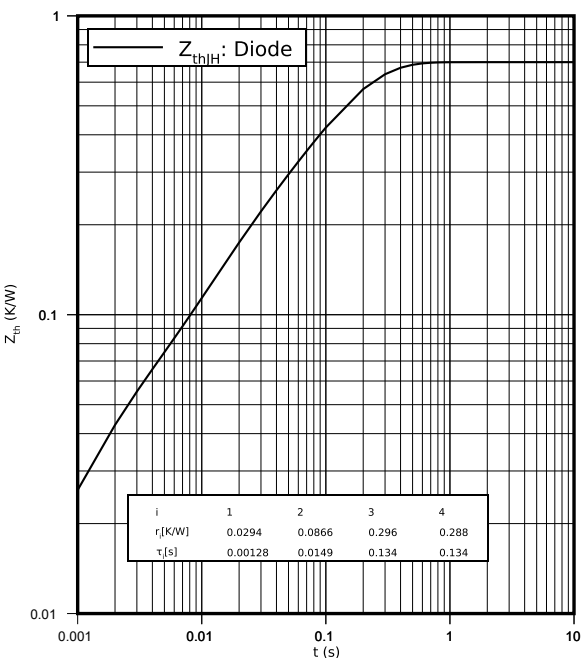


8 特征参数图表

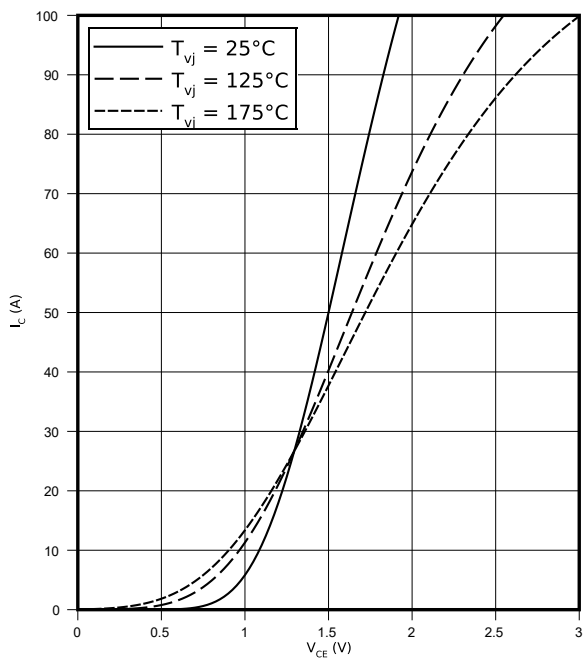
正向偏压特性（典型), 二极管,整流器
 $I_F = f(V_F)$



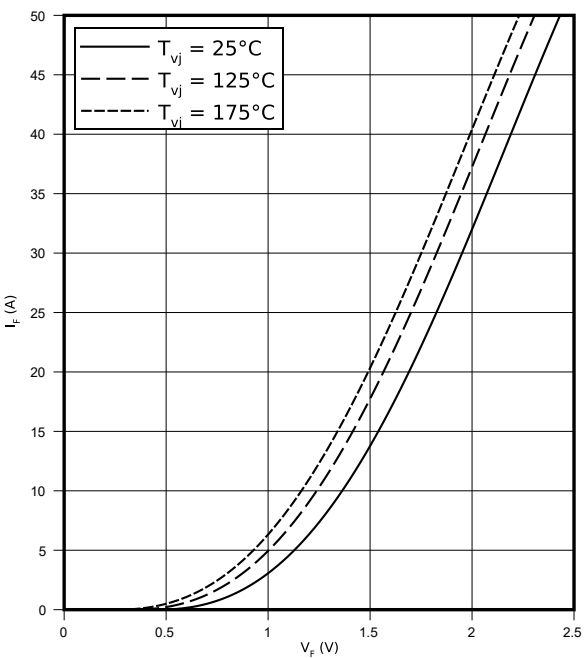
瞬态热阻抗, 二极管,整流器
 $Z_{th} = f(t)$



输出特性（典型), IGBT, 制动-斩波器
 $I_C = f(V_{CE})$
 $V_{GE} = 15\text{ V}$

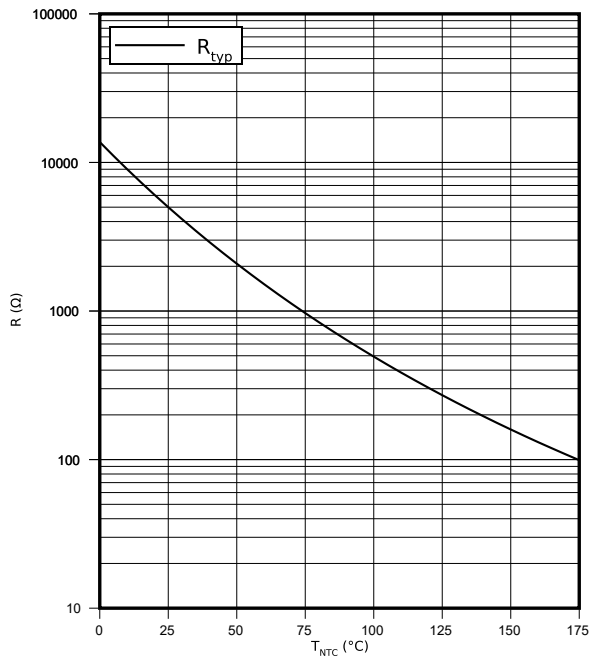


正向偏压特性（典型), 二极管, 制动-斩波器
 $I_F = f(V_F)$



8 特征参数图表

温度特性, 负温度系数热敏电阻
 $R = f(T_{NTC})$



9 电路拓扑图

9 电路拓扑图

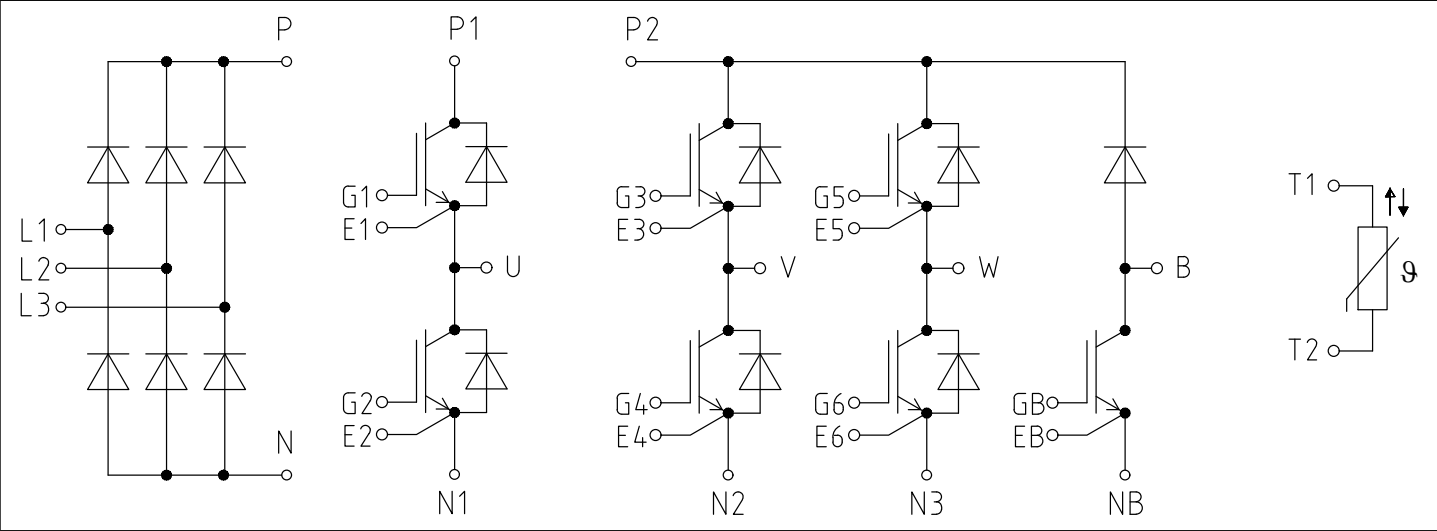


图 2

10 封装尺寸

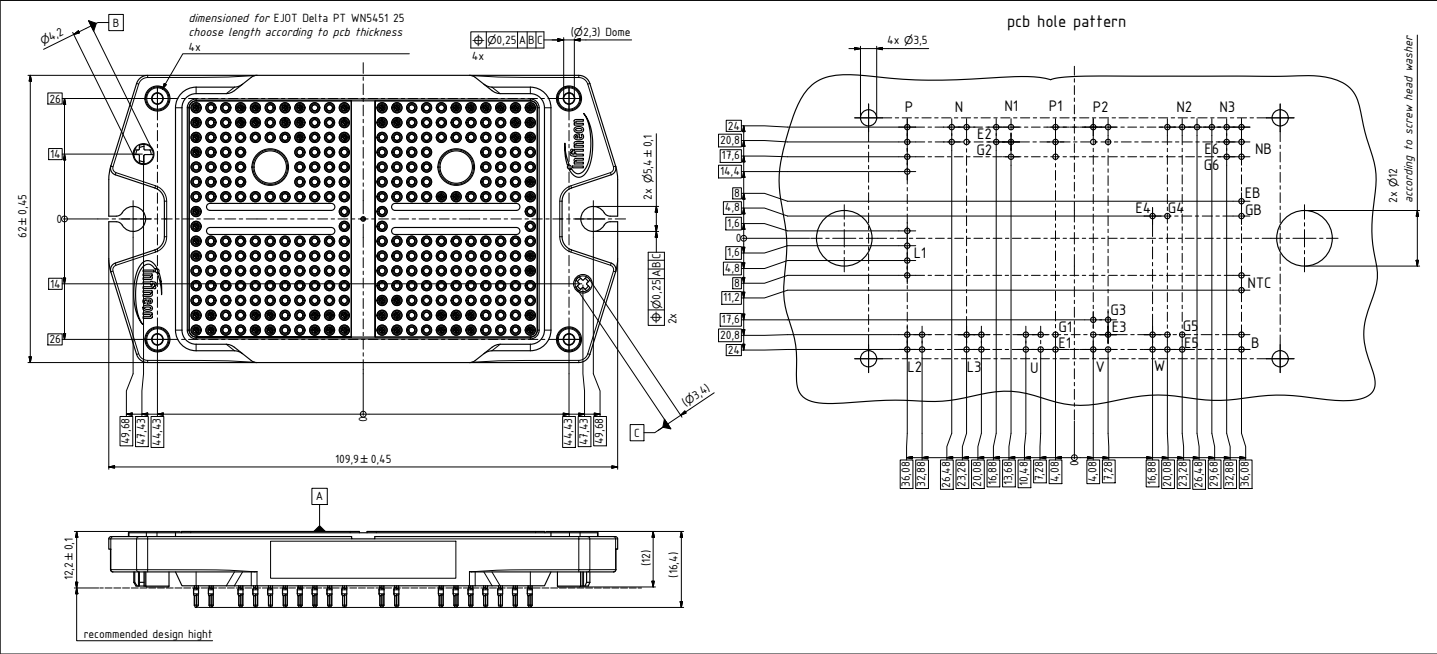


图 3

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