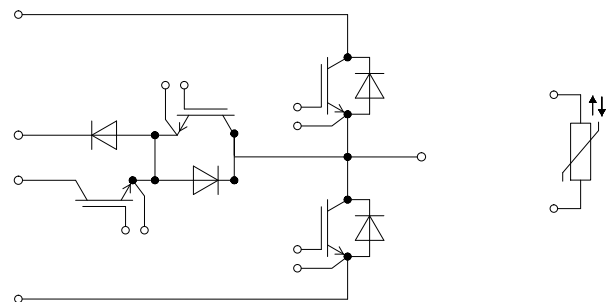
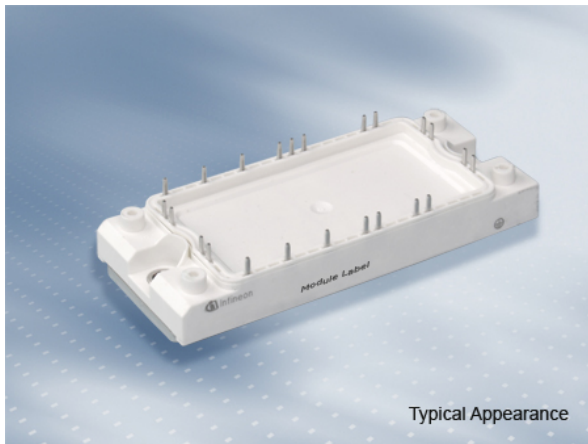


EconoPACK™2 模块 采用第二类中点钳位拓扑 (NPC2) 带有温度检测NTC
EconoPACK™2 module with active "Neutral Point Clamp 2" topology and NTC



$V_{CES} = 1200V$
 $I_{C\ nom} = 150A / I_{CRM} = 300A$

潜在应用

- UPS系统
- 三电平应用
- 太阳能应用
- 电机传动

电气特性

- $T_{vj\ op} = 150^{\circ}C$
- 低开关损耗
- 高速IGBT H3

机械特性

- 2.5 kV 交流 1分钟 绝缘
- 焊接技术
- 符合RoHS

Potential Applications

- UPS systems
- 3-level-applications
- Solar applications
- Motor drives

Electrical Features

- $T_{vj\ op} = 150^{\circ}C$
- Low switching losses
- High speed IGBT H3

Mechanical Features

- 2.5 kV AC 1min insulation
- Solder contact technology
- RoHS compliant

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}	1200	V
集电极电流 Implemented collector current		I_{CN}	200	A
连续集电极直流电流 Continuous DC collector current	$T_C = 100^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	I_{CDC}	150	A
集电极重复峰值电流 Repetitive peak collector current	$t_P = 1\text{ ms}$	I_{CRM}	400	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	$I_C = 150\text{ A}$ $V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{ sat}}$		1,80 2,10 2,20	V V V
栅极阈值电压 Gate threshold voltage	$I_C = 7,60\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		V_{Geth}	5,25	5,80	6,35 V
栅极电荷 Gate charge	$V_{GE} = -15 / 15\text{ V}, V_{CE} = 350\text{ V}$		Q_G		1,60	μC
内部栅极电阻 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		R_{Gint}		3,8	Ω
输入电容 Input capacitance	$f = 1000\text{ kHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		C_{ies}		11,5	nF
反向传输电容 Reverse transfer capacitance	$f = 1000\text{ kHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		C_{res}		0,63	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}			1,0 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}			100 nA
开通延迟时间(电感负载) Turn-on delay time, inductive load	$I_C = 150\text{ A}, V_{CE} = 350\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Gon} = 2,4\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{don}		0,19 0,20 0,20	μs μs μs
上升时间(电感负载) Rise time, inductive load	$I_C = 150\text{ A}, V_{CE} = 350\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Gon} = 2,4\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_r		0,044 0,052 0,053	μs μs μs
关断延迟时间(电感负载) Turn-off delay time, inductive load	$I_C = 150\text{ A}, V_{CE} = 350\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Goff} = 2,4\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{doff}		0,31 0,39 0,40	μs μs μs
下降时间(电感负载) Fall time, inductive load	$I_C = 150\text{ A}, V_{CE} = 350\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Goff} = 2,4\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_f		0,04 0,10 0,12	μs μs μs
开通损耗能量(每脉冲) Turn-on energy loss per pulse	$I_C = 150\text{ A}, V_{CE} = 350\text{ V}, L_{\sigma} = 35\text{ nH}$ $di/dt = 2900\text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $V_{GE} = -15 / 15\text{ V}, R_{Gon} = 2,4\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{on}		3,00 4,90 5,30	mJ mJ mJ
关断损耗能量(每脉冲) Turn-off energy loss per pulse	$I_C = 150\text{ A}, V_{CE} = 350\text{ V}, L_{\sigma} = 35\text{ nH}$ $du/dt = 2800\text{ V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $V_{GE} = -15 / 15\text{ V}, R_{Goff} = 2,4\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{off}		4,55 6,95 7,70	mJ mJ mJ
短路数据 SC data	$V_{GE} \leq 15\text{ V}, V_{CC} = 800\text{ V}$ $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$ $t_P \leq 10\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$		I_{SC}		720	A
结 - 外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT		R_{thJC}		0,162	K/W
外壳 - 散热器热阻 Thermal resistance, case to heatsink	每个 IGBT / per IGBT $\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K}) / \lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$		R_{thCH}		0,111	K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\text{ op}}$	-40	150	$^{\circ}\text{C}$

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}	1200	V
连续正向直流电流 Continuous DC forward current		I_F	100	A
正向重复峰值电流 Repetitive peak forward current	$t_P = 1\text{ ms}$	I_{FRM}	200	A
I^2t -值 I^2t - value	$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	I^2t	1950 1850	A^2s A^2s

特征值 / Characteristic Values

				min.	typ.	max.	
正向电压 Forward voltage	$I_F = 100\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 100\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 100\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	V_F		1,75 1,70 1,70	2,15	V V V
反向恢复峰值电流 Peak reverse recovery current	$I_F = 100\text{ A}, -di_F/dt = 2600\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 350\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	I_{RM}		102 123 128		A A A
恢复电荷 Recovered charge	$I_F = 100\text{ A}, -di_F/dt = 2600\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 350\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	Q_r		7,50 13,6 15,5		μC μC μC
反向恢复损耗 (每脉冲) Reverse recovery energy	$I_F = 100\text{ A}, -di_F/dt = 2600\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 350\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{rec}		2,00 3,80 4,35		mJ mJ mJ
结 - 外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode		R_{thJC}			0,491	K/W
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}		0,146		K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\text{ op}}$	-40		150	$^{\circ}\text{C}$

IGBT, 三电平 / IGBT, 3-Level

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}	650	V
连续集电极直流电流 Continuous DC collector current	$T_C = 50^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	I_{CDC}	150	A
集电极重复峰值电流 Repetitive peak collector current	$t_P = 1\text{ ms}$	I_{CRM}	300	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	$I_C = 150\text{ A}$ $V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{ sat}}$	1,45 1,60 1,70	1,90	V V V
栅极阈值电压 Gate threshold voltage	$I_C = 2,40\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		V_{GEth}	5,05	5,80	6,45 V
栅极电荷 Gate charge	$V_{GE} = -15 / 15\text{ V}$		Q_G	1,50		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	$f = 1000\text{ kHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		C_{ies}	9,30		nF
反向传输电容 Reverse transfer capacitance	$f = 1000\text{ kHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		C_{res}	0,285		nF
集电极-发射极截止电流 Collector-emitter cut-off current	$V_{CE} = 650\text{ V}, V_{GE} = 0\text{ V}, T_{vj} = 25^{\circ}\text{C}$		I_{CES}		1,0	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}		100	nA
开通延迟时间(电感负载) Turn-on delay time, inductive load	$I_C = 150\text{ A}, V_{CE} = 350\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Gon} = 3,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{don}	0,08 0,10 0,10		μs μs μs
上升时间(电感负载) Rise time, inductive load	$I_C = 150\text{ A}, V_{CE} = 350\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Gon} = 3,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_r	0,051 0,057 0,062		μs μs μs
关断延迟时间(电感负载) Turn-off delay time, inductive load	$I_C = 150\text{ A}, V_{CE} = 350\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Goff} = 3,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{doff}	0,29 0,32 0,34		μs μs μs
下降时间(电感负载) Fall time, inductive load	$I_C = 150\text{ A}, V_{CE} = 350\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Goff} = 3,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_f	0,07 0,12 0,14		μs μs μs
开通损耗能量(每脉冲) Turn-on energy loss per pulse	$I_C = 150\text{ A}, V_{CE} = 350\text{ V}, L\sigma = 35\text{ nH}$ $di/dt = 2800\text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $V_{GE} = -15 / 15\text{ V}, R_{Gon} = 3,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{on}	7,20 9,45 10,0		mJ mJ mJ
关断损耗能量(每脉冲) Turn-off energy loss per pulse	$I_C = 150\text{ A}, V_{CE} = 350\text{ V}, L\sigma = 35\text{ nH}$ $du/dt = 4000\text{ V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $V_{GE} = -15 / 15\text{ V}, R_{Goff} = 3,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{off}	4,50 6,40 7,00		mJ mJ mJ
短路数据 SC data	$V_{GE} \leq 15\text{ V}, V_{CC} = 360\text{ V}$ $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$ $t_P \leq 6\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$		I_{SC}	750		A
结 - 外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT		R_{thJC}		0,349	K/W
外壳 - 散热器热阻 Thermal resistance, case to heatsink	每个 IGBT / per IGBT $\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K}) / \lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$		R_{thCH}	0,138		K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\text{ op}}$	-40	150	$^{\circ}\text{C}$

二极管, 三电平 / Diode, 3-Level

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}	650	V
连续正向直流电流 Continuous DC forward current		I_F	150	A
正向重复峰值电流 Repetitive peak forward current	$t_P = 1\text{ ms}$	I_{FRM}	300	A
I_{2t} -值 I_{2t} - value	$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	I_{2t}	1700 1650	A^2s A^2s

特征值 / Characteristic Values

			min.	typ.	max.	
正向电压 Forward voltage	$I_F = 150\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 150\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 150\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	V_F	1,65 1,55 1,50	2,15	V V V
反向恢复峰值电流 Peak reverse recovery current	$I_F = 150\text{ A}, -di_F/dt = 2900\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 350\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	I_{RM}	69,0 89,0 95,0		A A A
恢复电荷 Recovered charge	$I_F = 150\text{ A}, -di_F/dt = 2900\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 350\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	Q_r	4,40 8,10 9,50		μC μC μC
反向恢复损耗 (每脉冲) Reverse recovery energy	$I_F = 150\text{ A}, -di_F/dt = 2900\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 350\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{rec}	1,15 1,90 2,20		mJ mJ mJ
结 - 外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode		R_{thJC}		0,645	K/W
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}	0,154		K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\text{ op}}$	-40	150	$^{\circ}\text{C}$

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

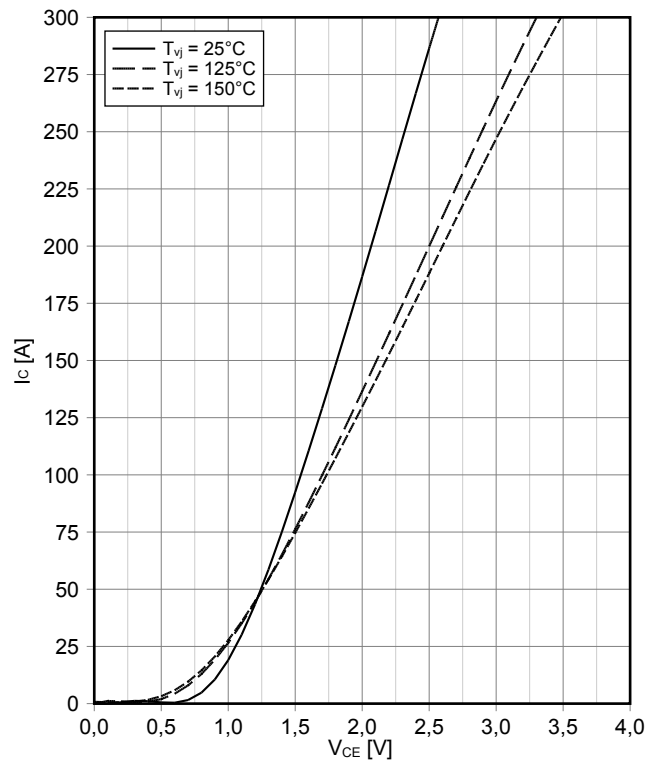
绝缘测试电压 Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V _{ISOL}	2,5	kV		
模块基板材料 Material of module baseplate			Cu			
内部绝缘 Internal isolation	基本绝缘 (class 1, IEC 61140) basic insulation (class 1, IEC 61140)		Al ₂ O ₃			
爬电距离 Creepage distance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal		10,0	mm		
电气间隙 Clearance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal		7,5	mm		
相对电痕指数 Comperative tracking index		CTI	> 200			
min. typ. max.						
杂散电感,模块 Stray inductance module		L _{sCE}		17		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'}		2,50		mΩ
储存温度 Storage temperature		T _{stg}	-40		125	°C
模块安装的安装扭矩 Mounting torque for modul mounting	螺丝 根据相应的应用手册进行安装 Screw - Mounting according to valid application note	M	3,00		6,00	Nm
重量 Weight		G		180		g

输出特性 IGBT, 逆变器 (典型)

output characteristic IGBT, Inverter (typical)

$I_C = f(V_{CE})$

$V_{GE} = 15\text{ V}$

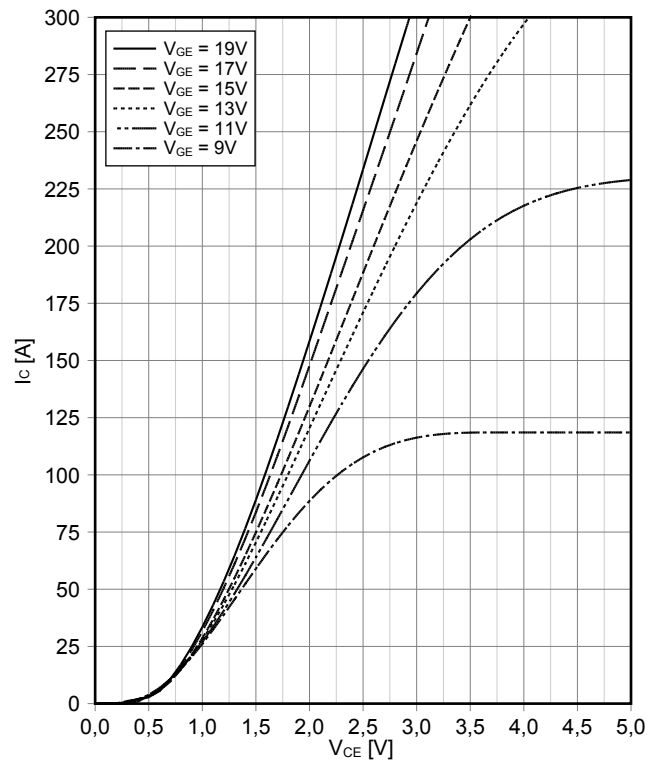


输出特性 IGBT, 逆变器 (典型)

output characteristic IGBT, Inverter (typical)

$I_C = f(V_{CE})$

$T_{vj} = 150^\circ\text{C}$

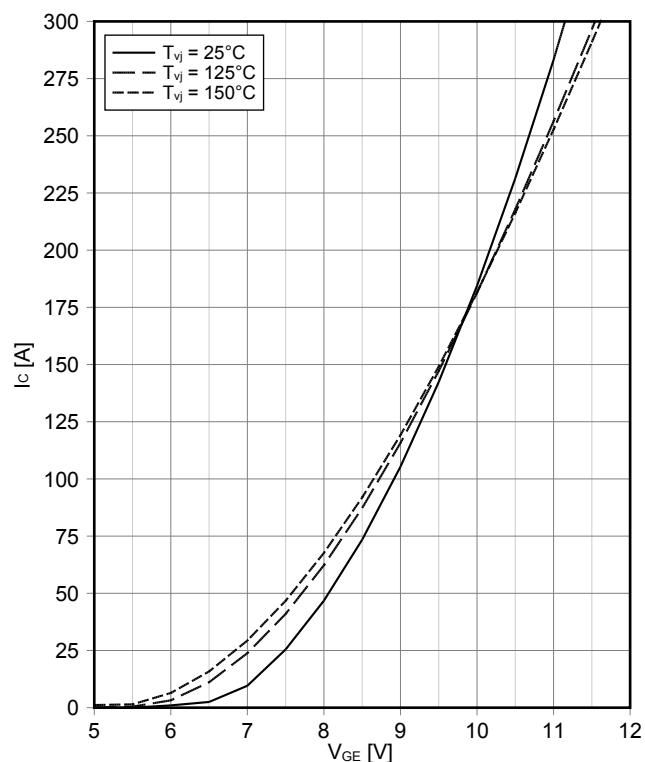


传输特性 IGBT, 逆变器 (典型)

transfer characteristic IGBT, Inverter (typical)

$I_C = f(V_{GE})$

$V_{CE} = 20\text{ V}$

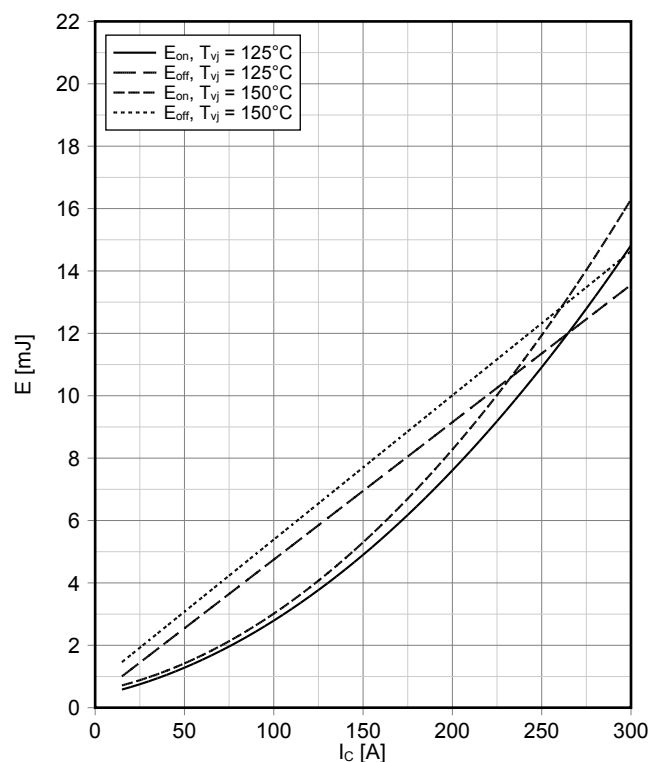


开关损耗 IGBT, 逆变器 (典型)

switching losses IGBT, Inverter (typical)

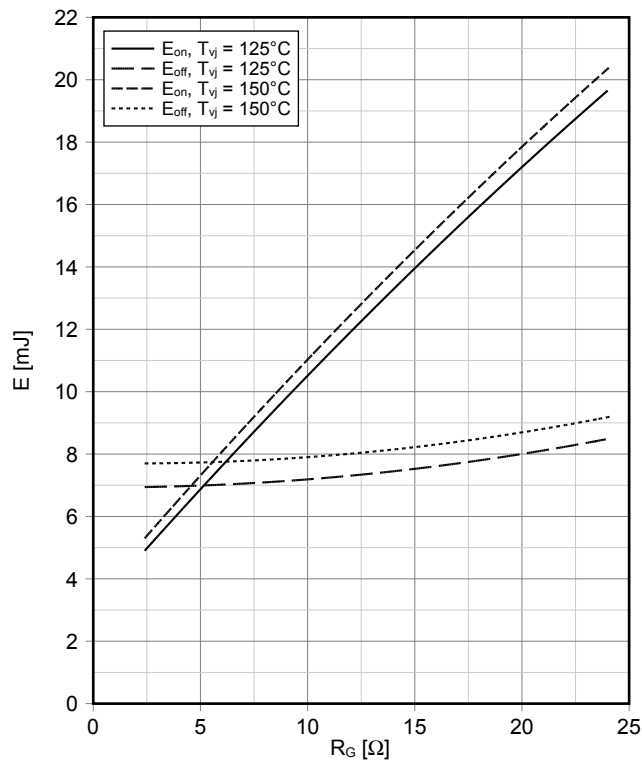
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$

$V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 2.4\ \Omega$, $R_{Goff} = 2.4\ \Omega$, $V_{CE} = 350\text{ V}$



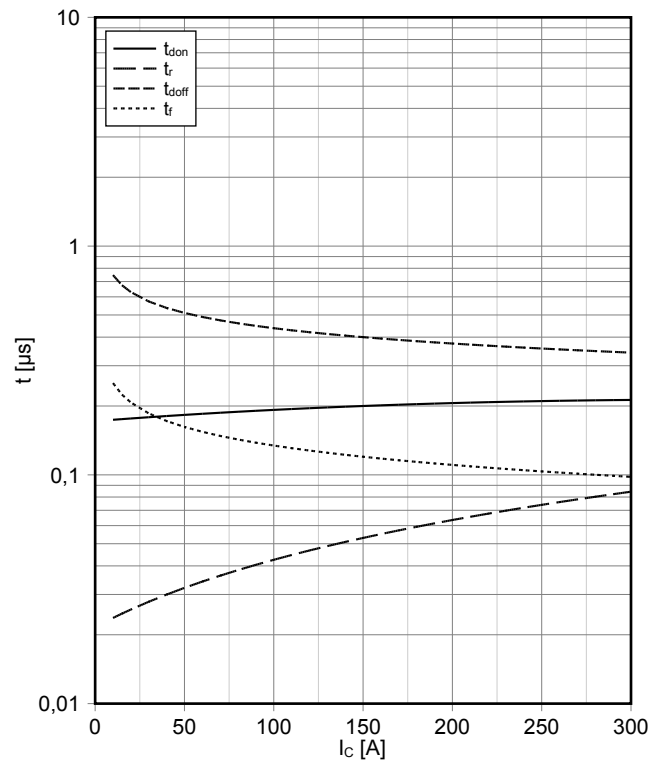
开关损耗 IGBT, 逆变器 (典型) switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
 $V_{GE} = \pm 15 \text{ V}$, $I_C = 150 \text{ A}$, $V_{CE} = 350 \text{ V}$



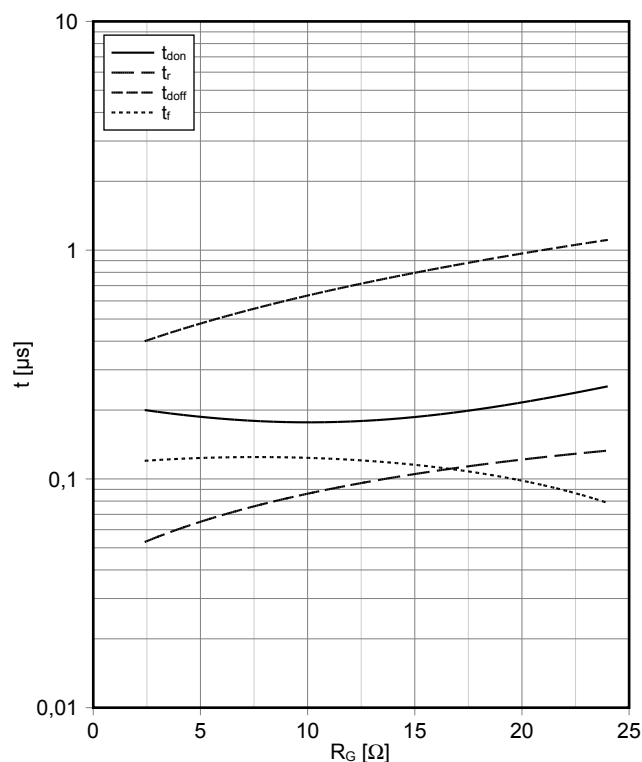
??? IGBT, 逆变器 (典型) switching times IGBT, Inverter (typical)

$t_{don} = f(I_C)$, $t_r = f(I_C)$, $t_{doff} = f(I_C)$, $t_f = f(I_C)$
 $V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 2.4 \Omega$, $R_{Goff} = 2.4 \Omega$, $V_{CE} = 350 \text{ V}$, $T_{vj} = 150^\circ\text{C}$



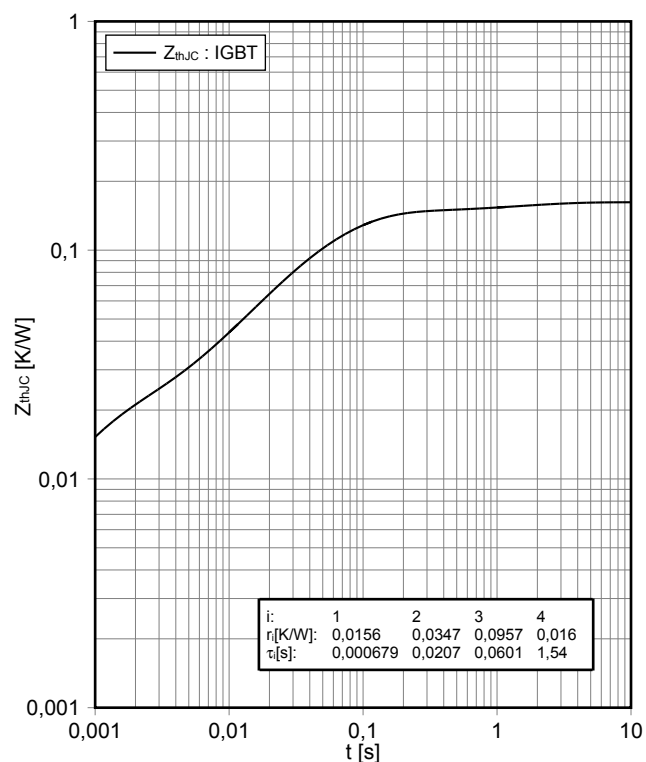
??? IGBT, 逆变器 (典型) switching times IGBT, Inverter (typical)

$t_{don} = f(R_G)$, $t_r = f(R_G)$, $t_{doff} = f(R_G)$, $t_f = f(R_G)$
 $V_{GE} = \pm 15 \text{ V}$, $I_C = 150 \text{ A}$, $V_{CE} = 350 \text{ V}$, $T_{vj} = 150^\circ\text{C}$

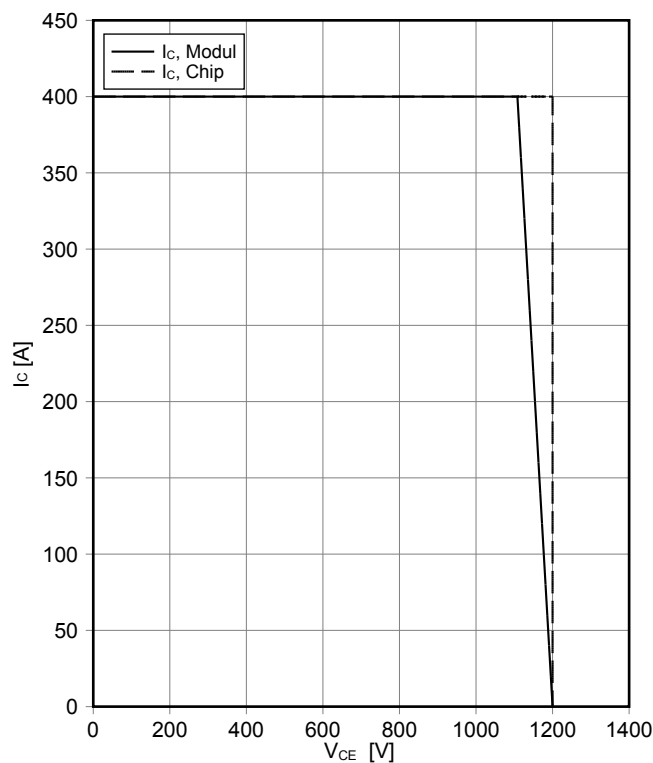


瞬态热阻抗 IGBT, 逆变器 transient thermal impedance IGBT, Inverter

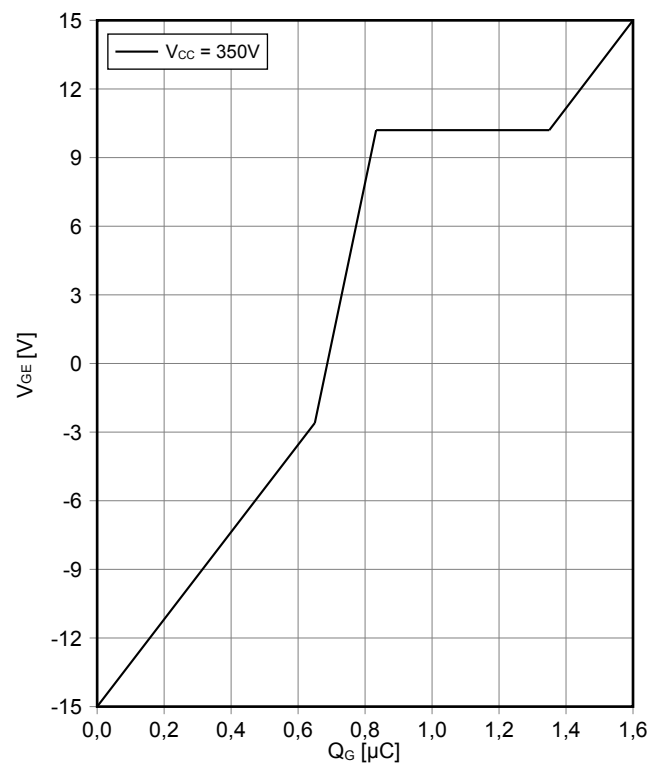
$Z_{thJC} = f(t)$



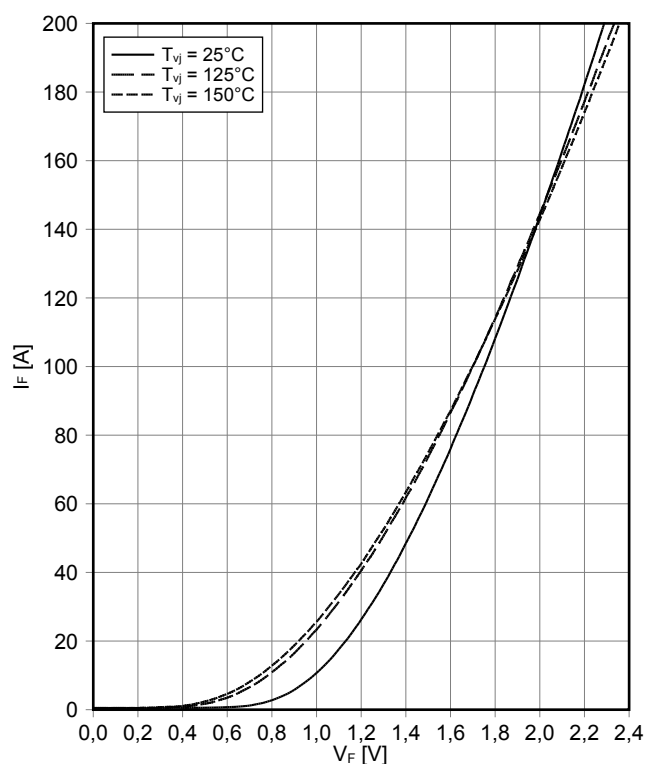
反偏安全工作区 IGBT, 逆变器 (RBSOA)
reverse bias safe operating area IGBT, Inverter (RBSOA)
 $I_C = f(V_{CE})$
 $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 2.4 \Omega$, $T_{vj} = 150^\circ\text{C}$



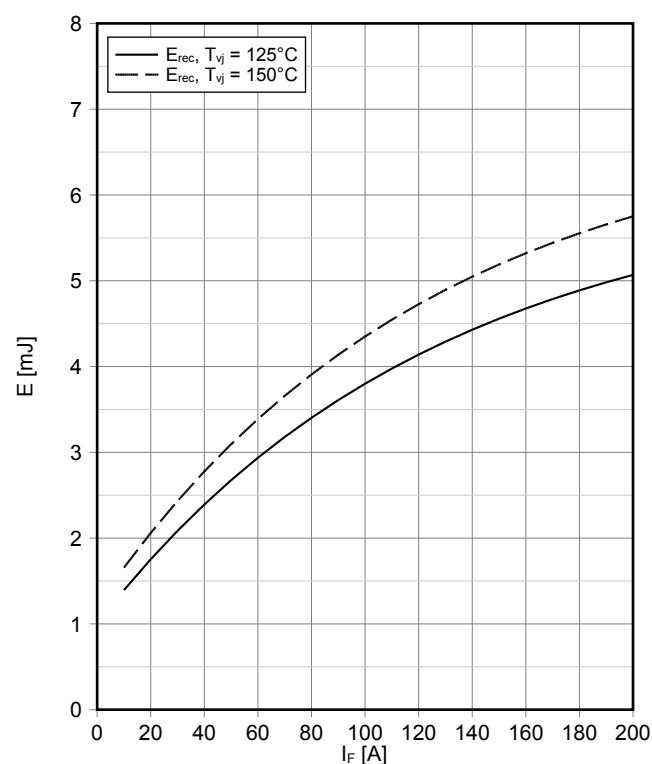
栅极电荷特性 IGBT, 逆变器 (典型)
gate charge characteristic IGBT, Inverter (typical)
 $V_{GE} = f(Q_G)$
 $I_C = 150 \text{ A}$, $T_{vj} = 25^\circ\text{C}$



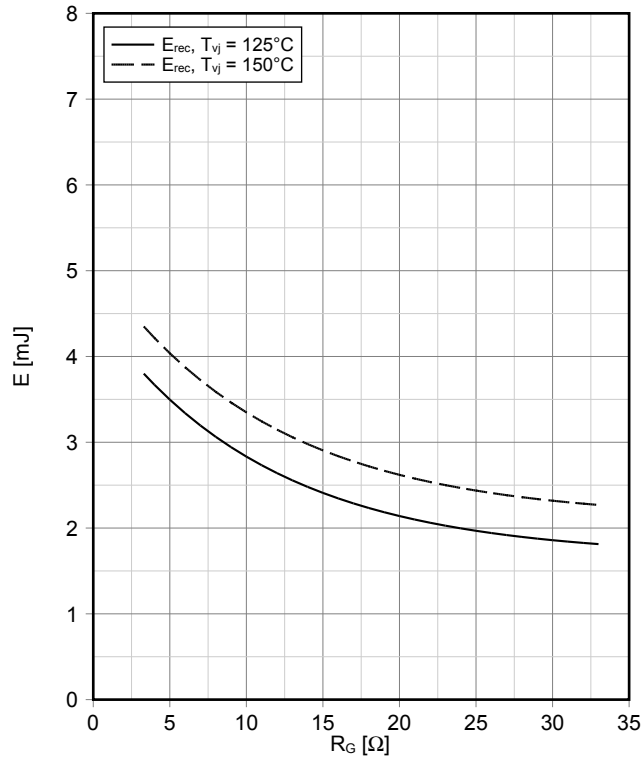
正向偏压特性 二极管, 逆变器 (典型)
forward characteristic of Diode, Inverter (typical)
 $I_F = f(V_F)$



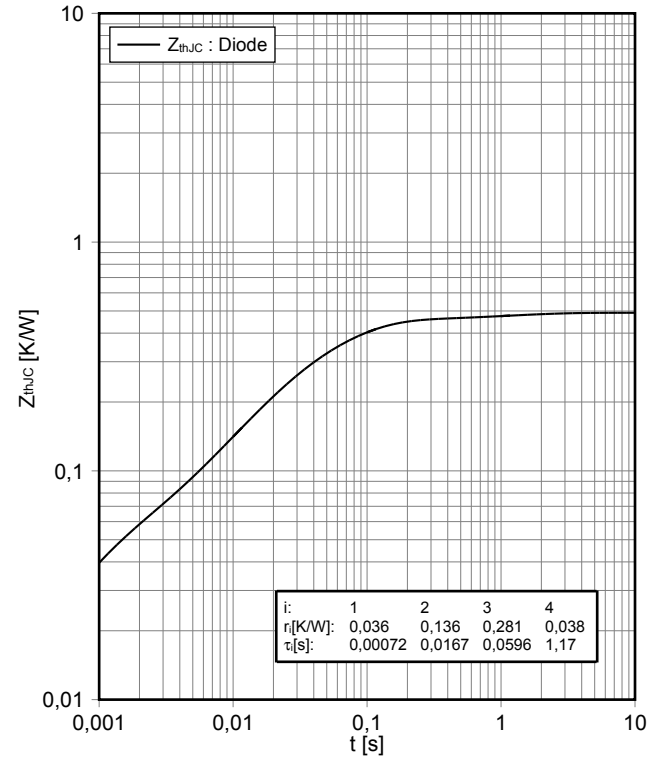
开关损耗 二极管, 逆变器 (典型)
switching losses Diode, Inverter (typical)
 $E_{rec} = f(I_F)$
 $R_{Gon} = 3.3 \Omega$, $V_{CE} = 350 \text{ V}$



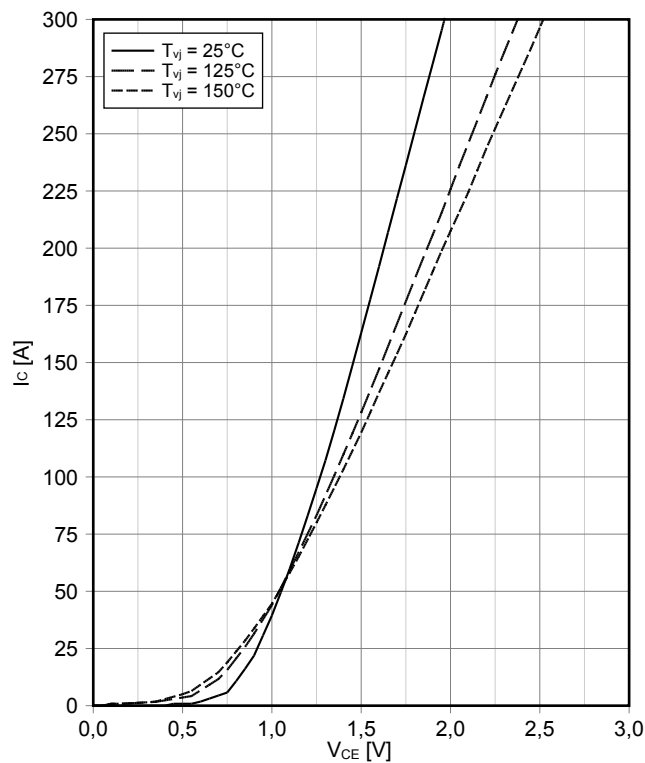
开关损耗 二极管,逆变器 (典型)
switching losses Diode, Inverter (typical)
 $E_{rec} = f(R_G)$
 $I_F = 100\text{ A}$, $V_{CE} = 350\text{ V}$



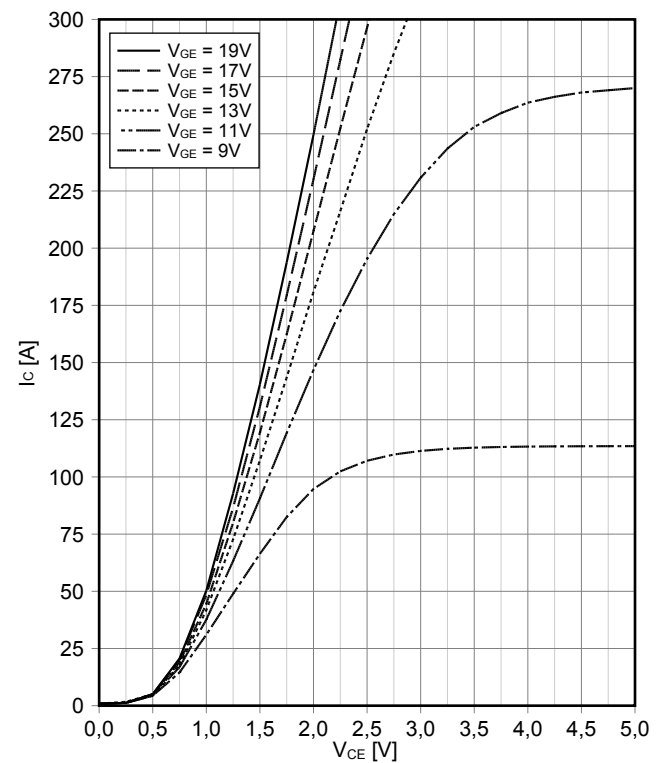
瞬态热阻抗 二极管,逆变器
transient thermal impedance Diode, Inverter
 $Z_{thJC} = f(t)$



输出特性 IGBT, 三电平 (典型)
output characteristic IGBT,3-Level (typical)
 $I_C = f(V_{CE})$
 $V_{GE} = 15\text{ V}$



输出特性 IGBT, 三电平 (典型)
output characteristic IGBT,3-Level (typical)
 $I_C = f(V_{CE})$
 $T_{vj} = 150^\circ\text{C}$

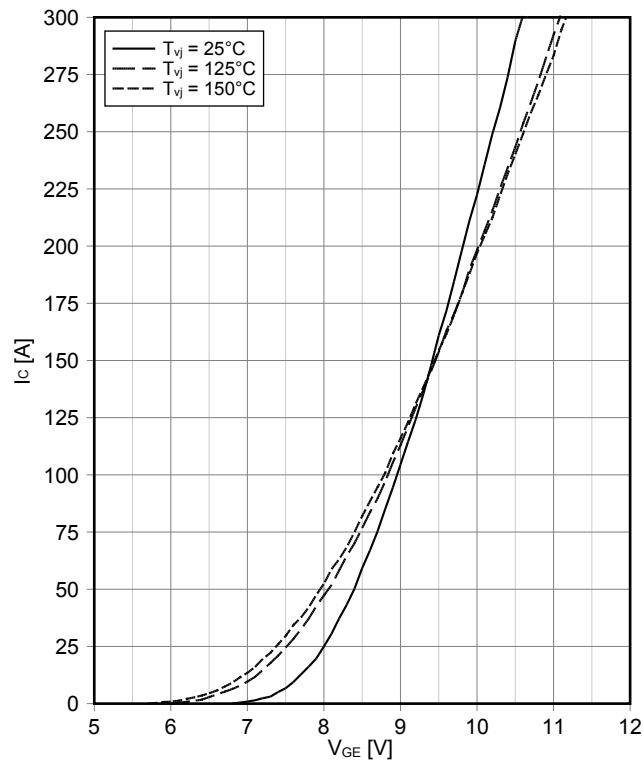


传输特性 IGBT, 三电平 (典型)

transfer characteristic IGBT,3-Level (typical)

$I_C = f(V_{GE})$

$V_{CE} = 20 \text{ V}$

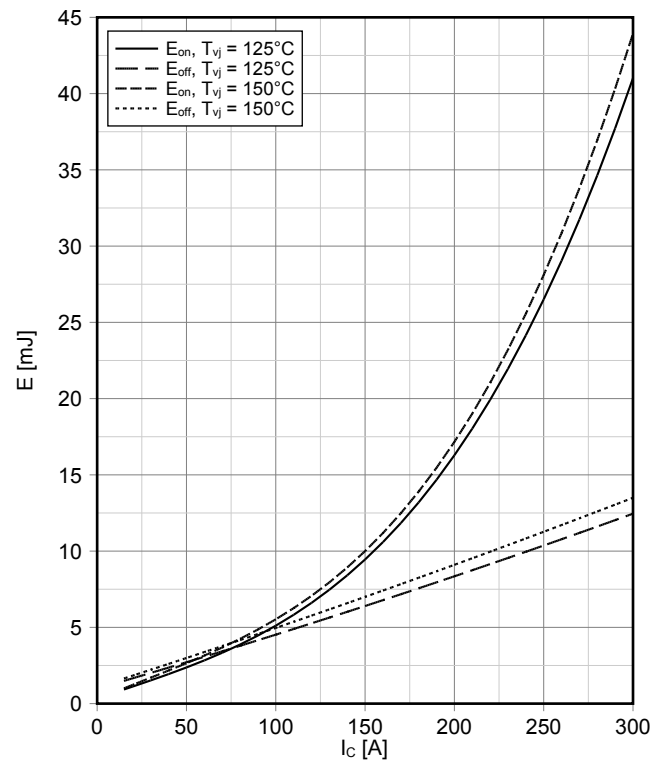


开关损耗 IGBT, 三电平 (典型)

switching losses IGBT,3-Level (typical)

$E_{on} = f(I_C)$, $E_{off} = f(I_C)$

$V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 3.3 \Omega$, $R_{Goff} = 3.3 \Omega$, $V_{CE} = 350 \text{ V}$

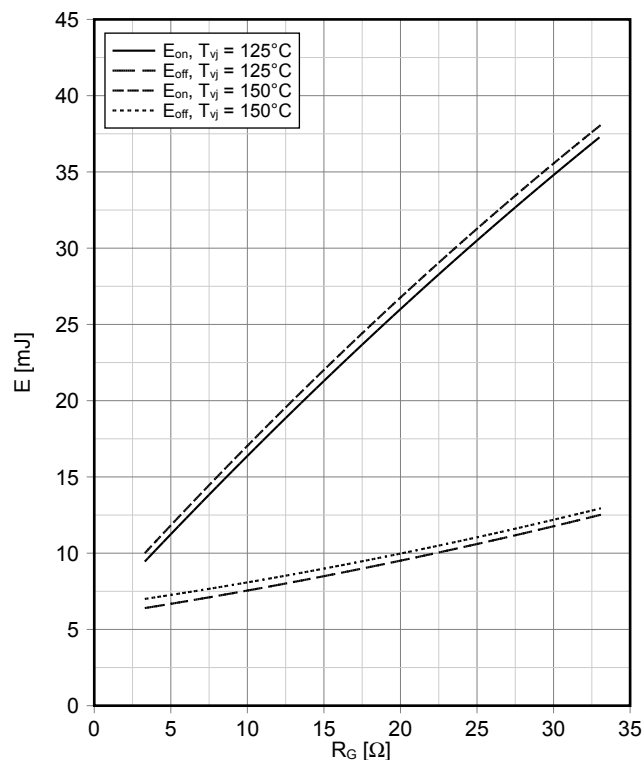


开关损耗 IGBT, 三电平 (典型)

switching losses IGBT,3-Level (typical)

$E_{on} = f(R_G)$, $E_{off} = f(R_G)$

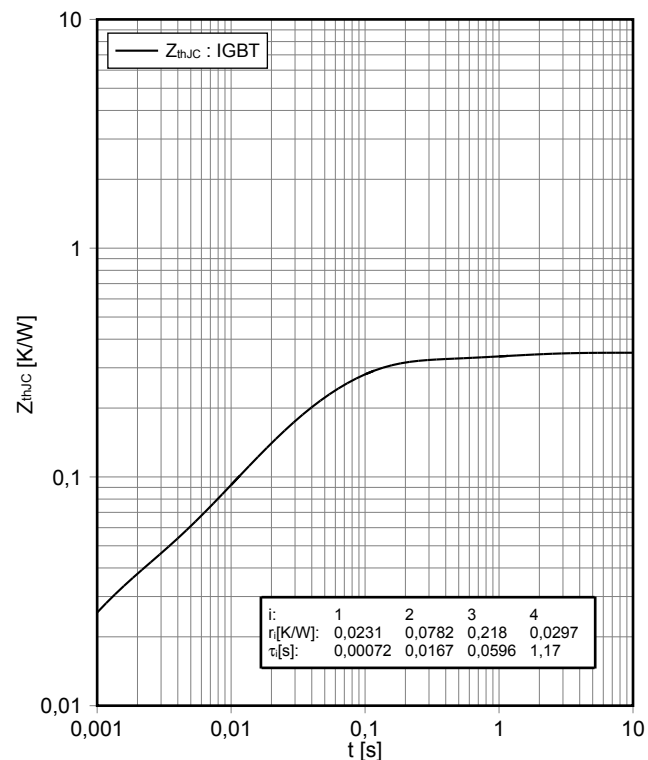
$V_{GE} = \pm 15 \text{ V}$, $I_C = 150 \text{ A}$, $V_{CE} = 350 \text{ V}$



瞬态热阻抗 IGBT, 三电平

transient thermal impedance IGBT,3-Level

$Z_{thJC} = f(t)$

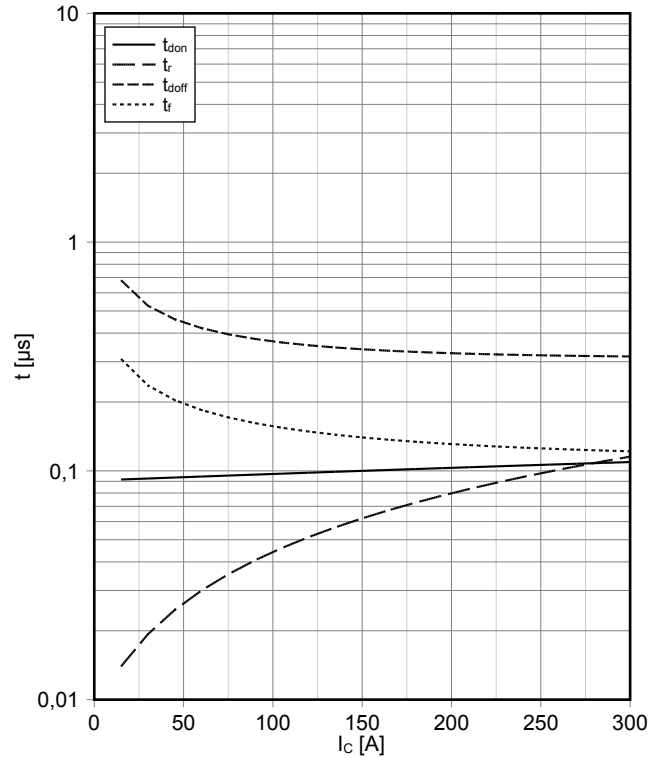


??? IGBT, 三电平 (典型)

switching times IGBT,3-Level (typical)

$t_{don} = f(I_C)$, $t_r = f(I_C)$, $t_{doff} = f(I_C)$, $t_f = f(I_C)$

$V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 3.3 \Omega$, $R_{Goff} = 3.3 \Omega$, $V_{CE} = 350 \text{ V}$, $T_{vj} = 150^\circ\text{C}$

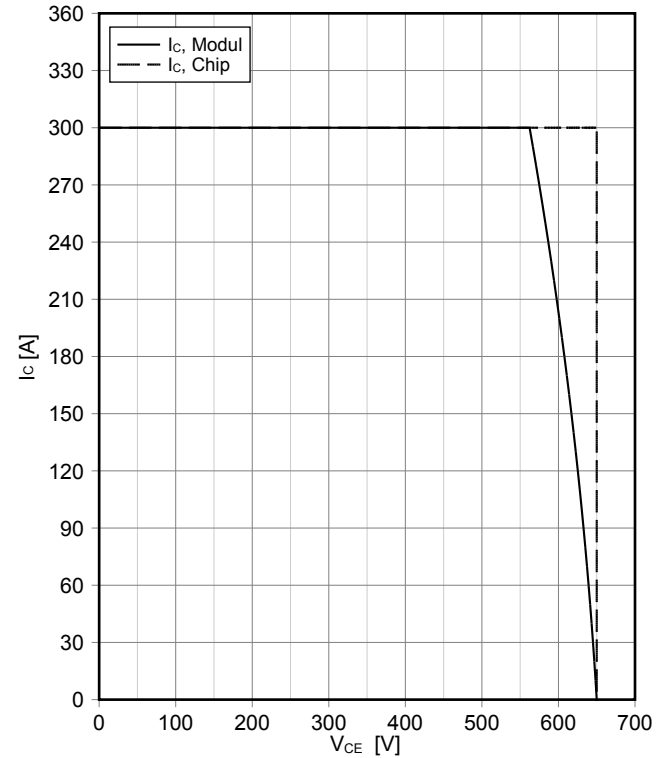


反偏安全工作区 IGBT, 三电平 (RBSOA)

reverse bias safe operating area IGBT,3-Level (RBSOA)

$I_C = f(V_{CE})$

$V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 3.3 \Omega$, $T_{vj} = 150^\circ\text{C}$

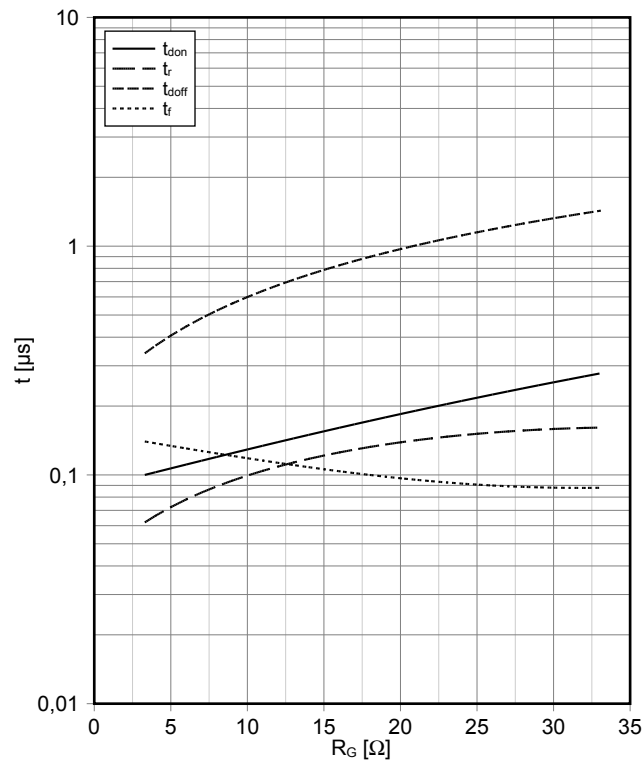


??? IGBT, 三电平 (典型)

switching times IGBT,3-Level (typical)

$t_{don} = f(R_G)$, $t_r = f(R_G)$, $t_{doff} = f(R_G)$, $t_f = f(R_G)$

$V_{GE} = \pm 15 \text{ V}$, $I_C = 150 \text{ A}$, $V_{CE} = 350 \text{ V}$, $T_{vj} = 150^\circ\text{C}$

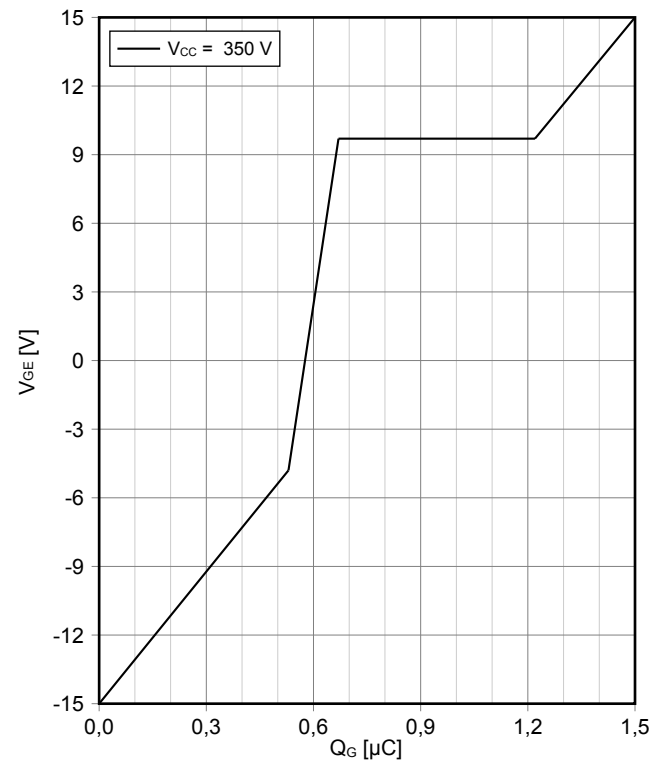


栅极电荷特性 IGBT, 三电平 (典型)

gate charge characteristic IGBT,3-Level (typical)

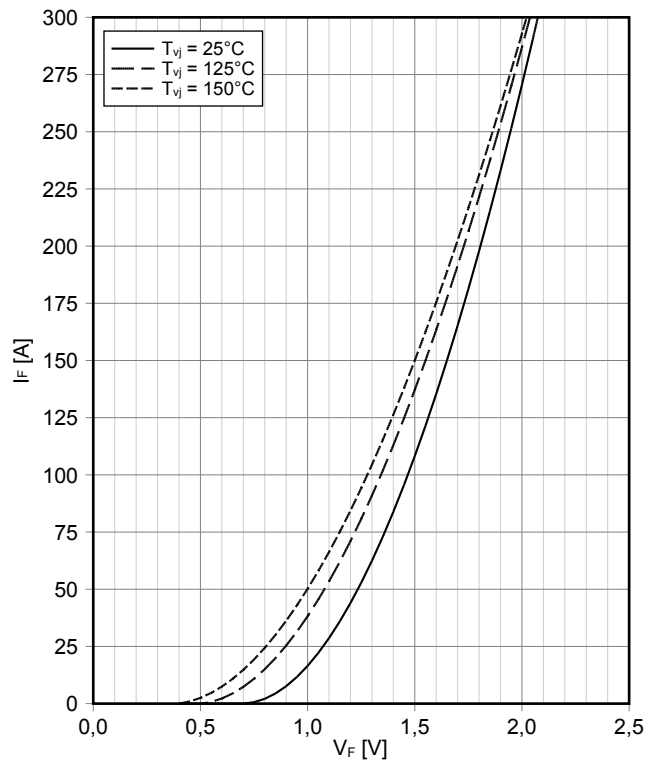
$V_{GE} = f(Q_G)$

$I_C = 150 \text{ A}$, $T_{vj} = 25^\circ\text{C}$



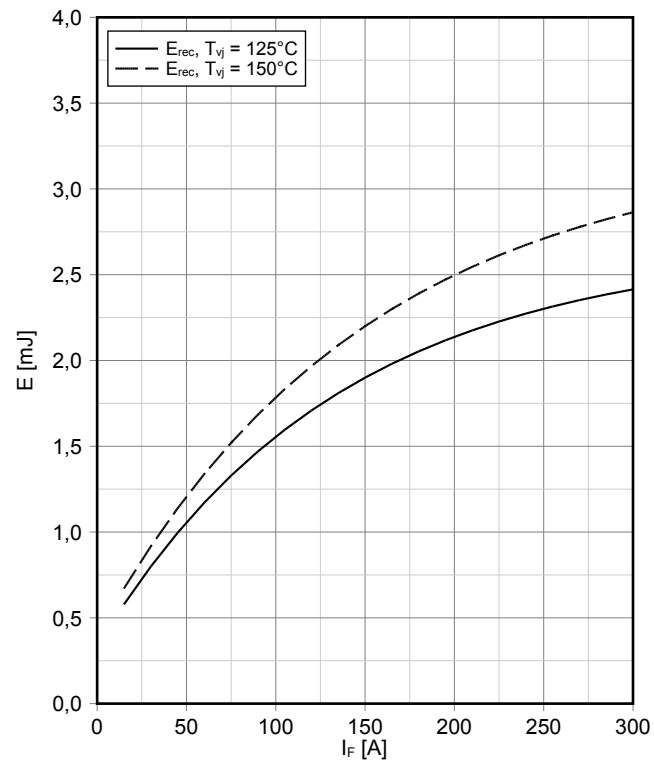
正向偏压特性 二极管, 三电平 (典型)

forward characteristic of Diode, 3-Level (typical)

 $I_F = f(V_F)$ 

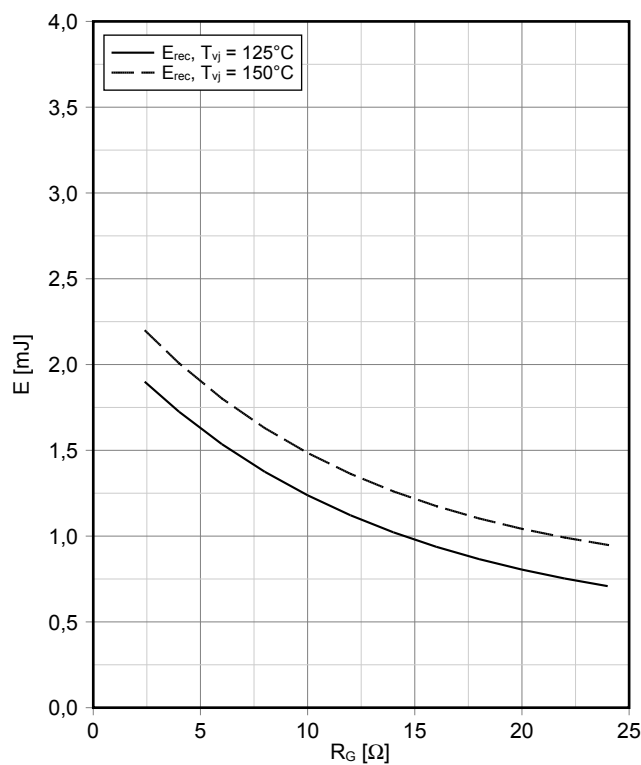
开关损耗 二极管, 三电平 (典型)

switching losses Diode, 3-Level (typical)

 $E_{rec} = f(I_F)$ $R_{Gon} = 2.4 \Omega$, $V_{CE} = 350 \text{ V}$ 

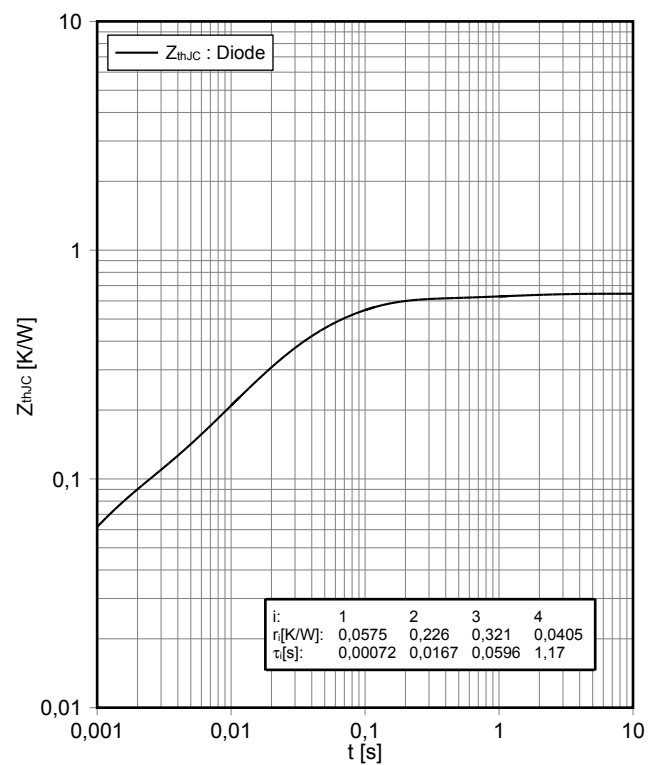
开关损耗 二极管, 三电平 (典型)

switching losses Diode, 3-Level (typical)

 $E_{rec} = f(R_G)$ $I_F = 150 \text{ A}$, $V_{CE} = 350 \text{ V}$ 

瞬态热阻抗 二极管, 三电平

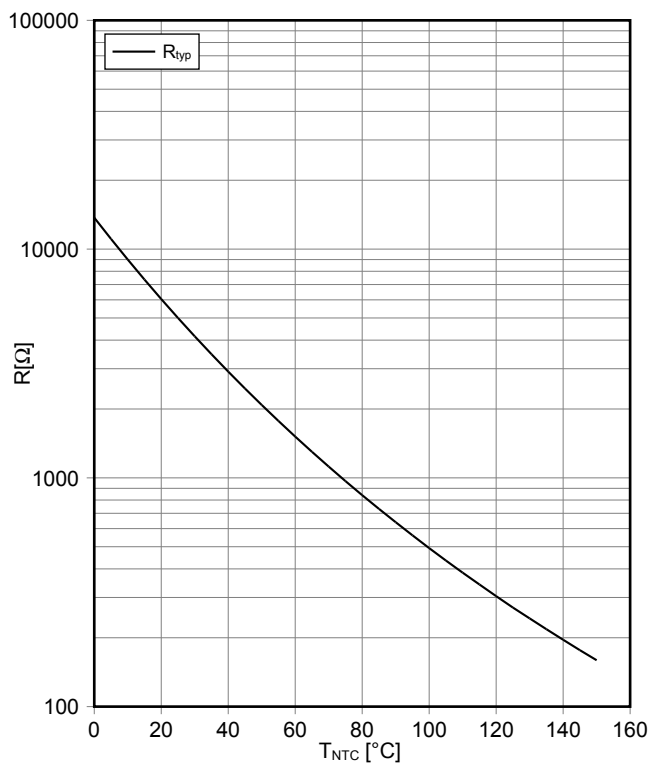
transient thermal impedance Diode, 3-Level

 $Z_{thJC} = f(t)$ 

负温度系数热敏电阻 温度特性

NTC-Thermistor-temperature characteristic (typical)

$R = f(T)$



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