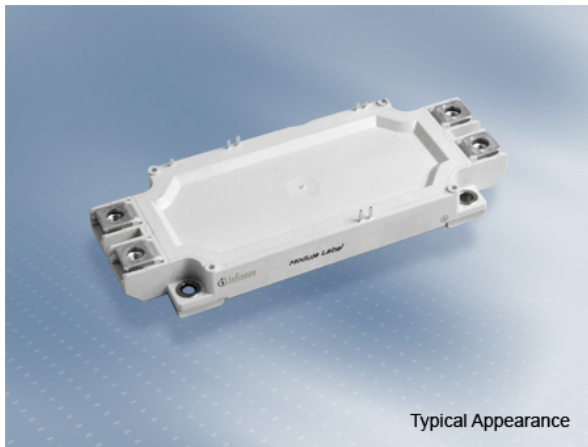


EconoDUAL™3 模块 采用第四代沟槽栅/场终止IGBT4和HE型发射极控制二极管 带有温度检测NTC 和预涂导热介质
EconoDUAL™3 module with Trench/Fieldstop IGBT4 and Emitter Controlled HE diode and NTC / pre-applied Thermal Interface Material



潜在应用

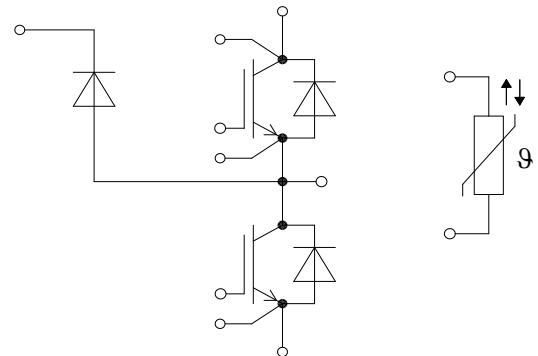
- 三电平应用

电气特性

- $T_{vj\ op} = 150^{\circ}\text{C}$
- V_{CEsat} 带正温度系数
- 低 V_{CEsat}
- 低开关损耗
- 提高工作结温 $T_{vj\ op}$
- 无与伦比的坚固性

机械特性

- 标准封装
- 绝缘的基板
- 预涂导热介质



$$V_{CES} = 1200\text{V}$$

$$I_{C\ nom} = 300\text{A} / I_{CRM} = 600\text{A}$$

Potential Applications

- 3-level-applications

Electrical Features

- $T_{vj\ op} = 150^{\circ}\text{C}$
- V_{CEsat} with positive temperature coefficient
- Low V_{CEsat}
- Low switching losses
- Extended operating temperature $T_{vj\ op}$
- Unbeatable robustness

Mechanical Features

- Standard housing
- Isolated base plate
- Pre-applied Thermal Interface Material

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
连续集电极直流电流 Continuous DC collector current	$T_H = 90^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	$I_{C\text{nom}}$	300	A
集电极重复峰值电流 Repetitive peak collector current	$t_P = 1\text{ ms}$	I_{CRM}	600	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	$I_C = 300\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 300\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 300\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{sat}}$	1,75 2,00 2,05	2,10	V V V
栅极阈值电压 Gate threshold voltage	$I_C = 11,5\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		V_{GEth}	5,20	5,80	6,40 V
栅极电荷 Gate charge	$V_{GE} = -15\text{ V} \dots +15\text{ V}$		Q_G	2,25		μC
内部栅极电阻 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		R_{Gint}	2,5		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}	19,0		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}	1,05		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	$I_C = 300\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 1,0\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{don}	0,18 0,21 0,22		μs μs μs
上升时间(电感负载) Rise time, inductive load	$I_C = 300\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 1,0\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_r	0,05 0,06 0,06		μs μs μs
关断延迟时间(电感负载) Turn-off delay time, inductive load	$I_C = 300\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 1,0\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{doff}	0,38 0,48 0,51		μs μs μs
下降时间(电感负载) Fall time, inductive load	$I_C = 300\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 1,0\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_f	0,05 0,07 0,08		μs μs μs
开通损耗能量(每脉冲) Turn-on energy loss per pulse	$I_C = 300\text{ A}, V_{CE} = 600\text{ V}, L_S = 35\text{ nH}$ $V_{GE} = \pm 15\text{ V}, di/dt = 4300\text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Gon} = 1,0\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{on}	22,5 34,0 37,0		mJ mJ mJ
关断损耗能量(每脉冲) Turn-off energy loss per pulse	$I_C = 300\text{ A}, V_{CE} = 600\text{ V}, L_S = 35\text{ nH}$ $V_{GE} = \pm 15\text{ V}, du/dt = 3450\text{ V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Goff} = 1,0\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{off}	17,5 28,0 31,5		mJ mJ mJ
短路数据 SC data	$V_{GE} \leq 15\text{ V}, V_{CC} = 800\text{ V}$ $V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$	$t_P \leq 10\ \mu\text{s}, T_{vj} = 25^{\circ}\text{C}$ $t_P \leq 10\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$	I_{SC}	1900 1400		A A
结 - 散热器热阻 Thermal resistance, junction to heatsink	每个 IGBT / per IGBT valid with IFX pre-applied thermal interface material		R_{thJH}		0,105	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	300	A
正向重复峰值电流 Repetitive peak forward current	$t_P = 1\text{ ms}$	I_{FRM}	600	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}	19000 15500	A^2s A^2s

特征值 / Characteristic Values

			min.	typ.	max.	
正向电压 Forward voltage	$I_F = 300\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 300\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 300\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	V_F	1,65 1,65 1,65	2,15	V V V
反向恢复峰值电流 Peak reverse recovery current	$I_F = 300\text{ A}, -di_F/dt = 4300\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	I_{RM}	225 265 275		A A A
恢复电荷 Recovered charge	$I_F = 300\text{ A}, -di_F/dt = 4300\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	Q_r	29,5 57,0 65,5		μC μC μC
反向恢复损耗 (每脉冲) Reverse recovery energy	$I_F = 300\text{ A}, -di_F/dt = 4300\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{rec}	10,5 21,5 25,5		mJ mJ mJ
结 - 散热器热阻 Thermal resistance, junction to heatsink	每个二极管 / per diode valid with IFX pre-applied thermal interface material		R_{thJH}		0,133	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}	1200	V
连续正向直流电流 Continuous DC forward current		I_F	300	A
正向重复峰值电流 Repetitive peak forward current	$t_P = 1\text{ ms}$	I_{FRM}	600	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}	19000 15500	A^2s A^2s

特征值 / Characteristic Values

			min.	typ.	max.	
正向电压 Forward voltage	$I_F = 300\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 300\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 300\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	V_F	1,65 1,65 1,65	2,15	V V V
反向恢复峰值电流 Peak reverse recovery current	$I_F = 300\text{ A}, -di_F/dt = 4300\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	I_{RM}	225 265 275		A A A
恢复电荷 Recovered charge	$I_F = 300\text{ A}, -di_F/dt = 4300\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	Q_r	29,5 57,0 65,5		μC μC μC
反向恢复损耗 (每脉冲) Reverse recovery energy	$I_F = 300\text{ A}, -di_F/dt = 4300\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{rec}	10,5 21,5 25,5		mJ mJ mJ
结 - 散热器热阻 Thermal resistance, junction to heatsink	每个二极管 / per diode valid with IFX pre-applied thermal interface material		R_{thJH}		0,133	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	$T_{NTC} = 100^{\circ}\text{C}$, $R_{100} = 493 \Omega$	$\Delta R/R$	-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, $f = 50 \text{ Hz}$, $t = 1 \text{ min}$	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_2O_3		
爬电距离 Creepage distance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal			14,5 13,0		mm
电气间隙 Clearance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal			12,5 10,0		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}		35		nH
模块引线电阻,端子-芯片 Module lead resistance, terminals - chip	$T_H = 25^{\circ}\text{C}$, 每个开关 / per switch	$R_{\text{CC}+\text{EE}'}$		1,45		m Ω
储存温度 Storage temperature		T_{stg}	-40		125	$^{\circ}\text{C}$
最高基板工作温度 Maximum baseplate operation temperature		T_{BPmax}			125	$^{\circ}\text{C}$
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 M6 根据相应的应用手册进行安装 Screw M6 - Mounting according to valid application note	M	3,0	-	6,0	Nm
重量 Weight		G		345		g

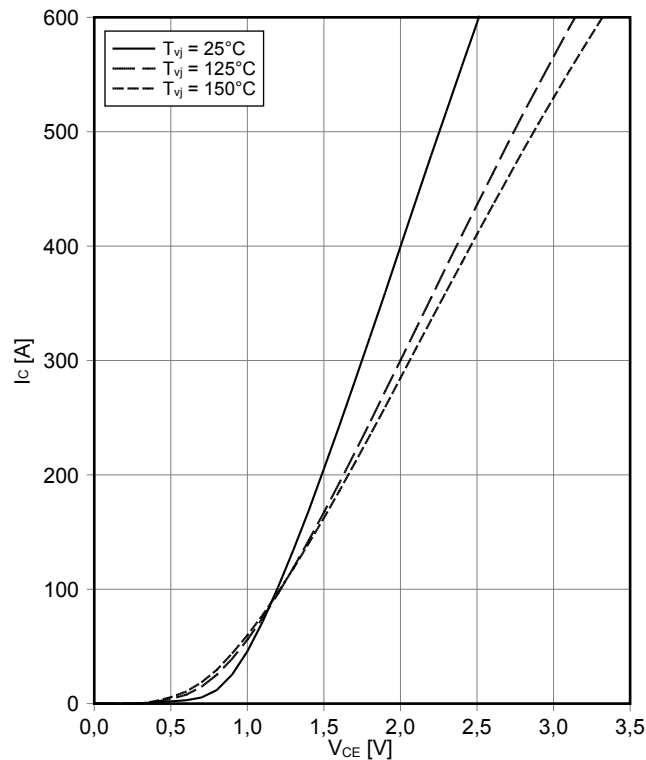
Lagerung und Transport von Modulen mit TIM => siehe AN2012-07
 Storage and shipment of modules with TIM => see AN2012-07

输出特性 IGBT, 逆变器 (典型)

output characteristic IGBT, Inverter (typical)

$I_C = f(V_{CE})$

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

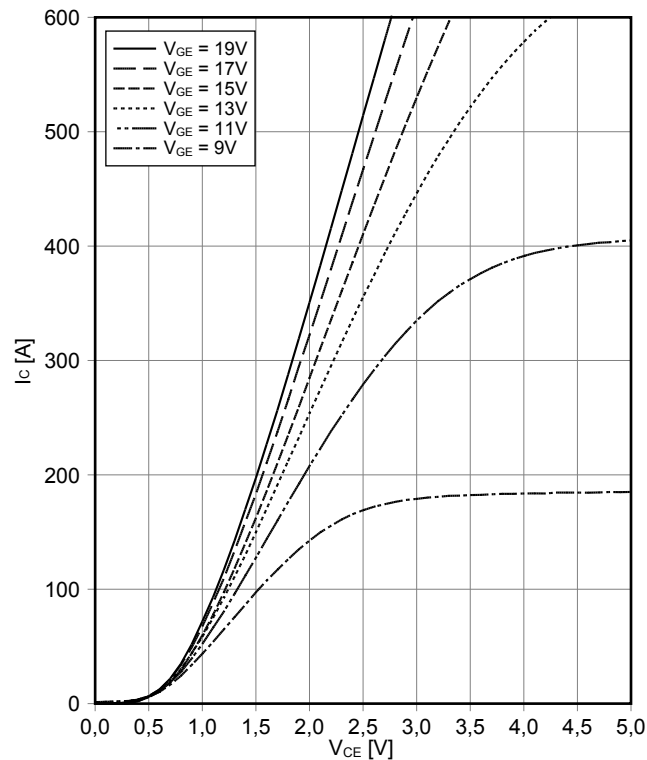


输出特性 IGBT, 逆变器 (典型)

output characteristic IGBT, Inverter (typical)

$I_C = f(V_{CE})$

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

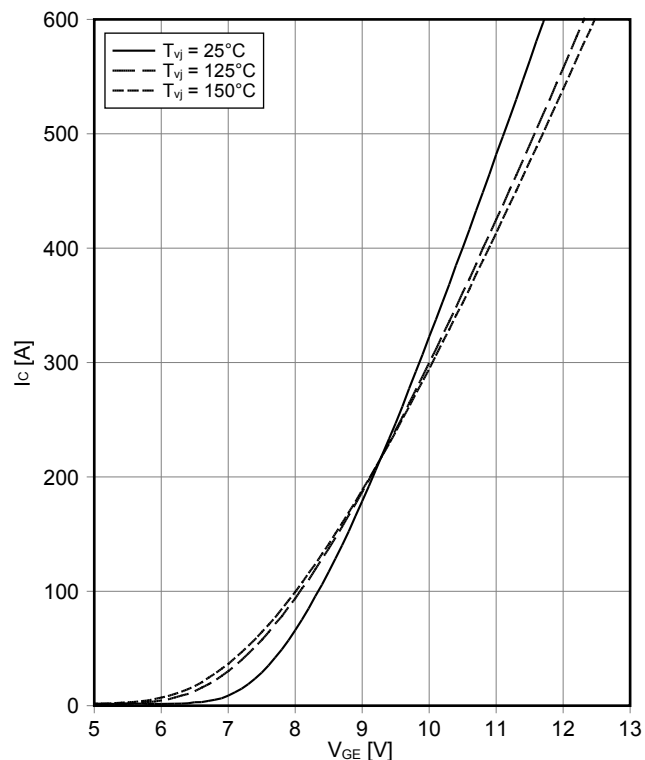


传输特性 IGBT, 逆变器 (典型)

transfer characteristic IGBT, Inverter (typical)

$I_C = f(V_{GE})$

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

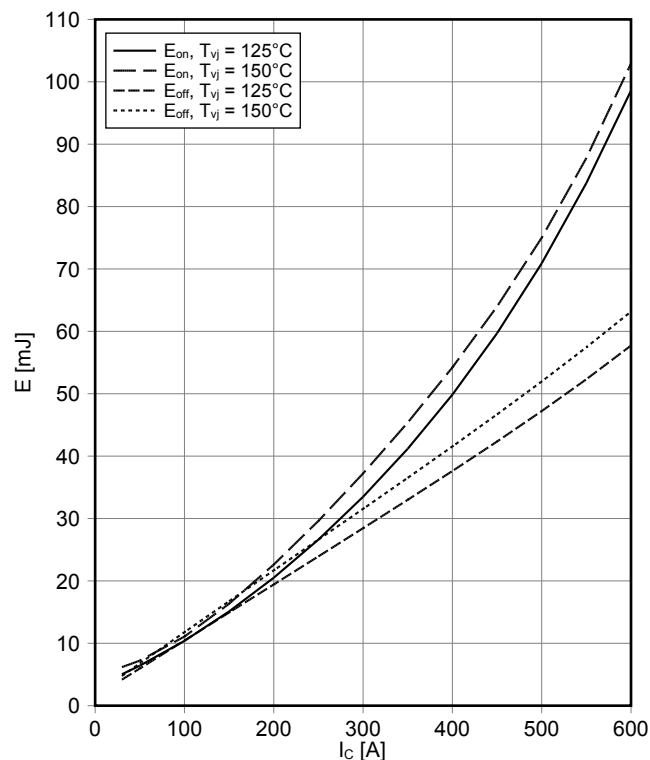


开关损耗 IGBT, 逆变器 (典型)

switching losses IGBT, Inverter (typical)

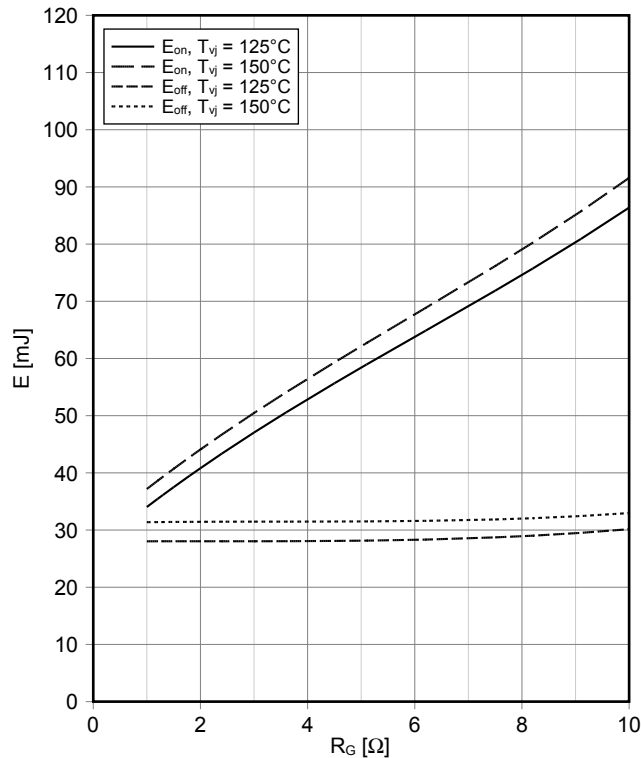
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$

$V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 1\ \Omega$, $R_{Goff} = 1\ \Omega$, $V_{CE} = 600\text{ V}$



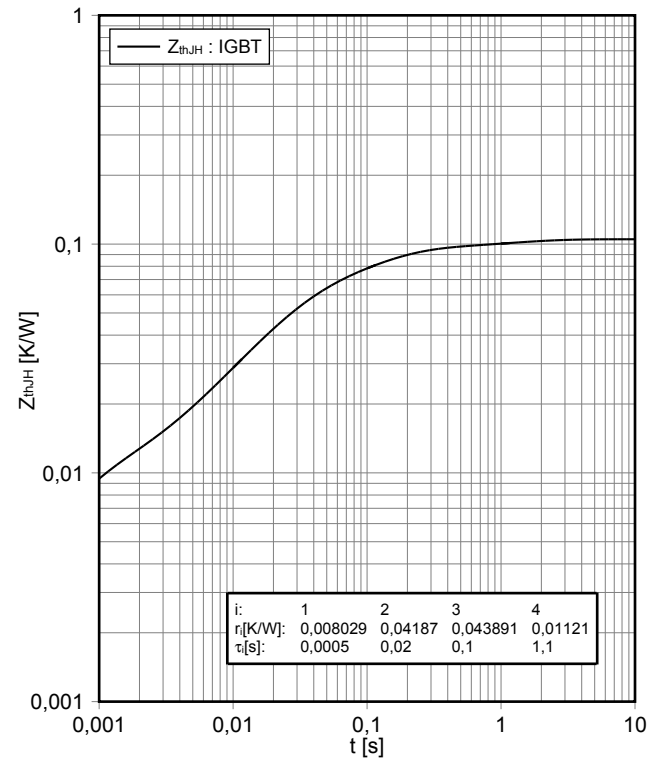
开关损耗 IGBT, 逆变器 (典型) switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
 $V_{GE} = \pm 15 \text{ V}$, $I_C = 300 \text{ A}$, $V_{CE} = 600 \text{ V}$



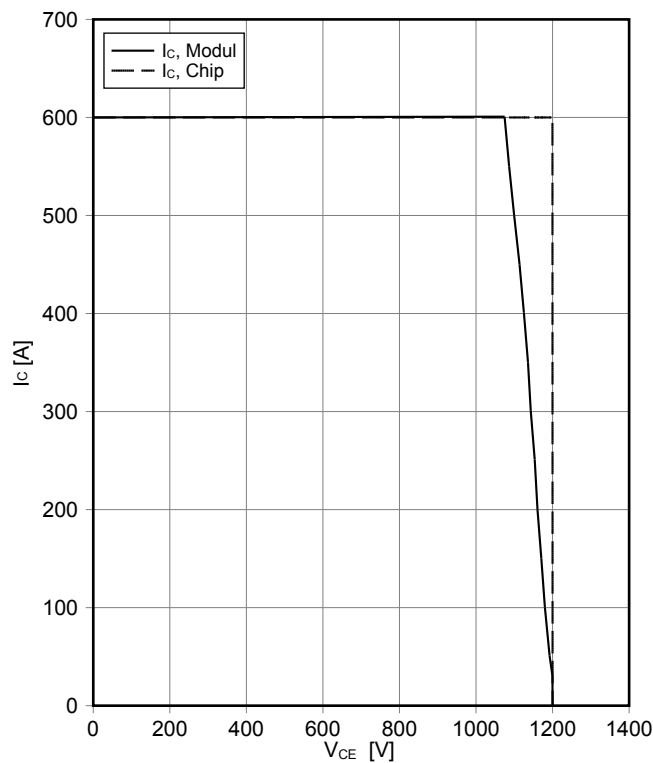
瞬态热阻抗 IGBT, 逆变器 transient thermal impedance IGBT, Inverter

$Z_{thJH} = f(t)$



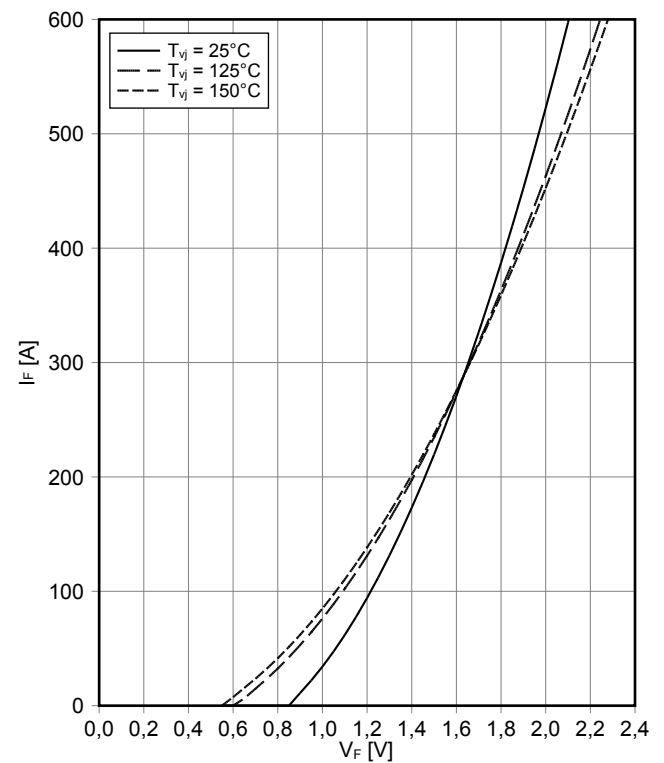
反偏安全工作区 IGBT, 逆变器 (RBSOA) reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$
 $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 1 \Omega$, $T_{vj} = 150^\circ\text{C}$

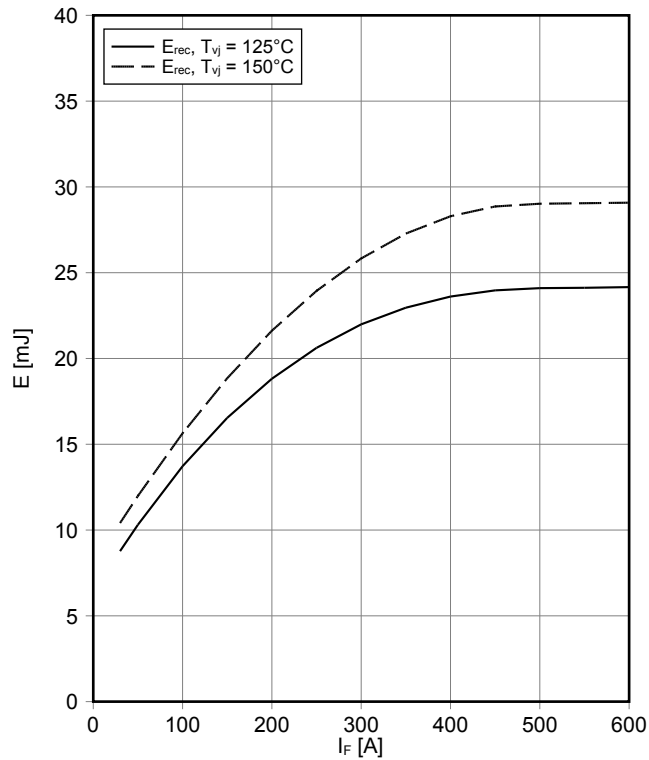


正向偏压特性 二极管, 逆变器 (典型) forward characteristic of Diode, Inverter (typical)

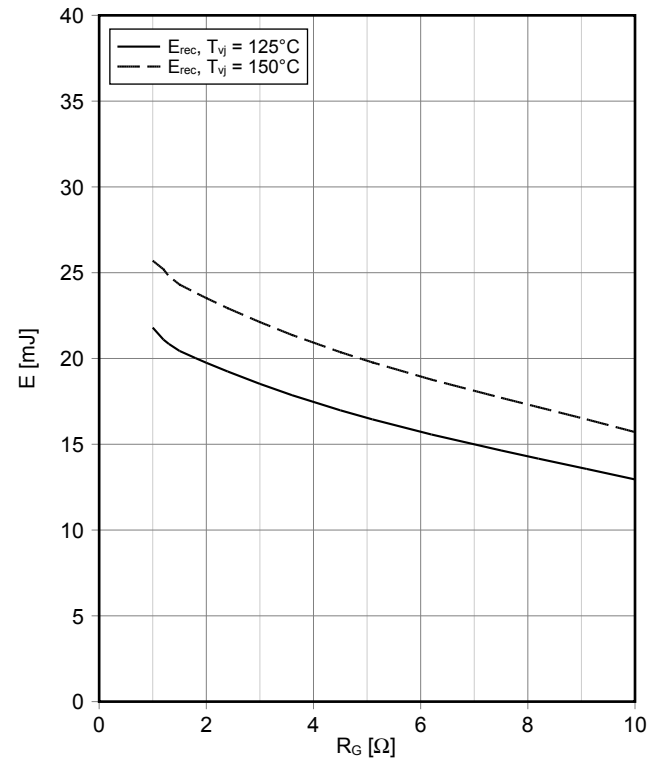
$I_F = f(V_F)$



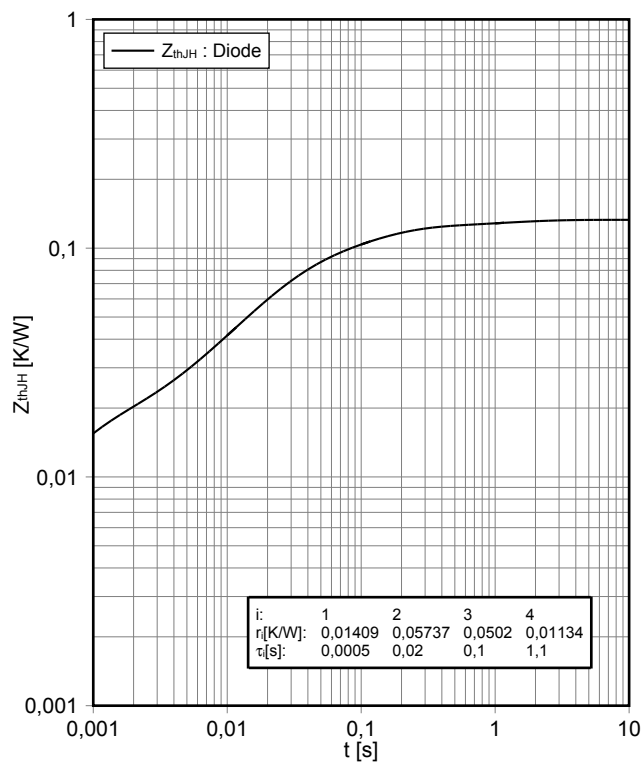
开关损耗 二极管,逆变器 (典型)
switching losses Diode, Inverter (typical)
 $E_{rec} = f(I_F)$
 $R_{Gon} = 1 \Omega$, $V_{CE} = 600 V$



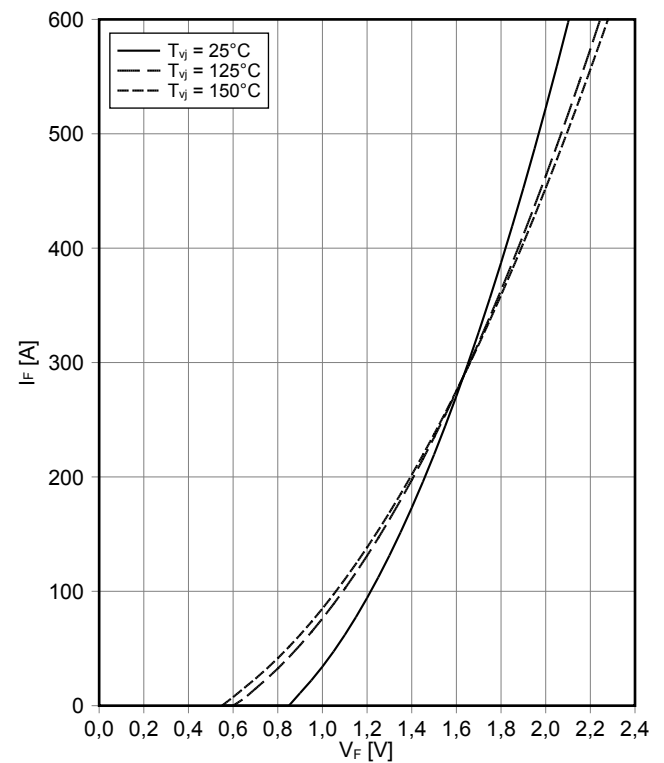
开关损耗 二极管,逆变器 (典型)
switching losses Diode, Inverter (typical)
 $E_{rec} = f(R_G)$
 $I_F = 300 A$, $V_{CE} = 600 V$



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



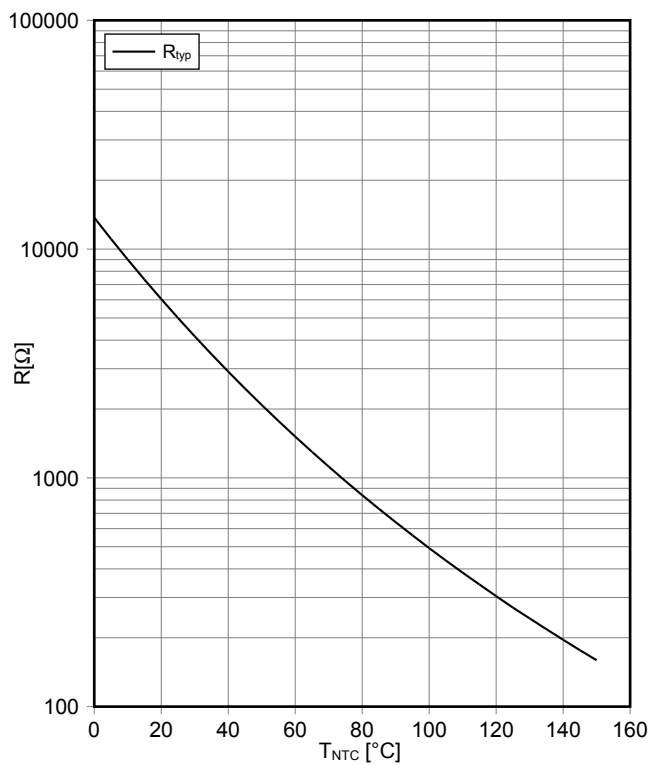
正向偏压特性 二极管, 三电平 (典型)
forward characteristic of Diode, 3-Level (typical)
 $I_F = f(V_F)$



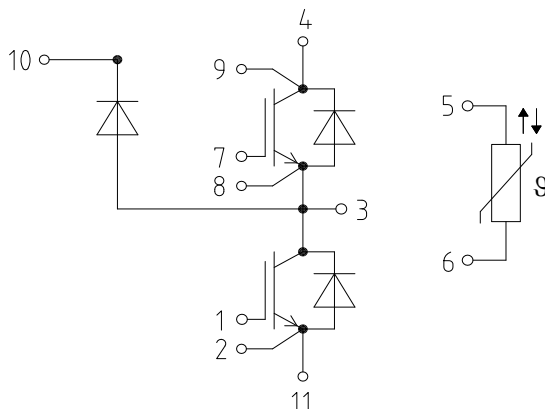
负温度系数热敏电阻 温度特性

NTC-Thermistor-temperature characteristic (typical)

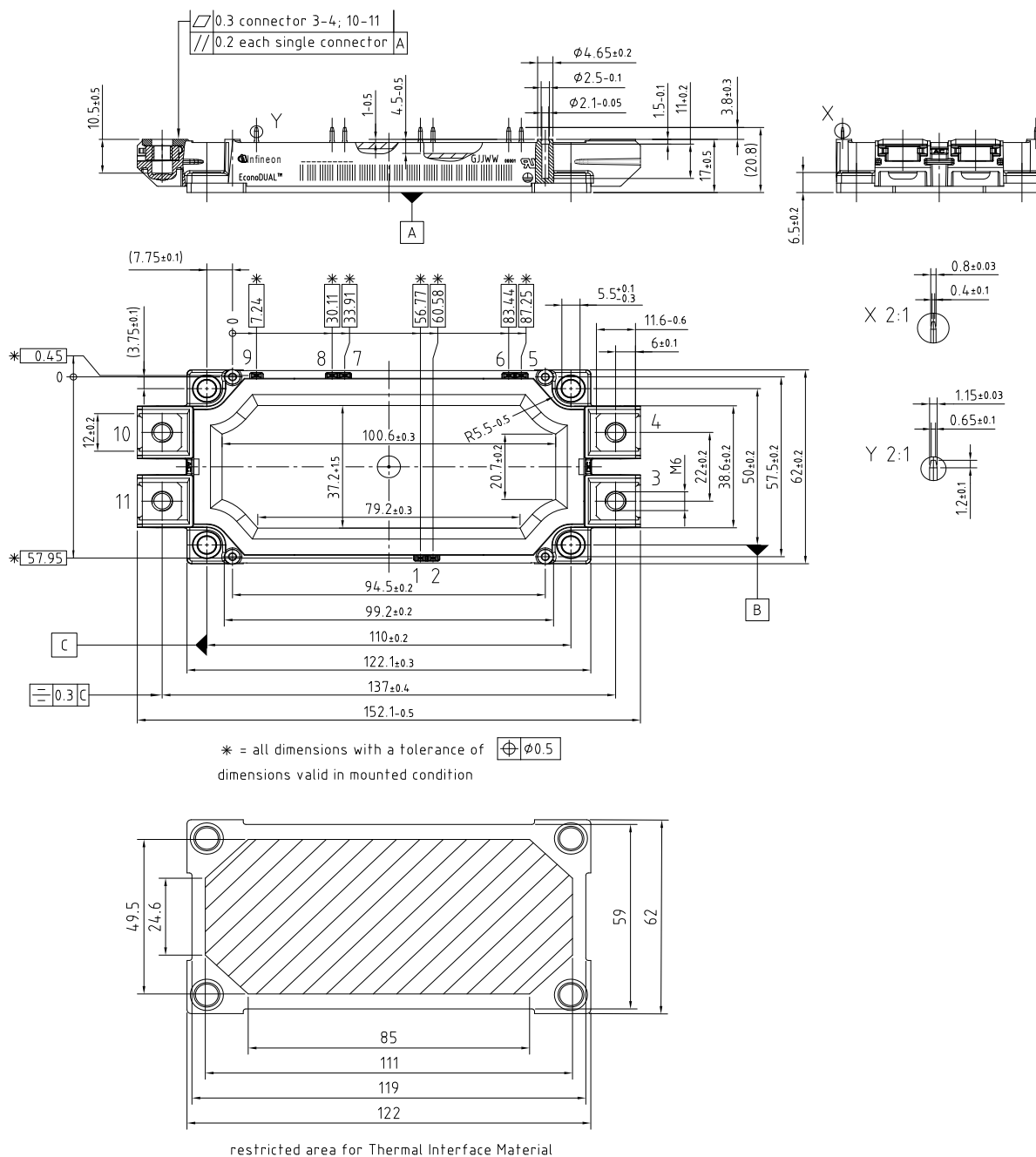
$R = f(T)$



接线图 / Circuit diagram



封装尺寸 / Package outlines



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