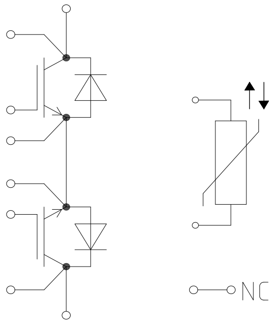
FF600R12ME4E_B11

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pressfit压接管脚和温度检测NTC
EconoDUAL™3 module with Trench/Fieldstop IGBT4 and Emitter Controlled HE diode and PressFIT / NTC

Typical Appearance



V_{CES} = 1200V
$I_{C\ nom}$ = 600A / I_{CRM} = 1200A

潜在应用
• UPS系统
• 太阳能应用
• 电机传动
• 辅助逆变器

Potential Applications
• UPS systems
• Solar applications
• Motor drives
• Auxiliary inverters

电气特性
• $T_{vj\ op}$ = 150°C
• V_{CEsat} 带正温度系数
• 低 V_{CEsat}

Electrical Features
• $T_{vj\ op}$ = 150°C
• V_{CEsat} with positive temperature coefficient
• Low V_{CEsat}

机械特性
• PressFIT 压接技术
• 标准封装
• 绝缘的基板
• 高功率密度

Mechanical Features
• PressFIT contact technology
• Standard housing
• Isolated base plate
• High power density

Module Label Code

Barcode Code 128

00000123456000000000000

DMX - 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°C	V_{CES}	1200	V
连续集电极直流电流 Continuous DC collector current	T_C = 100°C, $T_{vj\,max}$ = 175°C	$I_{C\,nom}$	600	A
集电极重复峰值电流 Repetitive peak collector current	t_P = 1 ms	I_{CRM}	1200	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 = 600 A, V_{GE} = 15 V I_C = 600 A, V_{GE} = 15 V I_C = 600 A, V_{GE} = 15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$V_{CE\,sat}$		1,75 2,00 2,05	2,10	V V V
栅极阈值电压 Gate threshold voltage	I_C = 23,0 mA, V_{CE} = V_{GE}, T_{vj} = 25°C		V_{GEth}	5,25	5,80	6,35	V
栅极电荷 Gate charge	V_{GE} = -15 V ... +15 V		Q_G		4,40		µC
内部栅极电阻 Internal gate resistor	T_{vj} = 25°C		R_{Gint}		1,2		Ω
输入电容 Input capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V		C_{ies}		37,0		nF
反向传输电容 Reverse transfer capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V		C_{res}		2,05		nF
集电极-发射极截止电流 Collector-emitter cut-off current	V_{CE} = 1200 V, V_{GE} = 0 V, T_{vj} = 25°C		I_{CES}			3,0	mA
栅极-发射极漏电流 Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25°C		I_{GES}			400	nA
开通延迟时间(电感负载) Turn-on delay time, inductive load	I_C = 600 A, V_{CE} = 400 V V_{GE} = ±15 V R_{Gon} = 1,3 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\,on}$		0,16 0,19 0,19		µs µs µs
上升时间(电感负载) Rise time, inductive load	I_C = 600 A, V_{CE} = 400 V V_{GE} = ±15 V R_{Gon} = 1,3 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_r		0,13 0,14 0,15		µs µs µs
关断延迟时间(电感负载) Turn-off delay time, inductive load	I_C = 600 A, V_{CE} = 400 V V_{GE} = ±15 V R_{Goff} = 1,3 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\,off}$		0,40 0,47 0,51		µs µs µs
下降时间(电感负载) Fall time, inductive load	I_C = 600 A, V_{CE} = 400 V V_{GE} = ±15 V R_{Goff} = 1,3 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_f		0,10 0,17 0,19		µs µs µs
开通损耗能量 (每脉冲) Turn-on energy loss per pulse	I_C = 600 A, V_{CE} = 400 V, L_S = 65 nH V_{GE} = ±15 V, di/dt = 3050 A/µs (T_{vj} = 150°C) R_{Gon} = 1,3 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{on}		36,0 54,0 59,0		mJ mJ mJ
关断损耗能量 (每脉冲) Turn-off energy loss per pulse	I_C = 600 A, V_{CE} = 400 V, L_S = 65 nH V_{GE} = ±15 V, du/dt = 2700 V/µs (T_{vj} = 150°C) R_{Goff} = 1,3 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{off}		38,5 55,0 62,0		mJ mJ mJ
短路数据 SC data	V_{GE} ≤ 15 V, V_{CC} = 800 V V_{CEmax} = V_{CES} -L_{sCE} ·di/dt	t_P ≤ 10 µs, T_{vj} = 150°C	I_{SC}		2400		A
结 - 外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT		R_{thJC}			0,0473	K/W
外壳 - 散热器热阻 Thermal resistance, case to heatsink	每个 IGBT / per IGBT λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)		R_{thCH}		0,0302		K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\,op}$	-40		150	°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°C	V_{RRM}	1200	V
连续正向直流电流 Continuous DC forward current		I_F	600	A
正向重复峰值电流 Repetitive peak forward current	t_P = 1 ms	I_{FRM}	1200	A
I2t-值 I^2t - value	V_R = 0 V, t_P = 10 ms, T_{vj} = 125°C V_R = 0 V, t_P = 10 ms, T_{vj} = 150°C	I^2t	40000 37500	A^2s A^2s

特征值 / Characteristic Values

				min.	typ.	max.	
正向电压 Forward voltage	I_F = 600 A, V_{GE} = 0 V I_F = 600 A, V_{GE} = 0 V I_F = 600 A, V_{GE} = 0 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	V_F		1,65 1,65 1,65	2,10	V V V
反向恢复峰值电流 Peak reverse recovery current	I_F = 600 A, - di_F/dt = 3750 A/µs (T_{vj}=150°C) V_R = 400 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	I_{RM}		285 355 375		A A A
恢复电荷 Recovered charge	I_F = 600 A, - di_F/dt = 3750 A/µs (T_{vj}=150°C) V_R = 400 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	Q_r		57,0 105 115		µC µC µC
反向恢复损耗(每脉冲) Reverse recovery energy	I_F = 600 A, - di_F/dt = 3750 A/µs (T_{vj}=150°C) V_R = 400 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{rec}		20,0 35,0 39,5		mJ mJ mJ
结 - 外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode		R_{thJC}			0,0766	K/W
外壳 - 散热器热阻 Thermal resistance, case to heatsink	每个二极管 / per diode λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)		R_{thCH}		0,0474		K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\ op}$	-40		150	°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°C	R_{25}		5,00		kΩ
R100 偏差 Deviation of R100	T_{NTC} = 100°C, R_{100} = 493 Ω	ΔR/R	-5		5	%
耗散功率 Power dissipation	T_{NTC} = 25°C	P_{25}			20,0	mW
B-值 B-value	$R_2 = R_{25}$ exp [$B_{25/50}$(1/T_2 - 1/(298,15 K))]	$B_{25/50}$		3375		K
B-值 B-value	$R_2 = R_{25}$ exp [$B_{25/80}$(1/T_2 - 1/(298,15 K))]	$B_{25/80}$		3411		K
B-值 B-value	$R_2 = R_{25}$ exp [$B_{25/100}$(1/T_2 - 1/(298,15 K))]	$B_{25/100}$		3433		K

根据应用手册标定
Specification according to the valid application note.

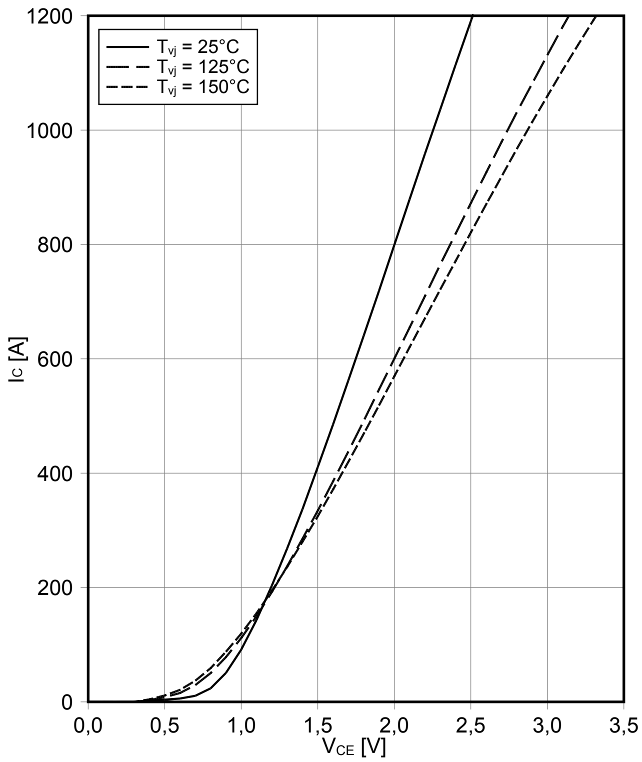
模块 / Module

绝缘测试电压 Isolation test voltage	RMS, f = 50 Hz, t = 1 min	V_{ISOL}	3,4		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		

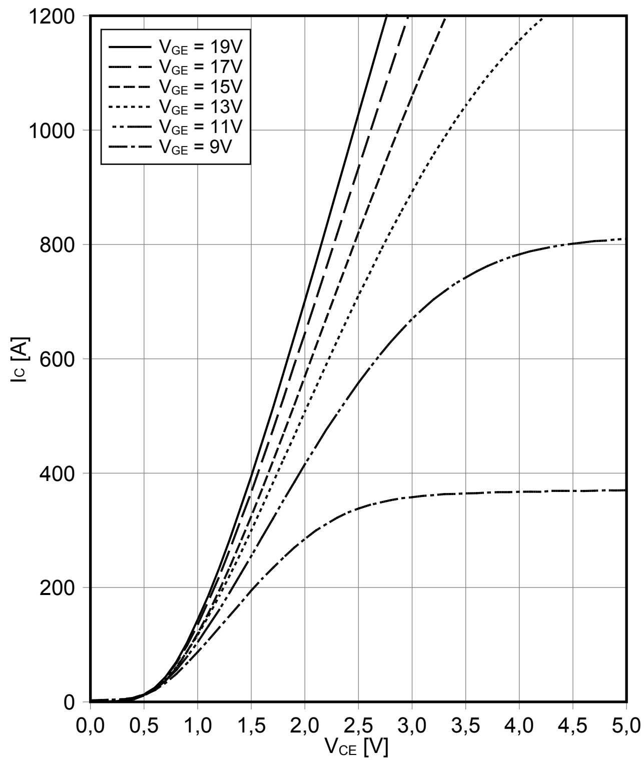
			min.	typ.	max.	
杂散电感,模块 Stray inductance module		L_{sCE}		20		nH
储存温度 Storage temperature		T_{stg}	-40		125	°C
模块安装的安装扭距 Mounting torque for modul mounting	螺丝 M5 根据相应的应用手册进行安装 Screw M5 - Mounting according to valid application note	M	3,00		6,00	Nm
端子联接扭距 Terminal connection torque	螺丝 M6 根据相应的应用手册进行安装 Screw M6 - Mounting according to valid application note	M	3,0	-	6,0	Nm
重量 Weight		G		345		g

The electrical characterization was performed in NPC2 topology, which combines the modules FF600R12ME4E_B11 and FF600R12ME4_B11. It has to be considered, that the commutation in this configuration takes place between both modules.
Die elektrische Charakterisierung wurde in NPC2-Topologie durchgeführt. Dabei werden die Module FF600R12ME4E_B11 und FF600R12ME4_B11 kombiniert. Es ist zu beachten, dass die Kommutierung zwischen den beiden Modulen stattfindet.

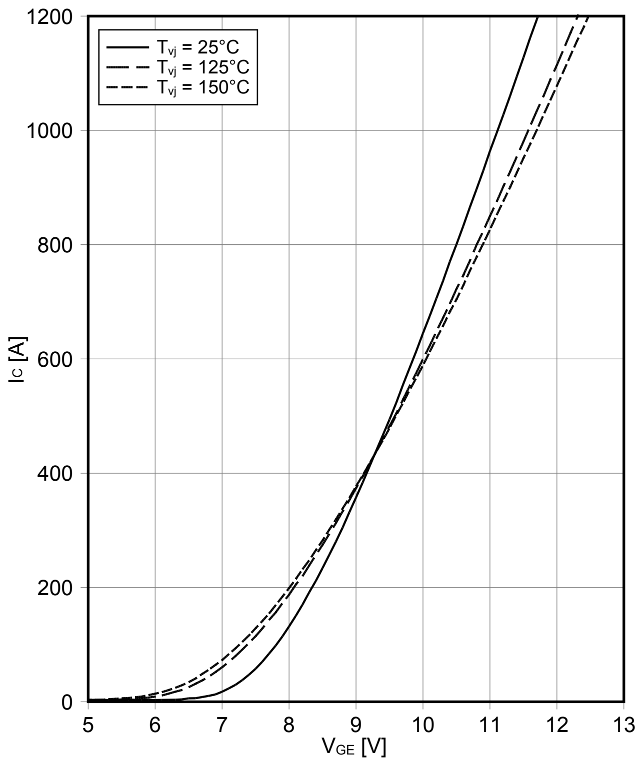
输出特性 IGBT, 逆变器 （典型）
output characteristic IGBT,Inverter (typical)
$I_C = f(V_{CE})$
$V_{GE} = 15$ V



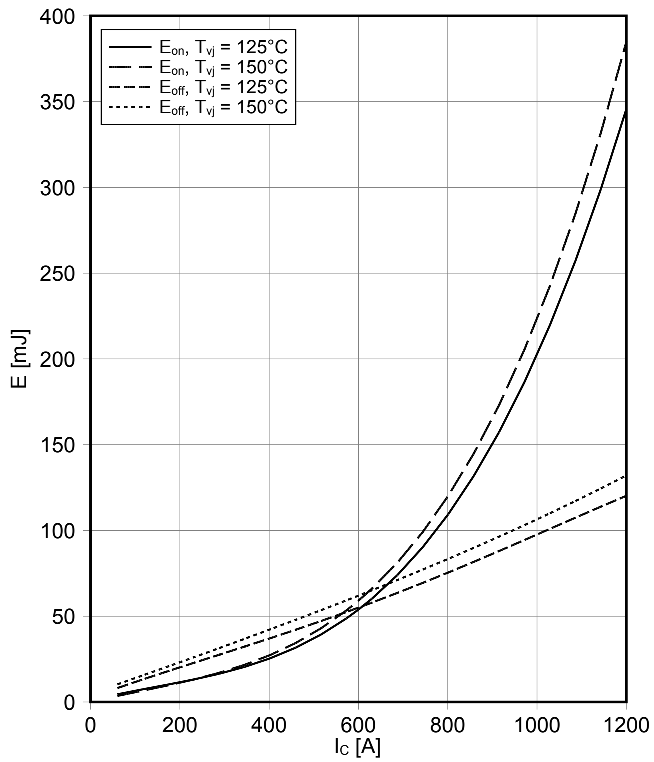
输出特性 IGBT, 逆变器 （典型）
output characteristic IGBT,Inverter (typical)
$I_C = f(V_{CE})$
$T_{vj} = 150°C$



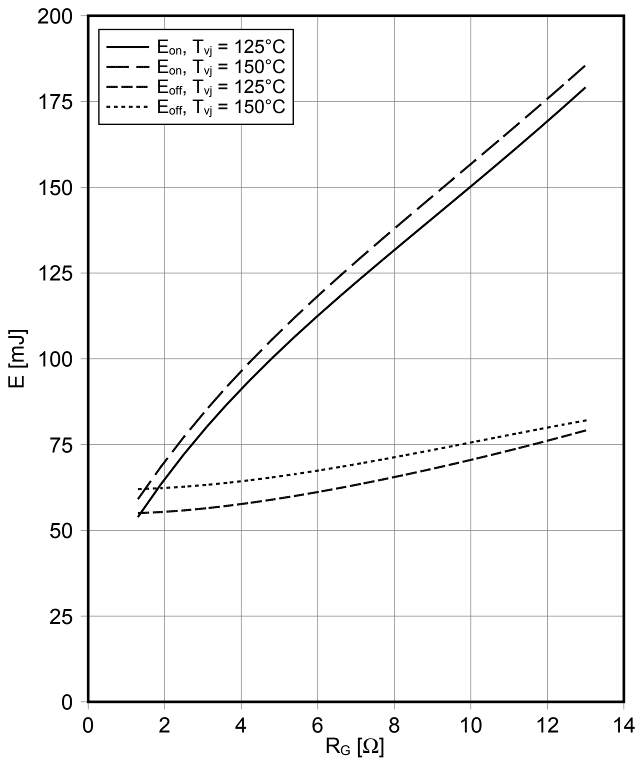
传输特性 IGBT, 逆变器 (典型)
transfer characteristic IGBT,Inverter (typical)
$I_C = f(V_{GE})$
$V_{CE} = 20$ V



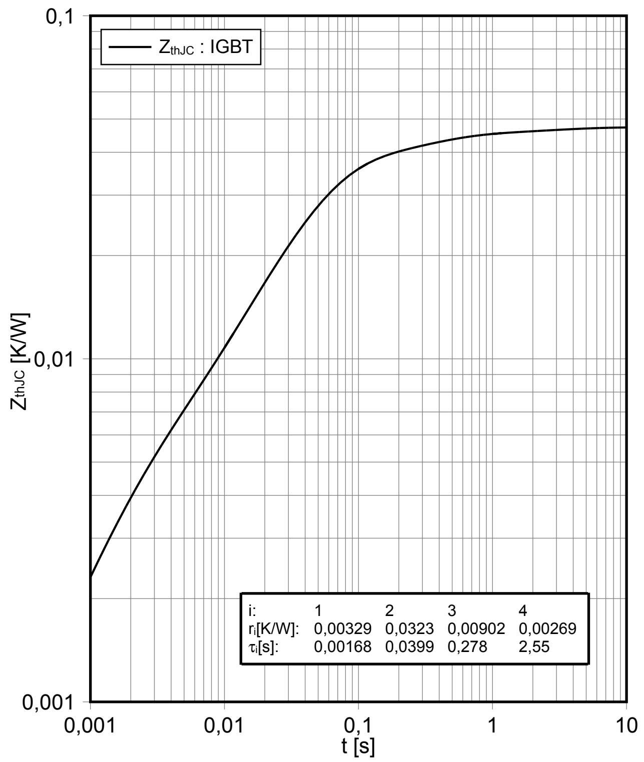
开关损耗 IGBT, 逆变器 （典型）
switching losses IGBT,Inverter (typical)
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
$V_{GE} = \pm 15$ V, $R_{Gon} = 1.3\ \Omega$, $R_{Goff} = 1.3\ \Omega$, $V_{CE} = 400$ V



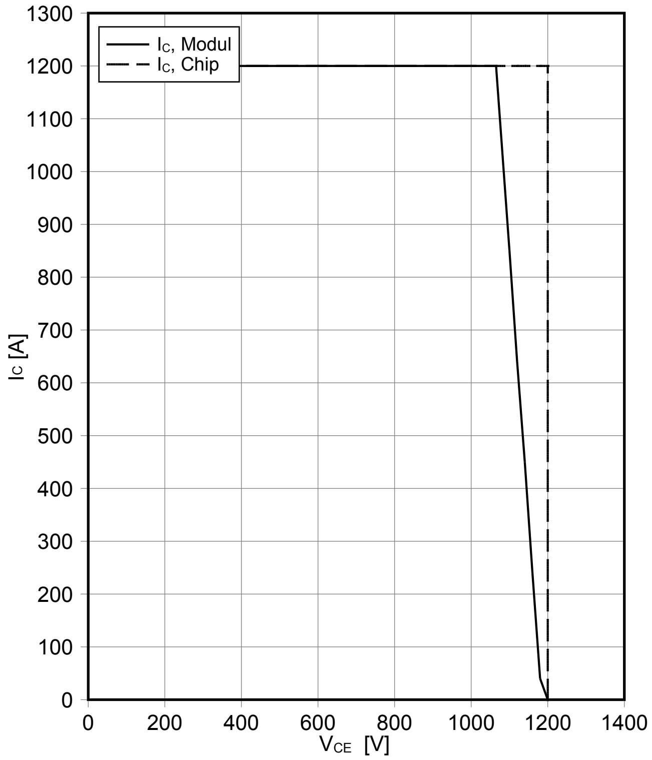
开关损耗 IGBT, 逆变器 （典型)
switching losses IGBT,Inverter (typical)
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
$V_{GE} = \pm15$ V, $I_C = 600$ A, $V_{CE} = 400$ V



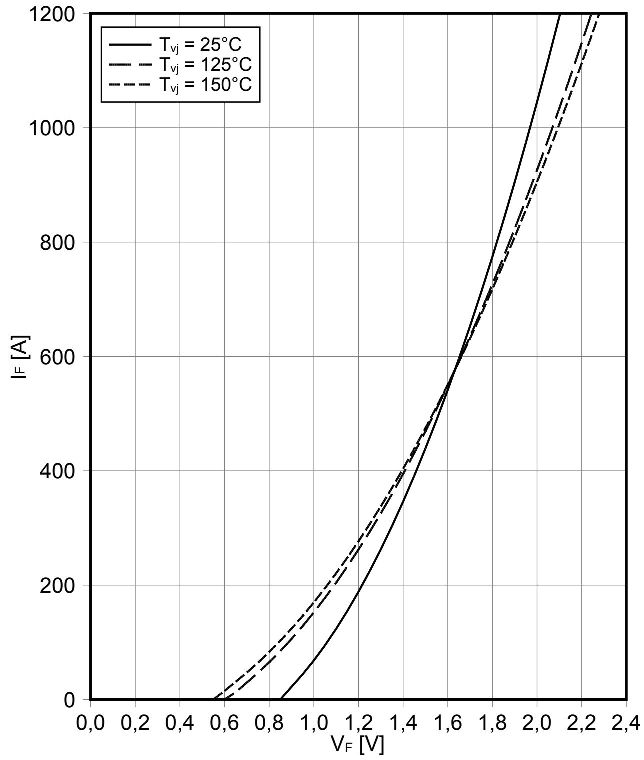
瞬态热阻抗 IGBT, 逆变器
transient thermal impedance IGBT,Inverter
$Z_{thJC} = f(t)$



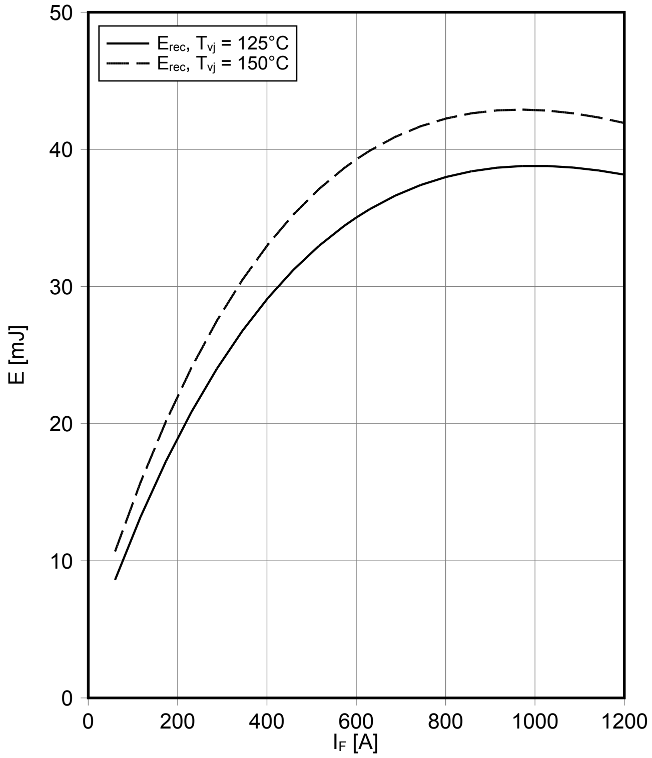
反偏安全工作区 IGBT, 逆变器 （RBSOA）
reverse bias safe operating area IGBT,Inverter (RBSOA)
$I_C = f(V_{CE})$
$V_{GE} = \pm15$ V, $R_{Goff} = 1.3$ Ω, $T_{vj} = 150$°C



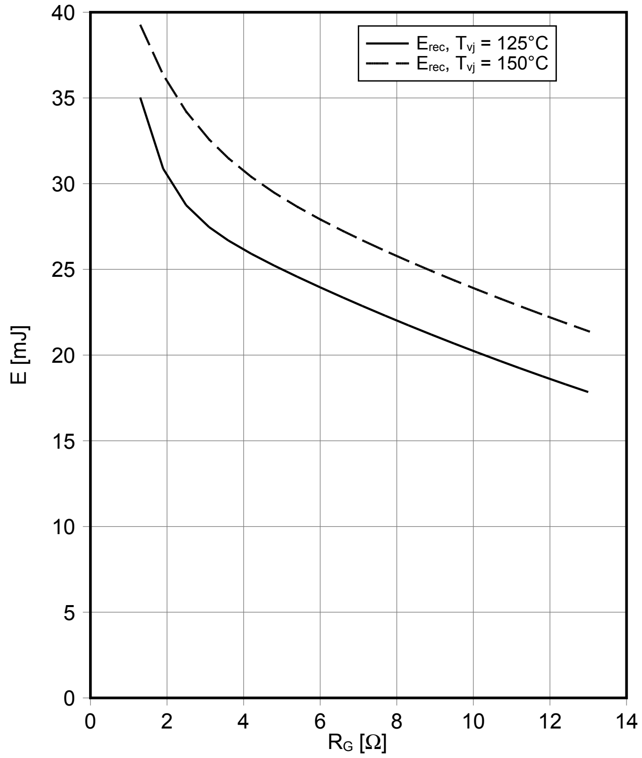
正向偏压特性 二极管,逆变器 （典型)
forward characteristic of Diode, Inverter (typical)
$I_F = f(V_F)$



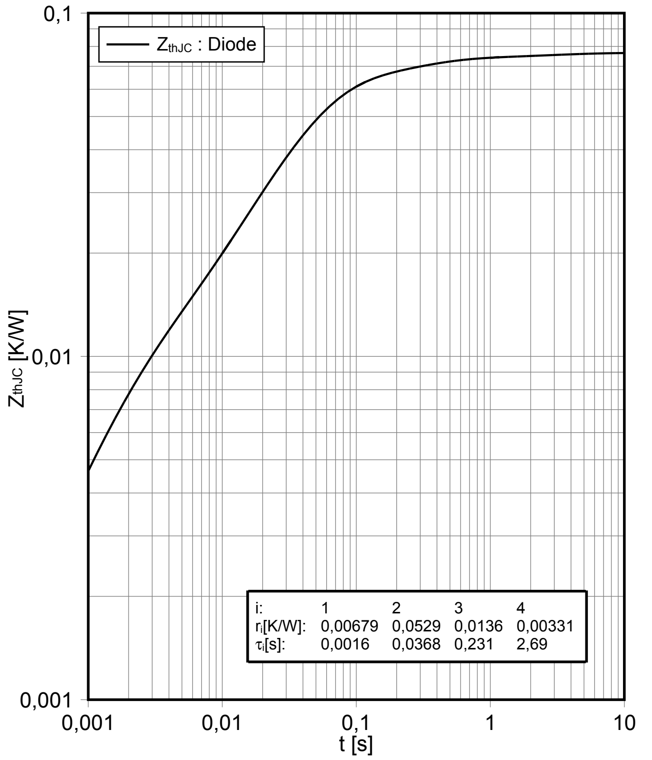
开关损耗 二极管,逆变器 （典型)
switching losses Diode, Inverter (typical)
$E_{rec} = f(I_F)$
$R_{Gon} = 1.3\ \Omega$, $V_{CE} = 400$ V



开关损耗 二极管,逆变器 （典型)
switching losses Diode, Inverter (typical)
$E_{rec} = f(R_G)$
$I_F = 600$ A, $V_{CE} = 400$ V

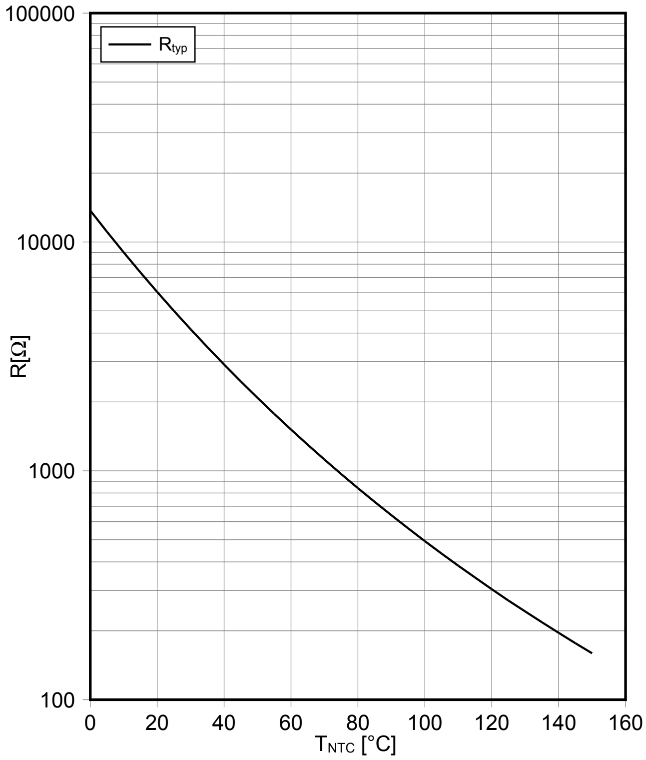


瞬态热阻抗 二极管,逆变器
transient thermal impedance Diode, Inverter
$Z_{thJC} = f(t)$

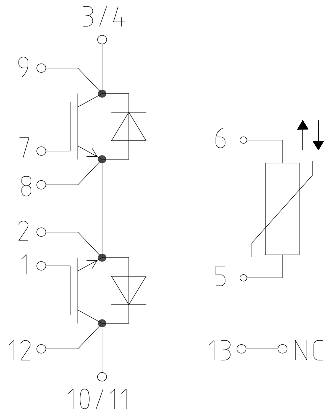


i:	1	2	3	4
r_i[K/W]:	0,00679	0,0529	0,0136	0,00331
τ_i[s]:	0,0016	0,0368	0,231	2,69

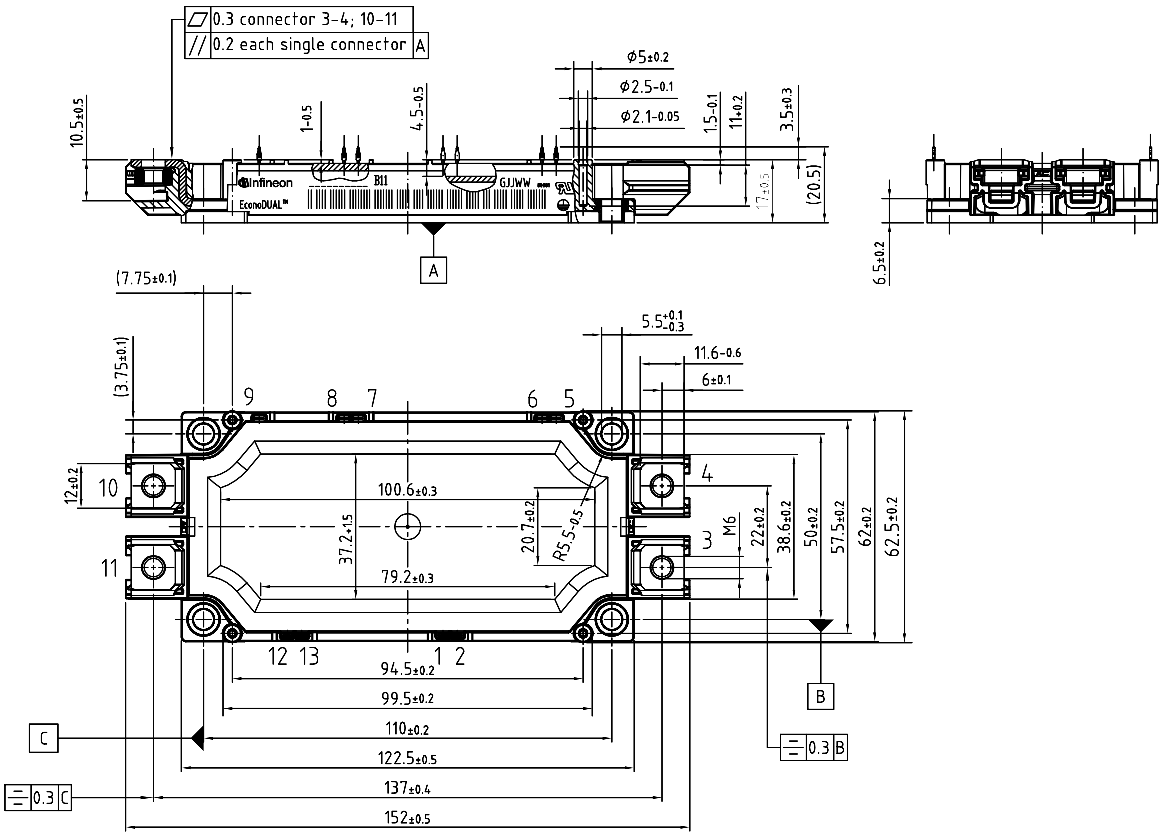
负温度系数热敏电阻 温度特性
NTC-Thermistor-temperature characteristic (typical)
$R = f(T)$



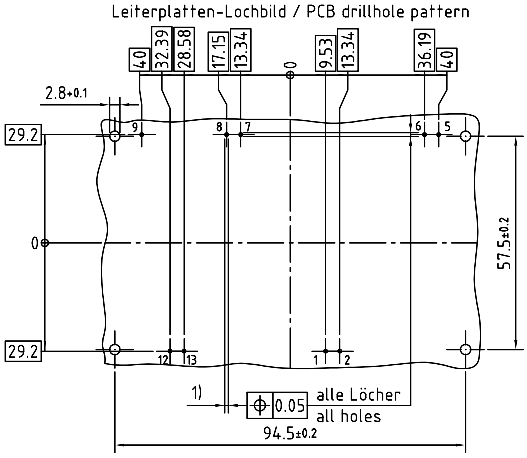
接线图 / Circuit diagram



封装尺寸 / Package outlines



Leiterplatten-Lochbild / PCB drillhole pattern



1) ⌀1 $^{+0.09}_{-0.06}$ Durchmesser des metallierten Loches
⌀1 $^{+0.09}_{-0.06}$ Diameter of finished plated-through hole
⌀1.15 Bohrungsdurchmesser des Loches
⌀1.15 Diameter of drilled hole

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Do you have a question about this document?
Email: erratum@infineon.com

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