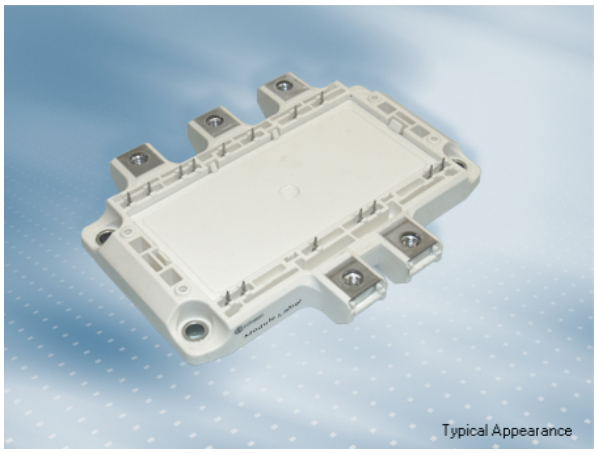
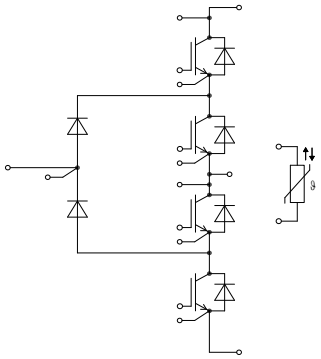
EconoPACK™4 模块 采用第四代沟槽栅/场终止IGBT4和第四代发射极控制二极管 带有pressfit预涂导热材料
EconoPACK™4 module with Trench/Fieldstop IGBT4 and Emitter Controlled 4 diode and PressFIT / pre-applied Thermal Interface Material

初步数据 / Preliminary Data





V_{CES} = 650V
$I_{C\ nom}$ = 300A / I_{CRM} = 600A

典型应用
- 三电平应用

Typical Applications
- 3-level-applications

电气特性
- 增加阻断电压至650V
- 提高工作结温 $T_{vj\ op}$
- $T_{vj\ op}$ = 150°C
- 沟槽栅IGBT4
- V_{CEsat} 带正温度系数

Electrical Features
- Increased blocking voltage capability up to 650V
- Extended operating temperature $T_{vj\ op}$
- $T_{vj\ op}$ = 150°C
- Trench IGBT 4
- V_{CEsat} with positive temperature coefficient

机械特性
- 4 kV 交流 1分钟 绝缘
- 高机械坚固性
- 集成NTC温度传感器
- 绝缘的基板
- 标准封装
- 预涂导热介质

Mechanical Features
- 4 kV AC 1min insulation
- High mechanical robustness
- Integrated NTC temperature sensor
- Isolated base plate
- Standard housing
- Pre-applied Thermal Interface Material

Module Label Code

Barcode Code 128

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

初步数据
Preliminary Data

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}	650	V
集电极电流 Implemented collector current		I_{CN}	300	A
连续集电极直流电流 Continuous DC collector current	T_H = 25°C, $T_{vj\,max}$ = 175°C	$I_{C\,nom}$	280	A
集电极重复峰值电流 Repetitive peak collector current	t_P = 1 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 = 280 A, V_{GE} = 15 V I_C = 280 A, V_{GE} = 15 V I_C = 280 A, V_{GE} = 15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$V_{CE\,sat}$		1,50 1,65 1,70	1,75	V V V
栅极阈值电压 Gate threshold voltage	I_C = 4,80 mA, V_{CE} = V_{GE}, T_{vj} = 25°C		V_{GEth}	5,00	5,80	6,50	V
栅极电荷 Gate charge	V_{GE} = -15 V ... +15 V		Q_G		3,00		µC
内部栅极电阻 Internal gate resistor	T_{vj} = 25°C		R_{Gint}		1,0		Ω
输入电容 Input capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V		C_{ies}		18,5		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}		0,57		nF
集电极-发射极截止电流 Collector-emitter cut-off current	V_{CE} = 650 V, V_{GE} = 0 V, T_{vj} = 25°C		I_{CES}			1,0	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 = 280 A, V_{CE} = 300 V V_{GE} = ±15 V R_{Gon} = 2,0 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\,on}$		0,09 0,11 0,12		µs µs µs
上升时间(电感负载) Rise time, inductive load	I_C = 280 A, V_{CE} = 300 V V_{GE} = ±15 V R_{Gon} = 2,0 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°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 = 280 A, V_{CE} = 300 V V_{GE} = ±15 V R_{Goff} = 2,0 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\,off}$		0,49 0,52 0,53		µs µs µs
下降时间(电感负载) Fall time, inductive load	I_C = 280 A, V_{CE} = 300 V V_{GE} = ±15 V R_{Goff} = 2,0 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_f		0,05 0,07 0,07		µs µs µs
开通损耗能量 (每脉冲) Turn-on energy loss per pulse	I_C = 280 A, V_{CE} = 300 V, L_S = 30 nH V_{GE} = ±15 V, di/dt = 3300 A/µs (T_{vj} = 150°C) R_{Gon} = 2,0 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{on}		1,30 1,90 2,40		mJ mJ mJ
关断损耗能量 (每脉冲) Turn-off energy loss per pulse	I_C = 280 A, V_{CE} = 300 V, L_S = 30 nH V_{GE} = ±15 V, du/dt = 3300 V/µs (T_{vj} = 150°C) R_{Goff} = 2,0 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{off}		13,0 16,0 17,0		mJ mJ mJ
短路数据 SC data	V_{GE} ≤ 15 V, V_{CC} = 360 V V_{CEmax} = V_{CES} -L_{sCE} ·di/dt	t_P ≤ 10 µs, T_{vj} = 25°C t_P ≤ 10 µs, T_{vj} = 150°C	I_{SC}		1500 1200		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}			0,250	K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\,op}$	-40		150	°C

初步数据
Preliminary Data

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}	650	V
正向电流 Implemented forward current		I_{FN}	300	A
连续正向直流电流 Continuous DC forward current		I_F	280	A
正向重复峰值电流 Repetitive peak forward current	t_P = 1 ms	I_{FRM}	600	A
I2t-值 I²t - 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	I²t	6000 5600	A²s A²s

特征值 / Characteristic Values

			min.	typ.	max.	
正向电压 Forward voltage	I_F = 280 A, V_{GE} = 0 V I_F = 280 A, V_{GE} = 0 V I_F = 280 A, V_{GE} = 0 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	V_F		1,50 1,45 1,40	1,90	V V V
反向恢复峰值电流 Peak reverse recovery current	I_F = 280 A, - di_F/dt = 3300 A/µs (T_{vj}=150°C) V_R = 300 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	I_{RM}		130 190 200		A A A
恢复电荷 Recovered charge	I_F = 280 A, - di_F/dt = 3300 A/µs (T_{vj}=150°C) V_R = 300 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	Q_r		9,00 20,0 23,0		µC µC µC
反向恢复损耗（每脉冲） Reverse recovery energy	I_F = 280 A, - di_F/dt = 3300 A/µs (T_{vj}=150°C) V_R = 300 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{rec}		3,25 5,90 6,80		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}			0,369	K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\,op}$	-40		150	°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°C	V_{RRM}	650	V
正向电流 Implemented forward current		I_{FN}	300	A
连续正向直流电流 Continuous DC forward current		I_F	280	A
正向重复峰值电流 Repetitive peak forward current	t_P = 1 ms	I_{FRM}	600	A
I2t-值 I²t - 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	I²t	6000 5600	A²s A²s

特征值 / Characteristic Values

			min.	typ.	max.	
正向电压 Forward voltage	I_F = 280 A, V_{GE} = 0 V I_F = 280 A, V_{GE} = 0 V I_F = 280 A, V_{GE} = 0 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	V_F		1,50 1,45 1,40	1,90	V V V
反向恢复峰值电流 Peak reverse recovery current	I_F = 280 A, - di_F/dt = 3300 A/µs (T_{vj}=150°C) V_R = 300 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	I_{RM}		130 190 200		A A A
恢复电荷 Recovered charge	I_F = 280 A, - di_F/dt = 3300 A/µs (T_{vj}=150°C) V_R = 300 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	Q_r		9,00 20,0 23,0		µC µC µC
反向恢复损耗（每脉冲） Reverse recovery energy	I_F = 280 A, - di_F/dt = 3300 A/µs (T_{vj}=150°C) V_R = 300 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{rec}		3,25 5,90 6,80		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}			0,369	K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\,op}$	-40		150	°C

初步数据
Preliminary Data

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.

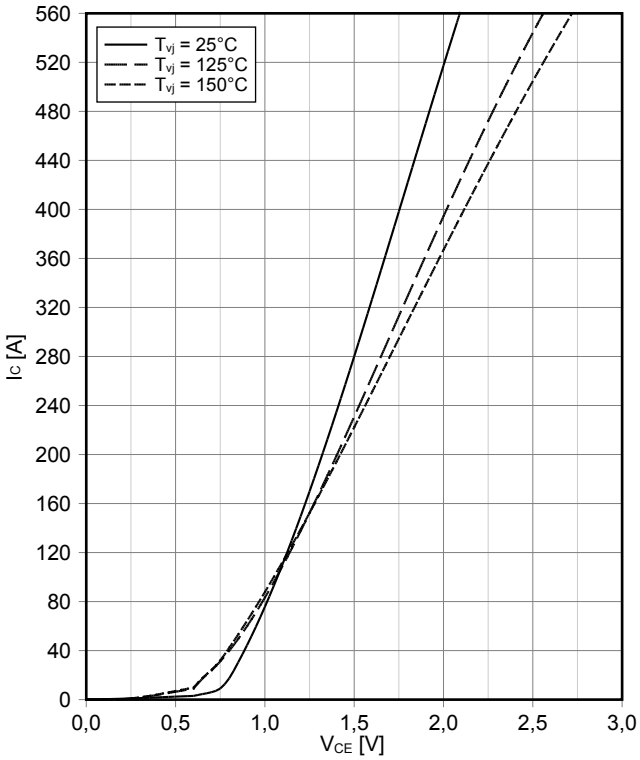
模块 / Module

绝缘测试电压 Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V_{ISOL}		4,0		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			25,0 12,5		mm
电气间隙 Clearance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal			11,0 7,0		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}		45		nH
储存温度 Storage temperature		T_{stg}	-40		125	°C
最高基板工作温度 Maximum baseplate operation temperature		T_{BPmax}			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		400		g

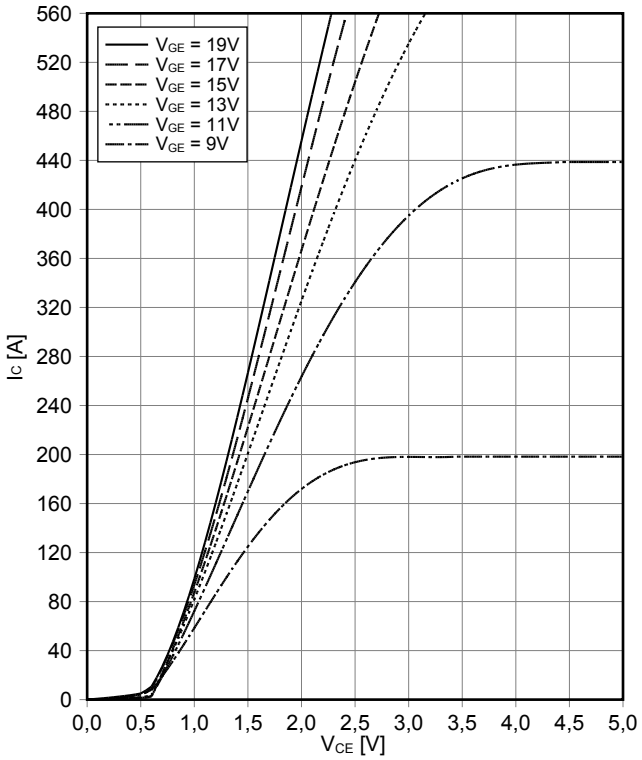
Lagerung und Transport von Modulen mit TIM => siehe AN2012-07
Storage and shipment of modules with TIM => see AN2012-07

初步数据
Preliminary Data

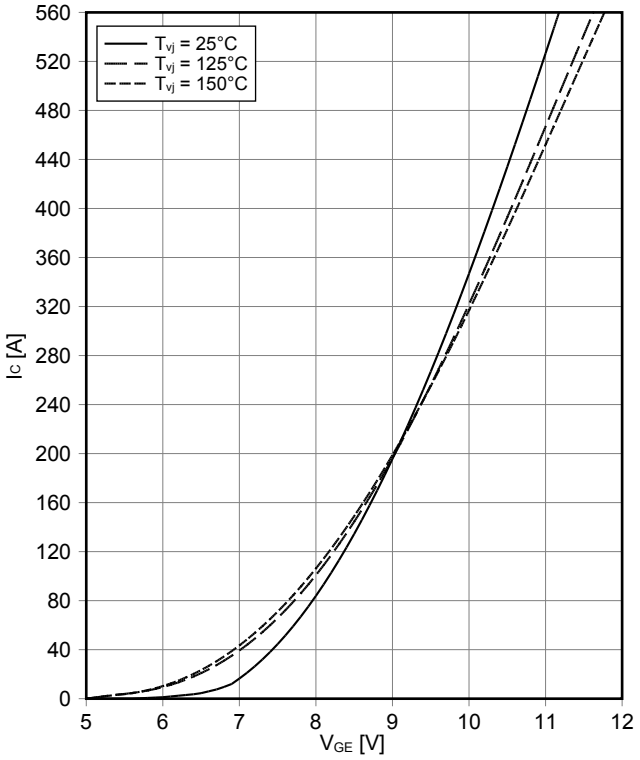
输出特性 IGBT, 逆变器 (典型)
output characteristic IGBT,Inverter (typical)
$I_C = f(V_{CE})$
V_{GE} = 15 V



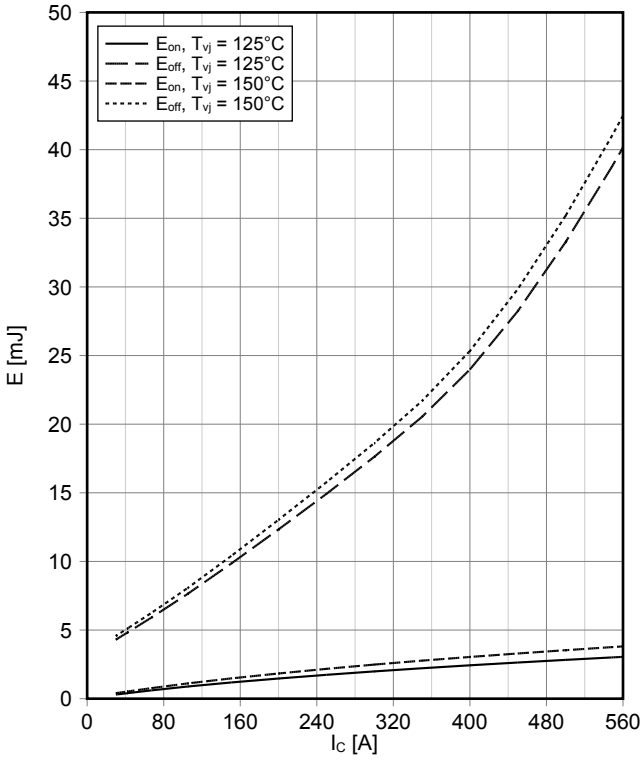
输出特性 IGBT, 逆变器 (典型)
output characteristic IGBT,Inverter (typical)
$I_C = f(V_{CE})$
T_{vj} = 150°C



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

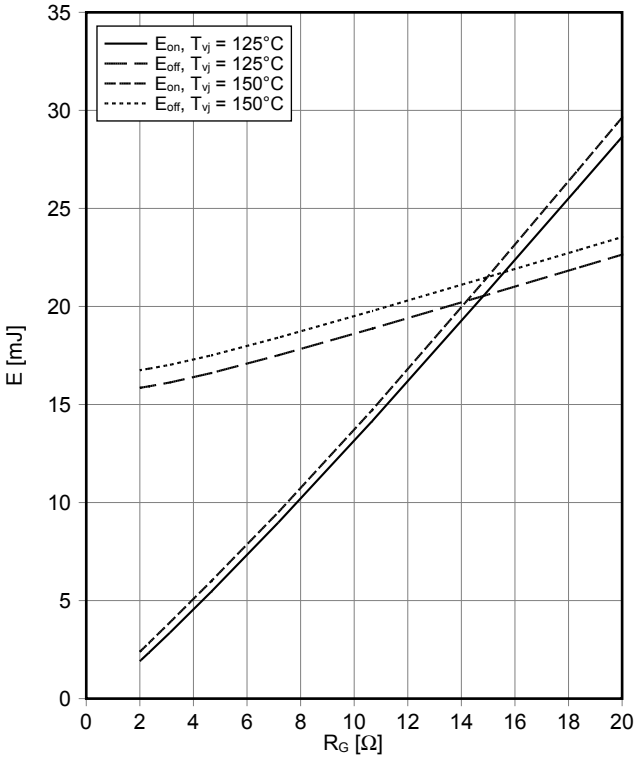


开关损耗 IGBT, 逆变器 (典型)
switching losses IGBT,Inverter (typical)
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
V_{GE} = ±15 V, R_{Gon} = 2 Ω, R_{Goff} = 2 Ω, V_{CE} = 300 V

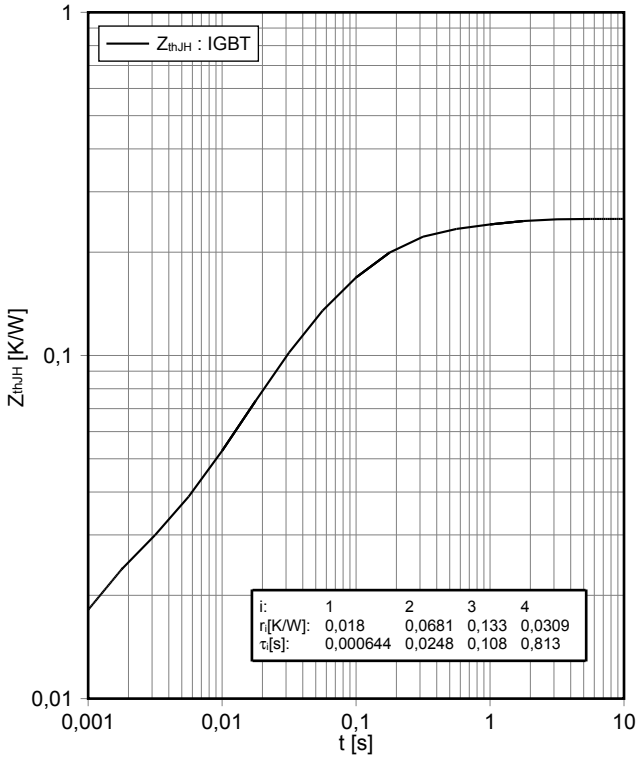


初步数据
Preliminary Data

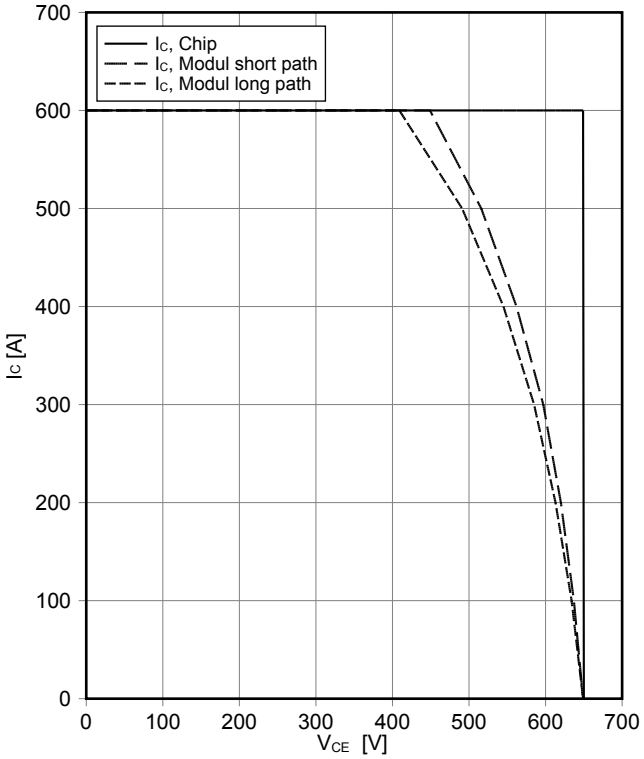
开关损耗 IGBT, 逆变器 （典型）
switching losses IGBT,Inverter (typical)
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
V_{GE} = ±15 V, I_C = 280 A, V_{CE} = 300 V



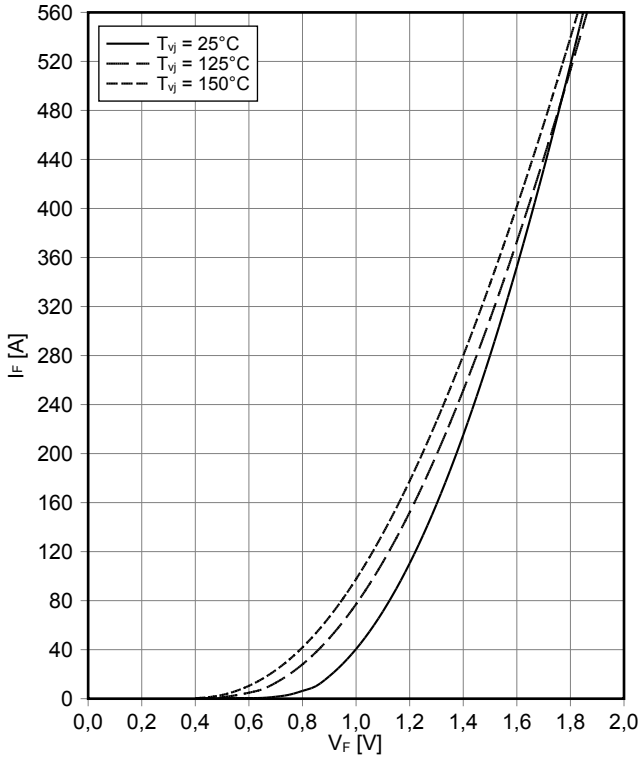
瞬态热阻抗 IGBT, 逆变器
transient thermal impedance IGBT,Inverter
$Z_{thJH} = f(t)$



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} = ±15 V, R_{Goff} = 2 Ω, T_{vj} = 150°C

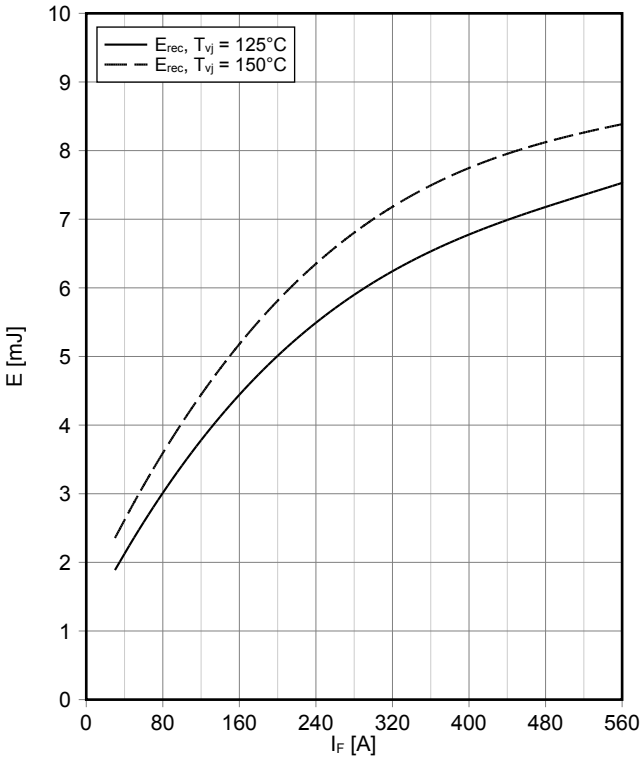


正向偏压特性 二极管,逆变器 （典型）
forward characteristic of Diode, Inverter (typical)
$I_F = f(V_F)$

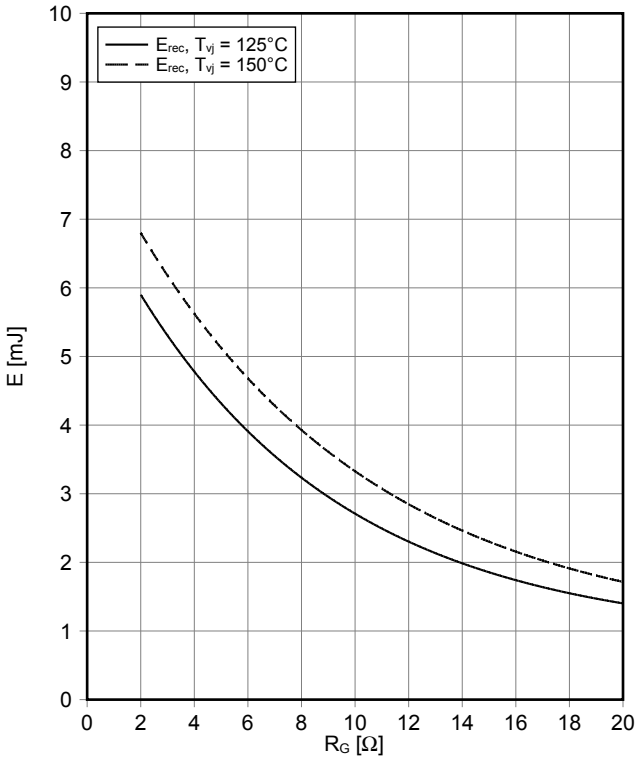


初步数据
Preliminary Data

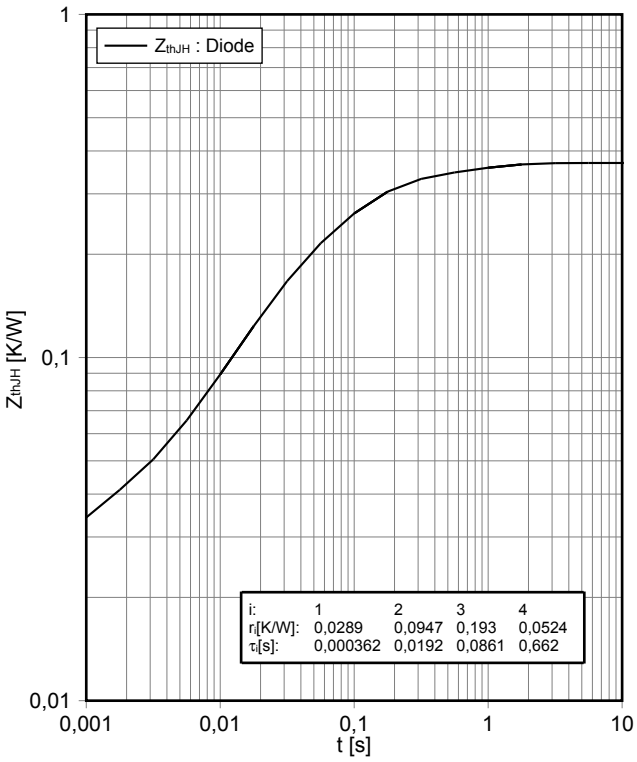
开关损耗 二极管,逆变器 （典型）
switching losses Diode, Inverter (typical)
$E_{rec} = f(I_F)$
$R_{Gon} = 2\ \Omega$, $V_{CE} = 300$ V



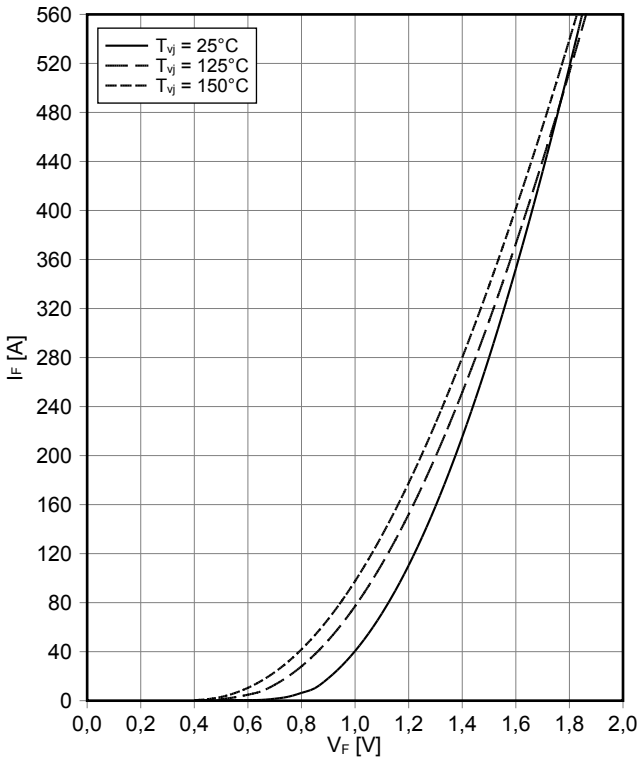
开关损耗 二极管,逆变器 （典型）
switching losses Diode, Inverter (typical)
$E_{rec} = f(R_G)$
$I_F = 280$ A, $V_{CE} = 300$ V



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

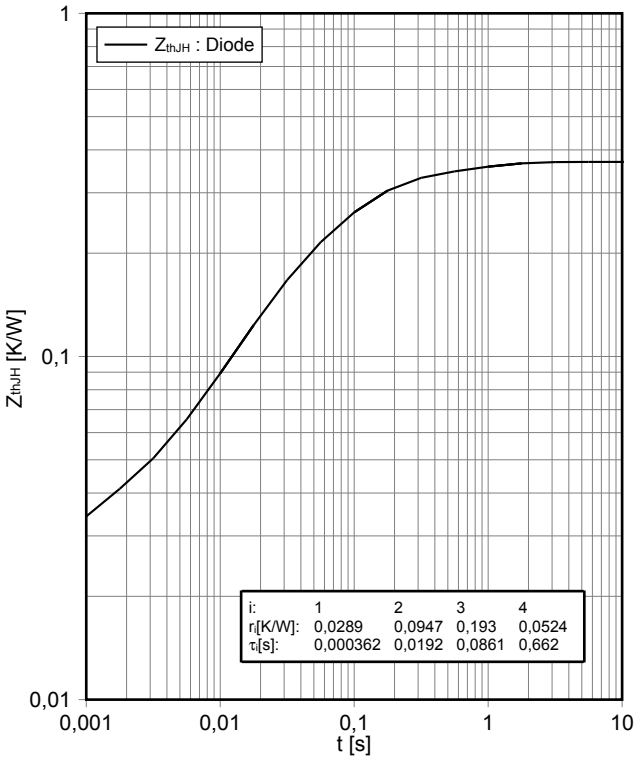


正向偏压特性 二极管, 三电平 （典型）
forward characteristic of Diode, 3-Level (typical)
$I_F = f(V_F)$

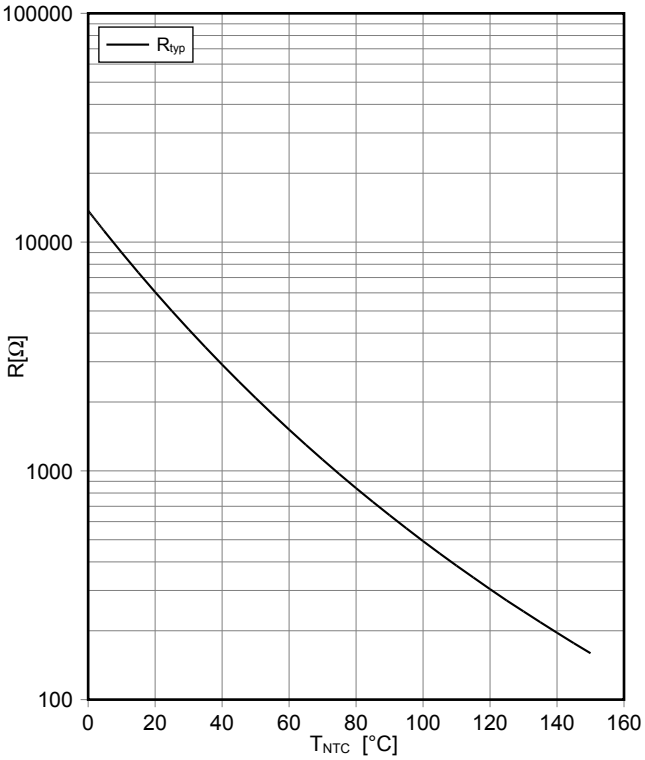


初步数据
Preliminary Data

瞬态热阻抗 二极管, 三电平
transient thermal impedance Diode, 3-Level
$Z_{thJH} = f(t)$

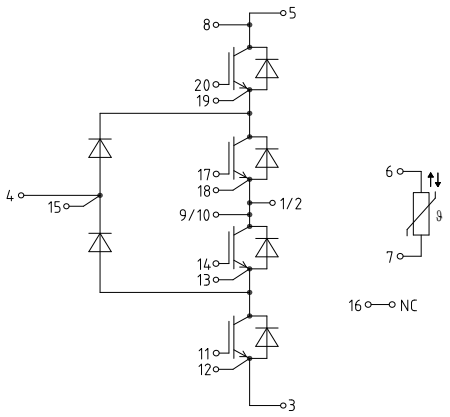


负温度系数热敏电阻 温度特性
NTC-Thermistor-temperature characteristic (typical)
$R = f(T)$

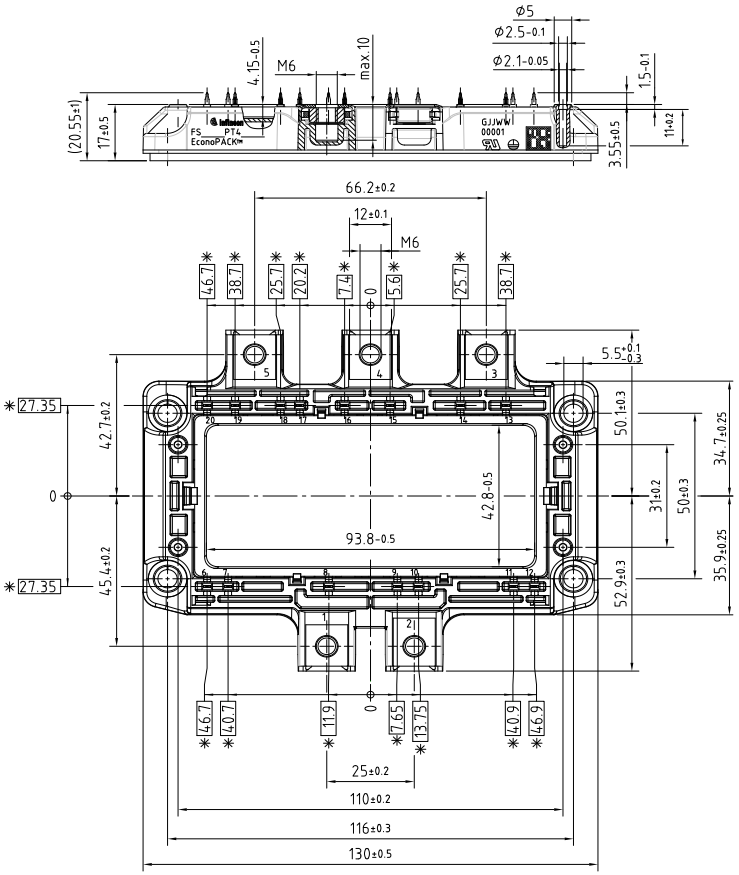


初步数据
Preliminary Data

接线图 / Circuit diagram

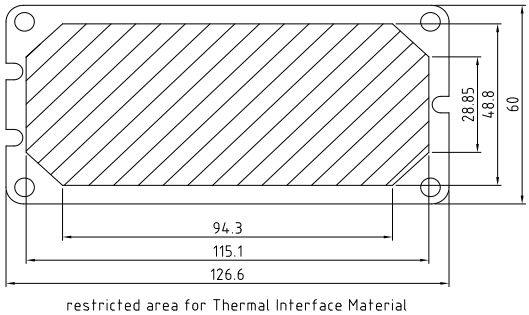


封装尺寸 / Package outlines



✳ = alle Maße mit einer Toleranz von
✳ = all dimensions with tolerance of ⌖ ϕ0.4

Maße im aufgeschraubtem Zustand gemessen
dimensions valid in mounted condition



restricted area for Thermal Interface Material

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