英飞凌HybridPACK™ 2模块

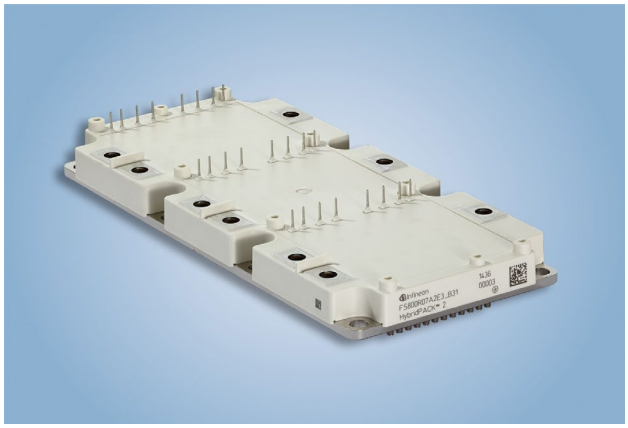
FS900R08A2P2_B31

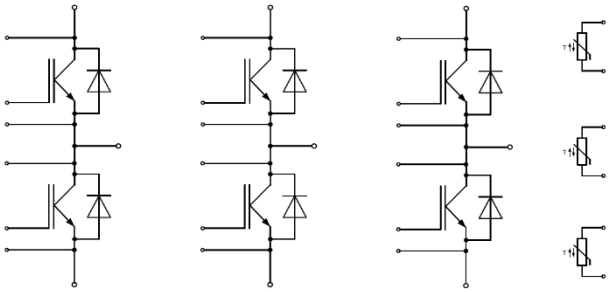
最终数据手册

V3.2, 2017-08-30

汽车高功率

1 特性/描述





V_{CES} = 750V
$I_{C\ nom}$ = 900A

典型应用

- 汽车应用
- 混合动力汽车
- 商业性农用车辆
- 电机驱动
- 针对带DC母线的汽车应用进行了优化
  最高电压达 450 V

电气特性

- 具有正温度系数的V_{CEsat}
- 低 V_{CEsat}
- 低开关损耗
- 低Qg和Cres
- 低杂散电感设计
- $T_{vj\ op}$ = 150°C
- 短时延长工作温度
  $T_{vj\ op}$ = 175°C

机械特性

- 2.5kV AC 1min 绝缘
- 直冷式 PinFin底板
- 高功率密度
- 集成NTC温度传感器
- 铜底板
- 绝缘基板
- 符合 RoHS 标准

Product Name	Ordering Code
FS900R08A2P2_B31	-

本数据手册的原文使用英文撰写。为方便起见，英飞凌提供了译文；由于翻译过程中可能使用了自动化工具，英飞凌不保证译文的准确性。 为确认准确性，请务必访问 infineon.com 参考最新的英文版本（控制文档）。

2 IGBT、逆变器

2.1 最大额定值

Parameter	Conditions	Symbol	Value	Unit
Collector-emitter voltage	T_{vj} = 25°C	V_{CES}	750	V
Implemented collector current		I_{CN}	900	A
Continuous DC collector current	T_F = 105°C, $T_{vj\,max}$ = 175°C	$I_{C\,nom}$	550	A
Repetitive peak collector current	t_P = 1 ms	I_{CRM}	1800	A
Total power dissipation	T_F = 25°C, $T_{vj\,max}$ = 175°C	P_{tot}	1546	W
Gate-emitter peak voltage		V_{GES}	+/-20	V

2.2 特征值

				min.	typ.	max.	
Collector-emitter saturation voltage	I_C = 550 A, V_{GE} = 15 V I_C = 550 A, V_{GE} = 15 V I_C = 550 A, V_{GE} = 15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$V_{CE\,sat}$		1.10 1.10 1.10	1.25	V
Gate threshold voltage	I_C = 13.0 mA, V_{CE} = V_{GE}	T_{vj} = 25°C	V_{GEth}	4.90	5.80	6.50	V
Gate charge	V_{GE} = -8 V ... 15 V, V_{CE} = 400V		Q_G		5.80		µC
Internal gate resistor		T_{vj} = 25°C	R_{Gint}		0.5		Ω
Input capacitance	f = 1 MHz, V_{CE} = 25 V, V_{GE} = 0 V	T_{vj} = 25°C	C_{ies}		105		nF
Reverse transfer capacitance	f = 1 MHz, V_{CE} = 25 V, V_{GE} = 0 V	T_{vj} = 25°C	C_{res}		0.50		nF
Collector-emitter cut-off current	V_{CE} = 450 V, V_{GE} = 0 V	T_{vj} = 25°C	I_{CES}			0.5	mA
Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = 20 V	T_{vj} = 25°C	I_{GES}			400	nA
Turn-on delay time, inductive load	I_C = 550 A, V_{CE} = 400 V V_{GE} = -8 V / +15 V R_{Gon} = 3.3 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\,on}$		0.39 0.39 0.39		µs
Rise time, inductive load	I_C = 550 A, V_{CE} = 400 V V_{GE} = -8 V / +15 V R_{Gon} = 3.3 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_r		0.09 0.11 0.11		µs
Turn-off delay time, inductive load	I_C = 550 A, V_{CE} = 400 V V_{GE} = -8 V / +15 V R_{Goff} = 2.0 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\,off}$		0.63 0.71 0.74		µs
Fall time, inductive load	I_C = 550 A, V_{CE} = 400 V V_{GE} = -8 V / +15 V R_{Goff} = 2.0 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_f		0.06 0.08 0.08		µs
Turn-on energy loss per pulse	I_C = 550 A, V_{CE} = 400 V, L_S = 20 nH V_{GE} = -8 V / +15 V R_{Gon} = 3.3 Ω di/dt (T_{vj} = 150°C) = 4100 A/µs	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{on}		21.0 29.0 30.5		mJ
Turn-off energy loss per pulse	I_C = 550 A, V_{CE} = 400 V, L_S = 20 nH V_{GE} = -8 V / +15 V R_{Goff} = 2.0 Ω dv/dt (T_{vj} = 150°C) = 2600 V/µs	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{off}		27.5 36.0 38.5		mJ
SC data	$V_{GE} \leq$ 15 V, V_{CC} = 400 V V_{CEmax} = V_{CES} -L_{sCE} ·di/dt	$t_P \leq$ 4 µs, T_{vj} = 150°C	I_{SC}		4500		A
Thermal resistance, junction to cooling fluid	per IGBT; $\Delta V/\Delta t$ = 10 dm^3/min		R_{thJF}			0.097	K/W
Temperature under switching conditions	t_{op} continuous $t_{op\,max}$ 30h over life time, for 10s within period of 10min		$T_{vj\,op}$	-40 150		150 175	°C

3 二极管、逆变器

3.1 最大额定值

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	750	V
Implemented forward current		I_{FN}	860	A
Continuous DC forward current		I_F	550	A
Repetitive peak forward current	t_P = 1 ms	I_{FRM}	1720	A
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	19500 19000	A^2s A^2s

3.2 特征值

			min.	typ.	max.	
Forward voltage	I_F = 550 A, V_{GE} = 0 V I_F = 550 A, V_{GE} = 0 V I_F = 550 A, V_{GE} = 0 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	V_F		1.40 1.30 1.25	1.65	V
Peak reverse recovery current	I_F = 550 A, - di_F/dt = 4100 A/µs (T_{vj} = 150°C) V_R = 400 V V_{GE} = -8 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	I_{RM}		265 385 420		A
Recovered charge	I_F = 550 A, - di_F/dt = 4100 A/µs (T_{vj} = 150°C) V_R = 400 V V_{GE} = -8 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	Q_r		23.0 49.5 58.5		µC
Reverse recovery energy	I_F = 550 A, - di_F/dt = 4100 A/µs (T_{vj} = 150°C) V_R = 400 V V_{GE} = -8 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{rec}		7.20 15.0 17.5		mJ
Thermal resistance, junction to cooling fluid	per diode; $\Delta V/\Delta t$ = 10 dm^3/min		R_{thJF}			0.125	K/W
Temperature under switching conditions	t_{op} continuous $t_{op\,max}$ 30h over life time, for 10s within period of 10min		$T_{vj\,op}$	-40 150		150 175	°C

4 NTC-热敏电阻

Parameter	Conditions	Symbol	min.	typ.	max.	Unit
Rated resistance	T_C = 25°C	R_{25}		5.00		kΩ
Deviation of R100	T_C = 100°C, R_{100} = 493 Ω	$\Delta R/R$	5		5	%
Power dissipation	T_C = 25°C	P_{25}			20.0	mW
B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298{,}15\ K))]$	$B_{25/50}$		3375		K
B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298{,}15\ K))]$	$B_{25/80}$		3411		K
B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298{,}15\ K))]$	$B_{25/100}$		3433		K

根据应用笔记标定

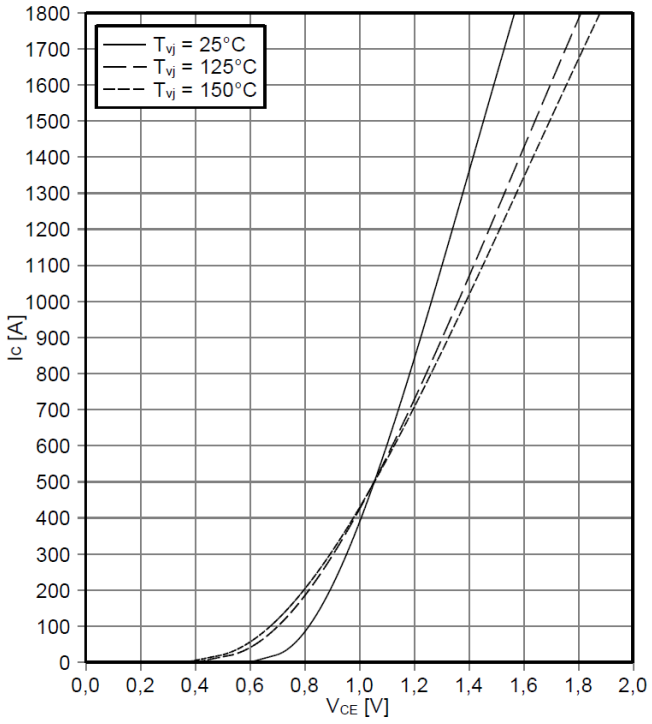
5 模块

Parameter	Conditions	Symbol	Value			Unit
Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V_{ISOL}		2.5		kV
Material of module baseplate				Cu		
Internal isolation	basic insulation (class 1, IEC 61140)			Al_2O_3		
Creepage distance	terminal to heatsink terminal to terminal	d_{Creep}		7.0 5.5		mm
Clearance	terminal to heatsink terminal to terminal	d_{Clear}		7.0 5.0		mm
Comperative tracking index		CTI		> 200		
			min.	typ.	max.	
Pressure drop in cooling circuit	$\Delta V/\Delta t$ = 10.0 dm^3/min; T_F = 25°C	Δp		119		mbar
Maximum pressure in cooling circuit		p			2.5	bar
Stray inductance module		L_{sCE}		14		nH
Module lead resistance, terminals - chip	T_F = 25 °C, per switch	$R_{CC'+EE'}$		0.80		mΩ
Storage temperature		T_{stg}	-40		125	°C
Mounting torque for modul mounting	Screw M6 baseplate to heatsink	M	3.00		6.00	Nm
Terminal connection torque	Screw M6	M	2.5	-	5.0	Nm
Weight		G		1340		g

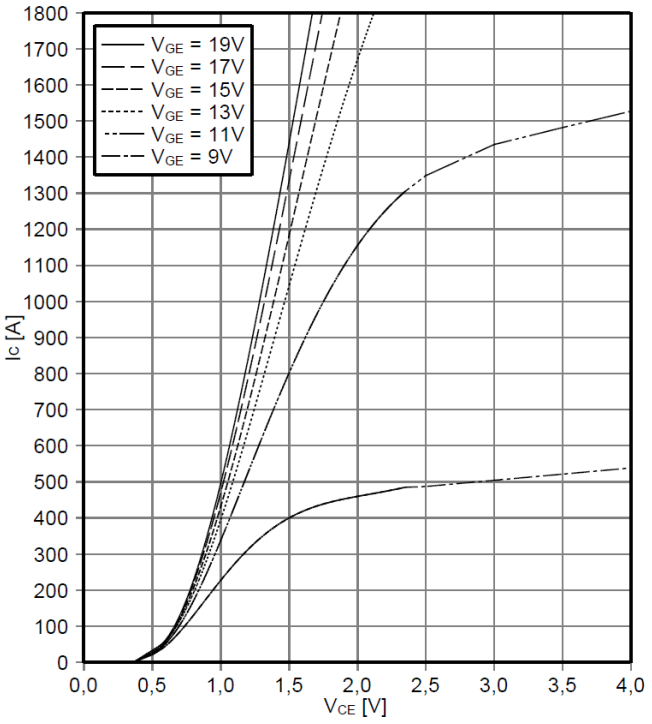
* Kühleraufbau gemäß gültiger Application Note.
* 根据现行应用笔记安装冷却器。

6 特性图

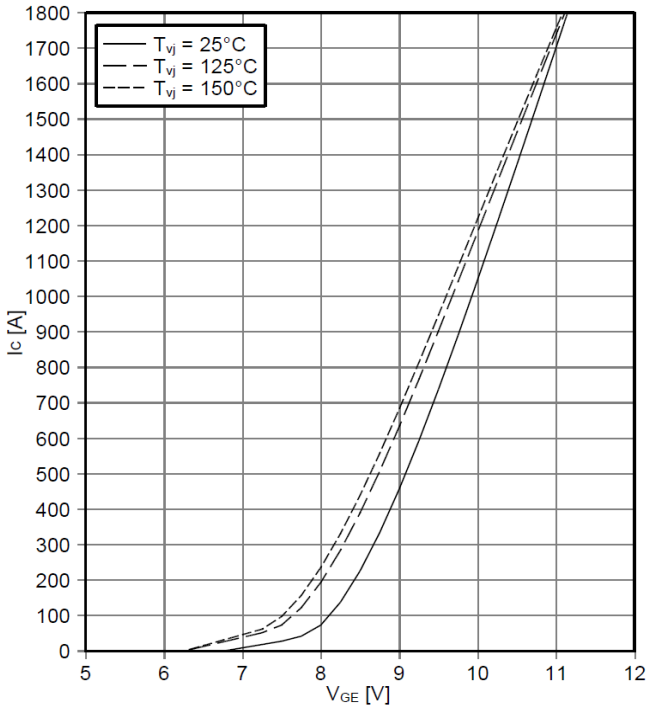
output characteristic IGBT,Inverter (typical)
$I_C = f(V_{CE})$
V_{GE} = 15 V



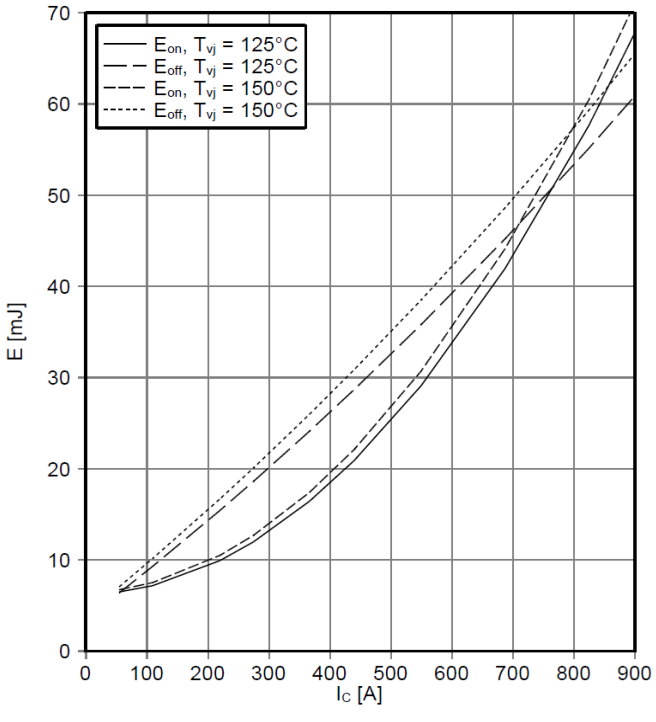
output characteristic IGBT,Inverter (typical)
$I_C = f(V_{CE})$
T_{vj} = 150°C



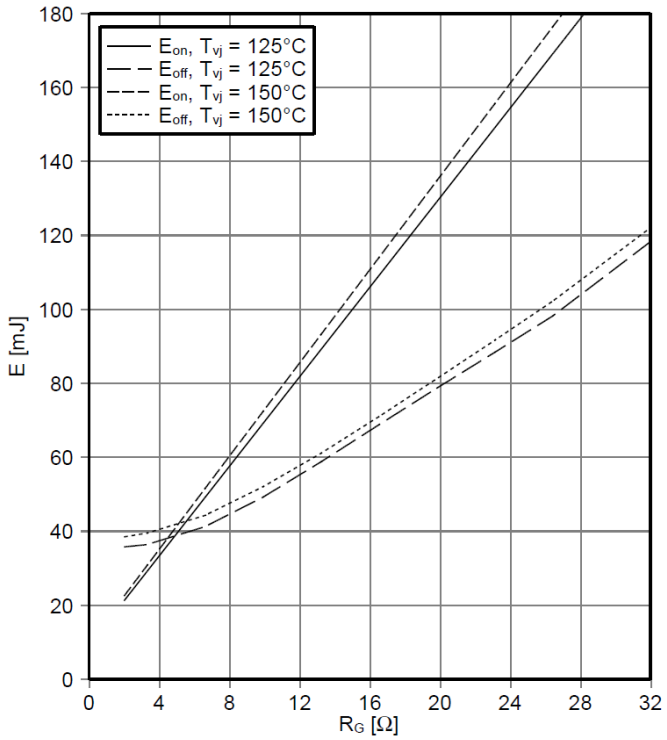
transfer characteristic IGBT,Inverter (typical)
$I_C = f(V_{GE})$
V_{CE} = 20 V



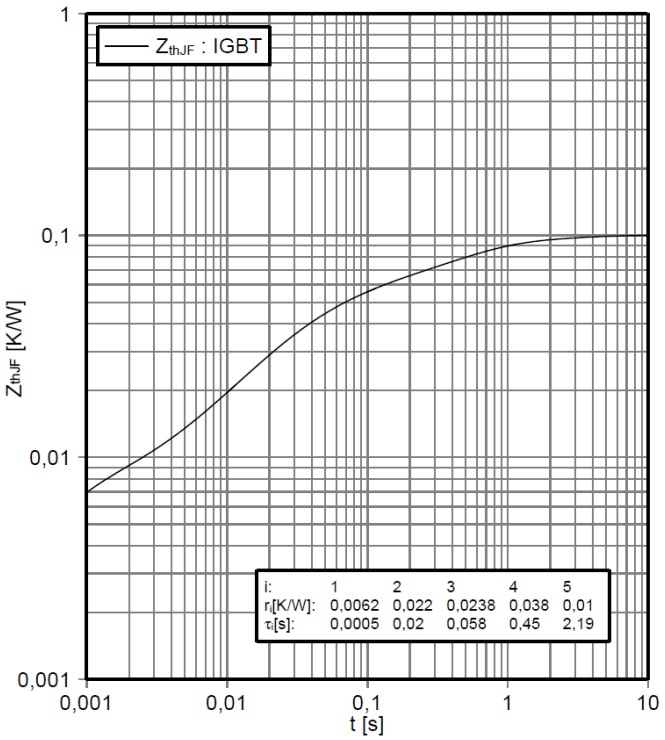
switching losses IGBT,Inverter (typical)
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
V_{GE} = ±15 V, R_{Gon} = 3.3 Ω, R_{Goff} = 2 Ω, V_{CE} = 400 V



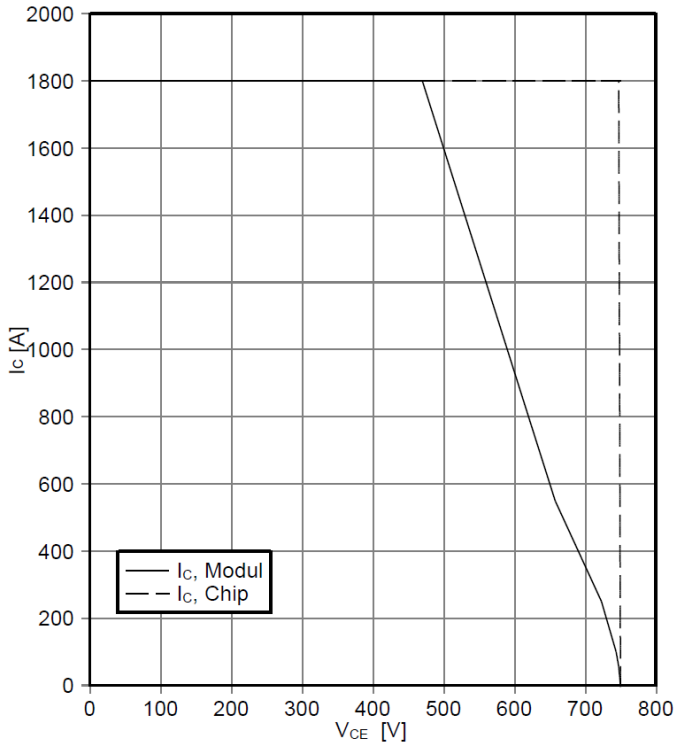
switching losses IGBT,Inverter (typical)
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
V_{GE} = ±15 V, I_C = 550 A, V_{CE} = 400 V



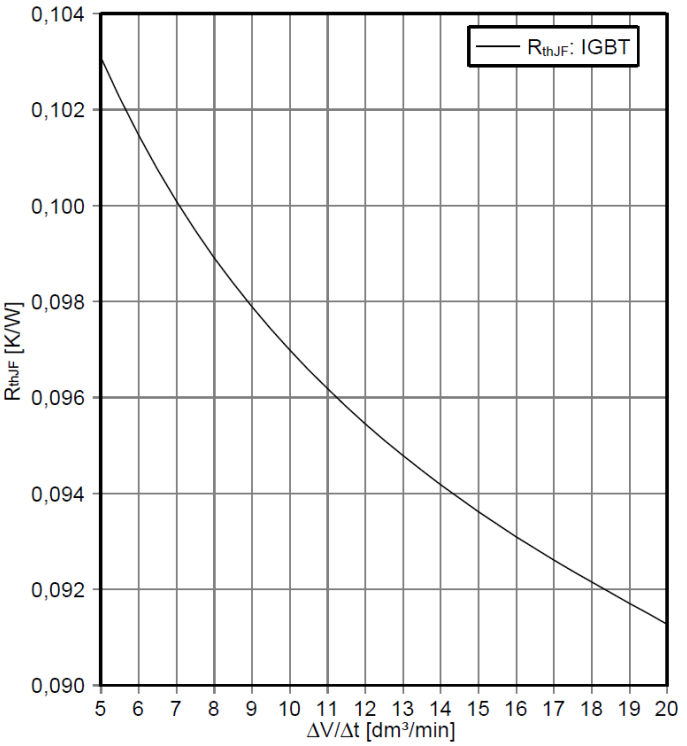
transient thermal impedance IGBT,Inverter
$Z_{thJF} = f(t)$ ($\Delta V/\Delta t$=10 dm³/min)



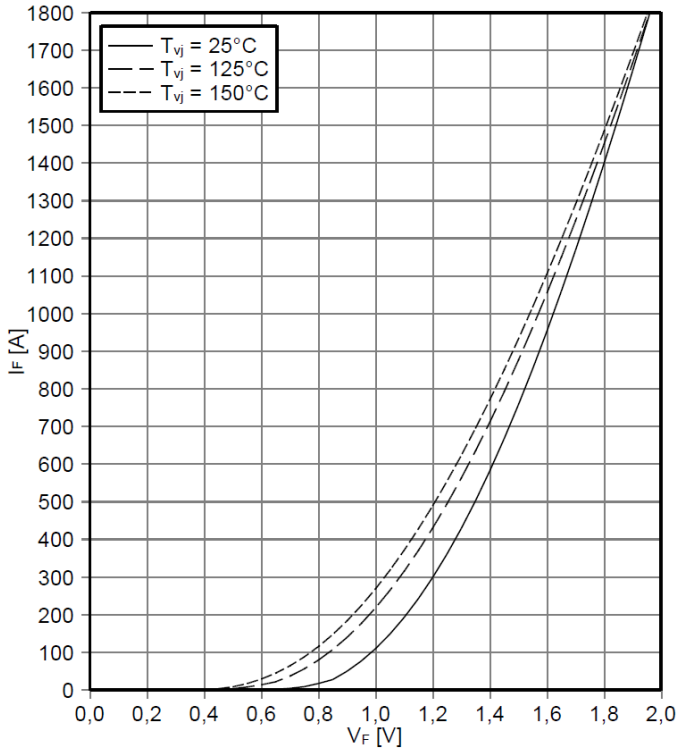
reverse bias safe operating area IGBT,Inverter (RBSOA)
$I_C = f(V_{CE})$
V_{GE} = ±15 V, R_{Goff} = 2 Ω, T_{vj} = 150°C



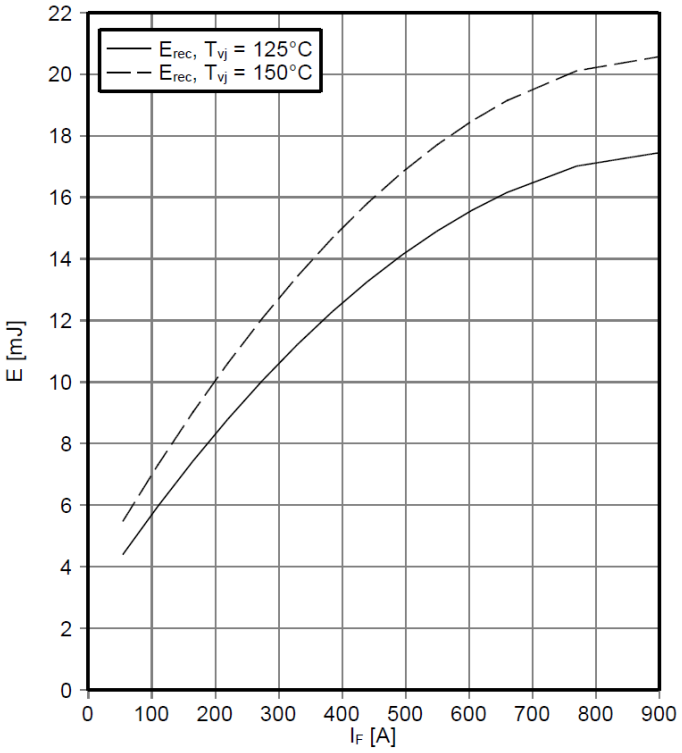
thermal impedance IGBT,Inverter
$R_{thJF} = f(\Delta V/\Delta t)$
cooling fluid = 50% water/50% ethylenglycol



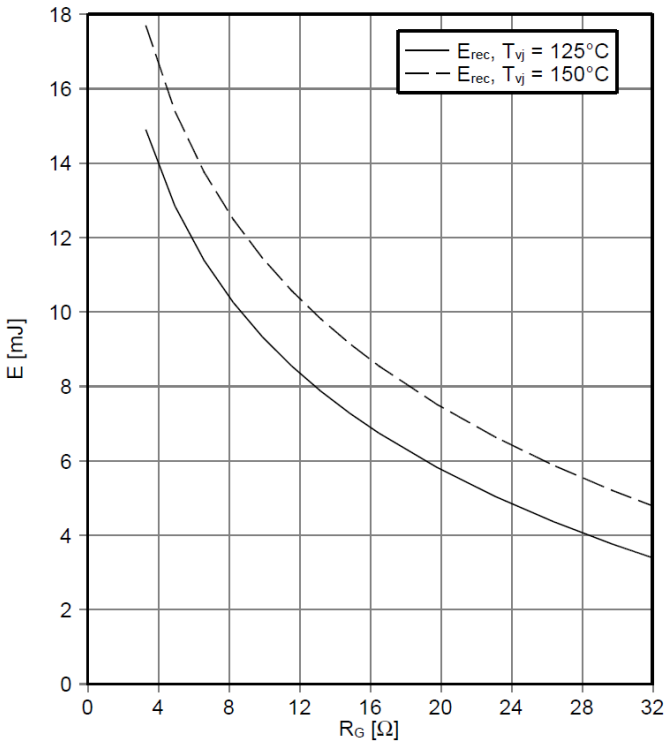
forward characteristic of Diode, Inverter (typical)
$I_F = f(V_F)$



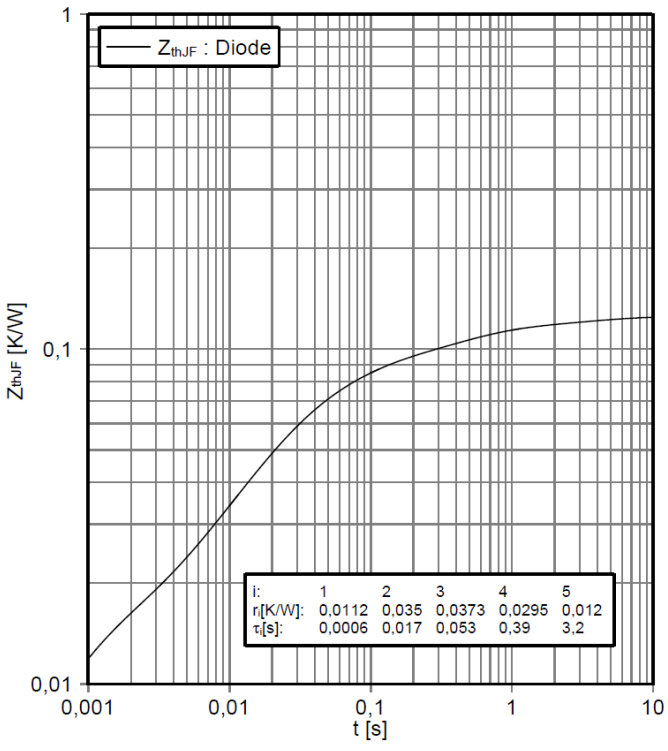
switching losses Diode, Inverter (typical)
$E_{rec} = f(I_F)$
$R_{Gon} = 3.3\ \Omega$, $V_{CE} = 400\ V$



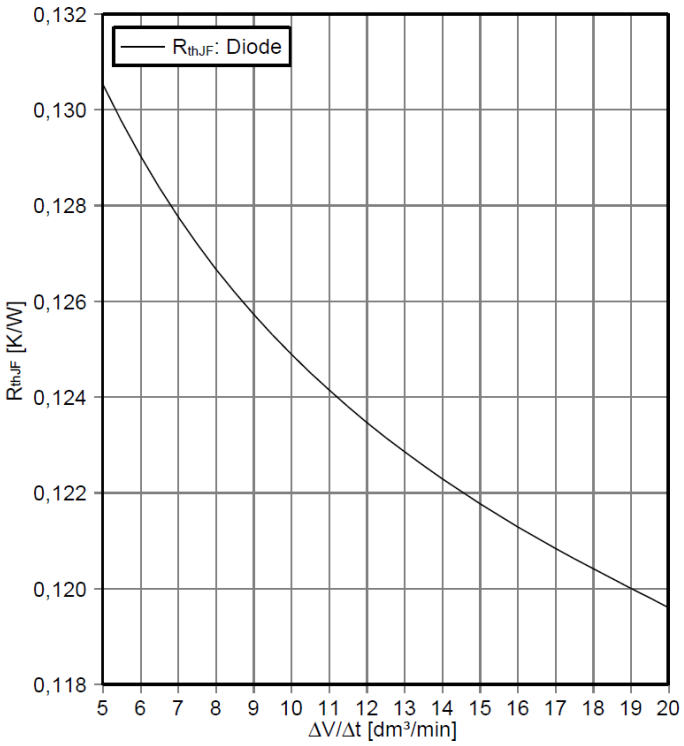
switching losses Diode, Inverter (typical)
$E_{rec} = f(R_G)$
$I_F = 550\ A$, $V_{CE} = 400\ V$



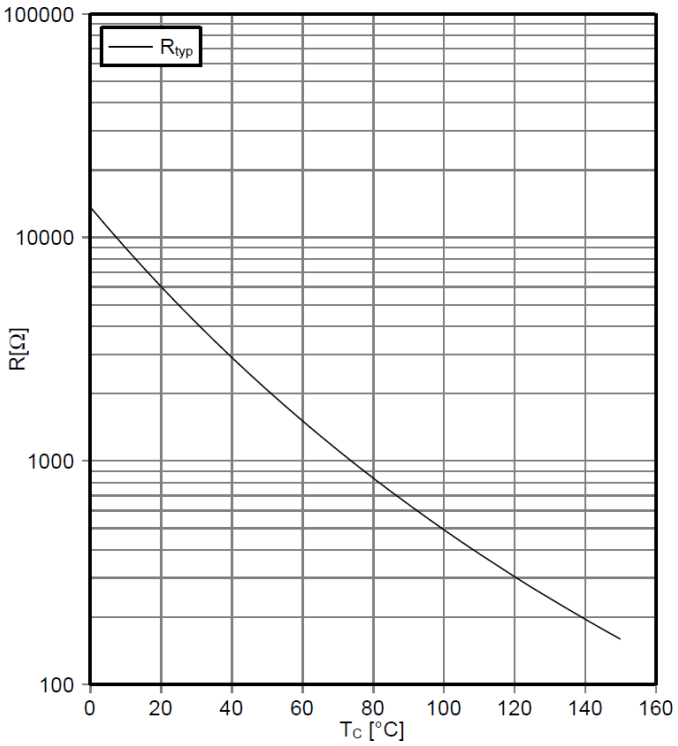
transient thermal impedance Diode, Inverter
$Z_{thJF} = f(t)$ $(\Delta V/\Delta t = 10\ dm^3/min)$



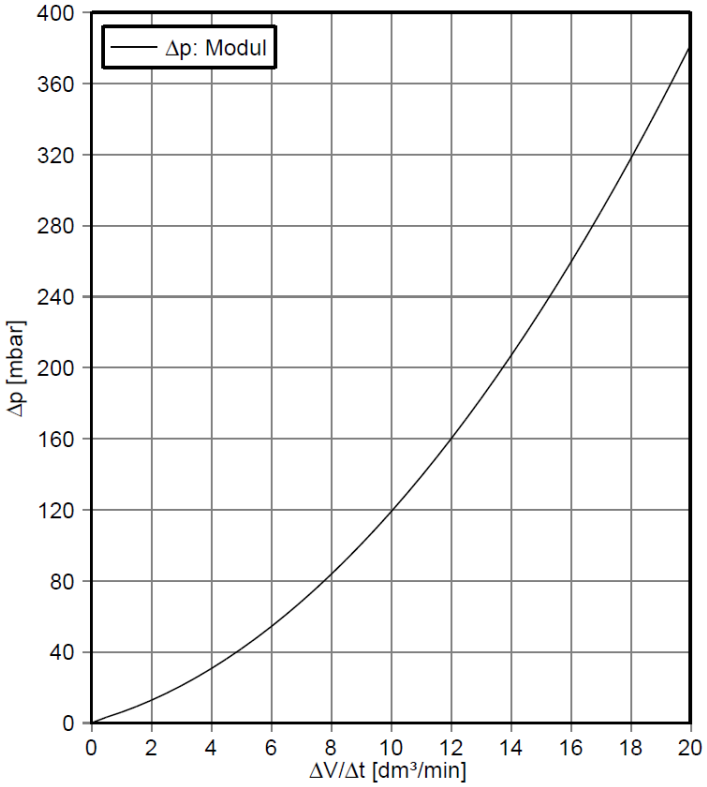
thermal impedance Diode, Inverter
$R_{thJF} = f(\Delta V/\Delta t)$
cooling fluid = 50% water/50% ethylenglycol



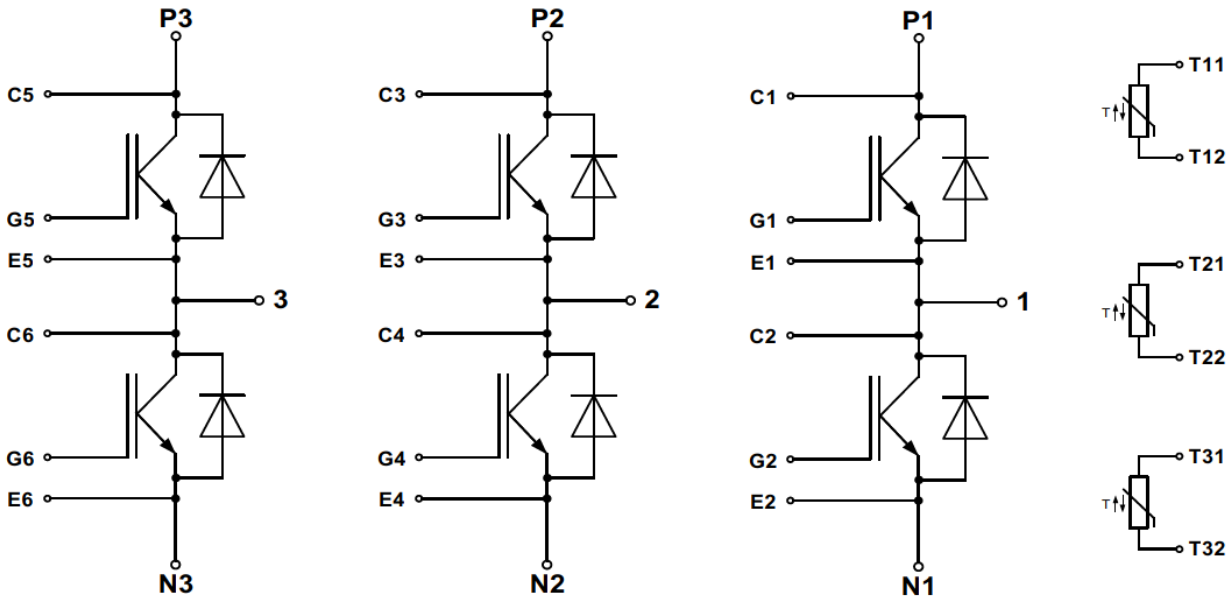
NTC-Thermistor-temperature characteristic (typical)
R = f (T)



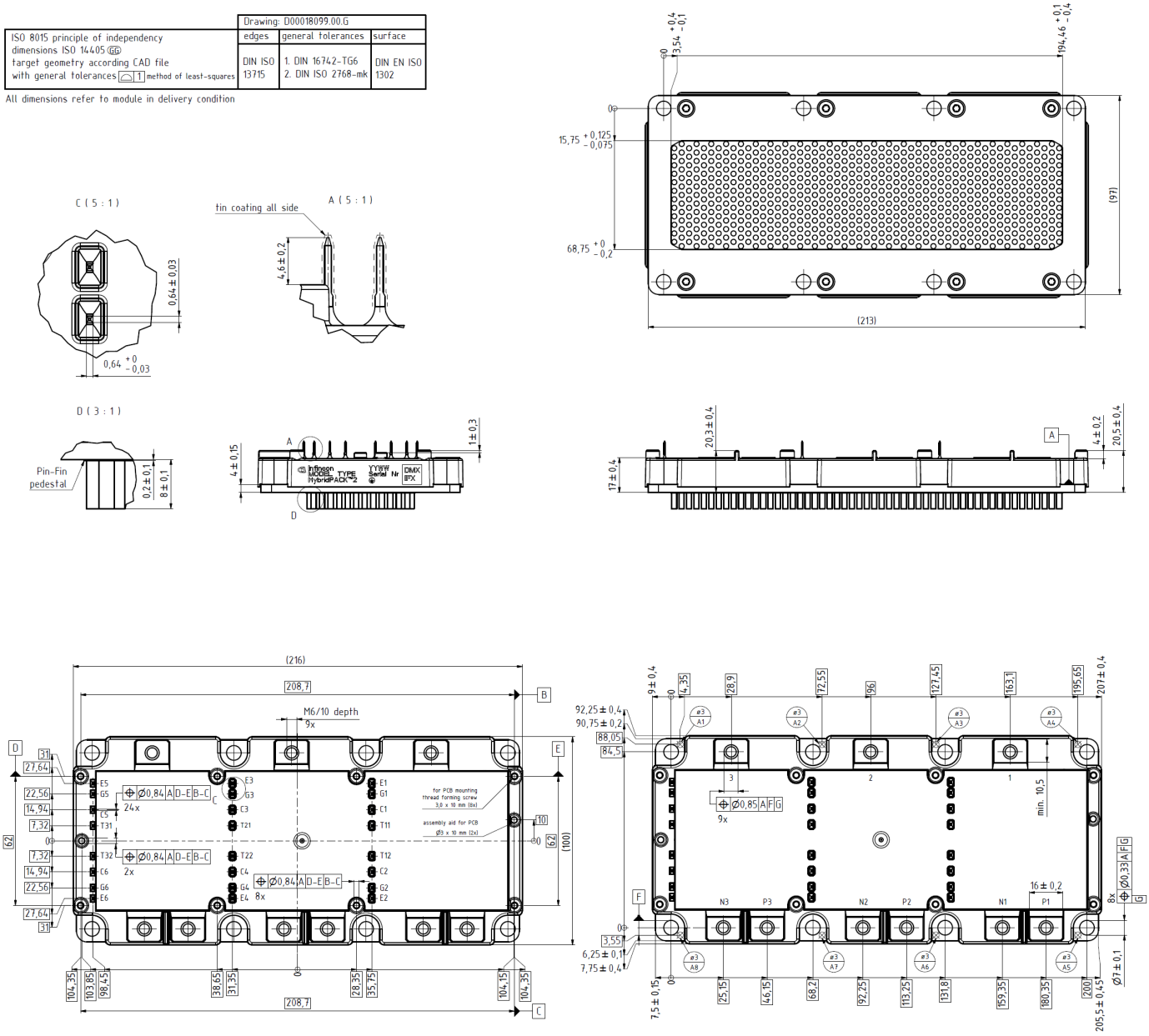
pressure drop in cooling circuit
$\Delta p = f(\Delta V/\Delta t)$
cooling fluid = 50% water/50% ethylenglycol, T_F = 25°C



7 电路图


P3
C5
G5
E5
3
C6
G6
E6
N3
P2
C3
G3
E3
2
C4
G4
E4
N2
P1
C1
G1
E1
1
C2
G2
E2
N1
T11
T12
T21
T22
T31
T32

8 封装外形


Drawing: D00018099.00.G
ISO 8015 principle of independency
dimensions ISO 14405
target geometry according CAD file
with general tolerances
edges
general tolerances
surface
DIN ISO 13715
1. DIN 16742-TG6
2. DIN ISO 2768-mk
DIN EN ISO 1302
All dimensions refer to module in delivery condition
C (5 : 1)
A (5 : 1)
tin coating all side
D (3 : 1)
Pin-Fin
pedestal
(213)
(97)
(216)
208,7
M6/10 depth
9x
24x
2x
8x
for PCB mounting
thread forming screw
3,0 x 10 mm (6x)
assembly aid for PCB
Ø3 x 10 mm (2x)
min. 10,5
16 ± 0,2

9 标签代码

9.1 模块代码

Code Format	Data Matrix		
Encoding	ASCII Text		
Symbol Size	16x16		
Standard	IEC24720 and IEC16022		
Code Content	**Content** Module Serial Number Module Material Number Production Order Number Datecode (Production Year) Datecode (Production Week)	**Digit** 1 - 5 6 - 11 12 - 19 20 - 21 22 - 23	**Example (below)** 71549 142846 55054991 15 30
Example	7154914284655054991530		

9.2 包装代码

Code Format	Code128			
Encoding	Code Set A			
Symbol Size	34 digits			
Standard	IEC8859-1			
Code Content	**Content** Backend Construction Number Production Lot Number Serial Number Date Code Box Quantity	**Identifier** X 1T S 9D Q	**Digit** 2 - 9 12 - 19 21 - 25 28 - 31 33 - 34	**Example (below)** 95056609 2X0003E0 754389 1139 15
Example	X950566091T2X0003E0S754389D1139Q15			

修订记录

自上次修订以来的主要变化

修订记录

Reference	Date	Description
V1.0	2014-07-11	Initial Version
V2.0	2016-01-13	preliminary data
V2.1	2016-04-11	-
V3.0	2016-11-07	Final datasheet
V3.1	2016-11-14	-
V3.2	2017-08-30	-

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Edition 2014-05-30

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Infineon Technologies AG
81726 Munich, Germany
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Last update	2011-11-11

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版本 **2026-09-29**

Infineon Technologies AG 出版，
德国 **Neubiberg 85579**

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