BFR360F

Low profile silicon NPN RF bipolar transistor

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Product description

The BFR360F is a low noise device based on Si that is part of Infineon's established third generation RF bipolar transistor family. Its low current and low voltage characteristics make the device suitable for low current amplifiers. It remains cost competitive without compromising on ease of use.

Feature list

- Minimum noise figure NF_{min} = 1 dB at 1.8 GHz, 3 V, 3 mA
- High gain G_{ma} = 15.5 dB at 1.8 GHz, 3 V, 15 mA
- OIP_3 = 24 dBm at 1.8 GHz, 3 V, 15 mA

Product validation

Qualified for industrial applications according to the relevant tests of JEDEC47/20/22.

Potential applications

- Low noise amplifiers (LNAs) for FM and AM radio
- LNAs for sub-1 GHz ISM band applications

Device information

Table 1 Part information

Product name / Ordering code	Package	Pin configuration			Marking	Pieces / Reel
BFR360F / BFR360FH6327XTSA1	TSFP-3-1	1 = B	2 = E	3 = C	FBs	3000

Attention: ***ESD (Electrostatic discharge) sensitive device, observe handling precautions***

Table of contents

1 Absolute maximum ratings

Table 2 Absolute maximum ratings at T_A = 25 °C (unless otherwise specified)

Parameter	Symbol	Values		Unit	Note or test condition
		Min.	Max.		
Collector emitter voltage	V_{CEO}	–	6	V	Open base
Collector emitter voltage	V_{CES}		15		E-B short circuited
Collector base voltage	V_{CBO}		15		Open emitter
Emitter base voltage	V_{EBO}		2		Open collector
Base current	I_B		4	mA	–
Collector current	I_C		35		
Total power dissipation [1]	P_{tot}		210	mW	$T_S \leq 98$ °C
Junction temperature	T_J		150	°C	–
Storage temperature	T_{Stg}	-55			

*Attention: **Stresses above the max. values listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Exceeding only one of these values may cause irreversible damage to the integrated circuit.***

1 T_S is the soldering point temperature. T_S is measured on the emitter lead at the soldering point of the PCB.

2 Thermal characteristics

Table 3 Thermal resistance

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Junction - soldering point	R_{thJS}	–	250	–	K/W	–

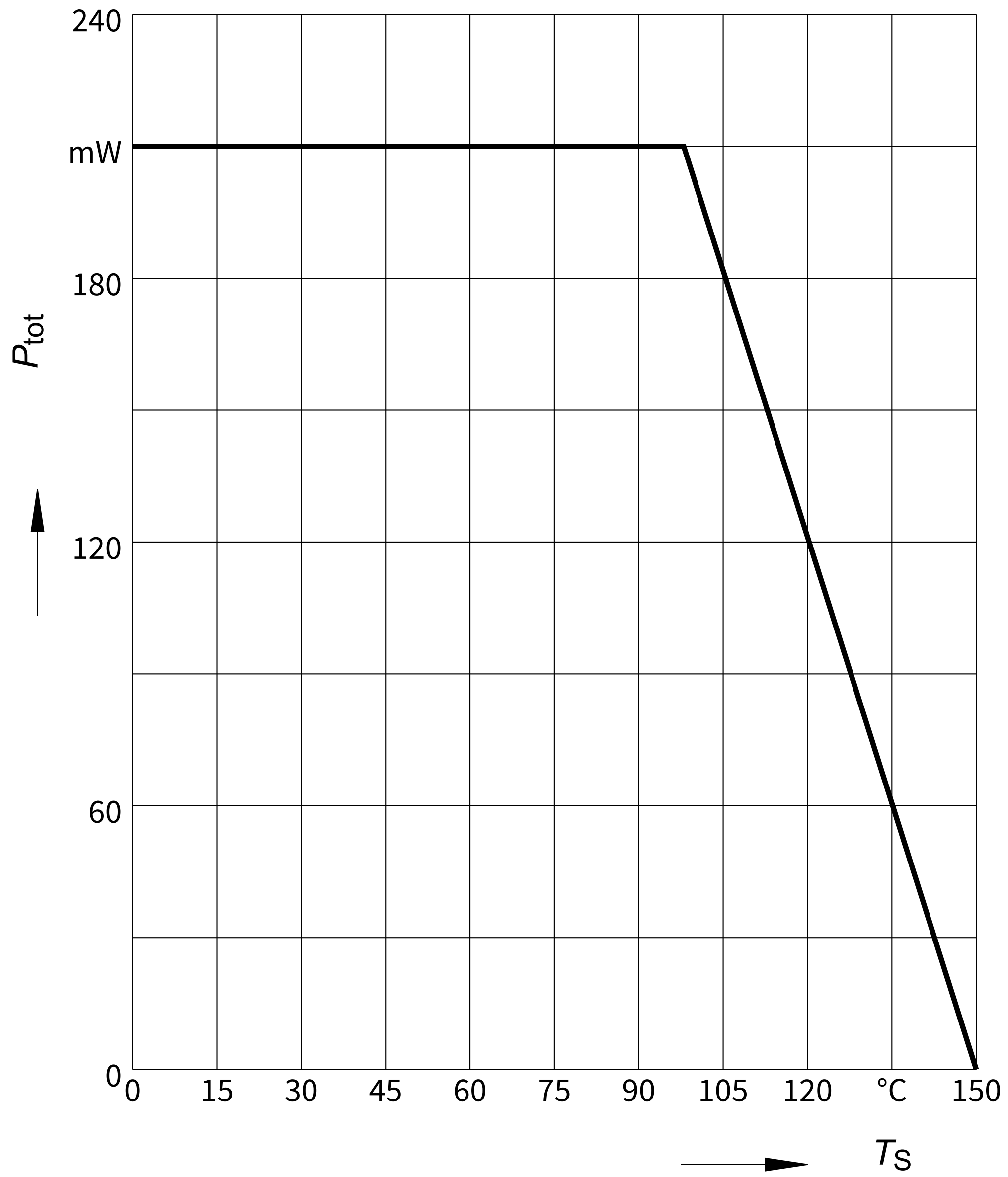

Figure 1 Total power dissipation P_{tot} = f(T_S)

3 Electrical characteristics

3.1 DC characteristics

Table 4 DC characteristics at T_A = 25 °C (unless otherwise specified)

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Collector emitter breakdown voltage	$V_{(BR)CEO}$	6	9	–	V	I_C = 1 mA, I_B = 0, open base
Collector emitter leakage current	I_{CES}	–	1	30 [2]	nA	V_{CE} = 4 V, V_{BE} = 0, E-B short circuited
			2	50 [2]		V_{CE} = 10 V, V_{BE} = 0, T_A = 85 °C, E-B short circuited
Collector base leakage current	I_{CBO}		1	30 [2]		V_{CB} = 4 V, I_E = 0, open emitter
Emitter base leakage current	I_{EBO}		1	500 [2]		V_{EB} = 1 V, I_C = 0, open collector
DC current gain	h_{FE}	90	120	160		V_{CE} = 3 V, I_C = 15 mA, pulse measured

3.2 General AC characteristics

Table 5 General AC characteristics at T_A = 25 °C

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Transition frequency	f_T	11	14	–	GHz	V_{CE} = 3 V, I_C = 15 mA, f = 1 GHz
Collector base capacitance	C_{CB}	–	0.32	0.5	pF	V_{CB} = 5 V, V_{BE} = 0, f = 1 MHz, emitter grounded
Collector emitter capacitance	C_{CE}		0.2	–		V_{CE} = 5 V, V_{BE} = 0, f = 1 MHz, base grounded
Emitter base capacitance	C_{EB}		0.4			V_{EB} = 0.5 V, V_{CB} = 0, f = 1 MHz, collector grounded

2 Maximum values not limited by the device but by the short cycle time of the 100% test.

3.3 Frequency dependent AC characteristics

Measurement setup is a test fixture with Bias-T's in a 50 Ω system, T_A = 25 °C.

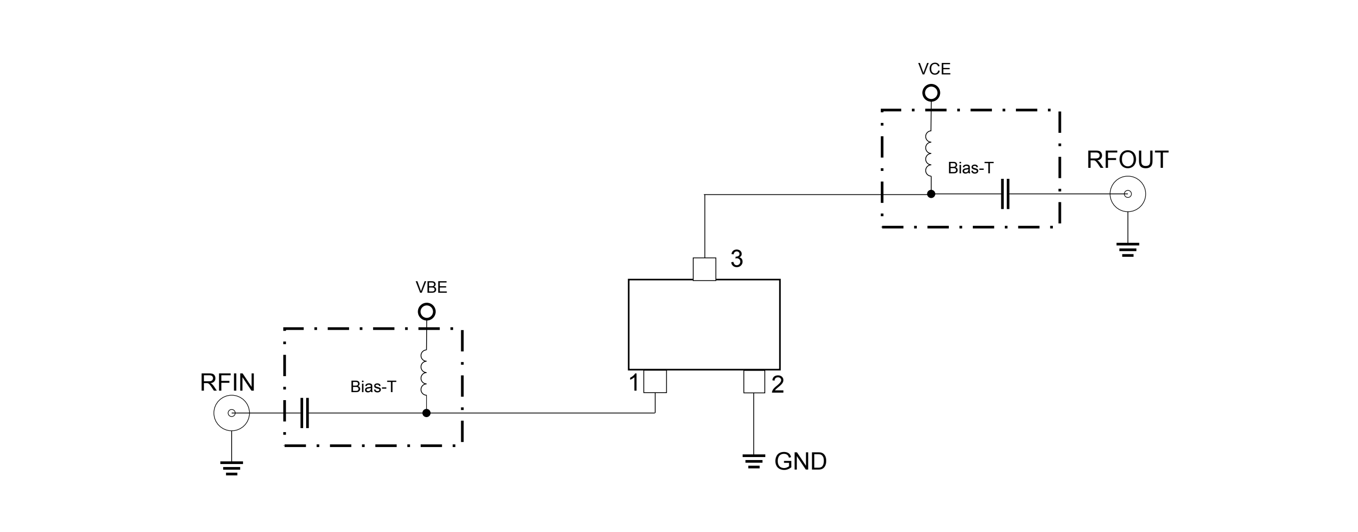

Figure 2 Testing circuit

Table 6 AC characteristics, V_{CE} = 3 V, f = 1.8 GHz

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Power gain • Maximum power gain • Transducer gain	 G_{ma} $\|S_{21}\|^2$	–	 15.5 13	–	dB	 I_C = 15 mA
Noise figure • Minimum noise figure	 NF_{min}		 1			 I_C = 3 mA
Linearity • 3rd order intercept point at output • 1 dB gain compression point at output	 OIP_3 OP_{1dB}		 24 9		dBm	 I_C = 15 mA, Z_S = Z_L = 50 Ω

Table 7 AC characteristics, V_{CE} = 3 V, f = 3 GHz

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Power gain • Maximum power gain • Transducer gain	 G_{ma} $\|S_{21}\|^2$	–	 11 9	–	dB	 I_C = 15 mA

Note: *$G_{ms} = |S_{21} / S_{12}|$ for k < 1; $G_{ma} = |S_{21} / S_{12}| (k-(k^2-1)^{1/2})$ for k > 1. In order to get the NF_{min} values stated in this chapter, the test fixture losses have been subtracted from all measured results. OIP_3 value depends on termination of all intermodulation frequency components. Termination used for this measurement is 50 Ω from 0.1 MHz to 6 GHz.*

3.4 Characteristic AC diagrams

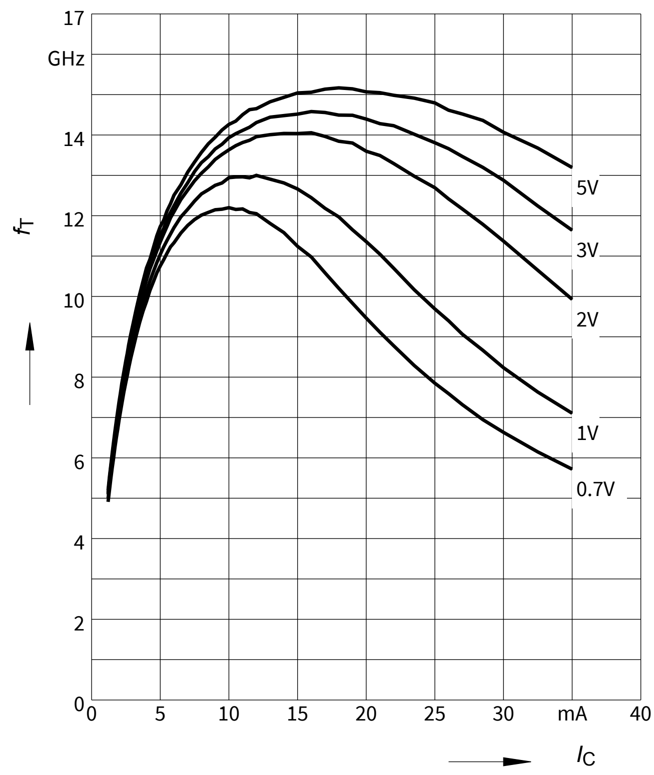

Figure 3 Transition frequency $f_T = f(I_C)$, $f = 1$ GHz, V_{CE} = parameter

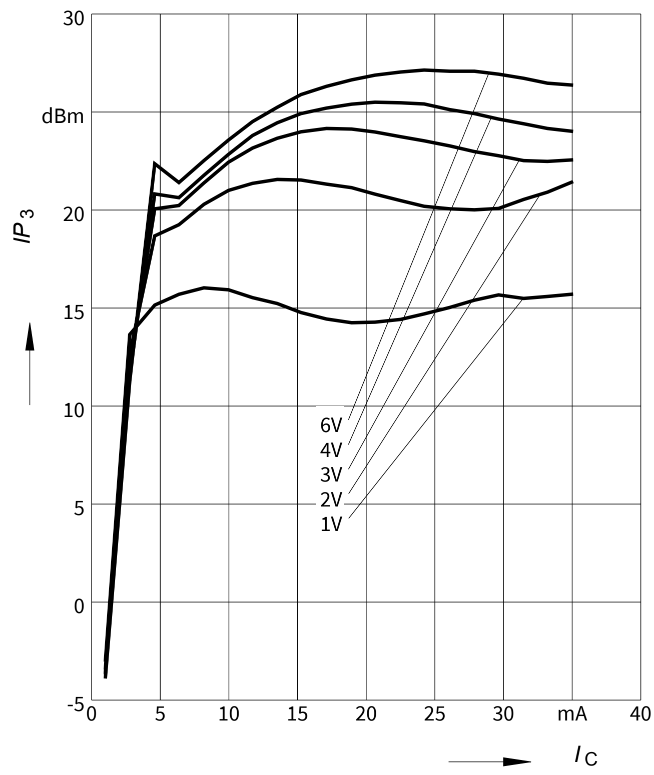

Figure 4 3rd order intercept point $OIP_3 = f(I_C)$, $Z_S = Z_L = 50\ \Omega$, V_{CE}, $f = 1.8$ GHz, V_{CE} = parameter

Electrical characteristics

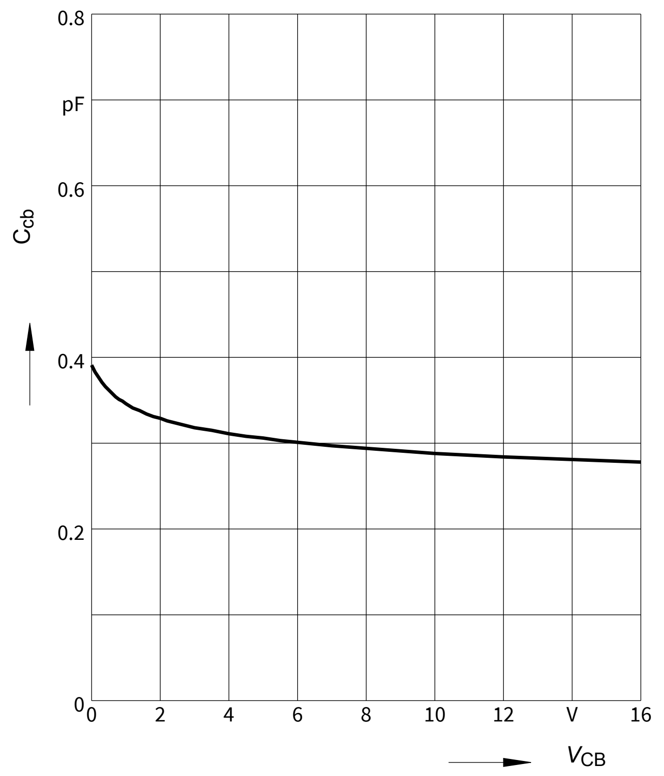

Figure 5 **Collector base capacitance C_{CB} = f(V_{CB}), f = 1 MHz**

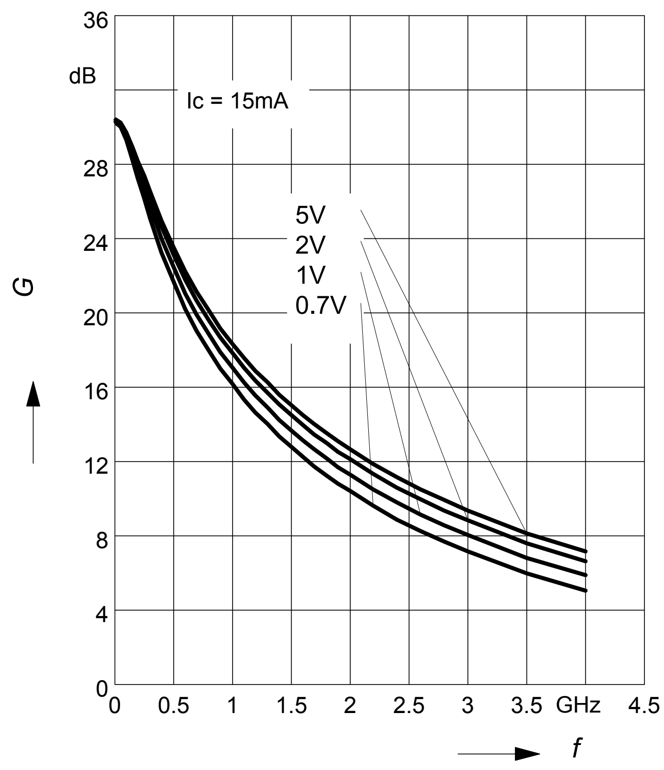

Figure 6 **Transducer Gain $|S_{21}|^2$ = f(f), I_C = 15 mA, V_{CE} = parameter**

Electrical characteristics

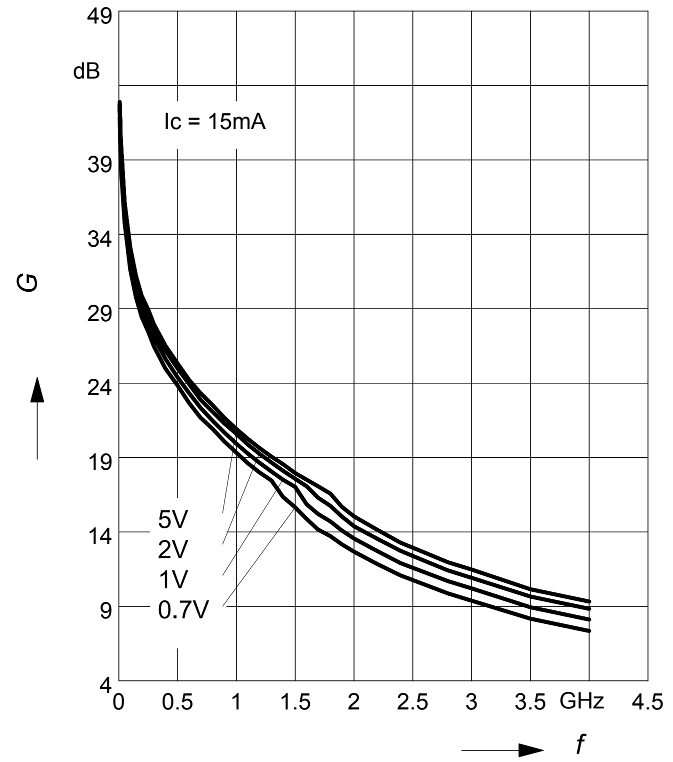

Figure 7 **Gain G_{ma}, G_{ms} = f(f), I_C = 15 mA, V_{CE} = parameter**

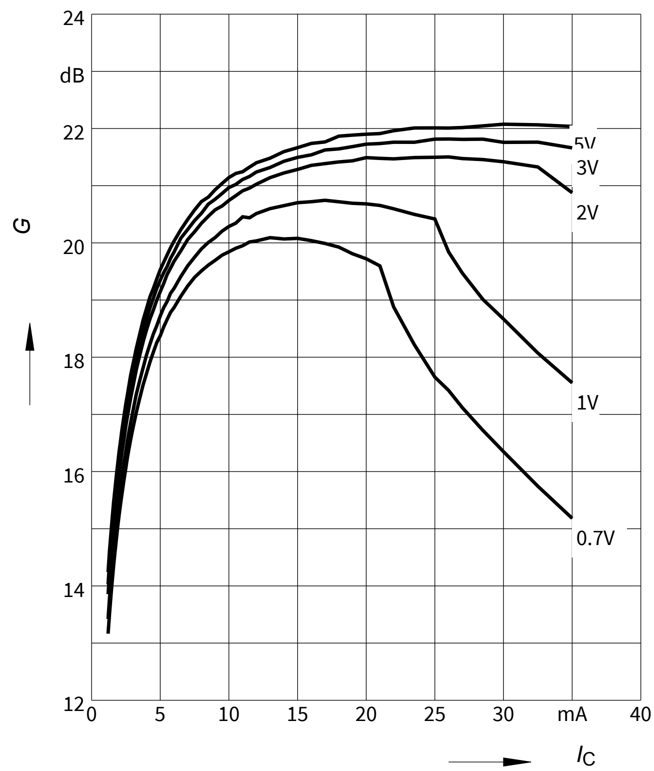

Figure 8 **Gain G_{ma}, G_{ms} = f(I_C), f = 900 MHz, V_{CE} = parameter**

Electrical characteristics

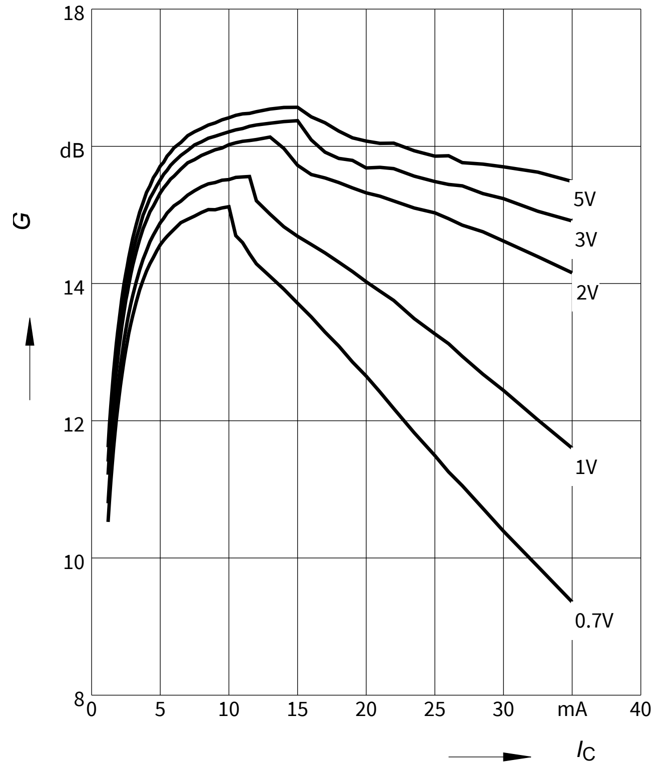

Figure 9 Gain G_{ma}, G_{ms} = f(I_C), f = 1.8 GHz, V_{CE} = parameter

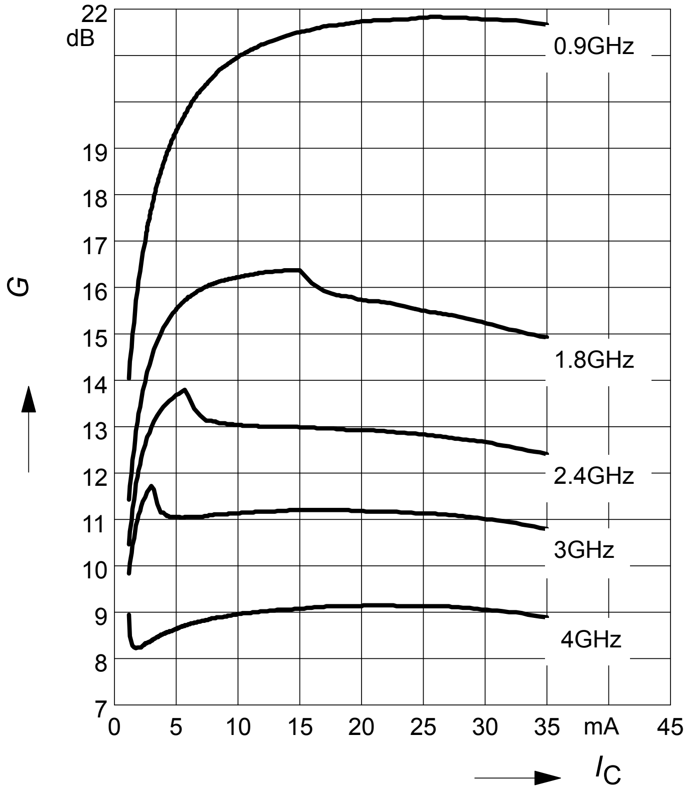

Figure 10 Maximum power gain G_{max} = f(I_C), V_{CE} = 3 V, f = parameter in GHz

Electrical characteristics

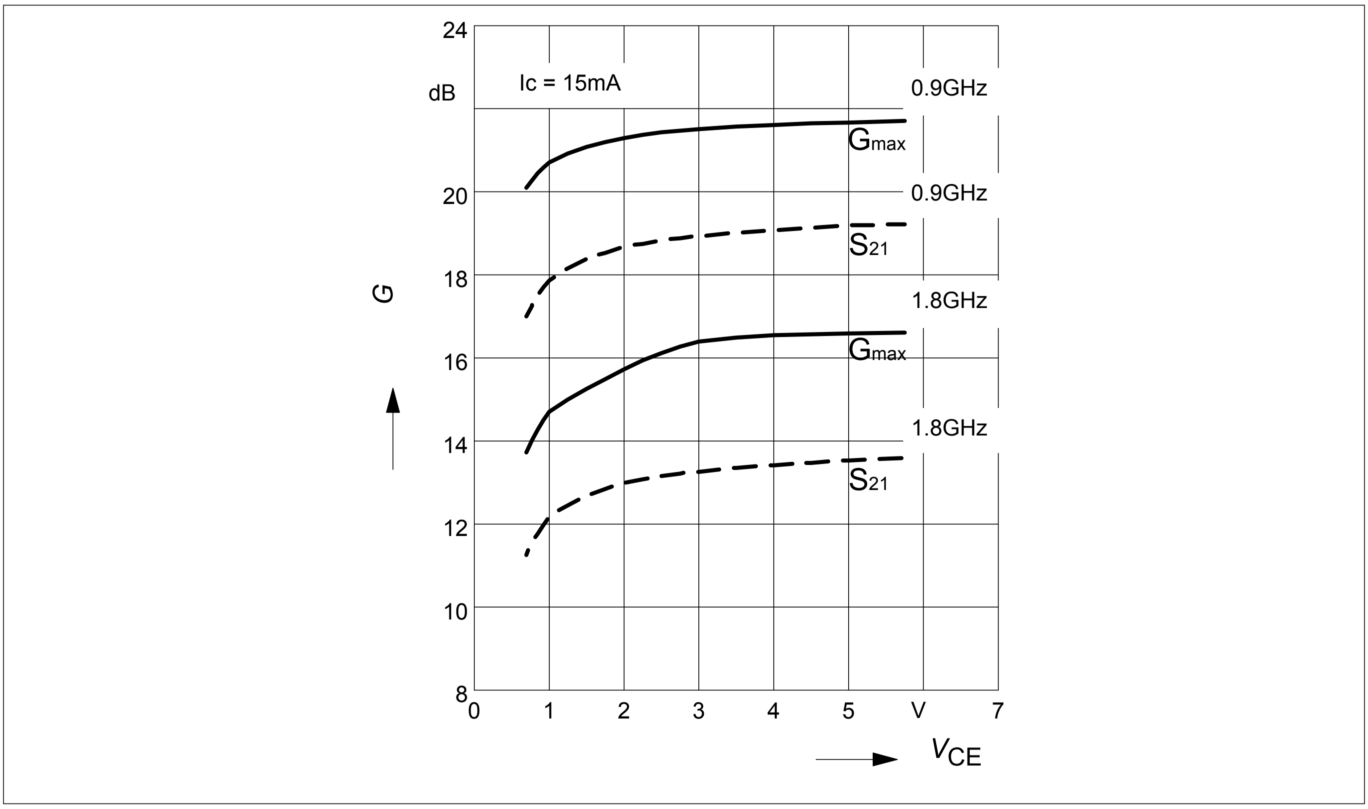

Figure 11 Maximum power gain G_{max} = f(V_{CE}), transducer gain $|S_{21}|^2$ = f(V_{CE}), I_C = 15 mA, f = parameter in GHz

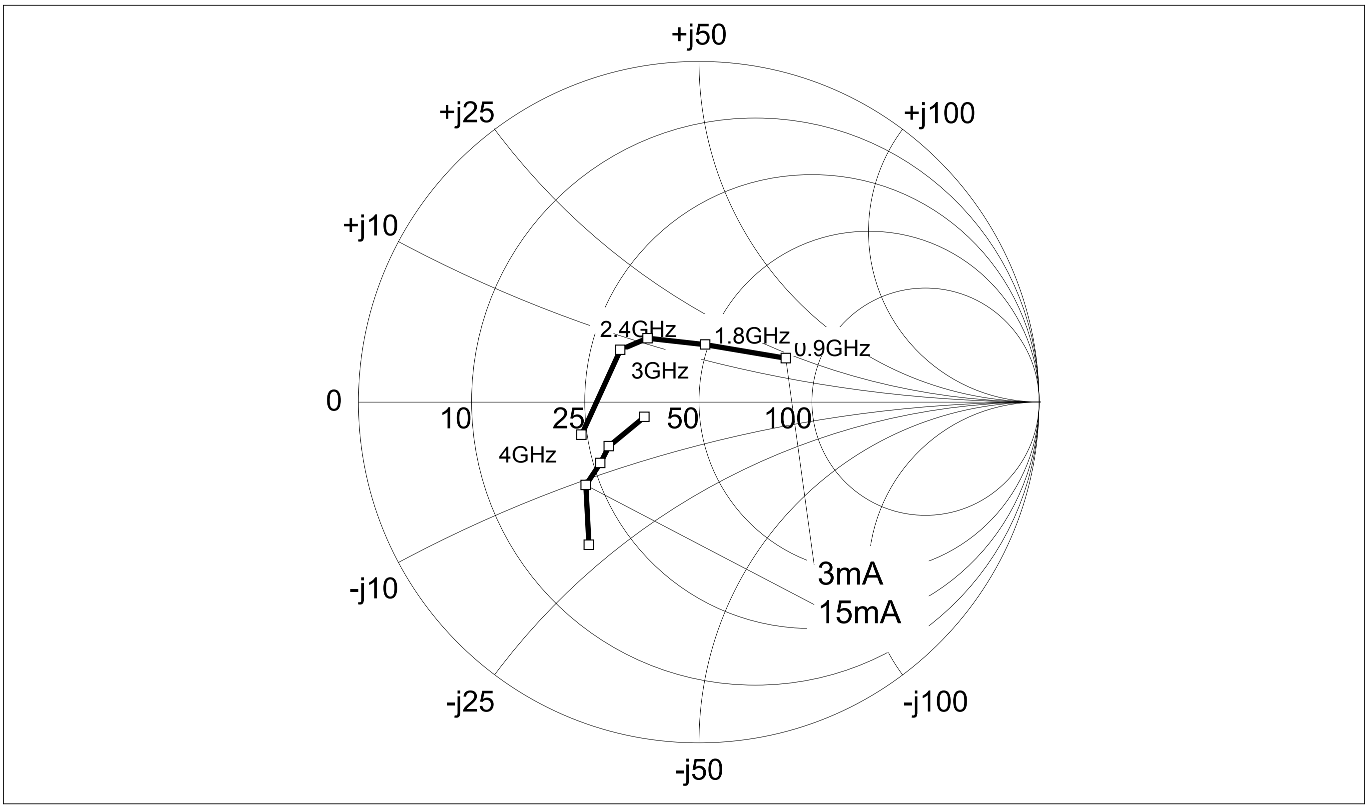

Figure 12 Source impedance for minimum noise figure $Z_{S,opt}$ = f(f), V_{CE} = 3 V, I_C = 3 / 15 mA

Electrical characteristics

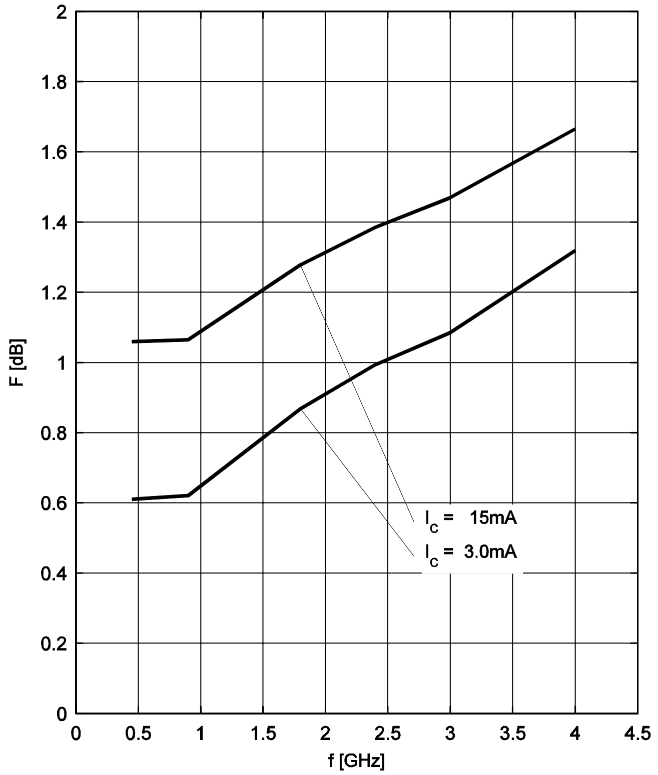

Figure 13 Minimum noise figure NF_{min} = f(f), V_{CE} = 3 V, Z_S = $Z_{S,opt}$, I_C = 3 / 15 mA

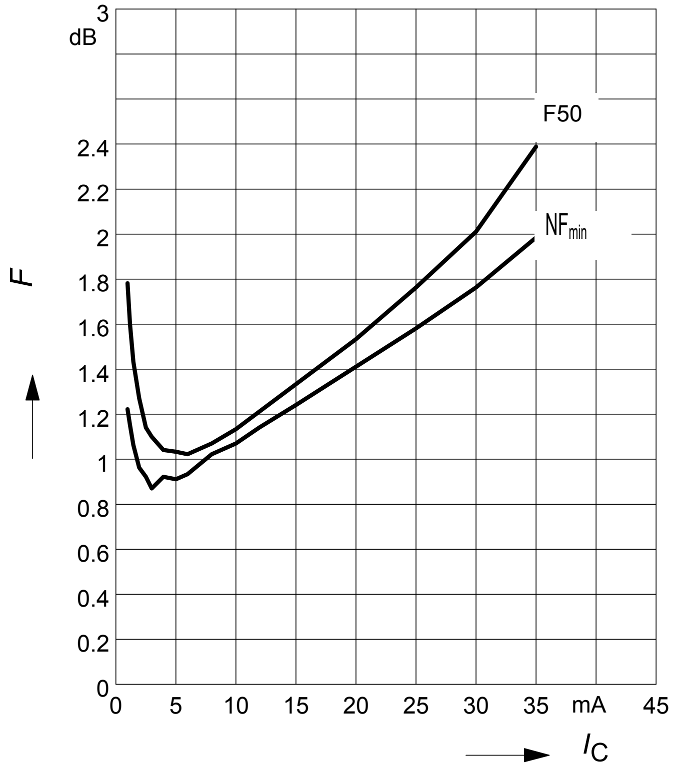

Figure 14 Noise figure NF_{min} = f(I_C), Z_S = $Z_{S,opt}$, NF_{50} = f(I_C), Z_S = 50 Ω, V_{CE} = 3 V, f = 1.8 GHz

Note: The curves shown in this chapter have been generated using typical devices but shall not be considered as a guarantee that all devices have identical characteristic curves. T_A = 25 °C.

4 Package information TSFP-3-1

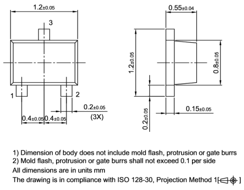

Figure 15 Package outline

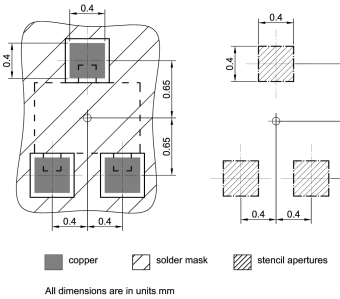

Figure 16 Foot print

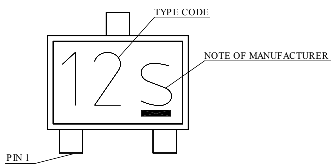

Figure 17 Marking layout example

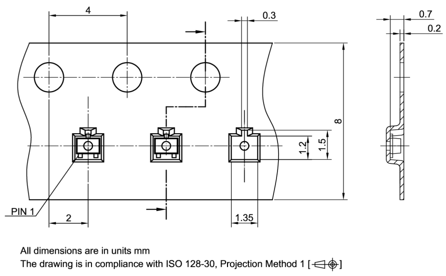

Figure 18 Tape information

Revision history

Document version	Date of release	Description of changes
Revision 2.0	2019-01-25	New datasheet layout.

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Edition 2019-01-25

Published by

Infineon Technologies AG

81726 Munich, Germany

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Document reference
IFX-kan1525443952290