BFP750

High Linearity Low Noise SiGe:C NPN RF Transistor

Data Sheet

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BFP750, High Linearity Low Noise SiGe:C NPN RF Transistor

Revision History: 2015-01-14, Revision 1.1

Page	Subjects (major changes since last revision)
	This data sheet replaces the revision from 2010-10-22.

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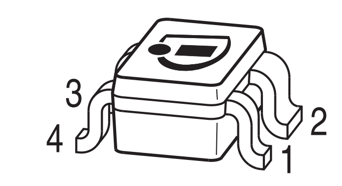
1 Product Brief

The BFP750 is a wideband linear low noise NPN bipolar RF transistor. The device is based on Infineon's reliable high volume silicon germanium carbon (SiGe:C) heterojunction bipolar technology. The collector design supports voltages up to VCEO = 4 V and currents up to IC = 120 mA. With its high linearity at currents as low as 20 mA the device supports energy efficient designs. The typical transistor frequency is approximately 41 GHz, hence the device offers high power gain at frequencies up to 7 GHz in amplifiers applications. The device is housed in an easy to use plastic package with visible leads.

2 Features

- Highly linear low noise amplifier for all RF frontends up to 5.5 GHz
- Output compression point OP_{1dB} = 16 dBm at 60 mA, 3 V, 1.9 GHz, 50 Ω system
- Output 3rd order intermodulation point OIP_3 = 30 dBm at 60 mA, 3 V, 1.9 GHz, 50 Ω system
- Maximum gain G_{ms} = 19 dB at 60 mA, 3 V, 3.5 GHz
- Minimum noise figure NF_{min} = 0.9 dB at 30 mA, 3 V, 1.9 GHz
- Based on Infineon´s reliable, high volume SiGe:C wafer technology
- Easy to use Pb-free (RoHS compliant) and halogen-free standard package with visible leads
- Qualification report according to AEC-Q101 available



RoHS

Application Examples

Driver amplifier

- 1.9 GHz and 5.8 GHz cordless phones

Transmitter driver amplifier

- 2.4 GHz WLAN / Bluetooth / WiMAX
- 3.5 GHz WiMax
- 5.5 GHz WLAN / WiMAX

Output stage LNA for active antennas

- GPS, SDARS
- 2.4 / 5.5 GHz WLAN
- 2.4 / 3.5 / 5.5 GHz WiMAX, etc

Suitable for 8 - 12 GHz oscillators

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

Product Name	Package	Pin configuration				Marking
BFP750	SOT343	1 = B	2 = E	3 = C	4 = E	R8s

3 Maximum Ratings

Table 3-1 Maximum Ratings at T_A = 25 °C (unless otherwise specified)

Parameter	Symbol	Values		Unit	Note / Test Condition
		Min.	Max.		
Collector emitter voltage	V_{CEO}				Open base
		–	4.0	V	T_A = 25 °C
		–	3.5	V	T_A = -55 °C
Collector emitter voltage	V_{CES}	–	13	V	Emitter / base shortened
Collector base voltage	V_{CBO}	–	13	V	Open emitter
Emitter base voltage	V_{EBO}	–	1.2	V	Open collector
Collector current	I_C	–	120	mA	–
Base current	I_B	–	12	mA	–
Total power dissipation[1)]	P_{tot}	–	360	mW	$T_S \leq 85$ °C
Junction temperature	T_J	–	150	°C	–
Storage temperature	T_{Stg}	-55	150	°C	–

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

***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. Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to the integrated circuit.*

4 Thermal Characteristics

Table 4-1 Thermal Resistance

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Junction - soldering point[1)]	R_{thJS}	–	–	180	K/W	–

1) For the definition of R_{thJS} please refer to Application Note AN077 (Thermal Resistance Calculation).

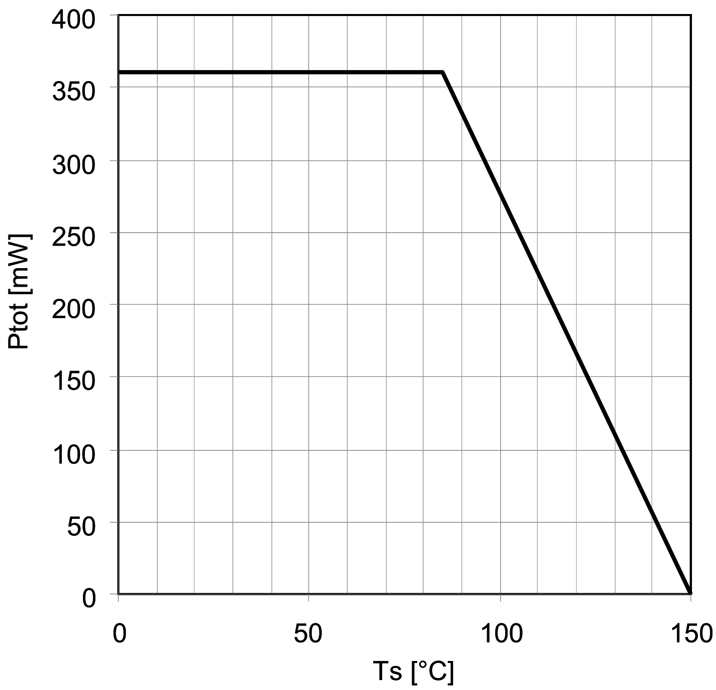


Figure 4-1 Total Power Dissipation $P_{tot} = f(T_s)$

5 Electrical Characteristics

5.1 DC Characteristics

Table 5-1 DC Characteristics at T_A = 25 °C

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Collector emitter breakdown voltage	$V_{(BR)CEO}$	4	4.7	–	V	I_C = 1 mA, I_B = 0 Open base
Collector emitter leakage current	I_{CES}	–	1	40	nA	V_{CE} = 5 V, V_{BE} = 0 Emitter/base shortened
Collector base leakage current	I_{CBO}	–	1	40	nA	V_{CB} = 5 V, I_E = 0 Open emitter
Emitter base leakage current	I_{EBO}	–	0.1	3	µA	V_{EB} = 0.5 V, I_C = 0 Open collector
DC current gain	h_{FE}	160	250	400		V_{CE} = 3 V, I_C = 60 mA Pulse measured

5.2 General AC Characteristics

Table 5-2 General AC Characteristics at T_A = 25 °C

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Transition frequency	f_T	–	41	–	GHz	V_{CE} = 3 V, I_C = 60 mA, f = 1 GHz
Collector base capacitance	C_{CB}	–	0.24	–	pF	V_{CB} = 3 V, V_{BE} = 0 V f = 1 MHz Emitter grounded
Collector emitter capacitance	C_{CE}	–	0.55	–	pF	V_{CE} = 3 V, V_{BE} = 0 V f = 1 MHz Base grounded
Emitter base capacitance	C_{EB}	–	1	–	pF	V_{EB} = 0.5 V, V_{CB} = 0 V f = 1 MHz Collector grounded

5.3 Frequency Dependent AC Characteristics

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

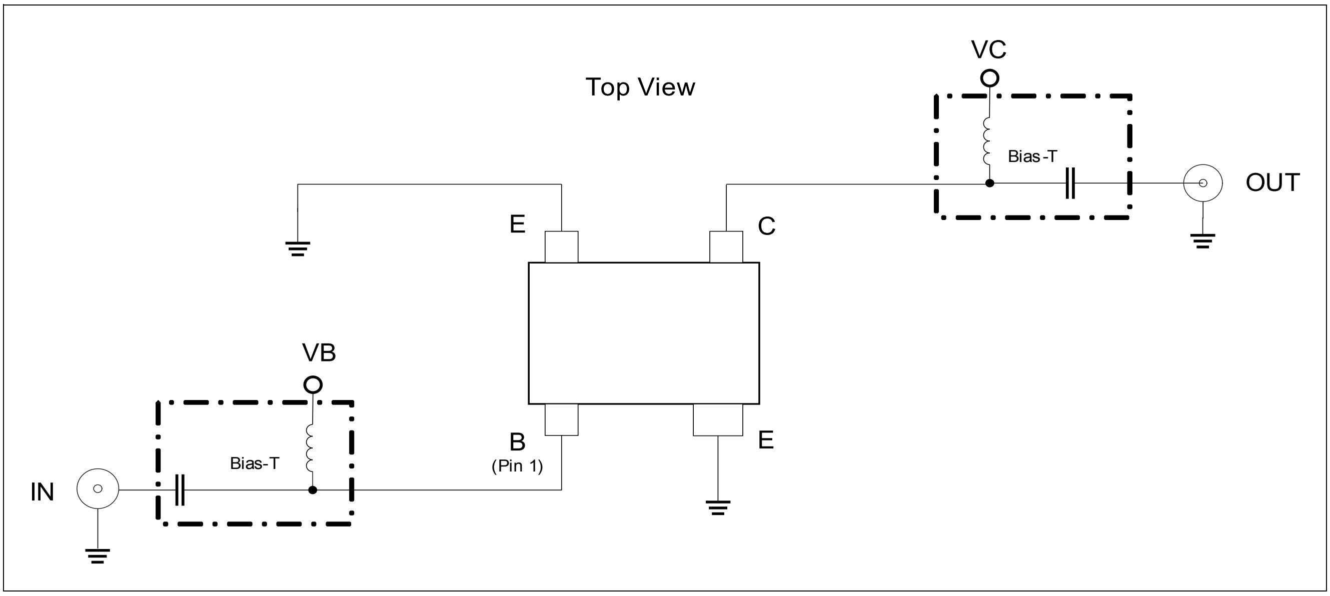


Figure 5-1 BFP750 Testing Circuit

Table 5-3 AC Characteristics, V_{CE} = 3 V, f = 150 MHz

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum power gain					dB	
High linearity operation point	G_{ms}	–	34.5	–		I_C = 30 mA
Class A operation point	G_{ms}	–	35.5	–		I_C = 60 mA
Transducer gain					dB	$Z_S = Z_L$ = 50 Ω
High linearity operation point	S_{21}	–	33	–		I_C = 30 mA
Class A operation point	S_{21}	–	33.5	–		I_C = 60 mA
Minimum noise figure					dB	$Z_S = Z_{opt}$
Minimum noise figure	NF_{min}	–	0.85	–		I_C = 30 mA
Associated gain	G_{ass}	–	32.5	–		I_C = 30 mA
Linearity					dBm	$Z_S = Z_L$ = 50 Ω
1 dB gain compression point	OP_{1dB}	–	15	–		I_C = 60 mA
3rd order intercept point	OIP_3	–	27.5	–		I_C = 60 mA

Table 5-4 AC Characteristics, V_{CE} = 3 V, f = 450 MHz

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum power gain					dB	
High linearity operation point	G_{ms}	–	29.5	–		I_C = 30 mA
Class A operation point	G_{ms}	–	31.5	–		I_C = 60 mA
Transducer gain					dB	$Z_S = Z_L$ = 50 Ω
High linearity operation point	S_{21}	–	29.5	–		I_C = 30 mA
Class A operation point	S_{21}	–	30.5	–		I_C = 60 mA
Minimum noise figure					dB	$Z_S = Z_{opt}$
Minimum noise figure	NF_{min}	–	0.85	–		I_C = 30 mA
Associated gain	G_{ass}	–	29.5	–		I_C = 30 mA
Linearity					dBm	$Z_S = Z_L$ = 50 Ω
1 dB gain compression point	OP_{1dB}	–	15.5	–		I_C = 60 mA
3rd order intercept point	OIP_3	–	29	–		I_C = 60 mA

Table 5-5 AC Characteristics, V_{CE} = 3 V, f = 900 MHz

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum power gain					dB	
High linearity operation point	G_{ms}	–	26	–		I_C = 30 mA
Class A operation point	G_{ms}	–	27.5	–		I_C = 60 mA
Transducer gain					dB	$Z_S = Z_L$ = 50 Ω
High linearity operation point	S_{21}	–	25	–		I_C = 30 mA
Class A operation point	S_{21}	–	25	–		I_C = 60 mA
Minimum noise figure					dB	$Z_S = Z_{opt}$
Minimum noise figure	NF_{min}	–	0.85	–		I_C = 30 mA
Associated gain	G_{ass}	–	24.5	–		I_C = 30 mA
Linearity					dBm	$Z_S = Z_L$ = 50 Ω
1 dB gain compression point	OP_{1dB}	–	16	–		I_C = 60 mA
3rd order intercept point	OIP_3	–	30	–		I_C = 60 mA

Table 5-6 AC Characteristics, V_{CE} = 3 V, f = 1.5 GHz

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum power gain					dB	
High linearity operation point	G_{ms}	–	23.5	–		I_C = 30 mA
Class A operation point	G_{ms}	–	24.5	–		I_C = 60 mA
Transducer gain					dB	$Z_S = Z_L$ = 50 Ω
High linearity operation point	S_{21}	–	20.5	–		I_C = 30 mA
Class A operation point	S_{21}	–	21	–		I_C = 60 mA
Minimum noise figure					dB	$Z_S = Z_{opt}$
Minimum noise figure	NF_{min}	–	0.85	–		I_C = 30 mA
Associated gain	G_{ass}	–	20.5	–		I_C = 30 mA
Linearity					dBm	$Z_S = Z_L$ = 50 Ω
1 dB gain compression point	OP_{1dB}	–	16	–		I_C = 60 mA
3rd order intercept point	OIP_3	–	30	–		I_C = 60 mA

Table 5-7 AC Characteristics, V_{CE} = 3 V, f = 1.9 GHz

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum power gain					dB	
High linearity operation point	G_{ms}	–	22.5	–		I_C = 30 mA
Class A operation point	G_{ms}	–	23.5	–		I_C = 60 mA
Transducer gain					dB	$Z_S = Z_L$ = 50 Ω
High linearity operation point	S_{21}	–	18.5	–		I_C = 30 mA
Class A operation point	S_{21}	–	19	–		I_C = 60 mA
Minimum noise figure					dB	$Z_S = Z_{opt}$
Minimum noise figure	NF_{min}	–	0.9	–		I_C = 30 mA
Associated gain	G_{ass}	–	18.5	–		I_C = 30 mA
Linearity					dBm	$Z_S = Z_L$ = 50 Ω
1 dB gain compression point	OP_{1dB}	–	16	–		I_C = 60 mA
3rd order intercept point	OIP_3	–	30	–		I_C = 60 mA

Table 5-8 AC Characteristics, V_{CE} = 3 V, f = 2.4 GHz

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum power gain					dB	
High linearity operation point	G_{ms}	–	21	–		I_C = 30 mA
Class A operation point	G_{ms}	–	22	–		I_C = 60 mA
Transducer gain					dB	$Z_S = Z_L$ = 50 Ω
High linearity operation point	S_{21}	–	16.5	–		I_C = 30 mA
Class A operation point	S_{21}	–	16.5	–		I_C = 60 mA
Minimum noise figure					dB	$Z_S = Z_{opt}$
Minimum noise figure	NF_{min}	–	0.9	–		I_C = 30 mA
Associated gain	G_{ass}	–	16	–		I_C = 30 mA
Linearity					dBm	$Z_S = Z_L$ = 50 Ω
1 dB gain compression point	OP_{1dB}	–	16	–		I_C = 60 mA
3rd order intercept point	OIP_3	–	29.5	–		I_C = 60 mA

Table 5-9 AC Characteristics, V_{CE} = 3 V, f = 3.5 GHz

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum power gain					dB	
High linearity operation point	G_{ms}	–	19	–		I_C = 30 mA
Class A operation point	G_{ms}	–	19	–		I_C = 60 mA
Transducer gain					dB	$Z_S = Z_L$ = 50 Ω
High linearity operation point	S_{21}	–	13	–		I_C = 30 mA
Class A operation point	S_{21}	–	13	–		I_C = 60 mA
Minimum noise figure					dB	$Z_S = Z_{opt}$
Minimum noise figure	NF_{min}	–	1.15	–		I_C = 30 mA
Associated gain	G_{ass}	–	13.5	–		I_C = 30 mA
Linearity					dBm	$Z_S = Z_L$ = 50 Ω
1 dB gain compression point	OP_{1dB}	–	16	–		I_C = 60 mA
3rd order intercept point	OIP_3	–	28.5	–		I_C = 60 mA

Table 5-10 AC Characteristics, V_{CE} = 3 V, f = 5.5 GHz

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum power gain					dB	
High linearity operation point	G_{ma}	–	14	–		I_C = 30 mA
Class A operation point	G_{ma}	–	14	–		I_C = 60 mA
Transducer gain					dB	$Z_S = Z_L$ = 50 Ω
High linearity operation point	S_{21}	–	8	–		I_C = 30 mA
Class A operation point	S_{21}	–	8	–		I_C = 60 mA
Minimum noise figure					dB	$Z_S = Z_{opt}$
Minimum noise figure	NF_{min}	–	1.4	–		I_C = 30 mA
Associated gain	G_{ass}	–	11	–		I_C = 30 mA
Linearity					dBm	$Z_S = Z_L$ = 50 Ω
1 dB gain compression point	OP_{1dB}	–	15	–		I_C = 60 mA
3rd order intercept point	$OIP3$	–	27	–		I_C = 60 mA

Note:

1. *In order to get the NF_{min} values stated in this chapter the test fixture losses have been subtracted from all measured result*
2. *OIP3 value depends on termination of all intermodulation frequency components. Termination used for this measurement is 50 Ω from 0.2 MHz to 12 GHz.*

5.4 Characteristic DC Diagrams

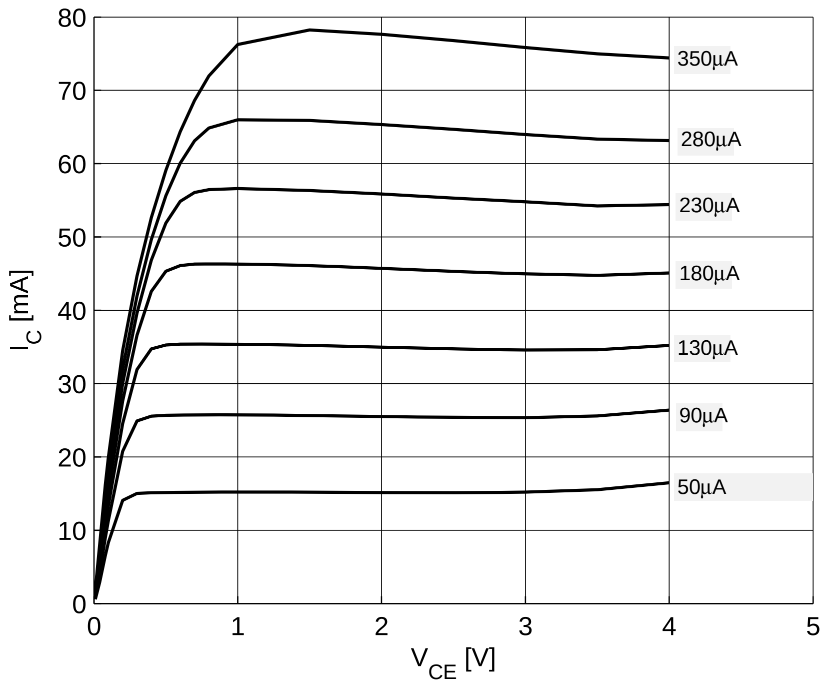


Figure 5-2 Collector Current vs. Collector Emitter Voltage $I_C = f(V_{CE})$, I_B = Parameters

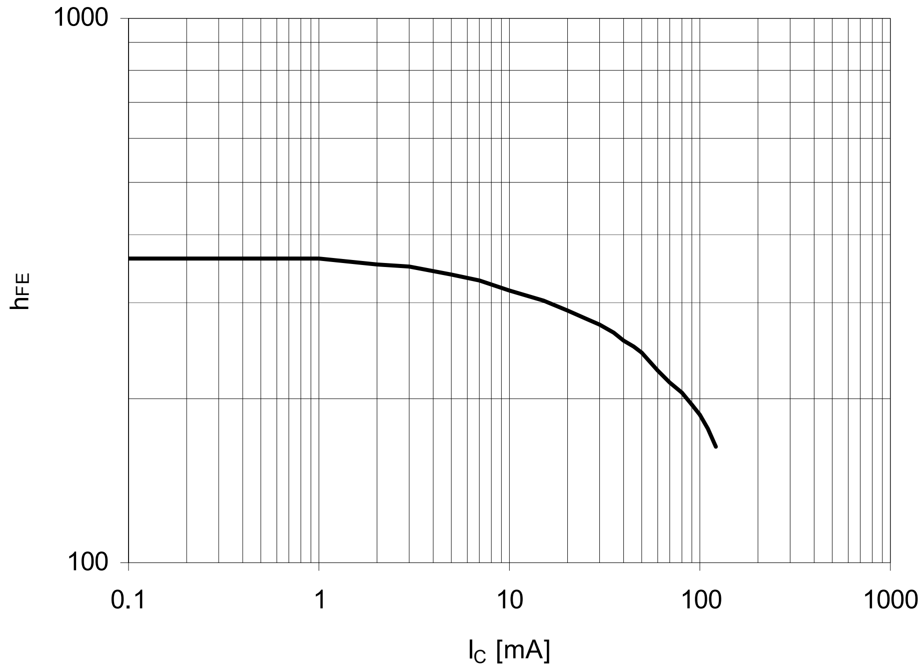


Figure 5-3 DC Current Gain $h_{FE} = f(I_C)$, V_{CE} = 3 V

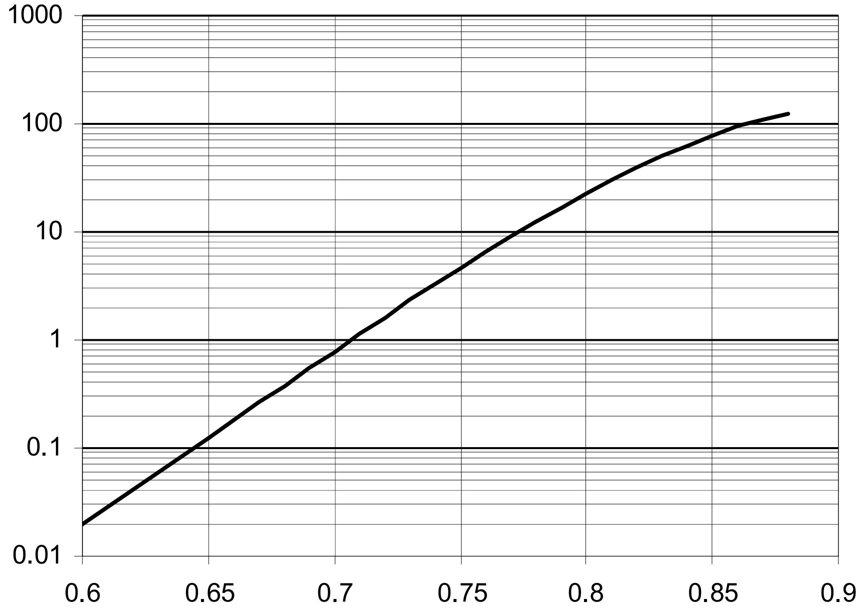


Figure 5-4 Collector Current vs. Base Emitter Voltage $I_C = f(V_{BE})$, V_{CE} = 2 V

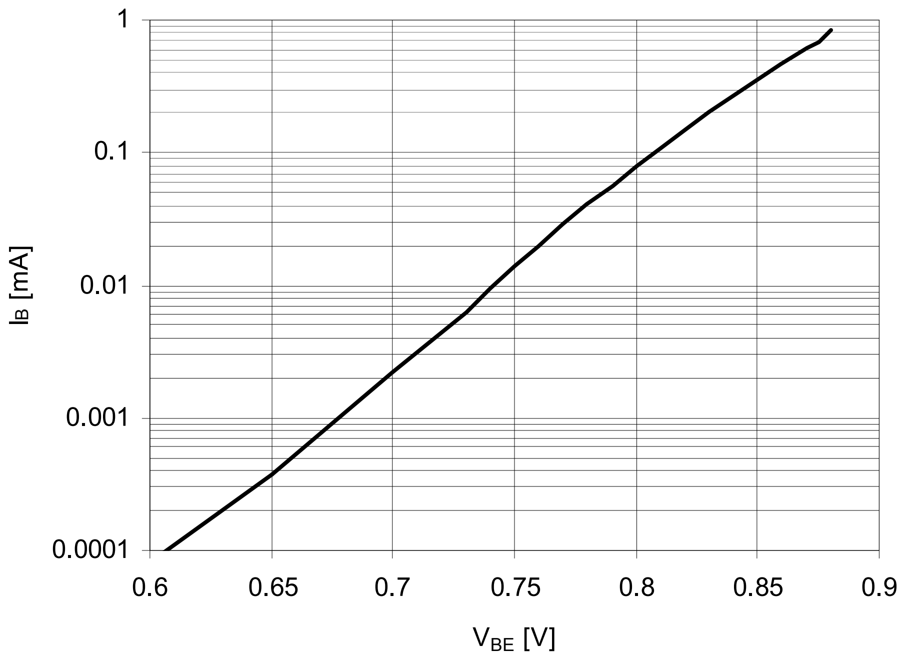


Figure 5-5 Base Current vs. Base Emitter Forward Voltage $I_B = f(V_{BE})$, V_{CE} = 2 V

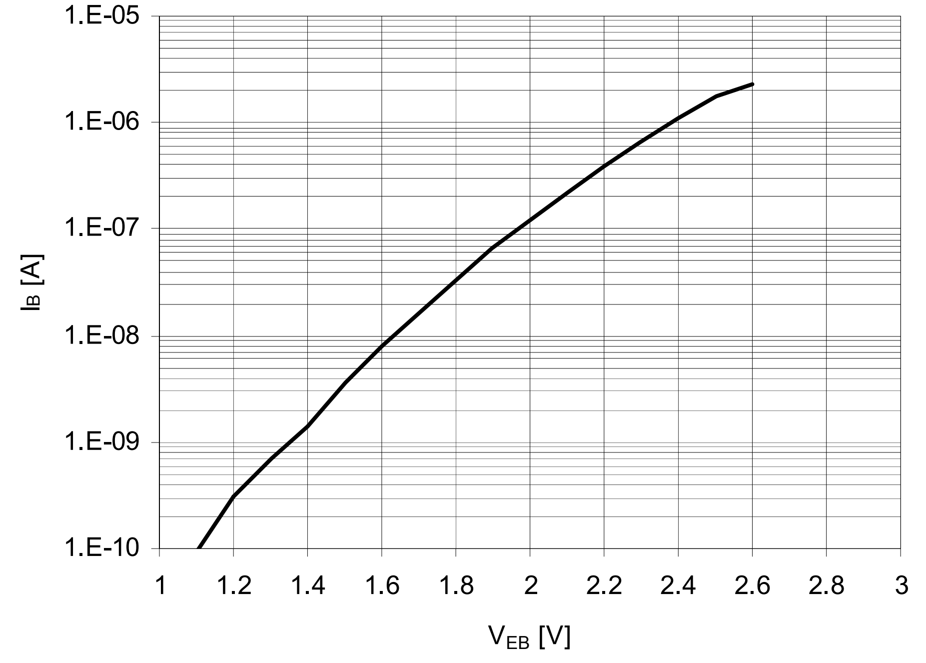


Figure 5-6 Base Current vs. Base Emitter Reverse Voltage $I_B = f(V_{EB})$, V_{CE} = 2 V

5.5 Characteristic AC Diagrams

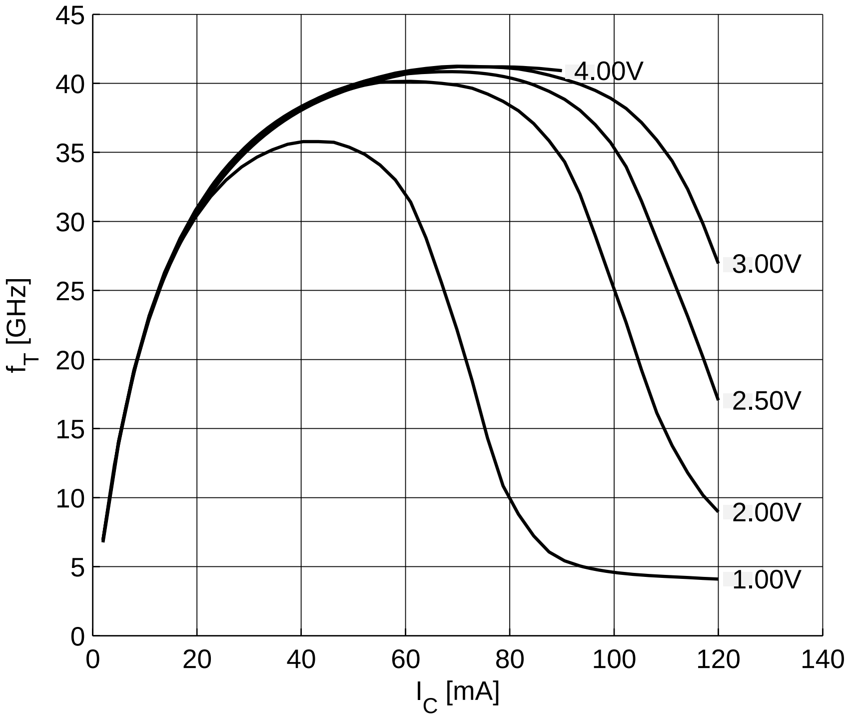


Figure 5-7 Transition Frequency $f_T = f(I_C)$, f = 1 GHz, V_{CE} = Parameters

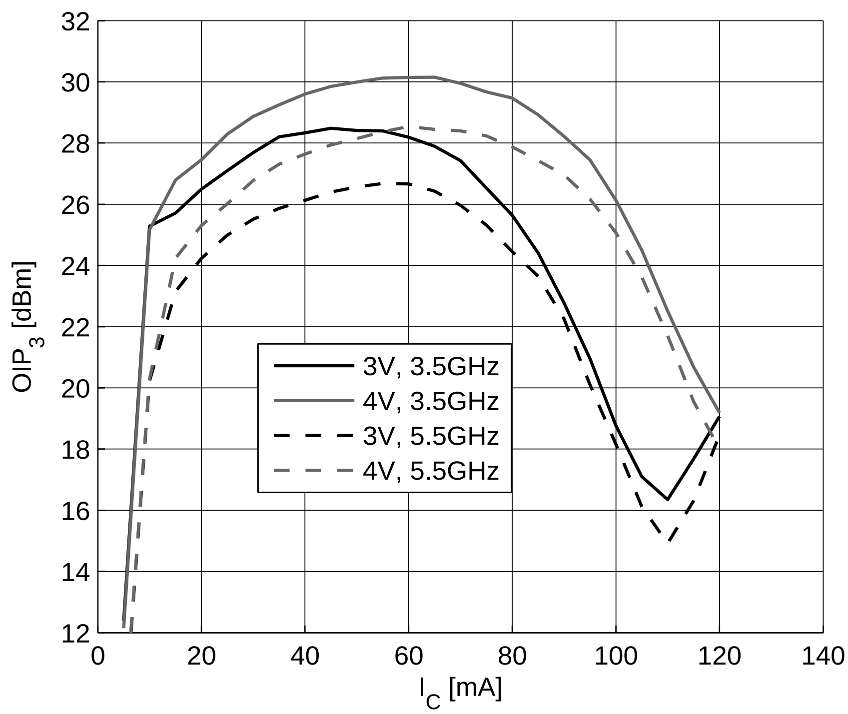


Figure 5-8 3rd Order Intercept Point $OIP_3 = f(I_C)$, $Z_S = Z_L$= 50 Ω, V_{CE}, f = Parameters

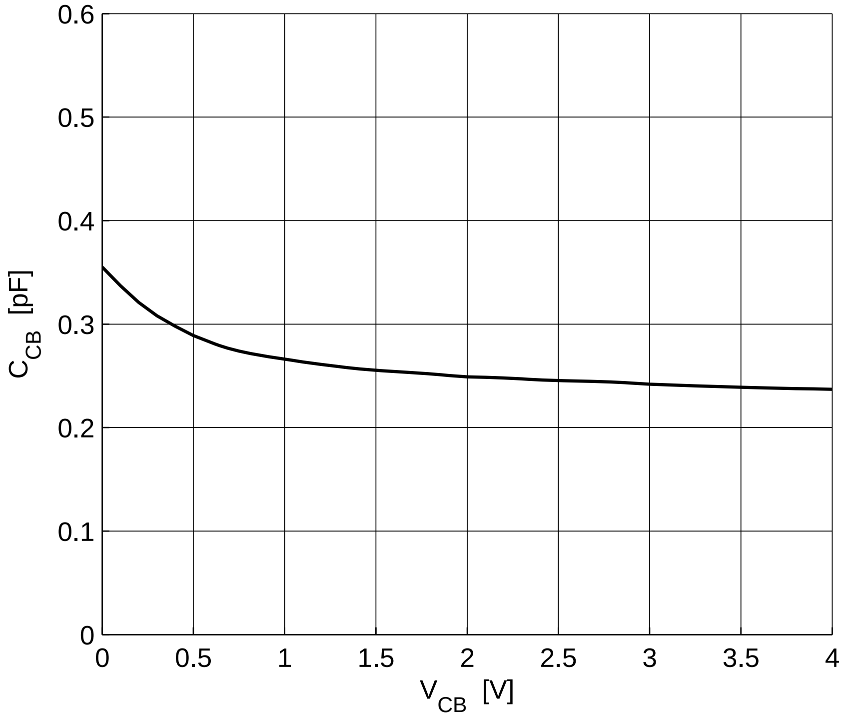


Figure 5-9 Collector Base Capacitance $C_{CB} = f(V_{CB})$, f = 1 MHz

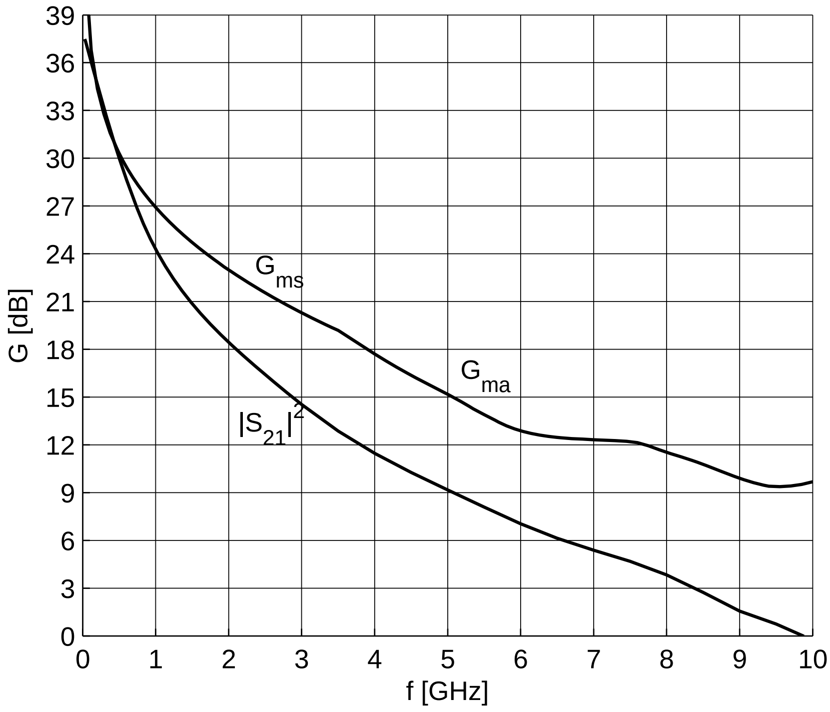


Figure 5-10 Gain G_{ma}, G_{ms}, $|S_{21}|^2 = f(f)$, V_{CE} = 3 V, I_C = 60 mA

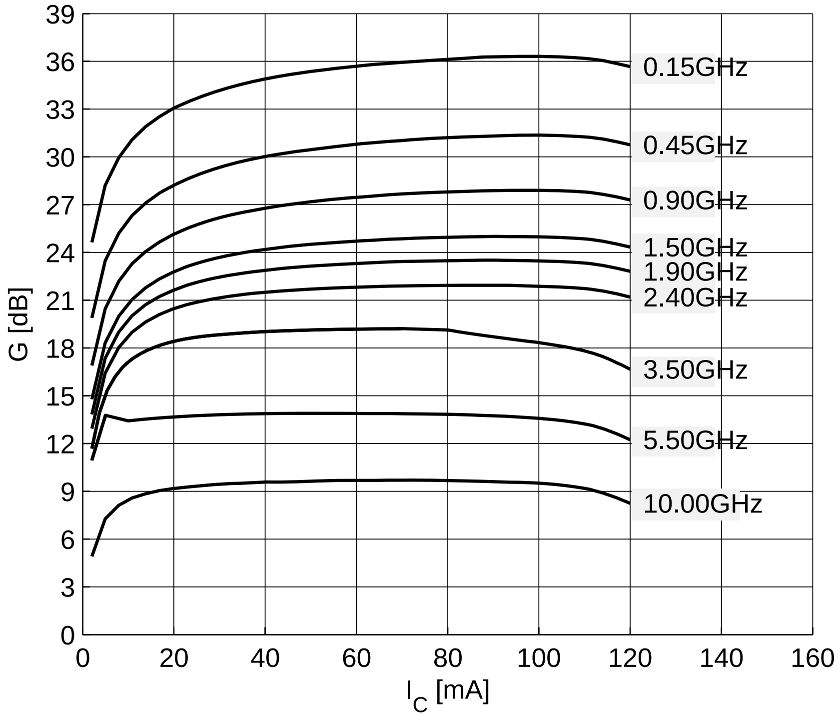


Figure 5-11 Maximum Power Gain G_{max} = f (I_C), V_{CE} = 3 V, f = Parameter in GHz

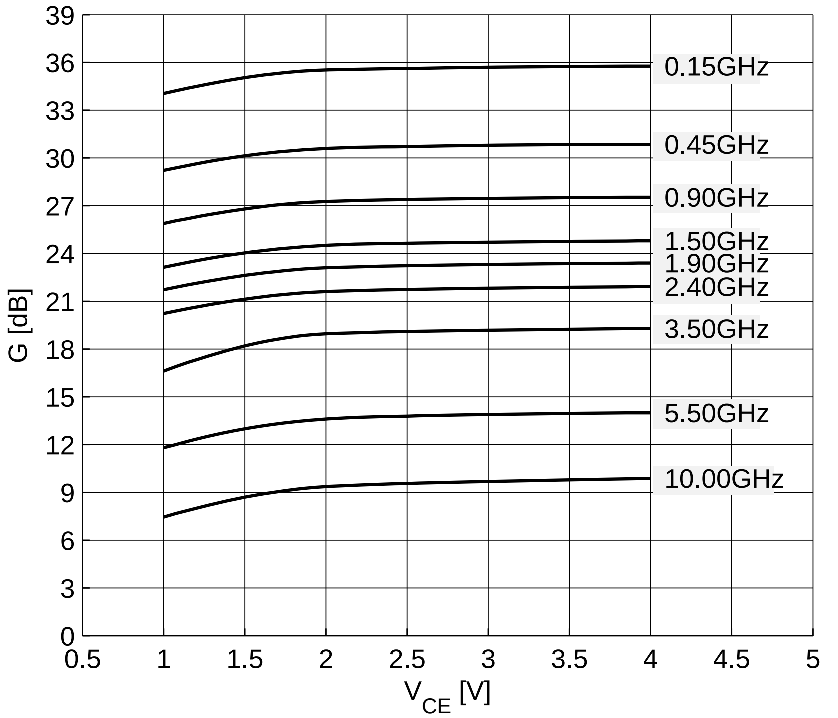


Figure 5-12 Maximum Power Gain G_{max} = f (V_{CE}), I_C = 60 mA, f = Parameter in GHz

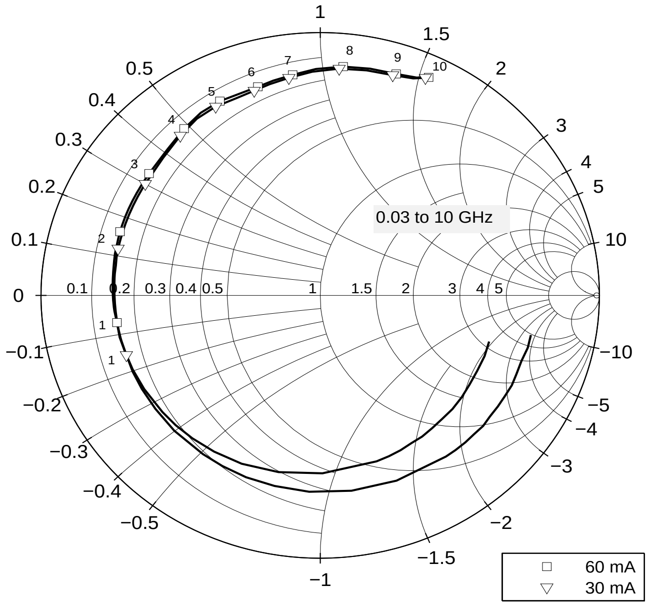


Figure 5-13 Input Matching S_{11} = f (f), V_{CE} = 3 V, I_C = 30 / 60 mA

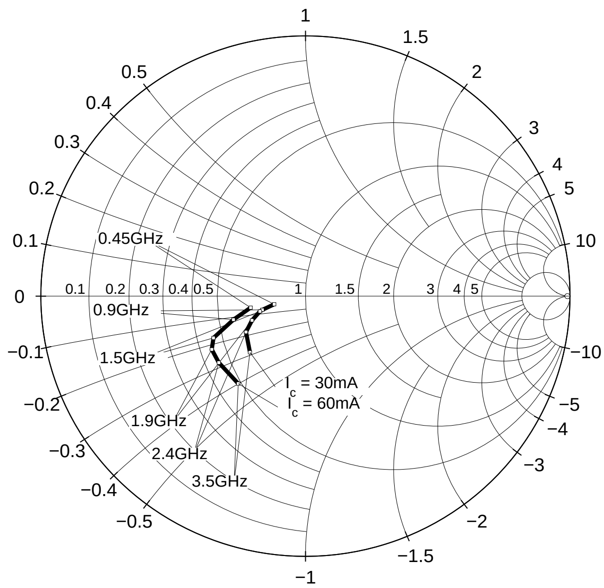


Figure 5-14 Source Impedance for Minimum Noise Figure Z_{opt} = f (f), V_{CE} = 3 V, I_C = 30 / 60 mA

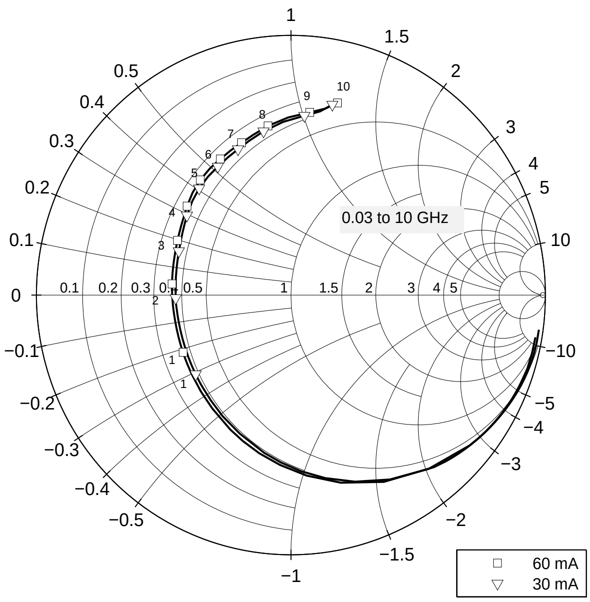


Figure 5-15 Output Matching $S_{22} = f(f)$, V_{CE} = 3 V, I_C = 30 / 60 mA

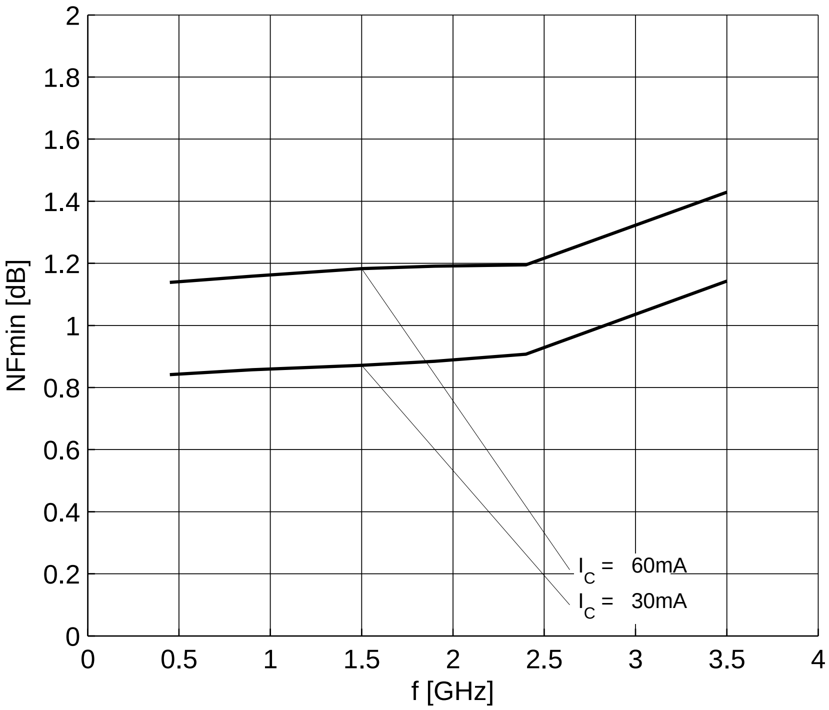


Figure 5-16 Noise Figure $NF_{min} = f(f)$, V_{CE} = 3 V, I_C = 30 / 60 mA, $Z_S = Z_{opt}$

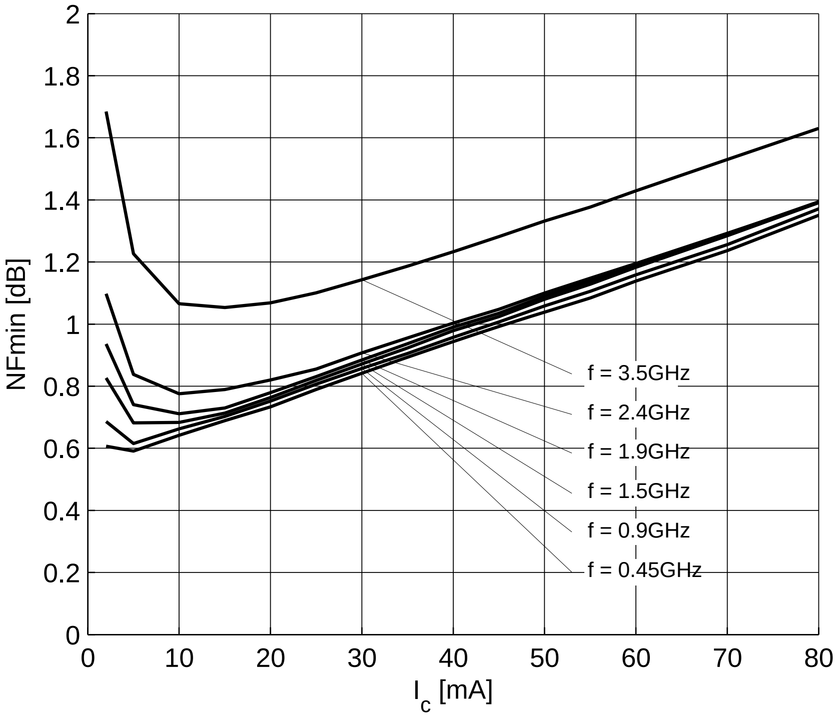


Figure 5-17 Noise Figure NF_{min} = f (I_C), V_{CE} = 3 V, Z_S = Z_{opt}, f = Parameter in GHz

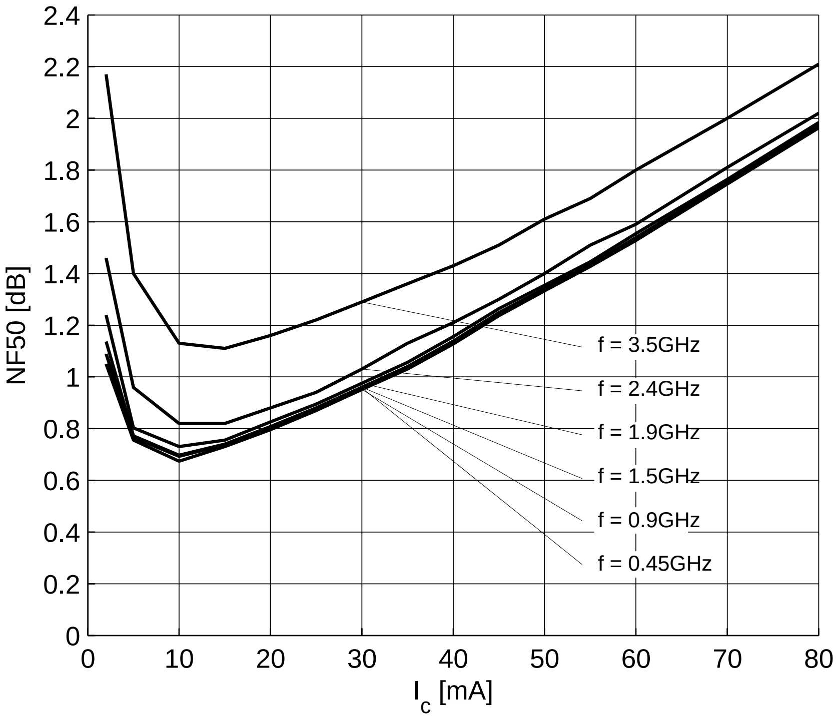


Figure 5-18 Noise Figure NF_{50} = f (I_C), V_{CE} = 3 V, Z_S = 50 Ω, f = Parameter in GHz

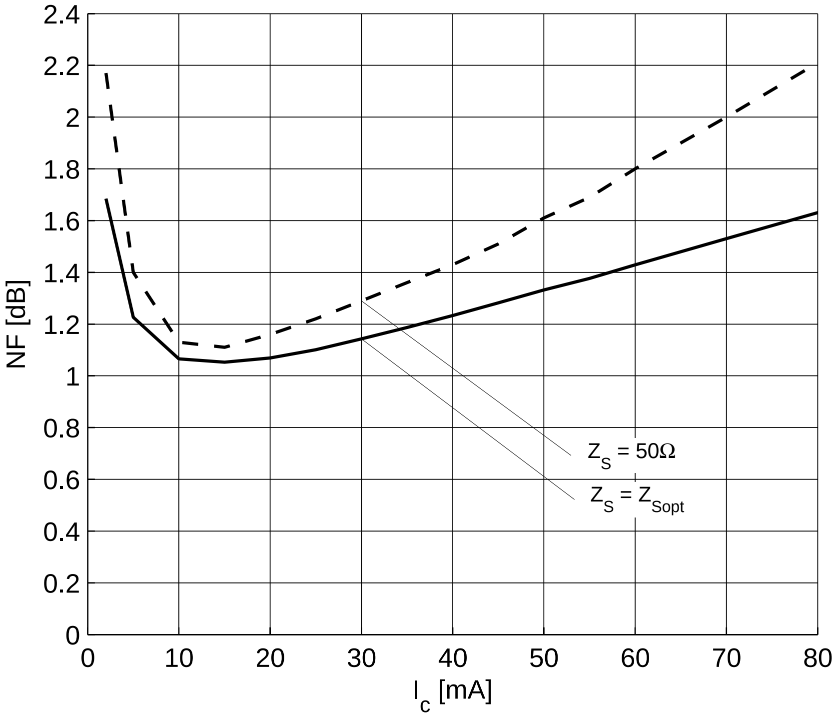


Figure 5-19 Comparison Noise Figure NF_{50} / NF_{min}= f (I_C), V_{CE} = 3 V, f = 3.5 GHz

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.

6 Simulation Data

For the SPICE Gummel Poon (GP) model as well as for the S-parameters (including noise parameters) please refer to our internet website: **www.infineon.com/rf.models**. Please consult our website and download the latest versions before actually starting your design.

You find the BFP750 SPICE GP model in the internet in MWO- and ADS-format, which you can import into these circuit simulation tools very quickly and conveniently. The model already contains the package parasitics and is ready to use for DC- and high frequency simulations. The terminals of the model circuit correspond to the pin configuration of the device.

The model parameters have been extracted and verified up to 10 GHz using typical devices. The BFP750 SPICE GP model reflects the typical DC- and RF-performance within the limitations which are given by the SPICE GP model itself.

7 Package Information SOT343

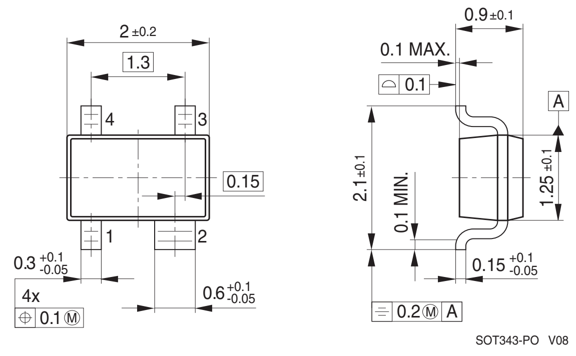


Figure 7-1 Package Outline

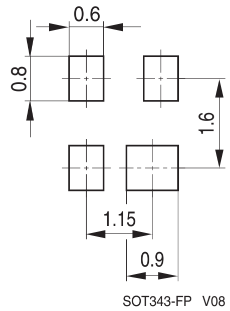


Figure 7-2 Package Foot Print

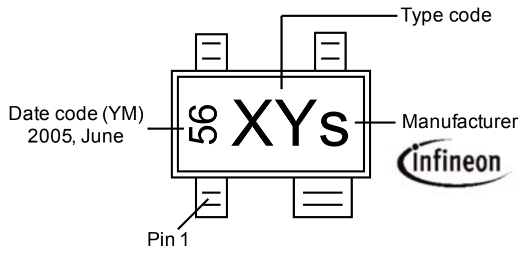


Figure 7-3 Marking Description (Marking BFP750: R8s)

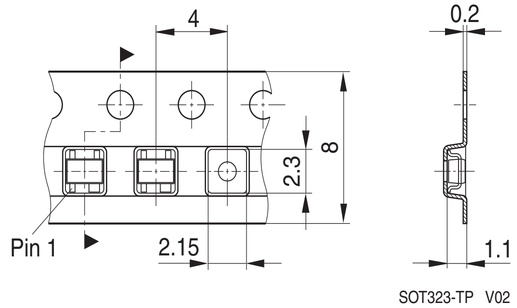


Figure 7-4 Tape Dimensions

w w w . i n f i n e o n . c o m

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