BF776

High performance RF bipolar transistor

Product description

The BF776 is an NPN Bipolar RF Transistor for high performance low noise amplifier applications. It comes in a standard, easy-to-use package with visible leads

Feature list

- Noise Figure NF_{min} = 0.8 dB at 1.8 GHz, 3 V, 5 mA

Product validation

Qualified for industrial applications according to the relevant tests of JEDEC JESD47, JESD22, and J-STD-020.
Qualified for industrial applications according to the relevant tests of AEC-Q 101.

Potential applications

- WLAN, WiMax, UWB, Bluetooth
- GPS, SDARS, DAB, LNB
- UMTS/LTE, and ISM bands

Device information

Table 1 Part information

Product name / Ordering code	Package	Pin configuration				Marking	Pieces / Reel
BF776 / BF776H6327XTSA1	SOT343	1 = B	2 = E	3 = C	4 = E	R3s	3k

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}	–	4.0	V	Open base
			3.5		T_A = -55 °C, open base
Collector emitter voltage	V_{CES}		13		E-B short circuited
Collector base voltage	V_{CBO}		13		Open emitter
Emitter base voltage	V_{EBO}		1.2		Open collector
Base current	I_B		3	mA	–
Collector current	I_C		50		
Total power dissipation [1]	P_{tot}		200	mW	$T_S \leq$ 90 °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.		
Thermal resistance (junction - soldering point)	R_{thJS}	–	300	–	K/W	–

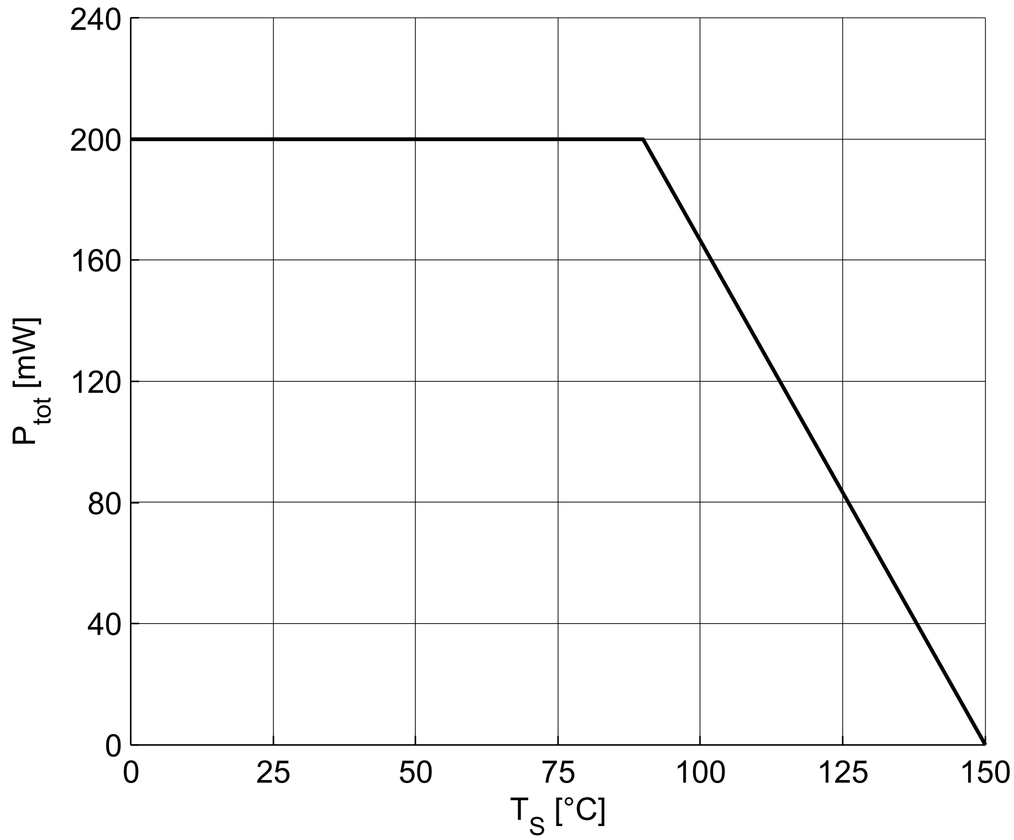


Figure 1 Total power dissipation $P_{tot} = f(T_S)$

3 Electrical characteristics

3.1 DC characteristics

Table 4 DC characteristics at T_A = 25 °C

Parameter	Symbol	Values			Unit	Note or 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	–	nA	V_{CE} = 5 V, V_{BE} = 0, E-B short circuited
Collector base leakage current	I_{CBO}					V_{CB} = 5 V, I_E = 0, open emitter
Emitter base leakage current	I_{EBO}	–	10	–		V_{EB} = 0.5 V, I_C = 0, open collector
DC current gain	h_{FE}	–	180	–		V_{CE} = 3 V, I_C = 30 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	–	46	–	GHz	V_{CE} = 3 V, I_C = 30mA, f =1 GHz
Collector base capacitance	C_{CB}	–	0.09	–	pF	V_{CB} = 3V, V_{BE} = 0, f = 1 MHz, emitter grounded
Collector emitter capacitance	C_{CE}		0.25	–		V_{CE} =3 V, V_{BE} = 0, f = 1 MHz, base grounded
Emitter base capacitance	C_{EB}		0.5			V_{EB} = 0.5 V, V_{CB} = 0, f = 1 MHz, collector grounded

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.

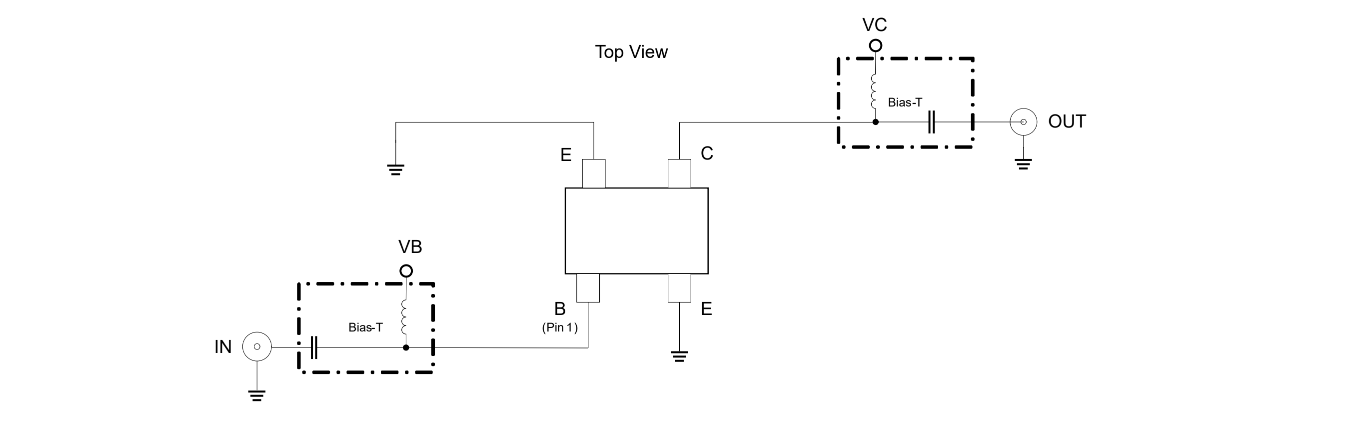


Figure 2 Testing circuit

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	G_{ms}	–	24	–	dB	I_C = 30mA
• Transducer gain	$\|S_{21}\|^2$		21.5			I_C = 30 mA, Z_S = Z_L = 50 Ω
Noise figure						
• Minimum noise figure	NF_{min}		0.8			I_C = 5 mA
• Associated gain	G_{ass}		18.5			
Linearity						
• 3rd order intercept point at output	OIP_3		28		dBm	Z_S = Z_L = 50 Ω, I_C = 30 mA
• 1 dB gain compression point at output	OP_{1dB}		13			

Table 7 AC characteristics, V_{CE} = 3 V, f = 2.4 GHz

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Power gain						
• Maximum power gain	G_{ms}	–	22	–	dB	I_C = 30 mA
• Transducer gain	$\|S_{21}\|^2$		20			
Noise figure						
• Minimum noise figure	NF_{min}		0.85			I_C = 5 mA
• Associated gain	G_{ass}		18			
Linearity						
• 3rd order intercept point at output	OIP_3		27		dBm	Z_S = Z_L = 50 Ω, I_C = 30 mA
• 1 dB gain compression point at output	OP_{1dB}		12			

Table 8 AC characteristics, V_{CE} = 3 V, f = 6.0 GHz

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Power gain						
• Maximum power gain	G_{ma}	–	12.5	–	dB	I_C = 30 mA
• Transducer gain	$\|S_{21}\|^2$		11			
Noise figure						
• Minimum noise figure	NF_{min}		1.3			I_C = 5 mA
Linearity						
• 3rd order intercept point at output	OIP_3		27		dBm	$Z_S = Z_L$ = 50 Ω, I_C = 30 mA
• 1 dB gain compression point at output	OP_{1dB}		12			

***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 0.2 MHz to 6 GHz.*

3.4 Characteristic DC diagrams

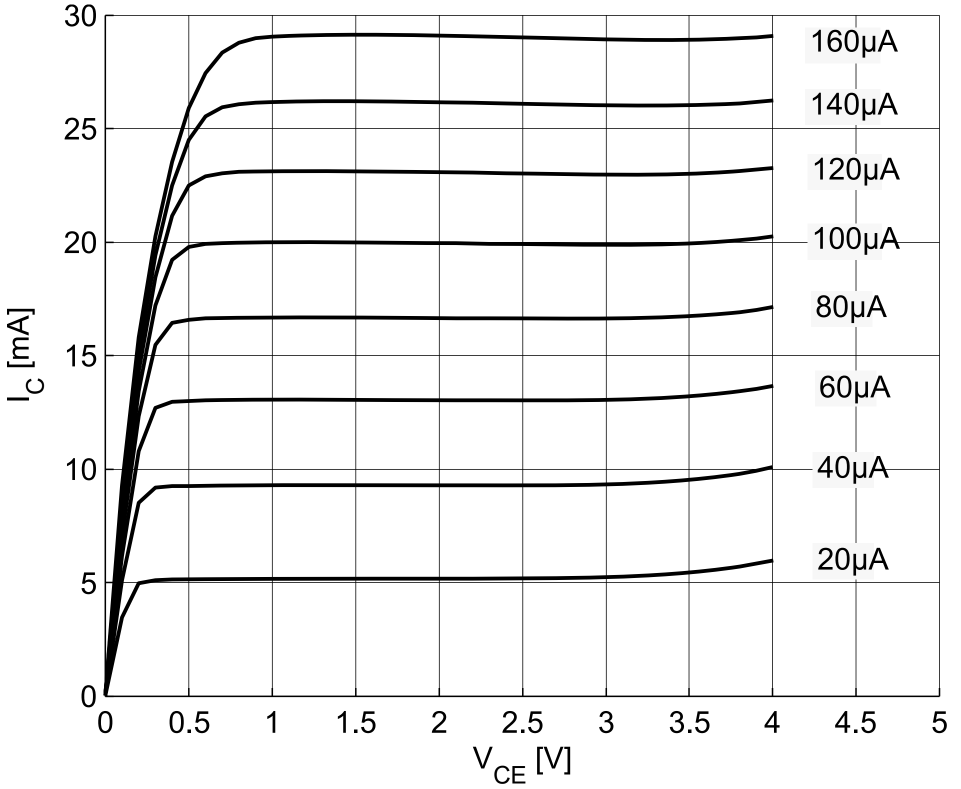


Figure 3 **Collector current vs. collector emitter voltage $I_C = f(V_{CE})$, I_B = parameter**

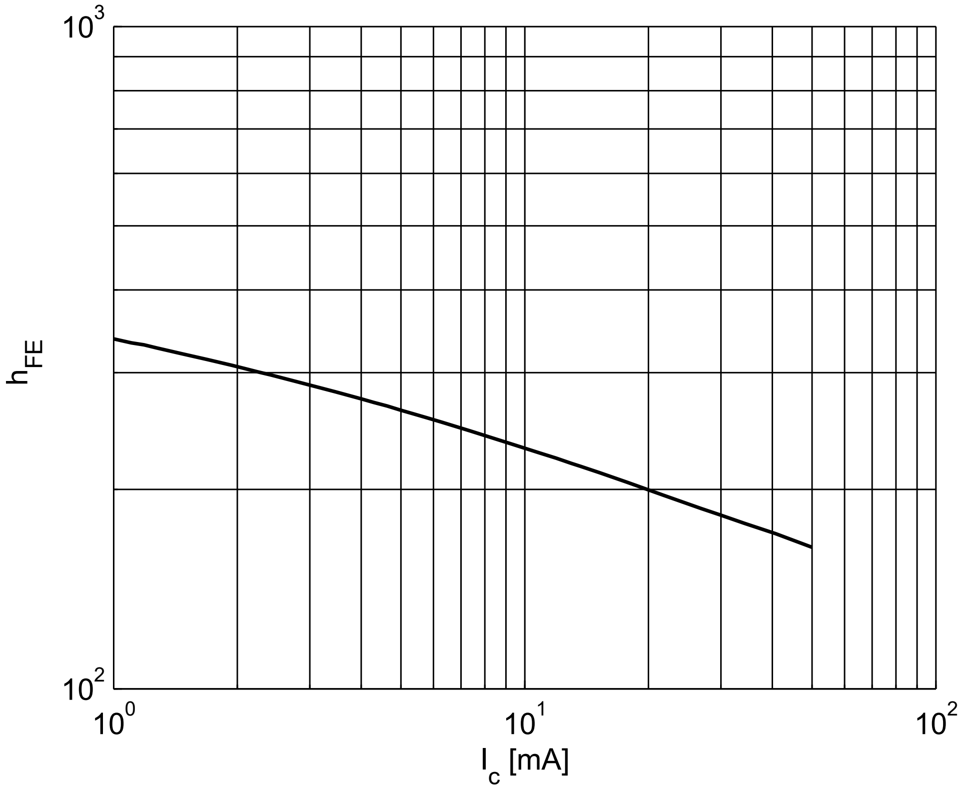


Figure 4 **DC current gain $h_{FE} = f(I_C)$, $V_{CE} = 3$ V**

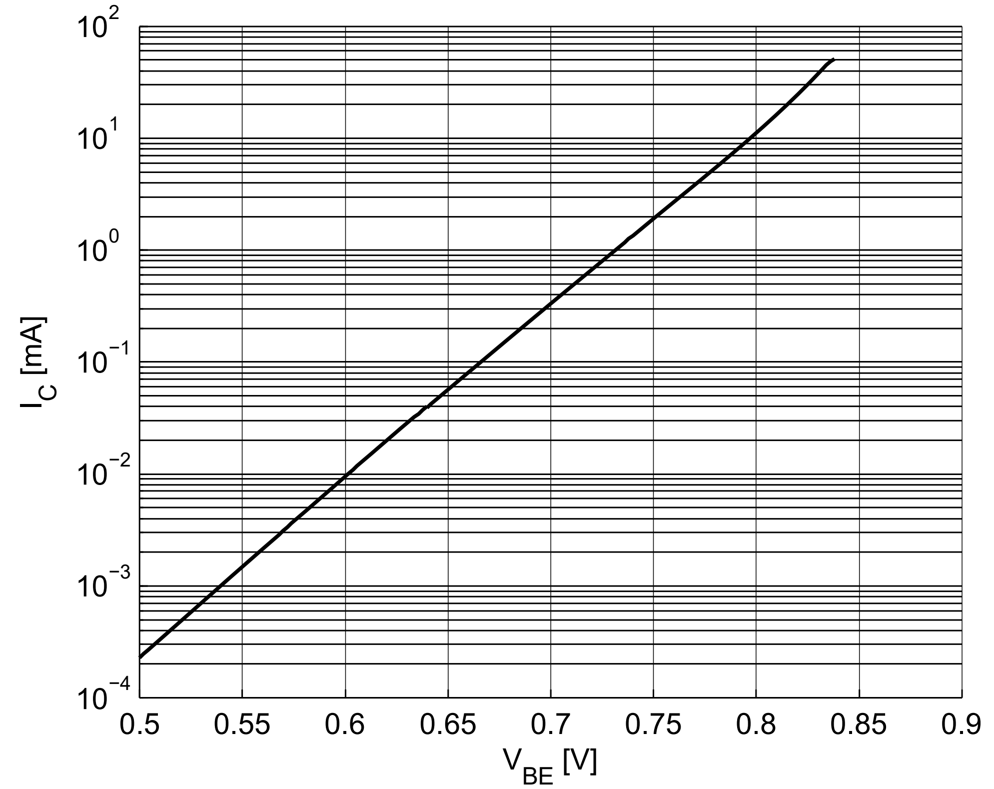


Figure 5 **Collector current vs. base emitter forward voltage $I_C = f(V_{BE})$, V_{CE} = 3 V**

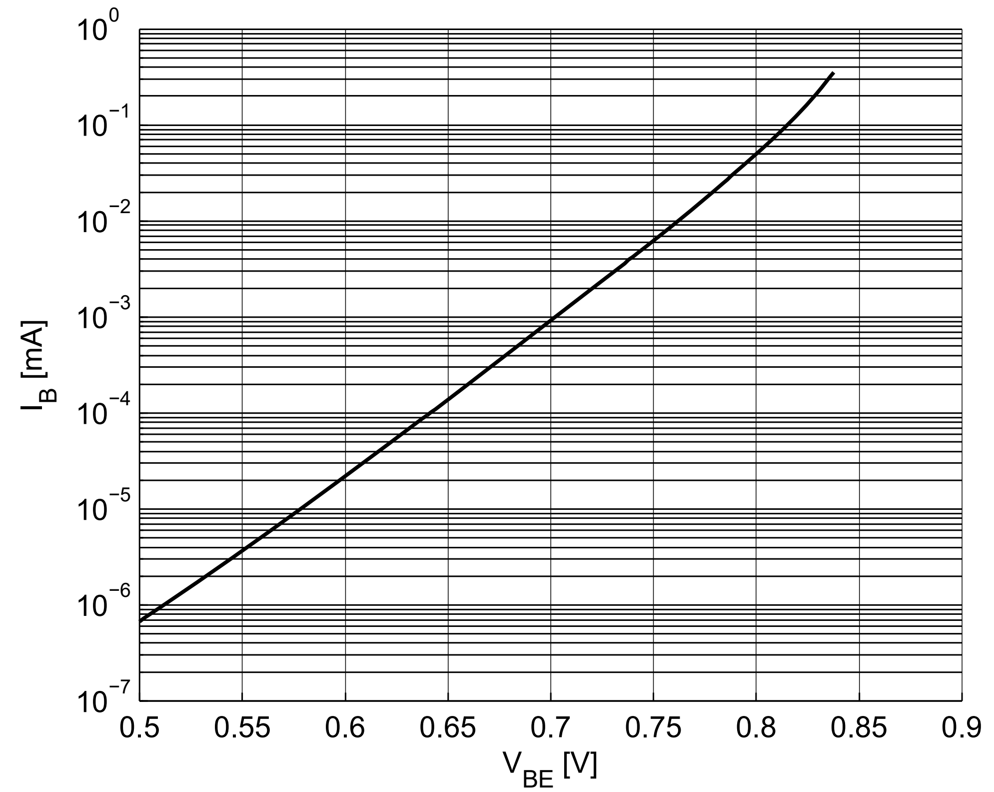


Figure 6 **Base current vs. base emitter forward voltage $I_B = f(V_{BE})$, V_{CE} = 3 V**

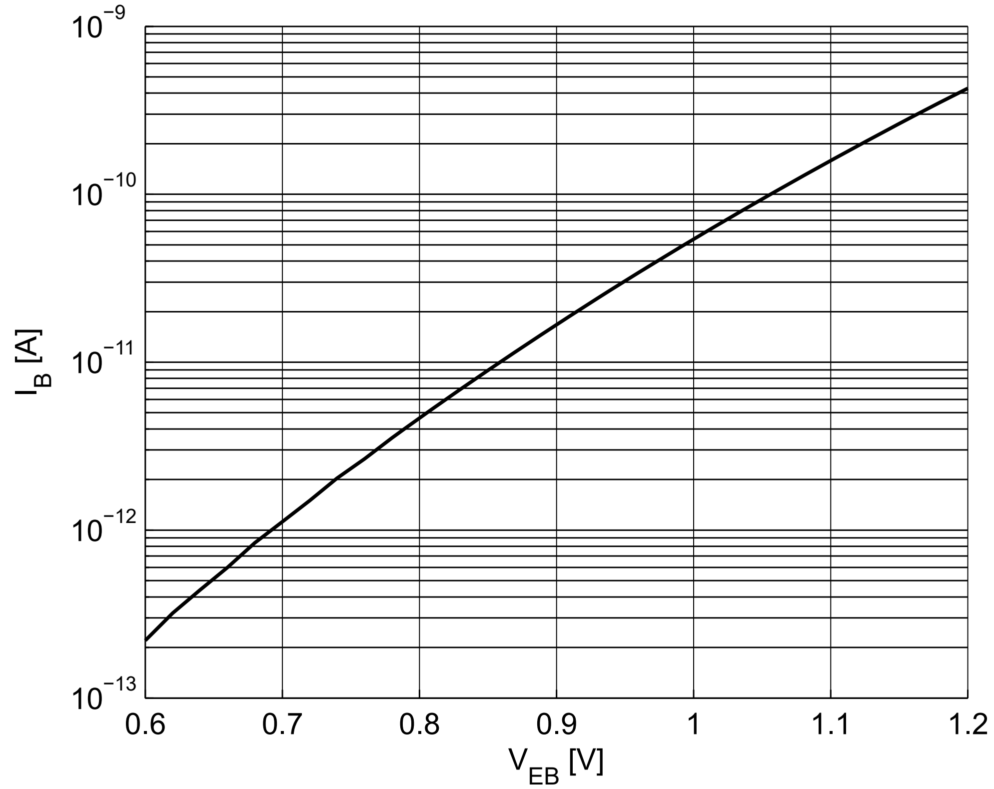


Figure 7 **Base current vs. base emitter reverse voltage $I_B = f(V_{EB})$, V_{CE} = 3 V**

3.5 Characteristic AC diagrams

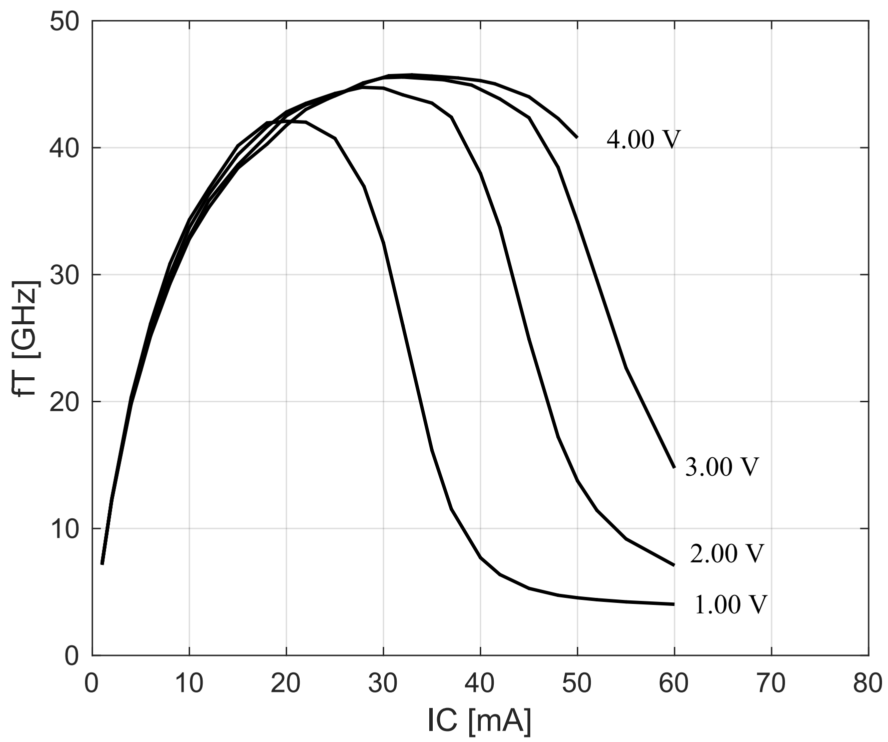


Figure 8 **Transition frequency $f_T = f(I_C)$, V_{CE} = parameter**

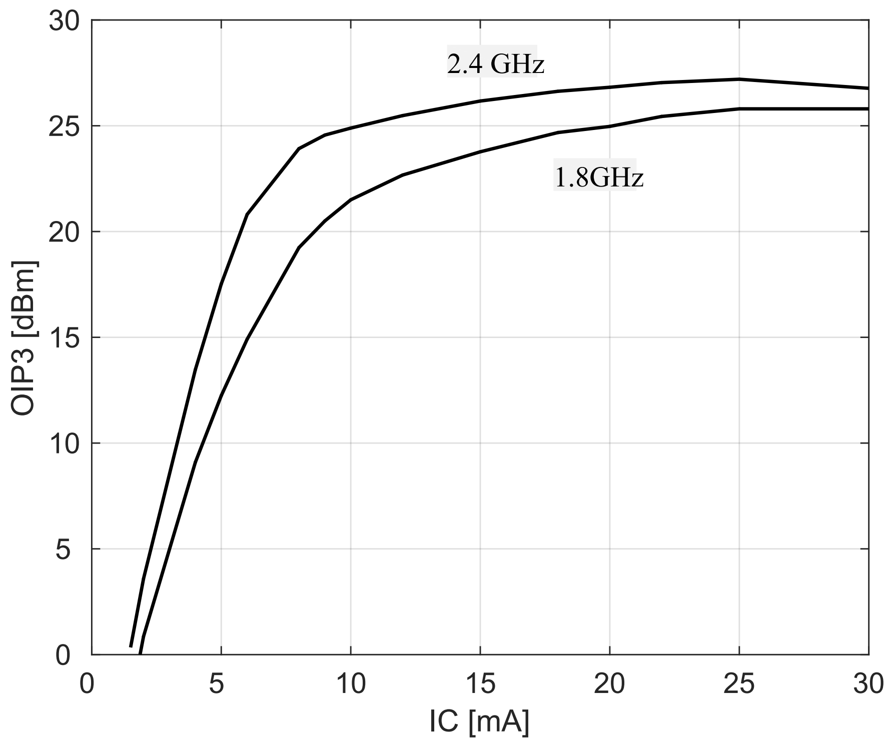


Figure 9 **3rd order intercept point at output $OIP_3 = f(I_C)$, $Z_S = Z_L$ = 50 Ω, V_{CE}, f = parameters**

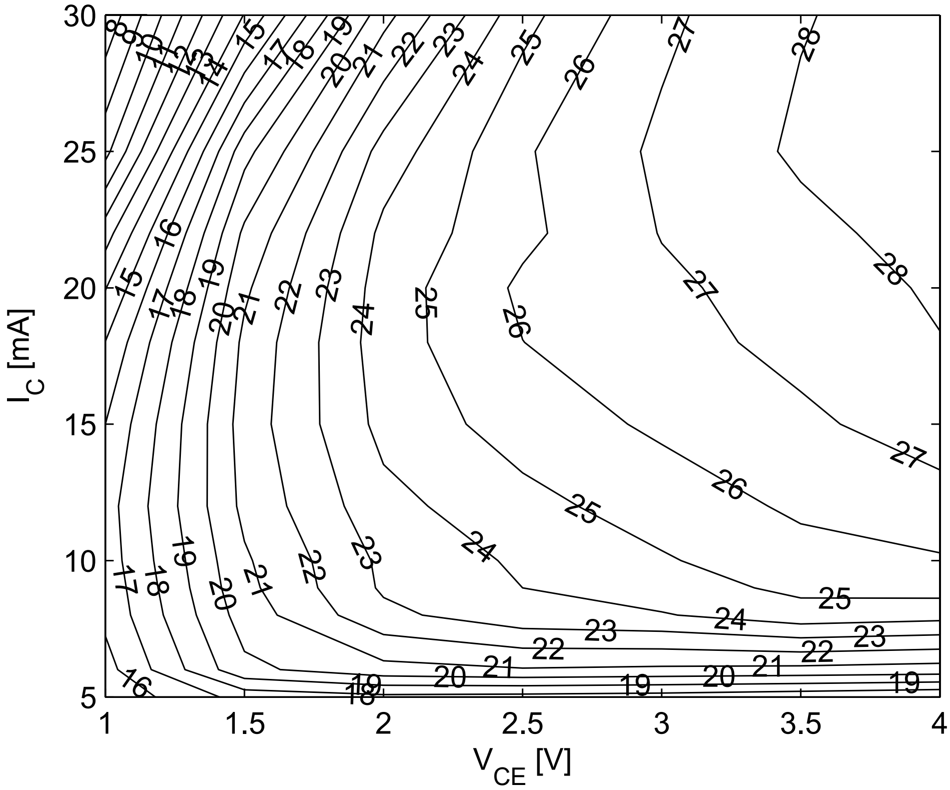


Figure 10 3rd order intercept point at output OIP_3 [dBm] = $f(I_C, V_{CE})$, $Z_S = Z_L = 50\ \Omega$, $f = 2.4$ GHz

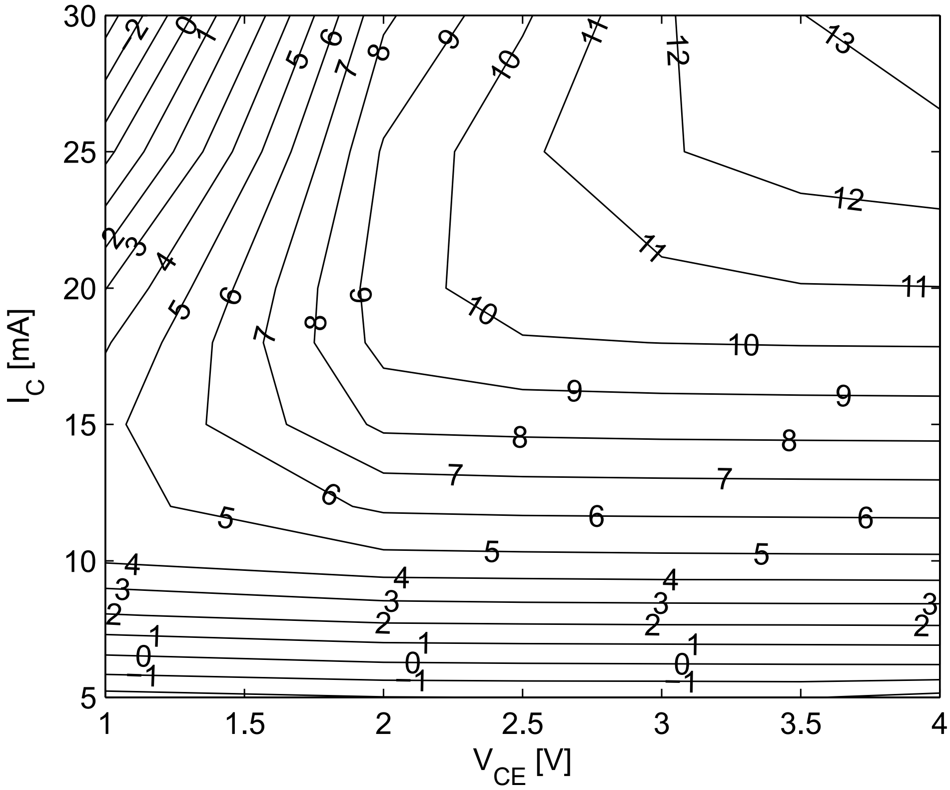


Figure 11 Compression point at output OP_{1dB} [dBm] = $f(I_C, V_{CE})$, $Z_S = Z_L = 50\ \Omega$, $f = 2.4$ GHz

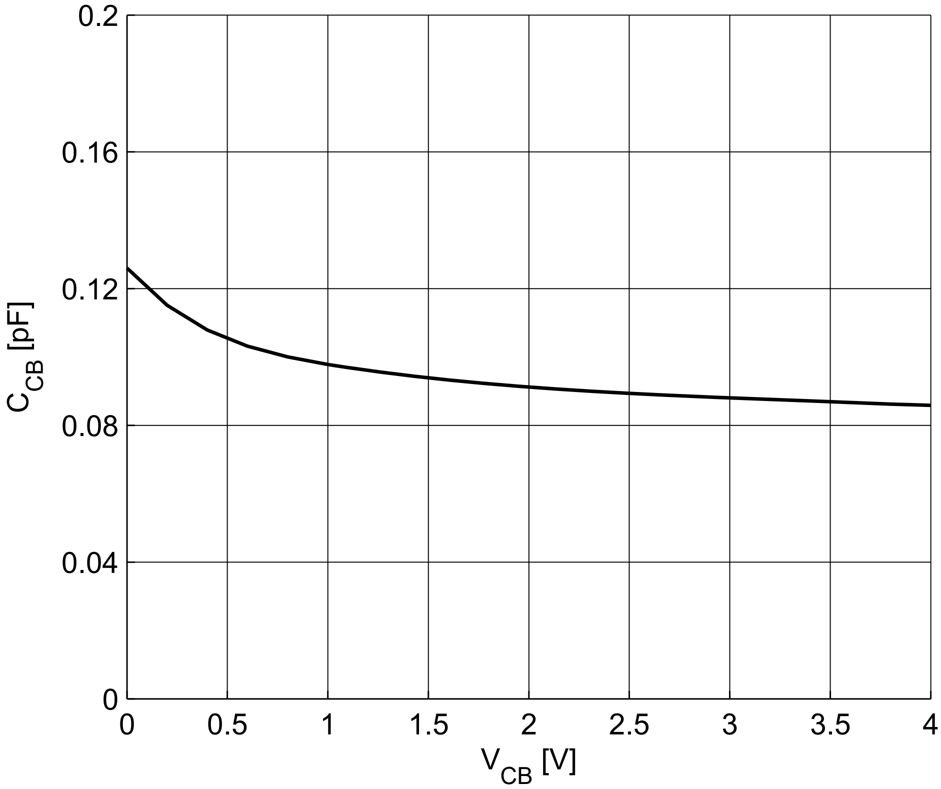


Figure 12 **Collector base capacitance $C_{CB} = f(V_{CB})$, f = 1 MHz**

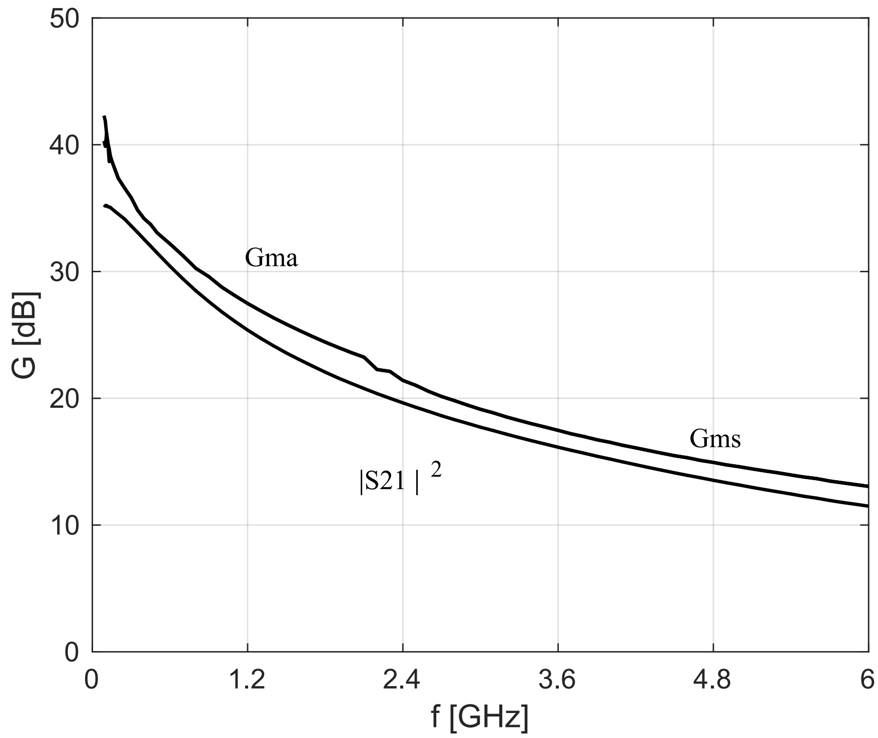


Figure 13 **Gain G_{ma}, G_{ms}, $|S_{21}|^2 = f(f)$, V_{CE} = 3 V, I_C = 30 mA**

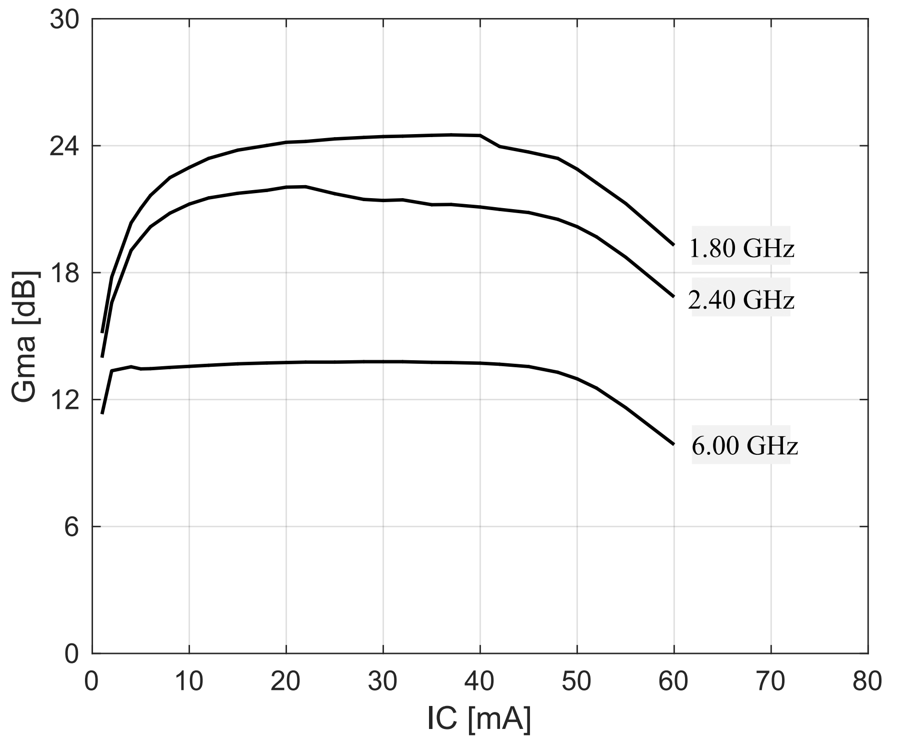


Figure 14 **Maximum power gain $G_{max} = f(I_C)$, V_{CE} = 3 V, f = parameter**

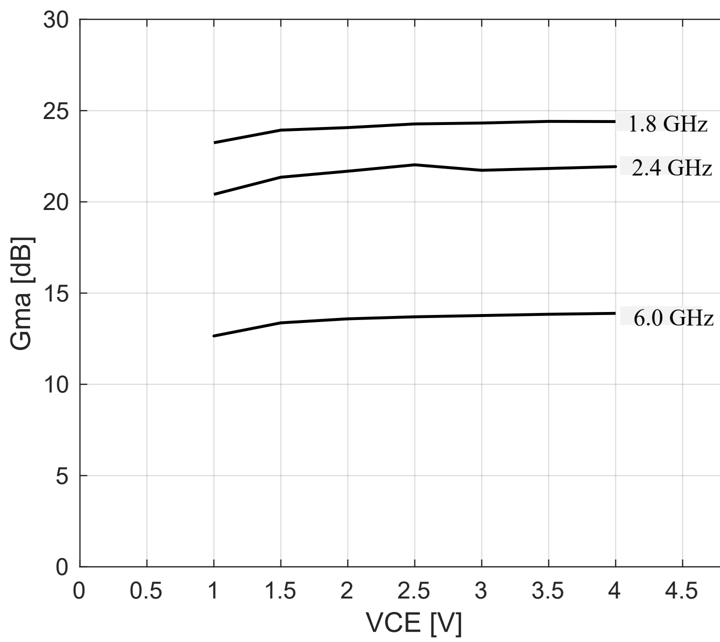


Figure 15 **Maximum power gain $G_{max} = f(V_{CE})$, I_C = 30 mA, f = parameter**

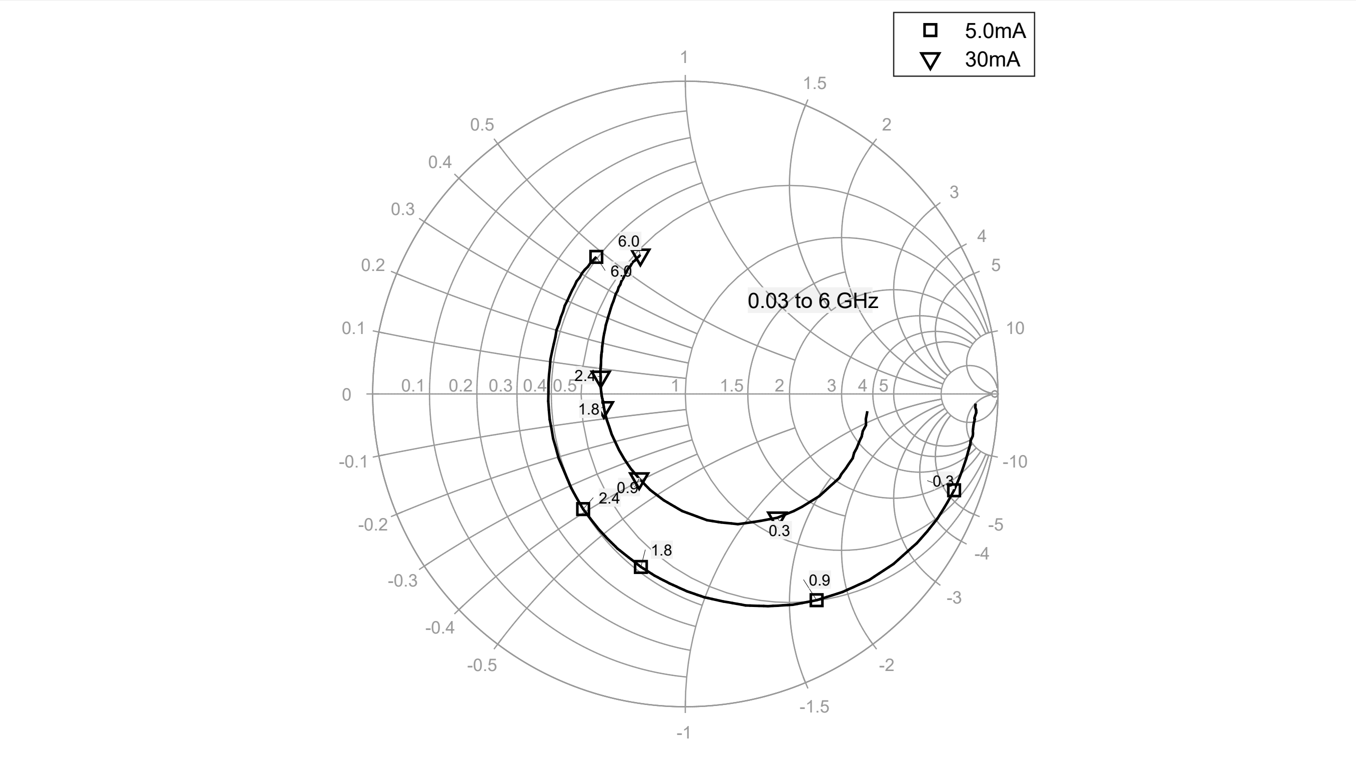


Figure 16 Input reflection coefficient $S_{11} = f(f)$, V_{CE} = 3 V, I_C = 5 / 30 mA

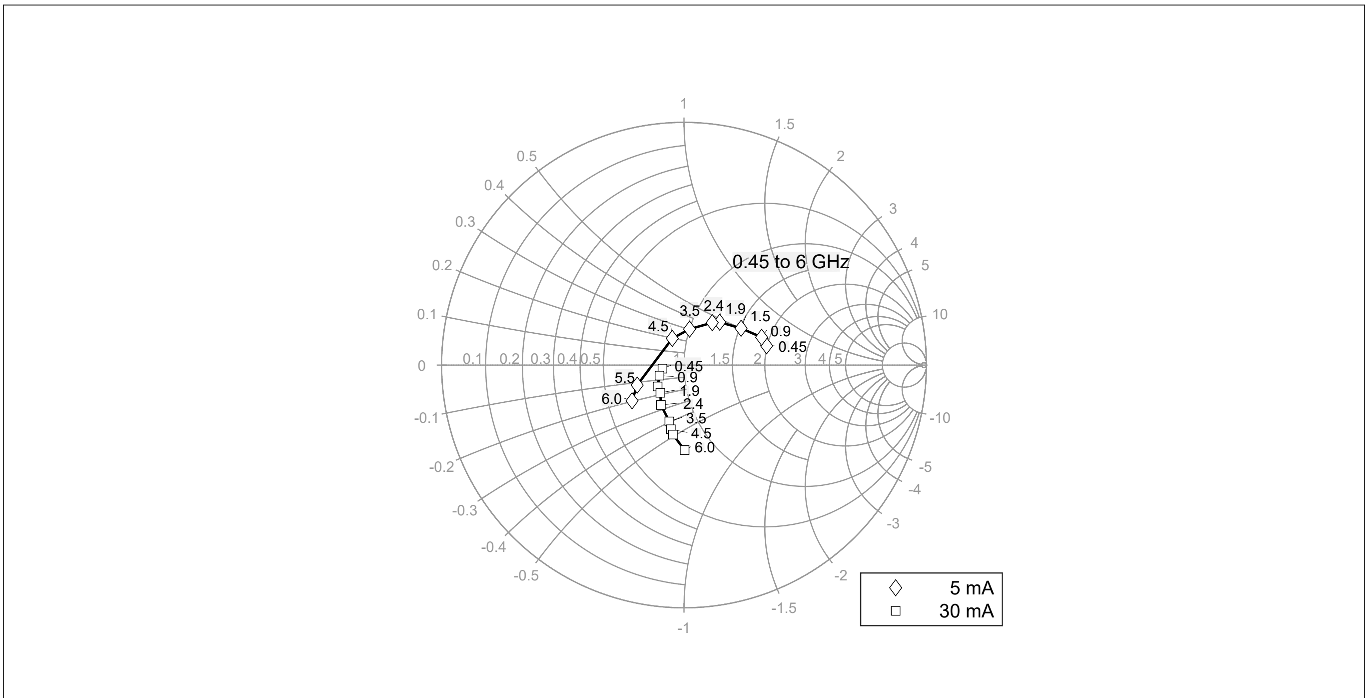


Figure 17 Source impedance for minimum noise figure $Z_{S,opt} = f(f)$, V_{CE} = 3 V, I_C = 5 / 30 mA

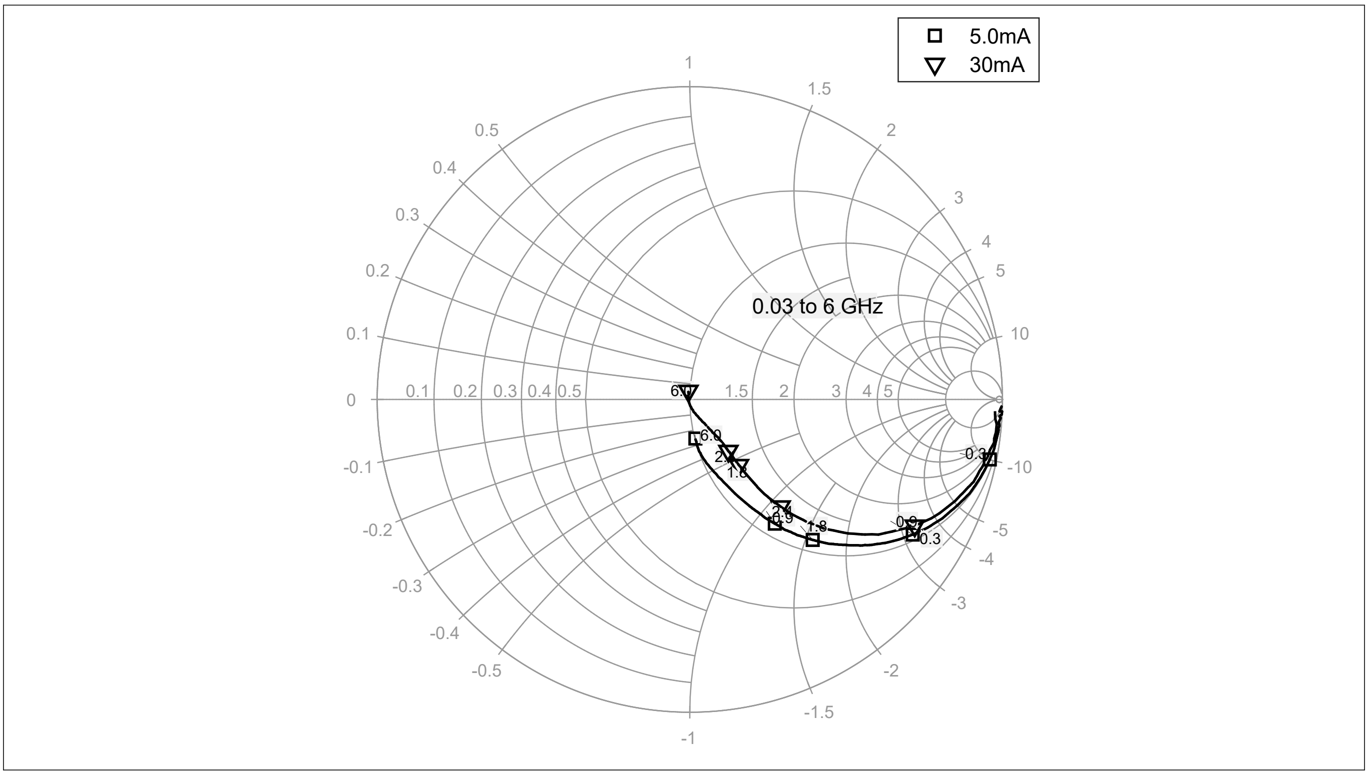


Figure 18 Output reflection coefficient $S_{22} = f(f)$, $V_{CE} = 3$ V, $I_C = 5$ / 30 mA

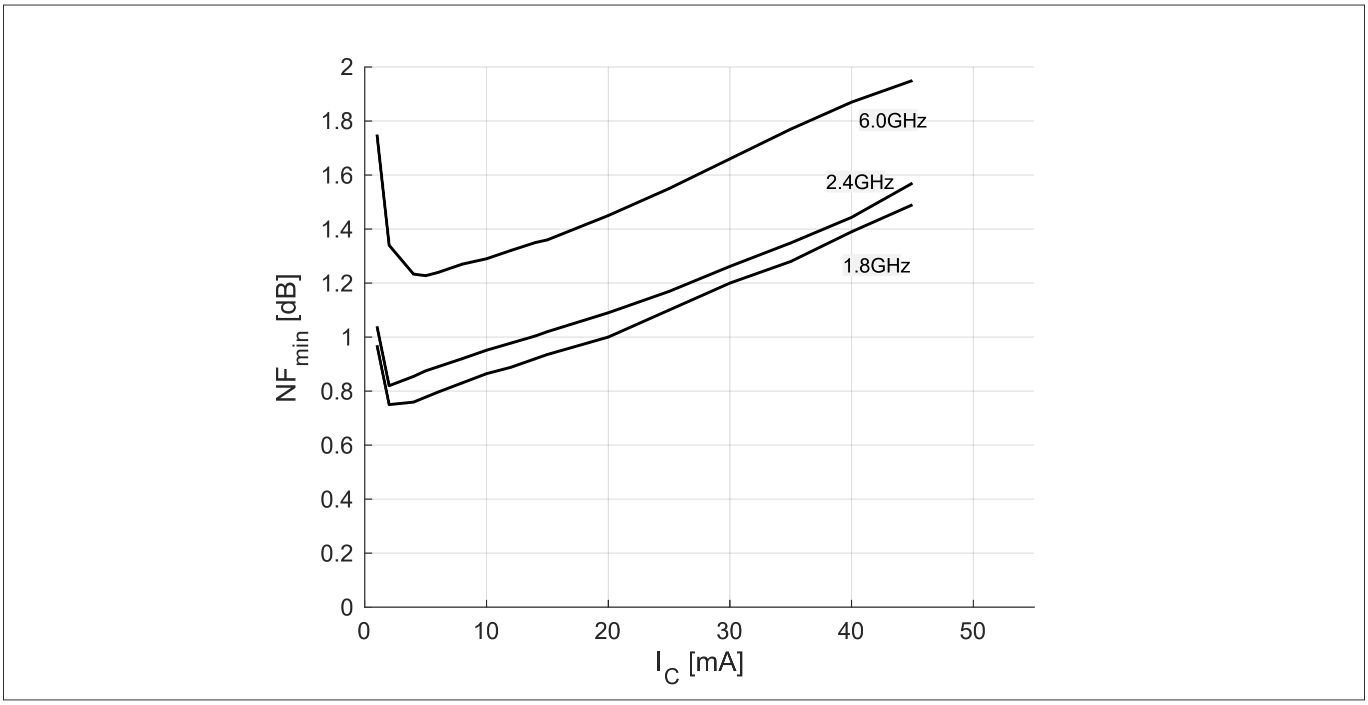


Figure 19 Noise figure $NF_{min} = f(I_C)$, $V_{CE} = 3$ V, $Z_S = Z_{S,opt}$, f = parameter

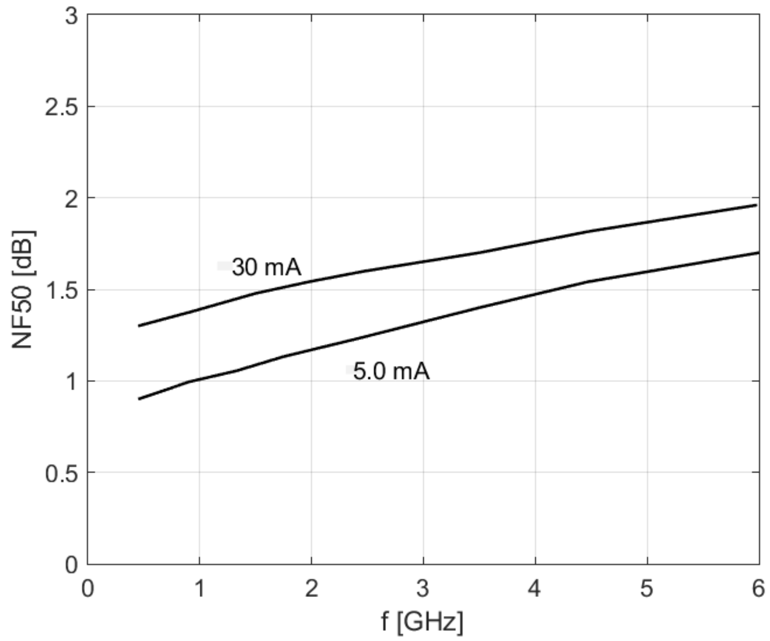
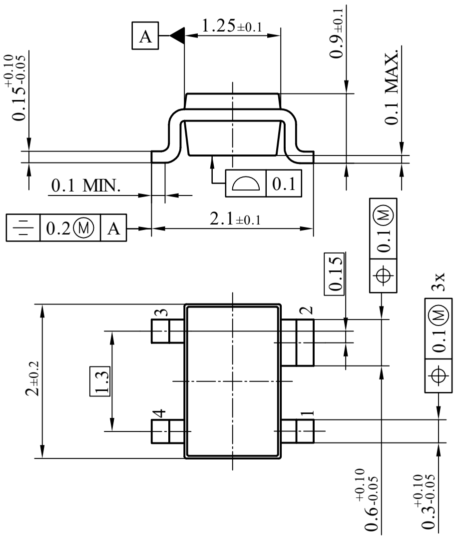


Figure 20 **Noise figure $NF_{50} = f(I_C)$, V_{CE} = 3 V, Z_S = 50 Ω, f = parameter**

***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 SOT343



MOLD FLASH, PROTRUSION OR GATE BURRS OF 0.2 MM MAXIMUM PER SIDE ARE NOT INCLUDED
ALL DIMENSIONS ARE IN UNITS MM
THE DRAWING IS IN COMPLIANCE WITH ISO 128 & PROJECTION METHOD 1 [ ]

Figure 21 **SOT343 package**

***Note**: For package information including footprint, packing and assembly recommendation refer to:*

https://www.infineon.com/cms/en/product/packages/PG-SOT343/PG-SOT343-4-1

Revision history

Document version	Date of release	Description of changes
1.0	2010-04-06	Initial datasheet layout.
2.0	2021-03-18	New datasheet layout. Additional tables and curves added
3.0	2024-07-01	Updated product validation

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