

BFP450

Surface mount high linearity wideband silicon NPN RF bipolar transistor



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Technical documents



Simulation



Support

Product description

The BFP450 is a low noise device based on a grounded emitter (SIEGET™) that is part of Infineon's established fourth generation RF bipolar transistor family. Its transition frequency f_T of 24 GHz, collector design and high linearity characteristics make the device suitable for energy efficiency applications up to 3 GHz. It remains cost competitive without compromising on ease of use.



Feature list

- Minimum noise figure $NF_{min} = 1.7$ dB at 1.9 GHz, 3 V, 50 mA
- High gain $G_{ma} = 15.5$ dB at 1.9 GHz, 3 V, 90 mA
- $OIP_3 = 31$ dBm at 1.9 GHz, 3 V, 90 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

- Broadband amplifiers
- Low noise, high linearity amplifiers for sub-1 GHz ISM band applications

Device information

Table 1 Part information

Product name / Ordering code	Package	Pin configuration				Marking	Pieces / Reel
BFP450 / BFP450H6327XTSA1	SOT343	1 = B	2 = E	3 = C	4 = E	ANs	3000
BFP450 / BFP450H6433XTMA1							10000

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

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Absolute maximum ratings

1 Absolute maximum ratings

Table 2 Absolute maximum ratings at $T_A = 25\text{ °C}$ (unless otherwise specified)

Parameter	Symbol	Values		Unit	Note or test condition
		Min.	Max.		
Collector emitter voltage	V_{CEO}	–	4.5	V	Open base
			4.1		$T_A = -55\text{ °C}$, 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}		1.5		Open collector
Base current	I_B		10	mA	–
Collector current	I_C		170		
Total power dissipation ¹⁾	P_{tot}		500	mW	$T_S \leq 90\text{ °C}$
Junction temperature	T_J	–55	150	°C	–
Storage temperature	T_{Stg}				

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}	–	120	–	K/W	–

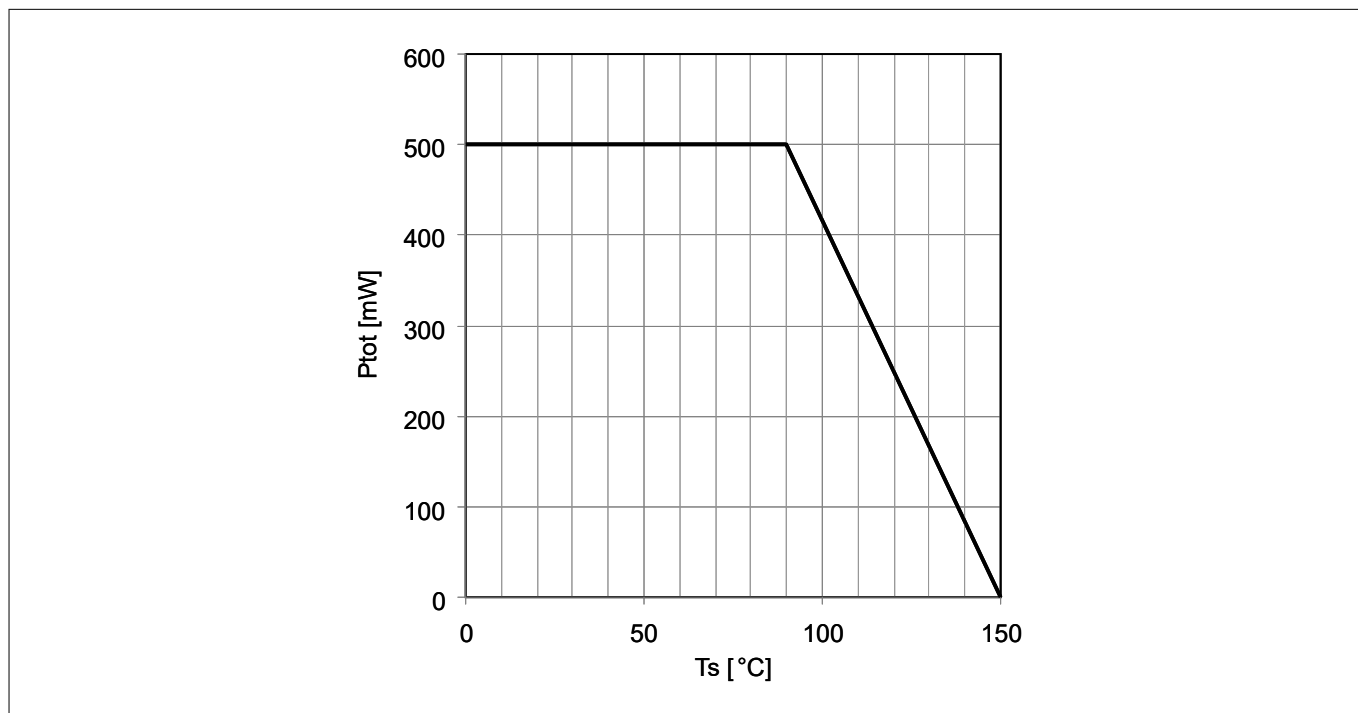


Figure 1 Total power dissipation $P_{tot} = f(T_s)$

Electrical characteristics

3 Electrical characteristics

3.1 DC characteristics

Table 4 DC characteristics at $T_A = 25\text{ °C}$

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Collector emitter breakdown voltage	$V_{(BR)CEO}$	4.5	5	–	V	$I_C = 1\text{ mA}$, $I_B = 0$, open base
Collector emitter leakage current	I_{CES}	–	–	1 ²⁾ 30 ²⁾	μA nA	$V_{CE} = 15\text{ V}$, $V_{BE} = 0$, $V_{CE} = 3\text{ V}$, $V_{BE} = 0$, E-B short circuited
Collector base leakage current	I_{CBO}		1	30 ²⁾	nA	$V_{CB} = 3\text{ V}$, $I_E = 0$, open emitter
Emitter base leakage current	I_{EBO}		0.05	3 ²⁾	μA	$V_{EB} = 0.5\text{ V}$, $I_C = 0$, open collector
DC current gain	h_{FE}	60 50	95 85	130 120		$V_{CE} = 4\text{ V}$, $I_C = 50\text{ mA}$, $V_{CE} = 3\text{ V}$, $I_C = 90\text{ mA}$, pulse measured

3.2 General AC characteristics

Table 5 General AC characteristics at $T_A = 25\text{ °C}$

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Transition frequency	f_T	18	24	–	GHz	$V_{CE} = 3\text{ V}$, $I_C = 90\text{ mA}$, $f = 1\text{ GHz}$
Collector base capacitance	C_{CB}	–	0.48	0.8	pF	$V_{CB} = 3\text{ V}$, $V_{BE} = 0$, $f = 1\text{ MHz}$, emitter grounded
Collector emitter capacitance	C_{CE}		1.2	–		$V_{CE} = 3\text{ V}$, $V_{BE} = 0$, $f = 1\text{ MHz}$, base grounded
Emitter base capacitance	C_{EB}		1.7	–		$V_{EB} = 0.5\text{ V}$, $V_{CB} = 0$, $f = 1\text{ MHz}$, 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, $T_A = 25^\circ\text{C}$.

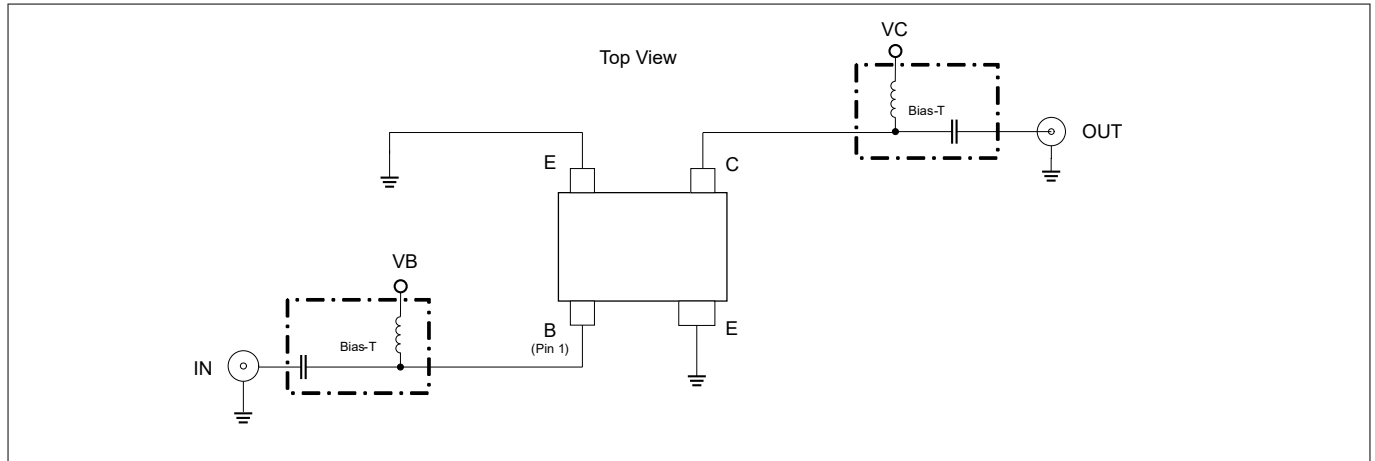


Figure 2 Testing circuit

Table 6 AC characteristics, $V_{CE} = 3\text{ V}$, $f = 150\text{ MHz}$

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Power gain		–		–	dB	
• Maximum power gain	G_{ms}		35.5			$I_C = 90\text{ mA}$
• Transducer gain	$ S_{21} ^2$		33.5			
Noise figure						
• Minimum noise figure	NF_{min}		1.55			$I_C = 50\text{ mA}$
• Associated gain	G_{ass}		32			
Linearity					dBm	
• 3rd order intercept point at output	OIP_3		30.5			$Z_S = Z_L = 50\ \Omega$, $I_C = 90\text{ mA}$
• 1 dB gain compression point at output	OP_{1dB}		19			

Table 7 AC characteristics, $V_{CE} = 3\text{ V}$, $f = 450\text{ MHz}$

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Power gain		–		–	dB	
• Maximum power gain	G_{ms}		29			$I_C = 90\text{ mA}$
• Transducer gain	$ S_{21} ^2$		25			
Noise figure						
• Minimum noise figure	NF_{min}		1.55			$I_C = 50\text{ mA}$
• Associated gain	G_{ass}		27.5			
Linearity					dBm	
• 3rd order intercept point at output	OIP_3		30			$Z_S = Z_L = 50\ \Omega$, $I_C = 90\text{ mA}$
• 1 dB gain compression point at output	OP_{1dB}		19			

Electrical characteristics

Table 8 AC characteristics, $V_{CE} = 3\text{ V}$, $f = 900\text{ MHz}$

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Power gain		–		–	dB	$I_C = 90\text{ mA}$
• Maximum power gain	G_{ms}		23.5			
• Transducer gain	$ S_{21} ^2$		19			
Noise figure						$I_C = 50\text{ mA}$
• Minimum noise figure	NF_{min}		1.6			
• Associated gain	G_{ass}		23			
Linearity					dBm	$Z_S = Z_L = 50\ \Omega$, $I_C = 90\text{ mA}$
• 3rd order intercept point at output	OIP_3		30.5			
• 1 dB gain compression point at output	OP_{1dB}		19			

Table 9 AC characteristics, $V_{CE} = 3\text{ V}$, $f = 1.5\text{ GHz}$

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Power gain		–		–	dB	$I_C = 90\text{ mA}$
• Maximum power gain	G_{ma}		18			
• Transducer gain	$ S_{21} ^2$		14			
Noise figure						$I_C = 50\text{ mA}$
• Minimum noise figure	NF_{min}		1.65			
• Associated gain	G_{ass}		17			
Linearity					dBm	$Z_S = Z_L = 50\ \Omega$, $I_C = 90\text{ mA}$
• 3rd order intercept point at output	OIP_3		31			
• 1 dB gain compression point at output	OP_{1dB}		19			

Table 10 AC characteristics, $V_{CE} = 3\text{ V}$, $f = 1.9\text{ GHz}$

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Power gain		–		–	dB	$I_C = 90\text{ mA}$
• Maximum power gain	G_{ma}		15.5			
• Transducer gain	$ S_{21} ^2$		11.5			
Noise figure						$I_C = 50\text{ mA}$
• Minimum noise figure	NF_{min}		1.7			
• Associated gain	G_{ass}		14			
Linearity					dBm	$Z_S = Z_L = 50\ \Omega$, $I_C = 90\text{ mA}$
• 3rd order intercept point at output	OIP_3		31			
• 1 dB gain compression point at output	OP_{1dB}		19			

Electrical characteristics

Table 11 AC characteristics, $V_{CE} = 3 \text{ V}$, $f = 2.4 \text{ GHz}$

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Power gain		–		–	dB	$I_C = 90 \text{ mA}$
• Maximum power gain	G_{ma}		13.5			
• Transducer gain	$ S_{21} ^2$		9.5			
Noise figure					dBm	$I_C = 50 \text{ mA}$
• Minimum noise figure	NF_{min}		1.8			
• Associated gain	G_{ass}		12			
Linearity					dBm	$Z_S = Z_L = 50 \Omega$, $I_C = 90 \text{ mA}$
• 3rd order intercept point at output	OIP_3		30			
• 1 dB gain compression point at output	OP_{1dB}		19			

Table 12 AC characteristics, $V_{CE} = 3 \text{ V}$, $f = 3.5 \text{ GHz}$

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Power gain		–		–	dB	$I_C = 90 \text{ mA}$
• Maximum power gain	G_{ma}		10			
• Transducer gain	$ S_{21} ^2$		6			
Noise figure					dBm	$I_C = 50 \text{ mA}$
• Minimum noise figure	NF_{min}		2.05			
• Associated gain	G_{ass}		9			
Linearity					dBm	$Z_S = Z_L = 50 \Omega$, $I_C = 90 \text{ mA}$
• 3rd order intercept point at output	OIP_3		29.5			
• 1 dB gain compression point at output	OP_{1dB}		18.5			

Note: $G_{ms} = |S_{21}| / |S_{12}|$ for $k < 1$; $G_{ma} = |S_{21}| / |S_{12}| I(k - (k^2 - 1)^{1/2})$ 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 50Ω from 0.1 MHz to 6 GHz.

3.4 Characteristic DC diagrams

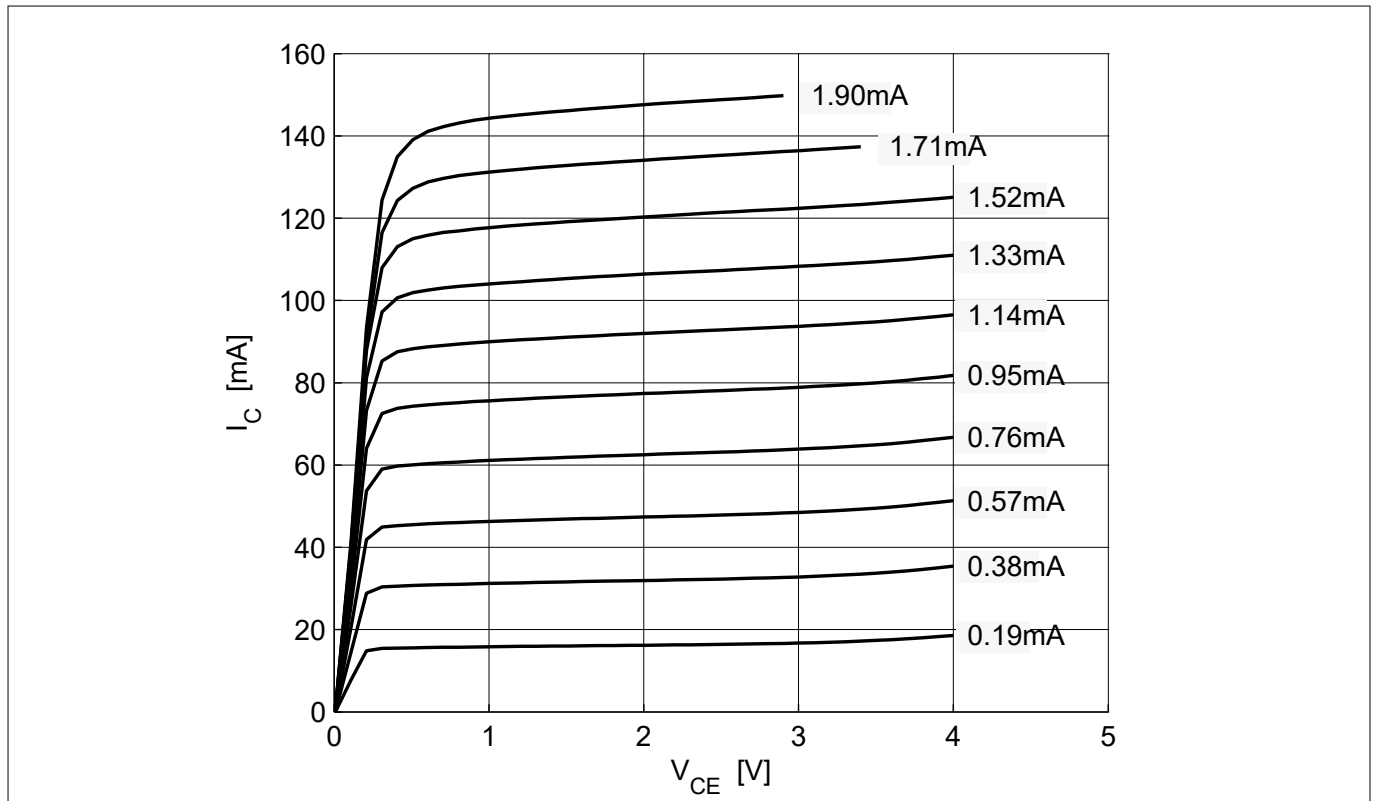


Figure 3 Collector current vs. collector emitter voltage $I_C = f(V_{CE})$, I_B = parameter

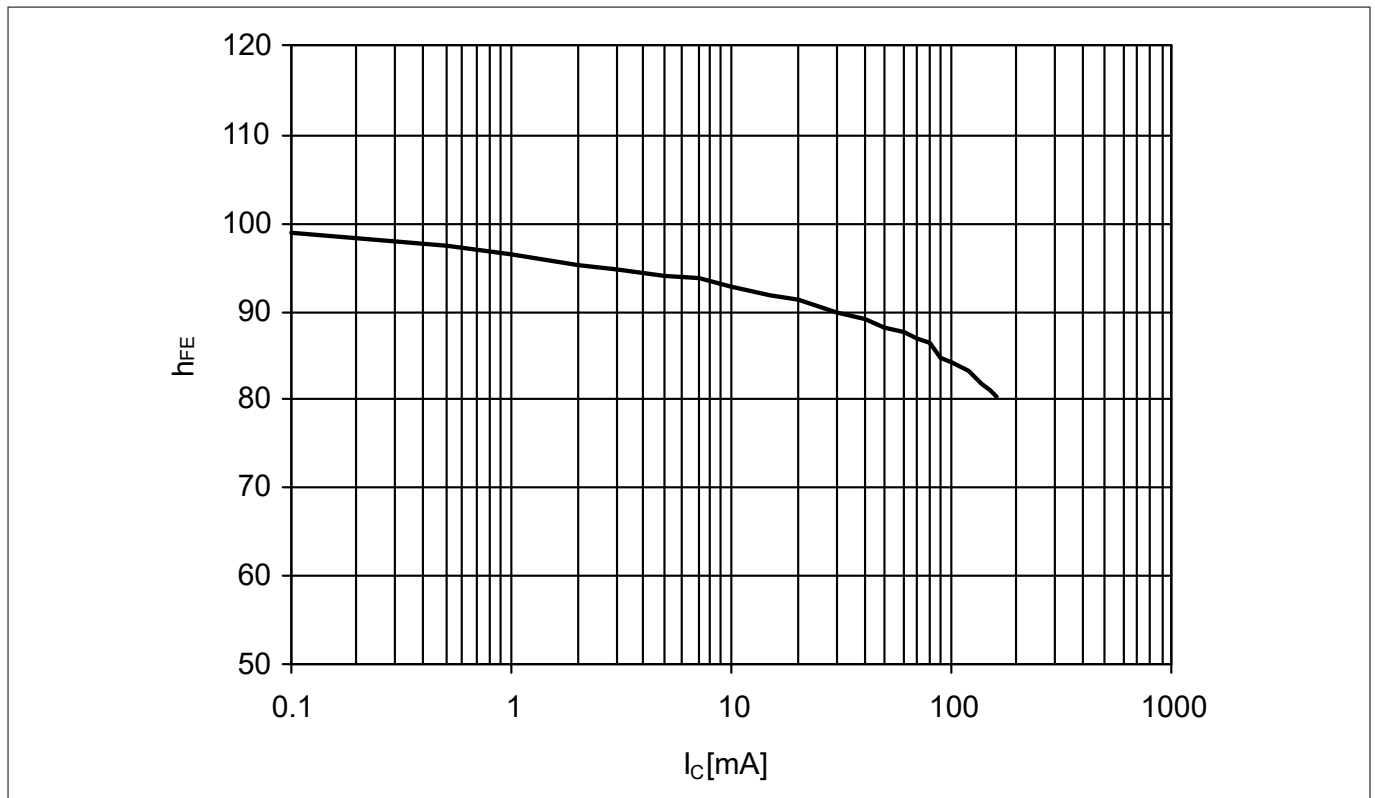


Figure 4 DC current gain $h_{FE} = f(I_C)$, $V_{CE} = 3$ V

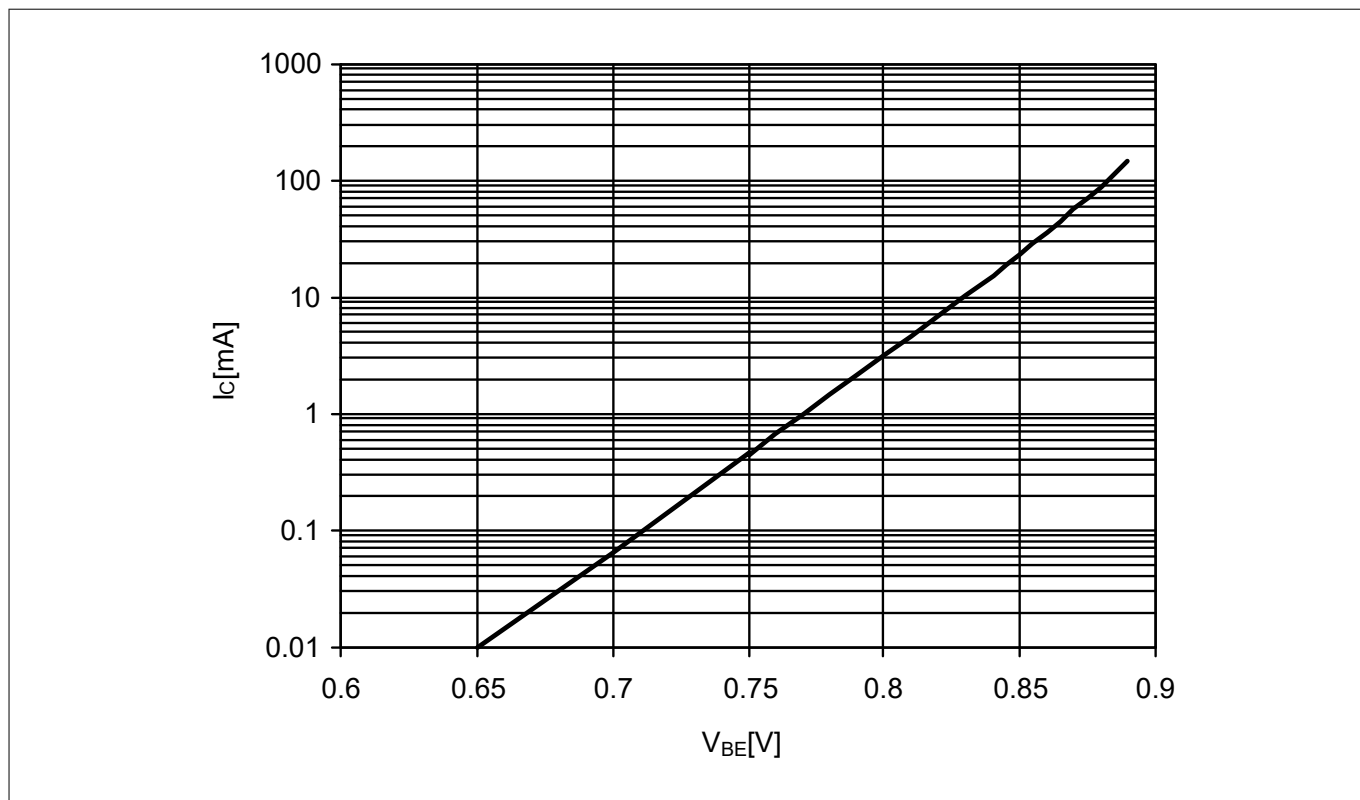


Figure 5 Collector current vs. base emitter forward voltage $I_C = f(V_{BE})$, $V_{CE} = 2\text{ V}$

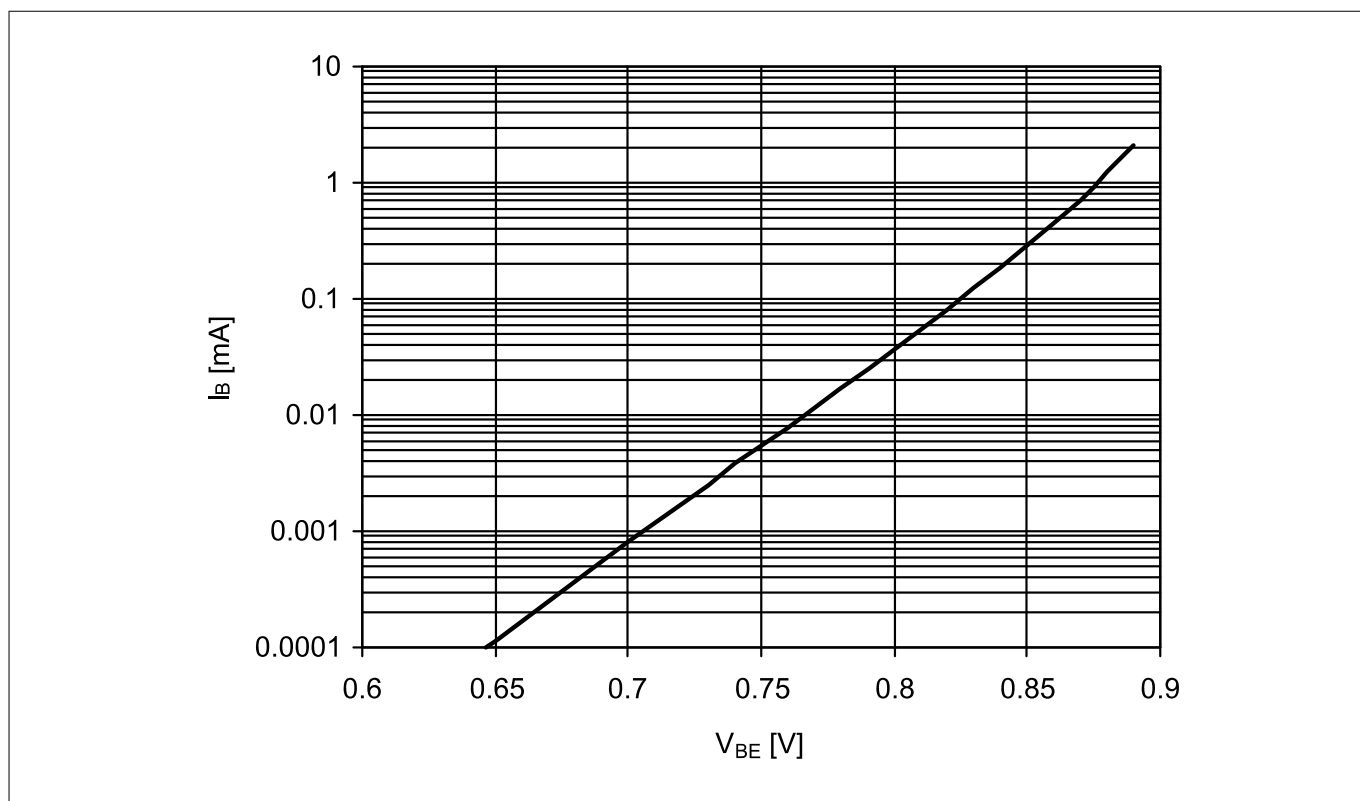


Figure 6 Base current vs. base emitter forward voltage $I_B = f(V_{BE})$, $V_{CE} = 2\text{ V}$

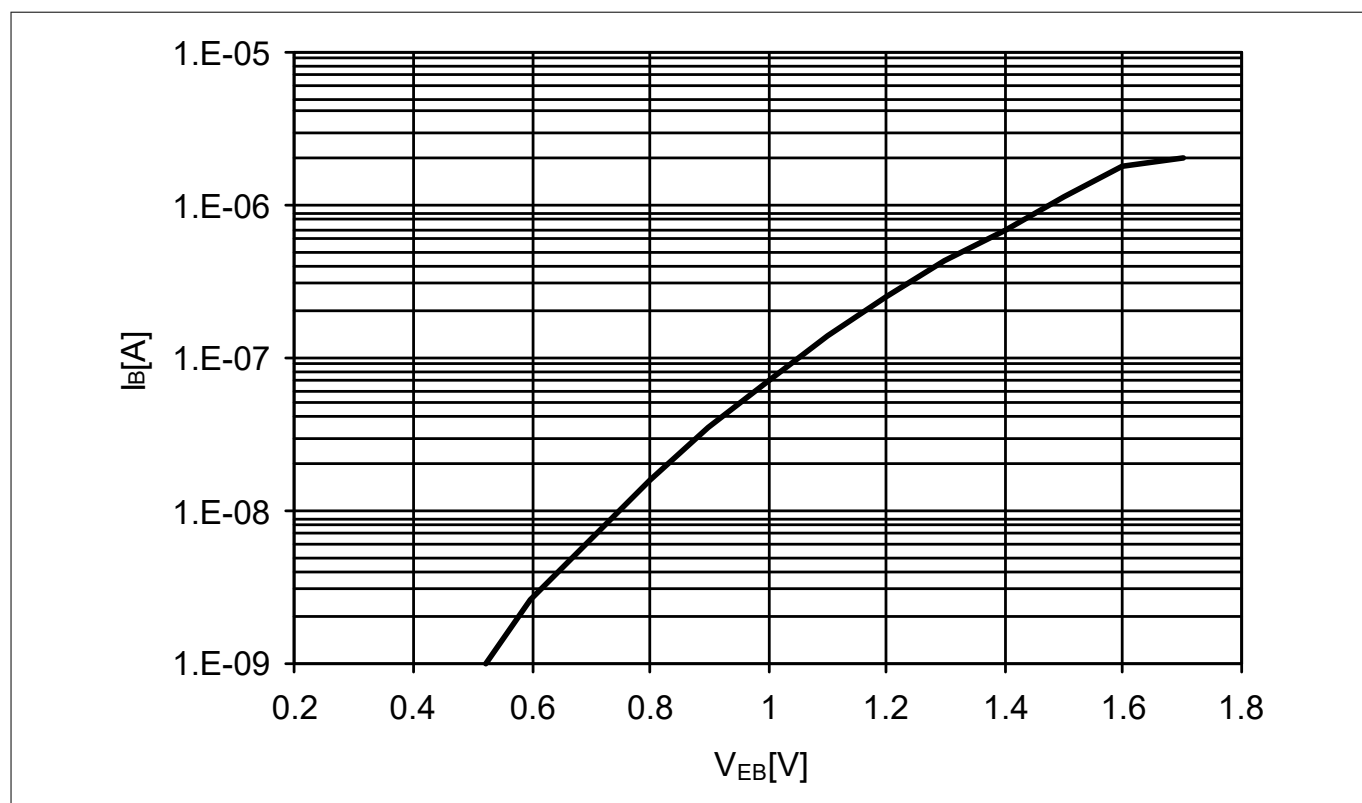


Figure 7 Base current vs. base emitter reverse voltage $I_B = f(V_{EB})$, $V_{CE} = 2$ V

3.5 Characteristic AC diagrams

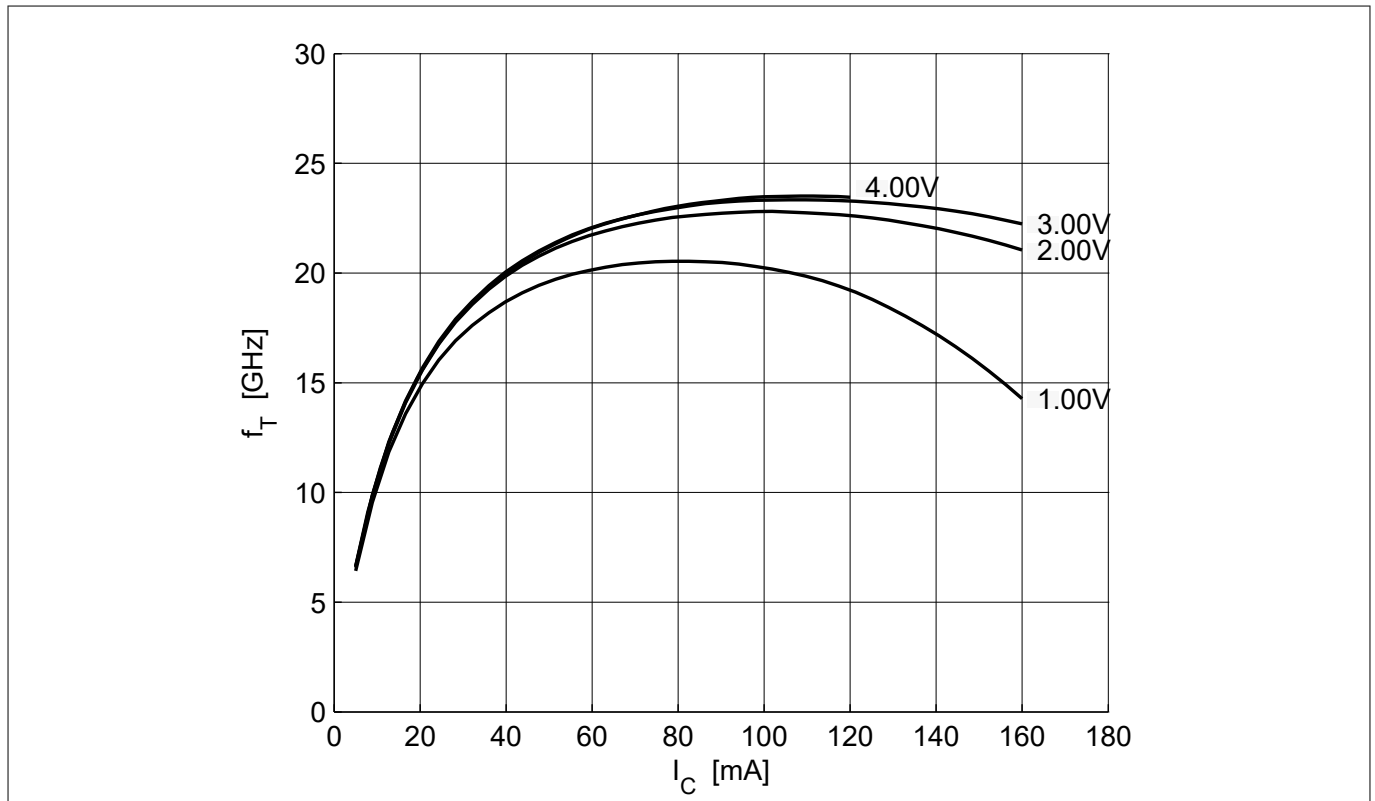


Figure 8 Transition frequency $f_T = f(I_C)$, $f = 1$ GHz, $V_{CE} = \text{parameter}$

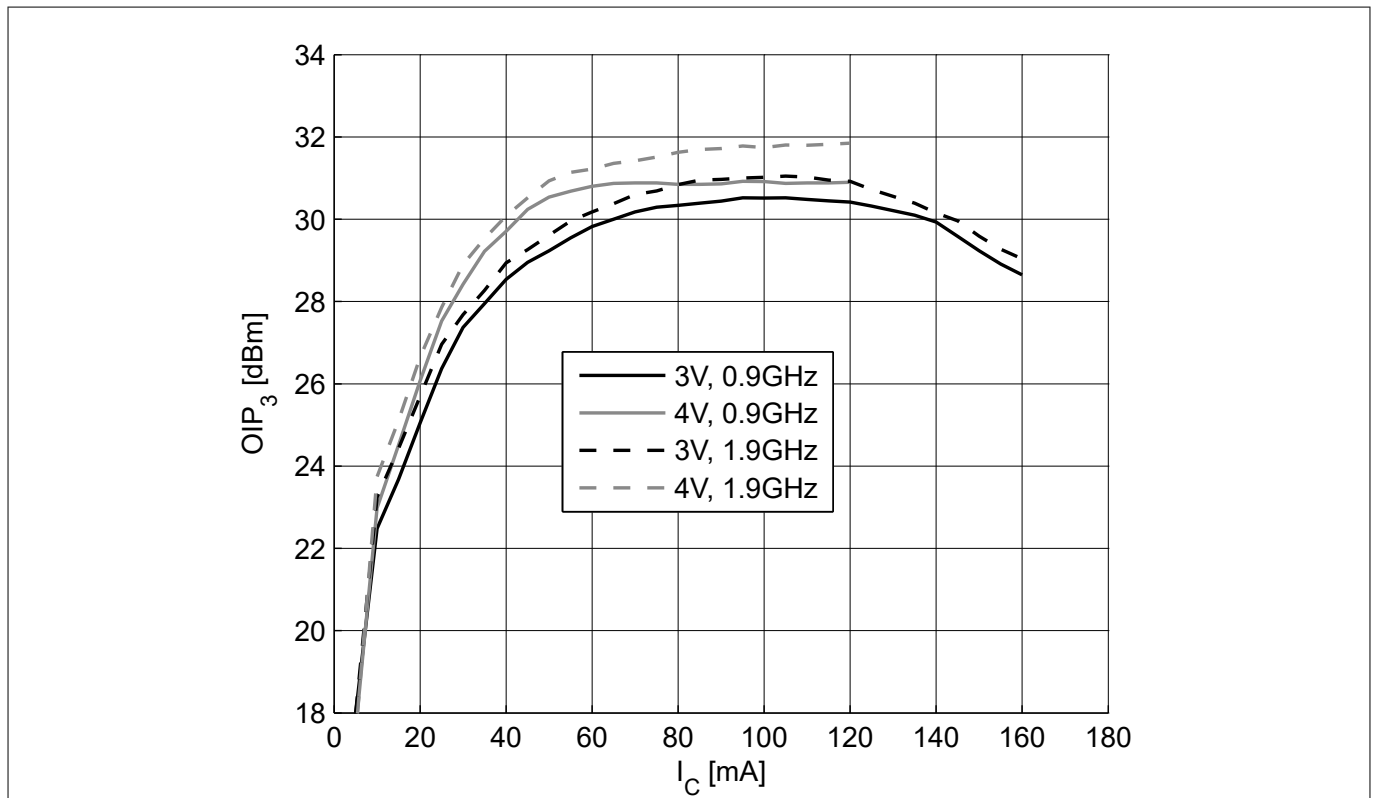


Figure 9 3rd order intercept point $OIP_3 = f(I_C)$, $Z_S = Z_L = 50 \Omega$, V_{CE} , $f = \text{parameters}$

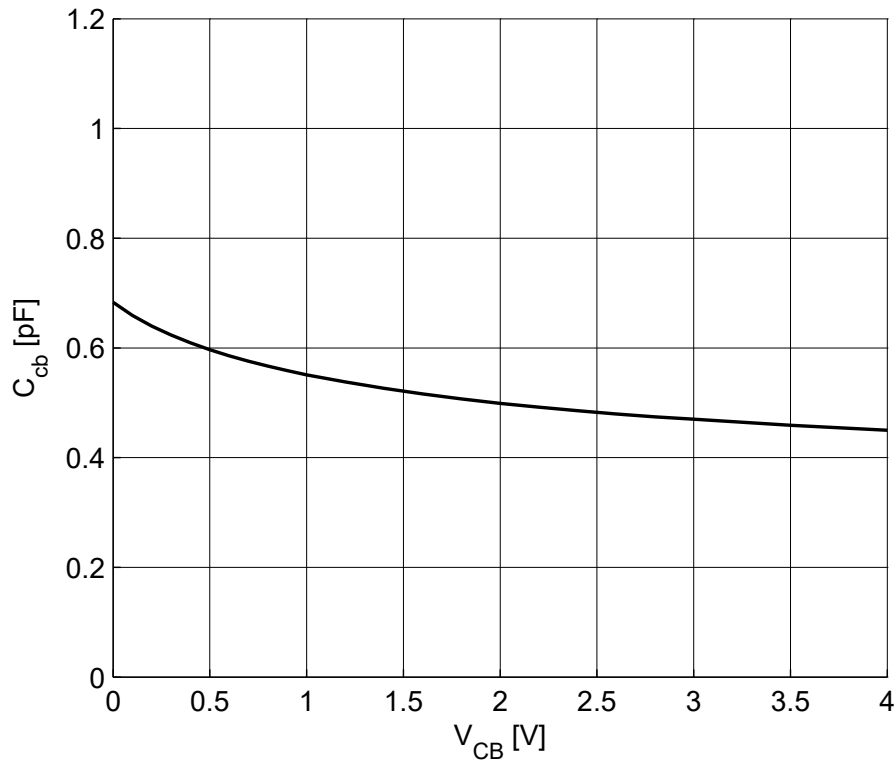


Figure 10 Collector base capacitance $C_{CB} = f(V_{CB})$, $f = 1$ MHz

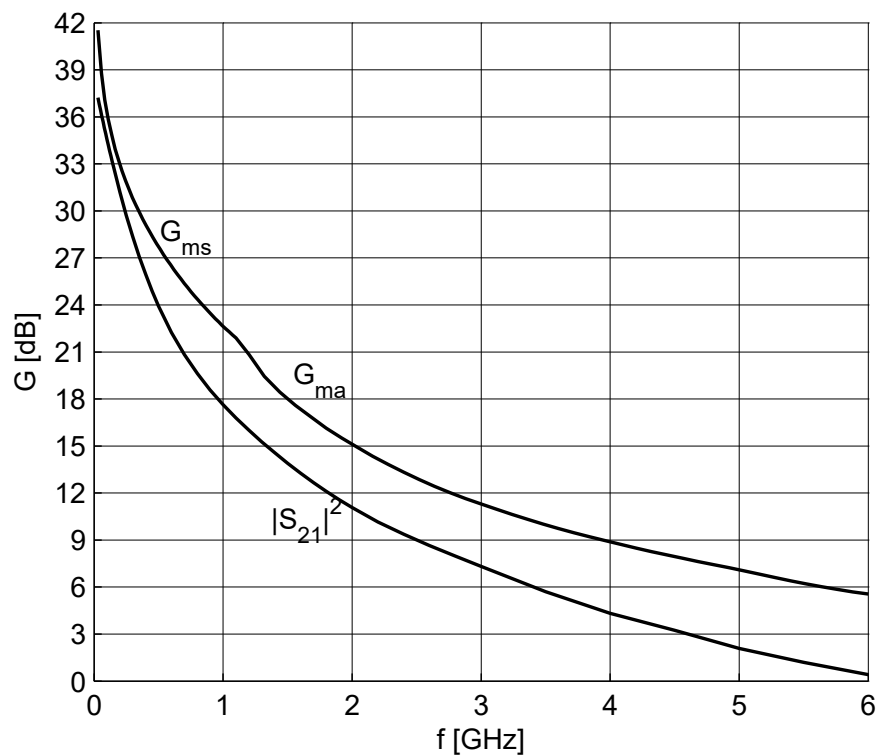


Figure 11 Gain G_{ma} , G_{ms} , $|S_{21}|^2 = f(f)$, $V_{CE} = 3$ V, $I_C = 90$ mA

Electrical characteristics

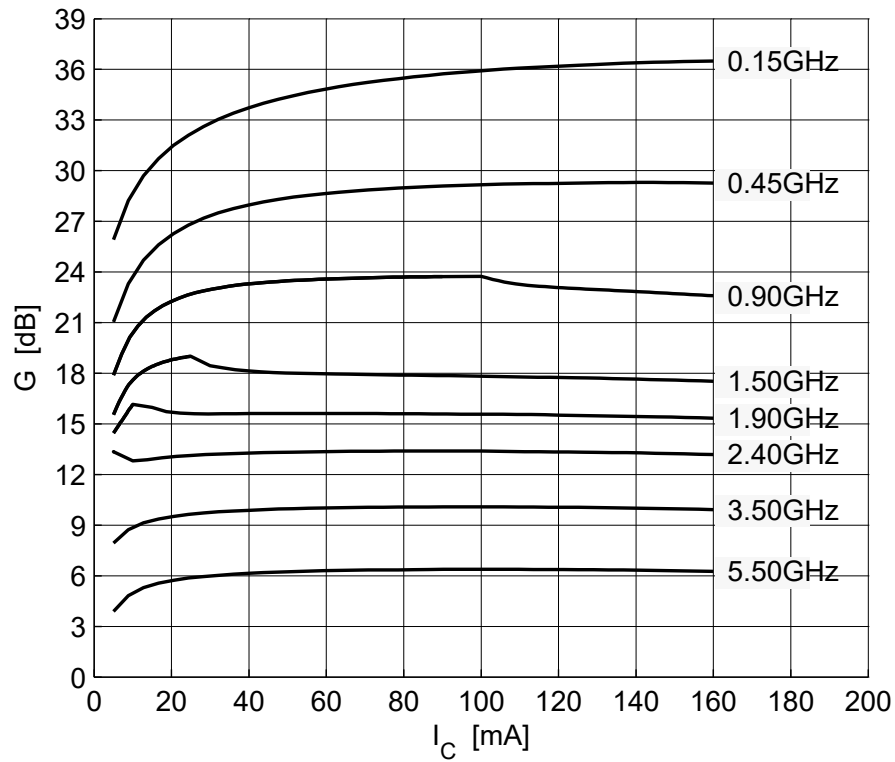


Figure 12 Maximum power gain $G_{\max} = f(I_C)$, $V_{CE} = 3\text{ V}$, $f = \text{parameter in GHz}$

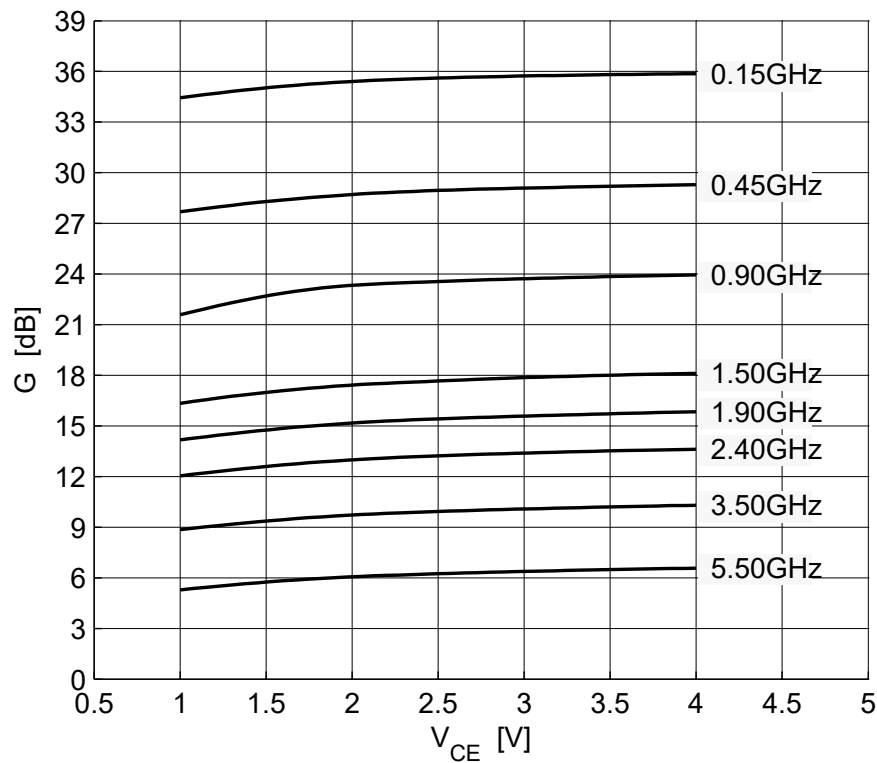


Figure 13 Maximum power gain $G_{\max} = f(V_{CE})$, $I_C = 90\text{ mA}$, $f = \text{parameter in GHz}$

Electrical characteristics

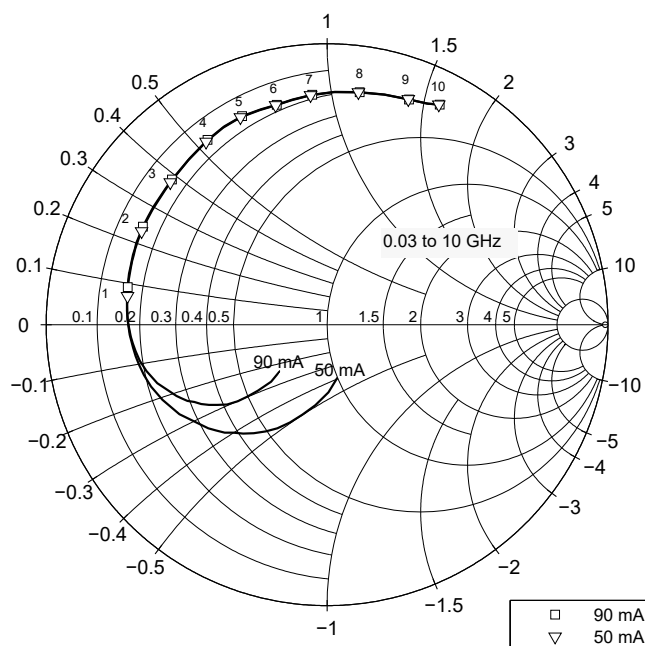


Figure 14 Input reflection coefficient $S_{11} = f(f)$, $V_{CE} = 3\text{ V}$, $I_C = 50 / 90\text{ mA}$

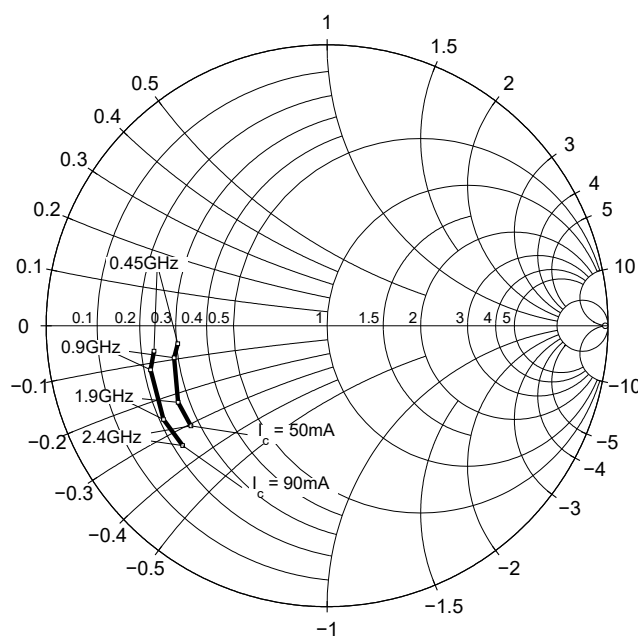


Figure 15 Source impedance for minimum noise figure $Z_{s,opt} = f(f)$, $V_{CE} = 3\text{ V}$, $I_C = 50 / 90\text{ mA}$

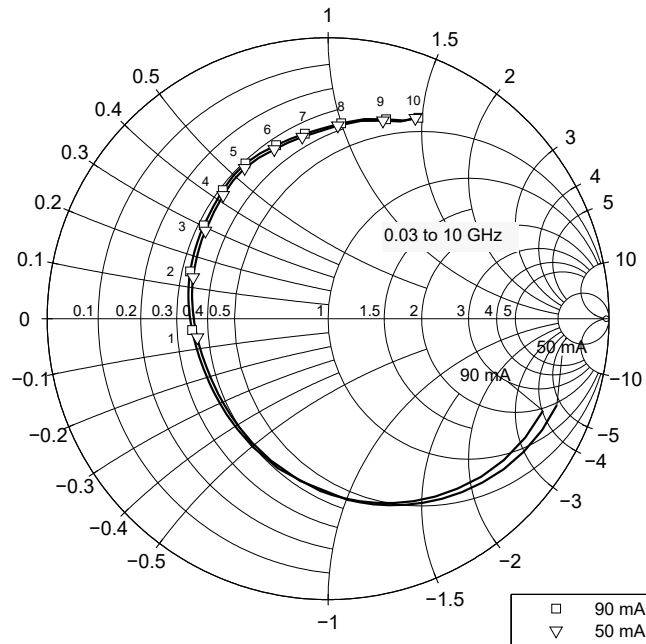


Figure 16 Output reflection coefficient $S_{22} = f(f)$, $V_{CE} = 3\text{ V}$, $I_C = 50 / 90\text{ mA}$

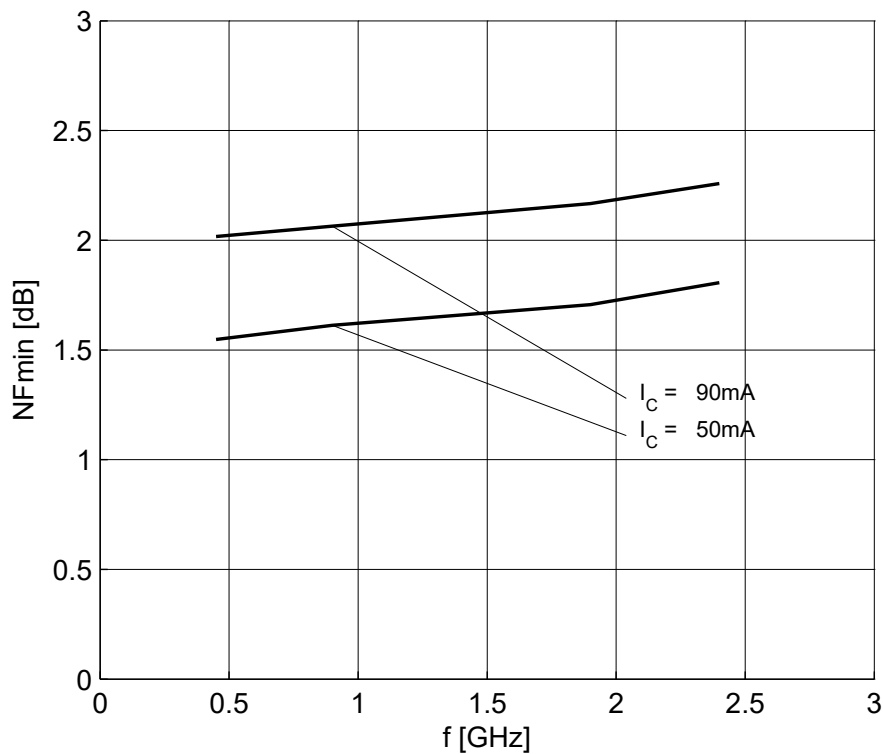


Figure 17 Noise figure $NF_{min} = f(f)$, $Z_S = Z_{S,opt}$, $V_{CE} = 3\text{ V}$, $I_C = 50 / 90\text{ mA}$

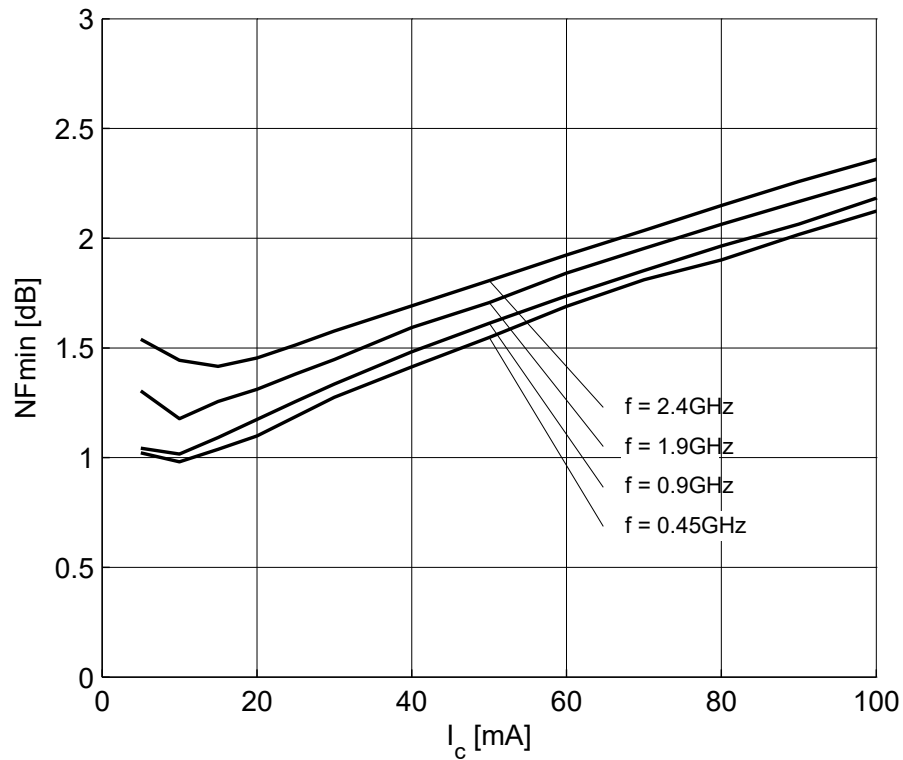


Figure 18 Noise figure $NF_{min} = f(I_C)$, $Z_S = Z_{S,opt}$, $V_{CE} = 3\text{ V}$, $f =$ parameter in GHz

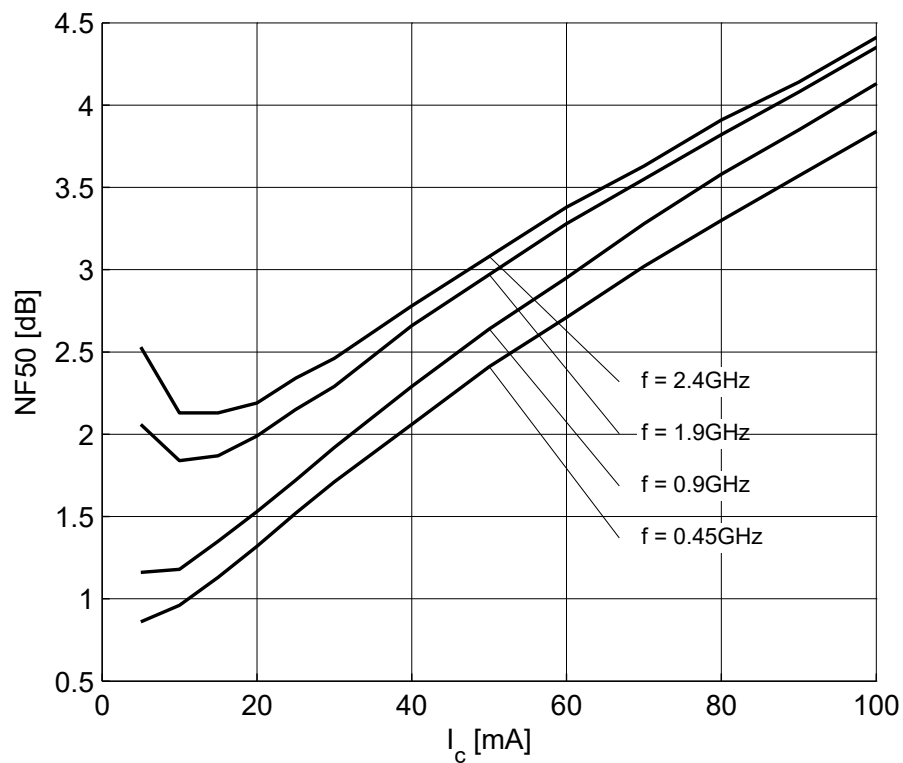


Figure 19 Noise figure $NF_{50} = f(I_C)$, $Z_S = 50\ \Omega$, $V_{CE} = 3\text{ V}$, $f =$ parameter in GHz

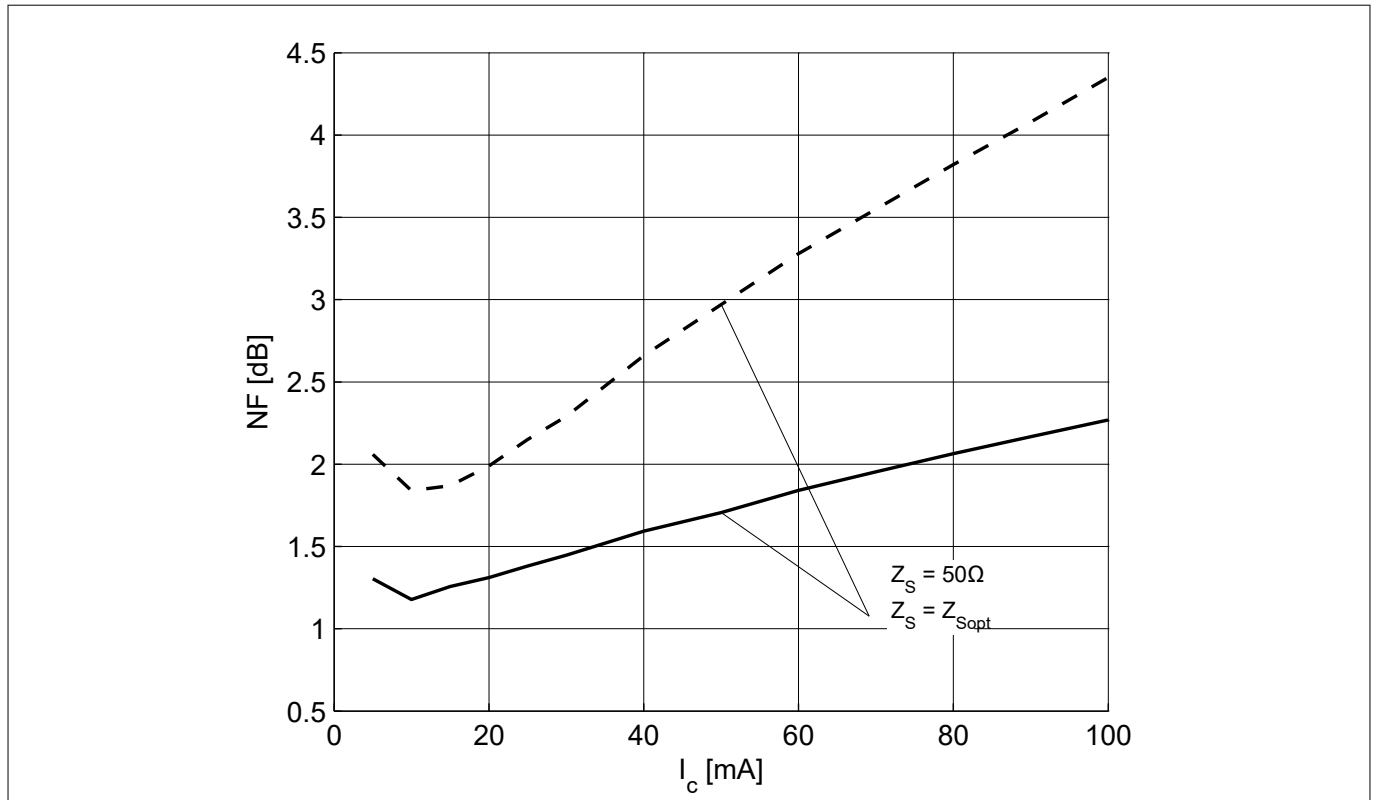
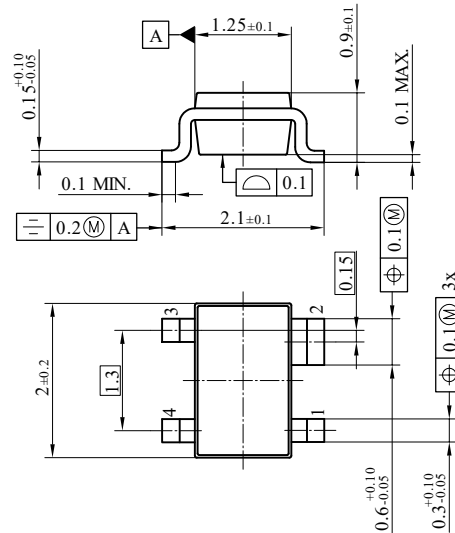


Figure 20 Noise figure $NF_{50} = f(I_C)$, $Z_S = 50 \Omega$, $NF_{min} = f(I_C)$, $Z_S = Z_{S,opt}$, $V_{CE} = 3 V$, $f = 1.9 GHz$

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. $T_A = 25 ^\circ C$.

Package information SOT343

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

Revision history

Document version	Date of release	Description of changes
Revision 2.0	2019-01-25	New datasheet layout.
Revision 3.0	2024-07-01	Updated product validation

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