

BFP196WN

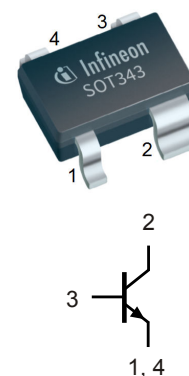
Low noise silicon bipolar RF transistor

Product description

- NPN silicon planar epitaxial transistor in 4-pin dual-emitter SOT343 package for low noise and low distortion wideband amplifiers. This RF transistor benefits from Infineon long-term experience in RF components and combines ease-of-use to stable volumes production, at benchmark quality and reliability.

Features

- For high voltage applications $V_{CE} < 12\text{ V}$
- Maximal power $P_{tot} = 700\text{ mW}$
- Transition frequency $f_T = 7.5\text{ GHz}$
- Noise figure $NF_{min} = 1.3\text{ dB}$ at 900 MHz
- Easy to use Pb-free (RoHS compliant) and halogen-free industry standard SOT343 package with visible leads



Application

- GNSS active antenna
- Amplifiers in antenna and telecommunications systems
- CATV
- Power amplifier for DECT and PCN systems

Product validation

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

Device information

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

Type / Ordering code	Package	Pin configuration				Marking	Related Links
BFP196WN / BFP196WNH6327XTSA1	SOT343	1=E	2=C	3=B	4=E	RLs	see SOT343 Package

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Absolute maximum ratings

1 Absolute maximum ratings

Table 1 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}	–	12	V	Base open
Collector emitter voltage	V_{CES}	–	20	V	Emitter / base short circuited
Collector base voltage	V_{CBO}	–	20	V	Emitter open
Emitter base voltage	V_{EBO}	–	2	V	Collector open
DC collector current	I_C	–	150	mA	–
DC base current	I_B	–	15	mA	–
Total power	P_{tot}	–	700	mW	–
Junction temperature	T_J	–	150	°C	–
Storage temperature	T_{Stg}	-55	150	°C	–

Attention: *Stresses above the maximum 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 component.*

Thermal characteristics

2 Thermal characteristics

Table 2 Thermal resistance

Parameter	Symbol	Values			Unit	Note or Test Condition
		Min.	Typ.	Max.		
Junction - soldering point	R_{thJS}	–	115	–	K/W	1)

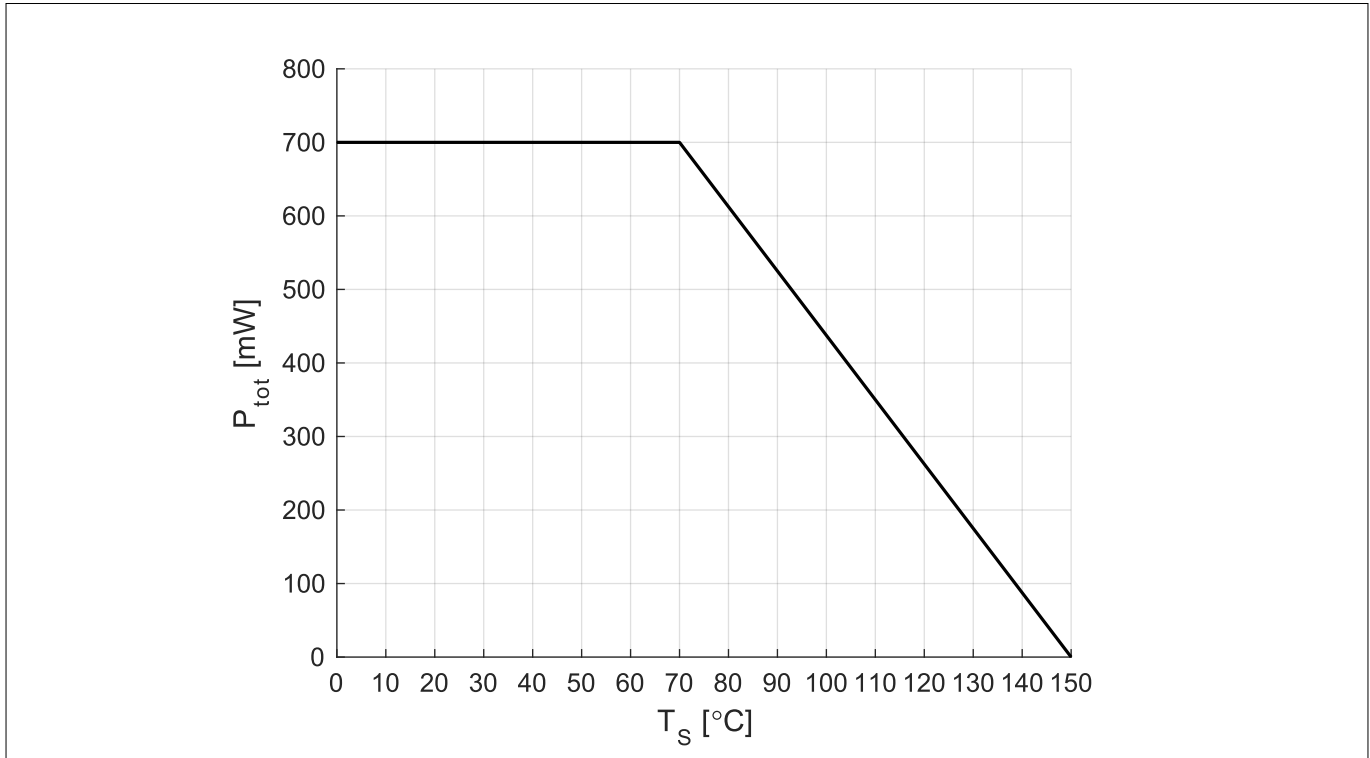


Figure 1 Absolute maximum power dissipation P_{tot} vs. T_s

Note: In the horizontal part of the above curve the junction temperature T_J is lower than $T_{J,max}$. In the declining slope it is $T_J = T_{J,max}$. P_{tot} has to be reduced according to the curve in order not to exceed $T_{J,max}$. It is $T_{J,max} = T_s + P_{tot} * R_{thJS}$.

¹ For the definition of R_{thJS} please refer to the application note AN077

Electrical performance in test fixture

3 Electrical performance in test fixture

3.1 DC parameter table

Table 3 DC characteristics at $T_A = 25\text{ }^\circ\text{C}$

Parameter	Symbol	Values			Unit	Note or Test Condition
		Min.	Typ.	Max.		
Collector emitter breakdown voltage	V_{CEO}	12	–	–	V	$I_C = 1\text{ mA}$, open base
Collector emitter leakage current	I_{CES}	–	–	100	μA	$V_{CE} = 20\text{ V}$, $V_{BE} = 0\text{ V}$ Emitter / base short circuited
Collector base leakage current	I_{CBO}	–	–	100	nA	$V_{CB} = 10\text{ V}$, $V_{BE} = 0$ Open emitter
Emitter base leakage current	I_{EBO}	–	–	1	μA	$V_{EB} = 1\text{ V}$, $I_C = 0$ Open collector
DC current gain	h_{FE}	70	100	140		$V_{CE} = 8\text{ V}$, $I_C = 50\text{ mA}$ Pulse measured

3.2 AC parameter tables

Table 4 General AC characteristics at $T_A = 25\text{ }^\circ\text{C}$

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Transition frequency	f_T	5	7.5	–	GHz	$V_{CE} = 8\text{ V}$, $I_C = 90\text{ mA}$, $f = 500\text{ MHz}$
Collector base capacitance	C_{CB}	–	0.9	–	pF	$V_{CB} = 10\text{ V}$, $V_{BE} = 0\text{ V}$, $f = 1\text{ MHz}$ Emitter grounded
Collector emitter capacitance	C_{CE}	–	0.35	–	pF	$V_{CE} = 10\text{ V}$, $V_{BE} = 0\text{ V}$, $f = 1\text{ MHz}$ Base grounded
Emitter base capacitance	C_{EB}	–	3.8	–	pF	$V_{EB} = 0.5\text{ V}$, $V_{CB} = 0\text{ V}$, $f = 1\text{ MHz}$ Collector grounded

Electrical performance in test fixture

Measurement setup for the AC characteristics shown in the following tables is a test fixture with Bias T's in a 50 Ω system, $T_A = 25\text{ °C}$.

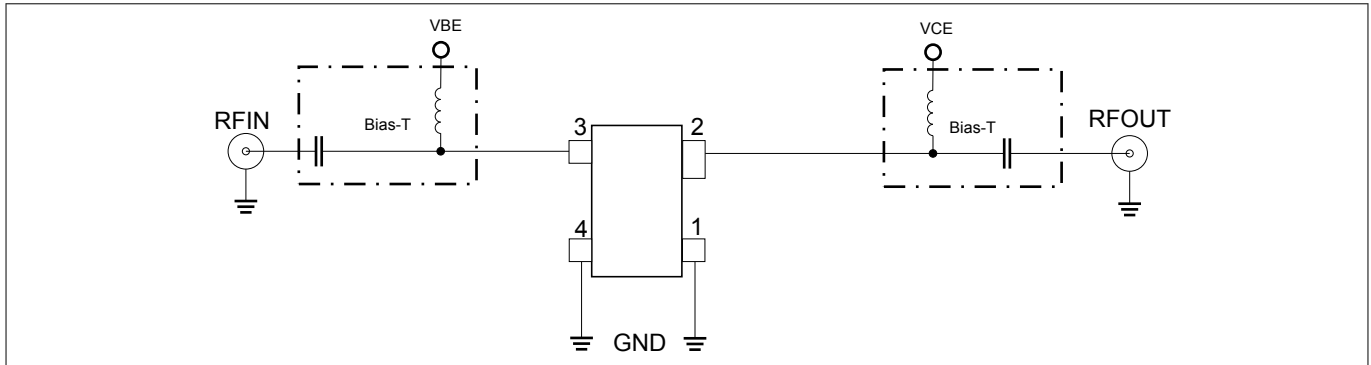


Figure 2 BFP196WN testing circuit

Table 5 AC characteristics, $V_{CE} = 8\text{ V}$, $f = 0.45\text{ GHz}$

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Power gain					dB	
Maximum power gain	G_{ms}	–	23.5	–		$I_C = 50\text{ mA}$ $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$
Transducer gain	$ S_{21} ^2$	–	19.0	–		$Z_S = Z_L = 50\text{ }\Omega$
Minimum noise figure	NFmin	–	0.95	–	dB	$I_C = 20\text{ mA}$, $Z_S = Z_{Sopt}$
Linearity					dBm	
1 dB compression point at output	OP1dB	–	19	–		$I_C = 50\text{ mA}$ $Z_S = Z_L = 50\text{ }\Omega$
3rd order intercept point at output	OIP3	–	32	–		

Table 6 AC characteristics, $V_{CE} = 8\text{ V}$, $f = 0.9\text{ GHz}$

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Power gain					dB	
Maximum power gain	G_{ms}	–	17.0	–		$I_C = 50\text{ mA}$ $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$
Transducer gain	$ S_{21} ^2$	–	13.0	–		$Z_S = Z_L = 50\text{ }\Omega$
Minimum noise figure	NFmin	–	1.1	–	dB	$I_C = 20\text{ mA}$, $Z_S = Z_{Sopt}$
Linearity					dBm	
1 dB compression point at output	OP1dB	–	19	–		$I_C = 50\text{ mA}$ $Z_S = Z_L = 50\text{ }\Omega$
3rd order intercept point at output	OIP3	–	32	–		

Electrical performance in test fixture

Table 7 AC characteristics, $V_{CE} = 8\text{ V}$, $f = 1.5\text{ GHz}$

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Power gain					dB	$I_C = 50\text{ mA}$ $Z_S = Z_{Sopt}, Z_L = Z_{Lopt}$ $Z_S = Z_L = 50\ \Omega$
Maximum power gain	G_{ms}	–	12.5	–		
Transducer gain	$ S_{21} ^2$	–	8.5	–		
Minimum noise figure	NFmin	–	1.7	–	dB	$I_C = 20\text{ mA}, Z_S = Z_{Sopt}$
Linearity					dBm	$I_C = 50\text{ mA}$ $Z_S = Z_L = 50\ \Omega$
1 dB compression point at output	OP1dB	–	19	–		
3rd order intercept point at output	OIP3	–	32	–		

Table 8 AC characteristics, $V_{CE} = 8\text{ V}$, $f = 1.9\text{ GHz}$

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Power gain					dB	$I_C = 50\text{ mA}$ $Z_S = Z_{Sopt}, Z_L = Z_{Lopt}$ $Z_S = Z_L = 50\ \Omega$
Maximum power gain	G_{ms}	–	11	–		
Transducer gain	$ S_{21} ^2$	–	6.5	–		
Minimum noise figure	NFmin	–	2.1	–	dB	$I_C = 20\text{ mA}, Z_S = Z_{Sopt}$
Linearity					dBm	$I_C = 50\text{ mA}$ $Z_S = Z_L = 50\ \Omega$
1 dB compression point at output	OP1dB	–	19	–		
3rd order intercept point at output	OIP3	–	32	–		

Table 9 AC characteristics, $V_{CE} = 5\text{ V}$, $f = 2.4\text{ GHz}$

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Power gain					dB	$I_C = 50\text{ mA}$ $Z_S = Z_{Sopt}, Z_L = Z_{Lopt}$ $Z_S = Z_L = 50\ \Omega$
Maximum power gain	G_{ms}	–	9.7	–		
Transducer gain	$ S_{21} ^2$	–	4.8	–		
Minimum noise figure	NFmin	–	2.5	–	dB	$I_C = 20\text{ mA}, Z_S = Z_{Sopt}$
Linearity					dBm	$I_C = 50\text{ mA}$ $Z_S = Z_L = 50\ \Omega$
1 dB compression point at output	OP1dB	–	19	–		
3rd order intercept point at output	OIP3	–	32	–		

Electrical performance in test fixture

3.3 Characteristic DC diagrams

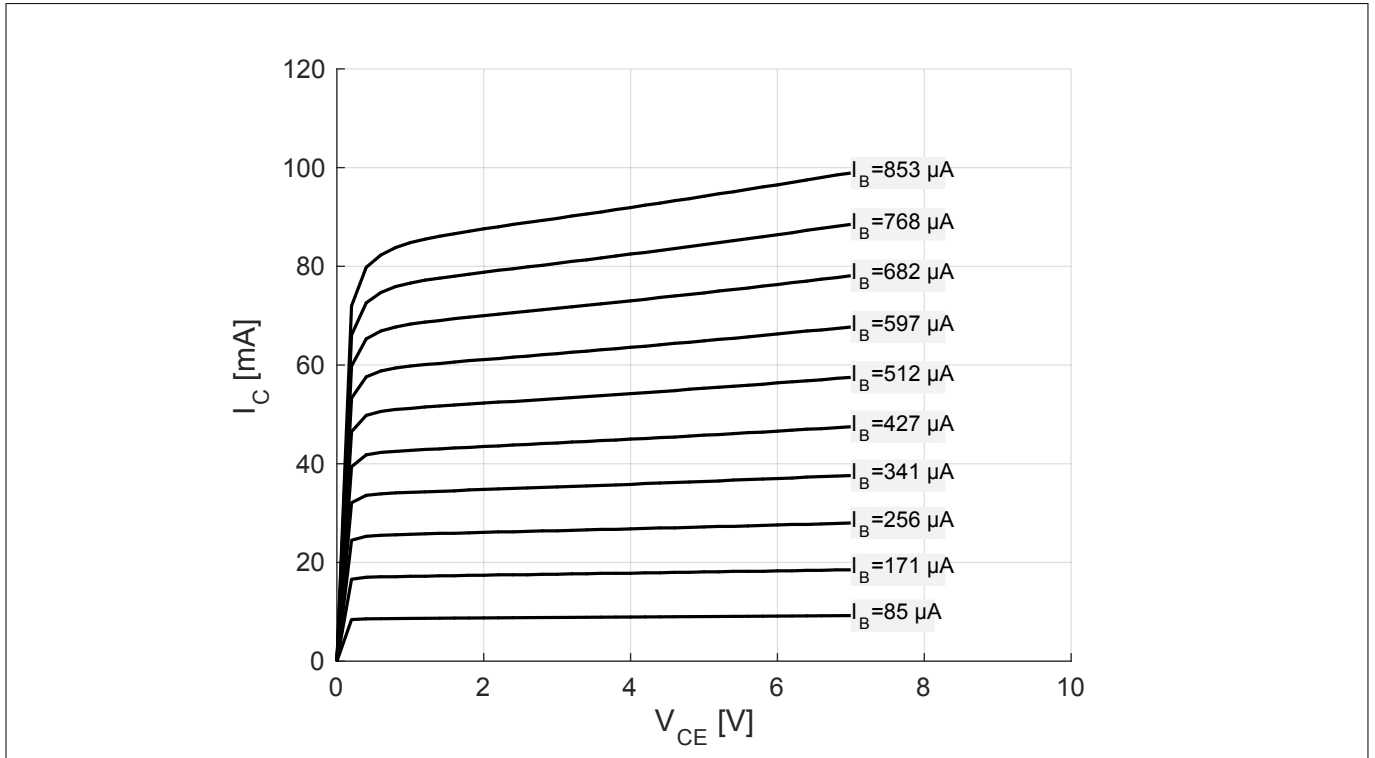


Figure 3 Collector current $I_C = f(V_{CE})$, $I_B =$ parameter

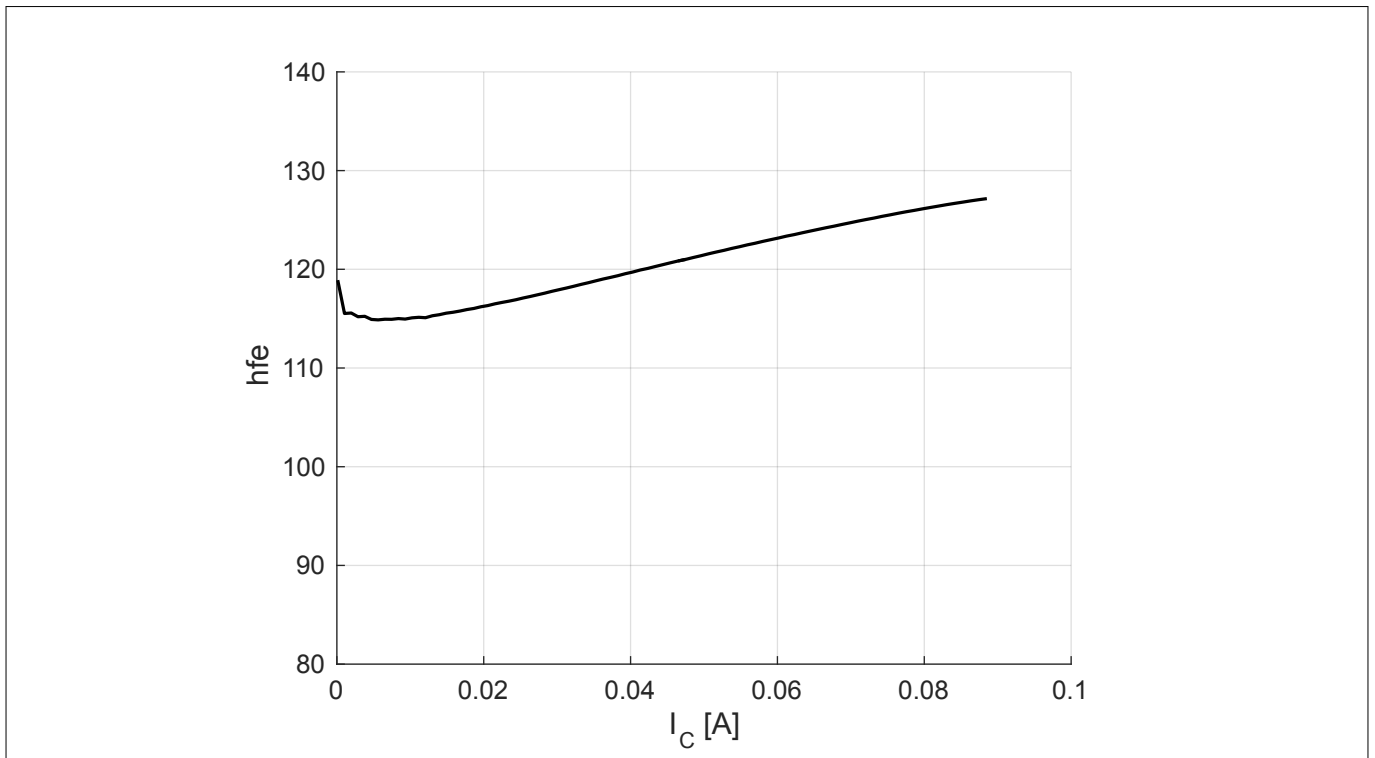


Figure 4 Current gain $h_{FE} = f(I_C)$, $V_{CE} = 8$ V

Electrical performance in test fixture

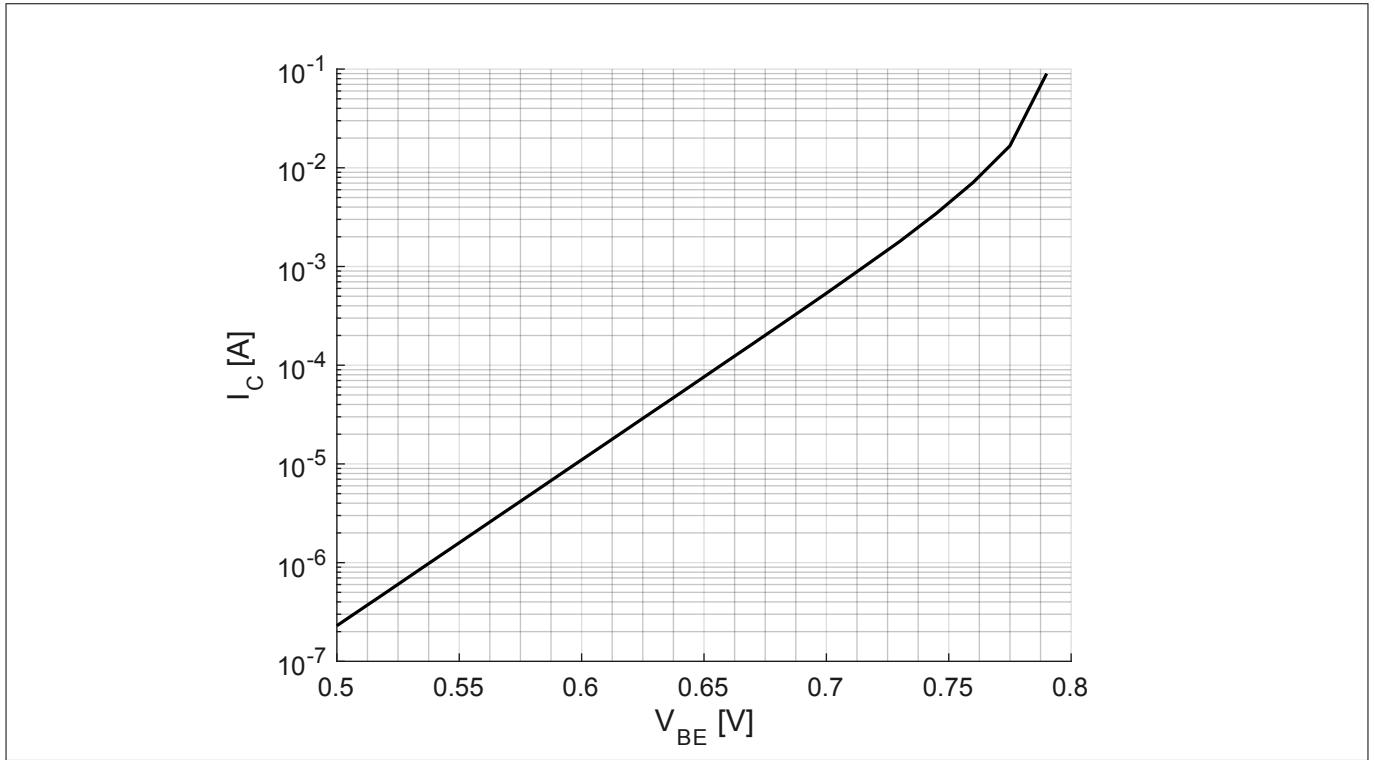


Figure 5 Collector current $I_C = f(V_{BE})$, $V_{CE} = 8\text{ V}$

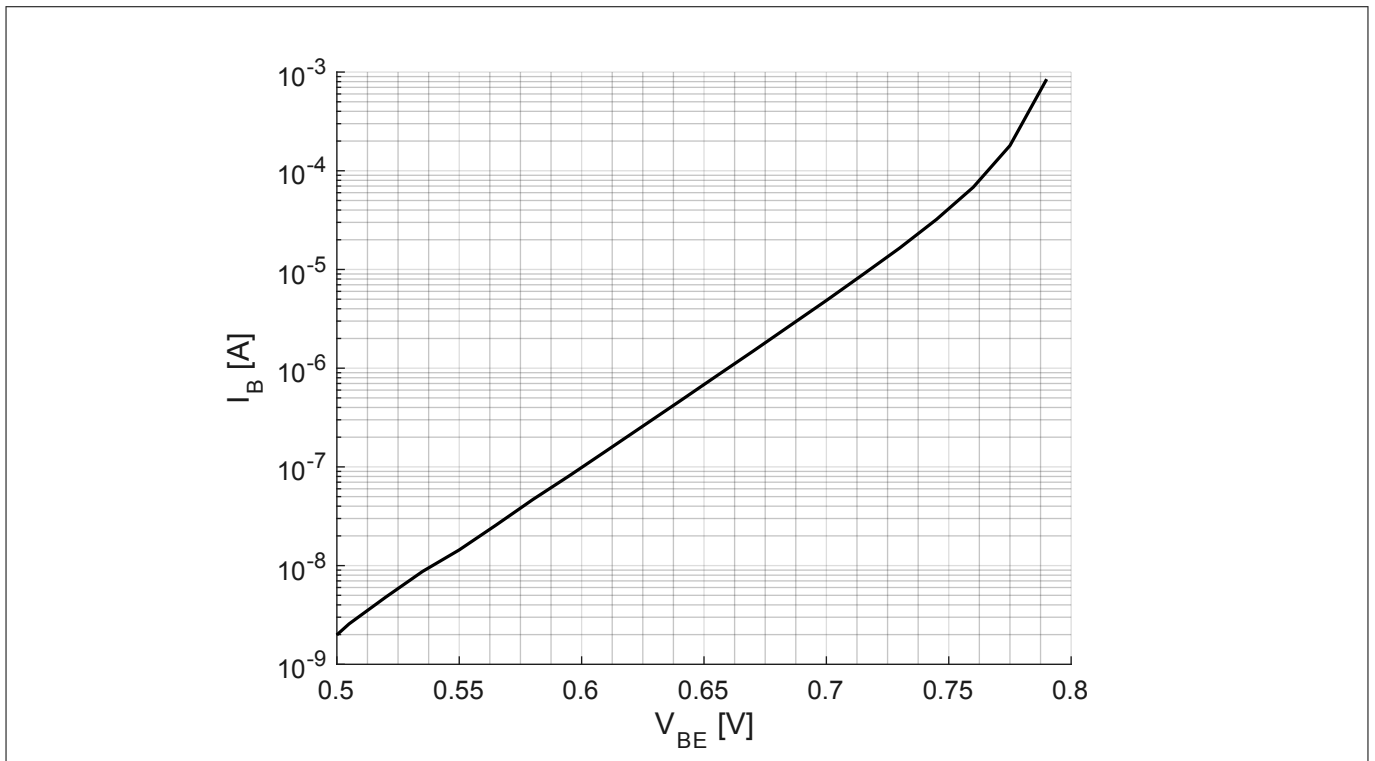


Figure 6 Base current $I_B = f(V_{BE})$, $V_{CE} = 8\text{ V}$

Electrical performance in test fixture

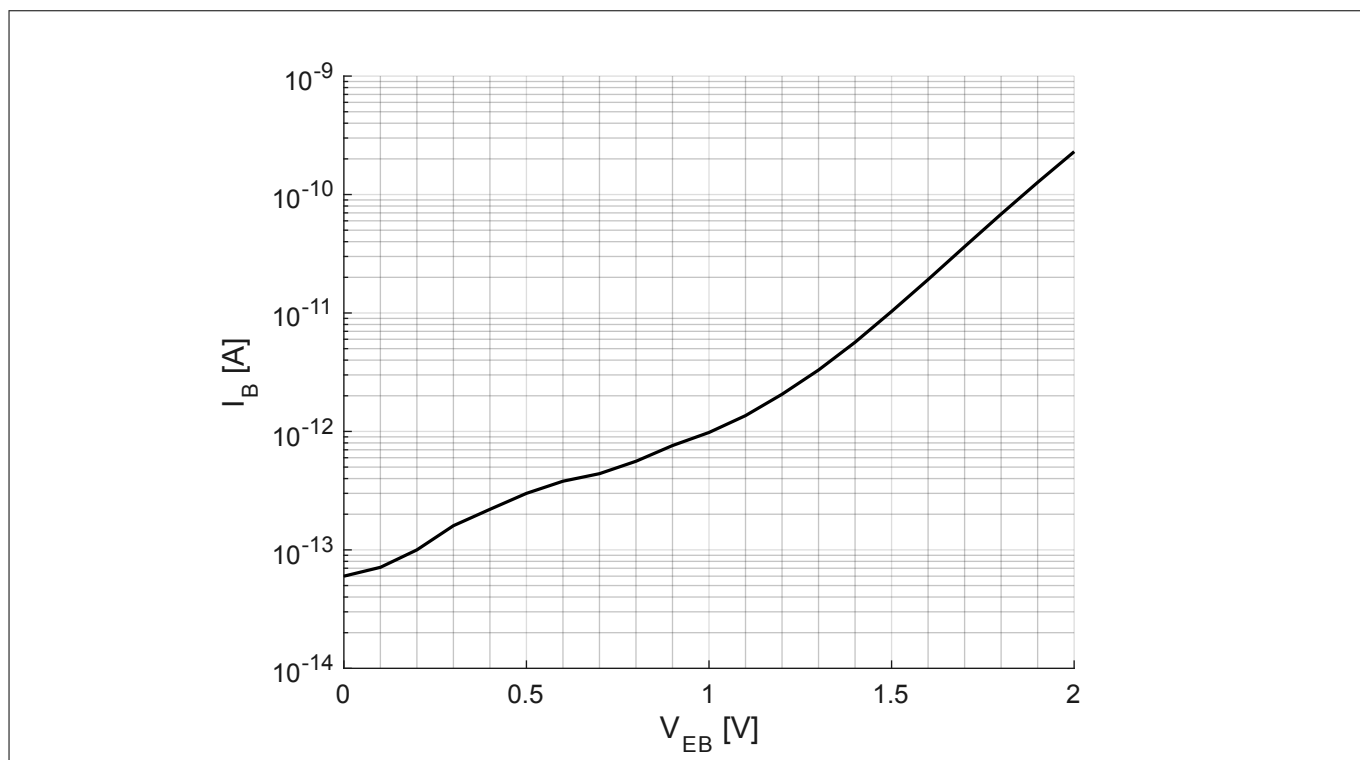


Figure 7 Base/emitter leakage current $I_B = f(V_{EB})$, $V_{CE} = 8$ V

Note: Regard absolute maximum ratings for I_C , V_{CE} and P_{tot} (see [Table 1](#))

Electrical performance in test fixture

3.4 Characteristic AC diagrams

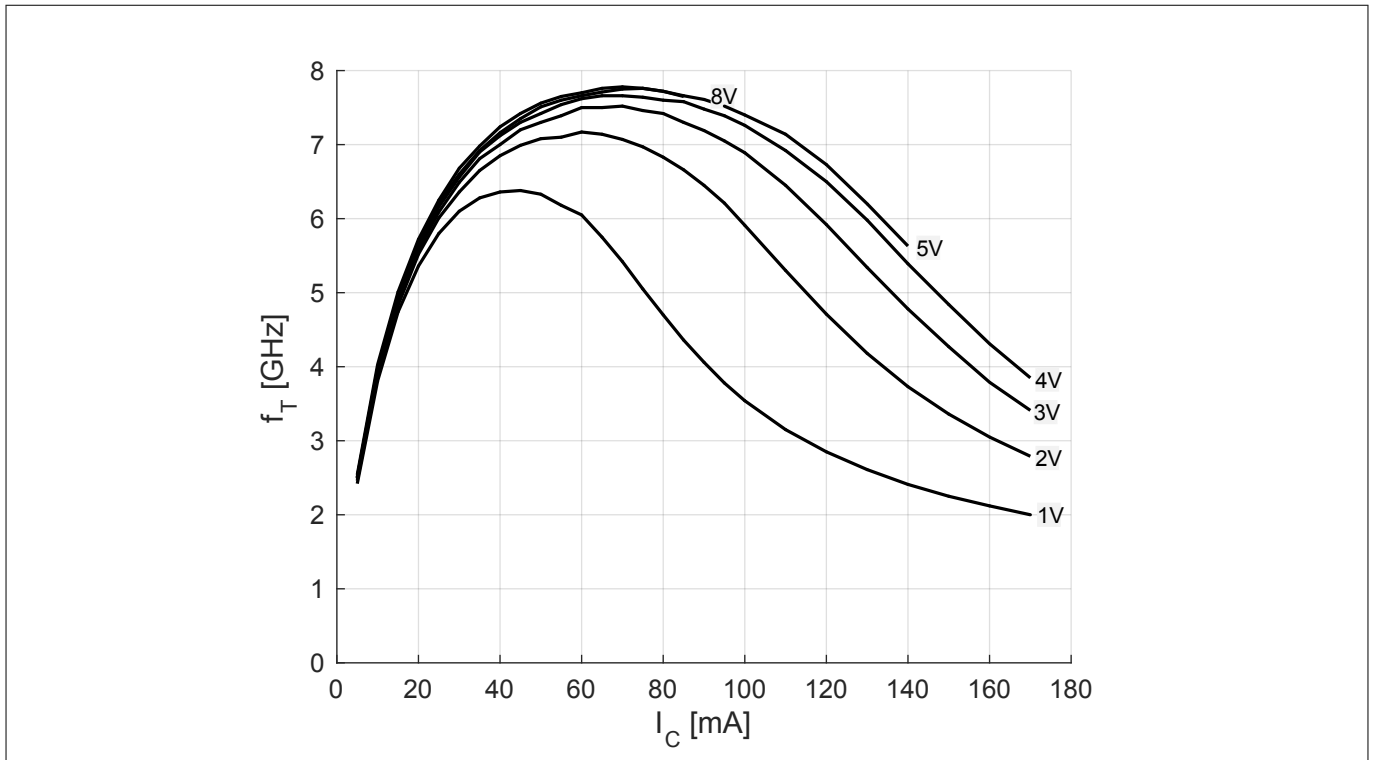


Figure 8 Transition frequency $f_T = f(I_C)$, $V_{CE} = \text{parameter}$

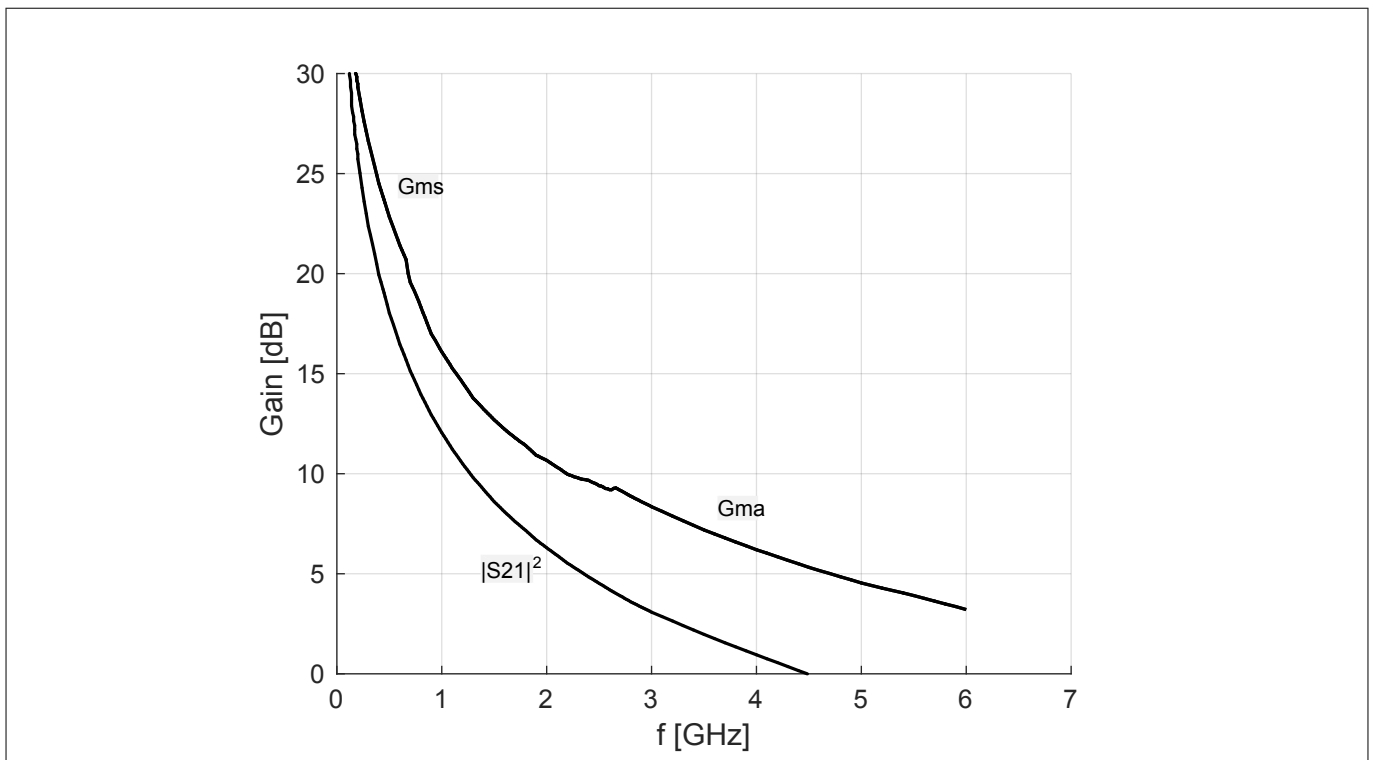


Figure 9 Gain G_{ms} , G_{ma} , $|S_{21}|^2 = f(f)$, $I_C = 50 \text{ mA}$, $V_{CE} = 8 \text{ V}$

Electrical performance in test fixture

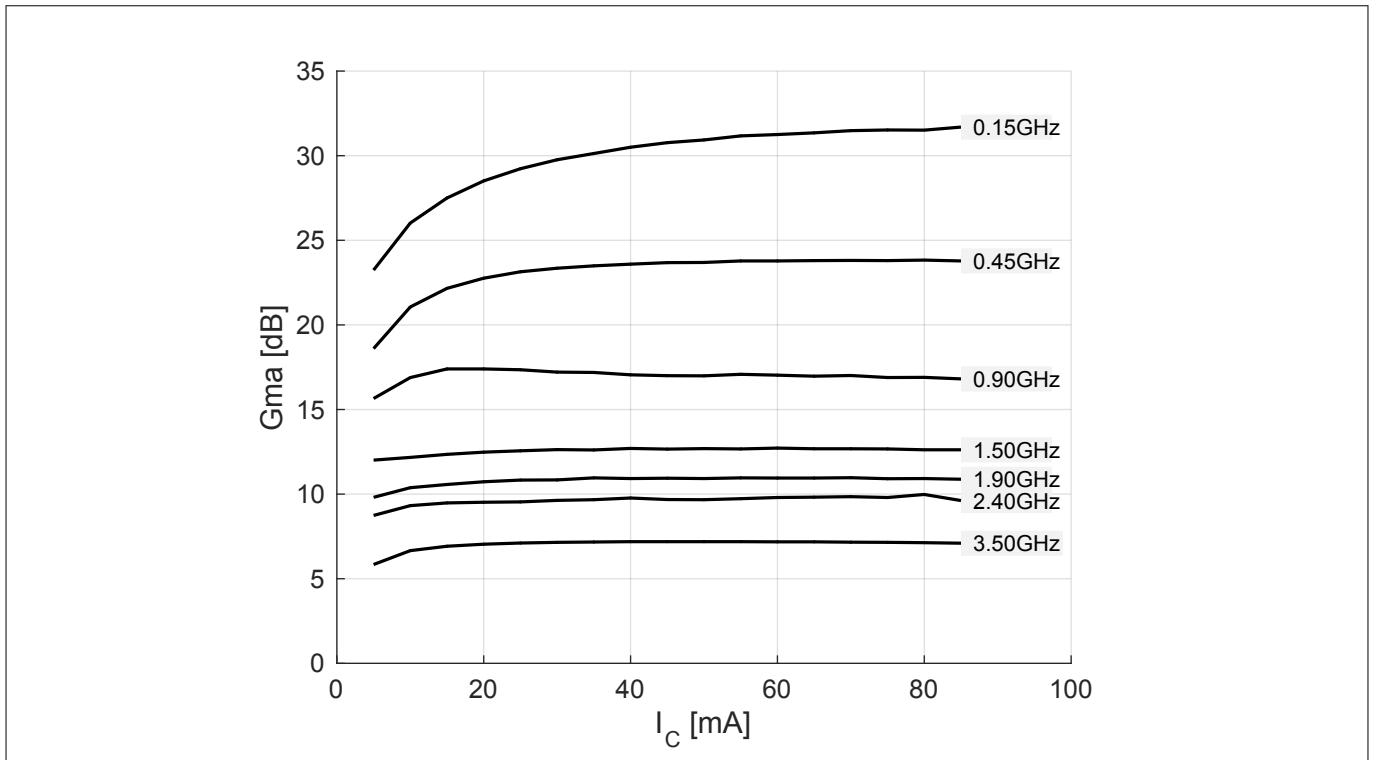


Figure 10 Maximum power gain $G_{max} = f(I_C)$, $V_{CE} = 8V$, $f = \text{parameter}$

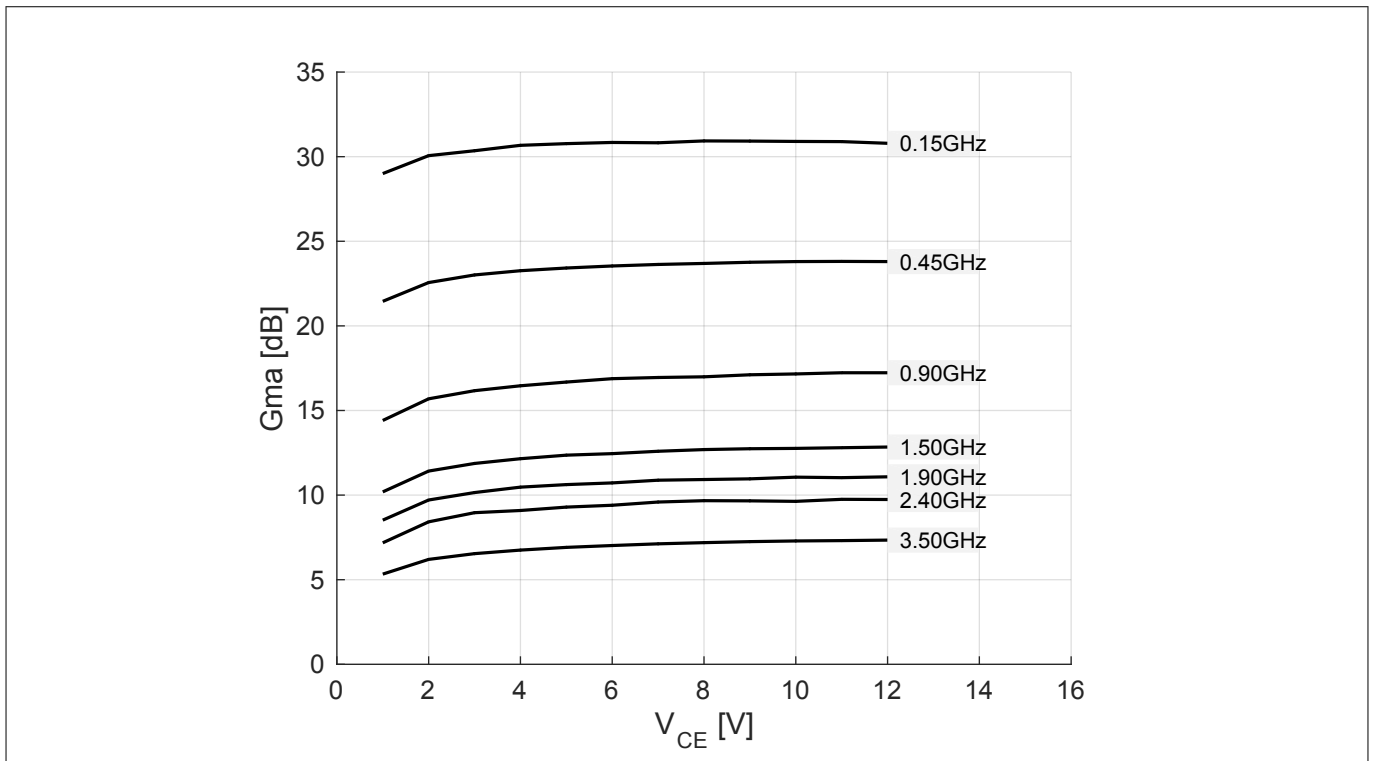


Figure 11 Maximum power gain $G_{max} = f(V_{CE})$, $I_C = 50mA$, $f = \text{parameter}$

Electrical performance in test fixture

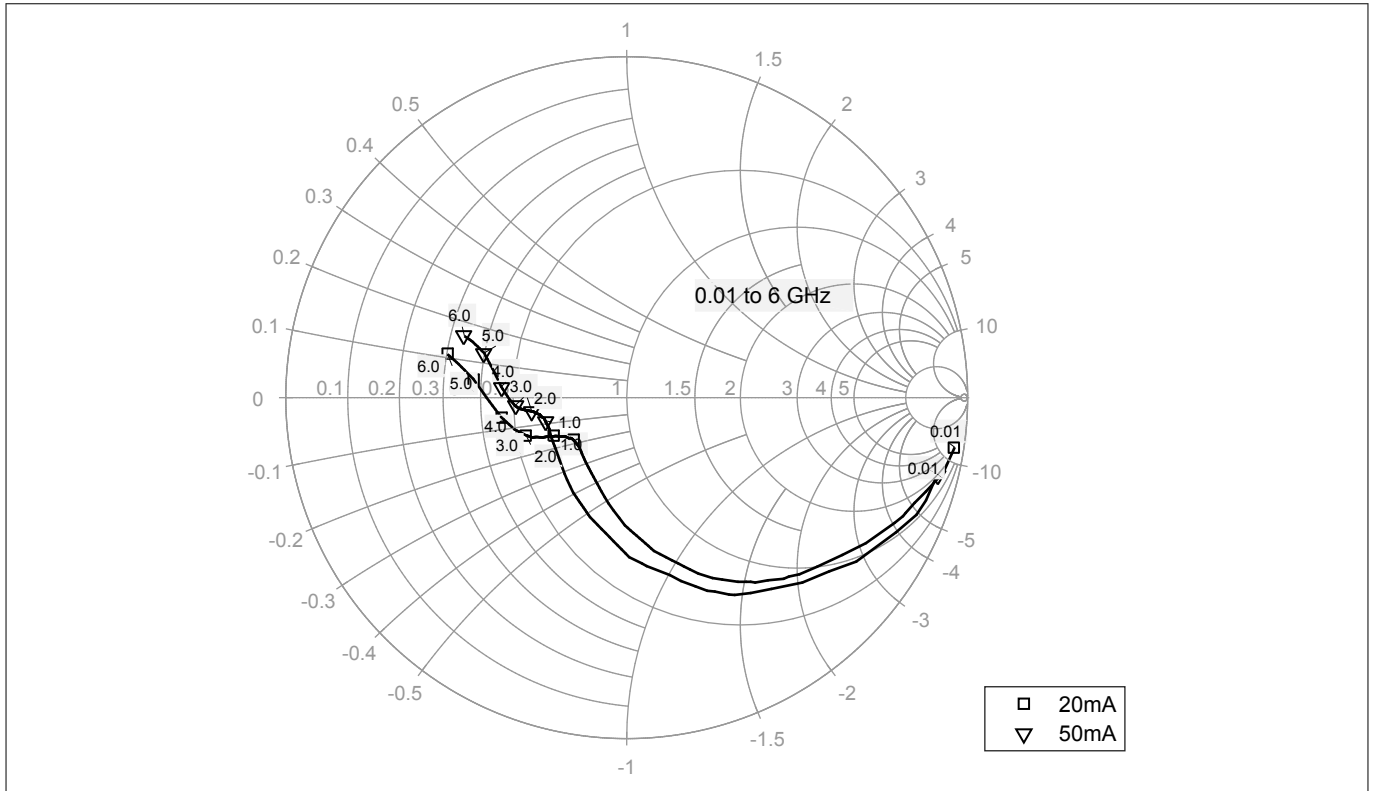


Figure 12 Output reflection coefficient $S_{22} = f(f)$ at $V_{CE} = 8\text{ V}$, $I_C = 20, 50\text{ mA}$

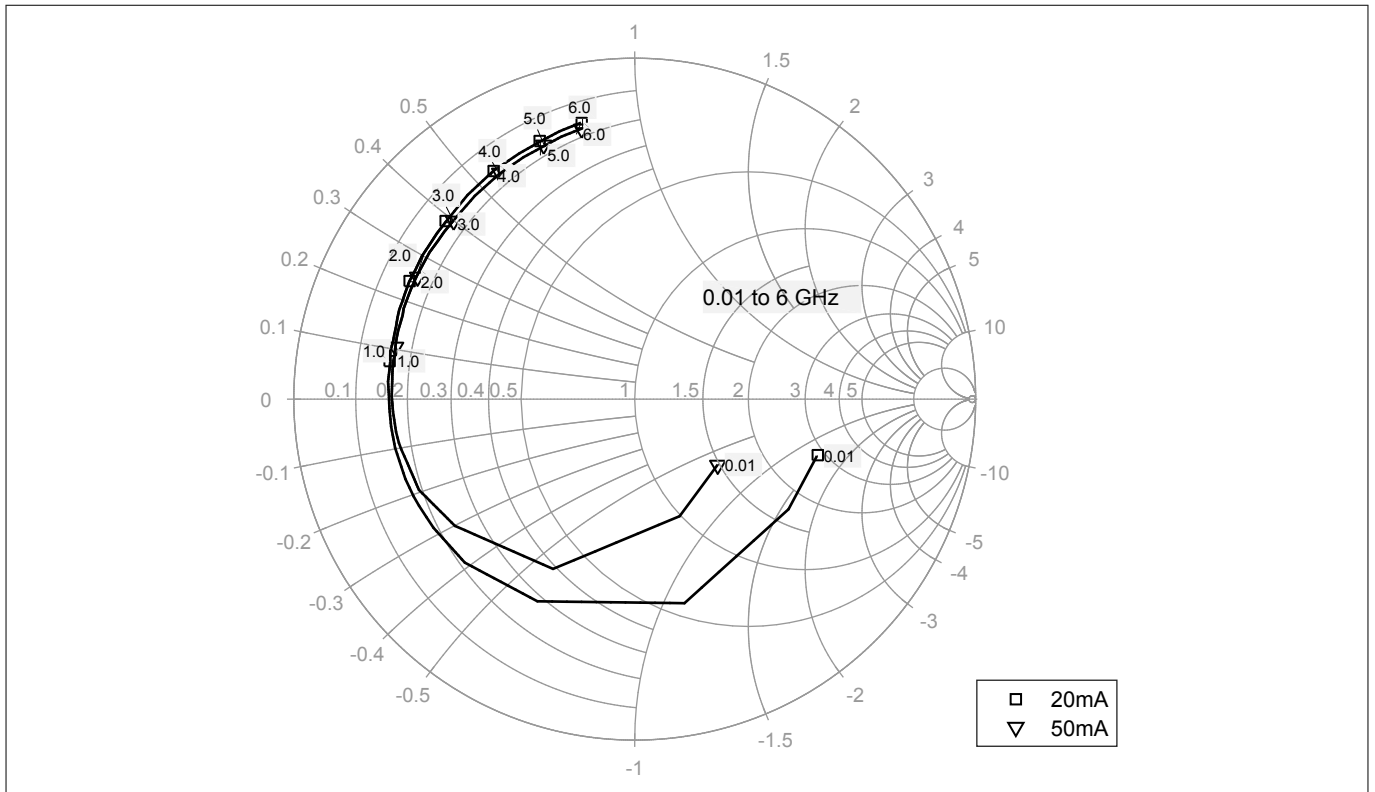


Figure 13 Input reflection coefficient $S_{11} = f(f)$ at $V_{CE} = 8\text{ V}$, $I_C = 20, 50\text{ mA}$

Electrical performance in test fixture

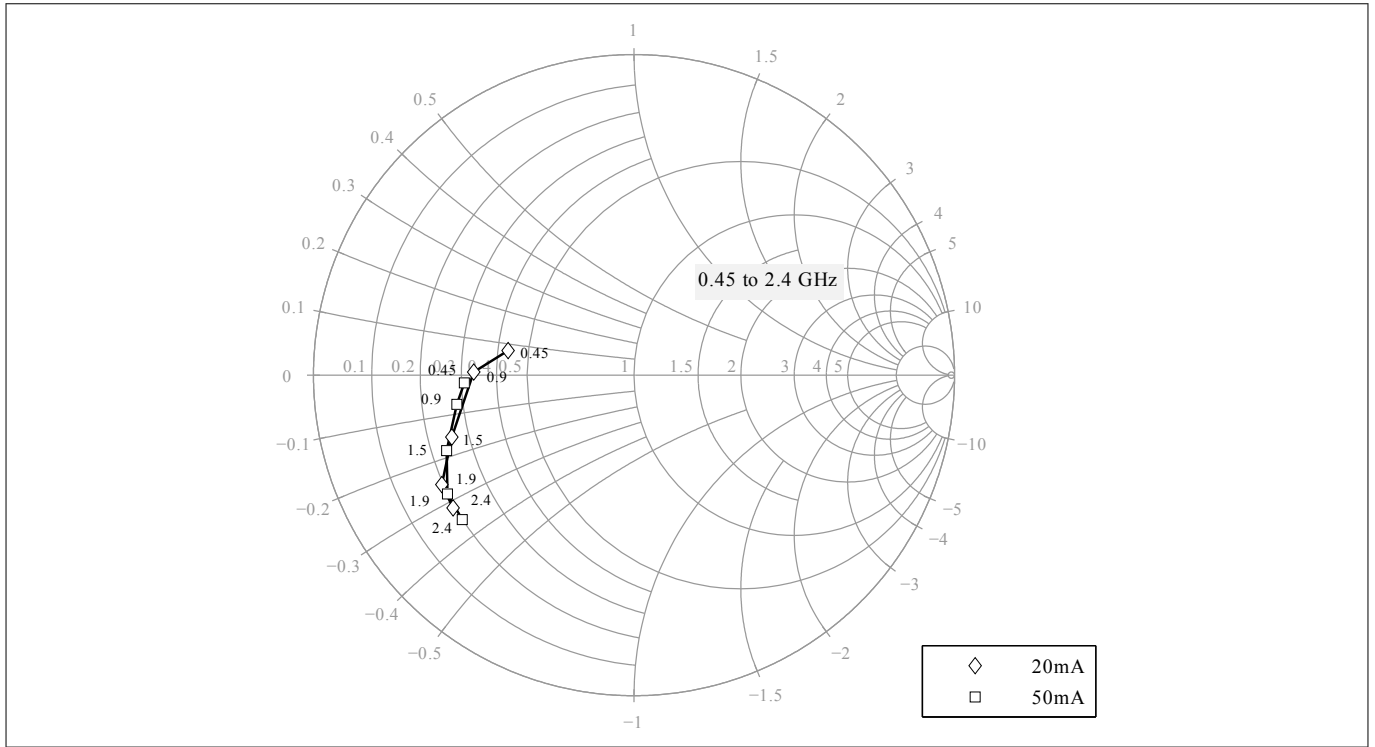


Figure 14 Source impedance for minimum noise figure $Z_{Sopt} = f(f)$, $V_{CE} = 8\text{ V}$, $I_C = 20, 50\text{ mA}$

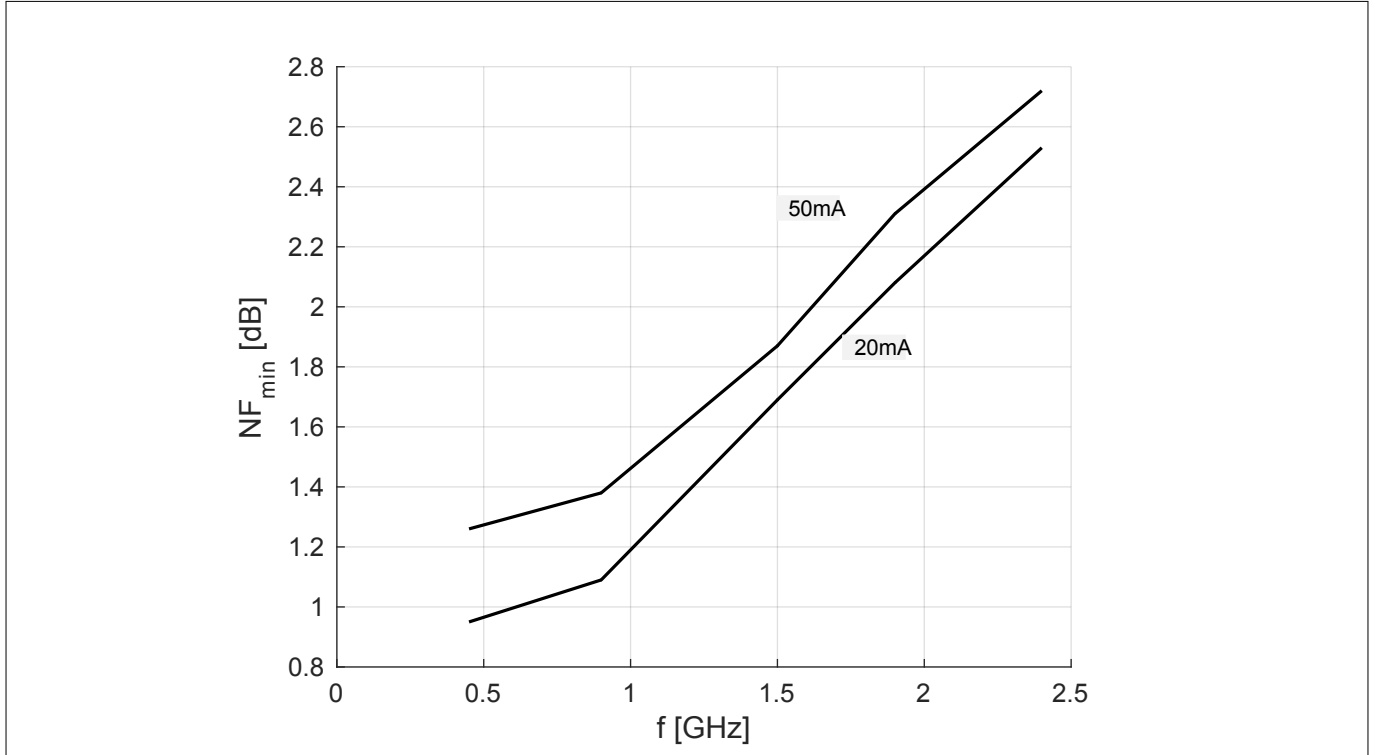


Figure 15 Noise figure $N_{Fmin} = f(f)$, $V_{CE} = 8\text{ V}$, $I_C = 20, 50\text{ mA}$, $Z_S = Z_{Sopt}$

Electrical performance in test fixture

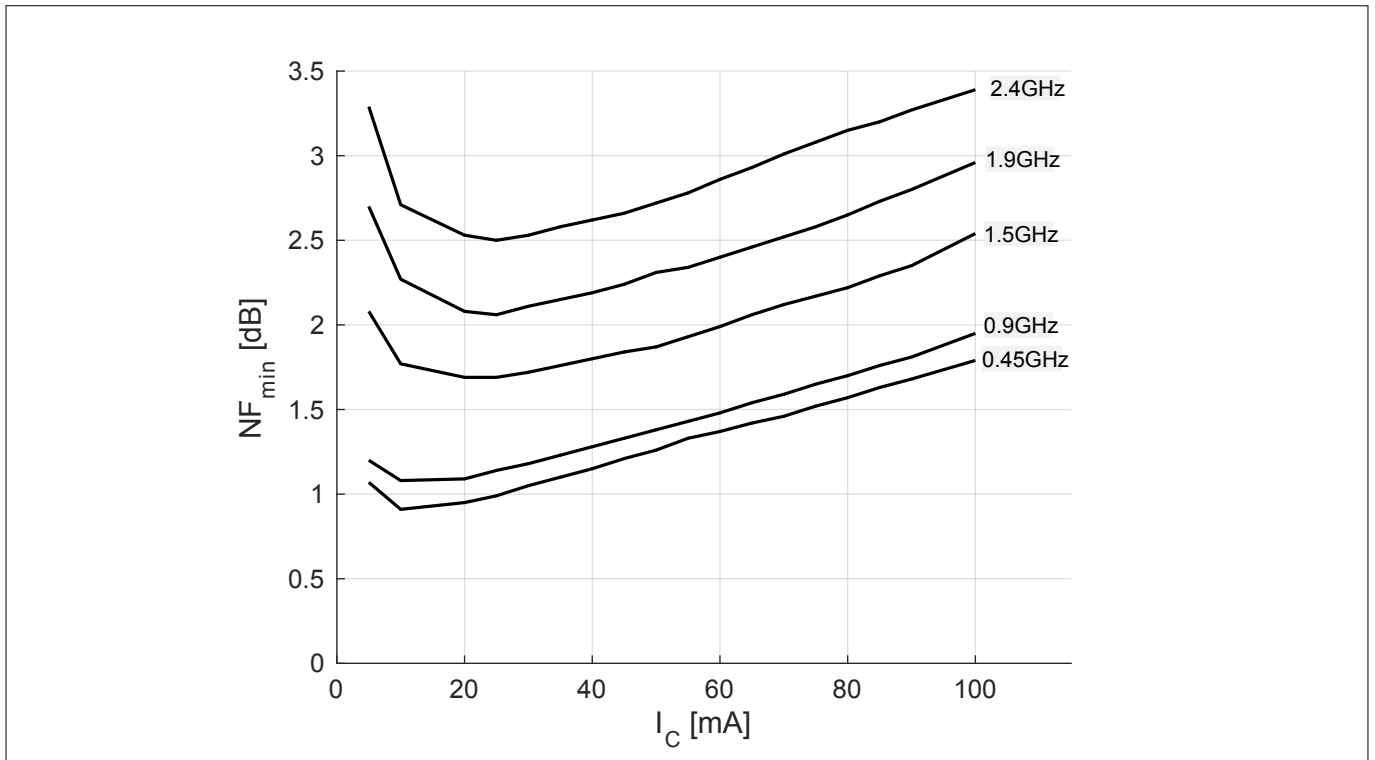


Figure 16 Noise figure $NF_{min} = f(I_C)$, $V_{CE} = 8\text{ V}$, $f = \text{parameter}$, $Z_S = Z_{Sopt}$

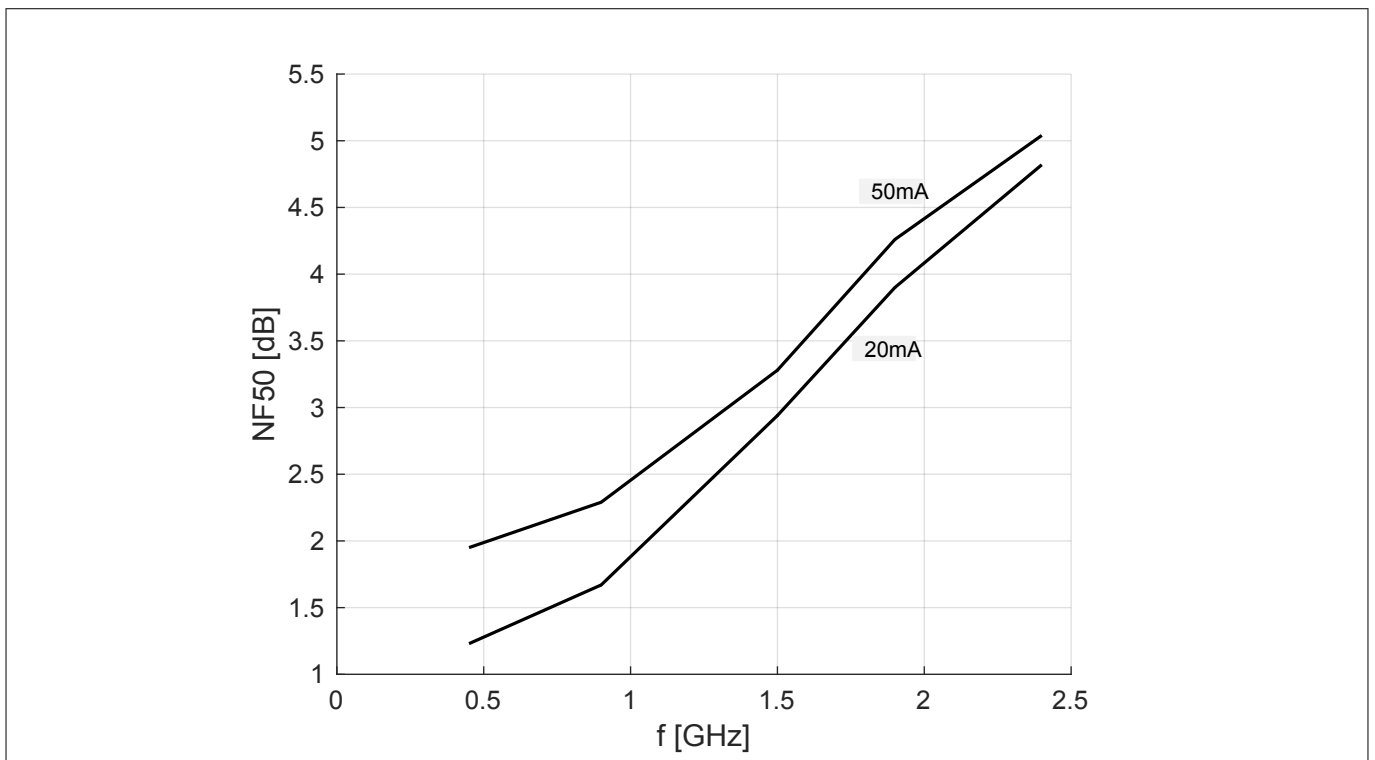


Figure 17 Noise figure $NF_{50} = f(f)$, $V_{CE} = 8\text{ V}$, $I_C = 20, 50\text{ mA}$, $Z_S = 50\ \Omega$

Electrical performance in test fixture

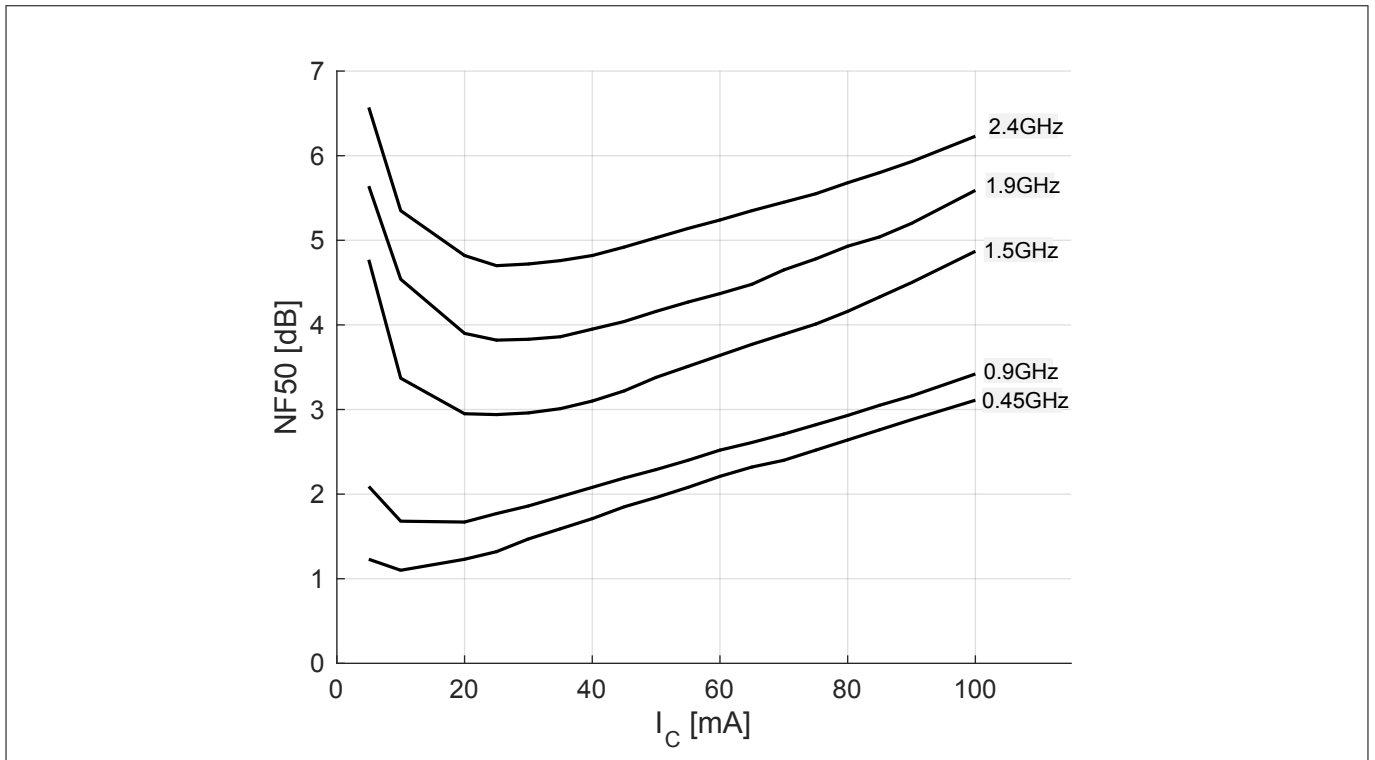


Figure 18 Noise figure $NF_{50} = f(I_C)$, $V_{CE} = 8\text{ V}$, $f = \text{parameter}$, $Z_S = 50\ \Omega$

Note: The curves shown in this chapter **Characteristic AC diagrams** have been generated using typical devices but shall not be understood as a guarantee that all devices have identical characteristic curves. $T_A = 25\text{ }^\circ\text{C}$.

4 SOT343 Package

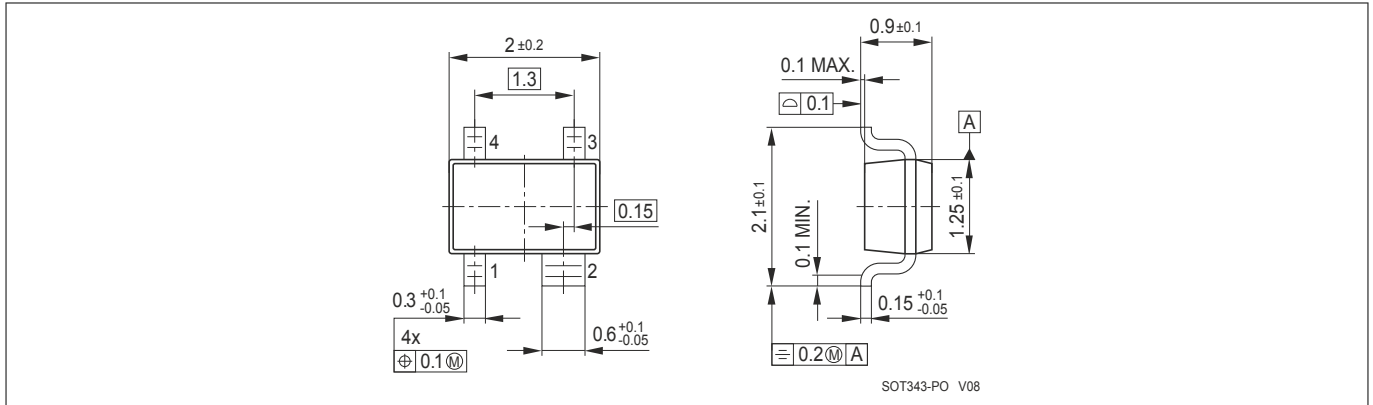


Figure 19 SOT343 package outline (dimension in mm)

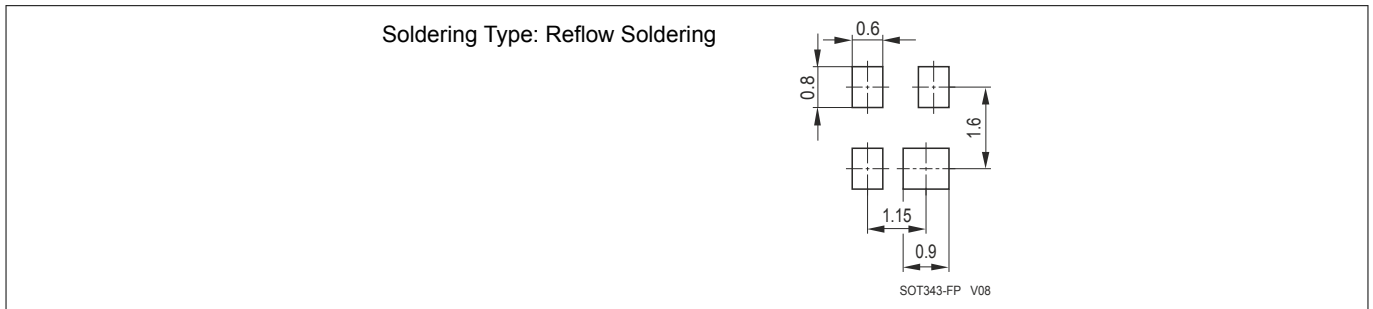


Figure 20 SOT343 footprint (dimension in mm)

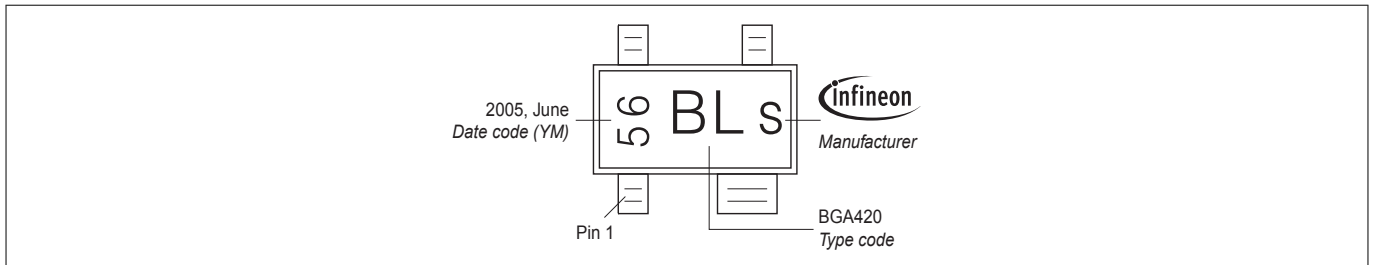


Figure 21 SOT343 marking layout

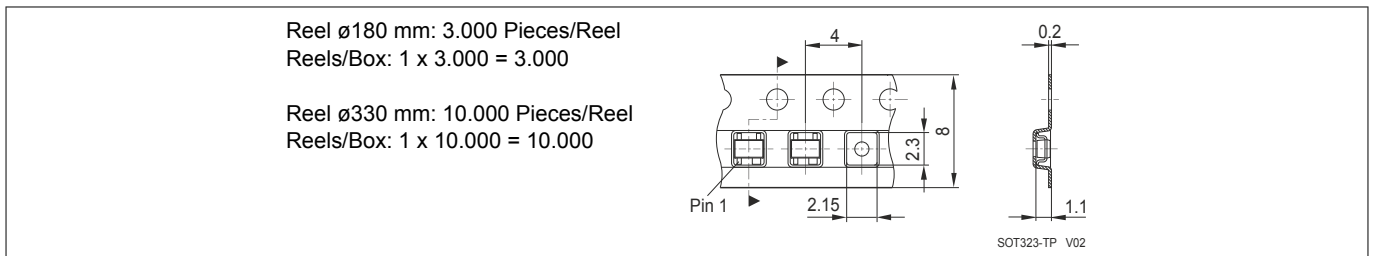


Figure 22 SOT343 standard packing (dimension in mm)

Revision history

Revision history

Major changes since previous revision

Reference	Description
Revision History: 2016-12-21, Revision 0.9	
rev 0.9	Preliminary datasheet

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