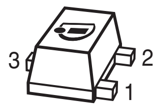
Low Noise Silicon Bipolar RF Transistor



- General purpose Low Noise Amplifier
- Ideal for low current operation
- High breakdown voltage enables operation in automotive applications
- Minimum noise figure 1.0 dB @ 1mA,1.5 V,1.9 GHz
- Pb-free (RoHS compliant) and halogen-free thin small flat package (1.2 x 1.2 mm^2) with visible leads
- Qualification report according to AEC-Q101 available

ESD (**E**lectro**s**tatic **d**ischarge) sensitive device, observe handling precaution!

Type	**Marking**	**Pin Configuration**			**Package**
BFR340F	FAs	1 = B	2 = E	3 = C	TSFP-3

Maximum Ratings at T_A = 25 °C, unless otherwise specified

Parameter	**Symbol**	**Value**	**Unit**
Collector-emitter voltage	V_{CEO}	6	V
Collector-emitter voltage	V_{CES}	15	
Collector-base voltage	V_{CBO}	15	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	20	mA
Base current	I_B	2	
Total power dissipation[1)] $T_S \leq$ 110°C	P_{tot}	75	mW
Junction temperature	T_J	150	°C
Storage temperature	T_{Stg}	-55 ... 150	

Thermal Resistance

Parameter	**Symbol**	**Value**	**Unit**
Junction - soldering point[2)]	R_{thJS}	530	K/W

[1] T_S is measured on the collector lead at the soldering point to the pcb

[2] For the definition of R_{thJS} please refer to Application Note AN077 (Thermal Resistance Calculation)

Electrical Characteristics at T_A = 25 °C, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	6	9	-	V
Collector-emitter cutoff current V_{CE} = 4 V, V_{BE} = 0, T_A = 25°C V_{CE} = 10 V, V_{BE} = 0, T_A = 85°C Verified by random sampling	I_{CES}	 - -	 1 2	 30 50	nA
Collector-base cutoff current V_{CB} = 4 V, I_E = 0	I_{CBO}	-	1	30	
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EBO}	-	1	500	
DC current gain I_C = 5 mA, V_{CE} = 3 V, pulse measured	h_{FE}	90	120	160	-

Electrical Characteristics at T_A = 25 °C, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics (verified by random sampling)					
Transition frequency I_C = 6 mA, V_{CE} = 3 V, f = 1 GHz	f_T	11	14	-	GHz
Collector-base capacitance V_{CB} = 5 V, f = 1 MHz, V_{BE} = 0 , emitter grounded	C_{cb}	-	0.21	0.4	pF
Collector emitter capacitance V_{CE} = 5 V, f = 1 MHz, V_{BE} = 0 , base grounded	C_{ce}	-	0.17	-	
Emitter-base capacitance V_{EB} = 0.5 V, f = 1 MHz, V_{CB} = 0 , collector grounded	C_{eb}	-	0.11	-	
Minimum noise figure	NF_{min}				dB
I_C = 3 mA, V_{CE} = 1.5 V, Z_S = Z_{Sopt}, f = 100 MHz		-	0.9	-	
I_C = 1 mA, V_{CE} = 1.5 V, Z_S = Z_{Sopt}, f = 1.9 GHz		-	1	-	
I_C = 1 mA, V_{CE} = 1.5 V, Z_S = Z_{Sopt}, f = 2.4 GHz		-	1.2	-	

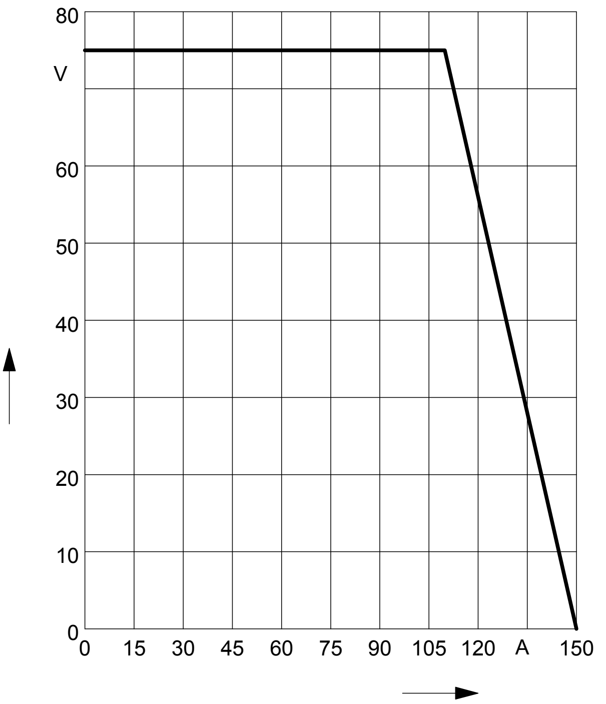
Electrical Characteristics at T_A = 25 °C, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics (verified by random sampling)					
Maximum power gain[1]	G_{max}				dB
I_C = 3 mA, V_{CE} = 1.5 V, Z_S = Z_{Sopt}, Z_L = Z_{Lopt} , f = 100 MHz		-	28	-	
I_C = 5 mA, V_{CE} = 3 V, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}, f = 1.8 GHz		-	16.5	-	
f = 3 GHz		-	13	-	
Transducer gain	$\|S_{21e}\|^2$				dB
I_C = 3 mA, V_{CE} = 1.5 V, Z_S = Z_L = 50Ω , f = 100 MHz		-	19	-	
I_C = 5 mA, V_{CE} = 3 V, Z_S = Z_L = 50Ω , f = 1.8 GHz		-	14	-	
f = 3 GHz		-	10	-	
Third order intercept point at output[2]	$IP3$				dBm
V_{CE} = 3 V, I_C = 5 mA, f = 100 MHz, Z_S = Z_L = 50Ω		-	14	-	
V_{CE} = 3 V, I_C = 5 mA, f = 1.8 GHz, Z_S = Z_L = 50Ω		-	13	-	
1dB compression point at output	P_{-1dB}				
V_{CE} = 3V, I_C = 5 mA, Z_S = Z_L = 50Ω, f = 100 MHz		-	-3	-	
V_{CE} = 3V, I_C = 5 mA, Z_S = Z_L = 50Ω, f = 1.8 GHz		-	-1	-	

[1] $G_{ma} = |S_{21e} / S_{12e}| (k-(k^2-1)^{1/2})$, $G_{ms} = |S_{21e} / S_{12e}|$

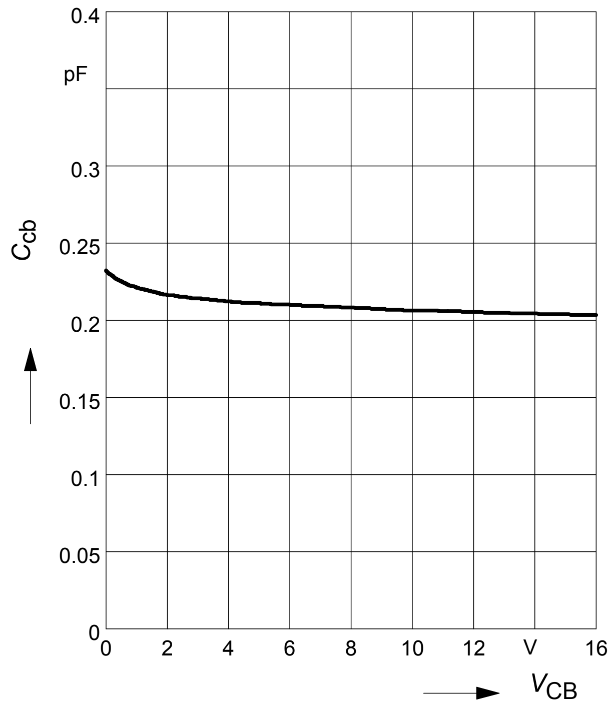
[2] IP3 value depends on termination of all intermodulation frequency components. Termination used for this measurement is 50Ω from 0.1 MHz to 6 GHz

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



Collector-base capacitance $C_{cb} = f(V_{CB})$

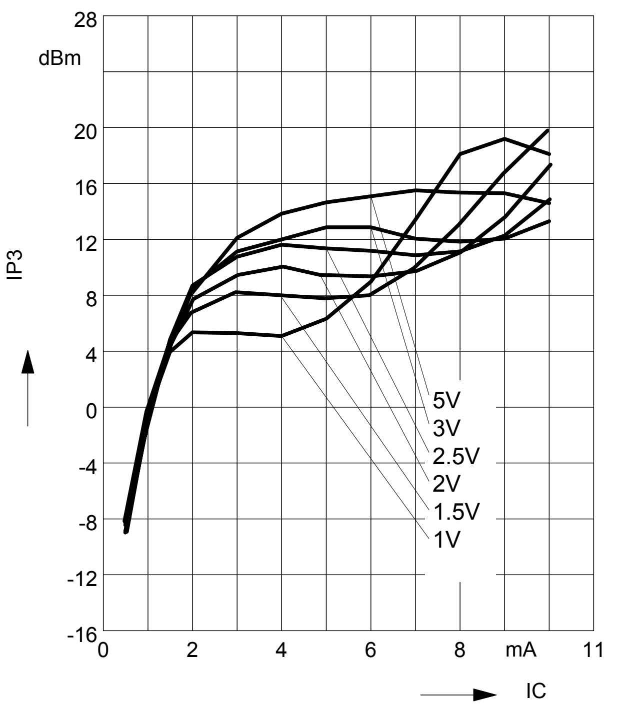
f = 1MHz



Third order Intercept Point $IP_3 = f(I_C)$

(Output, $Z_S = Z_L = 50\Omega$)

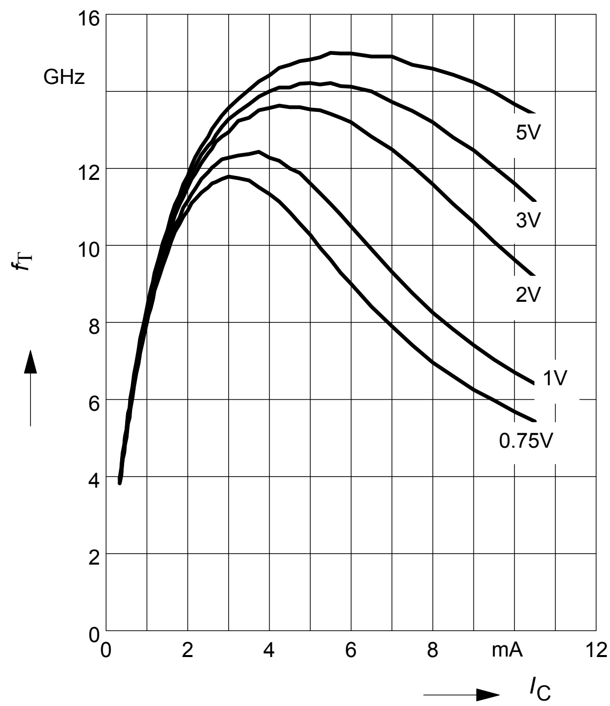
V_{CE} = parameter, f = 1.9GHz



Transition frequency $f_T = f(I_C)$

f = 1GHz

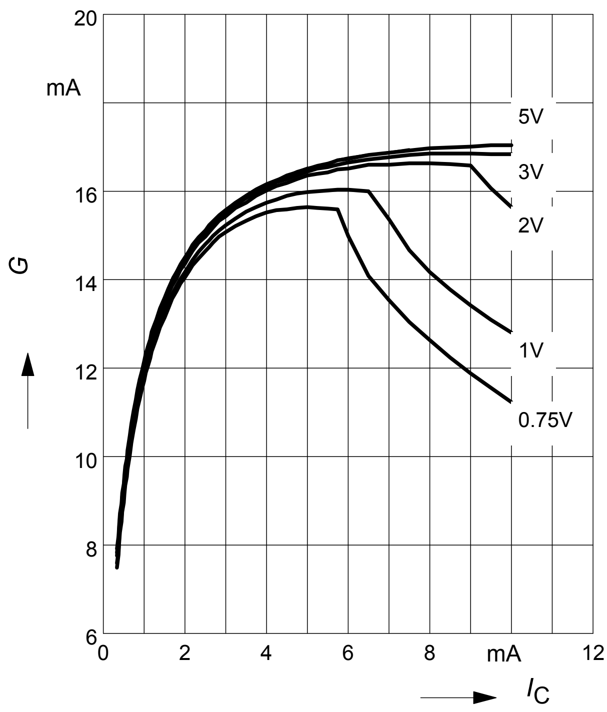
V_{CE} = parameter



Power gain G_{ma}, G_{ms} = $f(I_C)$

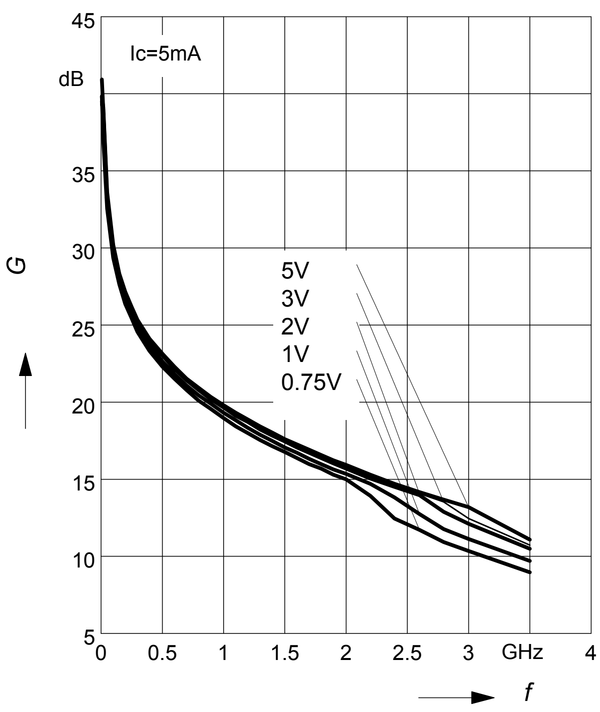
f = 1.8GHz

V_{CE} = parameter



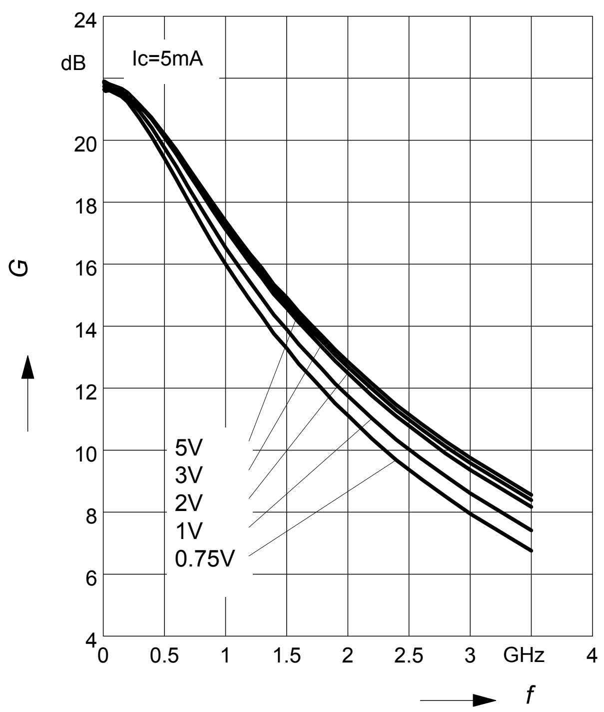
Power Gain G_{ma}, G_{ms} = $f(f)$

V_{CE} = parameter



Insertion Power Gain $|S_{21}|^2$ = $f(f)$

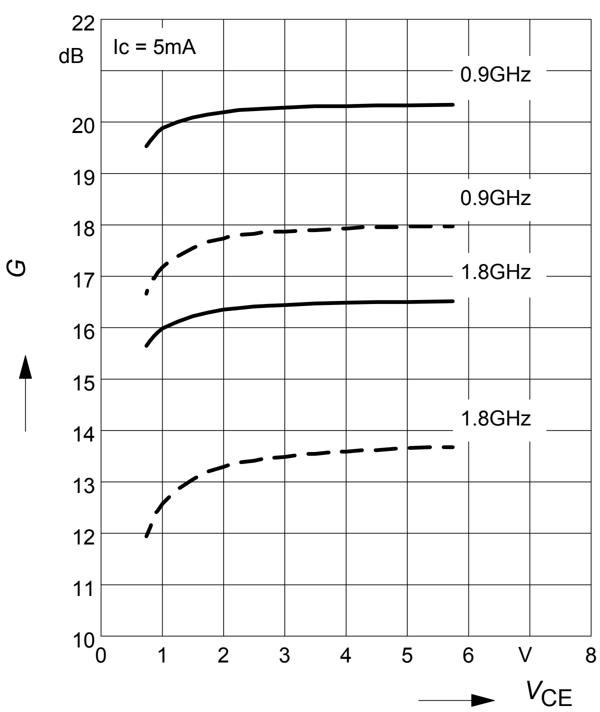
V_{CE} = parameter



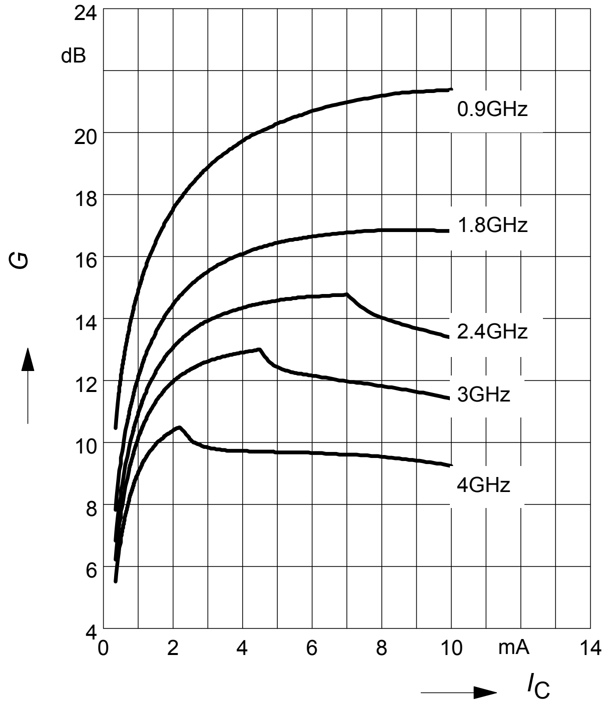
Power Gain G_{ma}, G_{ms} = $f(V_{CE})$: ——

$|S_{21}|^2$ = $f(V_{CE})$: - - - -

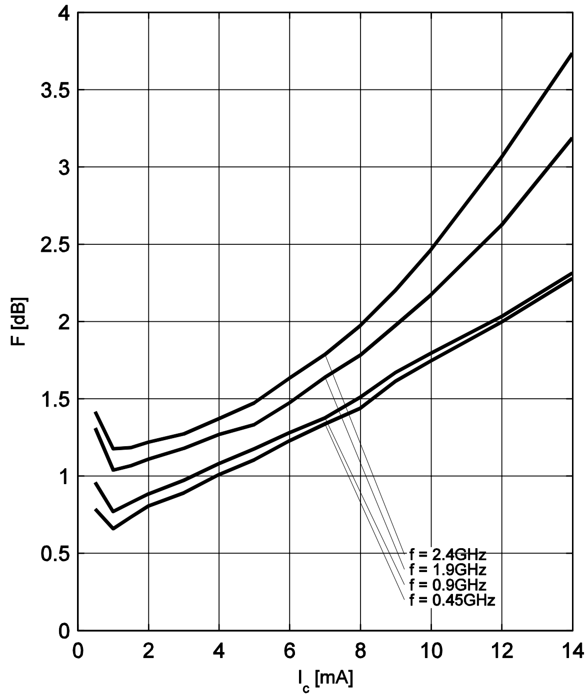
f = parameter



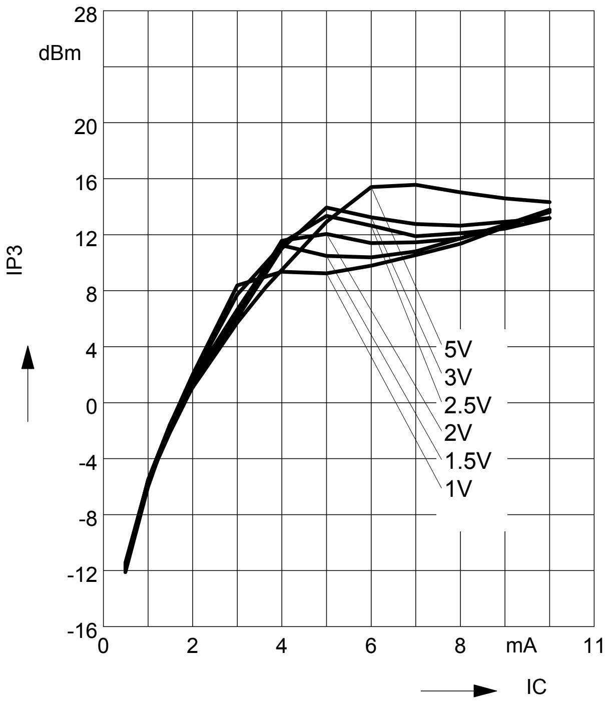
Power gain G_{ma}, G_{ms} = f (I_C)
V_{CE} = 3V
f = parameter



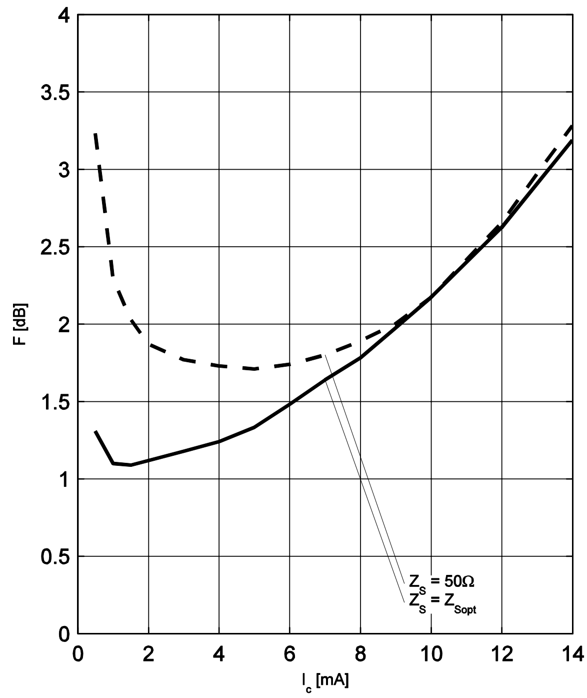
Noise figure F = f(I_C)
V_{CE} = 1.5V, Z_S = Z_{Sopt}



Third order Intercept Point IP_3=f(I_C)
(Output, Z_S=Z_L=50Ω)
V_{CE} = parameter, f = 100MHz

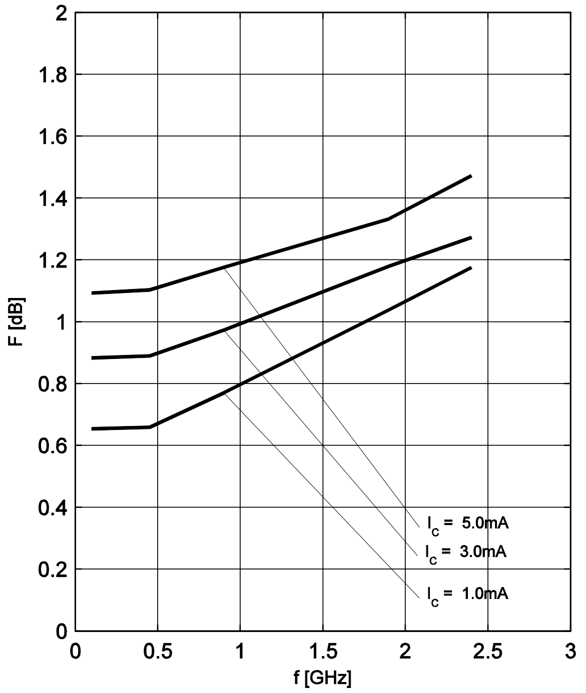


Noise figure F = f(I_C)
V_{CE} = 1.5V, f = 1.9GHz



Noise figure $F = f(f)$

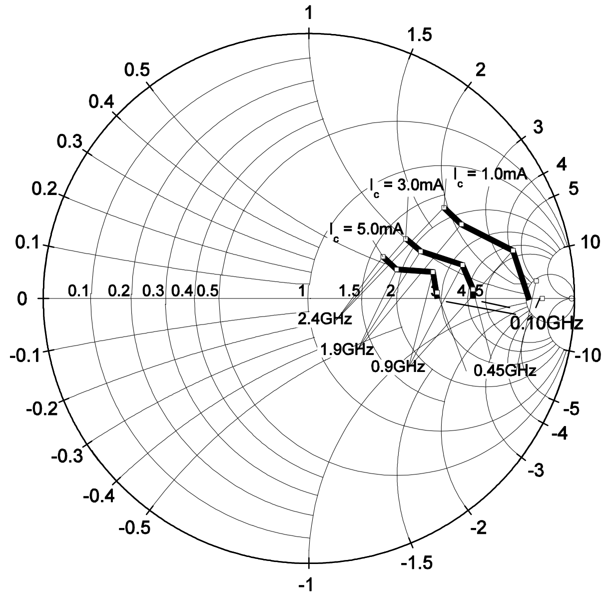
V_{CE} = 1.5V, $Z_S=Z_{Sopt}$, I_C=Parameter



Source impedance for min.

noise figure vs. frequency

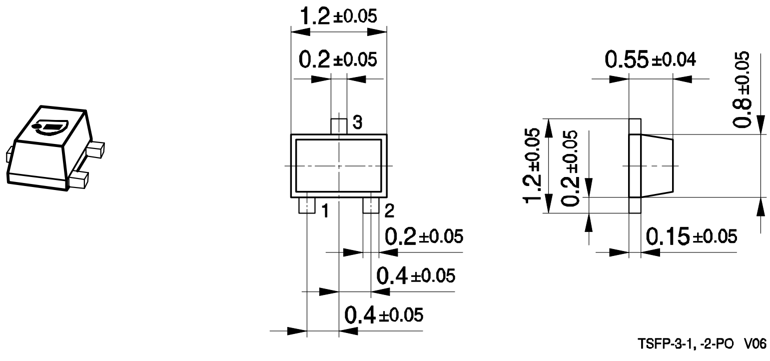
V_{CE} = 1.5V, I_C=Parameter



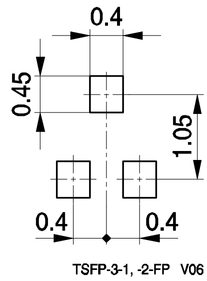
SPICE GP Model

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 BFR340F 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 BFR340F SPICE GP model reflects the typical DC- and RF-performance within the limitations which are given by the SPICE GP model itself. Besides the DC characteristics all S-parameters in magnitude and phase, as well as noise figure (including optimum source impedance, equivalent noise resistance and flicker noise) and intermodulation have been extracted.

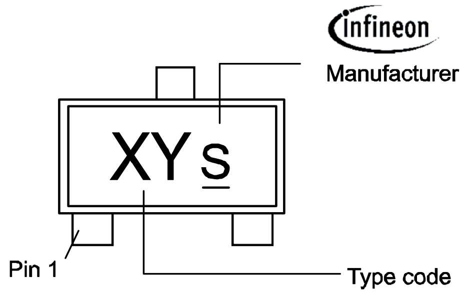
Package Outline



Foot Print



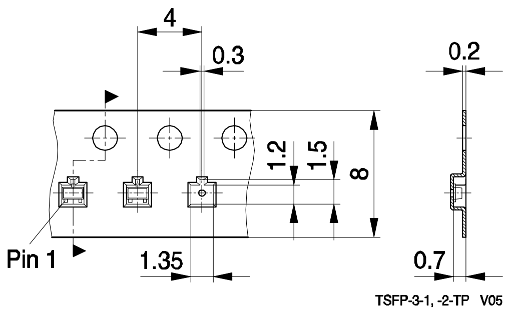
Marking Layout (Example)



Standard Packing

Reel Ø 180 mm = 3.000 Pieces/Reel

Reel Ø 330 mm = 10.000 Pieces/Reel



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