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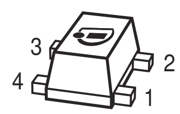
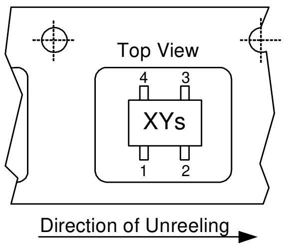
NPN Silicon Germanium RF Transistor*



- High gain low noise RF transistor
- Small package 1.4 x 0.8 x 0.59 mm
- Outstanding noise figure F = 0.7 dB at 1.8 GHz
  Outstanding noise figure F = 1.3 dB at 6 GHz
- Maximum stable gain
  G_{ms} = 21 dB at 1.8 GHz
  G_{ma} = 10 dB at 6 GHz
- Gold metallization for extra high reliability
- Pb-free (RoHS compliant) package[1)]
- Qualified according AEC Q101



* Short term description

AEC Qualified RoHS

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

Type	Marking	Pin Configuration						Package
BFP620F	R2s	1=B	2=E	3=C	4=E	-	-	TSFP-4

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}		V
T_A > 0 °C		2.3	
T_A ≤ 0 °C		2.1	
Collector-emitter voltage	V_{CES}	7.5	
Collector-base voltage	V_{CBO}	7.5	
Emitter-base voltage	V_{EBO}	1.2	
Collector current	I_C	80	mA
Base current	I_B	3	
Total power dissipation[2)] T_S ≤ 96°C	P_{tot}	185	mW
Junction temperature	T_j	150	°C
Ambient temperature	T_A	-65 ... 150	
Storage temperature	T_{stg}	-65 ... 150	

[1]Pb-containing package may be available upon special request
[2]T_S is measured on the collector lead at the soldering point to the pcb

Thermal Resistance

Parameter	Symbol	Value	Unit
Junction - soldering point[1]	R_{thJS}	$\leq$ 290	K/W

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	$V_{(BR)CEO}$	2.3	2.8	-	V
Collector-emitter cutoff current V_{CE} = 7.5 V, V_{BE} = 0	I_{CES}	-	-	10	µA
Collector-base cutoff current V_{CB} = 5 V, I_E = 0	I_{CBO}	-	-	100	nA
Emitter-base cutoff current V_{EB} = 0.5 V, I_C = 0	I_{EBO}	-	-	3	µA
DC current gain I_C = 50 mA, V_{CE} = 1.5 V, pulse measured	h_{FE}	110	180	270	-

[1]For calculation of R_{thJA} please refer to Application Note Thermal Resistance

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 = 50 mA, V_{CE} = 1.5 V, f = 1 GHz	f_T	-	65	-	GHz
Collector-base capacitance V_{CB} = 2 V, f = 1 MHz, V_{BE} = 0 , emitter grounded	C_{cb}	-	0.12	0.2	pF
Collector emitter capacitance V_{CE} = 2 V, f = 1 MHz, V_{BE} = 0 , base grounded	C_{ce}	-	0.2	-	
Emitter-base capacitance V_{EB} = 0.5 V, f = 1 MHz, V_{CB} = 0 , collector grounded	C_{eb}	-	0.45	-	
Noise figure I_C = 5 mA, V_{CE} = 1.5 V, f = 1.8 GHz, $Z_S = Z_{Sopt}$ I_C = 5 mA, V_{CE} = 1.5 V, f = 6 GHz, $Z_S = Z_{Sopt}$	F	 - -	 0.7 1.3	 - -	dB
Power gain, maximum stable[1)] I_C = 50 mA, V_{CE} = 1.5 V, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$, f = 1.8 GHz	G_{ms}	-	21	-	dB
Power gain, maximum available[1)] I_C = 50 mA, V_{CE} = 1.5 V, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$, f = 6 GHz	G_{ma}	-	10	-	dB
Transducer gain I_C = 50 mA, V_{CE} = 1.5 V, $Z_S = Z_L$ = 50 Ω, f = 1.8 GHz f = 6 GHz	$\|S_{21e}\|^2$	 - -	 19.5 9.5	 - -	dB
Third order intercept point at output[2)] V_{CE} = 2 V, I_C = 50 mA, Z_S=Z_L=50 Ω, f = 1.8 GHz	IP_3	-	25	-	dBm
1dB Compression point at output I_C = 50 mA, V_{CE} = 2 V, Z_S=Z_L=50 Ω, f = 1.8 GHz	P_{-1dB}	-	14	-	

[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

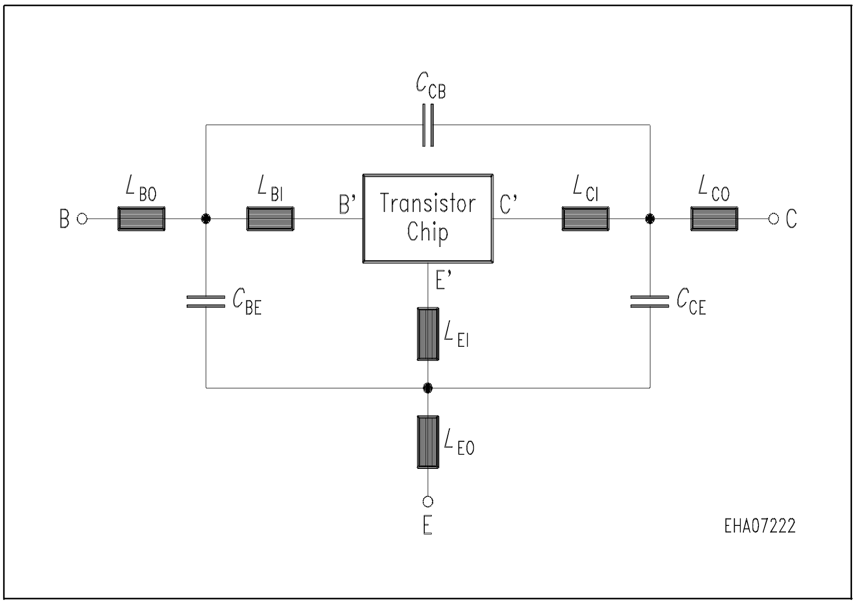
SPICE Parameter (Gummel-Poon Model, Berkley-SPICE 2G.6 Syntax):

Transistor Chip Data:

IS =	0.22	fA	BF =	425	-	NF =	1.025	-
VAF =	1000	V	IKF =	0.25	A	ISE =	21	fA
NE =	2	-	BR =	50	-	NR =	1	-
VAR =	2	V	IKR =	10	mA	ISC =	18	pA
NC =	2	-	RB =	3.129	Ω	IRB =	1.522	mA
RBM =	2.707	Ω	RE =	0.6	-	RC =	2.364	Ω
CJE =	250.7	fF	VJE =	0.75	V	MJE =	0.3	-
TF =	1.43	ps	XTF =	10	-	VTF =	1.5	V
ITF =	2.4	A	PTF =	0	deg	CJC =	124.9	fF
VJC =	0.6	V	MJC =	0.5	-	XCJC =	1	-
TR =	0.2	ns	CJS =	128.1	fF	VJS =	0.52	V
MJS =	0.5	-	NK =	-1.42	-	EG =	1.078	eV
XTI =	3	-	FC =	0.8		TNOM	298	K
AF =	2	-	KF =	7.291E-11				
TITF1	-0.0065	-	TITF2	1.0E-5				

All parameters are ready to use, no scalling is necessary.

Package Equivalent Circuit:

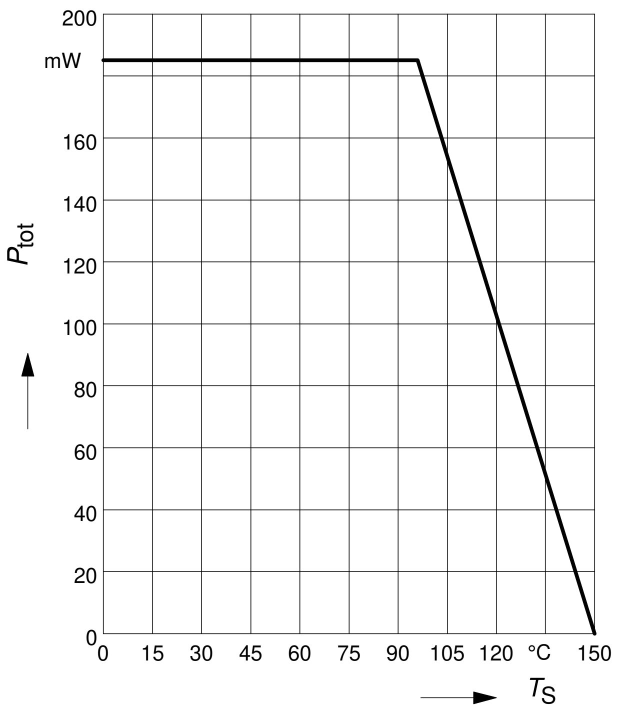


L_{B0} =	0.22	nH
L_{E0} =	0.28	nH
L_{C0} =	0.22	nH
$K_{B0\text{-}E0}$ =	0.1	-
$K_{B0\text{-}C0}$ =	0.01	-
$K_{E0\text{-}C0}$ =	0.11	-
C_{BE} =	34	fF
C_{BC} =	2	fF
C_{CE} =	33	fF
L_{BI} =	0.42	nH
R_{LBI} =	0.15	Ω
L_{EI} =	0.26	nH
R_{LEI} =	0.11	Ω
L_{CI} =	0.35	nH
R_{LI} =	0.13	Ω
$K_{BI\text{-}EI}$ =	-0.05	-
$K_{BI\text{-}CI}$ =	-0.08	-
$K_{EI\text{-}CI}$ =	0.2	-

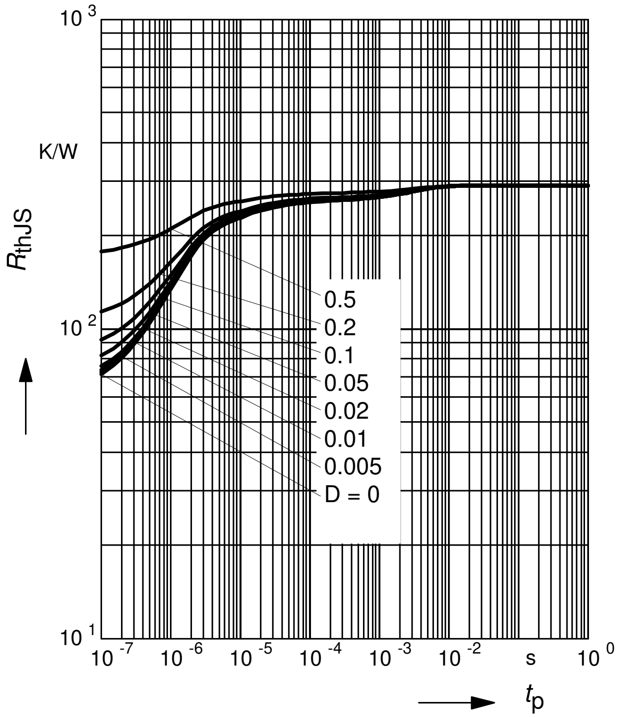
Valid up to 6GHz

To avoid high complexity of the package equivalent circuit, both emitter leads of TSFP-4 are combined in one electrical connection. R_{LxI} are series resistors for the inductances L_{xI} and $K_{xa\text{-}yb}$ are the coupling coefficients between the inductances L_{xa} and L_{yb}.

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

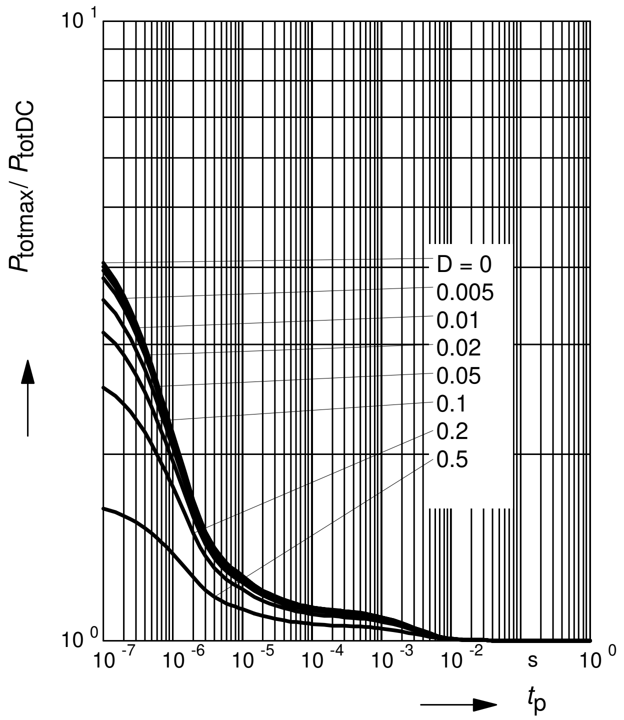


Permissible Pulse Load $R_{thJS} = f(t_p)$



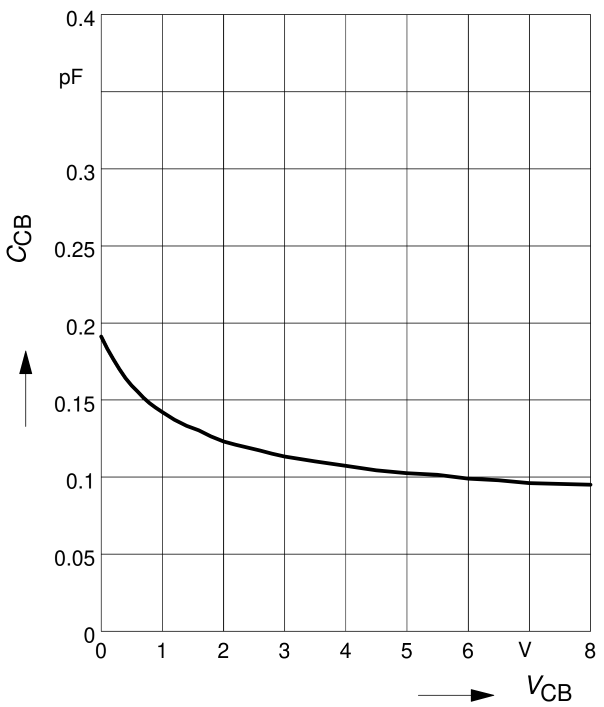
Permissible Pulse Load

$P_{totmax}/P_{totDC} = f(t_p)$

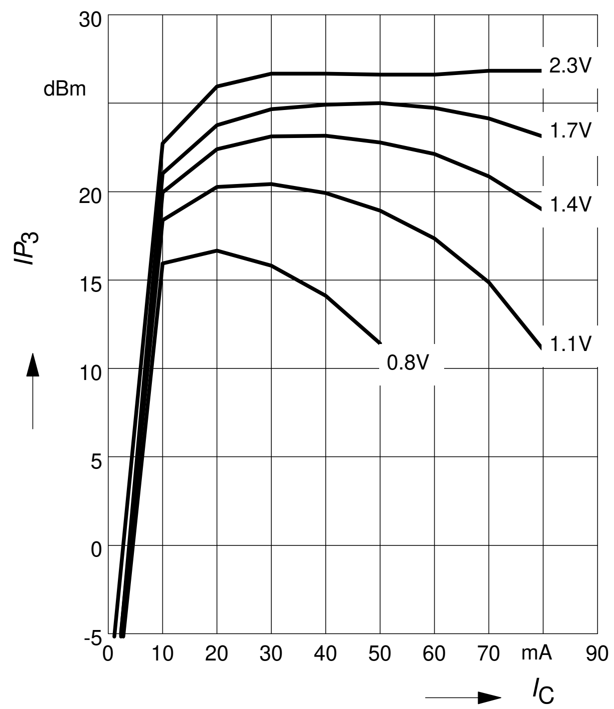


Collector-base capacitance $C_{cb} = f(V_{CB})$

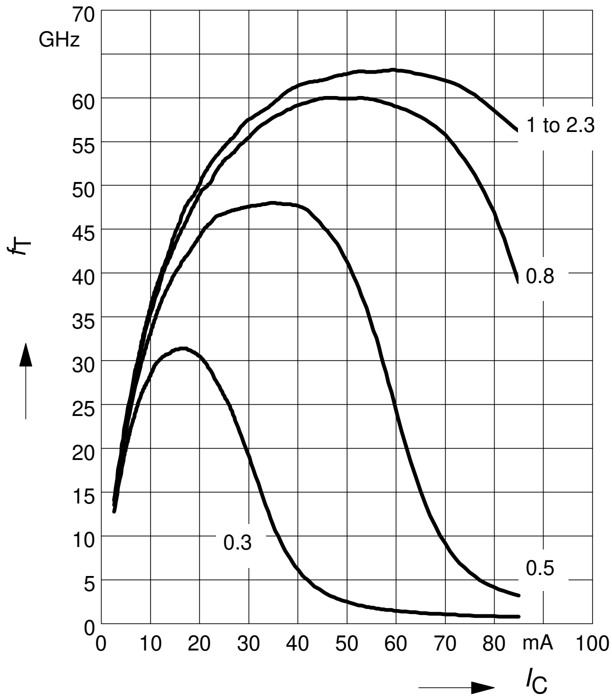
f = 1MHz



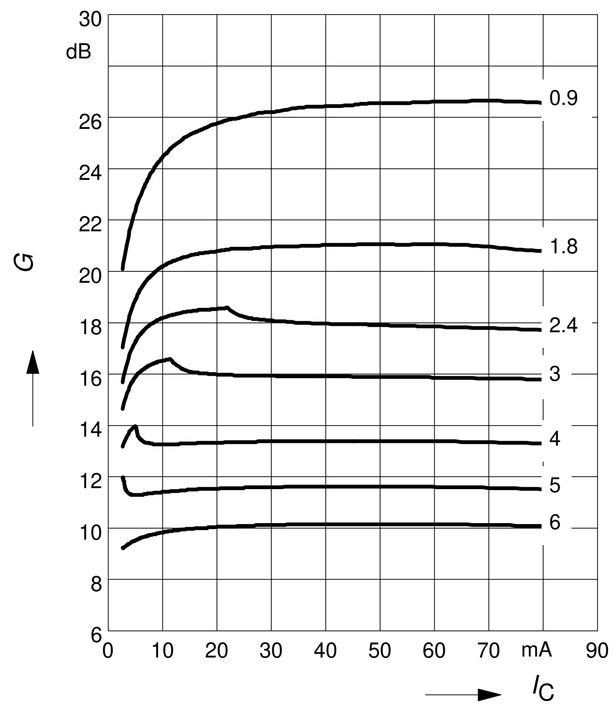
Third order Intercept Point $IP_3 = f(I_C)$
(Output, $Z_S = Z_L = 50\Omega$)
V_{CE} = parameter, f = 1.8GHz



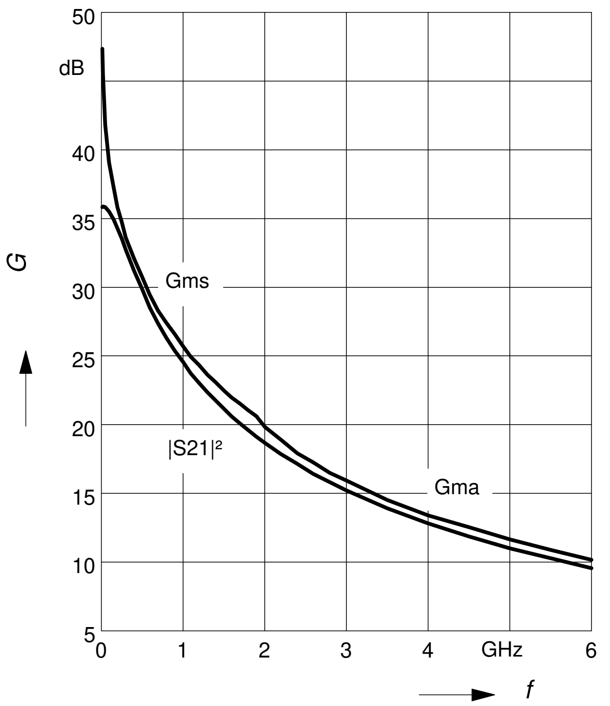
Transition frequency $f_T = f(I_C)$
f = 1GHz
V_{CE} = Parameter in V



Power gain G_{ma}, $G_{ms} = f(I_C)$
V_{CE} = 1.5V
f = Parameter in GHz



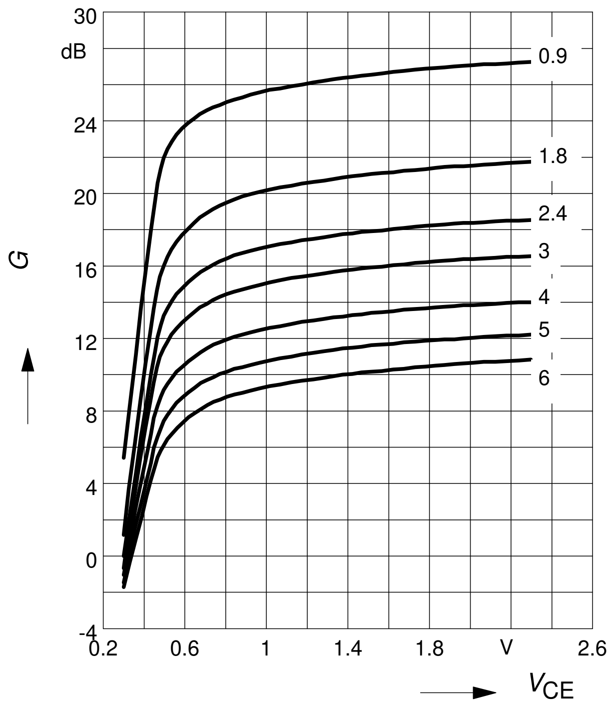
Power Gain G_{ma}, $G_{ms} = f(f)$,
$|S_{21}|^2 = f$ (f)
V_{CE} = 1.5V, I_C = 50mA



Power gain G_{ma}, $G_{ms} = f\,(V_{CE})$

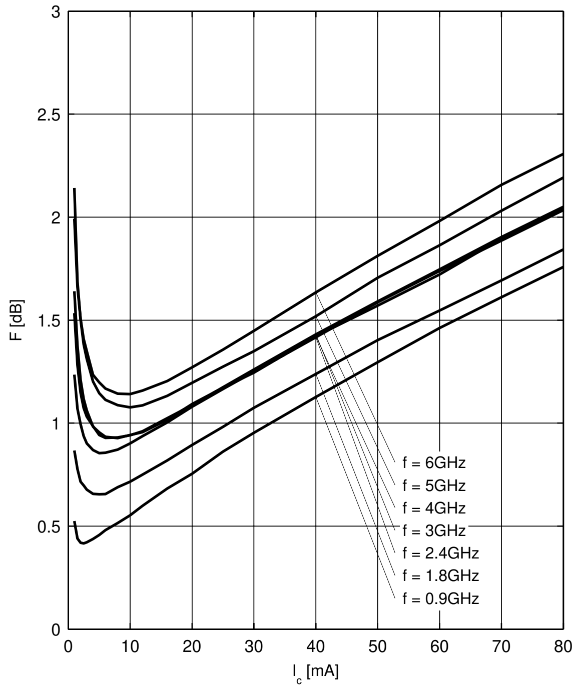
I_C = 50mA

f = Parameter in GHz



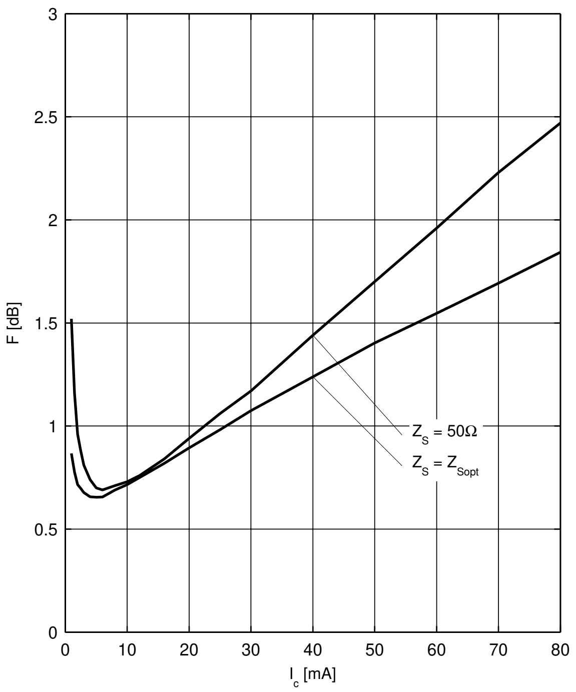
Noise figure $F = f(I_C)$

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



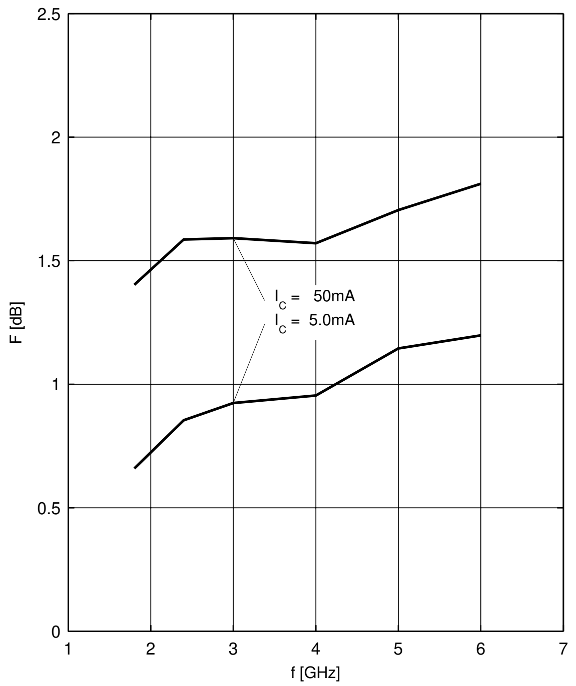
Noise figure $F = f(I_C)$

V_{CE} = 1.5V, f = 1.8 GHz

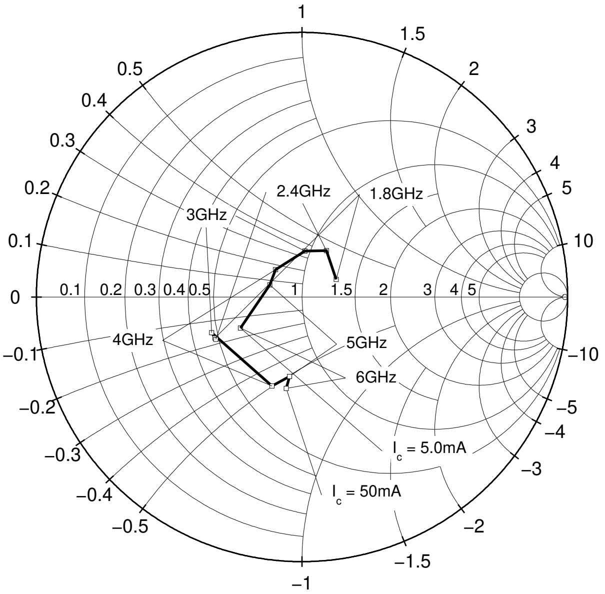


Noise figure $F = f(f)$

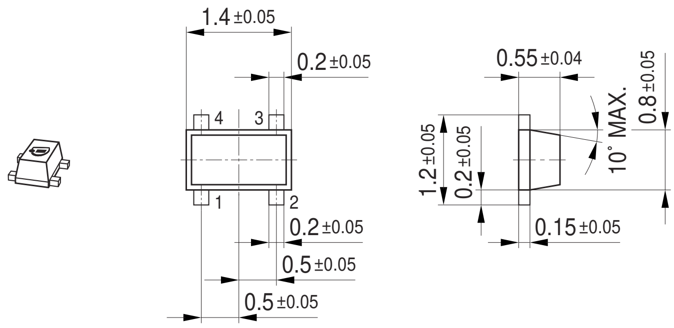
V_{CE} = 1.5V, $Z_S = Z_{Sopt}$



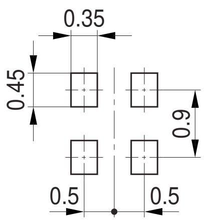
Source impedance for min.
noise figure vs. frequency
V_{CE} = 1.5V, I_C = 5.0mA/50.0mA



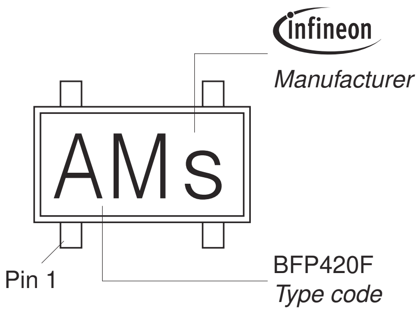
Package Outline



Foot Print

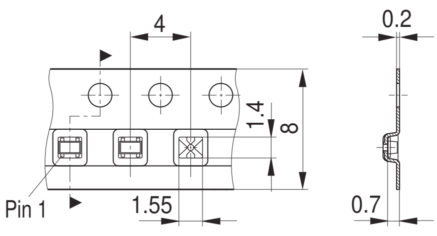


Marking Layout (Example)



Standard Packing

Reel ø180 mm = 3.000 Pieces/Reel
Reel ø330 mm = 10.000 Pieces/Reel



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