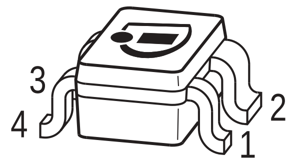
NPN Silicon Germanium RF Transistor



- High gain low noise RF transistor
- Provides outstanding performance
  for a wide range of wireless applications
- Ideal for CDMA and WLAN applications
- Outstanding noise figure F = 0.65 dB at 1.8 GHz
  Outstanding noise figure F = 1.2 dB at 6 GHz
- High maximum stable gain
  G_{ms} = 24 dB at 1.8 GHz
- Gold metallization for extra high reliability
- 70 GHz f_T-Silicon Germanium technology
- Pb-free (RoHS compliant) package[1)]
- Qualified according AEC Q101

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

Type	Marking	Pin Configuration						Package
BFP640	R4s	1=B	2=E	3=C	4=E	-	-	SOT343

[1]Pb-containing package may be available upon special request

2007-05-29

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage T_A > 0 °C $T_A \leq$ 0 °C	V_{CEO}	 4 3.7	V
Collector-emitter voltage	V_{CES}	13	
Collector-base voltage	V_{CBO}	13	
Emitter-base voltage	V_{EBO}	1.2	
Collector current	I_C	50	mA
Base current	I_B	3	
Total power dissipation[1)] $T_S \leq$ 90°C	P_{tot}	200	mW
Junction temperature	T_j	150	°C
Ambient temperature	T_A	-65 ... 150	
Storage temperature	T_{stg}	-65 ... 150	

Thermal Resistance

Parameter	Symbol	Value	Unit
Junction - soldering point[2)]	R_{thJS}	$\leq$ 300	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	$V_{(BR)CEO}$	4	4.5	-	V
Collector-emitter cutoff current V_{CE} = 13 V, V_{BE} = 0	I_{CES}	-	-	30	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 = 30 mA, V_{CE} = 3 V, pulse measured	h_{FE}	110	180	270	-

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

[2]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 = 30 mA, V_{CE} = 3 V, f = 1 GHz	f_T	30	40	-	GHz
Collector-base capacitance V_{CB} = 3 V, f = 1 MHz, V_{BE} = 0 , emitter grounded	C_{cb}	-	0.09	0.2	pF
Collector emitter capacitance V_{CE} = 3 V, f = 1 MHz, V_{BE} = 0 , base grounded	C_{ce}	-	0.23	-	
Emitter-base capacitance V_{EB} = 0.5 V, f = 1 MHz, V_{CB} = 0 , collector grounded	C_{eb}	-	0.5	-	
Noise figure I_C = 5 mA, V_{CE} = 3 V, f = 1.8 GHz, $Z_S = Z_{Sopt}$ I_C = 5 mA, V_{CE} = 3 V, f = 6 GHz, $Z_S = Z_{Sopt}$	F	 - -	 0.65 1.2	 - -	dB
Power gain, maximum stable[1)] I_C = 30 mA, V_{CE} = 3 V, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$, f = 1.8 GHz	G_{ms}	-	24	-	dB
Power gain, maximum available[1)] I_C = 30 mA, V_{CE} = 3 V, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$, f = 6 GHz	G_{ma}	-	12.5	-	dB
Transducer gain I_C = 30 mA, V_{CE} = 3 V, $Z_S = Z_L$ = 50 Ω, f = 1.8 GHz f = 6 GHz	$\|S_{21e}\|^2$	 - -	 21 10.5	 - -	dB
Third order intercept point at output[2)] V_{CE} = 3 V, I_C = 30 mA, Z_S=Z_L=50 Ω, f = 1.8 GHz	IP_3	-	26.5	-	dBm
1dB Compression point at output I_C = 30 mA, V_{CE} = 3 V, Z_S=Z_L=50 Ω, f = 1.8 GHz	P_{-1dB}	-	13	-	

[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

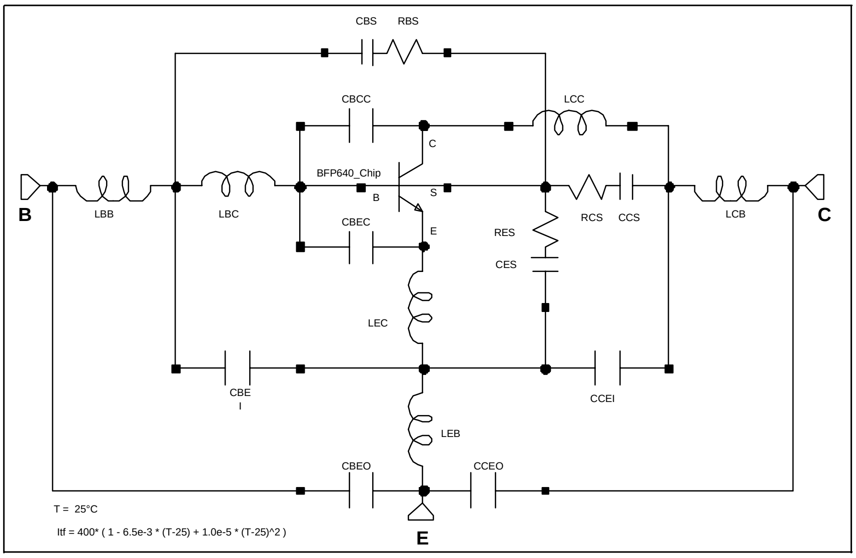
SPICE Parameter (Gummel-Poon Model, Berkley-SPICE 2G.6 Syntax):

Transistor Chip Data:

IS =	0.22	fA	BF =	450	-	NF =	1.025	-
VAF =	1000	V	IKF =	0.15	A	ISE =	21	fA
NE =	2	-	BR =	55	-	NR =	1	-
VAR =	2	V	IKR =	3.8	mA	ISC =	400	fA
NC =	1.8	-	RB =	3.129	Ω	IRB =	1.522	mA
RBM =	2.707	Ω	RE =	0.6	-	RC =	3.061	Ω
CJE =	227.6	fF	VJE =	0.8	V	MJE =	0.3	-
TF =	1.8	ps	XTF =	10	-	VTF =	1.5	V
ITF =	0.4	A	PTF =	0	deg	CJC =	67.43	fF
VJC =	0.6	V	MJC =	0.5	-	XCJC =	1	-
TR =	0.2	ns	CJS =	93.4	fF	VJS =	0.6	V
MJS =	0.27	-	XTB =	-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:

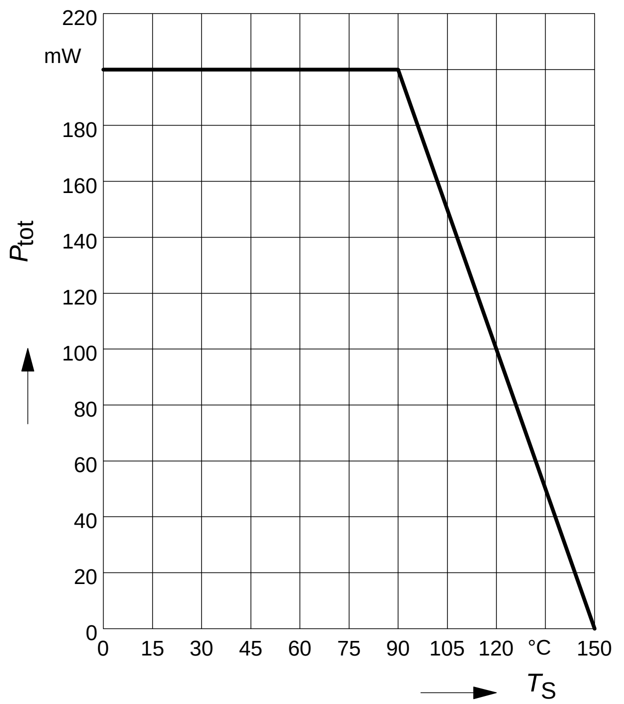


LBC =	120	pH
LCC =	120	pH
LEC =	20	pH
LBB =	696.2	pH
LCB =	682.4	pH
LEB =	230.6	pH
CBEC =	98.4	fF
CBCC =	55.9	fF
CES =	180	fF
CBS =	79	fF
CCS =	75	fF
CCEO =	131.2	fF
CBEO =	102.5	fF
CCEI =	112.6	fF
CBEI =	180.4	fF
RBS =	1200	Ω
RCS =	1200	Ω
RES =	300	Ω

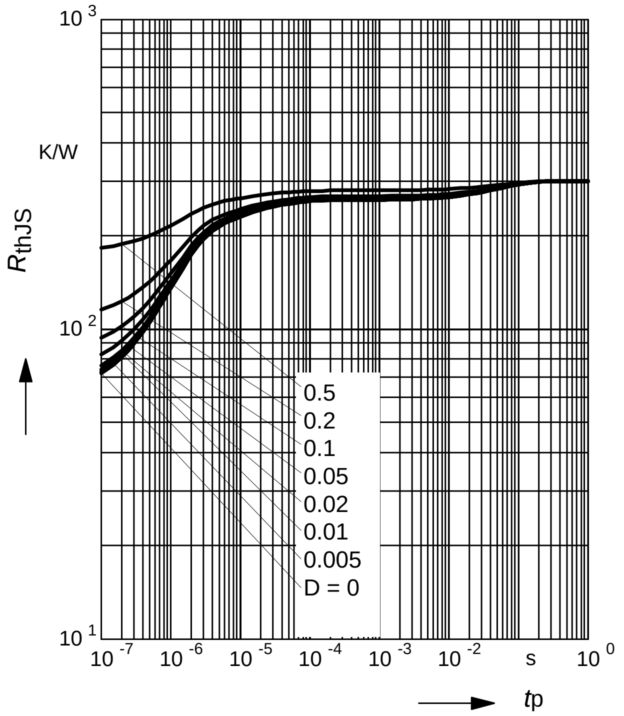
Valid up to 6GHz

For examples and ready to use parameters please contact your local Infineon Technologies distributor or sales office to obtain a Infineon Technologies CD-ROM or see Internet: http://www.infineon.com

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

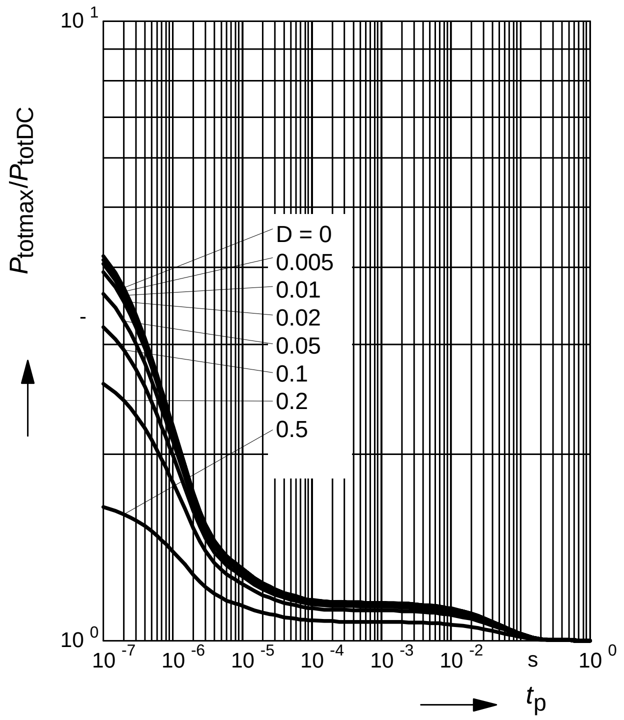


Permissible Pulse Load $R_{thJS} = f(t_p)$



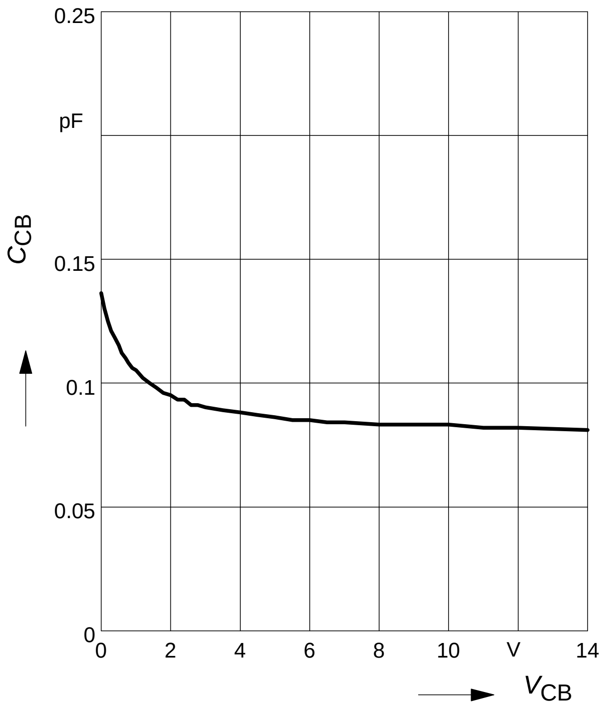
Permissible Pulse Load

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

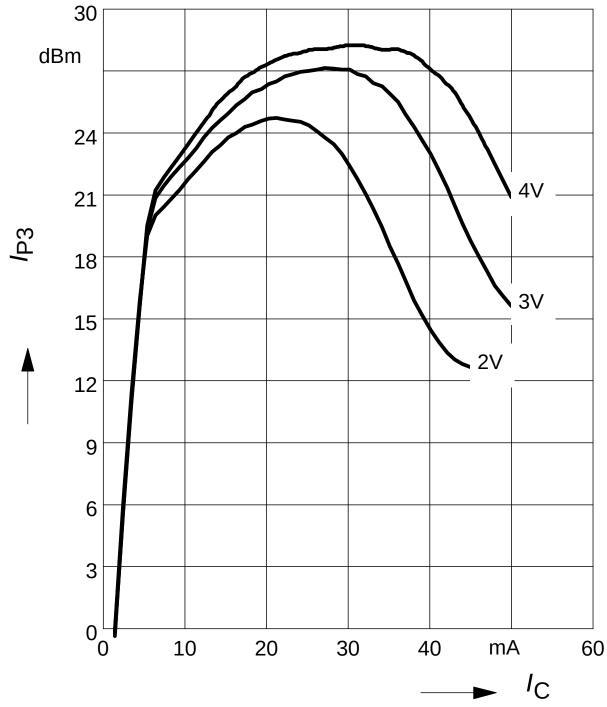


Collector-base capacitance $C_{cb} = f(V_{CB})$

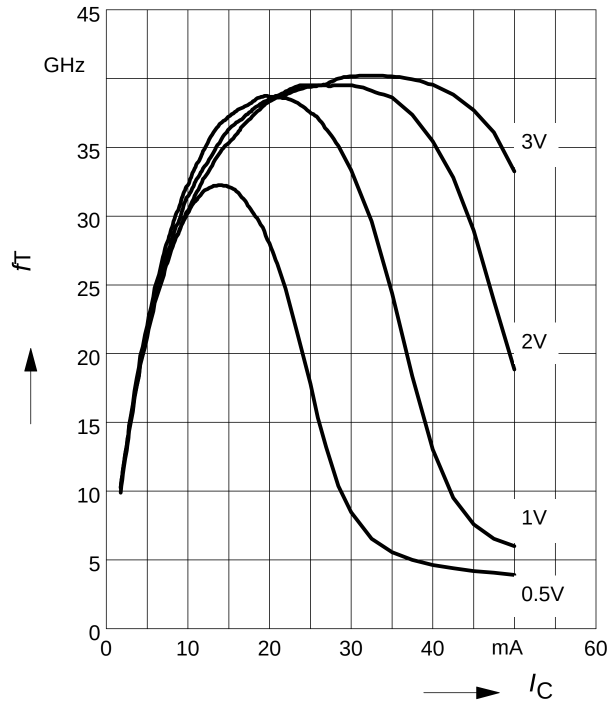
f = 1MHz



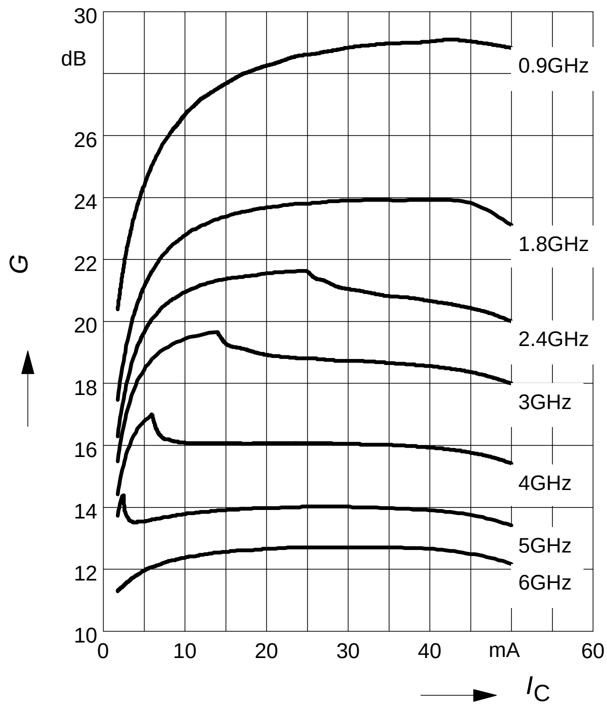
Third order Intercept Point $IP_3 = f(I_C)$
(Output, $Z_S = Z_L = 50\Omega$)
V_{CE} = parameter, f = 1.8 GHz



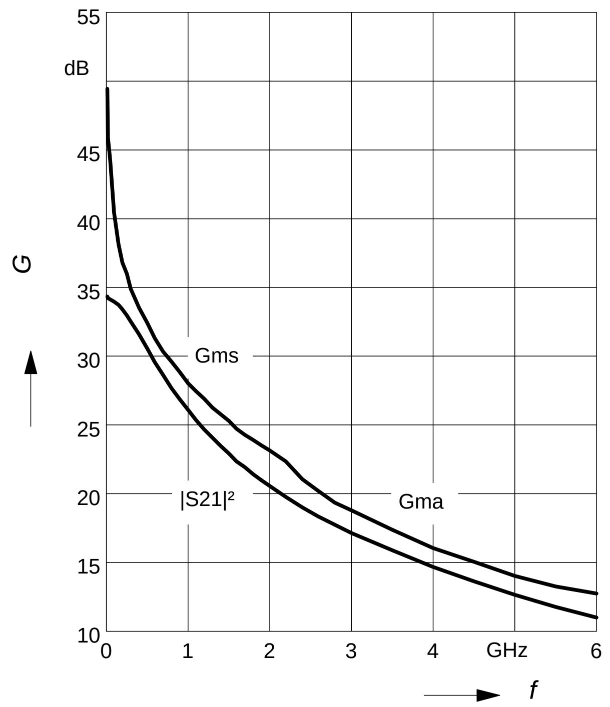
Transition frequency $f_T = f(I_C)$
f = 1GHz
V_{CE} = parameter



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



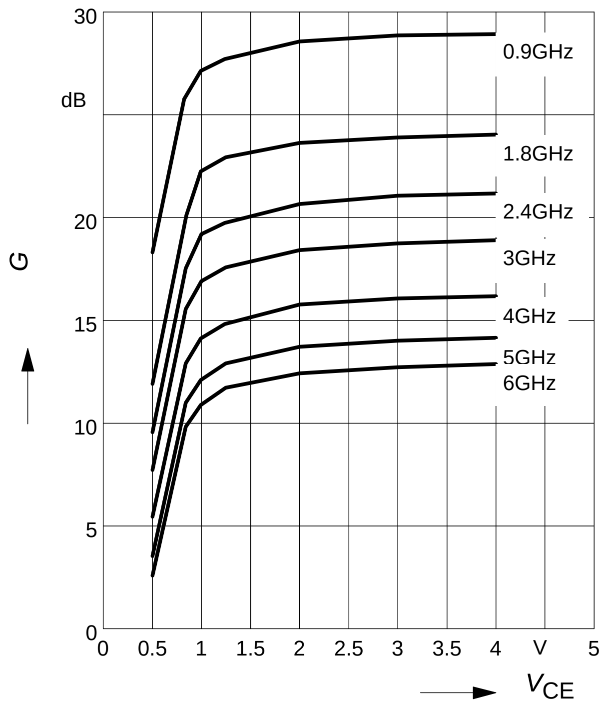
Power Gain G_{ma}, $G_{ms} = f(f)$,
$|S_{21}|^2 = f$ (f)
V_{CE} = 3V, I_C = 30mA



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

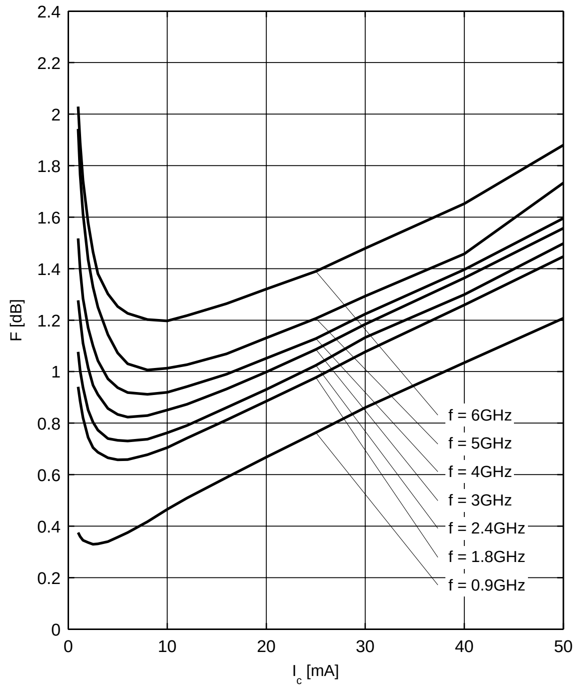
I_C = 30mA

f = parameter



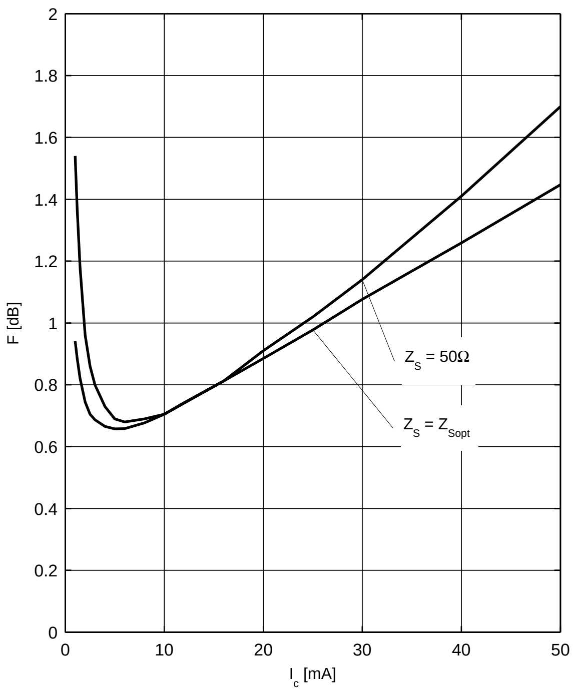
Noise figure F = f(I_C)

V_{CE} = 3V, Z_S = Z_{Sopt}



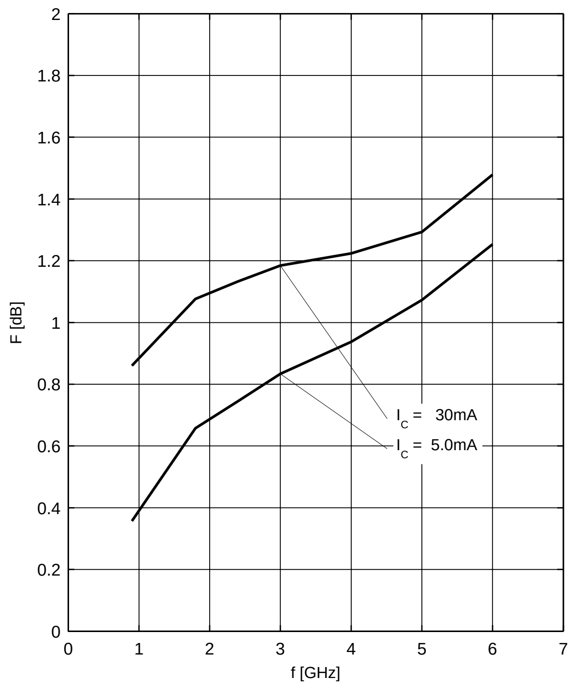
Noise figure F = f(I_C)

V_{CE} = 3V, f = 1.8 GHz

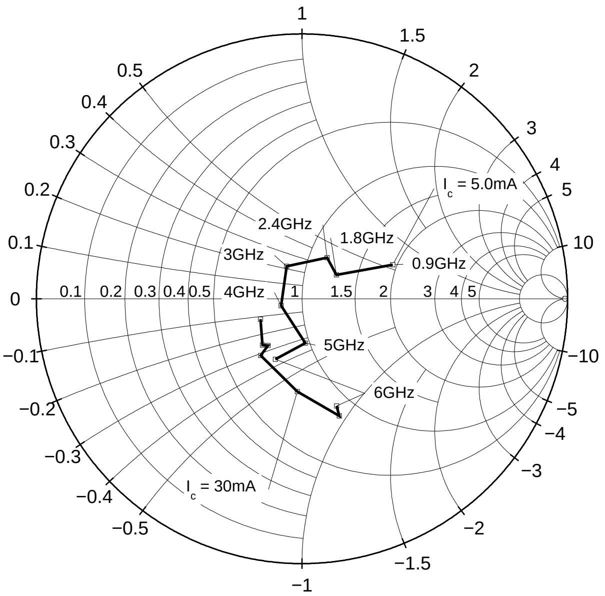


Noise figure F = f(f)

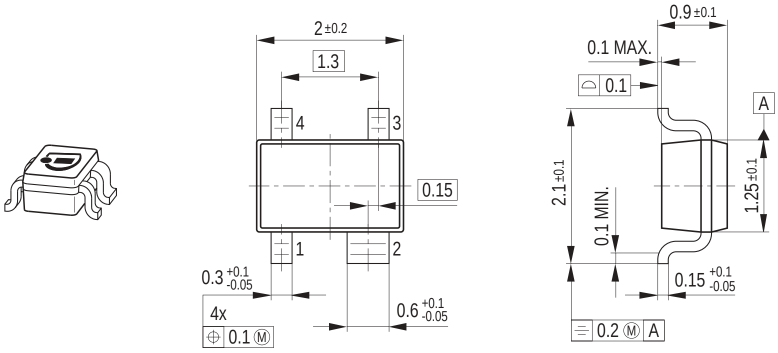
V_{CE} = 3V, Z_S = Z_{Sopt}



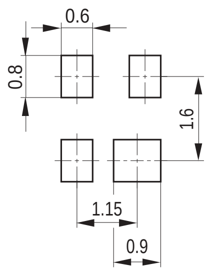
Source impedance for min.
noise figure vs. frequency
V_{CE} = 3 V, I_C = 5 mA/ 30 mA



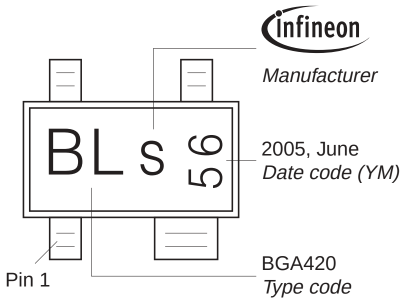
Package Outline



Foot Print

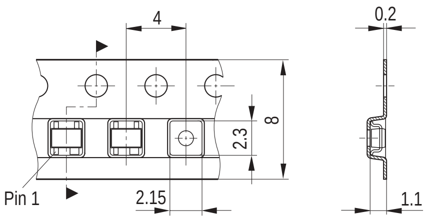


Marking Layout (Example)



Standard Packing

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



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