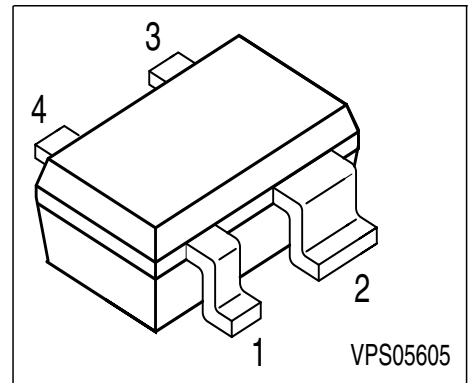


NPN Silicon RF Transistor

- For medium power amplifiers
- Compression point $P_{-1\text{dB}} = +19 \text{ dBm}$ at 1.8 GHz
maximum available gain $G_{\text{ma}} = 15.5 \text{ dB}$ at 1.8 GHz;
Noise figure $F = 1.25 \text{ dB}$ at 1.8 GHz
- Transition frequency $f_T = 24 \text{ GHz}$
- Gold metallization for high reliability
- **SIEGET® 25 GHz f_T - Line**



ESD: Electrostatic discharge sensitive device, observe handling precaution!

Type	Marking	Pin Configuration				Package
BFP 450	ANs	1 = B	2 = E	3 = C	4 = E	SOT-343

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	4.5	V
Collector-base voltage	V_{CBO}	15	
Emitter-base voltage	V_{EBO}	1.5	
Collector current	I_{C}	100	mA
Base current	I_{B}	10	
Total power dissipation, $T_{\text{S}} \leq 96 \text{ °C}$ ¹⁾	P_{tot}	450	mW
Junction temperature	T_{j}	150	°C
Ambient temperature	T_{A}	-65 ... 150	
Storage temperature	T_{stg}	-65 ... 150	

Thermal Resistance

Junction - soldering point	R_{thJS}	≤ 130	K/W
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¹⁾ T_{S} is measured on the emitter lead at the soldering point to the pcb

Electrical Characteristics at $T_A = 25^\circ\text{C}$, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC characteristics					
Collector-emitter breakdown voltage $I_C = 1\text{ mA}, I_B = 0$	$V_{(BR)CEO}$	4.5	5	-	V
Collector-base cutoff current $V_{CB} = 5\text{ V}, I_E = 0$	I_{CBO}	-	-	600	nA
Emitter-base cutoff current $V_{EB} = 1.5\text{ V}, I_C = 0$	I_{EBO}	-	-	100	μA
DC current gain $I_C = 50\text{ mA}, V_{CE} = 4\text{ V}$	h_{FE}	50	80	150	-
AC characteristics (verified by random sampling)					
Transition frequency $I_C = 90\text{ mA}, V_{CE} = 3\text{ V}, f = 1\text{ GHz}$ $I_C = 90\text{ mA}, V_{CE} = 3\text{ V}, f = 2\text{ GHz}$	f_T	- 15	24 17	- -	GHz
Collector-base capacitance $V_{CB} = 2\text{ V}, f = 1\text{ MHz}$	C_{cb}	-	0.48	0.8	pF
Collector-emitter capacitance $V_{CE} = 2\text{ V}, f = 1\text{ MHz}$	C_{ce}	-	1.2	-	
Emitter-base capacitance $V_{EB} = 0.5\text{ V}, f = 1\text{ MHz}$	C_{eb}	-	1.75	-	
Noise figure $I_C = 10\text{ mA}, V_{CE} = 2\text{ V}, Z_S = Z_{Sopt}, f = 1.8\text{ GHz}$	F	-	1.25	-	dB
Power gain, maximum available ¹⁾ $I_C = 50\text{ mA}, V_{CE} = 2\text{ V}, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}, f = 1.8\text{ GHz}$	G_{ma}	-	15.5	-	
Insertion power gain $I_C = 50\text{ mA}, V_{CE} = 2\text{ V}, f = 1.8\text{ GHz}, Z_S = Z_L = 50\Omega$	$ S_{21} ^2$	8	11.5	-	
Third order intercept point $I_C = 50\text{ mA}, V_{CE} = 3\text{ V}, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}, f = 1.8\text{ GHz}$	IP_3	-	29	-	dBm
1dB Compression point $I_C = 50\text{ mA}, V_{CE} = 3\text{ V}, f = 1.8\text{ GHz}, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}$	P_{-1dB}	-	19	-	

$$^1G_{ma} = |S_{21} / S_{12}| (k - (k^2 - 1)^{1/2})$$

Common Emitter Noise Parameters

f	$F_{\min}^{1)}$	$G_a^{1)}$	Γ_{opt}		R_N	r_n	$F_{50\Omega}^{2)}$	$ S_{21} ^2^{2)}$
GHz	dB	dB	MAG	ANG	Ω	-	dB	dB

 $V_{CE} = 2V, I_C = 10mA$

0.9	0.9	15.5	0.29	175	2.7	0.054	0.98	16
1.8	1.25	11.8	0.47	-171	3	0.06	1.74	9.5
2.4	1.45	10.9	0.56	-159	3.5	0.07	2.23	6.8
3	1.7	8.5	0.62	-147	5.5	0.11	3.05	4.7
4	2.1	6.6	0.66	-127	15.5	0.31	4.49	1.9

1) Input matched for minimum noise figure, output for maximum gain

2) $Z_S = Z_L = 50\Omega$

For more and detailed S- and Noise-parameters please contact your local Infineon Technologies distributor or sales office to obtain a Infineon Technologies Application Notes CD-ROM or see Internet: <http://www.infineon.com/products/discrete/index.htm>

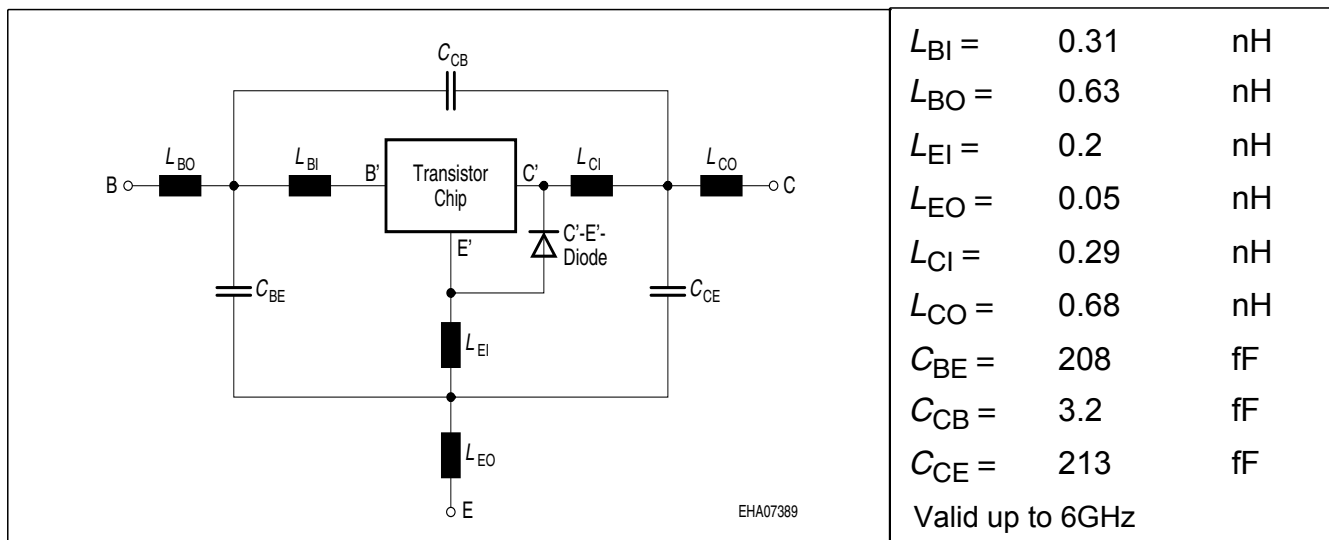
SPICE Parameters (Gummel-Poon Model, Berkley-SPICE 2G.6 Syntax) :
Transistor Chip Data

IS =	0.13125	fA	BF =	76.123	-	NF =	0.79652	-
VAF =	24.165	V	IKF =	0.58905	A	ISE =	28.341	fA
NE =	1.5563	-	BR =	21.254	-	NR =	1.2966	-
VAR =	13.461	V	IKR =	0.25878	A	ISC =	0.012292	fA
NC =	0.70543	-	RB =	5.403	Ω	IRB =	0.013181	mA
RBM =	2.1659	Ω	RE =	0.45346		RC =	0.50084	Ω
CJE =	3.2276	fF	VJE =	0.95292	V	MJE =	0.48672	-
TF =	7.5068	ps	XTF =	0.69972	-	VTF =	0.66148	V
ITF =	0.017655	mA	PTF =	0	deg	CJC =	1049.5	fF
VJC =	1.1487	V	MJC =	0.50644	-	XCJC =	0.28285	-
TR =	2.6912	ns	CJS =	0	F	VJS =	0.75	V
MJS =	0	-	XTB =	0	-	EG =	1.11	eV
XTI =	3	-	FC =	0.91274	-	TNOM	300	K

C'-E'-Diode Data (Berkley-SPICE 2G.6 Syntax) :

IS =	25	fA	N =	1.05	-	RS =	5	Ω
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All parameters are ready to use, no scaling is necessary

Package Equivalent Circuit:


The SOT-343 package has two emitter leads. To avoid high complexity of the package equivalent circuit, both leads are combined in one electrical connection.

Extracted on behalf of SIEMENS Small Signal Semiconductors by:
Institut für Mobil-und Satellitentechnik (IMST)

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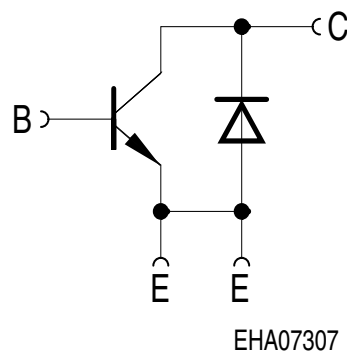
For examples and ready to use parameters please contact your local Infineon Technologies distributor or sales office to obtain a Infineon Technologies CD-ROM or see Internet:
<http://www.infineon.com/products/discrete/index.htm>

For non-linear simulation:

- Use transistor chip parameters in Berkeley SPICE 2G.6 syntax for all simulators.
- If you need simulation of the reverse characteristics, add the diode with the C'-E'- diode data between collector and emitter.
- Simulation of package is not necessary for frequencies < 100MHz.
For higher frequencies add the wiring of package equivalent circuit around the non-linear transistor and diode model.

Note:

- This transistor is constructed in a common emitter configuration. This feature causes an additional reverse biased diode between emitter and collector, which does not effect normal operation.



Transistor Schematic Diagram

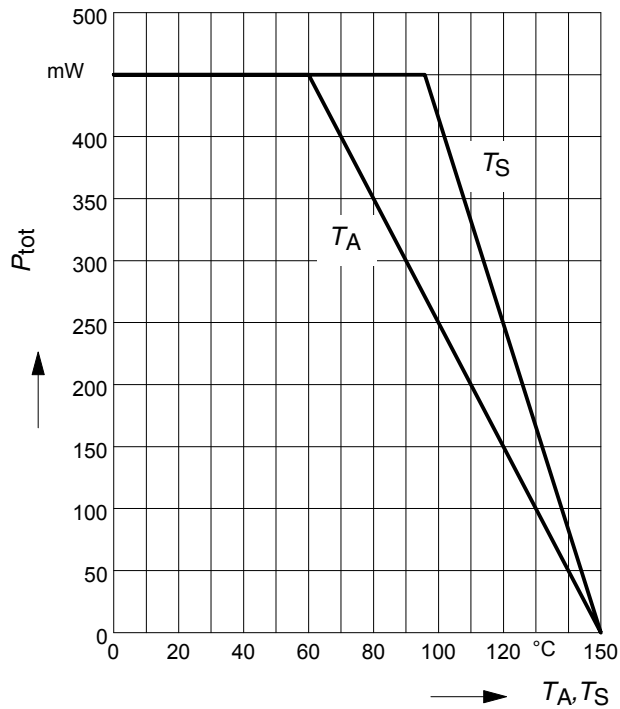
The common emitter configuration shows the following advantages:

- Higher gain because of lower emitter inductance.
- Power is dissipated via the grounded emitter leads, because the chip is mounted on copper emitter leadframe.

Please note, that the broadest lead is the emitter lead.

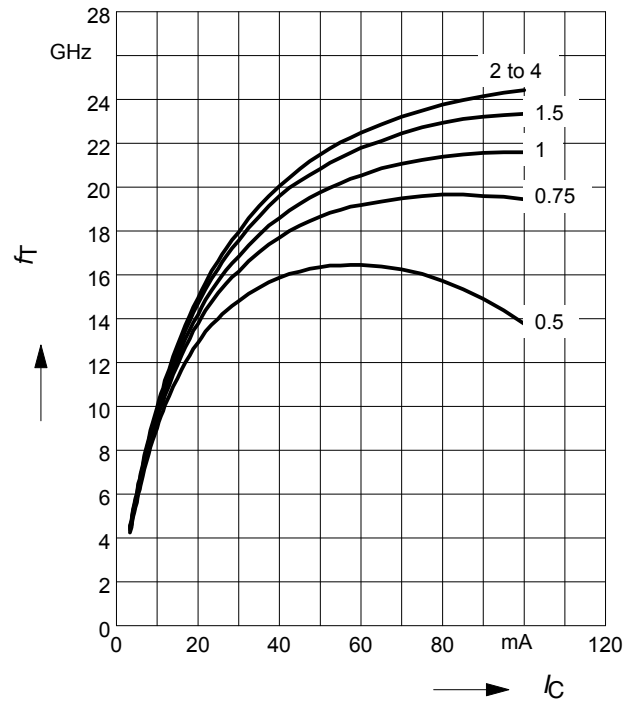
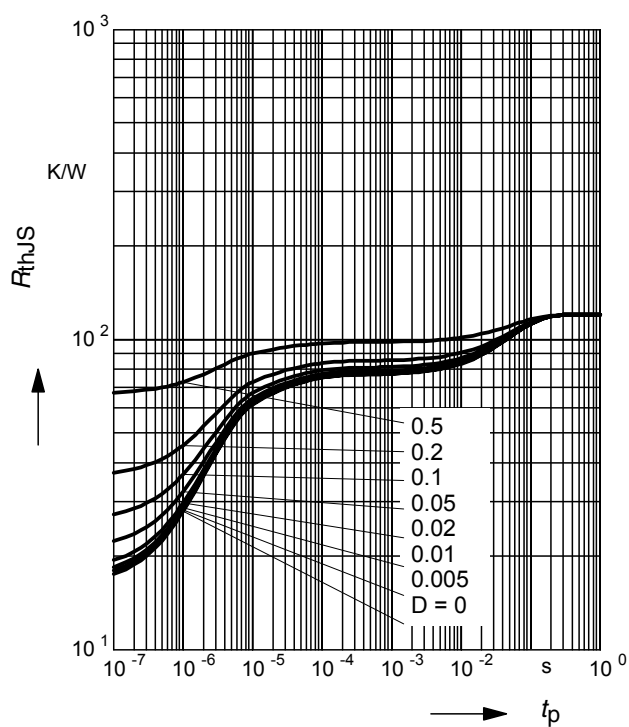
Total power dissipation $P_{\text{tot}} = f(T_A^*, T_S)$

* Package mounted on epoxy

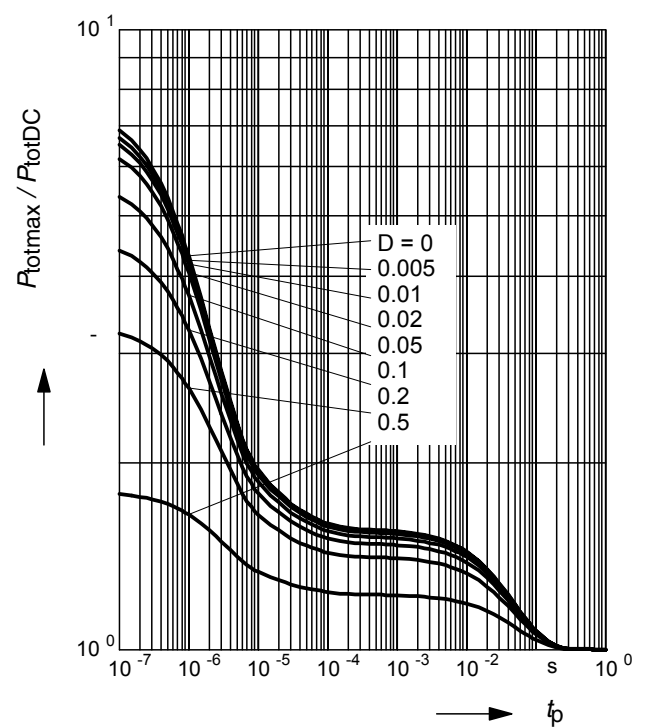

Transition frequency $f_T = f(I_C)$

$f = 1$ GHz

$V_{\text{CE}} = \text{parameter in V}$

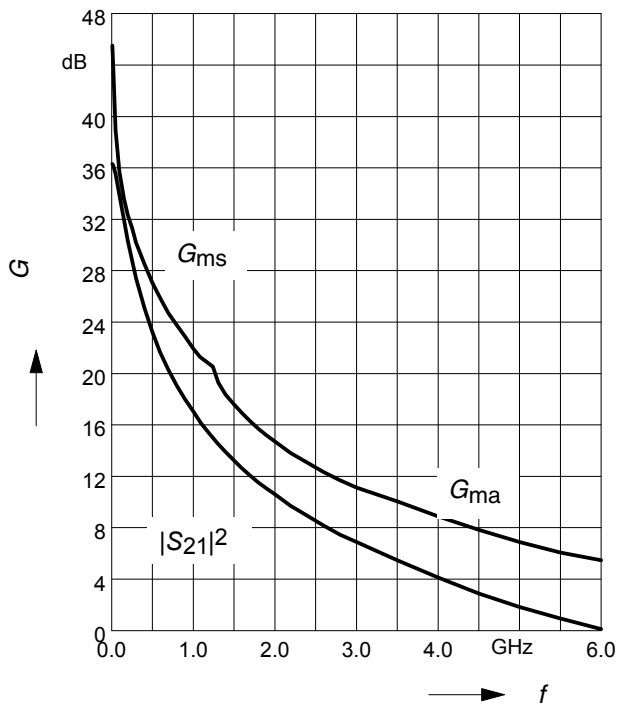

Permissible Pulse Load $R_{\text{thJS}} = f(t_p)$

Permissible Pulse Load

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



Power gain G_{ma} , G_{ms} , $|S_{21}|^2 = f(f)$

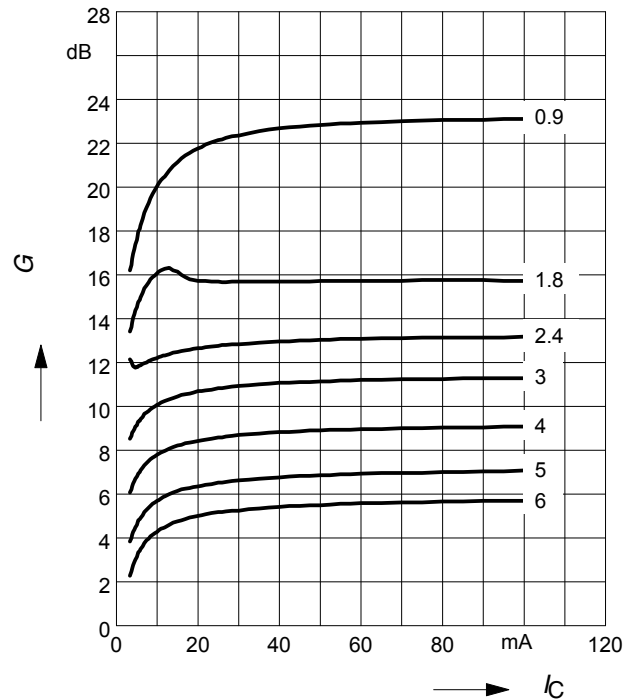
$V_{CE} = 2V$, $I_C = 50\text{ mA}$



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

$V_{CE} = 2V$

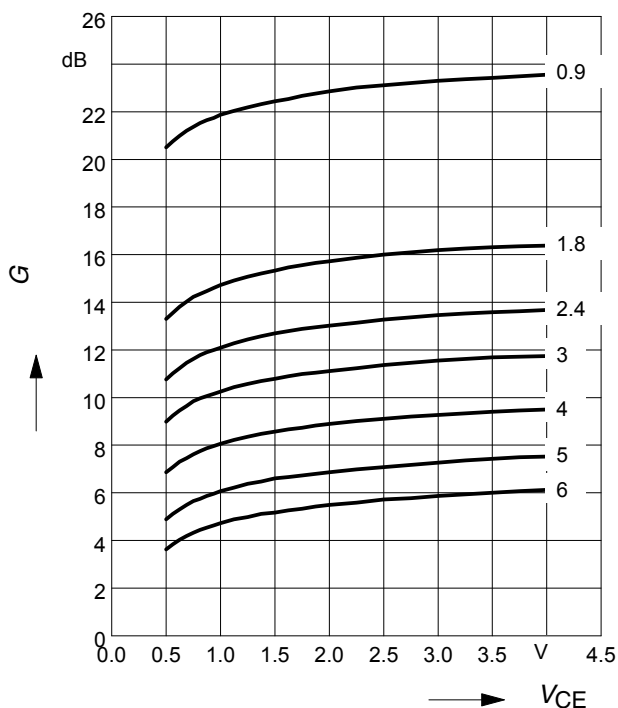
$f = \text{parameter in GHz}$



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

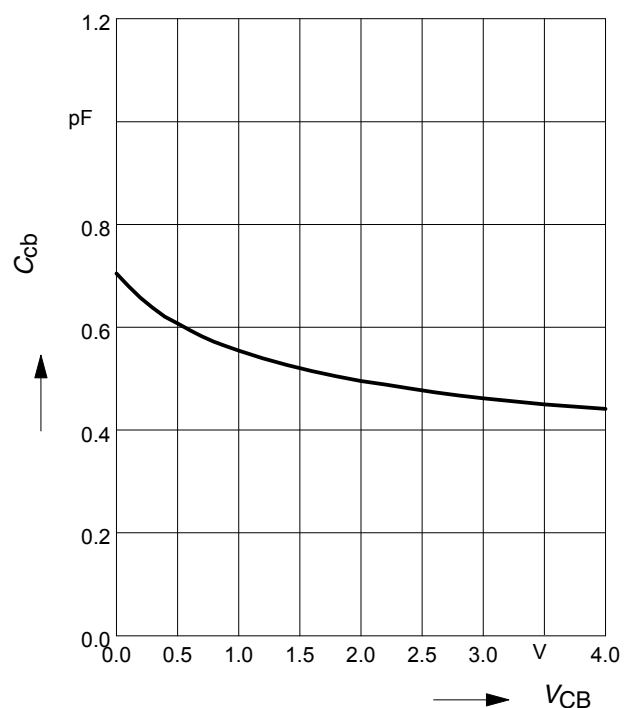
$I_C = 50\text{ mA}$

$f = \text{Parameter in GHz}$



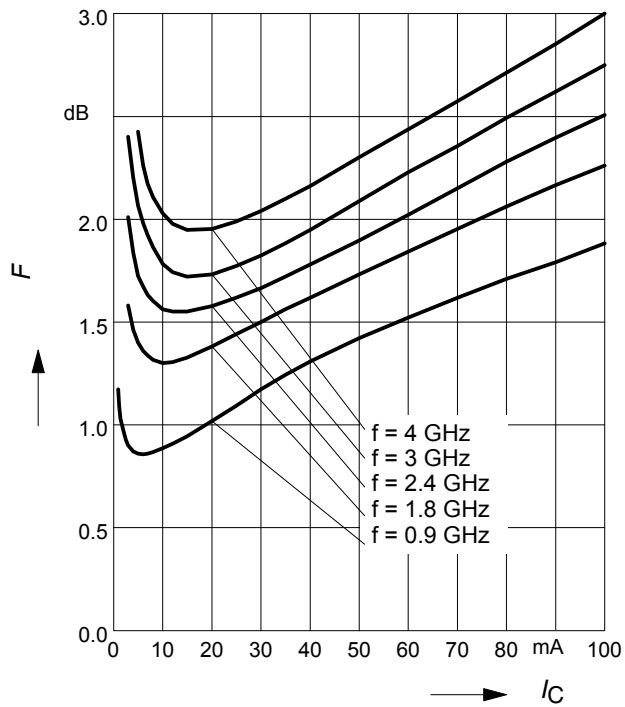
Collector-base capacitance $C_{cb} = f(V_{CB})$

$f = 1\text{ MHz}$



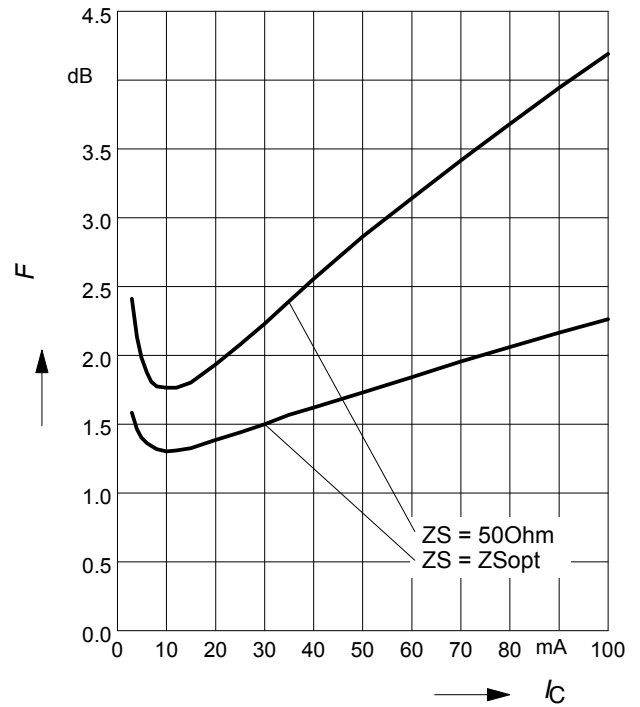
Noise figure $F = f(I_C)$

$V_{CE} = 2\text{ V}$, $Z_S = Z_{Sopt}$



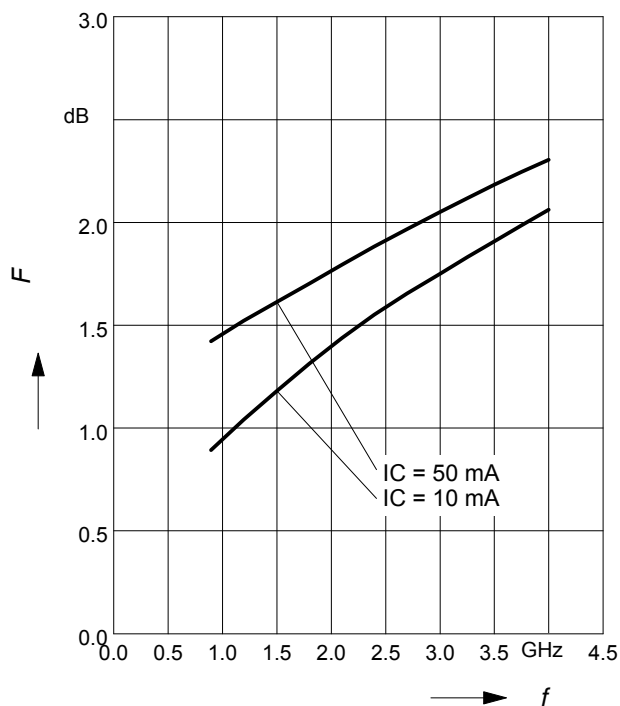
Noise figure $F = f(I_C)$

$V_{CE} = 2\text{ V}$, $f = 1.8\text{ GHz}$



Noise figure $F = f(f)$

$V_{CE} = 2\text{ V}$, $Z_S = Z_{Sopt}$



Source impedance for min.

Noise Figure versus Frequency

$V_{CE} = 2\text{ V}$, $I_C = 10\text{ mA} / 50\text{ mA}$

