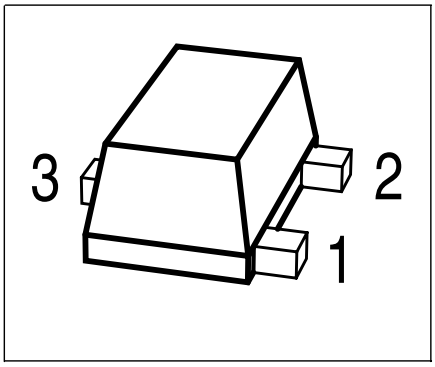
NPN Silicon RF Transistor

Preliminary data

- Low voltage/ low current operation
- For low noise amplifiers
- For Oscillators up to 3.5 GHz and Pout > 10 dBm
- Low noise figure: 1.0 dB at 1.8 GHz



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

Type	Marking	Pin Configuration			Package
BFR360F	FBs	1 = B	2 = E	3 = C	TSFP-3

Maximum Ratings

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	35	mA
Base current	I_B	4	
Total power dissipation[1)] $T_S \leq 98°C$	P_{tot}	210	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}	≤ 250	K/W

[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.	
Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	6	9	-	V
Collector-emitter cutoff current V_{CE} = 15 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} = 1 V, I_C = 0	I_{EBO}	-	-	1	µA
DC current gain- I_C = 15 mA, V_{CE} = 3 V	h_{FE}	60	130	200	-

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 = 15 mA, V_{CE} = 3 V, f = 1 GHz	f_T	11	14	-	GHz
Collector-base capacitance V_{CB} = 5 V, f = 1 MHz, emitter grounded	C_{cb}	-	0.32	0.5	pF
Collector emitter capacitance V_{CE} = 5 V, f = 1 MHz, base grounded	C_{ce}	-	0.2	-	
Emitter-base capacitance V_{EB} = 0.5 V, f = 1 MHz, collector grounded	C_{eb}	-	0.4	-	
Noise figure I_C = 3 mA, V_{CE} = 3 V, Z_S = Z_{Sopt}, f = 1.8 GHz	F_{min}	-	1	-	dB
Power gain, maximum available[1)] I_C = 15 mA, V_{CE} = 3 V, Z_S = Z_{Sopt} , Z_L = Z_{Lopt} , f = 1.8 GHz I_C = 15 mA, V_{CE} = 3 V, Z_S = Z_{Sopt} , Z_L = Z_{Lopt} , f = 3 GHz	G_{ma}	 - -	 15.5 11	 - -	
Transducer gain I_C = 15 mA, V_{CE} = 3 V, Z_S = Z_L = 50Ω , f = 1.8 GHz I_C = 15 mA, V_{CE} = 3 V, Z_S = Z_L = 50Ω , f = 3 GHz	$\lvert S_{21e}\rvert^2$	 - -	 13 9	 - -	dB
Third order intercept point at output[2)] V_{CE} = 3 V, I_C = 15 mA, f = 1.8 GHz, Z_S = Z_L = 50Ω	IP_3	-	24	-	dBm
1dB Compression point at output I_C = 15 mA, V_{CE} = 3 V, Z_S = Z_L = 50Ω , f = 1.8 GHz	P_{-1dB}	-	9	-	

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

[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

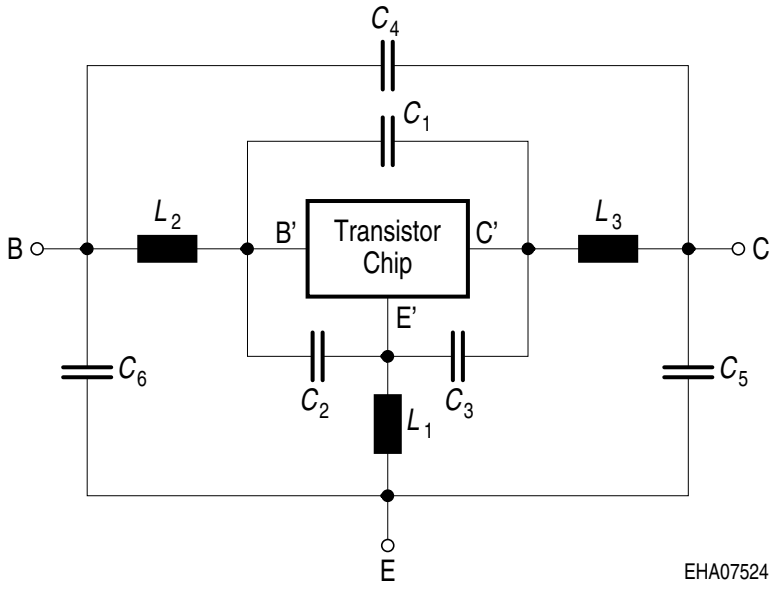
SPICE Parameter (Gummel-Poon Model, Berkley-SPICE 2G.6 Syntax):

Transitor Chip Data:

IS =	0.0689	fA	BF =	147	-	NF =	1	-
VAF =	20	V	IKF =	77.28	mA	ISE =	150	fA
NE =	2.4	-	BR =	6	-	NR =	1	-
VAR =	60	V	IKR =	0.3	A	ISC =	20	fA
NC =	1.4	-	RB =	0.1	Ω	IRB =	75	µA
RBM =	7.31	Ω	RE =	78.2	mΩ	RC =	0.35	Ω
CJE =	400	fF	VJE =	1.3	V	MJE =	0.5	-
TF =	9.219	ps	XTF =	0.115	-	VTF =	0.198	V
ITF =	1.336	mA	PTF =	0	deg	CJC =	473	fF
VJC =	0.864	V	MJC =	0.486	-	XCJC =	0.129	-
TR =	1.92	ns	CJS =	0	fF	VJS =	0.75	V
MJS =	0	-	XTB =	0.5	K	EG =	1.11	eV
XTI =	0	-	FC =	0.954		NK =	0.5	K
AF =	1	-	KF =	1E-14	-			

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

Package Equivalent Circuit:

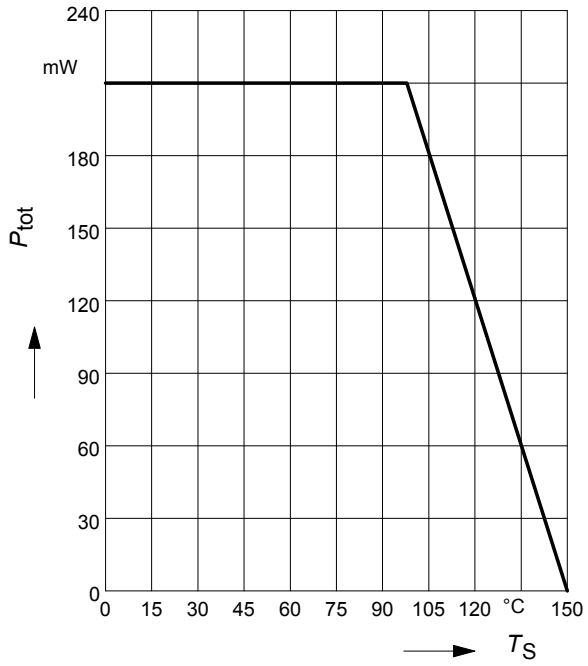


L_1 =	0.556	nH
L_2 =	0.657	nH
L_3 =	0.381	nH
C_1 =	43	fF
C_2 =	123	fF
C_3 =	66	fF
C_4 =	10	fF
C_5 =	36	fF
C_6 =	47	fF

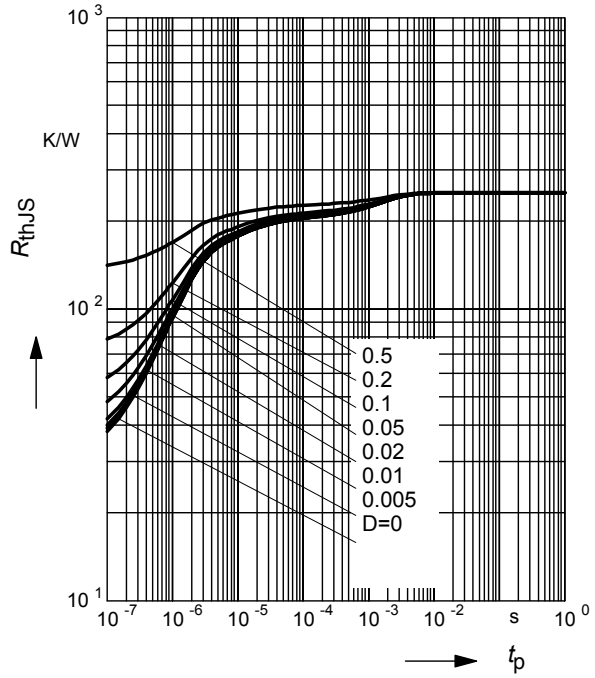
Valid up to 6GHz

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/silicondiscretes

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

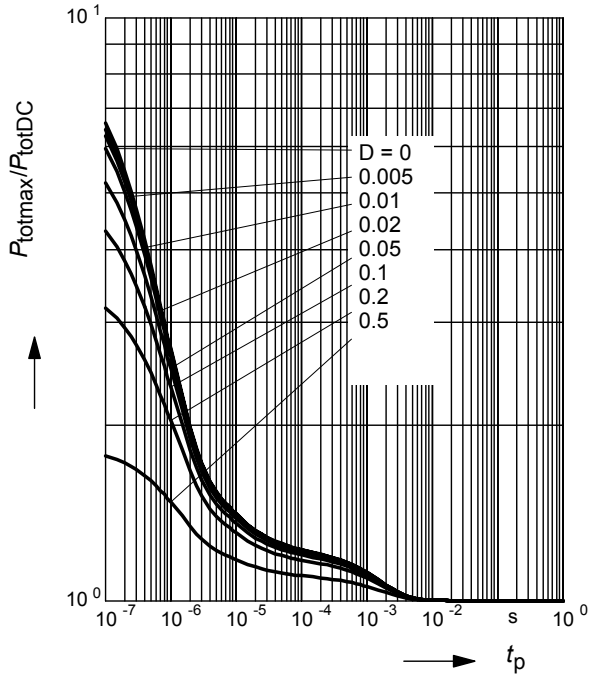


Permissible Pulse Load $R_{thJS} = f(t_p)$



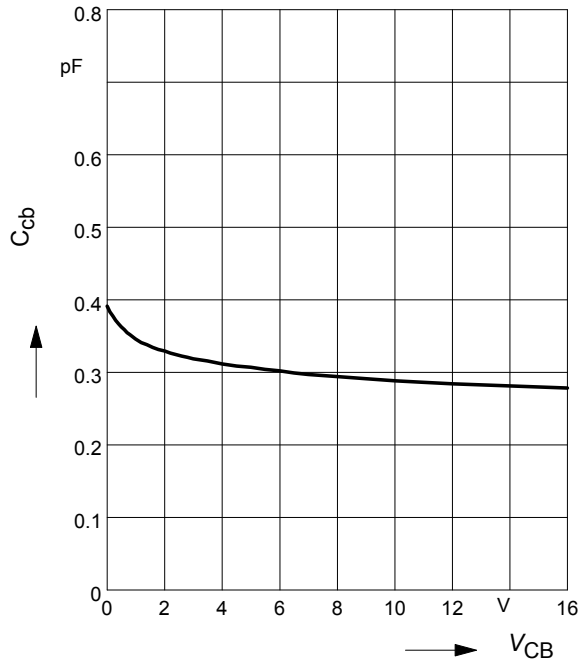
Permissible Pulse Load

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



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

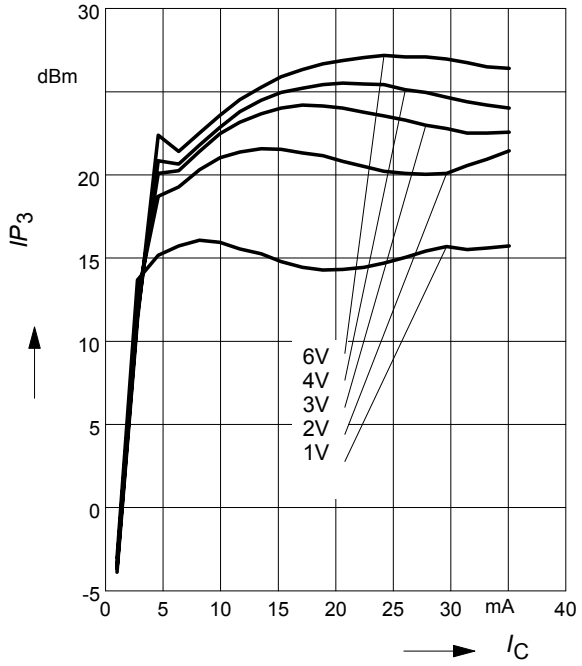
f = 1MHz



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

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

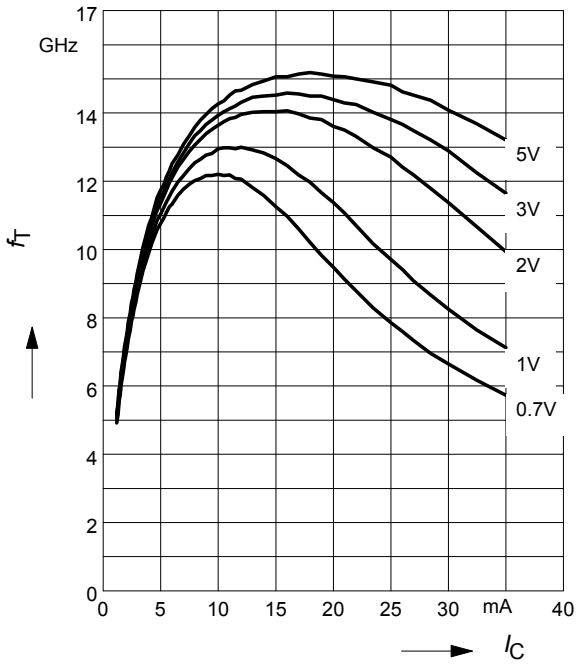
V_{CE} = parameter, f = 1.8GHz



Transition frequency $f_T= f(I_C)$

f = 1GHz

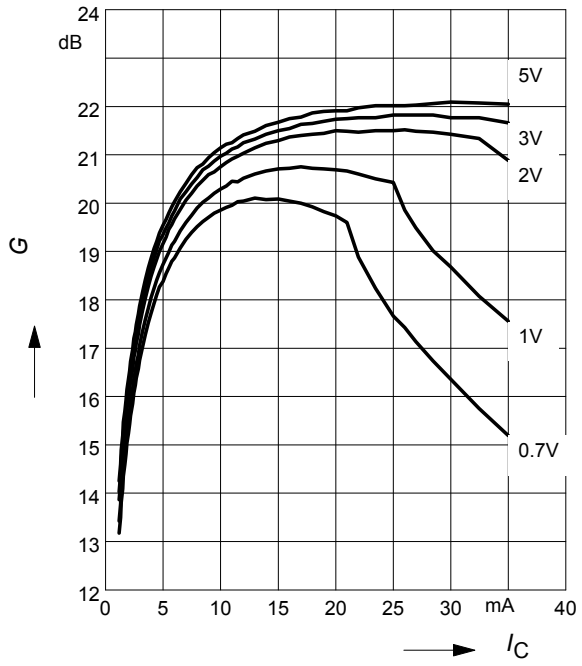
V_{CE} = parameter



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

f = 0.9GHz

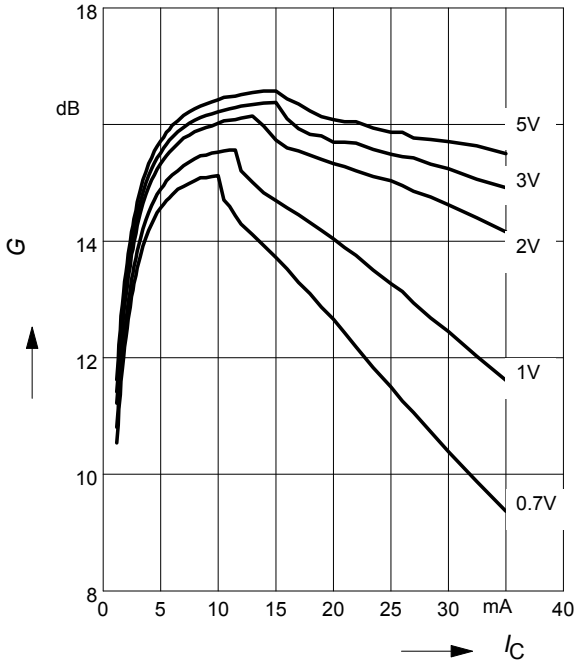
V_{CE} = parameter



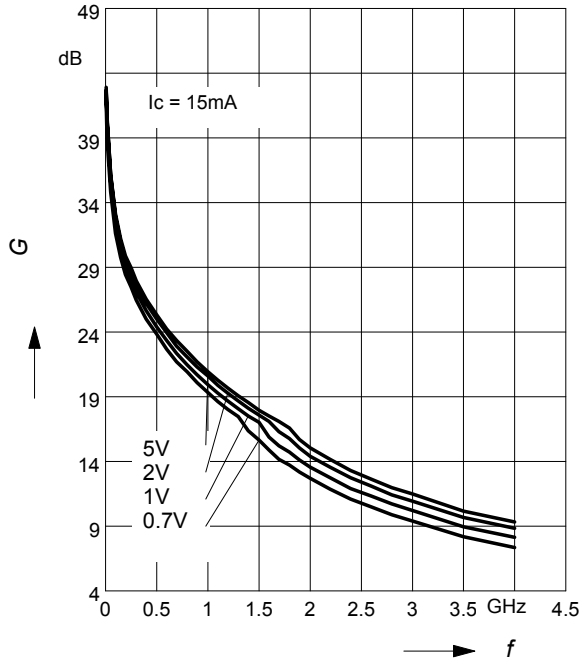
Power gain G_{ma}, G_{ms} = $f(I_C)$

f = 1.8GHz

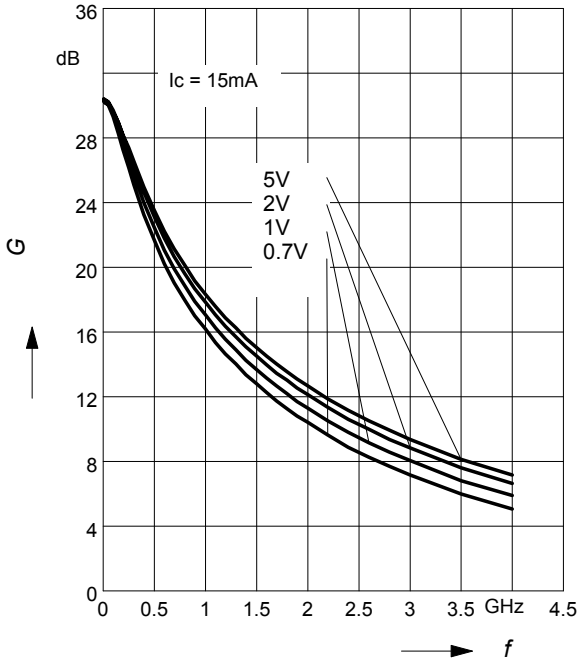
V_{CE} = parameter



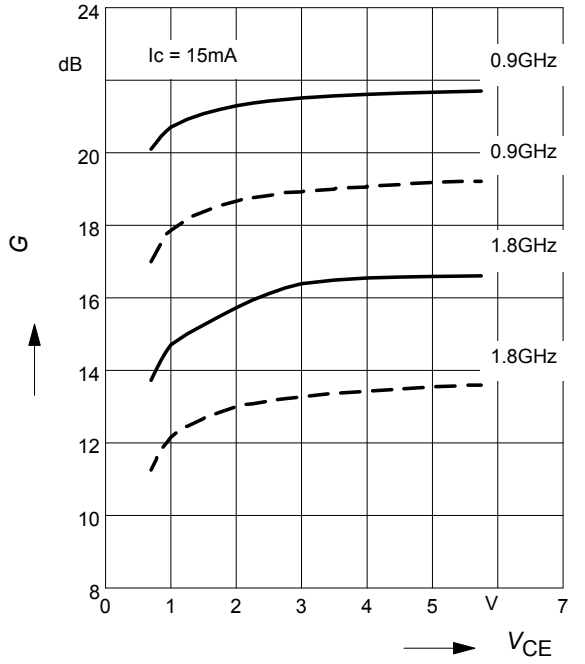
Power Gain G_{ma}, G_{ms} = $f(f)$
V_{CE} = parameter



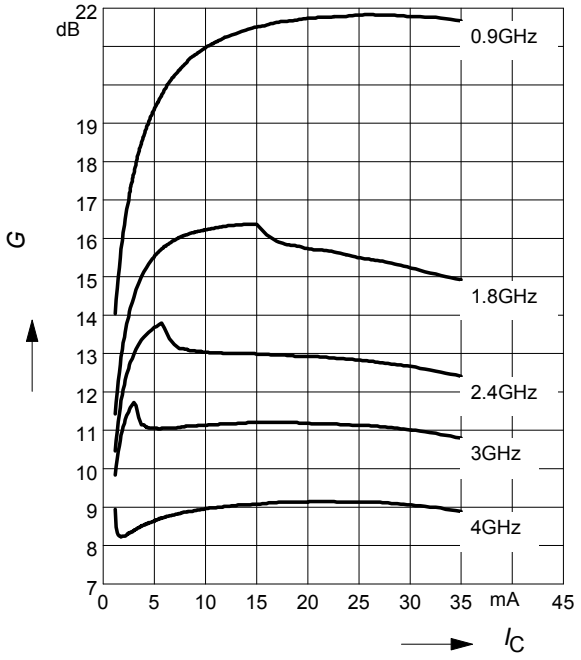
Insertion Power Gain $|S_{21}|^2$ = $f(f)$
V_{CE} = parameter



Power Gain G_{ma}, G_{ms} = $f(V_{CE})$: ——
$|S_{21}|^2$ = $f(V_{CE})$: - - - -
f = parameter

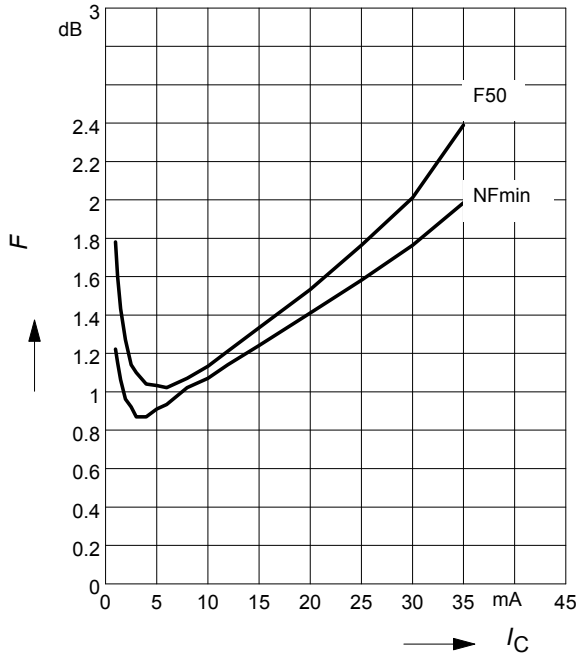


Power gain G_{ma}, G_{ms} = $f(I_C)$
V_{CE} = 3V
f = parameter



Noise figure $NF = f(I_C)$

V_{CE} = 3V, f = 1,8 GHz



Source impedance for min. noise figure vs. frequency

V_{CE} = 3 V