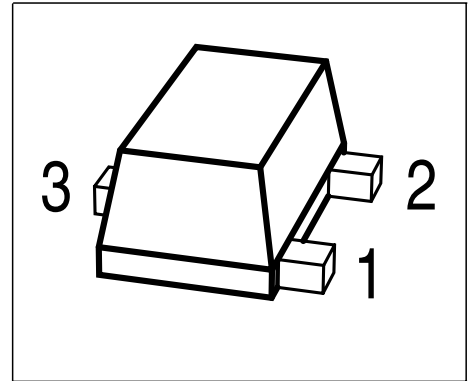


NPN Silicon RF Transistor

Preliminary data

- High current capability and low figure for wide dynamic range application
- Low voltage operation
- Ideal for low phase noise oscillators up to 3.5 GHz
- Low noise figure: 1.1 dB at 1.8 GHz



ESD: Electrostatic discharge sensitive device, observe handling precaution!

Type	Marking	Pin Configuration			Package
BFR380F	FCs	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	80	mA
Base current	I_B	14	
Total power dissipation ¹⁾ $T_S \leq 95^\circ\text{C}$	P_{tot}	380	mW
Junction temperature	T_j	150	$^\circ\text{C}$
Ambient temperature	T_A	-65 ... 150	
Storage temperature	T_{stg}	-65 ... 150	

Thermal Resistance

Parameter	Symbol	Value	Unit
Junction - soldering point ²⁾	R_{thJS}	≤ 145	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 $T_A = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Characteristics					
Collector-emitter breakdown voltage $I_C = 1\text{ mA}$, $I_B = 0$	$V_{(BR)CEO}$	6	9	-	V
Collector-base cutoff current $V_{CB} = 5\text{ V}$, $I_E = 0$	I_{CBO}	-	-	100	nA
Emitter-base cutoff current $V_{EB} = 1\text{ V}$, $I_C = 0$	I_{EBO}	-	-	1	μA
DC current gain- $I_C = 40\text{ mA}$, $V_{CE} = 3\text{ V}$	h_{FE}	60	100	200	-

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics (verified by random sampling)					
Transition frequency $I_C = 40\text{ mA}$, $V_{CE} = 3\text{ V}$, $f = 1\text{ GHz}$	f_T	11	14	-	GHz
Collector-base capacitance $V_{CB} = 5\text{ V}$, $f = 1\text{ MHz}$, emitter grounded	C_{cb}	-	0.47	0.7	pF
Collector emitter capacitance $V_{CE} = 5\text{ V}$, $f = 1\text{ MHz}$, base grounded	C_{ce}	-	0.2	-	
Emitter-base capacitance $V_{EB} = 0.5\text{ V}$, $f = 1\text{ MHz}$, collector grounded	C_{eb}	-	1	-	
Noise figure $I_C = 8\text{ mA}$, $V_{CE} = 3\text{ V}$, $Z_S = Z_{Sopt}$, $f = 1.8\text{ GHz}$	F_{min}	-	1.1	-	dB
Power gain, maximum available ¹⁾ $I_C = 40\text{ mA}$, $V_{CE} = 3\text{ V}$, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$, $f = 1.8\text{ GHz}$	G_{ma}	-	13.5	-	
$I_C = 40\text{ mA}$, $V_{CE} = 3\text{ V}$, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$, $f = 3\text{ GHz}$		-	9	-	
Insertion power gain $V_{CE} = 3\text{ V}$, $I_C = 40\text{ mA}$, $f = 1.8\text{ GHz}$, $Z_S = Z_L = 50\Omega$	$ S_{21} ^2$	-	11	-	dB
$V_{CE} = 3\text{ V}$, $I_C = 40\text{ mA}$, $f = 3\text{ GHz}$, $Z_S = Z_L = 50\Omega$		-	6.5	-	
Third order intercept point at output ²⁾ $V_{CE} = 3\text{ V}$, $I_C = 40\text{ mA}$, $f = 1.8\text{ GHz}$, $Z_S = Z_L = 50\Omega$	IP_3	-	29	-	dBm
1dB Compression point at output ³⁾ $I_C = 40\text{ mA}$, $V_{CE} = 3\text{ V}$, $Z_S = Z_L = 50\Omega$, $f = 1.8\text{ GHz}$	P_{-1dB}	-	16	-	

¹ $G_{ma} = |S_{21}| / |S_{12}| (k - (k^2 - 1)^{1/2})$
² IP_3 value depends on termination of all intermodulation frequency components.
Termination used for this measurement is 50Ω from 0.1 MHz to 6 GHz

³DC current at no input power

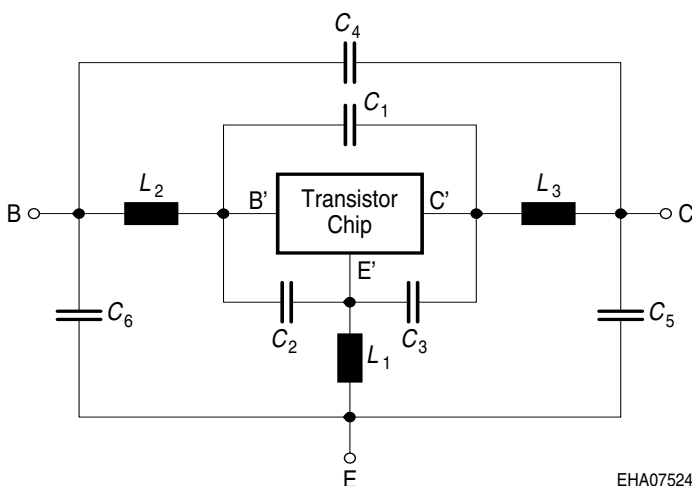
SPICE Parameter (Gummel-Poon Model, Berkley-SPICE 2G.6 Syntax):

Transistor Chip Data:

IS =	9.965	fA	BF =	116.376	-	NF =	1.107	-
VAF =	27.69	V	IKF =	736	mA	ISE =	0.2676	fA
NE =	1.64	-	BR =	22.802	-	NR =	1.056	-
VAR =	30	V	IKR =	0.011	A	ISC =	6.9739	pA
NC =	1.678	-	RB =	9.71	Ω	IRB =	0.2564	mA
RBM =	1.322	Ω	RE =	221	m Ω	RC =	0.101	Ω
CJE =	116.7	fF	VJE =	0.782	V	MJE =	0.5	-
TF =	8.789	ps	XTF =	0.496	-	VTF =	0.338	V
ITF =	1.529	mA	PTF =	0	deg	CJC =	840	fF
VJC =	6.949	V	MJC =	0.472	-	XCJC =	0.202	-
TR =	6.949	ns	CJS =	0	fF	VJS =	0.75	V
MJS =	0	-	NK =	0.5	-	EG =	1.11	eV
XTI =	0	-	FC =	0.975		TNOM	300	K

All parameters are ready to use, no scalling is necessary. Extracted on behalf of Infineon Technologies AG by:
Institut für Mobil- und Satellitentechnik (IMST)

Package Equivalent Circuit:

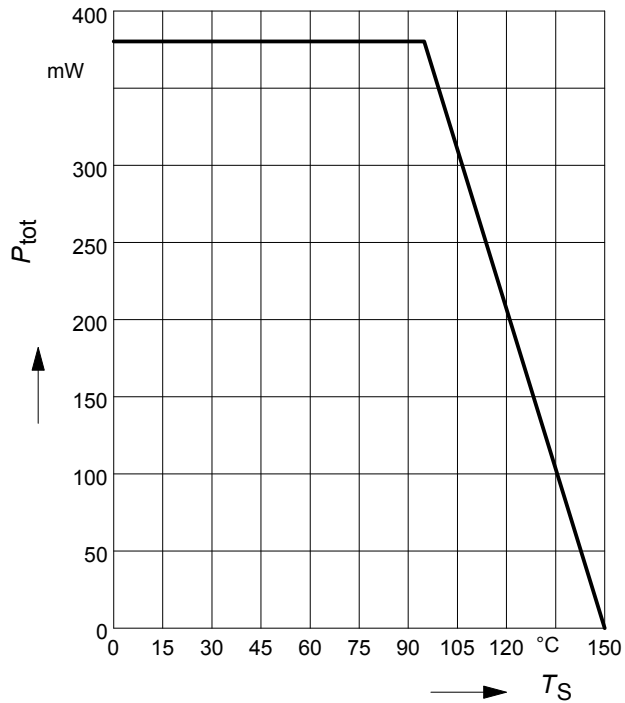


$L_1 =$	0.556	nH
$L_2 =$	0.675	nH
$L_3 =$	0.381	nH
$C_1 =$	43	fF
$C_2 =$	123	fF
$C_3 =$	66	fF
$C_4 =$	10	fF
$C_5 =$	36	fF
$C_6 =$	47	fF

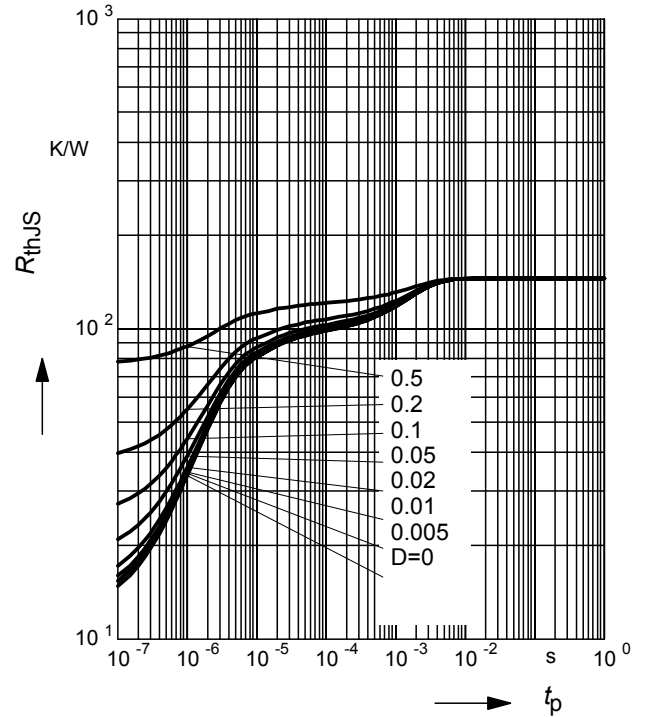
Valid up to 6GHz

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 $P_{\text{tot}} = f(T_S)$

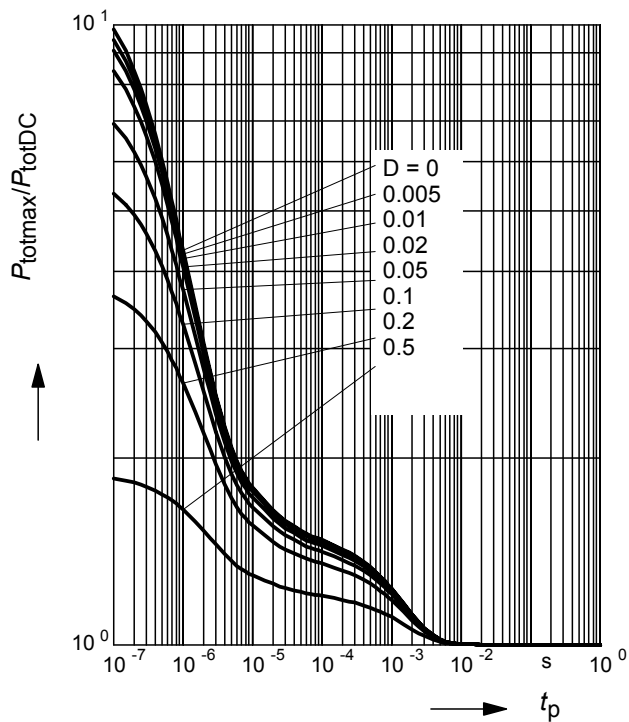


Permissible Pulse Load $R_{\text{thJS}} = f(t_p)$



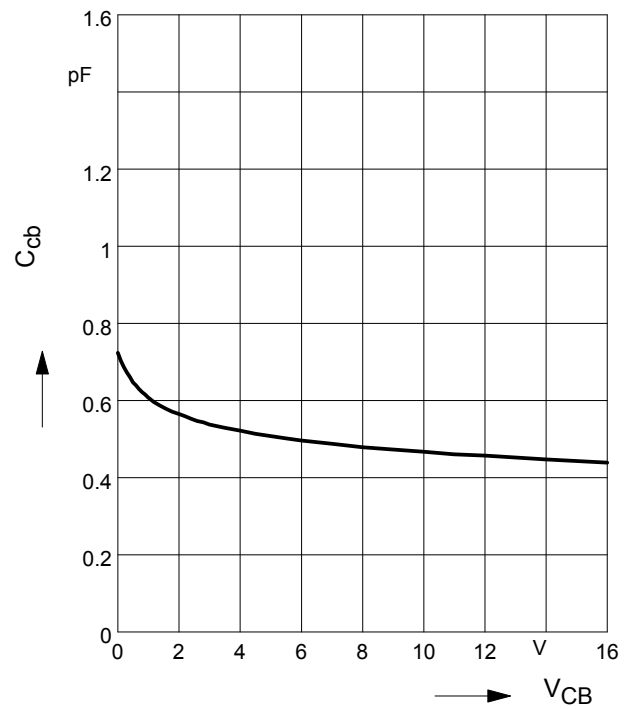
Permissible Pulse Load

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



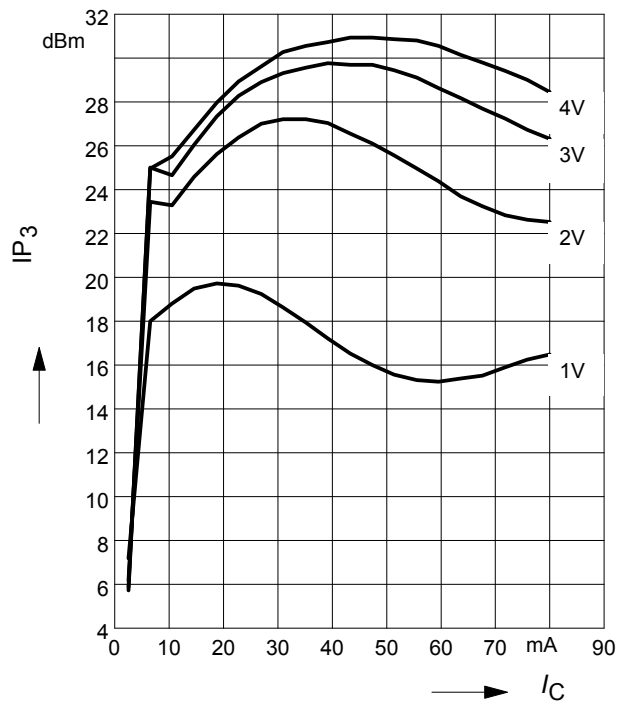
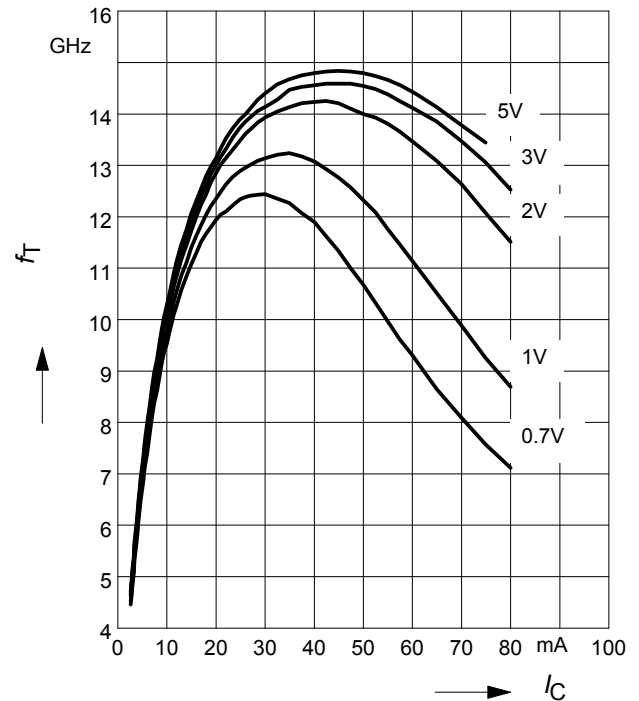
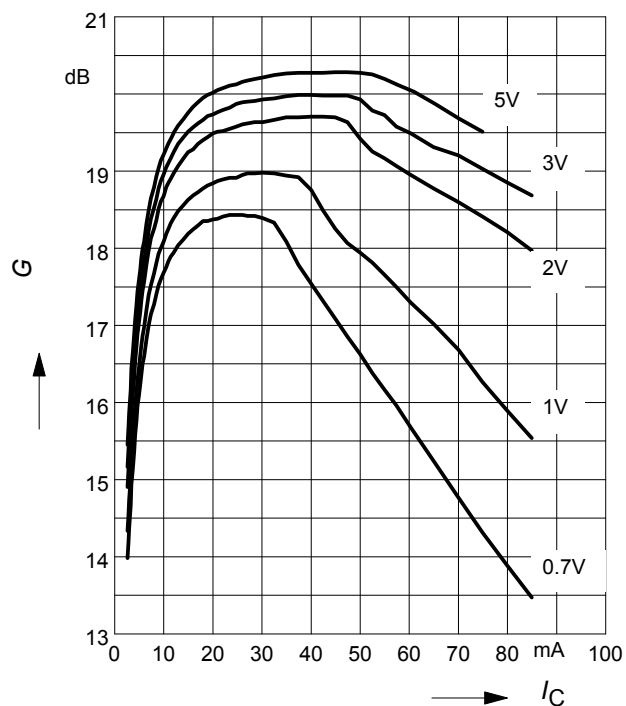
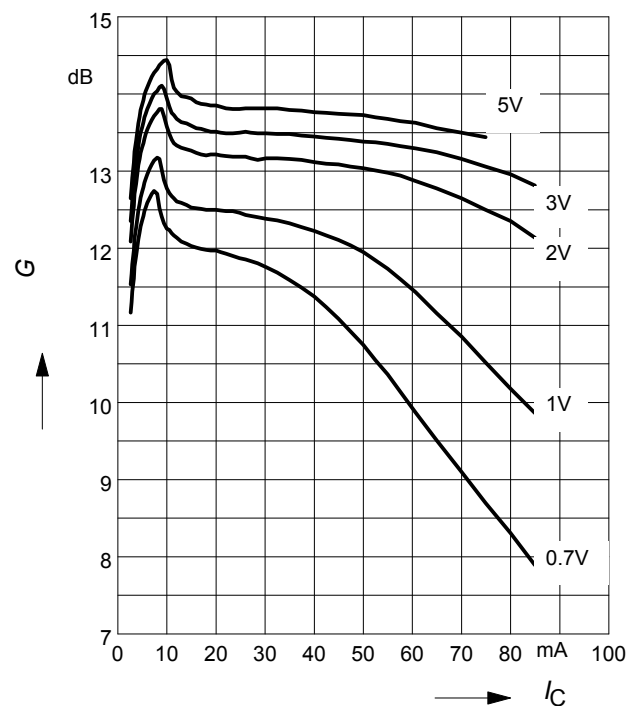
Collector-base capacitance $C_{\text{cb}} = f(V_{\text{CB}})$

$f = 1\text{ MHz}$



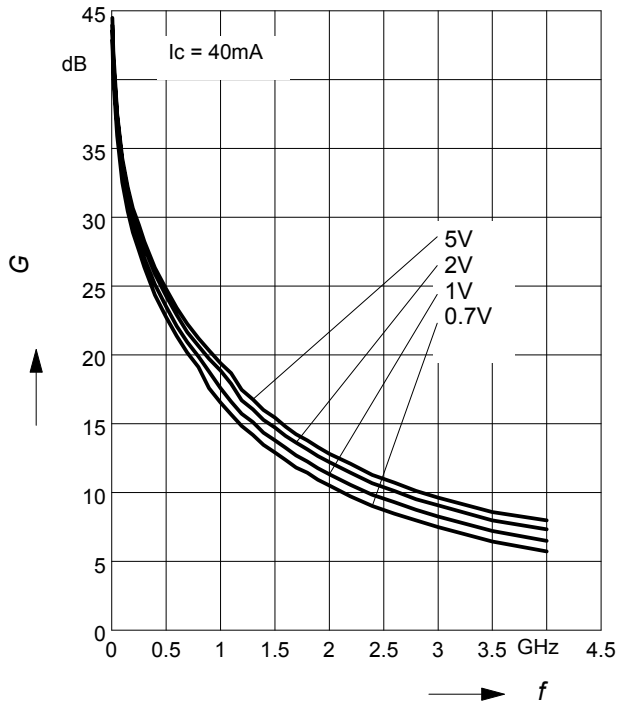
Third order Intercept Point $IP_3 = f(I_C)$

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

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

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

Power gain $G_{ma}, G_{ms} = f(I_C)$
 $f = 0.9\text{GHz}$
 V_{CE} = parameter

Power gain $G_{ma}, G_{ms} = f(I_C)$
 $f = 1.8\text{GHz}$
 V_{CE} = parameter


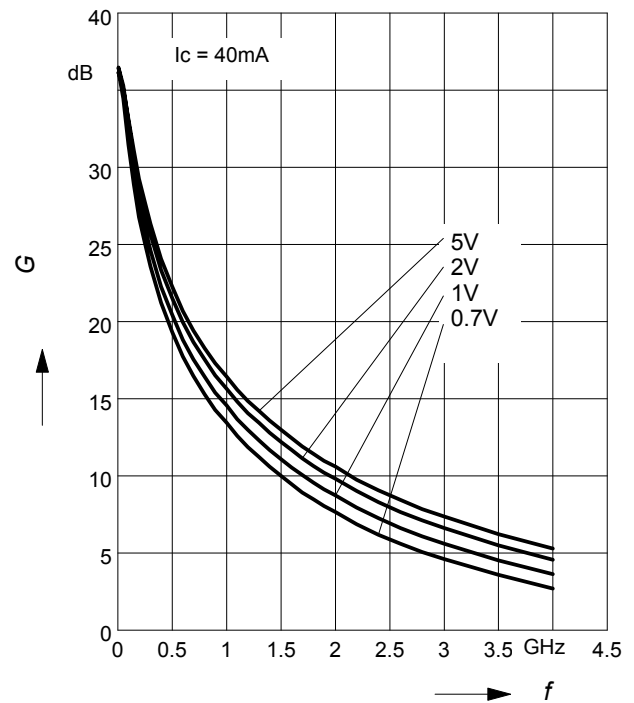
Power Gain G_{ma} , $G_{ms} = f(f)$

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



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

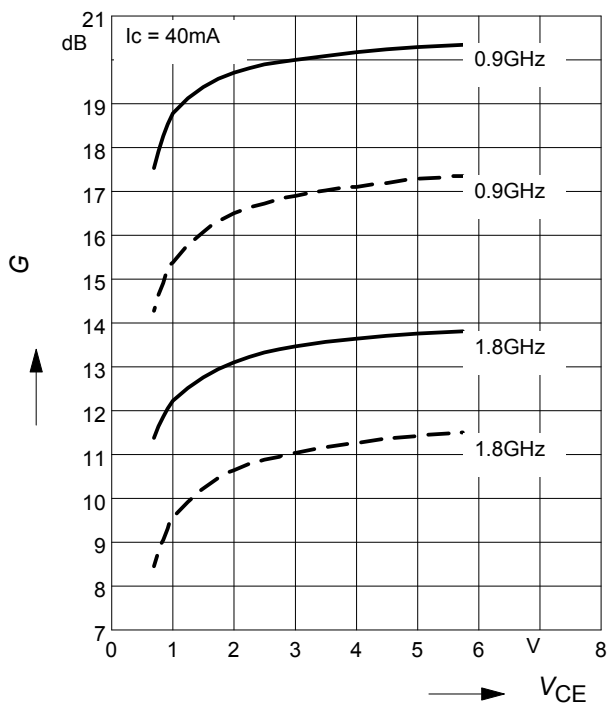
$V_{CE} = \text{parameter}$



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

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

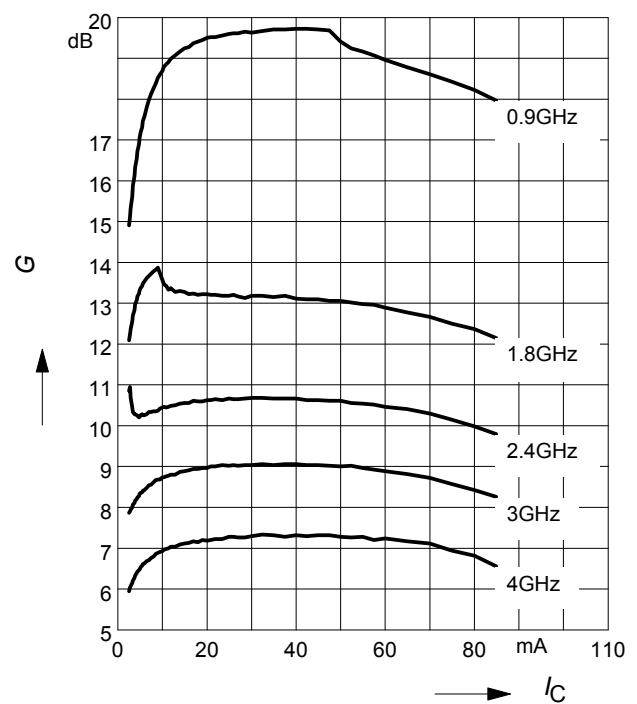
$f = \text{parameter}$



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

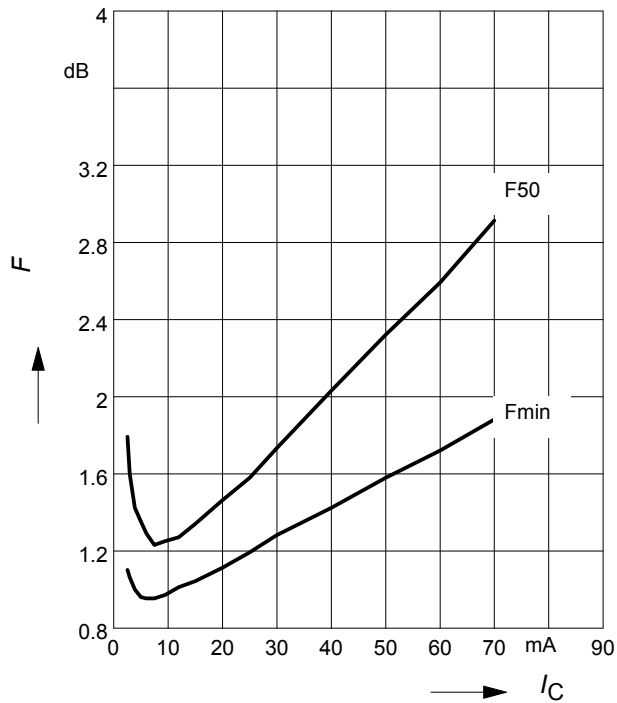
$V_{CE} = 2V$

$f = \text{parameter}$



Noise figure $NF = f(I_C)$

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



Source impedance for min.

noise figure vs. frequency

$V_{CE} = 3 \text{ V}$

