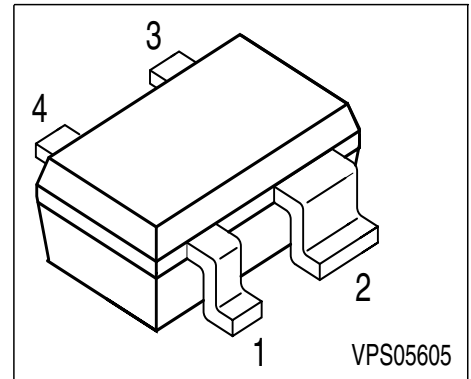


**NPN Silicon Germanium RF Transistor**

- 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  $F = 1.3$  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



**ESD: Electrostatic discharge sensitive device, observe handling precaution!**

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

**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 <sup>1)</sup> $T_S \leq 90$ °C	$P_{tot}$	200	mW
Junction temperature	$T_j$	150	°C
Ambient temperature	$T_A$	-65 ... 150	
Storage temperature	$T_{stg}$	-65 ... 150	

<sup>1)</sup>  $T_S$  is measured on the collector lead at the soldering point to the pcb

**Thermal Resistance**

Parameter	Symbol	Value	Unit
Junction - soldering point <sup>1)</sup>	$R_{thJS}$	$\leq 300$	K/W

**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	4.5	-	V
Collector-emitter cutoff current $V_{CE} = 13 \text{ V}, V_{BE} = 0$	$I_{CES}$	-	-	30	$\mu\text{A}$
Collector-base cutoff current $V_{CB} = 5 \text{ V}, I_E = 0$	$I_{CBO}$	-	-	100	nA
Emitter-base cutoff current $V_{EB} = 0.5 \text{ V}, I_C = 0$	$I_{EBO}$	-	-	3	$\mu\text{A}$
DC current gain $I_C = 30 \text{ mA}, V_{CE} = 3 \text{ V}, \text{ pulse measured}$	$h_{FE}$	110	180	270	-

<sup>1)</sup>For calculation of  $R_{thJA}$  please refer to Application Note Thermal Resistance

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

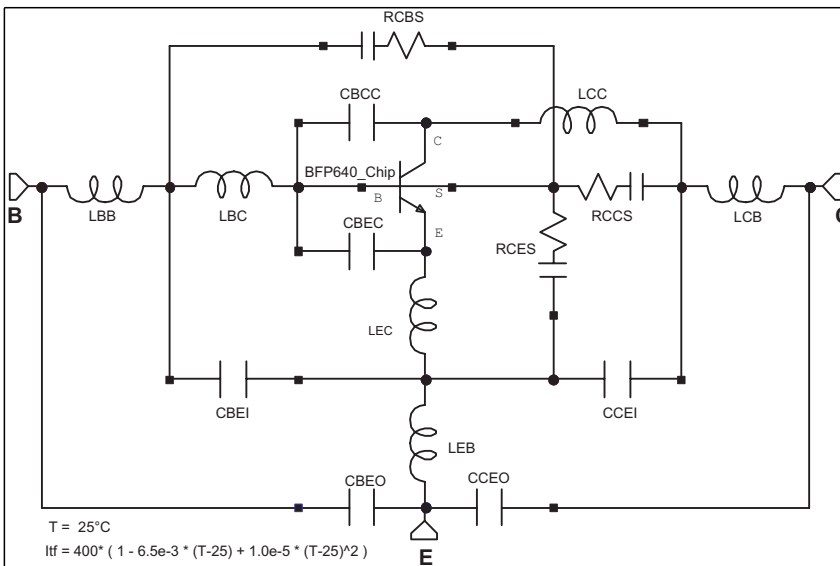
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>AC Characteristics (verified by random sampling)</b>					
Transition frequency $I_C = 30\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $f = 1\text{ GHz}$	$f_T$	30	40	-	GHz
Collector-base capacitance $V_{CB} = 3\text{ V}$ , $f = 1\text{ MHz}$	$C_{cb}$	-	0.09	0.2	pF
Collector emitter capacitance $V_{CE} = 3\text{ V}$ , $f = 1\text{ MHz}$	$C_{ce}$	-	0.23	-	
Emitter-base capacitance $V_{EB} = 0.5\text{ V}$ , $f = 1\text{ MHz}$	$C_{eb}$	-	0.5	-	
Noise figure $I_C = 5\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $f = 1.8\text{ GHz}$ , $Z_S = Z_{Sopt}$ $I_C = 5\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $f = 6\text{ GHz}$ , $Z_S = Z_{Sopt}$	$F$	-	0.65 1.3	-	dB
Power gain, maximum stable <sup>1)</sup> $I_C = 30\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $Z_S = Z_{Sopt}$ , $Z_L = Z_{Lopt}$ , $f = 1.8\text{ GHz}$	$G_{ms}$	-	24	-	dB
Power gain, maximum available <sup>1)</sup> $I_C = 30\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $Z_S = Z_{Sopt}$ , $Z_L = Z_{Lopt}$ , $f = 6\text{ GHz}$	$G_{ma}$	-	12.5	-	dB
Transducer gain $I_C = 30\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $Z_S = Z_L = 50\ \Omega$ , $f = 1.8\text{ GHz}$ $I_C = 30\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $Z_S = Z_L = 50\ \Omega$ , $f = 6\text{ GHz}$	$ S_{21e} ^2$	-	21 10.5	-	dB
Third order intercept point at output <sup>2)</sup> $V_{CE} = 3\text{ V}$ , $I_C = 30\text{ mA}$ , $f = 1.8\text{ GHz}$ , $Z_S = Z_L = 50\ \Omega$	$IP_3$	-	26.5	-	dBm
1dB Compression point at output $I_C = 30\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $Z_S = Z_L = 50\ \Omega$ , $f = 1.8\text{ GHz}$	$P_{-1dB}$	-	13	-	

<sup>1)</sup>  $G_{ma} = |S_{21e} / S_{12e}| (k - (k^2 - 1)^{1/2})$ ,  $G_{ms} = |S_{21e} / S_{12e}|$ 
<sup>2)</sup>  $IP_3$  value depends on termination of all intermodulation frequency components.  
Termination used for this measurement is  $50\ \Omega$  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 scaling is necessary. Extracted on behalf of Infineon Technologies AG by: Institut für Mobil- und Satellitentechnik (IMST)

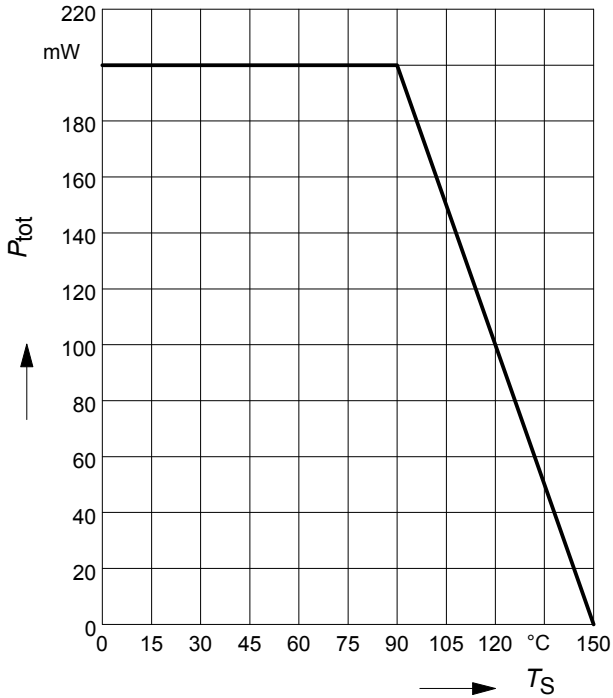
**Package Equivalent Circuit:**


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

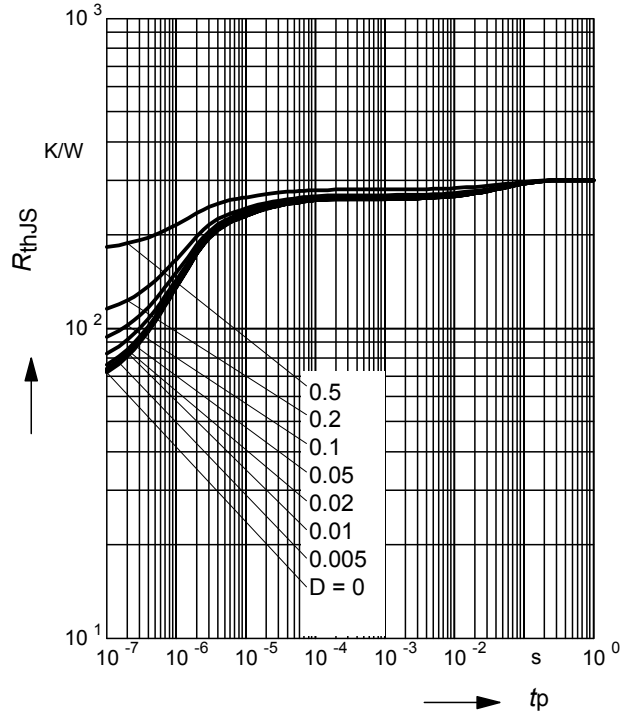
For examples and ready to use parameters please contact your local Infineon Technologies distributor or sales office to obtain a Infineon Technologies CD-ROM or see Internet: <http://www.infineon.com/silicondiscretet>

Valid up to 6GHz

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

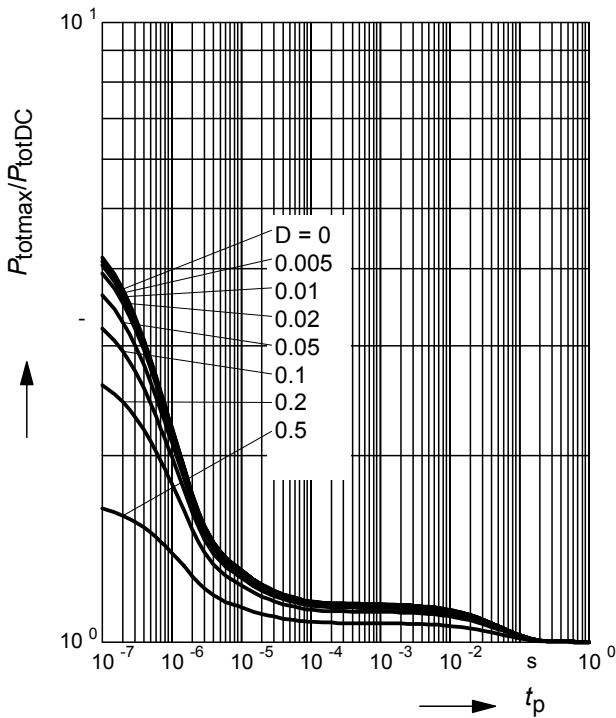


**Permissible Pulse Load  $R_{thJS} = f(t_p)$**



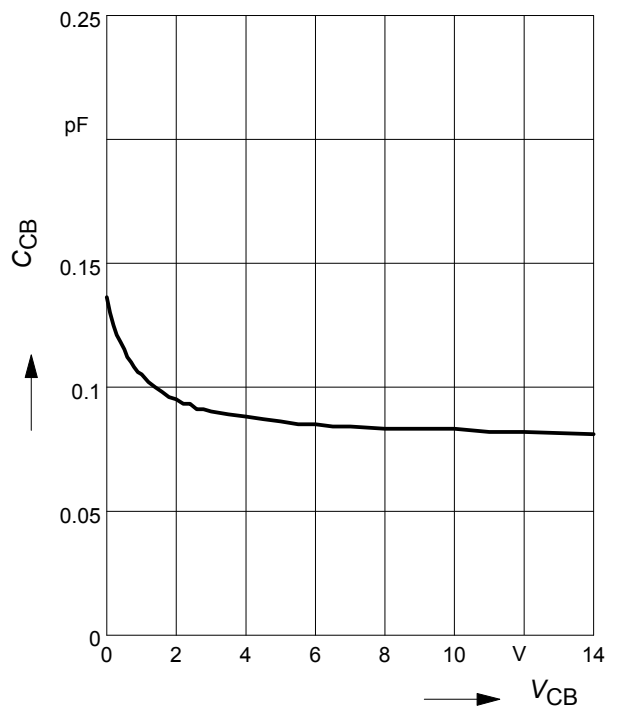
**Permissible Pulse Load**

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



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

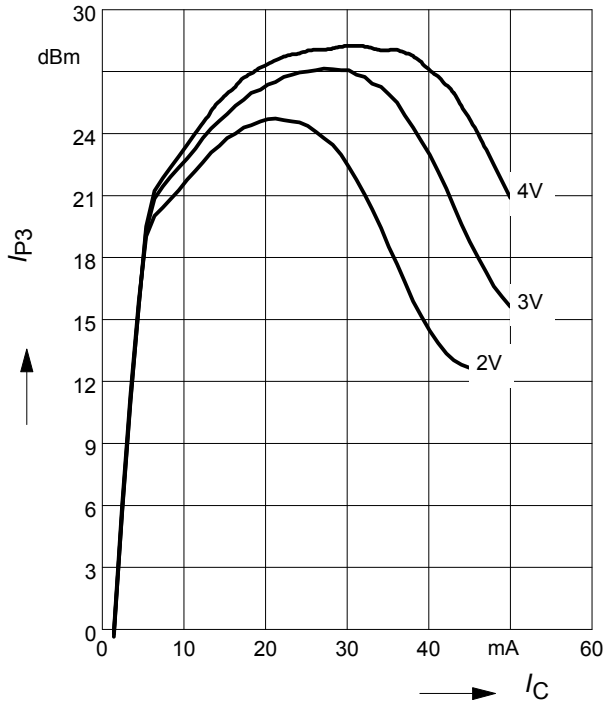
$f = 1\text{MHz}$



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

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

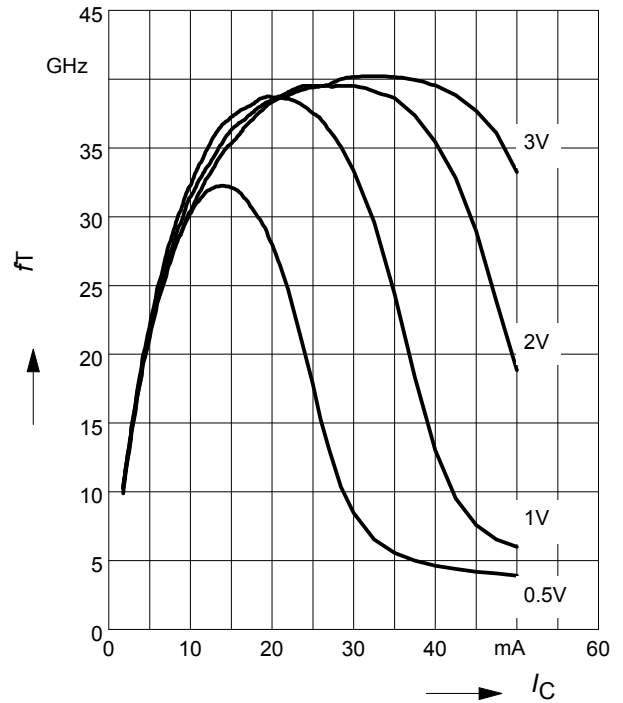
$V_{CE}$  = parameter,  $f = 1.8\text{ GHz}$



**Transition frequency  $f_T=f(I_C)$**

$f = 1\text{ GHz}$

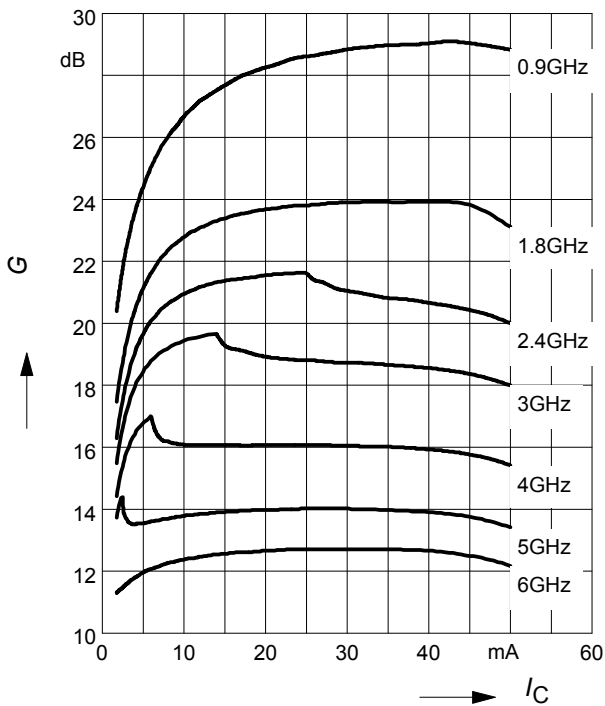
$V_{CE}$  = parameter



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

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

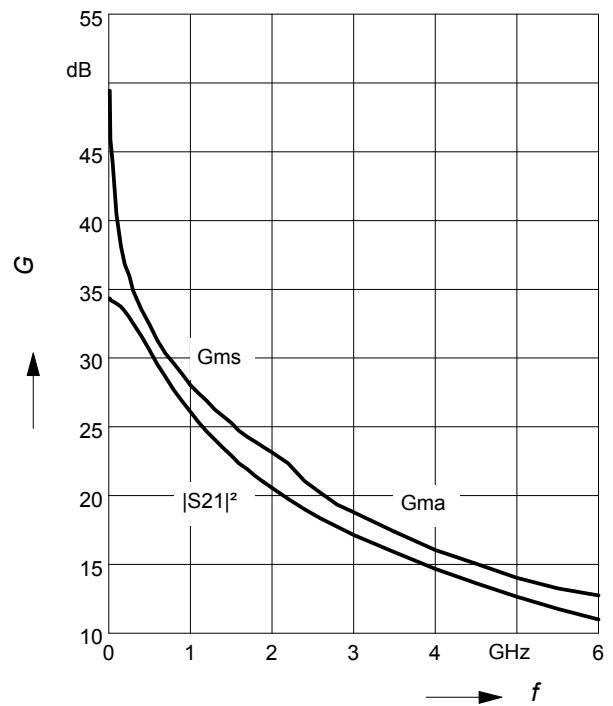
$f =$  parameter



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

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

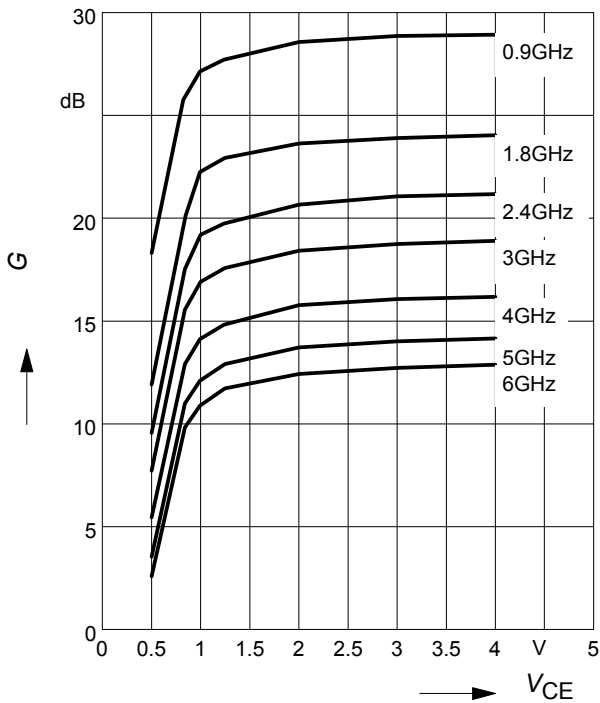
$V_{CE} = 3\text{ V}, I_C = 30\text{ mA}$



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

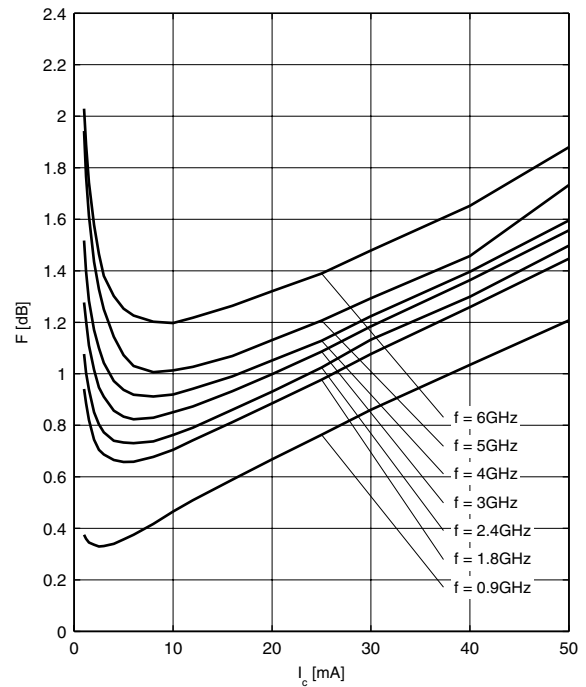
$I_C = 30\text{mA}$

$f = \text{parameter}$



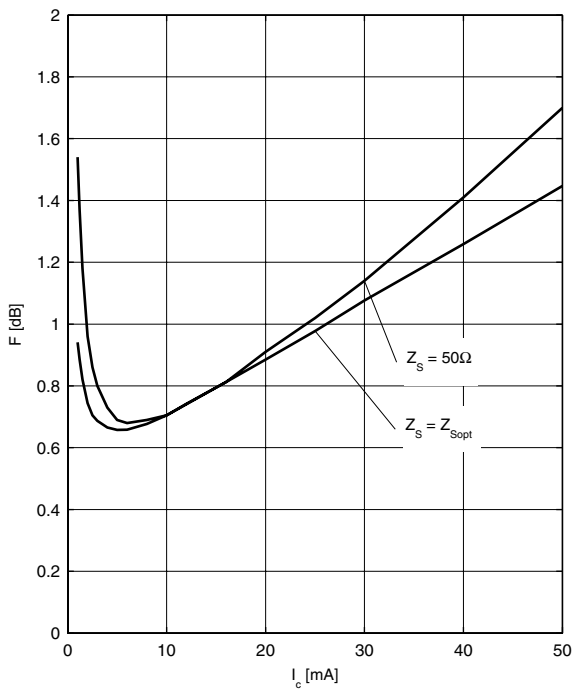
**Noise figure  $F = f(I_C)$**

$V_{CE} = 3\text{V}$ ,  $Z_S = Z_{Sopt}$



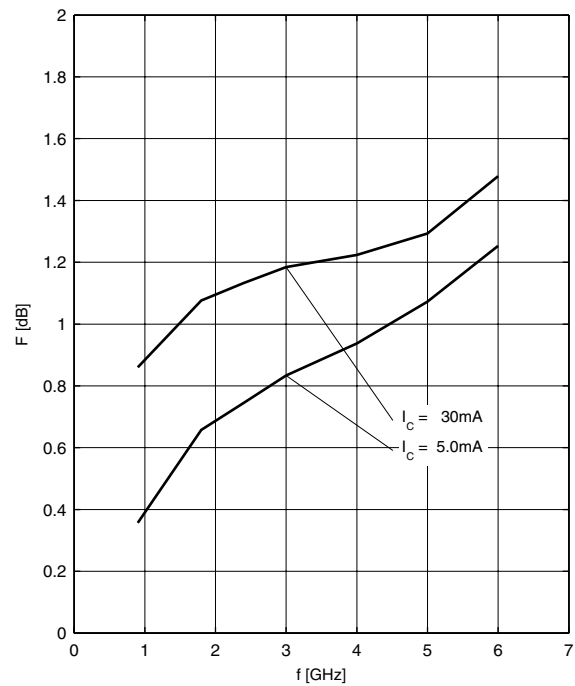
**Noise figure  $F = f(I_C)$**

$V_{CE} = 3\text{V}$ ,  $f = 1.8\text{GHz}$



**Noise figure  $F = f(f)$**

$V_{CE} = 3\text{V}$ ,  $Z_S = Z_{Sopt}$



**Source impedance for min.**

noise figure vs. frequency

$V_{CE} = 3\text{ V}$ ,  $I_C = 5\text{ mA}/30\text{ mA}$

