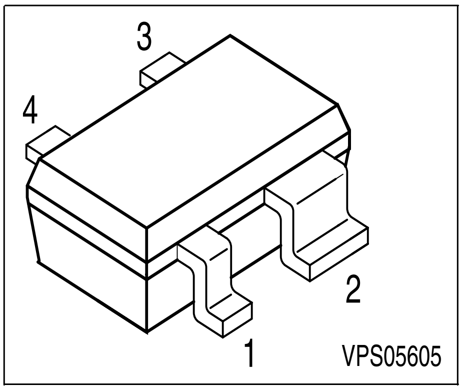
NPN Silicon Germanium RF Transistor



Preliminary data

- 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: **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

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	4	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}	≤ 300	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.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0 A	$V_{(BR)CEO}$	4	4.5	-	V
Collector-emitter cutoff current V_{CE} = 13 V, V_{BE} = 0 V	I_{CES}	-	-	30	µA
Collector -base cutoff current V_{CB} = 5 V, I_E = 0 A	I_{CBO}	-	-	100	nA
Emitter-base cutoff current V_{EB} = 0.5 V, I_C = 0 A	I_{EBO}	-	-	3	µA
DC current gain I_C = 30 mA, V_{CE} = 3 V	h_{FE}	100	180	320	-

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	-	40	-	GHz
Collector-base capacitance V_{CB} = 3 V, f = 1 MHz	C_{cb}	-	0.09	0.2	pF
Collector emitter capacitance V_{CE} = 3 V, f = 1 MHz	C_{ce}	-	0.23	-	
Emitter-base capacitance V_{EB} = 0.5 V, f = 1 MHz	C_{eb}	-	0.48	-	
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 1.3	 - -	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 I_C = 30 mA, V_{CE} = 3 V, $Z_S = Z_L$ = 50 Ω, 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, f = 1.8 GHz, $Z_S = Z_L$ = 50 Ω	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] $G_{ma} = |S_{21} / S_{12}| (k-(k^2-1)^{1/2})$, $G_{ms} = |S_{21} / S_{12}|$

[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

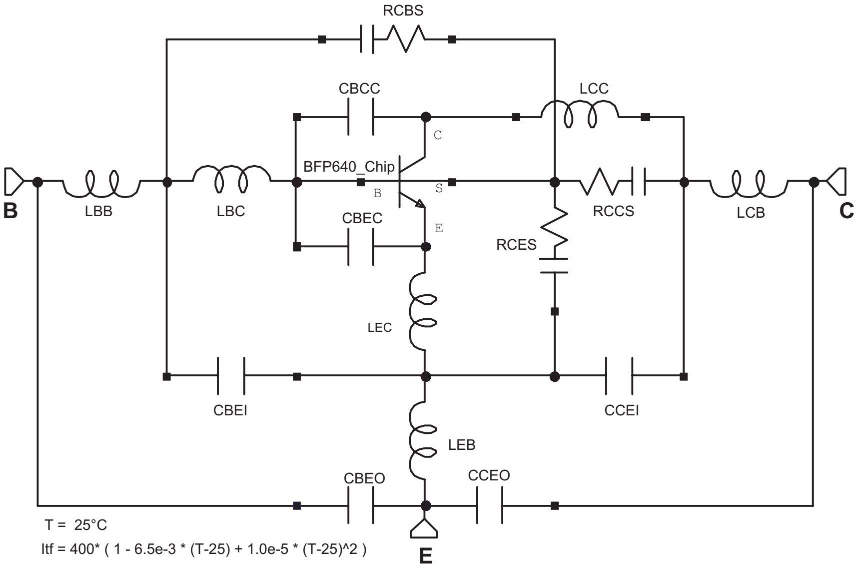
SPICE Parameter (Gummel-Poon Model, Berkley-SPICE 2G.6 Syntax):

Transitor Chip Data:

IS =	0.22	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	-	NK =	-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 necessery. Extracted on behalf of Infineon Technologies AG by: Institut für Mobil- und Satellitentechnik (IMST)

Package Equivalent Circuit:



T = 25°C

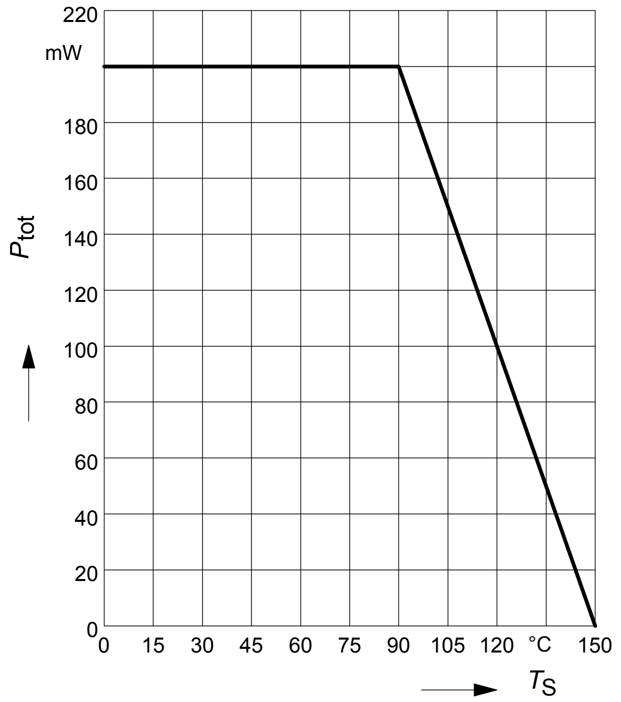
Itf = 400* (1 - 6.5e-3 * (T-25) + 1.0e-5 * (T-25)^2)

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

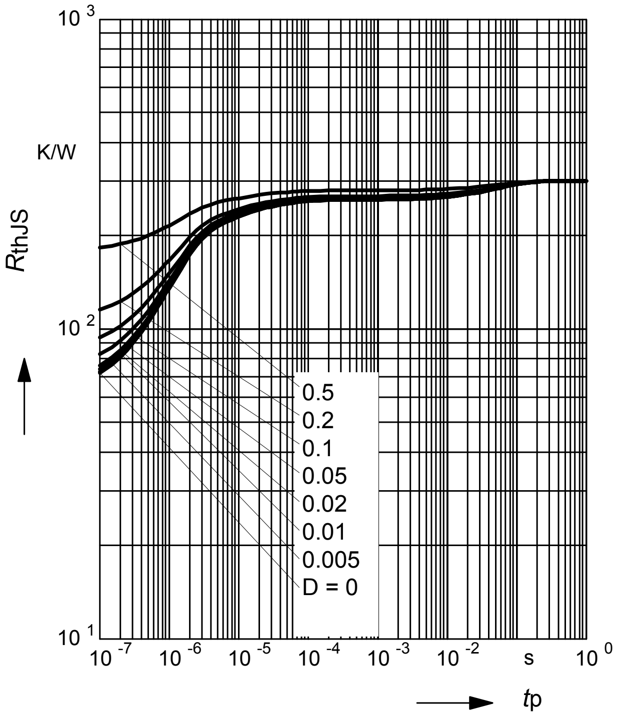
Valid up to 6GHz

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/silicondiscretes

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

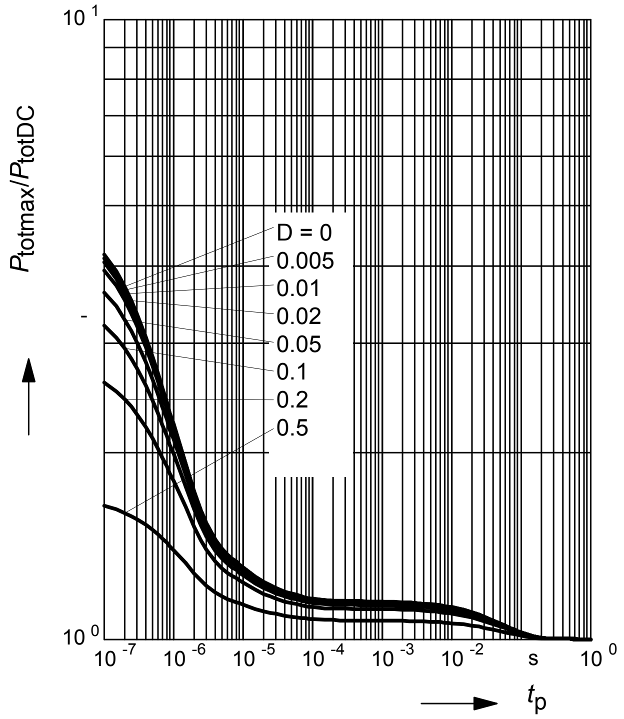


Permissible Pulse Load $R_{thJS} = f(t_p)$



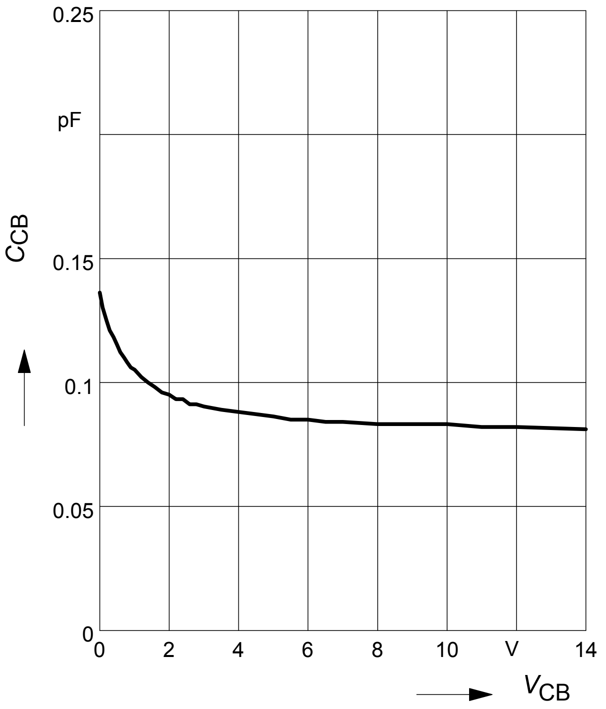
Permissible Pulse Load

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



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

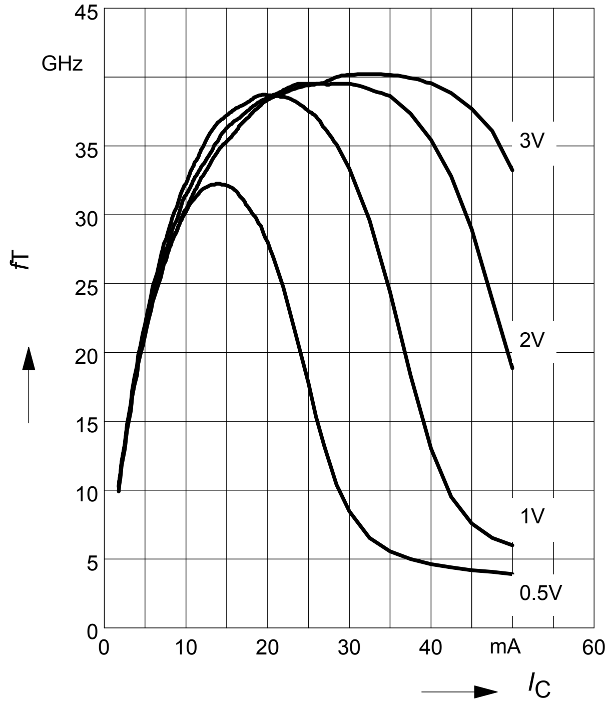
f = 1MHz



Transition frequency $f_T = f(I_C)$

f = 1GHz

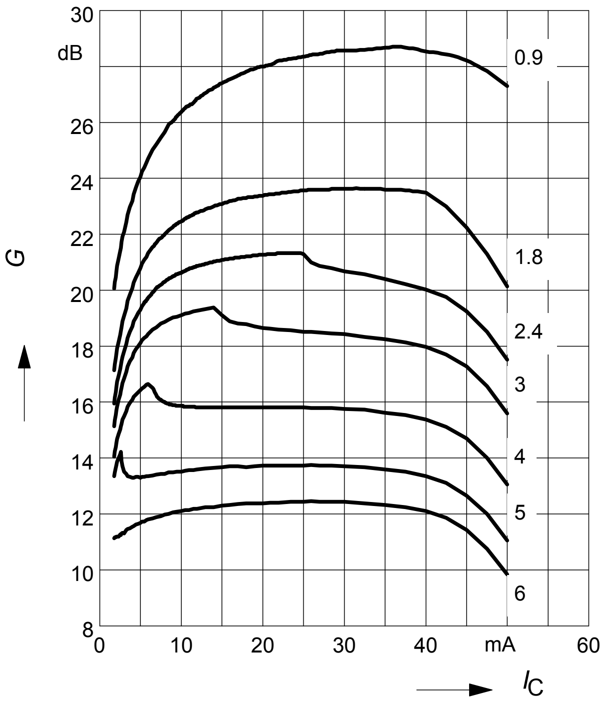
V_{CE} = parameter in V



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

V_{CE} = 2V

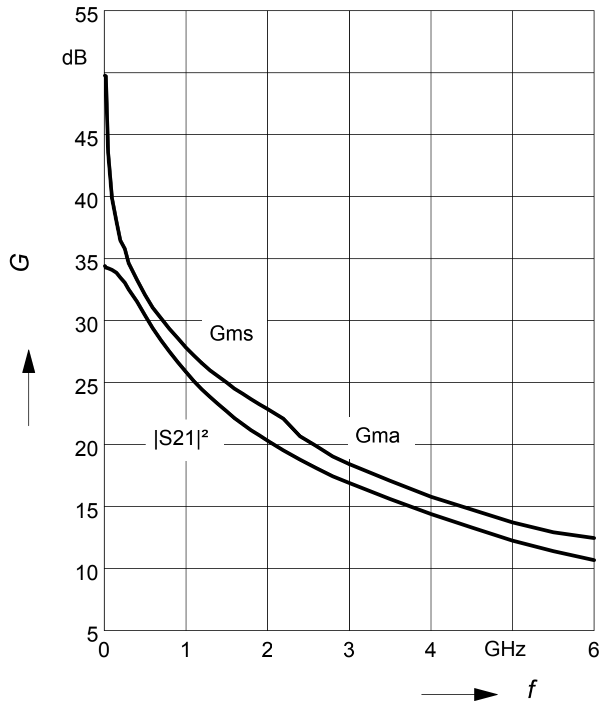
f = parameter in GHz



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

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

V_{CE} = 2V, I_C = 30mA



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

I_C = 30mA

f = parameter in GHz