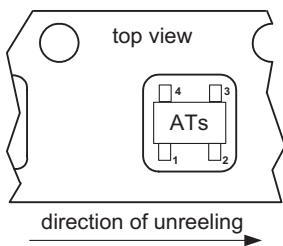
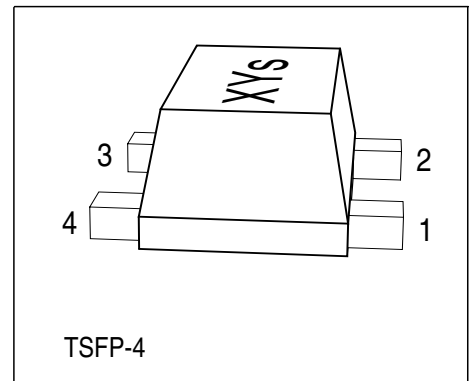


**NPN Silicon RF Transistor**

- For highest gain low noise amplifier at 1.8 GHz
- Outstanding  $G_{ms} = 20$  dB  
Noise Figure  $F = 0.9$  dB
- Gold metallization for high reliability
- SIEGET 45 - Line



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

Type	Marking	Pin Configuration						Package
BFP540F	ATs*	1=B	2=E	3=C	4=E	-	-	TSFP-4

\* Pin configuration fixed relative to marking (see package picture)

**Maximum Ratings**

Parameter	Symbol	Value	Unit
Collector-emitter voltage	$V_{CEO}$	4.5	V
Collector-emitter voltage	$V_{CES}$	14	
Collector-base voltage	$V_{CBO}$	14	
Emitter-base voltage	$V_{EBO}$	1	
Collector current	$I_C$	80	mA
Base current	$I_B$	8	
Total power dissipation <sup>1)</sup> $T_S \leq 80^\circ\text{C}$	$P_{tot}$	250	mW
Junction temperature	$T_j$	150	
Ambient temperature	$T_A$	-65 ... 150	
Storage temperature	$T_{stg}$	-65 ... 150	

**Thermal Resistance**

Parameter	Symbol	Value	Unit
Junction - soldering point <sup>2)</sup>	$R_{thJS}$	$\leq 280$	K/W

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

<sup>2)</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>DC Characteristics</b>					
Collector-emitter breakdown voltage $I_C = 1 \text{ mA}, I_B = 0$	$V_{(BR)CEO}$	4.5	5	-	V
Collector-emitter cutoff current $V_{CE} = 14 \text{ V}, V_{BE} = 0$	$I_{CES}$	-	-	10	$\mu\text{A}$
Collector-base cutoff current $V_{CB} = 5 \text{ V}, I_E = 0$	$I_{CBO}$	-	-	100	nA
Emitter-base cutoff current $V_{EB} = 0.5 \text{ V}, I_C = 0$	$I_{EBO}$	-	-	10	$\mu\text{A}$
DC current gain $I_C = 20 \text{ mA}, V_{CE} = 3.5 \text{ V}$	$h_{FE}$	50	110	200	-

**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 $I_C = 50 \text{ mA}$ , $V_{CE} = 4 \text{ V}$ , $f = 1 \text{ GHz}$	$f_T$	21	30	-	GHz
Collector-base capacitance $V_{CB} = 2 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{cb}$	-	0.14	0.24	pF
Collector emitter capacitance $V_{CE} = 2 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{ce}$	-	0.3	-	
Emitter-base capacitance $V_{EB} = 0.5 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{eb}$	-	0.6	-	
Noise figure $I_C = 5 \text{ mA}$ , $V_{CE} = 2 \text{ V}$ , $f = 1.8 \text{ GHz}$ , $Z_S = Z_{Sopt}$ $I_C = 5 \text{ mA}$ , $V_{CE} = 2 \text{ V}$ , $f = 3 \text{ GHz}$ , $Z_S = Z_{Sopt}$	$F$	-	0.9	1.4	dB
		-	1.3	-	
Power gain, maximum available <sup>1)</sup> $I_C = 20 \text{ mA}$ , $V_{CE} = 2 \text{ V}$ , $Z_S = Z_{Sopt}$ , $Z_L = Z_{Lopt}$ , $f = 1.8 \text{ GHz}$ $I_C = 20 \text{ mA}$ , $V_{CE} = 2 \text{ V}$ , $Z_S = Z_{Sopt}$ , $Z_L = Z_{Lopt}$ , $f = 3 \text{ GHz}$	$G_{ma}$	-	20	-	
		-	14.5	-	
Transducer gain $I_C = 20 \text{ mA}$ , $V_{CE} = 2 \text{ V}$ , $Z_S = Z_L = 50 \Omega$ , $f = 1.8 \text{ GHz}$ $I_C = 20 \text{ mA}$ , $V_{CE} = 2 \text{ V}$ , $Z_S = Z_L = 50 \Omega$ , $f = 3 \text{ GHz}$	$ S_{21e} ^2$	15.5	18	-	dB
		-	13	-	
Third order intercept point at output <sup>2)</sup> $V_{CE} = 2 \text{ V}$ , $I_C = 20 \text{ mA}$ , $f = 1.8 \text{ GHz}$ , $Z_S = Z_L = 50 \Omega$	$IP_3$	-	24.5	-	dBm
1dB Compression point at output $I_C = 20 \text{ mA}$ , $V_{CE} = 2 \text{ V}$ , $Z_S = Z_L = 50 \Omega$ , $f = 1.8 \text{ GHz}$	$P_{-1dB}$	-	11	-	

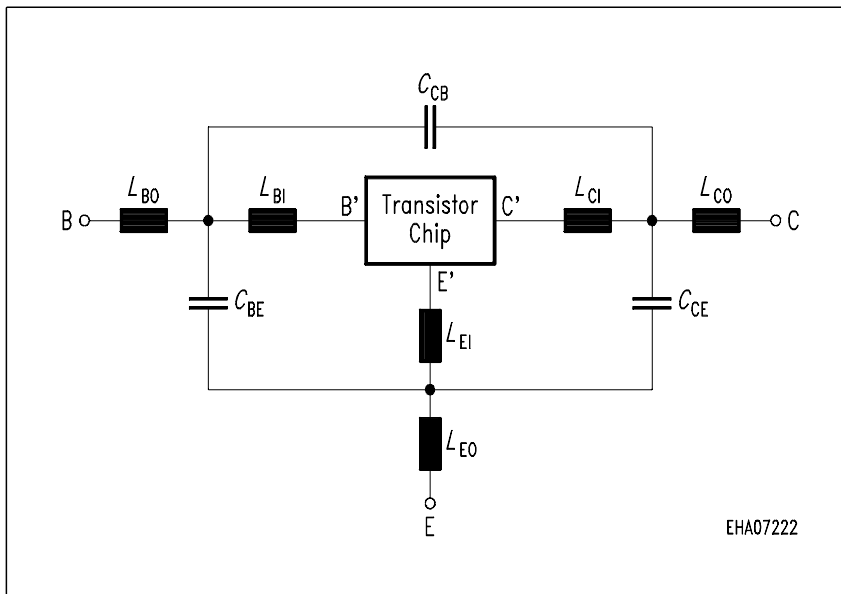
$$^1G_{ma} = |S_{21e} / S_{12e}| (k - (k^2 - 1)^{1/2}), G_{ms} = |S_{21e} / S_{12e}|$$

<sup>2</sup>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):**
**Transistor Chip Data:**

IS =	82.84	aA	BF =	107.5	-	NF =	1	-
VAF =	28.383	V	IKF =	0.48731	A	ISE =	11.15	fA
NE =	3.19	-	BR =	5.5	-	NR =	1	-
VAR =	19.705	V	IKR =	0.02	A	ISC =	19.237	aA
NC =	1.172	-	RB =	5.4	$\Omega$	IRB =	0.72983	mA
RBM =	1.3	$\Omega$	RE =	0.31111	-	RC =	4	$\Omega$
CJE =	1.8063	fF	VJE =	0.8051	V	MJE =	0.46576	-
TF =	6.76	ps	XTF =	0.4219	-	VTF =	0.23794	V
ITF =	1	mA	PTF =	0	deg	CJC =	234	fF
VJC =	0.81969	V	MJC =	0.30232	-	XCJC =	0.3	-
TR =	2.324	ns	CJS =	0	fF	VJS =	0.75	V
MJS =	0	-	XTB =	0	-	EG =	1.11	eV
XTI =	3	-	FC =	0.73234	-	TNOM	300	K

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

**Package Equivalent Circuit:**


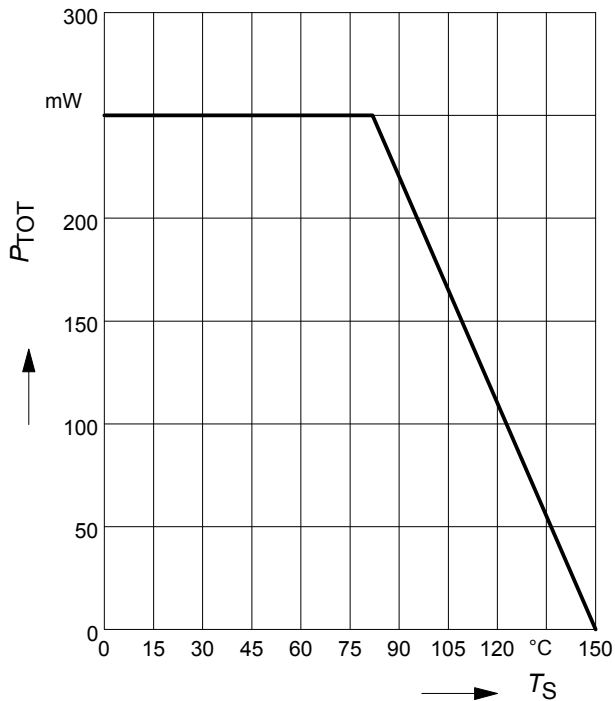
$L_{BI}$ =	0.42	nH
$L_{BO}$ =	0.22	nH
$L_{EI}$ =	0.26	nH
$L_{EO}$ =	0.28	nH
$L_{CI}$ =	0.35	pH
$L_{CO}$ =	0.22	nH
$C_{BE}$ =	34	fF
$C_{BC}$ =	2	fF
$C_{CE}$ =	33	fF
$K_{BO-EO}$ =	0.1	-
$K_{BO-CO}$ =	0.01	-
$K_{EO-CO}$ =	0.11	-
$K_{CI-EI}$ =	-0.05	-
$K_{BI-CI}$ =	-0.08	-
$K_{EI-CI}$ =	0.2	-
$R_{LBI}$ =	0.15	$\Omega$
$R_{LEI}$ =	0.11	$\Omega$
$R_{LCI}$ =	0.13	$\Omega$

The TSFP-4 package has two emitter leads. To avoid high complexity of the package equivalent circuit, both lead are combined in on electrical connection.  $R_{LxI}$  are series resistors for the inductance  $L_{xI}$  and  $K_{xa-yb}$  are the coupling coefficients between the inductance  $L_{xa}$  and  $L_{yb}$ . The referencepins for the couple ports are B, E, C, B', E', C'.

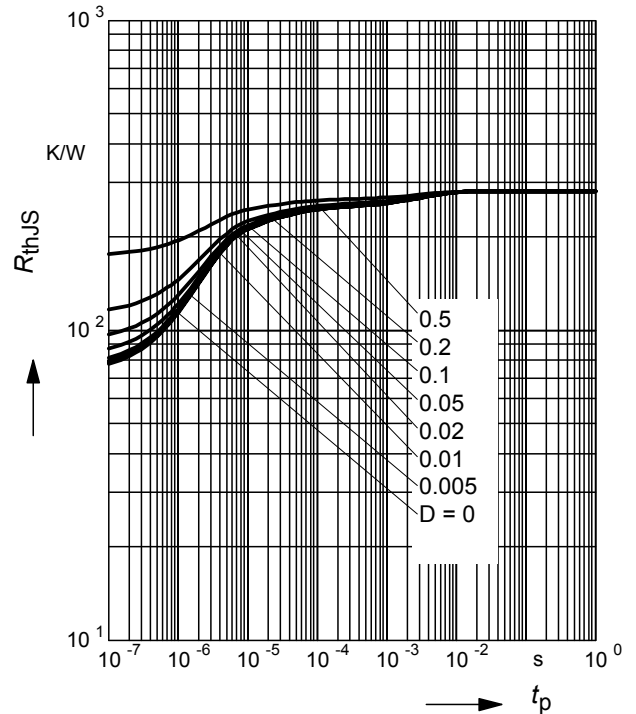
For examples and ready to use parameters please contact your local Infineon Technologies distributor or sales office to obtain a Infineon Technologies CD-ROM or see Internet: <http://www.infineon.com/silicondiscretetes>

Valid up to 6GHz

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

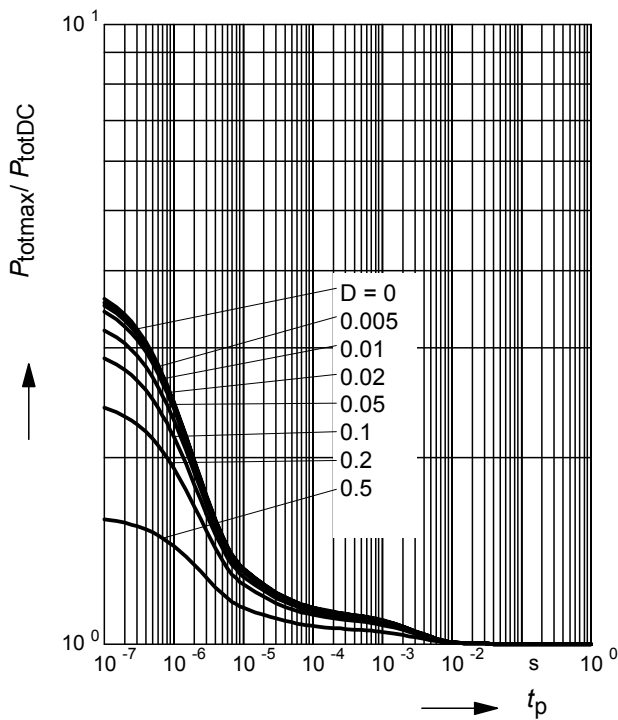


**Permissible Pulse Load  $R_{thJS} = f(t_p)$**



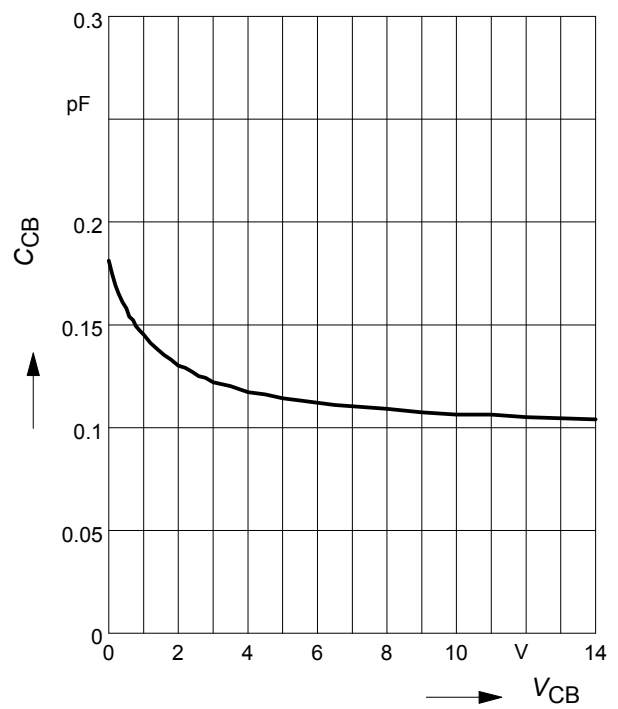
**Permissible Pulse Load**

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



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

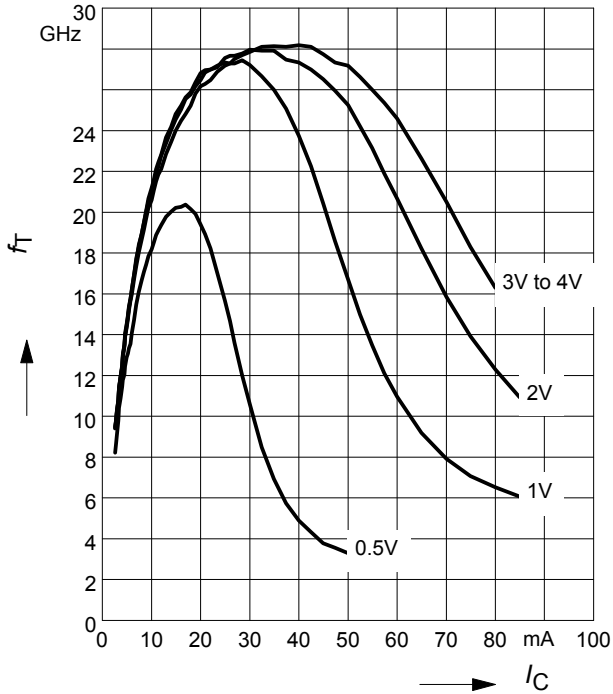
$f = 1\text{MHz}$



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

$f = 1\text{GHz}$

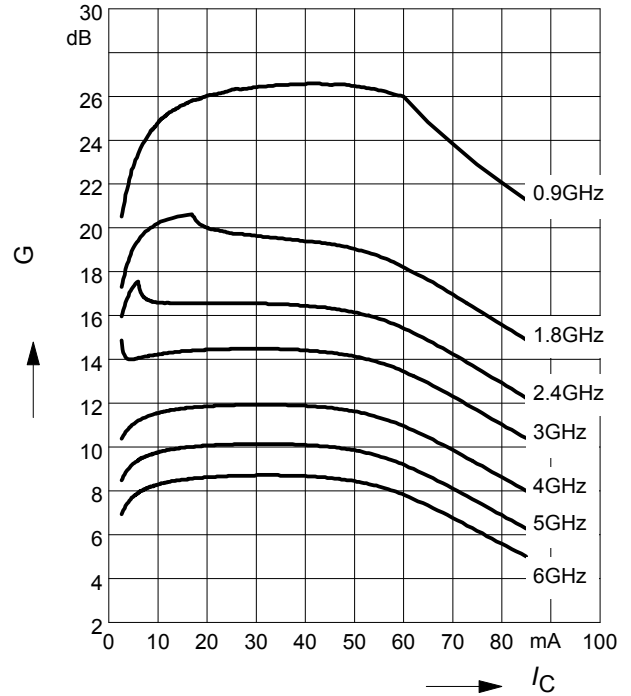
$V_{CE} = \text{Parameter in V}$



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

$V_{CE} = 2\text{V}$

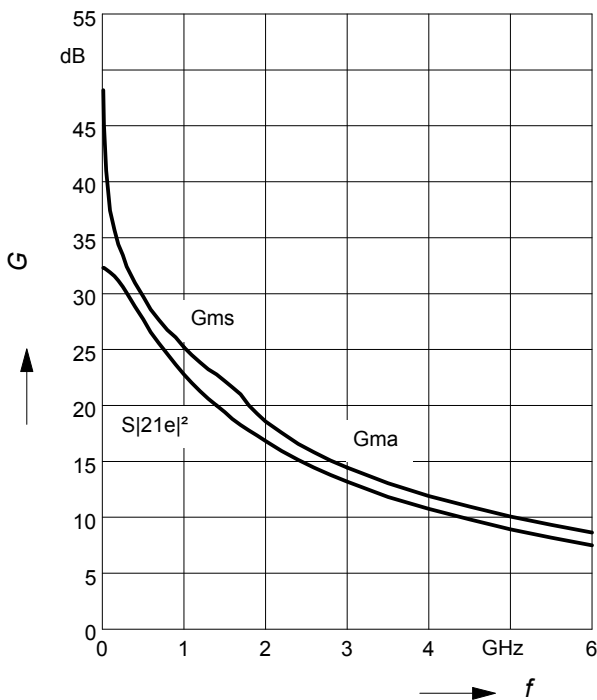
$f = \text{Parameter in GHz}$



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

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

$V_{CE} = 2\text{V}, I_C = 20\text{mA}$



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

$I_C = 20\text{mA}$

$f = \text{Parameter in GHz}$

