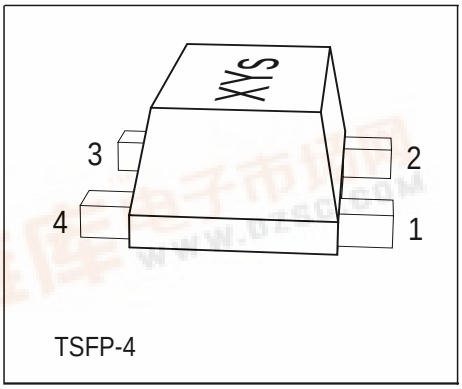
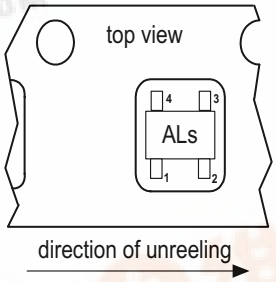
NPN Silicon RF Transistor

Preliminary data

- For low current applications
- Smallest Package 1.4 x 0.8 x 0.59mm
- Noise figure F = 1.25 dB at 1.8 GHz
  outstanding G_{ms} = 23 dB at 1.8 GHz
- Transition frequency f_T = 25 GHz
- Gold metallization for high reliability
- **SIEGET ® 25** GHz f_T - **Line**



TSFP-4



direction of unreeling

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

Type	Marking	Pin Configuration				Package
BFP405F	ALs	1=B	2=E	3=C	4=E	TSFP-4

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	4.5	V
Collector-base voltage	V_{CBO}	15	
Emitter-base voltage	V_{EBO}	1.5	
Collector current	I_C	12	mA
Base current	I_B	1	
Total power dissipation $T_S \leq 122°C$ 1)	P_{tot}	55	mW
Junction temperature	T_j	150	°C
Ambient temperature	T_A	-65 ... 150	
Storage temperature	T_{stg}	-65 ... 150	

Thermal Resistance

Junction - soldering point2)	R_{thJS}	≤ 500	K/W

1 T_S is measured on the emitter 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	$V_{(BR)CEO}$	4.5	5	-	V
Collector-base cutoff current V_{CB} = 5 V, I_E = 0	I_{CBO}	-	-	150	nA
Emitter-base cutoff current V_{EB} = 1.5 V, I_C = 0	I_{EBO}	-	-	15	µA
DC current gain I_C = 5 mA, V_{CE} = 4 V	h_{FE}	50	90	150	-
AC characteristics (verified by random sampling)					
Transition frequency I_C = 10 mA, V_{CE} = 3 V, f = 2 GHz	f_T	18	25	-	GHz
Collector-base capacitance V_{CB} = 2 V, f = 1 MHz	C_{cb}	-	0.05	0.1	pF
Collector-emitter capacitance V_{CE} = 2 V, f = 1 MHz	C_{ce}	-	0.2	-	
Emitter-base capacitance V_{EB} = 0.5 V, f = 1 MHz	C_{eb}	-	0.25	-	
Noise figure I_C = 2 mA, V_{CE} = 2 V, Z_S = Z_{Sopt} , f = 1.8 GHz	F	-	1.25	-	dB
Power gain, maximum stable [1)] I_C = 5 mA, V_{CE} = 2 V, Z_S = Z_{Sopt}, Z_L = Z_{Lopt} , f = 1.8 GHz	G_{ms}	-	23	-	
Insertion power gain I_C = 5 mA, V_{CE} = 2 V, f = 1.8 GHz, Z_S = Z_L = 50Ω	$\|S_{21}\|^2$	-	18	-	
Third order intercept point at output[2)] I_C = 5 mA, V_{CE} = 2 V, Z_S=Z_L=50Ω, f = 1.8 GHz	IP_3	-	14	-	dBm
1dB Compression point at output[3)] I_C = 5 mA, V_{CE} = 2 V, f = 1.8 GHz, Z_S=Z_L =50Ω	P_{-1dB}	-	0	-	

[1] $G_{ms} = |S_{21} / S_{12}|$

[2] IP3 value depends on termination of all intermodulation frequency components. Termination used for this measurement is 50Ω from 0.1MHz to 6GHz.

[3] DC current no input power

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

Transistor Chip Data

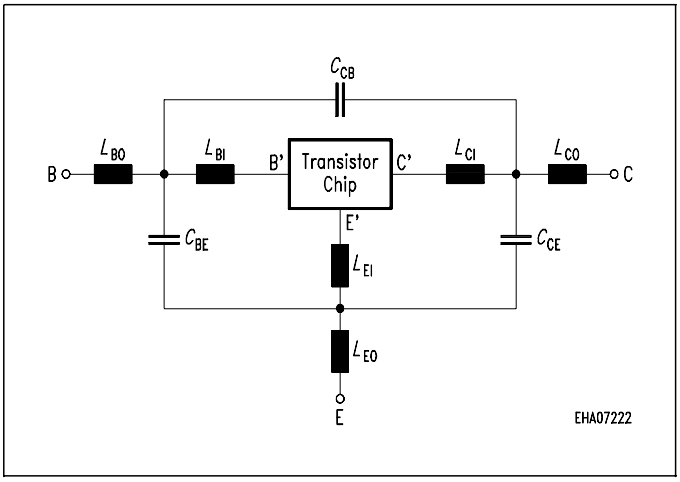
IS =	0.21024	fA	BF =	83.23	-	NF =	1.0405	-
VAF =	39.251	V	IKF =	0.16493	A	ISE =	15.761	fA
NE =	1.7763	-	BR =	10.526	-	NR =	0.96647	-
VAR =	34.368	V	IKR =	0.25052	A	ISC =	0.037223	fA
NC =	1.3152	-	RB =	15	Ω	IRB =	0.21215	A
RBM =	1.3491	Ω	RE =	1.9289		RC =	0.12691	Ω
CJE =	3.7265	fF	VJE =	0.70367	V	MJE =	0.37747	-
TF =	4.5899	ps	XTF =	0.3641	-	VTF =	0.19762	V
ITF =	1.3364	mA	PTF =	0	deg	CJC =	96.941	fF
VJC =	0.99532	V	MJC =	0.48652	-	XCJC =	0.08161	-
TR =	1.4935	ns	CJS =	0	fF	VJS =	0.75	V
MJS =	0	-	XTB =	0	-	EG =	1.11	eV
XTI =	3	-	FC =	0.99469	-	TNOM	300	K

C'-E'-Diode Data (Berkley-SPICE 2G.6 Syntax) :

IS =	2	fA	N =	1.02	-	RS =	20	Ω

All parameters are ready to use, no scaling is necessary

Package Equivalent Circuit:



L_{BO} =	0.22	nH	L_{BI} =	0.42	nH
L_{EO} =	0.28	nH	R_{LBI} =	0.15	Ω
L_{CO} =	0.22	nH	L_{EI} =	0.26	nH
K_{BO-EO} =	0.10	-	R_{LEI} =	0.11	Ω
K_{BO-CO} =	0.01	-	L_{CI} =	0.35	nH
K_{EO-CO} =	0.11	-	R_{LCI} =	0.13	Ω
C_{BE} =	34	fF	K_{CI-EI} =	-0.05	-
C_{BC} =	2	fF	K_{BI-CI} =	-0.08	-
C_{CE} =	33	fF	K_{BI-EI} =	0.20	-

Valid up to 6GHz

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

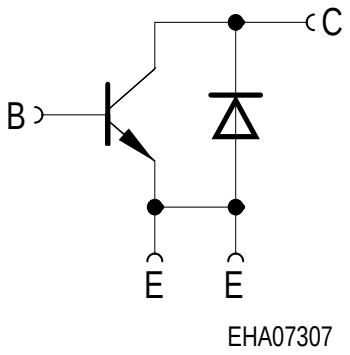
For examples and ready to use parameters please contact your local Infineon Technologies distributor or sales office to obtain a Infineon Technologies CD-ROM or see Internet: http://www.infineon.com/silicondiscretes

For non-linear simulation:

- Use transistor chip parameters in Berkeley SPICE 2G.6 syntax for all simulators.
- If you need simulation of the reverse characteristics, add the diode with the C'-E'- diode data between collector and emitter.
- Simulation of package is not necessary for frequencies < 100MHz. For higher frequencies add the wiring of package equivalent circuit around the non-linear transistor and diode model.

Note:

- This transistor is constructed in a common emitter configuration. This feature causes an additional reverse biased diode between emitter and collector, which does not effect normal operation.



Transistor Schematic Diagram

The common emitter configuration shows the following advantages:

- Higher gain because of lower emitter inductance.
- Power is dissipated via the grounded emitter leads, because the chip is mounted on copper emitter leadframe.

Please note, that the broadest lead is the emitter lead.