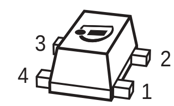
BFP405F

NPN Silicon RF Transistor*



- For low current applications
- Smallest Package 1.4 x 0.8 x 0.59 mm
- 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
- Pb-free (RoHS compliant) package[1)]
- Qualified according AEC Q101

* Short term description

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}		V
T_A > 0 °C		4.5	
$T_A \leq$ 0 °C		4.1	
Collector-emitter voltage	V_{CES}	15	
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[2)]	P_{tot}	55	mW
$T_S \leq$ 122 °C			
Junction temperature	T_j	150	°C
Ambient temperature	T_A	-65 ... 150	
Storage temperature	T_{stg}	-65 ... 150	

[1]Pb-containing package may be available upon special request
[2]T_S is measured on the collector lead at the soldering point to the pcb

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Thermal Resistance

Parameter	Symbol	Value	Unit
Junction - soldering point[1)]	R_{thJS}	≤ 500	K/W

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	-	V
Collector-emitter cutoff current V_{CE} = 15 V, V_{BE} = 0	I_{CES}	-	-	10	µA
Collector-base cutoff current V_{CB} = 5 V, I_E = 0	I_{CBO}	-	-	100	nA
Emitter-base cutoff current V_{EB} = 0.5 V, I_C = 0	I_{EBO}	-	-	1	µA
DC current gain I_C = 5 mA, V_{CE} = 4 V, pulse measured	h_{FE}	60	95	130	-

[1]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.	
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, V_{BE} = 0 , emitter grounded	C_{cb}	-	0.05	0.1	pF
Collector emitter capacitance V_{CE} = 2 V, f = 1 MHz, V_{BE} = 0 , base grounded	C_{ce}	-	0.2	-	
Emitter-base capacitance V_{EB} = 0.5 V, f = 1 MHz, V_{CB} = 0 , collector grounded	C_{eb}	-	0.25	-	
Noise figure I_C = 2 mA, V_{CE} = 2 V, f = 1.8 GHz, $Z_S = Z_{Sopt}$	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}	-	22.5	-	dB
Insertion power gain V_{CE} = 2 V, I_C = 5 mA, f = 1.8 GHz, $Z_S = Z_L$ = 50 Ω	$\|S_{21}\|^2$	-	18	-	
Third order intercept point at output[2)] V_{CE} = 2 V, I_C = 5 mA, f = 1.8 GHz, $Z_S = Z_L$ = 50 Ω	IP_3	-	14	-	dBm
1dB Compression point at output I_C = 5 mA, V_{CE} = 2 V, $Z_S = Z_L$ = 50 Ω, f = 1.8 GHz	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 0.1 MHz to 6 GHz

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

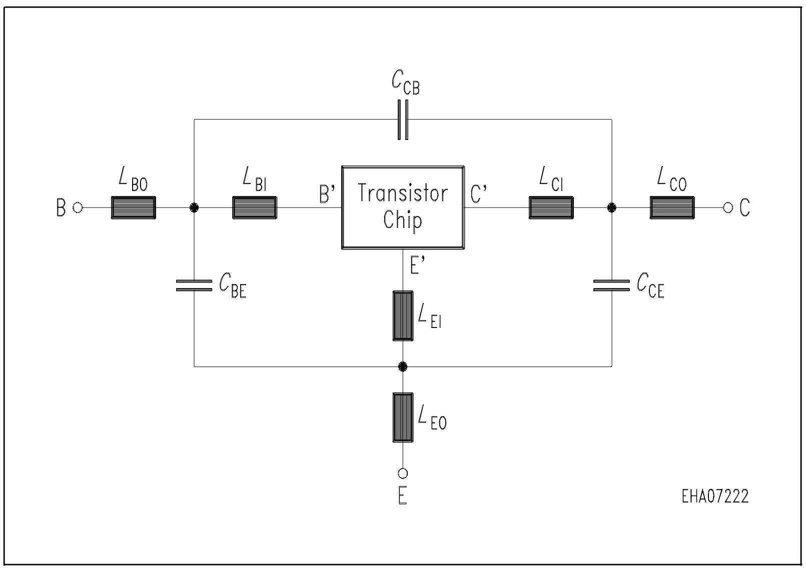
Transistor Chip Data:

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	mA	ISC =	0.037223	fA
NC =	1.3152	-	RB =	15	Ω	IRB =	0.21215	mA
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	A	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`-dioden Data (Berkley-Spice 1G.6 Syntax): IS = 2 fA; N = 1.02 -, RS = 20 Ω

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

Package Equivalent Circuit:



L_{BO} =	0.22	nH
L_{EO} =	0.28	nH
L_{CO} =	0.22	nH
L_{BI}=	0.42	nH
L_{EI} =	0.26	nH
L_{CI} =	0.35	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_{BI-EI}=	0.2	-
R_{LBI} =	0.15	Ω
R_{LEI} =	0.11	Ω
R_{LCI} =	0.13	Ω

Valid up to 6GHz

The TSFP-4 package has two emitter leads. To avoid high complexity fo the package equivalent circuit, both leads are combined in one electrical connection.
RLXI are series resistors for the inductances LXI and K_{xa-by} are the coupling coefficients between the inductances L_{ax} and L_{yb}. The referencepin 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 InfineonTechnologies CD-ROM or see Internet: http//www.infineon.com/silicondiscretes

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For non-linear simulation:

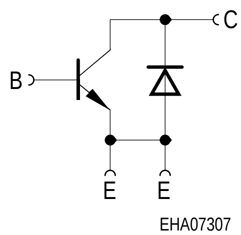
· Use transistor chip parameters in Berkeley SPICE 2G.6 syntax for all simulators.

· 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.



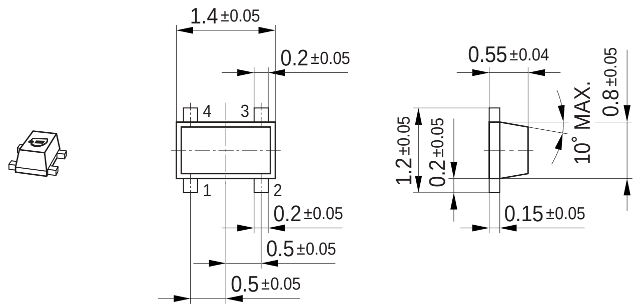
Transistor Schematic Diagram

The common emitter configuration shows the following advantages:

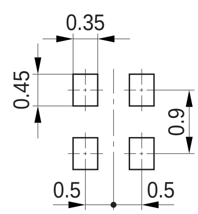
· Higher gain because of lower emitter inductance.
· Power is dissipated via the grounded emitter leads, because the chip is mounted on copper emitter leadframe.

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

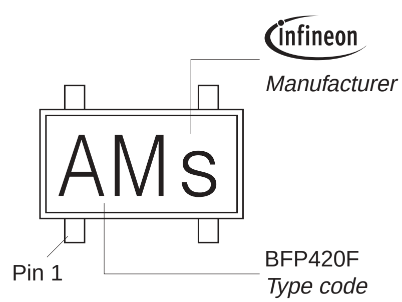
Package Outline



Foot Print

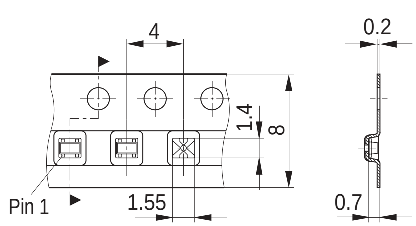


Marking Layout (Example)



Standard Packing

Reel ø180 mm = 3.000 Pieces/Reel
Reel ø330 mm = 10.000 Pieces/Reel



2007-04-20

Edition 2006-02-01
Published by
Infineon Technologies AG
81726 München, Germany

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