Application Note No. 020

A Low-Noise-Amplifier at 1.9 GHz using BFP405

RF & Protection Devices

Never stop thinking

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A Low-Noise-Amplifier at 1.9 GHz using BFP405 Revision History: 2006-11-08, Rev. 2.0	
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Page	**Subjects (major changes since last revision)**
All	Document layout change

Trademarks

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1 Low-Noise-Amplifier at 1.9 GHz using BFP405

This application note describes a low noise amplifier at 1.9 GHz using SIEMENS SIEGET®25 BFP405. The design emphasis has been on achieving a low noise figure. A circuit description, schematic, PCB layout and components list are shown below together with measured performance data.

Data at 1.9 GHz (3 V and 4.2 mA)

Gain:	16.5 dB
IP_{3out}:	5 dBm
NF:	1.75 dB
$R_{Lin-out}$	>10 dB

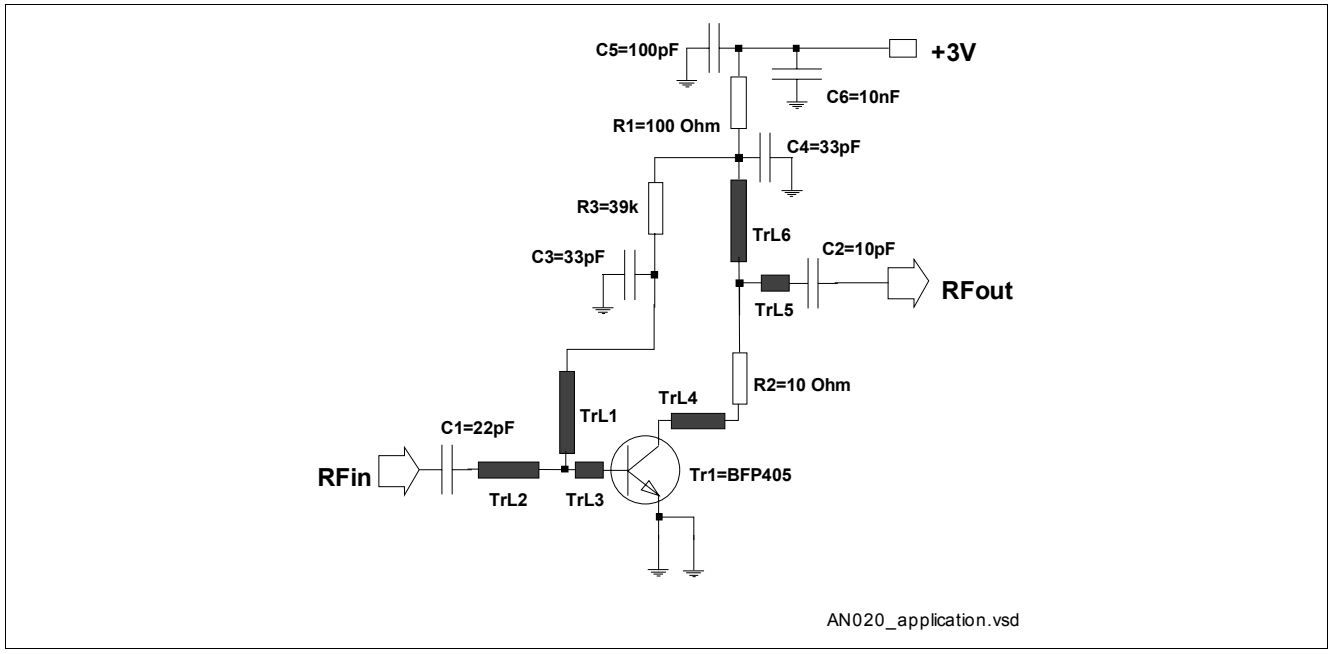

Figure 1 Application

This amplifier at 1.9 GHz has been realized by using microstrip lines as matching elements. The design offers a good compromise between high IIP_3 values, low noise figure and high return loss.

In order to optimize the design for a particular application please observe the following points:

- The layout size can be reduced by using chip-inductors instead of the microstrip lines TrL1 and TrL6
- Improved stabilization behaviour versus temperature and reduced variation in amplifier performance due to the device‘s Beta (current gain) distribution can be achieved by using an active bias circuit. Such a circuit is available as a single device from Infineon - BCR400W. For further information please refer to Application Note No.14. However, the resistors R1 and R3 are sufficient in most applications for stabilization purposes.
- This circuit is not optimized, for low noise figure, it is a first step to a good design. The measured figures include losses of SMA-connectors and the relatively high loss of the microstrip lines on the epoxy-board.
- The use of teflon material would provide an improvement of ≅ 0.1 dB.
- Resistor R2 is used to improve RF-circuit-stability and return loss values at the output. It also affects the output intermodulation performance.

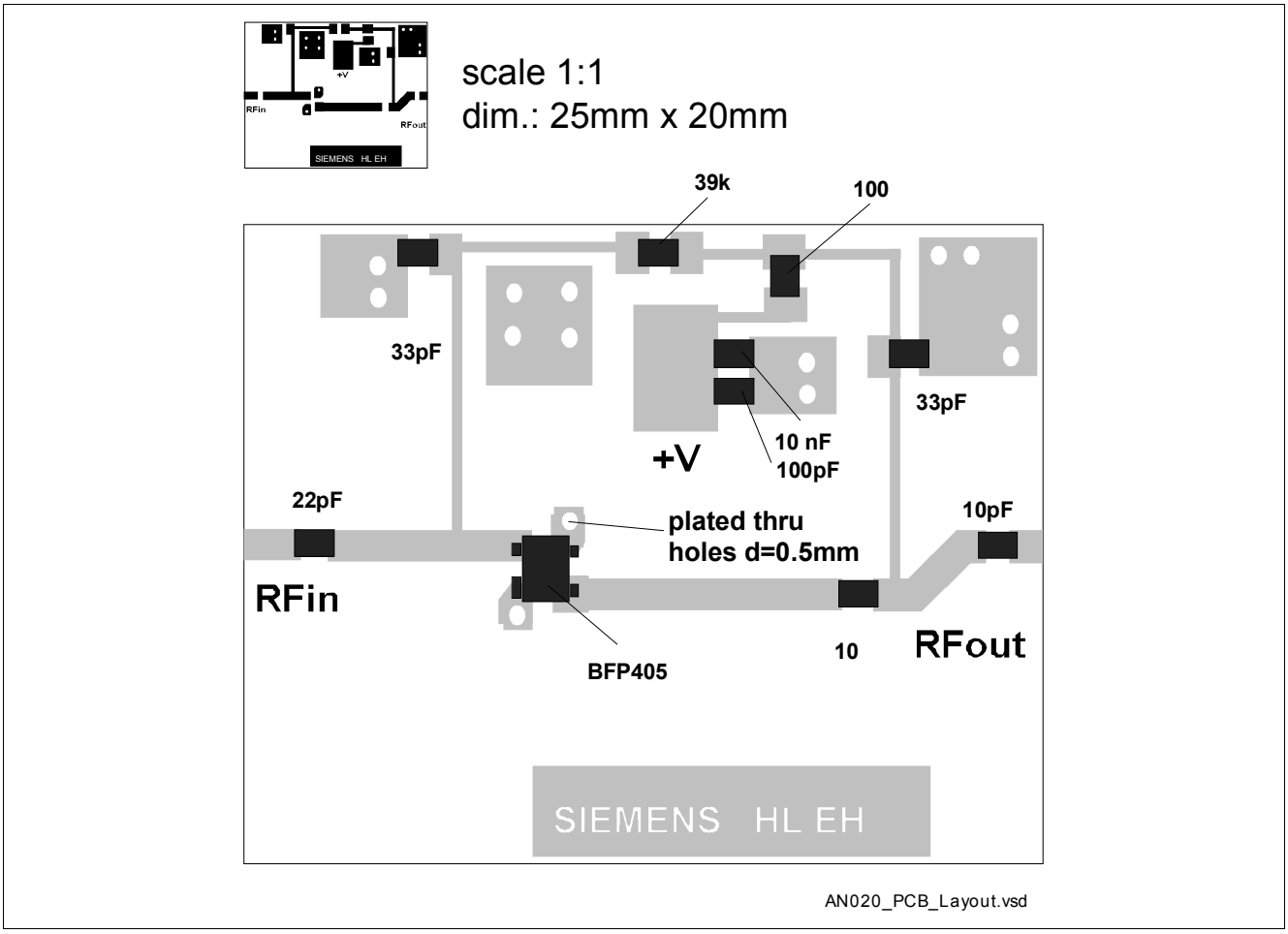

Figure 2 PCB Layout and Component Placement

Table 1 Component

Component	Value	Unit		Comment
R1	100	Ω	0603	Bias / collector-resistance / $V_{R1} \cong 0.5$ V 0603
R2	10	Ω	0603	To improve stability and output return loss 0603
R3	39	kΩ	0603	Bias / base-resistor 0603
C1	22	pF	0603	Input match 0603
C2	10	pF	0603	Output match 0603
C3	33	pF	0603	RF-short 0603
C4	33	pF		Output match
C5	100	pF	0603	RF-short 0603
C6	10	nF	0603	RF-short 0603
Tr1			SOT343	SIEGET® BFP405 SOT343
TrL1				Input match, w = 0.3 mm
TrL2				Input match, w = 0.95 mm
TrL3				Input match, w = 0.95 mm
TrL4				Output match, w = 0.95 mm
TrL5				Output match, w = 0.95 mm
TrL6				Output match, w = 0.3 mm
Substrate	FR4			h = 0.5 mm, ε_r = 4.5

Measurements

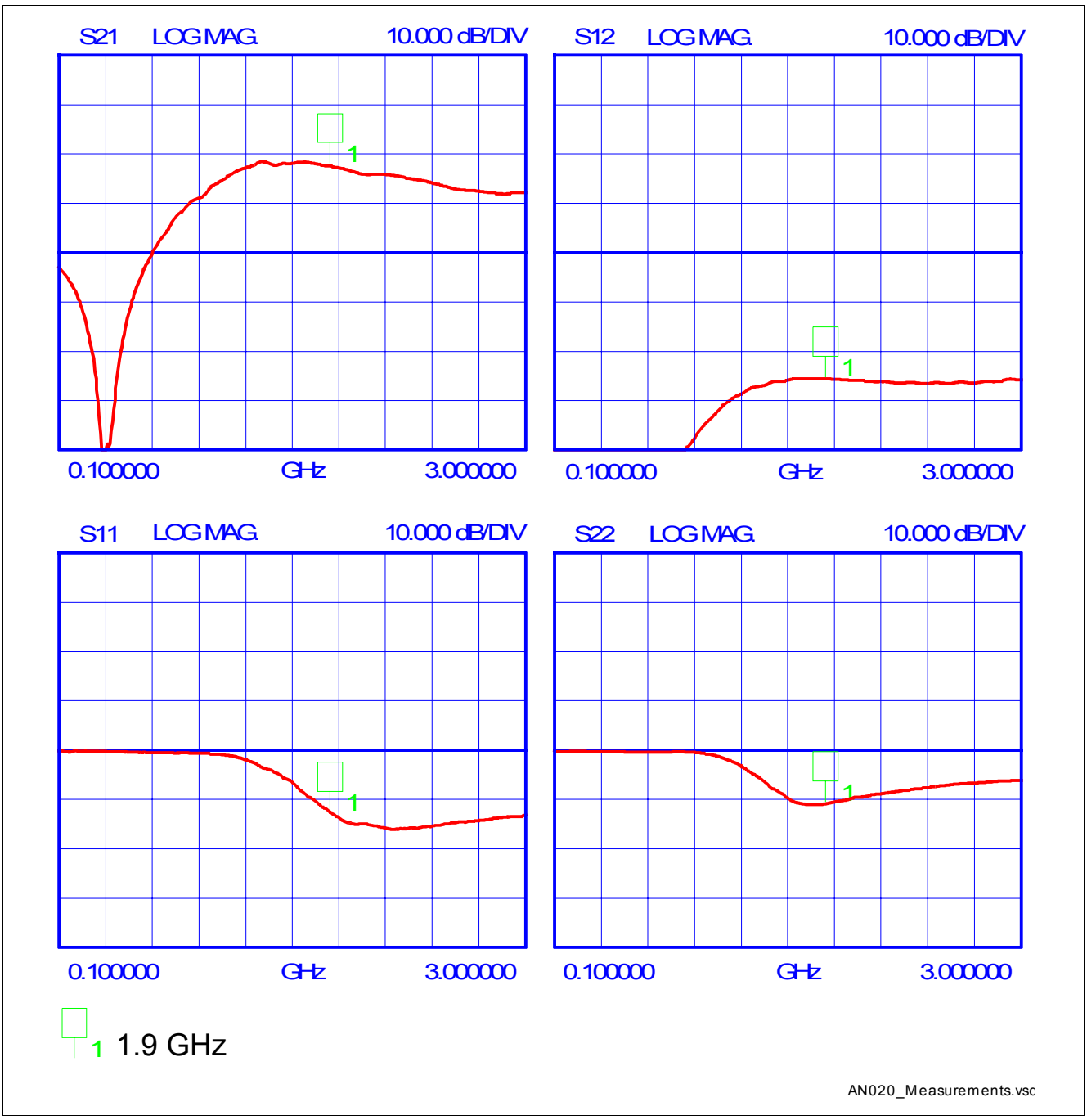

Figure 3 Measurements