Application Note No. 018

A Low-Noise-Amplifier at 900 MHz using SIEGET BFP420

Small Signal Discretes

Never stop thinking

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Previous Version: 2000-07-27	
Page	**Subjects (major changes since last revision)**
All	Document layout change

Trademarks

1 A Low-Noise-Amplifier at 900 MHz using SIEGET BFP420

This application note describes a low noise amplifier at 900 MHz using SIEMENS SIEGET®25 BFP420. The design emphasis has been on achieving low noise figure. A circuit description, schematic, PCB layout and components list are shown below together with measured performance data.

Data at 0.9 GHz (3 V and 5 mA)

Gain:	18 dB
IP_{3out}:	10 dBm
NF:	1.35 dB
$R_{Lin\text{-}out}$:	>10 dB

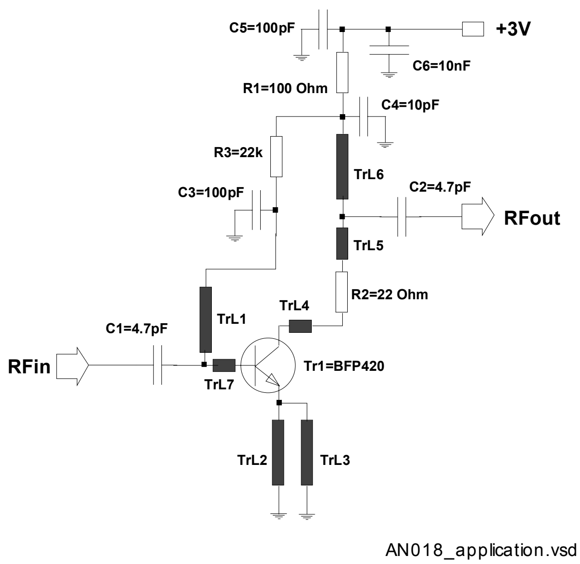

Figure 1 Application

This amplifier at 900 MHz 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 - BCR400. 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 get higher RF-circuit-stability and return loss values at the output. It also affects the output intermodulation performance.

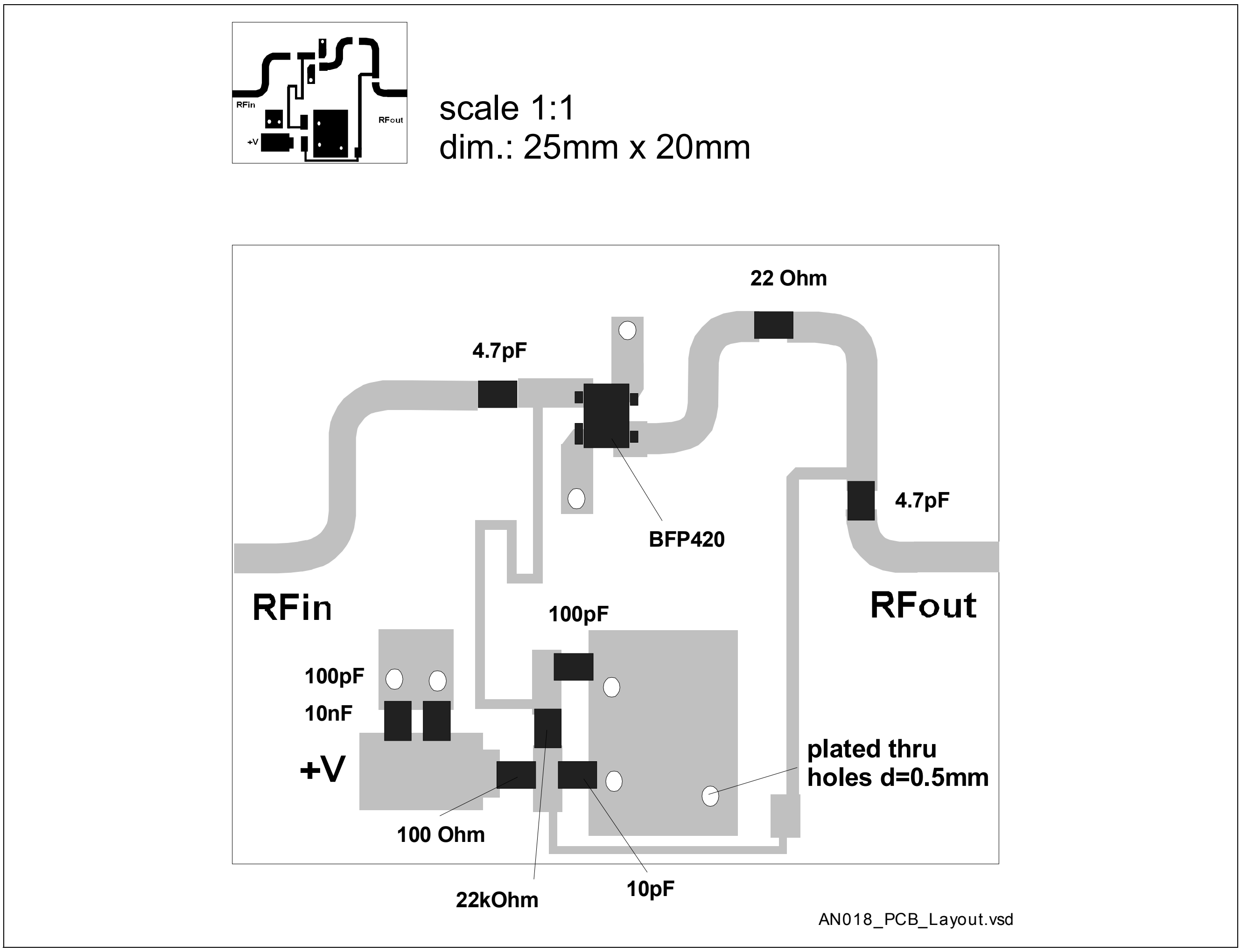

Figure 2 PCB Layout and Component Placement

Table 1 Component

Component	Value	Unit	Size	Comment
R1	100	Ω	0603	Bias / collector-resistance / $V_{R1} \cong 0.5$ V
R2	22	Ω	0603	To improve stability and output return loss
R3	22	kΩ	0603	Bias / base-resistor
C1	4.7	pF	0603	Input match
C2	4.7	pF	0603	Output match
C3	100	pF	0603	RF-short
C4	10	pF	0603	Output match
C5	100	pF	0603	RF-short
C6	10	nF	0603	RF-short
Tr1			SOT343	SIEGET® BFP420
TrL1				Input match and bias, w = 0.3 mm
TrL2				Emitter-microstrip-line, w = 0.95 mm
TrL3				Emitter-microstrip-line, w = 0.95 mm
TrL4				Output match, w = 0.95 mm
TrL5				Output match, w = 0.95 mm
TrL6				Output match and DC-bias, w = 0.95 mm
TrL7				Input match, w = 0.95 mm
Substrate	FR4			h = 0.5 mm, ε_r = 4.5

Measurements

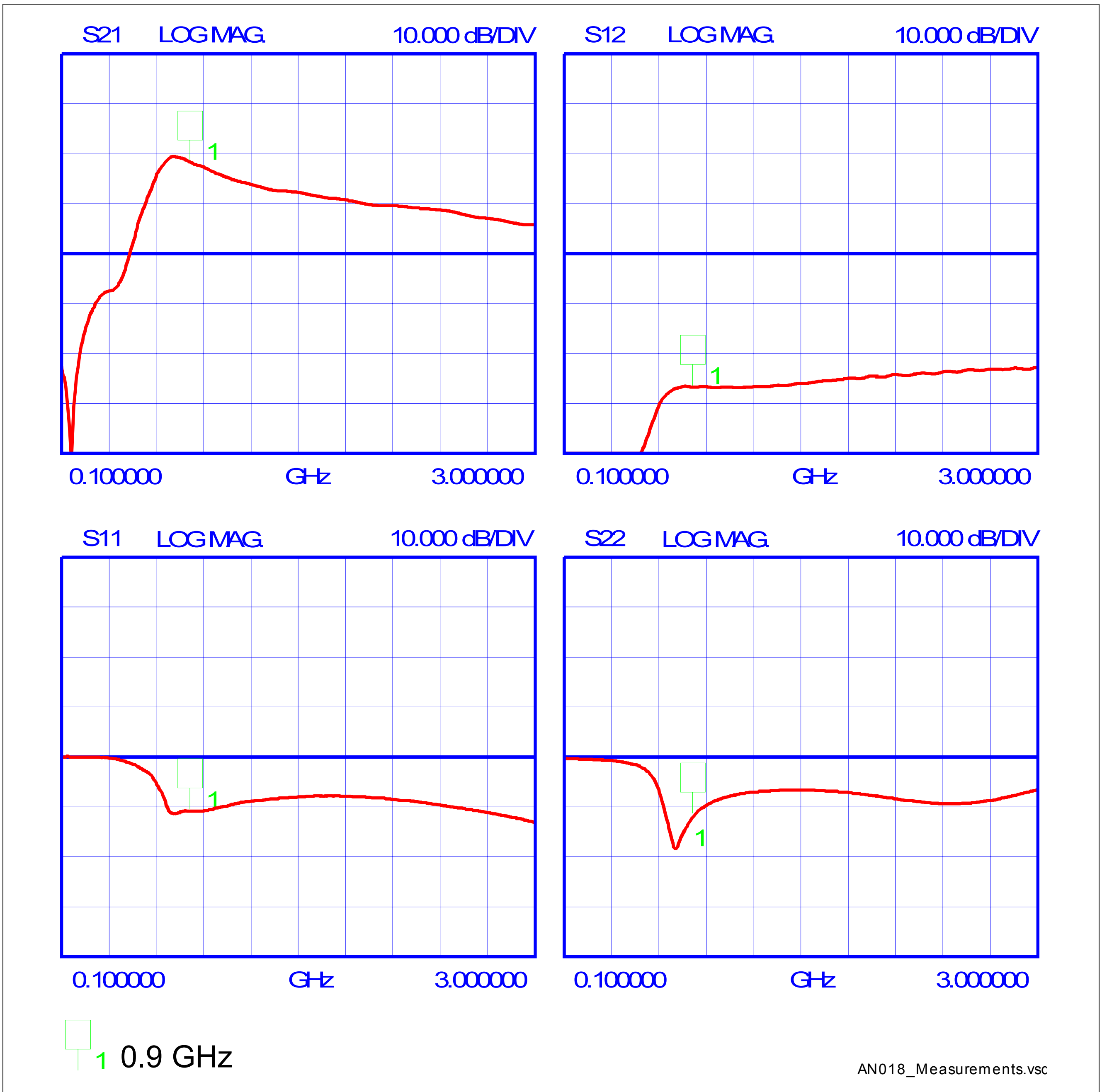

Figure 3 Measurements