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900MHz DRIVER-AMPLIFIER WITH ENABLE-SWITCH USING THE BFG425W

Abstract:
This application note contains an example of a Driver-Amplifier using the new BFG425W Double Poly RF-transistor. The driver can be switched on and off with a control-voltage V_{CON}=0...3V. The driver is designed for a frequency f=900MHz.
Performance at f=900MHz, T=25^{0}C: Power Gain >12dB.

Appendix I: Schematic of the circuit

Appendix II: Results of measurements

Appendix III: Printlayout and list of used components & materials

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Introduction:
With the new Philips silicon bipolar double poly BFG400W series, it is possible to design driver-amplifiers for high frequency applications with a low current and a low supply voltage. These amplifiers are well suited for the new generation low voltage high frequency wireless applications. In this note an example of such an amplifier for 900MHz will be given. This driver can be switched on and off with a control-voltage V_{CON}.

Designing the circuit:
The circuit is designed to show the following performance (target):

transistor: BFG425W
V_{SUP}=3V, V_{CON}=0V (driver disabled), I_{SUP}~0mA
V_{SUP}=3V, V_{CON}=3.0V (driver enabled), I_{SUP}~11mA
freq=900MHz
Power Gain: >12dB
VSWRi<1:2.5
VSWRo<1:2

The in- and outputmatching-circuits are realised with a RC-combination. No coils are used to reduce the price. The Enable is controlled at the base in order to reduce the control-current (V_{CON}=3V : I_{CON}~0.6mA). DC-decoupling in the emitter is used reduce the influence of HFE-spread.

Designing the layout:
A lay-out has been designed with HP-MDS. Appendix III contains the printlayout.

Measurements:
Measurements of the total circuit (epoxy PCB) are done (Appendix II).

Appendix I: Schematic of the circuit

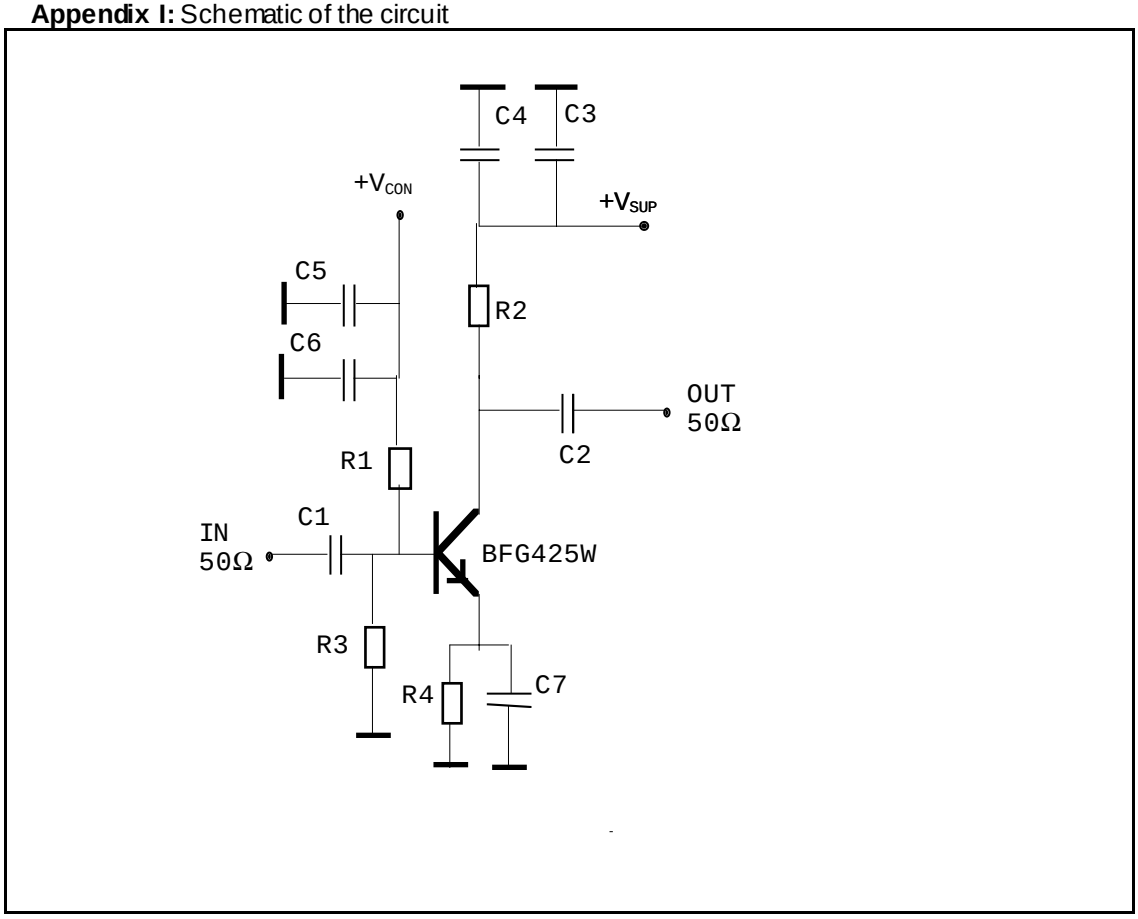

Figure 1: Driver circuit

900MHz Driver Component list:

Component:	Value:	Comment:
R1	2.7 kΩ	Bias, RF-block
R2	100 Ω	RF-block
R3	3.9 kΩ	Bias.
R4	56 Ω	DC-decoupling
C1	150 pF	Input match.
C2	150 pF	Output match.
C3	27 pF	900MHz short.
C4	1 nF	RF Decoupling
C5	27 pF	900MHz short.
C6	1 nF	RF Decoupling
C7	27 pF	900MHz short.

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Appendix II: Results measurements:

BFG425W, V_{SUP}=3.0V, I_{SUP}~11.0mA@T=25°C, V_{CON}=3.0V, I_{CON}~0.6mA@T=25°C

	Measurements PCB:	**Comment:**
f=900MHz		
$\|S_{21}\|^2$ [dB]	15.5	P_{IN}=-30dBm, T=25°C
G_P [dB]	13	P_{IN}=-10dBm, T=25°C
G_P [dB]	~11	P_{IN}=-10dBm, **T ≈ -40°C** (Freeze spray)
VSWRi	2.5	P_{IN}=-30dBm, T=25°C
VSWRo	1.7	P_{IN}=-30dBm, T=25°C
Noise Figure [dB]	~2.5	P_{IN}=-30dBm, T=25°C
IP3 [dBm] (output)	-	not measured

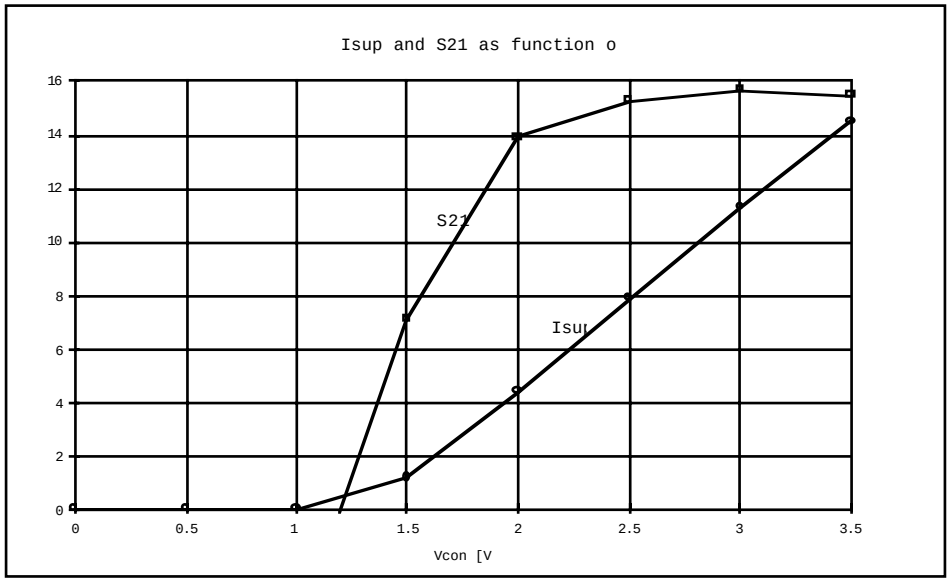

Figure 2: I_{SUP} and S_{21} as funcion of V_{CON}. (V_{SUP}=3.0V, f=900MHz)

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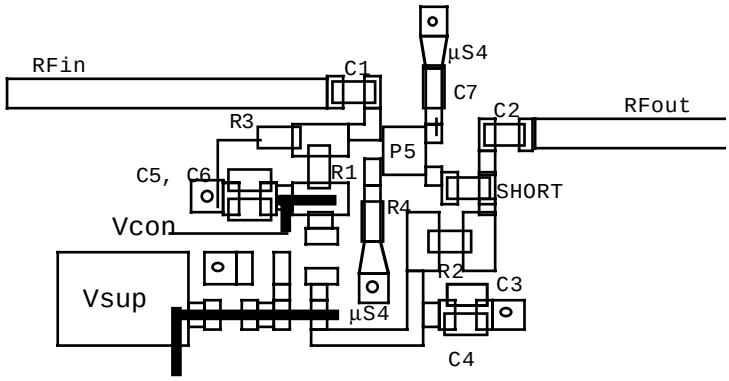
Appendix III: Printlayout and list of used components & materials



900MHz Driver Amplifier with enable-switch
BFG425W

Figure 3: Printlayout

900MHz Driver Component list:

Component:	Value:	size:
R1	2.7 kΩ	0603 Philips
R2	100 Ω	0603 Philips
R3	3.9 kΩ	0603 Philips
R4	56 Ω	0603 Philips
C1	150 pF	0603 Philips
C2	150 pF	0603 Philips
C3	27 pF	0603 Philips
C4	1 nF	0603 Philips
C5	27 pF	0603 Philips
C6	1 nF	0603 Philips
C7	27 pF	0603 Philips
P5	BFG425W	SOT343R Philips
PCB	ε_r ~4.6, H=0.5mm	FR4

note 1: The used PCB was designed for Low Noise Amplifier applications. Shorts and wires are used to adapt the PCB for this driver application.