

# Low Noise Amplifier for 5.7 GHz using the ATF-36077 Low Noise PHEMT

## Application Note 1133

### Introduction

This application bulletin describes the use of the ATF-36077 in a 5.7 GHz application. The ATF-36077 amplifier uses microstripline matching circuitry to obtain a low noise stable amplifier with good input and output return loss.

### Design

The input microstripline network matches the ATF-36077 for low noise and reasonable input return loss. The output microstripline network provides a conjugate impedance match for maximum associated gain. Some resistive loading is used to improve stability. Quarterwave bias decoupling lines with low frequency resistive terminations are used to couple in the gate and drain voltage.

For best overall performance including stability, it is suggested that both source leads be dc grounded. The somewhat customary low frequency LNA design approach of using a source resistor to bias the FET would require a source bypass capacitor with extremely low series inductance. Even a tenth of a nanohenry of source inductance can cause very high frequency stability problems with HEMT devices. The

use of dc grounded source leads necessitates the use of a negative voltage to be applied to the gate to set the desired drain current.

The artwork for the 5.7 GHz amplifier is shown in Figure 1. The amplifier was originally designed for the amateur radio band at 5760 MHz and provides very low noise performance over the 5725 to 5800 MHz ISM band with no additional tuning. With minimal tuning the amplifier can be used anywhere in the 5 to 6 GHz frequency range. A schematic diagram and component parts list is shown in Figure 2.

The nominal gate bias is -0.2 volts for a drain current of 10 mA.  $V_{ds}$  is set to 1.5 volts. Measured noise figure is approximately 0.75 dB at

5.76 GHz. A graph of noise figure and gain versus frequency is shown in Figure 3. Input and Output return loss are shown in Figure 4.

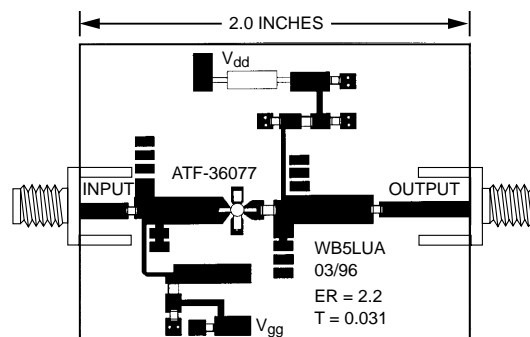
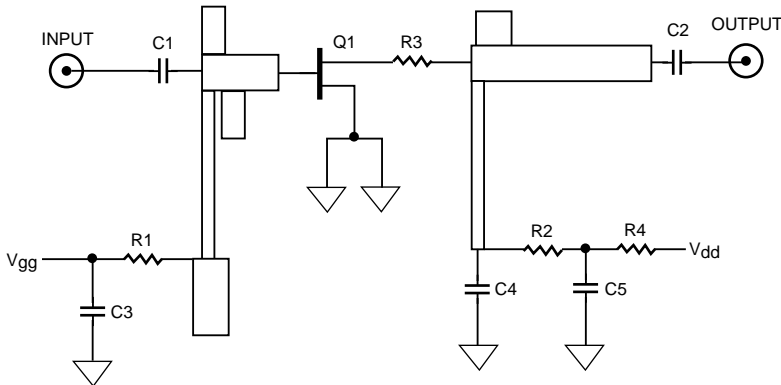


Figure 1. Artwork for 5.7 GHz Low Noise Amplifier for ER = 2.2 and PCB thickness 0.031 inches



PARTS LIST

- C1 1 pF CHIP CAPACITOR (1 TO 2 pF OK)
- C2 1 pF CHIP CAPACITOR (1 TO 2 pF OK)
- C3, C5 1000 pF // 0.01  $\mu$ F CHIP CAPACITOR IN PARALLEL
- C4 22 pF CHIP CAPACITOR
- Q1 HEWLETT-PACKARD ATF-36077 PHEMT
- R1, R2 50 OHM CHIP RESISTOR
- R3 10-27 OHM CHIP RESISTOR (EFFECTS GAIN/STABILITY)  
HIGHER R = LOWER GAIN AND BETTER STABILITY
- R4 FOR OPERATION FROM A POWER SUPPLY VOLTAGE OF  
5 VOLTS, R4 = 200 OHMS - R3 - R2

Figure 2. 5.7 GHz Low Noise Amplifier Schematic Diagram

Freq. (MHz)	Gain (dB)	Noise Figure (dB)
5000	13.2	1.10
5050	13.4	1.06
5100	13.6	1.02
5150	13.7	0.99
5200	13.8	0.96
5250	13.8	0.92
5300	13.8	0.90
5350	13.7	0.86
5400	13.6	0.83
5450	13.4	0.82
5500	13.2	0.79
5550	13.1	0.79
5600	12.9	0.78
5650	12.7	0.76
5700	12.6	0.76
5750	12.3	0.75
5800	12.1	0.77
5850	11.6	0.78
5900	11.4	0.80
5950	11.1	0.81
6000	10.6	0.86

Figure 3. Gain and Noise Figure

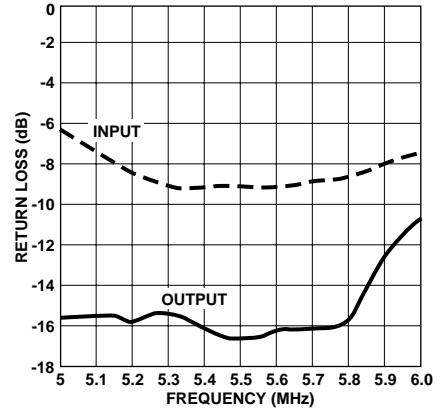


Figure 4. Input and Output Return Loss

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