# AN1438 APPLICATION NOTE LOW NOISE AMPLIFIER OPTIMIZED FOR MINIMUM NOISE FIGURE AT 1.9 GHz USING START420

Data at 1.9GHz (3V, 5mA)

Gain = 14dB,  $IP3_{out}$  = 10dBm, NF = 1.4dB,  $RL_{in}$  = 7dB,  $RL_{out}$  = 14dB

# 1. INTRODUCTION.

START420 is a product of the START Family (ST Advanced Radio frequency Transistor). It is a high performance silicon bipolar transistor housed in the ultra miniature 4-lead SC-70 (SOT-343) surface mount plastic package. The amplifier is designed for use with 30mils thickness FR-4 printed circuit board material. The amplifier application circuit has been optimized to achieve a good compromise among Noise Figure, Gain and return loss at 1.9GHz, with  $V_{ce}$ =2V and  $I_c$ =5mA. The amplifier has 1.4dB of Noise Fifure, 14dB of Gain, an Input Return Loss>7dB, an output Return Loss>14dB and an IP3 of +10dBm (1.9GHz, 3V, 5mA).

# 2. LNA DESIGN.

## Figure 1: Schematic Design



# **AN1438 - APPLICATION NOTE**

This amplifier is realized with a microstrip line as matching elements and a small number of surfacemount components. A single pin ( $V_{cc}$ =3V) for voltage supply is used. A 1µF bypass capacitor to filter the supply at the common  $V_{cc}$  node is also used. The transistor's base is connected to the power supply through a choke inductor (microstrip line TrL3) and the transistor's collector is connected to the voltage supply through a choke inductor (microstrip line TrL4). The collector's voltage is 2V. The input matching is realized with a 60 Ohm series transmission line of 15° electrical length (TrL1).The L1 inductor is used to reduce the Noise Figure value The output matching is realized with both a resistor (R4) chip-inductor (L1) and a 60 Ohm series transmission line of 16° electrical length (TrL2). Resistor (R2) is used to improve RF circuit stability.



## Figure 2: Demoboard Layout

#### Table 1: Bill of Materials

Component	Value	Unit	Size
R1	47	KΩ	0603
R2	15	Ω	0603
R3	180	Ω	0603
R4	10	Ω	
C1	1	μF	0603
C2	4	pF	0603
C3	100	pF	0603
C4	10	nF	0603
C5	100	pF	0603
C6	10	nF	0603
C7	10	pF	0603
L1	8.2	nH	0603
Tr1			SOT-343
TrL1			
TrL2			
TrL3			
TrL4			
TrL5			
TrL6			
J1			
J2			
J3			

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## 3. LNA PERFORMANCE.



## Figure 3: Noise Figure

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