A New Technique for Implementation of LNA using Tina pro

Shilpa Mehta[1], Mahima Goel[2], and Bhupender[3]

***Abstract*—** This paper presents an UWB low noise amplifier (LNA) based on current reuse technique. Working on Low noise Amplifier and achieving low power, high gain in band defined is one of the major challenges in receiver design. In present article, CMOS implementation of LNA has been proposed by using Tina Pro simulation tool. Simulation results show the utility of work done and justify the approach in terms of power dissipation and gain..

***Keywords*—** LNA, MOSFET, TINA PRO

I. Introduction

In day to day life mobile cellular, cordless telephones or wireless local area network are very commonly used. The sensitivity of any receiver circuit is very critical to an extent over which any wireless network can operate which is dependent on number of components like filter circuits, low noise amplifier, mixers and converters. But the main parameter on which receiver sensitivity is dependent is extremely correlated with the low noise amplifier (LNA) as it is considered as first stage of any receiver circuit. Next, we come to interfacing between the antennas and the LNA that will not only differentiate among analog designers and microwave engineers [1]. Fig. 1 explains the distribution of receiving band of current within specified range .The main aim of LNA is to amplify the signal which we have received from the antenna which also reduces the noise so that it can be provided to further stages.[7] An LNA design is one of the challenges as it requires high gain, low noise figure, good input and output matching and unconditional stability when current drawn from amplifier is minimum.

II. TINA PRO based Implementation of LNA

The main aim is to find the low noise, low power designing of circuit for Low noise Amplifier using Tina pro simulator.

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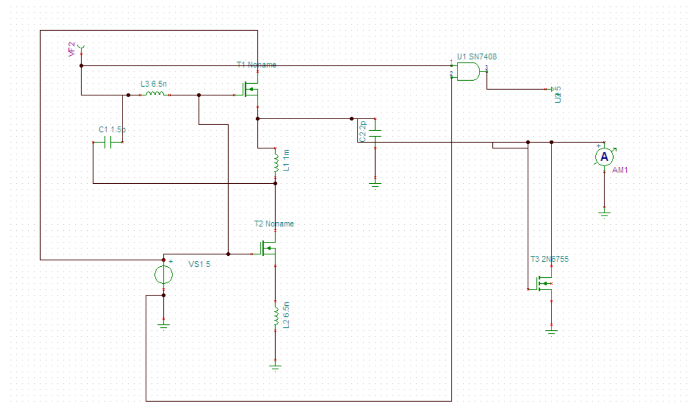

Fig. 1 Circuit diagram of Proposed Technique

Here we are designing LNA with help of common source (CS) input matched network at its gate terminal, and output matched network at its drain terminal of Ist MOSFET. There are no of transistors that are cascaded in a way that the supply (biasing voltage) is provided between the transistors for achieving the property of current reuse.[9,8] The RF input is given to the gate of 2nd Transistor. The main amplifier section consists of a parallel connection of resonant circuit with resistances.[4,5] The second stage shares (reuses) the bias current with the first stage.[10] The resonant circuit is used for tuning the amplifier to that particular frequency. There are different techniques like input matching network and current reuse technique for LNA.

III. Impedance Matching Network

In case of input matching network is designed for reducing size and chip area.[2,3] Such circuit is designed for reducing use of bias element as resistor as noise can be generated with this so rather than using resistor use inductor in this case.[6] As we know that transistors, inductors and capacitors have their own internal resistances which can be used for impedance matching purpose using any matched network whereas capacitance will provide imaginary part during this impedance matching.

IV. Current reuse technique

The current reuse technique is used to get low power consumption and for improving gain and proper matching should be done for proper gain compensation.

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V. Components Used In Proposed Design

Different components are used in designing the circuit like mosfets ,capacitors , supply and resistors. Here we are defining these components alongwith variations of different parameters while choosing them.

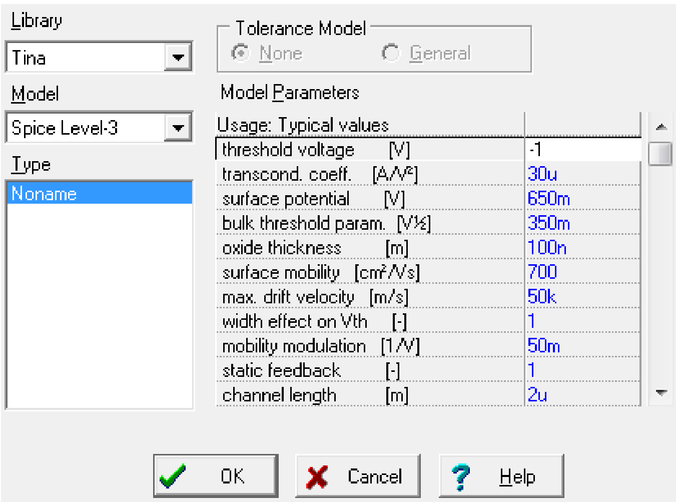

Fig. 2 Parameters defined for MOSFET1

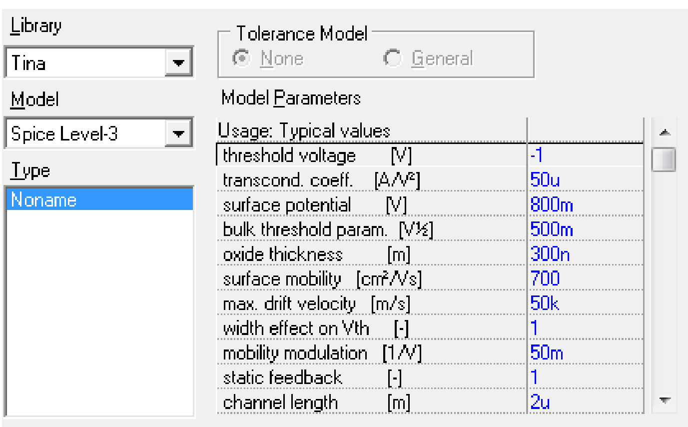

Fig. 3 Parameters defined for MOSFET2

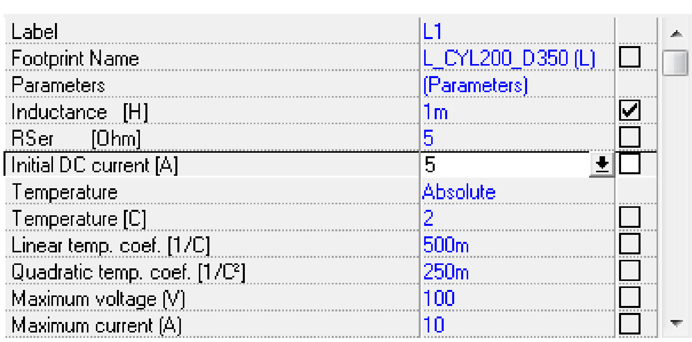

Fig. 4 Parameters defined for INDUCTOR(L_CYL200)

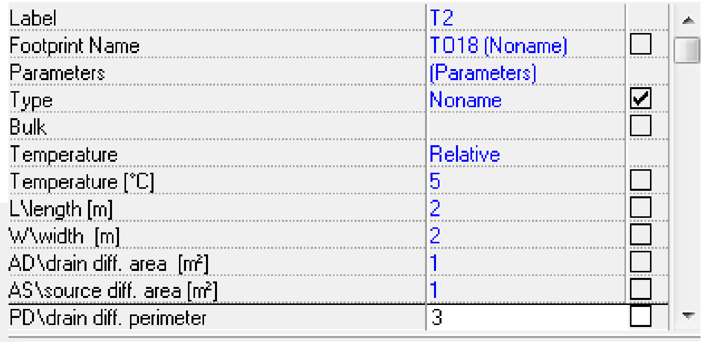

Fig. 5 Parameters defined for Capacitor1

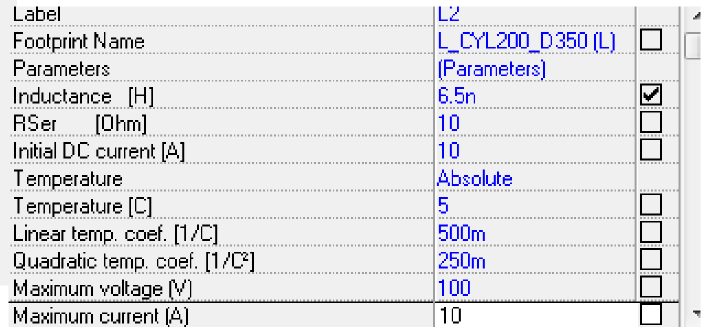

Fig. 6 Parameters defined for Capacitor2

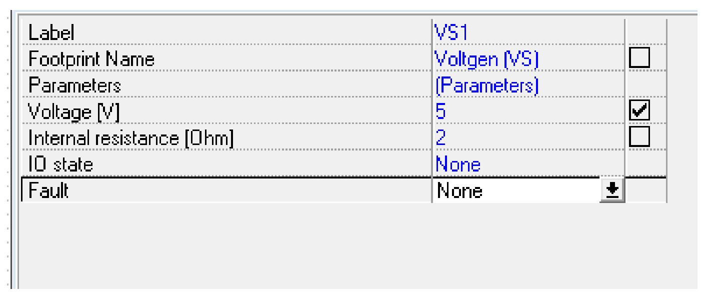

Fig. 7 Specifications for voltage source

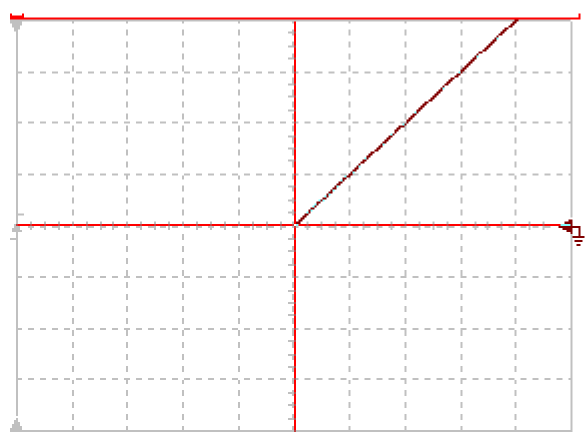

Fig. 8 Output Waveform defining amplitude versus frequency curve

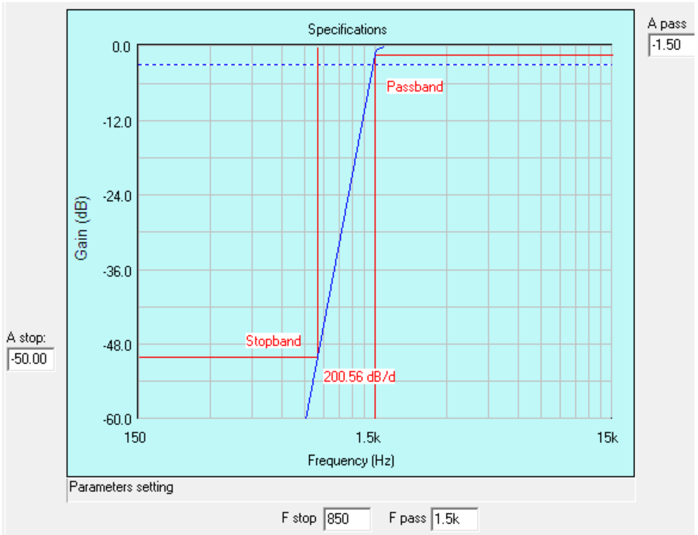

Fig. 9 Filter output defining bands

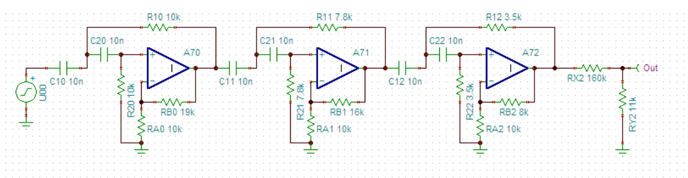

Fig. 10 Designing similar to high pass filter

VI. Simulation Results

Frequency	2.5GHZ
Gain	15.82
Input reflection coefficient	-29.745
Output reflection coefficient	-15.6
Reverse Isolation	-20.458

Fig. 10 Simulated Results of proposed LNA

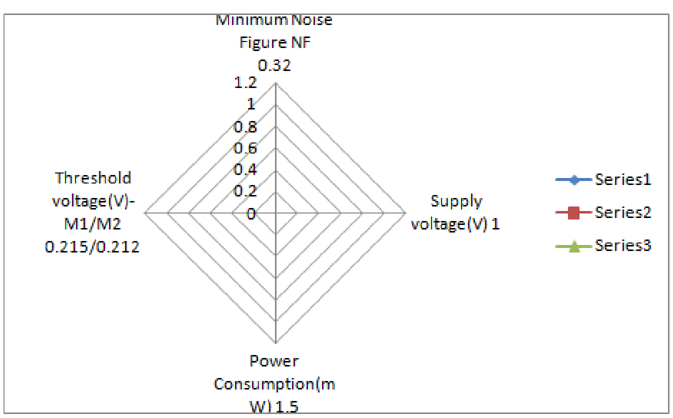

Fig. 11 Parameters defined with respect to Noise Figure

Minimum Noise Figure (NF)	frequency(GHz)
0.32	2.5
0.35	2.7
0.4	2.9
0.45	3
0.49	3.2
0.5	3.5

Fig. 12 Noise figure wrt Frequency

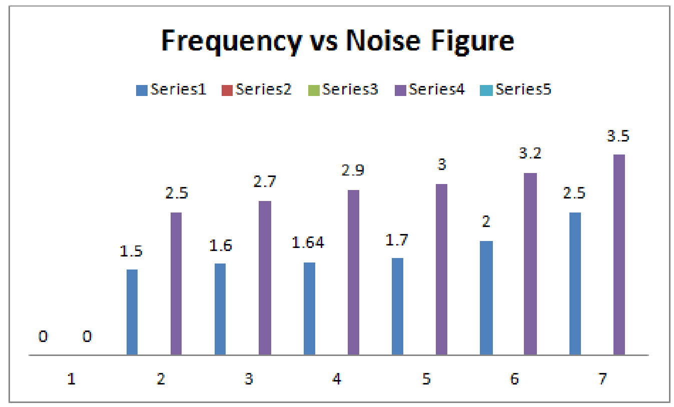

Fig. 13 Variation of Noise figure and Frequency at different values

Gain	frequency(GHz)
1.5	2.5
1.6	2.7
1.64	2.9
1.7	3
2	3.2
2.5	3.5

Fig. 14 Gain wrt Frequency

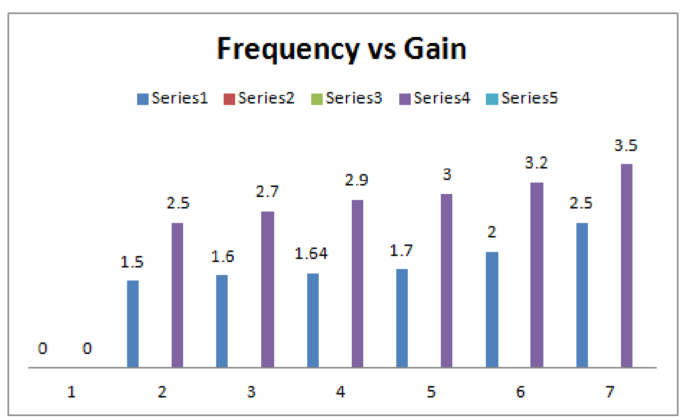

Fig. 15 Variation of Gain and Frequency at different values

VII. Conclusion

This paper provides basic and of LNA and purposes implementation of LNA by the use of TINA pro by minimizing hardware requirements to the maximum extent possible. Its designing based on different techniques have been discussed and compared. The simulation results show reduction of power dissipation and improved gain with minimization of hardware requirements for the design of a Low noise Amplifier.

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