IOSR Journal of VLSI and Signal Processing (IOSR-JVSP)
Volume 5, Issue 2, Ver. I (Mar. - Apr. 2015), PP 31-34
e-ISSN: 2319 – 4200, p-ISSN No. : 2319 – 4197
www.iosrjournals.org

Design of Ultra Wideband Low Noise Amplifier with the Negative Feedback using Micro strip Line Technique

[1]Bhushan R. Vidhale, [2]Dipali C . Nitnaware , [3]Dr.M.M.Khanapurkar
Research Scholar, Dept. of Electronics and Telecommunication Engineering, GHRCE,Nagpur (M.S.), India
Research Scholar,Dept. of Electronics and Telecommunication Engineering, GHRCE,Nagpur (M.S.), India
Head,Dept. of Electronics and Telecommunication Engineering, GHRCE,Nagpur (M.S.), India

Abstract**:** *In this paper the well organized design of Ultra wideband low noise amplifier with the negative feedback using micro strip line is discussed. LNA design is very significant and exigent work at the receiver because the signal which we received is very weak in amplitude and get despoiled easily the noise. Therefore it is necessary it must give noise figure low as possible over a wide range. As it is not possible to get all the characteristics of LNA perfectly therefore there is always a tradeoff between it. So we have to optimize the values of the component such that we get the optimum results. To achieve all this characteristics, the negative feedback is used with a matching mechanism which consists of some passive elements and micro strip line. The software ADS is used to optimize design and simulations.*

Keywords: *Ultra wideband, Low noise amplifier (LNA), Negative feedback, Micro strip lines.*

I. Introduction

As in the recent years there is a huge growth in the high speed field of communication , the ultra wide band technology has became more and more imperative. The indispensable necessity of the UWB systems is the low noise amplifier which plays the essential part regarding system sensitivity. As we know the LNA is the first end cog in the recipient configuration it ought to endow with hefty gain and stumpy noise figure. While designing the LNA, we have to mull over the subsequent mandatory parameters of LNA which is gain, noise figure, stability, linearity, input output matching. Gain is the relative amount of output to input. Matching is employed to transfer maximum power to the load when TL is matched both at load and source ends. This stipulation satisfies the conjugate matching. With suitably matched TL more signal power is transferred to the load which improves the sensitivity of the recipient system.

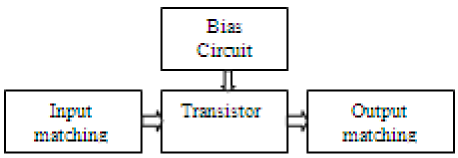


Figure 1 Simple Block Diagram For LNA

II. Design Concept

The choice of transistor is the first step in LNA design. The proper care must be taken very carefully while selecting the transistor by keeping the tradeoffs regarding features in consideration .We have selected PHEMT transistor which is Pseudomorphic high electron mobility transistor. This is very helpful in designing microwave monolithic circuits and also helpful for designing circuits at higher frequency range of operation. It is generally referred as heterojuction field effect transistor i.e FET because it has two layers of dissimilar semiconductor with two unlike semiconductor with two different band gap energies. These HEMTS transistors are very superior because they have a high speed and they are also radiation hard circuits with low power consumption values.

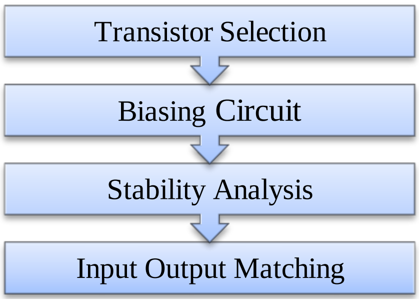


Figure 2: Design steps for LNA

DC biasing circuit is the next part in LNA design. It gives a stable bias point for the device. So in this paper we used simple resistive biasing which gives least 0.05 tolerances. Stability depends upon how its resist to oscillations which means as being an amplifier it should be stable, any sorts of oscillation will completely destroy the system. For that correct method be supposed to used to make it stable for the complete given frequency range. Therefore to accomplish this S-parameters plays a most important function in stability analysis. The fourth part is the matching of output and input. The fundamental aim of matching device is to offer maximum power. To get the paramount results or we can say tradeoff between gain and noise figure. Rather than input and output matching another matching used is the inter stage matching networks which are used as cascade between two or more stages. The input side should provide least noise where as output ought to give hefty amount of gain. Now as we know its ultra wideband, to get least flat gain and also to get stability in whole band is very complex to realize. If we evaluate with other common structures which are accessible, the negative feedback amplifier gives the performance better than the others by sacrificing little noise figure. Negative feedback can be connected in series and in parallel. When it is correctly used it will preserve the flatness of gain and will give the better impedance matching, it can also be used to diminish the temperature element tolerance effects, and also improves the dc and RF stability with fewer distortion.

III. Circuit Design And Simulations

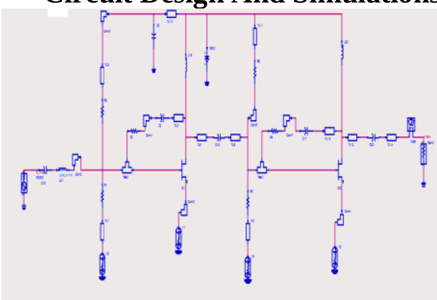
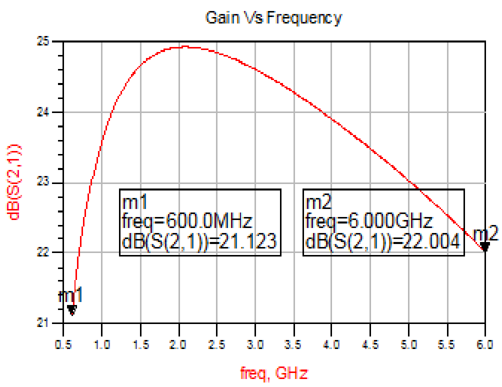
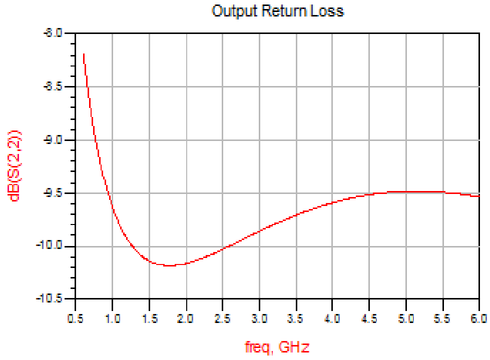


Figure 3. ADS schematic for 0.5ghz To 6 Ghz UWB Low noise Amplifier





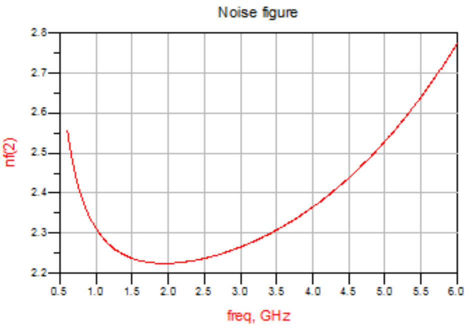


Table1. Comparison between previous work and current work

PARAMETER	CURRENT WORK	[2]	[1]	[18]
GAIN	22DB	12.25DB	18.85 DB	18 DB
INPUT RETURN LOSS	<-10 DB	1.173DB	2.4 DB	<2.2 DB
OUTPUT RETURN LOSS	<-10 DB	<2 DB	<2 DB	<1.7 DB
NOISE FIGURE	2.3 DB AT 3GHZ	1.74 DB	2.42 DB	<3.5DB

IV. Conclusion

This paper gives the efficient ultra wide band low noise amplifier with the negative feedback using micro strip lines method. By using the ADS software tool the UWB LNA gives the gain around 22 dB with noise figure < 2.7 dB and < -10 dB input return loss.

References

[1]. Design of wideband high gain and low noise amplifierYinhua Yao and Tongxiu Fan.
[2]. Design of DC-3.4GHz Ultra-Wideband Low Noise Amplifier with Parasitic Parameters of FET Yinhua Yao*, Tongxiu Fan.
[3]. D. Barras, F. Ellinger, and H. Jackel, "A comparison between ultrawideband and narrow-band transceivers," TRLabs/IEEE Wireless 2002, pp. 211–214, Jul. 2002.
[4]. Rowan Gilmore, Les Besser, Practical RF Circuit Design For Modern Wireless Systems, vol. II: Active Circuits And Systems,2003, pp. 123- 141.
[5]. Kenington, P. B., High-Linearity RF Amplifier Design, Norwood, MA: Artech House, 2000.
[6]. C.W. Kim, M.-S. Kang, P. T. Anh, H.-T. Kim, and S.-G. Lee, "An ultra wide-band CMOS low-noise amplifier for 3–5-GHz UWB system,"IEEE J. Solid-State Circuits, vol. 40, pp. 544–547, Feb. 2005.
[7]. Fujitsu Compound Semiconductor ,Inc, FHX35LG Data Sheet, www.fujitsu.com.
[8]. Avago Technologies, ATF-54143 Data Sheet , www.avagotech.cn.
[9]. Guangku Liu, Nini Rao, "Analog Circuit", Cheng Du: University of Electronic Science and Technology Press, Vol 4, 2003
[10]. Besser, L., "Stability Considerations of Low-Noise Transistor Amplifiers with Simultaneous Noise and Power Match," IEEE MTT International Microwave Symposium Digest, 1975.
[11]. Zuwen Wang, Zhilin Wu and Shi Yu, "Design of the 0.2-3GHz Ultrawide-band Low Noise Amplifier", J Magn Mater Devices, Vol. 41, pp. 64-67, Jun. 2010.
[12]. Giacoletto, G. S., Electronics Designers' Handbook, 2nd ed., NewYork: McGraw-Hill,1977.2519
[13]. A O.08-3GHz High Gain UWB LNA with Improved Flatness.
[14]. Hua Chen, Peng Gao, Shuang He, and Bin Yuan Research Institute of Electronic Science and Technology, University of Electronic Science and Technology of China, Chengdu, 611731, China. 2013 International Workshop on Microwave and Millimeter Wave Circuits and System Technology .
[15]. A Low Power Low Noise Amplifier for Ultra wideband Applications .
[16]. Rajesh Khatri Shri G. S. Institute of Technology and Science Indore, India, D. K. Mishra Shri G. S. Institute of Technology and Science Indore, India ,Preet Jain Shri Vaishnav Institute of Technology & Science Indore, India. 2012 International Conference on Communication Systems and Network Technologies.

[17]. Design of UWB Low Power Low Noise Amplifier with Body Bias Technique . Meng-Ting Hsu *1, Member, IEEE, Kun-Long Wu *2 Proceedings of the Asia-Pacific Microwave Conference 2011
[18]. An 0.5-6GHz Ultra-Wideband Low Noise Amplifier Design.Meng-Ting Hsu *1, Member, IEEE, Kun-Long Wu *2, 2011
[19]. Design of a 1GHz~4GHz ultra-wide band low noise amplifier. Yanhui Lu1, Qinghua Tang1, Wenguang Li1*, Guoan Wu1, Huijie Qi2 Department of electronic science and Technology, Huazhong University of Science andTechnology, Wuhan, China Radio, Film & TV Administration of Pingxiang, Pingxiang, Jiangxi 2010.
[20]. A Novel High Gain Two Stage Ultra-Wide Band CMOS LNA in 0.18μm Technology. Ehsan Kargaran , Hojat Khosrowjerdi , Karim Ghaffarzadegan and Moosa Kenarroodi. 5th European Conference on Circuits and Systems for Communications (ECCSC'10), November 23–25, 2010, Belgrade, Serbia.
[21]. Hari Varma, Nisha Kunder, Kerman Daruwalla. Low Noise Amplifier Design Project ; ELE 791 Microwave Transistor Amplifiers. pp: 1-22.
[22]. Md. Asif Mahmood Chowdhury , Prasenjit Chowdhury ,"Design of an Ultra Wideband Low Noise Amplifier(LNA) Circuit with High Center Frequency and Low Power Consumption", 2013 Third International Conference on Advanced Computing & Communication Technologies.
[23]. "RF Microelectronics", Behzad Razavi. Prentice Hall, NJ, 1998.
[24]. Guillermo Gonzalez, "Microwave Transistor Amplifiers", Prentice Hall, 1984.