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DESIGN OF OSCILLATOR USING 0.18µm CMOS TECHNOLOGY FOR UWB SYSTEMS

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ABSTRACT

This paper gives the design of oscillator circuit using 0.18µm technology. The proposed oscillator has been designed using the active inductor topology. The Hartley oscillator technique has been implemented in the proposed circuit. The proposed oscillator circuit gives the oscillation frequency of 5GHz and the power consumption of the circuit is 11.599mW. The proposed circuit can be used for the UWB system whose frequency range is 3.1GHz-10.6GHz.

***Keywords**: CMOS, Mixer, UWB*

I. INTRODUCTION

The oscillator are the circuits which are used to generate the frequency signal. The oscillator circuit must satisfy the Barkhausen criteria to get the sustained oscillation at the ouput. In RF receiver systems, the various blocks are connected as shown in Fig. 1.

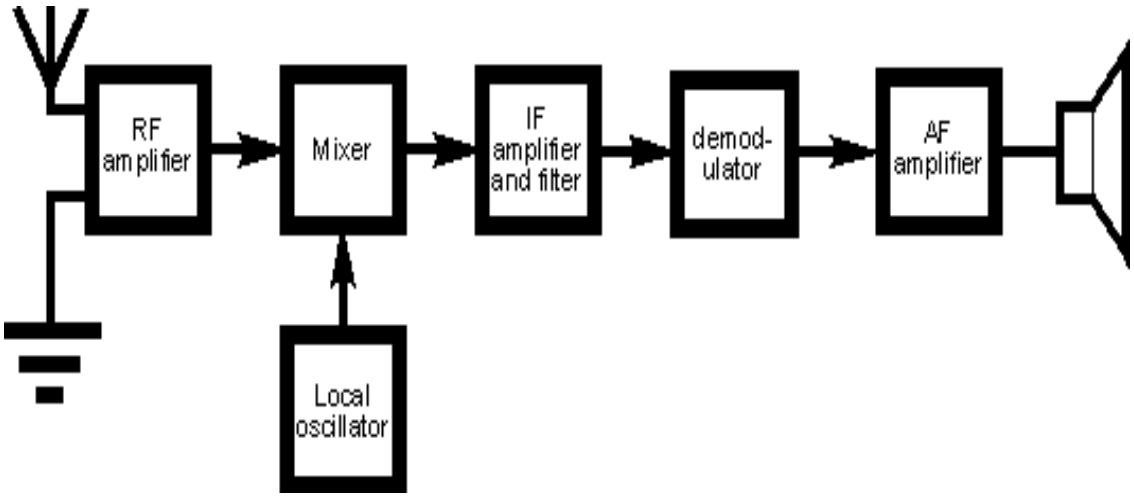

Fig. 1 Block Diagram of RF Receiver Systems

The block local oscillator gives input to the mixer and decides the frequency of mixer's output [2]. In receiver systems the frequency of mixer's output signal the frequency difference of local oscillator signal and RF signal. So, the quality of mixer's output depends on the RF signal as well as oscillator signal quality. There are various types of oscillators circuit for example RC oscillators, LC oscillators, crystal oscillator etc. The RC oscillator circuit is used to produce the signal frequency from KHz to MHz while LC oscillator circuit produce the signal frequency of MHz to GHz. The various LC oscillator circuit are Hartley oscillator and Colpitt oscillator. The

Hartley oscillator composed of amplifier circuit, two inductors and one capacitors as shown in Fig. 2. The frequecy of oscillations for Hartley is given by $f = \frac{1}{2\pi\sqrt{(L_1 + L_2 + 2M)C_1}}$ where L, M and C are inductance, Mutual inductance and capacitance value.

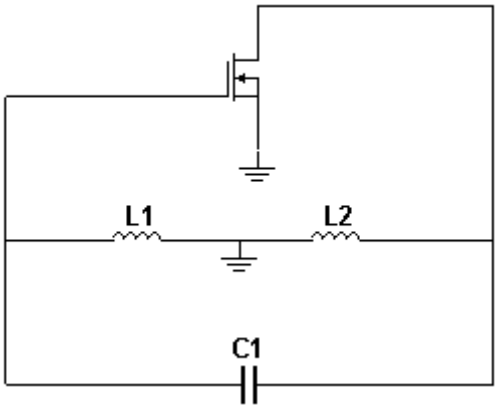

Fig. 2 MOS Hartley Oscillator

The amplifier circuit is the MOSFET connected in common source configuration. The inductor has been designed using MOSFET by which the size of the circuit has been reduced.

II. CIRCUIT DESIGN

The inductor using CMOS technology is shown in Fig. 3.

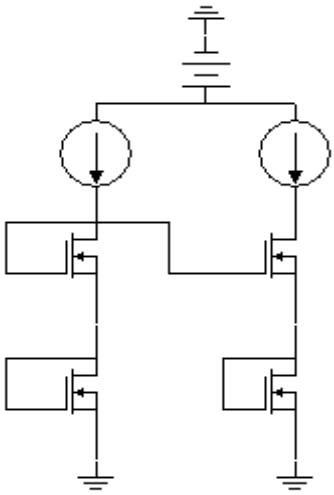

Fig. 3 CMOS Active Inductor

The circuit shows the low impedance at the low frequency whereas high impedance at high frequency[1]. Low noise and simple structure are the benefits of this circuit. The proposed oscillator circuit using the CMOS active inductor is shown in Fig. 4. The transistors M1 and M2 are connected in common source configuration to amplify the signal. The transistor M3 is connected in the common

drain configuration for impedance matching. The other transistors are connected in the active inductor topology.

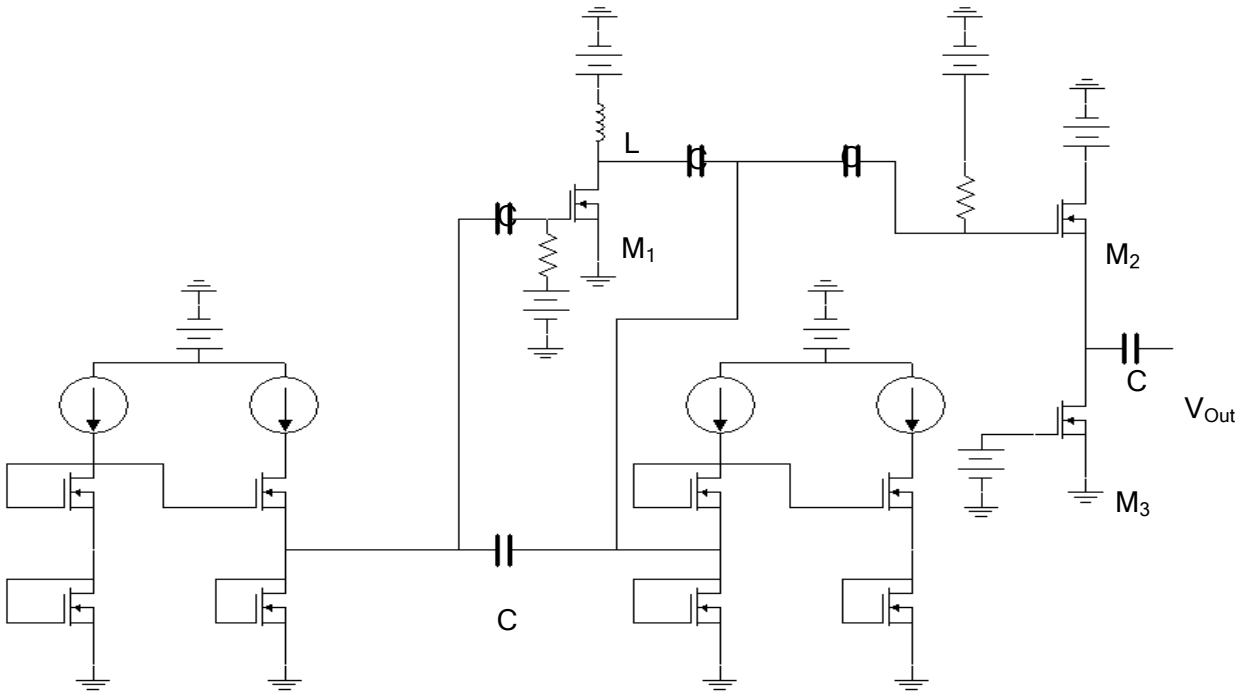

Fig. 4 Proposed Oscillator Circuit

III. SIMULATION RESULTS

The proposed circuit is simulated in ADS software using 0.18µm CMOS technology. The simulation result for the Vout v/s time is shown in Fig. 5.

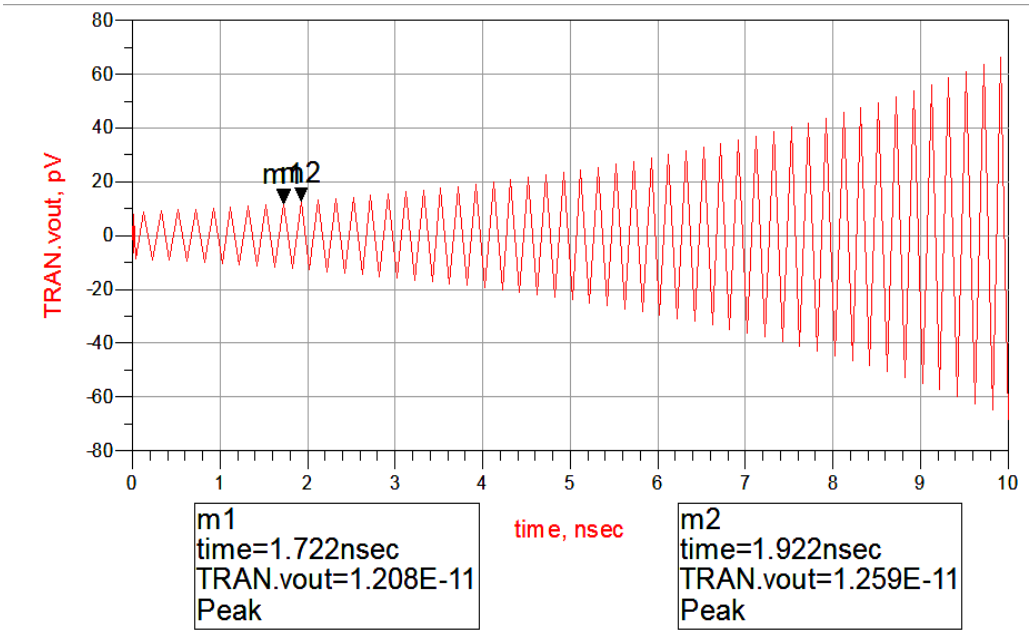

Fig. 5 Simulation Result of Vout v/s time

This is the transient response of the oscillator circuit designed using active inductor topology. The time period is 0.2ns, and the frequency obtained is 1/0.2ns i.e. 5GHz which is in the UWB range of (3.1 GHz to 10.6GHz). The total power consumption in this circuit is 11.599 mW.

IV. CONCLUSION

The proposed oscillator circuit has been simulated using 0.18µm CMOS technology. The frequency signal obtained is 5GHZ which is in the UWB range. The power consumption of the circuit is 11.599 mW.

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