

Voltage Controlled Oscillator (VCO) Using 0.35 μ m VLSI Technology

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ABSTRACT: CMOS refer to both a particular design of digital circuitry design, and that circuit on integrated circuit (chips) of the family process used to implementation. In this paper we use 0.35 μ m VLSI technology and compare the power dissipation of VCO between 5 VCO, 7 VCO & 9 VCO. In today's wireless communication system, greater maximum frequency required by the VCO with respect to the digital phones that use these circuit law, power consumption, small size and cost is important design factor of low fabrication. This report is a brief study of VCO using 0.35 μ m VLSI technology to achieve some objective as mention above. In this paper, we take each of these component and design, simulate them using various combination we work to improve the efficiency of the system.

KEYWORDS: Voltage Controlled Oscillator, TSMC 0.35 μ m, Power Optimization, CMOS Logic.

I. INTRODUCTION

A VCO is an electrical circuit that generate an oscillatory output voltage. A VCO provides a periodic signal where the frequency is dependent to the input voltage control signal supplied to the VCO. A VCO is simply oscillates an oscillator having a frequency output is proportional to the input voltage.

Oscillator frequently consists of one or two transistor, an inductor (L), and a capacitor (C) in an LC circuit, followed by a buffering amplifier. An oscillator circuit may be implemented with a tuned amplifier having positive feedback from the amplifier's output terminal to its input terminal, which design takes advantage of the instability possible in circuit having such a feedback loop.

The trade-offs and techniques for VCO design are then reviewed and relations between noise performance and power consumption are investigated. The performance of VCOs realized in different implementation styles is compared and finally we try to evaluate if or when integrated GHz VCO's are desirable.

II. RELATED WORK

VOLTAGE CONTROLLED OSCILLATOR

A Voltage Controlled Oscillator or VCO is a electronic oscillator whose oscillation frequency due to input voltage. We applied the input voltage for determine the instantaneous oscillation frequency. A voltage controlled oscillator using CMOS is work combination of NMOS and PMOS, NMOS and PMOS are connected to each other for simulate of VCO. Input voltage applied then simulate in VCO.

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BLOCK DIAGRAM:

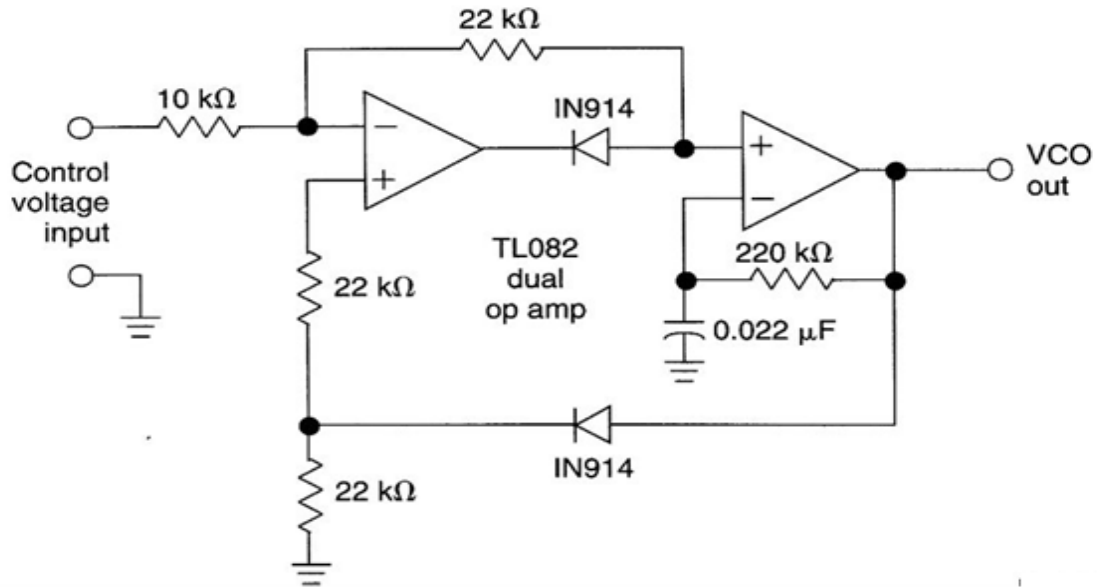


Figure 1: Block diagram of Voltage Controlled Oscillator (VCO)[2]

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In figure 2, transistor M2 and M3 operate as an inverter while M1 and M4 operate as current sources. The current sources, M1 and M4, limit the current available to the inverter, M2 and M3.

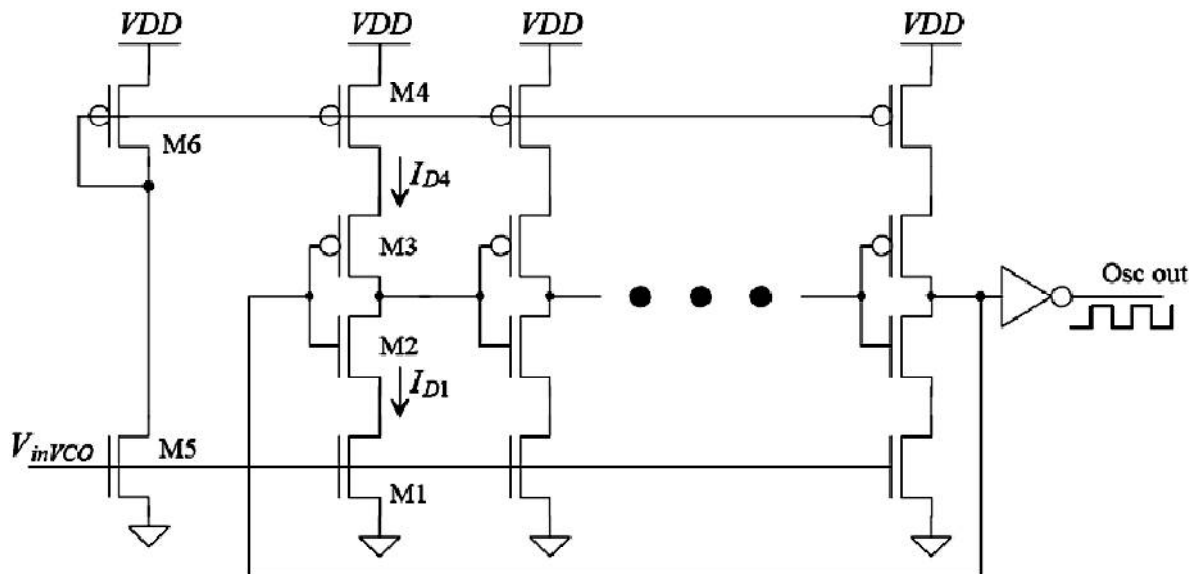


Figure 2: Schematic Diagram of Voltage Controlled Oscillator (VCO)[7]

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III. RING OSCILLATOR

A ring oscillator is a device work of an odd number of NOT gates. Output oscillates between two voltages, representing 0 or 1. The NOT gates and inverters are connected in series, and output connects the feedback network. If we connected the inverters more than 3 in series, so first inverter replace NAND gates with enable [1].

Properties of ring oscillator [2]

1. Oscillation may occur if the circuit multiple stages and hence multiple poles.
2. The total number of inversion in the loop must be odd, so that the circuit does not latch up.
3. The number of stages in ring oscillators is determined by various requirements, including speed, power dissipation, noise immunity etc.
4. Three to five stages provide optimum performance.
5. The ring oscillator is a member of the class of time delay oscillator.
6. Changing the supply voltage changes the delay through each inverter, with higher voltages typically decreasing the delay and increasing the oscillator frequency.

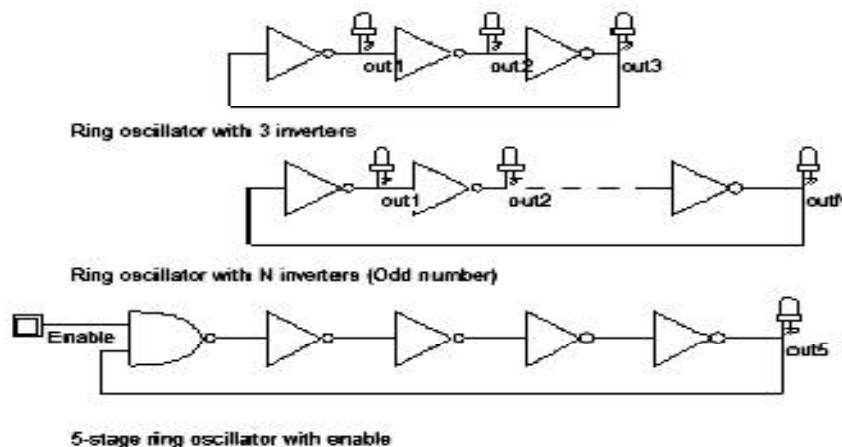


Figure3: A Ring Oscillator Based on an Odd Number of Inverter [1]

IV. EXPERIMENTAL RESULTS

SIMULATION AND PERFORMANCE ANALYSIS:

In this paper VCO shown is consisted of a CMOS inverter and an extra PMOS and NMOS is Controlled the output voltage. We apply the DC voltage in input terminal as a voltage source and connected to the controlled PMOS and NMOS transistor and the supply voltage as a VDD at 5V. We use the CMOS inverter and apply the voltage and controlled the voltage. We use the different numbers of VCO (5 VCO, 7VCO and 9 VCO) and simulate at the different DC voltages and compare the total power dissipation and define the best power dissipation at the different voltages.

The circuit diagram using Mentor graphics software at 0.35 μ m technology is shown below:

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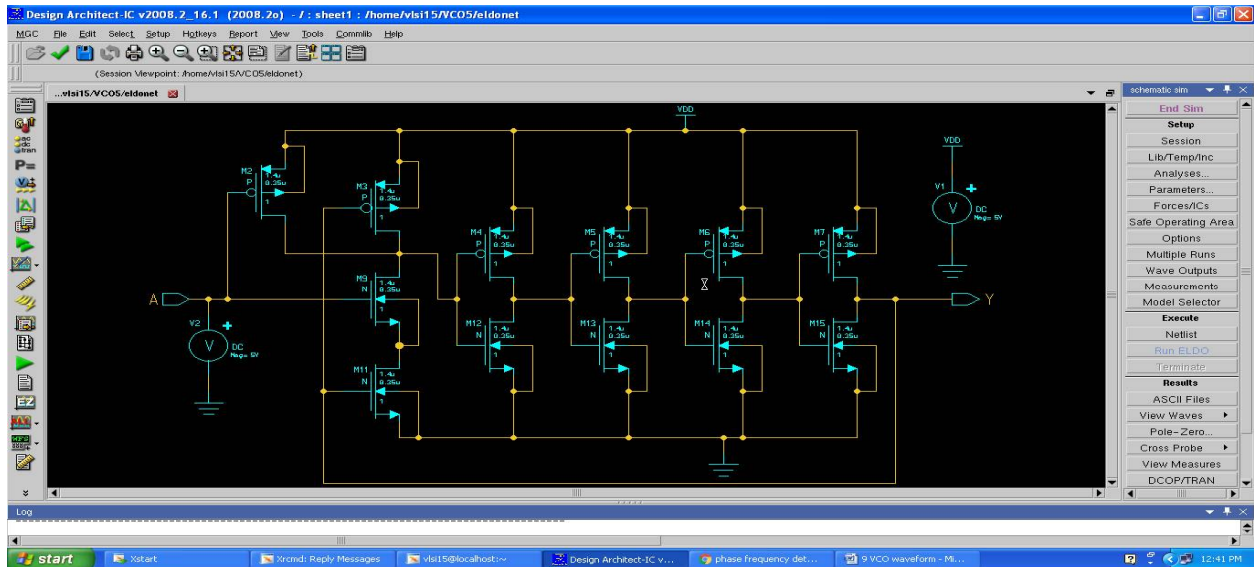


Figure 4: Schematic diagram of 5 VCO

In this schematic diagram we use five inverters, all transistors are diode connected and DC voltage supply in input as a voltage source and supply voltage also DC voltage. VCO only work on DC voltage M2 and M9 are controlled inverters. Output waveform is oscillates on 5 DC voltage, and total power dissipation is 7.0261m Watts.

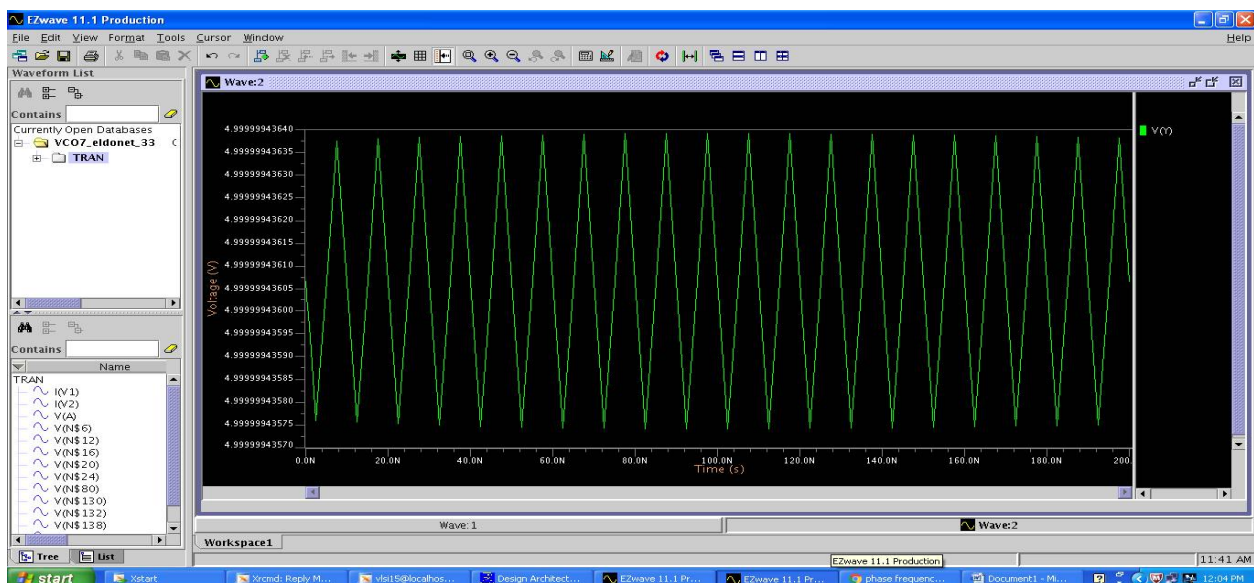


Figure 5: Waveform of VCO.

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COMPARISION of VCO's:

DC Voltage	5 VCO (TPD)	7 VCO (TPD)	9 VCO (TPD)
0.5 Voltage	4.1744 μ W	4.1758 μ W	4.1766 μ W
1.0 Voltage	278.5213 μ W	278.5369 μ W	278.5376 μ W
1.5 Voltage	754.0062 μ W	754.0080 μ W	754.0078 μ W
2.0 Voltage	1.9524mW	1.9525mW	1.9525mW
2.5 Voltage	7.1155mW	9.9293mW	12.7430mW
3.0 Voltage	7.3542mW	10.1669mW	12.9807mW
3.5 Voltage	7.2188mW	10.0326mW	12.8464mW
4.0 Voltage	7.0659mW	9.8797mW	12.6935mW
4.5 Voltage	7.0253mW	9.8391mW	12.6528mW
5.0 Voltage	7.0261mW	9.8399mW	12.6537mW

V. CONCLUSION

In this paper we define which VCO is better for power dissipation and decided the VCO. 5 VCO is better for total power dissipation as compare to 7 VCO and 9 VCO at different voltages.

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