Design and Implementation of CMOS Schmitt Trigger

Arpit Sharma, Inderprastha Engineering College, Ghaziabad

Abstract— In this paper, I am going to design and Implement Schmitt trigger Circuit using CMOS Technology and I will also simulate the circuit using 28nm technology. This Design & Implementation will be done on Synopsys Custom Design Platform and libraries available on Cloud. The Schmitt Trigger is a comparator circuit that incorporates positive feedback, are extensively used in digital as well as analog systems to filter out any noise present in a signal line and produce a clean digital signal. We can verify the design using Circuit Schematic and Waveforms.

Keywords—CMOS, VLSI, Schmitt trigger, PMOS, NMOS noise immunity.

I. REFERENCE CIRCUIT DETAILS

Schmitt Trigger is a very Important circuit as far as both Analog & Digital Electronics is concerned. It has got a wide range of applications in mixed signal circuits also. Schmitt Trigger is basically a Voltage comparator, but with positive feedback employed in the circuit. Schmitt Trigger's circuit can be made from an Op-Amp, 555 timer IC and at transistor level as well. It is also called as Bistable Multivibrator, because it has two stable states and the transition from one state to another requires an external stimulus, this is the concept which gives rise to flip flops in digital electronics.

Since the circuit has positive feedback, the output of the circuit can only be upper or lower saturation voltage levels of the circuit. Due to positive feedback, the transfer function of the circuit has different forward and backward paths i.e., Hysteresis curve is obtained. There are upper and lower threshold voltage levels in input, depending on which the output level is determined. So, if an alternating, periodic Sinusoidal or Triangular input signal is given to the circuit, a square waveform is obtained at the output.
When a transmitted signal is received at a receiver, the signal is generally affected by noise during transmission, so at the end of receiver, a Schmitt trigger is used to remove noise from the received signal and produce a clean digital signal at the output, due to its hysteresis shaped transfer characteristics. So, it takes noisy signals & produces signal with clean and ripple free transitions.

In general, it works as an inverter which consists of two PMOS transistors, two NMOS transistors, one feedback PMOS transistor and one feedback NMOS transistor. The output is high when the input is below the negative threshold voltage, while the output is low if the input exceeds the positive threshold voltage. By calibrating the transistor's performances and dimensions, the threshold voltages can be adjusted and controlled (PMOS and NMOS).

II. REFERENCE CIRCUIT

Figure 1 shows the CMOS circuit of a Schmitt trigger. It consists of 6 transistors, 3 PMOS P1, P2, P3 and 3 NMOS N1, N2, N3 as shown.

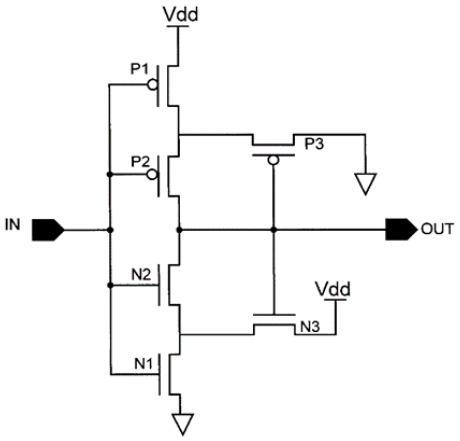

Figure 1 CMOS Schmitt trigger circuit

III. REFERENCE CIRCUIT WAVEFORMS

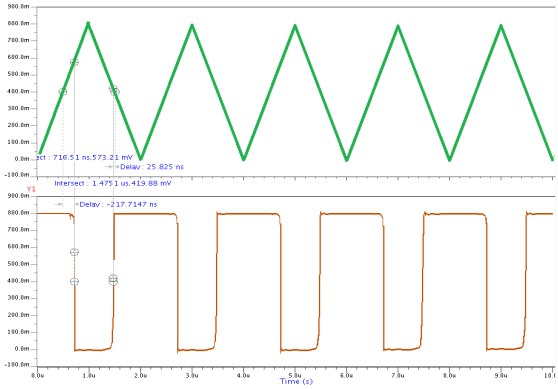

Figure 2 Input and Output Waveforms

IV. REFERENCES

[1.] Pranay Kumar Rahi, Shashi Dewangan, Tanuj Yadav, Md Muzaherul Haque, "Design and Simulation of CMOS Schmitt Trigger" IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 3 Issue 8, August 2016.

[2.] Nahid A Jahan, Mohammad Fairuz Bin Amir, Md. Ashraful Islam, M Mofazzal Hossain, Mamun Bin Ibne Reaz, "Design and Performance Analysis of Low Voltage and Low Power Schmitt Trigger for 0.18 µm CMOS Process" IOSR Journal of VLSI and Signal Processing (IOSR-JVSP) Volume 11, Issue 3, Ser. I (May. - June. 2021), PP 01-17.