

Design of 3-Bit Flash ADC using Inverter Threshold Comparator

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Abstract—Analog to Digital Converter (ADC) converts time continuous physical signal to digital number. In simple words, ADC converts analog signals in to digital signals that can be used by electronic circuits. In this paper a 3-bit Flash ADC will be designed and implemented using comparator circuit called Inverter Threshold Comparator (ITC). The Sample & Hold circuit for ADC will be implemented using Transmission Gate Switch (TGS). The Priority encoder will be implemented as a Digital Circuit and coded using Verilog. The design will be implemented using e-sim tool.

Keywords—Analog to Digital Converter (ADC), Inverter Threshold Comparator (ITC), Transmission Gate Switch (TGS), Width (W), Length (L), Voltage(V)

I. CIRCUIT DETAILS

ADC has its applications in high-speed communication and signal processing systems. Therefore there is a need of low power, low area and low cost ADC's. Comparator and encoder are the basic building blocks of Flash ADC. A 3-bit Flash ADC requires 7 comparators. The supply voltage for the ADC will be 1 V. Seven different voltage values between 0 V and 1 V will be used as reference voltage for each comparator. The L and W values of MOS transistors used in the inverter are varied to obtain different threshold voltages for different ITCs. These modified threshold voltages are considered as the comparator reference voltages. The output of the comparators is fed as input to the priority encoder.

The Sample and Hold circuit will be designed using TGS by varying the W and L of PMOS and NMOS and Capacitor value in TGS to get required sampling frequency.

The priority encoder will be designed for the below truth table.

A ₇	A ₆	A ₅	A ₄	A ₃	A ₂	A ₁	Y ₃	Y ₂	Y ₁
1	1	1	1	1	1	1	0	0	0
1	1	1	1	1	1	0	0	0	1
1	1	1	1	1	0	0	0	1	0
1	1	1	1	0	0	0	0	1	1
1	1	1	0	0	0	0	1	0	0
1	1	0	0	0	0	0	1	0	1
1	0	0	0	0	0	0	1	1	0
0	0	0	0	0	0	0	1	1	1

Table I. Truth Table of the encoder

The output of the encoder will be given to the latches to store the output.

II. REFERENCE CIRCUIT

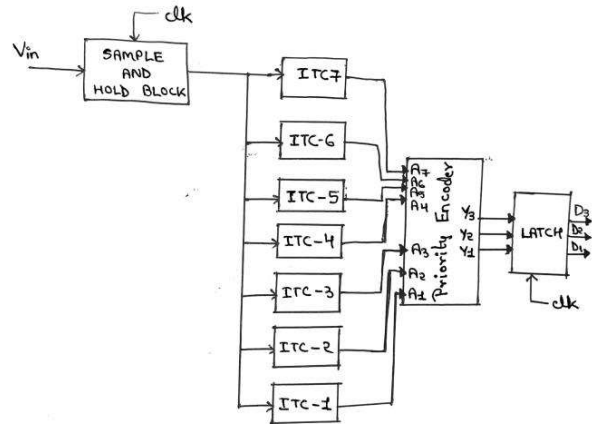


Figure 1. Block Diagram of 3-bit Flash ADC

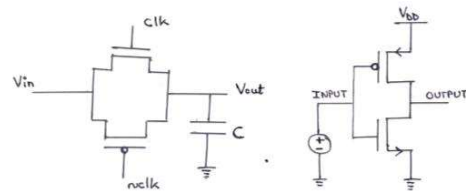
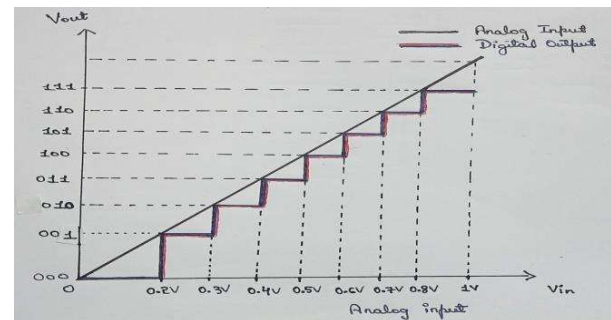


Figure 2. Transmission Gate Switch Figure 3. Transistor Schematic of ITC

III. REFERENCE WAVEFORMS



REFERENCES

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