

Design of 3-bit Flash ADC

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Abstract— This paper proposes a 3-bit Flash Analog to Digital Converter for low-power integrated circuits and system applications which will be implemented using ngspice and verilog simulation. The circuit design, implementation and analysis will be done using FOSSEE's eSim software. The 3-bit Flash ADC is designed using comparator and a priority encoder to facilitate the conversion of analog to digital signals. Using the reference circuit waveforms, we can verify the circuit design. This 3-bit Flash ADC can be used in the design of large integrated circuits which has many digital decoding functions.

Keywords— Flash ADC, Comparator, Encoder, low power

I. REFERENCE CIRCUIT DETAILS

The Flash ADC is a type of analog to digital converter which functions on the basis of comparing analog signals with reference voltages and converts them into digital data. Generally, Flash ADC's design consists of a resistor ladder, comparator and an encoder.

The voltage divider circuit in the Flash ADC is a simple network of resistors in series which has an input voltage to be scaled down along the resistors. The primary purpose of this circuit is to scale down and provide the voltage ratio according to the position of the resistor. In this circuit, we use voltage divider circuit with 8 resistors for dividing the voltage with respect to the reference voltage.

The comparator circuit is used to compare the inputs with the reference voltage V_{ref} and the inputs from the voltage divider. For the comparator circuit, we use a basic opamp for comparing the voltages. If the voltage V_{in} is higher than V_{ref} , then the output voltage will be V_{cc} . If the voltage V_{in} is lower than V_{ref} , then the output voltage will be $-V_{cc}$.

Encoder is a type of combinational circuit which performs the encoding of 2^N inputs to N outputs. This basic encoder has a problem when it comes to multiple input being high at a same time. In order to rectify this problem, priority encoder is used. Priority Encoder gives us the output based on the highest priority input. In this circuit, we are going to use 8 x 3 priority encoder as encoding circuit. We will implement 3-bit Flash ADC circuit design using ngspice and verilog software and verify with the waveform obtained as an output.

II. REFERENCE CIRCUIT DESIGN

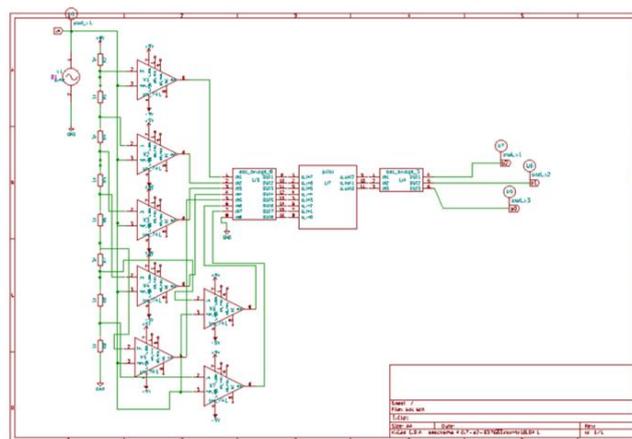


Fig. 1 Design of the 3-bit Flash ADC

III. REFERENCE CIRCUIT WAVEFORM

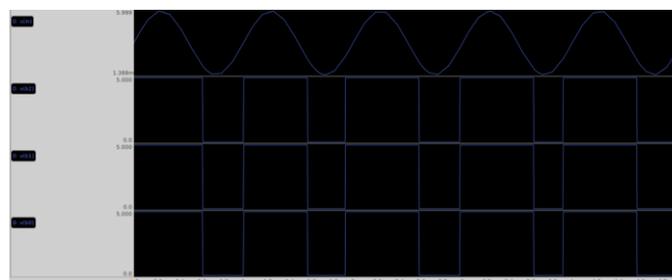


Fig. 2 Output Waveform

REFERENCES

- [1] J. Nidagundi, S. Bettakusugal, "Design and Implementation of 3-bit Flash Analog to Digital Converter (ADC)," *International Journal of Latest Trends in Engineering and Technology*, vol. 10, no. 3, pp.208-214
- [2] S. Franco, *Design with Operational Amplifiers and Analog Integrated Circuits*. New York: McGraw-Hill Education, 2015