3-BIT FLASH ANALOG TO DIGITAL CONVERTER (ADC) USING eSIM

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Abstract —

Flash ADC is also known as the *parallel A/D converter*. It is formed of a series of comparators, each one comparing the input signal to an unique reference voltage. The comparator outputs connect to the inputs of a priority encoder circuit built with gates and diode which then produces a binary output. Flash converters are extremely fast compared to many other types of ADCs. This paper explains the simulation of flash adc using eSim.

Keywords — parallel A/D converter, Comparator, Encoder, eSim

I. INTRODUCTION

A flash ADC gives nonlinear response to the analog input signal. The flash converter designed in this paper is the simplest and efficient in terms of speed, being limited only in comparator and gate propagation delays. The circuit is implemented using eSim, an integrated tool with Makerchip IDE, KiCad, Ngspice, GHDL and Verilator.

II. IMPLEMENTED CIRCUIT DIAGRAM

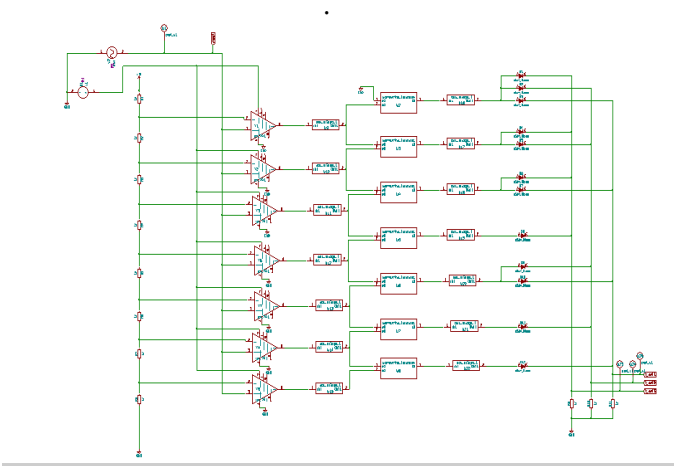

Fig.1 : 3-Bit Flash ADC

This three-bit flash ADC requires seven comparators. A four-bit version would require 15 comparators. With each additional output bit, the number of required comparators doubles.
It has seven op-amps and seven Exclusive-OR gates. V_{ref} is a stable reference voltage provided by a precision voltage regulator as part of the converter circuit and Vin is given as 5V. The V_{ref} used here is PWL wave and its connected to non – inverting terminal of the op-amp.

Due to the nature of the sequential comparator output states the same "highest-order-input selection" effect may be realized through a set of Exclusive-OR gates, allowing the use of a simpler, non-priority encoder.
An additional advantage of the flash converter, often overlooked, is the ability for it to produce a non-linear output.
In this circuit, the digital Ex-OR block is designed.
In Makerchip using a verilog code for Ex-OR gate and the other Components are in-built in eSim which is used to simulate the mixed signal.

III. IMPLEMENTED WAVEFORM:

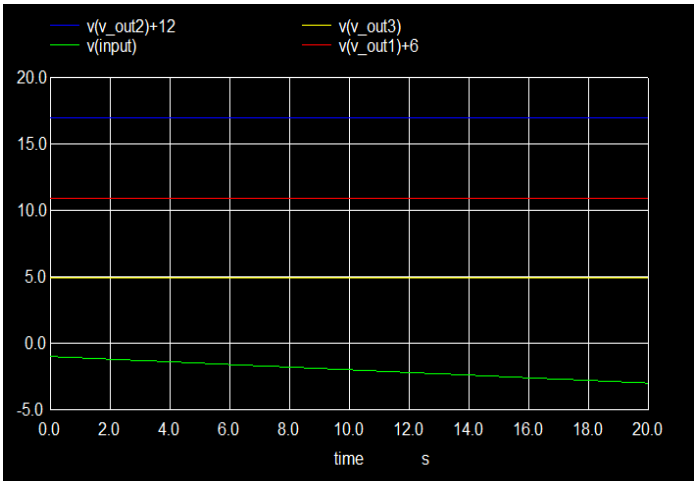

Fig.2 : Output Waveforms

IV. REFERENCES

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