Design of 8-to-3-bit priority Encoder using mixed signal.

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Abstract

An encoder is a combinational circuit, it encodes the data from 2^n inputs into an n-bit code. To overcome the disadvantages of conventional binary encoders, priority encoders were designed which gives output based on highest priority given to the input bits. The proposed work shows the implementation of 8-to-3-bit priority encoder, using ADC bridge to convert the analog input to digital and DAC bridge to convert digital output back to analog form.

1. Reference circuit Details

8-to-3-bit priority encoder consists of 8 inputs: I8 to I1 and 3 outputs: Q2, Q1 and Q0. Each input line corresponds to each octal digit and three outputs generate corresponding binary code. Priority encoder gives output according to highest priority given to the input.

If there are two or more inputs are logic high simultaneously then the input with the highest priority is considered by ignoring all other input lines. The input that has the highest priority is encoded first rather than other input lines. Hence, the generated output is based on the priority assigned to the inputs.

Truth table for 8-to-3-bit priority encoder:

IN[7]	IN[6]	IN[5]	IN[4]	IN[3]	IN[2]	IN[1]	IN[0]	OUT[2]	OUT[2]	OUT[2]
1	x	x	x	x	x	x	x	1	1	1
0	1	x	x	x	x	x	x	1	1	0
0	0	1	x	x	x	x	x	1	0	1
0	0	0	1	x	x	x	x	1	0	0
0	0	0	0	1	x	x	x	0	1	1
0	0	0	0	0	1	x	x	0	1	0
0	0	0	0	0	0	1	x	0	0	1
0	0	0	0	0	0	0	1	0	0	0

Logical expressions:

$Q0 = I1+I3+I5+I7$

$Q1 = I2+I3+I6+I7$

$Q2 = I4+I5+I6+I7$

ADC bridge is used to convert the analog input to corresponding digital input, which is given input to the priority encoder. The ADC bridge can be designed using voltage divider resistors and operational amplifier as a comparator, which is also called as flash ADC.

Similarly, the DAC bridge is used to convert the digital output into analog form. The DAC bridge can be designed using R-2R resistors and operational amplifier DAC, which use two precision resistors to convert a digital binary number into an analog output signal proportional to the value of the digital number.
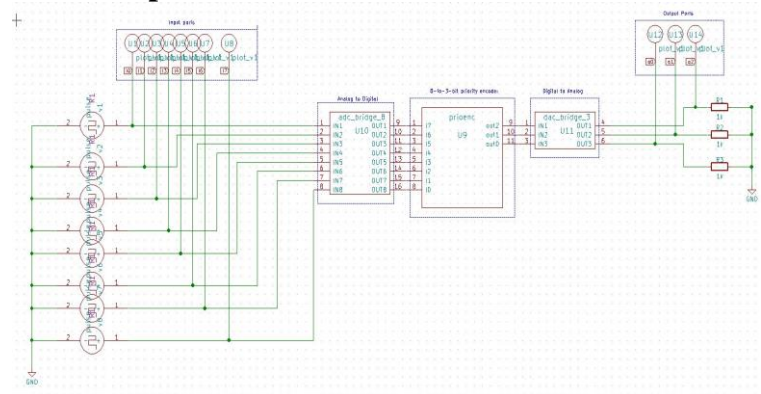
2. Implemented Circuit

Fig 1: 8-to-3-bit priority encoder using mixed mode.

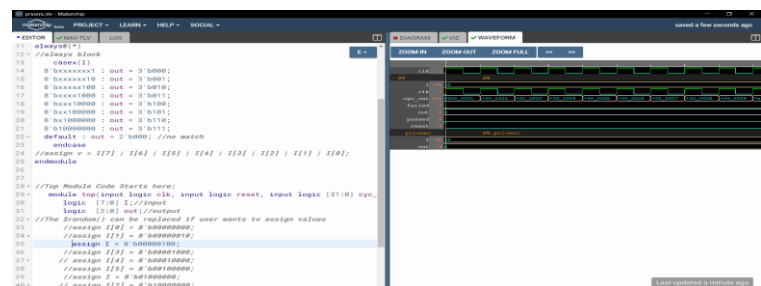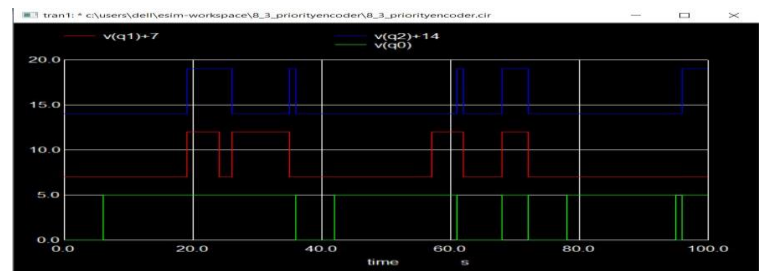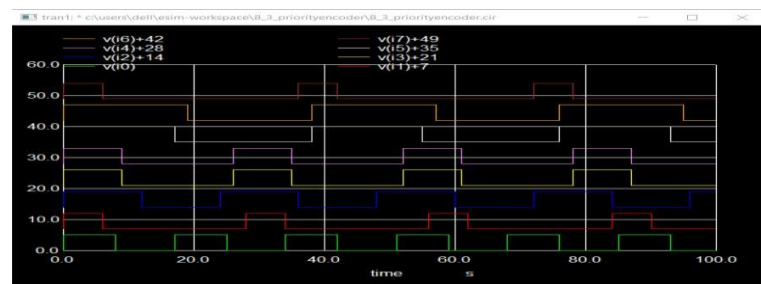## 3. Circuit Waveforms

Fig 2: Simulated Waveforms.

References

[1] WatElectronics.com. 2022. *Priority Encoder: Truth Table, Differences & Its Applications*. [online] Available at: <https://www.watelectronics.com/priority-encoder/>.