Design and Analysis of a 2 to 1 Multiplexer

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***Abstract*—Multiplexer (MUX) being one of the most useful tool in communication, so in this paper we will try to find effective way of designing the mux using the knwoledge of both analog and digital circuits. Hence in here, usage of CMOS technologies along with the gates to effectively construct the component having the best of efficiency and speed.**

***Index Terms*—PMOS gates,NMOS gates,MUX (multiplexer)**

I. Introduction

MUX is a data selector tool that selects one of the given sets of inputs and passes to the output line.General formula to design the mux goes as follows where if there are **n** inputs and then the mux contains 2^n select lines.It is also called **switch box** as the name suggests, it does the job of switching between the inputs. A 2:1 mux has two input lines D1 and D0, one select line S, one output line O. A very simple thing to design and the working of the mux is equally simple. When the select line is 0, then the input D1 is passed to the output line and for S to be equal to 1, D0 is passes through to the output line O. Now generally the design is done either in analog or in digital.

Analog design is about designing the component in the gate level design for example and gate,nor gates and so on. It is comparatively easy to design and has an advantage of being the most effective as it is being driven in-out based systems.

Digital Design is considered bit complicated as compared to analog design. Here component is initially broken down to gate level diagrams initially and then the gates are further broken down to the more simple level of hierarchy or basic building blocks of the circuits i.e C PMOS and NMOS logic. It is collectively known as CMOS technologies. It is considered complicated as it uses multiple level of hierarchy to design the simple logic.

x = any of 0/1.

Select	D_0	D_1	Y
0	0	x	0
0	1	x	1
1	x	0	0
1	x	1	1

Fig. 1: Truth Table of 2:1 mux

As we discussed about the ways of designing the logic in analog and digital, both comes with some pros and cons. Analog design is considered to be effective in getting the results whereas Digital design is considered to be faster than the analog design.So designing using a particular method has some advantage over other.Our goal here is to be find a better way to have good efficiency as well as quickly getting the outputs to the match the speed demands.

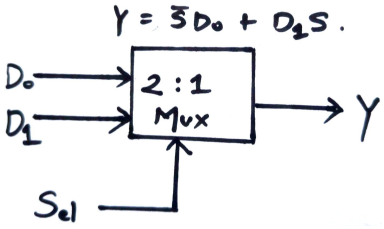

Fig. 2: Block diagram of 2:1 mux

We will design the mux with both analog and digital signals as "mixed signal" where some part of the design will be in the analog and some part in the digital design to get the best efficiency and speed of the design.

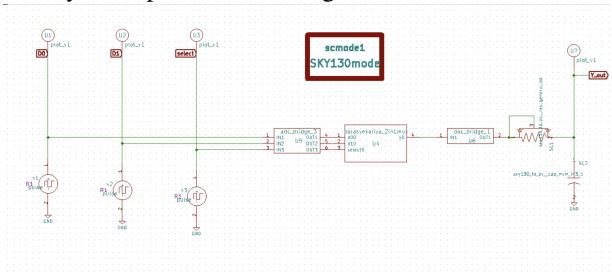

Fig. 3: Circuit Design using eSim

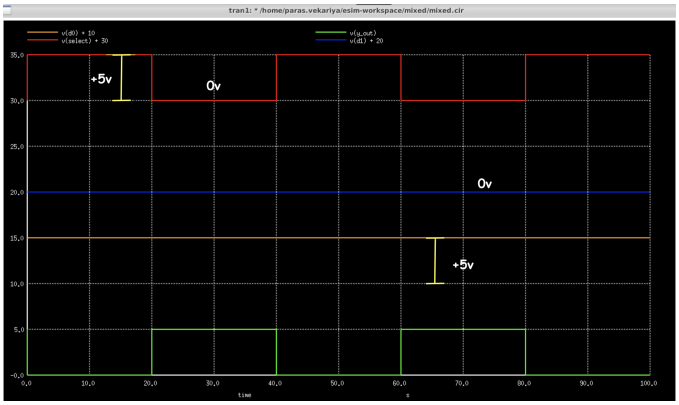

Fig. 4: Final Plots

References

[1] R. V. Anugraha, D. S. Durga and R. Avudaiammam, "Design and performance analysis of 2:1 multiplexer using multiple logic families at 180 nm technology," 2017 2nd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT), 2017, pp. 1849-1853, doi: 10.1109/RTEICT.2017.8256918.