Full Adder Design Using CMOS

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***Abstract*— The conventional Full Adder Circuit consists of 2 blocks one for sun calculation and other for carry calculation, the output of the carry operation is used as an input for the sum block.**

Keywords*— *CMOS, Full Adder, Adder, Adders, Sum, Carry, Addition, Binary Addition, MOSFET

I. Introduction (*Heading 1*)

The Full Adder Circuit is 3 input circuit which computes the binary addition result of the three inputs, it is sub part of many circuits like Ripple Carry Adders where an array of Full Adders is used to compute a n bit value result. Other common circuits that use Full adders are ALU, Multipliers.

II. Reference Circuit

The circuit for Full Adder is as shown in Figure 1.

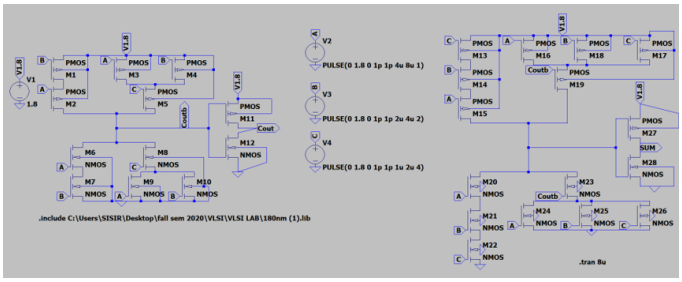

Figure 1

This circuit is divided into 2 blocks Sum Block and Carry Block, the Sum Block consists of 14 MOSFETS and Carry Block consists of 12 MOSFETS, the output of the Carry Block is given to the Sum Block.

For obtaining final sum and carry values we need to invert the output obtained from both the blocks as MOSFETS Implement only negative logic.

III. Reference Waveform and Area Estimation

The output obtained from the above circuit simulated on LT Spice tool is shown in Figure 2.

Inputs			Outputs	
A	B	C_{in}	Sum	Carry
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Table 1

The Table 1 shows the Truth table of the Full Adder.

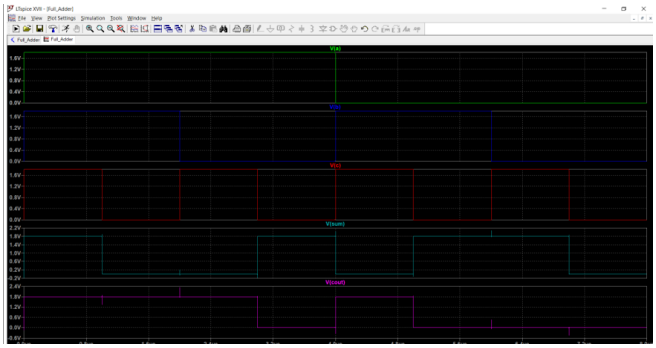

Figure 2

According to SCMOS (Standard CMOS) design rules, the area of 1 mosfet can roughly be calculated as shown in Figure 3 (polly crossed by diffusion is called MOSFET)

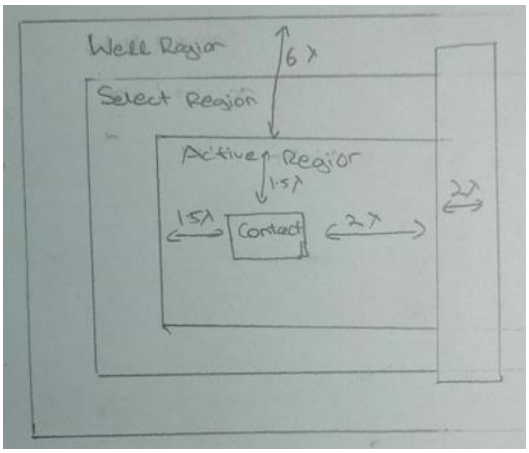

Figure 3 Approximate layout of a CMOS

Here the vertical column is the poly layer, the λ(lambda) is a parameter used to represent various lengths in a CMOS layout design, λ = L/2, where L is the minimum feature size.

Using Figure 3 as a basis of our estimation we find out area of 1 MOSFET is approximately 230*λ^2 units and for 28 MOSFETS we are using it would be 6440* λ^2 units in 5*10^6 nm^2 for the complete circuit Approximately.

References

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[2] Neil H.Weste, Harris, A. Banerjee, “CMOS VLSI Design, A circuits and System Perspective”, 2014, Fourth Edition, Pearson Education, Noida