

Comparative Analysis of Different Types of Full Adders using 180nm and 90nm Technology

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ABSTRACT

The full adder circuit is the major cell in many processing Systems. The full adder is used to add the partial products of multipliers. Decreasing the number of transistor count in full adder can result in the less power consumption. In this paper different types of full adders has been implemented by using cadence virtuoso 180nm and 90nm technology this results decreasing the total power consumption of full adder.

Keywords

Full Adder, Adiabatic Logic, 28T, 20T, 14T, Half Adder

1. INTRODUCTION

Now a day's increase in the demand for high speed and low power VLSI applications such as processors. In order to achieve this multiplier are developed. Multipliers are used to multiply the two binary numbers. This multiplier will generate the partial products and these partial products are then added by the adder's mostly full adders. The 1-Bit full adder cell is the main building block for the multipliers. The full adder is consists of three inputs A, B, C_{in} and two outputs sum and carry. [1] The sum is given as $SUM = A \text{ ex-or } B \text{ ex-or } C_{in}$ and carry is given as $CARRY = AB + BC + CA$. The block diagram of the full adder is given in figure1.

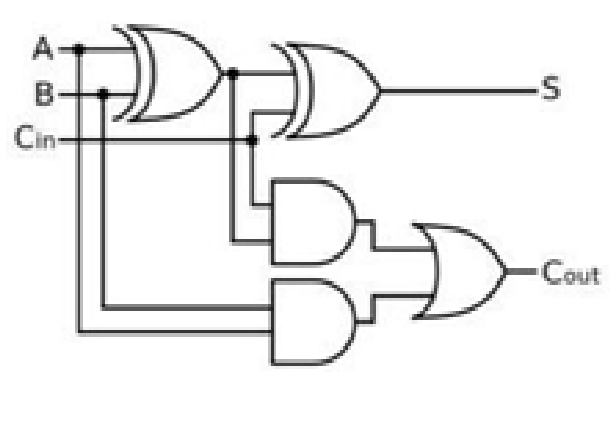


Fig 1: Full adder Block Diagram

The truth table for full adder is given in figure 2

A	B	C_i	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

Fig 2: Truth table for Full adder

So, the main research is going on to reduce the transistor count of a full adder. There are many techniques has been introduced to reduce the number of transistors in full adder like Dynamic and domino Cmos logic, Gate Diffusion Input (GDI), Pass Transistor Logic (PTL).[2]

2. DIFFERENT TYPES OF FULL ADDERS

In this section discussed about different types of full adders. There are different types of full adders present like Conventional full adder with 46T, 28T, 20T, 14T, 8T and 6T.

2.1 Conventional 46 T Full adder

The conventional full adder is designed with two half adders and one OR gate. The half adder is again consists of one ex-or gate and one AND gate[3]. The block diagram of the conventional 46T full adder is shown in figure 3.

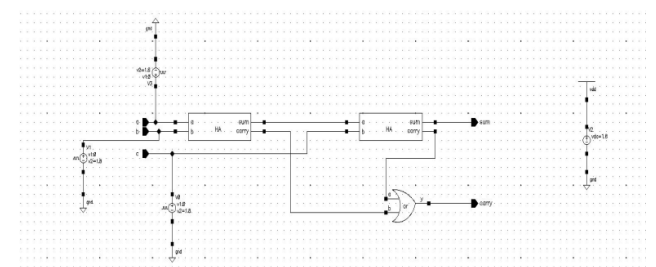


Fig 3: Conventional 46T Full adder

In this full adder, the number of transistors is 46. This type of full adder has high power consumption due to the more number of transistors. So, need to decrease the power consumption. In order to reduce the power consumption reduces the total number of transistors.

2.2 28 T Full Adder Circuit

In 28T full adder circuit used 28 transistors to perform the full adder function. This technique gives the low power consumption and less delay as compared to 46T full adder[4]. The block diagram for 28T full adder is given in figure 4.

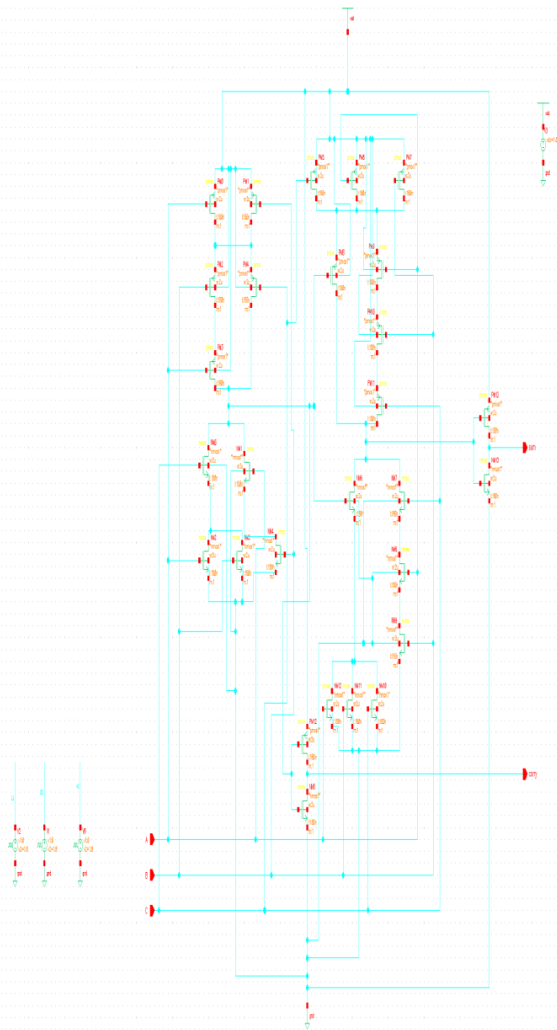


Fig 4: 28T Full Adder

2.3 20T Full Adder circuit

In 20T full adder used 20 transistor acts as a full adder. Because of reducing the total number of transistors the power consumption of full adder circuit is reduced and delay also reduced as compared to the 28T full adder[4]. The structure of 20T full adder is given in figure 5.

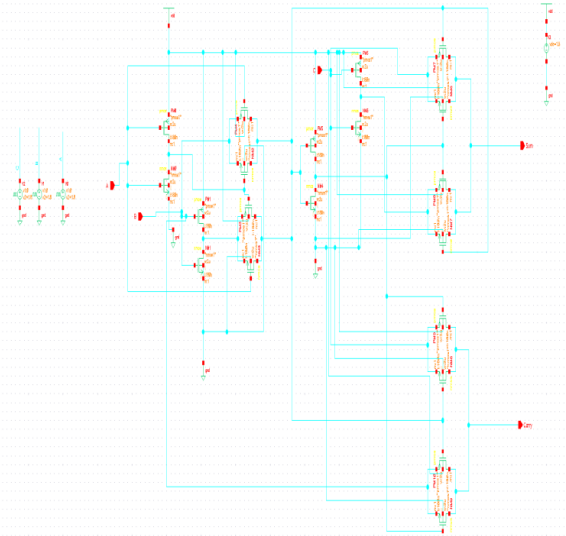


Fig 5: 20T Full Adder

2.4 14T Full Adder Circuit

The 14T full adder is designed with XOR- XNOR module and it consists of 14 transistors. But this 14T full adder will consumes more power than the other because of high voltage swing[5][6]. The block diagram of 14T is given in figure 6.

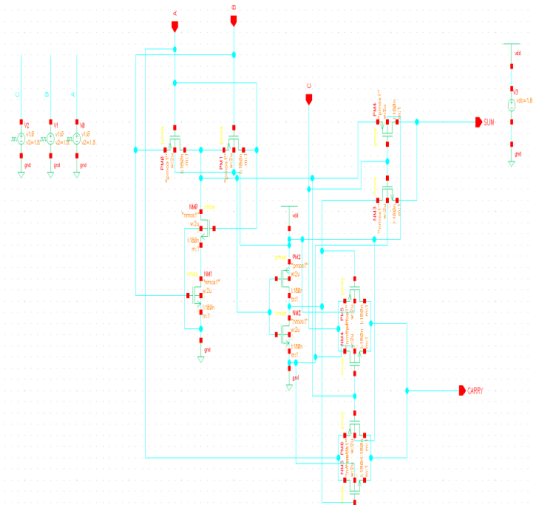


Fig 6: Block diagram of 14 T Full Adder

3. SIMULATION RESULTS

The simulation results of the conventional 46T full adder are given in figure 7.

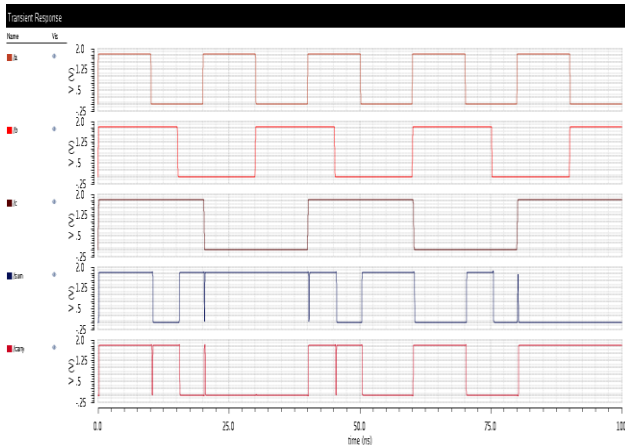


Fig 7: Output wave forms of 46T Full Adder

The output wave forms for 28T are given in figure 8.

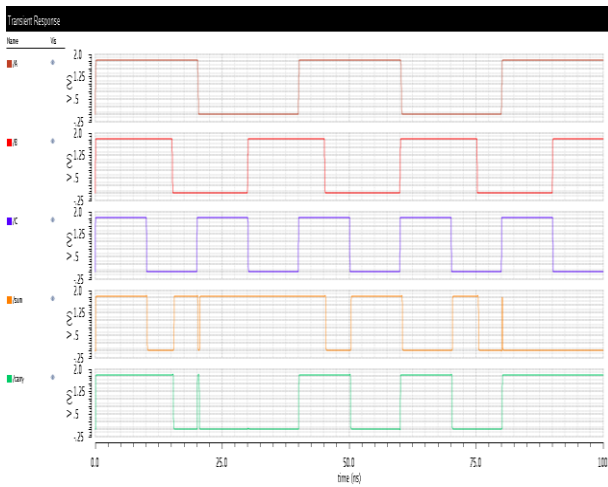


Fig 8: Output waveforms of 28T full adder

The output waveforms for 20T full adder are given in figure 9.

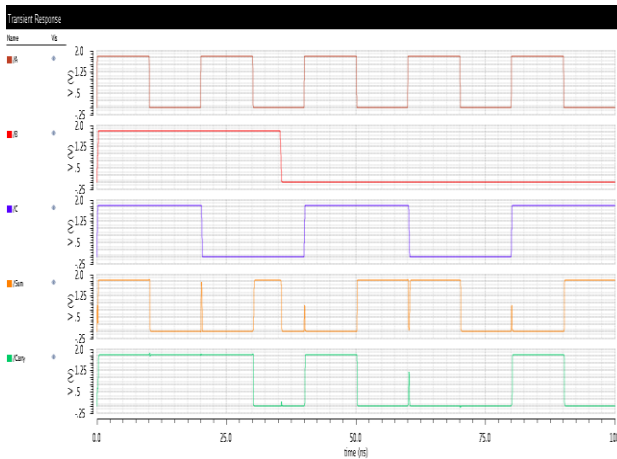


Fig 9: Output waveforms of 20T Full Adder

The output waveforms of 14T full adder are given in figure 10.

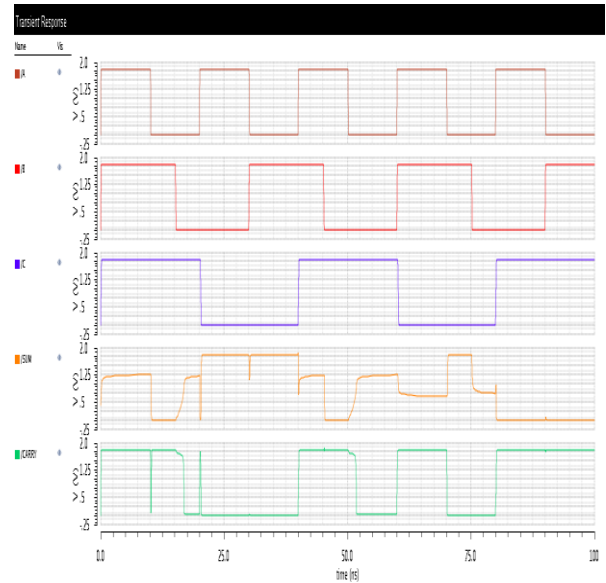


Fig 10: Output waveforms of 14T Full Adder

Table 1. Comparison table of power consumption by different types of full adders in 180nm Technology

Full adder	Power Consumption
46T	43.74×10^{-6}
28T	18.59×10^{-6}
20T	18.56×10^{-6}
14T	28.6×10^{-6}

All the above outputs are getting at input voltage 1.8V

Table 2. Comparison table of power consumption by different types of full adders in 90nm Technology

Full adder	Power Consumption
46T	4.651×10^{-6}

28T	0.3454×10^{-6}
20T	0.3568×10^{-6}
14T	0.8926×10^{-6}

All the above results are getting at input voltage 0.9 V

From the above two table, we observe that the power consumption of full adder is decreasing by decreasing the total number of transistors and technology. But the 14T full 2012adder is taking more power than the other full adders because of the switching activity is more than the other full adders due to its complex design.

4. CONCLUSION

In this paper different types of full adder's circuits are implemented and calculated their power consumption. The full adder cell is the basic building block of the many applications of multipliers. According to the results, the 20T full adder is consumed the less power compare to other. But in the 14T full adder, the transistor count is less but power is more due to the high output swing. So the 20T full can be used for low power applications. In future we can reduce the power consumption of full adder by reducing the transistors

like 10T, 8T, 6T and these can be used to implement the full adder circuits which are main building blocks of the multiplier circuits.

5. REFERENCES

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