

4-Bit Barrel Shifter

Jovin P John
Electronics and Communication
Engineering
Albertian Institute of Science and
Technology
Kochi, Kerala

Abstract— This project implements a 4-bit Barrel Shifter for performing fast data shifts in digital systems. The design allows circular shifting of input data either to the left or right by a specified number of positions, controlled by select inputs. Unlike conventional shifters, a barrel shifter performs the operation in a single step using multiplexers. The goal is to construct the truth table, implement the circuit in eSim, and validate results through transient analysis.

Keywords— Barrel Shifter, Multiplexer, Data Shift, Digital Circuits

I. INTRODUCTION

A Barrel Shifter is a combinational circuit used to shift binary data. Unlike simple shifters that shift one bit at a time, a barrel shifter can shift by multiple positions in a single operation. This makes it useful in processors and digital systems where speed is important. A 4-bit Barrel Shifter works with 4 input bits and can shift them by 0, 1, 2, or 3 positions depending on the control inputs.

II. OBJECTIVES

The objective of this project is to design and test a 4-bit Barrel Shifter that shifts a 4-bit input word by 0 to 3 positions based on two control inputs. The circuit should give correct shifted outputs and be verified using a truth table and transient analysis in eSim.

III. IMPLEMENTATION

The objective of this project is to design and test a 4-bit Barrel Shifter that shifts a 4-bit input word by 0 to 3 positions based on two control inputs. The circuit should give correct shifted outputs and be verified using a truth table and transient analysis in eSim.

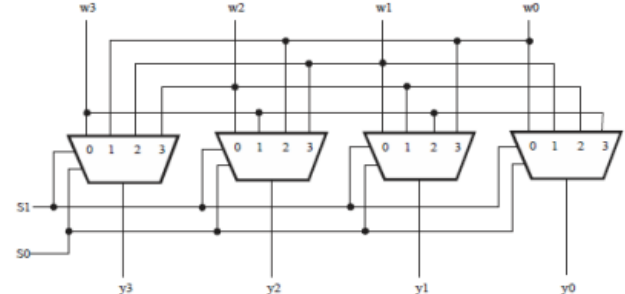


Fig. 2. Logic Diagram

IV. RESULTS

The 4-bit Barrel Shifter was implemented and tested in eSim using different input values and control signals. When the input was 1001, the outputs changed according to the control lines: with control 00 the output remained 1001, with control 01 the output became 0011, with control 10 the output became 0110, and with control 11 the output became 1100. These results confirm that the circuit shifts the bits correctly in a circular manner.

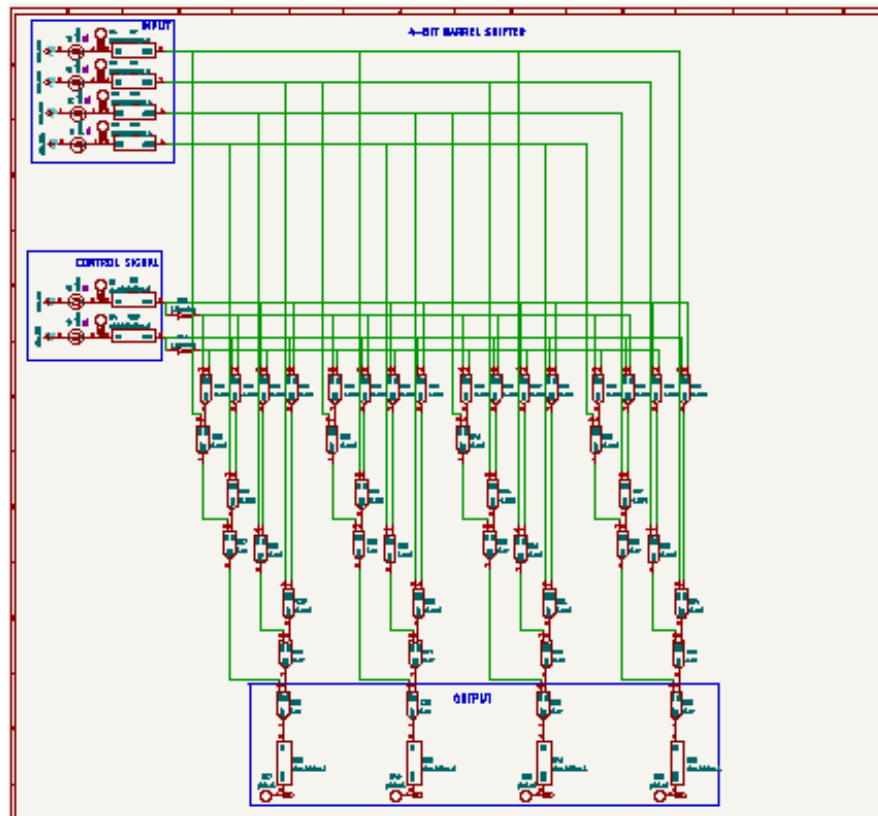


Fig. 1. eSim Circuit Schematic

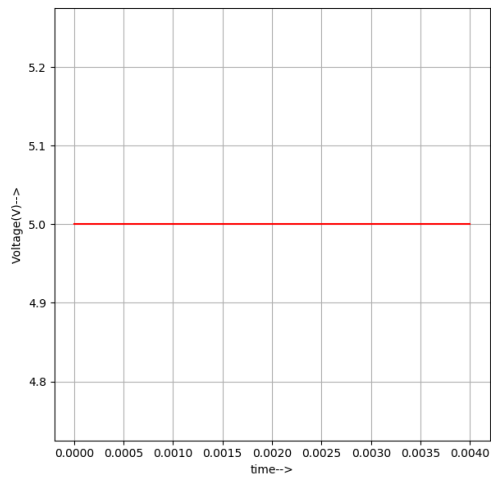


Fig. 3. Input A0

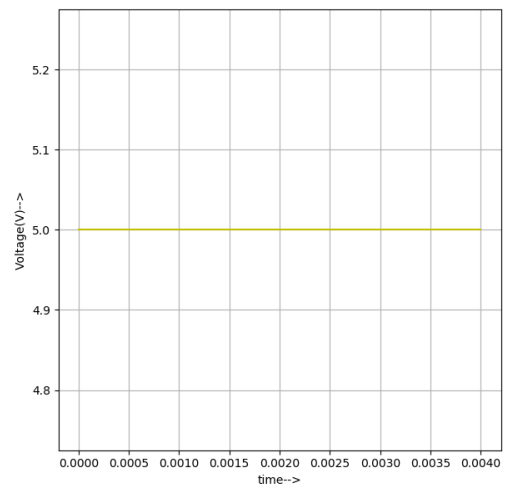


Fig. 6. Input A4

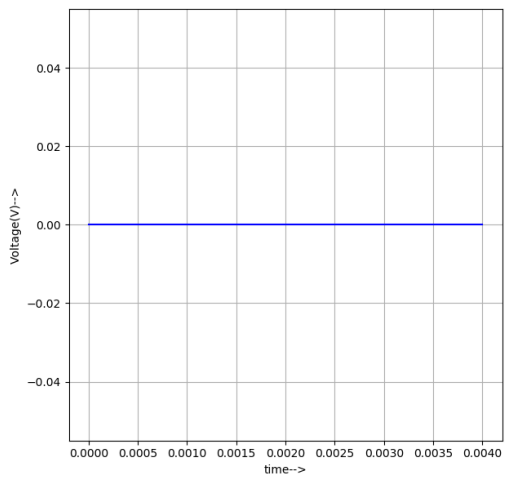


Fig. 4. Input A1

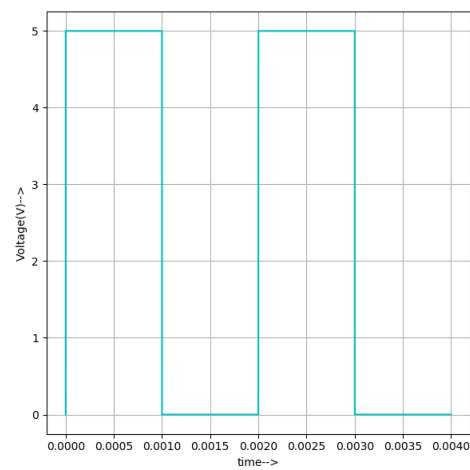


Fig. 7. Control Signal S0

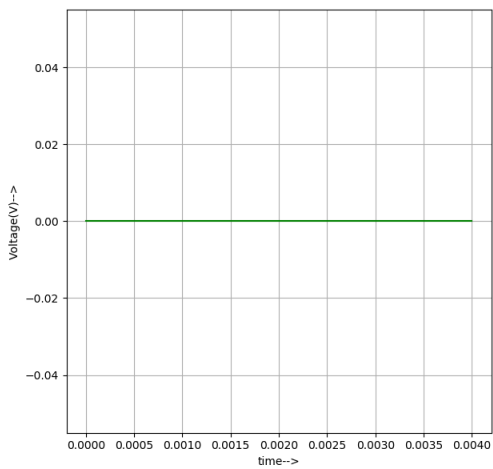


Fig. 5. Input A2

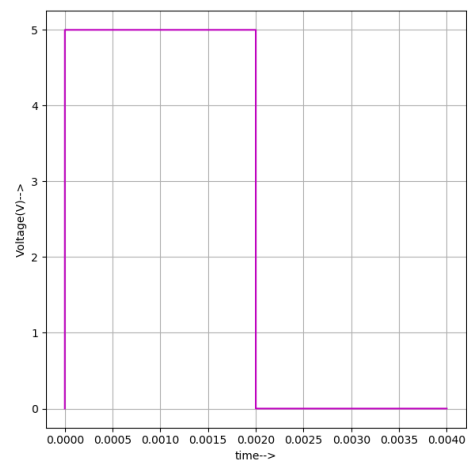


Fig. 8. Control Signal S1

Figures 3 to 8 represent the four input bits of A and control signals.

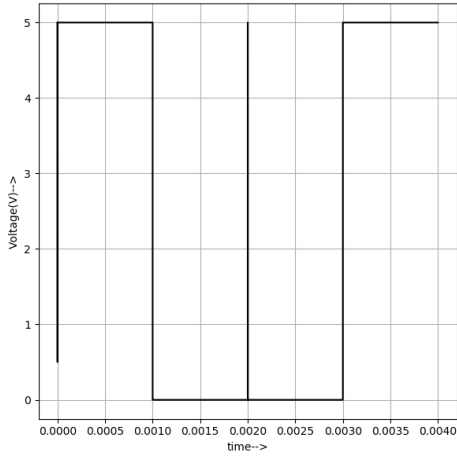


Fig. 9. Output Y0

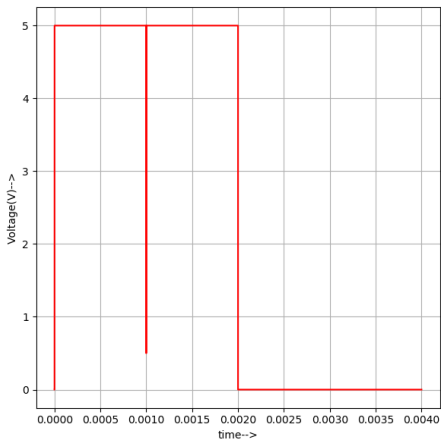


Fig. 10. Output Y1

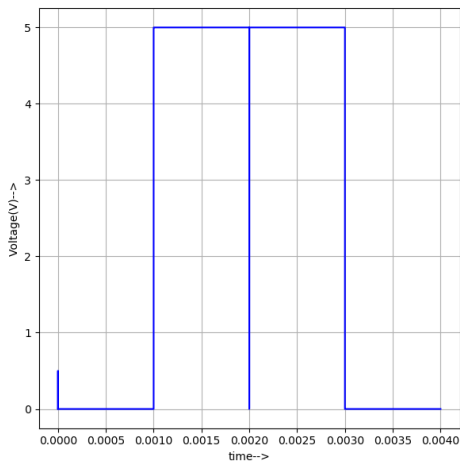


Fig. 11. Output Y2

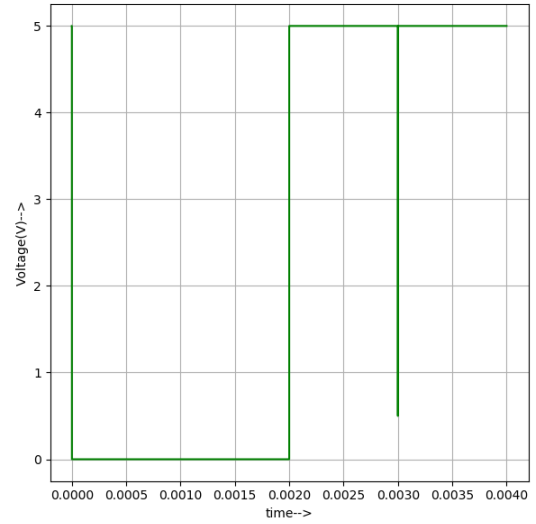


Fig. 12. Output Y3

Figures 9 to 13 represent the output bits Y.

V. ANALYSIS

The transient analysis in eSim showed that the output responded immediately to the changes in the control inputs. The shifting operation was carried out correctly for all test cases, and the results confirmed that the barrel shifter performs the shift in a single step without delay, making it faster than conventional shifters.

VI. CONCLUSION

The transient analysis in eSim showed that the output responded immediately to the changes in the control inputs. The shifting operation was carried out correctly for all test cases, and the results confirmed that the barrel shifter performs the shift in a single step without delay, making it faster than conventional shifters.

REFERENCES

Praveen, G., Manasa, M., Chandana, S., & Jyothisna, T. (n.d.). *Design and analysis of a 4-bit low power universal barrel-shifter using 2×1 MUX in 16nm FinFET technology.*