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Adiabatic Logic Based Power Efficient Multiplexer

P. Gomathi[1*], P. Kaviya Priya[2], and Tha. Sugapriyaa[3]
[1]Assistant Professor, Department of ECE, M. Kumarasamy College of Engineering, Karur, Tamil Nadu, India.
[2]Department of ECE, M. Kumarasamy College of Engineering, Karur, Tamil Nadu, India.
Email: kaviyapriyap.ece@mkce.ac.in
*Corresponding Author

Abstract: This paper gives low power answers for VLSI. Power utilization of CMOS is quickly turning into a noteworthy worry in VLSI outline. Through adiabatic method dynamic power utilization in pull up system can be decreased and vitality put away on the heap capacitance can be reused. In this paper distinctive rationale style multiplexes have been dissected and low power 2:1 multiplexer is outlined utilizing positive criticism adiabatic rationale. It has been watched that adiabatic multiplexer devours 53.1% less power than vitality conserved pass-transistor (EEPL) multiplexer. An adiabatic compressor has been planned utilizing PFAL rationale, which has indicated 79% change than ordinary CMOS compressor as far as power. Every one of the reproductions are completed by Microwind 3.1 apparatus.

Keywords: CMOS, VLSI.

I. Introduction

In this day and age of compact gadgets, for example, PCs, phones, PC control utilization has turned out to be significant worry in VLSI plan. Because of the restricted power provided by the power supplies, the hardware engaged with these gadgets must to be intended to expend power minimum.

Likewise substantial energy power dissemination needs costly and commotion hardware, power supply and power protection networks. Mux is fundamental part in computerized plan. This is widely utilized inside data-path-concentrated plans. In this manner limiting the energy power dissemination of the mux is one among the principle worries of less power plan [1]. A large portion of the energy power sparing methods included improving of the power supply, which comes about, efficient increment in sub-threshold spillage current additionally it causes vulnerability in the process variety. It has been discovered that there is principal association amongst calculation and power dissemination. That is if by one means or another calculation could be actualized with no loss of data; at that point vitality required by it could be possibly lessened to zero. This can be accomplished by playing out all the calculation in a reversible way. In this manner least power utilization amid charge exchange stage is known as adiabatic exchanging. Traditional CMOS based plans expend a considerable measure of vitality amid exchanging process. Adiabatic exchanging system diminishes the vitality dissemination through PMOS amid charging process and reuses a portion of the vitality which is put away on stack capacitor amid the releasing stage [2-3].

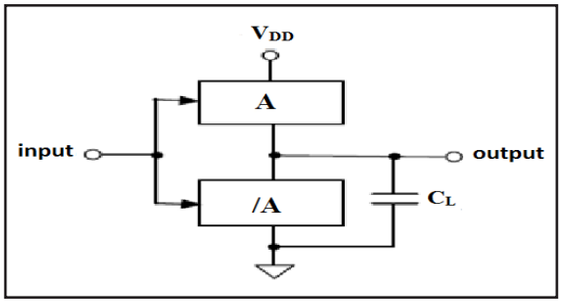

Fig. 1: Conventional CMOS Logic Circuit

In Fig. 2 C_L is charged by a consistent source of current rather than a steady source of voltage utilized as a part of customary structures of CMOS[3].

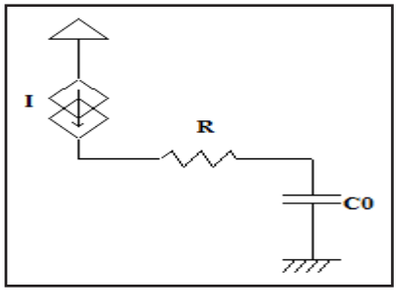

Fig. 2: Adiabatic Circuits-Charging Process

In this way vitality dispersal relies on protection R, by lessening it vitality scattering can be limited. Additionally by expanding the charging time more prominent than 2RC0 dispersal can be lessened up to huge degree. By switching the heading of steady current source vitality put away upon capacitor that

can be accomplished. Adiabatic circuits don't utilize supplies of standard power as in CMOS, it employments beat control supply [4].

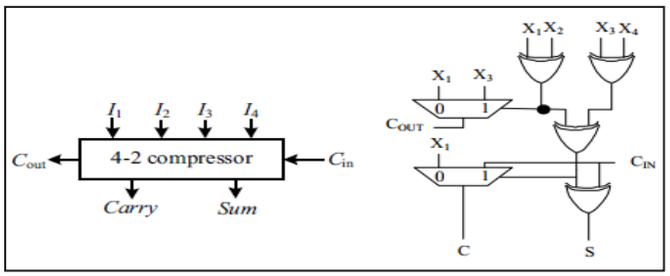

Fig. 3: Compressor Design using XOR and Multiplexer

II. Multiplexer Designs

A rationale work is gotten from an arrangement of transistors. This influences the VLSI parameters and wiring unpredictability of a network. Every one of this qualities slightly differ significantly starting with one rationale style then onto the next and hence settle on the best possible decision of rationale style critical for circuit execution [7]. MUX using DCVSL is appeared in Fig. 4.

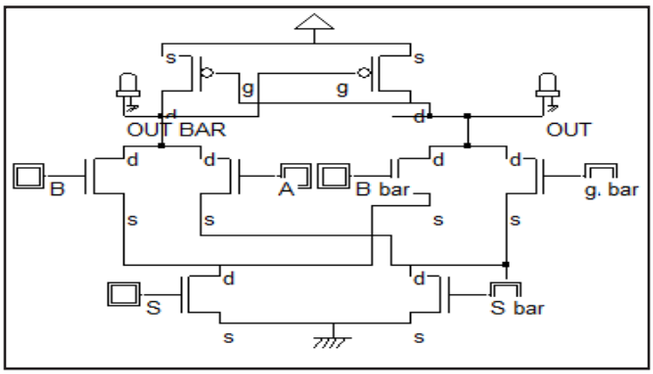

Fig. 4: DCVSL 2:1 Multiplexer

Benefit of DCVSL is rationale thickness which is accomplished by end of extensive from every rationale work. Capacities are actualized utilizing NFETS just, and PFETS just as draw up gadgets. DCVSL can be separated into essential parts: Differential hooking circuit and a fell corresponding rationale exhibit [8]. Lock in rationale circuits is acknowledged with PMOS transistors. Cascode reciprocal rationale cluster is acknowledged with NMOS rationale tree [9].

CPL circuit needs reciprocal sources of info and creates correlative yields to pass on to the following CPL that is in this rationale for each flag its supplement is produced.

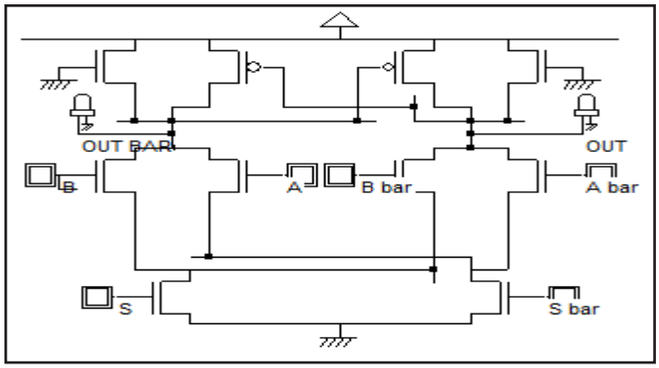

Fig. 5: MDCVSL 2:1 Multiplexer

CPL needs fewer transistors. Edge voltages of NMOS should be lessened to minimum by edge modification inserts. It performs quick task as contrast with CMOS. Benefits of CPL rationale are great yield capacity because of yield inverters, quick differential stage because of PMOS and little information loads. Schematic plan of CPL MUX is appeared in Fig. 6.

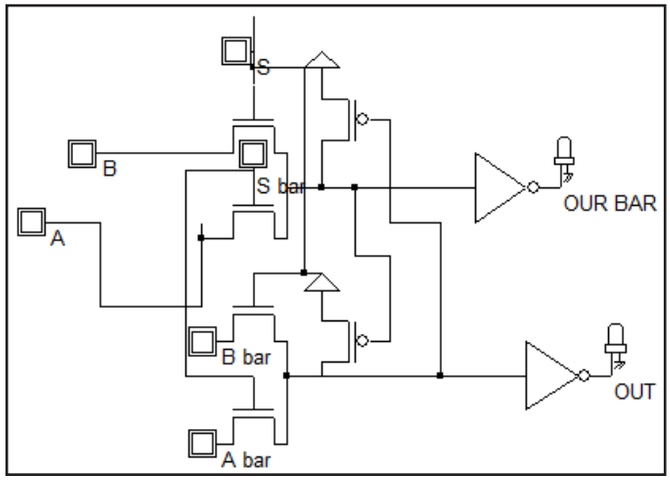

Fig. 6: 2:1 Multiplexer-CPL

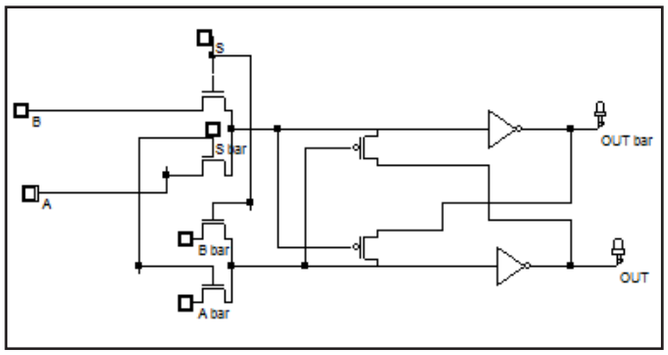

Fig. 7: 2:1 Multiplexer-EEPL

III. Proposed Design

This plan 2:1 MUX depends on a couple of cross coupled inverters. In this hook is produced using two PMOS and two NMOS that keeps away from the corruption of the rationale level at the yield hub. These NMOS gadgets are associated amongst yield and ground. A sinusoidal supply is connected [13-14]. This rationale family additionally produces both positive and negative yields.

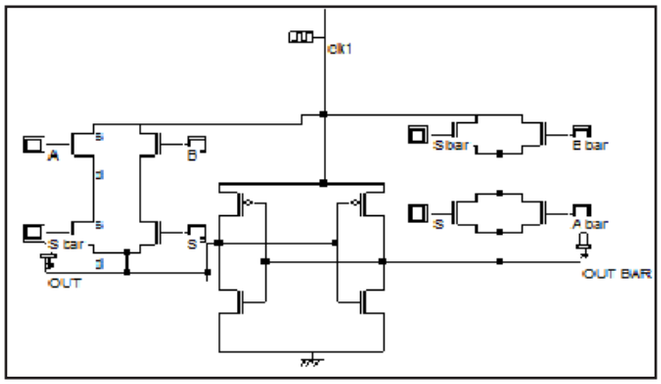

Fig. 8: 2:1 Adiabatic Multiplexer

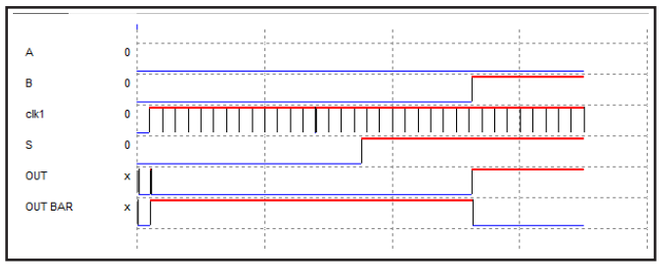

Fig. 9: Proposed 2:1 Adiabatic Multiplexer-Timing Diagram

It gets an information C in from the previous module of one double piece arrange bring down in importance, and produces a yield Cout to next compressor module of higher criticalness.

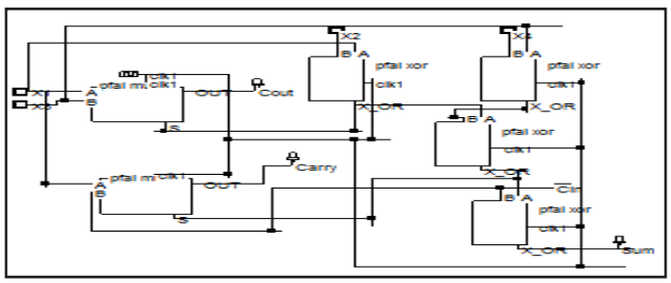

Fig. 10: Compressor

IV. Simulation Results

Simulations have been finished utilizing Micro-wind 3.1 instrument. Every one of the schematics are drawn utilizing 0.12-µm innovation with a 1.2V supply voltage. Format out outline of proposed multiplexer is appeared in Fig.

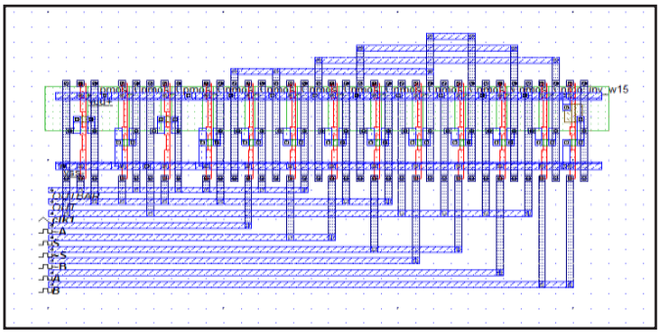

Fig. 11: Layout of Proposed 2:1 Multiplexer

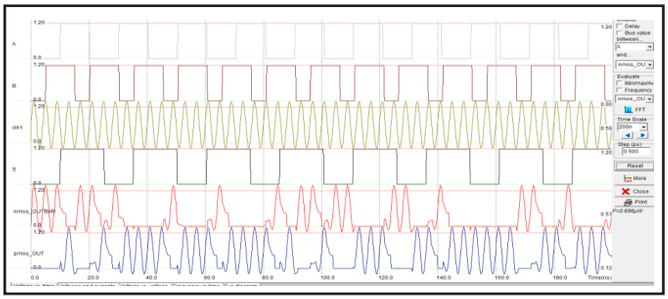

Fig. 12: Multiplexer-Layout-Propose Structure

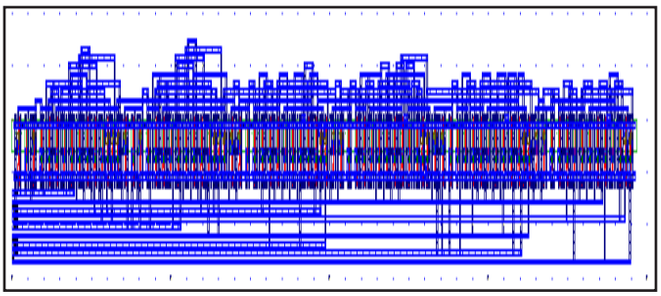

Fig. 13: Proposed Compressor-Layout

Fig. 12 demonstrates time area recreation of Multiplexer. Rationale '0' relates to a zero voltage and rationale '1' compares to 1.2V.

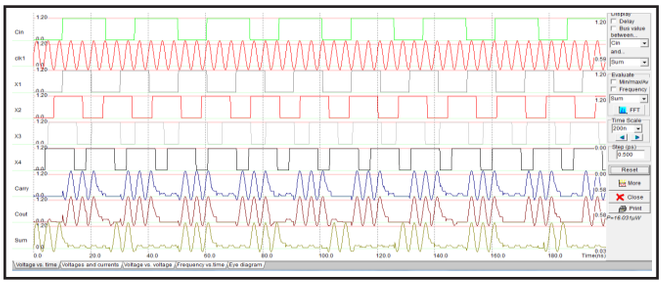

Fig. 14: 4-2 Adiabatic Compressor-Output

V. Results & Comparison

Comparison of different multipliers

Table I: Comparison -2:1 Multiplexer

Parameters	MDCVSL	DCVSL	CPL	EEPL	Proposed
Mosfet's number	2 PMOS 8 NMOS	2 PMOS 6 NMOS	2 PMOS 4 NMOS	2 PMOS 4 NMOS	2 PMOS 4 NMOS
Supply Voltage	1.23V	1.23V	1.23V	1.23V	1.23V
VDD Frequency	66.2 MHz	66.2 MHz	66.2 MHz	66.2 MHz	66.2 MHz
Power dissipation (µW)	2.28	1.96	1.88	1.47	0.67
Drain current(mA)	0.154	0.125	0.246	0.152	0.123
Threshold voltage	0.42V	0.42V	0.42V	0.42V	0.42V

Table 2: Power Comparison

Design of compressor	Power Dissipation (µW)
Conventional architecture of compressor	77.338
Adiabatic architecture of compressor	16.32

Power utilization of the circuits unequivocally relies on the parameters varieties. Effect of parameter minor departure from control utilization is researched for various rationale style MUX by utilizing BSIM4 Mos display. Proposed multiplexer indicates best outcomes as far as power utilization among all multiplexers actualized with various rationale. Every one of the re-enactments are completed at a particular scope of voltages to demonstrate the best outcomes [18].

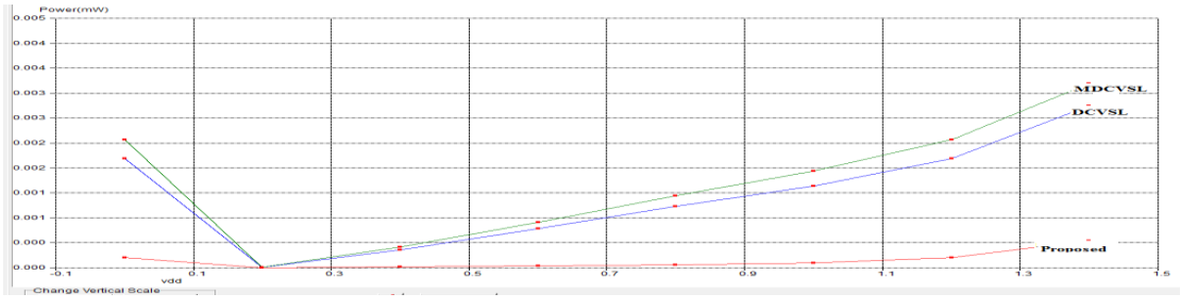

Fig. 15: Variation of Power Consumption with Respect to Supply Voltage at 270C

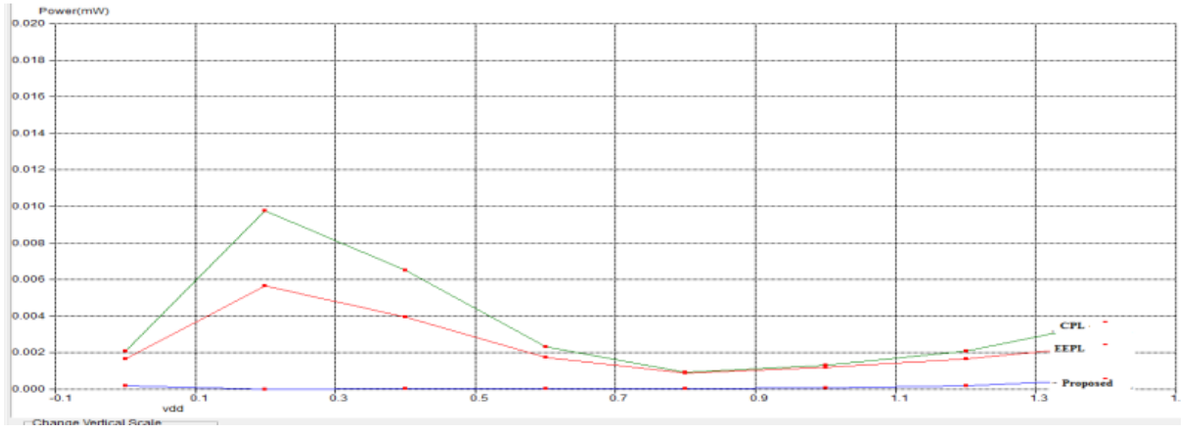

Fig. 16: Power Consumption at 270C

In this re-enactment parameters are worried about the affectability to temperature: Threshold voltage, portability and incline in the sub-limit mode [19].

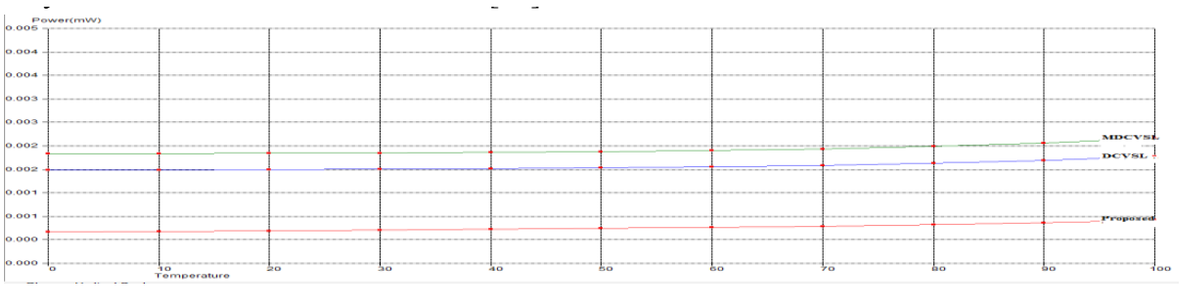

Fig. 17: Power Consumption at 1.2V

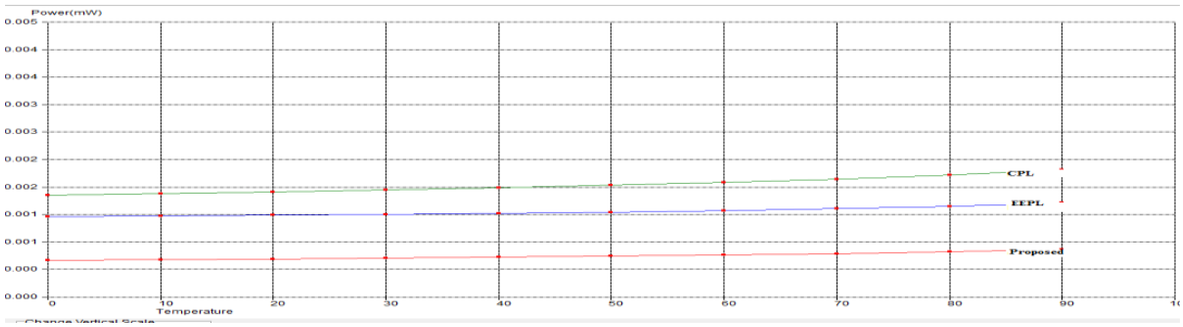

Fig. 18: Variation of Power Consumption at 1.2V

VI. Conclusion

The proposed architecture spares 79% power than traditional CMOS. All outcomes are checked at various voltage and temperature. Proposed Multiplexer demonstrates great execution with supply voltage and temperature.

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