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Implementation of Modified PMOS Biased Sense Amplifier Using 180nm

Ayesha Farheen[1], Renuka. B. J[2].

[1]PG Scholar, Department of ECE (VLSI & Embedded System), Sharnbasva University, Kalaburagi, India.

[2]Assistant Professor, Department of ECE, Sharnbasva University, Kalaburagi, India.

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ABSTRACT

A sensing amplifier is a component of a semiconductor memory chip's circuitry. The functionality, performance, and reliability of core memory architectures are all influenced by sense amplifiers. Two circuits are defined in this study. The suggested PMOS biased sensing amplifier is implemented in this circuit, which produces the same output results as prior work, but with a much higher decreased sense delay and power dissipation due to lower output impedance attributed to the use of lector approach in power gating strategies. As a conclusion, the simulation results accomplish the same functions as traditional circuits while consuming less energy. Using Tanner EDA and 180nm technology file, the total performance of the proposed sense amplifiers was simulated and analyzed.

Keywords: Sense delay, Sense Amplifier, lector approach, Power gating techniques.

I. INTRODUCTION

Memory is the most important and critical component in DSP, microprocessors, microcontrollers, and computers. Computer application devices, image sensors, and digital cameras which store data on the basis of photos, audio, video, and voice in a flash drives should use lesser energy and have a high memory capacity performance on a silicon wafer. A minimal detection delay and increased capacity are necessary to improve the quality of stored data.

To enhance the very small voltage differential on the bit lines at congruent sense times, sense amplifiers [1] are often utilized [2-11] in order to achieve the staggering rate of staging. The SA will be unable to adequately amplify the minor voltage differential if the sense amplifiers enable signal is asserted too soon. If the SAE is asserted late, the cost of access time and power usage rises. As a result, for such a high-speed and low-power SRAM cell, the optimal SAE timing is important.

One of the most important components of memory is a sensory amplifier. The memory access time is the most recognized by the sense amplifier. If any changes in the bit-lines are identified, signals are amplified and supplied to the memory.

Sense Amplifier:

The circuitry contains a sensory amplifier devices on just a semiconducting storage device (integrated

circuit) in modern computer memory; its terminology itself originates as from superconductor memory period. A sensing amplifier is a part of such scan circuit which allows data to be read through memory. The task is to enhance the limited power supply swing to instantly recognizable logic levels, such that data can be appropriately understood by logic even when the memory is not available.

Sense amplifiers can be classified into two groups. Current mode sense amplifiers are another name for non-differential amplifiers. Both dynamic and static voltage sensing amplifiers are available in the category of voltage sensing amplifiers. Dynamic designs continuously check the difference for both the bit lines and adjust their output, whereas static designs are latch-based as well as read the discrepancy among the bit lines once but hold the output appropriately.

The reliability of voltage mode sense amplifiers is influenced by bit line capacitances [1.]The bigger the higher the bit line capacitance, the longer the delay between turning on the cells and producing a significant enough differential between the bit lines for a voltage mode sensing amplifier 29 to detect and display the value. Current mode amplifiers are frequently cascaded and using it as a buffering step to isolate overly capacitive bit lines from voltage mode sense amplifier sources if the bit line capacitance becomes so high and also the bit lines can hardly be drained in an acceptable length of time [11].

As a result, the current mode large memory arrays with much increased bit line capacitances frequently use sense amplifiers. Current mode sensing amplifiers can be utilized on their own as well. The bit lines are linked to the amplifier inputs, and the discharging bit line produces a drop the output voltage level is determined by the current flow after precharge.

The durability of embedded storage as well as peripheral circuitry might threaten a system's overall performance as well as power. In CMOS memory, the Sense Amplifier is the most important peripheral circuit for sensing or identifying recorded data from read-only memory.

II. EARLIER WORK

One of the most crucial components is a sensory amplifier in memory [22]. The memory access time is the most recognized by the sense amplifier. If any changes in the bit-lines are identified, signals are amplified and supplied to the memory. Designing a quick, Low-power sensing amplifiers, particularly in submicron CMOS [23-25] technology, is a difficult task for any designer.

PMOS Bias Sense Amplifier:

Sense Amplifier Circuit-1:

Precharge and sense signal amplification are two aspects of sense amplifier operation. The required signals are applied to the sensor nodes during the precharge phase to force them to specified potentials. A comparison of the sensing nodes currents is performed during the sense process. As a result of this comparison, the memory cell's content is obtained. The circuit-1 of the Sense amplifier has a There is no static error and the output impedance is large. Because T1, T2, and T17 all have short-circuited gate terminals in this Sense amplifier circuit Ir exceeds Ic, current flows across both bit lines with a little difference.

As a result, current the bit-line BL2 will carry Ii-Id, while BL1 is the bit-line through which current I1 will pass. Figure 1 illustrates 1 sensing amplifier circuit that has been proposed with PMOS biasing.

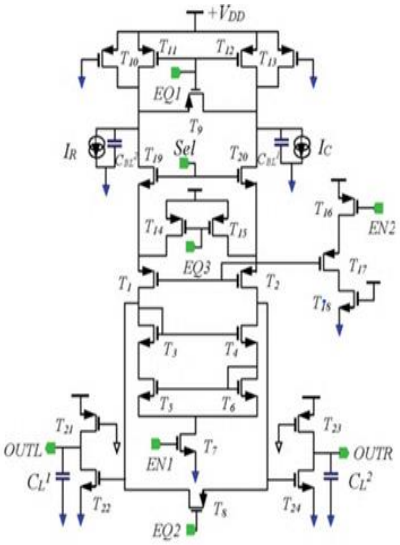

Fig1: Circuit of a sense amplifier-1.

T3-T4 and T5-T6 transistor pairs are in perfect sync. So, if the potentials for input and output are similar, the input and output currents are theoretically equal. When compared to conventional sense amplifiers, the number of transistors used is minimized. As a result, power dissipation and sensory latency are decreased. Traditional PMOS bias type sense amplifiers have more transistors and require more power. OUTL is used all over the T1 & T3 in the Sense amplifier circuit, while OUTR is taken between T2 & T4. The new power consumption of the sensing amplifier is reduced and has a shorter sensing delay.

B. Circuit of a sense amplifier -2

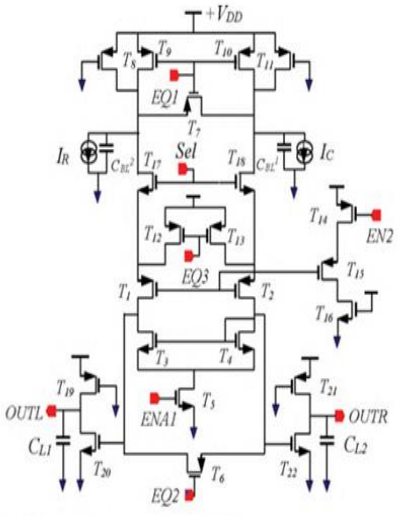

Fig2: Circuit of a sense amplifier -2

Figure 2 depicts the second suggested sense amplifier. T1 and T5 receive OUTL, while T2 as well as T6 receive OUTR. The new amplification system consumes less power and has a shorter sensing delay.

The input configuration for the two suggested sense amplifier circuits is as follows:

T7 to T11 transistors are used to precharge the bit lines in the phase of the preamplifier in the upper part of the circuit-2. To provide differential currents to the circuits, the selection input is used. The bit-line capacitance is connected between two constant current sources for this. The bit lines are brought to equal potential by using three equalisation inputs. EQ1 is usually set to equalisation in these cases. The inverters, which are coupled across load capacitance, receive the outputs outL and outR. From the voltage bias generator comes the gate signal for the EQ3 input. Furthermore, just one current mirror circuit exists in this circuit.

III. PROPOSED WORK

Power gating, clock gating, and transistor stacking are all low-power approaches. Leakage currents in MOSFET devices are the main cause of static power consumption. It occurs when and through the transistor's channel, an undesirable current (sub threshold current) flows even when it is turned off. The voltage at which transistors in circuits reach their threshold is substantially influenced by this. Scholars have devised a variety of power gating approaches to mitigate this flaw. We propose two sense amplifier circuits based on the lector technique in this paper. One of the power gating strategies is the lector approach. We can save energy by turning off the circuit's electricity using this method.

Basic Lector Approach:

The key concept underlying our technique for decreasing leakage power is the appropriate stacking of transistors in the circuit connecting supply voltage through grounding. A supply voltage to grounded pathway with more than one transistor switched off is significantly less leaky than that for a supply voltage - ground route with only one transistor shut out. Each CMOS gate has two leakage control transistors (LCTs), one of which is near the cutoff zone, as part of our plan.

PMOS Based Sense Amplifier:

A. Proposed Circuit of a sense amplifier -1:

The present pmos bias sense amplifier circuit of this recommended sense amplifier circuit was modified using the lector method at load inverters to reduce static power consumption.

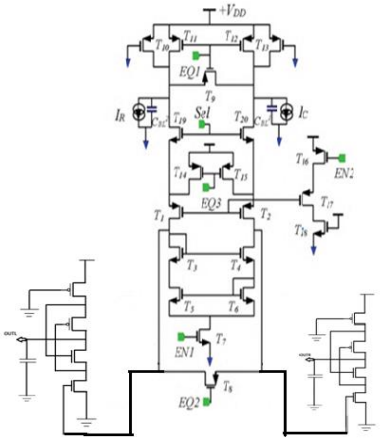

Fig3: Proposed sense amplifier circuit-1

B. Proposed Circuit of a sense amplifier -2:

In contrast, as illustrated in the picture below, the proposed sense amplifier circuit-2 uses a lector method at the load inverters to reduce energy usage.

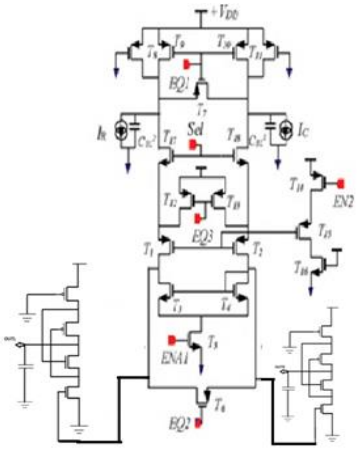

Fig4: Proposed Circuit of a sense amplifier -2.

The input configuration for the two suggested sense amplifier circuits is as follows:

Transistors T7 through T11 are utilized to precharge the bit lines in the phase of the preamplifier in the upper part of the circuit. To provide differential currents to the circuits, the selection input is used. The bit-line capacitance is connected between two constant current sources for this. The bit lines are brought to equal potential by using three equalization inputs. EQ1 is usually set to equalization in these cases. The inverters, which are coupled across load capacitance, receive the outputs outL and outR. From the voltage bias generator comes the gate signal for the EQ3 input.

IV. EXPERIMENTAL RESULTS

The Tanner EDA Tool was used to simulate utilising 180 nm CMOS technology. The same fan-in and fan-out were used in all simulations. The current mirror's transistors sense amplifiers in Figure 1 are of the same size, L =0.18 m. Ir stands for memory, and Ic stands for reference cell current.

The sensing amplifier's performance is largely determined by bit-line capacitances. Figure 5 shows the For the suggested sense amplifier, a transient analysis was performed-1.

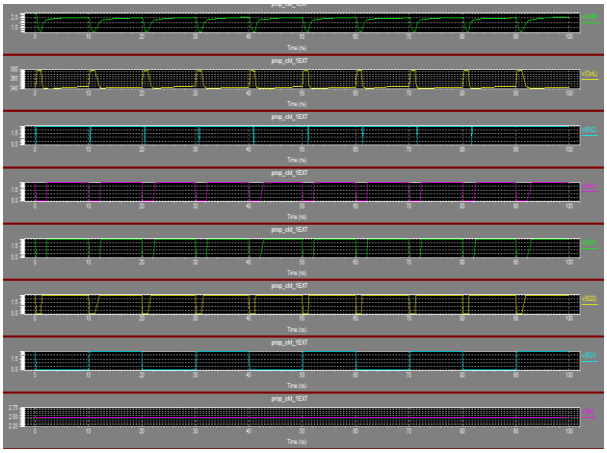

Fig5: Transient results of proposed sense amplifier-1.

Whereas Figure 6 shows the for the suggested sense amplifier, a transient analysis was performed. -2.

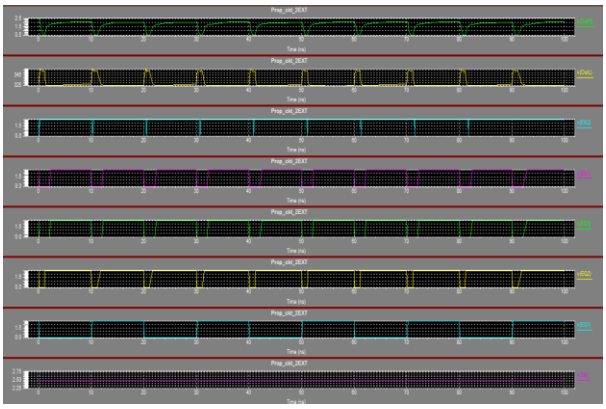

Fig6: Transient results of proposed sense amplifier-2.

V. CONCLUSION

Tanner EDA was used to build two novel sense amplifiers utilizing 180nm the transient results of the recommended sense amplifiers and CMOS technology matched the results of the original sense amplifiers theoretical analysis. A graph at various supply voltages for a simulated sensing delay is also drawn. The circuits proposed are employ a lector technique to reduce power consumption and delay by forward biasing load transistors.

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