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PERFORMANCE ANALYSIS OF AN EFFICIENT PRECISION SCALE MAC UNIT USING GNRFET TECHNOLOGY

ABSTRACT

The relentless pursuit of enhanced computing capabilities with reduced power consumption has led to the exploration of novel technologies and architectures. One such emerging technology is Graphene Nanoribbon Field-Effect Transistor (GNRFET), which promises substantial improvements in performance and energy efficiency over conventional silicon-based devices. This project commences by providing an overview of the motivations behind adopting GNRFET technology for the MAC unit design. Traditional silicon-based transistors are reaching their physical limits, leading to increased power consumption and thermal issues. GNRFET technology offers exceptional properties, such as ultrahigh carrier mobility, superior thermal conductivity, and reduced short-channel effects, making it a promising candidate for high-performance and low-power computing applications.

OBJECTIVES

1. To analyse the existing mac unit and note the values.
2. To enhance the GNRFET Technology to solve the major issues and develop the design in a more efficient way.
3.General-purpose computing, and numerous other applications that demand high-performance computation with minimal power consumption.
4.Hence our goal is to look up in this and have a proper outcome.
5.To develop a more efficient MAC unit for a high precision output.

METHODOLOGY

The project involves researching and developing advanced stacking methodologies tailored specifically for high precision and less complexity. Leveraging insights from existing research papers, we have explored many methods to reduce the basic fundamentals of the VLSI i.e power, area and delay with high speed. From our explorations we got to learn that applying stacking techniques on the existing mac unit which comprises of several components like Half adders, full adders and accumulators out of which the full adder is the heart of mac. Hence applying the stacking method on the full adder will give us the optimum result to create a precision mac.

CONCLUSION

In conclusion, the comprehensive analysis and design of the Precision Scale MAC unit utilizing Graphene Nanoribbon Field-Effect Transistor (GNRFET) technology represent a significant advancement in high-performance computing. By leveraging the unique properties of GNRFETs, including ultrahigh carrier mobility, superior thermal conductivity, and reduced short-channel effects, the proposed MAC unit offers substantial improvements in performance and energy efficiency over conventional silicon-based devices.

BLOCK DIAGRAMS

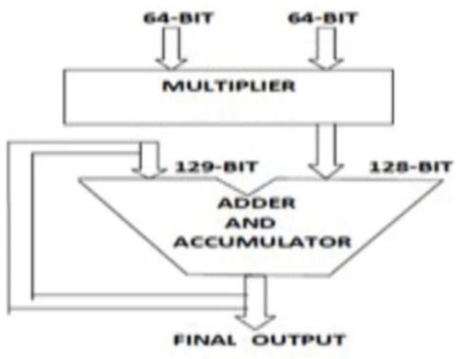

Fig. 1: Block diagram of MAC

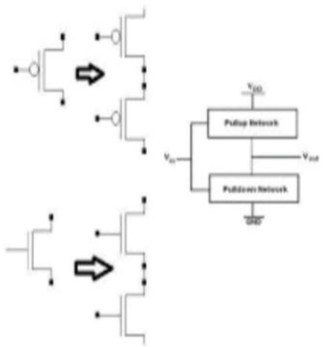

Fig. 4: Circuit diagram showing n stack and p stack

HARDWARE SETUP/SIMULATION OUTPUT

Fig: Full adder with n stack technique

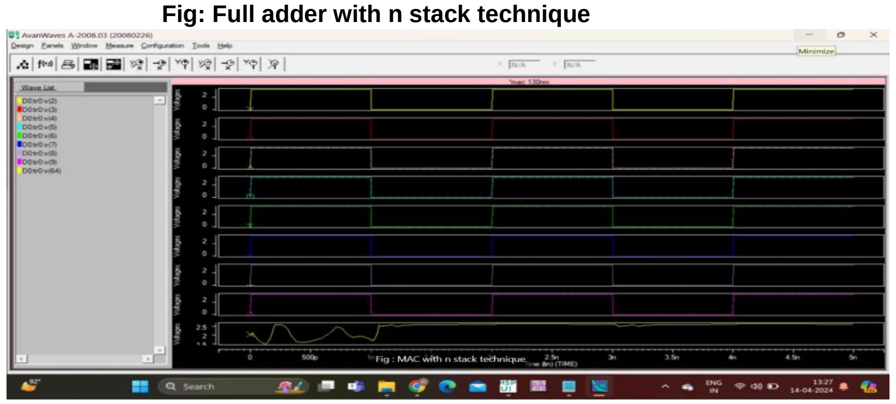

Fig: MAC with n stack technique

RESULT AND DISCUSSIONS

DEVICE	32nm MOSSFET		
	Power(W)	Delay(s)	PDP(J)
FULL ADDER	5.590x10^-6	33.48p	187.15x10^-18
FULL ADDER P STACK	8.5193 x10^-6	9.4541p	80.54x10^-18
FULL ADDER N STACK	8.338x10^-6	4.9571p	24..65x10^-18
FULL ADDER FULL STACK	7.14x10^-6	126.4p	902.49x10^-18
MAC	2.717x10^-5	77.071p	209.40x10^-17
MAC P STACK	2.831x10^-5	85.61p	242.36x10^-17
MAC N STACK	2.831x10^-5	72.12p	204.17x10^-17
MAC FULL STACK	3.414x10^-5	100.12p	341.80x10^-17

Table 6.2 : 32nm MOSFET

DEVICE	16nm GNRFET		
	Power(W)	Delay(s)	PDP(J)
FULL ADDER	6.446 x 10^-7	14.913p	96.12 x10^-19
FULL ADDER P STACK	3.016x10^-7	269.13f	811.69x10^-22
FULL ADDER N STACK	1.896x10^-7	2.77p	171.60x10^-19
FULL ADDER FULL STACK	1.319x10^-7	1.4131p	1.86x10^-19
MAC	1.414x10^-7	54.123p	76.52x10^-19
MAC P STACK	1.214x10^-7	23.14p	28.09x10^
MAC N STACK	1.378x10^-7	20.20p	27.83x10^-19
MAC FULL STACK	2.14x10^-7	40.14p	84.83x10^-19

Table 3 : 16nm GNRFET

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