

DESIGNING HIGH-SPEED, LOW-POWER FULL ADDER CELLS BASED ON CARBON NANOTUBE TECHNOLOGY

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ABSTRACT

This article presents novel high speed and low power full adder cells based on carbon nanotube field effect transistor (CNFET). Four full adder cells are proposed in this article. First one (named CN9P4G) and second one (CN9P8GBUFF) utilizes 13 and 17 CNFETs respectively. Third design that we named CN10PFS uses only 10 transistors and is full swing. Finally, CN8P10G uses 18 transistors and divided into two modules, causing Sum and Cout signals are produced in a parallel manner. All inputs have been used straight, without inverting. These designs also used the special feature of CNFET that is controlling the threshold voltage by adjusting the diameters of CNFETs to achieve the best performance and right voltage levels. All simulation performed using Synopsys HSPICE software and the proposed designs are compared to other classical and modern CMOS and CNFET-based full adder cells in terms of delay, power consumption and power delay product.

KEYWORDS

Full Adder, CNT, Carbon Nanotube Field Effect Transistor, High Speed, Low Power, High Performance & Power Delay Product

1. INTRODUCTION

In digital electronic world, delay and power consumption improvement are the most important performance parameters of a circuit. To reach this goal, we can reduce scaling of the feature size. In complementary metal oxide semiconductor (CMOS) technology, reducing the length of channel to below about 65nm leads to critical problems and challenges such as decreasing gate control, short channel effect, high power density, high sensitivity to process variation and exponential leakage current increment [1]. For this reasons reducing the transistors size finally will stop at a point, leading to taking advantage of new technologies that do not have above problems may be felt. Therefore, new technologies such as benzene rings, quantum dot cellular automata (QCA), single electron transistor (SET), carbon nanotube field effect transistor (CNFET) and others have risen up [2-7].

Special properties of the carbon nanotubes (CNTs) cause to be utilized in various industries such as nanoelectronic. Some of these features are high thermal conductivity, high tensile strength, super conductivity, extreme rigidity and be conductor or semiconductor basis on structure.