

## Comparison of Cu Interconnects With CNT Interconnect For High Performances Applications

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**Abstract:** Now a days as far as technology going to advances still some problem in VLSI interconnect. Cu interconnect is better As compared with gold, silver Even though cu interconnect also major drawback because billion of transistor were integrating single chip. So Interconnect Delay is major problem. In this paper compares the Cu interconnect with CNT interconnect and performances parameter like power delay and power delay product were taken at Intermediate and global level with Different technology for analysis. from the Simulation, it found that CNT based interconnect is suited for high performances application .the simulation has done using T\_Spices

**Keywords:** Cu, CNT, T\_SPICE, Power, Delay

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### I. Introduction

The increasing demand for Interconnect in VLSI Application at Different level at local, Intermediate and global such way that Interconnect Delay, power Reduction requirement plays very important role for VLSI CNT Based Interconnect is Less delay and power compared with Cu interconnects. So In this paper Compared Cu interconnects with CNT interconnect at Different Technology.

AS Interconnect feature size is Reduced, copper resistivity is increased due to grain boundary and surface scattering and also surfaces Roughness [1] , The steep rise in parasitic resistances of copper interconnect poses seriousness' challenge for interconnect delay. According to ITRS, the Cu wires are becoming more and more vulnerable to Electro migration because of rapid increase in current density which causes the electro migration [2]. . All these factors result in degraded interconnect performance with each technology generation which conflicts with the high performance requirement, such as low power, low interconnect de-lay and reliability of VLSI circuits in VDSM. In order to over-come the limitation of copper interconnects, bundle of CNTs have been proposed as possible replacement for copper inter-connects in future technologies due to its higher conductivity and current carrying capabilities without Electro migration problem. However, the resistance of an isolated SWCNT is quite high (of the order of 6.45 K $\Omega$ ) [3].

The paper is organized in the following manner. Section II explained types of interconnect .Section III explained Interconnect modal analysis section III of the paper. Simulation results and comparison of SWCNT interconnect with conventional Cu interconnect has been reported in section IV concludes the paper.

### II. Interconnect

#### 2.1 Global Interconnects

Global interconnects provides power supply, clock distribution and long distance communication between functional blocks and deliver ground to all functions in a chip . Global interconnect lengths can be the order of millimetres. Low resistive material like aluminium, copper are generally use in global inter-connect to reduce the overall delay. Repeaters are normally in-serted in order to reduce the delay and increase the drive capability [4].With the advancement of technology global interconnect length increases due to increasing chip complexity. The comparison of delay and power for global interconnect length of 1000 $\mu$ m between SWCNT bundle and Cu at different technology nodes are shown in fig.6 and fig. 7.

#### 2.2 Intermediate Interconnects

The length of intermediate level of interconnects are shorter than that of global interconnects, despite being shorter in length as compared to the global interconnect, intermediate interconnect still require repeaters. All the parameters for intermediate interconnect used for simulation are used from ITRS 2011as Taken References .Fig 4 and 5 show that delay and power comparison of CNT and Cu for intermediate interconnect length of 100 $\mu$ m for different technology nodes.

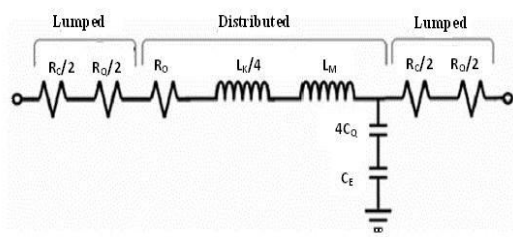


Fig. 1. Equivalent Circuit model of SWCNT

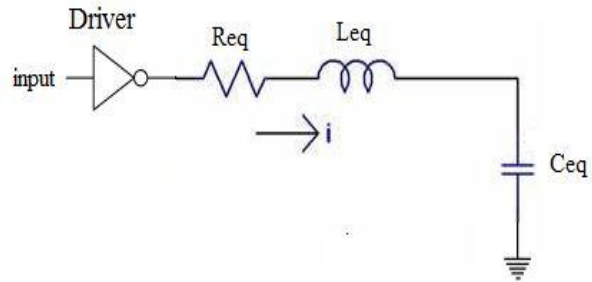


Fig. 2 Equivalent Circuit model of copper interconnect

3.3 Interconnect Modal analysis

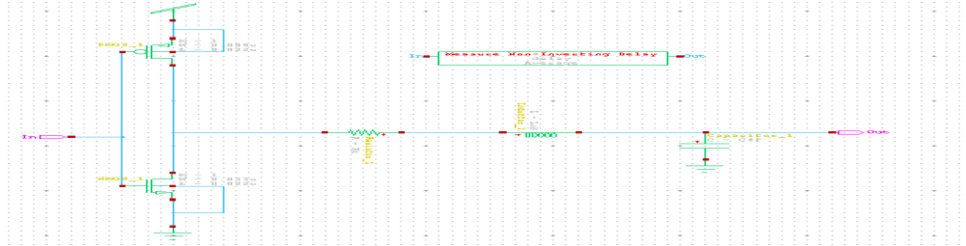


Figure3 Inverter Interconnect Modal

For Cu and CNT Interconnect Delay and power analysis purposes Inverter has taken example and simulated using T \_ spices at Different Technology

3.4 Simulation Results

3.4.1 Delay and power comparison for Intermediate interconnect length at Different Technology

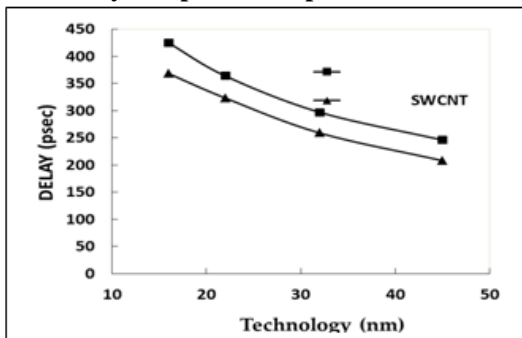


Figure4 Delay Vs Technology

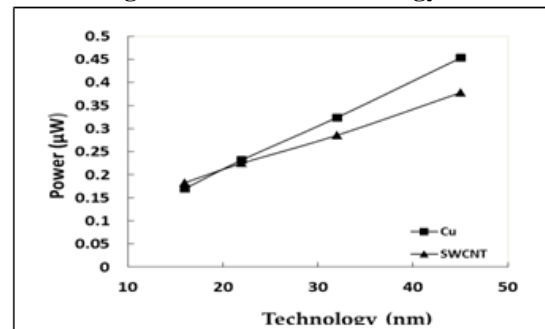


Figure5 Power dissipation Vs technology

3.4.2 Delay and power comparison for Global interconnect length at Different Technology.

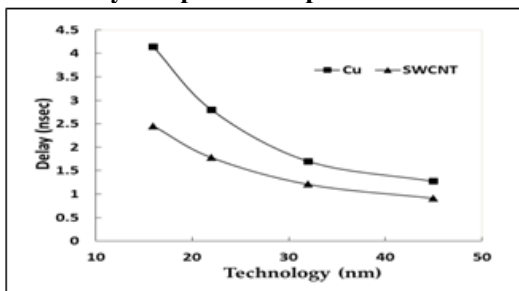


Figure 6 Delay vs Technology

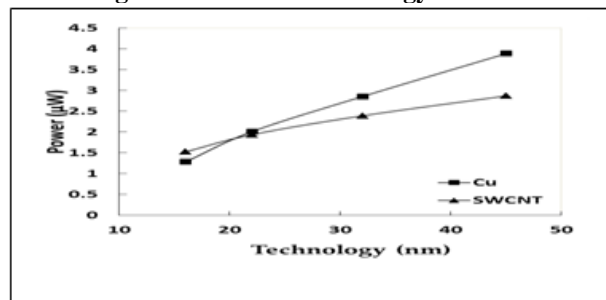


Figure7 Power Vs Technology

III. Main conclusion

From the Simulation Result, CNT based Interconnect is suited present day technology at Intermediate and global Level. The comparison has done Cu interconnect with CNT based Interconnect and CNT based interconnect has got less delay As well as less power dissipation. So it is effectively useful for high performance Application in VLSI. From the compared Result shown that CNT based interconnect is suited for high performances application

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