

MODELLING OF MOSFETS WITH VARIED CHANNEL LENGTH TO PERFORM A CMOS INVERTER CIRCUIT USING SPICE

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ABSTRACT

This report describes the characteristics of n-channel enhancement-type and p-channel enhancement-type of MOS Field Effect Transistor (MOSFET) to perform a Complementary MOS (CMOS) inverter. This CMOS inverter will calculate the output of Voltage Transfer Characteristic (VTC) and Propagation Delay time. In order to allow this inverter to function properly, the ideal current – voltage characteristic of MOSFET has been examined using the .MODEL description of PSpice. The analysis has been performed using various channel length from 0.35 microns to 3.5 microns. The simulated results from the PSpice agree with the theory.

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CHAPTER 1

MOS TRANSISTOR

1.1 Introduction

MOS Field Effect Transistor (MOSFET) is the fundamental building block of *Metal Oxide semiconductor (MOS)* digital integrated circuits. In this project, the basic structure and the electrical behavior are examined for *NMOS* transistor (pull down) and *PMOS* transistor (pull up) that are used as the primary switching of the driver that controls the operation of the inverter. Consequently, both devices contribute equally to the circuit operation characteristics of the Complementary MOS (CMOS).

Over the past decade, the complexity of MOS Integrated Circuits (IC) has increased at an astonishing rate and this is realized mainly through the reduction of MOS transistor dimension in addition to the improvements in processing. The purpose of this project is to introduce Simulation Program with Integrated Circuit Emphasis (SPICE), a standard circuit simulator that is used to analyze the characteristic of the MOSFET for various *channel length* (L). The Voltage Transfer Characteristic (VTC) and Propagation Delay also can be obtained in the MOSFET characteristic. Also, practical comparison among the different models available in SPICE will be discussed.