# ELECTRICAL CHARACTERISTICS OF 90 NM NMOS USING SILVACO

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# ABSTRACT

In this paper, a 90 nm NMOS was designed and fabricate to study its electrical characteristics. ATHENA and ATLAS module of SILVACO software are the tools used in simulating the electrical performance of the transistor. The parameters under investigation were the $V_{TH}$, Id-Vg and Id-Vd relationship. From the simulation result, it was shown that the gate oxide thickness, channel doping, $V_{TH}$ adjust implant and the dosage of halo implantation were contribute in determining the $V_{TH}$ value and Id-Vg curve. Besides that, halo implant is major domain contribute in determining $V_{TH}$ value. From the simulation result, optimum solution is found in which $V_{TH}$ value of 0.2685 is achieved. $V_{TH}$ is one of the main factors in determining whether the transistor works or not. The value is in line with ITRS guideline for 90 nm device.

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# CHAPTER 1

# INTRODUCTION

## 1.1 PERSPECTIVE FOLLOW HISTORY

Over the past 50 years of the semiconductor industry, the size of MOSFET has been scaled down obeying the Moore's Law: feature sizes of transistor are scaled at a rate of approximately 0.7 times every 18 months [17].

The gate length of high performance MOSFETs has been aggressively scaled year by year because of a strong requirement for constant improvement of circuit performance. The history of the International Technology Roadmap for Semiconductors (ITRS) demonstrates how the gate length of high performance MOSFETs was scaled in the past was required to set the pace for scaling in the future [18].

MOSFET technology is an industry standard. This technology has been around for many years, and the fabrication methods are continually improving although they are well established. There has been consistent gain in the performance of these devices every few years since their creation. The cost and size are main advantages of MOSFET devices. Fabrication methods have become relatively expensive since the technology has been established. Besides that, the device itself is physically smaller than other technologies, allowing for the placement of more devices on a silicon wafer during fabrication. MOSFET devices are mainly used in the creation of CMOS logic chips, which are the heart of every computer. Figure 1.1 shows the basic structure of this style MOSFET device [8].