

**MEMRISTOR-BASED CROSSBAR ARCHITECTURE
FOR DIGITAL LOGIC IMPLEMENTATION**

This thesis is presented in partial fulfillment for the award of the
Bachelor of Engineering (Hons.) in Electronic Engineering
UNIVERSITI TEKNOLOGI MARA MALAYSIA



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JANUARY 2014

ACKNOWLEDGEMENT

I would like to express my gratitude to Allah S.W.T. for giving me the opportunity to complete this Final Year Project. I am deeply indebted to individuals who, directly or indirectly, are responsible for this project.

I am most grateful to the most kind heartedness supervisor Dr. Wan Fazlida Hanim for her guidance, advice, ideas and opinions in this project. Not forget to the panel of seminar presentation En. Abdul Karimi and Miss Ili Shairah with their superior guidance, information and ideas for this project become abundance. Also I would like to acknowledge with much appreciation of my partners Nur Liyana and Siti Musliha as they help me much more in doing my research for final year project. May Almighty Allah bless and give reward to all of them for their generosity.

A part from that I would like to thanks to my family who have been so tolerant and supports me all these years. Thanks for their encouragement, love and supports that they had given to me. Besides that, last but not least, I would like to thanks my friends Nur Fatimah, Faridah, Hasliadi and all those who supported me in providing the ideas, theories and any piece of work upon completion of this project.

ABSTRACT

It has been discovered that, the transistors become an issue where in digital implementation where the dimension of the transistor cannot be shrink any further. Other than that, due to the limitation of materials and current technology have become more relevant as the demanding on the higher density of electronics. In this project, an alternative solution is investigated for the implementation of digital module from memristor-based by using crossbar architecture. This project will compare device performances between memristor crossbar design and conventional CMOS technology. These comparison are in attempt to reduce the area and the limitations with analysis of data. LTSPICE open source platform is used to demonstrate the device model and schematic design. The EDA Tools such as Silvaco Expert is used to design the layouts for conventional CMOS and memristor crossbar design. The dimensions for the memristor layout is based on the published works only. The design implementation that has been carried out are inverting and non-inverting configurations, wired-AND and also for NAND gate with the analysis of data needed. By using memristor-based crossbar architecture, the devices is smaller with a high density and low power consumption.

Keywords - Memristor, Crossbar, Nano-electronic, CMOS, layout design

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	TITLE	i
	DECLARATION	ii
	ACKNOWLEDGEMENT	iii
	ABSTRACT	iv
	TABLE OF CONTENTS	v
	LIST OF FIGURES	viii
	LIST OF GRAPHS	x
	LIST OF TABLES	xi
	LIST OF ABBREVIATION	xii
CHAPTER 1	INTRODUCTION	
	1.1 Introduction	1
	1.2 Background of Project Research	1
	1.3 Problem Statement	3
	1.4 Research Objectives	3
	1.5 Scope of Work and Methodology	4
	1.6 Thesis Arrangement	7
CHAPTER 2	LITERATURE REVIEW	
	2.1 CMOS Scaling Technology Trend Memristor	8

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

In this chapter, an overview of the project background will be introduced. Appropriate techniques have been used in the project and all the expected performance of the project will be discussed in a few sections with respectively. Besides that, the problem statement has been stated and a few of the objectives of the project also included. Other than that, the methodology and scope of work have been written down together with the thesis arrangement.

1.2 BACKGROUND OF PROJECT RESEARCH

Memristor has been proposed by Prof Leon Chua in 1971 to become as the fourth element with the other three passive circuit elements in basic fundamental which are the resistor, capacitor and inductor. Memristor was a product relationship from magnetic flux, ϕ and electric charge, q which only proved using a mathematical relationship between electric charge and magnetic flux. Memristor is stands for “*memristor resistor*” which it can store logical value as in impedance rather than voltage. It has been discovered that, the transistors become an issue in digital implementation where the dimension of the transistor cannot be shrink any further. Other than that, due to the limitation of materials and current technology have become more relevant as the demanding on the higher density of electronics. Alternative and possible solutions are needed to produce a better and higher density of electronics application. One of the alternative is by using the concept of memristor which this