

# HARRWARE DEVELOPMENT OF IC TESTER FOR DIGITAL LOGIC GATES



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**HARDWARE DEVELOPMENT OF IC TESTER FOR  
DIGITAL LOGIC GATES**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Computer Engineering Technology (Computer System) with Honours.

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**NUR HIDAYU BINTI MUSA**

**B071710509**

**960807145234**

FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING

TECHNOLOGY

2021

**BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA**

Tajuk: Hardware Development of IC Tester for Digital Logic Gates

Sesi Pengajian: 2021

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Yang benar,



.....  
NUR HIDAYU BINTI MUSA

Alamat Tetap:  
232 Jalan Medan 15,  
Taman Medan Baru,  
46000 Petaling Jaya,

Tarikh: 14/2/2020

Disahkan oleh penyelia:



.....  
Dr. Suhaila Binti Mohd Najib

Cop Rasmi Penyelia

**DR. SUHAILA BINTI MOHD NAJIB**

*Pensyarah Kanan*  
Jabatan Teknologi Kejuruteraan Elektronik dan Komputer  
Fakulti Teknologi Kejuruteraan Elektrik dan Elektronik  
Universiti Teknikal Malaysia Melaka

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Signature: .....

Author : NUR HIDAYU BINTI MUSA

Date: 14/2/2020



## APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electronics Engineering Technology (Computer System) with Honours. The member of the supervisory is as follow:



## ABSTRAK

Pengujian ialah satu proses yang kritikal dalam pembuatan IC. Tujuan pengujian ialah untuk memastikan komponen-komponen IC dan sambungan-sambungan diantara komponen adalah dalam keadaan baik untuk digunakan dalam litar tertentu. Objektif bagi projek ini adalah untuk mencapai dengan mengembangkan perkakasan pengujian IC digital perkakasan untuk gerbang logik IC dan menganalisis kecekapan sistem untuk IC terpilih. Kaedah yang digunakan dalam projek adalah dengan simulasi dan memasang komponen. Dari itu, keluaran bagi IC tersebut dapat dikeluarkan seperti yang dijangka secara teori melalui jadual kebenaran. Penguji IC ini menggunakan ciri-ciri fleksibel pengawal mikro PIC16F887 yang boleh diprogramkan untuk pelbagai litar. Pengawal mikro ini digunakan sebagai pusat pemproses bagi 2 tekan butang, 16x2 paparan segmen, dan masukan serta keluaran IC diuji melalui 1 soket ZIF. 2 tekan butang berfungsi untuk memilih nombor siri IC. Papan 16x2 segmen berfungsi untuk memaparkan nombor IC dan keputusan ujian. Soket ZIF berfungsi sebagai tempat IC yang hendak diuji diletakkan, dan sebagai saluran untuk masukan dan keluaran dihubungkan kepada pengawal mikro. Kaedah pengujian yang digunakan ialah kaedah dari jadual kebenaran melalui teori. Melalui kaedah ini, semua kombinasi masukan dipertimbangkan untuk ujian. Untuk projek ini, IC diuji untuk pintu logik. Hasilnya dihasilkan pada LCD sama ada ICnya baik atau rosak. Berdasarkan kecekapan projek, data direkodkan berdasarkan percubaan lima kali setiap IC.

## ABSTRACT

Testing is a critical part in IC manufacturing. The purposes of IC testing are to ensure IC components and connections between them are in good condition for uses. The objective for this project is to achieve by develop the hardware digital IC testing hardware for IC logic gates and analyses the efficiency of the system for the selected IC. The method used in the project is by simulation and assemble the component. Hence the output generates from as well as had estimated theoretically based on the truth table. This tester is using the flexible programmable features of PIC16F887 microcontroller for many applications. The microcontroller was using as a central processing unit for 2 push button, 16x2 segments displays, and input and output IC under test via a ZIF socket. Keypad was function as a medium for entering IC series number. 16x2 segment display was function as a platform for displaying IC under test series numbers and results of tests. ZIF socket was function as a platform to place IC under test, and as a channel for input and output IC under test to be connected to microcontroller as central processing unit. Through this method, all input combinations are considered for tests. For this project, IC might be tested have for IC logic gates. The result is generated on the LCD either the IC is good or faulty. Based on the efficiency of the project, the data is recorded based on the five times trial every each of the IC.

## DEDICATION

I dedicate this thesis to my beloved parents, supervisor, and my fellow friends. May Allah bless them.





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First and foremost, all praise to Allah for His mercy that this thesis can be completed on time. I am thankful to my supervisor, Dr Suhaila Binti Mohd Najib for her advice and guidance from beginning until I can complete my project. To my beloved parents, I offer them my deepest gratitude for all their prayers and support. Lastly, I offer my regards and blessings to my housemate and classmate who always supported me in any aspects during the completion of this project.

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# CHAPTER 1

## INTRODUCTION

### 1.0 Background

Consistent effort is made in cost reserve funds, quality upgrades and by and large efficiencies in each assembling industry. In the electronic business, with the exceptional ascent in circuit multifaceted nature and the requirement for the higher dependability rates, the testing can be a significant giver cost in any item. In any case, in reality we ought to perceive that no item is great, so testing and particularly programmed testing within a reasonable time-frame will be a basic piece of creation. Some normal IC's are every now and again utilized in enterprises, research focuses, and school; ordinarily individuals face issues because of some issue in these incorporated circuits. Be that as it may, checking them until they are truly utilized in any of the applications is significant. Computerized IC Tester concentrated on microcontroller is the ideal response to such issues. The IC testing just figures out which entryways can be utilized and which are imperfect. The task is for the most part planned for improving a far less exorbitant and helpful remote IC analyser that in the accessible markets. The objective is to screen ICs and show after-effects of ICs immediately. The essential info signal conditions were set to the door contributions with a microcontroller and each entryway yield is observed and contrasted with reality table, and it is checked. On the off chance that it is acceptable or damaged dependent on the examination IC. The essential capacity of the computerized IC analyser is to test the rationale working of the ICs as characterized in the table of truth/capacities. Be that as it may, we have made an entirely reasonable, minimized, simple to keep up and as well as reconfigurable.

## 1.1 Problem Statement

In general, testing the ICs before using it is the most important requirement to assemble the circuit. Some students require assembling the circuit in the project but they have a problem to check the condition for IC gates or to troubleshoot whether the problem is from connection or the IC itself. Faulty ICs give us wrong and unexpected results. The consequences of these wrong outcomes contribute to inaccurate measurement and evaluation in the project. In this changing age, time and money are quite critical. It is wasting the time in finding the problem faults caused by faulty ICs. Thus, a low cost and easy-to-maintain digital IC tester must be developed.

## 1.2 Objective

The objectives of this project are:

- i. To develop the digital IC testing hardware for IC logic gates
- ii. To analyse the efficiency of the system for the selected IC

## 1.3 Scope

The project is split into two sections which are the software and the hardware. Software implementation is used to design the circuit for this IC tester project, and the written program would be able to control all the hardware parts. At the same time, by using PIC16F887A, hardware development is used for the digital IC testing system. This project recommends the best concept and development for interactive IC testers to be produced.

#### **1.4 Project significant**

The IC testers currently available on the market are too expensive for student to own. So, we wanted to create an IC tester that's cheap and user-friendly. The important is to create cheap IC tester is to test the logic gates and the feature. The test sequence specifies in the microcontroller helps detects faulty ICs. In fact, the IC tester needs to be compact, easy to operate, lightweight, portable and low power consumption.

#### **1.5 Summary chapter**

This report consists of five chapters in general, and in this segment a brief description is given for each chapter. Chapter 1 explains briefly the background, problem statement, objective, scope and significant of the project in order to creates a functional tester for the logic IC. In addition, this chapter also clearly explains and addresses how the project is being carried out and states the scope of research of the project.

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## CHAPTER 2

### LITERATURE REVIEW

The main objective of the chapter is to cover the concepts and theory that are used in the project. Furthermore, this project read up about the Different methods that had been attempted to solve the problem or different ways to implement the system, and to compare their achievements.

#### 2.1 IC tester introduction

The main component of each and every electronic circuit that could be used for a wide variety of purposes and functions was integrated circuit (IC). However, sometime the circuit has not work due to faulty IC. In fact, it leads tedious work for the debugging of circuits and confirms whether the circuit had a creating problem. Therefore, in ordered to solve these kinds of problems, this project intends to create a test project that would confirm whether the IC being considered works properly or not. An IC tester could be used for regular testing and configuration on an IC. Every IC was evaluated by adding test patterns to the chip's input pins and then testing for correctness the respective outputs

#### 2.2 Overview of electronic packaging

This paper is supported by Tseung Yuen (2014) who developed the IC revolutionized the life of humans in the 20th century since the first integrated circuit (IC) which was invented by Jack Kilby and Robert Noyce in 1958. With unremitting demand

for better performance, the electronics industry has been forcing on smaller device. As the circuit density increases on the chip, the speed and functions it performs increases; however, a chip was not an isolated system, it must communicate with the other IC chips in the input / output (I / O) interconnect system in a device from side to side. In addition, the IC chips and their embedded circuitry were delicate, requiring both the carrying and the protection of a package. The integrated circuit chip alone is functionless if we do not have electronic packaging.

### **2.3 Overview of hardware microcontroller**

This researched included parts of the hardware and applications. Uses a microcontroller for hardware AT89C51, Arduino Atmega 2560, PIC16F874A/877A and ARM7 LPC 2148

#### **2.3.1 AT89C51 microcontroller**

The AT89C51 was an old, Atmel family 8-bit microcontroller. It works with the popular 8051 architecture and was thus used till date by most beginners. It was a package with 40 pinned IC and 4kb flashed memory. It had four ports, providing 32 programmable GPIO pins all together. It had no built-in ADC module, and only supports USART communication. Though it may interface with external ADC ICs such as ADC084 or ADC0808. The AT89C51 was no longer in service and newer version was not sponsored by Atmel.



Figure 2.1: AT89C51 microcontroller

P1.0	1	40	VCC
P1.1	2	39	P0.0 (AD0)
P1.2	3	38	P0.1 (AD1)
P1.3	4	37	P0.2 (AD2)
P1.4	5	36	P0.3 (AD3)
P1.5	6	35	P0.4 (AD4)
P1.6	7	34	P0.5 (AD5)
P1.7	8	33	P0.6 (AD6)
RST	9	32	P0.7 (AD7)
(RXD) P3.0	10	31	$\bar{E}$ A/VPP
(TXD) P3.1	11	30	ALE/PROG
( $\overline{\text{INT0}}$ ) P3.2	12	29	PSEN
( $\overline{\text{INT1}}$ ) P3.3	13	28	P2.7 (A15)
(T0) P3.4	14	27	P2.6 (A14)
(T1) P3.5	15	26	P2.5 (A13)
( $\overline{\text{WR}}$ ) P3.6	16	25	P2.4 (A12)
( $\overline{\text{RD}}$ ) P3.7	17	24	P2.3 (A11)
XTAL2	18	23	P2.2 (A10)
XTAL1	19	22	P2.1 (A9)
GND	20	21	P2.0 (A8)

Figure 2.2: AT89C51 datasheet