

74XX SERIES IC TESTER USING MC68HC11

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Special dedicated to my beloved parents Mr Mohd Ramli bin Ahmad and Mrs Juma binti Muhamed Ali, my lovely siblings and fiancee, my kindly supervisor Engr Zulkifli bin Shariff and special greeting to the dear friends.....

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ABSTRACT

This project is created to design an Integrated Circuit Tester (IC Tester) which used to test the functionality of 74xx series ICs. The IC tester is constructed using MC68HC11 microcontroller along with a keypad and display unit. It can test the functionality of various 14 pin ICs. The system is divided into three modules that are Microcontroller Module, Keypad Module and 7 – Segment Module. The MC68HC11A1 microcontroller uses bootstrap mode to produce a simple and low cost IC Tester. Assembly language is used to program the microcontroller. The simple IC Tester is design to counter this issue facing by the student, which currently test 14 pins common ICs manually that cause a lot of time wasting. This project successfully solves problems relate the 74xx series ICs functionality, where previously requires for manual handling.

TABLE OF CONTENTS

	Page
DECLARATION	ii
DEDICATION	v
AKNOWLEDGEMENT	vi
ABSTRACT	vii
TABLE OF CONTENTS	viii -xi
LIST OF FIGURE	xii -xiv
LIST OF TABLE	xv
CHAPTER 1: INTRODUCTION	1
1.1 Background	1-2
1.2 Problem Statement	2-3
1.3 Project Objective	3
1.4 Project Scope	3
1.5 Project Detail	4
1.6 Project Expected Outcome	4
1.7 Thesis Organization	5
CHAPTER 2: LITERITURE REVIEW	6
2.1 Introduction	6-7
2.2 Integrated Circuit Tester in Market	7

2.2.1	GUT-7000 Linear IC Tester	7-8
2.2.2	DICT – 02 and DICT – 03 Universal IC Testers	8-9
2.2.3	Modal 570A Analog and 575A Digital IC Tester	9-10
2.2.4	LinearMaster and ChipMaster Compact Professional	10-12
2.2.5	LEAPER – 1 Digital IC Tester	12-13
2.2.6	GUT – 6600 Digital IC Tester	13-14
2.2.7	Specification Comparison	15
2.3	Project Solution	16

CHAPTER 3: PROJECT DESIGN AND METHODOLOGY **17**

3.1	Introduction	17
3.2	Hardware	17-18
3.2.1	Microcontroller	18-20
3.2.2	Keypad	21
3.3.3	Keypad Encoder	21-22
3.3.4	7 – Segment Display	22-24
3.3.5	Power Supply	24
3.3.6	Voltage regulator	25
3.3.7	ZIF Socket	25-26
3.3	Interface Circuit	26-27
3.3.1	DB9 Female Connection	27
3.3.2	WP11	28
3.3.3	MC68HC11A1 (Bootstrap Mode) Programming	28-29
3.4	Device Configuration	29
3.4.1	Microcontroller Module	29-30
3.4.2	Keypad Module	30
3.4.3	7 - Segment Module	30-31
3.4.4	Technique	31
3.5	Software	32

3.5.1	PCB Design with Diptrace Software	32
3.5.2	PCB Design Simulation with Proteus 7 Professional	33
3.5.3	Programming	34
3.5.4	List of IC	34-35
3.5.5	Boolean Equation and Truth Table	36
3.5.6	Keypad and 7 segments	37
3.5.7	Microcontroller Module	38
3.5.8	IC Tester	39
 CHAPTER 4: RESULT AND DISCUSSION		40
4.1	Introduction	40
4.2	Microcontroller Module	40-41
4.3	PCB Designed	41
4.3.1	Main Circuit Design	41-43
4.3.2	Power Supply Circuit Design	43-45
4.4	Programming development	45
4.4.1	Testing the programming of IC Tester	46-52
4.5	Schematic Simulation by Proteus 7 Professional	52-53
4.5.1	Simulation of NAND Gate	54
4.5.2	Simulation of AND Gate	54
4.5.3	Simulation of NOR Gate	55
4.5.4	Simulation of OR Gate	55
4.5.5	Simulation of NOT Gate	56
4.5.6	Simulation of XOR Gate	56
4.6	PCB Layout	57
4.6.1	Main Circuit PCB Layout	57
	4.6.1.1 Bottom side of Main circuit PCB Layout	57
	4.6.1.2 Top side of Main Circuit PCB Layout	58
4.6.2	Power Supply Circuit PCB Layout	58

4.6.2.1	Bottom side of Power Supply PCB Layout	58
4.6.2.2	Top side of Power Supply PCB Layout	59
4.7	Hardware Development	59-62
4.8	Program Downloading towards Hardware	62
4.8.1	Program downloading to MC68HC11A1 (BOOTSTRAP MODE)	62-66
4.9	Step to test the 74xx Series ICs by using IC tester	67-69
4.10	Testing the performance of IC tester	69-70
 CHAPTER 5: CONCLUSION AND RECOMMENDATION		71
5.1	Conclusion	71-72
5.2	Recommendations	72-73
5.2.1	Costing and Commercialization	73-74
 REFERENCES		75-76
 APPENDIXES A		77
APPENDIXES B		78
APPENDIXES C		79

LIST OF FIGURE

FIGURE	TITLE	PAGE
Figure 1.0	Overview of the project structure and idea	2
Figure 2.1	GUT-7000 Linear IC Tester	8
Figure 2.2	DICT – 02 and DICT – 03 Universal IC Testers	9
Figure 2.3	Modal 570A Analog and 575A Digital IC Tester	10
Figure 2.4	LinearMaster and ChipMaster Compact Professional	12
Figure 2.5	LEAPER – 1 Digital IC Tester	13
Figure 2.6	GUT-6600 Digital IC Tester	14
Figure 3.1	Block Diagram of Hardware	18
Figure 3.2	48-Pin DIP Pin Assignments	29
Figure 3.3	68HC11A1 Block Diagram	20
Figure 3.4	4x4 Keypad with Pin Assignments	21
Figure 3.5	Keypad Encoder Pin Assignment	22
Figure 3.6	7-Segment Display	23
Figure 3.7	7 – Segment Display Internal Wiring	23
Figure 3.8	Voltage Regulator LM7805	25
Figure 3.9	14 Way of ZIF socket	26
Figure 3.10	Block Diagram of Interface Circuit	26
Figure 3.11	DB9 Connection (Female)	27
Figure 3.12	WP11 Screen shot	28
Figure 3.13	Block Diagram of Microcontroller Module	30

Figure 3.14	Block Diagram of Keypad Module	30
Figure 3.15	Block Diagram of 7 – Segment Connection	31
Figure 3.16	Diptrace Software	32
Figure 3.17	ISIS of Proteus 7 Professional	33
Figure 3.18	Internal Configuration of 7400, 7408, 7432 and 7486	34
Figure 3.19	Gate	35
Figure 3.20	Internal Configuration of 7402	35
Figure 3.21	Internal Configuration of 7404	35
Figure 3.22	Flow Chart of Keypad and 7-Segment	37
Figure 3.23	Flow Chart of Microcontroller Module	38
Figure 3.24	Flow Chart of IC Tester	39
Figure 4.1	Main Circuit Diagram	43
Figure 4.2	Power Supply Circuit Diagram	45
Figure 4.3	Program of keypad recognition for 74xx series IC tester	46
Figure 4.4	Program of Listed ICs	47
Figure 4.5	Program of ‘Standard’ ICs	48
Figure 4.6	Program of ‘AND Gate	48
Figure 4.7	Program of ‘OR’ Gate	49
Figure 4.8	Program of ‘NAND’ Gate	49
Figure 4.9	Program of ‘XOR’ Gate	50
Figure 4.10	Program of ‘Pass or Fail’	50
Figure 4.11	Program of NOR Gate	51
Figure 4.12	Program of NOT Gate	52
Figure 4.13	Program loaded from program file	53
Figure 4.14	Simulation ‘Play’ button	53
Figure 4.15	NAND Gate simulation	54
Figure 4.16	AND Gate simulation	54
Figure 4.17	NOR Gate simulation	55

Figure 4.18	OR Gate simulation	55
Figure 4.19	NOT Gate simulation	56
Figure 4.20	XOR Gate simulation	56
Figure 4.21	Bottom Side of Main Circuit	57
Figure 4.22	Top Side of Main Circuit	58
Figure 4.23	Bottom Side of Power Supply Circuit	58
Figure 4.24	Top Side of Power Supply Circuit	59
Figure 4.25	Microcontroller Module, Keypad Module and BCD to seven segment Module (Main Circuit)	60
Figure 4.26	Power Supply Module	61
Figure 4.27	Completed Circuit Combination	61
Figure 4.28	74xx Series IC Tester	62
Figure 4.29	MiniIDE assembler	63
Figure 4.30	WP11.EXE file	63
Figure 4.31	Main GUI	64
Figure 4.32	Computer's Port Test	64
Figure 4.33	Initializing Device	65
Figure 4.34	Device Blank Check	65
Figure 4.35	Load Program from File	66
Figure 4.36	Programming Successful	66
Figure 4.37	Switching ON the IC Tester	67
Figure 4.38	Pressing Reset Button	67
Figure 4.39	Inserting the IC into the ZIF Socket	68
Figure 4.40	Keying-in the last two digit of IC's number	68
Figure 4.41	Result of the tested ICs	69

LIST OF TABLE

TABLE	TITLE	PAGE
Table 1.0	Gantt Chart of Project	4
Table 1.1	Thesis Organization	5
Table 2.1	Specification Comparison of IC Tester	15
Table 3.1	The Truth Table of BCD – 7 - Segment Decoder	24
Table 3.2	DB9 Pin Assignment	27
Table 3.3	Boolean Equation and Truth Table for Two Input Gates	36
Table 3.4	Boolean Equation and Truth Table for NOT gate	36
Table 4.1	Gate Condition	70

CHAPTER 1

INTRODUCTION

1.1 Background

Integrated Circuit Tester (IC Tester) is used to test the functionality of ICs. This developed IC Tester is affordable, unlike the IC testers available in the market today, which is usually expensive. This IC Tester is constructed using MC68HC11 microcontroller along with a keypad and a display unit. It can test the functionality of various 14 pin ICs. For instant, few common 14 pin ICs are :7400 (Quad 2-input NAND gate), 7402 (Quad 2-input NOR gate), 7404 (Hex Inverter), 7408(Quad 2-input AND gate), 7432 (Quad 2-input OR gate) and 7386 (Quad 2 input XOR gate).

The system is divided into three modules. The modules are Microcontroller Module, Keypad Module and 7-segment Module. An IC can be tested by keying in the series number of IC using the keyboard and inserting the IC on the ZIF socket. Result will be displayed in the seven segments immediately after completely keying in the series numbers of IC; either 'P' for pass of 'F' for fails.

This project uses the Motorola MC68HC11A1 high performance microcontroller. It is an 8 bit microcontroller 68HC11 family and consist 48-Pin Dual In-Line Package (DIP). This project also uses bootstrap mode to allow a program to be download in EEPROM by way of the serial communications interface. MC68HC11 assembly language will be uses for this IC tester.



Figure 1.0: Overview of the project structure and idea

1.2 Problem Statement

As a student in the electronic field, Digital Logic Lab is compulsory, where it involves 74xx series ICs in the experiment. These ICs commonly consists of 14 pins with 4 basic gates. During the lab session for instant, if the experiment was unsuccessful, student will normally assume that the IC was burn, damage or fail instead of wrong connection.

In order to avoid student from making wrong assumption and to counter this issues as well, 74xx series IC tester can be use before doing the experiment. Otherwise, only the 'Pass' ICs will be taking by the student for doing the experiment of digital system as well. Perhaps, lab technicians or instructors also can use this IC tester in order to test the 74xx series ICs before distribute to students as it is easy and practical to be use.

1.3 Project Objective

- I. To design a simple IC tester that can be used to test various 14 pin ICs using MC68HC11
- II. To produce a simple and low-cost IC tester uses bootstrap mode
- III. To construct three modules which are Microcontroller Module, Keypad Module and 7-Segment Module
- IV. To create and works with the assembly programming of microcontroller MC68HC11 which will operate the tester in order to produce proper result.

1.4 Project Scope

- I. Do research on microcontroller MC68HC11 instructions (assembly program).
- II. Do researches on MC68HC11A1P ('A' series microcontroller) datasheet, pin assignments and basic circuit connection.
- III. Do research on keypad (input device) and the type of keypad that suitable for this project.
- IV. Do research on 7-segment display, which is a display device that widely used in electronic equipment as a method of displaying numerical and character information. Do research on power supply and Zero insertion force (ZIF) as IC socket.

1.5 Project Details

Table 1.1 shows the Gantt chart of project. Gantt charts illustrate the start and finish dates of the terminal elements and summary elements of a project. This project is divided into two parts, including the hardware design and software development to the integration of both. Each module is tested and analyzed individually before they are integrated into a complete IC tester system. At the same time, the report will be completed together with the work.

Table 1.0: Gantt Chart of Project

		Senaraikan aktiviti-aktiviti utama bagi projek yang dicadangkan. Nyatakan jangka masa yang diperlukan bagi setiap aktiviti.																																							
		2010												2011																											
BIL	ACTIVITIES	JULAI	OGOS	SEPTEMBER	OKTOBER	NOVEMBER	DISEMBER	JANUARI	FEBRUARI	MAC	APRIL																														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1	Project title discussion																																								
2	Interpretation problems																																								
3	Find information and understanding the project																																								
4	Meeting & Discuss with project supervisor																																								
5	Submit PSM Proposal																																								
6	Assessments																																								
7	Literature Studies for hardware and software																																								
8	Hardware Design																																								
9	Seminar for PSM I																																								
10	Prepare and submit PSM I report																																								
11	Hardware development and fabrication																																								
12	Software development																																								
13	Link the hardware and software																																								
14	Project testing and troubleshooting																																								
15	Project Fizing																																								
16	Discuss and prepare report PSM II																																								
17	Complete and submit report PSM II																																								
18	Seminar PSM II																																								

1.6 Project Expected Outcome

- I. Manage to build up a simple IC tester that can be use as a first screening to check the functionality of ICs as it is easy and practical to use.
- II. Manage to have all of the modules that can communicate very well.
- III. Manage to develop an IC tester that is efficient with effective cost compare to other high-cost IC tester in current market.

1.7 Thesis Organization

This thesis consists of five chapters. It is organized as follow:

Table 1.1: Thesis Organization

Chapter 1	Contain the objectives and overview of the project
Chapter 2	Discuss and review some of the available IC testers in the market today. The end of this chapter is described concerning the IC tester that is designed
Chapter 3	Described the details of project. It reviews the hardware description of each circuitry and component used in the project. Besides that, this chapter also elaborates software development of this project by using flow graph approach.
Chapter 4	Discuss all the tests and result obtained from various tests conducted on each module and the complete system. The discussions are concentrated on the problems faced during the testing process and steps taken to overcome the problem.
Chapter 5	Provide summaries of the project. A few recommendations are proposed to enhance the current design.

CHAPTER 2

LITERITURE REVIEW

2.1 Introduction

In half a century after the integrated circuit (IC) development was initiated, it became popular everywhere. The IC is a great technology, from the simple IC like the voltage regulator to the complex IC such as microcontrollers. Nowadays, computers, cellular phones, and other digital appliance devices use IC to make circuit – building becomes easy and simple. There are several types of ICs such as integrated injection logic, transistor – transistor logic (TTL), bipolar junction transistor, emitter – coupled logic (ECL), MOSFET, NMOS, CMOS, BiCMOS, BCDMOS and mixed – signal integrated circuit.

ICs should be tested before they are used in any application. Each IC needs to be tested using different hardware circuits, which makes it more complicated and time – consuming. In any electronic manufacturer processes, thousands of ICs are checked every day. Hence, the IC tester is developed to overcome this problem. The IC tester is a device that is use to test the functionality of ICs. There are three types of IC testers namely the linear (analog) IC tester, digital IC tester and universal IC tester. The IC

testers are manufactured from several electronic companies. They come with different functions, sizes, and prices, as well as simplicity of operation.

This chapter will discuss and review some of the available IC testers in the market today. The specification of the IC testers that will be focused on this type, price, type of output display, keypad's keys, ZIF's pins, weight and dimension. The conclusion of this chapter, concerning the IC tester that will be designed, is described at the end.

2.2 Integrated Circuit Tester in Market

2.2.1 GUT-7000 Linear IC Tester

Figure 2.1 shows the GUT-7000 Linear IC Tester model. GUT – 7000 can identify and test wide range of linear ICs including timers, op-amps, comparators, regulators, zener diodes, photo coupler, communication IC, driver and switching power supply ICs which up to 24 pin devices. Furthermore, GUT utomatically identifies the unknown devices and lists the same function of IC number. Various tones are used to identify the test result. The power source is AC 110/220V $\pm 10\%$, 50/60Hz and the test voltage is $\pm 5V \sim \pm 24V$. GUT- 7000 is embedded with 16 character LCD display and keypad for 10 numeric (0-9) keys. The weight is approximately 1.5kg with dimensions 335mm (w) x 105mm (h) x 300mm (d). [MAPO Electronic, 2000]



Figure 2.1: GUT-7000 Linear IC Tester

2.2.2 DICT – 02 and DICT – 03 Universal IC Testers

DICT-02 and DICT- 03 Universal IC Tester shown in figure 2.2 are the IC testers manufactured by SALICON. These two models are digital and analog IC Tester. Both of them are fabricated using the finest grade of electrical components.

The IC tester can test a wide range of digital ICs, such as the TTL74xxx series and CMOS 40/45 series, as well as testing microprocessors manufactured by Intel, analog ICs such as op – amp, timer 555, transistor array, analog switch coupler; and also to test seven segment display of common cathode and common anode type. They have Auto search facility of IC's which tests ICs by using truth table/sequence table comparison. The supply input voltage is 230V AC.

The different between these two products are the keys and the display unit. DICT – 02 consist of 40 pin DIP ZIF socket, 28 cherry keys keypad with numerical and functional keys, and nine digit seven – segment displays. It can test more than 600+ ICs .Whereas DICT – 03 consists of two numbers of 40 pin DIP ZIF sockets for digital and analog IC's, 50 cherry keys keypad with numerical & functional keys, and 16x2 backlit LCD display. It can test more than 600+ ICs such as Micro- processor 8085, 8086, Z80,

8051, 89c51. DICT – 03 probably tests a wide range of ADC, DAC, Comparators [Salicon Nano Technology, 2009].



Figure 2.2: DICT – 02 and DICT – 03 Universal IC Testers

2.2.3 Modal 570A Analog and 575A Digital IC Tester

Figure 2.3 shows Model 570A Analog and Model 575A Digital IC Tester. The result of the test, PASS or FAIL, is displayed on a 2 – line x 16 character dot matrix LCD. Both IC testers are fitted using membrane keypad. These IC testers can be powered by either batteries 4 x 1.5V AA adaptor. Proven test software and advanced technology make these IC testers an ideal addition to any tool kit.

Model 570A automatically senses the functionality of the device to be tested and displays a list of possible equivalents for a replacement. This IC tester has high quality pin ZIF socket. Devices that can be tested include all common Analog ICs such as op – amp, comparator, voltage regulator, voltage references and audio ICs. The price of this model is RM4725.55.