74XX SERIES IC TESTER USING MC68HC11

NURLIYANA BINTI HJ MOHD RAMLI

This Report Is Submitted In Partial Fulfillment Of The Requirements For The Award Of
Bachelor Of Electronic Engineering (Telecommunication)
With Honours

Faculty of Electronic and Computer Engineering
Universiti Teknikal Malaysia Melaka

May 2011

UNIVERSTI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek	:	74XX SERIES IC TESTER USING MC68HC11
Sesi Pengajian	:	2010/2011

Saya NURLIYANA BINTI HJ MOHD RAMLI

mengaku membenarkan Laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.

2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.

3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.

4. Sila tandakan (√) :

    ☐   **SULIT***   (Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

    ☐   **TERHAD***   (Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

    ☐   **TIDAK TERHAD**

                                       Disahkan oleh:

_____   _____
(TANDATANGAN PENULIS)   (COP DAN TANDATANGAN PENYELIA)

Alamat Tetap: No 11, Lintang Pauh Indah 1,

                Taman Pauh Indah, 13500,

                Permatang Pauh, P.Pinang

Tarikh : 29th APRIL 2011   Tarikh: 29th APRIL 2011

"I hereby declare that this report is the result of my own work except for quotes as cited in the references"

Signature   :……………………………………………….

Author   :……………………………………………….

Date   :……………………………………………….

"I hereby declare that I have read this report and in my opinion this report is sufficient in terms of the scope and quality for the award of Bachelor of Electronic Engineering (Computer Engineering) With Honours."

Signature   :……………………………………………………….

Supervisor's Name :……………………………………………………….

Date   :……………………………………………………….

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………

ACKNOWLEDGEMENT

Assalamulaikum W.B.T. with the name of ALLAH, the infinitely Compassionate and Merciful. I wish the deepest sense of gratitude to ALLAH who has given me the strength and ability to complete this project and thesis entitle 74XX Series IC Tester using MC68HC11.

This thesis would not have been possible without the support of many people. First of all, I would like to express my deepest appreciation to my supervisor, Engr. Zulkifli Bin Shariff, for the consistent consultation and invaluable advice throughout the preparation and completion of this final year project. Without his kindness and guidance this project might not have been the same as presented in this thesis as well.

I would like to record my sincere gratitude and heartfelt thanks to my Microcontroller's lecturer at Polytecnic Tuanku Sultanah Bahiyah; Pn Normala binti Ahmad as for her guidance toward the software of this project. She has made available her support in a number of ways. Besides that, it is an honor for me to thanks my beloved family and fiancée. Special thanks to my father, Hj Mohd. Ramli Bin Ahmad; that through his caring, motivations and understanding, endless love, he has taught me to have the courage to believe in myself and even more.

Last but not least, I also please my gratitude to Lab technicians and to my entire friends who has directly contributed with my final year project as well. I offer my regards and blessings to all of those who supported me in any respect during the completion of this final year project and thesis.

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

CHAPTER 3: PROJECT DESIGN AND METHODOLOGY 17

LIST OF FIGURE

LIST OF TABLE

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 bootsrap 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

BIL	ACTIVITIES	JULAI			OGOS				SEPTEMBER				OKTOBER				NOVEMBER				DISEMBER				JANUARI				FEBRUARI				MAC				APRIL			
	Senaraikan aktiviti-aktiviti utama bagi projek yang dicadangkan. Nyatakan jangka masa yang diperlukan bagi setiap aktiviti. 2010 / 2011	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 1																																								
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 Fixing																																								
16	Discuss and prepare report PSM II																																								
17	Complete and submit report PSM II																																								
18	Seminar PSM II																																								

Note: The shaded region at weeks 8–10 is labelled "MID SEMESTER BREAK", weeks 16–19 "EXAMINATION WEEK", weeks 20–23 "END SEMESTER BREAK". The left column region is labelled "PSM BRIEFING".

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 ±10%, 50/60Hz and the test voltage is ±5V~ ±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.