Digital Integrated Circuit Tester Using AT89S52

Sameer Dinesh Mohadikar
Student, Department of EXTC, Atharva College of Engineering
Affiliated to Mumbai University, Mumbai, India

Abstract— This is a project based on microcontroller, which test the 74xx series IC. The coding includes testing of 7400, 7402, 7404, 7408, 7432, 7486 IC. It can be extended further Based on the need. This includes an extra board which have IC holder and which holds the IC's which are to be tested. And this board also includes some push button which tells the system which IC is being tested. You just have to put in the IC and press the relative button to test the IC.

Keywords— Digital IC tester, Microcontroller AT89S52

I. INTRODUCTION

The digital IC tester is implemented by using the 8051 (AT89S52) microcontroller. The processing of the inputs and outputs is done by the microcontroller. The display part on the microcontroller board is modelled using LCD. After the successful testing of the IC, the result is displayed on the LCD.

The basic function of the digital IC tester is to test a digital IC for correct logical functioning as described in the truth table and/or function table. It can test digital ICs having a maximum of 14 or 16 pins. Since it is programmable, any number of ICs can be tested within the constraint of the memory available. This model applies the necessary signals to the inputs of the IC, monitoring the outputs at each stage and comparing them with the outputs in the truth table. Any discrepancy in the functioning of the IC results in a fail indication, displays the faulty and good gates on the LCD. The testing procedure is accomplished with the help of keys present on the main board.

This project has been tested with most commonly used digital IC's, mainly belonging to the 74TTL series. Digital IC tester support various types of IC's like OR, XOR, NAND, AND, NOT, NOR, XNOR GATES and FLIP-FLOP IC's (7400, 7402, 7404, 7408, 7432, 7474, 7486)

II. TECHNICAL SPECIFICATION

- Working Voltage = 12V AC/DC
- 16 x 2 LCD Display Module With Back-Light
- 16 pin ZIP Socket
- On board jumper for 14 or 16 pin IC selection
- Push on switches to select Device / IC
- Power on / status LED Indication
- Onboard regulator for regulated supply to the kit
- Bridge Rectifier protection for reverse polarity connection of DC supply to the PCB
- Operating Current - 500ma Approx
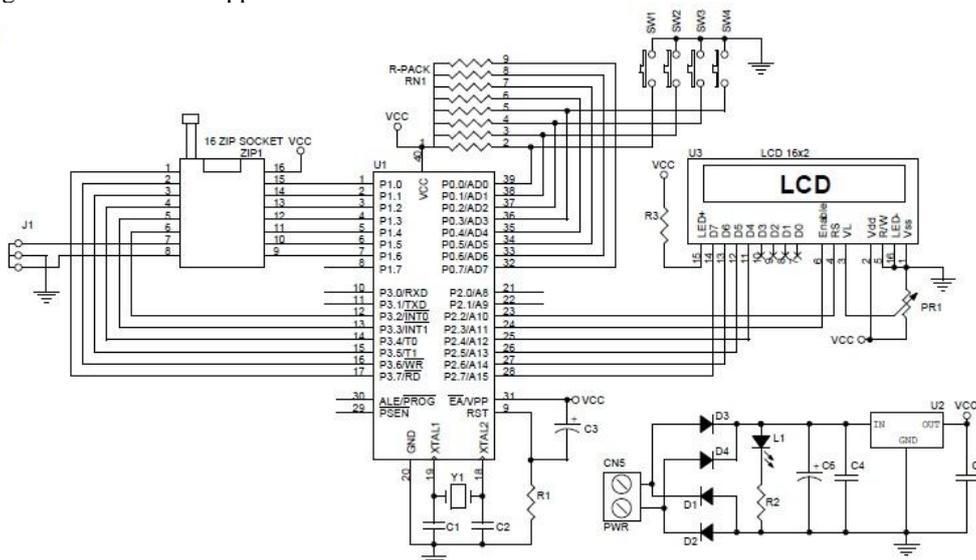
III. HOW IT'S WORK

Microcontroller Interface
See the circuit / block diagram of the digital IC tester using 89Sxx Microcontroller. The circuit used in this kit uses only one IC – the AT89Sxx (8051). It is one of the 8051-based microcontrollers from ATMEL. The IC is pre programmed. Using a microcontroller greatly reduces the component count while providing more features than could be found using dedicated logic ICs. Cost is also lower. It is pre-programmed with software to provide all the timing functions.

Switches / Push Button Interface
Port pins P0.0 through P0.3 of U1 are connected to SW1, SW2, SW3 and SW4 switches.. These pins are pulled high through a 10-kilo-ohm resistor bank (R-PACK).

LCD Interface
The dot-matrix liquid crystal display controller and driver LSI displays alphanumeric, characters, and symbols. It can be configured to drive a dot-matrix liquid crystal display under the control of a 4 or 8-bit microprocessor. Since all the functions such as display RAM, character generator, and liquid crystal driver, required for driving a dot-matrix liquid crystal display are internally provided on one chip, a minimal system can be interfaced with this controller/driver. A single HD44780U can display up to two 8-character lines (16 x 2).
Data transfer between the MCU and the LCD module will occur in the 4-bit mode. The R/W pin (5) of the LCD module is permanently grounded as there won't be any data read from the LCD module. P2.4 – P2.7 serves the 4-bit data lines (D4-D7, pins 11-14) of the LCD module. Control lines, RS and E, are connected to P2.2 and P2.3. Thus, altogether 6 I/O pins of the microcontrollers are used by the LCD module. The contrast adjustment is done with a 20K preset (potentiometer) as shown below. If your LCD module has backlight LED, use a 22Ω resistance in series with the pin 15 or 16 to limit the current through the LED. The detail of the circuit diagram is shown below.

MCU Clock
Clock signal for the micro controller provided by crystal Y1 (11.0592 MHZ) and two 33PF (C1, C2) capacitors hanging off it ensure correct loading for the crystal, so that it starts reliably. The frequency of the oscillator is internally divided and to get the operating frequency. This high frequency clock source is used to control the sequencing of CPU instruction.

MCU Reset
Power on reset is provided by R1 and C3. The 89xxx micro controller has an active high reset signal.

Power Supply
The power supply circuit. It's based on 3 terminal voltage regulators, which provide the required regulated +5V. Power is deliver initially from standard 12V AC/DC adapter or 12V_1000ma Transformer. This is fed to bridge rectifier (Diode D1 ~ 4) the output of which is then filtered using 1000uf electrolytic capacitor (C6) and fed to U2 (voltage regulator). U2 +5V output powers the micro controller and other logic circuitry. LED L1 and its associate 1K current limiting resistors provide power indication.

IV. PART EXPLANATION

Microcontroller At89s51 / 52
The AT89xxx is a low-power, high-performance CMOS 8-bit microcomputer with 4K / 8K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high density non-volatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89xxx is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications
Features
- 4K / 8K Bytes of In-System Reprogram able Flash Memory
- Compatible with MCS-51™ Products
- Fully Static Operation: 0 Hz to 24 MHz
- Three-level Program Memory Lock
- 128 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Two 16-bit Timer/Counters
- Six Interrupt Sources
- Programmable Serial Channel
- Low-power Idle and Power-down Modes
- 8-bit
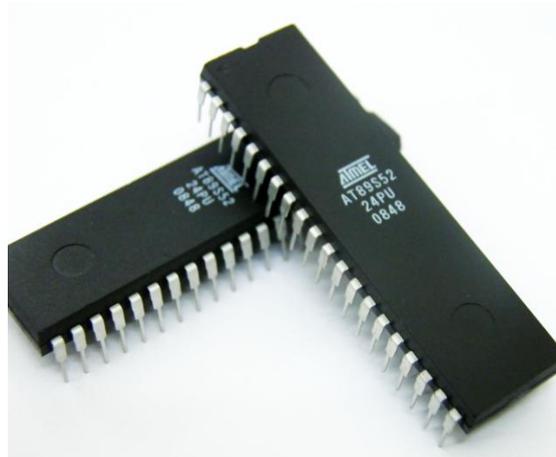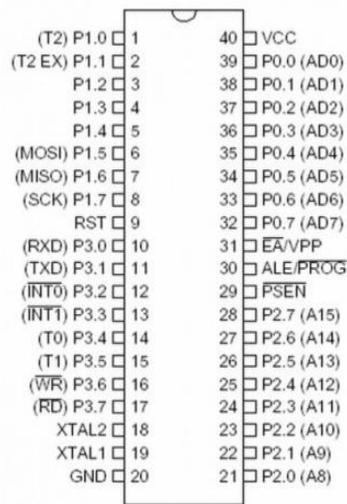
Crystal Oscillator

A crystal oscillator is an electronic circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a very precise frequency. This frequency is commonly used to keep track of time (as in quartz wristwatches), to provide a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters/receivers.

Lm7805 (3 Terminal Voltage Regulater)
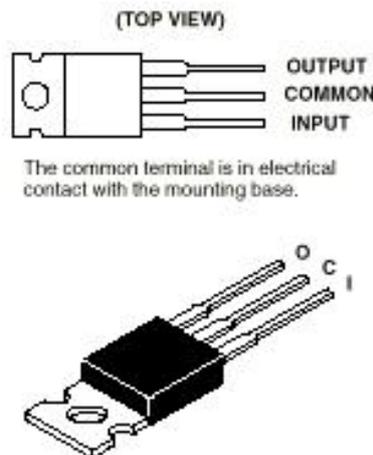
This is used to make the stable voltage of +5V for circuits. The LM7805 is three terminal positive regulators are available in the TO-220 - package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, More information please refer Data sheet 0f LM7805

16 x 2 LCD Modules
HD44780 based LCD displays are very popular among hobbyists because they are cheap and they can display characters. Besides they are very easy to interface with microcontrollers and most of the present day high-level compilers have in-built library routines for them. The interface requires 6 I/O lines of the microcontroller: 4 data lines and 2 control lines.

A. Required Theory
All HD44780 based character LCD displays are connected through 14 pins: 8 data pins (D0-D7), 3 control pins (RS, E, R/W), and three power lines (Vdd, Vss, Vee). Some LCDs have LED backlight feature that helps to read the data on the

display during low illumination conditions. So they have two additional connections (LED+ and LED-), making altogether 16 pin. A 16-pin LCD module with its pin diagram is shown below.

PIN No	Name	Function
1	VSS	Ground voltage
2	VCC	+5V
3	VEE	Contrast voltage
4	RS	Register Select 0 = Instruction Register 1 = Data Register
5	R/W	Read/Write, to choose write or read mode 0 = write mode 1 = read mode
6	E	Enable 0 = start to latch data to LCD character 1= disable
7	DB0	Data bit 0 (LSB)
8	DB1	Data bit 1
9	DB2	Data bit 2
10	DB3	Data bit 3
11	DB4	Data bit 4
12	DB5	Data bit 5
13	DB6	Data bit 6
14	DB7	Data bit 7 (MSB)
15	BPL	Back Plane Light +5V or lower (Optional)
16	GND	Ground voltage (Optional)

B.   Control pins

The control pin RS determines if the data transfer between the LCD module and an external microcontroller are actual character data or command/status. When the microcontroller needs to send commands to LCD or to read the LCD status, it must be pulled low. Similarly, this must be pulled high if character data is to be sent to and from the LCD module.

The direction of data transfer is controlled by the R/W pin. If it is pulled Low, the commands or character data is written to the LCD module. And, when it is pulled high, the character data or status information from the LCD registers is read. Here, we will use one way data transfer, i.e., from microcontroller to LCD module, so the R/W pin will be grounded permanently.

The enable pin (E) initiates the actual data transfer. When writing to the LCD display, the data is transferred only on the high to low transition of the E pin.

C.   Power supply pins

Although most of the LCD module data sheets recommend +5V DC. Supply for operation, some LCDs may work well for a wider range (3.0 to 5.5 V). The Vdd pin should be connected to the positive power supply and Vss to ground. Pin 3 is Vee, which is used to adjust the contrast of the display. In most of the cases, this pin is connected to a voltage between 0 and 2V by using a preset potentiometer.

D.   Data pins

Pins 7 to 14 are data lines (D0-D7). Data transfer to and from the display can be achieved either in 8-bit or 4-bit mode. The 8-bit mode uses all eight data lines to transfer a byte, whereas, in a 4-bit mode, a byte is transferred as two 4-bit nibbles. In the later case, only the upper 4 data lines (D4-D7) are used. This technique is beneficial as this saves 4 input/output pins of microcontroller. We will use the 4-bit mode.

V.   CONCLUSIONS

The project has been successfully completed and the main objective of emulating an IC tester on AT89S52 micro controller has been achieved. For a given specification any IC can be checked for its functionality. It takes more time to test an IC manually, with the implementation of the system with microcontroller makes the testing procedure simpler.

Any digital IC with the given specifications can be implemented on IC tester circuit. This system is capable of testing the IC's having up to 16 pins.

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