Chittagong University of Engineering and Technology

Department of Electrical and Electronic Engineering

Project Title:

Diode Tester

Group No: 25

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Abstract:

The Diode Tester Project seeks to create a flexible and user-friendly testing tool for precisely determining the features and operation of diodes. Diodes are basic semiconductor components that are frequently employed in electronic circuits for voltage regulation, signal modulation, and rectification. Diode performance and reliability are essential for the overall efficiency and dependability of electronic systems.

By offering a variety of testing modes and measuring capabilities, the suggested Diode Tester provides an all-inclusive solution to diode testing. The apparatus uses sophisticated circuitry and microcontroller-based control to precisely measure diode properties, such as whether the diode is shorted or open or the diode is ok. Diodes of all kinds, including rectifier diodes, Zener diodes, Schottky diodes, and light-emitting diodes (LEDs), can also be analysed by the tester. In this experiment lcd diplay showed wheather diode is good or not.The Diode Tester's user interface is made to be simple to use, with a graphical display and easy-to-use buttons. The testing procedure can be started by connecting the diode being tested and choosing the desired testing mode with ease. The device's small size and portability increase its usefulness in both field and laboratory settings.

Key words: diode tester, semiconductor components, electronic circuits, LED, functionality, breakdown voltage, microcontroller.

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Chapter 1

Introduction

Diodes are key parts of electronics that are essential for determining the behaviour and performance of electronic devices. The examination and analysis of these crucial parts is facilitated by the diode tester, a useful instrument in the hands of experts, amateurs, and technicians. This project explores the complex ideas behind diodes, illustrates the key elements used in diode testers, and charts the technological development over time. The precision and adaptability of the device depend on the integration of many different parts in order to build an efficient diode tester. The adjustable current source, which sends a regulated current through the diode being tested, is one of the main parts. To determine the diode's forward voltage, a voltmeter monitors the voltage drop across the device. A switching mechanism additionally enables a quick changeover between the forward and reverse bias situations, allowing for thorough examination of diode behaviour. As semiconductor devices, diodes have a unique characteristic: they allow electric current to flow in one direction while fiercely opposing it in the opposite direction. The interaction of electrons and electron holes within the semiconductor material, which results in the development of a diode junction, is what causes this fascinating behaviour. To understand how diodes function, one must delve into the areas of forward and reverse biassing, the distinctive current-voltage curve of the device, and the crucial transition between conducting and blocking states. In this experiment we used Pic 16F877A , LCD display, diode, wires , power source(9v Dc battery) , switch, resistor, capacitor etc.

Chapter 2

Working and Design of Circuit

The working process along with circuit diagram, codes for PIC and necessary mathematical and logical calculation has been shown below

2.1 Figures

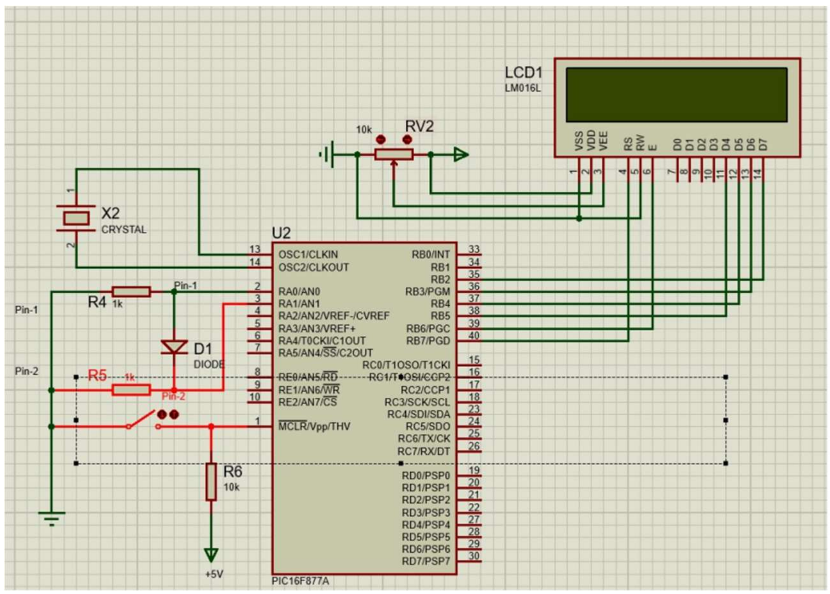

Figure 2.1 Simulated Circuit Diagram for the Project

A diode, a two-terminal electronic component that only permits current to flow in one direction, can have its properties tested using a diode tester circuit. A diode tester circuit's basic operation entails exposing the diode to a known voltage or current while monitoring the diode's behaviour to check for proper operation. We Connected the LM7805 voltage regulator's input pin (Vin) to the battery's positive terminal.Connect the voltage regulator's ground (GND) connector to the battery's common ground (GND).Connect the Vcc (power supply) pin of the PIC 16F877A microcontroller (Pin 11) to the output pin (+5V) of the voltage regulator.For microcontroller setup Connect the GND pin of the microcontroller (Pin 12) to the ground (GND) terminal of the voltage regulator.Connect a capacitor (10uF) between the Vcc (Pin 11) and GND (Pin 12) pins of the microcontroller to stabilize the power supply. Connect a resistor (e.g., 220 ohms) in series with the anode of the diode under test (DUT).
Connect the cathode of the DUT to the ground (GND) terminal. Connect the LCD display's data pins (D4–D7) to the microcontroller's digital I/O pins as follows: D4 to Pin 33, D5 to Pin 34, D6 to Pin 35, and D7 to Pin 36.Connect the LCD display's RS (Register Select) pin to one of the

microcontroller's digital I/O pins, such as Pin 37.Connect the microcontroller's digital I/O pin (such as Pin 38) to the LCD display's EN (Enable) pin.Connect the LCD display's RW (Read/Write) pin to ground. we Createed a programme for the PIC microcontroller that initialises the digital I/O pins required for controlling the diode tester circuit and the LCD display's required I/O pins.A forward bias voltage should be applied to the diode using programme logic, such as by setting a particular digital I/O pin HIGH, and then the diode's response should be measured. Apply the program to the PIC microcontroller using a programmer.Connected the diode under test to the circuit. we gave Power on the circuit by connecting the battery. When the diode is forward-biased and functional, the LCD display should show a positive response, indicating that the diode is conducting.When the diode is reverse-biased or faulty, the LCD display should show a negative response, indicating that the diode is not conducting.

list item:

1. **microcontroller Pic 16F877A :** The PIC16F877A is a popular microcontroller from the PIC (Peripheral Interface Controller) family, manufactured by Microchip Technology. It features a range of I/O pins, built-in peripherals, and processing capabilities suitable for various embedded systems and microcontroller-based projects.

Fig 2.2 : Pic 16F877A

2. **LCD (LM016L):** The LM016L is not a common or well-known designation for an LCD. However, assuming you mean a general LCD (Liquid Crystal Display), it is a flat-panel display technology that uses liquid crystals to modulate light and display information. LCD are commonly used in devices like digital watches, calculators, monitors, and more for visual representation.

Fig 2.3 : LCD

3. **Crystal oscillator:** A crystal oscillator is an electronic circuit that uses the mechanical resonance of a vibrating crystal to generate a precise frequency. It is commonly used as a timing reference for microcontrollers and digital systems, ensuring accurate clock signals.

Fig 2.4: Crystal oscillator

4. **potentiometer:** A potentiometer, often referred to as a ”pot,” is a three-terminal variable resistor. It allows you to adjust the resistance value manually, which can be used to control aspects like volume, brightness, or other analog parameters in electronic circuits.

Fig 2.5 : Voltage regulator

5. **Resistors 10K and 1K:** A resistor is an electrical device that controls the amount of electric current flowing through a circuit. The term "10k" signifies a resistance of 10,000 ohms and 1k means 1000 ohm. These components find application in electronics for tasks like creating voltage dividers, and restricting current flow.

Fig 2.6 : Resistor

6. **Voltage Regulator:** A voltage regulator, often referred to as a voltage converter, is an apparatus or circuit designed to uphold a steady output voltage, regardless of shifts in input voltage or changes in connected load. Its purpose is to ensure a dependable power supply to other elements within an electrical circuit

Fig 2.7 : Voltage Regulator

7. **Batterey:** One or more electrochemical cells with external connections make up a battery, which is a source of electric power used to run electrical appliances. We used one battery in this project

Fig 2.8 : Battery

8. **Push button:** It helps to reset the data in Display.

Fig 2.9 : Push button

The components, that are used in our circuit follows:

1. 1 PIC 16F877A (40 pins)
2. 1 LCD (2 x 16)
3. 1 Crystal Oscillator(8 MHz)
4. 1 Diode
5. 1 Transistor Potentiometer
6. Resistors

(a) 1 of 10 kilo Ohm

(b) 1 of 1 kilo Ohm

8. Voltage Regulator

2.2 Mathematical Formula :

If Diode is short, then R= 0,
hence, Voltage V=I*R = I*0
V=0
If Diode is open, then R= Infinity(Very high)
hence , Voltage V= I*R
V=Infinity(Very high)
Read data Decisions : A= test1 ; B= test2 ;

Table 2.1: Diode Test Decision table

A	B	Decision
0	0	open
0	1	Good
1	0	Good
1	1	Short

2.3 Programe Code :

```
// LCD module connections
sbit LCD_RS at RB7_bit;
sbit LCD_EN at RB6_bit;
sbit LCD_D4 at RB5_bit;
sbit LCD_D5 at RB4_bit;
sbit LCD_D6 at RB3_bit;
sbit LCD_D7 at RB2_bit;


sbit LCD_RS_Direction at TRISB7_bit;
sbit LCD_EN_Direction at TRISB6_bit;
sbit LCD_D4_Direction at TRISB5_bit;
sbit LCD_D5_Direction at TRISB4_bit;
sbit LCD_D6_Direction at TRISB3_bit;
sbit LCD_D7_Direction at TRISB2_bit;
// End LCD module connections
sbit TestPin1 at RA0_bit;
sbit TestPin2 at RA1_bit;


// Declear variable for store data
unsigned int test1, test2;
void main() {
   ADCON1 = 7;                  // All analog pin set as digital pin, Take value as VDD or VSS
   CMCON = 7;                   //to shut off the comparators and
   Lcd_Init();                  // Initialize LCD
   Lcd_Cmd(_LCD_CLEAR);         // CLEAR display
   Lcd_Cmd(_LCD_CURSOR_OFF);    // Cursor off
   Lcd_Out(1,2,"Diode Testing");   // Write message1 in 1st row


 do {
    TRISA = 0b00000010;         // RA0 as Output pin , RA1 as Input
    TestPin1 = 1;               // Make output pin(RA0) HIGH
    test1 = TestPin2 ;          // Read data (VSS or VDD) from RA2

    TestPin1 = 0;               // Clear data from RA0
    TRISA = 0b00000001;         // RA0 as input pin , RA1 as Output
    TestPin2 = 1;               // Make output pin(RA2) HIGH
```

```
    test2 = TestPin1;            // Read data (VSS or VDD) from RA0
    TestPin2 = 0;                // Clear data from RA2
    if((test1==1) && (test2 ==1)){
         Lcd_Out(2,2,"Result: Short");
    }
    else if((test1==1) && (test2 ==0)){
        Lcd_Out(2,2,"Result: Good");
    }

    else if((test1==0) && (test2 ==1)){
       Lcd_Out(2,2,"Result: Good");
    }

    else if((test1==0) && (test2 ==0)){
      Lcd_Out(2,2,"Result: Open");
    }

  } while(1);   // End Loop
}
```

Chapter 3

PCB layout

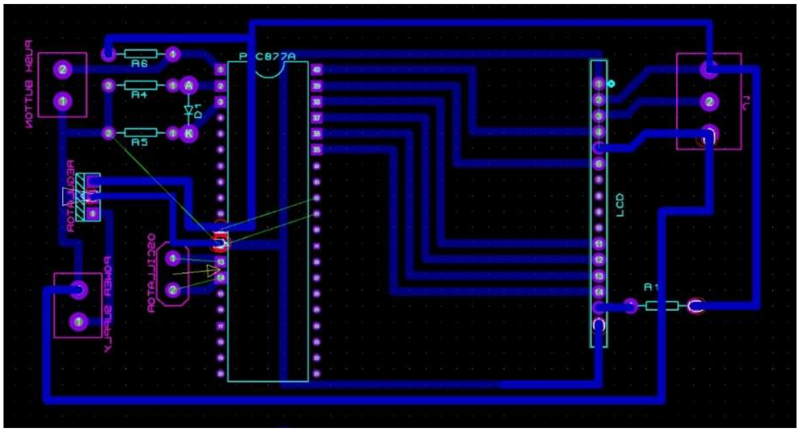

Figure 3.1 : PCB Layout in proteous

The process of creating a PCB layout for a diode tester circuit based on a didoe involves several steps. It begins with designing a schematic diagram using Proteus, a PCB design software. This diagram includes the didoe , necessary resistors, capacitors, voltage regulators, and other components. Next, these components are positioned correctly on the PCB layout. To minimize signal interference and noise, the remaining components are arranged logically and compactly.The routing stage follows, where traces are meticulously laid out to maintain signal integrity. To prevent interference, digital and analog traces are separated. Ground and power planes are employed to ensure signal stability. Additionally, sensitive traces are positioned away from components or areas that could introduce noise.

Chapter 4

Breadboard Implementation

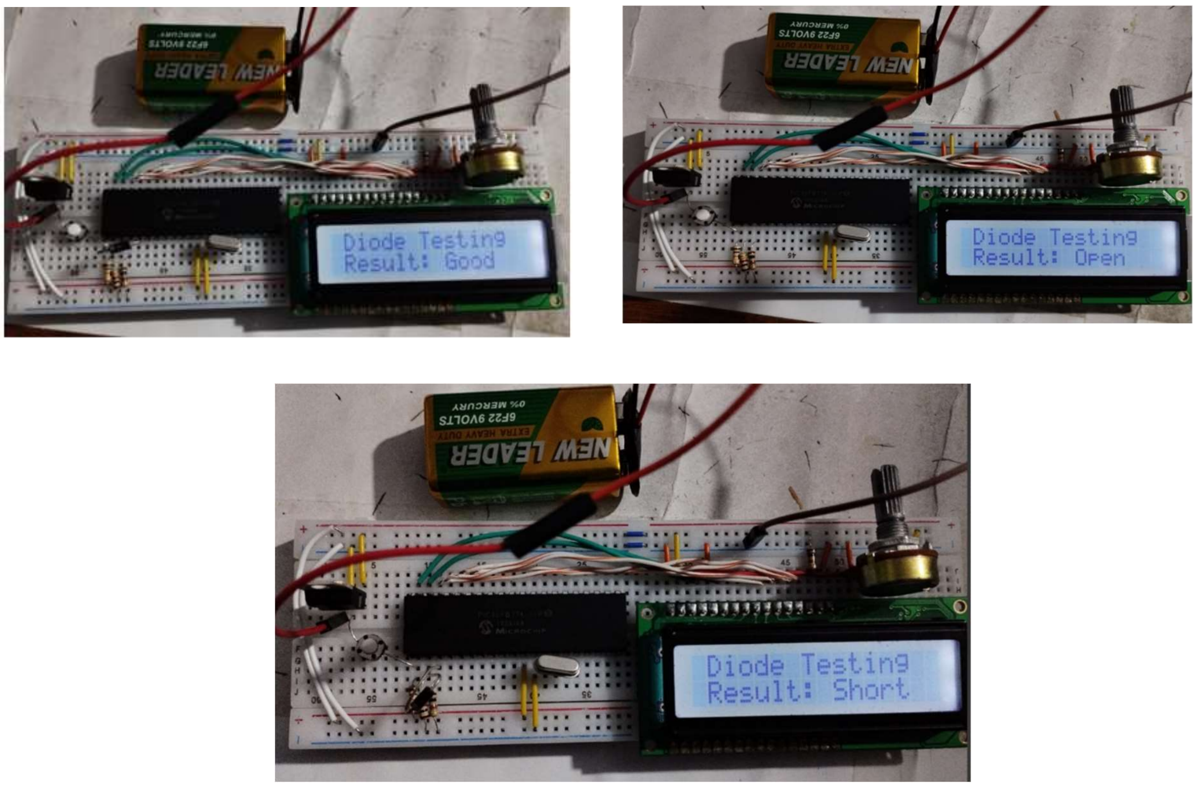

Figure 4.1 : Breadboard Implementation

A breadboard is a slender plastic substrate utilized for the assembly of electronic components such as transistors, resistors, and chips, facilitating their interconnected configuration. The breadboard features an array of minuscule perforations, through which these components can be conveniently inserted for prototyping purposes. We meticulously affixed all the requisite components onto the breadboard, commencing with the connection of the PIC microcontroller. Subsequently, we proceeded to initialize the LCD display unit. Following this phase, we systematically integrated the remaining components onto the breadboard, interconnecting them utilizing jumper wires. To enhance stability and consistency, a switch was integrated into the circuit design to mitigate output fluctuations. Subsequent steps encompassed the uploading of code onto the microcontroller and the provision of power via a battery source. Additionally, a potentiometer was incorporated into the arrangement. The culminating outcome manifested as the successful presentation of our output on the LCD display, reflecting the proficiency of our design and implementation process.

Chapter 5 PCB Implementation

Figuren 5.1 : PCB Implementation

Description: First, we created a PCB layout from the intended simulated circuit we created using the Proteus software. After that, it was printed on the PCB. The PCB was dipped in a ferric chloride solution to get rid of the extra copper. We used isopropyl alcohol to clean the pads on the PCB. Next, using a drilling machine, we drilled a hole in a fixed spot in accordance with our design.The component has been put on the PCB.It should be mentioned that our links have previously been demonstrated, and both Chapters 2 and 4 describe. We've used our fingers to hold the component in place.Then solder was applied to the junction. We had removed the soldering iron after the solder had melted and allowed the
cool joint.

Chapter 6

Price Table

Table 6.1 : Table of cost of component

SL no	Name	Price
01	PIC16F877A(Microcontroller)	350
02	Resistor(10K,1k)	4
03	Crystal Oscillator (8Mhz)	15
04	Potentiometer(10k)	20
05	LCD (16*2 display)	200
06	Push Button	1
07	Breadboard Wire	20
08	Breadboard	100
09	Battery (9V)	70
10	Voltage Regulator (LM7805)	10
11	Header(Male & Female)	15
12	Chemical Compound ($FeCl_3$,Isopropyl Alcohol, Lead)	60
Total		865

Chapter 7

Future Improvement

Future improvement of our project can be:

1)Energy Efficiency: Reduce the need for frequent battery replacements or recharges by optimising power use.

2) Application in smart device: Create a mobile application that connects to the diode tester and allows for remote operation, real-time data visualisation, and the sharing of results with coworkers or online communities.

3)Use a graphical display to depict voltage-current curves, diode properties, and other pertinent data. Users may benefit from this visual representation in their understanding of diode behaviour.

4)Provide a user calibration option to ensure accurate results and account for any equipment changes over time.

5)Include a component identification mode that, in addition to diodes, can identify and display data on a variety of components (resistors, capacitors, and transistors).

6)Interactive lessons or instructions that explain how to interpret test findings and resolve typical problems should be built into the system.

7) Integrate safety features such as overvoltage or reverse polarity protection, to shield the tester and the user from potential risks.

8) User Interface Enhancement: For a more user-friendly experience, upgrade the user interface with intuitive controls, touchscreen capabilities, and user-customizable settings.

Chapter 8

Conclusion

In conclusion, the diode tester project was successful in producing a useful tool for both experts and electronics hobbyists. The diode tester has achieved its intended goals and provides a number of noteworthy benefits as a result of careful design, innovation, and consideration for user needs.

The diode tester is adaptive to changing user needs and technological improvements thanks to its connectivity with smart devices and possibilities for software updates.Overall, the diode tester project is an excellent example of how technology, design, and user-centered thinking can work together successfully. It is proof of the value of continuous innovation and development in the field of electronics testing.

The diode tester is positioned to become an essential tool for everyone working in the field of electronics, promoting increased efficiency, accuracy, and research within the industry as the project team continues to gather consumer input and explore new possibilities.

Chapter 9

Plagiarism Declaration

All information contained in this study, with the exception of any statements to the contrary, is the result of our own work. In addition, no portions of this material were taken literally from other sources.

We are aware that any instances of plagiarism and/or the unauthorised use of materials from third parties will be taken strongly. Design a diode tester using a PIC microcontroller is the title of the project paper that we, project members formally declare that it is wholly our specific work. This paper's arguments, facts, and themes are all the product of our own independent investigation and work. We also certify that no text in this project paper has been taken completely or partially from another source without due credit. All text passages, graphics, tables, & bits of code that were taken from other sources have been properly cited and acknowledged. We are aware of the value of academic candour and the repercussions of plagiarism and copyright breaches. We thus declare that this project paper has not been published or presented anywhere, nor has it been submitted to any other academic programme or institution.

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