

Design and Analysis of Electronics Devices V-I Characteristics Using Universal Component Tester

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ABSTRACT – An electronic component under the area of power electronics in which many electronics components are combined into the high density modules. The main component of each and every electronic circuit can be used for a wide variety of purpose and function. The component consists of active and passive component like SCR, TRIAC, DIAC, IGBT, MOSFET, TRANSISTOR, UJT, DIODE, FET etc. Thus, all components mount on a single board which reduce the system size, reduce complexity of the system and the cost of the overall system. But when we want to check different device characteristics we need the different setup for each device. So we are designing universal component tester which reduces overall system cost and able to check V-I characteristics of electronic devices with graphical representation using GUI (Graphical User Interface). So we are able to check electronic specification of components.

Keywords: Arduino, Current Sensor, Voltage Sensor, GUI, Variable Power Supply, etc.

1. INTRODUCTION:

We can easily test any electronic devices using this kind of a universal V-I characteristic tester. The circuit design is made more reliable and easy since we don't need to rig up different kind of circuits for different kind of components, each time we need to test them. This tester is affordable and user-friendly. It is constructed using Arduino (UNO) along with a voltage sensor, current sensor and GUI unit. It can test maximum nine different electronics devices having a different voltage and different current. By a simple hardware and software addition, this tester can test a wide variety of devices which includes SCR, TRIAC, DIAC, IGBT, MOSFET, TRANSISTOR, UJT, DIODE, FET etc. The input voltage is given to the input terminal of the devices and the output getting from that device is given to the Arduino. During the checking the v-I characteristics of different devices, it is needed to take the different samples of different voltages and currents for different devices to plot the v-I characteristics. The Arduino converts the input analog value into digitize value and by using GUI we directly plot v-I characteristics.

2. METHODOLOGY:

In this process designing device, it is necessary to define the detailed test plan. Test plan contains the detailed requirements that are based on the specification of the

devices. In this project universal tester kit is used to test and measure the universal characteristics, if different devices such as SCR, DIAC, TRIAC, UJT etc. When we plot the V-I characteristics of vertical lines, then we put the voltage source is fixed and can allow to pass any current through the circuit, so its V-I characteristics is known as vertical characteristics. When we plot the horizontal V-I characteristics, then put the current source is fixed and vary or change the voltage source can allow to pass any voltage drop through the circuits so it is called as horizontal V-I characteristics. In this project to measure the current and voltage we use the voltage and current sensor and it requires the variable and fixed power supply for different units. From the universal characteristic tester we measure the V-I characteristics of electronic device and display it to monitor using GUI interface to monitor. Here we can test the V-I characteristics of the different electronics devices like SCR, DIAC, TRIAC, UJT etc. Using the using the test kit and test kit output is given to the Arduino Microcontroller and display the characteristics on the monitor using GUI interface to monitor through Arduino Microcontroller and current and voltage sensor as an input to the Arduino.

2.1 BLOCK DIAGRAM:

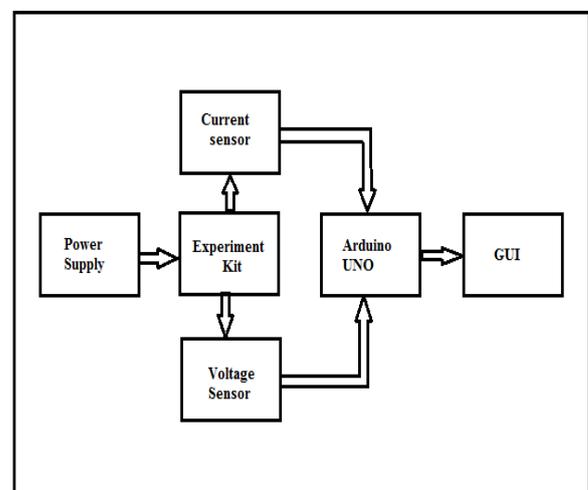


Fig. Block diagram

2.2 POWERSUPPLY:

Any electronics circuit can require the power supply to start it working. All power supplies have an input

connection, which receives energy in the form of electric current from a source and one or more power output connection that deliver current to the load. In this project we have to use the two types of power supply that is variable power supply and fixed power supply.

2.3 VARIABLE POWER SUPPLY:

In this project we have to use the variable power supply to the universal tester kit as an input. It provides the different or varying input to the tester kit and according to the input of kit output also changes and V-I characteristics of the devices are also changes according to the input voltage.

2.4 FIXED POWER SUPPLY:

There are various types of power supply is there like AC to DC converter, DC to AC converter, DC to DC converter, Voltage stabilizer and so on. These current sensor modules and Arduino Microcontroller require a 5V DC supply, so the AC 230V needs to be converted into 5V DC using the step down converter.

2.5 ARDUINO:

The Arduino UNO board is used in the real time application project the Arduino UNO board is a Microcontroller board based on the ATmega 328. It has 14 digital input/output pins in which 6 can be used as PWM outputs, 16MHZ.Ceramic resonator and, an ICSP header, a USB connection, 6 Analog inputs, a power jack and a reset button. Here the input is given to the Arduino is the output from the current and the voltage sensor module and the Arduino can give the required output at the output side and the result can be shown onto the monitor.



Fig. Arduino diagram

2.6 CURRENT SENSOR:

A current sensor is a device that detects and convert the current to an easily measured output voltage, which is proportional to the current through the measured path. When a current flows through the wire or in circuit,

voltage drop occurs. Also, a magnetic field is generated surrounding the current carrying conductor. The generated single from the current sensor should be analog voltage or current or even a digital output, which duplicate the wave shape of the sensed current. The generated single from the current sensor should be analog voltage or current or even a digital output, which duplicate the wave shape of the sensed current. Here we use the current sensor is ACS712. The ACS712 provides the economical and precise solutions for AC or DC senses in industrial current and it provides,commercial communication system. The device package allows for easy implementation by the customer. Typical applications include motor control, load detection and management, switch mode power supplies, and over current fault protection.



Fig. Current Sensor

Specification:

Parameter	Module rating
Supply Voltage	5V DC nominal
Measurement Range	-5 to +5 Amps
Voltage at 0A	VCC/2
Scale factor	185 MV/Amp
Chip	ACS712ELC-05A

2.7 VOLTAGE SENSOR:

In voltage sensors, the measurement is based on the divider. Mainly two types of voltage dividers are available capacitive type sensor and resistive type sensors. Here we use the resistive type sensor. Voltage measurement is the simplest task that we can perform using Arduino. The Arduino has 10 bits internal ADC so $2^{10}=1024$ samples for 0V to 5V scale and the Arduino internal ADC reference voltage is 5V so the maximum voltage that we can measure up to 5V. The measure higher voltage than we need extra circuit voltage, i.e. Voltage divider circuit to match the ADC requirements, it converts required measurement into 0 to 5V scale. It can be possible by using only two resistors R1 and R2 of values 9k and 1k respectively is shown in below figure.

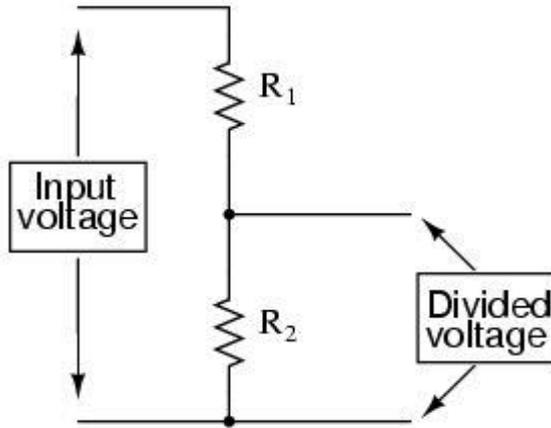


Fig. Voltage Divide

2.8 GUI:

The graphical user interface type of user interface that can allow to interface interact with electronics devices through graphical icons and visual indicator such as secondary notation, instead of text based interfaces, typed command labels or text navigation. A major advantage of GUI is that they can make computer operation more intuitive, and thus easier to learn and use. It is easier for new user to move and identify the files on the computer and observe. In this project we have to use the GUI for displaying the V-I characteristics of electronics measured from tester on the computer in graphical format. An icon small picture or symbol in a GUI that that represent a file ,a directory a device measured from tester within application programs.

3. CONCLUSION:

There are many disadvantages of measuring the V-I characteristics of many electronics devices on a single kit and observe the output so we have to design this project to measure the input current and voltage and accordingly measure the change in characteristics of different devices on a monitor through the GUI interface to the computer and it is easy to learn the characteristics. In this project we have to use the GUI interface to represent the characteristics graphically so it is easy to understand for new user.

REFERENCES:

1. <https://www.arduino.cc>
2. L. Kamas, S. Sanders, "Parameter and State Estimation in Power Electronics Circuits", IEEE Transactions on Circuits and Systems, vol. 40, no. 12, pp. 920-928, 1993.
3. M. Joshi, R. A. Akerkar, "Algorithm to Improve Performance of Natural Language Interface", International Journal of Computer Science and Applications, vol. 5, no. 2, pp. 52-68, 2008.

4. Abhishek Jain, Anshul Goyal, Siddharth Garg, "Digital IC tester." Electronics club, IIT Kanapur.

5. Baliga, B. Jayant. Power characteristics of Thermionic amplifier. "Proceedings of the IRE. Institute of Radio Engineers. 7 (2): 97-126. DOI: 10.1109/JRPROC.1919.217425.

6. Popadic, Milos; Lorito, Gianpaola; Nanver Lis K (2009). "Analytical Model of I-V Characteristics of Arbitrarily Shallow p-n Junctions". IEEE Transactions on Electronic devices. 56; 116-125. Doi 10.1109/TED.2008.2009028 Semiconductor devices. Boston: PWS Publishing Company. ISBN 0-534-94098-6.

7. Tooley, Mike (2012). Electronic Circuits: Fundamentals and Applications, 3rd Ed. Routledge. p. 81. ISBN 1-136-407316.