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Power supply project report

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ABSTRACT

A well-known device that is called power supply, which simply we have made ourown in this project by using an electrical and electronics components, it is a simple circuit, although there are many components. The power supply that have been done has two circuits. To be more clear one of them is called the main circuit and the anotheris the current cut-off circuit. Certainly, two circuits are connected at the end. Furthermore, our power supply has three DC outputs that are 5V,10V,and 15V,also anAC output has been made. A transformer that is 220V is used to step down the voltage to 24V as to add fuse before the transformer, then the bridge that convert the current from AC to DC is implemented. Moreover, the capacitor works to smoothing the waveand remove any ripple voltage. Three zener diode are used to ensure for the three DC outputs, three are added, they are one zener diode for output of the screen that is used, two transistors from the same type also another transistor ,but is has another type that needed resistor ,a variable resistors, LED and ceramic capacitor.There is a specific job for each one of all these components that is used ,this was about the main circuit, whilethe current cut-off circuit is used the follow components: operation amplifier ,relay, transistor, resistor, variable resistor, and a tactile switch. The components are connected as it should be. Eventually, we have got our own power supply project. Every simple step that is done is further explained and simplified. [1]

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CHAPTER 1 HOW THE POWER SUPPLY WORK

1.1 AC-DC CONVERSION BASICS

A power supply takes the AC from the wall outlet, converts it to unregulated DC, and reduces the voltage using an input power transformer, typically stepping it down to the voltage required by the load. For safety reasons, the .transformer also separates the output power supply from the mains input. [1]

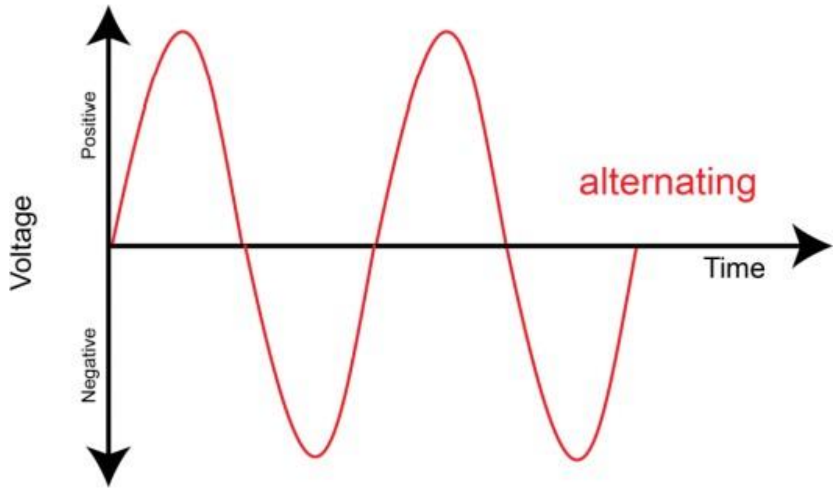


Figure 1: Alternating Current from Wall Outlet

In the first step of the process, the voltage is rectified using a set of diodes. Rectification transforms the sinusoidal AC. The rectifier converts the sine .waves into a series of positive peaks. [1]

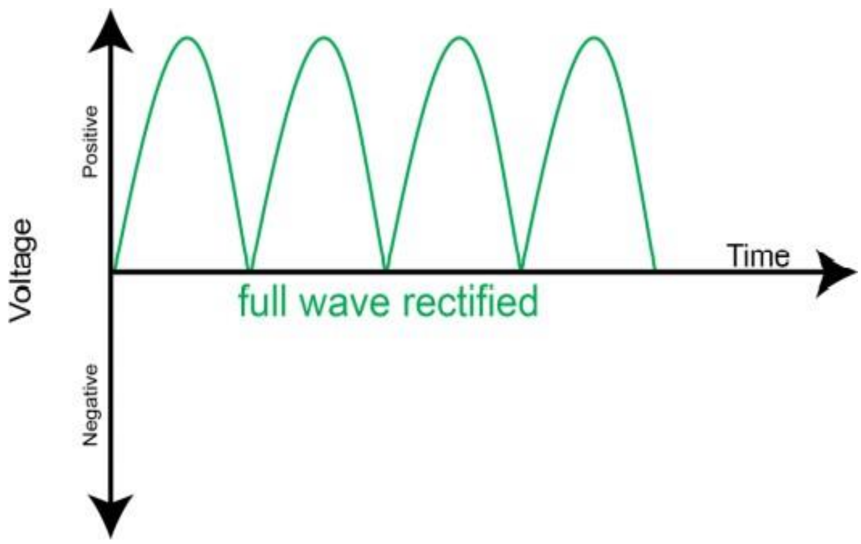


Figure 2: Full Wave Rectified

with a capacitor ”smoothed “The rectified AC voltage is then filtered or The capacitor is typically quite large and creates a reservoir of energy that is applied to the load when the rectified voltage drops. The incoming energy is stored in the capacitor on the rising edge and expended when the voltage falls. This significantly reduces the amount of voltage droop and smooths out the voltage. Increasing the storage capacity of the capacitor generally produces a. higher quality power supply. [1]

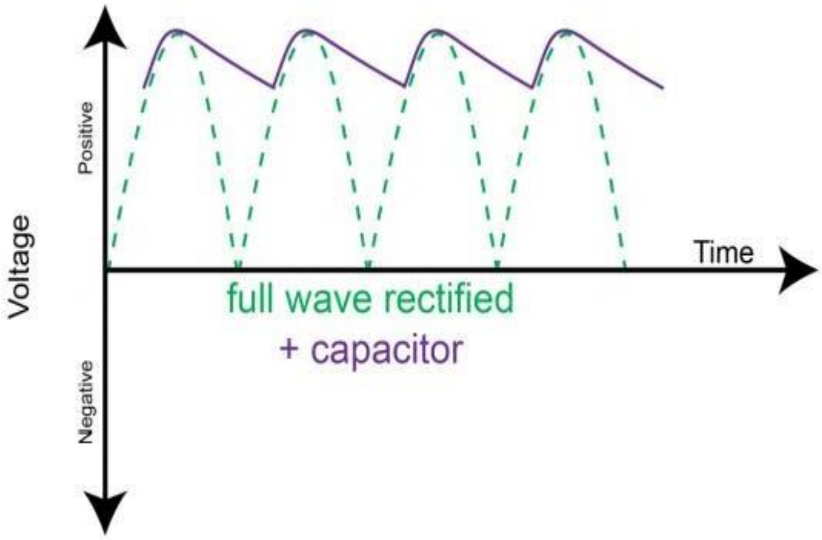


Figure 3: Full Wave Rectified + Capacitor

In a regulated power supply, the voltage is then passed through a regulator tocreate a fixed DC output with less ripple (10).

CHAPTER 2 INTRODUCTION

Power supplies are used in most electric equipment. Their applications cut across a wide spectrum of product types, ranging from consumer appliances to industrial utilities, from milliwatts to megawatts, and from handheld tools to satellite communications. A power supply can either be regulated or unregulated. In a regulated power supply ,the changes in the input voltage do not affect the output. On the other hand,in an unregulated power supply, the output depends on any changes in the input. The one thing all power supplies have in common is that they take electric power from the source at the input, transform it in some way, and deliver it to the load at the output.By definition, a power supply is a device that converts the output from an AC power line to a steady DC output or multiple output. A power supply takes the AC from the wall outlet, convert it to unregulated DC, and reduces the voltage using an input power transformer, typically stepping it down to the voltage required by the load. For safety reasons, the transformer also separates the output power supply from the mains input. [2] [3]

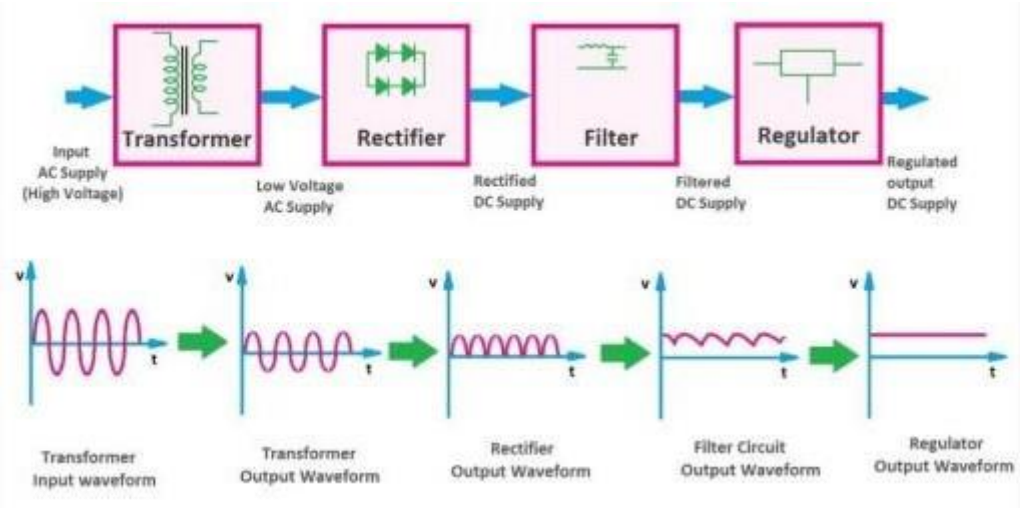


Figure 4: diagram

CHAPTER 3 OBJECTIVE

- To convert the power delivered to its input by the sinusoidally alternating mains electricity supply into power available at its output in the form of a smooth andconstant direct voltage.
- To power the load with the proper voltage and current.
- To get three outputs DC and one output AC [2]

CHAPTER 4 METHODOLOGY

4.1 Equipment

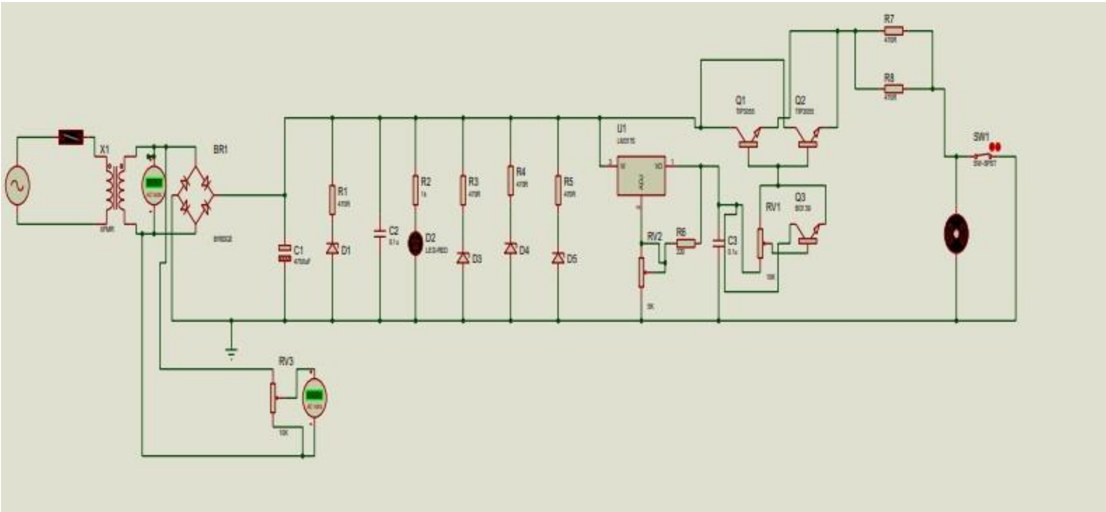
- Transformer.
- Bridge Rectifier(1B4B42).
- 1* Aluminum Capacitor (4700uF,50V).
- 2* Ceramic Capacitor (0.1u).
- 2* Transistors type (TIP3055).
- 1* Transistor type (BD139).
- 1* Voltage Regulator (LM317).
- 6* Resistors (470Ω ,2W).
- 1* Resistor (1kΩ).
- 1* Resistor (10 Ω ,5W).
- 1* Resistor (220Ω).
- 2* Variable Resistance (10kΩ).
- 1* Variable Resistance (5kΩ).
- 1* 1N751A Zener Diode (5V) (0.5W).
- 1* 1N758A Zener Diode (10V) (0.5W).
- 1* N5245B Zener Diode (15V) (0.5W).
- LED.
- Switch(SPST).
- Copper board.
- Holder fuse.
- Fuse.
- Iron.
- Soldering Iron.
- Voltmeter Screen.
- Iron (III) Chloride ($FeCl_3$)

CHAPTER 5 PROCEDURES

Frist of all we have plugged the transformer to AC source.

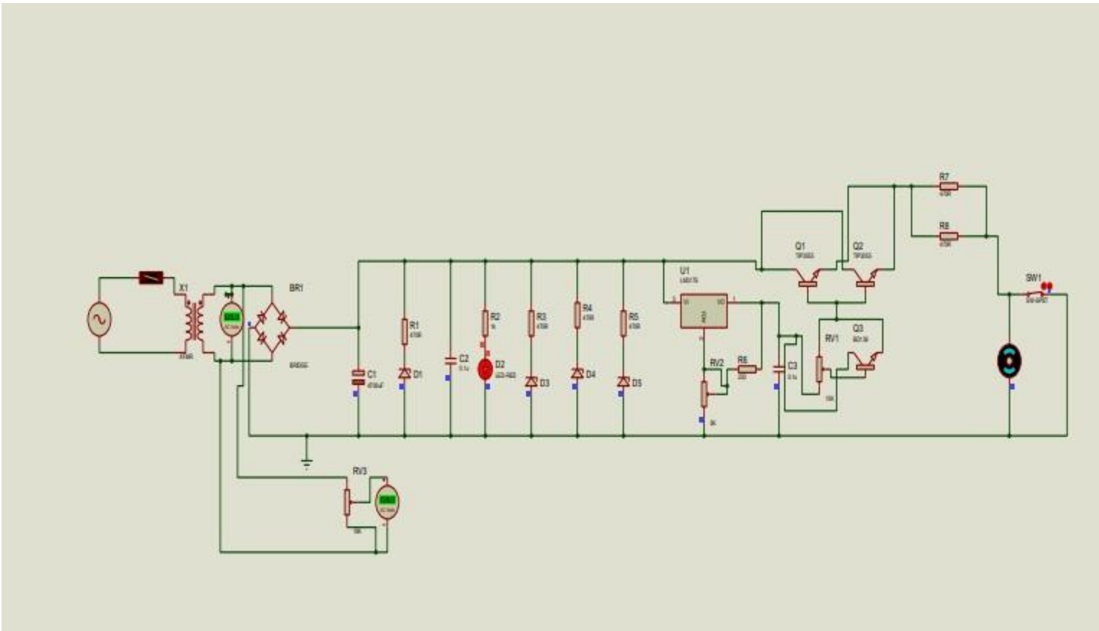
1. We have connected the output of the transformer (TIP3055) with the 1 and 2terminals of the bridge Rectifier.
2. We have connected the 4 terminal of the bridge to the ground then whole thecomponents we have connected to this ground.
3. We have connected the terminal 3 of the bridge with the aluminum Capacitor4700uF.
4. Then we have connected the aluminum capacitor 4700uF to the collector ofthe transistor.
5. We have connected the ceramic capacitor 0.1u to the aluminum capacitor4700uF.
6. We have also connected the four zener diode each one of them with each 470Ω Resistor that one of them is the output of the screen supply as it shownon fig.
7. After that we have connected all of them to the the aluminum Capacitor4700uF.
8. We have connected the LED with the 1kΩ resistor then, connect it to thealuminum Capacitor 4700uF.
9. We have connected the terminal 3 of the voltage regulator with the aluminumCapacitor 4700uF.
10. We have connected the terminal 2 of the voltage regulator with the 5kΩVariable Resistance.
11. We have connected the emitter of the another the transistor (TIP3055) with the470Ω .
12. We have connected the collector of the transistor (TIP3055) to the another collector of the (TIP3055),and we have plugged the base of both (TIP3055)with each other.
13. We have connected the 220Ω resistor to the 5kΩ Variable Resistance,alsoconnected to the 2 terminal of the voltage regulator.
14. We have connected the another ceramic capacitor 0.1u to the terminal 1 of thevoltage regulator.
15. We have connected each of the collecter of the transistor (BD139) and the 10kΩ Variable Resistance with the another Ceramic capacitor 0.1u.
16. We have connected the emitter of the (BD139) transistor and the 10kΩ Variable Resistance with the base of the two(TIP3055) transistors.
17. We have connected the 470Ω to the another 470Ω resistor that is connected to the emitter of the (TIP3055) transistor,and connected the 470Ω to the 470Ω resistor that is connected to the switch.
18. Finally we have connected the ground that are all the components connected toit with the another terminal of the switch

CHAPTER 6 SIMULATION



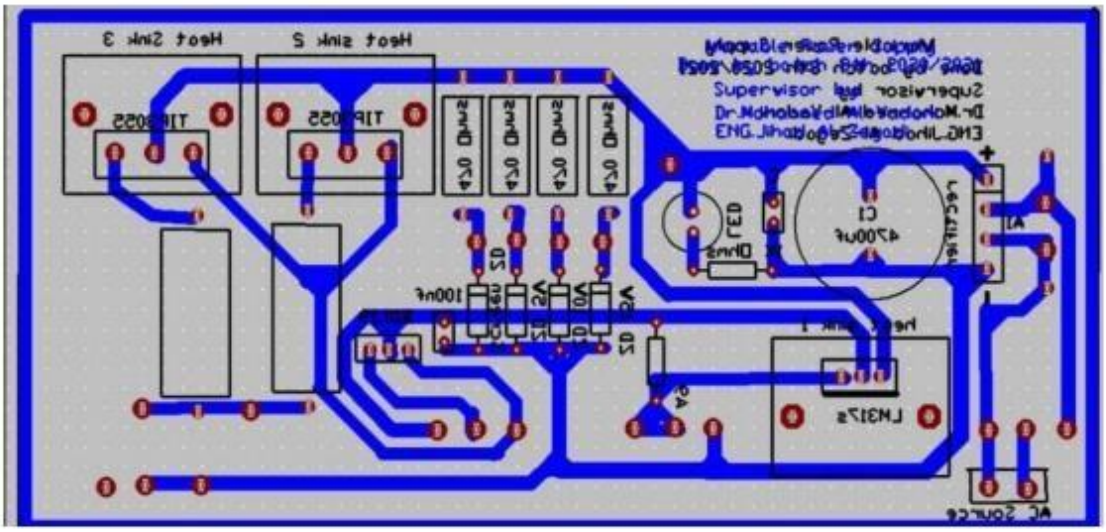
[3]

Figure 5: power supply circuit (off)



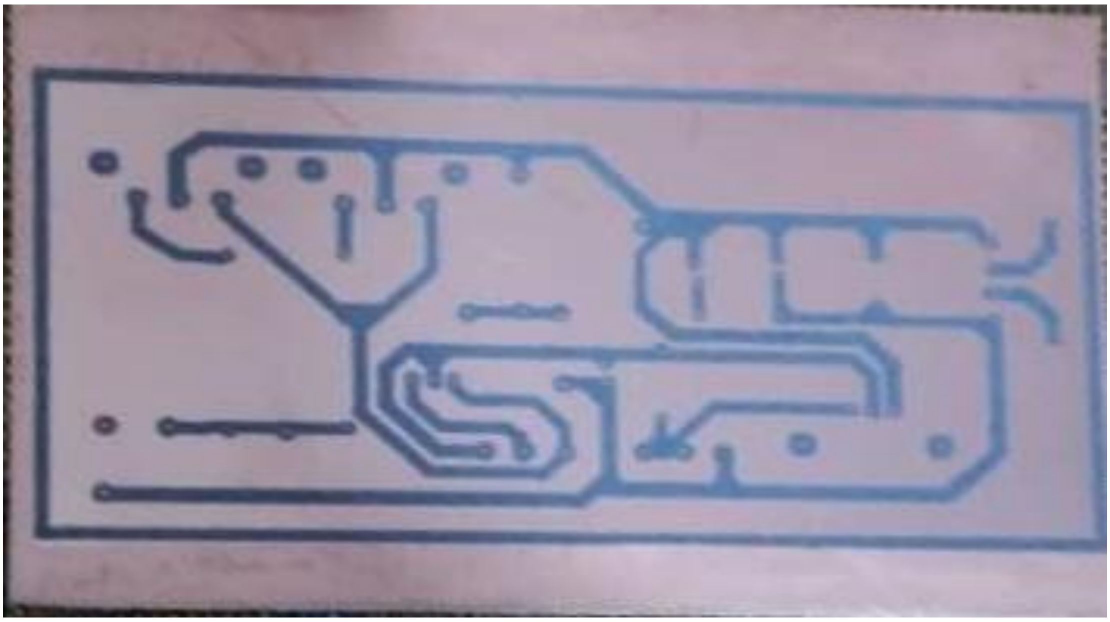
[3]

Figure 6: power supply circuit (on)



[3]

Figure 7: power supply PCB circuit (simulated)



[3]

Figure 8: power supply PCB circuit (real)

CHAPTER 7 SAFETY APPROVALS

Is to ensure a safe segregation of the low-voltage circuitry, which may be accessible to the user, from the high-voltage input, which must be inaccessible. Segregation is normally assured in a power supply by maintaining a minimum distance around all parts that are connected to the mains, including spacing between the primary and secondary of the transformer. This, of course, adds extra space to the design requirements. Insulation of at least a minimum .thickness may be substituted for emptyspace [2]

CHAPTER 8 CONCLUSION

Indeed, the power supply finally worked and we verified the results with a multimetter and it showed results as expected. There was errors, yet they were negligible due to its small value. we got three constant DC values 5V, 10V, and 15V. Also, there is variable AC, and variable DC outputs.

CHAPTER 9 REFERENCE

]1[Google" ، google 8 "،oct 202 Available: www.google.com.

]2[thomas" ،www.electronics.com.]0200 6 11 .0202 4 4 "،

]3[m. alhetary" ،www.su.edu.y

]4[Barbara Thompson" ،power supply 10 "،Feb 2022 .Available: www.guru99.com.

]5[amazon" ،www.amazon.net .0202 6 3 "،

]6[alibaba" ،www.alibaba.com .،

CHAPTER 10 ATTACHMENT

NAME	PICTURES	DESCRIPTION
1. Transformer	 **Figure 9:** Transformer	• Raising or lowering the voltage level in the circuit of an AC. • Increasing or decreasing the value of an inductor or capacitor in an AC circuit. • Preventing the passage of DC from one circuit to another. • Isolating two electric circuits. • Stepping up the voltage level at the site of power generation before the transmission and distribution can take place [5]
2. Bridge Rectifier.	 **Figure 10:** Bridge Rectifier.	• High current capability. • High surge current capability. • High reliability. • Low reverse. • Low forward voltage drop. • Ideal for printed circuit board. [5]
3. Aluminum Capacitor.	 **Figure 11:** Aluminum Capacitor.	• Smaller case size and lower impedance than PM series. • Low impedance and high reliability withstanding 2000 hours to 8000 hours. • Capacitance ranges available based on the numerical values in E12 series under JIS. Compliant to the ROHS directive. [5]
4. Ceramic Capacitor.	 **Figure 12: Ceramic Capacitor.**	• Low losses. • High capacitance in small. • High stability. • Radial. Applications: • Lighting ballasts. • SMPS. • DC and pulse high voltage. [5]
5. " TIP3055 " Transistor.	 **Figure 13:** Transistor.	• DC current gain- =20-70 = 4.0 Adc. • Collector- Emitter saturation voltage- (sat) =1.1 Vdc (max) = 4.0 Adc. • Excellent safe operating area. • These are Pb-free devices. [5]

Table 1

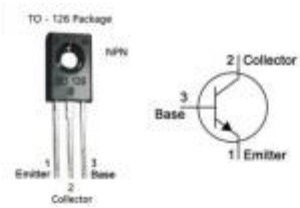
6. " BD139" Transistor.	 **Figure 14:** Transistor.	 • Plastic casing npn transistor. • Continuous collector current ( ) is 1.5A. • Collector –Emitter voltage ( ) is 80V. • Collector- Base voltage ( ) is 80V. • Base current ( ) is 0.5A. • Emitter base breakdown voltage( ) is 5V. • Dc current gain(hfe) is 40 to 160. • Available in to-225 package [5]
7. " LM317" Voltage Regulator.	 **Figure 15:** Voltage Regulator.	 • Output current in excess of 1.5 A. • Output adjustable between 1.2V and 37V. • Internal thermal overload protection. • Internal short circuit current limiting constant with temperature. • Output transistor safe-area compensation. • Floating operation for high voltage applications. • Eliminates stocking many fixed voltages. • Available in surface mount PAK-3, and standard 3-lead transistor package. • NCV prefix for automotive and other applications requiring unique site and control change requirements; AEC-Q100 qualified and PPAP capable. • These devices are Pb-free, halogen free and are RoHS. [5]

Table 2

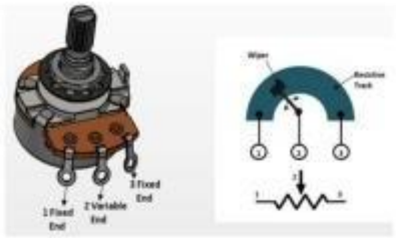
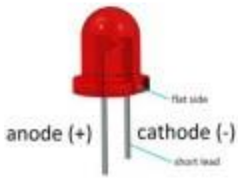
8. Variable Resistance.	 **Figure 16:** Variable Resistance.	 • Type: rotary a.k.a radio POT. • Available in different resistance values. • Power rating: 0.3W. • Maximum input voltage: 200Vdc. • Rotational life: 2000k cycles. [5]
9. PCB Terminal.	 **Figure 17:** PCB Terminal.	• The wire connections pluggable terminal blocks allow for the circuit to be broken without any unwiring. • Can often be combined in such a manner that removing a single plug disconnects power to the entire group of terminals at once.
10. LED.	 **Figure 18:** LED.	 • Superior weather resistance. • 5mm round standard directivity. • UV resistant epoxy. • Forward current (IF) : 30mA. • Forward voltage (VF): 1.8V to 2.4V. • Reverse voltage: 5V. • Operating temperature: -30 ˚C to + 85 ˚C. • Storage temperature: -40 ˚C to + 100 ˚C. • Luminous intensity: 20mcd. [6]
11. Voltmeter Screen.	 **Figure 19:** Voltmeter Screen.	• Measuring and indicating range separate programmable. • LED display 14.2mm red, indicating range 9999 digit. • Max. 4 alarm outputs relay SPDT or transistor. [6]

Table 3

12. Copper Board.	 **Figure 20:** Copper Board.	• Range of sizes. • Single- sided. • Grade: FR2. • SRBP Board. • Thickness: 1.6mm. • 35um Copper thickness. • Easier to drill than epoxy glass fiber. • Suitable for punching at +40 ˚C to + 70˚C. • War page and twist are small and stable. Application: • Producing low-cost PCBs for: prototyping, design projects, computers, communications equipment, instrument, OA equipment. [6]
13. Electric Fuse	 **Figure 21:** Electric Fuse	• Fast-acting, low breaking capacity. • Optional axial leads available. • 5× 20mm physical size. • Glass tube, silver-plated (63mA-315mA) and nickel-plated(500mA-15A) brass end cap construction. • Designed to UL/CSA 248-14. [6]

Table 4