5V-1Amp Power Supply

Miss. Bhagyashree Patil[1], Miss. Trupti Lanjewar[2], Miss. Roshni Wakle[3,] Prof. Neha Wani[4]
[1,2,3,4]*Department of Computer Science*

Abstract- **Every electrical and electronic device that we use in our day-to-day life will require a power supply. In general, we use an AC supply of 230V 50Hz, but this power has to be changed into the required form with required values or voltage range for providing power supply to different types of devices. There are various types of power electronic converters such as step-down converter, step-up converter, voltage stabilizer, AC to DC converter, DC to DC converter, DC to AC converter, and so on. In most of our electronic products or projects we need a power supply for converting mains AC voltage to a regulated DC voltage. For making a power supply designing of each and every component is essential. Here we are going to discuss the designing of regulated 5V Power Supply. Power supply circuit, the name itself indicates that this circuit is used to supply the power to other electrical and electronic circuits or devices. There are different types of power supply circuits based on the power they are used to provide for devices.**

1. INTRODUCTION

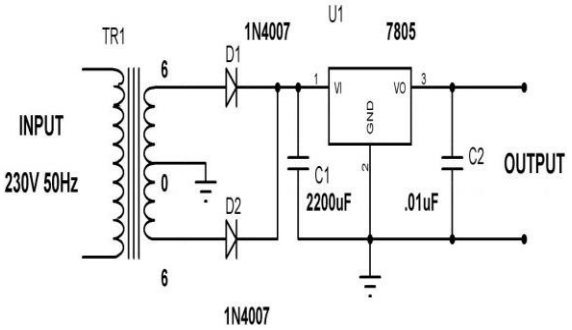
A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment, while others are built into the load appliances that they power. Examples of the latter include power supplies found in desktop computers and consumer electronics devices. Other functions that power supplies may perform include limiting the current drawn by the load to safe levels, shutting off the current in the event of an electrical fault, power conditioning to prevent electronic noise or voltage surges on the input from reaching the load, power-factor correction, and storing energy so it can continue to power the load in the event of a temporary interruption in the source power (uninterruptible power supply).

All power supplies have a power input connection, which receives energy in the form of electric current from a source, and one or more power output connections that deliver current to the load. The source power may come from the electric power grid, such as an electrical outlet, energy storage devices such as batteries or fuel cells, generators or alternators, solar power converters, or another power supply. The input and output are usually hardwired circuit connections, though some power supplies employ wireless energy transfer to power their loads without wired connections. Some power supplies have other types of inputs and outputs as well, for functions such as external monitoring and control. DC power supplies use AC mains electricity as an energy source. Such power supplies will employ a transformer to convert the input voltage to a higher or lower AC voltage. A rectifier is used to convert the transformer output voltage to a varying DC voltage, which in turn is passed through an electronic filter to convert it to an unregulated DC voltage.

The filter removes most, but not all of the AC voltage variations; the remaining AC voltage is known as ripple. The electric load's tolerance of ripple dictates the minimum amount of filtering that must be provided by a power supply. In some applications, high ripple is tolerated and therefore no filtering is required. For example, in some battery charging applications it is possible to implement a mains-powered DC power supply with nothing more than a transformer and a single rectifier diode, with a resistor in series with the output to limit charging current.

II.SYSTEM DEVELOPMENT

In this chapter the block diagram of the project and design aspects of independent module are considered. Block diagram is shown in fig.(a)



I.TRANSFORMER

The working principle of Transformer is very simple. It depends upon Faraday's law of electromagnetic induction. Actually, mutual induction between two or more winding is responsible for transformation action in an Electrical Transformer. According to Faraday's laws of electromagnetic induction, "Rate of change of flux linkage with respect to time is directly proportional to the induced EMF in a conductor or coil". The alternating current through the winding produces a continually changing flux or alternating flux that surrounds the winding.

II.DIODE

It is a device with two terminals and unidirectional which means it permits the flow of current in only one direction when it is forward biased. Hence in it flow of current is in one way only and block the other way for the current flow (when reversed biased). AC current can be converted into DC with the help of diode unidirectional behavior. Here we are using two types of diode as follows.

III.VOLATGE REGULATOR

As we require a 5V we need LM7805 Voltage Regulator IC.

7805 IC Rating :

- Input voltage range 7V- 35V
- Current rating I_c = 1A
- Output voltage range $V_{Max=5.2V}, V_{Min=4.8V}$

IV.CAPACITOR

The capacitor is a component which has the ability or "capacity" to store energy in the form of an electrical charge producing a potential difference (Static Voltage) across its plates, much like a small rechargeable battery. There are many different kinds of capacitors available from very small capacitor beads used in resonance circuits to large power factor correction capacitors, but they all do the same thing, they store charge. In its basic form, a capacitor consists of two or more parallel conductive (metal) plates which are not connected or touching each other, but are electrically separated either by air or by some form of a good insulating material such as waxed paper, mica, ceramic, plastic or some form of a liquid gel as used in electrolytic capacitors. The insulating layer between a capacitors plate is commonly called the Dielectric.

V.DESIGN OF POWER SUPPLY

1. Choice of rectifier configuration
2. Choice of transformer :

-It depends on secondary volt ampere rating and diode voltage drop.

$$V_{sec}(rms) = \frac{2V_m}{\sqrt{2}} + voltage\ drop\ across\ diode$$

3. Diode selection
   - -PIV rating
   - -Average current rating

   25% greater than I_{dc}(maximum current)
4. Selection of filter circuit
   - -Good regulation and less ripple.
5. Calculation of capacitor :

$$\text{Ripple factor} = \frac{1}{4\sqrt{3}}\frac{1}{f_c}\frac{1}{R_l}$$

$$= \frac{2990}{CR_l}$$

$$C = \frac{2990}{rR_l} = \frac{2990}{(0.02)(100)} = 1495\ F$$

6. Selection of Transformer :

$$V_{\sec(rms)} = \frac{2V_m}{\sqrt{2}} + 1.4$$

$$V_{dc} = V_m - \frac{5000 I_{dc}}{C}$$

$$V_m = V_{dc} + \frac{5000\, I_{dc}}{1495}$$

$$I_{dc} = \frac{V_{dc}}{R_l} = \frac{12v}{100} = 0.12 = 120\ mA$$

$$V_m = 12 + \frac{5000(120mA)}{1495}$$

V_m = 12 + 0.4013

V_m = 12.04 V

$V_{\sec(rms)} = \frac{2(12.04)}{\sqrt{2}} + 1.4$

= 18.42 V

$I_m = \frac{V_m}{R_l} = \frac{12.04}{100} =$ 120mA

III. IMPLEMENTATION

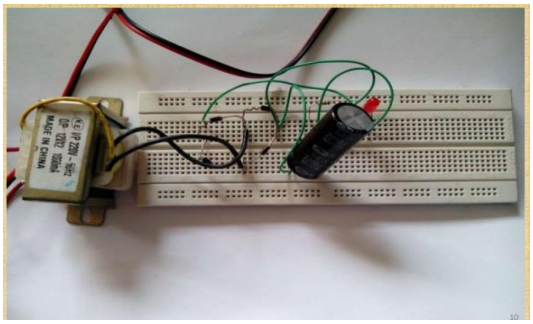


Fig. (b) power supply before ON.

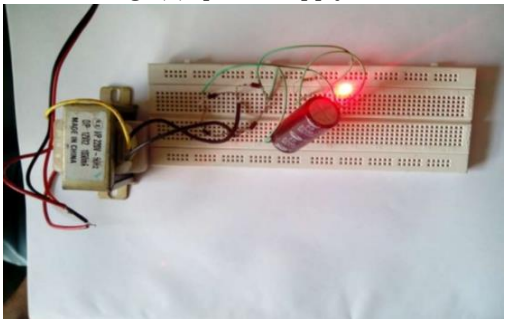


Fig. (c) power supply after implementation

IV. SYSTEM REQUIRMENTS

Selection of software :

- Express PCB

Selection of hardware :

- Transformer
- Power Supply
- IC 7805
- Buzzer
- LED
- Photodiode
- IR
- IC 393N

V. CONCLUSION

The power supply that has been designed provide a good alternative to a more expensive power supply. The power supply has few components, covers a small area, and is very simple in design.

REFERENCES

[1] Ramakant Gaikwad " OP-AMP & linear integrated circuits"
[2] Employement skill in circuit designing
[3] http://www.electroschematics.com/9023/infrared-beam-break-detector/
[4] http://www.electronicshub.org/security-alarm-circuit.