

USB LED Lamp Circuit

Ms. Anshu Mala Kispotta

Department of Electronics and Communication Engineering, H.O.D of Engineering, Xavier Institute of Polytechnic and Technology Ranchi, Jharkhand.

Date of Submission: 01-02-2023

Date of acceptance: 10-02-2023

About the Problem – To make a LED LAMP luminated by USB power source.

The reason for selecting the topic–This topic matches with our course syllabus electronics subject, so it will give clear picture of functionality of electronics components. As well as it will demonstrate the function of real life uses of these components.

The main objective of the project – Get familiar with real use of electronics components like Resistors and diodes.

Scope of the Project –

- This can be used as an emergency light. Get an idea about Working of Automatic LED Emergency Lights Circuit.
- This can be used to work with laptop or computer without disturbing the others sleep.
- This can be used as a reading lamp.

Working Methodology –

The circuit mainly consists of a USB Connector. USBs can be mainly divided into two standard types – USB of ‘A’ type and USB of ‘B’ type. These different types of USBs connectors differ in their shapes. Type ‘A’ USB can be used with the upstream devices such as USB hub or host. Type ‘B’ USB can be used with downstream devices such as printers.

The cables will have same number of pins but they differ mechanically. Many versions in USB were released. The first version USB 1.0 and 1.1 had the data rate of 12 Mbps. USB 2.0 has data rate of 480 Mbps. USB 3.0 is expected to have data rate of 4.8 Gbps.

USB used here is of type ‘A’. It has 4 pins. These pins are VCC, GND, D+, D-. The D+ and D- pins are the data pins. VCC pin outputs the voltage of 5V. The USB LED Lamp with Type ‘A’ USB connector can be simply connected to the USB port of the computer.

LED is a semiconductor device with two leads. Generally, LEDs were used for indicating but now-a-days, LEDs are becoming the main sources of lighting in homes, offices, streets, automobiles, etc. An LED is similar to a normal P-N junction diode. The energy emitted is in the form of light when applied with the required voltage, while normal P-N junction diode emits energy in the form of heat.

The colour of light emitted depends on the band gap of the semiconductor. The LEDs used here are normal white LEDs. They have voltage drop of 3.6V. The current required by the LEDs is 40mA. Initially these LEDs are limited to the red colour, later high-power LEDs and other coloured LEDs such as blue LEDs, white LEDs etc. were developed.

A resistor of 100Ω is connected between the Light Emitting Diode and the USB. This acts as a current limiting resistor. As the LEDs require maximum current of 40mA to glow with full brightness, they are required to protect from current more than this.

So, for that reason, a resistor is to be placed between the LED and the power supply to limit the amount of current flowing through the LED. The supply voltage coming from the USB is 5V and the current drop at the Light Emitting Diode is 40 milli amperes. The following formula can be used to calculate the resistor value.

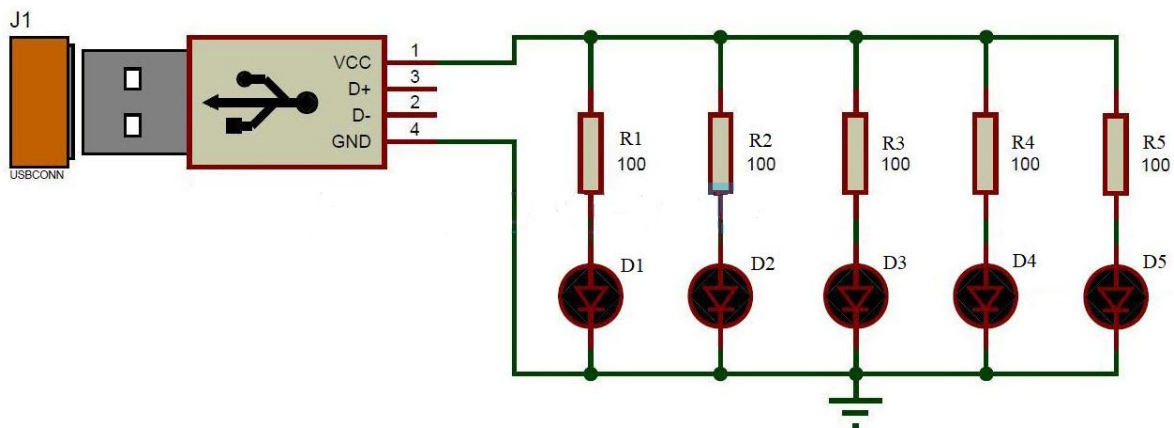
$$R=V/I$$

where, the value of V is 5 volts and the value of I is 40 mA.

$$\text{So, } R= 5V/0.04A =125 \text{ ohms}$$

But generally, 125-ohm resistor does not exist in real time. Therefore, a resistor of 100Ω is used instead of 125Ω. Though it gives an output current of 50 mA, this can be tolerated by the LED.

USB LED Lamp Circuit Diagram



Details about Hardware –

- USB Connector
- Light Emitting Diodes – 5 X 5mm White LEDs
- Resistors – 100Ω X 5
- Perf Board

Limitations of System Proposed – It can work only if USB has power source. This system cannot work without Resistors circuit.

Your Contribution –

- Designing the circuit diagram.
- Identifying the optimal value of Resistor.
- Making circuit with real components.

Conclusion -

In this project, we will show you how to make a simple USB LED Lamp circuit with the help of diodes and resistors. This is an easy to implement circuit that can be used to provide an extra lighting for laptop or tablet.