MOBILE CHARGING CIRCUIT USING LM7805 IC

COURSE PROJECT - ANALOG CIRCUITS (ECT202)

Submitted by:

Adithya M - NSS20EC005,

Arun R - NSS20EC024,

Gopika G Krishnan - NSS20EC040,

Kalidas C K - NSS20EC045,

S4ECA,

NSS College of Engineering, Palakkad.

Submitted to: **Dr. Sreeleja Unnithan**,

Department of Electronics and Communication Engineering,

NSS College of Engineering, Palakkad.

Date: 08.08.2022

Contents

1 Introduction

The course project that we have implemented is, 'Mobile charging circuit using LM7805 IC'. It is a simple, yet an effective way of supplying the required DC voltage to the device. The circuit can be assembled on both Printed Circuit Board(PCB) or a breadboard. A bridge-like arrangement of 4 diodes will convert the unregulated supply(in real-time it is an AC supply) to a pulsating DC voltage. After this, the LM7805 IC, the heart of the circuit gives the required output DC voltage for the mobile battery to charge.

2 Abbreviations

AC	Alternating Current
DC	Direct Current
IC	Integrated Circuit
LED	Light Emitting Diode
SOA	Safe Operating Area

3 Components of the circuit

The components used for the circuit are LM7805 IC, Four 1N4001 Diodes, One indication bulb(Light Emitting Diode), Two Capacitors - 0.1 µF, One Resistor - 2.2KΩ.

3.1 LM7805

LM7805 regulator IC is a common but important part of many 5V power supply circuits available in the market today. It is a 5V three-terminal positive voltage linear regulator IC. Linear regulators are step-down converters. The regulator utilizes an active elements (mainly transistors), which is controlled by an operational amplifier. To maintain a constant output voltage, the linear regulator adjusts the active element's resistance by comparing the internal voltage reference to the sampled output voltage, and then driving the error to zero.

The LM7805 IC has many features other than voltage regulation. Input pin of LM7805 is used for receiving the rippling DC voltage. The output pin gives us the regulated output

voltage of value 5V.

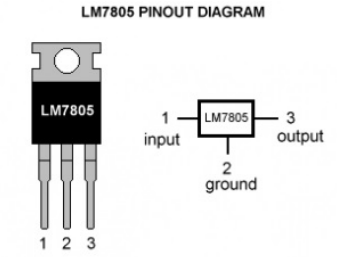

Figure 1: Pinout of LM7805

3.1.1 Inside LM7805

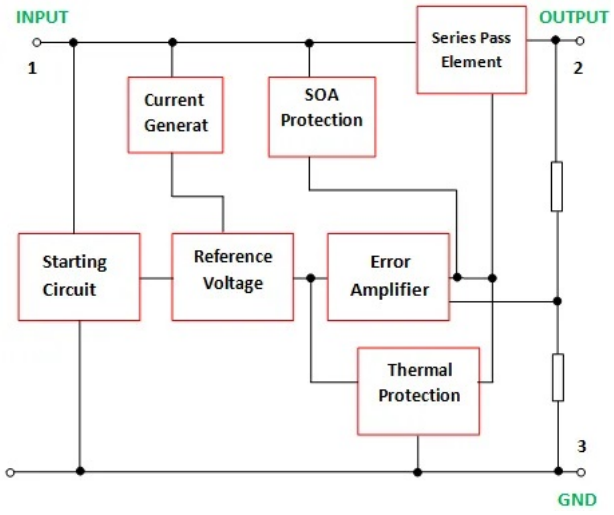

Figure 2: Internal Block diagram of LM7805

The internal block diagram of the chip comprises of an error amplifier, series pass element, current generator, reference voltage, starting circuit, SOA protection and thermal protection which are the extra feature incorporated in the chip other than linear regulation.

1). Error Amplifier - An operational amplifier acts as an error amplifier.

2). Reference Voltage - A zener diode gives the reference voltage.

3). Series pass element - A transistor is incorporated as the series pass element in the IC. It dissipates the additional energy in the form of heat. It controls the output voltage by controlling the current among the input and output.

4). Safe Operating Area - It is the conditions of voltage and current in which the equipment is expected to work without any damage to the self. A bipolar transistor is with a series resistor and an auxiliary transistor enables the SOA protection.

5). Thermal Protection - A heat sink is implemented inorder to provide thermal protection for the circuit.

3.2 Bridge Rectifier

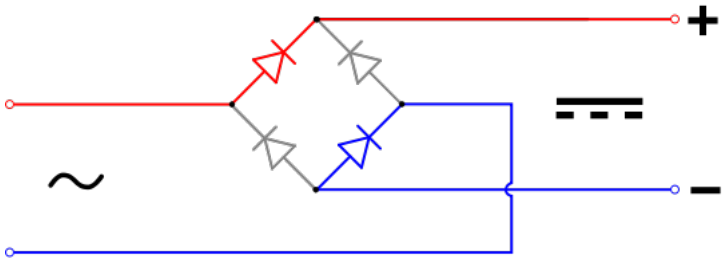

Figure 3: Bridge Rectifier arrangement

Bridge rectifier is a type of full-wave rectifier that uses minimum four or more diodes in a bridge circuit configuration to efficiently convert alternating (AC) current to a direct (DC) current. When an AC signal is applied across the bridge rectifier, one terminal becomes positive during the positive half cycle while other terminal becomes negative. This results in two of the diodes becoming forward biased while the other two becoming reverse biased. During the negative half cycle vice-versa happens. Thus, we will get a current flow which is same during both the half-cycles.

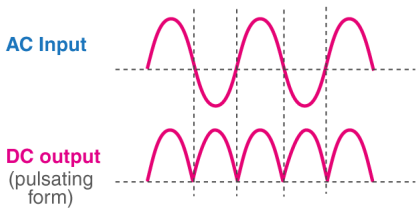

Figure 4: Bridge Rectifier - Input and Output waveforms

4 Working of the Circuit

In a real scenario, an AC input voltage of 230V 50Hz is applied at the V_{in} which goes to the bridge-rectifier arrangement of the diodes. The unregulated signal from the supply is converted to rippling DC signal with the help of rectifier. The DC signal then passes through smoothing capacitors C1 and C2 before passing on to an LM7805 voltage regulator IC which produces a constant regulated 5V DC signal at the output. For feasibility and safety, we have used a 9V battery to represent the supply voltage. The LED bulb along with the resistor is used to indicate whether the circuit is charging the device or not. It glows when the circuit is not faulty. The output of the regulators is then fed to the USB adapter which provides an inlet for the USB plug of a mobile charger. Thus by connecting so, the device will start charging with the received regulated 5V.

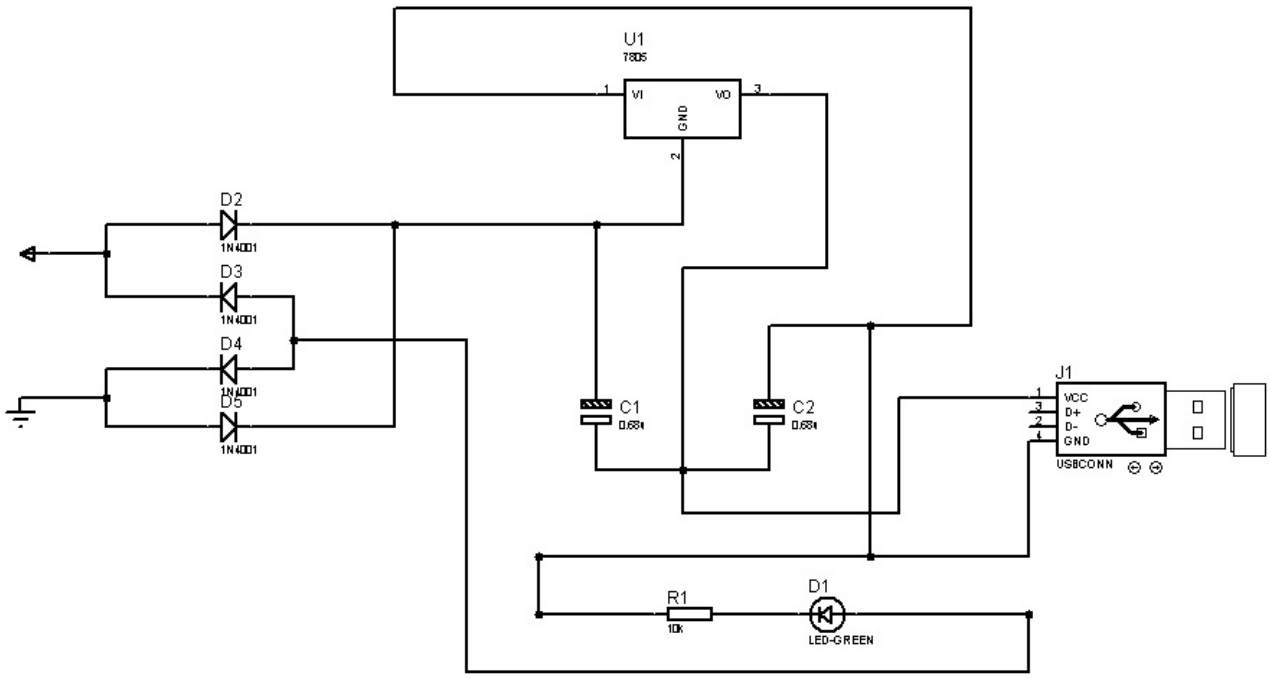

Figure 5: Schematic of the circuit

5 Results and Inference

The aim of our project was to deploy a basic mobile charging circuit using a linear voltage regulator. We were able to apply the concepts of linear voltage regulation, rectification that we had studied in this and the previous curriculum. The device connected to the USB adapter output was charging when the supply was connected to the circuit. The indication bulb shows that the charging circuit is working correctly with no fault. Hence, the main objective of our project was achieved.

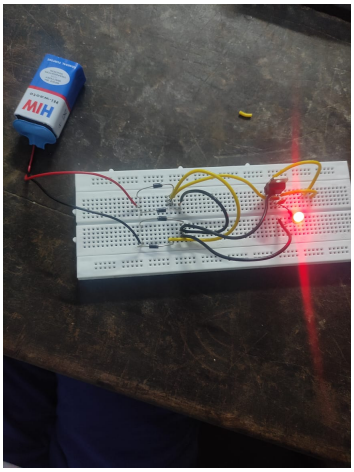

Figure 6: The real-time Circuit

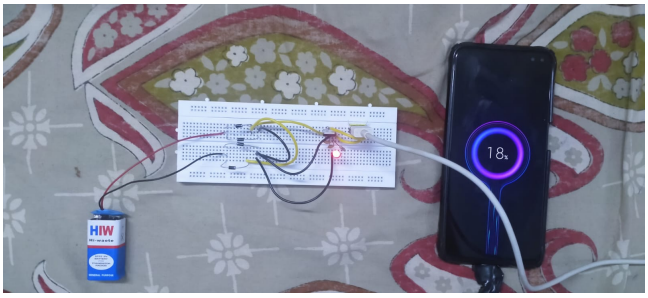

Figure 7: Demonstration of the working circuit

The circuit is a basic one, which differs highly from the present charging circuits. Even then, this circuit can be a life-saver at times when it is necessary to charge a device. For emergency purposes like, at times having no AC supply and with only a battery, we can charge a device for a short-time use.