

5 V Charger Using a Low Pass Filter

Gautam Singh

CONTENTS

1	Materials Used	1
2	Circuit Diagram	1
3	Working	1
3.1	Step-down Transformer . . .	1
3.2	Full-wave Bridge Rectifier .	1
3.3	Capacitor	1
3.4	Regulator	1
4	Observations	2
5	Result	2

Abstract—This is a lab report on the realization of a 5 V charger using a low pass analog filter.

1 MATERIALS USED

The key components of the charging circuit are:

- 1) Step-down transformer (12-0-12)
- 2) Full-wave bridge rectifier
- 3) RC filtering circuit
- 4) 5 V Regulator (7805)
- 5) 4 diodes and a 100 μ F capacitor
- 6) Multimeter
- 7) Cathode Ray Oscilloscope

2 CIRCUIT DIAGRAM

The schematic diagram of the entire circuit is shown in Fig. 2.1.

3 WORKING

3.1 Step-down Transformer

The step-down transformer was used to convert the 230 V AC mains voltage to 12 V AC. The transformed voltage is given by

$$v(t) = 12 \sqrt{2} \sin(100\pi t + \phi) \text{ V}$$

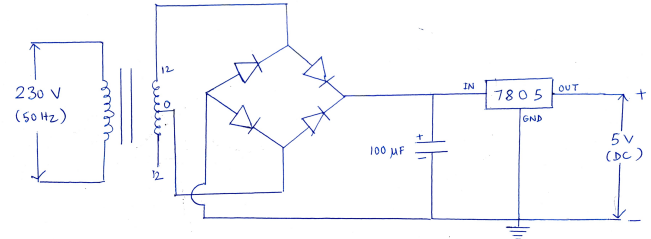


Fig. 2.1: Schematic diagram of the circuit.

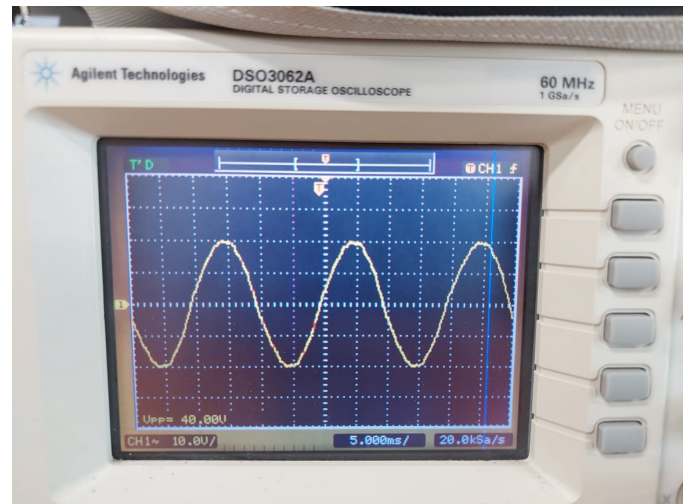


Fig. 3.1: Transformer Readings

3.2 Full-wave Bridge Rectifier

The full-wave bridge rectifier was used to convert the AC voltage to DC.

$$v(t) = 12 \sqrt{2} |\sin(100\pi t + \phi)| \text{ V}$$

3.3 Capacitor

The capacitor is used as a low-pass filter to choose only the zero frequency component converting the signal into a pure DC voltage $12 \sqrt{2} \text{ V}$.

3.4 Regulator

The regulator is used to convert the DC voltage to a fixed voltage of 5 V.

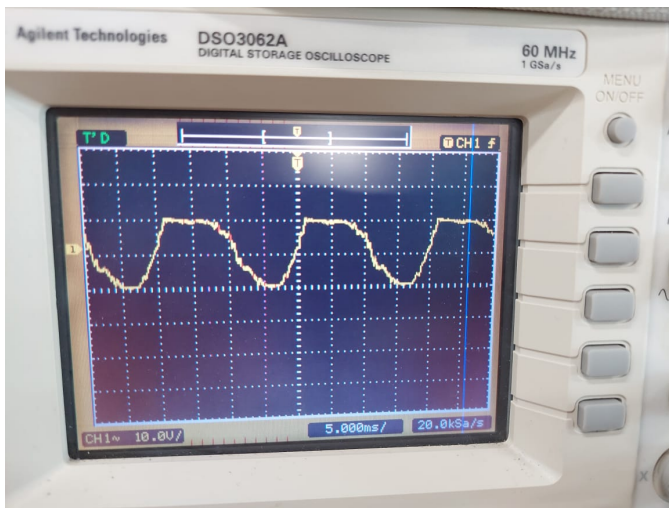


Fig. 3.2: Half Wave Rectified Voltage

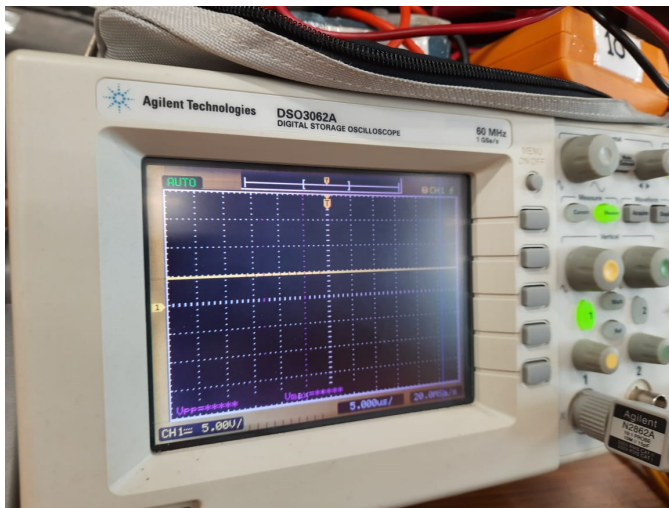


Fig. 3.3: Fully Rectified Voltage

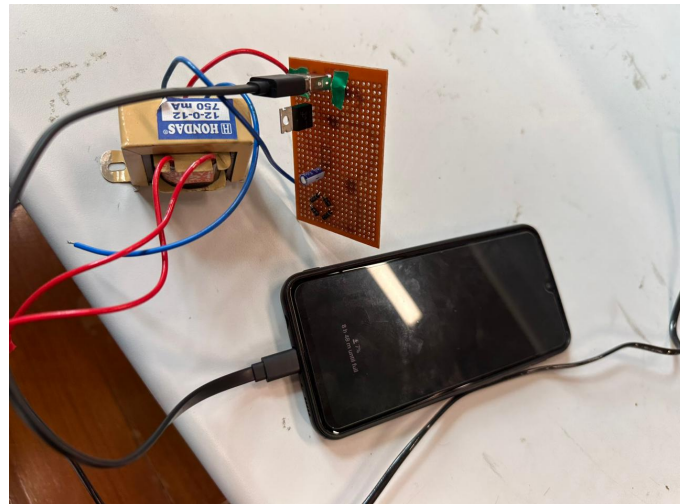


Fig. 5.1: Mobile Charging

4 OBSERVATIONS

- 1) Peak voltage after transformer and rectifier stage, $V_p = 18\text{ V}$.
- 2) DC component after filter stage, $V_{DC} = 18\text{ V}$.
- 3) DC component after regulator stage, $V'_{DC} = 5\text{ V}$.

5 RESULT

Once the circuit is assembled and soldered and the output voltage is measured to be 5 V DC, the circuit is ready to be used.

Using a USB cable, the circuit can be used to charge a mobile phone or any other device. An image of the circuit being used to charge a mobile phone is shown in Fig. 5.1.