

# 5 V Charger Using a Low Pass Analog Filter

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## 1 CIRCUIT DESCRIPTION

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)

The schematic diagram of the entire circuit is shown below.

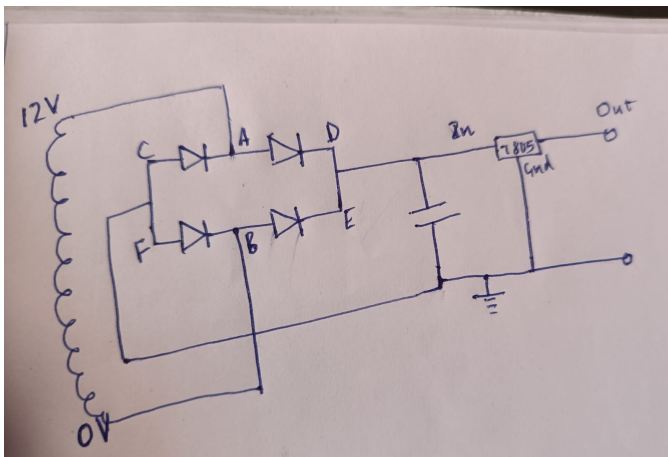


Fig. 1.1: Schematic diagram of the circuit.

### 1.1 Transformer

The transformer used is a step down transformer which gives 12 V ,50 Hz output.

### 1.2 Rectifier

The full-wave rectifier is realized using four diodes.output is a DC 12 V, 50 Hz rectified sinusoid.

### 1.3 Filter

This is the main component of the charging circuit. The 100  $\mu$ F capacitor acts as a first order analog low pass filter. It filters around the zero frequency DC component and partially eliminates the even harmonics associated with the rectified sinusoid. The output waveform at this stage consists of the constant DC component. Note there is no gain and hence we require a regulator to obtain the required DC 5V supply.

### 1.4 Regulator

The regulator used in this circuit is a 7805 regulator, which outputs a constant DC supply of 5 V. Thus, we obtain an almost constant supply of 5 V DC to charge a mobile phone.

## 2 RESULTS

The screenshots of the waveforms at each stage are shown ahead.

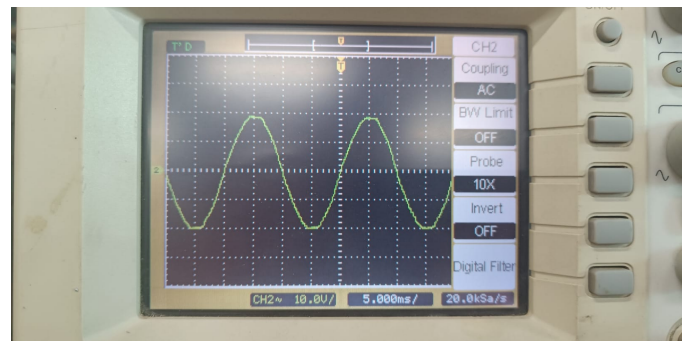


Fig. 2.1: Output AC waveform at transformer stage across AB (18 V peak).

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

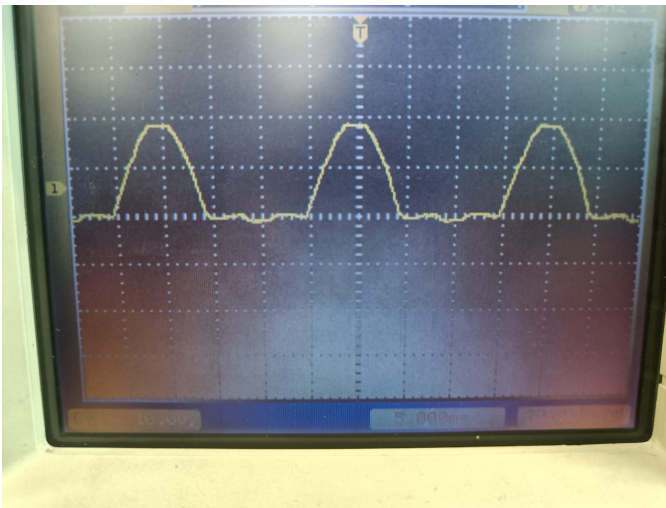


Fig. 2.2: Output half-wave rectified waveform across diode across AD (18 V peak).

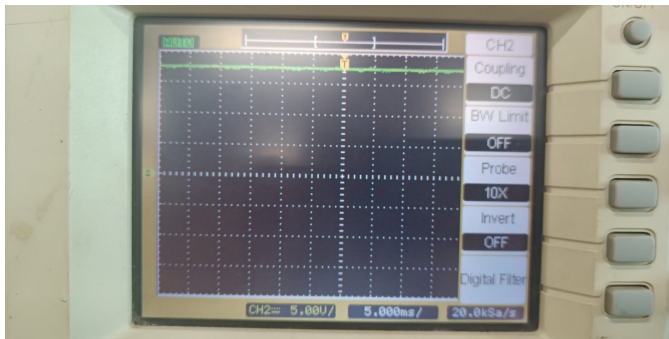


Fig. 2.3: Output DC waveform at filter stage across In-Gnd (18 V).

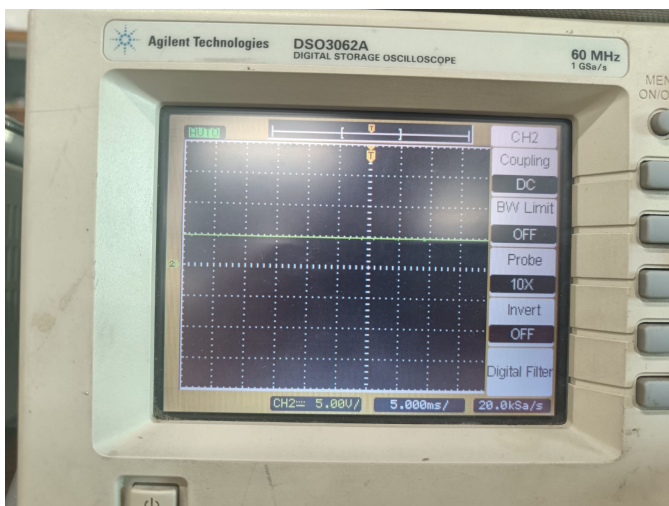


Fig. 2.4: Output DC waveform at regulator stage across Out-Gnd (5 V).

### 3 LEARNING OUTCOMES

- 1) Working and implementation of a low-pass analog filter.
- 2) Use of lab equipment such as solder, oscilloscope, breadboard, PCB, etc. to realize a circuit.