Proposal: Variable Voltage Linear Power Supply

Team Wave Formers

August 25, 2024

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Introduction

This proposal presents the design and implementation of a variable voltage linear power supply. The power supply is designed to provide a regulated DC output voltage ranging from 2V to 20V, with a maximum current output of 2.5A. A low-dropout (LDO) voltage regulator is employed to ensure stable operation and efficient power conversion.

Functionality

The proposed linear power supply functions by first converting high-voltage AC from the mains supply into a lower AC voltage via a transformer. This AC voltage is then rectified to produce DC, filtered to smooth out the waveform, and finally regulated to the desired output voltage.

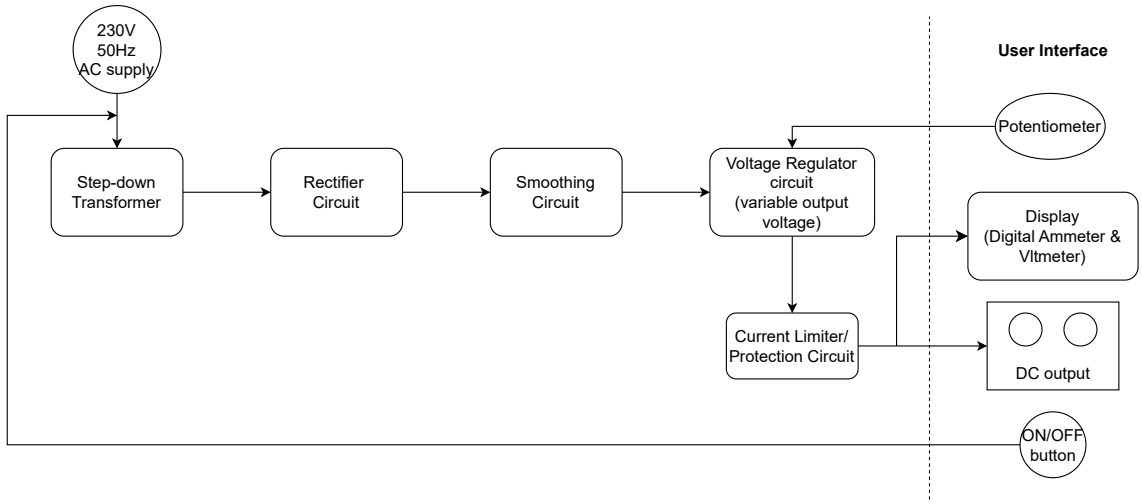

Figure 1: Block diagram of the power supply operation.

Transformer

The power supply utilizes a step-down transformer to reduce the mains voltage (230 VAC) to a level suitable for rectification. A transformer designed for PCB use, such as the Triad Magnetics FP16-3000, would be appropriate for this application.

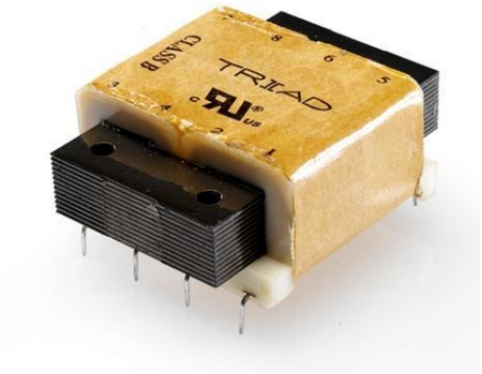

Figure 2: Transformer configuration for stepping down voltage.

Rectification

A full-wave bridge rectifier is employed to convert the AC voltage from the transformer into a pulsating DC voltage. The rectifier uses four diodes in a bridge configuration to ensure efficient conversion. The rectifier module should be selected based on its suitability for PCB design.

Filtering

To smooth the rectified DC voltage, a large electrolytic capacitor is used. This capacitor reduces the ripple voltage, providing a more stable DC output.

Voltage Regulation

The final stage involves regulating the smoothed DC voltage to the desired level. A low-dropout (LDO) voltage regulator, specifically the LD1085, is chosen due to its ability to handle up to 2.5A of current with minimal voltage drop.

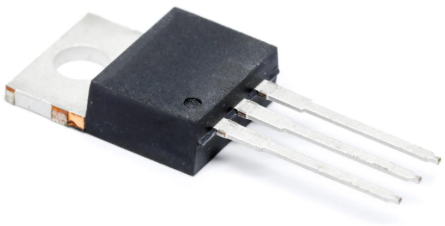

Figure 3: Voltage regulator LD1085.

The output voltage can be varied using a 10-turn precision potentiometer, allowing fine adjustment from 2V to 20V.

Methodology

The construction of the power supply involves the following steps:

1. **Transformer Selection:** Choose a transformer that steps down the mains voltage to an appropriate level for rectification.
2. **Rectifier Assembly:** Construct the bridge rectifier circuit using high-efficiency diodes.
3. **Filter Design:** Select and connect a capacitor to smooth the rectified voltage.

4. **Regulation Circuit:** Implement the LD1085 voltage regulator circuit with appropriate heatsinking.
5. **Enclosure Design:** Assemble the components into a metal chassis for durability and heat dissipation.
6. **Testing:** Verify the output voltage range and load current capacity.

Micro-Products and Their Interconnections

The power supply is divided into several micro-products:

- **Transformer Module:** Steps down the AC voltage.
- **Rectifier Module:** Converts AC to DC.
- **Filter Module:** Smooths the DC voltage.
- **Regulation Module:** Provides a stable, adjustable output voltage.

The interconnections between these modules are illustrated in the block diagram (Figure 1).

Micro-Product Allocation

The tasks are allocated among team members as follows:

- **Yehen Asuramuni:** Transformer selection and rectifier assembly.
- **Sineth Jayawaradhena:** Enclosure design and final assembly.
- **Oshadha Nimantha:** Regulation circuit design and testing.
- **Agrajith Pavithra:** Filter design and implementation.