

Feasibility Report - Linear Power Supply

Feasibility Analysis

Software Feasibility

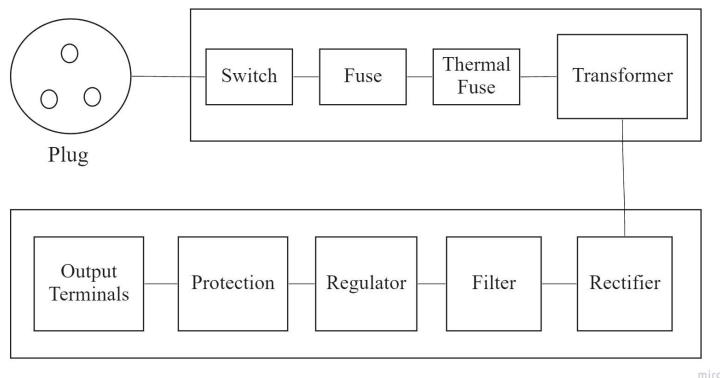
- Notion, Miro - for project management
- LTspice - for circuit simulations
- SubVersion Control provided by Helix core - for version control (Since Github is unable to recognize changes in binary files)
- Altium - for PCB designing and testing
- Solidworks - for enclosure design

Components Feasibility

- A step-down transformer is provided.
- Diodes, Capacitors, Fuses, Switches, Regulators are available in the local market or can be acquired through online stores. (Ex: Mouser, Digi-Key, Arrow Electronics, LCSC).
- PCB manufacturing can be done through an appropriate company (Ex: PCBWay, JLCPCB).
- Soldering equipment is already available.
- A 3D model of enclosure design can be printed by a local 3D printing company. (Ex: CircuitBreakers Robotics).

Block Level Designs

The main blocks of a linear power supply are as follows,



We are given a 230V to 15V transformer; We are using full-wave bridge rectification for the rectification. Here we should consider the Peak-Inverse-Voltage (*PIV*) of each diode. Next, we may use smoothing capacitors to smooth the voltage and reduce the ripple factor. Since we have a rectified voltage wave at this point, we can regulate it and get a good DC output at the load. Considering

the current limiting of the circuit, we may have circuitry for regulation with current limiting. Since LM78xx series voltage regulators are commonly used for voltage regulation, we can consider using them for the regulation as well. We can get variable voltage output from these ICs by just adding extra resistors.

- Protection from contact
 - The wires will be double-insulated within a tough PVC sheath and attached to a molded PVC plug, which will avoid accidental contact with any live pins. Then it enters the insulated or earthed power supply case via a correctly installed and suitable grommet opening.
 - The connectors also should be designed properly to withstand unexpected pullouts.
 - The casing design should be done considering the exact component placement, screw placement, avoiding live part contacts, and even how big a hole can be before there is a possibility of contact.

- Isolation switch
 - When designing a power supply unit, we need to add a switch to the main supply rather than directly plug in and out. It is better to use a bipolar switch for this which will turn off both live and neutral.
- Protection fuse
 - This fuse is available in most devices. Fuses are there to avoid damage to the device from accidental high currents.
- The earth connection
 - Grounding is necessary to reduce the short voltage if a short happens between live and neutral.
- Thermal fuse
 - Transformers and coils are required to have a thermal fuse embedded within the coil winding, or in intimate contact with the windings. When a coil fails the insulation of the coil melts down and the contacts in the coil cause a fire. Therefore a thermal fuse is required to prevent this kind of accident.

Comparison with an Alternative Method

	Switching Power Supply	Linear Power Supply
Theory	Without employing a transformer, convert AC line voltage to DC. Then, the high-frequency DC is transmitted to the regulating circuit, which employs PWM.	To convert AC line voltage to DC, a massive transformer is used. The Lower Frequency DC was then supplied to the regulation circuit.
Advantages	Small and light. More effective. (around 80%)	Small ripple. Low radio frequency noise. Quick transient response.
Disadvantages	Produce Noise and interference. Higher ripple. Complex circuitry.	Larger and heavier. Less effective (less than 60%)

Project Flow

- Feasibility Study - 2 weeks
- Qualitative and quantitative analysis of each block with the simulations. - 3 weeks
- Verifying the proper working of the overall circuit. - 1 week
- 3D enclosure design and PCB design - 2 weeks
- Testing and making minor changes - ½ week
- Manufacturing the enclosure and the PCB - 1 week
- Final assembly and finishing - ½ week

Reference

https://diyodemag.com/education/the_classroom_the_linear_power_supply

<https://resources.pcb.cadence.com/blog/2020-linear-power-supply-vs-switching-power-supply-advantages-and-disadvantages>