

Phase 3: Simulations and preliminary prototype design template – 2021

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1. Introduction

This document details the design of a switch mode power supply. Unlike the linear power supply, the switch mode power supply can have an efficiency of up to 95%, which is not the case for linear power supplies. Switch mode power supply are also built using relatively light components. The components count is however larger compared to that of liners power supplies. They are also quite complex compared to linear power supplies.

2. Schematic Diagram

Fig. 1 below show a schematic diagram of the switch mode power supply to be built.

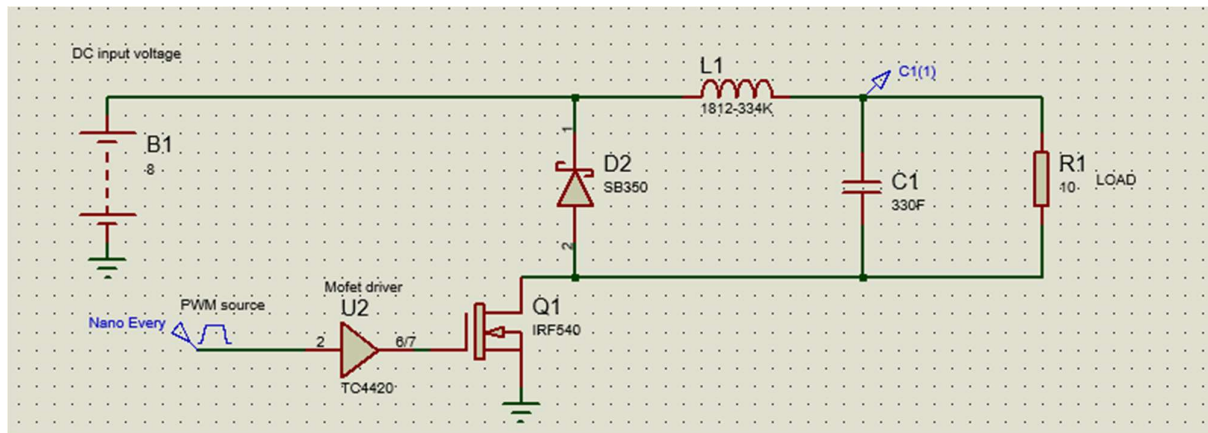


Figure 1: Switch mode power supply.

3. Components and Sizing

The expected maximum ripple voltage is 1% of the output voltage, which is 0.05V. Using this as the ripple-to-ripple voltage, the capacitor minimum capacitor size was calculated, using (1).

$$C = V_o / 2fR V_{rpp} \quad (1)$$

Using the frequency of 20kHz, an output voltage of 5V, a load resistance of (5/0.6), the capacitor size was found to be 250uF. Given it was only the minimum, the capacitor value of 330uF was used instead since it the one with the closest value greater than the required minimum 250uF.

The following components will be need to built the currently proposed switch mode power supply:

- A DC power source.
- A Schottky diode (for its low voltage drop)
- A MOSFET driver
- A square wave generator
- A 330uF capacitor
- A 330uH inductor
- A high power 10 ohms resistor

4. Simulations

The current built is not giving the expected waveforms for voltage and current. The voltage seems to not getting to the load. This could because of the simulation program used.

5. Conclusion and discussion

The current construction is not yet working as expected. It will be investigated more to figure out what the problem is.