

In Experiment 3-1, you will design, construct, test, and demonstrate a buck converter power stage to interface the PV panels and batteries of the PV cart tested in Experiment 1. You should design your converter to operate well when the PV panel operates according to its nameplate specifications.

1. Current waveforms of power components (40 points)

Sketch the waveforms of the currents in each of the following power stage components:

- Input filter capacitor C_1
- Output filter capacitor C_2 (for a resistive load as in Experiment 3 week 1)
- Inductor L_1
- The MOSFET drain current
- The diode current

Compute the numerical maximum, minimum, and rms values of each of the above current waveforms.

2. Inductor design (30 points)

Your laboratory kit contains several ferrite cores. Datasheets describing the important parameters of this core shape and core material are available on the course website in the Experiment 3-1 folder.

Design the best inductor you can for the application described in the above paragraphs. Specify: wire gauge, number of turns, and air gap length.

3. Balance of the converter (30 points)

Select components from your parts kit to be used for the MOSFET, diode, capacitor C_1 , and capacitor C_2 . Compare the datasheet voltage and current ratings of these parts with the expected full power voltage and current stresses with your inductor design. Will all power elements operate within their specified limits?