ECE 556 Power Electronics: Linear and Switching Power Supplies
Lab 5

For the remaining labs we will build and test the buck-boost power supply shown in Figure 1. This supply creates a negative DC supply from a positive DC supply. For this design we will create a -25 V DC voltage supply from a +12 V DC input. The maximum output current of this supply 2 amps.

This supply will be split into three labs:
- Lab 5 – Layout of the power section.
- Lab 6 – Construction of the PWM circuitry.
- Lab 7 – Construction of the isolated gate drive.
- Lab 8 – Construction of a charge-pump negative voltage supply and OP-AMP monitor.

Calculations:
We will be building a supply with the following specifications:
- 12 V ≤ Vin ≤ 14 V
- Output voltage = -25 V
- Output current less than or equal to 2 A.
- Output voltage ripple: Less than 100 mV.

Available Parts
1. Coilcraft p/n PCV-2-274-10, 270 µH Inductor
2. Coilcraft p/n PCV-2-394-05L, 394 µH Inductor
3. Coilcraft p/n PCV-2-564-08L, 564 µH Inductor
4. 10,000 µF Capacitor

Make the following calculations:
- Verify that the inductor and capacitor values specified in Figure 1 achieve the specifications.
- Calculate the inductor currents (I1 and I2) at full load.
- Calculate the peak diode current and choose a diode.
- Calculate the capacitor RMS ripple current.

Lab Procedure
For this lab, we will build the high-current portion of the circuit. Layout of this part is very important. Even if you wire the entire circuit correctly, the circuit may not function if you have a poor layout. We will construct the portion of the circuit shown in Figure 2. This portion contains two high-current loops:
You must construct your board so that these loops have as little cross-sectional area as possible.

When you layout and construct your board, you must remember the following:

5. MOSFET’s are static sensitive.
6. Use banana plug connectors to for the input and output power connections.
7. Remember that the gate connections should be as short as possible. We will not connect the gates in this lab, but you need to keep this in mind.
8. Use bus-bar wire for as many connections as possible.
12 Volt to -25 Volt Buck-Boost Converter

Figure 1
Figure 2

Input 12 - 14 Volts

Output Voltage: -25 Volts
Max Output Current: 2 A

Ground Input

Output Voltage

Ground Out

Figure 2