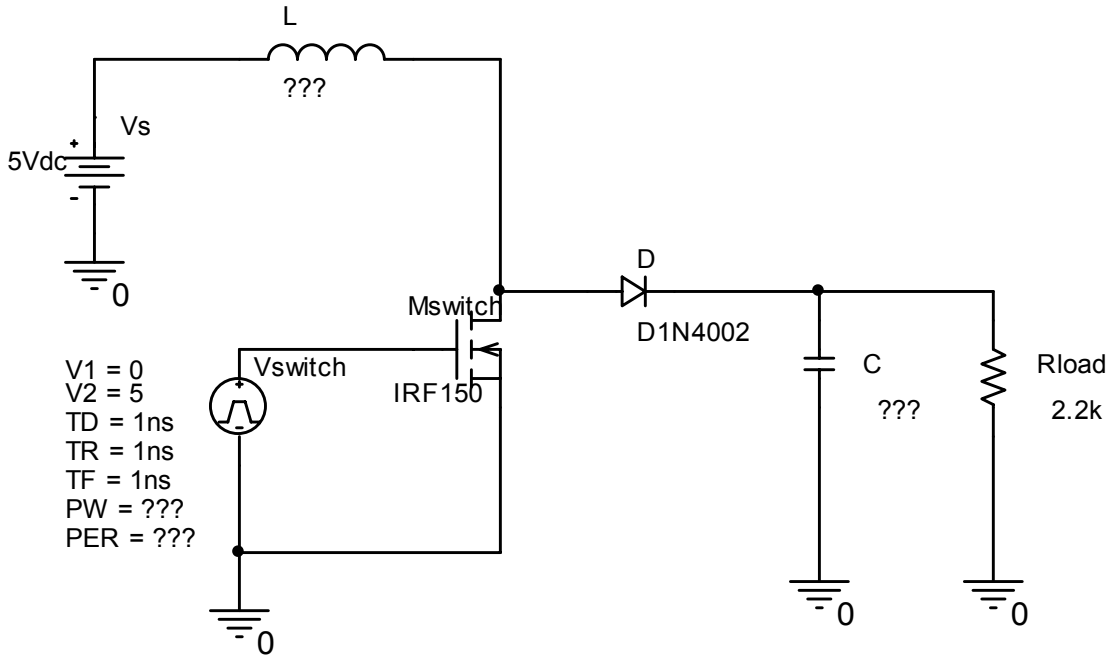
ECE 2274
Pre-Lab for Experiment 9
Boost Converter (DC-to-DC Voltage Booster)

1. Using the equations in Microelectronic Circuit Design (Jaeger&Blalock p. 146) figure out T, T_{ON}, L, C, and duty cycle for the boost converter shown below, using the following specifications. Run a simulation graph of the output voltage $V_{L.}$

   $V_S = 5V$
   $V_O = 25V$
   $V_r = 454.54mV$
   $I_r = 7.4mA$
   $f = 20kHz$

PSpice Hint: Simulation Settings:Time Domain, Run time 100ms, Start 0 sec., Step Size 10us, PW=40us, PER=50us.



Laboratory Exercise

1. Build the boost converter you designed. Use the function generator for your pulse generator. Set the FG for 20khz square wave, duty cycle 80%, 5vpp, 2.5v offset.
2. Use the "Scope Capture" to view the output waveform of your circuit. oscilloscope.
3. **Capture and save the waveform to be printed out and turn in**.
4. Notice that Vout is not as great as it was in your simulation. **List all reasons you might think that this is the case**. *Hint: The low voltage of Vout is probably due to the components being non-ideal. Think about a component that might cause a voltage drop in general. Which component in the circuit could also contain this characteristic?*
5. Now figure out a possible solution to your theories from part 4. In other words, **how would you solve the problem of the voltage drop?**
6. Remove the inductor and measure its dc resistance. Since the inductor is non-ideal, it contains resistance. This is the main cause of the voltage drop. If you were to add the same resistance you just measured in series with your inductor in PSpice, you would be getting similar results to what you are obtaining now? Add the measured dc inductor resistance into the PSpice simulation in series with the inductor, and do a new simulation. **Graph your results to be turned in with the lab. Did you observe a drop in the output** voltage? How did the output voltage compare with your lab output voltage**? How might you reduce the resistance caused by the inductor without changing the circuit?** *Hint: How can you use resistors to decrease the equivalent resistance seen by the circuit from them? How can you do this with inductors?*
7. **Capture and save the waveforms to the computer to print out and turn in later**.
8. The capacitor you chose in pre-lab was only due to the ripple voltage given in the specs. Changing the capacitance value would only change the ripple voltage since the period, duty cycle, and resistance are constant as well as the output voltage (which is only dependent on the voltage source and duty cycle, which are constant). **Measure the ripple voltage Vr using the scope. (what type of coupling do you use and why?)** Change your capacitor to 220 ufd. **Measure the Vr. Did Vr increase of decrease? Why? % change**. **Capture and save your waveform to print out and turn in later**.