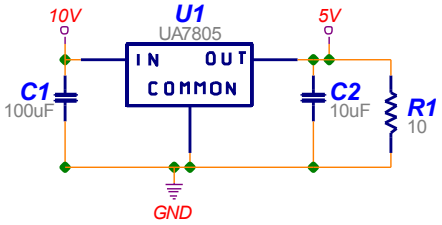
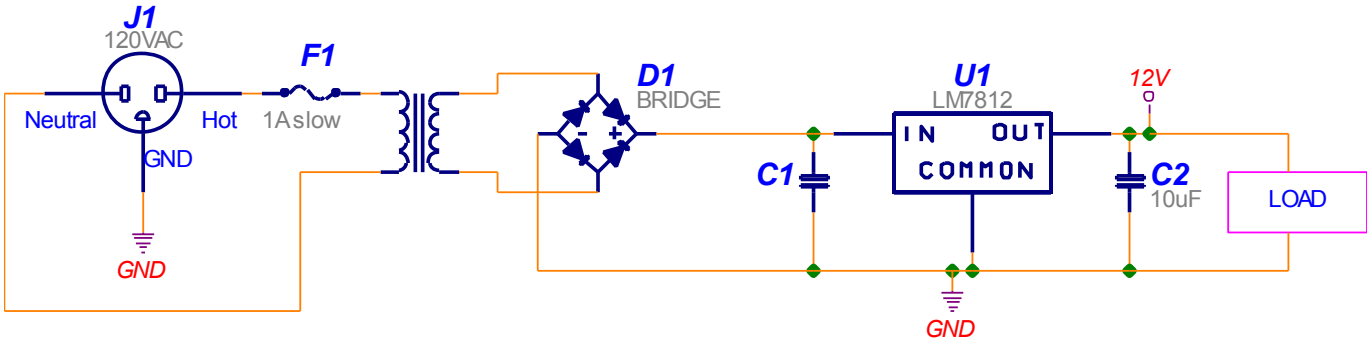
Midterm Review (Part 2)

In this voltage regulator circuit:
a) How much power is dissipated in the voltage regulator (you can neglect the few mA of current that flow through the regulator ground pin)?
b) How much power is dissipated in the load (R1)?
c) What is the efficiency of this regulator with the given input and output voltages?

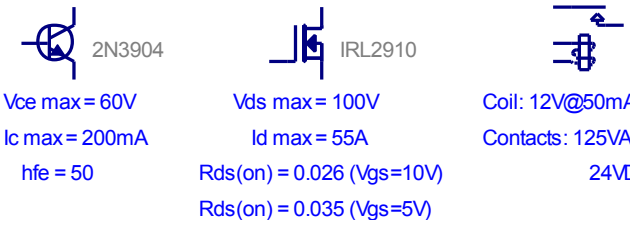


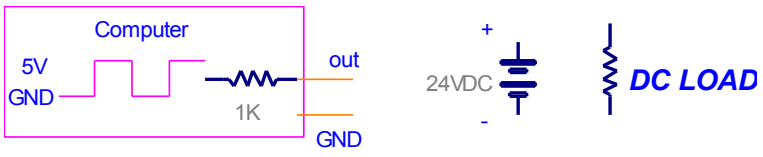
The LM7805 in the TO-220 package has the following thermal impedance:
4°C/W junction to case
50°C/W case to ambient.
a) If no heatsink is used, how far above ambient will the junction temperature get when dissipating 2W of power?
b) If the ambient temperature is 25C, what size heatsink (in °C/W) should be used to keep the junction temperature below 70C?

In the circuit below the load draws 1A from the 12V regulator.
a) How large should C1 be to limit the ripple voltage on C1 to 2V?
b) Assuming C1 has a ripple voltage of 2V what are the minimum voltage requirements for the transformer that will allow the regulator to still provide 12V to the load? Give your answer in AC Volts (rms).
Note: If I ask you to design a power supply to produce 12V@1A you should be able to come up with the schematic below and label the parts accordingly (including the transformer output voltage).



You need to control a DC load (24VDC@2A) from a computer. The signal from the computer is a 0-5V TTL signal with a source impedance of 1KΩ (see block below). Use any parts to the right and what's shown below and as many resistors, capacitors, and diodes as needed to complete the circuit. Draw the schematic and add a few sentences that explain how the circuit works.





Re-design the circuit to switch an AC load instead of a DC load. The AC load runs off 120VAC and draws 1A. Add a few sentences explaining how the circuit works. You still have the 24VDC power source available to use.