Lab 2 Linear regulators

In this lab you will build a discrete-component regulator and configure an IC voltage regulator.

Pre-lab

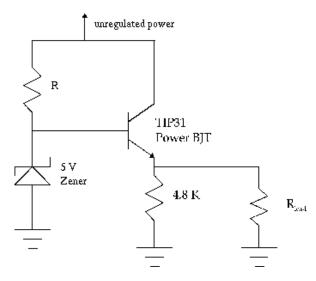
- 1. Obtain the data sheets for the different components as necessary. www.digikey.com is often a good source.
- 2. Derive the expression for the ripple in step 2.
- 3. Answer the question in step 3.
- 4. Answer the questions in step 10 and 11.
- 5. Design the circuit in step 14.

Full-wave rectifier

- 1. Build a full-wave rectifier from four 1N4001 diodes followed by a $100 \,\mu\text{F}$ capacitor. Be sure to observe the correct polarity on the capacitor.
- 2. Connect the input to a 12 V transformer and measure the ripple for several different load resistances between 200Ω and $1 \text{ k}\Omega$, and compare with a theoretical calculation.

Discrete component regulator

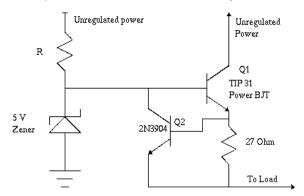
3. Explain how the following regulator circuit functions. What is the output voltage, and what is the purpose of the $4.8 \text{ k}\Omega$ resistor?



- 4. Build the circuit, choosing R such that 10 mA current flows through the zener diode.
- 5. Measure the output DC voltage for zero current and compare with a theoretical prediction.
- 6. Measure the ripple at the rectifier, the zener, and the load for several different load resistance between 200Ω and $1 \text{ k}\Omega$.
- 7. What fraction of the output ripple comes from the zener ripple?
- 8. What is the ripple rejection factor, the output ripple divided by the input ripple.

Current limiter

9. Add a current limiter to your circuit as shown here (leave the $4.8 \,\mathrm{k}\Omega$ resistor in place).



- 10. Explain how this circuit works.
- 11. What is the theoretical output current limit of this circuit?
- 12. Measure and plot the output voltage as a function of the output current by applying several different resistors corresponding to currents both below and above the current limit.
- 13. Short the output and compare the short circuit current with the theoretical current limit.

IC regulator

- 14. Use a LM317 to design and build a 5 V regulator and attach it to the rectifier. Follow the recommendations in the data sheet.
- 15. Measure the ripple rejection factor for several different load currents and compare with information from the data sheet.
- 16. What is the short-circuit current?