

Zener Diode Characteristics - Zener regulator

Prelab:

You are tasked to determine experimentally the characteristic curve of a reverse-biased Zener diode. You must also design a circuit that demonstrates the operation of a $7\text{ V} \pm 5\%$ loaded Zener regulator powered by a 12 V DC voltage source.

With your lab partner, brainstorm on the following ideas:

- How can you determine the characteristic curve of a reverse-biased Zener diode?
- How do you construct the laboratory experiment that will allow you to make this determination and measure the characteristic curve? What will you vary and over what range? What will you measure? What instruments will you use for your observations?
- Based on the data sheets, what difference do you expect between the characteristics of the 1N 5223B and the 1N 5235B Zener diodes? How will the limits of the parameters you vary change for these two diodes?
- What is the function of a Zener regulator? What considerations are important when sizing the source resistance, the load resistance, and the Zener diode used in the circuit? Assume your regulator should be able to operate from no load (i.e. very high or no resistor attached) to a maximum load (smallest load resistor) you will need to estimate.

You will turn-in a draft of your answers and your preliminary experimental plan as prelab for this assignment.

- Collect in a single folder the data sheet for the Zener diodes you will use in the lab.
- Draw a schematic of the circuits you plan to build. Use Multisim to draw the circuit. Test the circuits' operation with Multisim. Keep the Multisim file handy to refer it to in the lab.
- Summarize what parameters you intend to vary and over what range of values when you determine the Zener diode characteristics.
- Summarize how you will build and test your Zener regulator.
- Indicate what instruments you will use and what you will measure.
- Regroup all this information in a single document.

At the beginning of the laboratory, we will discuss your ideas and settle on an experimental approach to determine the Zener characteristics and on a basic design to demonstrate the operation of the Zener regulator.

Report:

Each work group will submit a report due one week after the laboratory experiment which should include the following sections:

1. All the initial answers to the questions of the assignment (i.e. the prelab corrected and augmented by the discussion).
2. The experimental approach you established during the lab discussion and the list of deliverables agreed on in the lab.

3. The data (measurements and calculations) you obtained for the two Zener diodes and plots of the characteristic curves.
4. Your analysis of the data and comparison with the practical Zener model: you should determine the experimental Zener resistance and compare it to the value listed in the data sheet.
5. Your assessment of the Zener regulator: how well did it operate? Comment on its practicality and limitations when compared to the integrated voltage regulator used to build a linear power supply in the previous experiment
6. Excerpts of the data sheets for the Zener diodes you used in the laboratory, including a discussion of what information you used in the data sheets for your experiments.
7. Conclude with a summary of your investigations and recommendations for improving the experiment if you were to repeat it.