Name/NetID:

Teammate/NetID:

Section AB/BB:

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Pre-lab 8: Semiconductor Devices and Measurement

Oscilloscope Usage

Use your knowledge of the oscilloscope t answer these two questions.

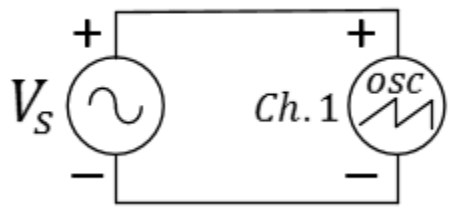

Figure 1: An oscilloscope measurement.

Question 1: Given that $V_S = 2\sin(2\pi 100t)$, suggest an appropriate horizontal and vertical scale/division for this measurement.

Question 2: Given that $V_S = 2\sin(2\pi 100t)$, suggest an appropriate trigger threshold for this measurement.

Notes:

Diode Basics

In this week's experiment, we'll explore the basic functions of diodes and transistors. These devices behave very differently than the devices we've studied so far. In order to gain a more intuitive understanding of their behavior, it will be helpful to watch the following video that details the basic functions of diodes as well as some history of how the device was discovered. Take a few minutes to watch the video in order to answer the following questions.

https://www.youtube.com/watch?v=AqzYsuTRVRc (or, if the link is broken, search the Internet for "youtube make presents the diode")

Question 3: What is the most important characteristic that distinguishes a Signal Diodes from a Rectifier Diodes?

Question 4: What is the process of converting AC current to DC current called?

Question 5: Explain what break-down means.

Question 6: Explain how a 1N4001 rectifier diode is used for power protection.

Notes:

Data Sheets of Diodes and **Transistors**

Diodes

When using diodes in your proto-type it is very important to identify the direction of a diode before wiring it into your circuit. Both diodes and transistors are not like resistors where the orientation in the circuit is unimportant. If you put the diode in backwards your circuit will probably not work at all. Usually a stripe is put on one end to help orient it properly. This stripe is related to the schematic symbol of diode as shown in the figure below:

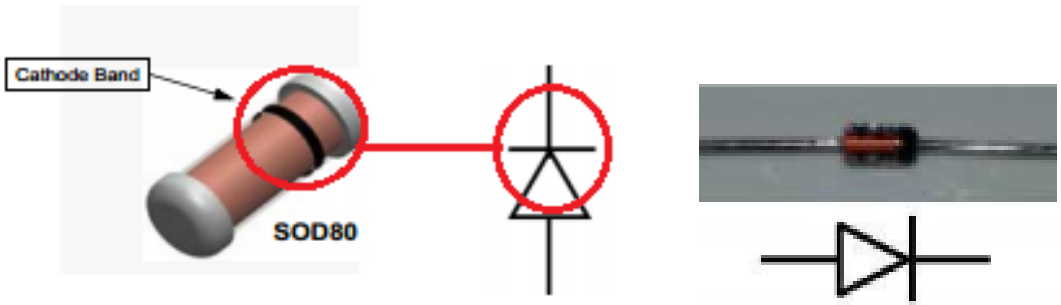

Figure 1: Description of a diode.

Take a look at the datasheet for the 1N4148 diode found in your ECE110 electronics kit. It can be easily found by entering "1N4148 datasheet" into the search engine of your choosing or you can find it listed on the course website (the Modules page).

Question 7: Suppose we have the diode connected into a circuit where it might receive pulses of current that are less than 1s in duration. What is the maximum current that the diode will be able to withstand?

Question 8: What is the largest voltage we can reverse bias the diode before it permanently breaks down?

Notes:

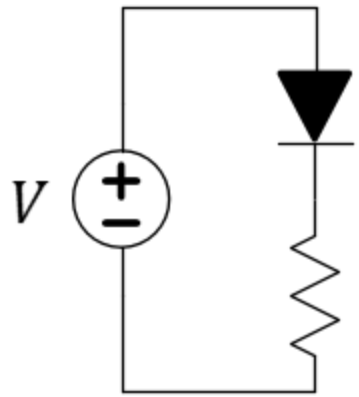

Figure 2: Simple circuit for collecting IV characteristics of a diode

Question 9: Consider the DC circuit shown in 2. Assume that the resistor ($R = 330\ \Omega$) is capable of dissipating up to 1/4 W of power before it burns up. Also assume that the diode behaves according to an ideal offset model with V_{ON} (given by the maximum V_F specified in the datasheet). Find the maximum forward current of the diode from the datasheet, then determine which device, the diode or the resistor, will be destroyed first if the voltage is slowly increased. Specify all information that you used from the datasheet.

Notes:

Transistors

Now let's consider the 2N5192G transistor that we'll use in Experiment #6. Look up the datasheet for the transistor (using the same methods as you did for the diode) and answer the following questions. Watch this video for more information https://www.youtube.com/watch?v=-td7YT-Pums. (or, if the link is broken, search the Internet for "youtube make presents the transistor")

Question 10: Draw the circuit schematic of the "pressure-controlled LED fader switch" described at the end of the MAKE Presents video in the space below.

Question 11: Build the "pressure-controlled LED fader switch" using your electronics kit. Use the 2N2222 transistor from your kit. Have your TA check your circuit at the beginning of lab and sign here.

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Question 12: Using information found on the first and on the last page of the datasheet, mark the location of the emitter, collector and base on the photo and circuit symbol shown below.

Notes:

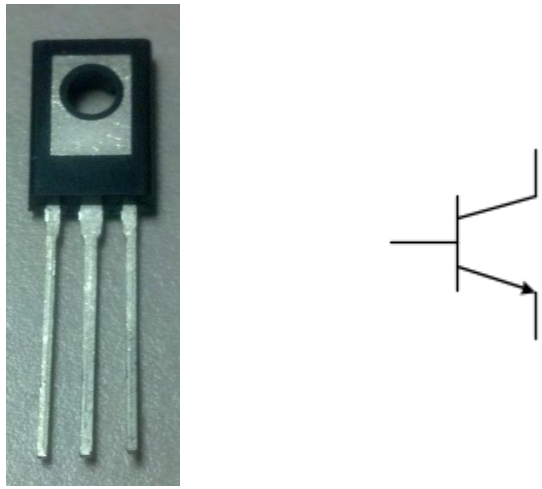

Figure 3: A physical transistor and its circuit schematic.

Question 13: What is the maximum current that can flow into the **base** of the transistor before the device is likely to incur damage?