ELECENG 2EI5 Lab 2

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The Minimum

1. The IV-characteristics of the 1N5225B zener diode included in our 2EI5 parts kit is shown in Figure 1.

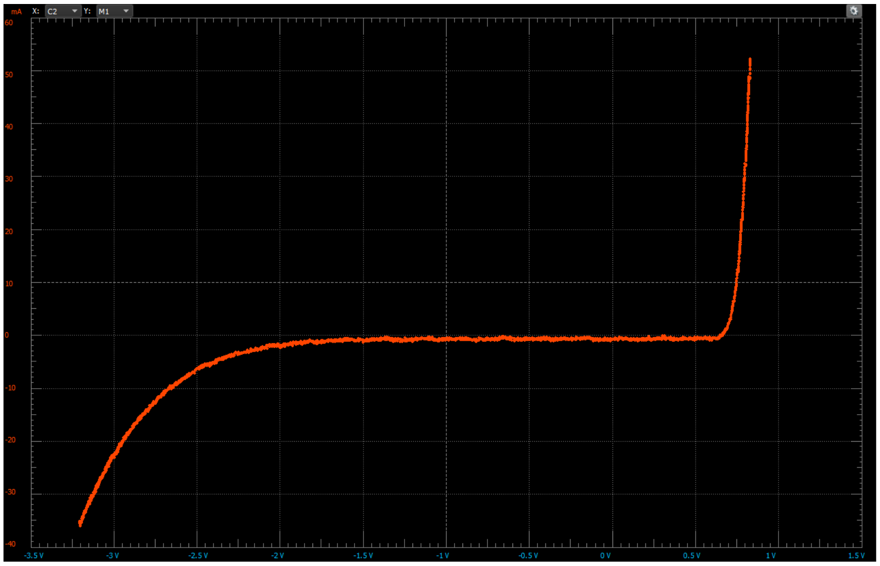

Figure 1: IV-characteristics of 1N5225B zener diode

2. A photograph of the circuit setup used to produce the IV-characteristics in Figure 1 is shown in Figure 2.

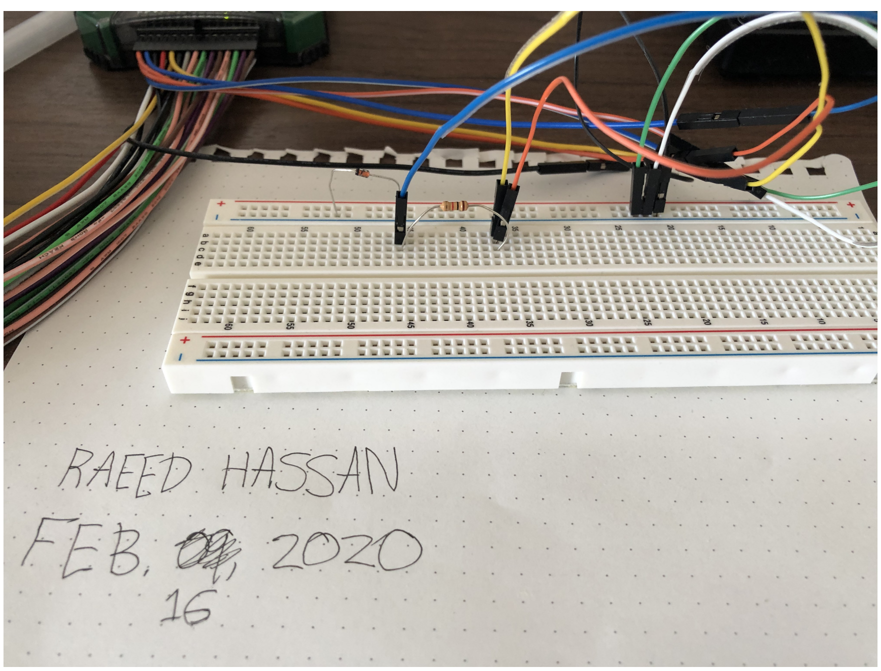

Figure 2: Photograph of circuit setup

3. According to the datasheet for the 1N5225B zener diode, the zener breakdown voltage is typically $3V$, with minimum and maximum values being $2.85V$ and $3.15V$. The minimum current required to put the diode in zener breakdown is $20mA$.
   (a) The measured zener breakdown voltage approximately 2.90V, which is between the typical and minimum rated values for the diode.
   (b) The minimum current required to put the diode in zener breakdown is measured to be approximately 16.5mA, which is slightly less than the value in the datasheet. However, it is expected the current would be slightly less as the zener breakdown voltage is less than the typical value.

The Bulk

1. The simulations for the circuit are shown in Figure 3.

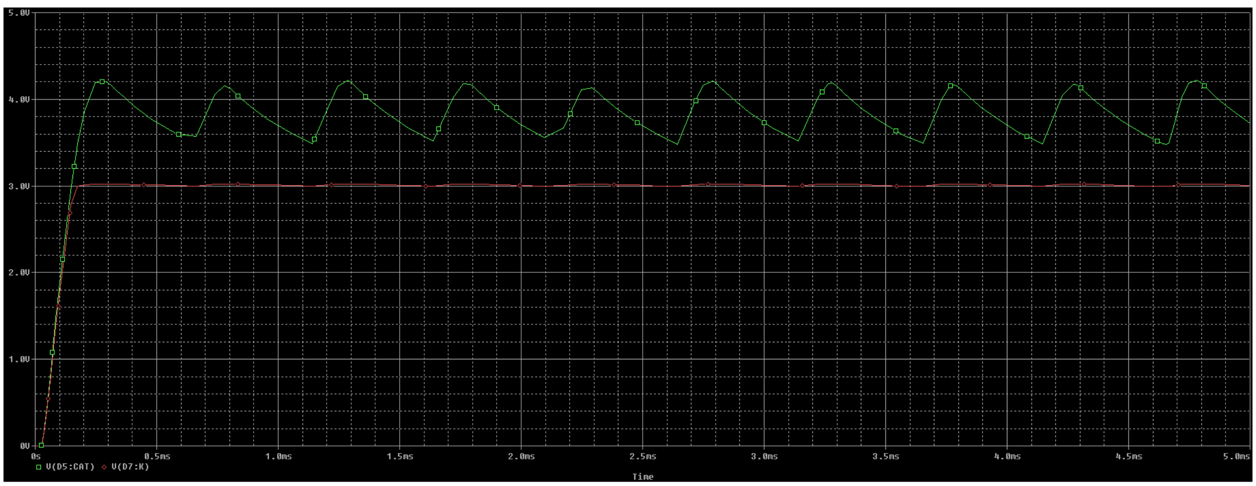

Figure 3: Simulation of v_c (green) and v_o (red).

2. An increase in R causes a decrease in v_o, an increase in v_c, and a decrease in the voltage ripple in both v_c and v_o, while a decrease in R leave the average value of v_o unchanged but causes a decrease in v_c and an in the voltage ripple in both v_c and v_o. The changes in v_o and v_c eventually stop and their values will plateau at a fixed value. An increase in C causes a decrease in the voltage ripple of both v_c and v_o, while a decrease in C causes an increase in the voltage ripple of both v_c and v_o. Changes in C do not affect the average value of v_o or v_c, but does increase the time constant of the circuit (increase in C increases time constant, decrease in C decreases time constant).
3. The voltage plots for v_c and v_o for the circuit built using $R_L = 340\Omega$, $R = 20\Omega$, and $C = 20\mu F$ is shown in Figure 4. This is the same scenario that was simulated in Figure 1, which was found to have safe current values for the components in the build circuit.

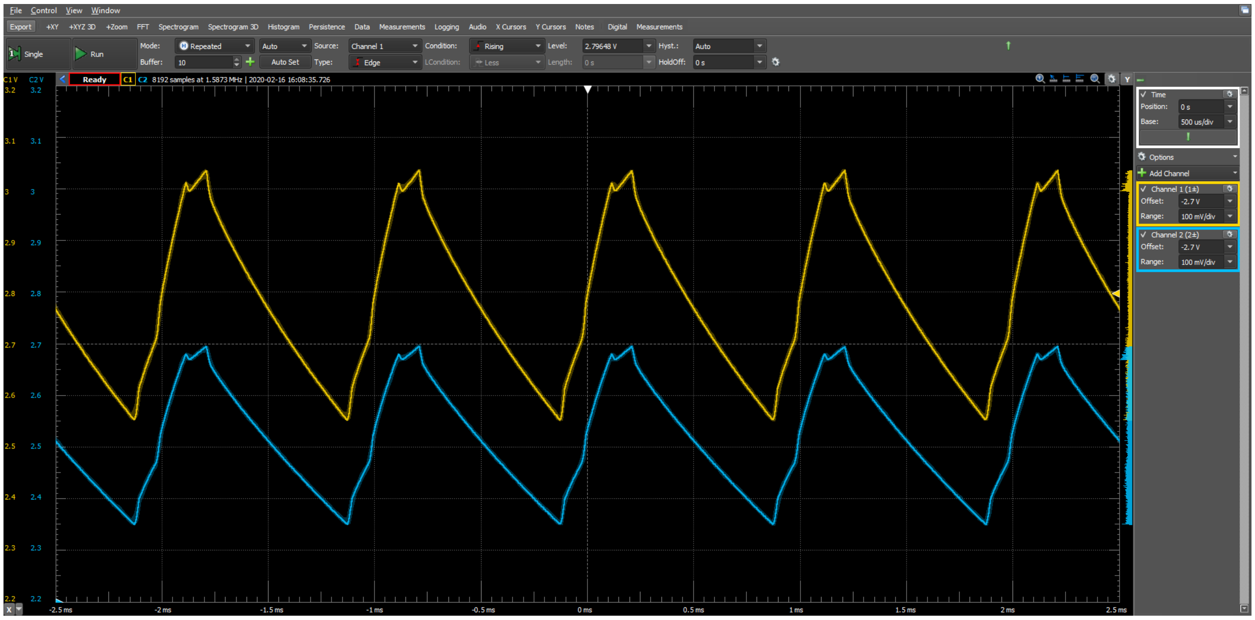

Figure 4: Measurements of v_c (yellow) and v_o (blue).

The Max

The period of the voltage ripple increases substantially when there is only one source present. The voltage ripple also increases with a single source. This result can be seen in Figure 5.

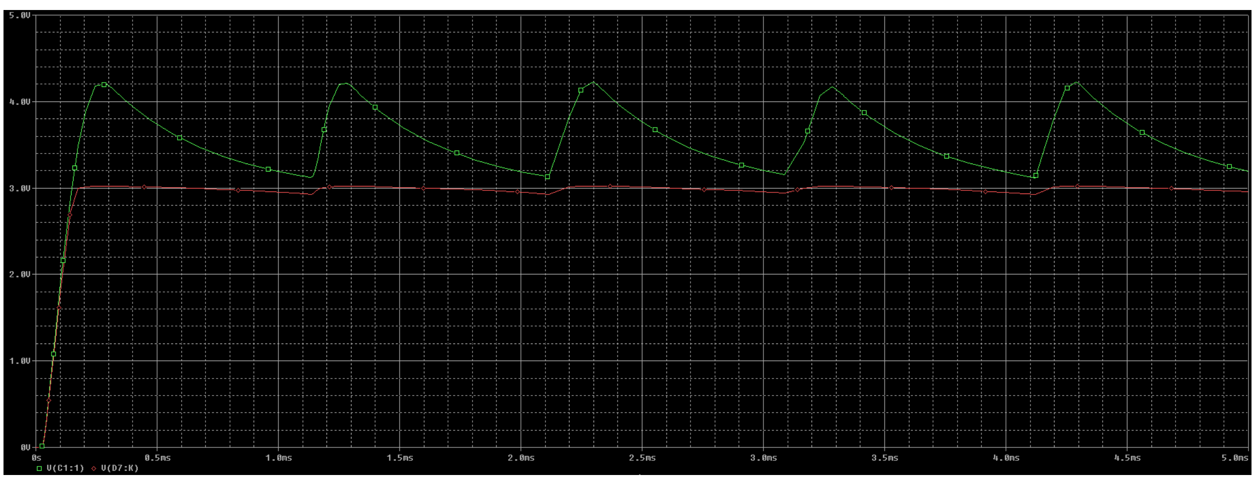

Figure 5: Simulation with single source

Increasing the amplitude of the source to 8V causes the average value and the voltage ripple in v_c to increase substantially, however v_o remains largely unchanged. This effect can be seen in Figure 6.

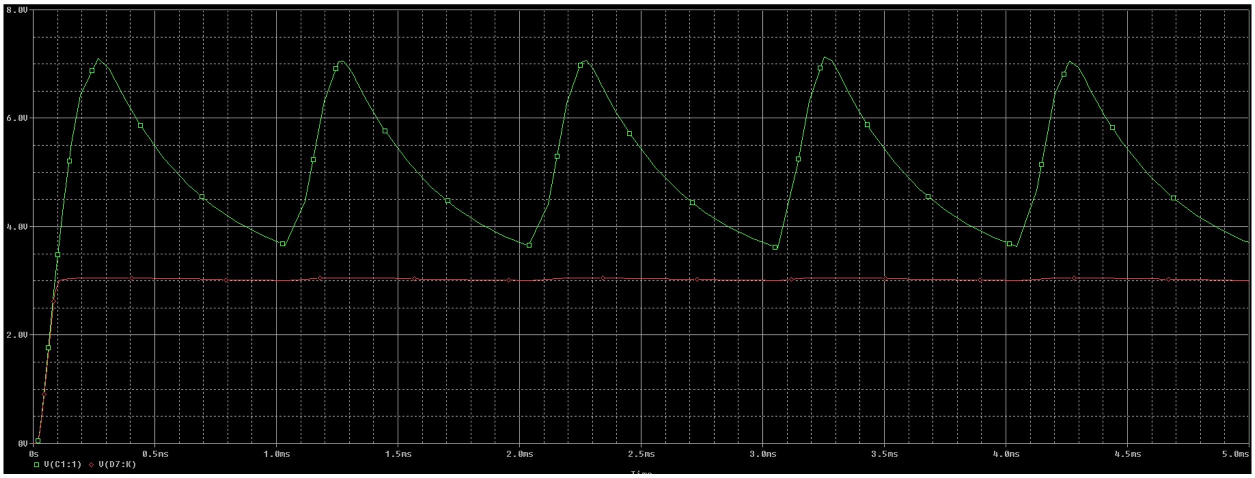

Figure 6: Simulation with source ampltiude at tV