Multi-Range 555 Frequency Source

In this lab you will be creating a multi-frequency oscillator using a LM555CN. The general circuit is shown in Figure 1 for convinience.

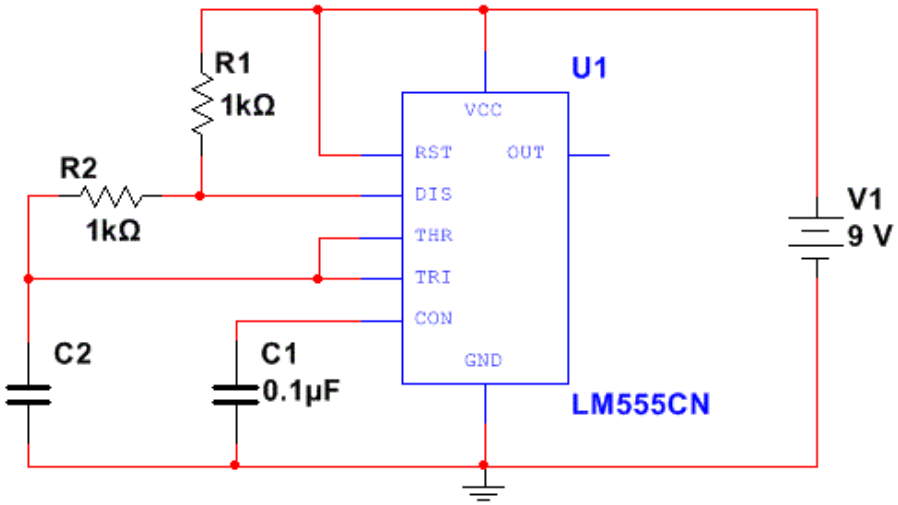

Figure 1: 555 timer circuit

.

Recall that your 555 output frequency is determined by the formula:

$$f = \frac{1.44}{(R_1 + 2R_2)C_2}\text{Hz} \tag{1}$$

Prelab Exercises

Assume you are using a 1kΩ resistor for R_1 and a 1kΩ resistor for R_2. Also assume C_1 is .1µF capicitor.

1. Using the Equation 1, determine a capacitor value for C_2 to achieve an output of 10Hz, 100Hz, 1kHz and 10kHz. Be sure to show the math for each and include the actual frequency numbers for each value.

   Hint: The analog lab has fairly limited choices in capacitor values. In order to make your life easier, you should swing by and see what values are available.

2. Draw a schematic. Use Figure 2 as an example of how to draw it. In this application, a jumper wire is used to select which capacitor will be used by connecting "node A" to the desired capacitor. When you build the circuit you will not use a bank, you'll simply replace the capacitor with another one.

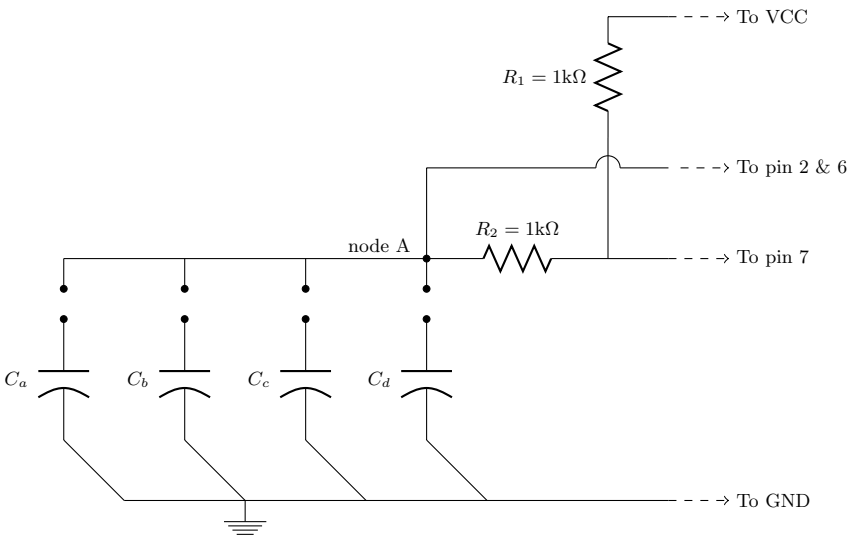

Figure 2: Capacitor bank for multi-range 555 frequency source

Lab Exercises

1. Build the circuit. Use as few wires as possible, make them as short as possible, and take advantage of the red and blue Vcc and Ground bus lines provided on the breadboard. **Before proceding, have a TA check to see that your circuit is safely wired BEFORE turning on the power supply.**
2. Test the functionality of your circuit with an oscilloscope.
   (a) Attach the positive oscilloscope test lead clip to the out-put pin of the 555 (pin 3), and attach the negative (ground) test lead clip to your ground.
   (b) After you have a stable waveform on the screen (ask the TA for help if needed) measure and note the period of your circuits waveform and then calculate frequency.
   (c) Record your systems functionality (does it work as expected) and a brief note on quality of function (note what the wave looks like, is it a good, clean squarewave? if not what does it look like?).
   (d) Draw a sample waveform. Make sure you draw the screen as it is, showing the dotted grid lines and labeling the divisions for each axis.
3. Repeat the testing process for the other frequencies by switching out the capacitor. Compare this data to your prelab data.

Extra Credit

Build the circuit from Lab 5 and measure the output with the oscilloscope. Measure the frequency at both ends of the potentiometer adjustment (effectively 0Ω and 1kΩ). Describe how the output compares to what you witnessed in Multisim. Be sure to compare the look of the waveform created and include the %error to the calculated frequencies in the Lab 5 Prelab.