Western Carolina University
Kimmel School of Engineering, Technology, and Construction Management

Experiment No. 7 – Electronic Project

Overview:

This experiment will have the student investigate the characteristics of the 555 timer. After that the student will build an electronic project.

The 555 timer

The 555 timer is an 8-pin IC that can be used to generate a pulsed waveform as shown below

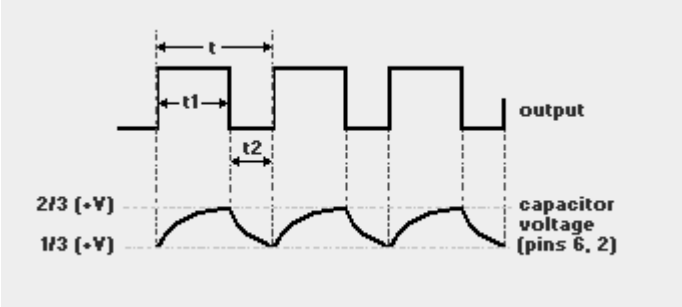

Figure 1. Pulsed waveform of a 555 timer

The frequency of operation of the 555 timer circuit is dependent upon the values of R1, R2, and C. The frequency can be calculated with the formula:

$$\mathbf{f = 1/(.693 \times C \times (R1 + 2 \times R2))}$$

The Frequency f is in Hz, R1 and R2 are in ohms, and C is in farads. The time duration between pulses is known as the 'period', and usually designated with a 't'. The pulse is on for t1 seconds, then off for t2 seconds. The total period (t) is t1 + t2 (see fig. 1). That time interval is related to the frequency by the familiar relationship:

$$f = 1/t$$

The time intervals for the on and off portions of the output depend upon the values of R1 and R2. The ratio of the time duration when the output pulse is high to the total period is known as the duty-cycle. The duty-cycle can be calculated with the formula:

$$D = t1/t = (R1 + R2) / (R1 + 2R2)$$

You can calculate t1 and t2 times with the formulas below:

$$t1 = .693(R1+R2)C$$
$$t2 = .693 \times R2 \times C$$

Prelab.
Suppose you would like to generate a 1000 Hz signal with a 1μF capacitor. You would like to have a 90% duty cycle.

(a) What is ther period in seconds?
(b) What is the on-time, t1?
(c) What is the off-time, t2?
(d) What must R1 and R2 be to achieve the desired signal?

(INSTRUCTOR'S SIGNATURE_____DATE_____)

Lab Session – Parallel and Series Parallel Circuits

Part One – Selection of a project

1 Show your pre-lab work to the instructor at the beginning of the lab session.
2. You will be provided the instructions for building a tone generator and an LED flasher. Look over the projects and decide which one you are going to construct. Indicate your choice:

Tone generator LED flasher

Part Two – Video on Soldering Techniques

1 The instructor will show you a video on soldering techniques. Answer the following:
(a) Once he/she has a hot soldering tip, a good solderer will be able to make a soldering connection within

1 second 3 seconds

10 seconds 60 seconds

(b) Solder used for electronics consists of

brass and tin lead and tin

lead and magnesium tin and aluminum

(c) Which of the following are proper procedures for cleaning a solder tip (choose all that are correct)

Soak soldering tip in acid, dry off, and use sand paper to buff to a shine

Heat up the soldering iron and press soldering tip into a canister of tip cleaner

Use a grinder, file or steel wool on a cold soldering iron to buff the tip to a shiny surface, then heat up the soldering iron and coat the tip with solder.

Heat up the soldering iron and coat the tip with solder.

(d) Which of the following is the proper procedure for soldering a component to a circuit board:

Place hot soldering tip on component wire and place solder on pad. When solder melts, lift solder and soldering iron.

Place hot soldering tip on component wire and place solder on component wire. When solder melts, lift solder and soldering iron.

Place hot soldering tip so that it touches the pad and the component wire. Apply solder to both. When solder melts, lift solder and soldering iron.

Place hot soldering tip on pad, place solder on soldering pad. When solder melts, lift solder and soldering iron.

(e) The profile of a good soldering connection of a component wire to a circuit board pad looks like which of the following objects

A circle

An oval

A rectangle

A triangle

A volcano

(f) A good soldering connection of a component wire to a circuit board has a

shiny, smooth surface

shiny, rough surface

dull, smooth surface

dull, rough surface

(g) Which of the following are proper tools or methods for removing solder from a soldering connection (choose all that are correct)

a solder sucker

a chisel

acid

soldering wick

a screwdriver

sandpaper

Part Two – Construction of the project

1 Follow the instructions to build the project.
2 Plug in the battery and test for correct operation.

Part Three – Testing of the project

Tone Generator testing

1 Connect the channel 1 probe of an oscilloscope to the 555 pin 3 side of the 100 Ω resistor.
2 Adjust the tone generator to the lowest pitch available.
3 Measure the period of the waveform and calculate the resulting frequency.

Period = _____ frequency = _____ Hz

4 Save the waveform displayed on the oscilloscope.
5 Adjust the tone generator for the highest pitch that you can hear.
6 Measure the period of the waveform and calculate the resulting frequency.

Period = _____ frequency = _____ Hz

7 Save the waveform displayed on the oscilloscope.
8 Adjust the tone generator to the highest pitch that it is capable of producing. You probably will not be able to hear anything.
9 Measure the period of the waveform and calculate the resulting frequency.

Period = _____ frequency = _____ Hz

10 Save the waveform displayed on the oscilloscope.

LED Flasher testing

1 Connect the channel 1 probe of an oscilloscope to the 555 pin 3 side of the 100 Ω resistor.
2 Adjust the LED flasher to the lowest flash rate that it is capable of producing.
3 Measure the period of the waveform and calculate the resulting frequency.

Period = _____ frequency = _____ Hz

4 Save the waveform displayed on the oscilloscope.
5 Adjust the LED flasher for the highest flash rate that you can observe.
6 Measure the period of the waveform and calculate the resulting frequency.

Period = _____ frequency = _____ Hz

7 Save the waveform displayed on the oscilloscope.
8 Adjust the LED flasher to the highest pitch that it is capable of producing. You should see a constant light on both LEDs.
9 Measure the period of the waveform and calculate the resulting frequency.

Period = _____ frequency = _____ Hz

10 Save the waveform displayed on the oscilloscope.