555 LED Flasher Circuit

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Materials List

- 9 Volt Battery
- 555 Timer
- 10 μF Electrolytic Capacitor
- Breadboard
- 8.2k Resistor
- 270 Resistor (x2)
- 33k Resistor
- LED (x2)
- Lots of Wires

Nodes list

Node 1 = - Battery to Pin 1

Node 2 = - Battery to - Capacitor

Node 3 = - Battery to - Led 2

Node 4 = Pin 1 to - Capacitor

Node 5 = Pin 1 to - Led 2

Node 6 = - Capacitor to - Led 2

Node 7 = + Capacitor to Pin 2

Node 8 = Pin 2 to Pin 6

Node 9 = + Led 2 to - Resistor 4

Node 10 = + Resistor 4 to Pin 3

Node 11 = + Resistor 4 to - Resistor 3

Node 12 = Pin 3 to - Resistor 3

Node 13 = + Resistor 3 to - Led 1

Node 14 = + Led 1 to Pin 4

Node 15 = + Led 1 to Pin 8

Node 16 = + Led 1 to + Battery

Node 17 = + Led 1 to + Resistor 1

Node 18 = Pin 4 to + Resistor 1

Node 19 = Pin 4 to Pin 8

Node 20 = Pin 4 to + Battery

Node 21 = + Battery to Pin 8

Node 22 = + Battery to + Resistor 1

Node 23 = Pin 8 to + Resistor 1

Node 24 = - Resistor 1 to Pin 7

Node 25 = - Resistor 1 to + Resistor 2

Node 25 = Pin 7 to + Resistor 2

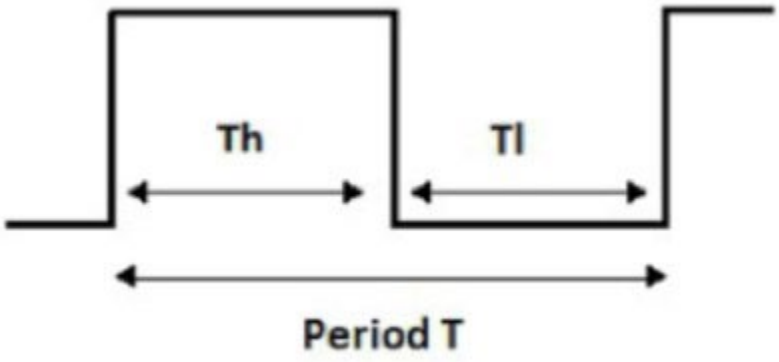
Node 26 = - Resistor 2 to Pin 6

The Goal of the 555 LED Flasher Circuit Project

The goal of the 555 LED Flasher Circuit is to teach me more about the process of planning, testing, and evaluating an electrical circuit. More specifically, an electrical circuit that causes 2 LEDs to flash. This process includes utilizing Circuit Maker, Super PCB, and actually testing the circuit on a breadboard.

What is a 555 Timer?

The 555 Timer is a very versatile integrated circuit that can be used anywhere from a "Light Up Flashing New Year's Hats" to "Automatic Aerosol Air Dispensers for Air Fresheners." It can be used as a pulse generator or an oscillator by using it's astable and monostable modes. These modes and the duration of the pulses/oscillations can be varied using combinations of different resistors and capacitors. Basically, it is a versatile timer that is used in electrical circuits.



Problems with Researching the Applications of the 555 Timer Integrated Circuit

Honestly, it was quite hard to find specific products where 555 timers are found. Most websites just say something along the lines of, "The 555 Timer's ease of use, simplicity, and low cost allows it to be used in thousands of applications". If any examples were listed, it usually cites DIY craft project. The reason for this is probably due to how prevalent and widely used the 555 timer is. It's like searching up specific uses for a Logic Gate. Logic Gates and 555 Timer Circuits are used so much in the industry that people don't bother to write about it. The only people that seem to write about 555 timers are the tutorial and DIY communities.

The Uses of Each Pin in the 555 Timer

Pin 1 (Ground)

- Connected to circuit ground

Pin 2 (Trigger)

- A low voltage (less than ⅓ supply Voltage) applied to trigger momentarily will cause the output to go high. The output will remain high until high voltage applied to threshold pin

Pin 3 (Output)

- Low state = close to 0 V
- High state = 1.7 V lower than the supply voltage

Pin 4 (Reset)

- A low voltage of less than 0.7V will cause the output to become low

Pin 5 (Control)

- The control threshold voltage (default it ⅔ supply voltage
- You can vary threshold from 45% to 90% of supply Voltage
- Allows you to vary the length of the output pulse in monostable mode
- Allows you to vary the output frequency in astable mode

Pin 6 (Threshold)

- the voltage across the timing capacitor is monitored through the Threshold input.
- When the voltage at this input rises above the threshold value the output will go from high to low.

Pin 7 (Discharge)

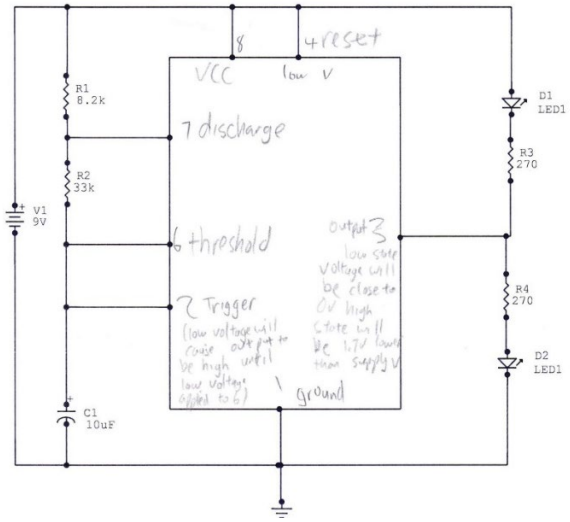
- The extra voltage will come out of here

Pin 8 (Vcc)

- Power supply

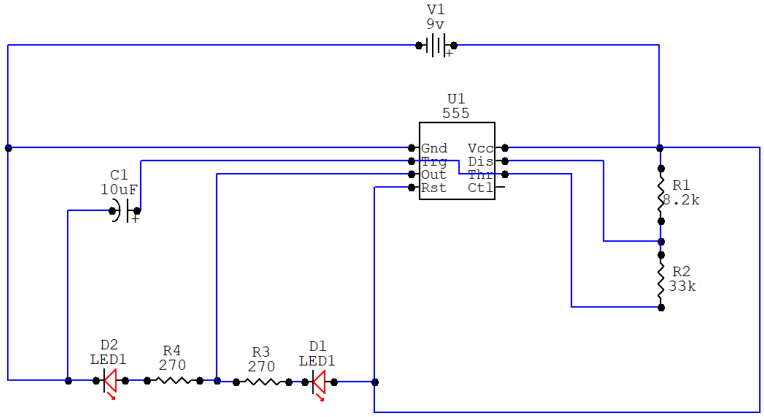
The Use of Circuit Maker to Plan the LED Flasher Circuit

Circuit Maker is a great program that can be used to make circuit diagrams and plan the design of your circuit. The creation of the Circuit in Circuit Maker is honestly the hardest part of this entire process. The problem is that you need to recreate this Circuit without overlapping lines. If you copy this exact diagram in Circuit Maker, the pins won't line up. This means that I need to modify the positioning of some wires in order to get it to work.



The LED Flasher Circuit Diagram (Left)

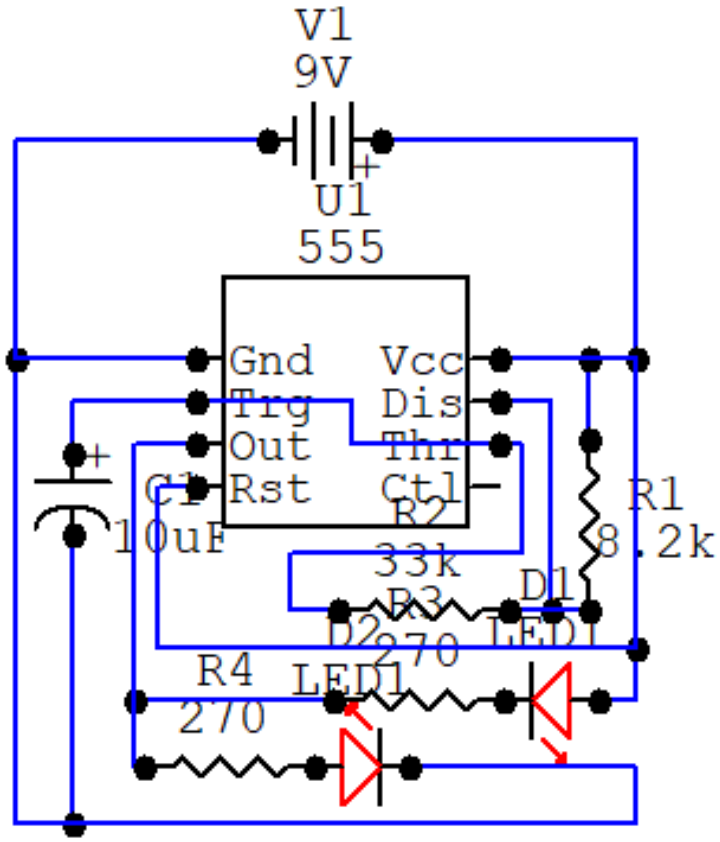
In order to recreate this Circuit in Circuit Maker, some modifications had to be made. For example, in order to connect Pin 6 to Pin 2, a trace must be added beneath the Timer. It's just figuring out these tiny things that are a little difficult.



My Circuit Maker LED Flasher Diagram (above)

The Reducing of The Overall Size of the LED Flasher Circuit

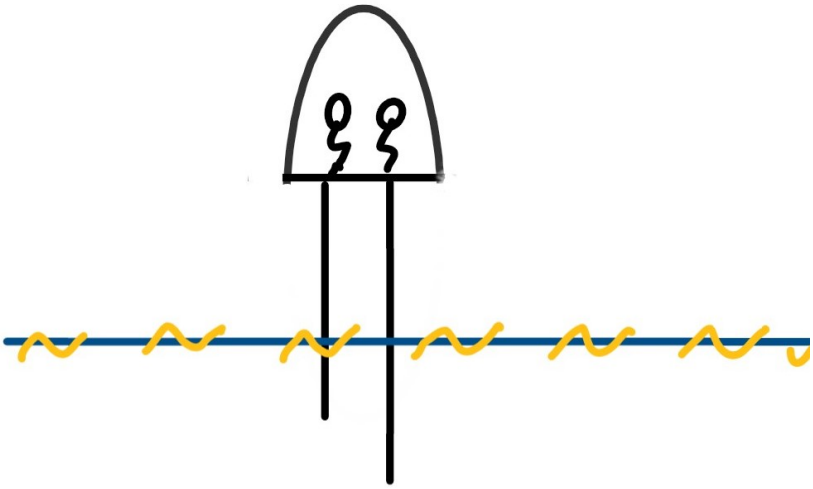
Now that I have figured out how the circuit will look like; I can't simply leave it like that. The circuit is no compact at all! I needed to reduce the overall footprint of the circuitry. Why do I need to reduce the footprint? The reason for doing this is to save on material. In the real world, cost-saving is key. Why waste material and practically give out money when you can just have a more efficient design? It is good practice learning how to reduce the size of a circuit.



My more compact circuit (Left)

Creating the Circuit on a Breadboard

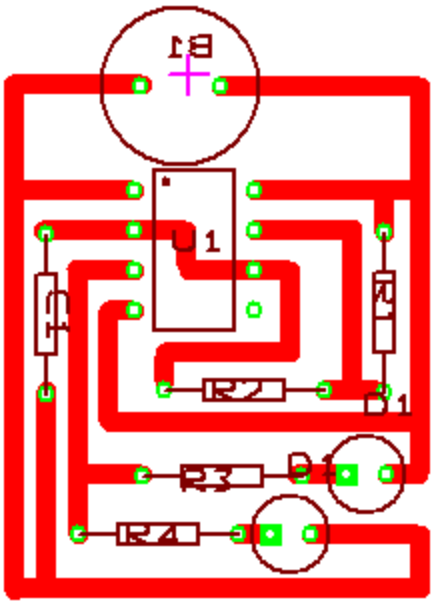
Before fully finalizing my design for the 555 LED Flasher Circuit, I need to confirm that my design actually works! Before building my own circuit, I decided to follow the instructions for a single led flasher circuit that I know works. By doing this, I can confirm all of my parts work. If I didn't test my parts and my 555 LED Flasher Circuit didn't work, I wouldn't know if I had a problem with my parts or my actual design. After following the instructions of the single LED Flasher circuit and testing out the circuit, I found out that the circuit didn't work. Is one of my parts broken? After double-checking my circuit, I realized that the instructions had a flaw. I don't know if I understood the instructions incorrectly or the instructions were inherently wrong, but the placement of the LED caused the circuit to not work.



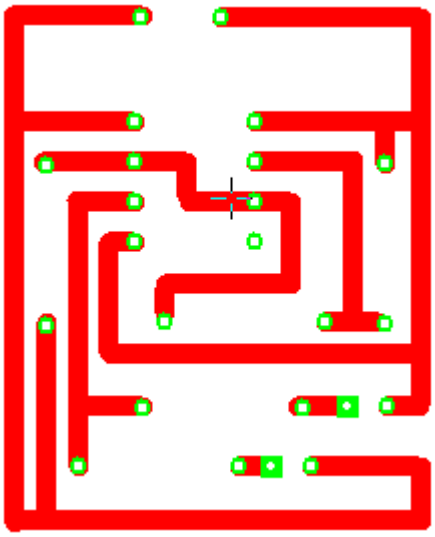
The image provided with the instructions seemed to imply that both LED leads should be put in the same breadboard row. Having this LED positioning causes the Flasher Circuit to not work due to the breadboard acting as a conductor. The electricity would rather go through the breadboard rather than the LED and this causes the LED to not work. When I moved the LED leads to two separate rows, the circuit worked due to the electricity being forced to go through the LED. Now that I figured out that all the parts that I have works. I started to build my 555 Flasher Circuit, I was successful, and my design worked.

The Use of Super PCB to Make the Final Circuit Design

Now that I have tested my circuit design and have finished the Circuit Maker design, I have my work cut out for me. I just needed to copy my Circuit Maker design into Super PCB, and I would be ready to actually create my circuit board in real life. It was pretty simple. I already did all the heavy lifting in the previous steps. Below are my Super PCB designs.



Scaled design with all the parts



Scaled design without the parts.

(just the traces and the holes)

Conclusion

In this project, not only did I learn about how the 555 Timer IC works, I learned more about the process of creating an electrical circuit. From first starting out and creating a schematic diagram in Circuit Maker to actually creating it on a breadboard. This project helped me develop crucial skills that will help me build more circuits in the future: Skills like manipulating parts and wires in Circuit Maker to get no overlapping lines, diagnosing malfunctioning circuits, creating node lists, the ability to use and understand 555 Timer ICs; the list goes on and on. All these tools will definitely help me in the creation of the next project (the digital piano), where many of the same designs and processes will be used. I will be using the same circuit creation system constantly throughout this semester, like creating a schematic diagram first, then going into Super PCB, etc. Basically, this introductory project helped me advance my electrical circuitry skills and is key for my success in this Computer Engineering course, for I will need to refer back to the skills developed in this project regularly in the future.

References

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