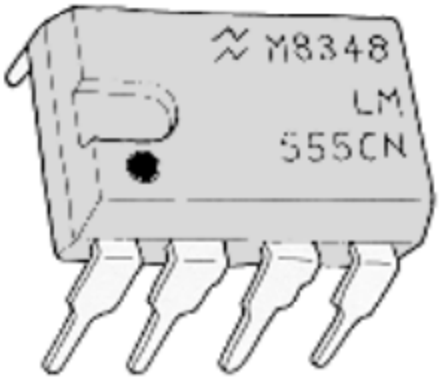
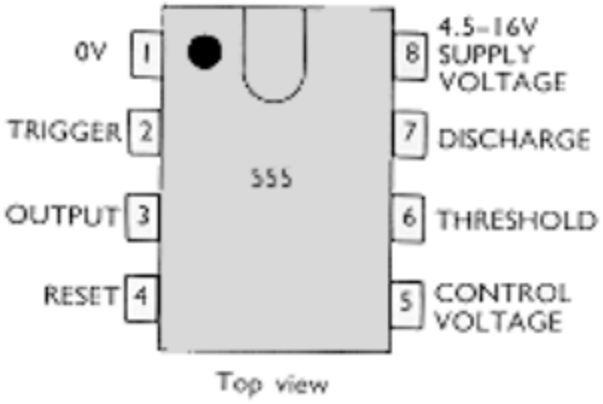
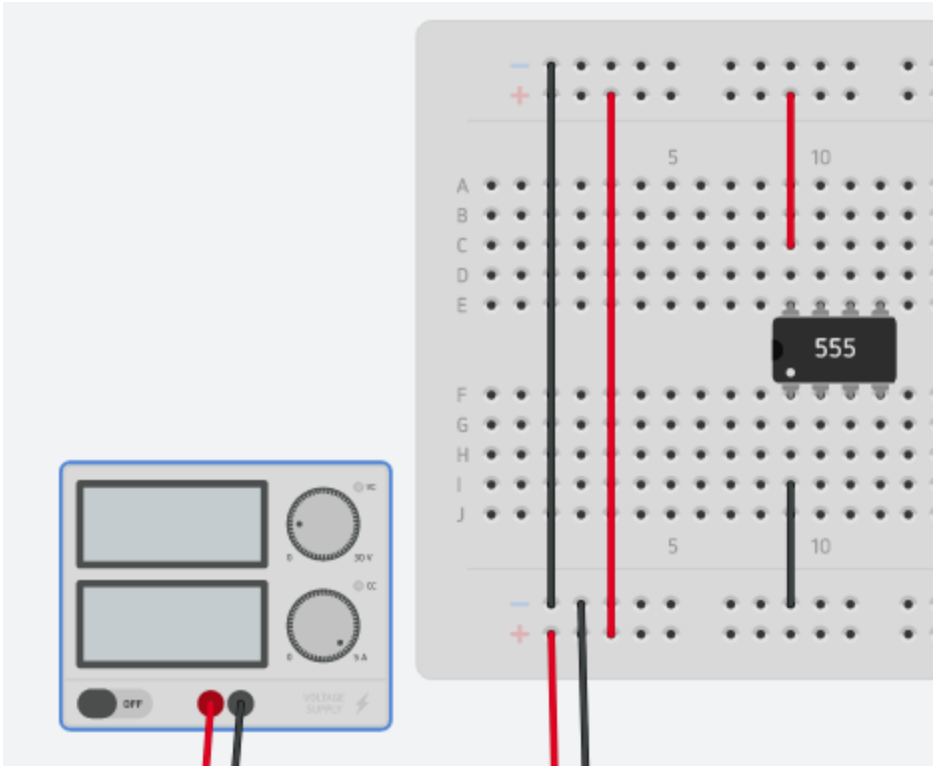
The 555 timer is a very popular and versatile integrated circuit that includes 23 transistors, 2 diodes and 16 resistors in an 8-pin DIP (Dual In-line Package). This chip is widely used to generate a constant on/off signal. The duration of the on/off time can be changed by varying, R1, R2 and C1 in the schematic provided below.





Initial Breadboard Setup:

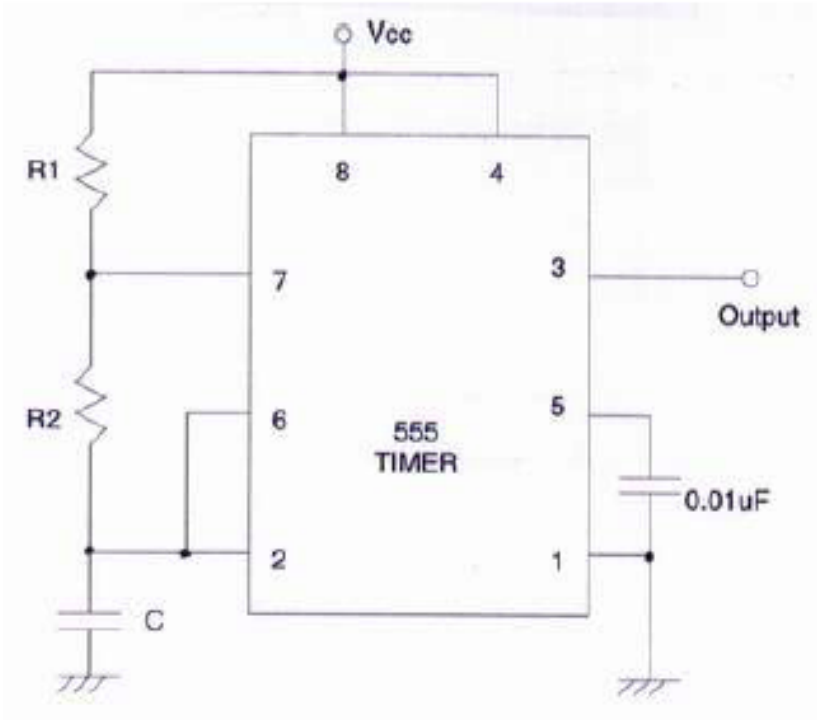


It has two main operating modes:

Monostable Mode – the 555 functions as a 'one-shot'. Applications include timers, missing pulse detectors, bounce-free switches and touch switches.

Astable Mode – the 555 functions as an oscillator. This mode is used for circuits such as LED and lamp flashers, pulse generators, logic clocks, tone generators and security alarms.

Circuit:



PROCEDURE:

1. Assemble the circuit above on the breadboard. Connect pins 4 and 8 to +5V and pin 1 to ground.
2. Resistor R1 will always be 220 ohm for this lab.
3. Connect pin 3 (Output) to a LED, through a 220 ohm resistor.
4. For Resistor R2, use the various values as indicated in the results table below. With each value of R2, use your watch/clock to approximate and record the time that the LED remains on, and the time it remains off. Note: this may be difficult to do for the lower resistance values.
5. Calculate the period (Time On + Time Off) and the frequency of the LED pulse and record these in the results table.

RESULTS TABLE:

C	R1	R2	Time On	Time Off	Total Time	Frequency (Hz) = 1/Total Time
100 µF	220 Ω	10 kΩ	1	0.5	1.5	0.66
100 µF	220 Ω	22 kΩ	2	1	3	0.33
100 µF	220 Ω	47 kΩ	5	4	9	0.11
100 µF	220 Ω	100 KΩ	10	8	18	0.055
100 µF	220 Ω	620 KΩ	63	29.4	92.4	0.010

Change the value of the capacitor from to 1000 µF

C	R1	R2	Time On	Time Off	Total Time	Frequency (Hz) = 1/Total Time
1000 µF	220 Ω	10 kΩ	11	7	18	0.05
1000 µF	220 Ω	22 kΩ	24	16	40	0.025
1000 µF	220 Ω	47 kΩ	52	24	76	0.013

Questions:

1. What happens to the speed of the flashing as R2 increases in value?

The speed of the flashing decreases as R2 increases in value

2. What impact does increasing the value of the capacitor have on the frequency?

As the value of the capacitor increases, the frequency decreases.

3. What happens if the value of R1 is bigger than R2? You will need to experiment here with different values.

If the value of R1 is bigger than R2, the frequency decreases dramatically as R1 comes before R2 hence R1 has a greater effect on the frequency than R2.

4. What is the relationship between the time the LED is on and the time it is off?

The LED stays on for a longer time than it stays off. This can be calculated using the Duty Cycle equation which determines the time where the LED is on and functioning.

555 Timer Circuit