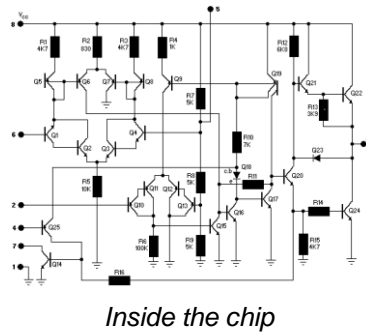
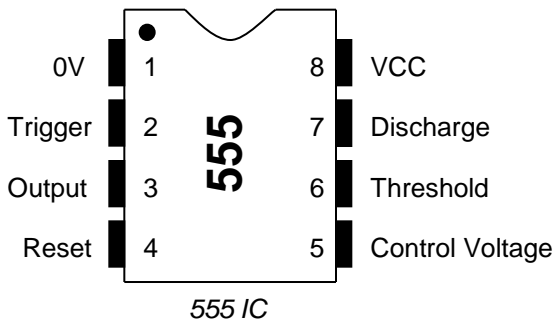


The 555 Timer

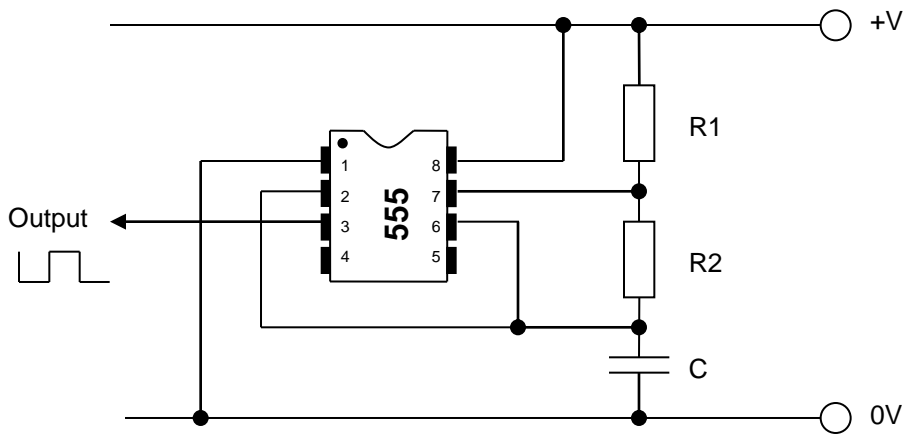
(Process)

The 555 Timer is a highly versatile integrated circuit (chip) that can be used to produce time delays and oscillators. We will look at the Astable and Monostable circuits.



Astable Circuit

An astable circuit continually switches the output on and off at a rate dependent on the timing components (R1, R2 and C). Its operation works on the principle that it takes a capacitor a certain amount of time to charge up when a source of current is applied. The resistors limit the amount of current that is allowed to flow into the capacitor and therefore the speed it is allowed to charge up (the larger the resistor value the longer it takes for the capacitor to charge up.) Also, increasing the capacitance of the capacitor increases the time it takes to charge up.



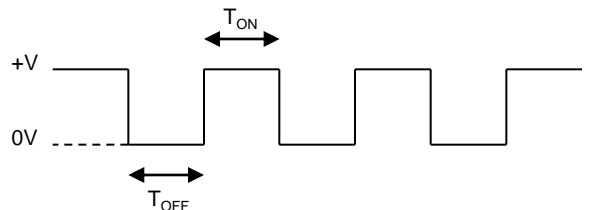
Frequency

Frequency is the number of pulses that occur in one second. For example, if the output was connected to an LED and it flashed 10 times in 1 second we would say it had a frequency of 10Hertz (or 10Hz)

As we know the frequency is dependant on the resistors and the capacitors in the circuit, the formula below allows you to calculate the frequency of the output signal:

$$F = \frac{1}{0.693 \times (R_1 + 2 \times R_2) \times C}$$

Calculating On and Off times



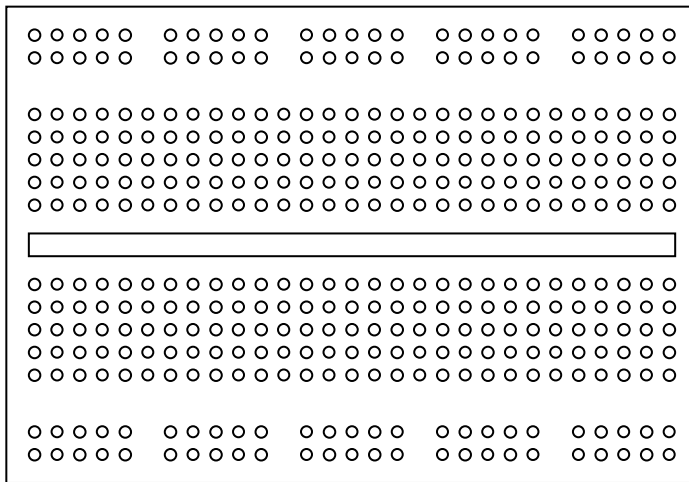
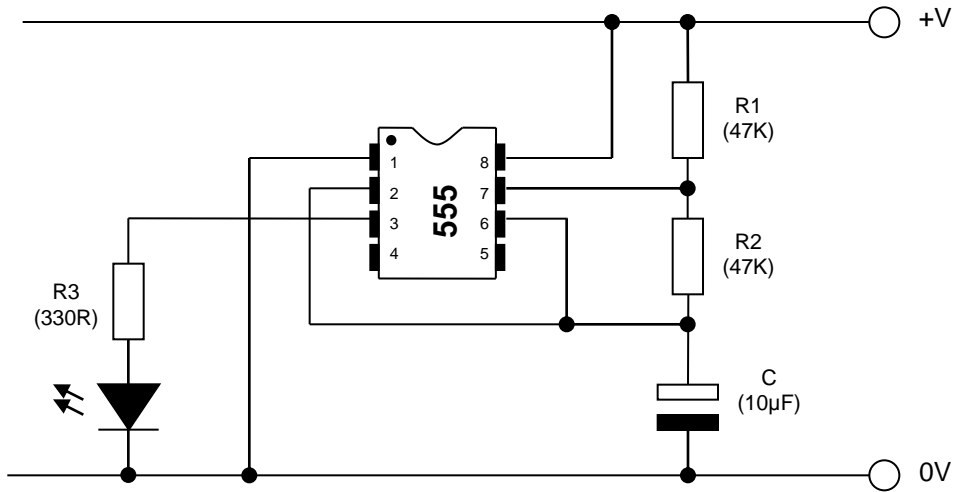
$$\text{Off time } (T_{\text{OFF}}) = 0.693 \times R_2 \times C$$

$$\text{On timer } (T_{\text{ON}}) = 0.693 \times (R_1 + R_2) \times C$$

Prototyping a 555 Astable Circuit

(Process)

The circuit below makes the LED flash at a fixed rate. Plan where you are going to put the components first before using the prototyping board.



Exercise:

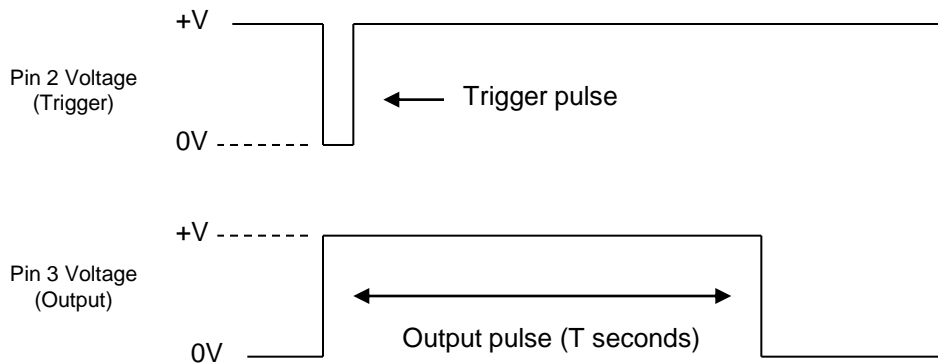
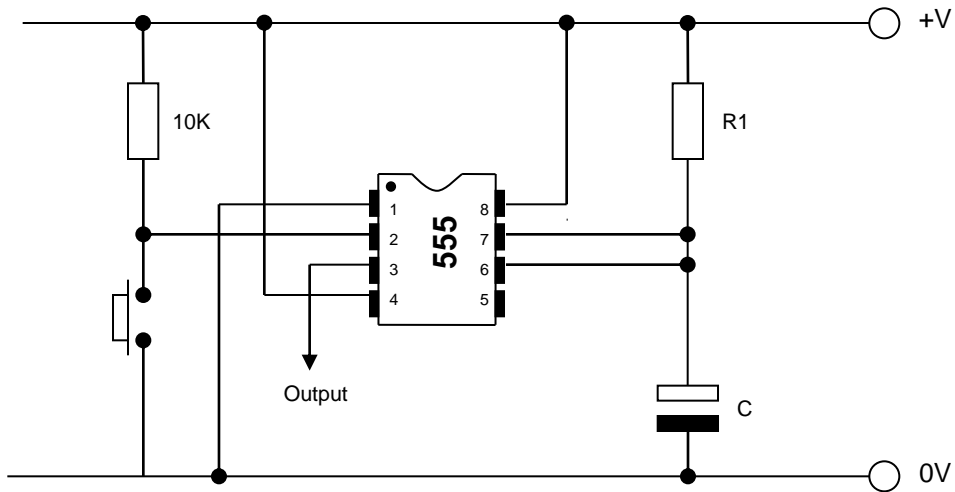
1. Count how many flashes occur one ten seconds?
2. Calculate the frequency.
3. Calculate the On Time.
4. Calculate the Off Time.

Answers:

Monostable Circuit

(Process)

The monostable circuit allows you to produce accurate time delays. In its normal state the output is turned off. But when it receives a trigger pulse the output is switched on for a set period depending on the values of R1 and C.



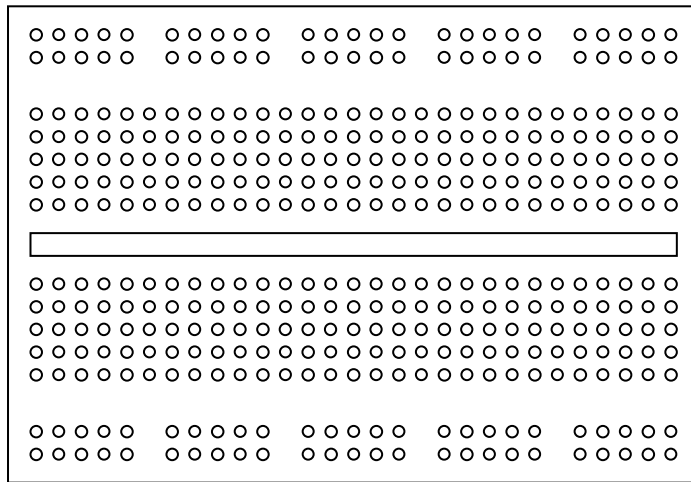
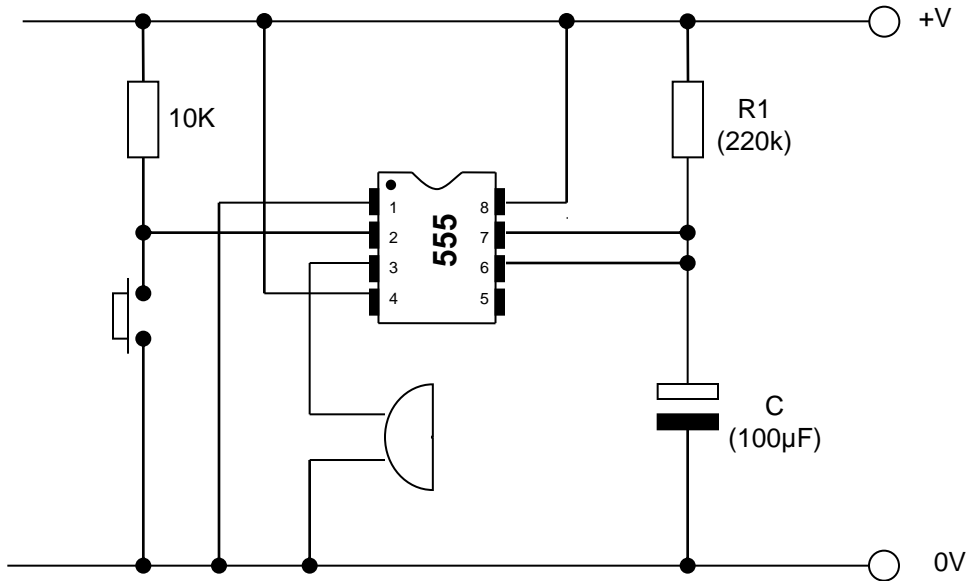
Once the circuit is triggered the period of the output pulse is equal to:

$$T = 1.1 \times R \times C \text{ (Seconds)}$$

Prototyping a 555 Monostable Circuit

(Process)

The circuit shown below will make a buzzer sound for a period set by the timing components R1 and C one the trigger button has been pressed. Plan where you are going to put the components first before using the prototyping board.



Exercise:

1. Once triggered, how long does the buzzer sound for?
2. Calculate the time you would expect the buzzer to sound using the given formula.

Answers: