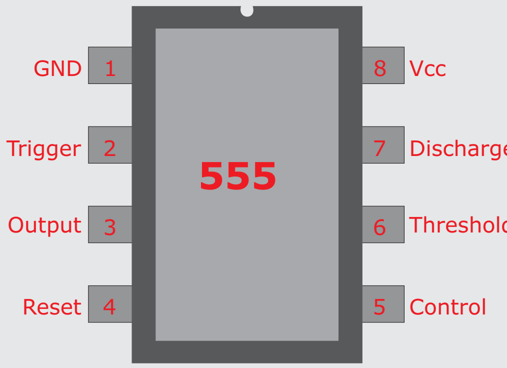
**Tesca Technologies Pvt. Ltd.**

# 555 Timer

## 555 Timer Overview

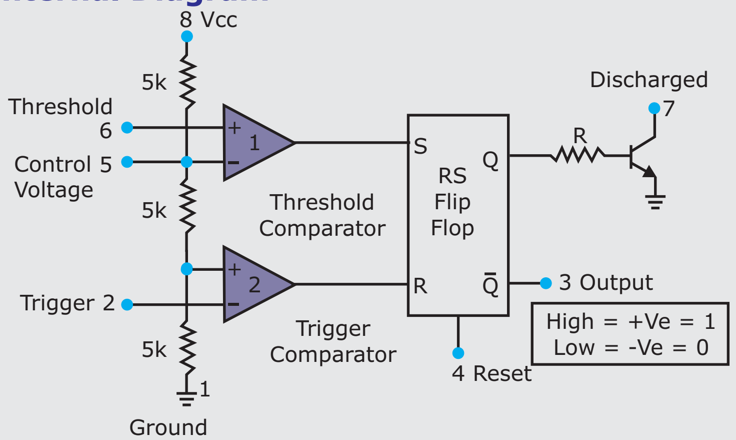
555 timer IC was first introduced in 1971 by the Signetics Corporation.

### Pin Out Diagram

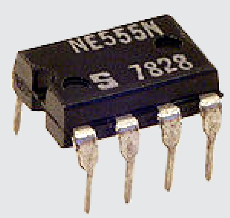



| Pin No. | Function | Name |
|---|---|---|
| 1. | Ground (0V) | Ground |
| 2. | Voltage Below 1/3 Vcc trigger the pulse | Trigger |
| 3. | Pulsating output | Output |
| 4. | Active low, interrupt the timing interval at output | Reset |
| 5. | Provide access to the internal voltage divider default 2/3 Vcc | Control Voltage |
| 6. | The pulse ends when the voltage is greater than control | Threshold |
| 7. | Open collector output, to discharge the capacitor | Discharge |
| 8. | Supply voltage 5V (4.5V-16V) | Vcc |

### Internal Diagram




### Physical Appearance

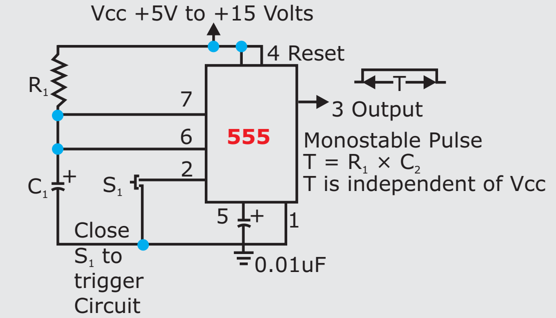


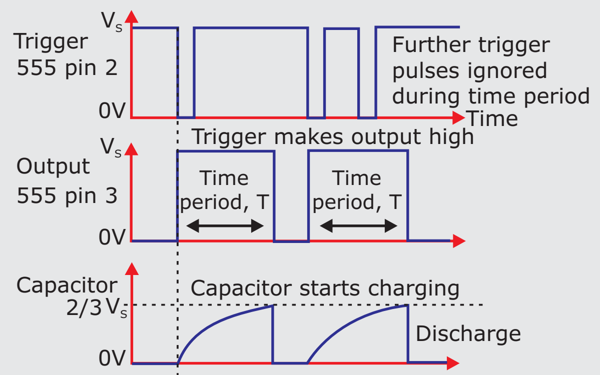
Operating Voltage 4.5 to 15V DC

## Monostable Mode

Also called as one shot multivibrator. It is a pulse generator circuit in which the duration of the pulse is determined by the R-C network. One state of output is stable while the other is quasi-stable (unstable).

Pin 1 is grounded. Trigger input is applied to pin 2. In quiescent condition of output this input is kept at +Vcc to obtain transition of output from stable state to quasi-stable state, a negative going pulse of narrow width and amplitude of greater than +2/3Vcc is applied to pin 2. Output is taken from pin3. Pin4 is usually connected to +Vcc to avoid accidental reset. Pin 5 is grounded through a 0.01 uF capacitor to avoid noise problem. Pin 6 (threshold) is shorted to pin 7. A resistor $R_A$ is connected between pins 6 and 8. At pins 7 a discharge capacitor is connected while pin 88 is connected to supply Vcc.




### Monostable Operation:

The timing period is triggered (started) when the trigger input (555 pin 2) is less than 1/3 Vs, this makes the output high (+Vs) and the capacitor C1 starts to charge through resistor R1. Once the time period has started further trigger pulses are ignored.

The threshold input (555 pin 6) monitors the voltage across C1 and when this reaches 2/3 Vs the time period is over and the output becomes low. At the same time discharge (555 pin 7) is connected to 0V, discharging the capacitor ready for the next trigger.

The capacitor C has to charge through resistance RA. The larger the time constant RAC, the longer it takes for the capacitor voltage to reach $+2/3V_{CC}$.

The time during which the timer output remains high is given as TP = $1.0986R_AC$. Where $R_A$ is in ohms and C is in farads. The above relation is derived as below. Voltage across the capacitor at any instant during changing period is given as $V_c = V_{cc}\ (1-e^{-t/R_AC})$

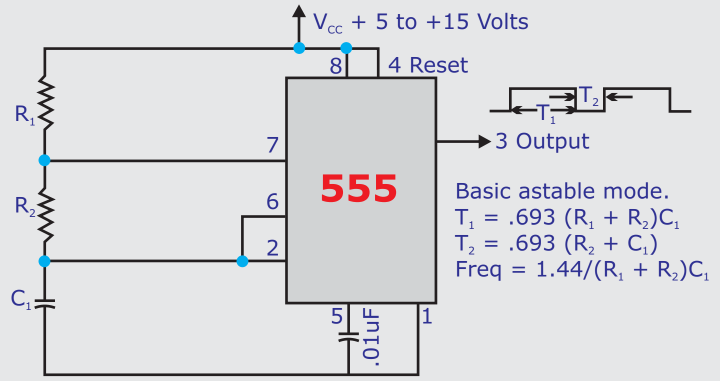
Substituting VC=2/3 $V_{cc}$ in above equation we get the time taken by the capacitor to charge from 0 to $+2/3V_{cc}$.

So, $+2/3V_{cc} = V_c = V_{cc}\ (1-e^{-t/R_AC})$ or $t = R_AC \log_e 3 = 1.0986\ R_AC$

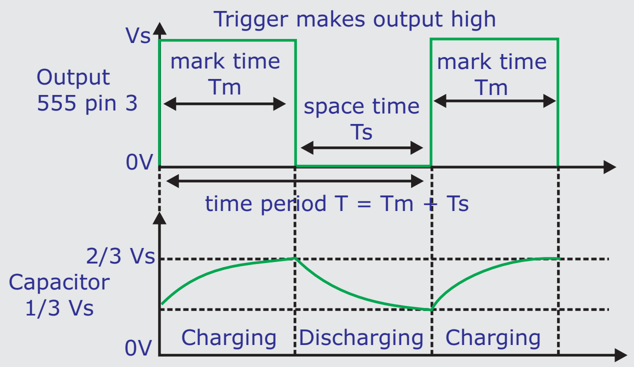
So, pulse width, $t_p = 1.0986\ R_AC \approx 1.1\ R_AC$

## Astable Mode

An astable circuit produces a 'square wave' the circuit will keep re-triggering itself, resulting in a pulse train.




With the output high ($+V_s$) the capacitor $C_1$ is charged by current flowing through $R_1$ and $R_2$. The threshold and trigger inputs monitor the capacitor voltage and when it reaches $2/3V_s$ (threshold voltage) the output becomes low and discharges with current flowing through R2 into the discharge pin. When the voltage falls to $1/3V_s$ (trigger voltage) the output becomes high again and the discharge pin is disconnected, allowing the capacitor to start charging again. This cycle repeats continuously unless the reset input is connected to 0V which forces the output low while reset is 0V.




The Design Formula for the frequency of the pulses is: $f = \dfrac{1.44}{(R_1 + 2R_2) \times C}$

The period t, of the pulse is given by: $t = \dfrac{1}{f} = 0.69(R_1 + 2R_2) \times C$

The HIGH and LOW times of each pulse can be calculated from: HIGH time $= 0.69(R_1 + R_2) \times C$; LOW time $= 069(R_2 \times C)$

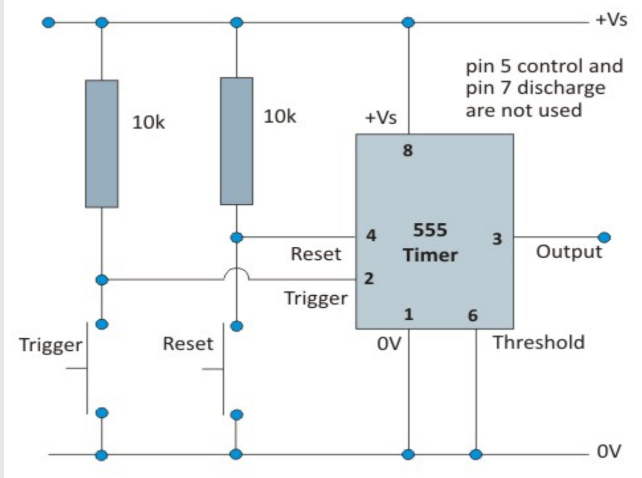
The duty cycle of the waveform, usually expressed as a percentage, is given by: $\text{duty cycle} = \dfrac{\text{HIGH time}}{\text{pulse period time}}$

An alternative measurement of HIGH and LOW times is the mark space rating $\text{mark space ratio} = \dfrac{\text{HIGH time}}{\text{LOW time}}$

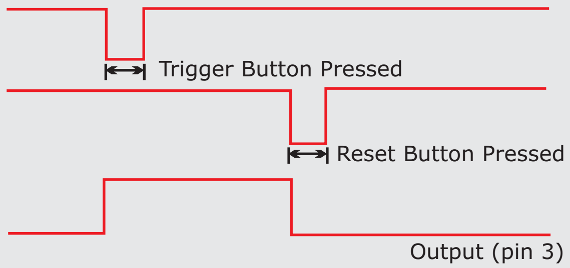
Before calculating a frequency, you should know that it is usual to mark $R_1$ = 1KΩ because this helps to give the output pulses a duty cycle close to 50%, that is, the HIGH and LOW times of the pulses are approximately equal.

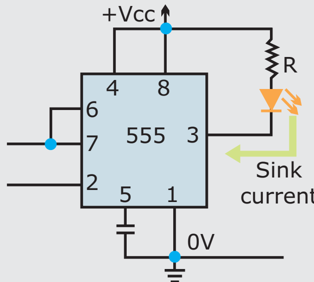
## Bistable Mode

Also called as Schmitt Trigger, has two stable states, HIGH and LOW.

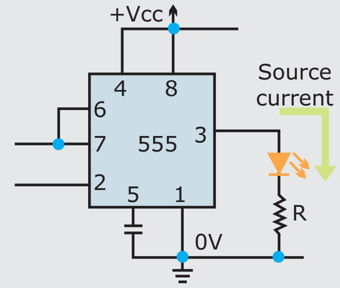



Two resistors $R_1$ and $R_2$ are connected between Vcc and the Trigger and Reset inputs. These resistors hold the Trigger and Reset input high until pushing either the Trigger or Reset push button grounds one or the other of these inputs.

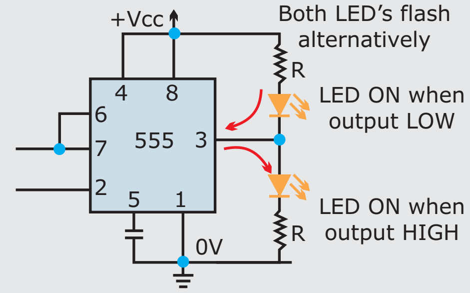



LED On when pin 3 is LOW (Sinking)

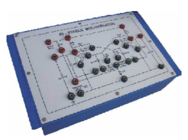



LED ON when pin 3 is HIGH (Sourcing)




33502
Analog Lab

36127
Free Running Multivibrator



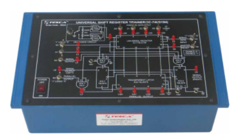
36128
Bi-Stable Multivibrator

36129
Mono-Stable Multivibrator

36185
Discrete Component Trainer

36195
Multivibrators

36236
Multivibrators
(BMV, AMV & MMV) using IC 555



38643
Universal Shift Register

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