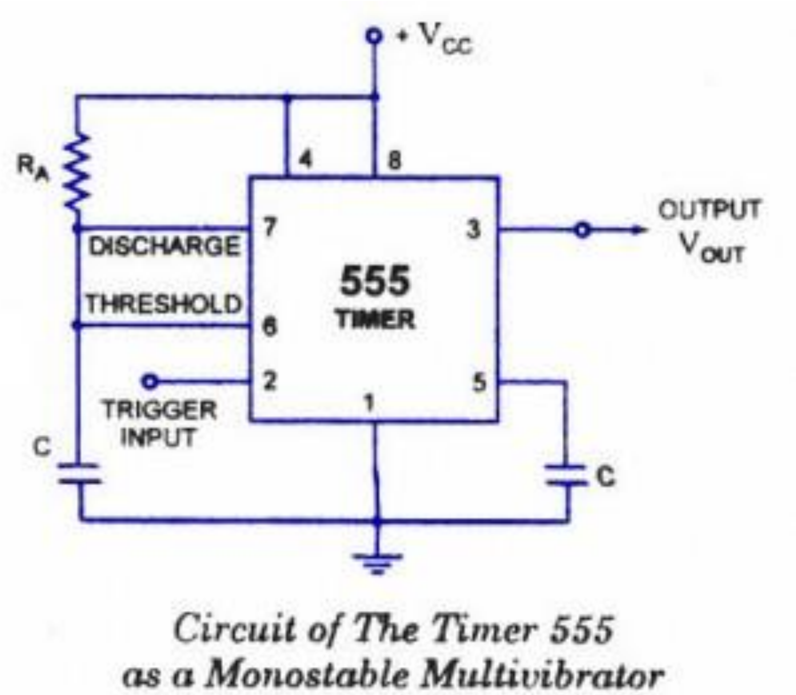
# 555 TIMER AS MONOSTABLE MULTIVIBRATOR

***A monostable multivibrator (MMV) often called a one-shot multivibrator,*** is a pulse generator circuit in which the duration of the pulse is determined by the R-C network,connected externally to the **555 timer**. In such a vibrator, one state of output is stable while the other is quasi-stable (unstable). For auto-triggering of output from quasi-stable state to stable state energy is stored by an externally connected capacitor C to a reference level. The time taken in storage determines the pulse width. The transition of output from stable state to quasi-stable state is accomplished by external triggering. The **schematic of a 555 timer** in monostable mode of operation is shown in figure.

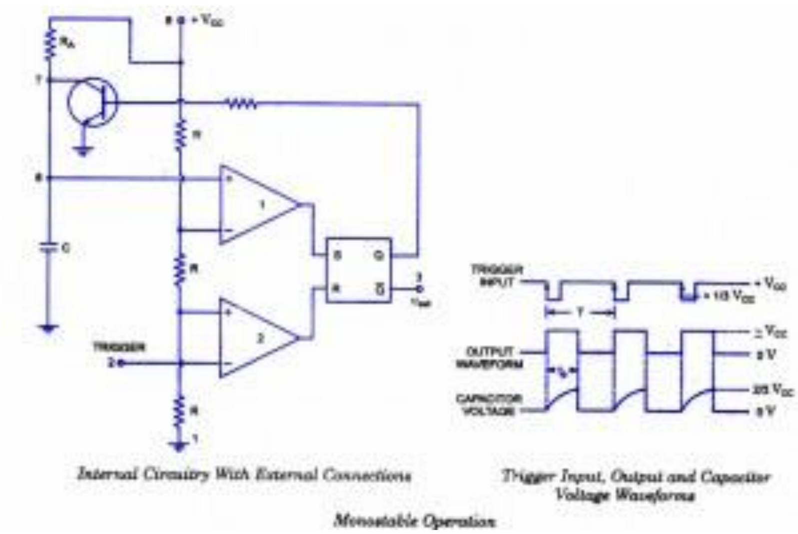



555-timer-monostable-multivibrator

## Monostable Multivibrator Circuit details

Pin 1 is grounded. Trigger input is applied to pin 2. In quiescent condition of output this input is kept at + $V_{CC}$. To obtain transition of output from stable state to quasi-stable state, a negative-going pulse of narrow width (a width smaller than expected pulse width of output waveform) and amplitude of greater than + 2/3 $V_{CC}$ is applied to pin 2. Output is taken from pin 3. Pin 4 is usually connected to + $V_{CC}$ to avoid accidental reset. Pin 5 is grounded through a 0.01 u F 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 8 is connected to supply $V_{CC}$.

## 555 IC Monostable Multivibrator Operation.




555 monostable-multivibrator-operation

For explaining the operation of timer 555 as a monostable **multivibrator**, necessary internal circuitry with external connections are shown in figure.

## The operation of the circuit is explained below:

Initially, when the output at pin 3 is low i.e. the circuit is in a stable state, the transistor is on and capacitor- C is shorted to ground. When a negative pulse is applied to pin 2, the trigger input falls below +1/3 $V_{CC}$, the output of comparator goes high which resets the flip-flop and consequently the transistor turns off and the output at pin 3 goes high. This is the transition of the output from stable to quasi-stable state, as shown in figure. As the discharge transistor is cutoff, the capacitor C begins charging toward $+V_{CC}$ through resistance $R_A$ with a time constant equal to $R_AC$. When the increasing capacitor voltage becomes slightly greater than +2/3 $V_{CC}$, the output of comparator 1 goes high, which sets the flip-flop. The transistor goes to saturation, thereby discharging the capacitor C and the output of the timer goes low, as illustrated in figure.

***Thus the output returns back to stable state from quasi-stable state.***

The output of the Monostable Multivibrator remains low until a trigger pulse is again applied. Then the cycle repeats. Trigger input, output voltage and capacitor voltage waveforms are shown in figure.

## Monostable Multivibrator Design Using 555 timer IC

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

In other words, the RC time constant controls the width of the output pulse. The time during which the timer output remains high is given as

$$t_p = 1.0986\ R_AC$$

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 charging period is given as

$$v_c = V_{CC}\ (1 - e^{-t/R_AC})$$

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

So $+2/3V_{CC}. = V_{CC}. (1 - e^{-t/RAC})$ **or** $t - R_AC \log_e 3 = 1.0986\ R_AC$

So pulse width, $t_P = 1.0986\ R_AC$ **s** $1.1\ R_AC$

The pulse width of the circuit may range from micro-seconds to many seconds. This circuit is widely used in industry for many different timing applications.

Source : http://todayscircuits.blogspot.com/2011/06/555-timer-as-monostable-multivibrator.html#.VUBuwdKqqko