Monostable Operations And Applications Using 555 Timer

One of the most versatile linear integrated circuits is 555 timer. A sample of these applications are monostable and astable multivibrators, digital logic probes, waveform generators, burgalar and toxic alarms. The 555 is a monolithic circuit that can produce accurate and highly stable time delays or oscillations.

Pin diagram of 555 timer:

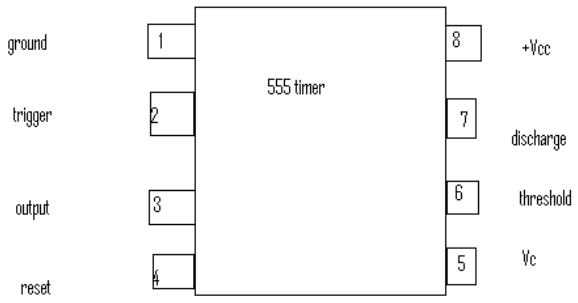

Figure 4.3

555 as a monostable multivibrator:

In the monostable mode, the 555 timer acts as a "one-shot" pulse generator. The pulse begins when the 555 timer receives a signal at the trigger input that falls below a third of the voltage supply. The width of the pulse is determined by the time constant of an RC network, which consists of a capacitor (C) and a resistor (R). The pulse ends when the charge on the C equals 2/3 of the supply voltage. The pulse width can be lengthened or shortened to the need of the specific application by adjusting the values of R and C.

The pulse width of time *t*, which is the time it takes to charge C to 2/3 of the supply voltage, is given by

$$t = RC\ln(3) \approx 1.1RC$$

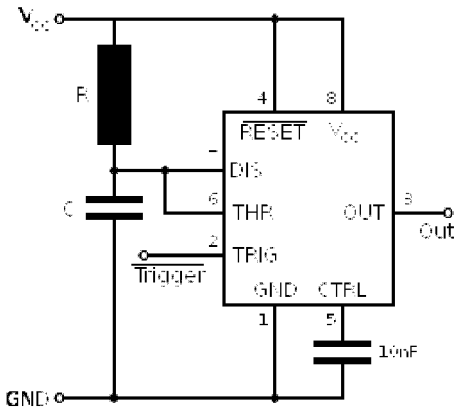

Figure 4.4

Initially when the circuit is in the stable state i.e , when the output is low, transistor Q1 is ON and the capacitor C is shorted out to ground. Upon the application of a negative trigger pulse to pin 2, transistor Q1 is turned OFF, which releases the short circuit across the external capacitor C and drives the output high. The capacitor C now starts charging up towards V_{CC} through R. When the voltage across the capacitor equals 2/3 $V_{CC,}$ comparator 1's output switches from low to high, which inturn drives the output to its low state via the output of the flip-flop. At the same time the output of the flip-flop turns transistor Q1 ON and hence the capacitor C rapidly discharges through the transistor. The output of the monostable remains low until a trigger pulse is again applied. Then the cycle repeats.

The pulse width of the trigger input must be smaller than the expected pulse width of the output waveform. Also the trigger pulse must be a negative going input signal with amplitude larger than 1/3 V_{CC}.

Once triggered, the circuit's output will remain in the high state until the set time, *t* elapses. The output will not change its state even if an input trigger is applied again during this time interval *t*. The circuit can be reset during the timing cycle by applying negative pulse to the reset terminal. The output will remain in the low state until a trigger is again applied.

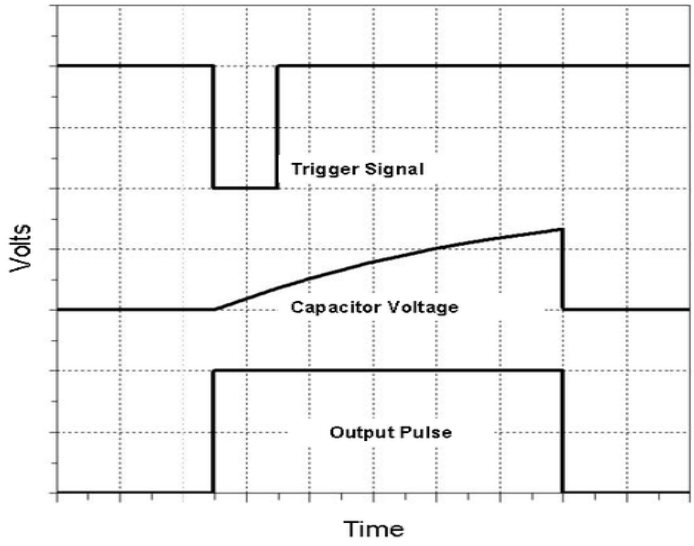

Figure 4.5

Monostable multivibrator applications:

1. Frequency divider
2. Pulse stretcher
3. For driving LED display