ASTABLE AND MONOSTABLE MULTIVIBRATOR USING NE555 TIMER

IC555 is a combination of linear comparators and digital flip flops. The output of comparators is used to set/reset the FF. The output FF circuit is brought out through an amplifier stage. The FF output is also give to a transistor to discharge a timing capacitor. The 555 timer has two basic operational modes: astable and monostable.

Astable operation

When IC555 is to be configured as an astable multivibrator, both the trigger and threshold inputs (pins 2 and 6) to the two comparators are connected together and to the external capacitor. The capacitor charges toward the supply voltage through the two resistors, R1 and R2. The discharge pin (7) connected to the internal transistor is connected to the junction of those two resistors.

When power is first applied to the circuit, the capacitor will be uncharged; therefore, both the trigger and threshold inputs will be near zero volts. The lower comparator sets the control flip-flop causing the output to switch high. That also turns off transistor T1.

That allows the capacitor to begin charging through RA and RB.

As soon as the charge on the capacitor reaches 2/3 of the supply voltage, the upper comparator will trigger causing the flip-flop to reset. That causes the output to switch low. Transistor T1 also conducts. The effect of T1 conducting causes resistor RB to be connected across the external capacitor. Resistor RB is effectively connected to ground through internal transistor T1. The result of that is that the capacitor now begins to discharge through RB.

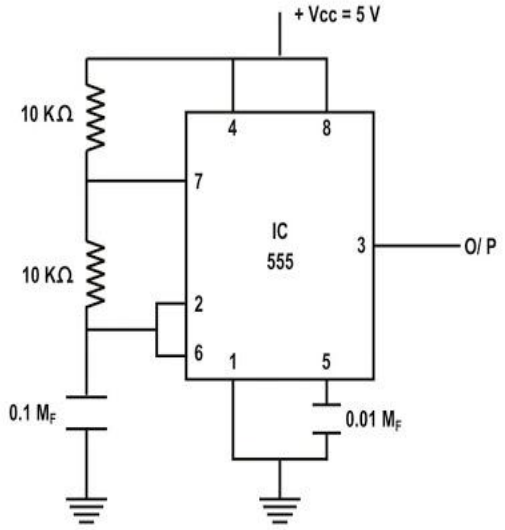
As soon as the voltage across the capacitor reaches 1/3 of the supply voltage, the lower comparator is triggered. That again causes the control flip-flop to set and the output to go high. Transistor T1 cuts off and again the capacitor begins to charge. That cycle continues to repeat with the capacitor alternately charging and discharging, as the comparators cause the flip-flop to be repeatedly set and reset. The resulting output is a continuous stream of rectangular pulses.

Monostable operation

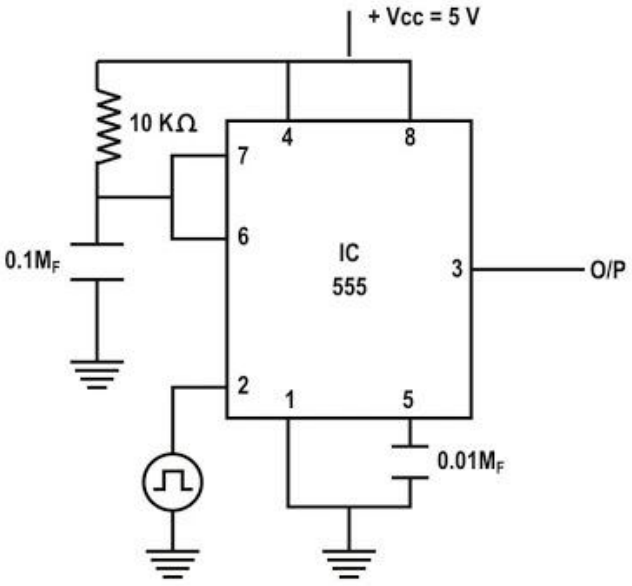
The trigger input is initially high (about 1/3 of +V). When a negative-going trigger pulse is applied to the trigger input, the threshold on the lower comparator is exceeded. The lower comparator, therefore, sets the flip-flop. That causes T1 to cut off, acting as an open circuit. The setting of the flip-flop also causes a positive-going output level which is the beginning of the output timing pulse.

CIRCUIT DIAGRAM

ASTABLE MULTIVIBRATOR



MONOSTABLE MULTIVIBRATOR



DESIGN

Astable Multivibrator

$T = 0.693(R_A+2R_B)\,C$

$= 0.7\,(R_A+2R_B)\,C$

Let $R_A=R_B=R$

$T = 2.1\,RC$

Assume $R=10K\Omega$ and $C = 0.1\mu F$ for $T=2.1msec$

Also $T_{ON} = 0.7(R_A+R_B)C = 1.4msec$

$T_{OFF} = 0.7RBC = 0.7msec$

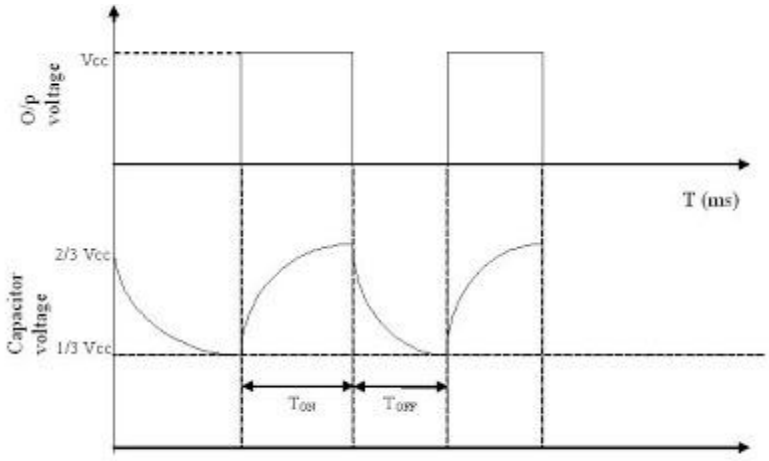
Monostable Multivibrator

$T_{ON} = 1.1\,RC$

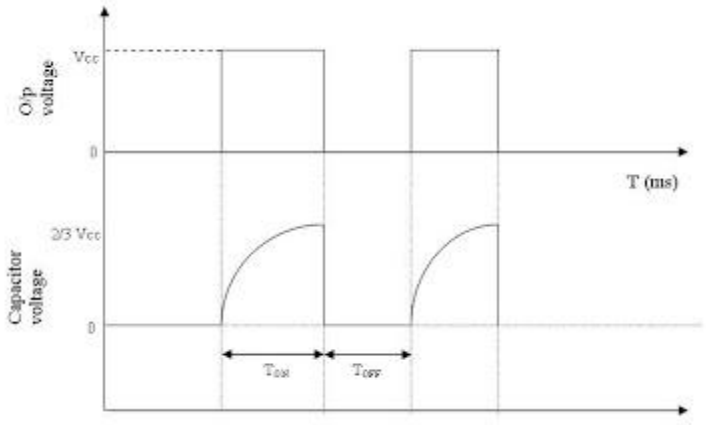
Assume $R=10K\Omega$ and $C=0.1\mu F$ for $T_{ON}=1.1msec$

MODEL GRAPH

ASTABLE MULTIVIBRATOR



MONOSTABLE MULTIVIBRATOR



The capacitor now begins to charge through the external resistor. As soon as the charge on the capacitor equal 2/3 of the supply voltage, the upper comparator triggers and resets the control flip-flop. That terminates the output pulse which switches back to zero. At this time, T1 again conducts thereby discharging the capacitor.

Whenever a trigger pulse is applied to the input, the 555 will generate its single-duration output pulse. Depending upon the values of external resistance and capacitance used, the output timing pulse may be adjusted and the duration of the output pulse is approximately equal to $T = 1.1 \times R \times C$

Source: http://mediatoget.blogspot.in/2012/01/astable-and-monostable-multivibrator.html