Monostable multivibrator using IC 555

By – Miss G. G. jadhav

M.Sc., SET

DEPARTMENT OF PHYSICS

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Content

- Introduction
- IC 555 pin configuration
- Functions and working of IC 555
- Charging and discharging of capacitor
- Monosatble multivibrator
- Experiment of monostable multivibrator

THEORY OF EXPERIMENT

Introduction

- An electronic circuit that generates square wave or non -sinusoidal is known as multivibrator.

  Three types of multivirator

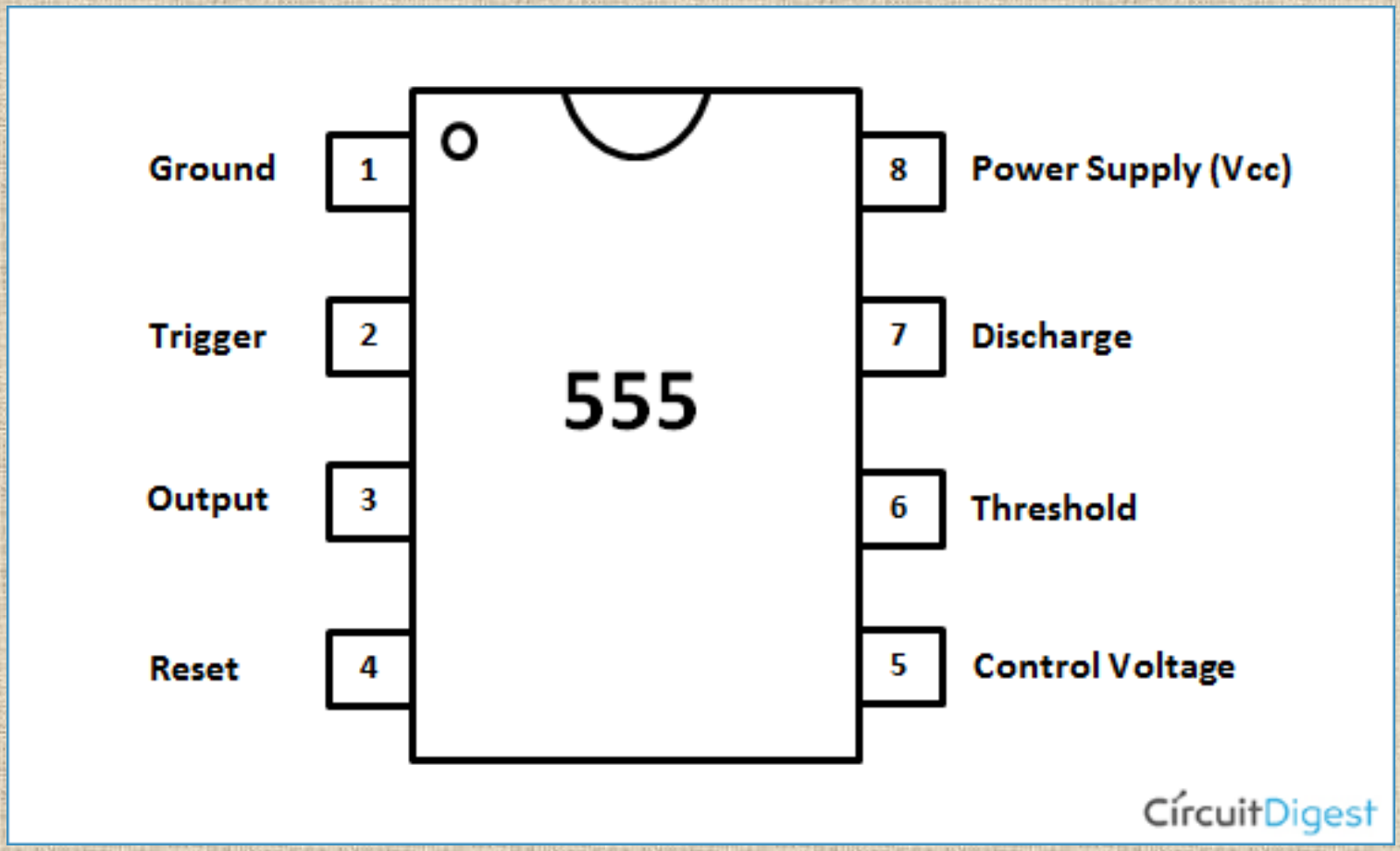
  1) Astable multivirator
  2) Monostable multivibrator
  3) Bistable multivibrator

- Monostable multivibrator have only one stable state.
- These multivibrators can be designed using IC 555.

IC 555

- It is an circuit which generate waveform or pulse of definite time interval.
- It is an eight pin integrated circuit (IC)
- IC 555 basically has
  1) Two comparators
  2) R-S flip - flop
  3) Two transistor T1 and T2
  4) resistor network and an inverter

Pin configuration of IC 555



Functions of components

- It contains
- Voltage divider network :- it consist of three 5KΩ resistor
- Comparator :- two comparators compares the two inputs that are applied to it and produce an output. Upper comparator and Lower comparator .
- R-S flip- flop :-It operates with either positive clock transition or negative clock transition.

Truth table of RS flip-flop

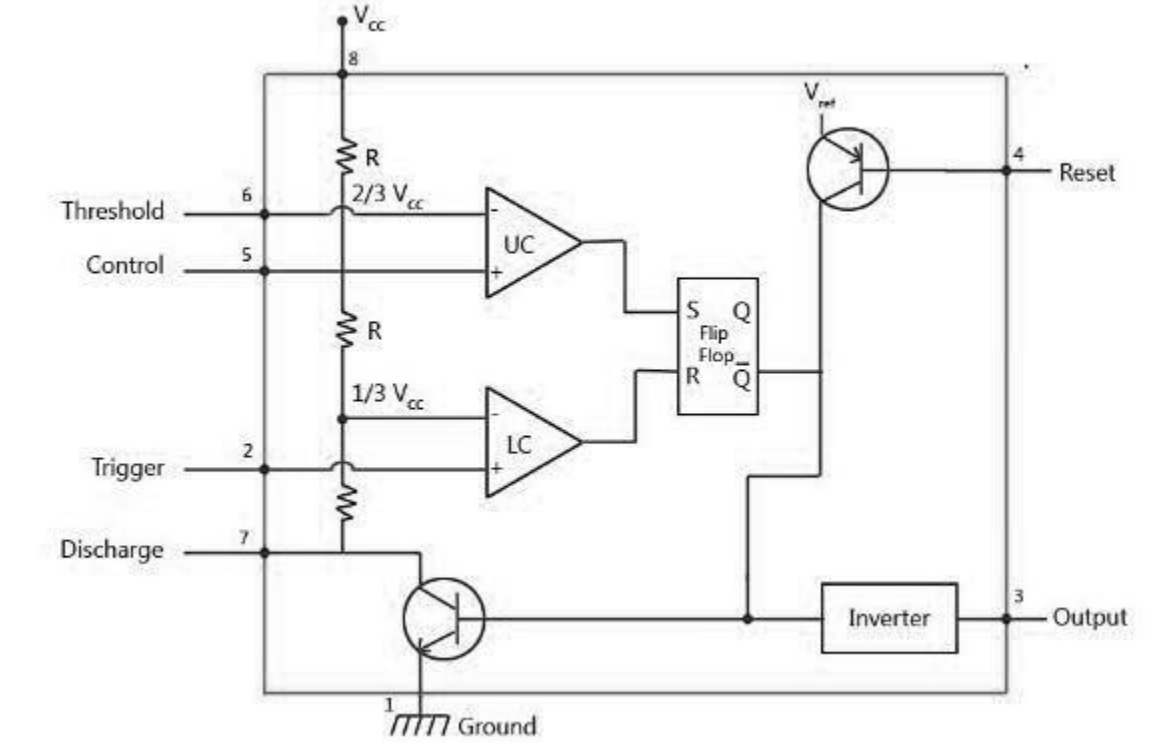
INPUTS		OUTPUT	STATE
S	R	Q	
0	0	No Change	Previous
0	1	0	Reset
1	0	1	Set
1	1	-	Forbidden

●Transistor and Inverter

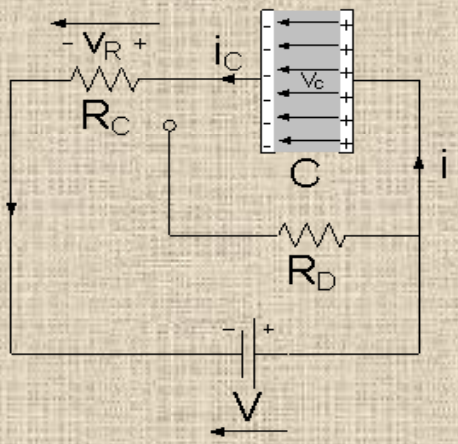
It consist of one npn transistor Q_1 and other is pnp transistor Q_2 .

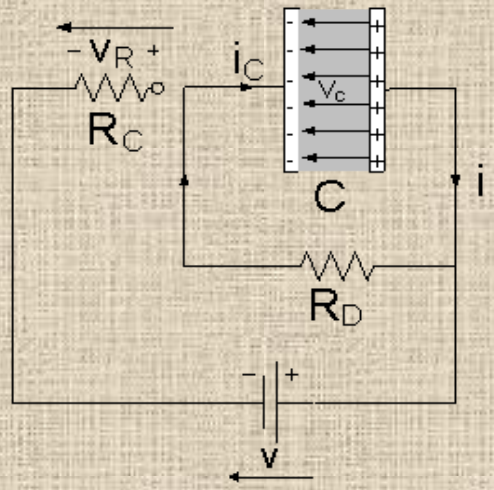
Inverter is used to performs the inverting action and also amplifies the power level.

●Working of IC 555



- # Charging and discharging of capacitor
- A capacitor is a passive device that stores energy in its Electric Field and returns energy to the circuit whenever required.
- When a capacitor is connected to a circuit with Direct current source ,two processes ,which are called “charging” and “discharging” the capacitor will happen in specific conditions.

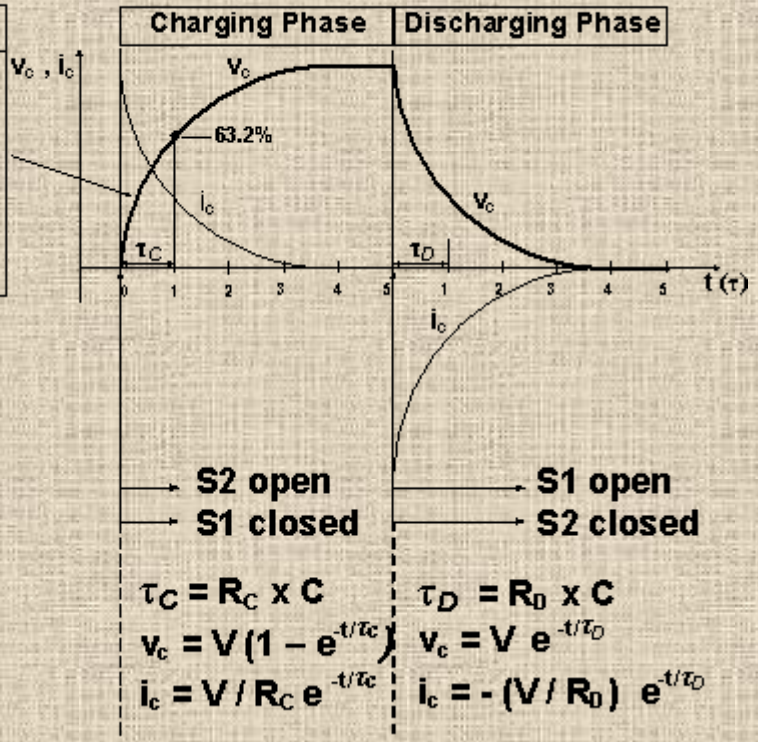




- The product of Resistance R and capacitance C is called the Time constant, which characterizes the rate of charging and discharging of a capacitor.

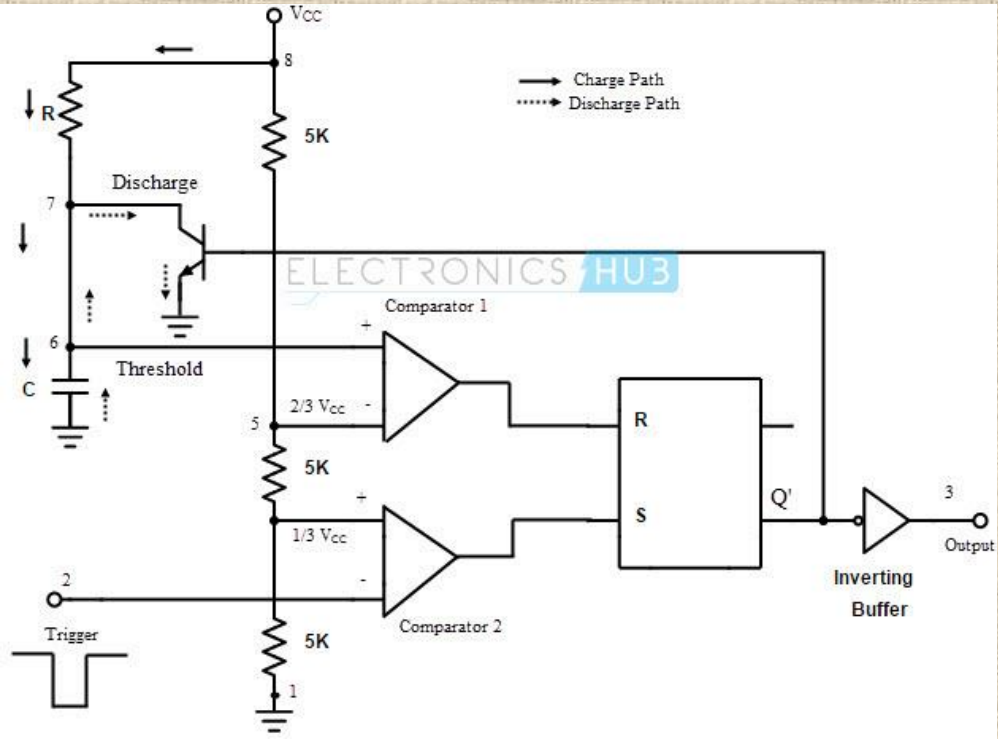
Charging Phase
V_c versus τ_c

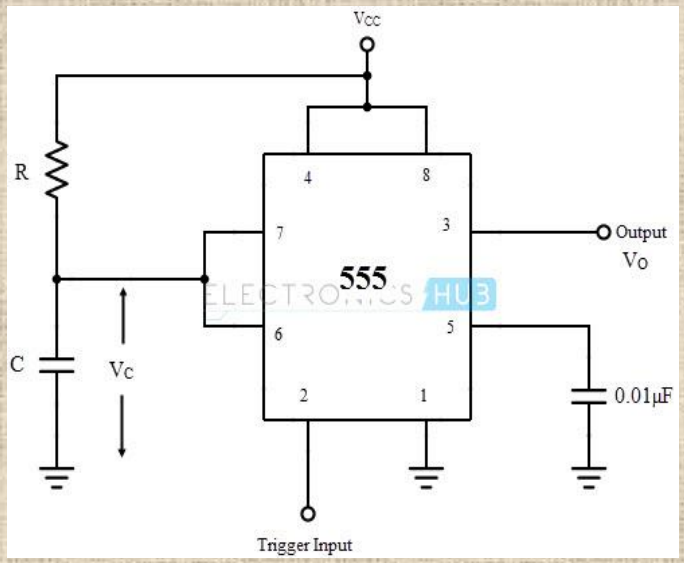
τ_c	Magnitude (V)
0	0%
1 τ_c	63.2%
2 τ_c	86.5%
3 τ_c	95%
4 τ_c	98.2%
5 τ_c	100%



- The Voltage V_c and the current i_c during the charging phase and Discharging phase.

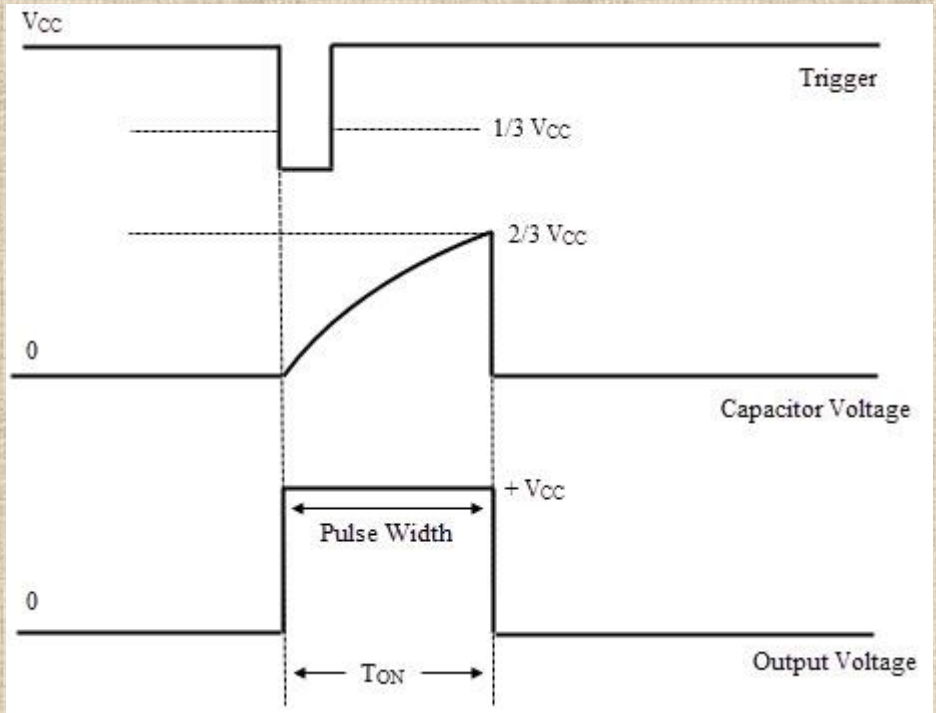
Monostable multivibrator





R is connected between pin 4,pin 8 and pin 7, pin 6. The capacitor C is connected between pin 6 and pin 7 and ground . Trigger input pulse of voltage is given externally to pin 2. pin 1 and pin 5 is ,capacitor is grounded. Pin 4 and 8 are connected to +Vcc which can be between 5 v to 15 v .

The waveforms of the monostable operation are shown below.



Expression for frequency

voltage VC can be written as

$$VC = VCC\ (1 - e^{-t/RC})$$

When the capacitor voltage is 2/3 VCC, then

$$2/3\ VCC = VCC\ (1 - e^{-t/RC})$$

$$2/3 = 1 - e^{-t/RC}$$

$$e^{-t/RC} = 1/3$$

$$-\ t/RC = \ln (1/3)$$

$$-\ t/RC = -1.098$$

$$t = 1.098\ RC$$

$$\therefore t \approx 1.1\ RC$$

Advantages

1) It is inexpensive

2) The circuit is simple

3) It is very accurate monostable to produce variety of application.

Disadvantages

- The time between the application of the next trigger pulse has to be greater than the preset RC time constant of the circuit to allow the capacitor time to charge and discharge.

Experiment

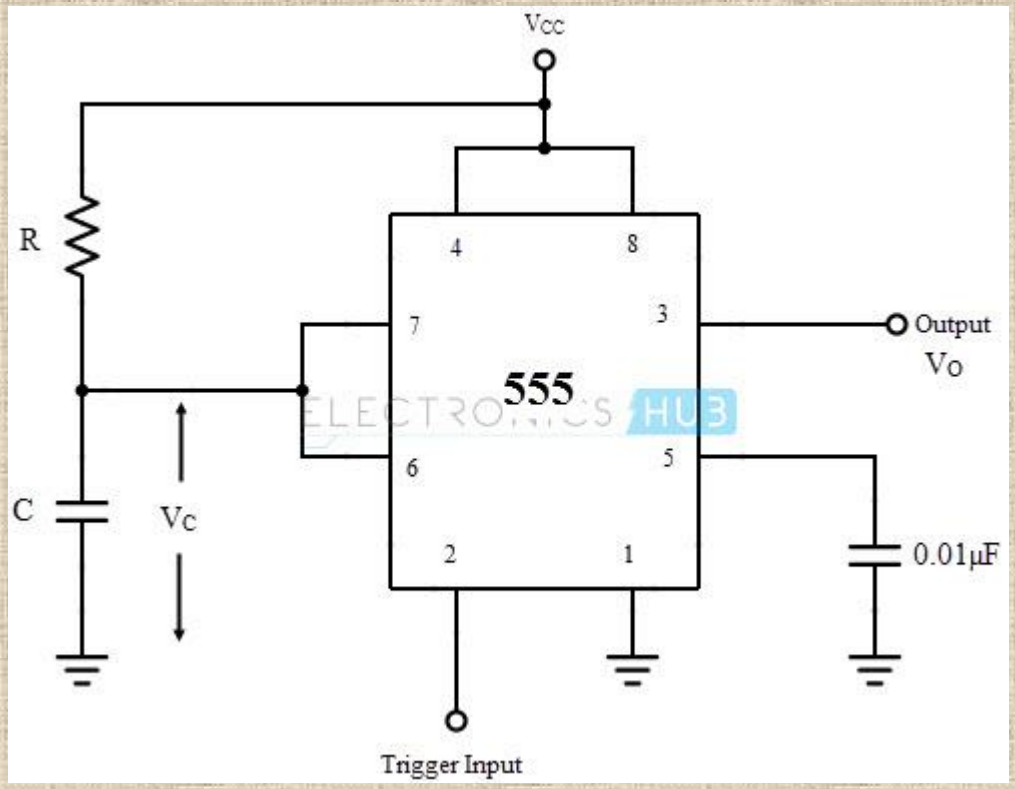
Experiment

Aim:- Draw the circuit diagram of monostable multivibrator using IC 555. trace the waveform measure the frequency for there different sets of corresponding resistance and verify the observed frequency and verify the observed frequency by the given formula.

Apparatus :- IC 555, LED bulb, stop watch, connecting wires etc .

Components:- IC 555, resistor, capacitor, etc.

Circuit diagram :-



Formula :- $1.1\times RC$

Observation table :-

Obs. No.	$R_A\ \Omega$	T (s)	Mean (s)	Observed Frequency (Hz)	Calculated Frequency (Hz)
1	67×10^3	17.62	17.56	0.056	0.061
		17.56			
		17.50			
2	100×10^3	27.03	27.05	0.036	0.041
		27.31			
		26.82			

Calculation :-

1) $T = 1.1 \times RC$

$= 1.1 \times 67 \times 10^{3} \times 220 \times 10^{-6}$

$= 16214 \times 10^{-3}$ sec

$F = 1/T$

$= 1/ 16214 \times 10^{-3}$

$= 0.061$ Hz

2) $T = 1.1 \times RC$

$= 1.1 \times 100 \times 10^{3} \times 220 \times 10^{-6}$

$= 2420 \times 10^{-2}$

$F = 1/T$

$= 1/ 2420 \times 10^{-2}$

$= 0.041$ Hz

Result :- In this experiment the experimental and theoretical frequency are in good agreement .

Conclusion :- Multivibrator can be used and designed by using IC 555.

THANK YOU