INSTITUTE OF INFORMATION TECHNOLOGY

JAHANGIRNAGAR UNIVERSITY

Number of Lab Report : 01

Name of Lab Report : Setting up astable multi-vibrator using 555 timer.

Course Tittle : Digital Logic Design Lab

Course Code : ICT – 2104

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Submitted To

Dr. Md. Sazzadur Rahman

Assistant Professor

IIT – JU

Submitted By

MD. Shakil Hossain

Roll – 2023

2nd year 1st Semester

IIT – JU

MD. Shakil Hossain

Roll – 2023

Experiment No : 01

Experiment Name: Setting up astable multi-vibrator using 555 Timer

Objectives:

(1) To assemble the circuit of astable multi-vibrator using 555 timer.

(2) To know the characteristics of 555 timer

(3) To observe the output.

Theory :

IC 555 timer is an analog IC used for generating accurate time delay or oscillations. The entire ~~ex~~ circuit is housed in an 8-pin package. A series connection of three resistors inside the IC sets the reference voltage levels to the two comparators at $\frac{2}{3}V_{cc}$ and $\frac{1}{3}V_{cc}$, the output of these comparators setting or ~~s~~ resetting the flip-flop unit. The output of the flip-flop is then brought out through an output buffer stage. In the stable state, $\overline{Q}$ = high and Q = low. This makes the output low, because of the buffer which is actually an inverter. The flip-flop circuits also operates a transistor in which, the collector usually being driven low to discharge a timing capacitor connected at pin 7.

The description of each pin is described below:

Pin 1 : (Ground) → Supply ground is connected to this pin.

Pin 2 : (Trigger) → This pin is used to give the trigger input in monostable multivibrator.

Pin 3 : (Output)

Pin 4 : (Reset) → A logic low at this pin will reset output. For normal operation pin 4 is connected to V_{cc}.

Pin 5 : (Control) → Voltage applied to this pin will control the instant at which the comparator switches. When this pin is not used, it is bypassed to ground using a 0.01 μF capacitor.

Pin 6 : (Threshold) → If the voltage applied to this pin is greater than $2/3 V_{cc}$, flip-flop gets reset.

Pin 7 : (Discharge) → When the output is low, the external capacitor is discharged through this pin.

Pin 8 : (V_{cc}) → The power supply pin.

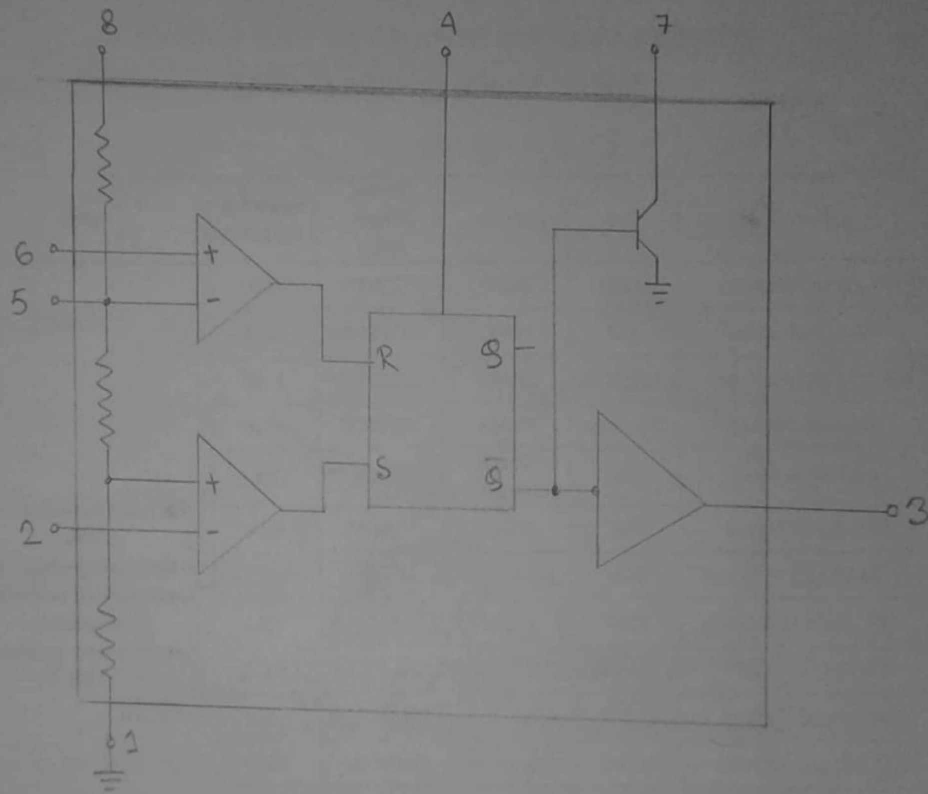

Fig : IC 555 functional block diagram.

Astable multivibrator using IC 555 :-

One popular application of IC 555 is an astable multivibrator or clock circuit. We can built it using 2 external circuit and a capacitor to set the timing interval of the output signal. Capacitor C charges toward V_{cc} through external resistors R_A and R_B. The capacitor voltage rises until it goes above $2/3\, V_{cc}$.

The voltage is the threshold voltage at pin 6, which drives comparator 1 to trigger the flip-flop (Q low, $\bar{Q}$ high) so that the output at pin 3 goes low. And also the discharge transistor is driven on, causing the output, at pin 7, to discharge the capacitor through resistor R_B. The capacitor voltage then decreases until it drops below the trigger level $1/3 V_{cc}$. The flip-flop is triggered so that the output goes back high and the discharge is turned off, so that the capacitor can again charge.

Apparatus :

1. Breadboard
2. IC 555
3. Resistor (R_A and R_B)
4. Capacitor (C_1)
5. Power supply (5V).
6. Connecting wires
7. LED.

Working Diagram:

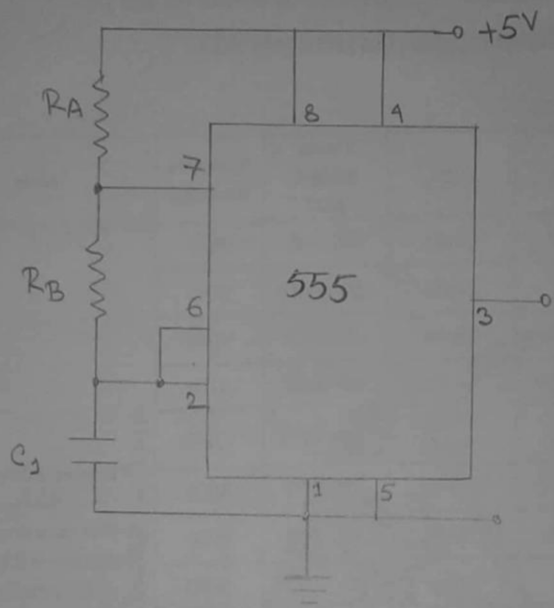

Fig: astable multivibrator circuit using IC 555.

Results :

Assume, $R_A = 1\,M\Omega$

$R_B = 100\,K\Omega$

$C = 1\,\mu F$

$t_L = 0.693 \times R_B \times C$

$= 69.3$ milliseconds

$t_H = 0.693 \times (R_A + R_B) \times C$

$= 0.693 \times (1M\Omega + 100K\Omega) \times 1\mu F$

$= 762.3$ milliseconds

$T = T_L + T_H$

$= (69.3 + 762.3)\ mS = 831.6\ mS$

$f = \frac{1}{T} = 1.203 \times 10^{-3}\ Hz$

Duty cycle $= \frac{T_H}{T} \times 100\%$

$= \frac{762.3}{831.6} \times 100\%$

$= 91.67\%$

Discussion:

If we ~~let~~ increase the value of C, we will get more cycle time, which will at the same time reduce frequency. Increasing R_A will increase Time High (T_H) but will ~~reduce T_L~~ leave Time low (T_L) unaffected. Increasing R_B will increase T_H and T_L and reduce the duty cycle (down to a minimum of 50%). In this type of circuit, the duty cycle can never be 50% or lower.

Reference:

(1) Digital Systems Principles and Application by Ronald J. Tocci, 12th edition.
[Date: 23/01/2021]

(2) www.ohmslawcalculator.com
[Access date: 23/01/2021]

(3) www.Quora.Com
[Access date: 23/01/2021]

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