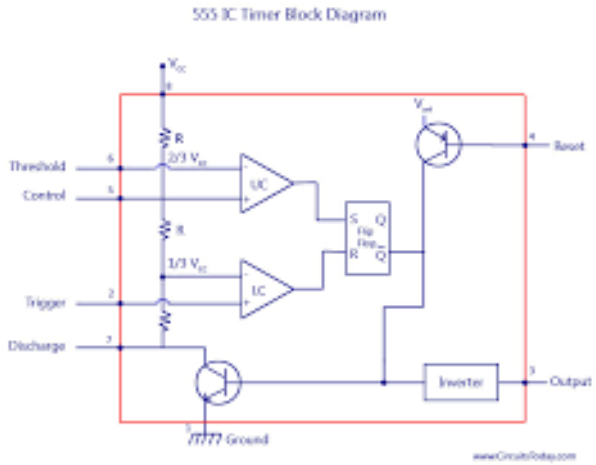
A REPORT ON
NE555 TIMER astable multivibrator

By **Jyotsana Sampatharao**

Introduction:



The **555 TIMER IC** was introduced in **1971** by **Hans. R Camenzind** by the American company **Signetics**. It is still widespread in use due to its low price, ease of use and stability. It is an IC (chip) used in a variety of timer, pulse generation, and oscillator applications. The **555 TIMER OSCILLATOR** commonly known as **555 TIMER** especially designed to accurately produce the required output wavefrom with the addition of just a few timing components. It is designed to produce a variety of output wavefroms with addition of an external RC network. These can be used to provide time delays, as an oscillator and as a flip-flop element among other applications.

Depending on the manufactures, the standard 555 TIMER package includes 25 transistors, 2 diodes and 15 resistors on a silver chip installed in an 8-pin mini dual-in-line package (DIP-8). Variants consist of combining multiple chips on one board. The “NE” and “SE” prefix letters of the original Signetic parts numbers, **NE555** and **SE555**, were temperature designations for analog chips, where “NE” was commercial temperature family and “SE” was military temperature family. The NE555 parts were of commercial temperature range; 0 degree Celsius to 70 degree Celsius, and the SE555, part number designated the military temperature range, -55 degree Celsius and 125 degree Celsius. These were available in both high-reliability metal can (T package) and inexpensive epoxy plastic (V package) packages. As well as the 555 TIMER there is also available the **NE556 TIMER OSCILLATOR** which combines two

individual 555's within a single 14 pin DIP package and low power CMOS versions of the single 555 TIMER such as the 7555 and LMC555 which use MOSEFT transistors instead.

Some important features of the 555 TIMER:

For a 555 TIMER working as a flip flop or as a multi-vibrator, it has a particular set of configurations. Some of the major features of the 555 TIMER would be,

*It operates from a wide range of power ranging from 5 Volts to 18 Volts supply voltage.

* Sinking or sourcing 200 mA of load current.

*The external components should be selected properly so that the time intervals can be made into several minutes along with the frequencies exceeding several hundred kilohertz.

*The output of a 555 TIMER can drive transistor-transistor logic (TTL) due to its high current output.

*It has a temperature stability of 50 parts per million (ppm) per degree Celsius change in temperature which is equivalent to 0.005%/ degree Celsius.

* The duty cycle of timer is adjustable.

*Also, the maximum power dissipation per package is 600mW and its trigger and reset inputs have logic compatibility.

Modes:

The 555 TIMER chip can be operated either as a very accurate **Monostable** , **Bistable** or **Astable Multivibrator** to produce a variety of applications such as one-shot or delay timers, pulse generations, LED and lamp flashers, alarms and tone generation, logic clocks , frequency division , power supplies and converters etc…

The 555 generally operates in the following modes:

* Monostable
* Astable
* Bistable
* Schmitt Trigger

ASTABLE MODE (free running)

This means there will be no stable level at the output. So the output will be swinging between high and low. This character of unstable output is used as a clock or square wave output for many applications.

MONO-STABLE MODE (one shot)

This configuration consists of one stable and one unstable state. The stable state can be chosen either high or low by the user. If the stable output is set at high (1), the output of the timer is high (1). At the application of an interrupt, the timer output turns low (0). Since the low state is unstable it goes to high (1) automatically after the interrupt passes. Similar is the case for a low stable monostable mode.

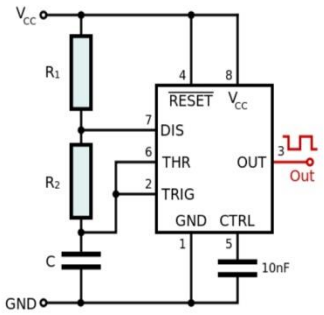
BISTABLE MODE (flip flop)

In bistable mode, both the output states are stable. At each interrupt, the output changes from low (0) to high (1) and vice versa, and stays there. For example, if we have a high (1) output, it will go low (0) once it receives an interrupt changes the status.

SCHMITT TRIGGER MODE (inverter)

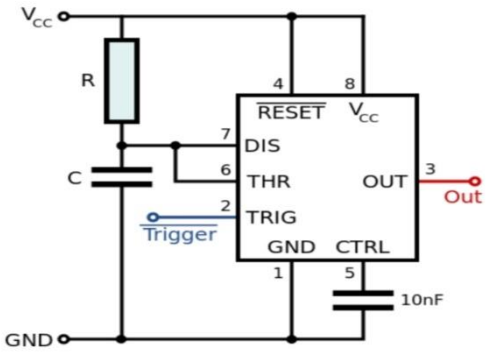
The 555 operates as a Schmitt trigger inverter gate which converts a noisy input into a clean digit output. The input signal should be connected through a series capacitor which then connects to the trigger and threshold pins. A resistor divider, from Vcc to GROUND, is connected to the previous tied pins. The reset pin is tied to Vcc.

Astable



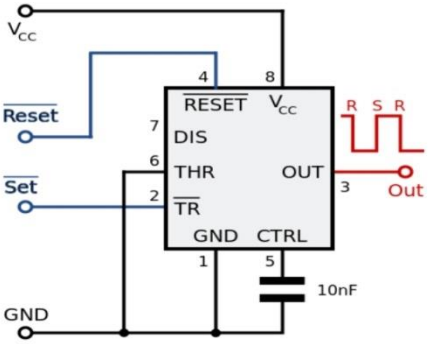
Schematic of a 555 timer in astable mode.

Monostable



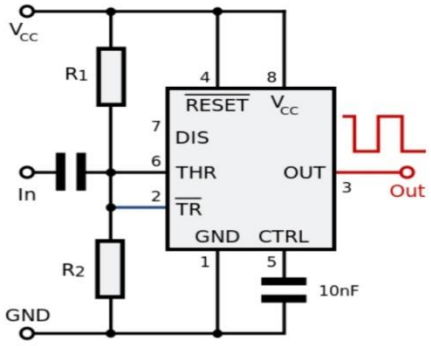
Schematic of a 555 in monostable mode. Example values R = 220K, C = 100nF for debouncing a pushbutton.

Bistable



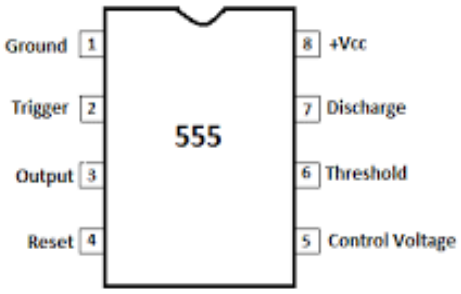
Schematic of a 555 in bistable flip-flop mode. High-value pull-up resistors should be added to the two inputs.

Schmitt trigger



Schematic of a 555 in bistable schmitt trigger mode. Example values R1 and R2 = 100K, C = 10nF.

Description of PINs of 555 TIMER:



PIN 1 known as ***GROUND*** connects the 555 TIMER to the negative (0V) supply rail.

PIN 2 known as ***TRIGGER***, The negative input to comparator No 1. A negative pulse on this pin "sets" the internal flip-flop when the voltage drops below 1/3 Vcc causing the output to switch from a "LOW" to a "HIGH" state.

PIN 3 known as ***OUTPUT*** , The output pin can derive any TTL circuit and is capable of sourcing or sinking up to 200mA of current at an output voltage equal to approximately Vcc -1.5V so small speakers, LEDs or motors can be connected directly to the output.

PIN 4 known as ***RESET***, This pin is used to “reset” the internal flip flop controlling the state of the output, pin 3. This is an active –low input and is generally connected to a logic “1” level when not used to prevent any unwanted resetting of the output.

PIN 5 known as ***CONTROL VOLTAGE,*** this pin controls the timing of 55 by overriding the 2/3 Vcc level of the voltage divider network. By applying a voltage to this pin the width of the output signal can be varied independently of the RC timing network. When not used it is connected to ground via a 10nF capacitor to eliminate any noise.

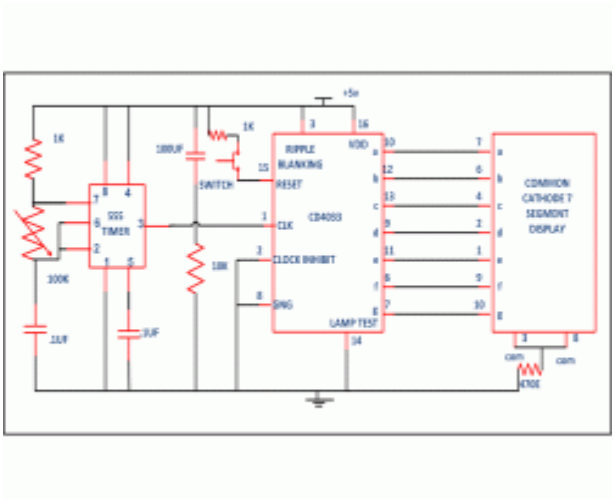
PIN 6 known as ***THERSHOLD***, the positive input to comparator No.2. This pin is used to reset the flip-flop when the voltage is applied to it exceeds 2/3 Vcc causing the output to switch from “HIGH” to “LOW” state. This pin connects directly to the RC timing circuit.

PIN 7 known as **DISCHARGE**, The discharge pin is connected directly to the collector of an internal NPN transistor which is used to “discharge” the timing capacitor to ground when the output at pin 3 switches “LOW”.

PIN 8 known as ***SUPPLY +VCC,*** This is the power supply pin and for general purpose TTL 555 TIMERs is between 4.5V and 15V.

Applications:

DISPLAY DIVIDER



In the following circuit we have used a 555 TIMER in astable oscillator mode to provide clock signal to input of IC CD4033 to start its counting which can be

displayed on 7 SEGMENT DISPLAY . Here reset switch is used to reset the counting any time needed by the user. Whenever you press the switch, clock input receives the signal and counter advances one by one up to 9 and again starts counting from 0 on each successive pressing of switch.

References:

https://www.electronics-tutorials.ws/waveforms/555_timer.html

https://en.wikipedia.org/wiki/555_timer_IC

https://www.electronicsforu.com/resources/learn-electronics/555-timer-working-specifications