

Understanding of IC555 Timer and IC 555 Timer Tester

Himani Goyal

Abstract— As 555 timer is robust, stable and most commonly used IC in the area of electronics and also use in many electronic circuits. IC 555 is a square wave generator and its duty cycle range from 50% to 100%. The time delay in the circuit is provided by an oscillator. 555 timer IC got its name from the three 5 kilo-ohm resistor attached as a pattern of voltage divider as shown in the below figure. While in the full circuit 555 timer IC consists of many other components via 16 resistors, 20 transistors and 2 diodes also included flip-flop.

Index Terms—ic technology,ic555 timer,ic555 timer tester

I. INTRODUCTION

NE555 timer IC is a 8 pin dip package IC which performs array of timing tasks in the electronic circuits. There is a huge list of experiments which can be performed with 555 IC, that's why it is very popular among electronics hobbyists. But before using the IC, one should check it that it is working properly or not. So we have described a simple circuit through which you can test 555 timer IC.

II. REQUIRMENTS

- 1.IC-NE555
- 2.R1-68K
- 3.R2-39K
- 4.R3,R4-20E
- 5.C1-1uF/25V
- 6.C2-1nF
- 7.LED1,LED2

III. DESCRIPTION

555 Timer IC has basically three functional parts. They are as follows:

1. **Comparator:** It is used to compare two voltages at the input level which is inverting (-) one and non inverting (+). If the voltage at the non-inverting is higher than other than the output is high. For ideal comparator input resistance is infinite.
2. **Voltage Divider:** As the input resistance is infinite in the comparator so the voltage among all three resistors is being divided equally. Value across each resistor is $V_{in}/3$.
3. **Flip/Flop:** Digital electronic device with memory. If the input is high while low at R then the output at Q is high. It means when S is high Q output is high and if R is high Q output is low.

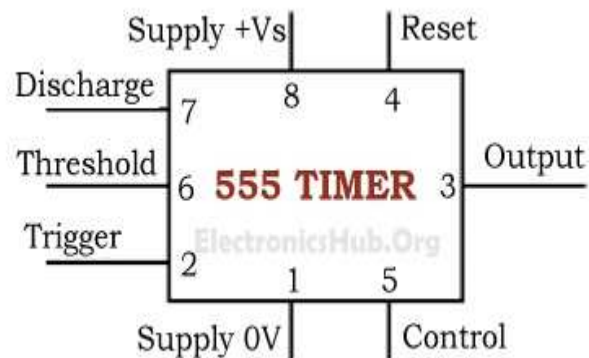
Manuscript Received on December 2014.

Dr. Himani Goyal, Dean, Department of Electronics and Communications, M.L.R Institute of Technology, Dundigal, Hyderabad-43 Telengana, India.

To get more knowledge about 555 timer, one should need to get aware about the pins. Description of the 555 Timer pins is given below.

IV. METHODOLOGY COMPRESSING METHOD:-

STEP 1 Before knowing more about IC first have a glance at the pin diagram.



Pin Diagram of 555 Timer Image Source: ElectronicsClub.info/555timer.htm IC 555 timer is a renowned device in the field of electronics, although the majority of the people does not have any information regarding the internal circuitry as well as about the pins present on the IC. So here I have tried to explain the working of this IC so that you can build many projects around it and do your experiments.

STEP 2

Pin Description of 555 Timers:

1. **Trigger Input:** If the input $<1/3V_s$ than at that condition output is high. It is useful in examining the timing capacitor discharging in a stable circuit.
2. **Threshold Input:** This pin is attached to the first comparator at the non-inverting input terminal. If the threshold voltage is higher than $(2/3)V_{in}$ than the output is high at the comparator thus reset the output from high to low in the flip flop.
3. **Reset Input:** As based on the internal condition of the flip-flop this pin reset the output of the flip-flop. To get rid of any noise interference an active low pin is attached to high state till any reset operator is required. So for most of the time it is attached to the supply voltage as in the figure.
4. **Control Input:** An external voltage applied to this terminal changes the threshold as well as trigger voltage. Thus by imposing a voltage on this pin or by connecting a pot between this pin and ground, the pulse width of the output wave can be varied. when not used, the control pin should be bypassed to ground with a 0.01uF capacitor to prevent any noise

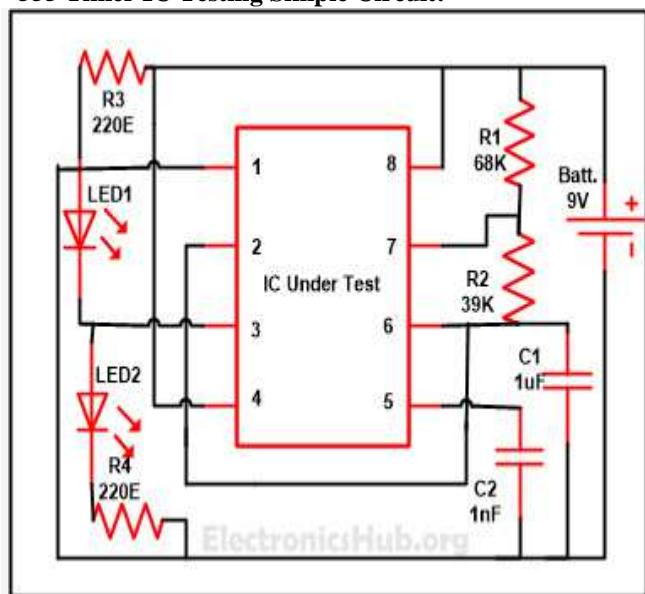
problem.

5. **Discharge Pin:** When the timer output is low this pin is connected to 0 volts. It is used to discharge the timing capacitor in astable and monostable mode.
6. **Ground:** The reference point or ground point of IC555 is connected to the ground terminal of the dc voltage source, Voltages of the entire circuit are measured with respect to this terminal.
7. **Output:** The output of timer and the load is connected to this pin.
8. **Supply:** This voltage must be a pure ripple free DC voltage which is obtained by connecting a positive regulated power supply.

STEP 3

NE555 timer IC is a 8 pin dip package IC which performs array of timing tasks in the electronic circuits. There is a huge list of experiments which can be performed with 555 IC, that's why it is very popular among electronics hobbyists. But before using the IC, one should check it that it is working properly or not. So we have described a simple circuit through which you can test **555 timer IC**.

555 Timer IC Testing Simple Circuit:



555 Timer IC Testing Circuit

In this circuit, we have used the NE555 IC as an astable multivibrator and when power is provided to circuit, the LEDs will start blinking which will show that the IC is working. The blinking rate of LEDs can be changed by increasing or decreasing the values of resistor R1 and R2 and capacitor C1.

You can calculate the time duration with the help of formula given below:

$$T = 0.7(R1+2R2)*C1 \text{ in seconds.}$$

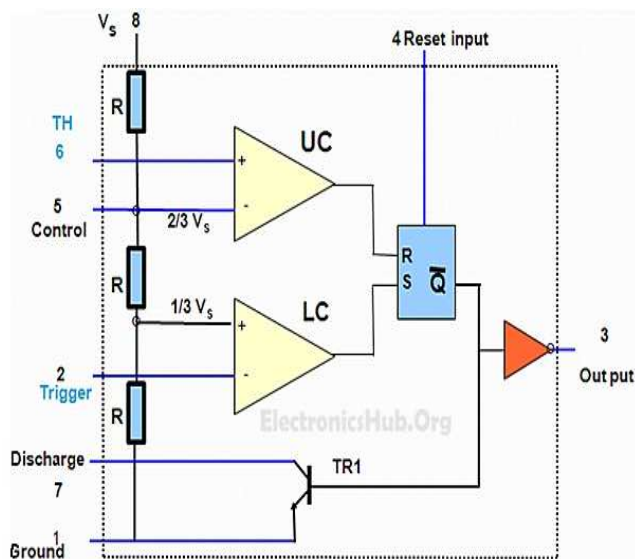
As soon as power supply is provided, C1 will start charging through R1 and R2. When the voltage across C1 rises above 2/3 of supply voltage, the internal Flip Flop toggles. As a result, pin 7 becomes low and C1 starts discharging. When the voltage across C1 goes below 1/3 of supply voltage, the internal Flip Flop resets and pin 7 goes high. The C1 again starts charging. All this will happen only when your IC is in good condition. According to the frequency as set with the help of resistor R1, R2 and capacitor C1 charging and discharging take place and LED1 and LED2 will flash

accordingly. From these observations, we can conclude that IC NE555 is faulty or not.

I. DECOMPRESSING METHOD:-

As 555 timer is robust, stable and most commonly used IC in the area of electronics and also use in many electronic circuits. IC 555 is a square wave generator and its duty cycle range from 50% to 100%. The time delay in the circuit is provided by an oscillator. 555 timer IC got its name from the three 5 kilo-ohm resistor attached as a pattern of voltage divider as shown in the below figure. While in the full circuit 555 timer IC consists of many other components via 16 resistors, 20 transistors and 2 diodes also included flip-flop.

The internal circuitry of the IC in the simplest form is shown below:



555 Timer – Internal Arrangement

Important Note: The 555 can be used with a supply voltage (Vs) in the range 4.5 to 15V (18V absolute maximum).

Functional Parts of 555 Timer IC:

555 Timer IC has basically three functional parts. They are as follows:

1. **Comparator:** It is used to compare two voltages at the input level which is inverting (-) one and non inverting (+). If the voltage at the non-inverting is higher than other than the output is high. For ideal comparator input resistance is infinite.
2. **Voltage Divider:** As the input resistance is infinite in the comparator so the voltage among all three resistors is being divided equally. Value across each resistor is $V_{in}/3$.
3. **Flip/Flop:** Digital electronic device with memory. If the input is high while low at R then the output at Q is high. It means when S is high Q output is high and if R is high Q output is low.

To get more knowledge about 555 timer, one should need to get aware about the pins. Description of the 555 Timer pins is given below.

Modes of 555 Timer:

The 555 Timer has three operating modes and the details are explained below.

1. Monostable Mode: In this mode, the 555 functions as a “one-shot” pulse generator. Applications comprise many



things viz timers, missing pulse detection also included bounce free switches, touch switches as well as frequency divider, capacitance measurement and pulse-width modulation (PWM) and many more.

2. Astable Mode: In this mode, the 555 work as a free running mode. The output of this astable multivibrator toggle between low and high continuously there by generating a train of pulse, that is why it is known as pulse generator. They are used as an inverter and also used in many of the internal part of the radio. Selecting a thermistor as a timing resistor allows the use of the 555 in a temperature sensor.

II. ILLUSTRATIVE EXAMPLE

The 555 has three operating modes:

- **Monostable** mode: In this mode, the 555 functions as a "one-shot" pulse generator. Applications include timers, missing pulse detection, bouncefree switches, touch switches, frequency divider, capacitance measurement, pulse-width modulation (PWM) and so on.
- **Astable** (free-running) mode: The 555 can operate as an oscillator. Uses include LED and lamp flashers, pulse generation, logic clocks, tone generation, security alarms, pulse position modulation and so on. The 555 can be used as a simple ADC, converting an analog value to a pulse length. E.g. selecting a thermistor as timing resistor allows the use of the 555 in a temperature sensor: the period of the output pulse is determined by the temperature. The use of a microprocessor based circuit can then convert the pulse period to temperature, linearize it and even provide calibration means.
- **Bistable** mode or Schmitt trigger: The 555 can operate as a flip-flop, if the DIS pin is not connected and no capacitor is used. Uses include bounce-free latched switches.

III. CONCLUSION

The IC was designed in 1971 by Hans Camenzind under contract to Signetics, which was later acquired by Philips (now NXF). Depending on the manufacturer, the standard 555 package includes 25 transistors, 2 diodes and 15 resistors on a silicon chip installed in an 8-pin mini dual-in-line package (DIP-8).^[2] Variants available include the 556 (a 14-pin DIP combining two 555s on one chip), and the two 558 & 559s (both a 16-pin DIP combining four slightly modified 555s with DIS & THR connected internally, and TR is falling edge sensitive instead of level sensitive). The **NE555** parts were commercial temperature range, 0 °C to +70 °C, and the **SE555** part number designated the military temperature range, -55 °C to +125 °C. These were available in both high-reliability metal can (T package) and inexpensive epoxy plastic (V package) packages. Thus the full part numbers were NE555V, NE555T, SE555V, and SE555T. It has been hypothesized that the 555 got its name from the three 5 kΩ resistors used within,^[3] but Hans Camenzind has stated that the number was arbitrary.^[1] Low-power versions of the 555 are also available, such as the 7555 and CMOS TLC555.^[4] The 7555 is designed to cause less supply noise than the classic 555 and the manufacturer

claims that it usually does not require a "control" capacitor and in many cases does not require adecoupling capacitor on the power supply. Those parts should generally be included, however, because noise produced by the timer or variation in power supply voltage might interfere with other parts of a circuit or influence its threshold voltages.

REFERENCES

- [1] Ward, Jack (2004). The 555 Timer IC – An Interview with Hans Camenzind. The Semiconductor Museum. Retrieved 2010-04-05
- [2] **Jump up** van Roon, Fig 3 & related text.
- [3] **Jump up** Scherz, Paul (2000) "Practical Electronics for Inventors", p. 589. McGraw-Hill/TAB Electronics. ISBN 978-0-07-058078-7. Retrieved 2010-04-05.
- [4] **Jump up** Jung, Walter G. (1983) "IC Timer Cookbook, Second Edition", pp. 40-41. Sams Technical Publishing; 2nd ed. ISBN 978-0-672-21932-0. Retrieved 2010-04-05.
- [5] **Jump up** van Roon, Chapter "Monostable Mode". (Using the 555 timer as a logic clock)
- [6] **Jump up** <http://www.national.com/ds/LM/LM555.pdf>
- [7] **Jump up** <http://www.555-timer-circuits.com/operating-modes.html>
- [8] van Roon Chapter: "Astable operation".
- [9] **Jump up** <http://www.customsiliconsolutions.com/products-for-ASIC-solutions/standard-IC-products.aspx>
- [10] **Jump up** 15 X-REL Semiconductor Data Sheet, 38100 Grenoble France
- [11] **Jump up** Engdahl, pg 1.
- [12] **Jump up** Engdahl, "Circuit diagram of PC joystick interface"

AUTHORS PROFILE



Dr Himani, is a Senior Member of IEEE and Member of IEEE Nanotechnology Council and IEEE Sensors Council. She is Vice Editor in Chief of Blue Eyes Intelligence International Journal, also an Editorial Board member of IJARSET. She has completed her Ph.D. degree from Center for Energy Studies, Indian Institute of Technology, Delhi. She did her BE in Electronics Engineering from R.A.I.T., University Of Mumbai, Mumbai, India in 1995 and M.Tech. in Alternate Hydro Energy Systems from, IIT Roorkee in 2000-2001. She has also done her Masters in Business Administration with specialization in International Marketing from University of Pune. She is working in the area of Automatic Control of Small hydro power plants and has published and presented number of papers in international conferences. Dr Himani has more than 20 years of experience in teaching, research and development. She is at present working as Dean of Electronics and Communication Engineering department at MLR Institute of Technology, Dundigal, Hyderabad- 5000 43.