# Timer IC 555

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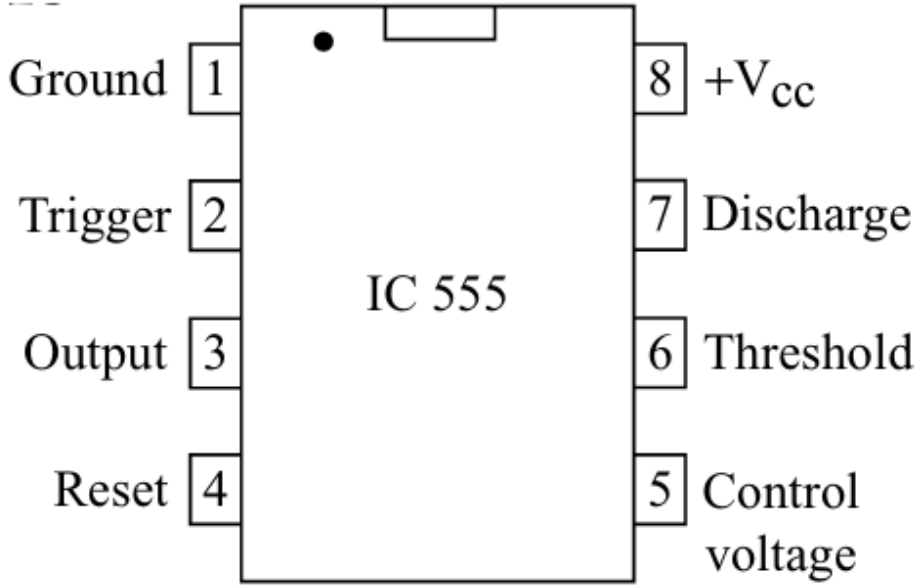
# IC 555:


The 555 timer is a very popular timer IC widely used in the field of electronics and control engineering.

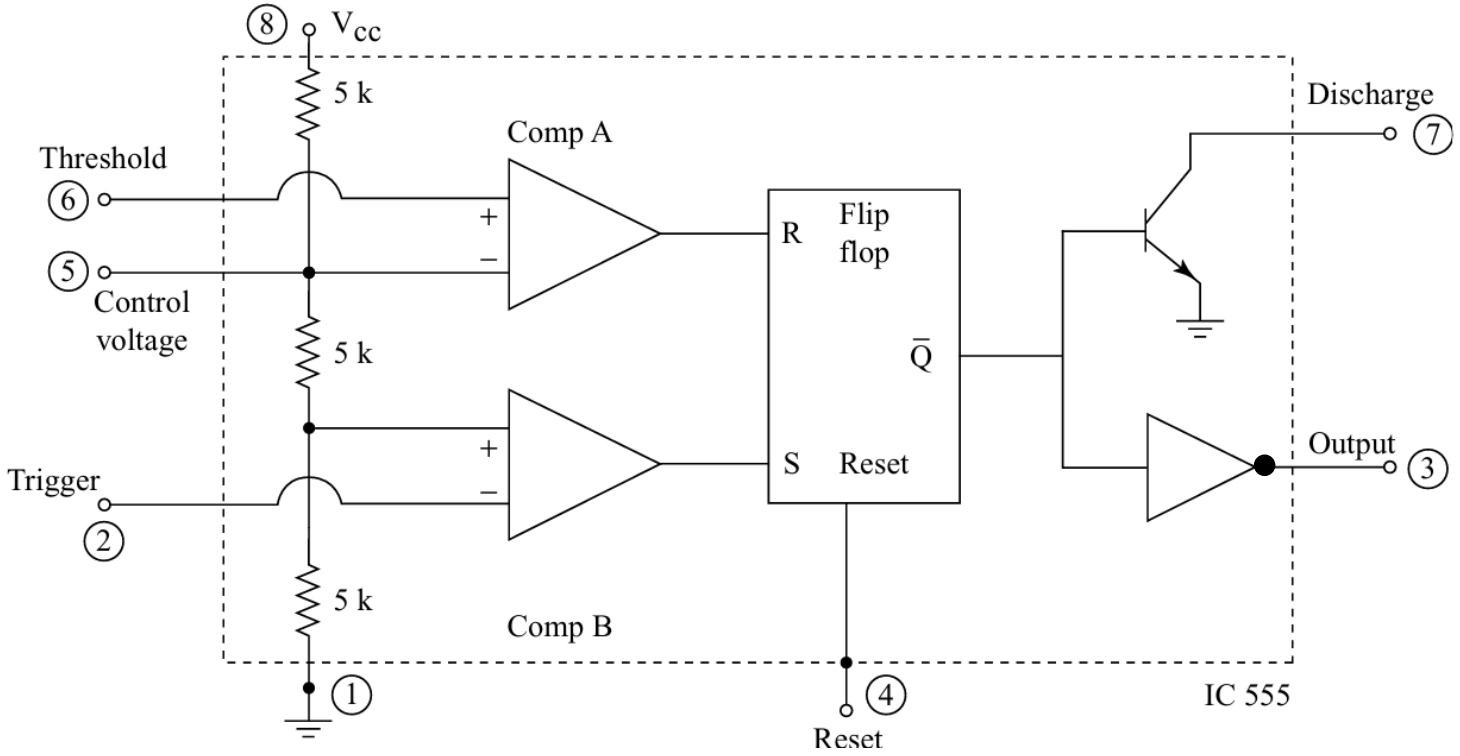
These ICs can be used in any circuit which requires some sort of time control.

It can be used to generate various types of pulses, time delays, and also for Pulse Width Modulation (PWM).

The 555 timer is an eight pin IC which contains 23 transistors, 2 diodes, and 16 resistors on a single silicon chip.

It can directly drive the loads up to 200 mA.

# FUNCTIONAL BLOCK DIAGRAM OF IC 555:




The timer consists of two comparators (op-amps), one R–S flip-flop, two transistors and three equal-value (5 kΩ) resistors in series forming a voltage divider.

Because of the use of three 5 kΩ resistors, the timer is called 555.

The three resistors of equal value, i.e., R = 5 kΩ, divides the $V_{CC}$ into $\frac{1}{3}V_{CC}$.

The behavior of the 555 timers is controlled by the three input pins: **Threshold, Trigger, and Control Voltage**.

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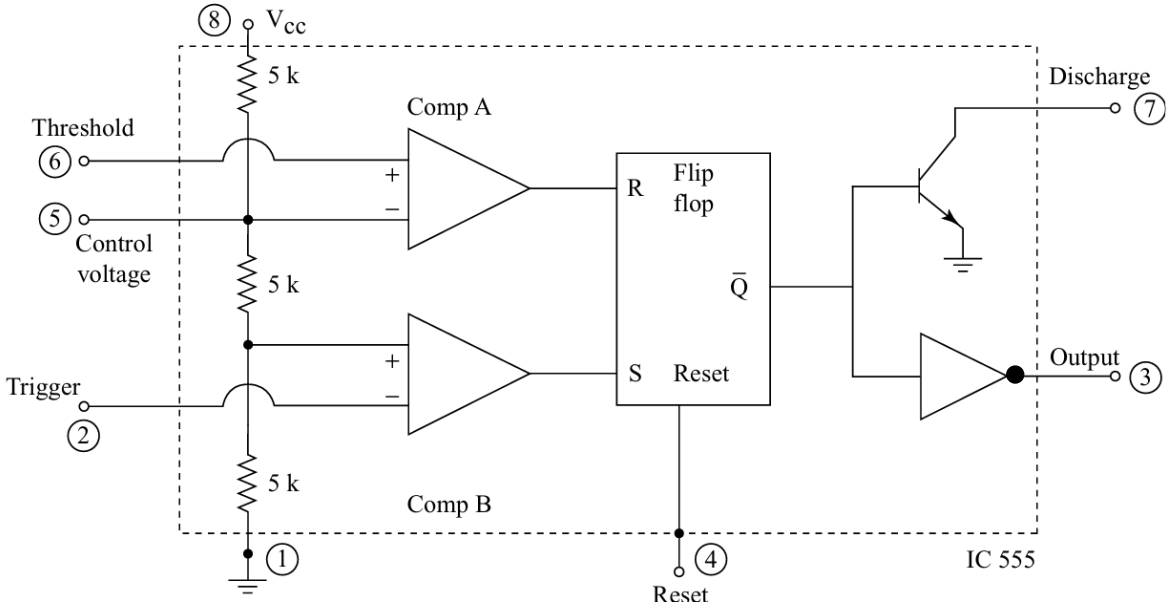


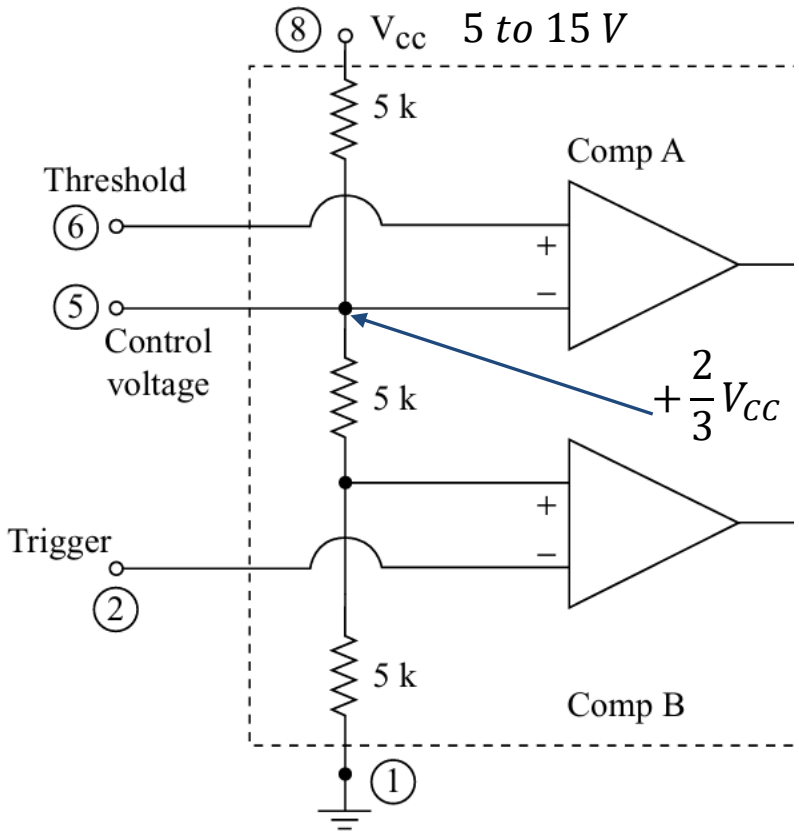


The voltage across the inverting terminal of the comparator A is $+\frac{2}{3}V_{CC}$.

The comparator A compares the threshold voltage with reference voltage $+\frac{2}{3}V_{CC}$.

When the voltage on the threshold pin increases above the $+\frac{2}{3}V_{CC}$, we get a logic “1” (High) at the output of comparator A . Otherwise, the output of comparator A is a logic “0” (Low).

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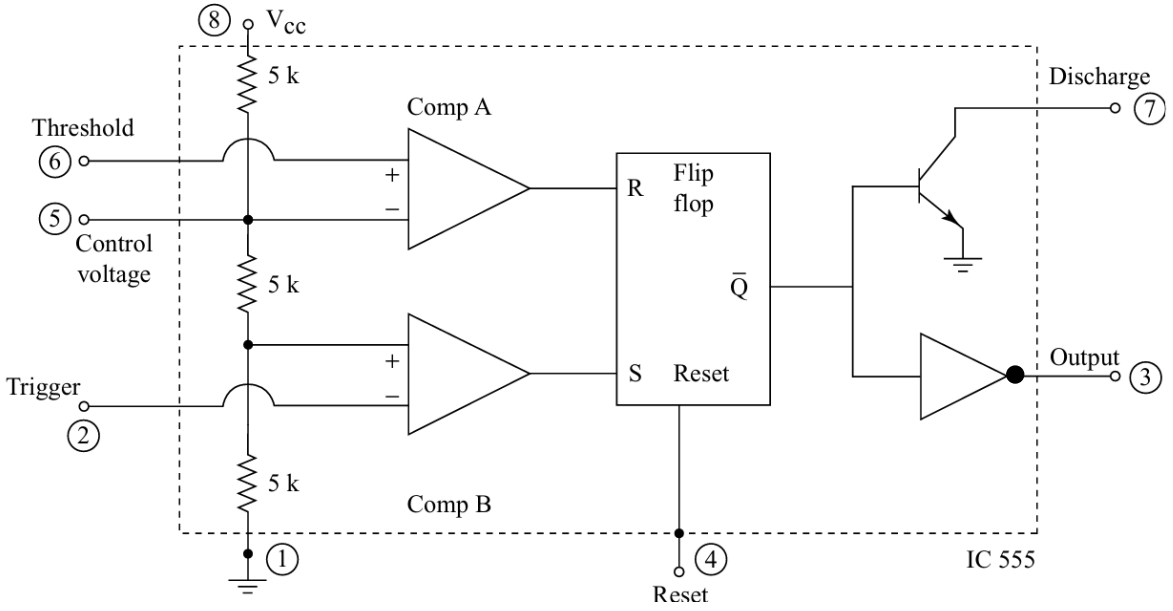


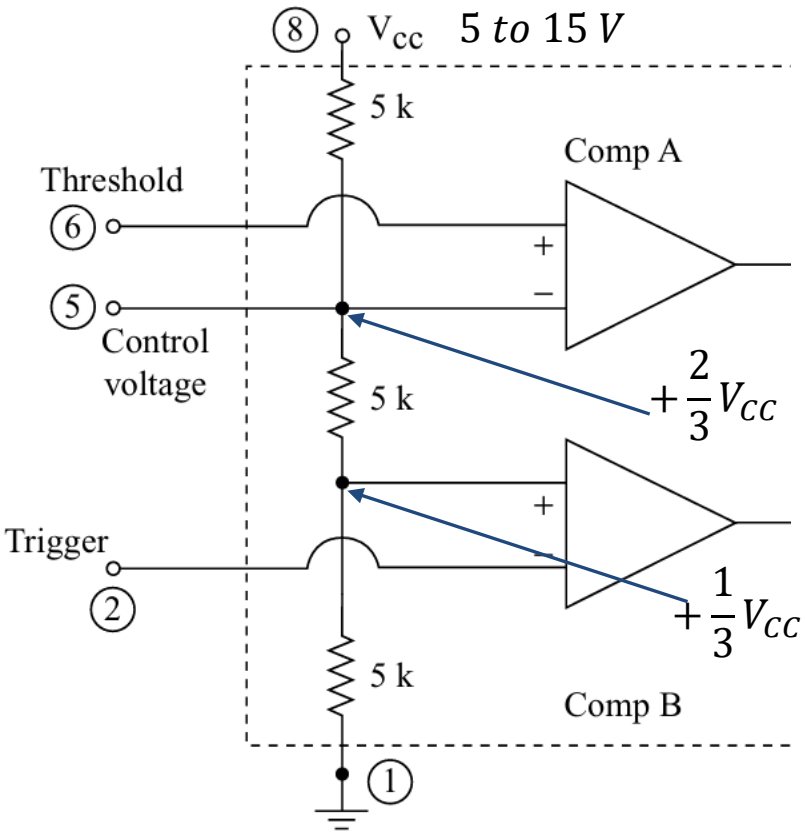


Voltage across the noninverting terminal of the comparator B is $+\frac{1}{3}V_{CC}$.

Comparator B compares the trigger voltage with reference voltage $+\frac{1}{3}V_{CC}$.

When the voltage on the trigger pin is less than the $+\frac{1}{3}V_{CC}$, we get a logic “1” (High) at output of comparator B. Otherwise, we get a logic “0” (Low).

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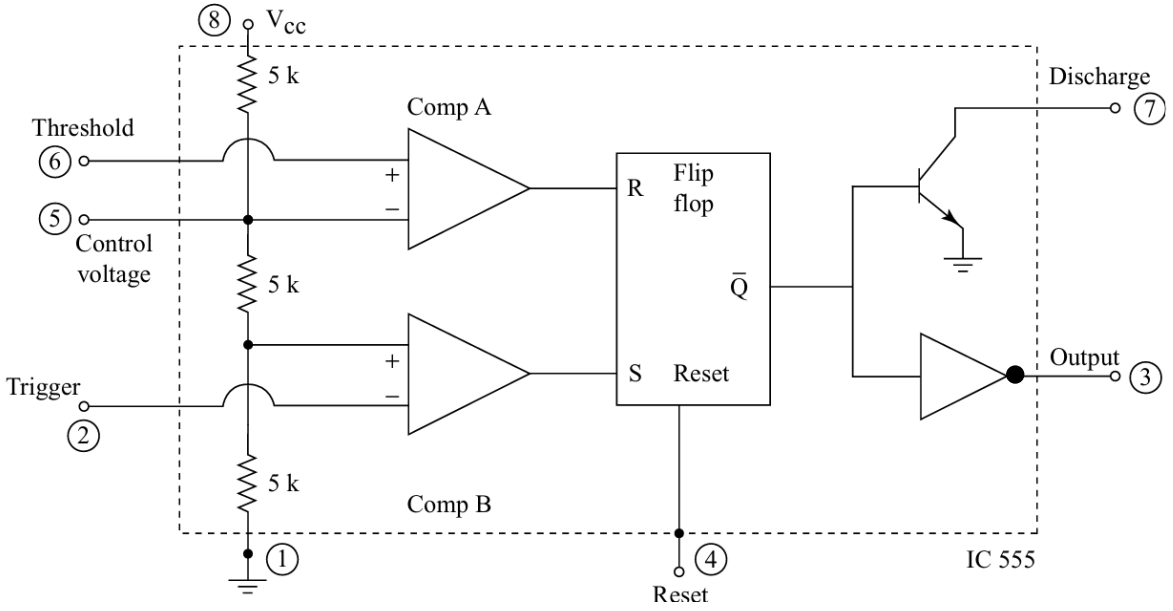


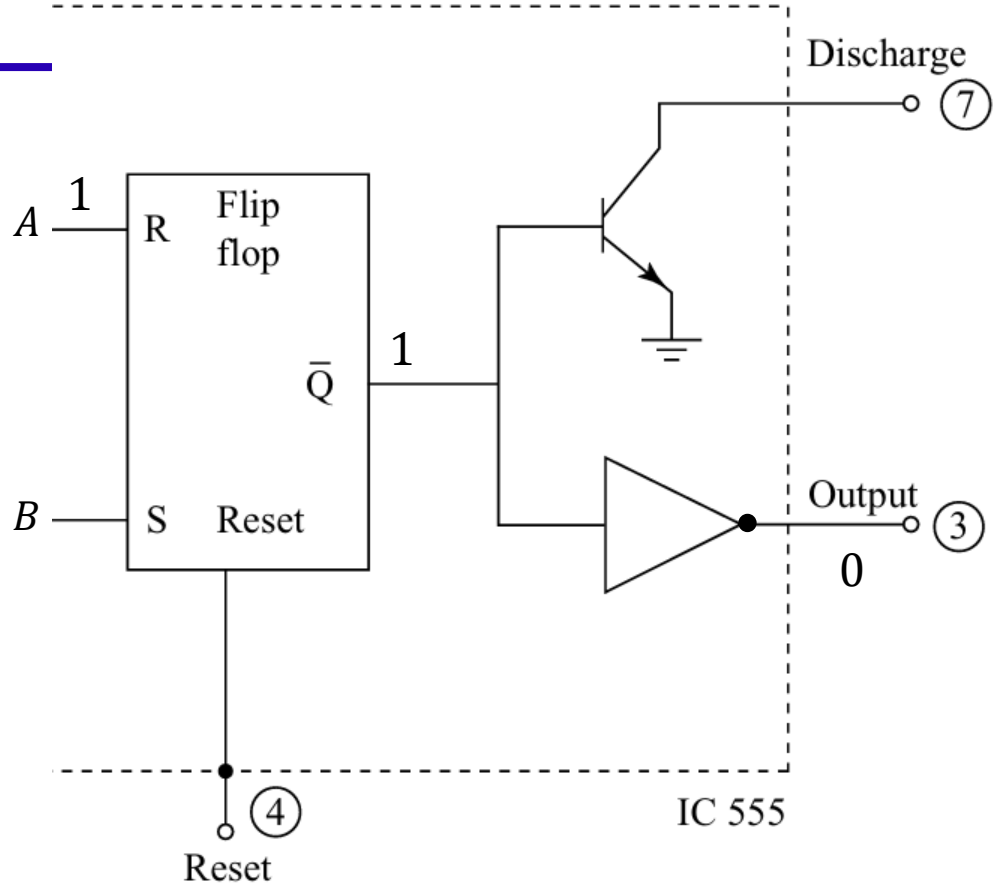


RS flip-flop has two inputs $S$ (SET) and $R$ (RESET), and two outputs $Q$ (not shown) and $\bar{Q}$.

If $S = 0$, and $R = 1$, the flip-flop is reset, $Q = 0$ and $\bar{Q} = 1$.

The output driving circuit inverts it and therefore, output = 0 or low (pin 3).

If $S = 1$, and $R = 0$, the flip-flop is set, $Q = 1$ and $\bar{Q} = 0$.

The output at pin 3 = 1 (High) due to inverting output circuit.

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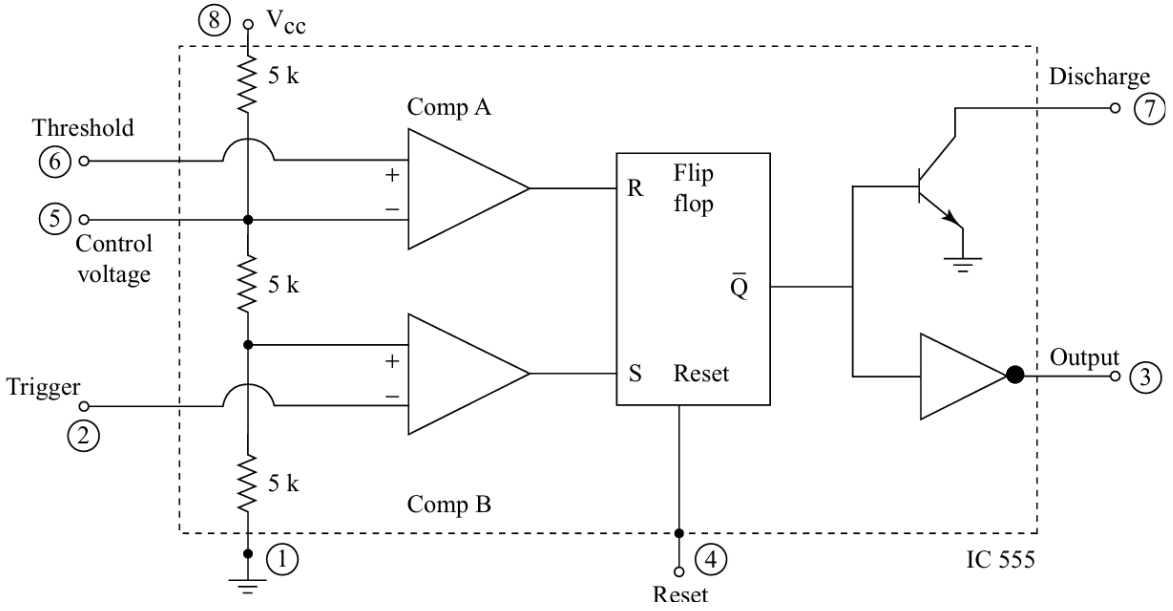


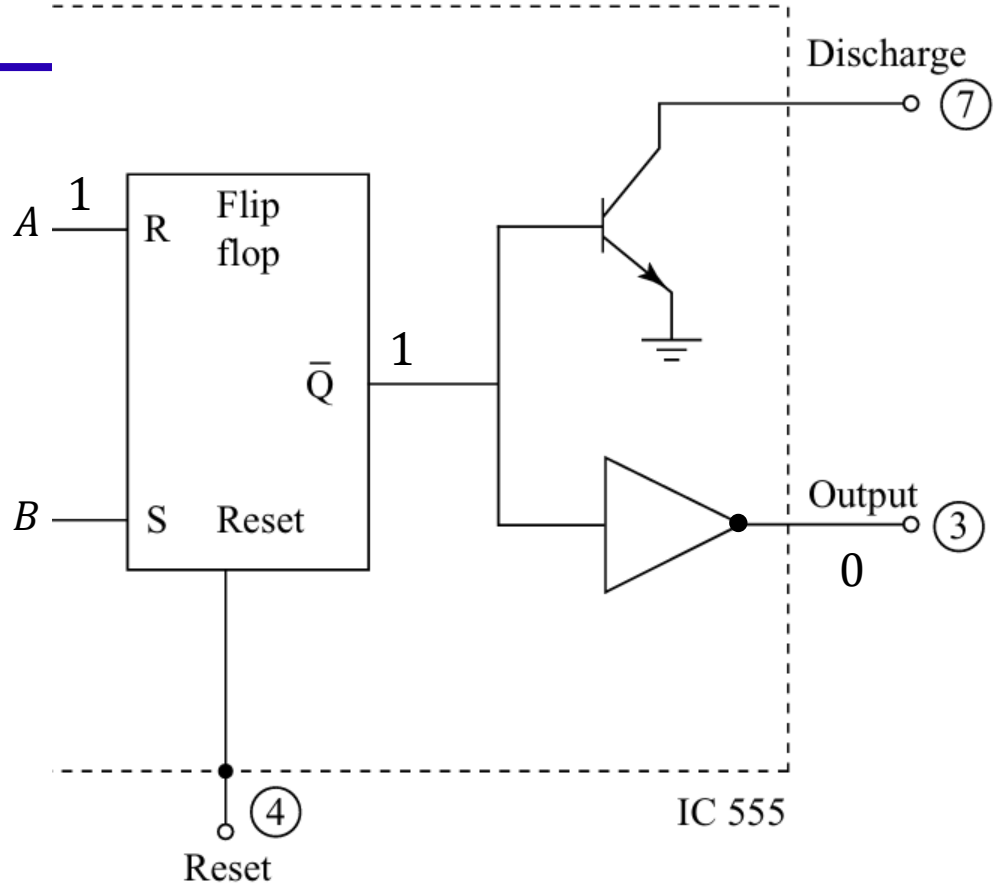


The output of comparator A is connected to the Reset input (R) of RS flip-flop.

Thus, if the threshold input (at pin 6) is raised above $+\frac{2}{3}V_{CC}$, the output of comparator A becomes high.

The flip-flop will reset and the output at pin 3 changes its state to ground (zero volt, i.e., Low or 0).

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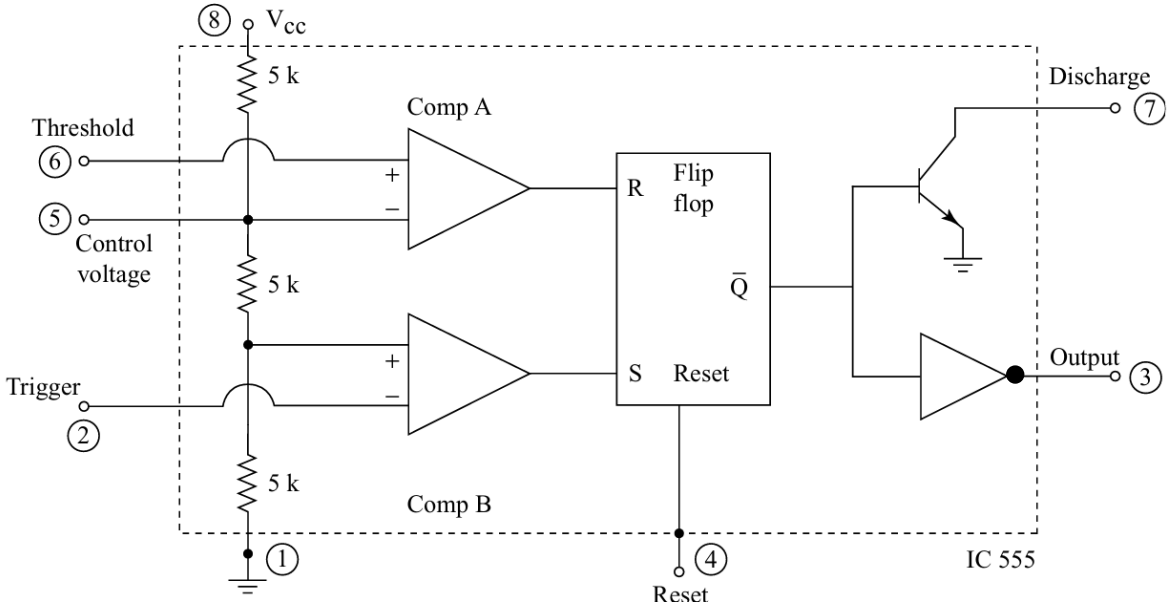


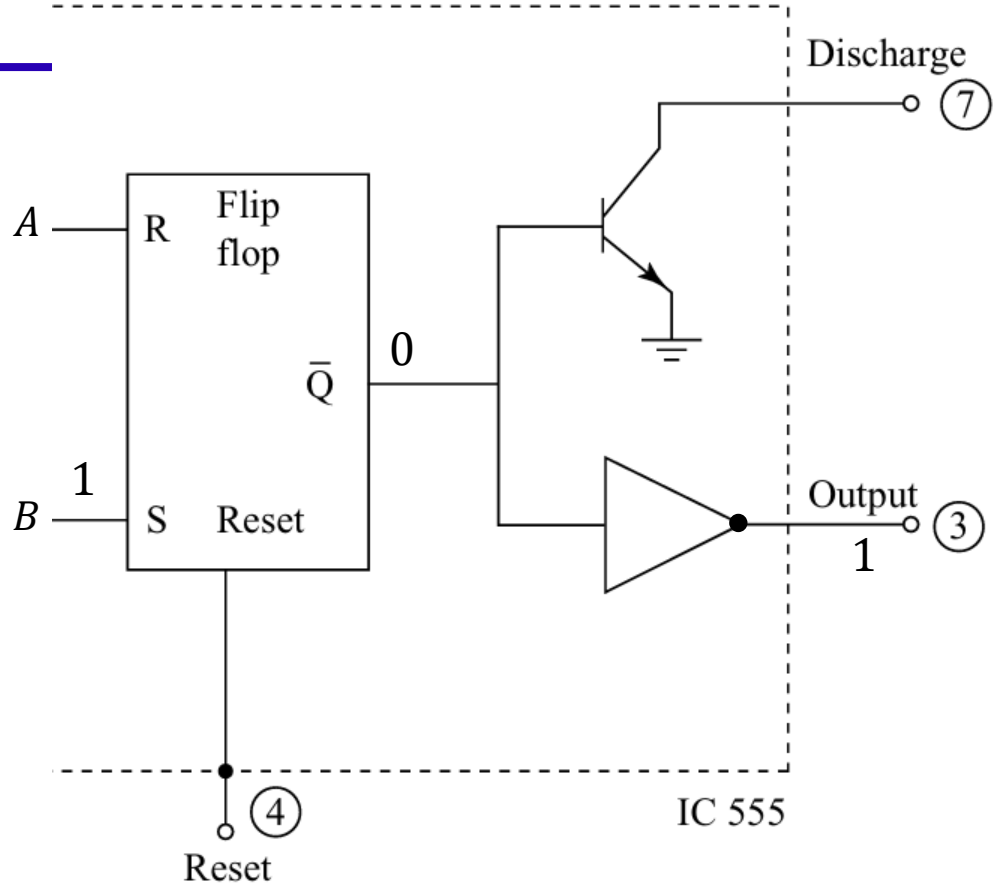


The output of comparator B is connected to the S input of RS flip-flop.

If the output of comparator B becomes high, the flip-flop will set.

Thus, if the trigger input at pin 2 is brought down below $+\frac{1}{3}V_{CC}$, the output at pin 3 changes state to $+V_{CC}$ (High or 1).

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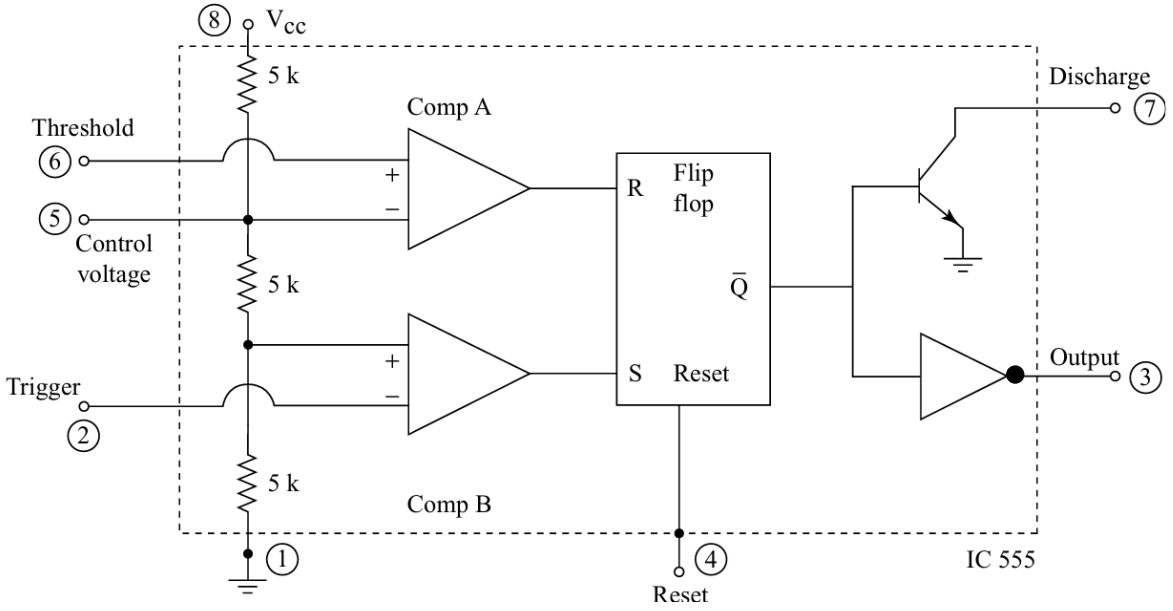


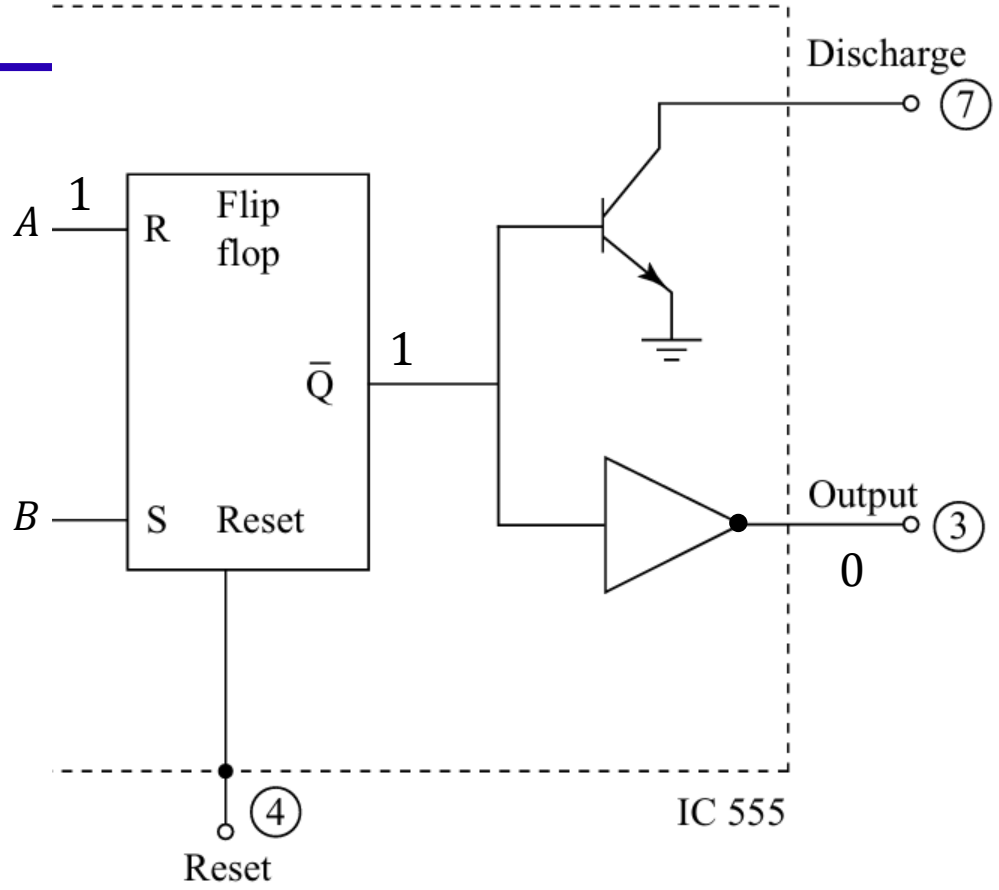


Pin 7, i.e., the discharge pin is connected to the collector of a transistor called discharge transistor.

The emitter of discharge transistor is connected to the ground.

When the output at pin 3 is low, $\bar{Q} = 1$. Transistor acts as a closed switch.

The external capacitor connected to pin 7 will discharge to ground through the discharge transistor.

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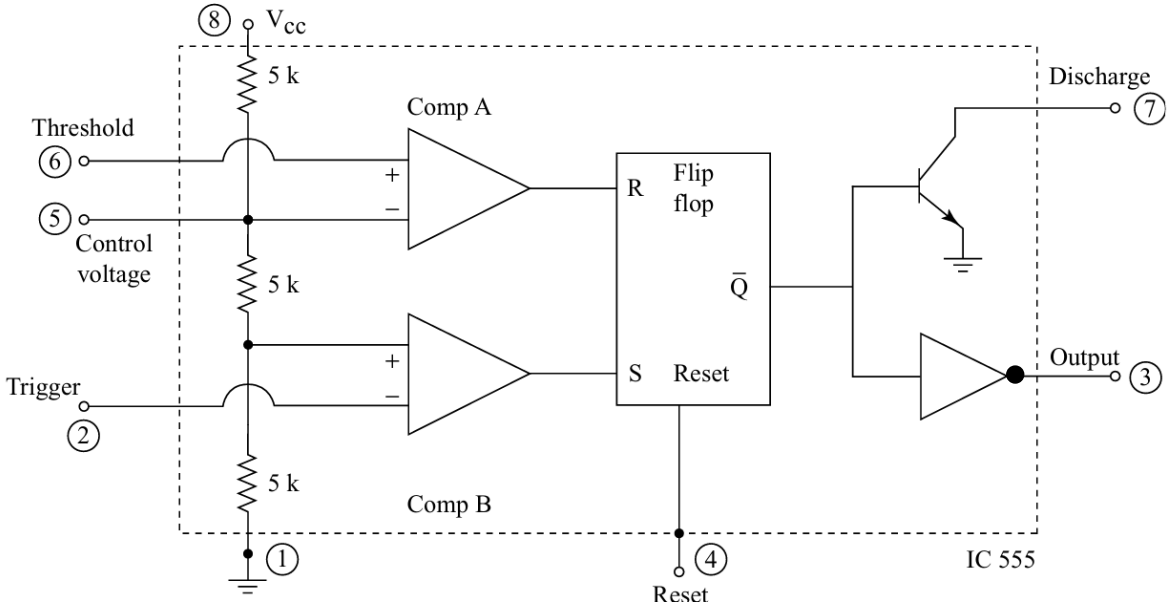
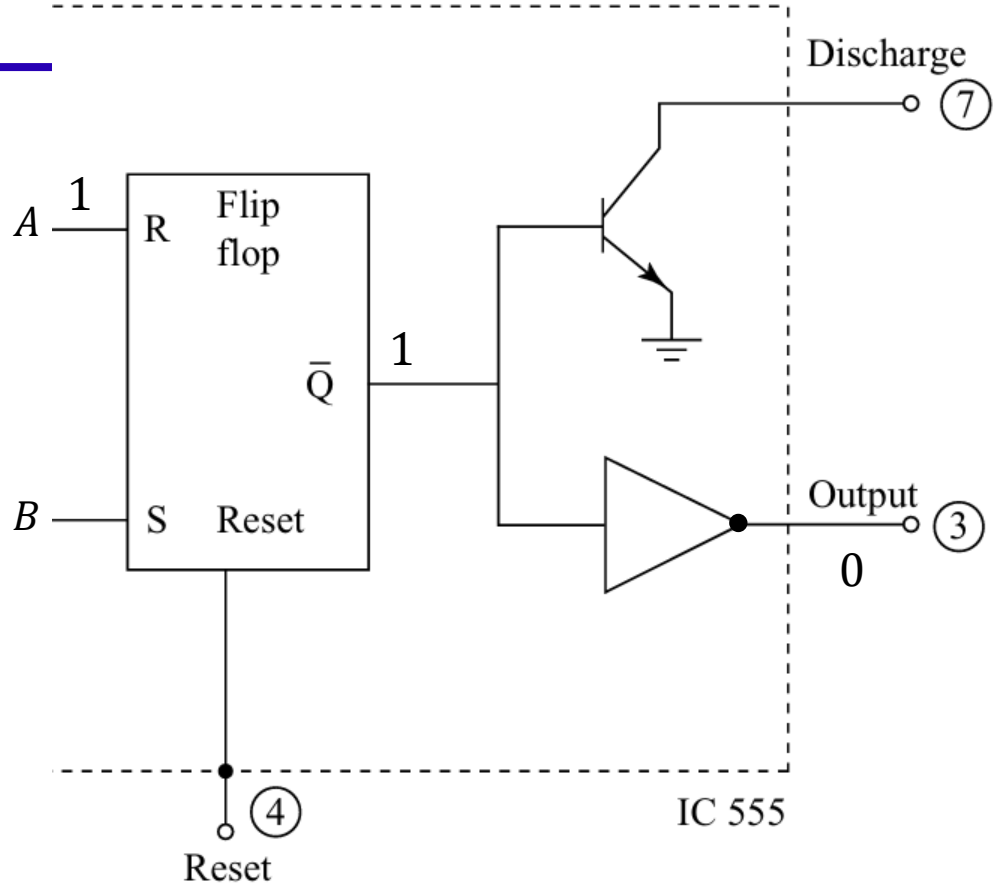


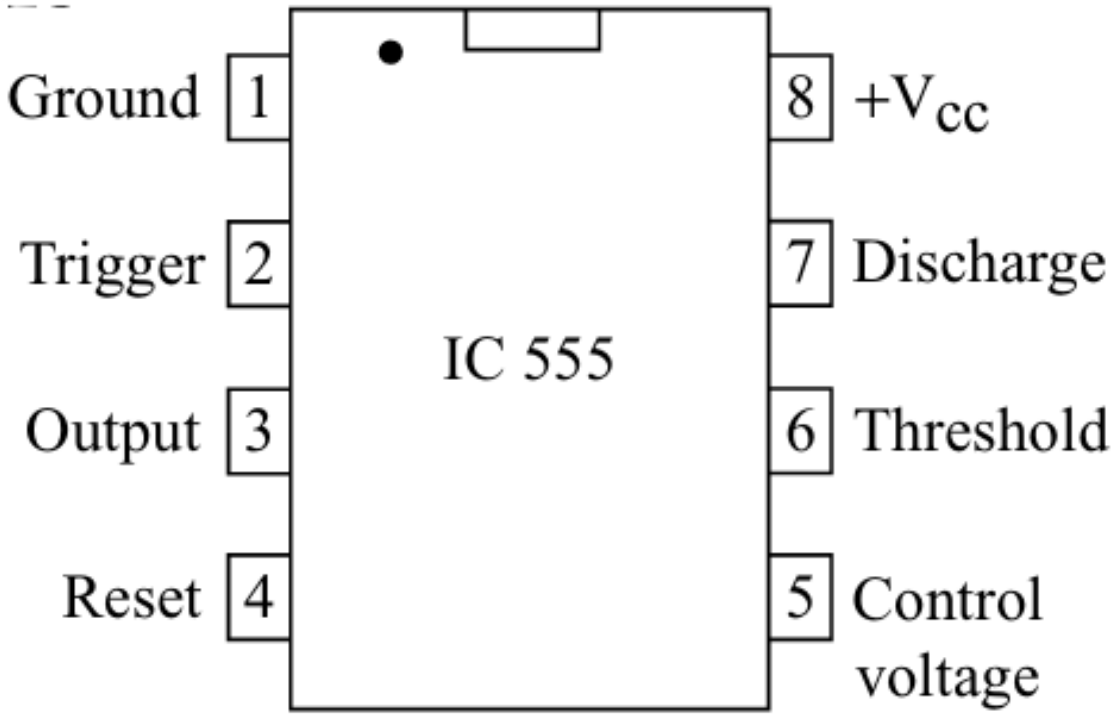

The Reset pin (pin 4) if made low, the flip-flop resets, $\bar{Q} = 1$, and the output at pin 3 becomes low irrespective of the state of the trigger pin.

The reset pin is normally connected to $+V_{CC}$ to avoid the possibility of false resetting.

Control voltage pin no. 5 is used to change the reference voltage of comparator A.

By applying a voltage to this pin, it is possible to vary the timing of the timer chip independent of the RC network.

# PIN CONFIGURATION OF IC 555:




The functions of each pin is as mentioned below:

**Pin 1 ground:**

This is the ground pin connected to 0 V.

All the voltages are measured with respect to this terminal.

**Pin 2 trigger:**

IC 555 can be triggered by applying a voltage to this pin below a certain value called low.

If low voltage is applied to this pin, the output becomes high.

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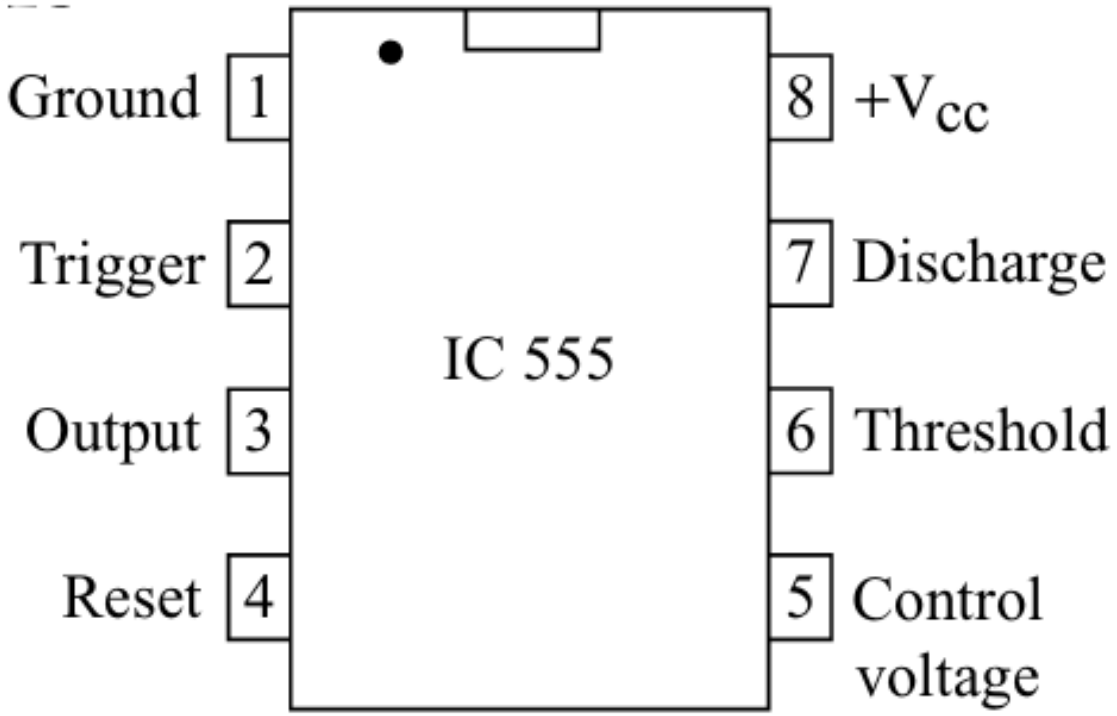


**Pin 3 output:**

Output is taken from pin 3.

The load can be connected between pin 3 and pin 1 (Ground) or between pin 3 and pin 8 ($+V_{CC}$).

**Pin 4 reset:**

The reset pin will force the output to go low regard less of the state of the trigger pin (pin 2).

**Pin 5 control voltage:**

By applying a voltage to this pin, it is possible to vary the timing of the timer chip independent of the RC network.

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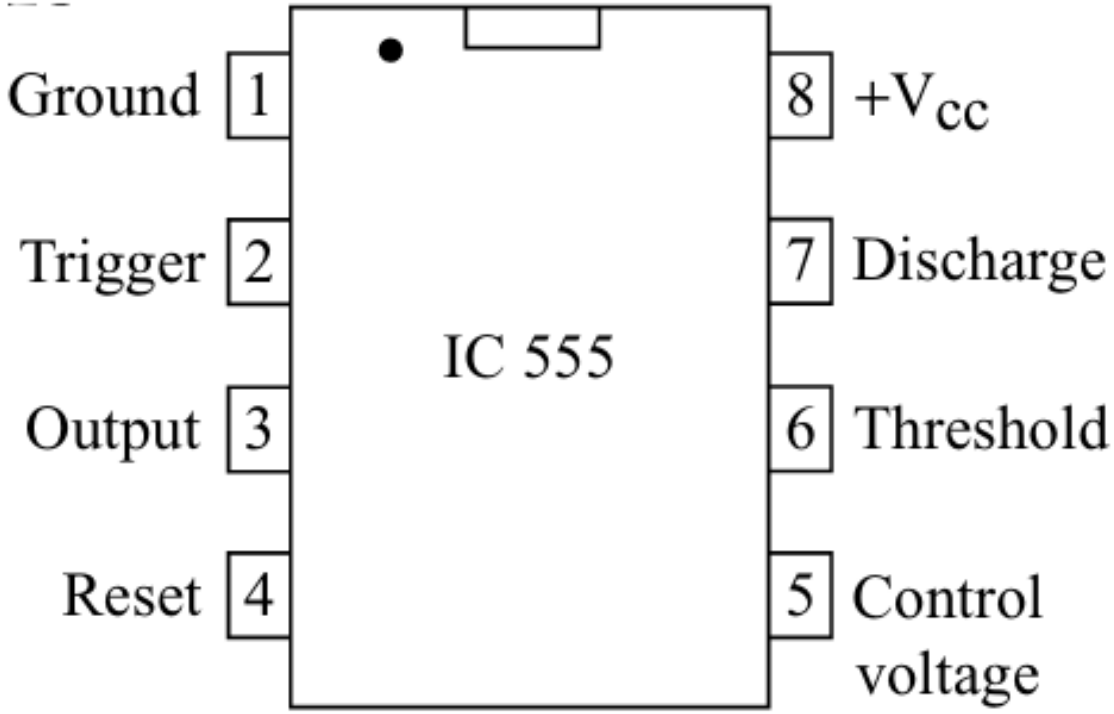


**Pin 6 threshold:**

If the voltage at this pin is increased above $+\frac{2}{3}V_{CC}$, the output will become low.

**Pin 7 discharge:**

A capacitor connected between pin 7 and ground gets discharged through the internal discharge transistor when the output becomes low.

**Pin 8 supply terminal:**

This pin is the positive supply terminal for the 555, also referred to as +VCC . The supply voltage operating range is from +5V to +18V.

# Thank You