LONG RANGE IR TRANSMITTER

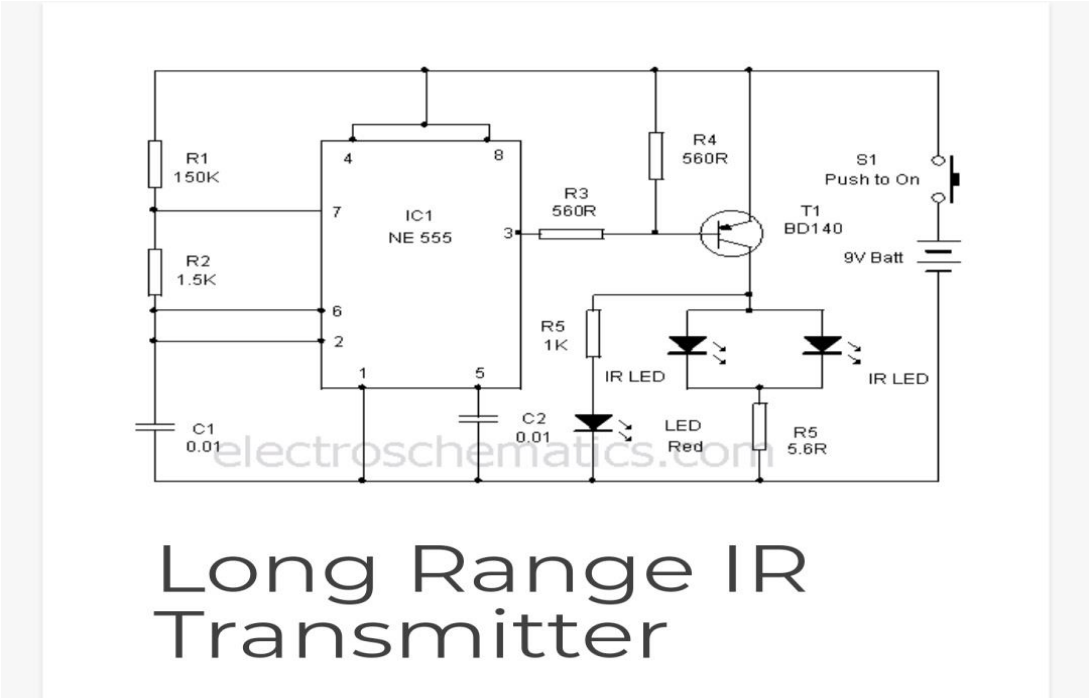
INTRODUCTION:

One of the most commonly used sensors in Electronics is IR sensor (Infrared Sensor). IR sensor helps in detecting the heat and the motion of an object. In the infrared spectrum, all the objects emit some form of thermal radiations. These radiations are invisible to a human eye and can only be sensed or detected by an IR sensor. An IR sensor consists of IR Transmitter which is used for emitting IR rays and IR Receiver (Photodiode) which is used for detecting that emitted IR rays. By using this Circuit, we can increase the range of emitted IR radiation up to 10m. Here we have used multiple IR LEDs to increase the distance.

COMPONENTS REQUIRED:

1. NE 555 timer
2 R1-150k
3.R2-1.5k
4.R3=R4=560k
5.R5=1k
6.T1-BD140
7.C1=C2=.01micro F
8.IR leds-3
9.9v battery
10.Switch

CIRCUIT DIAGRAM:

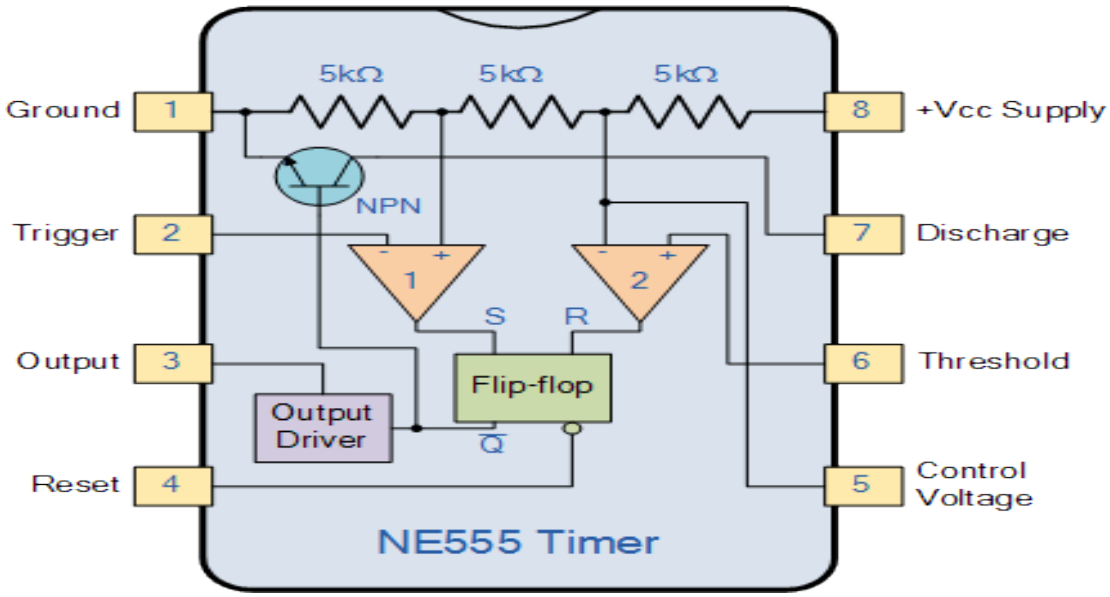


WORKING OF LONG RANGE IR TANSMITTER:

This Long range Infrared transmitter can emit pulsed IR rays up to 10 meters. This IR transmitter is ideal to use in Infrared receivers using Phototransistor or Photodiode as IR sensor.

The circuit is a simple Astable Multivibrator using IC NE555. Resistors R1, R2 and capacitor C1 fix the output frequency to 1 kHz. T1 is the Darlington high gain PNP transistor that drives two Infrared LEDs. Resistor R4 is the pull up resistor that keeps the base of T1 high for its proper working. By changing R2 with a 4.7K preset, output frequency can be changed. Red LED indicates whether the IR LED is working or not.

INTERNAL CIRCUIT DIAGRAM OF IC 555 TIMER:



Pin 1. – Ground, The ground pin connects the 555 timer to the negative (0v) supply rail.

• Pin 2. – Trigger, The negative input to comparator No 1. A negative pulse on this pin “sets” the internal Flip-flop when the voltage drops below 1/3Vcc causing the output to switch from a “LOW” to a “HIGH” state.

• Pin 3. – Output, The output pin can drive 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. – 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.

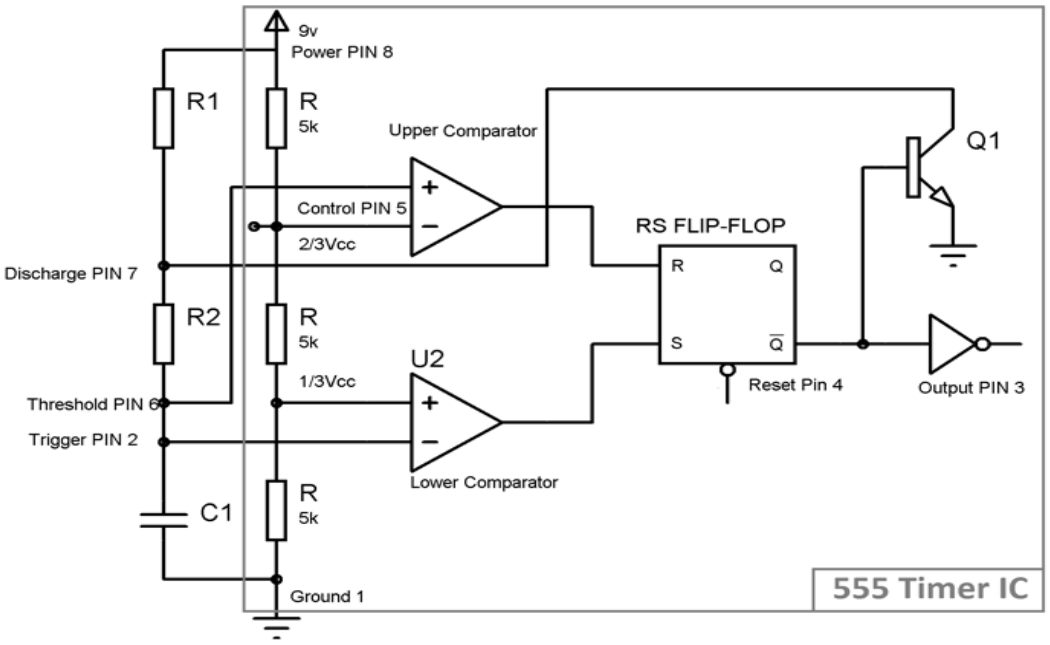
• Pin 5. – Control Voltage, This pin controls the timing of the 555 by overriding the 2/3Vcc level of the voltage divider network. By applying a voltage to this pin the width of the output signal can be varied independently of the RC timing network. When not used it is connected to ground via a 10nF capacitor to eliminate any noise.

• Pin 6. – Threshold, The positive input to comparator No 2. This pin is used to reset the Flip-flop when the voltage applied to it exceeds 2/3Vcc causing the output to switch from “HIGH” to “LOW” state. This pin connects directly to the RC timing circuit.

• Pin 7. – 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. – Supply +Vcc, This is the power supply pin and for general purpose TTL 555 timers is between 4.5V and 15V.

WORKING OF NE555 TIMER IN ASTABLE MODE



555 Timer in Astable Mode

When initially power is turned ON, Trigger Pin voltage is below Vcc/3, that makes the lower comparator output HIGH and SETS the flip flop and output of the 555 chip is HIGH.

This makes the transistor Q1 OFF, because Qbar, Q’=0 is directly applied to base of transistor. As the transistor is OFF, capacitor C1 starts charging and when it gets charged to a voltage above than Vcc/3, then Lower comparator output becomes LOW (Upper comparator is also at LOW) and Flip flop output remains the same as previous (555 output remains HIGH).

Now when capacitor charging gets to voltage above than 2/3Vcc, then the voltage of non-inverting end (Threshold PIN 6) becomes higher than the inverting end of the comparator. This makes Upper comparator output HIGH and RESETs the Flip flop, output of 555 chip becomes LOW.

As soon as the output of 555 get LOW means Q'=1, then transistor Q1 becomes ON and short the capacitor C1 to the Ground. So the capacitor C1 starts discharging to the ground through the Discharge PIN 7 and resistor R2.

As capacitor voltage get down below the 2/3 Vcc, upper comparator output becomes LOW, now SR Flip flop remains in the previous state as both the comparators are LOW.

While discharging, when capacitor voltage gets down below Vcc/3, this makes the Lower comparator output HIGH (upper comparator remain LOW) and Sets the flip flop again and 555 output becomes HIGH.

Transistor Q1 becomes OFF and again capacitor C1 starts charging.

This charging and discharging of capacitor continues and a rectangular oscillating output wave for is generated. While capacitor is getting charge the output of 555 is HIGH, and while capacitor is getting discharge output will be LOW. So this is called Astable mode because none of the state is stable and 555 automatically interchange its state from HIGH to LOW and LOW to HIGH, so it is called Free running Multivibrator.