
EXPERIMENT 6: Triangular Wave Generator and Implementation of Monostable Multivibrator in 555 Timer IC

Objectives: To design a triangular and saw tooth wave generator as an application of regenerative positive feedback.
Implementation of monostable multivibrator in 555 timer IC.

Materials and Equipment:

Resistors: 10K Ω [2], 22K Ω [Pot] [1], 10K Ω [Pot] [2], 100K Ω [1] IC 555: [1]
Capacitors: 330nF [1], 0.001 μ F [1], 10 μ F [1] IC 741: [2]

Theory:

If the feedback is positive and if $A_0\beta \gg 1$ then it will result in the positive feedback with regeneration. In effect, the output amplitude grows boundlessly hitting the power supply limitation. Output will quickly saturate to the level $+V_{SAT}$ OR $-V_{SAT}$ depending upon the initial disturbance.

When the capacitor is charged by a constant current of magnitude I then the voltage developed across a capacitor is

$$v_c = \frac{I}{C}t$$

When the capacitor is kept in the feedback loop of an op-amp as in fig 1 then the output will be a Ramp type of waveform with either increasing or decreasing slope.

Ramp amplitude depends upon the Schmitt trigger *state change voltage*. Using a pot in the feedback loop of Schmitt trigger we can control the amplitude of a Ramp. The frequency can also be controlled with this pot.

There is 10K Ω pot which connects the output of Schmitt trigger to the input of integrator. This pot changes the magnitude of charging and discharging current (*and hence RC time constant*) of the capacitor and controls the frequency of oscillation.

In fig 1, after using 10K Ω pot in the non-inverting terminal of integrator controls the frequency of oscillation as well as the rising and falling time period of triangular wave. This is a SawTooth wave generator.

555 Timer:

A high quality Multivibrators can be generated using 555 timer adding external resistors and capacitors. In this lab we will see the Monostable operation of 555 timer. The time delay is given by $1.1RC$ (See fig 2).

Triangular Wave Generator

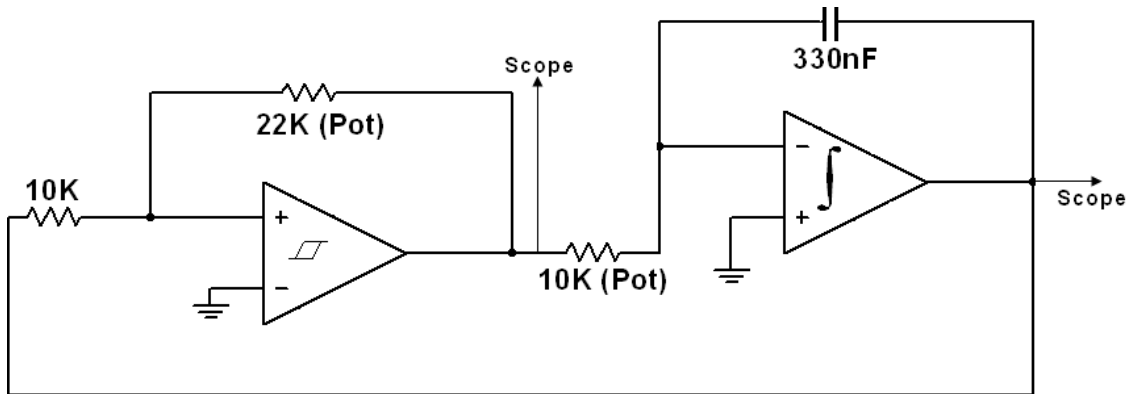


Fig 1

Procedure

1. Set the supply voltage of both op-amps to be $\pm 15V$
2. Replace 22K pot by 10K fixed resistor and see the output. ☹
3. See the output of Schmitt trigger and Integrator
4. 22K pot controls the amplitude of Ramp and frequency of oscillation
5. 10K pot controls the frequency of oscillation
6. See the point where the Schmitt trigger changes its state.

SawTooth Wave Generator

Procedure

1. Use 10K pot at the non-inverting terminal of integrator
2. Use one end of the pot to $+V_{CC}$ Supply another end to $-V_{EE}$ supply
3. Change the pot setting to change triangular wave to Saw Tooth wave.

Monostable Multivibrator using 555 Timer IC

Procedure

1. Connect the circuit as shown in fig 2.
2. Set the supply voltage to 6V
3. See the initial state of 555 timer output through pin 3
4. First remove 10K resistor and give the trigger at pin 2 and see the output.
5. Put 10K resistor in its own place.
6. Give the trigger at pin 2
7. See the output. The output will change state for $1.1RC$ seconds. Here $R=100K$ and $C=10\mu F$.
8. Give trigger again.
9. See the voltage across capacitor when the output is changing the state using the horizontal sweep of oscilloscope at 0.1S.
10. Note that the capacitor voltage will reach up to $2V_{CC}/3$ and discharge quickly.

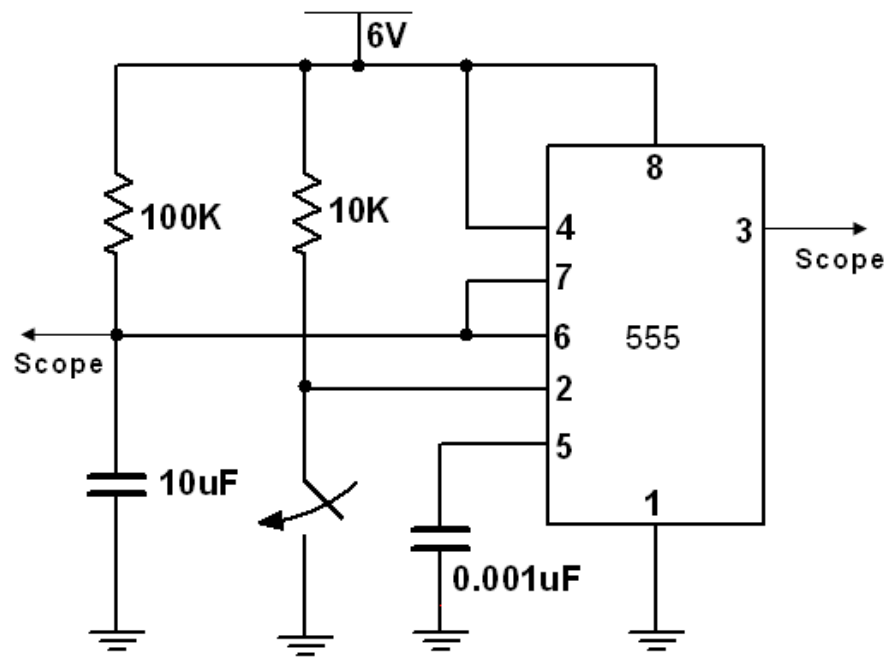


Fig 2