

EXPERIMENT NO: 6

AIM: To study the waveform of square wave generator using 741 Op-Amp IC.

THEORY: A square wave generator is an electronic circuit which generates square wave. In the circuit of an op-amp based square wave generator, the resistor R_1 is connected between the inverting input terminal of the op-amp and its output of op-amp. So, the resistor R_1 is used in the negative feedback. Similarly, the resistor R_2 is connected between the noninverting input terminal of the op-amp and its output. So, the resistor R_2 is used in the positive feedback path.

A capacitor C is connected between the inverting input terminal of the op-amp and ground. So, the voltage across capacitor C will be the input voltage at this inverting terminal of op-amp. Similarly, a resistor R_3 is connected between the non-inverting input terminal of the op-amp and ground. So, the voltage across resistor R_3 will be the input voltage at this non-inverting terminal of the op-amp.

The operation of a square wave generator is explained below :

Assume, there is no charge stored in the capacitor initially. Then, the voltage present at the inverting terminal of the op-amp is zero volts. But there is some offset voltage at non-inverting terminal of op-amp. Due to this, the value present at the output of above circuit will be $+V_{sat}$.

Now, the capacitor C The value present at the output of the above circuit will change to $-V_{sat}$, when the voltage across the capacitor C reaches just greater than the voltage (positive value) across resistor R_3 .

The capacitor C starts discharging through a resistor R_1 , when the output of above circuit is $-V_{sat}$. The value present at the output of above circuit will change to $+V_{sat}$, when the voltage across capacitor C reaches just less than (more negative)

the voltage (negative value) across resistor R_3 and capacitor starts charging through a resistor R_1 . This process continues and produce a square wave at the output as shown in the following figure.

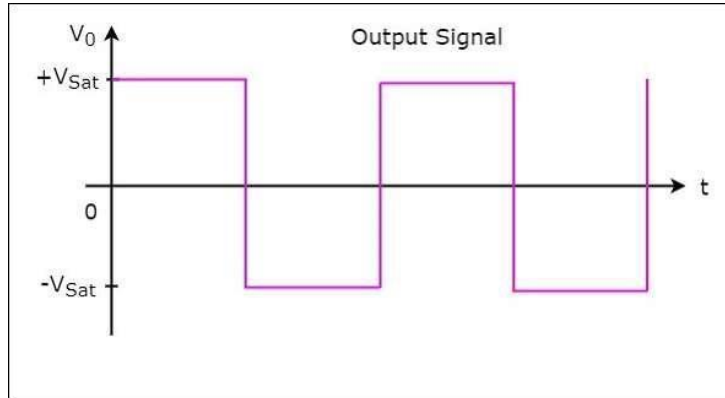


Figure 6.1: output waveform of square wave generator circuit

From the above figure we can observe that the output of square wave generator will have one of the two values: $+V_{sat}$ and $-V_{sat}$. So, the output remains at one value for some duration and then transitions to another value and remains there for some duration. In this way, it continues.

Hints for Design

$$T = 2R_1C, \text{ when } R_2 = 1.16R_3$$

Calculation:

$$\text{Let } T = 1\text{ms}$$

$$\text{Let } R_3 = 10 \text{ K}\Omega, \text{ then } R_2 = 11.6\text{K}\Omega$$

$$\text{let } C = 0.1 \mu\text{F}, R_1 = 5 \text{ K}\Omega$$

CIRCUIT DIAGRAM

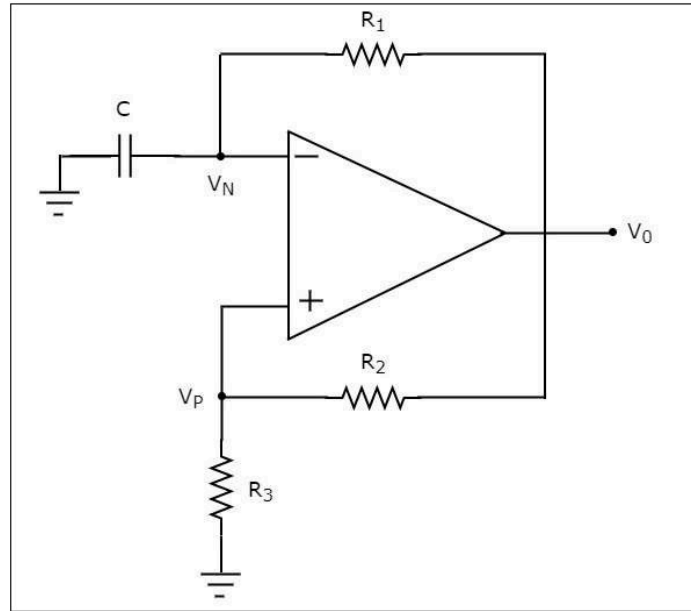


Figure 6.2: Circuit diagram of square wave generator circuit

Observation:

Output voltage V_o

Amplitude =?

Frequency =?

Draw the output waveform on the graph.

Graph:

CONCLUSION