

IC-555 timer as Astable Multivibrator

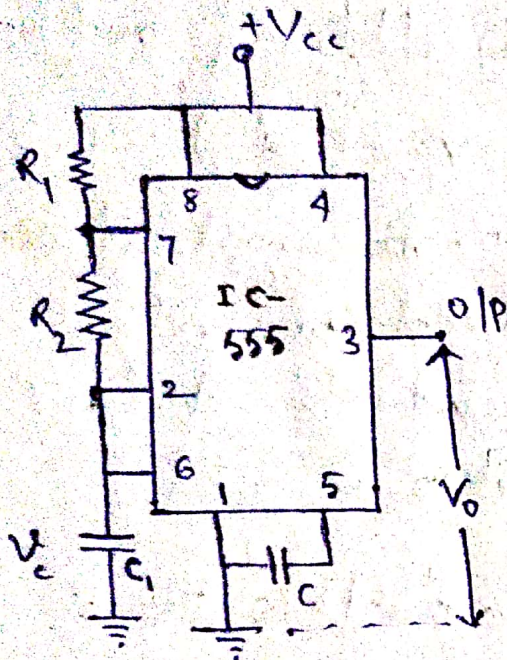


Fig-3.

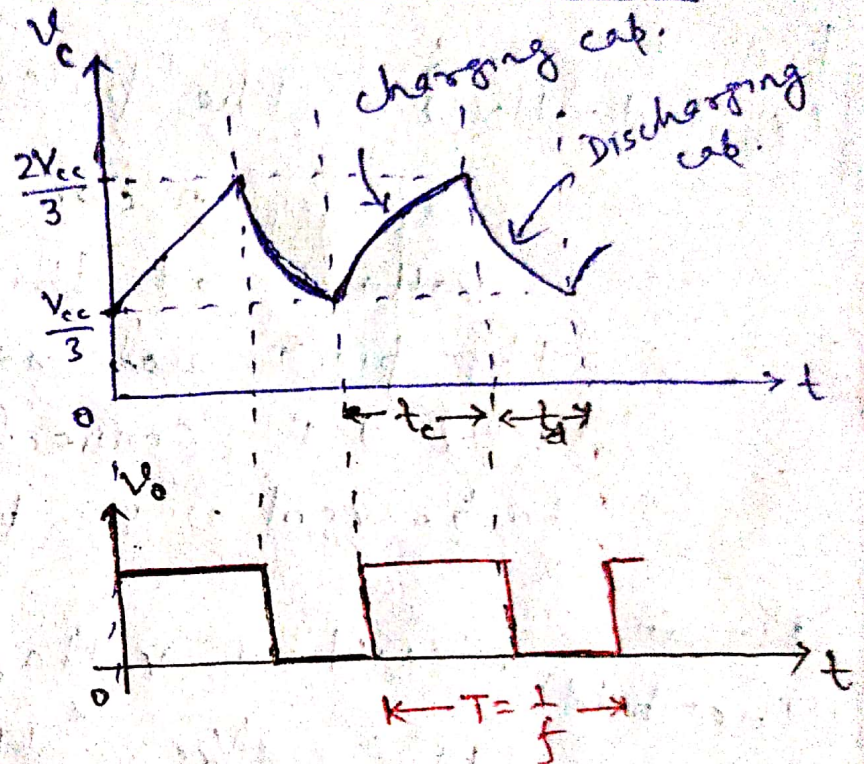


Fig-4

Above fig-3 shows a typical circuit diagram using 555-timer IC for executing as astable multi-vibrator. Here, Pin-2 is not utilized as triggering and IC-timer changes its state in

~~across~~ accordance to charging and discharging interval of capacitor, hence ckt is also called free-running multi-vibrator.

Operation:- It is clear from fig-3, that pin-② and ⑥ are shorted for it to work as free-running multi-vibrator. It can be easily understood that when the voltage across capacitor C_1 equals to $V_c = \frac{2V_{cc}}{3}$, comparator-I triggers the flip-flop inside the timer and output goes LOW ^(discharging time, $T_1 \rightarrow ON$) as we have discussed earlier. At this point cap. C_1 starts discharging through R_2 and transistor inside the timer. As soon as voltage V_c equals to $\frac{V_{cc}}{3}$, ~~comparator-II~~ ~~(inside timer)~~ the output of comparator-II (inside timer) triggers the flip-flop and output goes high ^{and discharging time, $T_1 \rightarrow OFF$} . The cycle goes on repeating.

Hence we see that the external capacitor C_1 charges through R_1 and R_2 and discharges through R_2 only. Thus, we also noted that capacitor C_1 charges and discharges b/w $\frac{2V_{cc}}{3}$ and $\frac{V_{cc}}{3}$ respectively.

The time during which capacitor charges from $\frac{V_{cc}}{3}$ to $\frac{2V_{cc}}{3}$ is equal to the time the output is high and is given by —

$$t_c = \text{charging time} = 0.693 (R_1 + R_2) C_1$$

Similarly,

the time during which ~~the capacitor~~ capacitor discharges from $\frac{2V_{cc}}{3}$ to $\frac{V_{cc}}{3}$ is equal to the time the o/p is Low and is given by

$$t_d = 0.693 R_2 C_1$$

∴ Total period of o/p waveform —

$$T = t_d + t_c$$

$$\text{or } T = 0.693 (R_1 + R_2) C_1 + 0.693 R_2 C_1$$

$$\Rightarrow \boxed{T = 0.693 (R_1 + 2R_2) C_1}$$

$$\text{Duty cycle} = \frac{t_c}{T} = \frac{R_1 + R_2}{R_1 + 2R_2}$$

$$\boxed{f = \frac{1}{T} = \frac{1}{0.693 (R_1 + 2R_2) C_1}}$$