Comparator

Comparator :- An electronic device that accept input of linear voltages and provides digital output which indicates one input is less than or greater than the second, is called comparator. A comparator is basically Analog to Digital converter. An op-am is used as comparator.

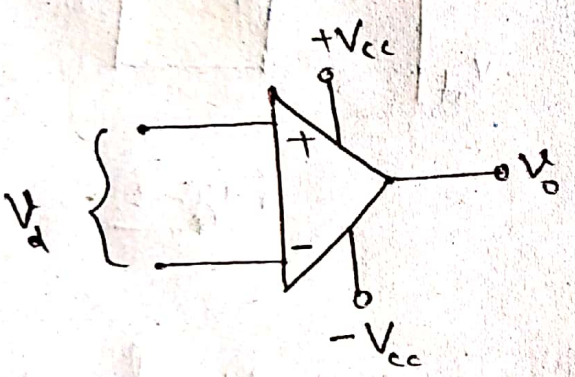

Fig-1 (a)

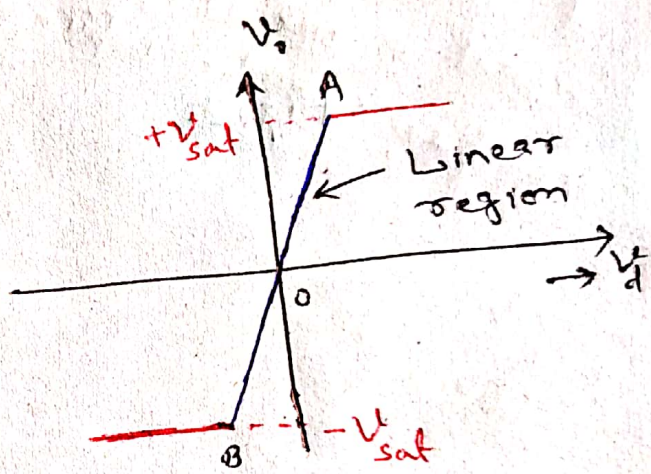

Fig-1(b) voltage transfer characteristics

Fig-1(b) shows, op-amp can operate in three mode depending on applied differential input voltage V_d

Three operating modes are —

i) Positive saturation $+V_{sat}$

ii) Negative " $-V_{sat}$

iii) Linear region, $-V_{sat} \leq V_o < +V_{sat}$, (AB)

Let, us consider, a non-inverting op-amp, with open loop configuration shown in fig-2. The output voltage is saturated due to open-loop configuration and large (ideally infinitely large) voltage gain

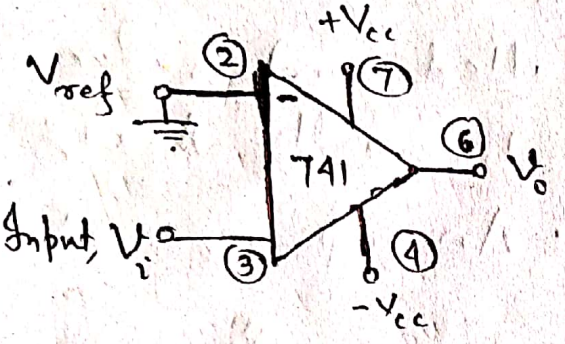

fig-2.

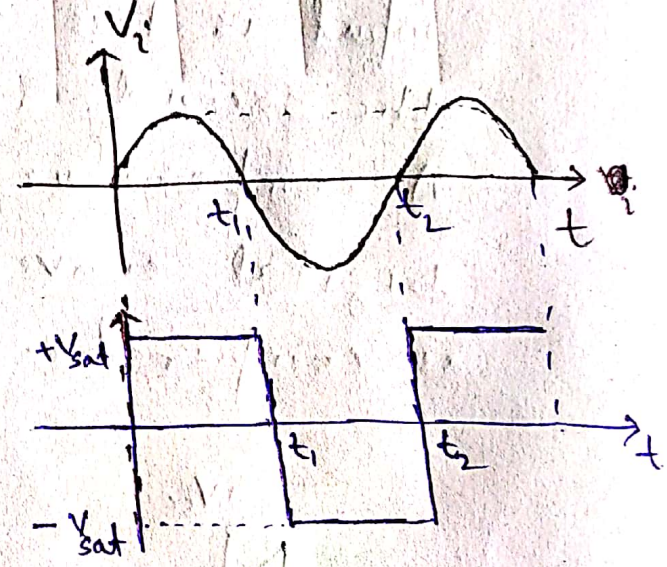

fig-3.

From fig-2 & 3, we see that, when a reference voltage given at pin no-2 is set to 0 volt, a sinusoidal signal applied to non-inverting input-pin-(3) will cause the output to switch between its two output states $+V_{sat}$ and $-V_{sat}$ as shown in fig-3. The applied input voltage V_i going even a fraction of a mV above 0-volt reference level (given pin-(2)) will

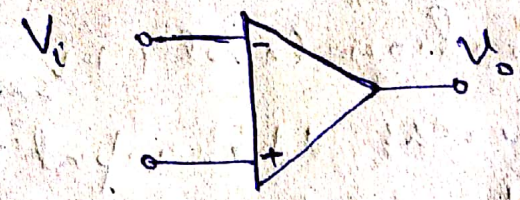

Fig-4

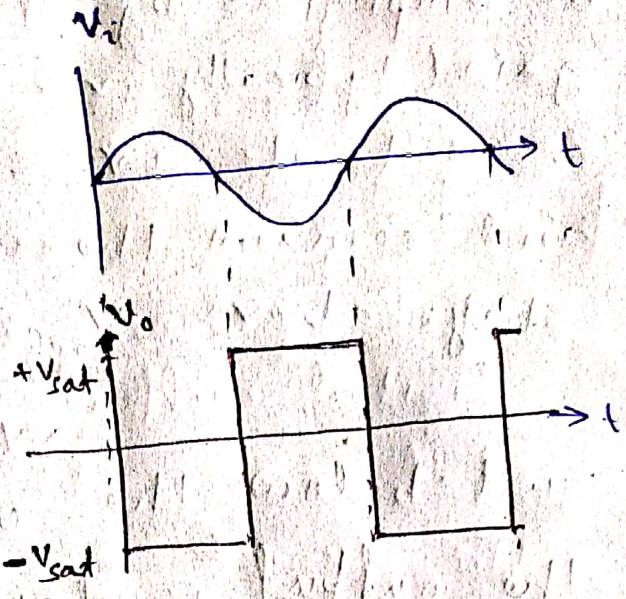

Fig-5

Here, input V_i is applied to inverting terminal, hence output signal is inverted in comparison to input signal

IC-555 Timer

In op-amp ckt, and applications, We require a circuit which produces timing interval. The IC-555 timer is most versatile linear integrated circuit used for this purpose. IC-555 timer can be used in variety of applications as - mono-stable and astable multivibrators d.c to d.c converters.

IC-555 timer is available as 8-pin metal can, or a 14-pin DIP (Dual-In-Package → IC-556). 14-pin IC-556 consist of two IC-555 timer.

PIN diagram and internal config. of IC-555 timer

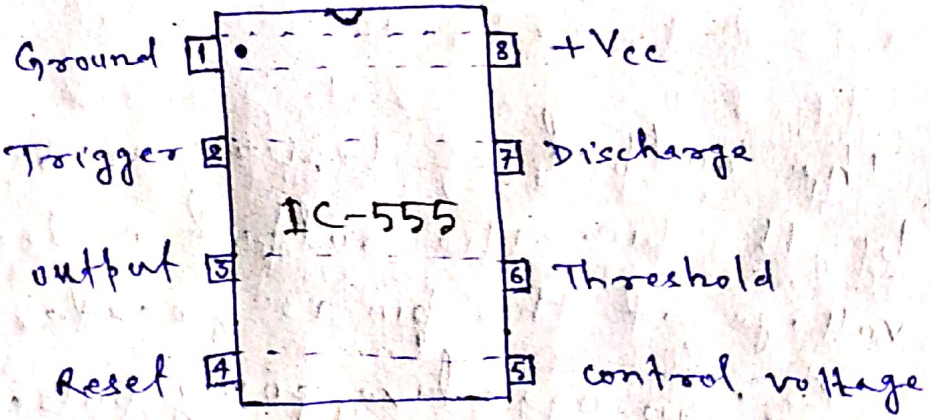

Fig-1.

Above fig-1. shows the various pins of IC-555 timer. Fig-2 shows internal structure.

Pin :- 1. (Ground) It is the chip ground and all voltages are measured with respect to this terminal.

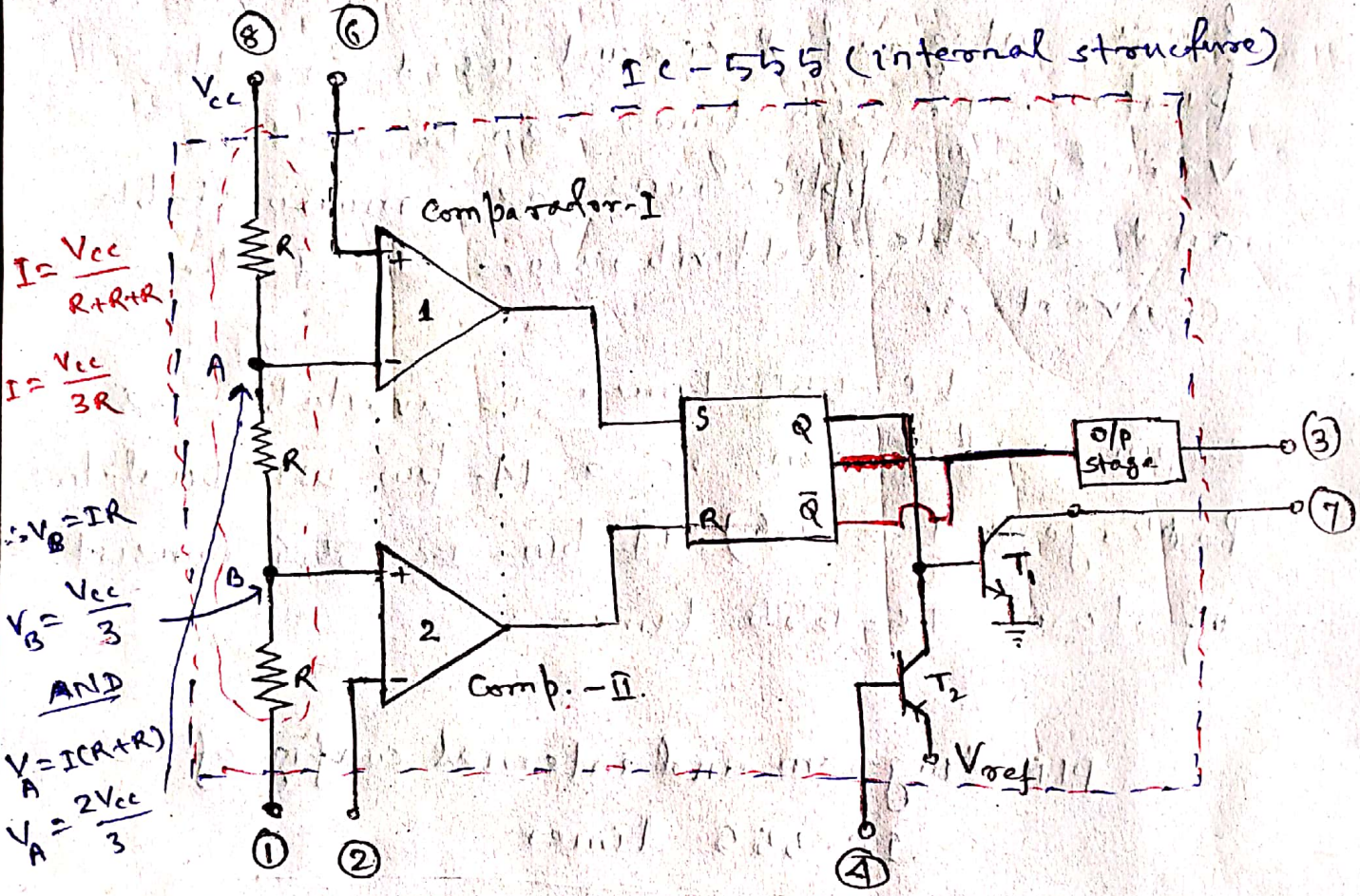

Fig-2

Pin-2. (Trigger) The output of timer can be controlled by this pin. The output is low if the voltage at this pin is greater than $\frac{2V_{cc}}{3}$. On negative going pulse of amplitude larger than $\frac{V_{cc}}{3}$, is applied to this pin, comparator-II output goes LOW, which in turn

makes the output high. The output will remain high as long as the trigger terminal has a low voltage.

Pin-3 (Output) :- The complementary signal out ($\bar{Q}$) of the flip-flop goes through an output stage and becomes o/p of timer.

Pin-4 (Reset) :- In most of the applications, Pin-4 is not used and this pin is connected to supply $+V_{cc}$ to avoid any false triggering

Pin-5 (Control voltage) :- The pulse width of output waveform can be varied by impressing a voltage at this pin. In most application, this pin is not required and a capacitor, (0.01 μF) is connected at this pin and ground to prevent noise problem in ckt.

Pin-6 (Threshold) : When, voltage at this pin is greater than $\frac{2V_{cc}}{3}$, the output of comparator-I goes HIGH which makes the output of timer LOW, (as o/p taken from $\bar{Q}$)

Pin-7 (Discharge) : A capacitor is connected externally to ground at this pin. Internally the collector of discharge transistor is coming at this Pin. Now a high $\bar{Q}$ output from flip-flop makes transistor T_1 – OFF. i.e, open-ckt

and the external capacitor charges at the rate determined by external RC network. When, the output Q is LOW, transistor gets saturated and external capacitor discharges.

Pin-8 (Supply $+V_{cc}$) : The IC-555 timer works with voltage +5 volt to +18 volt with respect to Pin-1. V_{cc} is applied at Pin-8.