

03/10/2023

UNIT-2

COMPARATORS AND SPECIAL FUNCTION IC'S

Comparator:

\* It is a circuit that compares a single voltage on one input of an operational amplifier with reference voltage and on the other input.

\*  $i/p \Rightarrow V_{in} > V_{ref}$

\*  $o/p \Rightarrow +V_{sat}, -V_{sat}$

Types of comparator:

(i) Non-inverting

(ii) Inverting

(i) Non-inverting:

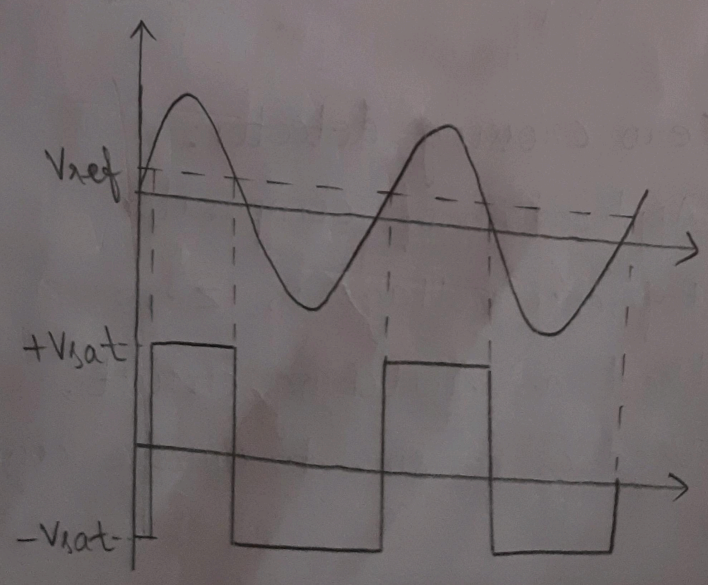
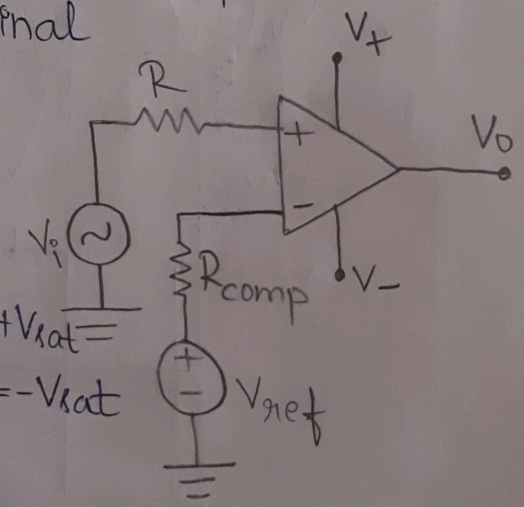
\* If the  $i/p$  voltage is applied at non-inverting terminal

$V_i =$  input voltage

$V_{ref} =$  Reference voltage

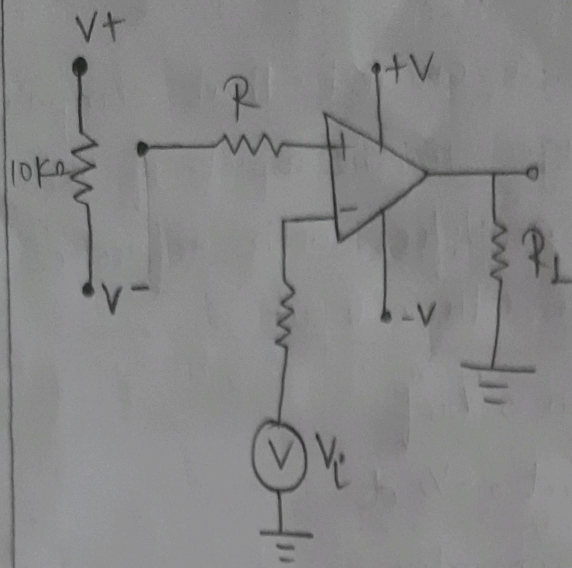
$V_i > V_{ref} \Rightarrow$  Output is  $+V_{sat}$

$V_i < V_{ref} \Rightarrow$  output  $V_o = -V_{sat}$



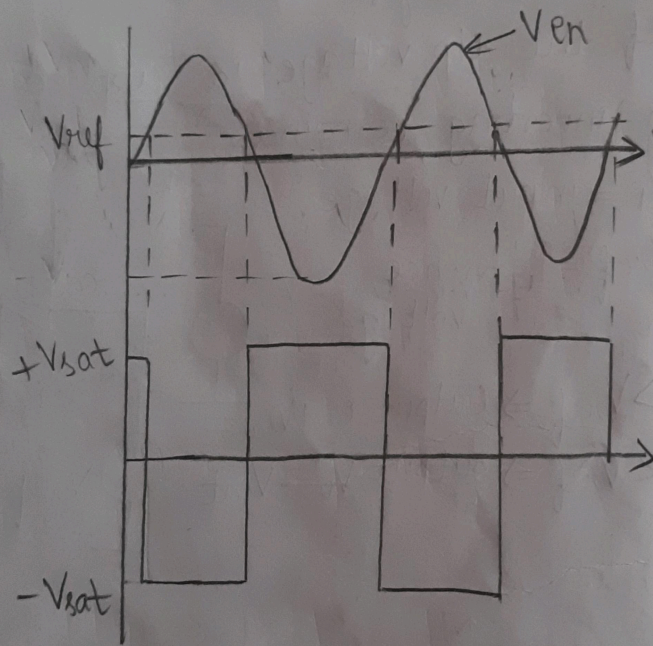
(ii) Inverting comparator:

Potentiometer  $\Rightarrow$  Can vary the input voltage.



$$V_i > V_{ref} \Rightarrow V_o = -V_{sat}$$

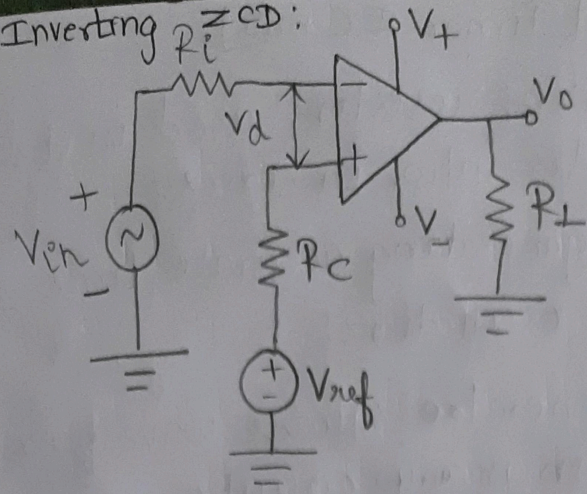
$$V_i < V_{ref} \Rightarrow V_o = +V_{sat}$$



Zero crossing detector:

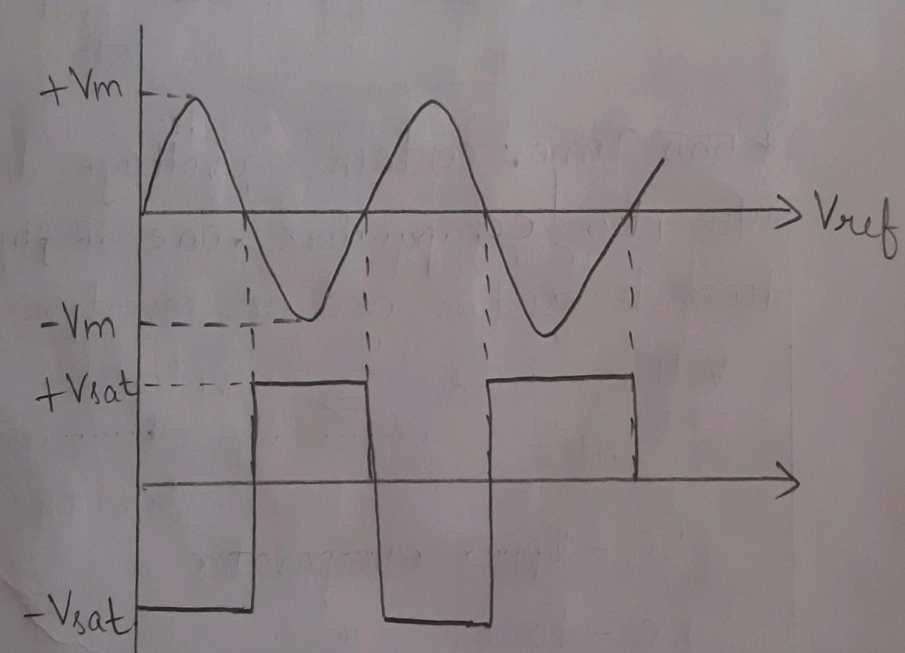
- \* Application of comparator
- \* Reference voltage is zero.
- \* Used as switching circuit.
- \* Used as a sine to square converter.

Inverting ZCD:

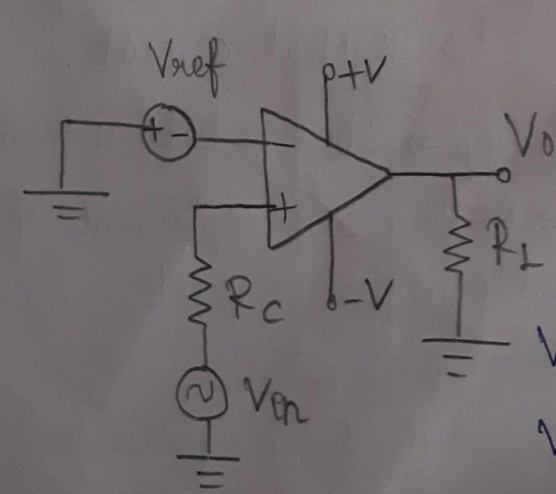


$V_{in} \geq V_{ref}:$   
 $V_d = V_{ref} - V_{in}$   
 $V_d = 0 - (+V_m)$   
 $V_d = -V_m$   
 $V_d = -V_{sat}$

$V_{in} < V_{ref}:$   
 $V_d = V_{ref} - V_{in}$   
 $V_d = 0 - (-V_m)$   
 $V_d = +V_m$   
 $V_d = +V_{sat}$



Non-inverting ZCD:



$V_d = V_{ref} - V_{in}$   
 $V_{ref} = 0$   
 $V_{in} > V_{ref} = +V_{sat}$   
 $V_{in} < V_{ref} = -V_{sat}$

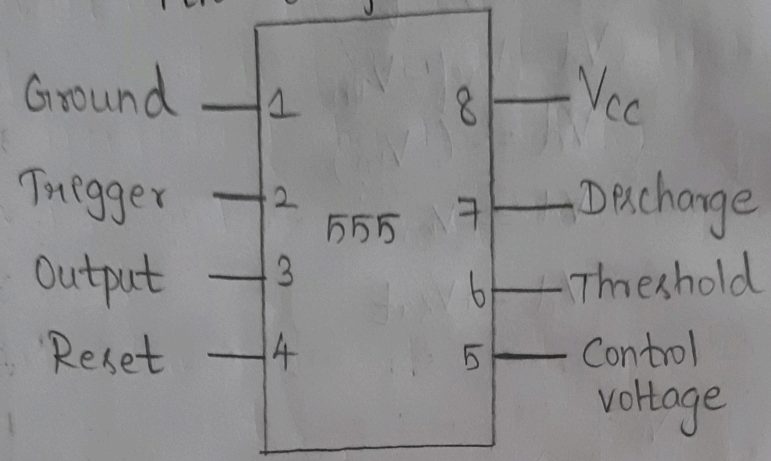
05/10/2023 IC 555: [Timer IC 555]

\* Three  $5K\Omega$  resistors used in its voltage divider n/w. in series.

\* Used for generating accurate time delays and oscillations.

\* Used to generate square wave form and used in many circuits.

Pin diagram



\* 555 Timer contains a voltage divider n/w, two comparators, one SR flip-flop, two transistors and an inverter.

Voltage divider  $\Rightarrow$  Divides the total  $V_{CC}$  voltage into fraction n/w

UC - Upper comparator

LC - Lower "

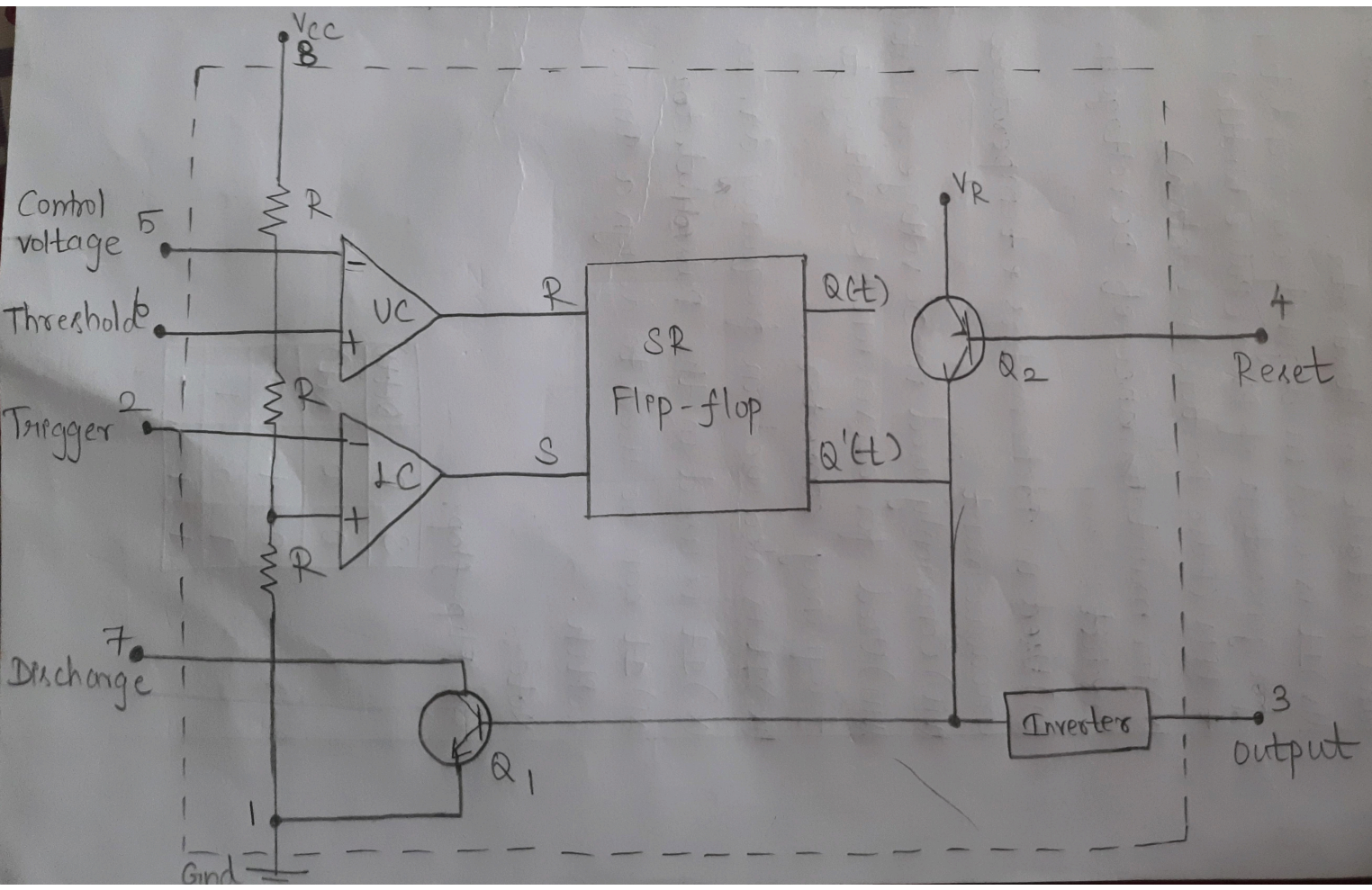
\* Flip-Flop  $\Rightarrow$  To store the information  $\hookrightarrow$  Digital circuit.

\* SR flip-flop  $\Rightarrow$  Store 1 bit information.

1  $\leftarrow$  Set  $\leftarrow$  Reset  $\Rightarrow$  Both are complement of each other  
 Two f/p  $\Rightarrow$  Sequential circuit.

Combinational circuit

\* Consist of memory  
 \* O/p depends on present + previous i/p



## Applications:

- (i) Generation of non-sinusoidal wave like square, triangular, rectangular, etc...
- (ii) For time delay generation, precision timing, and sequential timing.
- (iii) Used as a mono-stable multivibrator and a-stable multivibrator.
- (iv) It is used in digital communication for generation of PWM (Pulse Width Modulation) & PPM (Pulse Position Modulation).
- (v) For maintenance of DC voltage in circuit.
- (vi) Used in Tachometers & temperature measurement.
- (vii) Commonly used in DC voltage regulators.
- (viii) Used for conversion like voltage to frequency converter.
- (ix) It is also used in frequency divider.
- (x) It is used in the Pulse detector.
- (xi) It can be used to design a Timer switch.