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Comparators

A comparator is an electronic circuit, which compares the two inputs that are applied to it and produces an output. The output value of the comparator indicates which of the inputs is greater or lesser. Please note that comparator falls under non-linear applications of Op-Cs.

An OP-amp consists of two input terminals and hence an OP-amp based comparator compares the two inputs that are applied to it and produces the result of comparison as the output. This chapter discusses about OP-amp based comparators.

Types of Comparators :-

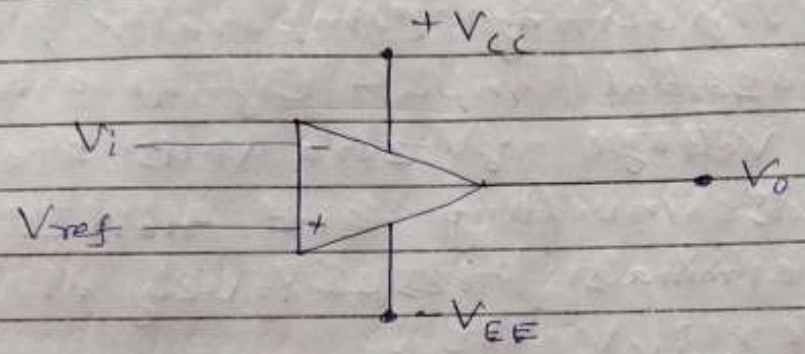
Comparator are of two types:

1) Inverting Comparator :-

An inverting Comparator is an OP-amp based comparator for which a reference voltage is applied to its non-inverting terminal and the input voltage is applied to its inverting terminal. This comparator is called as inverting comparator

because the input voltage, which has to be compared is applied to the inverting terminal of OP-amp.

The circuit diagram of an inverting Comparator is shown in the following figure —



The operation of an inverting Comparator is very simple. It produces one of the two values, +Vsat and −Vsat at the output based on the values of its input voltage Vi and the reference voltage Vref.

* The output value of an inverting comparator will be −Vsat, for which the input Vi voltage is greater than the reference voltage Vref.

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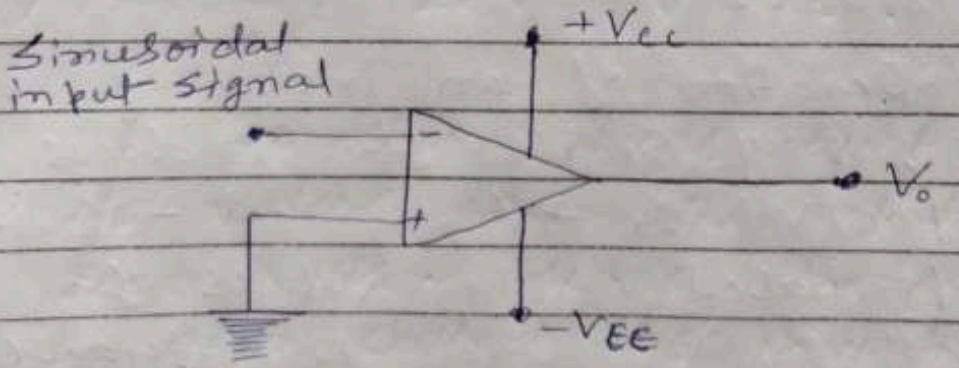
* The output value of an inverting Comparator will be $+V_{sat}$, for which the input V_i is less than the reference voltage V_{ref}.

Example –

Let us draw the output wave form of an inverting Comparator, when a Sinusoidal input Signal and a reference voltage of zero volts are applied to its inverting and non-inverting terminals respectively.



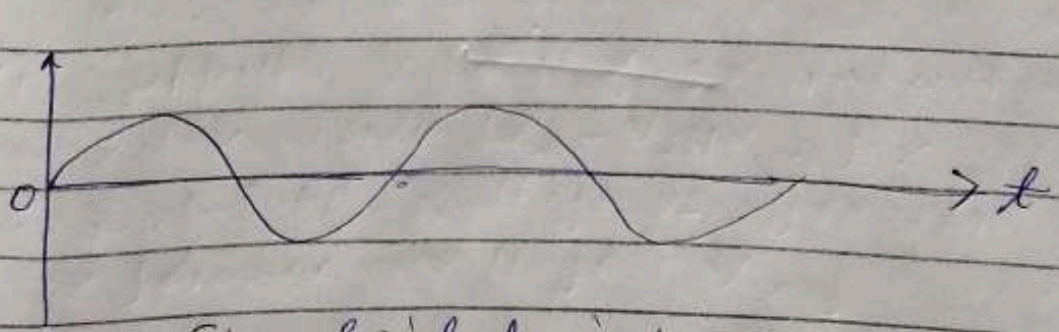
The operation of the inverting comparator shown above is discussed below →

* During the +ve half cycle of the Sinusoidal input Signal, the voltage present at the inverting terminal

of OP-amplifier is greater than Zero volts. Hence the output value of the inverting Comparator will be equal to $-V_{sat}$ during +Ve half cycle of the Sinusoidal input signal.

* Similarly during the -Ve half cycle of the Sinusoidal input signal, the Voltage present at the inverting terminal of the OP-amp. is less than Zero Volts. Hence, the output value of the inverting Comparator will be equal to $+V_{sat}$ during -Ve half cycle of the Sinusoidal input signal.

The following figure shows the input and output waveforms of an inverting Comparator, when the reference Voltage is Zero Volts.



Sinusoidal input signal

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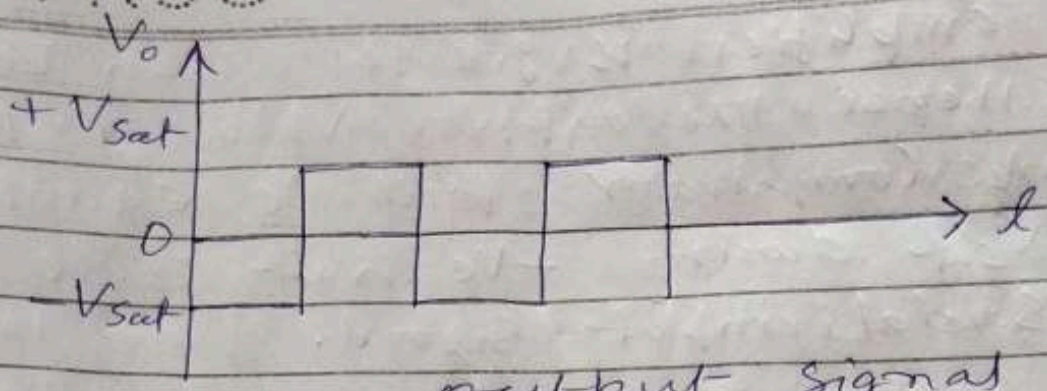

output signal

In the figure shown above, we can observe that the output transitions either from $-V_{sat}$ to $+V_{sat}$ or from $+V_{sat}$ to $-V_{sat}$ whenever the sinusoidal input signal is crossing zero volts.

In other words output changes its value when the input is crossing zero volts. Hence, the above circuit is also called as inverting zero crossing detector.