Clipper

Wave shaping circuits are the electronic circuits, which produce the desired shape at the output from the applied input wave form. These circuits perform two functions −

- Attenuate the applied wave
- Alter the dc level of the applied wave.

There are two types of wave shaping circuits: **Clippers** and **Clampers**

Op-amp based Clippers

A **clipper** is an electronic circuit that produces an output by removing a part of the input above or below a reference value. That means, the output of a clipper will be same as that of the input for other than the clipped part. Due to this, the peak to peak amplitude of the output of a clipper will be always less than that of the input.

The main advantage of clippers is that they eliminate the unwanted noise present in the amplitude of an ac signal.

Clippers can be classified into the following two types based on the clipping portion of the input.

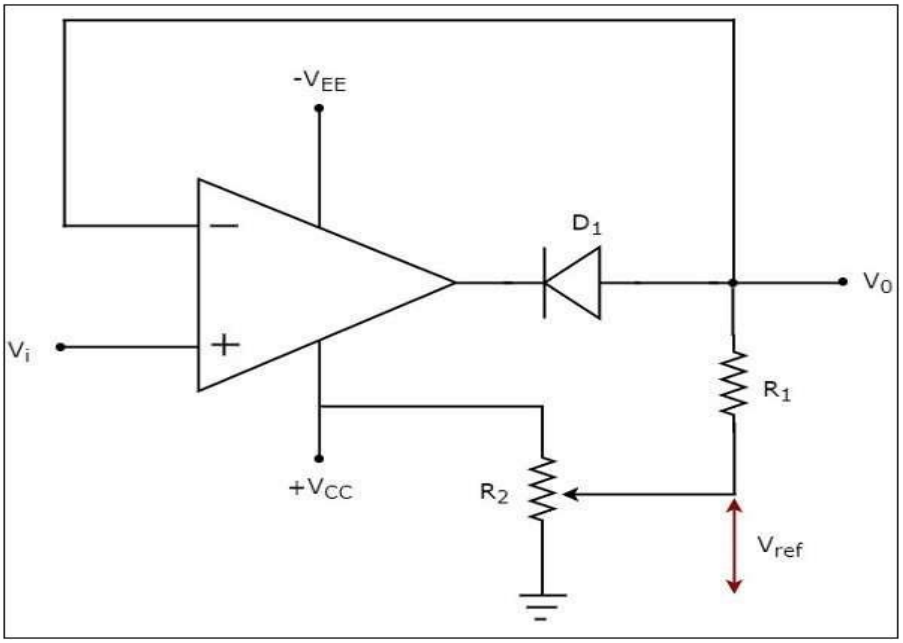
- Positive Clipper
- Negative Clipper

These are discussed in detail as given below −

Positive Clipper

A **positive clipper** is a clipper that clips only the positive portion(s) of the input signal.

The **circuit diagram**of positive clipper is shown in the following figure −

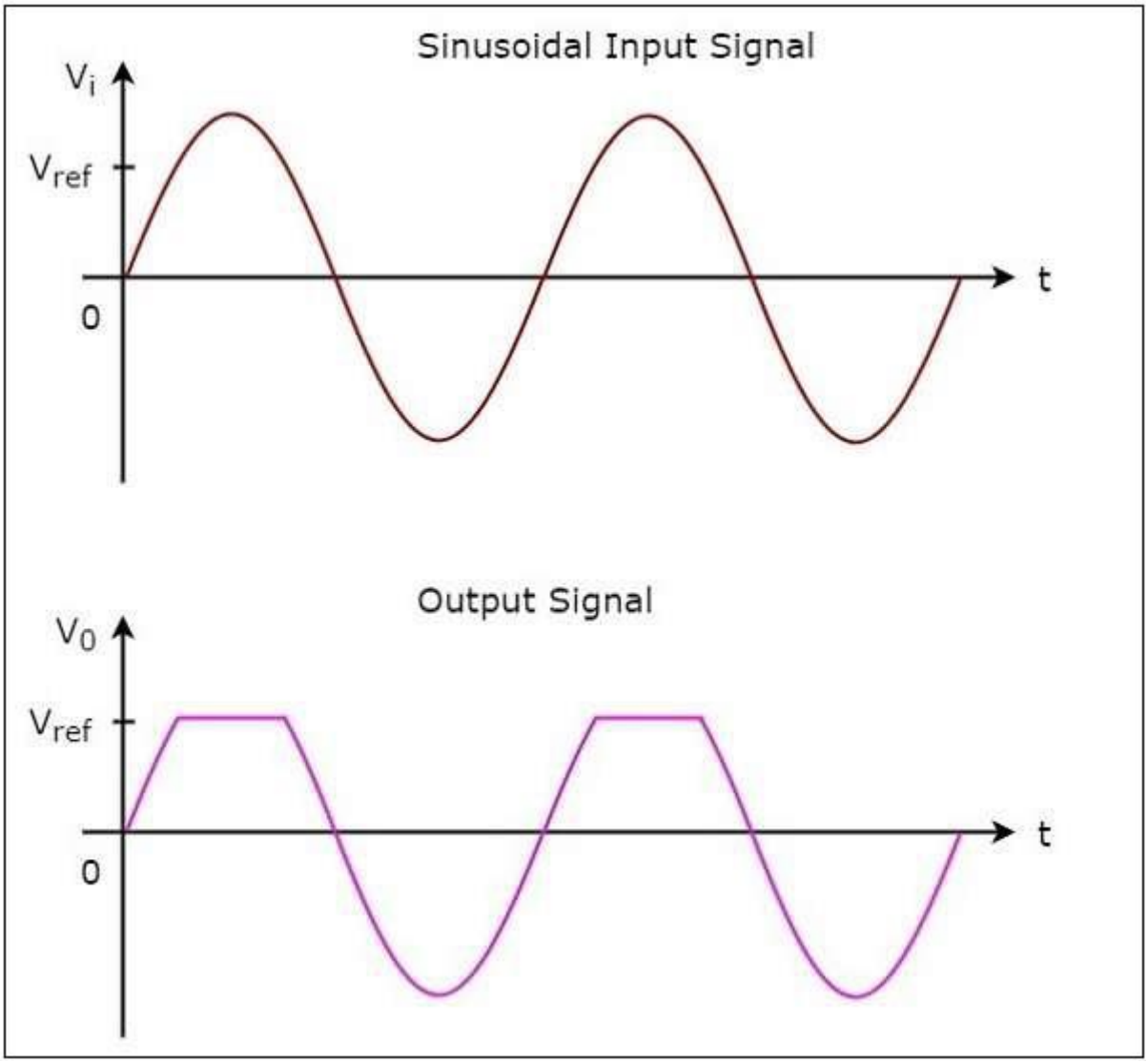


In the circuit shown above, a sinusoidal voltage signal V_t is applied to the non-inverting terminal of the op-amp. The value of the reference voltage V_{ref} can be chosen by varying the resistor R_2.

The **operation** of the circuit shown above is explained below −

- If the value of the input voltage V_i is less than the value of the reference voltage V_{ref}, then the diode D_1 conducts. Then, the circuit given above behaves as a **voltage follower**. Therefore, the output voltage V_0 of the above circuit will be same as that of the input voltage V_i, for $V_i < V_{ref}$.
- If the value of the input voltage V_i is greater than the value of reference voltage V_{ref}, then the diode D_1 will be off. Now, the op-amp operates in an open loop since the feedback path was open. Therefore, the output voltage V_0 of the above circuit will be equal to the value of the reference voltage V_{ref}, for $V_i > V_{ref}$.

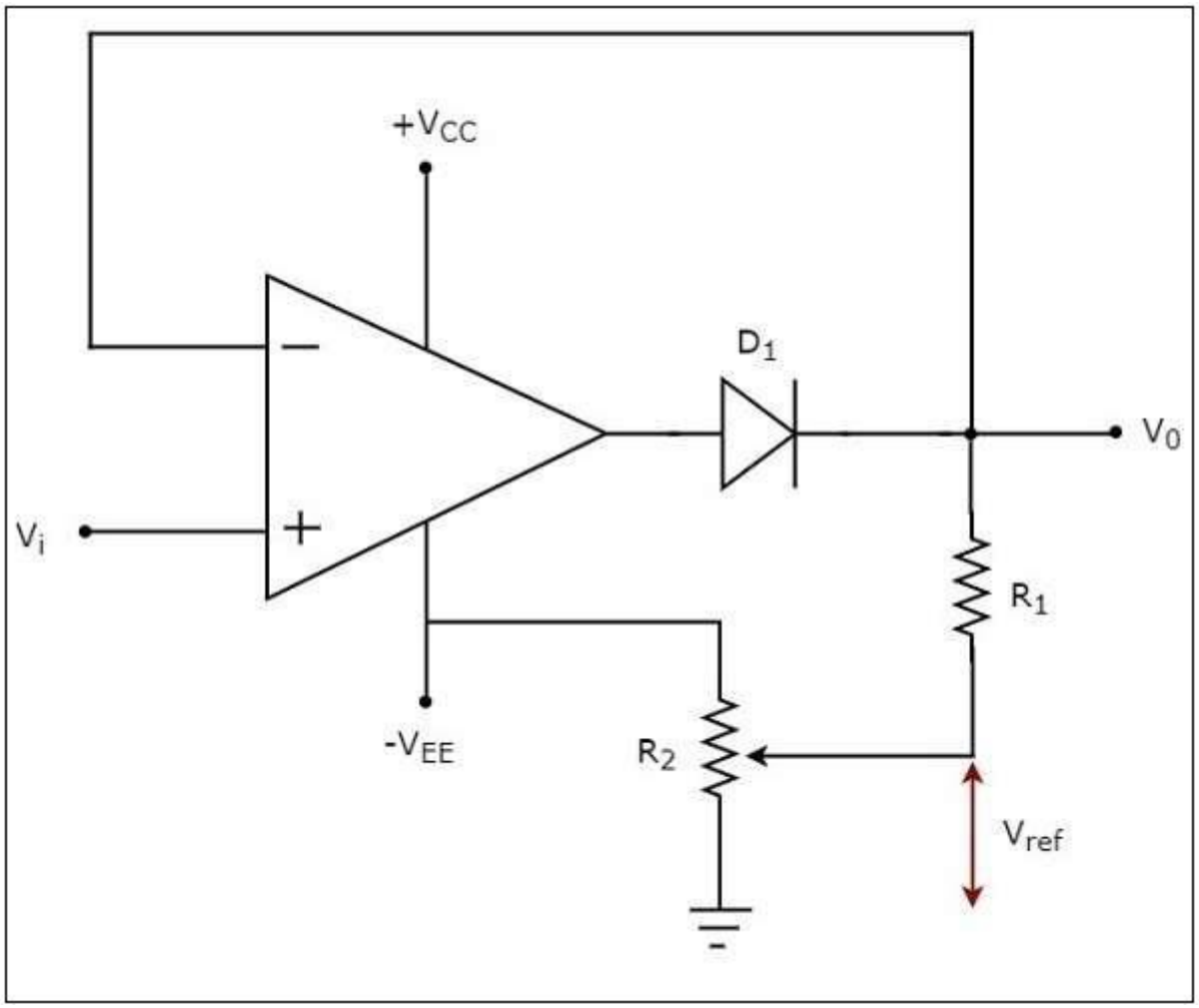
The **input wave form** and the corresponding **output wave form** of a positive clipper for a positive reference voltage V_{ref} are shown in the following figure −



Negative Clipper

A **negative clipper** is a clipper that clips only the negative portion(s) of the input signal. You can obtain the circuit of the negative clipper just by reversing the diode and taking the reverse polarity of the reference voltage, in the circuit that you have seen for a positive clipper.

The **circuit diagram** of a negative clipper is shown in the following figure −



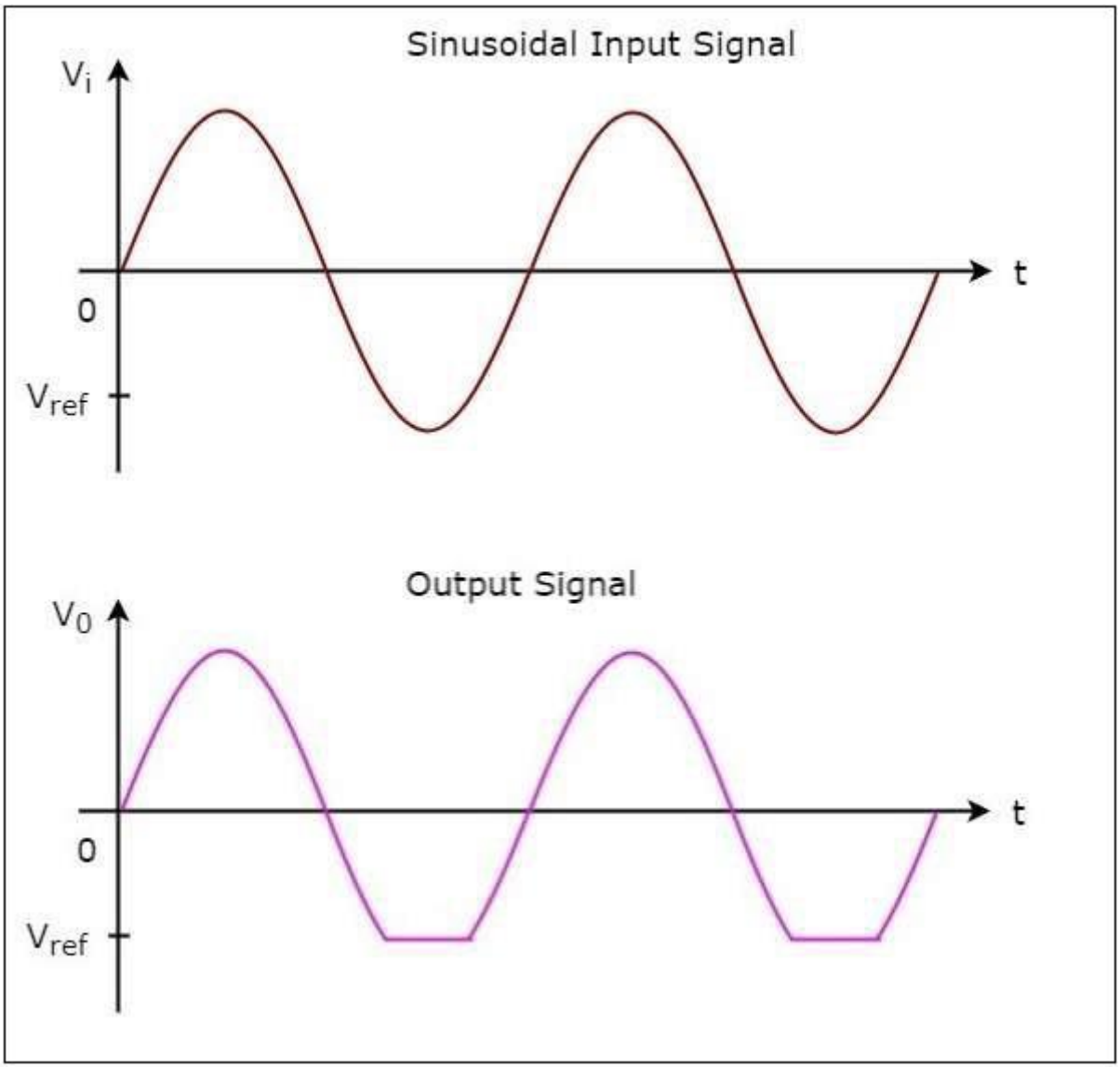
In the above circuit, a sinusoidal voltage signal V_i is applied to the non-inverting terminal of the op-amp. The value of the reference voltage V_{ref} can be chosen by varying the resistor R_2.

The **operation** of a negative clipper circuit is explained below −

If the value of the input voltage V_t is greater than the value of reference voltage V_{ref}, then the diode D_1 conducts. Then, the above circuit behaves as a **voltage follower**. Therefore, the output voltage V_0 of the above circuit will be same as that of the input voltage V_i for $V_i > V_{ref}$.

If the value of the input voltage V_i is less than the value of reference voltage , then the diode D_1 will be off. Now, the op-amp operates in an open loop since the feedback path is open. Therefore, the output voltage V_0 of the above circuit will be equal to the value of reference voltage ,V_{ref} for $V_i < V_{ref}$.

The **input wave form** and the corresponding **output wave form** of a negative clipper, for a negative reference voltage V_{ref}, are shown in the following figure −


Sinusoidal Input Signal
V_i
t
0
V_{ref}
Output Signal
V_0
t
0
V_{ref}