Op-Amp Characteristics

An ideal op amp is usually considered to have the following characteristics:

- Infinite open-loop gain G = v_{out} / v. ...
- Infinite input impedance R_{in}, and so zero input current.
- Zero input offset voltage.
- Infinite output voltage range.
- Infinite bandwidth with zero phase shift and infinite slew rate.

Inverting and Non-Inverting Operational Amplifiers

An operational amplifier is a three-terminal device consisting of two high impedance input terminals, one is called the **inverting input** denoted by a negative sign and the other is the **non-inverting input** denoted with a positive sign. The third terminal is the output of the Op-Amp.

Inverting Operational Amplifier

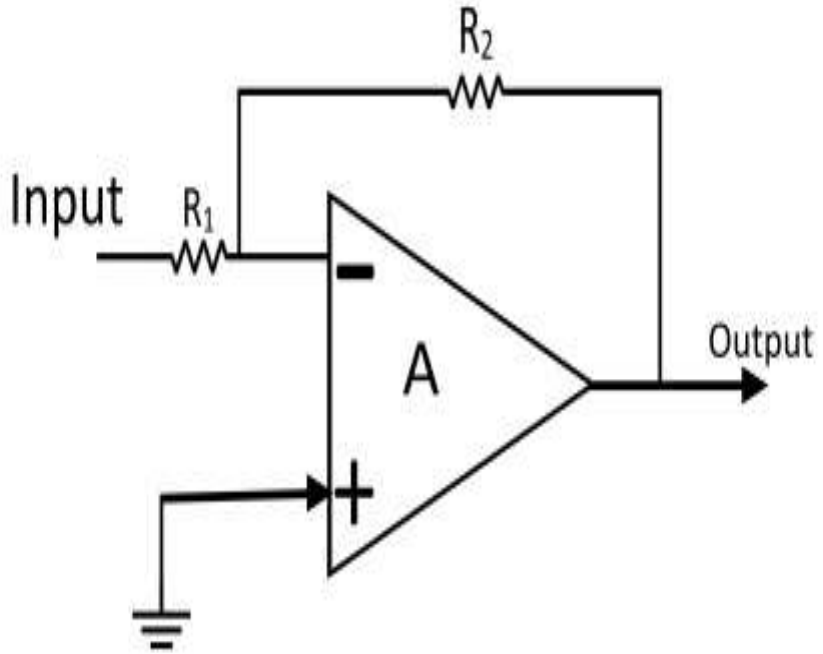
In the inverting operational amplifier circuit, the signal is applied at the inverting input and the non-inverting input is connected to the ground.

In this type of amplifier, the output is 180^0 out of phase to the input, i.e. when positive signal is applied to circuit, the output of the circuit will be negative.

By assuming the Op-Amp is ideal, then the concept of virtual short can be applied at the input terminals of the Op-Amp.

So that voltage at the inverting terminal is equal to the voltage at non-inverting terminal.

Inverting Operational Amplifier- circuit diagram



Inverting Operational Amplifier Gain Formula

$$\text{VoltageGain}(A_v) = V_{out} / V_{in} = -R_2 / R_1$$

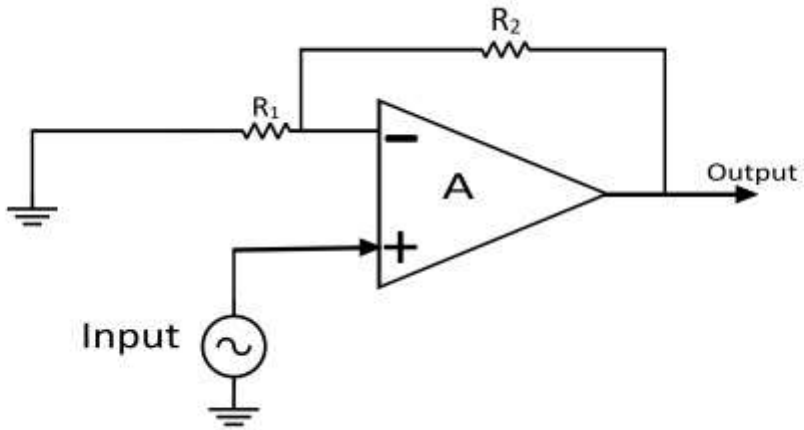
Non Inverting Operational Amplifier

When the signal is applied at the non-inverting input, the resulting circuit is known as Non-Inverting Op-Amp.

In this amplifier the output is exactly in phase with the input i.e. when a positive voltage is applied to the circuit, the output will also be positive.

By assuming the Op-Amp is ideal, then concept of virtual short can be applied i.e. the voltage at the inverting and non-inverting terminal is equal.

Non Inverting Operational Amplifier



VoltageGain(Av)=V_{out} / V_{in} = 1+R2 / R1

Difference Between Inverting & Non Inverting Operational Amplifier

Inverting Op-Amp	Non-Inverting Op-Amp
The type of feedback used is voltage shunt.	The type of feedback used is voltage series.
The input and output voltages of this amplifier are 180^{o} out of phase.	The input and output voltages are in phase.
Voltage Gain(Av)=Vout/Vin=−R2/R1	Voltage Gain(Av)=Vout /Vin= 1+R2 /R1

Advantages & Disadvantages of Op-Amp

Advantages

High input impedance: The input impedance of op–amp is extremely high, which leads to low current loading of the input signal source.

High Gain: The gain of op–amp is extremely high, which makes it suitable for applications such as amplification, filters, and oscillators.

Disadvantages

voltage Supply Limitations.

- Finite Bandwidth Limitations.
- Input Offset Voltage Limitations.
- Input Bias Current Limitations.
- Output Offset Voltage Limits.
- Slew Rate Limitation.
- Short Circuit Output Limits.
- Limited Common Mode Rejection Ratio.