

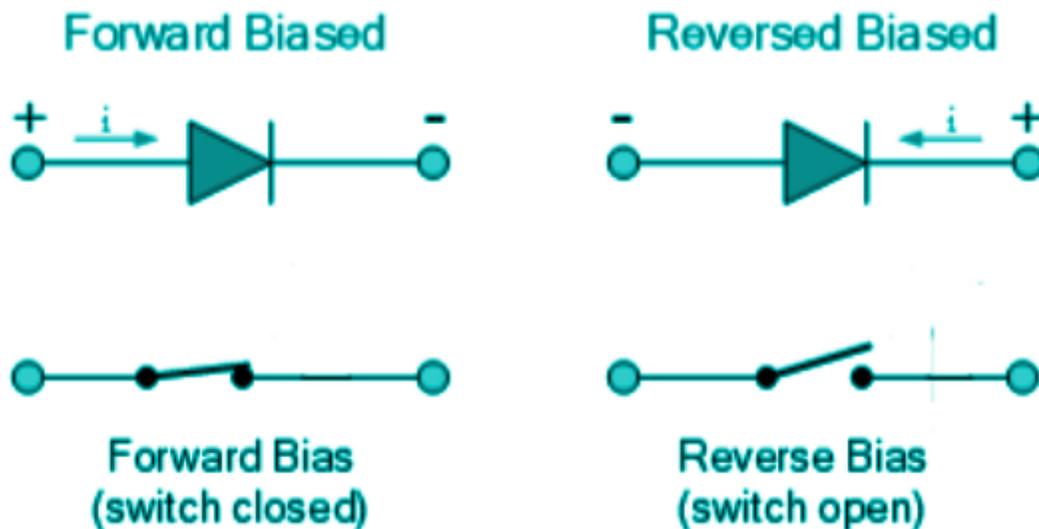
Ideal Diode

As the name suggests, an ideal diode is a diode that has all of its properties perfectly without any flaws. Diodes may operate either forwardly or reversely biased. Thus, these two modes of operation can be analyzed separately to determine the characteristics of the ideal diode.

Ideal Diode Circuit Symbol

The circuit symbol of an ideal diode is the simple representation of a diode by a triangle device. This symbol becomes a short or open circuit when forward and reverse biased, respectively.

In forward bias, the current flows from p to n side, and in reverse bias, there is supposed to be a small current from n to p, but since we are dealing with an ideal diode, the reverse current would be zero. This ideal behavior and its respective symbol representation are shown below.



Modes of Operation of Ideal Diode

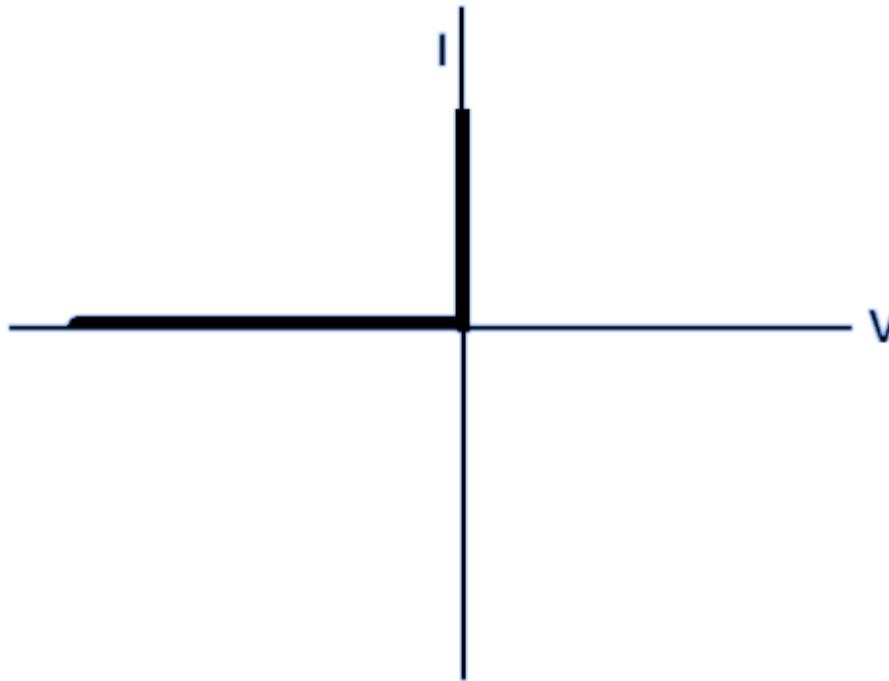
The two modes of operation of idea diode are-

- Forward Bias
- Reverse Bias.

Ideal Diode V-I Curve

An ideal diode has the same characteristics curve as an ideal switch, which conducts when applied potential and is open-circuited when there is no supply. This means that the ideal diode offers zero resistance in forward bias and infinite resistance in reverse bias. Hence no current flows in reverse bias and maximum current flows in forward bias.

The characteristics curve of an ideal diode is shown below.



Characteristics of Ideal Diode When Forward Biased

An ideal diode in forward bias offers zero resistance, zero threshold voltage, no depletion barrier, and infinite current. In addition, an ideal diode in forward bias is expected to act as a short circuit, as shown below.



Forward Biased

Zero Resistance

When forward-biased, an ideal diode will not resist the flow of current, which means it will be a perfect conductor. As a perfect conductor, it offers zero resistance to the flow of charge carriers.

Infinite Amount of Current

To explain why the ideal diodes offer infinite current when forward-biased, we can see the above property of zero resistance. From ohms law, we can say that

$$I=V/R,$$

and therefore,

$$\text{for } R=0,$$

we will get $I=\text{infinite}$.

Zero Threshold Voltage,

This property of the ideal diode, under the forward bias, is also directly related to its first property, which is zero resistance. A threshold voltage is a minimum voltage needed to overcome a diode's barrier potential and enable it to conduct; since there is zero resistance, there would not be any need for a threshold voltage for the diode to conduct.

Characteristics of Ideal Diode When Reverse Biased

An ideal diode in reverse bias offers characteristics such as infinite resistance, zero reverse leakage current, and no reverse breakdown.

Considering an ideal case, an ideal diode in the forward bias is expected to act as a short circuit, as shown below.



Reverse Biased

Infinite Resistance

When reverse-biased, an ideal diode should completely inhibit current flow. When reverse-biased, the ideal diode mimics a perfect insulator and offers infinite resistance to the flow of charge carriers.

Zero Reverse Leakage Current

This property can be justified with the property that the ideal diode offers infinite resistance when reverse-biased. Since there is infinite resistance, there can not be any current flow.

No Reverse Breakdown Voltage

When a reverse bias diode fails and starts to conduct heavy currents, it is said to have reverse breakdown voltage. Still, since there can be no current with the presence of infinite resistance, there would be no breakdown and hence no reverse breakdown voltage. Irrespective of the voltage magnitude, the diode will behave like an insulator.

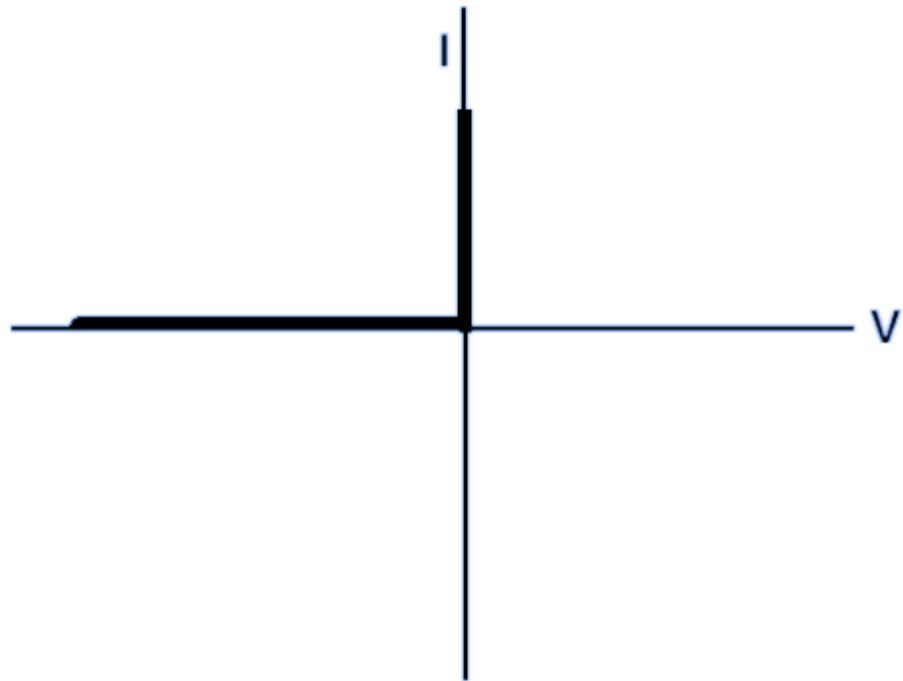
Comparison Between Conventional and Ideal Diode

Below, we will distinguish between an ideal's and conventional diode's properties and characteristics.

Characteristics Ideal Diode

Threshold Voltage	The junctions of an ideal diode do not have a threshold voltage, so they conduct current when you apply a forward voltage across them.
Forward Current	A diode would have zero internal resistance in an ideal condition, resulting in an infinite forward current when a forward voltage is applied across its terminals.
Breakdown Voltage	Due to their infinite resistance to reverse voltage, ideal diodes do not have a breakdown voltage.
Reverse Leakage Current	As an ideal diode has no breakdown point, it never conducts reverse current, also known as leakage current.

Characteristics
Curve



Biasing Circuit

