VOLTAGE-CURRENT CHARACTERISTIC OF A DIODE

1. When a forward-bias voltage is applied across a diode, there is current.
2. This current is called the *forward current* and is designated *I*F.
3. The resistor is used to limit the forward
4. Current to a value that will not overheat the diode and cause damage.
5. With 0 V across the diode, there is no forward current.

The Complete *V-I* Characteristic Curve

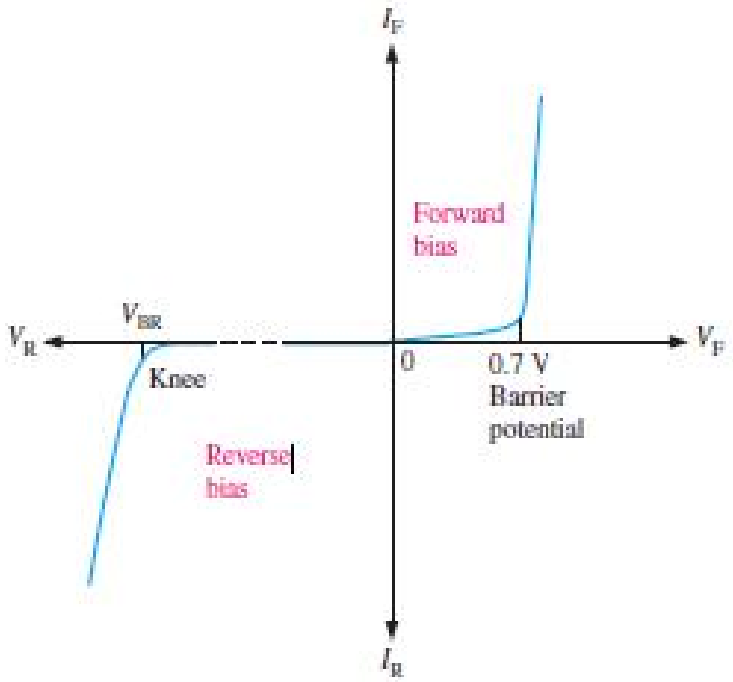
Forward Bias

1. As you gradually increase the forward-bias voltage, the forward current *and* the voltage across the diode gradually increase.
2. A portion of the forward-bias voltage is dropped across the limiting resistor. When the forward-bias voltage is increased to a value where the voltage across the diode reaches approximately 0.7 V (barrier potential), the forward current begins to increase rapidly.
3. As you continue to increase the forward-bias voltage, the current continues to increase very rapidly, but the voltage across the diode increases only gradually above 0.7 V. This small increase in the diode voltage above the barrier potential is due to the voltage drop across the internal dynamic resistance of the semi conductive material.

Reverse Bias

1. When a reverse-bias voltage is applied across a diode, there is only an extremely small reverse current (I_R) through the *pn* junction. With 0 V across the diode, there is no reverse current.
2. As you gradually increase the reverse-bias voltage, there is a very small reverse current and the voltage across the diode increases. When the applied bias voltage is increased to a value where the reverse voltage across the diode (V_R) reaches the breakdown value (V_{BR}), the reverse current begins to increase rapidly.
3. As you continue to increase the bias voltage, the current continues to increase very rapidly, but the voltage across the diode increases very little above V_{BR}. Breakdown, with exceptions, is not a normal mode of operation for most *pn* junction devices.

The Complete *V-I* Characteristic Curve

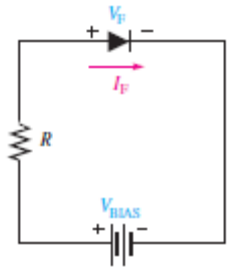


DIODE MODELS:

Bias connections

1. Forward Bias:

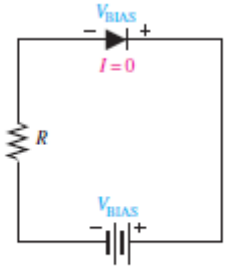
Recall that a diode is forward-biased when a voltage source is connected as shown in Figure below. The positive terminal of the source is connected to the anode through a current-limiting resistor. The negative terminal of the source is connected to the cathode. The forward current (*I*F) is from anode to cathode as indicated. The forward voltage drop (*V*F) due to the barrier potential is from positive at the anode to negative at the cathode.



(a) Forward bias

2. Reverse Bias

A diode is reverse-biased when a voltage source is connected as shown in Figure below. The negative terminal of the source is connected to the anode side of the circuit, and the positive terminal is connected to the cathode side. A resistor is not necessary in reverse bias but it is shown for circuit consistency. The reverse current is extremely small and can be considered to be zero. Notice that the entire bias voltage (V_{BIAS}) appears across the diode.



(b) Reverse bias