

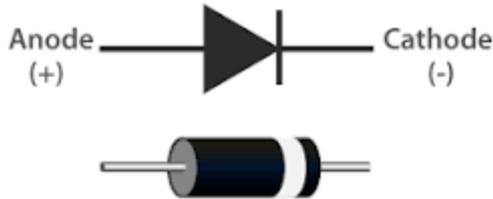
ELECTRONICS DEVICES & CIRCUITS

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LECTURE ON DIODE V-I CHARACTERISTICS

Diode Schematic Symbol

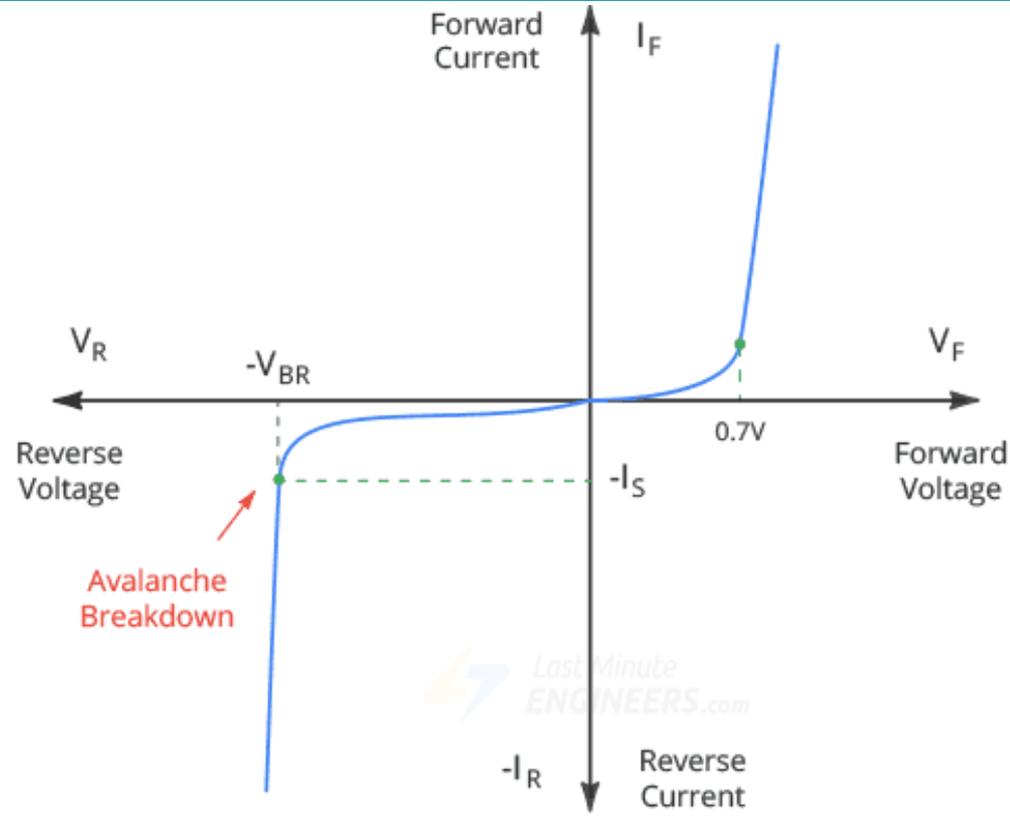
- **Following figure shows the schematic symbol of a diode.**
- **The symbol looks like an arrow that points from the p side to the n side.**
- **The p side is called the anode and the n side the cathode.**
- **The arrow direction in the diode symbol indicates the direction of hole flow (Direction of conventional current).**



Diode I-V Characteristics

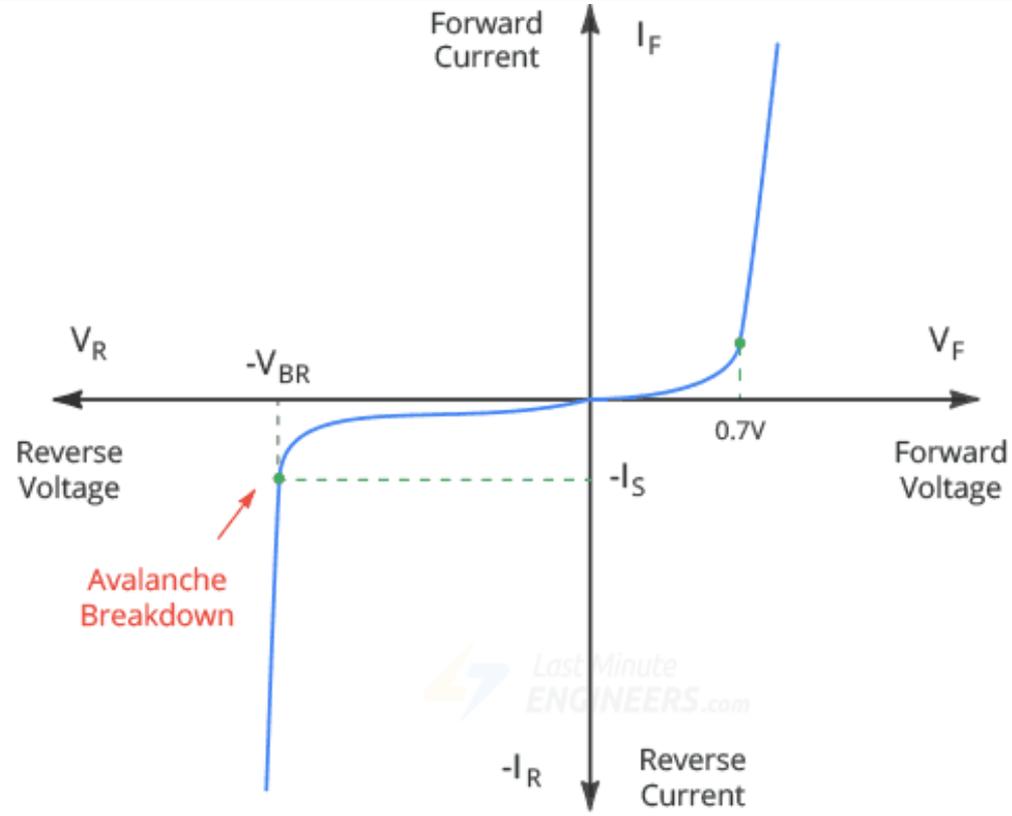
This plot is called Current-Voltage (I-V) characteristics.

- Following figure shows a basic diode circuit in which the diode is forward biased. A series resistor R_S is usually used to limit the amount of forward current I_F
- After connecting this circuit, if you measure the voltage and current of the diode for forward and reverse bias, and plot it, you will get a graph that looks as shown



Diode I-V Characteristics

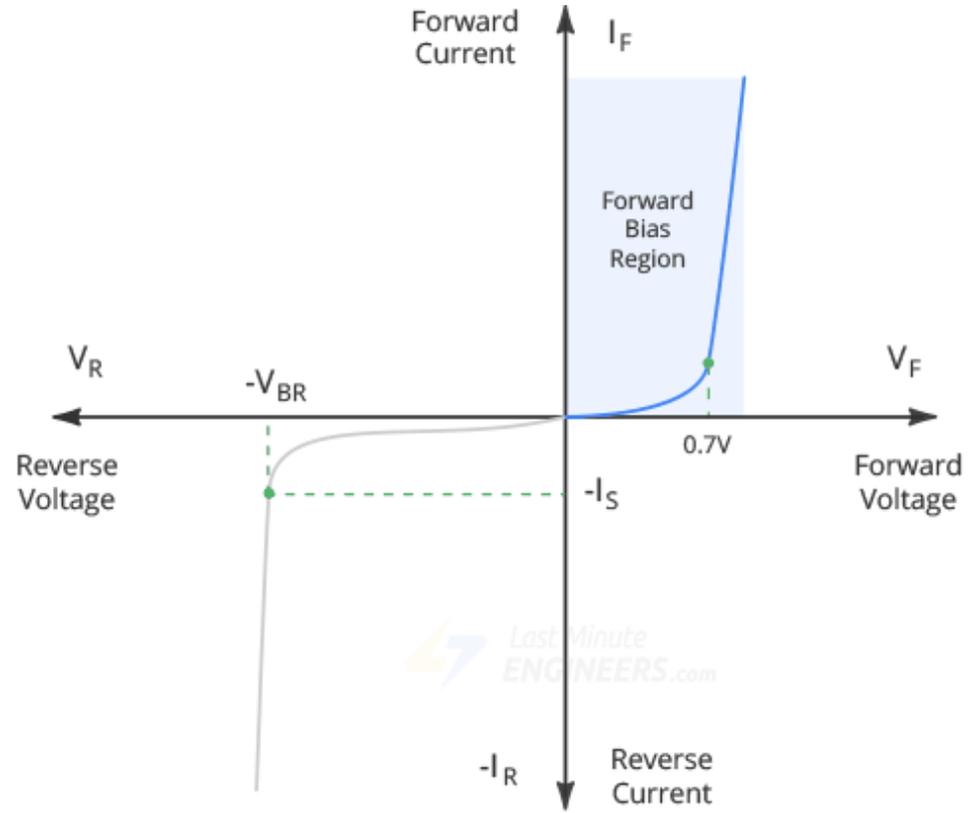
- Depending on the voltage applied across it, a diode will operate in one of three regions:
 - Forward Bias
 - Reverse bias
 - Breakdown.



Diode I-V Characteristics

Forward Bias Region

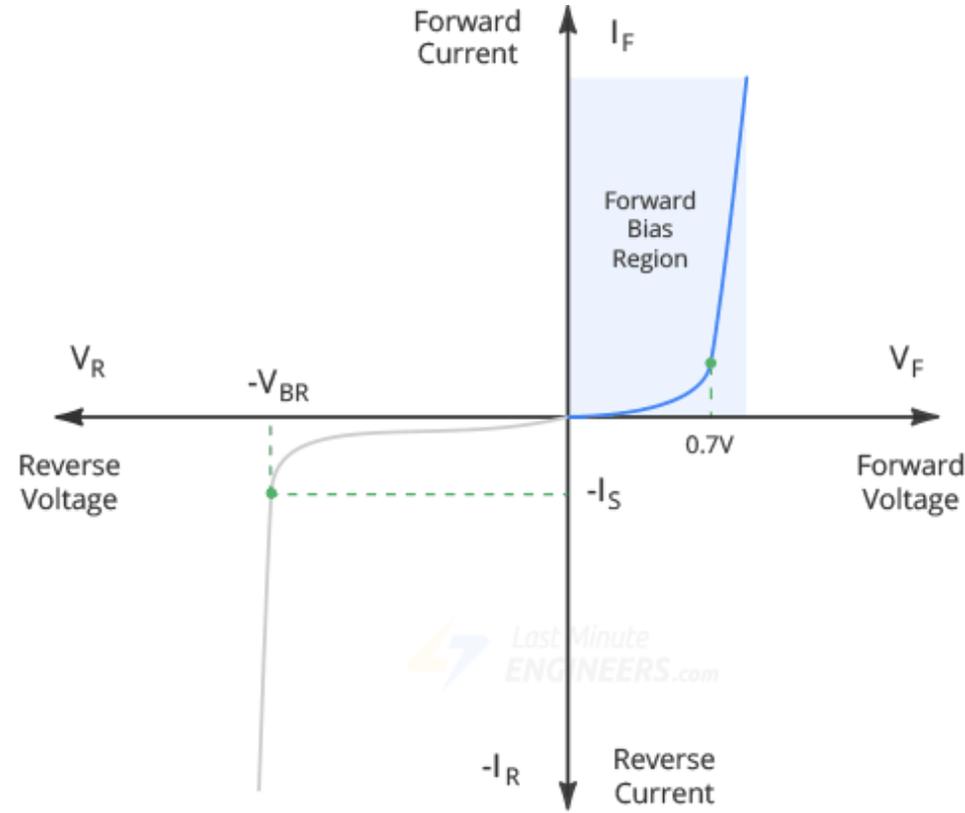
- When the diode voltage is less than the barrier potential, a small current flows through the diode.
- When the diode voltage exceeds the barrier potential, the current flowing through the diode increases rapidly.



Diode I-V Characteristics

Forward Bias Region

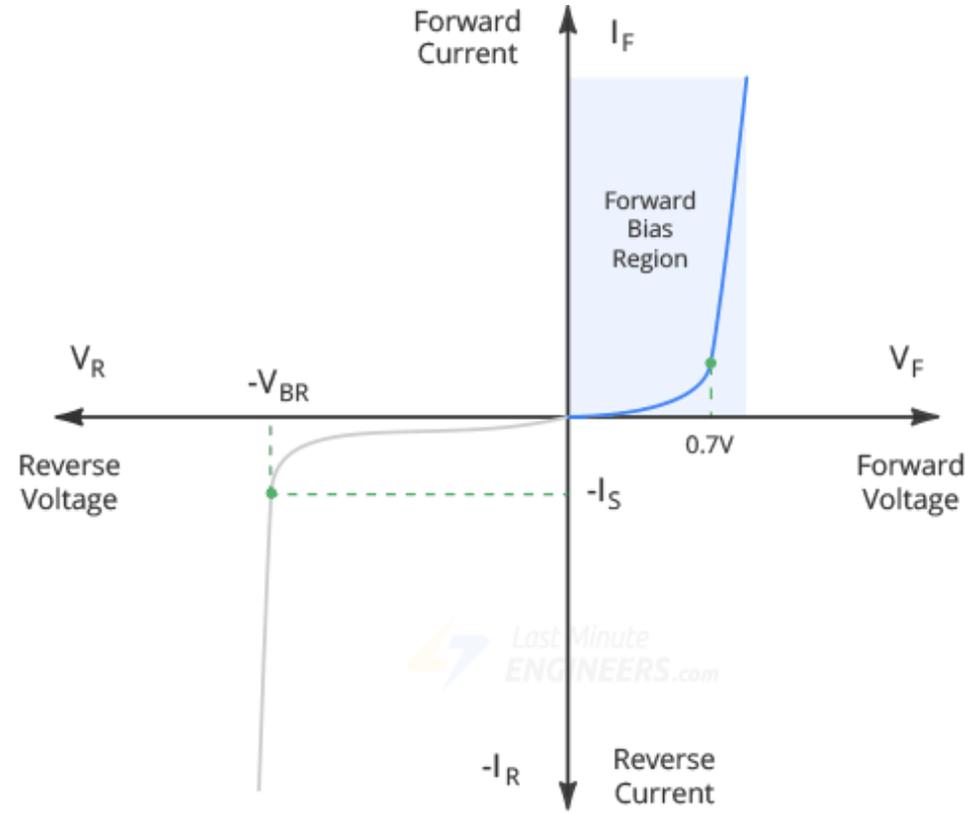
- The voltage at which current starts to increase rapidly is called the forward voltage (V_F) of the diode.
- It is also called **cut-in voltage** or knee voltage.



Diode I-V Characteristics

Forward Bias Region

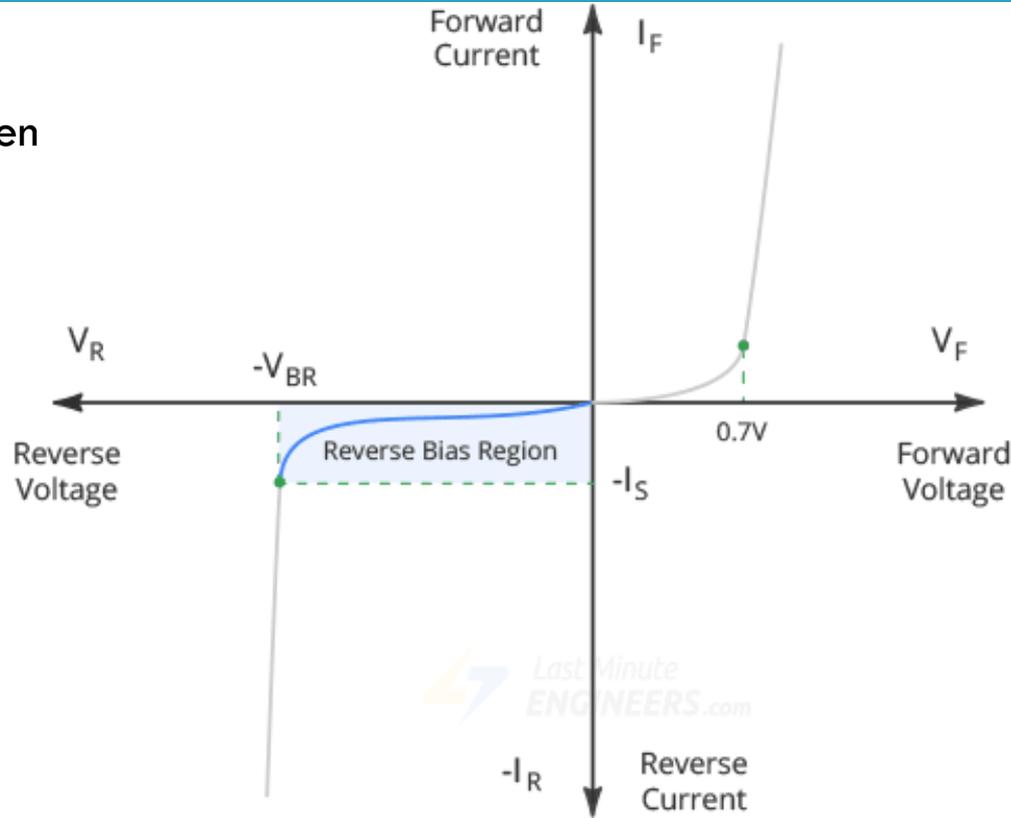
- Typically, a silicon diode has a V_F around 0.7V and a germanium-based diode has around 0.3V.



Diode I-V Characteristics

Reverse Bias Region

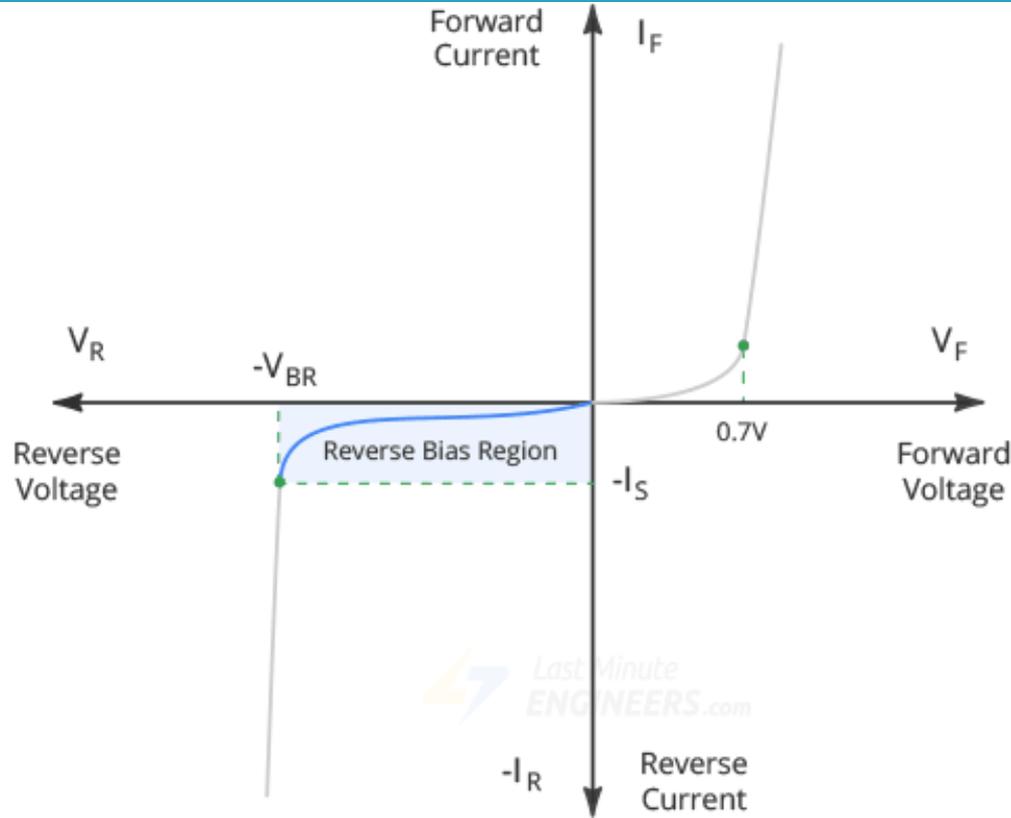
- The reverse bias region exists between zero current and breakdown.
- In this region, a small reverse current flows through the diode. This reverse current is caused by the thermally produced minority carriers.



Diode I-V Characteristics

Reverse Bias Region

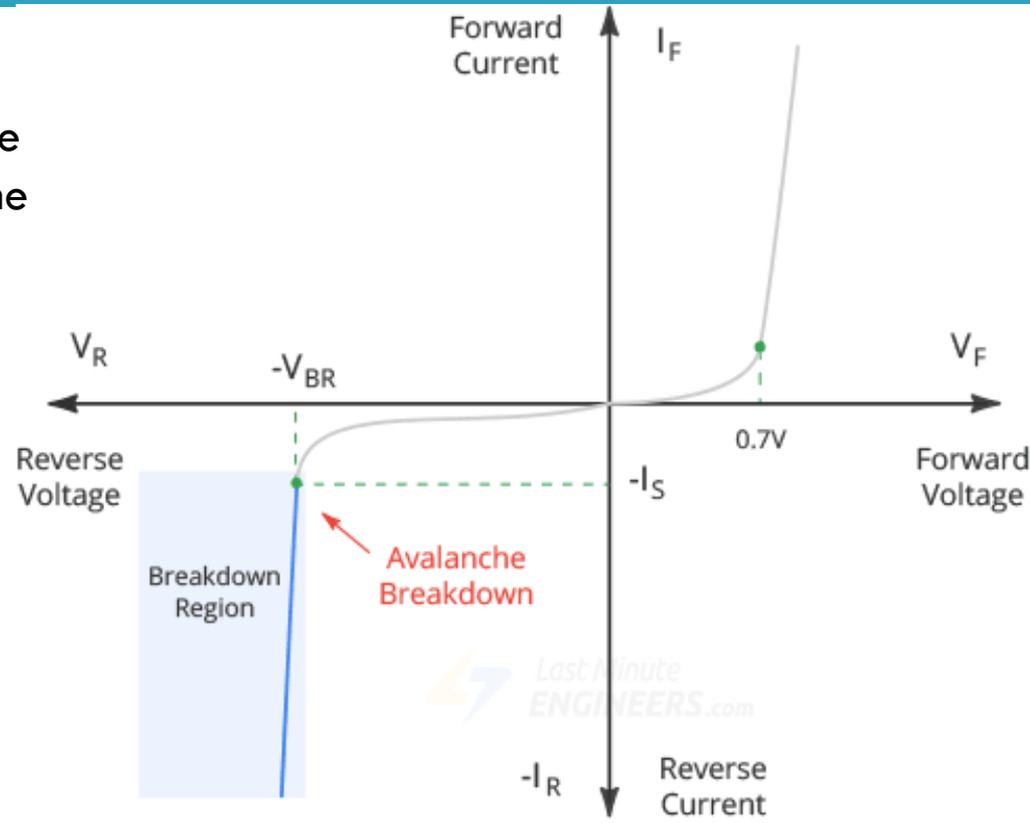
- This reverse current is so small that you cannot even notice it and it is considered almost zero.



Diode I-V Characteristics

Breakdown Region

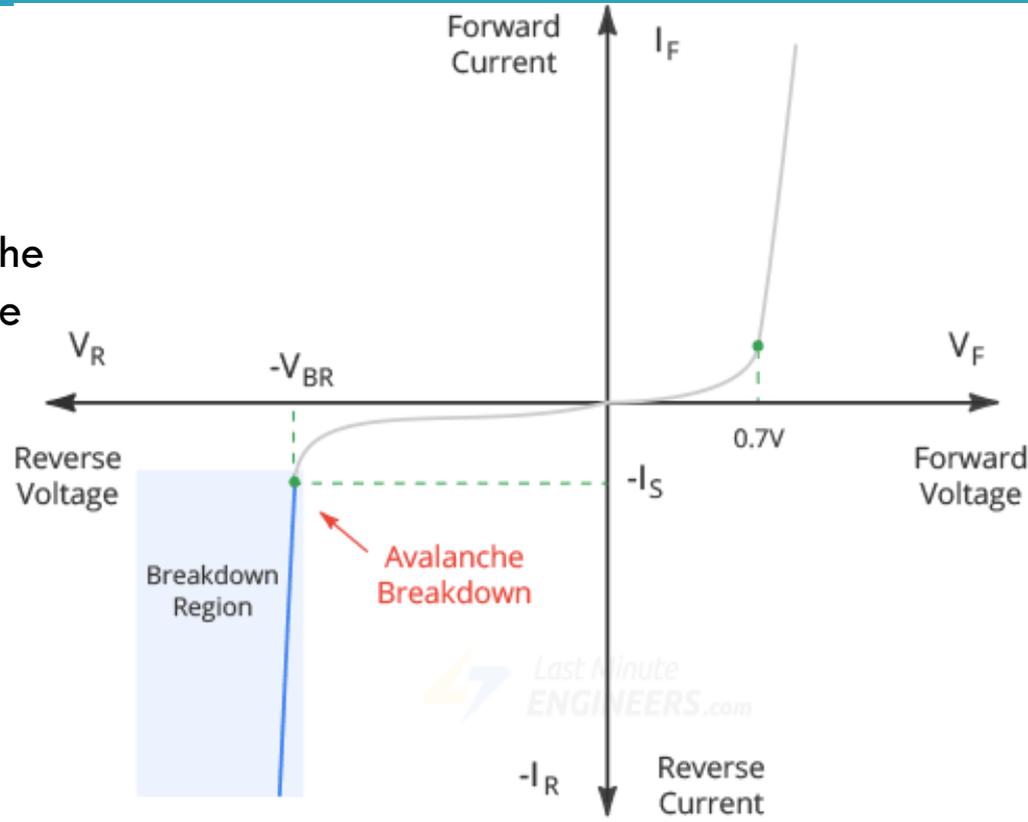
- If you continue increasing the reverse voltage, you will eventually reach the so-called breakdown voltage of the diode.



Diode I-V Characteristics

Breakdown Region

- At this point, a process called Avalanche Breakdown occurs in the semiconductor depletion layer and the diode starts conducting heavily in the reverse direction, destroying the diode.





Thank You