16장 PN 접합 다이오드

16-1 PN 접합

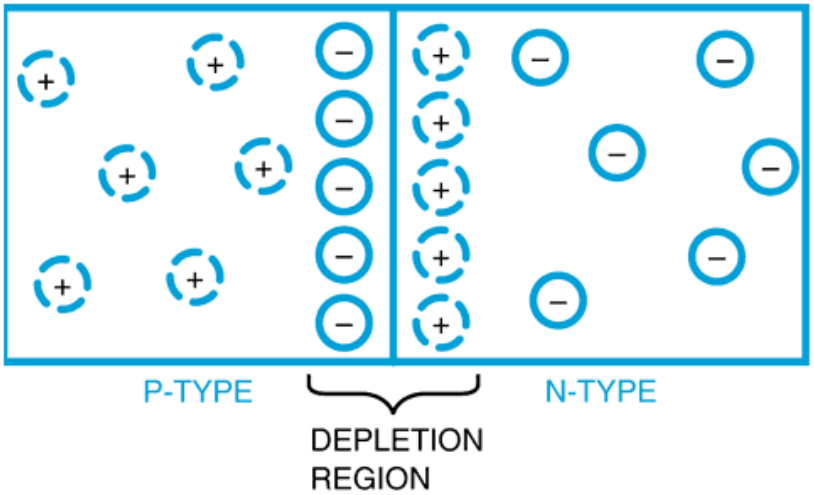
- Mobile charges
  - Electrons and holes that drift.
- Positive ions
  - An atom that has more protons than electrons.
- Negative ions
  - An atom that has more electrons than protons.

16-1 PN 접합

Created by joining N- and P-type materials together.

- When these materials come in contact with each other, they form a junction called a *junction diode*.

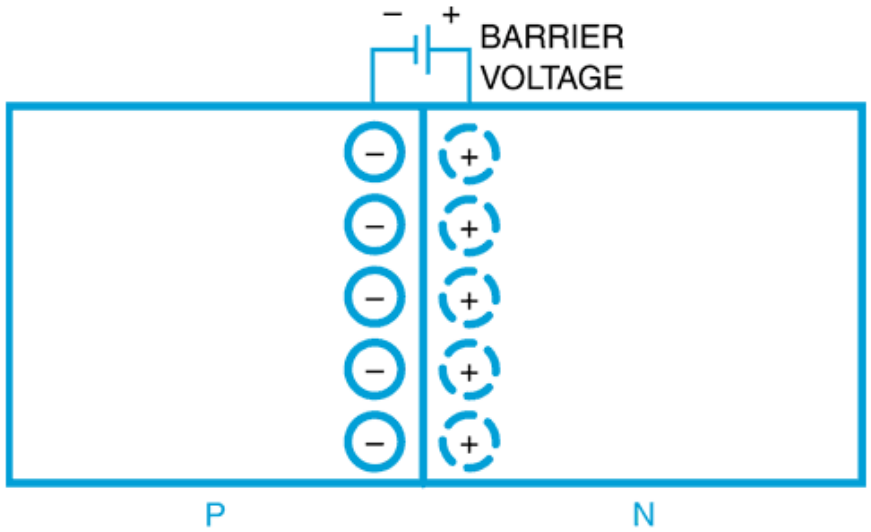
16-1 PN 접합



The depletion region is the area near the junction where electrons and holes are depleted; it extends only a short distance on either side of the junction.

16-1 PN 접합

- Barrier voltage
  - Opposite charges that build up on each side of the junction.
  - Can be represented as an external voltage source.



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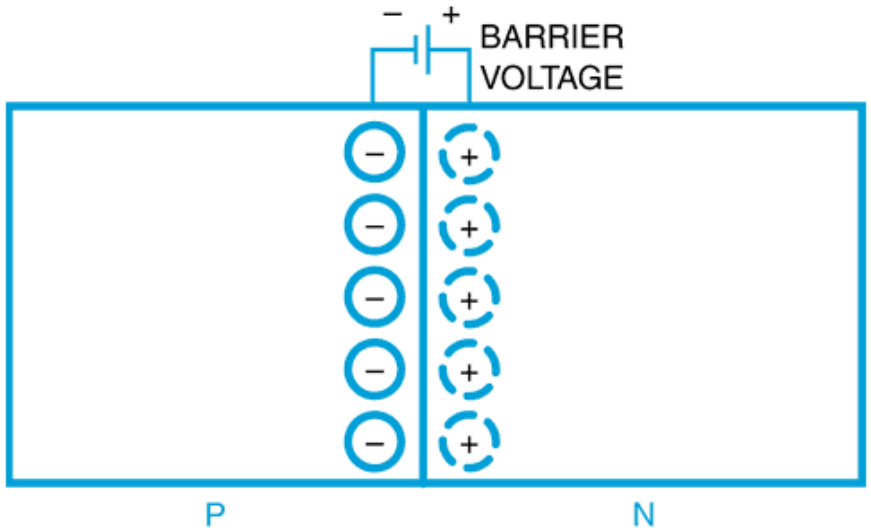
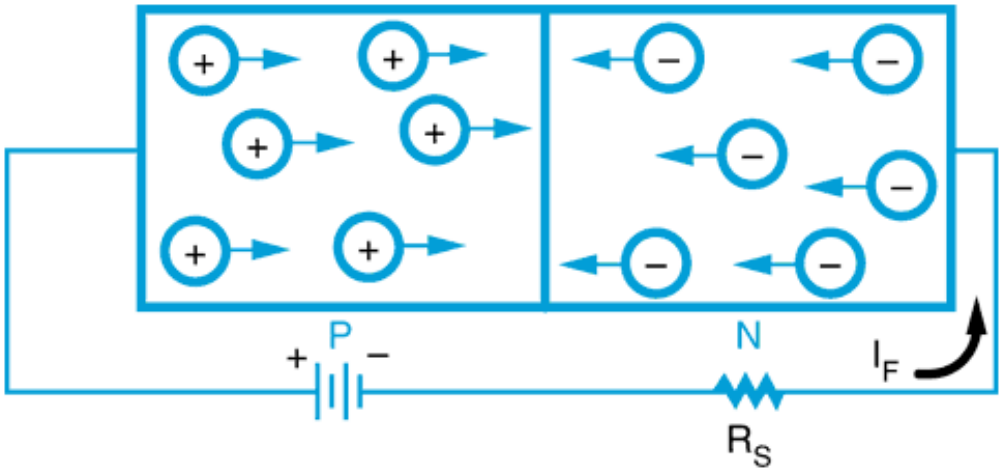


16-2 다이오드의 바이어스

► Bias voltage

- When a voltage is applied to a diode it is referred to as a bias voltage.



16-2 다이오드의 바이어스

► Forward bias voltage

– When the current flows from the N-type to the P-type material, the diode has a forward bias.

  § Germanium diodes require a minimum bias flow of .03 volt.
  § Silicon diodes require a minimum bias flow of .07 volt.

16-2 다이오드의 바이어스

► Forward bias voltage

– Once a diode starts conducting, a voltage drop known as a forward voltage drop occurs.

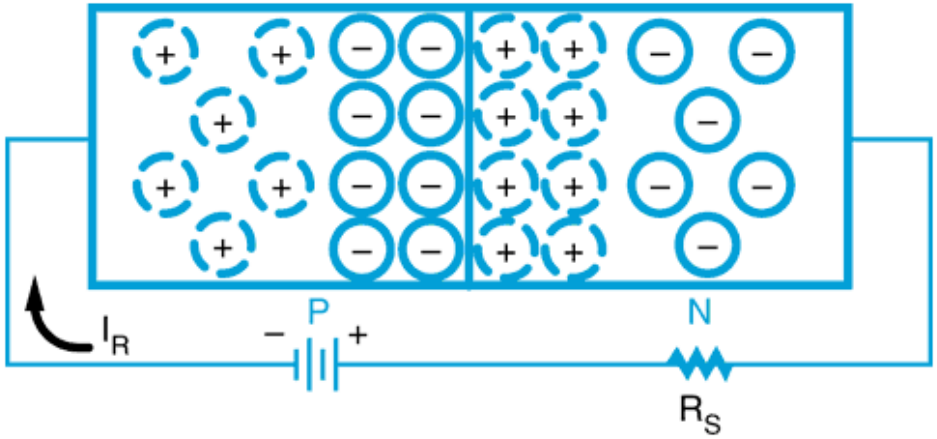
§ Voltage drop for germanium = .03 volt.

§ Voltage drop for silicon = .07 volt.

16-2 다이오드의 바이어스

► Reverse bias voltage

– A diode where the terminals are reversed.
– The diode does not conduct.
– Only a small leakage current flows.



16-3 다이오드의 특성

- Can be damaged by excessive heat.
- Can be damaged by excessive reverse voltage.
- At room temperature, reverse current is small.
  - Reverse current is higher in germanium than in silicon.

16-4 다이오드의 제조기술

- Three types of PN junctions:
  - A grown junction.
  - An alloyed junction.
  - A diffused junction.

16-4 다이오드의 제조기술

► Grown Junctions

- Intrinsic semiconductor material and P-type impurities are melted in a quartz container.
- A semiconductor crystal, called a seed, is lowered into the molten mixture.
- The seed is rotated and slowly withdrawn, allowing the molten mixture to cling to it.
- The molten mixture cools and rehardens, assuming the same characteristics as the seed.
- As the seed is withdrawn, it is alternately doped with N- and P-type impurities.
- The resulting crystal is sliced into many PN sections.

16-4 다이오드의 제조기술

► Alloyed Junctions

- A small pellet or trivalent material is placed on an N-type semiconductor crystal.
- The two are heated until the pellet melts and partially fuses with the crystal.
- The area where the two materials combine forms the P-type material.
- The material recrystallizes, forming a solid PN junction.

16-4 다이오드의 제조기술

► Diffused Junctions

- Most used today.
- Place a mask with openings on a thin section of N- or P-type semiconductor material called a wafer.
- Place the wafer in an oven and expose it to an impurity in a gaseous state.
- The impure atoms penetrate through the exposed surfaces of the wafer at extremely high temperatures.
- The depth of diffusion is controlled by the length of exposure and the temperature.

16-4 PN 접합 다이오드의 검사

- Check the forward-to-reverse-resistance ratio (~100) with an ohmmeter.

- An ohmmeter test should show a low forward resistance and a high reverse resistance.