

# 1. Conductors, semiconductors, and insulators

Materials can be divided into three categories according to their ability to conduct an electric current:

- Conductors: Materials that easily conduct electricity (i.e., materials with high electrical conductivity and low electrical resistivity)
- Semiconductors: Materials with an electrical conductivity value that falls between that of a conductor and that of an insulator
- Insulators: Materials that do not readily conduct electricity (i.e., materials with high electrical resistivity)

Conductors have electrical resistivity on the order of  $10^{-8}$  to  $10^{-4}$   $\Omega\text{cm}$  whereas insulators have electrical resistivity on the order of  $10^8$  to  $10^{18}$   $\Omega\text{cm}$ . Semiconductors have an electrical resistivity value between those of conductors and insulators— $10^{-4}$  to  $10^8$   $\Omega\text{cm}$ .

Electrical resistivity:  $\Omega\text{cm}$

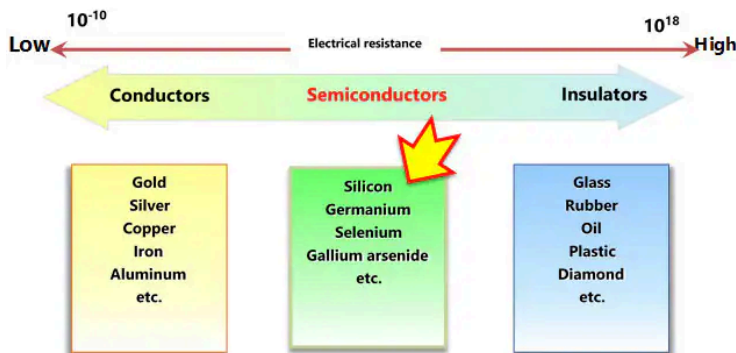


Figure 1-1 Categories of materials according to their electrical resistivity

Electrical resistance ( $R$ ) is the resistance to a flow of electric current through a material. The electrical resistance of a material is proportional to its length ( $l$ ) and inversely proportional to its cross-sectional area ( $A$ ). Each material has also an intrinsic property called electrical resistivity ( $\rho$ ). Electrical resistance ( $R$ ) is expressed as follows as a function of  $\rho$ ,  $l$  and  $A$ . Electrical resistivity ( $\rho$ ) is determined by the energy level (band) of the electrons in the outermost shell of an atom, crystalline states, and other factors.

$$R = \rho \times \frac{l}{A}$$

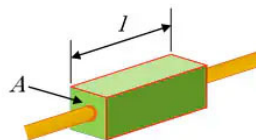


Figure 1-2 Definition of the electrical resistance of a material

# Chapter1 Basics of Schottky Barrier Diodes (Basic of Semiconductor Device)

1-1. Energy band diagram	1-2. Characteristics of an intrinsic silicon semiconductor	1-3. pn junction	1-3-1. Forward biasing	1-3-2. Reverse biasing
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[Chapter2 Basics of Schottky Barrier Diodes \(Basic of Metal-semiconductor junction\)](#)

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