

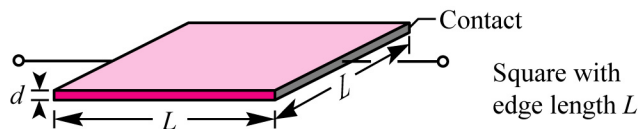
## Sheet resistance

### Resistivity

- Define the resistivity of a material,  $\rho$ ! What is the unit of resistivity? ( $\Omega \text{ cm}$ )
- The resistivity is a *materials property* and does not depend on the geometry of the material (thickness, length, etc.).
- What is the resistance of a wire with length  $L$  and cross section  $A$ ?

$$R = \rho \frac{L}{A}$$

### Sheet resistance



- What is sheet resistance,  $R_{\text{sheet}}$ ?
- What is the unit of sheet resistance? ( $\Omega$ )
- Have you come across the unit “Ohms per square”? It is OK to use. However, strictly speaking such a unit (“Ohms per square”) does not exist. This “unit” is used to assist our mind.
- How is sheet resistance related to resistivity of a material?

$$R_{\text{sheet}} = \rho / d$$

where  $d$  is the thickness of the thin film.

- Why is the sheet resistance an important quantity?
  - Because for thin films (such as a wafers), the sheet resistance can be *directly measured*. That is, the sheet resistance is a *primary result*, whereas the resistivity is a *secondary result*, i.e. the sample thickness is needed to determine the resistivity.
- How can we measure sheet resistance?
  - By the four-point probe technique.
  - By the Van der Pauw technique.
  - By cutting a square out of a wafer, contacting the edges, and measuring the resistance (not very practical).
- How can we obtain the resistivity of a thin film?
  - By multiplying the measured sheet resistance by the film thickness  $d$ .