

Chapter 2: Circuit Elements

ECE 2040

1 Definitions

Students who have taken Physics 2 are likely to know these already.

- **Superposition:** $i_1 + i_2 \Rightarrow v_1 + v_2$
- **Homogeneity:** $ki_1 \Rightarrow kv_1$
- **Linear Element:** Satisfies both superposition and homogeneity
- **Passive Element:** Absorbs energy (hence the name Passive Convention)
- **Active Element:** Supplies energy
- **Resistance:** Physical property of an element or device that impedes the flow of current

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

where,

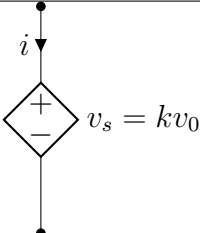
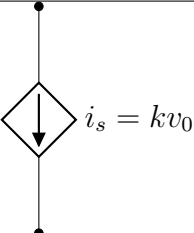
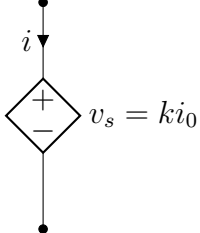
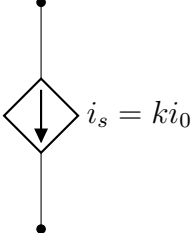
- R = Resistance of element
- ρ = Resistivity of material
- L = length
- A = cross-sectional area

Ohm's law: $v = iR$

- **Source:** Voltage or current generator capable of supplying energy to a circuit
 - **Independent Source:** Voltage or current generator not dependent on other circuit variables
 - **Ideal Source:** Voltage or current generator independent of the current through the voltage source or the voltage across the current source.
 - * Voltage or current is given to be a specified function
 - * In real life, batteries have some internal resistance
 - **Short Circuit:** Ideal voltage source having $v(t) = 0$
 - **Open Circuit:** Ideal current source having $i(t) = 0$



2 Dependent Sources

TABLE 1
DEPENDENT SOURCES

	Voltage source	Current source
Voltage-controlled		
Current-controlled		

3 Switches

TABLE 2
COMMON SWITCHES

	Single throw	Double throw
Single pole		
Double pole	