# Highlights of *Fundamentals of Microelectronics*

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## 1 Introduction to Microelectronics

**Voltage Gain**

*Voltage gain* $A_v$ in a voltage amplifier:

$$A_v = \quad . \tag{1}$$

Expressed in decibels (dB):

$$A_v|_{\text{dB}} = \quad . \tag{2}$$

**Kirchoff's Laws**

*The Kirchoff Current Law (KCL).*

*The Kirchoff Voltage Law (KVL).*

**Thevenin and Norton Equivalents**

*Thevenin's theorem.* A linear one-port network can be replaced with . The *equivalent voltage* $v_{\text{Thev}}$ can be calculated by ; The *equivalent impedance* $Z_{\text{Thev}}$ can be determined by .

*Norton's theorem.* A linear one-port network can be replaced with . The *equivalent current* $i_{\text{Nor}}$ can be obtained by ; The *equivalent impedance* $Z_{\text{Nor}}$ can be determined by .

Note that $Z_{\text{Thev}} = Z_{\text{Nor}}$.

## 2 Basic Physics of Semiconductors

**Bandgap Energy**

The *bandgap energy* $E_g$ is
. This is a fundamental property of the material, e.g., for silicon
$E_g =$ . ($1\,\text{eV} = 1.6 \times 10^{-19}\,\text{J}$)

**Electron Density (Charge Carrier Density)**

The *density of electrons* $n_i$, i.e., the number of electrons per unit volumn is

$$n_i = \qquad . \tag{5}$$

where $k = 1.39 \times 10^{-23}\,\text{J/K}$ is the Boltzmann constant.