

Physical Quantity	Symbol	Units	Definition
Charge	Q	Coulomb (C)	$1C = 6.241 \times 10^{18}$ electrons
Current	I	Ampere (A)	$1A = 1C / \text{sec}$
Resistance	R	Ohm (Ω)	$1\Omega = 1V/1A$
Voltage	V	Volt (V)	$1V = 1A \times 1\Omega$
Power	P	Watt (W)	$1W = 1V \times 1A$
Energy	E	Joule (J)	$1J = 1W \times 1 \text{ sec}$
Capacitance	C	Farad (F)	$1F = (1A \times 1 \text{ sec}) / 1V$
Inductance	L	Henry (H)	$1H = (1V \times 1 \text{ sec}) / 1A$

Ohm's Law $I = \frac{V}{R}$ $V = IR$

Biased Bipolar Transistor $I_C = \beta I_B$

Kirchhoff's Current Law (KCL) $\sum_{node} I = 0$

Decibels for Power $10 \log_{10} \frac{A}{B}$

Kirchhoff's Voltage Law (KVL) $\sum_{loop} V = 0$

Decibels for Amplitude $20 \log_{10} \frac{A}{B}$

Resistance $R = \rho \frac{l}{A}$ $P = \frac{V^2}{R}$ $P = I^2 R$

Euler's Identity $e^{j\theta} = \cos\theta + j\sin\theta$

ρ = resistivity A = cross sectional area l = length

$$\cos\theta = \text{Re}\{e^{j\theta}\} = \frac{e^{j\theta} + e^{-j\theta}}{2}$$

Capcitance

$$\sin\theta = \text{Im}\{e^{j\theta}\} = \frac{e^{j\theta} - e^{-j\theta}}{2j}$$

$$Q = CV \quad C = \epsilon \frac{A}{d} \quad \epsilon = k\epsilon_0$$

$$I = C \frac{dV}{dt} \quad V = \frac{1}{C} \int I dt \quad E = \frac{1}{2} CV^2$$

ϵ = permittivity, ϵ_0 = permittivity of free space,
 k = dielectric constant

A = area of plates, d = distance between plates

Complex Impedance

$$Z_R = R$$

$$Z_C = 1/j\omega C$$

$$Z_L = j\omega L$$

Inductance

$$L_{solenoid} = \mu \frac{N^2 A}{\ell}$$

$$V = L \frac{dI}{dt} \quad I = \frac{1}{L} \int V dt \quad E = \frac{1}{2} L I^2$$

μ = permeability, μ_0 = permeability of free space,

N = number of turns, A = area within solenoid,

ℓ = length of solenoid

Series $R_S = R_1 + R_2$ $C_S = \frac{C_1 C_2}{C_1 + C_2}$ $L_S = L_1 + L_2$

Parallel $R_P = \frac{R_1 R_2}{R_1 + R_2}$ $C_P = C_1 + C_2$ $L_P = \frac{L_1 L_2}{L_1 + L_2}$

