

Area Of Study 2, Electronic And Photonics, Formula Sheet

Current: $I = \frac{q}{t}$

Voltage: $V = \frac{W}{q}$

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

Peak & RMS Voltage

$$V_{RMS} = \frac{V_{peak}}{\sqrt{2}}$$

$$V_{peak} = \sqrt{2} \times V_{RMS}$$

Total Series Resistance: $R_T = R_1 + R_2 + R_3 \dots + R_n$

Total Parallel Resistance: $R_T = (R_1^{-1} + R_2^{-1} + R_3^{-1} \dots + R_n^{-1})^{-1}$

Parallel Current: $I_T = I_1 + I_2 + I_3$

Parallel Voltage: $V_T = V_1 = V_2 = V_3$

Kirchoff's Current Law: $I_{in} = I_{out}$

Series Current: $I_T = I_1 = I_2 = I_3$

Series Voltage: $V_T = V_1 + V_2 + V_3$

Kirchoff's Voltage Law: $V_{supply} = V_{R_1} + V_{R_2} + V_{R_3}$

Voltage Dividers

$$\frac{V_{out}}{V_{in}} = \frac{R_2}{R_T} = \frac{R_2}{R_1 + R_2}$$

$$V_{out} = \frac{V_{in} R_2}{R_T}$$

$$V_{in} = \frac{V_{out} R_T}{R_2}$$

$$R_1 = \frac{V_{in} R_2}{V_{out}} - R_2$$

$$R_2 = \frac{V_{out} R_1}{V_{in} - V_{out}}$$

Load Resistance & Effective Resistance

$$R_E = (R_2^{-1} + R_L^{-1})^{-1}$$

$$\begin{aligned} \text{Actual } R_T &= R_1 + R_E \\ &= R_1 + (R_2^{-1} + R_L^{-1})^{-1} \end{aligned}$$

$$\text{Actual } V_{out} = \frac{V_{in} R_E}{R_{T, \text{Actual}}} = \frac{V_{in} (R_2^{-1} + R_L^{-1})^{-1}}{R_1 + (R_2^{-1} + R_L^{-1})^{-1}}$$

Power

$$P = \frac{E}{t} = VI = I^2 R = \frac{V^2}{R}$$

Amplifiers

$$\text{Gain} = \frac{V_{OUT}}{V_{IN}}$$

$$\text{Current Gain} = \frac{I_{OUT}}{I_{IN}}$$