

Summary of Series and Parallel Circuits

Series Circuit Characteristics:

i. **Voltage:** Kirchhoff's voltage law: The total source voltage applied to a series circuit is equal to the total number of individual voltage drops in the series circuit. $V_T =$ sum of all voltage drops.

ii. **Current:** The current must be the same value at any point in the circuit.

iii. Resistance:

$$R_T = R_1 + R_2 + R_3 + \dots + R_N$$

The large resistor dominates

iv. Power:

$$P_T = V_T * I_T, \text{ and}$$

$$P_T = P_1 + P_2 + P_3 + \dots + P_N$$

v. **Open circuits** across a series resistor cause the current to go to zero everywhere in the circuit.

vi. **Short circuits** across a series resistor cause the current to increase some.

Parallel Circuit Characteristics:

vii. **Voltage:** The voltage drop across each component is the same as the source voltage.

viii. **Current:** Kirchhoff's Current Law: The sum of the currents into a junction is equal to the sum of the currents leaving that junction.

ix. Resistance:

Case 1: All resistors the same value: $R_T = R/N$

Case 2: Two resistors with different values: $R_T = R_1 R_2 / R_1 + R_2$

Case 3: More than two resistors with different values:

$$1/R_T = 1/R_1 + 1/R_2 + 1/R_3 + \dots + 1/R_N$$

The small resistor dominates

x. Power:

$$P_T = V_T * I_T, \text{ and}$$

$$P_T = P_1 + P_2 + P_3 + \dots + P_N$$

xi. **Open circuits** across a parallel resistor cause no change in the good branches.

xii. **Short circuits** across a parallel resistor cause the current to increase drastically.