

Series vs. Parallel Circuits Cheat Sheet

Ohm's law, equivalent resistance and dividers

ENGINEERING
CHEAT SHEET

Key equations

Quantity	Equation	Notes
Ohm's law	$V = I R$	Foundation for every formula below
Series resistance	$R_t = R_1 + R_2 + R_3 + \dots$	More resistors = more resistance
Parallel resistance	$1 / R_t = 1 / R_1 + 1 / R_2 + \dots$	Always less than the smallest branch
Two parallel resistors	$R_t = R_1 R_2 / (R_1 + R_2)$	Shortcut for two branches
Voltage divider (series)	$V_x = V_{in} \cdot R_x / R_{total}$	Steps a voltage down with resistors
Current divider (2 branches)	$I_1 = I_{total} \cdot R_2 / (R_1 + R_2)$	More current takes the lower-resistance branch
Power	$P = V I = I^2 R = V^2 / R$	Watts

Key takeaways

- **Series:** one path, same current everywhere, voltage divides. If one component fails, the whole circuit stops.
- **Parallel:** multiple paths, same voltage on every branch, current divides. Other branches keep working if one fails.
- Capacitors and inductors combine with the **opposite** rules to resistors: capacitors in parallel add like series resistors.
- Use cases: series for string lights, flashlights and voltage dividers. Parallel for household outlets, car headlights and most consumer electronics.
- Household wiring is parallel so one failed device does not take down the rest.

Quick comparison

Property	Series	Parallel
Current	Same through all	Divides across branches
Voltage	Divides across parts	Same across all
Total resistance	Sum of all	Less than smallest
One part fails	Circuit stops	Others keep working