

Resistors & LEDs

Electronics / Ohm's law

Read polarity and choose a resistor before lighting your first LED.

01 LED polarity

Anode (+)

Usually the longer lead on an untrimmed through-hole LED.

Cathode (-)

Usually shorter lead / flat case edge; confirm with diode-test mode.

Series circuit

GPIO -> resistor -> LED anode; LED cathode -> GND. Resistor may also go on the cathode side.

02 Choose resistance

Formula

$R = (V_{\text{supply}} - V_{\text{forward}}) / I_{\text{led}}$, with current in amperes.

Example

5 V supply, 2 V red LED, 5 mA: $R = 600 \text{ ohm}$; choose 680 ohm.

Power

$P_{\text{resistor}} = I^2 \times R$. Choose a power rating with margin.

03 Bench values

Common values

220, 330, 470, 680 ohm; 1 kohm, 4.7 kohm, 10 kohm. Calculate for your circuit.

4-band code

First two bands = digits, third = multiplier, fourth = tolerance.

Brown-black-red-gold = 1 kohm +/-5%.

Digits

Black 0, brown 1, red 2, orange 3, yellow 4, green 5, blue 6, violet 7, gray 8, white 9.

Before you power on

Every parallel LED branch needs its own current limiter. Stay within GPIO and total port current limits.

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Datasheets & further reading

SparkFun: voltage, current & resistance

<https://learn.sparkfun.com/tutorials/voltage-current-resistance-and-ohms-law/all>