



LED Voltage Requirements

A quick-reference guide to volts, current, and safe wiring



1.8V



2.2V



3.4V



12V



220V

LED lighting: key stats and figures

25%

ENERGY STAR-certified LED bulbs use about 25% of the energy of an equivalent incandescent bulb.

Source: U.S. Department of Energy / ENERGY STAR

25x

Qualified LED lighting can last up to 25 times longer than the incandescent bulbs it replaces.

Source: U.S. Department of Energy / ENERGY STAR

84%

LED lamps and luminaires are projected to hold 84% of all U.S. lighting installations by 2035.

Source: DOE, Energy Savings Forecast of Solid-State Lighting, 2020

\$265B

Rapid U.S. LED adoption over 20 years could deliver roughly \$265 billion in energy savings.

Source: U.S. Department of Energy, Guide to Energy-Efficient Lighting

1.1 quads

LED lighting enabled 1.1 quadrillion BTUs of energy savings in 2017 alone, worth \$12 billion.

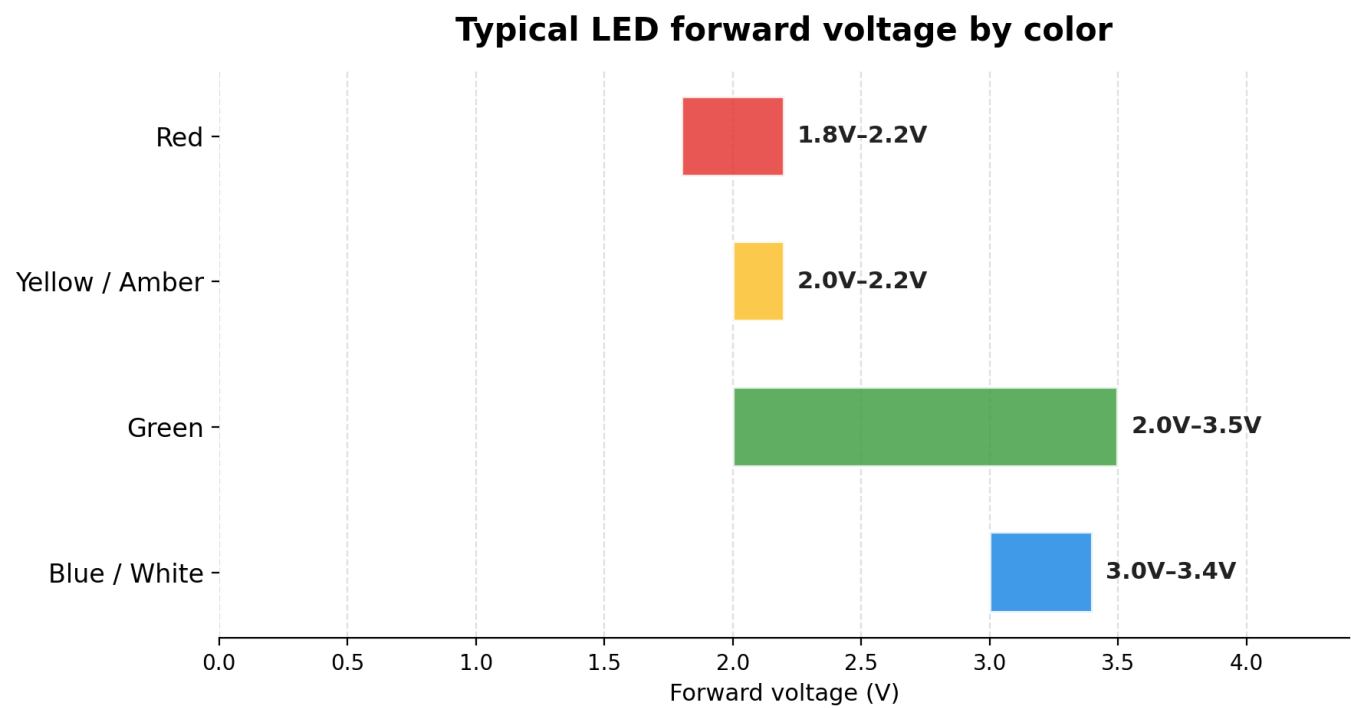
Source: DOE, Energy Savings Forecast of Solid-State Lighting, 2020

40

Widescale LED adoption could avoid the need to build 40 new power plants in the U.S.

Source: U.S. Department of Energy, Guide to Energy-Efficient Lighting

Forward voltage and current cheat sheet

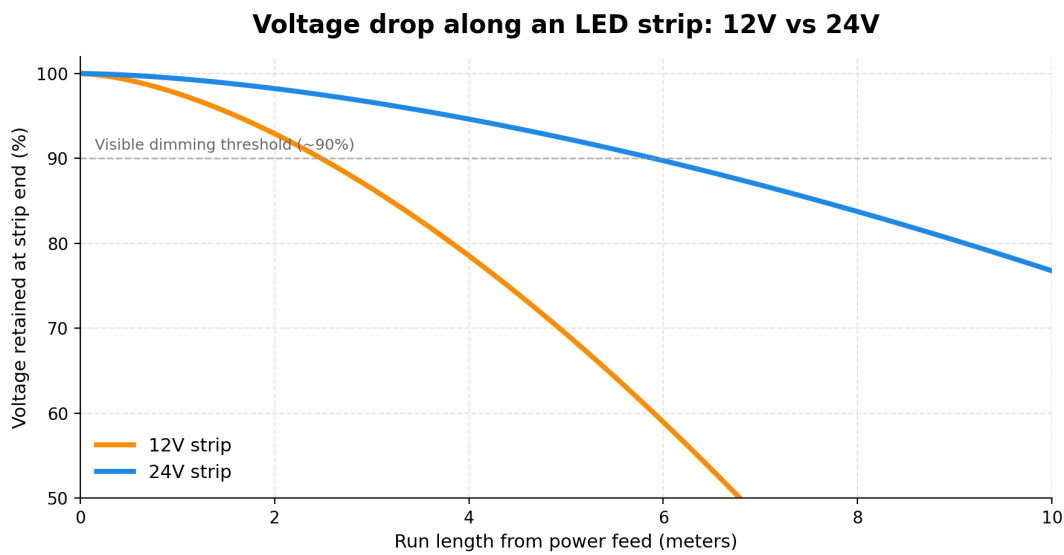


Approximate ranges at low-to-moderate drive current. Source: Analog Devices / Maxim LED design guide; manufacturer datasheets.

Color	Forward voltage	Typical current
Red	1.8V - 2.2V	10mA - 20mA
Yellow / Amber	2.0V - 2.2V	10mA - 20mA
Green	2.0V - 3.5V	15mA - 20mA
Blue / White	3.0V - 3.4V	15mA - 20mA
High-power LED (any color)	3V - 36V (array)	350mA - 1A+

Ranges are typical at low-to-moderate drive current; always check the manufacturer datasheet for exact values.
Source: Analog Devices / Maxim LED design guide; manufacturer datasheets.

LED strips, bulbs, and 220V chips



Illustrative curve based on the general voltage-drop relationship described by LED strip manufacturers (HitLights, Waveform Lighting). Actual drop varies by copper thickness and wattage per meter.

Factor	12V strip	24V strip
Best run length	Under 5m without a mid-feed	Up to ~10m without visible dimming
Current draw (same watts)	Double that of 24V	Half that of 12V
Cut increments	Every 3 LEDs	Every 6 LEDs

Quick facts: bulbs and 220V driverless chips

- Standard LED bulbs run on 100-240V AC directly; a built-in driver converts and regulates the power internally.
- 220V driverless COB chips wire roughly 60-70 LEDs in series so their combined forward voltage matches mains voltage.
- A bulb rated for a narrow voltage band is more likely to fail during a brownout or voltage spike than a 100-240V rated one.
- Driverless COB chips shift heat management entirely onto the chip itself, since there's no separate driver to share the load.