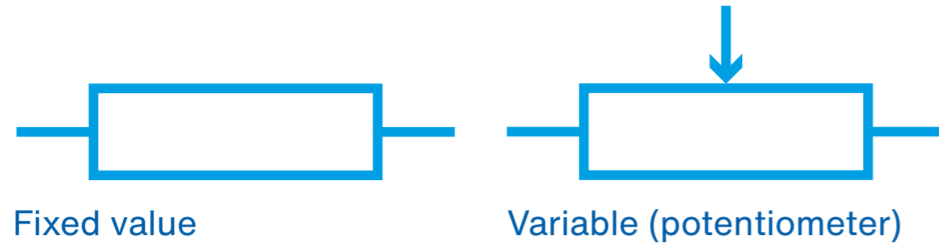


Resistors Reference Guide

Circuit symbol



Ohm's law:

$$V = I * R \text{ (Mouser Ohm's law calculator)}$$

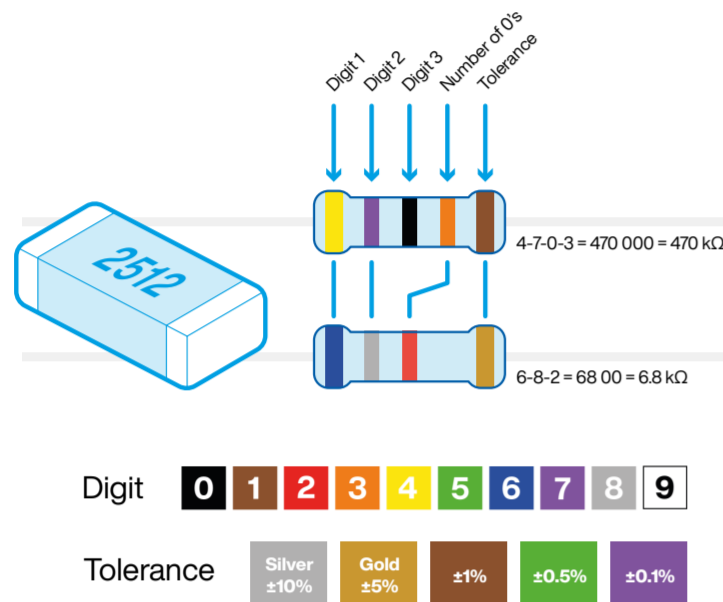
SI Unit: Ohm, Ω

Basics

Resistance is a fundamental property of electrical and electronic circuits. In electronics, every circuit consists of discrete resistors (as stand-alone passive components) and the intrinsic resistance values of other components like wires, semiconductors, other passives & solder, resistance has the following impact on the electric current proportional to the number of charge carriers:

- 1 The free charge carriers inside a conductor bump against atoms, impeding their flow. This effect is called the resistance, limiting the current flowing inside an electric circuit.
- 2 The collisions between charge carriers and atoms also have a thermal effect, heating up the component in question. Take care not to exceed maximum power rating.
- 3 At any instant, the power P (Watt) consumed by a resistor of resistance R (Ω) is calculated as $P = I * V = I^2 * R = V^2 / R$

Resistance values



Axial through-hole resistors are usually color-coded.

The Mouser [Resistor Colour Code Calculator](#) helps decode the markings.

Resistors with:

3 Rings: #1 and #2 indicate the value, #3 is the multiplier. Tolerance 20%.

4 Rings: #1 and #2 indicate the value, #3 is the multiplier, #4 is the tolerance.

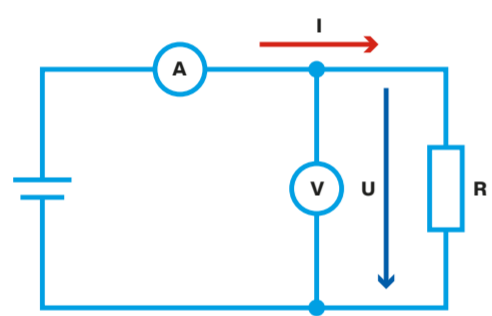
5 Rings: #1, #2, #3: value, #4: multiplier, #5: tolerance.

6 Rings: #1, #2, #3: value, #4: multiplier, #5: tolerance, #6: temperature coefficient.

Standard SMT resistors usually have a numerical three-digit code printed on. The first two digits are the first two significant digits of the value, and the third indicates the power of ten. R indicates the position of the decimal point. For example, 4R7 = 4.7 Ω , or R300 = 0.30 Ω .

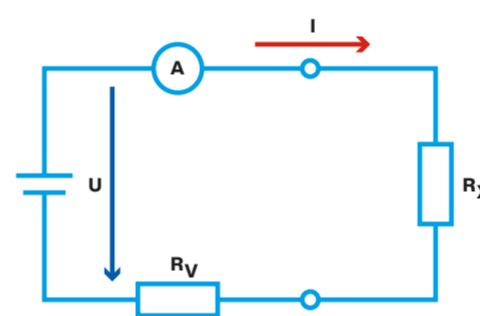
The EIA-96 marking system is intended for small high-precision resistors. The two digits indicate one of the 96 "positions" in the standard E96 series of 1% resistor values. The uppercase letter indicates a power of ten multiplier. For example, "01C" represents 10k Ω ; "96C" is 97.6k Ω .

Measuring resistance



Indirect measurement:

The voltage V at the resistor and the current I through the resistor are measured concurrently. Ohm's law $R = V/I$ gives the resistance value.



Direct measurement:

Measuring the current through a serial connection of an unknown R_x and a known R_v . Used in measurement devices like Ohmmeters.

See Mouser's "[Ohm's Law Calculator](#)".

Common resistor types, construction and typical applications

Type	Description	Typical Application
Carbon Composition Resistors (CCR)	Solid cylindrical element with wire leads. Keep numbers at end.	Large power supplies and welding controls
Carbon Pile	A stack of carbon disks compressed between two metal contact plates. Adjustable.	Automatic voltage regulators for generators
Carbon Film	Carbon film on insulating substrate. Keep numbers	Applications requiring high pulse stability
Printed Carbon	Printed directly on PCBs. Large tolerances.	Non-critical pull-up resistors
Thin film resistors	Resistive material sputtered on to insulating substrate	Resistor networks in measurement devices
Thick film resistors	Manufactured using screen and stencil printing processes.	Noise suppression in delicate electronic systems
Metal film	Composite of glass, ceramic and metal film (e.g. NiCr).	Applications that require long-term stability
Metal oxide film	The same with metal oxide materials.	Applications with high endurance demands
Wire-wound	Nichrome wire wound around an insulating core	Applications that require high power ratings, but not RF.
Foil resistor	employs a chromium nickel alloy foil several micrometers thick.	Applications that require a high thermal stability
Potentiometer	Variable resistor controlled by rotary or linear slider	Volume control in audio systems
Varistor	The resistance varies with the applied voltage.	Transient suppression, e.g. in telecommunication lines
Rheostat	Two-terminal variable resistor with power ratings > 1W	DC motor drives, electric welding controls, load banks for testing automobile batteries & power supplies