What is a Resistor

Preview

Resistor is electrical or electronic components which resist the flow of current across the resistor device.

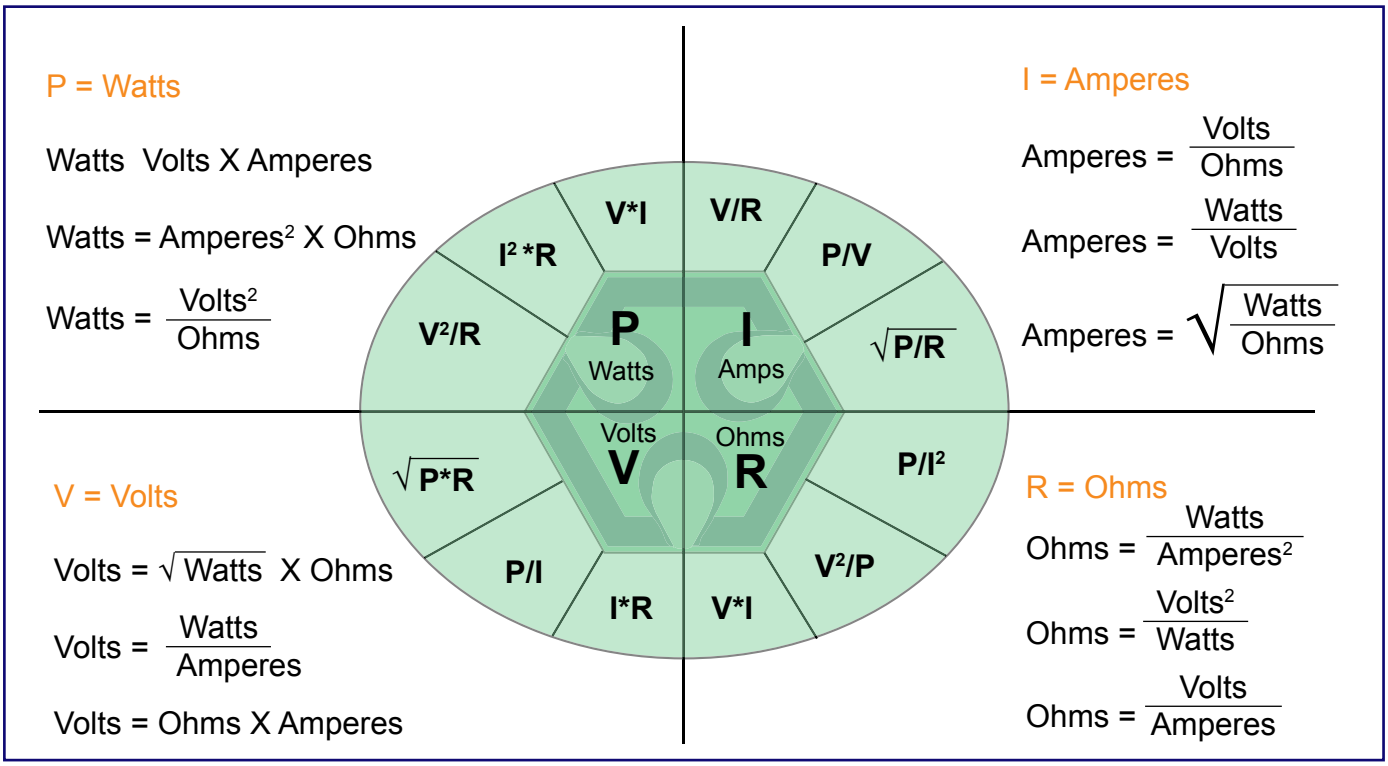
The resistance to current flow results in a voltage drop across the resistor device. Resistors are used extensively throughout electrical and electronic ircuits.

Resistor devices may provide a fixed, variable, or adjustable value of resistance. Adjustable resistors are refers to as ostats, or iometers. Resistor values are expressed in Ohms, the lectric resistance unit.

Resistors are incorporated within a electrical or electronic circuit create a known voltage drop or current to voltage relationship. If the electrical current in a circuit is known (current is measured in amperes), then a resistor can be used to create a known potential difference (voltage difference) proportional to that current. Conversely, if the voltage drop (potential difference) across two points in a circuit is known, a resistor can be used to create a known current proportional to that difference.

An attenuator is a network of two or more resistors (a voltage divider).A line terminator is a resistor at the end of a transmission line or daisy chain bus, designed to match impedance and minimize reflections of the electronic signal.

What is Ohm's Law?



Ohm's law is a simple equation that shows the relationship between resistance, voltage and current through a metal wire, or some other type of resistive material. In mathematical terms, Ohm's law is written as:

$$I = V/R ,$$

where I is the current (Amps), V is the voltage (Volts), and R is the resistance (Ohms).

Ohm's law can also show the relationship between resistance, voltage and power using the following equation:

$$P = V^2 /R ,$$

where P is the power (Watts), V is the voltage (Volts), and R is the resistance (Ohms).

Types of Resistors

Fixed Resistors

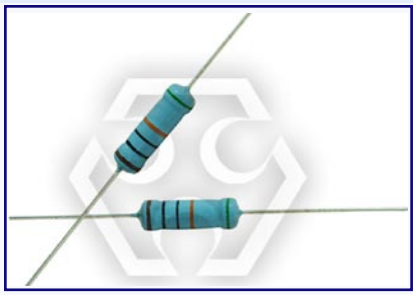
A fixed resistor is one in which the value of its resistance cannot change.

Non-Linear Resistors

A non-linear resistor is a resistor that has resistances that vary significantly with applied voltage, temperature or light.
Types of non-linear resistors are varistors, thermistors and photoresistors.

Metal-Film Resistors

A type of cylindrical resistors made by depositing a resistive element made of a thin conducting film of a metal or metal alloy, such as nichrome,
onto a cylindrical ceramic or glass core.
The resistance is controlled by cutting a helical groove through the conducting film.



Metal Oxide Resistors

A type of cylindrical resistor that uses materials such as ruthenium oxide or tin oxide as the resistive element.
These resistors can be excellent high-voltage or high-power devices.

Thick Film Resistors

Specially built surface-mount film resistor that carries high power for the part size.
For thick film resistors, a ruthenium oxide film or metal glaze film is applied using traditional screen-printing technology.
These resistor film can be excellent high-voltage or high-power devices.

Thin Film Resistors

A type of surface-mount film resistor with a relatively thin resistive element, measured in angstroms (millionths of an inch).
Thin film resistors are made by sputtering (also known as vacuum deposition) a resistive material, such as nichrome or tantalum nitride, onto the surface of a substrate.

Carbon Composition Resistors

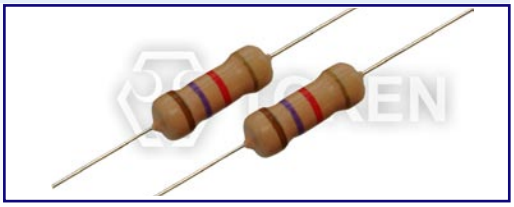
A general class description for resistors consisting of a carbon mixture resistive core and a molded outer insulating core.

Ceramic Composition Resistors

A type of resistor that consists of a clay, alumina, and carbon mixture that has been blended and pressurized into a resistive core and then covered with a molded outer insulating core.

Carbon Film Resistors

A general class description
for cylindrical resistors made
by depositing a carbon film
on the surface of a center core insulator.



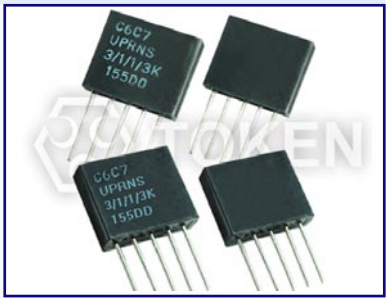
Wirewound Resistors

Consist of a cylindrical core which is wrapped or wound with wire.The cylindrical core is typically made from a ceramic, plastic, or fiberglass core material.
The wire is a type of resistance wire, such as nichrome. Wire wound resistors are a type of power resistor and are accurate.
Wirewound resistors are available as fixed, or adjustable to be used as a rheostat or potentiometer.
Typical application for wirewound resistors include device requiring high current handling capability, heat dissipation and resistance stability and accuracy.

High Precision Resistors

A variety of test instruments rely on stable, low TCR, High accuracy Resistive devices for use as reference devices in their circuits.

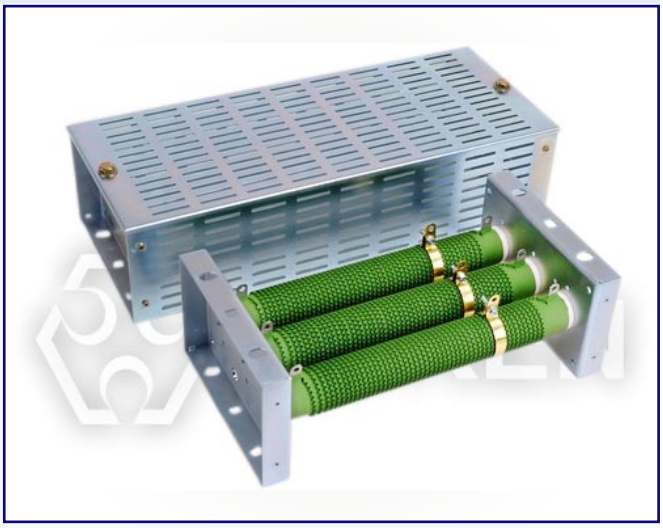
While there are low cost metal film, chip devices, and wirewound resistors which offer the desired characteristics, Token's Thin-Film technology is unique in their performance as they could offer very high stability with very low TCR's and the ability to give a long drift free service.



Neutral Grounding Resistors

Neutral grounding resistors are incorporated into electrical circuits to protect the system and devices.
Neutral grounding resistors protect electrical circuit components by limiting the ground fault current to an acceptable level.
Within three phase electric voltage system, the neutral branch is referenced to ground (earth).
In the event that a current fault occurs (short to ground), extreme current causes by the fault will damage electrical circuit system and components.
By installing a neutral grounding resistor, the faulty current will be limited to a predetermined level.

Dynamic Braking Resistor



Dynamic Braking Resistor is a high power / wattage resistor used by a electric motor to assist in the process known as dynamic braking.

DC motors, unlike AC motors, act like a electrical generator when the motor has been disconnected from the power source.
The motor functions like a generator due to the DC motors permanent magnet. The resistance to rotation causes the dynamic braking.
The voltage and current produced by the DC motor generator) is directed into the dynamic braking resistor to dissipate the heat energy.

Installation design considerations:
Dynamic braking resistors should be located and mounted into the target assembly such that maximum thermal dissipation through the resistor device may occur.
Thermal dissipation will depend on the resistor selected and the power application duty cycle.
Care should be taken to ensure the braking resistor installation is clear of combustible materials.

Power Resistors

Power Resistors are resistors which are capable of handling a lot of power, as their name implies.
They are designed and manufactured to handle more power with respect to their size than other resistors types.
Power resistors are manufactured in a variety of configurations.
Some of power resistors are free wound similar to a electrical heater element.
Free wound power resistors typically require external sources of cooling in order to handle any significant amount of power.
Power resistors may be cooled by fans, or immersed in a non-conductive liquid.

Power resistors are designed to operate at maximum power rating in the smallest package size,the core on which the windings are made is a material which exhibits a high heat conductivity.
Typical power resistor cores for would type power resistors are;
Steatite, Alumina, Beryllium Oxide, or hard anodized Aluminum.
Power resistors are available in various shapes, such as; oval, flat, or cylindrical. Often, power resistors are packaged or integrated with a convection type heat sink.

Variable Resistors

Variable resistors consist of a resistance track with connections at both ends and a wiper which moves along the track as you turn the spindle.
The track is usually rotary but straight track versions, usually called sliders, are also available.
The track may be made from carbon, cermet (ceramic and metal mixture) or a coil of wire (for low resistances).

Variable resistors are often called potentiometers in books and catalogues.
They are specified by their maximum resistance, linear or logarithmic track, and their physical size.

Variable resistors may be used as a rheostat with two connections (the wiper and just one end of the track) or as a potentiometer with all three connections in use.

Miniature versions called presets are made for setting up circuits which will not require further adjustment.

Rheostat

A rheostat is an electrical component that has an adjustable resistance.
It is a type of potentiometer that has two terminals instead of three.
The two main types of rheostat are the rotary and slider.
The symbol for a rheostat is a resistor symbol with an arrow diagonally across it.
They are used in many different applications, from light dimmers to the motor controllers in large industrial machines.

The Rheostat is the simplest way of using a variable resistor.
Two terminals are used: one connected to an end of the track, the other to the moveable wiper.
Turning the spindle changes the resistance between the two terminals from zero up to the maximum resistance.

Rheostats are often used to vary current, for example to control the brightness of a lamp or the rate at which a capacitor charges.

The rheostat is still a common and fundamental electronic component used to control the flow of current in a circuit.
However, it has largely been replaced by the triac, a solid-state device also known as a silicon controlled rectifier (SCR).
A triac do not waste as much power as a rheostat and has better reliability due to the absence of mechanical parts.
Rheostats commonly fail because their contacts become dirty or the coil wire corrodes and breaks.

Potentiometer

Variable resistors used as potentiometers have all three terminals connected.
This arrangement is normally used to vary voltage, for example to set the switching point of a circuit with a sensor, or control the volume (loudness) in an amplifier circuit.
If the terminals at the ends of the track are connected across the power supply then the wiper terminal will provide a voltage which can be varied from zero up to the maximum of the supply.

Presets

These are miniature versions of the standard variable resistor.
They are designed to be mounted directly onto the circuit board and adjusted only when the circuit is built.
For example to set the frequency of an alarm tone or the sensitivity of a light-sensitive circuit.
A small screwdriver or similar tool is required to adjust presets.

Presets are much cheaper than standard variable resistors so they are sometimes used in projects where a standard variable resistor would normally be used.

Multiturn presets

Multiturn Presets are used where very precise adjustments must be made.
The screw must be turned many times (10+) to move the slider from one end of the track to the other, giving very fine control.

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