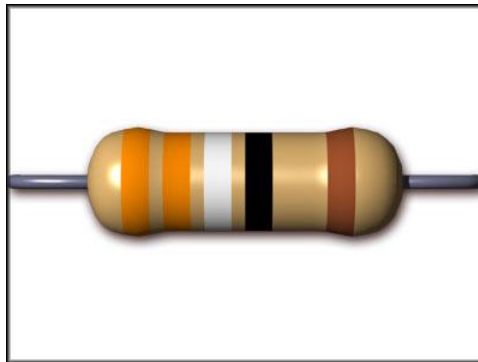


Resistor Color Code and Types of Resistors

Introduction to Resistors:

A resistor is an electric element that limits the flow of the electric current into an electric circuit. A current that is passed through the resistor is always directly proportional to the voltage across the terminals of the resistors. This is clearly defined in Ohm's law. Which states $I=V$ divided by R . Almost every electric circuit and electric network consists of resistors. Resistors can be integrated into both hybrid and printed circuits. Without a resistor an electric circuit cannot work properly. Thus resistors play an important role in running circuits.



Resistor Color Code:

For the purpose of calculating the value of the resistor of a particular resistor you require color codes. There are different colors of resistors and each color of resistor represents specific number. Below mentioned are the number and the color of resistors:

0 black, 1 brown, 2 red, 3 orange, 4 yellow, 5 green, 6 blue, 7 violet, 8 grey, 9 white. In this, the gold is of 5% and the silver is of 10%. By using these colors you can calculate the value of the resistor with the help of ohm's law. Most of the time on electronic repairs the five band resistor colors are used. The reason behind using these 5 color bands is that, it provides accurate values as compared to the four color band. Most of the resistors inside a multimeter use these five color bands because you will get a precise voltage and measure of the current. Overall the five color band resistor makes the circuit precise and the output received too is that desired by the engineers.

The standard resistor color code table:

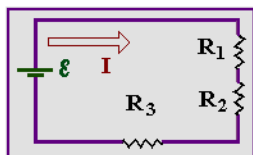
Color	Digit 1	Digit 2	Digit 3*	Multiplier	Tolerance	Temp. Coef.	Fail Rate
Black	0	0	0	$\times 10^0$			
Brown	1	1	1	$\times 10^1$	$\pm 1\%$ (F)	100 ppm/K	1%
Red	2	2	2	$\times 10^2$	$\pm 2\%$ (G)	50 ppm/K	0.1%
Orange	3	3	3	$\times 10^3$		15 ppm/K	0.01%
Yellow	4	4	4	$\times 10^4$		25 ppm/K	0.001%
Green	5	5	5	$\times 10^5$	$\pm 0.5\%$ (D)		
Blue	6	6	6	$\times 10^6$	$\pm 0.25\%$ (C)		
Violet	7	7	7	$\times 10^7$	$\pm 0.1\%$ (B)		
Gray	8	8	8	$\times 10^8$	$\pm 0.05\%$ (A)		
White	9	9	9	$\times 10^9$			
Gold				$\times 0.1$	$\pm 5\%$ (J)		
Silver				$\times 0.01$	$\pm 10\%$ (K)		
None					$\pm 20\%$ (M)		

* 3rd digit - only for 5-band resistors

How to Use Resistors:

In order to use a resistor you first need to check its effect in a circuit. The drop in voltage inside a circuit can be calculated using the Ohm' law which is $V=IR$ where V stands for drop in voltage, I stands for the current inside the circuit and R stands for the resistance of the resistor. In order to control the voltage the resistor needs to be on each side of the electrical component later the resistance of the resistors needs to be identified with the help of the color coding method. Components that are sued by students generally has for band color schemes, the four band identification systems needs to be studied as the color of all the four bands are painted on the resistor in order to provide the resistance in Ohms.

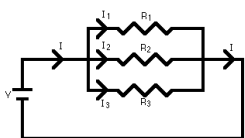
Resistors in Series:



The current inside the resistor flows from one to another and thus they can be connected in series.

Here the resistors are arranged in chain so that the current just has a single path to take. The current in series of resistors is the same and the total resistance of a circuit is calculated by adding up the resistance value of the individual resistors. Equivalent resistance of resistor in series is: $R= R_1 + R_2 + R_3$. It just provides one route for the current to flow inside the circuit.

Resistors in Parallel:



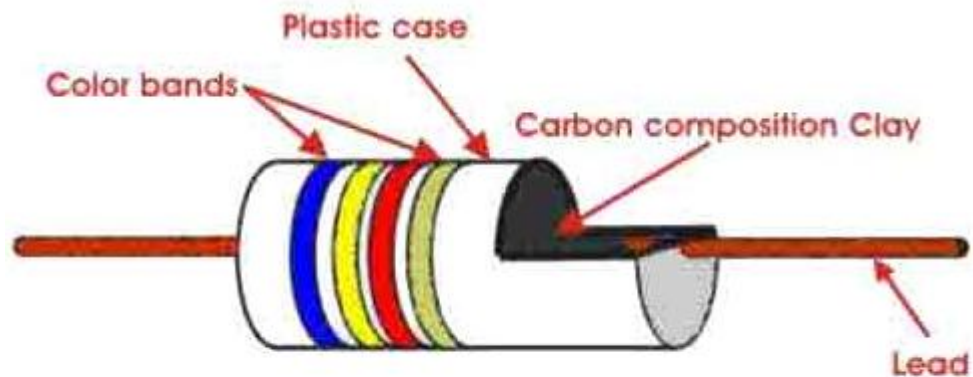
In this If more than two elements are connected in a parallel way they have same potential difference in their ends. They are the same in magnitude and also have identical polarity. The voltage level is same to all the

circuit elements that are connected in a parallel way. Thus the total current is the sum of all the currents through the individual element.

Types of Resistors:

There are many types of resistors for making circuits starting from a small surface mount chip to large wire wound resistors. The main aim of the resistor inside a circuit is to set the flow of electrons through them. However resistors can be classified broadly into four different types namely

- **Carbon Composition Resistor:** These are the most common type of resistors and are extremely inexpensive. These are made of either carbon dust or paste of graphite. They are used in electronic circuits. The resistor's lead is manufactured from tinned copper. The key advantage of this carbon resistor is that they are easily available in market at a reasonable cost and these resistors are durable as well. These resistors have a tendency to create noise owing to the transferring of current from one carbon particle to another. These resistors are given different colored rings on its



Carbon Composition Resistor

cylindrical body.

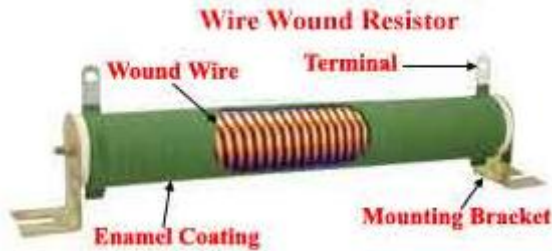
- **Metal Film Resistor:** These are made of conductive metal oxide paste. It consists of metal film, carbon film and metal oxide film, they are mainly made by depositing pure metals. The preferred resistance value of **carbon film resistor** or **metal film resistor** can simply be attained by either trimming the thickness layer or by slicing helical channels of appropriate pitch beside its length. A contact cap made of metal is fixed at both sides of the resistor. These metal caps have to be in touch with helical grooves or resistive film. The lead wires are soldered to these metallic contact



caps.

- **Wire Wound Resistor:** This type of resistor is made by winding a wire made of alloy into an insulating ceramic former in the method of spiral helix. They are designed in such a way that they can be physically mounted into heat sinks or metal plates. The wire wound resistor is coated with a material like baked enamel, these materials are insulating materials. This insulating material cover is given on the resistor to defy the outcome of ambient temperature deviation. Different ratings &

sizes the resistor can be obtained by changing the length & diameter of the wire.



- **Semiconductor Resistor:** They are high in frequency.

Variable Resistor:

Variable resistors are also known as potentiometer. A variable resistor has only two wires that connect instead of three. It has a very difficult task to do. The pot helps in controlling the potential passed through the circuit. Thus the variable resistor helps us in adjusting the resistance between two points within a circuit. It is used at the time when the amount of resistor



value is unknown in a circuit.

Some of these variable resistors are intended to directly mount on the circuit board. These resistors are priced by their highest resistance, logarithmic or linear track, and their bodily dimension. The ordinary spindle diameter of variable resistor is 6mm.

Wire Wound Resistor:

This kind of resistor is made by winding a wire made of alloy into an insulating ceramic former (plastic or fiberglass) in the form of a spiral helix. The wire ends are welded to 2 caps, fixed at the core's end. These kinds of resistors are available at a very low ohmic and high precision value because of the wire that is used and the number of times it's twisted on the former to make them fit enough to be used for the purpose measuring



circuits.

Apart from this they are capable enough to hold high currents as compared to other resistors of the same ohmic value and the power ratings to an extent of 300 watts. As wire wound resistors are twisted they have additional inductance than any other sort of resistor, even though this attribute can be reduced by twisting the wire in segments with reverse direction alternately.

SMD Resistor:

SMD resistors are made from a technology named SMT (surface mount technology); In this technique parts are placed directly or mounted on the circuit board (PCBs). They are the most extensively employed element as everyday millions of

gadgets are made out of this technique. Starting from cell phones, to television to MP3 players to all high technology equipment all make use of this resistor. Their shape is rectangle and is made of ceramic substrate which is deposited by a metal oxide. They are stable and have good acceptance. They are available in various packages.



Preset Resistor:

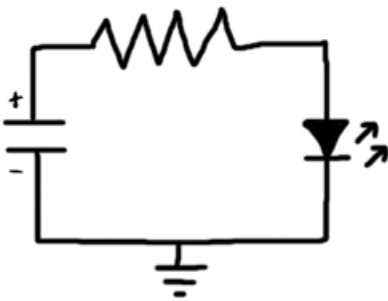


This kind of resistor is used in the circuit when there is a necessity of altering the resistance. In simpler terms preset resistors are a small PCB mounted edition of potentiometer. Temperature sensors generally have these elements as the preset resistor helps in making the circuit more or less sensitive. They can either be turned up or down for either increasing or decreasing the resistance. The adjustment in this can be done with the help of a screw driver.

Resistor Calculator:

Resistors are used to oppose the flow of electricity whose resistance is measured in ohms. Color bands represent the value of the resistance. A resistor calculator is a tool that helps in decoding information for the color band axial lead resistors. It helps in calculating at the most 6 band resistors and is simple, to use. In this way you can easily calculate the resistance.

To calculate the resistor required for a simple circuit, just takes the voltage falling away from the voltage source then application of Ohm's law. In simple words-



Where- E_s is measured in V (volts), it is source voltage

E_{led} - Is voltage drop across the LED, measured in V (volts)

I_{led} - current passing through LED, measured in Amps/A (Amperes)

R- is the resistance, measured in Ω (ohms), this calculator is working on the Ohms Law, it considers the voltage drop from the LED.

Source: <http://www.electronicshub.org/resistors/>