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The resistor color code was developed during the year 1920. The color bands are printed on the body of tiny resistor components. Generally, for color code, we can use this resistor mnemonic called BBROY Great Britain Very Good Wife. Whereas, the beginning letter indicates a unique color. This color-coding shortcut has an acronym for how to identify a resistor value. Resistor Color Code Representation Color Code Resistor Acronym Band Color 0 B Black 1 B Brown 2 R Red 3 O Orange 4 Y Yellow 5 G Green 6 B Blue 7 V Violet 8 G Grey 9 W White Resistors use the BS1852 (British standard) coding standard for value representation. It uses letter 'R' for ohms, 'K' for Kilo ohms, and 'M' for Megaohms. For example, a 4.7K ohm resistor is shown as 4K7. The Carbon composition resistors have 3 to 6 resistor color bands. The 3-band resistor has three colors with multiplier and no tolerance. The three bands can be selected to know the resistor value. Whereas, the 4 band, 5 band, and 6 band resistors have an extra band known as tolerance. The color code chart shows the 3 bands, 4 band, 5 band, and 6 band resistor strips. 3 Band Resistor 4 Band Resistor 5 Band Resistor 6 Band Resistor 1st band First Digit First Digit First Digit First Digit 2nd band Second Digit Second Digit Second Digit Second Digit 3rd band Multiplier Value Multiplier Value Third Digit Third Digit 4th band Tolerance Value Multiplier Value Multiplier Value 5th band Tolerance Value Tolerance Value 6th band Temperature Coefficient To know, how to find color code, each color indicates a number starting from 0 to 9. This number can be used as the first significant digit and second significant digit for 3 band and 4 band. For 5 band and 6 band resistors, the first 3 digits indicate significant numbers. The multiplier value is multiplied with the significant digit number (one, two, or three digits) to get the desired resistance value. In addition to this the 4 band, 5 band, and 6 band resistors have tolerance value ranging from ±0.10 to ±10. The 6-band resistor has a special property of temperature coefficient of resistance represented in ppm/Kelvin. The higher ppm value indicates that a resistor can withstand the higher or lower temperature. The variation of resistance is constant to temperature. To understand how to read the resistor color code for 3 /4/5/6 band resistors you can use this color chart. From the above chart, each color band on the resistor represents a number. For example, to calculate 1.2MΩ, the resistor shows Brown Red Green colors (read from left side to right). Now place the first two bands as the numeric value and third band as a multiplier (105). Reliability To meet the military specification resistors often manufactured with reliability band. This band is not found in commercial electronics. Typically, a 4-band resistor comes with a reliability band. Zero Ohm resistor This resistor comes with a single black band used to connect the traces on a Printed Circuit Board (PCB). It is used as an interconnection between two joints. Resistor bands with Gold and Silver The gold and silver bands are prone to misconceptions of true colors in a resistor. Hence, they are replaced with grey and yellow color bands. The resistor calculator tool calculates the color code for 3band, 4 band, 5 band, and 6 band resistors typically in the range of ohms, Kilo Ohms, and Mega Ohms. The resistance calculator has 1 to 6 band colors with Multiplier (Mul) and tolerance (Tol) and PPM/Kelvin. You must select the right color corresponding to each column. The tolerance value tells the accuracy at which the resistor is manufactured. Normally, for gold, it is 5% and for silver, it is 10%. This will display the true resistance value with tolerance and temperature coefficient of resistance. To explore more, let's discuss a few examples of resistor color code for 4, 5, and 6 band resistors. 4 band Color Code For example, 4-band resistor has color Brown Black Orange Gold. What's the resistor value? By using the color chart, write the values as, 1/0/103 = 10 * 103 = 10K ohm/10K. The tolerance is ±5% for Gold. So, the value ranges from 9.5KΩ to 10.5KΩ. 5 Band Color Code Another example (From chart): 5-band resistor has color Black - Brown Black Red Brown. Write the values as, 0/1/0/102 = 10 * 100 = 1K ohm/1K. The tolerance is ±1% for Brown. Hence, the resistor value is 900Ω to 1.01KΩ 6 Band Color Code A 6-band resistor has Black Brown Red Brown Blue Brown Using the chart, the values are 0/1/2/101 = 120 Ohm/120R. The tolerance is ±0.25% for Blue and the temperature coefficient of resistance is 100ppm. So, the resistance becomes 119.7Ω -120.3Ω Electronic color coding is standardized by the Electronic Industries Association (EIA) and later by the Radio Manufacturers Association (RMA) as standard color marking for resistors. This marking code changes from one decade to another decade. This is known as the EIA color code. For each tolerance band, the EIA allocates E-series (E3, E6, E12, E24 and E96) to name the resistor values. The standard decade resistors (also known as preferred values) are shown in the below table. The resistance calculation is starting from 1 ohm with tolerance range (36%, 10%, 5% and 1%). E3 Series - Resistance with ±36% Tolerance (Value in Ohms) 1.0 2.2 4.7 E6 Series - Resistance with ±20% Tolerance (Value in Ohms) 1.0 1.5 2.2 3.3 4.7 6.8 E12 Series - Resistance with ±10% Tolerance (Value in Ohms) 1.0 1.2 1.5 1.8 2.2 2.7 3.3 3.9 4.7 5.6 E24 Series - Resistance with ±5% Tolerance (Value in Ohms) 1.0 1.1 1.2 1.3 1.5 1.6 1.8 2.0 2.2 2.4 2.7 2.9 3.0 3.3 3.6 4.3 4.7 5.1 5.6 6.2 6.8 7.2 8.2 9.1 E96 Series - Resistance with ±1% Tolerance (Value in Ohms) 1 1.02 1.05 1.07 1.10 1.13 1.15 1.18 1.21 1.24 1.27 1.30 1.33 1.37 1.40 1.43 1.47 1.50 1.54 1.58 1.62 1.65 1.69 1.74 1.78 1.82 1.87 1.91 1.96 2.00 2.05 2.10 2.15 2.21 2.26 2.32 2.37 2.43 2.49 2.55 2.61 2.67 2.74 2.80 2.87 2.94 3.01 3.09 3.16 3.24 3.32 3.40 3.48 3.57 3.65 3.74 3.83 3.92 4.02 4.12 4.22 4.32 4.42 4.53 4.64 4.75 4.87 4.99 5.11 5.23 5.36 5.49 5.62 5.76 5.90 6.04 6.19 6.34 6.49 6.65 6.81 6.98 7.15 7.32 7.50 7.68 7.87 8.06 8.25 8.45 8.66 8.87 9.09 9.31 9.53 9.76 To find the resistor values from E-series, take the preferred resistor with tolerance. We will get resistances by multiplying value with the multiplier constant. For example, E6 series resistor (1 ohm) with tolerance ±20, the set of resistances is 1, 20, 400, 8K, 160K. Carbon strip resistors do not have their resistance value and tolerance printed on their body due to their size. Hence the resistor color code chart and calculator help to find out the resistor value without using a digital multimeter. Here are some points to remember on resistor color coding. Resistor color code saying the Fifth band is black, which type of resistor? For a wire wound resistor, the 5th band is black and for a fusible resistor, the 5th band is white color. If the only single band (black color) in the middle it is a zero-ohm resistor. From which side should I read the resistor? Read from the left side to right. The idea is, the gold or silver bands (for tolerance) are present on the right side. If the gold, silver bands are not present, then the band that is close to the lead will be the first band. Which type of E-Series is mostly used? In most of the circuits, the preferred series are E6, E12, and E24. E96 series are high in cost as their tolerance is less. If these are 1 percent tolerance resistors, which they probably are, the tolerance band will be brown. The tolerance band is the 5th band on one end of the resistor. Deductive logic: If there is a brown band on one end, and a different color band on the other end, the brown band is the tolerance band and the other band is the first number of the value. Now, the value is a three digit number. The 4th band is a multiplier and the 5th band is the tolerance. The problem is a LOT of values start with "1" (100, 15, 150, 18, 18000, et cetera) which is a brown band. So you will have a brown band on each end. Grrrr. Keep your multimeter handy. For example, it looks like some of your resistors in the picture are marked as follows: red-red-black-orange-brown. If these are 1 percent resistors, the brown band, per the deductive logic, is the 5th, tolerance band. The first three numbers are the three digit value: 220 (red-red-black). The 4th band is a multiplier: X1000 (orange). So these are 220 x 1000 resistors: 220,000 ohms. 220K ohms. As some other persons said in their answers, a resistor is not a polarized device. There is no "+" or "-" orientation. You can insert a resistor into a circuit without worrying about which end of the resistor is which. Resistors are the passive components used in the electrical circuits to reduce the flow of electric current to certain level. The ability to restrict the flow of electric current is called resistance. The resistors with high resistance value will restricts large amount of electric current whereas the resistors with low resistance value will restricts only a small amount of electric current. The resistance of a resistor is measured in ohms. What is a color code? Generally, color refers to a representation of information in another form by using symbols, signals, and letters for the purposes of secrecy. Here, the signals or symbols act as codes. In the similar way, in resistors we use different colors as codes to specify the resistance (information) of the resistor. Here, the different colors coated on the resistor act as codes. The color codes are also used to specify the tolerance and reliability of the resistor. We can also directly find the resistance value of a resistor by using ohmmeter. The color codes are used not only in resistors but also in other electronic components such as capacitors and inductors. Specifying the values or ratings of electronic components such resistors, capacitors, and inductors by using the color codes printed on them is called electronic color code system. The electronic color code system was developed in the early 1920s by the radio manufacturers association, which is now part of Electronic Industries Alliance (EIA). The color-coding is done only in the fixed resistors but not in variable resistors because the color coding technique shows only a fixed resistance value. The variable resistors have varying resistance. Hence, it is not possible to use the color coding technique in variable resistors. Why color codes are used in resistors instead of directly printing the resistance value? Printing the numbers on large electronic components is very easy, but it is very difficult to print the numbers or resistance values on tiny components. Hence, instead of directly printing the numbers, we print the color codes or color bands. However, by using the latest printing technology we can directly print the numbers on resistors. The color coding technique has some drawbacks. For blind people, it is impossible to find the resistance of the resistor, because they cannot see the colors coated on the resistor. Another drawback is recognizing the difference between two colors in an overheated resistor is very difficult. When the resistor is overheated, the colors on the resistor changes slightly. Therefore, it becomes impossible to recognize the difference between brown color and red color or brown color and orange color. Representing the resistance of a resistor by using color bands In a color coding technique, the resistors value is marked on the resistors body by using colors. The colors painted on the resistors body are called color bands. All the color bands painted on the resistor body are used to indicate the resistance value and tolerance. Each color on the resistors body represents a different number. The color bands of resistors are basically of three types: 4 band resistor, 5 band resistor, and 6 band resistor. In order to find the resistance of a resistor, we need to decode the colors painted on the resistors body. The decoding changes based upon the number of color bands painted on the resistors body. 4 band color code resistor A 4 band color code resistor has 3 color bands on left side and one color band on right side. The 3 color bands on left side are very close to each other and the 4th color band on right side is separated from first 3 bands with some space. The 3 color bands on the left side are grouped together to indicate the resistors resistance value and the 4th color band on the right side indicates the tolerance of the resistor. What is tolerance? Tolerance is the variation in the resistance of a resistor from its actual resistance. The resistors of high tolerance have high variation in the resistance. The resistors of low tolerance have low variation in the resistance. For example, a resistor that has a tolerance of 5% may vary 5% of its resistance from its actual resistance value. Similarly, a resistor that has a tolerance of 8% may vary 8% of its resistance from its actual resistance value. Tolerance of a resistor is normally specified in percentage." The 1st color band on the resistor indicates the 1st significant value or 1st digit of the resistors resistance and the 2nd color band indicates 2nd significant value or 2nd digit of the resistors resistance. The 3rd color band is the decimal multiplier and the 4th color band indicates the resistors tolerance. The 1st and 2nd color bands together make up a 2 digit number and the 3rd color band or multiplier is multiplied with this 2 digit number to obtain the resistance value of the resistor. If the 4th color band or tolerance band is left blank, it is considered as the 3 band resistor and the tolerance for the 3 band resistor is assumed to be 20%. Resistors that are manufactured for military use may also include an extra band called 5th band which indicates resistor failure rate. Example: If the colors on a 4 band resistor is in this order: brown, green, red and violet (as shown in figure). The values of color bands will be like this: Brown = 1, Green = 5, Red = 102 or 100, Violet = 0.10%. In the color code table, brown has a value of 1 which is the 1st digit and green has a value of 5 which is the second digit. The first and second color bands are grouped together to make up a two digit number 15. The 3rd color band red has a value of 100. This value is multiplied with the two digit number I.e., 15 x 100 = 1500 ohms. Violet specifies that the tolerance is 0.10%. Therefore, the resistor color coded with brown-green-red-violet would have a resistance of 1500 ohms with a tolerance of ± 0.10%. 5 band color code resistor A 5 band color code resistor has 4 color bands on left side and one color band on right side. The 4 color bands on left side are very close to each other and the 5th color band on right side is separated from the first 4 bands with some space. The 4 color bands on the left side are grouped together to indicate the resistors resistance value of a resistor and the 5th color band on the right side indicates the tolerance of the resistor. The 1st color band indicates the 1st significant value or 1st digit of the resistors value. The 2nd color band indicates the 2nd significant value or 2nd digit of the resistor value. The 3rd color band indicates the 3rd significant value or 3rd digit of the resistors value. The 4th color band is the decimal multiplier. The 5th color band indicates the resistors tolerance. The 1st, 2nd and 3rd color bands together make up a 3 digit number and the 4th color band or multiplier is multiplied with this 3 digit number to obtain the resistance value of the resistor. Example: If the colors on a 5 band resistor is in this order: brown, green, red, blue and violet (as shown in figure). The values of color bands will be like this: Brown = 1, Green = 5, Red = 2, blue = 106, Violet = 0.10%. In the color code table, brown has a value of 1 which is the 1st digit, green has a value of 5 which is the second digit and red has a value of 2 which is the 3rd digit. The first, second and third color bands together make up a three digit number 152. The 4th color band blue has a value of 106. This value is multiplied with the three digit number 152 I.e., 152 x 106 = 152MΩ. Violet specifies that the tolerance is 0.10%. Therefore, the resistor color coded with brown-green-red-blue-violet would have a resistance of 152MΩ with a tolerance of ± 0.10%. 6 band color code resistor A 6 band color code resistor consists of 6 color bands. The 4 color bands on the left side are grouped together to represent the resistors resistance value. The 5th color band on the right side represent the tolerance of the resistor and the 6th color band represents the TCR (Temperature Co-efficient of Resistance). The 1st color band indicates the 1st significant value of the resistors value. The 2nd color band indicates the 2nd significant value of the resistors value. The 3rd color band indicates the 3rd significant value of the resistors value. The 4th color band is the decimal multiplier. The 5th color band indicates the resistors tolerance. The 6th color band indicates the TCR (Temperature Co-efficient of Resistance). The 1st, 2nd, and 3rd color bands together make up a 3 digit number and the fourth color band is multiplied with this 3 digit number to get the resistance value of the resistor. Example: If the colors on a 6 band resistor is in this order: green, brown, violet, black, gold and orange. The values of color bands will be like this: Green = 5, Brown = 1, Violet = 7, Black = 100, Gold = 5%, Orange = 15ppm. In the color code table, green has a value of 5 which is the 1st digit, brown has a value of 1 which is the second digit and violet has a value of 7 which is the 3rd digit. The first, second and third color bands together make up a three digit number 517. The 4th color band black has a value of 100. This value is multiplied with the three digit number 517 I.e., 517 x 100 = 517 ohms. Gold specifies that the tolerance is 5% and orange specifies that the TCR is 15ppm. Therefore, the resistor color coded with green-brown-violet-black-gold-orange would have a resistance of 517 ohms with a tolerance of 5% and TCR (Temperature Co-efficient of Resistance) of 15ppm. What is TCR? The rate at which the resistance of the resistor changes with change in temperature is called TCR (Temperature Co-efficient of Resistance). How to read or decode resistor color codes The placement of the color bands on the resistor is very important. Generally, the color bands placed closest to the lead or end of the resistor is considered as the first band. The next to the first band is second band and so on. Another way is the extra space between the two bands (3rd and 4th bands) also indicates the reading direction. If you feel difficult to find the resistance of the resistor by using its color bands, you can directly find the resistance by using ohmmeter or multimeter. How to remember color codes on the resistor? If you find difficult to remember the color codes on the resistor, use these mnemonics to remember them easily. The bold letters represents color names. Some mnemonics that are easy to remember include: B.B. ROY of Great Britain has a Very Good Watch made of Gold Silver Bye Bye Rosie Off You Go Birmingham Via Great Western Bye Bye Rosie Off You Go Bristol Via Great Western Better Buy Resistors Or Your Grid Bias Voltages Go West

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