Salahaddin of University

Collage of basic education

Second stage

Electricity Laboratory Experiments

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زانکۆی سەلاحەدین

کۆلیژی پەروەردەی بنەڕەتی

بەشی زانستی گشتی

قۆناغی دووەمی زانستی گشتی

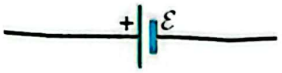
تاقی کردنەوەکانی تاقیگەی کارەبایی

ئامادەکردنی د ع

Symbols for Circuit Diagrams

Conductor with negligible resistance

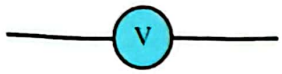
Resistor



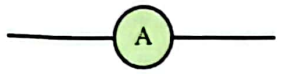
Source of emf (longer vertical line always represents the positive terminal, usually the terminal with higher potential)

Source of emf with internal resistance *r* (*r* can be placed on either side)

or



Voltmeter (measures potential difference between its terminals)



Ammeter (measures current through it)

Electric fields

Electric field vectors

Electric field component vectors

Magnetic fields

Magnetic field vectors

Magnetic field component vectors

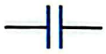
Positive charges 

Negative charges 

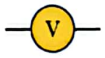
Resistors 

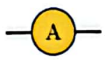
Batteries and other DC power supplies 

Switches 

Capacitors 

Inductors (coils) 

Voltmeters 

Ammeters 

AC Sources 

Lightbulbs 

Ground symbol 

Current 

Power delivered to or extracted from a circuit element

$$P = V_{ab} I$$

V_{ab}: Voltage across circuit element

I: Current in circuit element

Power delivered to a resistor

$$P = V_{ab} I = I^2 R = \frac{V_{ab}^2}{R}$$

V_{ab}: Voltage across resistor

I: Current in resistor

R: Resistance of resistor

Power delivered to or extracted from a circuit element

$$P = V_{ab} I$$

V_{ab}: Voltage across circuit element

I: Current in circuit element

Power delivered to a resistor

$$P = V_{ab} I = I^2 R = \frac{V_{ab}^2}{R}$$

V_{ab}: Voltage across resistor

I: Current in resistor

R: Resistance of resistor

Experiments No (A): Color Code Resistance

There are three types of bands color code resistance

Four band color code resistance

Maximum resistance and minmum resistance can calculate by this law $R_{max} = nominal + Tolerance$

$R_{Nominal} = AB \times 10^{C}$

$R_{max} = AB \times 10^{C} + perstantage \times nominal$

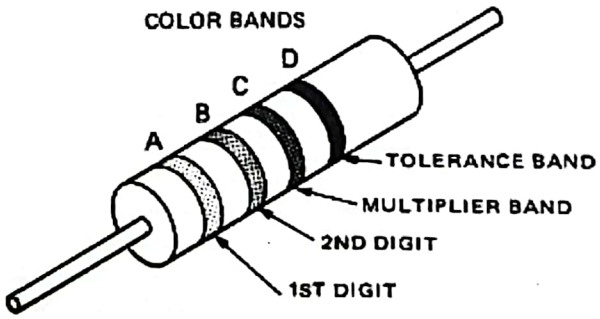
$Tolerance = perstantage \times nominal$ $R_{Tol} = \%(AB \times 10^{C})$

$R_{max} = AB \times 10^{C} + \%(AB \times 10^{C})$ $R_{mim} = AB \times 10^{C} - \%(AB \times 10^{C})$

A and B significant Digital C power

Five band color code $R_{Nominal} = ABC \times 10^{D}$

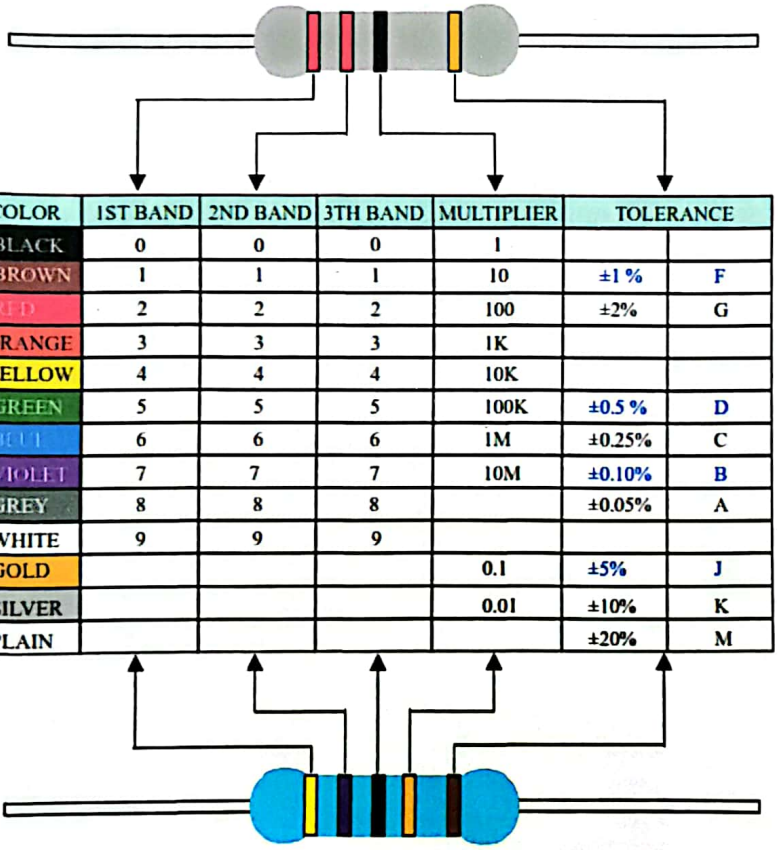
$R_{max} = ABC \times 10^{D} + \%(ABC \times 10^{D})$ $R_{min} = ABC \times 10^{D} - \%(ABC \times 10^{D})$



RESISTOR COLOR CODE TABLE

COLOR BANDS	NUMERICAL VALUE 1ST DIGIT	NUMERICAL VALUE 2ND DIGIT	DECIMAL MULTIPLIER	TOLERANCE PERCENTAGE
BLACK	–	0	1	
BROWN	1	1	10	
RED	2	2	100	
ORANGE	3	3	1000	
YELLOW	4	4	10,000	
GREEN	5	5	100,000	
BLUE	6	6	1,000,000	
VIOLET	7	7	10,000,000	
GRAY	8	8	100,000,000	
WHITE	9	9	1,000,000,000	
SILVER	–	–	0.01	± 10%
GOLD	–	–	0.1	± 5%
NONE	–	–	–	± 20%

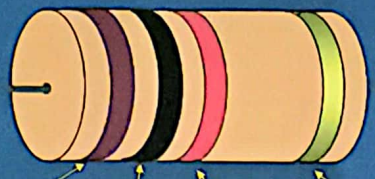
TOKEN RESISTOR COLOR CODE



COLOR	1ST BAND	2ND BAND	3TH BAND	MULTIPLIER	TOLERANCE	
BLACK	0	0	0	1		
BROWN	1	1	1	10	±1 %	F
RED	2	2	2	100	±2%	G
ORANGE	3	3	3	1K		
YELLOW	4	4	4	10K		
GREEN	5	5	5	100K	±0.5 %	D
BLUE	6	6	6	1M	±0.25%	C
VIOLET	7	7	7	10M	±0.10%	B
GREY	8	8	8		±0.05%	A
WHITE	9	9	9			
GOLD				0.1	±5%	J
SILVER				0.01	±10%	K
PLAIN					±20%	M

4-Band Resistors

The resistor nominal value is encoded in the color code in Powers of Ten Notation. The template for determining the nominal value and tolerance of a resistor with 4 color bands is given below:



1st Band = 1st Significant Digit

2nd Band = 2nd Significant Digit

3rd Band = Multiplier

4th Band = Tolerance

___ ___ × 10^___ Ω ± ___ %

How do we know which color corresponds to which number?

Answer: Using the Resistor Color Code Table

Color	Digit	Multiplier	Tolerance
Black	0	$10^0 = 1$	
Brown	1	$10^1 = 10$	±1%
Red	2	$10^2 = 100$	±2%
Orange	3	$10^3 = 1{,}000$	
Yellow	4	$10^4 = 10{,}000$	
Green	5	$10^5 = 100{,}000$	
Blue	6	$10^6 = 1{,}000{,}000$	
Violet	7	$10^7 = 10{,}000{,}000$	
Gray	8	$10^8 = 100{,}000{,}000$	
White	9	$10^9 = 1{,}000{,}000{,}000$	
Silver		$10^{-2} = 0.01$	±10%
Gold		$10^{-1} = 0.1$	±5%
No band	---	---------	±20%