H.I Tech 10S
Electronics

Electrical Theory

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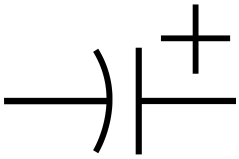
Electrical Components

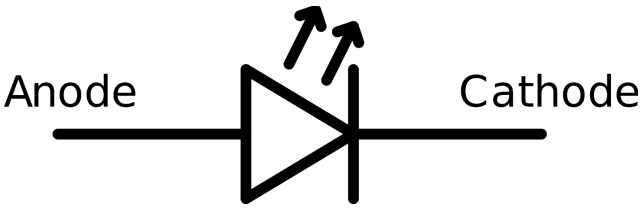
Resistor-> A resistor is a component that restricts the flow of current in a circuit. Think of it like a kink in a hose, water can get through but not as much as before.

Capacitor-> A capacitor is used to store charge and then discharge once it has reached a certain power.

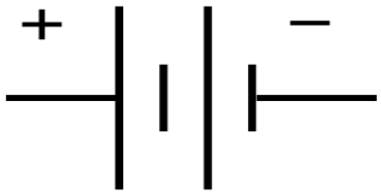


Diode -> A Diode is a one way gate, electrons can flow one way through the gate but not the other way.

Light Emitting Diode (LED)-> A LED is a diode which also emits a light when current flows through it.

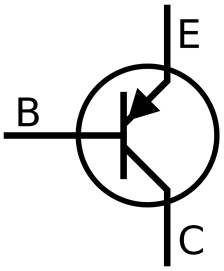


Power Supply -> A power supply is where voltage and current and brought into the circuit, such as a battery.

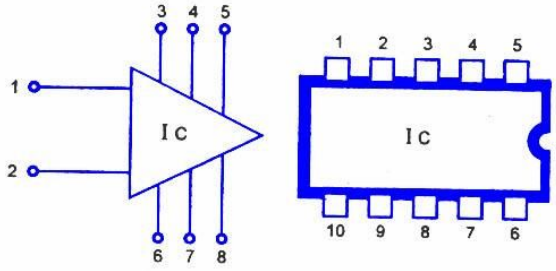


Switch -> A switch is a device which breaks the flow of electrons

Transistor -> A transistor helps regulate voltage and current in a circuit. It also guides the flow of electricity in the way a diode would but with three leads.



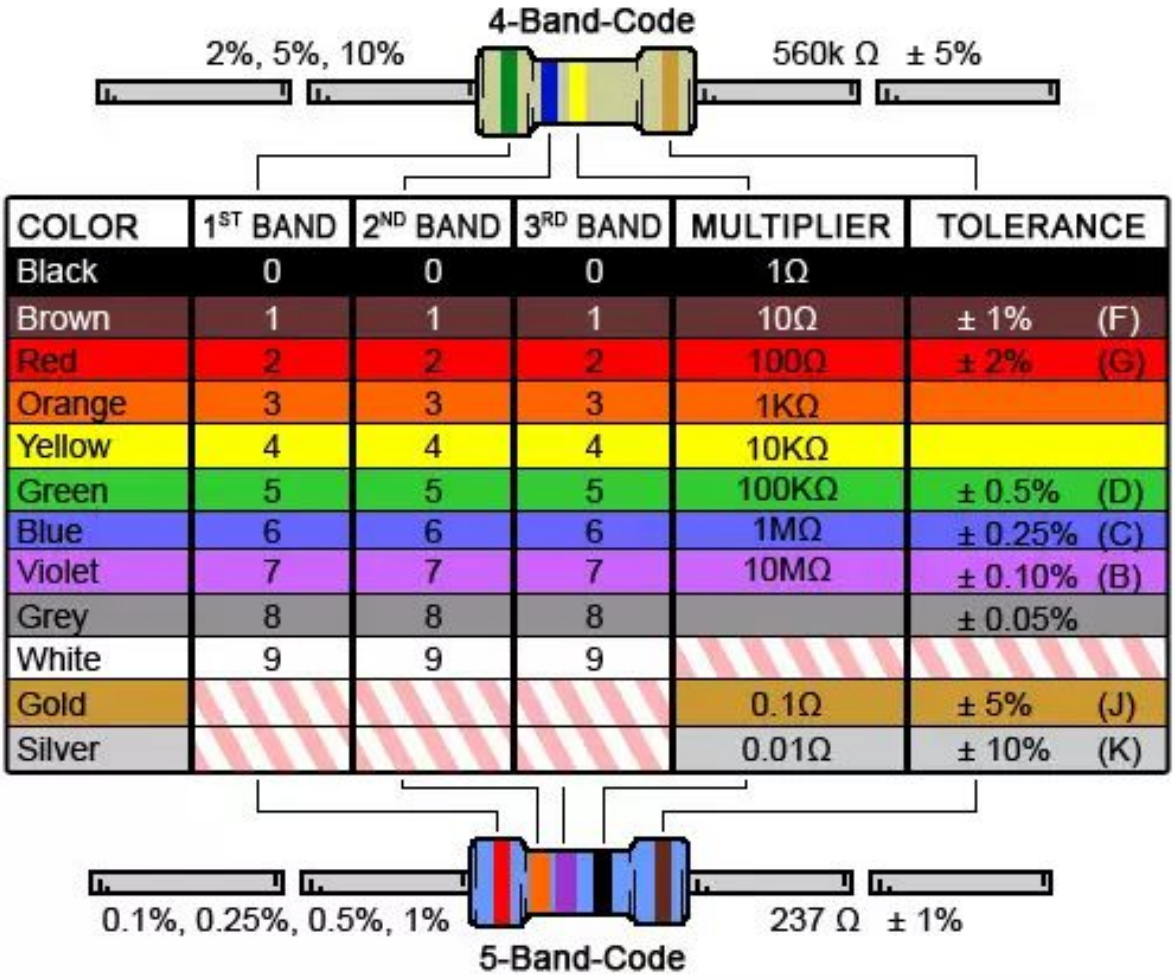
IC -> An Integrated Chip is the brains behind the operation, these can be programed to control the device to operate specific tasks



IC Symbols

Resistor Colour Codes

Resistors can get very small, due to the size of the resistor and the large values they represent each resistor has 4-5 colours to tell you it's value. For purposes in our shop we will only worry about the 5 Colour band as shown below.



COLOR	1ST BAND	2ND BAND	3RD BAND	MULTIPLIER	TOLERANCE
Black	0	0	0	1Ω	
Brown	1	1	1	10Ω	± 1% (F)
Red	2	2	2	100Ω	± 2% (G)
Orange	3	3	3	1KΩ	
Yellow	4	4	4	10KΩ	
Green	5	5	5	100KΩ	± 0.5% (D)
Blue	6	6	6	1MΩ	± 0.25% (C)
Violet	7	7	7	10MΩ	± 0.10% (B)
Grey	8	8	8		± 0.05%
White	9	9	9		
Gold				0.1Ω	± 5% (J)
Silver				0.01Ω	± 10% (K)

Example 1

Example 2

Example 3

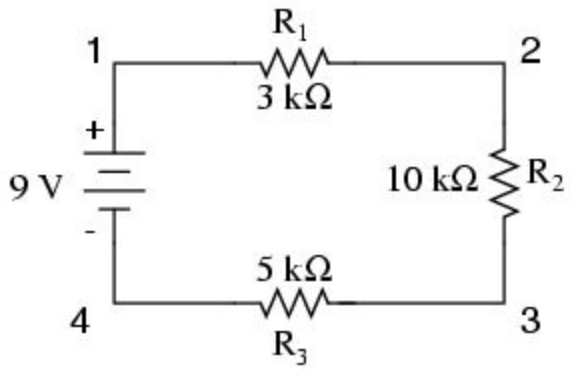
Example 4

Example 5

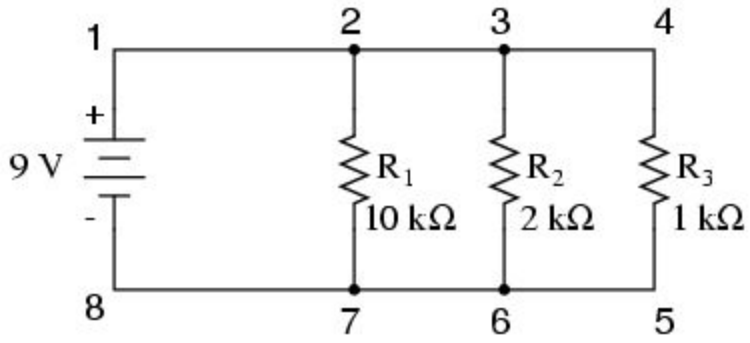
Example 6

Types of Circuits

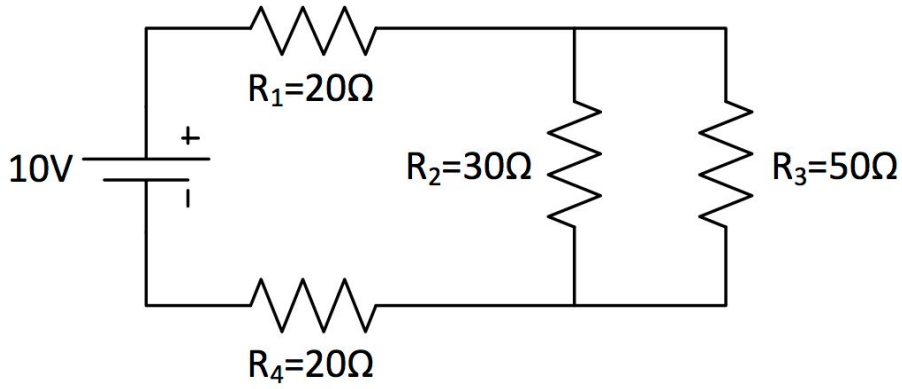
Series Circuit-> A series circuit is one which there is only one path for electrons to flow. Electricity must flow through each component in the circuit to complete its path, if any device isn't working or the chain is broken the entire circuit stops to work. Think of old Christmas lights, when one went out the entire chain went out until you found that single bulb that burnt out.



Parallel Circuit -> A parallel circuit is one which there are multiple paths for electricity to flow. Electricity can take multiple paths throughout the entire circuit, if one chain breaks or one component fails the rest of the circuit still works. However the load will increase on the rest of the circuit. Think of modern Christmas lights where if one light goes out the rest of them still work, even if half are burnt out the rest still work.

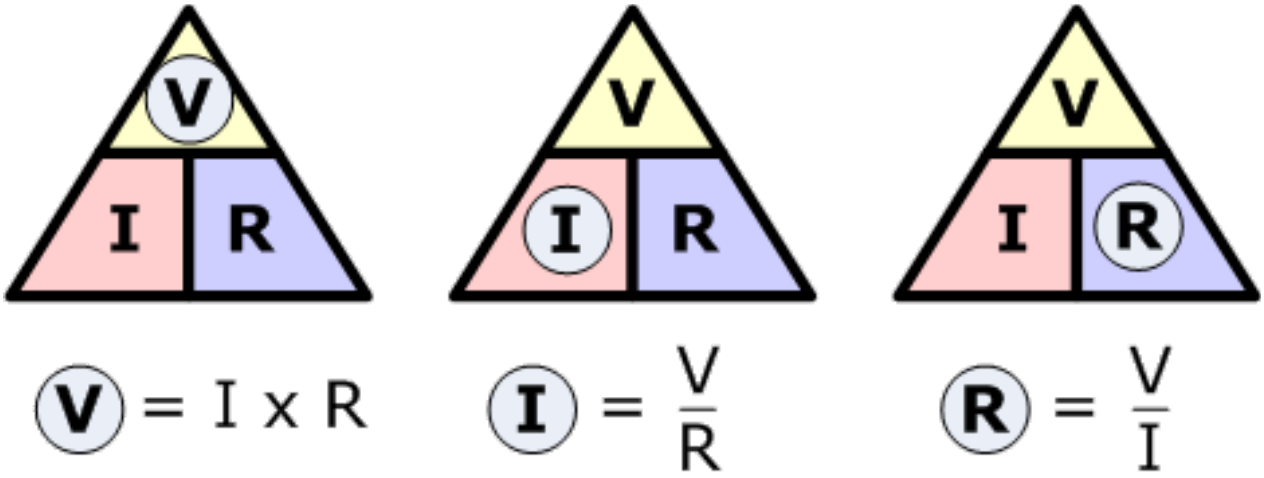


Combination Circuit -> A combination circuit is one which consists of a series circuit and a parallel one. Current may have to flow through certain components, then when passed those parts may flow in multiple paths.



Ohms Law

Ohms law allows us to calculate resistance, voltage and current when we know two of the values. This is very useful for when it comes to troubleshooting your projects, to know how much amperage should be measured across a resistor will help you know if that resistor is damaged.



V- Voltage, measured in volts the unit of measure is (v)

I - Amperage/current, measured in amps the unit of measure is (a)

R- Resistance, measured in ohms the unit of measure is (Ω)

Ohms law is a simple equation for calculated one of the missing values.

Example 1

Example 2

Example 3

Example 4

Example 5

Example 6

Example 7

Example 8

Units of Measure and Values

Resistor - Ω (Ohms) - R

Capacitor - F (Farad) - C

Transistor- NPN PNP - T

Voltage - V (Volts)

Amperage - a (Amps)

Switch- No unit of measure - S

LED- No unit of measure - L

Prefix	Symbol	Meaning
giga-	G	10^{9}
mega-	M	10^{6}
kilo-	k	10^{3}
deci-	d	10^{-1}
centi-	c	10^{-2}
milli-	m	10^{-3}
micro-	m	10^{-6}
nano-	n	10^{-9}
pico-	p	10^{-12}
femto-	f	10^{-15}

SI Prefixes to Memorize

Example 1
12,000 = 12K
.00002 = 20m
1,000,000= 1M
76,000,000,000= 76G