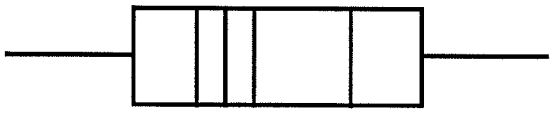
Basic Electronics Explained

Introduction

Electricity is 'pushed' along the wire by the voltage from a battery, the larger the 'push' the higher the voltage. This is measured in *Volts (V)*. The current in a circuit is the amount of electricity flowing along the wire. This is measured in *Amps (A)*.



(Circuit Symbol)

The Resistor

Colour	Colour Code 1st&2nd Band	Multiplier Band 3rd Band	Tolerance Band 4th Band
Black	0	x1	±1%
Brown	1	x10	±2%
Red	2	x100	±3%
Orange	3	x1000	±4%
Yellow	4	x10000	
Green	5	x100000	
Blue	6	x1000000	
Violet	7	x10000000	
Grey	8		
White	9		
Gold	-	x0.1	±5%
Silver	-	x0.01	±10%

A resistor possesses a property called resistance which is measured in *Ohms (Ω)*. Resistance reduces the flow of current in a circuit. The higher the resistance in the resistor, the greater the reduction in current. The value of resistance can be identified by a colour coding on the resistor. The colour code is made up of three bands, and a further single band. To read the value, the three bands must be on the left. The component can be read from the left, as follows:

1st Band: This is the first digit of the value.
2nd Band: This is the second digit.
3rd Band: This is the factor by which the first two numbers are multiplied to get the final value.
4th Band: This indicates the tolerance, or more simply, the accuracy of the component value.

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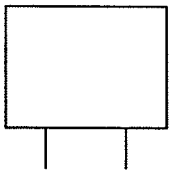
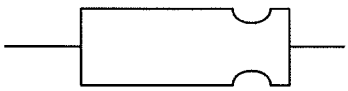
The Capacitor



(Circuit Symbol)



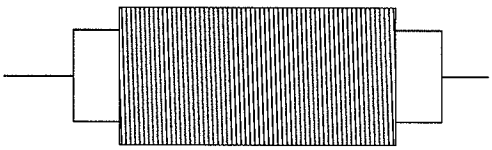
Electrolytic

(Circuit Symbol)

A capacitor is a component which is used to store electricity. The amount of electricity that can be stored by a capacitor is its capacitance. This is measured in *Microfarads (µF)* and *Picofarads (pF)*. **N.B. 1µF = 1000000 pF.** Electrolytic capacitors are specially made and usually have higher values than ordinary capacitors. The value is normally written on the component.

It takes a capacitor a certain amount of time to charge-up. While it is charging, a current is flowing. A capacitor can therefore be used in a timing circuit.

The Coil or Inductor



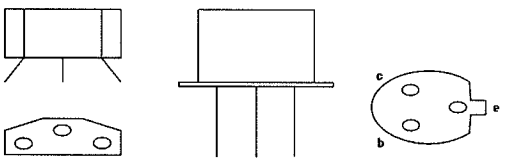
Air Core

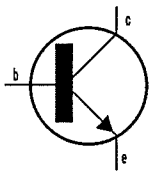
Ferro-Magnetic Core

(Circuit Symbols)

A coil is made-up of a core, around which, insulated copper wire is wound. A coil possesses a property called inductance. This is measured in *Henry's (H)* and is most often used for tuning in a circuit such as a radio receiver.

The Transistor





(Circuit Symbol)

A transistor is a semiconductor device. It is made-up of a material which is neither a conductor or insulator, such as Germanium or Silicon. It has three legs; these are the base (b), the emitter (e), and the collector (c).

In operation, a transistor is basically a switch. The base current controls the switch because, when there is a current at the base a current will flow across the collector and the emitter. When there is no current at the base, there will be no conduction between the collector and the emitter, i.e. no current. Another important factor in the operation of a transistor is that the collector/emitter current is much larger than that of the base-current (somewhere in the region of 50-100 times larger). This means that the transistor is also an amplifying device, and is used in the most present day amplifying circuits.

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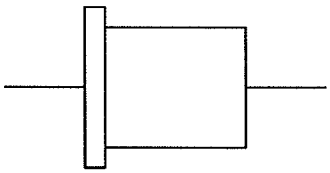
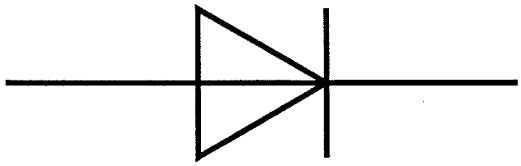
The Diode





(Circuit Symbol)

A diode is a semiconductor device, similar to a transistor. It has two legs or terminals, one of which is marked in some way to identify it as the positive leg/terminal.

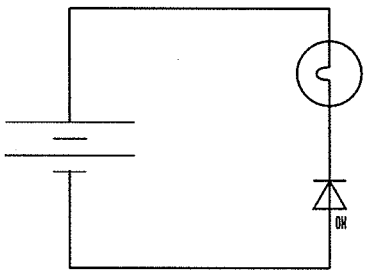


Diagram 1

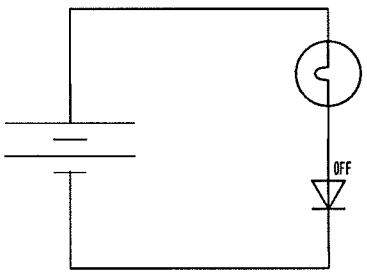
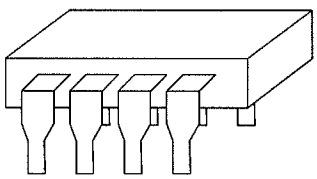
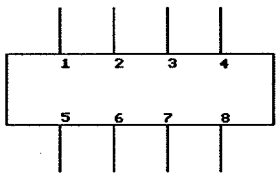


Diagram 2

In operation, the diodes resistance changes, depending upon the way the current flows through it. Connected as in diagram 1 *(Forward Direction)*, the resistance is low, and the diode conducts, lighting the bulb. However, connected as in diagram 2 nî*(Reverse Direction)*, the resistance is high, so the diode does not conduct, and consequently, the bulb does not light. A diode can be used to protect equipment from being connected the wrong way round, as it will not conduct.

The Integrated Circuit (I.C.)





(General Circuit Symbol)

An I.C. consists of a silicon chip onto which layers of semi-conducting material are arranged to form a specific circuit. Connections are then made onto this chip, and the whole thing is encapsulated into a ceramic or plastic package.

The silicon chip itself, can contain several hundred or thousand components, the most common of which are the transistors. It can also contain resistors, capacitors or sometimes coils.

Integrated Circuit types are identified by a number printed on the package.

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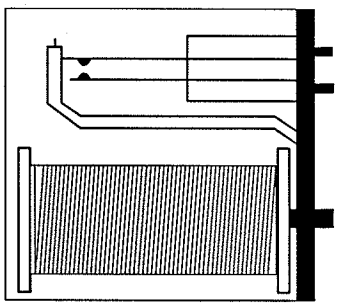
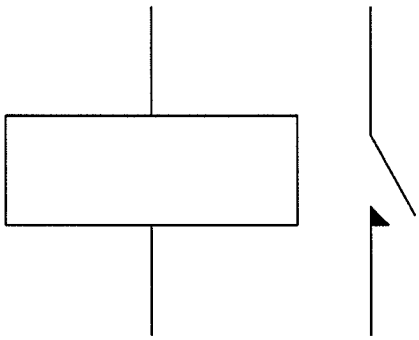
The Relay

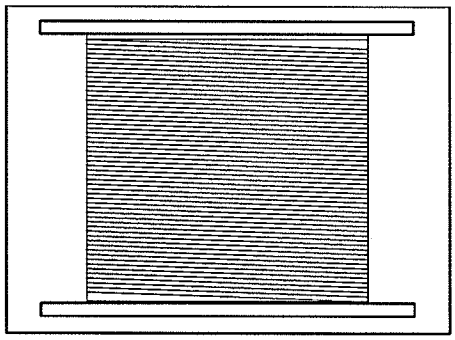


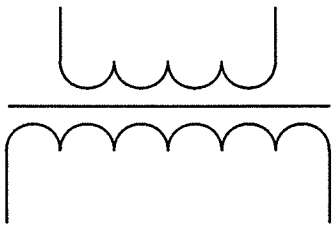


(Circuit Symbol)

A relay consists of an electromagnet which, when a voltage is applied across it, either opens or closes a series of switch contacts. In this way, a small voltage with a low current can be used to switch a large voltage with a high current (similar to a transistor used as a switch).

The Transformer





(Circuit Symbol)

All the previous components use *Direct Current (D.C.)* in their operation. The transformer however, uses *Alternating Current (A.C.)*. Direct current travels in one direction only, whereas alternating current changes direction periodically. A transformer consists of two lengths of wire wound on a common core. These coils are called the primary and secondary windings. A transformer is used to change the voltage-level of electricity, the type of change being determined by the number of coils on the primary winding, compared to the secondary winding. If there are more coils on the primary, the voltage will be reduced, if there are more on the secondary than the primary, it will be increased.

