KJ’s Educational Institutes

K J College Of Engineering & Management Research, Pune.

Department of E & TC

CLASS: S. E. (E &TC) **SUBJECT:-ESD**

Experiment No: 1 **Date:**

Aim: To study various electronic components.

Apparatus: Resistors, Capacitors, Inductor, Relays, Switches etc.

Breadboards:

In order to temporarily construct a circuit without damaging the components used to build it, we must have some sort of a platform that will both hold the components in place and provide the needed electrical connections. In the early days of electronics, most experimenters were amateur radio operators. They constructed their radio circuits on wooden breadboards. Although more sophisticated techniques and devices have been developed to make the assembly and testing of electronic circuits easier, the concept of the breadboard still remains in assembling components on a temporary platform.

(a)

(b)

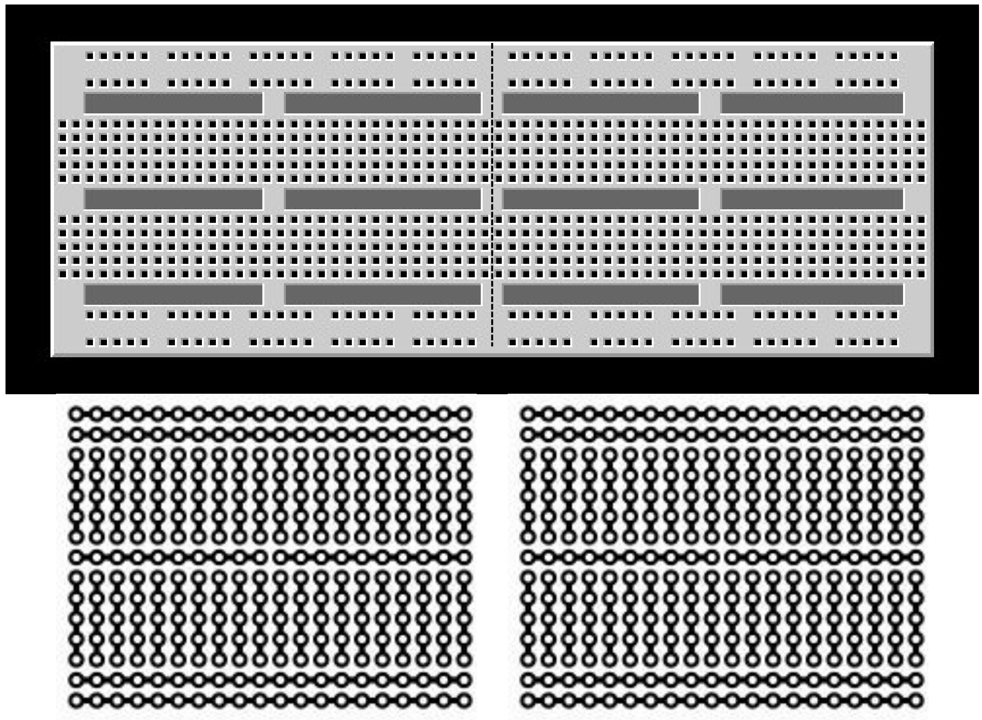


Fig. 1: (a) A typical Breadboard and (b) its connection details

A real breadboard is shown in Fig. 1(a) and the connection details on its rear side are shown in Fig. 1(b). The five holes in each individual column on either side of the central groove are electrically connected to each other, but remain insulated from all other sets of holes. In addition to the main columns of holes, however, you'll note four sets or groups of holes along the top and bottom. Each of these consists of five separate sets of five holes each, for a total of 25 holes. These groups of 25 holes are all connected together on either side of the dotted line indicated on Fig.1(a) and needs an external connection if one wishes the entire row to be connected. This makes them ideal for distributing power to multiple ICs or other circuits.

These breadboard sockets are sturdy and rugged, and can take quite a bit of handling. However, there are a few rules you need to observe, in order to extend the useful life of the electrical contacts and to avoid damage to components. These rules are:

- Always make sure power is disconnected when constructing or modifying your experimental circuit. It is possible to damage components or incur an electrical shock if you leave power connected when making changes.
- Never use larger wire as jumpers. #24 wire (used for normal telephone wiring) is an excellent choice for this application. Observe the same limitation with respect to the size of component leads.
- Whenever possible, use ¼ watt resistors in your circuits. ½ watt resistors may be used when necessary; resistors of higher power ratings should never be inserted directly into a breadboard socket.
- Never force component leads into contact holes on the breadboard socket. Doing so can damage the contact and make it useless.
- Do not insert stranded wire or soldered wire into the breadboard socket. If you must have stranded wire (as with an inductor or transformer lead), solder (or use a wire nut to connect) the stranded wire to a short length of solid hookup wire, and insert only the solid wire into the breadboard.

If you follow these basic rules, your breadboard will last indefinitely, and your experimental components will last a long time.

Resistors

Fixed Resistors:

A linear resistor is a linear, passive two-terminal electrical component that implements electrical resistance as a circuit element. The current through a resistor is in direct proportion to the voltage across the resistor's terminals. Thus, the ratio of the voltage applied across a resistor's terminals to the intensity of current through the circuit is called resistance. This relation is represented by Ohm's law:

$$I = \frac{V}{R}$$

- Resistance - the value of resistance, measured in Ohms.
- Power - The amount of power the resistor can handle safely.
- Voltage - This is the maximum voltage that may appear across a resistor.

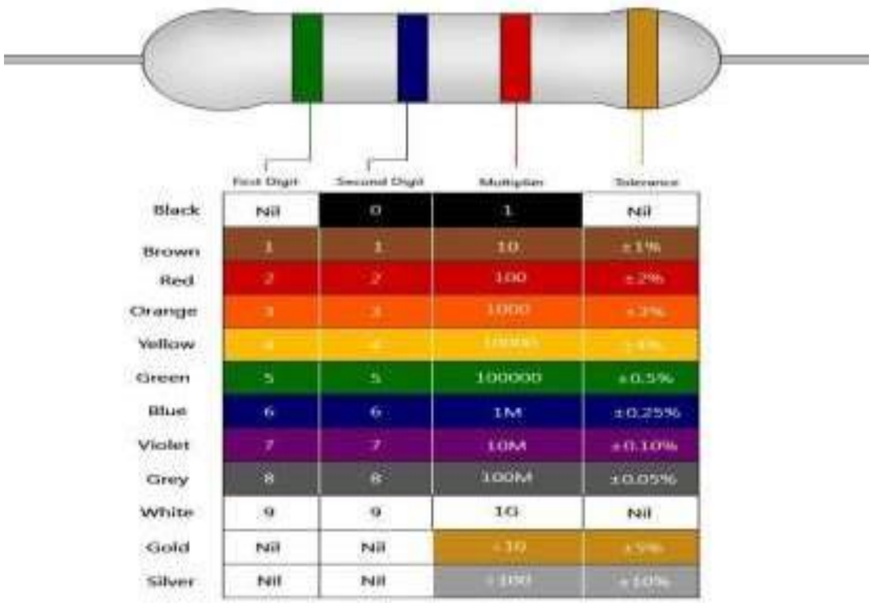
Symbol for a resistor

Color-Code System

Low power (<= 2W) resistors are nearly always marked using the standard color code. This comes in two variants - 4 band and 5 band. The 4 band code is most common with 5% and 10% tolerance, and the 5 band code is used with 1% and better. With the 4 band code, the third digit column is not used; it is only used with the 5 band code.

Tolerance

The tolerance of resistors is mostly 1%, 2%, 5% and 10%. In the old days, 20% was also common, but these are now rare. Even 10% resistors are hard to get except in extremely high or low values (> 1M or < 1R), where they may be the only options available at a sensible price.



	First Digit	Second Digit	Multiplier	Tolerance
Black	Nil	0	1	Nil
Brown	1	1	10	±1%
Red	2	2	100	±2%
Orange	3	3	1000	[illegible]
Yellow	[illegible]	[illegible]	[illegible]	[illegible]
Green	5	5	100000	±0.5%
Blue	6	6	1M	±0.25%
Violet	7	7	10M	±0.10%
Grey	8	8	100M	±0.05%
White	9	9	1G	Nil
Gold	Nil	Nil	[illegible]	±5%
Silver	Nil	Nil	[illegible]	±10%

Variable Resistance:

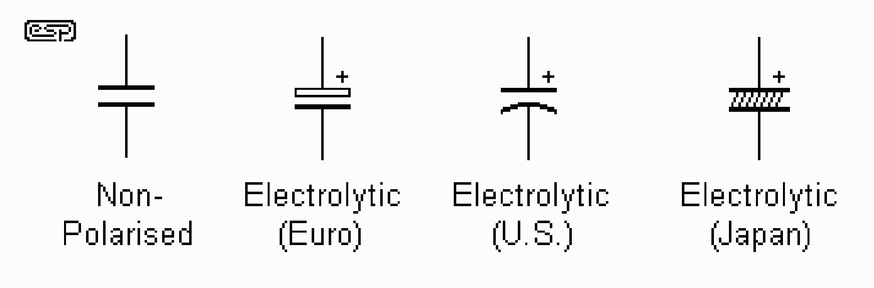
A variable resistor is a resistor of which the electric resistance value can be adjusted. A variable resistor is in essence an electro-mechanical transducer and normally works by sliding a contact (wiper) over a resistive element. When a variable resistor is used as a potential divider by using 3 terminals it is called a potentiometer. When only two terminals are used, it functions as a variable resistance and is called a rheostat.

Measurement of Resistor By color code system:

Resistance	Colors	Resistance Value
1) R1 =		
2) R2 =		
3) R3 =		

Capacitors :

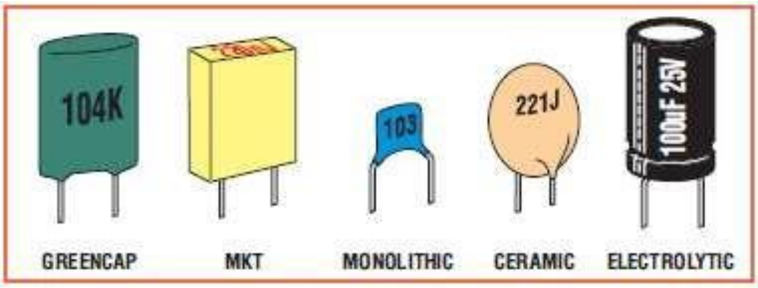
A capacitor is essentially two conductive plates, separated by an insulator (the dielectric). the assembly is commonly rolled up, or consists of many small plates in parallel for each terminal, each separated from the other by a thin plastic film. Caps come in two primary versions - polarised and non-polarised. Polarised capacitors must have DC present at all times, of the correct polarity and exceeding any AC that may be present on the DC polarizing voltage.



Capacitor Symbols

Capacitors are rated in Farads, and the standard symbol is "C" or "F", depending upon the context. A Farad is so big that capacitors are most commonly rated in micro-Farads (uF). Because of the nature of capacitors, they are also rated in very much smaller units than the micro-Farad - the units used are

- mF: Milli-Farad, $1x10^{-3}$ Farad
- **uF**: Micro-Farad, $1x10^{-6}$
- **nF**: Nano-Farad, $1x10^{-9}$ Farad
- **pF**: Pico-Farad, $1x10^{-12}$ Farad .



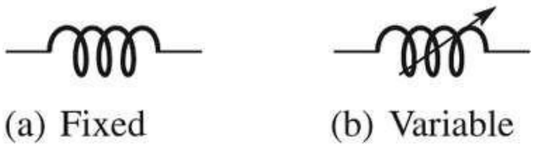
Applications:

1. In tuned circuits.
2. As bypass capacitors to bypass ac through it.
3. Blocking capacitor to block dc components.

Inductors:

These are the class of the purely passive components. An inductor is most commonly a coil, but in reality, even a straight piece of wire has inductance. Winding it into a coil simply concentrates the magnetic field, and increases the inductance considerably for a given length of wire. Small inductors are sometimes used in the output of power amplifiers to prevent instability with capacitive loads.

An inductor can be considered the opposite of a capacitor. It passes DC with little resistance, but becomes more of an obstacle to the signal as frequency increases. There are a number of different symbols for inductors, and three of them are shown below. Somewhat perversely perhaps, I use the "standard" symbol most of the time, since this is what is supported best by my schematic drawing package.



Inductor Symbols

Dotted lines instead of solid mean that the core is ferrite or powdered iron, rather than steel laminations or a toroidal steel core. The use of a magnetic core further concentrates the magnetic field, and increases inductance, but at the expense of linearity. Steel or ferrite cores should never be used in crossover networks for this reason (although many manufacturers do just that, and use bipolar electrolytic capacitors to save costs).

Inductance is measured in Henrys (H) and has the symbol "L" The typical range is from a few micro-Henrys up to 10H or more. Like a capacitor, an inductor has reactance as well, but it works in the opposite direction.

Switches:

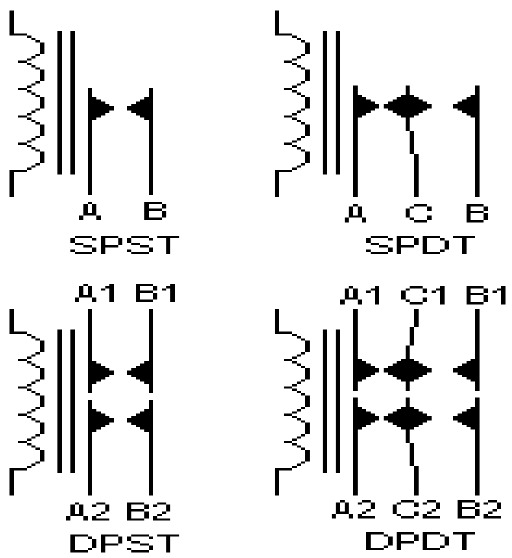
A switch is a device which can connect two points in a circuit (or) disconnect two points. If the switch is acting so has to connect two points. It is said to be in ON position. If the switch is acting so has to disconnect two points. It is said to be in OFF position.

SPST - **S**ingle **P**ole **S**ingle **T**hrow. These have two terminals which can be connected or disconnected.

SPDT - **S**ingle **P**ole **D**ouble **T**hrow. A common terminal connects to either of two others. If there are two independent circuits to be connected using two throws but still connecting one poll then it is called single pole double throw.

DPST - **D**ouble **P**ole **S**ingle **T**hrow. These have two pairs of terminals. Equivalent to two SPST switches or relays actuated by a single coil.

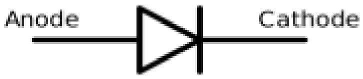
DPDT - **D**ouble **P**ole **D**ouble **T**hrow. This switch is capable of connecting the receiver to either Antenna-I or Antenna-II at the same time and it connects two poles hence the DPDT switch



DIODE:

A popular semiconductor device called a diode is made by combining P & N type semiconductor materials. The doped regions meet to form a P-N junction. Diodes are unidirectional devices that allow current to flow through them in one direction only.

The schematic symbol for a semiconductor diode is shown in fig-1. The P-side of the diode is called the anode (A), while the N-side of the diode is called the cathode (K).



Breakdown voltage rating VBR

The Breakdown voltage rating VBR is the voltage at which avalanche occurs. This rating can be designed by any of the following: Peak Inverse Voltage (PIV); Peak Reverse Voltage (PRV); Break down voltage rating VBR

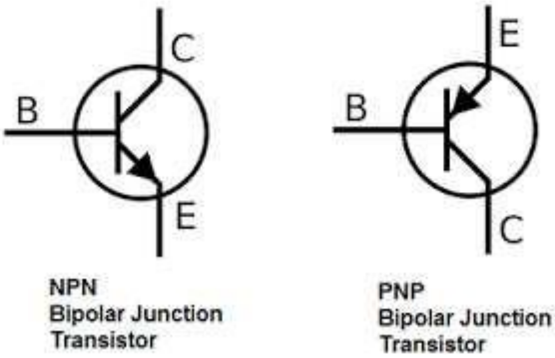
Average forward – current rating, IF

This important rating indicates the maximum allowable average current that the diode can handle safely, the average forward current rating is usually designated as IF Maximum reverse current, IR1N4007 silicon diode specifies a typical IR of 0.05 A for a diode junction.

Diodes are used in Rectifiers, Clippers and Clampers, signal detector, digital logic gates etc.

BIPOLAR JUNCTION TRANSISTOR (BJT):

A transistor has three doped regions there are two types of transistors one is npn and other is pnp. Notice that for both types, the base is narrow region sandwiched between the larger collector and moderate emitter regions.



In n-p-n transistors, the majority current carriers are free electrons in the emitter and collector, while the majority current carriers are holes in the base. The opposite is true in the pnp transistor where the majority current carriers are holes in the emitter and collector, and the majority current carriers are free electrons in the base.

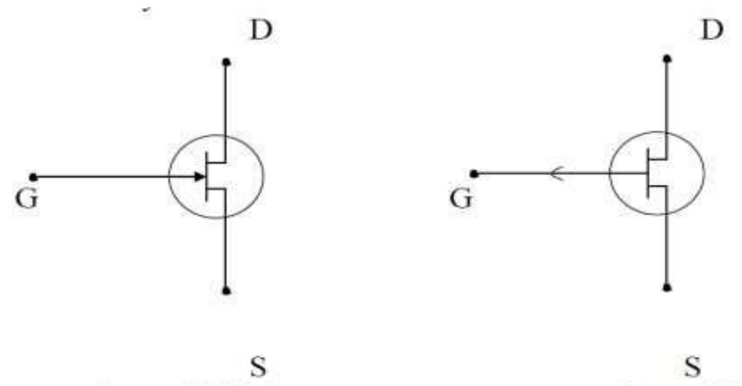
1. Emitter 2. Base 3. Collector

Schematic symbols for transistors (a) npn transistor (b) pnp transistor.

In order for a transistor to function properly as an amplifier, the emitter-base junction must be forward biased and the collector base junctions must be reverse biased.

FIELD EFFECT TRANSISTORS (FETS)

The field effect transistor (FET) is a three terminal device similar to the bipolar junction transistor. The FET, however, is a unipolar device, which depends on only one type of charge carriers; either electrons or holes. There are basically two types of FETs. The junction field effect transistor, abbreviated JFET, and the metal oxide semiconductor field effect transistor, abbreviated MOSFET.



n-channel JFET p-channel JFET

A junction field effect Transistor is a three terminal semiconductor device in which current conduction is by one type of carriers i.e., electrons or holes.

There are two basic types of FET‟s

1. Junction field effect transistor (JFET)
2. Metal oxide field effect transistor (MOSFET)

CONCLUSION :-

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