Basic Electronic Circuits Lab (IEC-103)

Experiment-01

Objective

Familiarization with basic test equipment and passive devices.

Topics

- Components – types, ratings
- Measuring instruments – multi-meter, oscilloscope
- Power supplies
- Testing device - Function Generator
- Breadboards

Components

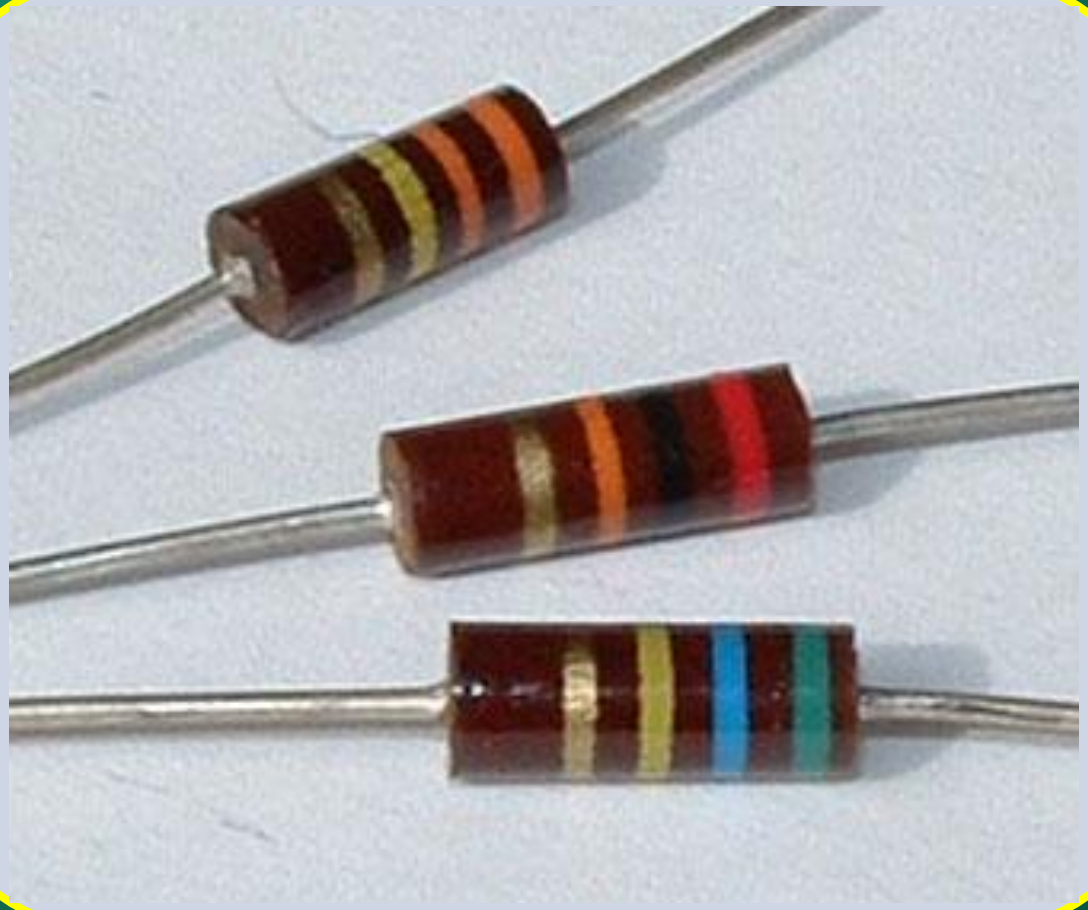
- Resistors, Capacitors, Inductors
- Diodes (Nonlinear)

Resistors

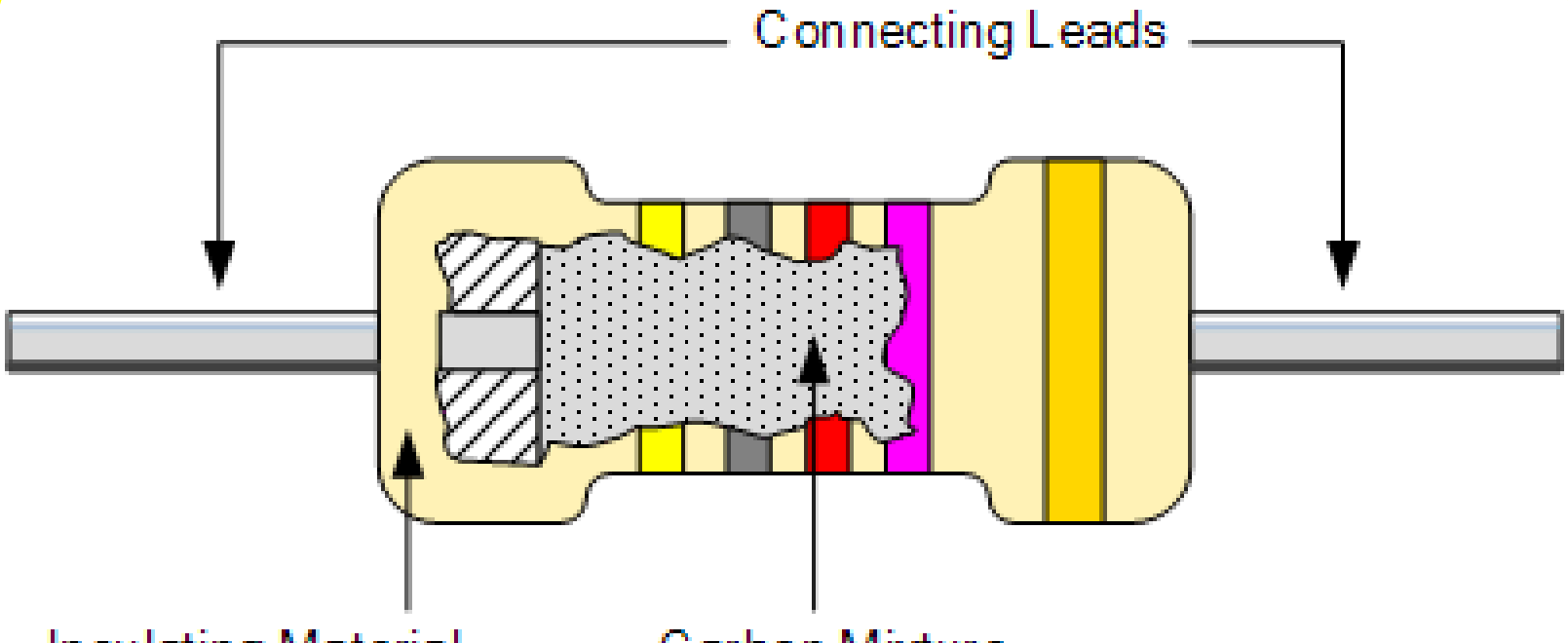
Resistors

- Fixed Resistors
  - Carbon Composition Resistors
  - Film Type Resistors
  - Wire Wound Resistors
- Variable Resistors (Potentiometers)
- Finding the value of the resistor (Resistor color coding)

Carbon Composition Resistors



Carbon Composition Resistors

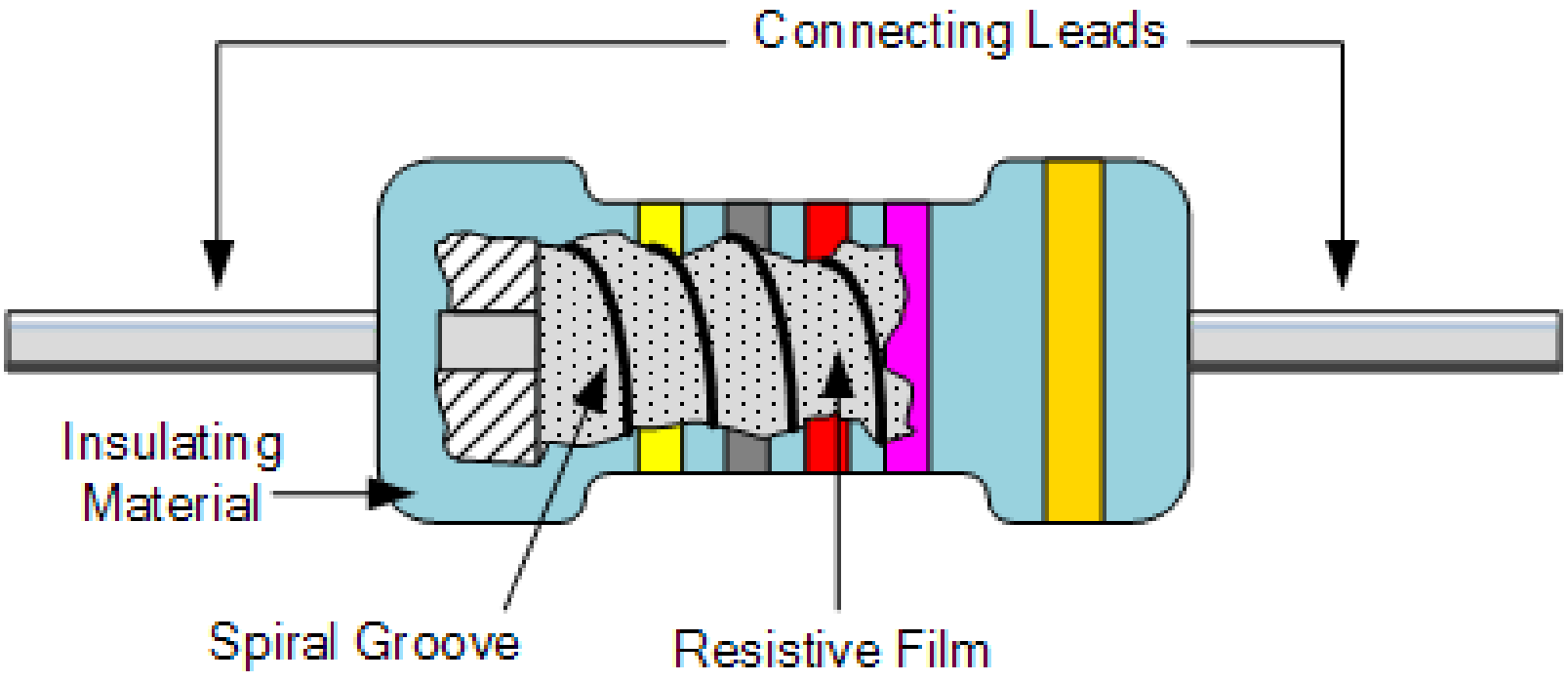


Carbon Composition Resistors

- Cheap
- Easy to manufacture
- Low Inductance
- Made from mixture of graphite and clay
- Rating from few ohms to mega ohms
- Power rating - 1/4 watt to 5 watt
- Low precision (high tolerance)

Film Type Resistors

Film Type Resistors



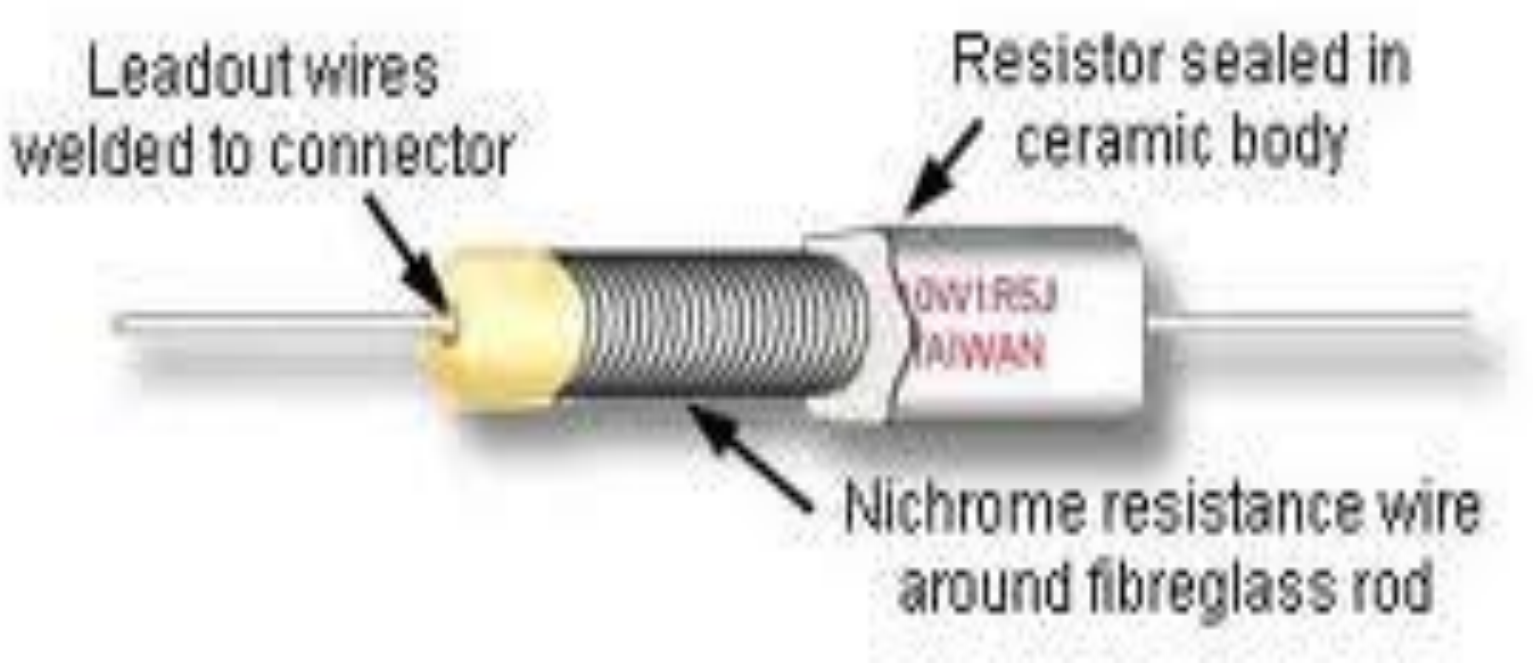
Film Type Resistors

- 3 types (Metal Film, Carbon Film, Metal Oxide Film)
- Fully non inductive (because of construction)
- Can be made up to 10,000 mega ohms
- Very precise than carbon composition resistors
- Complex manufacturing process
- Costlier

Wire Wound Resistors

Wire Wound Resistors

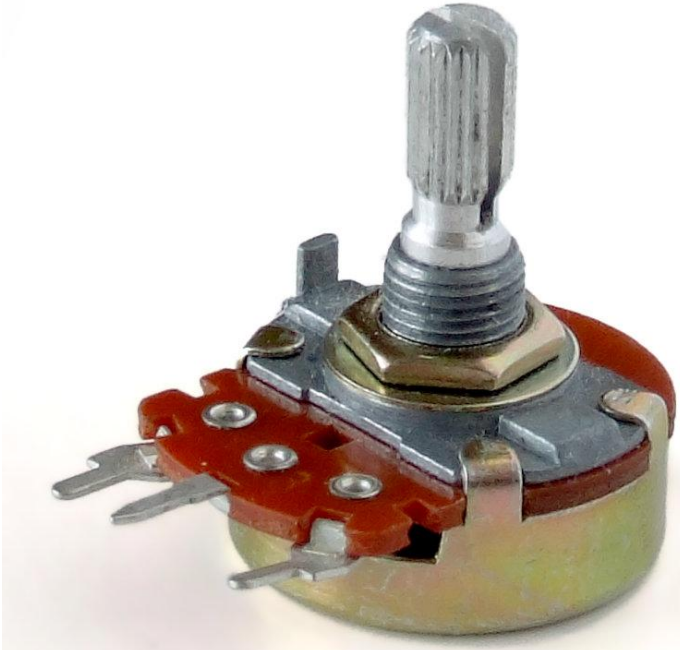
Wire Wound Resistors



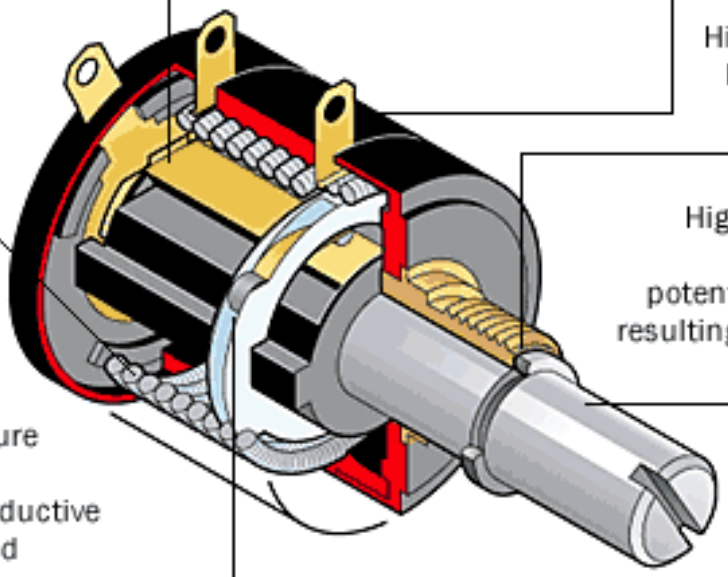
Wire Wound Resistors

- High power rating (1000 watts or more)
- High power resistors come with heat sink
- Can withstand very high temperatures up to 450 degrees centigrade
- Available from very low resistance of 0.01 ohms to 10K ohms
- Undesirable inductance
- Not suitable for high frequency applications

Potentiometers



Potentiometers



GOLD PLATED TERMINALS AND CONTINUITY BAR:
Do not corrode or tarnish.

HOUSING:
High temp. plastic
Durable in harsh
environments.

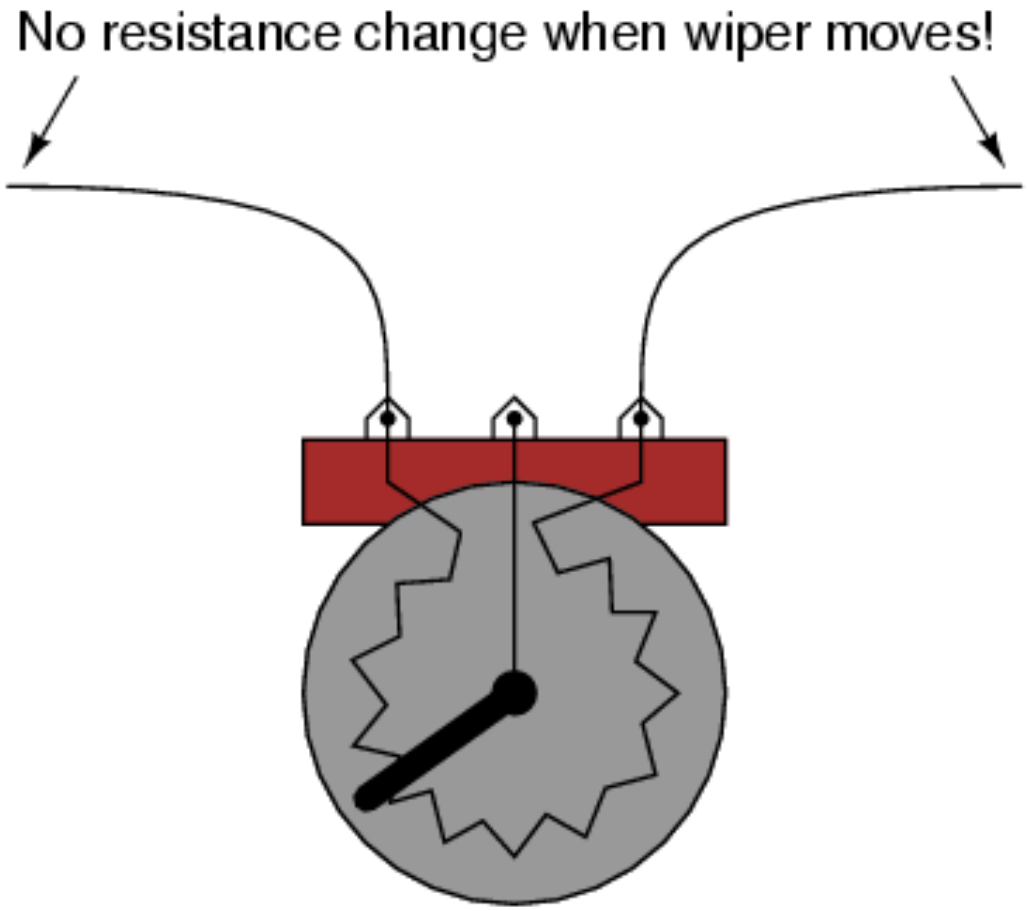
BRASS BUSHINGS:
Hign quality brass bushings.
Provde better support for
potentiometer shaft side loads,
resulting in long life expectancies

STAINLESS STEEL SHAFT:
Non-corrosive. Many
modifications available
for ease of linking
to your system

ELEMENT:
Wirewound (shown):
Most commonly used
in multi-turns. Offers
better stability and
linearity. Low temperature
coefficient.
Hybrid: Made with conductive
plastic over a wirewound
element. Lower inductance,
better resolution, and
longer life

PRECIOUS METAL WIPER:
Platinum alloy ensures
long life and low noise.

Potentiometers



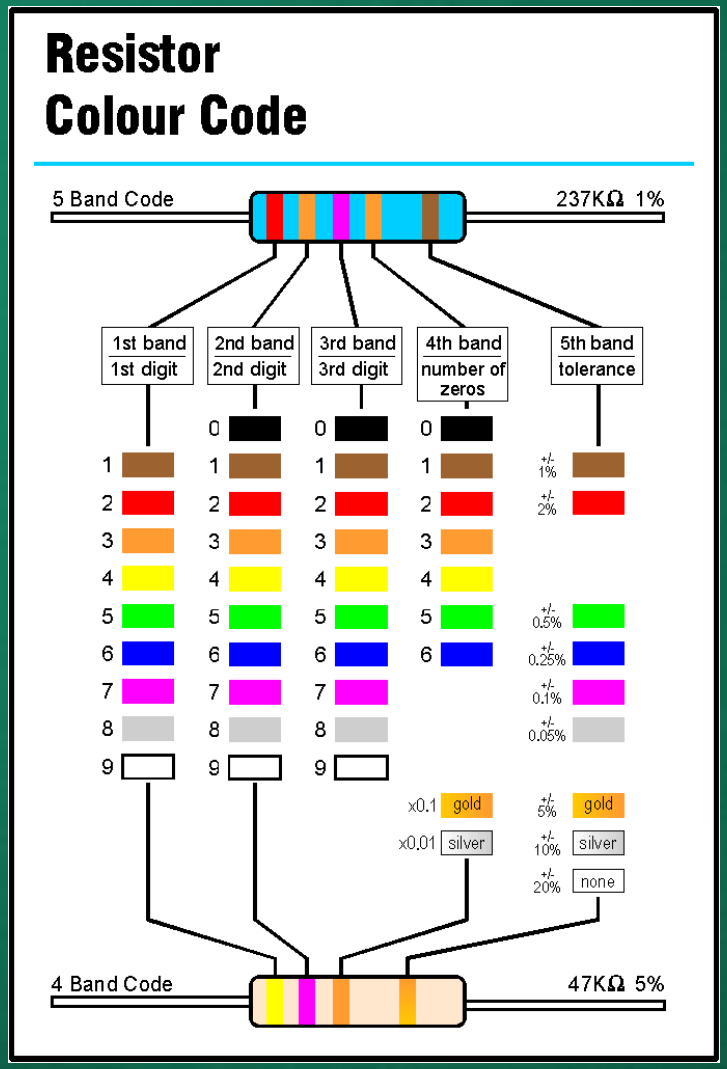
Potentiometers

- 3 terminals resistor
- Variable resistance from 0 to 10 K
- Can be used for voltage division (potential divider)
- Finds application as transducer in motion control
- Audio Control

Resistor Color Coding

- Color coding is used for carbon composition resistors and film type resistors
- Wire wound resistors will have the value of the resistance printed on them
- 4 band and 5 band color codes
- BBROYGBVGW (Sequence)

Resistor Color Coding



Inductors

Inductors

- Types based on the core used
  - Air Core Inductors
  - Ferromagnetic Core Inductors

- Finding the value of inductor (Inductor Color Code)
  - Electronic Industries Alliance (EIA) Standard
  - Military Standard (5 band)

Air Core Inductors

Air Core Inductors

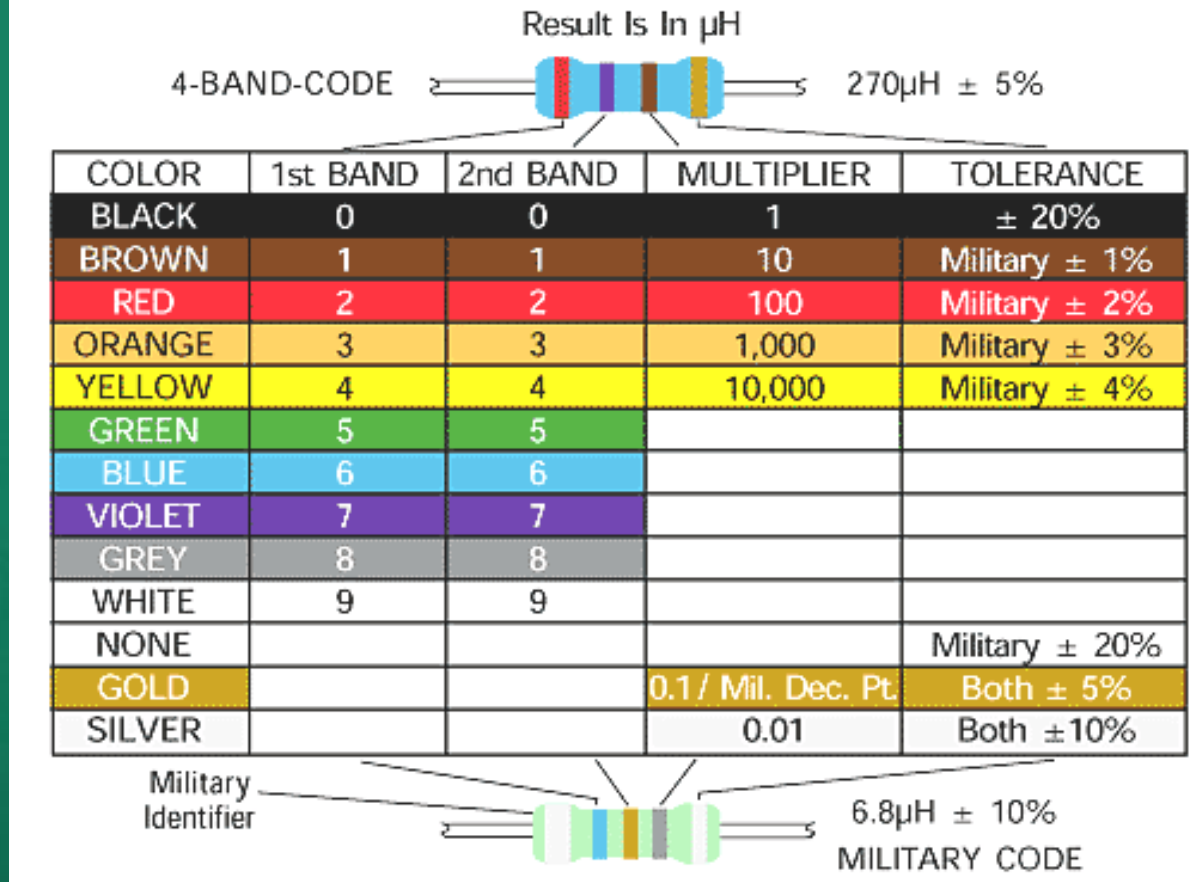
- They offer less distortion and used for RF applications as level of inductance required in small
- Low lossy
- High Q
- Low inductance compared ferromagnetic core inductors

Ferromagnetic Core Inductors

Ferromagnetic Core Inductors

- Cores are made of iron or ferrite
- High inductance values are possible
- Core losses are high
- Distortion of signals due to saturation (nonlinear)
- Applications in power engineering

Inductor Color Code



COLOR	1st BAND	2nd BAND	MULTIPLIER	TOLERANCE
BLACK	0	0	1	± 20%
BROWN	1	1	10	Military ± 1%
RED	2	2	100	Military ± 2%
ORANGE	3	3	1,000	Military ± 3%
YELLOW	4	4	10,000	Military ± 4%
GREEN	5	5		
BLUE	6	6		
VIOLET	7	7		
GREY	8	8		
WHITE	9	9		
NONE				Military ± 20%
GOLD			0.1 / Mil. Dec. Pt.	Both ± 5%
SILVER			0.01	Both ±10%

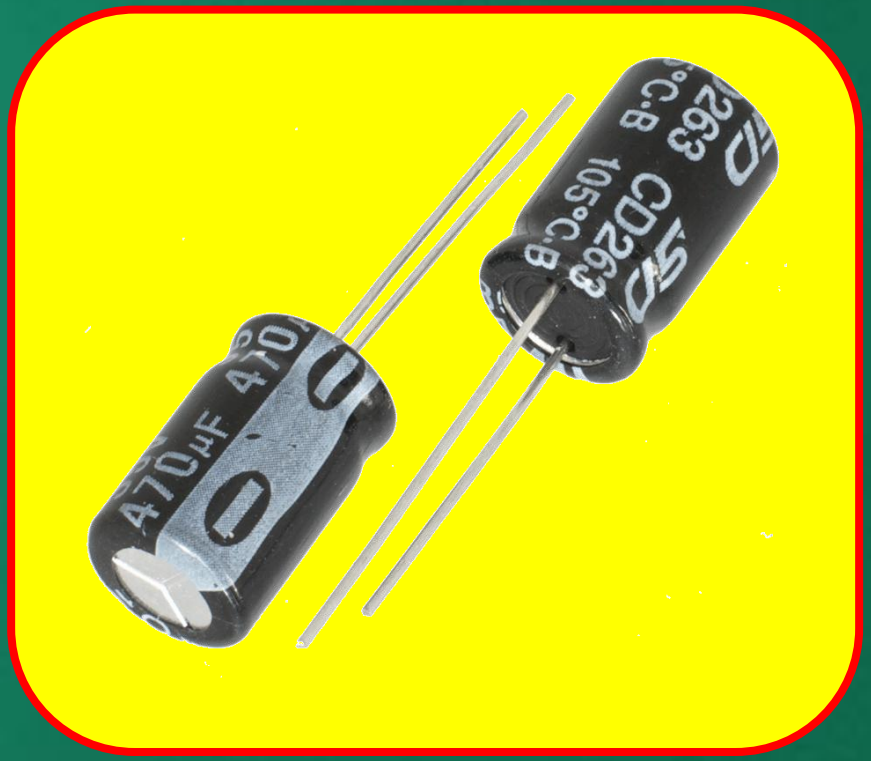
Capacitors

Capacitors

- Common types of capacitors used in lab
  - Electrolytic
  - Tantalum
  - Mylar
  - Ceramic
  - Polyester

- Finding the value of capacitor (Coding Convention)

Electrolytic Capacitors

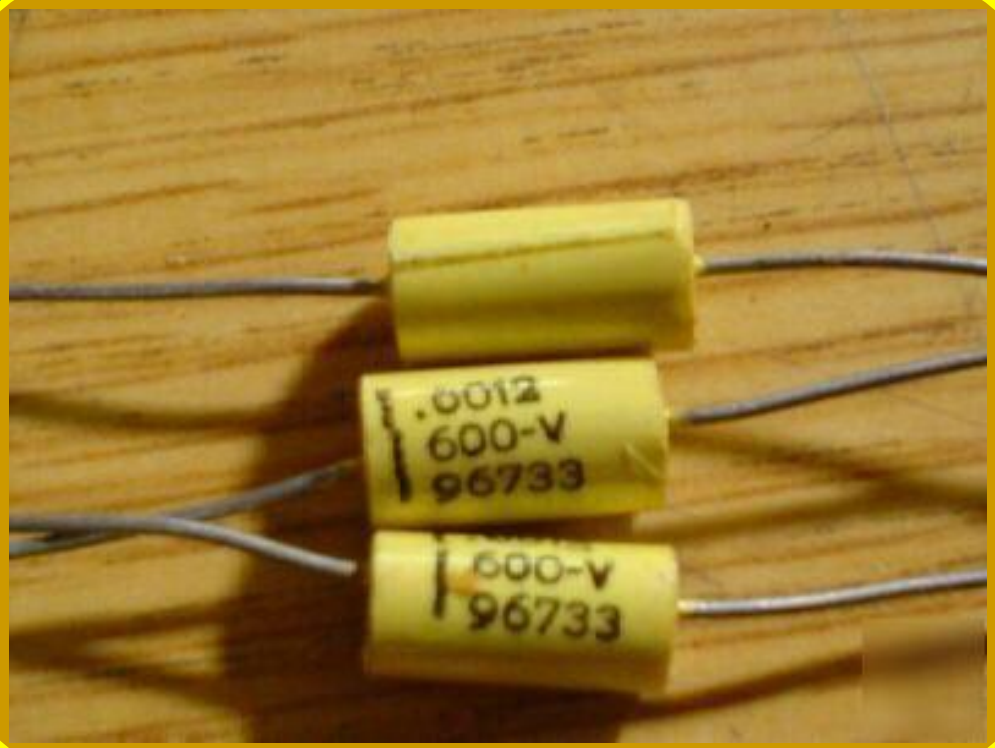


These are polarized, cylindrical in shape and the values of them will be higher compared to other types.

Tantalum Capacitors

These are polarized and have a deformed oval shape.

Mylar Capacitors



These are usually yellow cylinders and are not polarized

Ceramic Capacitors

These are generally circular shaped (usually orange) or look like little boxes (often blue) and are not polarized

Polyester Capacitors

These capacitors usually have a glossy cover and can have a square or oval shape. They are not polarized.

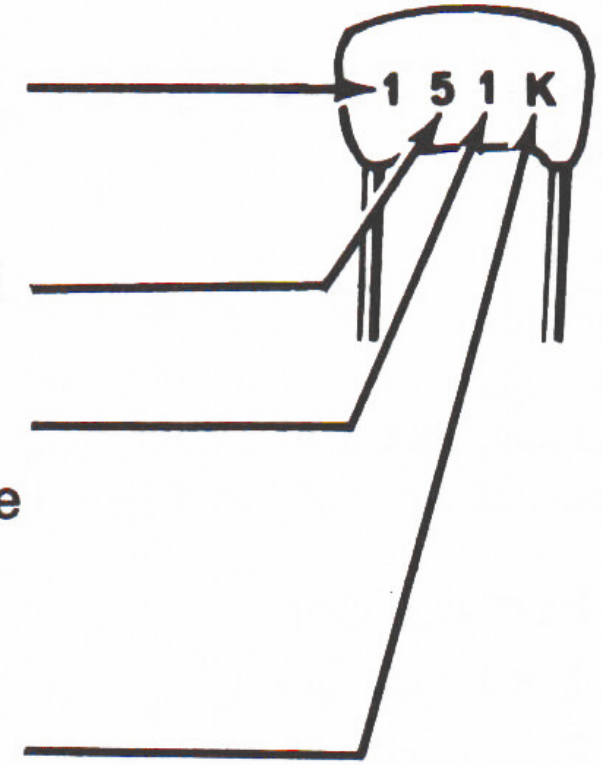
Capacitor Coding Convention

First digit of capacitor's value: 1

Second digit of capacitor's value: 5

Multiplier: Multiply the first & second digits by the proper value from the Multiplier Chart.

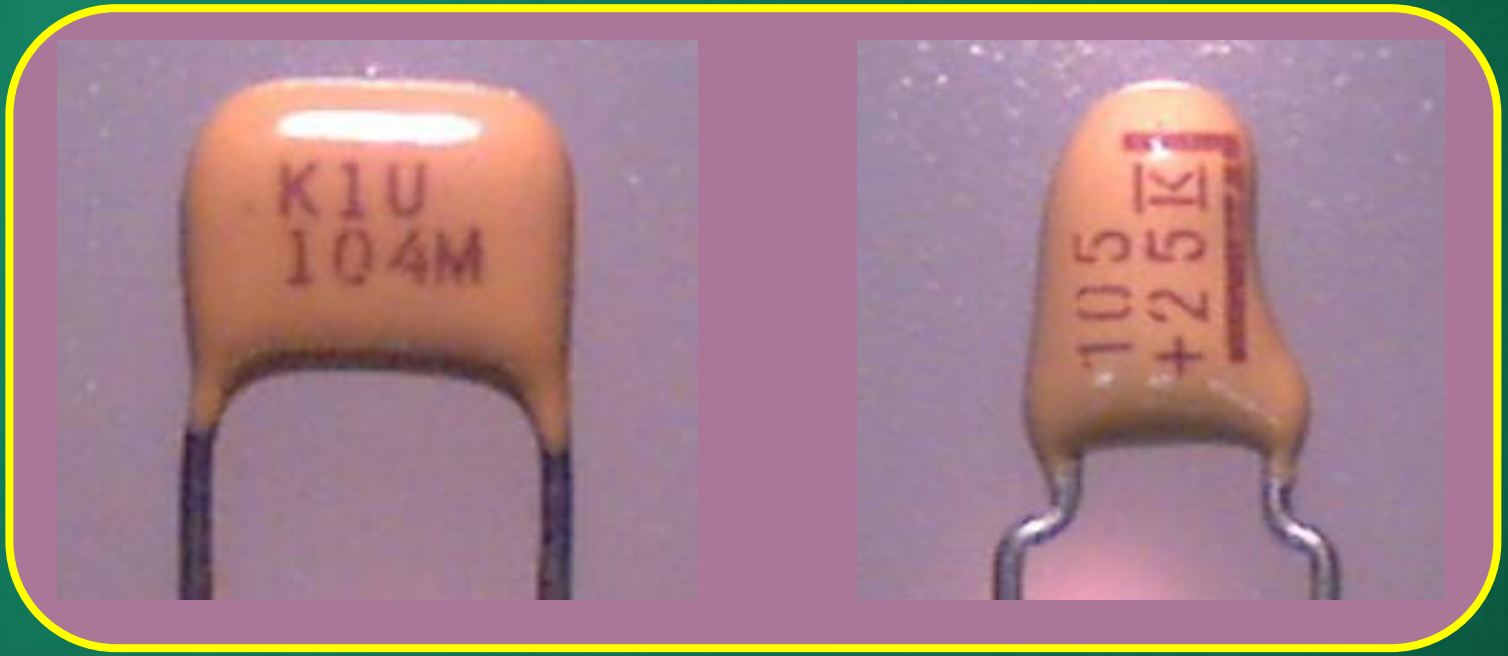
To find the tolerance of the capacitor, look up this letter in the Tolerance columns.



Tolerance Code for Capacitors

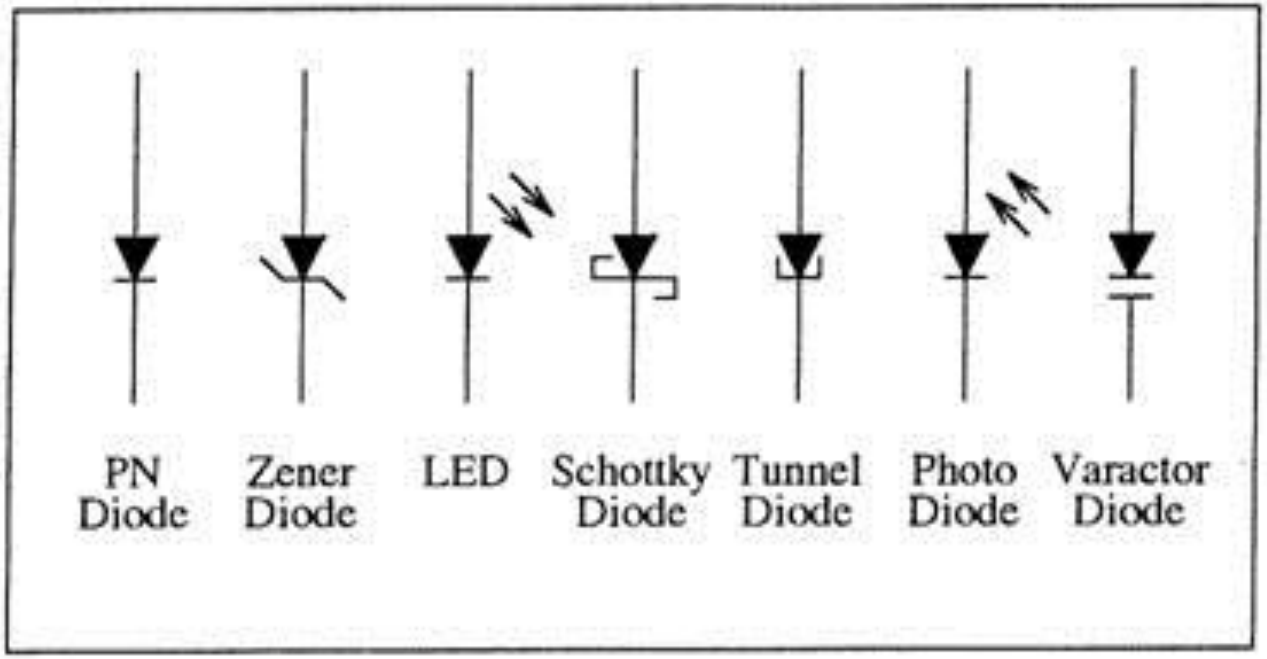
Tolerance Code	Value (+/- %)
M	20
K	10
J	5
G	2
F	1
D	0.5
C	0.25
B	0.1
A	0.05
Z	0.025

Finding Capacitor Values



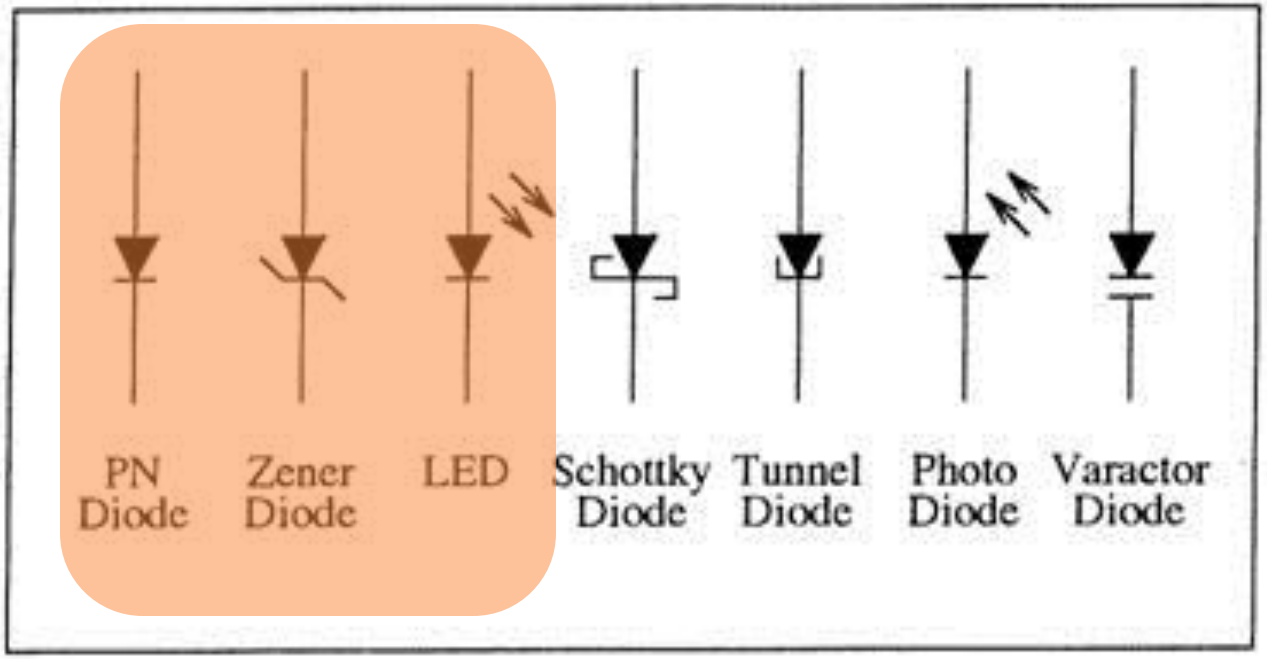
Diodes

Different Types of Diodes



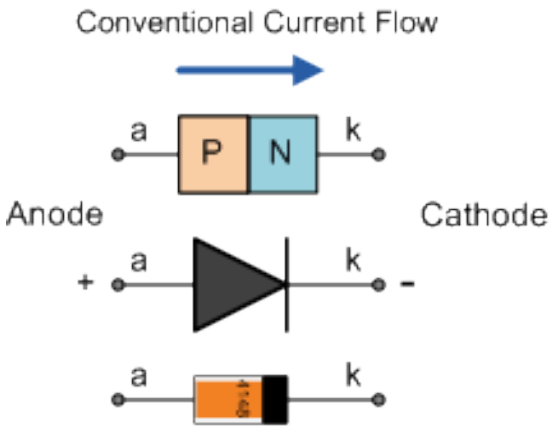
Diode Symbols

Different Types of Diodes

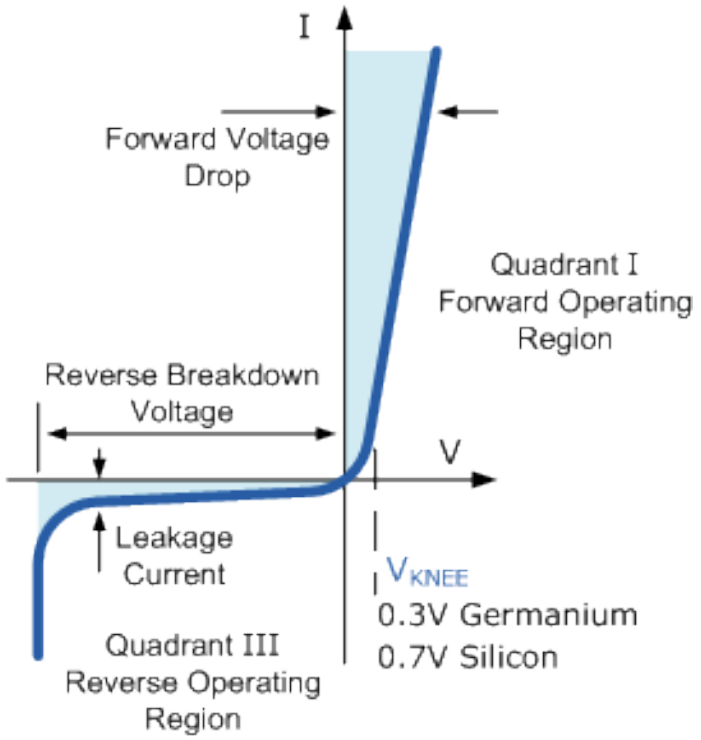


Diode Symbols

General Purpose Diode

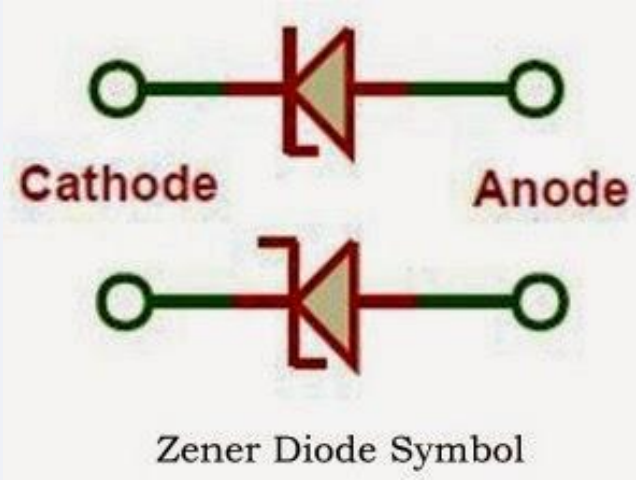


Silicon Diode and its V-I Characteristics

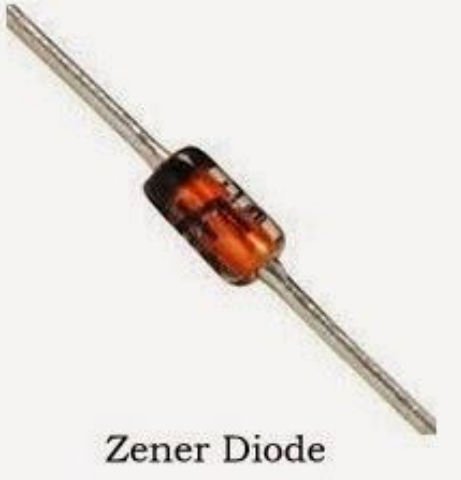


Rectifier Diode

Zener Diode

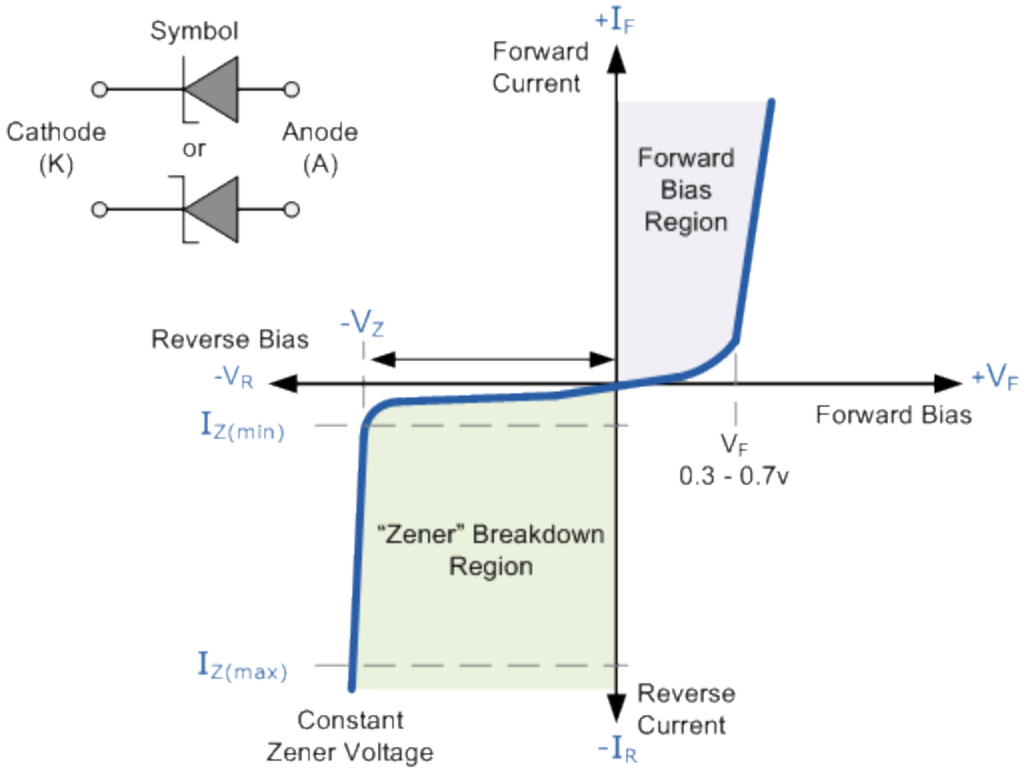


Zener Diode Symbol



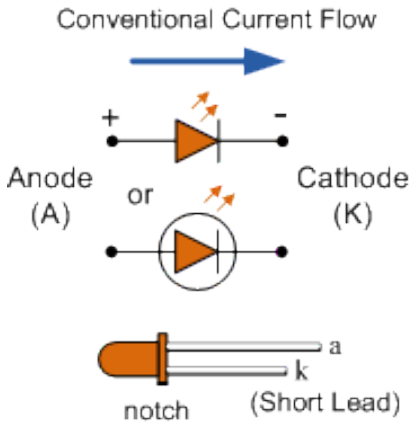
Zener Diode

Zener Diode

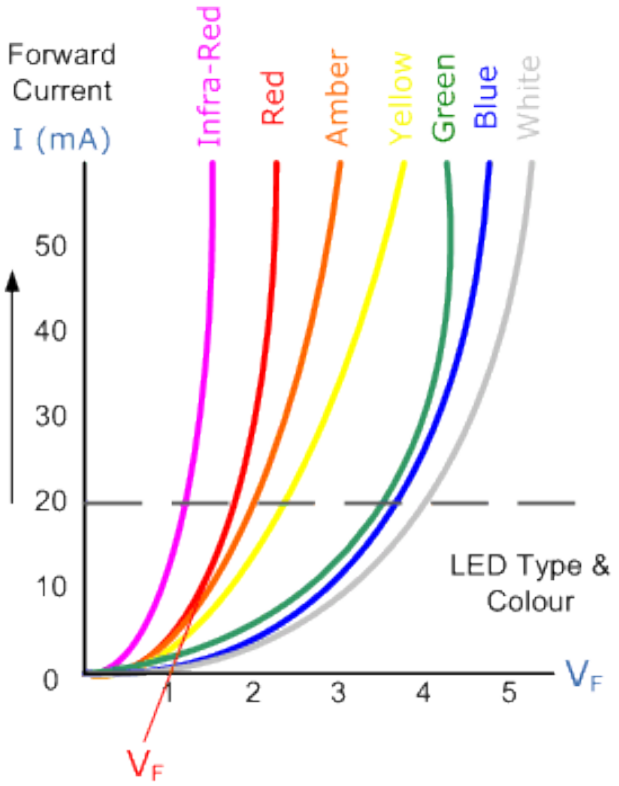

Symbol
Cathode
(K)
or
Anode
(A)
+I_F
Forward
Current
Forward
Bias
Region
Reverse Bias
-V_Z
-V_R
+V_F
I_Z(min)
Forward Bias
V_F
0.3 - 0.7v
"Zener" Breakdown
Region
I_Z(max)
Reverse
Current
-I_R
Constant
Zener Voltage

Light Emitting Diodes

Light Emitting Diodes



LED and its
I-V Characteristics



Measurement & Test Equipment

Digital Multimeter

- It's a preliminary instrument used in an electronics lab for measurement.

- A basic digital multimeter measures AC/DC voltage, resistance, and current in an electric circuit.

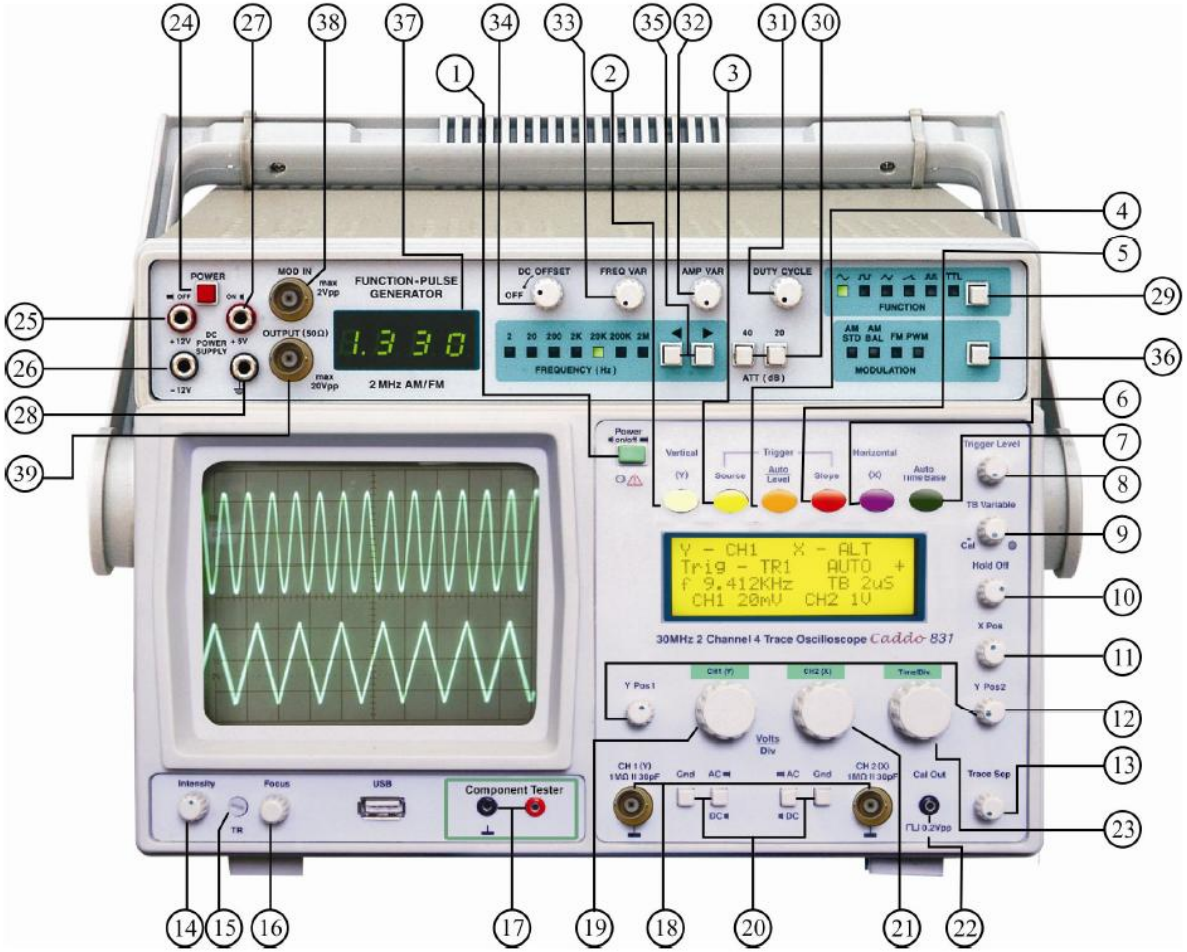
- Most of the DMMs now also measure frequency, temperature, capacitance and can also be used to check diodes , transistors, continuity in the circuit.

Digital Multimeter

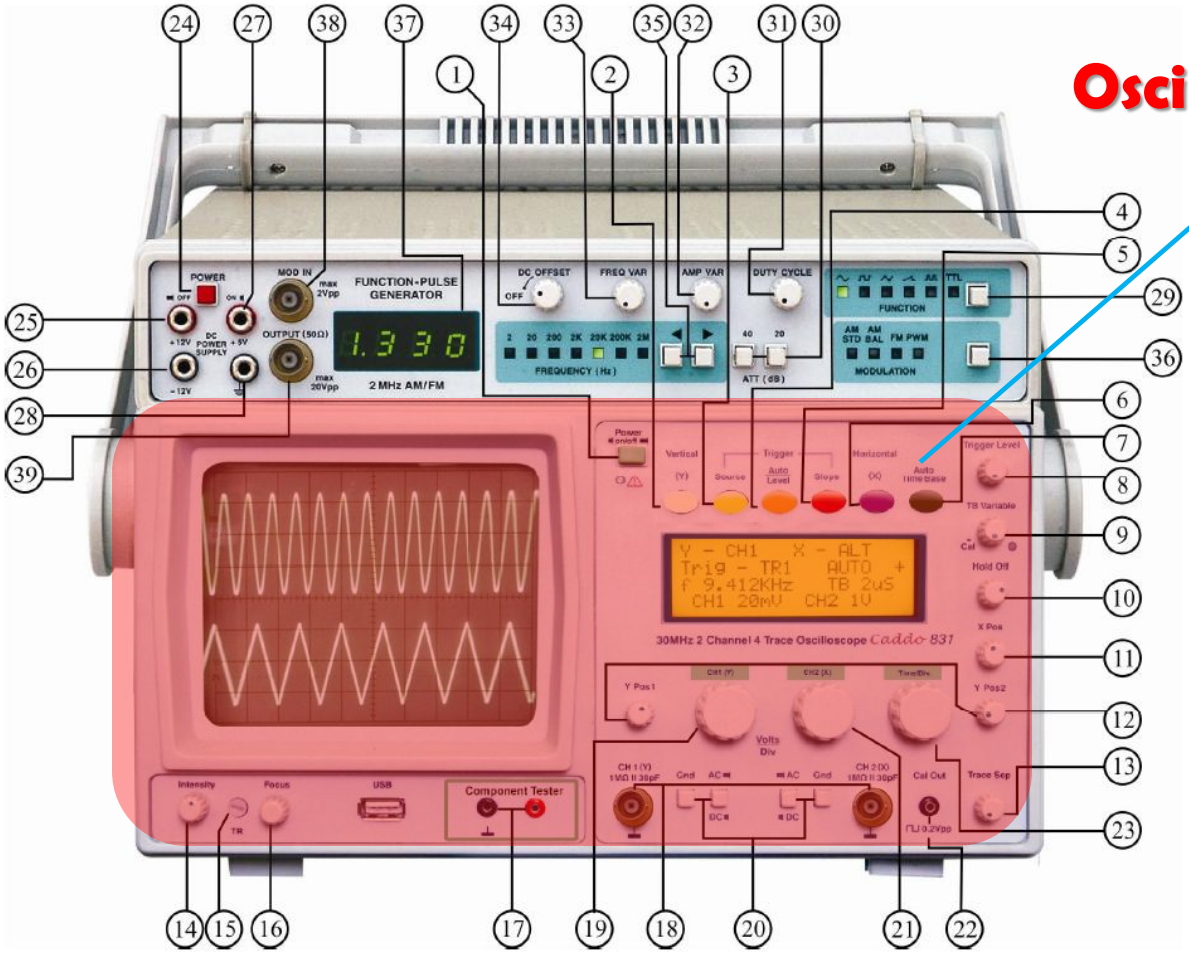
Oscilloscope

- It is more advanced instrument for making measurements .
- An oscilloscope's provides a graph of a signal's voltage over time.
- It is useful for measuring waveform at any node in the circuit with respect to another (which is usually ground)

Techlab Caddo 823A



Oscilloscope



DC Power Supplies

- A DC power supply provides required level of DC power to the chips for biasing.
- The standard bias voltages to various chips are +/- 5V, +/- 12 V, +/-15 V
- Generally it can supply fixed DC voltage levels or variable DC.

DC Power Supply

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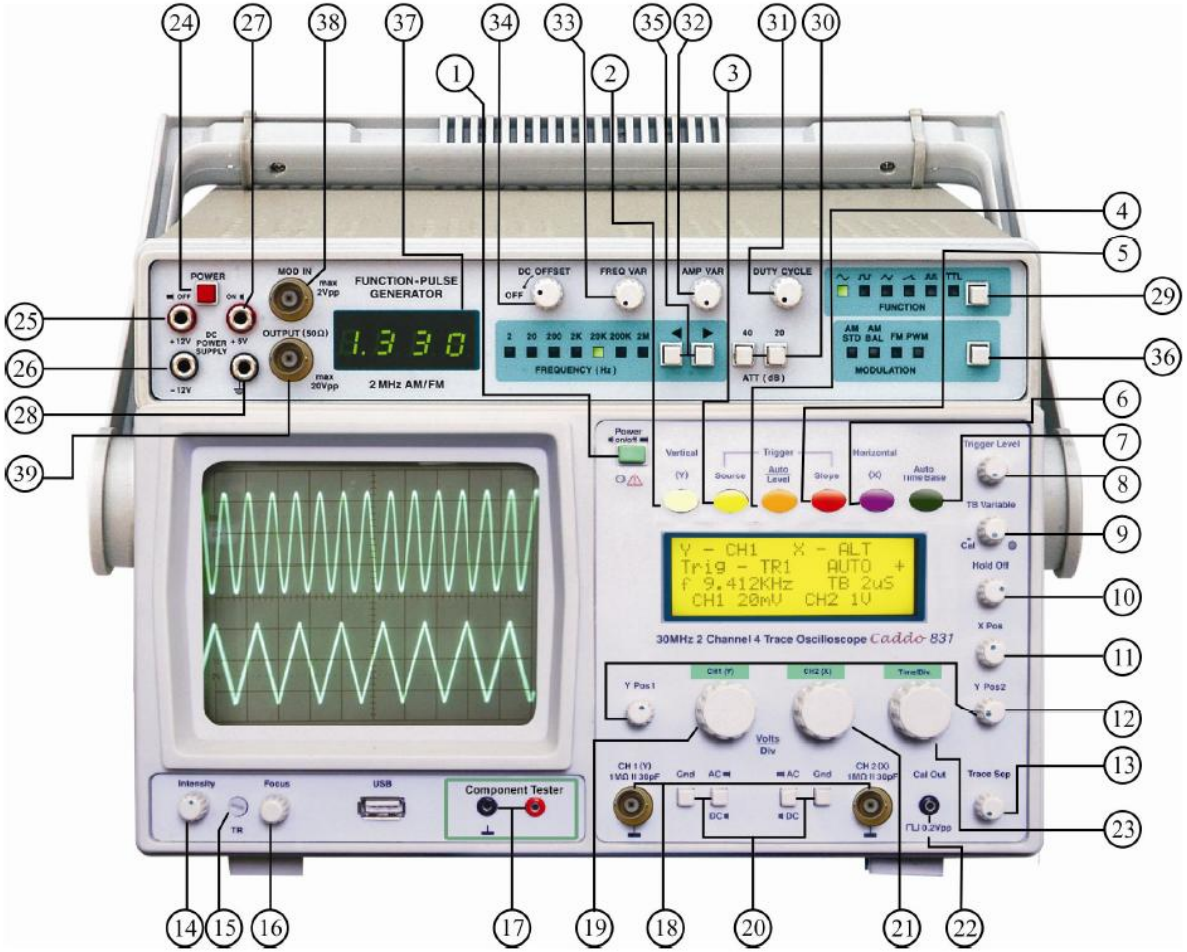
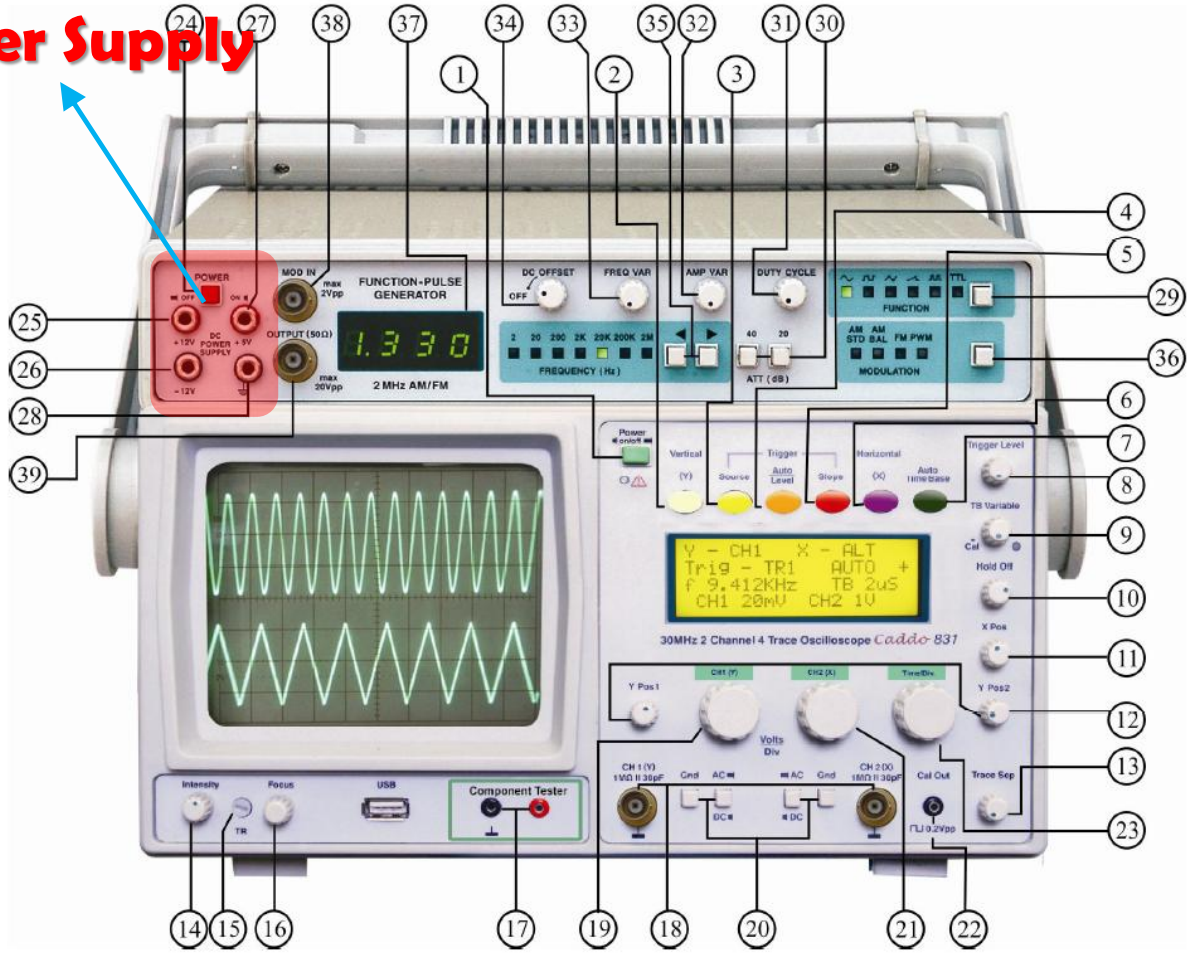


Power Supply (Fixed)



Function Generators

- A function generator is usually a electronic test equipment used to generate different types of voltage waveforms over a wide range of frequencies.

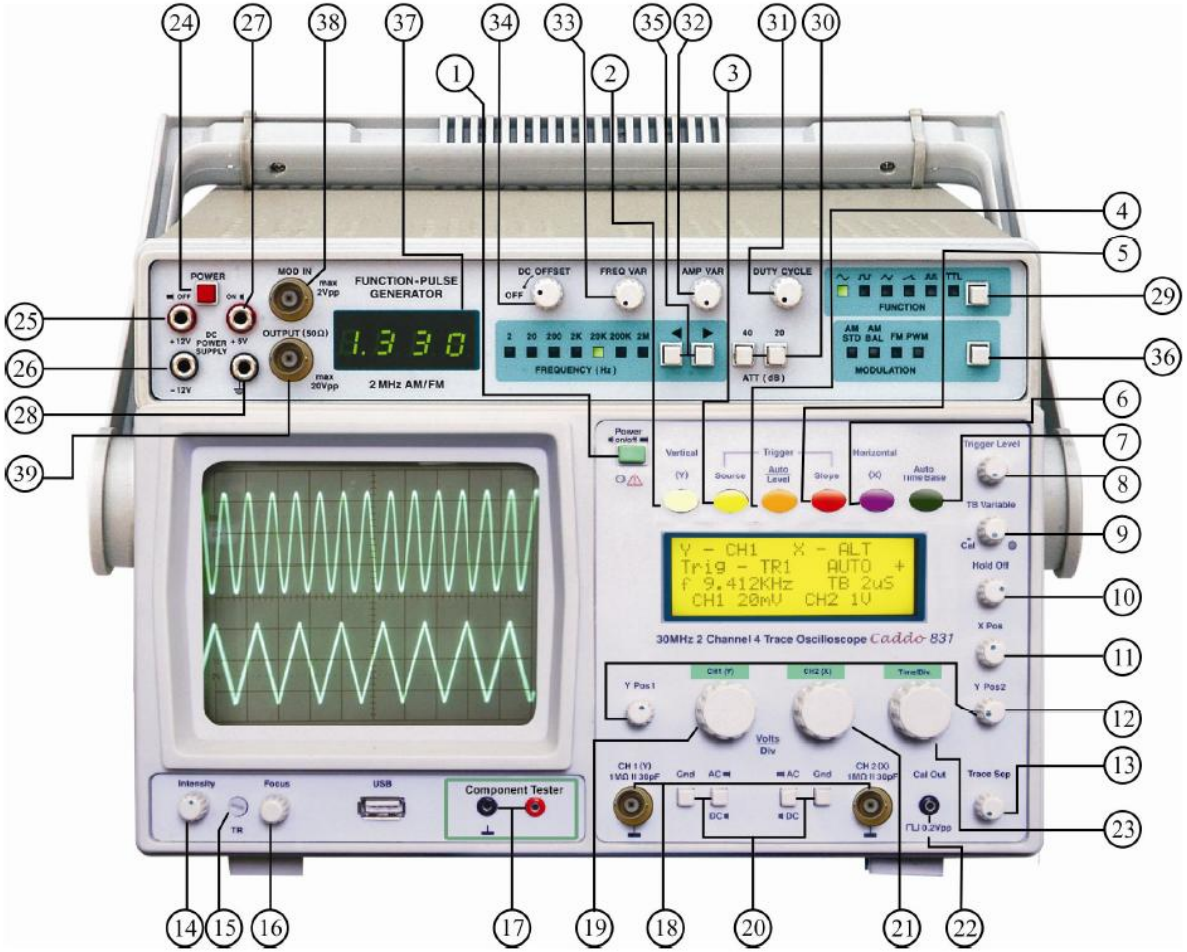
- Some of the most common waveforms produced by the function generator are the sine, square, triangular and sawtooth shapes.

- These waveforms can be either repetitive or single-shot

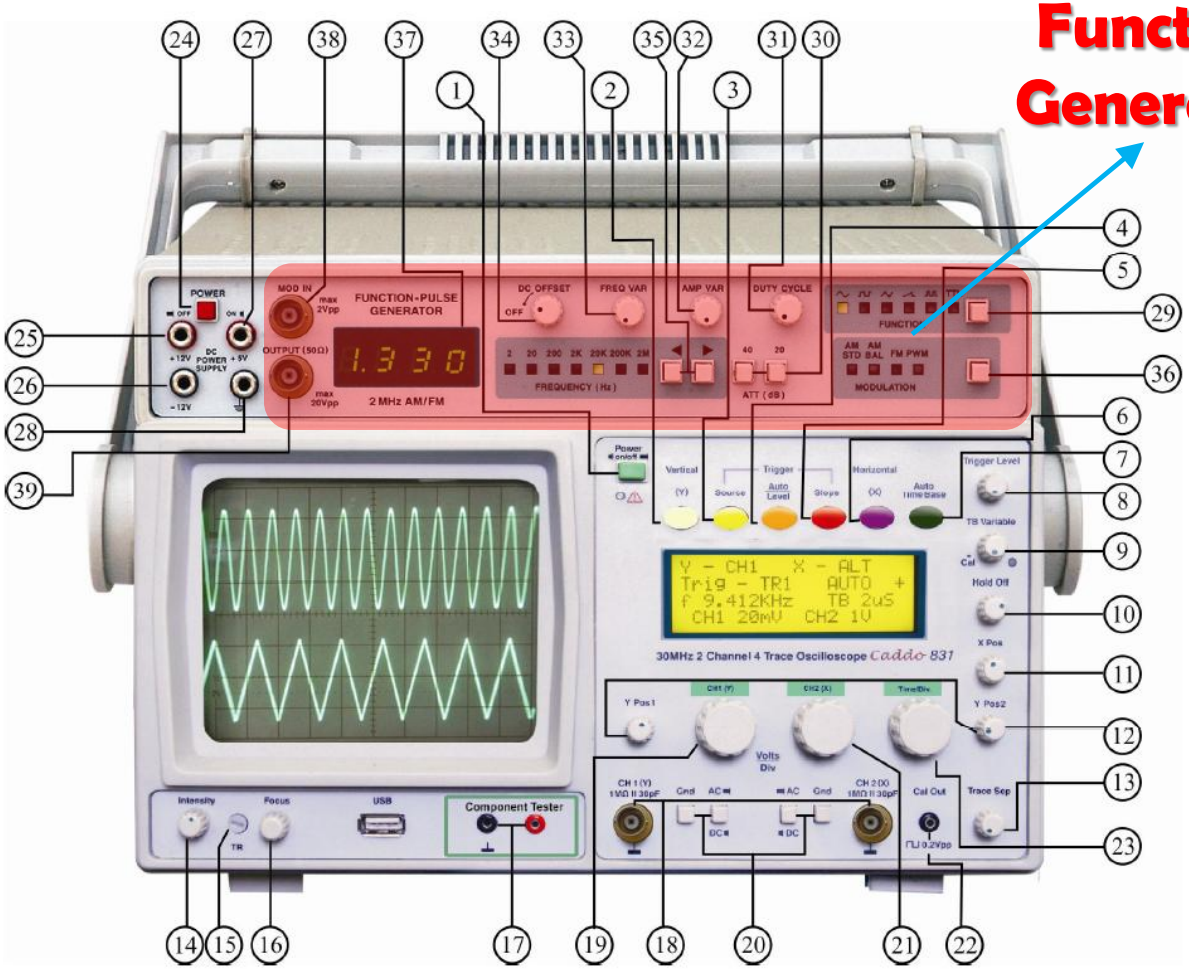
Function Generator

http://www.mcpsh.com

Techlab Caddo 823A



Techlab Caddo 823A

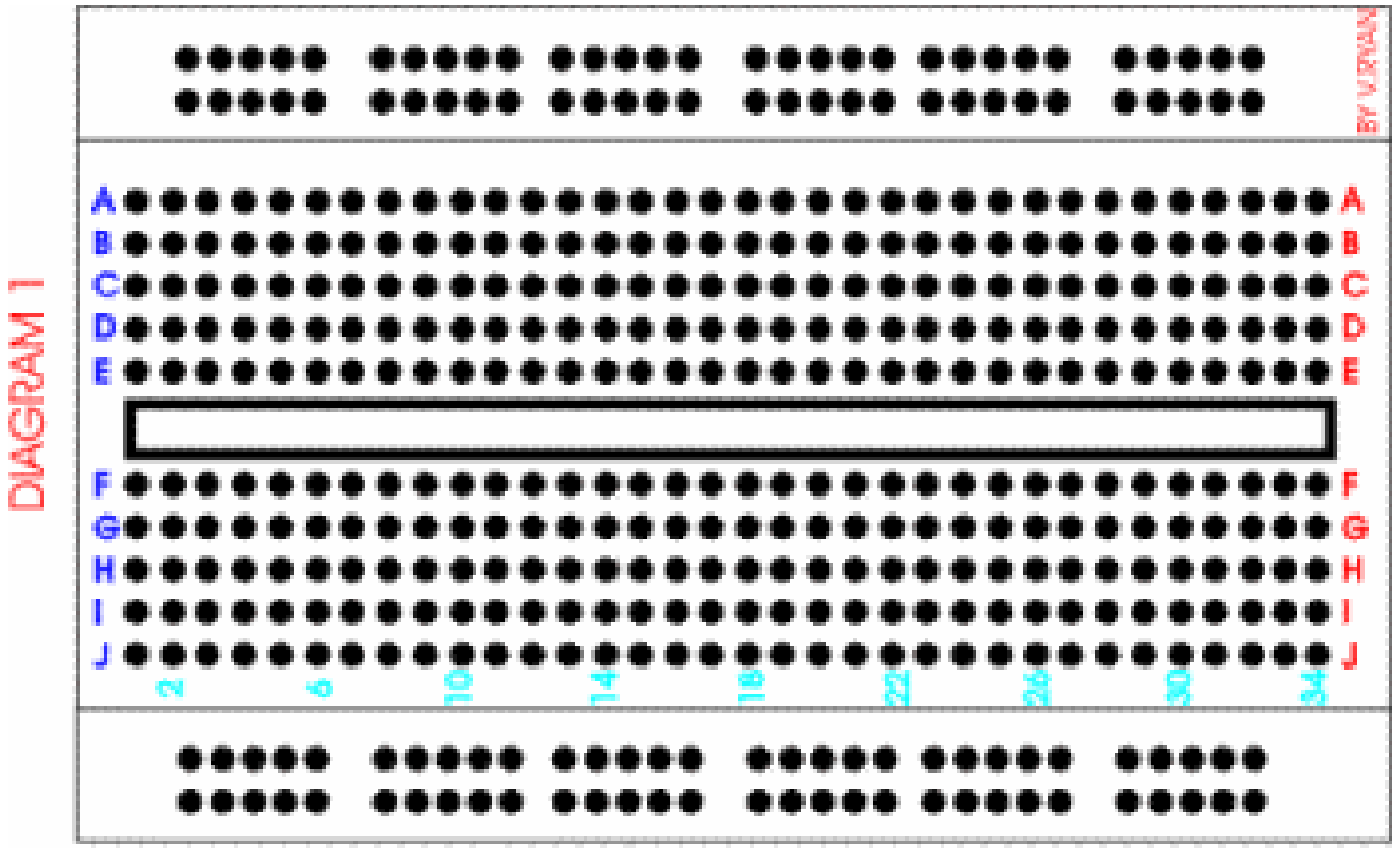


Breadboards

Breadboarding

- A breadboard is a temporary circuit board for testing and prototyping circuits, no soldering is done on the board
- It is faster and easier to prototype circuits.
- One of the main advantages of using a breadboard is that the components are not soldered and if they are positioned incorrectly they can be moved easily to a new position on the board.

Breadboard



Breadboard

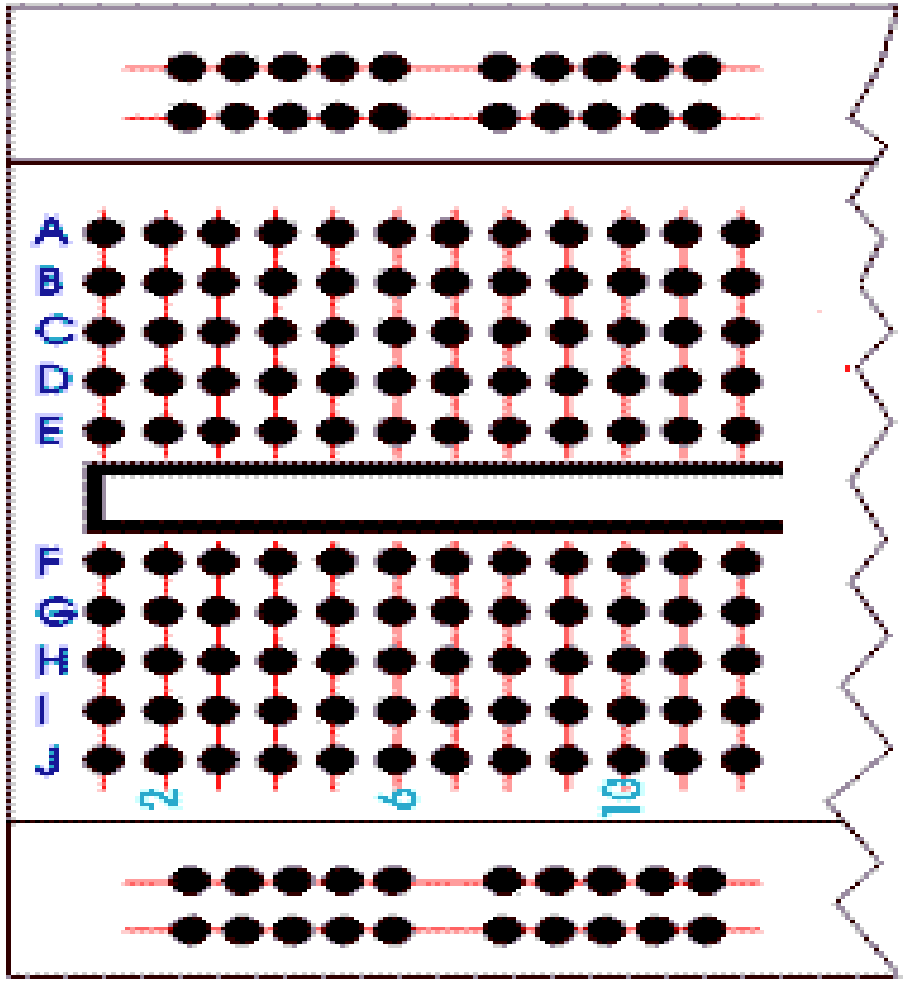


DIAGRAM 2

Breadboard