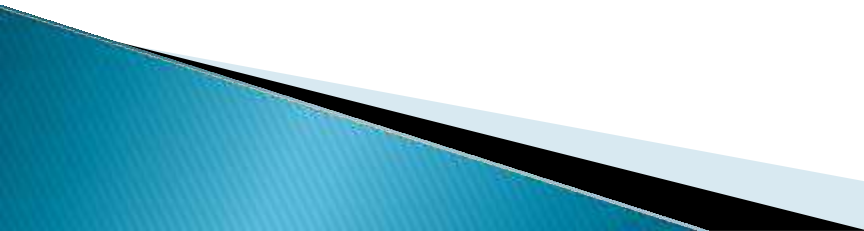




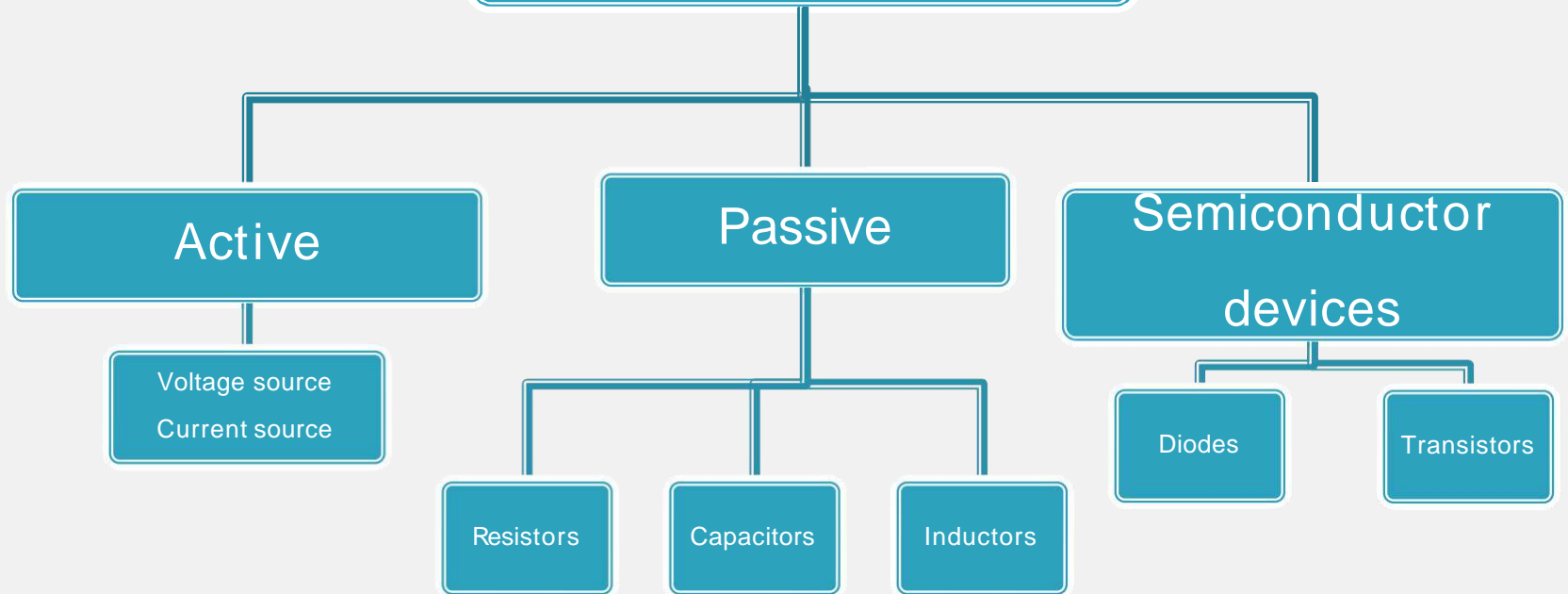
# Basic electronics

Dr. Bestoon Anwer Gozeh

Name some electronic  
components???



# Circuit components used in robotics



# Resistors

- Coding
- Types of values written
  - 47R
  - 5R6
  - 6k8
  - 1M2
- Uses

*The standard resistor color code table:*

Color	Digit 1	Digit 2	Digit 3*	Multiplier	Tolerance	Temp. Coef.	Fail Rate
Black	0	0	0	$\times 10^0$			
Brown	1	1	1	$\times 10^1$	$\pm 1\%$ (F)	100 ppm/K	1%
Red	2	2	2	$\times 10^2$	$\pm 2\%$ (G)	50 ppm/K	0.1%
Orange	3	3	3	$\times 10^3$		15 ppm/K	0.01%
Yellow	4	4	4	$\times 10^4$		25 ppm/K	0.001%
Green	5	5	5	$\times 10^5$	$\pm 0.5\%$ (D)		
Blue	6	6	6	$\times 10^6$	$\pm 0.25\%$ (C)		
Violet	7	7	7	$\times 10^7$	$\pm 0.1\%$ (B)		
Gray	8	8	8	$\times 10^8$	$\pm 0.05\%$ (A)		
White	9	9	9	$\times 10^9$			
Gold				$\times 0.1$	$\pm 5\%$ (J)		
Silver				$\times 0.01$	$\pm 10\%$ (K)		
None					$\pm 20\%$ (M)		

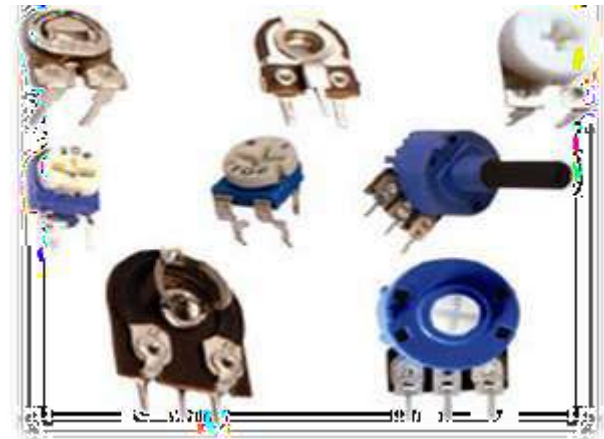
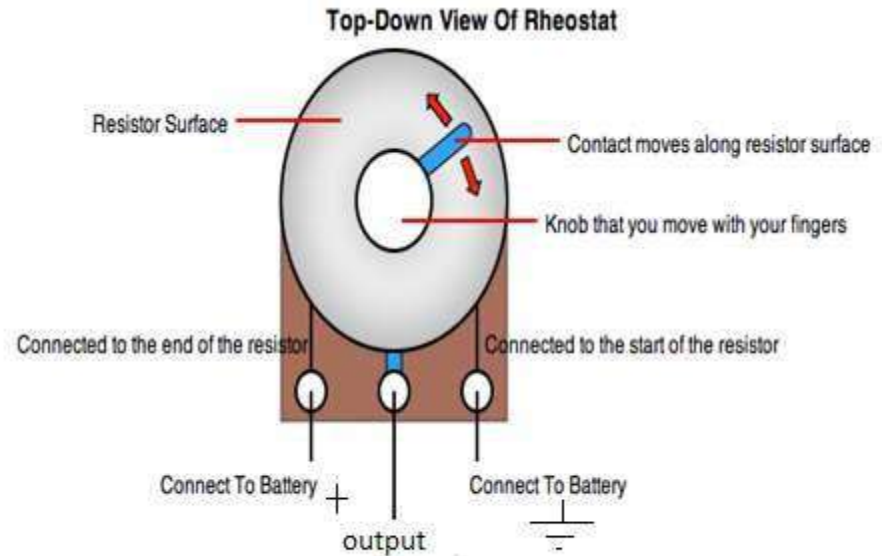
\* 3rd digit - only for 5-band resistors



# Variable resistors

Used in two configurations

- As variable resistor
- As potentiometer



# Other types of resistors

## Thermistors

### ➤ Equation of operation

$$\Delta R = k\Delta T$$

- PTC
  - Resistance increases with temperature
  
- NTC
  - Resistance decreases with temperature

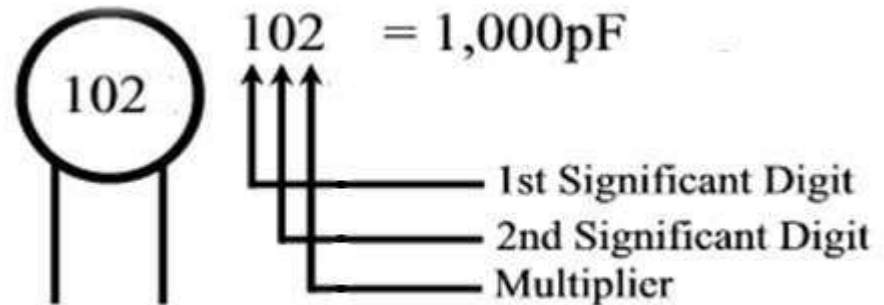
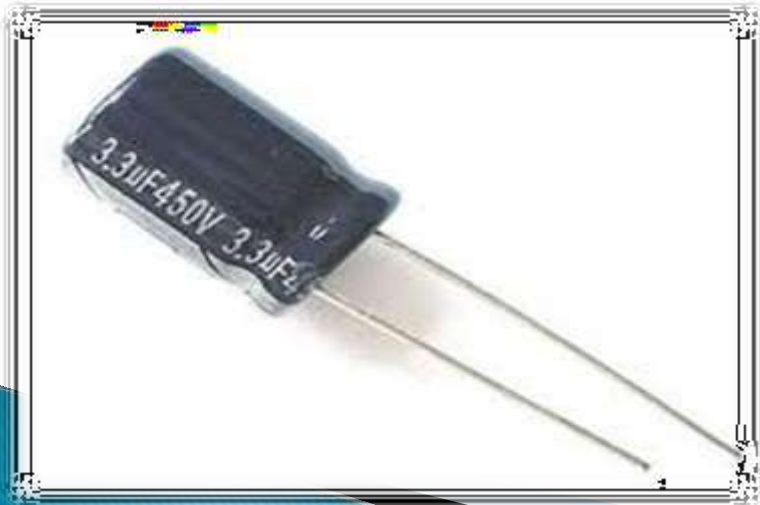
## LDR

- Light Dependent resistor
- Made of CdS, CdSe, PbS
- Uses
  - On off light relay
  - As a light meter to measure intensity of light



# Capacitors

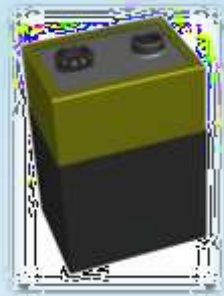
- Types
  - Ceramic
  - Electrolytic
- Measuring
- Uses



# Cells

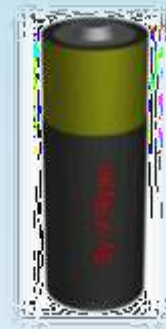
## ➤ Primary cells

- can be use only once
- Zinc–carbon battery
- Alkaline battery



## ➤ Secondary cells

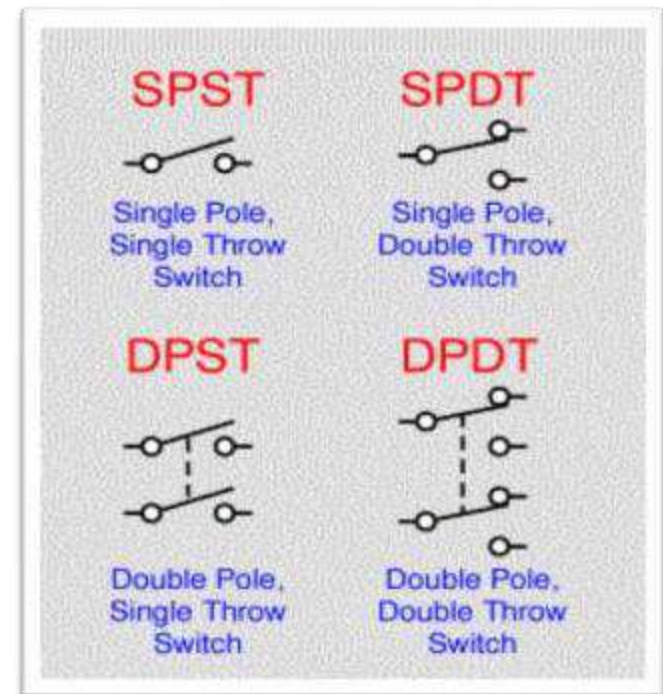
- Can be reused by charging
- Lead acid
- Lithium ion
- Lithium polymer





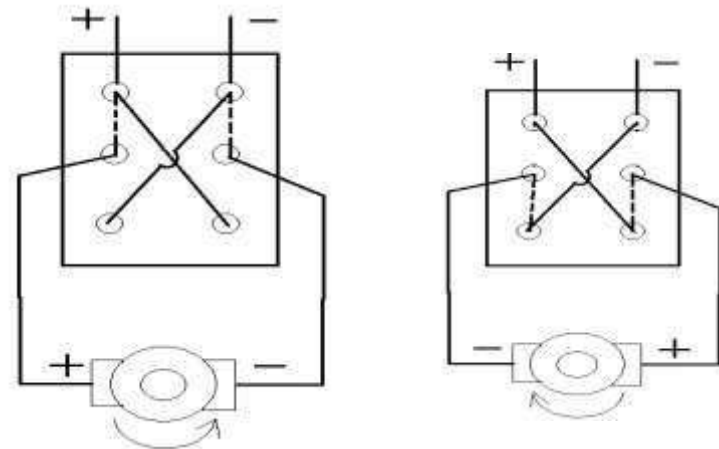
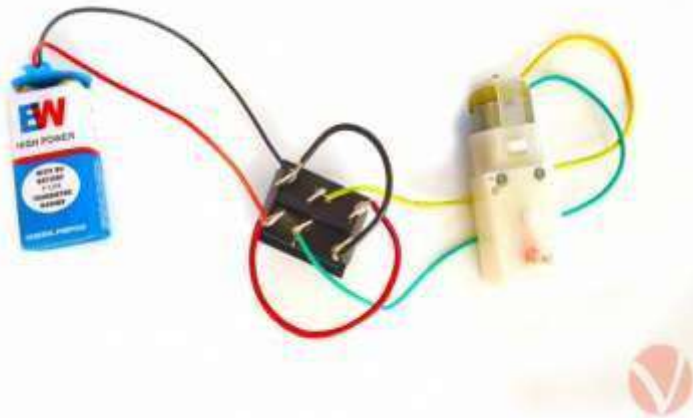
# Switches

- The number of **poles** defines the number of separate contacts for a switch position (*inputs*)
- The number of **throws** is the number of switch positions available (*output*)

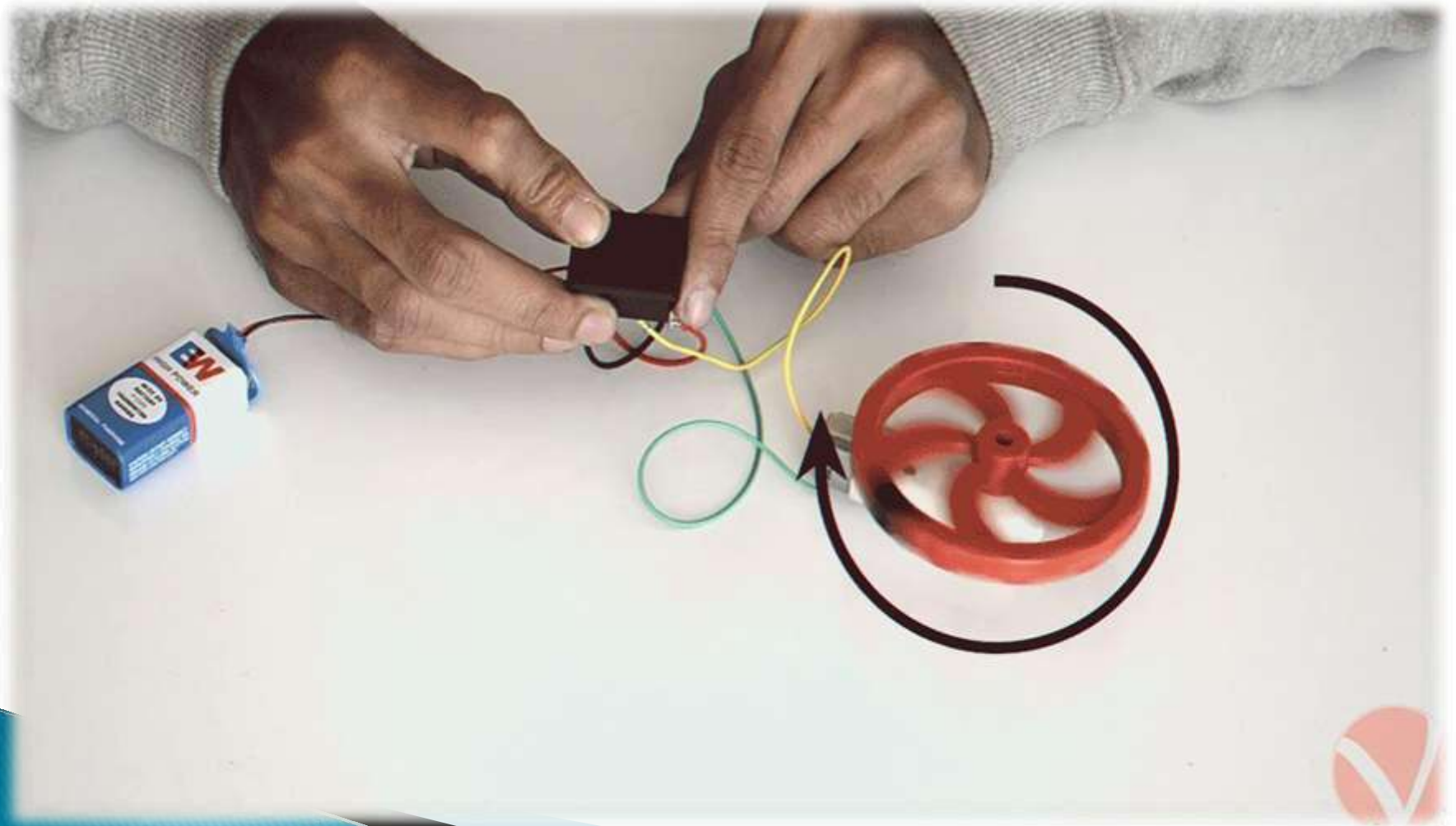


# DPDT

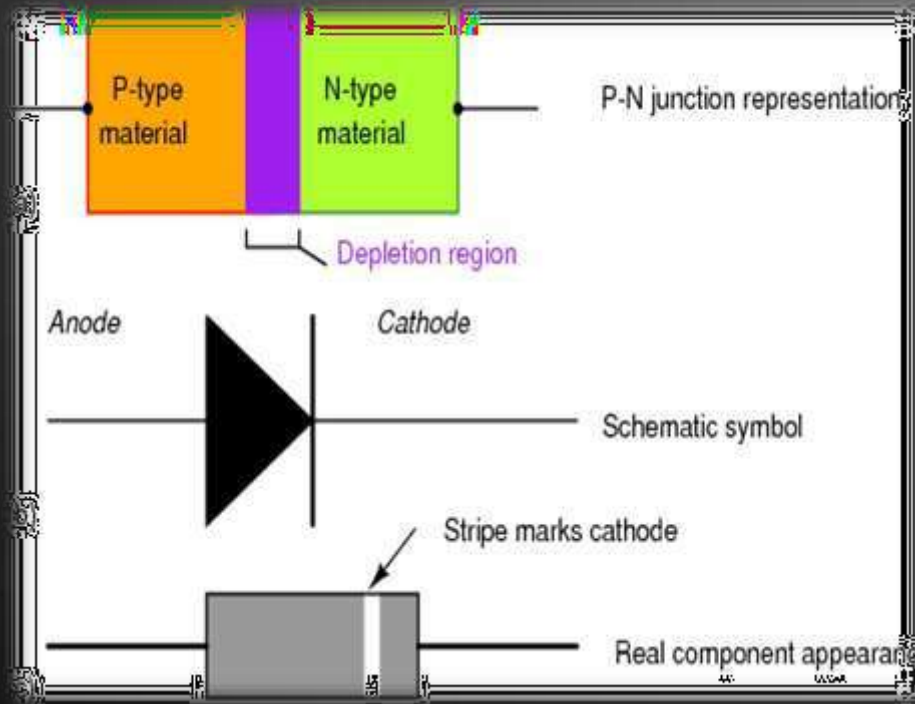
- Construction of DPDT switches
- Uses of DPDT switches
  - For reversal of polarity
  - Single switch to control 3 different outputs



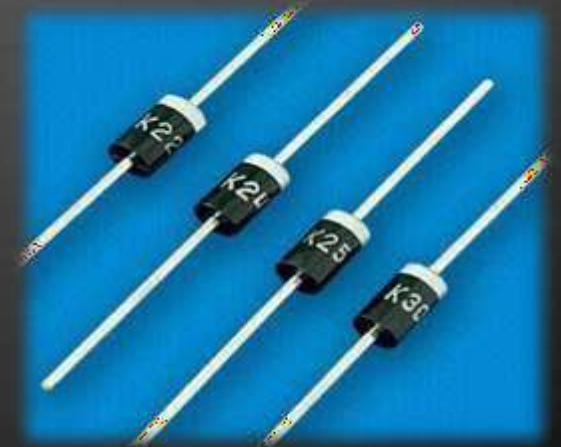
# Working of DPDT switches



# junction diode as a switch



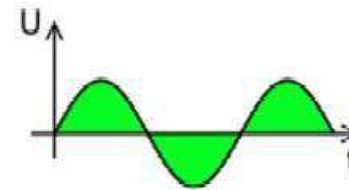
At the junction, free electrons from the N-type material fill holes from the P-type material.



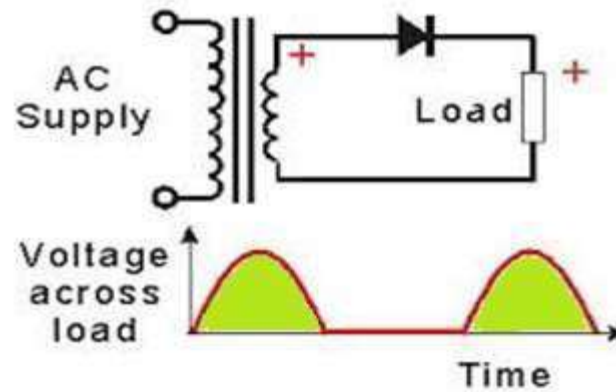
# Rectifiers

1. Half wave rectifier
2. Full wave rectifier
  - a. Centre tapped
  - b. Bridge type

## Half wave rectifier

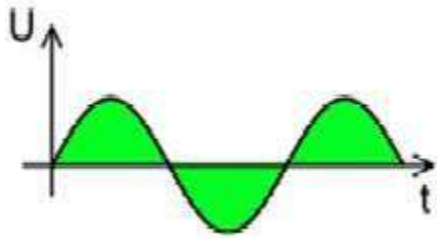


Input

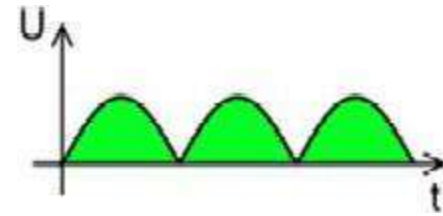
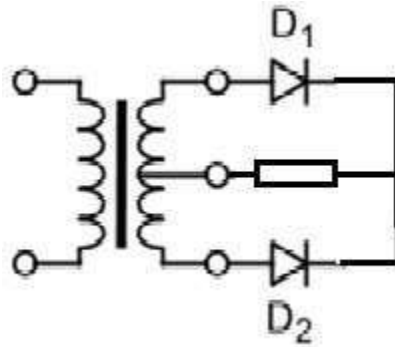


Output

# Full wave rectifier

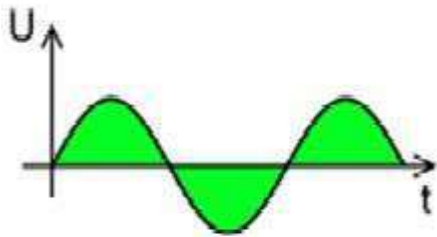


Input

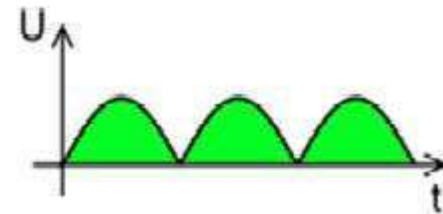
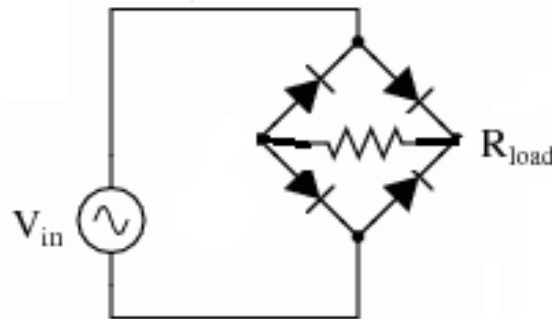


Output

**Centre - tapped**



Input

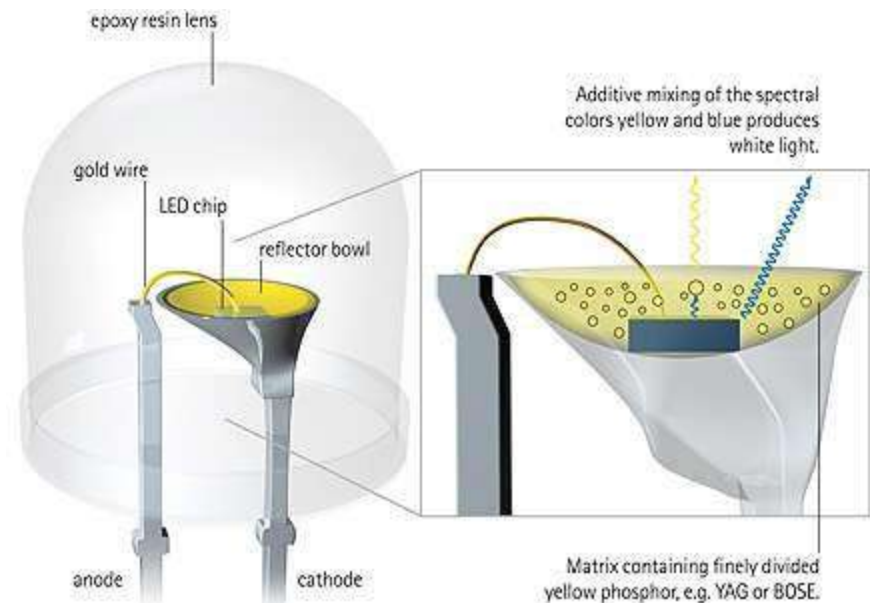
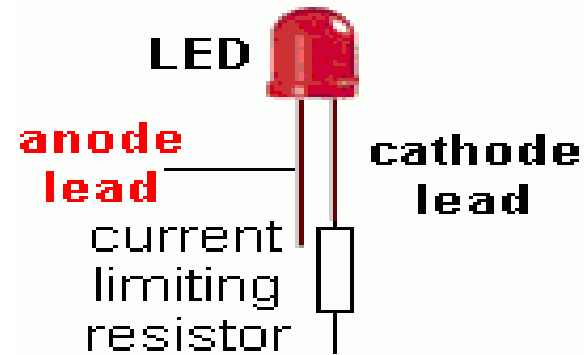


Output

**Bridge type**

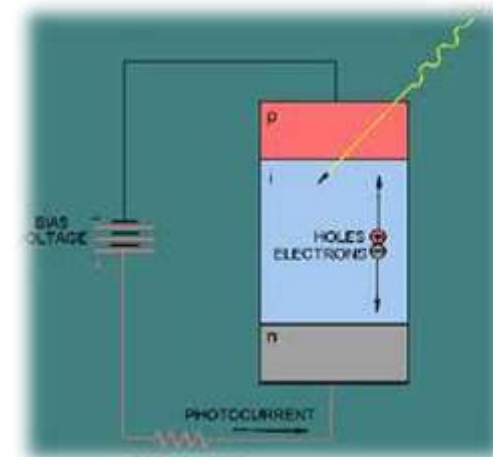
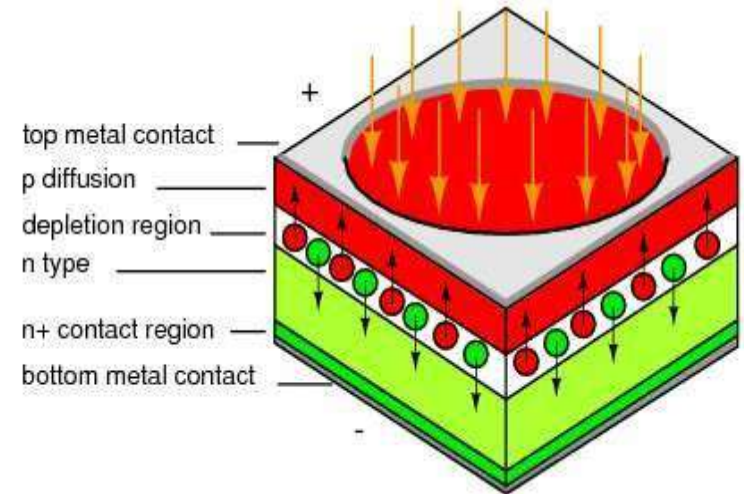
# Light emitting diode-LED

- An **LED** is a semiconductor light source.
- Uses
  - General lighting
  - Displays
  - Traffic and street lights
  - Decorative purposes



# Photodiode

- A **photodiode** is a type of photo detector capable of converting light into either current or voltage,
- A photodiode is designed to operate in reverse bias.
- Used in solar cells



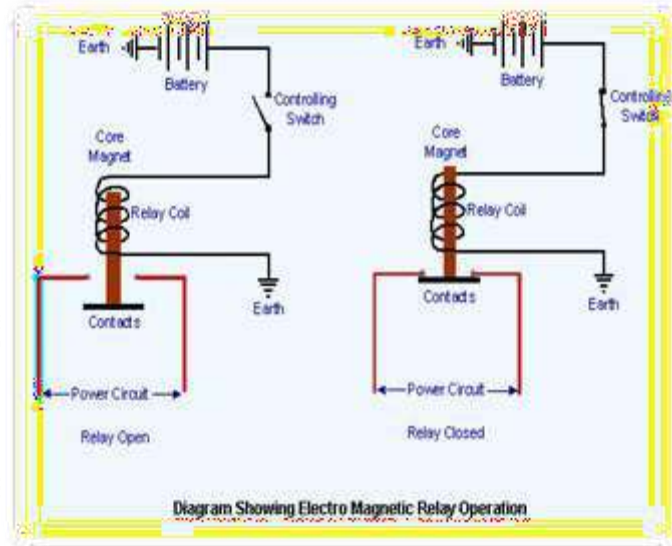
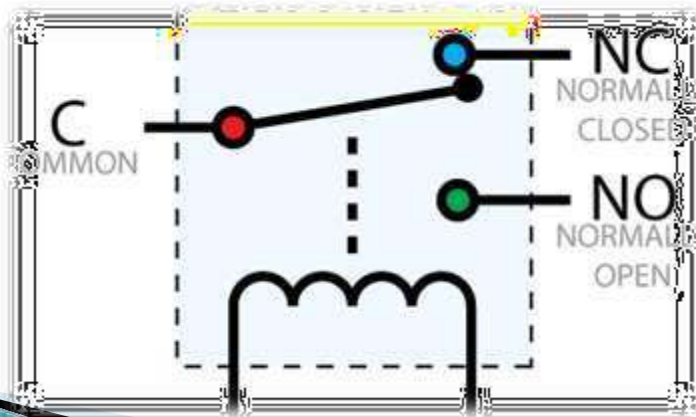


# Have a quick recap

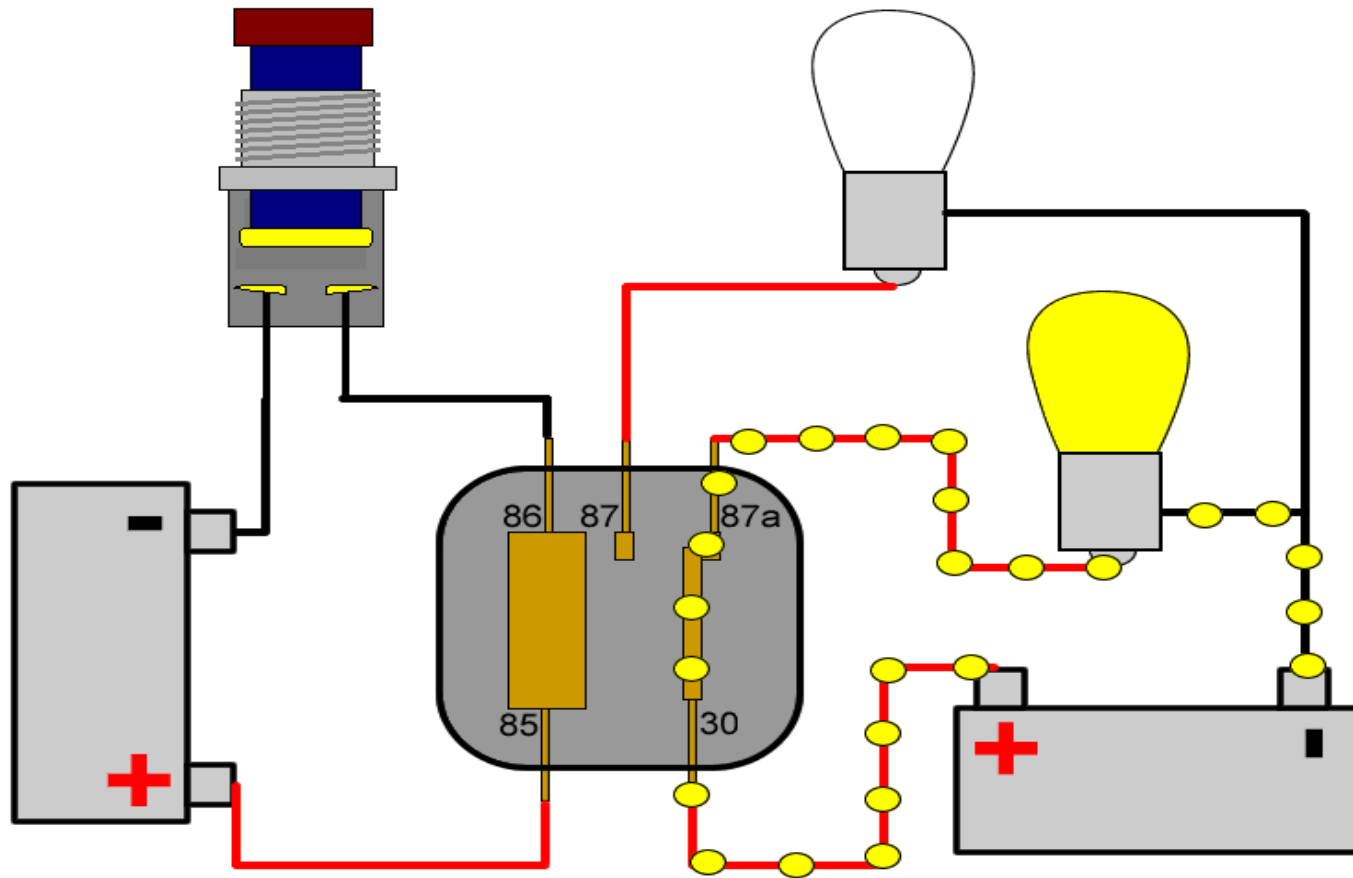
- Passive devices
  - Resistors
  - Capacitors
- Active devices
  - Batteries
- Semiconductor devices
  - Diodes
  - LED
  - Photodiode

# Relay

- Mechanically controlled electrically activated switch
- Uses
  - To switch from low current to high current

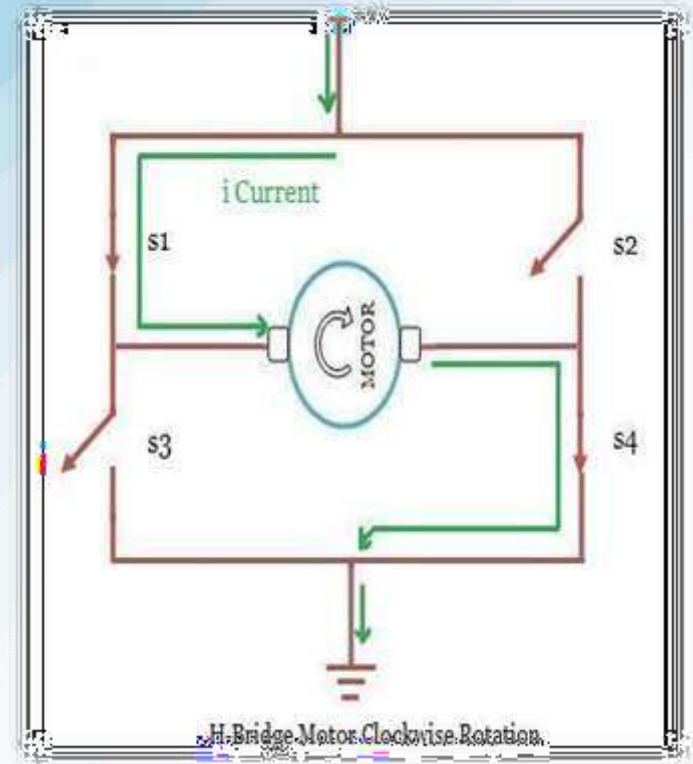
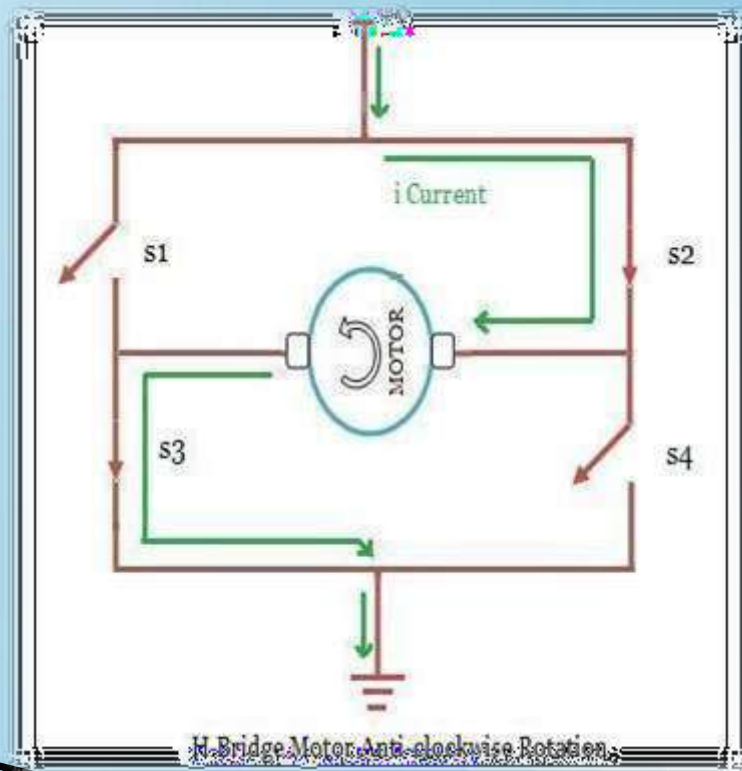


# Working of relay with a simple circuit

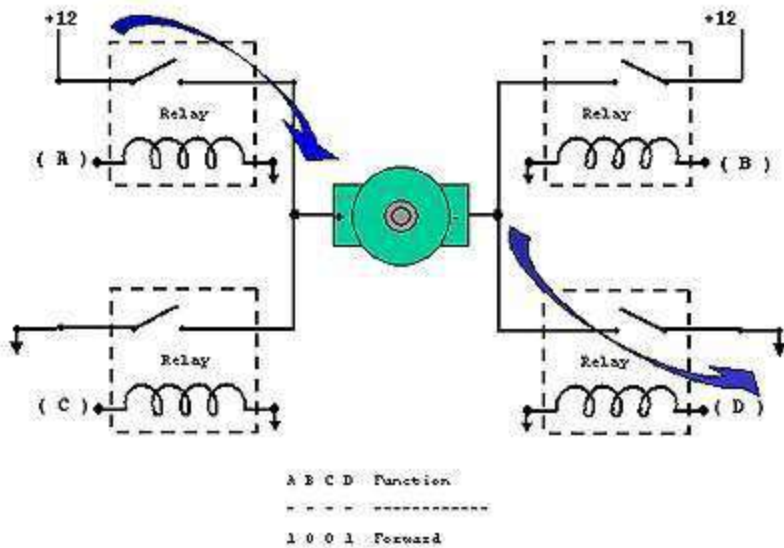


# H-bridge

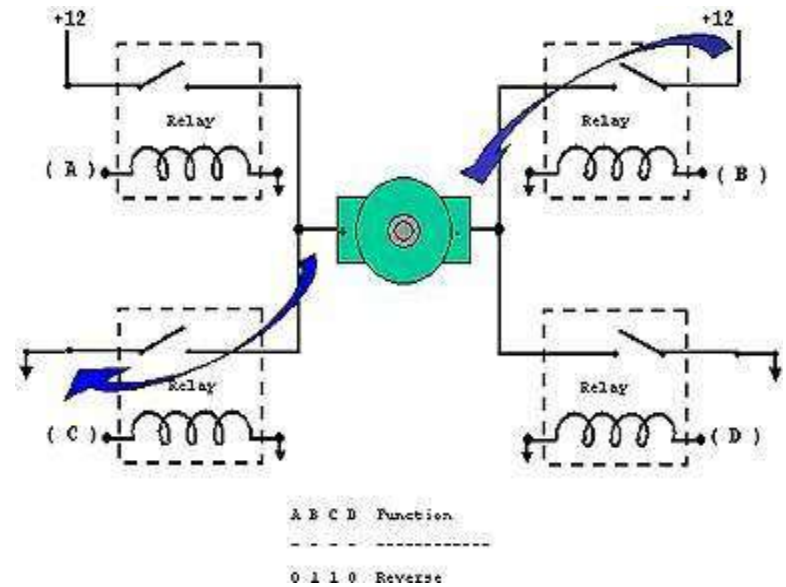
- Used for reversal of direction of motor
- Working



# H-bridge using 4 relay



Anti-Clockwise movement



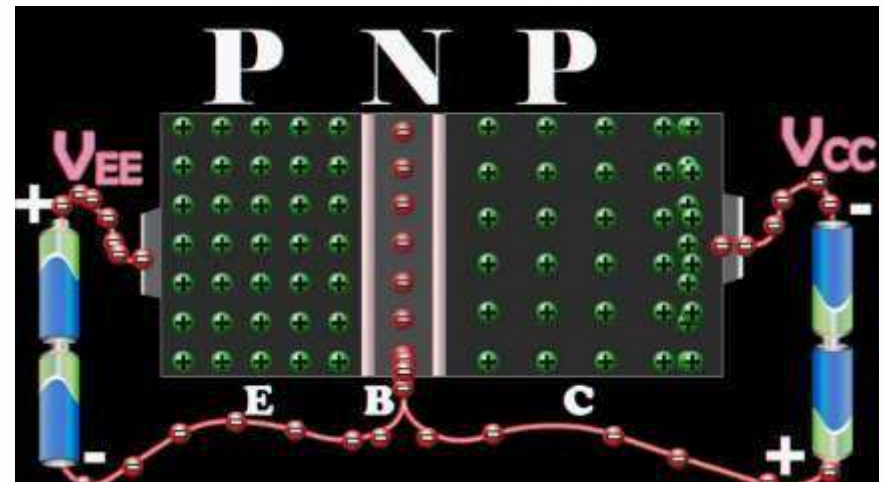
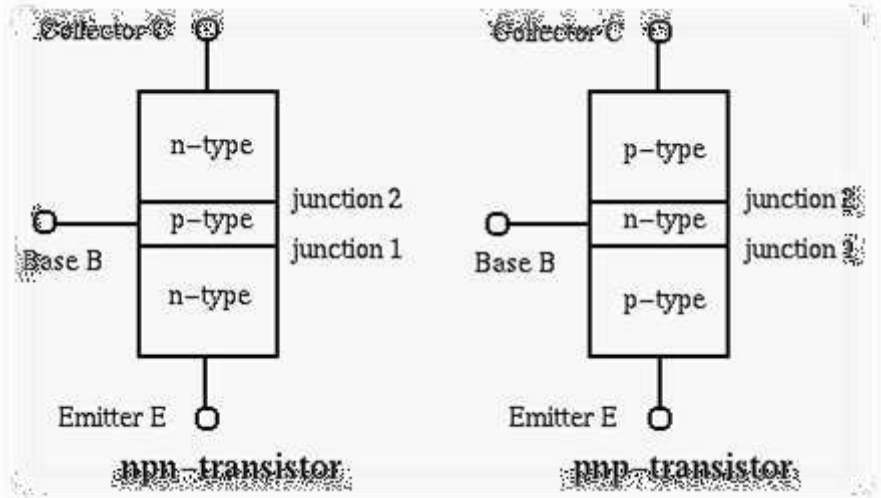
Clockwise movement

# Assignment

H bridge using 2 relays

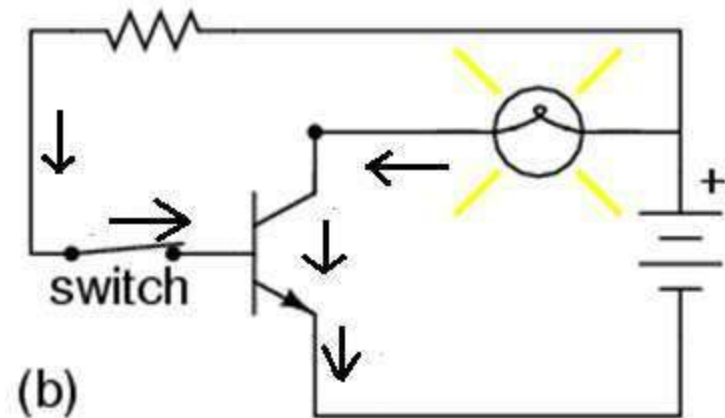
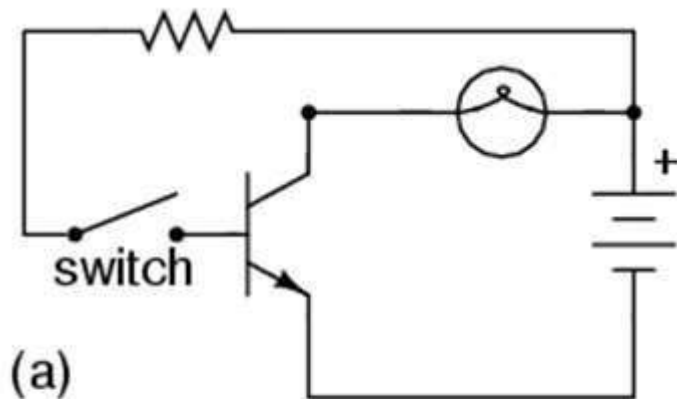
# Transistors

- Transfer resistor
- Types:-BJT, FET
- Uses
  - Amplifiers
  - Switches
  - Regulators



# Transistor as a switch

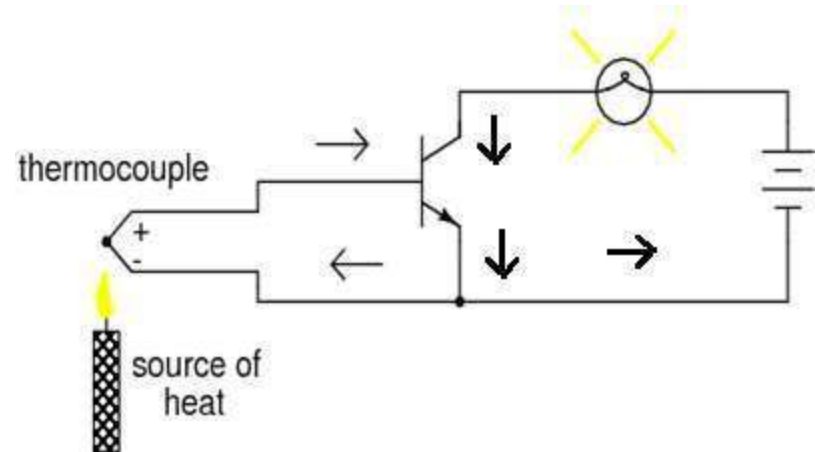
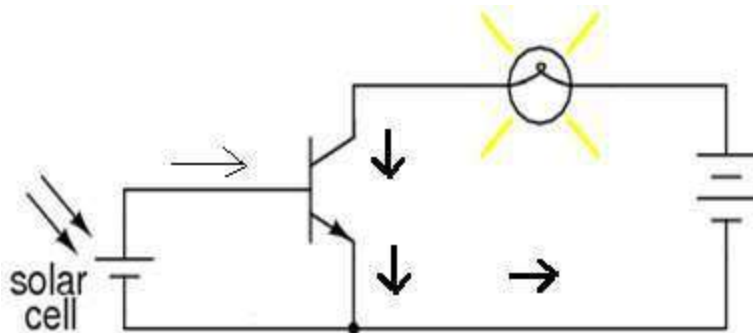
- Principle- Because a transistor's collector current is proportionally limited by its base current, it can be used as a sort of current-controlled switch.



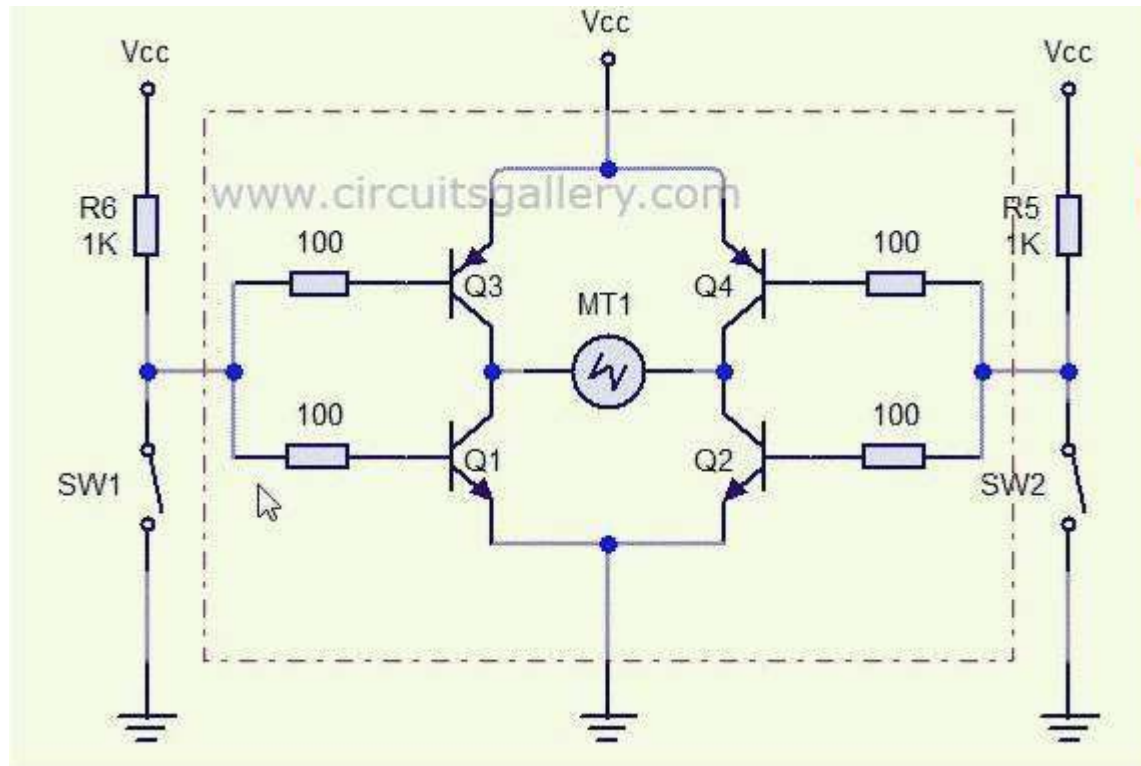


# Advantages of transistor switch over normal switch

- A small switch may be used to control a relatively high-current load
- Very quick and efficient

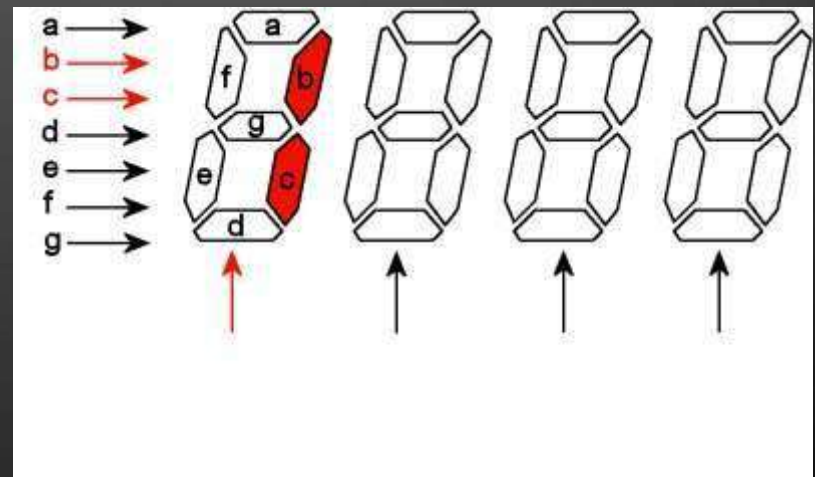
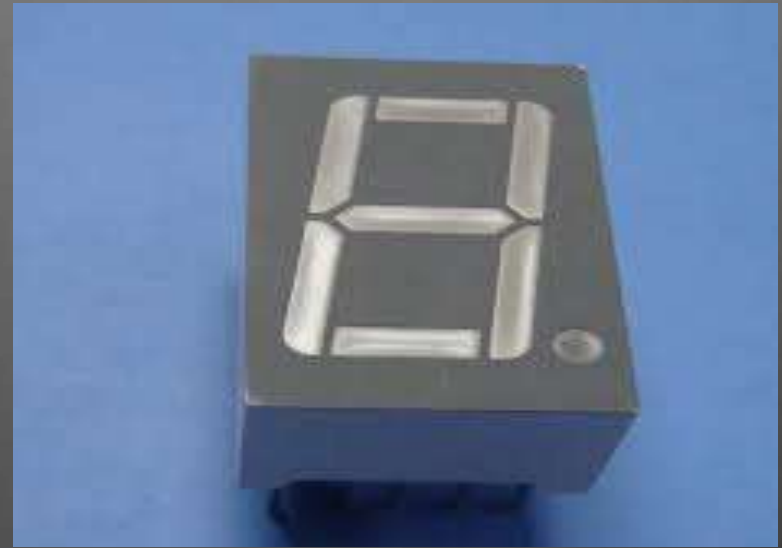


# H bridge using transistor



# Seven segment display

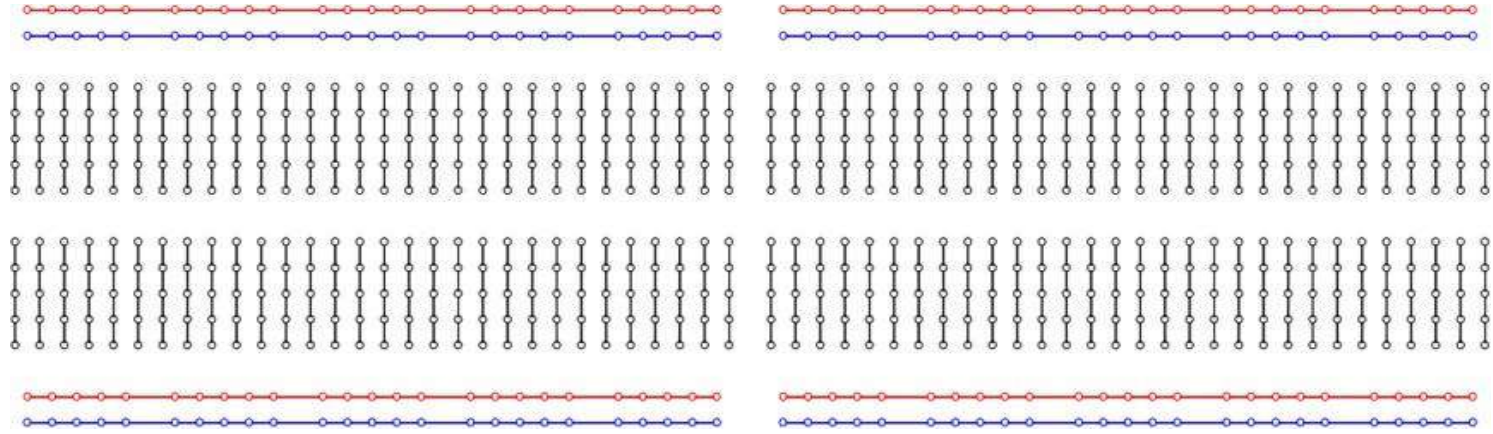
- A simple and less power consuming display
- Two configurations
  - Common anode
  - Common cathode
- For displaying numeric digits
- Used in condition of small spaces



# Assignments

- Write the terminals which will display the following digits?
  - 6
  - 9
  - 2
  - 5

# Breadboard

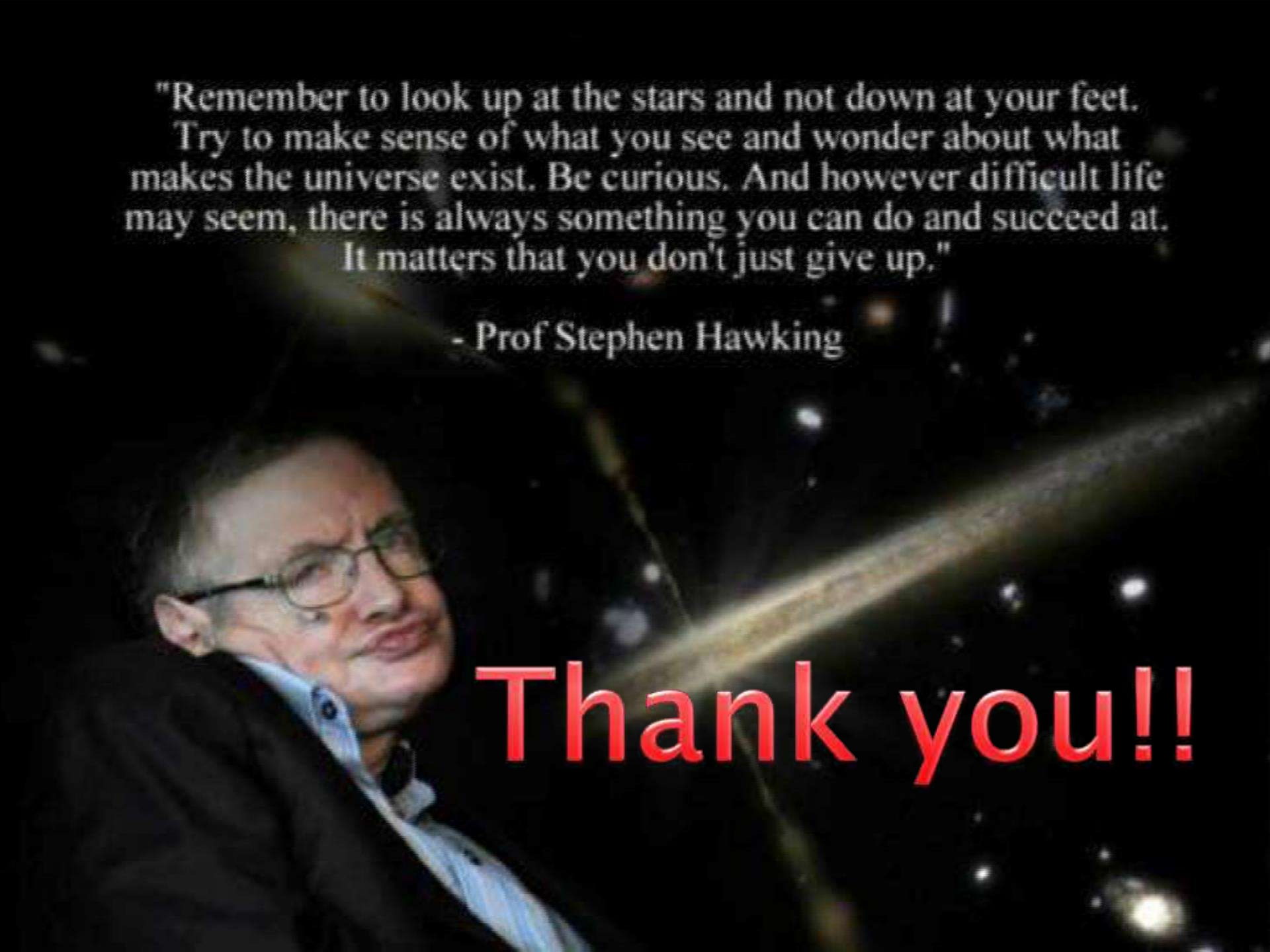


Internal connections in a breadboard

# Multimeter

- How to use is it?
- Measuring resistance
- Measuring current
- Measuring voltage
- Checking continuity
- Measuring the type of transistor



A portrait of Stephen Hawking is positioned in the lower-left corner of the image. He is wearing his characteristic glasses and a dark jacket over a light-colored shirt. The background is a deep space scene featuring a bright, glowing spiral galaxy and numerous distant stars of varying brightness.

"Remember to look up at the stars and not down at your feet.  
Try to make sense of what you see and wonder about what  
makes the universe exist. Be curious. And however difficult life  
may seem, there is always something you can do and succeed at.  
It matters that you don't just give up."

- Prof Stephen Hawking

**Thank you!!**

