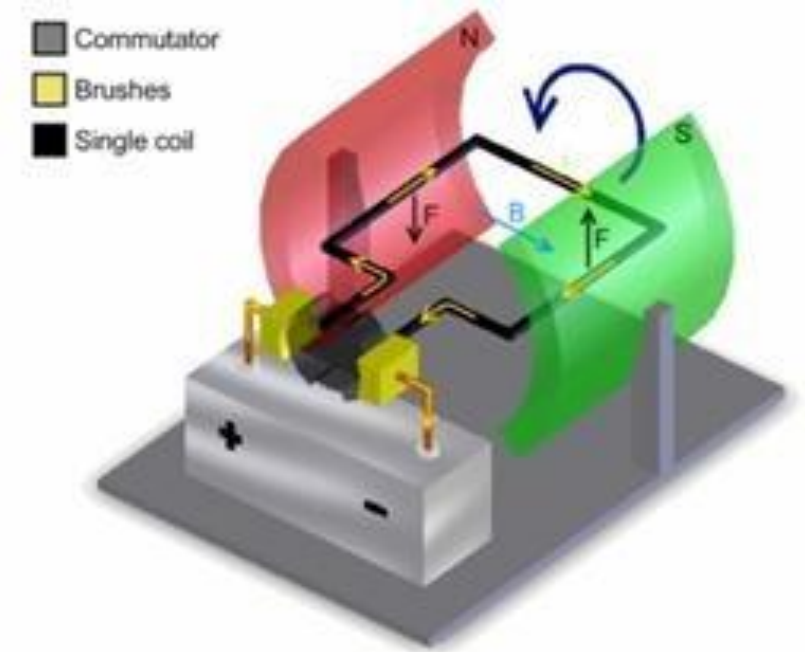# DC MOTORS

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DC Motors:

The main idea of DC Motors is :
There are three parameters:

- ➢ Electricity.
- ➢ Magnetic field.
- ➢ Motion.

 If any two parameters exist, third parameter will be generated.
- ➢ So, if there an electricity in a coil into a magnetic field, the motion will be generated.
- ➢ Fleming's Rule is used in an electric motor to determine the direction of the motive force of a conductor through which a current is flowing and cutting magnetic field lines.


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DC Motors:

Advantages of DC Motors:

➢ DC Motors generate a continuous motion.
➢ Simple to drive.
➢ Has a small size.
➢ Has an easy structure.
➢ Low Cost.

Commutator
Brushes
Single coil

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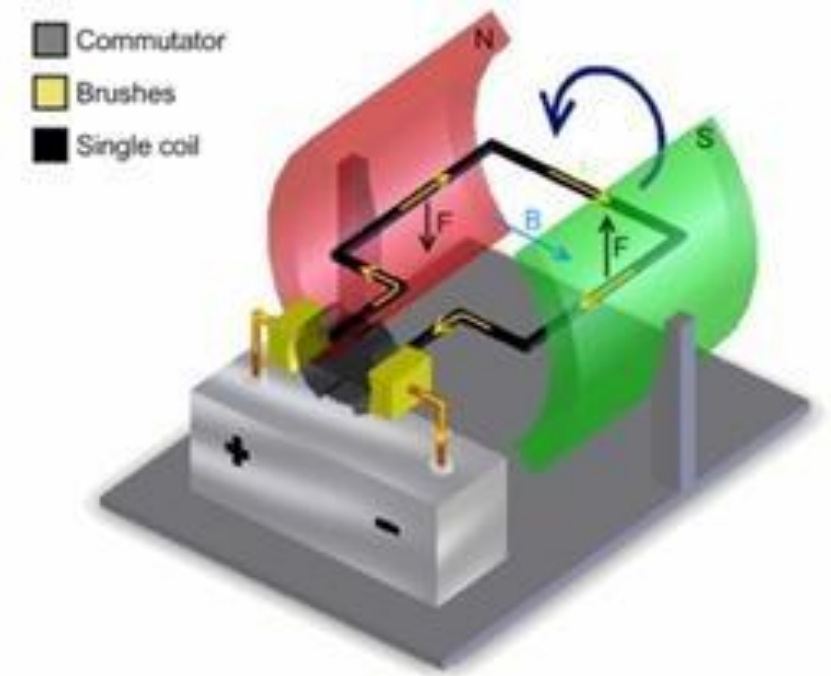
DC Motors:

Disadvantages of DC Motors:

➢ The direction is Uncontrollable without an extra hardware circuit.

➢ The rotation angle is Uncontrollable without an extra hardware circuit.

    ➢ We can use Encoder circuit like exists into the figure besides.

➢ Its speed highly varies if the load is changed or current or volt.

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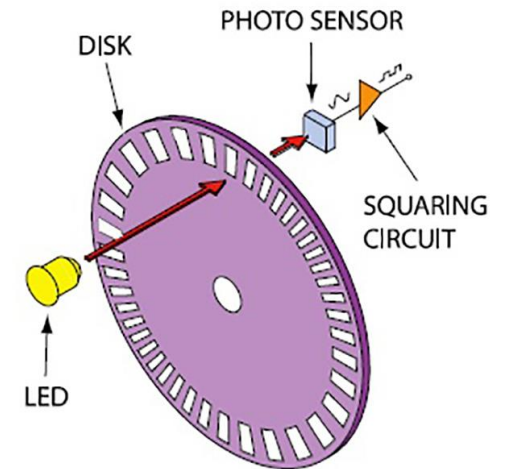
Controlling of DC Motors:

➢ The most common circuit is used to control the DC Motors is H-bridge.

➢ It is used to control the direction of DC Motor rotation.

➢ The figure besides, the simplest H-bridge can be implemented.

➢ It is implemented from four switches,

  ➢ S1,S4 are closed, the motor will rotate at Clock-wise direction.

  ➢ S2,S3 are closed, the motor will rotate at Counter-clock-wise direct
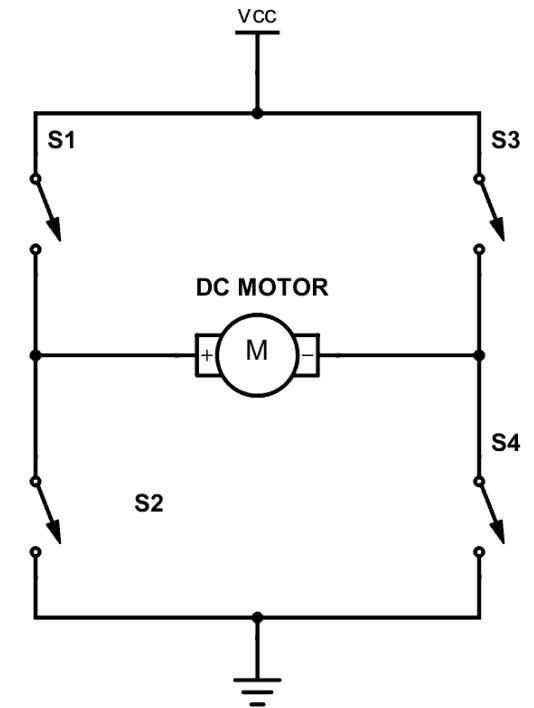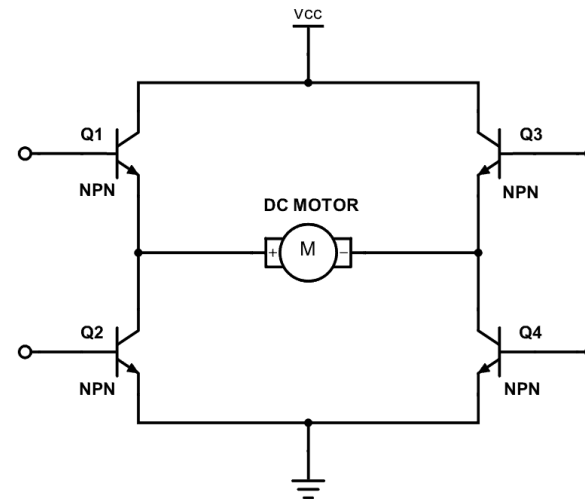
Controlling of DC Motors:

➢ -Unfortunately, This circuit has two main defects:

    ➢ It is a human dependency.

    ➢ It may cause a short circuit if the S1,S2 or S3,S4 are closed at the same time.

➢ So, we will replace the switches by transistors.
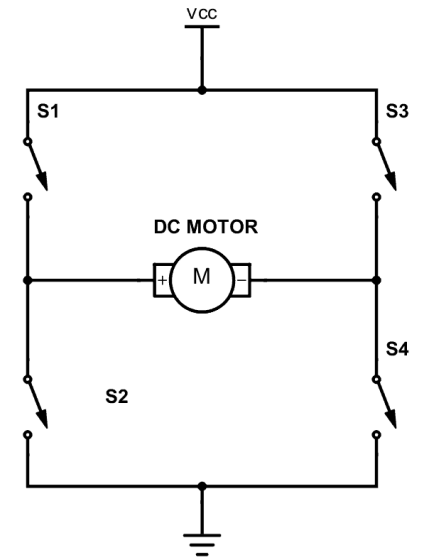
Controlling of DC Motors:

➢ We can Modify the last circuit by replacing switches by transistors.

➢ Now, it can be controlled by signals to change the polarity of motor and direction.

➢ Unfortunately, if Q3,Q4 or Q1,Q2 are closed, it will cause short circuit.

Controlling of DC Motors:

➢ To avoid short circuit cases, we can replace the NPN transistor with a PNP transistor.

➢ If Q1, Q2 have the same signal, HIGH or LOW, the circuit will be opened, so there is no way to cause the short circuit.

➢ To change the direction, apply different signals in Q1, Q2.
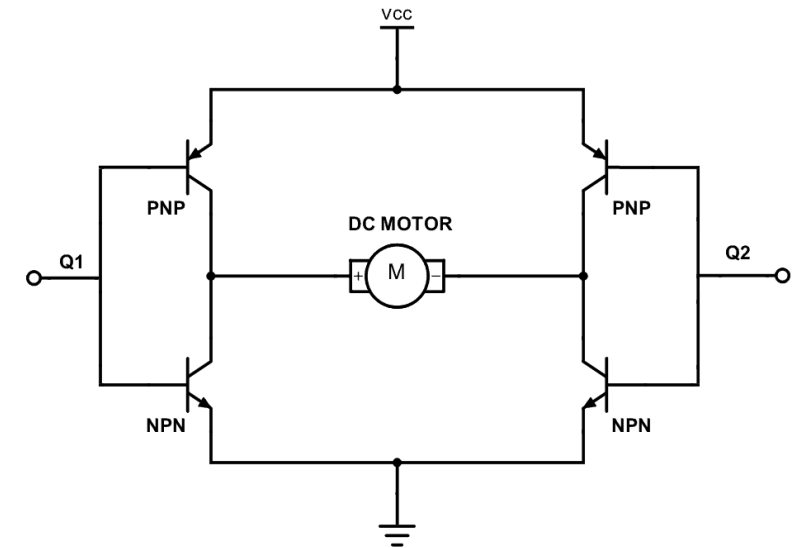
Controlling of DC Motors:

➢ This modification manages us to control the speed of the motor also, in addition to controlling the direction.

➢ This is the same idea on which the L293D IC is built.
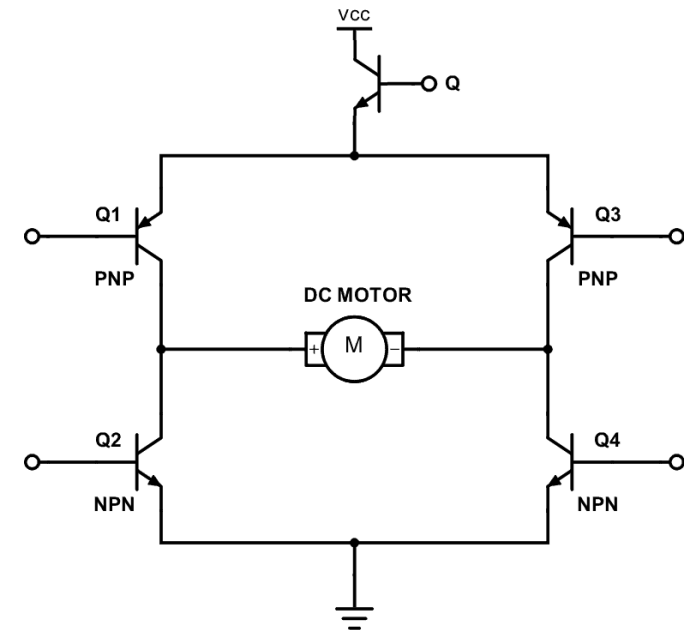
Controlling of DC Motors:

➢ L293D IC is The most common circuit is used to control the DC Motors.- L293D is used to control two motors at the same time.

➢ It can control the direction of speed and the direction of the DC Motor.

Enable 1, 2	1	16	Vcc 1 (Vss)
Input 1	2	15	Input 4
Output 1	3	14	Output 4
Ground	4	13	Ground
Ground	5	12	Ground
Output 2	6	11	Output 3
Input 2	7	10	Input 3
Vcc 2 (Vs)	8	9	Enable 3, 4

L293D

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Pin Configuration of L293D :

Pin Functions

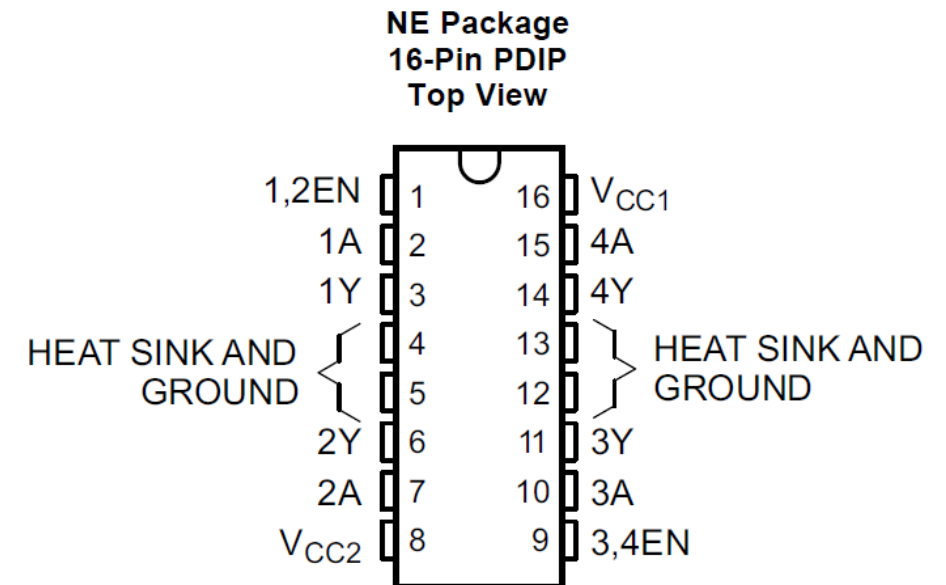| PIN		TYPE	DESCRIPTION
NAME	NO.		
1,2EN	1	I	Enable driver channels 1 and 2 (active high input)
<1:4>A	2, 7, 10, 15	I	Driver inputs, noninverting
<1:4>Y	3, 6, 11, 14	O	Driver outputs
3,4EN	9	I	Enable driver channels 3 and 4 (active high input)
GROUND	4, 5, 12, 13	—	Device ground and heat sink pin. Connect to printed-circuit-board ground plane with multiple solid vias
V_{CC1}	16	—	5-V supply for internal logic translation
V_{CC2}	8	—	Power VCC for drivers 4.5 V to 36 V

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Pin Configuration of L293D :

➤ Enable 1,2 & Enable 3,4 are used for enabling the activation of Directions pins, also they are used to control on the Motor speed if the signal on them became between 0→5 volts.

➤ 1A, 2A & A3, A4 are used for controlling the direction of motor, if 1A or A3 is High and 2A or A4 is Low, assume that the motor will rotate Clockwise, if the inverse, the motor will rotate Counterclockwise, if the same signals are applied on them, the motor will stop.

NE Package
16-Pin PDIP
Top View

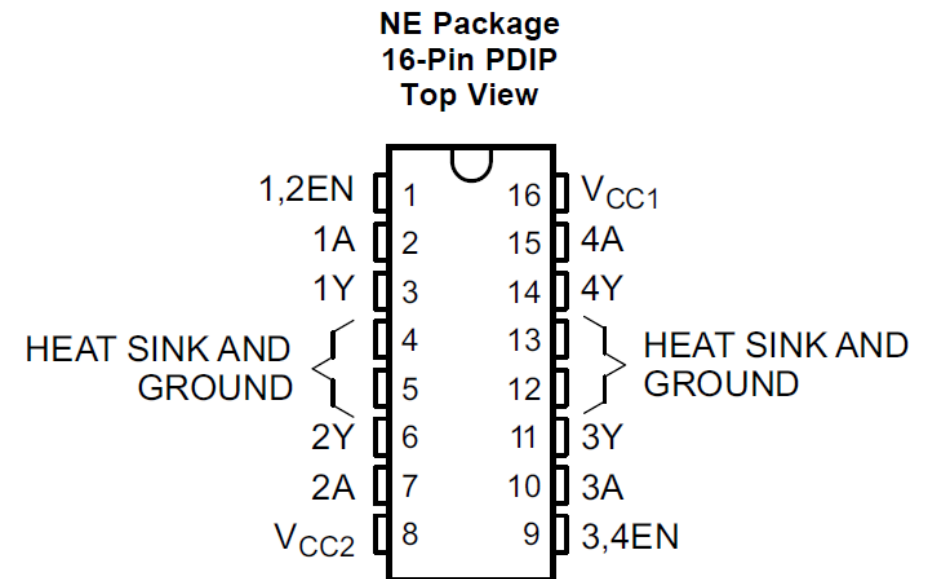| 1,2EN | 1 | 16 | V_{CC1} |
1A	2	15	4A
1Y	3	14	4Y
HEAT SINK AND GROUND	4	13	HEAT SINK AND GROUND
	5	12	
2Y	6	11	3Y
2A	7	10	3A
V_{CC2}	8	9	3,4EN

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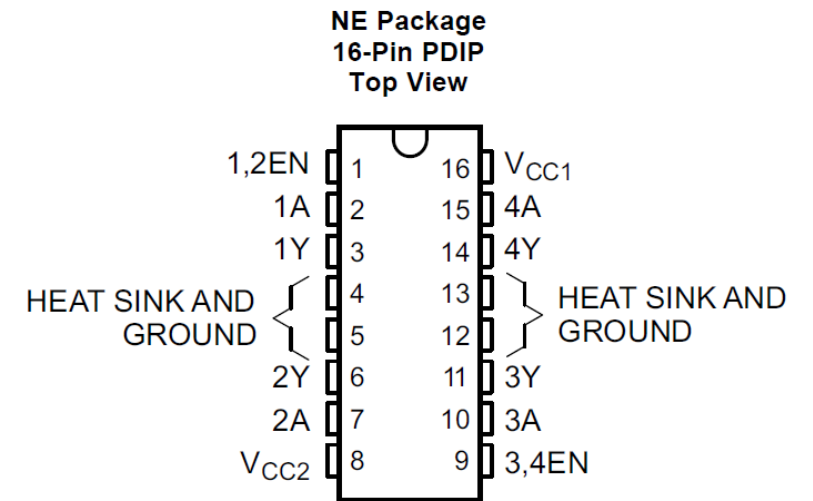
Pin Configuration of L293D :

➢ Y1, Y2 & Y3, Y4 are used for connecting the polar of motors as output pins from the IC.

➢ Vcc2 is used to connect the volt of motors, this pin can be connected to up to 36 Volts.

➢ Vcc1 is used to feed the IC with power to manage to work, it is connected to 5 Volts.
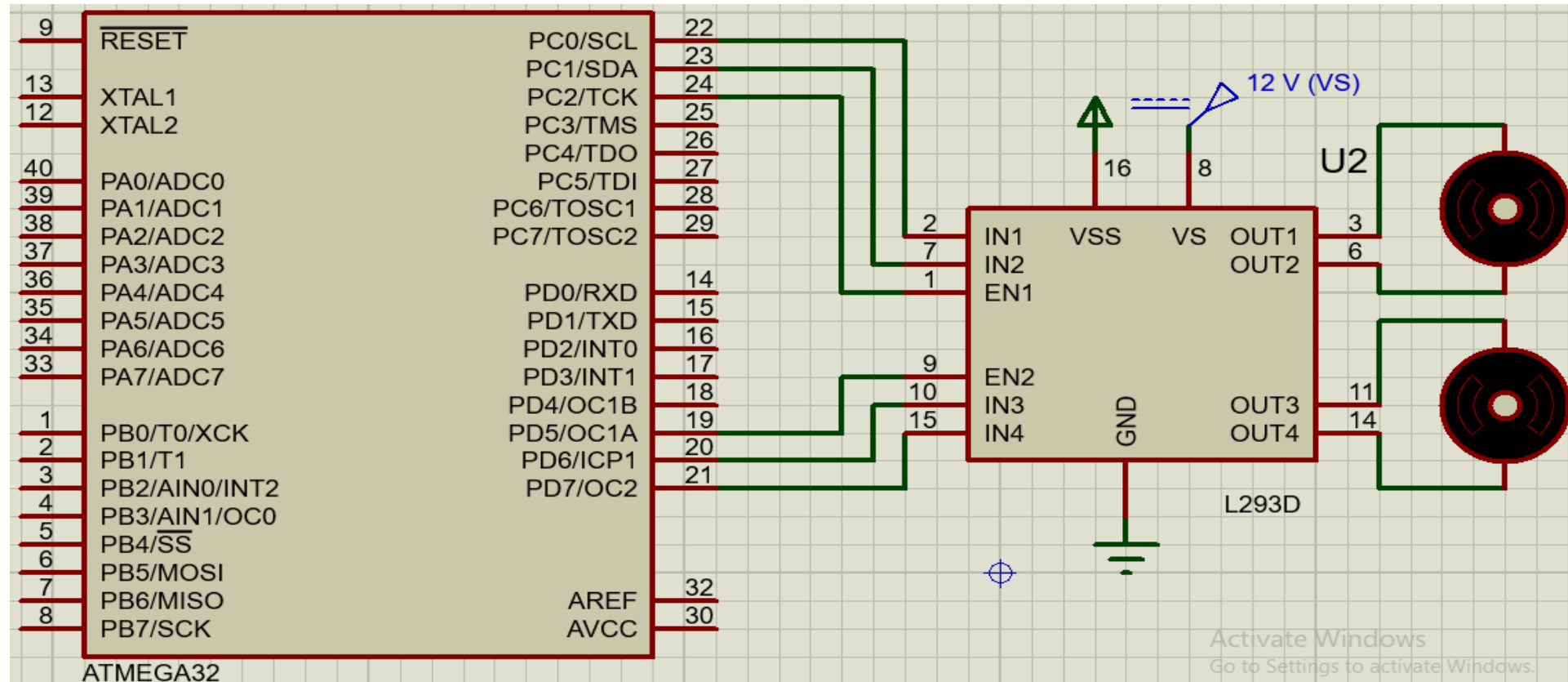
NE Package
16-Pin PDIP
Top View

1,2EN	1	16	V_{CC1}
1A	2	15	4A
1Y	3	14	4Y
HEAT SINK AND GROUND	4	13	HEAT SINK AND GROUND
	5	12	
2Y	6	11	3Y
2A	7	10	3A
V_{CC2}	8	9	3,4EN

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Pin Configuration of L293D :

➢ Pins 3,4,13,14 are used for connecting to the Ground.

Also, these pins are used for heat transferring, I mean

they are used to cool the IC circuit and throw the heat

out of the IC to Air.

NE Package
16-Pin PDIP
Top View

1,2EN	1	16	V_{CC1}
1A	2	15	4A
1Y	3	14	4Y
HEAT SINK AND GROUND	4	13	HEAT SINK AND GROUND
	5	12	
2Y	6	11	3Y
2A	7	10	3A
V_{CC2}	8	9	3,4EN

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Pin Connection with atmega32: