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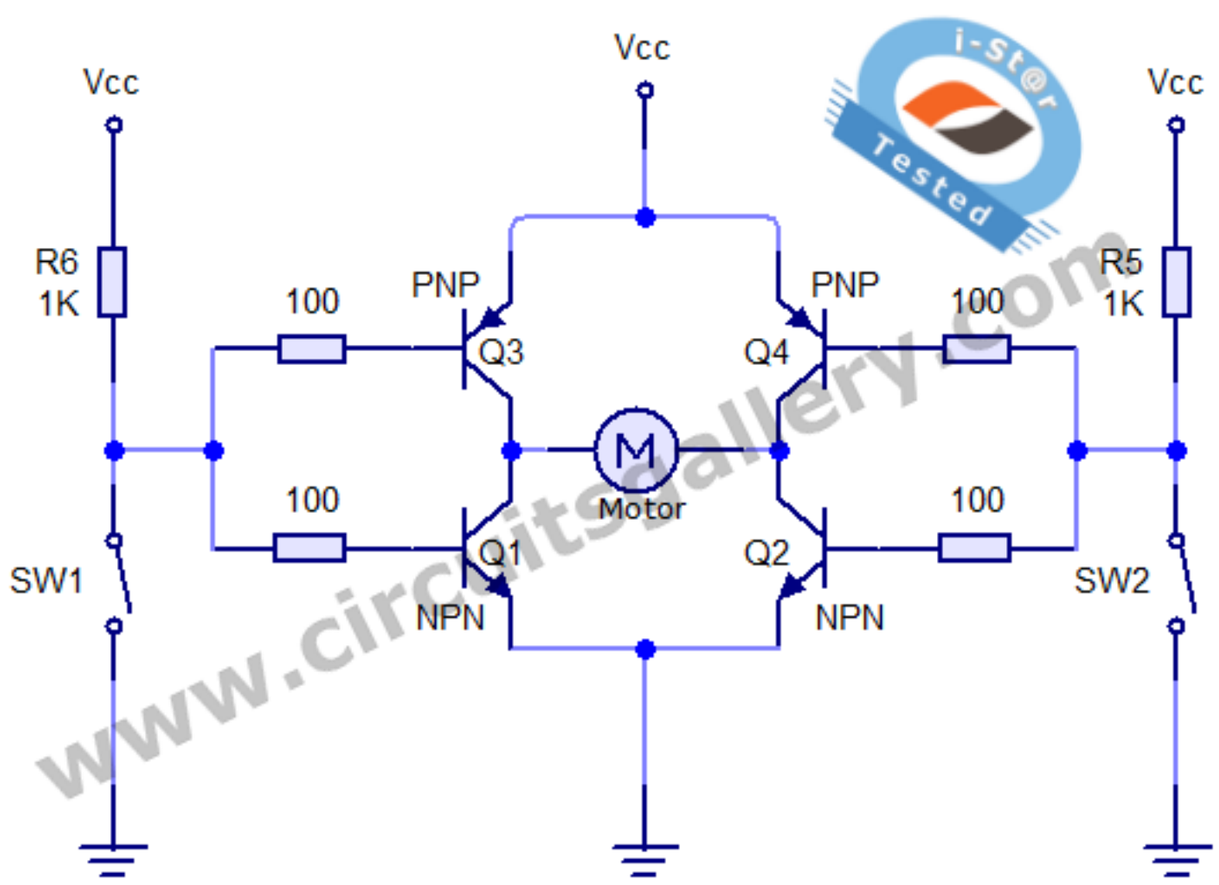
H Bridge motor driver theory & practical circuit using transistors- animation/ simulation: Getting started with Robotics

Jaseem vp / June 26, 2012

What is **H Bridge** driver circuit? How to build an H Bridge circuit? H Bridge is a topic of great discussion in **Robotics engineering and automation** and H bridge motor (driver) controllers are the most common circuit for many robotics hobbyists. Further H Bridge driver circuits are the initial step of **getting started with robotics** (how to make robots? build a robot, etc). This **Transistor H Bridge** tutorial is devoted to the theory and practical construction of simple H bridges for controlling DC motors. An H-bridge is a type of driver circuit that you can use to spin a DC motor both clockwise and counterclockwise. H Bridge ICs are also available, L293 dual H Bridge IC is used in many robotic applications.

Circuit diagram



H Bridge circuit using transistors

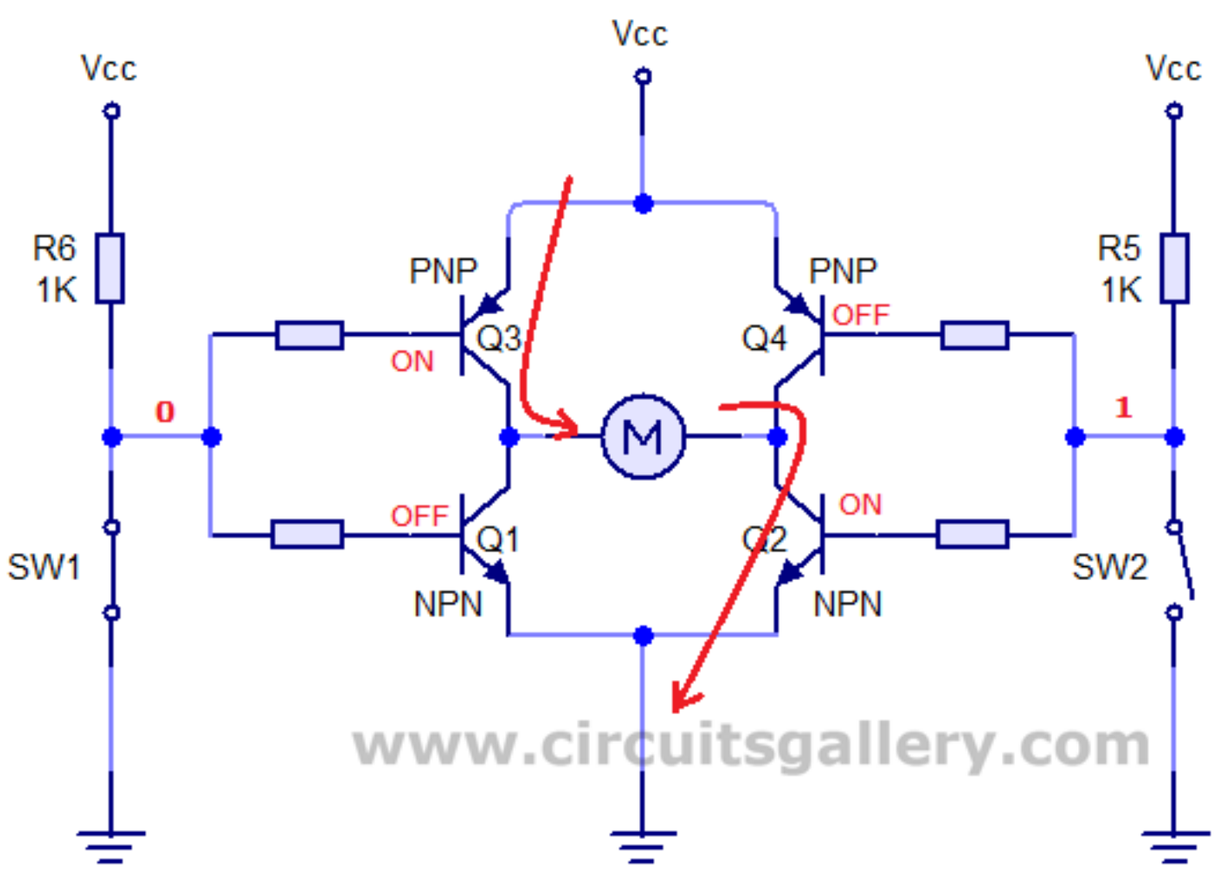
Components required

1. Resistors (100Ω x 4, 1kΩ x 2)
2. Switches x 2
3. Transistors (NPN x 2, PNP x 2)
4. Load (DC Motor)

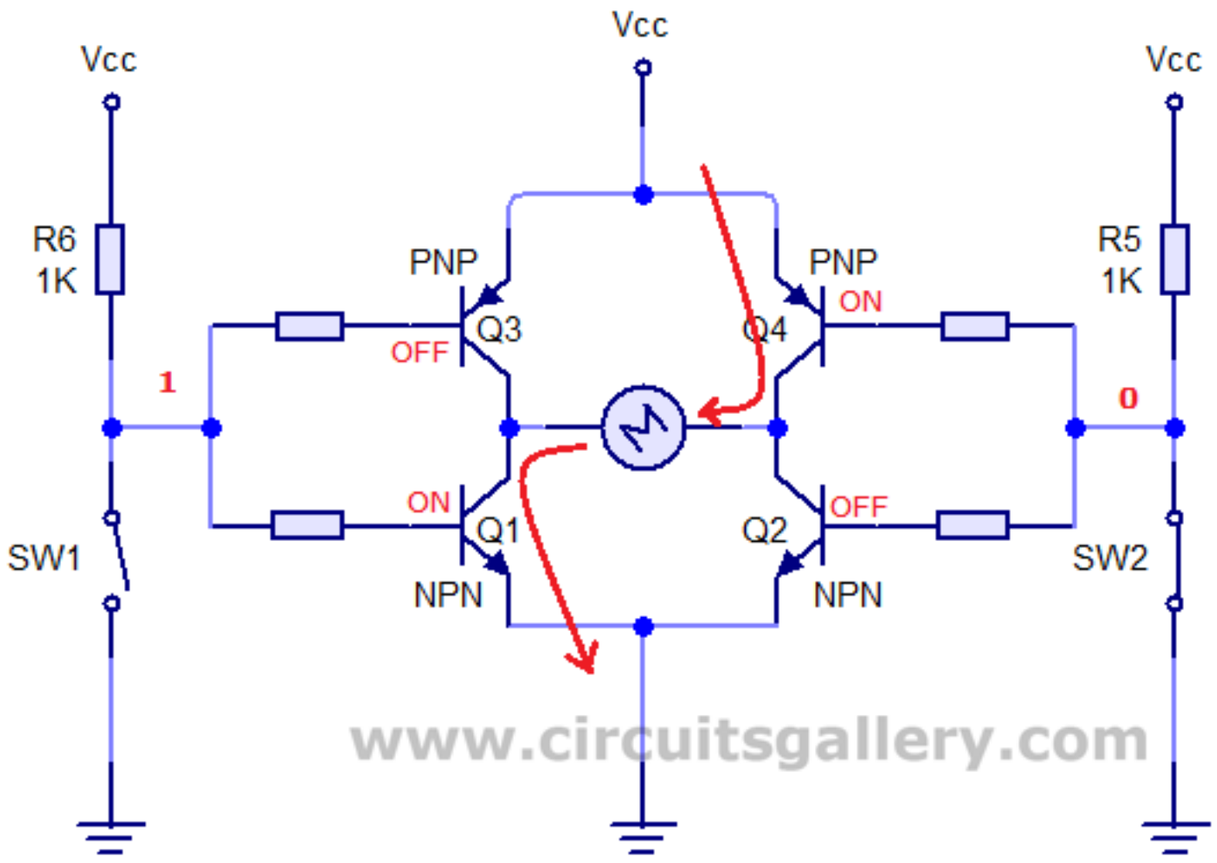
Working of H bridge circuit

- The switching property of NPN and PNP transistors are used in H bridge motor driver circuit. You can refer more on How a transistor acts as a switch?

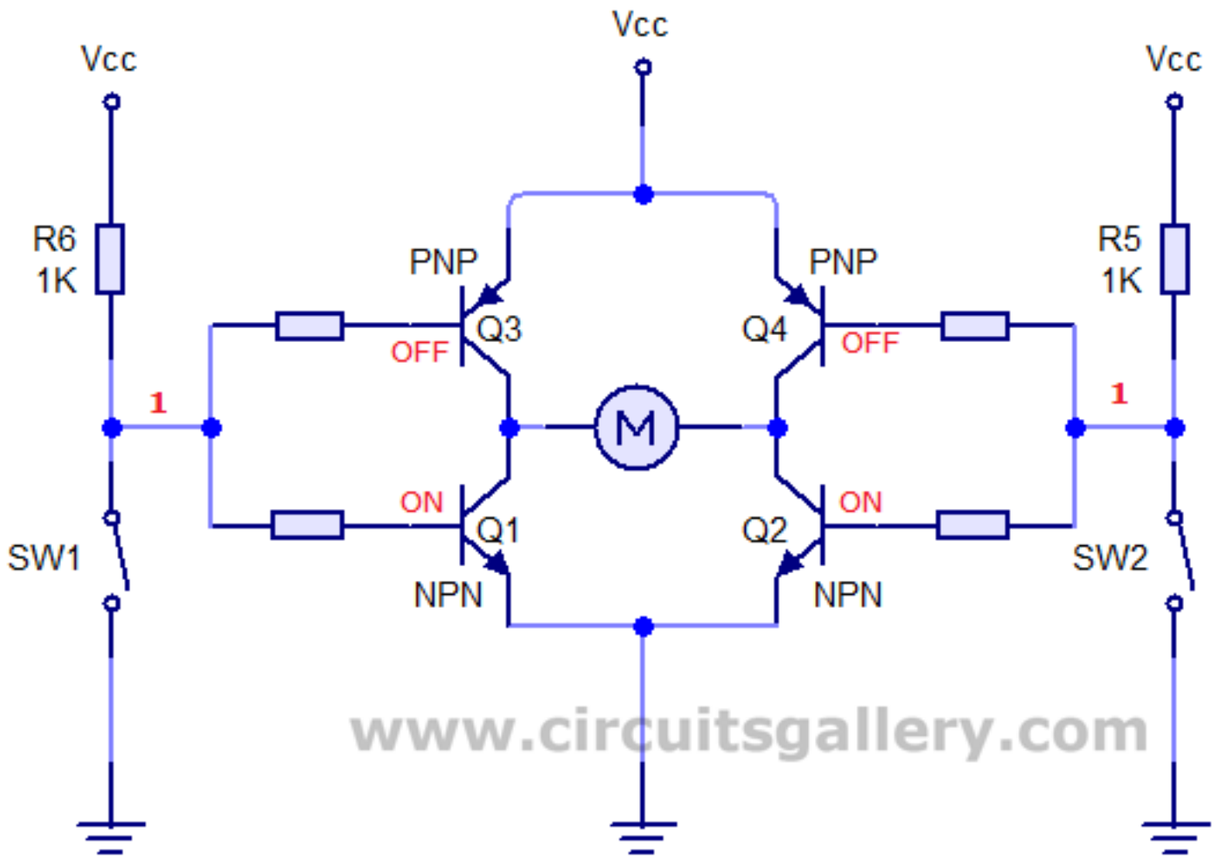
- From the circuit diagram when SW1 is closed, the 0V appear at the base of Q1 and Q3.

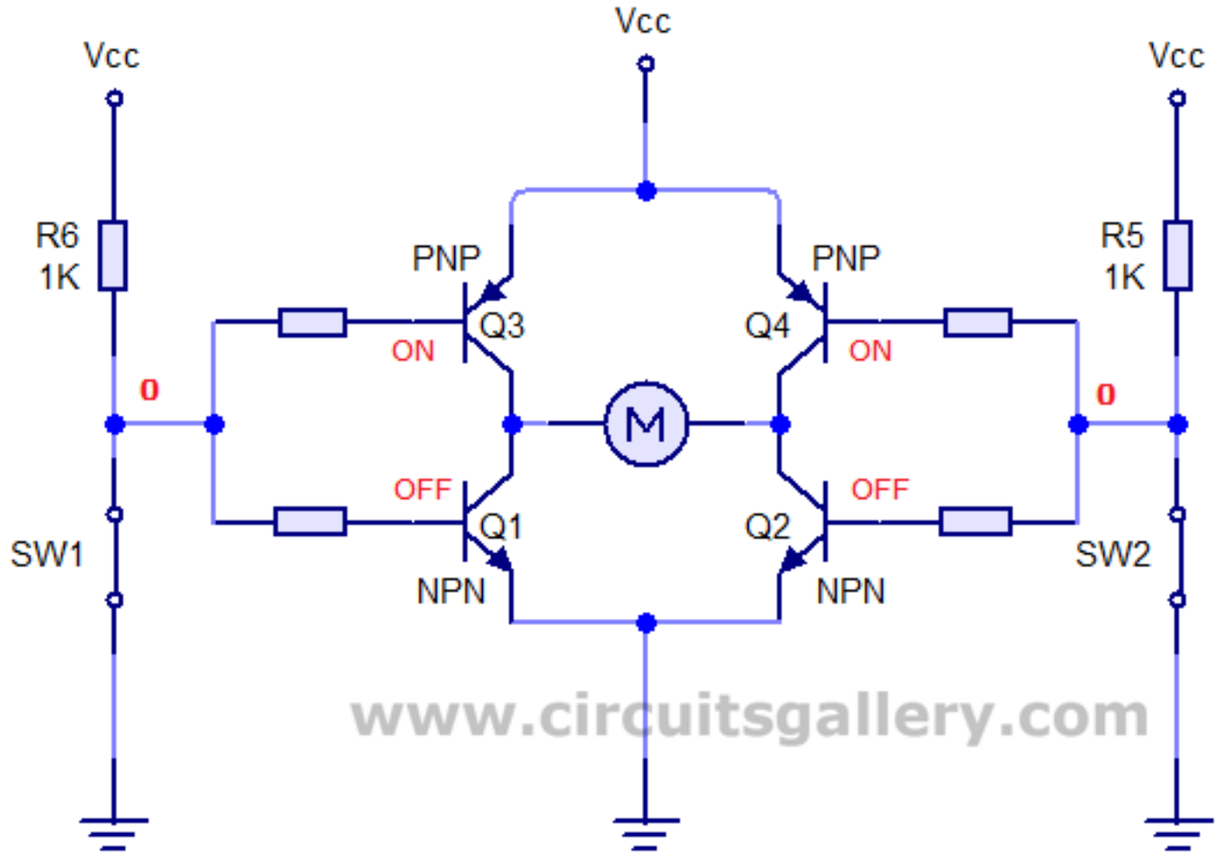


- Then transistor Q3 becomes ON since it is PNP, it needs LOW voltage to turn ON. But transistor Q1 remains OFF, because it is NPN and requires HIGH potential at the base to turn ON.
- SW2 is not closed so that transistor Q2 is ON and transistor Q4 is OFF because HIGH potential appear at the base terminals.
- So a current path exists via *Q3-> motor-> Q2* so the motor rotates in a particular direction (say clockwise direction).
- Consider SW2 is closed and SW1 is open, similarly Q4 and Q1 are ON and Q3 and Q2 are OFF.



- Then the current path is reversed, that is *Q4-> motor ->Q1*, this allows rotating the motor in opposite direction (anti clockwise direction).
- Thus an H bridge driver can effectively control the rotation of motor in both directions.
- If both inputs are simultaneously HIGH or LOW, then the Motor is in Rest.



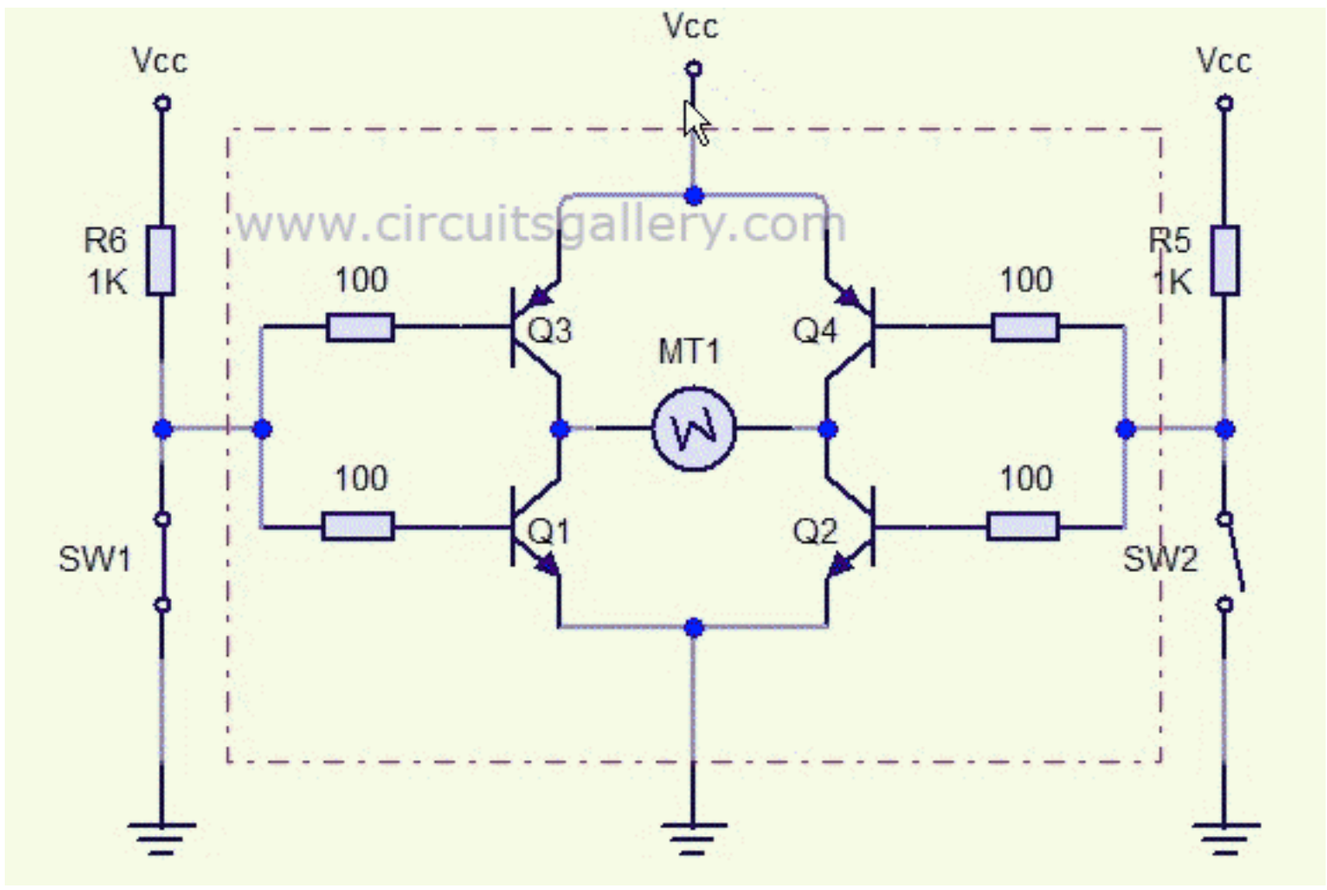


- Please have a look through the simulation/ animation of H bridge driver circuit.

Table showing the working

Please read: [L293 IC based H Bridge DC Motor driver circuit]

Simulation/ Animation of H bridge circuit



Hope this animation makes the concept clear. Don’t hesitate to comment if you like this.

June 26, 2012 in Electronics Animations, Robotics.

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10 thoughts on “H Bridge motor driver theory & practical circuit using transistors- animation/ simulation: Getting started with Robotics”

Saqlain January 27, 2014 at 4:09 pm

Which Type of transistors are to be used? Model Number??

Reply

Jaseem vp March 10, 2014 at 1:20 pm

Hi Saqlain,
This is an example circuit. You may use any PNP+NPN transistor configuration depends on the application. For example High power application use high current transistors. The same circuit is available in an embedded IC. Check out **L293 H Bridge IC**

Reply

Mike February 21, 2014 at 2:01 am

Wow, thanks so much for this great explanation and demonstration! I’d seen the circuit before, and understood what it was supposed to do, but never really tried to understand it. Your explanation made it so simple! I’ve already read through a lot of your circuits and gotten some great ideas, so thanks for this whole website.

Reply

antony February 24, 2014 at 6:18 pm

the contents are in this site is really very useful to us… thnx fr ur team..

Reply

Revati July 28, 2015 at 4:12 pm

working is so nicely explained on this site and the animation at last was of great help in clearing the concept of H Bridge tysm!

Reply

Habeesha July 29, 2015 at 2:47 pm

Hi Revati,
Thanks….

Reply

bhargavi September 4, 2015 at 7:15 am

thanks for the clear explanation. This is very helpful to my project

Reply

shah fahad January 9, 2016 at 10:23 am

Transistor of which number is used

Reply

ashish March 25, 2016 at 8:45 pm

hi sir how can I replace the manual switching by rc switching?

Reply

ashok July 24, 2016 at 9:23 am

did u get the answer for replacing manual switching by rc switching ?

Reply

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