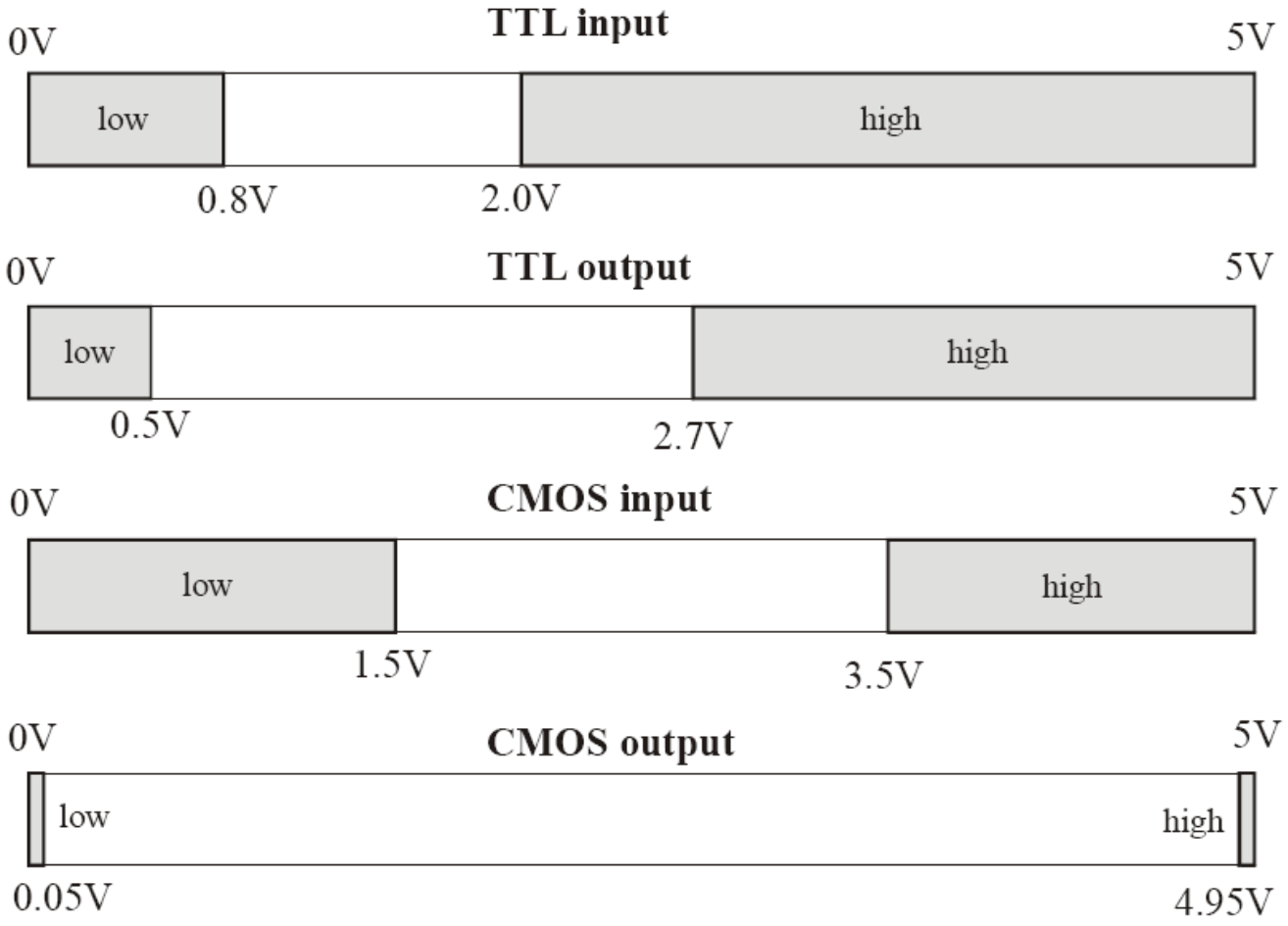
Course Code: MDP 454, Course Name: Mechatronics (2), Second Semester 2014

Interfacing

Prof. Dr. Magdy M. Abdelhameed

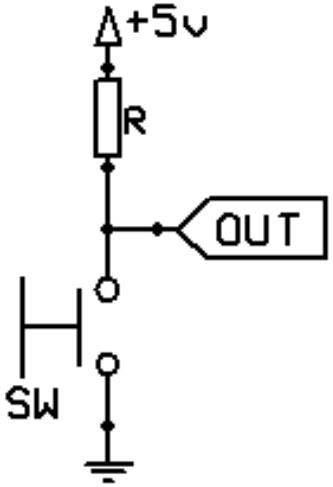
TTL and CMOS voltage levels



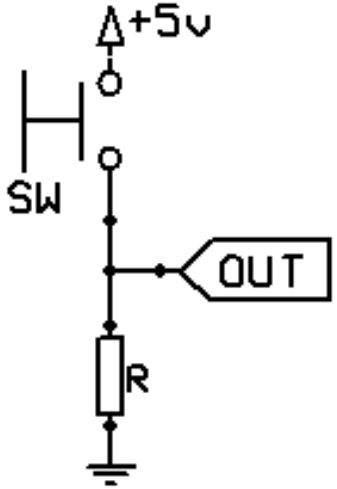
TTL and CMOS input and output levels

Interfacing a switch

Interfacing a switch (input device) to a digital circuit:



Using pull-up resistor

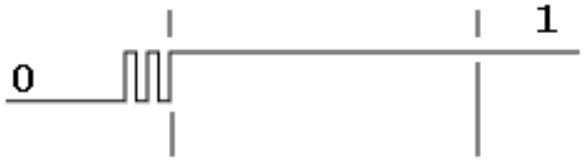


Using pull-down resistor

Switch De-bouncing

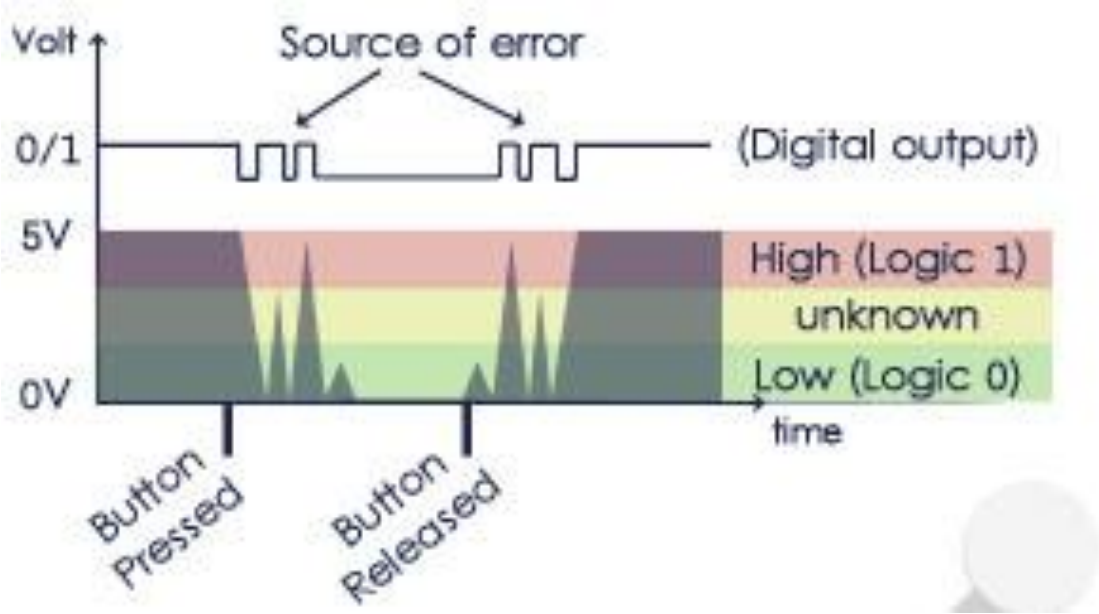
The function of a switch is simple. When we press a switch, two contacts are joined together and connection is made. Still, it is not that simple. The problem lies in the imperfection of mechanical contacts. That is to say, before contact is made or cut off, there is a short time period when vibration (oscillation) can occur as a result of unevenness of mechanical contacts, or as a result of the different speed in pressing a key (this depends on person who presses the key). The term given to this phenomenon is called **SWITCH (CONTACT) DEBOUNCE**.

Bouncing while transition from high to low



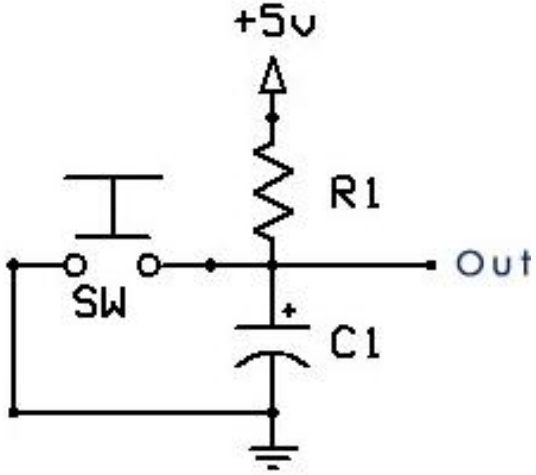
Bouncing while transition from low to high

Switch De-bouncing

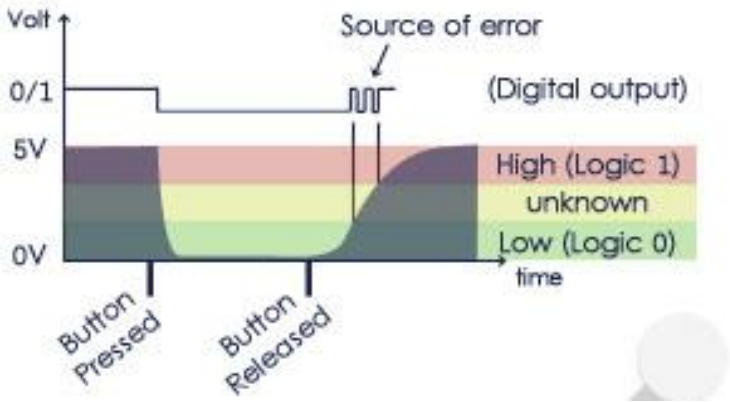


Behavior of a switch without a de-bouncing circuit

The Analog de-bouncing circuit



A switch with a de-bouncing circuit

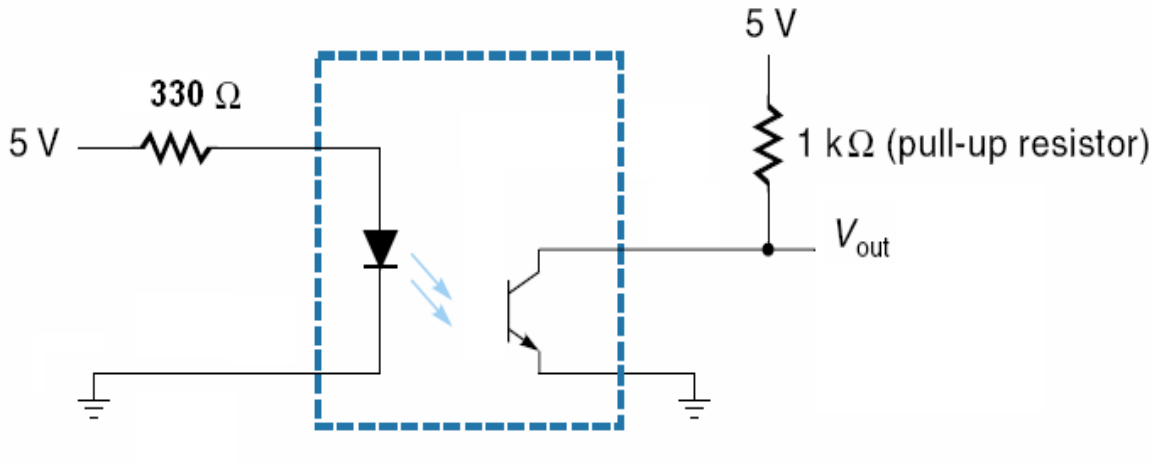


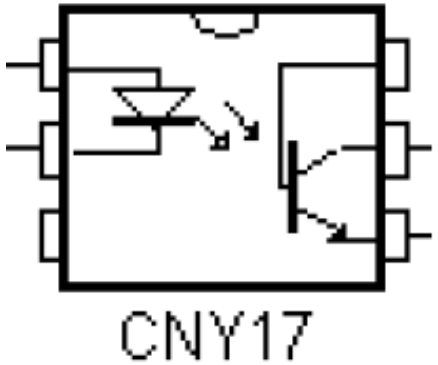
Behavior of a switch with a de-bouncing circuit

• The analog solution relies principally on a capacitor, which plays the role of resisting the voltage changes on the output.

Optocoupler

Optocoupler combines a LED and photo-transistor in the same case. The purpose of an optocoupler is to separate two parts of a circuit.





Optocoupler

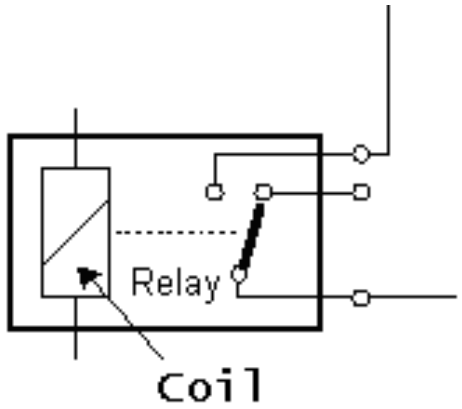
Why optocoupler?

Interference. One part of a circuit may be in a location where it picks up a lot of interference (such as from electric motors, welding equipment, petrol motors etc.) If the output of this circuit goes through an optocoupler to another circuit, only the intended signals will pass through the optocoupler. The interference signals will not have enough "strength" to activate the LED in the optocoupler and thus they are eliminated. To protect a section of the device. Typical examples are industrial units with lots of interferences which affect signals in the wires. If these interferences affect the function of control section, errors will occur and the unit will stop working.

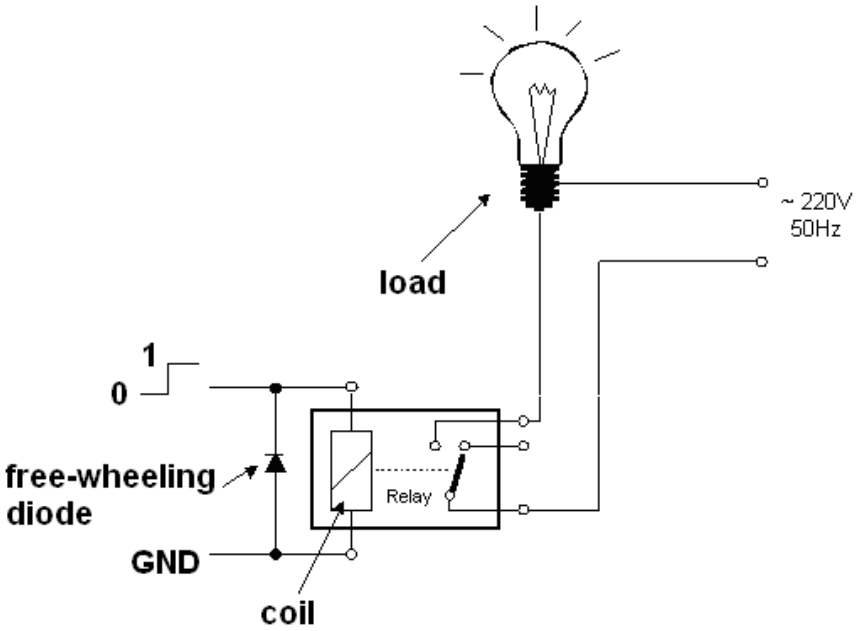
High Voltage Separation. Optocouplers have inherent high voltage separation qualities. Since the LED is completely separate from the photo-transistor, optocouplers can exhibit voltage isolation of 3kv or higher.

The Relay

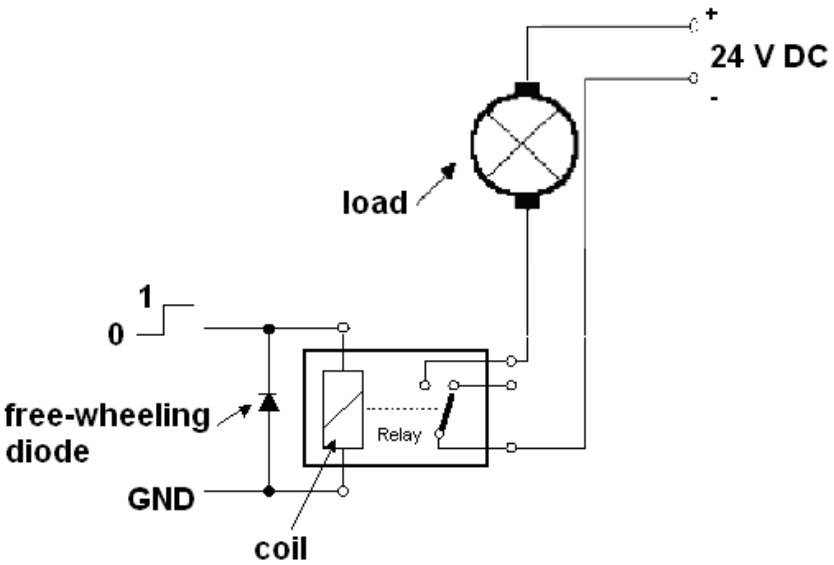
The relay is an electromechanical device, which transforms an electrical signal into mechanical movement. It consists of a coil of insulated wire on a metal core, and a metal armature with one or more contacts. When a supply voltage was delivered to the coil, current would flow and a magnetic field would be produced that moves the armature to close one set of contacts and/or open another set. When power is removed from the relay, the magnetic flux in the coil collapses and produces a fairly high voltage in the opposite direction.



The Relay



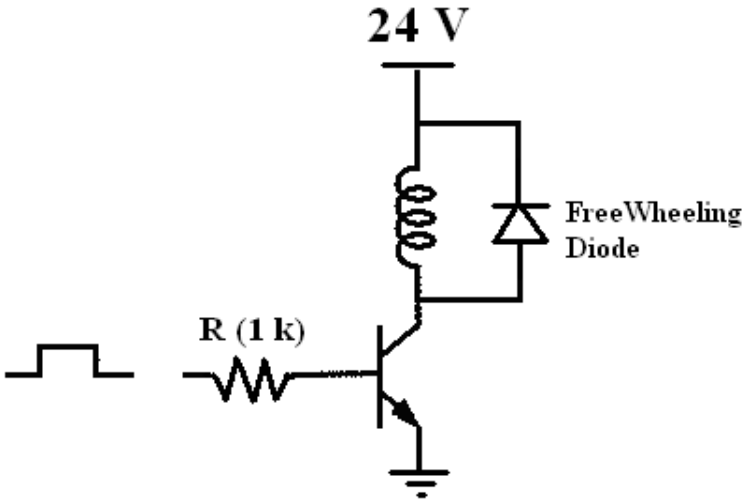
Interfacing an AC load to a digital circuit through a relay



Interfacing a DC load to a digital circuit through a relay

Transistors

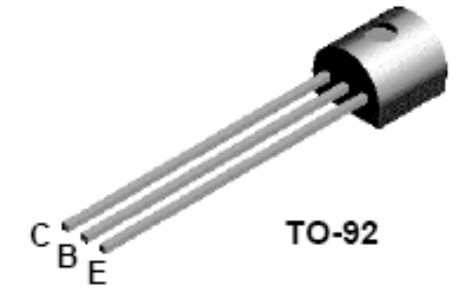
A **transistor** is a semiconductor device used to amplify and switch electronic signals. Transistors are commonly used as electronic switches. You can imagine the collector and emitter as two contact points of a switch. If the base is activated, then both contact points are closed Together; otherwise they are opened.



Interfacing an inductive load to a digital circuit through a transistor

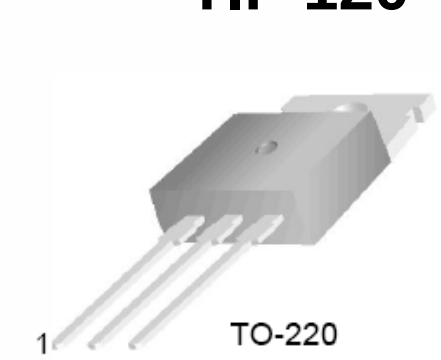
Transistors (Examples)

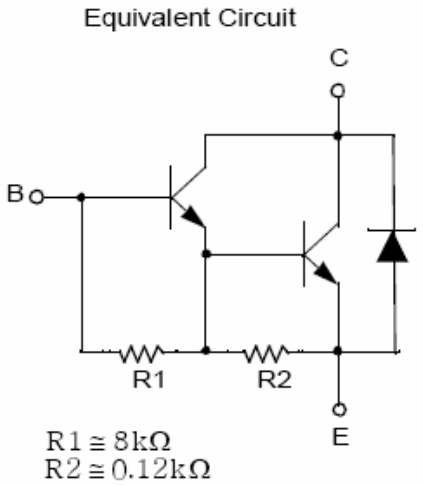
2N3904



Continuous collector current =200 mA

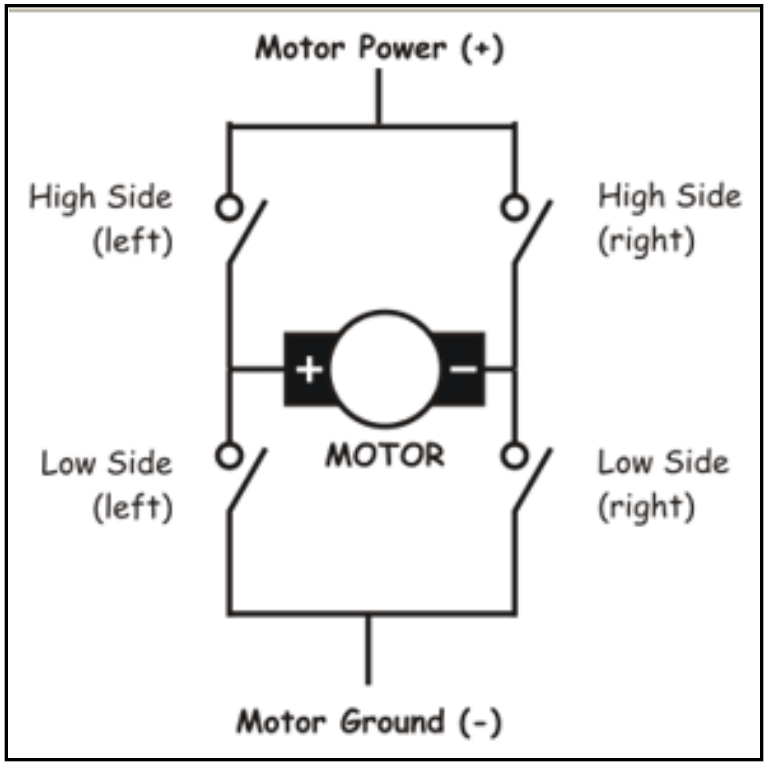
TIP 120

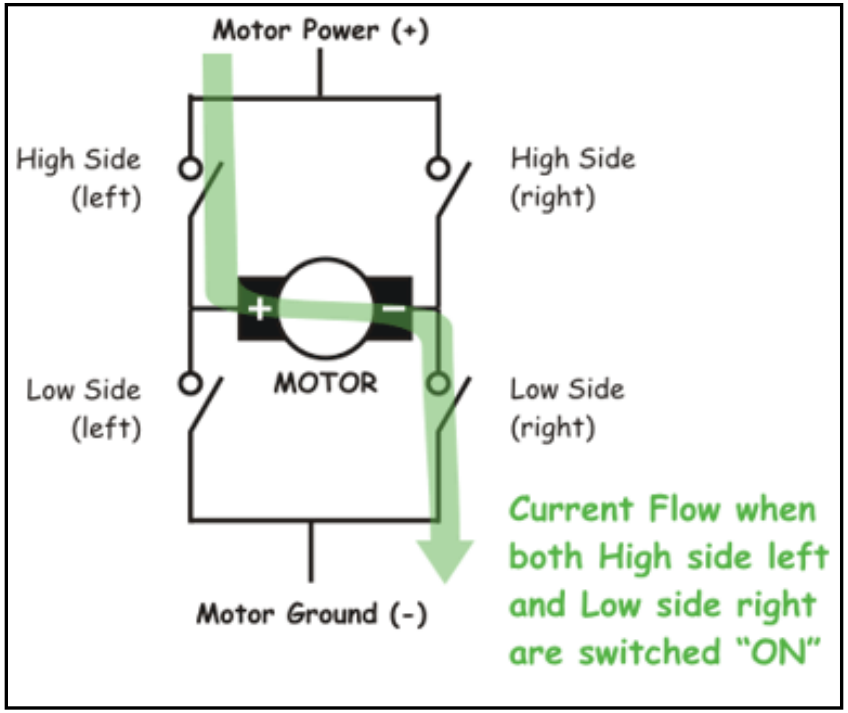




Continuous collector current = 5 A

H-Bridge

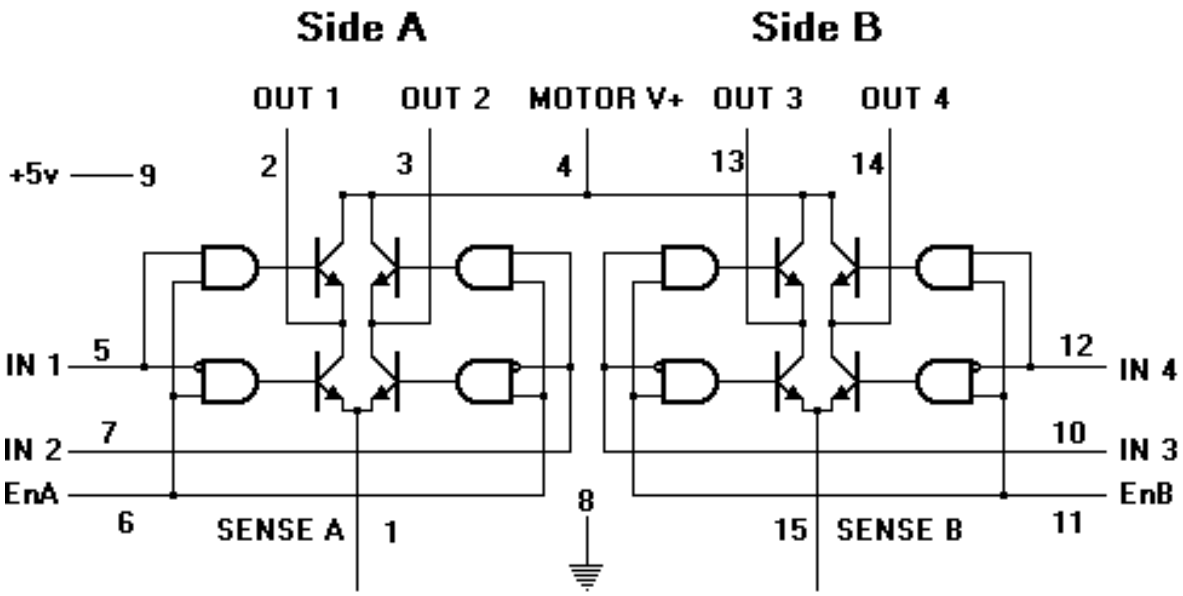

Motor Power (+)
High Side (left)
High Side (right)
MOTOR
Low Side (left)
Low Side (right)
Motor Ground (-)

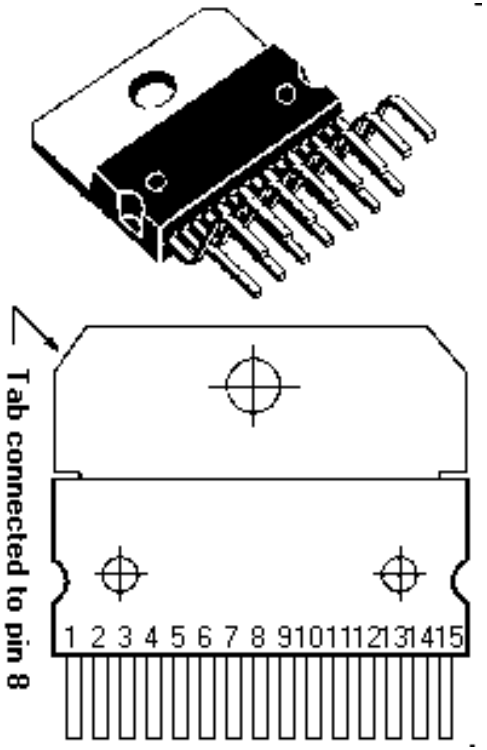

Motor Power (+)
High Side (left)
High Side (right)
MOTOR
Low Side (left)
Low Side (right)
Motor Ground (-)
Current Flow when both High side left and Low side right are switched "ON"

H-Bridge

Upper Left	Upper Right	Lower Left	Lower Right	Quadrant Description
On	Off	Off	On	Motor goes Clockwise
Off	On	On	Off	Motor goes Counter-clockwise
On	On	Off	Off	Motor "brakes" and decelerates
Off	Off	On	On	Motor "brakes" and decelerates

L298 Dual-Full Bridge Driver





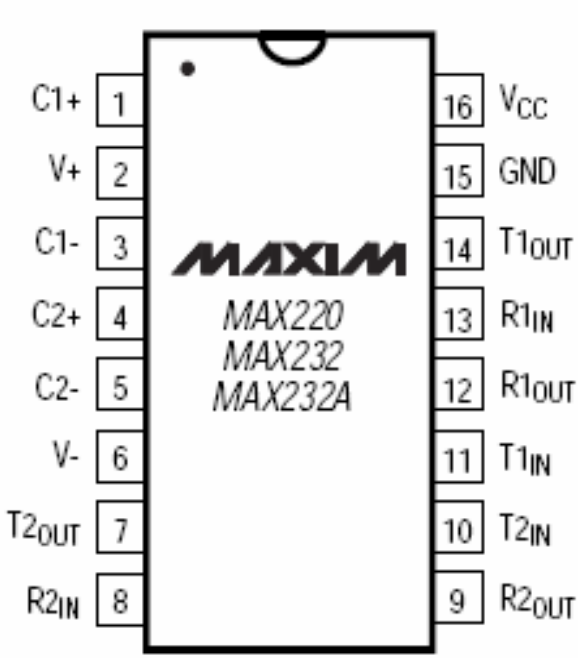
L298 Dual-Full Bridge Driver

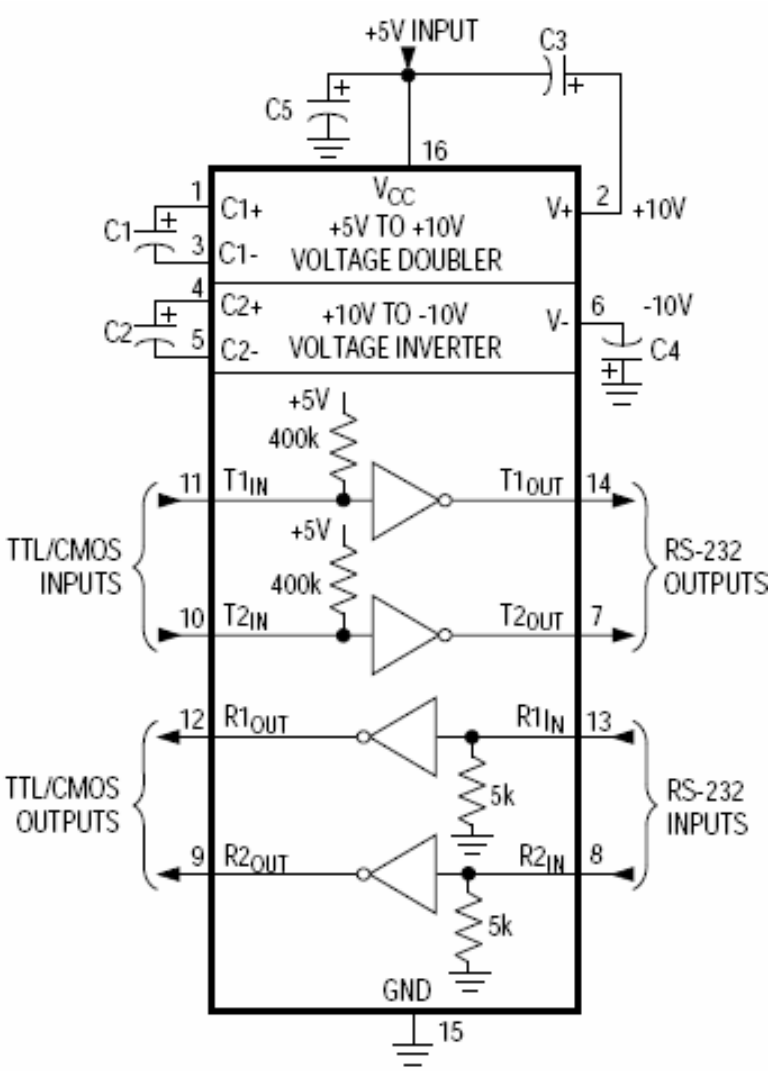
PIN FUNCTIONS (refer to the block diagram)

MW.15	Name	Function
1;15	Sense A; Sense B	Between this pin and ground is connected the sense resistor to control the current of the load.
2;3	Out 1; Out 2	Outputs of the Bridge A; the current that flows through the load connected between these two pins is monitored at pin 1.
4	V_S	Supply Voltage for the Power Output Stages. A non-inductive 100nF capacitor must be connected between this pin and ground.
5;7	Input 1; Input 2	TTL Compatible Inputs of the Bridge A.
6;11	Enable A; Enable B	TTL Compatible Enable Input: the L state disables the bridge A (enable A) and/or the bridge B (enable B).
8	GND	Ground.
9	VSS	Supply Voltage for the Logic Blocks. A100nF capacitor must be connected between this pin and ground.
10; 12	Input 3; Input 4	TTL Compatible Inputs of the Bridge B.
13; 14	Out 3; Out 4	Outputs of the Bridge B. The current that flows through the load connected between these two pins is monitored at pin 15.
–	N.C.	Not Connected

MAX 232

RS-232	TTL	Logic
-15V … -3V	+2V … +5V	High
+3V … +15V	0V … +0.8V	Low





Thank You For Your Attention!

Questions?