The ECE-118 L298N Dual 3A H-Bridge Module

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Background:

The STMicroelectronics L298N is a high-current dual H-bridge driver with integrated control logic. The L298 is an integrated monolithic circuit in a 15-lead Multiwatt and PowerSO20 packages with an integrated ground pad. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Internal circuit protection includes thermal shutdown with hysteresis, undervoltage monitoring, and crossover/short circuit current protection.

The ECE-118 L298N Dual 3A H-Bridge Module provides a convenient interface for the L298N. Separate connectors provide access to the logic-level inputs, H-bridge output connections, and the IC's power supply. This module makes use of a separate 7805 regulator to provide the required logic power voltage to the L298N. External Clamping diodes are included to complement the L298N and protect against inductive kickback.

The data sheet for the L298N motor driver 3A H-bridge chip can be found on the STMicroelectronics website at: https://www.st.com/resource/en/datasheet/l298.pdf

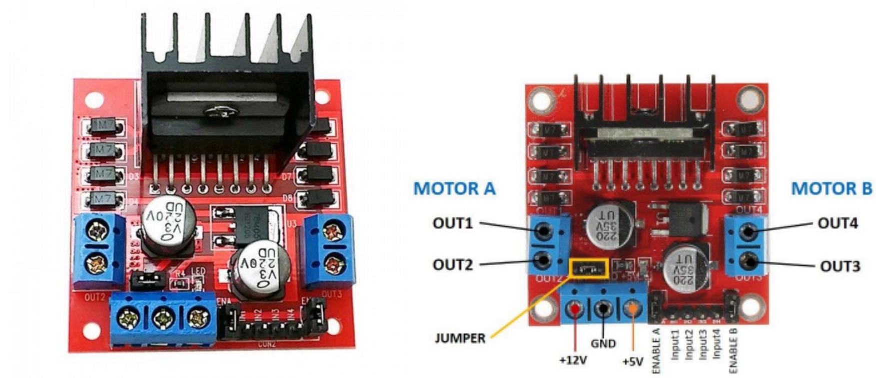


Figure 1: ECE118 L298N Dual H-Bridge Module and Connectors

Using the ECE118 L298N Dual 3A H-Bridge Module:

In order to make use of the ECE118 L298N Dual H-Bridge Module (shown in Fig. 1), you will need to be familiar with the various connectors and their purposes. Since each connector has a single logical function (inputs, outputs, power supply, etc.) this is straightforward.

Logic-Level Inputs (CON2):

Access to the logic-level inputs of the L298N is provided through CON2. Directional and transistor control for each of the two H-Bridges is specified through these connections, and marked on the PCB. Note that the two jumpers attached to ENA and ENB inputs should be removed before use (unless you are using dynamic braking); these jumpers connect the logical 5V output of the onboard regulator to the ENA/ENB pins.

There is no separate logic ground on this board to reduce noise. As such, care must be taken to provide a common ground between your micro and the L298 module.

The pinout of CON2 is as follows:

CON2	Connection
Pin 1	Enable A
Pin 2	In 1
Pin 3	In 2

Pin 4	In 3
Pin 5	In 4
Pin 6	Enable B

Note that pin 1 is on the left bottom side of the board, next to the power inputs. As per the datasheets, the acceptable logic level low (V_{IL}) ≤ 1.5V, and logic level high (V_{IH}) ≥ 2.3V. The H-bridge is symmetric in two "halves," with ENA, IN1, and IN2 controlling OUT1/OUT2, and ENB, IN3, and IN4 controlling OUT3/OUT4. Thus operation of only one side is discussed.

If the ENA line is low, the H-bridge is not enabled and the motor can coast freely as the drive is completely off and effectively disconnected from the motor leads. If the ENA is asserted (high), then the H-bridge is enabled and there are three possible states based on IN1 and IN2. If IN1 is high and IN2 is low, then the motor turns in the forward direction. If IN1 is low and IN2 is high, then the motor turns in the reverse direction. If IN1 and IN2 are either both high or both low, the motor is put into dynamic braking, where the leads of the motor are effectively shorted together.† This is show in the truth table below:

ENA	**IN1**	**IN2**	**OUTPUT**
0	X	X	Motor Free
1	1	0	Motor Forward
1	0	1	Motor Reverse
1	1/0	1/0	Dynamic Braking (In1 = In2)

In normal operation, you would connect your PWM signal to the ENA pin, and control the direction using the IN1/IN2 pins (in this mode, IN1 and IN2 would never be the same). Note that there are other ways to drive the load to get increased linearity using dynamic braking, but at the cost of increased complexity as you would need to switch the PWM input depending on which direction you were driving.‡

Motor/Load Connections (MOTOR A and MOTOR B):

Connections of one or two independent motors or similar loads should be made through the screw-terminal connector on the left or right side of the board (as pictured in Fig. 1):

MOTOR A	**Connection**
OUT1 & OUT2	motor/load A
MOTOR B	**Connection**
OUT3 & OUT4	motor/load B

Power Supply and High-Current Ground Connector (POWER):

The first requirement is that the module be powered. The motor voltage (V_s) is connected to the leftmost pin on the bottom of the board (this is one of the screw connectors and the one labeled "+12V" in Fig.1). Immediately next to it goes the ground. The module comes with an on-board regulator that will supply the 5V logic to the L298N chip; if for whatever reason you do not wish to use this regulator, then pull the jumper from just above the "+12V" pin and supply your own logic level to the chip through the "+5V" pin. The logic internal to the L298N must be powered either from the on-board regulator or through an externally applied logic voltage source. Note that there is no ground connection between the input port (CON2) and the power input (POWER), for noise reasons. The source of the input signal should be connected back to ground at the power supply or batteries.

Thought the power input pin is labeled as "+12V," the true range of power supply requirements is:

† Dynamic braking refers to the feedback of the EMF such that the motor is turned into an electrodynamic braking system. The spinning of the motor in the magnetic field induced a current in the coil, which flows around and produces an opposing torque. The faster the motor spins, the greater the opposing torque. Do a quick experiment: take a motor and spin it by hand, then do so again while the leads are shorted together. You will notice the dynamic braking easily.

‡ You should ensure that IN1 and IN2 are inverted using your software (`#defines` are helpful here). Alternately you can use an inverter to ensure the polarity is correct. IN1 and IN2 set the drive direction, and the PWM duty cycle on ENA determines the speed of rotation (or effective voltage).

L298N Power Supply Requirements: ***+7V < Vin (POWER, pin 1) < +46V***

Power, pin 2: Since the module is capable of switching two H-Bridge channels at a maximum of 2.5A each, care must be taken in the methods employed returning this substantial current to ground. For this reason, a robust ground connection should be made between pin 2 and the power supply of the motors/loads connected to the IC's outputs. This will ensure that the logic power supply maintains a clean ground.

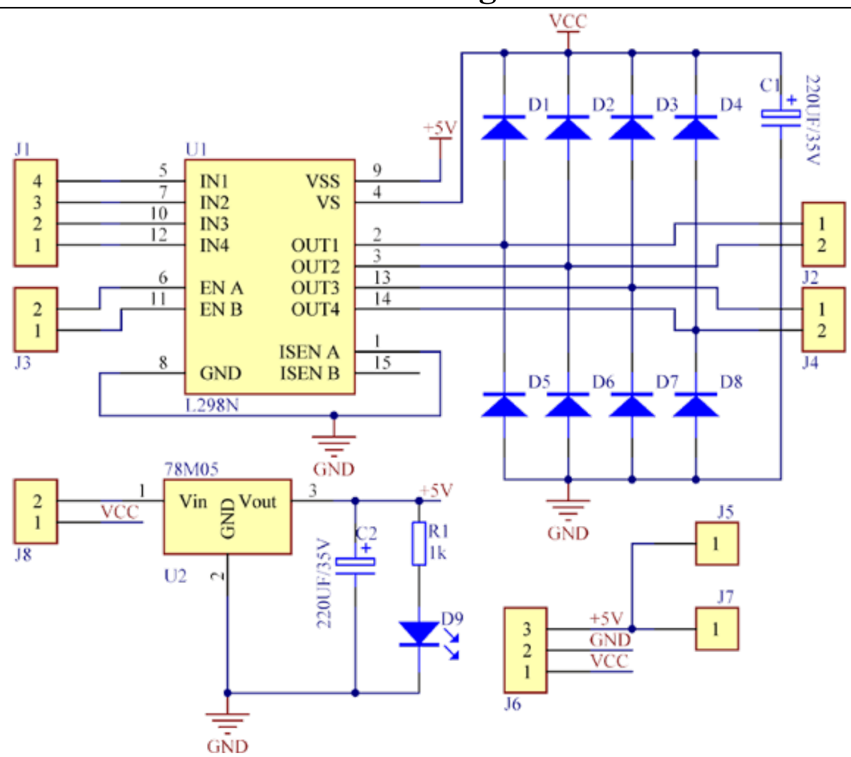
Power, pin 3: The module contains an on-board 7805 5V LDO regulator to generate the logic level V_{ss} required to operate the L298. The regulator requires a minimum of 2V drop to maintain its output voltage, thus the minimum V_s of 7V is required. If the onboard regulator is not used, then you must supply the logic level V_{ss} on pin 3 of the power connector, between 4.5V and 7V.[§] The regulator can be disabled by removing the jumper just above the "+12V" power input. Note that if the jumper is left in, then the 5V output from the 7805 is available on pin 3.

POWER	Connection
Pin 1	Power (7V to 46V)
Pin 2	High Current Ground
Pin 3	5V from 7805 or V_{ss} (4.5V to 7V)

Vss LED (LED6):

The L298N module has a single power good LED on the 5V logic level rail (V_{ss}). This is either from the on-board 7805 regulator or from the user supplied V_{ss} (assuming that the 5V power jumper has been removed).

CMPE118 DRV8814 Dual 2.5A H-Bridge Module Schematic:



[§] Note here that the maximum voltage for the 7805 is 35V, which means that if you drive the L298N module at greater than 35V, you will need to supply your own Vss. Furthermore, while the maximum voltage for the 7805 is 35V, likely you will have thermal shutdown and overheating since the on board 7805 does not have a heatsink on it.