HB-310: 10-Amp H-Bridge

The HB-310 single channel H-bridge enables smooth control of the speed and direction of a DC motor using 3 logic-level inputs. Low on-resistance MOSFETs allow for high efficiency control with minimal power loss. Designed to mount onto a proto-board, the controller also has terminal blocks for quick connection to the motor and power supply.

Features:

- 6 V to 30 V Operation
- Supports Forward, Reverse, Brake and Coast of the Motor.
- PWM Input allows variable speed control.
- H-Bridge Disable Input
- High Efficiency MOSFET design for cool operation

Ample Protection:

- Short-circuit protection
- Over-temperature shutoff
- Under-voltage lockout
- Reverse-polarity protected

Versatile Connections:

- 8 pin SIP header for vertical proto-board mounting
- Terminal blocks for power and motor connections

Absolute Maximum Ratings:

Parameter	Max	Units
DC Input Voltage	30	V
Continuous Output Current	10	A
Momentary Output Current, T=0.5 second	20	A
Logic Level Input	6	V

Warning – operating at or above the absolute maximum ratings may damage the controller and/or the equipment under control.

Electrical Characteristics:

Power Supply:

Parameter	Min	Typical	Max	Units
Power Supply Voltage	6	--	30	V
Logic Supply Voltage	4.5	5	6	V
Continuous Output Current	--	--	10	A
Quiescent Current Drain (Motor Output Current = 0)	--	--	15	mA
Temperature	-40	25	+85	°C

Logic Inputs:

Parameter	Min	Typical	Max	Units
Low Level (IN1, IN2, PWM)	0	0	1.4	V
High Level (IN1, IN2, PWM)	3.4	5	6	V

Power Outputs: (M+, M-)

Parameter	Min	Typical	Max	Units
Switch On Resistance, High Side (I_{OUT} = 10A)	--	23	60	mΩ
Switch On Resistance, Low Side (I_{OUT} = 10A)	--	11	30	mΩ
Leakage Current (output stage switched off)	--	--	100	µA
Free-Wheeling Diode Forward Voltage (I_{out} = 10A)	--	0.6	1.1	V
Free-Wheeling Diode Reverse Recovery Time	100	--	--	nS
Switch-Off Temperature (Over-Heat Protection)	--	160	190	°C

Timing:

Parameter	Min	Typical	Max	Units
PWM Frequency	--	--	10	kHz
Output On Delay (IN1 → M+ or IN2 → M-)	--	100	300	µS
Output Off Delay (IN1 → M+ or IN2 → M-)	--	85	255	µS

Pin-out:

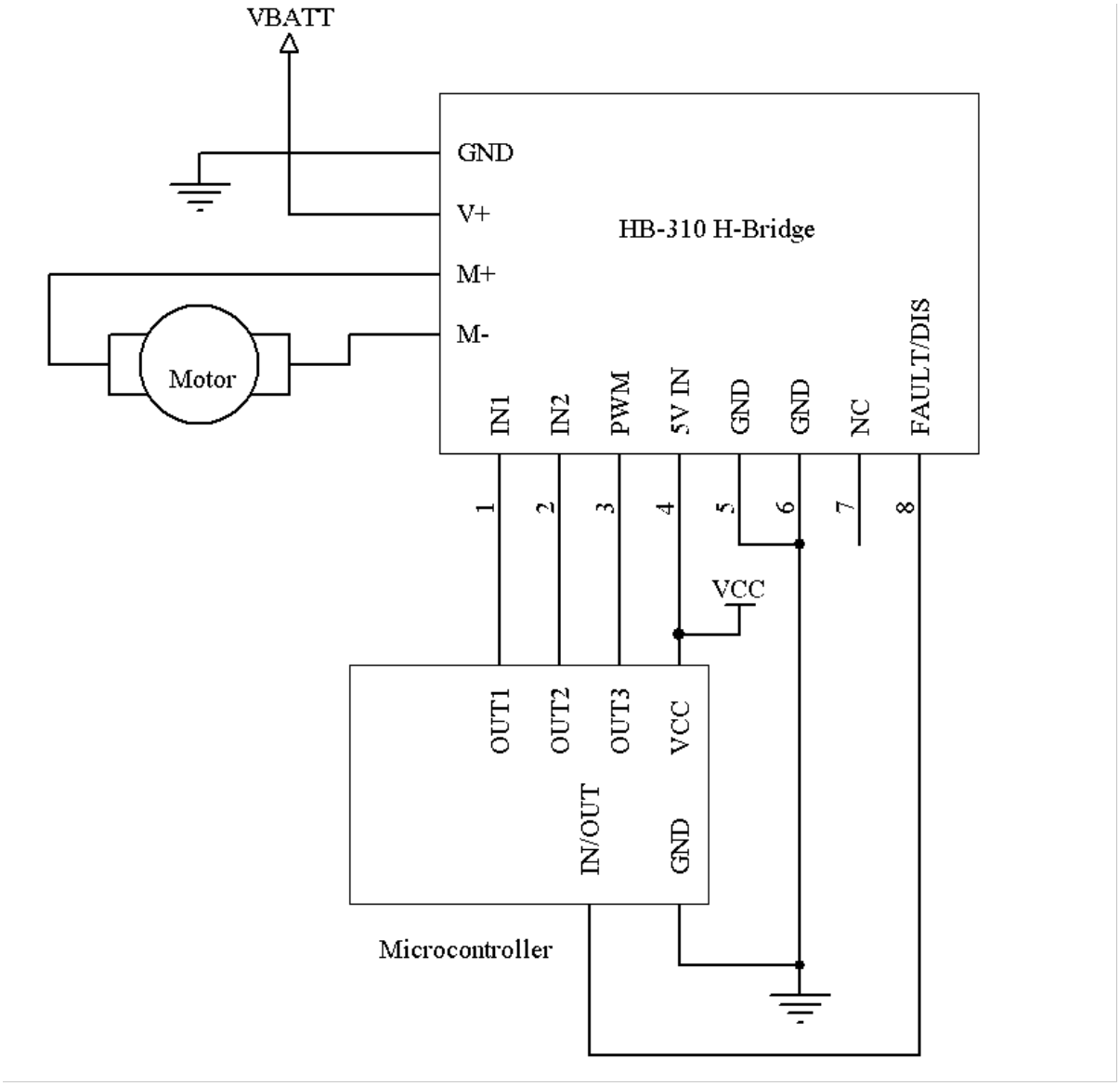
8 pin SIP header pins (left to right):

Pin Number	Pin Label	Function	Notes
1	**IN1**	Switch Input 1	See truth table
2	**IN2**	Switch Input 2	See truth table
3	**PWM**	Switch Enable	See truth table
4	**5V IN**	5V Supply voltage to Logic	
5	**GND**	Negative terminal (ground) from power supply	Also on terminal blocks
6	**GND**	Negative terminal (ground) from power supply	Also on terminal blocks
7	**NA**	Not Used	
8	**FAULT / DIS**	Fault Output, Disable Input	Active Low

Device Truth Table:

Modes	Device State	Input Conditions			Outputs		
		IN1	IN2	PWM	M+	M-	FAULT
Typical	1 – Forward	L	H	H	H	L	H
	2 – Reverse	H	L	H	L	H	H
	3 – Free-Wheeling Low (Brake)	L	L	H	L	L	H
	4 – Free-Wheeling High (Brake)	H	H	H	H	H	H
	5 – Coast	X	X	L	Z	Z	H
Protection Active	9 – Under Voltage Lockout	X	X	X	Z	Z	L
	10 – Over Temperature	X	X	X	Z	Z	L
	11 – Over Current	X	X	X	Z	Z	L

Typical Connections:



Pin 4 should be connected to the microcontroller's 5V power supply.

VBATT is the supply voltage for the motor. This voltage should not exceed 30 volts.

The FAULT in can be left disconnected if not used.

Installation:

The HB-310 can be installed onto a proto-board using the 8-pin SIP connector. The SIP connector only carries the logic signals. Use the terminal blocks for the power supply and motor connections.

For permanent installations, mounting holes are provided at the corners of the board. A SIP socket can be used to connect to the logic pins.

Operation:

The three inputs, IN1, IN2 and PWM are used to control the operation of the H-bridge.

IN1 and IN2 effectively control the direction of the motor. If both IN1 and IN2 are at the same logic level, the controller is in Braking mode.

The PWM input is typically switched on and off using pulse width modulation to control the average driving power to the motor in either direction. When in braking mode, it controls the average braking power of the motor. When the PWM pin is held low, the motor coasts freely.

Please see the truth table for more detail.

The FAULT/DIS pin acts as both an input pin and an output pin. During normal operation, this pin is held high. A low on this pin will cause both drivers to go into a high impedance state, and the motor coasts. If there is a fault condition during normal operation, such as over temperature, or over current, the FAULT pin will be pulled low internally. This can be used to detect that a fault condition has occurred. If this feature is not used, leave this pin disconnected.

Pin 4 is the 5V power supply input. This should be regulated, and should be the same supply voltage used by the microcontroller or device controlling the IN1, IN2 and PWM logic inputs.

Protection Modes:

Short Circuit:

If the output is shorted and the current draw exceeds 45 Amps, the output will shut down. However, if the power source cannot sustain that much current anyway, the supply voltage will sag, effectively limiting the current that flows through the bridge. Ensure that a fuse rated for the size of the load is used to protect the motor and the wiring.

Under-voltage:

If the input voltage is less than 6 volts, the H-Bridge will become disabled to prevent unpredictable operation. If the voltage momentarily sags below 6 volts, such as during motor startup, the bridge may also go into under-voltage lockout mode. Ensure that your power supply is adequate to handle the current to prevent severe voltage drops when the load is started.

Over-temperature:

During normal operation within the maximum limits of the controller, the controller should not go into over-temperature shut down. In the event that the internal die temperature goes above 150 degrees C, the controller will automatically shut down to prevent damage.

Reverse Polarity:

A reverse polarity protection circuit prevents any damage should the board be inadvertently connected backwards to the power supply.

Design Considerations:

Ensure that the wires carrying the load current are adequately sized. The controller should be located as close to the power supply as possible. If the wires between the power source and the controller need to be greater than 3 feet long, then add a 470 µF capacitor rated for at least twice the supply voltage across the power input terminals of the controller.

Keep the POWER ground wires and the LOGIC ground wires separate. The microcontroller's ground connection should go to the 8 pin header and not directly to the terminal blocks. The terminal blocks should only be used to connect directly to the motor power supply and the motor.

PWM controllers switch currents at high frequencies to vary the average power to the load. This switching can cause undesirable RF interference. To minimize such interference, it is recommended to twist the input V+ and Ground wire pair as well as the M+ and M- wire pair. In addition, installation of a small capacitor from each of the two motor terminals to the metal case may reduce noise emission.

Always turn off the power supply before making any changes to the wiring.

This H-Bridge has a maximum PWM frequency rating of 10 kHz. Exceeding this frequency can result in damage to the bridge.

Ensure that the controller has adequate air flow for proper cooling. If operating for extended periods of time in high temperature environments at maximum capacity, a cooling fan may be necessary.

30-Day Limited Warranty: