

DC Motor Board

User Manual

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Chapter 1. DC Motor Board

1. Overview

The DC Motor Board is a variable speed controller for 12V brushed DC motors at upto 1.0 Amp continuous current. The board offers a high degree of isolation with the use of high speed 10 MBps Logic Gate opto-isolators for isolation between low voltage control side and high voltage motor side.

The heart of the board is an Si9986, an integrated buffered H-bridge, with TTL compatible inputs. The Si9986 has the capability of delivering a continuous 1.0 Amp at 12V with switching rates up to 200kHz. By supporting high-frequency pulse width modulation (PWM), the DC motor can run smoothly and quietly over a wide speed range.

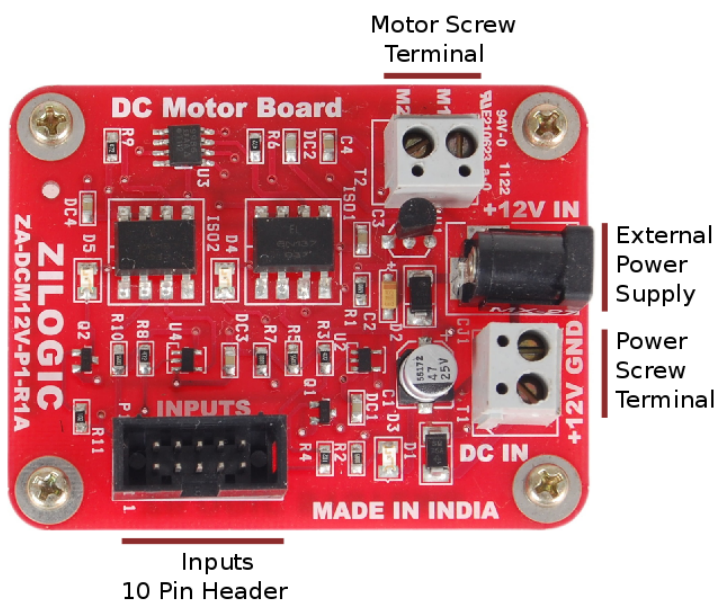
2. Board Features

- Controls brushed 12 V DC motors up to 1.0 A continuous current.
- High Speed Opto-isolated inputs.
- 200 kHz Switching Rate.
- PWM input signal state indication by LEDs.
- Heavy duty screw terminal blocks for motor connection.
- Standard TTL compatible inputs used with most microcontrollers and control systems.
- 0.1" FRC header for connection to control logic/MCU.
- Ready to go with Zilogic's motherboards.
- Controlled through digital or PWM signals.
- Supports forward, reverse & brake mode.

3. Locating Components

The location of the components on the board is indicated in the following diagram.

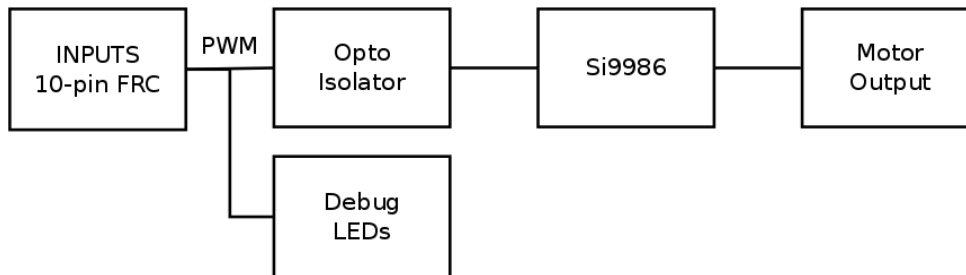
Figure 1.1. Front View



4. Block Diagram

The devices available on the board, is shown in the following block diagram. Each device is described in detail in the following sections.

Figure 1.2. Block Diagram



5. Power Supply

The DC motor board is powered from the motherboard through the **VCC** on the 14-pin FRC header. The motor is itself powered from a 12V external power supply, applied through a standard power jack or screw terminal. Detailed power supply specifications are available in section Specifications.

6. Debug LEDs

The Debug LEDs indicate the duty cycle of the PWM signal. If the PWM signal duty cycle is 100%, then the corresponding LED turns ON. If the PWM signal duty cycle is 0%, then the corresponding LED turns OFF. For intermediate duty cycles, the corresponding LED's brightness varies between ON and OFF.

7. Connectivity

7.1. INPUTS Header

The DC motor board can be interfaced with a motherboard through the **INPUTS** 10 pin FRC connector. The signal details are given below.

Table 1.1. FRC-10 Connector

Pin #	Signal	Signal Type
1	5V	Supply from motherboard
2	PWM0	TTL In ¹
3	PWM1	TTL In ¹
4	Not Connected	-
5	Not Connected	-
6	Not Connected	-
7	Not Connected	-
8	Not Connected	-
9	Not Connected	-
10	GND	Ground

¹ 5V tolerant input

7.2. DC IN Connector


The DC IN connector is used to provide an external 12V power supply for the DC motor.

Table 1.2. DC IN Connector

Signal	Signal Type
+12V	+12V from external supply
GND	Ground

8. Specification

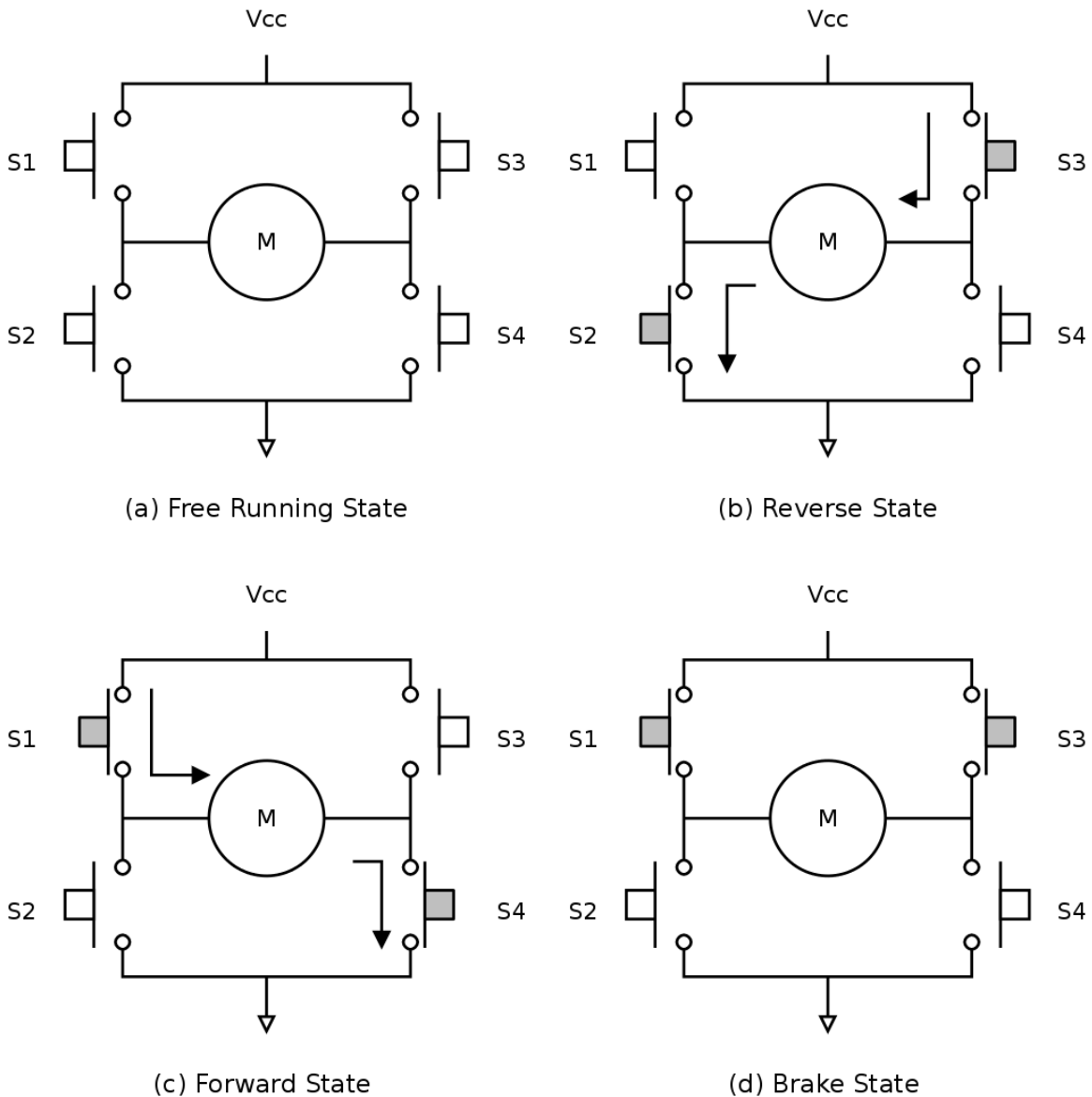
Table 1.3. Specifications

Parameter	Value	Condition
VCC		
Voltage	5V	
Max. Current	10mA	
External Power Supply		
Voltage	12V	
Max. Current	1A	
Polarity		
Digital Input		
Input Low Voltage	0.0 - 0.8V	
Input High Voltage	2.0 - 5.0V	
Max. Switching Rate	200KHz	

Chapter 2. Board Usage

1. Basic H-Bridge Operation

The H-Bridge is an electronic circuit that allows voltage to be applied to a motor in either direction, and thus control the direction of rotation of the motor. A simple H-Bridge constructed using switches is shown in the following diagram. By controlling the switches the motor can be made to rotate forward, reverse, brake, and free run. The various switch states and their effect on the motor is shown in the following table.



S1	S2	S3	S4	Function
0	0	0	0	Free-run
0	1	1	0	Reverse
1	0	0	1	Forward
0	1	0	1	Brake
1	0	1	0	Brake

Forward	The current to flows in one direction through the motor.
Reverse	The current flows in the opposite direction through the motor.
Brake	Applying same voltage to both the terminals, counters the back EMF produced by the motor, and causes it to come to a sudden stop.
Free-run	Power is cut-off from the motor, and the motor free-runs and eventually stops.

To control the motor through digital / PWM signals, the switches are replaced by transistors / MOSFETs. Driver ICs like the Si9986, A3901, L298, etc. that implement the H-Bridge can also be used for motor control applications.

2. Motor Control

The DC motor board has H-bridge motor driver IC, Si9986. By controlling the inputs, various functions can be selected, as shown in the table below.

Table 2.1. DC Motor

PWM0	PWM1	Function
0	0	Free-run
1	0	Forward
0	1	Reverse
1	1	Brake

When in Forward state or Reverse state, the speed of the motor can be controlled by driving the inputs with a PWM signal

PWM0 Duty	PWM1 Duty	Function
0%	0%	Brake
100%	100%	Brake
0%	100%	Reverse, full speed
100%	0%	Forward, full speed
0%	X%	Reverse, speed proportional to duty cycle
X%	0%	Forward, speed proportional to duty cycle

Appendix A. Legal Information

1. Copying

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The warranties provided by Zilogic Systems in this Limited Hardware Warranty apply only to Hardware Products you purchase for your use, and not for resale. The term "Hardware Product" means a computing device with a specific function and limited configuration ability.

2.1. LIMITED HARDWARE WARRANTY

Zilogic Systems warrants that the hardware components of its Hardware Product shall be free from material defects in design, materials, and workmanship and will function, under normal use and circumstances, in accordance with the documentation provided, for a period of one (1) year from the date of purchase of the Hardware Product.

Your sole and exclusive remedy, and Zilogic Systems' sole and exclusive liability for defective hardware components, shall be that Zilogic Systems, subject to the terms and conditions of this Section, and solely upon confirmation of a defect or failure of a hardware component to perform as warranted, shall at its sole option, either repair or replace the nonconforming hardware component. All replacement parts furnished to you under this warranty shall be refurbished and equivalent to new, and shall be warranted as new for the remainder of the original warranty period. All defective parts, which have been replaced, shall become the property of Zilogic Systems. All defective parts that have been repaired shall remain your property.

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2.3. HARDWARE RETURN PROCEDURES

If a Hardware Product or one of its component parts does not function as warranted during the warranty period, and such nonconformance can be verified by Zilogic Systems, Zilogic Systems, at

its election, will provide either return and replacement service or replacement with a refurbished part/unit for the Hardware Product under the type of warranty service Zilogic Systems designates for that Hardware Product. A defective Hardware Product or one of its component parts may only be returned to Zilogic Systems upon Zilogic Systems' prior written approval. Any such approval shall reference an RMA number issued by an authorized Zilogic Systems service representative. If you do not register the Hardware Product with Zilogic Systems, you may be required to present proof of purchase as evidence of your entitlement to warranty service. The Hardware Product's serial number will be required for all RMA cases.

Transportation costs, if any, incurred in connection with the return of a defective item to Zilogic Systems shall be borne by You. Any transportation costs incurred in connection with the redelivery of a repaired or replacement item to You by Zilogic Systems shall be borne by Zilogic Systems; provided, however, that if Zilogic Systems determines, in its sole discretion, that the allegedly defective item is not covered by the terms and conditions of the warranty or that a warranty claim is made after the warranty period, the cost of the repair by Zilogic Systems, including all shipping expenses, shall be reimbursed by You.

2.4. HARDWARE REPLACEMENT PROCEDURES

Zilogic Systems will attempt to diagnose and resolve your problem over the phone or e-mail. Upon determination of the hardware issue is related to a malfunction of one of the Hardware Product components, an RMA process will be initiated by Zilogic Systems.

For Warranty Replacement service, it is required that you deliver the faulty unit to a location Zilogic Systems designates, and provide courier name and tracking number to Zilogic Systems. After the Faulty unit is returned to Zilogic Systems, Zilogic Systems will use commercially reasonable efforts to ship the replacement hardware within fourteen (14) business days. Actual delivery times may vary depending on availability of the spares and customer's location.

2.5. ADDITIONAL RESPONSIBILITIES

You agree:

- To provide Zilogic Systems or its partner with sufficient and safe access to your facilities to permit Zilogic Systems to fulfill its obligations.
- To ship back the faulty Hardware Product (or replaceable unit) suitably packaged, quoting the RMA number, to the Zilogic Systems designated location.
- You shall ship the faulty Hardware Product once Zilogic Systems approves the RMA and provide the courier name and tracking number.
- To securely erase from any Hardware Product you return to Zilogic Systems for any reason all programs and data not provided by Zilogic Systems with the Hardware Product. You acknowledge that in order to perform its responsibilities under this Limited Hardware Warranty, Zilogic Systems may ship all or part of the Hardware Product or its software to third party locations around the world, and you authorize Zilogic Systems to do so.

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