DRV8704 Evaluation Module

This document is provided with the DRV8704 customer evaluation module (EVM) as a supplement to the DRV8704 datasheet (SLVSD29). The datasheet details the hardware implementation of the EVM.

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1 Printed Circuit Board (PCB) Layout

Figure 1 illustrates the typical EVM board configuration.

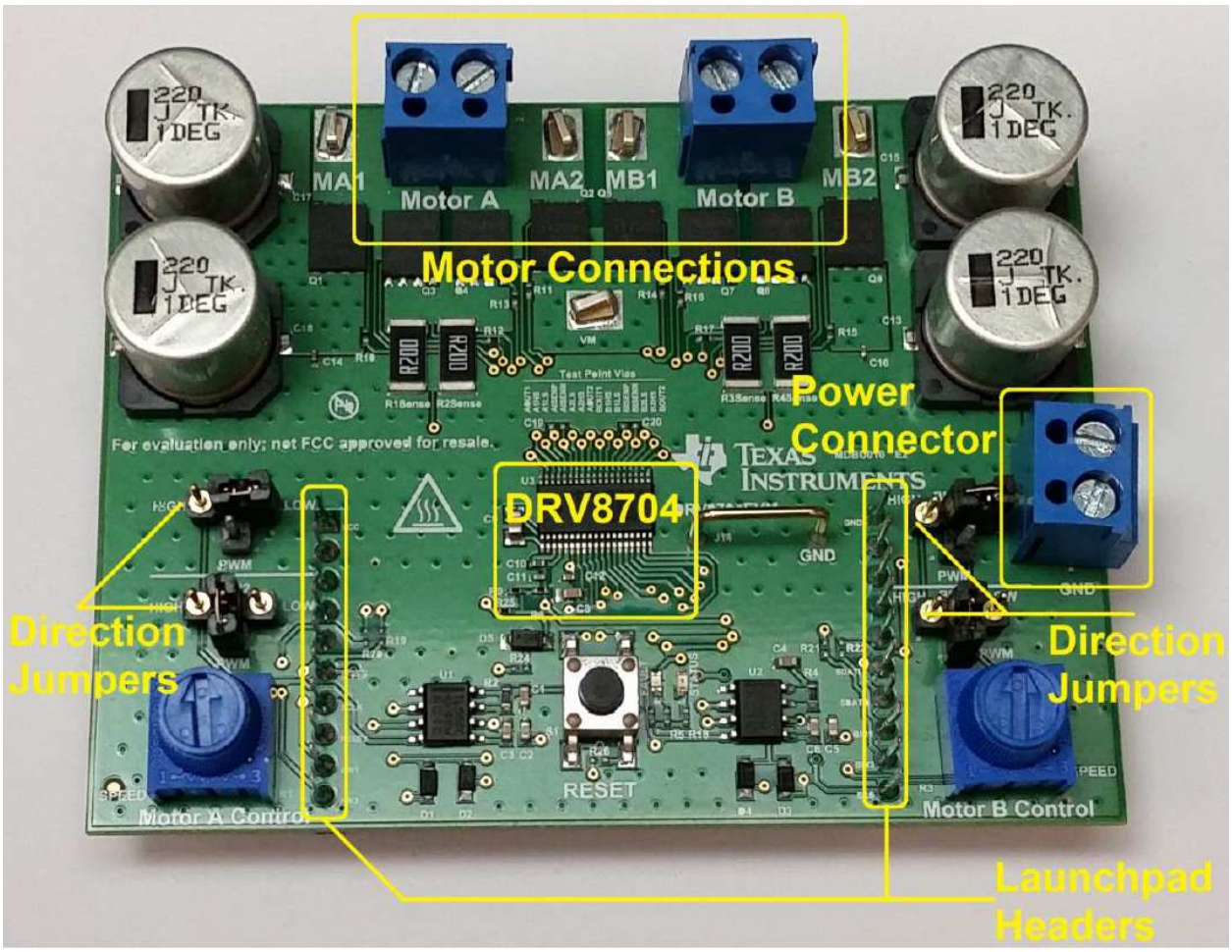


Figure 1. Typical Board Configuration (EVM Provided may Vary)

2 Introduction

The DRV8704 customer EVM is a platform built around the DRV8704, a dual H-bridge brushed DC motor driver with highly-configurable power stage. This device is optimized to drive two different brushed DC motors with variable current limiting and an internal 5-V LDO for powering peripheral devices.

The EVM includes two 555-timer circuits configured to switch at approximately 25 kHz with independently variable duty-cycles. Each 555 timer is tied to a jumper pin allowing the user to select which channel of the DRV8704 is receiving the PWM signal. This analog generation of PWM signals allows for standalone use of the EVM without any firmware being flashed onto a microcontroller.

If the user would like to control the EVM using an MCU, the two 10×1, 100-mil headers can be docked to TI's MSP430™ LaunchPad™ and controlled using whatever firmware is supplied by the user. SPI commands can be written or read by simply docking the EVM to a LaunchPad or tying into the 4 SPI pins with another MCU.

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2.1 Connectors

The DRV8704EVM allows connections to VM (motor voltage) power rail via a terminal block (J9). A test clip labeled VM is available to probe the input power rail. Figure 2 shows the connections to the EVM.

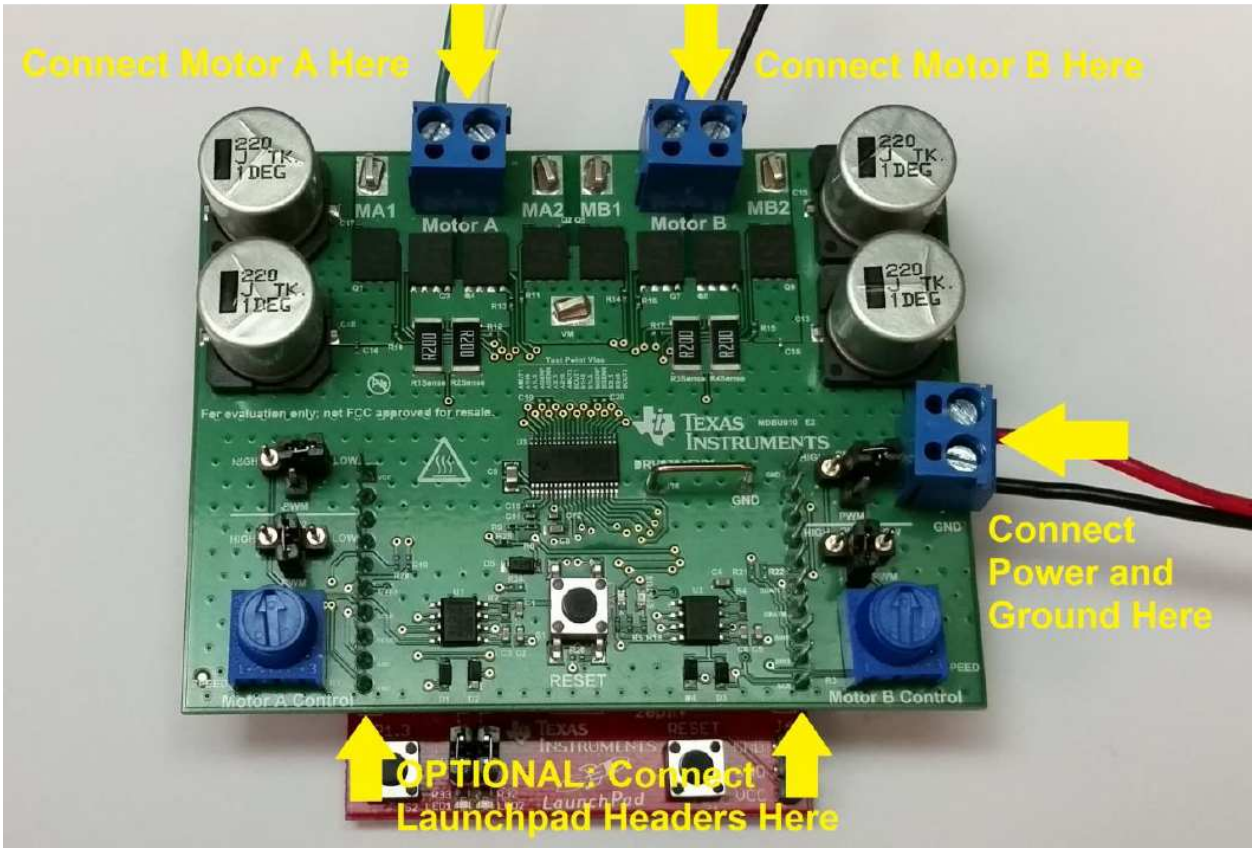


Figure 2. EVM Connections

2.2 Test Points

Five SMT test points are provided for VM, MA1, MA2, MB1, and MB2 on each of their respective board planes. The DRV8704 output control signals are labeled and can be measured by probing the vias with the designated output label. Two 10×1, 100-mil headers on the board can be probed to monitor SPI signals going between the driver and external MCU, if connected. Each test point is labeled on the evaluation module and connects to a same named pin of the DRV8704.

Table 1. Test Point Labels and Descriptions

Test Point Label	Description
MA1	MA1, Motor A bridge connection 1
MA2	MA2, Motor A bridge connection 2
MB1	MB1, Motor B bridge connection 1
MB2	MB2, Motor B bridge connection 2
VM	VM, Motor voltage supply
AOUT1	AOUT1, Output node of bridge A out 1
A1HS	A1HS, Bridge A out 1 HS FET gate
A1LS	A1LS, Bridge A out 1 LS FET gate
AISENP	AISENP, Current sense resistor for bridge A
AISENN	AISENN, Ground at sense resistor for bridge A

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Table 1. Test Point Labels and Descriptions (continued)

Test Point Label	Description
A2LS	A2LS, Bridge A out 2 LS FET gate
A2HS	A2HS, Bridge A out 2 HS FET gate
AOUT2	BOUT2, Output node of bridge B out 2
BOUT1	BOUT1, Output node of bridge B out 1
B1HS	B1HS, Bridge B out 1 HS FET gate
B1LS	B1LS, Bridge B out 1 LS FET gate
BISENP	BISENP, Current sense resistor for bridge B
BISENN	BISENN, Ground at sense resistor for bridge B
B2LS	B2LS, Bridge B out 2 LS FET gate
B2HS	B2HS, Bridge B out 2 HS FET gate
BOUT2	BOUT2, Output node of bridge B out 2

2.3 Jumpers

If the user is not controlling the DRV8704 using the LaunchPad headers, then the two LM555 timers are supplying the speed signals and must be properly configured for each of the four motor inputs. For motor A. the inputs AIN1 and AIN2 are located on the left side of the board and motor B inputs BIN1 and BIN2 are located on the right side of the board. The headers used to configure the speed and direction signals are shown in Table 2.

Table 2. Motor Input Pins and Assigned Headers

Motor Input Pin	Assigned Headers
AIN1	J1, J2
AIN2	J3, J4
BIN1	J5, J6
BIN2	J7, J8

Table 3 shows the different connection states for both motor A and motor B inputs.

NOTE: The direction the motor will spin in is dependent on the polarity of the motor lead connections to the bridge connections. Refer to the motor datasheet to determine which phase should be connected to each terminal block.

Table 3. Motor Input Pin States and Output Conditions

xIN1	xIN2	Motor x Output
High	Low	Full speed forward current
High	High	Brake, Low-side slow decay
Low	Low	Coast, H-bridge disabled
Low	High	Full speed reverse current
High	PWM	Reverse current + Slow decay
PWM	High	Forward current + Slow decay
Low	PWM	Reverse current + Fast decay
PWM	Low	Forward current + Fast decay
PWM	PWM	No output
No Connection	No Connection	External controller connected

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2.4 Duty-Cycle Potentiometers (R1 and R3)

To control the speed of motors A and B, the blue potentiometers located in the bottom left and right corners of the EVM can be used to vary the duty-cycle of the control signal sent to each motors' respective input channels. The potentiometer with the label “Motor A Control” can be used to vary the duty-cycle of the PWM input available to AIN1/AIN2 and the potentiometer with the label “Motor B Control” can be used to vary the duty-cycle of the PWM input available to BIN1/BIN2.

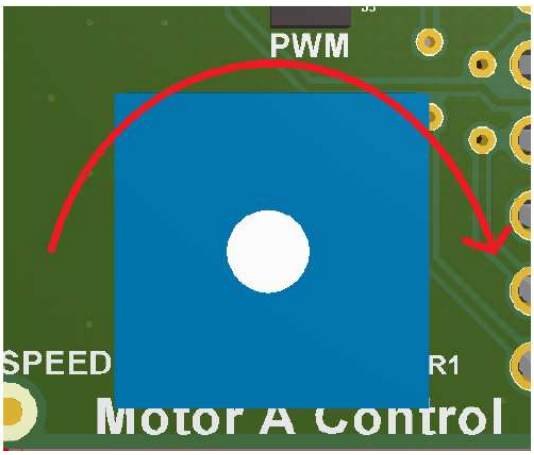


Figure 3. Motor Speed Control Potentiometer

2.5 Motor Outputs

Two motor connectors are provided through J10 and J11 as shown in Figure 2.

2.6 Operation of the EVM

Use the following steps to operate the EVM:

1. Connect two brushed DC motors to connectors J10 and J11.
2. Adjust the motor (A or B) control potentiometers R1 and R3 to a minimum voltage by turning them all the way counter-clockwise.
3. Connect VM and GND to the J9 connector. If the DRV8704 EVM is powered, a green status LED will be lit.
4. Configure the AIN1, AIN2, BIN1, and BIN2 jumpers as desired. If using the PWM signals, adjust the motor (A or B) control potentiometers clockwise to increase speed and the respective motor (A or B, depending on which potentiometer is adjusted) will start to turn.
5. To change direction, reconfigure the AIN1/AIN2 or BIN1/BIN2 connections to provide desired input states as described in the DRV8704 data sheet (SLVSD29).

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2.7 SPI Operation of the EVM

To operate the DRV8704 using SPI registers and an MSP430 LaunchPad, the following instructions are a guide on how to configure the EVM. For an introduction to SPI communication programming an Energia SPI library function definition, use the following link: http://energia.nu/reference/spi

1. Once the pads have been connected, locate R22 connected to the SLEEP Net and remove from the board. This will stop the Zener diode and voltage divider circuit from automatically pulling up the SLEEP pin on the DRV8704.

CAUTION

Failure to remove R22 prior to powering on the EVM while the LaunchPad is connected will damage the LaunchPad.

2. To operate the EVM using only SPI commands, remove the jumpers from headers J1/J2, J3/J4, J5/J6, and J7/J8.
3. Next, locate the solder pads for R17, R18, R19, R20, R21, and R26 as shown in Figure 4. These pads need to be connected using 0-Ω, 0402 package resistors in order to control the DRV8704 using just an MCU.

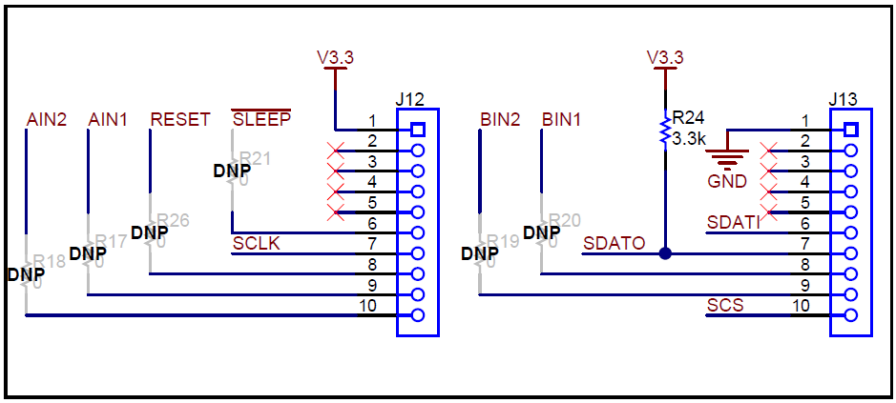


Figure 4. LaunchPad Headers

4. Now the EVM has been configured for use with an MSP430 LaunchPad and can be docked using the J12 and J13 headers as shown in Figure 2. User supplied firmware can now be used to control the DRV8704EVM.

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