User's Guide

DRV8770EVM User's Guide

ABSTRACT

This document is provided with the DRV8770EVM customer evaluation module (EVM) as a supplement to the DRV8770 100-V gate driver datasheet. This user's guide details the hardware implementation of the EVM, description of the EVM components, how to flash the on-board MCU with modified firmware, and the procedure of spinning a motor with the EVM.

CAUTION

The DRV8770EVM is rated for power supply voltages up to 50-V. Make sure the total power dissipation is such that the board temperature is below 130 C°.

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1 Introduction

The DRV8770EVM is a complete solution for evaluating the DRV8770 gate driver. This EVM can be used to evaluate all of the features of the DRV8770. The EVM includes an on-board MCU which is used to provide the necessary logic signals to the DRV8770 in order to drive the external H-bridge FETs. The logic signals (INHA, INLA, INHB, and INLB) come from the MCU can the duty cycle can be adjusted via potentiometers on the board.

The DRV8770 can drive an H-bridge with power supply up to 100 V. For voltages above 50-V, proper high voltage safety procedures should be taken.

To expand beyond the included firmware capability, the MSP430 MCU can be reprogrammed through the eZ-FET™ emulation circuit found in most MSP430 Launchpads. We recommend the MSP-EXP430FR5969. Note that a four pin angled male header is required and must be soldered to J21 of this Launchpad from V+ pin to GND pin. We recommend a pin header with pin dimensions similar to 850-10-050-20-001000 (Digikey part number). The U1 MCU must be removed from the Launchpad.

2 PCB Connectors and Headers

The DRV8770EVM top PCB view and top assembly view are shown in Figure 2-2 and Figure 2-1. The board connectors and headers are listed and described in Table 2-1.

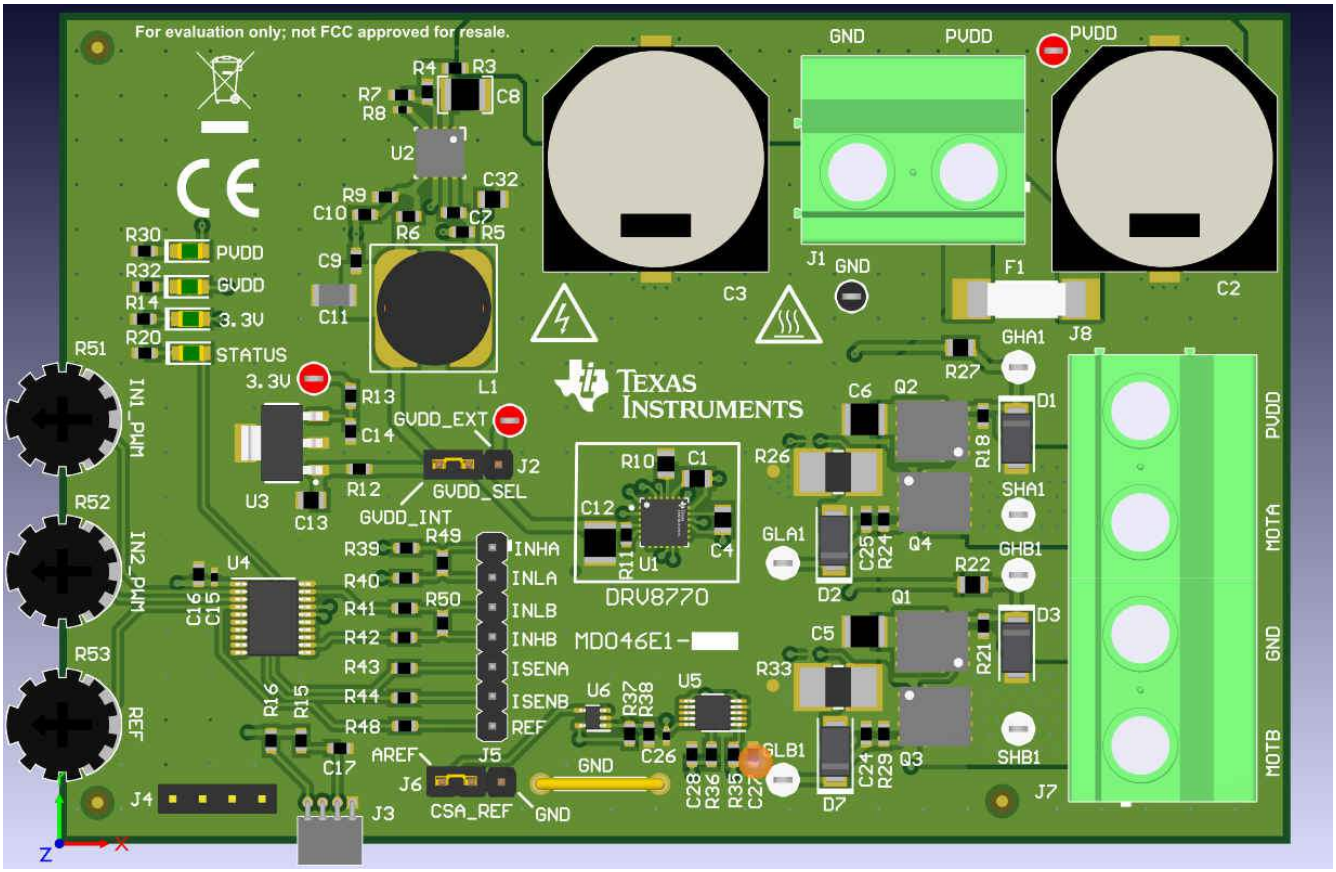

Figure 2-1. DRV8770EVM PCB Top View

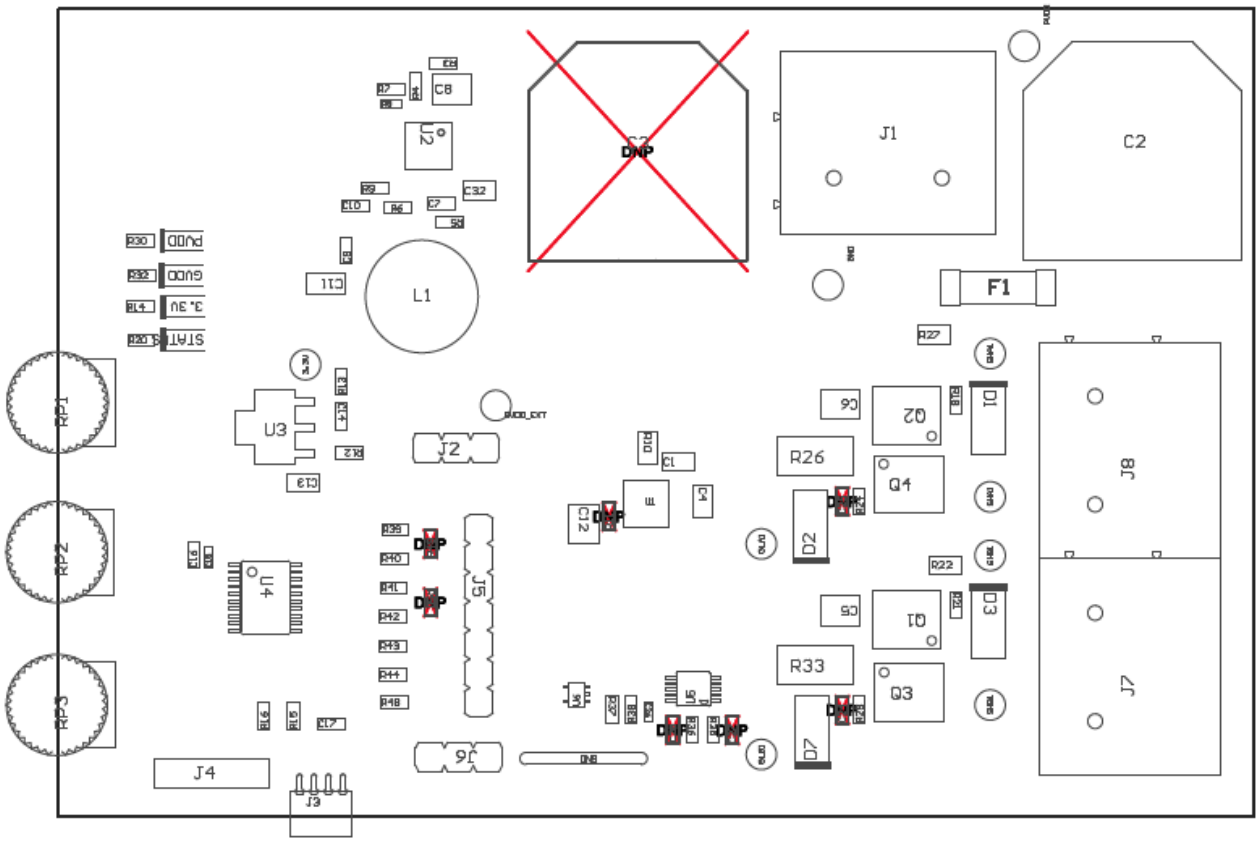

Figure 2-2. DRV8770EVM Top Assembly View

Table 2-1. Board Component and Connector

Component	Function
J1	PVDD supply connector
J7/J8	Output connector (MOTA, MOTB, PVDD, GND)
J2	Header for GVDD supply selection. If shorted between middle pin and "GVDD_INT" pin, GVDD will come from internal buck converter. If middle pin and "GVDD_EXT" is shorted, GVDD supply will come from external source connected to "GVDD_EXT" red test point.
J3	Connector for programming the MCU on the board.
J4	Header connected to J3 connector. Can manually place jumper wires to Spi-By-Wire pins on the LaunchPad
J5	Main control signal header test poin.
J6	Current sense amplifier (CSA) reference voltage selector header. Short middle pin to "AREF" to set REF voltage of CSA to 1.65-V (mainly used for bi-directional current sensing). Short middle pin to "GND" to set the CSA REF voltage to 0-V.
PVDD LED	PVDD LED indication
GVDD LED	GVDD LED indication
3.3 V LED	3.3 V LED indication
STATUS LED	MCU STATUS LED indicator. Will turn ON when MCU is working
RP1	Potentiometer for adjusting duty cycle of INHA and INLA
RP2	Potentiometer for adjusting duty cycle of INHB and INLB
RP3	Unused potentiometer.

3 EVM operation

The following sections will describe how to spin a motor using the DRV8770EVM.

3.1 EVM connection

The EVM to motor connections to power supply and motor in Figure 3-1. If the power is correctly being distributed to the board and the MCU is active, all of the four LEDs on the top left should be ON. If one of the LEDs is not ON, then the board will not work. Further debugging will be needed to figure out what is wrong with the board. IF assistance is needed from TI, feel free to post a question to the E2E forum.

Since the DRV8770 can independently drive each half-bridge, two motors can be driven unidirectionally in either low-side or high-side configurations (MOTx to PVDD or MOTx to GND). If bi-directional motor control is required, then the motor should be connected between MOTA and MOTB.

If the user wants to bypass the on-board 12-V buck converter used for the DRV8770 supply, the shunt on J2 can be placed between the middle pin and GVDD_EXT. The external power supply will be connected on the "GVDD_EXT" red test point near J2. Make sure the external GVDD voltage does not exceed the maximum ratings of the DRV8770.

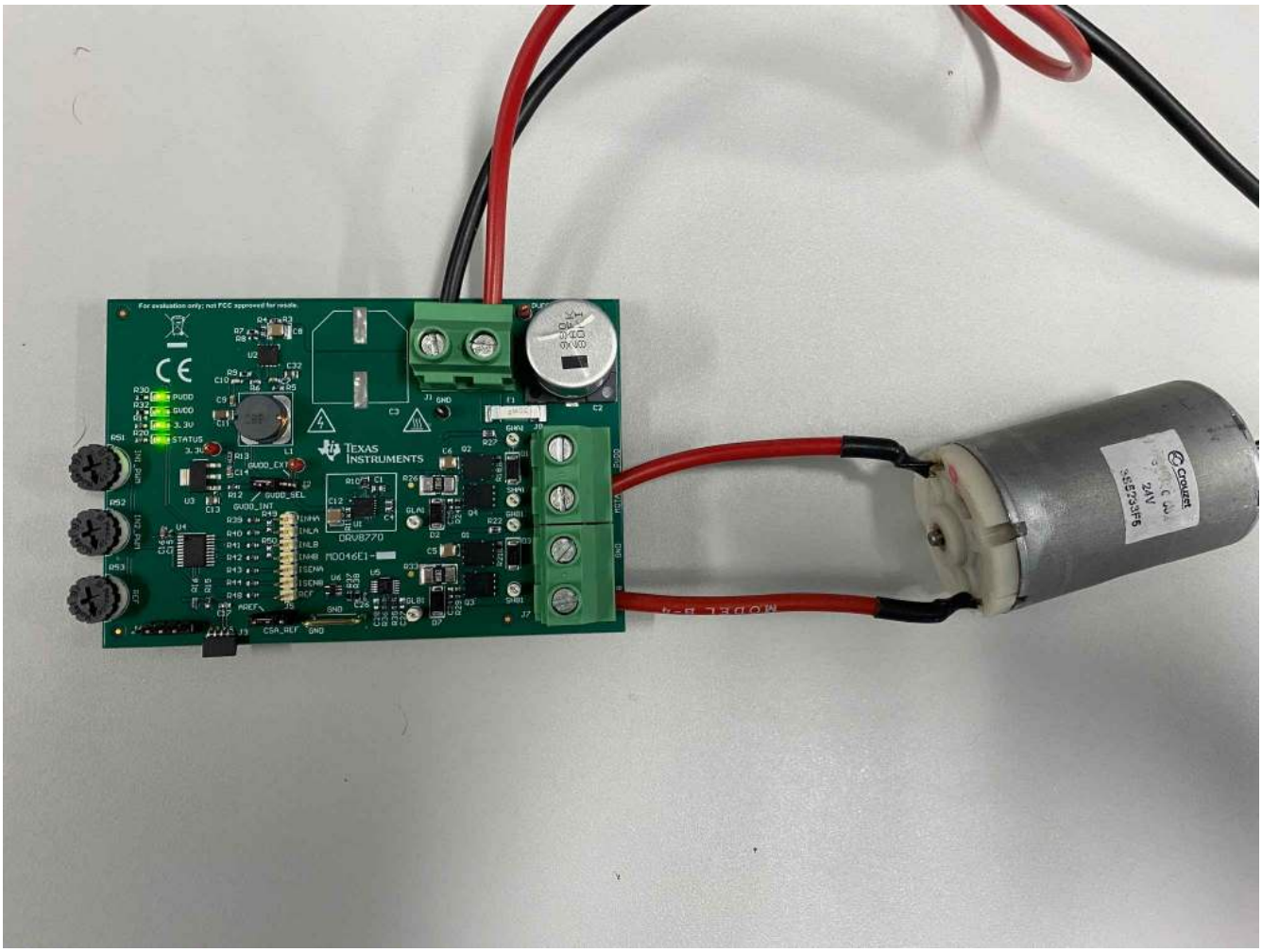

Figure 3-1. EVM Power Supply and Motor Connections

3.2 PWM Control with Potentiometers

After the power and motor have been connected properly as described in Section 3.1, The motor is ready to be driven.

The INHx and INLx control signals are control by a fixed 20 kHz frequency with the duty cycle adjusted by potentiometer 1 (IN1_PWM) and potentiometer 2 (IN2_PWM). POT1 controls the duty cycle of INHA and INLA and POT2 the duty cycle of INHB and INLB. If the user wants to use an external PWM signal for INHx and INLx, R19, R50, R40, and R42 should be removed and the external signal connected to INHA, INLA, INHB, and INLB test points on J5.

Adjusting the duty cycle with POT1 and POT2 can be done by moving the potentiometer either clock-wise or counter-clockwise with in the board orientation shown in Figure 3-2. Moving the potentiometer counter-clockwise will decrease the duty cycle and clock-wise will increase the duty cycle.

There can be three possible motor configurations with the DRV8770. The control procedure is different for each configuration. The steps below explain how to control a motor or load dependig on the configuration:

1. Motor or load is connected between MOTA and MOTB. Im this configuration, the motor is connected between both half bridges allowing for bi-directional control. This is the standard PWM control full bridge configuration with POT1 (INHA and INLA) controlling the duty cycle of MOTA and POT2 (INHB and INLB) controlling the duty cycle of MOTB. Adjusting the duty cycle of MOTA and MOTB will adjust the speed and direction of the motor.
2. Motor or load is connected between either MOTA or MOTB and PVDD. This configuration allows for uni-directional control of the motor. POT1 controls MOTA and POT2 controls MOTB. If motor is connected between MOTA and PVDD for example, a **LOWER** INHA and INLA duty cycle will result in **HIGHER** motor speed and **LOWER** speed when the duty cycle is higher.
3. Motor or load is connected between either MOTA or MOTB and GND. This configuration allows for uni-directional control of the motor. POT1 controls MOTA and POT2 controls MOTB. If motor is connected between MOTA and PVDD for example, a **LOWER** INHA and INLA duty cycle will result in **LOWER** motor speed and **HIGHER** speed when the duty cycle is higher.

Note that the DRV8770 has a bootstrap architecture which does not allow for 100% duty cycle control when configured in either full bridge or low-side control control. Therefore, when the potentiometer is moved all the way clock-wise and the PWM duty cycle approaches 100%, the motor will stop spinning. To keep the motor spinning, please keep the duty cycle below 90%.

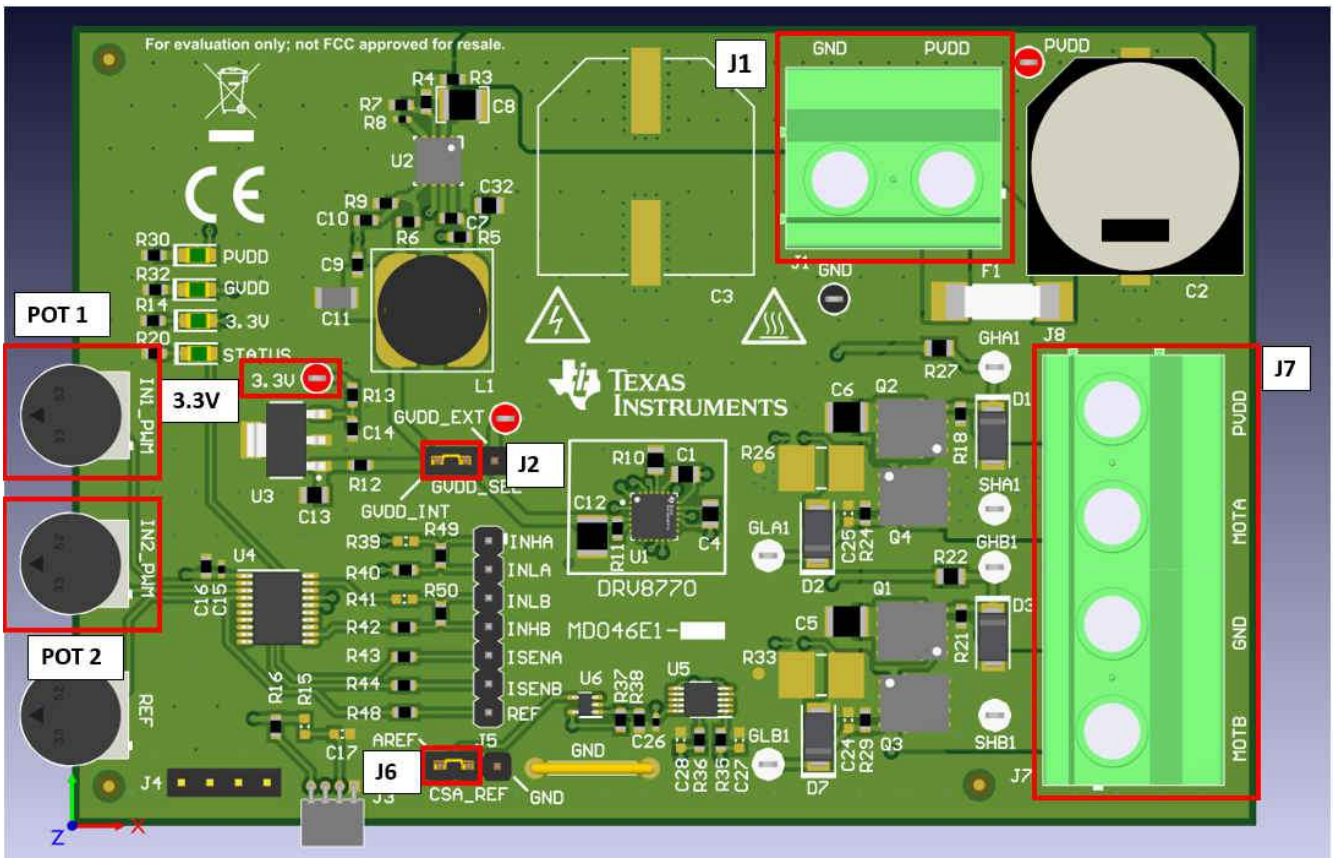

Figure 3-2. Detailed top 3D view of the DRV8770EVM

4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

DATE	REVISION	NOTES
September 2021	*	Initial Release

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