DRV10963 Evaluation Module

This document is provided with the DRV10963 customer evaluation module (EVM) as a supplement to the DRV10963 datasheet (SLAS955). It details the hardware implementation of the EVM.

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1 Printed-Circuit Board (Top 3D View)

Figure 1 illustrates the top view of the DRV10963 printed-circuit board (PCB).

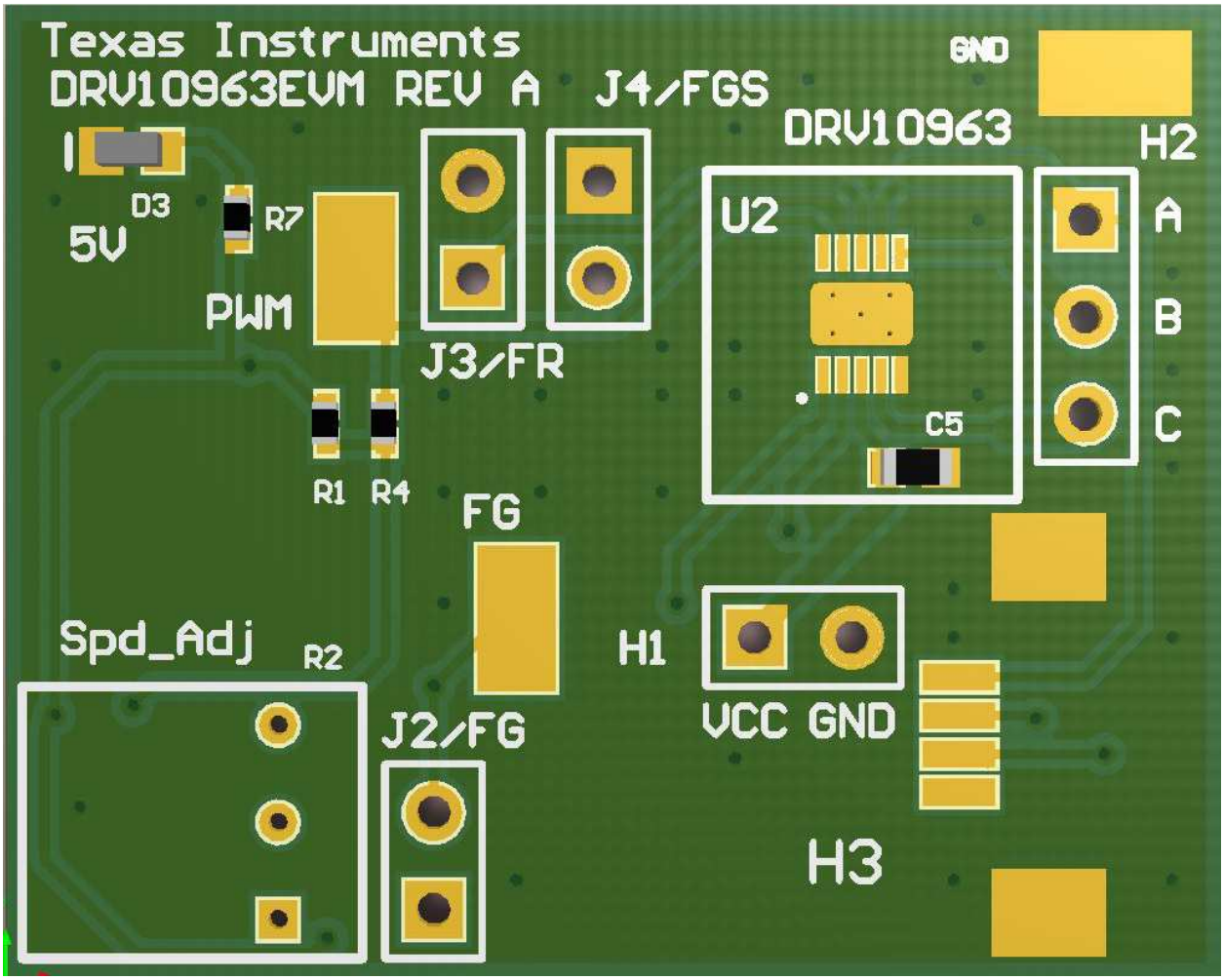

Figure 1. DRV10963EVM PCB Top View

2 Introduction

The DRV10963EVM is a complete solution for evaluating the DRV10963 5-V, Three-Phase Sensorless BLDC Motor Driver. It includes a TLC555 Timer configured to supply a PWM to the DRV10963, a potentiometer to adjust the speed of the motor by varying the duty cycle of the PWM, a jumper on the FG pin to allow the use of an external pull-up resistor, and a jumper on the FGS pin to set ½ or normal frequency output on the FG pin. DRV10963EVM also has a jumper on the FR pin to select forward or reverse. Power can be provided externally, up to 6 V, through the power header or through a micro USB connector. The PWM, FG, and GND signals are all brought out to surface mounted test points.

The DRV10963EVM is configured so that only connections to the motor and power supply are required.

2.1 Power Connectors

The DRV10963EVM uses a combination of headers for the application or monitoring of power. For the EVM, a single power supply rail is necessary. Minimum recommended Vin for the EVM is 4.5 V and maximum is 5.5 V. Please see the DRV10963 datasheet (SLAS955) for the complete voltage range information of the driver itself. When power is supplied to the board, a green LED (D3) in the upper left corner should enable.

VCC for the DRV10963 is available through two connections. A USB micro connector can provide power to the EVM by connecting J1 on the bottom of the EVM. The H1 header can also be used to power the EVM. The H1 header is located on the top side of the EVM near the middle of the board, as shown in Figure 2.

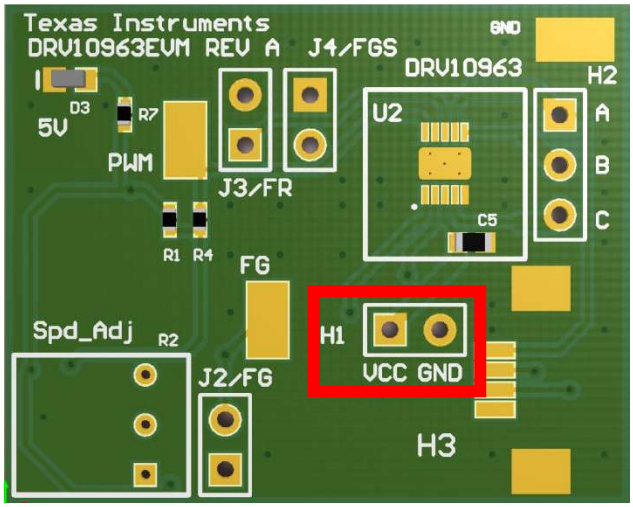

Figure 2. Top View (H1 Power Supply Header)

2.2 Test Points

Test points are provided and labeled according to the inputs and outputs of the DRV10963 motor driver. The signals brought out to test points are labeled *FG*, *PWM*, and *GND*.

The signal *PWM* is generated by circuitry on the EVM. In order to provide an external PWM signal to the motor driver, remove the 0.0-Ω resistor (**R4**) and connect the external PWM signal to the *PWM* test point. The *PWM* signal generated by the circuitry on the EVM is approximately 25 kHz and can be adjusted from 5% to 95% duty cycle by the potentiometer (R6) located on the EVM.

The FG signal's frequency represents the motor speed and phase information.

RPM = (FG × 60) / pole pairs if FGS = 0 *or*

RPM = (FG × 30) / pole pairs if FGS = 1

Please refer to the DRV10963 datasheet (SLAS955) for more information regarding the FG pin.

2.3 Jumpers

Four jumpers (J1 – J4) are normally installed on the EVM.

Jumper J1 connects the power to the EVM using the USB micro connector on the bottom side of the board.

Jumper J2 connects the FG pin of the DRV10963 to VCC through an onboard pull-up resistor. If a connection to an external pull-up resistor is desired, remove the jumper and connect an external pull-up resistor.

Jumper J3 connects the FR pin of the DRV10963 to VCC. When installed, the pin is automatically set low for reverse rotation. When removed, the pin is pulled high and the motor spins forward.

Jumper J4 connects the FGS pin of the DRV10963 to adjust for different speed selections for various applications. When installed, the FGS pin is set to pull low. When J4 is open, the FGS pin pulls high. For normal operation right out of the box, install jumpers J2 and J4.

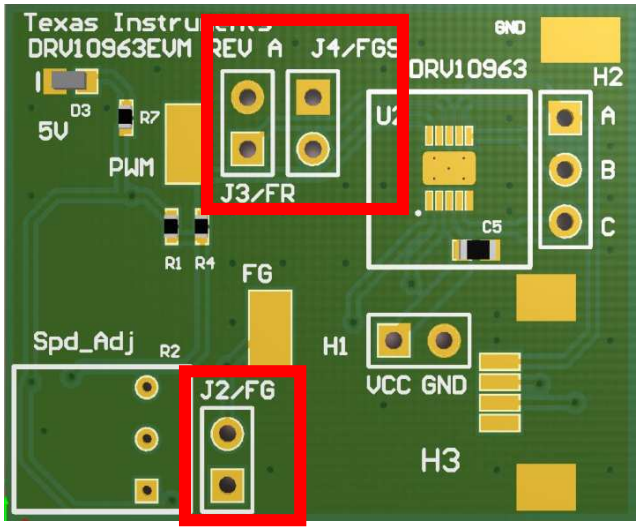

Figure 3. Jumper Settings

2.3.1 FG Frequency Generator (J2) Jumper

J2 is shown in Figure 3. Installing jumper J2 connects the FG pin of the DRV10963 to an onboard pull-up resistor. If an external pull-up resistor to FG is desired, remove jumper J2. Connect pin 2 of J2 to an external pull-up resistor. The FG test point is located in the center of the EVM. Please note that if the jumper is removed, an external pull-up resistor is needed for connection of FG to an external system. For more information regarding the FG pin, please refer to the DRV10963 datasheet (SLAS955).

2.3.2 FR Forward/Reverse (J3) Jumper

J3 is illustrated in Figure 3. Installing the jumper connects the FR pin on the DRV10963 to GND. When the FR pin is tied to GND, the motor is set to spin in the reverse direction. When removed, the pin is pulled high and the motor will spin in the forward direction.

2.3.3 FGS Frequency Select (J4) Jumper

J4 is shown in Figure 3. Installing the jumper connects the FGS pin on the DRV10963 to GND. When the FGS pin is tied to GND, the FG output of the DRV10963 is set to toggle once every two electrical cycles. When J4 is removed, the FGS pin is connected to VCC through an onboard pull-up resistor. When FGS is connected to VCC, the FG output will toggle once per electrical cycle. **Please note that for any change of FGS to take effect, power must be cycled.**

2.4 Speed Adjust Potentiometer (R2)

The speed adjust potentiometer *Spd_Adj* is shown in Figure 4. The potentiometer adjusts the duty cycle of the PWM signal which will in turn adjust the speed of the motor. In order to lower the duty cycle and in turn lower the speed, turn the potentiometer counter-clockwise. In order to increase the duty cycle and in turn increase the speed, turn the potentiometer clockwise.

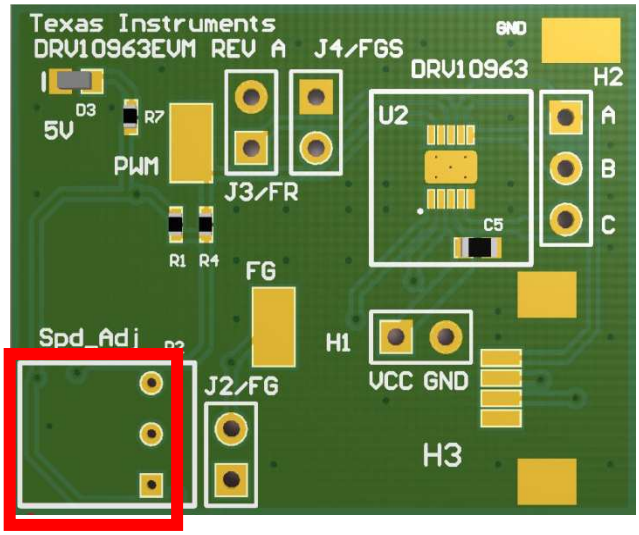

Figure 4. Speed-Adjust Potentiometer

The onboard PWM signal for the DRV10963 is generated by a circuit based upon TI's TLC555 Low-Power Timer. It is capable of approximately a 25-kHz output that can be adjusted from 5% to 95% duty cycle. This square output signal will switch from 0 V to VCC.

In order to provide an external PWM signal to the DRV10963, first remove the 0.0-Ω resistor *R4*. Next, connect the external PWM signal to the *PWM* surface mounted test point. For more information on the PWM input required by the DRV10963, please refer to the datasheet (SLAS955).

2.5 Motor Outputs

Two motor connectors are provided. Header H2 and H3 are available as shown in Figure 5.

Header H3 is intended to be used with the supplied motor. To connect the supplied motor to header H3, make sure that the tabs on either side of the header are out. Insert the flat flex cable with the four exposed pins facing up into header H3. Press the tabs on either side of header H3 toward header H3 to lock the flat flex cable in place.

An alternate connection is provided through header H2. Connect a three-phase 5-V BLDC motor to pins A, B, and C of the header H2. Polarity is not critical for A, B, and C.

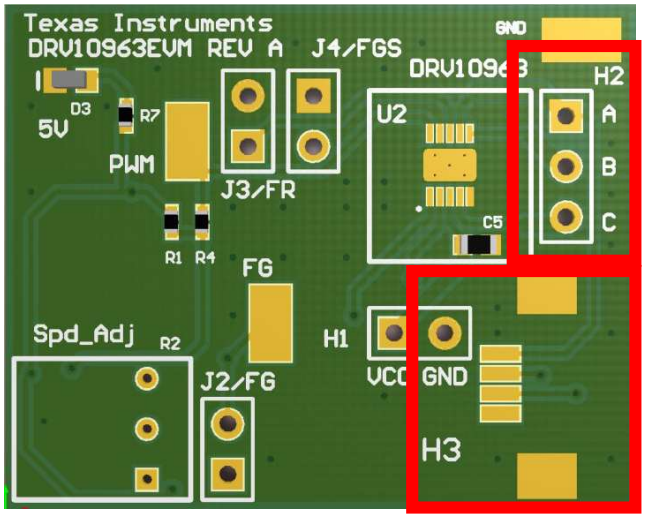

Figure 5. Motor Outputs

2.6 Operation of the EVM

1. Connect the supplied 5-V three-phase BLDC motor to header H3.
2. Adjust the *Spd_Adj* potentiometer **R2** to minimum voltage by turning it all the way counter-clockwise. This will minimize the motor speed.
3. Apply power by connecting the USB-A to Micro USB-B cable to connector J1 on the bottom of the board.
4. Adjust the *Spd_Adj* potentiometer clockwise towards the motor outputs to increase speed and the motor will start to turn. Continue adjusting as desired.
5. To change direction, connect jumper J3.

3 Schematic

Figure 6 is the DRV10963 schematic.

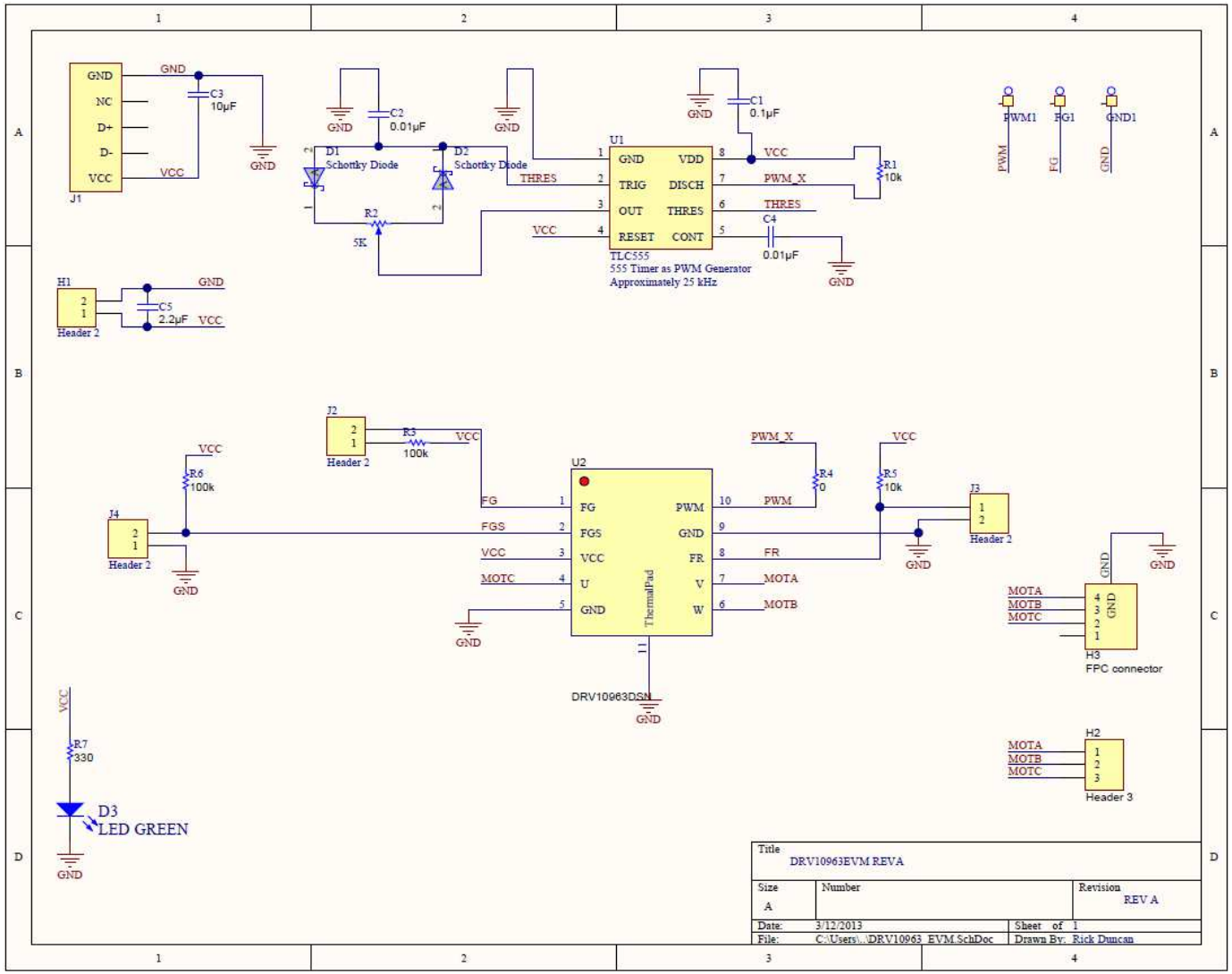

Figure 6. DRV10963 Schematic

4 Bill of Materials

Table 1 is the bill of materials for the EVM.

Table 1. DRV10963 Bill of Materials

Description	Designator	Manufacturer	MFG Part Number	Qty
CAP, CERM, 0.1uF, 10V, +/-10%, X5R, 0402	C1	TDK	C1005X5R1A104K	1
CAP, CERM, 0.01uF, 10V, +/-10%, X5R, 0402	C2, C4	MuRata	GRM155R61A103KA01D	2
CAP, CERM, 10uF, 10V, +/-10%, X5R, 0805	C3	Kemet	C0805C106K8PACTU	1
CAP, CERM, 2.2uF, 10V, +/-10%, X5R, 0603	C5	Kemet	C0603C225K8PACTU	1
Diode, Schottky, 40V, 1A	D1, D2	Vishay	MSS1P4-M3/89A	2
LED 1.6X0.8MM 570NM GRN CLR SMD	D3	Kingbright Corp	APT1608CGCK	1
PC TEST POINT MINIATURE SMT	FG1, GND1, PWM1	Keystone Electronics	5019	3
Header, 2-Pin	H1, J2, J3, J4	3M	961102-6404-AR	4
Header, 3-Pin	H2	3M	961103-6404-AR	1
4 pin FPC Connector, 1.0mm pitch	H3	Molex Inc	0522070460	1
Micro USB connector	J1	TE Connectivity	1981584-1	1
RES, 10k ohm, 5%, 0.063W, 0402	R1, R5	Vishay-Dale	CRCW040210K0JNED	2
POT 5.0K OHM THUMBWHEEL CERM ST	R2	Bourns Inc.	3352T-1-502LF	1
RES, 100k ohm, 5%, 0.063W, 0402	R3, R6	Vishay-Dale	CRCW0402100KJNED	2
RES, 0 ohm, 5%, 0.063W, 0402	R4	Panasonic	ERJ-2GE0R00X	1
RES, 330 ohm, 5%, 0.063W, 0402	R7	Vishay-Dale	CRCW0402330RJNED	1
IC OSC MONO TIMING 2.1MHZ 8-SOIC	U1	Texas Instruments	TLC555QDR	1
5V 3-phase sensorless BLDC motor driver	U2	Texas Instruments	DRV10963DSNR	1
5V BLDC 3-phase motor	Motor		DRV109xx Motor	1

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