DRV10866EVM User's Guide

This document is provided with the DRV10866 customer evaluation module (EVM) as a supplement to the DRV10866 (SBVS206) datasheet. It details the hardware implementation of the EVM.

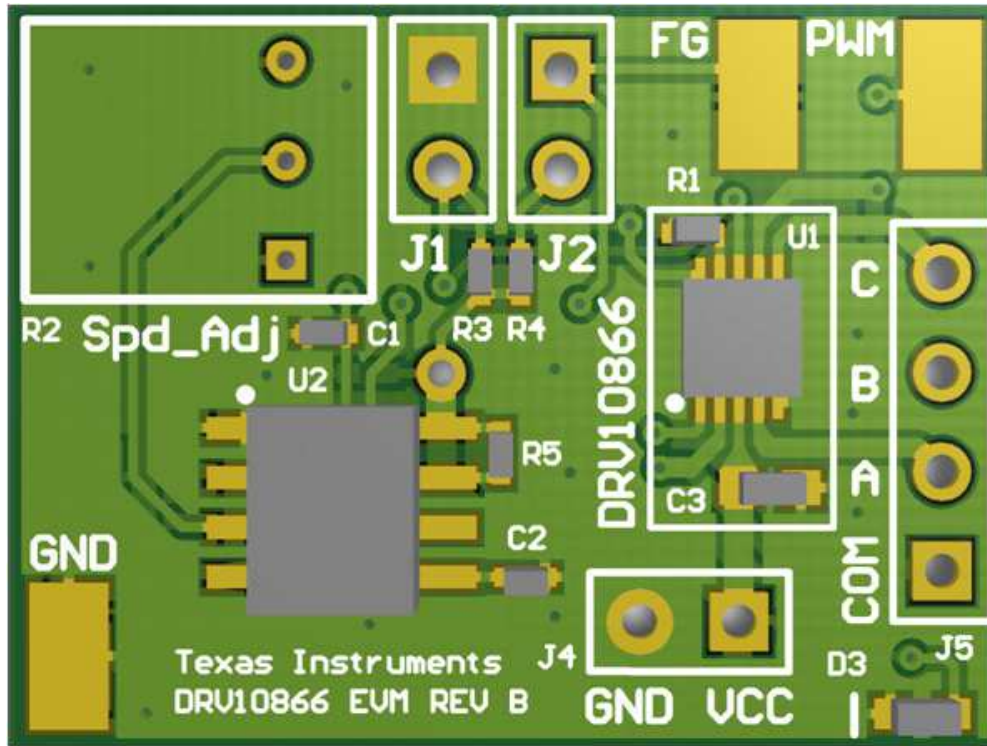**Contents**

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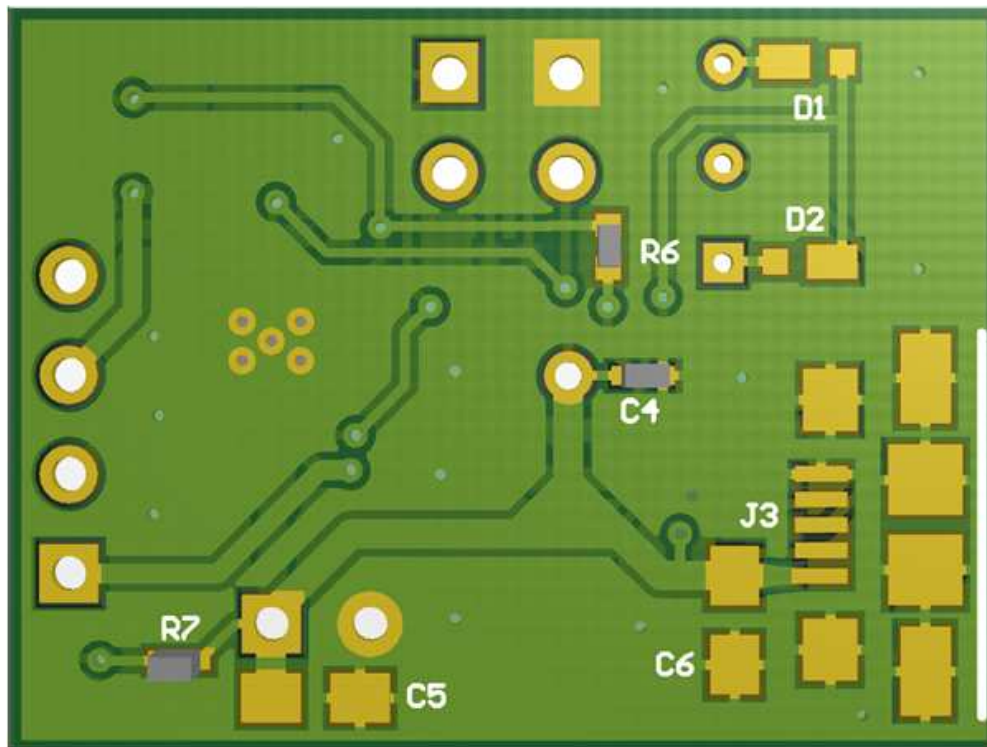
1   PCB

Figure 1. Top 3D View

Figure 2. Bottom 3D View

2   INTRODUCTION

The DRV10866EVM is a complete solution for evaluating the DRV10866 5-V, three-phase sensorless BLDC motor driver. It includes a TLC555 timer configured to supply a PWM to the DRV10866, 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. Power can be provided with the included micro-USB cable for 5 V or externally provided, up to 5.5 V, through the power header. The PWN, FG, and GND signals are all brought out to surface mounted test points.

The DRV10866EVM is configured so that connections to only the motor and power supply are required.

2.1   Power Connectors

The DRV10866EVM uses a combination of headers and a USB input jack (on bottom side) for the application/monitoring of power. For the EVM, only a single power supply rail is necessary. Minimum recommended V_{IN} for the EVM is 2 V and maximum is 5.5 V. Please see the datasheet for the DRV10866 for complete voltage range information of the driver itself. When power is supplied to the board a green LED (D3) in the bottom right corner should enable.

The overcurrent threshold setup pin sets the current limit for the device and is connected to a 3.8-kΩ resistor (R6) on the DRV10866EVM. This sets the current limit at 820 mA for the DRV10866. This resistor can be replaced and a new current limit set using the equation seen below. Please see the datasheet for the DRV10866 for more information on the overcurrent threshold setup pin.

$$I_{LIMIT} \text{ (mA)} = 3120/R_{CS} \text{ (kΩ)} \tag{1}$$

VCC for the DRV10866 is directly taken off the micro USB jack supply or J4 power supply header. The J4 header is located on the top side of the EVM near the bottom right of the board as shown in Figure 3. The micro USB jack is located on the bottom side of the board as shown in Figure 4. The micro USB jack is only to supply power for the EVM and does not provide any additional functionality. Please choose only one method for providing power to the EVM.
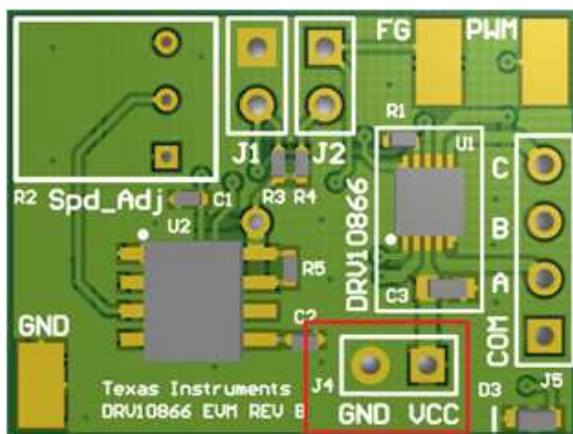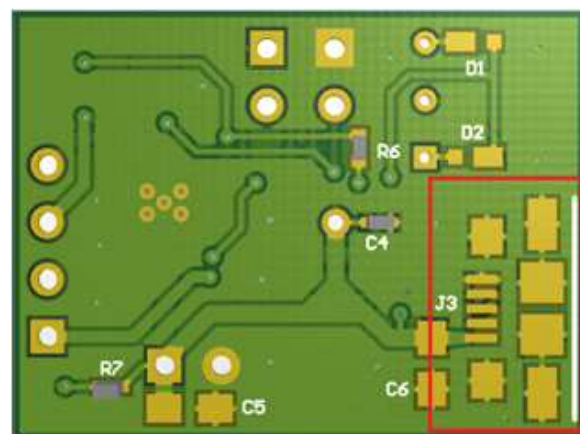

Figure 3. Top View (J4 Power Supply Header)

Figure 4. Bottom View (Micro USB Jack)

> **NOTE:**   It is only necessary to provide one source of power for the EVM. DO NOT connect to both the micro USB jack and the J4 power supply header.

2.2   Test Points

Test points are provided and labeled according to the inputs/outputs of the DRV10866 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 your own PWM signal to the motor driver, remove the 0-Ω resistor (R6) and connect your own 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 (R1) located on the EVM.

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

RPM = (FG x 60)/pole pairs (2)

Please refer to the datasheet of the DRV10866 for more information regarding the FG pin.

2.3 Jumpers

There are two jumpers (J1 and J2) on the EVM that are normally installed.

One jumper connects the FG pin of the DRV10866 to a pull up resistor and the other jumper determines whether FG is ½ or normal frequency output by connecting FGS to either VCC or GND.

For normal operation right out of the box both jumpers should be installed.

2.3.1 FGS Frequency Generator Select (J1) Jumper

J1 can be found in the image below, Figure 5. Installing the jumper connects the FGS pin on the DRV10866 to GND. When the FGS pin is tied to GND, the FG output of the DRV10866 is set for normal frequency output. With the jumper out, the FGS pin pulls up to VCC. When the FGS pin is tied to VCC, the FG output of the DRV10866 is set for ½ of the original FG frequency. FGS is latched upon power to the EVM so power must be cycled in order for the FG output to change.
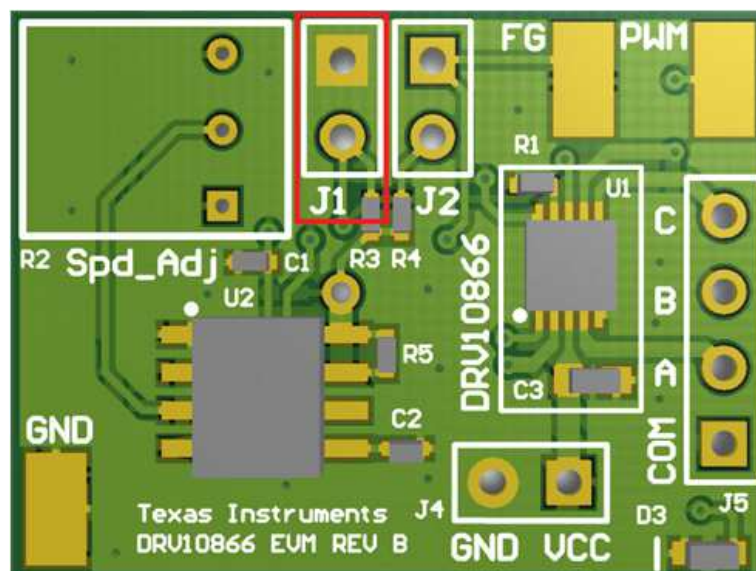

Figure 5. J1 Location

2.3.2 FG Pull Up (J2) Jumper

JP2 can be found in Figure 6. Installing the jumper will connect the FG pin of the DRV10866 to an on board pull up resistor.
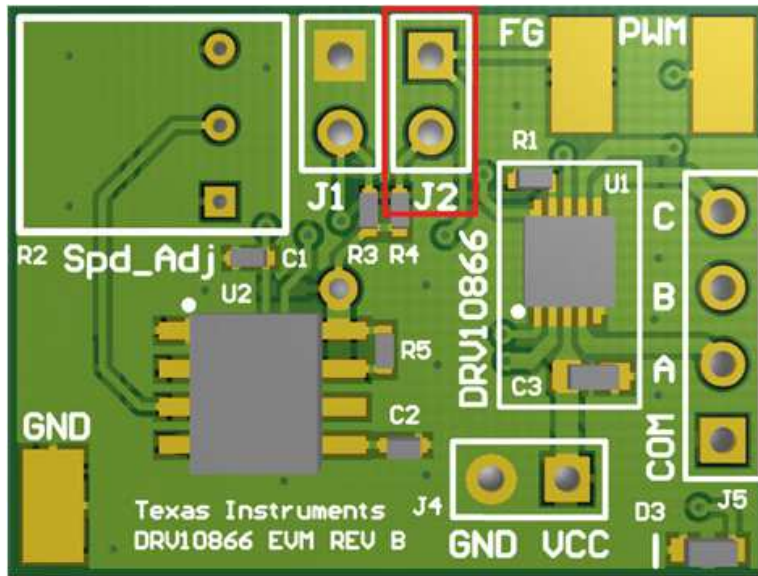

Figure 6. J2 Location

To make an external connection to FG, the jumper can be removed and pin 1 of the header provides a direct connection to the FG pin of the DRV10866. Pin 1 of J2 is highlighted in the image below, Figure 7. 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 datasheet of the DRV10866.
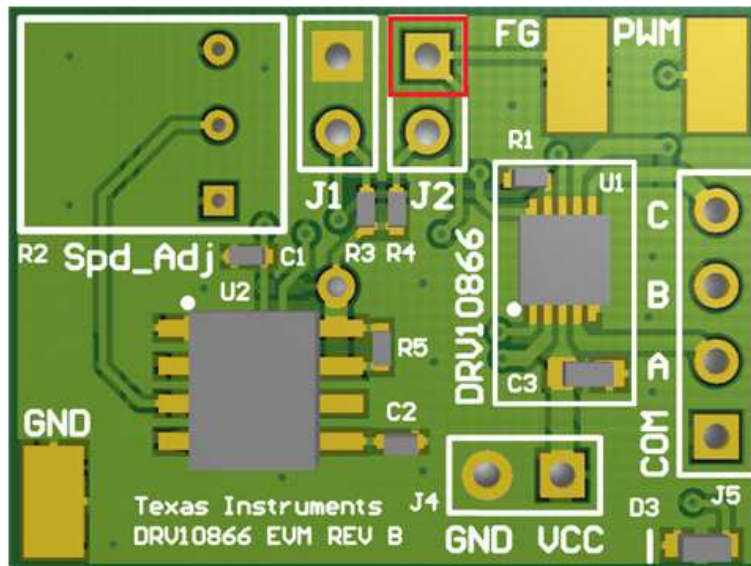

Figure 7. Pin 1 of J2

2.4   Speed Adjust Potentiometer (R1)

The speed adjust potentiometer (Spd_Adj) can be found in Figure 8. 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.
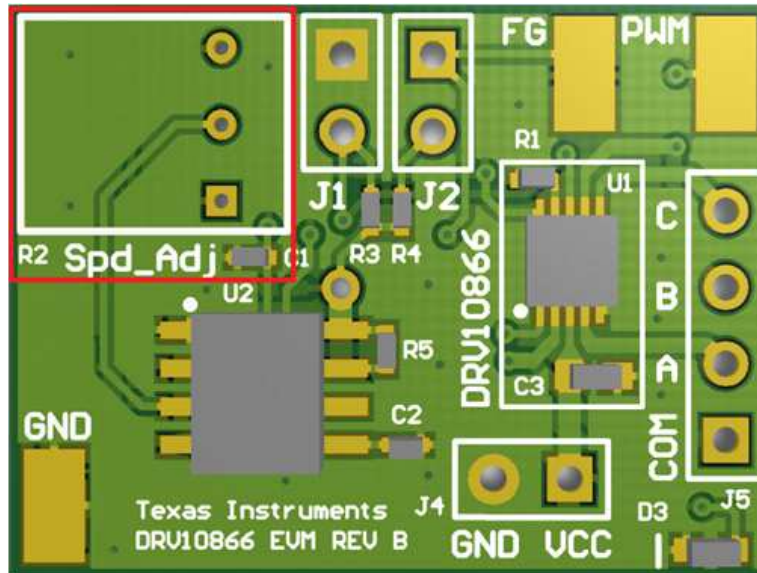

Figure 8. Speed Adjust Potentiometer

The onboard PWM signal for the DRV10866 is generated by a circuit based upon the Texas Instruments TLC555 low power timer. It is capable of an approximately 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 DRV10866, first remove the 0-Ω resistor (R6). Next, connect the external PWM signal to the "PWM" surface mounted test point. For more information on the PWM input required by the DRV10866 please refer to the datasheet.

2.5 Motor Outputs

Connect a three-phase 5-V BLDC motor to pins A, B, C, and COM of the header J5. Polarity is not critical for A, B, and C. If you wish to rotate the motor in the opposite direction switch two out of the three wires to A, B, and C. The motor outputs are located on J5 as shown in Figure 9.
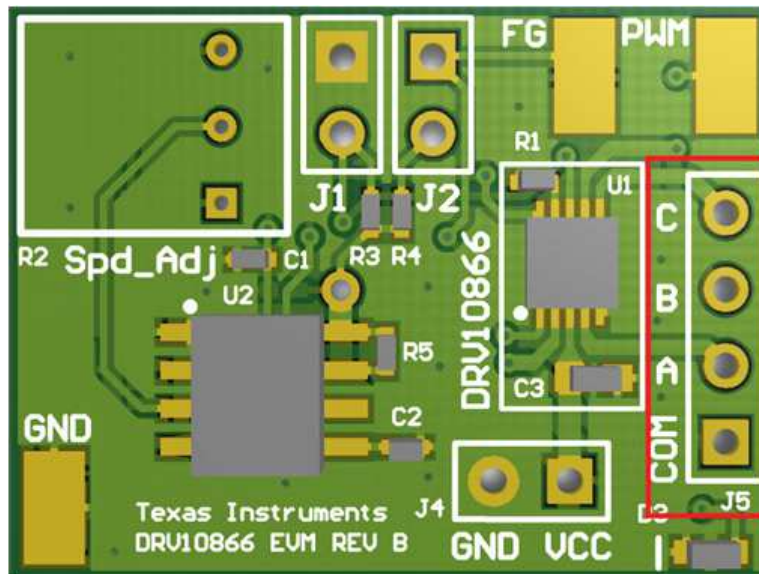

Figure 9. Motor Outputs

2.6 Operation of the EVM

1. Connect the included 5-V, three-phase BLDC motor to pins A, B, C, and COM of J5. The COM connector on the included motor is colored black. Figure 10 shows an image of the motor with a red mark next to the black wire for the COM connection.

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 to the J4 header or with external USB cable plugged into a computer USB jack. DO NOT connect to both the micro USB jack and the J4 power supply header.

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, switch two out of the three wires to A, B, and C.

Figure 10. COM Connection

3 SCHEMATIC AND BILL OF MATERIALS

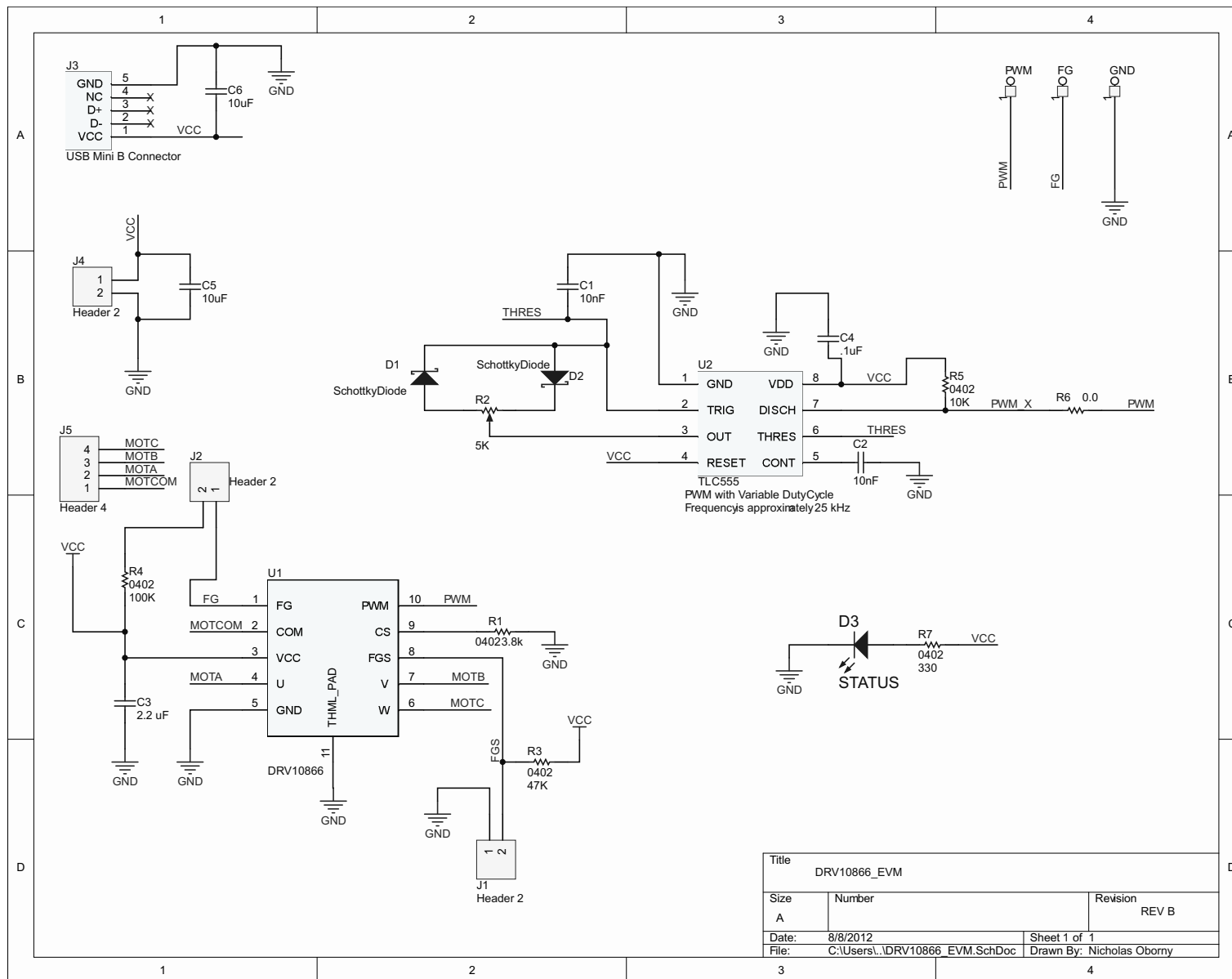The following pages contain the DRV10866EVM schematic and bill of materials.

Figure 11. DRV10866EVM Schematic

Table 1. DRV10866EVM Bill of Materials

Item No.	Qty	Designator	Vendor	Vendor Part #	Manufacturer	Part No.	Description
1	1	C3	DigiKey	587-2909-1-ND	Taiyo Yuden	TMK107ABJ225KA-T	CAP CER 2.2UF 25V 10% X5R 0603
2	1	C4	DigiKey	490-3261-1-ND	Murata Electronics North America	GRM155R71C104KA88D	CAP CER 0.1UF 16V 10% X7R 0402
3	1	D3	DigiKey	754-1116-1-ND	Stanley Electric & Co	HBR1105W-TR	LED 1.6X0.8MM 570NM GRN CLR SMD
4	1	J3	DigiKey	A97799CT-ND	TE Connectivity	1981584-1	CONN RCPT MICRO USB TYPE AB
5	1	J5	DigiKey	3M9449-ND	3M	961104-6404-AR	CONN HEADER VERT SGL 4POS GOLD
6	1	R1	DigiKey	P3.83KLCT-ND	Panasonic - ECG	ERJ-2RKF3831X	RES 3.83K OHM 1/10W 1% 0402 SMD
7	1	R2	DigiKey	3352T-502LF-ND	Bourns Inc.	3352T-1-502LF	POT 5.0K OHM THUMBWHEEL CERM ST
8	1	R3	DigiKey	P47KJCT-ND	Panasonic - ECG	ERJ-2GEJ473X	RES 47K OHM 1/10W 5% 0402 SMD
9	1	R4	DigiKey	P100KJCT-ND	Panasonic - ECG	ERJ-2GEJ104X	RES 100K OHM 1/10W 5% 0402 SMD
10	1	R5	DigiKey	P10KJCT-ND	Panasonic - ECG	ERJ-2GEJ103X	RES 10K OHM 1/10W 5% 0402 SMD
11	1	R6	DigiKey	311-0.0JRCT-ND	Yageo	RC0402JR-070RL	RES 0.0 OHM 1/16W 0402 SMD
12	1	R7	DigiKey	P330JCT-ND	Panasonic - ECG	ERJ-2GEJ331X	RES 330 OHM 1/10W 5% 0402 SMD
13	1	U1	Supplied	Supplied	Texas Instruments	Supplied	5-V, Three-Phase Sensorless BLDC Motor Driver
14	1	U2	DigiKey	296-10341-1-ND	Texas Instruments	TLC555QDR	IC OSC MONO TIMING 2.1MHZ 8-SOIC
15	2	C1, C2	DigiKey	445-1260-1-ND	TDK Corporation	C1005X7R1E103K	CAP CER 10000PF 25V 10% X7R 0402
16	2	C5, C6	DigiKey	445-7645-1-ND	TDK Corporation	C2012X5R1C106M/0.85	CAP CER 10UF 16V 20% X5R 0805
17	2	D1, D2	DigiKey	MSS1P4-M3/89AGICT-ND	Vishay General Semiconductor	MSS1P4-M3/89A	DIODE SCHOTTKY 1A 40V MICROSMP
18	3	FG, GND, PWM	Mouser	534-5019	Keystone Electronics	5019	PC TEST POINT MINIATURE SMT
19	3	J1, J2, J4	DigiKey	3M9447-ND	3M	961102-6404-AR	CONN HEADER VERT SGL 2POS GOLD

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General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant

Caution

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concerning EVMs including detachable antennas

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

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Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

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2. Use this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or

3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

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