DRV8839 Evaluation Module

This document is provided with the DRV8839 customer evaluation module (EVM) as a supplement to the DRV8839 datasheet. It details the hardware implementation of the EVM.

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1 PCB (Top-Assembly View)

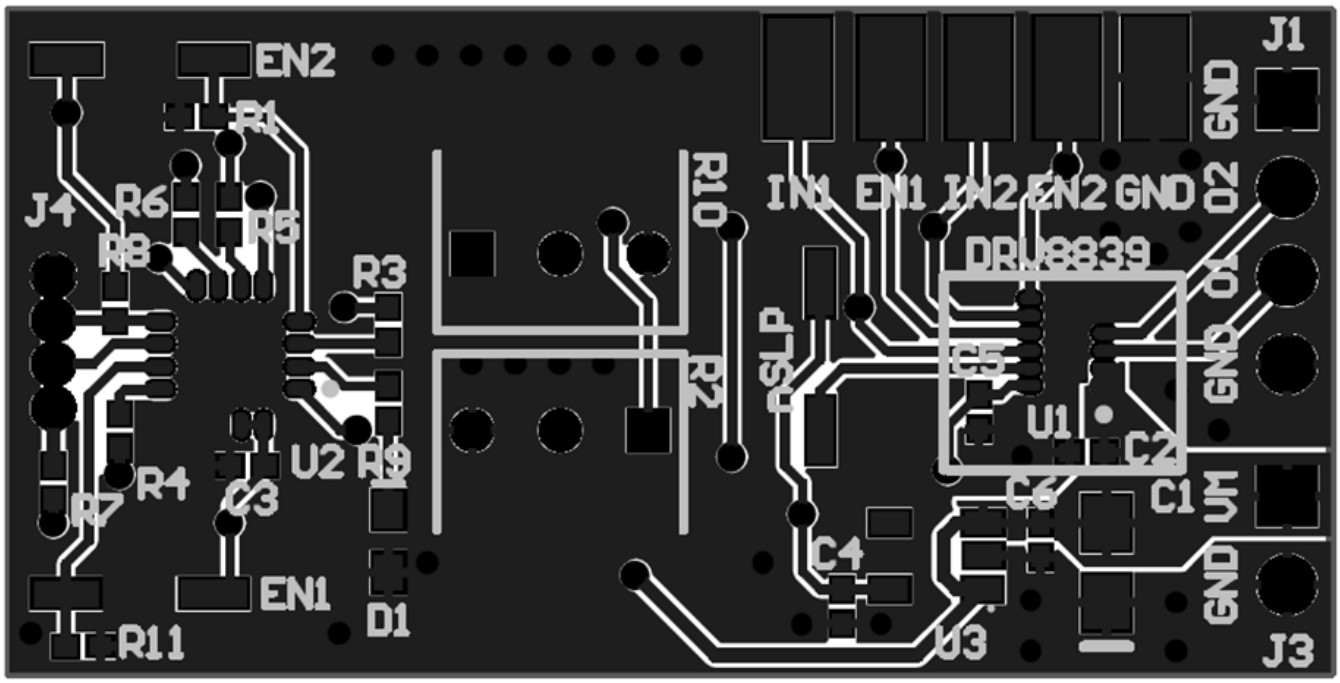


Figure 1. PCB (Top Assembly View)

2 Introduction

The DRV8839EVM is a complete solution for evaluating the DRV8839 low voltage brushed DC motor driver. It includes a MSP430 microcontroller that is preprogrammed to take input from two dedicated analog potentiometers, for PWM speed control of 2 motors. Two enable jumpers provide the ability to HIZ the motor outputs. Power can be provided with the included micro-USB cable for 5 V or externally provided up to 11 V through the power header. To expand beyond the included firmware capability, the MSP430 can easily be reprogrammed via an external MSP430 USB Stick Development Tool available at www.ti.com/tool/ez430-f2013.

2.1 Power Connectors

The DRV8839EVM uses a combination of headers and a USB input jack (on the bottom side) for the application and monitoring of power. For the EVM, only a single power supply rail is necessary and an onboard 3.3-V regulator provides power to the MSP430 micro and the logic core, VCC, of the DRV8839 motor driver. The minimum recommended Vin for the EVM is 1.8 V and maximum is 11 V. Please see the datasheet for the DRV8839 (SLVSBN4) for complete voltage range information of the driver itself.

VM for the DRV8839 is directly taken off the USB jack supply of the J1 power supply header. The J1 header is located on the top side of the EVM near the bottom-center of the board. The USB jack is located on the bottom side of the board. Choose one method ONLY for providing power to the EVM.

As previously mentioned, the MSP430 comes preprogrammed to control basic DC motor operation. If changing the firmware via the external ez430 development tool is desired, it is NOT necessary or recommended to provide any input power to the DRV8839EVM. Power is provided from the ez430 board.

2.2 Test Points

Test points are provided and labeled for the inputs to the DRV8839 motor driver and also the control signals back to the MCU. The inputs are labeled *IN1* and *IN2*. The control inputs for enabling and disabling the motor outputs are labeled as *EN1* and *EN2*.

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2.3 Jumpers

There are three jumpers normally installed on the EVM.

Two jumpers, *EN1* and *EN2*, control the enable inputs on the DRV8839 and are used to enable or disable the motors attached to *O1* and *O2*. The other jumper, labeled *nSLP*, controls the low-power state, or sleep state, on the DRV8839.

2.3.1 ENABLE Jumpers (EN1 and EN2)

The EN1 and EN2 jumpers are found in Figure 2. Installing the EN1 jumper provides a logic high to the DRV8839 EN1 pin and the motor connected to the *O1* output is enabled. Installing the EN2 jumper provides a logic high to the DRV8839 EN2 pin and the motor connected to the *O2* output is enabled.

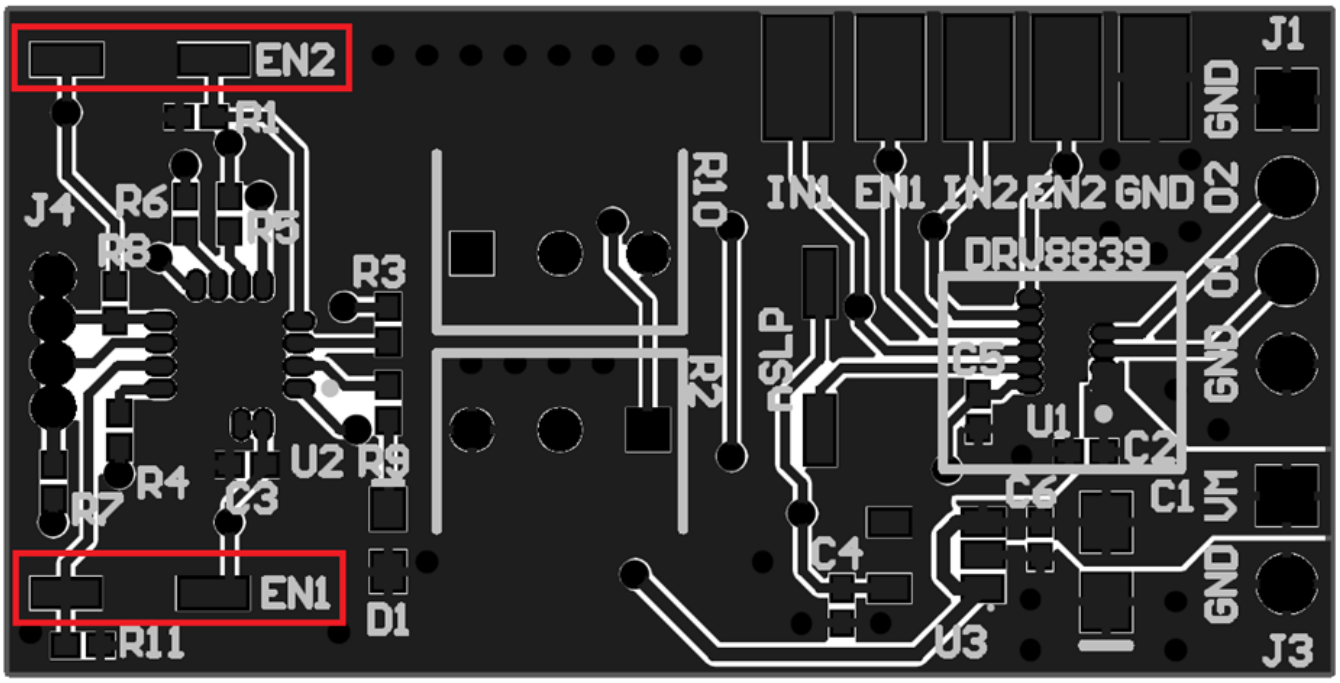


Figure 2. ENABLE Jumpers (EN1 and EN2)

2.3.2 SLEEP SELECT (nSLP) Jumper

The nSLP jumper is found in Figure 3. Installing the jumper places the DRV8839 in an ACTIVE state and the motors will spin. Removing the jumper places the DRV8839 in a low power consumption, or sleep state, and the motor outputs along with internal circuitry will be turned OFF.

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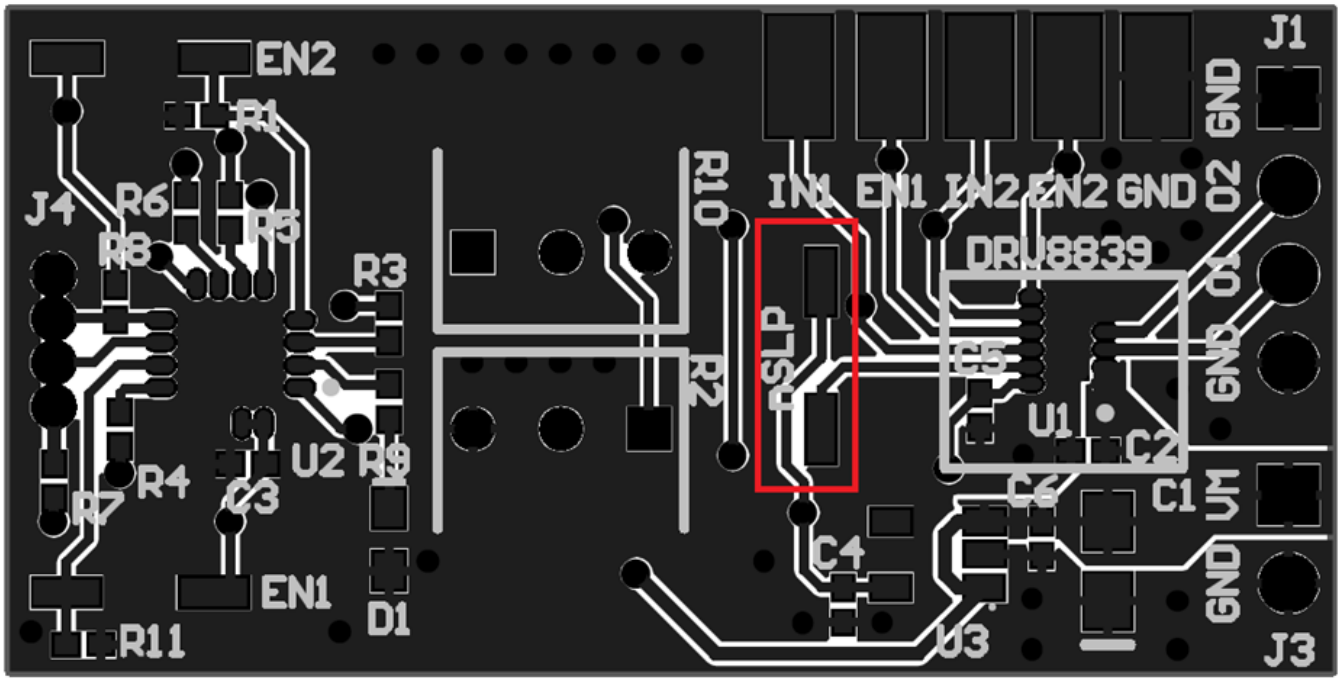


Figure 3. SLEEP SELECT (nSLP) Jumper

2.4 Speed Adjust Potentiometer (R2 and R10)

The speed adjust potentiometers are found in Figure 4. Turning the wheel clockwise will slow down the input PWM duty cycle to the DRV8839 and the motor turns slower. Turn the wheel counter-clockwise and the motor will spin faster. R10 controls the motor connected across *O2* and *GND*. R2 controls the motor connected across *O1* and GND.

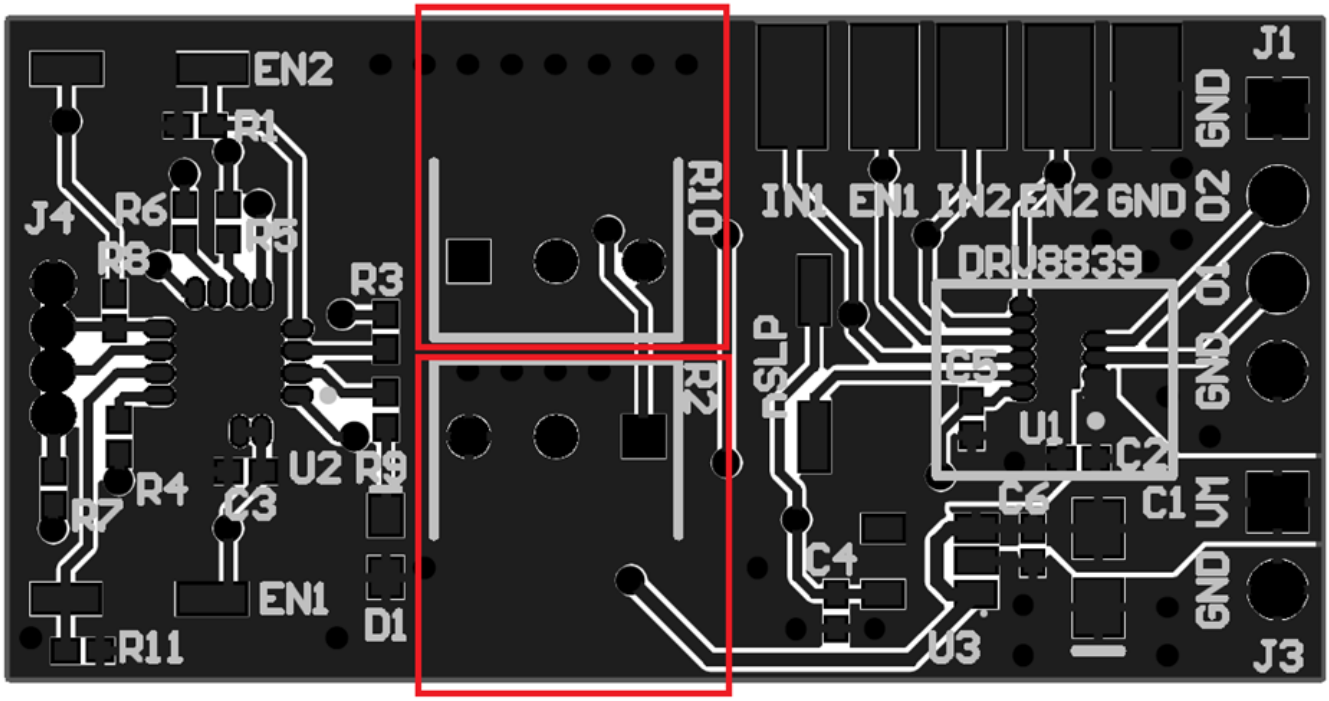


Figure 4. Speed Adjust Potentiometer (R2 and R10)

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2.5 Motor Outputs

Connect a DC motor across *O1* and GND. If desired, connect an additional DC motor across *O2* and GND. To reverse motor direction, connect the motor across *O1* and VM or *O2* and VM.

2.6 Operation of the EVM

Use the following steps to operate the EVM:

1. Connect the included DC motor across *O1* and GND. If desired, connect an additional DC motor across *O2* and GND.
2. Adjust the potentiometer, *R2*, to minimum voltage by turning the wheel clockwise all the way. This minimizes the motor speed.
3. Apply power to J3 header or with external USB cable plugged into a computer USB jack.
4. Turn potentiometer, R2, counter-clockwise and the motor will start to turn. Continue adjusting, as desired, until you reach maximum speed.

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3 DRV8839 Schematic

Figure 5 shows the DRV8839EVM schematic.

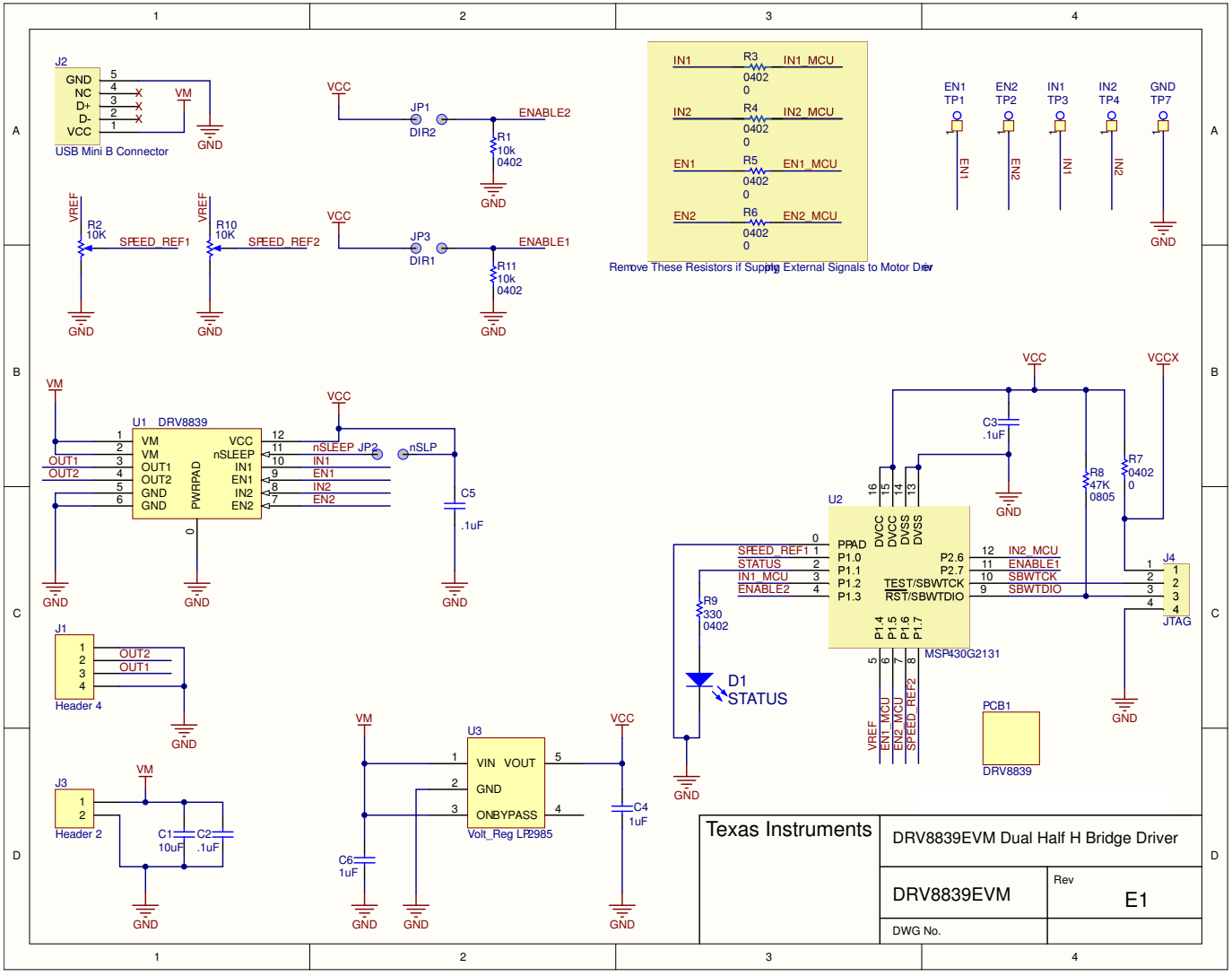


Figure 5. DRV8839EVM Schematic

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4 DRV8839 Bill of Materials

Table 1 is the BOM for the DRV8839EVM.

Table 1. DRV8839EVM Bill of Materials

Item No.	Qty.	Designator	Value	DigiKey Part #	Manufacturer	MFG Part Number	Description
1	1	C1	10uF	445-7645-1-ND	TDK Corp.	C2012X5R1C106M/0.85	CAP CER 10UF 16V 20% X5R 0805
2	3	C2, C3, C5	.1uF	490-3261-1-ND	Murata Elec.	GRM155R71C104KA88D	CAP CER 0.1UF 16V 10% X7R 0402
3	2	C4, C6	1uF	311-1438-1-ND	Yageo	CC0402KRX5R5BB105	CAP CER 1UF 6.3V 10% X5R 0402, CAP CER 1UF 16V 20% X5R 0402
4	1	D1	LED GREEN	754-1116-1-ND	Kingbright Corp.	APT1608CGCK	LED 1.6X0.8MM 570NM GRN CLR SMD
5	1	J1	4-pin Header	3M9447-ND	3M	961102-6404-AR	Header, 2-Pin
6	1	J3	2-Pin Header	3M9449-ND	3M	961104-6404-AR	Header, 4-Pin
7	1	J2	Micro USB AB	A97799CT-ND	TE Connectivity	1981584-1	CONN RCPT MICRO USB TYPE AB
8	1	J4	4-Pin Socket	ED90474-ND	Mill-Max Manufacturing	851-43-004-20-001000	SOCKET .050" GRID SIP 4 POS R/A
9	3	JP1, JP2, JP3	2-Pin Header	S9012E-01-ND	Sullins	GRPB012VWQS-RC	CONN HEADER VERT SGL 2POS GOLD
10	2	R1, R11	10k	P10KJCT-ND	Panasonic	ERJ-2GEJ103X	RES 10K OHM 1/10W 5% 0402 SMD
11	2	R2, R10	10K	3352T-103LF-ND	Bourns	3352T-1-103LF	POT 10K OHM THUMBWHEEL CERM ST
12	5	R3, R4, R5, R6, R7	0	311-0.0JRCT-ND	Yageo	RC0402JR-070RL	RES 0.0 OHM 1/16W 0402 SMD
13	1	R8	47K	P47KJCT-ND	Panasonic	ERJ-2GEJ473X	RES 47K OHM 1/10W 5% 0402 SMD
14	1	R9	330	P330JCT-ND	Panasonic	ERJ-2GEJ331X	RES 330 OHM 1/10W 5% 0402 SMD
15	3	EN1, EN2, nSLP Shunts	Shunts	952-1727-ND	Harwin Inc	M50-1920005	SHUNT JUMPER .05" RED GOLD
16	5	TP1, TP2, TP3, TP4, TP7	TP	534-5019 (Mouser)	Keystone	5019	PC TEST POINT MINIATURE SMT
17	1	U1	DRV8839	N/A	Texas Instruments	DRV8839DSG	Low Voltage H-bridge IC
18	1	U2	MCU	296-27472-1-ND	Texas Instruments	MSP430G2131IRSA16R	Value Line Mixed Signal Microcontroller
19	1	U3	3.3V	296-18476-1-ND	Texas Instruments	LP2985-33DBVR	IC LDO REG 3.3V 150MA SOT23-5
20	1	5V Brushed DC Motor	N/A	P14355-ND	NMB	PPN7PA12C1	Low voltage DC brushed motor

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Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

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For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

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.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

Concernant les EVMs avec appareils radio

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.

Concernant les EVMs avec antennes détachables

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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This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
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.

Texas Instruments Japan Limited
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Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
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3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
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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.

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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.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

Concernant les EVMs avec appareils radio

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.

Concernant les EVMs avec antennes détachables

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.

【Important Notice for Users of this Product in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
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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EVALUATION BOARD/KIT/MODULE (EVM)
WARNINGS, RESTRICTIONS AND DISCLAIMERS

For Feasibility Evaluation Only, in Laboratory/Development Environments. Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard.
3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

Certain Instructions. It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

Agreement to Defend, Indemnify and Hold Harmless. You agree to defend, indemnify and hold TI, its licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, "Claims") arising out of or in connection with any use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

Safety-Critical or Life-Critical Applications. If you intend to evaluate the components for possible use in safety critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

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TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

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