DRV3202EVM User's Guide

User's Guide

Literature Number: SLVU810
December 2012

Overview

About This Manual

This document is a supplement to the DRV3202-Q1 Data Sheet. It details the hardware implementation of DRV3202-Q1 evaluation module (EVM). This document does not cover the motor-driver application and the software.

How to Use This Manual

Chapter 1 and Chapter 2 list the hardware descriptions of the EVM, Appendix A helps the user get started with the evaluation, and Appendix B describes the 3.3-V interface (I/F) board.

Related Documents from TI

DRV3202-Q1 Data Sheet, SLVSBJ4

1.1 Introduction

The DRV3202EVM is an application board to evaluate the DRV3202-Q1 device. The DRV3202-Q1 device is a field effect transistor (FET) pre-driver designed for 3-phase brushless DC motor control. The EVM consists of the DRV3202-Q1 device, six N-channel MOSFETs, and passive devices. The DRV3202EVM has a 5-V level interface to communicate with an external micro-controller unit (MCU). A 3.3-V I/F board is also provided to support the 3.3-V MCU.

1.2 Block Diagram

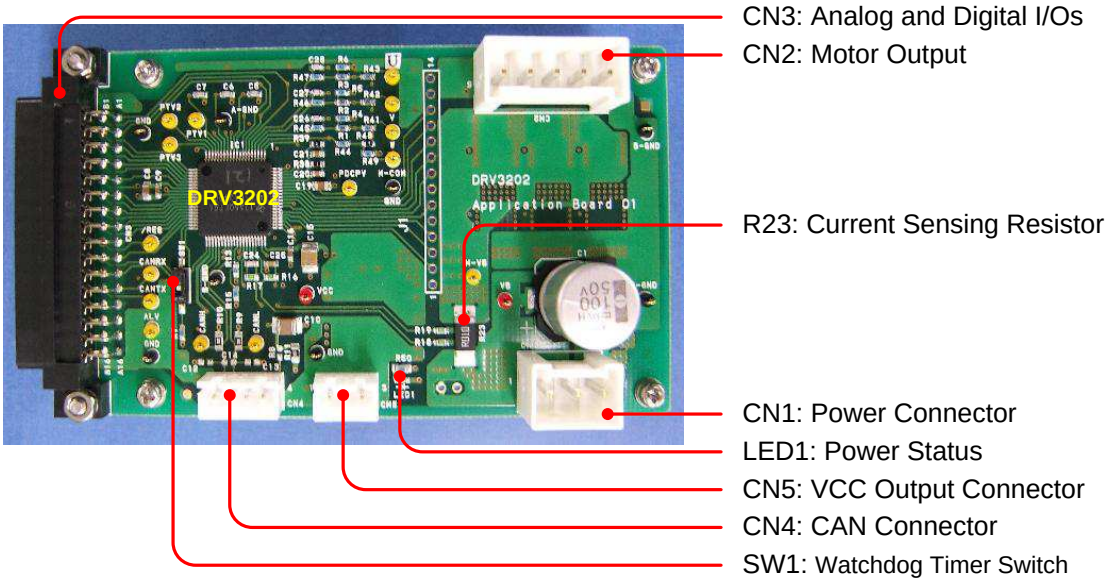

Figure 1-1. Board Layout (Front Side)

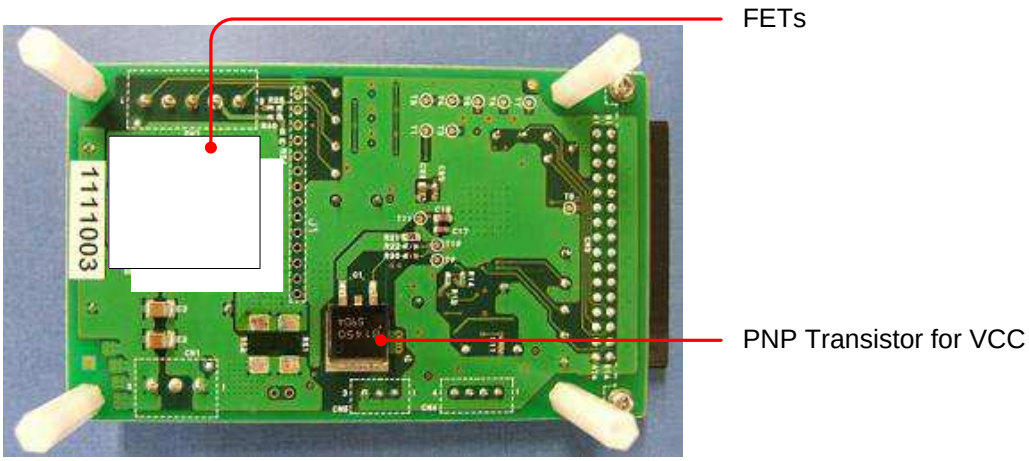

Figure 1-2. Board Layout (Back Side)

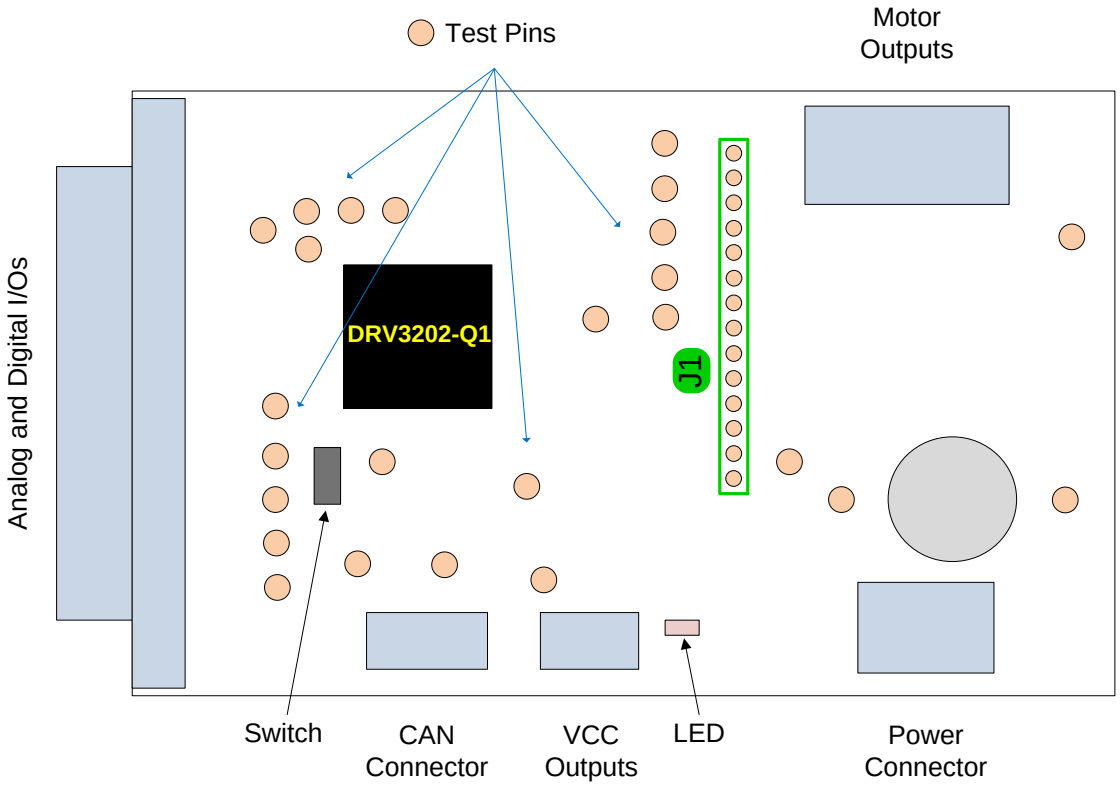

Figure 1-3. Block Diagram

1.2.1 Power and Communication Connectors

The EVM offers terminal blocks for the application of power, motor outputs, as well as digital input/output (I/O) and communication. This section briefly describes the functions. The pin assignments are described in Chapter 2.

1.2.1.1 Power Connector

The VB power rail (typically 12 V) must be externally supplied. The power for the external MCU and other analog and digital functions are supplied by the regulator implemented in the DRV3202-Q1 device.

1.2.1.2 Motor Outputs

A brushless DC motor is connected to the EVM through the motor outputs.

1.2.1.3 Analog and Digital I/O

The analog and digital I/O, controller area network (CAN) I/F and SPI communication of the DRV3202-Q1 can be used through the connector. All of the terminals are 5 volts.

1.2.1.4 CAN Connector

This EVM can be used to evaluate the applications of the CAN. The DRV3202-Q1 device integrates a CAN transceiver, which provides a high-speed (up to 1 Mbps) communication interface through the CAN bus to the external system.

1.2.1.5 VCC Output

A 5-V power supply is available through the VCC output terminal. It is used for components on the board, and external devices such as the MCU.

1.2.2 LED

The LED turns on when the DRV3202EVM power is supplied.

1.2.3 Switch

Switch is connected to the active low watchdog timer enable ($\overline{\text{WDEN}}$) input pin of DRV3202-Q1. Use the disable watchdog timer while the MCU is in software debug mode.

1.2.4 FETs

Six N-channel MOSFETs are implemented on the board to drive the brushless DC motor. A 10-A maximum brushless DC motor can be evaluated using this EVM board.

1.2.5 Test Pins

The DRV3202-Q1 pins are brought out to the test pin, test through-hole, or test pad (11 test pads are located on the back side of the EVM). For each test pin, a label on the silkscreen identifies the signal. The user can access the signals by using 14 through-holes, marked as J1.

Connectors and Switches

This section describes the pin assignment of the connectors and switches.

2.1 Connectors

2.1.1 CN1

Table 2-1. Power Connectors

Pin No.	Name	Description
Part Number: B3P-VH-FB-B (LF) (SN) (JST)		
1	VB	External power supply (typ 12 V, max 10 A)
2	NC	No connection
3	GND	Base ground (B-GND)

2.1.2 CN2

Table 2-2. Motor Outputs

Pin No.	Name	Description
Part Number: B5P-VH-FB-B (LF) (SN) (JST)		
1	Motor1	Motor terminal 1
2	NC	No connection
3	Motor2	Motor terminal 2
4	NC	No connection
5	NC	Motor terminal 3

2.1.3 CN3

Table 2-3. Analog and Digital I/O

Pin No.	Name	Description
Part Number: FCN-365J032-AU (Fujitsu Component)		
A1	PMV1	Phase comparator output 1
B1	PMV2	Phase comparator output 2
A2	PMV3	Phase comparator output 3
B2	PSS1	Sample and hold control signal input 1
A3	PSS2	Sample and hold control signal input 2
B3	PSS3	Sample and hold control signal input 3
A4	$\overline{CS}$	SPI chip select signal input
B4	DOUT	SPI data signal output
A5	SCK	SPI clock signal input
B5	DIN	SPI data signal input

Table 2-3. Analog and Digital I/O (continued)

Pin No.	Name	Description
A6	CTLEN	Pre-driver parallel enable input
B6	CTLWL	Pre-driver parallel input
A7	CTLWH	Pre-driver parallel input
B7	CTLVL	Pre-driver parallel input
A8	CTLVH	Pre-driver parallel input
B8	CTLUL	Pre-driver parallel input
A9	CTLUH	Pre-driver parallel input
B9	$\overline{\text{RES}}$	Reset output
A10	PRN	Watchdog timer pulse input
B10	FAULT	Diagnosis output
A11	$\overline{\text{OVCR}}$	Overcurrent reset input
B11	NC	No connection
A12	CANRX	CAN digital receive data output
B12	CANTX	CAN digital transmit data input
A13	NC	No connection
B13	PTV1	Phase amplifier output 1
A14	PTV2	Phase amplifier output 2
B14	PTV3	Phase amplifier output 3
A15	GND	Ground
B15	ALV	Motor current sense amp output
A16	GND	Ground
B16	VCC	5-V VCC supply output

2.1.4 CN4

Table 2-4. CAN Bus Connector

Pin No.	Name	Description
Part Number: B4B-XH-A (LF) (SN) (JST)		
1	CANH	CAN driver I/O – High in dominant state
2	CANL	CAN driver I/O – Low in dominant state
3	GND	Ground
4	NC	No connection

2.1.5 CN5

Table 2-5. VCC Output Connector

Pin No.	Name	Description
Part Number: B3B-XH-A (LF) (SN) (JST)		
1	VCC	VCC power supply output
2	NC	No connection
3	GND	Ground

2.2 Switches

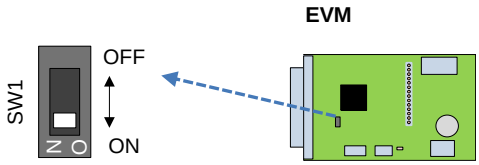

Figure 2-1. $\overline{\text{WDEN}}$ Switch

Table 2-6. $\overline{\text{WDEN}}$ Switch

Switch	Description
ON	DRV3202-Q1 $\overline{\text{WDEN}}$ = VCC (5 V) Watchdog timer is disabled
OFF	DRV3202-Q1 $\overline{\text{WDEN}}$ = GND Watchdog timer is enabled A 1-KHz pulse must be generated by the CPU.

Application Evaluation

This chapter gives an overview of an application evaluation environment. It uses an F28035 (C2000) Control CARD and TI Code Composer Studio (CCS) to control and monitor the DRV3202-Q1 and motor-driver application.

A.1 Example of Evaluation Environment

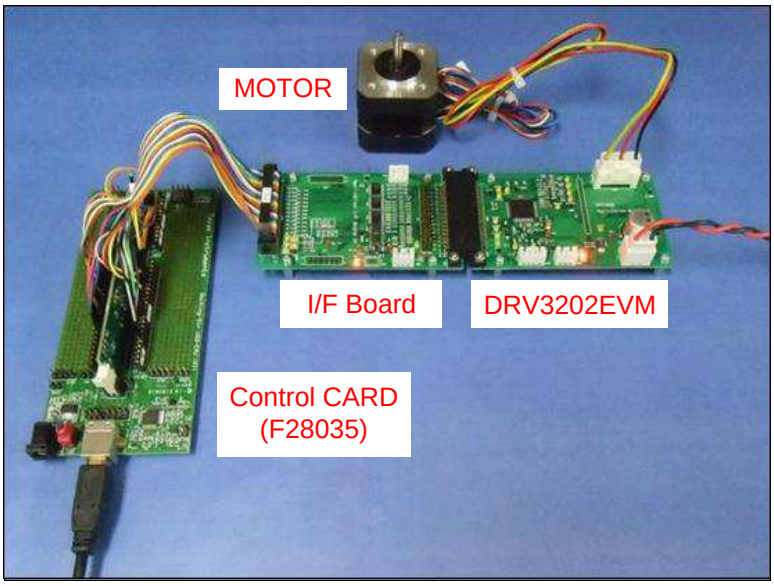

Figure A-1. Example of Evaluation Environment

Figure A-1 shows a typical environment to evaluate the brushless DC motor system, Figure A-2 shows the block diagram, and Table A-1 lists the components.

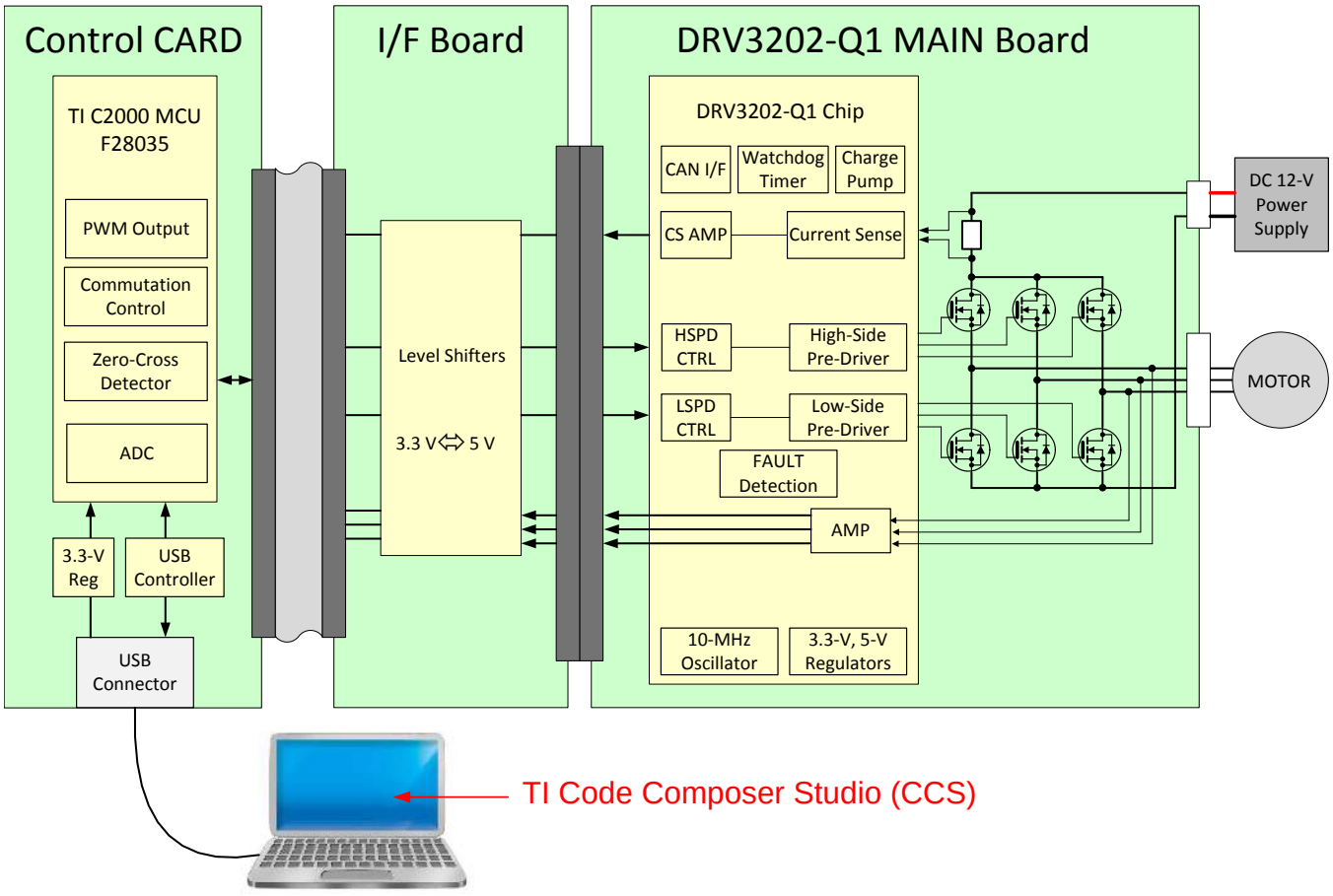

Figure A-2. EVM Block Diagram

Table A-1. Debugging Environment Example

Component	Description
CCS	CCS is the integrated development environment (IDE) for TI's micro-controllers. It provides a compiler of the user's code, a source code editor, a project build environment and a real-time debugger.
Control CARD	The Piccolo F28035 Control CARD is a TI 32-bit CPU suitable for motor-driver or power management applications.
I/F board	The I/F board converts the I/O voltage level between the Control CARD (3.3 V) and the DRV3202EVM (5 V).
MOTOR	A 3-phase brushless DC motor
Power supply	A 12-V power supply to the EVM board

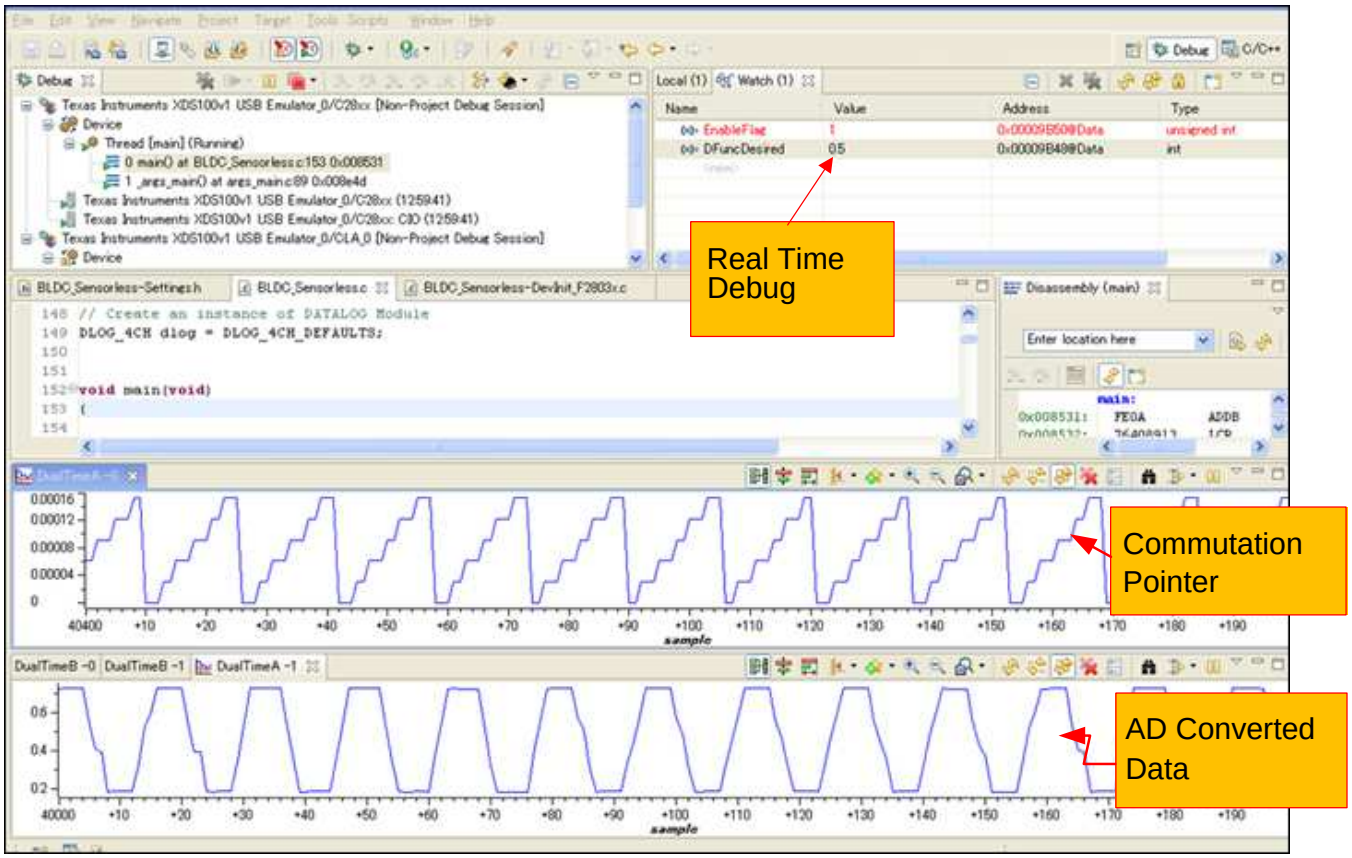

Figure A-3. TI Code Composer Studio Screen Capture

The TI CCS offers real-time debugging with a C2000 MCU. It controls the C2000 parameters or displays a motor-control status.

For more information, refer to the *DRV3202EVM User's Guide Using C2000*.

I/F Board

B.1 I/F Board Overview

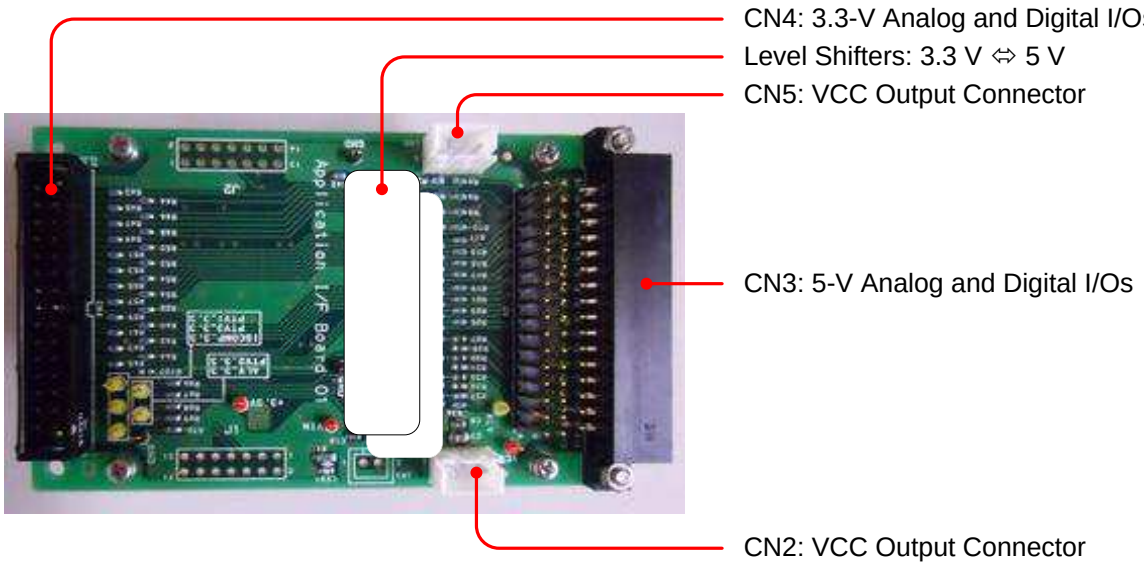

Figure B-1. Board Layout (Front Side)

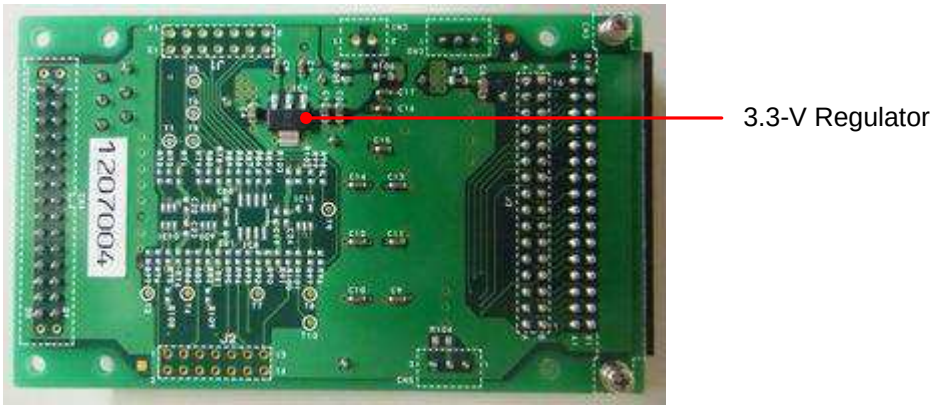

Figure B-2. Board Layout (Back Side)

B.2 Connectors

B.2.1 CN1

Not used

B.2.2 CN2 and CN5

CN2 and CN5 are 5-V power supplies to components on the board or external devices.

Table B-1. VCC Output Connector

Pin No.	Name	Description
Part Number: B3B-XH-A(LF)(SN) (JST)		
1	VCC	VCC power supply output
2	NC	No connection
3	GND	Ground

B.2.3 CN3

CN3 is a 5-V voltage level I/F connector, and it is connected to CN3 on the DRV3202EVM. Refer to Table 2-3, *Analog and Digital I/O*. The part number is: FCN-365P032-AU (Fujitsu Component).

B.2.4 CN4

CN4 is a 3.3-V voltage level I/F connector, and it is used on the C2000 Control CARD.

Table B-2. 3.3-V Analog and Digital I/O

Pin No.	Name	Description
Part Number: XG4C-3031 (omrom)		
1	GND	Ground
2	ISCOMP	Current comparator output
3	ALV	Motor current sense amp output
4	PTV3	Phase amplifier output 3
5	PTV2	Phase amplifier output 2
6	PTV1	Phase amplifier output 1
7	NC	No connection
8	PRN	Pulse input
9	CTLUH	Pre-driver parallel input
10	CTLUL	Pre-driver parallel input
11	CTLVH	Pre-driver parallel input
12	CTLVL	Pre-driver parallel input
13	CTLWH	Pre-driver parallel input
14	CTLWL	Pre-driver parallel input
15	CTLEN	Pre-driver parallel enable input
16	DIN	SPI data signal input
17	SCK	SPI clock signal input
18	$\overline{CS}$	SPI chip select signal input
19	PSS3	Sample and hold control signal input 3
20	PSS2	Sample and hold control signal input 2
21	PSS1	Sample and hold control signal input 1
22	$\overline{OVCR}$	Overcurrent reset input
23	CANTX	CAN digital input
24	CANRX	CAN digital output
25	FAULT	Diagnosis output
26	$\overline{RES}$	Reset output
27	DOUT	SPI data signal output
28	PMV3	Phase comparator output 3
29	PMV2	Phase comparator output 2

Table B-2. 3.3-V Analog and Digital I/O (continued)

Pin No.	Name	Description
30	PMV1	Phase comparator output 1

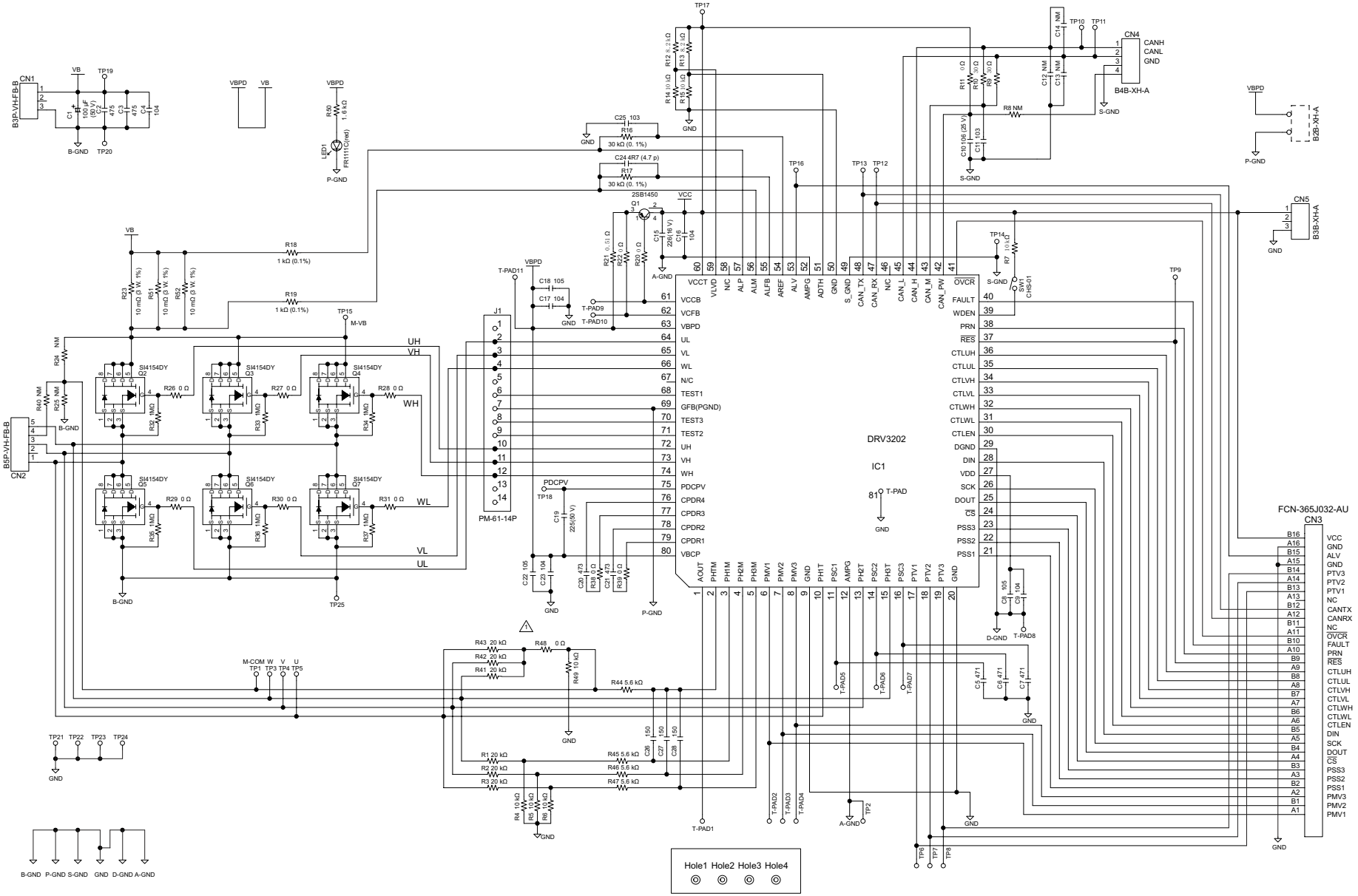

Figure B-3. EVM Main Schematic

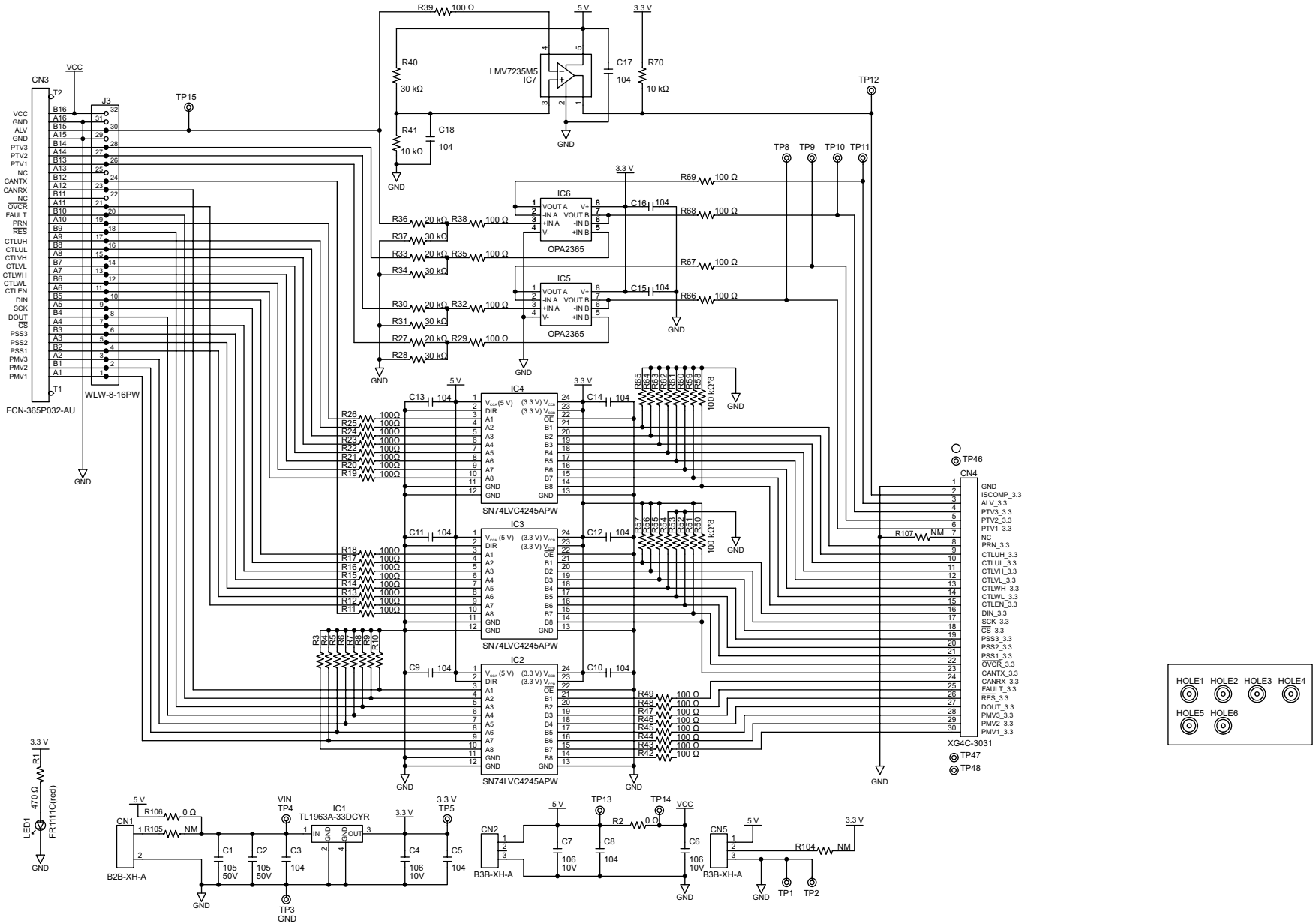

Figure B-4. EVM Interface Schematic

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2 *Limited Warranty and Related Remedies/Disclaimers*:

   2.1 These terms and conditions do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.

   2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for any defects that are caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI. Moreover, TI shall not be liable for any defects that result from User's design, specifications or instructions for such EVMs. Testing and other quality control techniques are used to the extent TI deems necessary or as mandated by government requirements. TI does not test all parameters of each EVM.

   2.3 If any EVM fails to conform to the warranty set forth above, TI's sole liability shall be at its option to repair or replace such EVM, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

3 *Regulatory Notices:*

   3.1 *United States*

      3.1.1 *Notice applicable to EVMs not FCC-Approved:*

      This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

      3.1.2 *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

      NOTE: 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

NOTE: 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.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-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.

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.

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.

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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3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
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If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

1. Use EVMs 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 EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should 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 also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user 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, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure 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. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

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