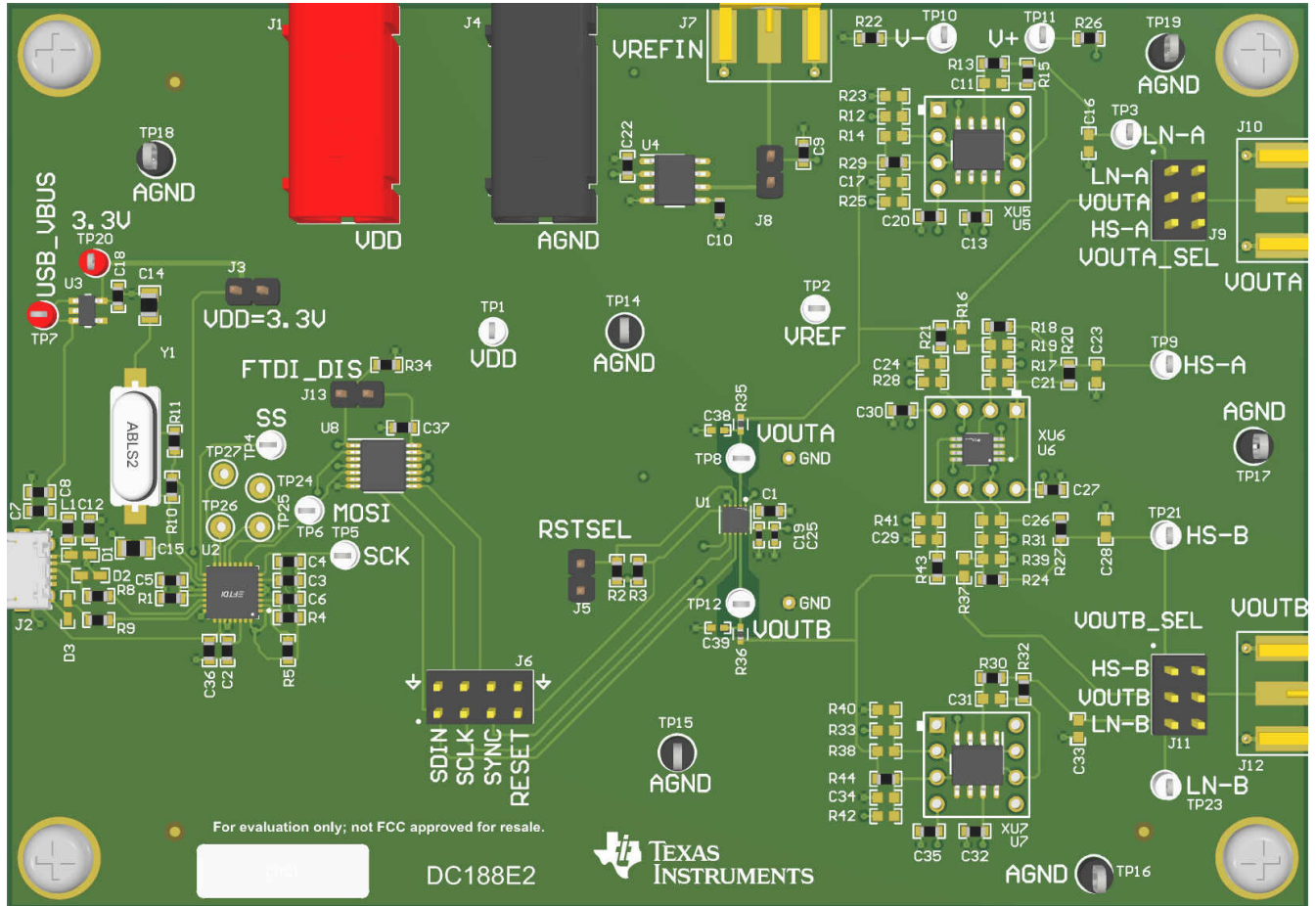


User's Guide

DAC82002EVM User's Guide



ABSTRACT



This user's guide describes the characteristics, operation, and use of the DAC82002 evaluation module (EVM). This EVM is designed to evaluate the performance of the [DAC82002](#) commercial, unbuffered voltage output DAC in a variety of configurations. Throughout this document, the terms evaluation board, evaluation module, and EVM are synonymous with the DAC82002EVM. This document includes a schematic, printed-circuit board (PCB) layouts, and a complete bill of materials.

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1 Overview

The [DAC82002EVM](#) is an easy-to-use platform to evaluate the functionality and performance of the DAC82002 commercial device.

The 16-bit DAC82002 is a high-accuracy, low-power, dual-channel digital-to-analog converter (DAC). The DAC82002 uses a power-on-reset circuit to power up at either zero scale (0x0000) or midscale (0x8000), depending on the RSTSEL pin. The DAC82002 uses a 3-wire serial peripheral interface (SPI) for digital communication that operates at clock rates of up to 50 MHz.

1.1 Kit Contents

[Table 1-1](#) details the contents of the EVM kit. Contact the nearest TI Product Information Center if any component is missing. Download the latest versions of the related software in the [DAC82002EVM tool folder](#).

Table 1-1. Contents of DAC82002EVM Kit

Item	Quantity
DAC82002EVM evaluation board PCB	1
USB micro-B plug to USB-A plug cable	1

1.2 Related Documentation from Texas Instruments

The following document provides information regarding Texas Instruments integrated circuits used in the assembly of the DAC82002EVM. This user's guide is available from the TI web site under literature number [SBAU401](#). Any letter appended to the literature number corresponds to the document revision that is current at the time of the writing of this document. Newer revisions may be available from the TI web site at www.ti.com, or call the Texas Instruments Literature Response Center at (800) 477-8924 or the Product Information Center at (972) 644-5580. When ordering, identify the document by both title and literature number.

2 System Setup

2.1 Software Setup

This section provides the procedure for EVM software installation.

2.1.1 Operating Systems

The EVM software is compatible with the Windows™ 7 and 10 operating systems.

2.1.2 Software Installation

Before installing the software, make sure that the DAC82002EVM is not connected to the local machine.

Download the software from [DAC82002EVM tool folder](#). After the software is downloaded, navigate to the download folder, and run the DAC82002EVM software installer executable file.

When the DAC82002EVM software is launched, an installation dialog window opens and prompts the user to select an installation directory. If left unchanged, [Figure 2-1](#) shows that the software location defaults to `C:\Program Files (x86)\Texas Instruments\DAC82002EVM`.

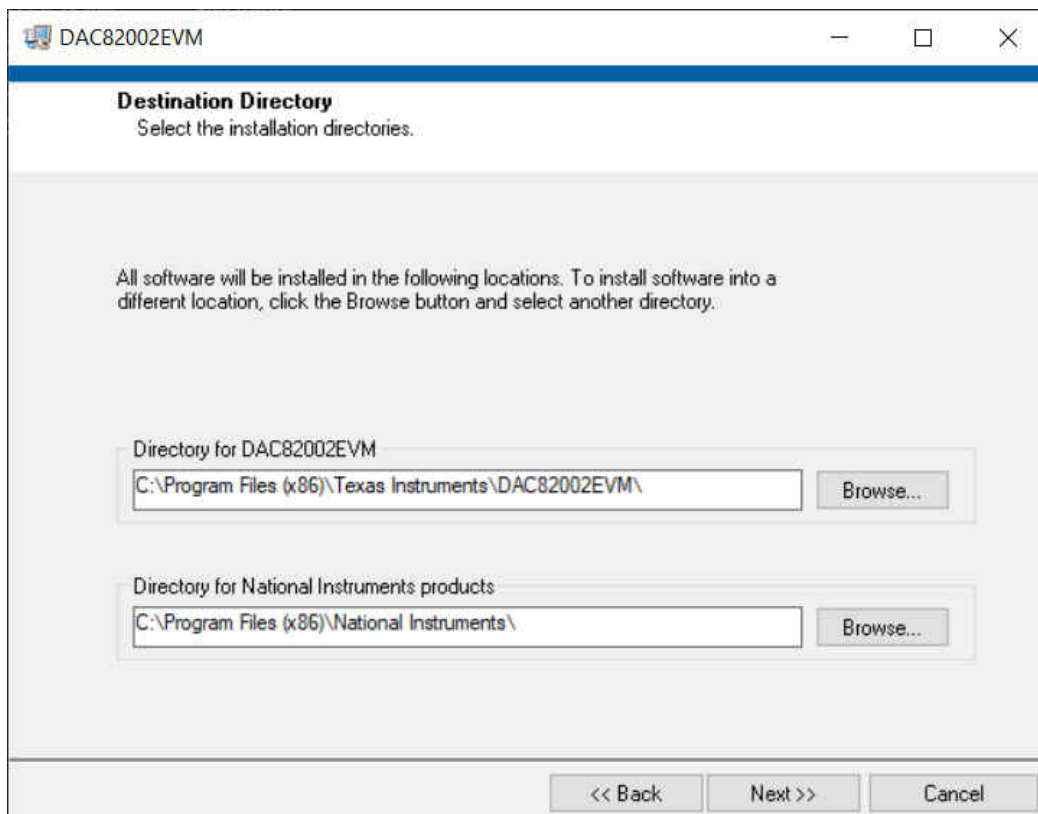


Figure 2-1. Software Installation Path

The EVM software also installs the FTDI USB drivers using a separate executable file, and automatically copies the required LabVIEW™ software files and drivers to the local machine. [Figure 2-2](#) shows the FTDI USB drivers installation window that is automatically launched after the DAC82002EVM software installation is complete.

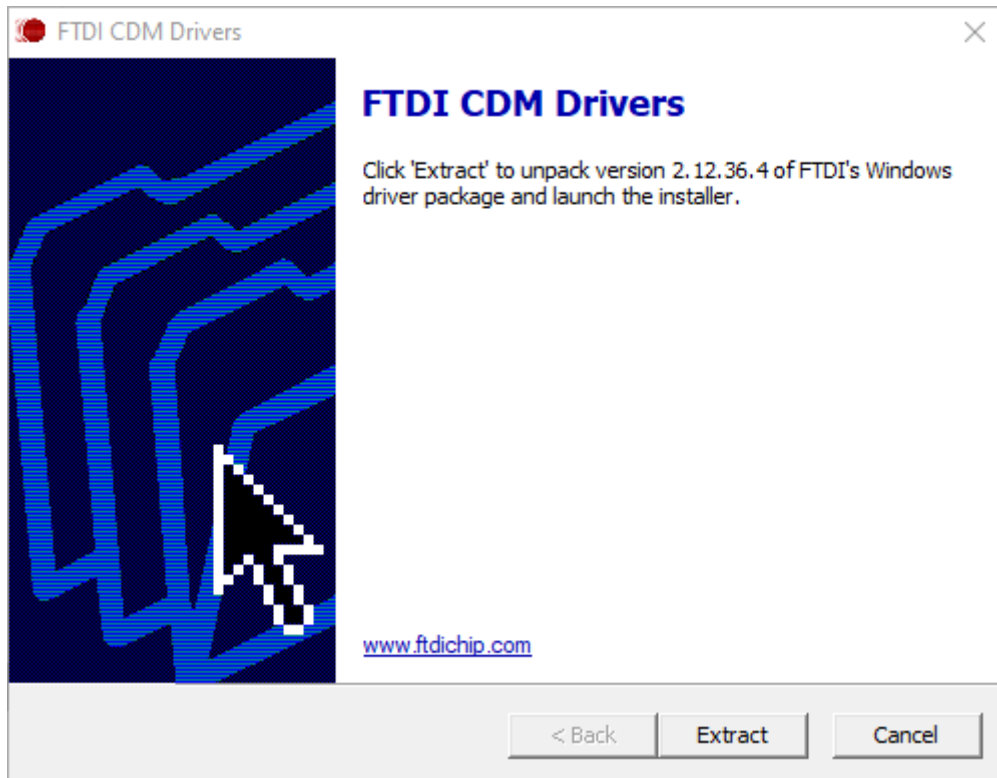


Figure 2-2. FTDI USB Drivers

2.2 Hardware Setup

This section describes the overall system setup for the EVM. A local machine runs the software that provides an interface to the DAC82002EVM through the onboard controller.

The USB connection generates 5 V of power for use as the DAC supply voltage (VDD). The onboard controller generates 3.3 V of power for the input/output (I/O) signals generated by the controller. These I/O signals are level-translated to the VDD voltage of the DAC. [Figure 2-3](#) displays the system hardware setup.

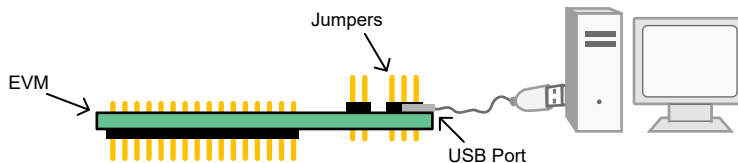


Figure 2-3. Hardware Setup

2.2.1 Electrostatic Discharge Caution

CAUTION

Many of the components on the DAC82002EVM are susceptible to damage by electrostatic discharge (ESD). Observe proper ESD handling precautions when unpacking and handling the EVM, including the use of a grounded wrist strap at an approved ESD workstation.

2.2.2 Power Configurations and Jumper Settings

The DAC82002EVM provides electrical connections to the device supply pins. [Table 2-1](#) shows the connections.

Table 2-1. DAC82002EVM Power Supply Inputs

DAC82002EVM Connector	Supply Name	Voltage Range
J1	VDD	1.8 V to 5.5 V; remove J3 if applying an external VDD to the DAC
J4	AGND	0 V
J7	VREFIN	2 V to VDD; ignore if J8 is shorted and onboard 2.5-V VREF is used

The jumper settings on the DAC82002EVM are crucial to the proper operation of the EVM. [Table 2-2](#) provides the details of the configurable jumper settings on the EVM. [Figure 4-1](#) defines the DAC82002EVM pin numbers.

Table 2-2. DAC82002EVM Jumper Settings

Jumper	Default Position	Available Option	Description
J3	Short: 3.3 V from USB used as VDD	Open: External VDD used	External or onboard 3.3-V VDD selection
J5	Short: Reset DAC Value is 0	Open: Reset DAC value is midscale	Reset DAC value selection
J8	Short: Onboard 2.5-V VREF used	Open: External VREFIN used	External or onboard 2.5-V VREF selection
J9	VOUTA: Unbuffered VOUTA output	LN-A: Low-noise VOUTA output HS-A: High-speed VOUTA output	VOUTA Output Selection
J11	VOUTB: Unbuffered VOUTB output	HS-B: High-speed VOUTB output LN-B: Low-noise VOUTB output	VOUTB Output Selection
J13	Short: FTDI disabled	Open: FTDI enabled	FTDI disable

If an external supply is applied to the DAC VDD input, remove jumper J3 to disconnect the 5-V USB supply from the DAC VDD pin. For SPI communication to operate, J13 must be open.

For J9 and J11, use only one short at a time for each. Short the J10 and J12 SMA connectors to output VOUTA and VOUTB, respectively.

2.2.3 Connecting the Hardware

After the power and jumper configurations are set up per [Section 2.2.2](#), connect the USB cable from the DAC82002EVM USB port to the local machine.

3 Detailed Description

3.1 Hardware Description

The following sections provide detailed information on the EVM hardware and jumper configuration settings.

3.1.1 Theory of Operation

Figure 3-1 shows a simplified schematic of the DAC82002EVM board. By default, the DAC82002EVM features two OPA388 single-channel, low-noise operational amplifiers, and one OPA2328 dual-channel high-speed operational amplifier. Use jumpers J9 and J11 to select between unbuffered, low-noise, or high-speed output configurations for VOUTA and VOUTB. Adapters for 8-pin DIP packages are available that allow for the replacement of the default operational amplifiers with other options.

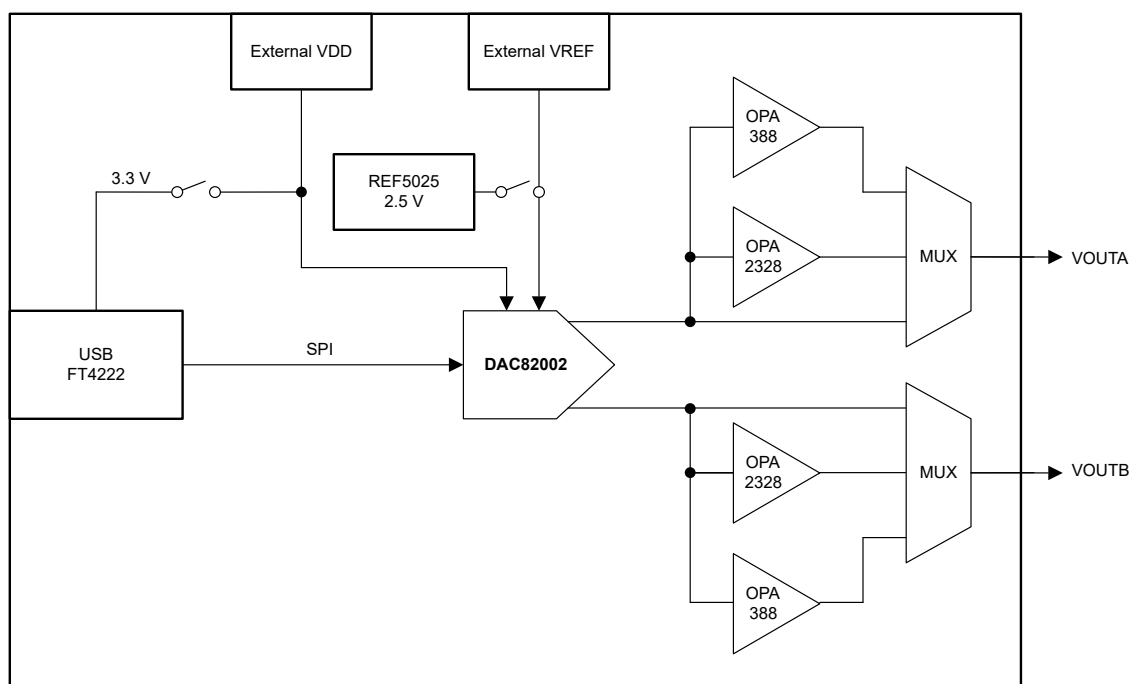


Figure 3-1. DAC82002EVM Hardware Simplified Schematic

3.1.1.1 Signal Definitions

The DAC82002EVM provides access to DAC pins through connection J6. Table 3-1 lists the J6 pin definitions.

Table 3-1. DAC82002EVM J6 Pin Definitions

Pin#	Signal	Description
1	SDIN	FTDI serial data signal for DAC
2	GND	Ground
3	SCLK	FTDI serial CLK signal for DAC
4	GND	Ground
5	$\overline{\text{SYNC}}$	Serial data enable of SPI. Active low. This input is the frame-synchronization signal for the serial data.
6	GND	Ground
7	$\overline{\text{RESET}}$	Active-low RESET for DAC
8	GND	Ground

3.1.1.2 Buffer Customization

The DAC82002EVM has three operational amplifier circuits that can be configured using 0-Ω resistors. All three circuits act as unity gain buffers with the default resistor placement. The following figure shows the 0-Ω resistors are the only resistors that are populated on the DAC82002EVM by default.

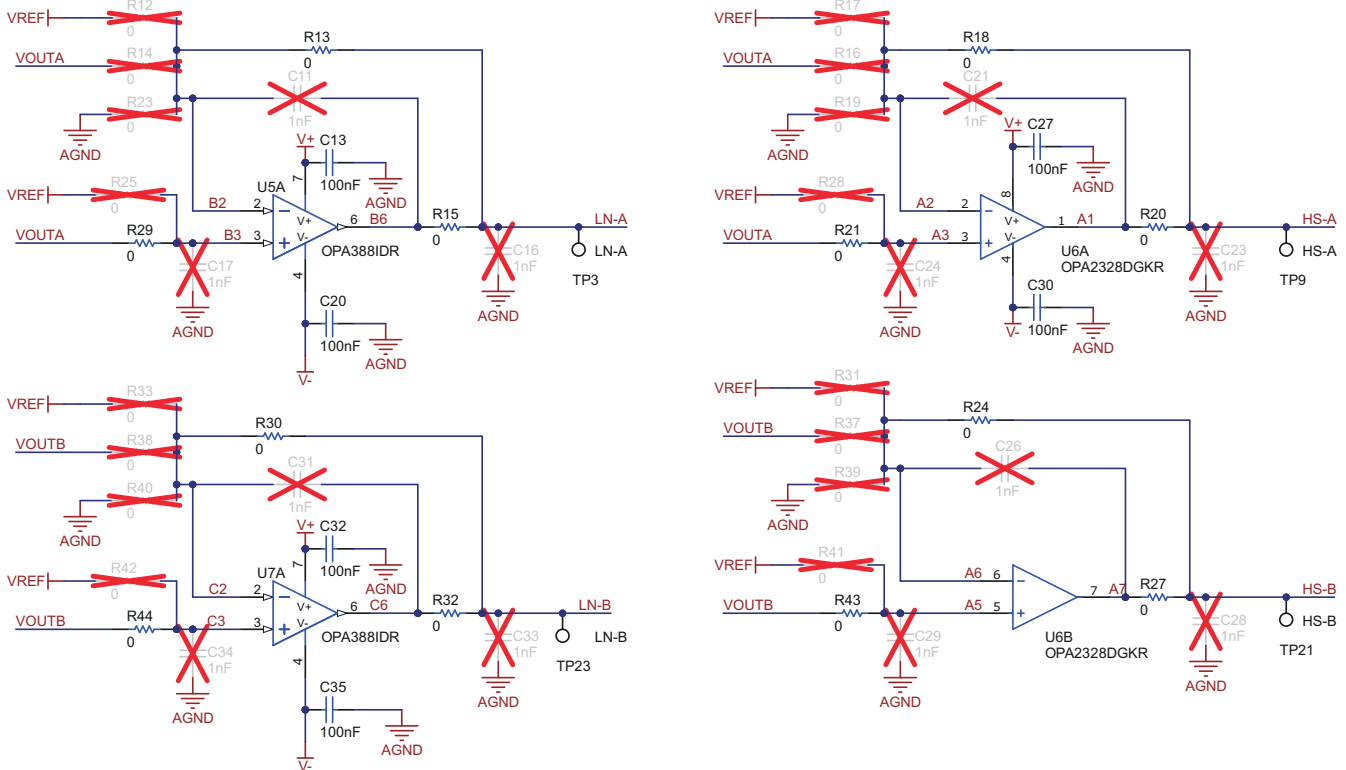


Figure 3-2. Default Buffer Configuration

The three operational amplifiers can be replaced by the desired DIP-8 package. The inserted packages must follow the same pin mapping as the default operational amplifiers. Figure 3-3 shows the buffer DIP adapter connections.

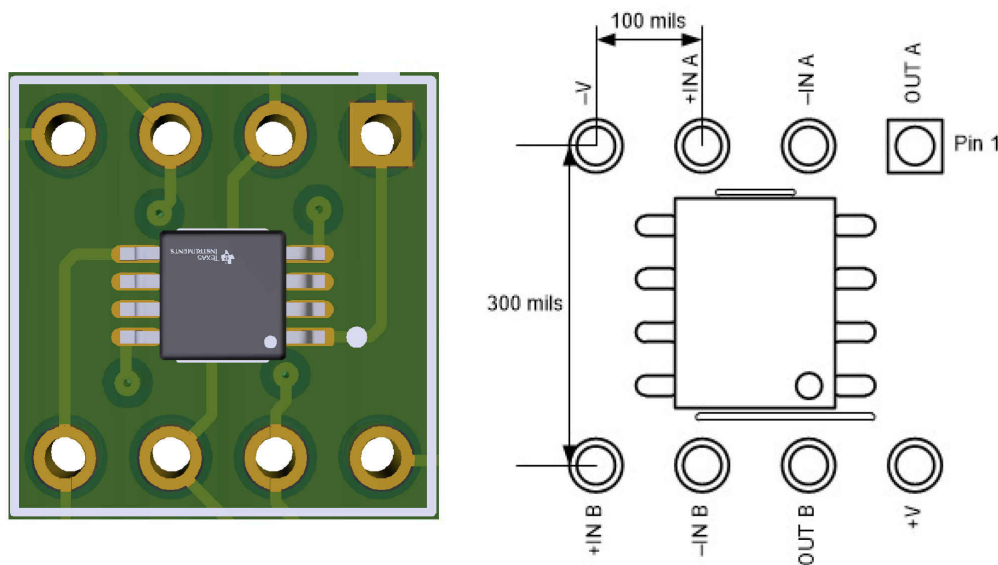


Figure 3-3. Buffer DIP Adapter Connections

3.2 Software Description

This section describes the features of the DAC82002EVM software, and discusses how to use these features. The software provides basic control of all the DAC82002 registers and functions.

3.2.1 Starting the Software

To launch the software, locate the *Texas Instruments* folder in the *All Programs* menu, and select the *DAC82002EVM* icon.

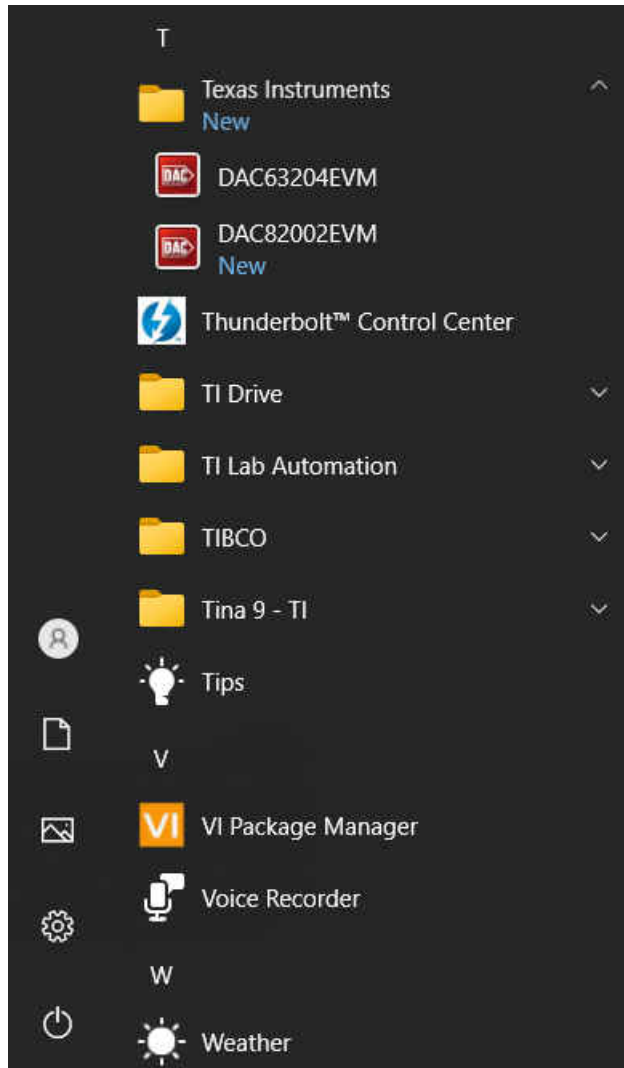


Figure 3-4. DAC82002EVM GUI Location

Figure 3-5 shows that if the onboard controller is connected correctly, the status bar at the bottom of the screen displays *CONNECTED*. If the controller is not properly connected or not connected at all, the status displays *DEMO*. If the graphical user interface (GUI) is not displaying the *CONNECTED* status while the EVM is connected, unplug and reconnect the EVM, and then relaunch the GUI software.

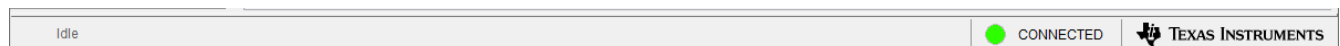


Figure 3-5. DAC82002EVM GUI Connection Detection

3.2.2 Software Features

The DAC82002EVM GUI allows for easy access to the registers that help configure an individual DAC82002 device using SPI communication.

Before using the GUI, see the [DAC82002 device data sheet](#) for detailed programming instructions.

3.2.2.1 Low Level Configuration Page

The *Low Level Configuration* page (Figure 3-6) allows access to low-level communication directly with the DAC82002 device registers. Select a register on the *Register Map* list to show a description of the values in that register, as well as information on the register address, default value, size, and current value. Data are written to the registers by entering a value in the value column of the GUI.

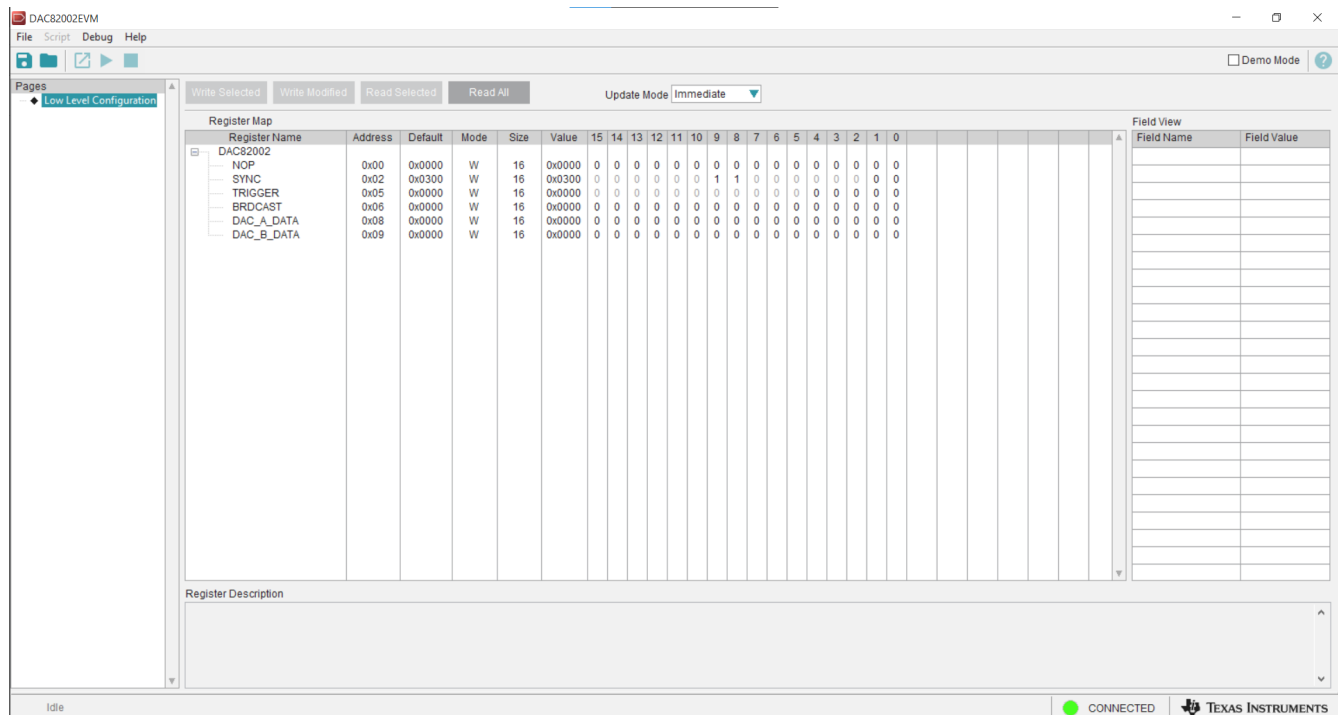


Figure 3-6. Low Level Configuration Page

To store the values of the register map locally, select *Save Configuration* under the *File* menu option. The stored configuration files can be recalled and loaded by selecting *Open Configuration*.

Figure 3-7 shows the four configuration buttons provided on the *Low Level Configuration* page that allow the user to interact with the device registers:

- **Write Selected**
- **Write Modified**
- **Read Selected**
- **Read All**

The DAC82002EVM only supports writing to the device registers, so **Read Selected** and **Read All** have no effect.

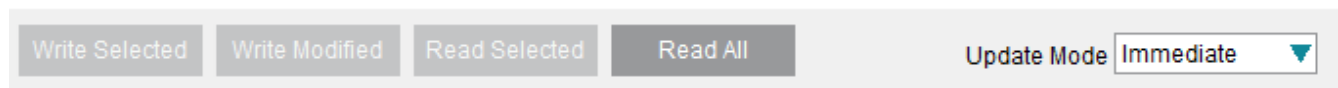


Figure 3-7. Low Level Configuration Page Options

4 Schematic, PCB Layout, and Bill of Materials

This section contains the schematics, printed circuit board (PCB) layout diagrams, and a complete bill of materials for the DAC82002EVM.

4.1 Schematic

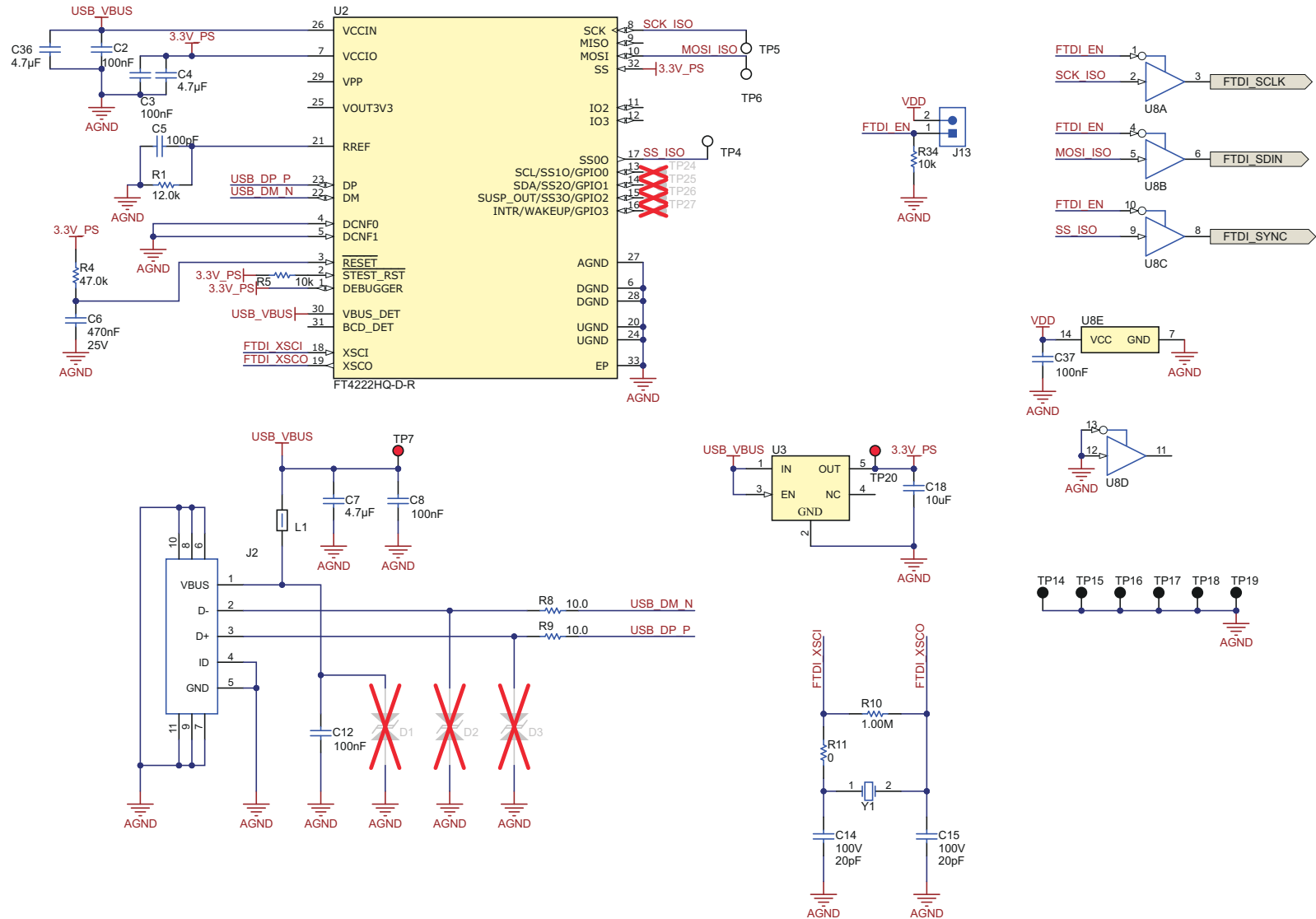


Figure 4-1. DAC82002EVM Schematic Page 1

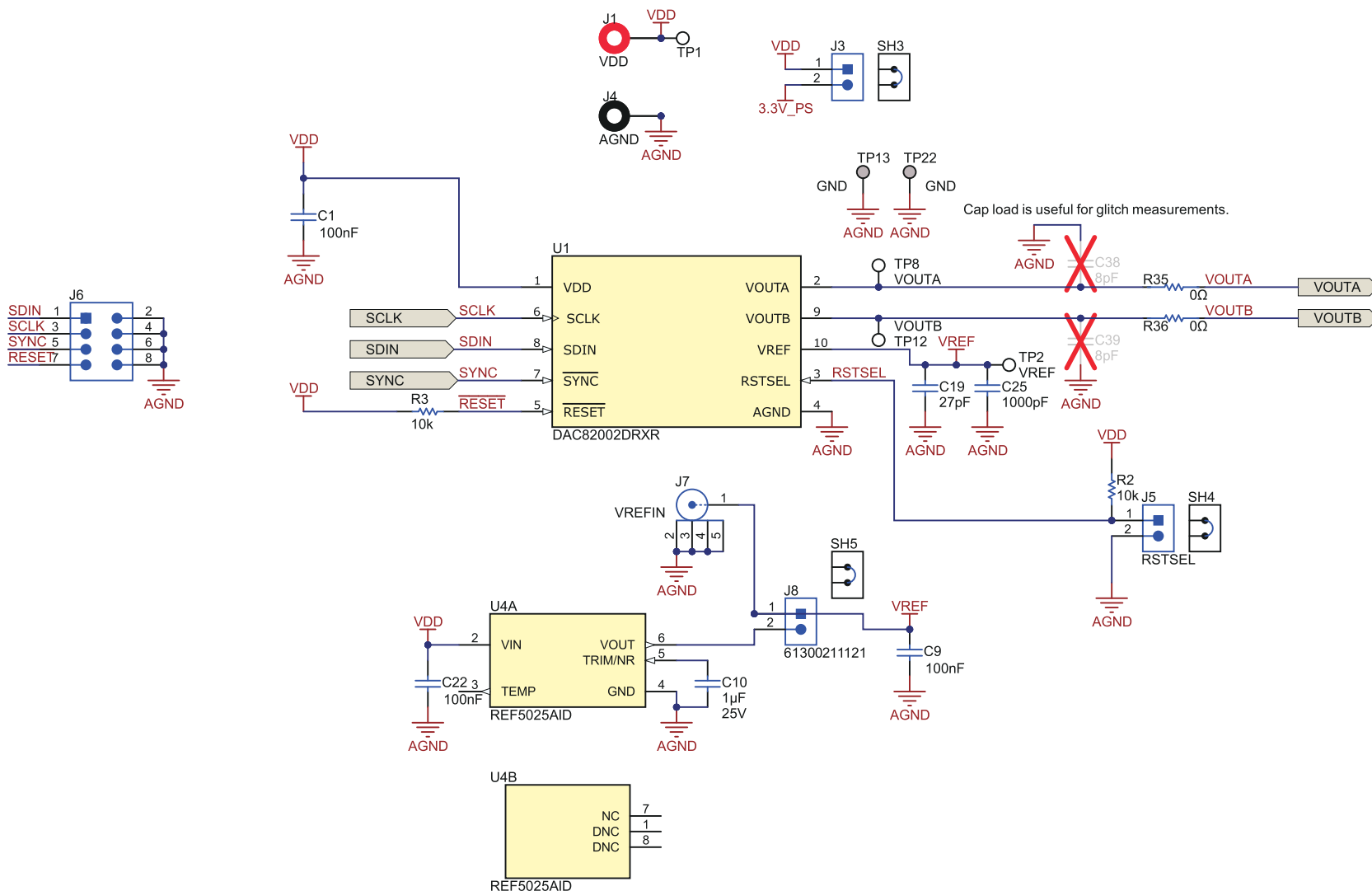


Figure 4-2. DAC82002EVM Schematic Page 2

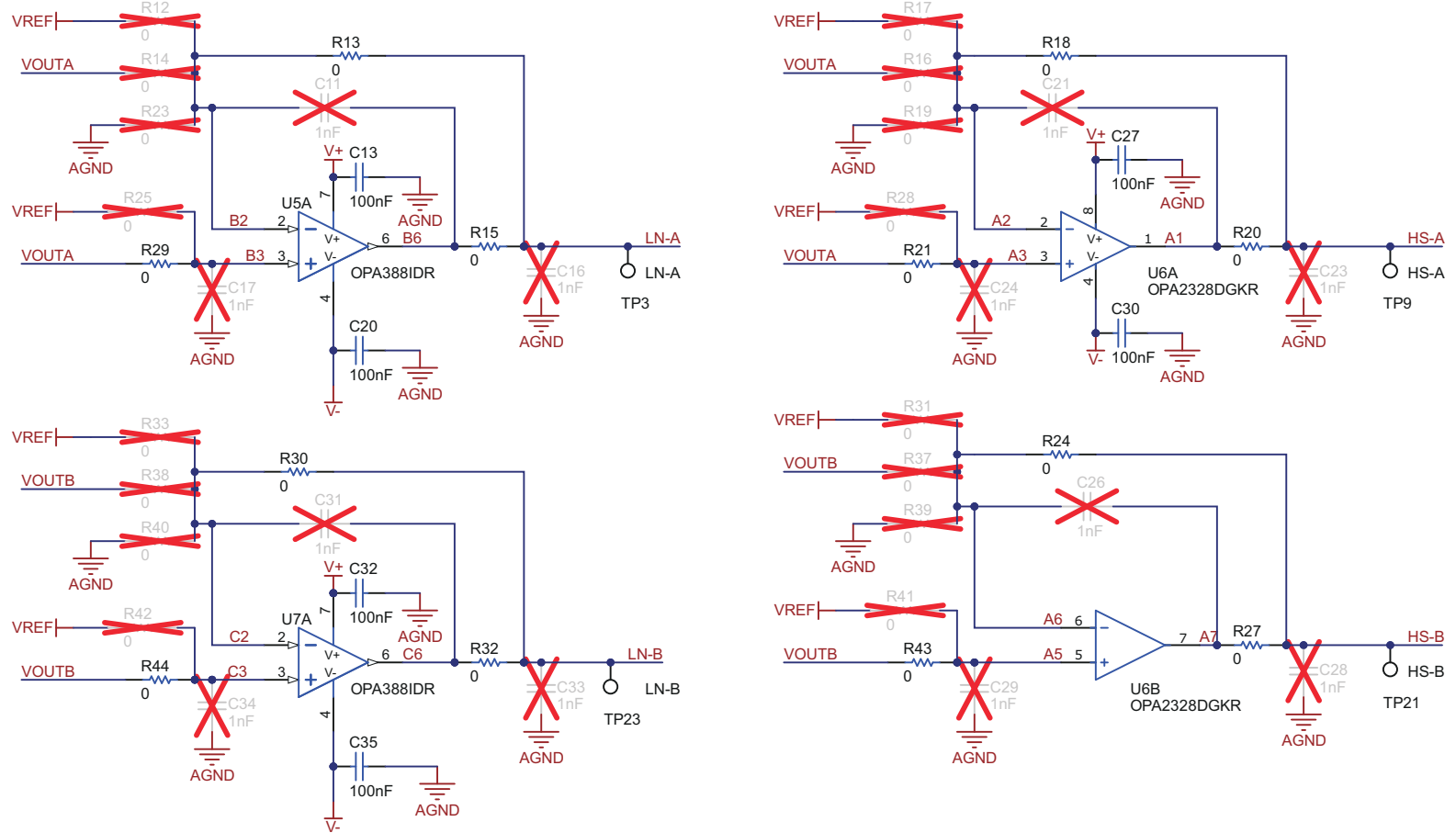


Figure 4-3. DAC82002EVM Schematic Page 3

4.2 PCB Layout

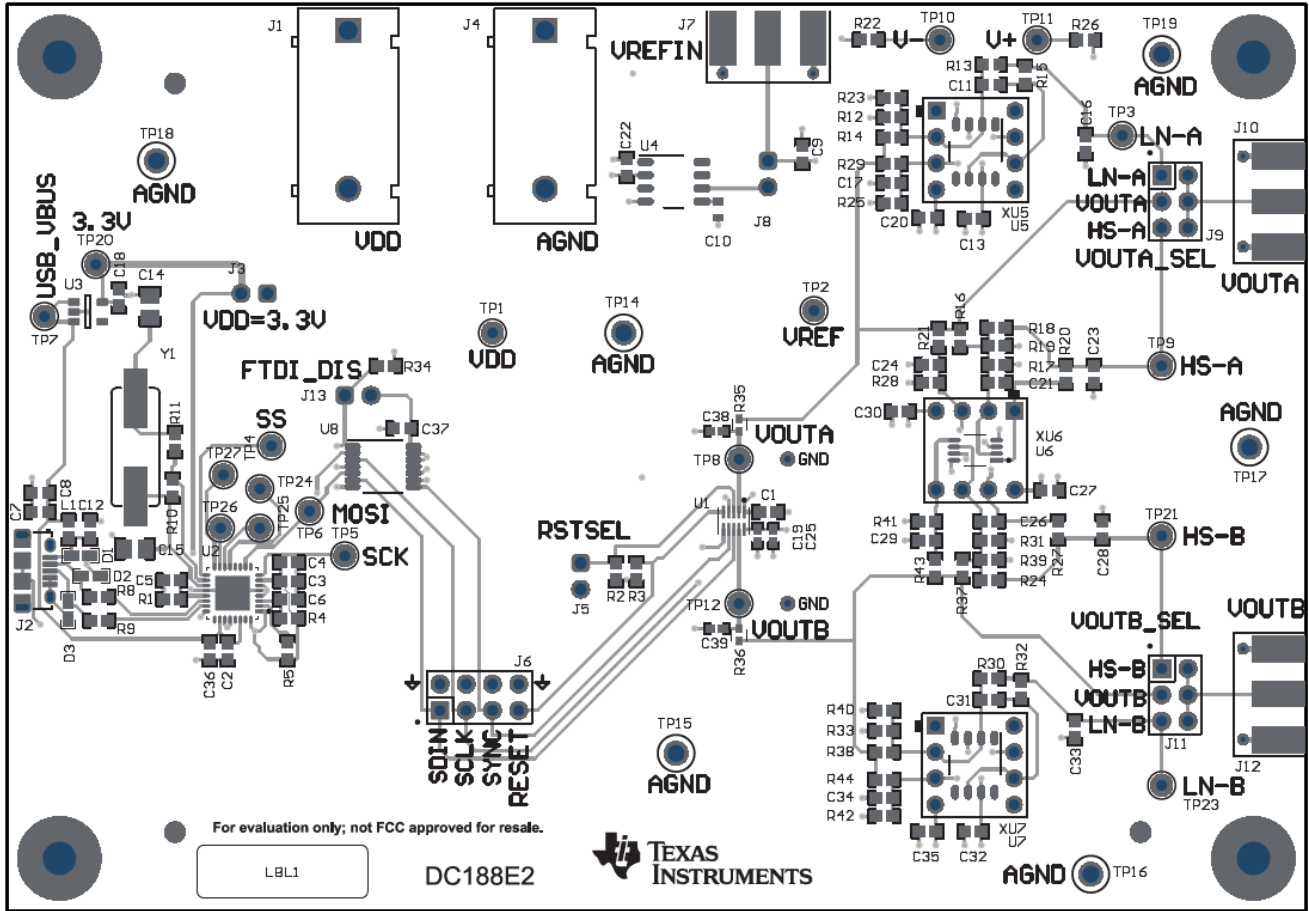


Figure 4-4. DAC82002EVM PCB Components Layout

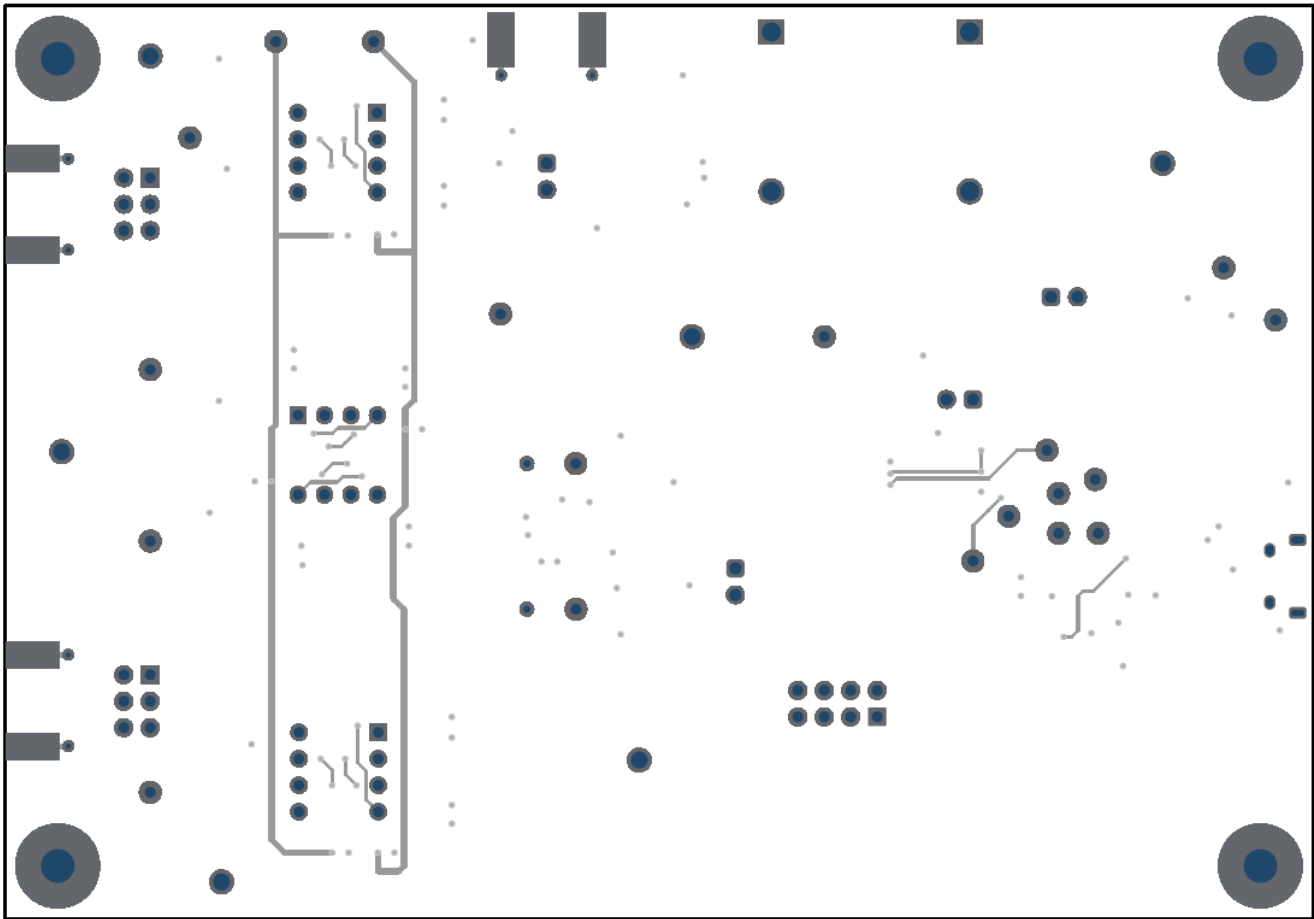


Figure 4-5. DAC82002EVM PCB Layers

4.3 Bill of Materials

Table 4-1. DAC82002EVM Bill of Materials

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
!PCB	1		Printed circuit board		DC188	Any
C1, C2, C3, C8, C9, C12, C13, C20, C22, C27, C30, C32, C35, C37	14	0.1 μ F	CAP, CERM, 0.1 μ F, 50 V, \pm 10%, X7R, AEC-Q200 grade 0, 0603	603	06035C104K4Z4A	AVX
C4, C7, C36	3	4.7 μ F	CAP, CERM, 4.7 μ F, 16 V, \pm 10%, X7R, 0603	603	GRM188Z71C475KE21D	MuRata
C5	1	100 pF	CAP, CERM, 100 pF, 25 V, \pm 10%, X7R, 0603	603	06033C101KAT2A	AVX
C6	1	0.47 μ F	CAP, CERM, 0.47 μ F, 25 V, \pm 10%, X7R, 0603	603	GRM188R71E474KA12D	MuRata
C10	1	1 μ F	CAP, CERM, 1 μ F, 25 V, \pm 10%, X7R, AEC-Q200 grade 1, 0603	603	CGA3E1X7R1E105K080AC	TDK
C11, C16, C17, C21, C23, C24, C26, C28, C29, C31, C33, C34	12	1000 pF	CAP, CERM, 1000 pF, 50 V, \pm 5%, X7R, AEC-Q200 grade 1, 0603	603	C0603C102J5RACAUTO	Kemet
C14, C15	2	20 pF	CAP, CERM, 20 pF, 100 V, \pm 5%, C0G/NP0, 0805	805	08051A200JAT2A	AVX
C18	1	10 μ F	CAP, CERM, 10 μ F, 10 V, \pm 20%, X5R, 0603	603	C1608X5R1A106M080AC	TDK
C19	1	27 pF	CAP, CERM, 27 pF, 25 V, \pm 5%, C0G/NP0, 0402	402	C0402C270J3GAC7867	Kemet
C25	1	1000 pF	CAP, CERM, 1000 pF, 25 V, \pm 5%, X7R, 0402	402	C0402C102J3RACTU	Kemet
C38, C39	2	8 pF	CAP, CERM, 8 pF, 50 V, \pm 6.25%, C0G/NP0, 0402	402	CC0402DRNPO9BN8R0	Yageo
D1, D2, D3	3	24 V	PulseGuard ESD suppressor, 24 VDC, SMT	0603 TVS diode	PGB1010603MR	Littelfuse
FID1, FID2, FID3	3		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A
H1, H2, H3, H4	4		Machine screw, round, #4-40 \times 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	4		Standoff, hex, 0.5"L #4-40 nylon	Standoff	1902C	Keystone
J1	1		Standard banana jack, insulated, 10 A, red	571-0500	571-0500	DEM Manufacturing
J2	1		Receptacle, USB 2.0, micro-USB Type B, R/A, SMT	USB-micro B USB 2.0, 0.65 mm, 5 pos, R/A, SMT	10118194-0001LF	FCI
J3, J5, J8, J13	1		Header, 2.54 mm, 2 \times 1, gold, TH	Header, 2.54 mm, 2 \times 1, TH	61300211121	Würth Elektronik
J4	1		Standard banana jack, insulated, 10 A, black	571-0100	571-0100	DEM Manufacturing
J6	1		Header, 100 mil, 4 \times 2, gold, TH	4 \times 2 header	TSW-104-07-G-D	Samtec
J7, J10, J12	1		Connector, end launch SMA, 50 Ω , SMT	End launch SMA	142-0701-801	Cinch Connectivity
J9, J11	1		Header, 100 mil, 3 \times 2, gold, TH	3 \times 2 header	TSW-103-07-G-D	Samtec

Table 4-1. DAC82002EVM Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
L1	1	600 Ω	Ferrite bead, 600 Ω at 100 MHz, 1 A, 0603	603	782633601	Würth Elektronik
LBL1	1		Thermal transfer printable labels, 0.650" W x 0.200" H - 10,000 per roll	PCB label 0.650 × 0.200 inch	THT-14-423-10	Brady
R1	1	12.0 kΩ	RES, 12.0 kΩ, 0.1%, 0.1 W, 0603	603	RG1608P-123-B-T5	Susumu Co Ltd
R2, R3, R5, R34	4	10 kΩ	RES, 10 kΩ, 5%, 0.1 W, 0603	603	RC0603JR-0710KL	Yageo
R4	1	47.0 kΩ	RES, 47.0 kΩ, 1%, 0.1 W, 0603	603	RC0603FR-0747KL	Yageo
R8, R9	2	10 Ω	RES, 10.0 Ω, 1%, 0.1 W, 0603	603	RC0603FR-0710RL	Yageo
R10	1	1.00 MΩ	RES, 1.00 MΩ, 1%, 0.1 W, AEC-Q200 grade 0, 0603	603	RMCF0603FG1M00	Stackpole Electronics Inc
R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33, R37, R38, R39, R40, R41, R42, R43, R44	31	0 Ω	RES, 0 Ω, 5%, 0.1 W, 0603	603	RC0603JR-070RL	Yageo
R35, R36	2	0 Ω	0-Ω jumper 0.1 W, 1/10 W chip resistor 0402 (1005 metric), thick film	402	CR0402-10W-000T	Venkel
SH1, SH2, SH3, SH4, SH5	5		Shunt, 100 mil, gold-plated, black	Shunt, 2 pos, 100 mil	881545-2	TE Connectivity
TP1, TP2, TP3, TP4, TP5, TP6, TP8, TP9, TP10, TP11, TP12, TP21, TP23, TP24, TP25, TP26, TP27	1		Test point, miniature, white, TH	White miniature test point	5002	Keystone
TP7, TP20	1		Test point, miniature, red, TH	Red miniature test point	5000	Keystone
TP14, TP15, TP16, TP17, TP18, TP19	6		Test point, multipurpose, black, TH	Black multipurpose test point	5011	Keystone
U1	1		16-bit, low-glitch-energy, dual-channel voltage-output DAC, WSON-10	WSON10	DAC82002DRXR	Texas Instruments
U2	1		USB bridge, USB to I ² C or SPI USB 2.0 I ² C, SPI 32-VQFN (5×5)	VQFN32	FT4222HQ-D-R	FTDI
U3	1		Micropower, 150-mA low-dropout CMOS voltage regulator, 5-pin SOT-23, Pb-free	DBV0005A	LP5951MFX-3.3/NOPB	Texas Instruments
U4	1		Low-noise, very low drift, precision voltage reference, -40°C to +125°C, 8-pin SOIC (D), green (RoHS and no Sb/Br)	D0008A	REF5025AID	Texas Instruments
U5, U7	2		Precision, zero-drift, zero-crossover, true rail-to-rail input/output, operational amplifier, D0008A (SOIC-8)	D0008A	OPA388IDR	Texas Instruments
U6	1		Precision, 40-MHz, 1.0-pA, low-noise, RRIO, CMOS operational amplifier, VSSOP-8	VSSOP8	OPA2328DGKR	Texas Instruments

Table 4-1. DAC82002EVM Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
U8	1		Single power supply, quadruple buffer gate with 3-state output CMOS logic level shifter, PW0014A, large T and R	PW0014A	SN74LV4T125PWR	Texas Instruments
XU5, XU6, XU7	3		Socket, DIP-8, 2.54 mm pitch	Socket, DIP-8, 2.54-mm pitch	4808-3004-CP	3M
Y1	1		Crystal, 12 MHz, 30 ppm, 18 pF, SMD	11.4 mm × 4.7 mm	ABLS2-12.000MHZ-D4Y-T	Abracon Corporation

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
 - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software
 - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. *Limited Warranty and Related Remedies/Disclaimers:*
 - 2.1 These terms 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 a nonconforming EVM if (a) the nonconformity was 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, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
 - 2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, 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.

WARNING

Evaluation Kits 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 shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 Regulatory Notices:

3.1 United States

3.1.1 Notice applicable to EVMs not FCC-Approved:

FCC NOTICE: 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 or RSS-247

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. 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.

3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lstds/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。
http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

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.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。技術適合証明を受けていないものご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

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2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

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東京都新宿区西新宿 6 丁目 2 4 番 1 号
西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page
電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page

3.4 European Union

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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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.
 5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.
 6. *Disclaimers:*
 - 6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.
 - 6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT, REGARDLESS OF WHEN MADE, CONCEIVED OR ACQUIRED.
 7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL 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 HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.
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8. *Limitations on Damages and Liability:*

8.1 *General Limitations.* IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVMS , REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.

8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMNITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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