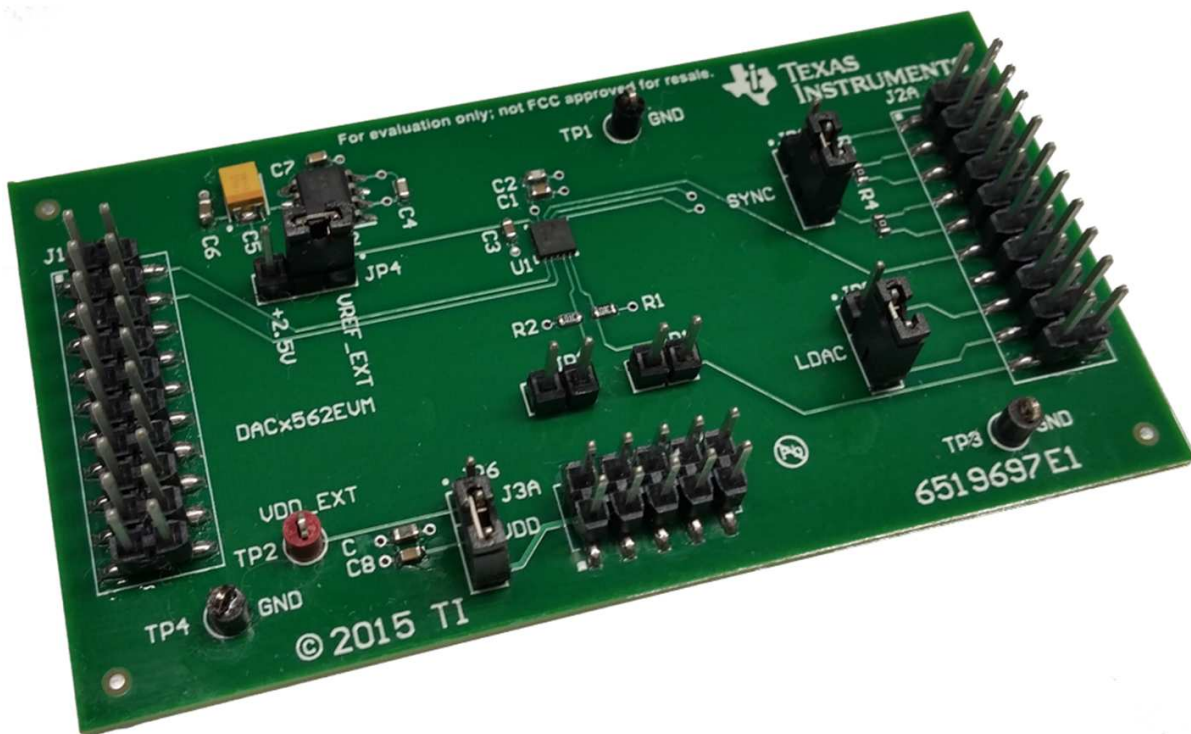


## DAC8562T Evaluation Module

This user's guide describes the characteristics, operation, and use of the DAC8562TEVM. The evaluation model (EVM) is an evaluation board for the DAC8562T. The DAC8562T is a low-power, buffered voltage-output, 16-bit, dual channel digital-to-analog converter (DAC) with an integrated reference. This converter is controlled through a serial peripheral interface (SPI) that can operate at clock rates of up to 50 MHz. Additionally, the EVM includes a 2.5-V external reference voltage, resulting in an output range from 0 V to 2.5 V. The EVM allows evaluation of all aspects of the device and allows user control over every pin on the DAC8562T. Complete circuit descriptions, schematic diagrams, and bill of material are included in this document.



**DAC8562TEVM**

The following related documents are available for download through the Texas Instruments web site at <http://www.ti.com>:

### EVM-Related Device Datasheets

Device	Literature Number
DAC8562T	<a href="#">SLAS719</a>
REF5025	<a href="#">SBOS410</a>

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## 1 EVM Overview

### 1.1 Features

The DAC8562TEVM has the following features:

- Full-featured evaluation board for the DAC8562T
- Onboard external reference selection
- Wide selection of digital and I/O voltages
- Hardware and software control logic
- Compatible with the TI Modular EVM Motherboard MMB0

This manual covers the operation of the DAC8562TEVM. The abbreviation EVM and the term evaluation module are synonymous with the DAC8562TEVM.

### 1.2 Introduction

The DAC8562T is a 16-bit, low-power, buffered voltage-output, dual channel digital-to-analog converter (DAC) that operates from a single 2.7-V to 5.5-V supply. The DAC is controlled through a serial peripheral interface (SPI) that can operate at clock rates of up to 50 MHz. The EVM is designed to highlight the features and the performance of the 16-bit DAC. Additionally, the EVM includes a 2.5-V external reference voltage, resulting in an output range from 0 V to 2.5 V.

The DAC8562TEVM is designed to give the user easy access to all pins on the DAC8562T. The evaluation module allows the user to control the DAC logic using onboard jumpers, or digitally through the J2 header. By default, the evaluation module is configured to be used with an onboard 2.5-V external reference, but can be easily modified to use the DAC internal reference by changing a jumper setting and enabling the internal reference using software.

### 1.3 Power and Motherboard Requirements

This DAC8562TEVM board can be used as a standalone board or as a daughter card to the MMB0 Modular EVM motherboard.

#### 1.3.1 Supply Voltage Ranges

[Table 1](#) lists the supply voltage ranges for the EVM.

**Table 1. Supply Voltage Ranges**

Signal	Range
VDD	+2.7 V to +5.5 V
VREF_VIN	+2.7 V to +15 V
VREF_EXT	0 V to VDD

#### 1.3.2 Motherboard Supply Mode

The MMB0 motherboard can supply the digital interface as well as the power supply voltage required by the DAC8562TEVM. This user's guide focuses on the motherboard supply mode and its software.

#### 1.3.3 Standalone Supply Mode

The DAC8562TEVM can also be used without a motherboard, provided that the digital interface is driven by an external source. The supply voltage must be applied at TP1/VDD according to the specifications in [Table 1](#).

The MMB0 can still be used as a digital interface while using an external power supply. Remember to disconnect any shunt from JP1.

### 1.3.4 Reference Voltage

The EVM includes an on-board reference as well as the option to provide an external reference voltage. JP9 chooses between the on-board reference and the external reference. TP1 can be used to measure the selected reference, which is the on-board reference by default.

## 1.4 EVM Default Hardware Setup

Table 2 lists the default jumper settings for the MMB0 modular EVM motherboard and Table 3 lists the default jumper settings for the DAC8562TEVM.

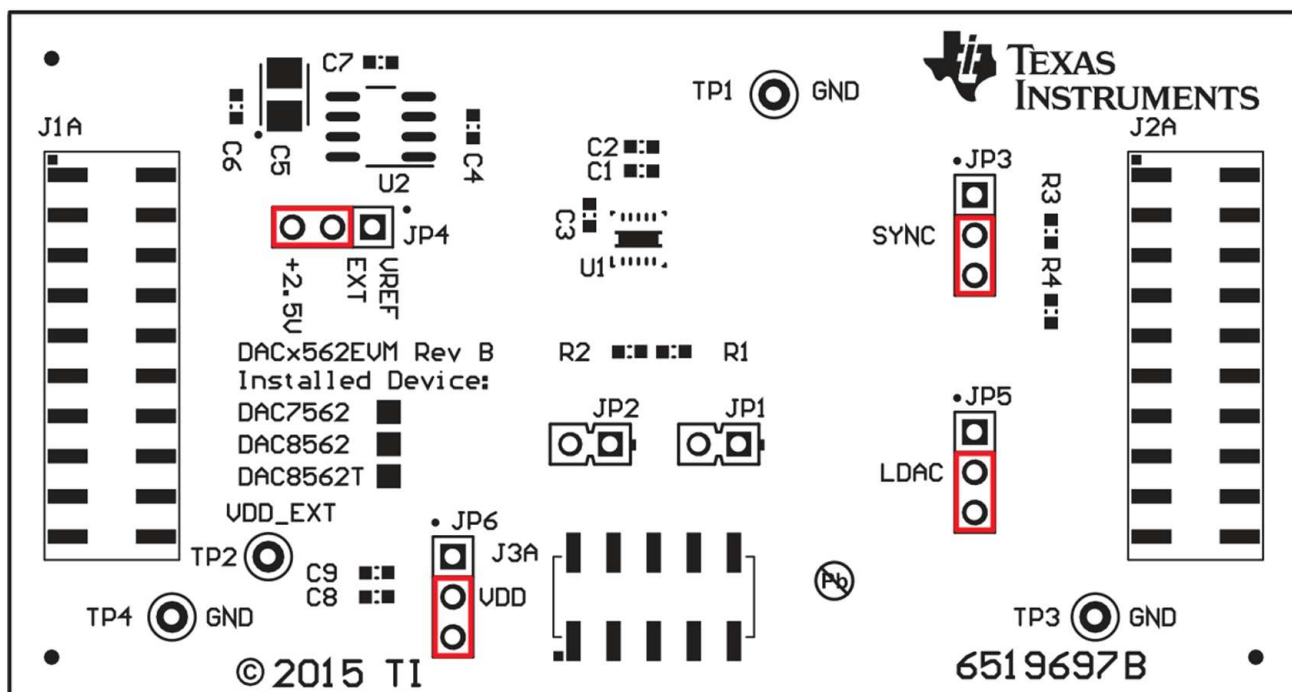
**Table 2. Default Jumper Settings for the MMB0 Modular EVM Motherboard**

Jumper	Position
J12	CLOSED
J13A	OPEN
J13B	CLOSED

**Table 3. Default Jumper Settings for the DAC8562TEVM**

Jumper	Position
JP1	OPEN
JP2	OPEN
JP3	2-3
JP4	2-3
JP5	2-3
JP6	2-3

Figure 1 illustrates the default jumper settings for the DAC8562TEVM.



**Figure 1. Default Jumper Settings for the DAC8562TEVM**

## 1.5 Questions and Support for This or Other Precision Data Converter EVMs

Join TI's E2E precision data converter support forum at [e2e.ti.com/support/data\\_converters/precision\\_data\\_converters](http://e2e.ti.com/support/data_converters/precision_data_converters)

Post your question in the forum and one of our experts will assist you.

## 2 EVM Hardware

This section provide descriptions of the hardware and digital interfaces, and a quick-start guide.

### 2.1 Hardware Interface

Table 4 provides hardware descriptions.

**Table 4. Hardware Description**

Jumper	Default Position	Description
JP1	OPEN	LDAC GND tie. Selects between an LDAC signal from J2A with a pullup resistor and GND.
JP2	OPEN	RST GND tie. Selects between a RST signal from J2A with a pullup resistor and GND.
JP3	2-3	SYNC selector. Selects the SYNC signal between J2.1 and J2.7.
JP4	1-2	VREF selector. Selects between the on-board reference and an external reference.
JP5	2-3	LDAC selector. Selects between an LDAC signal from J2A.15 and J2A.17.
JP5	2-3	VDD selector. Selects between 5VA on J3A.3 and an external supply from TP2/VDD_EXT.

---

**NOTE:** For more details, view the [Section 4.1](#).

---

### 2.2 Digital Interface

Some of the hardware options are also available using the DXP software when the jumpers are in their default positions.

**Table 5. Software Description**

Jumper	Default Position	Description
JP4	1-2	PD selector. Enables/disables the power-down mode.
JP5	1-2	DCEN selector. Enables/disables the Daisy Chain feature.
JP7	1-2	RST selector. Reset state selector.
JP8	1-2	RSTSEL selector. Selects the output state of the DAC after a RST has been asserted.

### 2.3 Quick-Start

This section explains a quick method to test the EVM's functionality without using a motherboard.

The minimum requirements are:

- An external source to provide the SPI master signals
- An external 5-V power supply
- A DC digital multimeter

Use the following steps:

1. Ensure that all of the jumpers are in their default position.
2. Ensure that all the power supplies are switched off.
3. Connect the power supply ground to any of the ground leads on the EVM board. (that is, TP1 and TP3).
4. Connect the SPI master ground to any of the ground leads on the EVM board.
5. Connect the DC DMM ground probe to any of the ground leads on the EVM board.
6. Connect 5 V to J3A.3.
7. Connect the DC DMM signal probe to J1A.2.
8. Power on the power supplies.
9. The DC DMM should display mid-scale 1.25 V. This means that the hardware setup is working.
  - If it does not, something may be wrong. Please check your connections and the jumper settings.
10. Send the SPI code 0x19FFFF using the DXP software.
11. The DC DMM should display full-scale 5 V. This means that your hardware and software setup are working.
  - If it does not, something may be wrong. Please check your digital interface implementation by looking at the digital signals on a signal analyzer or an oscilloscope.

### 3 EVM Operation

#### 3.1 DXP Software Installation

The DXP software required to use the DAC8562TEVM with the MMB0 must be downloaded from the Texas Instruments website, which is available at [www.ti.com/dxp](http://www.ti.com/dxp). The software is listed under the “Software” category in this product folder, as shown in [Figure 2](#).

<p><b>Description</b></p> <p>DAC Exerciser Program (DXP) is a software tool from Texas Instruments for evaluating DACs without the requirements of expensive pattern generators or writing complex software. When used with a Texas Instruments DAC EVM and a modular motherboard, it allows for simple and easy digital signal generation for the DAC to produce analog outputs for measurement and evaluation purposes.</p> <p><b>Features</b></p> <ul style="list-style-type: none"> <li>• Modular design allows additional EVMs to be supported</li> <li>• Graphical user interface provides easy setup to send signals to a DAC</li> </ul> <p><b>Free Evaluation Tool Description</b></p> <p>Software:</p> <p><a href="#">Download DXP Setup</a></p>
---

**Figure 2. EVM Software Link**

Once the download is complete, run the executable file and follow the installer instructions. After the DXP software installs, copy the DAC8562T.xml file into the “Devices” directory that the installer created. Typically located in ‘C:\Users\Public\Documents\DXP\Devices’. If you cannot find the “Devices” directory, go to the DXP install directory, typically “C:\Program Files\DXP” and open the file “DXP.ini”. Locate the line that starts with “DXPDevices”; it will contain the location of the “Devices” directory.

## 4 Schematic, PCB Layout, and Bill of Materials

This section contains the [DAC8562TEVM schematic](#), [DAC8562TEVM PCB layout](#), and the [DAC8562TEVM BOM](#).

### 4.1 Schematic

Figure 3 illustrates the DAC8562TEVM schematic.

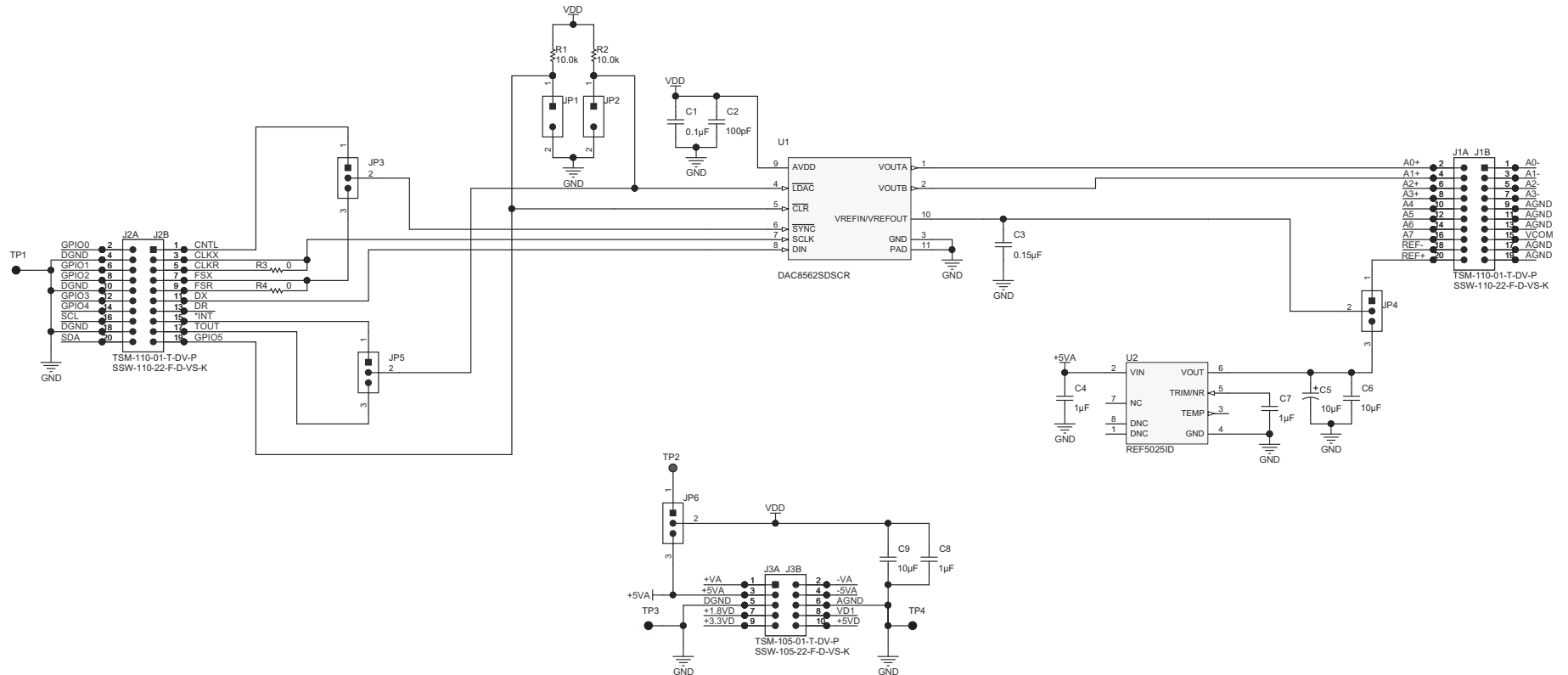


Figure 3. DAC8562TEVM Schematic

## 4.2 PCB Layout

Figure 4 shows the DAC8562TEVM PCB layout.

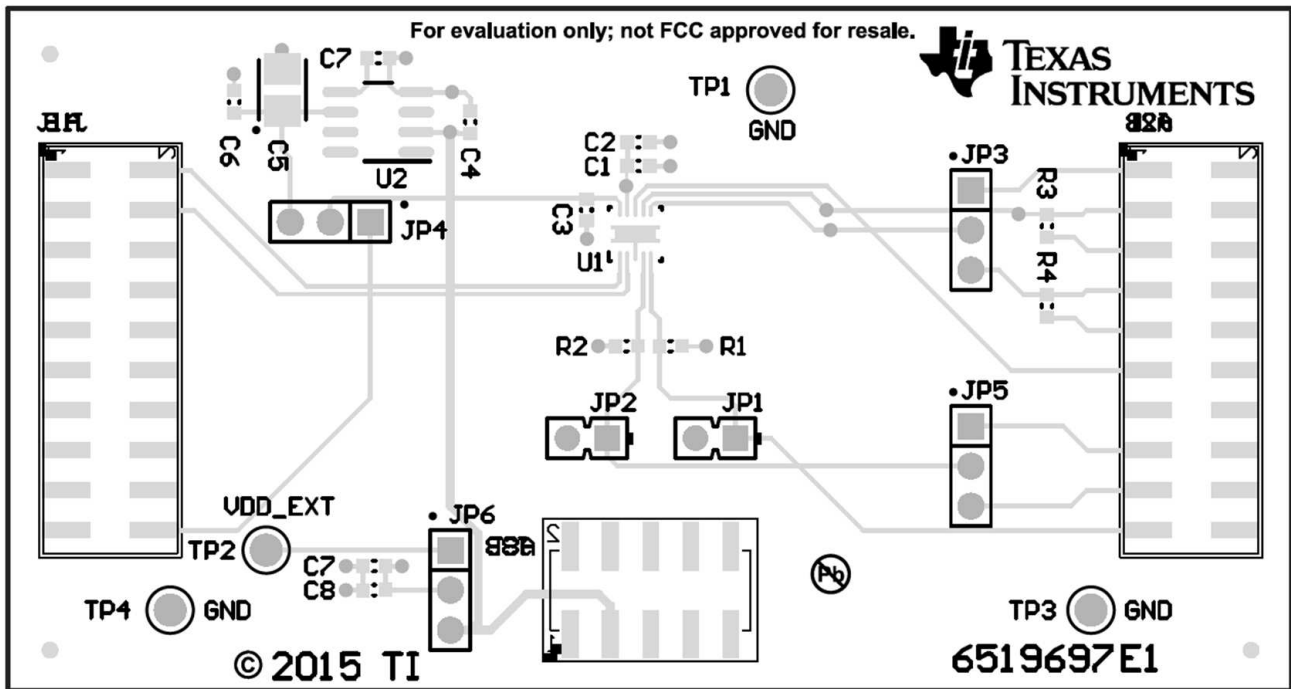


Figure 4. PCB Layout



### 4.3 Bill of Materials

Table 6 lists the BOM for the DAC8562TEVM.

**Table 6. DAC8562TEVM Bill of Materials**

Designator	Qty	Description	Manufacturer	Part Number
IPCB	1	Printed Circuit Board	Any	6519697
C1, C3, C9, C12	4	CAP, CERM, 1 $\mu$ F, 50 V, +/- 10%, X5R, 0603	Murata	GRM188R61H105KAALD
C2, C4, C10	3	CAP, CERM, 10 $\mu$ F, 25 V, +/- 10%, X5R, 0805	TDK	C2012X5R1E106K125AB
C5, C7	2	CAP, CERM, 100 pF, 100 V, +/- 5%, COG/NP0, 0603	Murata	GRM1885C2A101JA01D
C6, C8	2	CAP, CERM, 0.1 $\mu$ F, 50 V, +/- 10%, X7R, 0603	Murata	GRM188R71H104KA93D
C11	1	CAP, TA, 10 $\mu$ F, 16 V, +/- 10%, 0.8 ohm, SMD	AVX	TPSB106K016R0800
J1A, J2A	2	Header, 100mil, 10x2, SMD	Samtec, Inc.	TSM-110-01-T-DV-P
J1B, J2B	2	Connector, Receptacle, 100mil, 10x2, Gold plated, SMD	Samtec, Inc.	SSW-110-22-F-D-VS-K
J3A	1	Header, 100mil, 5x2, SMD	Samtec, Inc.	TSM-105-01-T-DV-P
J3B	1	Connector, Header, 10-Pos (10x2), Receptacle, 100x100-mil Pitch	Samtec, Inc.	SSW-105-22-F-D-VS-K
JP1, JP2, JP4, JP5, JP6, JP7, JP8, JP9	8	Header, 100mil, 3x1, Gold, TH	Samtec	TSW-103-07-G-S
JP3	1	Header, 100mil, 4x2, Gold, TH	Samtec	TSW-104-07-G-D
R1, R2, R3, R11, R12	5	RES, 0, 5%, 0.1 W, 0603	Vishay-Dale	CRCW06030000Z0EA
R4, R5, R6, R7	4	RES, 10.0 k, 1%, 0.1 W, 0603	Yageo America	RC0603FR-0710KL
R8, R9, R10	0	NI	Any	
TP1, TP4, TP5	3	Test Point, Miniature, Red, TH	Keystone	5000
TP2, TP3	2	Test Point, Miniature, Black, TH	Keystone	5001
U1	1	12-BIT OCTAL, ULTRALOW GLITCH, VOLTAGE OUTPUT DIGITAL-TO-ANALOG CONVERTER, RHB0032E	Texas Instruments	DAC8562TIRHBR
U2	1	Low-Noise, Very Low Drift, Precision VOLTAGE REFERENCE, 4.096V, D008A	Texas Instruments	REF5040AID

## STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, or documentation (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms and conditions set forth herein. Acceptance of the EVM is expressly subject to the following terms and conditions.
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  - 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 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

### 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](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](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 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.

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.

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