

# User's Guide

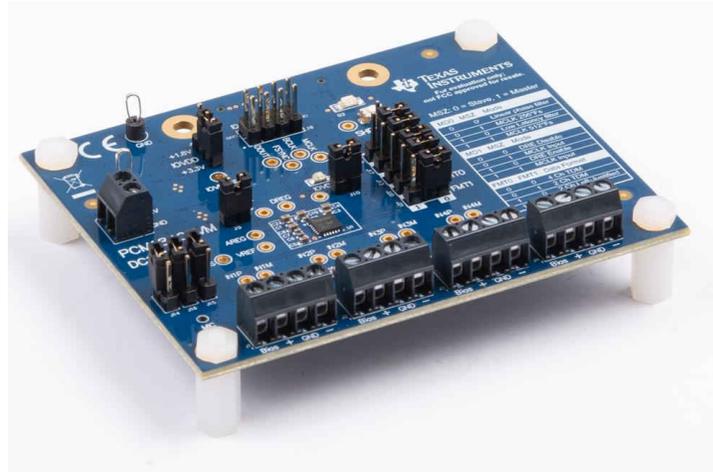
## PCM1840 Evaluation Module



Zak Kaye

### ABSTRACT

This user's guide describes the function and use of the PCM1840EVM. This document includes the hardware configuration instructions, a quick-start guide, jumper and connector descriptions, schematics, and printed-circuit board (PCB) layout that demonstrate TI's recommended practices for these devices.



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## Trademarks

Burr-Brown™ is a trademark of Texas Instruments.

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## 1 Introduction

The PCM1840EVM is an evaluation module (EVM) designed to demonstrate the performance and functionality of the PCM1840 device. The PCM1840 is a high-performance audio analog-to-digital converter (ADC) that is configured through logic-level mode selection pins and does not require a digital interface such as I2C or SPI to configure registers. As such, no software is necessary to interface with the EVM. The EVM is powered with a single 5-V supply. Access to the converter output is provided on the audio serial interface in I2S, LJ, or TDM format.

## 2 Power Supply

The PCM1840EVM can be powered with a single 5-V power supply connected to J6. Onboard low dropout regulators convert the 5-V supply to the 3.3-V and 1.8-V rails used by the ADC. The analog supply, AVDD, is fixed at 3.3 V. The digital supply, IOVDD, can be set to either 1.8 V or 3.3 V with J5. It is also possible to power the ADC directly by removing J9 and J5 and applying a voltage directly to the AVDD and IOVDD test points. Note that if this is done, it is important to keep J10 populated (or ensure there is a path between the pins if the supply current is being monitored) as this jumper connects the applied IOVDD to the mode selection pins and other circuitry that relies on IOVDD. If external supplies are used, there is an onboard voltage supervisor, U3, that will hold the ADC in shutdown until both AVDD and IOVDD have reached their respective threshold voltages. The shutdown thresholds for the supply voltages can be adjusted as shown in [Equation 1](#) and [Equation 2](#). The supervisor can also be removed from the shutdown logic by depopulating R5. For more information on the reset supervisor, see the [TPS37xx Dual-Channel, Low-Power, High-Accuracy Voltage Detectors Data Sheet](#).

$$V_{\text{MON(AVDD)}} = \left( 1 + \frac{R_3}{R_4} \right) \times 1.188 \quad (1)$$

$$V_{\text{MON(IOVDD)}} = \left( 1 + \frac{R_1}{R_2} \right) \times 1.188 \quad (2)$$

### 3 Hardware Configuration

The format of the audio data and the operating mode of the ADC are controlled by the following pins: MD0, MD1, MSZ, FMT0, and FMT1. These signals are referenced to IOVDD and can be set to high (1) or low (0). If no shunt is installed, then a 10-k $\Omega$  pulldown resistor will set the pin low so that the ADC remains in a defined state. [Table 3-1](#) shows the header numbers and their pin functions and [Table 3-2](#) shows the possible modes and output formats. The MSZ pin selects whether the device is a master or a slave on the audio bus. When MSZ is pulled high, the device is in slave mode and MD1 becomes an input for MCLK. A shunt connecting J19 to the center pin of J18 will route the MCLK signal provided on J8 to the MD1 pin on the ADC to allow for easy interfacing with audio measurement equipment.

**Table 3-1. PCM1840 EVM Headers and Jumpers**

Designator	Function
J1	Differential line, microphone input 1
J2	Differential line, microphone input 2
J3	Differential line, microphone input 3
J4	Differential line, microphone input 4
J5	IOVDD-SYS voltage selection (1.8 V or 3.3 V)
J6	+5-V supply input
J7	Connector to AC-MB
J8	Digital audio serial interface
J9	Connect AVDD to onboard 3.3-V regulator
J10	Connect IOVDD to IOVDD-SYS
J13	MSZ select
J14	Connect MICBIAS to onboard microphone
J15	Microphone OUT+ to ADC IN1P
J16	Microphone OUT- to ADC IN1M
J17	MDO select
J18	MD1 select
J19	Connect MCLK to MD1
J20	FMT0 select
J21	FMT1 select

**Table 3-2. PCM1840 Hardware Controllable Settings**

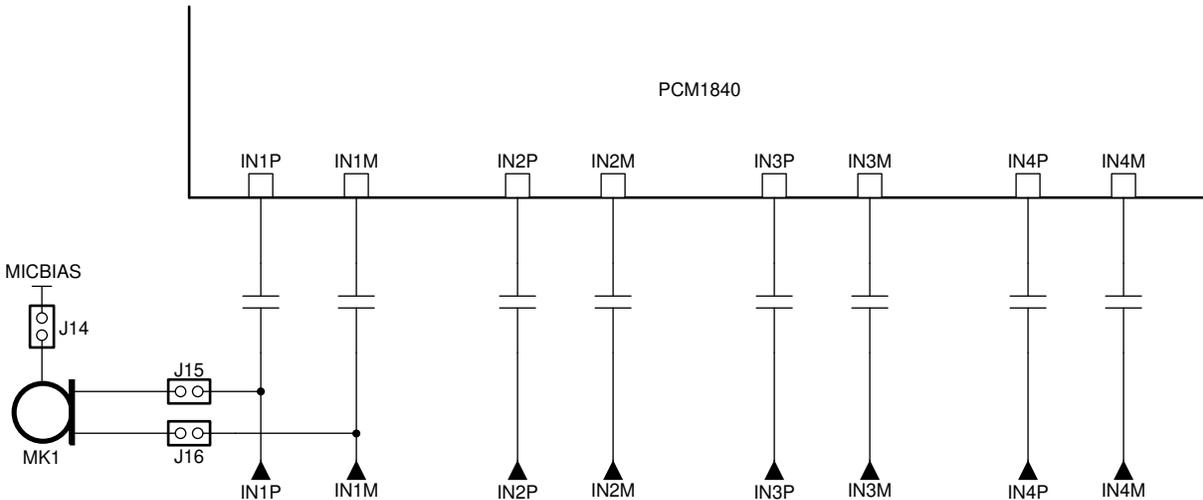
MD0 Modes		
MD0	MSZ (0 = Slave, 1 = Master)	MD0 Functional Mode
0	0	Linear phase filter
0	1	MCLK = 256 $\times$ Fs
1	0	Low latency filter
1	1	MCLK = 512 $\times$ Fs
MD1 Modes		
MD1	MSZ (0 = Slave, 1 = Master)	MD1 Functional Mode
0	0	DRE disabled
0	1	MCLK input
1	0	DRE enabled
1	1	MCLK input
Audio Output Data Format		
FMT0	FMT1	Data Format
0	0	4 channel TDM
0	1	2 channel TDM
1	0	2 channel left-justified
1	1	2 channel I2S

All hardware pins are tied low by default, placing the device in slave mode with a linear phase filter, DRE disabled, and 4-channel TDM audio output.

For more information on the operating modes of the PCM1840 device, see the [PCM1840 Quad Channel, 32-Bit, 192-kHz, Burr-Brown™ Audio ADC Data Sheet](#).

### 3.1 PCM1840EVM Inputs

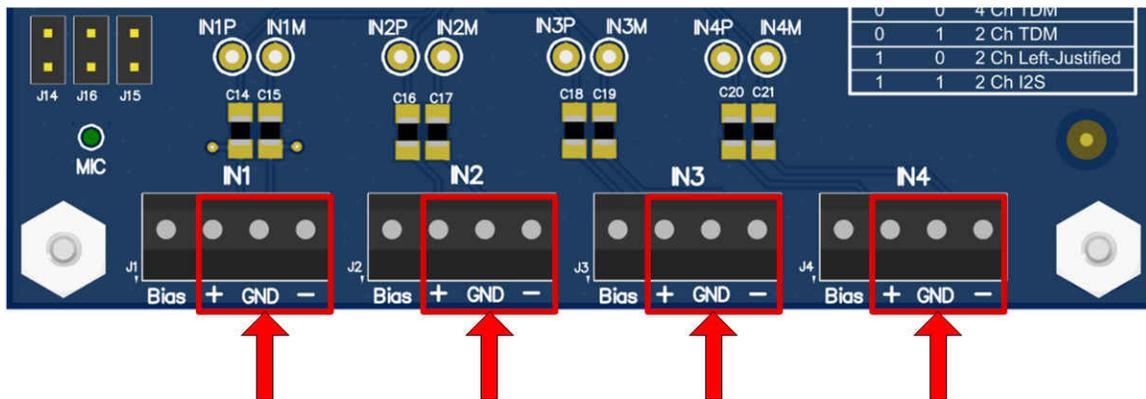
The PCM1840 device is intended to be driven with differential line inputs or microphone inputs. Each of the inputs has a 1-μF AC coupling film capacitor. Coupled with the 2.5-kΩ input impedance, this sets the high pass filter cutoff frequency at approximately 63 Hz. This can be adjusted by replacing the input AC coupling capacitors on the EVM if necessary. [Figure 3-1](#) shows the architecture of the inputs to the evaluation module. The EVM supports a differential full scale input range of 2 V<sub>RMS</sub> with an AVDD of 3.3 V.



**Figure 3-1. PCM1840EVM Input Architecture**

#### 3.1.1 Line Inputs

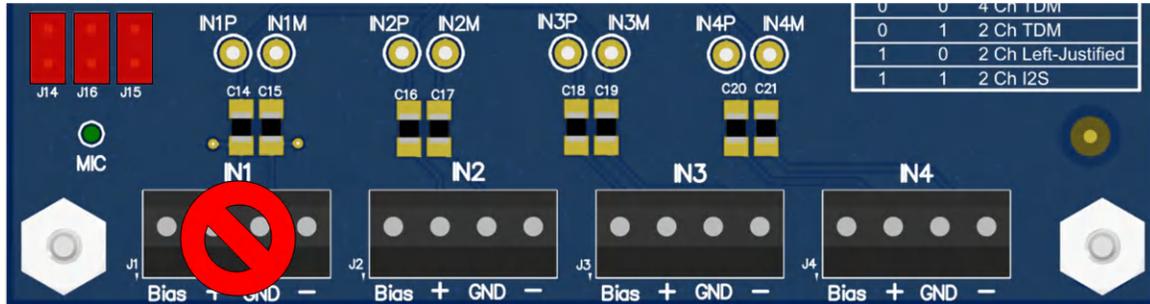
For the line input configuration, shown in [Figure 3-2](#), the PCM1840 captures the audio signal provided through terminals J1 (IN1), J2 (IN2), J3 (IN3), and J4 (IN4). The input accepted in this mode is a differential, 2 V<sub>RMS</sub>, full-scale audio signal. Single-ended inputs are not supported by the PCM1840 device and the inputs should be AC coupled.



**Figure 3-2. PCM1840EVM Connection for Line Input Application**

### 3.1.2 Onboard Microphone Input

For the onboard microphone input configuration (shown in [Figure 3-3](#)), the PCM1840EVM records the audio captured from the microphone located on the bottom-left edge of the board. MICBIAS is used to power the onboard microphone through J14. J15, and J16 must be installed to connect the microphone output to the ADC inputs. There must not be any connections to J1 during onboard microphone use to preserve the performance of the microphone.



**Figure 3-3. PCM1840EVM Connection for the Onboard Microphone Test**

## 4 EVM Overview

Figure 4-1 shows an overview of the system.

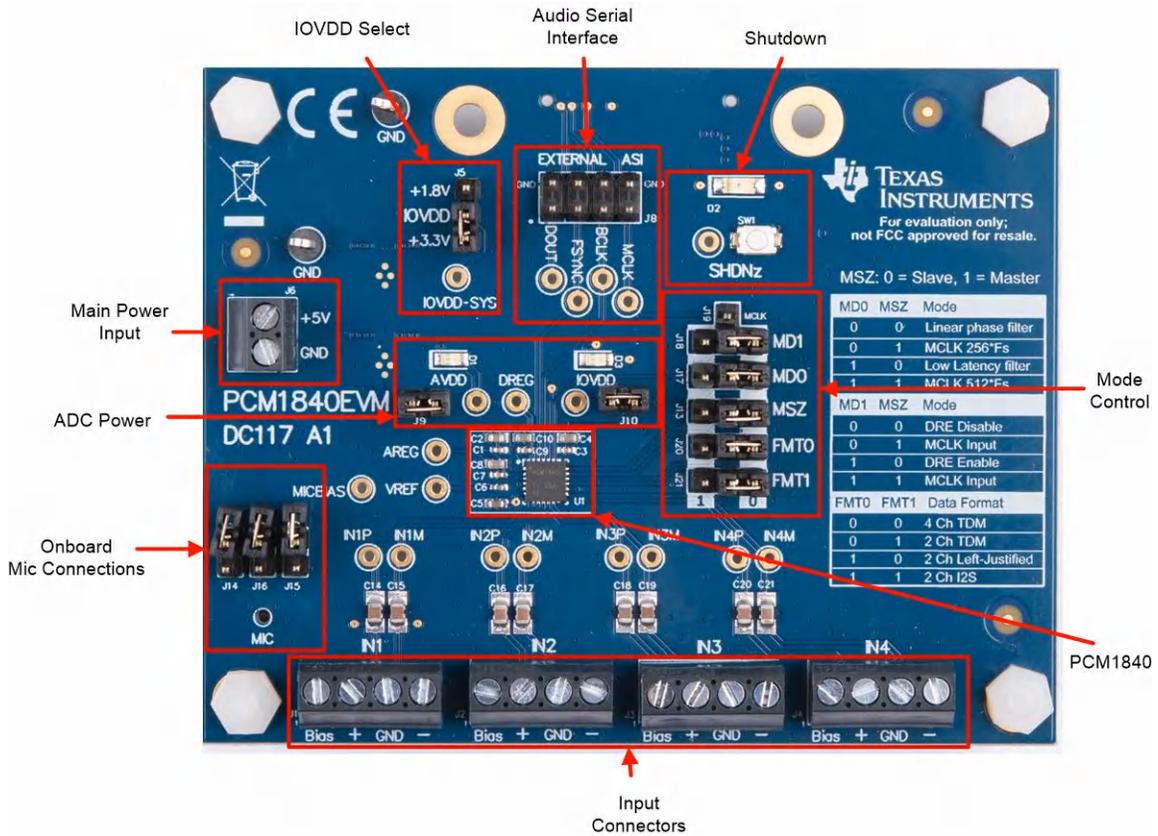


Figure 4-1. EVM Front Overview

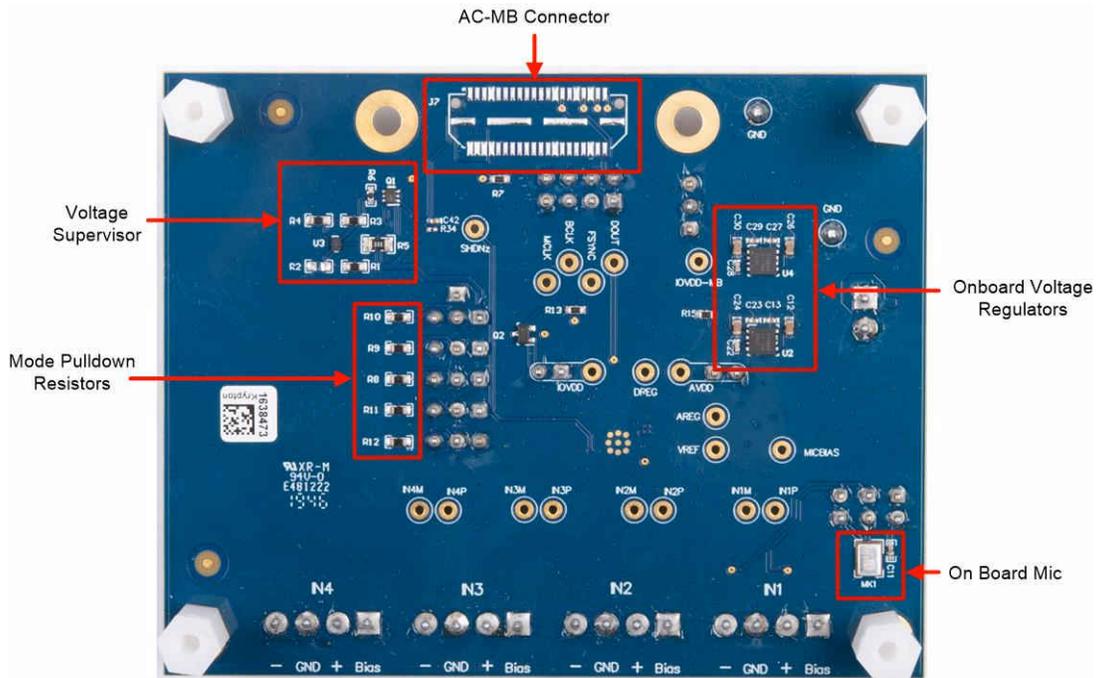
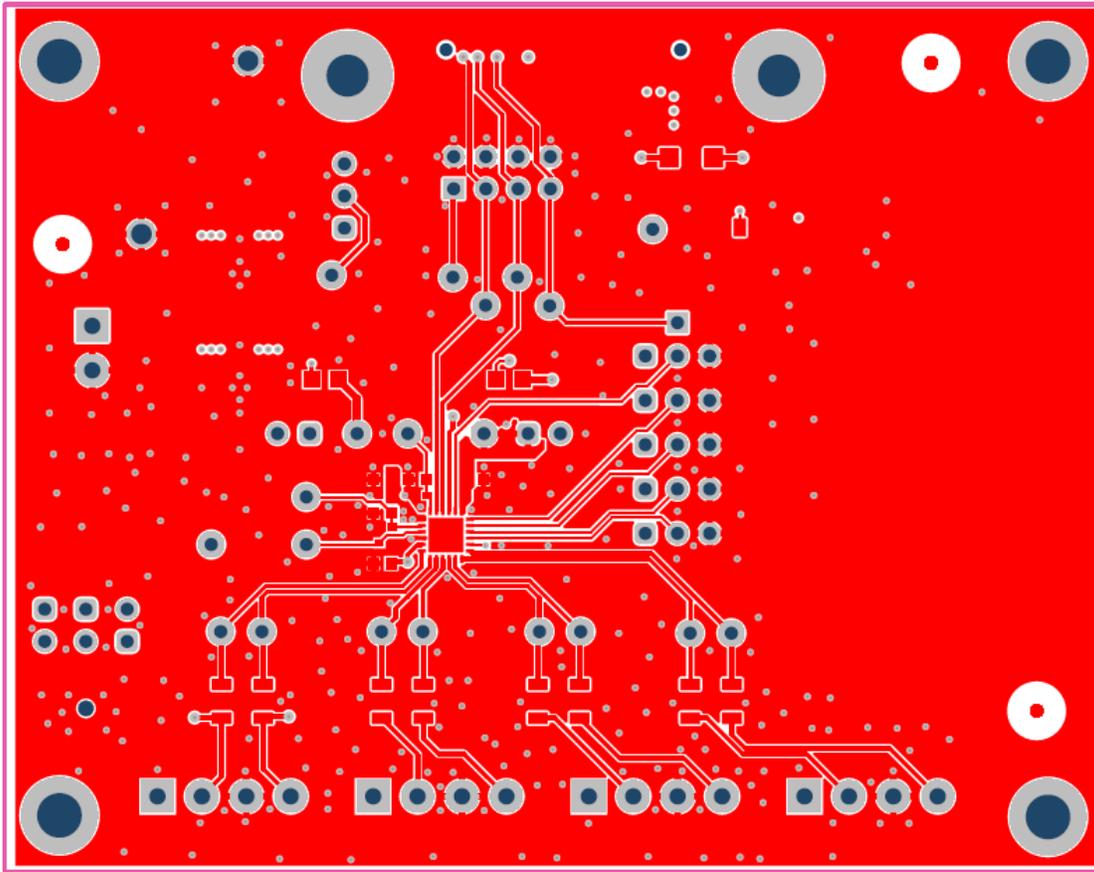
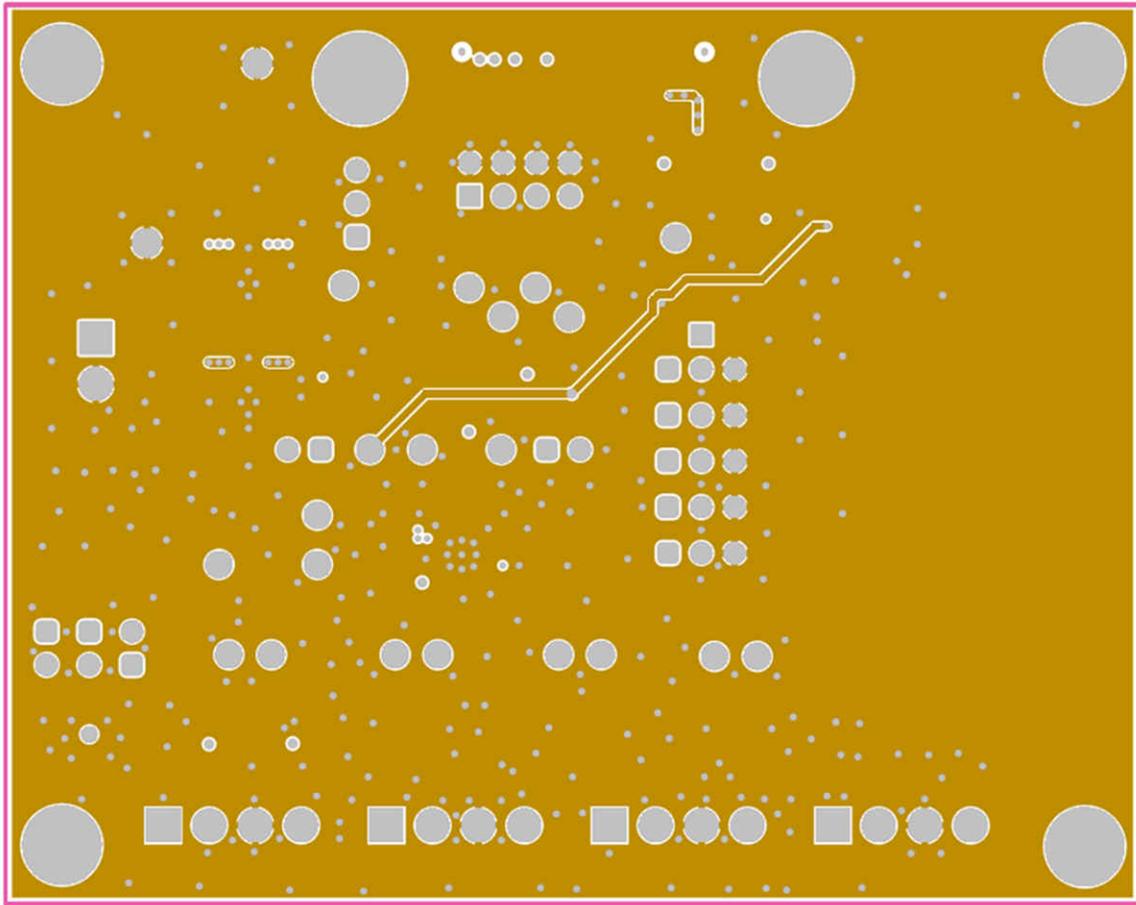


Figure 4-2. EVM Back Overview

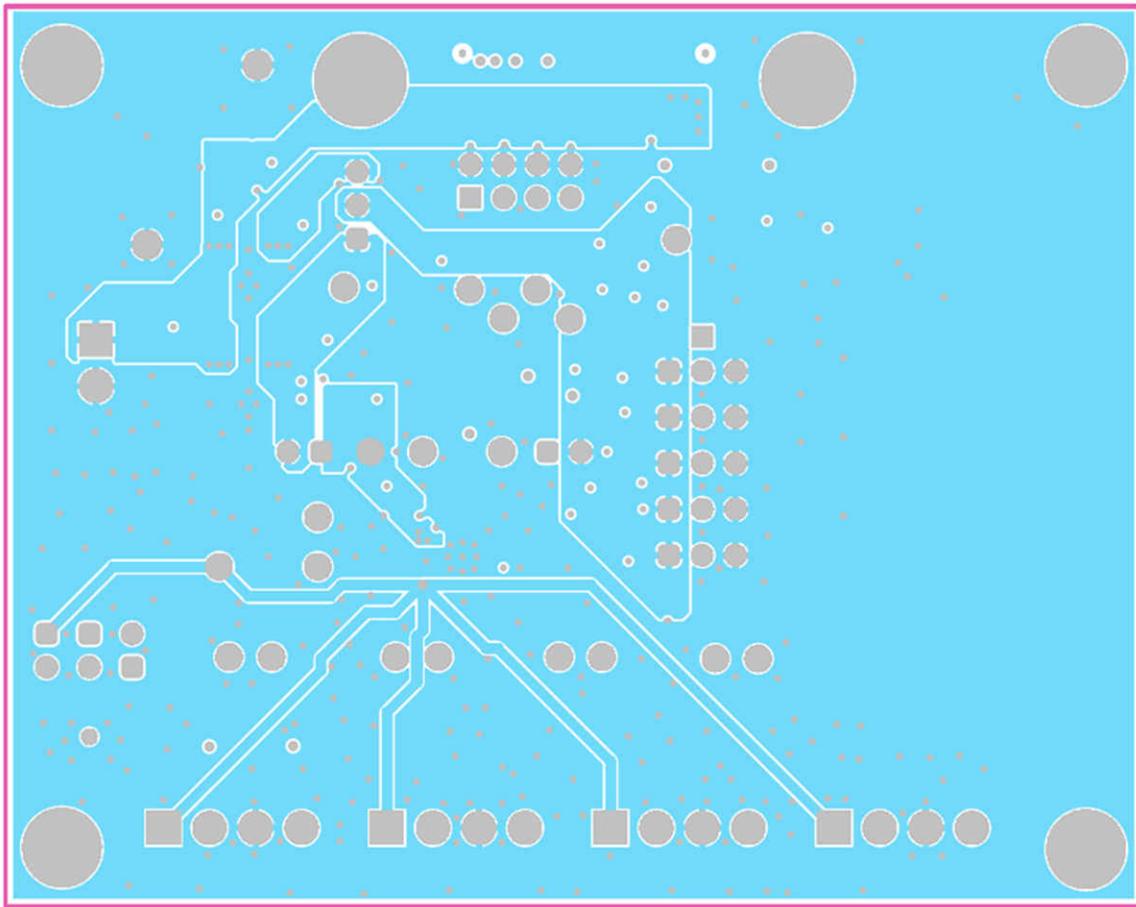
## 5 Layer Plots



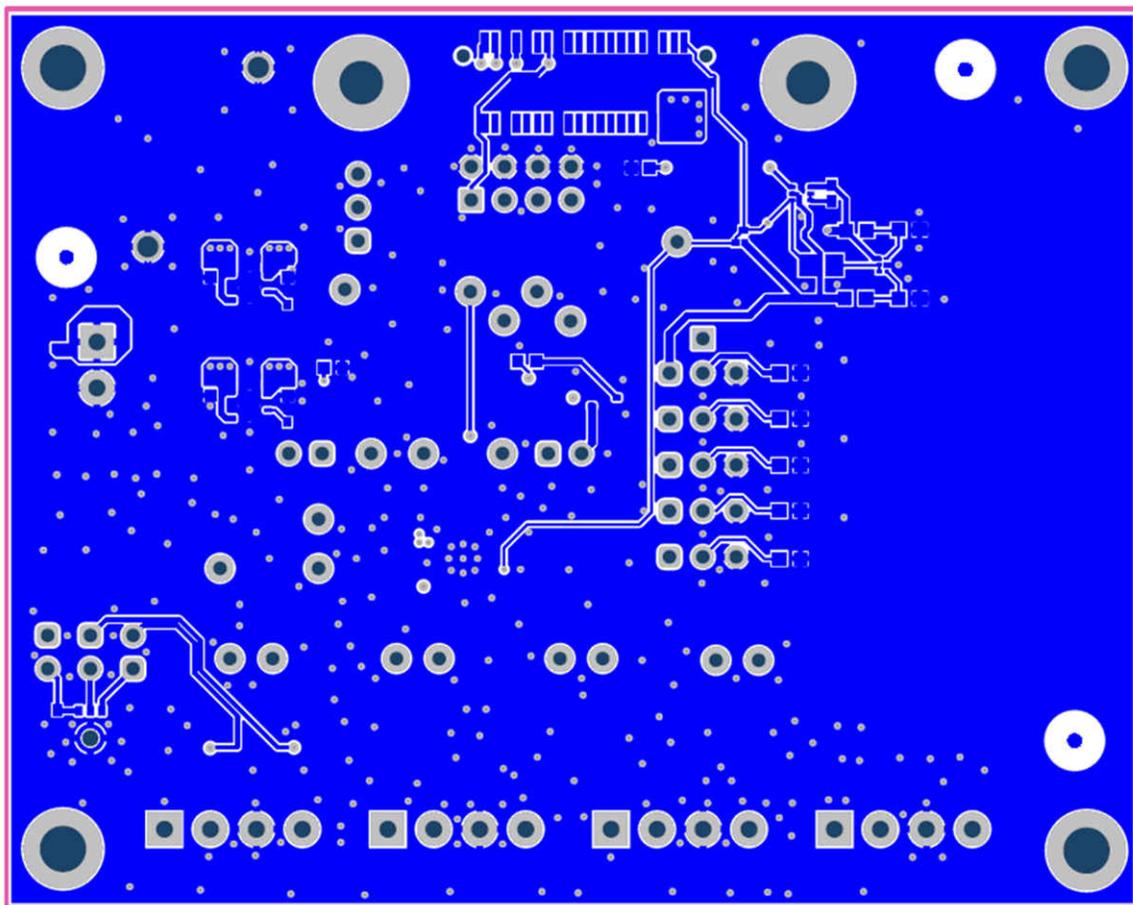
**Figure 5-1. Top Layer**



**Figure 5-2. Power Plane 1**



**Figure 5-3. Power Plane 2**



**Figure 5-4. Bottom Layer**

## 6 Schematic and Bill of Materials

### 6.1 PCM1840EVM Schematic

Figure 6-1 and Figure 6-2 show the schematics for the PCM1840EVM.

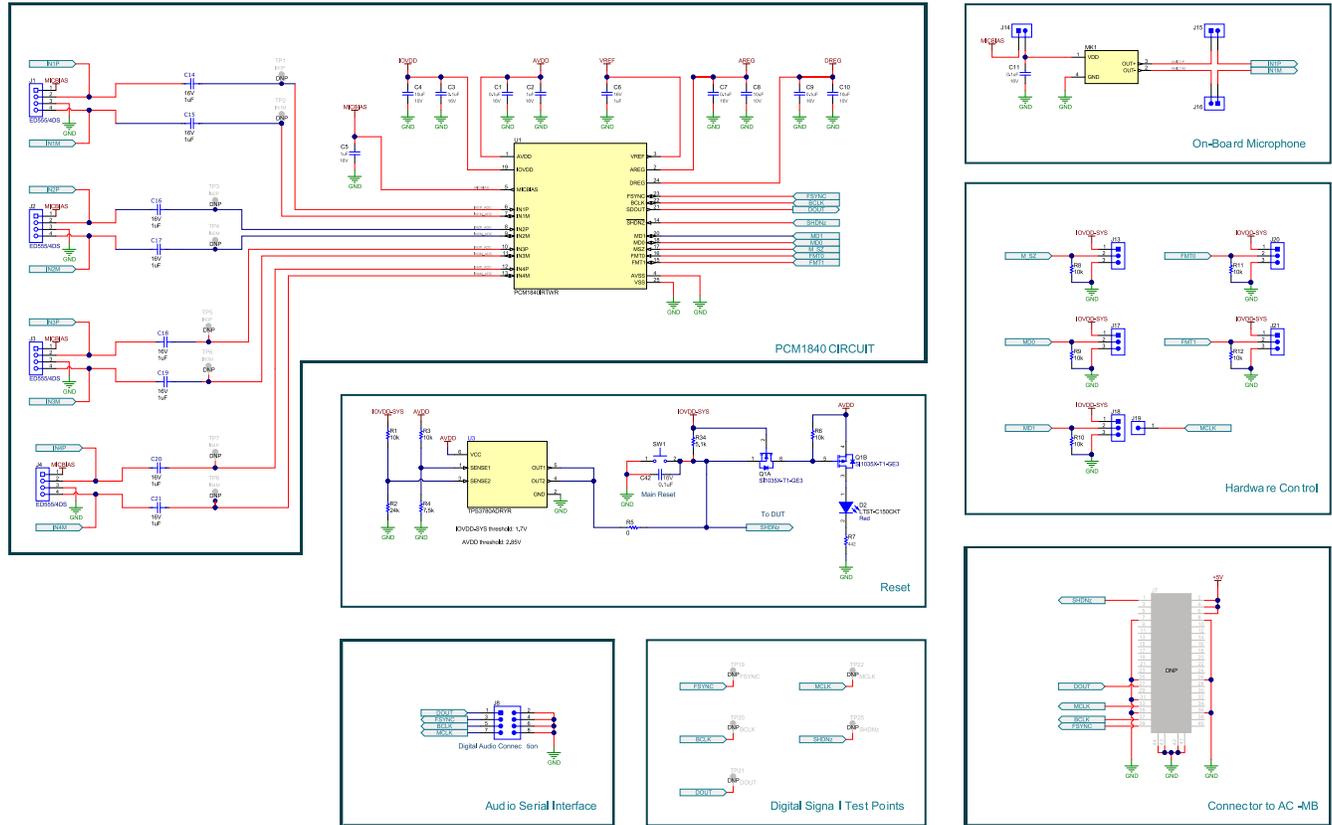


Figure 6-1. PCM1840EVM Schematics - Main

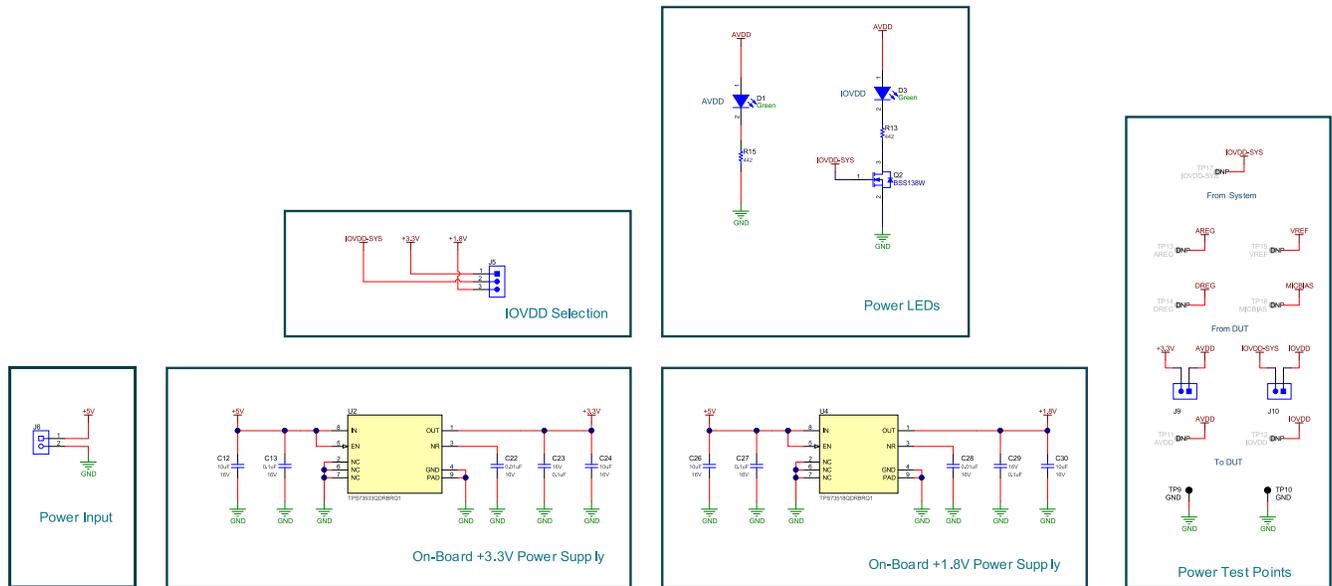


Figure 6-2. PCM1840 Schematics - Power

## 6.2 PCM1840EVM Bill of Materials

**Table 6-1. PCM1840EVM Bill of Materials**

Designator	QTY	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		DC117	Any
C1, C3, C7, C9, C11, C13, C23, C27, C29, C42	10	0.1 uF	CAP, CERM, 0.1 uF, 16 V, ±10%, X7R, 0402	0402	885012205037	Würth Elektronik
C2	1	1 uF	CAP, CERM, 1 uF, 16 V, ±10%, X7R, 0603	0603	885012206052	Würth Elektronik
C4, C8, C10	3	10 uF	CAP, CERM, 10 uF, 10 V, ±20%, X5R, 0603	0603	C1608X5R1A106M080AC	TDK
C5	1	1 uF	CAP, CERM, 1 uF, 16 V, ±10%, X7R, 0603	0603	EMK107B7105KA-T	Taiyo Yuden
C6	1	1 uF	CAP, CERM, 1 uF, 16 V, ±10%, X5R, 0402	0402	EMK105BJ105KVHF	Taiyo Yuden
C12, C24, C26, C30	4	10 uF	CAP, CERM, 10 uF, 16 V, ±20%, X5R, 0603	0603	EMK107BBJ106MA-T	Taiyo Yuden
C14, C15, C16, C17, C18, C19, C20, C21	8		1µF Film Capacitor 12V 10V Acrylic, Metallized 1206 (3216 Metric)	1206	FCA1206A105M-H3	Cornell Dubilier Electronics
C22, C28	2	0.01 uF	CAP, CERM, 0.01 uF, 16 V, ±10%, X7R, 0402	0402	520L103KT16T	AT Ceramics
D1, D3	2	Green	LED, Green, SMD	LED_0805	LTST-C170KGKT	Lite-On
D2	1	Red	LED, Red, SMD	1206	LTST-C150CKT	Lite-On
H1, H2, H3, H4	4		Small nylon hex nut, 0.10 thick with a 0.250 outside diameter and a 4-40 threading	Hex Nut, 4-40 Thread, 250" Head Dia	9605	Keystone
H5, H6, H7, H8	4		Standoff, Hex, Male/Female, 4-40, Nylon, 1/2"	Standoff, Hex, Male/Female, 4-40, Nylon, 1/2"	4802	Keystone
J1, J2, J3, J4	4		Terminal Block, 3.5mm Pitch, 4 × 1, TH	14 × 8.2 × 6.5mm	ED555/4DS	On-Shore Technology
J5, J13, J17, J18, J20, J21	6		Header, 100mil, 3 × 1, Gold, TH	3 × 1 Header	TSW-103-07-G-S	Samtec
J6	1		Terminal Block, 3.5mm Pitch, 2 × 1, TH	7.0 × 8.2 × 6.5mm	ED555/2DS	On-Shore Technology
J8	1		Header, 100mil, 4 × 2, Gold, TH	4 × 2 Header	TSW-104-07-G-D	Samtec
J9, J10, J14, J15, J16	5		Header, 100mil, 2 × 1, Gold, TH	2 × 1 Header	TSW-102-07-G-S	Samtec
J19	1		Header, 100mil, 1pos, Gold, TH	Testpoint	TSW-101-07-G-S	Samtec
MK1	1		Ultra-Low Noise Microphone with Differential Output, LGA-4	4 × 3mm, LGA	ICS-40720	InvenSense
Q1	1	20 V	MOSFET, 2-CH, N/P-CH, 20 V, 0.18 A, SOT-563	SOT-563	SI1035X-T1-GE3	Vishay-Siliconix
Q2	1	50 V	MOSFET, N-CH, 50 V, 0.21 A, SOT-323	SOT-323	BSS138W	Fairchild Semiconductor
R1, R3, R8, R9, R10, R11, R12	7	10 kΩ	RES, 10 k, 5%, 0.1 W, 0603	0603	CRCW060310K0JNEA	Vishay-Dale
R2	1	24 kΩ	RES, 24 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060324K0JNEA	Vishay-Dale
R4	1	7.5 kΩ	RES, 7.5 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06037K50JNEA	Vishay-Dale
R5	1	0	RES, 0, 5%, 0.125 W, 0805	0805	CRCW08050000Z0EA	Vishay-Dale
R6	1	10 kΩ	RES, 10 k, 5%, 0.063 W, 0402	0402	CRCW040210K0JNED	Vishay-Dale

**Table 6-1. PCM1840EVM Bill of Materials (continued)**

Designator	QTY	Value	Description	Package Reference	Part Number	Manufacturer
R7, R13, R15	3	442	RES, 442, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW0603442RFKEA	Vishay-Dale
R34	1	5.1 kΩ	RES, 5.1 k, 5%, 0.05 W, 0201	0201	RC0201JR-075K1L	Yageo America
SH1, SH2, SH3, SH4, SH5, SH6, SH7, SH8, SH9, SH10, SH11	11	1 × 2	Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec
SW1	1		Switch, Tactile, SPST-NO, 0.05A, 12V, SMT	Switch, 4.4 × 2 × 2.9 mm	TL1015AF160QG	E-Switch
TP9, TP10	2		Test Point, Multipurpose, Black, TH	Black Multipurpose Testpoint	5011	Keystone
U1	1		PCM1840IRTWR, RTW0024H (WQFN-24)	RTW0024H	PCM1840IRTWR	Texas Instruments
U2	1		500-mA, Low Quiescent Current, Low-Noise, High PSRR, Low-Dropout Linear Regulator for Automotive, DRB0008B (VSON-8)	DRB0008B	TPS73533QDRBRQ1	Texas Instruments
U3	1		Low Power, Dual Voltage Detector in Small uSON package, DRY0006A (USON-6)	DRY0006A	TPS3780ADRYR	Texas Instruments
U4	1		500-mA, Low Quiescent Current, Low-Noise, High PSRR, Low-Dropout Linear Regulator for Automotive, DRB0008B (VSON-8)	DRB0008B	TPS73518QDRBRQ1	Texas Instruments
FID1, FID2, FID3, FID4, FID5, FID6	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A
J7	0		Connector, Header, High Speed, 20 pairs, SMT	QTE-020-01-X-D-A	QTE-020-01-L-D-A	Samtec
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP11, TP12, TP13, TP14, TP15, TP16, TP17	0		Test Point, Miniature, Red, TH	Red Miniature Testpoint	5000	Keystone
TP19, TP20, TP21, TP22, TP25	0		Test Point, Miniature, Green, TH	Green Miniature Testpoint	5116	Keystone

## 7 Related Documentation

- Texas Instruments, [PCM1840 Quad Channel, 32-Bit, 192-kHz, Burr-Brown™ Audio ADC Data Sheet](#)
- Texas Instruments, [TPS37xx Dual-Channel, Low-Power, High-Accuracy Voltage Detectors Data Sheet](#)

## 8 Revision History

<b>Changes from Revision * (March 2020) to Revision A (May 2022)</b>	<b>Page</b>
• Updated the numbering format for tables, figures, and cross-references throughout the document.....	<b>3</b>

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## 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](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 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.

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2. 実験局の免許を取得後ご使用いただく。
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#### 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.
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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.

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