PCM2706/PCM2707EVM-U Evaluation Module

This user's guide contains information on the setup, operation, and construction of the PCM2706/PCM2707EVM-U, an evaluation module (EVM) for digital-to-analog converters (DAC) PCM2706 and PCM2707.

Contents

1 Description 2
1.1 Related Documentation From Texas Instruments 2
1.2 Block Diagram 2
1.3 Basic Operating Connections 2
2 Schematic, Bill of Materials, and Printed Circuit Board 4
2.1 PCM2706/PCM2707EVM-U Schematic 4
2.2 PCM2706/PCM2707EVM-U Bill of Materials 5
2.3 PCM2706/PCM2707EVM-U Printed Circuit Board 6

List of Figures

1 PCM2706/PCM2707EVM-U Block Diagram 2
2 PCM2706/PCM2707EVM-U Circuit Diagram 4
3 PCM2706/PCM2707EVM-U Silkscreen 6
4 PCM2706/PCM2707EVM-U – Top View 6
5 PCM2706/PCM2707EVM-U – Bottom View 7

List of Tables

1 Bill of Materials 5

Toslink is a trademark of Kabushiki Kaisha Toshiba DBA Toshiba Corporation.
Microsoft Windows is a trademark of Microsoft Corporation.

Copyright © 2012, Texas Instruments Incorporated

1 Description

The PCM2706/PCM2707EVM-U is an evaluation module for the USB interface DACs PCM2706 and PCM2707. Updating the PCM270x audio devices enabled them to pass the Microsoft Windows™ Logo Kit (WLK) v1.5 certification. For additional information on this update, see the Texas Instruments application report SBFA019.

A USB connector is mounted on the PCM2706/7EVM-U. This connector allows a designer to evaluate DAC performance by connecting a USB interface to it. The designer can power the PCM2706/7EVM-U module with either the USB bus power or an external 5-V power supply by use of the EVM jumper settings.

The PCM2706/7EVM-U outputs a stereo audio signal for headphones at stereo minijack CN2, (PD = 12 mW at R_L = 32 Ω) and an S/PDIF digital interface output at the optical Toslink™ connector U4.

The PCM2706/7EVM-U is fully compliant with the USB 1.1 specification with full-speed transceiver format.

1.1 Related Documentation From Texas Instruments

1. *PCM2704C, PCM2705C, PCM2706C, PCM2707C, Stereo Audio DAC with USB Interface, Single-Ended Headphone Output and S/PDIF Output* data sheet (SBFS036)
2. *Key Differences Between the PCM270x and PCM270xC* application report (SBFA019)

1.2 Block Diagram

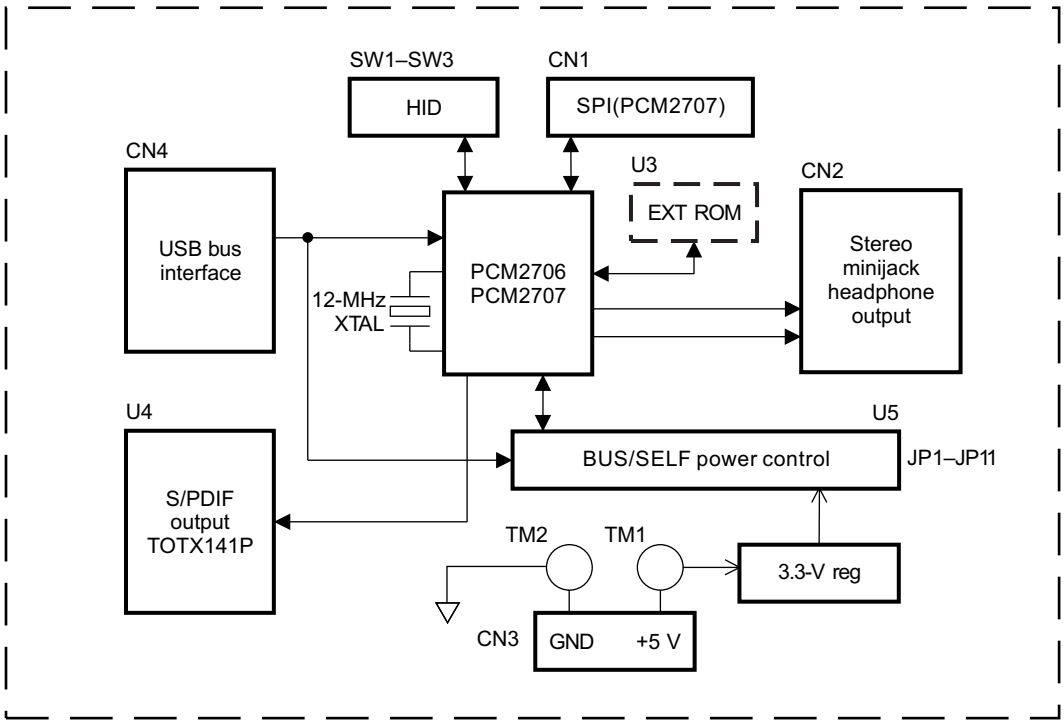


Figure 1. PCM2706/PCM2707EVM-U Block Diagram

1.3 Basic Operating Connections

1.3.1 Universal Serial Bus

A universal serial bus (USB) interface is connected to USB connector CN4.

1.3.2 Stereo Headphone Output

A stereo headphone plug is connected to stereo minijack audio output connector CN2.

Copyright © 2012, Texas Instruments Incorporated

1.3.3 Bus-Power/Self-Power Selection

Operation in the bus-powered or self-powered mode is user selectable, chosen by jumper plug settings on the board. The default setting is self-powered operation.

Bus-Powered

JP2, (JP7): Shorting plug of jumper JP2 must be connected. (JP7 can be removed if the application draws less than 100 mA.)

JP3–JP6, JP8: Shorting plugs of jumpers JP3–JP6, JP8 must be removed.

JP9, JP10, JP11: Shorting plugs of jumpers JP9, JP10, and JP11 must be connected on the BUS side.

P1-P2: Shorting plug of jumper P2 must be connected.

J7: Shorting pins 2-3. The white dot on the board represents pin 1 for these jumpers.

J1-J2: Shorting pins 1-2. The white dot on the board represents pin 1 for these jumpers.

J3-J6: Leave these open.

CN3 or TM1, TM2 external power supply:

External 5-V power supply must not be connected.

Self-Powered (Default Setting)

P1: Shorting plug of jumper P1 must be removed.

P2: Shorting plug of jumper P2 must be connected.

J1-J2: Short pins 1-2 on these jumpers. The white dot on the board represents pin 1 for these jumpers.

J3-J7: Leave these open.

JP2–JP8: Shorting plugs of jumpers JP2–JP8 must be connected.

JP9, JP10, JP11: Shorting plugs of jumpers JP9, JP10, and JP11 must be connected on the SELF side.

CN3 or TM1, TM2 external power supply:

External power supply must be connected either to CN3 or to TM1 and TM2. (V_{CC} = 4.5 V to 10 V, I_{CC} = 30 mA typical, 70 mA maximum) A 3.3-V regulator IC is mounted to provide a 3.3-V power supply for PCM2706/PCM2707 and logic circuitry on the board from the external power supply.

In the case of self-powered operation, the device is enabled when the USB interface is connected and HOST is set to High.

1.3.4 SPI Interface, PCM2707

An SPI interface (MS, MC, MD) for operational control of the PCM2707 can be connected at CN1.

1.3.5 Suspend

Suspend status is indicated at the SSPND pin of CN1.

1.3.6 S/PDIF Output

USB audio data input to the PCM2706 and PCM2707 is output in S/PDIF format. This electrical output is sent to U4, which converts the S/PDIF signal into light for optical transmission.

Copyright © 2012, Texas Instruments Incorporated

2 Schematic, Bill of Materials, and Printed Circuit Board

This section presents the PCM2706/PCM2707EVM-U schematic, bill of materials, and PCB.

2.1 PCM2706/PCM2707EVM-U Schematic

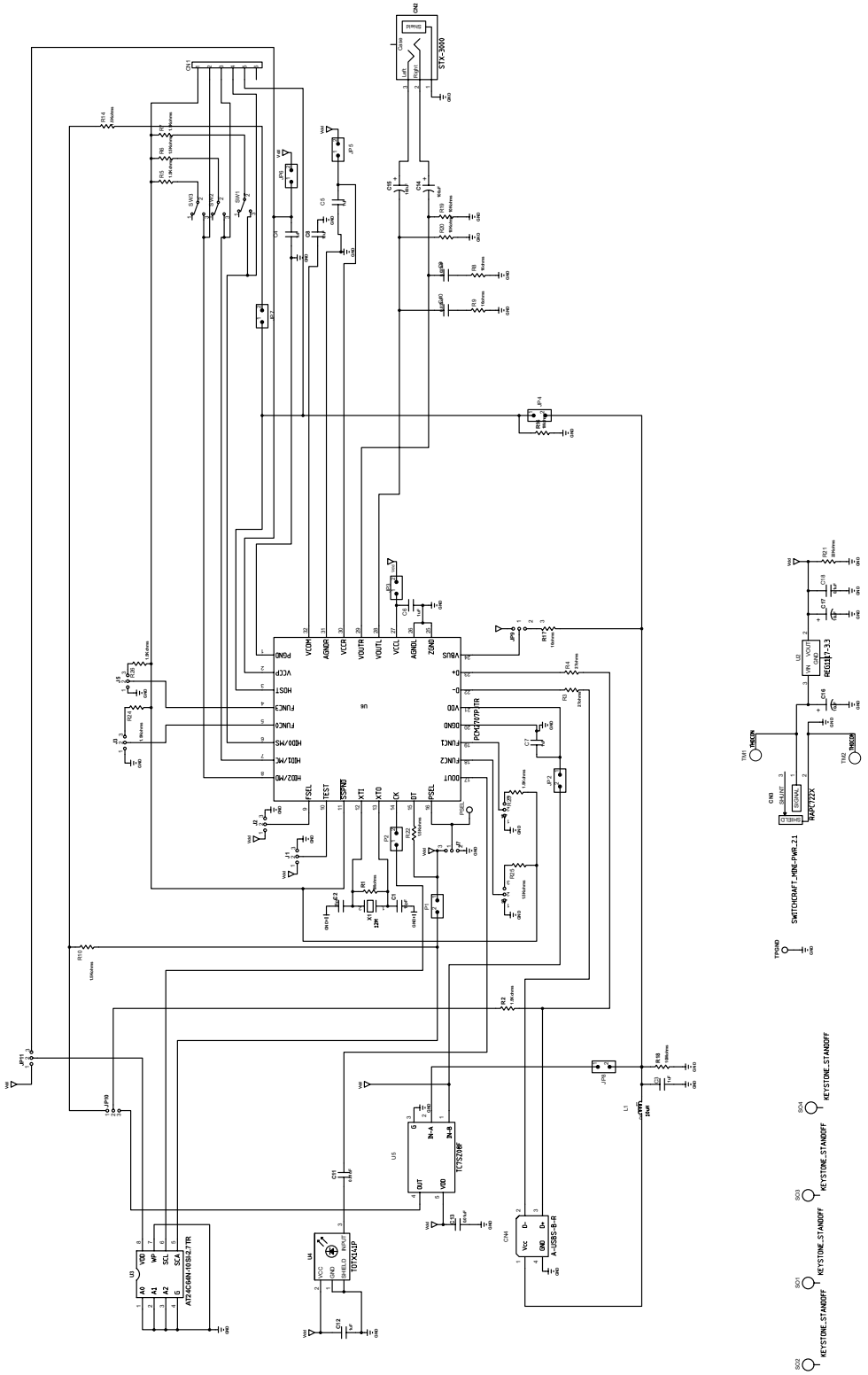


Figure 2. PCM2706/PCM2707EVM-U Circuit Diagram

Copyright © 2012, Texas Instruments Incorporated

2.2 PCM2706/PCM2707EVM-U Bill of Materials

Table 1. Bill of Materials

Item	QTY	MFG	MFG Part No.	REF DES	Description	Value or Function
1	4		2031	SO1-SO4		STANDOFF, 4-40, 1.0INx3/16IN,ALUM RND F-F
2	10		26630301RP2	JP9, JP10, JP11, J1, J2, J3, J4, J5, J6, J7		HEADER 3 PIN, PCB 2.0 MM RoHS
3	1		26630601RP2	CN1		HEADER 6 PIN, PCB 2.0 MM RoHS
4	1		RAPC722X	CN3		JACK MINI-PWR THRU-RA 2,1ID/5.5OD 5A RoHS
5	1		STX-3000	CN2		JACK, MINI-STEREO, RoHS
6	1		TC7SZ08F	U5		2-Input AND Gate
7	1		TOTX141P	U4		TOSLINK TRANSMITTER 3.3 V 15 MB SHUTTER RoHS
8	6		141	C3, C4, C5, C6, C7, C12	603	CAP SMD0603 CERM 1.0 UFD 10 V, 10%, X5R, RoHS
9	1		GRM21BR71A106KE51L-VSA	C8	805	CAP SMD0805 CERM 10 UFD 10 V, 10%, X7R, RoHS
10	1		3750-0	TM2	Black	BINDING POST, BLACK 60 V/15 A GOLD RoHS
11	1		5011	TPGND	Black	PC TESTPOINT BLACK 063 HOLE RoHS
12	1	PANASONIC	ECQ-V1H104JL	C18	CAP, RAD, POLY	CAP, THU, POLYES-FILM, 0.1 µF, 50 V, 5%, 85°C
13	2	MURATA	GRM39X7R223K16V	C9, C10	CAP, SMT, 0603	CAPACITOR, SMT, 0603, CERAMIC, 16 V, 10%, 0.022 µF
14	2	MURATA	GRM40COG150J50V	C1, C2	CAP, SMT, 0805	50 V, ±5%, 15 pF
15	2	MURATA	GRM40X7R103K50V	C11, C13	CAP, SMT, 0805	50 V, 10%, 0.010 µF
16	2	PANASONIC	EEVFC0J101P	C14, C15	CAPACITOR, SMT, ELEC	CAPACITOR, SMT, ELEC, 100 µF, 6.3 V, 20%, –40~105°C
17	1		292304-2	CN4	CONNECTOR, THU, 4P	CONNECTOR, THU, 4P, USB RECEPTACLE, TYPE B, PCB MOUNT
18	1	ECS	ECS-120-18-5P	X1	CRYSTAL, SMT, 2P	XTL, SMT, 12.000 MHz, 18 pF, Fund, 50 ppm,-10~70°C
19	3		G12AP-RO	SW1, SW2, SW3	G12AP	SWITCH THRU SPDT STRAIGHT ULTRA MINIATURE RoHS
20	8	SAMTEC	TSW-101-07-G-D	JP1, JP2, JP3, JP4, JP5, JP6, JP7, JP8	HEADER, THU	HEADER, THU, 2P, 2X1, MALE, DUAL ROW, 100LS, 100TL
21	1		24LC64-I/SN	U3	IC, SMT, 8P	2 WIRE SERIAL EEPROM
22	1	PANASONIC	ELJFA100KJ/F	L1	INDUCTOR, SMT	10.0 µH
23	2		ECA1CM100	C16, C17	M	CAP ALUM ELEC M RADIAL 10UFD 16 V 20% RoHS
24	2	VISHAY	CRCW08051002F	R19, R20	RES, SMT, 0805	RESISTOR, SMT, 0805,THICK FILM, 1%, 1/8W, 10.0 k
25	3	VISHAY	CRCW08051004F	R1, R15, R16	RES, SMT, 0805	RESISTER, SMT, 0805,THICK FILM, 1%, 1/8W, 1.00 M
26	1	VISHAY	CRCW080510R0F	R17	RES, SMT, 0805	RESISTER, SMT, 0805,THICK FILM, 1%, 1/8W,10.0 Ω
27	9	VISHAY	CRCW08051501F	R2, R5, R6, R7, R10, R11, R12, R13, R14	RES, SMT, 0805	RESISTER, SMT, 0805,THICK FILM, 1%, 1/8W, 1.50 k
28	1	PANASONIC	ERJ-6GEYJ106V	R18	RES, SMT, 0805	RESISTOR, SMT, 0805,THICK FILM, 10 M, 5%, 1/8W
29	2	PANASONIC	ERJ-6GEYJ160V	R8, R9	RES, SMT, 0805	RESISTOR, SMT, 0805,THICK FILM, 5%, 1/8W, 16
30	2	PANASONIC	ERJ-6GEYJ270V	R3, R4	RES, SMT, 0805	RESISTOR, SMT, 0805,THICK FILM,5%, 1/8W, 27
31	1	PANASONIC	ERA-6YEB223V	R21	RES, SMT, 2P	RESISTOR, SMT, 0805,22 k, 0.1%, 1/10W, 25 ppm
32	1		3750-2	TM1	Red	BINDING POST, RED 60 V/15 A GOLD RoHS
33	1		REG1117-3.3	U2	SOT223-DCY	VOLT REG 3.3 V, 800 mA SOT223-DCY RoHS
34	1		PCM2707PJTR	U6	TQFP32-PJT	STEREO AUDIO DAC W/USB SE HEADPHONE/SPDIF OUT SSOP28-DB RoHS
35	1		5002	PSEL	White	PC TESTPOINT, WHITE, RoHS

NOTE: ASTERISK(*) NEXT TO PART MANUFACTURER'S NAME DENOTES POSSIBLE LONG LEAD TIME ITEM.

Copyright © 2012, Texas Instruments Incorporated

2.3 PCM2706/PCM2707EVM-U Printed Circuit Board

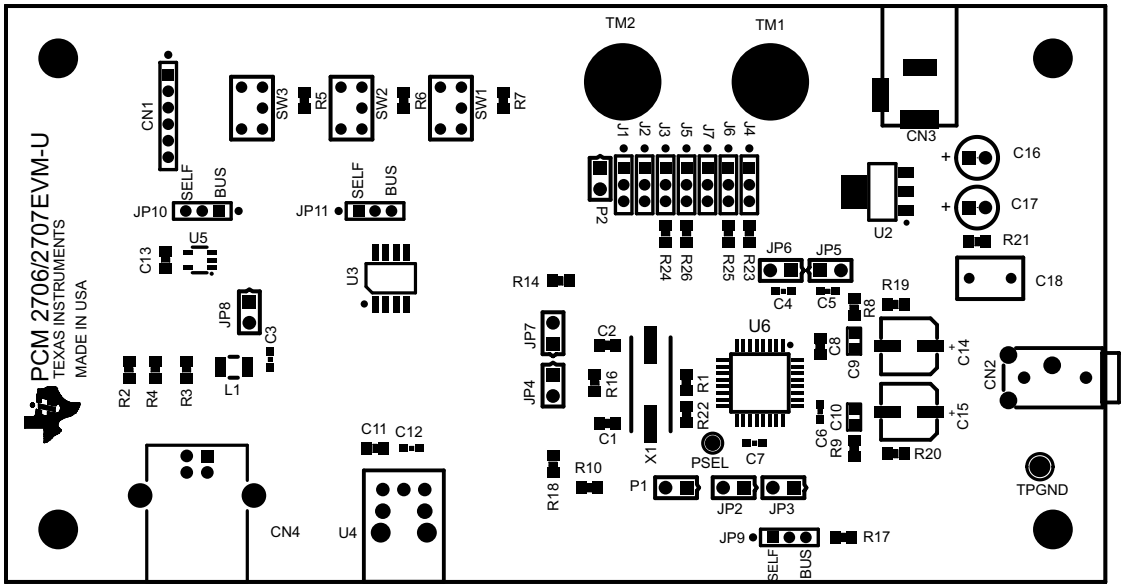


Figure 3. PCM2706/PCM2707EVM-U Silkscreen

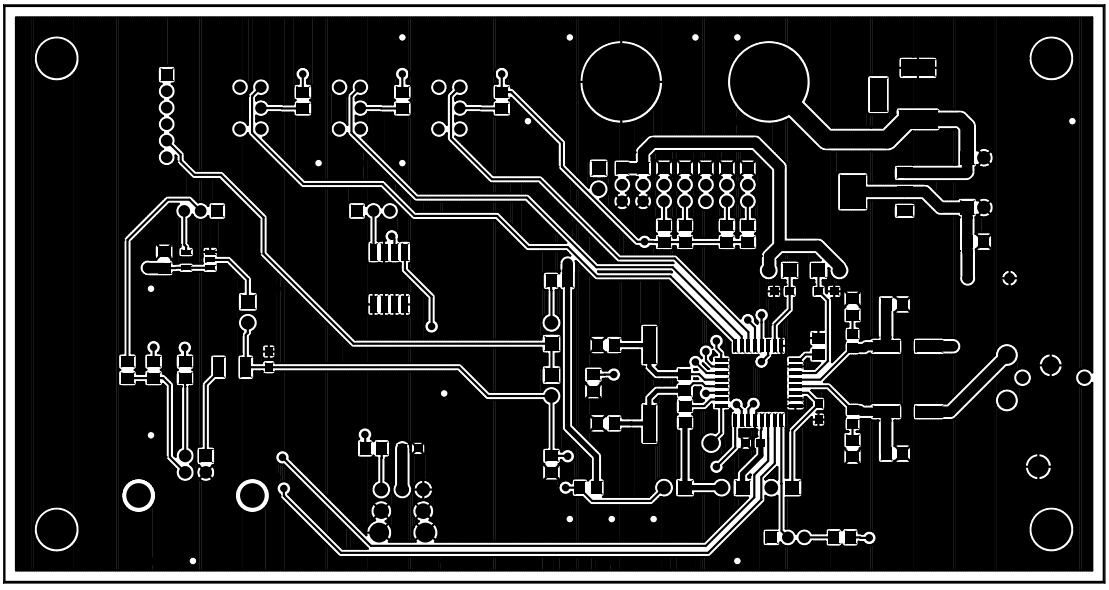


Figure 4. PCM2706/PCM2707EVM-U – Top View

Copyright © 2012, Texas Instruments Incorporated

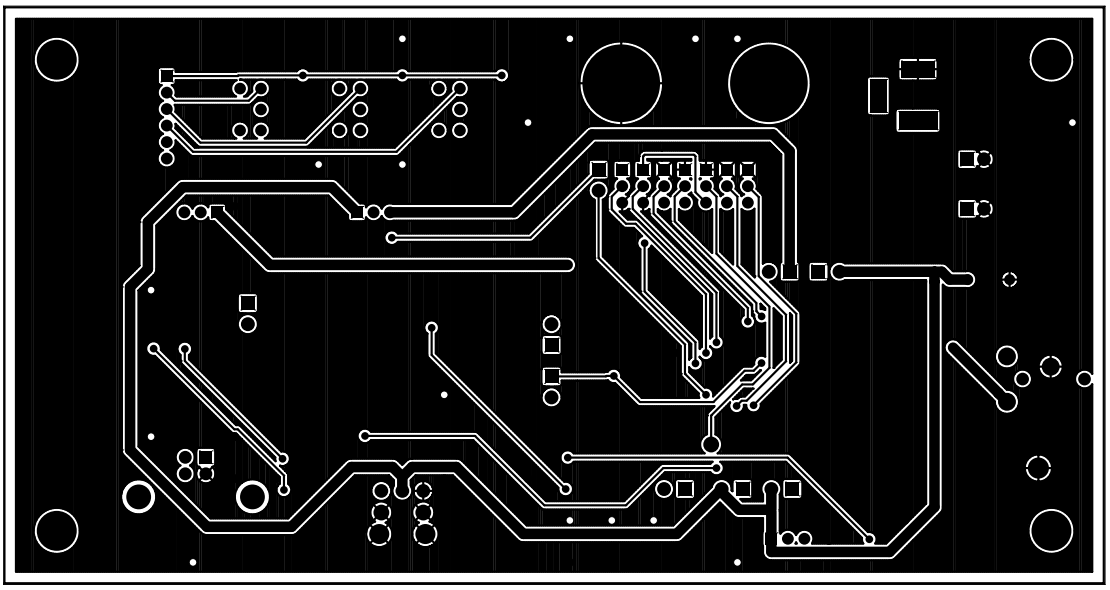


Figure 5. PCM2706/PCM2707EVM-U – Bottom View

Copyright © 2012, Texas Instruments Incorporated

EVALUATION BOARD/KIT/MODULE (EVM) ADDITIONAL TERMS

Texas Instruments (TI) provides the enclosed Evaluation Board/Kit/Module (EVM) under the following conditions:

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods.

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

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please visit www.ti.com/esh or contact TI.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used. TI currently deals with a variety of customers for products, and therefore our arrangement with the user is not exclusive. TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein.

REGULATORY COMPLIANCE INFORMATION

As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

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

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant

Caution

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concerning EVMs including detachable antennas

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

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

Concernant les EVMs avec appareils radio

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

【Important Notice for Users of this Product in Japan】

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

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

1. Use this product in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

Texas Instruments Japan Limited
(address) 24-1, Nishi-Shinjuku 6 chome, Shinjukku-ku, Tokyo, Japan

http://www.tij.co.jp

【ご使用にあたっての注】

本開発キットは技術基準適合証明を受けておりません。

本製品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。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
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。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。

日本テキサス・インスツルメンツ株式会社
東京都新宿区西新宿６丁目２４番１号
西新宿三井ビル
http://www.tij.co.jp

EVALUATION BOARD/KIT/MODULE (EVM)
WARNINGS, RESTRICTIONS AND DISCLAIMERS

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

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

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

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

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

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

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2012, Texas Instruments Incorporated

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Mobile Processors	www.ti.com/omap		
Wireless Connectivity	www.ti.com/wirelessconnectivity		
	TI E2E Community Home Page		e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2012, Texas Instruments Incorporated