

PCM186xEVM

The PCM186xEVM (EVM) is an easy-to-use evaluation board for the PCM186x family of ADCs. This document details the materials received with the EVM, how to get started with the software and hardware, the schematics, bill of materials (BOM), and layouts. Throughout this user's guide, the abbreviations *EVM*, *PCM186xEVM*, and the term *evaluation module* are synonymous with the PCM1860EVM, PCM1861EVM, PCM1862EVM, PCM1863EVM, PCM1864EVM, or PCM1865EVM, unless otherwise noted.

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1 Introduction

The PCM186xEVM (EVM) is an easy-to-use evaluation board for the PCM186x family of ADCs. Due to the pin-for-pin nature of the PCM186x family, any of the following part numbers can be used with this board; PCM1860, PCM1861, PCM1862, PCM1863, PCM1864, and PCM1865. The differences between these parts are shown in [Table 1](#).

Table 1. Part Differences

Part Number	Register Programmable	Hardware Programmable	Number of ADC Channels
PCM1860		Yes	2
PCM1861		Yes	2
PCM1862	Yes		2
PCM1863	Yes		2
PCM1864	Yes		4
PCM1865	Yes		4

The PCM186xEVM has an external +5-V power connection or USB +5 V through the USB-I2X board to power the EVM. In conjunction with the USB-I2X board, all of the register programming can be done via USB. In the case of the hardware-controlled parts, resistors are included to tie inputs high or low. There are headers and test points for most signals to and from the PCM186x. Digital audio can be streamed from the included SPDIF optical connectors or through a USB to a PC.

2 What's in the Box?

2.1 PCM186xEVM

Figure 1 is a photo of the EVM.

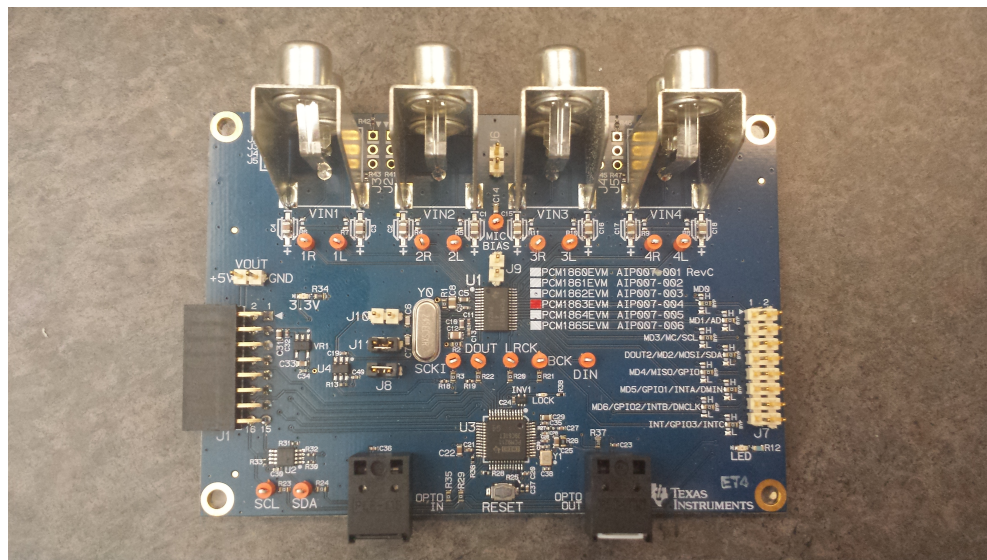


Figure 1. Picture of PCM186xEVM

2.2 USB-I2X board

Figure 2 is a photo of the USB-I2X board.

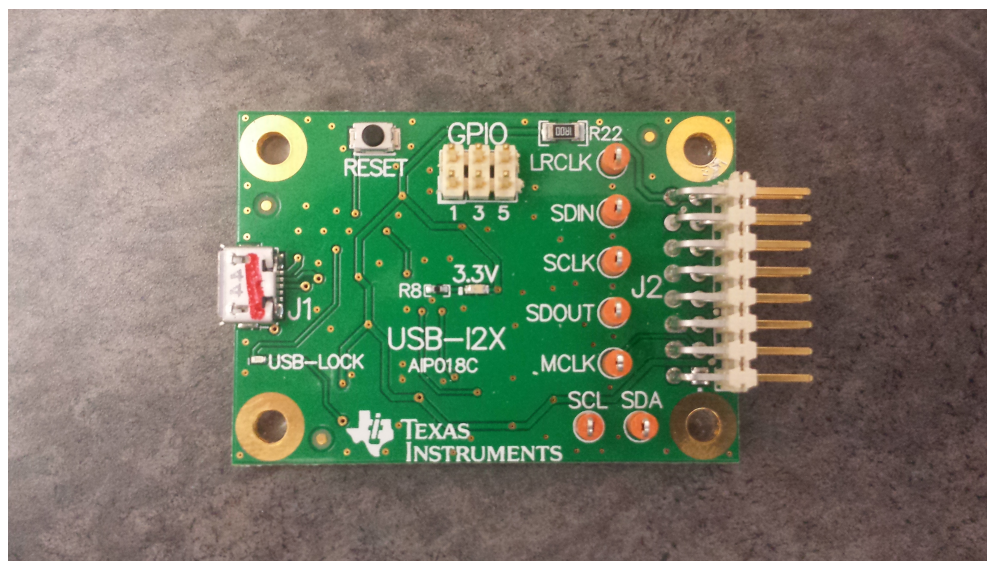


Figure 2. Picture of USB-I2X Board

2.3 Micro USB Cable

A micro USB cable is also included in the box

3 Getting Started

3.1 System Hardware Overview

The PCM186xEVM can be controlled through the use of the USB using the included USB-I2X board. The USB-I2X board connects to a PC via USB and provides digital control signals to the EVM board via I2C. The USB-I2X board also can supply serial digital audio in and out from the PC to the EVM through an I2S interface. When connected, the USB-I2X board also supplies all of the power required for the EVM through USB. The PCM186xEVM also uses a PCM9211 which allows the EVM to receive and transmit digital audio via optical/SPDIF connectors on the EVM. The PCM9211 converts the optical data to I2S which can be routed to the PCM186xEVM.

The USB-I2X board mates to the PCM186xEVM as shown in [Figure 3](#).

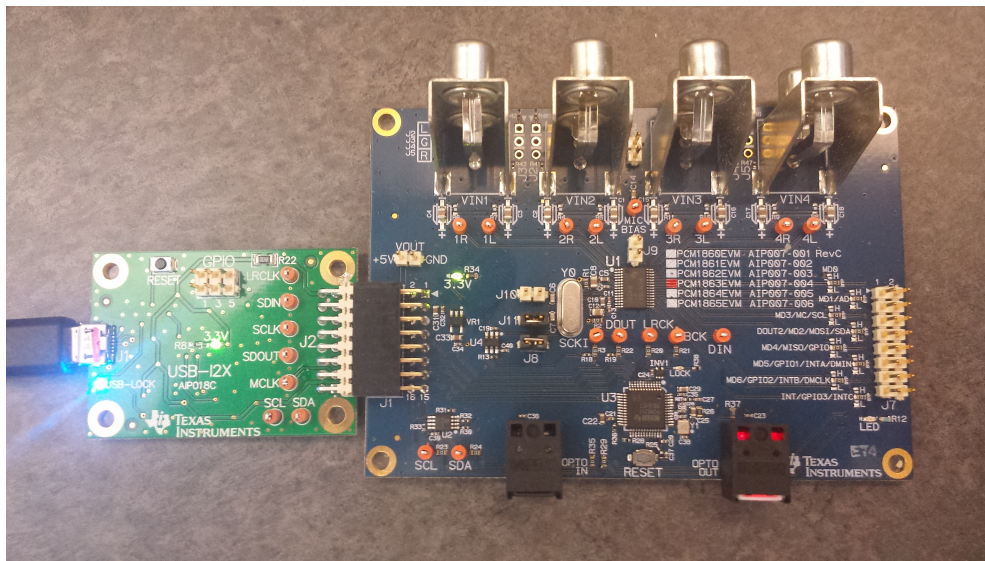


Figure 3. PCM186xEVM Mated to the USB-I2X Board

3.2 Block Diagram

Figure 4 shows a block diagram of the mated boards.

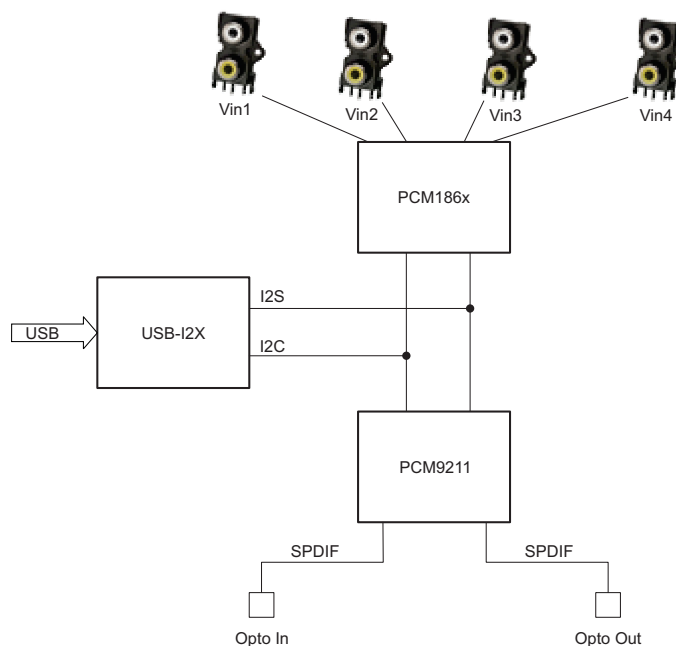


Figure 4. Block Diagram

The EVM has several different clocking options and can be run in one of three different modes. These modes also control how the audio data is routed. The default mode is **Mode 0**, for more detail on the available modes, refer to [Section 4.3](#).

3.3 Software Download

The EVM is controlled through the PurePath™ Console. Request PurePath Console access here: www.ti.com/tool/purepathconsole.

Once access is granted, download the PurePath Console here: <http://cc.ext.ti.com>

4 Hardware

4.1 Power Requirements

The PCM186xEVM requires a 5-V power supply. This can be sourced from the I2X board via USB or applied directly to the EVM on the +5-V header just above J1. Once 5 V is applied, the PCM186x board regulates the 5 V down to a clean analog 3.3 V. A green LED just to the right of the 5-V header illuminates if the voltages are present.

4.2 Connectors and Headers

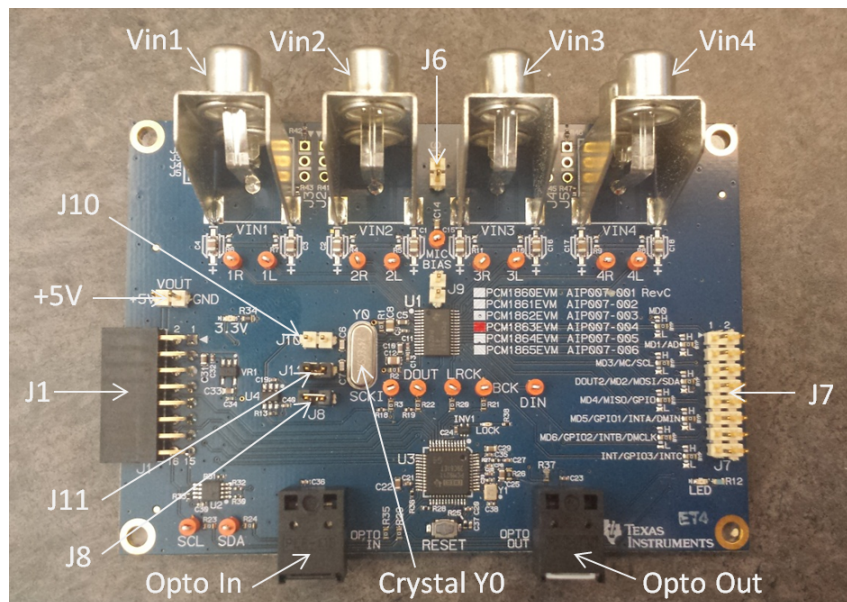


Figure 5. Diagram of Connector/Header Locations

- **J1** – J1 is the I2X board connector. Provides I2C, I2S and +5 V connections to the PCM186x EVM.
- **+5V** – Input for power if no USB-I2X board is used. Output for +5 V, if USB-I2X board is used.
- **Vin1** – Pins 3 (red-top input) and 4 (white-bottom input) of the PCM186x. AC coupled.
- **Vin2** – Pins 1 (red-top input) and 2 (white-bottom input) of the PCM186x. AC coupled.
- **Vin3** – Pins 30 (red-top input) and 29 (white-bottom input) of the PCM186x. AC coupled.
- **Vin4** – Pins 28 (red-top input) and 27 (white-bottom input) of the PCM186x. AC coupled.
- **J6** – J6 can be used to insert an external Mic Bias (remove J9).
- **J7** – Most of the PCM186x GPIO, hardware control, and I2C signals are available here.

Table 2. J7 Controls

J7 Pin	Description
1	MD0
2	Ground
3	MD1/AD
4	Ground
5	MD3/MC/SCL
6	Ground
7	Dout2/MD2/MOSI/SDA
8	Ground
9	MD4/MISO/GPIO
10	Ground
11	MD5/GPIO1/INTA/DMIN
12	Ground
13	MD6/GPIO2/INTB/DMCLK
14	Ground
15	INT/GPIO3/INTC
16	Ground

- **J8** – J8 is used to enable or disable the Y0 crystal buffer. With the jumper inserted, this buffer is disabled. With the jumper removed, the buffer is enabled.
- **J9** – J9 is used to connect Mic Bias to the inputs for use with an electric microphone. If the jumper is installed, the Mic Bias is connected to the inputs, if the jumper is removed, Mic Bias is disconnected.
- **J10** – J10 is used to connect the crystal output (Y0) to a buffer. If the crystal output is being used, insert J10.
- **J11** – J11 is used to connect the Xi pin of the PCM186x to ground. If the crystal (Y0) is not used, Xi should be grounded by inserting a jumper on J11. If the crystal is used, remove the J11 jumper.
- **Opto Out** – Opto out is the SPDIF output of the PCM9211.
- **Y0** – Y0 is a socked crystal for the PCM186x. If using the PCM186x as the master, insert this crystal. If the PCM186x is used as a slave, remove the crystal.
- **Opto In** – Opto in is the SPDIF input to the PCM9211. The PCM186x can mix this digital input with ADC output.

4.3 Board Configurations

Mode 0 is the default mode after power up (Figure 6). In mode 0, the master clock is supplied from the PCM9211 and the PCM186x is the slave. Optical inputs are routed to the PCM186x I2S inputs. The optical input also sets the sample rate of the system to match the optical rate. If no input is provided, the sample rate is generated by the PCM9211 and is 48 kHz. The I2X board provides I2C control and power only. In mode 0, Y0 can be removed and jumpers should be placed on J8 and J11.

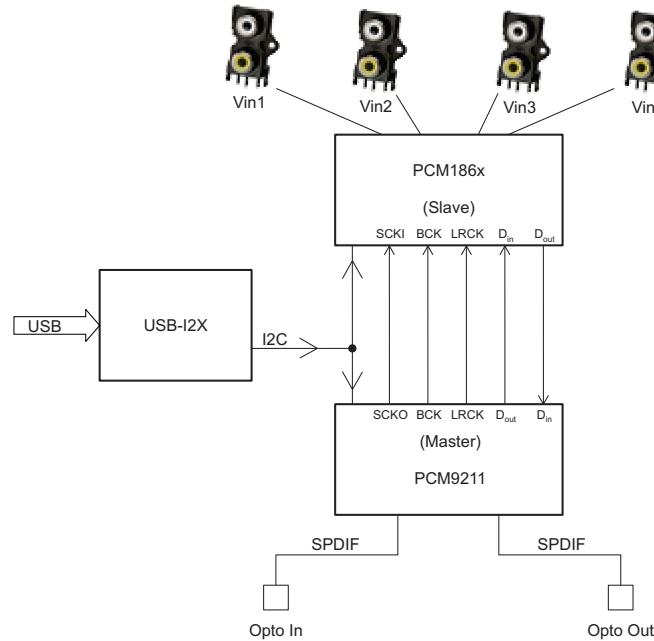


Figure 6. Mode 0 Block Diagram

In **Mode 1**, the PCM186x is the master (Figure 7). Clocking is provided by Y0. I2S is sent to the optical output. The optical input is not available in this mode. The I2X board will provide I2C control and power only. In mode 1, install Y0 and J10.

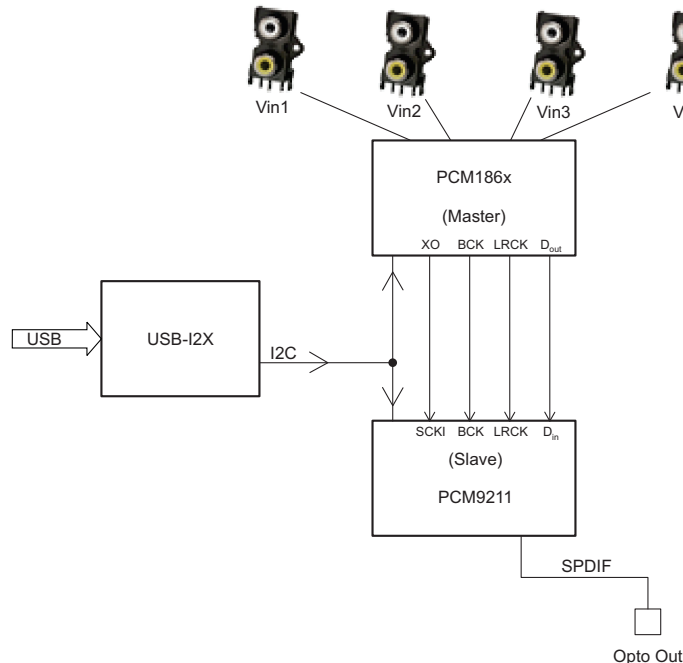


Figure 7. Mode 1 Block Diagram

In **Mode 2**, the I2X board is the master (Figure 8). I2S in and out to the PCM186x is via the I2X board and is available to a PC via USB. The optical input and output are not available. Remove Y0 and place jumpers on J8 and J11 to use this mode.

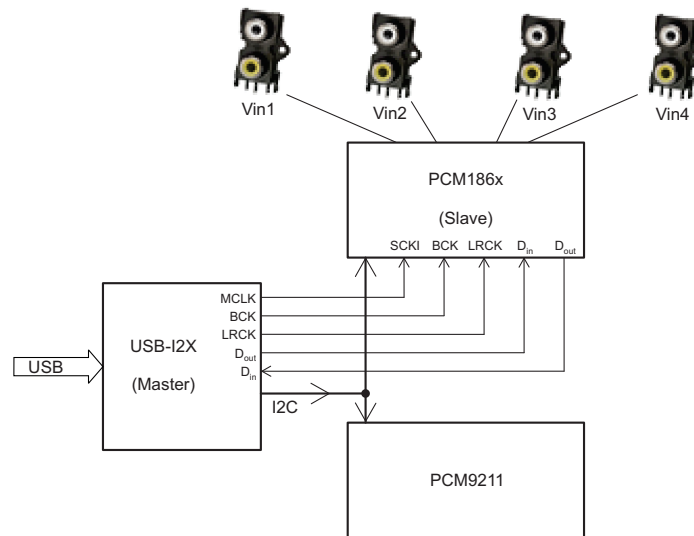


Figure 8. Mode 2 Block Diagram

Table 3. Mode Summary

Mode	Function	J8	J10	J11	Crystal Y0
Mode 0	I2S input and output to PCM9211, running on I2S clocks	Installed	Removed	Installed	Do not care
Mode1	I2S output to PCM9211 running on crystal	Installed	Installed	Removed	Installed
Mode2	I2S input and output to USB running on I2S clocks	Installed	Removed	Installed	Do not care

4.4 Solder Options

The PCM1861 is completely hardware controlled. In addition to the hardware controlled versions of the PCM186x family, all of the devices have GPIO. In order to accommodate these hardware and GPIO options, a series of 3-way resistor connections are included on the EVM. Just to the left of J7, there are 8 zero-Ω resistors. By default, they are connected to pass the signals to J7. These resistors can also be reoriented up to tie these pins high, or down to tie these pins low. For the proper settings of these multi-function pins, see the PCM186x data sheet ([SLAS831](#)).

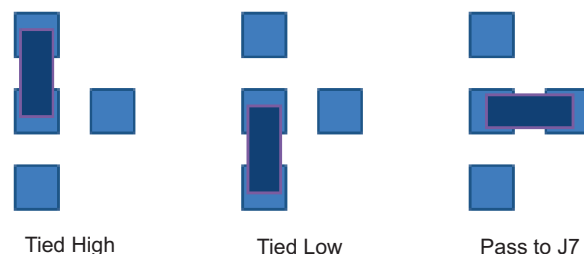


Figure 9. Solder Options

5 Software

5.1 Installation

Access to the PurePath™ Console (PPC2) can be requested here: www.ti.com/tool/purepathconsole.

Once access is granted, download the PurePath Console here: <http://cc.ext.ti.com>.

After downloading the zip file containing the PPC2 release for PCM186X, unzip the contents. Inside the zip file is an executable to install PPC2 and a .ppc2 file, this is the PCM186X plugin. Save the plugin in a file to access later, start the PPC2 installation.

Once the installation is complete, start PPC2. Plug in the USB cable connected to the USB-I2X board, which should be connected to the PCM186X EVM. If the GUI does not automatically load the PCM186X GUI, you must manually select the plugin.

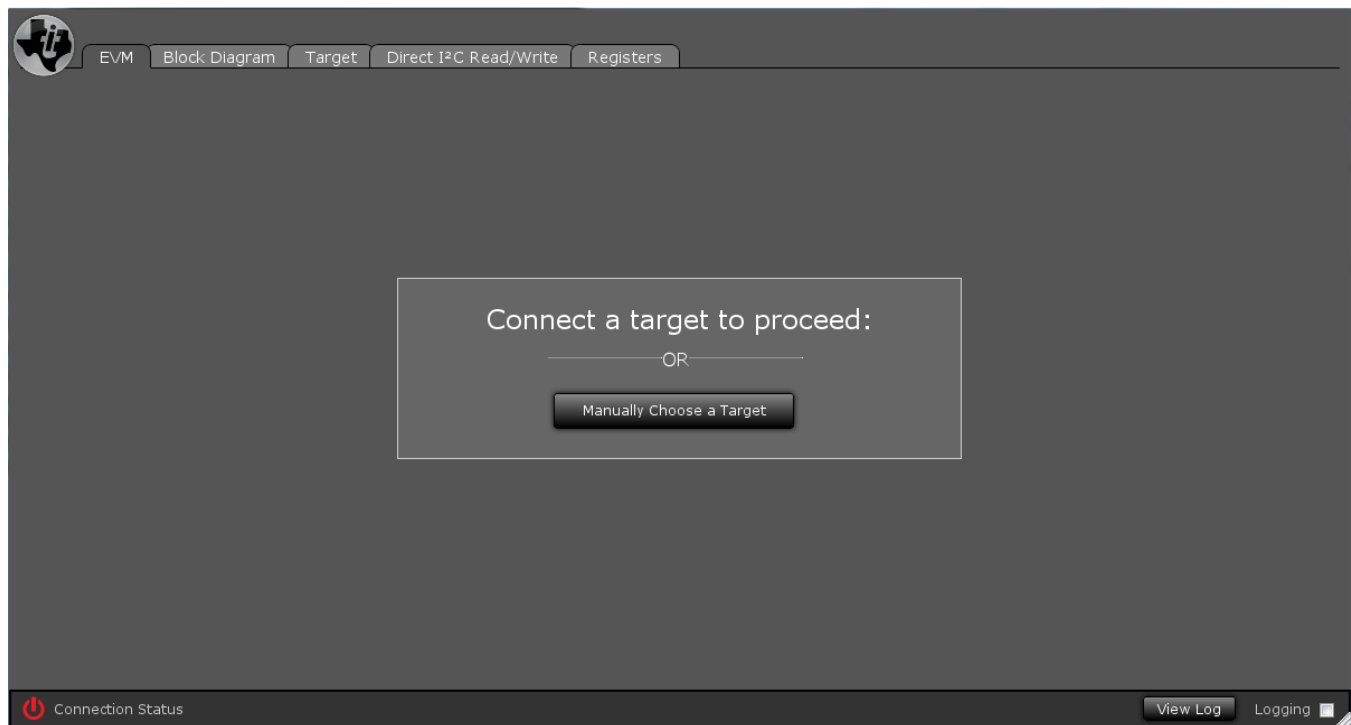


Figure 10. PCM186X EVM GUI

Select *Manually Choose a Target*, a menu should appear that will show the list on installed plugins and the option to add a target.

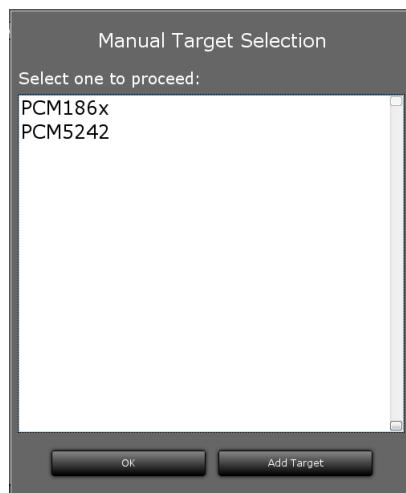


Figure 11. Manual Target Selection Window

If PCM186X does not appear in the list, select *Add Target*. Find the PCM186X plugin that was previously downloaded.

5.2 Navigation and Features

After the plugin is loaded and the device has been connected, the first window should look like [Figure 12](#). The mode can be changed by the drop down menu on the right.

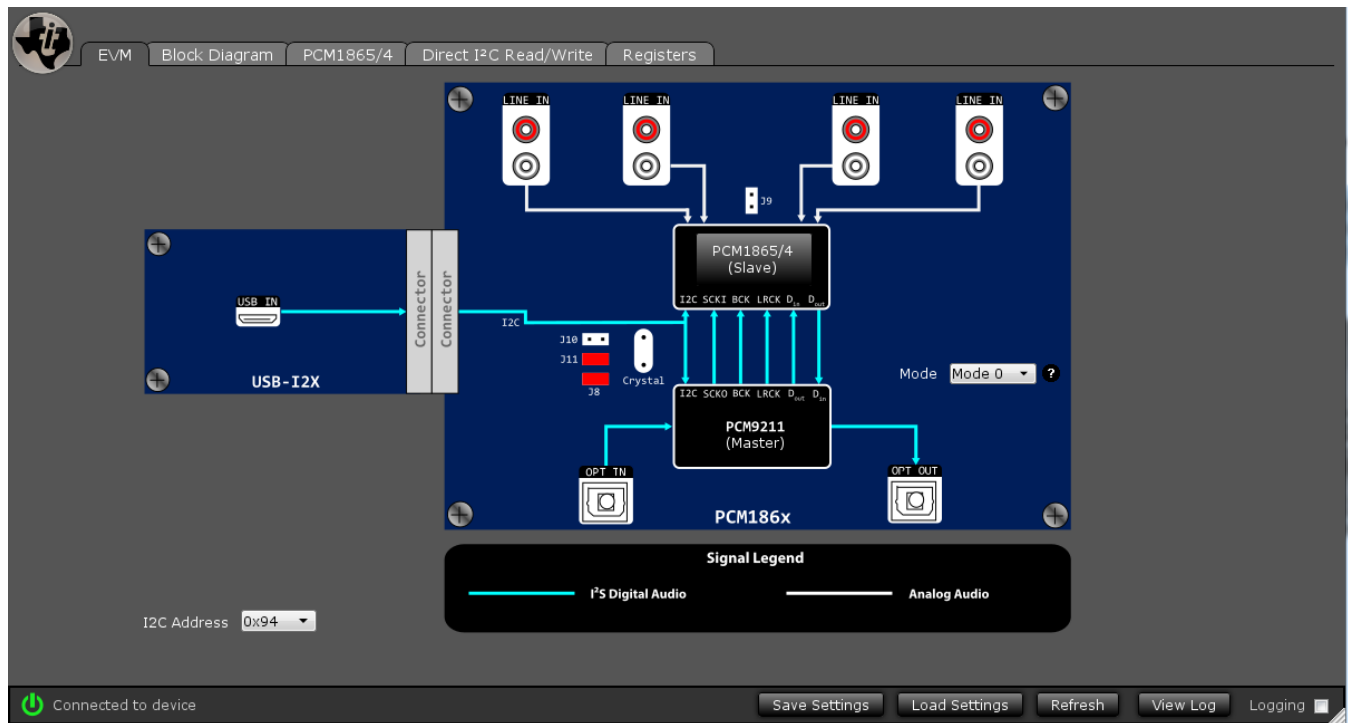


Figure 12. EVM Tab

One very useful feature of the PurePath Console is the ability to load, save, and run scripts. Scripts are text files that include each I2C write that is going to be sent to the PCM186x. Although the GUI is useful for making rapid changes and experiments, the goal is developing a script that can be run and saved.

To access the script editing area, click on the *Direct I²C Read/Write* tab.

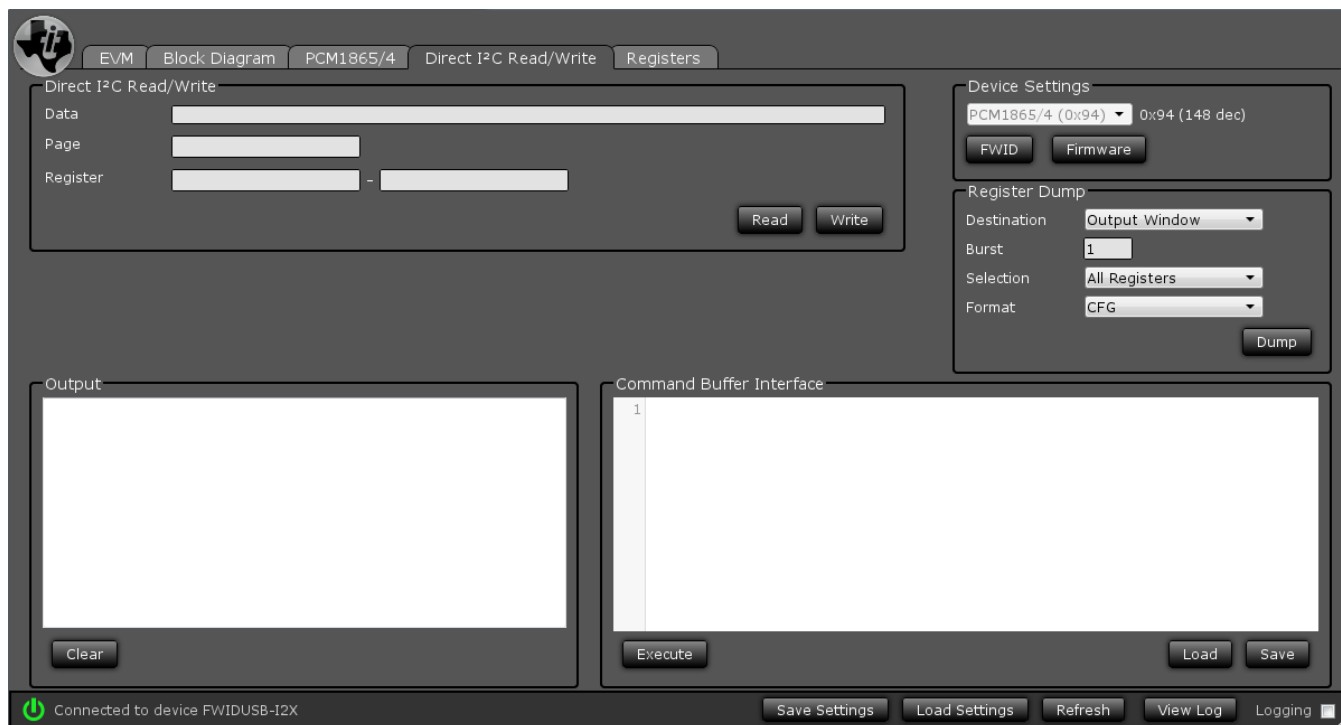


Figure 13. Direct I²C Read/Write Tab

By clicking on the *Load* button in the right window, any script.txt file can be opened. Editing, saving and running the script from this window is also possible.

In the default setting, to get audio out from the EVM quickly, connect a left and right analog audio signal into Vin1, and connect a system that accepts digital audio through the optical out. To improve performance, supply a differential audio signal to the part and select *1P-1M Differential* and *2P-2M Differential* in the *Block Diagram* tab.

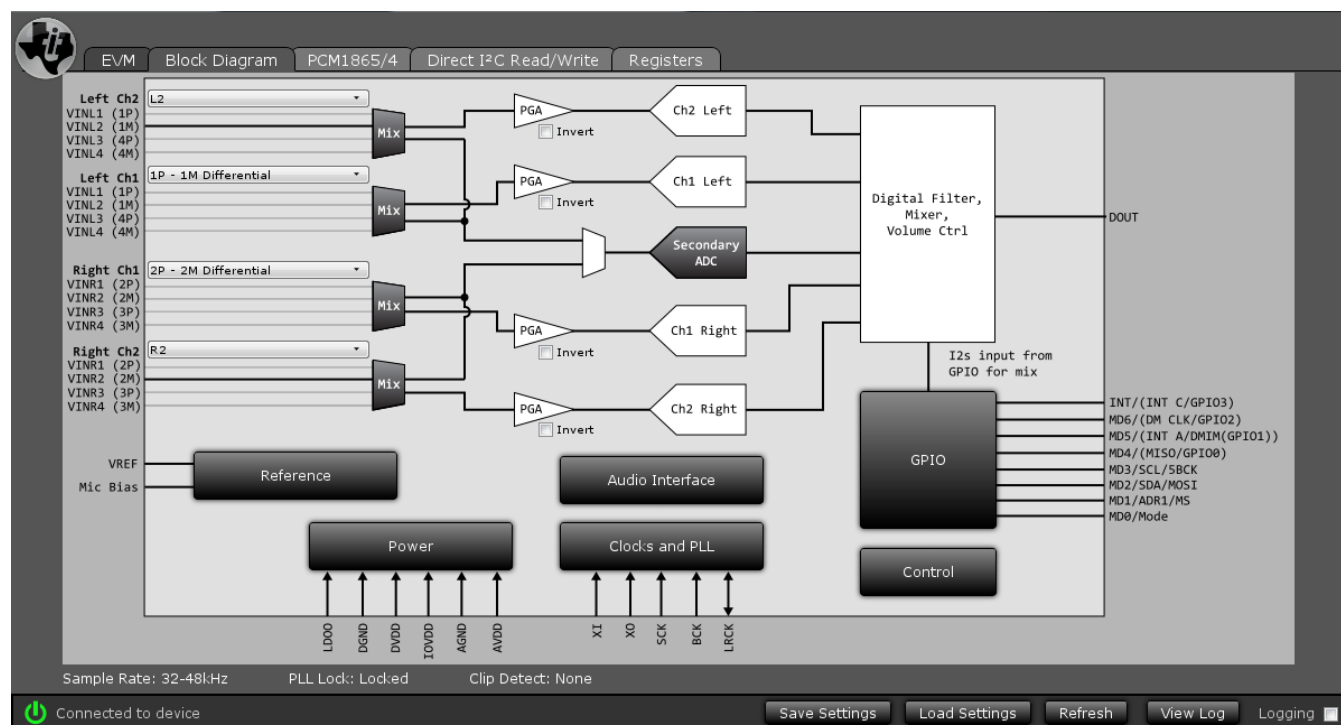


Figure 14. 1P-1M Differential and 2P-2M Differential Shown in Block Diagram Tab

6 Schematics, Bill of Materials and Layouts

6.1 Schematics

Figure 15 and Figure 16 are the schematics for the PCM186xEVM.

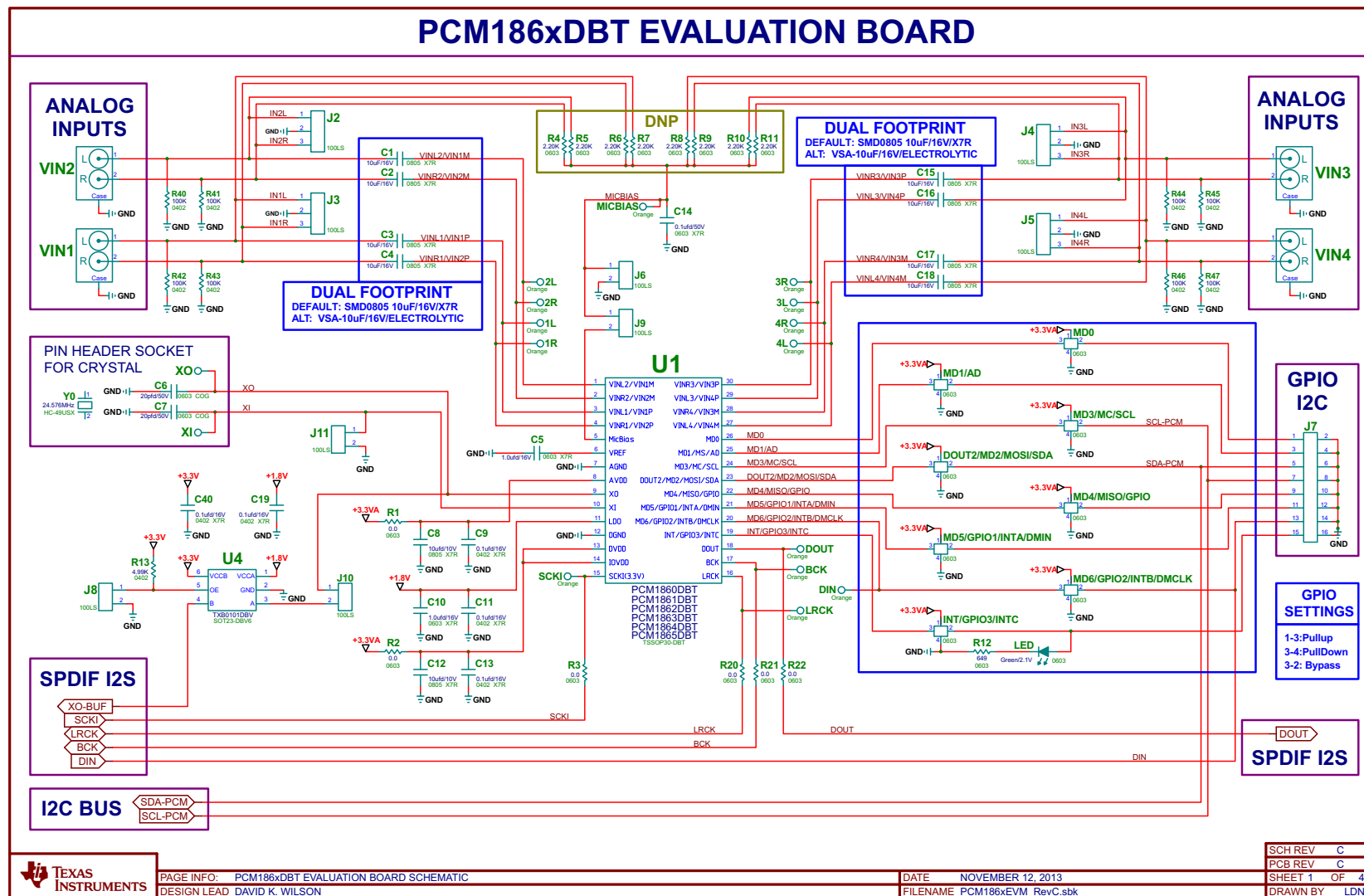


Figure 15. PCM186xEVM Schematic

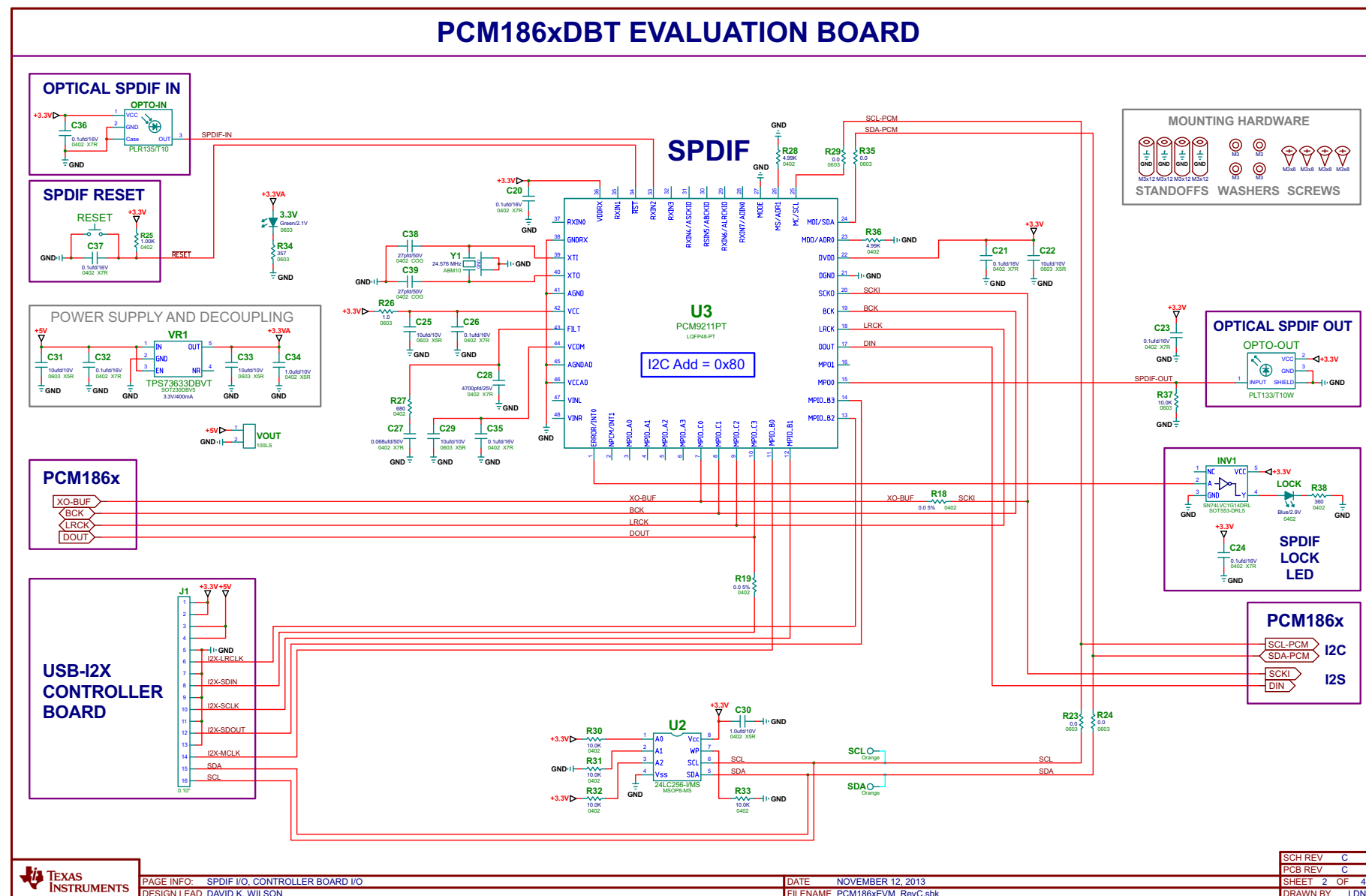


Figure 16. PCM186xEVM Schematic, SPDIF I/O and Controller Board I/O

6.2 Bill of Materials

Table 4 lists the PCM186xEVM BOM.

Table 4. Bill of Materials for PCM186xEVM

Item	MANU PART NUM	MANU	Qty	REF DES	Description
1	PCM1865DBT	TEXAS INSTRUMENTS	1	U1	MIC TO 2VRMS ANALOG IN 24-BIT 192 kHz STEREO FRONT END TSSOP30-DBT ROHS
2	24LC256-I/MS	MICROCHIP	1	U2	SERIAL EEPROM I2C 256K 400kHz MSOP8-MS ROHS
3	PCM9211PTR	TEXAS INSTRUMENTS	1	U3	192kHz DIG AUDIO INTERFACE TRANSCEIVER W/STEREO ADC AND ROUTING LQFP48-PT ROHS
4	TXB0101DBVR	TEXAS INSTRUMENTS	1	U4	1-BIT BIDIR LEVEL TRANSLATOR SOT23-DBV6 ROHS
5	SN74LVC1G14DRLR	TEXAS INSTRUMENTS	1	INV1	SINGLE INVERTER GATE SCHMITT-TRIGGER SOT553-DRL5 ROHS
6	TPS73633DBVT	TEXAS INSTRUMENTS	1	VR1	VOLT REG 3.3V 400MA LDO CAP FREE NMOS SOT23-DBV5 ROHS
7	PLR135/T10	EVERLIGHT ELECTRONICS	1	OPTO-IN	PHOTOLINK FIBER OPTIC RECEIVER 2.4-5.5V 15MB PCB-RA SHUTTER ROHS
8	PLT133/T10W	EVERLIGHT ELECTRONICS	1	OPTO-OUT	PHOTOLINK FIBER OPTIC TRANSMITTER 2.4-5.5V 15MB PCB-RA SHUTTER ROHS
9	LTST-C190GKT	LITE-ON INC.	2	LED, 3.3V	LED GREEN SMD0603 2.1V 10mA ROHS
10	SMLP12BC7TT86	ROHM SEMICONDUCTOR	1	LOCK	LED BLUE SMD0402 2.9V 10mA ROHS
11	ABM10-24.576MHZ-E20-T	ABRACON	1	Y1	CRYSTAL SMT-ABM10 24.576MHz 4 PIN 10PFD FUNDAMENTAL ROHS
12	EMK212BB7106MG-T	TAIYO YUDEN	8	C1-C4, C15, C16, C17, C18	CAP SMD0805 CERM 10uF 16V 20% X7R ROHS
13	C1608X7R1C105K	TDK	2	C5, C10	CAP SMD0603 CERM 1.0UFD 16V 10% X7R ROHS
14	GRM1885C1H200JA01D	MURATA	2	C6, C7	CAP SMD0603 CERM 20PFD 50V 5% COG ROHS
15	GRM21BR71A106KE51L	MURATA	2	C8, C12	CAP SMD0805 CERM 10UFD 10V10% X7R ROHS
16	GRM155R71C104KA88D	MURATA	14	C9, C11, C13, C19, C20, C21, C23, C24, C26, C32, C35-C37, C40	CAP SMD0402 CERM 0.1UFD 16V X7R 10% ROHS
17	GRM188R71H104KA93D	MURATA	1	C14	CAP SMD0603 CERM 0.1UFD 50V 10% X7R ROHS
18	C1608X5R1A106K	TDK CORP	5	C22, C25, C29, C31, C33	CAP SMD0603 CERM 10ufd 10V 10% X5R ROHS
19	CGA2B3X7R1H683K	TDK CORP	1	C27	CAP SMD0402 CERM 0.068ufd 50V 10% X7R ROHS
20	CC0402KRX7R8BB472	YAGEO	1	C28	CAP SMD0402 CERM 4700pfd 25V 10% X7R ROHS
21	C1005X5R1A105K	TDK CORP	2	C30, C34	CAP SMD0402 CERM 1.0UFD 10V 10% X5R ROHS
22	GRM1555C1H270JZ01D	MURATA	2	C38, C39	CAP SMD0402 CERM 27PFD 5% 50V COG ROHS
23	ERJ-3GEY0R00V	PANASONIC	10	R1, R2, R3, R20, R21, R22, R23, R24, R29, R35	RESISTOR SMD0603 0.0 OHM 5% THICK FILM 1/10W ROHS
24	ERJ-3EKF2201V	PANASONIC	0	R4, R5, R6, R7, R8, R9, R10, R11	RESISTOR SMD0603 2.20K OHMS 1% THICK FILM 1/10W ROHS
25	RC0603FR-07649RL	YAGEO	1	R12	RESISTOR SMD0603 THICK FILM 649 OHMS 1% 1/10W ROHS
26	ERJ-2RKF4991X	PANASONIC	3	R13, R28, R36	RESISTOR SMD0402 4.99K 1%,1/16W ROHS
27	RMCF0402ZT0R00	STACKPOLE ELECTRONICS	2	R18, R19	ZERO OHM JUMPER SMT 0402 0 OHM 1/16W,5% ROHS
28	CRCW04021K00FKED	VISHAY	1	R25	RESISTOR SMD0402 1.00K 1% 1/16W 100ppm ROHS
29	ERJ-3GEYJ1R0V	PANASONIC	1	R26	RESISTOR SMD0603 1.0 OHMS 1% THICK FILM 1/10W ROHS
30	RC0402FR-07680RL	YAGEO	1	R27	RESISTOR SMD0402 THICK FILM 680 OHMS 1% 1/16W ROHS

Table 4. Bill of Materials for PCM186xEVM (continued)

Item	MANU PART NUM	MANU	Qty	REF DES	Description
31	CRCW040210K0FKED	VISHAY	4	R30, R31, R32, R33	RESISTOR SMD0402 10.0K OHMS 1% 1/16W ROHS
32	ERJ-3EKF1002V	PANASONIC	1	R37	RESISTOR SMD0603 10.0K 1% THICK FILM 1/10W ROHS
33	CRCW0402360RFKED	VISHAY	1	R38	RESISTOR SMD0402 360 1/16W 1% ROHS
34	ERJ-3EKF3570V	PANASONIC	1	R34	RESISTOR SMD0603 357 OHM 1% THICK FILM 1/10W ROHS
35	ERJ-2RK1003X	PANASONIC	8	R40, R41, R42, R43, R44, R45, R46, R47	RESISTOR SMD0402 THICK FILM 100K OHMS 1/16W 1% ROHS
36	ERJ-3GEY0R00V	PANASONIC	8	MD0(Byp), MD1/AD(Byp), MD3/MC/SCL(Byp), MD4/MISO/GPIO(Byp), INT/GPIO3/INTC(Byp), DOUT2/MD2/MOSI/SDA(Byp), MD5/GPIO1/INTA/DMIN(Byp), MD6/GPIO2/INTB/DMCLK(Byp)	RESISTOR SMD0603 0.0 OHM 5% THICK FILM 1/10W ROHS
37	PPPC082LJBN-RC	SULLINS	1	J1	HEADER THRU FEMALE-RA 2X8 100LS 120 TAIL GOLD ROHS
38	PBC02SAAN	SULLINS	0	J2, J3, J4, J5	HEADER THRU MALE 2 PIN 100LS 120 TAIL GOLD ROHS
39	PBC02SAAN	SULLINS	6	J6, J8, J9, J10, J11, VOUT	HEADER THRU MALE 2 PIN 100LS 120 TAIL GOLD ROHS
40	PBC08DAAN	SULLINS	1	J7	HEADER THRU MALE 2X8 100LS 120 TAIL GOLD ROHS
41	CTP-019-8	CONNECT TECH PRODUCTS	4	VIN1, VIN2, VIN3, VIN4	JACK DUAL RCA RA-PCB METAL SHELL ROHS
42	4015-0-67-80-30-27-10-0	MILL-MAX	2	XI, XO	PIN SOCKET .015-.025in 70x55x1.0in GOLD ROHS
	Y0 IS INSERTED INTO XI AND XO PIN SOCKETS				
43	ECS-245.7-20-4X	ECS	1	Y0	CRYSTAL HC-49USX 24.576MHz SERIES 30ppm 20pfd FUND ROHS
44	5003	KEYSTONE ELECTRONICS	16	1L, 1R, 2L, 2R, 3L, 3R, 4L, 4R, BCK, DIN, SCL, SDA, DOUT, LRCK, SCKI, MICBIAS	PC TESTPOINT ORANGE ROHS
45	TL1015AF160QG	E-SWITCH	1	RESET	SWITCH, MOM, 160G SMT 4X3MM ROHS
46	95947A121	MCMaster-CARR	4	STANDOFFS	STANDOFF M3x12mm 4.5mm DIA HEX ALUM F-F ROHS
47	92148A150	MCMaster-CARR	4	STANDOFF WASHERS	WASHER SPLIT-LOCK M3 6.2mm OD 0.7mm THICK STAINLESS STEEL ROHS
48	92000A118	MCMaster-CARR	4	STANDOFF SCREWS	SCREW M3x8 PHILIPS PANHEAD STAINLESS STEEL ROHS
		TOTAL	138		
Special notes to this bill of materials					
SN1	These assemblies are ESD sensitive, observe ESD precautions.				
SN2	These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.				
SN3	These assemblies must comply with workmanship standards IPC-A-610 Class 2.				

6.3 Layouts

Figure 17 through Figure 19 display the board layouts for the PCM186xEVM.

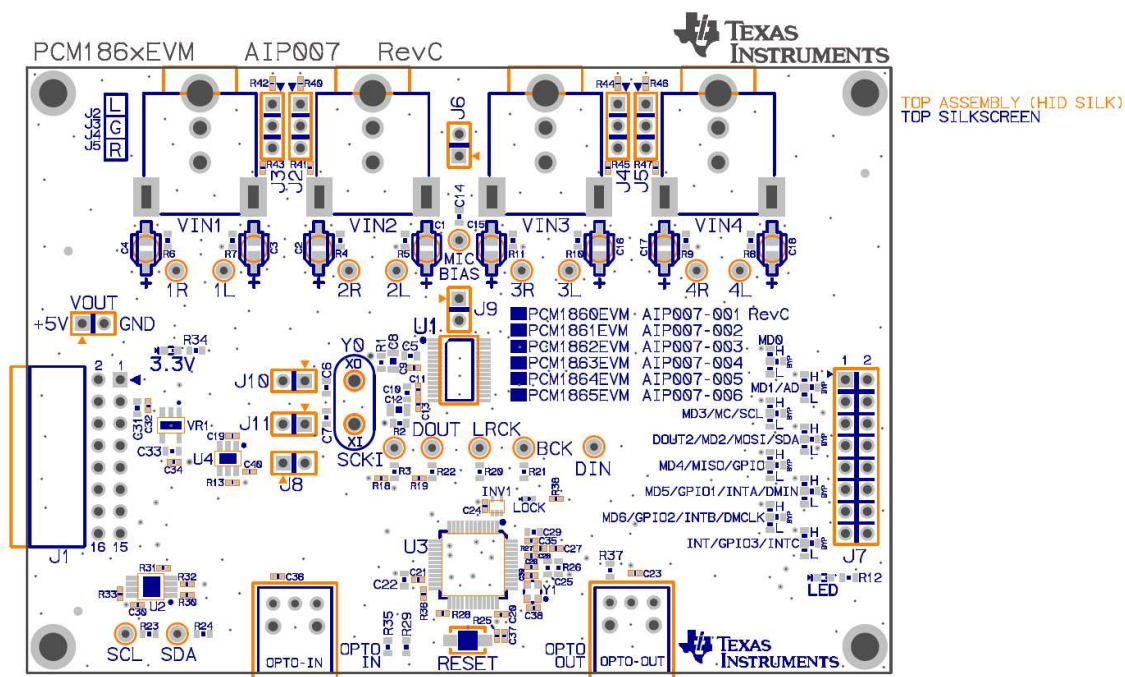


Figure 17. Top Silk Screen

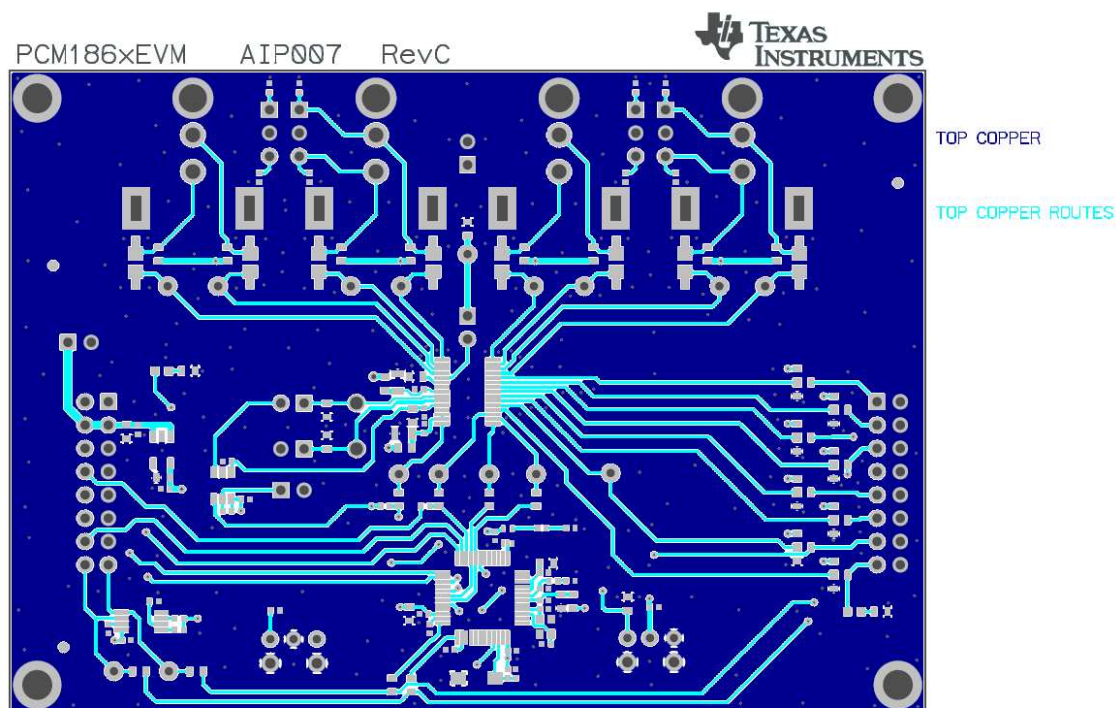


Figure 18. Top copper

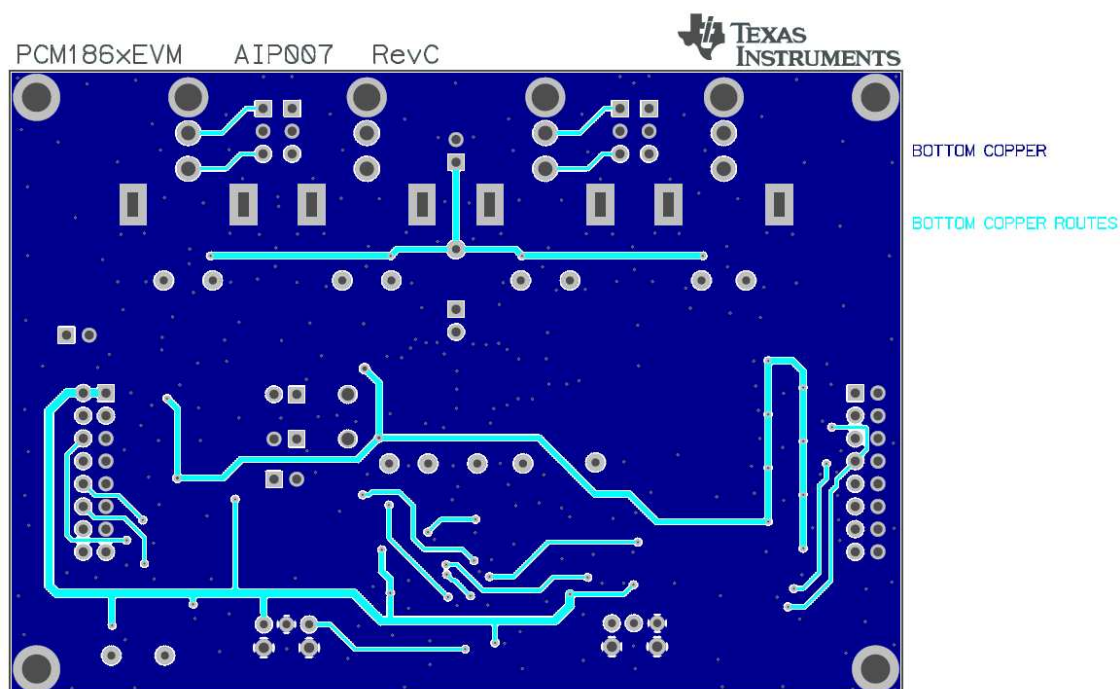


Figure 19. Bottom Copper

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.

- 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 and conditions 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 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 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 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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2. 実験局の免許を取得後ご利用いただく。
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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 WRITTEN DESIGN MATERIALS PROVIDED WITH THE EVM (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 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 AND CONDITIONS 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 MADE, CONCEIVED OR ACQUIRED PRIOR TO OR AFTER DELIVERY OF THE EVM.

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 AND CONDITIONS. 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.

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 AND CONDITIONS OR THE USE OF THE EVMS PROVIDED HEREUNDER, 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 ONE YEAR AFTER THE RELATED CAUSE OF ACTION HAS OCCURRED.

8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY WARRANTY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS AND CONDITIONS, OR ANY USE OF ANY TI EVM PROVIDED HEREUNDER, EXCEED THE TOTAL AMOUNT PAID TO TI FOR THE PARTICULAR UNITS SOLD UNDER THESE TERMS AND CONDITIONS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM AGAINST THE PARTICULAR UNITS SOLD TO USER UNDER THESE TERMS AND CONDITIONS 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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Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

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