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 though a USB to a PC.

2   What's in the Box?

2.1   *PCM186xEVM*

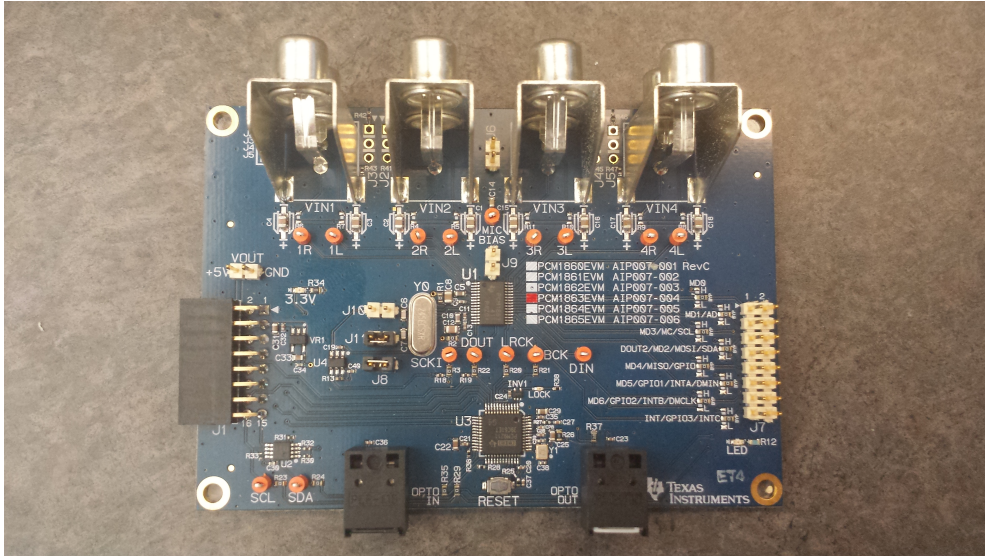Figure 1 is a photo of the EVM.

Figure 1. Picture of PCM186xEVM

2.2   *USB-I2X board*

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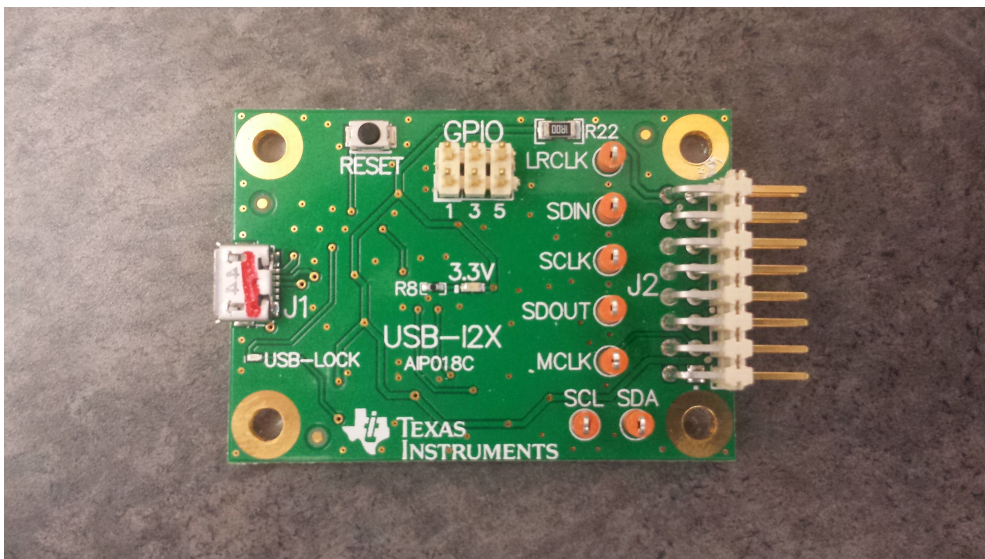
Figure 2. Picture of USB-I2X Board

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 though 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.
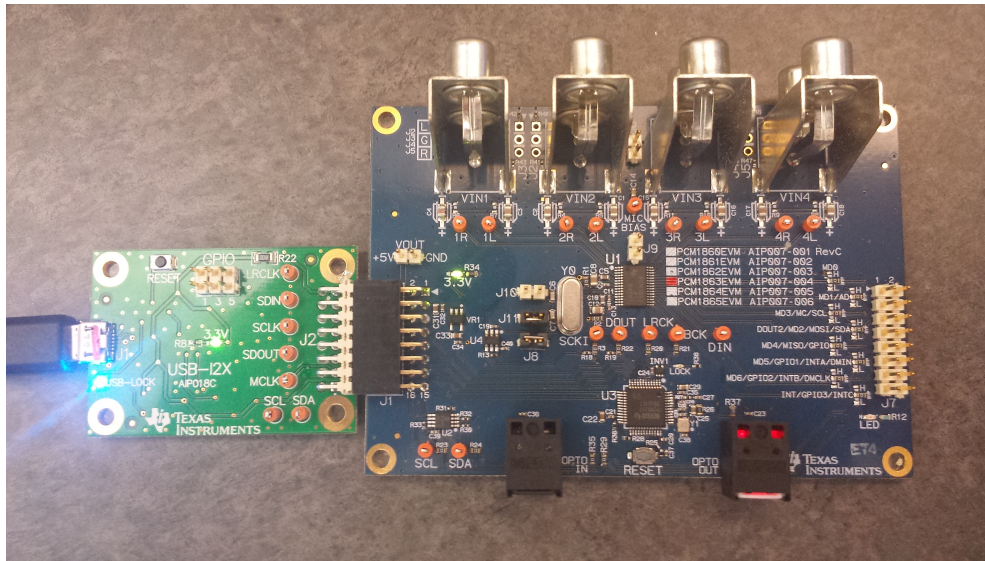
Figure 3. PCM186xEVM Mated to the USB-I2X Board

3.2 Block Diagram

Figure 4 shows a block diagram of the mated boards.
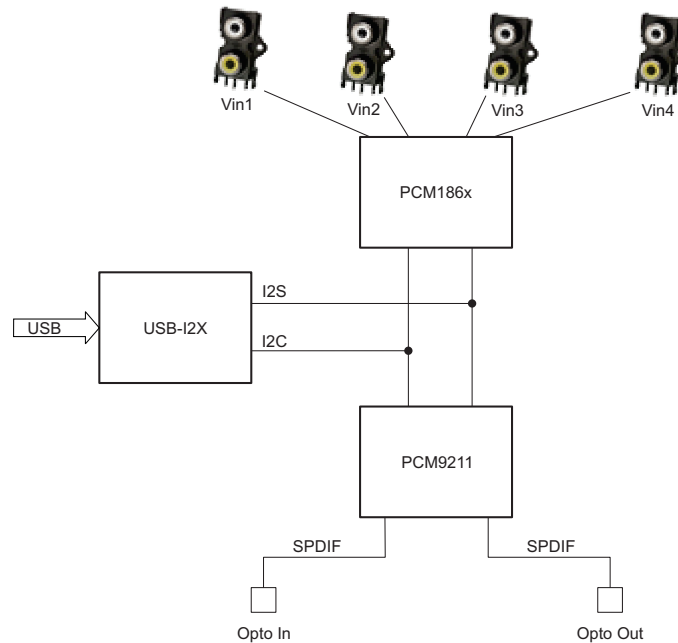
Figure 4. Block Diagram

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
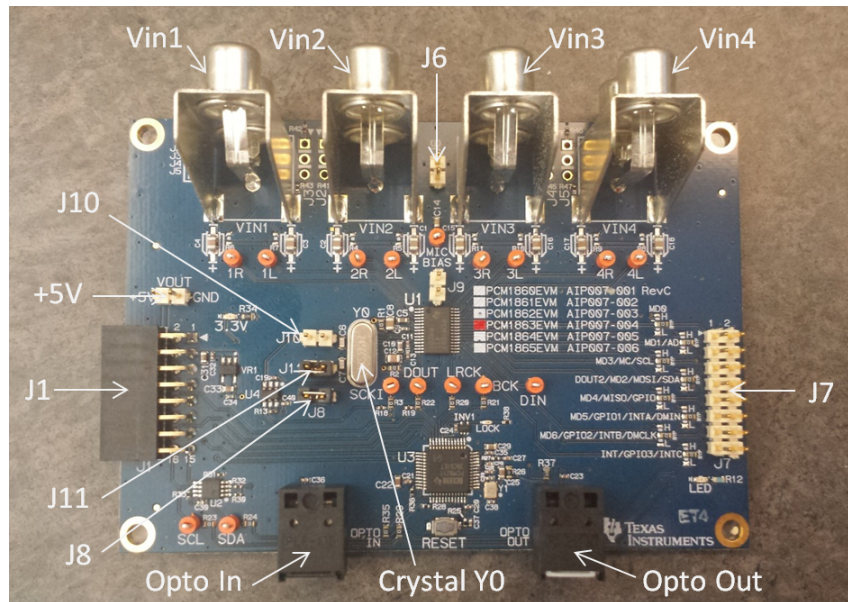
Figure 5. Diagram of Connector/Header Locations

- **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.
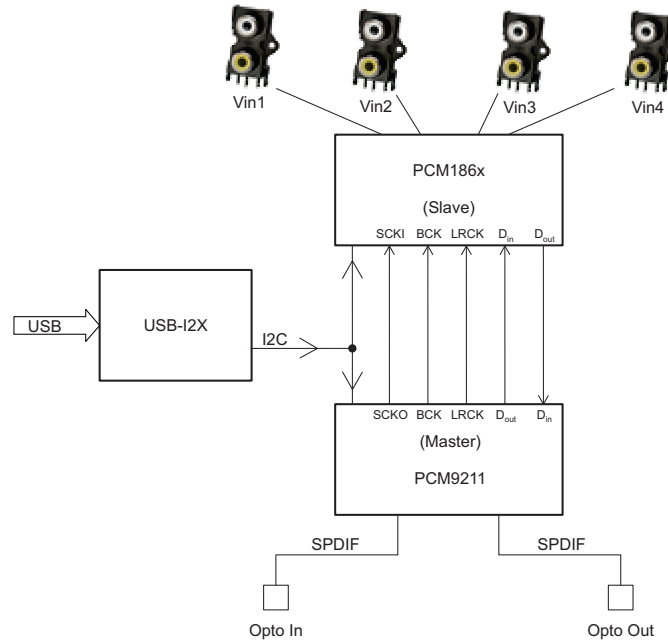
Figure 6. Mode 0 Block Diagram

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.
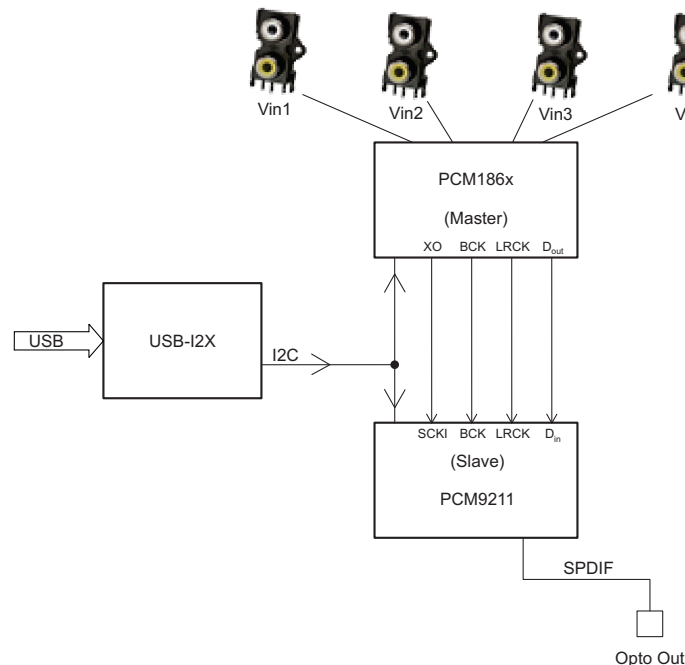
Figure 7. Mode 1 Block Diagram

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.
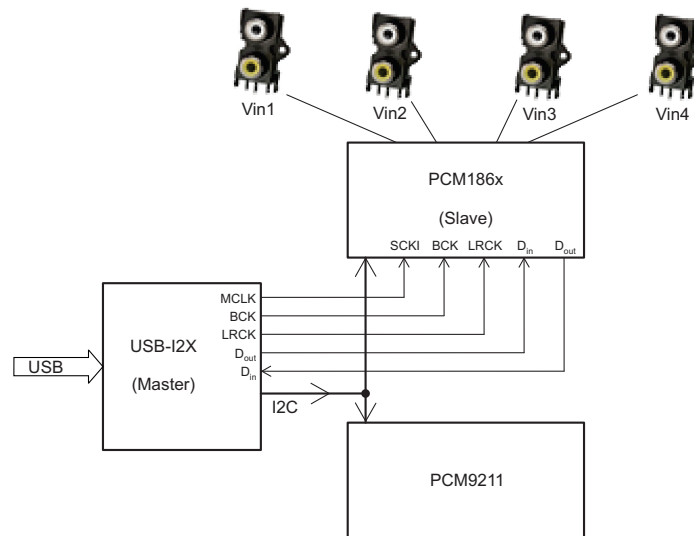
Figure 8. Mode 2 Block Diagram

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](#)).

Tied High   Tied Low   Pass to J7
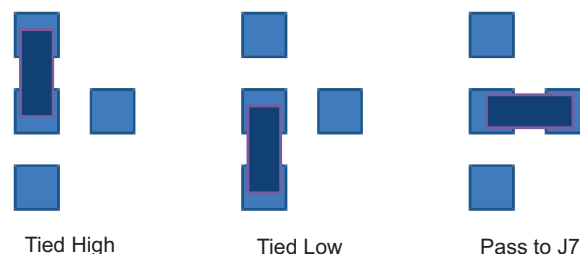
Figure 9. Solder Options

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.
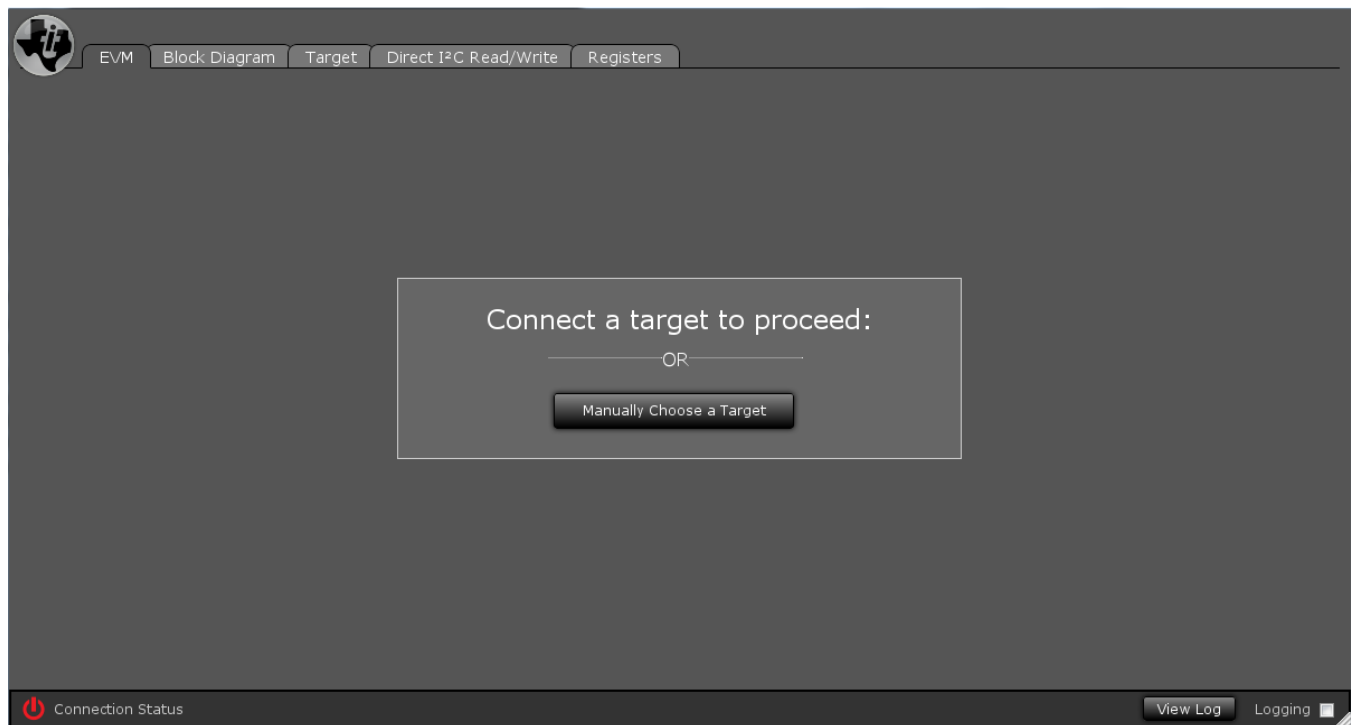
Figure 10. PCM186X EVM GUI

Select *Manually Choose a Target*, a menu should appear that will show the list on installed plugins and the option to add a target.
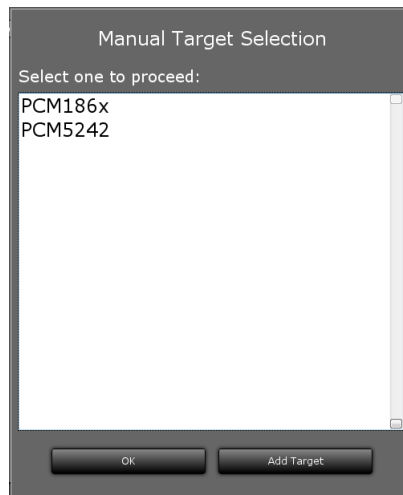
Figure 11. Manual Target Selection Window

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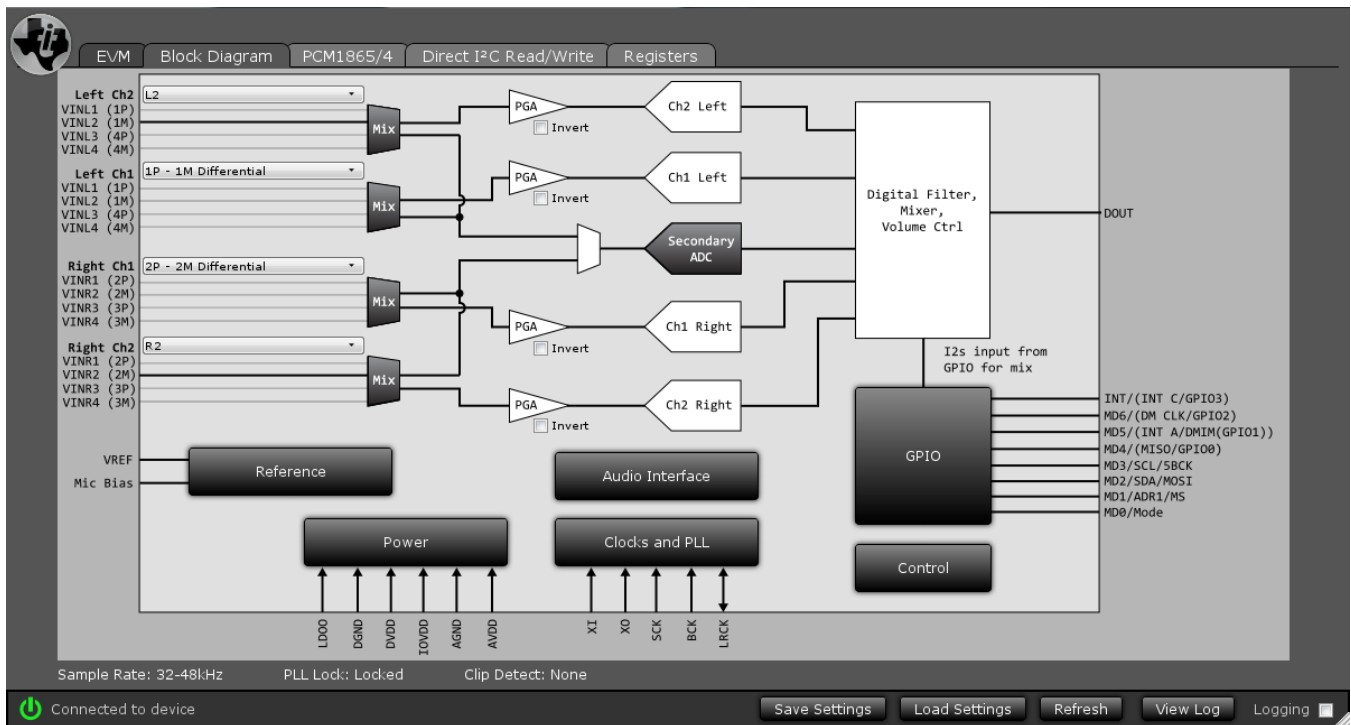
Figure 14. 1P-1M Differential and 2P-2M Differential Shown in Block Diagram Tab

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

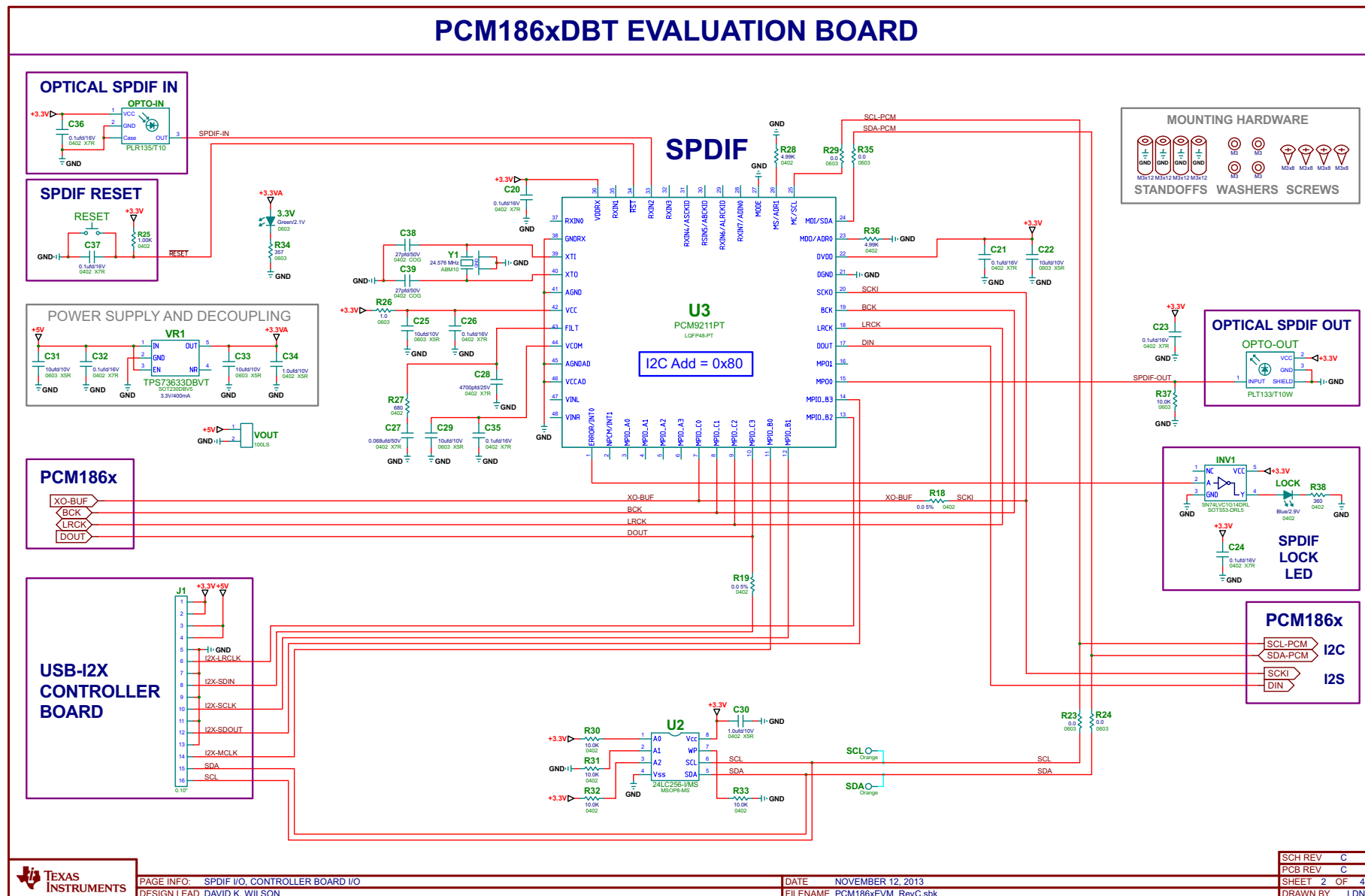# PCM186xDBT EVALUATION BOARD

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-2RKF1003X	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

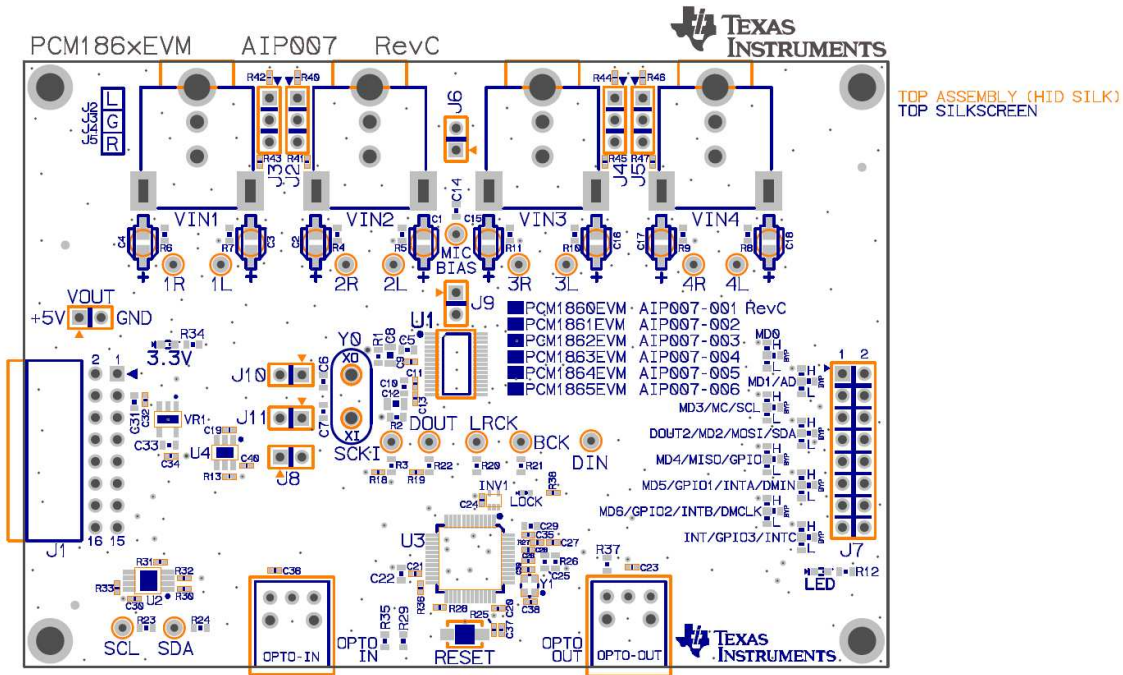Figure 17 through Figure 19 display the board layouts for the PCM186xEVM.
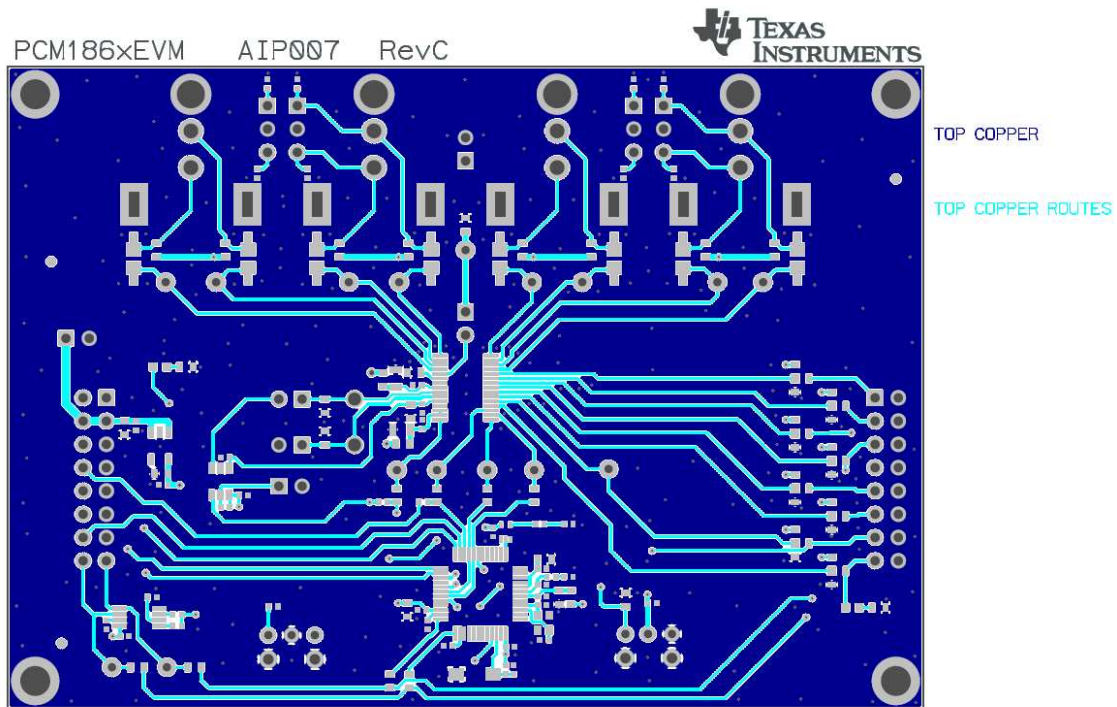

Figure 17. Top Silk Screen

Figure 18. Top copper

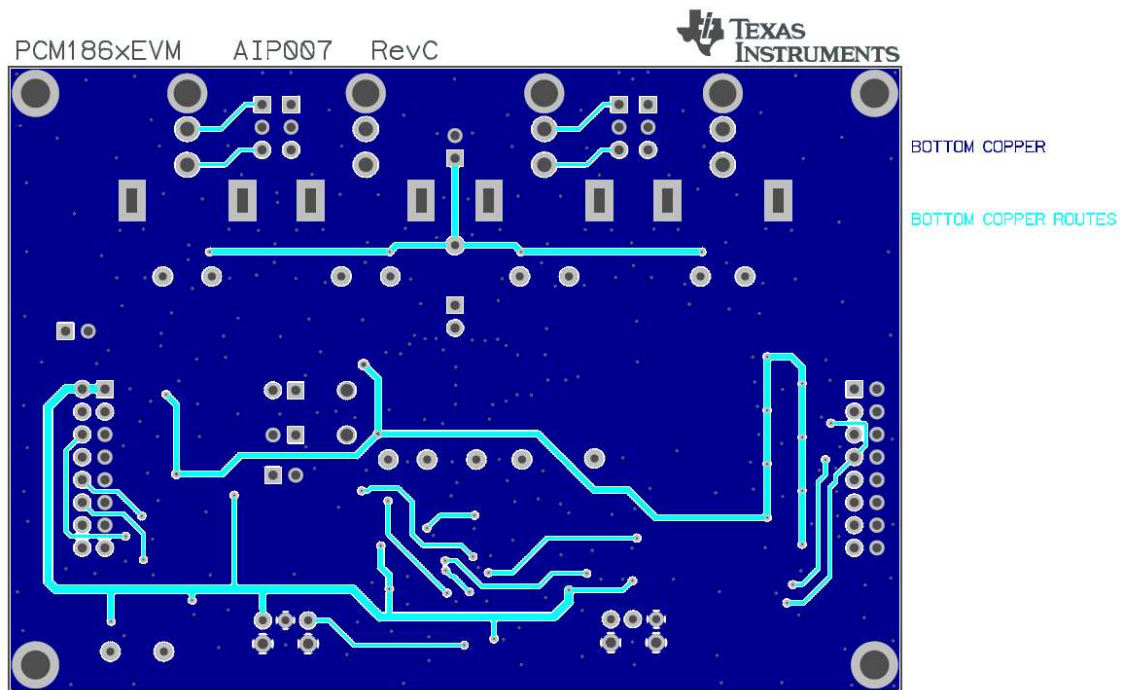Copyright © 2014, Texas Instruments Incorporated

Figure 19. Bottom Copper

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