Ver 0.1 – Dec 2013

# PCM186xEVM User's Guide

*Audio Products*

## Intro

The PCM186xEVM is an easy to use evaluation board for the PCM186x family of ADC's. 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.

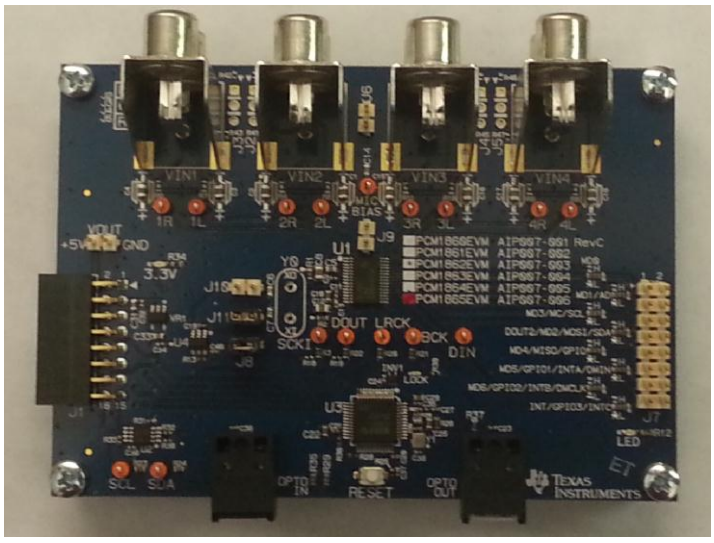
| Part # | Register Programmable | Hardware Programmable | # of ADC Channels | SNR | THD |
|---|---|---|---|---|---|
| PCM1860 | No | Yes | 2 | 100 dB | 90 dB |
| PCM1861 | No | Yes | 2 | 106 dB | 95 dB |
| PCM1862 | Yes | No | 2 | 100 dB | 90 dB |
| PCM1863 | Yes | No | 2 | 106 dB | 95 dB |
| PCM1864 | Yes | No | 4 | 100 dB | 90 dB |
| PCM1865 | Yes | No | 4 | 106 dB | 95 dB |

Table 1.

The PCM186xEVM has an external +5V power connection 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 USB to a PC.

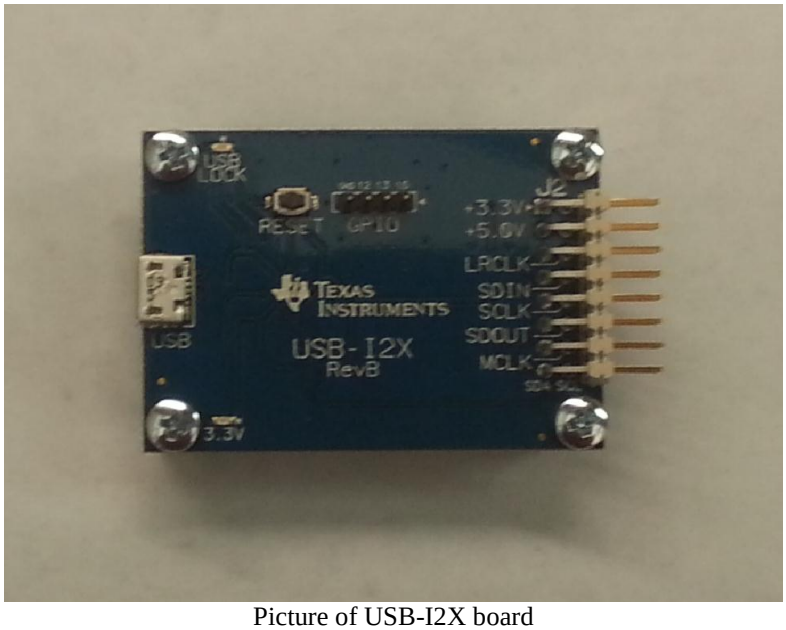
## What's in the box?

### *PCM186xEVM*



Picture of PCM186xEVM

### *USB-I2X board*




Picture of USB-I2X board

# Getting Started

## *System Hardware Overview*

The PCM186xEVM can be controlled though the use of USB using the included USB-I2X board. The USB- I2X board connects to a PC via USB and provides digital control signals to the PCM186xEVM board via I2C. The USB- I2X board also can supply serial digital audio in and out from the PC to the PCM186xEVM through an I2S interface. When connected, the USB- I2x board will also supply all of the power required for the PCM186xEVM through USB. The PCM186xEVM also uses a PCM9211 which allows the PCM186xEVM to receive and transmit digital audio via optical/SPDIF connectors on the PCM186xEVM. The PCM9211 converts the optical data to I2S which can be routed to the PCM186xEVM.

TheUSB-I2X board mates to the PCM186xEVM as shown in figure “mated”.

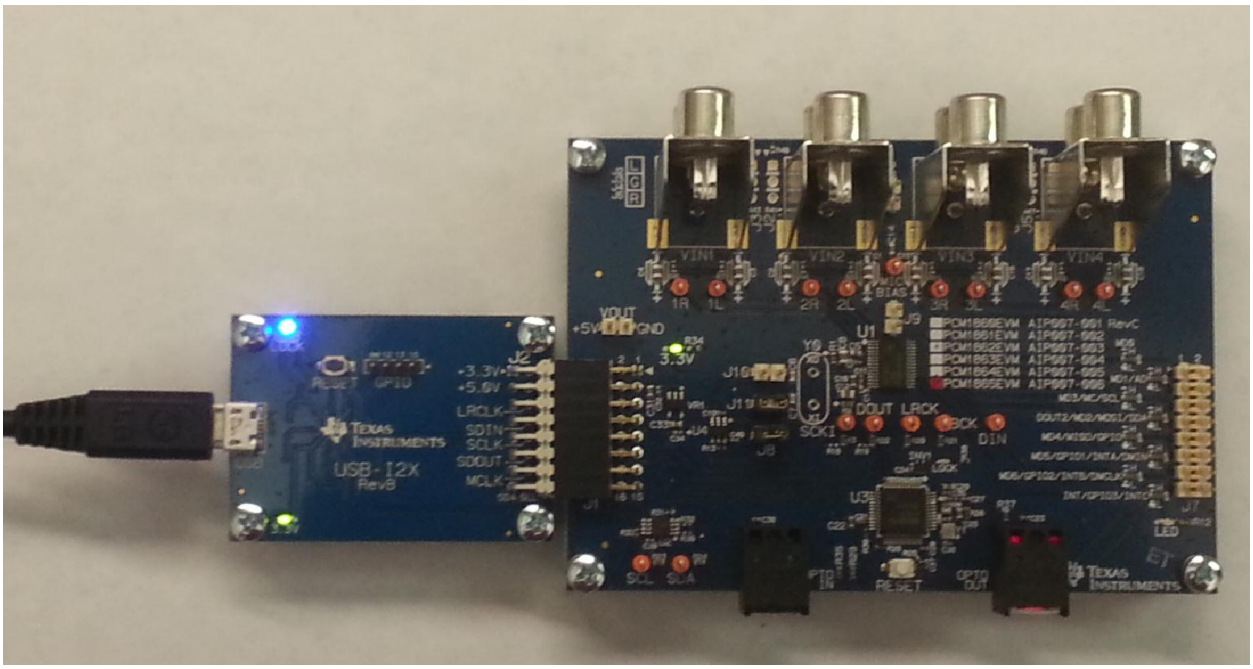
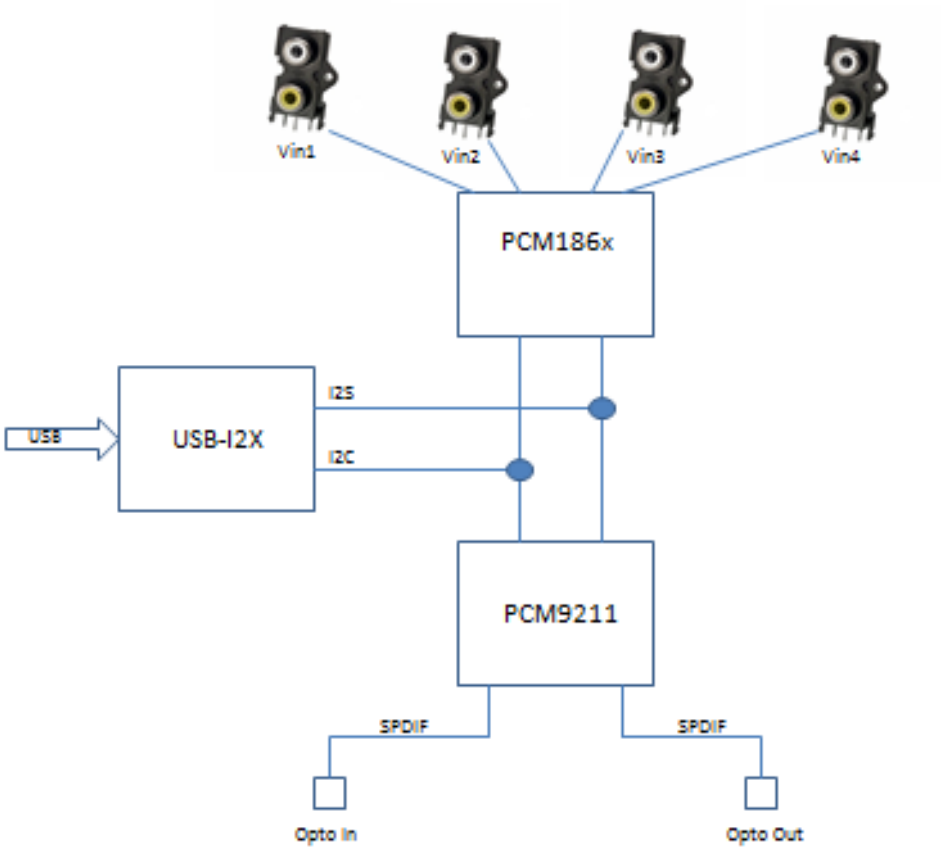



Figure Mated

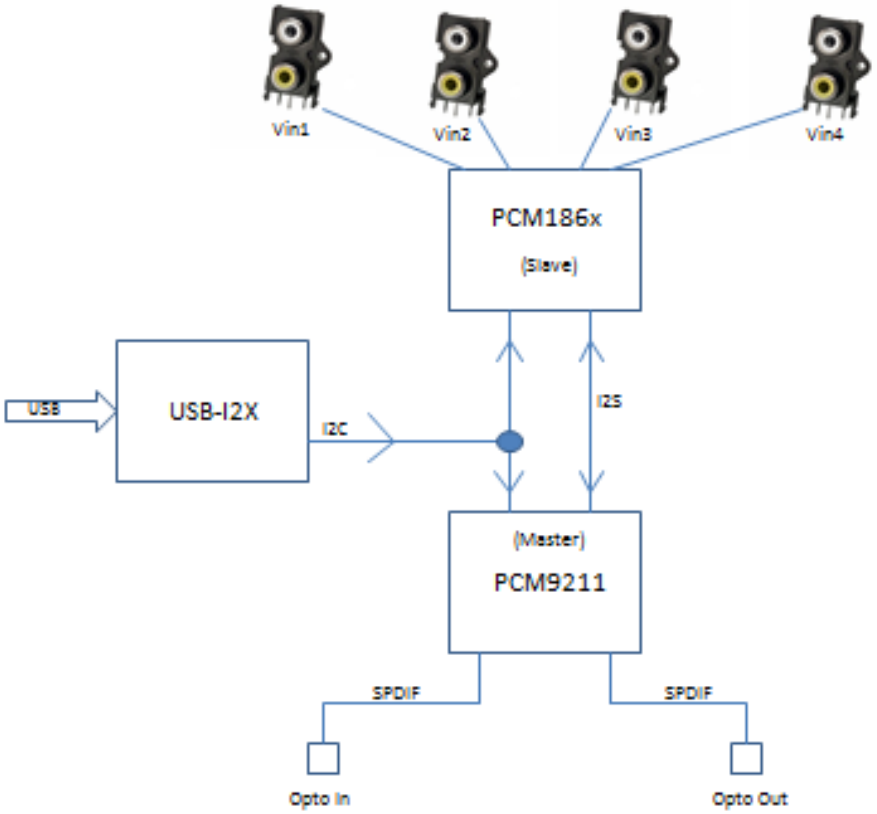
## Block Diagram




Block Diagram

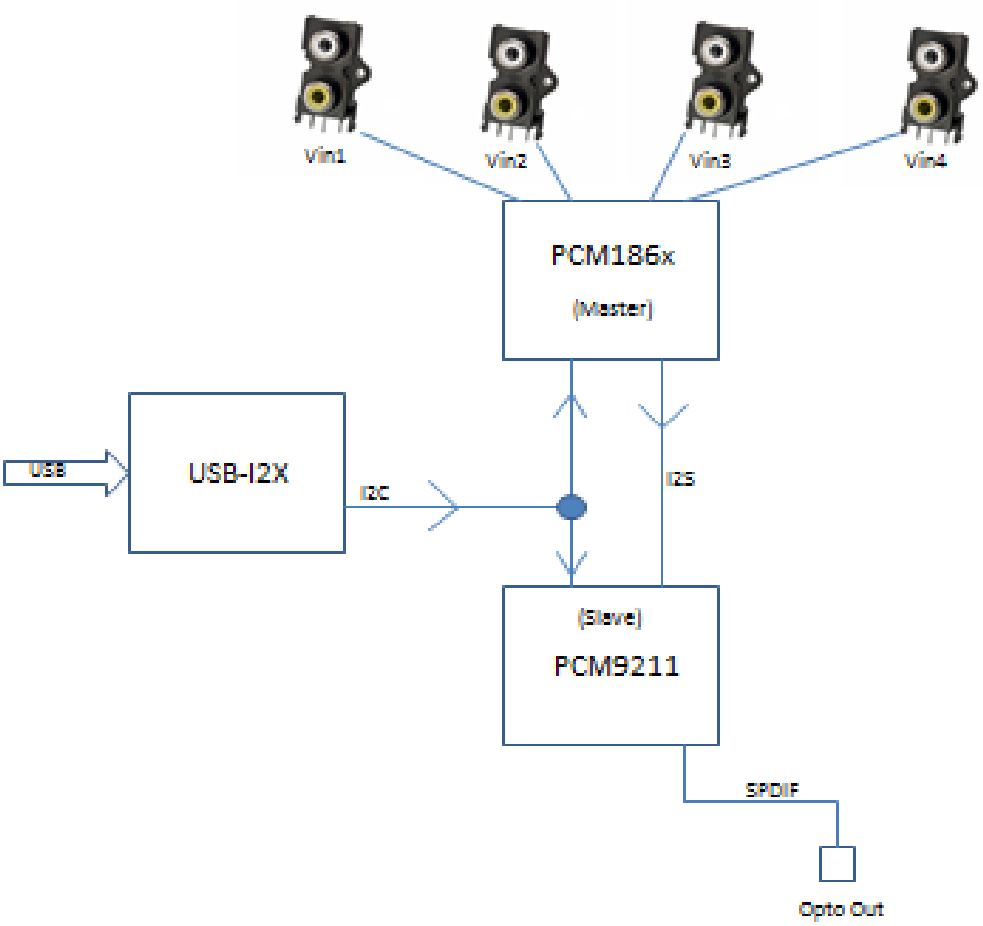
The PCM186xEVM has several different clocking options and can be run in one of 4 different modes. These modes will also control how the audio data is routed.

**Mode 0** is the default mode after power up. In mode 0, the master clock is supplied from the PCM9211 and the PCM186x will be the slave. Optical inputs will be routed to the PCM186x I2S inputs. The optical input will also set the sample rate of the system to match the optical rate. If no input is provided, the sample rate will be generated by the PCM9211 and will be 48 kHz. The I2x board will provide I2C control and power only. In mode 0, Y0 should be removed and jumpers should be placed on J8 and J11.




Mode 0 BD

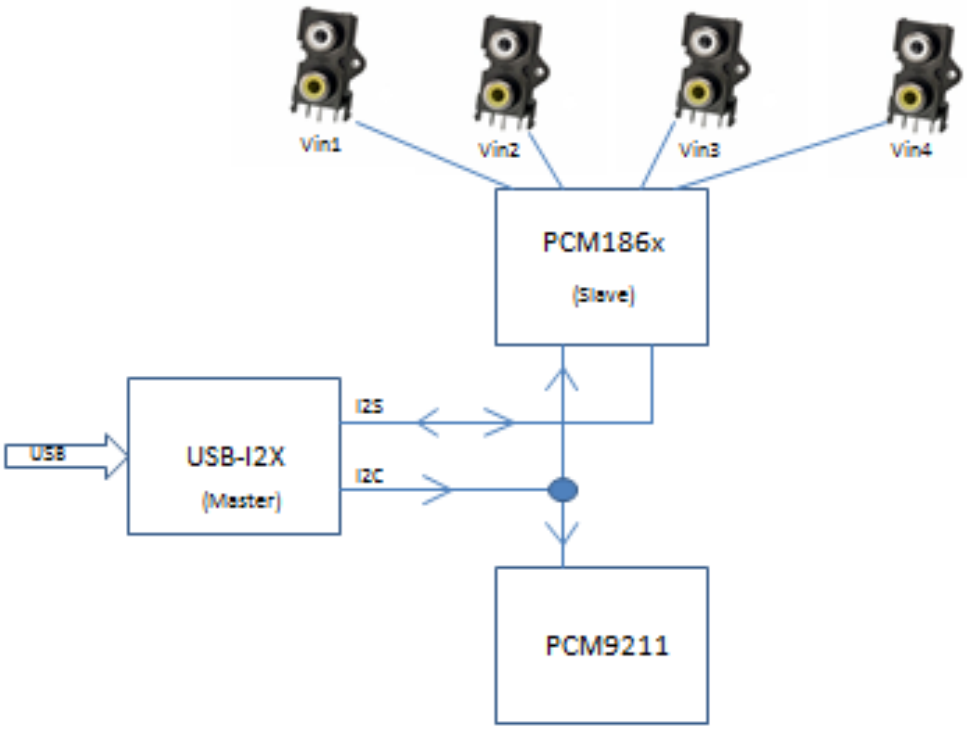
In **Mode 1**, the PCM186x is the master. Clocking is provided by Y0. I2S is sent to the optical output. The optical input is not available in this mode. The I2x board will provide I2C control and power only. In mode 1, Y0 and J10 should be installed.




Mode 1 BD

**Mode 2** is the same as Mode 0. Please see mode 0.

In **Mode 3**, the I2X board is the master. I2S in and out to the 186x will be via the I2X board and will be available to a PC via USB. The optical input and output will not be available. Y0 should be removed and jumpers should be placed on J8 and J11 to use this mode.




Mode 3 BD

## *Software Overview*

The evm can be controlled through PurePath Console. Access to PurePath Console can be requested here:
www.ti.com/tool/purepathconsole

Once you have access you can download PurePath Console from here:
http://cc.ext.ti.com

**Important note for Beta Users**

The Beta release requires the use of a plugin for the PCM186x in PurePath Console. You will need to obtain this plugin from your TI sales contact. Once you have the plugin, launch PurePath Console and click on the "Add Target" button. Navigate to where you have saved the plugin and click "Load".

The Beta release is not the final version and still has some unusable features. It is best to use scripts in the command window when possible.

# Hardware

## *Power Requirements*

The PCM186x EVM requires a 5 V power supply. This can be sourced from the I2X board via USB or applied directly to the EVM on the +5V header just above J1. Once 5V is applied, the PCM186x board will regulate the 5V down to a clean analog 3.3V. You should see a green LED just to the Right of the 5V header if the voltages are present.

## *Connectors and Headers*

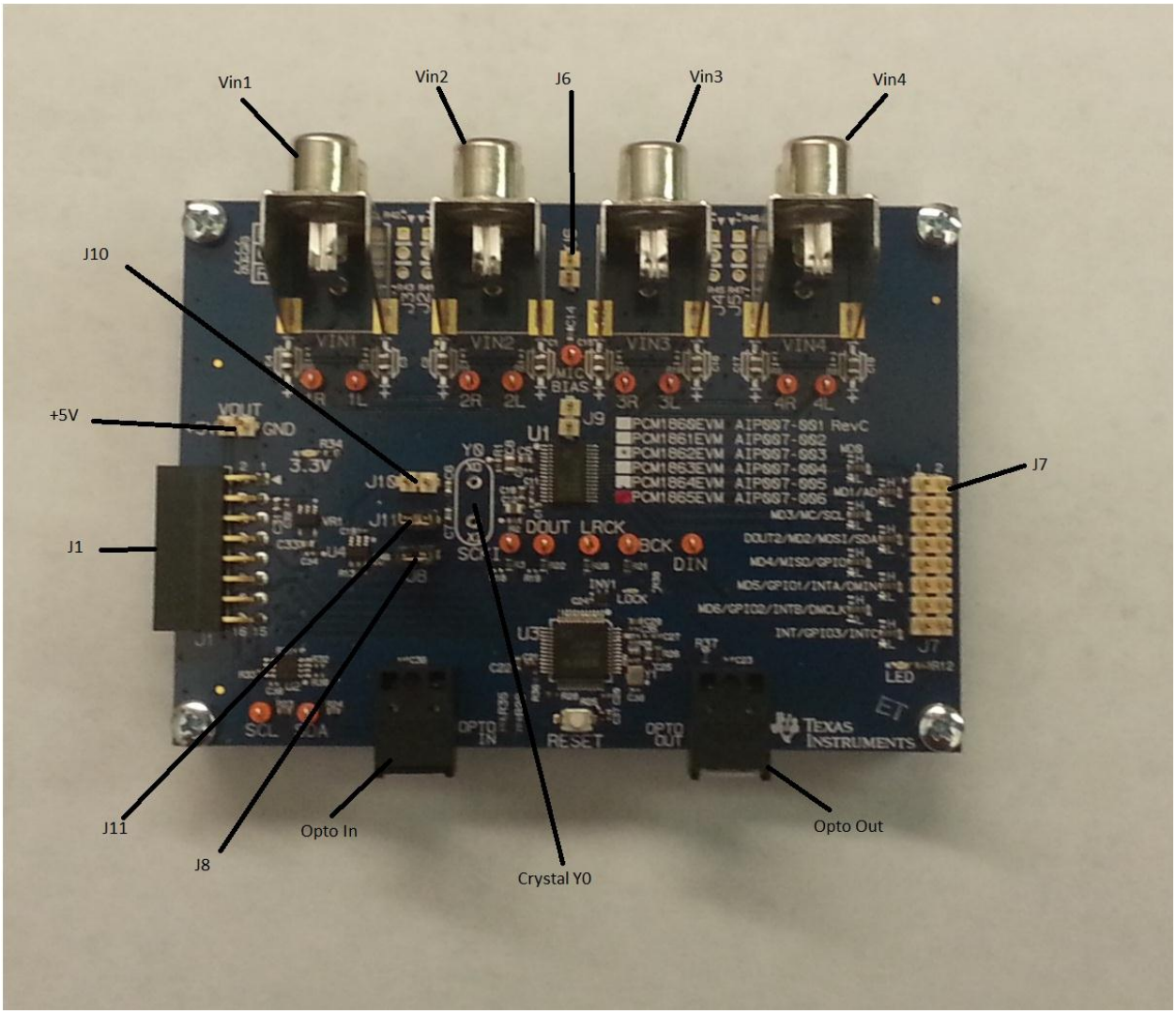



Diagram of connector/header locations

**J1**. - J1 is the I2X board connector. Provides I2C, I2S and +5 V connections to the PCM186 EVM
**+5V**. – Input for Power if no USB-I2X board is used. Output for +5V 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 (J9 should be removed).
**J7**. – Most of the PCM186x GPIO, hardware control and I2C signals are available here.

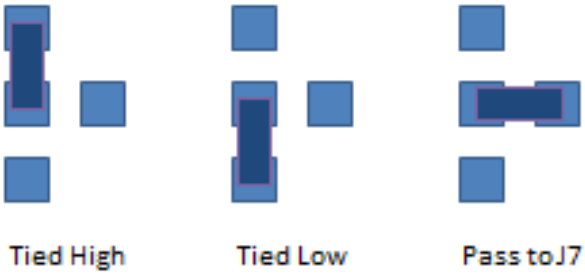
| J7 Pin | Description |
|---|---|
| 1 | MD0 |
| 2 | Ground |
| 3 | MD1/AD |
| 4 | Ground |
| 5 | MD3/MC/SCL |
| 6 | Ground |
| 7 | Dout2/MD2/MOSI/SDA |
| 8 | Ground |
| 9 | MD4/MISO/GPIO |
| 10 | Ground |
| 11 | MD5/GPIO1/INTA/DMIN |
| 12 | Ground |
| 13 | MD6/GPIO2/INTB/DMCLK |
| 14 | Ground |
| 15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

J7 Diagram

**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 electret mic. 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 J10 should be inserted.
**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, J11 jumper should be removed.
**Opto Out**. -Opto out is the SPDIF output of the PCM9211.
**Y0**. -Y0 is a socked crystal for the PCM186x. If the PCM186x is to be used as the master, this crystal can be inserted. If the PCM186x is to be used as a slave it can be removed.
**Opto In**. – Opto in is the SPDIF input to the PCM9211. The PCM186x can mix this digital input with ADC output.

## *Solder Options*

The PCM1860 and PCM1861 are 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 Ohm 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.




Solder Options

# Software

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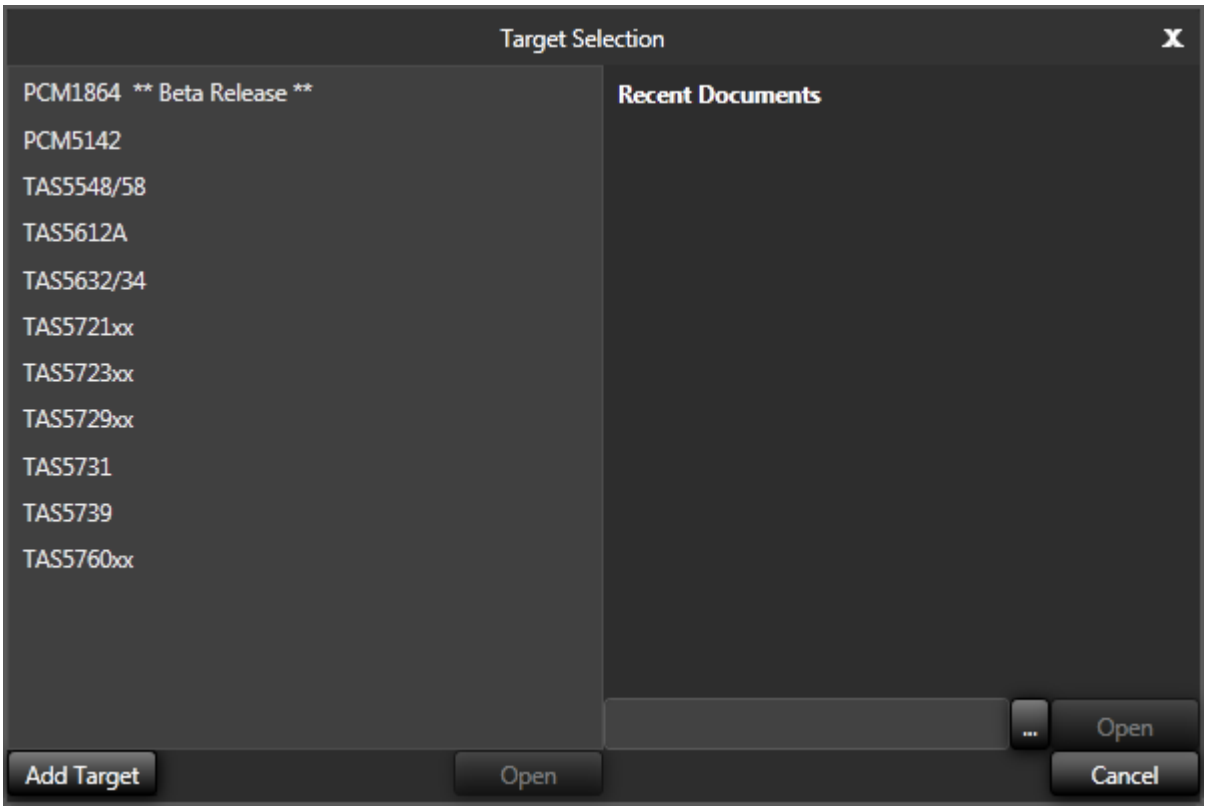
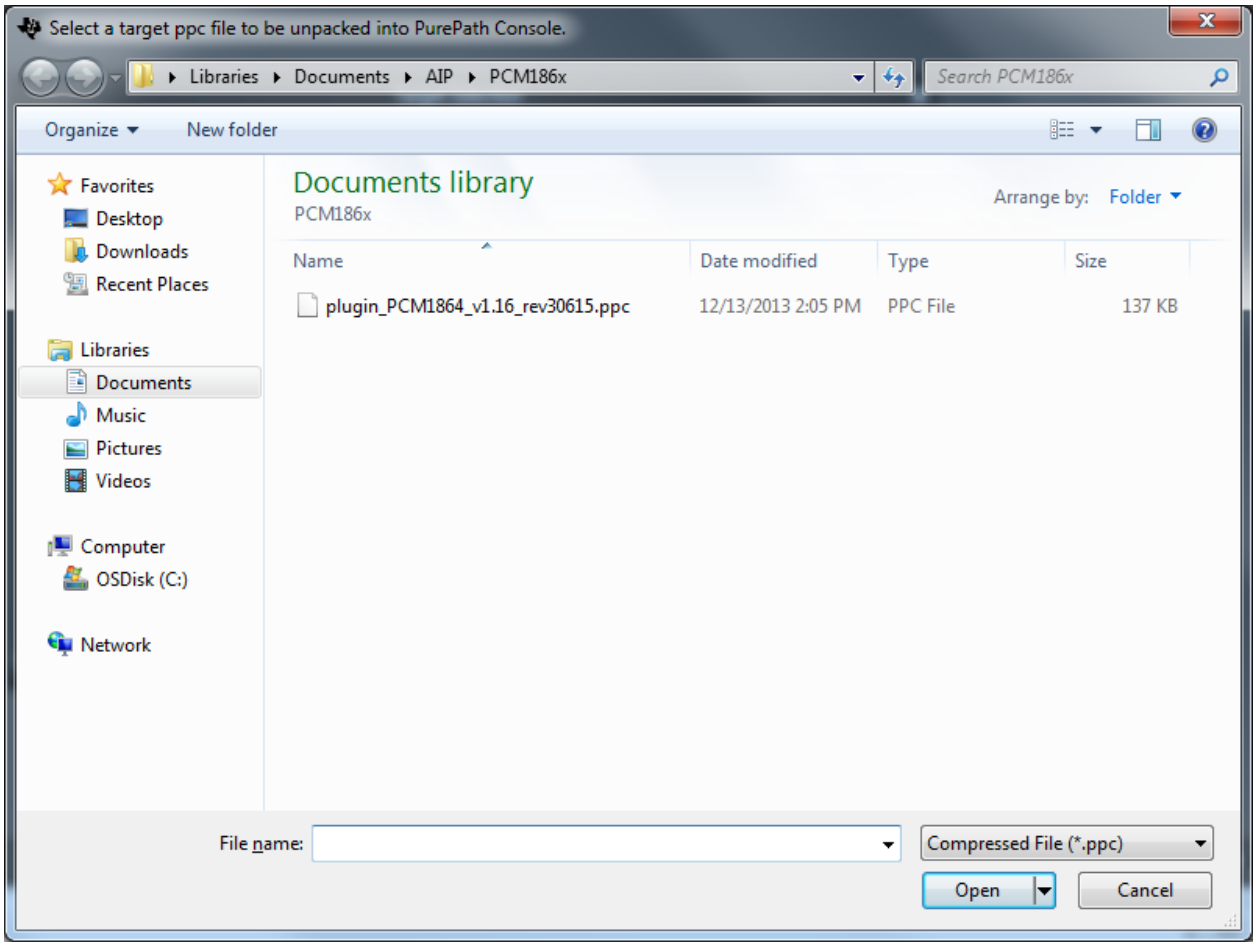



Navigate to where you have saved the plugin and click “Load”.

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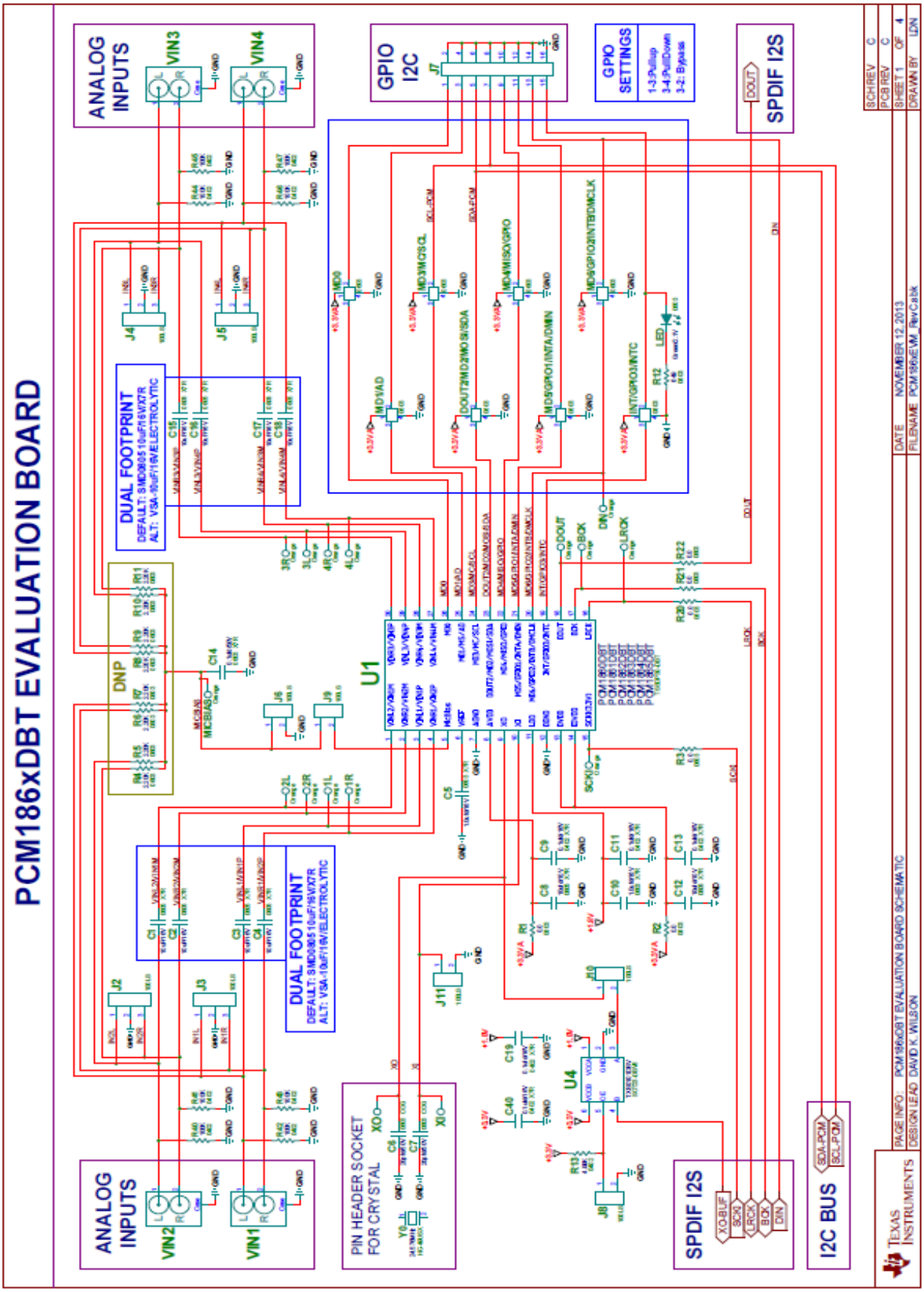
## *Navigation and Features*

# Appendix

## *Schematic*


PCM186xDBT EVALUATION BOARD
ANALOG INPUTS
VIN3
VIN4
VIN2
VIN1
GPIO I2C
GPIO SETTINGS
SPDIF I2S
I2C BUS
DUAL FOOTPRINT
DEFAULT: SMD0805 10uF/16V/X7R
ALT: V3A-10uF/16V/ELECTROLYTIC
DNP
U1
U4
PIN HEADER SOCKET FOR CRYSTAL
DOUT
DIN
BCK
LRCK
SCKI
XO-BUF
SDA-PCM
SCL-PCM
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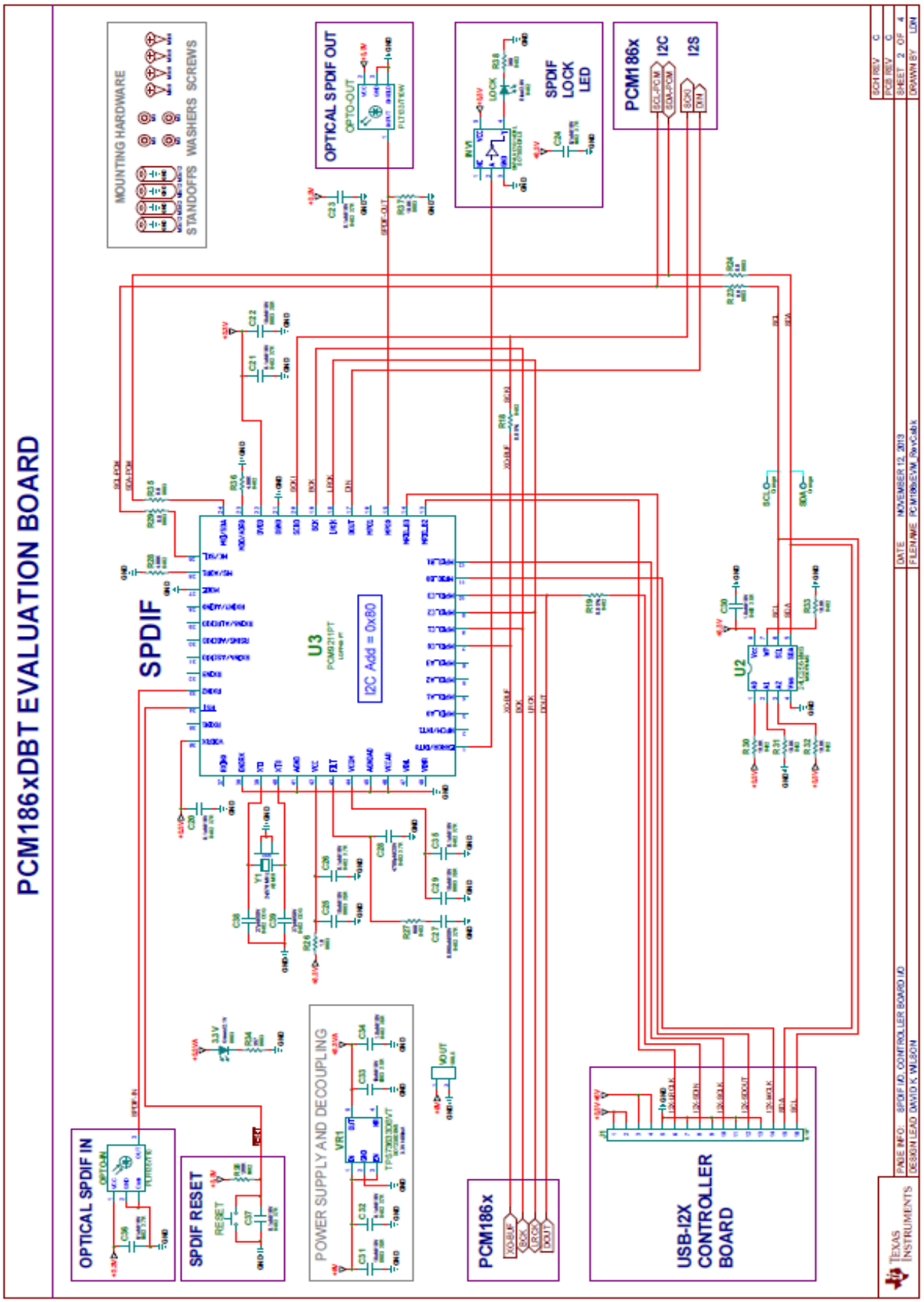
DESIGN LEAD: DAVID K. WILSON
DATE: NOVEMBER 12, 2013
FILENAME: PCM186xEVM_RevCa.Sch
DRAWN BY: LDN
SCH REV: C
PCB REV: C
SHEET 1 OF 4


PCM186xDBT EVALUATION BOARD
MOUNTING HARDWARE
STANDOFFS WASHERS SCREWS
OPTICAL SPDIF OUT
OPTO-OUT
SPDIF LOCK LED
PCM186x
I2C
I2S
SPDIF
U3
PCM9211PT
I2C Add = 0x80
U2
OPTICAL SPDIF IN
SPDIF RESET
POWER SUPPLY AND DECOUPLING
PCM186x
USB-I2X CONTROLLER BOARD
SCH REV C
PCB REV C
SHEET 2 OF 4
DRAWN BY LDN
DATE NOVEMBER 12, 2013
FILENAME PCM186xEVM RevCdbk
PAGE INFO: SPDIF I/O CONTROLLER BOARD I/O
DESIGN LEAD DAVID K. WILSON
TEXAS INSTRUMENTS

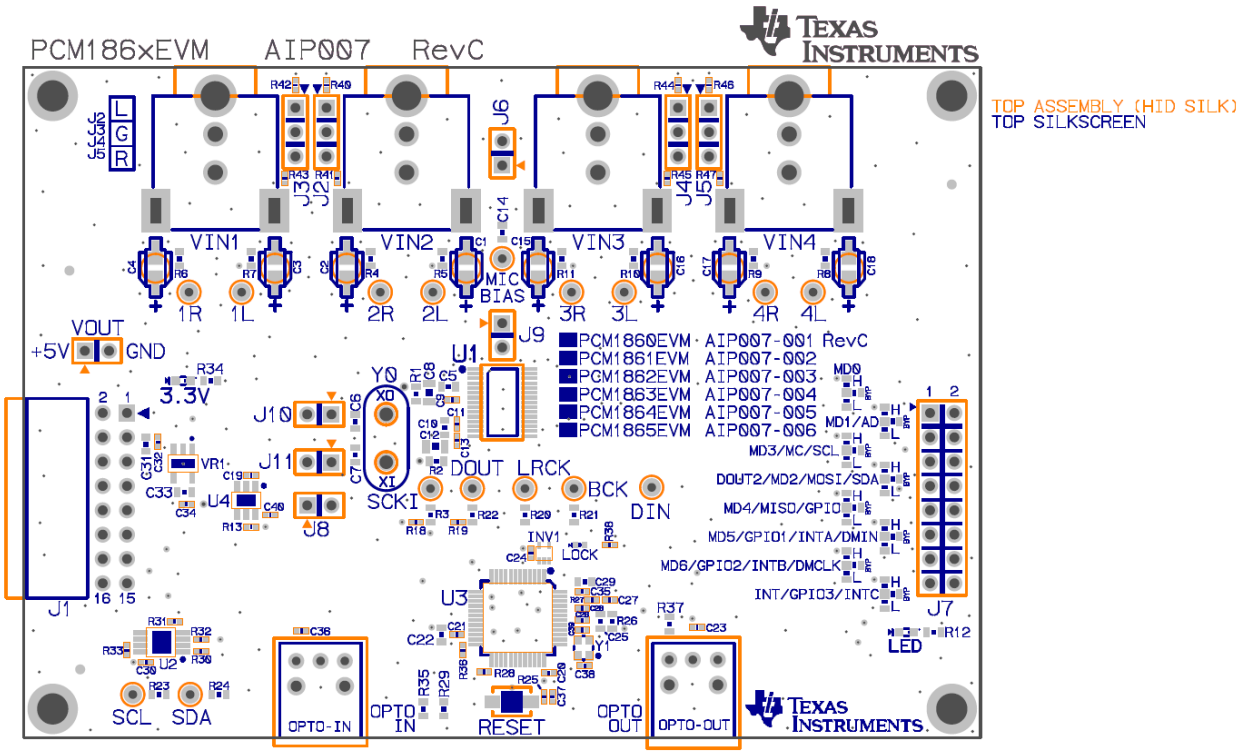
## *Bill of Materials*

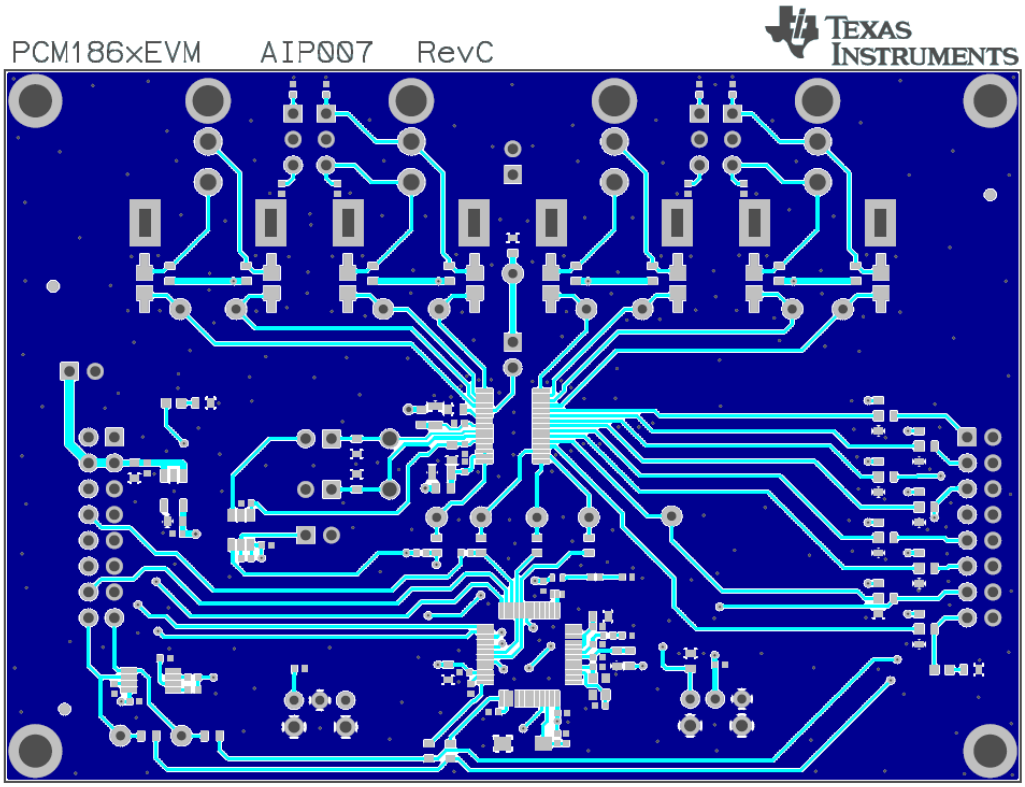
| BILL OF MATERIALS for PCM1865EVM RevC) | | | | | November 12, 2013 |
|---|---|---|---|---|---|
| ITEM | MANU PART NUM | MANU | QTY | REF DESIGNATORS | DESCRIPTION |
| 1 | PCM1865DBT | TEXAS INSTRUMENTS | 1 | U1 | MIC TO 2VRMS ANALOG IN 24-BIT 192 kHz STEREO FRONT END TSSOP30-DBT ROHS |
| 2 | 24LC256-I/MS | 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, C2, C3, 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, C36, | CAP SMD0402 CERM 0.1UFD 16V X7R 10% ROHS |

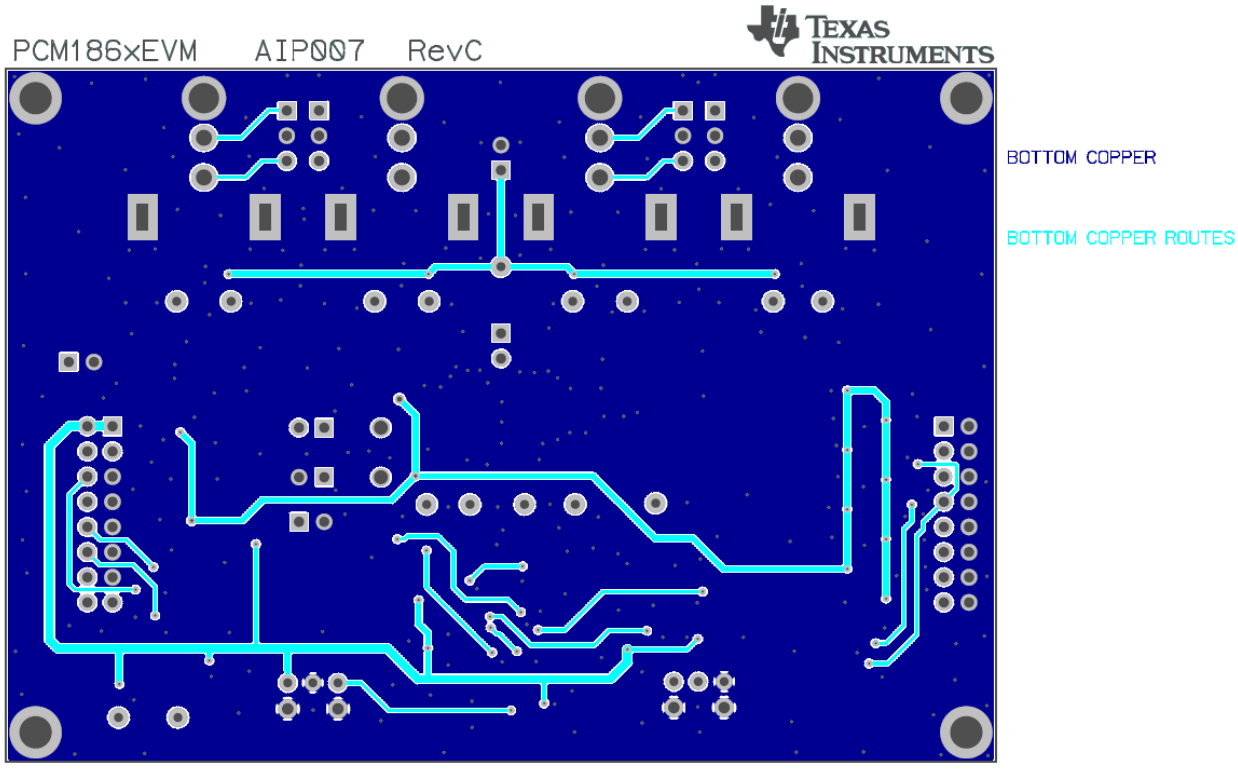
| | | | | | |
|---|---|---|---|---|---|
| | | | | C37, C40 | |
| 17 | GRM188R71H104KA93D | MURATA | 1 | C14 | CAP SMD0603 CERM 0.1UFD 50V 10% X7R ROHS |
| 18 | C1608X5R1A106K | TDK CORP | 5 | C22, C25, C29, C31, C33 | CAP SMD0603 CERM 10ufd 10V 10% X5R ROHS |
| 19 | CGA2B3X7R1H683K | TDK CORP | 1 | C27 | 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 |
| 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), | RESISTOR SMD0603 0.0 OHM 5% THICK FILM 1/10W ROHS |

| | | | | | |
|---|---|---|---|---|---|
| | | | | INT/GPIO3/INTC(Byp), DOUT2/MD2/MOSI/SDA(Byp), MD5/GPIO1/INTA/DMIN(Byp), MD6/GPIO2/INTB/DMCLK(Byp) | |
| 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 |

## Layout


PCM186xEVM AIP007 RevC
TOP ASSEMBLY (HID SILK)
TOP SILKSCREEN
VIN1
VIN2
VIN3
VIN4
MIC BIAS
VOUT
+5V
GND
3.3V
SCL
SDA
OPTO-IN
OPTO-OUT
RESET
DOUT
LRCK
BCK
DIN
SCKI
LOCK
LED
PCM1860EVM AIP007-001 RevC
PCM1861EVM AIP007-002
PCM1862EVM AIP007-003
PCM1863EVM AIP007-004
PCM1864EVM AIP007-005
PCM1865EVM AIP007-006


PCM186xEVM AIP007 RevC
TEXAS INSTRUMENTS
TOP COPPER
TOP COPPER ROUTES


PCM186xEVM AIP007 RevC
TEXAS INSTRUMENTS
BOTTOM COPPER
BOTTOM COPPER ROUTES