

TAS5782M Evaluation Module

This user's guide describes the operation of the TAS5782M Evaluation Module (EVM). The EVM is connected to the PurePath™ Console Motherboard (PPCMB). The main contents of this document include:

- Hardware descriptions and implementation

Related documents:

- TAS5782M data sheet ([SLASEG8](#))
- PurePath Console Motherboard User's Guide ([SLOU366](#))
- PPC3 User Manual ⁽¹⁾
- PurePath Graphic Development Suite ([PurePath Console](#))
- TAS5782M Process Flows ([SLAA737](#))

Required equipment and accessories:

1. TAS5782MEVM
2. PurePath console motherboard
3. A USB micro type-B cable
4. Power supply unit (PSU) 9.5 – 26.4 VDC ⁽²⁾
5. Speakers and cables
6. Desktop or laptop running Microsoft® Windows® 7, Windows 8, or Windows 8.1
7. Audio source: This can be a DVD player with appropriate SPDIF cable or playback media from Windows 7, Windows 8, or Windows 8.1

Contents

| | | |
|---|---|----|
| 1 | Hardware Overview..... | 3 |
| 2 | Hardware Setup..... | 6 |
| 3 | Software Overview..... | 8 |
| 4 | Troubleshooting | 20 |
| 5 | Board Layouts, Bill of Materials, and Schematic | 21 |

List of Figures

| | | |
|----|---------------------------------------|----|
| 1 | TAS5782MEVM | 3 |
| 2 | Device Manager | 4 |
| 3 | Default Format | 5 |
| 4 | PPCMB and TAS5782MEVM Connection..... | 6 |
| 5 | PBTL Configuration..... | 7 |
| 6 | PBTL Connection at EVM | 7 |
| 7 | PBTL Connection to Speaker | 7 |
| 8 | PPC3 Download Window | 8 |
| 9 | PPC3 Window..... | 9 |
| 10 | Installed EVM Apps | 10 |
| 11 | TAS5782M Home Page | 11 |

⁽¹⁾ The PPC3 User Manual is only available after requesting the PPC3 software.

⁽²⁾ Power supply minimum voltage can be lower than stated depending on the version of PPCMB used. PPCMB rev. E and earlier requires greater than 9.02 V. PPCMB rev. F and later requires greater than 4.5 V.

| | | |
|----|--|----|
| 12 | System Checks Page..... | 12 |
| 13 | Direct I ² C Page, I/O Tab..... | 13 |
| 14 | Direct I ² C Page, Log Tab..... | 14 |
| 15 | Audio I/O Page | 15 |
| 16 | Register Map Page | 16 |
| 17 | End System Integration Page | 17 |
| 18 | Header File Generation..... | 18 |
| 19 | In-System Debugging..... | 19 |
| 20 | In-System Tuning | 20 |
| 21 | TAS5782MEVM Schematic (1 of 3) | 21 |
| 22 | TAS5782MEVM Schematic (2 of 3) | 22 |
| 23 | TAS5782MEVM Schematic (3 of 3) | 23 |
| 24 | TAS5782MEVM Top Composite Assembly..... | 24 |
| 25 | TAS5782MEVM Bottom Composite Assembly..... | 25 |

List of Tables

| | | |
|---|-------------------------------------|----|
| 1 | TAS5782MEVM Bill of Materials | 26 |
|---|-------------------------------------|----|

Trademarks

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1 Hardware Overview

The TAS5782MEVM showcases the latest TI digital input class-D closed loop amplifier. The TAS5782M is an I²S or TDM input class-D amplifier with up to 96-kHz processing. The EVM is used in conjunction with the PPCMB. The PVDD supply is provided via the TAS5782MEVM and is regulated to 5 VDC and 3.3 VDC on the PPCMB. The PPCMB provides the I²S, I²C, and 3.3 VDC to the TAS5782MEVM.

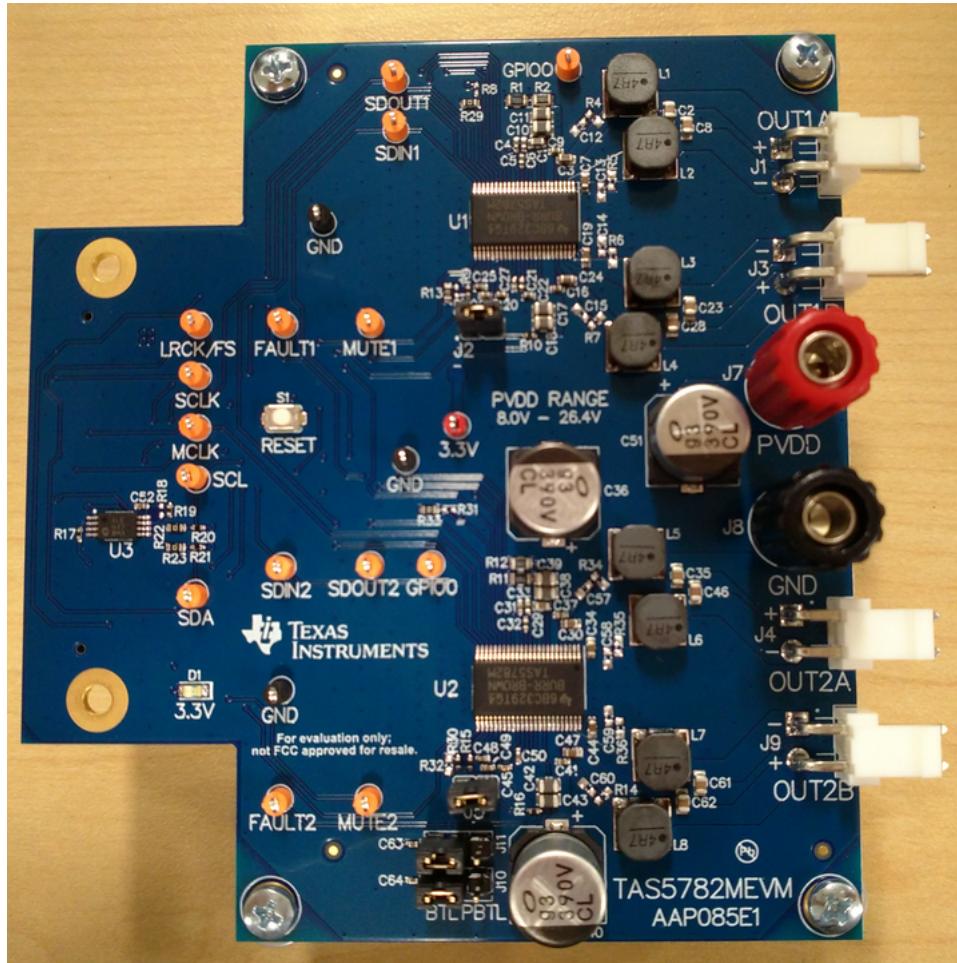


Figure 1. TAS5782MEVM

1.1 Features

- GUI control via USB port
- Stereo and mono channels with I²S input
- Processed and non-processed mono channel I²S input
- Operates in BTL or PBTL

1.2 Functions

The TAS5782MEVM is controlled by the PPCMB. The digital audio data input to the TAS5782MEVM is sent from PPCMB and is selectable from USB audio, optical SPDIF, coaxial SPDIF, PSIA (external I²S), and analog ADC sources.

1.3 Detailed Operations

Upon power-on, the PPCMB uses USB audio input (default). The I²S signals LRCLK, SCLK, SDIN and MCLK come from the TAS1020B. [foobar2000](#) or similar non-processing media source can be used to stream audio. The TAS1020B enumerates as the following device on a Microsoft Windows operating system (OS): USB audio (USB-AudioEVM), Human Interface Devices, and USB Composite Device, see [Figure 2](#).

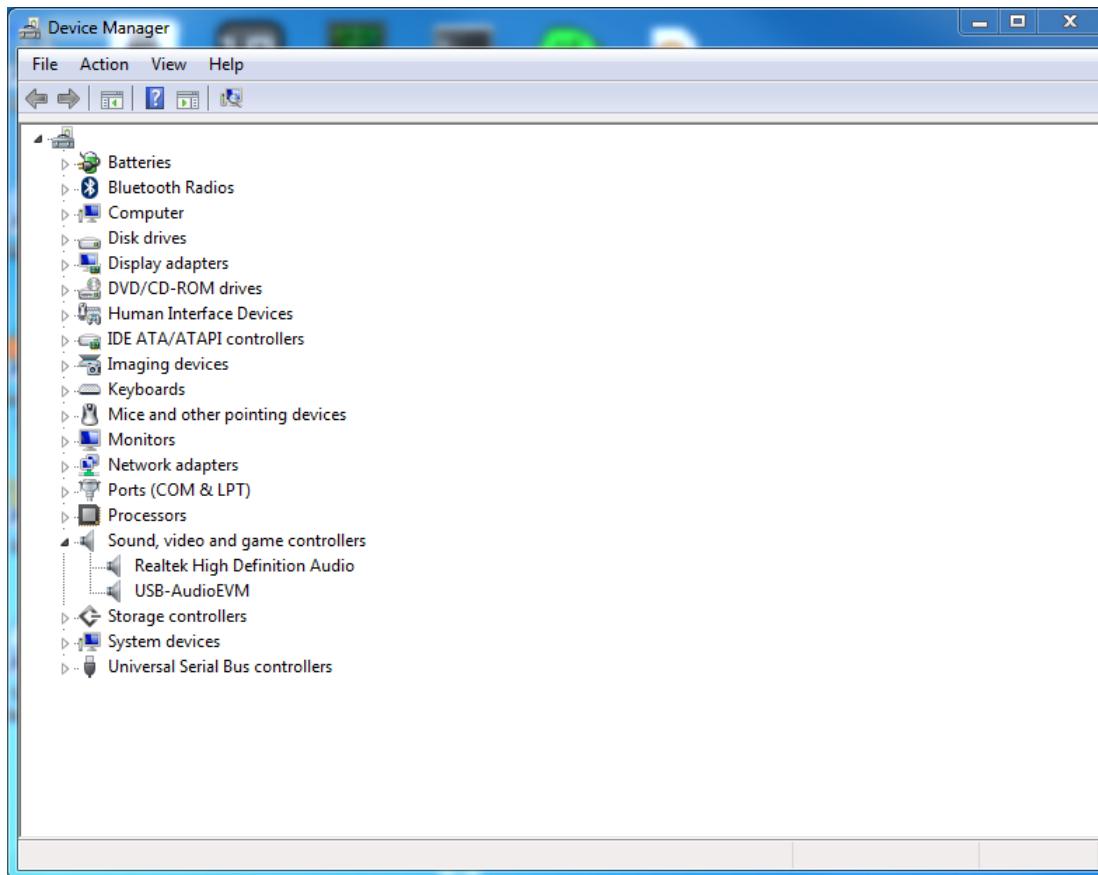


Figure 2. Device Manager

USB audio output quality can be configured as shown in [Figure 3](#). The user must select "2 channel, 16 bit, 48000 Hz (DVD Quality)".

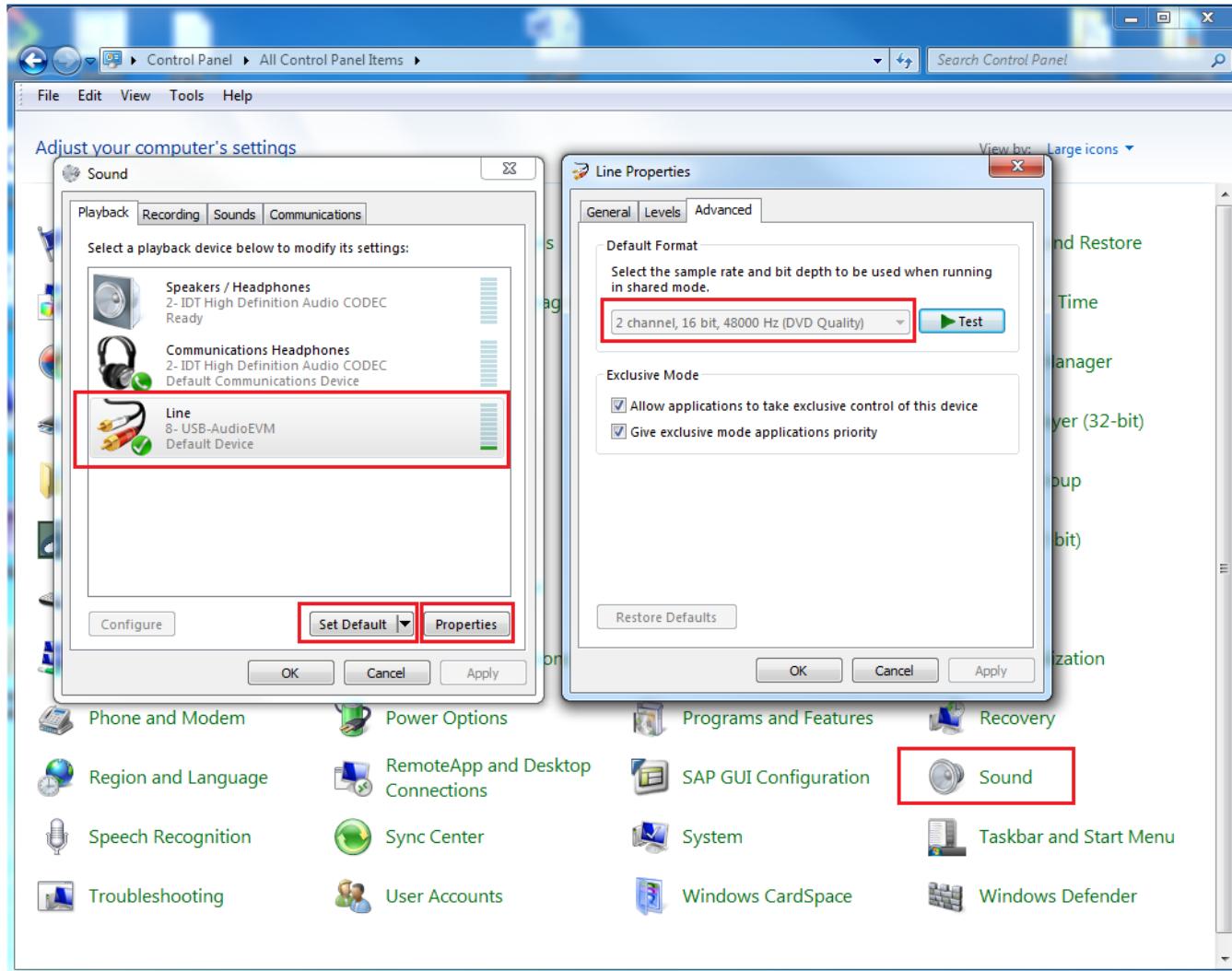


Figure 3. Default Format

2 Hardware Setup

- Step 1. Connect the PPCMB to the TAS5782MEVM.
- Step 2. Connect speakers to the TAS5782MEVM.
- Step 3. Connect a PSU to the TAS5782MEVM and turn on the power. 5-V and 3.3-V LEDs (Yellow) are illuminated. The USB Lock LED (Blue) is also illuminated. The PSU voltage range is 9.5 to 26.4 VDC.
- Step 4. Plug in a USB cable from the PC to the PPCMB.
- Step 5. If an optical SPDIF source is used, the blue SPDIF clock-locked LED is illuminated.

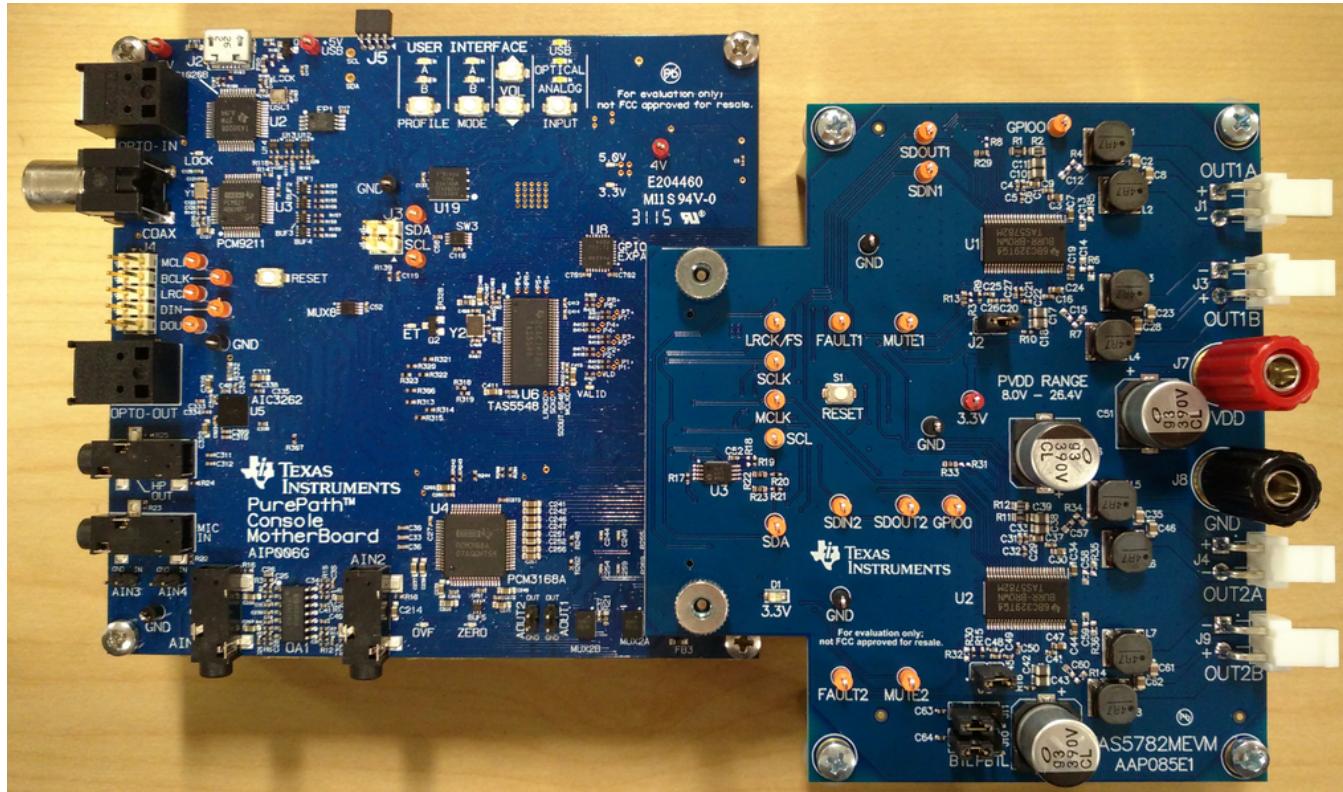


Figure 4. PPCMB and TAS5782MEVM Connection

2.1 PBTL Hardware Setup

1. The EVM and PPCMB need to be disconnected from the power supply.
2. Set J10 and J11 on the EVM to PBTL mode (right position)
3. Connect speaker terminals (J4 and J9) to the speaker in PBTL mode (See [Figure 7](#)).
4. Power up the EVM and it will now operate in PBTL mode.

NOTE: The EVM has two devices (U1 and U2), only the bottom one (U2) can operate in PBTL mode.

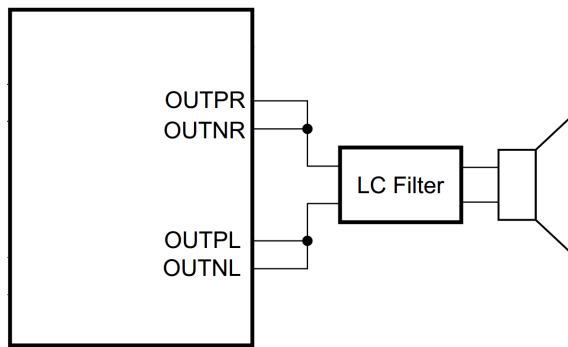


Figure 5. PBTL Configuration

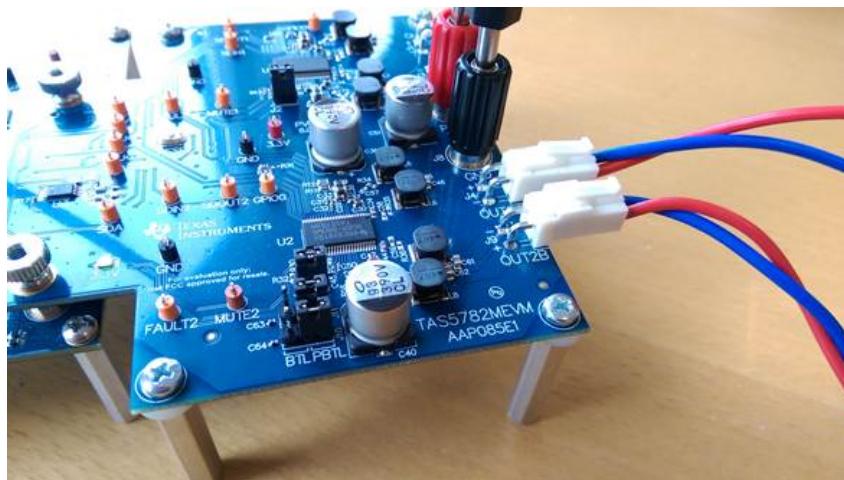


Figure 6. PBTL Connection at EVM

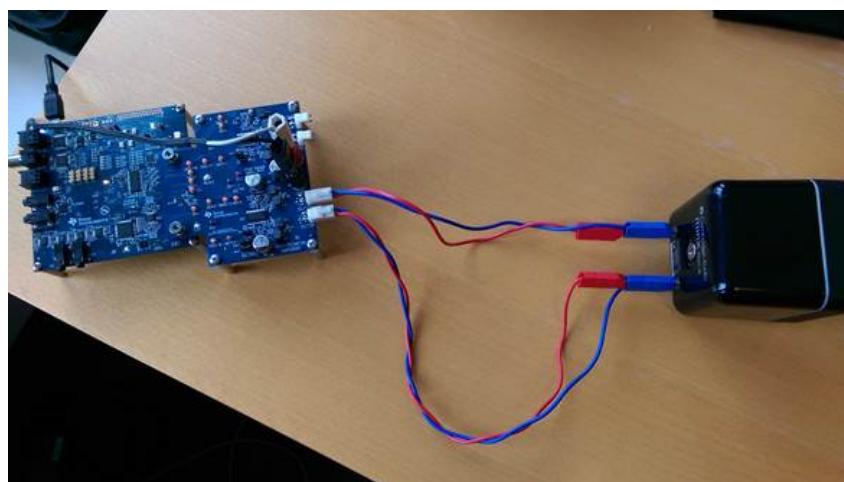


Figure 7. PBTL Connection to Speaker

2.2 I²C Device Addresses

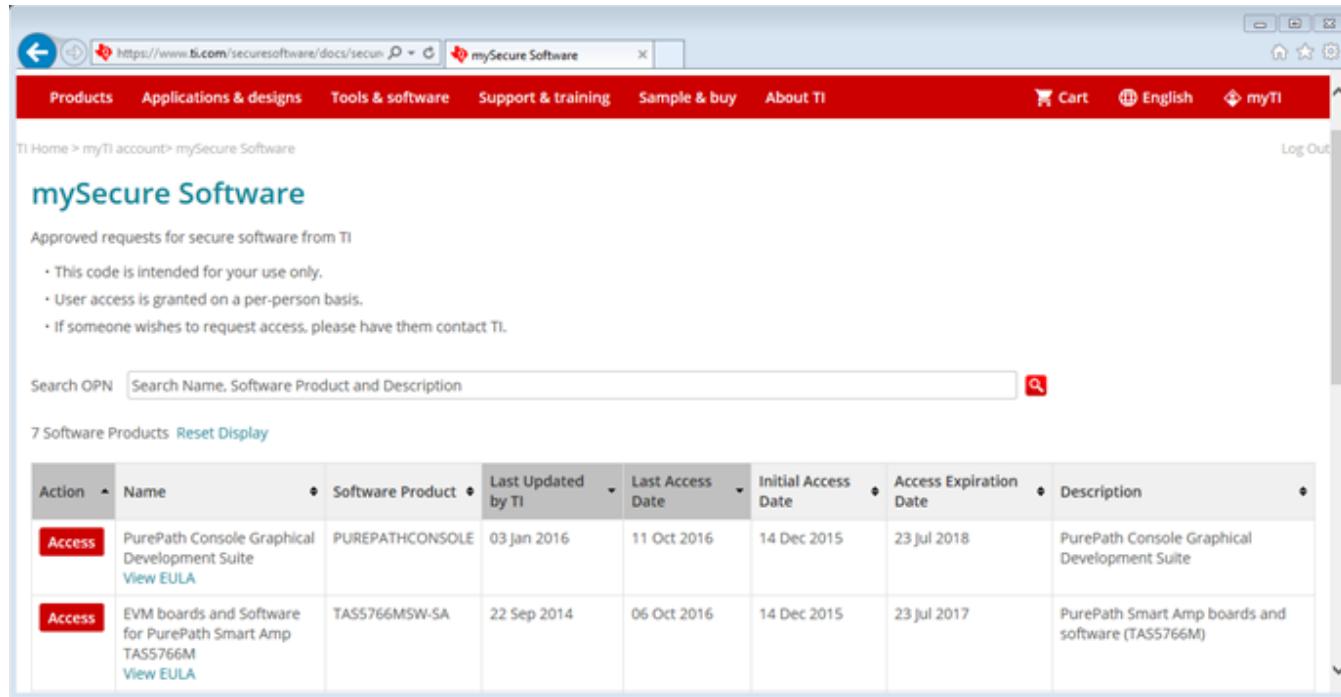
The default I²C addresses on the EVM are set to 0x90 for the top device (U1) and 0x92 for the bottom one (U2).

3 Software Overview

3.1 PurePath Console 3 (PPC3)

PurePath™ Console 3 (PPC3) is a software platform for Texas Instruments' audio devices. Many of these audio devices can be configured, tuned, and validated. This platform has the ability to support a number of TI audio devices with features that make the audio tuning experience more intuitive and exciting. Request access on <http://www.ti.com/tool/PUREPATHCONSOLE>.

Once approval is given, go to www.ti.com/mysecuresoftware to download the software. After login, users will see this webpage with a similar list of software products available for download.



The screenshot shows a web browser window for the Texas Instruments mySecure Software page. The URL in the address bar is <https://www.ti.com/securesoftware/docs/secun>. The page title is "mySecure Software". The top navigation bar includes links for "Products", "Applications & designs", "Tools & software", "Support & training", "Sample & buy", and "About TI". On the right side of the top bar are "Cart", "English", and "myTI" buttons. Below the top bar, the text "TI Home > myTI account > mySecure Software" is displayed, along with a "Log Out" link. The main content area is titled "mySecure Software" and contains the sub-headline "Approved requests for secure software from TI". It lists two software products:

| Action | Name | Software Product | Last Updated by TI | Last Access Date | Initial Access Date | Access Expiration Date | Description |
|--------|--|------------------|--------------------|------------------|---------------------|------------------------|---|
| Access | PurePath Console Graphical Development Suite View EULA | PUREPATHCONSOLE | 03 Jan 2016 | 11 Oct 2016 | 14 Dec 2015 | 23 Jul 2018 | PurePath Console Graphical Development Suite |
| Access | EVM boards and Software for PurePath Smart Amp TAS5766M View EULA | TAS5766MSW-SA | 22 Sep 2014 | 06 Oct 2016 | 14 Dec 2015 | 23 Jul 2017 | PurePath Smart Amp boards and software (TAS5766M) |

Below the table, there is a search bar with the placeholder "Search Name, Software Product and Description" and a magnifying glass icon. The text "7 Software Products" and "Reset Display" are also visible.

Figure 8. PPC3 Download Window

Run the installation program. Also, download the PPC3 User Manual (after requesting the PPC3 software) for further instructions. The following window is displayed when PPC3 is launched for the first time.

When the window in [Figure 9](#) is displayed, click on “sign in” to see TAS5782 EVM application. Click on TAS5782M box to download TAS5782M EVM App. Installation window will pop up, then click “Install”.



Figure 9. PPC3 Window

After installation, TAS5782 EVM box will appear in “Installed EVM Apps” section, see [Figure 10](#). Click on TAS5782 box to launch TAS5782 App.

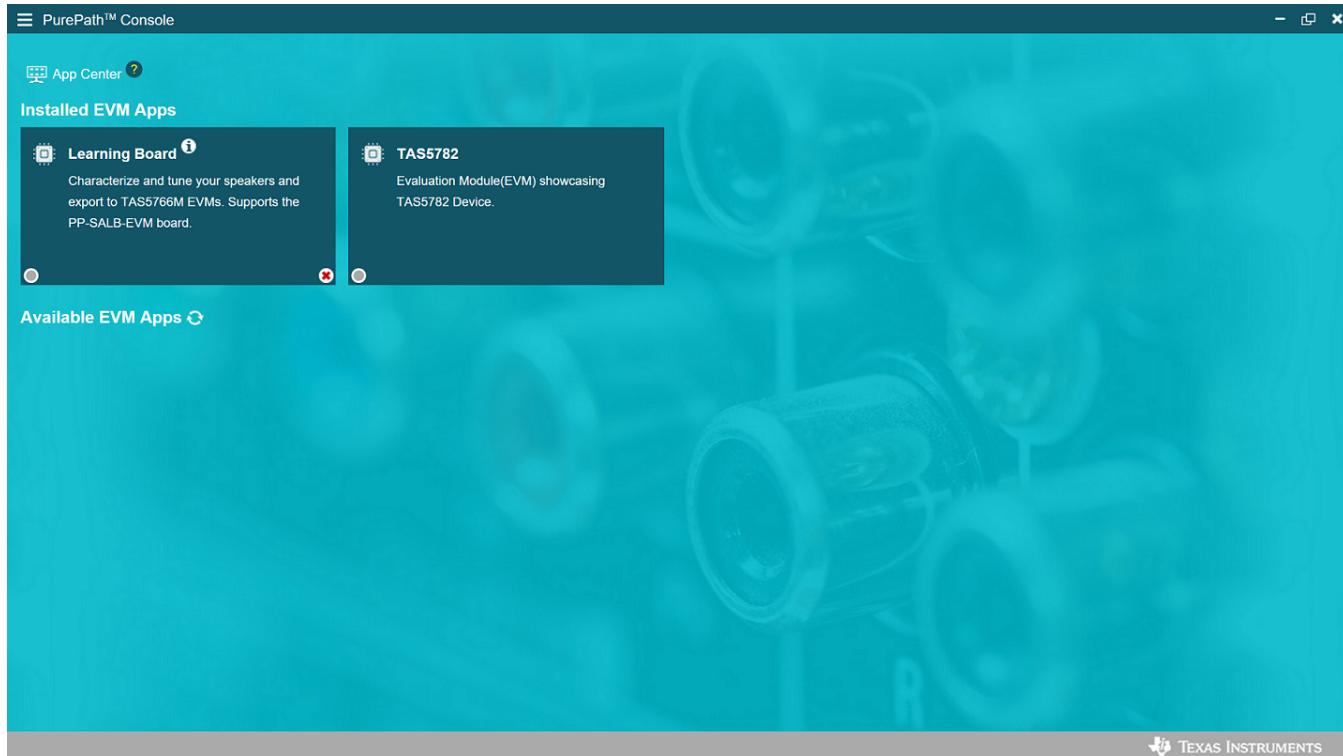


Figure 10. Installed EVM Apps

3.2 TAS5782M Home Page

When the TAS5782M EVM App is launched, the TAS5782M Home Page is shown, see [Figure 11](#). It displays features that are available for that EVM. When a feature is selected, then the respective page is loaded.

If the EVM is powered on and the USB is connected to the PC, the Home Page will display “Connect” button in the bottom left corner. If the USB is not connected, only “TAS5782M – offline” is shown.

There are six pages available in the TAS5782 EVM App: System Checks, Direct I²C, Audio I/O, Register Map, End System Integration and Tuning and Audio Processing.

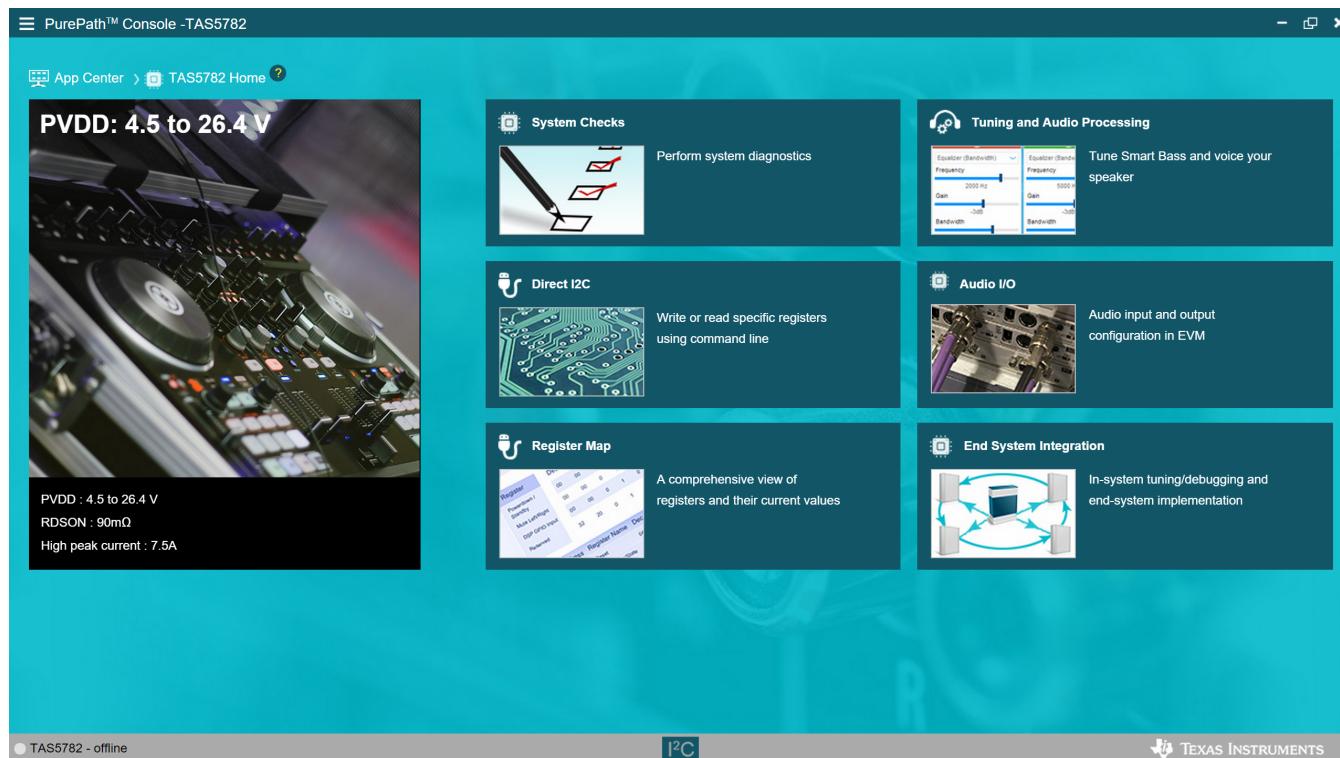


Figure 11. TAS5782M Home Page

3.3 System Checks

The System Checks Page (See [Figure 12](#)) is used to determine whether the EVM can be configured correctly and receive audio stream from PC via USB. These checks will complete in a few minutes if no problem is detected. It is recommended to run the system checks before proceeding to the Tuning and Audio Processing Page.

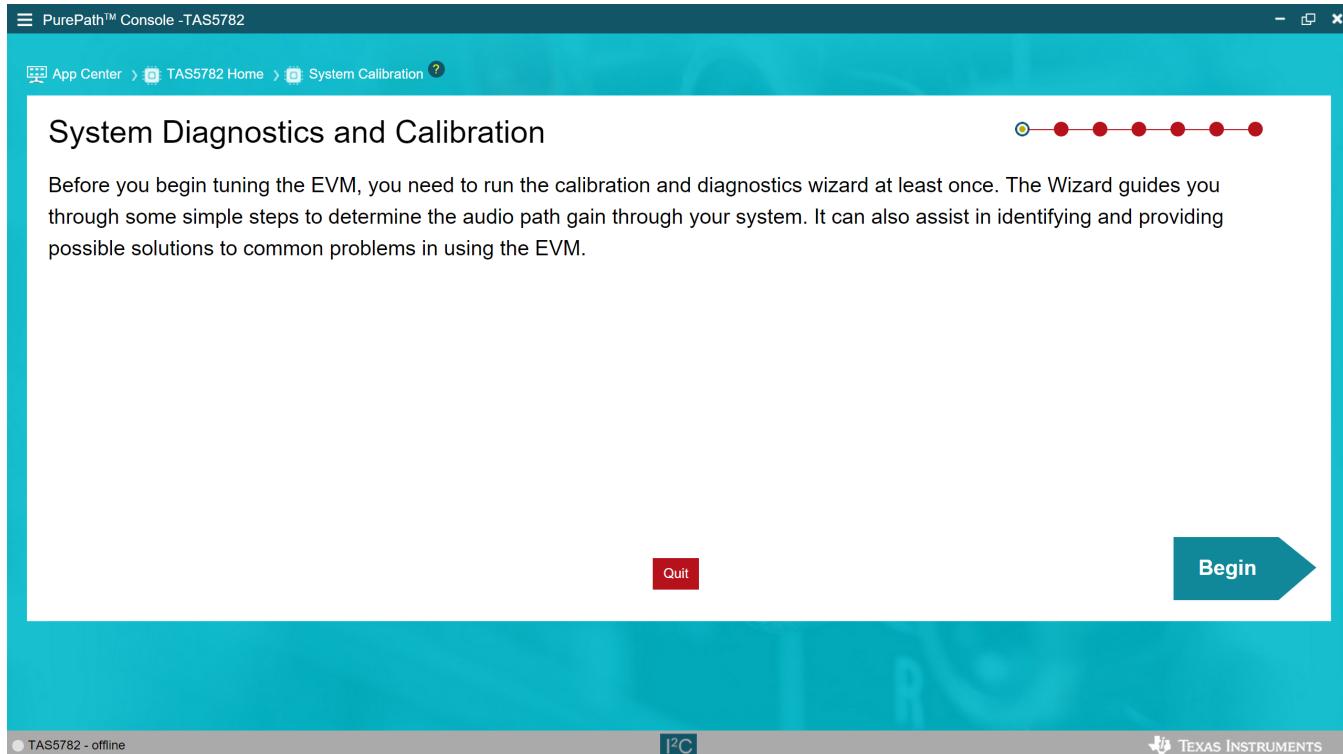


Figure 12. System Checks Page

3.4 Direct I²C

The I/O tab in the Direct I²C has two sub sections. The Input section has the provision to enter the read or write commands scripts. Clicking the Execute button will execute the commands written in the Input section. The status of the execution is displayed in the Output section as shown in [Figure 13](#).

The Checksum button on the right is used to compute the checksum value of a cfg file. Load a cfg file by clicking the Checksum button and then the computed XOR and CRC checksum will show on the Output section.

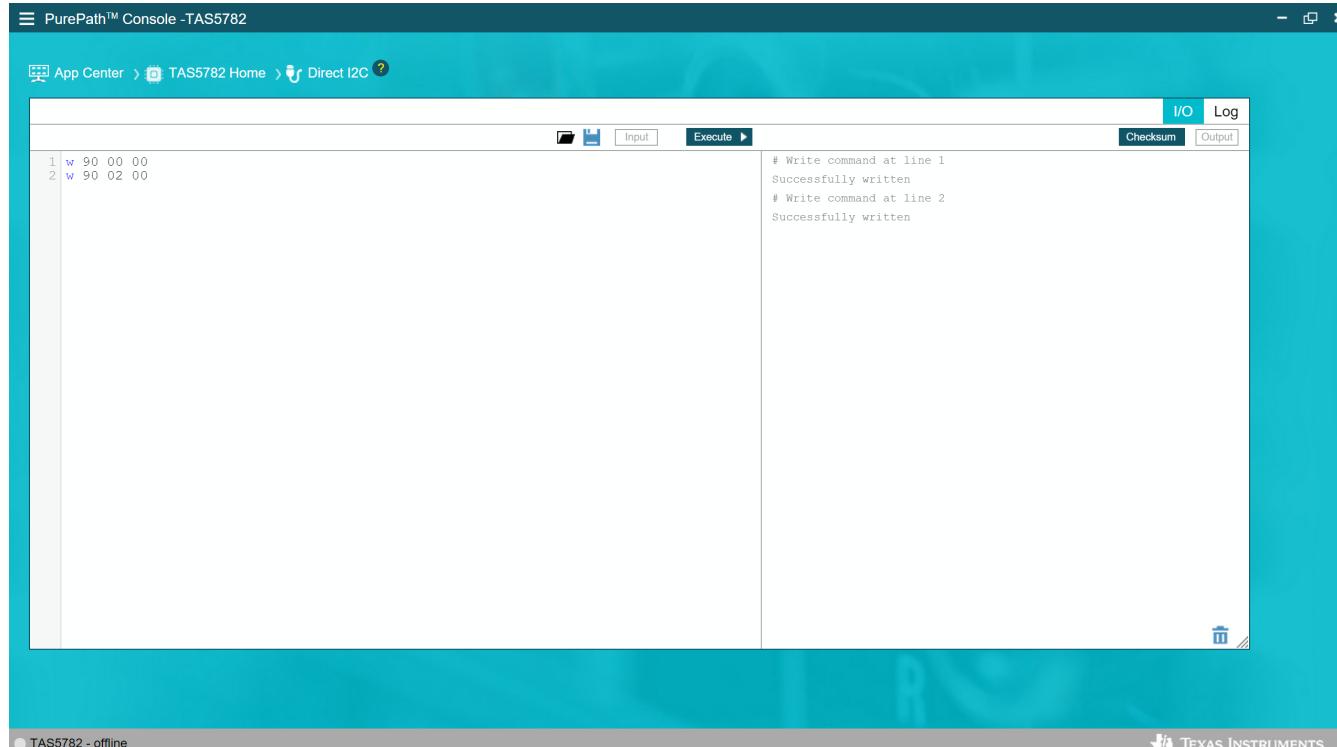


Figure 13. Direct I²C Page, I/O Tab

The Log tab in the Direct I²C displays the I²C command history, if the record option is enabled. The log tab has a search option to search for a particular command. The search key is found at the top left of the window with the search icon. 'Save to a file' is used to save the log as a .cfg file. 'Delete Output' clears the log history. 'Copy to a Clipboard' copies the log text to the clipboard. Clicking the 'Start Recording' button starts recording the I²C transactions and displays them in the log window. 'Stop Recording' stops recording I²C transactions.

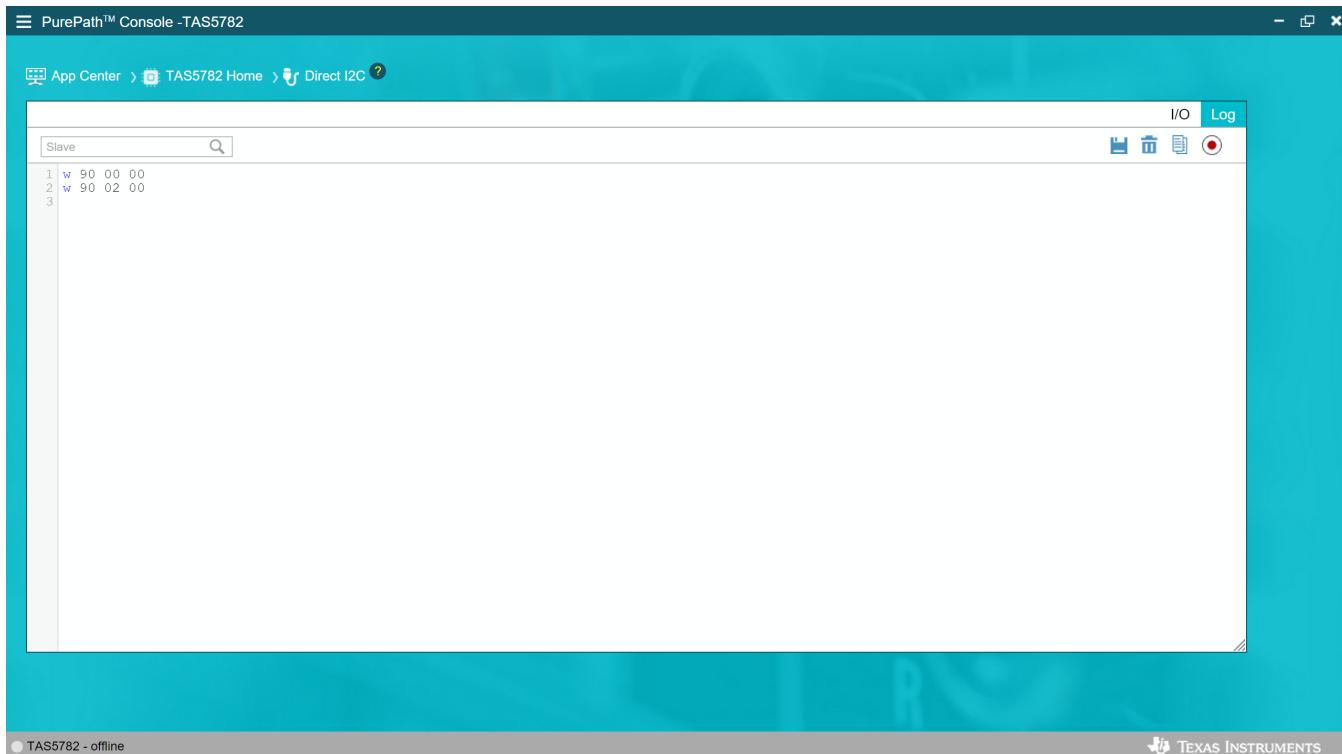


Figure 14. Direct I²C Page, Log Tab

3.5 Audio I/O

This tool selects the desired audio input to the EVM. USB, coax, analog, optical, and PSIA (external I²S) inputs are supported by the motherboard. USB audio source is selected as default.

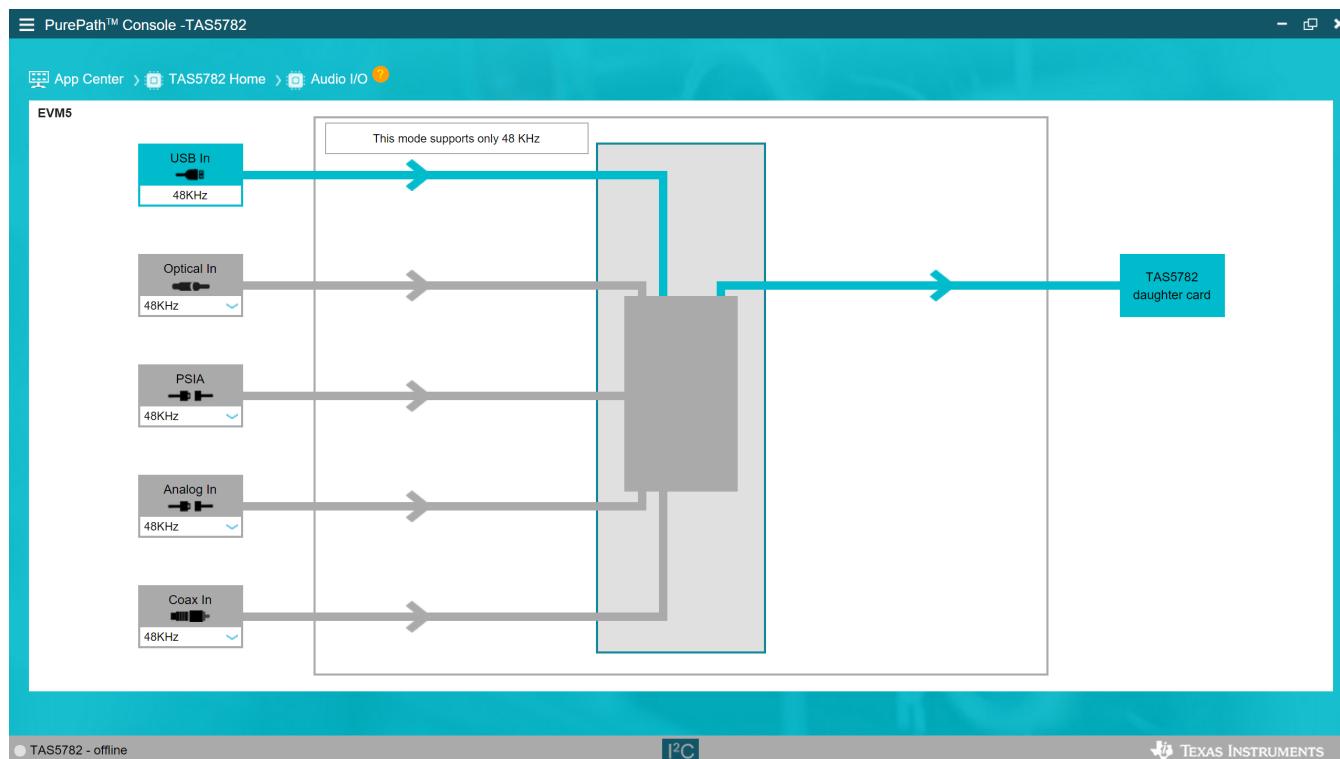
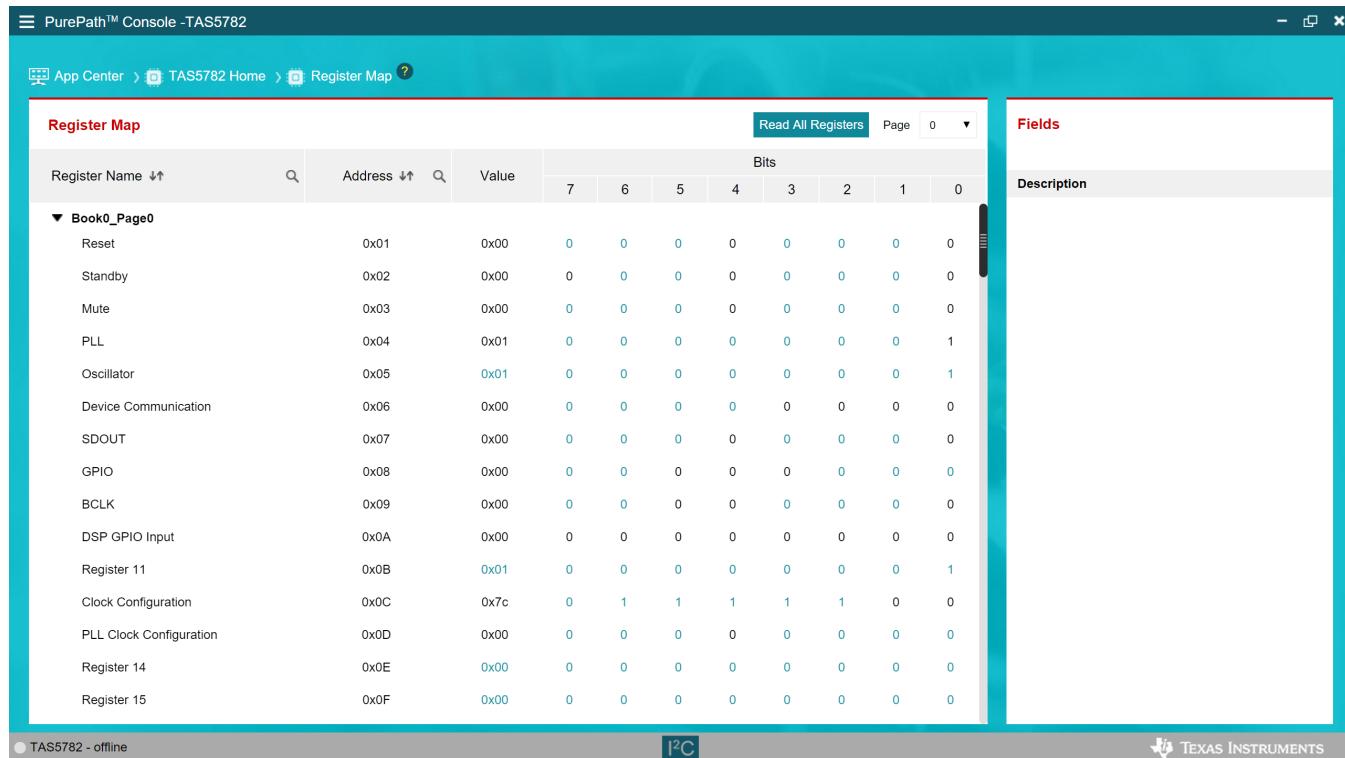


Figure 15. Audio I/O Page

3.6 Register Map

The Register Map Page shows the current I²C register values (hexadecimal) in the TAS5782M and it can also be used to change the register values. Manually changing register values is accomplished by double-clicking in the desired bit to change. Clicking on Read All Registers allows monitoring of the register status of the amplifier. The Fields section shows the register name and a brief description of each bit that affects the selected register.



Register Map

| Register Name | Address | Value | Bits | | | | | | | |
|-------------------------|---------|-------|------|---|---|---|---|---|---|---|
| | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| ▼ Book0_Page0 | | | | | | | | | | |
| Reset | 0x01 | 0x00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Standby | 0x02 | 0x00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mute | 0x03 | 0x00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PLL | 0x04 | 0x01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Oscillator | 0x05 | 0x01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Device Communication | 0x06 | 0x00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SDOUT | 0x07 | 0x00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GPIO | 0x08 | 0x00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BCLK | 0x09 | 0x00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSP GPIO Input | 0x0A | 0x00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Register 11 | 0x0B | 0x01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Clock Configuration | 0x0C | 0x7c | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| PLL Clock Configuration | 0x0D | 0x00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Register 14 | 0x0E | 0x00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Register 15 | 0x0F | 0x00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Fields

| Description |
|-------------|
|-------------|

Figure 16. Register Map Page

3.7 End System Integration

The End System Integration Page offers a powerful tool to generate a configuration file to use with processors and a method to debug the device in the end system. Three options are available:

1. Dump Current State into a Header file
2. In-System Debugging
3. In-System Tuning

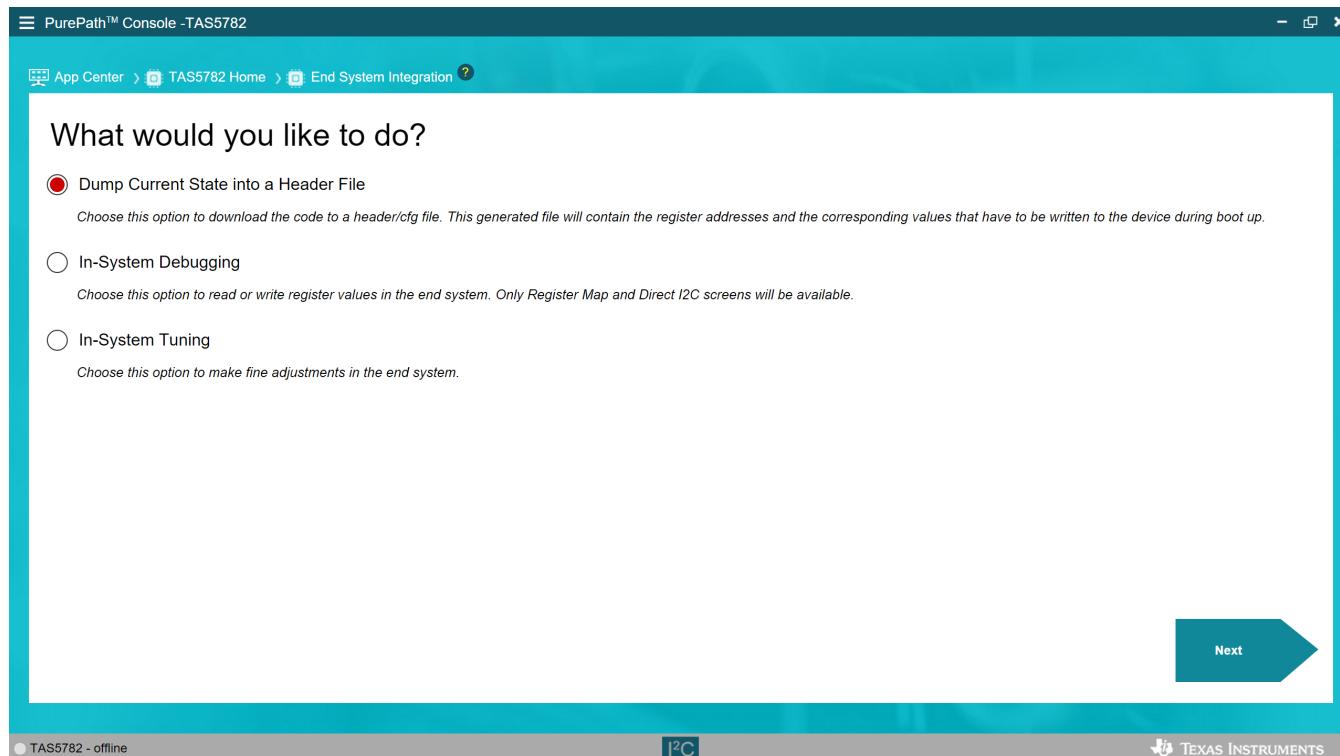


Figure 17. End System Integration Page

3.7.1 Dump Current State into a Header File

This tool is used to generate a header or configuration file for the evaluated device according to the features evaluated and configured with PPC3. A few settings are available for file generation, including the format, end system I²C address, burst length and so forth. The generated file can be saved in the PC or shown in the output window on the right.

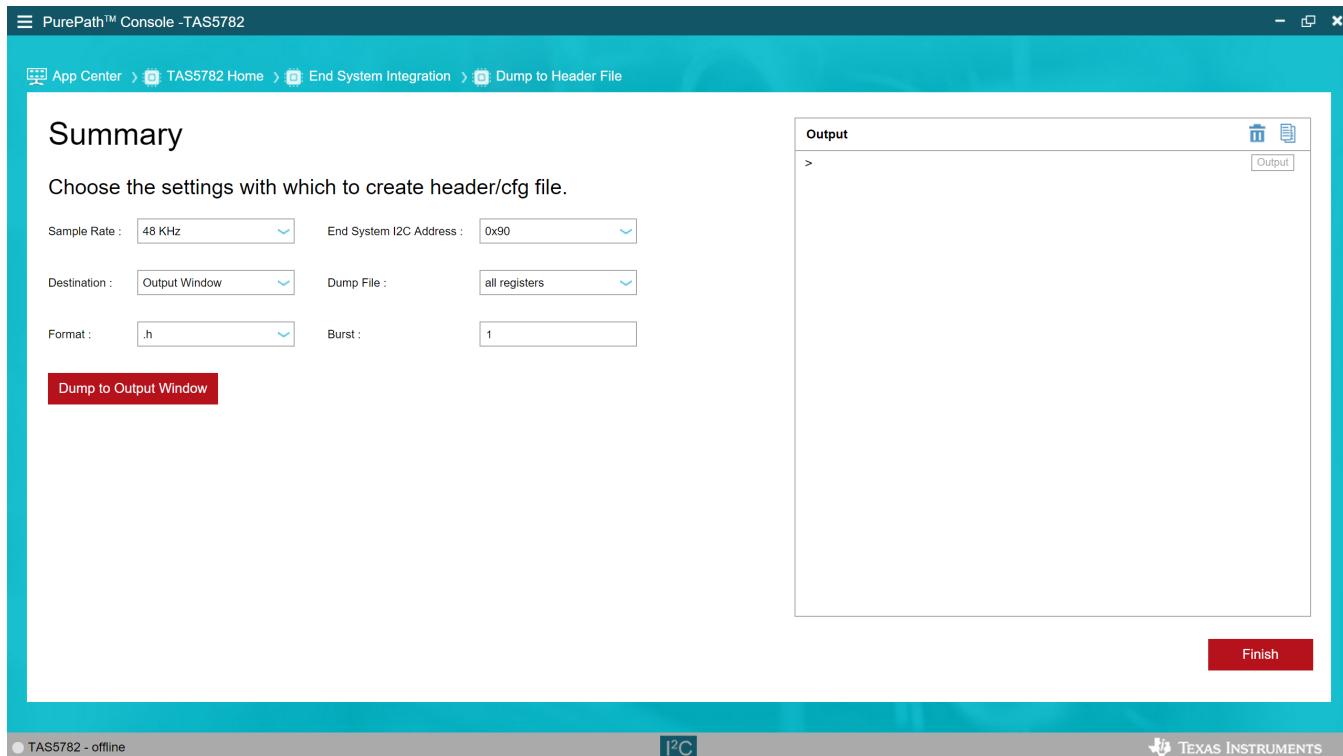


Figure 18. Header File Generation

3.7.2 In-System Debugging

This tool helps debug the device which is already integrated in the end-system. This is possible by connecting the I²C signals of the end-system device to the SCL, SDA, and GND test points of PPCMB. Only Register Map and Direct I²C will be available in this mode. Leave the In-System Debugging Mode by clicking on the Disconnect button on the bottom left corner of the window.

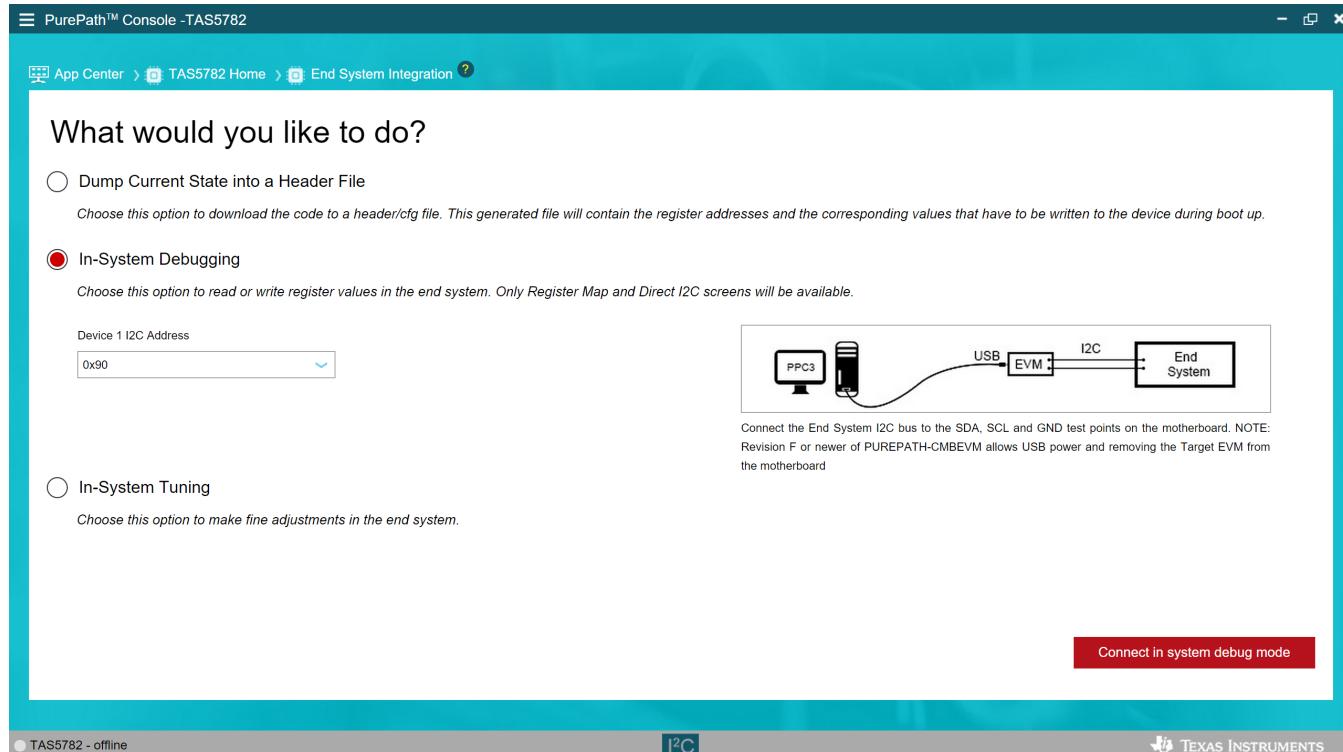


Figure 19. In-System Debugging

3.7.3 In-System Tuning

Even if the device is integrated in the end application, it is still possible to make fine adjustments with the help of In-System Tuning. Like the In-System Debugging above, this is done by connecting I²C signals from PPCMB to the TAS5782M device in the end-system.

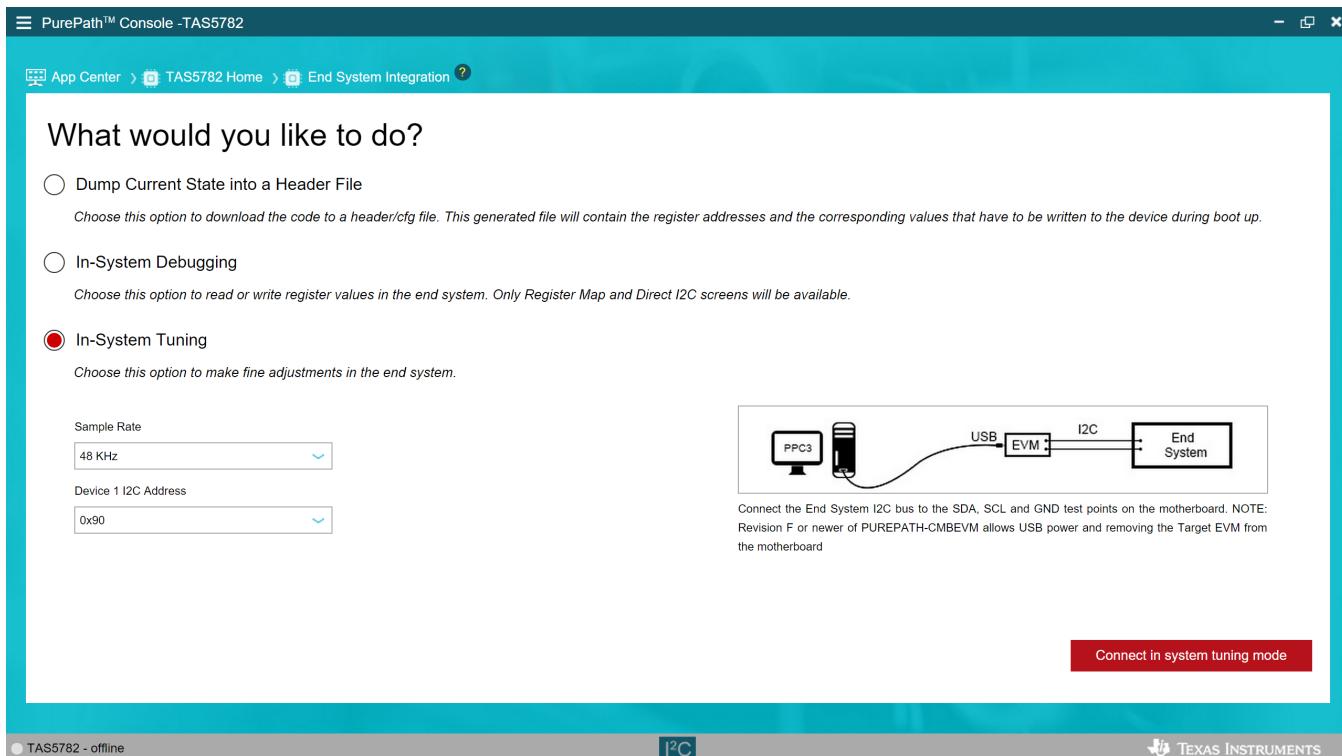


Figure 20. In-System Tuning

4 Troubleshooting

4.1 Power Cycle

To perform a power cycle disconnect both the USB cable and the power supply from the board.

4.2 Changing PPCMB Sample Rate

Older PPCMB devices may require a firmware update to support 48-kHz audio over USB. Instructions for updating the PPCMB firmware is found [here](#). Please note this update applies only to audio over USB. 96-kHz audio over USB is not supported, for now.

5 Board Layouts, Bill of Materials, and Schematic

This section includes the EVM schematics, board layouts and bill of materials.

5.1 *Schematics*

Figure 21 through Figure 23 illustrate the schematics for this EVM.

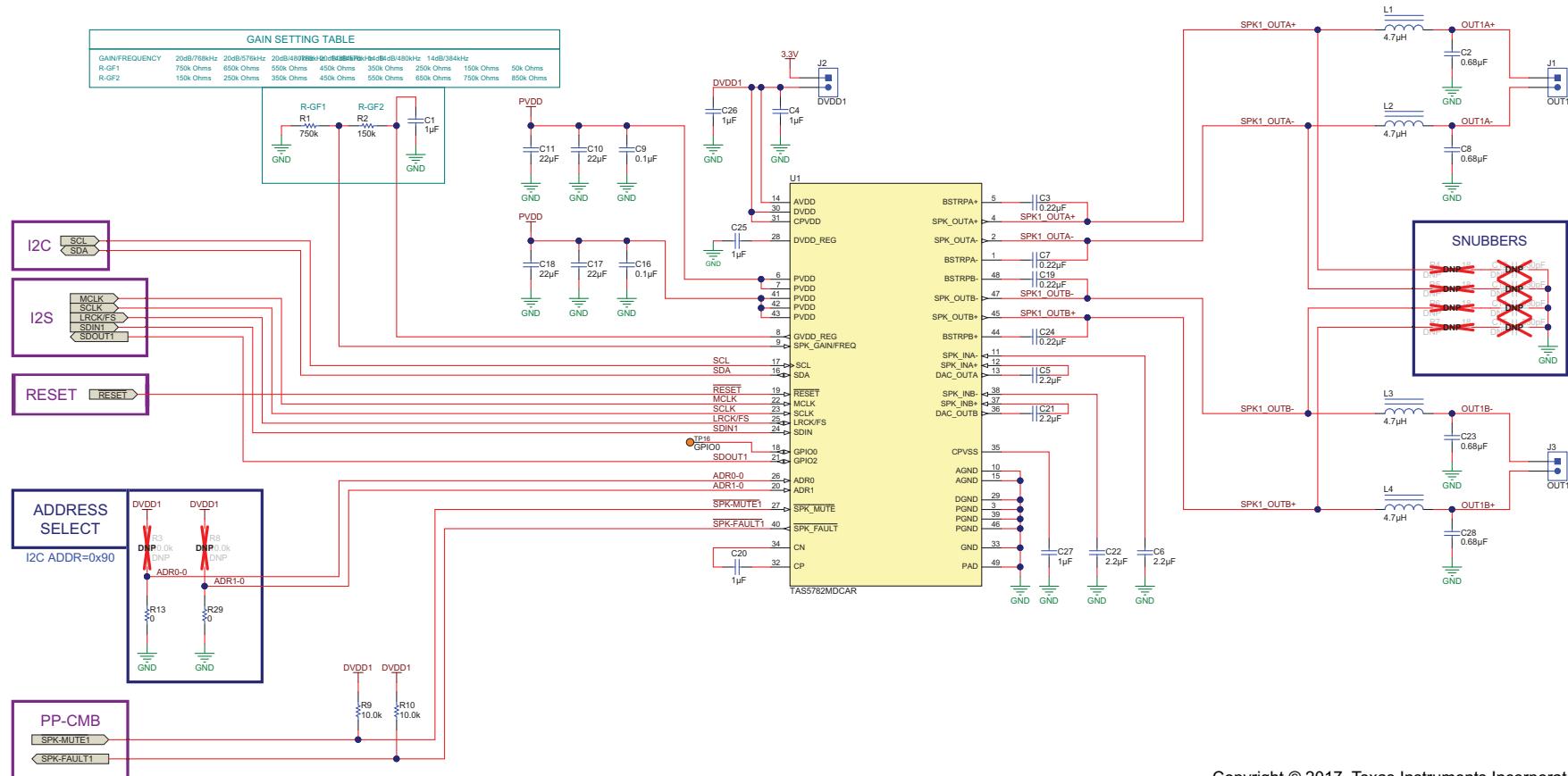


Figure 21. TAS5782MEVM Schematic (1 of 3)

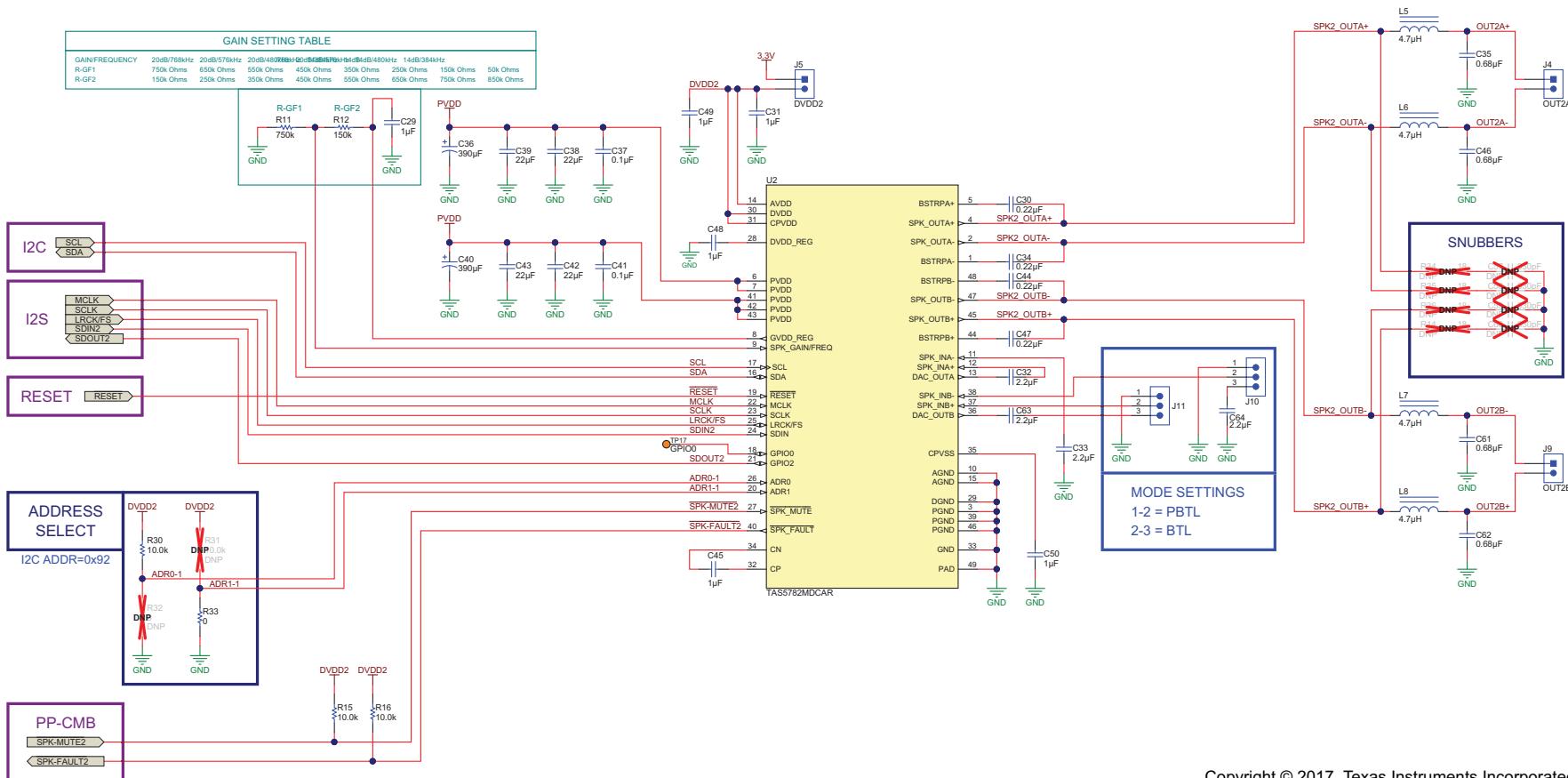
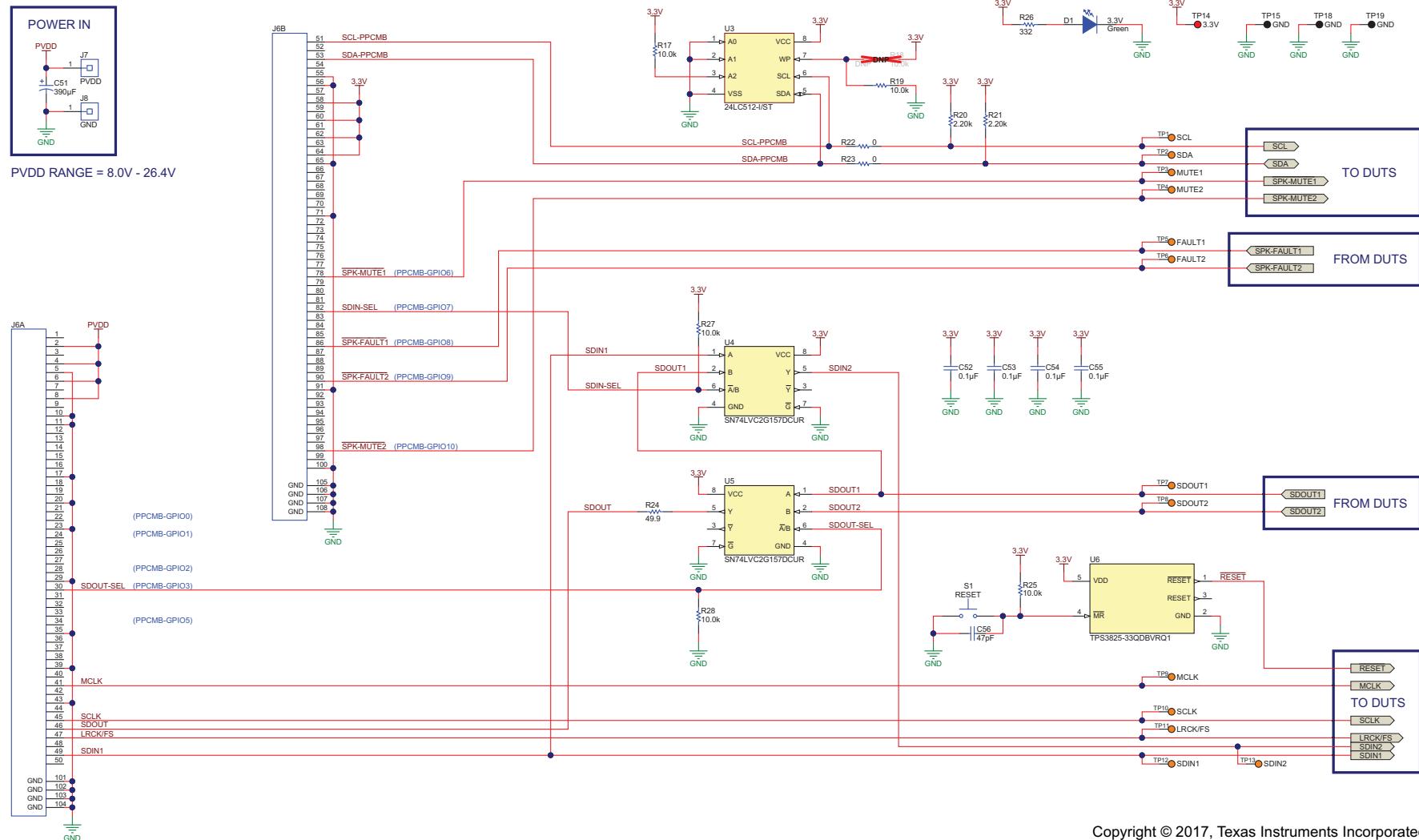


Figure 22. TAS5782MEVM Schematic (2 of 3)



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Figure 23. TAS5782MEVM Schematic (3 of 3)

5.2 *Board Layouts*

Figure 24 and Figure 25 illustrate the board layouts for the EVM.

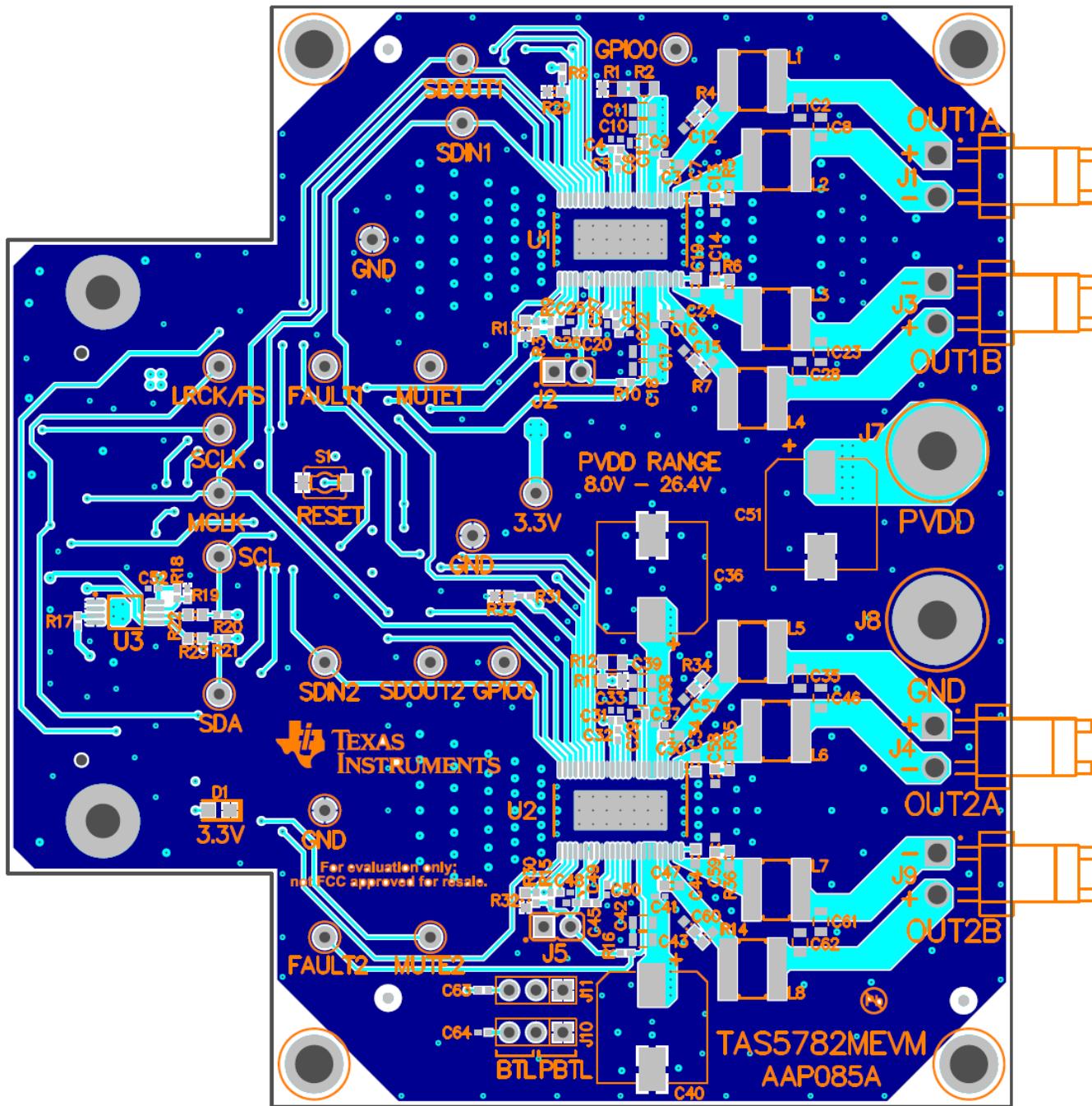


Figure 24. TAS5782MEVM Top Composite Assembly

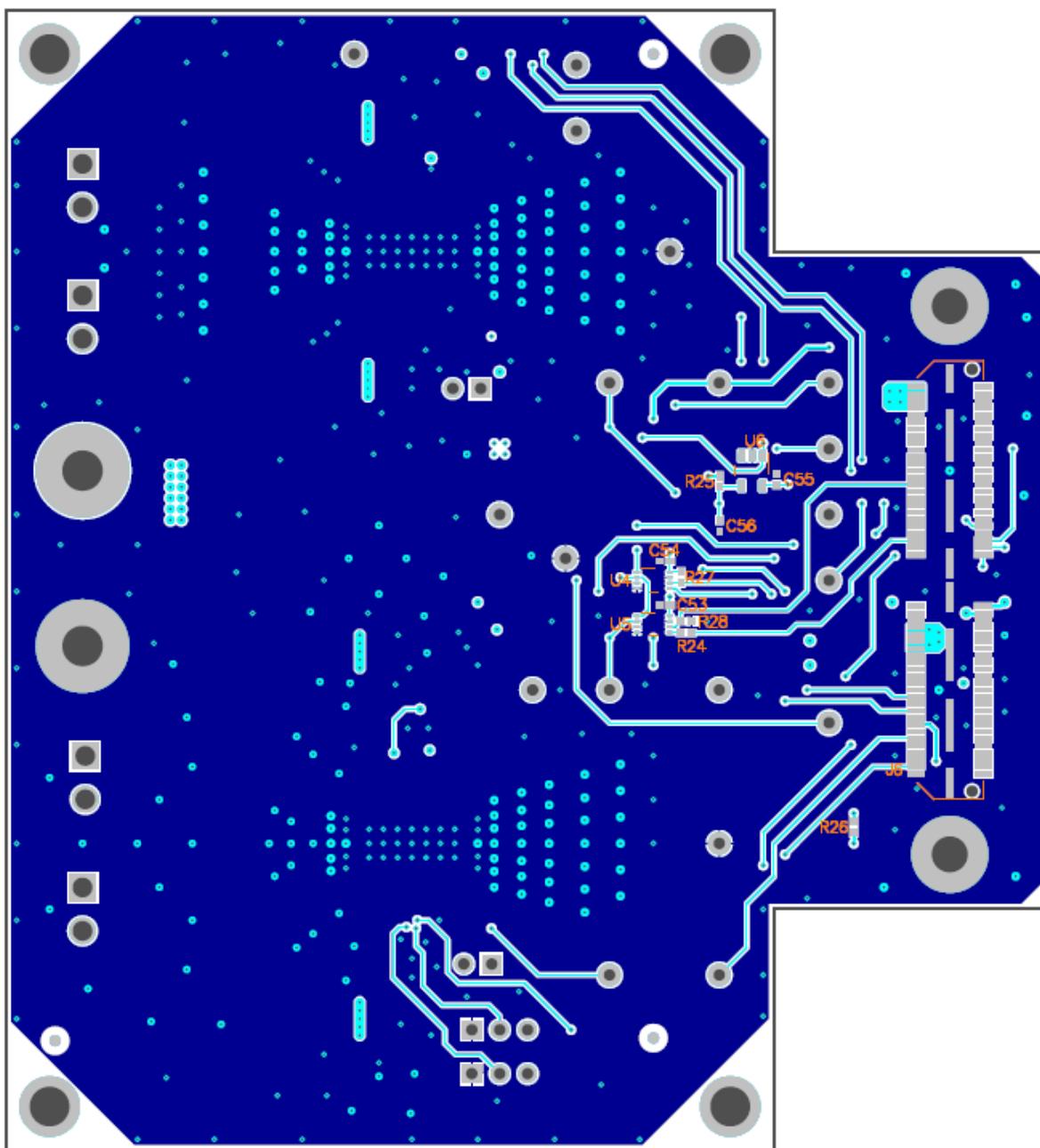


Figure 25. TAS5782MEVM Bottom Composite Assembly

5.3 Bill of Materials

Table 1 lists the TAS5782MEVM bill of materials.

Table 1. TAS5782MEVM Bill of Materials⁽¹⁾

| Designator | Qty | Value | Description | Package Reference | Part Number | Manufacturer | Alternate Part Number | Alternate Manufacturer |
|---|-----|--------|--|--|---------------------|-----------------------------|-----------------------|------------------------|
| C1, C29 | 2 | 1uF | CAP, CERM, 1 μ F, 16 V, +/- 10%, X5R, 0603 | 0603 | GRM185R61C105KE44D | Murata | | |
| C2, C8, C23, C28, C35, C46, C61, C62 | 8 | 0.68uF | CAP, CERM, 0.68 μ F, 50 V, +/- 20%, X7R, 0805 | 0805 | C2012X7R1H684M125AB | TDK | | |
| C3, C7, C19, C24, C30, C34, C44, C47 | 8 | 0.22uF | CAP, CERM, 0.22 μ F, 50 V, +/- 10%, X7R, 0603 | 0603 | C1608X7R1H224K080AB | TDK | | |
| C4, C20, C25, C26, C27, C31, C45, C48, C49, C50 | 10 | 1uF | CAP, CERM, 1 μ F, 25 V, +/- 10%, X5R, 0402 | 0402 | C1005X5R1E105K050BC | TDK | | |
| C5, C6, C21, C22, C32, C33, C63, C64 | 8 | 2.2uF | CAP, CERM, 2.2 μ F, 16 V, +/- 10%, X5R, 0402 | 0402 | C1005X5R1C225K050BC | TDK | | |
| C9, C16, C37, C41, C52, C53, C54, C55 | 8 | 0.1uF | CAP, CERM, 0.1 μ F, 50 V, +/- 10%, X7R, 0402 | 0402 | C1005X7R1H104K050BB | TDK | | |
| C10, C11, C17, C18, C38, C39, C42, C43 | 8 | 22uF | CAP, CERM, 22 μ F, 35 V, +/- 20%, JB, 0805 | 0805 | C2012JB1V226M125AC | TDK | | |
| C36, C40, C51 | 3 | 390uF | CAP, AL, 390 μ F, 35 V, +/- 20%, 0.08 ohm, SMD | 10x10 | UCL1V391MNL1GS | Nichicon | | |
| C56 | 1 | 47pF | CAP, CERM, 47pF, 25V, +/-5%, C0G/NP0, 0402 | 0402 | GRM1555C1E470JA01D | Murata | | |
| D1 | 1 | Green | LED, Green, SMD | LED_0805 | LTST-C170KGKT | Lite-On | | |
| H1, H2, H3, H4 | 4 | | MACHINE SCREW PAN PHILLIPS M3 | M3 Screw | RM3X8MM 2701 | APM HEXSEAL | | |
| H5, H6, H7, H8 | 4 | | Washer, Flat, #4 Nylon | | 3200 | Keystone | | |
| H9, H10, H11, H12 | 4 | | Standoff, HexBrass M3, 30 mm | Spacer M3, 30mm | R30-1003002 | Harwin | | |
| J1, J3, J4, J9 | 4 | | Header (friction lock), 3.96mm, 2x1, Tin, R/A, TH | Header, 2x1, 3.96mm, R/A | B2PS-VH(LF)(SN) | JST Manufacturing | | |
| J2, J5 | 2 | | Header, 100mil, 2x1, Gold, TH | Sullins 100mil, 1x2, 230 mil above insulator | PBC02SAAN | Sullins Connector Solutions | | |
| J6 | 1 | | Connector, 100 Pos. 0.635mm, SMT | Connector, 1575x235x280 mil | QTS-050-01-F-D-A | Samtec | | |
| J7 | 1 | | Binding Post, RED, TH | 11.4x27.2mm | 7006 | Keystone | | |
| J8 | 1 | | Binding Post, BLACK, TH | 11.4x27.2mm | 7007 | Keystone | | |
| J10, J11 | 2 | | Header, 100mil, 3x1, Gold, TH | PBC03SAAN | PBC03SAAN | Sullins Connector Solutions | | |
| L1, L2, L3, L4, L5, L6, L7, L8 | 8 | 4.7uH | Inductor, Shielded, 4.7 μ H, 4 A, 0.023 ohm, SMD | 6.3x4.5x6.3mm | 1255AY-4R7M=P3 | Murata Toko | | |
| R1, R11 | 2 | 750k | RES, 750 k, 1%, 0.125 W, 0805 | 0805 | ERJ-6ENF7503V | Panasonic | | |
| R2, R12 | 2 | 150k | RES, 150 k, 1%, 0.125 W, 0805 | 0805 | ERJ-6ENF1503V | Panasonic | | |
| R9, R10, R15, R16, R17, R19 | 6 | 10.0k | RES, 10.0 k, 1%, 0.063 W, 0402 | 0402 | CRCW040210K0FKED | Vishay-Dale | | |
| R13, R22, R23, R29, R33 | 5 | 0 | RES, 0, 5%, 0.1 W, 0603 | 0603 | CRCW06030000Z0EA | Vishay-Dale | | |
| R20, R21 | 2 | 2.20k | RES, 2.20 k, 1%, 0.063 W, 0402 | 0402 | CRCW04022K20FKED | Vishay-Dale | | |
| R24 | 1 | 49.9 | RES, 49.9, 1%, 0.063 W, 0402 | 0402 | CRCW040249R9FKED | Vishay-Dale | | |
| R25, R27, R28, R30 | 4 | 10.0k | RES, 10.0k ohm, 1%, 0.063W, 0402 | 0402 | CRCW040210K0FKED | Vishay-Dale | | |
| R26 | 1 | 332 | RES, 332, 1%, 0.063 W, 0402 | 0402 | CRCW0402332RFKED | Vishay-Dale | | |
| S1 | 1 | | Switch, Tactile, SPST-NO, 0.05A, 12V, SMT | Switch, 4.4x2x2.9 mm | TL1015AF160QG | E-Switch | | |

⁽¹⁾ Unless otherwise noted in the Alternate Part Number or Alternate Manufacturer columns, all parts may be substituted with equivalents.

Table 1. TAS5782MEVM Bill of Materials⁽¹⁾ (continued)

| Designator | Qty | Value | Description | Package Reference | Part Number | Manufacturer | Alternate Part Number | Alternate Manufacturer |
|---|-----|-------|--|----------------------------|--------------------|-------------------|-----------------------|------------------------|
| SH1, SH2, SH3, SH4 | 4 | 1x2 | Shunt, 100mil, Gold plated, Black | Shunt | 969102-0000-DA | 3M | SNT-100-BK-G | Samtec |
| TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP16, TP17 | 15 | | Test Point, Miniature, Orange, TH | Orange Miniature Testpoint | 5003 | Keystone | | |
| TP14 | 1 | | Test Point, Miniature, Red, TH | Red Miniature Testpoint | 5000 | Keystone | | |
| TP15, TP18, TP19 | 3 | | Test Point, Miniature, Black, TH | Black Miniature Testpoint | 5001 | Keystone | | |
| U1, U2 | 2 | | Digital Input, Closed-Loop Class-D Amplifier with 96-kHz Processing, DCA0048G (TSSOP-48) | DCA0048G | TAS5782MDCAR | Texas Instruments | TAS5782MDCA | Texas Instruments |
| U3 | 1 | | EEPROM, 512KBIT, 400KHZ, 8TSSOP | TSSOP-8 | 24LC512-I/ST | Microchip | | |
| U4, U5 | 2 | | Single 2-Line to 1-Line Data Selector Multiplexer, DCU0008A | DCU0008A | SN74LVC2G157DCUR | Texas Instruments | SN74LVC2G157DCUT | Texas Instruments |
| U6 | 1 | | Processor Supervisory Circuit, DBV0005A | DBV0005A | TPS3825-33QDBVRQ1 | Texas Instruments | | Texas Instruments |
| C12, C13, C14, C15, C57, C58, C59, C60 | 0 | 330pF | CAP, CERM, 330 pF, 50 V, +/- 5%, C0G/NP0, 0603 | 0603 | GRM1885C1H331JA01D | Murata | | |
| FID1, FID2, FID3, FID4, FID5, FID6 | 0 | | Fiducial mark. There is nothing to buy or mount. | N/A | N/A | N/A | | |
| R3, R8, R31 | 0 | 10.0k | RES, 10.0k ohm, 1%, 0.063W, 0402 | 0402 | CRCW040210K0FKED | Vishay-Dale | | |
| R4, R5, R6, R7, R14, R34, R35, R36 | 0 | 18 | RES, 18, 5%, 0.1 W, 0603 | 0603 | CRCW060318R0JNEA | Vishay-Dale | | |
| R18 | 0 | 10.0k | RES, 10.0 k, 1%, 0.063 W, 0402 | 0402 | CRCW040210K0FKED | Vishay-Dale | | |
| R32 | 0 | 0 | RES, 0, 5%, 0.1 W, 0603 | 0603 | CRCW06030000Z0EA | Vishay-Dale | | |

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 - 2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

3 Regulatory Notices:

3.1 United States

3.1.1 *Notice applicable to EVMs not FCC-Approved:*

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

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

CAUTION

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

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

FCC Interference Statement for Class A EVM devices

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

FCC Interference Statement for Class B EVM devices

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

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

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

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

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

3.3 Japan

3.3.1 Notice for EVMs delivered in Japan: Please see http://www.tij.co.jp/lsds/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/lsds/ti_ja/general/eStore/notice_01.page

3.3.2 Notice for Users of EVMs Considered "Radio Frequency Products" in Japan: EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

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

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3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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- 4.3 *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.
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Last updated 10/2025