

EVM User's Guide: TAS2573EVM

TAS2573 Evaluation Module



Description

The TAS2573 evaluation module (EVM) is designed to demonstrate the performance of TAS2573 in a dual-mono configuration. This tool uses the AC-MB or AA-EVM-MB motherboard to provide an interface and supply voltages to the EVM daughter card. Up to four devices can share a common bus through I2S/TDM + I2C interfaces, and two EVMs can be mounted one on top of each other.

Features

- Mono or dual-mono speaker evaluation
- Interface using PurePath™ Console 3 (PPC3) Windows® software
- EVM interconnection for up to four audio channels
- USB audio and control input
- External I²C and I²S/TDM host controller connections available

Get Started

1. Order the EVM at TAS2573 product folder.
2. Request access and download PPC3.
3. Download the PPC3 software guide.
4. Download the TAS2573 datasheet.
5. Download the comprehensive design guidelines.

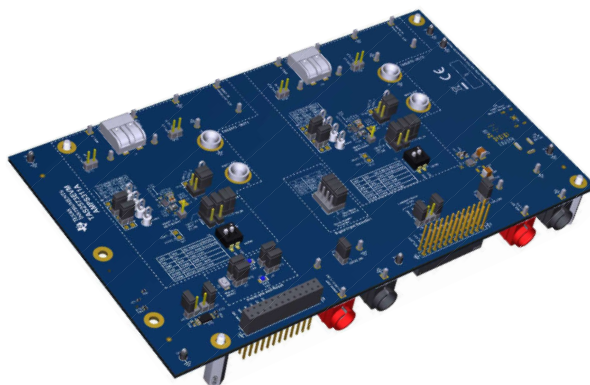


Figure 1-1. TAS2573 Dual-Mono Evaluation Module

1 Evaluation Module Overview

1.1 Introduction

This user's guide describes the function and use of the TAS2573EVM. This document includes the hardware configuration instructions, a quick-start guide, jumper and connector descriptions, software overview, schematics, and printed circuit board (PCB) layout that demonstrate TI's recommended practices for this device.

This section provides details on what is included inside the evaluation module box, what are TAS2573 capabilities and operation ranges, as well as what is the additional test equipment that can be required for a full audio evaluation.

1.2 Kit Contents

The evaluation kit includes TAS2573EVM. This board must be paired with an AC-MB controller board.

A speaker is included in the kit, the default settings in PPC3 are designed to drive this speaker. However, any speaker can be connected to each of the amplifier outputs using the banana jacks or screw headers. Note that for peak performance the new speaker must be characterized first.

Similarly, a power supply is not part of the kit, but the barrel jack connector can be connected to any power supply in a range of 2.4V to 5.5V.

1.3 Specification

The TAS2573 is a digital input Class-D audio amplifier designed for delivering best battery life for real use cases of music playback and voice calls. The integrated boost operation is flexible so that TAS2573 can be implemented in 1S, 2S and 3S battery applications. TAS2573EVM showcases the 1S battery broadly used in mobile and industrial applications.

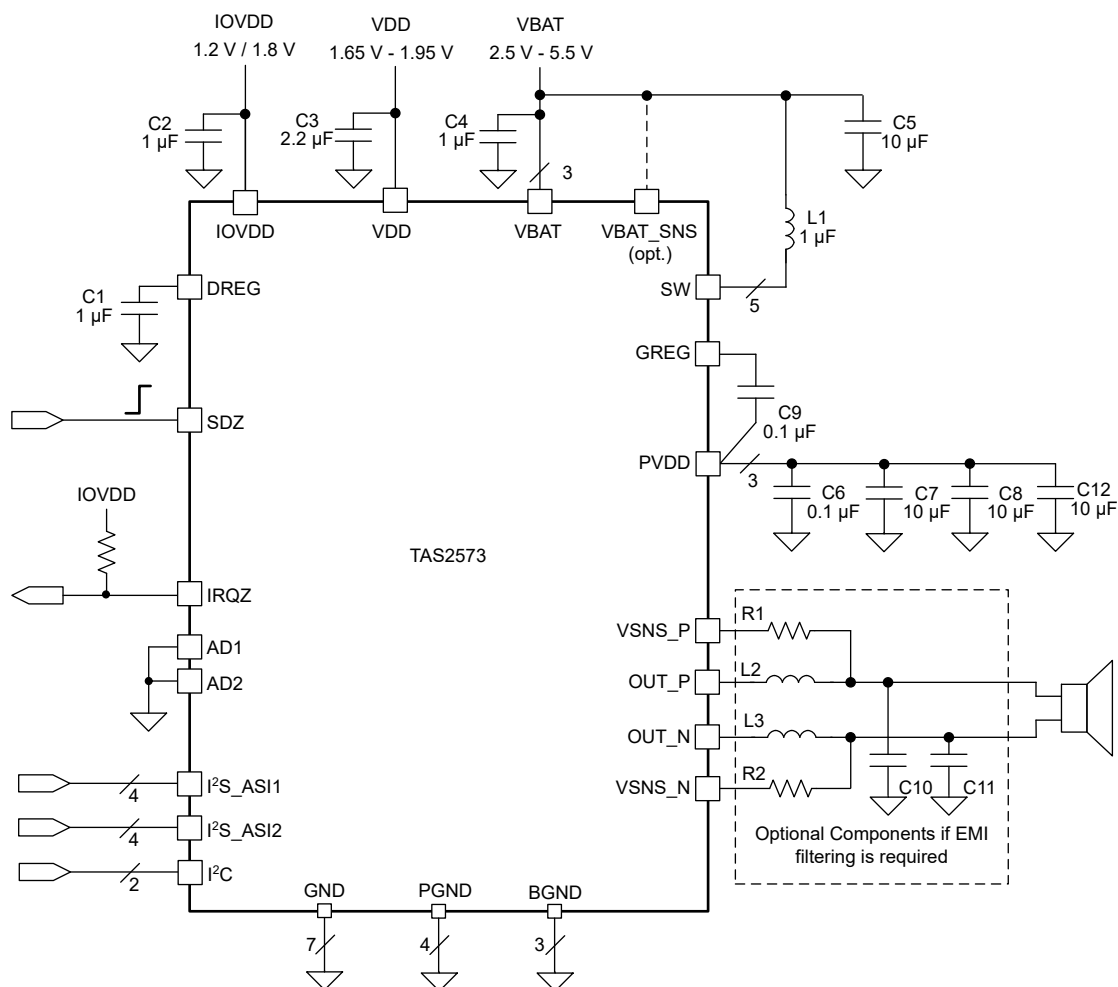


Figure 1-1. Application Diagram for 1S Battery System

For 2S battery applications, the boost inductor can be supplied by a higher supply from 4.5V to 9V. VBAT pin must still be supplied by a voltage from 2.5V to 5.5V.

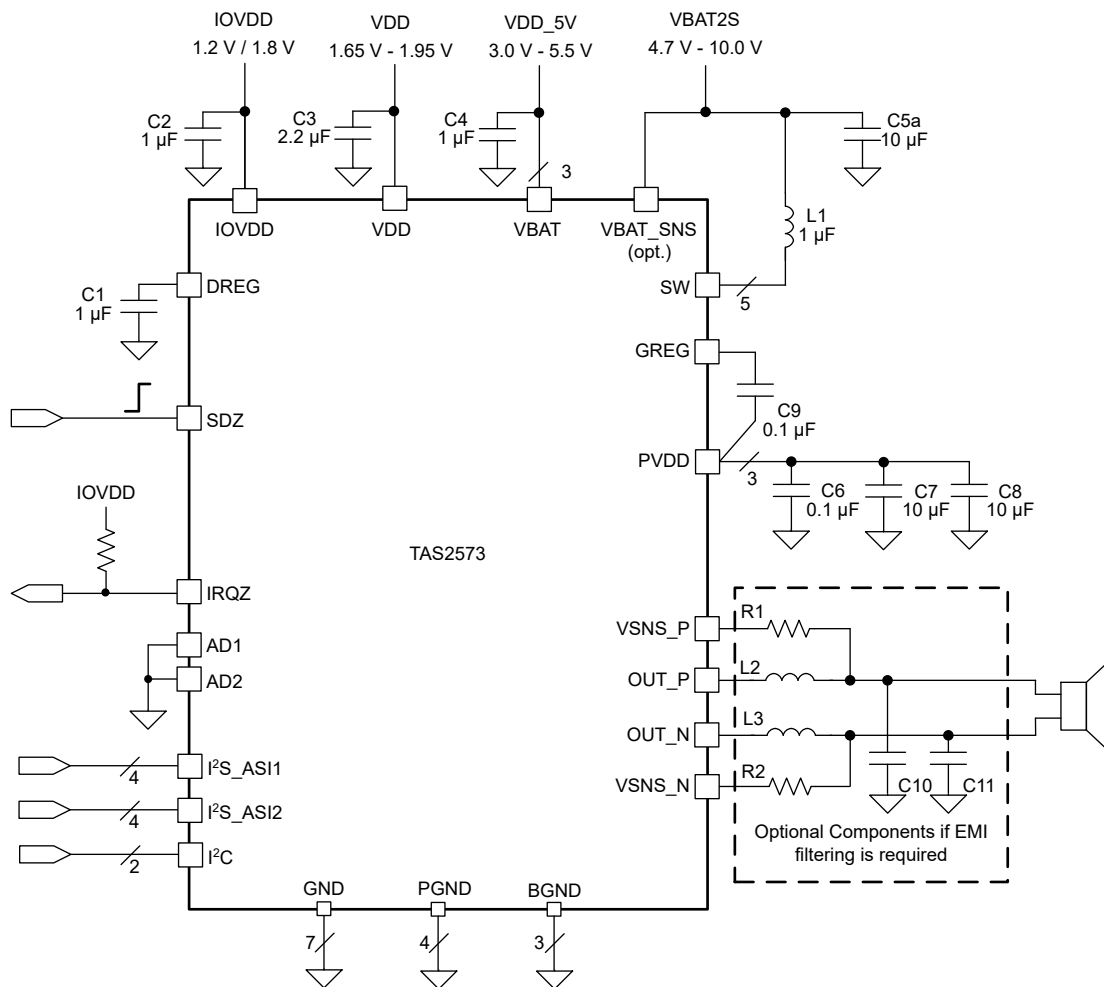


Figure 1-2. Application Diagram for 2S Battery System

In a 3S battery application, the integrated boost can be bypassed, and an external power rail up to 14V can supply PVDD directly. The boost inductor is not required in this case and SW pins are left open. VBAT pin must still be supplied by a voltage from 2.5V to 5.5V.

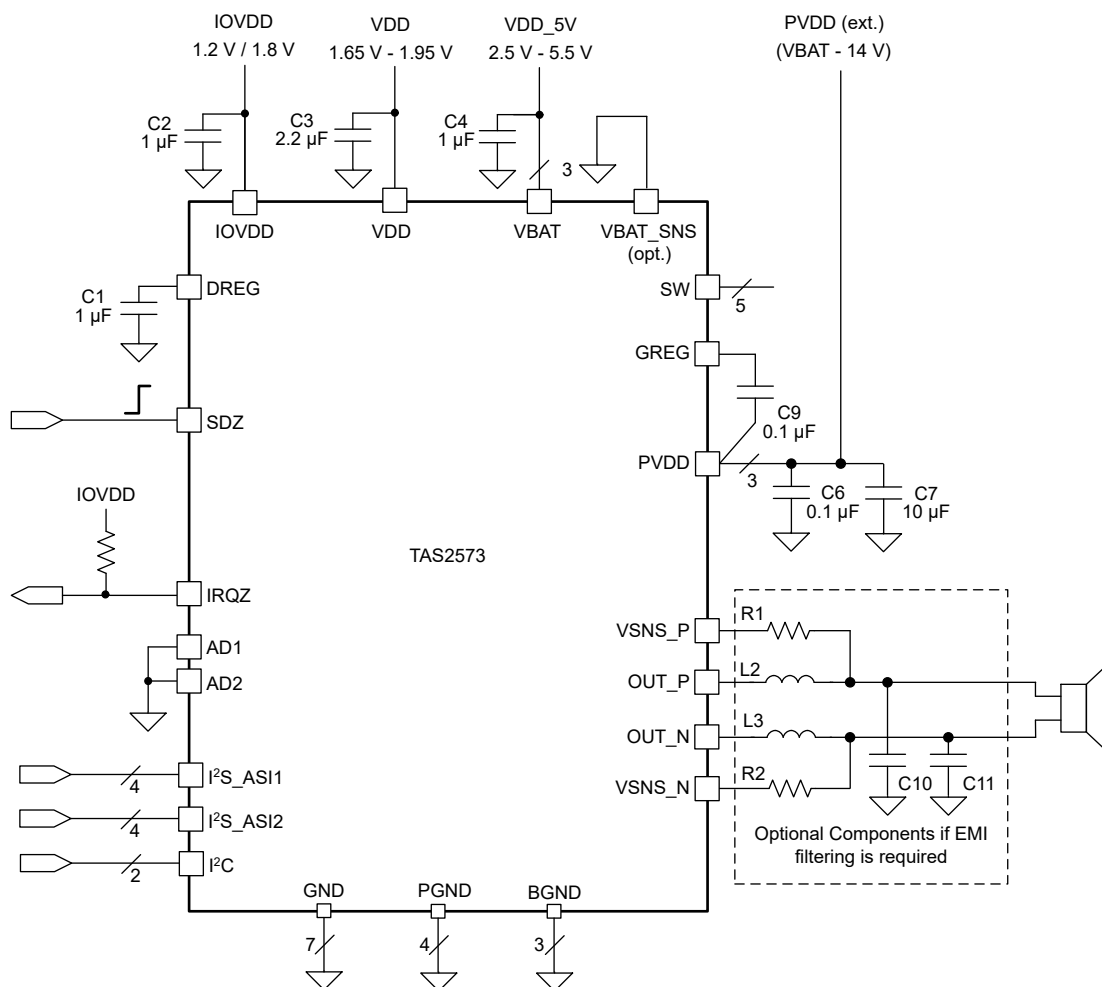


Figure 1-3. Application Diagram for 3S Battery System

1.4 Device Information

TAS2573 is a mono, digital-input, Class-D audio amplifier designed for efficiently driving high peak power into small loudspeaker applications. The Class-D amplifier can deliver 6W of max average power into 8Ω load at a battery voltage of 4.2V. Integrated speaker voltage and current sense provide real time monitoring of loudspeakers. Up to four devices can share a common bus through I²S/TDM and I²C interfaces.

2 Hardware

2.1 AC-MB Settings

2.1.1 Audio Serial Interface Settings

The AC-MB provides digital audio signals to the evaluation module from the USB, optical connector and external audio serial interface (ASI) header. [Figure 2-1](#) shows a block diagram of the ASI routing on the AC-MB.

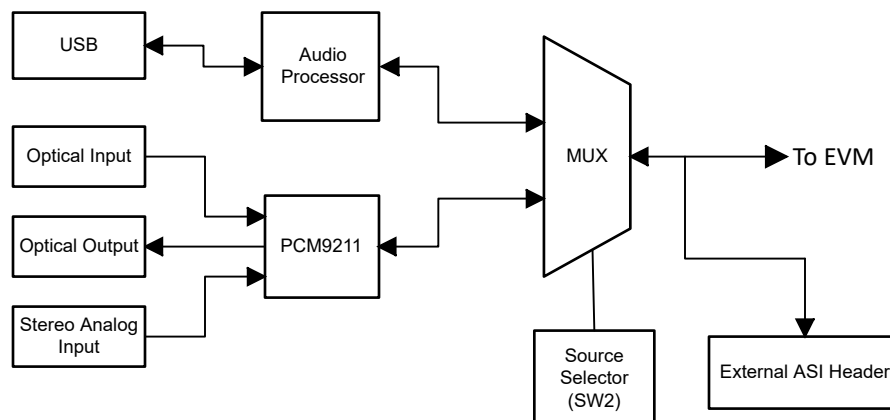


Figure 2-1. AC-MB Audio Serial Interface Routing

Switch SW2 on the AC-MB selects the audio serial bus that interfaces with the TAS2573EVM daughter card. Next to switch SW2, the AC-MB has a quick reference table to identify the audio serial interface source options and switch settings. The AC-MB acts as the controller for the audio serial interface, with three different modes of operation: USB, optical, or external ASI.

2.1.2 USB Control

The serial interface clocks and data are provided from the USB interface. The sampling rate and format are determined by the USB audio class driver on the operating system. The default settings for the USB audio interface are 32-bit frame size, 48kHz sampling rate, BCLK to FSYNC ratio is 256, and the format is time division multiplexing (TDM). The AC-MB is detected by the OS as an audio device with the name TI USB Audio UAC2.0. [Figure 2-2](#) shows the AC-MB audio setting for the USB mode of operation.

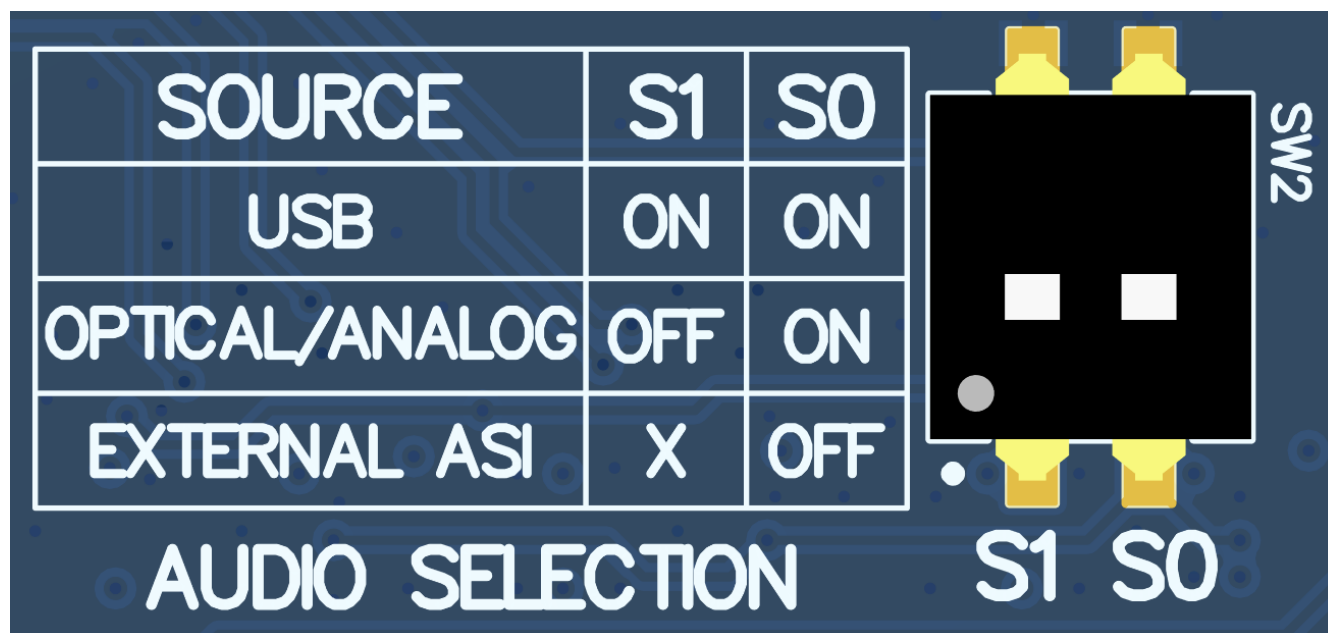


Figure 2-2. AC-MB USB Audio Setting

2.1.3 External Control

In this mode, the audio serial interface clocks for the evaluation board are provided through connector J7 from an external source. This architecture allows the use of an external system to communicate with the evaluation board, such as a different host processor or test equipment (for instance, Audio Precision PSIA). The clocks generated from the USB interface and PCM9211 are isolated with this setting. [Figure 2-3](#) shows the AC-MB audio setting for the external mode of operation.

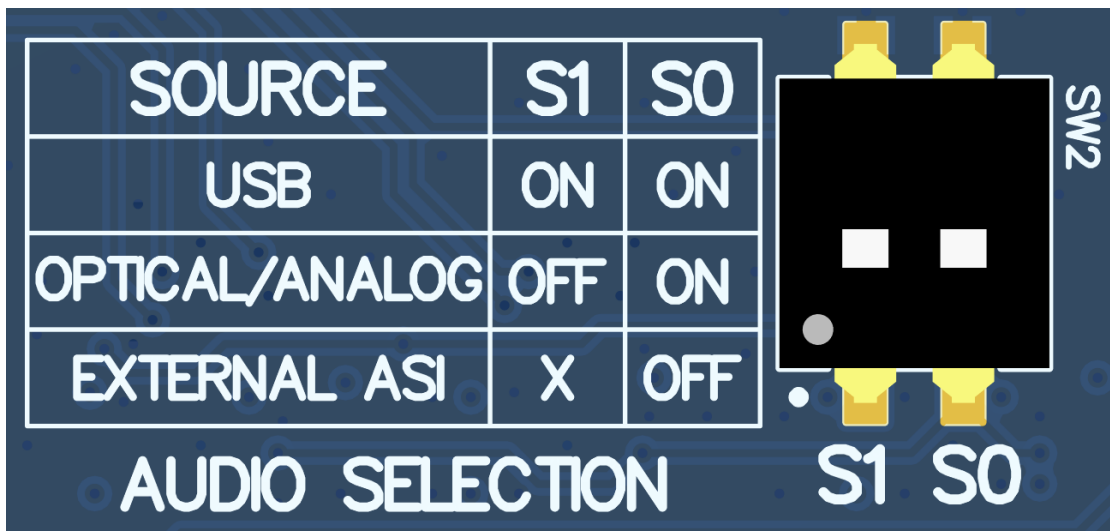


Figure 2-3. AC-MB External Audio Setting

[Figure 2-4](#) shows how to connect the external audio interface, with the bottom row for the signal and the top row for ground.

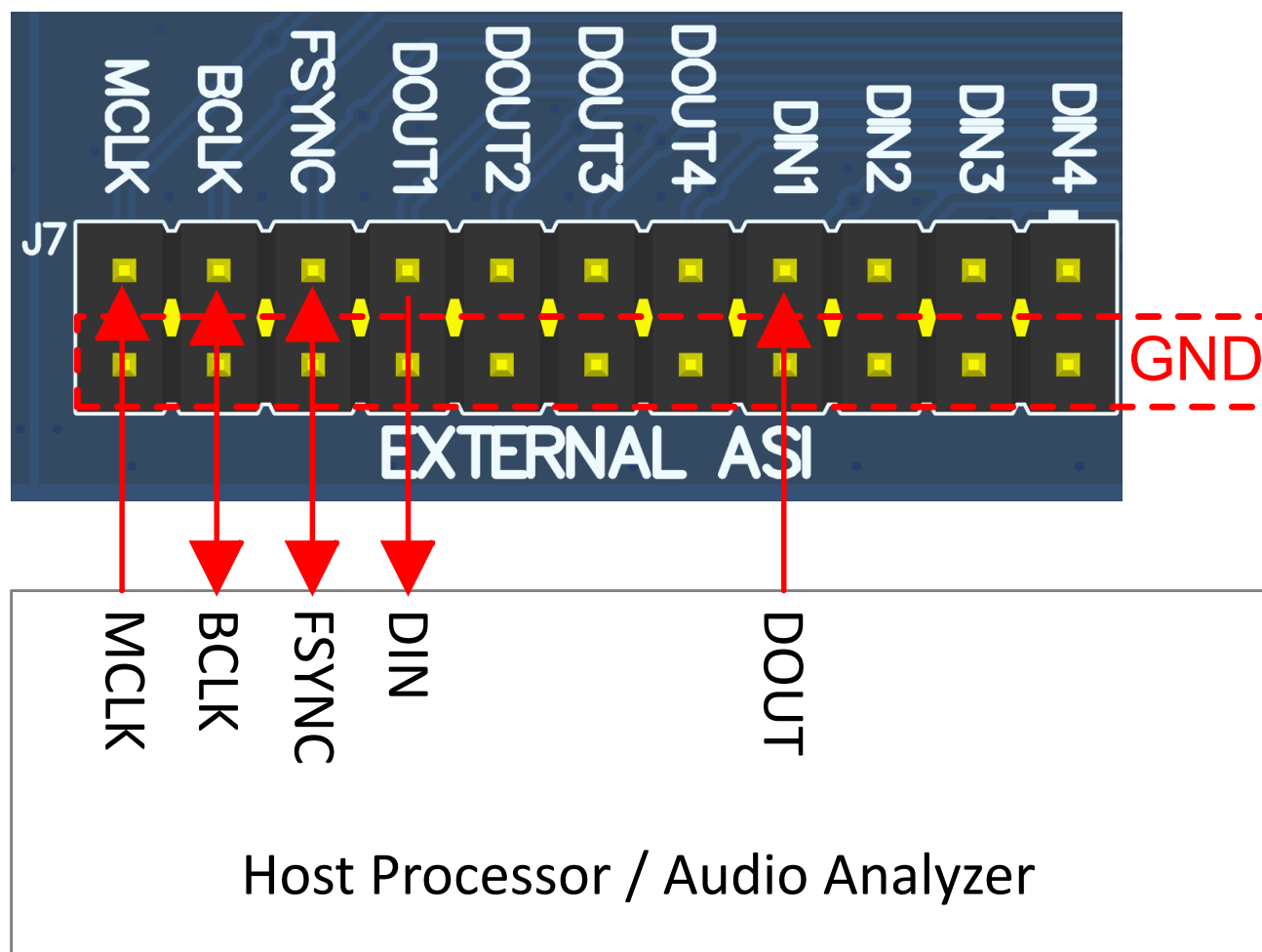


Figure 2-4. AC-MB Connection with External Audio Serial Interface

2.2 AC-MB Power Supply

The AC-MB motherboard is powered from a single 5V power supply. However, the motherboard has different low-dropout regulators (LDOs) integrated that provide the required power supplies to the different blocks of the board. [Figure 2-5](#) shows a block diagram depicting the power structure of the AC-MB. The AC-MB can be powered from the host computer by using the USB 5V power supply (VBUS) by shorting header J5, USB POWER. Additionally, the AC-MB can be powered from an external power supply connected to terminal J4, EXTERNAL POWER. Header J5 must be open for external supply operation. The IOVDD voltage for the digital signals that are provided to the evaluation module is generated on the motherboard from the main power supply (USB or external). The voltage levels available are 1.2V, 1.8V and 3.3V, and can be selected through the J3 header IOVDD. Default setting for TAS2573EVM operation is 1.8V; *3.3V operation cannot be used for TAS2573EVM*. When the motherboard is fully powered and the power supplies from the onboard LDOs are correct, the green POWER LED (D3) turns ON. The USB READY LED indicates that successful USB communication is established between the AC-MB and the host computer.

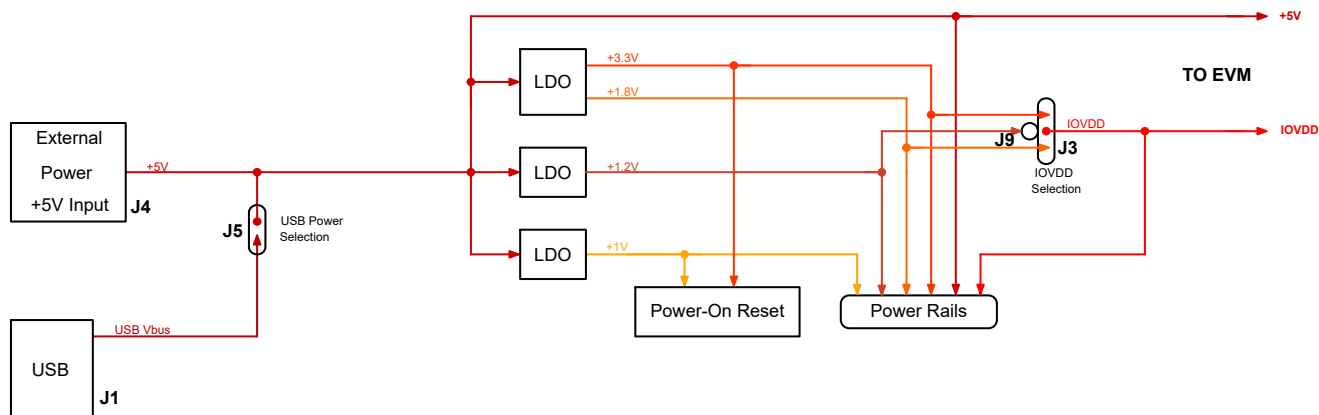


Figure 2-5. Power-Supply Distribution of the AC-MB

2.3 Default Jumper Settings on TAS2573EVM

Figure 2-6 given below illustrates all the default jumper settings for TAS2573EVM.

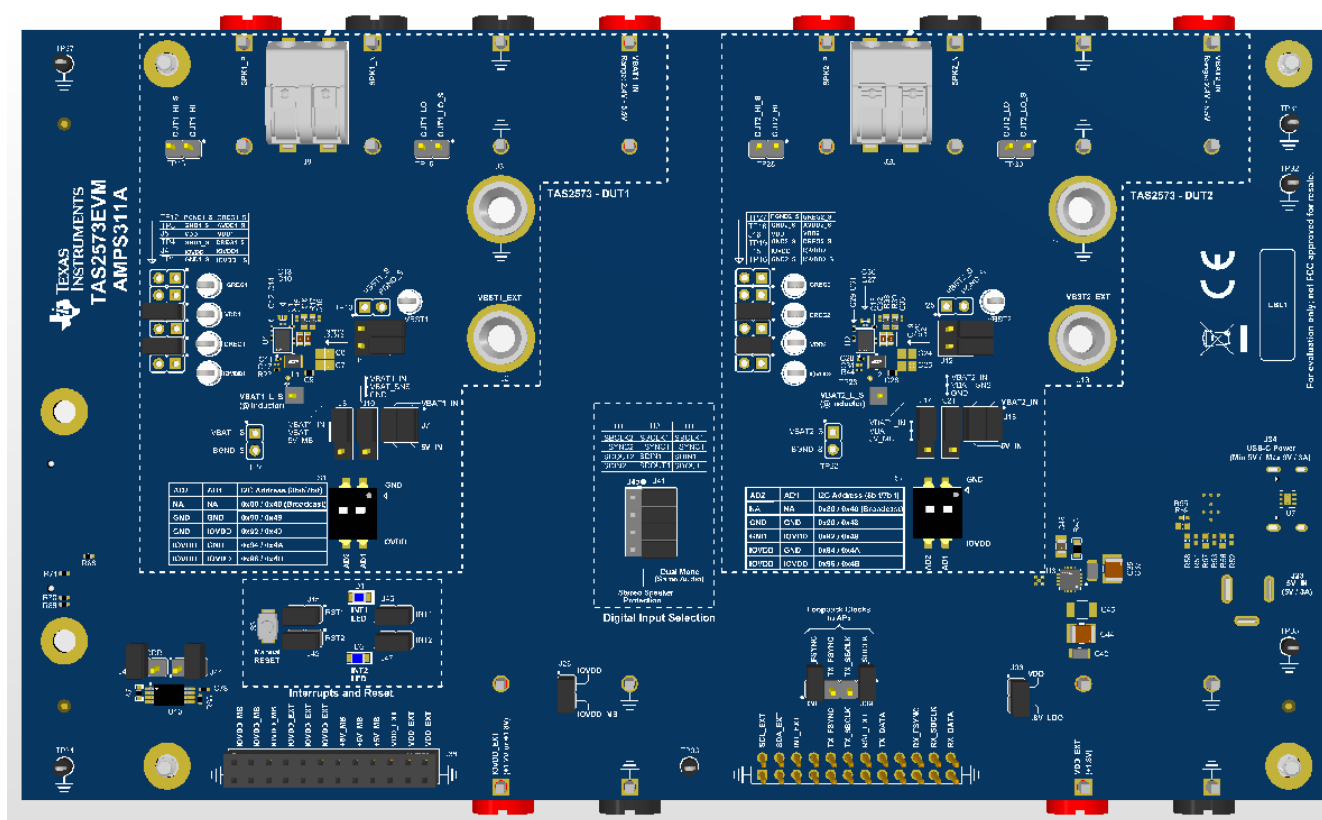


Figure 2-6. Default Jumper Settings

Table 2-1 shows the default positions for all the jumpers on TAS2573EVM.

Table 2-1. Default Jumper Settings

Jumper	Setting	Description
J4	Insert	IOVDD current sense for U1
J5	Insert	VDD current sense for U1
J1	DNI	External VBAT for U1
J6	Insert (1-2)	VBAT pin current sense for U1
J10	Insert (1-2)	VBAT_SNS selector for U1

Table 2-1. Default Jumper Settings (continued)

Jumper	Setting	Description
J7	Insert (double)	VBAT power selector for U1
J15	Insert	IOVDD current sense for U2
J16	Insert	VDD current sense for U2
J12	DNI	External VBST for U2
J17	Insert (1-2)	VBAT pin current sense for U2
J21	Insert (1-2)	VBAT_SNS selector for U2
J18	Insert (double)	VBAT power selector for U2
J40	DNI	Digital input selector 1
J41	Insert (1-2), (3-4), (5-6), (7-8)	Digital input selector 2
J42	DNI	EEPROM address selector
J44	Insert	EEPROM write protect
J45	Insert	RST break for U1
J43	Insert	RST break for U2
J46	Insert	INT break for U1
J47	Insert	INT break for U2
J26	Insert	IOVDD source selector
J33	Insert	VDD source selector
J38	DNI	FSYNC loopback for APx connection
J39	DNI	SBCLK loopback for APx connection

2.4 I²C Target Address Selection

TAS2573EVM has DIP switches S1 and S2 for setting the I²C target address for each channel individually as per the table provided in the silk screen of the PCB. Verify both the devices have different target addresses.

S1				
AD2	AD1	I2C Address (8bit/7bit)		
NA	NA	0x80 / 0x40 (Broadcast)		
GND	GND	0x00 / 0x48 0x98 / 0x4C		
GND	IOVDD	0x02 / 0x49 0x9A / 0x4D		
IOVDD	GND	0x04 / 0x4A 0x9C / 0x4E		
IOVDD	IOVDD	0x06 / 0x4B 0x9E / 0x4F		


Figure 2-7. DIP Switch S1-S2 for I2C Address Selection

2.5 IOVDD and VDD Power Supply Options on EVM

TAS2573EVM daughter card provides flexible options for IOVDD and VDD power supplies. There are options to select between internal or external voltage sources for each of these supplies individually.

IOVDD is the input/output power supply for TAS2573 device, which can be either 1.2V or 1.8V.

VDD is the analog power supply for TAS2573 device, which must be fixed 1.8V.

By default, 1.8V coming from the AC-MB motherboard (IOVDD_MB) has been selected for IOVDD. VDD is powered from an on-board 1.8V LDO (1.8V_LDO).

If an external supply is to be used, simply remove J26-IOVDD or J33-VDD, and connect the voltage source to J24-IOVDD or J27-VDD.

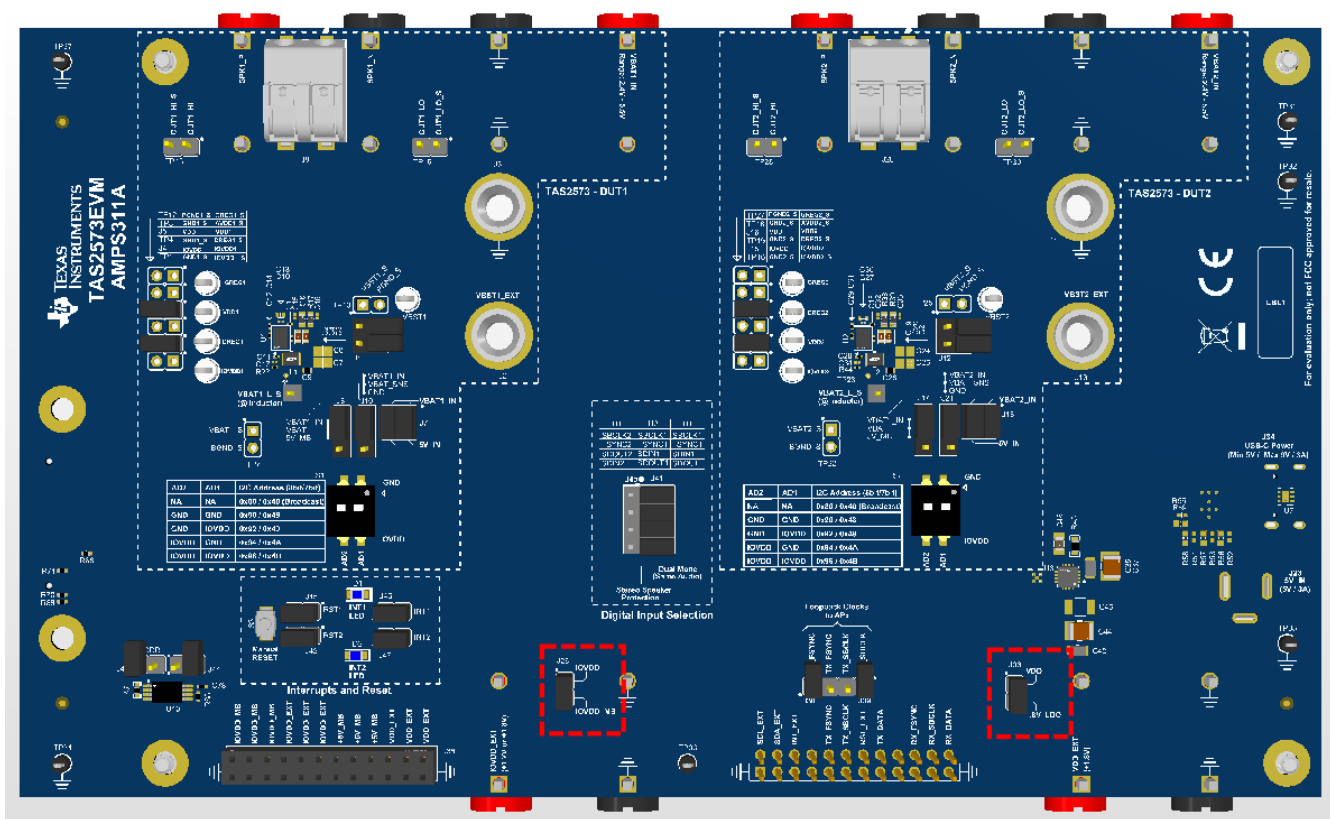


Figure 2-8. IOVDD and VDD Power Selection Jumpers

2.6 VBAT Power Supply for TAS2573 on EVM

By default, the barrel jack connector J23 is used to power VBAT on both TAS2573 channels. Supply 3.6V to 5.5V on this connector.

Alternatively, independent connectors can be used for the external VBAT supply for both the channels – VBAT1_IN and VBAT2_IN. Jumpers J7 must be open to disconnect VBAT to VBAT1_IN from J23 input, and similarly J18 must be open to disconnect VBAT to VBAT2_IN from J23 input.

For channel-1, external VBAT1_IN can be connected between connectors J28 and J31 (or J3) as shown in [Figure 2-9](#).

For channel-2, external VBAT2_IN can be connected between connectors J32 and J29 (or J14) as shown in [Figure 2-9](#).

Note

J23 barrel jack (5V_IN) must always be powered regardless of J7 and J18 jumpers inserted or not to power U1 and U2.

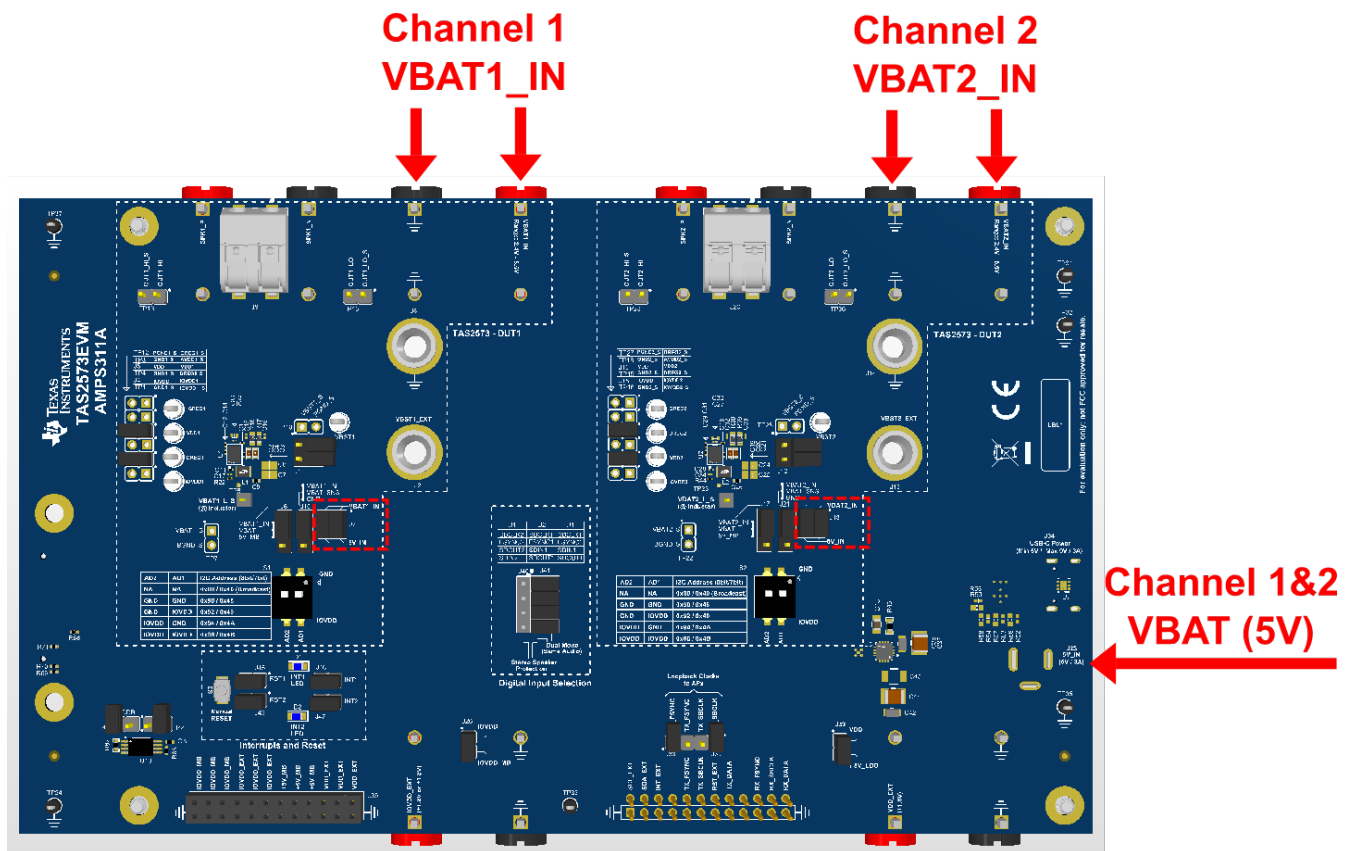


Figure 2-9. VBAT Connector for Channel-1 and Channel-2

2.6.1 VBAT 2S EVM Hardware Configuration

This section shows how to set the EVM jumpers to evaluate TAS2573EVM in a 2S battery application for VBAT, as depicted in [Figure 1-2](#).

In this case, VBAT pins C1, C2 and C3 must still be connected to a power supply range from 3V up to 5V, while VBAT_SNS and the boost inductor can be connected to a higher 2S supply range from 4.5V up to 9V.

- VBAT pins C1, C2 and C3 connection can be connected to USB-5V by changing J6 position to 2-3 instead of 1-2.
- VBAT_SNS pin C6 connection can be modified using J10, this connection is optional.
- 2S VBAT supply is directly available at J28 and J31 (or J3) for channel-1 and J32 and J29 (or J14) for channel-2.

2.6.2 VBAT 3S (External PVDD) EVM Hardware Configuration

This section shows how to set the EVM jumpers to evaluate TAS2573EVM in a 3S battery (external PVDD) application as depicted in [Figure 1-3](#).

VBAT pins C1, C2 and C3 must still be connected to a power supply range from 3V up to 5V. VBAT_SNS cannot be used, so VBAT_SNS must be shorted to GND. The internal boost is not used, so the SW pins are left floating, and the inductor can be removed from the circuit.

3S battery supply range from VBAT pin C1, C2 and C3 level up to 14V is directly connected to PVDD node, the decoupling capacitors and GREG capacitor are still required.

- VBAT pins C1, C2 and C3 connection can be connected to USB-5V by changing J6 position to 2-3 instead of 1-2.
- VBAT_SNS pin C6 must be connected to GND with J10 shorted across pins 2-3.
- 3S battery supply must be connected to J2 for channel-1 and J13 for channel-2, short the jumpers across J1 and J12.

2.7 Speaker Outputs

Since TAS2573EVM is a dual-mono EVM, each channel has a speaker output connector.

SPK1_P and SPK1_N are the outputs for channel-1 device, whereas SPK2_P and SPK2_N are the outputs for channel-2. Two different types of connectors have been provided: horizontal banana connectors and push horizontal sockets, to be able to connect speaker or dummy load with fly-wires or male banana connectors. These can also be used to connect to an audio analyzer analog input cable for performance measurements.

Channel-1 output connectors as shown in Figure 2-10:

- J8 (SPK1_P) and J11 (SPK1_N)
- J9 (SPK1_P and SPK1_N)

Channel-2 output connectors as shown in Figure 2-10:

- J19 (SPK2_P) and J22 (SPK2_N)
- J20 (SPK2_P and SPK2_N)

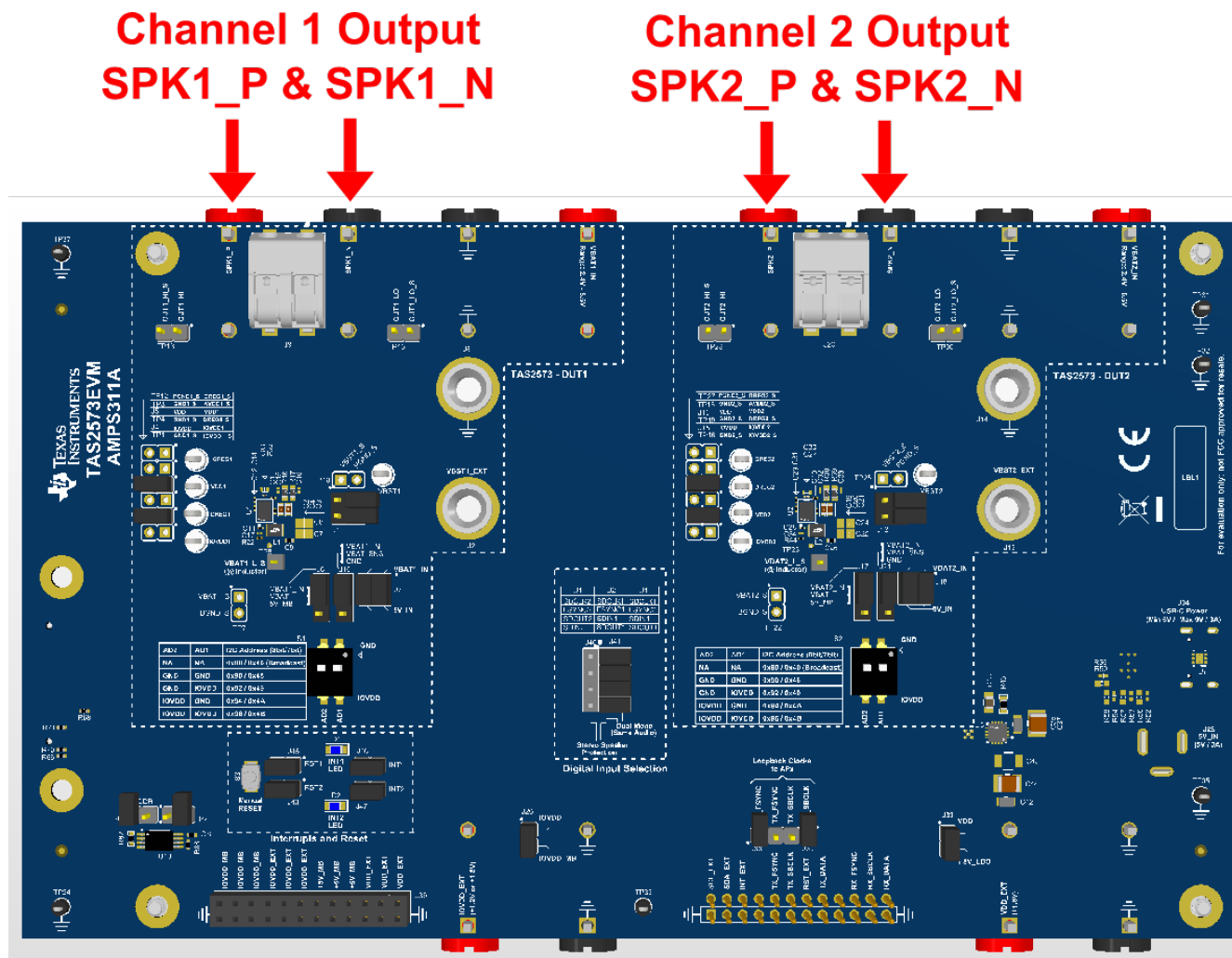


Figure 2-10. Speaker Output Connector for Channel-1 and Channel-2

2.8 1-Channel Configuration

When only 1 of the amplifiers on the TAS2573EVM is required, the other device can be removed from the circuit. This section includes instructions on how to disconnect U2, however the same procedure can be applied to disconnect U1.

- J18 jumpers must be removed to disconnect VBAT supply from the boost inductor L2.

- J17 and J21 must be removed to disconnect VBAT and VBAT_SNS pins respectively.
- J15 and J16 to the left of U2 must be disconnected as well. This removes IOVDD and VDD supplies.
- Removing jumpers from J40/J41 is optional to disconnect the ASI digital signals, however this can only be done to remove U2 as U1 is always connected to the ASI signal source from AC-MB.

2.9 4-Channel Configuration

Two dual-mono EVMs can be interconnected using J35 and J36 headers, mounting one EVM on top of another. This enables the evaluation of a total of four audio channels. When two EVMs are interconnected, the following jumper configuration must be considered:

- Short jumper J42 on one of the EVMs, this jumper is open by default.

In addition to the jumper configurations, verify each amplifier is set for a different I2C address using S1 and S2 on each EVM.

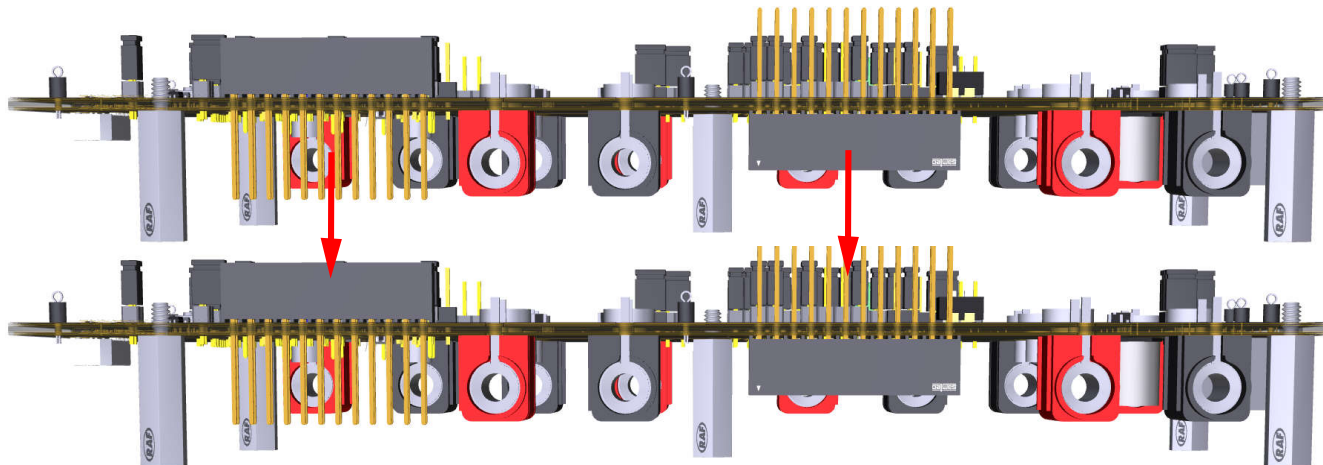


Figure 2-11. 4-Channel EVM Interconnection

2.10 4-Wire Measurement of Load

TAS2573EVM has been designed such that the dummy load or speaker load connected to the device can be measured very accurately directly from the device pin including board parasitic and connector contact resistance using 4-wire method in digital multimeter. Pin headers have been provided to be able to connect digital multimeter in 4-wire mode as shown in [Figure 2-12](#).

For channel-1: Connect HI of DMM to pin-1 and HI_SNS of DMM to pin-2 of TP13 test point.

Connect LO of DMM to pin-2 and LO_SNS of DMM to pin-1 of TP15 test point.

For channel-2: Connect HI of DMM to pin-1 and HI_SNS of DMM to pin-2 of TP28 test point.

Connect LO of DMM to pin-2 and LO_SNS of DMM to pin-1 of TP30 test point.

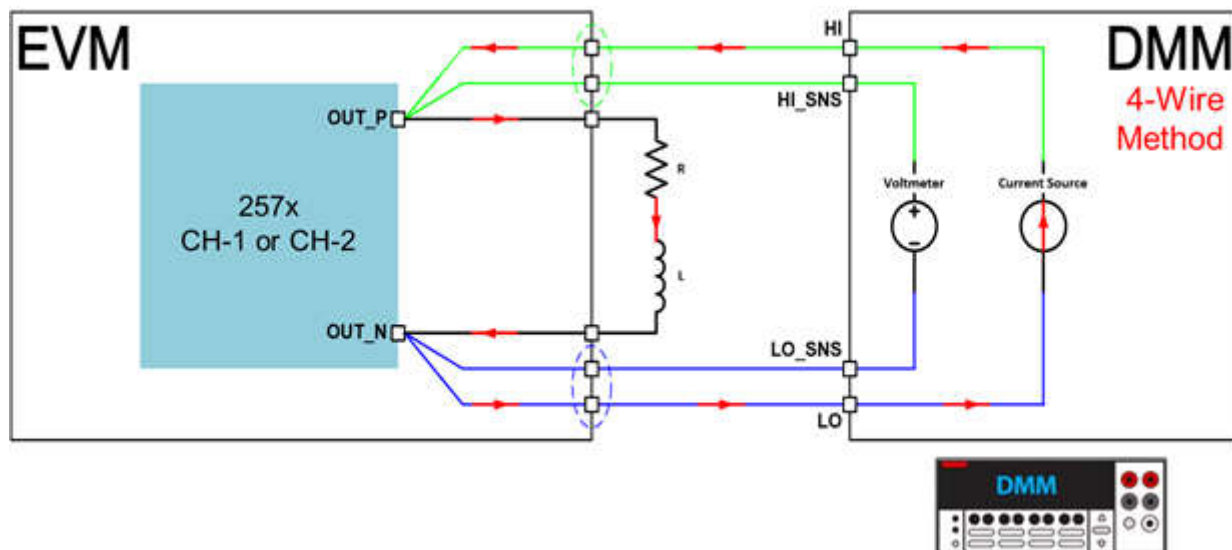


Figure 2-12. Load DC Resistance Measurement in 4-Wire Mode Using Digital Multimeter

2.11 Jumper Settings Quick Reference

Table 2-2. Jumper Settings Quick Reference

Jumper	Description	1S Boost Mode	2S Boost Mode	Ext PVDD
J4	IOVDD current sense for U1	Insert	Insert	Insert
J5	VDD current sense for U1	Insert	Insert	Insert
J1	External VBST for U1	DNI	DNI	Insert (double)
J6	VBAT pin current sense for U1	Insert (1-2)	Insert (2-3)	Insert (1-2)
J10	VBAT_SNS selector for U1	Insert (1-2)	Insert (1-2)	Insert (2-3)
J7	VBAT power selector for U1	Insert (double)	DNI	Insert (double)
J15	IOVDD current sense for U2	Insert	Insert	Insert
J16	VDD current sense for U2	Insert	Insert	Insert
J12	External VBST for U2	DNI	DNI	Insert (double)
J17	VBAT pin current sense for U2	Insert (1-2)	Insert (2-3)	Insert (1-2)
J21	VBAT_SNS selector for U2	Insert (1-2)	Insert (1-2)	Insert (2-3)
J18	VBAT power selector for U2	Insert (double)	DNI	Insert (double)
J40	Digital input selector 1	DNI	DNI	DNI
J41	Digital input selector 2	Insert (1-2), (3-4), (5-6), (7-8)	Insert (1-2), (3-4), (5-6), (7-8)	Insert (1-2), (3-4), (5-6), (7-8)
J42	EEPROM address selector	Insert	Insert	Insert
J44	EEPROM write protect	DNI	DNI	DNI
J45	RST break for U1	Insert	Insert	Insert
J43	RST break for U2	Insert	Insert	Insert
J46	INT break for U1	Insert	Insert	Insert
J47	INT break for U2	Insert	Insert	Insert
J26	IOVDD source selector	Insert	Insert	Insert
J33	VDD source selector	Insert	Insert	Insert
J38	FSYNC loopback for APx connection	DNI	DNI	DNI
J39	SBCLK loopback for APx connection	DNI	DNI	DNI

3 Hardware Design Files

3.1 Schematics

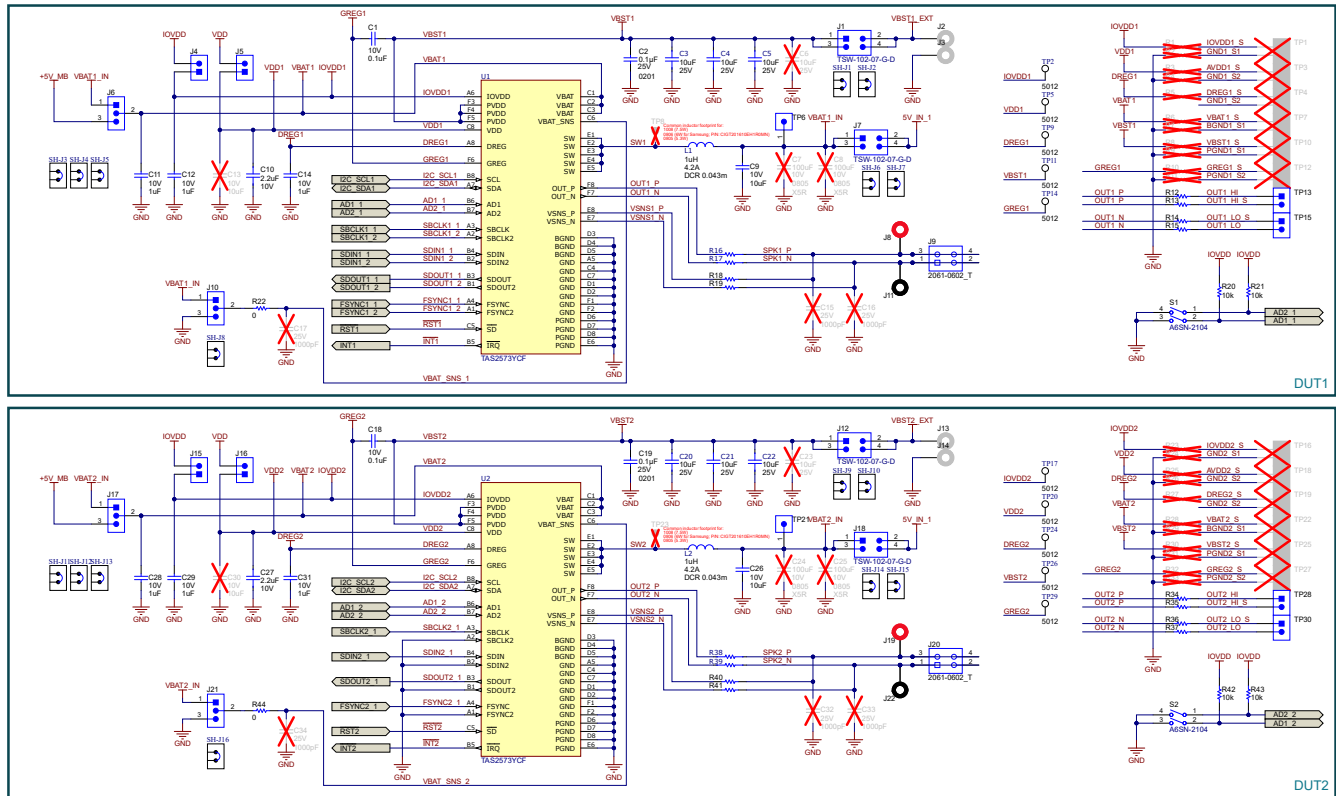


Figure 3-1. TAS2573EVM Schematic (Sheet 1 of 4)

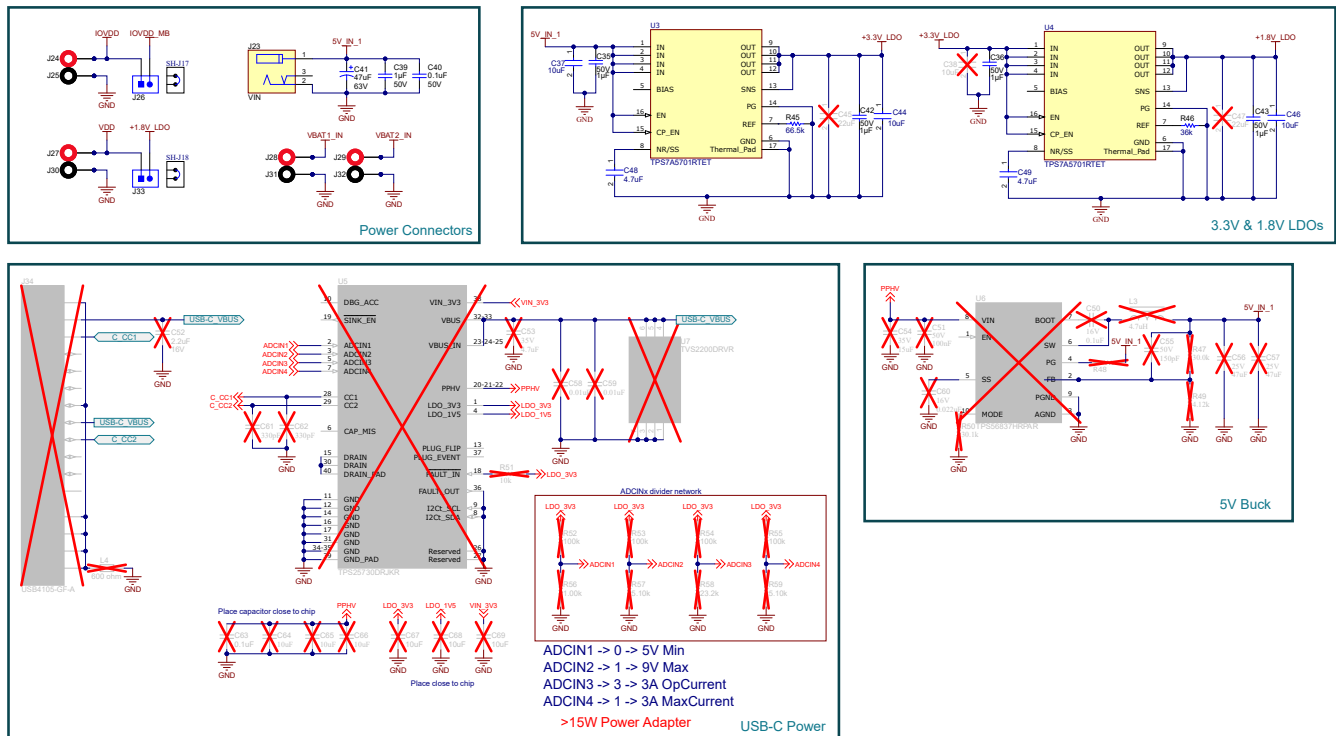


Figure 3-2. TAS2573EVM Schematic (Sheet 2 of 4)

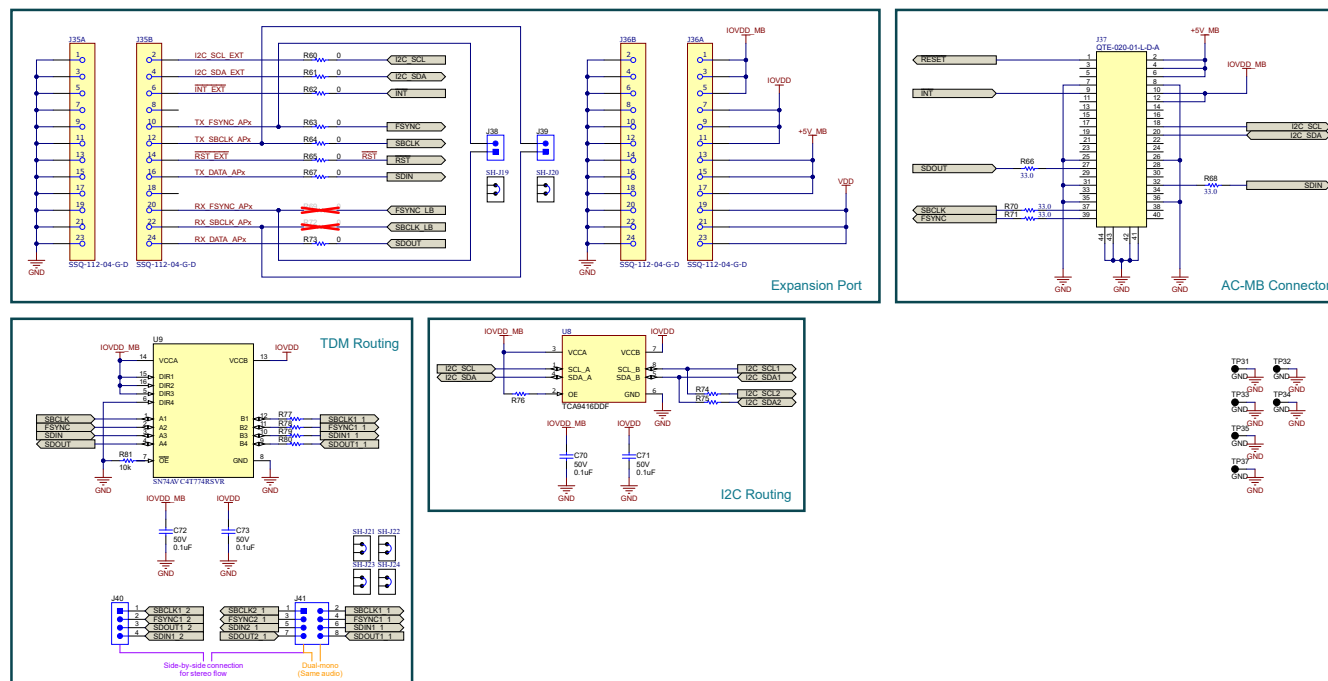


Figure 3-3. TAS2573EVM Schematic (Sheet 3 of 4)

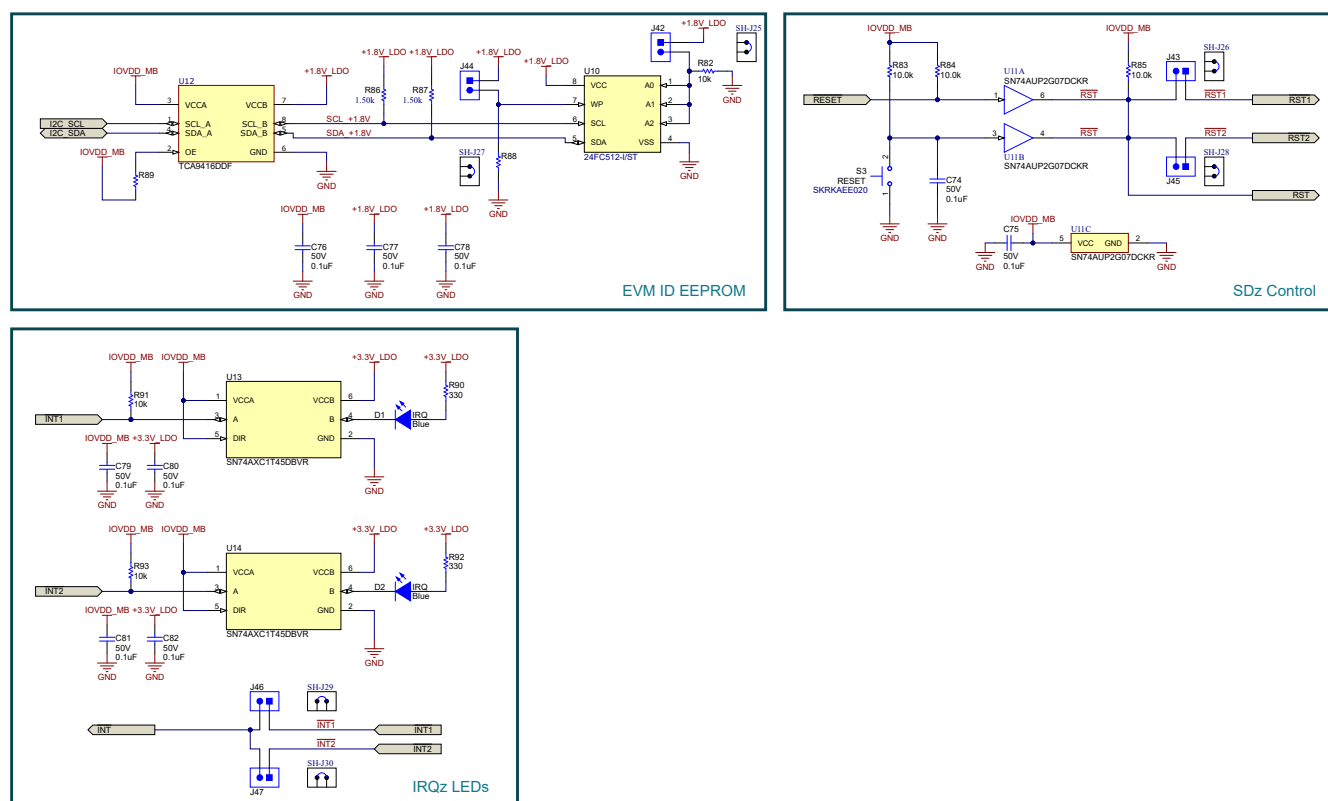


Figure 3-4. TAS2573EVM Schematic (Sheet 4 of 4)

3.2 PCB Layouts

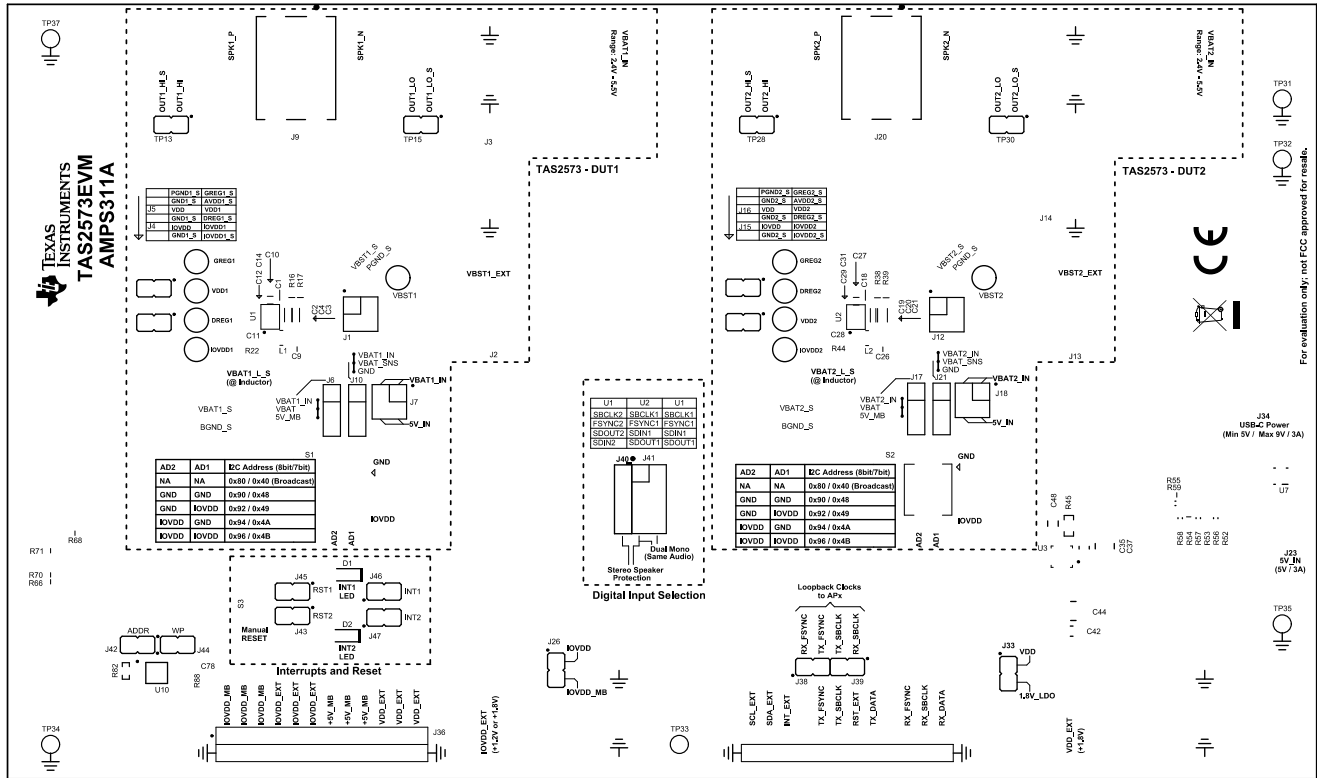


Figure 3-5. TAS2573EVM Top Overlay

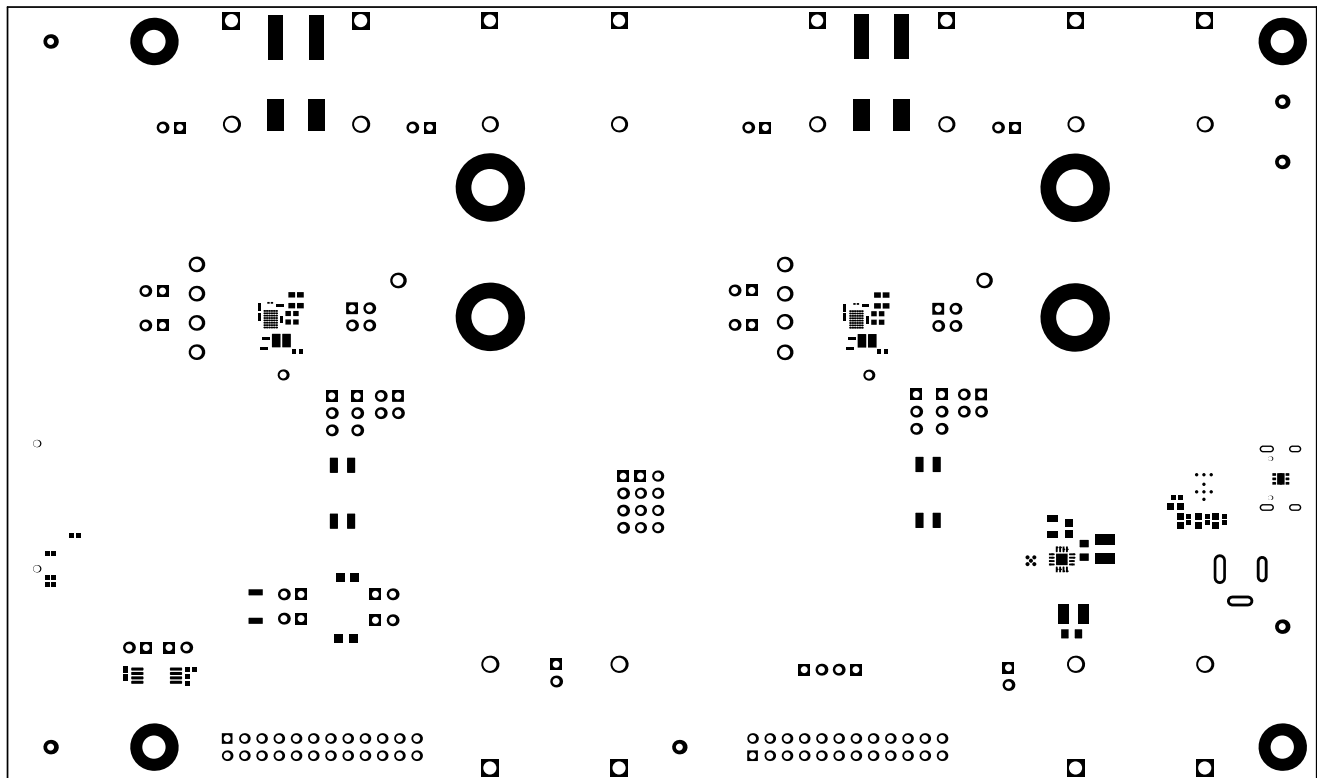


Figure 3-6. TAS2573EVM Top Solder Mask

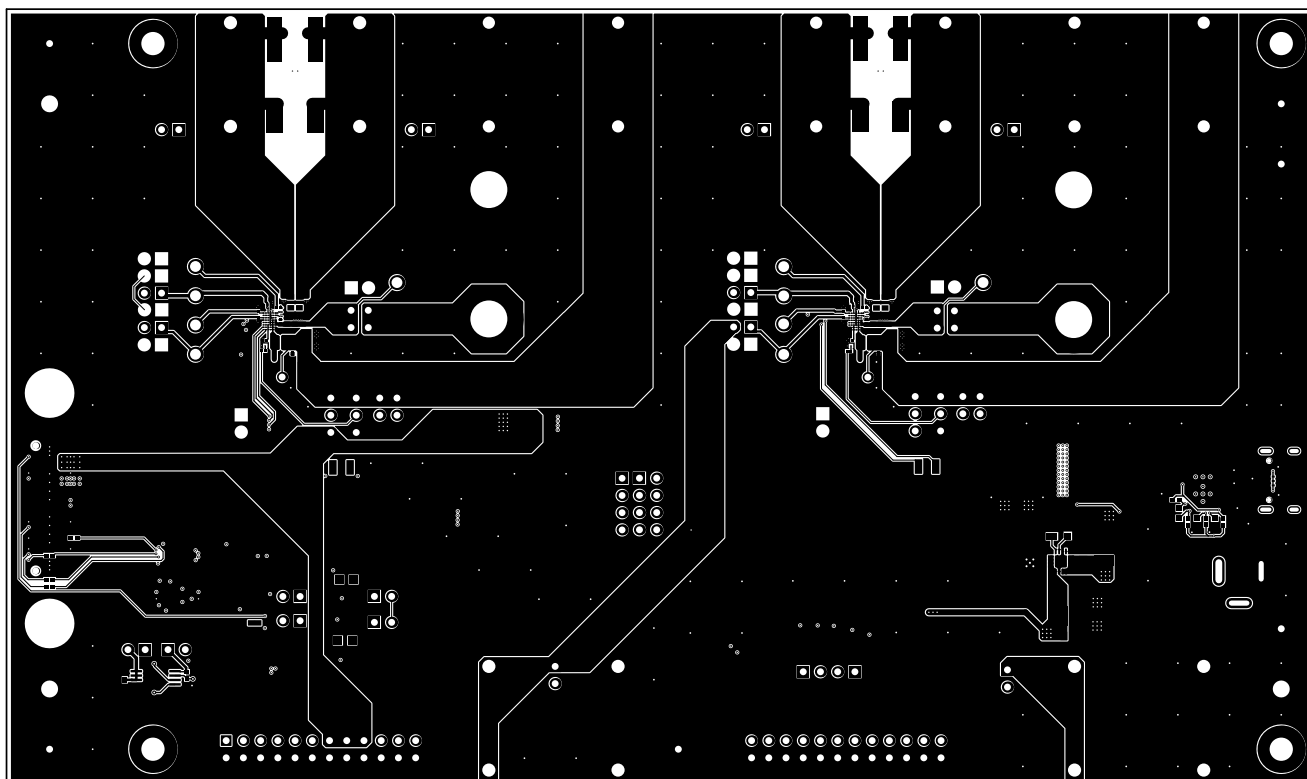


Figure 3-7. TAS2573EVM Top Layer

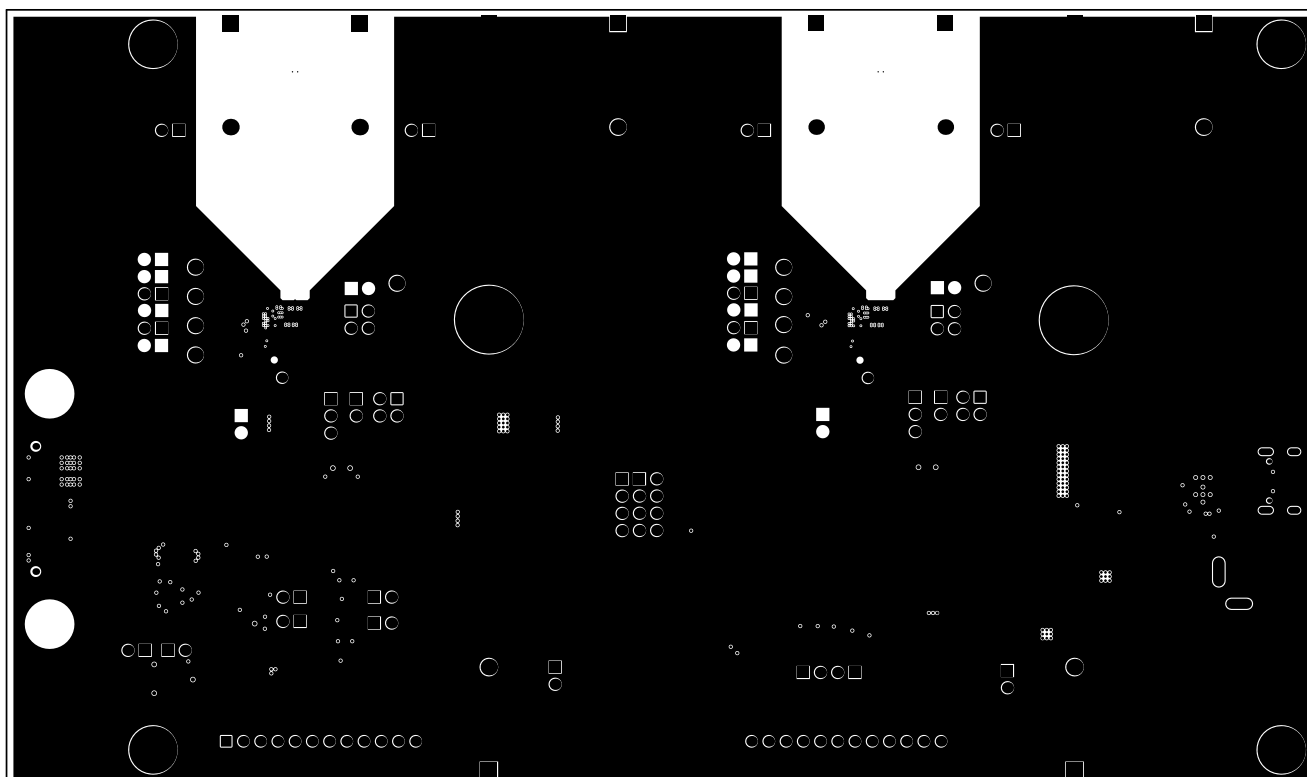
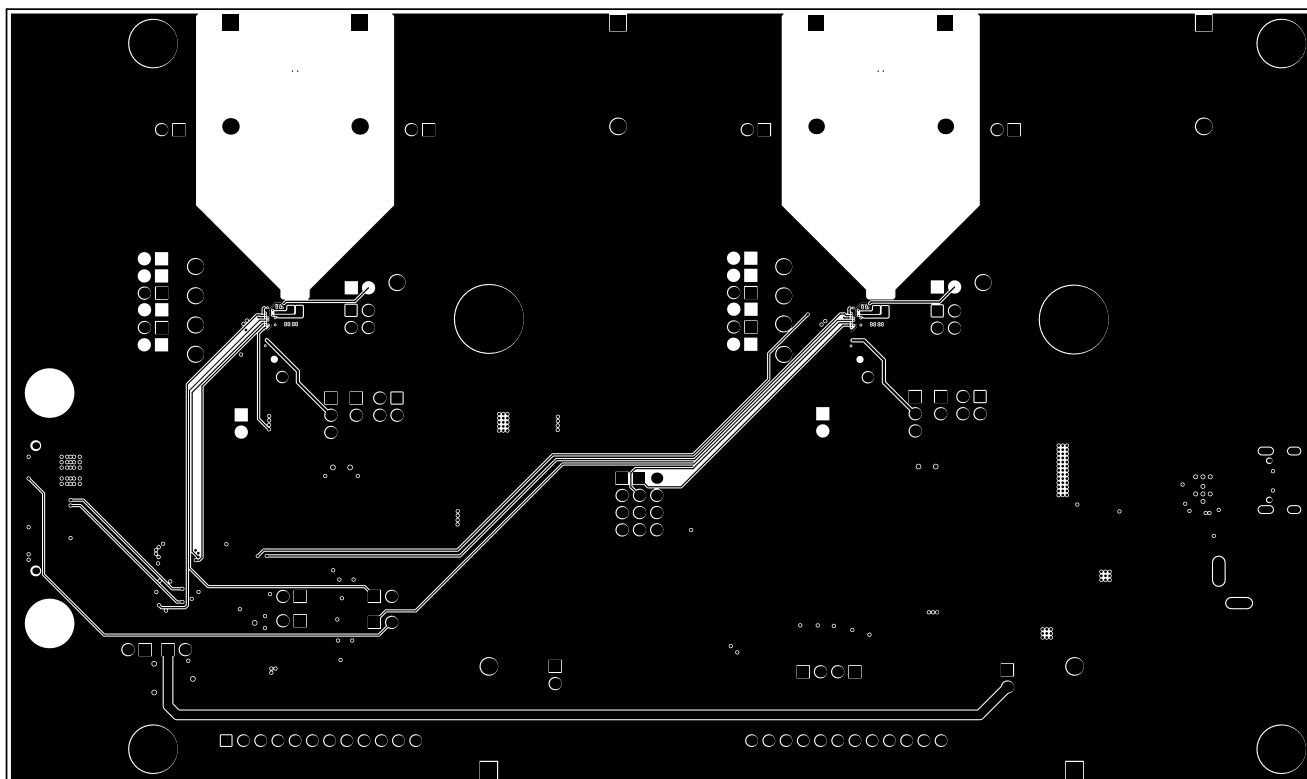
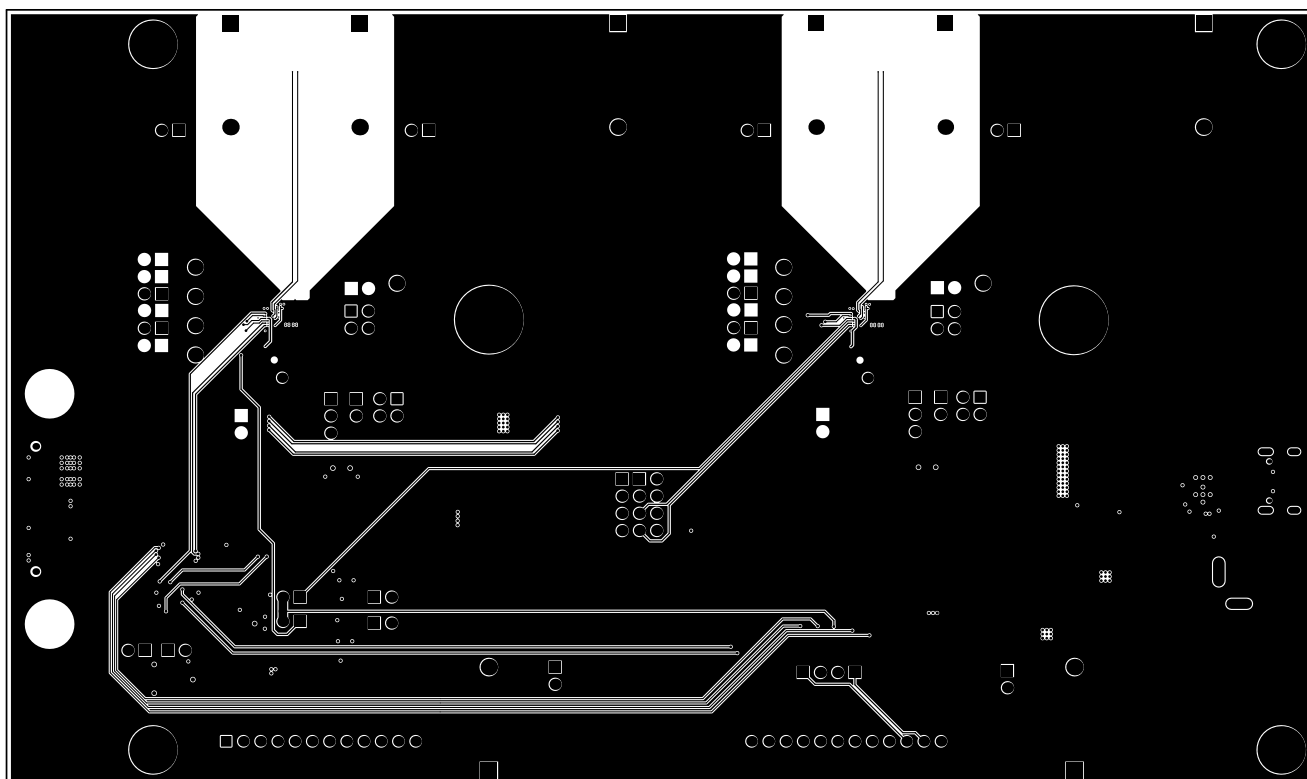


Figure 3-8. TAS2573EVM Layer 2

**Figure 3-9. TAS2573EVM Layer 3****Figure 3-10. TAS2573EVM Layer 4**

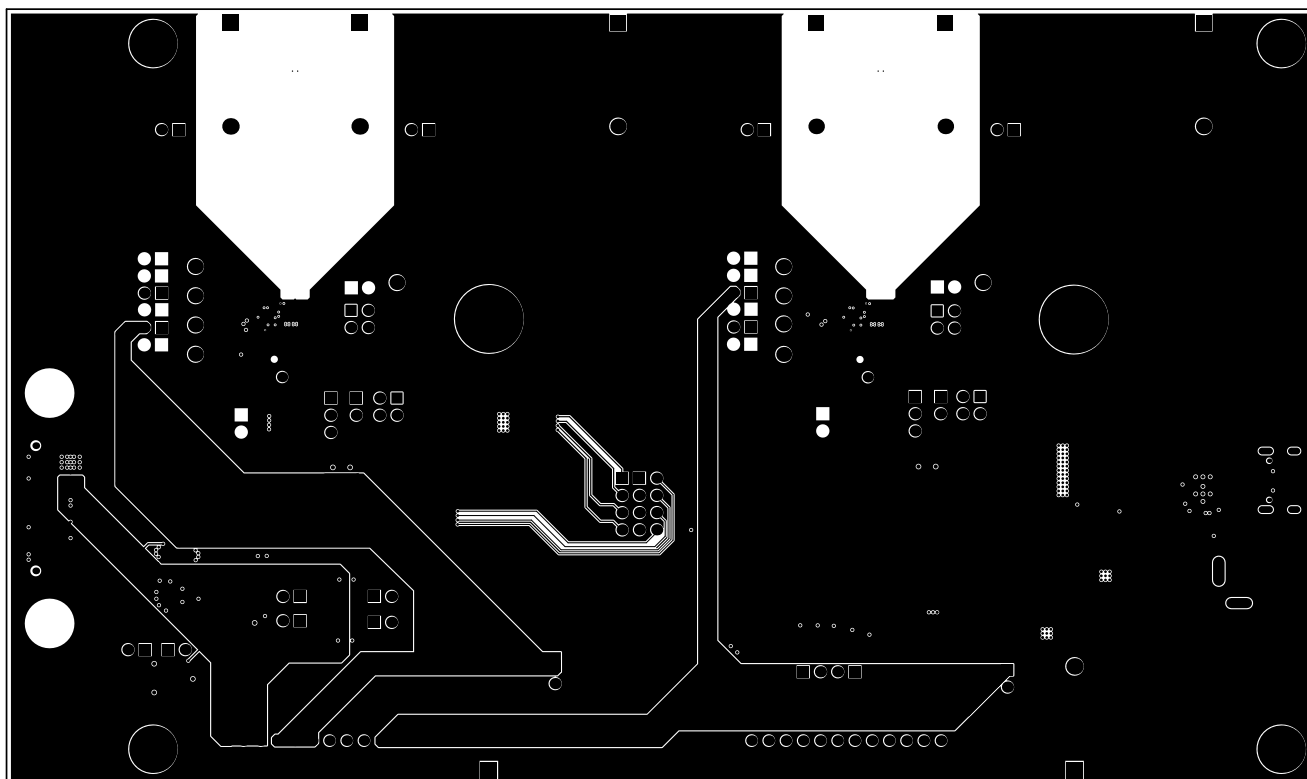


Figure 3-11. TAS2573EVM Layer 5

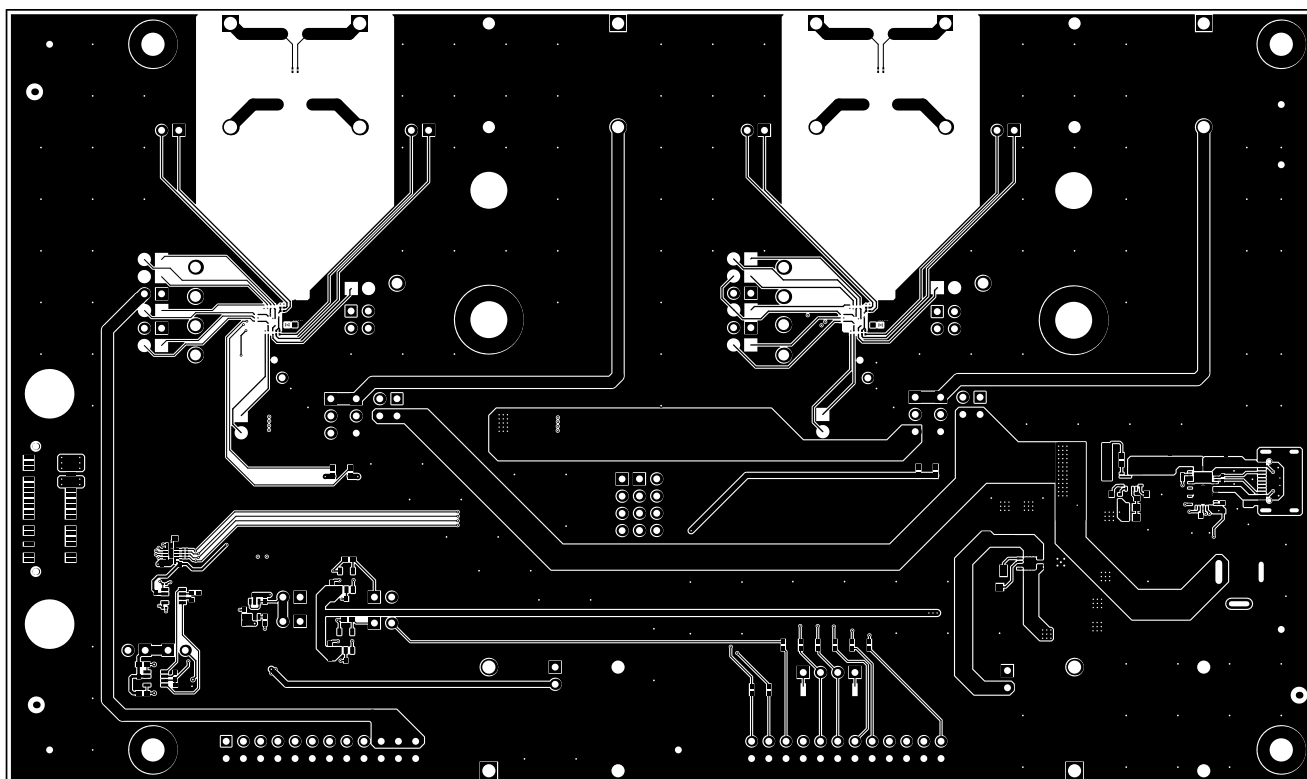


Figure 3-12. TAS2573EVM Bottom Layer

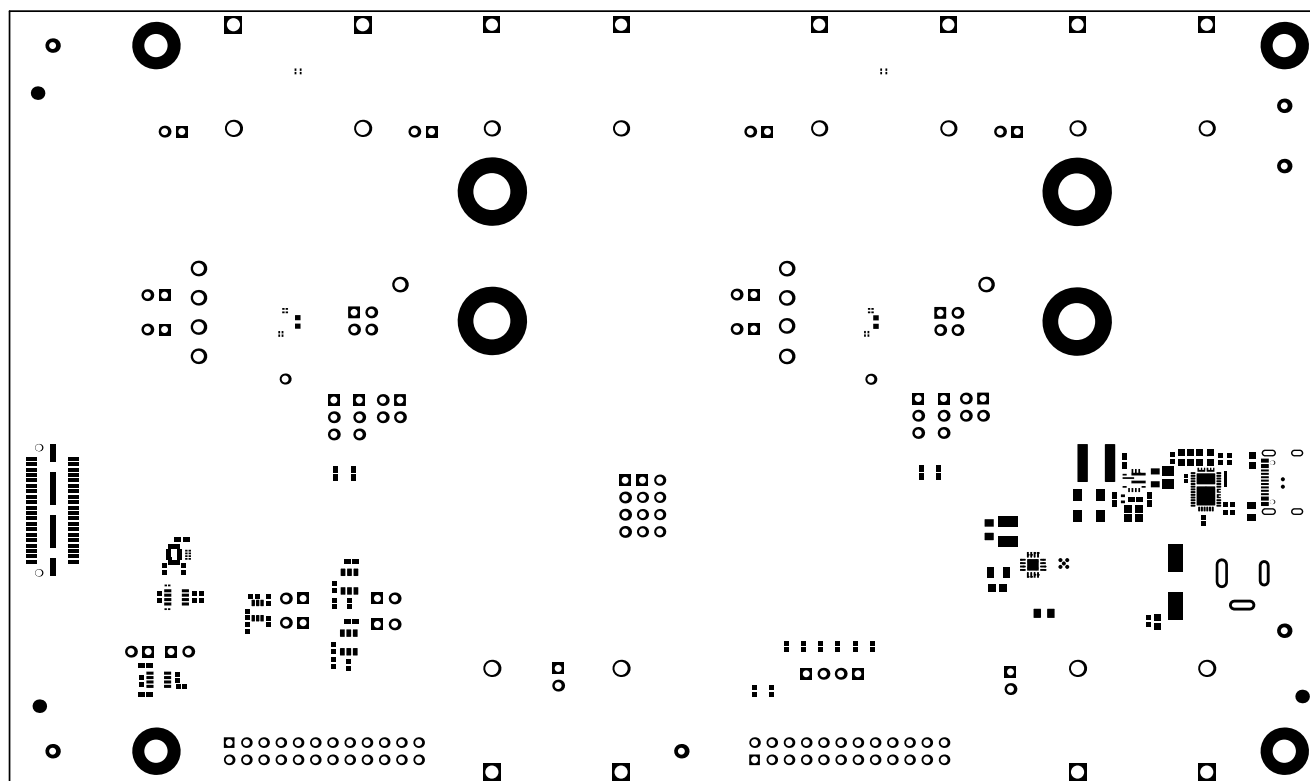


Figure 3-13. TAS2573EVM Bottom Solder Mask

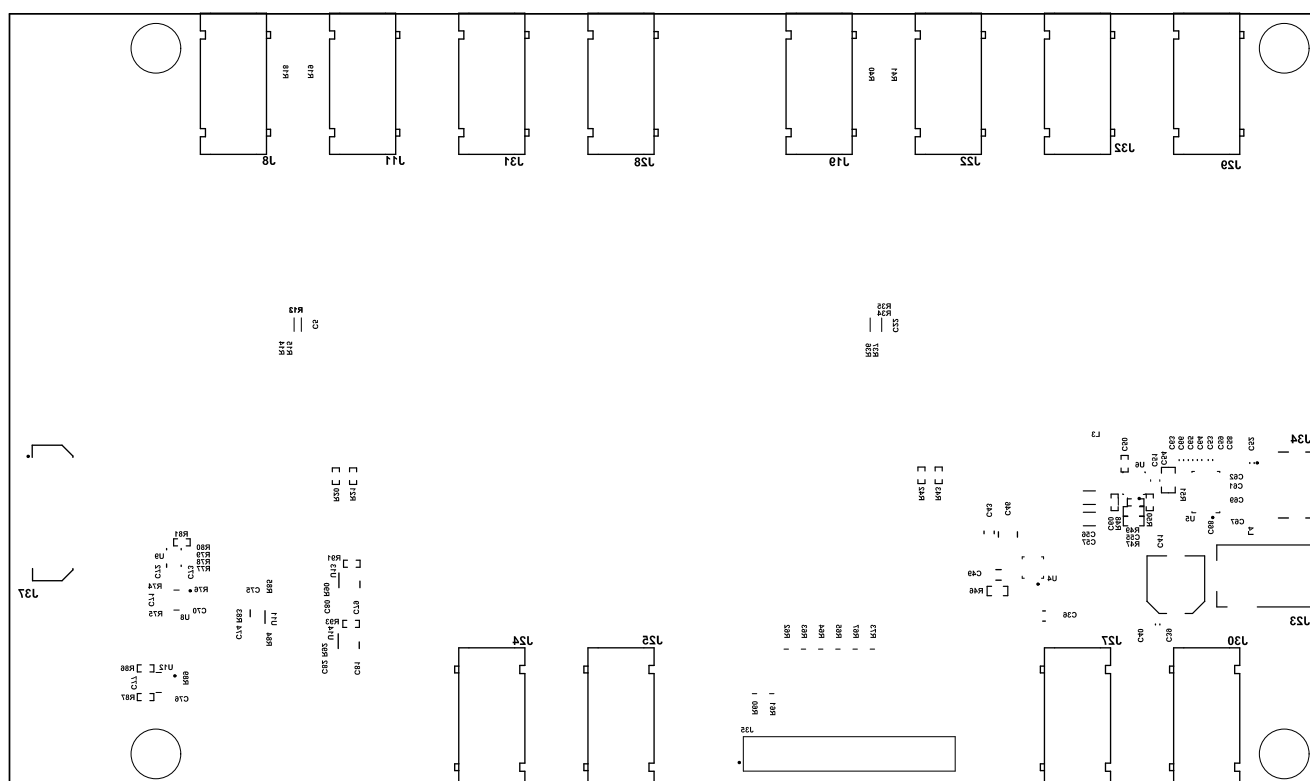


Figure 3-14. TAS2573EVM Bottom Overlay

3.3 Bill of Materials (BOM)

To download the bill of materials (BOM), see the [Design files](#) page.

4 Additional Information

4.1 Known Issues

1. Silkscreen next to S1 and S2 switches shows incorrect hex values, consider the following corresponding values for each case:
 - a. 0x90 -> 0x98
 - b. 0x92 -> 0x9a
 - c. 0x94 -> 0x9c
 - d. 0x96 -> 0x9e
2. Silkscreen next to S1 and S2 switches for AD1 and AD2 identification is backwards, the switch next to AD1 label is AD2 and vice versa.
3. Silkscreen next to VDD2 and DREG2 test points are backwards. These must be placed similar to VDD1 and DREG1 close to U1.

4.2 Troubleshooting

1. Audio is louder than expected or distorted
 - a. Re-configure the digital audio receiver configuration. Navigate to Device Control, select the gear icon at the top-right, toggle the USB Audio Settings button to reset the settings, then enable the device again and check if audio output is correct.
2. There is no audio output
 - a. Make sure S2 in AC-MB is set to ON-ON as explained in section 2.1.2.
 - b. Make sure the EVM is selected as default playback device in PC audio settings.
 - c. Power cycle the EVM and disconnect/re-connect the USB cable and re-initialize the device.
3. INT LEDs light up even though output is correct.
 - a. Go to Device Control -> Miscellaneous -> Fault Interrupt Mask, then check the box next to Device Active Mask. Enable the device again and check if INT LED is still coming up.
 - b. Read the interrupts in Device Control, IRQ button at the top-right corner, then click Read button at the pop-up window.

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1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
 - 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 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 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 a nonconforming EVM if (a) the nonconformity was 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, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
 - 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.

WARNING

Evaluation Kits 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 shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

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 instructions, 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/sds/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。

<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

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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2. 実験局の免許を取得後ご使用いただく。
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3.4 European Union

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.

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:

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8. *Limitations on Damages and Liability:*

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8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMNITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM 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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