Texas Instruments

TAS3108EVM2 User's Guide

Evaluation Module for the TAS3108 Digital Audio Signal Processor

User's Guide

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Digital Audio and Video Products

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TAS3108EVM2 User's Guide

Evaluation Module for the TAS3108 Digital Audio Signal Processor

User's Guide

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TEXAS INSTRUMENTS

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Read This First

About This Manual

This manual describes the operation of the TAS3108EVM2 evaluation module from Texas Instruments.

How to Use this Manual

This document contains the following chapters:

Chapter 1 - Overview

Chapter 2 - Quick Setup Guide

Chapter 3 - System Interfaces

Information About Cautions and Warnings

This manual may contain cautions and warnings.

This is an example of a caution statement.

A caution statement describes a situation that could potentially damage your software or equipment.

CAUTION

This is an example of a warning statement.

A warning statement describes a situation that could potentially cause harm to you.

WARNING

The information in a caution or a warning is provided for your protection. Please read each caution and warning carefully.

Related Documentation from Texas Instruments

The following table contains a list of data manuals that have detailed descriptions of the integrated circuits used in the design of the TAS3108EVM2. The data manuals can be obtained at the URL http://www.ti.com.

Table 1. Related Documentation from Texas Instruments

PART NUMBER	LITERATURE NUMBER
TAS3108	SLES152
TLV1117-33	SLVS561
TPS3825-33	SLVS165

Additional Documentation

1. TAS3108EVM2 Application Report
2. Graphical Development tool (GDE) for TAS3108 (GDE version 1.11 or later)
3. General Application Notes

Trademarks

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All other trademarks are the property of their respective owners.

Overview

The TAS3108EVM2 PurePath Digital™ customer evaluation amplifier module demonstrates the digital audio processor TAS3108/TAS3108IA from Texas Instruments (TI).

TAS3108DCP/TAS3108IADCP is a fully programmable high-performance audio processor. It uses an efficient, custom, multi-instruction programming environment optimized for digital audio processing algorithms. The TAS3108/TAS3108IA architecture provides high-quality audio processing by using a 48-bit data path, 28-bit filter coefficients, and a single-cycle 28 × 48-bit multiplier with a 76-bit accumulator. An embedded 8051 microprocessor provides algorithm and data control for the TAS3108/TAS3108IA. The TAS3108 is the commercial version, intended for home audio and other commercial applications. The TAS3108IA is the automotive version that is qualified for use in automotive applications. This EVM uses the TAS3108 version, and the active/passive parts used are not qualified for automotive use.

This EVM is delivered together with two boards: an input board with SPDIF, ACD, and USB for PC control, and an output board with DACs and a SPDIF transmitter. This system is a complete eight-channel digital audio processor system that includes digital input/output (S/PDIF), analog inputs/outputs, interface to PC, and DAP features like digital volume control, input and output mixers, auto mute, equalization, tone controls, loudness, dynamic range compression, and surround effects.

The TAS3108 applications could be automotive sound systems, digital televisions, home theater systems, mini-component audio systems, and pro-audio.

Replacing the DAC-DIT output board with one of the TI PurePath digital-amplifier EVMs makes it possible to test the TAS3108 with a speaker connected directly. Examples of EVMs that can be connected include, but are not limited to, TAS5508-5142K7EVM, TAS5518-5152K8EVM, TAS5518-5182C8EVM2, and TAS5086-5186V6EVM. This system is designed for home theater applications such as A/V receivers, DVD mini-component systems, home theater in a box (HTIB), DVD receivers, or plasma display panels (PDP).

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1.1 TAS3108EVM2 System Features

- Socketed EEPROM for download of program and coefficients
- Eight-channel analog-to-digital converter, four PCM1802 devices, 102-dB DYR A-weighted
- Eight-channel digital-to-analog converter, two PCM4104 devices, 116-dB DYR A-weighted
- Two-channel SPDIF receiver, coaxial and optical input
- Two-channel SPDIF transmitter, coaxial and optical output
- I2S input and output connectors
- USB-to-PC connection for software control
- Double-sided plated-through PCB layout

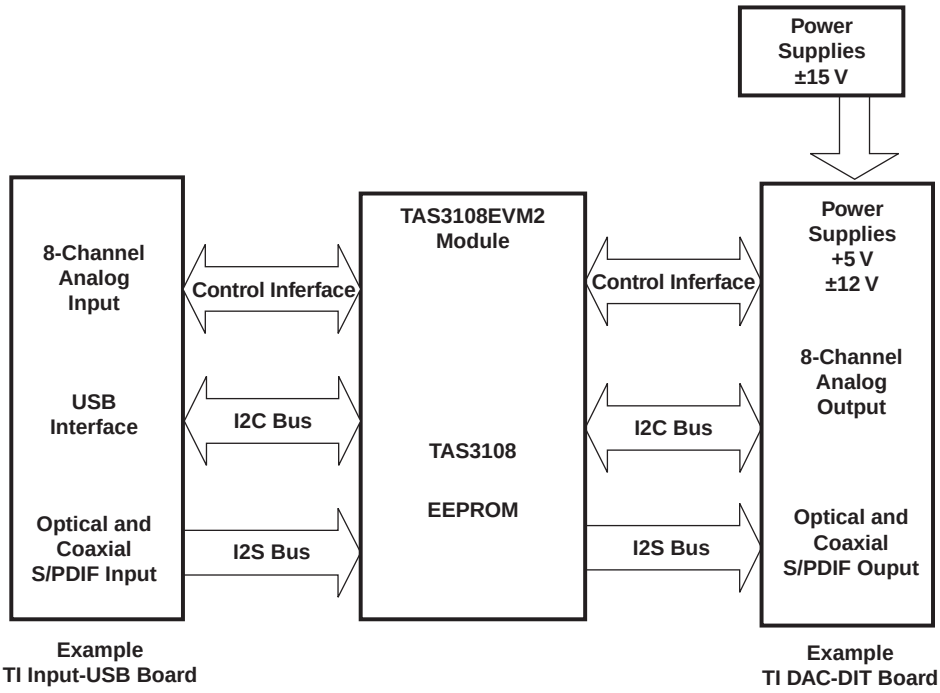


Figure 1-1. TAS3108EVM2 System

1.2 PCB Key Map

Physical structure for the TAS3108EVM2 is illustrated in Figure 1-2.

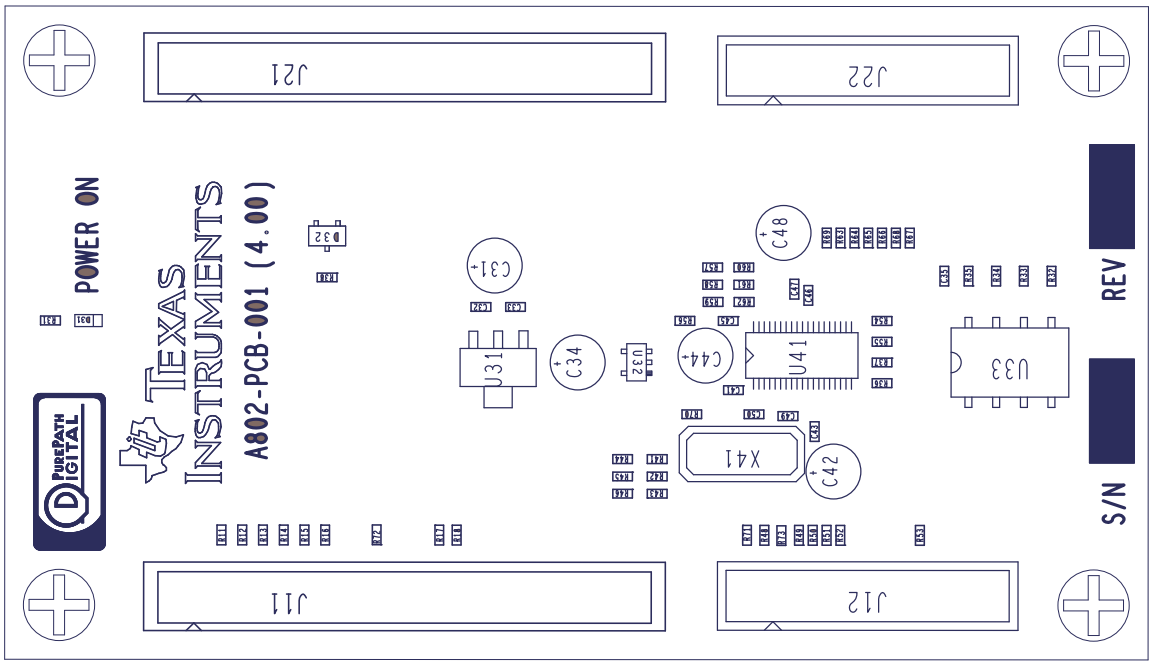


Figure 1-2. Physical Structure for the TAS3108EVM2 (Rough Outline)

U41 is the TAS3108 device. U33 is the EEPROM for program and coefficient storage. Digital audio data (I2S) is input on J12 and output on J22. J11 is used for I2C control, reset signal, and power-supply voltage. Signals in J11 are duplicated in J21 for further control of a DAC output board or speaker amplifier.

D31, a green LED, indicates that the power-supply voltage is within specifications and that the device is brought out of reset.

1.3 Input Board

The input board contains an eight-channel ADC, SPDIF receiver, and USB connection. Buttons for MUTE, RESET, and selection between 48-kHz and 96-kHz sample rate.

Physical structure for the input-USB board is illustrated in Figure 1-3.

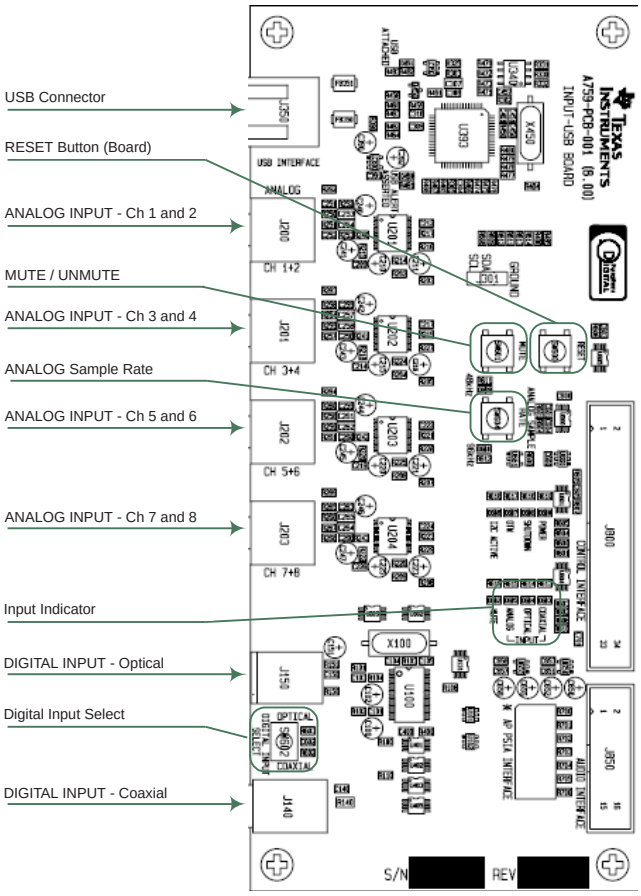


Figure 1-3. Input Board Outline

1.4 Output Board

- Eight-channel digital-to-analog converter, two PCM4104 devices, automatic sample-rate detection, and supports 44.1 kHz, 48 kHz, and 96 kHz in this application. Relation between master clock and sample rate clock must be 256. 4-Vrms for 0-dB and 116-dB DYR A-weighted.
- Two-channel digital audio output, SPDIF format, DIT4192, optical and electrical output
- ±12-V and 5-V power-supply regulators

The physical structure of the output DAC8-DIT2 board is illustrated in Figure 1-4.

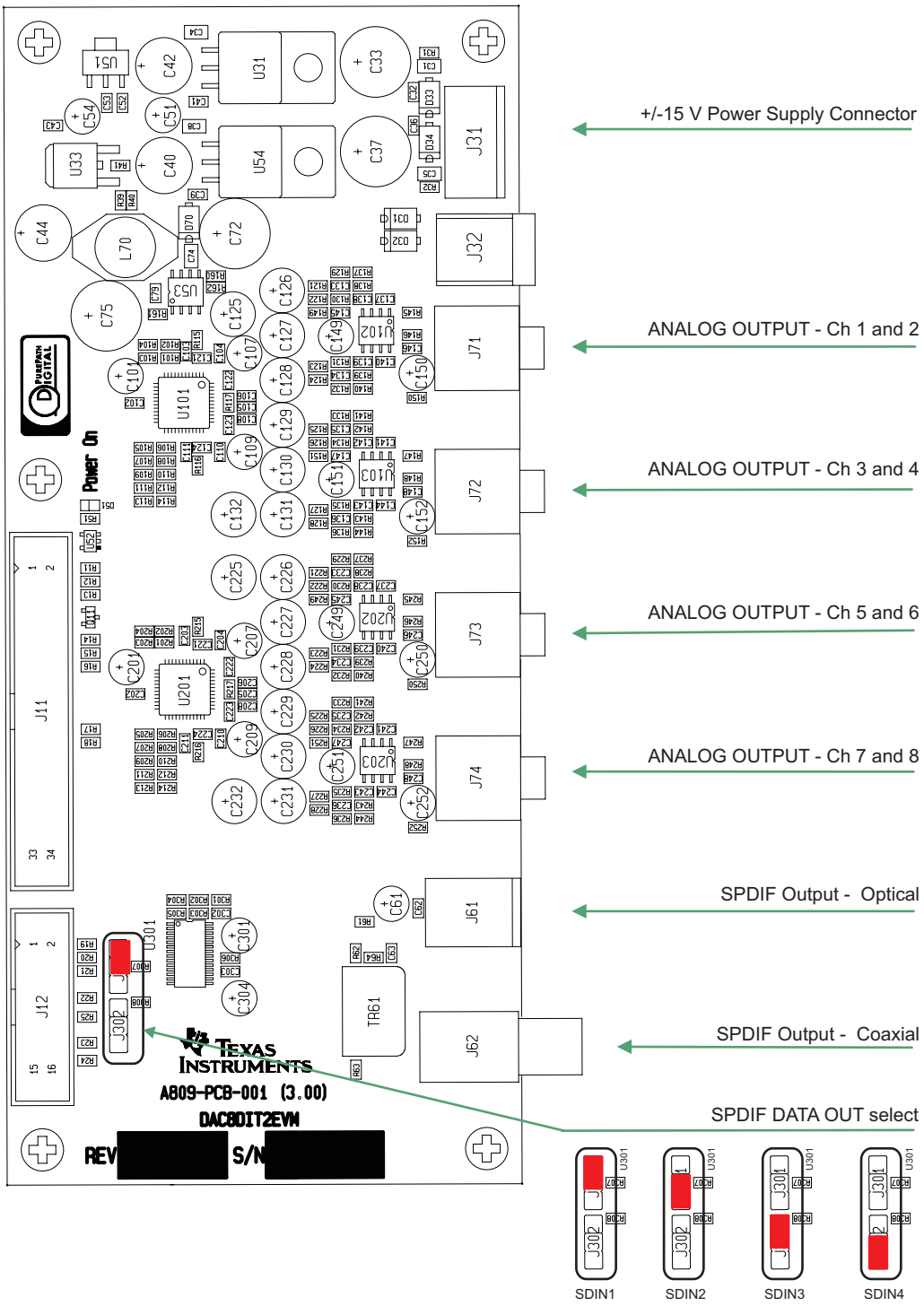


Figure 1-4. Physical Structure for Output DAC8-DIT2 Board Outline

A picture of the complete system is shown in Figure 1-5. The input board is to the left, the TAS3108EVM2 is in the middle, and the output board is to the right.

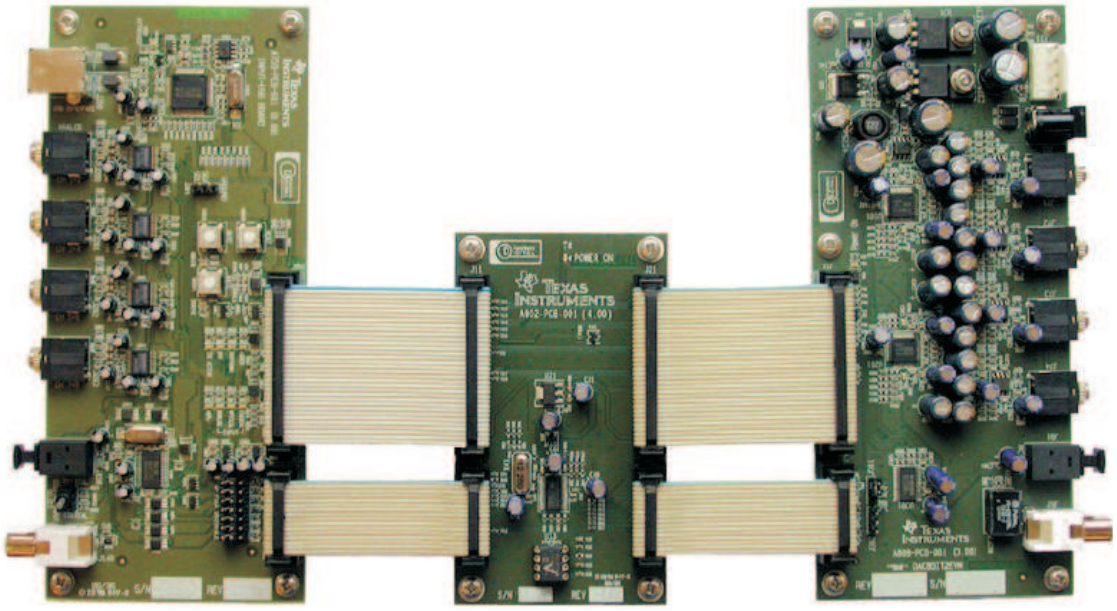


Figure 1-5. Complete System

Quick Setup Guide

This chapter describes the TAS3108EVM2 board, with regard to power supplies and system interfaces. The chapter provides information regarding handling and unpacking, absolute operating conditions, and a description of the factory default switch and jumper configuration.

This chapter provides a step-by-step guide to configuring the TAS3108EVM2 for device evaluation.

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2.1 Electrostatic Discharge Warning

Many of the components on the TAS3108EVM2 are susceptible to damage by electrostatic discharge (ESD). Customers are advised to observe proper ESD handling precautions when unpacking and handling the EVM, including the use of a grounded wrist strap at an approved ESD workstation.

Failure to observe ESD handling procedues may result in damage to EVM components.

2.2 Unpacking the EVM

Upon opening the TAS3108EVM2 package, please ensure that the following items are included:

- One TAS3108EVM2 board using one TAS3108DCP
- One TI input-USB board for interfacing TAS3108EVM2 with SPDIF receiver and eight-channel analog-to-digital converter and USB for PC control
- One TI DAC8-DIT2 board for interfacing TAS3108EVM2 with SPDIF transmitter and digital-to-analog converter outputs and power-supply regulators
- Two signal interface IDC cables for connection to an I2S back-end like the attached TI DAC8-DIT2 board, 14 pin
- Two control interface IDC cables for connection to an I2C back-end like the attached TI DAC8-DIT2 board, 34 pin
- One cable for connecting input-USB board to a USB port on a PC for TAS3108 control by software
- One cable for connecting DAC8-DIT2 board to the power supplies
- One PurePath CD-ROM containing data sheets, application notes, user's guides, gerber files, and PC software tools

If any of these items are missing, please contact the Texas Instruments Product Information Center nearest you to obtain a replacement.

Connect the input-USB board to TAS3108EVM2 using the two included delivered IDC cables. Connect TAS3108EVM2 board to DAC8-DIT2 board using the two included IDC cables.

2.3 Power Supply Setup

The TAS3108EVM2 is powered via the DAC8-DIT2 board or another output board, like a TAS5086-5186EVM. The DAC8-DIT2 board generates a +5-V supply that is fed to the TAS3108EVM2. The +5-V supply is further regulated to +3.3 V with the aid of a low-dropout linear regulator, U31.

Set the power supplies to ±15 V, switch off the power supply, connect all cables to the EVM, and switch on the power supply. Current consumption should be less than is shown in Table 2-1. If it is higher, switch off the power supply and double check the cabling.

Table 2-1. Recommended Supply Voltages for DAC8DIT2 Board

DESCRIPTION	VOLTAGE LIMITATIONS	CURRENT REQUIREMENT	CABLE
+15 V	+14.5 V to +15.5 V	0.3 A	J31 pin 2
–15 V	–15.5 V to –14.4V	0.1 A	J31 pin 1

Applying voltages above the limitations given in the table above may cause permanent damage to your hardware.

2.4 Digital Audio Inputs/Outputs

The digital audio inputs can be connected to the board in two ways, either in the SPDIF format on the coaxial connector or optical TosLink input or in I2S format on connector J12. The pinouts are shown in Section 3.5 and Section 3.6.

The digital audio outputs can be both SPDIF and I2S. SPDIF format is output on the coaxial connector (J62) or optical TosLink® connector (J61), or I2S format is output on connector J22. Jumpers J301 and J302 select the SDATA line to feed to the SPDIF transmitter.

2.5 Master/Slave Mode

The TAS3108EVM2 is delivered in Slave mode.

The SPDIF receiver, on the input board, is the MCLK clock master in this system.

The digital audio outputs can be both SPDIF and I2S. SPDIF format is output on coaxial connector, J62, or optical TosLink, J61, or in I2S format on connector J22. Jumpers J301 and J302 selects the SDATA line to feed to the SPDIF transmitter.

After each reset, either auto-generated during power-up sequence or manual pressing RESET button, the input-USB board is always in the following configuration:

- Mute enabled
- Analog input set to 48-kHz sample rate

To start up a PurePath EVM, use following procedure:

1. Turn on all power supplies before connecting USB interface.
2. Connect USB interface and press RESET button.
3. Start GUI software and press RESET in GUI window. Make sure that the "USB attached" LED is on and that the status indicator changes to "OK".
4. Load EVM configuration file. Ensure that the correct file is selected, according to the EVM in use.
5. Press MUTE to unmute the EVM.
6. The EVM is now ready to use.

2.6 TAS3108 Software Installation

The TAS3108 GDE and IDE software provide easy programming of the TAS3108 and enable programming of the EEPROM on the EVM board.

1. Insert the PurePath CD-ROM
   - If it does not autorun, run the ReadMe file.
   - Select "SOFTWARE" in the menu to the left.
   - Select the TAS3108 tools, and follow the instructions given to install.
2. After installation, turn on power supplies and connect USB cable to input-USB board.
3. Start GDE program from the Windows Start menu. Startup of GDE requires a few seconds.

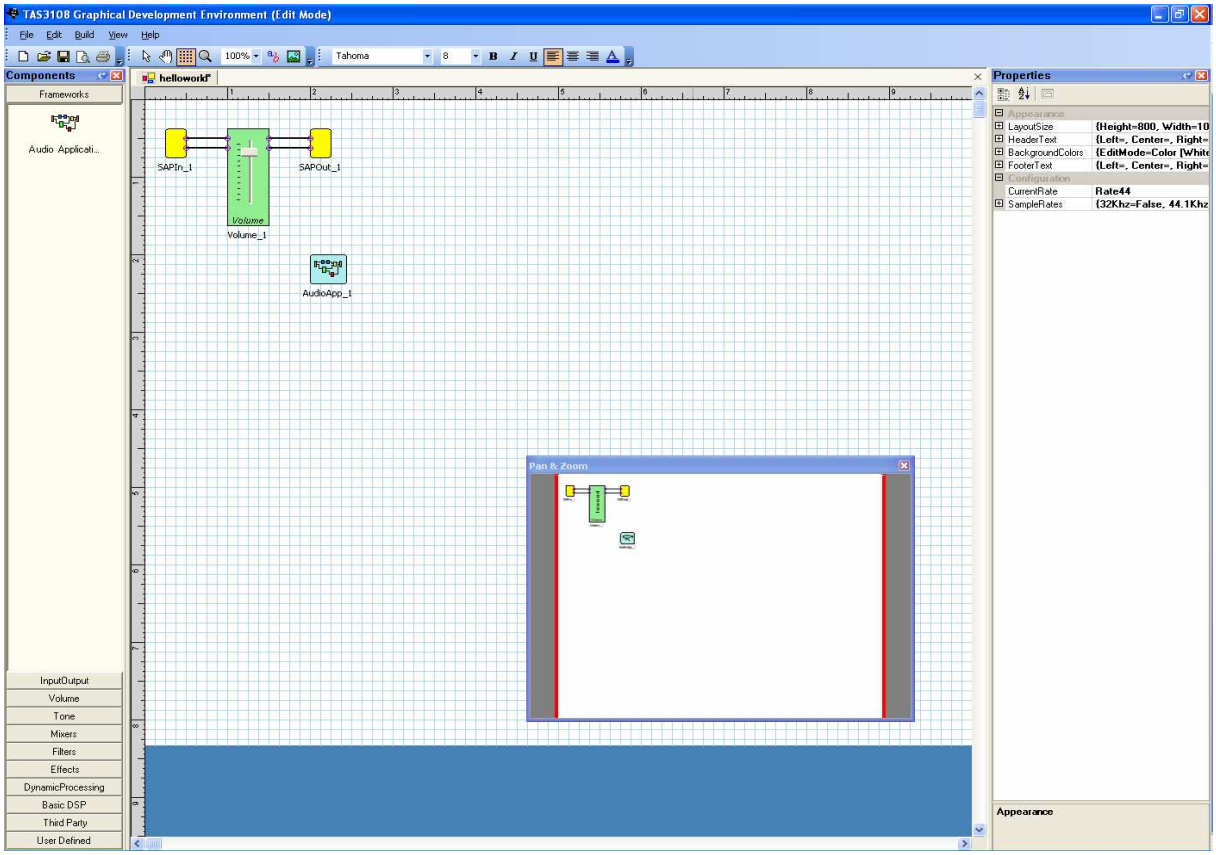


Figure 2-1. TAS3108 GDE Window

To test the connection from PC to EVM, load the TAS3108EVM2 test file (helloworld.pfw), located in C:\Program Files\Texas Instruments Inc\TAS3108 Development Tools\Examples\HelloWorld.pfw.

For more advanced use of the GDE, see the GDE online help, GDE release notes, and TAS3108 MCU programmer's reference guide.

System Interfaces

This chapter describes the TAS3108EVM2 board regard to power supplies and system interfaces.

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3.1 Control Interface (J11), Input

This interface connects the TAS3108EVM2 board to a TI input-USB board. This is a general-purpose interface, so not all signals are used by the TAS3108. Unused signals are shaded in Table 3-1.

Table 3-1. J11 Pin Description

PIN NO.	NET-NAME AT SCHEMATICS	DESCRIPTION
1	GND	Ground
2	RESERVED	
3	GND	Ground
4	$\overline{\text{RESET}}$	System reset (bidirectional). Activate $\overline{\text{MUTE}}$ before $\overline{\text{RESET}}$ for quiet reset.
5	RESERVED	
6	$\overline{\text{MUTE}}$	Ramp volume from any setting to noiseless soft mute. Mute can also be activated by I2C.
7	$\overline{\text{PDN}}$	Power down. TAS3108 goes ino power down state when activated.
8	RESERVED	
9	RESERVED	
10	SDA	I2C data clock
11	GND	Ground
12	SCL	I2C bit clock
13	GPIO1	
14	GPIO2	
15	GPIO3	
16	GPIO4	General-purpose input/output 4, used to reset the TAS3108 after programming.
17	GND	Ground
18	GPIO5	
19	GPIO6	
20	$\overline{\text{SD}}$	Shutdown reporting. Used for speaker-output EVMs.
21	RESERVED	
22	$\overline{\text{OTW}}$	Temperature warning. Used for speaker-output EVMs.
23	RESERVED	
24	RESERVED	
25	GND	Ground
26	GND	Ground
27	RESERVED	
28	RESERVED	
29	RESERVED	
30	RESERVED	
31	GND	Ground
32	GND	Ground
33	+5V	+5-Vdc power supply (output)
34	+5V	+5-Vdc power supply (output)

3.2 Digital Audio Interface, Input (J12)

The digital audio interface contains digital audio signal data (I2S), clocks, etc. See the TAS3108 data manual for signal timing and details not covered in this document.

Table 3-2. J12 Pin Description

PIN NUMBER	NET-NAME AT SCHEMATICS	DESCRIPTION
1	GND	Ground
2	MCLK	Master clock input
3	GND	Ground
4	SDIN1	I2S data 1, Channel 1 and 2
5	SDIN2	I2S data 2, Channel 3 and 4
6	SDIN3	I2S data 3, Channel 5 and 6
7	SDIN4	I2S data 4, Channel 7 and 8
8		Reserved
9		Reserved
10	GND	Ground
11	SCLK	I2S bit clock
12	GND	Ground
13	LRCLK	I2S left-right clock
14	GND	Ground
15		Reserved
16	GND	Ground

3.3 Control Interface, Output (J21)

This interface connects the TAS3108EVM2 board to a TI DAC8-DIT2 output board or a general amplifier power EVM. This is a general-purpose interface, so not all signals are used by the TAS3108. Unused signals are shaded in Table 3-3.

Table 3-3. J21 Pin Description

PIN NO.	NET-NAME AT SCHEMATICS	DESCRIPTION
1	GND	Ground
2	RESERVED	
3	GND	Ground
4	$\overline{\text{RESET}}$	System reset (bidirectional). Activate $\overline{\text{MUTE}}$ before $\overline{\text{RESET}}$ for quiet reset.
5	RESERVED	
6	$\overline{\text{MUTE}}$	Ramp volume from any setting to noiseless soft mute. Mute can also be activated by I2C.
7	$\overline{\text{PDN}}$	Power down. TAS3108 goes ino power down state when activated.
8	RESERVED	
9	RESERVED	
10	SDA	I2C data clock
11	GND	Ground
12	SCL	I2C bit clock
13	GPIO1	
14	GPIO2	
15	GPIO3	
16	GPIO4	General-purpose input/output 4, used to reset the TAS3108 after programming.
17	GND	Ground
18	GPIO5	
19	GPIO6	
20	$\overline{\text{SD}}$	Shutdown reporting. Used for speaker output EVMs.
21	RESERVED	
22	$\overline{\text{OTW}}$	Temperature warning. Used for speaker output EVMs.
23	RESERVED	
24	RESERVED	
25	GND	Ground
26	GND	Ground
27	RESERVED	
28	RESERVED	
29	RESERVED	
30	RESERVED	
31	GND	Ground
32	GND	Ground
33	+5V	+5-Vdc power supply (output)
34	+5V	+5-Vdc power supply (output)

3.4 Digital Audio Interface, output (J22)

The digital audio interface contains digital audio signal data (I2S), clocks, etc. See the TAS3108 data manual for signal timing and details not covered in this document.

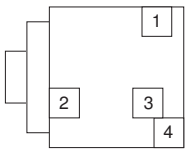
Table 3-4. J22 Pin Description

PIN NO.	NET-NAME AT SCHEMATICS	DESCRIPTION
1	GND	Ground
2	MCLKO	Master clock output
3	GND	Ground
4	SDOUT1	I2S data 1, channels 1 and 2
5	SDOUT2	I2S data 2, channels 3 and 4
6	SDOUT3	I2S data 3, channels 5 and 6
7	SDOUT4	I2S data 4, channels 7 and 8
8		Reserved
9		Reserved
10	GND	Ground
11	SCLKOUT	I2S bit clock output
12	GND	Ground
13	LRCLKO	I2S left-right clock output
14	GND	Ground
15		Reserved
16	GND	Ground

3.5 Connectors on the Input-USB board

3.5.1 Analog Inputs

The mini-jack 3.5-mm connector for analog inputs is shown in Figure 3-1.



PCB Connector (Top View)

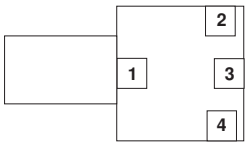
Figure 3-1. J200… J203 Pin Pumbers

Table 3-5. J200 Pin Description (Similar for J201 to J203)

PIN NO.	NET-NAME AT SCHEMATICS	DESCRIPTION
1	CH1	Channel 1 input – tip
2	AGND	Analog ground – sleeve
3		For future use
4	CH2	Channel 2 input – ring

3.5.2 SPDIF Coax

The SPDIF input for coax is shown in Figure 3-2.



PCB Connector (Top View)

Figure 3-2. J140 Pin Numbers

Table 3-6. J140 Pin Description

PIN NO.	NET-NAME AT SCHEMATICS	DESCRIPTION
1	GND	Ground
2	IN1	Coax SPDIF input
3	IN1	Coax SPDIF input
4	IN1	Coax SPDIF input

3.5.3 AP PSIA Interface

The input-USB board provides the ability to input I2S directly into the PurePath EVM. I2S source could be, for example, an Audio Precision with a Programmable Serial Interface Adaptor (PSIA).

Default jumper settings are shown in Figure 3-3. In this setting, data out is: analog channels 1 and 2 routed to Data1, analog channels 3 and 4 to Data2, etc., when analog inputs are selected. When digital input is selected, either coax or TosLink channel A+B is copied into all data outputs.

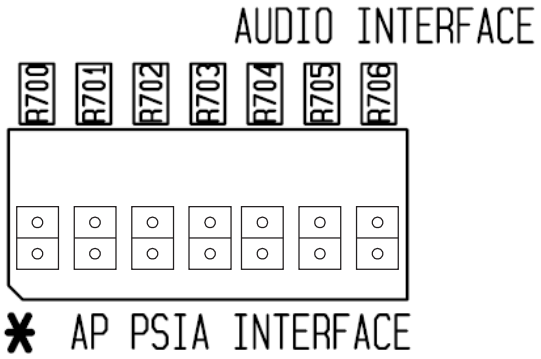


Figure 3-3. AP PSIA Default Setting

When using the input-USB board with an external I2S source connection, the jumper settings in Figure 3-4 should be used. Placing the jumper as shown copies I2S data into all data outputs.

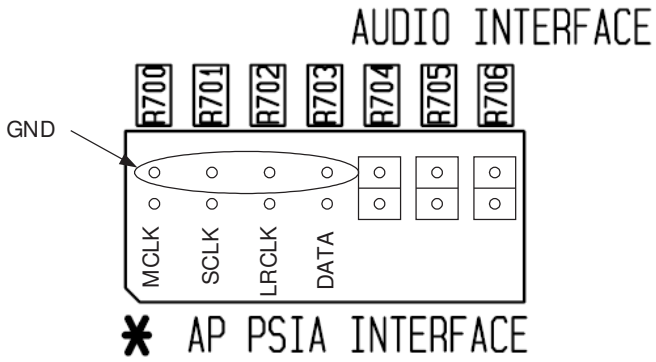


Figure 3-4. AP PSIA Settings Using External I2S Source

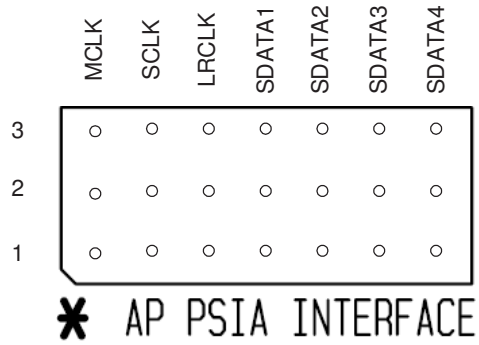


Figure 3-5. AP PSIA Interface Pin Numbers

Table 3-7. AP PSIA Pin Description

PIN NO.		NET-NAME AT SCHEMATICS	DESCRIPTION
MCLK	1	MCLK Source	From MCLK source
	2	MCLK Out	MCLK output
	3	GND	Ground
SCLK	1	SCLK Source	From SCLK source
	2	SCLK Out	SCLK ouput
	3	GND	Ground
LRCLK	1	LRCLK Source	From LRCLK source
	2	LRCLK Out	LRCLK output
	3	GND	Ground
SDATA1	1	SDATA1 Source	From SPDIF or analog channels 1 and 2
	2	SDATA1 Out	SDATA1 output
	3	GND	Ground
SDATA2	1	SDATA2 Source	From SPDIF or analog channels 3 and 4
	2	SDATA2 Out	SDATA2 output
	3	SDATA1 Out	Connected to SDATA1 Out
SDATA3	1	SDATA3 Source	From SPDIF or analog channels 5 and 6
	2	SDATA3 Out	SDATA3 output
	3	SDATA1 Out	Connected to SDATA1 Out

Table 3-7. AP PSIA Pin Description (continued)

PIN NO.		NET-NAME AT SCHEMATICS	DESCRIPTION
SDATA4	1	SDATA4 Source	From SPDIF or analog channels 7 and 8
	2	SDATA4 Out	SDATA4 output
	3	SDATA1 Out	Connected to SDATA1 Out

3.5.4 I2C Connector (J301)



PCB Connector (Top View)

Figure 3-6. J301 Pin Numbers

Table 3-8. J301 Pin Description

PIN NO.	NET-NAME AT SCHEMATICS	DESCRIPTION
1	SCL	I2C clock
2	SDA	I2C data
3	GND	Ground

3.5.5 Control Interface (J800)

This interface connects the EVM.

Table 3-9. J800 Pin Description

PIN NO.	NET-NAME AT SCHEMATICS	DESCRIPTION
1	GND	Ground
2	RESERVED	
3	GND	Ground
4	$\overline{\text{RESET}}$	System reset (bidirectional). Activate $\overline{\text{MUTE}}$ before $\overline{\text{RESET}}$ for quiet reset.
5	RESERVED	
6	$\overline{\text{MUTE}}$	Activate $\overline{\text{MUTE}}$ pin on modulator
7	RESERVED	
8	RESERVED	
9	RESERVED	
10	SDA	I2C data clock
11	GND	Ground
12	SCL	I2C bit clock
13	GPIO1	General-purpose port for GUIs
14	GPIO2	General-purpose port for GUIs
15	GPIO3	General-purpose port for GUIs
16	GPIO4	General-purpose port for GUIs
17	GND	Ground
18	GPIO5	General-purpose port for GUIs

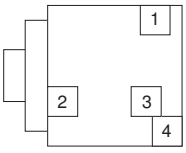
Table 3-9. J800 Pin Description (continued)

PIN NO.	NET-NAME AT SCHEMATICS	DESCRIPTION
19	GPIO6	General-purpose port for GUIs
20	$\overline{SD1}$	Shutdown reporting
21	$\overline{SD2}$	Shutdown reporting
22	$\overline{TW1}$	Temperature warning
23	$\overline{TW2}$	Temperature warning
24	RESERVED	
25	GND	Ground
26	GND	Ground
27	RESERVED	
28	RESERVED	
29	RESERVED	
30	RESERVED	
31	GND	Ground
32	GND	Ground
33	+5V	+5-Vdc power supply (output)
34	+5V	+5-Vdc power supply (output)

3.6 Connectors on the DAC8-DIT2 Board

3.6.1 Analog Outputs

The mini-jack 3.5-mm connector for analog outputs is shown in Figure 3-7.



PCB Connector (Top View)

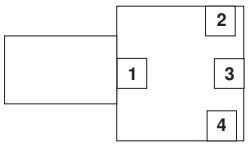
Figure 3-7. J71 to J74 Pin Numbers

Table 3-10. J71 Pin Description

PIN NO.	NET-NAME AT SCHEMATICS	DESCRIPTION
1	CH1	Channel 1, left output – tip
2	AGND	Analog ground – sleeve
3		For future use
4	CH2	Channel 2, right output – ring

3.6.2 3.6.2 SPDIF Coax

The SPDIF input for coax is shown in Figure 3-8.



PCB Connector (Top View)

Figure 3-8. J62 Pin Numbers

Table 3-11. J62 Pin Description

PIN NO.	NET-NAME AT SCHEMATICS	DESCRIPTION
1	GND	Ground
2	IN1	Coax SPDIF output
3	IN1	Coax SPDIF output
4	IN1	Coax SPDIF output

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