

TAS3208EVM

***Evaluation Module for
TAS3208 Digital Audio Signal Processor***

User's Guide

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User's Guide

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Read This First

About This Manual

This manual describes the operation of the TAS3208EVM 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

Chapter 4 – MSP Programming

Information About Cautions and Warnings

This manual may contain cautions and warnings.

CAUTION

This is an example of a caution statement.

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

WARNING

This is an example of a warning statement.

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

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 TAS3208EVM. The data manuals can be obtained at the URL <http://www.ti.com>.

Table 1. Related Documentation from Texas Instruments

Part Number	Literature Number
TAS3208	SLES152
TLV1117-33	SLVS561
TPS3825-33	SLVS165

Additional Documentation

1. Graphical Development tool (GDE) for TAS3208 (GDE ver. TBD or later)
2. General Application Notes

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Overview

The TAS3208EVM PurePath Digital™ customer evaluation amplifier module demonstrates the Digital Audio Processor TAS3208/TAS3208IA from Texas Instruments (TI).

TAS3208DCP/TAS3208IADCP is a fully programmable high-performance audio processor. It uses an efficient, custom, multi-instruction programming environment optimized for digital audio processing algorithms. The TAS3208/TAS3208IA 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 TAS3208/TAS3208IA. The TAS3208 is the commercial version intended for home audio and other commercial applications.

This is a signal board EVM. The EVM is delivered together with two boards – an input board with SPDIF, ACD, and USB for PC control, and a output board with DACs and SPDIF transmitter. This system is a complete 8-channel digital audio processor system that includes digital input/output (S/PDIF), analog inputs/outputs, interface to PC and DAP features, such as digital volume control, input and output mixers, auto mute, equalization, tone controls, loudness, dynamic range compression, and surround effects.

TAS3208 applications include digital televisions, home theater systems, mini-component audio systems, and pro audio.

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1.1 TAS3208EVM System Features

- Socketed EEPROM for download of program and coefficients
- 8-channel discrete I²S input/outputs
- 2-channel SPDIF receiver, optical input, into TAS3208 SDIN1
- 2-channel SPDIF transmitter, optical output from TAS3208 SDOUT1
- 2-channel SPDIF, optical input to TAS3208 SPDIFin
- 2-channel SPDIF, optical output from TAS3208 SDOUT2/SPDIFout
- 10-input multiplexed analog-to-digital converter (ADC) input
- Two digital-to-analog converter (DAC) line outputs
- One DAC headphone output
- One line output
- USB to PC connection for software control
- MSP430 for stand-alone operation
- Double-sided plated-through PCB layout

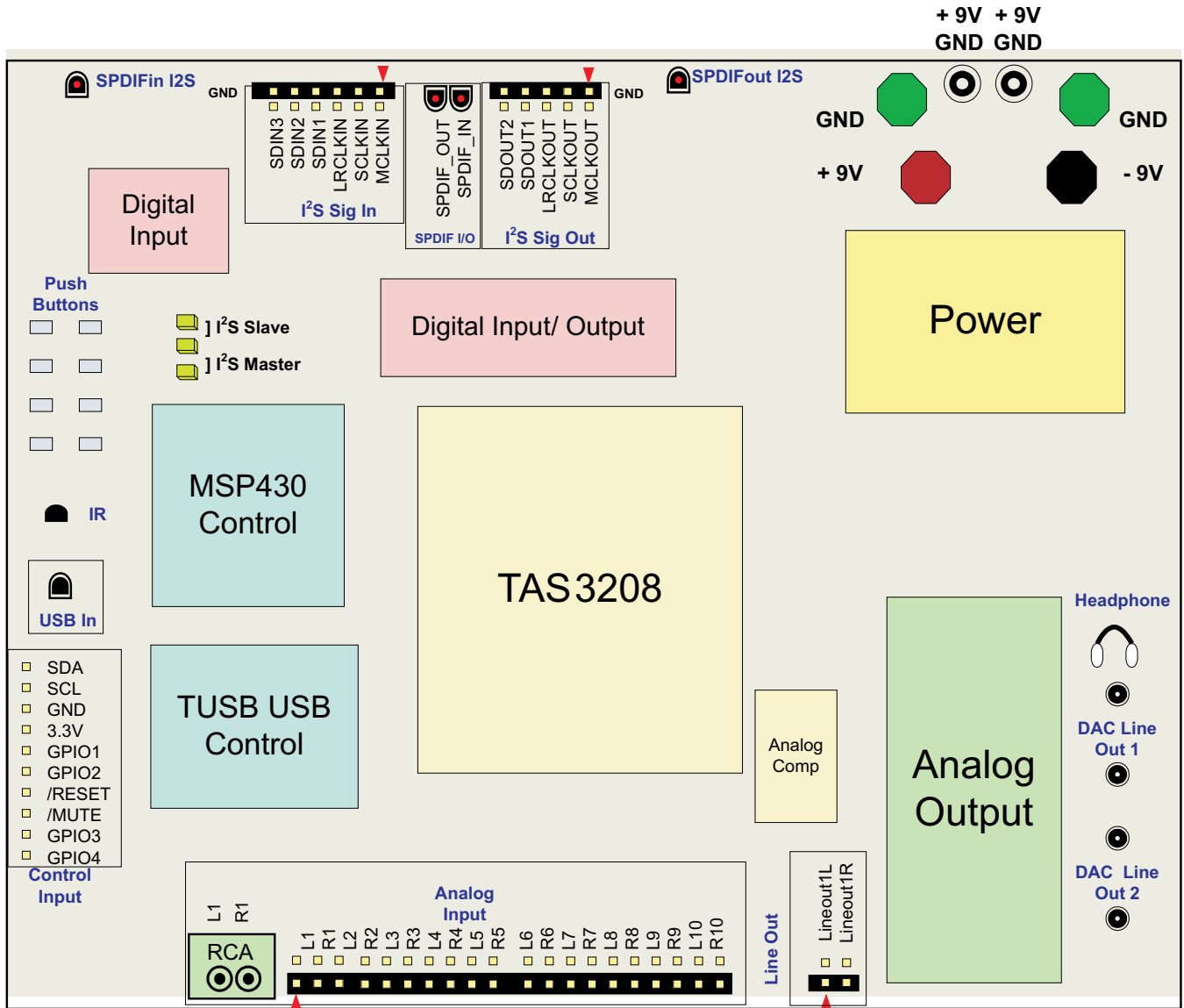


Figure 1-1. TAS3208EVM System

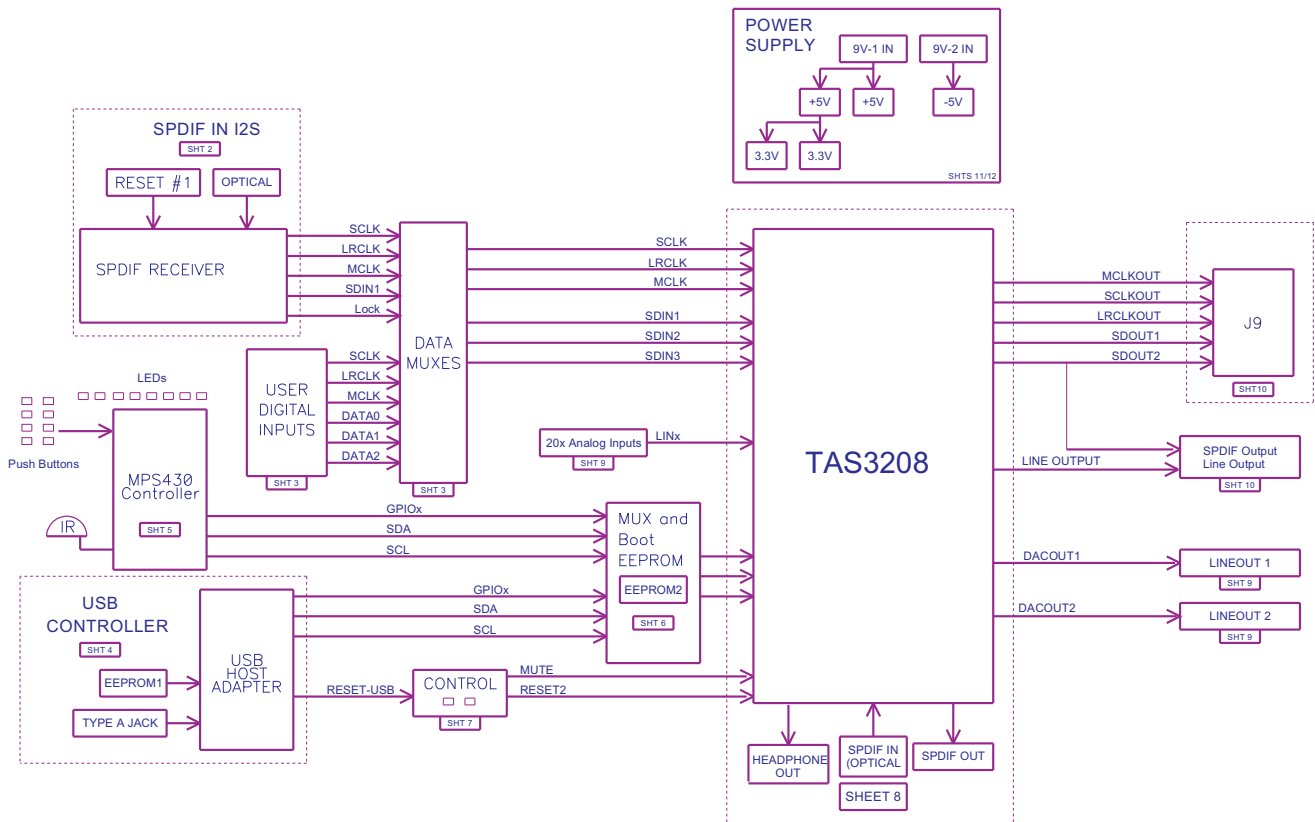


Figure 1-2. TAS3208EVM System

1.2 PCB Key Map

The physical structure for the TAS3208EVM is shown in [Figure 1-3](#).

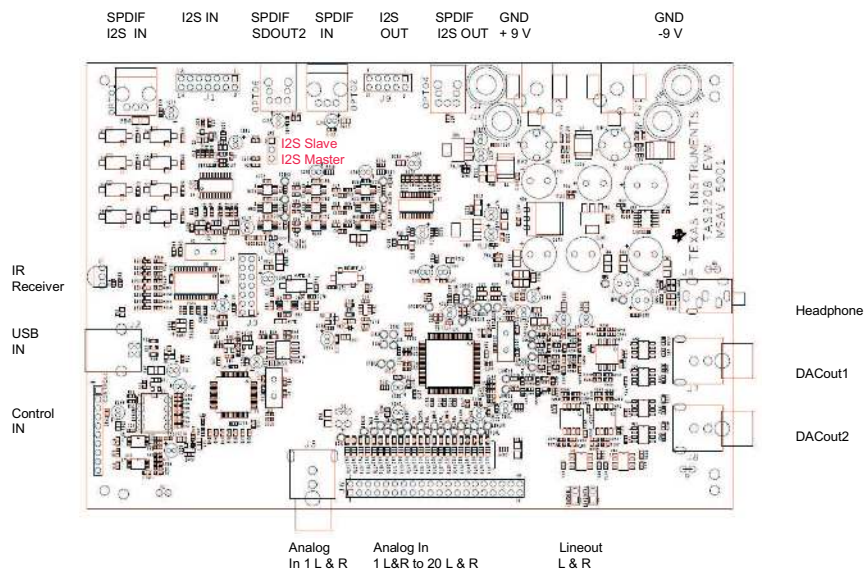


Figure 1-3. TAS3208EVM Physical Structure

Quick Setup Guide

This chapter describes the TAS3208EVM board in regards 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 TAS3208EVM for device evaluation.

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2.1 Electrostatic Discharge (ESD) Warning

Many of the components on the TAS3208EVM are susceptible to damage by 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.

CAUTION

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

2.2 Unpacking the EVM

Upon opening the TAS3208EVM package, check that the following items are included:

- TAS3208EVM board using one TAS3208DCP (1 pc.)
- 9-V ac-to-dc adapters (2 pc.)
- USB cable for connecting TAS3208EVM board to USB port on a PC for PurePath Studio™ software (1 pc.)
- PurePath CD-ROM containing data sheets, application reports, user's guides, gerber files, and PC software tools (1 pc.)

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

2.3 Power-Supply Setup

The TAS3208EVM is powered via the ± 9 -V terminals or the 9-V (center hot) power connectors, PJ1 and PJ2. The TAS3208EVM generates a 5-V, -5 -V, and 3.3-V supply that is fed to the TAS3208EVM.

1. Set the power supplies to 9 V and -9 V. Then turn off the supplies and connect them to the EVM.
2. Once the cables are connected, switch on the power supply. Current consumption should be less than shown in [Table 2-1](#). If it is higher, switch off and double check the cabling.

Table 2-1. DAC8DIT2 Board Recommended Supply Voltages

Description	Voltage Limitations	Current Requirement
9 V	8.5 V to 9.5 V	0.3 A
-9 V	-8.5 V to 9.4 V	0.1 A

2.4 Digital Audio Inputs/Outputs

Format optical TOSLINK input, OPTO1, or in I²S format on connector J1. The pinout this and the other connectors is shown in [Chapter 3](#).

The SPDIF I²S IN input supplies signal to the TAS3208 SDIN1. When a valid lock is detected by the DIR9001 SPDIF receiver, a blue SPDIF lock LED is lit.

The digital audio outputs can be to I²S or SPDIF format optical TOSLINK. The I²S output is provided on connector J9. There are two SPDIF output options. One SPDIF output can be produced by the TAS3208 on SDOUT2. This is set by a TAS3208 I²C register configuration option. This output is available on OPTO3. The other SPDIF output is SDOUT1, which is converted into SPDIF format by an external encoder. This is output on OPTO4.

The TAS3208 has an optical SPDIF input from OPTO2. This is a pass-through-only connection to the TAS3208 SDOUT2/SPDIF output on OPTO3.

2.5 Master/Slave Mode Operation

The TAS3208EVM is delivered and configured to operate in clock master mode. However, the TAS3208 can be configured as a clock slave or master using JP3.

Table 2-2. JP3 Clock Master/Slave Setting

Pin No.	I ² S Clock Mode
1, 2	Slave
2, 3	Master

2.5.1 Master Mode

In master mode, the master clock (MCLK), SCLK_< and LRCLK for the system are provided on J9. Data can be input on the analog input and as I²S data on J1.

SPDIF I²S input from OPTO1 is not supported in master mode.

Data can be output from the I²S outputs on J9, SPDIF I²S output, OPTO4, and from SPDIF SDOOUT2 when the SDOOUT2 is configured for SPDIF output.

2.5.2 Slave Mode

In slave mode, data and clocks can be input in the SPDIF I²S IN, OPTO1, or the I²S input, J1. The SPDIF input is selected automatically when the EVM detects a valid SPDIF signal on OPTO1. If the EVM does not detect a valid SPDIF signal on OPTO1, the I²S inputs are used.

In slave mode, the TAS3208 ADC requires an external clock input from the I²S IN or the SPDIF I²S IN for correct operation. The performance of the ADC is affected by the clock source jitter.

Data can be output from the I²S outputs on J9, SPDIF I²S output, OPTO4, and from SPDIF SDOOUT2 when the SDOOUT2 is configured for SPDIF output.

2.6 EVM Default Configuration

The TAS3208 is placed into the default configuration by receiving a reset. The TAS3208 receives a reset from the power-up circuitry by pressing the Reset button, or by receiving a reset signal through the USB interface. Following the receipt of reset, the TAS3208EVM loads the contents of EEPROM2 and comes up with Mute enabled, clock master mode enabled.

As described in this section, an example PurePath Studio GDE processing flow is supplied that configures the TAS3208 to support an I²S digital PCM input, analog input, digital output, Line output, headphone output, and TAS5601 power stage for both master and slave mode.

2.7 TAS3208 Software Installation

The TAS3208 is programmed and configured using PurePath Studio. PurePath Studio is composed of a graphical development environment (GDE), integrated development environment (IDE), and component publisher. The GDE permits the user to program the TAS3208 using predefined signal processing components that are placed and connected graphically on the GDE pallet. PurePath Studio runs on a Windows® XP computer.

The IDE is a software development environment that permits the user to construct and test the code for a new GDE component.

The component publisher is used to create the component, define the component's control interface and the ways in which the component can be used.

PurePath Studio software is supplied on the TAS3208 Software CD-ROM. The latest version of PurePath Studio is also available on the TI extranet to registered users.

Accessing the TI PurePath Studio extranet site

- Open a web browser and go to the following site and fill in the requested information:
<http://iag.itg.ti.com/msa/>
- There are two types of licenses:
 - For those who are interested only in evaluating the tools, there is an evaluation license.
 - For those who are interested in product development using PurePath Studio tools, there is a production license. This is the software license that is needed to support the EVM.

Access to the extranet is available by using a browser to access my.ti.com and selecting Extranets. The PurePath Studio software is contained under the link TAS3108-PurePath Studio.

Loading the PurePath Studio software suite

- **From CD-ROM** – Insert the TAS3208 Software CD-ROM. Open the TAS3208GDE directory and run setup_PurePath_Studio_vx.xx.exe. Follow the instructions to complete the installation.
- **From download** – Save the installation file to temporary directory. Go to the temporary directory and run setup_PurePath_Studio_vx.xx.exe. Follow the instructions to complete the installation.
- The CD-ROM also contains initialization files for master and slave EVM initialization and a simple process flow that can be used to verify the TAS3208EVM operation.
- After PurePath Studio installation is complete, copy the contents of the CD-ROM TAS3208_Config directory to C:\Program Files\Texas Instruments Inc\PurePath Studio\MyProcessFlows.

Using the TAS3208EVM

After completing the software installation, turn on power supplies and connect the USB cable to the Input-USB board.

To start the GDE, go to the Start menu and select All Programs/Texas Instruments/PurePath Studio/Pure Path Studio GDE.

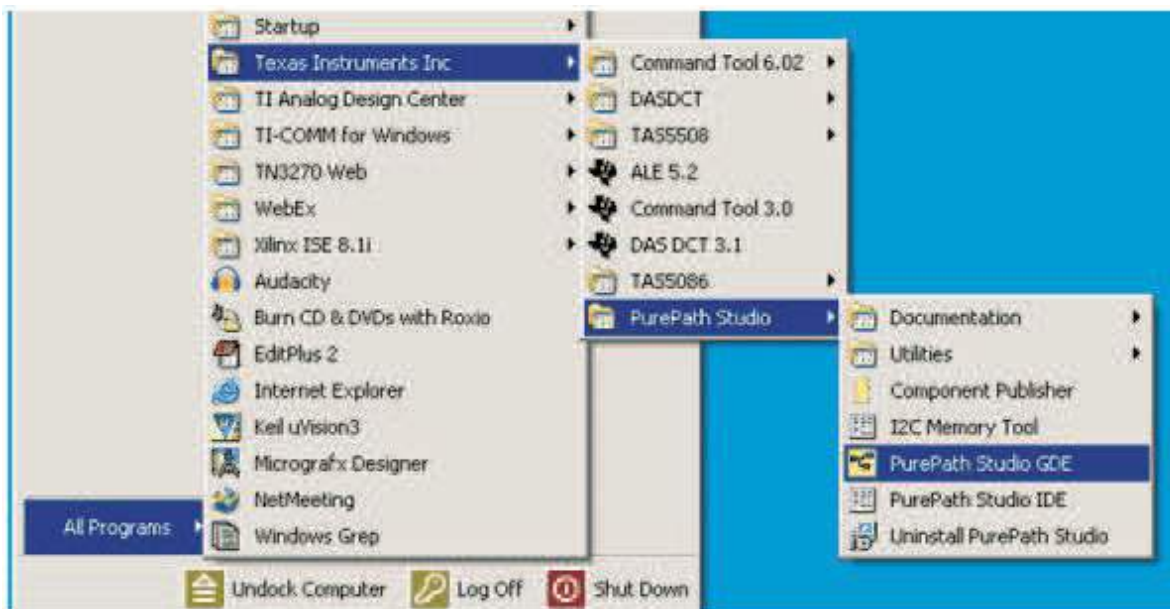


Figure 2-1. GDE Startup

The start-up of GDE takes a few seconds.

The TAS3208 requires an initialization configuration file to be loaded after a reset. This file configures the TAS3208 for the EVM configuration, enables the analog outputs, and sets the clock master/slave mode. Before loading or building a process flow, verify that an initialization file is specified in the Execute I²C command file window. This window is found under Tools/I²C Command Tool.

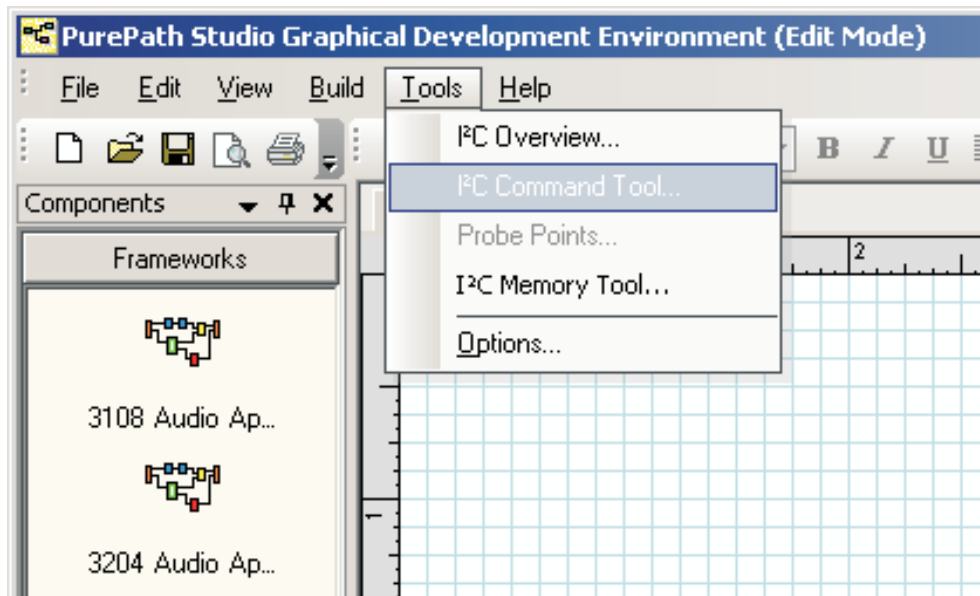


Figure 2-2. Setting the I²C Initialization Sequence

If the EVM is to be operate in Master mode, select 3208EVM_init_master.cfg.

If the EVM is to be operate in Slave mode, select 3208EVM_init_slave.cfg.

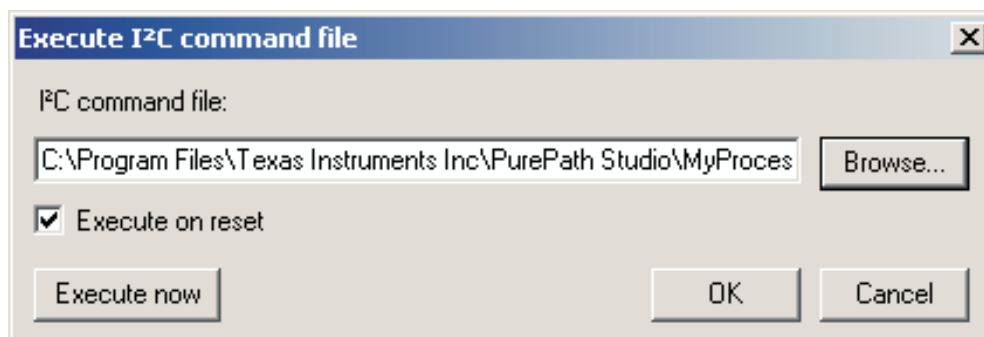
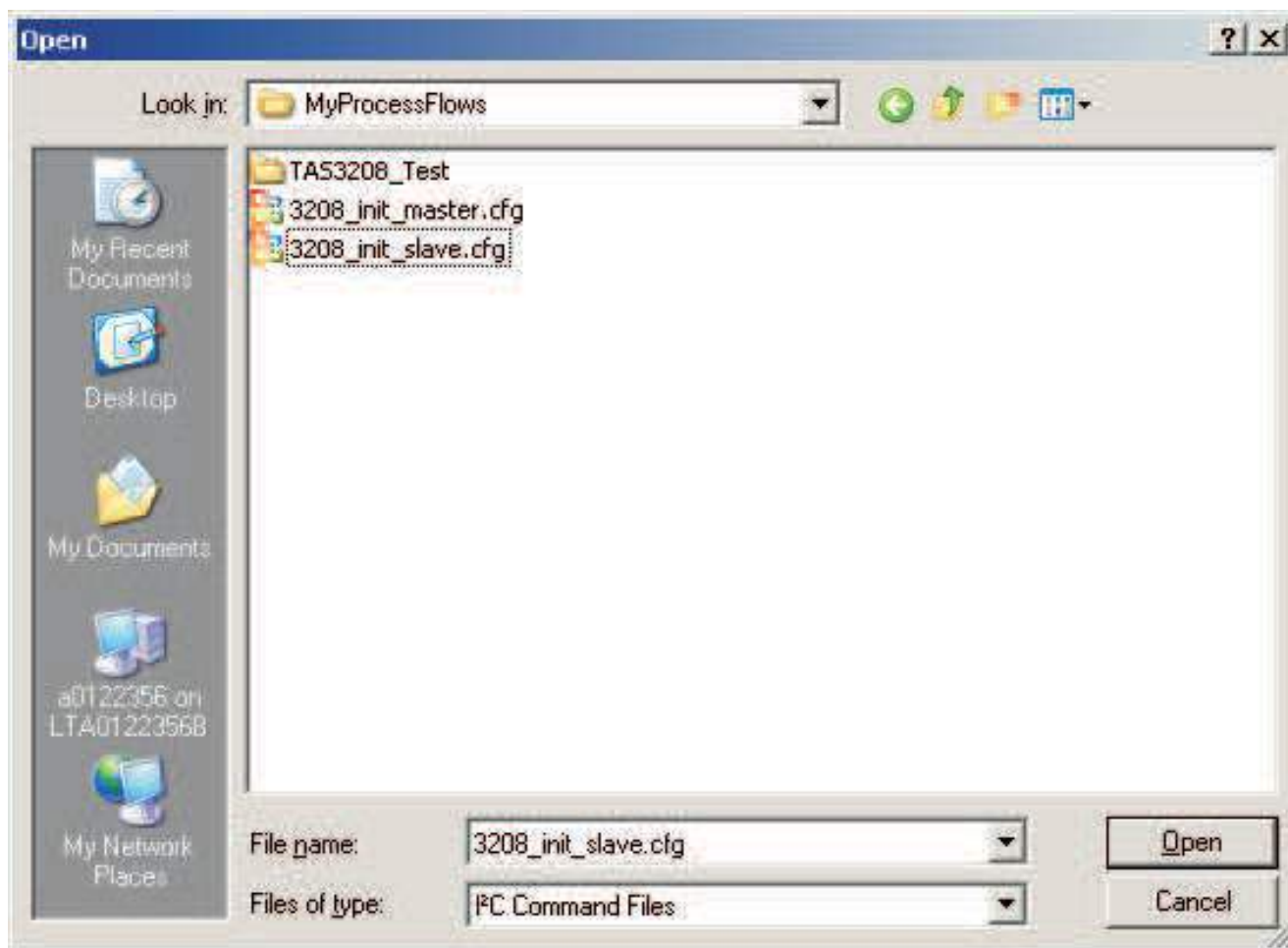


Figure 2-3. Specifying the I²C Initialization Sequence

Then verify that the “Execute on reset” box is checked.

At this point, a process flow can be built using the TAS3208 application framework, the TAS3208 I/O components, and the audio processing components.

Building and running a process flow

A good starting point is to load the predefined TAS3208 Test process flow.

This flow is loaded by selecting File/Open.

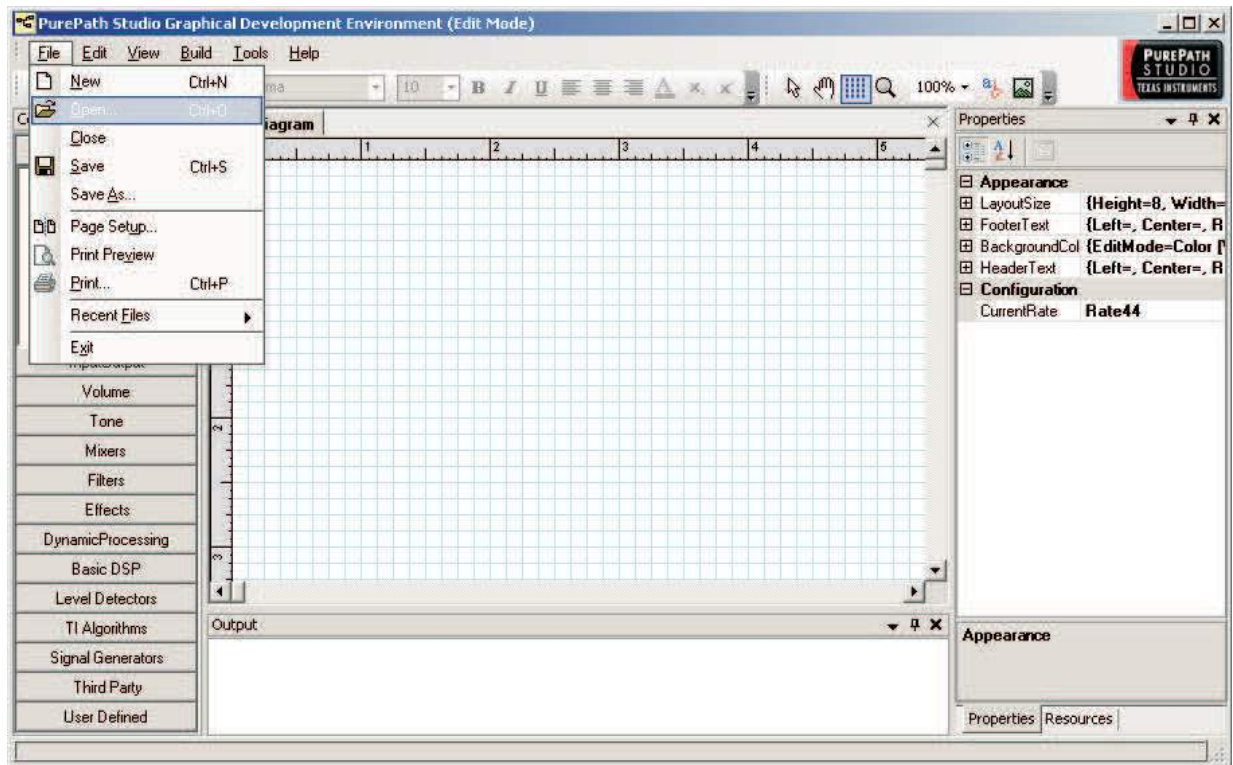


Figure 2-4. Loading a Process Flow

Select TAS3208TEST.pfw (see [Figure 2-5](#)).

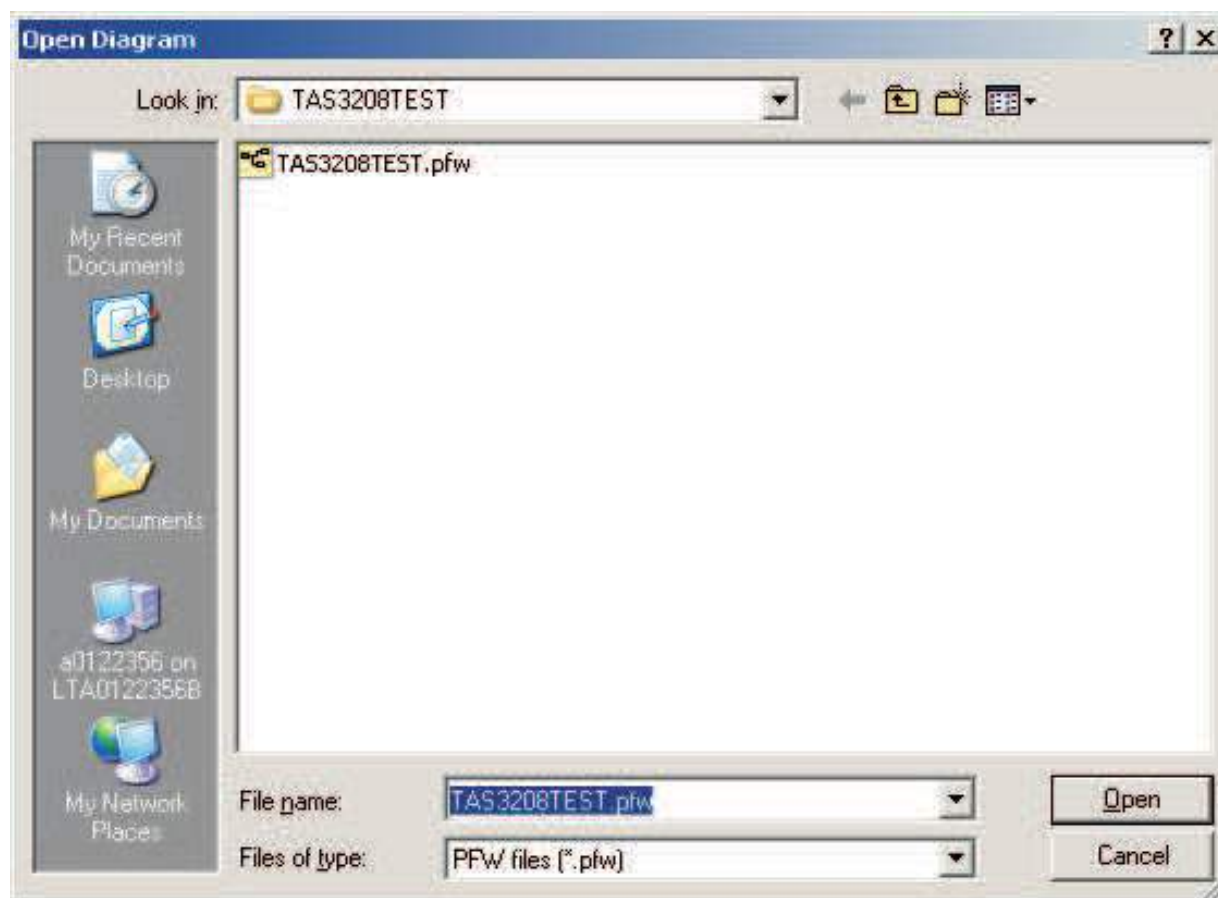


Figure 2-5. Loading a Process Flow (Part B)

This will load a process flow that streams a signal from either the ADC or SAP1 input to the DAC and SAP outputs.

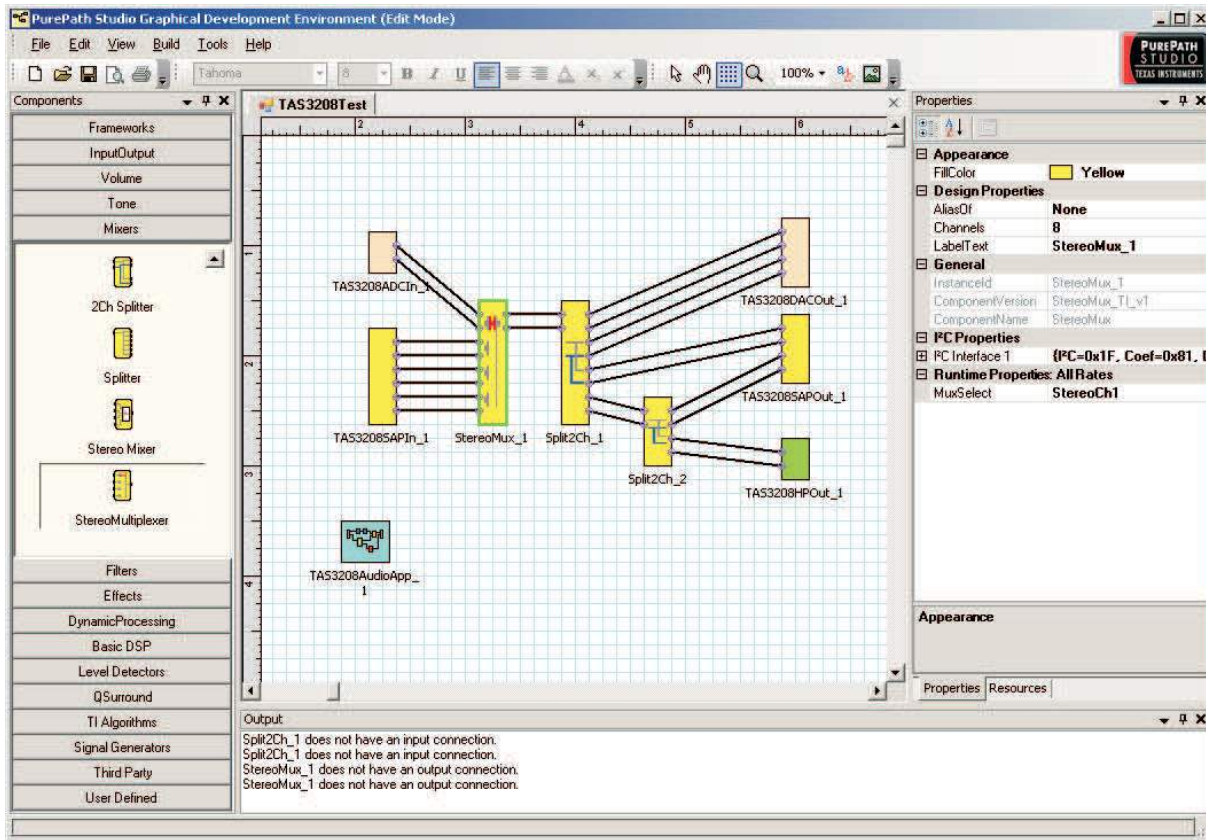


Figure 2-6. GDE Test Process Flow

The input selection is performed by selecting the Stereo Multiplexer and changing the Mux Select Property to StereoCh1, StereoCh2, StereoCh3, or StereoCh4.

To build this process flow and execute it on the EVM, select Build/Generate Code, then Build/Download code, and finally Build/Run.

When the GDE transitions to run mode, the GDE resets the TAS3208EVM.

The reset restores the TAS3208 register to the default values.

The TAS3208 then loads the EEPROM image and the TAS3208_init_master/slave.cfg file.

At this point, the TAS3208EVM transitions to the run mode with the mute in the ON state.

For the TAS3208 to stream audio out of the DAC outputs, the mute must be returned to the inactive state. This is done by pressing the mute button. The mute LED will be extinguished.

For more advanced use of the GDE, please refer to GDE online help, GDE release notes, and the *TAS3108 MCU Programmer's Reference Guide*.

System Interfaces

This chapter describes the TAS3208EVM board power supplies and system interfaces.

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3.1 Control Interface (Control1), Input

This interface connects the TAS3208EVM board to an internal controller. This is a general-purpose interface.

Table 3-1. Control1 Pin Description

Pin No.	Net-Name at Schematics	Description
1	SDA	I ² C bidirectional data line
2	SCL	I ² C input clock line
3	GND	Ground
4	3.3 V	Power
5	GPIO1	General-purpose bidirectional I/O 1
6	GPIO2	General-purpose bidirectional I/O 2
7	RESETZ	System reset (bidirectional). Activate $\overline{\text{MUTE}}$ before $\overline{\text{RESET}}$ for quiet reset.
8	MUTEZ	Ramp volume from any setting to noiseless soft mute. Mute can also be activated by I ² C.
9	GPIO3	General-purpose bidirectional I/O 3
10	GPIO4	General-purpose bidirectional I/O 4

3.2 Digital Audio Interface, Input (J1)

The digital audio interface contains digital audio signal data (I²S), clocks, etc. Please see the *TAS3208 Data Manual* for signal timing and details not explained in this document.

Table 3-2. J1 Pin Description

Pin No.	Net-Name at Schematics	Description
1	GND	Ground
2	MCLKin	Master clock input
3	GND	Ground
4	SCLKin	I ² S bit clock
5	GND	Ground
6	LRCLKin	I ² S left-right clock
7	GND	Ground
8	SDIN1	I ² S data 1, channel 1 and 2
9	GND	Ground
10	SDIN2	I ² S data 2, channel 3 and 4
11	GND	Ground
12	SDIN3	I ² S data 3, channel 5 and 6
13	GND	Ground
14	GND	Ground

3.3 Analog Input (J6)

Table 3-3. J6 Pin Description

Pin No.	Net-Name at Schematics	Description
1	GND	Ground
2	LineIn1L	Line in left channel 1, also on RCA J5
3	GND	Ground
4	LineIn1R	Line in right channel 1, also on RCA J5
5	GND	Ground
6	LineIn2L	Line in left channel 2
7	GND	Ground
8	LineIn2R	Line in right channel 2
9	GND	Ground
10	LineIn3L	Line in left channel 3
11	GND	Ground
12	LineIn3R	Line in right channel 3
13	GND	Ground
14	LineIn4L	Line in left channel 4
15	GND	Ground
16	LineIn4R	Line in right channel 4
17	GND	Ground
18	LineIn5L	Line in left channel 5
19	GND	Ground
20	LineIn5R	Line in right channel 5
23	GND	Ground
22	LineIn6L	Line in left channel 6
23	GND	Ground
24	LineIn6R	Line in right channel 6
25	GND	Ground
26	LineIn7L	Line in left channel 7
27	GND	Ground
28	LineIn7R	Line in right channel 7
29	GND	Ground
30	LineIn8L	Line in left channel 8
31	GND	Ground
32	LineIn8R	Line in right channel 8
33	GND	Ground
34	LineIn9L	Line in left channel 9
35	GND	Ground
36	LineIn9R	Line in right channel 9
37	GND	Ground
38	LineIn10L	Line in left channel 10
39	GND	Ground
40	LineIn10R	Line in right channel 10

3.4 Digital Audio Interface, Output (J9)

The digital audio interface contains digital audio signal data (I²S), clocks, etc. Please see the *TAS3208 Data Manual* for signal timing and details not explained in this document.

Table 3-4. J9 Pin Description

Pin No.	Net-Name at Schematics	Description
1	GND	Ground
2	MCLKO	Master clock output
3	GND	Ground
4	SCLKout	I ² S bit clock
5	GND	Ground
6	LRCLKout	I ² S left-right clock
7	GND	Ground
8	SDOUT1	I ² S data 1, channel 1 and 2
9	GND	Ground
10	SDOUT2	I ² S data 2, channel 3 and 4

3.5 RCA Connectors

Table 3-5. RCA Connectors Pin Description

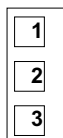
Pin No.	Net-Name at Schematics	Description
1	Signal	Channel input/output – tip
2	AGND	Analog ground – sleeve

3.6 MSP430 Port Connector (J3)

Table 3-6. J3 Pin Description

Pin No.	Net-Name at Schematics	Description
1	TDO	Test data out
2		
3	TCLK	Test clock
4	3.3V	3.3 V power supply
5	TMS	Test mode select
6		
7	TCK	Test clock
8	TEST	Test
9	GND	GND
10		
11	RESET	Reset
12		
13		
14		

3.7 I²S Master Slave Jumper (JP3)



PCB Connector (Top View)

Table 3-7. JP3 Pin Description

Pin No.	Description
1, 2	I ² S slave
2, 3	I ² S master

MSP430 Programming

This chapter describes the MSP430 programming.

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4.1 Example of MSP430 Programming

The MSP430 can be programmed to provide TAS3308 and power-stage initialization and control. During initialization, the MSP430 should wait for the TAS3308 to complete booting from EEPROM. It then sends an initialization sequence to the TAS3308. At this point, the MSP430 sends I²C commands to the TAS3308 when it receives an input from one of the onboard switches or the IR remote control.

The microcontroller has eight circuit-board pushbuttons and LEDs to support user control functions.

These controls can be programmed to provide functions and indications, such as:

- Select analog/digital source
- Function 1 (surround effect) on/off
- Function 2 (EQ) on/off
- Function 3 (DRC) on/off
- Volume up/volume down

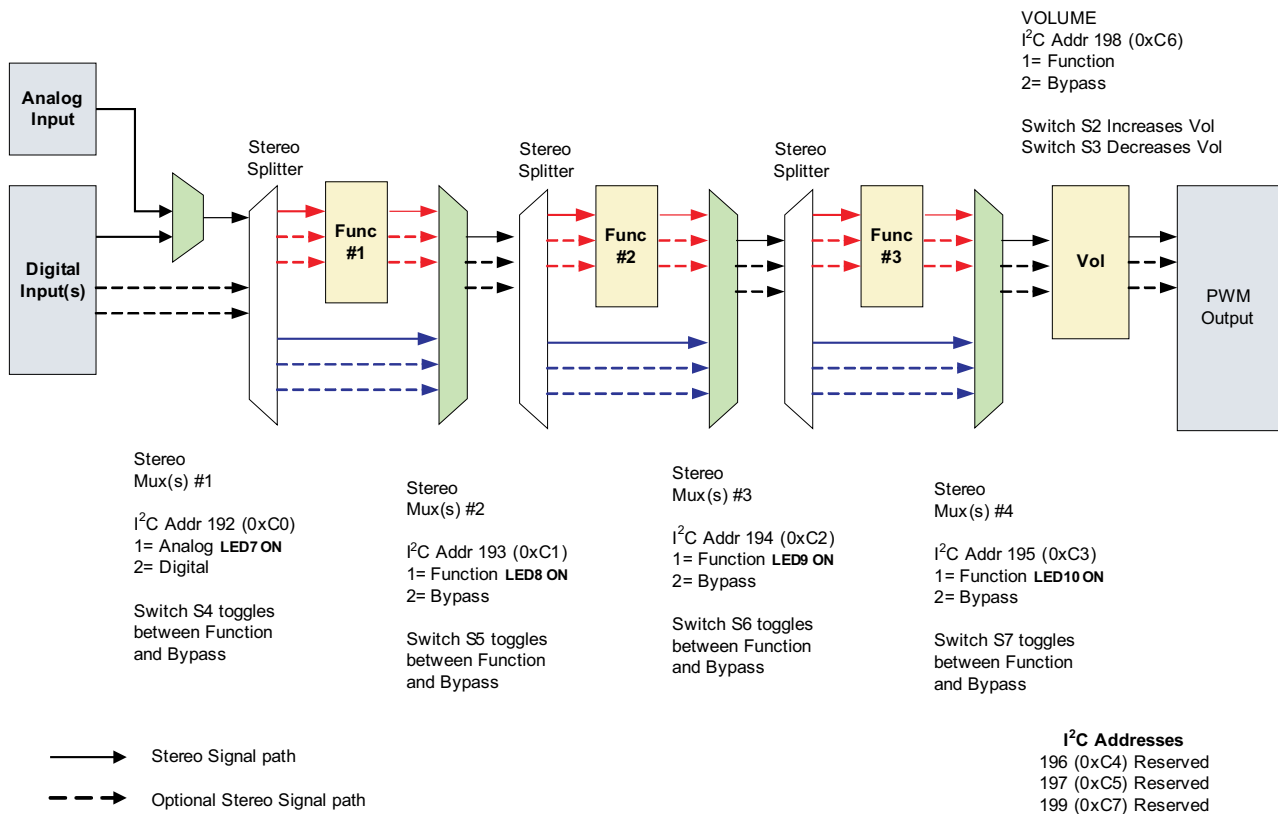


Figure 4-1. Example MSP430 Control

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Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
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