

### EVALUATION BOARD OVERVIEW

This evaluation board provides a simple analog input and output setup for the AD1940. The DSP is controlled by Analog Devices' SigmaStudio™ software, which interfaces to the board via a USB connection. This evaluation board may be powered either over the USB bus or by a single +6V supply, which is regulated to the voltages required on the board. The PC board is a 3" × 3" four-layer design, with a single ground plane and a single power plane on the inner layers. The AD1938 codec handles all signal conversion between the analog and digital domains.

### PACKAGE CONTENTS

The EVAL-AD1940MINIB package contains these items:

- EVAL-AD1940MINIB evaluation board
- EVAL-ADUSB1 USB adapter
- SigmaStudio software CD
- Universal power supply
- USB Cable
- Evaluation board/software quick-start guide

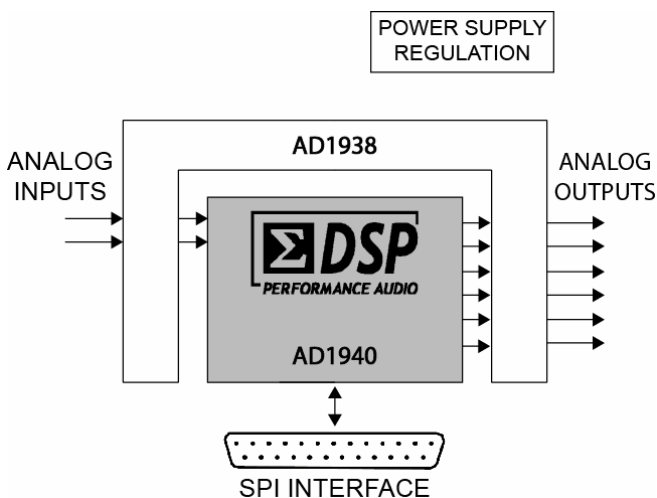


Figure 1. Evaluation Board Block Diagram

### AD1940 OVERVIEW

The AD1940 is a complete 28/56-bit, single-chip, multichannel audio DSP in the SigmaDSP family of parts. Processing includes equalization, crossover, bass enhancement, multiband dynamics processing, delay compensation, speaker compensation, and stereo image widening. These algorithms can be used to compensate for the real-world limitations of speakers, amplifiers, and listening environments, resulting in a dramatic improvement of perceived audio quality.

The signal processing used in the AD1940 is comparable to that found in high-end studio equipment. Most of the processing is done in full 56-bit double-precision mode, resulting in very good low-level signal performance and the absence of limit cycles or idle tones. The dynamics processor uses a sophisticated, multiple-breakpoint algorithm often found in high-end broadcast compressors.

The AD1940 is a fully programmable DSP. The easy-to-use SigmaStudio software allows the user to graphically configure a custom signal processing flow, using blocks such as biquad filters, dynamics processors, level controls, and surround sound processors. An extensive control port allows click-free parameter updates, along with readback capability from any point in the algorithm flow.

The EVAL-AD1940MINIB's onboard AD1938 Codec handles all A/D and D/A conversion. One stereo analog input and three stereo analog outputs are provided on the board, along with appropriate filters.

#### Rev. PrA

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**TABLE OF CONTENTS**

Setup.....	3	SigmaStudio Software Interface.....	4
Power Supply.....	3	Software Installation .....	4
Analog Audio Inputs and Outputs.....	3	Hardware Setup - USB.....	4
Control Interface .....	3	Using SigmaStudio .....	4
Switch Functions .....	3	Evaluation Board Schematics.....	5
IC Functions.....	3	Evaluation Board PCB Silkscreen Drawing.....	9
LED Functions .....	3	Ordering Guide.....	10
Reset .....	3		

**REVISION HISTORY**

5/06—Revision PrA: Initial Preliminary Version

## SETUP

### POWER SUPPLY

The evaluation board is powered by either single supply through connector J14 or through the USB port. The supply on J14 should be +6 V DC, with the ability to source at least 300 mA, and must have a tip-positive polarity. This single supply is regulated on the board to separate +5 V analog and digital planes. Regulator U8 generates a 3.3 V supply for use by the AD1938, which is further reduced to 2.5 V by the AD1940's on-chip regulator. The +5 V regulator is used to power the output opamps and SPI signal buffer/level shifter.

### ANALOG AUDIO INPUTS AND OUTPUTS

The evaluation board can input two analog audio signals and can output six signals. The converter connected to the AD1940 SigmaDSP is a 4-ADC/8-DAC AD1938. The full-scale input voltage can be set at either 1 V<sub>rms</sub> or 2 V<sub>rms</sub> by switch S2. The full-scale output voltage is always set at 1 V<sub>rms</sub>.

### CONTROL INTERFACE

Header J2 is the communications connector for Serial Peripheral Interface (SPI) control signals. Typically, the EVAL-ADUSB1 USB adapter board will attach here and connect to a USB port on the PC, enabling communication between the AD1940 and SigmaStudio graphical programming software. Communication is accomplished using the 4-wire SPI master/slave protocol. The USB adapter is provided with the evaluation board, or is available for standalone use in a target system. If necessary, the EVAL-AD1940MINIB can also connect directly to the PC's parallel port through J2, although this is not the recommended control interface. More information on the software connection is available in the SigmaStudio Software Interface section.

### SWITCH FUNCTIONS

This evaluation board is primarily fixed-function. Table 1 shows the function of each switch on the board.

**Table 1. Switch functions**

Reference Designator	Function
S1	Board reset
S2	Set full scale input range between 1 V <sub>rms</sub> (switch to the inside) or 2 V <sub>rms</sub> (switch to the outside).

### IC FUNCTIONS

Table 2 explains the function of each IC on the evaluation board.

**Table 2. IC Functions**

Reference Designator	Function
U1	AD1940 SigmaDSP audio processor
U2	AD1938 Codec for A/D and D/A conversion
U3	AD8608 Quad Opamp for analog audio buffering and filtering
U4	ADP3336 Power regulator for +5 V analog parts
U5	AD8608 Quad Opamp for analog audio output buffering and input clip detection
U6	AD8608 Quad Opamp for analog audio input buffering and filtering
U8	ADP3336 Power regulator for +3.3 V digital parts
U9	LC541A octal buffer/driver for control signals
U10	ADM811 for reset debounce

### LED FUNCTIONS

The two LEDs on the evaluation board are useful components that can indicate that the board is properly powered and set up.

D11 indicates that the +3.3 V supply is present (either through an external supply or through USB).

The clipping LED D2 will illuminate when the input signal reaches approximately 97% of the full-scale input range of the ADC, based on the setting of switch S2.

### RESET

The evaluation board can be reset with push-button switch S1. This reset signal is debounced by the ADM811 (U10). The board may also be reset by disconnecting the power. After reset, the AD1940 is muted by default, and a control port write will be necessary in order to pass audio again. See the Using SigmaStudio section for more specific details about this operation.

## SIGMASTUDIO SOFTWARE INTERFACE

The AD1940 SigmaDSP is controlled by Analog Devices' SigmaStudio Software. This software allows the developer to graphically build a fully customized audio signal processing flow. SigmaStudio generates run-time DSP code that is downloaded to the SigmaDSP through its SPI control port. This connection on the evaluation board is header J2.

### SOFTWARE INSTALLATION

The evaluation board cannot be run with a PC until the SigmaStudio software has been installed. SigmaStudio must be installed on a PC running Windows 2000 or XP. The following steps should be taken to properly install the software and drivers.

1. Insert the SigmaStudio CD and browse the disc.
2. Install Microsoft .NET Framework version 1.1  
Double-Click *dotnetfx.exe*  
.NET installation can be skipped if ver1.1 or newer has already been installed from  
[www.windowsupdate.com](http://www.windowsupdate.com) or  
<http://www.microsoft.com/net/>
3. Install SigmaStudio - double-click *setup.exe* and follow the prompts to install.
4. Restart the PC if the parallel port is to be used for communication.

### HARDWARE SETUP - USB

The steps below explain how to set up the USB connection on a PC.

1. Use the included USB cable to make a connection between the USB Adapter board and an available USB port on your computer.

2. Windows should recognize the device, and the **Found New Hardware Wizard** will appear on your screen.
3. **Select Install from a list or specific location (Advanced)**, and then click on **Next**.
4. Select **Search for the best driver in these locations**, then make sure **Search removable media (floppy, CD-ROM...)** is unchecked, and **Include this location in the search** is checked.
5. Click the **Browse** button.
6. Browse to the USB drivers folder. By default, it should be located at **C:\Program Files\Analog Devices\Sigma Studio\USB Drivers**.
7. Click **OK**.
8. Click **Next** to begin the installation.
9. Windows will tell you that the software has not passed Windows Logo testing. Click **Continue Anyway**.
10. When the installation is complete, click **Finish**.

### USING SIGMASTUDIO

The AD1940 does not pass an audio signal on power up. First, the user must write to bit 9 of the DSP Core Control Register, which will allow data to pass from input to output. This procedure may be done manually, but this bit is always set to 1 after the program and parameter loading procedure is completed by clicking the **Link-Compile-Download** button in SigmaStudio. For more information about using SigmaStudio with the evaluation board, please read the software's online help document.

Software updates are provided via Analog Devices' FTP site.

Please e-mail [SigmaDSP@analog.com](mailto:SigmaDSP@analog.com) for login information.

MINI BOARD SCHEMATICS

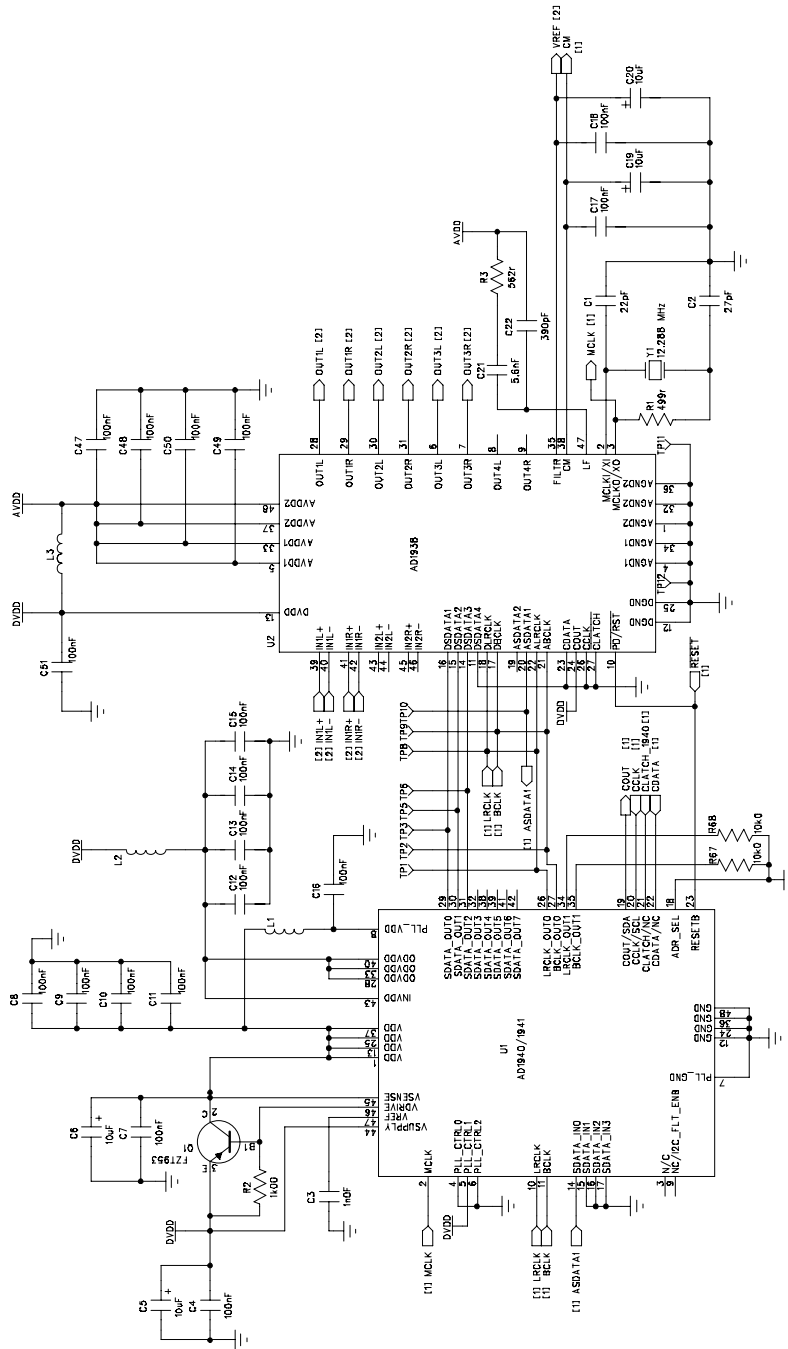


Figure 2. AD1940 SigmadSP and AD1938 Codec

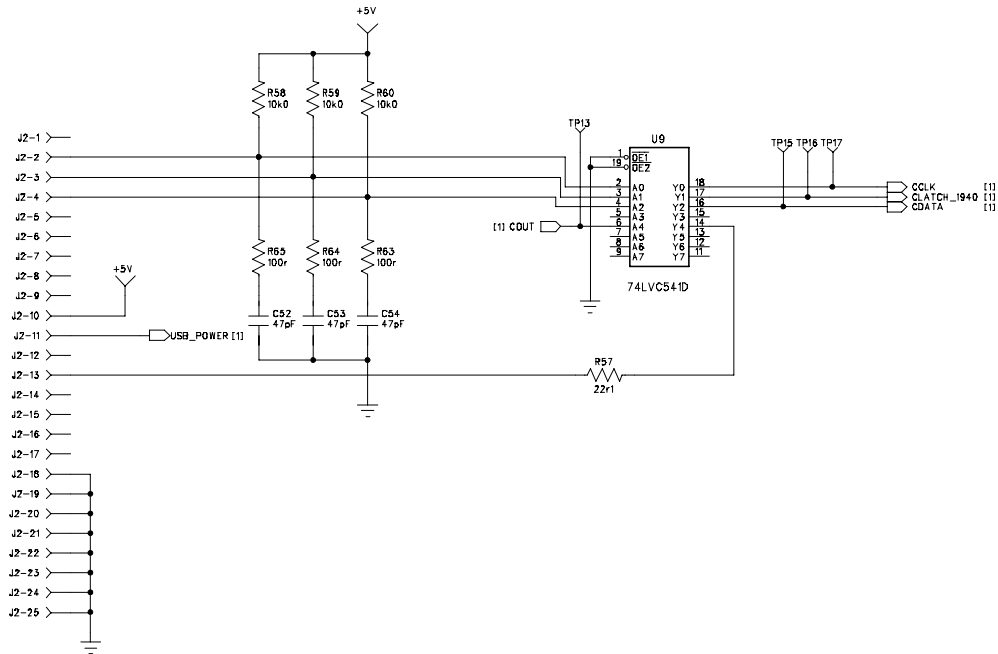


Figure 3. SPI Interface

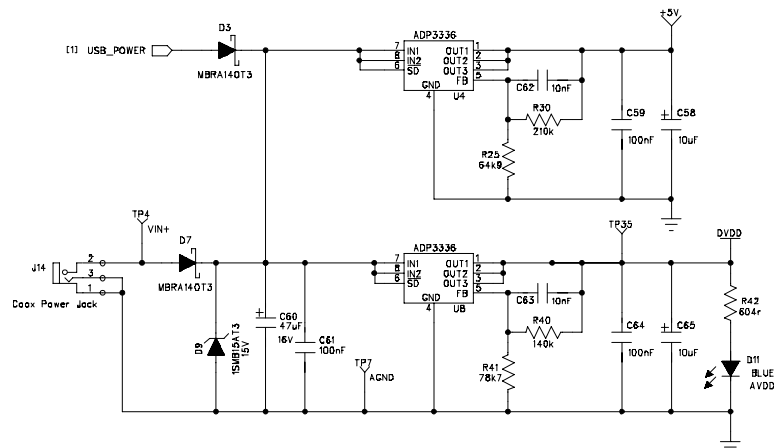


Figure 4. Power Supply

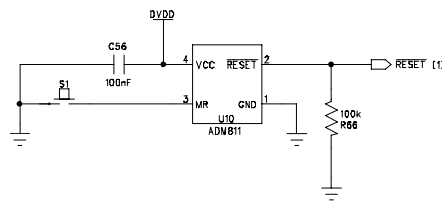


Figure 5. Reset Circuit

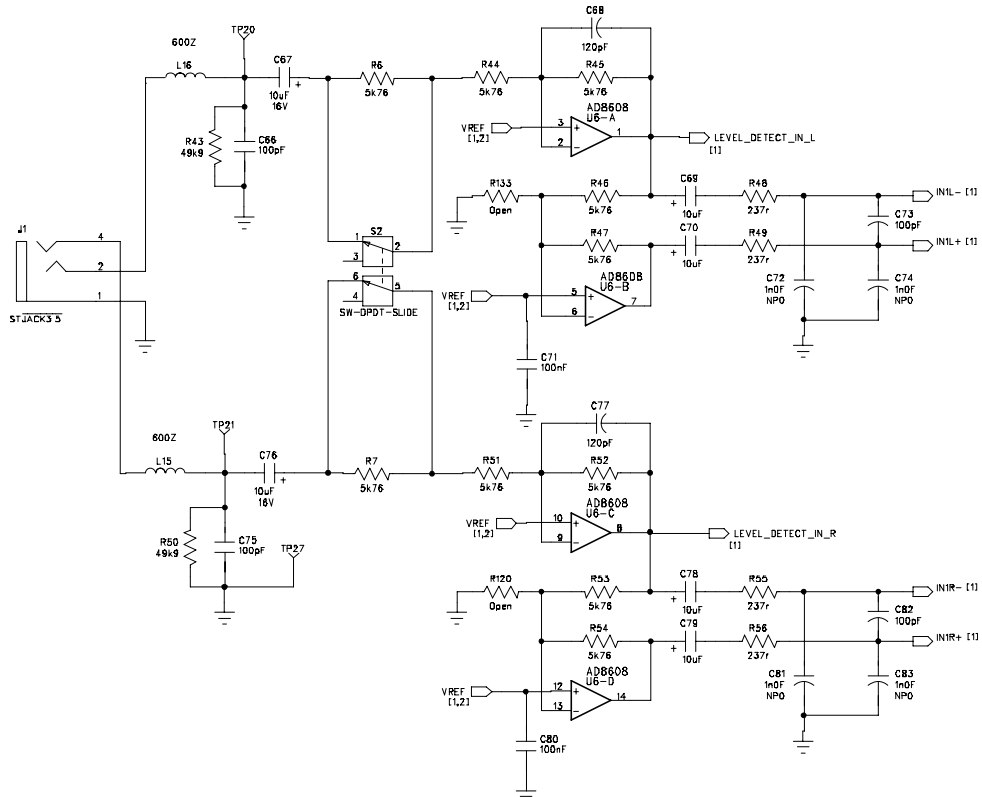


Figure 6. Input Filters

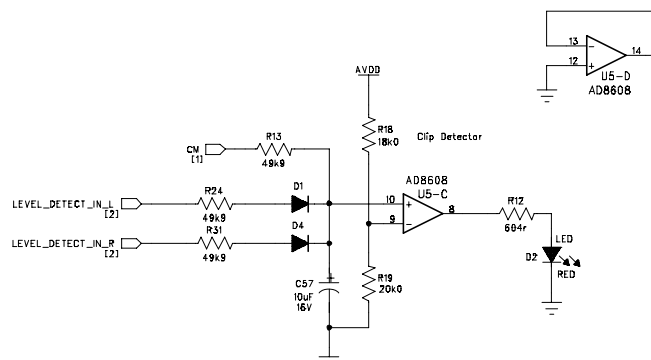


Figure 7. Input Clipping Detection Circuit

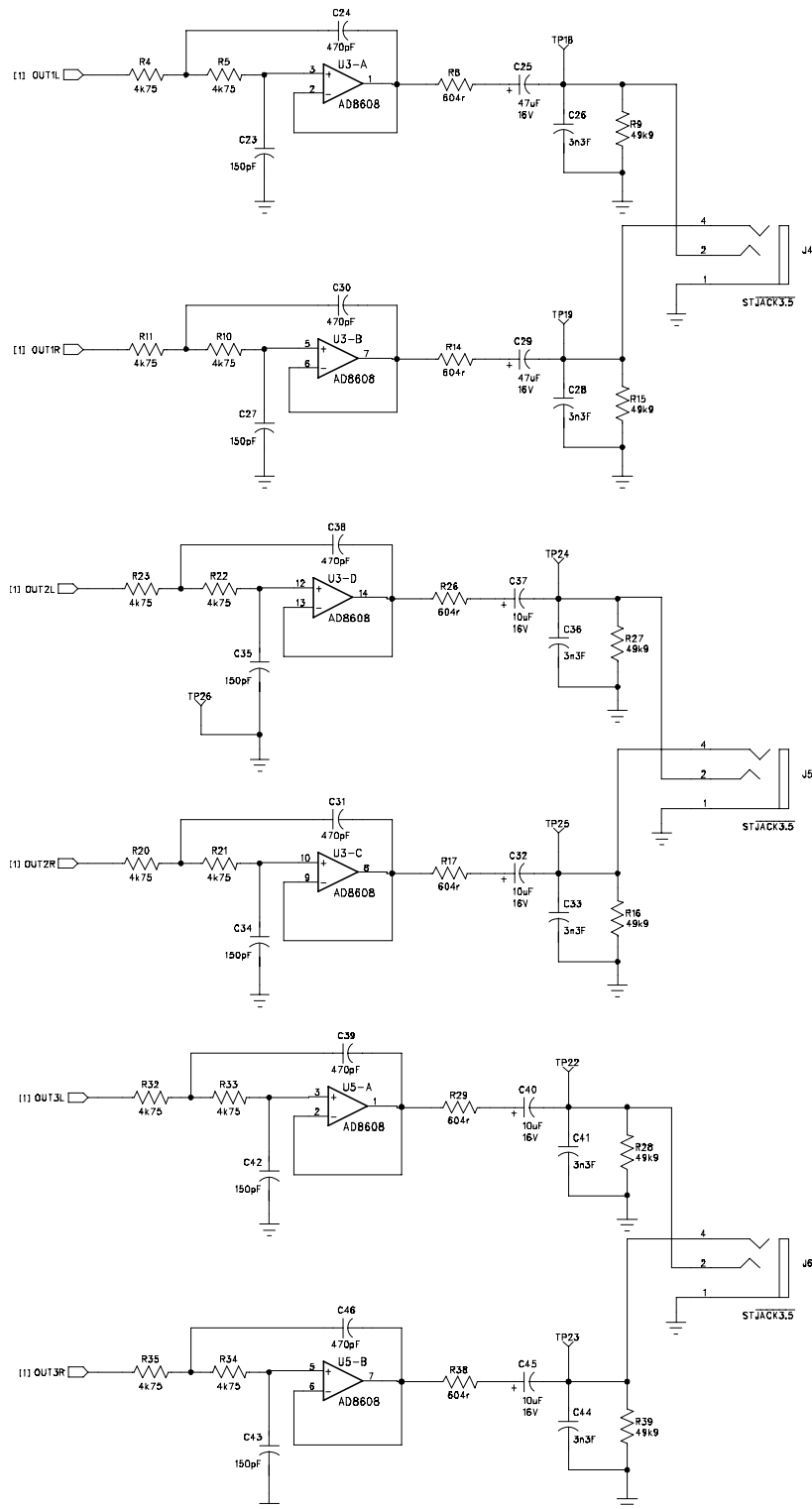


Figure 8. Output Filters



## EVALUATION BOARD PCB SILKSCREEN DRAWING

*Figure 9. Top Layer Silkscreen*

**ORDERING GUIDE**

<b>Model</b>	<b>Temperature Range</b>	<b>Package Description</b>	<b>Package Option</b>
EVAL-AD1940MINIB		Evaluation Board	
EVAL-ADUSB1		Evaluation Board	