

**Blackfin® Audio  
EZ-Extender® Manual**

Datasheet.Directory

Revision 2.2, July 2012

Part Number  
82-000195-01

Analog Devices, Inc.  
One Technology Way  
Norwood, Mass. 02062-9106



## **Copyright Information**

© 2012 Analog Devices, Inc., ALL RIGHTS RESERVED. This document may not be reproduced in any form without prior, express written consent from Analog Devices, Inc.

Printed in the USA.

## **Disclaimer**

Analog Devices, Inc. reserves the right to change this product without prior notice. Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use; nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under the patent rights of Analog Devices, Inc.

## **Trademark and Service Mark Notice**

The Analog Devices logo, Blackfin, CrossCore, EngineerZone, EZ-Extender, EZ-KIT Lite, and VisualDSP++ are registered trademarks of Analog Devices, Inc.

All other brand and product names are trademarks or service marks of their respective owners.

## Regulatory Compliance

The Blackfin Audio EZ-Extender is designed to be used solely in a laboratory environment. The board is not intended for use as a consumer end product or as a portion of a consumer end product. The board is an open system design which does not include a shielded enclosure and therefore may cause interference to other electrical devices in close proximity. This board should not be used in or near any medical equipment or RF devices.

The Blackfin Audio EZ-Extender has been certified to comply with the essential requirements of the European EMC directive 89/336/EEC (inclusive 93/68/EEC) and, therefore, carries the “CE” mark.

The Blackfin Audio EZ-Extender has been appended to Analog Devices, Inc. EMC Technical File (EMC TF) referenced ‘DSPTOOLS1’ dated December 21, 1997 and was declared CE compliant by an appointed Notified Body (No.0673) as listed below.

Notified Body Statement of Compliance: Z600ANA1.024



Issued by: Technology International (Europe) Limited  
56 Shrivenham Hundred Business Park  
Shrivenham, Swindon, SN6 8TY, UK

The Blackfin Audio EZ-Extender contains ESD (electrostatic discharge) sensitive devices. Electrostatic charges readily accumulate on the human body and equipment and can discharge without detection. Permanent damage may occur on devices subjected to high-energy discharges. Proper ESD precautions are recommended to avoid performance degradation or loss of functionality. Store unused extender boards in the protective shipping package.





# CONTENTS

## PREFACE

Product Overview .....	viii
Purpose of This Manual .....	ix
Intended Audience .....	ix
Manual Contents .....	x
What's New in This Manual .....	x
Technical Support .....	xi
Supported Products .....	xii
Product Information .....	xii
Analog Devices Web Site .....	xii
EngineerZone .....	xiii
Related Documents .....	xiv

## BLACKFIN AUDIO EZ-EXTENDER INTERFACES

Audio EZ-Extender Setup .....	1-1
Analog Audio Interface .....	1-2
Digital Audio Interface .....	1-4

# Contents

## AUDIO EZ-EXTENDER HARDWARE REFERENCE

System Architecture .....	2-2
Configuration Jumpers and Switches .....	2-4
ADSP-BF537 EZ-KIT Lite Select Jumper (JP1.1/2) .....	2-5
EZ-KIT Lite SPORT0 Enable Jumper (JP1.3/4) .....	2-6
EZ-KIT Lite SPORT1 Enable Jumper (JP1.5/6) .....	2-6
SPORT Select Jumper (JP1.7/8) .....	2-6
AD1938 MCLK Source Jumper (JP2) .....	2-6
SPDIF Loopback Jumper (JP4) .....	2-7
Analog Input Gain Switches (SW1–4) .....	2-7

## AUDIO EZ-EXTENDER BILL OF MATERIALS

## AUDIO EZ-EXTENDER SCHEMATIC

## INDEX

# PREFACE

Thank you for purchasing the Blackfin<sup>®</sup> Audio EZ-Extender<sup>®</sup>, Analog Devices, Inc. daughter board to the EZ-KIT Lite<sup>®</sup> evaluation system for the ADSP-BF533, ADSP-BF537, and ADSP-BF561 Blackfin processors.

Blackfin processors are embedded processors that support a Media Instruction Set Computing (MISC) architecture. This architecture is the natural merging of RISC, media functions, and digital signal processing characteristics towards delivering signal processing performance in a microprocessor-like environment.

EZ-KIT Lites and Audio EZ-Extenders are designed to be used in conjunction with the CrossCore<sup>®</sup> Embedded Studio (CCES) and VisualDSP++<sup>®</sup> software development environments. The development environment facilitates advanced application code development and debug, such as:

- Create, compile, assemble, and link application programs written in C++, C, and Audio EZ-Extender assembly
- Load, run, step, halt, and set breakpoints in application programs
- Read and write data and program memory
- Read and write core and peripheral registers
- Plot memory

To learn more about Analog Devices development software, go to <http://www.analog.com/processors/tools>.

# Product Overview

The Blackfin Audio EZ-Extender is a separately sold daughter board that plugs onto the expansion interface of the ADSP-BF533, ADSP-BF537, or ADSP-BF561 EZ-KIT Lite evaluation system. The daughter board aids the design and prototyping phases of the ADSP-BF533, ADSP-BF537, and ADSP-BF561 processor targeted applications.

Please visit [www.analog.com/EX1-Audio](http://www.analog.com/EX1-Audio) for additional information, including CCES support.

The board extends the capabilities of the evaluation system by providing a connection to audio codecs, including two analog audio codecs and one dual analog/digital audio codec with an interface to digital Sony Philips Digital Interface (SPDIF) audio.

The following is a list of the Blackfin Audio EZ-Extender interfaces.

- Analog audio interface
  - AD1938 – Analog Devices 192 kHz audio codecs
  - Four stereo analog audio inputs via RCA jacks
  - Eight stereo analog audio outputs via RCA jacks
- Digital audio interface

One ADAV801 – Analog Devices SPDIF transceiver with sample rate converter

- One SPDIF input via an RCA jack
- One SPDIF output via an RCA jack
- Expansion interface on both sides of the board for stacking other EZ-Extender boards



Before using any of the interfaces, follow the setup procedure in [“Audio EZ-Extender Setup”](#) on page 1-1.

Example programs are available to demonstrate capabilities of the Blackfin Audio EZ-Extender board.

## Purpose of This Manual

The *Blackfin Audio EZ-Extender Manual* describes operation and configuration of the extender board components. A schematic and a bill of materials are provided as a reference guide for future Blackfin processor board designs.

## Intended Audience

This manual is a user’s guide and reference to the Blackfin Audio EZ-Extender. Programmers who are familiar with the Analog Devices Blackfin processor architecture, operation, and development tools are the primary audience for this manual.

Programmers who are unfamiliar with Analog Devices processors can use this manual but should supplement it with other texts that describe your target architecture. For the locations of these documents, see [“Related Documents”](#).

Programmers who are unfamiliar with CCES or VisualDSP++ should refer to the online help and user’s manuals.

# Manual Contents

The manual consists of:

- Chapter 1, “[Blackfin Audio EZ-Extender Interfaces](#)” on page 1-1  
Provides basic board information.
- Chapter 2, “[Audio EZ-Extender Hardware Reference](#)” on page 2-1  
Provides information on the hardware aspects of the board.
- Appendix A, “[Audio EZ-Extender Bill Of Materials](#)” on page A-1  
Provides a list of components used to manufacture the EZ-Extender board.
- Appendix B, “[Audio EZ-Extender Schematic](#)” on page B-1  
Provides the resources to allow EZ-KIT Lite board-level debugging or to use as a reference guide. Appendix B is part of the online help.

## What’s New in This Manual

This is revision 2.2 of the *Blackfin Audio EZ-Extender Manual*. The manual has been updated to include CCES information. In addition, modifications and corrections based on errata reports against the previous manual revision have been made.

For the latest version of this manual, please refer to the Analog Devices Web site.

# Technical Support

You can reach Analog Devices processors and DSP technical support in the following ways:

- Post your questions in the processors and DSP support community at EngineerZone®:  
<http://ez.analog.com/community/dsp>
- Submit your questions to technical support directly at:  
<http://www.analog.com/support>
- E-mail your questions about processors, DSPs, and tools development software from **CrossCore Embedded Studio** or **VisualDSP++**:

Choose **Help > Email Support**. This creates an e-mail to [processor.tools.support@analog.com](mailto:processor.tools.support@analog.com) and automatically attaches your **CrossCore Embedded Studio** or **VisualDSP++** version information and `license.dat` file.

- E-mail your questions about processors and processor applications to:  
[processor.support@analog.com](mailto:processor.support@analog.com) or  
[processor.china@analog.com](mailto:processor.china@analog.com) (Greater China support)
- In the **USA only**, call **1-800-ANALOGD** (1-800-262-5643)
- Contact your Analog Devices sales office or authorized distributor. Locate one at:  
[www.analog.com/adi-sales](http://www.analog.com/adi-sales)

## Supported Products

- Send questions by mail to:  
Processors and DSP Technical Support  
Analog Devices, Inc.  
Three Technology Way  
P.O. Box 9106  
Norwood, MA 02062-9106  
USA

## Supported Products

The Blackfin Audio EZ-Extender is designed as an extender board to the ADSP-BF533, ADSP-BF537, and ADSP-BF561 EZ-KIT Lite evaluation systems.

## Product Information

Product information can be obtained from the Analog Devices Web site and the online help.

## Analog Devices Web Site

The Analog Devices Web site, [www.analog.com](http://www.analog.com), provides information about a broad range of products—analogue integrated circuits, amplifiers, converters, and digital signal processors.

To access a complete technical library for each processor family, go to [http://www.analog.com/processors/technical\\_library](http://www.analog.com/processors/technical_library). The manuals selection opens a list of current manuals related to the product as well as a link to the previous revisions of the manuals. When locating your manual title, note a possible errata check mark next to the title that leads to the current correction report against the manual.

Also note, [MyAnalog](#) is a free feature of the Analog Devices Web site that allows customization of a Web page to display only the latest information about products you are interested in. You can choose to receive weekly e-mail notifications containing updates to the Web pages that meet your interests, including documentation errata against all manuals. [MyAnalog](#) provides access to books, application notes, data sheets, code examples, and more.

Visit [MyAnalog](#) to sign up. If you are a registered user, just log on. Your user name is your e-mail address.

## EngineerZone

EngineerZone is a technical support forum from Analog Devices. It allows you direct access to ADI technical support engineers. You can search FAQs and technical information to get quick answers to your embedded processing and DSP design questions.

Use EngineerZone to connect with other DSP developers who face similar design challenges. You can also use this open forum to share knowledge and collaborate with the ADI support team and your peers. Visit <http://ez.analog.com> to sign up.

# Related Documents

For additional information about the product, refer to the following publications.

Table 1. Related Processor Publications

Title	Description
<ul style="list-style-type: none"><li>• <i>ADSP-BF531/ADSP-BF532/ADSP-BF533 Blackfin Embedded Processor Data Sheet</i></li><li>• <i>ADSP-BF534/ADSP-BF536/ADSP-BF537 Blackfin Embedded Processor Data Sheet</i></li><li>• <i>ADSP-BF561 Blackfin Embedded Symmetric Multiprocessor Data Sheet</i></li></ul>	General functional description, pinout, and timing
<ul style="list-style-type: none"><li>• <i>ADSP-BF533 Blackfin Processor Hardware Reference</i></li><li>• <i>ADSP-BF537 Blackfin Processor Hardware Reference</i></li><li>• <i>ADSP-BF561 Blackfin Processor Hardware Reference</i></li></ul>	Description of the internal processor architecture and all register functions
<i>Blackfin Processor Programming Reference</i>	Description of all allowed processor assembly instructions

# 1 BLACKFIN AUDIO EZ-EXTENDER INTERFACES

This chapter provides the Blackfin Audio EZ-Extender setup procedure and describes two types of interfaces the extender supports.

The information is presented in the following order.

- [“Audio EZ-Extender Setup” on page 1-1](#)
- [“Analog Audio Interface” on page 1-2](#)
- [“Digital Audio Interface” on page 1-4](#)

## Audio EZ-Extender Setup

It is very important to set up all components of the system containing the Blackfin Audio EZ-Extender, then apply power to the system. The following procedure is recommended for the correct setup.

## Analog Audio Interface

Power your system after these steps are completed:

1. Read the applicable design interface section in this chapter—the text provides an overview of the interface capabilities.
2. Read [“System Architecture” on page 2-2](#) to understand the physical connections of the daughter board. For detailed information, refer to [“Audio EZ-Extender Schematic” on page B-1](#).
3. Refer to the readme text files in the `Examples` folder of the installation directory for information on how to configure both the Audio EZ-Extender and EZ-KIT Lite boards. For custom setups, use [“System Architecture” on page 2-2](#) in conjunction with [“Configuration Jumpers and Switches” on page 2-4](#).

## Analog Audio Interface

For analog audio applications, the Blackfin Audio EZ-Extender uses two AD1938 multichannel 192 kHz audio codecs.

The AD1938 is a high-performance, single-chip codec chip that provides four analog-to-digital converters (ADCs) with differential inputs and eight digital-to-analog converters (DACs) with single-ended outputs. The DAC outputs operate using Analog Devices patented multibit sigma-delta architecture. The chip provides auxiliary input and output SPORTs to connect to other codecs, increasing the number of channels that a single SPORT supports. A serial peripheral interface (SPI) port is included, enabling the microcontroller to adjust volume and other audio parameters.

The audio interface connections are shown in [Figure 2-1 on page 2-3](#); for more detailed information, see [“Audio EZ-Extender Schematic” on page B-1](#). The two AD1938 chips (referred to as AD1938\_A and AD1938\_B) connect in parallel to a single SPORT. The chips connect for a time-division multiplexed (TDM) output mode:



## Blackfin Audio EZ-Extender Interfaces

- At a 48 kHz sample rate, TDM mode allows up to 16 channels of data to be sent from each chip in each direction. Each chip uses four of the 16 input channels and eight of the 16 output channels. The number of channels can be set up in the control registers and is dependant on the sample rate. As the sample rate increases, the number of possible channels decreases.
- At 96 kHz, the AD1938 operates with a maximum of eight channels in each direction. At 96 kHz, all of the TDM channels are used by all analog outputs, but there are still four extra input channels, two of which can be used by the digital inputs.
- At the 192 kHz sample rate, a maximum of four channels in each direction can be used, meaning that four of the output channels cannot be used.

The auxiliary SPORTs of the AD1938\_A codec connect to the ADAV801's auxiliary SPORT; see “[System Architecture](#)” on page 2-2 for more information. The Sony Philips Digital Interface (S/PDIF) stream requires two channels of the TDM stream for each direction: two channels for left and right input audio, and two channels for left and right output audio.

If the AD1938 codec runs at the 48 kHz sample rate, both the input and output digital streams can be put into the TDM stream. In this case, all of the clocks in the system must be set up relative to the recovered clock from the SPDIF input.

At the 96 kHz sample rate, only the SPDIF inputs can be added to the TDM stream. This is because at 96 kHz, only eight outputs channels are available, and all eight channels are used by the outputs.

The internal phase-locked loop (PLL) of the AD1938 codec can be configured to generate all of the clocking and frame sync signals. The source clock of the PLL can be from the serial port frame sync or from an externally supplied clock. The external master clock (MCLK) comes from the ADAV801 codec. A jumper (JP2) allows the master clock to come directly

## Digital Audio Interface

from the `SYSCLK3` pin of the AD1938 device or from a divided version of the `SYSCLK1` pin, divided by 2 or 4. The divided clocks are necessary when a sample rate less than 32 kHz is required. Otherwise, a signal clock frequency at the `MCLK` pin of the AD1938 codec can generate 48 kHz, 96 kHz, or 192 kHz sample rate.

The analog input pins of the AD1938's input signals operate in the range from 0 V<sub>rms</sub> to 1 V<sub>rms</sub>. For larger signals to be input at the RCA jacks, the input amplifiers (external to the AD1938 codec) are capable of attenuating the signals. See “[Configuration Jumpers and Switches](#)” on page 2-4 for more information.

The analog output pins of the AD1938's output signals operate in the range from 0 V<sub>rms</sub> to 1 V<sub>rms</sub>. The output amplifiers are set to a gain of 1.5x, giving the system unity gain when switches SW1-4 are all ON.

Example programs demonstrating the audio interface capabilities are included in the `Examples` folder of the installation directory.

For more information about the AD1938 codecs, go to <http://www.analog.com> and search for AD1938.

## Digital Audio Interface

For digital audio applications, the Blackfin Audio EZ-Extender uses the AD1938 codec chip. The AD1938 chip provides an analog stereo input, analog stereo output, digital stereo input, and a digital stereo output. In addition to the inputs and outputs, the AD1938 chip provides an internal sample rate converter, which can be used to change a sample rate between the chip interfaces.

On the Blackfin Audio EZ-Extender, the analog input and outputs are not used. The digital interface can operate at up to a 200 kHz sample rate. The AD1938 codec operates in I<sup>2</sup>S mode, which allows only two channels (left and right) of input and two channels of output. The codec also

supplies an auxiliary serial port for connecting to other devices. The configuration registers are configured using an SPI port connected to the processor.

The ADAV801 chip provides two internal PLLs, which can produce all necessary internal clocks for the chip interfaces. An external 27 MHz oscillator is used as a clock source for the PLLs. The external clocks, which also connect to the AD1938 codecs, are generated from the PLLs. The recovered clock from the SPDIF input can be used as a clock input for the serial ports, as well as for the generated external clock output `SYSCLK3`.

The primary serial port of the ADAV801 codec connects to the processor on the mother board, while the secondary serial port connects to the AD1938\_A codec. For a block diagram of the digital audio interface, see “System Architecture” on page 2-3; for details, see “Audio EZ-Extender Schematic” on page B-1. The internal routing of the ADAV801 interfaces is completely configurable. The SPDIF input and output can be routed separately to either or both the primary and secondary serial ports.

Example programs demonstrating the digital audio interface capabilities are included in the `Examples` folder of the installation directory.

For more information about the ADAV801 codecs, go to <http://www.analog.com> and search for ADAV801.

# Digital Audio Interface

# 2 AUDIO EZ-EXTENDER HARDWARE REFERENCE

This chapter describes the hardware design of the Blackfin Audio EZ-Extender.

The following topics are covered.

- [“System Architecture” on page 2-2](#)  
Describes the daughter board configuration and explains how the board components interface with the processor and EZ-KIT Lite.
- [“Configuration Jumpers and Switches” on page 2-4](#)  
Describes the configuration jumpers and switches.

# System Architecture

A block diagram of the Blackfin Audio EZ-Extender is shown in [Figure 2-1](#). The board layout, connector and jumper locations are shown in [Figure 2-2 on page 2-5](#).

The analog audio interface consists of two AD1938 audio codecs (referred to as AD1938\_A and AD1938\_B), which use one of the processor's serial ports (SPORTs). All clock and frame sync signals must be driven by one of the AD1938 chips. The analog audio interface is configured for time-division multiplexed (TDM) serial mode. In TDM mode, a single clock and frame sync are used to transmit and receive data. The data signals of the AD1938\_A codec connect to the primary SPORT (TX and RX pins) of the processor. The data signals of the AD1938\_B codec connect to the secondary SPORT (TX and RX pins) of the processor. See [“Analog Audio Interface” on page 1-2](#) for more information.

The digital audio interface consists of the ADAV801 codec. The codec chip communicates in I<sup>2</sup>S mode. In I<sup>2</sup>S mode, the transmit and receive clock, along with the frame sync signals, are set individually to transmit a sample rate that is different from the receive sample rate.

The ADAV801 codec has a secondary transmit and receive SPORT, which is interfaced with the auxiliary SPORT of the AD1938\_A codec. The interface operates in I<sup>2</sup>S mode and is mastered by the ADAV801 chip. The interface enables the digital audio data streams to be multiplexed into the analog audio data stream, providing access to all data signals via a single SPORT. This is dependent on a sample rate as described in [“Analog Audio Interface” on page 1-2](#).

A jumper setting allows the routing of the processor's SPORTs to be swapped with the SPORTs of the analog and digital interfaces. If the SPORT on the mother board is in use, this feature allows either of the audio interfaces be used instead. In addition, each SPORT can be disabled

# Audio EZ-Extender Hardware Reference

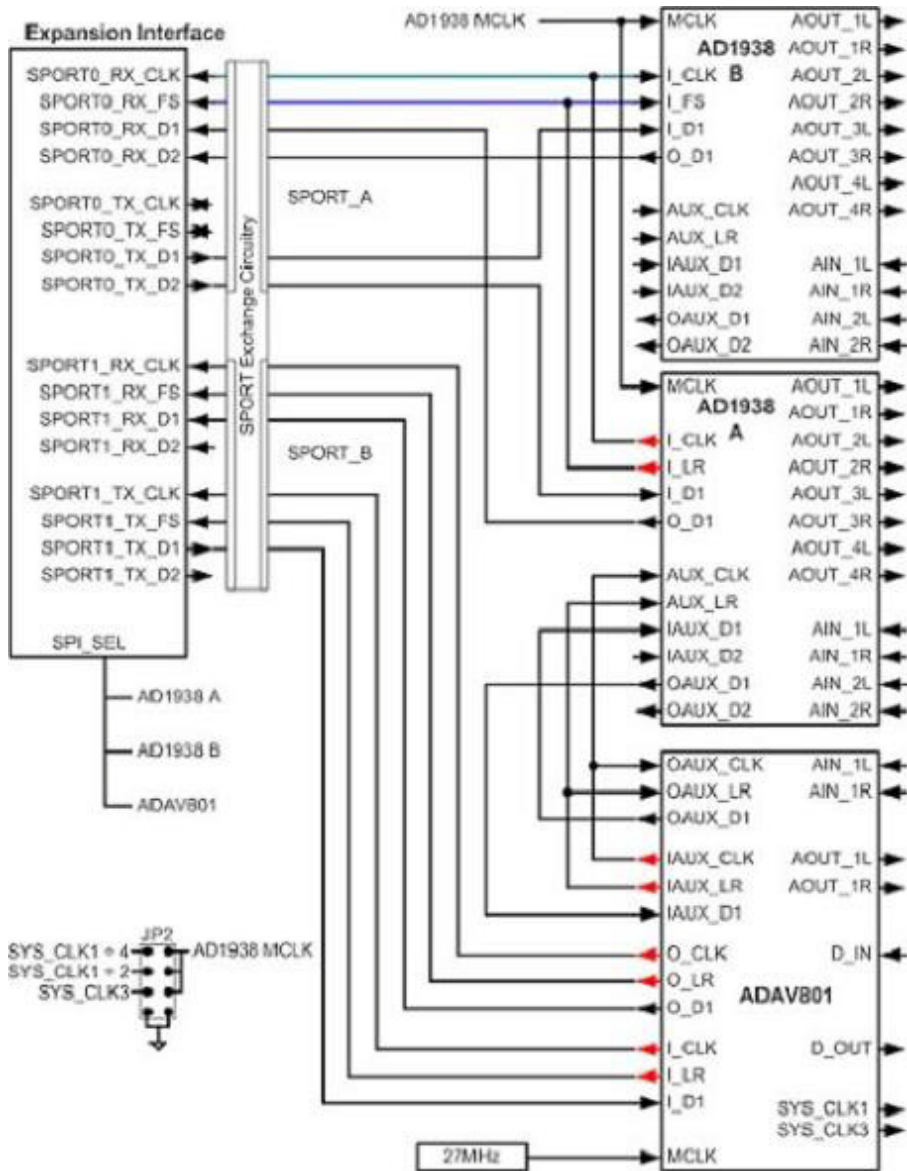


Figure 2-1. System Architecture

## Configuration Jumpers and Switches

individually and not driven by the extender on the mother board. For more information, see the following sections.

- [“SPORT Select Jumper \(JP1.7/8\)” on page 2-6](#)
- [“EZ-KIT Lite SPORT1 Enable Jumper \(JP1.5/6\)” on page 2-6](#)
- [“EZ-KIT Lite SPORT0 Enable Jumper \(JP1.3/4\)” on page 2-6.](#)

Each Blackfin Audio EZ-Extender IC (AD1938\_A, AD1938\_B, or ADAV801) is configured using the SPI interface of the processor. Each chip includes its own chip select pin. On the ADSP-BF537 EZ-KIT Lite, the location of the chip select signals on the expansion interface is different from that on the ADSP-BF533 and ADSP-BF561 EZ-KIT Lites. A jumper is used to define an EZ-KIT Lite for which the SPI select signals are being set. For more information, see [“ADSP-BF537 EZ-KIT Lite Select Jumper \(JP1.1/2\)” on page 2-5.](#)

All of the expansion interface signals are passed directly through the board, from the EZ-KIT Lite to another set of expansion interface connectors. This allows you to attach the Blackfin Audio EZ-Extender to other EZ-Extender boards.

## Configuration Jumpers and Switches

Before using the Blackfin Audio EZ-Extender, follow the setup procedure in [“Audio EZ-Extender Setup” on page 1-1.](#)

[Figure 2-2](#) shows the locations of the jumper headers, divided to show the placement and rotation of each jumper. The jumpers are described by the pins of the header on which the jumpers can be placed. For example, JP1.1/2 refers to a single jumper that can be placed across pins 1 and 2 of JP1. The dark pin indicates pin 1 of each header.





## Configuration Jumpers and Switches

### EZ-KIT Lite SPORT0 Enable Jumper (JP1.3/4)

Installing a jumper at this location enables the SPORT0 signals of the EZ-KIT Lite to drive and be driven by the Audio EZ-Extender. Do not install this jumper if SPORT0 is used elsewhere on the mother board.

### EZ-KIT Lite SPORT1 Enable Jumper (JP1.5/6)

Installing a jumper at this location enables the SPORT1 signals of the EZ-KIT Lite to drive and be driven by the Audio EZ-Extender. Do not install JP1.5/6 if SPORT0 is used elsewhere on the mother board.

### SPORT Select Jumper (JP1.7/8)

The JP1.7/8 jumper determines how SPORT0 and SPORT1 are routed to the analog SPORT interface (SPORT\_A) and the digital SPORT interface (SPORT\_B); see [Figure 2-1 on page 2-3](#). [Table 2-1](#) describes the jumper connections.

Table 2-1. SPORT Select Jumper (JP1.7/8)

SPORT_SEL (JP1.7/8) Setting	Connection
Not installed	SPORT0 = SPORT_B (digital) SPORT1 = SPORT_A (analog)
Installed	SPORT0 = SPORT_A (analog) SPORT1 = SPORT_B (digital)

### AD1938 MCLK Source Jumper (JP2)

The JP2 jumper determines the source of the master clock (MCLK) of the AD1938 audio codec. The standard configuration connects the SYSCLK3 pin of the ADAV801 codec to MCLK by installing the JP2.5/6 jumper. Two other jumper positions, JP2.1/2 and JP2.3/4, connect MCLK to the ADAV801 codec's SYSCLK1 pin, divided by 4 and 2 respectively. These

positions can be used to supply the AD1938 codec with lower master clock frequencies to reach the lower sample rates. For more information about the `SYSCLK1` and `SYSCLK3` pins, refer to the AD1938 data sheet. For more information about the `MCLK` frequencies and sample rates, see the AD1938 data sheet.

### SPDIF Loopback Jumper (JP4)

The JP4 jumpers are used for test purposes only; the SPDIF jumpers loop-back the digital output signals to digital input.

### Analog Input Gain Switches (SW1–4)

The SW1–4 switches enables the gain change of each analog input from  $1/(1.5)$  to  $1/(2.12)$ . This is useful when the input signals are too large for the AD1938 codec to handle. [Table 2-2](#) shows which switch position corresponds to each analog input channel.

Table 2-2. Analog Input Gain Switches (SW1–4)

Switch Position	Analog Input Channel
SW1.1	AIN1_L
SW1.2	AIN1_R
SW2.1	AIN2_L
SW2.2	AIN2_R
SW3.1	AIN3_L
SW3.2	AIN3_R
SW4.1	AIN4_L
SW4.2	AIN4_R

When the switch is ON, the gain is set to  $1/(1.5)$ . When the switch is OFF, the gain is set to  $1/(2.12)$ .

# Configuration Jumpers and Switches

# A AUDIO EZ-EXTENDER BILL OF MATERIALS

The bill of materials corresponds to [“Audio EZ-Extender Schematic”](#) on page B-1.

Ref.	Qty.	Description	Reference Designator	Manufacturer	Part Number
1	1	SN74LVC1G08 SOT23-5	U1	TI	SN74LVC1G08DBVR
2	1	74LVC74A TSSOP14	U9	PHILIPS	74LVC74APW
3	1	27MHZ OSC011	Y1	DIGI-KEY	300-8571-1-ND
4	6	SN74LVC257 TSSOP16	U3,U6,U10-11,U13, U16	DIGI-KEY	296-8506-1-ND
5	2	AD1938XSTZ LQFP48	U7,U18	ANALOG DEVICES	AD1938XSTZ
6	1	ADAV801ASTZ LQFP64	U14	ANALOG DEVICES	ADAV801ASTZ
7	8	AD8608ARUZ TSSOP14	U4-5,U8,U12,U15, U19,U21-22	ANALOG DEVICES	AD8608ARUZ
8	3	RCA 4X2 CON011	J4,J7-8	SWITCH- CRAFT	PJRS4X2U01X
9	2	RCA 1X1 CON012	J5-6	SWITCH- CRAFT	PJRN1X1U01X
10	3	0.05 45x2 CON018	P1-3	SAMTEC	TFC-145-32-F-D
11	3	.05 45X2 CON019	J1-3	SAMTEC	SFC-145-T2-F-D-A
12	2	0.05 10X2 CON040	J9-10	SAMTEC	SFC-110-T2-F-D-A
13	4	DIP2 SWT020	SW1-4	C&K	TDA02H0SB1

Ref.	Qty.	Description	Reference Designator	Manufacturer	Part Number
14	1	IDC 2X1 IDC2X1	JP4	FCI	90726-402HLF
15	5	IDC 1X1 IDC1X1	TP1-2,TP6,TP8-9	SULLINS	PEC01SAAN
16	2	IDC 4X2 IDC4X2	JP1-2	SULLINS	GEC04DAAN
17	2	22PF 50V 5% 0805	C152-153	AVX	08055A220JAT
18	16	600 100MHZ 200MA 0603	FER1-16	DIGI-KEY	490-1014-2-ND
19	1	750 1/10W 5% 0805	R72	VISHAY	CRCW0805750RJNEA
20	1	.082UF 50V 5% 0805	C73	AVX	08055C823JAT2A
21	15	10UF 6.3V 10% 0805	C22,C34-35,C52, C61,C85,C87,C158, C161,C167,C172, C174-175,C182, C185	AVX	080560106KAT2A
22	1	2.2UF 10V 10% 0805	C72	AVX	0805ZD225KAT2A
23	1	107.0 1/10W 1% 0805	R110	DIGI-KEY	311-107CRTR-ND
24	48	0.1UF 16V 10% 0603	C31,C55,C58,C76, C86,C125-130, C135,C138, C140-143,C146-147, C149-150,C154, C157,C162-165, C169-171,C176-177, C179,C183-184, C189-191,C194-195, C197,C199-200, C203,C205-206, C209-210	AVX	0603YC104KAT2A
25	1	0.01UF 16V 10% 0603	C116	AVX	0603YC103KAT2A
26	4	10UF 10V +80/-20% 0805	C9,C134,C186,C207	PANASONIC	ECJ-2FF1A106Z

## Audio EZ-Extender Bill Of Materials

Ref.	Qty.	Description	Reference Designator	Manufacturer	Part Number
27	40	4.7UF 6.3V 20% 0603	C20-21,C28-29, C38-39,C50-51, C59-60,C68-69, C77-78,C88-89, C117-124,C137, C144,C155,C159, C173,C180,C196, C201,C212-219	PANASONIC	ECJ-1VB0J475M
28	2	.033UF 25V 10% 0603	C44-45	AVX	06033C333KAT2A
29	12	22 1/10W 5% 0603	R27,R55,R58-60, R65,R128,R130-131, R133,R142-143	VISHAY	CRCW060322R0JNEA
30	9	0 1/10W 5% 0603	R31,R36,R45,R51, R63,R68,R77,R81, R203	PHYCOMP	232270296001L
31	16	237.0 1/10W 1% 0603	R25-26,R39-42, R53-54,R56-57, R70-71,R73-74, R83-84	DIGI-KEY	311-237HRTR-ND
32	16	3.32K 1/10W 1% 0603	R171-178,R186-193	DIGI-KEY	311-3.32KHRTR-ND
33	16	49.9K 1/10W 1% 0603	R111-118,R144-151	DIGI-KEY	311-49.9KHRTR-ND
34	16	604.0 1/10W 1% 0603	R1-8,R101-108	DIGI-KEY	311-604HRTR-ND
35	6	10.0K 1/10W 1% 0603	R119-120,R122-123, R153-154	DIGI-KEY	311-10.0KHRTR-ND
36	16	5.76K 1/10W 1% 0603	R29-30,R34-35, R43-44,R49-50, R61-62,R66-67, R75-76,R79-80	DIGI-KEY	311-5.76KHRTR-ND
37	8	120PF 50V 5% 0603	C23,C26,C41,C46, C62,C65,C80,C82	AVX	06035A121JAT2A

Ref.	Qty.	Description	Reference Designator	Manufacturer	Part Number
38	16	100PF 50V 5% 0603	C25,C30,C43,C48, C64,C67,C79,C84, C133,C148,C151, C166,C168,C188, C193,C204	AVX	06035A101JAT2A
39	16	1000PF 50V 5% 0603	C18-19,C32-33, C36-37,C53-54, C56-57,C70-71, C74-75,C90-91	PANASONIC	ECJ-1VC1H102J
40	16	220PF 50V 5% 0603	C5-8,C10-13, C96-103	PANASONIC	ECJ-1VC1H221J
41	16	2200PF 50V 5% 0603	C108-115,C220-227	PANASONIC	ECJ-1VB1H222K
42	1	75.0 1/10W 1% 0603	R109	DALE	CRCW060375R0FKEA
43	16	270PF 50V 5% 0603	C1-4,C14-17, C92-95,C104-107	DIGI-KEY	311-1185-2-ND
44	1	243.0 1/10W 1% 0603	R121	VISHAY	CRCW0603243RFKEA
45	3	732.0 1/10W 1% 0603	R47-48,R152	VISHAY	CRCW0603732RFKEA
46	2	562.0 1/10W 1% 0603	R125,R136	VISHAY	CRCW0603562RFKEA
47	2	390PF 25V 5% 0603	C136,C192	AVX	06033A391FAT2A
48	2	1800PF 50V 5% 0805	C40,C49	PANASONIC	ECJ2VB1H182K
49	2	5600PF 16V 5% 0805	C132,C187	AVX	0805YA562JAT2A
50	8	28.0K 1/10W 1% 0603	R155,R157-158, R161-162,R165-166, R169	DIGI-KEY	311-28.0KHTR-ND

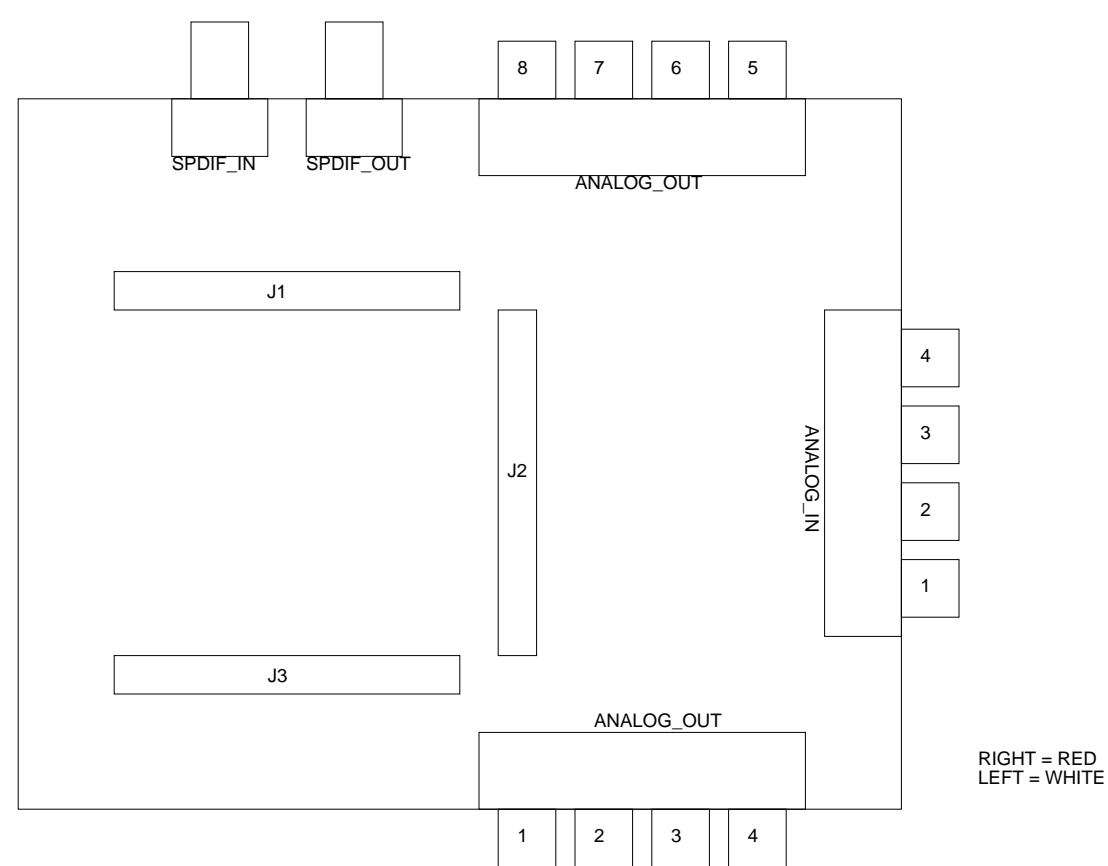


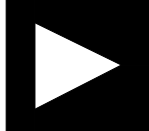
## Audio EZ-Extender Bill Of Materials

Ref.	Qty.	Description	Reference Designator	Manufacturer	Part Number
51	48	4.99K 1/16W 1% 0603	R9-24,R85-100, R170,R179-185, R194-201	VISHAY	CRCW06034K99FKEA
52	8	24.9K 1/10W 1% 0603	R126-127,R129, R132,R134-135, R138,R140	DIGI-KEY	311-24.9KHTR-ND
53	1	47UF 6.3V 10% B	CT1	PANASONIC	EEE0JA470WR
54	8	22.6K 1/16W 1% 0603	R124,R156,R159- 160,R163-164, R167-168	VISHAY	CRCW060322K6FKEA
55	1	GREEN LED001	LED1	PANASONIC	LN1361CTR

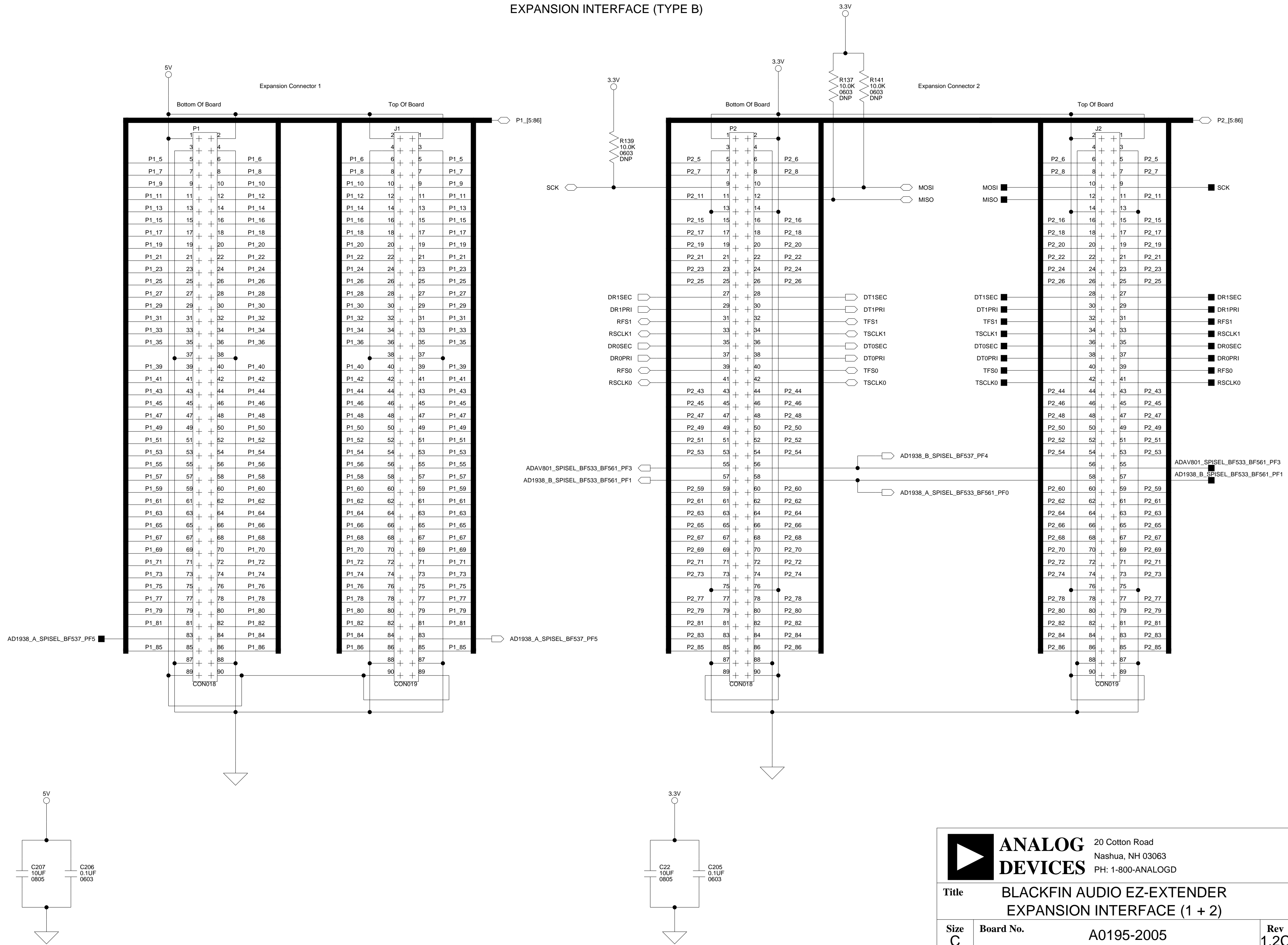


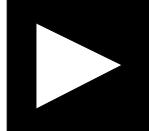
# Blackfin Audio EZ-Extender Schematic



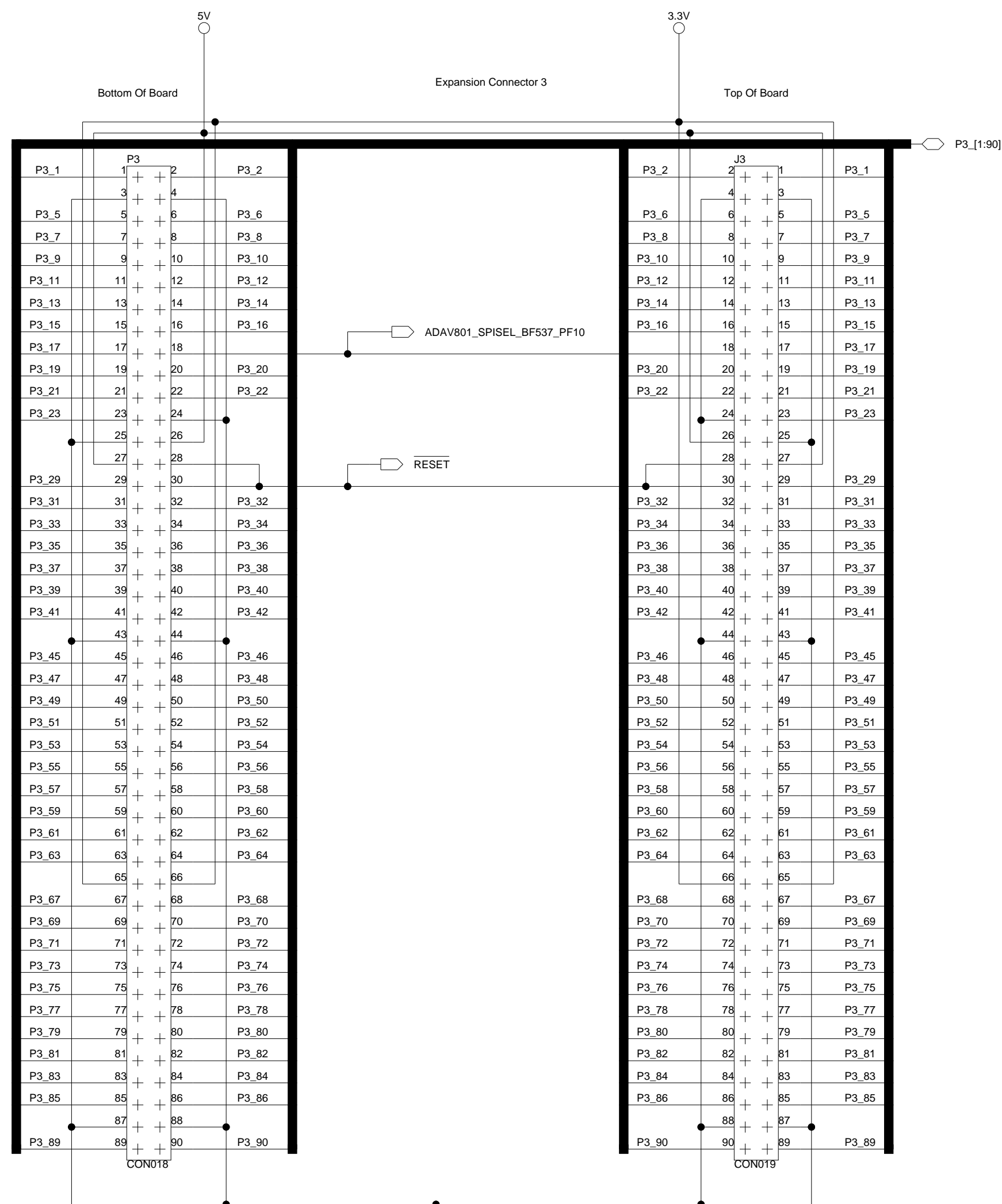
 <b>ANALOG DEVICES</b>		20 Cotton Road Nashua, NH 03063 PH: 1-800-ANALOGD	
		<b>Title</b> BLACKFIN AUDIO EZ-EXTENDER TITLE	
<b>Size</b> C	<b>Board No.</b> A0195-2005	<b>Rev</b> 1.2C	
<b>Date</b> 5-23-2007_11:47	<b>Sheet</b> 1 of 12		

# EXPANSION INTERFACE (TYPE B)

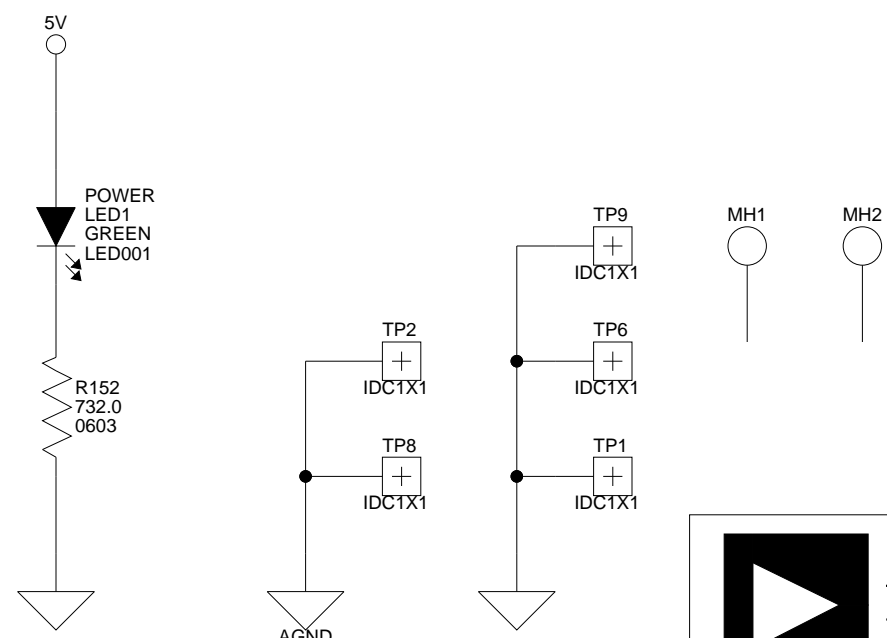
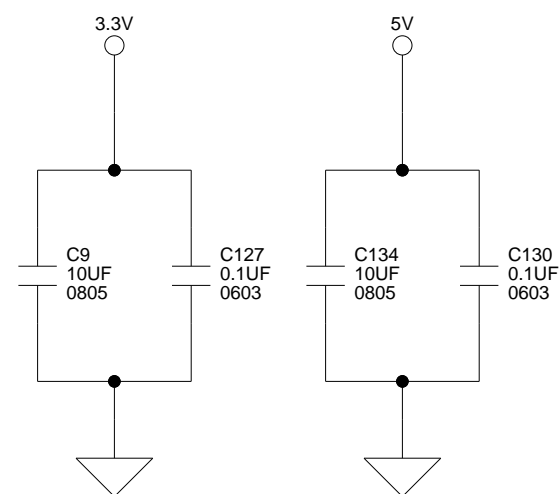
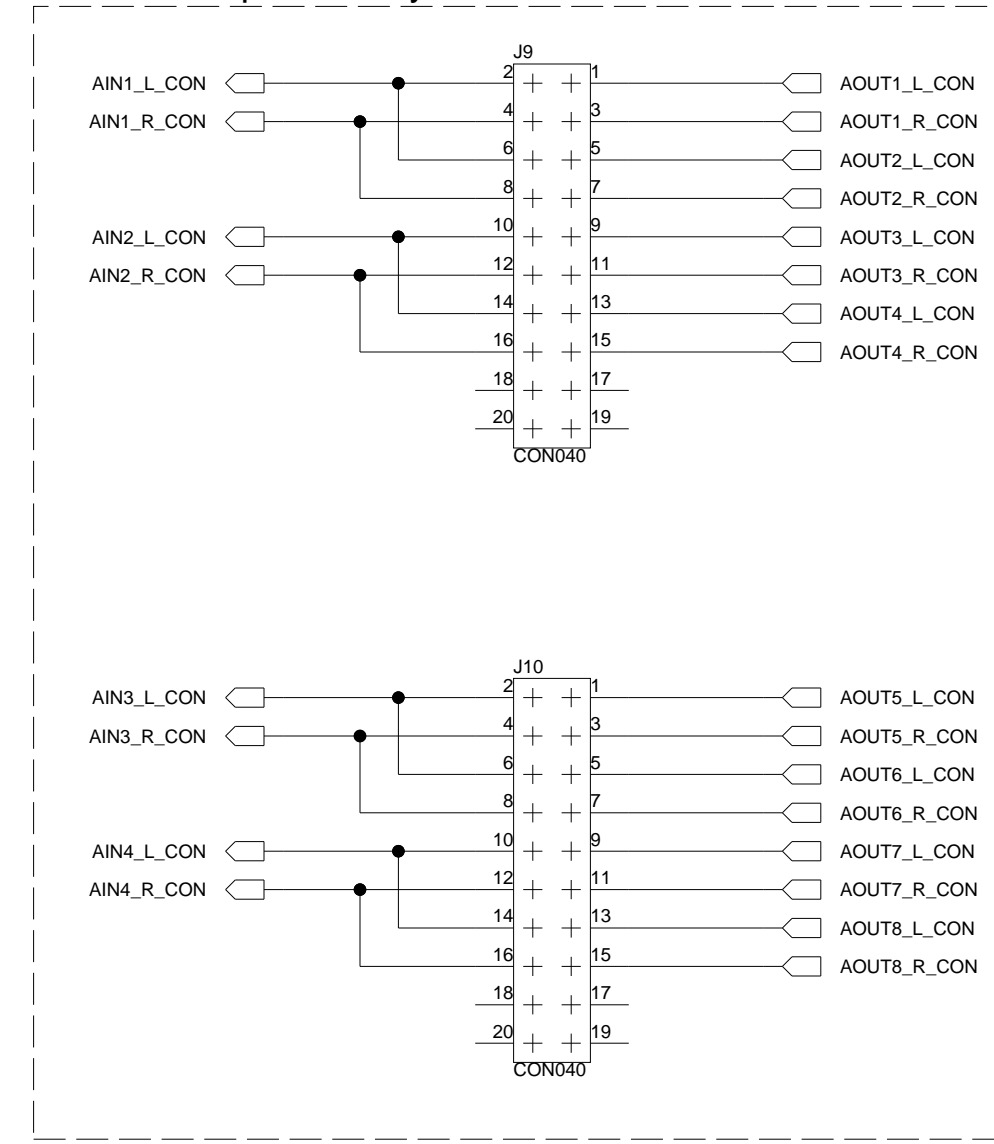


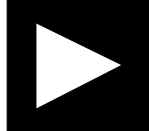
 <b>ANALOG DEVICES</b>		20 Cotton Road Nashua, NH 03063 PH: 1-800-ANALOGD
<b>Title</b> BLACKFIN AUDIO EZ-EXTENDER EXPANSION INTERFACE (1 + 2)		
<b>Size C</b>	<b>Board No.</b> A0195-2005	<b>Rev</b> 1.2C
<b>Date</b> 5-23-2007_11:47	<b>Sheet</b> 2 of 12	

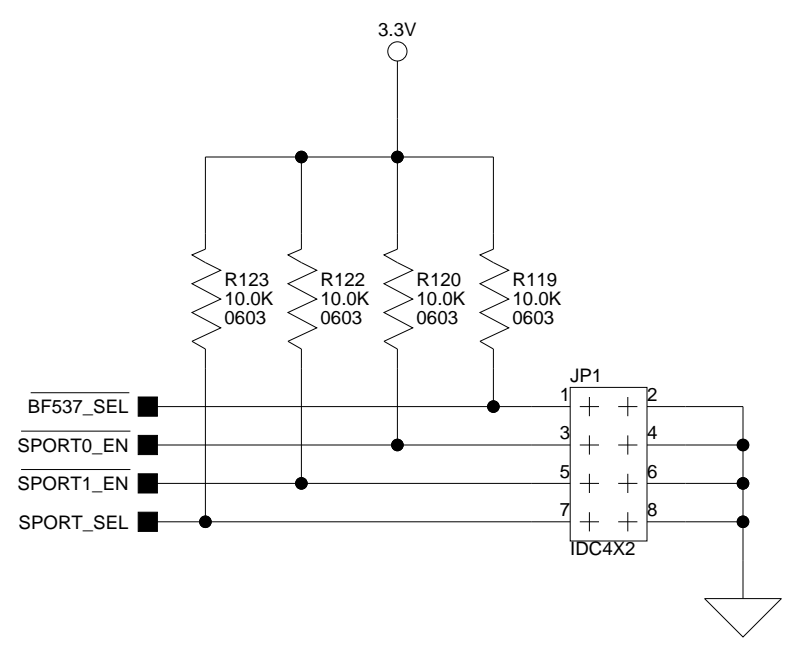
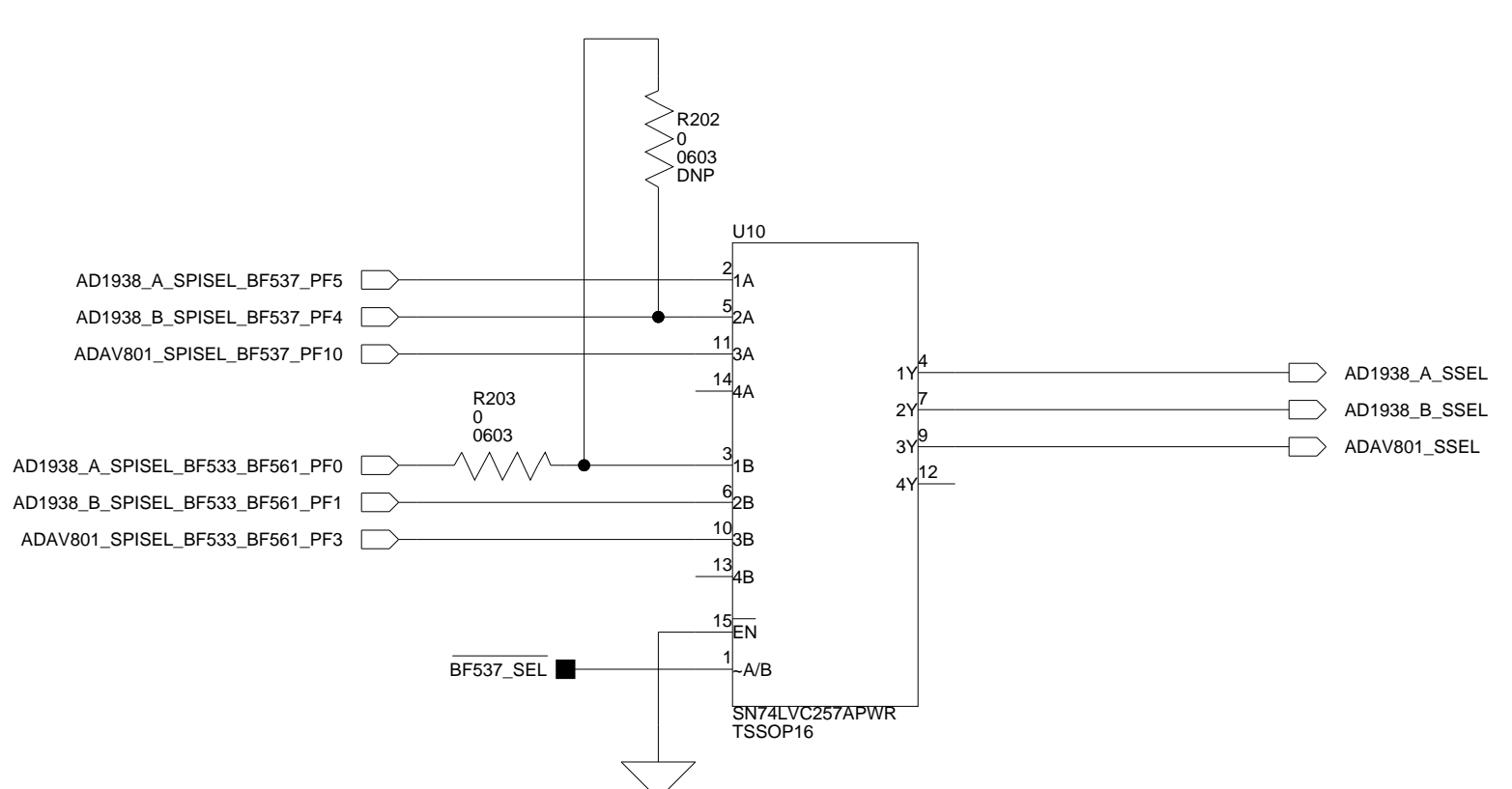
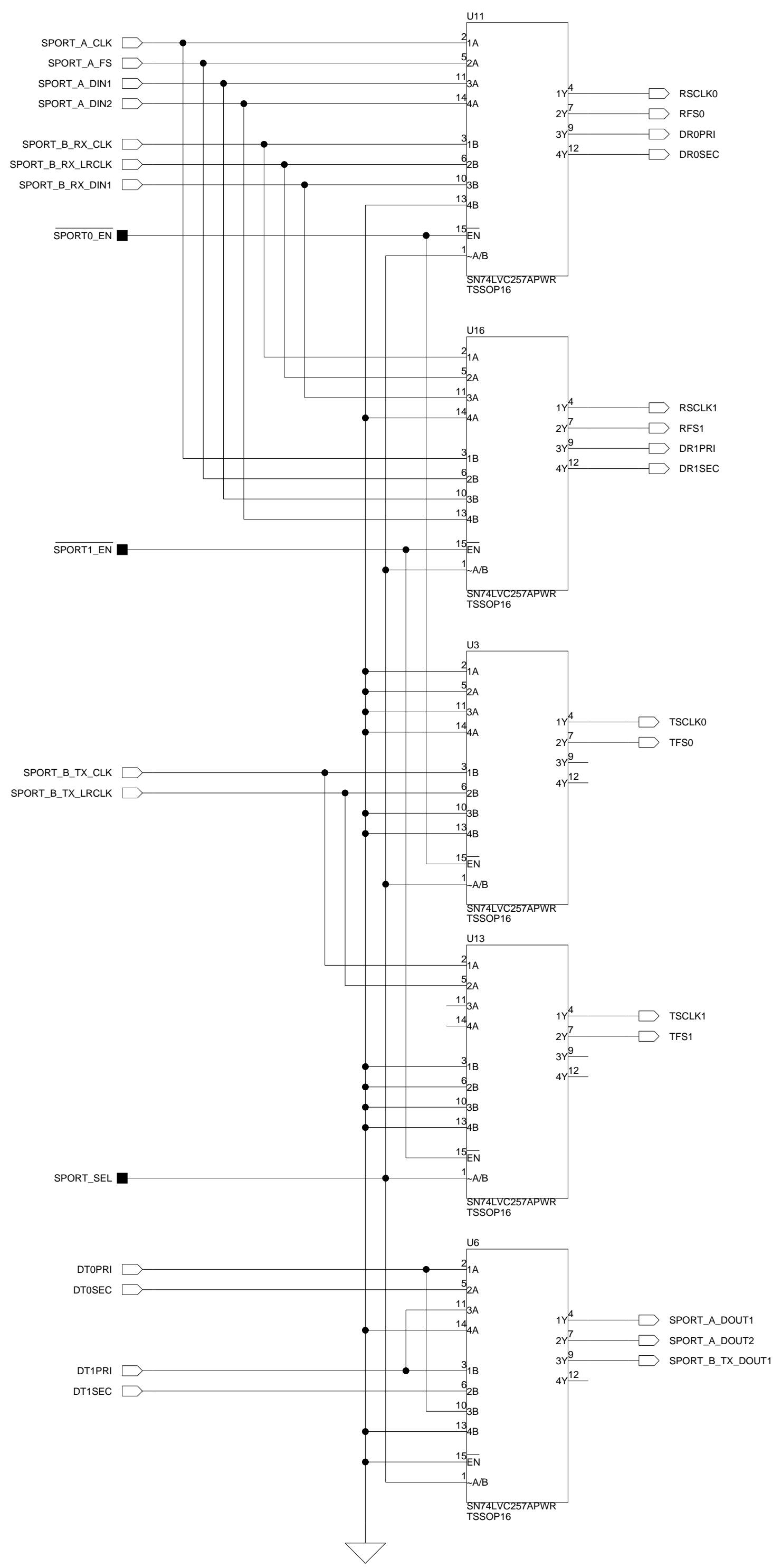
# EXPANSION INTERFACE (TYPE B)



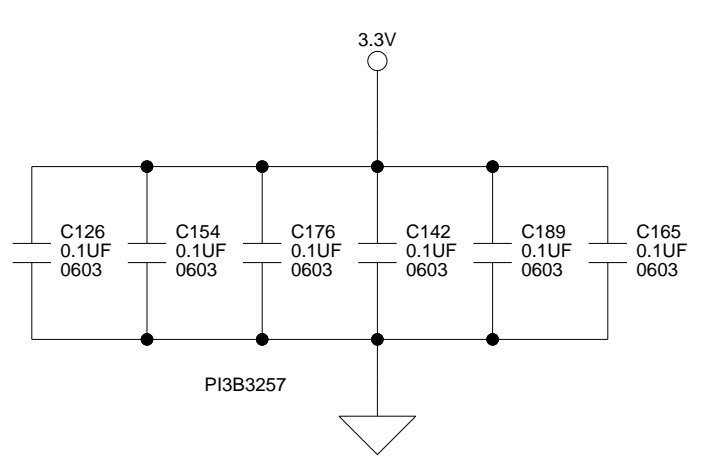
## For Test Purposes Only



 <b>ANALOG DEVICES</b>		20 Cotton Road Nashua, NH 03063 PH: 1-800-ANALOGD	
		<b>Title</b> BLACKFIN AUDIO EZ-EXTENDER EXPANSION INTERFACE (3)	
<b>Size C</b>	<b>Board No.</b> A0195-2005	<b>Rev</b> 1.2C	
<b>Date</b> 5-23-2007_11:47	<b>Sheet</b> 3 of 12		



SPORT_SEL (JP1.7/8)	Connection
Not Installed	SPORT0 = SPORT_B (Digital) SPORT1 = SPORT_A (Analog)
Installed	SPORT0 = SPORT_A (Analog) SPORT1 = SPORT_B (Digital)



**ANALOG DEVICES**

20 Cotton Road  
Nashua, NH 03063  
PH: 1-800-ANALOGD

<b>Title</b> BLACKFIN AUDIO EZ-EXTENDER CONFIG	
<b>Size C</b>	<b>Board No.</b> A0195-2005
<b>Date</b> 5-23-2007_11:47	<b>Rev</b> 1.2C
<b>Sheet</b> 4 <b>of</b> 12	

A

B

C

D

1

1

2

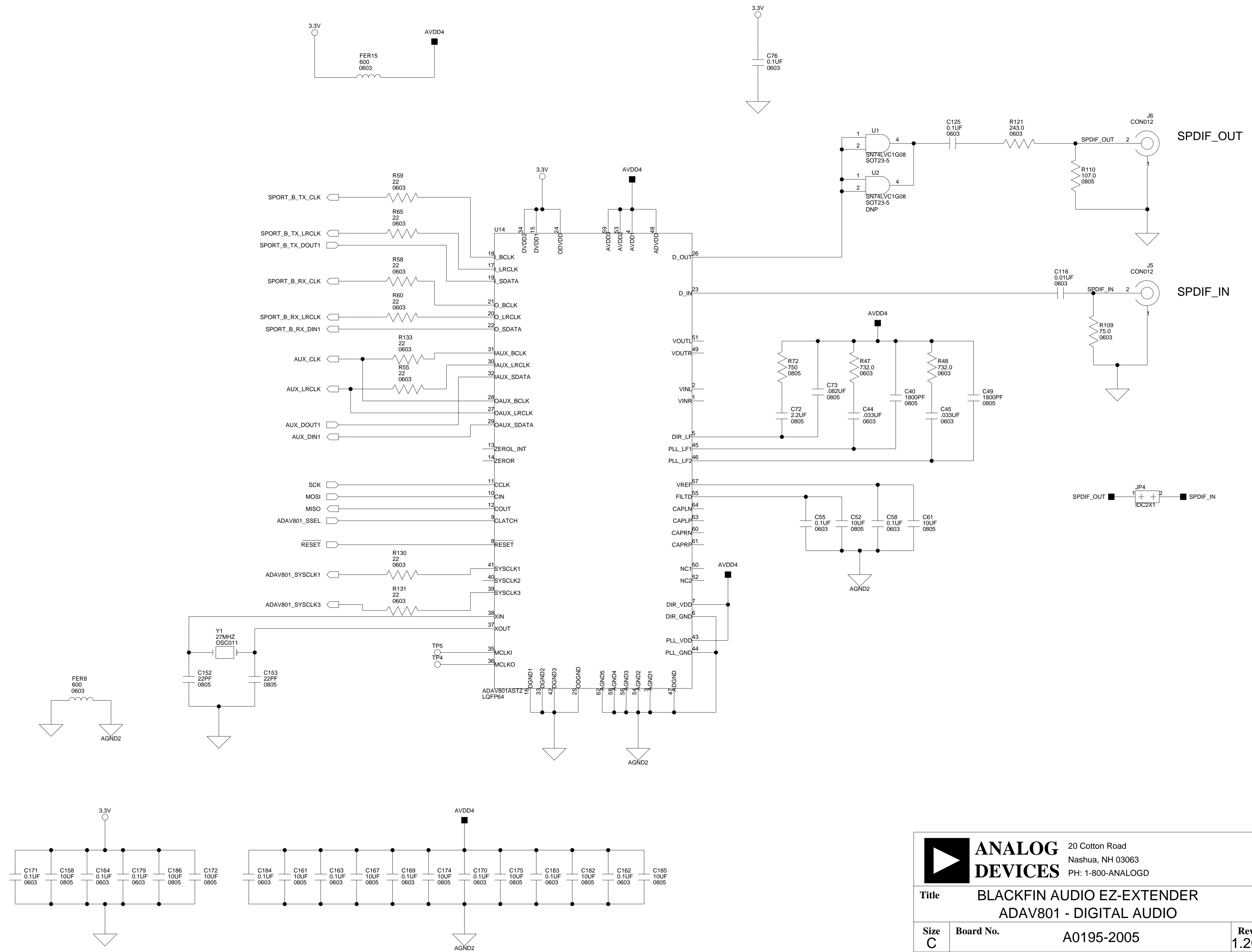
2

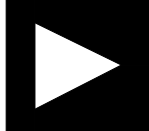
3

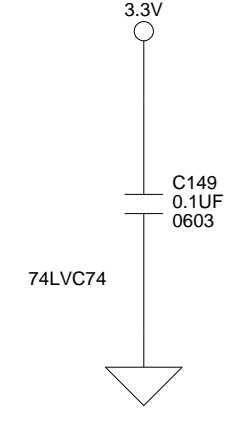
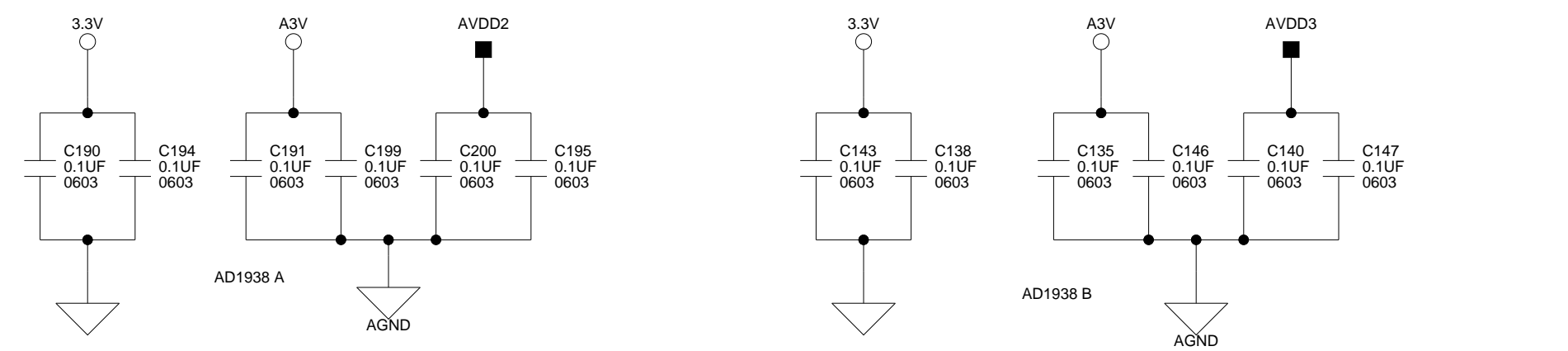
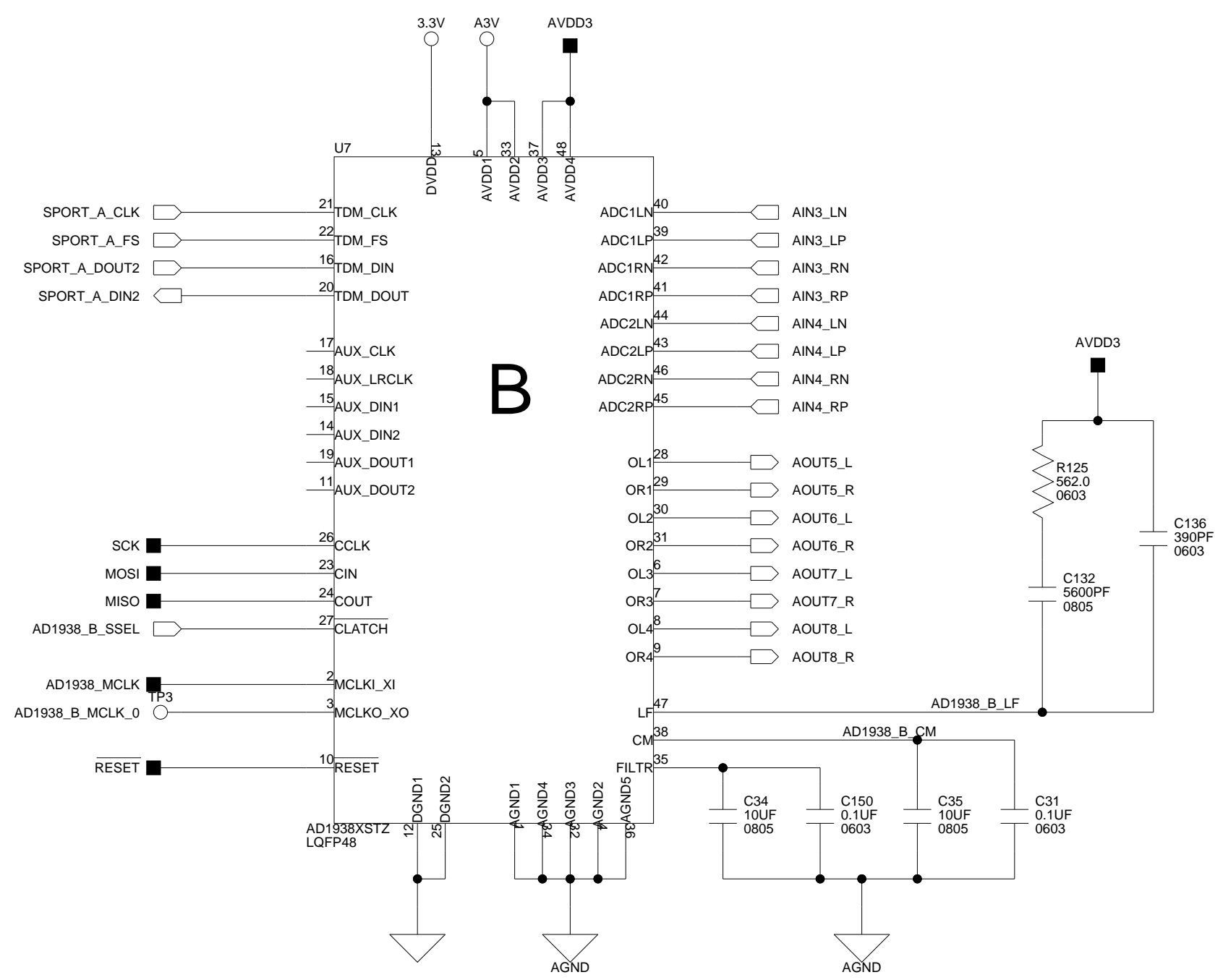
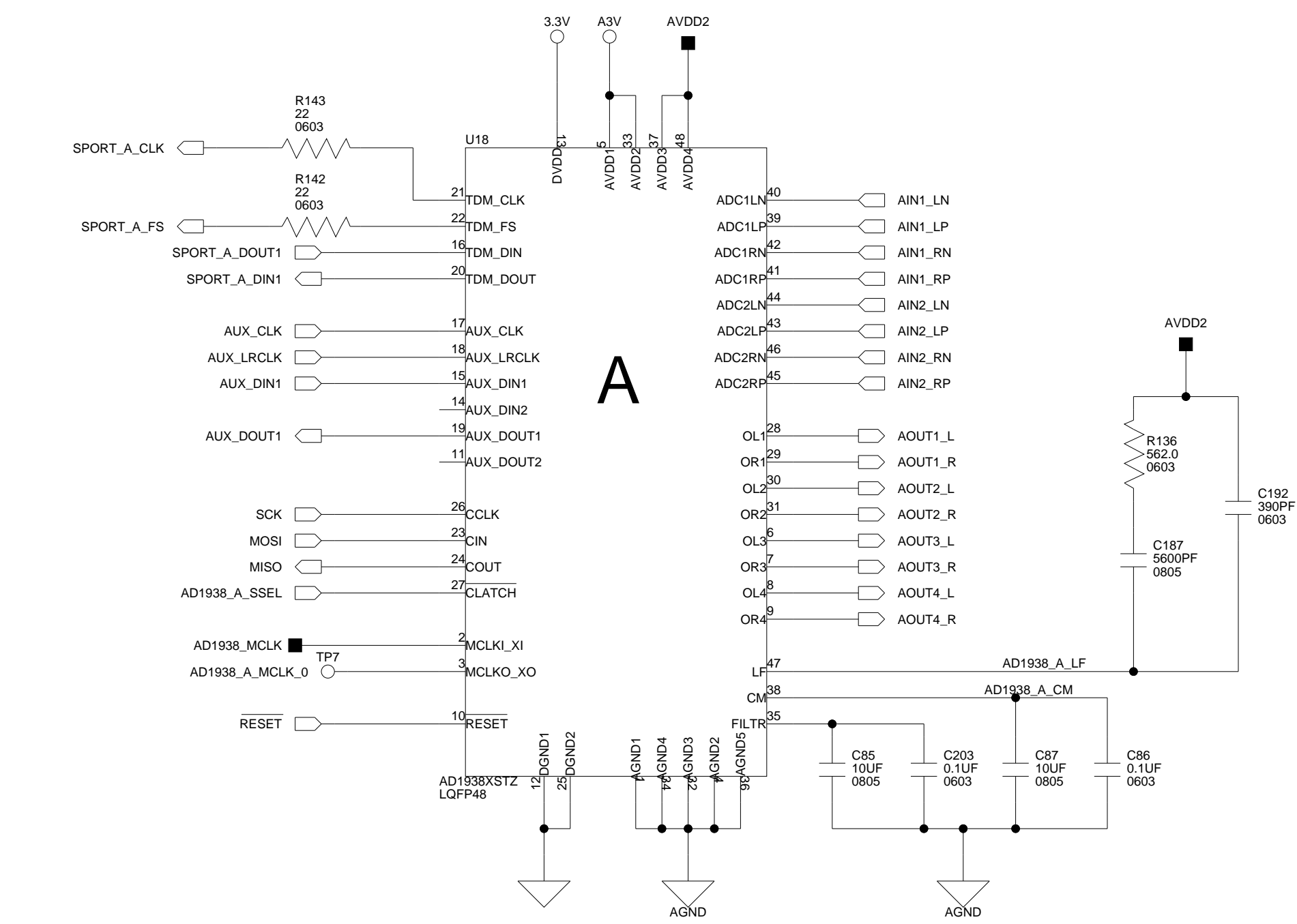
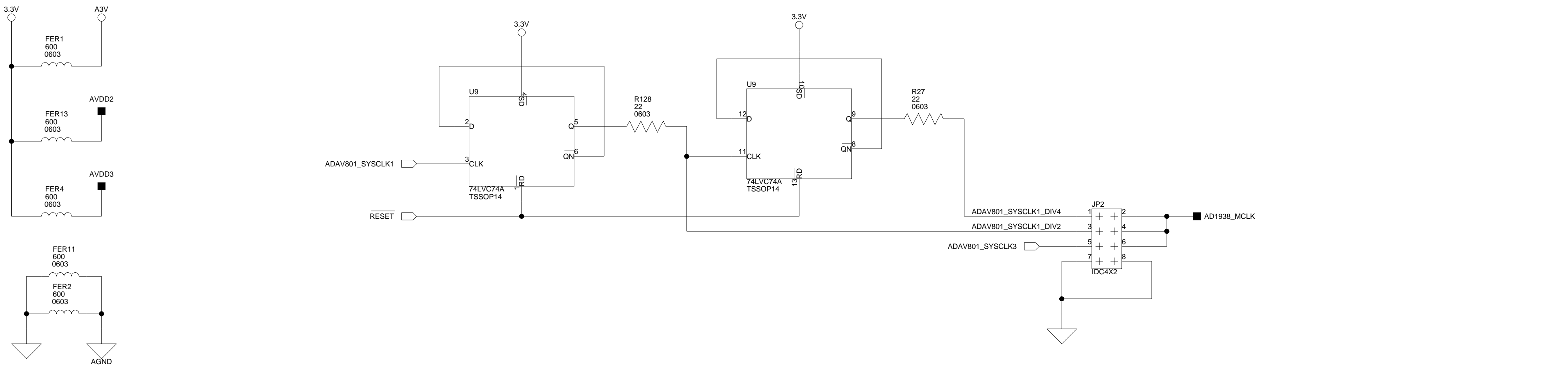
3

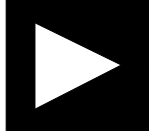
4

4



 <b>ANALOG DEVICES</b>		20 Cotton Road Nashua, NH 03063 PH: 1-800-ANALOGD	
		<b>Title</b> BLACKFIN AUDIO EZ-EXTENDER ADAV801 - DIGITAL AUDIO	
<b>Size C</b>	<b>Board No.</b> A0195-2005	<b>Rev</b> 1.2C	
<b>Date</b> 5-23-2007_11:47	<b>Sheet</b> 5 of 12		



 <b>ANALOG DEVICES</b>		20 Cotton Road Nashua, NH 03063 PH: 1-800-ANALOGD	
		<b>Title</b> BLACKFIN AUDIO EZ-EXTENDER AD1938 - ANALOG AUDIO	
<b>Size</b> C	<b>Board No.</b> A0195-2005	<b>Rev</b> 1.2C	
<b>Date</b> 5-23-2007_11:47	<b>Sheet</b> 6 of 12		

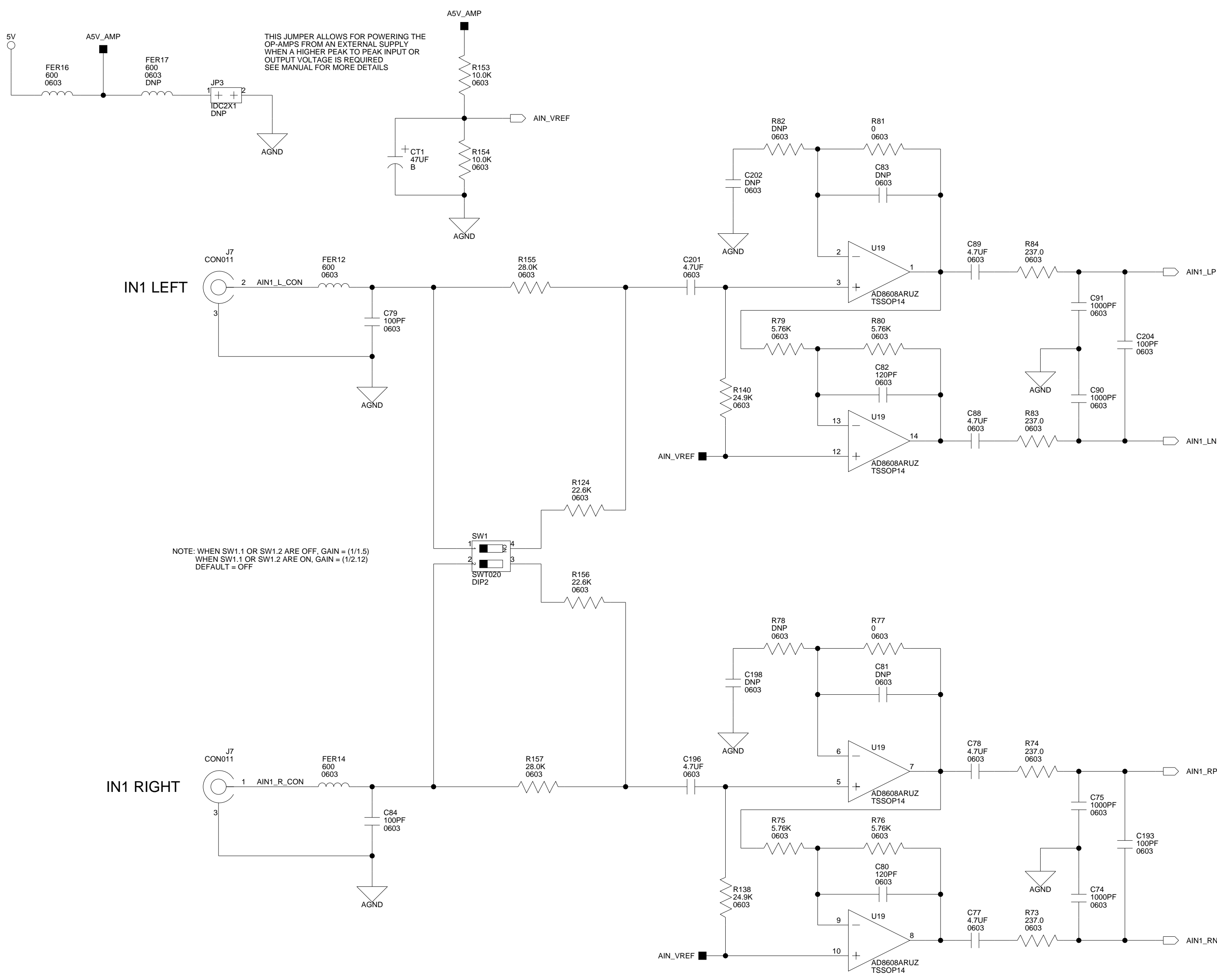


A

B

C

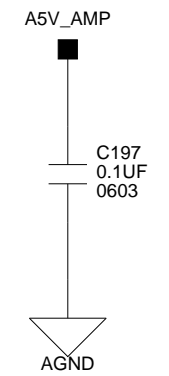
D

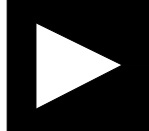


THIS JUMPER ALLOWS FOR POWERING THE OP-AMPS FROM AN EXTERNAL SUPPLY WHEN A HIGHER PEAK TO PEAK INPUT OR OUTPUT VOLTAGE IS REQUIRED SEE MANUAL FOR MORE DETAILS

NOTE: WHEN SW1.1 OR SW1.2 ARE OFF, GAIN = (1/1.5)  
 WHEN SW1.1 OR SW1.2 ARE ON, GAIN = (1/2.12)  
 DEFAULT = OFF

ANALOG INPUT SIGNAL SPECS CAN BE FOUND IN THE MANUAL



 <b>ANALOG DEVICES</b>		20 Cotton Road Nashua, NH 03063 PH: 1-800-ANALOGD	
		<b>Title</b> BLACKFIN AUDIO EZ-EXTENDER ANALOG IN 1	
<b>Size</b> C	<b>Board No.</b> A0195-2005	<b>Rev</b> 1.2C	
<b>Date</b> 5-23-2007_11:47	<b>Sheet</b> 7 of 12		

A

B

C

D

1

1

2

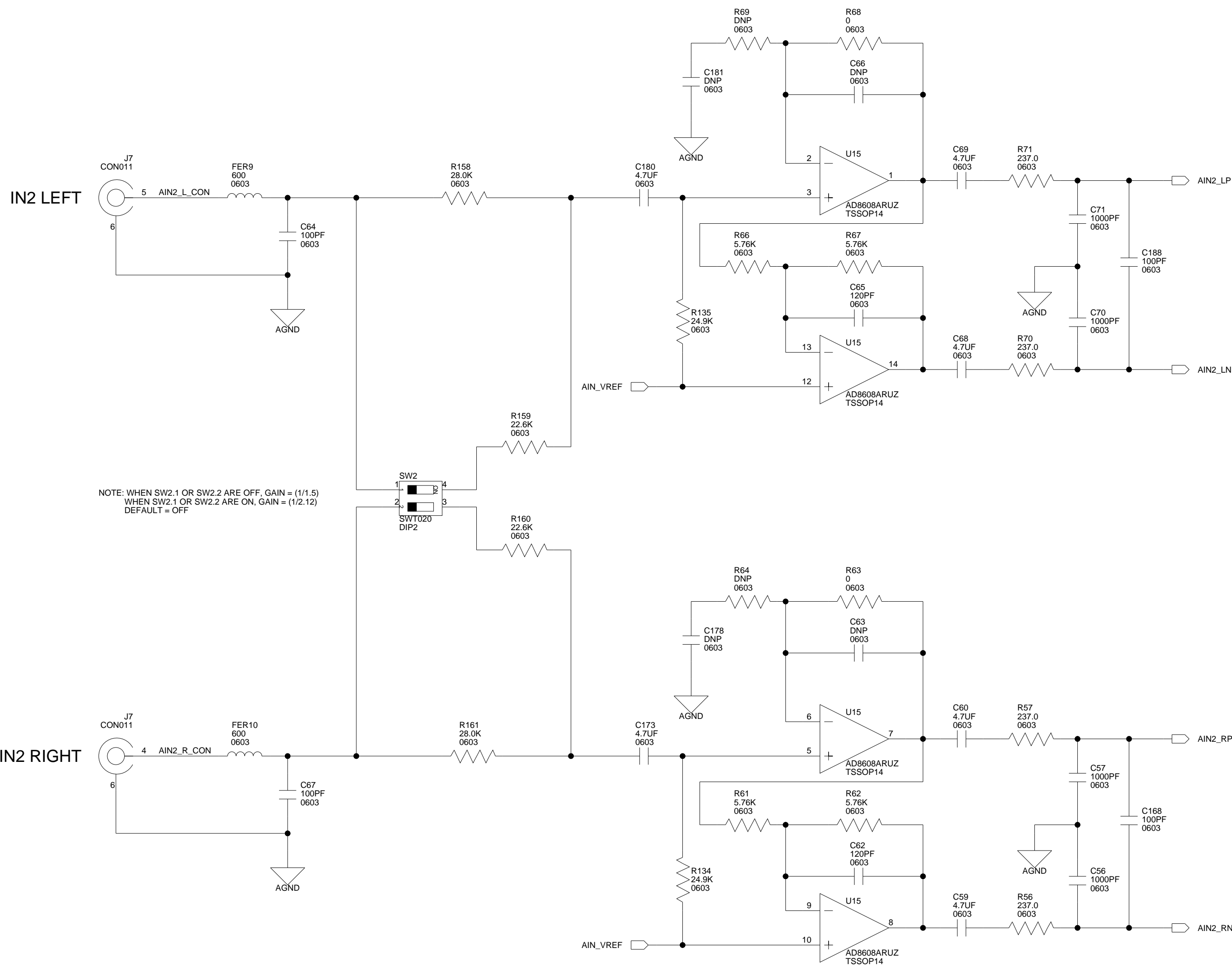
2

3

3

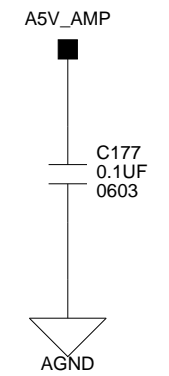
4

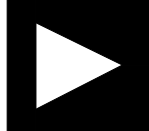
4

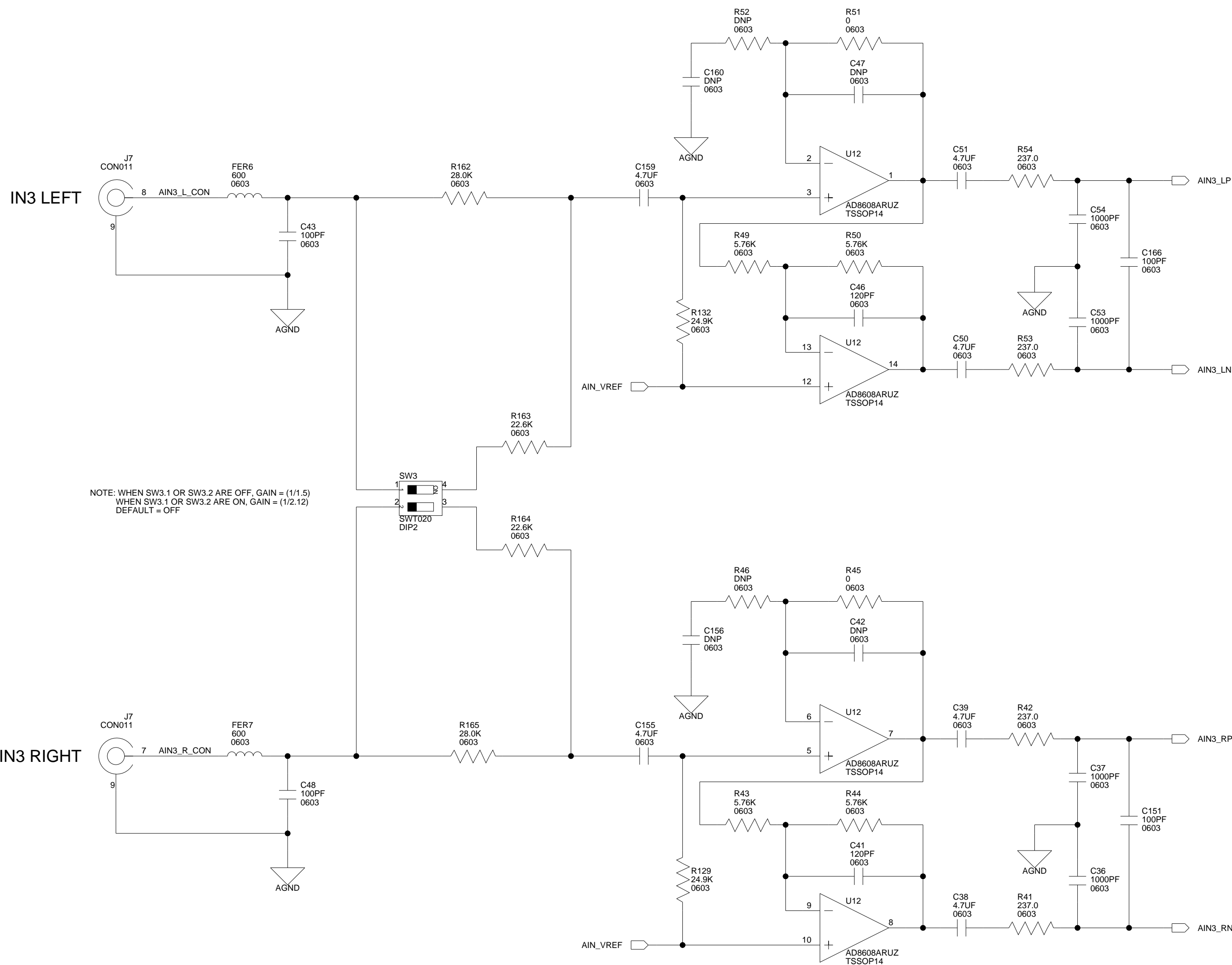


NOTE: WHEN SW2.1 OR SW2.2 ARE OFF, GAIN = (1/1.5)  
 WHEN SW2.1 OR SW2.2 ARE ON, GAIN = (1/2.12)  
 DEFAULT = OFF

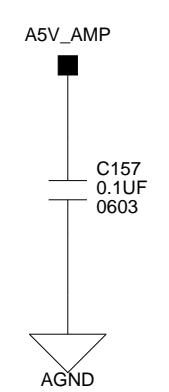
ANALOG INPUT SIGNAL SPECS CAN BE FOUND IN THE MANUAL

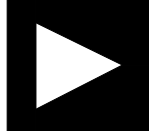


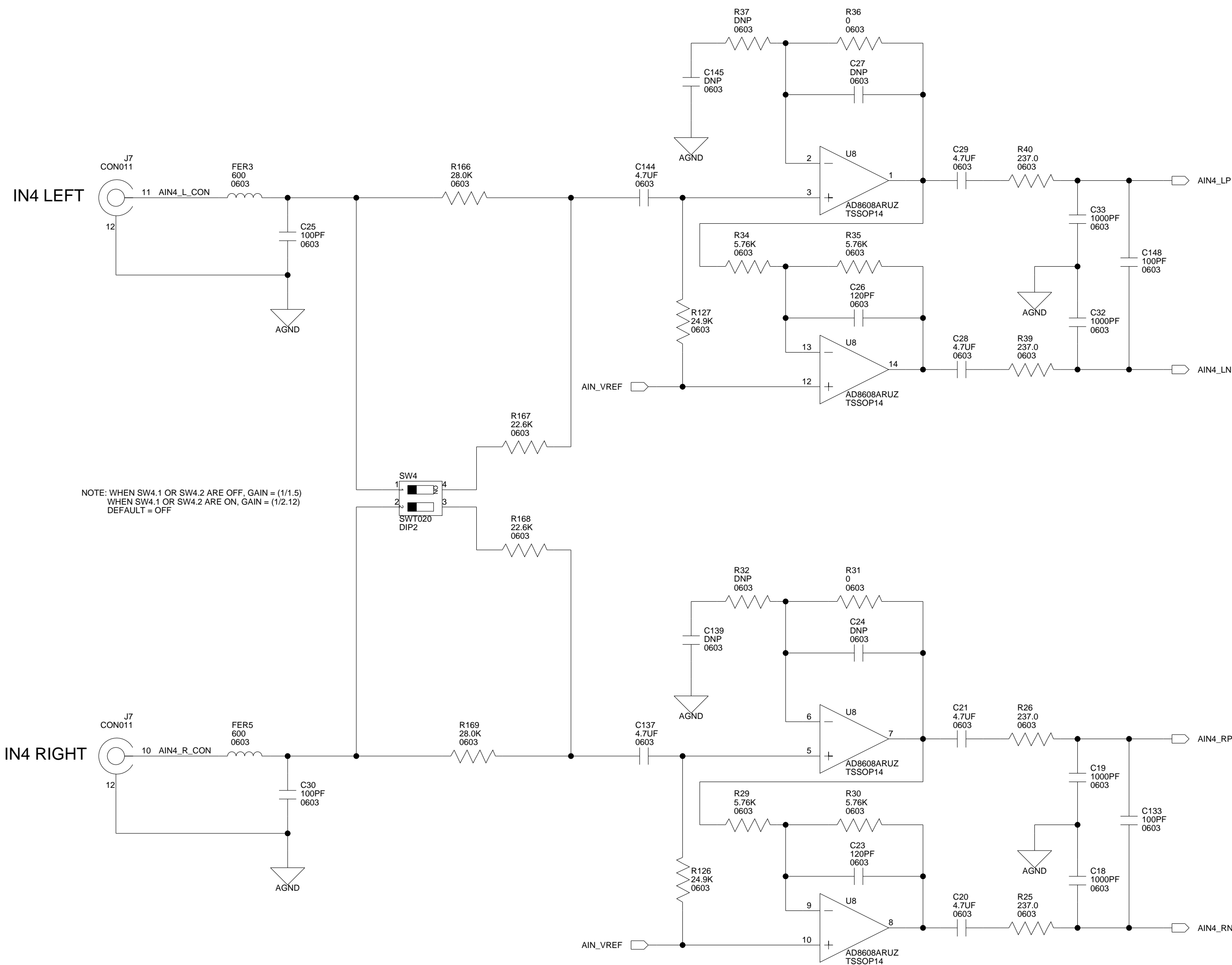
 <b>ANALOG DEVICES</b>		20 Cotton Road Nashua, NH 03063 PH: 1-800-ANALOGD	
		<b>Title</b> BLACKFIN AUDIO EZ-EXTENDER ANALOG IN 2	
<b>Size</b> C	<b>Board No.</b> A0195-2005	<b>Rev</b> 1.2C	
<b>Date</b> 5-23-2007_11:47	<b>Sheet</b> 8 of 12		



ANALOG INPUT SIGNAL SPECS CAN BE FOUND IN THE MANUAL

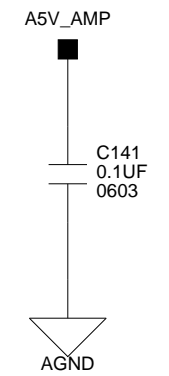


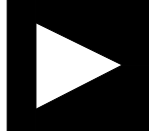
 <b>ANALOG DEVICES</b>		20 Cotton Road Nashua, NH 03063 PH: 1-800-ANALOGD	
		<b>Title</b> BLACKFIN AUDIO EZ-EXTENDER ANALOG IN 3	
<b>Size</b> C	<b>Board No.</b> A0195-2005	<b>Rev</b> 1.2C	
<b>Date</b> 5-23-2007_11:47	<b>Sheet</b> 9 of 12		

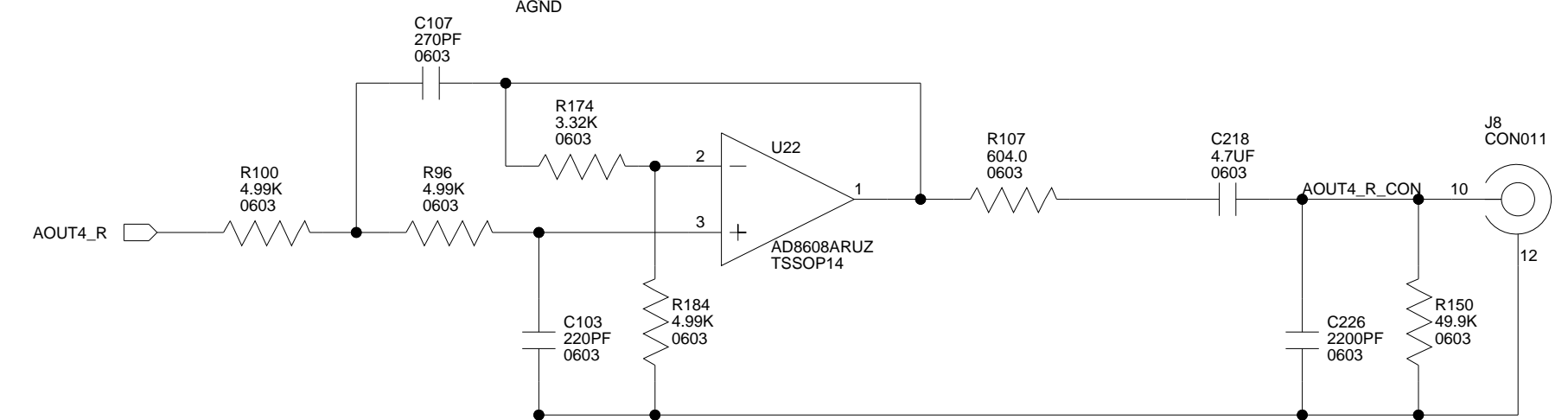
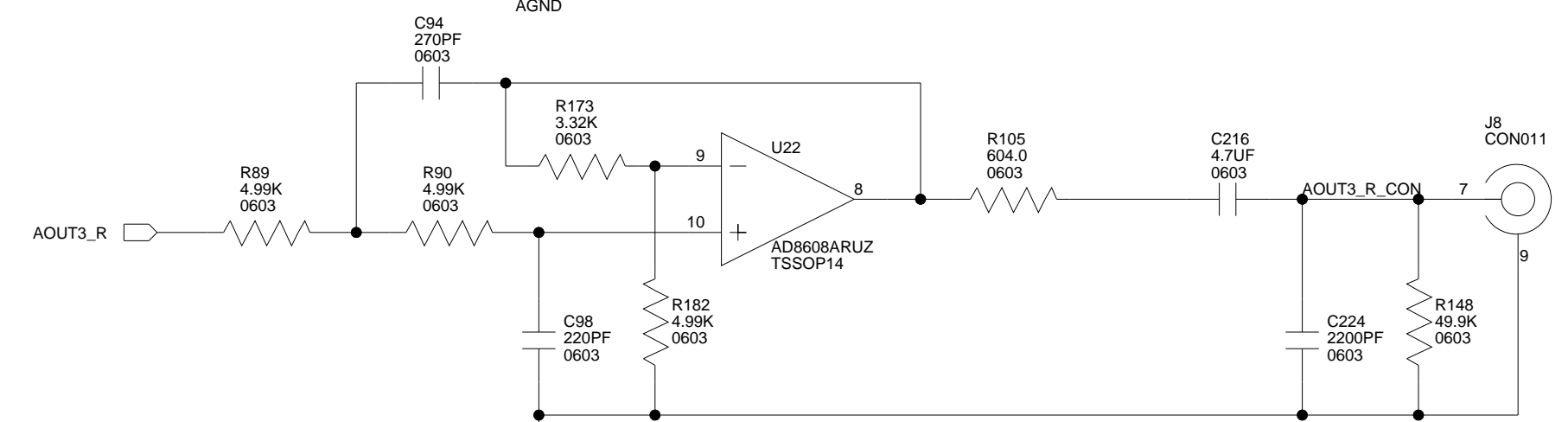
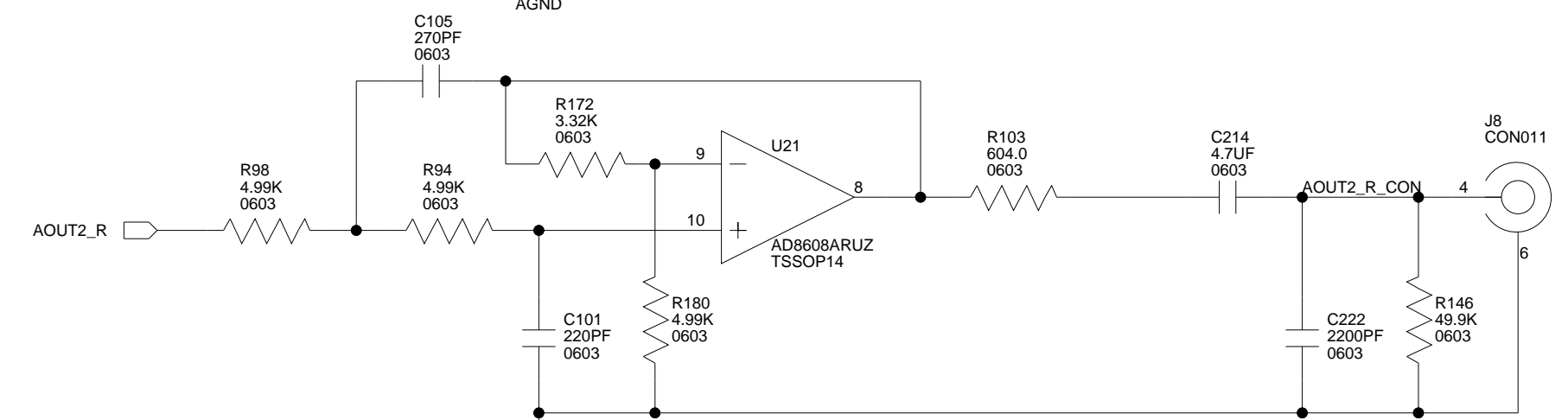
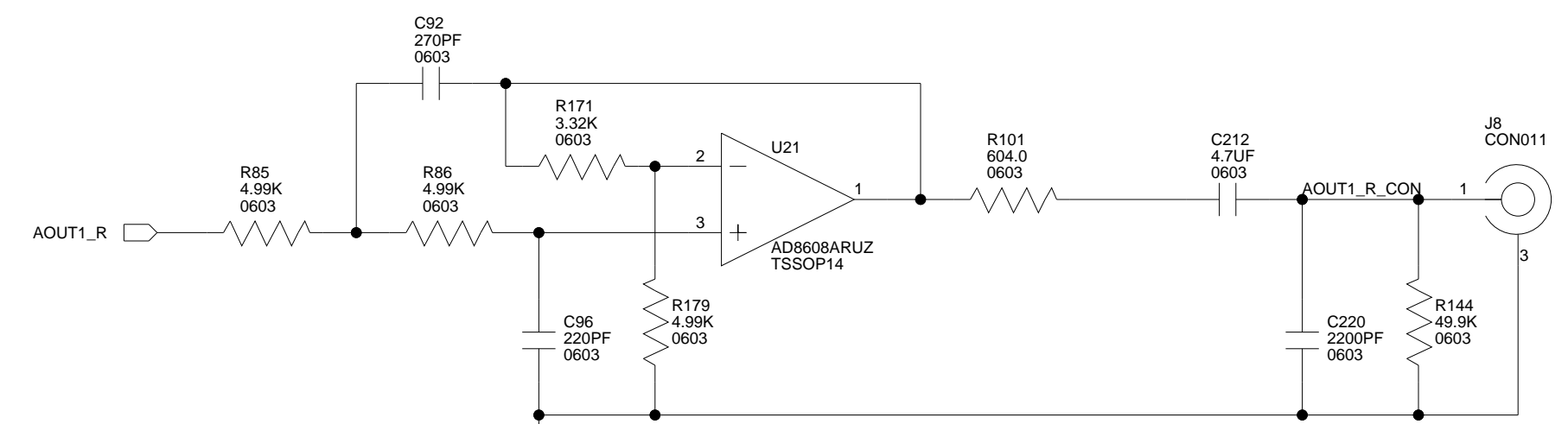
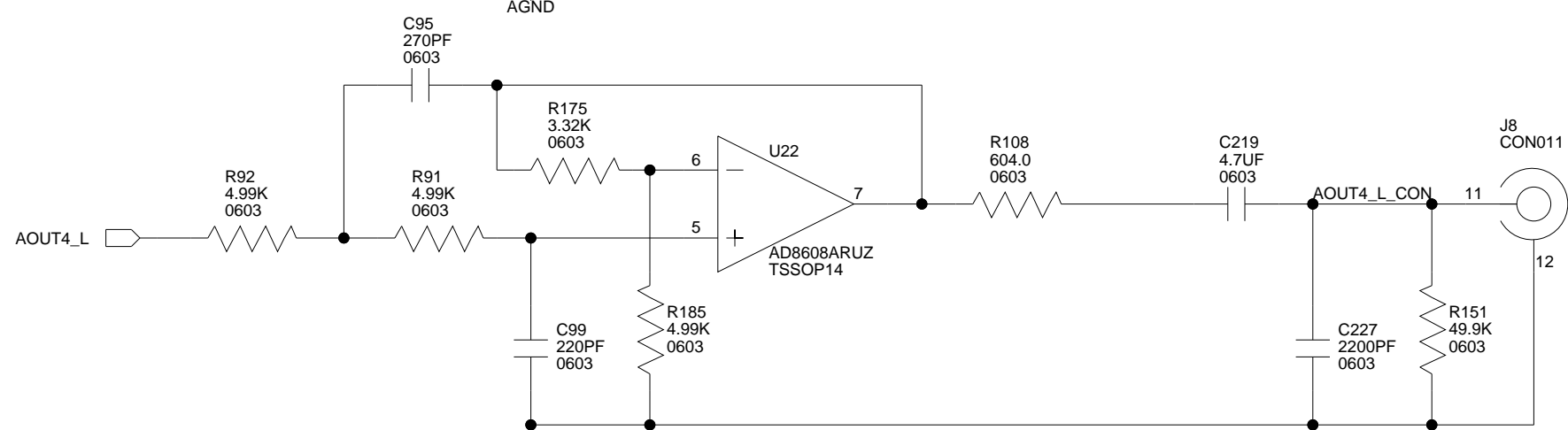
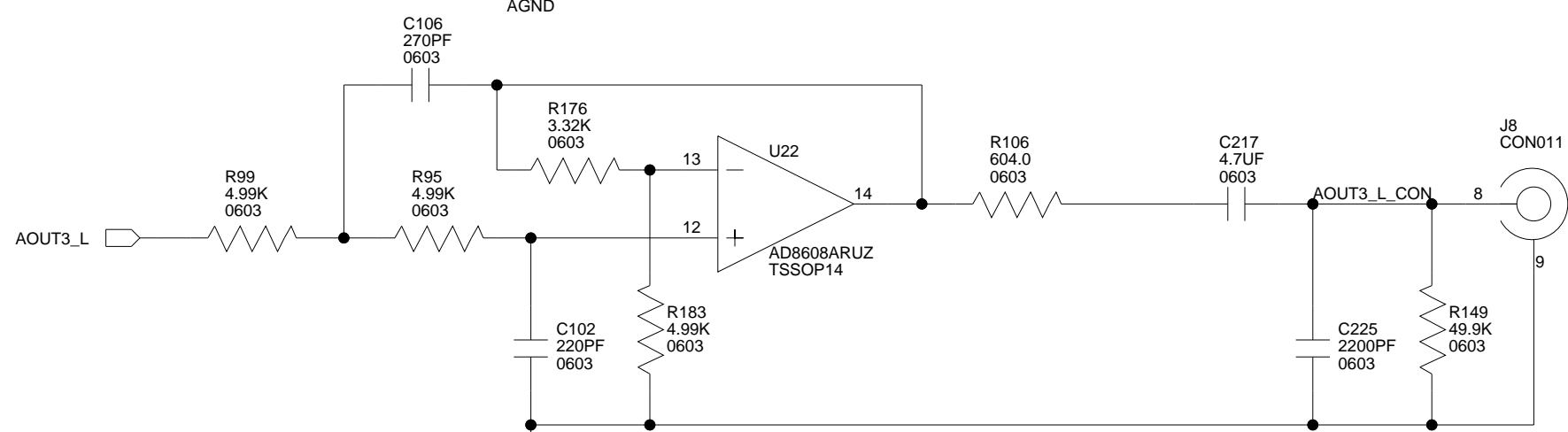
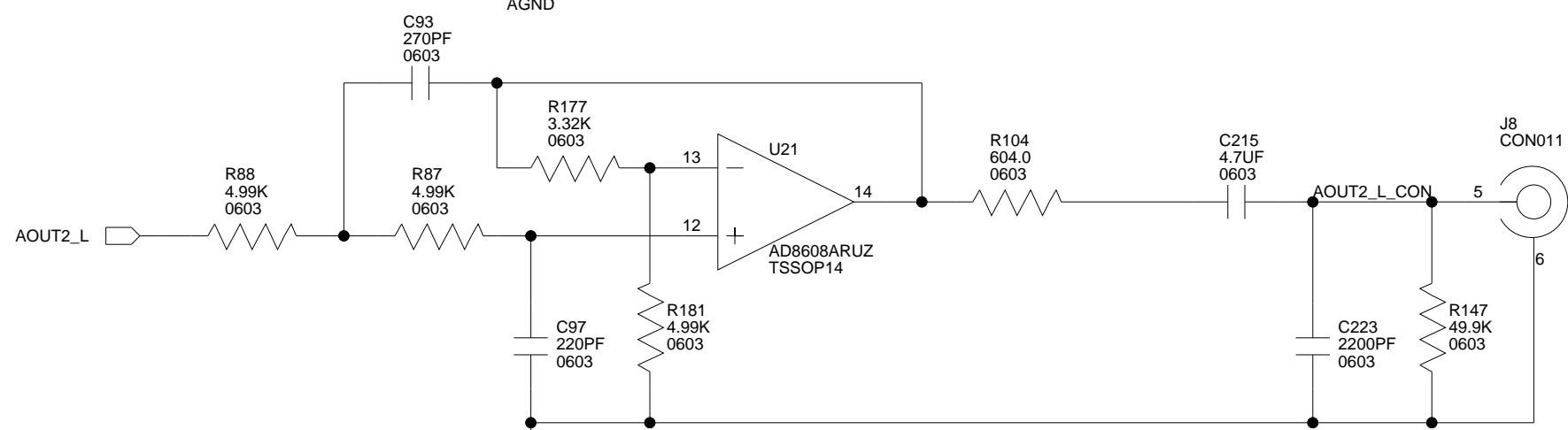
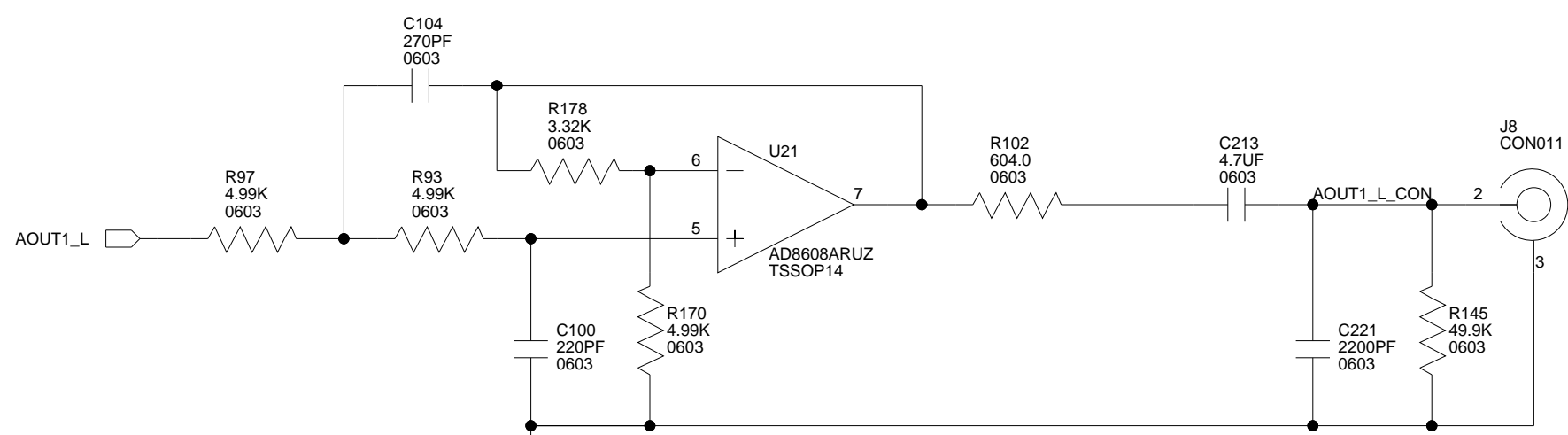


NOTE: WHEN SW4.1 OR SW4.2 ARE OFF, GAIN = (1/1.5)  
 WHEN SW4.1 OR SW4.2 ARE ON, GAIN = (1/2.12)  
 DEFAULT = OFF

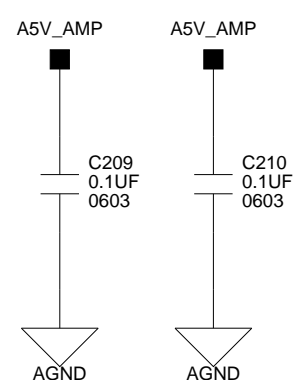
ANALOG INPUT SIGNAL SPECS CAN BE FOUND IN THE MANUAL

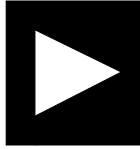


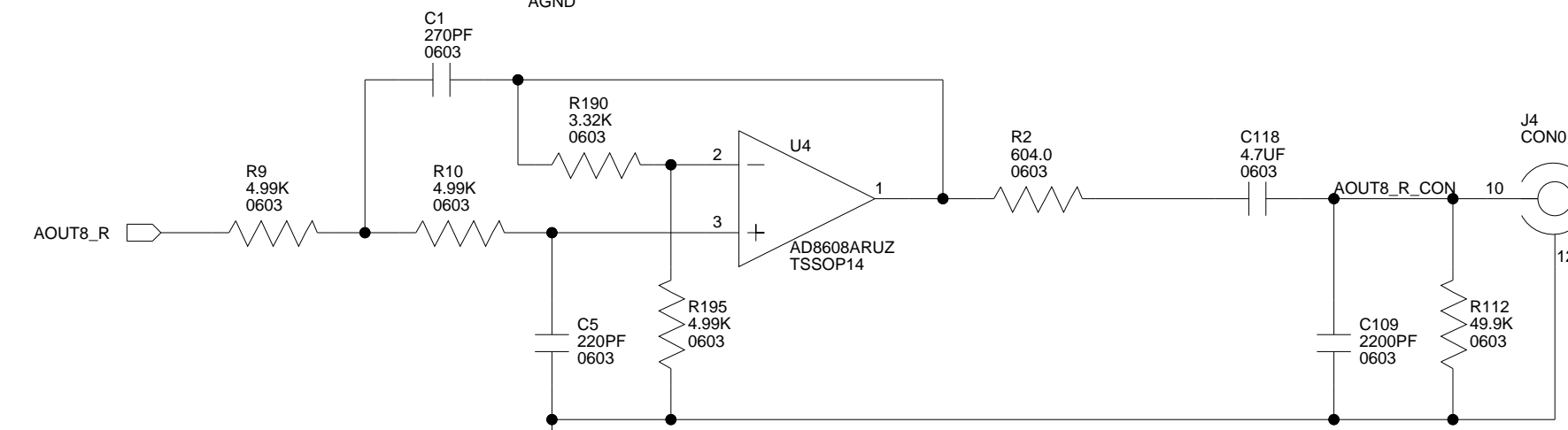
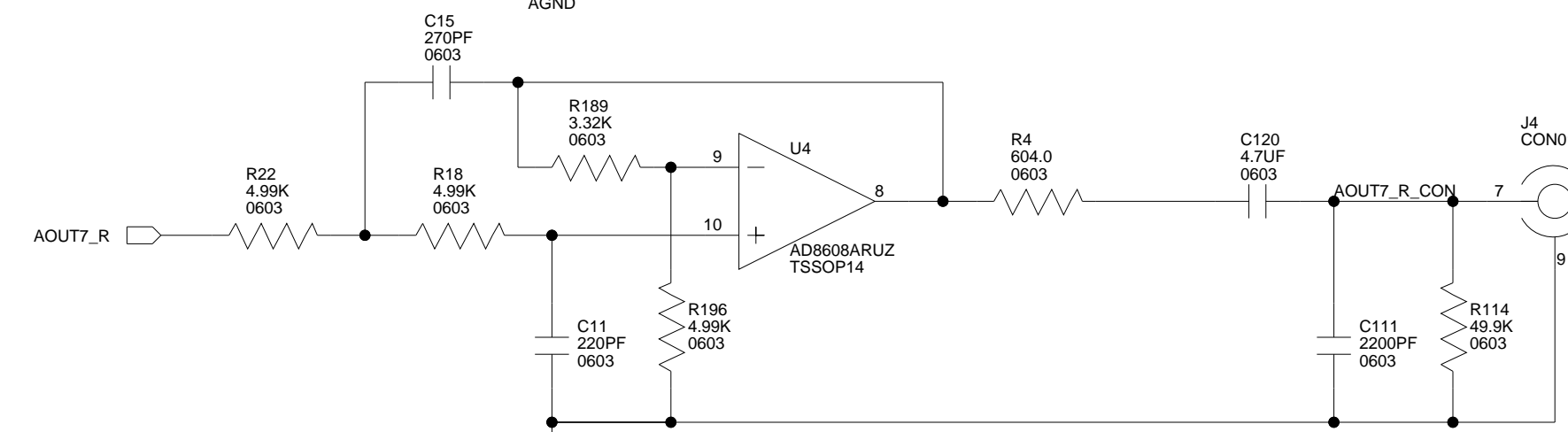
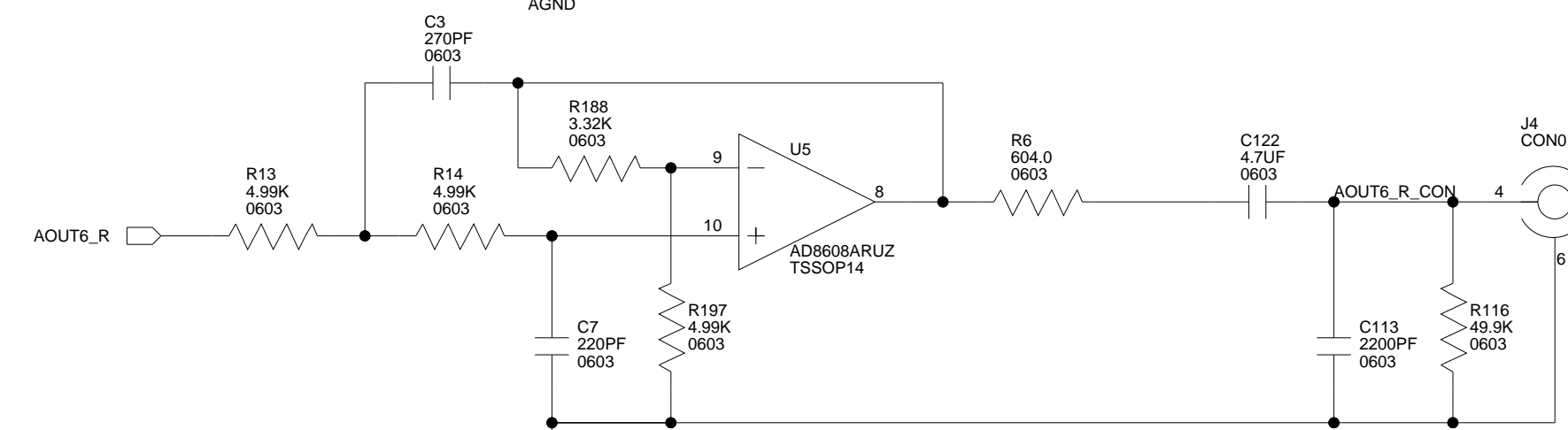
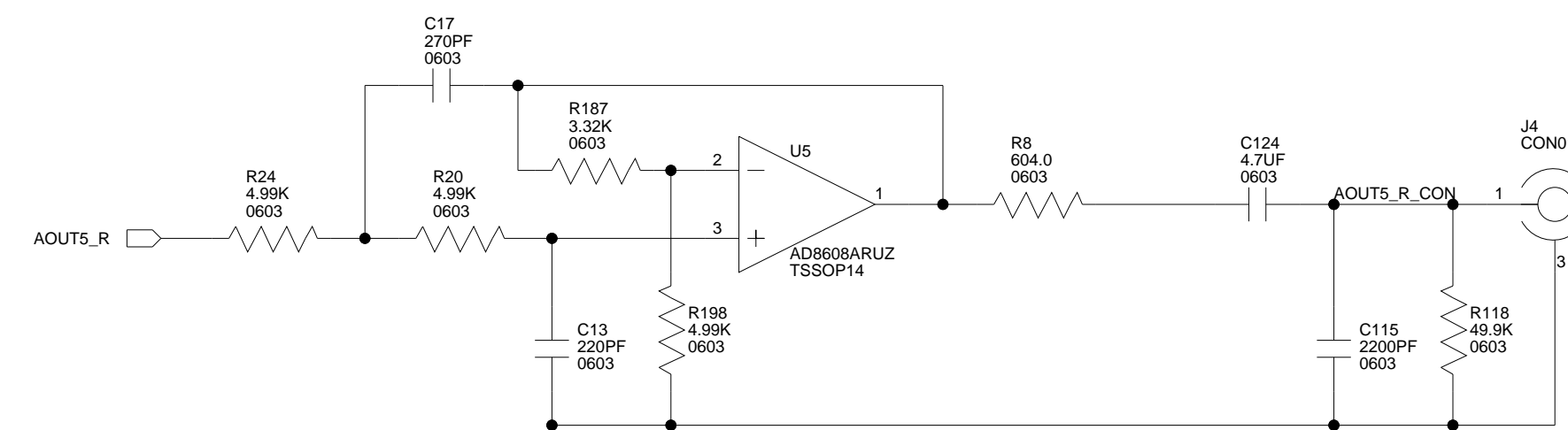
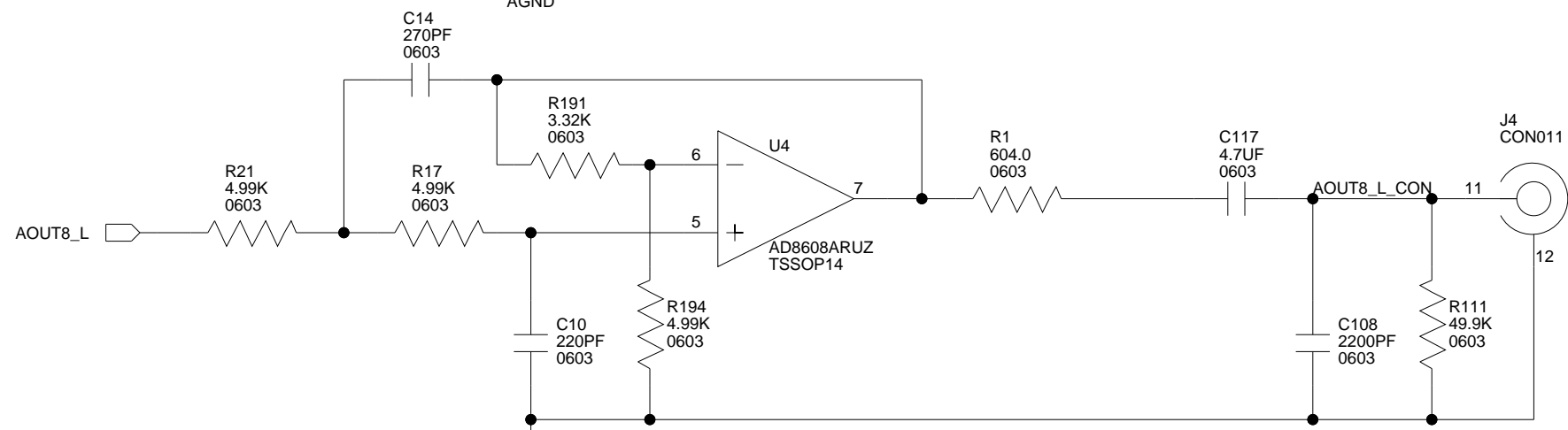
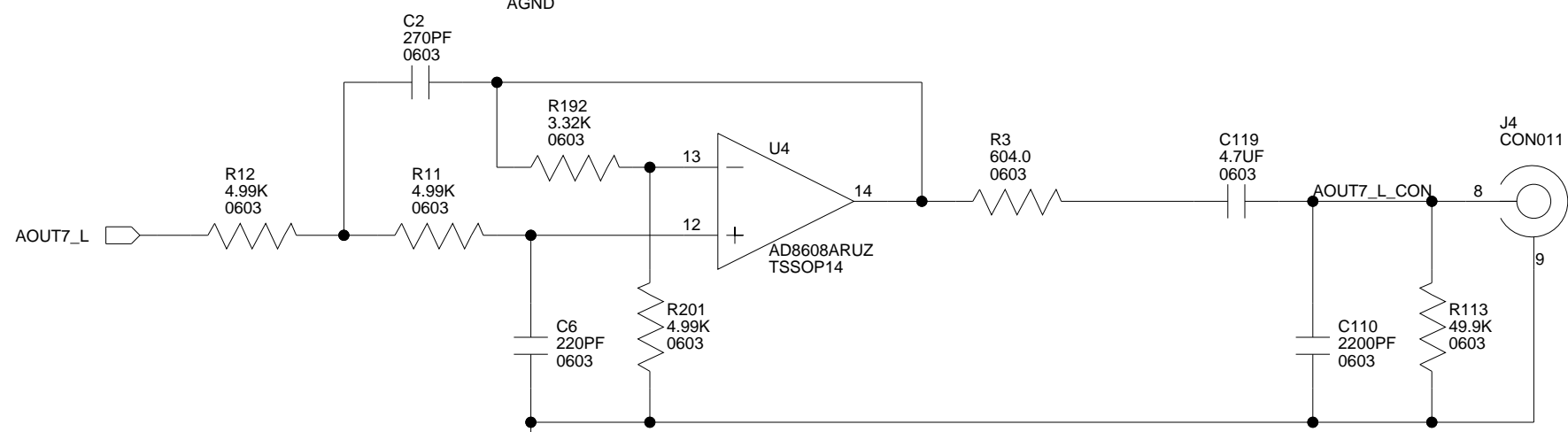
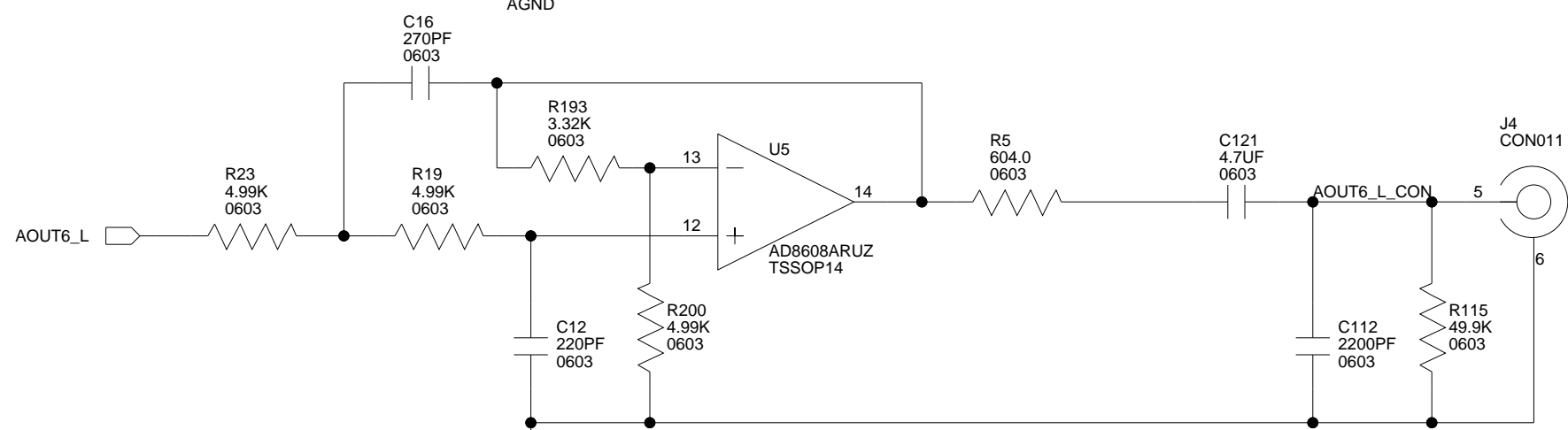
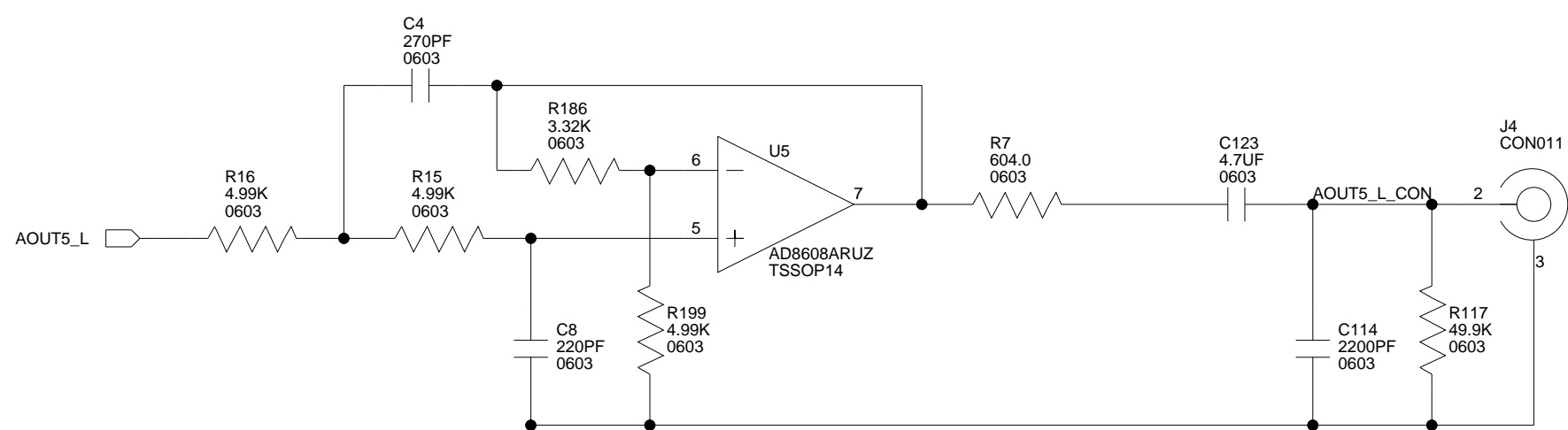
 <b>ANALOG DEVICES</b>		20 Cotton Road Nashua, NH 03063 PH: 1-800-ANALOGD	
		<b>Title</b> BLACKFIN AUDIO EZ-EXTENDER ANALOG IN 4	
<b>Size</b> C	<b>Board No.</b> A0195-2005	<b>Rev</b> 1.2C	
<b>Date</b> 5-23-2007_11:47	<b>Sheet</b> 10 of 12		



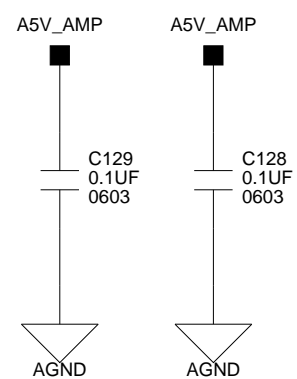
ANALOG OUTPUT SIGNAL SPECS CAN BE FOUND IN THE MANUAL

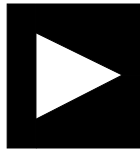


 <b>ANALOG DEVICES</b>		20 Cotton Road Nashua, NH 03063 PH: 1-800-ANALOGD	
		<b>Title</b> BLACKFIN AUDIO EZ-EXTENDER ANALOG OUT 1	
<b>Size C</b>	<b>Board No.</b>	A0195-2005	
<b>Date</b>	5-23-2007_11:47	<b>Sheet</b>	11 of 12
		<b>Rev</b>	1.2C



ANALOG OUTPUT SIGNAL SPECS CAN BE FOUND IN THE MANUAL



 <b>ANALOG DEVICES</b>		20 Cotton Road Nashua, NH 03063 PH: 1-800-ANALOGD	
		<b>Title</b> BLACKFIN AUDIO EZ-EXTENDER ANALOG OUT 2	
<b>Size C</b>	<b>Board No.</b>	A0195-2005	
<b>Date</b>	5-23-2007_11:47	<b>Sheet</b>	12 of 12
		<b>Rev</b>	1.2C

# I INDEX

## A

AD1938 analog audio codecs, [viii](#), [1-2](#), [1-5](#),  
[2-2](#), [2-6](#), [2-7](#)

ADAV801 dual analog/digital audio  
codecs, [viii](#), [1-3](#), [1-4](#), [2-2](#)

ADSP-BF537 EZ-KIT Lite select jumper  
(JP1.1/2), [2-5](#)

analog

- audio interface, [viii](#), [1-2](#), [2-2](#)
- input gain switches (SW1-4), [2-7](#)
- input/output pins, [1-4](#)
- stereo input/output, [1-4](#)

analog-to-digital converters (ADCs), [1-2](#)

architecture, of Blackfin Audio

- EZ-Extender, [2-2](#)

auxiliary serial ports, [1-3](#), [1-5](#)

## B

bill of materials, [A-1](#)

board schematic (Blackfin Audio  
EZ-Extender), [B-1](#)

## C

clock frequencies, [1-4](#), [2-7](#)

configuration, of Blackfin Audio

- EZ-Extender, [1-1](#)

connectors, diagram of locations, [2-2](#)

## D

digital

- audio interface, [viii](#), [1-4](#), [2-2](#)
- audio data streams, [2-2](#)
- input channels, [1-3](#)
- stereo input/output, [1-4](#)

digital-to-analog converters (DACs), [1-2](#)

## E

expansion interface, of EZ-KIT Lite, [viii](#)

external

- master clock (MCLK) signal, [1-3](#)
- oscillators, [1-5](#)

EZ-KIT Lites

- SPORT0 enable jumper (JP1.3/4), [2-6](#)
- SPORT1 enable jumper (JP1.5/6), [2-6](#)

## F

frame sync signals, [2-2](#)

## I

I2S mode, [1-4](#), [2-2](#)

input/output digital streams, [1-3](#)

interfaces, *See* analog audio interface, digital  
audio interface

internal clocks, [1-5](#)

# Index

## J

### jumpers

- diagram of locations, [2-5](#)
- JP1.1/2 jumper (ADSP-BF537 EZ-KIT Lite select), [2-5](#)
- JP1.3/4 (EZ-KIT Lite SPORT0 enable), [2-6](#)
- JP1.5/6 (EZ-KIT Lite SPORT1 enable), [2-6](#)
- JP1.7/8 (SPORT select), [2-6](#)
- JP2 (MCLK source), [1-3](#), [2-6](#)
- JP4 (SPDIF loopback), [2-7](#)

## M

- MCLK source jumper (JP2), [2-6](#)
- multibit sigma-delta architecture, [1-2](#)

## P

- phase-locked loop (PLL), [1-3](#), [1-5](#)

## R

- RCA jacks, [viii](#), [1-4](#)

## S

- sample rates, [1-3](#), [1-4](#), [2-2](#), [2-7](#)
- schematic, of Blackfin Audio EZ-Extender, [B-1](#)
- serial peripheral interface (SPI), [1-2](#), [1-5](#), [2-4](#), [2-5](#)
- serial ports (SPORTs), [1-2](#), [1-3](#), [2-2](#)
- setup, of Blackfin Audio EZ-Extender, [1-1](#)
- Sony Philips Digital Interface, *See* SPDIF
- SPDIF
  - input/output, [1-5](#)
  - loopback jumper (JP4), [2-7](#)
- SPORT0 signal, [2-6](#)
- SPORT1 signal, [2-6](#)
- SPORT select jumper (JP1.7/8), [2-6](#)
- SW1-4 (analog input gain) switches, [2-7](#)
- SYSCLK1 pin, [1-4](#), [2-6](#)
- SYSCLK3 pin, [1-4](#), [1-5](#), [2-6](#)
- system architecture, [2-2](#)

## T

- technical support, [xi](#)
- time-division multiplexed (TDM) mode, [1-2](#), [2-2](#)
- TX/RX pins, [2-2](#)



# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Analog Devices Inc.:](#)

[ADZS-BFAUDIO-EZEXT](#)