

# **Audio EI3 Extender Board Manual**

**an EZ-Extender® product**

Revision 1.0, April 2012

Part Number  
82-000300-01

Analog Devices, Inc.  
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## Regulatory Compliance

The Audio EI3 Extender Board 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 Audio EI3 Extender Board is in the process of being 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 extender board 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.





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# PREFACE

Thank you for purchasing the Audio EI3 Extender Board, an EZ-Extender<sup>®</sup> product for EZ-KIT Lite<sup>®</sup>/EZ-Board<sup>®</sup> evaluation systems.

The EZ-KIT Lite/EZ-Board and Audio EI3 Extender Board are designed to be used in conjunction with the CrossCore<sup>®</sup> Embedded Studio development environment. CrossCore Embedded Studio (CCES) offers a powerful programming tool with new flexibility that significantly decreases the time required to port software code to a processor, reducing time-to-market.

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

## Product Overview

The Audio EI3 Extender Board is a separately sold daughter board that plugs onto the expansion interface (EI3) of an EZ-KIT Lite/EZ-Board evaluation system. The extender board aids the design and prototyping phases of the embedded processor-targeted applications. For more information refer to the product website, <http://www.analog.com/EI3-Audio>.

The Audio EI3 Extender Board utilizes the ADAU1761 SigmaDSP<sup>®</sup> stereo, low power, 96 kHz, 24-bit audio codec. The codec provides line input, line output, auxiliary input and headphone output.

## Purpose of This Manual

The following is a list of the Audio EI3 Extender Board interfaces.

- 3.5 mm line input connector (J4)
- 3.5 mm line output connector (J3)
- 3.5 mm auxiliary input (J5)
- 3.5 mm headphone (J2)
- Two omnidirectional MEMs microphones (U3 and U4)

Before using any of the interfaces, follow the setup procedure in [“Audio EI3 Extender Board Setup” on page 1-3](#).

Example programs are available to demonstrate capabilities of the Audio EI3 Extender Board.

## Purpose of This Manual

The *Audio EI3 Extender Board 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 processor board designs.

## Intended Audience

The primary audience for this manual is a programmer who is familiar with Analog Devices processors. This manual assumes that the audience has a working knowledge of the appropriate processor architecture, instruction set, and C/C++ programming languages.

Programmers who are unfamiliar with Analog Devices processors can use this manual, but should supplement it with other texts that describe your target architecture and hardware development tools.

Programmers who are unfamiliar with the CrossCore Embedded Studio programming environment or the mating evaluation board, should refer to the CCES online help or the manual describing the board (see [“Related Documents”](#)).

# Manual Contents

The manual consists of:

- Chapter 1, [“Using Audio EI3 Extender Board”](#) on page 1-1  
Provides basic board information.
- Appendix A, [“Audio EI3 Extender Board Bill Of Materials”](#) on page A-1  
Provides a list of hardware components used to manufacture the EZ-Extender board.
- Appendix B, [“Audio EI3 Extender Board Schematic”](#) on page B-1  
Provides all of the circuits on the extender board.

# What's New in This Manual

This is the first revision of the *Audio EI3 Extender Board Manual*.

## 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)
- 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

This extender board supports the Expansion Interface 3 (EI3), and requires TWI and SPORT interfaces. When connecting to the ADSP-BF609 EZ-KIT Lite, use connector P1A, P1B, P2A, or P3A.

## Product Information

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

## 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

## Product Information

title, note a possible errata check mark next to the title that leads to the current correction report against the manual.

Also note, [myAnalog.com](http://myAnalog.com) 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.com](http://myAnalog.com) provides access to books, application notes, data sheets, code examples, and more.

Visit [myAnalog.com](http://myAnalog.com) (found on the Analog Devices home page) 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
<i>Processor Data Sheet</i>	General functional description, pinout, and timing of the processor
<i>Processor Hardware Reference</i>	Description of the internal processor architecture and all register functions
<i>Blackfin Processor Programming Reference</i>	Description of all allowed processor assembly instructions

Table 2. Related CCES Publications

Title	Description
<i>ADSP-BF60x EZ-KIT Lite Evaluation System Manual</i>	Description of the boards' interfaces and hardware components
<i>CrossCore Embedded Studio Licensing Guide</i>	Description of the product's licensing options, installation, and activation
<i>CrossCore Embedded Studio Assembler and Preprocessor Manual</i>	Description of the assembler functions and commands
<i>CrossCore Embedded Studio C/C++ Compiler and Library Manual for Blackfin Processors</i>	Description of the compiler functions and commands for Blackfin processors
<i>CrossCore Embedded Studio Linker and Utilities Manual</i>	Description of the linker functions and commands
<i>CrossCore Embedded Studio Loader and Utilities Manual</i>	Description of the loader/splitter functions and commands

# Notation Conventions

Text conventions used in this manual are identified and described as follows.

Example	Description
Close command (File menu)	Titles in reference sections indicate the location of an item within the CCES environment's menu system (for example, the <b>Close</b> command appears on the <b>File</b> menu).
{this   that}	Alternative required items in syntax descriptions appear within curly brackets and separated by vertical bars; read the example as <i>this</i> or <i>that</i> . One or the other is required.
[this   that]	Optional items in syntax descriptions appear within brackets and separated by vertical bars; read the example as an optional <i>this</i> or <i>that</i> .
[this,...]	Optional item lists in syntax descriptions appear within brackets delimited by commas and terminated with an ellipse; read the example as an optional comma-separated list of <i>this</i> .
.SECTION	Commands, directives, keywords, and feature names are in text with letter gothic font.
<i>filename</i>	Non-keyword placeholders appear in text with italic style format.
	<b>Note:</b> For correct operation, ... A Note provides supplementary information on a related topic. In the online version of this book, the word <b>Note</b> appears instead of this symbol.
	<b>Caution:</b> Incorrect device operation may result if ... <b>Caution:</b> Device damage may result if ... A Caution identifies conditions or inappropriate usage of the product that could lead to undesirable results or product damage. In the online version of this book, the word <b>Caution</b> appears instead of this symbol.
	<b>Warning:</b> Injury to device users may result if ... A Warning identifies conditions or inappropriate usage of the product that could lead to conditions that are potentially hazardous for the devices users. In the online version of this book, the word <b>Warning</b> appears instead of this symbol.

# 1 USING AUDIO EI3 EXTENDER BOARD

This chapter provides the Audio EI3 Extender Board setup procedure and describes the interfaces the extender supports.

The information is presented in the following order.

- “Package Contents” on page 1-2
- “Supported Operating Systems” on page 1-2
- “System Requirements” on page 1-3
- “Audio EI3 Extender Board Setup” on page 1-3
- “Audio Interface” on page 1-4
- “Connectors” on page 1-4
- “Power LED (LED1)” on page 1-6
- “Power” on page 1-6

# Package Contents

Your Audio EI3 Extender Board package contains the following items.

- Audio EI3 Extender Board
- A bag containing hardware for securing the extender board on the EZ-KIT Lite/EZ-Board
- One 3.5 mm male/male cable
- One set of stereo headphones
- Release note containing information about the product download

Contact the vendor where you purchased your extender board or contact Analog Devices, Inc. if any item is missing.

## Supported Operating Systems

CCES is supported on the following operating systems:

- Windows<sup>®</sup> XP Professional SP3 (32-bit only)
- Windows Vista<sup>™</sup> Business, Enterprise, or Ultimate SP2 (32-bit only)
- Windows 7 Professional, Enterprise, or Ultimate (32- and 64-bit)



Windows Vista and Windows 7 users may experience User Access Control (UAC) related errors if the software is installed into a protected location, such as Program Files or Program Files (x86). We recommend installing the software in a non-UAC-protected location.

# System Requirements

Verify that your PC has these minimum requirements for the CCSE installation:

- 2 GHz single-core processor
- 1 GB RAM
- 8 GB available disk space
- One open USB port



A faster disk drive decreases the build time, especially for a large amount of source files.

## Audio EI3 Extender Board Setup

The Audio EI3 Extender Board does not have any configuration that is required. Make sure the EZ-KIT Lite/EZ-Board that the Audio EI3 Extender Board will be connected to is set up properly.

Before powering the board, use the provided hardware to secure the extender to the EZ-KIT Lite/EZ-Board. The small spacers are intended for between the extender board and the mating board. If used, standoffs on the EZ-KIT Lite/EZ-Board may need to be removed. The extender board uses shorter standoffs and a screw secures these standoffs.

Refer to the readme text files in the CrossCore Embedded Studio directory (`<install_path>\Audio_EI3_Extender_Board-RelX.X.X\Audio_EI3`, where `X.X.X` denotes the support package release number) for information on how to configure the EZ-KIT Lite boards. For more information on the Audio EI3 Extender Board, please go to <http://www.analog.com/EI3-Audio>. The board support package (BSP) for the Audio EI3 Extender Board can be found at this website.

# Audio Interface

The SigmaDSP ADAU1761 (U2) connects to the SPORT interface of the EI3 connector (J1). All control and setup communication uses the TWI interface. The TWI address is set to 0111 000X (where X is the read or write bit) by resistors R9 and R10. The last two address bits can be adjusted through populating R7 and/or R8, in conjunction with depopulating R9 and/or R10.

There are two input connectors and two output connectors. J2 is the stereo headphone output. J3 is line out and is a single-ended stereo output. J5 is the auxiliary input. J4 connects a single-ended stereo line in to the codec. A standard 3.5 mm male-to-male cable connects to any of these four connectors.

The board also has two omnidirectional MEMS microphones, which are Analog Devices part number ADMP421 ICs (U3 and U4). The microphones connect gluelessly to the ADAU1761 processor.

Example programs demonstrating the audio interface capabilities are included in the CrossCore Embedded Studio directory. Once installed, the example programs can be found in the `<install_path>\Audio_EI3_Extender_Board-RelX.X.X\Audio_EI3` directory, where *X.X.X* denotes the support package release number.

## Connectors

The LED, connector, and jumper locations are shown in [Figure 1-1](#).

The J2-J5 connectors are 3.5 mm stereo jacks from CUI Inc. (part number SJ-3523-SMT). Use any 3.5 mm audio cable to connect to J2-J5.

The P1 connector is a 0.65 mm power jack from CUI Inc. (part number CP1-022PJTR-ND). Use this jack when the EZ-KIT Lite/EZ-Board cannot provide adequate power. The 5V adaptor is then connected to P1 and

the main board produces the 1.8–3.3V needed for the Audio EI3 Extender Board to operate on the signal  $V_{IO}$ .

The J1 connector is a 120-pin 0.6 mm pitch connector from Hirose (part number FX8-120S-SV(21)). This connector mates with Hirose part number FX8-120P-SV1(91).

P2 is the SigmaStudio interface connector. The interface cable is Analog Devices part number EVAL-ADUSB2EBZ, which is available through [www.analog.com](http://www.analog.com). This provides a USB connection to a host PC and the full capabilities of the SigmaDSP ADAU1761 are available through SigmaStudio. Only the I<sup>2</sup>C interface of the connection is available.

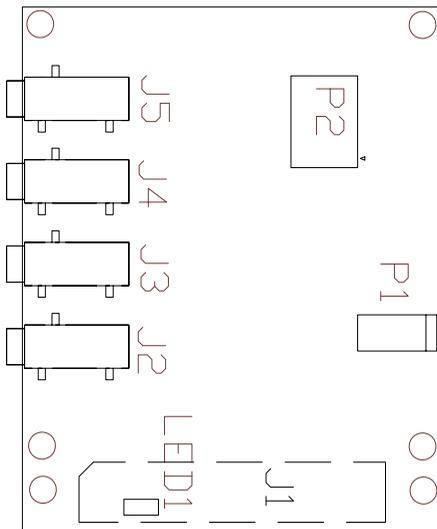


Figure 1-1. LED, Connector and Jumper Locations

**i** As shown in [Figure 1-1](#), connector J1 is located on the opposite side of the board. For this reason, J1 is shown with a dashed line.

## Power LED (LED1)

# Power LED (LED1)

The power LED (LED1) is located on the bottom of the board and is green when the Audio EI3 Extender Board is powered.

## Power

The Audio EI3 Audio Extender Board needs the EZ-KIT Lite/EZ-Board to be powered and does not require power input to the P2 power connector.

The V10 power rail of the Audio EI3 Extender Board must be in the range of 1.8V–3.3V for proper operation. Ensure that any main board connected to the Audio EI3 Extender Board supplies this voltage over pin 116 of J1.

# A AUDIO EI3 EXTENDER BOARD BILL OF MATERIALS

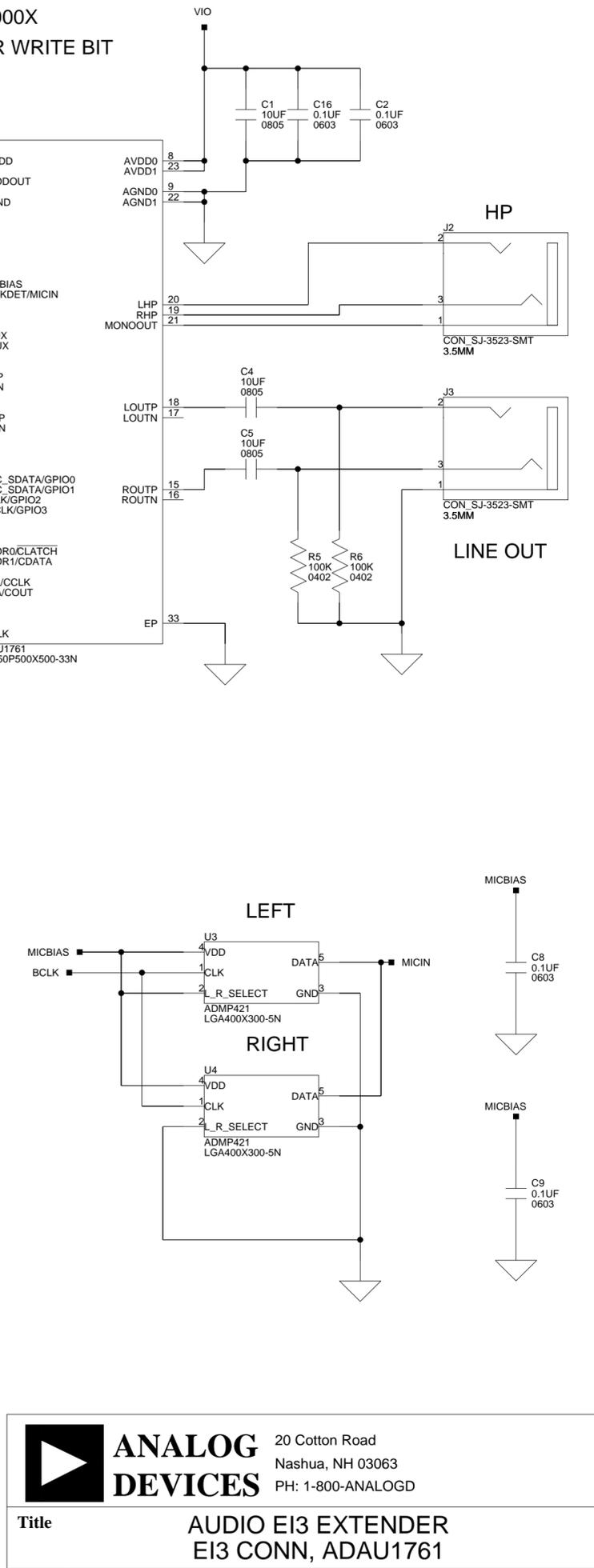
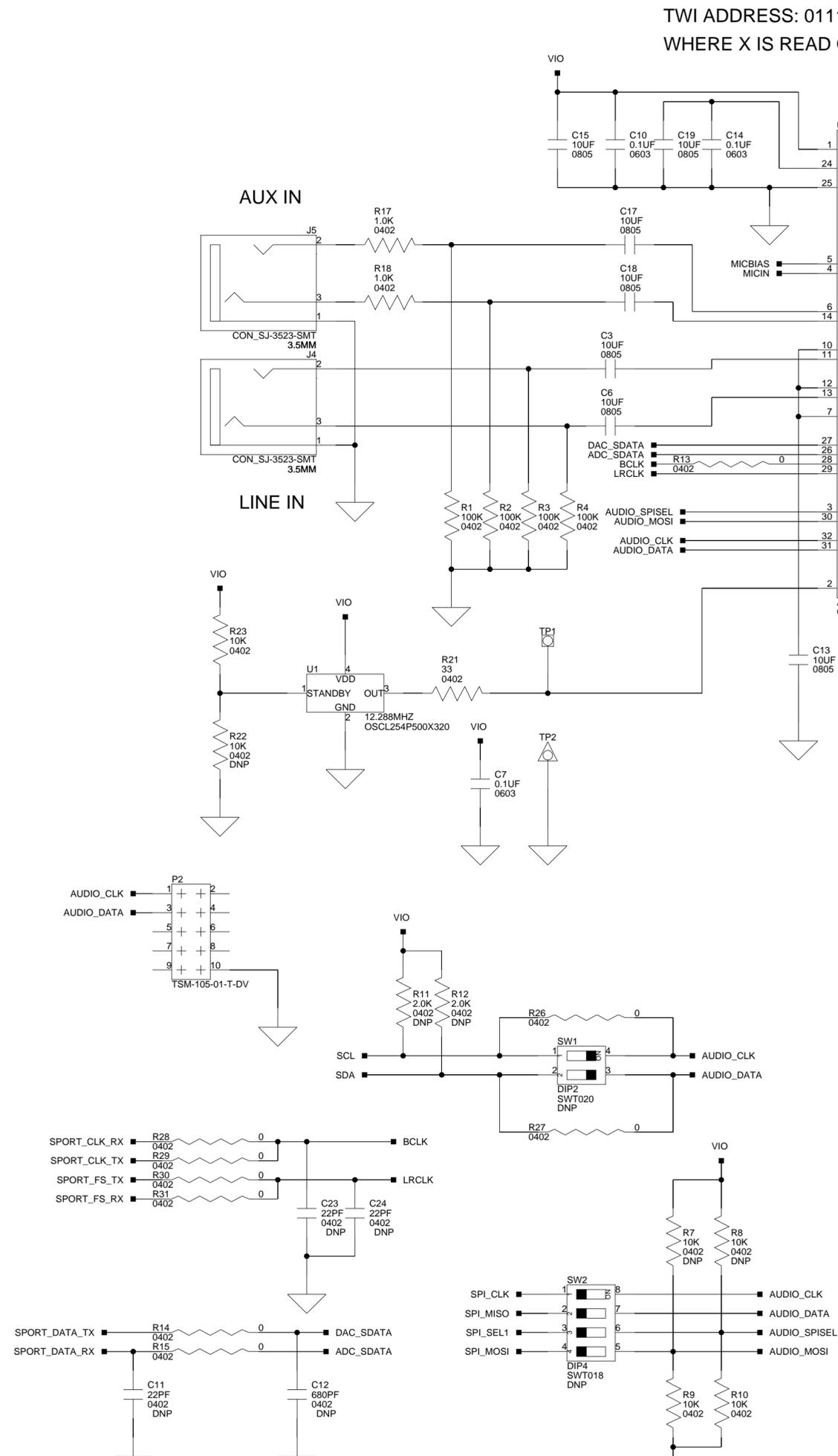
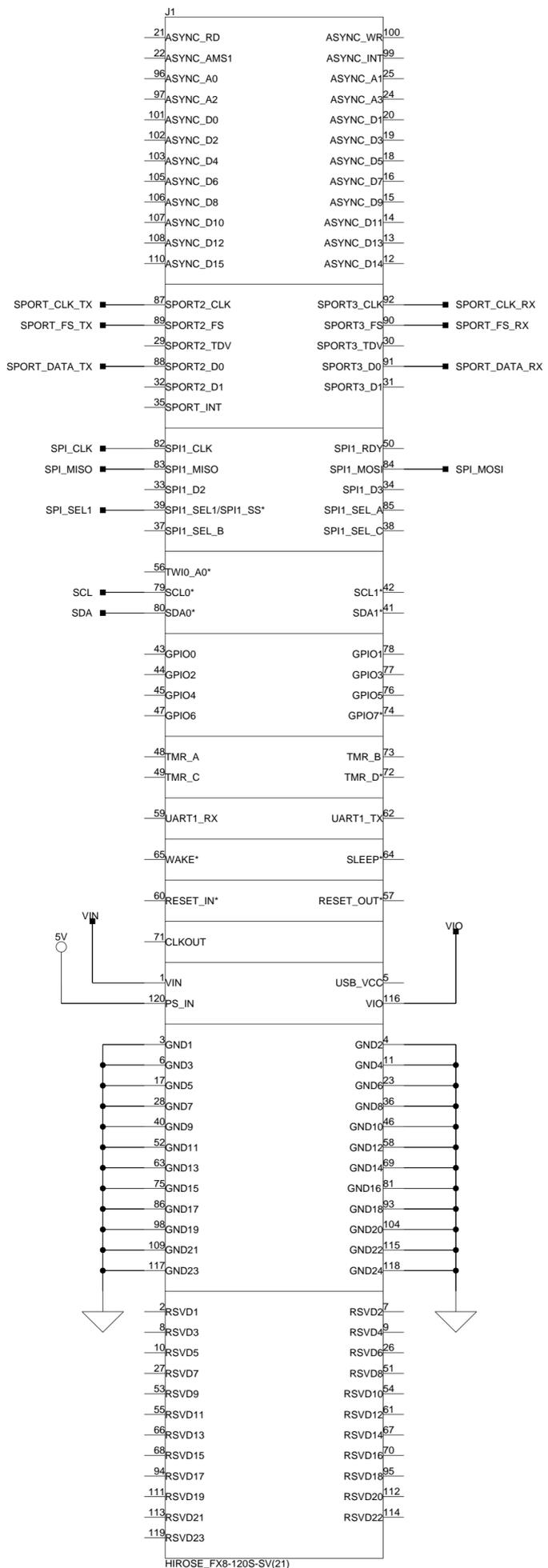
The bill of materials corresponds to “[Audio EI3 Extender Board Schematic](#)” on page B-1.

Ref.	Qty.	Description	Reference Designator	Manufacturer	Part Number
1	1	12.288MHZ OSCL254P500X320	U1	DIG01	535-10982-2-ND
2	1	ADAU1761 QFN50P500X500-33N	U2	ANALOG DEVICES	ADAU1761BCPZ-R7
3	2	ADMP421 LGA400X300-5N	U3-U4	ANALOG DEVICES	ADMP421ACEZ-RL7
4	1	PWR .65MM CON027	P1	DIGI-KEY	CP1-022PJCT-ND
5	1	3A RESETABLE FUS004	F1	TYCO	SMD300F-2
6	1	.6MM 120PIN HIROSE_FX8-120S-SV (21)	J1	HIROSE	FX8-120S-SV(21)
7	4	3.5MM STEREO_JACK CON_SJ-3523-SMT	J2-J5	DIGI-KEY	CP-3523SJCT-ND
8	1	IDC 5X2 TSM-105-01-T-DV	P2	SAMTEC	TSM-105-01-T-DV
9	2	600 100MHZ 500MA 1206	FER1-FER2	STEWART	HZ1206B601R-10
10	1	190 100MHZ 5A FER002	FER3	MURATA	DLW5BSN191SQ2
11	1	GREEN LED009	LED1	DIGI-KEY	160-1169-1-ND

Ref.	Qty.	Description	Reference Designator	Manufacturer	Part Number
12	9	10UF 6.3V 10% 0805	C1,C3-C6,C15,C17-C19	AVX	08056D106KAT2A
13	3	10K 1/16W 5% 0402	R9-R10,R23	VISHAY	CRCW040210K0FKED
14	9	0 1/16W 5% 0402	R13-R15,R26-R31	PANASONIC	ERJ-2GE0R00X
15	1	33 1/16W 5% 0402	R21	VISHAY	CRCW040233R0JNEA
16	7	0.1UF 16V 10% 0603	C2,C7-C10,C14,C16	AVX	0603YC104KAT2A
17	1	10UF 10V 10% 0805	C13	PANASONIC	ECJ-2FB1A106K
18	1	10UF 16V 10% 1210	C21	AVX	1210YD106KAT2A
19	2	1000PF 50V 5% 1206	C20,C22	AVX	12065A102JAT2A
20	1	430 1/16W 1% 0402	R32	DIGI-KEY	311-430LRCT-ND
21	1	5A MBRS540T3G SMC	D2	ON SEMI	MBRS540T3G
22	2	1.0K 1/16W 1% 0402	R17-R18	PANASONIC	ERJ-2RKF1001X
23	6	100K 1/16W 5% 0402	R1-R6	DIGI-KEY	541-100KJTR-ND
24	1	30A GSOT05 SOT23-3	D1	VISHAY	GSOT05-GS08

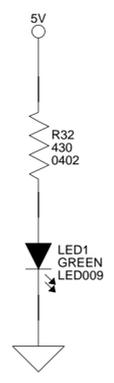
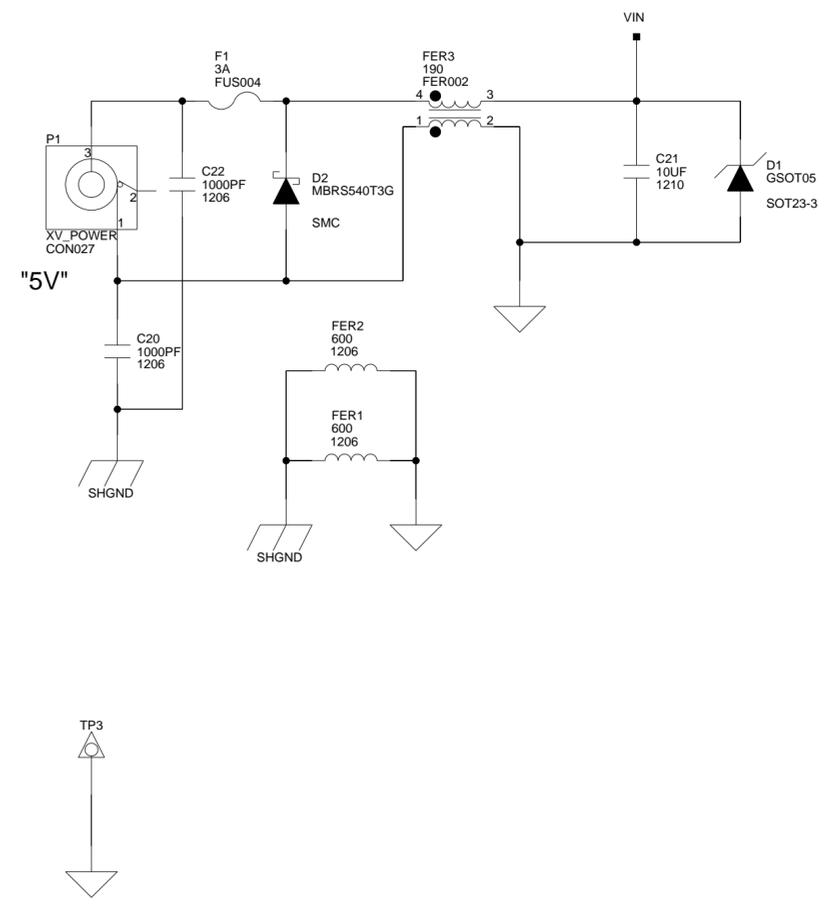
# AUDIO EI3 EXTENDER SCHEMATICS

	<b>ANALOG DEVICES</b>	20 Cotton Road Nashua, NH 03063 PH: 1-800-ANALOGD
<b>Title</b>	AUDIO EI3 EXTENDER TITLE PAGE	
<b>Size</b> C	<b>Board No.</b> A0300-2011	<b>Rev</b> 1.0
<b>Date</b>	1/20/12	<b>Sheet</b> 1 <b>of</b> 3



TWI ADDRESS: 0111 000X  
WHERE X IS READ OR WRITE BIT

		20 Cotton Road Nashua, NH 03063 PH: 1-800-ANALOGD	
		<b>Title</b> <b>AUDIO E13 EXTENDER</b> <b>E13 CONN, ADAU1761</b>	
<b>Size</b> <b>C</b>	<b>Board No.</b> <b>A0300-2011</b>	<b>Rev</b> <b>1.0</b>	
<b>Date</b> 1/20/12	<b>Sheet</b> 2	<b>of</b> 3	



 <b>ANALOG DEVICES</b>		20 Cotton Road Nashua, NH 03063 PH: 1-800-ANALOGD	
		<b>Title</b> AUDIO E13 EXTENDER POWER, LED	
<b>Size</b> C	<b>Board No.</b> A0300-2011	<b>Rev</b> 1.0	
<b>Date</b> 1/20/12	<b>Sheet</b> 3 <b>of</b> 3		

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