ADSP-TS101S EZ-KIT Lite®
Evaluation System Manual

Revision 2.1, April 2006

Part Number
82-000635-01

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

ANALOG DEVICES

Copyright Information

©2006 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.

Limited Warranty

The EZ-KIT Lite evaluation system is warranted against defects in materials and workmanship for a period of one year from the date of purchase from Analog Devices or from an authorized dealer.

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, TigerSHARC, VisualDSP++, the VisualDSP++ logo, CROSSCORE, the CROSSCORE logo, and EZ-KIT Lite 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 ADSP-TS101S EZ-KIT Lite evaluation system 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 ADSP-TS101S EZ-KIT Lite evaluation system had been appended to Analog Devices Development Tools Technical Construction File referenced "DSPTOOLS1" dated December 21, 1997 and was awarded CE Certification by an appointed European Competent Body and is on file.

CE

The EZ-KIT Lite evaluation system 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 EZ-KIT Lite boards in the protective shipping package.

CONTENTS

PREFACE

Purpose of This Manual xii
Intended Audience xii
Manual Contents xiii
What's New in This Manual xiii
Technical or Customer Support xiv
Supported Processors xiv
Product Information xv
MyAnalog.com xv
Processor Product Information xv
Related Documents xvi
Online Technical Documentation xvii
Accessing Documentation From VisualDSP++ xviii
Accessing Documentation From Windows xviii
Accessing Documentation From Web xix
Printed Manuals xix
VisualDSP++ Documentation Set xix
Hardware Tools Manuals xix
Processor Manuals xx

Data Sheets xx
Notation Conventions xxi

USING ADSP-TS101S EZ-KIT LITE

Package Contents 1-2
Default Configuration 1-3
Installation and Session Startup 1-5
Evaluation License Restrictions 1-7
Memory Map 1-7
SDRAM Interface 1-8
Programmable FLAG Pins 1-9
Interrupt Pins 1-10
Flash Memory 1-11
Audio Interface 1-11
Example Programs 1-12
Flash Programmer Utility 1-13
Handling ADSP-TS101S EZ-KIT Lite Flash Memory 1-13

ADSP-TS101S EZ-KIT LITE HARDWARE REFERENCE

System Architecture 2-2
External Port 2-3
Expansion Interface 2-3
JTAG Emulation Port 2-4
DIP Switch Settings 2-4
Control Impedance Selection 2-5

Drive Strength Selection 2-5
Boot Mode Settings 2-6
Interrupt Enable Settings 2-7
Clock Mode Settings 2-7
LEDs and Push Buttons 2-8
USB Monitor LED (LED1) 2-8
Reset LEDs (LED2, LED8–9) 2-8
Power LED (LED3) 2-9
FLAG LEDs (LED4–7) 2-10
Reset Push Button (SW1) 2-10
Programmable FLAG Push Buttons (SW2, SW4–5, and SW9) 2-10
Interrupt Push Buttons (SW3 and SW6) 2-11
Connectors 2-12
Audio (P2 and P3) 2-12
USB (P4) 2-13
JTAG (P5) 2-13
Expansion Interface (P11–13) 2-14
Link Ports (P7–10) 2-14
Power Connector (P14) 2-15
Power Supply Specifications 2-15

ADSP-TS101S EZ-KIT LITE BILL OF MATERIALS

ADSP-TS101S EZ-KIT LITE SCHEMATIC

Title Page B-1

Processor A B-2
Processor B B-3
SDRAM and Flash B-4
Audio Interface B-5
Audio In Amplifiers B-6
Audio Out Amplifiers B-7
Push Buttons and LEDs B-8
Configuration B-9
Expansion Connectors B-10
Power Supply B-11
Caps B-12

INDEX

PREFACE

Thank you for purchasing the ADSP-TS101S EZ-KIT Lite®, Analog Devices (ADI) evaluation system for TigerSHARC® floating-point embedded processors.

The TigerSHARC processor is a static super scalar (SSS) architecture targeted at software-defined radio applications. In these wireless infrastructure applications, the TigerSHARC processor is replacing field-programmable gate arrays (FPGAs) in the chip rate processing applications for third generation cellular. The performance, flexibility, multiprocessing and IO capabilities of the TigerSHARC processor makes it superior to FPGA implementations.

The evaluation board is designed to be used in conjunction with the VisualDSP++® development environment to test the capabilities of the ADSP-TS101S TigerSHARC processor. The VisualDSP++ development environment gives you the ability to perform advanced application code development and debug, such as:

- Create, compile, assemble, and link application programs written in C++, C, and ADSP-TS101S assembly
- Load, run, step-in, step-out, step-over, halt, and set breakpoints in application program
- Profile programs
- Read and write data and program memory

- Read and write core and peripheral registers
- Plot memory

Access to the ADSP-TS101S processor from a personal computer (PC) is achieved through a USB port or an optional JTAG emulator. The USB interface gives unrestricted access to the ADSP-TS101S processor and the evaluation board peripherals. Analog Devices JTAG emulators offer faster communication between the host PC and target hardware. Analog Devices carries a wide range of in-circuit emulation products. To learn more about Analog Devices emulators and processor development tools, go to `http://www.analog.com/dsp/tools/`.

ADSP-TS101S EZ-KIT Lite provides example programs to demonstrate the capabilities of the evaluation board.

The ADSP-TS101S EZ-KIT Lite installation is part of the VisualDSP++ installation. The EZ-KIT Lite is a licensed product that offers an unrestricted evaluation license for the first 90 days. For details about evaluation license restrictions after the 90 days, refer to "Evaluation License Restrictions" on page 1-7.

Refer to the *VisualDSP++ Installation Quick Reference Card* for details.

The board features:

- Two Analog Devices ADSP-TS101S processors
  - 250 MHz core clock speed
  - Configurable core clock mode
- USB debugging interface
- Analog Devices AD1871 96 kHz analog-to-digital converter (ADC)
  - Line-in 3.5 mm stereo jack

- Analog Devices AD1854 96 kHz digital-to-analog converter (DAC)
  - Line-out 3.5 mm stereo jack
- SDRAM memory
  - 32 MB (4M byte x 64) DIMM
- Flash memory (544K x 8)
  - 512K main flash memory
  - 32K secondary flash memory
- Interface connectors
  - 14-pin emulator connector for JTAG interface
  - Link port 0 and link port 1 for each processor
  - Expansion interface connectors (not populated)
- General-purpose IO
  - 4 push button flags (two for each processor)
  - 2 push button interrupts (one for each processor)
  - 4 LED flag outputs (two for each processor)
- Analog Devices ADP3338, ADP3339, ADM660, and ADP3170 for voltage regulation

The EZ-KIT Lite board has two external memories: flash memory and SDRAM. The flash memory can be used to store user-specific boot code. By configuring the boot mode switch (SW7) and programming the flash memory, the board can run as a stand-alone unit. For more information, see "Memory Map" on page 1-7.

The EZ-KIT Lite board also contains an audio interface, facilitating creation of audio signal processing applications.

Additionally, the EZ-KIT Lite board provides expansion connectors, allowing you to connect to the processor's external port (EP).

Purpose of This Manual

The *ADSP-TS101S EZ-KIT Lite Evaluation System Manual* provides instructions for installing the product hardware (board). The text describes the operation and configuration of the board components and provides guidelines for running your own code on the ADSP-TS101S EZ-KIT Lite. Finally, a schematic and a bill of materials are provided as a reference for future designs.

The product software installation is detailed in the *VisualDSP++ Installation Quick Reference Card*

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 and instruction set. Programmers who are unfamiliar with Analog Devices processors can use this manual but should supplement it with other texts (such as the *ADSP-TS101 TigerSHARC Processor Hardware Reference* and the *ADSP-TS101 TigerSHARC Processor Programming Reference*) that describe your target architecture.

Programmers who are unfamiliar with VisualDSP++ should refer to the VisualDSP++ online Help and user's or getting started guides. For the locations of these documents, see "Related Documents".

Manual Contents

The manual consists of:

- Chapter 1. "Using ADSP-TS101S EZ-KIT Lite" on page 1-1
  Provides information on the EZ-KIT Lite from a programmer's perspective and outlines the processor's memory map.
- Chapter 2, "ADSP-TS101S EZ-KIT Lite Hardware Reference" on page 2-1
  Provides information on the hardware aspects of the evaluation system.
- Appendix A,"ADSP-TS101S EZ-KIT Lite Bill Of Materials" on page A-1
  Provides a list of components used to manufacture the EZ-KIT Lite board.
- Appendix B, "ADSP-TS101S EZ-KIT Lite Schematic" on page B-1
  Provides the resources to allow EZ-KIT Lite board-level debugging or to use as a reference design.

Appendix B now is part of the online Help. The online Help viewers should go to the PDF version of the *ADSP-TS101S EZ-KIT Lite Evaluation System Manual* located in the `Docs\EZ-KIT Lite Manuals` folder on the installation CD. Alternatively, the schematic can be found on the Analog Devices Web site: `www.analog.com/processors`.

What's New in This Manual

This revision of the *ADSP-TS101S EZ-KIT Lite Evaluation System Manual* has been updated for VisualDSP++ 4.5.

Technical or Customer Support

You can reach Analog Devices, Inc. Customer Support in the following ways:

- Visit the Embedded Processing and DSP products Web site at
  `http://www.analog.com/processors/technicalSupport`
- E-mail tools questions to
  `processor.tools.support@analog.com`
- E-mail processor questions to
  `processor.support@analog.com (World wide support)`
  `processor.europe@analog.com (Europe support)`
  `processor.china@analog.com (China support)`
- Phone questions to **1-800-ANALOGD**
- Contact your Analog Devices, Inc. local sales office or authorized distributor
- Send questions by mail to:
  `Analog Devices, Inc.`
  `One Technology Way`
  `P.O. Box 9106`
  `Norwood, MA 02062-9106`
  `USA`

Supported Processors

This EZ-KIT Lite evaluation system supports the Analog Devices ADSP-TS101S TigerSHARC embedded processors.

Product Information

You can obtain product information from the Analog Devices Web site, from the product CD-ROM, or from the printed publications (manuals).

Analog Devices is online at www.analog.com. Our Web site provides information about a broad range of products—analog integrated circuits, amplifiers, converters, and digital signal processors.

MyAnalog.com

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 on products you are interested in. You can also choose to receive weekly e-mail notifications containing updates to the Web pages that meet your interests. MyAnalog.com provides access to books, application notes, data sheets, code examples, and more.

Registration:

Visit www.myanalog.com to sign up. Click **Register** to use MyAnalog.com. Registration takes about five minutes and serves as means for you to select the information you want to receive.

If you are already a registered user, just log on. Your user name is your e-mail address.

Processor Product Information

For information on embedded processors and DSPs, visit our Web site at www.analog.com/processors, which provides access to technical publications, data sheets, application notes, product overviews, and product announcements.

You may also obtain additional information about Analog Devices and its products in any of the following ways.

- E-mail questions or requests for information to
  processor.support@analog.com (World wide support)
  processor.europe@analog.com (Europe support)
  processor.china@analog.com (China support)
- Fax questions or requests for information to
  1-781-461-3010 (North America)
  +49-89-76903-157 (Europe)

Related Documents

For information on product related development software, see the following publications.

Table 1. Related Processor Publications

Title	Description
ADSP-TS101S TigerSHARC Embedded Processor Datasheet	General functional description, pinout, and timing
ADSP-TS101S TigerSHARC Processor Hardware Reference	Description of internal processor architecture and all register functions
TigerSHARC Processor Instruction Set Reference	Description of all allowed processor assembly instructions

Table 2. Related VisualDSP++ Publications

Title	Description
VisualDSP++ User's Guide	Description of VisualDSP++ features and usage
VisualDSP++ Assembler and Preprocessor Manual	Description of the assembler function and commands
VisualDSP++ C/C++ Complier and Library Manual for TigerSHARC Processors	Description of the complier function and commands for TigerSHARC processors

Table 2. Related VisualDSP++ Publications (Cont'd)

Title	Description
VisualDSP++ Linker and Utilities Manual	Description of the linker function and commands
VisualDSP++ Loader and Utilities Manual	Description of the loader/splitter function and commands

If you plan to use the EZ-KIT Lite board in conjunction with a JTAG emulator, also refer to the documentation that accompanies the emulator.

All documentation is available online. Most documentation is available in printed form.

Visit the Technical Library Web site to access all processor and tools manuals and data sheets:
http://www.analog.com/processors/resources/technicalLibrary.

Online Technical Documentation

Online documentation comprises the VisualDSP++ Help system, software tools manuals, hardware tools manuals, processor manuals, the Dinkum Abridged C++ library, and Flexible License Manager (FlexLM) network license manager software documentation. You can easily search across the entire VisualDSP++ documentation set for any topic of interest. For easy printing, supplementary `.pdf` files of most manuals are provided in the `Docs` folder on the VisualDSP++ installation CD.

Each documentation file type is described as follows.

File	Description
`.chm`	Help system files and manuals in Help format

File	Description
.htm or .html	Dinkum Abridged C++ library and FlexLM network license manager software documentation. Viewing and printing the .html files requires a browser, such as Internet Explorer 5.01 (or higher).
.pdf	VisualDSP++ and processor manuals in Portable Documentation Format (PDF). Viewing and printing the .pdf files requires a PDF reader, such as Adobe Acrobat Reader (4.0 or higher).

If documentation is not installed on your system as part of the software installation, you can add it from the VisualDSP++ CD at any time by running the Tools installation. Access the online documentation from the VisualDSP++ environment, Windows® Explorer, or the Analog Devices Web site.

Accessing Documentation From VisualDSP++

To view VisualDSP++ Help, click on the **Help** menu item or go to the Windows task bar and navigate to the VisualDSP++ documentation via the **Start** menu.

To view ADSP-TS101S EZ-KIT Lite Help, which is part of the VisualDSP++ Help system, use the **Contents** or **Search** tab of the Help window.

Accessing Documentation From Windows

In addition to any shortcuts you may have constructed, there are many ways to open VisualDSP++ online Help or the supplementary documentation from Windows.

Help system files (.chm) are located in the Help folder, and .pdf files are located in the Docs folder of your VisualDSP++ installation CD-ROM. The Docs folder also contains the Dinkum Abridged C++ library and the FlexLM network license manager software documentation.

Your software installation kit includes online Help as part of the Windows® interface. These help files provide information about VisualDSP++ and the ADSP-TS101S EZ-KIT Lite evaluation system.

Accessing Documentation From Web

Download manuals at the following Web site: http://www.analog.com/processors/resources/technicalLibrary/manuals.

Select a processor family and book title. Download archive (.zip) files, one for each manual. Use any archive management software, such as WinZip, to decompress downloaded files.

Printed Manuals

For general questions regarding literature ordering, call the Literature Center at **1-800-ANALOGD** (**1-800-262-5643**) and follow the prompts.

VisualDSP++ Documentation Set

To purchase VisualDSP++ manuals, call **1-603-883-2430**. The manuals may be purchased only as a kit.

If you do not have an account with Analog Devices, you are referred to Analog Devices distributors. For information on our distributors, log onto http://www.analog.com/salesdir/continent.asp.

Hardware Tools Manuals

To purchase EZ-KIT Lite and in-circuit emulator (ICE) manuals, call **1-603-883-2430**. The manuals may be ordered by title or by product number located on the back cover of each manual.

Processor Manuals

Hardware reference and instruction set reference manuals may be ordered through the Literature Center at **1-800-ANALOGD** (**1-800-262-5643**), or downloaded from the Analog Devices Web site. Manuals may be ordered by title or by product number located on the back cover of each manual.

Data Sheets

All data sheets (preliminary and production) may be downloaded from the Analog Devices Web site. Only production (final) data sheets (Rev. 0, A, B, C, and so on) can be obtained from the Literature Center at **1-800-ANALOGD** (**1-800-262-5643**); they also can be downloaded from the Web site.

To have a data sheet faxed to you, call the Analog Devices Faxback System at **1-800-446-6212**. Follow the prompts and a list of data sheet code numbers will be faxed to you. If the data sheet you want is not listed, check for it on the Web site.

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 VisualDSP++ environment's menu system (for example, the **Close** command appears on the **File** menu).
`{this | that}`	Alternative required items in syntax descriptions appear within curly brackets and separated by vertical bars; read the example as `this` or `that`. 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 `this` or `that`.
`[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 `this`.
`.SECTION`	Commands, directives, keywords, and feature names are in text with `letter gothic` font.
`filename`	Non-keyword placeholders appear in text with italic style format.
	Note: For correct operation, ... A Note provides supplementary information on a related topic. In the online version of this book, the word **Note** appears instead of this symbol.
	Caution: Incorrect device operation may result if ... **Caution:** 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 **Caution** appears instead of this symbol.
	Warning: 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 **Warning** appears instead of this symbol.

Additional conventions, which apply only to specific chapters, may appear throughout this document.

1 USING ADSP-TS101S EZ-KIT LITE

This chapter provides specific information to assist you with development of programs for the ADSP-TS101S EZ-KIT Lite evaluation system.

The information appears in the following sections.

- "Package Contents" on page 1-2
  Lists the items contained in your ADSP-TS101S EZ-KIT Lite package.
- "Default Configuration" on page 1-3
  Shows the default configuration of the ADSP-TS101S EZ-KIT Lite.
- "Installation and Session Startup" on page 1-5
  Instructs how to start a new or open an existing ADSP-TS101SEZ-KIT Lite session using VisualDSP++.
- "Evaluation License Restrictions" on page 1-7
  Describes the restrictions of the VisualDSP++ demo license shipped with the EZ-KIT Lite.
- "Memory Map" on page 1-7
  Describes the ADSP-TS101S EZ-KIT Lite board's memory map.
- "SDRAM Interface" on page 1-8
  Defines the register values needed to configure the external memory for SDRAM access.

- "Programmable FLAG Pins" on page 1-9
  Describes the function and use of the programmable FLAG pins on the EZ-KIT Lite evaluation system.
- "Interrupt Pins" on page 1-10
  Describes the function and use of the interrupt pins on the EZ-KIT Lite evaluation system.
- "Flash Memory" on page 1-11
  Describes how to program and use the flash memory.
- "Audio Interface" on page 1-11
  Describes how to use and configure the audio interface.
- "Example Programs" on page 1-12
  Provides information about the example programs included in the ADSP-TS101S EZ-KIT Lite evaluation system.
- "Flash Programmer Utility" on page 1-13
  Provides information on the Flash Programmer utility included with VisualDSP++.

For information on the graphical user interface, including the boot loading, target options, and other facilities of the EZ-KIT Lite system, refer to the online Help.

For detailed information about programming the ADSP-TS101S TigerSHARC processor, see the documents referred to as "Related Documents".

Package Contents

Your ADSP-TS101S EZ-KIT Lite evaluation system package contains the following items.

- ADSP-TS101S EZ-KIT Lite board

- *VisualDSP++ Installation Quick Reference* card
- CD containing:
  - VisualDSP++ software
  - ADSP-TS101S EZ-KIT Lite debug software
  - USB driver files
  - Example programs
  - ADSP-TS101S *EZ-KIT Lite Evaluation System Manual* (this document)
- Universal 7.5V DC power supply
- USB 2.0 cable
- Registration card (please fill out and return)

If any item is missing, contact the vendor where you purchased your EZ-KIT Lite or contact Analog Devices, Inc.

Default Configuration

The EZ-KIT Lite evaluation system 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 EZ-KIT Lite boards in the protective shipping package.

The ADSP-TS101S EZ-KIT Lite board is designed to run outside your personal computer as a stand-alone unit. You do not have to open your computer case.

When removing the EZ-KIT Lite board from the package, handle the board carefully to avoid the discharge of static electricity, which may damage some components. Figure 1-1 shows the default DIP switch, connector locations, and LEDs used in installation. Confirm that your board is set up in the default configuration before using the board.

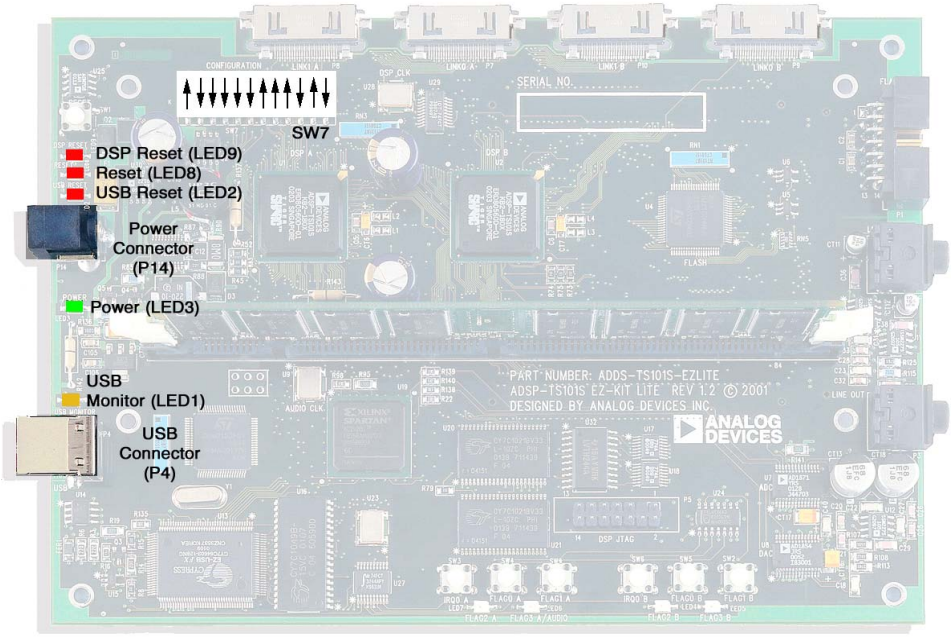


Figure 1-1. EZ-KIT Lite Hardware Setup

Installation and Session Startup

For correct operation, install the software and hardware in the order presented in the *VisualDSP++ Installation Quick Reference Card*.

1. Verify that the yellow USB monitor LED (`LED1`, located near the USB connector) is lit. This signifies that the board is communicating properly with the host PC and is ready to run VisualDSP++.

2. If you are running VisualDSP++ for the first time, navigate to the VisualDSP++ environment via the **Start** –> **Programs** menu. The main window appears. Note that VisualDSP++ does not connect to any session. Skip the rest of this step to step 3.

   If you have run VisualDSP++ previously, the last opened session appears on the screen. You can override the default behavior and force VisualDSP++ to start a new session by pressing and holding down the **Ctrl** key while starting VisualDSP++. Do not release the **Ctrl** key until the **Session Wizard** appears on the screen. Go to step 4.

3. To connect to a new EZ-KIT Lite session, start **Session Wizard** by selecting one of the following.

   - From the **Session** menu, **New Session**.
   - From the **Session** menu, **Session List**. Then click **New Session** from the **Session List** dialog box.
   - From the **Session** menu, **Connect to Target**. Then click **New Session** from the **Session List** dialog box.

4. The **Select Processor** page of the wizard appears on the screen. Ensure **TigerSHARC** is selected in **Processor family**. In **Choose a target processor**, select **ADSP-TS101**. Click **Next**.

5. The **Select Connection Type** page of the wizard appears on the screen. Select **EZ-KIT Lite** and click **Next**.
6. The **Select Platform** page of the wizard appears on the screen. In the **Select your platform** list, select **ADSP-TS101S EZ-KIT Lite via Debug Agent**. In **Session name**, highlight or specify the session name.

   The session name can be a string of any length; although, the box displays approximately 32 characters. The session name can include space characters. If you do not specify a session name, VisualDSP++ creates a session name by combining the name of the selected platform with the selected processor. The only way to change a session name later is to delete the session and to open a new session.

   Click **Next**.
7. The **Finish** page of the wizard appears on the screen. The page displays your selections. If you are satisfied, click **Finish**. If not, click **Back** to make changes.

To disconnect from a session, click the disconnect button or select **Session –> Disconnect from Target**.

To delete a session, select **Session –> Session List**. Select the session name from the list and click **Delete**. Click **OK**.

Evaluation License Restrictions

The ADSP-TS101S EZ-KIT Lite installation is part of the VisualDSP++ installation. The EZ-KIT Lite is a licensed product that offers an unrestricted evaluation license for the first 90 days. Once the initial unrestricted 90-day evaluation license expires:

- VisualDSP++ allows a connection to the ADSP-TS101S EZ-KIT Lite via the USB debug agent interface only. Connections to simulators and emulation products are no longer allowed.
- The linker restricts a users program to 96 KB of internal memory for code space with no restrictions for data space.

Refer to the *VisualDSP++ Installation Quick Reference Card* for details.

Memory Map

The ADSP-TS101S processor has 6 M bits of internal memory that can be used for program storage or data storage. The configuration of internal memory is detailed in the *ADSP-TS101 TigerSHARC Processor Hardware Reference*.

The ADSP-TS101S EZ-KIT Lite board contains 544K x 8-bits of external flash memory. The memory is separated into two sections. One section contains 512K bytes of main flash memory, and the other section contains 32K bytes of secondary flash memory. This memory is connected to the processor's `~BMS` pin. The flash memory can be accessed in boot memory space.

The board also contains one 4M x 64-bit SDRAM DIMM. This memory is connected to the processor's SDRAM interface.

Table 1-1. EZ-KIT Lite Evaluation Board Memory Map

	Start Address	End Address	Content
Internal Memory	0x0000 0000	0x0000 FFFF	Internal memory 0
	0x0008 0000	0x0008 FFFF	Internal memory 1
	0x0010 0000	0x0010 FFFF	Internal memory 2
	0x0018 0000	0x0018 07FF	Internal registers
	0x01C0 0000	0x01C0 FFFF	Broadcast
	0x0200 0000	0x023F FFFF	Processor ID 0
	0x0240 0000	0x027F FFFF	Processor ID 1
External Memory	0x0400 0000	0x047F FFFF	External memory space (SDRAM)

SDRAM Interface

The DIMM shipped with the EZ-KIT Lite evaluation board is a 32 MB module. You can upgrade to a 64 MB or 128 MB module. The module must be a 168-pin DIMM PC100 device. Modules can be purchased from such vendors as Viking, Infineon, or Crucial.

Revision 1.2 boards are shipped with 128 MB modules, but only 32 MB of the 128 MB can be accessed, and the boards cannot be upgraded with more memory. The issue is resolved in revision 1.3 boards.

To properly access SDRAM, the SYSCON and SDRCON registers must be configured properly. For the supplied DIMM, the SDRCON register should be configured as follows: SDRAM enable, CAS latency of two cycles, pipe depth of zero, page boundary of 256 words (1K words on revision 1.2 boards), refresh rate of every 1200 cycles (every 600 cycles on revision 1.2 boards), pre-charge to RAS of three cycles, RAS to pre-charge of four cycles, and init sequence is MRS cycle follows refresh.

When you are in a VisualDSP++ session and connected to the EZ-KIT Lite board, the SDRAM registers are set to the default values automatically when a reset operation is performed. Clearing the corresponding check box accessible through the **Target Options** dialog box, which is accessible through the **Settings** pull-down menu, disables this feature. The default values are:

- `SYSCON = 0x001A79E7` and `SDRCON = 0x00005223` (boards revision 1.2)
- `SDRCON = 0x00005303` (boards revision 1.3 and greater)

The `SYSCON` and `SDRCON` registers define bus control configuration. They can be written only once after reset and cannot be changed during system operation.

Programmable FLAG Pins

Each ADSP-TS101S processor has four programmable flag pins. Two flag pins from each processor (`FLAG0` and `FLAG1`) allow you to interact with the running program through the use of a switch (`SW2`, `SW4-5`, and `SW9`). The `FLAG2` and `FLAG3` connect to the LEDs (`LED4-5` and `LED6-7`).

After the processor is reset, the programmable flags are configured as inputs. The direction of each programmable flag is configured in the `SQCTL` register. If the flag is configured for output, the value is set in the `SQCTL` register. If the flag is configured for input, the value on the flag pin is read from the `SQSTAT` register. Programmable flags are summarized in Table 1-2. For more information on configuring the programmable flag pins, see the *ADSP-TS101 TigerSHARC Processor Hardware Reference*.

Table 1-2. Programmable FLAG Pin Summary

FLAG Pin	Connection	Description
FLAG0_A	SW4	The FLAG0 and FLAG1 pins connect to the push buttons to supply feedback for program execution. For instance, you can write your code to trigger a routine when the push button is pressed.
FLAG1_A	SW9	
FLAG0_B	SW5	
FLAG1_B	SW2	
FLAG2_A	LED7	The FLAG2 and FLAG3 pins connect to the LEDs to supply feedback during program execution.
FLAG3_A	LED6	
FLAG2_B	LED4	
FLAG3_B	LED5	

Interrupt Pins

The ADSP-TS101S processor has four interrupt pins (IRQ3-0) that allow you to interact with the running program. One external interrupt from each processor is directly accessible through the push button switches (SW3 and SW6) on the EZ-KIT Lite board. Interrupts are summarized in Table 1-3. For more information on configuring the interrupt pins, see the *ADSP-TS101 TigerSHARC Processor Programming Reference*.

Table 1-3. Interrupt Pin Summary

Interrupt Pin	Connection	Description
IRQ0_A	SW3	The IRQ0 interrupt connects to push the buttons to supply feedback for program execution. For instance, you can write your code to perform a different function when an interrupt is detected.
IRQ0_B	SW6	

Flash Memory

The DSM2150 flash/PLD chip provides a total of 544K x 8-bits of external flash memory, arranged into two independent flash arrays (main and secondary). The chip also has a series of configuration registers to control IO and PLD. The memory chip is initially configured with the memory sectors mapped to the processor, as shown in Figure 1-1 on page 1-8.

The DSM2150 can be re-programmed using the FlashLINK JTAG programming cable available from STMicroelectronics (`www.st.com/psd`). FlashLINK plugs into any PC parallel port. The software development tool, PSDsoft Express™, is required to modify the DSM2150 configuration and operate the FlashLINK cable. PSDsoft Express can be downloaded at no charge from the same Web site.

Audio Interface

The audio interface allows you to interface to the board's analog-to-digital converter (ADC) and digital-to-analog converter (DAC). See "Audio (P2 and P3)" on page 2-12 for more information about the connectors. The audio interface consists of two main ICs: AD1871 and AD1854.

The AD1871 is a stereo audio ADC intended for digital audio applications requiring high-performance analog-to-digital conversion. The AD1871 provides 97 dB THD+N and 107 dB dynamic range.

The AD1854 is a high-performance, single-chip stereo, audio DAC delivering 113 dB dynamic range and 112 dB SNR at a 48 kHz sample rate.

Because the ADSP-TS101S processor does not have any SPORTs, a Xilinx field-programmable gate array (FPGA) generates the audio interface control signals between the processor and the audio circuit. Setting the `FLAG3` signal of `DSP_A` high enables the audio interface inside of the FPGA. Once the audio interface has been enabled, the audio data can be transferred to and from the processor by generating a `DMAR0` cycle. The audio data inter-

faces with the processor via the lowest 24 bits of the data bus (D23-0). Refer to the audio example program included in the EZ-KIT Lite installation directory for more information on how to use the interface.

Example Programs

Example programs are provided with the ADSP-TS101S EZ-KIT Lite to demonstrate various capabilities of the evaluation board. These programs are installed with the EZ-KIT Lite software in the …\TS\Examples\ADSP-TS101 EZ-KIT Lite subdirectory of the VisualDSP++ installation directory. Please refer to the readme file provided with each example program for more information.

When running the examples, do not change these bits:

- DBGEN or NMOD (bits 8 or 9) in the SQCTL register
- DBG (bit 31) in the IMASKH register.

The change can disable communications with the host.

Flash Programmer Utility

The ADSP-TS101S EZ-KIT Lite evaluation system includes a Flash Programmer utility. The utility allows you to program the flash memory on the EZ-KIT Lite. The Flash Programmer is installed with VisualDSP++. Once the utility is installed, it is accessible from the **Tools** pull-down menu.

Handling ADSP-TS101S EZ-KIT Lite Flash Memory

When the entire flash memory contents is erased using the Flash Programmer (under **Advanced Options**), you cannot bring up the IDDE and open an ADSP-TS101S EZ-KIT session.

The following workaround brings the IDDE running again:

1. Power down the EZ-KIT Lite.
2. Move DIP switch 7 into the `OFF` position.
3. Power the EZ-KIT Lite board.
4. Start the IDDE.
5. Use the Flash Programmer from the **Tools** pull-down menu to load a valid program into the flash memory, such as an example program from the `…\TS\Examples\ADSP-TS101 EZ-KIT Lite` directory.

For more information on the Flash Programmer utility, refer to online Help.

2 ADSP-TS101S EZ-KIT LITE HARDWARE REFERENCE

This chapter describes the hardware design of the ADSP-TS101S EZ-KIT Lite board. The following topics are covered.

- "System Architecture" on page 2-2
  Describes the configuration of the ADSP-TS101S EZ-KIT Lite evaluation board and explains how the board components interface with the processor.
- "DIP Switch Settings" on page 2-4
  Shows the location and describes the function of the configuration DIP switch.
- "LEDs and Push Buttons" on page 2-8
  Shows the location and describes the function of the LEDs and push buttons.
- "Connectors" on page 2-12
  Shows the location of and gives the part number for all of the connectors on the board. In addition, provides the manufacturer and part number information for the mating parts.
- "Power Supply Specifications" on page 2-15
  Describes the power connector.

System Architecture

This section describes the processor's configuration on the EZ-KIT Lite board.

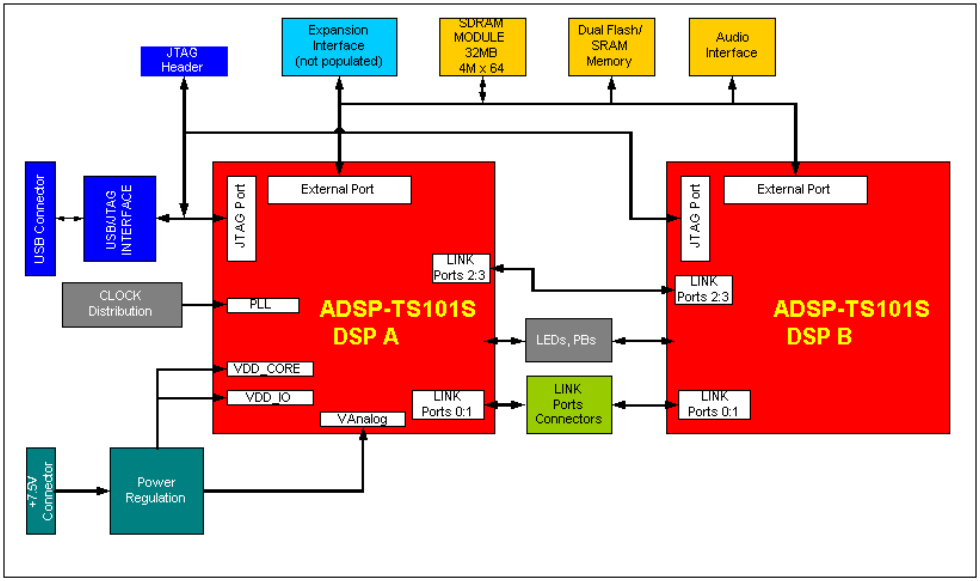


Figure 2-1. System Architecture

The EZ-KIT Lite has been designed to demonstrate the capabilities of the ADSP-TS101S TigerSHARC processor. The processor core voltage is 1.25V. The external interface operates at 3.3V.

An 83.33 MHz SMT oscillator supplies the input clock to the processor. The speed at which the core operates is determined by the settings of the processor switch `SW7`. For more information, see "Clock Mode Settings" on page 2-7. By default, the processor core runs at 250 MHz (83.3 MHz x 3).

External Port

The external port is connected to a 544K x 8-bit flash memory. The flash memory connects to the boot memory select pin (~BMS), allowing the memory to be used to boot the processor as well as to store information during normal operation. Refer to "Memory Map" on page 1-7 for information about the location of the flash memory on the processor's memory map.

The external port is also connected to a 4MB x 64-bit SDRAM DIMM. Refer to "SDRAM Interface" on page 1-8 for information on how to configure the SDRAM registers.

Expansion Interface

The expansion interface consists of three connectors (P1-3). The following table shows the interfaces each connector provides. For the exact pinout of the expansion connectors, refer to "ADSP-TS101S EZ-KIT Lite Schematic" on page B-1.

Table 2-1. Expansion Connector Interfaces

Connector	Interfaces
P11	5V, GND, address, data
P12	3.3V, GND, SDRAM control signals, flags, IRQs, timers
P13	GND, reset, DMA, memory control, CLKOUT, PSD IO signals

When using the expansion interface, limits to the current and to the interface speed must be taken into consideration. The maximum current limit depends on the regulator capabilities. Additional circuitry can also add extra loading to signals, decreasing their maximum effective speed.

Analog Devices does not support and is not responsible for the effects of additional circuitry.

JTAG Emulation Port

The JTAG emulation port allows an emulator to access the processor's internal and external memory, as well as the special function registers through a 14-pin header. See "JTAG (P5)" on page 2-13 for more information about the JTAG connector. To learn more about available emulators, contact Analog Devices as described in "Processor Product Information".

DIP Switch Settings

This section describes the function of the DIP switch, `SW7`. Figure 2-2 shows the location of the switch.

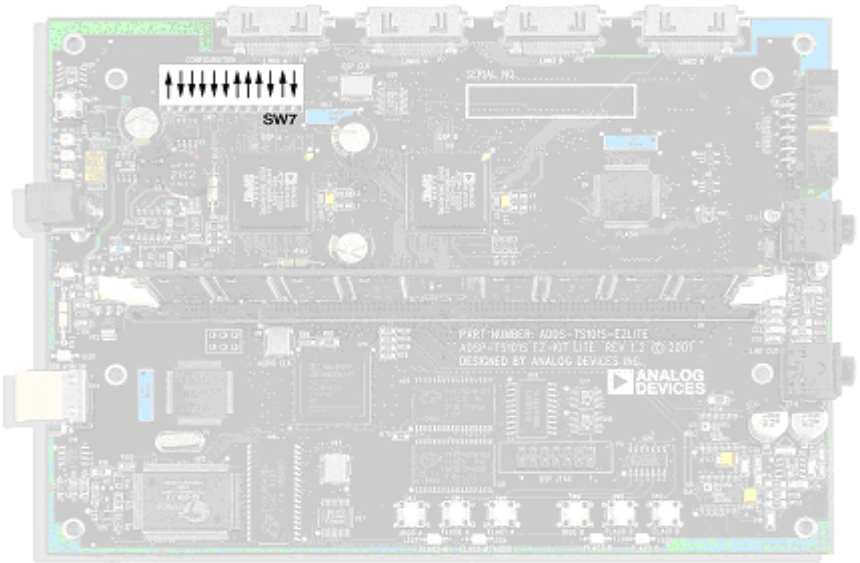


Figure 2-2. Switch Location

Control Impedance Selection

Positions 3 through 1 (CONTROLIMP$_{2-0}$) of SW7 determine the impedance for the ADC (address/data/controls) and LINK (all link port outputs). Refer to the ADSP-TS101S TigerSHARC processor data sheet at http://www.analog.com/UploadedFiles/Data_Sheets/40196385778873ADSP_TS101S_b.pdf for more information.

Table 2-2. Control Impedance Selection

SW7 Position 3	SW7 Position 2	SW7 Position 1	ADC		Link	
			dig_ctrl	pulse	dig_ctrl	pulse
ON	ON	ON	0	X	0	X
ON	ON	OFF	0	X	0	X
ON		ON	0	X	1	0
ON		OFF	0	X	1	1
OFF	ON	ON	1	0	0	X
OFF	ON	OFF	1	1	0	X
OFF[1]	**OFF**	**ON**	**1**	**0**	**1**	**0**
OFF	OFF	OFF	1	1	1	1

1 Default settings

Drive Strength Selection

Positions 6 through 4 (DS$_{2-0}$) of SW7 determine the digital drive strength. Refer to the ADSP-TS101S TigerSHARC processor data sheet at http://www.analog.com/UploadedFiles/Data_Sheets/40196385778873ADSP_TS101S_b.pdf for more information.

Table 2-3. Drive Strength Selection

SW7 Position 6	SW7 Position 5	SW7 Position 4	Drive Strength
ON	ON	ON	11%
ON	ON	OFF	29%
ON	OFF	ON	37%
ON	OFF	OFF	49%
OFF	ON	ON	62%
OFF	ON	OFF	75%
OFF	OFF	ON	88%
OFF[1]	**OFF**	**OFF**	**100%**

1 Default settings

Boot Mode Settings

Position 7 of `SW7` determines how the processor boots. Table 2-4 shows the setting for the boot modes. Refer to the ADSP-TS101S TigerSHARC processor data sheet at `http://www.analog.com/Uploaded-Files/Data_Sheets/40196385778873ADSP_TS101S_b.pdf` for more information.

Table 2-4. Boot Mode Settings

SW7 Position 7	Boot Mode
ON[1]	**EPROM BOOT**
OFF	External Boot

1 Default settings

Interrupt Enable Settings

Position 8 of SW2 determines how the processor handles interrupts. Table 2-5 shows the setting for the interrupt modes. Refer to the ADSP-TS101S TigerSHARC processor data sheet at http://www.analog.com/UploadedFiles/Data_Sheets/40196385778873ADSP_TS101S_b.pdf for more information.

Table 2-5. Interrupt Enable Settings

SW2 Position 8	Interrupt Enable Mode
ON[1]	**Level-sensitive mode**
OFF	Edge-sensitive mode

1 Default settings

Clock Mode Settings

Positions 9 through 11 ($LCLKRAT_{2-0}$) of SW7 determine the ADSP-TS101S processor's core speed. The frequency supplied to CLKIN of the processor may be changed by replacing the 83.33 MHz oscillator (U28) shipped with the board with a different oscillator. Ensure that the selected clock mode and frequency do not exceed the minimum and maximum specifications of the ADSP-TS101S processor.

Table 2-6 shows the jumper settings for the clock modes. For more information on the clock modes, see the ADSP-TS101S processor data sheet at http://www.analog.com/UploadedFiles/Data_Sheets/40196385778873ADSP_TS101S_b.pdf.

Table 2-6. Clock Mode Settings

SW7 Position 11	SW7 Position 10	SW7 Position 9	Ratio
ON	ON	ON	2
ON	ON	OFF	2.5

Table 2-6. Clock Mode Settings (Cont'd)

SW7 Position 11	SW7 Position 10	SW7 Position 9	Ratio
ON[1]	**OFF**	**ON**	**3**
ON	OFF	OFF	3.5
OFF	ON	ON	4
OFF	ON	OFF	5
OFF	OFF	ON	6
OFF	OFF	OFF	RSVD

1 Default settings

LEDs and Push Buttons

This section describes the function of the LEDs and push buttons. Figure 2-3 shows the locations of the LEDs and push buttons.

USB Monitor LED (LED1)

The USB monitor LED, LED1, indicates that USB communication has been initialized successfully, allowing you to connect to the processor using VisualDSP++. If the LED is not lit, try resetting the board and/or reinstalling the USB driver.

When VisualDSP++ is actively communicating with the EZ-KIT Lite target board, the LED can flicker, indicating communications handshake.

Reset LEDs (LED2, LED8–9)

When LED2 is lit, the USB interface is being reset. The USB interface is reset only when it is not configured. Once the USB interface has been configured, you must remove power to reset.

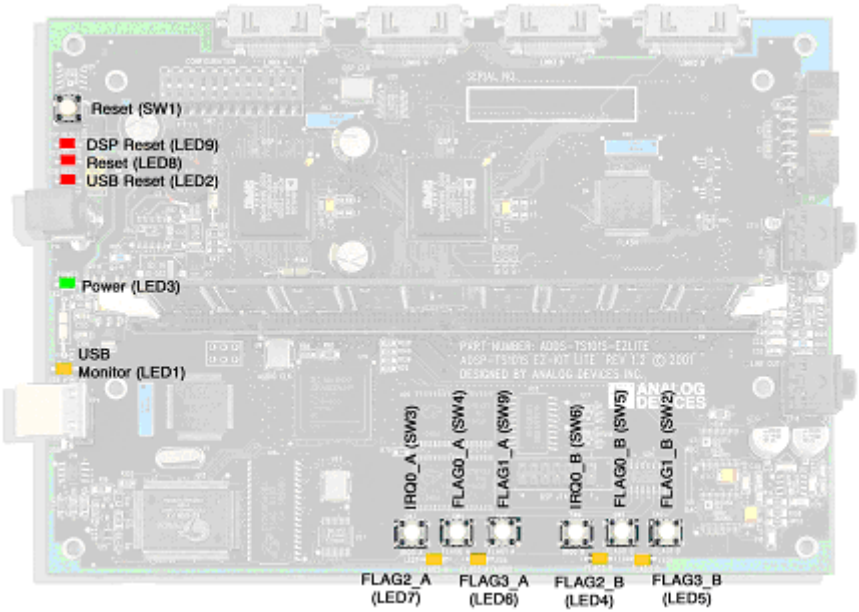


Figure 2-3. LEDs and Push Button Locations

When LED8 is lit, it indicates that the master reset of all the major ICs is active.

When LED9 is lit, the two ADSP-TS101S processors (U1 and U2) are being reset. The USB interface resets the ADSP-TS101S processor during USB communication initialization.

Power LED (LED3)

The green LED, LED3, indicates that power is being properly supplied to the board.

FLAG LEDs (LED4–7)

The flag LEDs connect to the processor's flag pins (FLAG2 and FLAG3). These LEDs are active high and are lit by an output of "1" from the processor. Refer to "SDRAM Interface" on page 1-8 for more information on how to utilize the flags when programming the processor. Table 2-7 shows the FLAG signals and the corresponding LEDs.

Table 2-7. FLAG LEDs

FLAG Pin	LED Reference Designator
FLAG2_A	LED7
FLAG3_A	LED6
FLAG2_B	LED4
FLAG3_B	LED5

Reset Push Button (SW1)

The RESET push button, SW1, resets all the ICs on the board, except the USB interface after it has been configured.

Programmable FLAG Push Buttons (SW2, SW4–5, and SW9)

Four push buttons are provided for general-purpose user input. The SW2, SW4, SW5, and SW9 push buttons connect to the processor's programmable FLAG pins. The push buttons are active high and when pressed, send a high (1) to the processor. Refer to "SDRAM Interface" on page 1-8 for more information on how to use the flags when programming the processor. Table 2-8 shows the flag signals and the corresponding switches.

Table 2-8. FLAG Push Buttons

FLAG Pin	Push Button Reference Designator
FLAG0_A	SW4
FLAG1_A	SW9
FLAG0_B	SW5
FLAG1_B	SW2

Interrupt Push Buttons (SW3 and SW6)

Two push buttons, SW3 and SW6, are provided for user input. The push buttons connect to the processor's interrupt pins. The push buttons are active low and, when pressed, send a low (0) to the processor. Refer to "SDRAM Interface" on page 1-8 for more information on how to use the push buttons when programming the processor. Table 2-9 shows the interrupt signals and corresponding switches.

Table 2-9. Interrupt Push Buttons

FLAG Pin	Push Button Reference Designator	FLAG Pin	Push Button Reference Designator
IRQ0_A	SW3	IRQ0_B	SW6

Connectors

This section describes the connector functionality and provides information about mating connectors. The locations of the connectors are shown in Figure 2-4.

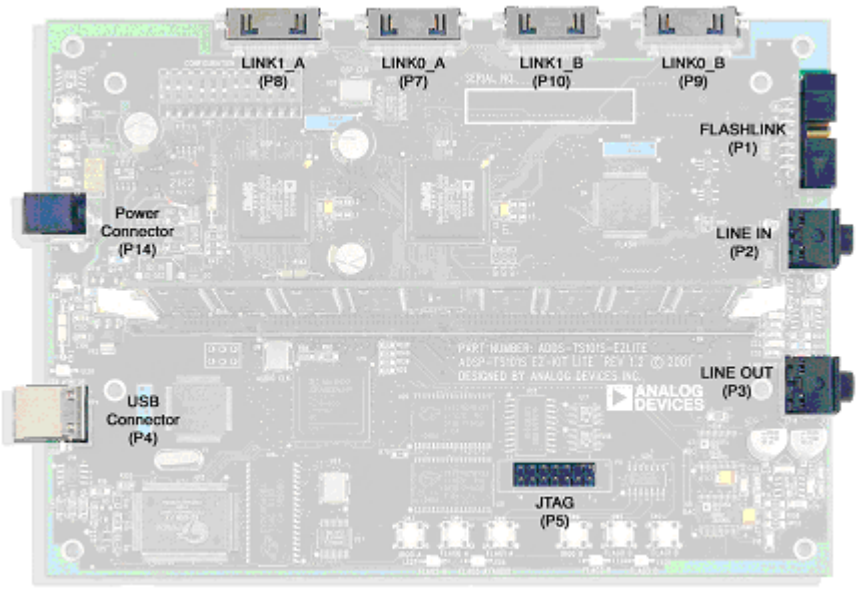


Figure 2-4. Connector Locations

Audio (P2 and P3)

There are two 3.5 mm stereo audio jacks.

Part Description	Manufacturer	Part Number
3.5 mm stereo jack	SHOGYO	SJ-0359AM-5

Part Description	Manufacturer	Part Number
Mating Connector		
3.5 mm stereo plug to 3.5 mm stereo cable	RADIO SHACK	L12-2397A

USB (P4)

The USB connector is a standard type B USB receptacle.

Part Description	Manufacturer	Part Number
Type B USB receptacle	MILL-MAX	897-30-004-90-000
	DIGI-KEY	ED90003-ND
Mating Connector		
USB cable (provided with the kit)	ASSMAN	AK672-5
	DIGI-KEY	AK672-5ND

JTAG (P5)

The JTAG header is the connecting point for a JTAG in-circuit emulator pod.

Pin 3 is missing to provide keying. Pin 3 in the mating connector should have a plug. When an emulator is connected to the JTAG header, the USB debug interface is disabled.

When using an emulator with the EZ-KIT Lite board, follow the connection instructions provided with the emulator.

Expansion Interface (P11–13)

Three board-to-board connector footprints provide signals for most of the processor's peripheral interfaces. The connectors are located at the bottom of the board. For more information about the interface, see "Expansion Interface" on page 2-3. For availability and pricing of the P11, P12, and P13 connectors, contact Samtec.

Part Description	Manufacturer	Part Number
90-position 0.05" spacing	SAMTEC	SFM-145-02-S-D
Mating Connectors		
90-position 0.05" spacing (through hole)	SAMTEC	TFM-145-x1 series
90-position 0.05" spacing (surface mount)	SAMTEC	TFM-145-x2 series
90-position 0.05" spacing (low cost)	SAMTEC	TFC-145 series

Link Ports (P7–10)

Two link ports from each processor connect to a 26-pin connector. Refer to EE-106 at http://www.analog.com/Uploaded-Files/Application_Notes/24075233ee_106.pdf for more information about the link port connectors. EE-106 discusses the link port assignments for ADSP-211xx SHARC processor applications.

In a TigerSHARC processor application, the link port cable connectors require pins 12 and 13 to be populated. The correct TigerSHARC link port cable assembly can be obtained from TransTech DSP (TTC44-30). The associated Gore Coaxial cable (DXN2132) should also be revised for the proper number of strands to include connector pins 12 and 13.

Part Description	Manufacturer	Part Number
26-position connector	TRANSTECH DSP	TTC44-30
Mating Connectors		
Cable connector	HONDA	RMCA-E26F1S-A
Shroud	HONDA	RMCA-E26L1A
Coaxial cable	GORE	DXN2132

Power Connector (P14)

The power connector provides all of the power necessary to operate the EZ-KIT Lite board.

Part Description	Manufacturer	Part Number
2.5 mm power jack (P14)	SWITCHCRAFT	RAPC712
	DIGI-KEY	SC1152-ND
Mating Power Supply (shipped with the EZ-KIT Lite)		
7.5V power supply	GLOBTEK	TR9CC2000LCP-Y

Power Supply Specifications

The power connector supplies DC power to the EZ-KIT Lite board. Table 2-10 shows the power connector pinout.

Table 2-10. Power Connectors

Terminal	Connection
Center pin	+7.5 VDC@2 amps
Outer ring	GND

A ADSP-TS101S EZ-KIT LITE BILL OF MATERIALS

The bill of materials corresponds to "ADSP-TS101S EZ-KIT Lite Schematic" on page B-1. Please check the latest schematic on the Analog Devices Web site:
http://www.analog.com/Processors/Processors/DevelopmentTools/technicalLibrary/manuals/DevToolsIndex.html#Evaluation%20Kit%20Manuals.

Ref.	Qty.	Description	Reference Designator	Manufacturer	Part Number
1	3	0.00 1/4W 5%	R137,R142–143	YAGEO	0.0QBK-ND
2	1	3.3V-OCTAL-BUFFER	U32	TI	SN74LVT244BDW
3	1	HEX-INVER-SCH MITT-TRIGGER	U24	TI	74LVC14AD
4	1	3.3V-OCTAL-BUFFER	U27	IDT	IDT74FCT3244APY
5	1	3.3V 1-10 CLOCK DRIVER	U29	IDT	IDT74FCT3807AQ
6	1	USB-TX/RX MICROCON-TROLLER	U13	CYPRESS	CY7C64603-128NC
7	1	NPN TRANSIS-TOR 200MA	Q3	FAIRCHILD	MMBT4401
8	1	128K X 8 SRAM	U16	CYPRESS	CY7C1019BV33-12VC
9	1	12.0MHZ CRYSTAL	Y1	DIG01	300-6027-ND

Ref.	Qty.	Description	Reference Designator	Manufacturer	Part Number
10	1	XILINX-SPARTAN2-FPGA	U19	XILINX	XC2S200-6FG256C
11	8	SINGLE-2-INPUT-NAND	U5–6, U15, U26, U35–U38	TI	SN74AHC1G00DBVR
12	1	N-CHANNEL-MOSFET	Q2	FAIRCHILD	FDS6982
13	1	POWER MOSFET	Q1	IR	IRFR024
14	1	12.288MHZ OSCILLATOR	U9	DIG01	SG-8002CA-PCC-ND
15	1	2N7002	Q5	FAIRCHILD	2N7002
16	1	MMBT3904	Q4	FAIR CHILD	MMBT3904
17	2	256Kx16 SRAM	U20, U21	GSI TECH-NOLOGY	GS74116TP-10
18	1	FLASH MEMORY	U4	STMICRO	DSM2150F5V
19	1	32K EEPROM	U14	MICROCHIP	24LC32A-I/SN
20	1	83.33MHZ OSCILLATOR	U28	DIG01	SG-8002CA-PCC-ND
21	1	FLASH MEMORY	U22	ST MICRO	DSM2150F5V
22	38	0.01uF 100V 10% CERM	C46–47, C52–53, C58–59, C64–65, C74–81, C94–97, C121–128, C136–142, C156–157, C161	AVX	12061C103KAT050M
23	2	1000pF 50V 5% CERM	C84–85	AVX	12065A102JAT2A
24	1	150pF 50V 5% CERM	C13	AVX	12065A151JAT2A
25	2	2200pF 50V 5% NPO	C19, C41	AVX	12065A222JAT2A

Ref.	Qty.	Description	Reference Designator	Manufacturer	Part Number
26	1	0.1uF 50V 20% CERM	C16	AVX	12065E104MAT2A
27	1	VOLTAGE-SUPERVISOR	U25	ANALOG DEVICES	ADM708SAR
28	1	2.5V-1.0AMP REGULATOR	VR1	ANALOG DEVICES	ADP3338AKC-2.5
29	1	5V-1.5A REGULATOR	VR2	ANALOG DEVICES	ADP3339AKC-5-REEL
30	3	DUAL AUDIO OP AMP	U10–12	ANALOG DEVICES	SSM2275S
31	2	ADSP-TS101SKB2180	U1–2	ANALOG DEVICES	ADSP-TS101SKB2180
32	1	STERO-DAC	U8	ANALOG DEVICES	AD1854JRS
33	1	STERO-ADC	U7	ANALOG DEVICES	AD1871YRS
34	1	SWITCHED-VOLT-CONVERTER	U30	ANALOG DEVICES	ADM660AR
35	1	SINGLE-PHASE-CORE-CONTROL	U31	ANALOG DEVICES	ADP3170
36	1	4.7uF 25V 10% TANT	CT10	AVX	TAJC475K025R
37	1	PWR 2.5MM_JACK	P14	SWITCH-CRAFT	SC1152-ND12
38	1	USB 4PIN	P4	MILL-MAX	897-30-004-90-000000
39	4	LNKPRT 12X2	P7–10	HONDA (TSUSHINK)	RMCA-EA26LMY-0M03-A
40	7	SPST-MOMEN-TARY 6MM	SW1–6, SW9	PANASONIC	EVQ-PAD04M
41	1	DIP12	SW7	DIGI-KEY	CKN3063-ND

Ref.	Qty.	Description	Reference Designator	Manufacturer	Part Number
42	1	IDC 7X2	P1	MOLEX	70247-1401
43	1	168PIN DIMM	U3	MOLEX	71251-0012
44	1	7A FAST-ACTING	F1	DIG01	283-2438-2-ND
45	13	0.00 1/8W 5%	R19, R23, R34, R49–51, R54–55, R131, R133–134, R141	YAGEO	0.0ECT-ND
46	1	220uF 10V 20% ELEC	CT14	SPRAGUE	293D227X9010E2T
47	5	AMBER-SMT GULL-WING	LED1, LED4–7	PANASONIC	LN1461C-TR
48	2	330pF 50V 5% NPO	C20, C26	AVX	08055A331JAT
49	4	0.01uF 100V 10% CERM	C10, C165, C167, C168	AVX	08051C103KAT2A
50	86	0.1uF 50V 10% CERM	C1, C9, C17, C42–45, C48–51, C54–57, C60–63, C66–73, C82–83, C86–93, C98–120, C129–135, C143–155, C158–160, 162, C172, C173	AVX	08055C104KAT
51	9	0.001uF 50V 5% NPO	C4–6, C12, C28, C30, C32–33, C164	AVX	08055A102JAT2A
52	3	10uF 16V 10% TANT	CT9, CT24–25	SPRAGUE	293D106X9025C2T

Ref.	Qty.	Description	Reference Designator	Manufacturer	Part Number
53	35	10K100MW5%	R8–10, R13, R15, R30, R32, R36, R45–47, R52, R53, R56, R58–59, R61, R63, R64, R67, R73–81, R83, R93, R97, R99, R151, R152	AVX	CR21-103J-T
54	12	33100MW5%	R22, R66, R68–71, R98, R130, R135, R138–140	AVX	CR21-330JTR
55	5	4.7K100MW5%	R28–29, R31, R35, R20	AVX	CR21-4701F-T
56	1	1M100MW5%	R7	AVX	CR21-1004F-T
57	1	1.5K100MW5%	R16	AVX	CR21-1501F-T
58	1	22uF 16V 10% TANT	CT26	DIG01	PCT3226CT-ND
59	1	2.00K1/8W1%	R2	DALE	CRCW1206-2001FRT1
60	2	49.9K1/8W1%	R102, R128	AVX	CR32-4992F-T
61	2	2.21K1/8W1%	R4–5	AVX	CR32-2211F-T
62	11	100pF 100V 5% NPO	C11, C18, C22–23, C27, C31, C34–35, C40, C166, C169	AVX	12061A101JAT2A
63	3	10uF 16V 10% TANT	CT15–17	AVX	TAJB106K016R
64	6	100 100MW 5%	R33, R44, R57, R60, R62, R65	AVX	CR21-101J-T
65	2	220pf 50V 10% NPO	C24, C29	AVX	12061A221JAT2A
66	4	1000 100MHZ 1.5A 0.06 CHOKE	L1–L4	MURATA	PLM250S40T1

Ref.	Qty.	Description	Reference Designator	Manufacturer	Part Number
67	3	SILICON RECTIFIER	D1–D3	GENER-ALSEMI	S2A
68	3	600 100MHZ 500MA 0.70 BEAD	FER1–3	DIGIKEY	240-1019-1-ND
69	4	237 1/8W 1%	R114, R116, R118, R121	KOA	P11.0FCT-ND
70	2	750K 1/8W 1%	R115, R117	KOA	RK73H2BT7503F
71	8	5.76K 1/8W 1%	R103, R119–120, R122–126	DALE	CRCW12065761FRT1
72	2	3.01K 1/8W 1%	R82, R85	KOA	RK73H2BT3011F
73	2	11.0K 1/8W 1%	R101, R129	DALE	CRCW12061102FTR1
74	4	120PF 50V 5%	C36–39	PHILLIPS	1206CG121J9B200
75	4	1UF 16V 10%	C2–3, C15, C163	MURATA	GRM40X7R105K 016AL
76	1	1.0K 1/8W 1%	R89	AVX	CR32-1001F-T
77	2	30PF 100V 5%	C7–8	AVX	12061A300JAT2A
78	4	10 100MW 5%	R25, R72, R149, R150	DALE	CRCW0805-10R0FRT1
79	2	680PF 50V 1% NPO	C21, C25	AVX	08055A681FAT2A
80	2	2.74K 1/8W 1%	R108, R113	PANASONIC	ERJ-8ENF2741V
81	4	5.49K 1/8W 1%	R104–105, R109–110	PANASONIC	ERJ-8ENF5491V
82	2	3.32K 1/8W 1%	R106, R111	PANASONIC	ERJ-8ENF3321V
83	3	1.65K 1/8W 1%	R1, R107, R112	PANASONIC	ERJ-8ENF1651V
84	2	10UF 16V 20% ELEC	CT11–12	DIG01	PCE3062TR-ND
85	2	68UF 25V 20% ELEC	CT13, CT18	PANASONIC	EEV-FC1E680P

Ref.	Qty.	Description	Reference Designator	Manufacturer	Part Number
86	1	1800UF 10V 20%	CT19	RUBYCON	10MBZ1800M
87	1	2.2UH X 20%	L5	COOPER ELE TEHC	UP2C-2R2
88	2	1800UF 6.3V 20%	CT20–21	RUBYCON	6.3MBZ1800M
89	4	10K 31MW 5%	RN2, RN4, RN5, RN7	CTS	746X101103J
90	1	3.9NF 50V 5%	C14	PANASONIC	ECH-U1C392JB5
91	1	3.6K 1/8W 1%	R86	PHYCOMP	311-3.60KFTR-ND
92	1	26.7K 1/8W 1%	R92	PHYCOMP	311-26.7KFTR-ND
93	1	.008 1W 5%	R90	PANASONIC	P8.0TTR-ND
94	1	12.1K 1/8W 1%	R91	PHYCOMP	311-12.1KFTR-ND
95	3	10K 50MW 5%	RN1, RN3, RN6	CTS	RT130B7
96	4	0.00 100MW 5%	R144, R147, R148, R153	PAN	ERJ-6GE10R00V
97	4	10UH X 10%	L1–L4	PANASONIC	ELJ-FC100KF
98	2	3.32K 100MW 1%	R11, R12	DIG01	P3.32KCCTR-ND
99	3	1K 1/8W 5%	R14, R21, R24	AVX	CR32-102J-T
100	1	10K 1/8W 5%	R17	DALE	CRCW1206-1002FRT1
101	3	100K 1/8W 5%	R94, R96, R136	AVX	CR1206-1003FTR1
102	1	20.0K 1/8W 1%	R84	DALE	CRCW1206-2002FRT1
103	2	220 1/8W 5%	R87–88	AVX	CR32-221J-T
104	2	22 1/8W 5%	R3, R6	AVX	CR32-220J-T
105	8	270 1/8W 5%	R18, R37–40, R42–43, R48	AVX	CR32-271J-T
106	1	680 1/8W 5%	R41	AVX	CR32-681J-T
107	3	RED-SMT GULL-WING	LED2, LED8, LED9	PANASONIC	LN1261C

Ref.	Qty.	Description	Reference Designator	Manufacturer	Part Number
108	1	GREEN-SMT GULL-WING	LED3	PANASONIC	LN1361C
109	2	604 1/8W 1%	R100, R127	PANASONIC	ERJ-8ENF6040V
110	10	1uF 25V 20%	CT1–8, CT22–23	PANASONIC	ECS-T1EY105R
111	2	QUICK-SWITCH-257	U17–18	ANALOG DEVICES	ADG774ABRQ
112	1	IDC 7X2	P5	BERG	54102-T08-07
113	2	3.5MM STEREO_JACK	P2–3	SHOGYO	SJ-0359AM-5
114	1	32MB SDRAM	U3	VIKING	PE464U4-CL2

ADSP-TS101 EZ-KIT LITE

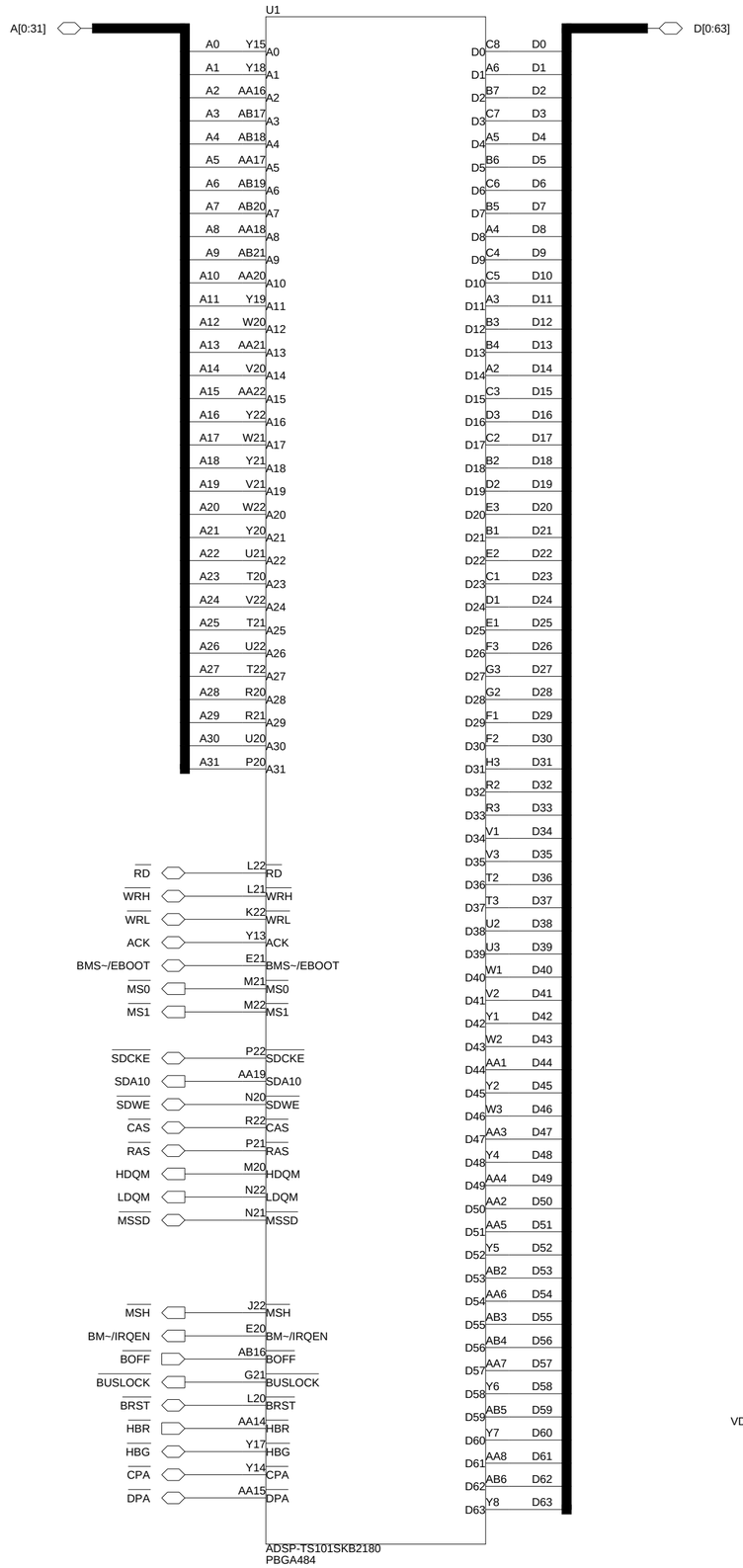
ANALOG DEVICES
20 Cotton Road
Nashua, NH 03063
PH: 1-800-ANALOGD

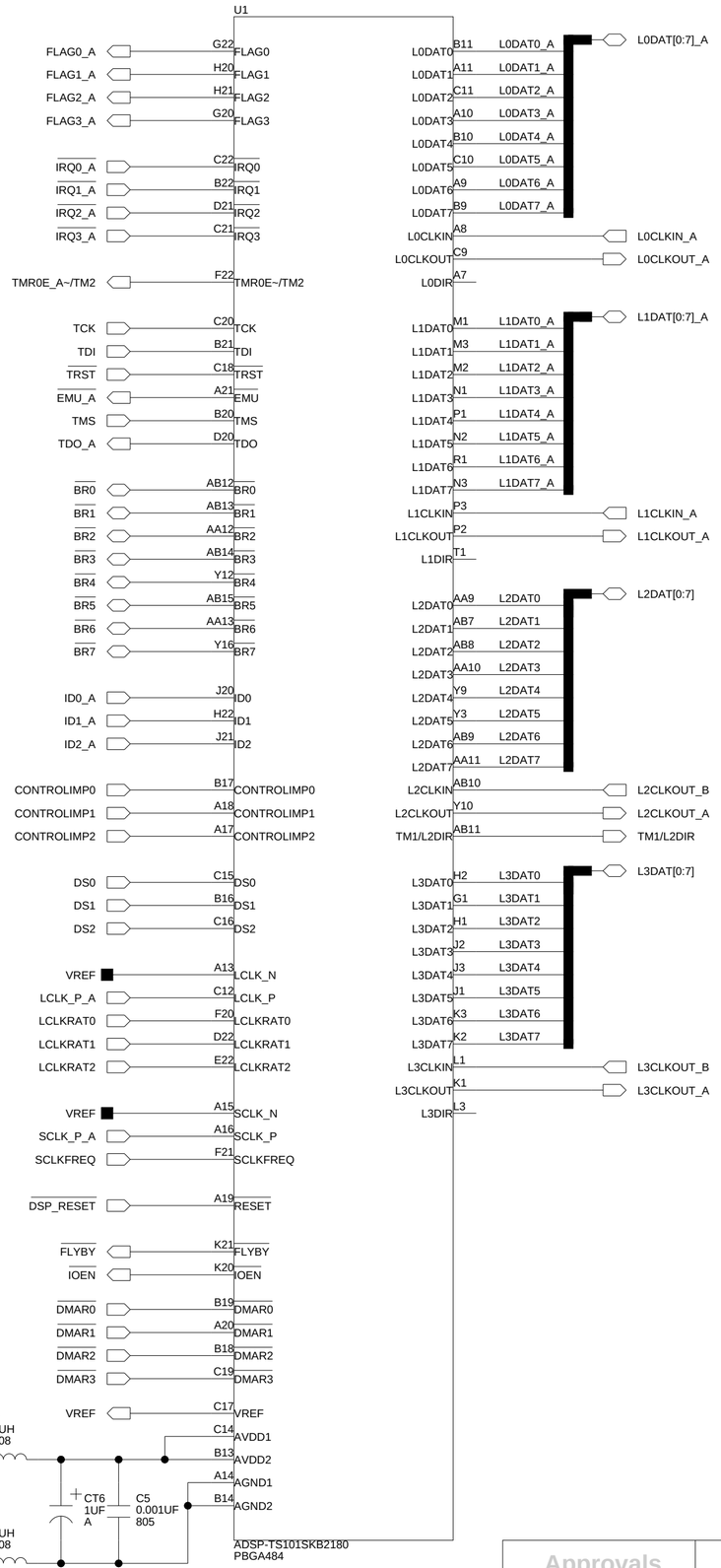
Approvals	Date
Drawn	
Checked	
Engineering	

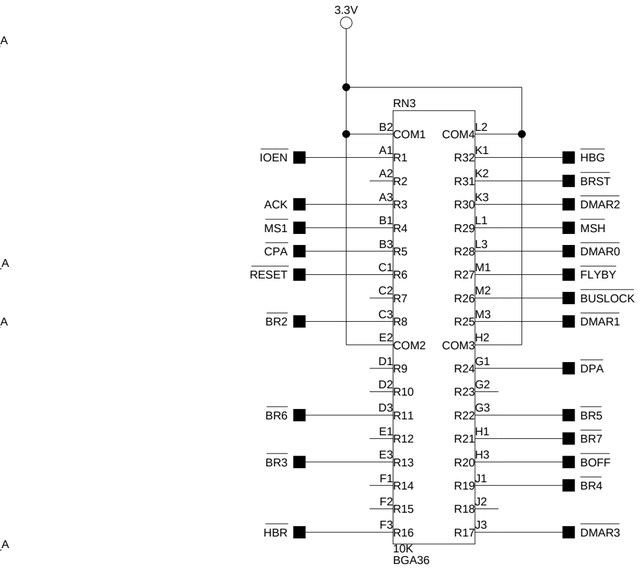
Title: ADSP-TS101 EZ-KIT LITE

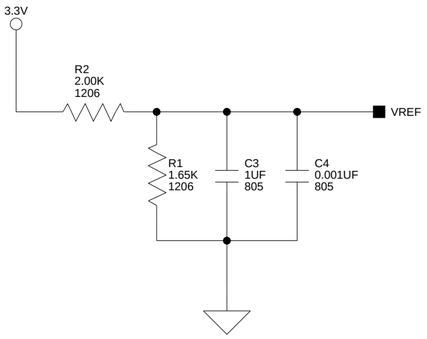
Size	Board No.	Rev
C	A0163-2001	1.4

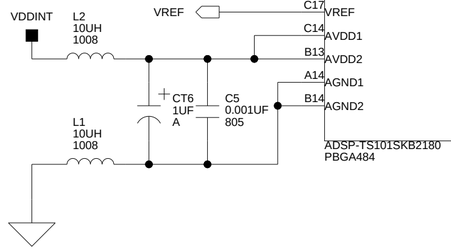
Date 1-19-2004_15:25 Sheet 1 of 12











ANALOG DEVICES

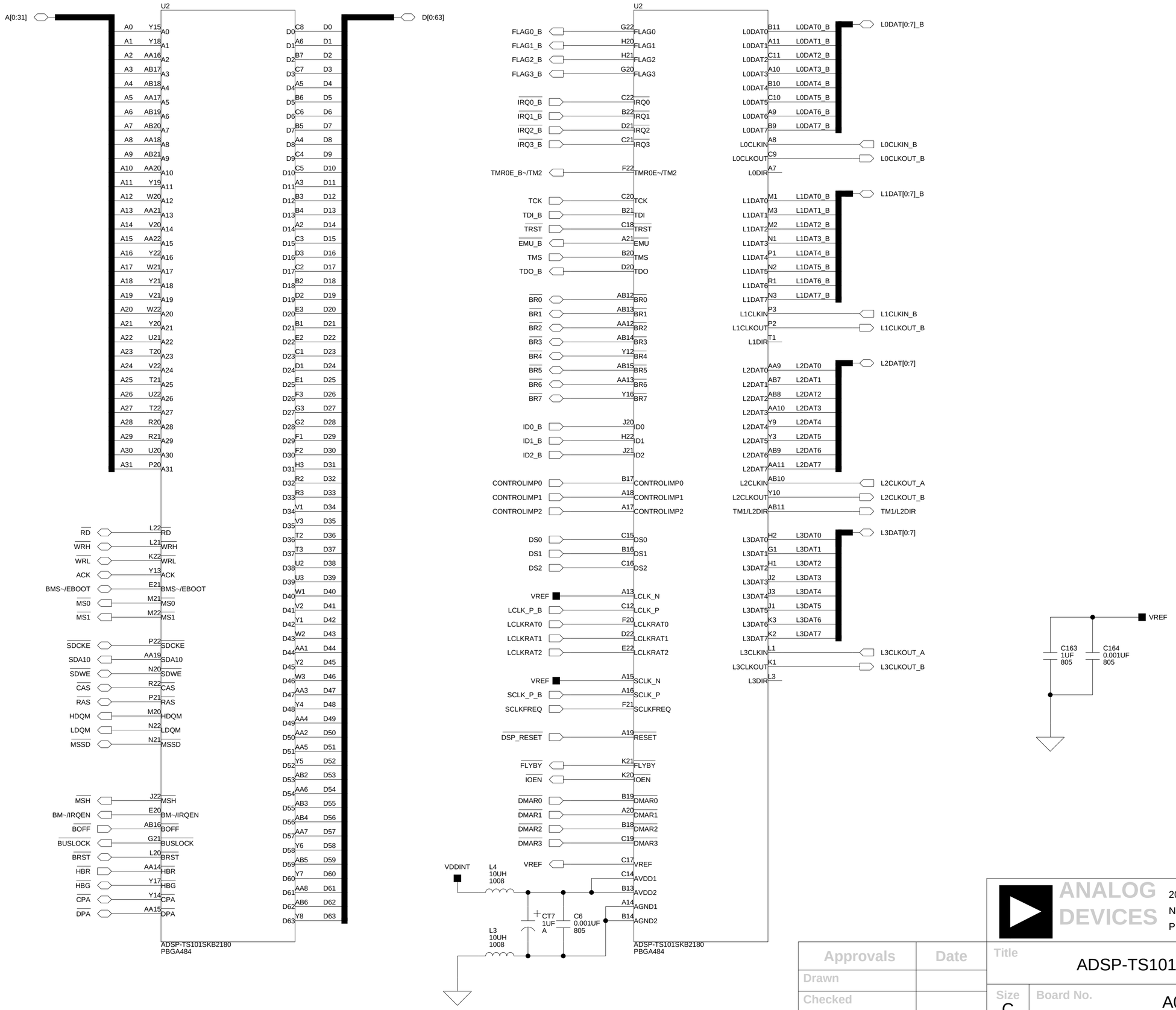
20 Cotton Road
Nashua, NH 03063
PH: 1-800-ANALOGD

Approvals	Date
Drawn	
Checked	
Engineering	

Title: ADSP-TS101 EZ-KIT LITE - DSP A

Size	Board No.	Rev
C	A0163-2001	1.4

Date: 1-19-2004_15:28 Sheet 2 of 12



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

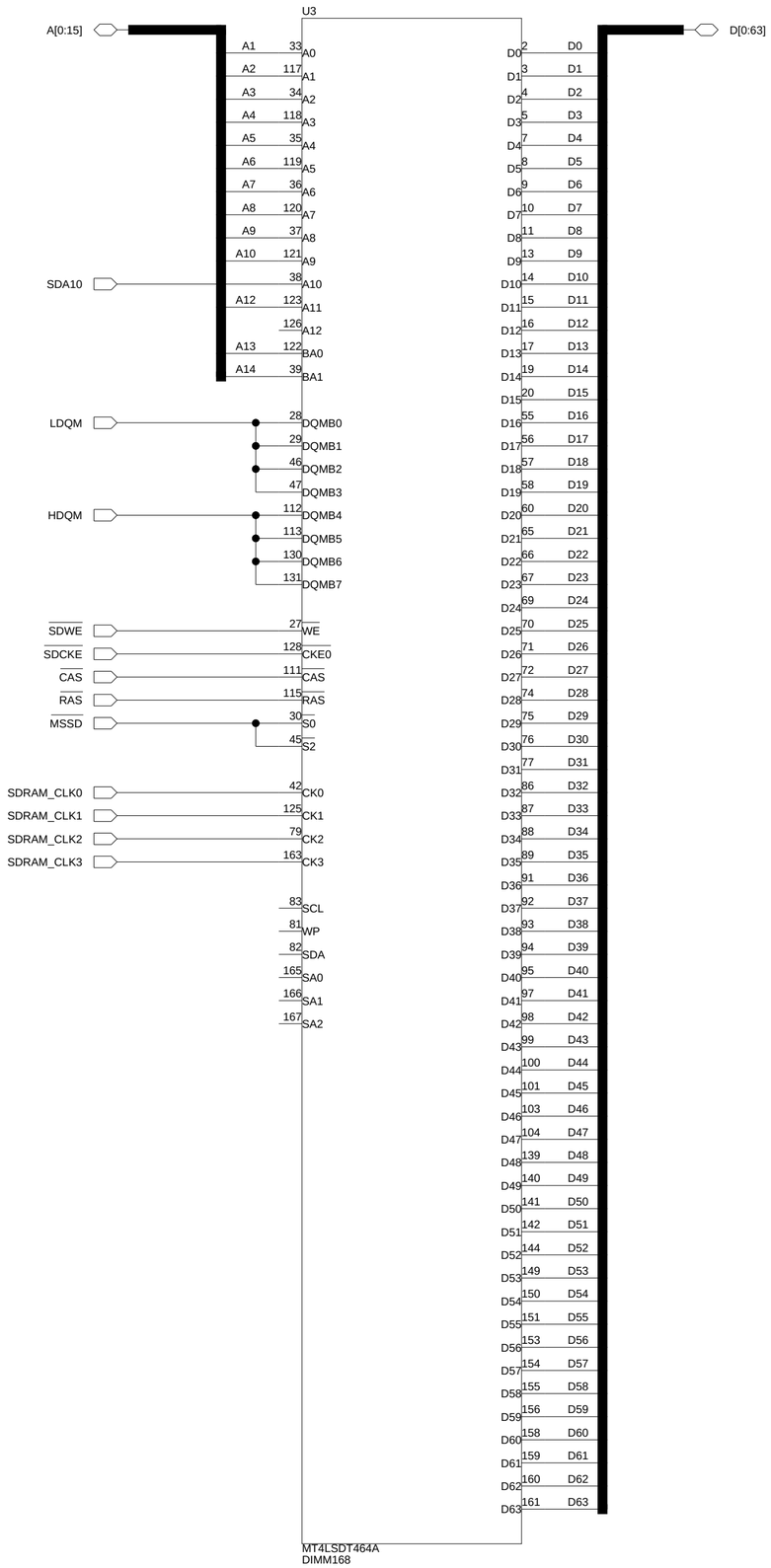
Approvals	Date
Drawn	
Checked	
Engineering	

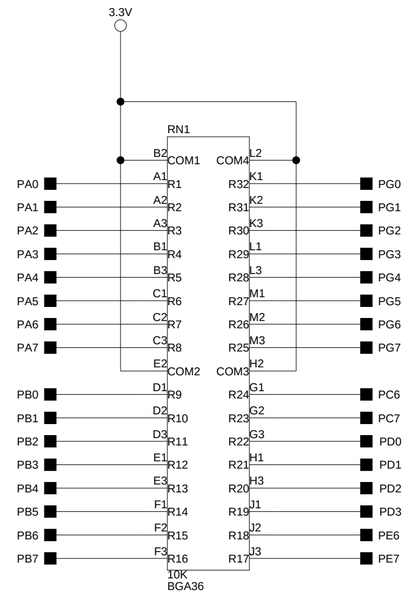
Title: ADSP-TS101 EZ-KIT LITE - DSP B

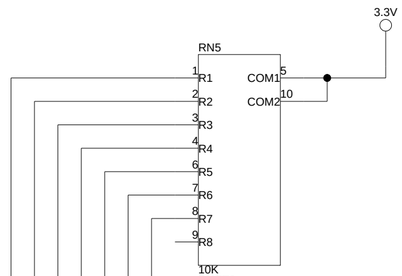
Size	Board No.	Rev
C	A0163-2001	1.4

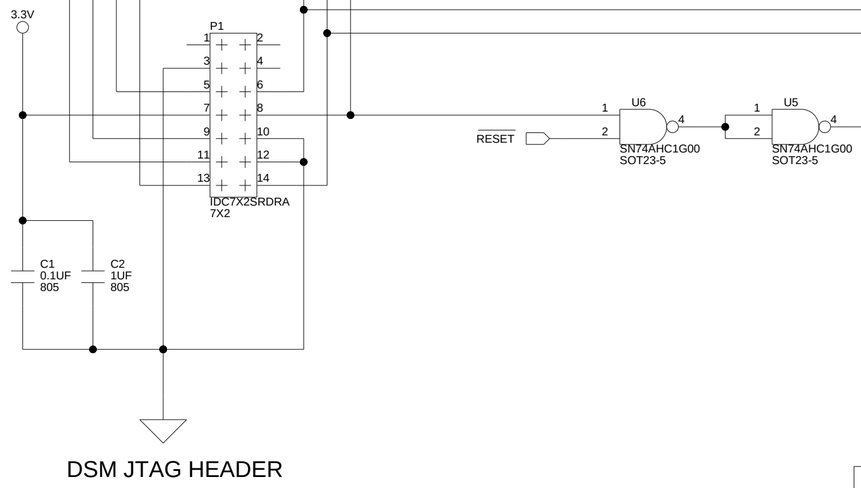
Date: 1-19-2004_15:28 Sheet 3 of 12

4M x 64 SDRAM



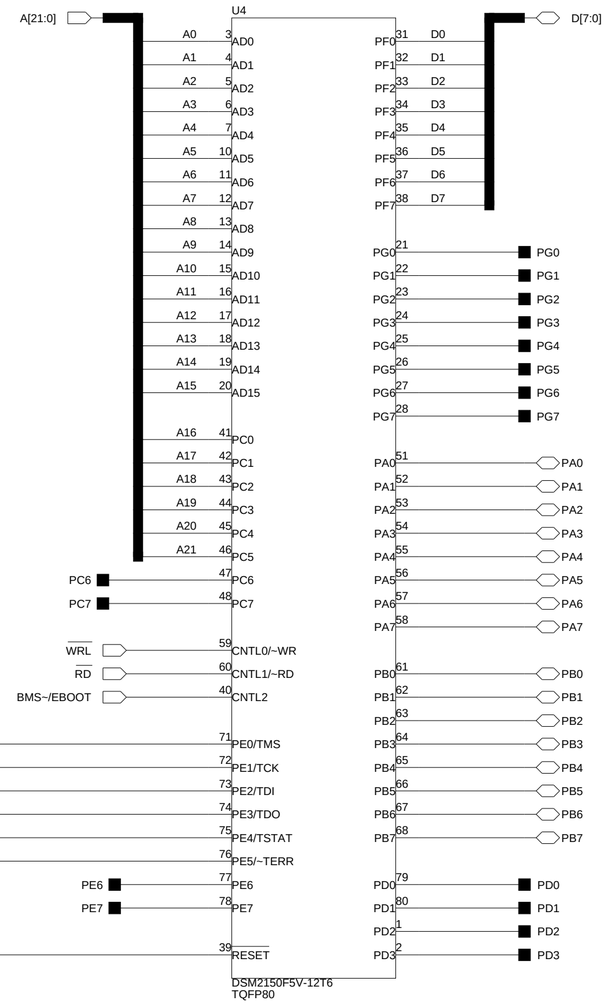






DSM JTAG HEADER

512 KB MAIN FLASH
32KB SECONDARY FLASH



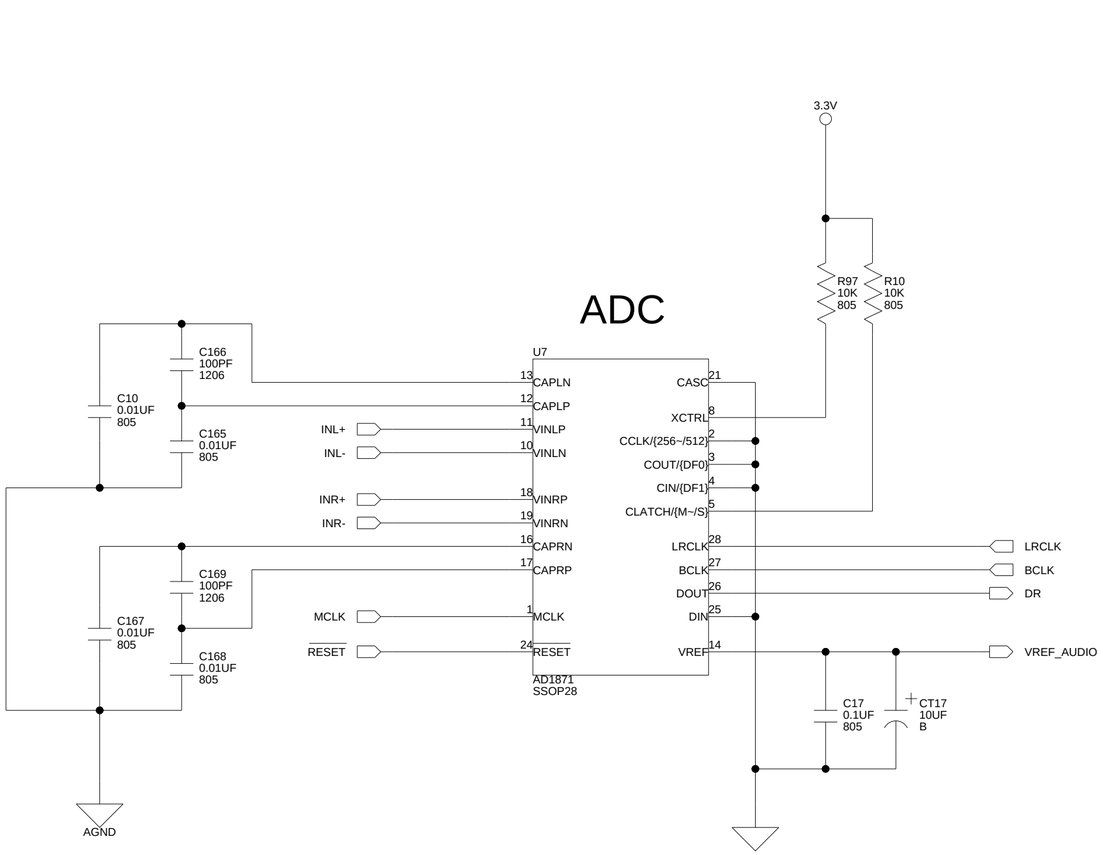
ANALOG DEVICES
20 Cotton Road
Nashua, NH 03063
PH: 1-800-ANALOGD

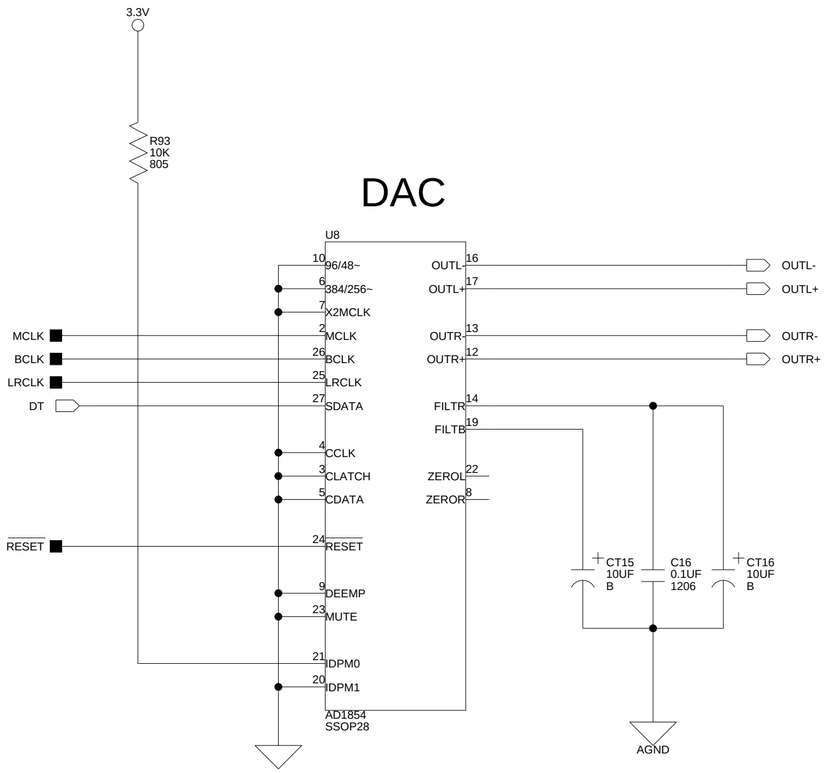
Approvals	Date
Drawn	
Checked	
Engineering	

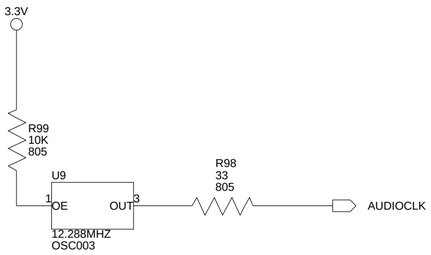
Title: ADSP-TS101 EZ-KIT LITE - SDRAM & FLASH

Size	Board No.	Rev
C	A0163-2001	1.4

Date: 1-19-2004_15:28 Sheet 4 of 12







SLAVE MODE
MCLK IS 256 x Fs
48 kHZ SAMPLE RATE
I^2S I/F MODE

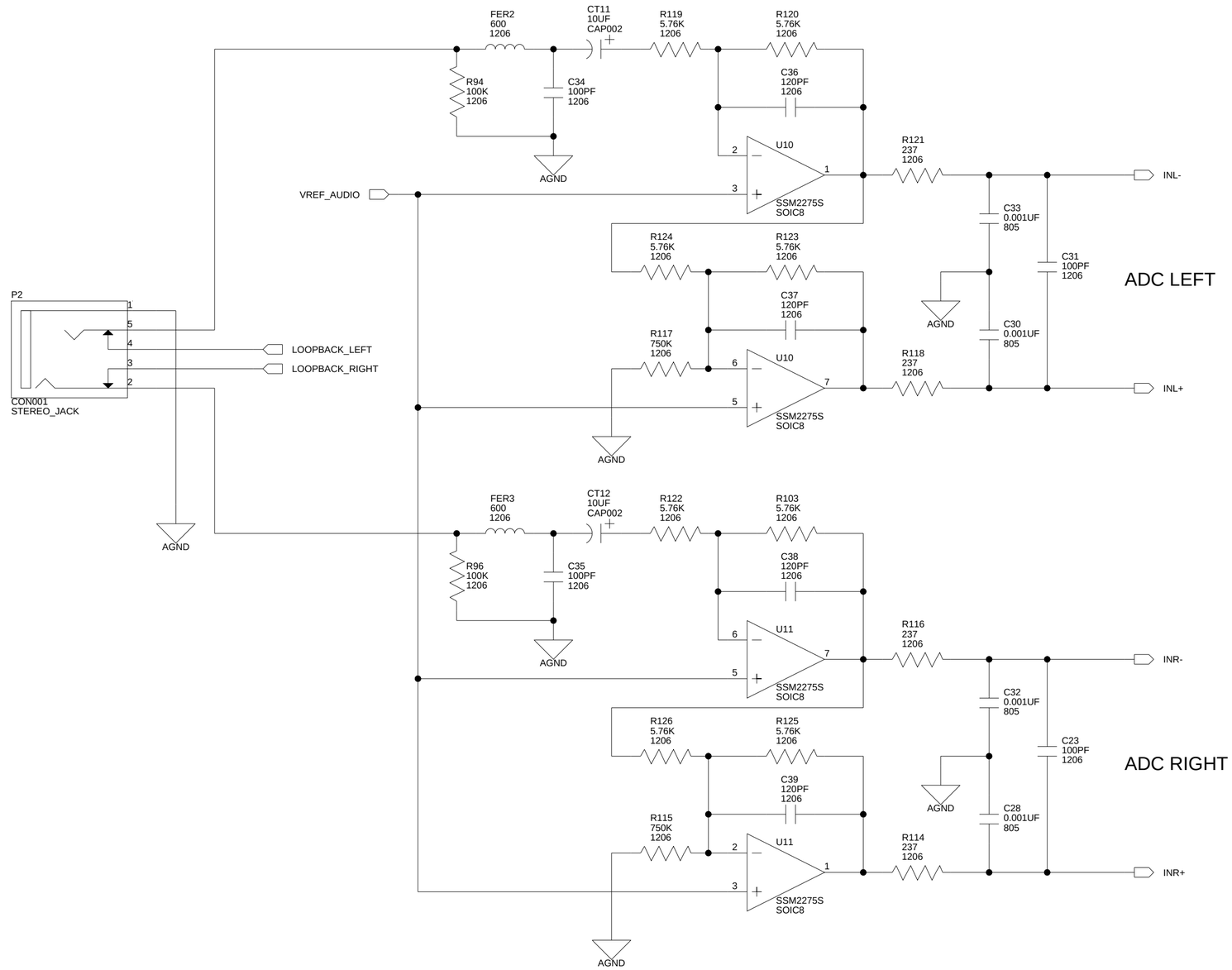
ANALOG DEVICES
20 Cotton Road
Nashua, NH 03063
PH: 1-800-ANALOGD

Approvals	Date
Drawn	
Checked	
Engineering	

Title: ADSP-TS101 EZ-KIT LITE - AUDIO INTERFACE

Size	Board No.	Rev
C	A0163-2001	1.4

Date: 1-19-2004_15:28 Sheet 5 of 12



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

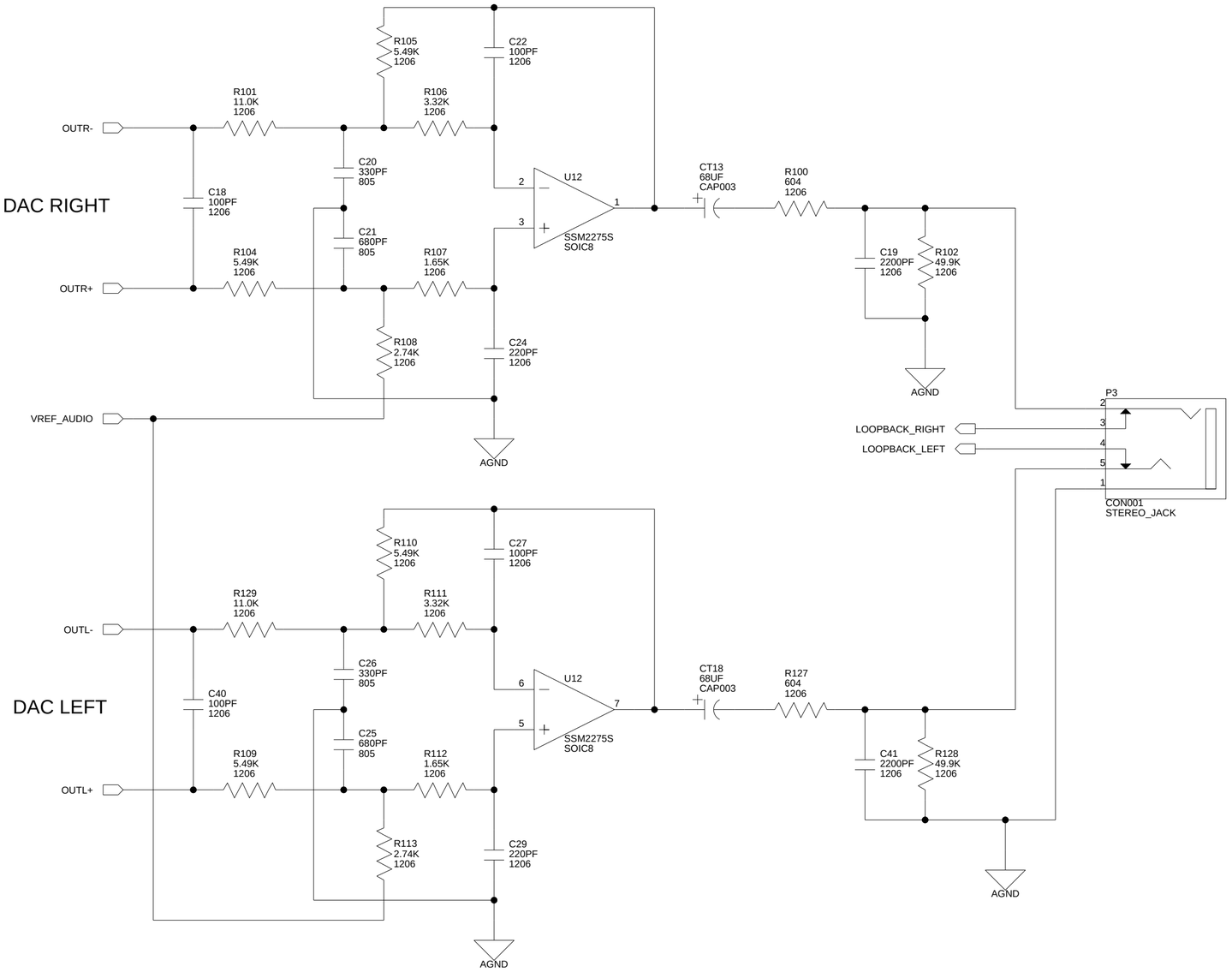
Approvals	Date
Drawn	
Checked	
Engineering	

Title: ADSP-TS101 EZ-KIT LITE - AUDIO IN AMPLIFIERS

Size	Board No.	Rev
C	A0163-2001	1.4

Date: 1-19-2004_15:28 Sheet 6 of 12

DAC RIGHT



DAC LEFT

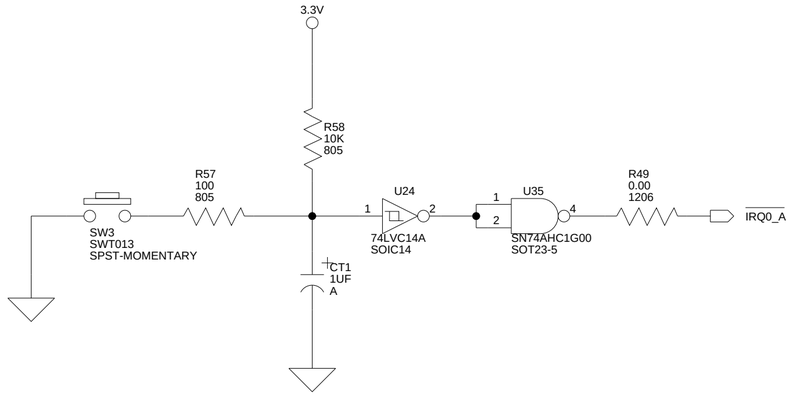
ANALOG DEVICES
20 Cotton Road
Nashua, NH 03063
PH: 1-800-ANALOGD

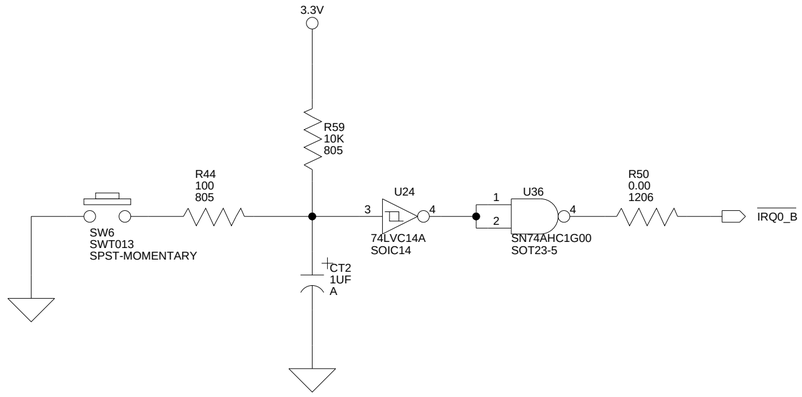
Approvals	Date
Drawn	
Checked	
Engineering	

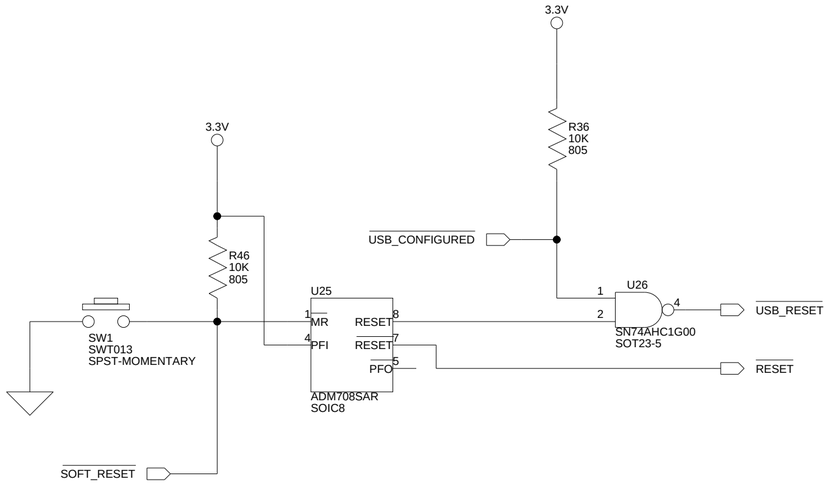
Title: ADSP-TS101 EZ-KIT LITE - AUDIO OUT AMPLIFIERS

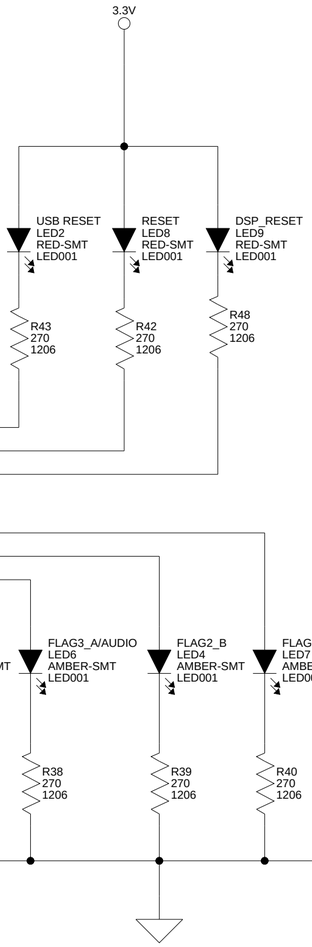
Size	Board No.	Rev
C	A0163-2001	1.4

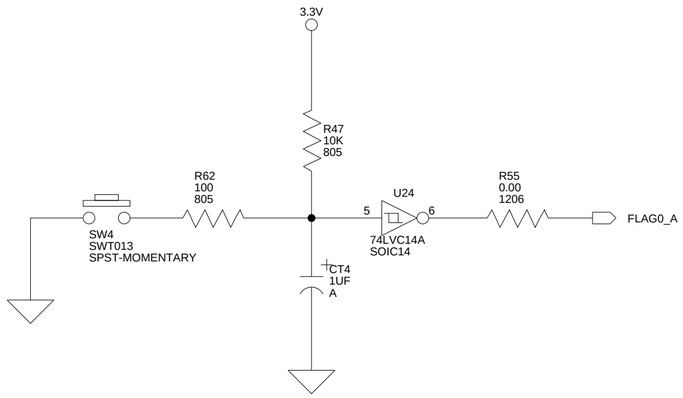
Date	Sheet
1-19-2004_15:28	7 of 12

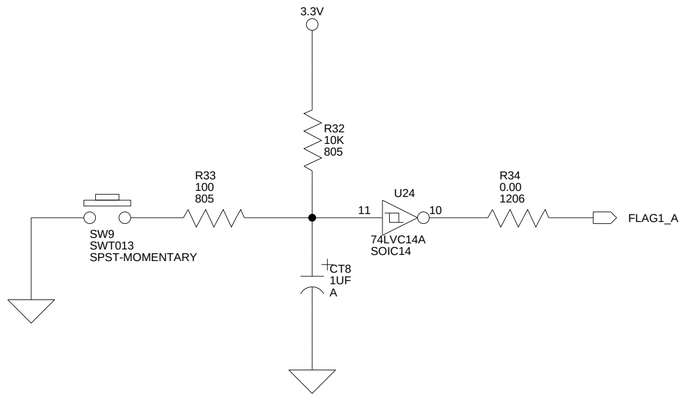


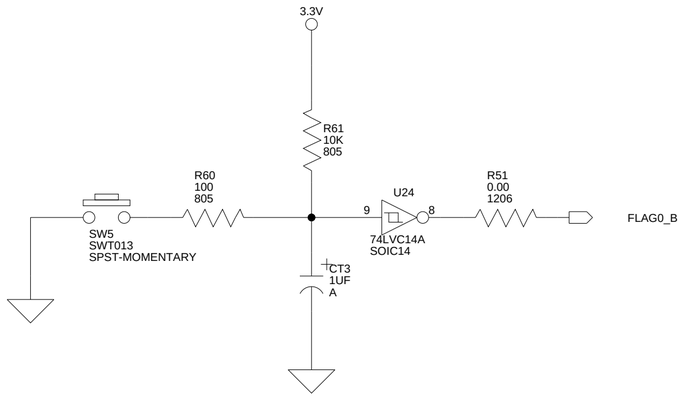


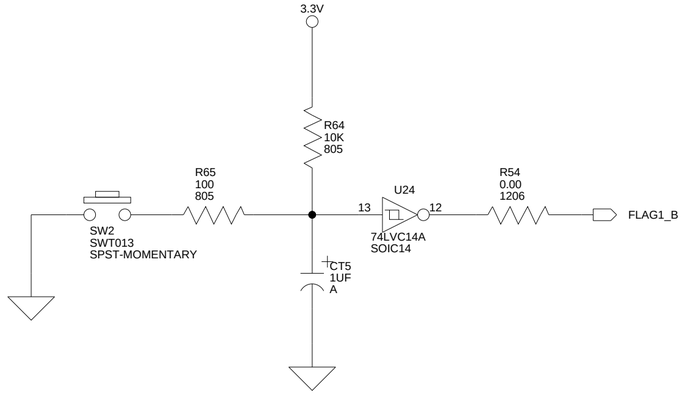












ANALOG DEVICES

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

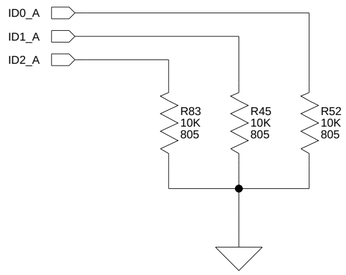
Approvals	Date
Drawn	
Checked	
Engineering	

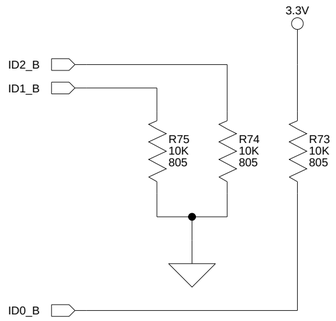
Title: ADSP-TS101 EZ-KIT LITE - PUSH BUTTONS & LEDS

Size	Board No.	Rev
C	A0163-2001	1.4

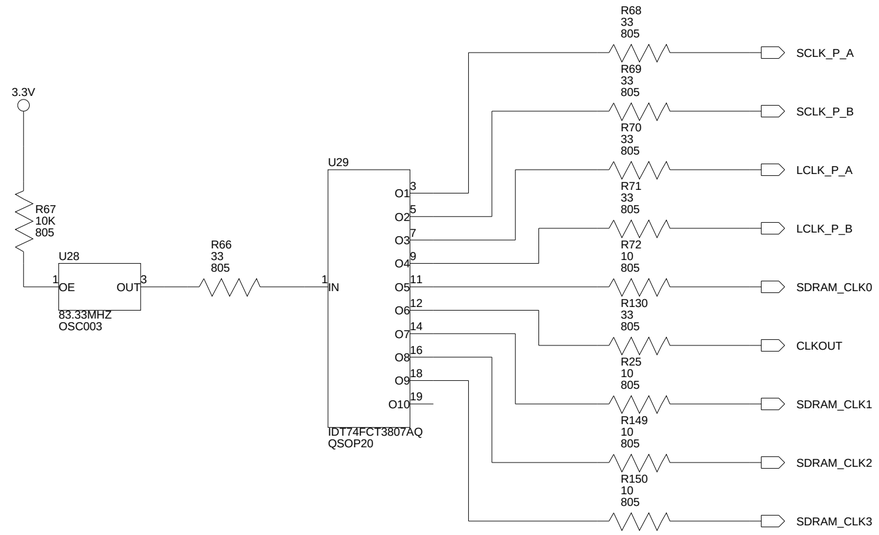
Date: 1-19-2004_15:28 Sheet 8 of 12

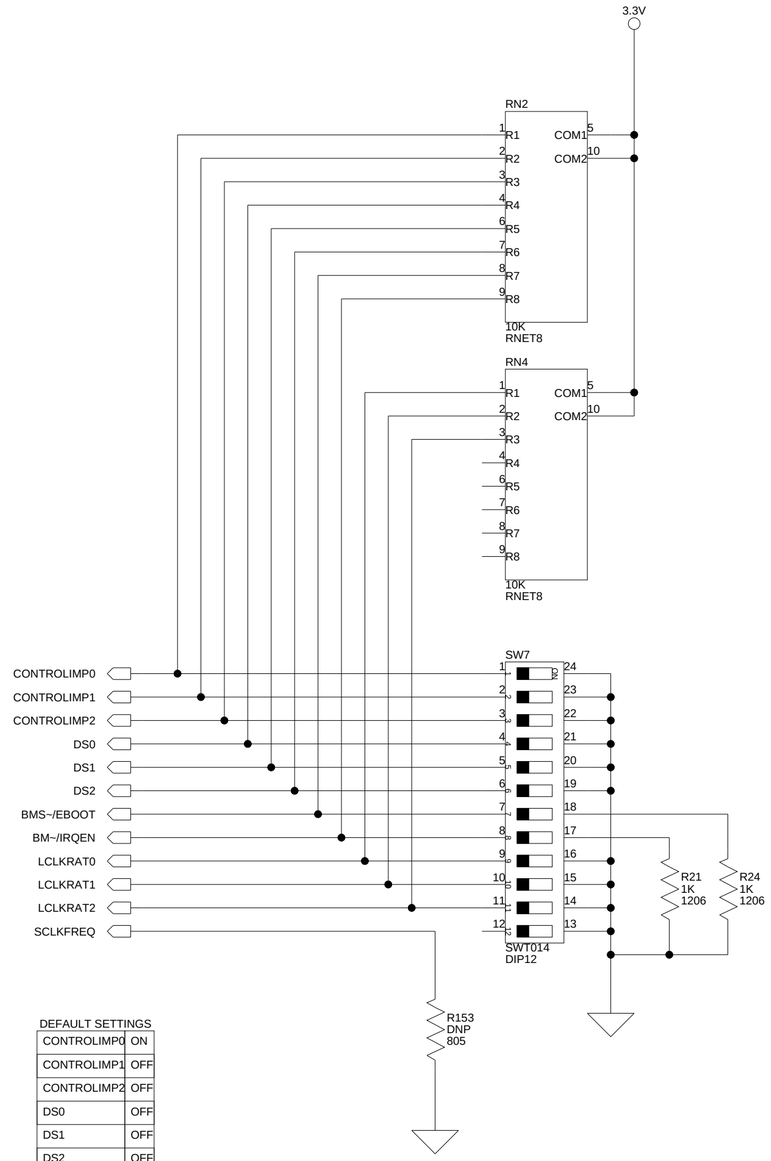
DSP_A ID = 000





DSP_B ID = 001





DEFAULT SETTINGS

CONTROLIMP0	ON
CONTROLIMP1	OFF
CONTROLIMP2	OFF
DS0	OFF
DS1	OFF
DS2	OFF
BMS~	ON
BM~	ON
LCLKRAT0	ON
LCLKRAT1	OFF
LCLKRAT2	ON

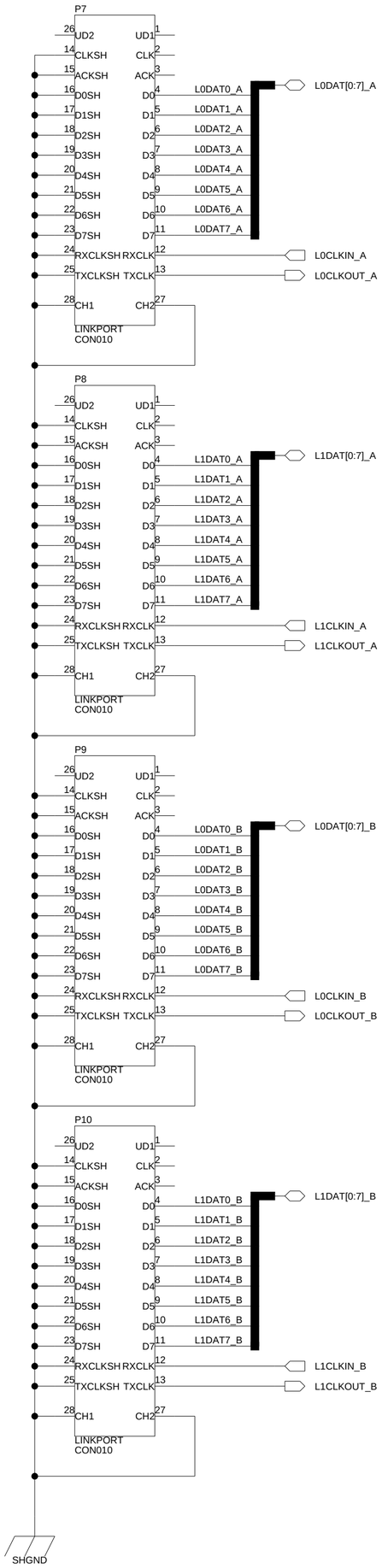
ANALOG DEVICES
20 Cotton Road
Nashua, NH 03063
PH: 1-800-ANALOGD

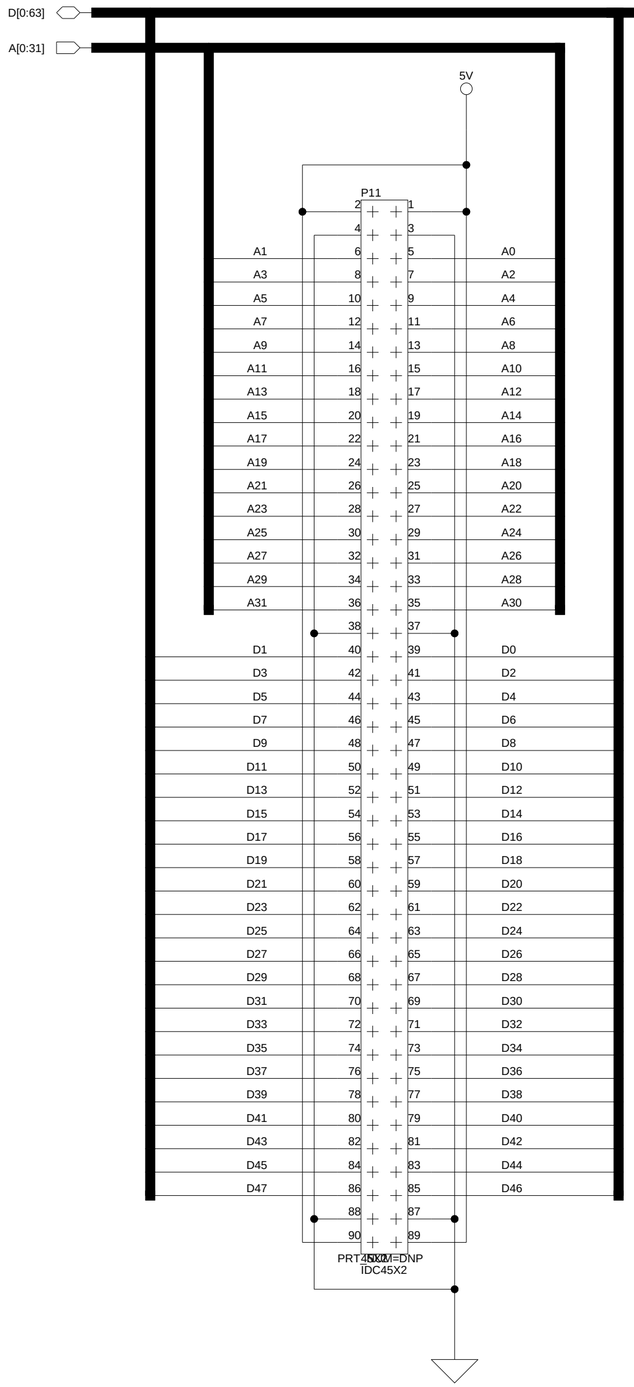
Approvals	Date
Drawn	
Checked	
Engineering	

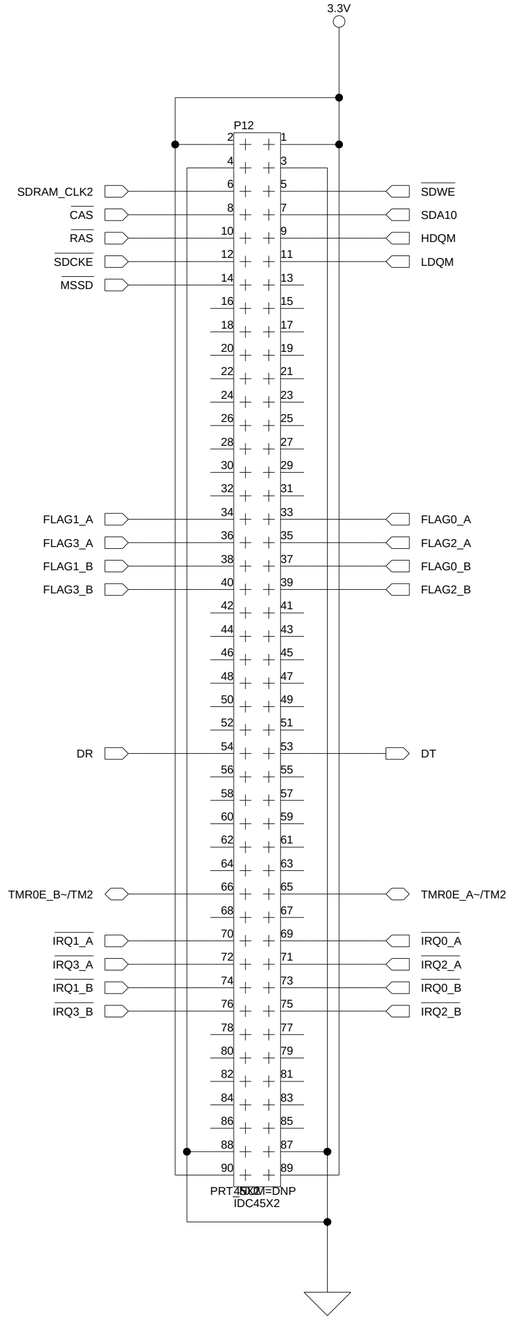
Title: ADSP-TS101 EZ-KIT LITE - CONFIGURATION

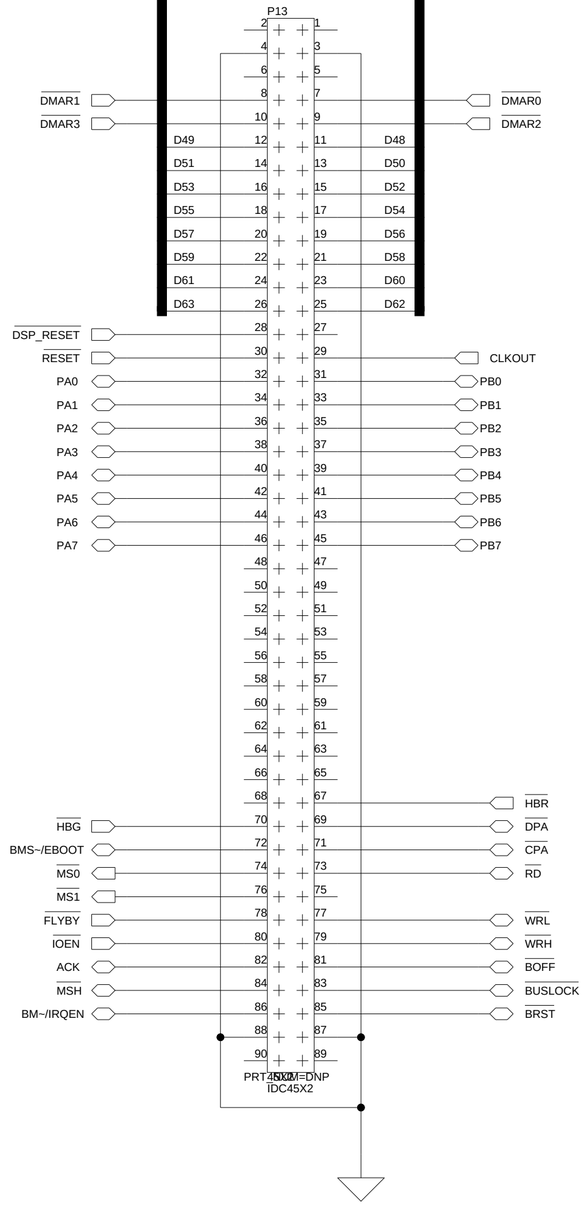
Size	Board No.	Rev
C	A0163-2001	1.4

Date: 1-19-2004_15:28 Sheet 9 of 12









ANALOG DEVICES

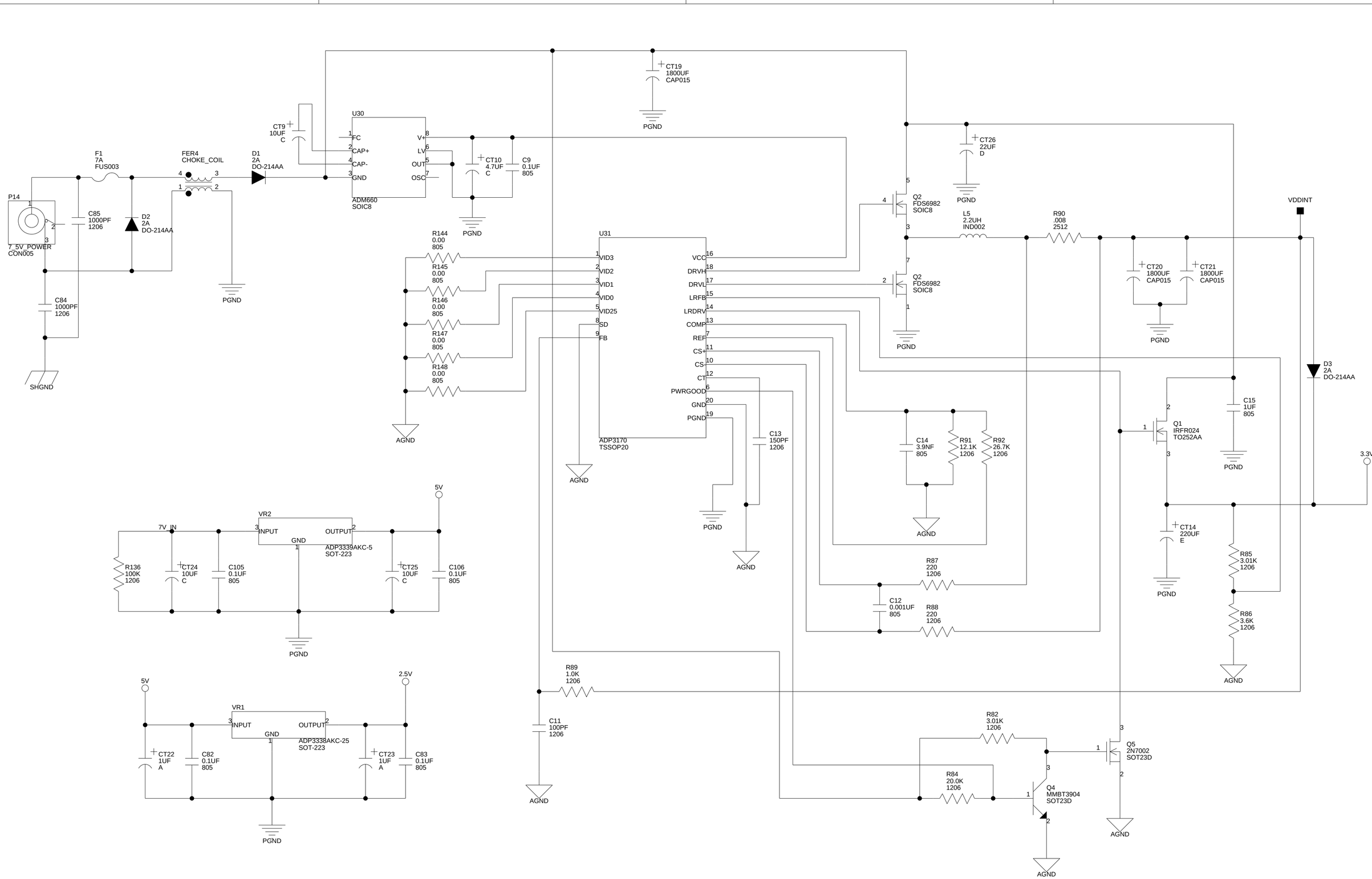
20 Cotton Road
Nashua, NH 03063
PH: 1-800-ANALOGD

Approvals	Date
Drawn	
Checked	
Engineering	

Title: ADSP-TS101 EZ-KIT LITE - EXPANSION CONNECTORS

Size	Board No.	Rev
C	A0163-2001	1.4

Date: 1-19-2004_15:28 Sheet 10 of 12



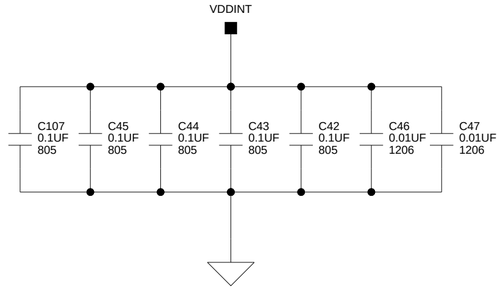
Approvals	Date
Drawn	
Checked	
Engineering	

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

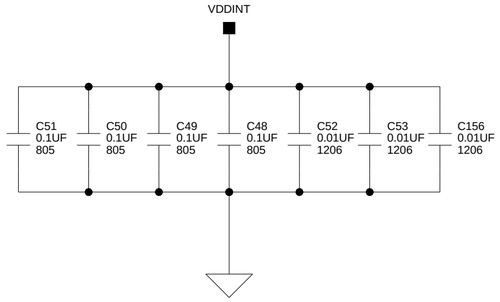
Title: ADSP-TS101 EZ-KIT LITE - POWER SUPPLY

Size	Board No.	Rev
C	A0163-2001	1.4

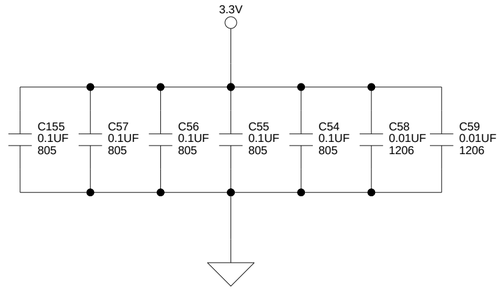
Date: 1-19-2004_15:28 Sheet 11 of 12

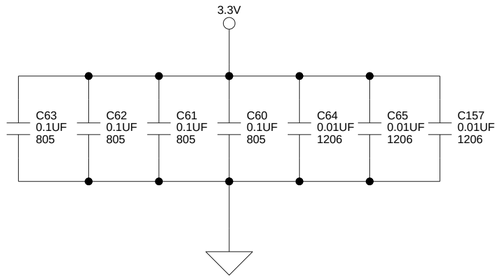


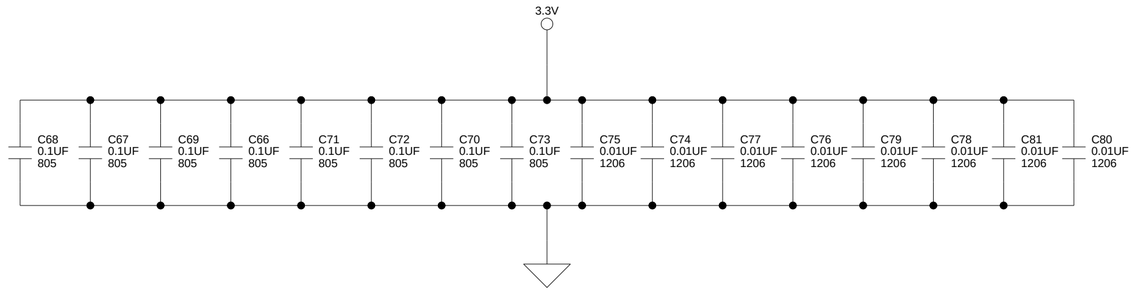
U1



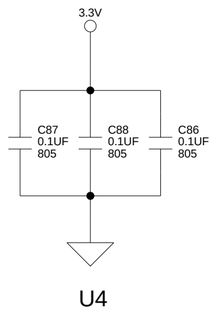
U2



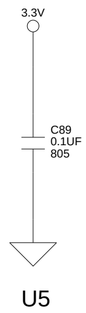




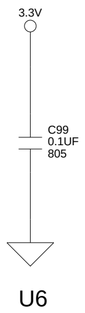
U3



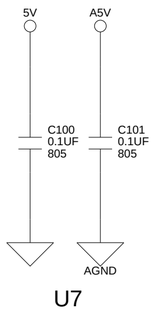
U4



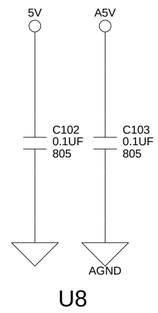
U5



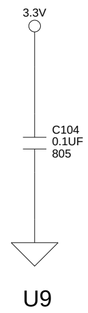
U6



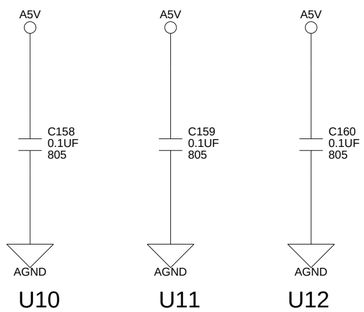
U7



U8



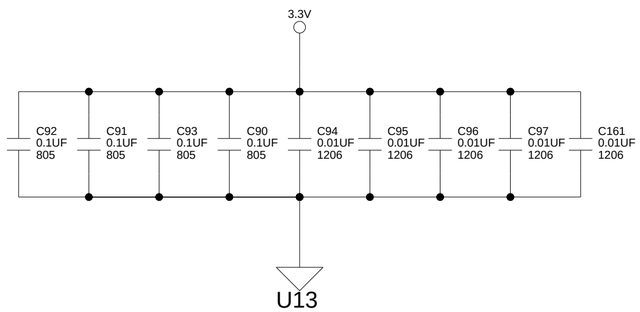
U9



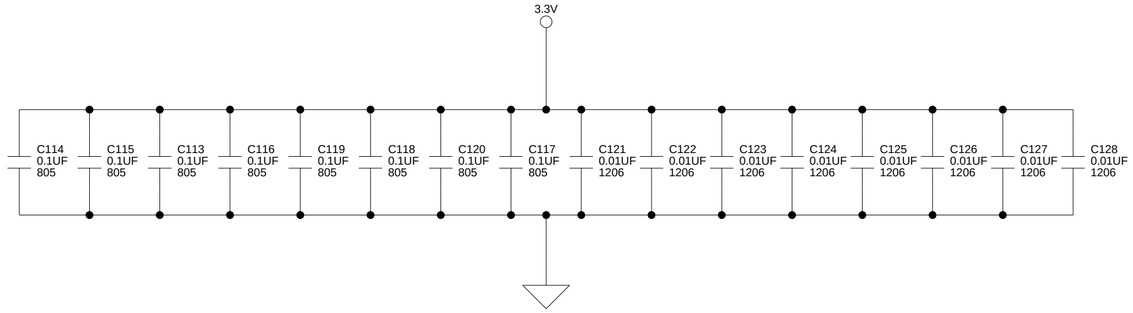
U10

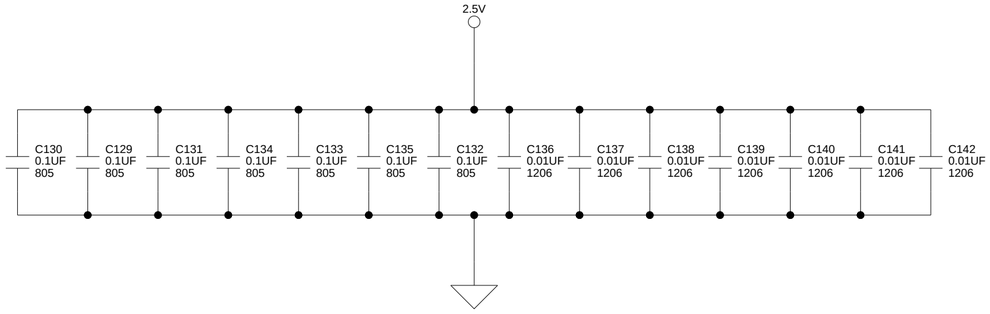
U11

U12

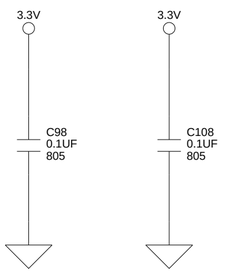


U13



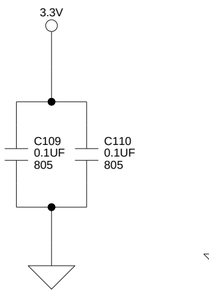


U19

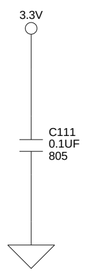


U14

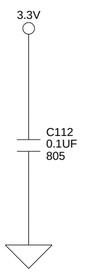
U15



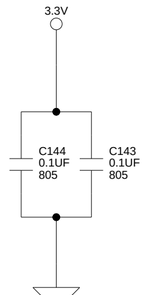
U16



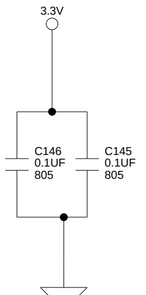
U17



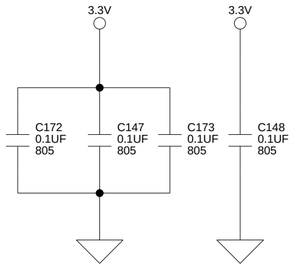
U18



U20

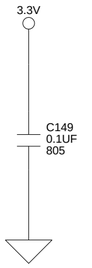


U21

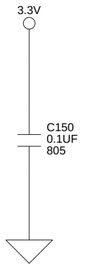


U22

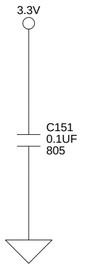
U23



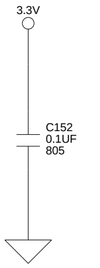
U24



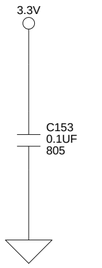
U25



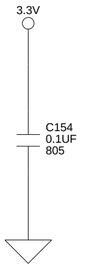
U26



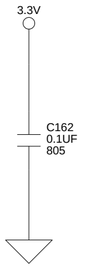
U27



U28



U29



U32

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

Approvals	Date
Drawn	
Checked	
Engineering	

Title: ADSP-TS101 EZ-KIT LITE - CAPS

Size: C | Board No.: A0163-2001 | Rev: 1.4

Date: 1-19-2004_15:28 | Sheet 12 of 12

I INDEX

A

AD1854 digital-to-analog converters (DACs), 1-11
AD1871 analog-to-digital converters (ADCs), 1-11
address data controls (ADC), 2-5
architecture, of this EZ-KIT Lite, 2-2
audio
  connectors (P2-3), 2-12
  interface, 1-11

B

bill of materials, A-1
~BMS boot memory select pins, 1-7, 2-3
board schematic, B-1
boot
  modes, 2-6
  mode switch (SW7), 2-6

C

CLKIN pins, 2-7
CLKOUT pins, 2-3
clock
  frequency, 2-7
  mode settings (SW7), 2-7
codecs, *See* AD1871, AD1854
connectors
  diagram of locations, 1-4, 2-12
  P11-13 (expansion), 2-3, 2-14
  P14 (power), 2-15
  P2-3 (audio), 2-12
  P4 (USB), 2-13
  P5 (JTAG), 2-13
  P7-10 (link ports), 2-14
contents, of this EZ-KIT Lite package, 1-2
control impedance selection (SW7), 2-5
core
  speed, 2-2, 2-7
  voltage, 2-2
customer support, -xiv

D

D23-0 pins, 1-12
DIP switch SW7, 2-4, 2-5, 2-6, 2-7
drive strength selection (SW7), 2-5

E

example programs, 1-12
expansion interface, 2-3, 2-14
external
  See also SDRAM
  interrupts, 1-10
  memory, -xi, 1-11
  ports, 2-3

F

features, of this EZ-KIT Lite, -x
FLAG
  LEDs (LED7-LED4), 2-10
  push buttons (SW2, SW4-5, SW9), 2-10
FLAG0_A (SW4) pins, 1-10, 2-11
FLAG0_B (SW5) pins, 1-10, 2-11
FLAG1_A (SW9) pins, 1-10, 2-11
FLAG1_B (SW2) pins, 1-10, 2-11
FLAG2_A (LED7) pins, 1-10, 2-10
FLAG2_B (LED4) pins, 1-10, 2-10
FLAG3_A (LED6) pins, 1-10, 1-11, 2-10
FLAG3_B (LED5) pins, 1-10, 1-11, 2-10
flash memory
  boot memory select pins, 2-3
  main/secondary, 1-7, 1-11

G

general-purpose IO pins, -xi, 1-10, 2-11

I

input clock, 2-2
installation, of this EZ-KIT Lite, 1-5
internal memory, 1-7
interrupt
  enable settings (SW2), 2-7
  pins (IR3-0), 1-10
  push buttons (SW3, SW6), 2-11
IRQ0_A (SW3) interrupt pins, 1-10, 2-11
IRQ0_B (SW6) interrupt pins, 1-10, 2-11

J

JTAG
  connector (P5), 2-4, 2-13
  emulation port, 2-4
  programming cable, 1-11

L

LEDs
  diagram of locations, 1-4, 2-8
  LED1 (USB monitor), 1-5, 2-8
  LED2 (USB reset), 2-8
  LED3 (power), 2-9
  LED4-7 (FLAG3-2), 1-10, 2-10
  LED8 (master reset), 2-9
  LED9 (processor reset), 2-9
license restrictions, 1-7
link port
  connectors (P7-10), 2-14
  outputs, 2-5

M

memory map, of this EZ-KIT Lite, 1-7

N

notation conventions, -xxi

O

oscillators, 2-7

P

package contents, 1-2
power
  connector (P14), 2-15
  LED (LED3), 2-9
  supply specifications, 2-15
programmable flag pins, *See* flags by name (FLAGx)
push buttons
  See also push buttons by name (SWx)
  diagram of locations, 2-8

R

registration, of this product, 1-3

reset
  LEDs (LED2, LED8-9), 2-8
  master (LED8), 2-9
  processor, 1-9, 2-9
  push button (SW1), 2-10
restrictions, of the license, 1-7

S

schematic, of this EZ-KIT Lite, B-1
SDRAM
  external port connection, 2-3
  interface, 1-8
  start/end addresses, 1-7
SDRCON registers, 1-8
setup, of this EZ-KIT Lite, 1-4
specifications, of the power supply, 2-15
SQCTL registers, 1-9
SQSTAT registers, 1-9
startup, of this EZ-KIT Lite, 1-5
SW1 (reset) push buttons, 2-10
SW2 (FLAG1_B/interrupt) push button, 1-10, 2-7, 2-11
SW3 (IRQ0_A) push button, 1-10, 2-11
SW4 (FLAG0_A) push button, 1-10, 2-11
SW5 (FLAG0_B) push button, 1-10, 2-11
SW6 (IRQ0_B) push button, 1-10, 2-11
SW7 DIP switch, 2-4, 2-5, 2-6, 2-7
SW9 (FLAG1_A) push button, 1-10, 2-11
SYSCON registers, 1-8
system architecture, of this EZ-KIT Lite, 2-2

T

Target Options dialog box, 1-9

U

USB
  cable, 1-3
  connector (P4), 2-13
  debug interface, 2-13
  monitor LED (LED1), 2-8
  reset LED (LED2), 2-8

V

VisualDSP++
  documentation, -xix
  environment, 1-5
  online Help, -xix
voltage regulators, -xi