ADSP-21992 EZ-KIT Lite™
Evaluation System Manual

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**ANALOG
DEVICES**

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PREFACE

Thank you for purchasing the ADSP-21992 EZ-KIT Lite® evaluation system. The evaluation board is designed to be used in conjunction with the VisualDSP++ development environment to test the capabilities of the ADSP-2199x fixed-point, mixed-signal, digital signal processor (DSP). The VisualDSP++ development environment gives you the ability to perform advanced application code development and debug tasks such as:

- Creating, compiling, assembling, and linking application programs written in C++, C and, ADSP-21992 assembly

- Loading running, stepping, halting, and setting breakpoints in application programs

- Reading and writing data memory and program memory

- Reading and writing core and peripheral registers

- Plotting memory

Access to the ADSP-21992 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-21992 processor and the evaluation board peripherals. Analog Devices JTAG emulators provide the fastest 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 DSP development tools, go to:

```
http://www.analog.com/dsp/tools/
```

ADSP-21992 EZ-KIT Lite provides example programs to demonstrate the capabilities of the evaluation board.

(i) The VisualDSP++ license provided with this EZ-KIT Lite evaluation system limits the size of a user program to 8K words of internal memory.

The board's features include:

- Analog Devices ADSP-21992 160 MHz, mixed-signal DSP

- USB debugging interface

- Analog input circuitry

- 8-channel 12-bit DAC (AD5328BRU) on SPI interface

- PWM outputs interface

- External memory interface

- Encoder interface circuitry

- General-purpose I/O interface

- UART interface (RS-232)

- CAN interface circuitry

- Flash memory (512K x 8)

- External SRAM (64K x 16)

- Interface connectors

- 14-pin emulator connector for JTAG interface

- Analog inputs connector

- DAC outputs connector

- PWM outputs connector

- Encoder interface connector

- SPORT connector

- RS-232 connector

- External memory interface connector

The EZ-KIT Lite board has a Flash memory device that can be used to store user-specific boot code. You can configure a jumper (SW1 switch) and program the Flash memory to run the board as a stand-alone unit. For information about using the Flash memory, see "Using Flash Programmer Utility" on page 2-6.

Additionally, the EZ-KIT Lite board provides un-installed expansion connector footprints that allow you to connect to the processor's External Memory Interface (EMI).

Purpose of This Manual

The *ADSP-21992 EZ-KIT Lite Evaluation System Manual* provides instructions for using the hardware and installing the software on your PC. This manual provides guidelines for running your own code on the ADSP-21992 EZ-KIT Lite. The manual also describes the operation and configuration of the evaluation board's components. Finally, a schematic and a bill of materials are provided as a reference for future ADSP-21992 board designs.

Intended Audience

This manual is a user's guide and reference to the ADSP-21992 EZ-KIT Lite evaluation system. Programmers who are familiar with the Analog Devices ADSP-21992 processor architecture, operation, and programming are the primary audience for this manual.

Programmers who are unfamiliar with Analog Devices DSPs can use this manual in conjunction with the *ADSP-2199x Mixed Signal DSP Hardware Reference* and the *ADSP-219x DSP Instruction Set Reference*, which describe the processor architecture and instruction set. Programmers who are unfamiliar with VisualDSP++ should refer to the VisualDSP++ online Help and the VisualDSP++ User's Guide or Getting Started Guide. For the locations of these documents, refer to "Related Documents" on page -xv.

Manual Contents

The manual consists of:

- Chapter 1, "Getting Started" on page 1-1

  Provides software and hardware installation procedures, PC system requirements, and basic board information.

- Chapter 2, "Using the EZ-KIT Lite" on page 2-1

  Provides information on the EZ-KIT Lite from a programmer's perspective and provides an easy-to-access memory map.

- Chapter 3, "EZ-KIT Lite Hardware Reference" on page 3-1

  Provides information on the hardware aspects of the evaluation system.

What's New in This Manual

This is the second revision of the *ADSP-21992 EZ-KIT Lite Evaluation System Manual*. The manual provides an updated listing of related documents.

Technical or Customer Support

You can reach DSP Tools Support in the following ways.

- Visit the DSP Development Tools website at

  www.analog.com/technology/dsp/developmentTools/index.html

- E-mail questions to

  dsptools.support@analog.com

- Phone questions to **1**-**800**-**ANALOGD**

- Contact your ADI local sales office or authorized distributor

- Send questions by mail to

  Analog Devices, Inc.
  DSP Division
  One Technology Way
  P.O. Box 9106
  Norwood, MA 02062-9106
  USA

Supported Processors

The ADSP-21992 EZ-KIT Lite evaluation system supports Analog Devices ADSP-21992 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 notification 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 email address.

DSP Product Information

For information on digital signal processors, visit our website at www.analog.com/dsp, 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
  `dsp.support@analog.com`

- Fax questions or requests for information to **1**-**781**-**461**-**3010** (North America) or **+49 (0) 89 76903**-**157** (Europe)

Related Documents

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

Table 1. Related DSP Publications

Title	Description
Mixed Signal DSP Controller With CAN Data Sheet	General functional description, pin-out, and timing.
ADSP-2199x Mixed Signal DSP Controller Hardware Reference	Description of internal processor architecture and all register functions.
ADSP-219x Instruction Set Reference	Description of all allowed processor assembly instructions.

Table 2. Related VisualDSP++ Publications

Title	Description
VisualDSP++ 3.5 User's Guide for 16-Bit Processors	Description of VisualDSP++ 3.5 features and usage.
VisualDSP++ 3.5 Assembler and Preprocessor Manual for ADSP-21xx Processors	Description of the assembler function and commands for ADSP-2199x DSPs.
VisualDSP++ 3.5 C/C++ Complier and Library Manual for ADSP-219x Processors	Description of the complier function and commands for ADSP-2199x DSPs

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

Title	Description
VisualDSP++ 3.5 Linker and Utilities Manual for 16-Bit Processors	Description of the linker function and commands for 16-bit processors.
VisualDSP++ 3.5 Loader Manual for 16-Bit Processors	Description of the loader/splitter function and commands for 16-bit processors.

These documents are located within VisualDSP+ online Help or in the `Docs` folder of your VisualDSP++ installation CD. Most documents are available in printed form.

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

Online Documentation

Your software installation kit includes online Help as part of the Windows® interface. The Help files provide information about VisualDSP++ and the ADSP-21992 EZ-KIT Lite evaluation system.

To view VisualDSP++ Help, click on the **Help** menu item or go to the Windows task bar and select **Start→Programs→Analog Devices→VisualDSP++ 3.5 for 16-bit Processors→VisualDSP++ Documentation**.

To view ADSP-21992 EZ-KIT Lite Help, which now is a part of online Help, go the **Contents** tab of the VisualDSP++ Help window and select **Manuals→Hardware Tools→EZ-Kit Lite Evaluation Systems→ADSP-21992 EZ-KIT Lite**.

For more documentation, please go to
`http://www.analog.com/technology/dsp/library.html`.

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

Printed copies of VisualDSP++ manuals may be purchased through Analog Devices Customer Service at **1**-**781**-**329**-**4700**; ask for a Customer Service representative. The manuals can be purchased only as a kit. For additional information, call **1**-**603**-**883**-**2430**.

If you do not have an account with Analog Devices, you will be referred to Analog Devices distributors. To get information on our distributors, log onto `www.analog.com/salesdir/continent.asp`.

Hardware Manuals

Printed copies of hardware reference and instruction set reference manuals can be ordered through the Literature Center or downloaded from the Analog Devices Web site. The phone number is **1**-**800**-**ANALOGD** (**1**-**800**-**262**-**5643**). The manuals can be ordered by a title or by product number located on the back cover of each manual.

Data Sheets

All data sheets can be downloaded from the Analog Devices Web site. As a general rule, printed copies of data sheets with a letter suffix (L, M, N, S) can be obtained from the Literature Center at **1**-**800**-**ANALOGD** (**1**-**800**-**262**-**5643**) or downloaded from the Web site. Data sheets without the suffix can be downloaded from the Web site only—no hard copies are available. You can ask for the data sheet by part name or by product number.

If you want to have a data sheet faxed to you, the phone number for that service is **1**-**800**-**446**-**6212**. Follow the prompts and a list of data sheet code numbers will be faxed to you. Call the Literature Center first to find out if requested data sheets are available.

Contacting DSP Publications

Please send your comments and recommendations on how to improve our manuals and online Help. You can contact us by sending e-mail to:
dsp.techpubs@analog.com

Notation Conventions

The following table describes text conventions used in this manual.

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

Example	Description
Close command (**File** menu) or **OK**	Text in **bold** style indicates the location of an item within the VisualDSP++ environment's and boards' menu system and user interface items.
{this | that}	Alternative required items in syntax descriptions appear within curly brackets separated by vertical bars; read the example as this or that.
[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 ellipsis; read the example as an optional comma-separated list of this.
PF9-0	Registers, connectors, pins, commands, directives, keywords, code examples, and feature names are in text with letter gothic font.
filename	Non-keyword placeholders appear in text with italic style format.

Example	Description
Note:	A note providing information of special interest or identifying a related topic. In the online version of this book, the word **Note** appears instead of this symbol.
Caution:	A caution providing information about critical design or programming issues that influence operation of a product. In the online version of this book, the word **Caution** appears instead of this symbol.

Notation Conventions

1 GETTING STARTED

This chapter provides the information you need to begin using ADSP-21992 EZ-KIT Lite evaluation system. For correct operation, install the software and hardware in the order presented.

The chapter includes the following sections.

-

  Provides a list of the components shipped with this EZ-KIT Lite evaluation system.

-

  Describes the minimum requirements for the PC to work with the EZ-KIT Lite evaluation system.

-

  Describes the step-by-step procedures for setting up the hardware and software.

Contents of EZ-KIT Lite Package

Your ADSP-21992 EZ-KIT Lite evaluation system package contains the following items.

- ADSP-21992 EZ-KIT Lite board

- *EZ-KIT Lite Quick Start Guide*

- CD containing:

    - ✓ VisualDSP++ (limited license) for 16-bit processors

    - ✓ ADSP-21992 EZ-KIT Lite debug software

    - ✓ USB driver files

    - ✓ Example programs

    - ✓ ADSP-21992 *EZ-KIT Lite Evaluation System Manual* (this document)

- *Installation Quick Reference Card for VisualDSP++*

- USB type 2.0 cable

- Registration card (please fill out and return)

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

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.

PC Configuration

For correct operation of the VisualDSP++ software and the EZ-KIT Lite, your computer must have the minimum configuration:

Windows 98, Windows 2000, Windows XP
Intel (or comparable) 166 MHz processor
VGA Monitor and color video card
2-button mouse
50 MB free on hard drive
32 MB RAM
Full-speed USB port
CD-ROM Drive

◯ EZ-KIT Lite does not run under Windows 95 or Windows NT.

Installation Tasks

The following task list is provided for the safe and effective use of the ADSP-21992 EZ-KIT Lite. Follow the instructions in the presented order to ensure correct operation of your software and hardware.

1. VisualDSP++ and EZ-KIT Lite software installation

2. VisualDSP++ license installation

3. EZ-KIT Lite hardware setup

4. EZ-KIT Lite USB driver installation

5. USB driver installation verification

6. VisualDSP++ startup

Installing VisualDSP++ and EZ-KIT Lite Software

This EZ-KIT Lite comes with the latest version of VisualDSP++ 3.5 for 16-bit processors. VisualDSP++ installation includes EZ-KIT Lite installations.

To install VisualDSP++ and EZ-KIT Lite software:

1. Insert the VisualDSP++ installation CD into the CD-ROM drive.

2. If Autoplay is enabled on your PC, you see the **Install Shield Wizard Welcome** screen. Otherwise, choose **Run** from the **Start** menu, and enter `D:\ADI_Setup.exe` in the **Open** field, where `D` is the name of your local CD-ROM drive.

3. Follow the on-screen instructions to continue installing the software.

4. At the **Custom Setup** screen, select your EZ-KIT Lite from the list of available systems and choose the installation directory. Click an icon in the **Feature Description** field to see the selected system's description. When you have finished, click **Next**.

5. At the **Ready to Install** screen, click **Back** to change your install options, click **Install** to install the software, or click **Cancel** to exit the install.

6. When the EZ-KIT Lite installs, the **Wizard Completed** screen appears. Click **Finish**.

Installing VisualDSP++ License

To install the VisualDSP++ license:

1. Locate the serial number provided on the sticker affixed to the CD sleeve and the registration form.

2. From the **Start** menu, choose **Programs**, **Analog Devices**, **VisualDSP++ 3.5 for 16-bit Processors**, **VisualDSP++ Environment**.

3. The information screen asks if you would like to install a license. Click **Yes**. The **About VisualDSP++** screen appears.

4. Select the **Licenses** tab and click **New**.

5. In the **Install a New License** dialog that opens, select **Single User**.

6. Fill in the tools serial number in the field provided exactly as it appears on your CD sleeve or registration form and click **Next**. An information window notifies of successful license installation.

Setting Up the EZ-KIT Lite Hardware

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-21992 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.

To connect the EZ-KIT Lite board:

1. Remove the EZ-KIT Lite board from the package. Be careful when handling the board to avoid the discharge of static electricity, which may damage some components.

2. Confirm that your board is set up in the default configuration before going to step 3. Refer to Figure 3-3 on page 3-11

3. Connect your power supply to P1 on the EZ-KIT Lite board. The ADSP-21992 EZ-KIT Lite board contains a 5-way terminal block for connection of external power supplies. For correct operation, the following supplies are required:

    - +5V, 800 mA (VDD)

    - +5V, 60 mA (+AVDD)

    - -5V, 60 mA (-AVDD)

    - Digital Ground (DGND)

    - Analog Ground (AGND)

    Regulators on the board provide the required +3.3V, +2.5V, and ±2.5V.

4. Connect one end of the USB cable to an available full-speed USB port on your PC and connect the other end to P11 on the ADSP-21992 EZ-KIT Lite board.

Installing EZ-KIT Lite USB Driver

The EZ-KIT Lite evaluation system installed on Windows 98, Windows 2000, and Windows XP requires one full-speed USB port.

- "Windows 98 USB Driver" on page 1-8 describes installation on Windows 98.

- "Windows 2000 USB Driver" on page 1-12 describes installation on Windows 2000.

- "Windows XP USB Driver" on page 1-13 describes installation on Windows XP.

The USB driver used by the debug agent is not Microsoft certified because it is intended for a development or laboratory environment, not a commercial environment.

Windows 98 USB Driver

Before using the ADSP-21992 EZ-KIT Lite for the first time, the Windows 98 USB driver must first be installed.

To install the USB driver:

1. Insert the CD into the CD-ROM drive.
   The connection of the device to the USB port activates the Windows 98 **Add New Hardware Wizard**, as shown in Figure 1-1.
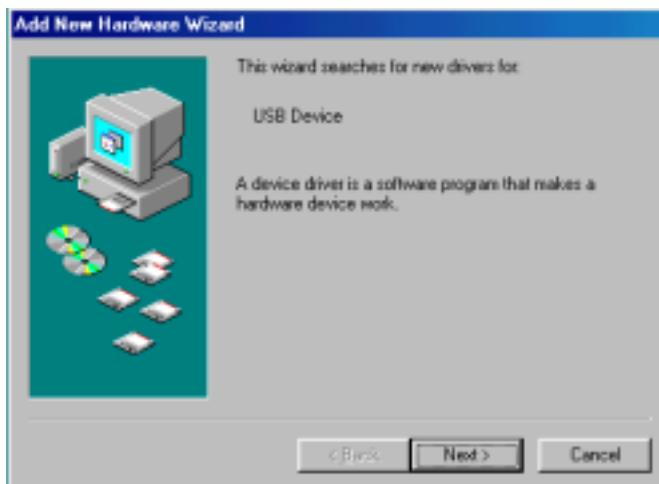
Figure 1-1. Windows 98 Add New Hardware Wizard

2. Click **Next**.

3. Select **Search for the best driver for your device**, as shown in Figure 1-2.

Figure 1-2. Searching for Driver

4. Click **Next**.

5. Select **CD-ROM drive**, as shown in Figure 1-3.

Figure 1-3. Searching for CD-ROM

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6. Click **Next**.
   Windows 98 locates the WmUSBEz.inf file on the installation CD, as shown in Figure 1-4.

Figure 1-4. Locating Driver

7. Click **Next**.
   The **Coping Files** dialog box appears (Figure 1-5).

Figure 1-5. Searching for .SYS File

8. Click **Browse**.

The **Open** dialog box, shown in Figure 1-6, appears on the screen.
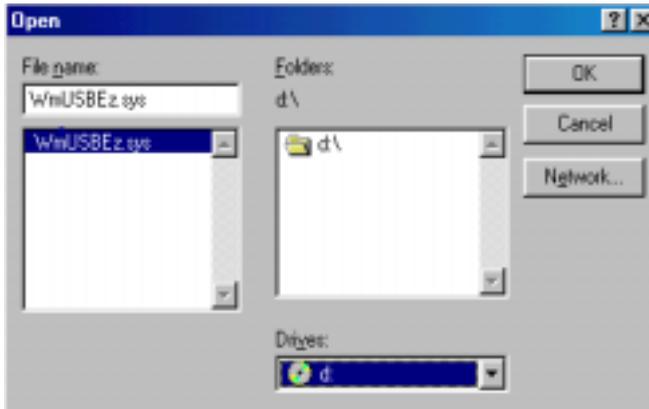
Figure 1-6. Opening .SYS File

  9. In **Drives**, select your CD-ROM drive.

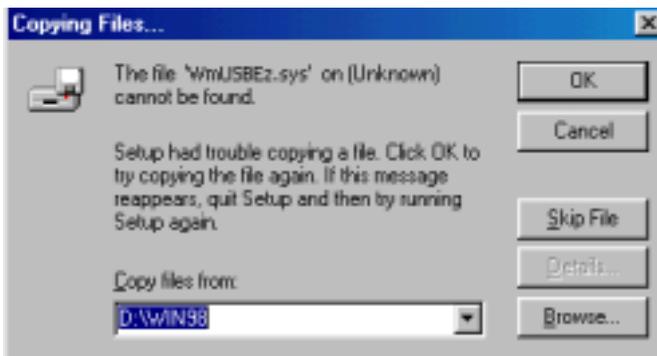 10. Click **OK**. The **Copying Files** dialog box (Figure 1-7) appears.
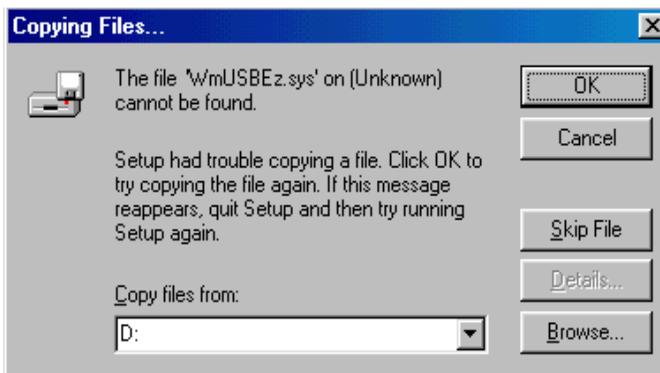
Figure 1-7. Copying .SYS File

  11. Click **OK**.

The driver installation is now complete, as shown in Figure 1-8.

Figure 1-8. Completing Software Installation

12. Click **Finish** to exit the wizard.

13. Verify the installation by following the instructions in "Verifying Driver Installation" on page 1-15.

Windows 2000 USB Driver

VisualDSP++ 3.5 installation software pre-installs the necessary drivers for the selected EZ-KIT Lite. The install also upgrades an older driver if such is detected in the system.

Prior to running the VisualDSP++ 3.5 installer, ensure there are no other Hardware Wizard windows running in the background. If there are any wizard windows running, close them before starting the installer.

To install the USB driver:

1. If VisualDSP++ 3.5 is already installed on your system, go to
   step 2.
   Otherwise, run VisualDSP++ 3.5 installation. Refer to the *Installation Quick Reference Card for VisualDSP++* for a detailed
   installation description.
   When installing VisualDSP++ 3.5 on Windows 2000, make sure
   the appropriate EZ-KIT Lite component is selected for the
   installation.

2. Connect the EZ-KIT Lite device to your PC's USB port.
   Windows 2000 automatically detects an EZ-KIT device and automatically installs the appropriate driver for the selected device (see
   step 1).

3. Verify the installation by following the instructions in "Verifying
   Driver Installation" on page 1-15.

Windows XP USB Driver

VisualDSP++ 3.5 installation software pre-installs the necessary drivers for
the selected EZ-KIT Lite. The install also upgrades an older driver if an
older driver be detected in the system.

> Prior to running the VisualDSP++ 3.5 installer, ensure that no
> other Hardware Wizard windows are running in the background.
> If a wizard window is running, close it before starting the installer.

To install the USB driver:

1. If VisualDSP++ 3.5 is already installed on your system, go to
   Step 2.
   Otherwise, run VisualDSP++ 3.5 installation. Refer to the *Installation Quick Reference Card for VisualDSP++* for a detailed installa-

tion description. When installing VisualDSP++ 3.5 on a Windows XP operating system, ensure that the appropriate EZ-KIT Lite component is selected for the installation.

2. Connect the EZ-KIT Lite device to your PC's USB port. Connecting the device to the USB activates the **Windows XP Found New Hardware Wizard**as shown in Figure 1-9.

Figure 1-9. Windows XP Found New Hardware Wizard

3. Select **Install the software automatically (Recommended)** and click **Next**.
When Windows XP completes the driver installation for the selected device (see step 1), the window shown in Figure 1-10 appears on the screen.

Figure 1-10. Completing Driver Installation

   4. Verify the installation by following the instructions in "Verifying Driver Installation" on page 1-15.

Verifying Driver Installation

Before you use the EZ-KIT Lite evaluation system, verify that the USB driver software is installed properly:

   1. Ensure that the USB cable is connected to the evaluation board and the PC.

   2. Press the **RESET** button (S1) on the evaluation board.

   3. Verify that the red USB monitor LED (CR7) is lit. This signifies that the board is communicating properly with the host PC, and is ready to run VisualDSP++.

Starting VisualDSP++

In order to start debugging, you must first set up a debug session in Visu-alDSP++. To set up a session:

1. Verify that the red USB monitor LED (CR7) is lit.

2. Hold down the **Control** (**CTRL**) key.

3. Click the **Start** button on the Windows taskbar, and then choose **Programs**-->**Analog Devices**-->**VisualDSP++ 3.5 for 16-bit Pro-cessors**-->**VisualDSP++ Environment**.
    If you are running VisualDSP++ for the first time, go to step 4.
    If you already have existing sessions, the **Session List** dialog box appears on the screen.

4. Click **New Session**.

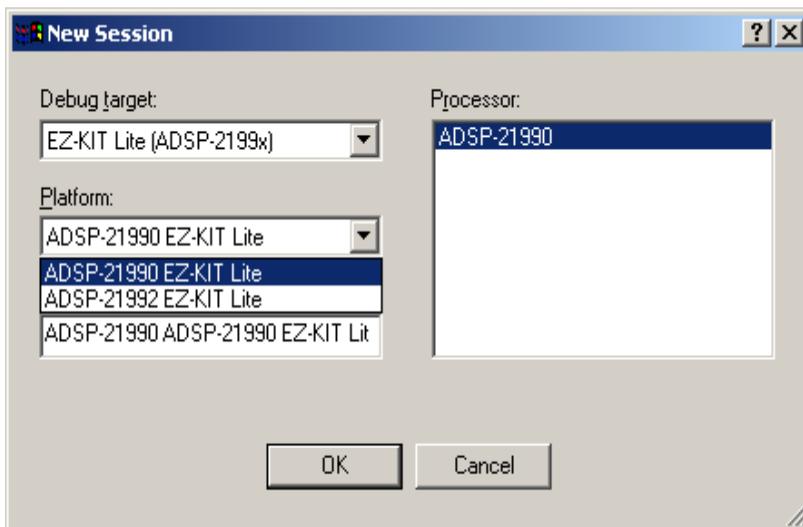5. The **New Session** dialog box, similar to Figure 1-11, appears.

Figure 1-11. New Session Dialog Box

6. In **Debug Target**, choose **EZ-KIT Lite (ADSP-21992)**.

7. In **Processor**, choose **ADSP-21992**.

8. Type a new target name in **Session Name** or accept the default name.

9. Click **OK** to return to the **Session List** dialog box.

10. Highlight the new session and click **Activate**.

Installation Tasks

2   USING THE EZ-KIT LITE

This chapter provides specific information to assist you with developing programs for the ADSP-21992 EZ-KIT Lite evaluation board. The following sections are provided.

- "EZ-KIT Lite License Restrictions" on page 2-2

  Describes the restrictions of the EZ-KIT Lite demo license.

- "Restricted Software Breakpoints" on page 2-2

  Provides information about the example programs included in the ADSP-21992 EZ-KIT Lite evaluation system.

- "Memory Map" on page 2-3

  Defines the memory map to assist in developing programs for the EZ-KIT Lite evaluation system.

- "Using Programmable Flag Pins" on page 2-5

  Describes the function and use of the programmable flag pins on the EZ-KIT Lite evaluation system.

- "Example Programs" on page 2-6

  Provides information about the example programs included in the ADSP-21992 EZ-KIT Lite evaluation system.

- "Using Flash Programmer Utility" on page 2-6

  Allows you to program flash memory.

For detailed information about programming the ADSP-21992 processor, see "Related Documents" on page -xv.

EZ-KIT Lite License Restrictions

The license shipped with the EZ-KIT Lite imposes the following restrictions.

- Program Memory (PM) space is limited to 8K words (1/4 of the ADSP-21992 PM space).

- No connections to simulator or emulator sessions are allowed.

Restricted Software Breakpoints

Under some conditions, breakpoints cannot effectively be placed.

Generally, the emulator or EZ-KIT Lite development system restricts breakpoint placement when certain conditions are met. These conditions depend on things such as bus architecture, pipeline depth, and ordering.

Software Breakpoints Within Delayed Slots

Software breakpoints within a delayed slot, such as within two instructions of a delayed branch, are restricted.

In the following example, placing a breakpoint at 100 is acceptable. However, a breakpoint's behavior at 101 or 102 is not defined and, therefore, is restricted.

```
100 IF EQ JUMP 0x0000    /* .+0  */ (DB);
101 NOP;
102 NOP;
```

Additionally, breakpoints within two instructions of an I/O access are restricted. In the following example, a breakpoint at 100 is acceptable, but a breakpoint at 101 or 102 is restricted.

```
100 DM(0x8000)=I0;    /* or I0=DM(0x8000); */
101 NOP;
102 NOP;
```

Memory Map

The ADSP-21992 processor has 48K words of internal SRAM that can be used for program storage or data storage. The configuration of internal SRAM is detailed in the *ADSP-2199x Mixed Signal DSP Controller Hardware Reference*.

The ADSP-21992 EZ-KIT Lite board contains 512K x 8 bits of external Flash memory. These flash memory ICs are connected to the boot memory select (BMS) pin or the memory select 0 (MS0) pin via a two-input AND gate (U1). Jumper JP31 is placed on the MS0 line to disconnect the MS0 pin if required. The flash memory can be accessed in either the boot memory space or the external memory space.

If booting from the external flash memory IC, JP31 can be left open. In this case, the external SRAM provided on the ADSP-21992 EZ-KIT Lite board can be mapped to any of the external memory banks using one of the jumpers (JP24 - JP27).

If not booting from the flash memory, but using it as external program or data memory, JP31 must be closed. In this case, do not map the external SRAM provided on the ADSP-21992 EZ-KIT Lite board to external memory bank 0 (JP24 should be open in this case); instead, map it to any of the other external memory banks using one of the jumpers (JP25 - JP27).

ⓘ Only 8K of program memory is available in the EZ-KIT Lite software.

Map the external memories provided on the ADSP-21992 EZ-KIT Lite to the start address of the chosen external memory bank.

Table 2-1. EZ-KIT Lite Evaluation Board Memory Map

Start Address		End Address	Page	Content
Internal Memory	0x00 0000	0x00 7FFF	0	32K x 24-bit program memory (internal)
	0x00 8000	0x00 BFEF	0	16K x 16-bit data memory (internal)
	0x00 0000	0x00 FFFF	05	Reserved (16K)
External Memory (at reset)	0x01 0000	0x3F FFFF	1–63	External Memory (Bank 0)
	0x40 0000	0x7F FFFF	64-127	External Memory (Bank 1)
	0x80 0000	0xBF FFFF	128–191	External Memory (Bank 2)
	0xC0 0000	0xFE FFFF	192–254	External Memory (Bank 3)
Reserved	0xFF 0000	0xFF 0FFF	255	4K x 24-bit Boot ROM (internal)
	0xFF 1000	0xFF FFFF	255	RESERVED (Internal)
	0x08 0000	0x0F FFFF	8–15	512 x 8 Flash Memory
	0x10 0000	0xFE FFFF	1–254	Boot Memory
I/O Memory	0x00 0000	0x00 1FFF	0–7	16-Bit Internal I/O Memory
	0x00 2000	0x03 FFFF	8–255	16-Bit External I/O Memory

Although the Flash memory starts at address 0x01 0000 in the Boot Memory Space, address 0x00 0000 is put on the address bus during EPROM boot.

Using Programmable Flag Pins

The ADSP-21992 DSP has eight asynchronous Programmable Flag (PF) I/O pins (PF7-0) that let you interact with the running program. Data pins 8-15 can also be used as Programmable Flag pins, depending on the configuration of the DSP.

During reset, the flag pins (PF7-0) are used to set the multiplication factor, which sets the core clock frequency. After the DSP is reset, the flags are configured as inputs. The direction of the flags is configured though the DIR register and are set and read though the FLAGC/S register. For more information on configuring the flag pins, see the *ADSP-2199x Mixed Signal DSP Controller Hardware Reference*. Flags and their uses are described in Table 2-2.

Table 2-2. Programmable Flag Pin Summary

Flag	Connected To	Description
PF0	LED8	PF3-0 are connected to the LEDs. They supply feedback for program execution. For instance, you can write your code to trigger a flag (and the corresponding LED) when a routine is complete.
PF1	LED9	
PF2	LED10	
PF3	LED11	
PF4	SW3 – Push button	PF5-4 are connected to the push buttons on the EZ-KIT Lite board and are for user input. For instance, you can tell your program to poll for a flag and when it occurs, do other operation, such as to jump to another instruction.
PF5	SW2 – Push button	
PF6	AD1803 Reset	PF6 is connected to the AD1803 telephony codec reset, and can be used to put the chip in reset.
PF7	AD1885 Reset	PF7 is connected to the AD1885 audio codec reset, and can be used to put the chip in reset.

ⓘ All the programmable flags are available on connector P9.

Example Programs

Example programs are provided with the ADSP-21992 EZ-KIT Lite to demonstrate various capabilities of the evaluation board. These programs are installed with the EZ-KIT Lite software and can be found in:

`<install path>\219x\EZ-KITs\ADSP-21990\Examples`

Please refer to the `readme` file provided with each example for more information.

Using Flash Programmer Utility

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

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

3 EZ-KIT LITE HARDWARE REFERENCE

This chapter describes the hardware design of the ADSP-21992 EZ-KIT Lite board. The following topics are covered.

- "System Architecture" on page 3-2

  Describes the configuration of the ADSP-21992 EZ-KIT Lite board and explains how the board components interface with the processor.

- "Jumper Settings" on page 3-11

  Shows the location and describes the function of the configuration jumpers.

- "Connectors" on page 3-18

  Shows the location, description, and pin-out of all connectors on the board. Also, the manufacturer and part number information is given for the mating parts.

- "Mechanical Dimensions" on page 3-27

  Provides board power requirements and mechanical locations of components of the board.

System Architecture

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

The EZ-KIT Lite development system has been designed to provide access to all the capabilities of the ADSP-21992 processor. For information about configuring the boot mode, refer to "Boot Mode and Bypass Mode Select Jumpers (JP9-JP12)" on page 3-16.

The processor core voltage is 2.5V, and the external interface operates at 3.3V. The analog input signal conditioning circuitry requires ±2.5V.

Power Supplies

Linear regulators are provided on the ADSP-21992 EZ-KIT Lite board for the 2.5V and 3.3V required by the ADSP-21992 from a 5V source. The linear regulators also provide the power for the digital peripheral circuitry on the ADSP-21992 EZ-KIT Lite board.

Linear regulators are also provided for the ±2.5V from ±5V sources, required by the analog input signal-conditioning circuitry. Appropriate decoupling capacitors are provided on the ADSP-21992 EZ-KIT Lite board for all power supply inputs (VDD, +AVDD, and -AVDD) to reduce noise coupling from the external power supplies. However, for best performance, well-regulated external power supplies and correct wiring are recommended.

The ADSP-21992 EZ-KIT Lite board is laid out with separate analog and digital ground planes, labeled AGND and DGND, respectively. `JP1` is a link that connects the analog and digital ground planes of the ADSP-21992 EZ-KIT Lite board.

(i) For correct operation, do not remove this link.

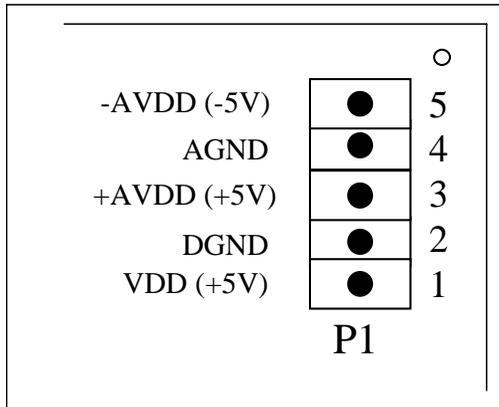The arrangement on the input power supply connector is illustrated in Figure 3-1.

Figure 3-1. Power Supply Connector

LEDs are provided to indicate that the power supplies are working correctly. Power supply LEDs are listed in Table 3-1 on page 3-3.

Table 3-1. Power Supply LEDs

LED	Power Supply Signal
CR1	+2.5V (DSP core voltage supply)
CR2	+3.3V (Vddext)
CR3	+2.5V (+AVdd)
CR4	-2.5V (-AVdd)

Reset Generation

The ADSP-21992 can be reset from a number of sources on the ADSP-21992 EZ-KIT Lite board. The sources of reset for the ADSP-21992 DSP are:

- POR (power-on reset output pin of the ADSP-21992)

- Reset button (S1)

- External power on reset IC (A7)

- USB Interface (software tools reset)

Choose the source of reset for the ADSP-21992 by configuring jumper JP2. When JP2 is in the 2-3 position, the POR output pin of the ADSP-21992 is tied to the reset pin of the ADSP-21992. When JP2 is in the 1-2 position, the source of reset for the ADSP-21992 is the reset button (S1), the external power-on reset IC (ADM708), or a reset command from VisualDSP++ through the USB interface. Position 1-2 (default) is recommended when using the VisualDSP++ development tools.

Analog Input Interface

The ADSP-21992 EZ-KIT Lite board permits up to eight analog inputs to be fed from the analog inputs connector (P4) to the eight ADC channels of the ADSP-21992. All eight analog inputs at the analog inputs connector may range from -1V to +1V.

There is a separate interface circuit for each of the eight ADC channels of the ADSP-21992. These analog interface circuits convert the nominal ±1V signals at the analog inputs connector P4 to signals centered on the ADSP-21992 reference voltage level (either the internally derived 1.0V level or the externally provided 1.024V level). The analog interface circuits, consisting of high-performance operational amplifiers and precision resistors, effectively offset the analog inputs by the reference voltage level.

Two AD8044 quad operational amplifiers (A5 and A6) are used for the analog interface and are configured as summing unity-gain stages. A5 is used to interface the VIN0, VIN1, VIN2, and VIN3 analog inputs. A6 is used to buffer the VIN4, VIN5, VIN6, and VIN7 inputs.

Precision 10 Kohm resistors for input and feedback ensure accurate gain matching of all channels. In addition, 47 pF feedback capacitors provide simple low-pass filtering with a very high cut-off frequency (339 kHz) on all analog inputs.

The analog inputs are applied to the ADSP-21992 in a single-ended fashion, so that the inverting inputs to the sample-and-hold amplifiers of the ADSP-21992 (ASHAN and BSHAN) are connected to a buffered version of the reference voltage. A representation of the analog interface circuit for one of the ADC channels is shown in Figure 3-2. As shown in the schematics at the end of this document, each analog input stage also contains a small RC filter at the operational amplifier output.
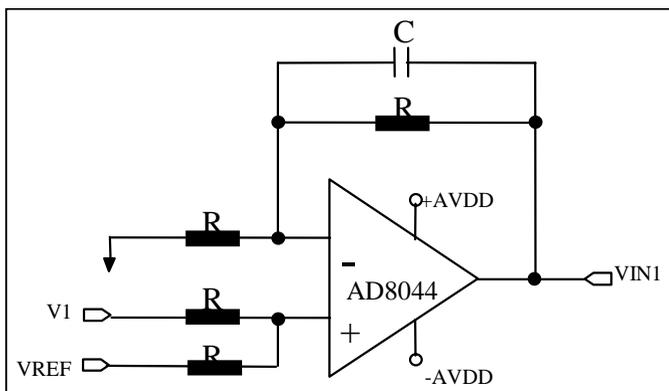
Figure 3-2. One Analog Interface Circuit

Reference Voltage Generation

The ADSP-21992 EZ-KIT Lite board contains an external voltage reference, the LM4140-1.0 (U3), which provides a precise 1.024V output. The ADSP-21992 EZ-KIT Lite board can be configured to operate from the internal (ADSP-21992 generated) or the external voltage reference. Two jumpers control the selection of the internal or external voltage reference.

Jumper JP3 ties the SENSE pin of the ADSP-21992 to the AVDD or GND levels. Connecting SENSE to AVDD (JP3 in position 2-3) selects external voltage reference operation. In this mode, the ADSP-21992 accepts an input voltage reference at the VREF pin.

To connect the external voltage reference to the ADSP-21992 on the evaluation board, close the JP4 jumper. This connects the external voltage reference from the LM4140-1.0 to the VREF pin of the ADSP-21992. The signal, which is buffered using an operational amplifier OP193 (A11), level-shifts the applied analog input signals on the analog inputs connector, P4, (as well as being connected to the ASHAN and BSHAN inputs to the sample-and-hold amplifiers).

To operate with the internally derived voltage reference of the ADSP-21992, tie the JP3 jumper in position 1-2 to connect the SENSE pin to AGND. Additionally, leave jumper JP4 open. The ADSP-21992 provides a 1V reference at the VREF pin that is buffered and applied to the ASHAN and BSHAN inputs. The buffered VREF signal is also used in the level-shifting circuitry.

See for more information.

External Memory Interface (EMI)

A 64K x 16-bit SRAM IC (U8) is provided on the External Memory Interface (EMI) of the ADSP-21992 EZ-KIT Lite board.

Sockets are provided on the ADSP-21992 EZ-KIT Lite board so that the EMI can also be connected to two 512K x 8-bit flash memory ICs (U5 and U6). These Flash memory ICs are connected to the boot memory select pin ($\overline{BMS}$) and the memory select 0 pin ($\overline{MS0}$), allowing the Flash memory to boot the DSP as well as store information during normal operation. 8-bit-wide (and 16-bit, if implemented in boot ROM) booting is possible. Refer to "Memory Map" on page 2-3 for information about the location of the flash memory in the DSP's memory map.

Jumpers are provided to allow mapping RAM into different banks. A two-nput AND gate with a jumper allows mapping the Flash memory into boot memory space or $\overline{MS0}$.

All address, data, and control signals are available externally on a connector. The pin-out of the EMI connector (P3) can be found in the schematics in the Appendix.

SPI Interface

The SPI signals (MISO, MOSI, and SCK) are available on connector P7.

SPI EEPROM

A socket for an 8-pin SPI Serial EEPROM (64K x 8-bit), such as the Microchip 25LC640, is provided on the ADSP-21992 EZ-KIT Lite board, for booting and/or data storage. The PF1/ SPISEL1 pin of the ADSP-21992 is used to select the SPI Serial EEPROM to be active on the SPI interface. Jumper JP14 is used to disable the EEPROM when the PF1/ SPISEL1 pin of the ADSP-21992 is being used as a programmable flag pin.

SPI Digital-to-Analog Converter

An 8-channel, serial, 12-bit DAC (A9) is provided on the ADSP-21992
EZ-KIT Lite board. The PF2/ SPISEL2 pin of the ADSP-21992 is used to
select the DAC (AD5328BRU) to be active on the SPI interface. PF3 is
used to update the DAC registers. Two jumpers (JP15 and JP16) are used
to disable the DACs when the PF2 and PF3 pins are being used as program-
mable flag pins.

The outputs of the DAC are available at connector P5. Refer to Table 3-5
on page 3-20 for the configuration of P5.

CAN Interface

A CAN transceiver IC (U2) is provided on the SPI Interface. The CAN
transceiver IC converts the input and output to the CAN bus voltages lev-
els. Connectors P12 and P13 provide connections to the user's CAN bus
and allow easy daisy-chaining of CAN devices. CAN bus termination of
120 ohms can be provided by closing jumper JP23.

Serial Port (SPORT) Interface

All programmable flag pins are available on connector P8. Refer to
Table 3-3 on page 3-19 for the configuration of P8.

Circuitry is also provided on the ADSP-21992 EZ-KIT Lite board to
allow you to use the SPORT for RS-232 emulation. An ADM3202ARN
line driver/receiver (A4) is provided to convert the SPORT signals to the
appropriate ±10V levels suitable for the UART connection to the PC. A
standard 9-pin female D-sub socket, P9, is provided on the ADSP-21992
EZ-KIT Lite board.

Jumpers JP18, JP19, and JP20 connect the SPORT signals to the RS-232
circuitry. All three jumpers must be closed to use the RS-232 interface
circuitry.

Programmable Flag Pins Interface

The SPORT pins are available at the SPORT interface connector (P2). Refer to Table 3-8 on page 3-22 for the configuration of P2.

PWM Generation Unit Interface

All six PWM output signals, AH-CL, are available at the PWM output connector (P10). The PWMSYNC output is also available at connector P10. A $\overline{\text{PWMTRIP}}$ input can be applied at connector P10. Refer to Table 3-10 on page 3-24 in section 4.4 for the configuration of P10.

Three jumpers are provided for the configuration of the PWM Generation Unit of the ADSP-21992. JP5 is used to enable/disable the $\overline{\text{PWMTRIP}}$ input. JP6 is used to enable/disable PWM switched reluctance mode. JP7 configures the polarity of the PWM output signals.

Auxiliary PWM Unit Interface

Both AUXPWM outputs signals (AUX0 and AUX1) are available on connector P10. An $\overline{\text{PWMTRIP}}$ input can be applied at connector P10. A jumper (JP8) is provided to enable/disable the $\overline{\text{PWMTRIP}}$ input signal. Refer to Table 3-10 on page 3-24 for the configuration of P10.

General-Purpose Timer Signals

The three general-purpose timer input/output signals (TMR0, TMR1, and TMR2) are available at connector P10. Refer to Table 3-10 on page 3-24 for the configuration of P10.

Encoder Interface Unit Circuitry

The ADSP-21992 EZ-KIT Lite board allows you to apply differential encoder signals to the board at the encoder interface connector (P6). A differential line receiver (A8) is provided to convert the differential encoder signals to single-ended signals for the EIU inputs of the ADSP-21992. Three jumpers (JP28, JP29, JP30) are provided to enable this encoder interface circuitry. It is also possible to apply encoder signals directly to the encoder interface of the ADSP-21992 at these jumpers when they are open.

JTAG Emulation Port

The JTAG emulation port allows an emulator to access the DSP's internal and external memory, as well as the special function registers. Refer to "JTAG Connector" on page 3-26 for information about the JTAG connector. To learn more about available emulators, contact Analog Devices.

Jumper Settings

This section describes the function and configurations of the jumpers on the ADSP-21992 EZ-KIT Lite board. Table 3-3 shows the location of all jumpers (`JP1-JP31`) on the ADSP-21992 EZ-KIT Lite board.
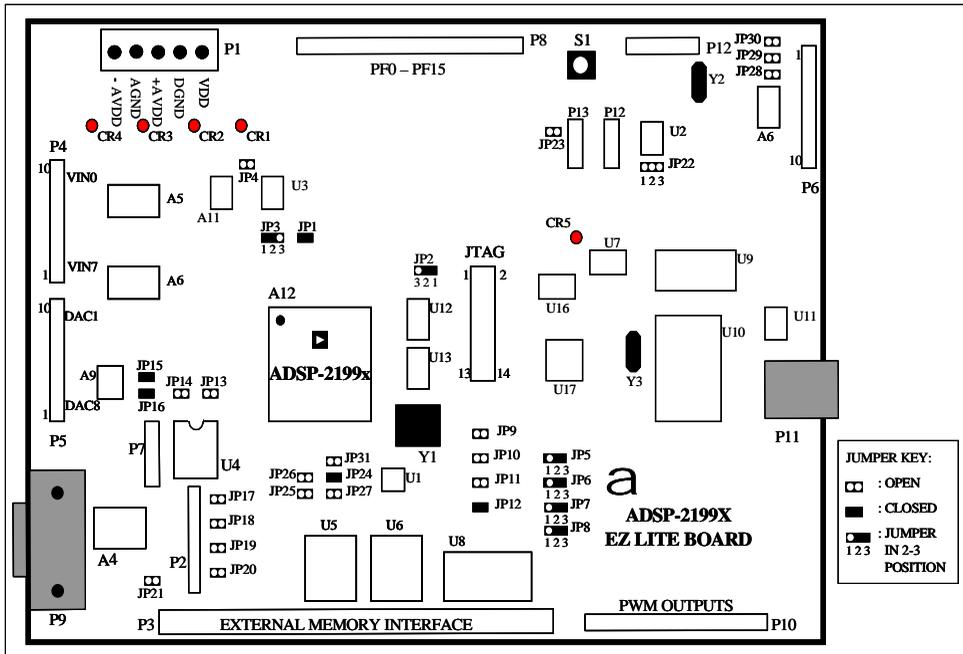
Figure 3-3. Jumper Locations

List of Jumpers

Table 3-2 lists the jumpers on the ADSP-21992 EZ-KIT Lite board. The Jumper Settings column shows the initial jumper configuration of the ADSP-21992 EZ-KIT Lite board (factory settings).

Table 3-2. Jumpers on the ADSP-21992 EZ-KIT Lite Board

Reference	Jumper Settings	Description
JP1	Closed	AGND / DGND ground link
JP2	1-2 position	Choice of reset
JP3	1-2 position	Internal/external Vref source
JP4	Open	Internal/external Vref source
JP5	1-2 position	Disable/enable PWMTRIP
JP6	1-2 position	PWM SR mode selection
JP7	1-2 position	PWM polarity selection
JP8	1-2 position	Disable/enable AUXTRIP
JP9	Open	Boot mode selection
JP10	Open	Boot mode selection
JP11	Open	Boot mode selection
JP12	Closed	PLL BYPASS mode
JP13	Open	SPI EEPROM select
JP14	Open	SPI EEPROM select
JP15	Closed	SPI DAC select
JP16	Closed	SPI DAC select
JP17	Open	TCLK0 / RCLK0 connection
JP18	Open	RS-232 circuit jumper
JP19	Open	RS-232 circuit jumper
JP20	Open	RS-232 circuit jumper

Table 3-2. Jumpers on the ADSP-21992 EZ-KIT Lite Board (Cont'd)

Reference	Jumper Settings	Description
JP21	Open	RS-232 circuit jumper
JP22	No shunt required	CAN circuitry jumper
JP23	Open	CAN circuitry jumper
JP24	Closed	External SRAM memory IC select
JP25	Open	External SRAM memory IC select
JP26	Open	External SRAM memory IC select
JP27	Open	External SRAM memory IC select
JP28	Open	External interface circuitry jumper
JP29	Open	External interface circuitry jumper
JP30	Open	External interface circuitry jumper
JP31	Open	External Flash memory IC select

Ground Plane Link (JP1)

JP1 is a link that connects the analog and digital ground planes of the ADSP-21992 EZ-KIT Lite board.

(i) For correct operation, do not remove this link.

External/Internal DSP Reset Selection Jumper (JP2)

JP2 enables you to select the source of reset for the ADSP-21992. When JP2 is in the 1-2 position, the ADSP-21992 can be reset from three external sources: pushbutton switch (S1), the external power-on reset IC (ADM708), or the USB interface circuitry on the ADSP-21992 EZ-KIT Lite board.

If `JP2` is in the 2-3 position, the power-on reset (POR) of the ADSP-21992 is directly connected to the reset pin of the ADSP-21992. The 1-2 position (default) is the recommended configuration when using the VisualDSP++ development tools.

Voltage Reference Selection Jumpers (JP3, JP4)

The configuration of two jumpers (`JP3` and `JP4`) is required to control the selection of the ADSP-21992 DSP's internal voltage reference or the external voltage reference provided on the ADSP-21992 EZ-KIT Lite board. The appropriate settings for the jumpers to select internal or external voltage reference operation are:

- Internal reference: `P3` in position 1-2, and `JP4` is open

- External reference: `P3` in position 2-3, and `JP4` is closed

Refer to "Reference Voltage Generation" on page 3-6 for details on voltage voltage operation.

PWM Trip Jumper (JP5)

Connecting jumper `JP5` in the 2-3 position ties the $\overline{\text{PWMTRIP}}$ pin of the ADSP-21992 to +3.3V via a 4.7 Kohm resistor and enables the `PWM` outputs. In this case, the $\overline{\text{PWMTRIP}}$ pin of the ADSP-21992 can be defined by external circuitry via the `PWM` connector (`P10`). Alternatively, connecting jumper `JP5` in the 1-2 position connects the $\overline{\text{PWMTRIP}}$ pin of the ADSP-21992 to `GND`, thereby permanently disabling the `PWM` outputs. A third alternative is to leave `JP5` unconnected. Again, in this case, the pin of the ADSP-21992 is connected to the `PWM` connector (`P10`) so that its value can be defined by external circuitry.

PWM Switched Reluctance Mode Jumper (JP6)

Connecting JP36 in the 2-3 position ties the $\overline{PWMSR}$ pin of the ADSP-21992 to +3.3V and disables the PWM switched reluctance mode. Alternatively, connecting JP6 in the 1-2 position ties the $\overline{PWMSR}$ pin of the ADSP-21992 to GND and enables PWM switched reluctance mode.

PWM Polarity Jumper (JP7)

Connecting JP7 in the 2-3 position ties the PWMPOL pin of the ADSP-21992 to +3.3V and enables active HI PWM outputs. Alternatively, connecting JP7 in the 1-2 position creates active LO PWM outputs from the ADSP-21992. The appropriate setting for this jumper is determined by the exact nature of the gate drive circuit of the target system. A third alternative is to leave JP5 unconnected. In this case, its state can be determined by external hardware.

AUXPWM Trip Jumper (JP8)

Connecting jumper JP8 in the 2-3 position ties the $\overline{AUXTRIP}$ pin of the ADSP-21992 to VDD and enables AUXPWM outputs. In this case, the $\overline{AUXTRIP}$ pin of the ADSP-21992 can be defined by external circuitry, via the PWM connector (P10). Alternatively, connecting jumper JP8 in the 1-2 position connects the $\overline{AUXTRIP}$ pin of the ADSP-21992 to GND, thereby permanently disabling AUXPWM outputs. A third alternative is to leave JP8 unconnected. Again, in this case, the $\overline{AUXTRIP}$ pin of the ADSP-21992 is connected to the PWM connector (P10) so that its value can be defined by external circuitry.

Boot Mode and Bypass Mode Select Jumpers (JP9-JP12)

The ADSP-21992 supports different boot modes, which are controlled by the three dedicated hardware boot mode control pins (BMODE2, BMODE1, and BMODE0). These modes can be selected by the configuration of the three 2-pin jumpers (JP9-JP11). The default setting for these three 2-pin jumpers is open, whereby no boot mode is selected.

The DSP provides a user-programmable (1x to 32x) multiplication of the input clock, including fractional values, to support 128 external-to-internal (DSP core) clock ratios. The BYPASS pin, MSEL6-0, and DF bits in the PLL configuration register, specify the PLL multiplication factor at reset. When JP12 is closed, BYPASS mode is selected (default).

SPI EEPROM Enable Jumpers (JP13, JP14)

A socket is available on the ADSP-21992 EZ-KIT Lite board for an 8-pin SPI Serial EEPROM, such as the Microchip 25LC640, which is used for booting and/or data storage. JP13 and JP14 are used to enable the SPI EEPROM. It is decoded at SPI slave select 1 via JP14. JP13 is used to enable/disable the write protection pin of the SPI EEPROM.

DAC Enable Jumpers (JP15, JP16)

JP13 and JP14 enable the 8-channel, serial, 12-bit DAC on the ADSP-21992 EZ-KIT Lite board. The DAC is decoded at SPI slave select 2, via JP15. PF3 is used to update the DAC register via JP16.

SPORT/UART Circuitry Jumpers (JP17-JP21)

Jumper JP17 connects the transmit clock of the Serial port to the receive clock of the Serial port.

Jumpers JP18-JP21 are used to configure the UART circuitry on the ADSP-21992 EZ-KIT Lite board. JP18-JP20 enable the UART circuitry, and JP21 enables the required loopback in the UART circuitry.

CAN Interface Jumpers (JP22-JP23)

A CAN transceiver (U2) is provided on the CAN interface. JP22 enables (2-3 position) or disables (1-2 position) the sleep mode on the CAN trans-ceiver. If no shunt is present, this mode can be defined by external circuitry. Connectors P12 and P13 provide connections to the user's CAN bus and allow easy daisy-chaining of CAN devices. CAN bus termination of 120 ohms is provided by closing jumper JP23.

External SRAM Enable Jumpers (JP24-JP27)

A 64K by 16-bit SRAM IC (U8) is provided on the External Memory Interface (EMI) of the ADSP-21992 EZ-KIT Lite board. External mem-ory space consists of four memory banks. Memory bank pins $\overline{MS3}$ through $\overline{MS0}$ select banks 3-0, respectively. JP24-JP27 map the external SRAM to $\overline{MS0}$, $\overline{MS1}$, $\overline{MS2}$, or $\overline{MS3}$.

(i) If using external SRAM, close only one of these 2-pin jumpers at any one time.

Encoder Interface Jumpers (JP28-JP30)

The ADSP-21992 EZ-KIT Lite board allows you to apply differential encoder signals to the board at the encoder interface connector (EIU), P6. A differential line receiver IC (A8) is provided to convert the differential encoder signals to single-ended signals for the EIU inputs of the ADSP-21992. Three 2-pin jumpers (JP28-JP30) are provided to enable this encoder interface circuitry. It is also possible to apply encoder signals directly to the Encoder Interface of the ADSP-21992 at these jumpers, when they are open (that is, when no shunt is installed).

External Flash Memory Enable Jumper (JP31)

Sockets are provided on the ADSP-21992 EZ-KIT Lite board to connect the External Memory Interface to two 512K x 8-bit Flash memory ICs (U5 and U6). These Flash memory ICs are connected to the boot memory select ($\overline{BMS}$) pin, or to the memory select 0 pin ($\overline{MS0}$) via a 2-input AND gate. Jumper JP31 is placed on the $\overline{MS0}$ line to disconnect the $\overline{MS0}$ pin if required.

Connectors

This section describes the function of the connectors on the ADSP-21992 EZ-KIT Lite board. Figure 3-4 shows the locations of connectors (P1-P13).
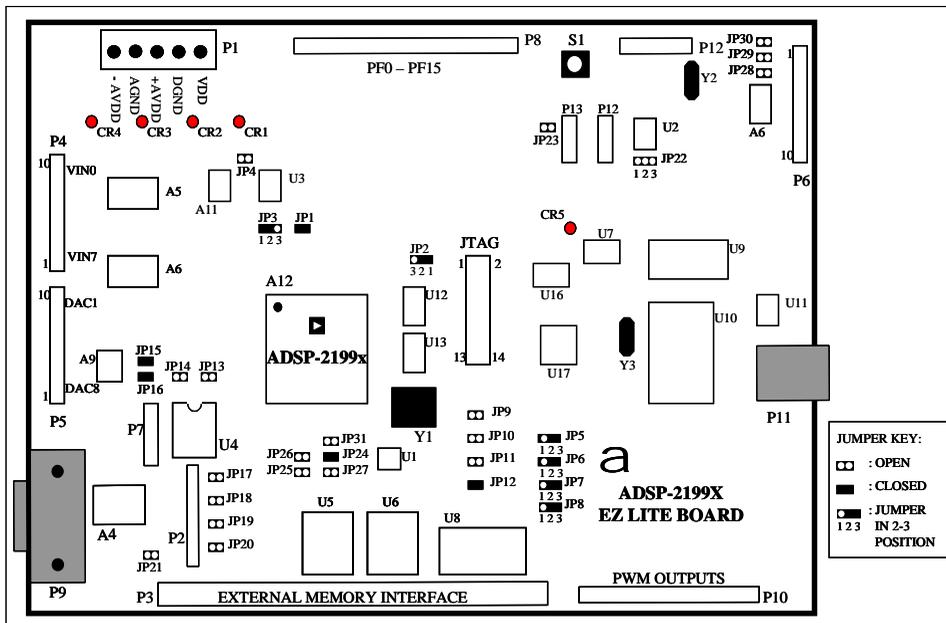
Figure 3-4. Connector Locations

Power Supply Connector (P1)

Refer to "Power Supplies" on page 3-2 for details of the input power supply connector (P1).

Serial Port Connector (P2)

The SPORT is connected to a 10-pin connector as shown in Table 3-3.

Table 3-3. SPORT Connector (P2)

Pins	Name	Signal
1	+3.3V	Vddext
2	DR	Receive data
3	DGND	Digital ground
4	DT	Transmit data
5	NC	No connection
6	+3.3V	Vddext
7	TCLK0	Transmit clock
8	TFS	Transmit frame sync
9	RFS	Receive frame sync
10	RCLK	Receive clock

External Memory Interface (EMI) Connector (P3)

Refer to the schematics in Appendix A, at the end of this document for the pinout of the EMI connector.

Analog Input Connector (P4)

Analog input signals to the ADSP-21992 EZ-KIT Lite board are supplied at the analog inputs connector (P4). Nominally, analog input signals between -1V and +1V may be applied to the ADSP-21992 EZ-KIT Lite board.

Table 3-4. Analog Input Connector (P4)

Pins	Name	Signal
1	AGND	Analog ground
2	VIN0	Analog input channel 0
3	VIN1	Analog input channel 1
4	VIN2	Analog input channel 2
5	VIN3	Analog input channel 3
6	VIN4	Analog input channel 4
7	VIN5	Analog input channel 5
8	VIN6	Analog input channel 6
9	VIN7	Analog input channel 7
10	AGND	Receive clock

DAC Outputs Connector (P5)

The outputs of the SPI DAC are brought out to the DAC outputs connector (P5) as shown in Table 3-5.

Table 3-5. DAC Outputs Connector (P5)

Pins	Name	Signal
1	AGND	Analog ground
2	DAC0	DAC channel 0

Table 3-5. DAC Outputs Connector (P5) (Cont'd)

Pins	Name	Signal
3	DAC1	DAC channel 1
4	DAC2	DAC channel 2
5	DAC3	DAC channel 3
6	DAC4	DAC channel 4
7	DAC5	DAC channel 5
8	DAC6	DAC channel 6
9	DAC7	DAC channel 7
10	AGND	Receive clock

Encoder Interface Connector (P6)

Differential encoder signals can be applied to the ADSP-21992 EZ-KIT Lite board at the encoder interface connector (P6) as shown in Table 3-6.

Table 3-6. Encode Interface Connector (P6)

Pins	Name	Signal
1	DGND	Digital ground
2	EIZ+	Differential north marker Z+
3	EIZ-	Differential north marker Z-
4	DGND	Digital ground
5	EIB+	Differential quadrature pulse input B+
6	EIB-	Differential quadrature pulse input B-
7	DGND	Digital ground
8	EIA+	Differential quadrature pulse input A+
9	EIA-	Differential quadrature pulse input A-
10	DGND	Digital ground

SPI Connector (P7)

The SPI signals are made available at the SPI connector (P7) as shown in Table 3-7.

Table 3-7. SPI Connector (P7)

Pins	Name	Signal
1	DGND	Digital ground
2	SCK	Clock
3	MISO	Master In Slave Out
4	MOSI	Master Out Slave In
5	DGND	Digital ground
6	DGND	Digital ground

Programmable Flag Interface Connector (P8)

All programmable flag pins and the external ADC conversion start pin are available on the programmable flag interface connector (P8) as shown in Table 3-8.

Table 3-8. Programmable Flag Interface Connector (P8)

Pin	Name	Signal
1	+3.3V	Vddext
2	PF0	Programmable flag 0
3	PF1	Programmable flag 1
4	PF2	Programmable flag 2
5	PF3	Programmable flag 3
6	PF4	Programmable flag 4
7	PF5	Programmable flag 5

Table 3-8. Programmable Flag Interface Connector (P8) (Cont'd)

Pin	Name	Signal
8	PF6	Programmable flag 6
9	PF7	Programmable flag 7
10	DGND	Digital ground
11	PF8	Programmable flag 8
12	PF9	Programmable flag 9
13	PF10	Programmable flag 10
14	PF11	Programmable flag 11
15	PF12	Programmable flag 12
16	PF13	Programmable flag 13
17	PF14	Programmable flag 14
18	PF15	Programmable flag 15
19	CONVST	ADC external convert start
20	DGND	Digital ground

UART (RS-232) Interface Connector (P9)

A standard female RS-232, D-sub, 9-pin connector is used for the UART interface circuitry on the ADSP-21992 EZ-KIT Lite board. Refer to .

Table 3-9. UART (RS-232) Interface Connector (P9)

Pin	Name	Signal
1	1-4-6	
2	T1O	Transmit
3	R1E	Receive
4	1-4-6	

Table 3-9. UART (RS-232) Interface Connector (P9) (Cont'd)

Pin	Name	Signal
5	DGND	Digital ground
6	1-4-6	
7	RTS	
8	CTS	
9	NC	No connection

PWM, AUXPWM, Timer Interface Connector (P10)

The PWM, AUXPWM, and general-purpose timer signals are available on P10. Refer to Table 3-10.

Table 3-10. PWM, AUXPWM, TMR Interface Connector (P10)

Pin	Name	Signal
1	AH	PWM channel A high output
2	AL	PWM channel A low output
3	BH	PWM channel B high output
4	BL	PWM channel B low output
5	CH	PWM channel C high output
6	CL	PWM channel C low output
7	$\overline{\text{PWMTRIP}}$	PWM trip input
8	PWMSYNC	PWM synchronization signal
9	DGND	Digital ground
10	AUX0	Auxiliary PWM output
11	AUX1	Auxiliary PWM output
12	DGND	Digital ground
13	$\overline{\text{AUXTRIP}}$	Auxiliary PWM trip input

Table 3-10. PWM, AUXPWM, TMR Interface Connector (P10) (Cont'd)

Pin	Name	Signal
14	TMR0	General-purpose timer I/O
15	TMR1	General-purpose timer I/O
16	TMR2	General-purpose timer I/O

USB Connector (P11)

The USB connector is a standard type B USB receptacle.

Table 3-11. USB Connector (P11)

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 EZ-KIT Lite	Assmann	AK672-5
	Digi-Key	AK672-5ND

CAN Interface Connectors (P12, P13)

There are two connectors associated with the CAN interface circuitry on the ADSP-21992 EZ-KIT Lite board. Connectors P12 and P13 provide connections to the user's CAN bus and allow easy daisy-chaining of CAN devices.

Table 3-12. CAN Interface Connectors (P12, P13)

Pin	Name	Signal
1	DGND	Digital ground
2	CANL	CAN receive

Table 3-12. CAN Interface Connectors (P12, P13) (Cont'd)

Pin	Name	Signal
3	CANH	CAN transmit
4	+3.3V	Vddext

JTAG Connector

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.

Mechanical Dimensions

Figure 3-5 shows the board's dimensions in inches.
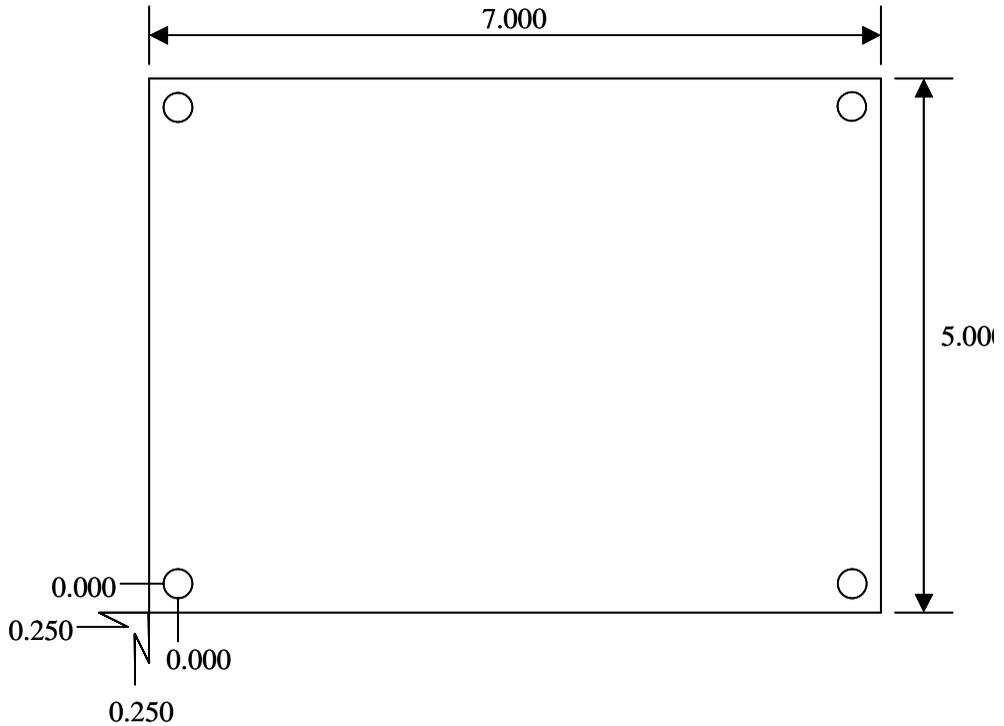
Figure 3-5. Mechanical Dimensions (in Inches)

Mechanical Dimensions

D

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	ORIGINATION		
	UPDATES TO SCHEMATIC TEMPLATE	9/00	

C

NOTE:

THIS TEMPLATE COMPLIES WITH WILMINGTON
ANALOG DEVICES CONFIGURATION.

B

PART NO	DESCRIPTION		REF DES		NOTES
HIGHEST REF DES USED					

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES

TOLERANCES
DECIMALS　FRACTIONS　ANGLES
.XX +-.010　+-1/32　+-2
.XXX +-.005

SCHEMATIC

ANALOG
DEVICES

804 WOBURN ST
WILMINGTON, MA 01887

	APPROVAL	DATE	TITLE
MATERIAL	DRAWN BY: S. FRANCIS	9/02	ADSP-2199X EZ-LITE BOARD
	DESIGNED BY:		A0170-2001
REF DES NOT USED	CHECKED:		
	APPROVED BY:		
FINISH	MFG ENGINEER:		

SIZE	FSCM NO	DRAWING NUMBER	REV
B		02-008057	B

| DO NOT SCALE | | SCALE　NONE | SHEET 1 OF 10 |

A

ADSP-2199X EZ-LITE BOARD
A0170-2001
Analog Devices Proprietary Information

ANALOG
DEVICES

804 WOBURN STREET
WILMINGTON, MA 01887

SIZE D

FSCM NO

DRAWING NUMBER
02-007802

REV B

DRAWN BY: S.FRANCIS

APPROVED BY:

SCALE NONE

DO NOT SCALE

SHEET 2 OF 10

ADSP21992YST
TQFP176

A12
VAL

A1
ADP3338AKC-2.5
IN   OUT
GND   NC

C58 C10
10UF 0.1UF

R93
0
-2.5V

DGND

A2
ADP3338AKC-3.3
IN   OUT
GND   NC

C59 C11
10UF 0.1UF

R94
0
+3.3V

LUMBERGKRM2
P1
VDD   1
DGNDSUPPLY 2

P1A
+AVDDSUPPLY 1
AGNDSUPPLY   2
-AVDDSUPPLY 3
LUMBERGKRM3

A3
ADP3338AKC-2.5
IN   OUT
GND   NC

C12
10UF 0.1UF

R95
0
+AVDD

R1
30S

R2
30S

R3
30S

R4
30S

CR1
RED

CR2
RED

CR3
RED

CR4
RED

DGND

JP1
AGND   DGND

LM337LM
VIN1
VIN2
VIN3
VIN
ADJ
OUT

R5 240

R6 240

C58 C13
10UF 0.1UF

R96
0
-AVDD

AGND

Power   Supplies

ADSP-2199X EZ-LITE BOARD
A0170-2001
Analog Devices Proprietary Information

SIZE D   F9CM NO   DRAWING NUMBER 02-007802   REV B
DRAWN BY: S.FRANCIS   APPROVED BY:
SCALE   NONE   DO NOT SCALE   SHEET 3 OF 10

Reset
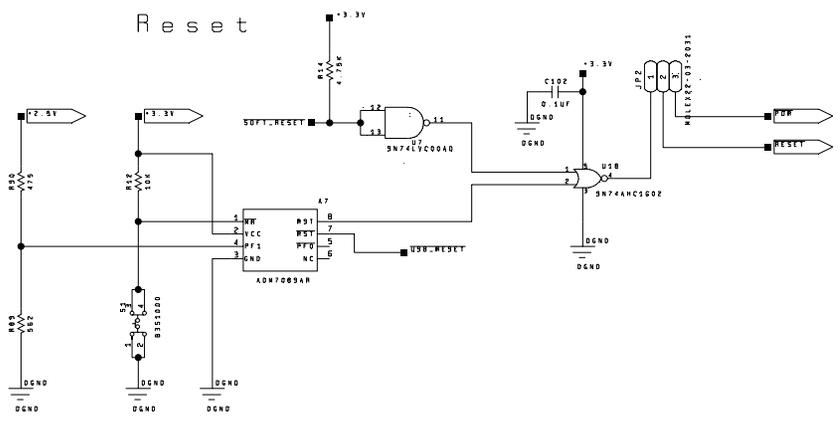
Oscillator Circuitry

NOTE: SOCKET
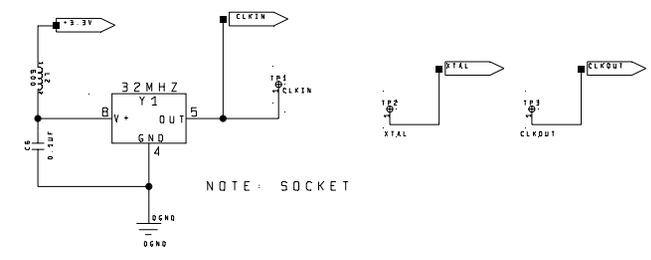
Boot Mode Selection & PLL Bypass
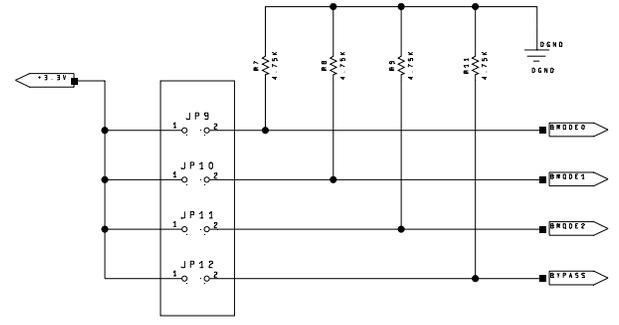
ANALOG
DEVICES

804 WOBURN STREET
WILMINGTON, MA 01887

SIZE D   FSCM NO   DRAWING NUMBER 02-007802   REV B

DRAWN BY: S. FRANCIS   APPROVED BY:

SCALE NONE   DO NOT SCALE   SHEET 4 OF 10

Analog Signal Conditioning

Reference Voltage
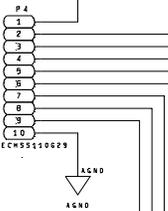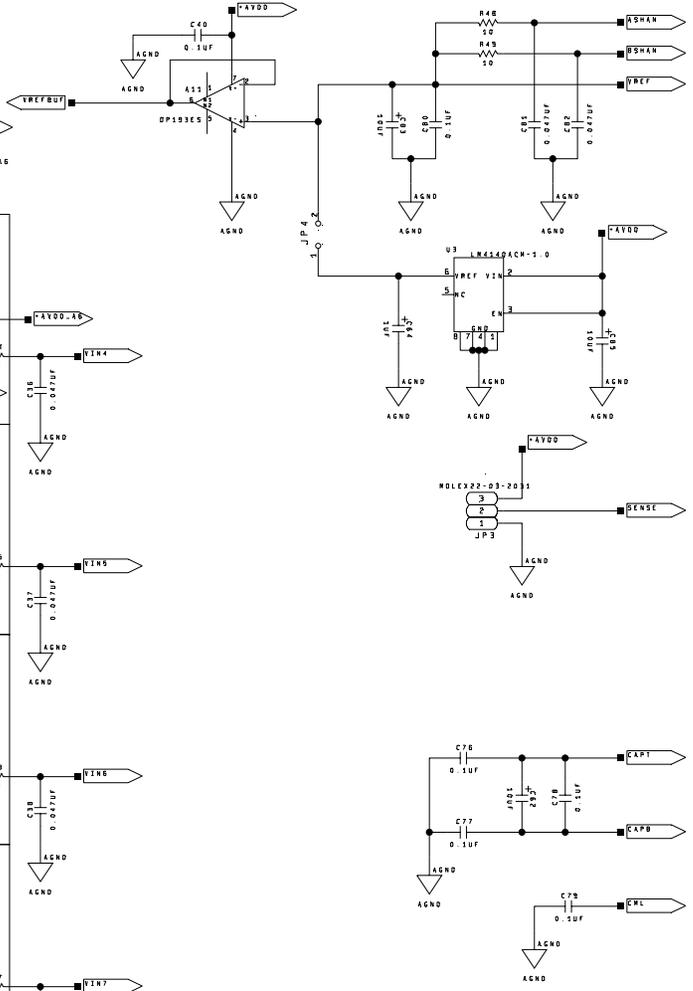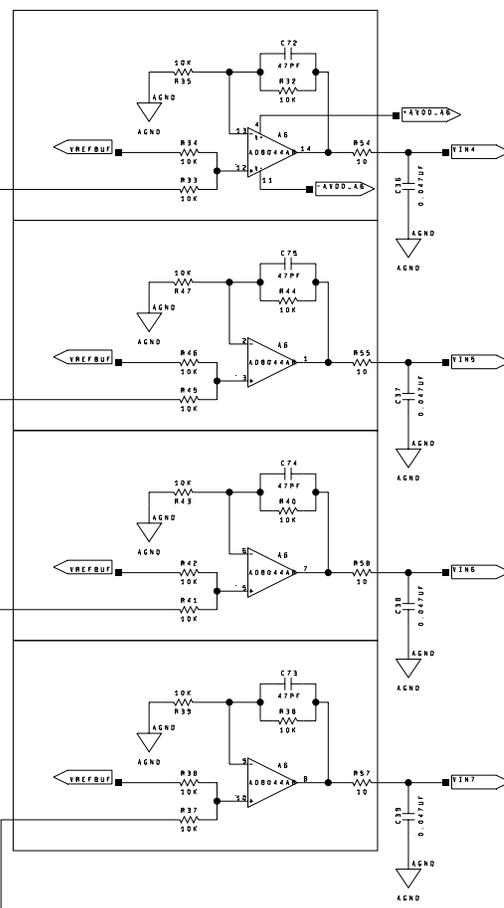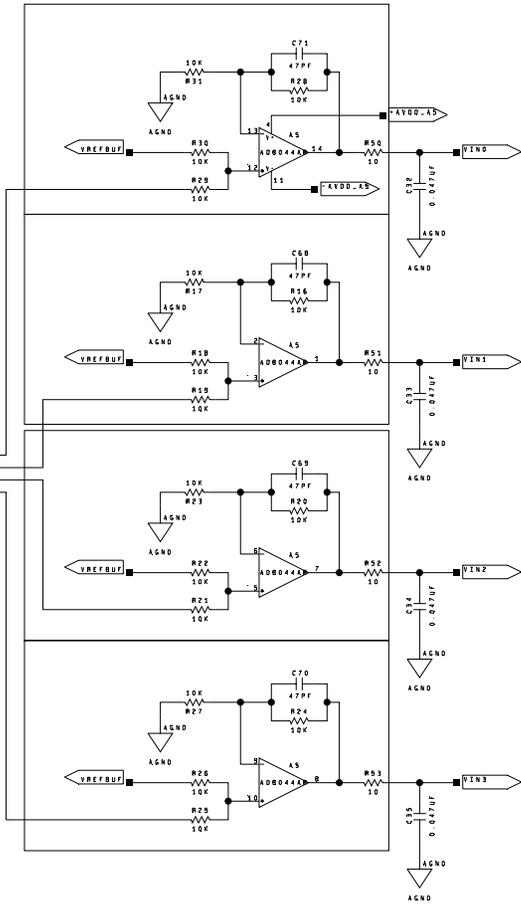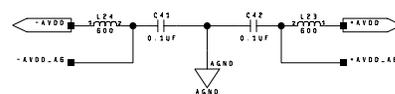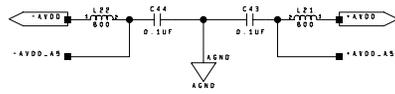
ADSP-2199X EZ-LITE BOARD
A0170-2001
Analog Devices Proprietary Information

ANALOG
DEVICES

804 WOBURN STREET
WILMINGTON, MA 01887

SIZE	FSCM NO	DRAWING NUMBER	REV
D		02-007802	B

DRAWN BY: S.FRANCIS
APPROVED BY:
SCALE   NONE
DO NOT SCALE
SHEET 9 OF 10

SCK
MISO
MOSI

PF1
PF2
PF3

+3.3V

JP15
1 2

JP16
1 2

+AVDD

R75
XTAL1
BOO

C46
0.1UF

AGND

AGND
AGND

JP14
1 2

R31
4.75K

+3.3V

A9
16 SCLK   LDAC 1
15 DIN   SYNC 2
14 GND   VDD 3
13 VOUTH   VOUTA 4
12 VOUTG   VOUTB 5
11 VOUTF   VOUTC 6
10 VOUTE   VOUTD 7
9 VREF2   VREF1 8
ADS328BRU

AGND

AGND

P5
1
2
3
4
5
6
7
8
9
10

SAMTECHSS110G29

AGND

VREFBUF

+3.3V

R76
XTAL1
BOO

JP13
1 2

U4
1 CS   VCC 8
2 SO   HOLD 7
3 WP   SCK 6
4 VSS   SI 5

25AA640IP

10K
R59

RESET

R58
10K

C45
0.1UF

DGND

SAMTEC1SX108GBB0B5SBP1N
6 5 4 3 2 1
P7

DGND
DGND

DGND
DGND

DGND

DGND
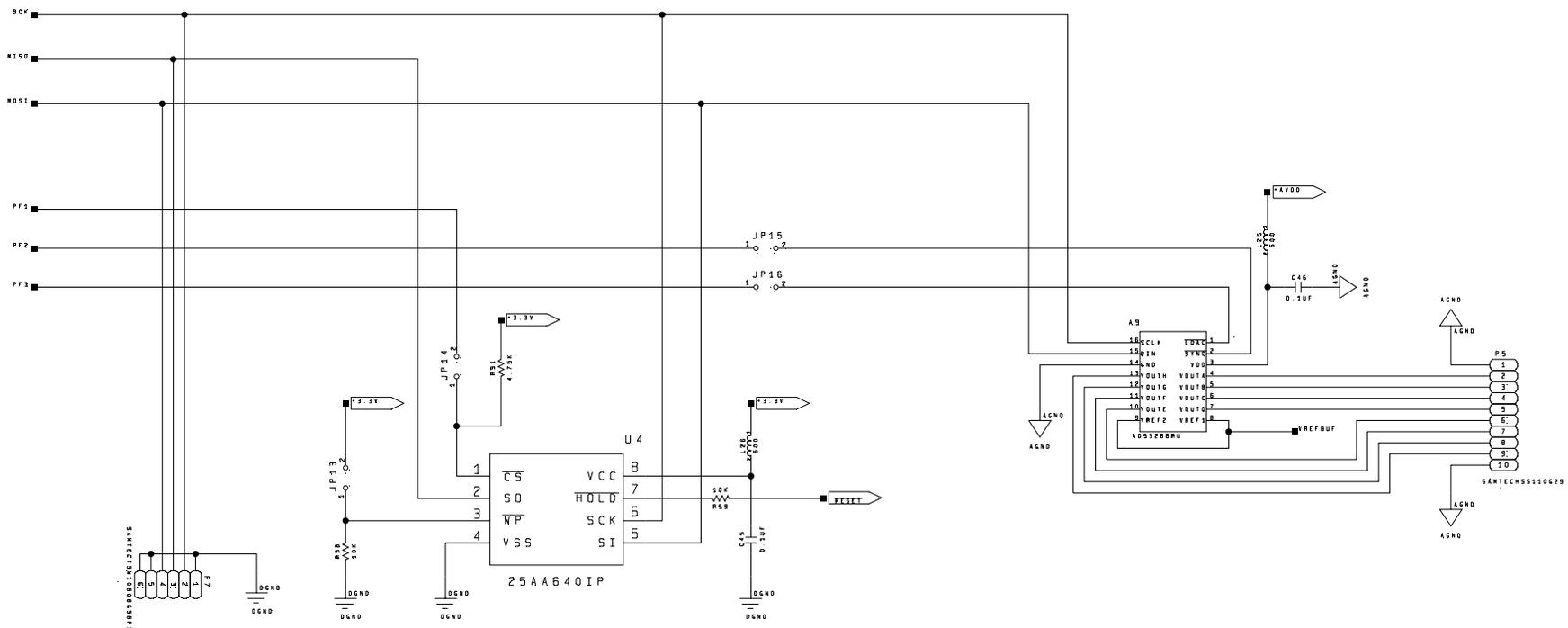
SPI EEPROM

DAC CIRCUITRY

ADSP-2199X EZ-LITE BOARD
A0170-2001
ANALOG DEVICES PROPRIETARY INFORMATION

SPORT Interface

UART Interface

JP18

JP19

JP20

JP17

ADM3202ARN   A4

1	C1+	VCC	16
3	C1-	V+	2
4	C2+		
5	C2-	V-	6
11	T1IN	T1OUT	14
10	T2IN	T2OUT	7
12	R1OUT	R1IN	13
9	R2OUT	R2IN	8
	GND		
	15		

+3.3V

JP21

P9

R61 1K
R60 1K

ADSP-2199X EZ-LITE BOARD
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Analog Devices Proprietary Information

ANALOG
DEVICES

804 WOBURN STREET
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D		02-007802	B

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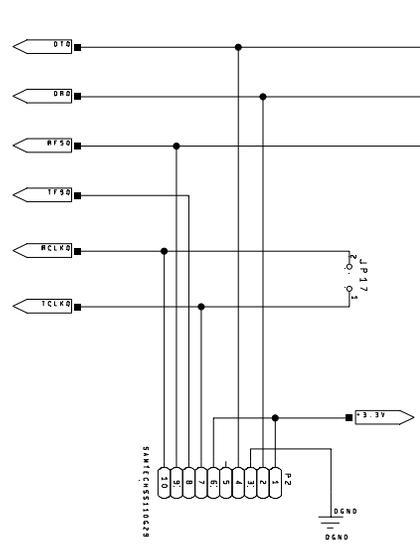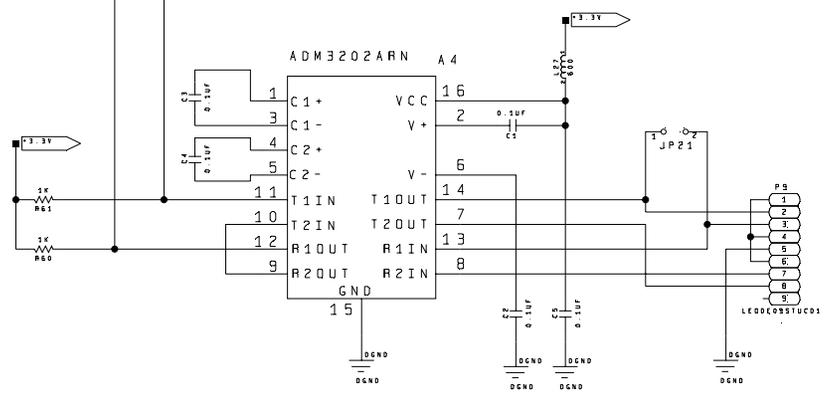
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Memory Interface
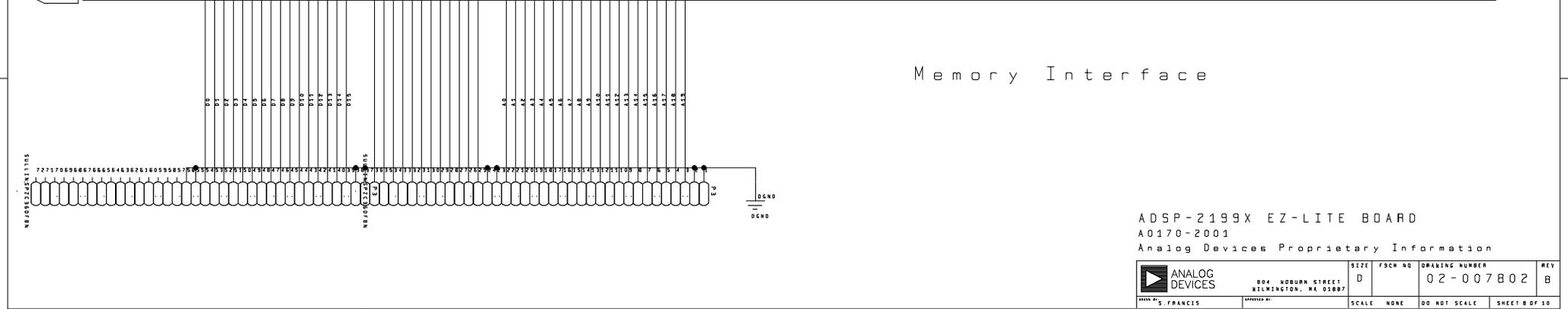
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General Purpose I/O
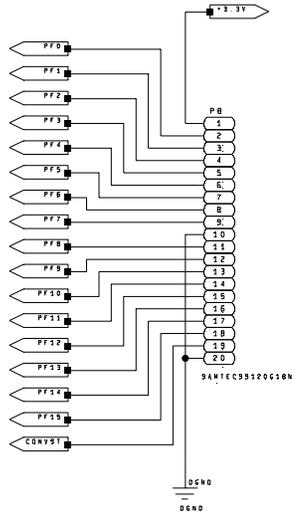
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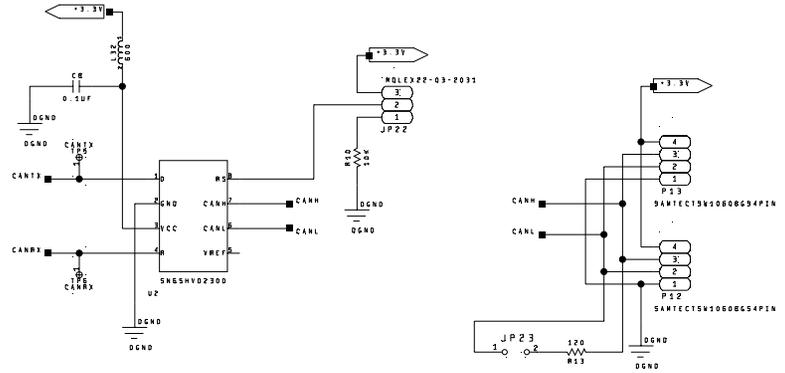
EIU circuitry

PWM Interface

ADSP-2199X EZ-LITE BOARD
A0170-2001
Analog Devices Proprietary Information

ANALOG DEVICES	804 WOBURN STREET WILMINGTON, MA 01887	SIZE D	F9CM NO	DRAWING NUMBER 02-007802	REV B
DRAWN BY: S.FRANCIS	APPROVED BY:	SCALE NONE	DO NOT SCALE	SHEET 9 OF 10

I INDEX