ADSP-21990 EZ-KIT LITE™

Evaluation System Manual

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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.

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

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

Thank you for purchasing the ADSP-21990 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-21990 fixed-point digital signal processor (DSP). 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-219x assembly
- Load, run, step in, step out, step over, halt, and set break points in application programs
- Read and write data and program memory
- Read and write core and peripheral registers
- Plot memory

Access to the ADSP-21990 from a PC is achieved through a USB port or an optional JTAG emulator. The USB interface gives unrestricted access to the ADSP-21990 DSP 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 DSP development tools, go to http://www.analog.com/dsp/tools/.

Example programs are provided with the ADSP-21990 EZ-KIT Lite to demonstrate the capabilities of the evaluation board.

Note: The VisualDSP++ license provided with this EZ-KIT Lite evaluation system limits use of program memory to 2K words.

The ADSP-21990 EZ-KIT Lite board features include:

- **Analog Devices ADSP-21990 160 MHz Mixed-Signal DSP**
- **USB debugging interface**
- **Analog input circuitry**
- **Two, 4-channel 12-bit DACs (AD5327BRU) on SPI interface**
- **PWM outputs interface**
- **External memory interface**
- **Encoder interface circuitry**
- **General-purpose I/O interface**
- **UART interface (RS-232)**
- **CAN controller/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 ADSP-21990 EZ-KIT Lite board has flash memory devices that can be used to store user-specific boot code. By configuring the jumpers for EPROM boot, the board can run as a stand-alone unit, without a PC. The ADSP-21990 EZ-KIT Lite package contains a flash programmer utility, which allows you to program the flash memory. The flash programmer is described in section 3.5.

Additionally, the ADSP-21990 EZ-KIT Lite board provides an expansion connector that allows you to connect to the processor's External Memory Interface (EMI).

1.1 For More Information About Analog Devices Products

Analog Devices can be accessed on the Internet at http://www.analog.com. You can directly access the Mixed-Signal and Motor Control DSP website at http://www.analog.com/motorcontrol. These pages provide access to Mixed-Signal DSP and Motor Control specific technical information and documentation, product overviews, and product announcements. For specific information about DSP tools, go to http://www.analog.com/dsp/tools.

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

- FAX questions or requests for information to (781)-937-1707.
- Access the Computer Products Division File Transfer Protocol (FTP) site at ftp ftp.analog.com or ftp 137.71.23.21 or ftp://ftp.analog.com.

1.2 For Technical or Customer Support

You can reach our Customer Support group in the following ways:

- DSP Tools Tech Support Form: http://www.analog.com/technology/dsp/EZAnswers/index.html
- Email DSP Tools questions to: dsptools.support@analog.com
- Email general ADSP-21990 questions to: MixedSignalDSP@analog.com
- Contact your local Analog Devices sales office or an authorized Analog Devices distributor.
- Call:(800)-ANALOGD

1.3 Purpose of This Manual

The *ADSP-21990 EZ-KIT Lite Evaluation System Manual* provides directions for installing the hardware and software on your PC. This manual provides guidelines for running your own code on the ADSP-21990. Also, this manual provides a description of the use and configuration of the components on the evaluation board. Finally, schematics are provided for the ADSP-21990 EZ-KIT Lite board.

1.4 Intended Audience

This manual is a user's guide and reference to the ADSP-21990 EZ-KIT Lite evaluation system. DSP programmers who are familiar with Analog Devices fixed-point DSP architecture, operation and programming are the primary audience for this manual.

DSP 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 Analog Devices DSP architecture and DSP instruction set. DSP programmers who are unfamiliar with VisualDSP++ should refer to the VisualDSP++ Help menu and the *VisualDSP++ User's Guide*. For the locations of these documents, refer to section 1.6.

1.5 Manual Contents

This manual contains the following information:

- Chapter 1 — Introduction
  Provides manual information and Analog Devices contact information.

- Chapter 2 — Getting Started
  Provides software and hardware installation procedures, PC system requirements, and basic board information.

- Chapter 3 — Using the ADSP-21990 EZ-KIT Lite
  Provides information on the EZ-KIT Lite from a software perspective, and provides an easy-to-access memory map.

- Chapter 4 — Working With ADSP-21990 EZ-KIT Lite Hardware
  Provides information on the hardware aspects of the evaluation system.

- Appendix A — Schematics
  Provides the resources to allow ADSP-21990 EZ-KIT Lite board-level debugging or to use as a reference.

1.6 On-line Help

Your software installation kit includes on-line Help as part of the Windows interface. These help files provide information about VisualDSP++ and the ADSP-21990 EZ-KIT Lite evaluation system.

To view Help on VisualDSP++, you can click on the ***Help*** menu item or go to the Windows task bar and select Start\Programs\VisualDSP\VisualDSP++ Help.

To view Help on additional ADSP-21990 EZ-KIT Lite features, go to the Windows task bar and select Start\Programs\VisualDSP\EZ-KIT Help.

The documents in the following two tables can be found through on-line help or in the Docs folder of your VisualDSP++ installation. For more documentation, please go to: http://www.analog.com/technology/dsp/developmentTools/gen_purpose.html.

Table 1-1: Related DSP Documents

Document Name	Description
ADSP-21990 DSP Datasheet	General functional description, pin-out and timing.
ADSP-2199x DSP Hardware Reference Manual	Description of internal DSP architecture, mixed signal peripherals and all register functions.
ADSP-219x DSP Instruction Set Reference	Description of all allowed DSP assembly instructions.

Table 1-2: Related VisualDSP++ Documents

Document Name	Description
VisualDSP++ Users Guide for ADSP-21xx DSPs	Detailed description of VisualDSP++ features and usage.
VisualDSP++ Assembler and Preprocessor Manual for ADSP-219x DSPs	Description of the assembler function and commands for ADSP-219x family DSPs
VisualDSP++ C/C++ Compiler and Library Manual for ADSP-219x DSPs	Description of the compiler function and commands for ADSP-219x family DSPs
VisualDSP++ Linker and Utilities Manual for ADSP-21xx DSPs	Description of the linker function and commands for the ADSP-219x family DSPs
VisualDSP++ Getting Started Guide for ADSP-21xx DSPs	Step-by-step tutorial that highlights the features of VisualDSP++ for the ADSP--21xx DSPs
VisualDSP++ Kernel (VDK) User's Guide	Description of the VDK function and commands for the ADSP-219x DSPs
VisualDSP++ Component Software Engineering User's Guide	Description of the VCSE function and commands for the ADSP-219x DSPs
VisualDSP++ Product Bulletin for ADSP-21xx DSPs	Description of the new features and enhancements of VisualDSP++

If you plan to use the ADSP-21990 EZ-KIT Lite board in conjunction with a JTAG emulator, refer to the documentation that accompanies the emulator.

2 GETTING STARTED

2.1 Overview

This chapter provides you with the information you need to install the software for the ADSP-21990 EZ-KIT Lite evaluation system. Install your software and hardware in the order presented for correct operation. This chapter has the following sections:

- Contents of your EZ-KIT Lite Package (Section 2.2)
  Provides a list of the components that are shipped with this EZ-KIT Lite evaluation system.

- PC Configuration (Section 2.3)
  Describes the minimum requirement for the PC to work with the EZ-KIT Lite evaluation system.

- Installation Tasks (Section 2.4)
  Describes the step-by-step procedure for setting up the hardware and software.

2.2 Contents of your EZ-KIT Lite Package

Your ADSP-21990 EZ-KIT Lite evaluation system package contains the following items.

- ADSP-21990 EZ-KIT Lite Board
- VisualDSP++ CD w/ demo license, containing:
  - VisualDSP++ software
  - EZ-KIT Lite specific debug software
  - USB driver files
  - Example programs
  - *ADSP-21990 EZ-KIT Lite Manual* (this document)
  - Flash programmer utility
- *EZ-KIT Lite Quick Start Guide*
- *Installation Quick Reference Card for VisualDSP++*
- 5 meter USB type A to type B 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.

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2.3 PC Configuration

For correct operation of the VisualDSP++ software and the EZ-KIT Lite, your computer must have the minimal configuration shown in Table 2-1.

Table 2-1: Minimum PC Configuration

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

- **Note: This EZ-KIT Lite does not run under Windows 95 or Windows NT.**

2.4 Installation Tasks

The following tasks are provided for the safe and effective use of the ADSP-21990 EZ-KIT Lite. Follow these instructions in the order presented to ensure correct operation of your software and hardware. Perform the following tasks to install the ADSP-21990 evaluation system.

1. Install VisualDSP++ software and EZ_KIT Lite debug software
2. Install VisualDSP++ license
3. Set up EZ-KIT Lite hardware
4. Install EZ-KIT Lite USB driver
5. Verify the USB driver installation
6. Start VisualDSP++

2.4.1 Install the VisualDSP++ Software

This EZ-KIT Lite comes with the latest version of VisualDSP++ for the ADSP-219x and ADSP-2199x DSP families.

Insert the VisualDSP++ CD-ROM into the CD-ROM drive. If Auto Run is enabled on your PC, you see the home screen of the VisualDSP++ install wizard. Otherwise, choose **Run** from the **Start** menu, and enter **D:\Setup.exe** in the **Open** field, where D is the name of you local CD-ROM drive. Click on the **VisualDSP++ 3.0 Installation** option. Then select **Install Tools**. This will launch the setup wizard. At the component selection screen, select the ADSP-2199x EZ-KIT Lite to install the EZ-KIT Lite debug software. Follow this wizard with the on-screen instructions to continue installing the software.

2.4.2 Install the VisualDSP++ License

Before the VisualDSP++ software can be used, the license must be installed.

To install the VisualDSP++ license:

1. Make sure VisualDSP++ has been installed.
2. Insert the VisualDSP++ CD-ROM into the CD-ROM drive if it is not already in the drive.
3. Once the CD-ROM browser is on the screen, select the **VisualDSP++ 3.0 Installation** option. Then select **Install License**.
4. Follow the setup wizard instructions. (Note: You will need the serial number located on the back of the CD-ROM sleeve.)

2.4.3 Set up the EZ-KIT Lite Hardware

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

The ADSP-21990 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. Use the following steps to connect the EZ- KIT Lite board:

1. Remove the ADSP-21990 EZ-KIT Lite board from the package. Be careful when handling these boards to avoid the discharge of static electricity, which may damage some components.

JUMPER	POSITION
JP1	Closed – Ground Link
JP2	1-2 Position
JP3	1-2 Position
JP4	OPEN
JP5	2-3 Position
JP6	2-3 Position
JP7	2-3 Position
JP8	2-3 Position
JP12	CLOSED
JP15	CLOSED
JP16	CLOSED
JP24	CLOSED

Table 2-2 Default Jumper Settings

2. Table 2-2 shows the start-up default jumper settings. All other jumpers are not configured. For the configuration of the jumpers on the ADSP-21990 EZ-KIT Lite board, refer to the jumper settings section, 4-34. Confirm that your board is set up in the default configuration.

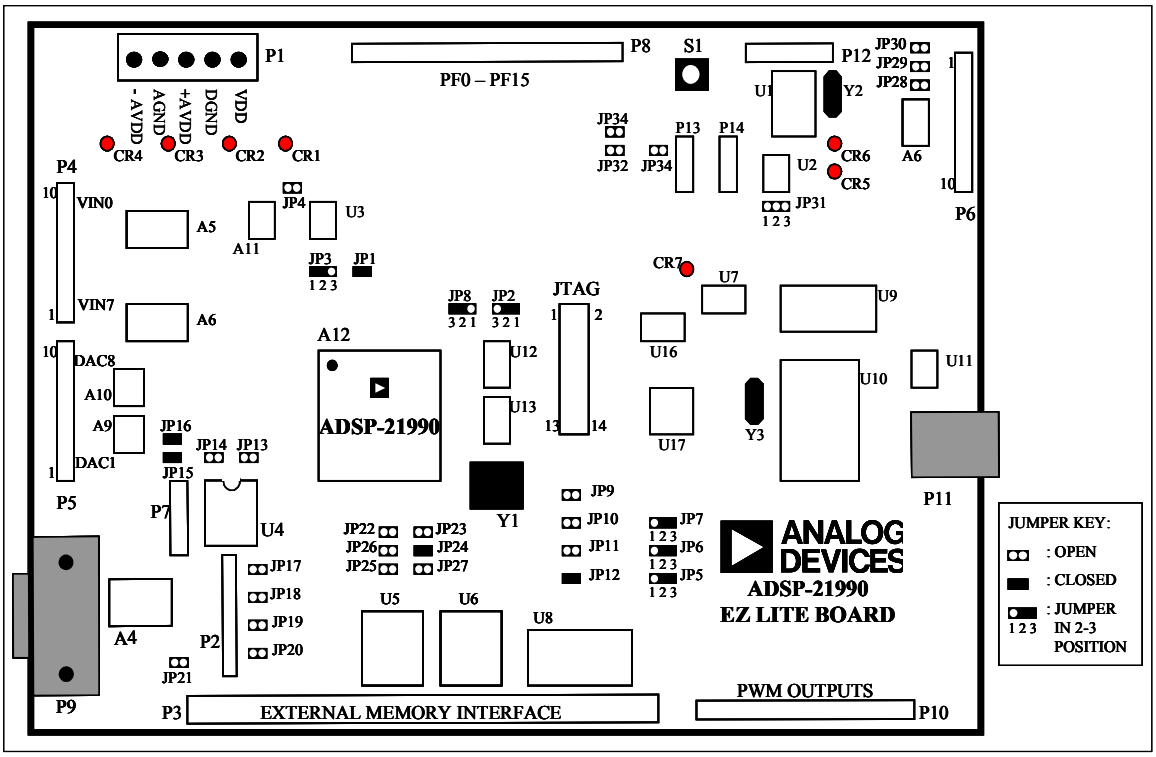


Figure 2-1: Default Jumper Settings

3. Connect your power supply to P1 on the EZ-KIT Lite board. The ADSP-21990 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 are provided on the board to provide the required +3.3V, +2.5V, and ±2.5V.
4. Connect the USB cable to an available full-speed USB Port and to P11 on the ADSP-21990 EZ-KIT Lite board.
5. Follow the USB driver installation instructions in section 2.4.4.

2.4.4 Install the EZ-KIT Lite USB Driver

The EZ-KIT Lite evaluation system can be installed on Windows 98, Windows 2000, and Windows XP. One full-speed USB port is also required. Section 2.4.4.1 describes the installation on Windows 98. Section 2.4.4.2 describes the installation on Windows 2000. Section 2.4.4.3 describes the installation on Windows XP.

2.4.4.1 Windows 98 USB Driver Installation

Before using the ADSP-21990 EZ-KIT Lite for the first time, the Windows 98 USB driver must first be installed. This is accomplished as follows:

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

The connection of the device to the USB port will activate the Windows 98 **Add New Hardware Wizard** as shown in Figure 2-2.

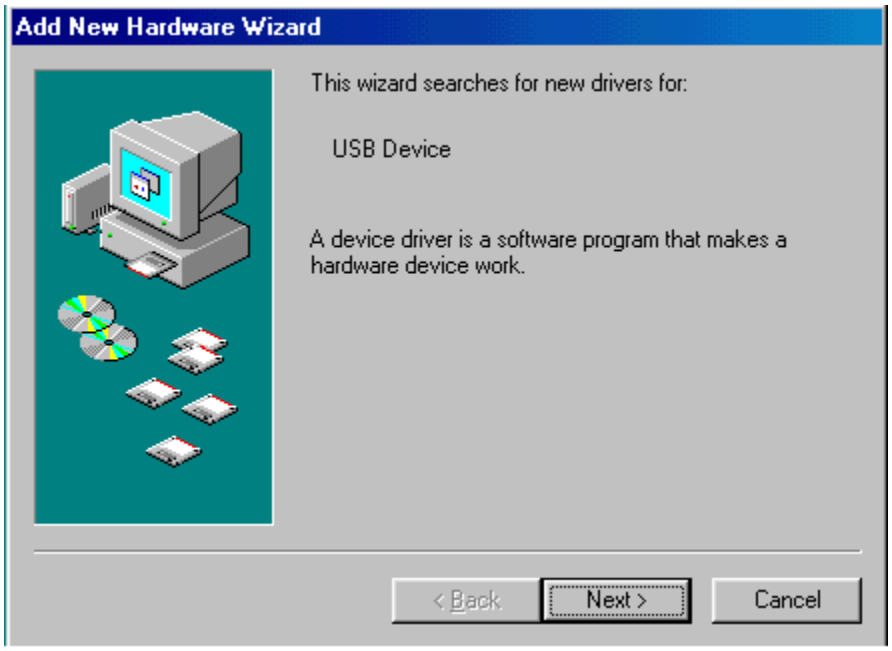


Figure 2-2: Add New Hardware Wizard Dialog Box

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

Figure 2-3: Search for the driver

4. Click **Next**.
5. Make sure there is a check in the box next to **CD-ROM drive** as shown in Figure 2-4.

Figure 2-4: Search the CD-ROM

6. Click **Next**.

Windows 98 will locate the WmUSBEz.inf file that is on the CD-ROM as shown in Figure 2-5.

Figure 2-5: The Driver is Located

7. Click **Next**.

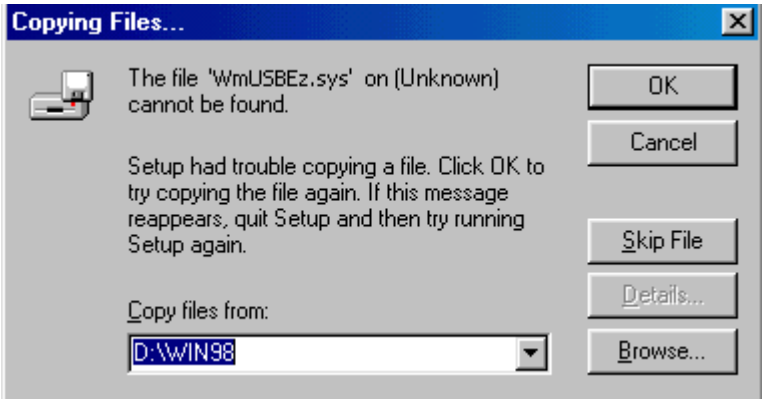


Figure 2-6: Search for .sys File Dialog Box

8. Click **Browse**.
9. In **Drives** (Figure 2-7), select your CD-ROM drive.

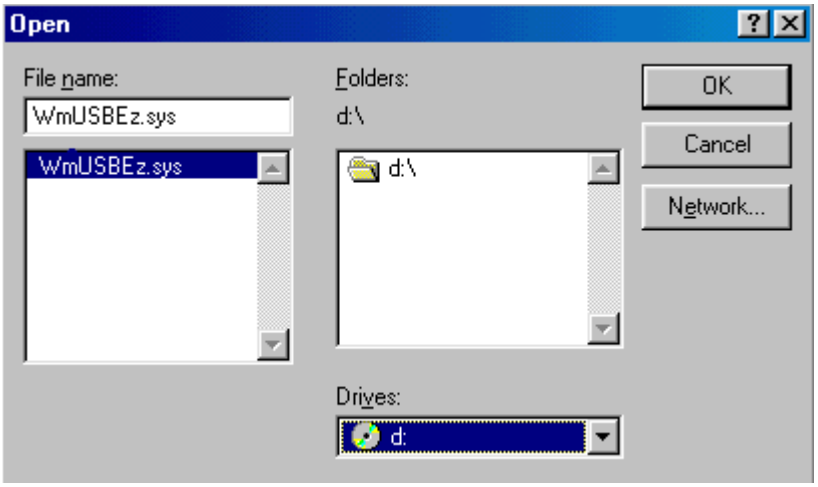


Figure 2-7: Open the .sys File

10. Click **OK**.

Figure 2-8 will appear.

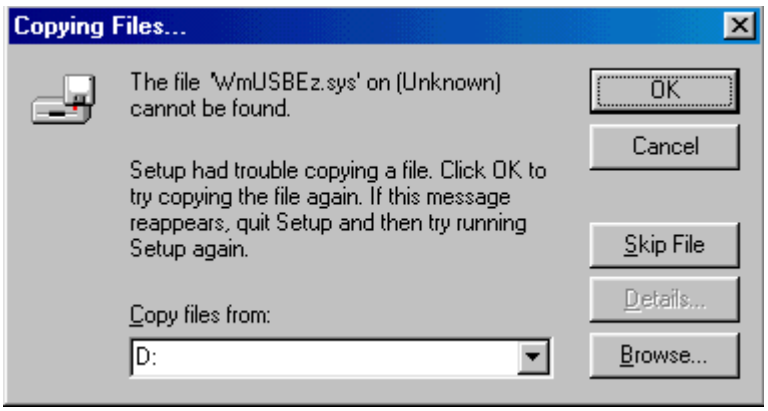


Figure 2-8: Copying Files

11. Click **OK**.

The driver installation is now complete as shown in Figure 2-9.

Figure 2-9: Finish the Software Installation

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

13. Verify the installation by following the instructions in section 2.4.5.

2.4.4.2 Windows 2000 USB Driver Installation

Before using the ADSP-21990 EZ-KIT Lite for the first time, the Windows 2000 driver must first be installed. This is accomplished as follows:

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

The connection of the device to the USB port will activate the Windows 2000 **Found New Hardware Wizard** as shown in Figure 2-10.

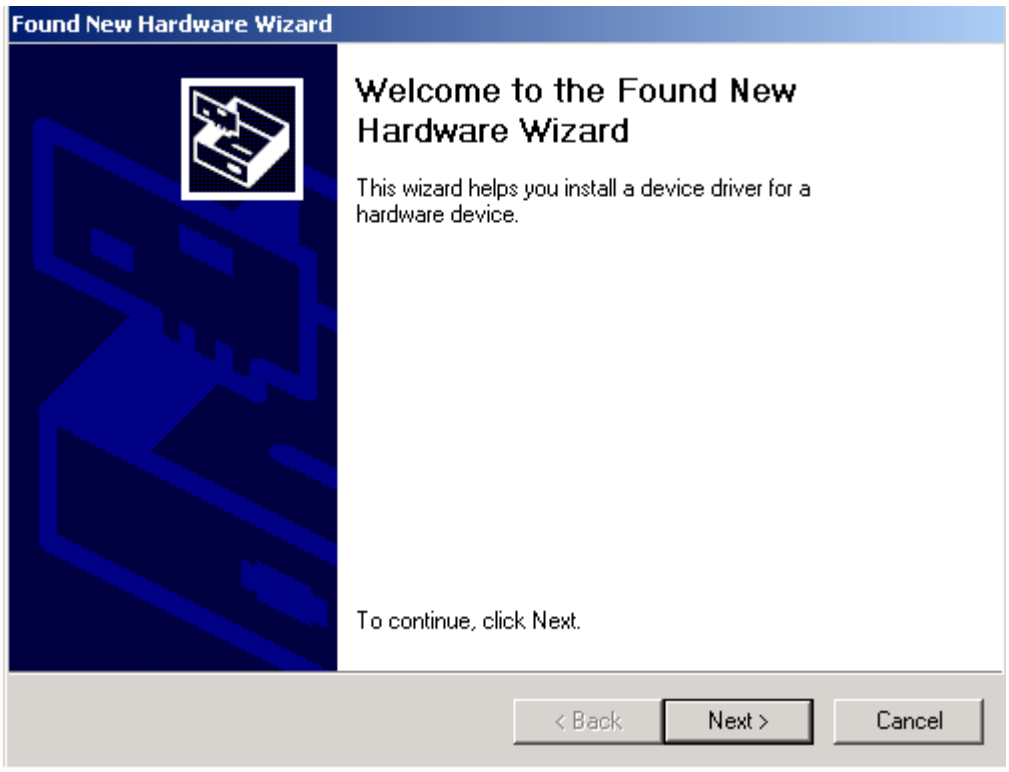


Figure 2-10: Found New Hardware Wizard

14. Click **Next**.
15. Select **Search for a suitable driver for my device** as shown in Figure 2-11.

Figure 2-11: Search for a Suitable Driver

16. Click **Next**.

17. Make sure there is a check in the box next to **CD-ROM drive** as shown in Figure 2-12.

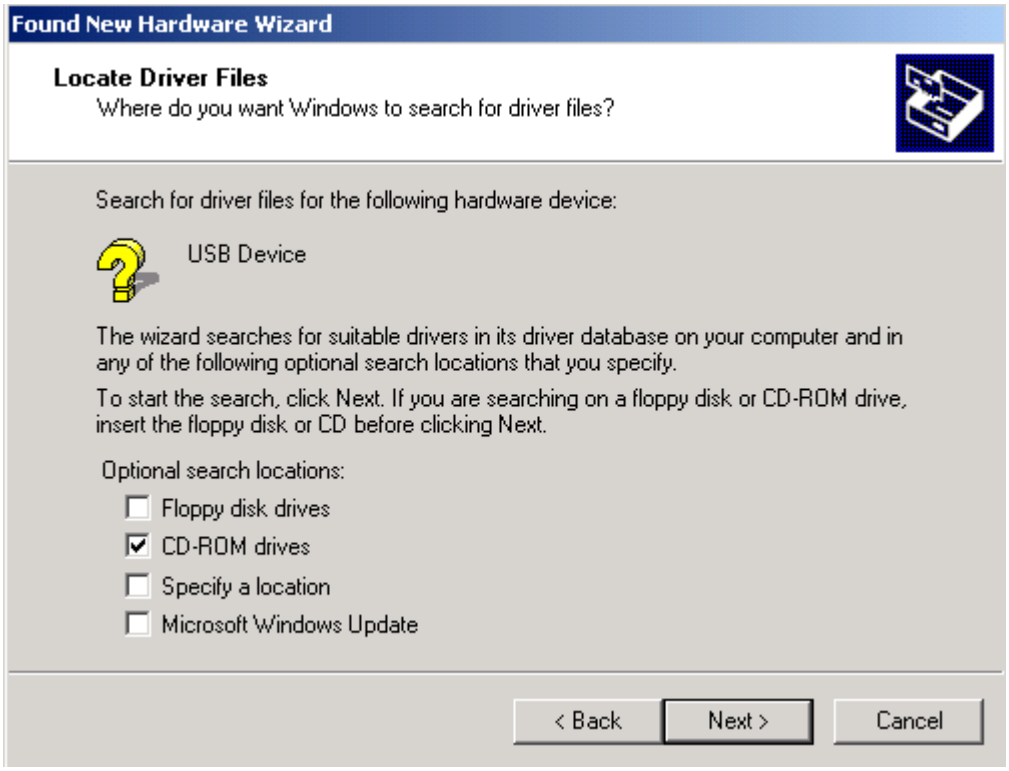


Figure 2-12: Locate Driver Files

18. Click **Next**.

Figure 2-13 appears.

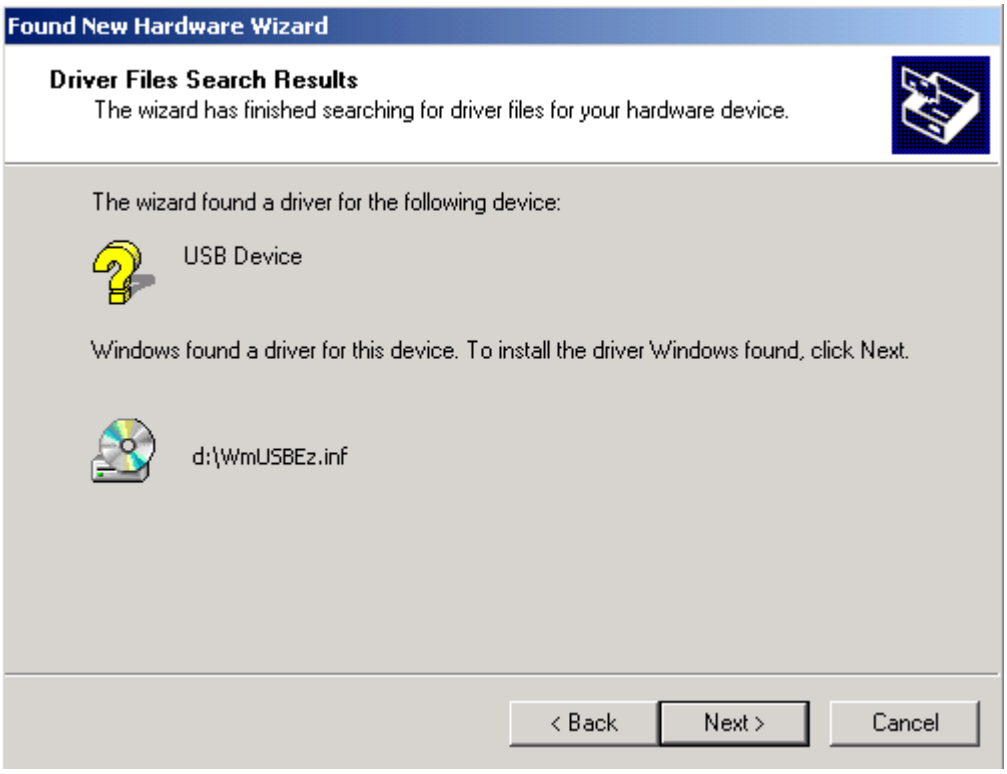


Figure 2-13: Driver File Search Results

19. Click **Next**.

Windows 2000 will automatically install the ADSP-21990 EZ-KIT Lite driver. The driver installation is now complete as shown in Figure 2-14.

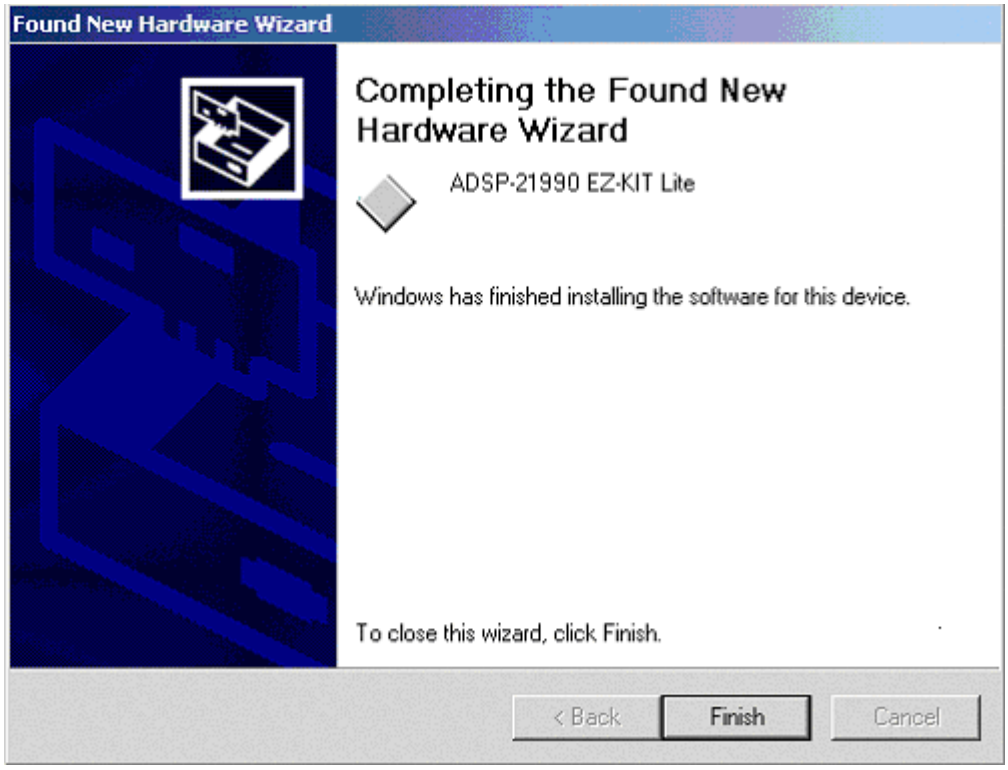


Figure 2-14: Completing Driver Installation Dialog Box

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

21. Verify the installation by following the instructions in section 2.4.5.

2.4.4.3 Windows XP USB Driver Installation

The Windows XP USB driver must first be installed before using the ADSP-21990 EZ-KIT Lite evaluation system for the first time.

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

The connection of the device to the USB port will activate the Windows XP **Found New Hardware Wizard** as shown in Figure 2-15.

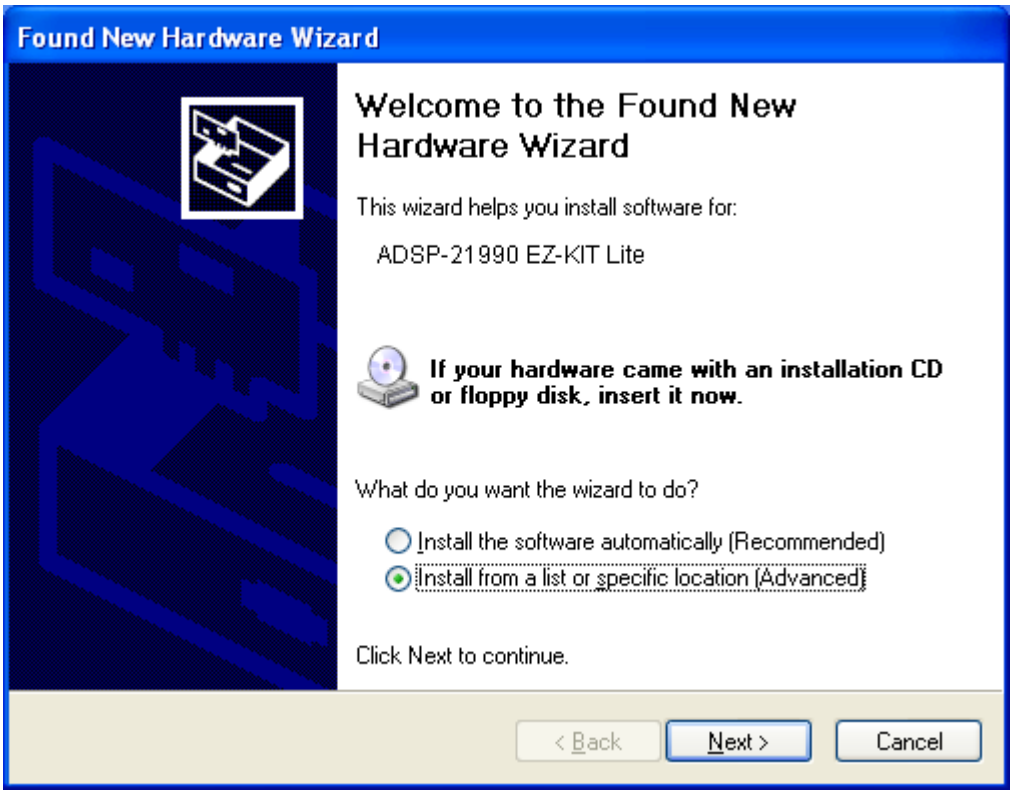


Figure 2-15: Found New Hardware Wizard

2. Select Install from a list or specific location.
3. Click **Next**.

Figure 2-16 appears

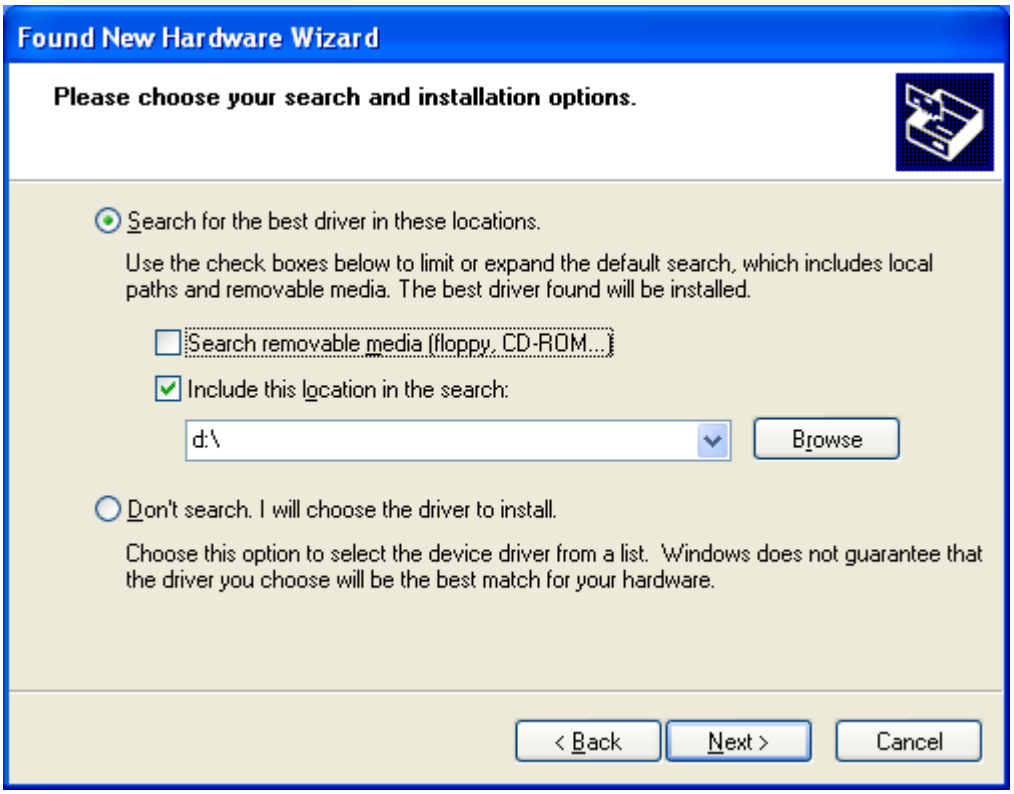


Figure 2-16: Search for the Best Driver.

4. Select Search for the best driver in these locations
5. Select **Include this location in the search** and put the path to your CD-ROM drive as shown in Figure 2-16.
6. Click **Next**

Windows XP will automatically install the ADSP-2191 EZ-KIT Lite driver. The driver installation is now complete as shown in Figure 2-17.

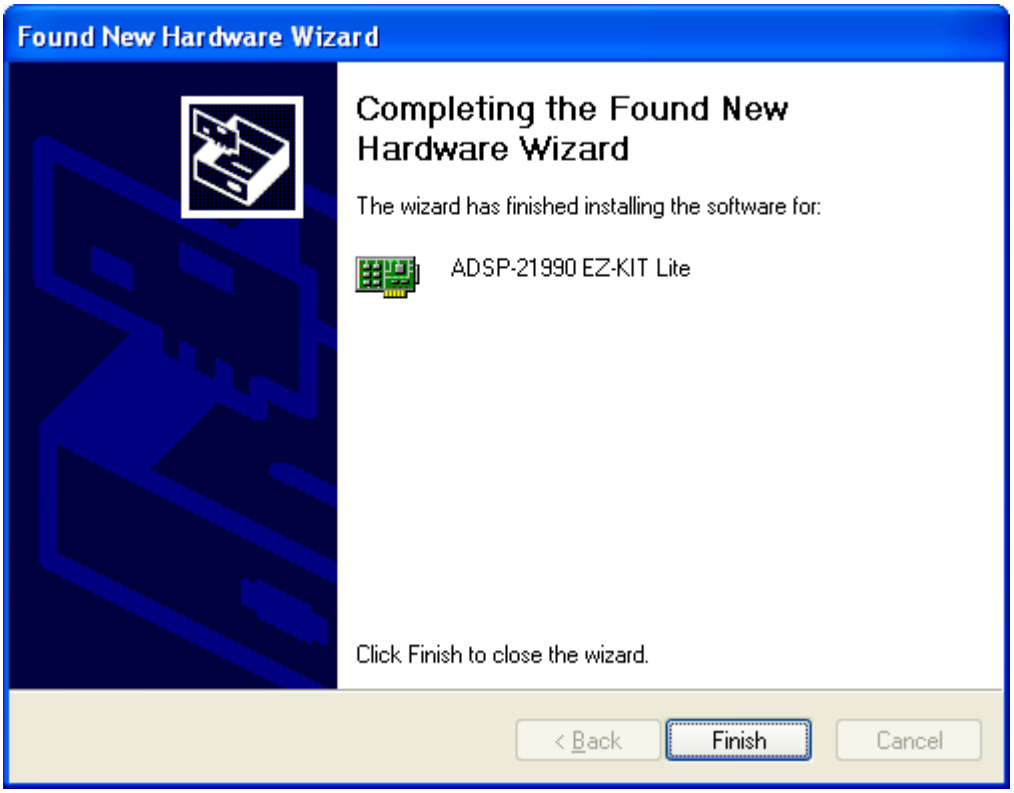


Figure 2-17: Completing Driver Installation Dialog Box

7. Click **Finish** to exit the wizard.
8. Verify the installation by following the instructions in section 2.4.5.

2.4.5 Driver Installation Verification

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++.

2.4.6 Starting VisualDSP++

In order to start debugging, you must set up a session in VisualDSP++.

1. Hold down the **Control** (CTRL) key.
2. Click the **Start** button on the Windows taskbar, and then choose **Programs**, **VisualDSP, VisualDSP++ Environment**.

The **Session List** dialog box appears if you already have existing sessions. Skip to step 4 if this is the first time running VisualDSP++.

3. Click New Session.
4. The **New Selection** dialog box will appear as shown in Figure 2-18.

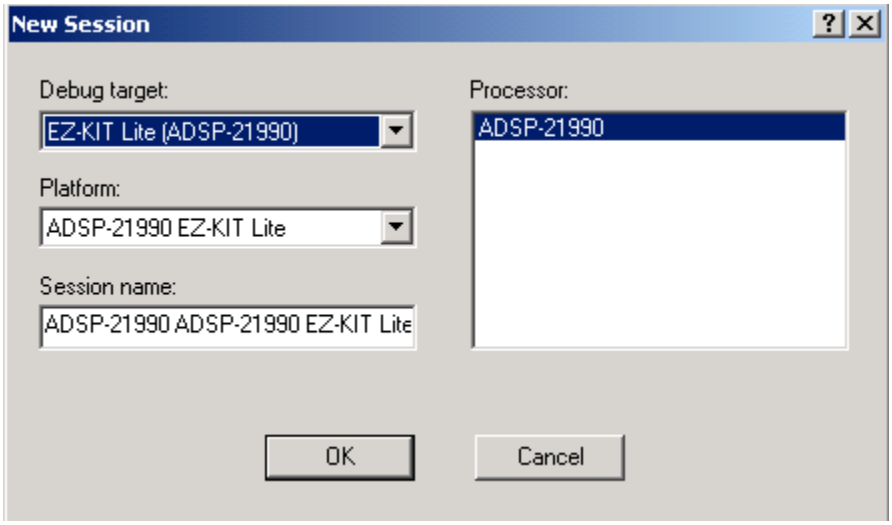


Figure 2-18: New Session Dialog Box

5. In Debug Target, choose EZ-KIT Lite (ADSP-21990).
6. Type the target name in **Session Name** or accept the default name.
7. Click **OK** to return to the **Session List**, make sure the new session is highlighted, and click **Activate**.

3 USING THE EZ-KIT LITE

3.1 Overview

This chapter provides specific information to assist you with developing your programs with the ADSP-21990 EZ-KIT Lite board. This information appears in the following sections:

- EZ-KIT Lite License Restrictions (Section 3.2)
  Describes the restrictions of the EZ-KIT Lite demo license.
- Memory Map (Section 3.3)
  Defines the memory map to assist in developing programs for the EZ-KIT Lite evaluation system.
- Example Programs (Section 3.4)
  Provides information about the example programs included in the ADSP-21990 EZ-KIT Lite evaluation system.
- Using the Flash Programmer Utility (Section 3.5)
  Provides information on the flash programmer utility included with VisualDSP++.

This section provides programming information specific to the EZ-KIT Lite board. For more detailed information about programming the ADSP-21990, see the documents referred to in section 1.6.

3.2 EZ-KIT Lite License Restrictions

The license that is shipped with the ADSP-21990 EZ-KIT Lite imposes the following restrictions:

- Program Memory (PM) space is limited to 2K words (1/2 of the ADSP-21990 PM space)
- No connections to Simulator or Emulator sessions are allowed.

3.3 Memory Map

The ADSP-21990 has 8K 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 DSP Hardware Reference*.

The ADSP-21990 EZ-KIT Lite board provides 512K x 8 bits of external flash memory. This memory is connected to the DSP's $\overline{\text{MS0}}$ or $\overline{\text{BMS}}$ memory select pins using Jumpers JP22 and JP23, respectively. The flash memory can be accessed in the boot memory space or the external memory space, but not at the same time.

If booting from the External Flash Memory IC, JP22 should be closed and JP23 should be open. In this case the external SRAM provided on the ADSP-21990 EZ-KIT Lite board can be mapped to any of the external memory banks using one of the jumpers, JP24 – JP27.

If using the Flash memory as external memory, JP22 should be open and JP23 should be closed. In this case the external SRAM provided on the ADSP-21990 EZ-KIT Lite board should not be mapped to the external memory bank 0 (JP24 should be open in this case) and can be mapped to any of the other external memory banks using one of the jumpers, JP25 – JP27.

When using the External memories provided on the ADSP-21990 EZ-KIT Lite board, they are mapped at the start address of the chosen external memory bank.

Table 3-1: ADSP-21990 Memory Map

	Start Address	End Address	Page	Content
Internal Memory	0x00 0000	0x00 0FFF	0	4K x 24-Bit Program Memory
	0x00 1000	0x00 7FFF	0	RESERVED (28K)
	0x00 8000	0x00 8FEF	0	4K x 16-Bit Data Memory
	0x00 8FF0	0x00 8FFF	0	RESERVED
	0x00 9000	0x00 FFFF	0	RESERVED (28K)
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)
IO 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

- **NOTE: Although the flash starts at address 0x01 0000 in the Boot Memory Space, during EPROM boot the address 0x00 0000 is put on the address bus.**

- **NOTE: Only 2K of Program Memory is available in the EZ-Kit Lite Software.**

3.4 Example Programs

Example programs are provided with the ADSP-21990 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 \…\VisualDSP\219x\EZ-KITs\ADSP-21990\Examples. Please refer to the example program readme files for more information.

3.5 Using the Flash Programmer Utility

The ADSP-2191 EZ-KIT Lite evaluation system includes a flash programmer utility. The utility allows you to program the flash device on the EZ-KIT Lite. For more information on the flash programmer utility, search on "Flash Programmer" in the VisualDSP++ Help.

4 EZ-KIT LITE HARDWARE REFERENCE

4.1 Overview

This chapter describes the hardware design of the ADSP-21990 EZ-KIT Lite board. The following topics are covered:

System Architecture (Section 4.2)

Describes the configuration of the DSP as well as all a description of how all of the components on the board interface with the DSP.

Jumper Settings (Section 4.3)

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

- Connectors (Section 4.4)

  Shows the location and gives a description and pin-out of all connectors on the ADSP-21990 EZ-KIT Lite board.

- Mechanical Dimensions (Section 4.5)

  Gives the physical dimensions of the ADSP-21990 EZ-KIT Lite board.

4.2 System Architecture

The ADSP-21990 EZ-KIT Lite board has been designed to provide access to all of the capabilities of the ADSP-21990 DSP. This section will describe the DSP's configuration on the EZ-KIT Lite board.

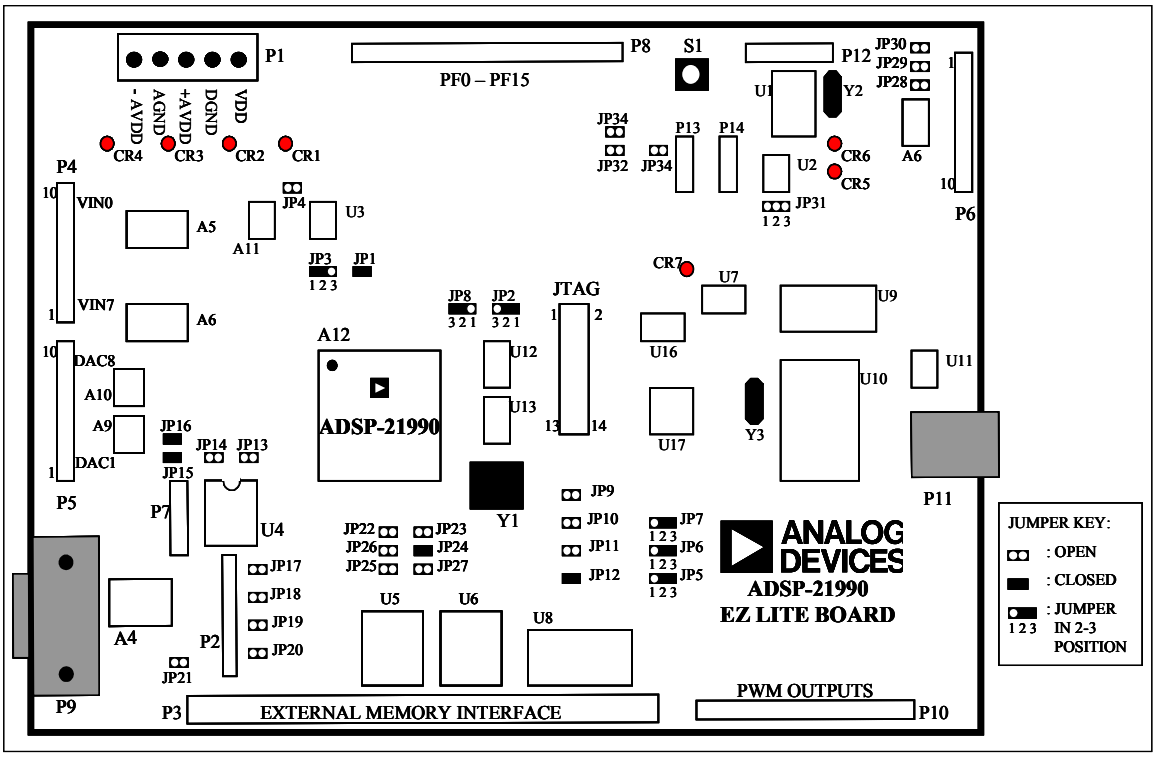


Figure 4-1: System Architecture

The ADSP-21990 EZ-KIT Lite board can be configured to boot in all of the possible ADSP-21990 boot modes. For information about configuring the boot mode, see section 4.3.1.

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

4.2.1 Power Supplies

Linear regulators are provided on the ADSP-21990 EZ-KIT Lite board for the 2.5V and 3.3V required by the ADSP-21990 from a 5V source. The linear regulators also provide the power for the digital peripheral circuitry on the ADSP-21990 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-21990 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-21990 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-21990 EZ-KIT Lite board. For correct operation, this link must not be removed.

The arrangement on the input power supply connector is illustrated in Figure 4-2.

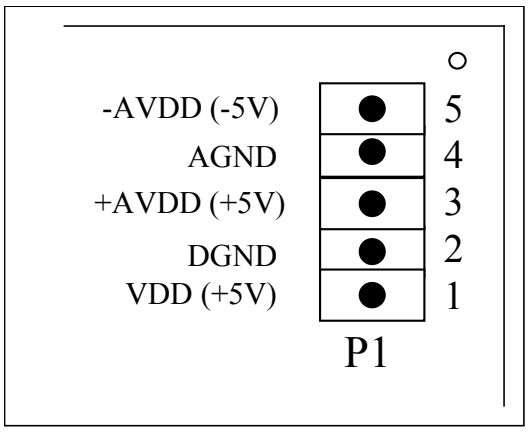


Figure 4-2: Power Supply Connector of ADSP-21990 EZ-KIT Lite Board

LEDs are provided to indicate that the power supplies are working correctly. The Power Supply LEDs are as follows in Table 4-1:

LED	Power Supply Signal
CR1	+2.5V (DSP Core Voltage Supply)
CR2	+3.3V (Vddext)
CR3	+2.5V (+AVdd)
CR4	- 2.5V (-AVdd)

Table 4-1: Power Supply LEDs

4.2.2 Reset Generation

The ADSP-21990 can be reset from a number of sources on the ADSP-21990 EZ-KIT Lite board. The sources of reset for the ADSP-21990 DSP are:

- POR (power-on reset output pin of the ADSP-21990)
- Reset button (S1)
- External power on reset IC (A7)
- USB Interface (software tools reset)

The source of reset for the ADSP-21990 can be chosen by configuring jumper JP2. When JP2 is in the 2-3 position, the POR output pin of the ADSP-21990 is tied to the reset pin of the ADSP-21990. When JP2 is in the 1-2 position, the source of reset for the ADSP-21990 is the reset button (S1), the external power-on reset IC (ADM708), or a reset command from the software tools through the USB interface. The 1-2 position is the default and recommended configuration when using the VisualDSP++ development tools.

4.2.3 Analog Input Interface

The ADSP-21990 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-21990. 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-21990. These analog interface circuits convert the nominally ±1 V signals at the Analog Inputs Connector, P4, to signals centered on the ADSP-21990 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 & 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 kΩ resistors are used for input and feedback resistors to ensure accurate gain matching of all channels. In addition, 47 pF feedback capacitors are used to 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-21990 in a single-ended fashion, so that the inverting inputs to the sample-and-hold amplifiers of the ADSP-21990 (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 4-3. As can be seen in the schematics at the end of this document, each analog input stage also contains a small RC filter at the operational amplifier output.

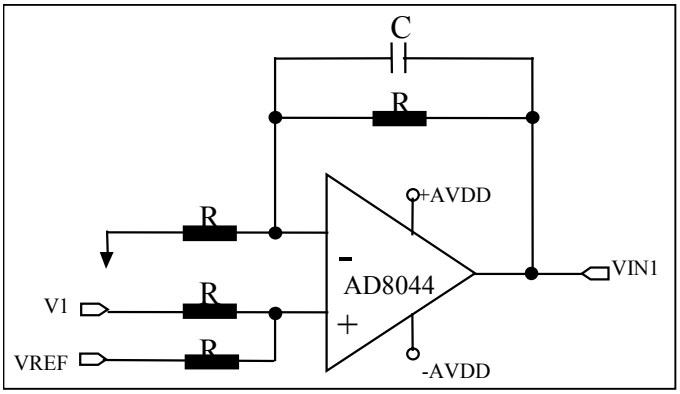


Figure 4-3: One Analog Interface Circuit of ADSP-21990 EZ-KIT Lite Board

4.2.4 Reference Voltage Generation

The ADSP-21990 EZ-KIT Lite board contains an external voltage reference, the LM4140-1.0 (U3), that can be used to provide a precise 1.024V output. The ADSP-21990 EZ-KIT Lite board can be configured to operate from the internal (ADSP-21990 generated) or the external voltage reference. Two jumpers control the selection of the internal or external voltage reference.

Jumper JP3 can be used to tie the SENSE pin of the ADSP-21990 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-21990 accepts an input voltage reference at the VREF pin. To connect the external voltage reference to the ADSP-21990 on the evaluation board, it is necessary to close the JP4 jumper. This connects the external voltage reference from the LM4140-1.0 device to the VREF pin of the ADSP-21990. The signal is also buffered using an operational amplifier OP193 (A11) and used to level-shift 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-21990, the JP3 jumper must be tied in position 1-2 so that the SENSE pin is connected to AGND. Additionally, jumper JP4 must be left open. The ADSP-21990 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.

In summary, the appropriate settings for jumpers JP3 and JP4 for internal and external voltage reference operation are:

INTERNAL Reference: JP3 in position 1-2, JP4 open

EXTERNAL Reference: JP3 in position 2-3, JP4 closed

4.2.5 External Memory Interface (EMI)

A 64K by 16-bit SRAM IC (U8) is provided on the External Memory Interface (EMI) of the ADSP-21990 EZ-KIT Lite board.

Sockets are provided on the ADSP-21990 EZ-KIT Lite board so that the EMI can also be connected to two 512K x 8-bit flash memory ICs (U5, 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 be used 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 section 3.3 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, and a jumper allows for mapping Flash into Boot memory space or $\overline{MS0}$.

All of the 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 APPENDIX A: SCHEMATICS.

4.2.6 SPI Interface

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

4.2.7 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-21990 EZ-KIT Lite board, for booting and/or data storage. The PF1/ SPISEL1 pin of the ADSP-21990 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-21990 is being used as a programmable flag pin.

4.2.8 SPI Digital-to-Analog Converters

Two 4-channel, serial, 12-bit DACs (A9, A10) are provided on the ADSP-21990 EZ-KIT Lite board. The DACs (AD5327BRU) are set up in daisy-chain mode. The PF2/ SPISEL2 pin of the ADSP-21990 is used to select the DACs 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 DAC's when the PF2 and PF3 pins are being used as programmable flag pins.

The outputs of the DACs are available at the connector, P5. Refer to Table 4-5 in section 4.4 for the configuration of P5.

4.2.9 SPI CAN Interface

A CAN Controller IC (U1) is provided on the SPI Interface. The MCP2510 from Microchip is used. The PF4/ SPISEL4 pin of the ADSP-21990 is used to select the CAN Controller IC to be active on the SPI interface. The PF5 pin is used to reset the CAN Controller IC. A CAN Transceiver IC (U2) converts the input and output to the CAN bus voltages levels. Connectors P13 and P14 provide connections to the user's CAN Bus and allow easy daisy-chaining of CAN devices. CAN bus termination of 120Ω can be provided by closing jumper JP34.

4.2.10 Serial Port (SPORT) Interface

The SPORT pins are available at the SPORT Interface Connector, P2. Refer to Table 4-3 in section 4.4 for the configuration of P2.

Circuitry is also provided on the ADSP-21990 EZ-KIT Lite board to allow you to use the SPORT for RS-232 emulation. An ADM3202ARN Line Driver/Receiver IC (A4) is provided to convert the SPORT signals to the appropriate ±10 V levels suitable for the UART connection to the PC. A standard 9-pin female D-Sub socket, P9, is provided on the ADSP-21990 EZ-KIT Lite board

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

4.2.11 Programmable Flag Pins Interface

All programmable flag pins are available on connector P8. Refer to Table 4-8 in section 4.4 for the Configuration of P8.

4.2.12 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 the connector, P10. A $\overline{\text{PWMTRIP}}$ input can be applied at connector P10. Refer to Table 4-10 in section 4.4 for the Configuration of P10.

Three jumpers are provided for the configuration of the PWM Generation Unit of the ADSP-21990. JP5 is used to enable/disable the $\overline{\text{PWMTRIP}}$ input. JP6 is used to enable/disable PWM Switched Reluctance mode. JP7 is used to configure the polarity of the PWM output signals.

4.2.13 Auxiliary PWM Unit Interface

Both AUXPWM output signals, AUX0 and AUX1, are available on connector P10. An $\overline{\text{AUXTRIP}}$ input can be applied at connector P10. A jumper, JP8, is provided to enable/disable the $\overline{\text{AUXTRIP}}$ input signal. Refer to Table 4-10 in section 4.4 for the configuration of P10.

4.2.14 General-Purpose Timer Signals

The three General-Purpose Timer input/output signals, TMR0, TMR1, and TMR2, are available at connector P10. Refer to Table 4-10 in section 4.4 for the configuration of P10.

4.2.15 Encoder Interface Unit Circuitry

The ADSP-21990 EZ-KIT Lite board allows you to apply differential encoder signals to the board at the Encoder Interface Connector, 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-21990. 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-21990 at these jumpers when they are open.

4.2.16 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. See section 4.4.13 for more information about the JTAG connector. To learn more about available emulators, contact Analog Devices. See section 1.1 for information about contacting Analog Devices.

4.3 Jumper Settings

This section describes the function and configurations of all the jumpers on the ADSP-21990 EZ-KIT Lite board. The following figure shows the location of all the jumpers (JP1 – JP34) on the ADSP-21990 EZ-KIT Lite board.

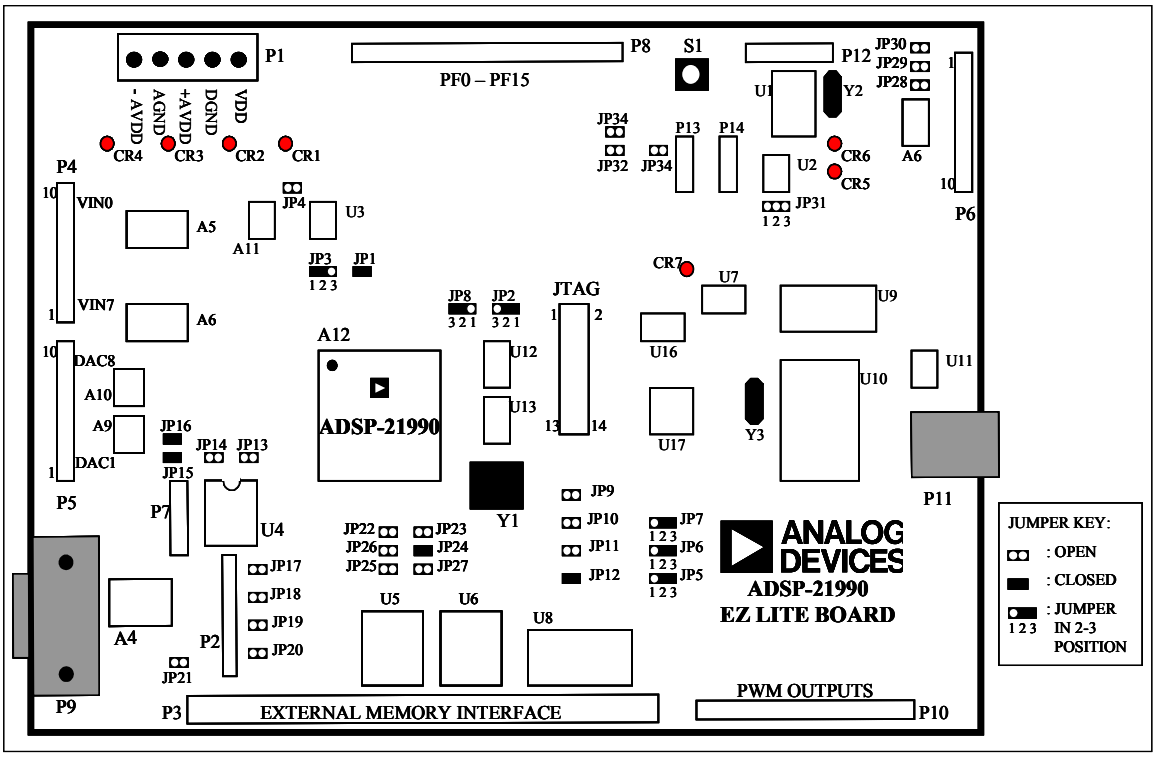


Figure 4-4: Jumpers Locations

4.3.1 List Of Jumpers

Table 4-2 provides a list of jumpers on the ADSP-21990 EZ-KIT Lite board, including the default initial jumper configuration when you receive the ADSP-21990 EZ-KIT Lite board:

Ref. Des.	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	2-3 Position	Disable / Enable PWMTRIP
JP6	2-3 Position	PWM SR Mode Selection
JP7	2-3 Position	PWM Polarity Selection
JP8	2-3 Position	Disable / Enable AUXTRIP
JP9	OPEN	Boot Mode Selection
JP10	OPEN	Boot Mode Selection
JP11	OPEN	Boot Mode Selection
JP12	CLOSED	Boot Mode Selection
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
JP21	OPEN	RS-232 Circuit Jumper
JP22	OPEN	External FLASH Memory IC Select
JP23	OPEN	External FLASH Memory IC Select
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	Encoder Interface Circuitry Jumper
JP29	OPEN	Encoder Interface Circuitry Jumper
JP30	OPEN	Encoder Interface Circuitry Jumper
JP31	NO Shunt required	CAN Circuitry Jumper
JP32	OPEN	CAN Circuitry Jumper
JP33	OPEN	CAN Circuitry Jumper
JP34	OPEN	CAN Circuitry Jumper

Table 4-2: Jumpers on the ADSP-21990 EZ-KIT Lite Board

4.3.2 Ground Plane Link, JP1

JP1 is a link that connects the analog and digital ground planes of the ADSP-21990 EZ-KIT Lite board. For correct operation, this link must not be removed.

4.3.3 External / Internal DSP Reset Selection Jumper, JP2

JP2 enables you to select the source of Reset for the ADSP-21990. When JP2 is in the 1-2 position, the ADSP-21990 can be reset from 3 external sources: pushbutton switch (S1) the external power-on reset IC (ADM708), or through the USB interface circuitry on the ADSP-21990 EZ-KIT Lite board. If JP2 is in the 2-3 position, the Power-on Reset (POR) of the ADSP-21990 is directly connected to the Reset pin of the ADSP-21990. The 1-2 position is the default and recommended configuration when using the VisualDSP++ development tools.

4.3.4 External/Internal Voltage Reference Selection Jumpers, JP3 and JP4

The configuration of two jumpers, JP3 and JP4, is required to control the selection of the ADSP-21990's internal voltage reference or the provided external voltage reference on the ADSP-21990 EZ-KIT Lite board. The appropriate settings for the jumpers to select internal or external voltage reference operation are:

INTERNAL Reference:	JP3 in position 1-2, JP4 open
EXTERNAL Reference:	JP3 in position 2-3, JP4 closed

Please see section 4.2.4 for more details on the Voltage reference operation.

4.3.5 PWM Trip Jumper, JP5

Connecting jumper JP5 in the 2-3 position ties the $\overline{\text{PWMTRIP}}$ pin of the ADSP-21990 to VDD and permanently enables the PWM outputs. Alternatively, connecting jumper JP5 in the 1-2 position connects the $\overline{\text{PWMTRIP}}$ pin of the ADSP-21990 to GND, thereby permanently disabling PWM outputs. A third alternative is to leave JP5 unconnected. In this case, the $\overline{\text{PWMTRIP}}$ pin of the ADSP-21990 is connected to the PWM connector, P10, so that its value can be defined by external circuitry.

4.3.6 PWM Switched Reluctance Mode Jumper, JP6

Connecting JP36 in the 2-3 position ties the $\overline{\text{PWMSR}}$ pin of the ADSP-21990 to +3.3V and disables the PWM switched reluctance mode. Alternatively, connecting JP6 in the 1-2 position ties the $\overline{\text{PWMSR}}$ pin of the ADSP-21990 to GND and enables the PWM switched reluctance mode.

4.3.7 PWM Polarity Jumper, JP7

Connecting JP7 in the 2-3 position ties the PWMPOL pin of the ADSP-21990 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-21990. 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.

4.3.8 AUXPWM Trip Jumper, JP8

Connecting jumper JP8 in the 2-3 position ties the $\overline{\text{AUXTRIP}}$ pin of the ADSP-21990 to VDD and permanently disables AUXPWM outputs. Alternatively, connecting jumper JP8 in the 1-2 position connects the $\overline{\text{AUXTRIP}}$ pin of the ADSP-21990 to GND, thereby permanently disabling AUXPWM outputs. A third alternative is to leave JP8 unconnected. In this case, the $\overline{\text{AUXTRIP}}$ pin of the ADSP-21990 is connected to the PWM connector, P10, so that its value can be defined by external circuitry.

4.3.9 Boot Mode and Bypass Mode Select Jumpers, JP9–JP12

The ADSP-21990 supports different boot modes that 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).

4.3.10 SPI EEPROM Enable Jumpers, JP13 and JP14

A socket is available on the ADSP-21990 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.

4.3.11 DAC Enable Jumpers, JP15 and JP16

JP13 and JP14 are used to enable the two 4-channel, serial, 12-bit DACs on the ADSP-21990 EZ-KIT Lite board. They are decoded at SPI Slave Select 2, via JP15. PF3 is used to update the DAC register via JP16.

4.3.12 Serial Port / UART Circuitry Jumpers, JP17–JP21

Jumper JP17 is used to connect 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-21990 EZ-KIT Lite board JP18–JP20 enable the UART circuitry, and JP21 enables the required loopback in the UART circuitry.

4.3.13 External FLASH Memory Enable Jumpers, JP22 and JP23

Sockets are provided on the ADSP-21990 EZ-KIT Lite board to connect the External Memory Interface to two 512K x 8-bit flash memory ICs (U5, U6). These flash memory ICs are connected to the boot memory select ($\overline{BMS}$) pin via JP22, or to the memory select 0 pin ($\overline{MS0}$) via JP23. **NOTE:** If using external Flash memory, only **one** of these 2-pin jumpers should be CLOSED at any one time.

4.3.14 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-21990 EZ-KIT Lite board. External memory space consists of four memory banks. The $\overline{MS3-MS0}$ memory bank pins select banks 3-0, respectively. JP24 – JP27 map the external SRAM to $\overline{MS0}$, $\overline{MS1}$, $\overline{MS2}$, or $\overline{MS3}$. **NOTE:** If using external SRAM, only **one** of these 2-pin jumpers should be CLOSED at any one time.

4.3.15 Encoder Interface Jumpers, JP28 – JP30

The ADSP-21990 EZ-KIT Lite board allows you to apply differential encoder signals to the board at the Encoder Interface Connector, 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-21990. Three 2-pin jumpers, JP28 – JP30, are provided to enable this encoder interface circuitry. It is also possible for you to apply encoder signals directly to the Encoder Interface of the ADSP-21990 at these jumpers, when they are OPEN (i.e., no shunt installed).

4.3.16 CAN Circuitry Jumpers, JP31 – JP34

A CAN Controller IC (U1) is provided on the SPI Interface. The MCP2510 from Microchip is used. The SPISEL4 pin of the ADSP-21990 is used to select the CAN Controller IC to be active on the SPI interface via JP33. The PF5 pin is used to reset the CAN Controller IC via JP32. JP34 can be used to enable (2-3 position) or disable (1-2 position) the sleep mode on the CAN transceiver. If no shunt is present, this mode can be defined by external circuitry.

4.4 Connectors

This section describes the function of the connectors on the ADSP-21990 EZ-KIT Lite board. The following figure shows the locations of connectors, P1 – P14.

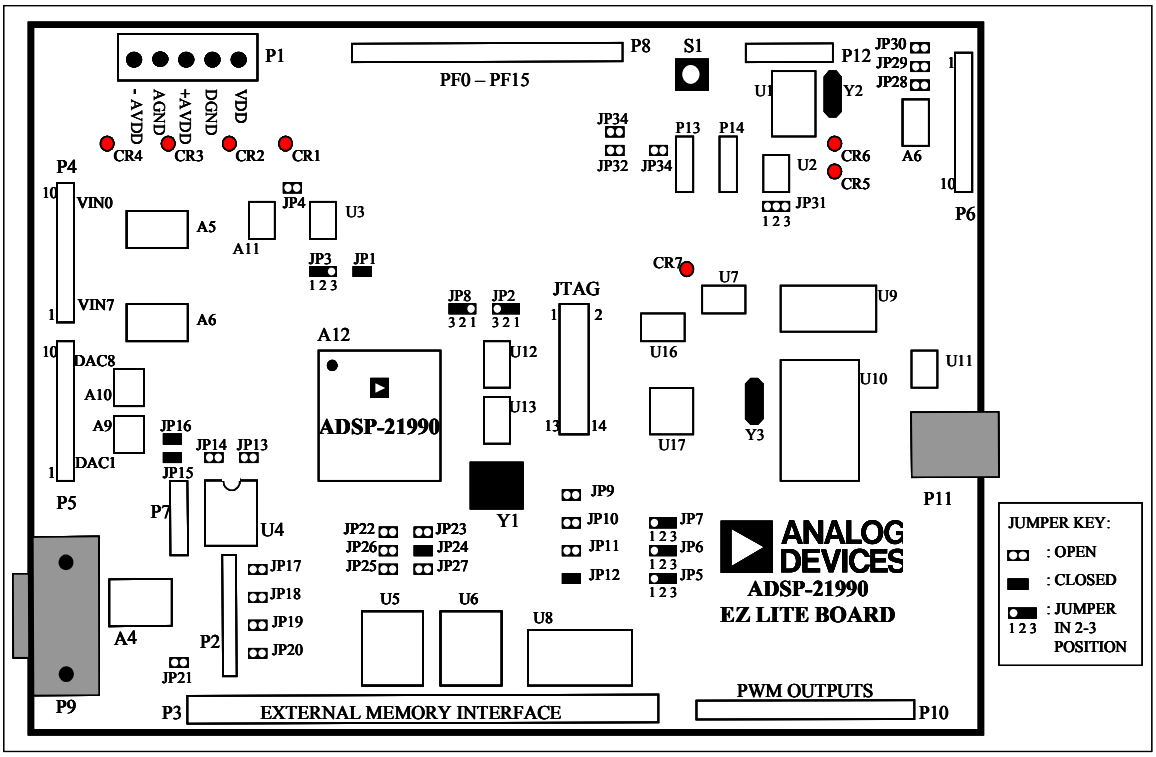


Figure 4-5: Connector Locations

4.4.1 Power Supply Connector, P1

Please refer to section 4.2.1 for details of the input power supply connector, P1.

4.4.2 Serial Port Connector, P2

The SPORT is connected to a 10-pin connector.

PIN	NAME	SIGNAL
1	+3.3V	Vddext
2	DR	Receive Data
3	DGND	Digital Ground
4	DT	Transmit Data
5	NC	No Connect
6	+3.3V	Vddext
7	TCLK0	Transmit Clock
8	TFS	Transmit Frame Sync
9	RFS	Receive Frame Sync
10	RCLK	Receive Clock

Table 4-3: SPORT Connector, P2

4.4.3 External Memory Interface (EMI) Connector, P3

Please refer to the schematics in APPENDIX A: SCHEMATICS, at the end of this document for the pin-out of the EMI Connector.

4.4.4 Analog Inputs Connector, P4

Analog input signals to the ADSP-21990 EZ-KIT Lite board are supplied at the P4 Analog Inputs connector. Nominally, analog input signals in the range –1V to +1V may be applied to the ADSP-21990 EZ-KIT Lite board.

PIN	NAME	SIGNAL
1	AGND	Analog Ground
2	VIN7	Analog Input Channel 7
3	VIN6	Analog Input Channel 6
4	VIN5	Analog Input Channel 5
5	VIN4	Analog Input Channel 4
6	VIN3	Analog Input Channel 3
7	VIN2	Analog Input Channel 2
8	VIN1	Analog Input Channel 1
9	VIN0	Analog Input Channel 0
10	AGND	Analog Ground

Table 4-4: Analog Input Connector, P4

4.4.5 DAC Outputs Connector, P5

The outputs of the SPI DACs are brought out to the DAC Outputs Connector, P5.

PIN	NAME	SIGNAL
1	AGND	Analog Ground
2	DAC0	DAC Channel 0
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	Analog Ground

Table 4-5: DAC Outputs Connector, P5

4.4.6 Encoder Interface Connector, P6

Differential encoder signals can be applied to the ADSP-21990 EZ-KIT Lite board at the Encoder Interface Connector, P6.

PIN	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 Quadr. Pulse input B+
6	EIB-	Differential Quadr. Pulse input B-
7	DGND	Digital Ground
8	EIA+	Differential Quadr. Pulse input A+
9	EIA-	Differential Quadr. Pulse input A-
10	DGND	Digital Ground

Table 4-6: Encoder Interface Connector, P6

4.4.7 SPI Connector, P7

The SPI signals are made available at the SPI connector, P7.

PIN	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

Table 4-7: SPI Connector, P7

4.4.8 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.

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
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

Table 4-8: Programmable Flag Interface Connector, P8

4.4.9 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-21990 EZ-KIT Lite board.

PIN	NAME	SIGNAL
1	1-4-6	
2	T1O	Transmit
3	R1E	Receive
4	1-4-6	
5	DGND	Digital Ground
6	1-4-6	
7	RTS	
8	CTS	
9	NC	Not Connected

Table 4-9: UART (RS-232) Interface Connector, P9

4.4.10 PWM, AUXPWM, Timer Interface Connector, P10

The PWM, AUXPWM and General-Purpose Timer Signals are available on 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
14	TMR0	General-Purpose Timer I/O
15	TMR1	General-Purpose Timer I/O
16	TMR2	General-Purpose Timer I/O

Table 4-10: PWM, AUX, TMR Interface Connector, P10

4.4.11 USB Connector, P11

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 kit)	Assmann	AK672-5
	Digi-Key	AK672-5ND

4.4.12 CAN Interface Connector, P12–P14

There are three connectors associated with the CAN Interface circuitry on the ADSP-21990 EZ-KIT Lite board. Some signals of the CAN Controller IC are made available on P12. Refer to the schematics in APPENDIX A: SCHEMATICS at the end of this document for the pin-out of P12. Connectors P13 and P14 provide connections to the user's CAN Bus and allow easy daisy-chaining of CAN devices.

PIN	NAME	SIGNAL
1	DGND	Digital Ground
2	CANL	CAN Receive
3	CANH	CAN Transmit
4	+3.3V	Vddext

Table 4-11: CAN Interface Connectors, P13 and P14

4.4.13 JTAG Connector

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

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

4.5 Mechanical Dimensions

Figure 4-6 shows the dimensions of the board.

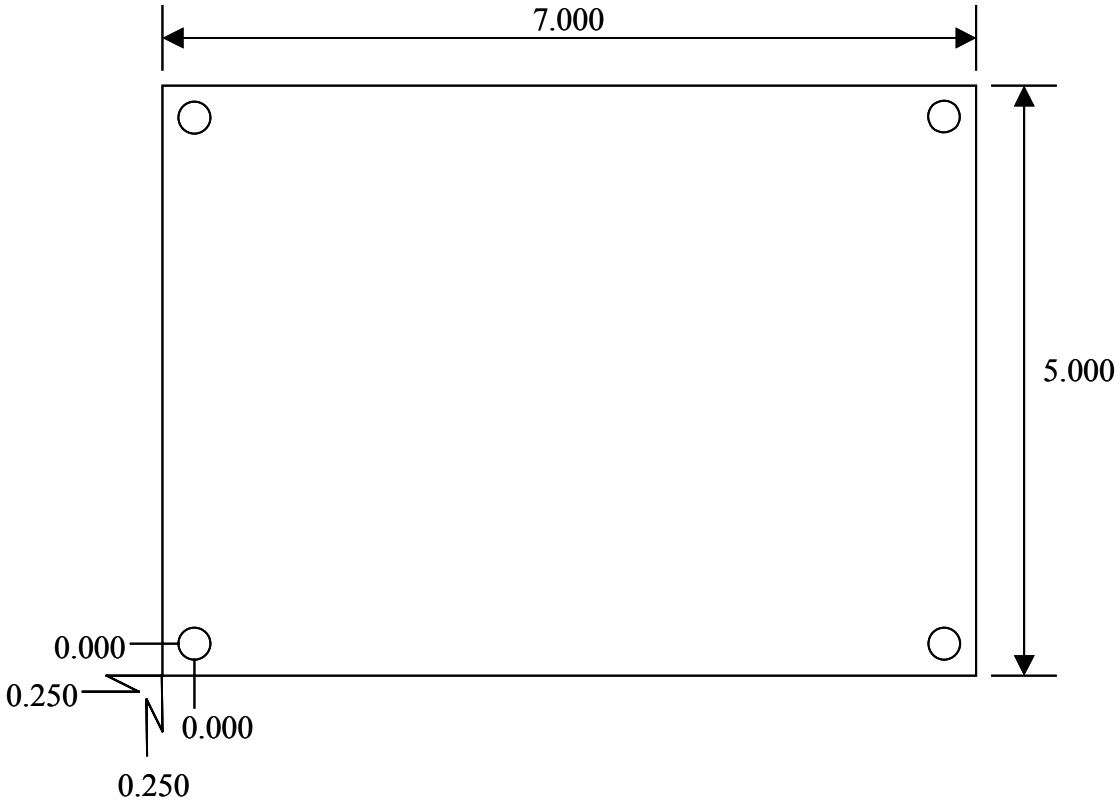


Figure 4-6: Mechanical Dimensions (Measurements are in Inches)

APPENDIX A: SCHEMATICS

The schematics for the ADSP-21990 EZ-KIT Lite board are available on the next 10 pages.

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

NOTE:

THIS TEMPLATE COMPLIES WITH WILMINGTON ANALOG DEVICES CONFIGURATION.

PART NO	DESCRIPTION	REF DES	NOTES

HIGHEST REF DES USED

REF DES NOT USED

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES

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

MATERIAL

FINISH

DO NOT SCALE

SCHEMATIC

APPROVAL	DATE
DRAWN BY: S. FRANCIS	1/02
DESIGNED BY:	
CHECKED:	
APPROVED BY:	
MFG ENGINEER:	

ANALOG DEVICES

804 WOBURN ST
WILMINGTON, MA 01887

TITLE

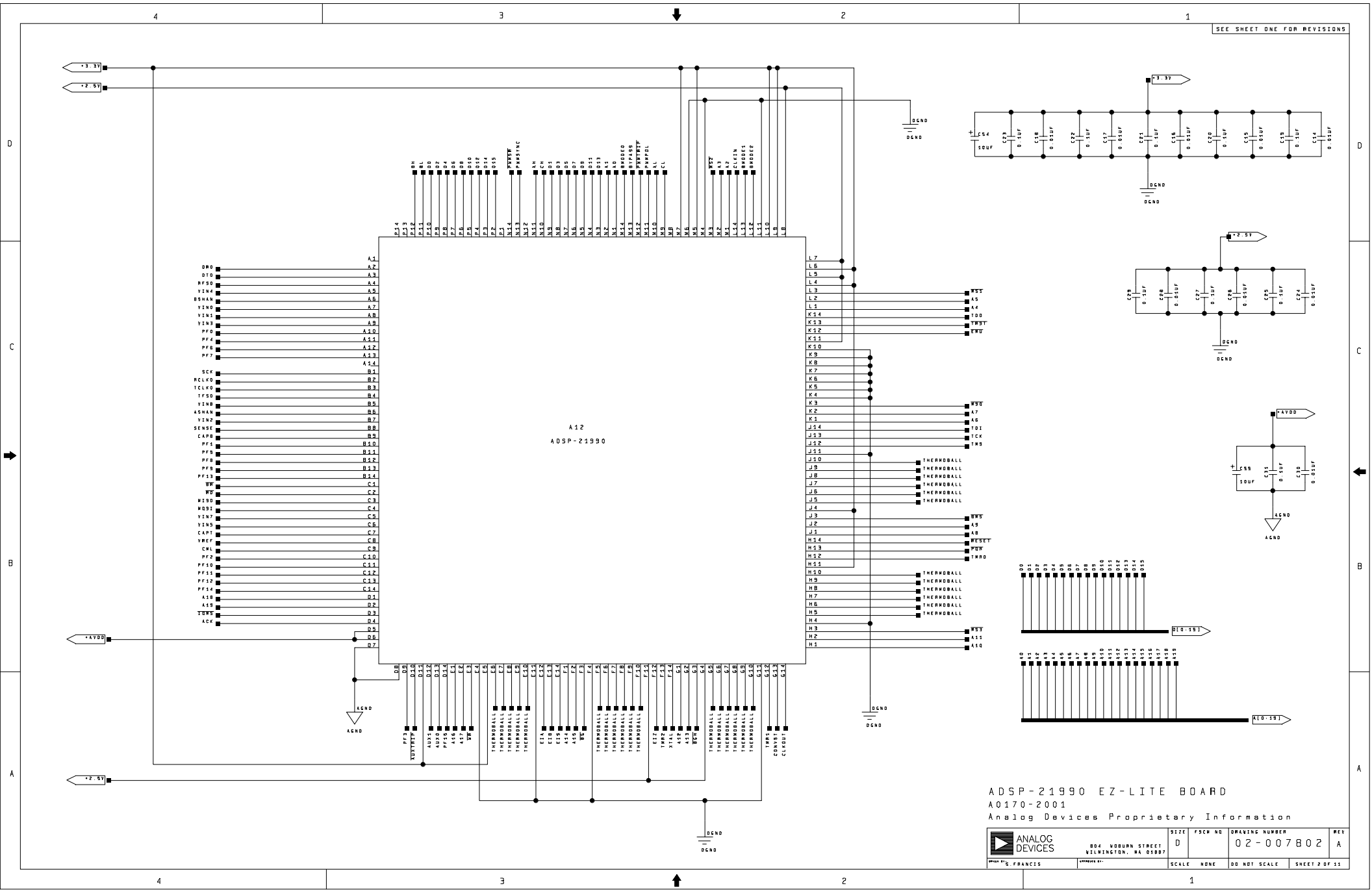
ADSP-21990 EZ-LITE BOARD

A0170-2001

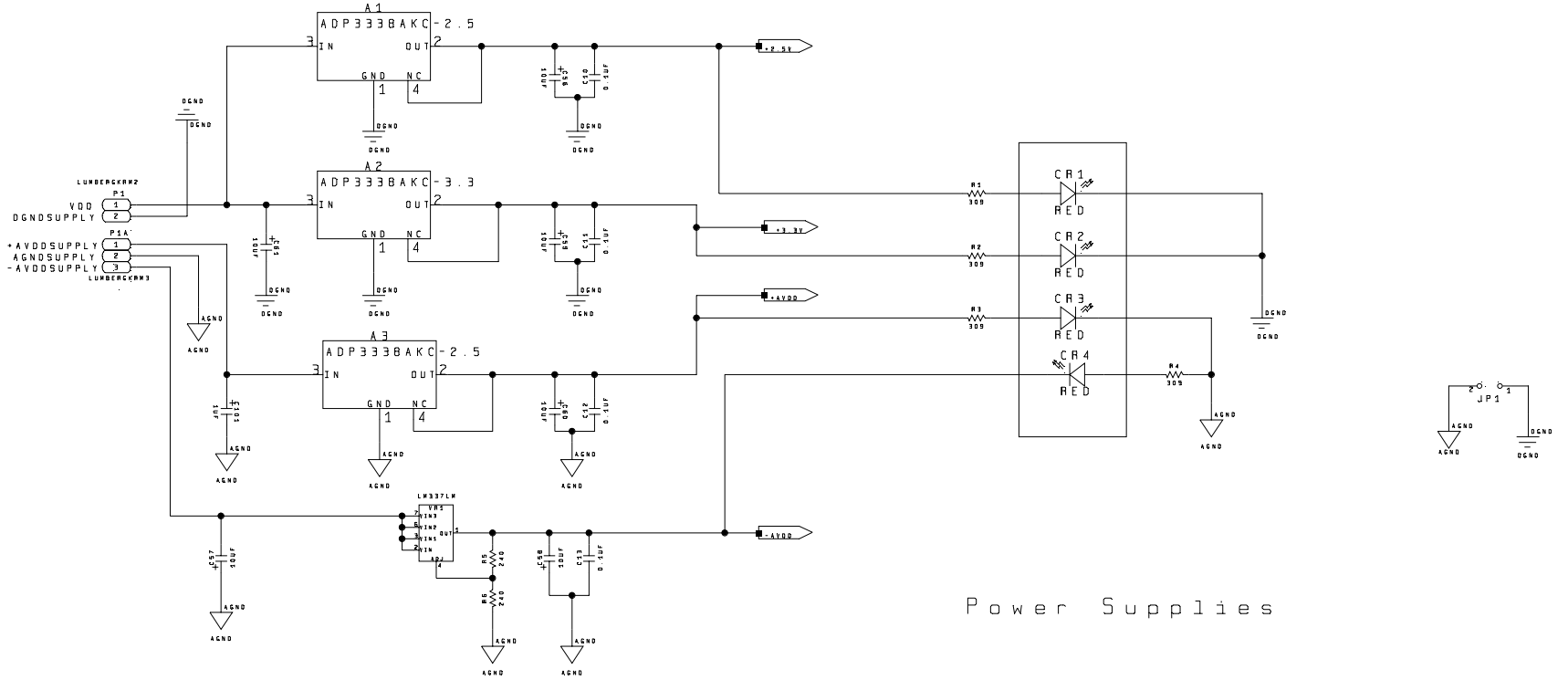
SIZE	FSCM NO	DRAWING NUMBER	REV
B		02-007802	A

SCALE NONE

SHEET 1 OF 11


SEE SHEET ONE FOR REVISIONS
A12
ADSP-21990
ADSP-21990 EZ-LITE BOARD
A0170-2001
Analog Devices Proprietary Information
ANALOG DEVICES
804 WOBURN STREET
WILMINGTON, MA 01887
S. FRANCIS
SIZE D
FSCM NO
DRAWING NUMBER 02-007802
REV A
SCALE NONE
DO NOT SCALE
SHEET 2 OF 11

SEE SHEET ONE FOR REVISIONS



Power Supplies

ADSP-21990 EZ-LITE BOARD
A0170-2001
Analog Devices Proprietary Information

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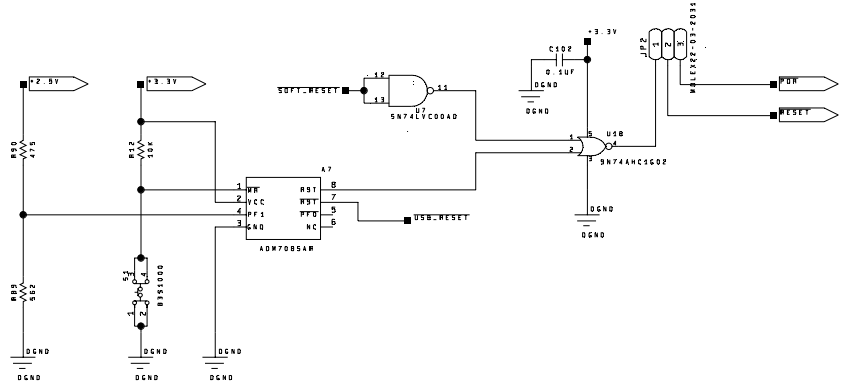
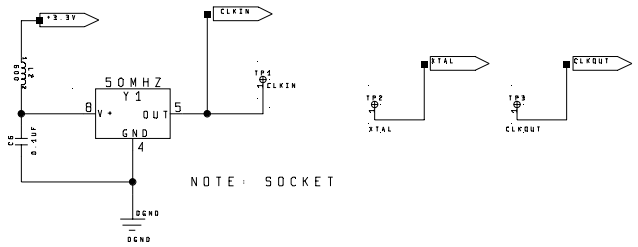
DRAWN BY: S. FRANCIS	APPROVED BY:	SCALE NONE	DO NOT SCALE	SHEET 3 OF 11	

NOTE: There is an additional Pull-Up Resistor required on $\overline{\text{SOFT\_RESET}}$

Reset

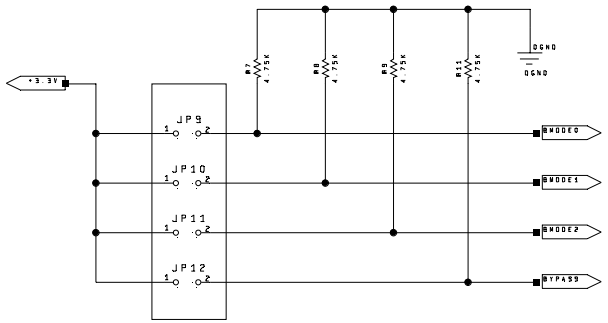


Oscillator Circuitry



NOTE: SOCKET

Boot Mode Selection & PLL Bypass



ADSP-21990 EZ-LITE BOARD
A0170-2001
Analog Devices Proprietary Information

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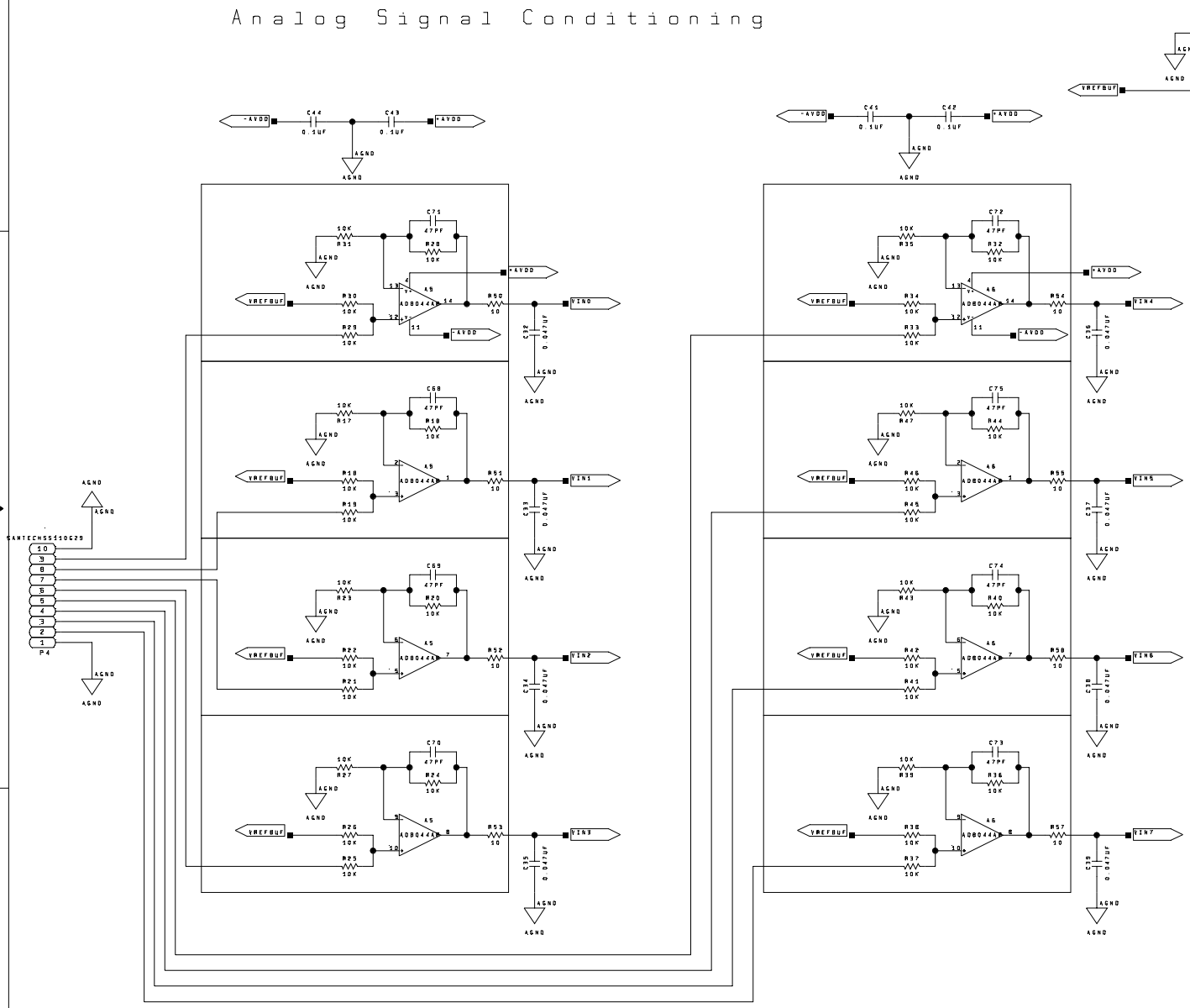
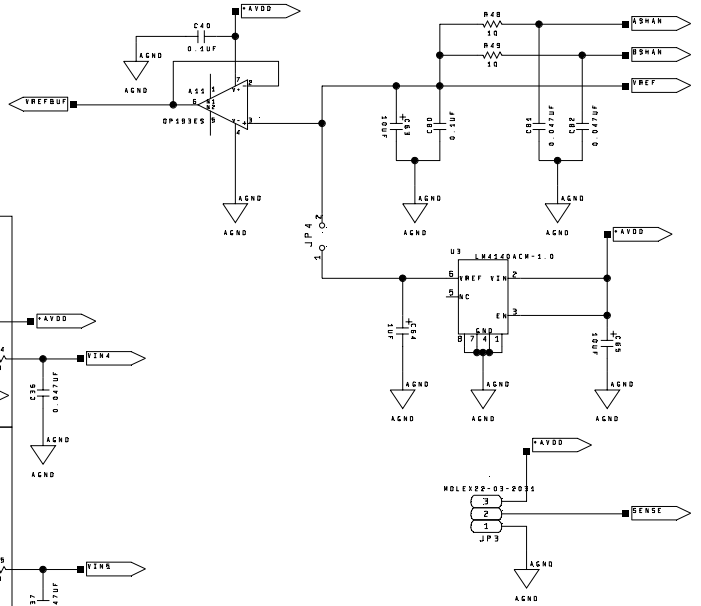
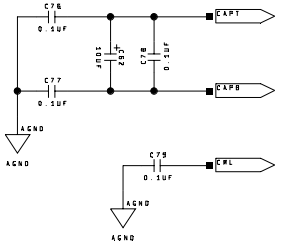
Analog Signal Conditioning



Reference Voltage





ADSP-21990 EZ-LITE BOARD

A0170-2001

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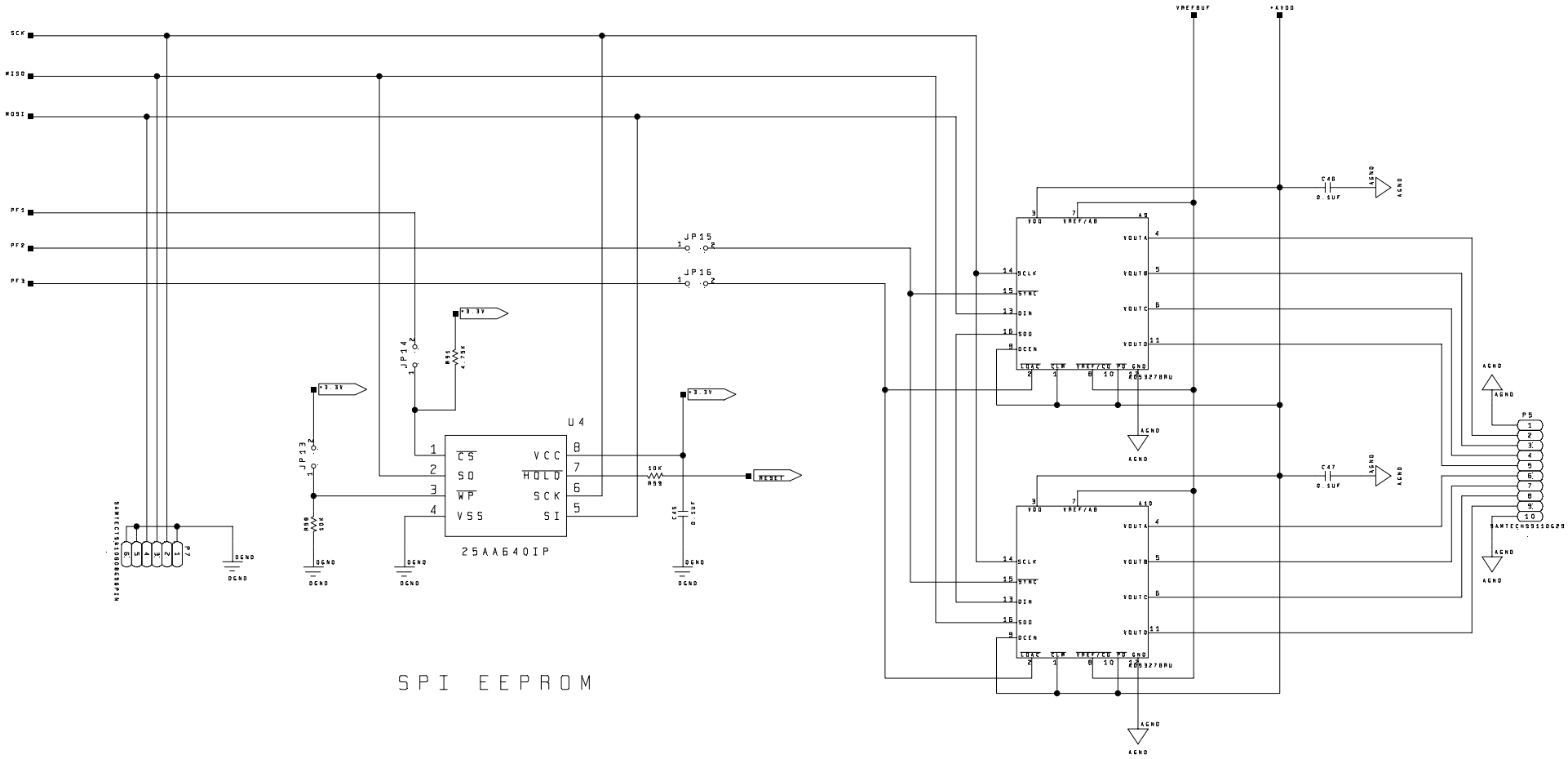

SPI EEPROM

DAC CIRCUITRY

ADSP-21990 EZ-LITE BOARD
A0170-2001
ANALOG DEVICES PROPRIETARY INFORMATION

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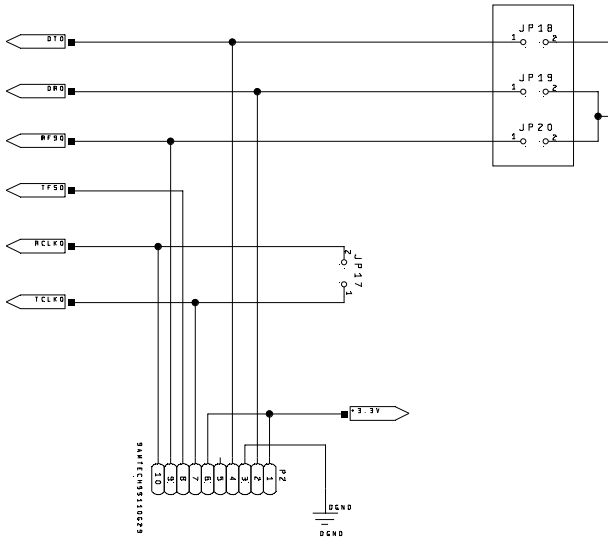
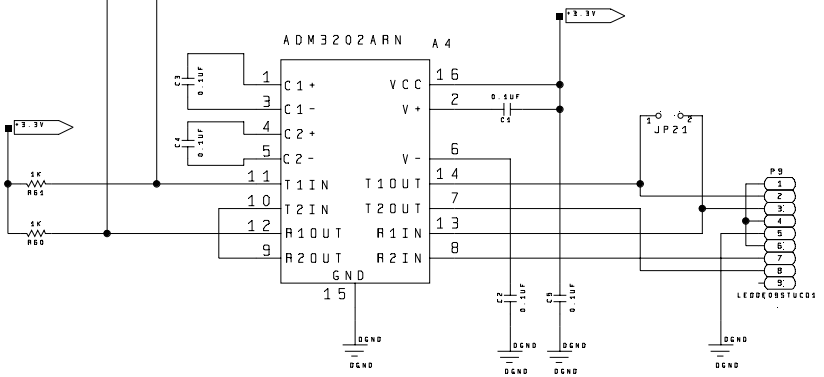


SPORT Interface



UART Interface

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Analog Devices Proprietary Information

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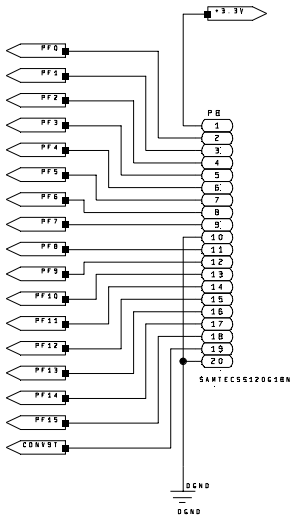
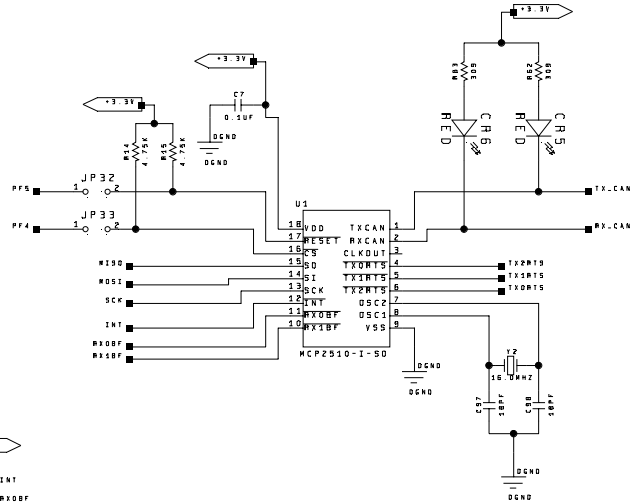
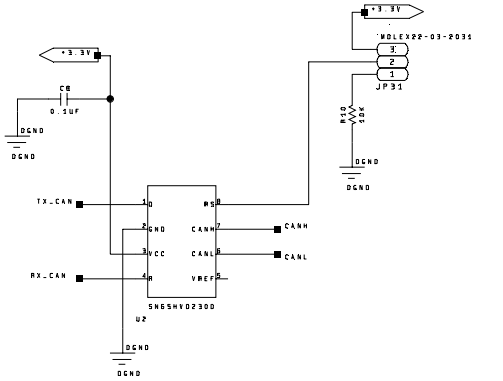
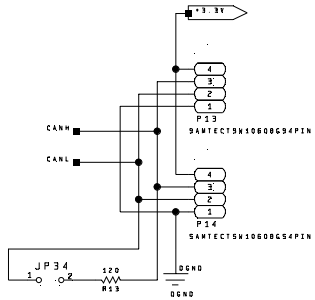
General Purpose I/O

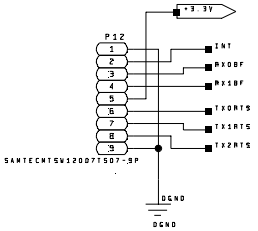


CAN Interface









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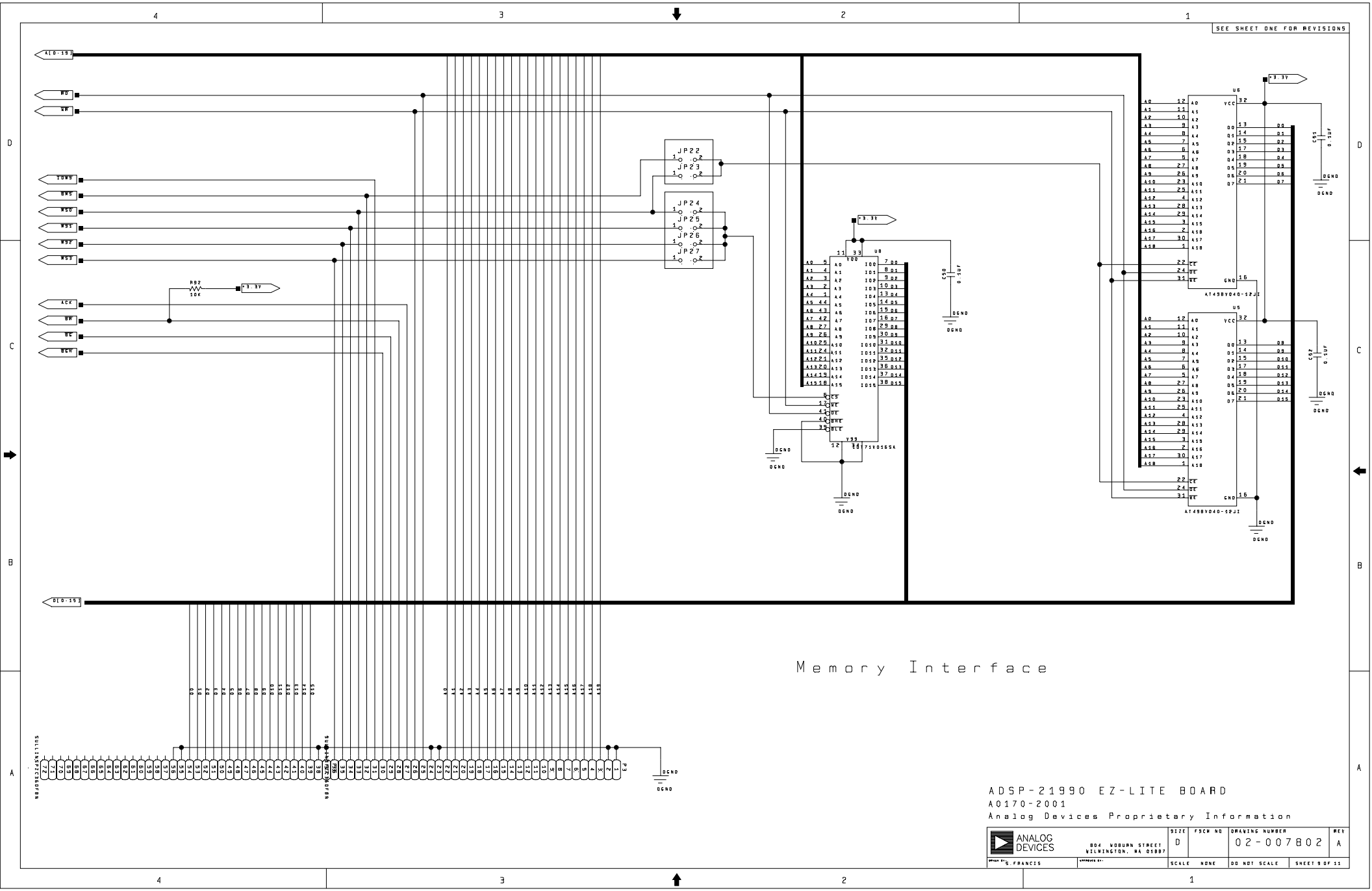

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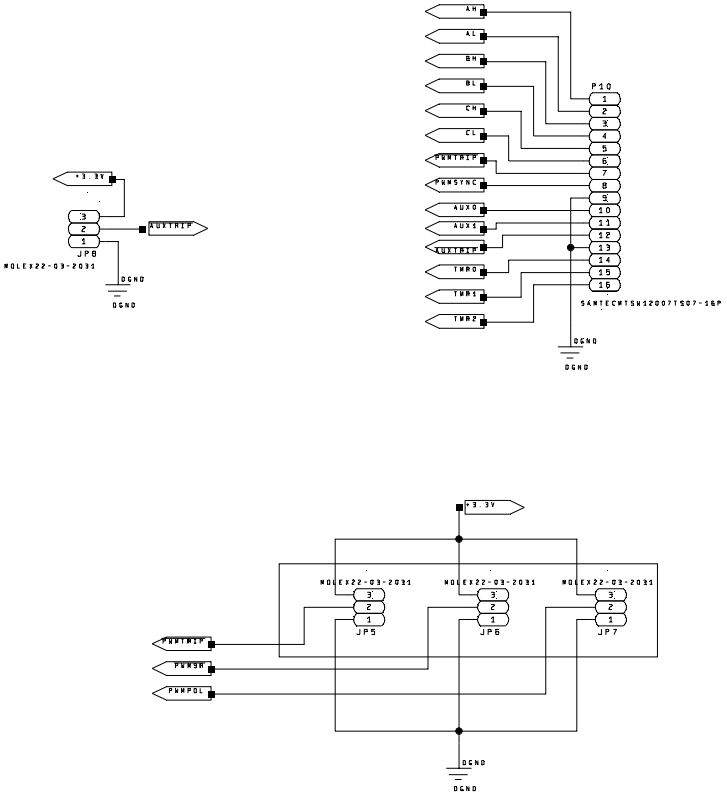
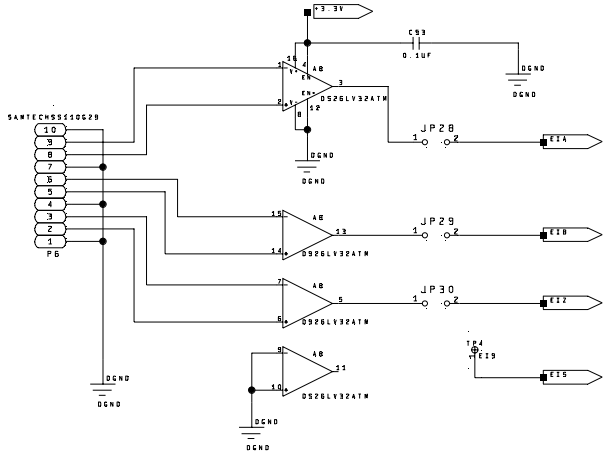
PWM Interface



EIU circuitry



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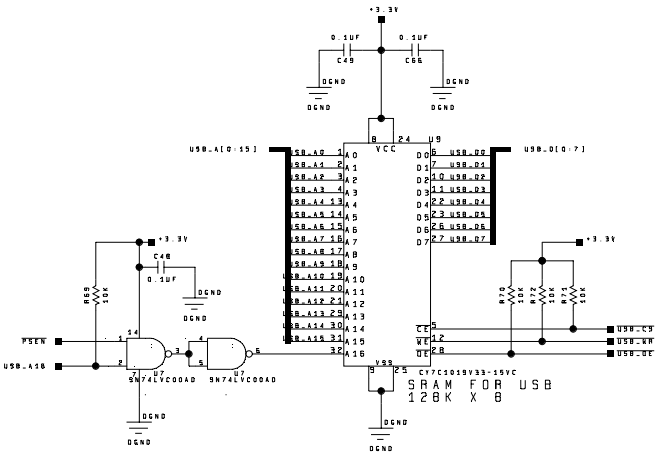
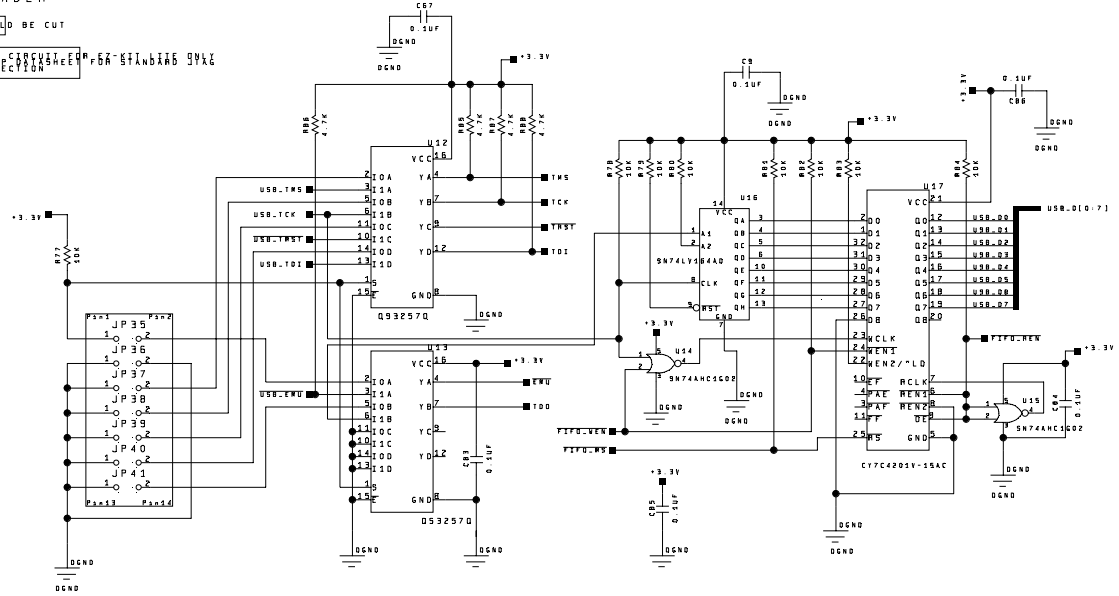
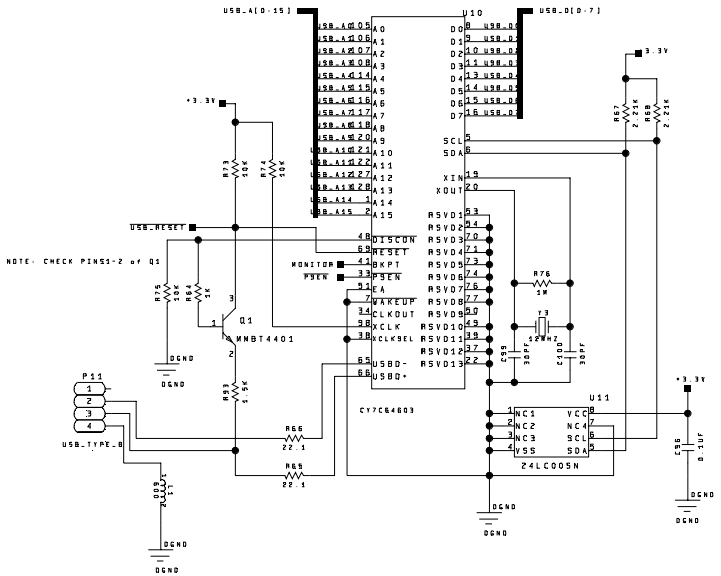
JTAG HEADER

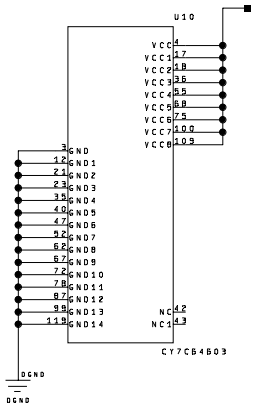
PIN 3 SHOULD BE CUT

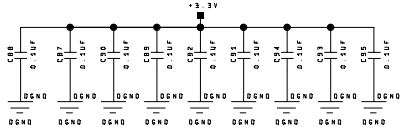
JTAG HEADER CIRCUIT FOR EZ-KIT LITE ONLY
REFER TO DSP.SCH/SHEET FOR STANDARD JTAG HEADER CONNECTION

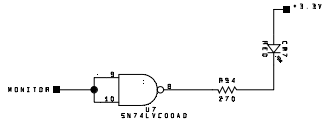












ADSP-21990 EZ-LITE BOARD
A0170-2001
Analog Devices Proprietary Information

ANALOG DEVICES	804 WOBURN STREET WILMINGTON, MA 01887	SIZE D	FSCM NO	DRAWING NUMBER 02-007802	REV A
DRAWN BY: S.FRANCIS	APPROVED BY:	SCALE NONE	DO NOT SCALE	SHEET 10 OF 11	

Index