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Printed in the USA.

Limited Warranty

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

Disclaimer

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Regulatory Compliance

The ADSP-2191 EZ-KIT Lite evaluation system has been certified to comply with the essential requirements of the European EMC directive 89/336/EEC (inclusive 93/68/EEC) and, therefore, carries the “CE” mark.

The ADSP-2191 EZ-KIT Lite evaluation system had been appended to the Technical Construction File referenced “DSPTOOLS1” dated December 21, 1997 and was awarded CE Certification by an appointed European Competent Body as listed below.

Technical Certificate No: Z600AN A1.006

Issued by: Technology International (Europe) Limited
41 Shrivenham Hundred Business Park
Shrivenham, Swindon, SN6 8T2, UK

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

PREFACE

Purpose of This Manual ................................................................. xi
Intended Audience ....................................................................... xii
Manual Contents ......................................................................... xii
What’s New in This Manual ......................................................... xiii
Technical or Customer Support .................................................... xiii
Supported Processors .................................................................. xiv
Product Information ..................................................................... xiv
  MyAnalog.com ....................................................................... xiv
  DSP Product Information ......................................................... xv
Related Documents ...................................................................... xvi
Online Documentation .................................................................. xvii
Printed Manuals ......................................................................... xvii
  VisualDSP++ Documentation Set ............................................ xvii
  Hardware Manuals ............................................................ xviii
  Data Sheets ........................................................................ xviii
  Contacting DSP Publications ................................................. xviii
  Notation Conventions ......................................................... xviii
CONTENTS

GETTING STARTED

Contents of EZ-KIT Lite Package ................................................. 1-1
PC Configuration ........................................................................ 1-3
Installation Tasks .......................................................................... 1-3
   Installing VisualDSP++ and EZ-KIT Lite Software ................. 1-4
   Installing VisualDSP++ License .......................................... 1-5
   Setting Up EZ-KIT Lite Hardware ...................................... 1-5
   Installing EZ-KIT Lite USB Driver .................................. 1-7
      Windows 98 USB Driver Installation ............................ 1-8
      Windows 2000 USB Driver Installation ....................... 1-12
      Windows XP USB Driver Installation ......................... 1-13
   Verifying Driver Installation .......................................... 1-15
   Starting VisualDSP++ ................................................... 1-16

USING EZ-KIT LITE

EZ-KIT Lite License Restrictions ............................................... 2-2
Memory Map ............................................................................... 2-2
Using Programmable Flag Pins ...................................................... 2-3
Example Programs ........................................................................ 2-5
Using Flash Programmer Utility .................................................... 2-5
Restricted Software Breakpoints .................................................... 2-5
   Software Breakpoints Within Delayed Slots ................. 2-5

EZ-KIT LITE HARDWARE REFERENCE

System Architecture .................................................................. 3-2
CONTENTS

External Memory Interface (EMI) ............................................ 3-3
Host Port Interface (HPI) ..................................................... 3-3
SPORT 0 – Audio Interface .................................................. 3-4
SPORT 1 Telephony Interface .............................................. 3-4
Breadboard Area .................................................................. 3-5
JTAG Emulation Port .......................................................... 3-6
Jumper and DIP Switch Settings ............................................. 3-6
  Audio Input Select Jumper (JP1) ....................................... 3-7
  Telephony Codec Serial Interface Mode (JP2) .................... 3-7
  Telephony Codec Disable (JP3) ....................................... 3-8
  Audio Codec Disable Jumper (JP4) .................................. 3-8
  Boot Mode Select Switch (JP6) ....................................... 3-9
  Bypass Mode Select Switch (JP7) .................................... 3-9
  DSP Clock Multipler Select Switch (SW4) ......................... 3-10
LEDs and Push Buttons .......................................................... 3-11
  Power LED (LED 1) ....................................................... 3-11
  Reset LEDs (LED 2, LED 3) .......................................... 3-12
  Telephony LEDs (LED 6-4) ............................................ 3-12
  USB Monitor LED (LED 7) ............................................. 3-12
  Programmable Flag LEDs (LED 10-8) ............................. 3-12
  Reset Push Button (SW 1) .............................................. 3-13
  Programmable Flag Push Buttons (SW 2 and SW 3) ............ 3-13
Connectors ............................................................... 3-14
  USB (P1) ................................................................. 3-14
CONTENTS

Audio (P3, P4) ................................................................. 3-15
Telephone (P5) ............................................................... 3-15
SPORT0 (P6) and SPORT1 (P7) ............................... 3-16
JTAG (P8) ............................................................... 3-16
External Memory Interface (P10, P11) ..................... 3-17
Host Port Interface (P12) .............................................. 3-17
Power Connector (P13) .............................................. 3-17
Specifications ........................................................... 3-18
  Power Supply .......................................................... 3-18
  Board Current Measurements ................................. 3-19
  Mechanical Dimensions ....................................... 3-20

BILL OF MATERIALS

INDEX
PREFACE

Thank you for purchasing the ADSP-2191 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-2191 fixed-point digital signal processor (DSP). The VisualDSP++ development environment gives you the ability to perform advanced application code development and debug tasks such as:

- Create, compile, assemble, and link application programs written in C++, C and ADSP-2191 assembly
- Load, run, step, halt, and set breakpoints in application program
- Read and write data and program memory
- Read and write core and peripheral registers
- Plot memory

Access to the ADSP-2191 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-2191 processor and the evaluation board peripherals. Analog Devices JTAG emulators offer faster communication between the host PC and target hardware. Analog Devices carries a wide range of in-circuit emulation products. To learn more about Analog Devices emulators and DSP development tools, go to:

http://www.analog.com/dsp/tools/
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-2191 processor
  - 160 MHz Core Clock Speed (default)
  - Core Clock Multiplication Factor Selection Switch
- USB Debugging Interface
  - This is not the DSP’s USB interface.
- Analog Devices AD1885 48 kHz AC’97 SoundMAX® Codec
  - Jumper-Selectable Line-In or Mic-In 3.5 mm Stereo Jack
  - Line-Out 3.5 mm Stereo Jack
- Analog Devices AD1803 Low-Power Modem Codec
  - RJ-11 Telephone Line Connector
  - Rx and Tx LEDs
- Flash Memory
  - 512K x 8
- Interface Connectors
  - 14-Pin Emulator Connector for JTAG Interface
  - SPORT0 and SPORT1 Connectors
  - External Memory Interface Connectors (not populated)
  - Host Port Interface Connector (not populated)
Preface

- General-Purpose IO
  - 2 Push Button Inputs
  - 4 LEDs Outputs
- Analog Devices ADP3338 and ADP3339 Voltage Regulators
- Breadboard area with typical SMT footprints

The EZ-KIT Lite board has a Flash memory device that can be used to store user-specific boot code. By configuring the jumpers (SW1 switch) and by programming the Flash memory, the board can run as a stand-alone unit. For information about using the Flash memory, see “Using Flash Programmer Utility” on page 2-5.

SPORT0 is interfaced with an audio codec, allowing you to create audio signal processing applications. SPORT1 is connected to a telephony codec allowing you to interface with a telephone line. Both SPORTs are attached to off-board connectors to connect to other serial devices.

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) and Host Port Interface (HPI).

Purpose of This Manual

The ADSP-2191 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-2191 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-2191 board designs.
Intended Audience

This manual is a user’s guide and reference to the ADSP-2191 EZ-KIT Lite evaluation system. Programmers who are familiar with the Analog Devices ADSP-2191 processor architecture, operation, and programming are the primary audience for this manual.

Programmers who are unfamiliar with Analog Devices Blackfin processors can use this manual in conjunction with the ADSP-219x/2191 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 or getting started guides. For the locations of these documents, refer to “Related Documents” in this “Preface.”

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 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.
Preface

- Appendix A, “Bill Of Materials” on page A-1
  Provides a list of components used to manufacture the EZ-KIT Lite board.

- Appendix B, “Schematics” on page B-1
  Provides the resources to allow EZ-KIT Lite board-level debugging or to use as a reference design.

This appendix is not part of the online Help. The online Help viewers should go the PDF version of the ADSP-2191 EZ-KIT Lite Evaluation System Manual located in the Docs\EZ-KIT Lite Manuals folder on the installation CD to see the schematics.

What’s New in This Manual

This is the third revision of the ADSP-2191 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

- Email questions to
dsptools.support@analog.com

- Phone questions to 1-800-ANALOGD

- Contact your ADI local sales office or authorized distributor
Supported Processors

The ADSP-2191 EZ-KIT Lite evaluation system supports Analog Devices ADSP-2191 processors.

Product Information

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

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

MyAnalog.com

MyAnalog.com is a free feature of the Analog Devices website that allows customization of a webpage to display only the latest information on products you are interested in. You can also choose to receive weekly email notification containing updates to the webpages 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.

- Email 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)
Product Information

Related Documents

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

Table 1. Related DSP Publications

<table>
<thead>
<tr>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADSP-2191 DSP Datasheet</td>
<td>General functional description, pin-out, and timing.</td>
</tr>
<tr>
<td>ADSP-219x/2191 DSP Hardware Reference</td>
<td>Description of internal processor architecture and all register functions.</td>
</tr>
<tr>
<td>ADSP-219x Instruction Set Reference</td>
<td>Description of all allowed processor assembly instructions.</td>
</tr>
</tbody>
</table>

Table 2. Related VisualDSP++ Publications

<table>
<thead>
<tr>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VisualDSP++ 3.5 Assembler and Preprocessor Manual for ADSP-21xx Processors</td>
<td>Description of the assembler function and commands for Blackfin processors.</td>
</tr>
<tr>
<td>VisualDSP++ 3.5 C/C++ Compiler and Library Manual for ADSP-219x Processors</td>
<td>Description of the compiler function and commands for Blackfin processors.</td>
</tr>
<tr>
<td>VisualDSP++ 3.5 Linker and Utilities Manual for 16-Bit Processors</td>
<td>Description of the linker function and commands for 16-bit processors.</td>
</tr>
<tr>
<td>VisualDSP++ 3.5 Loader Manual for 16-Bit Processors</td>
<td>Description of the loader/splitter function and commands for 16-bit processors.</td>
</tr>
</tbody>
</table>

The listed documents can be found through online Help or in the Docs folder of your VisualDSP++ installation. 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. These help files provide information about VisualDSP++ and the AD SP-2191 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→VisualDSP→VisualDSP++ Documentation.

To view AD SP-2191 EZ-KIT Lite Help, which now is a part of the VisualDSP++ Help system, go the Contents tab of the Help window and select Manuals→AD SP-2191 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.
Notation Conventions

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 website. 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 website. 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 website. Data sheets without the suffix can be downloaded from the website 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 email 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.
# Preface

<table>
<thead>
<tr>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Close</strong> command (File menu) or <strong>OK</strong></td>
<td>Text in <strong>bold</strong> style indicates the location of an item within the VisualDSP++ environment's and boards' menu system and user interface items.</td>
</tr>
<tr>
<td>*(this</td>
<td>that)*</td>
</tr>
<tr>
<td>*[this</td>
<td>that]*</td>
</tr>
<tr>
<td><em>[this,</em>..]*</td>
<td>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.</td>
</tr>
<tr>
<td><strong>PF9-0</strong></td>
<td>Registers, connectors, pins, commands, directives, keywords, code examples, and feature names are in text with letter gothic font.</td>
</tr>
<tr>
<td><strong>filename</strong></td>
<td>Non-keyword placeholders appear in text with italic style format.</td>
</tr>
<tr>
<td><strong>Note:</strong></td>
<td>A note providing information of special interest or identifying a related topic. In the online version of this book, the word <strong>Note</strong> appears instead of this symbol.</td>
</tr>
<tr>
<td><strong>Caution:</strong></td>
<td>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 <strong>Caution</strong> appears instead of this symbol.</td>
</tr>
</tbody>
</table>
Notation Conventions
Notation Conventions
Notation Conventions
Notation Conventions
GETTING STARTED

This chapter provides the information you need to begin using ADSP-2191 EZ-KIT Lite evaluation system. For correct operation, install the software and hardware in the order presented in “Installation Tasks” on page 1-3.

The chapter includes the following sections.

- “Contents of EZ-KIT Lite Package” on page 1-1
  Provides a list of the components shipped with this EZ-KIT Lite evaluation system.

- “PC Configuration” on page 1-3
  Describes the minimum requirements for the PC to work with the EZ-KIT Lite evaluation system.

- “Installation Tasks” on page 1-3
  Describes the step-by-step procedures for setting up the hardware and software.

Contents of EZ-KIT Lite Package

Your ADSP-2191 EZ-KIT Lite evaluation system package contains the following items.

- ADSP-2191 EZ-KIT Lite board
- EZ-KIT Lite Quick Start Guide
Contents of EZ-KIT Lite Package

- CD containing:
  - VisualDSP++ for 16-bit processors with a limited license
  - ADSP-2191 EZ-KIT Lite debug software
  - USB driver files
  - Example programs
  - ADSP-2191 EZ-KIT Lite Evaluation System Manual (this document)
- Installation Quick Reference Card for VisualDSP++
- Universal 7.5V DC power supply
- USB 2.0 type 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.

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.
Getting Started

PC Configuration

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

<table>
<thead>
<tr>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows 98, Windows 2000, Windows XP</td>
</tr>
<tr>
<td>Intel (or comparable) 166 MHz processor</td>
</tr>
<tr>
<td>VGA Monitor and color video card</td>
</tr>
<tr>
<td>2-button mouse</td>
</tr>
<tr>
<td>50 MB free on hard drive</td>
</tr>
<tr>
<td>32 MB RAM</td>
</tr>
<tr>
<td>Full-speed USB port</td>
</tr>
<tr>
<td>CD-ROM Drive</td>
</tr>
</tbody>
</table>

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-2191 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
Installation Tasks

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.
Getting Started

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.


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 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-2191 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.
Installation Tasks

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. Figure 1-1 shows the default jumper settings, DIP switch, connector locations, and LEDs used in installation. Confirm that your board is set up in the default configuration before going to step 3.

Figure 1-1. Default Jumper Settings
Getting Started

3. Plug the provided power supply into P13 on the EZ-KIT Lite board. Visually verify that the green power LED (LED1) is on. Also verify that the two red reset LEDs (LED2 and LED3) go on for a moment and then go off.

4. Connect one end of the USB cable to an available full speed USB port on your PC and the other end to P1 on the ADSP-2191 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 Installation" on page 1-8 describes the installation on Windows 98.
- "Windows XP USB Driver Installation" on page 1-13 describes the 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.
Installation Tasks

Windows 98 USB Driver Installation

Before using the ADSP-2191 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 1-2.

2. Click Next.

Figure 1-2. Windows 98 – Add New Hardware Wizard
3. Select **Search for the best driver for your device**, as shown in Figure 1-3.

![Figure 1-3. Windows 98 – Searching for Driver](image)

4. Click **Next**.

5. Select **CD-ROM drive**, as shown in Figure 1-4.

![Figure 1-4. Windows 98 – Searching for CD-ROM](image)
Installation Tasks

6. Click **Next**.  
   *Windows 98 locates the WmUSBEz.inf file on the installation CD, as shown in Figure 1-5.*  

![Figure 1-5. Windows 98 – Locating Driver](image)

7. Click **Next**.  
   The **Copying Files** dialog box appears (Figure 1-6).

![Figure 1-6. Windows 98 – Searching for .SYS File Dialog Box](image)
8. Click **Browse**. The **Open** dialog box, shown in **Figure 1-7**, appears on the screen.

![Figure 1-7. Windows 98 – Opening .SYS File](image1)


10. Click **OK**. The **Copying Files** dialog box (**Figure 1-8**) appears.

![Figure 1-8. Windows 98 – Copying .SYS File](image2)
Installation Tasks

11. Click **OK**. The driver installation is complete, as shown in Figure 1-9.

![Add New Hardware Wizard](image)

Figure 1-9. Windows 98 – 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 Installation

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 no other Hardware Wizard windows are running in the background. If any wizard windows are running, close them before starting the installer.
Getting Started

To install the USB driver:

1. If VisualDSP++ 3.5 is already installed on your system, go to step 2. Otherwise, insert the VisualDSP++ CD-ROM into the CD-ROM drive and 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 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. 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 Installation

VisualDSP++ 3.5 installation software pre-installs the necessary drivers for the selected EZ-KIT Lite. The installation 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 any wizard windows are 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, insert the VisualDSP++ CD-ROM into the CD drive and run the VisualDSP++ 3.5 installation. Refer to the Installation Quick Reference Card for VisualDSP++ for a detailed
When installing VisualDSP++ 3.5 on Windows XP, 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. Connecting the device to the USB port activates the Windows XP Found New Hardware Wizard, shown in Figure 1-10.

![Figure 1-10. Windows XP – Found New Hardware Wizard](image-url)
3. Select **Install the software automatically (Recommended)** and click **Next**.
When Windows XP completes the driver installation for the selected device (see step 1), a window shown in Figure 1-11 appears on the screen.

![Figure 1-11. Windows XP – Completing Driver Installation](image)

4. Verify the installation by following the instructions in “**Verifying Driver Installation**”.

**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.
Installation Tasks

2. Press the **RESET** button (**SW1**) on the evaluation board.

3. Verify that the red DSP **RESET** LED (**LED3**) stays lit for a few seconds.

4. After the DSP **RESET** LED (**LED3**) goes out, verify that the yellow USB monitor LED (**LED7**) is lit. This LED signifies that the board is communicating properly with the host PC and is ready to run VisualDSP++.

5. Open **Windows Device Manager** and verify that **ADSP-2191 EZ-KIT Lite** shows under **ADI Development Tools** with no exclamation point.

⚠️ If you are using an EZ-KIT Lite on Windows 98, disconnect the USB cable from the board before booting the PC. When Windows 98 is booted and you are logged on, re-connect the USB cable to the board. The operation should continue normally from this point.

Starting VisualDSP++

To set up a session in VisualDSP++:

1. Verify that the yellow USB monitor LED (**LED7**, located near the USB connector is lit). This signifies that the board is communicating properly with the host PC and is ready to run VisualDSP++.

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

3. Select the **Start** button on the Windows taskbar, then choose **Programs**-->**Analog Devices**-->**VisualDSP++ 3.5 for 16-bit Processors**-->**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, shown in Figure 1-12, appears on the screen.

![New Session Dialog Box](image)

Figure 1-12. New Session Dialog Box

6. In **Debug Target**, choose **EZ-KIT Lite (ADSP-2191)**.

7. In **Processor**, choose **ADSP-2191**.

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

9. Click **OK** to return to the **Session List**. Highlight the new session and click **Activate**.
2 USING EZ-KIT LITE

This chapter provides specific information to assist you with developing programs for the ADSP-2191 EZ-KIT Lite evaluation board. This information appears in the following sections.

- “EZ-KIT Lite License Restrictions” on page 2-2
  Describes the restrictions of the VisualDSP++ license shipped with the EZ-KIT Lite.

- “Memory Map” on page 2-2
  Defines the ADSP-2191 EZ-KIT Lite's memory map.

- “Using Programmable Flag Pins” on page 2-3
  Describes the function and use of the programmable flag pins on the EZ-KIT Lite evaluation system.

- “Example Programs” on page 2-5
  Provides information about the example programs included in the ADSP-2191 EZ-KIT Lite evaluation system.

- “Using Flash Programmer Utility” on page 2-5
  Provides information on the Flash Programmer utility included with the EZ-KIT Lite software.

- “Restricted Software Breakpoints” on page 2-5
  Describes the software breakpoint restrictions.
EZ-KIT Lite License Restrictions

For more detailed information about programming the ADSP-2191 processor, see “Related Documents” in the “Preface.”

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-2191 PM space).
- No connections to simulator or emulator sessions are allowed.

Memory Map

The ADSP-2191 processor has 32K words of internal SRAM that can be used for program storage or data storage. The configuration of internal SRAM is detailed in the ADSP-219x/2191 DSP Hardware Reference.

The ADSP-2191 EZ-KIT Lite board contains 512K x 8 bits of external Flash memory. This memory is connected to the processor’s ~MS0 and ~BMS memory select pins. The Flash memory can be accessed in either the boot memory space or the external memory space.

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

<table>
<thead>
<tr>
<th>Start Address</th>
<th>End Address</th>
<th>Page</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Memory</td>
<td>0x00 0000 0x00 7FFF</td>
<td>0</td>
<td>24-Bit Program Memory (Internal)</td>
</tr>
<tr>
<td>0x00 8000 0x00 FFFF</td>
<td>0</td>
<td>16-Bit Data Memory (Internal)</td>
<td></td>
</tr>
</tbody>
</table>
Using EZ-KIT Lite

Although the Flash memory starts at address $0x080000$ in the Boot Memory Space, during EPROM boot the address $0x000000$ is put on the address bus.

Using Programmable Flag Pins

The ADSP-2191 processor has eight asynchronous Programmable Flag (PF) IO 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.

### Table 2-1. EZ-KIT Lite Evaluation Board Memory Map (Cont'd)

<table>
<thead>
<tr>
<th>Start Address</th>
<th>End Address</th>
<th>Page</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Memory</td>
<td>$0x010000$</td>
<td>$0x077FFF$</td>
<td>1-7</td>
</tr>
<tr>
<td>$0x080000$</td>
<td>$0x0F FFFF$</td>
<td>8-15</td>
<td>512K x 8 Flash Memory (Bank 0)</td>
</tr>
<tr>
<td>$0x100000$</td>
<td>$0x3F FFFF$</td>
<td>16-63</td>
<td>External Memory (Bank 0)</td>
</tr>
<tr>
<td>$0x400000$</td>
<td>$0x7F FFFF$</td>
<td>64-127</td>
<td>External Memory (Bank 1)</td>
</tr>
<tr>
<td>$0x800000$</td>
<td>$0x8F FFFF$</td>
<td>128-191</td>
<td>External Memory (Bank 2)</td>
</tr>
<tr>
<td>$0xC00000$</td>
<td>$0xFE FFFF$</td>
<td>192-254</td>
<td>External Memory (Bank 3)</td>
</tr>
<tr>
<td>Reserved</td>
<td>$0xFF0000$</td>
<td>$0xFF F3FF$</td>
<td>255</td>
</tr>
<tr>
<td>$0xFF F400$</td>
<td>$0xFF FFFF$</td>
<td>255</td>
<td>RESERVED (Internal)</td>
</tr>
<tr>
<td>Boot Memory</td>
<td>$0x010000$</td>
<td>$0x07 FFFF$</td>
<td>1-7</td>
</tr>
<tr>
<td>$0x080000$</td>
<td>$0x0F FFFF$</td>
<td>8-15</td>
<td>512 x 8 Flash Memory</td>
</tr>
<tr>
<td>$0x100000$</td>
<td>$0xFE FFFF$</td>
<td>1-254</td>
<td>Boot Memory</td>
</tr>
<tr>
<td>I/O Memory</td>
<td>$0x000000$</td>
<td>$0x001FFF$</td>
<td>0-7</td>
</tr>
<tr>
<td>$0x002000$</td>
<td>$0x03 FFFF$</td>
<td>8-255</td>
<td>16-Bit External I/O Memory</td>
</tr>
</tbody>
</table>
Using Programmable Flag Pins

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-219x/2191 DSP Hardware Reference. Flags and their uses are described in Table 2-2.

Table 2-2. Programmable Flag Pin Summary

<table>
<thead>
<tr>
<th>Flag</th>
<th>Connected To</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF0</td>
<td>LED8</td>
<td>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.</td>
</tr>
<tr>
<td>PF1</td>
<td>LED9</td>
<td></td>
</tr>
<tr>
<td>PF2</td>
<td>LED10</td>
<td></td>
</tr>
<tr>
<td>PF3</td>
<td>LED11</td>
<td></td>
</tr>
<tr>
<td>PF4</td>
<td>SW3 – Push button</td>
<td>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.</td>
</tr>
<tr>
<td>PF5</td>
<td>SW2 – Push button</td>
<td></td>
</tr>
<tr>
<td>PF6</td>
<td>AD1803 Reset</td>
<td>PF6 is connected to the AD1803 telephony codec reset, and can be used to put the chip in reset.</td>
</tr>
<tr>
<td>PF7</td>
<td>AD1885 Reset</td>
<td>PF7 is connected to the AD1885 audio codec reset, and can be used to put the chip in reset.</td>
</tr>
</tbody>
</table>

All the programmable flags are available on connector P9.
Using EZ-KIT Lite

Example Programs

Example programs are provided with the ADSP-2191 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-2191\Examples

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

Using Flash Programmer Utility

The ADSP-2191 EZ-KIT Lite evaluation system includes a Flash Programmer utility. The utility allows you to program the Flash memory on the EZ-KIT Lite. The Flash Programmer is installed with VisualDSP++. Once the utility is installed, it is accessible from the Tools pull-down menu.

For more information on the Flash Programmer utility, select Start and choose Programs --> VisualDSP --> VisualDSP++ Documentation.

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.
Restricted Software Breakpoints

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 IO 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)=IO; /* or IO=DM(0x8000); */
101 NOP:
102 NOP:
3 EZ-KIT LITE HARDWARE REFERENCE

This chapter describes the hardware design of the ADSP-2191 EZ-KIT Lite board. The following topics are covered.

- “System Architecture” on page 3-2
  Describes the configuration of the ADSP-2191 EZ-KIT Lite board and explains how the board components interface with the processor.

- “Jumper and DIP Switch Settings” on page 3-6
  Shows the location and describes the function of the configuration jumpers and the clock multiplication factor selection switch.

- “LEDs and Push Buttons” on page 3-11
  Shows the location and describes the function of the LEDs and push buttons.

- “Connectors” on page 3-14
  Shows the location and gives the part number for all the connectors on the board. Also, the manufacturer and part number information is given for the mating parts.

- “Specifications” on page 3-18
  Gives the requirements for powering the board as well as the mechanical locations of some components of the board.
This section describes the processor’s configuration on the EZ-KIT Lite board.

Figure 3-1. System Architecture

The EZ-KIT Lite has been designed to provide access to all the capabilities of the ADSP-2191 processor. The EZ-KIT Lite board can be configured to boot in all of the possible ADSP-2191 boot modes. For information about configuring the boot mode, see “Boot Mode Select Switch (JP6)” on page 3-9.
The processor core voltage is 2.5V, and the external interface operates at 3.3V. The input clock to the DSP is a 16-MHz through-hole oscillator. Footprints are provided on the board for a surface-mount oscillator or a through-hole crystal. The speed at which the core operates is determined by the configuration of the multiplication factor switch (SW4) at reset and the state of the BYPASS jumper (JP7). (See “Bypass Mode Select Switch (JP7)” on page 3-9 and “DSP Clock Multiplier Select Switch (SW4)” on page 3-10.) By default, the processor core runs at 160 MHz.

**External Memory Interface (EMI)**

The External Memory Interface (EMI) is connected to a 512K x 8-bit Flash memory. This memory is connected to the boot memory select (~BMS) pin and the memory select 0 (~MS0) pin, allowing the Flash memory to be used to boot the processor as well as store information during normal operation. Refer to “Memory Map” on page 2-2 for information about the location of the Flash memory in the processor’s memory map.

All of the address, data, and control signals are available externally via two off-board connectors. The pinout of the EMI connectors (P10, P11) is shown in “Schematics” on page B-1.

The upper 8-bits of the data bus (D15–D8) can also be used as programmable flag pins.

**Host Port Interface (HPI)**

The Host Port Interface (HPI) signals are brought to an unpopulated off-board connector P12. This allows the HPI to interface to a user application. The pinout of the host port connector (P12) is shown in “Schematics” on page B-1.
SPORT0 - Audio Interface

SPORT0 is connected to the AD1885 SoundMAX codec (U10). Two 3.5mm stereo jacks (P3, P4) allow audio to be input and output. You can supply an audio input to the Codec Microphone Input Channel (MIC1) or to the stereo LINE_IN input channel. The jumper settings of JP1 determine the codec channel driven by the input jack (P3). The PF6 programmable flag, which is connected to the reset pin of the AD1885 codec, allows the processor to reset the codec.

SPORT0 is also routed to an off-board connector (P6). When you use the off-board connector, the codec must be disabled to avoid bus contention. JP3 disables the codec by putting it into reset and disabling the codec outputs from driving the processor's SPORT inputs. For more information about disabling the codec, see “Telephony Codec Disable (JP3)” on page 3-8.

SPORT1 Telephony Interface

SPORT1 is connected to the AD1803 telephony codec (U11). The telephony interface provided by the AD1803 allows the processor to act as a modem on a standard telephone line. Four of the general-purpose pins of the AD1803 codec are used. The following table gives the function of each of the general-purpose pins.

Table 3-1. AD1803 General-Purpose Pin Function

<table>
<thead>
<tr>
<th>AD1803 Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G[0]</td>
<td>Used to connect or disconnect from the telephone line</td>
</tr>
<tr>
<td>G[1]</td>
<td>Detects when the phone is ringing</td>
</tr>
<tr>
<td>G[4]</td>
<td>Used as a speaker output, to monitor the telephone communication</td>
</tr>
<tr>
<td>G[5]</td>
<td>Connected to an LED. This LED can be used for any application; for example, to indicate an incoming call or a phone in use</td>
</tr>
</tbody>
</table>
SPORT1 is also routed to an off-board connector (P7). When you use the off-board connector, the codec must be disabled to avoid bus contention. JP4 disables the codec by putting it into reset and disabling the codec outputs from driving the processor's SPORT inputs. For more information about disabling the codec, see “Audio Codec Disable Jumper (JP4)” on page 3-8.

**Breadboard Area**

Use the breadboard area to add external circuitry. You can connect the following processor interfaces to the breadboard area.

- Programmable flags (PF0–PF7)
- SPORT2/SPI0/SPI1
- UART
- Timers
- All board voltages and grounds
- Package Footprints
  - 1x SOIC 16
  - 1x SOIC 20
  - 4x SOT 23-6
  - 1x PSOP 44
  - 2x SOT 23
  - 27x 0805

⚠️ Any circuitry added to the breadboard area is not supported.
JTAG Emulation Port

The JTAG emulation port allows an emulator to access the processor’s internal and external memory, as well as the special function registers.

See “JTAG (P8)” on page 3-16 for more information about the JTAG connector. To learn more about available emulators, contact Analog Devices (see “Product Information” in the “Preface”).

Jumper and DIP Switch Settings

This section describes the function of all the jumpers and DIP switches. The following figure shows the location of all the jumpers and DIP switches.

![Diagram of Jumper and Switch Locations]

Figure 3-2. Jumper and Switch Locations
Audio Input Select Jumper (JP1)

The audio input jack (P3) can be connected to the MIC1 or the LINEIN input channels of the AD1885 codec. When the JP1 jumpers connect pins 1 and 3 and pins 2 and 4, P3 connects to the mono MIC1 channel.

When the jumpers connect pins 3 and 5 and pins 4 and 6, P3 connects to the stereo LINE_IN channel of the AD1885 codec. These jumper settings are shown in Figure 3-3. (The words MIC and LINE are on the board as a reference.)

<table>
<thead>
<tr>
<th>Microphone Input</th>
<th>Stereo LINE_IN (DEFAULT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIC 1 2</td>
<td>MIC 1 2</td>
</tr>
<tr>
<td>Line</td>
<td>Line</td>
</tr>
<tr>
<td>JP1</td>
<td>JP1</td>
</tr>
</tbody>
</table>

Figure 3-3. Audio Input Jumper Settings (JP1)

Telephony Codec Serial Interface Mode (JP2)

The AD1803 is capable of AC’97 communication or standard processor serial port communication. The Serial Interface Mode jumpers determine the type
**Jumper and DIP Switch Settings**

of serial interface that the AD 1803 emulates. The following table shows the jumper setting for each mode.

Table 3-2. Jumper Settings for Serial Interface Mode

<table>
<thead>
<tr>
<th>Pins 1 &amp; 2</th>
<th>Pins 3 &amp; 4</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Installed</td>
<td>Not Installed</td>
<td>AC'97 Primary (ID:00) (Default)</td>
</tr>
<tr>
<td>Not Installed</td>
<td>Installed</td>
<td>AC'97 Secondary (ID:10)</td>
</tr>
<tr>
<td>Installed</td>
<td>Not Installed</td>
<td>AC'97 Secondary (ID:01)</td>
</tr>
<tr>
<td>Installed</td>
<td>Installed</td>
<td>DSP Mode</td>
</tr>
</tbody>
</table>

**Telephony Codec Disable (JP3)**

Placing a jumper between pins 2 and 3 of JP3 places the AD 1803 into reset and isolates its serial port outputs, which are connected to the processor. When a jumper is between pins 1 and 2 of JP3, the AD 1803 is reset on power-up or it can be reset with PF6 of the processor. These positions are labeled on the board as DIS and ENA 1803.

**Audio Codec Disable Jumper (JP4)**

Placing a jumper between pins 2 and 3 of JP4 places the AD 1885 in reset and isolates its serial port outputs, which are connected to the processor. When a jumper is between pins 1 and 2 of JP4, the AD 1885 is reset on power-up or it can be reset with PF7 of the processor. These positions are labeled on the board as DIS and ENA 1885.
**Boot Mode Select Switch (JP6)**

The boot mode select switch determines how the processor boots. Table 3-3 shows the jumper settings for the boot modes.

Table 3-3. Boot Mode Select Jumper (JP6) Settings

<table>
<thead>
<tr>
<th>OPMODE Pins 1 and 2</th>
<th>BMODE1 Pins 3 and 4</th>
<th>BMODE0 Pins 5 and 6</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed</td>
<td>Installed</td>
<td>Installed</td>
<td>Execute from 16-bit external memory (no boot).</td>
</tr>
<tr>
<td>Installed</td>
<td>Installed</td>
<td>Not Installed</td>
<td>Boot from EPROM</td>
</tr>
<tr>
<td>Installed</td>
<td>Not Installed</td>
<td>Installed</td>
<td>Boot from Host (Default)</td>
</tr>
<tr>
<td>Installed</td>
<td>Not Installed</td>
<td>Not Installed</td>
<td>Reserved</td>
</tr>
<tr>
<td>Not Installed</td>
<td>Installed</td>
<td>Installed</td>
<td>Executed from 8-bit external memory (no boot)</td>
</tr>
<tr>
<td>Not Installed</td>
<td>Installed</td>
<td>Not Installed</td>
<td>Boot from UART</td>
</tr>
<tr>
<td>Not Installed</td>
<td>Not Installed</td>
<td>Installed</td>
<td>Boot from SPI, up to 4K bits</td>
</tr>
<tr>
<td>Not Installed</td>
<td>Not Installed</td>
<td>Not Installed</td>
<td>Boot from SPI, &gt;4K bits, up to 512K bits</td>
</tr>
</tbody>
</table>

**Bypass Mode Select Switch (JP7)**

When the bypass mode jumper is not installed, the processor's core clock and the input clock (CLKIN) run at the same speed. The evaluation board ships with a 16-MHz oscillator. When JP7 is removed, the core runs at 16 MHz.

*When you use VisualDSP++ to debug the processor, the core clock must run at a minimum of 24 MHz. The processor cannot be debugged in bypass mode.*

When the jumper is installed, the configuration of SW4 at reset determines the core clock speed.
**Jumper and DIP Switch Settings**

**DSP Clock Multiplier Select Switch (SW4)**

The core clock speed of the processor after reset is set by the position of the DSP Clock Multiplier Select Switch (SW4) settings at reset.

Table 3-4 shows the default setting for SW4. This setting will produce a 10x-multiplication factor, which results in a 160-MHz core clock speed. For more information about setting up the multiplication factors, refer to the “Managing DSP Clocks” section of the ADSP-219x/2191 DSP Hardware Reference.

<table>
<thead>
<tr>
<th>Pin Name</th>
<th>M SEL0</th>
<th>M SEL0</th>
<th>M SEL0</th>
<th>M SEL0</th>
<th>M SEL0</th>
<th>M SEL0</th>
<th>M SEL0</th>
<th>D F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch Location</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Switch Setting</td>
<td>On</td>
<td>Off</td>
<td>On</td>
<td>Off</td>
<td>On</td>
<td>Off</td>
<td>On</td>
<td>Off</td>
</tr>
</tbody>
</table>

Table 3-4. DSP Clock Multiplier Select Switch (SW4) Default Settings
LEDs and Push Buttons

This section describes the functionality of the LEDs and push buttons. Figure 3-4 shows the locations of the LEDs and push buttons.

**Power LED (LED1)**

When LED1 is lit (green), power is being properly supplied to the board.
LEDs and Push Buttons

Reset LEDs (LED2, LED3)

When LED2 is lit, the master reset for all the major ICs is active. Therefore, the ADSP-2191 processor (U1), CY7C64603 (U3), AD1885 (U10), and AD1803 (U11) are being reset.

When LED3 is lit, the ADSP-2191 (U1) is being reset. The USB interface resets the ADSP-2191 during USB communication initialization.

Telephony LEDs (LED6–4)

Three LEDs connect to the AD1803 telephony codec. LED4 indicates that the AD1803 is transmitting serial data to the processor’s SPORT1. LED5 indicates that the AD1803 is receiving serial data from the processor. LED6 is a user programmable flag connected to G[5], one of the general-purpose pins of the AD1803 codec. For more information about the AD1803, refer to “SPORT1 Telephony Interface” on page 3-4.

USB Monitor LED (LED7)

The USB Monitor LED (LED7) indicates that USB communication has been initialized successfully and you can connect to the processor by using a VisualDSP++ EZ-KIT Lite session. If the LED does not light, try resetting the board, reinstalling the USB driver (see “Installing EZ-KIT Lite USB Driver” on page 1-7), or both.

Programmable Flag LEDs (LED10–8)

Four LEDs are connected to four of the processor’s Programmable Flag (PF) pins, PF3–0. These LEDs are active HIGH and are lit by an output of “1” from the processor. Refer to “Using Programmable Flag Pins” on page 2-3 for more information on how the flags can be used to program the processor.
Table 3-5. Programmable Flag LEDs

<table>
<thead>
<tr>
<th>LED Reference Designator</th>
<th>DSP Programmable Flag Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED8</td>
<td>PF0</td>
</tr>
<tr>
<td>LED9</td>
<td>PF1</td>
</tr>
<tr>
<td>LED10</td>
<td>PF2</td>
</tr>
<tr>
<td>LED11</td>
<td>PF3</td>
</tr>
</tbody>
</table>

**Reset Push Button (SW1)**

The `RESET` push button resets the ADSP-2191 (U1), CY7C64603 (U3), AD 1885 (U10), and AD 1803 (U11). During reset, the USB interface is automatically reinitialized.

Warning: Pressing the `RESET` push button (SW1) while VisualDSP++ is running disrupts communication and causes errors in the current debug session. You must close and re-open VisualDSP++.

**Programmable Flag Push Buttons (SW2 and SW3)**

Two push buttons are provided for general-purpose user input. SW2 and SW3 connect to the processor’s programmable flag pins. The push buttons are active high and when pressed, send a high (1) to the processor. Refer to “Using Programmable Flag Pins” on page 2-3 for more information on how the flags can be used to program the processor.

Table 3-6. Programmable Flag Push Buttons

<table>
<thead>
<tr>
<th>Flag Pin</th>
<th>Push Button Reference Designator</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF4</td>
<td>SW3</td>
</tr>
<tr>
<td>PF5</td>
<td>SW2</td>
</tr>
</tbody>
</table>
Connectors

This section describes the connector functionality and provides information about mating connectors. The locations of the connectors are shown in Figure 3-5.

![Figure 3-5. Connector Locations](image)

**USB (P1)**

The USB connector is a standard Type B USB receptacle. This connector is used to debug the processor and is not connected to the processor’s USB interface.
Audio (P3, P4)

These connectors are two 3.5 mm stereo audio jacks: one input and one output.

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type B USB receptacle (P1)</td>
<td>Mill-Max</td>
<td>897-30-004-90-000</td>
</tr>
<tr>
<td></td>
<td>Digi-Key</td>
<td>ED 90003-ND</td>
</tr>
</tbody>
</table>

Mating Connector

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB cable (provided with kit)</td>
<td>Assmann</td>
<td>AK 672-5</td>
</tr>
<tr>
<td></td>
<td>Digi-Key</td>
<td>AK 672-5ND</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5 mm stereo jack (P3, P4)</td>
<td>Shogyo</td>
<td>Sj-0359AM-5</td>
</tr>
</tbody>
</table>

Mating Cable

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5 mm stereo plug to 3.5 mm stereo cable</td>
<td>Mouser</td>
<td>172-3504</td>
</tr>
</tbody>
</table>

Telephone (P5)

The telephone connector is a standard 6-position 4-contact phone jack.

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone jack (P5)</td>
<td>AMP</td>
<td>555165-2</td>
</tr>
</tbody>
</table>
Connectors

**SPORT0 (P6) and SPORT1 (P7)**

SPORT0 and SPORT1 are each connected to a 20-pin connector.

Table 3-7. SPORT Connectors

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 position AMP MODU system 50 receptacle</td>
<td>AMP</td>
<td>104069-1</td>
</tr>
<tr>
<td>Mating Connectors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 position AMP MODU system 20 connector</td>
<td>AMP</td>
<td>2-487937-0</td>
</tr>
<tr>
<td>20 position AMP MODU system 20 connector (without lock)</td>
<td>AMP</td>
<td>2-487938-0</td>
</tr>
<tr>
<td>Flexible film contacts (20 per connector)</td>
<td>AMP</td>
<td>487547-1</td>
</tr>
<tr>
<td>Mating Assembly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Straight-through assembly with locking connector on each end</td>
<td>Gopher Electronics</td>
<td>DRFFC10X7RH U-RHU 5</td>
</tr>
</tbody>
</table>

**JTAG (P8)**

The JTAG header is the connecting point for a JTAG in-circuit emulator pod. When an emulator is connected to the JTAG header, the USB debug interface is disabled.

- Pin 3 is missing to provide keying. Pin 3 in the mating connector should have a plug.

- When using an emulator with the EZ-KIT Lite board, follow the connection instructions provided with the emulator.
External Memory Interface (P10, P11)

Two MICTOR board-to-board connectors provide all of the processor’s External Memory Interface signals. Contact AMP for information about mating connectors. The location of these connectors is shown in “Mechanical Dimensions” on page 3-20.

Table 3-8. External Memory Connectors

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>38-Position MICTOR</td>
<td>AMP</td>
<td>2-767004-2</td>
</tr>
</tbody>
</table>

Host Port Interface (P12)

One MICTOR board-to-board connector provides all the processor’s Host Port Interface signals. Contact AMP for information about mating connectors. The location of this connector is shown in “Mechanical Dimensions” on page 3-20.

Table 3-9. Host Port Connector

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>38-Position MICTOR</td>
<td>AMP</td>
<td>2-767004-2</td>
</tr>
</tbody>
</table>

Power Connector (P13)

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

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5 mm Power Jack</td>
<td>Switchcraft</td>
<td>RAPC712</td>
</tr>
<tr>
<td></td>
<td>Digi-key</td>
<td>SC1152-N D</td>
</tr>
</tbody>
</table>
Specifications

This section provides the requirements for powering the board and the mechanical locations of board components.

Power Supply

The power connector supplies DC power to the EZ-KIT Lite board. Table 3-10 shows the power connector pinout.

Table 3-10. Power Connector

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center pin</td>
<td>+7.5 VDC @2amps</td>
</tr>
<tr>
<td>Outer Ring</td>
<td>GND</td>
</tr>
</tbody>
</table>

Table 3-11 shows the power supply specifications.

Table 3-11. Power Supply Specifications

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
<th>General</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage: 90–264 V AC</td>
<td>Voltage: 7.5 V DC +5%</td>
<td>Operating Temp: 0 to +40 C</td>
</tr>
<tr>
<td>Frequency: 47–63 Hz</td>
<td>Current: 2 A</td>
<td>Storage Temp: -20 to +85 C</td>
</tr>
<tr>
<td>Current: &lt;0.5 A</td>
<td>Regulation: &lt;5%</td>
<td>Efficiency: 65% typical</td>
</tr>
<tr>
<td>Inrush Current: &lt;40 A</td>
<td>Total Power: 15 W Max</td>
<td>Approvals: UL, CUL, CE</td>
</tr>
<tr>
<td>Protection: 1 A fuse</td>
<td>Noise and ripple: &lt;1%</td>
<td>EMC: EN 55022 Class B</td>
</tr>
</tbody>
</table>
Board Current Measurements

The ADSP-2191 EZ-KIT Lite board provides six zero-ohm resistors, which you can remove to measure current draw. Table 3-12 shows the resistor number, the voltage plane, and a description of each component on the plane.

Table 3-12. Current Measurement Resistors

<table>
<thead>
<tr>
<th>Resistor</th>
<th>Voltage Plane</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R89</td>
<td>5V</td>
<td>Main power of the entire board except A5V</td>
</tr>
<tr>
<td>R85</td>
<td>A5V</td>
<td>5V analog side of the AD1885</td>
</tr>
<tr>
<td>R90</td>
<td>3.3V</td>
<td>All 3.3V ICs, Pull-up Resistors, and LEDs</td>
</tr>
<tr>
<td>R87</td>
<td>VDDINT</td>
<td>Core Voltage of the processor</td>
</tr>
<tr>
<td>R88</td>
<td>VDDEXT</td>
<td>IO Voltage of the processor</td>
</tr>
</tbody>
</table>

Table 3-11. Power Supply Specifications (Cont’d)

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
<th>General</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector: IEC320 / C14 / 3 Pin</td>
<td>Protection: Short Ckt, Over Load, Over Volt</td>
<td></td>
</tr>
<tr>
<td>Connector: FB, 5.5 x 2.5 x 11 mm, CP</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Specifications

Mechanical Dimensions

Figure 3-6 shows the dimensions of the board and the location MICTOR connectors (P10, P11, P12).

Figure 3-6. Mechanical Dimensions
## A BILL OF MATERIALS

<table>
<thead>
<tr>
<th>Reference</th>
<th>Quantity</th>
<th>Description</th>
<th>Reference Design</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>0.00 1/4W 5% RC05</td>
<td>R87-89</td>
<td>YAGEO</td>
<td>0.0QBK-N</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>M29W040 PLCC32 FLASH-512K-X-8-3V</td>
<td>U7</td>
<td>ST MICRO</td>
<td>M29W040B120K6</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>74LVC14A SOIC14 HEX-INVER-SCHMITT-TRIGGER</td>
<td>U6</td>
<td>TI</td>
<td>74LVC14AD</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>IDT74FCT3244APY SSOP20 3.3V-OCTAL-BUFFER</td>
<td>U2, U16</td>
<td>IDT</td>
<td>IDT74FCT3244APY</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>24.576MHZ SMT OSC005 CRYSTAL</td>
<td>Y4</td>
<td>EPSON</td>
<td>M A505 24.576M-C2</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>CY7C64603-128 PQFP128 USB-TX/RX MICROCONTROLLER</td>
<td>U3</td>
<td>CYPRESS</td>
<td>CY7C64603-128NC</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>MMBT4401 SOT-23 NPN TRANSISTOR 200MA</td>
<td>Q1</td>
<td>FAIRCHILD</td>
<td>MMBT4401</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>74LVC00AD SOIC14</td>
<td>U5, U8</td>
<td>PHILIPS</td>
<td>74LVC00AD</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>24LC00-SN SOIC8 128 BIT SERIAL EEPROM</td>
<td>U4</td>
<td>MICROCHIP</td>
<td>24LC00-SN</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>82082R ICS004 1:1 TRANSFORMER</td>
<td>T1</td>
<td>MIDCOM</td>
<td>82082R</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>TS117P ICS003 TELECOM SWITCH</td>
<td>U14</td>
<td>CP CLARE</td>
<td>TS117P</td>
</tr>
<tr>
<td>Reference</td>
<td>Quantity</td>
<td>Description</td>
<td>Reference Design</td>
<td>Manufacturer</td>
<td>Part Number</td>
</tr>
<tr>
<td>-----------</td>
<td>----------</td>
<td>-------------</td>
<td>------------------</td>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>CY7C1019BV33-15VC SOJ32 128K X 8 SRAM</td>
<td>U12</td>
<td>CYPRESS</td>
<td>CY7C1019BV33-12VC</td>
</tr>
<tr>
<td>13</td>
<td>2</td>
<td>AD8532AR SOIC8 DUAL AMP 250MA</td>
<td>U12–U13</td>
<td>ANALOG DEVICES</td>
<td>AD8532AR</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>BC517 TO-92 DARLINGTON TRAN</td>
<td>Q2</td>
<td>ON SEMICONDUCTOR</td>
<td>BC517</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>16MHZ OSC001</td>
<td>U19</td>
<td>DIGI-KEY</td>
<td>SG-8002DC-PCC-ND (16MHZ)</td>
</tr>
<tr>
<td>16</td>
<td>1</td>
<td>SN74AH C1G02 SOT23-5 SINGLE-2 INPUT-NOR</td>
<td>U25</td>
<td>TI</td>
<td>SN74AH C1G02D BVR</td>
</tr>
<tr>
<td>17</td>
<td>1</td>
<td>SN74LV164A SOIC14 8-BIT-PARALLEL-SERIAL</td>
<td>U22</td>
<td>TI</td>
<td>SN74LV164AD</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>CY7C4201V-15AC TQFP32 64-BYTE-FIFO</td>
<td>U21</td>
<td>CYPRESS</td>
<td>CY7C4201V-15AC</td>
</tr>
<tr>
<td>19</td>
<td>1</td>
<td>12.0MHZ THR OSC006 CRYSTAL</td>
<td>Y2</td>
<td>DIGI01</td>
<td>300-6027-N-D</td>
</tr>
<tr>
<td>20</td>
<td>1</td>
<td>10 1/4W 5% RC05</td>
<td>R50</td>
<td>YAGEO</td>
<td>10QTR-N-D</td>
</tr>
<tr>
<td>21</td>
<td>3</td>
<td>1000pF 50V 5% 1206 CERM</td>
<td>C26, C36-37</td>
<td>AVX</td>
<td>12065A102J/AT2A</td>
</tr>
<tr>
<td>22</td>
<td>2</td>
<td>0.1uF 50V 10% 1206 CERM</td>
<td>C11–12</td>
<td>PHILIPS</td>
<td>12062R104K9BB2</td>
</tr>
<tr>
<td>23</td>
<td>1</td>
<td>22uF 25V 10% D TANT</td>
<td>CT12</td>
<td>SIEMENS</td>
<td>B45196-H 5226-K 409</td>
</tr>
<tr>
<td>24</td>
<td>1</td>
<td>AD1803JRU TSSOP24</td>
<td>U11</td>
<td>ANALOG DEVICES</td>
<td>AD1803JRU</td>
</tr>
<tr>
<td>25</td>
<td>1</td>
<td>ADM708SAR SOIC8 VOLTAGE-SUPERVISOR</td>
<td>U15</td>
<td>ANALOG DEVICES</td>
<td>ADM708SAR</td>
</tr>
<tr>
<td>26</td>
<td>1</td>
<td>AD1885JST LQFP48 AC97 STEREO CODEC</td>
<td>U10</td>
<td>ANALOG DEVICES</td>
<td>AD1885JST</td>
</tr>
<tr>
<td>Reference</td>
<td>Quantity</td>
<td>Description</td>
<td>Reference</td>
<td>Manufacturer</td>
<td></td>
</tr>
<tr>
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<td>----------</td>
<td>-------------</td>
<td>-----------</td>
<td>--------------</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>1</td>
<td>ADP3338AKC-33 SOT-223 3.3V-1.0AMP REGULATOR</td>
<td>VR3</td>
<td>ANALOG DEVICES</td>
<td>ADP3338AKC-3.3</td>
</tr>
<tr>
<td>28</td>
<td>1</td>
<td>ADP3338AKC-5 SOT-223 5.0V-1.0AMP REGULATOR</td>
<td>VR2</td>
<td>ANALOG DEVICES</td>
<td>ADP3338AKC-5</td>
</tr>
<tr>
<td>29</td>
<td>1</td>
<td>ADP3338AKC-25 SOT-223 2.5V-1.0AMP REGULATOR</td>
<td>VR4</td>
<td>ANALOG DEVICES</td>
<td>ADP3338AKC-2.5</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
<td>ADP3339AKC-5 SOT-223 5V-1.5A REGULATOR</td>
<td>VR1</td>
<td>ANALOG DEVICES</td>
<td>ADP3339AKC-5-REEL</td>
</tr>
<tr>
<td>31</td>
<td>1</td>
<td>ADSP-2191M KST160 LQFP144 1.3M BIT-FIXED-150MHZ</td>
<td>U1</td>
<td>ANALOG DEVICES</td>
<td>ADSP2191-22M KST160</td>
</tr>
<tr>
<td>32</td>
<td>1</td>
<td>RJ11 4PIN CON002 RIGHT ANGLE</td>
<td>P5</td>
<td>AMP</td>
<td>555165-1</td>
</tr>
<tr>
<td>33</td>
<td>1</td>
<td>PWR 2.5M M_JACK CON005 RA</td>
<td>P13</td>
<td>SWITCH- CRAFT</td>
<td>SC1152-ND12</td>
</tr>
<tr>
<td>34</td>
<td>1</td>
<td>USB 4PIN CON009 USB</td>
<td>P1</td>
<td>MILL-MAX</td>
<td>897-30-004-90-000000</td>
</tr>
<tr>
<td>35</td>
<td>2</td>
<td>.05 10X2 CON014 RA</td>
<td>P6-7</td>
<td>AMP</td>
<td>104069-1</td>
</tr>
<tr>
<td>36</td>
<td>1</td>
<td>DIP8 SWT012</td>
<td>SW4</td>
<td>DIGI-KEY</td>
<td>CKN 3060-ND</td>
</tr>
<tr>
<td>37</td>
<td>3</td>
<td>SPST-MOMENTARY SWT013 6MM</td>
<td>SW1-3</td>
<td>PANASONIC</td>
<td>EVQ-PAD 04M</td>
</tr>
<tr>
<td>38</td>
<td>6</td>
<td>0.001/8W 5% 1206</td>
<td>R28-29,R8 5,R90,R99 ,R111</td>
<td>YAGEO</td>
<td>0.0ECT-N-D</td>
</tr>
<tr>
<td>39</td>
<td>2</td>
<td>220uF 10V 20% ELECTRICAL</td>
<td>CT2-3</td>
<td>SPRAGUE</td>
<td>293D227X9010E2T</td>
</tr>
<tr>
<td>40</td>
<td>8</td>
<td>AMBER-SMT LED001 GULL-WING</td>
<td>LED4-11</td>
<td>PANASONIC</td>
<td>LN1461C-TR</td>
</tr>
<tr>
<td>41</td>
<td>2</td>
<td>0.22uF 25V 10% 805 CERM</td>
<td>C114</td>
<td>AVX</td>
<td>08053C 224FAT</td>
</tr>
<tr>
<td>Reference</td>
<td>Quantity</td>
<td>Description</td>
<td>Reference Design</td>
<td>Manufacturer</td>
<td>Part Number</td>
</tr>
<tr>
<td>-----------</td>
<td>----------</td>
<td>----------------------</td>
<td>-----------------------------------</td>
<td>--------------</td>
<td>------------------</td>
</tr>
<tr>
<td>42</td>
<td>29</td>
<td>0.01uF 100V 10% 805</td>
<td>C49-69, C75-82</td>
<td>AVX</td>
<td>08051C103KAT2A</td>
</tr>
<tr>
<td>43</td>
<td>1</td>
<td>0.22uF 25V 10% 805</td>
<td>C89</td>
<td>AVX</td>
<td>08053C224FAT</td>
</tr>
<tr>
<td>44</td>
<td>27</td>
<td>0.1uF 50V 10% 805</td>
<td>C21, C23-24, C33-C35, C38-48, C70-74, C83-84, C86-88</td>
<td>AVX</td>
<td>08055C104KAT</td>
</tr>
<tr>
<td>45</td>
<td>5</td>
<td>10uF 16V 10% C TANT</td>
<td>CT13-17</td>
<td>SPRAGUE</td>
<td>293D106X9025C2T</td>
</tr>
<tr>
<td>46</td>
<td>42</td>
<td>10K 100M W 5% 805</td>
<td>R8, R11, R13-16, R3 1-32, R45, R53-54, R59, R68, R70-81, R92-98, R100-102, R104-107, R110, R114-115</td>
<td>AVX</td>
<td>CR21-103J-T</td>
</tr>
<tr>
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<td>470PF 100V 10% 1206 CERM</td>
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<td>73</td>
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<tr>
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### Bill Of Materials

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ADSP-2191 EZ-KIT LITE
BREAD BOARD AREA

JTAG HEADER
PIN 3 SHOULD BE CUT

SPORT0

SPORT1

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

ADSP-2191 EZ-KIT LITE - CONNECTORS 1

Approvals Date Title
Drawn Checked Engineering
Rev Board No. Date

Sheet 11 OF 14
INDEX

Symbols
~BMS, memory select pin, 2-2, 3-3
~M S0, memory select pin, 2-2, 3-3

A
AC’97 communication, 3-7
AD1803 telephony codec, -x
coding (G5), 3-12
disable (JP3), 3-12
reset pin (U11), 3-12
resetting (PF6), 2-4
serial interface (JP2), 3-7
SPORT1 connect pin (U11), 3-4
SPORT1 connection (LED 4), 3-12
AD1885 audio codec, -x
audio input jack (P3), 3-7
disable (JP4), 3-12
reset pin (U11), 3-12
resetting (PF6), 3-4
resetting (PF7), 2-4
SPORT0 connection pin (U10), 3-4
Add New Hardware Wizard, Windows 98, 1-8
ADSP-2191 processor
boot modes, 3-2
Clock Multiplier Select switch (SW 4), 3-10
core voltage, 3-3
DF pin, 3-10
internal SRAM, 2-2
memory map
MSEL0 pin, 3-10
U1 pin (reset), 3-12
audio
applications, -xi
codec disable jumper (JP4), 3-8
input select jumper (JP1), 3-7
interface, 3-4
jacks (P3, P4), 3-15

B
bill of materials, A-1
BMODE0 pins, 3-9
BMODE1 pins, 3-9
board measurements, 3-19
boot
memory, 2-3
memory select pins, 3-3
memory space, 2-2
mode switch (SW 1), -xi
see also switch settings
breadboard area, -xi, 3-5
breakpoints, 2-5
bypass
INDEX

jumper, 3-3
mode select switch (JP7), 3-9

clock
frequency, 2-4
input (CLKIN), 3-9
multiplication factor selection, -x
speed, -x

codec microphone input channel
(MIC1), 3-4
codecs, EZ-KIT Lite supported, -x
connecting, EZ-KIT Lite board, 1-6
connectors, 1-6, 3-14
G0 pin (AD1803), 3-4
G1 pin (AD1803), 3-4
G4 pin (AD1803), 3-4
G5 pin (AD1803), 3-4
P1 (USB), 1-7, 3-14
P10 (MICTOR), 3-17, 3-20
P11 (MICTOR), 3-17, 3-20
P12 (HPI), 3-3, 3-17, 3-20
P13 (power), 3-17
P3 (audio), 3-4, 3-7, 3-15
P4 (audio), 3-4, 3-15
P5 (telephony), 3-15
P6 (SPORT0), 3-4, 3-16
P7 (off-board), 3-5
P8 (JTAG), 3-16
P9 (all PFs), 2-4
contents, EZ-KIT Lite package, 1-1
conventions, manual, -xviii
core voltage, 3-19
customer support, -xiii

CY7C64603
U3 pin (reset), 3-12

data
bus, 3-3
pins 8-15, 2-3
storage, 2-2
delayed slots, 2-5
Device Manager window, 1-16
dIP switches, 3-6
see also switches
D1R register, 2-4

electrostatic discharge, 1-2
emotion port (JTAG), 3-6
eMulator, -x, 3-16
EPROM, 3-9
eexample programs, 2-5
external
flash memory, see flash memory
interface, 3-3
memory boot (no-boot mode), 3-9
memory connectors (P10, P11), 3-17
memory interface (EMI), -x, -xi, 3-3
EZ-KIT Lite architecture, 3-2

F
features, product, -x
FLAGC/S register, 2-4
flash
memory, -x, 3-3
programmer, 2-5
INDEX

Found New Hardware Wizard
Windows 2000, 1-14
frequency, 3-18

H
Help, online, -xvii, 2-5
host
  boot mode, 3-9
  port interface (HPI), -xi, 3-3
  port interface connector (P12), 3-17

I
input
  (CLKIN), 3-3
  channels, 3-7
  clock (CLKIN), 3-9
  jack (P3), 3-4
installation, summary, 1-3
installing
  EZ-KIT Lite USB driver, 1-7
  VisualDSP++ and EZ-KIT Lite software, 1-4
  VisualDSP++ license, 1-5
memory map, see ADSP-2191 processor

J
JTAG
  connector (P8), 3-6, 3-16
  emulation port, 3-6
  interface, -x
  jumper settings, 1-6, 3-4, 3-6, 3-7
  codec disable (JP4), 3-8
  input select (JP1), 3-7

L
LEDs, 1-6, 3-11
  LED 1 (power), 1-7, 3-11
  LED 10 (PF2 flag), 2-4, 3-13
  LED 11 (PF3 flag), 2-4, 3-13
  LED 2 (reset), 1-7, 3-12
  LED 3 (reset), 1-7, 1-16, 3-12
  LED 4 (SPORT1), 3-12
  LED 5 (AD1803), 3-12
  LED 6 (AD1803), 3-12
  LED 7 (USB), 3-12
  LED 8 (PF0 flag), 2-4, 3-13
  LED 9 (PF1 flag), 2-4, 3-13
license restrictions, 2-2

M
managing DSP clocks, 3-10
mechanical dimensions, 3-20
memory map, see ADSP-2191 processor
memory select pins, 2-2
MICTROR connectors, 3-17, 3-20
modems, -x, 3-4

N
no boot mode, 3-9
INDEX

O
OPMODE pins, 3-9
oscillator, 3-3, 3-9

P
package
   contents, 1-1
   footprints, 3-5
PC configuration, 1-3
phone jack, 3-15
plane components, 3-19
power
   connector, 3-17
   connector (P13), 3-17
   LED (LED1), 3-11
   supply, 3-18
processor memory map, see
   ADSP-2191 processor
program storage, 2-2
programmable flags (PFs), 2-3, 3-3
   PF0, 2-4, 3-13
   PF1, 2-4, 3-13
   PF2, 2-4, 3-13
   PF3, 2-4, 3-13
   PF4, 2-4
   PF5, 2-4
   PF6, 2-4
   PF7, 2-4
   see also push buttons
push buttons, 3-11
   SW 1 (reset), 3-13
   SW 2 (PF5 flag), 2-4, 3-13
   SW 3 (PF4 flag), 2-4, 3-13

R
registering, this product, 1-2
regulatory compliance, -iii
reserved memory, AD SP-2191
   processor, 2-3
reset
   LED 3, 1-16
   processor, 2-4, 3-12
   push button (SW 1), 3-13
resetting
   AD1803, 3-13
   AD1885, 3-13
   AD SP-2191 processor, 3-13
   board (LED 3), 1-16
   CY7C64603, 3-13
   resistors, 3-19
   restricted software breakpoints, 2-5

S
selecting boot mode (JP6), 3-9
serial
   interface mode (JP2), 3-7
   port communication, 3-7
   port outputs, 3-8
setting up EZ-KIT Lite hardware, 1-5
software breakpoints, 2-5
specifications, 3-18
SPORT0
   codec connection pin, 3-16
   connector (P6), -xi
SPORT1
   codec connection pin, 3-4
   connector (P7), 3-16
SRAM memory, 2-2
INDEX

starting VisualDSP++, 1-16
stereo
  audio jacks, 3-15
  input channel, 3-4
switch settings
  boot mode select (JP6), 3-9
  also see boot mode switch switches
JP6 (boot mode select), 3-9
JP7 (bypass mode), 3-9
locations, 3-6
SW4 (clock select), 3-10
system
  board architecture, 3-2
  PC requirements, 1-3

T
telephony
  codec disable jumper (JP3), 3-8
  codec, see AD1803
  interface, 3-4
  jack (P5), 3-15
  line, 3-4
  timers, 3-5

U
U 10 connector (AD 1885), 3-4
U 11 connector (AD 1803), 3-4
UART, 3-5
  boot mode, 3-9
USB
  cable, 1-2
  connector (P1), 3-14
  driver installation, Windows 2000, 1-12
  driver installation, Windows 98, 1-8
  driver installation, Windows XP, 1-13
  interface, -x, 3-12, 3-13
  monitor LED (LED 7), 1-16, 3-12

V
verifying USB driver installation, 1-15
VisualDSP++
  documentation, -xvii
  installation, 1-4
  license, 1-5
  online Help, -xvii
  requirements, 1-3
  starting, 1-16
  voltage, 3-18
  plane, 3-19
  regulators, -xi