

# ADSP-2189M EZ-KIT Lite<sup>®</sup> Evaluation System Manual

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**RESTRICTIONS**

**BILL OF MATERIALS**

# PREFACE

Thank you for purchasing the ADSP-2189M EZ-KIT Lite<sup>®</sup>, Analog Devices (ADI) evaluation system for ADSP-2189 DSPs.

The ADSP-2189M DSP is a single-chip microcomputer optimized for digital signal processing (DSP) and other high-speed numeric processing applications.

The evaluation board is designed to be used in conjunction with VisualDSP++<sup>™</sup> development environment to test the capabilities of the ADSP-2189M DSPs. The VisualDSP++ software 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-2189M 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

Using the EZ-KIT Lite with VisualDSP++, you can observe the ADSP-2189M processor execute programs from on-chip RAM, interact with on-board devices, and communicate with other peripherals located on optional add-on modules.

You can access the ADSP-2189M processor from a personal computer (PC) through a serial port or an optional emulator. The monitor program gives you complete target debug capability through the serial port. In contrast, the emulator allows the PC to perform in-circuit emulation through the processor's emulation port.

The boards features:

- Analog Devices ADSP-2189MKST-300 processor
  - ✓ Operating at an instruction rate of 75 MIPS (37.57 external clock)
- Analog Audio Interface
  - ✓ AD73322AR – Analog Devices stereo codec
- Analog Inputs
  - ✓ One stereo pair of 2V RMS AC coupled line-level inputs
  - ✓ One stereo pair of 20 mV RMS AC coupled microphone inputs
- Analog Outputs
  - ✓ One stereo pair of 1V RMS AC coupled line-level outputs
- Power Source
  - ✓ 7.5V DC (+ or -5%) at 4.0 Amps (maximum)
- Environment
  - ✓ 0 to 70° centigrade
  - ✓ 10 to 90 percent relative humidity (non condensing)
- RS-232 Interface



- Flash memory
- User push buttons
- Prototype (expansion) area
- User configurable jumpers

The ADSP-2189M board is equipped with hardware that facilitates interactive demonstrations. Push button switches and user programmable LEDs provide user control and board status checking. Additionally, the AD73322 SoundPort codec provides access to an audio input (selectable as line level or microphone) and an audio output (line level). To learn more about AD73322 codec, see the data sheet at

[http://www.analog.com/Uploaded-Files/Data\\_Sheets/14950546AD73322\\_b.pdf](http://www.analog.com/Uploaded-Files/Data_Sheets/14950546AD73322_b.pdf).

The ADSP-2189MEZ-KIT Lite includes a monitor program stored in the original Flash memory. The monitor program lets the board communicate over the serial port to a PC. This monitor program lets you download, execute, and debug ADSP-2189M programs.

You can also connect an EZ-ICE (in-circuit emulator) to the EZ-KIT Lite. Through the EZ-ICE, you can load programs, start and stop program execution, observe and alter registers and memory, and perform other debugging operations. To learn more about Analog Devices emulators and DSP development tools, go to

<http://www.analog.com/dsp/tools/>.

Additionally, the EZ-KIT Lite provides user installed expansion connectors that let you examine processor signals, as well as provide an interface for host control.



The VisualDSP++ licence provided with this EZ-KIT Lite evaluation system limits the size of a user program to 8K bytes of internal memory.

# Purpose of This Manual

The *ADSP-2189M 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-2189M EZ-KIT Lite. The manual also describes the operation and configuration of the evaluation board's components. Finally, a bill of materials is provided as a reference for future ADSP-2189M board designs.

## Intended Audience

This manual is a user's guide and reference to the ADSP-2189M EZ-KIT Lite evaluation system. Programmers who are familiar with the Analog Devices processor architecture, operation, and programming are the primary audience for this manual.

Programmers who are unfamiliar with Analog Devices 16-bit fixed-point processors can use this manual in conjunction with the *ADSP-218x DSP Hardware Reference* and the *ADSP-218x 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"](#).

# 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 Software](#)” 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.
- Appendix A, “[Restrictions](#)” on page A-1  
Provides a list of restrictions applicable to Release 1.1 of the ADSP-2189MEZ-KIT Lite evaluation board.
- Appendix B, “[Bill Of Materials](#)” on page B-1  
Provides a list of components used to manufacture the EZ-KIT Lite.

## What’s New in This Manual

This is the second revision of the *ADSP-2189M EZ-KIT Lite Evaluation System Manual*. The manual provides the updated listing of related documents, updated installation procedure and Bill of Materials, and additional information on the processor’s internal memory.

# Technical or Customer Support

You can reach DSP Tools Support in the following ways.

- Visit the DSP Development Tools website at

[www.analog.com/technology/dsp/developmentTools/index.html](http://www.analog.com/technology/dsp/developmentTools/index.html)

- Email questions to

[dsptools.support@analog.com](mailto:dsptools.support@analog.com)

- Phone questions to **1-800-ANALOGD**
- Contact your ADI local sales office or authorized distributor
- Send questions by mail to

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

## Supported Processors

The ADSP-2189MEZ-KIT Lite evaluation system supports ADSP-2189M Analog Devices microprocessors.

## 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](http://www.analog.com). Our website provides information about a broad range of products—analog integrated circuits, amplifiers, converters, and digital signal processors.

## MyAnalog.com

MyAnalog.com is a free feature of the Analog Devices 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](http://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](http://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](mailto: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

Title	Description
<i>ADSP-2189M DSP Microcomputer Data Sheet</i>	General functional description, pinout, and timing.
<i>ADSP-218x DSP Hardware Reference</i>	Description of internal processor architecture and all register functions.
<i>ADSP-218x DSP Instruction Set Reference</i>	Description of all allowed processor assembly instructions.

Table 2. Related VisualDSP++ Publications

Title	Description
<i>VisualDSP++ 3.5 User's Guide for 16-Bit Processors</i>	Detailed description of VisualDSP++ 3.5 features and usage.
<i>VisualDSP++ 3.5 Assembler and Preprocessor Manual for ADSP-218x and 219x Processors</i>	Description of the assembler function and commands for processors.
<i>VisualDSP++ 3.5 C Compiler and Library Manual for ADSP-218x Processors</i>	Description of the compiler function and commands for processors
<i>VisualDSP++ 3.5 Linker &amp; Utilities Manual for 16-Bit Processors</i>	Description of the linker function and commands for 16-bit processors.
<i>VisualDSP++ 3.5 Loader Manual for 16-Bit Processors</i>	Description of the loader/splitter function and commands for 16-bit processors.

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 documentation that accompanies the emulator.

## Online Documentation

Your software installation kit includes online Help as part of the Windows® interface. These help files provide information about VisualDSP++ and the ADSP-2189M 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 ADSP-2189M 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 --> ADSP-BF533 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**.

## Product Information

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](http://www.analog.com/salesdir/continent.asp).

## Hardware Manuals

Printed copies of hardware reference and instruction set reference manuals can be ordered through the Literature Center or downloaded from the Analog Devices 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 at

[dsp.techpubs@analog.com](mailto:dsp.techpubs@analog.com).



## Notation Conventions

The following table identifies and describes text conventions used in this manual.

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

Example	Description
<b>Close command (File menu) or OK</b>	Text in <b>bold</b> style indicates the location of an item within the VisualDSP++ environment's and boards' menu system and user interface items.
{this   that}	Alternative required items in syntax descriptions appear within curly brackets separated by vertical bars; read the example as <i>this</i> or <i>that</i> .
[this   that]	Optional items in syntax descriptions appear within brackets and separated by vertical bars; read the example as an optional <i>this</i> or <i>that</i> .
[this,...]	Optional item lists in syntax descriptions appear within brackets delimited by commas and terminated with an ellipsis; read the example as an optional comma-separated list of <i>this</i> .
PF9-0	Registers, connectors, pins, commands, directives, keywords, code examples, and feature names are in text with <code>letter gothic</code> font.
<i>filename</i>	Non-keyword placeholders appear in text with italic style format.
<b>Note:</b>	A note providing information of special interest or identifying a related topic. In the online version of this book, the word <b>Note</b> appears instead of this symbol.
<b>Caution:</b>	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 <b>Caution</b> appears instead of this symbol.

# Notation Conventions

# 1 GETTING STARTED

This chapter provides the information you need to begin using ADSP-2189M 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 1-2](#)  
Provides a list of the components shipped with this EZ-KIT Lite evaluation system.
- [“System Requirements” 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-2189M EZ-KIT Lite evaluation system package contains the following items.

- ADSP-2189M EZ-KIT Lite board
- Power cable with 7.5V DC power supply
- RS-232 serial port 9-pin cable
- CD containing:
  - ✓ VisualDSP++ for 16-bit processors with a limited license
  - ✓ ADSP-2189M EZ-KIT Lite debug software
  - ✓ Example programs
  - ✓ *ADSP-2189M EZ-KIT Lite Evaluation System Manual* (this document)

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.



## System Requirements

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

Windows® 98, ME, 2000, XP	Windows NT™
Windows 98, ME, 2000, XP	Windows NT 4.0, Service Pack 3 or later
Pentium processor 166MHz or faster	Pentium processor 166MHz or faster
100 MB available space	100 MB available space
16 MB RAM	16 MB RAM
VGA Monitor and color video card	VGA Monitor and color video card
CD-ROM	CD-ROM

## Installation Tasks

The following task list is provided for the safe and effective use of the ADSP-2189M EZ-KIT Lite. Follow these instructions in the presented order to ensure correct operation of your software and hardware.

1. EZ-KIT Lite hardware setup VisualDSP++ and EZ-KIT Lite software installation
2. VisualDSP++ and EZ-KIT Lite software installation
3. VisualDSP++ 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-2189M EZ-KIT Lite board is designed to run outside your personal computer as a stand-alone unit. You do not have to remove your computer case.

To connect the EZ-KIT Lite board:

1. Remove the EZ-KIT Lite board from the package. Be careful when handling the board to avoid the discharge of static electricity, which may damage some components.
2. Connect the RS-232 cable to an available Comm Port on the PC and to P8 on the ADSP-2189M evaluation board.
3. Plug the provided cord into a 120-Volt AC receptacle and plug the connector at the other end of the cable into P7 on the evaluation board.

Visually verify that all of the LEDs light up briefly. The power (green) LED remains. If the LED does not light up, check the power connections.

To configure your board to take advantage of the audio capabilities of the demos, use the following procedure.

1. Plug a set of self-powered computer speakers into jack J2 on the board. Turn on the speakers and set the volume to an adequate level.
2. Connect the line out of an electronic audio device to jack J1 on the board. Set jumper JP3 to LINE.
3. Open Jumper JP2 to GND to enable the AD73322 codec. (This is the board default).

This completes the hardware installation. For information about the EZ-KIT Lite hardware design, refer to [“Board Layout” on page 3-3](#).

## Installing VisualDSP++ and EZ-KIT Lite Software

This EZ-KIT Lite comes with the latest version of VisualDSP++ 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**.


## Installation Tasks

5. At the **Ready to Install** screen, click **Back** to change your install options, click **Install** to install the software, or click **Cancel** to exit the install.
6. When the EZ-KIT Lite installs, the **Wizard Completed** screen appears. Click **Finish**.

## Installing VisualDSP++ License

To install the VisualDSP++ license:

1. Locate the serial number provided on the sticker affixed to the CD sleeve and the registration form.
2. From the **Start** menu, choose **Programs, Analog Devices, VisualDSP++ 3.5 for 16-bit Processors, VisualDSP++ Environment**.
3. The information screen asks if you would like to install a license. Click **Yes**. The **About VisualDSP++** screen appears.
4. Select the **Licenses** tab and click **New**.
5. In the **Install a New License** dialog that opens, select **Single User**.

 Please note that the VisualDSP++ software that comes with your EZ-KIT Lite is a demo version that limits executable file size to 8K bytes. This license lets you run EZ-KIT Lite sessions only. Simulation and emulation are not supported. For a full license, contact your local Analog Devices Sales representative.

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.



# 2 USING EZ-KIT LITE SOFTWARE

The combination of the EZ-KIT Lite board and the monitor software operate as a target for the VisualDSP++ debugger. The debugger lets you view the ADSP-2189M processor's registers and memory and perform several debugging activities, such as setting breakpoints, stepping through code, and plotting a range of memory.

The information in this chapter is organized as follows.

- [“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-2189M EZ-KIT Lite board's memory map.
- [“Standard Operations” on page 2-3](#)  
Covers the standard operation of the EZ-KIT Lite board.
- [“Using EZ-KIT Lite VisualDSP++ Interface” on page 2-11](#)  
Describes the facilities of the EZ-KIT Lite graphical user interface.

# EZ-KIT Lite License Restrictions

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

- The size of a user program is limited to 8 KB of the ADSP-2189M processor's internal memory space.
- No connections to Simulator or Emulator sessions are allowed.
- Only one EZ-KIT Lite board can be connected to the host PC and debugged at a time.
- The EZ-KIT Lite hardware must be connected and powered up in order to use VisualDSP++ with a kit license.

## Memory Map

The ADSP-2189M EZ-KIT Lite board contains 80K bytes configured as 16K x 24 program memory and 16K x 16 of internal SRAM that can be used for either program or data storage. [Table 2-1](#) shows the memory map of the ADSP-2189M EZ-KIT Lite. The configuration of on-chip SRAM is detailed in the *ADSP-2189 Microcomputer Data Sheet*.

Table 2-1. EZ-KIT Lite Memory Map

Start Address	End Address	Content
PM 0x00000	0x0002F	Interrupt vector table
PM 0x00030	0x017FF	Available for user code
PM 0x01800	0x03FFF	Reserved for monitor code
PM 0x20000	0x3FFF	Available for user code and up to four overlay pages
DM 0x00000	0x03AFF	Available for user data and up to six overlay pages

Table 2-1. EZ-KIT Lite Memory Map

Start Address	End Address	Content
DM 0x03B00	0x03DFF	Reserved for monitor data
DM 0x03E00	0x03FFF	Available for user data and up to six overlay pages

## Standard Operations

This section covers the standard operation of the EZ-KIT Lite board: the default settings and IO capabilities of the on-board components, board power-up, and on-board monitor program.

### Default Settings

After you have installed the board and utility software, your PC and EZ-KIT Lite have the default settings shown in [Table 2-2](#). You can change the settings in the dialog box that appears the first time you start VisualDSP++.

Table 2-2. User Configurable EZ-KIT Lite Settings

Selection	Default Setting
Comm Port	Comm 1
Baud rate	57600

### Input and Output Devices

The board's IO component are detailed in the following sections.

- [“Flags” on page 2-4](#)
- [“Interrupts” on page 2-4](#)
- [“Serial Ports” on page 2-5](#)

#### Flags

The ADSP-2189M processor has one asynchronous `FLAG` IO pin, `FL1`. The pin is connected to the amber `FL1` LED. This lets you visually inspect states of your program. The other nine programmable flags (PFs) connect to the expansion area.

#### Interrupts

The ADSP-2189M EZ-KIT Lite has one external interrupt connected through a push button switch, `SW1`. This corresponds to an external interrupt, `TRQ $\bar{E}$` .

The external interrupts are controlled through the `ICNTL` and `IMASK` registers and are configured by modifying the interrupt vector table or through instructions in user code. The `ICNTL` register also controls the interrupt sensitivity between level and edge. To prevent an interrupt from being masked, write to the `IMASK` register.

The monitor program running on the ADSP-2189M processor uses one interrupt (`Timer`) for normal operation. When downloading your own code through the monitor program, the timer interrupt vector is protected and cannot be overwritten. If these vectors are overwritten, or the timer

interrupt is masked in any way, the debugger is not able to communicate with the host program. The following rules and restrictions should be followed when using interrupts.

- You cannot step into an interrupt
- Interrupts are disabled when the user program is halted
- The board cannot communicate with the host if interrupt nesting is enabled.
- If you do not require the supplied monitor program, a start-up routine that dynamically alters the `Timer` interrupt vector can be used. This removes all monitor function.

### Serial Ports

The ADSP-2189M DSP features two synchronous bi-directional Serial Ports (SPORTs), `SPORT0` and `SPORT1`. The SPORTs can operate at up to 1x clock frequency, providing each with a maximum data rate of 30 Mbit/sec. SPORT data can be automatically transferred to and from on-chip memory using DMA.

`SPORT0` is connected to the on-board AD73322 codec. The `JP2` jumper can be used to disable the codec. `SPORT1` is connected to the RS-232 interface and is used as a software Universal Asynchronous Receiver/Transmitter (UART). Communications between the monitor and the host are through `SPORT1`, which can be disabled with the `JP6` jumper.

For more information on the Serial Ports, refer to the *ADSP-218x DSP Hardware Reference*.

### POST Routines

Power On Self-Test (POST) routines are a series of standard tests and initializations that the ADSP-2189M EZ-KIT Lite performs on a power-on reset. To perform a power-on reset, disconnect power to the board for at

## Standard Operations

least three seconds and then reconnect power. The board automatically resets (note that all the LEDs light up briefly). You may also reset the board during operation through the `DEBUG` and `RESET` command in the debugger. Both types of reset cause the DSP to reset to a known state. At this point you should reload any programs you were working on.

[Table 2-3](#) summarizes the types of resets.

Table 2-3. Post Routines

Routine	Power-On-Reset	Reset During Operation
Flash check	Yes	No
AD73322 check	Yes	No
Initializations	Yes	Yes

## Memory Checks

The monitor program performs some standard memory checks on Flash memory and internal SRAM. The Flash memory test consists of verifying a number in memory. If the monitor code is corrupted, the monitor may crash before reaching the actual program code.

## UART Check and Initialization

The software UART check is done when it attempts to connect to the EZ-KIT Lite through a Transmitted Loop Back routine. This UART test is performed by the host after the `POST` is complete. In this test, the host sends the UART test protocol. This protocol specifies the number of bytes that are transmitted to the EZ-KIT Lite board and instructs the board to echo the byte stream back to the host. This test determines whether the EZ-KIT Lite board is set to the correct baud rate and verifies the external connections between the board and the host.

On power up, the EZ-KIT Lite board defaults to a baud rate of 57600 baud with 8 data bits, 1 stop bit, and no parity. To change this rate, wait for the `POST` routine to complete and then use the **Settings, Baud Rate** command in the VisualDSP++. Note that setting the baud rate to a lower number can significantly slow the board's response to all debug activities.

Different baud rates depend upon your application's type: for real-time interrupt driven programs, a lower baud rate setting slows performance, but the timer interrupt occurs less frequently. This gives your program a larger share of the processor's resources.

### AD73322 Codec Check and Initialization

On reset, the AD73322 codec is inactive. An initialization routine initializes the codec by sending a series of command words through the `SPORT0 TX` interrupt. Once the commands have been sent and the AD73322 initialized, it begins transmitting the clock, which synchronizes data transfers to and from the DSP. Once this bit goes "High", the AD73322 is ready for standard communication over `SPORT0`.

### Monitor Program Operations

The monitor program runs on the EZ-KIT Lite board as part of the DSP executable and provides the ability to download, debug, and run user programs. The VisualDSP++ debugger is the interface for the monitor program. Using the EZ-KIT Lite as a target with the debugger lets you operate the board remotely.

There are three main components of the monitor program:

- "Halt loop"
- "UART ISR"
- "Command Processing"

## Standard Operations

### Halt loop

The monitor program idles in the halt loop when the program is not running user code. While there, you can `READ` and `WRITE` memory and registers, download programs, set breakpoints, change the UART's baud rate, and single step through your code. To enter the halt loop from code, you must suspend or stop the code, using either a breakpoint or a `HALT` instruction. At this point, the halt loop polls the UART. With every character received from the UART, the command-processing kernel verifies whether a full command has been received. If a full command has been received, the kernel processes the command; otherwise, control is returned to the halt loop to wait for more characters. The only method of executing your code once the halt loop has been entered is to send a `RUN` or `SINGLE STEP` command in the debugger.

### UART ISR

The UART Interrupt Service Routine (`Timer ISR`) is entered when your code is running, but the host is still interacting with the board. As the host sends bytes, the UART ISR takes the data stream from the UART and builds the command. As with the halt loop, each character received is passed to the command-processing kernel. Unlike the halt loop, the monitor returns to your code immediately after the interrupt is serviced.



- The following restrictions should be observed to ensure correct board operation.
- The host loses contact with the monitor while the user program is running if the user program disables the `Timer` interrupt or changes the `Timer` interrupt vector.



- The host loses contact with the monitor while the program is running and it enters an Interrupt Service Routine when nesting is turned on.
- The host cannot halt with the debugger's **Debug, Halt** command if global IRQ enable is disabled; however, breakpoints will work.

### Command Processing

Command processing, initiated from either the UART ISR or the Halt loop, is done in the command-processing kernel. This kernel parses the commands and executes the instructions. If the instruction requires data to be sent back to the host, the kernel initiates the response.

### Software Breakpoints

The ability to stop the execution of code and examine processor registers and memory is extremely helpful when debugging code. Note that the debugger automatically inserts breakpoints at the function `main()`, when the **Settings, Run To Main** command is checked, and at the `_exit` instruction.

### AD73322 Codec Dual Analog Front End

The monitor does not initialize the AD73322 codec. This provides you with greater flexibility to experiment with custom codec operations. Simple code examples, such as TalkThrough, are provided with your EZ-KIT Lite to demonstrate some basic codec operations. It is recommended that you model your code using these examples.



Once the codec has been initialized, you must use a hard reset to re-initialize it.

## Standard Operations

For more information about the AD73322 codec, go to

[http://www.analog.com/Analog\\_Root/productPage/productHome/0,2121,AD73322,00.html](http://www.analog.com/Analog_Root/productPage/productHome/0,2121,AD73322,00.html).

## AD73322 Codec Transmissions

After initialization, the AD73322 codec generates the clock used to transfer data across `SPORT0`. The ADSP-2189M DSP initiates all transmissions with the AD73322 device by sending a synchronization pulse. Even though the AD73322 transmits the data clock, it may not be ready for normal operation.

Initialization of the AD73322 codec is slightly different than that of other codecs. Initialization is performed by sending at least 8 and up to 16 control words contained in a circular buffer to the AD73322 codec. These control words correspond to the AD73322s control registers A through H. This is usually done via the `SPORT0 TX` interrupt routine.

Once the codec is initialized, normal operation mode is entered, and the `TX` interrupt routine is never used again until the device is reset. During normal operation, the `RX` interrupt of `SPORT0` is used. As each datum is received from the codec, an interrupt is generated. This interrupt is the `SPORT0 RX` interrupt. Inside the `RX` interrupt, datum are moved from the `RX` buffer into the users buffer (generally, this is a circular buffer). At that same `RX` interrupt, the codec is ready to receive data from the DSP. The DSP then moves the data (from the users circular buffer) into `SPORT0s TX` buffer and clocks it into the codec.

## Using EZ-KIT Lite VisualDSP++ Interface

This section outlines the process of developing, loading, and running the ADSP-2189M EZ-KIT Lite example programs supplied with VisualDSP++ software:

- [“Developing Programs” on page 2-11](#)
- [“Starting Visual DSP++” on page 2-12](#)
- [“Debugging With EZ-KIT Lite” on page 2-14](#)
- [“Loading Programs” on page 2-14](#)
- [“Example Programs” on page 2-16](#)

For detailed information about VisualDSP++ features and operation, see the *VisualDSP++ 3.5 User's Guide for 16-Bit Processors* and online Help.



### Developing Programs

A typical program development cycle using the VisualDSP++ environment includes the following steps:

1. Creating a new project file
2. Setting target processor project options
3. Adding and editing project source files
4. Customizing the project build options
5. Building a debug version of the project
6. Debugging the project
7. Building a release version of the project

## Using EZ-KIT Lite VisualDSP++ Interface

By following these steps, your DSP application programs build consistently and accurately with minimal project management. Note the following restrictions of this system:

-  The size of the DSP executable that you can build using the EZ-KIT Lite tools is limited to 8K.
-  Do not run more than one ADSP-2189M EZ-KIT Lite session in the debugger at any one time. You may run an EZ-KIT Lite session and a simulator or ICE session at the same time or you can open two debugger interfaces to run more than one EZ-KIT Lite session.

### Starting Visual DSP++

After the VisualDSP++ software and license have been installed, click the Windows **Start** menu.

1. 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.

2. Click **New Session**.
3. The **New Session** dialog box, shown in [Figure 2-1](#), appears on the screen.
4. In **Debug Target**, choose **EZ-KIT Lite (ADSP-218x)**.
5. In **Processor**, choose the appropriate processor, **ADSP-2189**.
6. Type a new target name in **Session Name** or accept the default name.



Figure 2-1. New Session Dialog Box

7. Click **OK** to return to the **Session List**. Highlight the new session and click **Activate**.
8. A message appears instructing you to press the **Reset** button. Click **OK** and press the reset button on the board.  
All the LEDs light up and after a brief delay (less than 2 seconds), all of the LEDs go dark except for the power LED. Verify that the LEDs do dark (except for the power LED) before going to the next step.
9. Click **OK**

The initialization completes and the disassembly window opens. The code in the disassembly window is the EZ-KIT Lite monitor program.

### Debugging With EZ-KIT Lite

The *VisualDSP++ User's Guide for 16-Bit Processors* and online Help contains most of the information you need to operate the VisualDSP++ debugger with the EZ-KIT Lite evaluation board. Because the manual was written using a simulator as a target, there are some differences and restrictions in the debugger operation when connected to a hardware target.

### Loading Programs

Because you are loading programs into a hardware target, the load process takes a slightly longer period of time than loading in the simulator. Wait for the **Load Complete** message in the **Output** window before you attempt any debug activities.

To load a program, use the following procedure:

1. From the **File** menu, select **Load**.

The **Open a Processor Program** dialog box appears.

2. Navigate to the folder where your DSP executable file resides. The demos supplied with the EZ-KIT Lite are located in the `..\218x\EZ-KITs\2189M\Examples` subdirectory of your VisualDSP++ installation directory.
3. Select the file and click **Open**.  
The file loads and the **Load Complete** message appears in the **Output** window when the load process has completed.

### Registers and Memory


To see current values in registers and memory, use the **F12** key or the **Window, Refresh** command.



Register and memory contents may not be changed while the user program is running.

## Setting Breakpoints and Stepping

The debugger automatically inserts breakpoints at the function `main()`, when the **Settings, Run To Main** command is checked, and at the `_exit` instruction.


-  Breakpoints set in the last three instructions of a do-loop are allowed, but this causes improper debugger operation.

## Resetting EZ-KIT Lite Board

The EZ-KIT Lite board can be reset with the push button, SW2, switch on the board or with the **Debug, Reset** command in the debugger. After performing a reset, reload any programs you were running. The **Debug, Restart** command also resets the processor. The processor, however, retains all debug information and memory contents.


The following sequence must be used when starting the debugger:

1. Start VisualDSP++ from the Windows **Start** menu.  
The debugger starts and the **Target** message **Hit Reset Button** appears.
2. Press the reset button. Wait approximately three seconds for the LEDs (except the power LED) to go dark.
3. Click **OK**.

-  Do not use the reset button while the debugger is open unless the debugger requested to do so.

### Example Programs

Example programs are included with the ADSP-2189M 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\218x\EZ-KITs\2189M\Examples`. Please refer to the readme file provided with each example for more information.

-  Do not run more than one ADSP-2189M EZ-KIT Lite session in the debugger at any one time. You may run an EZ-KIT Lite session and a simulator or ICE session at the same time or you can open two debugger interfaces to run more than one EZ-KIT Lite session.

### Convolution

Reads sample input from a memory buffer, performs a convolution filter on the data, then stores the manipulated data in an output buffer.

### IRQE

Demonstrates a simple external interrupt handler for the user interrupt button, SW1.

### Overlay

Demonstrates the ADSP-2189M overlay memory capabilities. Use the **Register, Program Control** command to **View** overlay activity.

### Primes

Calculates the first 20 prime numbers and sends them to the output window. The `printf` function is used in this program.




## TalkThrough


Demonstrates how to use a circular buffer, which spans five pages of the ADSP-2198M's DM overlay memory as input and then sends the data back out to the `Line Out` of the AD73322 codec. This program is interrupt intensive and performs best at a low baud rate (9600).

## Timer

Demonstrates how to hook into the timer interrupt handler. The timer interrupt generates a 1-second on/off pulse on the `FL1` LED. The idea behind the timer interrupt is that the monitor program sets a timer at 3 times the baud rate and expects to receive 10 bits ( $3 \times \text{BAUD} \times 10 = 1 \text{ second}$ ). When every counter has expired, the reset `FL1` is executed.

 You can not set breakpoints in the interrupt routine if using the ADSP-2189M monitor program

The `TPERIOD` register contains the current period of the timer. It is set to 3 times the baud rate. The timer is used as a baud rate generator so the smaller the period, the faster the interrupt will occur. It is not advisable to change the `TPERIOD` register since this will change the monitors baud rate, and communications is lost with the host.

 This interrupt will continue to be vectored to even after the program has halted.

# Using EZ-KIT Lite VisualDSP++ Interface

# 3 EZ-KIT LITE HARDWARE REFERENCE

This chapter discusses the hardware design of the ADSP-2189M EZ-KIT Lite board. The following topics are covered:

- [“System Architecture” on page 3-2](#)  
Illustrates the configuration of the ADSP-2189M EZ-KIT Lite board.
- [“EZ-KIT Lite Board Layout” on page 3-3](#)  
Shows the location and describes the function of the configuration jumpers, switches, and user LEDs.
- [“Connectors” on page 3-7](#)  
Shows the location and describes the function of the expansion connectors.
- [“Designing EZ-ICE Compatible Systems” on page 3-14](#)  
Outlines the ICE emulator theory of operation to aid your EZ-ICE compatible system designs.

# System Architecture

This section describes the processor configuration on the EZ-KIT Lite board (see [Figure 3-1](#)).

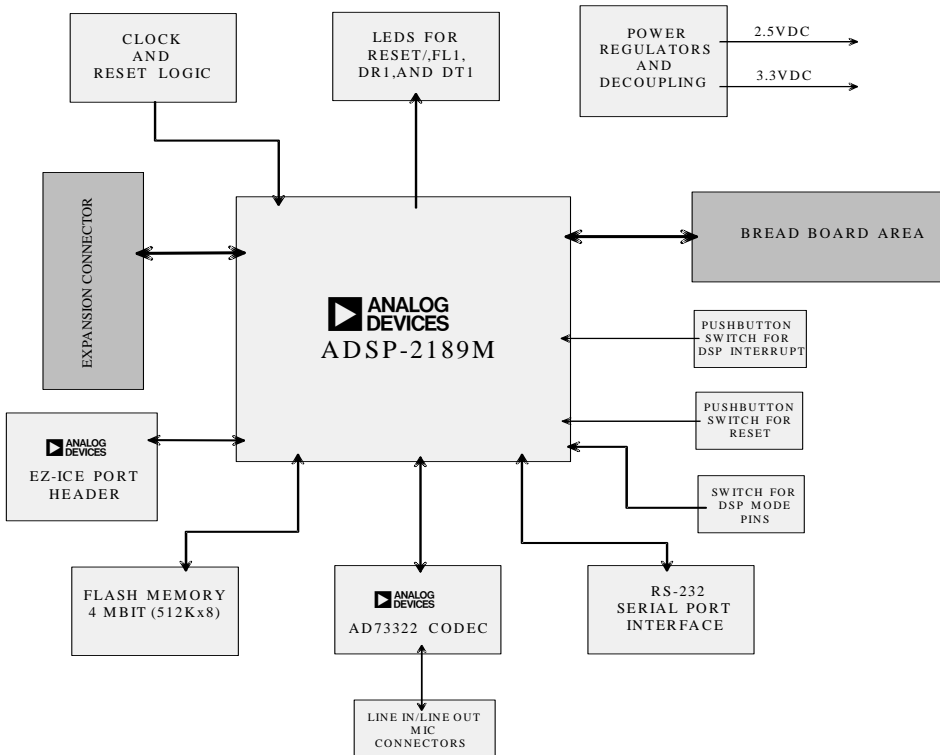


Figure 3-1. ADSP-2189M EZ-KIT Lite System Block Diagram

## Board Layout

Figure 3-2 shows the layout of the EZ-KIT Lite board. The figure highlights the locations of the major components and connectors. Each of these major components is described in the following sections

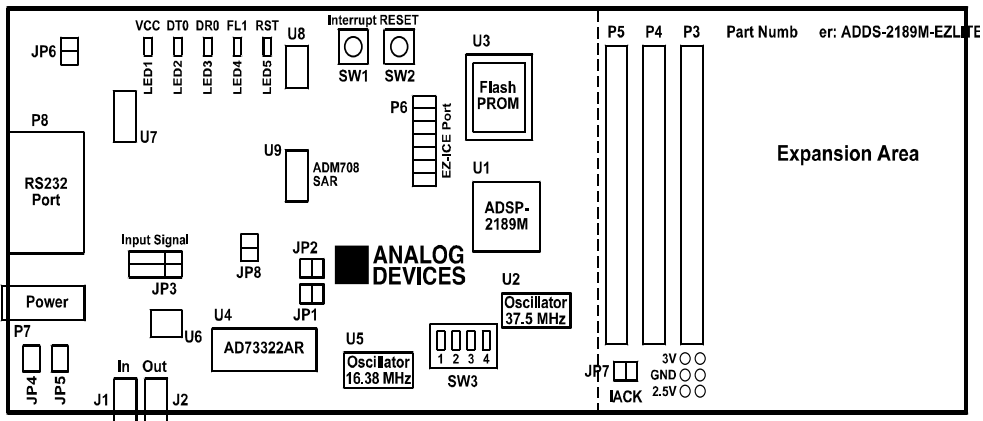


Figure 3-2. EZ-KIT Lite Board Layout

## Flash Memory

The flash memory provide up to 4M x 8 bits of program storage that can be loaded by the ADSP-2189M when it is programmed to boot from the BMS (Boot Memory Select) and Mode A, B, C, and D switches. After the ADSP-2189M processor is reset, the BDMA feature is used to load the first 32 words of program memory from the byte memory space. Program execution is held off until all 32 words are loaded. You can change the mode of operation using the toggles on the mode DIP switch (SW3). Refer to the *ADSP-218x DSP Hardware Reference* and data sheet for more information on the processor's boot modes.

## Board Layout

### User LEDs

- LED1 LED is a green light emitting diode which is on whenever the board has power.
- LED2 is an amber light emitting diode which is on whenever there is data transmitted via the serial port.
- LED3 is an amber light emitting diode, which is “ON” whenever data is received via the serial port.
- LED4 is an amber light emitting diode, which is controlled by the FL1 output of the ADSP-2189M processor. Software can control the state of this indicator by writing to an internal register.
- LED5 is a red light emitting diode which indicates whether RESET is asserted.

### Switches

- The SW1 switch is the interrupt push button switch. Pushing this button causes the ADSP-2189M to receive an  $\overline{TRQE}$  interrupt input. The processor then executes the current  $\overline{TRQE}$  interrupt handler software if the interrupt is enabled and the  $\overline{TRQE}$  interrupt vector is in place. The interrupt switch output is de-bounced electronically to prevent multiple interrupts due to mechanical contact bounce.
- The SW2 switch is the reset push button switch. Pushing this button causes the ADSP-2189M processor and the AD7322 codec to enter the hardware reset state and remain there until it is released. The switch outputs are de-bounced electronically to prevent multiple transitions due to mechanical contact bounce.

## Mode Selection Switch

The ADSP-2189M processor can be operated in several modes. While in most cases you set these modes in software, the EZ-KIT Lite board provides you with a set of switch settings,  $SW_3$ , that do this for you. The following graphics and their corresponding descriptions describe these operating modes.

**i** Configuration types 1, 4, and 6 are considered standard operating settings. Use of these settings allows for easier design and better memory management.

Table 3-1. Mode Selection Switches



CONFIGURATION TYPE 1  
(FACTORY DEFAULT)

BDMA feature is used to load the first 32 program memory words from the byte memory space. Program execution is held off until all 32 words have been loaded. The ADSP-2189M is configured in Full Memory Mode.

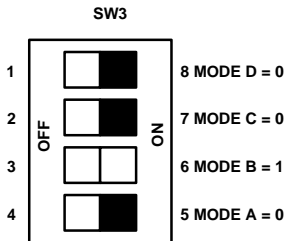


CONFIGURATION TYPE 2

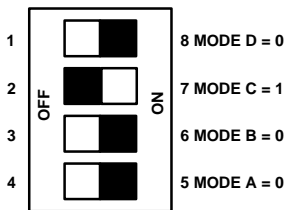
No Automatic boot operations occur. Program execution starts at external memory location 0. The ADSP-2189M is configured in Full Memory Mode. BDMA can still be used but the processor does not automatically use or wait for these operations.

# Board Layout

Table 3-1. Mode Selection Switches



BDMA feature is used to load the first 32 program memory words from the byte memory space. Program execution is held off until all 32 words have been loaded. The ADSP-2189M is configured in Host Mode.  $\overline{TACK}$  has an active pull-down. (Note: requires additional hardware).



CONFIGURATION TYPE 3

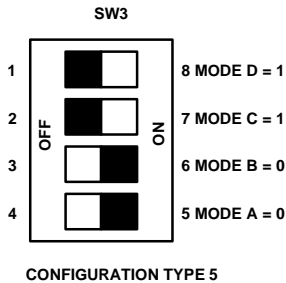


IDMA feature is used to load any internal memory as desired. Program execution is held off until internal program memory location 0 is written to. The ADSP-2189M is configured in Host Mode.  $\overline{TACK}$  has an active pull-down.

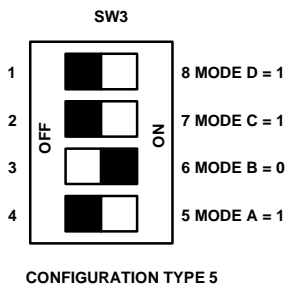
CONFIGURATION TYPE 4



Table 3-1. Mode Selection Switches



BDMA feature is used to load the first 32 program memory words from the byte memory space. Program execution is held off until all 32 words have been loaded. The ADSP-2189M is configured in Host Mode;  $\overline{TACK}$  requires an external pull-down. (Note: Requires additional hardware).



IDMA feature is used to load any internal memory as desired. Program execution is held off until internal program memory location 0 is written to. The ADSP-2189M is configured in Host Mode.  $\overline{TACK}$  requires an external pull-down.

## Connectors

This section describes headers and connectors supplied with this EZ-KIT Lite.

- The J1 connector is a 1/8 inch (3.5 mm) stereo jack. This jack is used to bring either line level or microphone audio signals into the board.
- The J2 connector is a 1/8 inch (3.5 mm) stereo jack. This jack is used to bring out line level audio signals from the board.

## Connectors

- The JP1 connector is a 2-pin header that causes the codec to be directly coupled when a shorting jumper is installed or causes the codec to be indirectly coupled when a shorting jumper is not installed. Default is not installed.
- The JP2 connector is a 2-pin header that disables the codec, when a shorting jumper is installed, and enables the coded, when a shorting jumper is not installed. Default is not installed (codec enabled).
- The JP3 connector is a 6-pin header. It is used to configure input jack J1 for either line level or microphone input. The center pin in each group of three is connected to one of the AD73322 codec's input pins. Jumpers (also known as shunts or shorting links) can be used to connect these pins to either the output of the microphone amplifier or to the output of the line level input filter.
- The JP4 connector is a 2-pin header that changes the line in gain from 47 to 400 when a shorting jumper is installed. Default is not installed.
- The JP5 connector is a 2-pin header that changes the line in gain from 47 to 400 when a shorting jumper is installed. Default is not installed.



- The JP4 and JP5 connectors should have the same configuration.
- The JP6 connector is a 2-pin header that disables the serial port when a shorting jumper is installed and enables the serial port when the jumper is not installed. Default is not installed.
- The JP7 connector is a 2-pin header that should have a shorting jumper installed for Mode D operation. Default is not installed.
- The JP8 connector is a 3-pin header that varies the I/O voltage to the DSP. For 2.5 volt operation, the jumper is placed on 2 and 3. For 3.3 volt operation, the jumper is placed on 1 and 2.
- The JP9 connector is restricted.

- The expansion port connectors (P3, P4, and P5) are sites for 50-pin header connectors. These connectors can be used to access the ADSP-2189M signals for expansion or test purposes. For more information, see [“Expansion Port Connectors” on page 3-9](#).
- The P6 connector is a 14-pin header connector connects to an ADDS-218x EZ-ICE in-circuit emulator. Pin 7 should be removed for keying purposes. For more information, see [“EZ-ICE Connector” on page 3-12](#).
- The P7 connector is a jack for a 6.35 mm cylindrical plug. It is used to supply power to the board. The center pin of the jack is 2.5 mm diameter and should connect to the positive side of the power source. The outer sleeve of the mating plug must be ground.
- The P8 connector is a male 9-pin D-Sub connector. It is used to communicate with a host computer using RS-232 signal levels and asynchronous serial protocols.

## Expansion Port Connectors

Three expansion port connectors (P3, P4, and P5) provide access to the ADSP-2189M processor’s interface pins, letting you watch data transmissions. The P3, P4, and P5 connectors are sites for 50-pin header connectors. These connectors can be used to access the ADSP-2189M signals for expansion or test purposes. In addition, all interrupts, bus signals, and PWT\_EVENT signals are available through the expansion port. The pin numbers on these connectors are arranged as follows.

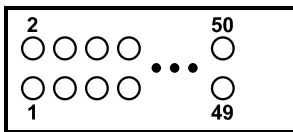


Figure 3-3. Expansion Connector

## Connectors


The signals available on these pins are shown in [Table 3-2](#). All numbered pins (2–50) are connected to ground.

Table 3-2. ADSP-2189M Pin Names

P3		P4		P5	
Pin Number	Signal Name	Pin Number	Signal Name	Pin Number	Signal Name
1	A0	1	WR	1	IRQWE/PF4
3	A1/IAD0	3	RD	3	IRQL0/PF5
5	A2/IAD1	5	BMS	5	IRQL1/PF6
7	A3/IAD2	7	DMS	7	IRQ2/PF7
9	A4/IAD3	9	PMS	9	DT0
11	A5/IAD4	11	IOMS	11	TFS0
13	A6/IAD5	13	CMS	13	RFS0
15	A7/IAD6	15	CLKOUT	15	DR0
17	A8/IAD7	17	D8	17	SCLK0
19	A9/IAD8	19	D9	19	DT1
21	A10/IAD9	21	D10	21	TFS1
23	A11/IAD10	23	D11	23	RFS1
25	A12/IAD11	25	D12	25	DR1
27	A13/IAD12	27	D13	27	SCLK1
29	D0/IAD13	29	D14	29	RESET
31	D1/IAD14	31	D15	31	PWDACK
33	D2/IAD15	33	D16	33	BGH
35	D3/IACK	35	D17	35	MODE_A/PF0
37	D4/IS	37	D18	37	MODE_B/PF1
39	D5/IAL	39	D19	39	PWD
41	D6/IRD	41	D20	41	MODE_C/PF2

Table 3-2. ADSP-2189M Pin Names (Cont'd)

P3		P4		P5	
Pin Number	Signal Name	Pin Number	Signal Name	Pin Number	Signal Name
43	D7/IWR	43	D21	43	MODE_D/PF3
45	BG	45	D22	45	FL0
47	BR	47	D23	47	FL1
49	GND	49	GND	49	FL2

 External port loading can effect external bus speed and performance.

## Power Connector

The power connector, J4, supplies DC voltages to the EZ-KIT Lite board. [Table 3-3](#) summarizes the power connector pinout. If you do not use the power supply provided with your EZ-KIT Lite board, replace it with one that has the connections shown in [Table 3-3](#).

Table 3-3. Power Connection

Terminal	Connection
Center pin	7.5 VDC @ 4 amps
Outer ring	GND

## Connectors

### European Power Supply Connections

[Table 3-4](#) summarizes the European power supply specifications.

Table 3-4. European Power Supply Connections

DC Voltage	8 to 10V DC
CURRENT	4 amps maximum rating
RIPPLE	500 mV rms (Max @ full load)
DC Connector	
Type	Switchcraft 760 style FEMALE
Plug Size	5.5 (OD) X 2.5 (ID) X 9.5 (length) millimeters
Polarity	Center is positive (inside terminal)

### AD73322 Codec Connectors

When the AD73322 codec is enabled on the EZ-KIT Lite board, you can access the audio input and output jacks on the board. Each of the audio connectors are stereo mini jacks and accept standard commercially available stereo mini plugs.

The Microphone/Line\_in Input jack connects to the `LINE_IN_L` (left) and `LINE_IN_R` (right) pins or the `MIC1` and `MIC2` of the AD73322 SoundPort Stereo codec, depending on the setting of jumpers `JP3`.

The `LINE` Output jack connects to the left (L) `LINE_OUT` and right (R) `LINE_OUT` pins of the codec.

### EZ-ICE Connector

The ADSP-218x EZ-ICE Emulator aids the hardware debugging of an ADSP-2189M system. The emulator consists of hardware, host computer resident software, and the target board connector. The ADSP-2189M integrates on-chip emulation support with a 14-pin ICE-Port interface

([Figure 3-4](#)). This interface provides a simpler target board connection that requires fewer mechanical clearance considerations than other ADSP-2100 EZ-ICEs. The ADSP-2189M device need not be removed from the target system when using the EZ-ICE, nor are any adapters needed. Due to the small footprint of the EZ-ICE connector, emulation can be supported in final board designs.

The EZ-ICE performs provides:

- In target operation
- Setting up to 30 breakpoints
- Single stepping or full speed operation
- Examining and altering registers and memory values
- Uploading and downloading PC functions
- Instruction-level emulation of program booting and execution
- Complete assembly and disassembly of instructions
- C source-level debugging

The EZ-ICE header is a 14-pin header with the connections shown in [Figure 3-4](#).

## Designing EZ-ICE Compatible Systems

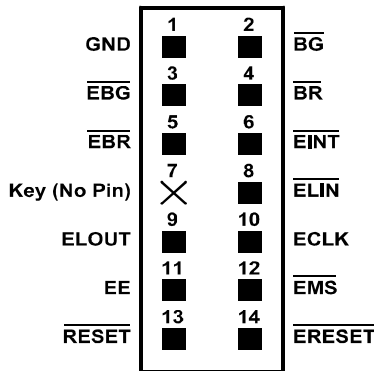


Figure 3-4. EZ-ICE 14-pin Header

## Designing EZ-ICE Compatible Systems

This section describes the ADSP-218x family EZ-ICE theory of operation to aid your EZ-ICE compatible system designs.

When power is applied to the board, a reset circuit holds the processor in  $\overline{\text{RESET}}$  for approximately 200 ms.  $\overline{\text{RESET}}$  is then de-asserted and the processor begins the boot process. The Mode A-D pins are set up by default to boot the processor from the byte-wide memory interface, which is connected to the Flash EPROM.

The hardware consists of a printed circuit board measuring 3.5 inches by 5.5 inches. Assembled onto the printed circuit board are: an ADSP-2189M digital signal processor, a Flash EPROM, an AD73322 codec, and various support circuits and connectors. The board is a complete signal processing system designed to demonstrate the capabilities of the ADSP-2189M digital signal processor. It can also be used as a platform to develop new applications targeting ADSP-2189M processors.



The EZ-KIT Lite board is an example of a minimum implementation of an ADSP-2189M processor. The Flash EPROM is connected to the processor via the Byte DMA Port. This interface uses only eight of the 24 data lines to carry data (D<sub>8</sub> through D<sub>15</sub>). Eight of the spare data lines (D<sub>16</sub> through D<sub>23</sub>) are used to provide additional address bits. This allows the ADSP-2189M to address up to 32 Mbits (4 Mbytes) of memory. The DSP is configured to boot from the Flash EPROM when RESET is de-asserted or if power is applied to the board.

The AD73322 codec is connected to the DSP via SPORT<sub>0</sub>. This high speed synchronous serial port carries all of the data, control, and status information between the DSP and the codec. It is possible to disable the codec if the serial port is to be used for another purpose. When the jumper (JP1) is shorted, the codec is disabled and its signals are put in a high impedance state.

The SPORT<sub>1</sub> pins are used to communicate with the host PC via the RS-232 interface (P8). The Flag In and Flag Out pins carry the receive and transmit data. Software running on the DSP emulates a UART to provide the proper protocol for asynchronous serial communications up to a data rate of 115K bits per second.

### Hardware Debugging

If the green LED fails to light, check your power connections. Verify that your power supply has the proper size connector and that the polarity is correct. The power supply voltage measured at the connector to the board should be 8V to 10V DC. Also, make sure that there are no objects beneath or on top of the board that may be causing a short circuit. Hit the reset button (SW1) if the board appears to be operating improperly.

# Designing EZ-ICE Compatible Systems

# A RESTRICTIONS

The following restrictions apply to release 1.1 of the ADSP-2189M EZ-KIT Lite evaluation board. For information on any ADSP-2189M silicon anomalies, see the anomaly sheet that accompanied this product.

1. Breakpoints set in the last three instructions of a do-loop are allowed but cause your code to run incorrectly.
2. The host loses contact with the monitor while the user program is running if the user program disables the `Timer` interrupt or changes the `Timer` interrupt vector.
3. The host loses contact with the monitor while the program is running and in an ISR when nesting is turned on.
4. Do not use the Reset button while the debugger is open unless the debugger requests you to do so. This causes the debugger to stop communicating.
5. Do not run more than one ADSP-2189M EZ-KIT Lite session in the debugger at any one time. You may run an EZ-KIT Lite session and a simulator or ICE session at the same time or you can open two debugger interfaces to run more than one EZ-KIT Lite session.



# B BILL OF MATERIALS

Reference	Quantity	Description	Manufacturer	Reference Design	Reference
1	2	0 OHMS 1/4W 5%	0.0QBK-ND	RC05	R43, R44
2	1	3.3V RS232 TRANS-CEIVER	LTC1327CG	SSOP28	U7
3	1	3.3 VOLT REGULATOR	LM3940IMP-3.3	SOT223	VR2
4	1	2.5 VOLT REGULATOR	TPS76325DBVT	SOT23	VR3
5	1	37.5MHZ OSCILLATOR	EC1300HS-37.5M	DIP8	U2
6	1	ADSP-2189 DSP	ADSP-2189MKST-300	LQFP100	U1
7	1	GP DUAL ANALOG FRONT END	AD73322AR	SOIC28	U4
8	1	5V REGULATOR	LM7805CT	T0220	VR1
9	1	HEX INVER SCHMITT TRIGGER	74LVC14AD	SOIC14	U8
10	1	AUDIO OP AMP	AD8058AR	SOIC8	U6
11	1	16.384 MHZ OSCILLATOR	EC1300HS-16384M	DIP8	U5
12	1	512K 3V FLASH	AT49BV040	PLCC32	U3
13	1	10uF 25V 10%	TAJD106K025R	D	CT18
14	2	1000pF 50V 5%	12065A102JATMA	1206	C11, C12

Reference	Quantity	Description	Manufacturer	Reference Design	Reference
15	2	0.1uF 50V 10%	12065C104KAT1A	1206	C1, C19
16	1	0.47uF 16V 10%	1206YC474KAT1A	1206	C13
17	1	VOLTAGE SUPERVISOR	ADM708SAR	SOIC8	U9
18	3	4.7uF 25V 10%	TAJC475K025R	C	CT15-CT17
19	1	2.5MM POWER JACK	SWC RAPC712		P7
20	1	750MA RESETABLE FUSE	MINISMDC075-2	SMT	F1
21	3	LED AMBER	LN1461C-TR	SMT	LED2-LED4
22	20	0.1uF 50V 10%	08055C104KAT	805	C6-C10, C14-C18, C20-C29
23	1	10uF 16V 10%	TAJC106K016R	C	CT10
24	3	22uF 16V 10%	PCT3226CT-ND	D	CT11-CT13
25	1	2.00K 1/8W 1%	CRCW1206-2001FRT1	1206	R30
26	1	SUPER FAST RECTIFIER	ES1B	SMA	D2
27	2	100 OHMS 100MW 5%	CRCW0805-101JRT1	805	R11, R19
28	2	5.1K OHMS 1/8W 1%	CR32-512F-T	1206	R14, R16
29	2	240K OHMS 1/8W 1%	CR32-244F-T	1206	R13, R18
30	2	47K OHMS 1/8W 5%	CR32-473F-T	1206	R21, R22
31	3	0.33uf 35V 10%	TAJA334K035R	A	CT3, CT5, CT9
32	2	220pf 50V 10%	12065A221JAT2A	1206	C3, C4
33	2	FERRITE BEAD	BLM31P500SPT	1206	FB6, FB7
34	4	FERRITE BEAD	BLM11A601SPT	603	FB1-FB4

Reference	Quantity	Description	Manufacturer	Reference Design	Reference
35	1	FERRITE CHOKE COIL	PLM250S40T1	2020	FB5
36	1	SILICON RECTIFIER	S2A	SMBJ	D1
37	2	0.047UF 16V 10%	1206YC473KAT05	1206	C2, C5
38	1	9 PIN MALE DB9	787203-2	DB9	P8
39	1	4 POS. DIP SWITCH	ADE04	DIP-4	SW3
40	1	1K OHMS 1/8W 5%	CR32-102J-T	1206	R42
41	16	10K OHMS 1/8W 5%	CRCW1206-103JRT1	1206	R3-R9, R23, R35-R40, R45-R46
42	6	100K OHMS 1/8W 5%	CRCW1206-104JRT1	1206	R29, R31-R34, R41
43	3	33 OHMS 1/8W 5%	NRC12J330TR	1206	R1, R2, R10
44	7	680 OHMS 1/8W 5%	CR32-681J-T	1206	R15, R17, R24-R28
45	1	LED RED	P503CT-ND	SMT	LED5
46	1	LED GREEN	P504CT-ND	SMT	LED1
47	2	MOMENTARY SWITCH	EVQ-QS205K	6mm	SW1, SW2
48	5	1uF 25V 20%	ECS-T1EY105R	A	CT2, CT4, CT7, CT8, CT14
49	6	IDC 2X1	68001-402H	IDC	JP1, JP2, JP4, JP5, JP6, JP7
50	1	IDC 3X1	S1012-03	IDC	JP8
51	1	IDC 3X2	PTC03DAANR	IDC	JP3

Reference	Quantity	Description	Manufacturer	Reference Design	Reference
52	1	IDC 7X2	PTC07DAAN	IDC	P6
53	2	3.5mm MINI STEREO JACK	ST-323-5	3.5mm	J1, J2



PROPRIETARY INFORMATION

REVISIONS

REV	ECO	DESCRIPTION	ENGR	DATE	APPR
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# ADSP2189 EZ - KIT LITE



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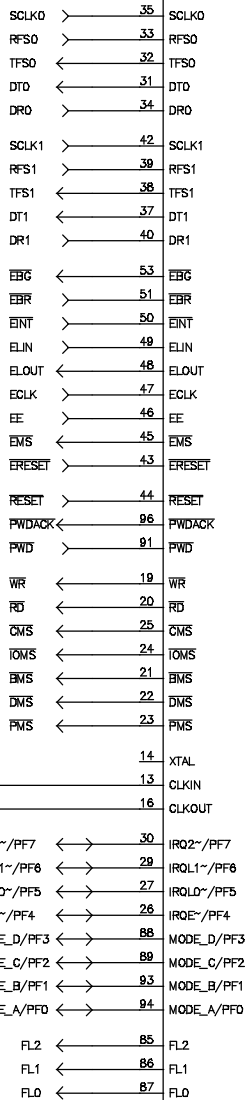
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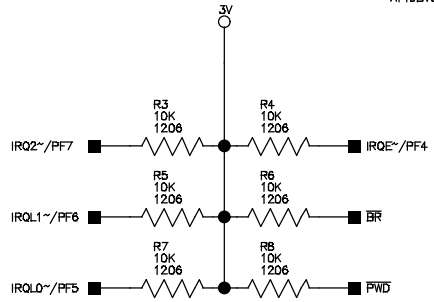
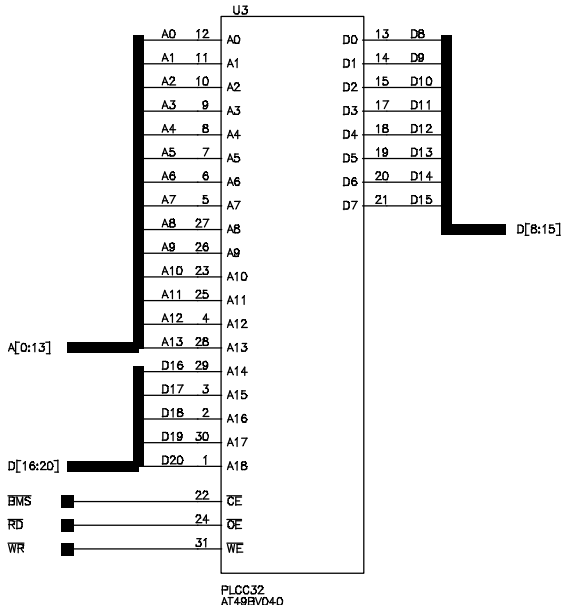
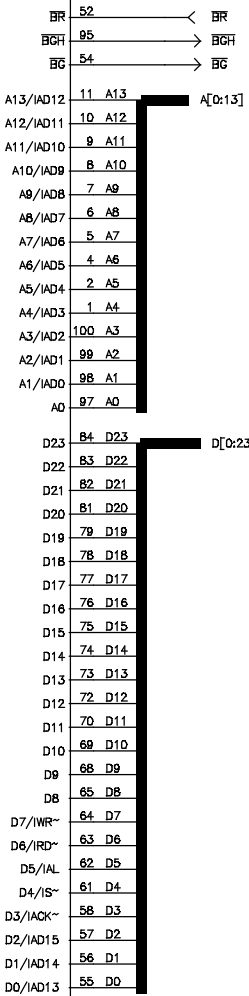
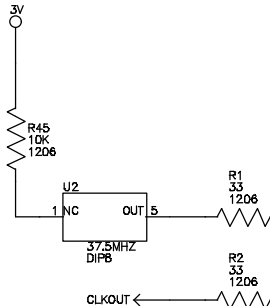
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U1



ADSP 2189M



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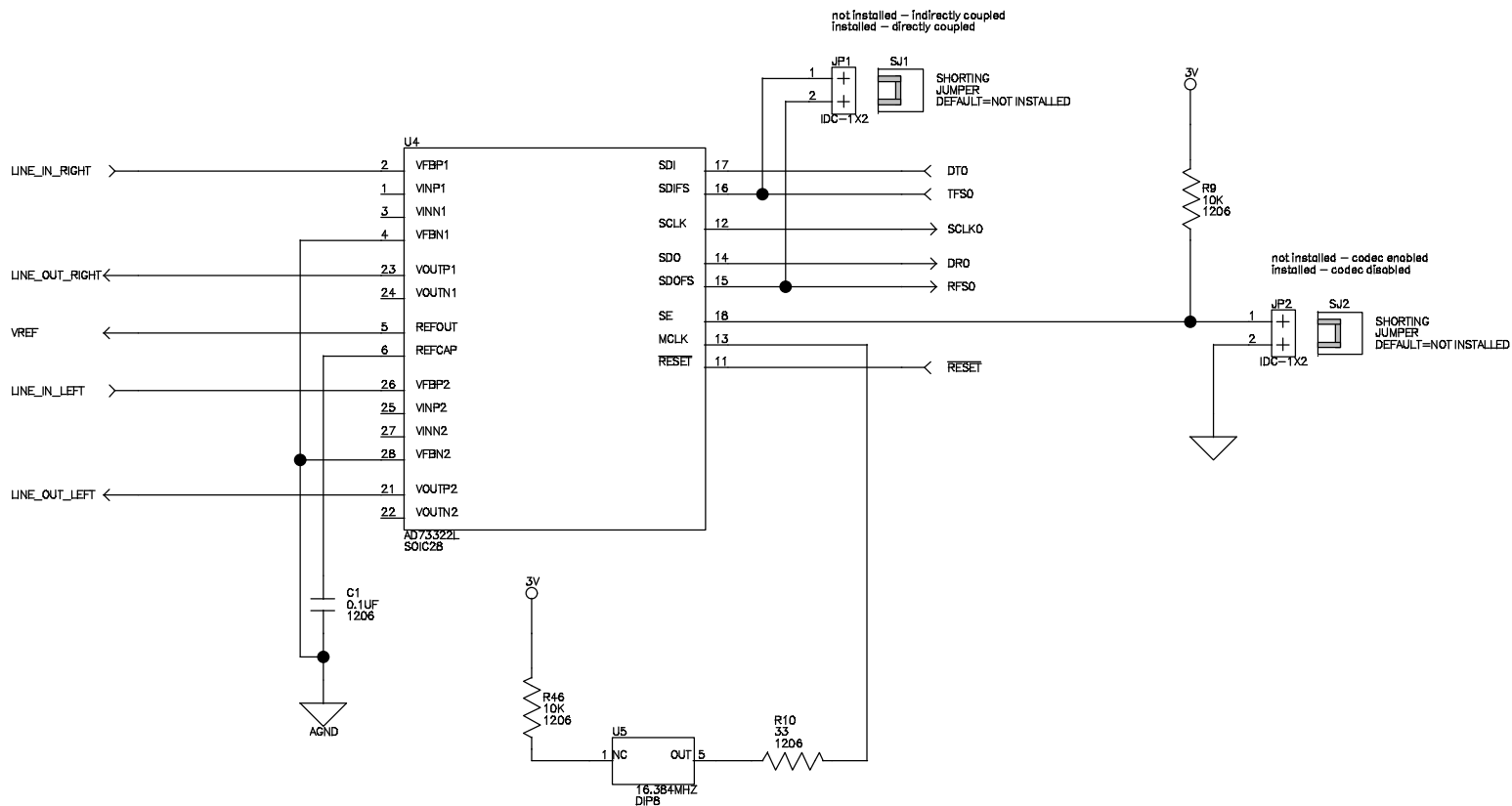
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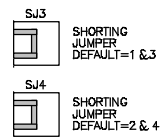
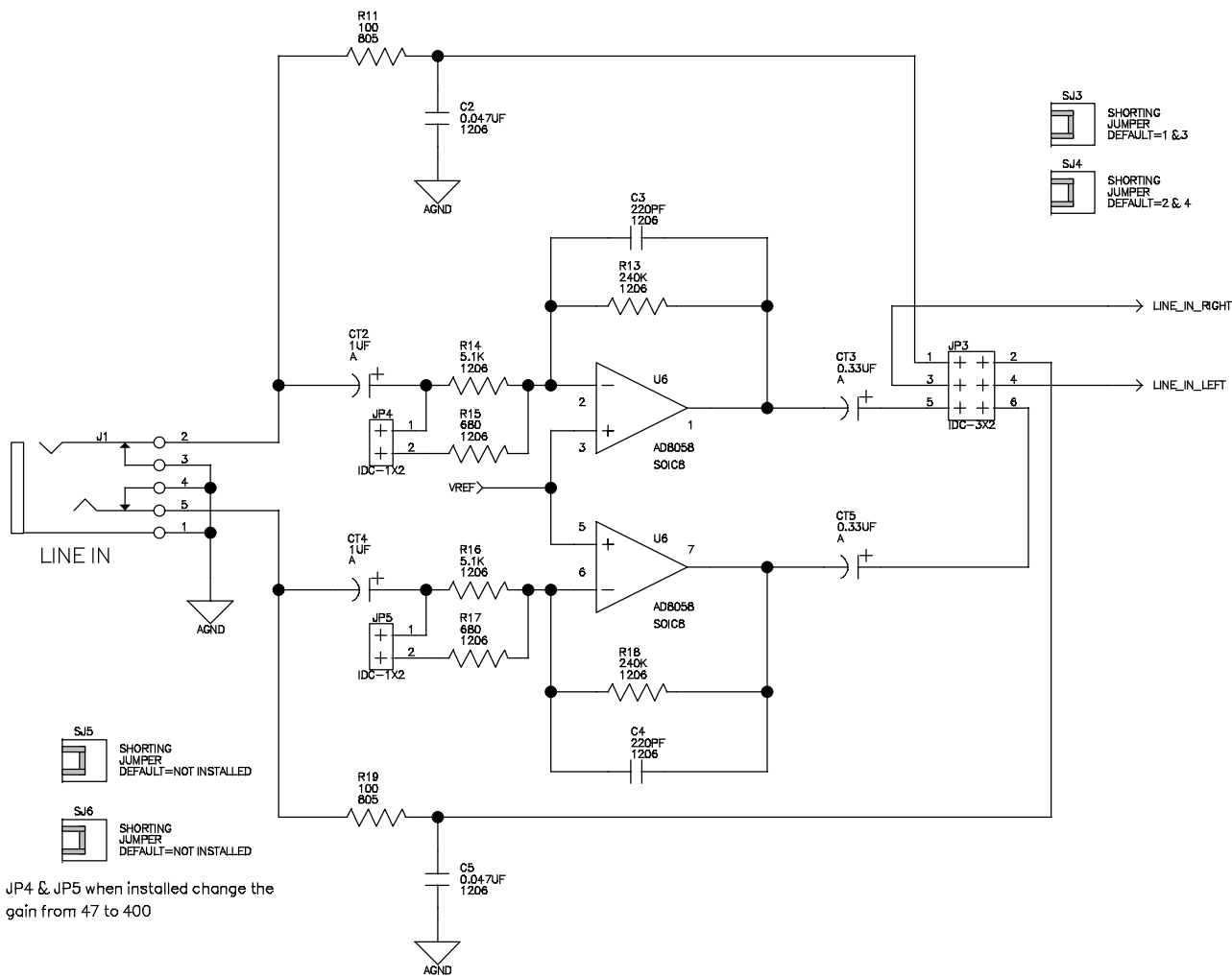
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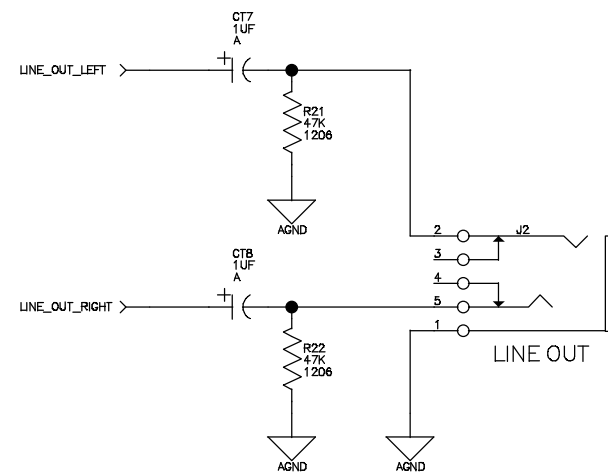
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JP4 & JP5 when installed change the gain from 47 to 400



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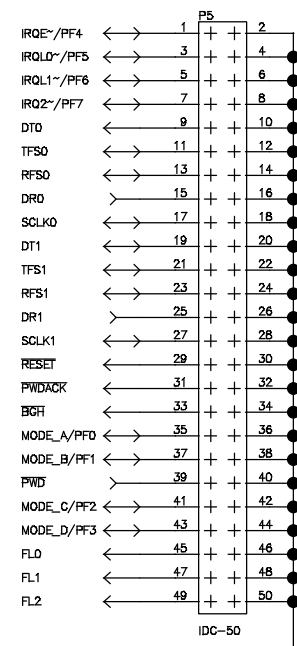
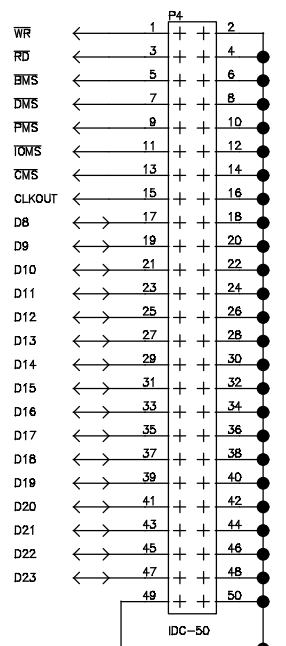
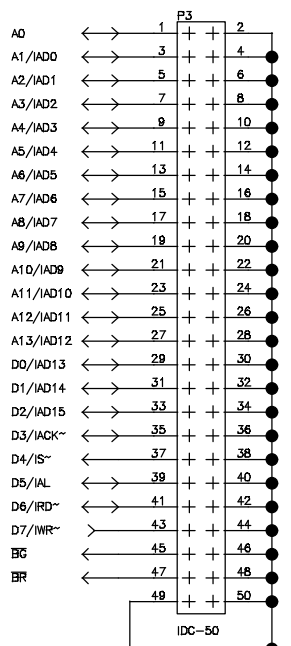
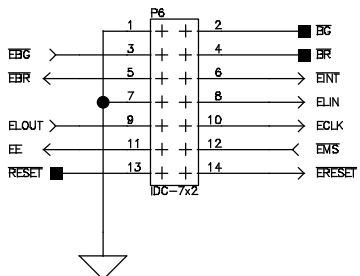
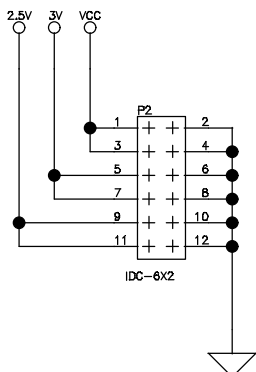
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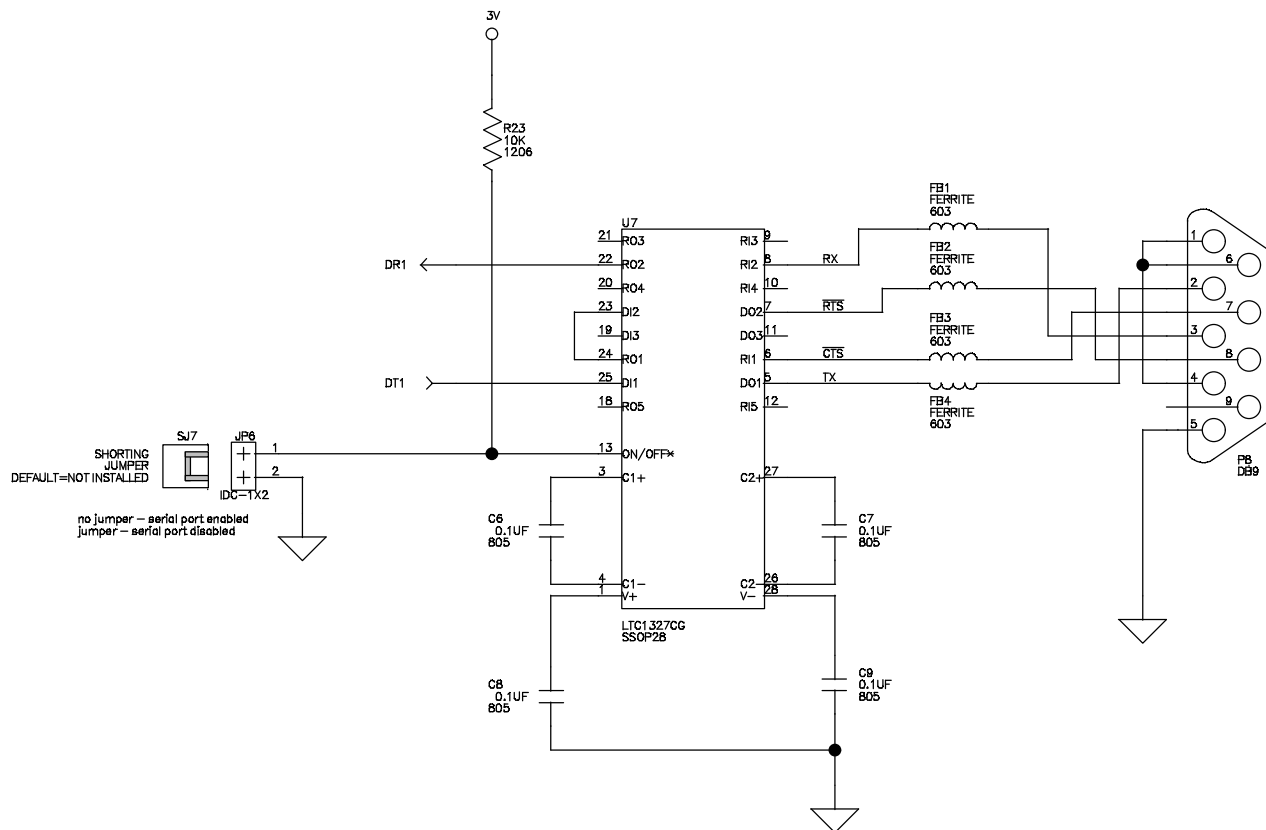
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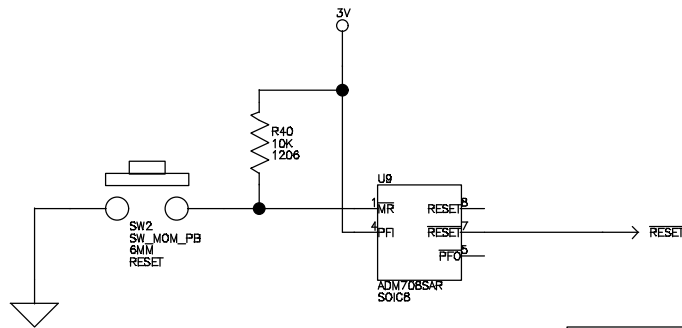
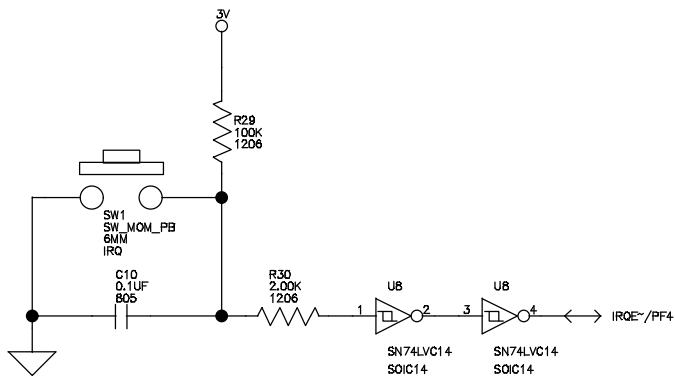
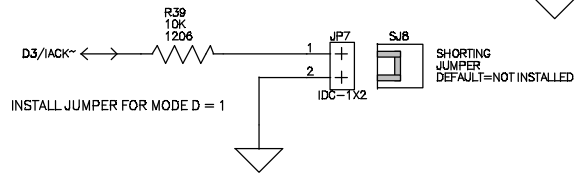
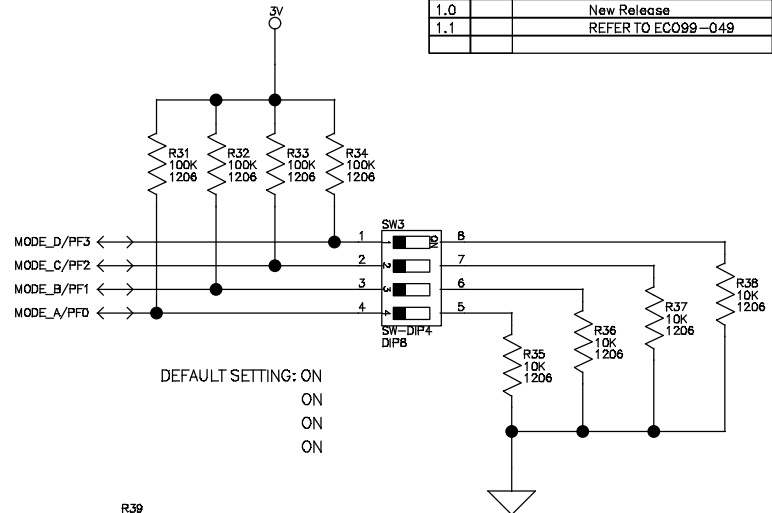
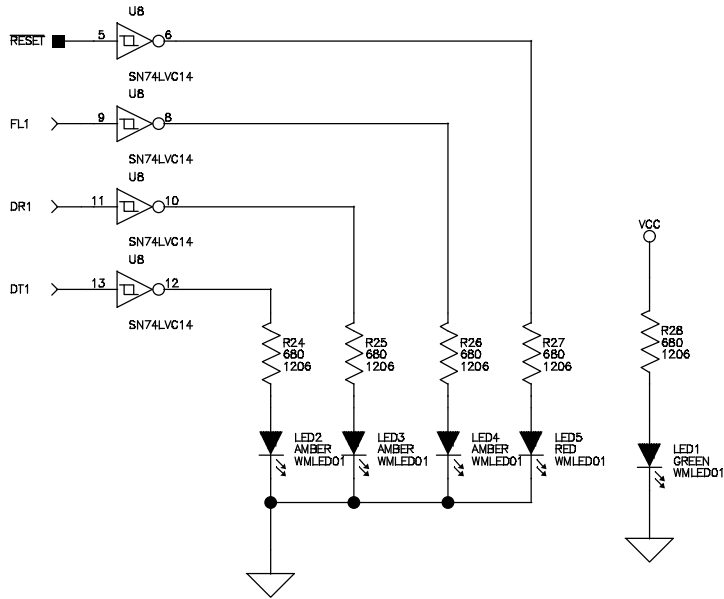
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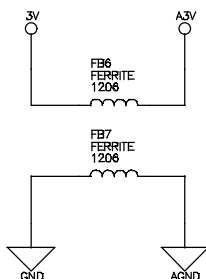
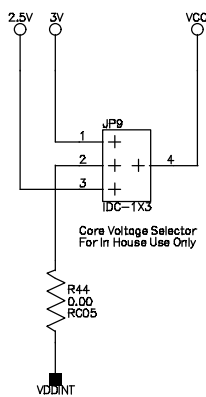
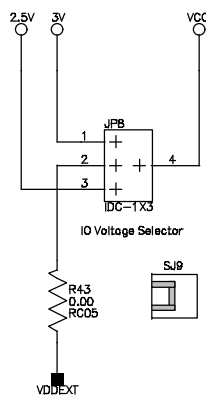
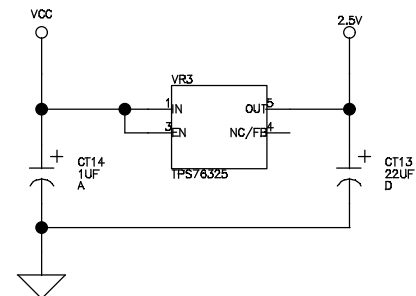
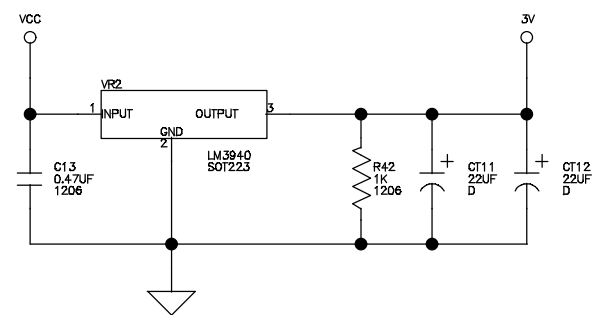
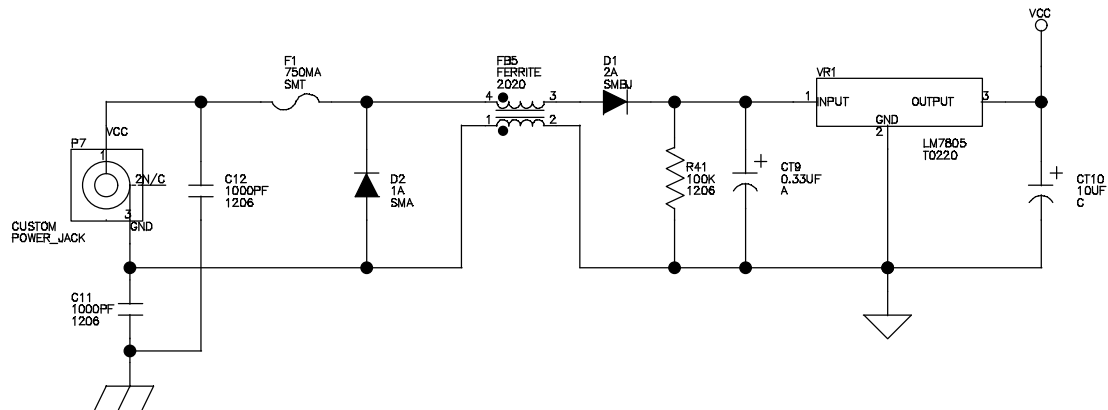
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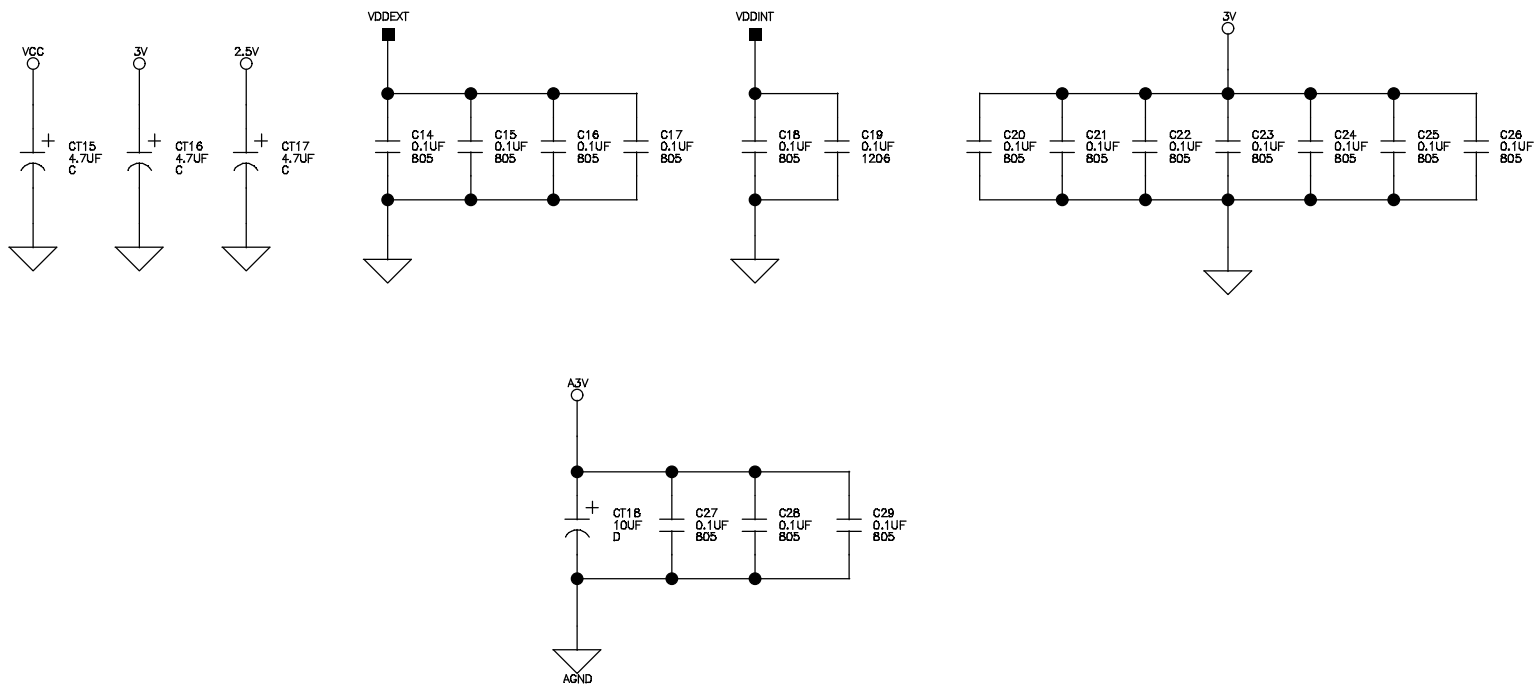
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