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Blackfin® A-V EZ-Extender® Manual

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Regulatory Compliance

The Blackfin A-V EZ-Extender is designed to be used solely in a laboratory environment. The board is not intended for use as a consumer end product or as a portion of a consumer end product. The board is an open system design which does not include a shielded enclosure and therefore may cause interference to other electrical devices in close proximity. This board should not be used in or near any medical equipment or RF devices.

The Blackfin A-V EZ-Extender has been certified to comply with the essential requirements of the European EMC directive 2004/108/EC and therefore carries the “CE” mark.

The Blackfin A-V EZ-Extender has been appended to Analog Devices, Inc. EMC Technical File (EMC TF) referenced **DSPTOOLS1**, issue 2 dated June 4, 2008 and was declared CE compliant by an appointed Notified Body (No.0673) as listed below.

Notified Body Statement of Compliance: Z600ANA1.023 dated December 2, 2004.

Issued by: Technology International (Europe) Limited
56 Shrivenham Hundred Business Park
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The Blackfin A-V EZ-Extender 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 extender boards in the protective shipping package.



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PREFACE

Thank you for purchasing the Blackfin[®] A-V EZ-Extender[®], Analog Devices, Inc. daughter board to the EZ-KIT Lite[®] evaluation system for the ADSP-BF533, ADSP-BF537, and ADSP-BF561 Blackfin processors.

Blackfin processors are embedded processors that support a Media Instruction Set Computing (MISC) architecture. This architecture is the natural merging of RISC, media functions, and digital signal processing characteristics towards delivering signal processing performance in a microprocessor-like environment.

EZ-KIT Lites and A-V EZ-Extenders are designed to be used in conjunction with the CrossCore[®] Embedded Studio (CCES) and VisualDSP++[®] software development environments. The development environment facilitates advanced application code development and debug, such as:

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

To learn more about Analog Devices development software, go to <http://www.analog.com/processors/tools>.

Product Overview

The Blackfin A-V EZ-Extender is a separately sold daughter board that plugs onto the expansion interface of the ADSP-BF533, ADSP-BF537, or ADSP-BF561 EZ-KIT Lite evaluation system. The extender board aids the design and prototyping phases of the ADSP-BF533, ADSP-BF537, or ADSP-BF561 processor targeted applications.

The board extends the evaluation system capabilities by providing a connection to a video decoder; video encoder; multiple camera evaluation boards; flat panel display; and 3-stereo input channel, 2-stereo output channel audio codec.

Please visit www.analog.com/EX1-AV for additional information, including CCES support.

The board features:

- Analog audio interface
 - AD1836A Analog Devices 96 kHz audio codec
 - Five 3.5 mm audio jacks, stacked in one connector
- Analog video interface
 - ADV7183B video decoder with three input RCA phono jacks
 - ADV7179 video encoder with three output RCA phono jacks
- OmniVision camera module interface
 - Connection to OmniVision camera evaluation modules; for example, OV6630AA (this part is no longer available)
 - 32-pin, right-angle, 0.1 in. spacing, female socket

- Micron camera module interface
 - Connection to Micron camera evaluation modules; for example, MT9V022 (this part is no longer available)
 - 26-pin, right-angle, 0.1 in. spacing, female socket
- Kodak camera module interface
 - Connection to Kodak camera evaluation modules; for example, KAC-9628 (this part is no longer available)
 - 28-pin, right-angle, 0.1 in. spacing, female socket
- Flat panel display interface (FPDI)
 - Connection to flat panel displays; for example, NL6448BC20-08E
 - DF9B-31S-1V connector

Before using any of the interfaces, follow the procedure in [“A-V EZ-Extender Interfaces”](#) on page 1-1.

Example programs are available to demonstrate the Blackfin A-V EZ-Extender capabilities.

Purpose of This Manual

The *Blackfin A-V EZ-Extender Manual* provides instructions for installing the product hardware (board). The text describes operation and configuration of the board components and provides guidelines for running your own code on the A-V EZ-Extender. Finally, a schematic and a bill of materials are provided for reference.

Intended Audience

The primary audience for this manual is a programmer who is familiar with Analog Devices processors. This manual assumes that the audience has a working knowledge of the appropriate processor architecture and instruction set.

Programmers who are unfamiliar with Analog Devices processors can use this manual but should supplement it with other texts that describe your target architecture. For the locations of these documents, see [“Related Documents”](#).

Programmers who are unfamiliar with CCES or VisualDSP++ should refer to the online help and user’s manuals.

Manual Contents

The manual consists of:

- Chapter 1, [“A-V EZ-Extender Interfaces”](#) on page 1-1
Provides basic board information.
- Chapter 2, [“A-V EZ-Extender Hardware Reference”](#) on page 2-1
Provides information on the hardware aspects of the board.
- Appendix A, [“A-V EZ-Extender Bill of Materials”](#) on page A-1
Provides a list of components used to manufacture the board.
- Appendix B, [“A-V EZ-Extender Schematic”](#) on page B-1
Provides the resources to allow EZ-KIT Lite board-level debugging or to use as a reference design. Appendix B is part of the online help.

What's New in This Manual

This is revision 2.1 of the *Blackfin A-V EZ-Extender Manual*. The manual has been updated to include CCES information. In addition, modifications and corrections based on errata reports against the previous manual revision have been made.

For the latest version of this manual, please refer to the Analog Devices Web site.

Technical Support

You can reach Analog Devices processors and DSP technical support in the following ways:

- Post your questions in the processors and DSP support community at EngineerZone[®]:

<http://ez.analog.com/community/dsp>

- Submit your questions to technical support directly at:

<http://www.analog.com/support>

- E-mail your questions about processors, DSPs, and tools development software from **CrossCore Embedded Studio** or **VisualDSP++**:

Choose **Help > Email Support**. This creates an e-mail to processor.tools.support@analog.com and automatically attaches your **CrossCore Embedded Studio** or **VisualDSP++** version information and `license.dat` file.

- E-mail your questions about processors and processor applications to:

processor.support@analog.com or

processor.china@analog.com (Greater China support)

Supported Processors

- In the **USA only**, call **1-800-ANALOGD** (1-800-262-5643)
- Contact your Analog Devices sales office or authorized distributor.
Locate one at:
www.analog.com/adi-sales
- Send questions by mail to:
Processors and DSP Technical Support
Analog Devices, Inc.
Three Technology Way
P.O. Box 9106
Norwood, MA 02062-9106
USA

Supported Processors

This extender board supports Analog Devices ADSP-BF533, ADSP-BF537, and ADSP-BF561 Blackfin embedded processors.

Product Information

Product information can be obtained from the Analog Devices Web site and the online help.

Analog Devices Web Site

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

To access a complete technical library for each processor family, go to http://www.analog.com/processors/technical_library. The manuals selection opens a list of current manuals related to the product as well as a

link to the previous revisions of the manuals. When locating your manual title, note a possible errata check mark next to the title that leads to the current correction report against the manual.

Also note, [MyAnalog](#) is a free feature of the Analog Devices Web site that allows customization of a Web page to display only the latest information about products you are interested in. You can choose to receive weekly e-mail notifications containing updates to the Web pages that meet your interests, including documentation errata against all manuals. [MyAnalog](#) provides access to books, application notes, data sheets, code examples, and more.

Visit [MyAnalog](#) to sign up. If you are a registered user, just log on. Your user name is your e-mail address.

EngineerZone

EngineerZone is a technical support forum from Analog Devices. It allows you direct access to ADI technical support engineers. You can search FAQs and technical information to get quick answers to your embedded processing and DSP design questions.

Use EngineerZone to connect with other DSP developers who face similar design challenges. You can also use this open forum to share knowledge and collaborate with the ADI support team and your peers. Visit <http://ez.analog.com> to sign up.

Related Documents

For additional information about the product, refer to the following publications.

Table 1. Related Processor Publications

Title	Description
<ul style="list-style-type: none">• <i>ADSP-BF531/ADSP-BF532/ADSP-BF533 Blackfin Embedded Processor Data Sheet</i>• <i>ADSP-BF534/ADSP-BF536/ADSP-BF537 Blackfin Embedded Processor Data Sheet</i>• <i>ADSP-BF561 Blackfin Embedded Symmetric Multiprocessor Data Sheet</i>	General functional description, pinout, and timing of the processor
<ul style="list-style-type: none">• <i>ADSP-BF533 Blackfin Processor Hardware Reference</i>• <i>ADSP-BF537 Blackfin Processor Hardware Reference</i>• <i>ADSP-BF561 Blackfin Processor Hardware Reference</i>	Description of the internal processor architecture and all register functions
<i>Blackfin Processor Programming Reference</i>	Description of all allowed processor assembly instructions

1 A-V EZ-EXTENDER INTERFACES

This chapter provides a setup procedure for the Blackfin A-V EZ-Extender and EZ-KIT Lite (ADSP-BF533, ADSP-BF537, or ADSP-BF561). The chapter also describes each evaluation interface the extender supports.

The information is presented in the following order.

- [“A-V EZ-Extender Setup” on page 1-2](#)
- [“Analog Audio Interface” on page 1-3](#)
- [“Analog Video Interface” on page 1-4](#)
- [“Camera Module Interfaces” on page 1-4](#)
- [“Flat Panel Display Interface” on page 1-6](#)
- [“Example Programs” on page 1-7](#)

A-V EZ-Extender Setup

It is very important to set up all components of the system containing the Blackfin A-V EZ-Extender, then apply power to the system.

Power your system after these steps are completed:

1. Read the applicable design interface section in this chapter—the text provides an overview of the interface capabilities.
2. Read [“System Architecture” on page 2-2](#) to understand the physical connections of the extender board. For more detailed information, refer to [“A-V EZ-Extender Schematic” on page B-1](#).
3. Set the jumpers on the extender board. Use the block diagram in [Figure 2-1 on page 2-3](#) in conjunction with [“Jumpers” on page 2-7](#).
4. Set the switches and jumpers on the EZ-KIT Lite board. If not already, familiarize yourself with the documentation and schematic drawing of the EZ-KIT Lite (see [“Related Documents”](#)). Compare the expansion interface signals of the extender with the EZ-KIT Lite signals to ensure there is no contention. For example, it may be necessary to disable other devices connected to the parallel peripheral interface (PPI) of the processor, change the routing of the PPI clocks, and disable the push buttons.
5. Configure any other interfacing boards; for example, another EZ-Extender or a camera evaluation board.

Analog Audio Interface

The Blackfin A-V EZ-Extender supports audio applications with the on-board AD1836A multichannel 96 kHz audio codec. The AD1836A codec is a high-performance single-chip device that provides three stereo digital-to-analog converters (outputs) and two stereo analog-to-digital converters (inputs), using Analog Devices patented multibit sigma-delta architecture. The board includes a serial peripheral interface (SPI) port, enabling the processor to adjust volume and other parameters. For a general overview of the audio interface connections, see [Figure 2-1 on page 2-3](#); for details, see [“A-V EZ-Extender Schematic” on page B-1](#).

SPORT0 of the expansion interface connects to the serial port of the AD1836A codec. The processor is capable of transferring data to the audio codec in time-division multiplexed (TDM) mode or I²S mode. In I²S mode, the codec can operate at a 96 kHz sample rate and allows two channels of output. In TDM mode, the codec can operate at a maximum of 48 kHz sample rate and allows simultaneous use of all input and output channels. To operate in I²S mode, install the JP7.1/2 jumper. For more information, see [“I2S Enable Jumper \(JP7.1/2\)” on page 2-13](#).

Internal registers of the AD1836A audio codec can be programmed via the SPI port of the processor. (For information on how to program the configuration registers, refer to the AD1836A data sheet.) The AD1836A codec reset comes from a flag pin located at PPI1_D11 of the expansion interface or from the reset signal on the EZ-KIT Lite. For information on how to configure the reset, see [“AV_RESET Source Jumper \(JP9.1/3/5\)” on page 2-14](#).

Before using the interface, follow the procedure in [“A-V EZ-Extender Setup” on page 1-2](#).

For more information about the codec, go to www.analog.com/AD1836A.

Analog Video Interface

The Blackfin A-V EZ-Extender supports video input and output applications with an on-board video encoder and decoder. The ADV7179 video encoder provides up to three output channels of analog video, while the ADV7183B video decoder provides up to three input channels of analog video. Both the encoder and decoder connect to PPI0 of the expansion interface, while the encoder also can connect to PPI1 (if the processor has two PPI ports). For a general overview of the analog video interface connectors, see [Figure 2-1 on page 2-3](#); for details, see “[AV_RESET Source Jumper \(JP9.1/3/5\)](#)” on page 2-14.

To use ADV7179 and ADV7183B, set up all of the jumpers related to the PPI data signals, frame sync signals, and clock signal. To program the internal register of video devices, configure the 2-wire interface signals (see “[TWI Source Selection Jumpers \(JP3.3/5/7, JP3.4/6/8\)](#)” on page 2-8). Finally, determine the source of encoder or decoder reset, as described in “[AV_RESET Source Jumper \(JP9.1/3/5\)](#)” on page 2-14.

Before using the interface, follow the procedure in “[A-V EZ-Extender Setup](#)” on page 1-2.

For more information about ADV7179 and ADV7183B, go to www.analog.com/ADV7179 and www.analog.com/ADV7183B.

Camera Module Interfaces

The Blackfin A-V EZ-Extender has three right-angle connectors (J4, J6, and P4) with control signals necessary to interface with three camera evaluation modules from different manufactures. For a general overview of the camera interface connections, see [Figure 2-1 on page 2-3](#); for details, see “[A-V EZ-Extender Schematic](#)” on page B-1. [Figure 1-1](#) shows the orientation of the camera modules as each camera connects to the board.

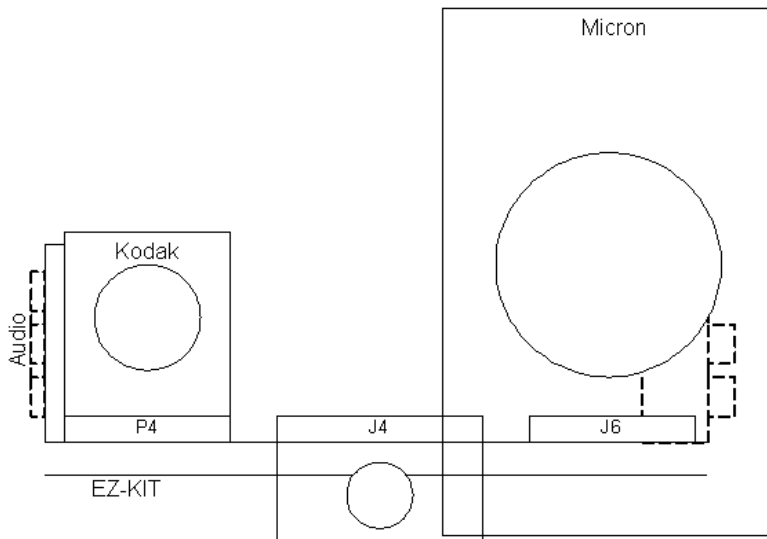


Figure 1-1. Camera Orientation

J6 is a connector designated for a Micron camera sensor evaluation module. The interface has been tested with the Micron MT9V022 camera. For information about Micron camera sensors and evaluation boards, go to <http://www.micron.com>.

J4 is a connector designated for an OmniVision camera sensor evaluation module. The interface has been tested with the OmniVision OV6630AA camera. For information about OmniVision camera sensors and evaluation boards, go to <http://www.ovt.com>.

P4 is a connector designated for a Kodak camera sensor evaluation module. The interface has been tested with the Kodak KAC-9628 camera. For information about Kodak camera sensors and evaluation boards, go to <http://www.kodak.com>.

To connect the Blackfin A-V EZ-Extender to a camera module, first determine the source of the PPI clock. To learn about possible clock settings, refer to “PPI Clock Setup Jumpers (JP4.1/2, JP4.3/4, JP4.5/6,

Flat Panel Display Interface


JP4.7/8)” on page 2-11. Then set the direction of the data and frame sync signals, which depend on the camera’s configuration. The data must be set as input to the PPI port; refer to “System Architecture” on page 2-2 and “Jumpers” on page 2-7 for details.

Before using the camera interfaces, follow the procedure in “A-V EZ-Extender Setup” on page 1-2.

Flat Panel Display Interface

The flat panel display interface (FPDI) consists of a 31-pin DB9 connector linked to the PPI port and frame sync signals of the processor. For a general overview of the display interface connections, see [Figure 2-1 on page 2-3](#); for details, see the “A-V EZ-Extender Schematic” on page B-1.

A timing and functional analysis is required to determine whether a specific LCD module can connect to the Blackfin A-V EZ-Extender. An example of display that can connect to the extender is the NEC NL6448BC20-08 display.

 The power for the backlight feature of the LCD module must be provided by the customer (use the backlight inverter recommended by the manufacturer). In addition, it is necessary to purchase a cable to connect the Blackfin A-V EZ-Extender to the display; for example, FDC31/xxxxAFF03 from Axon Cable (www.axon-cable.com, part number FDC31/xxxxAFF03). Different length cables are available.

Before using the interface, follow the procedure in “A-V EZ-Extender Setup” on page 1-2.

Example Programs

Example programs are provided with the A-V EZ-Extender EZ-KIT Lite to demonstrate various capabilities of the product. The programs are included in the product installation kit and can be found in the `Examples` folder of the installation. Refer to a readme file provided with each example for more information.

CCES users are encouraged to use the example browser to find examples included with the EZ-KIT Lite Board Support Package.

Example Programs

2 A-V EZ-EXTENDER HARDWARE REFERENCE

This chapter describes the hardware design of the Blackfin A-V EZ-Extender.

The following topics are covered.

- [“System Architecture” on page 2-2](#)
Describes the extender board configuration and explains how the board components interface with the processor and EZ-KIT Lite.
- [“Jumpers” on page 2-7](#)
Describes the configuration jumpers.