Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of "Quality Parts,Customers Priority,Honest Operation,and Considerate Service",our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

Contact us

WVGA/LCD EI3 Extender Board Manual

an EZ-Extender® product

Revision 1.0, April 2012

Part Number
82-000254-01

**ANALOG
DEVICES**

Regulatory Compliance

The WVGA/LCD EI3 Extender Board 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 WVGA/LCD EI3 Extender Board is in the process of being 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.

$$\mathcal{C}\,\mathcal{E}$$

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

CONTENTS

PREFACE

USING WVGA/LCD EI3 EXTENDER BOARD

Contents

WVGA/LCD EI3 EXTENDER BOARD HARDWARE REFERENCE

WVGA/LCD EI3 EXTENDER BOARD BILL OF MATERIALS

WVGA/LCD EI3 EXTENDER BOARD SCHEMATIC

INDEX

PREFACE

Thank you for purchasing the WVGA/LCD EI3 Extender Board, an EZ-Extender® for EZ-KIT Lite®/EZ-Board® evaluation systems with the Expansion Interface III (EI3).

The EZ-KIT Lite/EZ-Board and WVGA/LCD EI3 Extender Board are designed to be used in conjunction with the CrossCore® Embedded Studio (CCES) development environment.

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

Product Overview

The WVGA/LCD EI3 Extender Board is a separately sold daughter board that plugs onto the IE3 of an EZ-KIT Lite/EZ-Board evaluation system. The extender board aids the design and prototyping phases of embedded processor-targeted applications.

The board extends the capabilities of the evaluation system by providing a connection between the parallel peripheral interface (PPI) of the processor and on-board 4.1 inch liquid crystal display (LCD). The serial peripheral interface (SPI) and two-wire interface (TWI) of the processor are used to communicate with the LCD, AD7879 touch screen controller, AD7147 capacitive touch controller, and ADXL345 digital accelerometer on the extender.

The product features:

- LCD with touch screen

    - NEC NL8048HL11-01B 4.1 inch WVGA LCD with resistive touch

    - 800 (horizontal) x 480 (vertical) landscape

    - LCD backlight

- LCD touch screen controller

    - Analog Devices AD7879 touch screen controller

- Capacitive touch controller

    - Analog Devices AD7147 capacitive touch controller

    - Four push buttons and one scroll wheel

- Digital accelerometer

    - Analog Devices ADXL345 3-axis digital accelerometer

- Software-controlled switches for board configuration

- Expansion Interface III

- No power supply required: derives power from the EZ-KIT Lite/EZ-Board

- CE certified

Purpose of This Manual

The *WVGA/LCD EI3 Extender Board Manual* provides instructions for installing the product hardware (board). The text describes operation and configuration of the board components and provides guidelines for run-

ning your own code on the WVGA/LCD EI3 Extender Board. 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, instruction set, and C/C++ programming languages.

Programmers who are unfamiliar with Analog Devices processors can use this manual, but should supplement it with other texts that describe your target architecture and hardware development tools.

Programmers who are unfamiliar with the CrossCore Embedded Studio programming environment or the mating evaluation board, should refer to the CCES online help or the manual describing the board (see "Related Documents").

Manual Contents

The manual consists of:

- Chapter 1, "Using WVGA/LCD EI3 Extender Board" on page 1-1
  Provides basic product information.

- Chapter 2, "WVGA/LCD EI3 Extender Board Hardware Reference" on page 2-1.
  Provides information about the product's hardware components.

- Appendix A, "WVGA/LCD EI3 Extender Board Bill Of Materials" on page A-1
  Provides a list of hardware components used to manufacture the board.

- Appendix B, "WVGA/LCD EI3 Extender Board Schematic" on page B-1
  Provides all of the circuits on the extender board.

What's New in This Manual

This is the first revision of the *WVGA/LCD EI3 Extender Board Manual*.

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)

- 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 EZ-KIT Lite/EZ-Board evaluation systems with IE3.

Product Information

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

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.com 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.com provides access to books, application notes, data sheets, code examples, and more.

Visit MyAnalog.com 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
Processor Data Sheet	General functional description, pinout, and timing of the processor.
Processor Hardware Reference	Description of the internal processor architecture and all register functions.
Blackfin Processor Programming Reference	Description of all allowed processor assembly instructions.

Table 2. Related CCES Publications

Title	Description
ADSP-BF609 EZ-KIT Lite Evaluation System Manual	Description of the boards' interfaces and hardware components.
CrossCore Embedded Studio Licensing Guide	Description of the product's licensing options, installation, and activation.
CrossCore Embedded Studio Assembler and Pre-processor Manual	Description of the assembler functions and commands.
CrossCore Embedded Studio C/C++ Complier and Library Manual for Blackfin Processors	Description of the complier functions and commands for Blackfin processors.
CrossCore Embedded Studio Linker and Utilities Manual	Description of the linker functions and commands.
CrossCore Embedded Studio Loader and Utilities Manual	Description of the loader/splitter functions and commands.

Related Documents

1 USING WVGA/LCD EI3 EXTENDER BOARD

This chapter provides the setup procedure for the WVGA/LCD EI3 Extender Board and evaluation board and describes the interfaces the extender supports.

The information is presented in the following order.

- "Package Contents" on page 1-2
- "Supported Operating Systems" on page 1-2
- "System Requirements" on page 1-3
- "Extender Board Installation" on page 1-3
- "LCD" on page 1-4
- "LCD Touch Controller (AD7879)" on page 1-5
- "Capacitive Touch Controller (AD7147)" on page 1-5
- "Digital Accelerometer (ADXL345)" on page 1-6
- "Expansion Interface III" on page 1-7
- "Example Programs" on page 1-7
- "Board Design Database" on page 1-8

For information about the CCES integrated development environment (IDE), refer to the online help.

Package Contents

Your WVGA/LCD EI3 Extender Board package contains the following items.

- WVGA/LCD EI3 extender board

- A bag containing hardware for securing the extender board onto the EZ-KIT Lite/EZ-Board

- Release notes containing information about the product download

Contact the vendor where you purchased your extender board or contact Analog Devices, Inc. if any item is missing.

Supported Operating Systems

CCES is supported on the following operating systems:

- Windows® XP Professional SP3 (32-bit only)

- Windows Vista™ Business, Enterprise, or Ultimate SP2 (32-bit only)

- Windows 7 Professional, Enterprise, or Ultimate (32- and 64-bit)

Windows Vista and Windows 7 users may experience User Access Control (UAC) related errors if the software is installed into a protected location, such as `Program Files` or `Program Files (x86)`. We recommend installing the software in a non-UAC-protected location.

System Requirements

Verify that your PC has these minimum requirements for the CCES installation:

- 2 GHz single-core processor

- 1 GB RAM

- 8 GB available disk space

- One open USB port

A faster disk drive decreases the build time, especially for a large amount of source files.

Extender Board Installation

Follow these instructions to ensure correct operation of the product hardware and software.

1. Attach the extender board to the EZ-KIT Lite/EZ-Board.

   The J1 connector on the extender board can be connected to the P1A, P2A, or P3A connector on the EZ-KIT Lite/EZ-Board. Refer to the example program for a reference to the proper connector.

2. Use the provided hardware to secure the extender to the EZ-KIT Lite/EZ-Board.

   Insert the screws through the top of the board and screw into the

standoff on the bottom side of the board. Insert the plastic spacers between the bottom side of the EZ-KIT Lite/EZ-Board and to the top side of the extender.

3. Connect the EZ-KIT Lite/EZ-Board to a personal computer (PC) running CCES with the product BSP. Refer to the EZ-KIT Lite/EZ-Board manual for instructions.

LCD

The WVGA/LCD EI3 Extender Board is shipped with a NEC 4.1 inch WVGA (800 x 480) liquid crystal display (LCD) with backlight. All of the LCD data, touch screen pins, and power pins connect to the display via a single connector (P5). The 24-bit display connects to the processer via the processor's parallel peripheral interface (PPI).

The extender can be configured for 16-bit mode (RGB 565), 18-bit mode (RGB 666), or 24-bit mode (RGB 888) operation. The configuration is performed via a software switch (see "LCD Mode Select" on page 2-13) and "WVGA/LCD EI3 Extender Board Schematic" on page B-1).

The display also uses the serial peripheral interface (SPI) of the processor for register configurations.

The clock signal used for the LCD can be connected to the on-board oscillator or generated from the processor (see "PPICLK_DIR Select" on page 2-13 for more information).

The LCD backlight circuit is controlled via a GPIO signal on the AD7879 touch screen controller.

For more information about the LCD, go to the NEC Web site.

An example program demonstrating capabilities of the LCD is available by installing the WVGA/LCD EI3 Extender Board BSP.

LCD Touch Controller (AD7879)

The WVGA/LCD EI3 Extender Board is equipped with an Analog Devices resistive touch controller (AD7879). The AD7879 controller is connected to the LCD touch screen via four pins (X+, X-, Y+, Y-). You can access the controller via the SPI of the processor. The controller generates an interrupt request for the processor whenever the user touches the LCD. The processor uses the SPI to read the appropriate registers on the controller.

An interrupt signal from the AD7879 controller is connected to a GPIO signal of the processor. The GPIO signal is configured via a software switch. The SPI is used for communications between the controller and processor; the SPI signals are configured via software as well. Refer to "AD7879 PENIRQ Signal" and "AD7879 SPI Chip Select" on page 2-14 for details.

For more information about the AD7879 touch controller, go to `www.analog.com` and search for `AD7879`.

An example program demonstrating capabilities of the touch controller is available by installing the product BSP.

Capacitive Touch Controller (AD7147)

The WVGA/LCD EI3 Extender Board is equipped with an Analog Devices CapTouch® programmable controller (AD7147) for applications implementing push buttons and scroll wheels. The four push button sensors and one scroll wheel are located on the top side of the extender's printed circuit board (PCB).

The AD7147 controller generates an interrupt request for the processor whenever a user touches the push button or the scroll wheel. The two-wire interface (TWI) is used for communications between the controller and

processor. The push buttons and scroll wheel are copper pads on the PCB. Touch the respective button or traverse around the wheel with a finger to enable sensor pads and generate an interrupt request. An interrupt signal from the controller is connected to a GPIO signal on the processor. The GPIO signal is configured via a software switch. Refer to "AD7147 Interrupt Signal" for more information.

For more information about the AD7147 capacitive touch controller, go to `www.analog.com` and search for `AD7147`.

An example program demonstrating capabilities of the touch controller is available by installing the product BSP.

Digital Accelerometer (ADXL345)

The WVGA/LCD EI3 Extender Board is equipped with an Analog Devices 3-axis accelerometer (ADXL345) with high‑resolution (13-bit) measurement at up to +/- 16g. Digital output data is formatted as 16-bit twos complement and accessible through SPI or TWI.

Two interrupt signals from the ADXL345 accelerometer are connected to two GPIO signal of the processor. The GPIO signals are configured via a software switch (see "ADXL345 Interrupt Signals"). The SPI port or the TWI port is used for communications between the controller and processor; see "ADXL345 TWI/SPI Mode Select" for more information. The SPI signals are configured via software as described in "ADXL345 SPI Chip Select". Refer to "WVGA/LCD EI3 Extender Board Schematic" on page B-1 for more information.

For more information about the ADXL345 accelerometer, go to `www.analog.com` and search for `ADXl345`.

An example program demonstrating capabilities of the accelerometer is available by installing the product BSP.

Expansion Interface III

The Expansion Interface III (EI3) allows an extender board to be used across various hardware platforms that have the same expansion interface connectors.

The EI3 implemented on the WVGA/LCD EI3 Extender Board contains the PPI, SPI, TWI and GPIO ports. These signals are used for the peripherals on the extender. Signals that are not used on the extender are passed through to two connectors on the bottom side of the board (`P1` and `P2`) and can be used for stacking another EI3 extender board. The connectors contain a majority of the processor's signals. For pinout information, go to "WVGA/LCD EI3 Extender Board Schematic" on page B-1. The mechanical dimensions of the expansion connectors can be obtained by contacting "Technical Support".

For more information about extender boards, visit the Analog Devices Web site (`www.analog.com`).

Limits to current and interface speed must be taken into consideration when using the EI3. Current for the EI3 can be sourced from the EZ-KIT Lite/EZ-Board; therefore, the current should be limited to 200 mA for 5V and 300 mA for the 3.3V planes. If more current is required, then a separate power connector and a regulator must be designed on the daughter card. Additional circuitry can add extra loading to signals, decreasing their maximum effective speed.

(i) Analog Devices does not support and is not responsible for the effects of additional circuitry.

Example Programs

Example programs are included with the WVGA/LCD EI3 Extender Board BSP. Example programs demonstrate various capabilities of the product. The support package is installed on top of CrossCore Embedded

Studio. Once installed, the example programs can be found in the `<install_path>\WVGA_LCD_EI3_Extender_Board-RelX.X.X\WVGA_LCD_EI3` directory where *X.X.X* denotes the support package release number.

Board Design Database

A `.zip` file containing all of the electronic information required for the design, layout, fabrication and assembly of the product is available for download from the Analog Devices board design database at: `http://www.analog.com/en/processors-dsp/blackfin/proces-sors/board-design-database/resources/index.html`.

2 WVGA/LCD EI3 EXTENDER BOARD HARDWARE REFERENCE

This chapter describes the hardware design of the WVGA/LCD EI3 Extender Board.

The following topics are covered.

- "System Architecture" on page 2-2
  Describes the board's configuration and explains how the board components interface with the processor.

- "Software-Controlled Switches (SoftConfig)" on page 2-3
  List and describe signals routed through the software-controlled switches.

- "Connectors" on page 2-16
  Describes the on-board connectors.

- "Power LED (LED1)" on page 2-18
  Describes the on-board LED.