Blackfin® Landscape LCD EZ-Extender® Manual

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ANALOG DEVICES

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The Blackfin Landscape LCD 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 Landscape LCD EZ-Extender is currently being processed for certification that it complies with the essential requirements of the European EMC directive 89/336/EEC amended by 93/68/EEC and therefore carries the “CE” mark.

CE

The Blackfin Landscape LCD EZ-Extender 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 Blackfin Landscape LCD EZ-Extender boards in the protective shipping package.

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PREFACE

Thank you for purchasing the Blackfin® Landscape LCD EZ-Extender®, Analog Devices, Inc. extender board to the EZ-KIT Lite®/EZ-Board™ evaluation system for the ADSP-BF526, ADSP-BF537, ADSP-BF538, and ADSP-BF548 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.

The EZ-KIT Lite/EZ-Board and Landscape LCD EZ-Extender are designed to be used in conjunction with the VisualDSP++® development environment. VisualDSP++ offers a powerful programming tool with new flexibility that significantly decreases the time required to port software code to a processor, reducing time-to-market.

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

Product Overview

The Blackfin Landscape LCD EZ-Extender is a separately sold daughter board that plugs onto the expansion interface II of the ADSP-BF526 EZ-Board. The extender also plugs into the parallel peripheral interface (PPI) connector of the ADSP-BF537, ADSP-BF538, or ADSP-BF548 EZ-KIT Lite evaluation system. The extender board aids the design and prototyping phases of the ADSP-BF526, ADSP-BF537, ADSP-BF538, or ADSP-BF548 processor targeted applications.

The board extends the capabilities of the evaluation system by providing a connection between the PPI of the Blackfin processor and the on-board 3.5 in. LCD display. The serial peripheral interconnect (SPI) port and TWI interface of the Blackfin processor are used to communicate to the LCD display, AD7879 touch screen controller, AD7147 capacitive touch controller, and the 2 KB serial ROM of the extender.

The following is a list of the Blackfin Landscape LCD EZ-Extender interfaces.

- LCD display with touch capabilities:
  - Sharp LQ035Q1DH02 3.5 in. LCD with resistive touch
  - 320 (horizontal) x 240 (vertical) landscape
  - 1.8V to 3.6V I/O operation
  - LCD backlight
- LCD touch controller:
  - Analog Devices AD7879 touchscreen controller
  - 1.8V to 3.3V I/O operation

- Capacitive touch controller:
  - Analog Devices AD7147 capacitive touch controller
  - Four push buttons and one scroll wheel
  - 1.8V to 3.3V I/O operation
- No power supply required: derives power from the EZ-KIT Lite/EZ-Board
- CE certified
- Dimensions: 3.75 in. (height) x 3.5 in. (width)
- Before using any of the interfaces, follow the setup procedure in "Landscape LCD EZ-Extender Setup" on page 1-2.

Product capabilities are demonstrated in Example Programs installed with VisualDSP++.

Purpose of This Manual

The *Blackfin Landscape LCD EZ-Extender Manual* describes operation and configuration of the extender board's components. A schematic and a bill of materials are provided as a reference for future Blackfin processor board designs.

Intended Audience

The primary audience for this manual is a programmer who is familiar with Analog Devices processors. The manual assumes 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, such as hardware reference and programming reference manuals, that describe their target architecture.

Programmers who are unfamiliar with the VisualDSP++, EZ-Board or EZ-KIT Lite evaluation software should refer to the *ADSP-BF526*, *ADSP-BF537*, *ADSP-BF38F*, or *ADSP-BF548 Evaluation System Manual*, VisualDSP++ online Help, and user's or getting started guides. For locations of these documents, refer to "Product Information".

Manual Contents

The manual consists of:

- Chapter 1, "Landscape LCD EZ-Extender Interfaces" on page 1-1, provides basic board information.
- Chapter 2, "Landscape LCD EZ-Extender Hardware Reference" on page 2-1, provides information on the hardware aspects of the board.
- Appendix A, "Landscape LCD EZ-Extender Bill Of Materials" on page A-1, provides a list of components used to manufacture the EZ-Extender board.
- Appendix B, "Landscape LCD EZ-Extender Schematic" on page B-1, provides the resources to allow EZ-Board or 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 the first edition of the *Blackfin Landscape LCD EZ-Extender Manual*.

Technical or Customer Support

You can reach Analog Devices, Inc. Customer Support in the following ways:

- Visit the Embedded Processing and DSP products Web site at
  `http://www.analog.com/processors/technical_support`
- E-mail tools questions to
  `processor.tools.support@analog.com`
- E-mail processor questions to
  `processor.support@analog.com (World wide support)`
  `processor.europe@analog.com (Europe support)`
  `processor.china@analog.com (China support)`
- Phone questions to 1-800-ANALOGD
- Contact your Analog Devices, Inc. local sales office or authorized distributor
- Send questions by mail to:

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Supported Products

The Blackfin Landscape LCD EZ-Extender is a daughter board for the ADSP-BF526, ADSP-BF537, ADSP-BF538, and ADSP-BF548 processor evaluation systems.

Product Information

Product information can be obtained from the Analog Devices Web site, VisualDSP++ online Help system, and a technical library CD.

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.

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VisualDSP++ Online Documentation

Online documentation comprises the VisualDSP++ Help system, software tools manuals, hardware tools manuals, processor manuals, Dinkum Abridged C++ library, and FLEXnet License Tools software documentation. You can search easily across the entire VisualDSP++ documentation set for any topic of interest.

For easy printing, supplementary Portable Documentation Format (`.pdf`) files for all manuals are provided on the VisualDSP++ installation CD.

Each documentation file type is described as follows.

File	Description
`.chm`	Help system files and manuals in Microsoft help format
`.htm` or `.html`	Dinkum Abridged C++ library and FLEXnet License Tools software documentation. Viewing and printing the `.html` files requires a browser, such as Internet Explorer 6.0 (or higher).
`.pdf`	VisualDSP++ and processor manuals in PDF format. Viewing and printing the `.pdf` files requires a PDF reader, such as Adobe Acrobat Reader (4.0 or higher).

Technical Library CD

The technical library CD contains seminar materials, product highlights, a selection guide, and documentation files of processor manuals, VisualDSP++ software manuals, and hardware tools manuals for the following processor families: Blackfin, SHARC, TigerSHARC, ADSP-218x, and ADSP-219x.

To order the technical library CD, go to `http://www.analog.com/processors/technical_library`, navigate to the manuals page for your processor, click the request CD check mark, and fill out the order form.

Data sheets, which can be downloaded from the Analog Devices Web site, change rapidly, and therefore are not included on the technical library CD. Technical manuals change periodically. Check the Web site for the latest manual revisions and associated documentation errata.

Related Publications

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

Table 1. Related Processor Publications

Title	Description
Title	Description
• *ADSP-BF526 Blackfin Embedded Processor Data Sheet* • *ADSP-ADSP-BF537 Embedded Processor Datasheet* • *ADSP-BF538/ADSP-BF538F Blackfin Embedded Processor Data Sheet* • *ADSP-BF548 Blackfin Embedded Processor Data Sheet*	General functional description, pinout, and timing
• *ADSP-BF52x Blackfin Processor Hardware Reference* • *ADSP-BF537 Blackfin Processor Hardware Reference* • *ADSP-BF538/ADSP-BF538F Blackfin Processor Hardware Reference* • *ADSP-BF54x Blackfin Processor Hardware Reference*	Description of internal processor architecture and all register functions

Table 2. Related VisualDSP++ Publications

Title	Description
• *ADSP-BF526 EZ-Board Lite Evaluation System Manual* • *ADSP-BF537 EZ-KIT Lite Evaluation System Manual* • *ADSP-BF538F EZ-KIT Lite Evaluation System Manual* • *ADSP-BF548 EZ-KIT Lite Evaluation System Manual*	Description of the EZ-KIT Lite features and usage. Note: For the ADSP-BF537 EZ-KIT Lite, there is additional *Getting Started with ADSP-BF537 EZ-KIT Lite*.
VisualDSP++ User's Guide	Description of the VisualDSP++ features and usage
VisualDSP++ Assembler and Preprocessor Manual	Description of the assembler function and commands
VisualDSP++ C/C++ Complier and Library Manual for Blackfin Processors	Description of the complier function and commands for Blackfin processors
VisualDSP++ Linker and Utilities Manual	Description of the linker function and commands
VisualDSP++ Loader and Utilities Manual	Description of the loader function and commands

Notation Conventions

Text conventions used in this manual are identified and described as follows.

Example	Description
Close command (File menu)	Titles in reference sections indicate the location of an item within the VisualDSP++ environment's menu system (for example, the Close command appears on the File menu).
`{this | that}`	Alternative required items in syntax descriptions appear within curly brackets and separated by vertical bars; read the example as `this` or `that`. One or the other is required.

Example	Description
`[this | that]`	Optional items in syntax descriptions appear within brackets and separated by vertical bars; read the example as an optional `this` or `that`.
`[this,…]`	Optional item lists in syntax descriptions appear within brackets delimited by commas and terminated with an ellipse; read the example as an optional comma-separated list of `this`.
`.SECTION`	Commands, directives, keywords, and feature names are in text with `letter gothic` font.
`filename`	Non-keyword placeholders appear in text with italic style format.
	Note: For correct operation, ... A Note provides supplementary information on a related topic. In the online version of this book, the word Note appears instead of this symbol.
	Caution: Incorrect device operation may result if ... Caution: Device damage may result if ... A Caution identifies conditions or inappropriate usage of the product that could lead to undesirable results or product damage. In the online version of this book, the word Caution appears instead of this symbol.
	Warning: Injury to device users may result if ... A Warning identifies conditions or inappropriate usage of the product that could lead to conditions that are potentially hazardous for the devices users. In the online version of this book, the word Warning appears instead of this symbol.

1 LANDSCAPE LCD EZ-EXTENDER INTERFACES

This chapter provides the setup procedure for the Blackfin Landscape LCD EZ-Extender and EZ-KIT Lite/EZ-Board (ADSP-BF526, ADSP-BF537, ADSP-BF538, or ADSP-BF548) and describes all interfaces the extender supports.

The information is presented in the following order.

- "Landscape LCD EZ-Extender Setup" on page 1-2
- "LCD Display" on page 1-3
- "LCD Touch Controller (AD7879)" on page 1-4
- "Capacitive Touch Controller (AD7147)" on page 1-4
- "Serial ROM" on page 1-5
- "Example Programs" on page 1-6

Landscape LCD EZ-Extender Setup

It is very important to set up all components of the system containing the Blackfin Landscape LCD EZ-Extender, then apply power to the system. The following procedure is recommended for the correct setup.

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 detailed information, refer to "Landscape LCD 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 2-2 in conjunction with "Jumper Settings" on page 2-3.
4. Set the switches and jumpers on the EZ-KIT Lite/EZ-Board. If not already, familiarize yourself with the board documentation and schematic drawings (see "Product Information").

   Compare the parallel peripheral interface (PPI) or expansion interface II connector signals of the extender board with the EZ-KIT Lite/EZ-Board signals to ensure there is no contention. For example, it may be necessary to disable other devices connected to the PPI or expansion II connector of the processor or disable the push buttons on the EZ-KIT Lite/EZ-Board.
5. Install the extender on the EZ-KIT Lite/EZ-Board via the PPI or expansion II connector.
6. Configure any other interfacing boards; for example, another EZ-Extender board.
7. Power your system.

LCD Display

The Blackfin Landscape LCD EZ-Extender is shipped with a 3.5 in. landscape, QVGA (320 x RGB x 240) display with an LCD backlight. All LCD data, touchscreen pins, and power pins connect to the display via a single connector (P1). The 18-bit display operates in 16-bit mode (RGB 5-6-5) and connects to the PPI [15–0] data pins of the processor. The display also uses the serial peripheral interconnect (SPI) port of the processor for control register setup. The LCD display can operate at a VDDIO of 1.6V to 3.6V. This allows you to connect the LCD display to the PPI/SPI interface of the processor gluelessly, without the need for voltage translation circuitry— a great benefit for power-sensitive applications.

The PPI clock of a Blackfin processor and the clock required by the LCD display are driven by the on-board 5 MHz oscillator. By default, the oscillator is enabled and drives the PPI interface. You can use the clock generated by the processor or can disable the 5 MHz oscillator by setting the appropriate jumpers on the extender. See “Jumper Settings” on page 2-3 for more information.

At power-up, the LCD backlight circuit is disabled. By default, the shut pin of the LCD display turns the display OFF. Write to the respective control registers to enable the backlight and take the display out of the shut mode. These settings provide significant power savings and are suited for power-sensitive applications.

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

An example program demonstrating capabilities of the LCD display is available in VisualDSP++; see “Example Programs” on page 1-6.

LCD Touch Controller (AD7879)

The Blackfin Landscape LCD EZ-Extender is shipped with a low-cost resistive touch controller (Analog Devices AD7879). The four pins generated by activating the LCD display (X+, X-, Y+, Y-) connect to a single connector (P1), controlled via the LCD display. You can access the controller via the SPI interface of the Blackfin processor. The controller generates an interrupt request for the processor whenever any new data is available or when a user touches the LCD Display. The processor uses the SPI interface to read the appropriate registers of the AD7879 controller. The IRQ line connects the AD7879 controller to the processor via the processor's general-purpose I/O (GPIO) pin. By default, the AD7879 controller uses the SPI select 1 and GPIO1 pins. "Jumper Settings" on page 2-3 describe how the GPIO and SPI selects can be varied for different EZ-KIT Lites and EZ-Boards.

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 in VisualDSP++; see "Example Programs" on page 1-6.

Capacitive Touch Controller (AD7147)

The Landscape LCD EZ-Extender is equipped with a CapTouch™ programmable controller (Analog Devices 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).

When the respective sensor is activated, the captouch controller recognizes and communicates the change to the Blackfin processor via the processor's 2-wire interface (TWI). The AD7147 controller generates an interrupt request for the Blackfin processor whenever any new data is available or

when a user touches the push buttons (PB1–4) or scroll wheel. The push buttons and scroll wheel are copper pads created inside the PCB. Touch the respective push button or traverse around the scroll wheel with a finger to enable the sensor pads and to generate the interrupt request. The IRQ line connects the AD7147 controller to the processor via its GPIO pin. By default, the AD7147 controller uses the SPI select 2 and GPIO2 pins. "Jumper Settings" on page 2-3 describe how the GPIO and SPI selects can be varied for different EZ-KIT Lites and EZ-Boards.

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

An example program demonstrating capabilities of the touch controller is available in VisualDSP++; see "Example Programs" on page 1-6.

Serial ROM

The Blackfin Landscape LCD EZ-Extender is equipped with a 2 KB serial ROM device (M24C02) for revision and configuration control: bill of materials and PCB revision information is available by reading the ROM. The part connects to the Blackfin processor via the processor's TWI interface. By default, the serial ROM is read-only to protect the internally stored contents. On the extender, the last three significant TWI address bits are strapped to logic '0' (default). To modify the last three significant TWI address bits, use the provided jumpers; see "Jumper Settings" on page 2-3 for more information.

For more information on the M24C02 device, go to the STMicroelectronics Web site.

More information on the revision and configuration control is available in Example Programs.

Example Programs

Example programs are provided with the Landscape LCD EZ-Extender to demonstrate various capabilities of the product. Example code is installed with VisualDSP++ in the `<install_path>\Blackfin\Examples\Landscape LCD EZ-EXTENDER\Power_On_Self_Test` directory and is used by the `Power_On_Self_Test` examples for supported EZ-KIT Lites/EZ-Boards.

2 LANDSCAPE LCD EZ-EXTENDER HARDWARE REFERENCE

This chapter describes the hardware design of the Blackfin Landscape LCD EZ-Extender.

The following topics are covered.

- "System Architecture" on page 2-2
  Describes the board configuration and explains how the board components interface with the processor and EZ-KIT Lite/EZ-Board.
- "Jumper Settings" on page 2-3
  Describes the on-board configuration jumpers.
- "Connectors" on page 2-12
  Describes the the on-board connectors.

System Architecture

A block diagram of the Blackfin Landscape LCD EZ-Extender is shown in Figure 2-1.

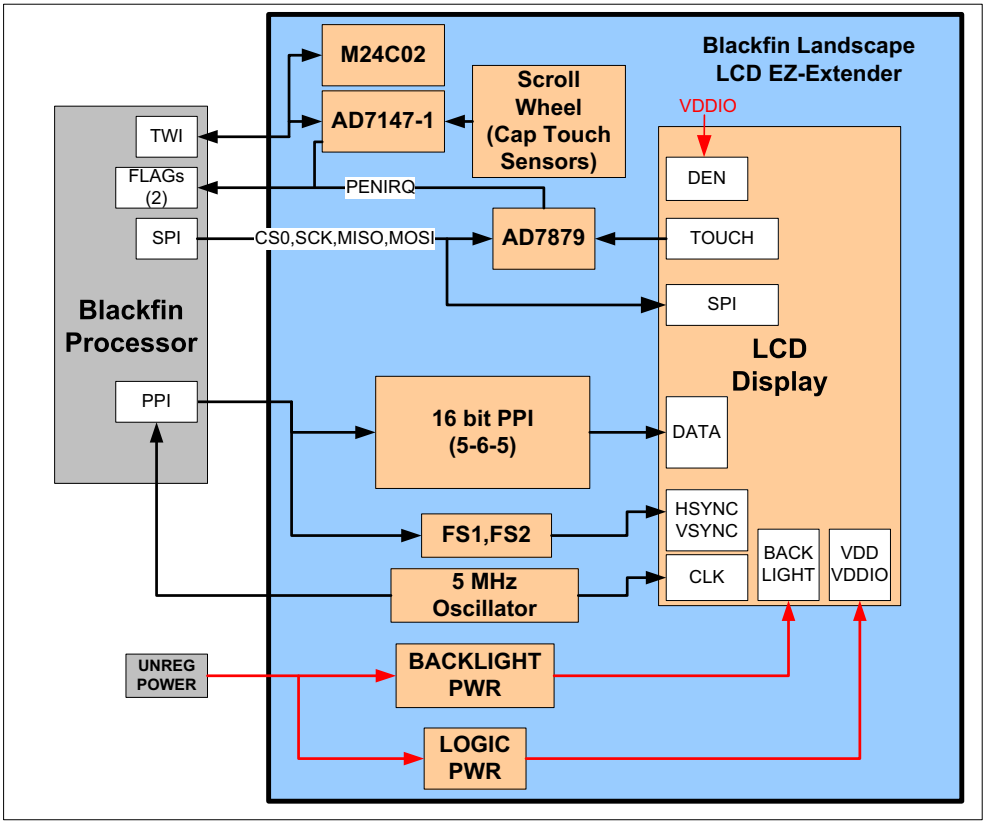

Figure 2-1. Block Diagram

Jumper Settings

Before using the Blackfin Landscape LCD EZ-Extender, follow the setup procedure on page 1-2.

Figure 2-3 shows the locations of all jumper headers. A two-pin jumper can be placed on the respective jumper header for different functionality. The following sections describe all possible jumper settings and associated functionality.

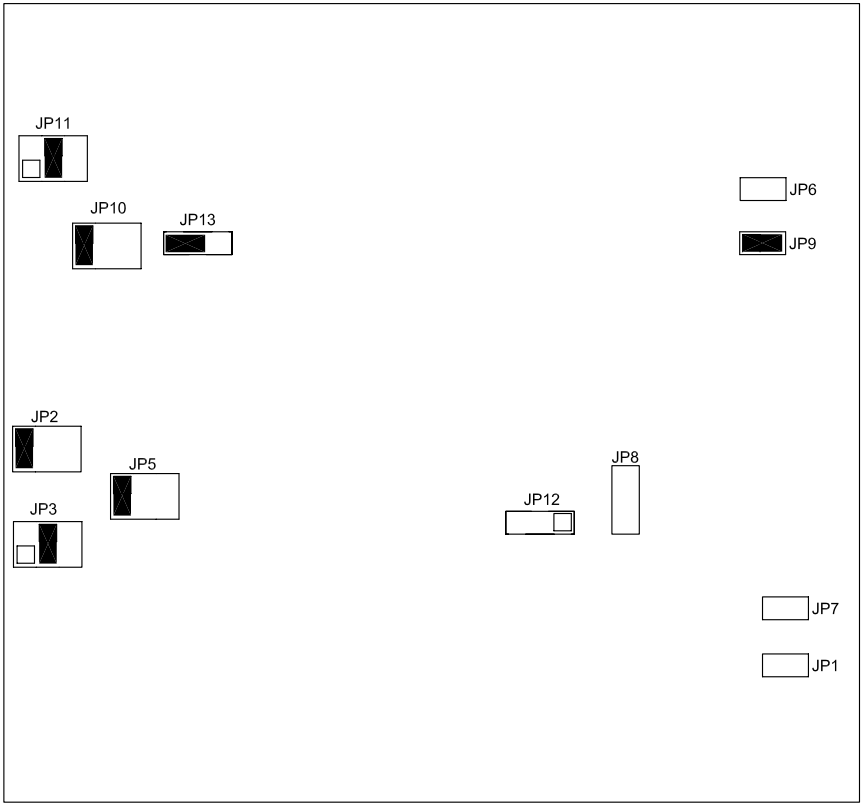

Figure 2-2. Jumper Locations

AD7147 ADDR0 Jumper (JP1)

The AD7147 ADDR0 jumper (JP1) changes the least significant address bit used to communicate to the AD7147 touch controller via the TWI interface of the processor. By default, JP1 requires no jumpers. When no jumper is installed, the ADDR0 bit is pulled low and is a logic '0' (see Table 2-1).

Table 2-1. JP1 Settings

AD7147 ADDR0	JP1 Setting
ADDR0 = logic '0'	No jumper installed (default)
ADDR0 = logic '1'	Jumper installed

LCD SPI Chip Select Jumper (JP2)

The LCD SPICS jumper (JP2) connects the chip select pin of the serial peripheral interconnect (SPI) interface of the LCD display to one of three SPI select pins of the Blackfin processor. JP2 allows you to choose any one of the available SPI select pins (SPISEL1–3) of the processor (see Table 2-2).

By default, JP2 is populated, so that the SPISEL1 pin of the expansion interface II or the parallel peripheral interface (PPI) stamp connector can be used. When the PPI stamp connector is used to attach the extender, SPISEL3 is unavailable and only SPISEL1 and SPISEL2 are available for JP2.

Table 2-2. JP2 Settings

Functionality	JP2 Setting
LCD SPICS connected to SPISEL1	JP2.1 and JP2.2 (default)
LCD SPICS connected to SPISEL2	JP2.3 and JP2.4
LCD SPICS connected to SPISEL3	JP2.5 and JP2.6

LCD Touch SPI Chip Select Jumper (JP3)

The LCD touch SPICS jumper (JP3) connects the chip select pin of the AD7879 SPI interface (U1) to one of three SPI select pins of the Blackfin processor. JP3 adds flexibility to the extender: you can choose any one of the available SPI select pins (SPISEL1–3) of the processor (see Table 2-3).

By default, JP3 is populated, so that SPISEL2 of the expansion interface II or the PPI stamp connector can be used. When the PPI stamp connector is used to attach the extender, SPISEL3 is unavailable and only SPISEL1 and SPISEL2 are available for JP3.

Table 2-3. JP3 Settings

Functionality	JP3 Setting
LCD touch SPICS connected to SPISEL1	JP3.1 and JP3.2
LCD touch SPICS connected to SPISEL2	JP3.3 and JP3.4 (default)
LCD touch SPICS connected to SPISEL3	JP3.5 and JP3.6

LCD Reset Jumper (JP5)

The LCD reset jumper (JP5) connects the reset pin of the LCD display to one of the following.

- The reset pin of the EZ-KIT Lite/EZ-Board
- A general-purpose I/O (GPIO) pin of the AD7147 capacitive touch controller (U3)
- A GPIO pin connected directly to the Blackfin processor

JP5 adds flexibility to the extender: you can control the LCD display reset by one of three available methods. By default, JP5 is populated so that the EZ-KIT Lite/EZ-Board reset pin connects to the reset pin of the LCD dis-

play (P1.28). Consequently, a reset supervisory circuit located on the EZ-KIT Lite/EZ-Board controls the reset pin going to the LCD display (see Table 2-4).

To control the LCD display reset via software, write to the respective AD7147 (U3) control registers using the 2-wire interface (TWI) of the processor and control the AD7147 GPIO pin.

When using the expansion interface II, you can also control the LCD display reset via the GPIO4 flag pin. GPIO4 connects directly to the processor and LCD display, and can be controlled without the need to communicate to the AD7147 controller. The GPIO4 pin is unavailable on the PPI stamp connector; as a result, when using a PPI connector, you can not use GPIO4 to control the LCD display reset.

Table 2-4. JP5 Settings

Functionality	JP5 Setting
EZ-KIT Lite/EZ-Extender reset connected to LCD reset	JP5.1 and JP5.2 (default)
AD7147 GPIO pin connected to LCD reset	JP5.3 and JP5.4
GPIO4 pin connected to LCD reset	JP5.5 and JP5.6

PPICLK Disable Jumper (JP6)

The PPICLK disable jumper (JP6) disables and tri-states the buffer (U4) that drives the 5 MHz clock coming from the on-board oscillator (U2). The buffer is powered via the V_Select pin and used for level translation of the 3.3V oscillator to the VDDIO coming from the EZ-KIT Lite/EZ-Board. Use JP6 to disable the buffer if the PPI clock is generated via the Blackfin processor. This tri-states the 5 MHz clock driven by the buffer and prevents any signal contention issues. By default, JP6 is not populated, and the 5 MHz clock is driven to the PPI clock line (see Table 2-6).

Table 2-5. JP6 Settings

Functionality	JP6 Setting
Buffer (U4) drives 5 MHz on the PPI0CLK net	No jumper installed (default)
Buffer (U4) is tri-stated	Jumper installed

AD7147 ADDR1 Jumper (JP7)

The AD7147 ADDR1 jumper (JP7) changes the second least significant address bit used to interface to the AD7147 capacitive touch controller via the TWI interface of the Blackfin processor. By default, JP7 requires no jumpers. When no jumper is installed, the ADDR1 bit is pulled low and is a logic '0' (see Table 2-6).

Table 2-6. JP7 Settings

AD7147 ADDR1	JP7 Setting
ADDR1 = logic '0'	No jumper installed (default)
ADDR1 = logic '1'	Jumper installed

Serial ROM Addr Jumper (JP8)

The serial ROM address jumper (JP8) can change the three least significant address bits (ADDR0–3) used to interface to the serial ROM device via the TWI interface of the Blackfin processor. By default, JP8 requires no jumpers. When no jumpers are installed, all three address bits are pulled low and are logic '0'. This causes the serial ROM device select (address) to default to a binary 1010 000. To change any one of the three least significant address bits to a logic '1', install the respective jumper (Table 2-7).

Table 2-7. JP8 Settings

Serial ROM TWI Address	JP8.5 and JP8.6 (ADDR2) Settings	JP8.3 and JP8.4 (ADDR1) Settings	JP8.1 and JP8.2 (ADDR0) Settings
1010 000	No jumper (default)	No jumper (default)	No jumper (default)
1010 001	No jumper	No jumper	Jumper installed
1010 010	No jumper	Jumper installed	No jumper
1010 011	No jumper	Jumper installed	Jumper installed
1010 100	Jumper installed	No jumper	No jumper
1010 101	Jumper installed	No jumper	Jumper installed
1010 110	Jumper installed	Jumper installed	No jumper
1010 111	Jumper installed	Jumper installed	Jumper installed

Serial ROM Write Protect Jumper (JP9)

The serial ROM write protect jumper (JP9) protects the entire contents of the memory device (M24C02) from inadvertent write operations. By default, JP9 has a jumper installed, making the memory a read-only device. The default setting ensures that any hardware or software revision information stored in the ROM is preserved. Remove JP9 when you need to write to serial ROM (see Table 2-8).

Table 2-8. JP9 Settings

Serial ROM Write Protect	JP9 Setting
Read operations only	Jumper installed (default)
Read and write operations	No jumper installed

AD7879 PENIRQ Jumper (JP10)

The AD7879 PENIRQ jumper (JP10) connects the interrupt pin of the Analog Devices AD7879 LCD touch controller (U1) to one of three GPIO pins of the Blackfin processor. JP10 adds flexibility to the extender: you can choose any one of the available GPIO pins (GPIO1–3). By default, JP10 is populated so that the GPIO1 pin of the expansion interface II or the PPI stamp connector can be used to connect to the AD7879 Penirq pin (see Table 2-9).

Table 2-9. JP10 Settings

Functionality	JP10 Setting
AD7879 PENIRQ connects to GPIO1	JP10.1 and JP10.2 (default)
AD7879 PENIRQ connects to GPIO2	JP10.3 and JP10.4
AD7879 PENIRQ connects to GPIO3	JP10.5 and JP10.6

AD7147 INT Jumper (JP11)

The AD7147 INT jumper (JP11) connects the interrupt pin of the Analog Devices AD7147 capacitive touch controller (U3) to one of three GPIO pins of the Blackfin processor. JP11 adds flexibility to the extender: you can choose any one of the available GPIO pins (GPIO1–3). By default, JP11 is populated so that the GPIO2 pin of the expansion interface II or the PPI stamp connector can be used to connect to the AD7147 interrupt pin (see Table 2-10).

Table 2-10. JP11 Settings

Functionality	JP11 Setting
AD7147 INT connected to GPIO1	JP11.1 and JP11.2
AD7147 INT connected to GPIO2	JP11.3 and JP11.4 (default)
AD7147 INT connected to GPIO3	JP11.5 and JP11.6

Oscillator Disable Jumper (JP12)

The oscillator disable jumper (JP12) disables the 5 MHz oscillator driving the PPI0CLK net and LCD display. The disabled oscillator mode is particularly suited for low-power applications.

By default, JP12 requires no jumpers. As a result, the oscillator is driving the 5 MHz clock. You can permanently disable the oscillator by populating a jumper between JP12.2 and JP12.3. The oscillator also can be enabled or disabled via the GPIO pin of the AD7147 capacitive touch controller. To enable or disable the oscillator, write to the respective control registers of the AD7147 controller (U3) and place a jumper between JP12.1 and JP12.2 (see Table 2-11).

Table 2-11. JP12 Settings

Oscillator	JP12 Setting
Enabled	No jumper installed (default)
Controlled via AD7147 GPIO	JP12.1 and JP12.2
Disabled	JP12.2 and JP12.3

LCD Backlight Enable Jumper (JP13)

The LCD backlight enable jumper controls the power circuitry for the LCD backlight. The disabled LCD backlight option is particularly suited for low-power applications.

By default, JP13 requires a jumper between JP13.1 and JP13.2. When the EZ-Extender is powered up, the backlight power circuit (VR1) is OFF.

To enable the LCD backlight, use the GPIO (Aux) pin of the AD7879 touch controller (U1). Write to the appropriate control registers of the controller using the SPI interface of the Blackfin processor. You also can control the LCD backlight via the GPIO3 flag pin, which is linked to the Blackfin processor directly. In the latter case, you do not need to commu-

nicate to the controller in order to control the LCD backlight. The benefit of using the AD7879 device over the GPIO3 flag pin for LCD control is that the flag pin remains free and can be used for other applications (see Table 2-12).

Table 2-12. JP13 Settings

LCD Backlight	JP13 Setting
Controlled via AD7879 GPIO	JP13.1 and JP13.2 (default)
Controlled via GPIO3	JP13.2 and JP13.3

Connectors

Figure 2-3 shows the locations of all connectors on the Blackfin Landscape EZ-Extender. The following sections describe the connectors and associated functionality.

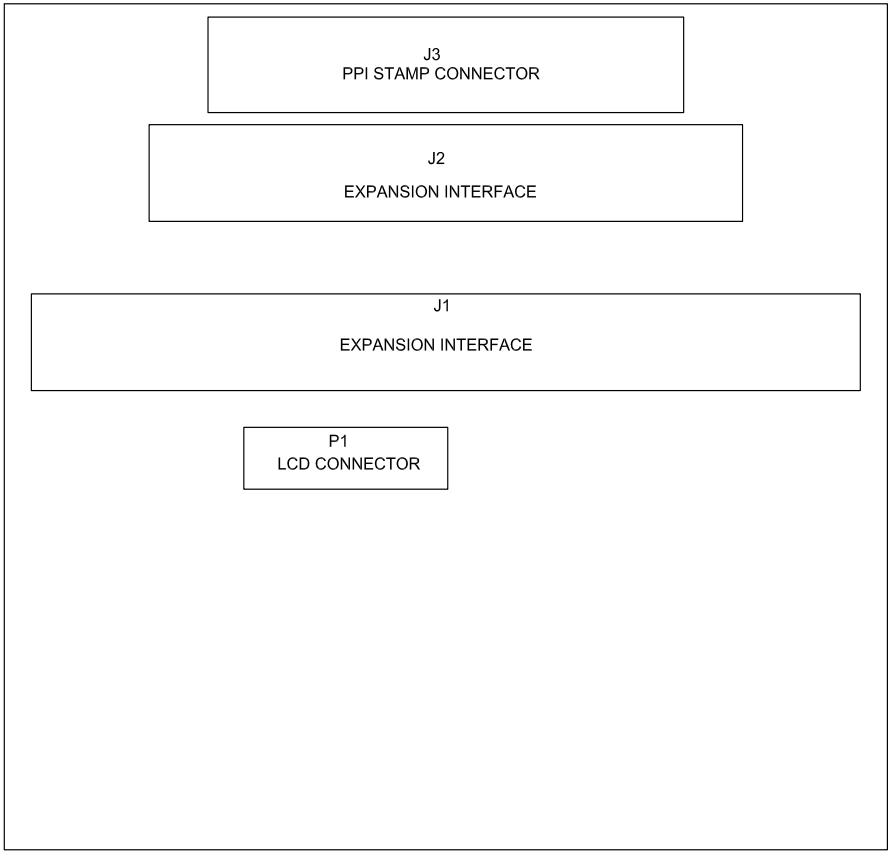

Figure 2-3. Connector Locations

Expansion II PPI Connector (J1)

The expansion II PPI connector (J1) connects the Landscape LCD EZ-Extender to the PPI interface of the Blackfin processor. Use J1 to connect the extender to the ADSP-BF526 EZ-Board/ EZ-KIT Lite. The reset, power, and ground lines from the ADSP-BF526 EZ-Board/ EZ-KIT Lite also are brought up from J1 to the extender.

Use the expansion II PPI connector and low speed I/O (LSIO) connector (J2, described in "Expansion II LSIO Connector (J2)") on the ADSP-BF526 EZ-Board/ EZ-KIT Lite for the extender to function properly.

Expansion II LSIO Connector (J2)

The expansion II LSIO connector (J2) connects the Landscape LCD EZ-Extender to the SPI, TWI, and GPIO pins of the Blackfin processor. Use J2 to connect the extender to the ADSP-BF526 EZ-Board/ EZ-KIT Lite. The power and ground lines from the ADSP-BF526 EZ-Board/ EZ-KIT Lite also are brought up from J2 to the extender.

Use the expansion II PPI connector and LSIO connector on the ADSP-BF526 EZ-Board/ EZ-KIT Lite for the extender to function properly.

PPI Stamp Connector (J3)

The PPI stamp connector (J3) connects the Landscape LCD EZ-Extender to the PPI, SPI, TWI, and GPIO pins of the Blackfin processor. J3 also connects the extender with the reset, power, and ground lines of the ADSP-BF537, ADSP-BF538, and ADSP-BF548 processors. Use J3 to connect the extender to the ADSP-BF537, ADSP-BF538, and ADSP-BF548 EZ-KIT Lites. When using J3, do not use J1 and J2.

LCD Connector (P1)

The LCD connector (P1) is used to attach the LCD display to the Landscape LCD EZ-Extender. The two backlight power pins, four resistive touch pins, LCD SPI interface, and well as the data, sync, and clock pins of the LCD display are extracted from the cable and connected to the extender.

A LANDSCAPE LCD EZ-EXTENDER BILL OF MATERIALS

The bill of materials corresponds to "Landscape LCD EZ-Extender Schematic" on page B-1.

Ref.	Qty.	Description	Reference Designator	Manufacturer	Part Number
1	1	SN74LVC1G125 SOT23-5	U4	TI	74LVC1G125DBVRE4
2	1	5MHZ OSC003	U2	EPSON	SG-8002CA-MP
3	1	MIC94040 MLF4	U6	MICREL	MIC94040YFL
4	1	M24C02 TSSOP8DW	U5	ST MICRO	M24C02-RDW6TP
5	1	ADP1611 MSOP8	VR1	ANALOG DEVICES	ADP1611ARMZ-R7
6	1	AD7879 LFCSP_VQ16	U1	ANALOG DEVICES	AD7879ACPZ-500R7
7	1	AD7147-1 LFCSP_VQ24	U3	ANALOG DEVICES	AD7147ACPZ-1500RL7
8	6	IDC 3X2 IDC3X2_SMT	JP2-3,JP5,JP8,JP10 -11	SAMTEC	TSM-103-01-T-DV
9	1	FPC 67PIN CON063	P1	KYOCERA ELCO	046281267212846+
10	1	IDC 35X2 IDC35x2_SMT_F	J1	SAMTEC	SSW-135-22-F-D-VS
11	1	IDC 25X2 IDC25x2_SMT_F	J2	SAMTEC	SSW-125-22-F-D-VS

Ref.	Qty.	Description	Reference Designator	Manufacturer	Part Number
12	1	IDC 20X2 IDC20x2_SMT_F	J3	SAMTEC	SSW-120-22-F-D-VS
13	4	IDC 2X1 IDC2X1_SMT	JP1,JP6-7,JP9	SAMTEC	TSM-102-01-T-SV
14	2	IDC 3X1 IDC3X1_SMT	JP12-13	SAMTEC	TSM-103-01-T-SV
15	5	0.22UF 25V 10% 0805	C1,C14-17	AVX	08053C224KAT2A
16	1	0.1UF 50V 10% 0805	C27	AVX	08055C104KAT
17	1	600 100MHZ 200MA 0603	FER1	DIGI-KEY	490-1014-2-ND
18	4	0.1UF 10V 10% 0402	C31-32,C34-35	AVX	0402ZD104KAT2A
19	2	0.01UF 16V 10% 0402	C18-19	AVX	0402YC103KAT2A
20	15	10K 1/16W 5% 0402	R1-4,R7-8,R17-19, R21-24,R26-27	VISHAY	CRCW040210K0FKED
21	10	2.2UF 10V 10% 0805	C2-3,C6-13	AVX	0805ZD225KAT2A
22	2	0.1UF 16V 10%0603	C23-24	AVX	0603YC104KAT2A
23	2	10K 1/10W 5% 0603	R10-11	VISHAY	CRCW060310K0JNEA
24	1	100K 1/10W 5% 0603	R9	VISHAY	CRCW0603100KJNEA
25	1	2.21K 1/10W 1% 0603	R14	DIGI-KEY	311-2.21KHRTR-ND
26	1	390PF 25V 5% 0603	C20	AVX	06033A391FAT2A

Ref.	Qty.	Description	Reference Designator	Manufacturer	Part Number
27	2	10UF 10V 10% 0805	C30,C33	PANASONIC	ECJ-2FB1A106K
28	1	1UF 50V 10% 0603	C22	DIGI-KEY	587-1257-1-ND
29	1	15uH 20% IND015	L1	COILCRAFT	MSS4020-153ML
30	3	.5A B0540W SOD-123	D1-3	DIODES INC	B0540W-7-F
31	1	.5A BZT52C33S SOD-323	D4	DIODES INC	BZT52C33S-7-F
32	5	2.2UF 25V 10% 0805	C4-5,C25-26,C28	DIGI-KEY	490-3331-1-ND
33	1	51.1 1/16W 1% 0402	R12	DIGI-KEY	541-51.1LCT-ND
34	1	10000PF 25V10% 0402	C29	DIGI-KEY	399-1278-1-ND

BLACKFIN LANDSCAPE LCD EZ-EXTENDER SCHEMATIC

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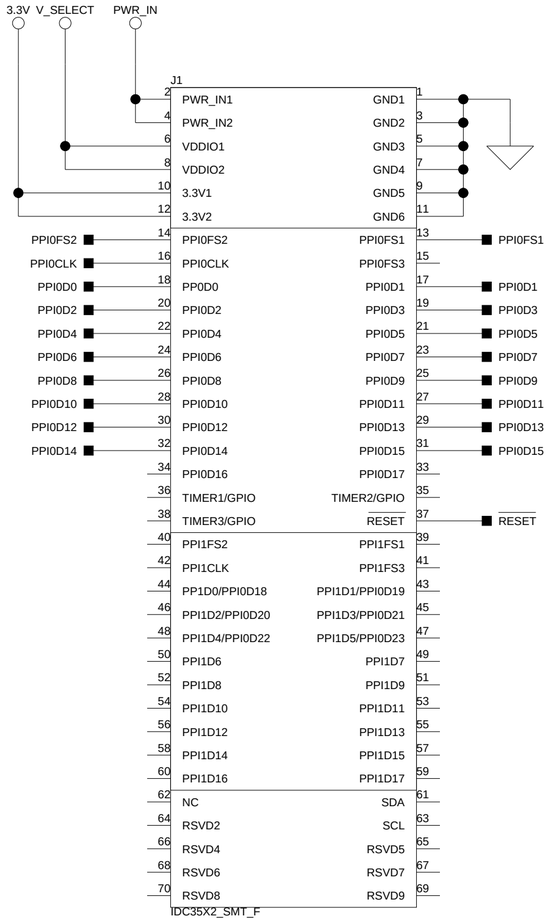
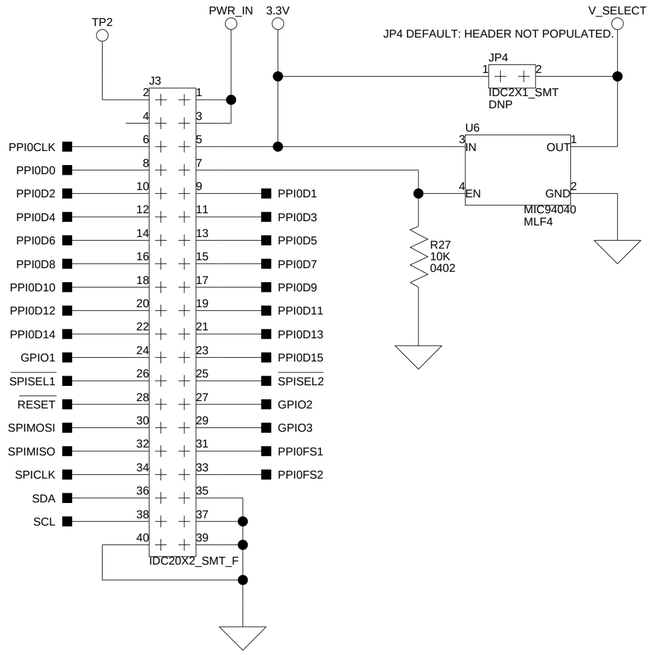
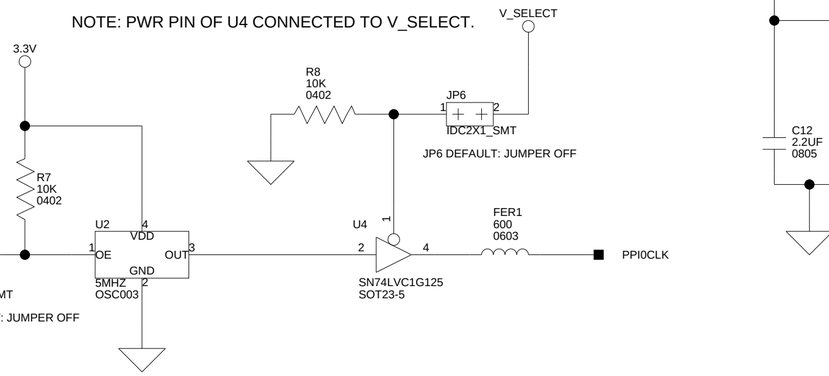
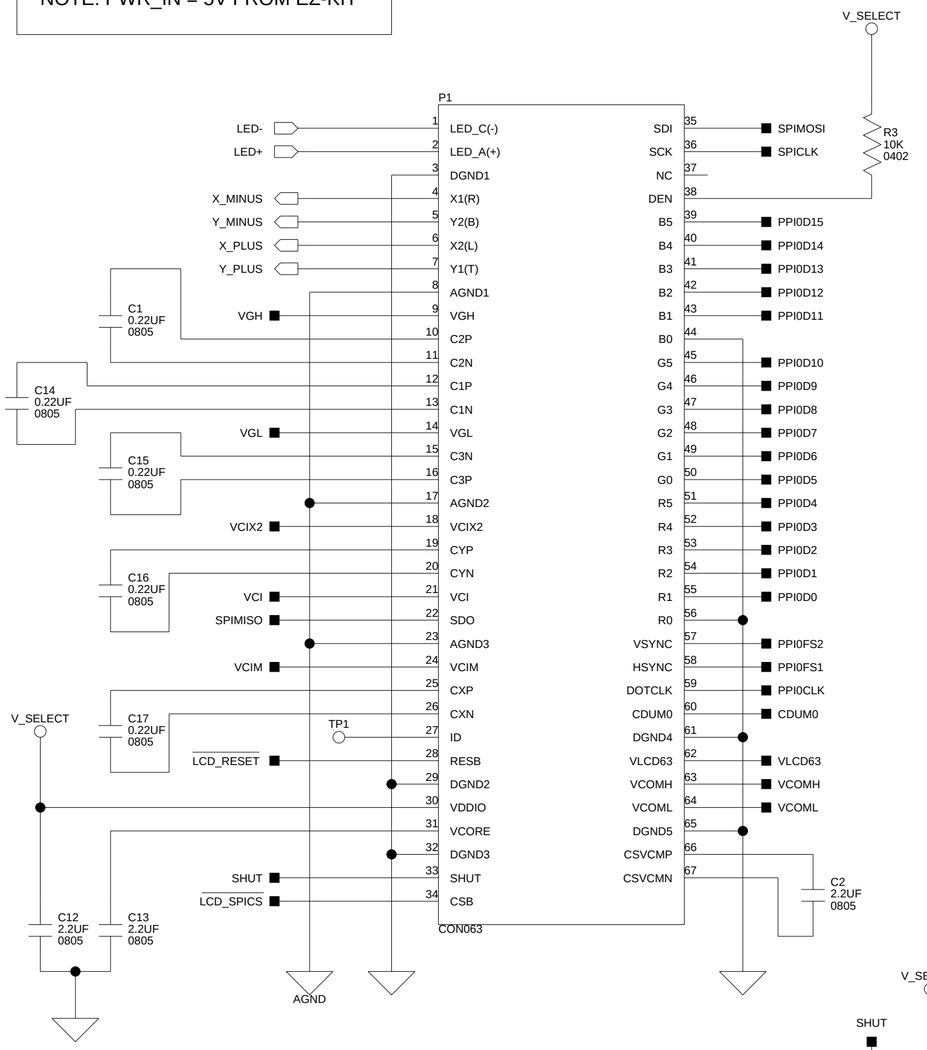
Title	BLACKFIN LANDSCAPE LCD EZ-EXTENDER TITLE		
Size: C	Board No.: A0216-2008		Rev: 1.1
Date: 7-18-2008_14:58		Sheet: 1 of 3	

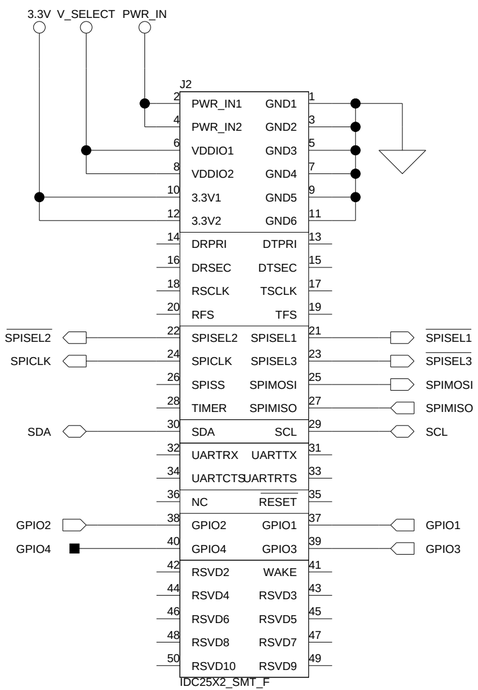


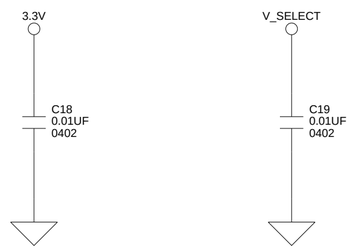


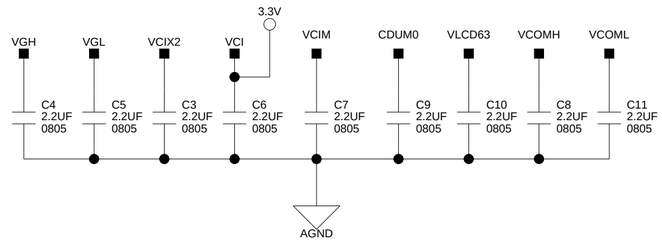
NOTE: PWR PIN OF U4 CONNECTED TO V_SELECT.

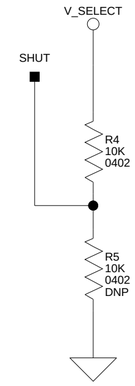


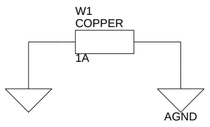


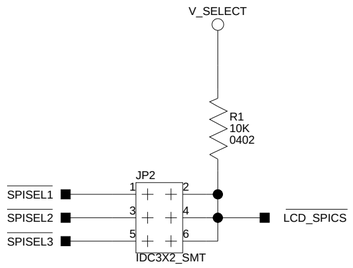




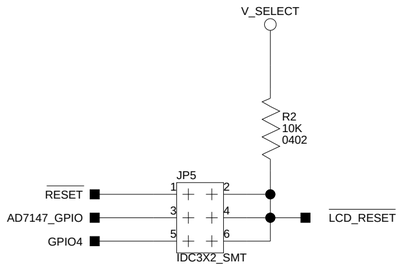








JP2 DEFAULT: JUMPER ON JP2.1 & JP2.2



JP5 DEFAULT: JUMPER ON JP5.1 & JP5.2

NOTE: PWR_IN = 5V FROM EZ-KIT

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Title BLACKFIN LANDSCAPE LCD EZ-EXTENDER CONNECTORS, PPI CLK

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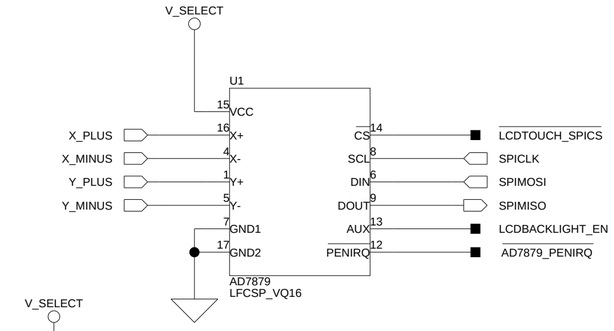
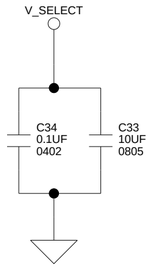
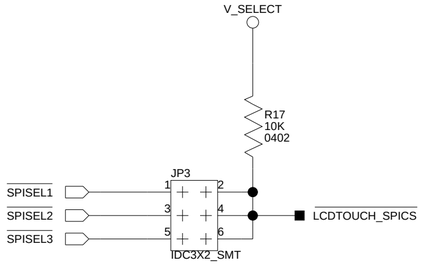
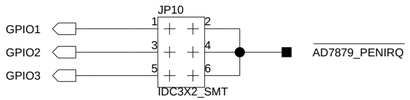


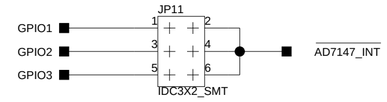




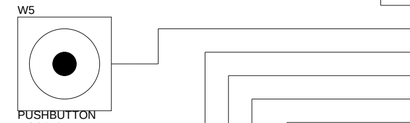
JP3 DEFAULT: JUMPER ON JP3.3 & JP3.4

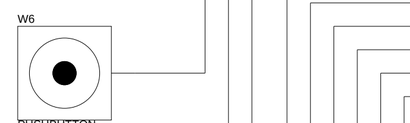


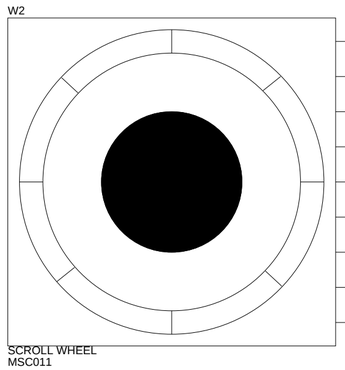
JP10 DEFAULT: JUMPER ON JP10.1 & JP10.2

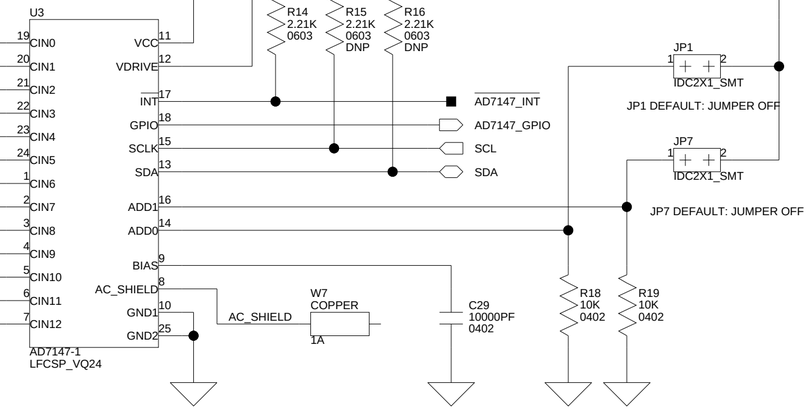


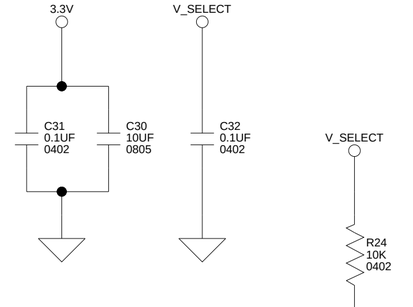
JP11 DEFAULT: JUMPER ON JP11.3 & JP11.4

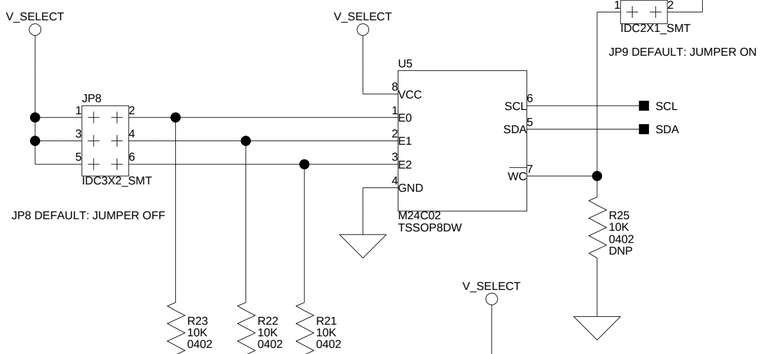


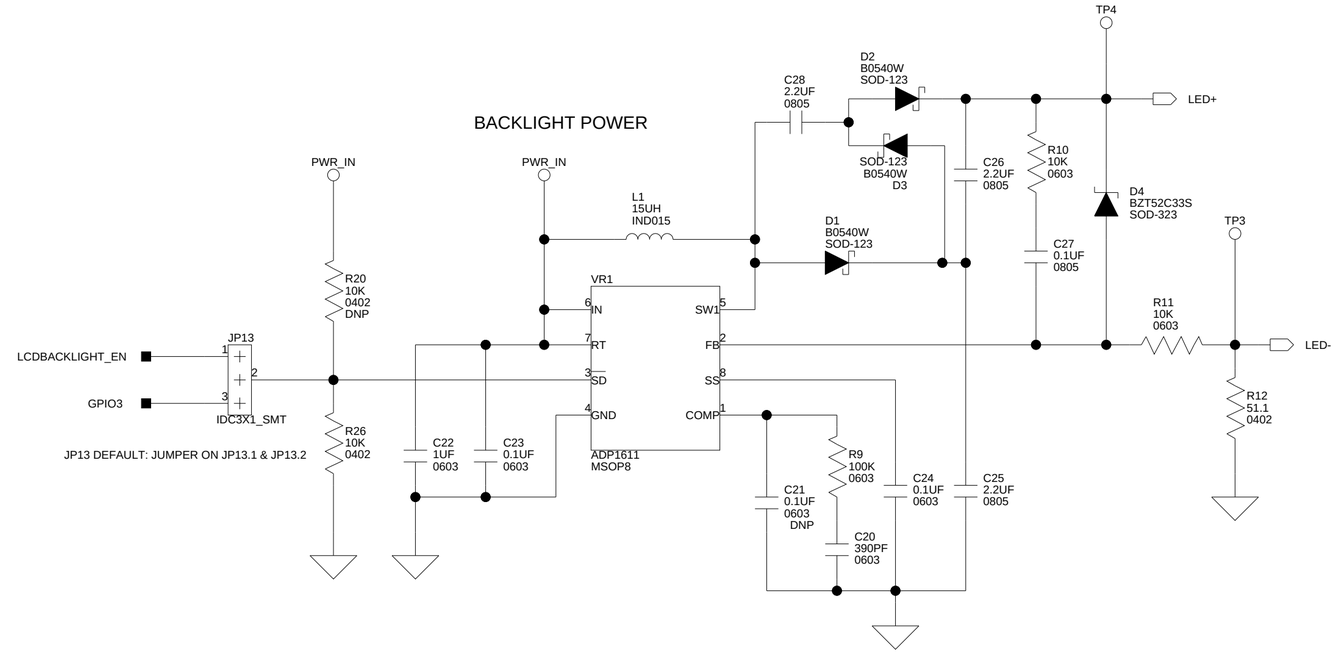












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Title BLACKFIN LANDSCAPE LCD EZ-EXTENDER TOUCH CONTROLLERS, TFT POWER,I2C EEPROM

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