**Regulatory Compliance**

The ADSP-CM408F EZ-KIT Lite 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 ADSP-CM408F EZ-KIT Lite is in the process of being certified to comply with the essential requirements of the European EMC directive 2004/108/EC and therefore carries the “CE” mark.

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.
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**ADSP-CM408F EZ-KIT LITE BILL OF MATERIALS**

**ADSP-CM408F EZ-KIT LITE SCHEMATIC**

**INDEX**
Thank you for purchasing the ADSP-CM408F EZ-KIT Lite®, Analog Devices, Inc. low-cost evaluation system for the ADSP-CM408F mixed-signal control processor.

The ADSP-CM408F processor is based on the ARM® Cortex®-M4 processor core and is designed for motor control and industrial applications. The EZ-KIT Lite is shipped with all of the necessary hardware—you can start the evaluation immediately. The package contains the standalone evaluation board, CE-approved power supply, and USB cable. The EZ-KIT Lite version ships with the J-Link Lite ARM, while the EZ-Board® version requires the customer to provide an emulator.

Two expansion connectors (analog interface and PWM/digital interface) are provided for connecting boards that incorporate motors. Another expansion connector is provided for connecting an Anybus board and/or a memory/FPGA extender card.

Traditional mechanical switches for changing the board’s factory setup have been removed in favor of I²C controlled software switches. The only remaining mechanical switches are the boot mode switch and push buttons.
Product Overview

The evaluation board is designed to be used in conjunction with the IAR Embedded Workbench development tools to test capabilities of the ADSP-CM408F processors. The development environment aids advanced application code development and debug, such as:

- Create, compile, assemble, and link application programs written in C++, C, and 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

Product Overview

The board features:

- Analog Devices ADSP-CM408F processor
  - 176-pin LQFP package
  - 30 MHz CLKIN core oscillator
- SRAM memory (SMC0) chip
  - 256K x 16-bit (4M bit)
  - Cypress CY7C1041DV33
- Ethernet PHY (ETH0)
  - 10/100 Mb/s
  - Texas Instruments DP83848C
• Universal Asynchronous Receiver/Transmitter (UART0)
  • Analog Devices ADM3252E RS-232 line transceiver
  • DB9 female connector
• Universal Asynchronous Receiver/Transmitter (UART1)
  • Analog Devices ADM2682E RS-485 line transceiver
  • DB9 female connector
• Controller Area Network (CAN) interfaces
  • CAN0—Analog Devices ADM3053 transceiver and RJ11 connector
  • CAN1—Analog Devices ADM3053 transceiver and RJ11 connector
• USB interface
  • Molex 56579-0576 connector
• Display
  • New Haven NHD-0220D3Z-FL-GBW
  • 2 x 20 character
  • 2-wire interface (TWI) control
• RESET controller
  • Analog Devices ADM708 microprocessor supervisory circuits
• Debug (JTAG/SWD/SWV/TRACE) interface
  • JTAG/SWD 20-pin 0.1” header for use with IAR emulators
  • Trace/JTAG/SWD/SWV 20-pin 0.05” header
Product Overview

- LEDs
  - Eight LEDs: one power (green), one board reset (red), one Ethernet speed (green), one SYS_FAULT (red), and four general-purpose (amber)

- Push buttons
  - Four push buttons: one reset, one wake, two IRQ/Flag

- Asynchronous connector
  - 180-pin Samtec (QSH-090-01-F-D-A) 0.5 mm spacing
  - SMC0 address, data, and control
  - CLKOUT
  - SPI1
  - UART2
  - TWI0
  - GPIOs
  - RESET
  - GND/3.3V/5V output

- Pulse-width modulation (PWM) connector
  - 180-pin Samtec (QSH-090-01-F-D-A) 0.5 mm spacing
  - PWM0—PWM2
  - SINC0
  - SPI1
  - SPT0
  - TWI0
Preface

- TMR0
- CNT0—CNT3
- GPIO
- RESET
- GND/3.3V/5V output
- 5V output
- Analog connector interface
  - 120-pin Samtec (QSH-060-01-F-D-A) 0.5 mm spacing
  - ADC0
  - AGND/GND/VREF/5VOUT
  - ADR441 voltage reference (VREF)
  - ADA4899 buffer—0.1” header for reference
- 1588 connector
  - 0.1” header 6-pin
- External power supply
  - CE compliant
  - 5V @ 3.6 Amps
  - Ability to power from the PWM connector
- Other features
  - 0.05-ohm resistors for processor current measurement

For information about the hardware components of the EZ-KIT Lite, refer to ADSP-CM408F EZ-KIT Lite Bill Of Materials.
Purpose of This Manual

The *ADSP-CM408F EZ-KIT Lite Evaluation System 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 ADSP-CM408F EZ-KIT Lite. 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 an ARM Cortex-M4-based processor core.

The ADSP-CM40x family of mixed-signal control processors is based on the ARM Cortex-M4 processor core with floating-point unit and integrated SRAM memory, flash memory, accelerators, and peripherals.

The applicable documentation for programming the ARM Cortex-M4 processor core includes:

- *Cortex-M4 Devices Generic User Guide*
- *CoreSight ETM-M4 Technical Reference Manual*
- *Cortex-M4 Technical Reference Manual*

For additional information on this Analog Devices processor, see the *ADSP-CM40x Mixed-Signal Control Processor Hardware Reference*. This document describes the ARM Cortex-M4 processor core and memory architecture used on the ADSP-CM40x processor, but does not provide detailed programming information for the ARM core.
For more information about programming the ARM core, visit the ARM Information Center:

http://infocenter.arm.com/help/

**Manual Contents**

The manual consists of:

- Chapter 1, *Using ADSP-CM408F EZ-KIT Lite*
  Describes EZ-KIT Lite functionality from a programmer’s perspective and provides a simplified memory map of the processor.

- Chapter 2, *ADSP-CM408F EZ-KIT Lite Hardware Reference*
  Provides information about the EZ-KIT Lite hardware components.

- Appendix A, *ADSP-CM408F EZ-KIT Lite Bill Of Materials*
  Provides a list of hardware components used to manufacture the EZ-KIT Lite board.

- Appendix B, *ADSP-CM408F EZ-KIT Lite Schematic*
  Lists the resources for board-level debugging.

**What’s New in This Manual**

This is Revision 1.1 of the *ADSP-CM408F EZ-KIT Lite Evaluation System Manual*. Changes from Revision 1.0 include an updated Bill of Materials and an updated schematic.
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 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 evaluation system supports Analog Devices ADSP-CM408F processors.
Supported Tools

Information on supported tools for the ADSP-CM408F EZ-KIT Lite and the ADSP-CM40x family of mixed-signal control processors is available at:

http://www.analog.com/CM408FEZKit

Product Information

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

Analog Devices Web Site


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 (found on the Analog Devices home page) 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.

**Notation Conventions**

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

<table>
<thead>
<tr>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>File &gt; Close</td>
<td>Titles in reference sections indicate the location of an item within the CCES environment’s menu system (for example, the Close command appears on the File menu).</td>
</tr>
<tr>
<td>(this</td>
<td>that)</td>
</tr>
<tr>
<td>[this</td>
<td>that]</td>
</tr>
<tr>
<td>[this,...]</td>
<td>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.</td>
</tr>
</tbody>
</table>
## Preface

<table>
<thead>
<tr>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>.SECTION</td>
<td>Commands, directives, keywords, and feature names are in text with letter gothic font.</td>
</tr>
<tr>
<td>filename</td>
<td>Non-keyword placeholders appear in text with italic style format.</td>
</tr>
</tbody>
</table>

**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.
Notation Conventions
1 USING ADSP-CM408F EZ-KIT LITE

This chapter provides information to assist you with development of programs for the ADSP-CM408F EZ-KIT Lite evaluation system.

The following topics are covered.

- Package Contents
- ADSP-CM408F EZ-Board
- Default Configuration
- IAR Embedded WorkBench and Board Installation
- IAR Embedded WorkBench Session Startup
- SRAM Memory (U2)
- SPI Flash
- Analog Interface
- UART0 Interface (RS-232)
- UART1 Interface (RS-485)
- CAN0 Interface
- CAN1 Interface
- USB OTG FS Interface
- Ethernet Interface
**Package Contents**

- Debug Interface
- Serial Liquid Crystal Display Module Interface
- Power-On-Self Test
- Expansion Interface
- Power Architecture
- Power Measurements
- Example Programs
- Reference Design Information

**Package Contents**

Your ADSP-CM408F EZ-KIT Lite package contains the following items.

- ADSP-CM408F EZ-KIT Lite board
- Universal 5V DC power
- USB 2.0 cable
- J-Link Lite ARM (only in the EZ-KIT Lite version)

Contact the vendor where you purchased your EZ-KIT Lite or contact Analog Devices, Inc. if any item is missing.
Using ADSP-CM408F EZ-KIT Lite

ADSP-CM408F EZ-Board

The ADSP-CM408F EZ-KIT Lite is shipped with the J-Link Lite ARM debugger. When the product is not shipped with the debugger, it is referred to as the ADSP-CM408F EZ-Board.

The EZ-Board requires a third party emulator.

Default Configuration

The ADSP-CM408F EZ-KIT Lite board is designed to run as a stand-alone unit.

When removing the EZ-KIT Lite board from the package, handle the board carefully to avoid the discharge of static electricity, which can damage some components.

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.
**Default Configuration**

Figure 1-1 shows the default jumper settings, connector locations, and LEDs used in installation. Confirm that your board is in the default configuration before using the board.

![Default EZ-KIT Lite Hardware Setup](image)

Figure 1-1. Default EZ-KIT Lite Hardware Setup
IAR Embedded WorkBench and Board Installation

For information about the IAR Embedded WorkBench® product and software download, go to:

http://www.iar.com/en/Products/IAR-Embedded-Workbench

The ADSP-CM408F EZ-KIT Lite software, based on the IAR Embedded WorkBench, can be found at:

http://www.analog.com/CM408FEZKit

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

Step 1: Connect the EZ-KIT Lite board to a personal computer (PC) running IAR Embedded WorkBench using a J-Link/J-Trace emulator.

1. Plug one side of the USB cable into the USB connector of the emulator. Plug the other side into a USB port of the PC running IAR Embedded WorkBench.

2. Attach the emulator to the header connector, P1 or P2, on the EZ-KIT Lite board.

Step 2: Attach the provided cord and appropriate plug to the 5V power adaptor.

1. Plug the jack-end of the power adaptor into the power connector P9 (labeled 5V) on the EZ-KIT Lite board.

2. Plug the other side of the power adaptor into a power outlet. The power LED (labeled LED7) is lit green when power is applied to the board.
IAR Embedded WorkBench Session Startup

IAR Embedded WorkBench Session Startup

It is assumed that the IAR Embedded WorkBench software is installed and running on your PC.

1. Navigate to the IAR Embedded WorkBench environment via the Start menu.

   Note that IAR Embedded WorkBench is not connected to the target board.

2. Choose File > Open > Workspace to open a workspace for the project to download and debug.

3. Choose Project > Options.

   The General Options, Target page appears.

4. In Processor variant, ensure Device is AnalogDevices ADSP-CM40z-X_Y, where X is the SRAM size in KB and Y is the internal flash size in KB of the part on the target board.

   On the Analog Devices ADSP-CM408F EZ-KIT Lite, SRAM size is 384 KB, and internal flash size is 2048 KB.
5. Choose Debugger in the Category pane.

The Debugger, Setup options page appears.

   a. In Driver, choose J-Link/J-Trace as the emulator to be used to debug the target board.

   b. Click the Download tab. The Debugger, Download options page appears.

   c. Ensure Use flash loader(s) is enabled. Note that other download settings are optional.


The emulator Setup options page appears.

   a. On the Setup page,

      • In Reset, select Connect during reset from the drop-down list.

      • In JTAG/SWD speed, select Auto.

      • (Optional) In Clock setup, change the default values.

   b. On the Connection page,

      • In Communication, select USB and Device 0.

      • In Interface, select JTAG or SWD.

7. Click OK to save the emulator settings.

8. Choose Project > Debug and Download to download the project and start debugging.
The ADSP-CM408F processor is connected to a 4 Mb Cypress asynchronous SRAM device (CY7C1041DV33). The upper and lower halves of the 16-bit-wide data bus are connected to SoftConfig circuitry, which disconnects the expansion interface. The connection to the expansion interface is OFF by default.

Byte-enable signals $ABE_0$ and $ABE_1$ on the processor’s pins $PE_{12}$ and $PE_{13}$ (respectively) are not connected by default; can be connected via SoftConfig.

For more information, refer to the SRAM example in the POST, which is included in the ADSP-CM40x Enablement Software.

**SPI Flash**

The EZ-KIT Lite ships with an internal 4 MB SPI flash, connected via the SPI2 interface, which is used for booting and scratchpad space. Refer to the *ADSP-CM40x Mixed-Signal Control Processor Hardware Reference* for more information about the internal SPI flash.

For more information, refer to the SPI flash example in the POST, which is included in the ADSP-CM40x Enablement Software.

**Analog Interface**

The ADSP-CM408F processor provides two 16-bit ADCs with 8 inputs each, $ADC_0$ and $ADC_1$. The ADC signals are connected to the Analog expansion connector (J9). Refer to *ADSP-CM408F EZ-KIT Lite Schematic* for more information.

Voltage reference for the ADC channels can be supplied internally from the processor or externally by ADR441 ICs. $U_5$ is the $V_{REF0}$ supply.
external source, and U47 is its VREF1 equivalent. To select the external source for either supply, place a jumper on JP1 or JP4. Refer to ADSP-CM408F EZ-KIT Lite Schematic for more information.

A buffered version of the voltage reference is available on J9 via a unity gain buffer ADA4889 (U33). By default, the internal VREF0 source is selected as the input to the buffer (JP3 positions 1 and 2). If the external voltage reference is desired, change the jumper to JP3 positions 2 and 3.

Voltage references for the analog inputs are configurable; refer to Jumpers for more information.

**UART0 Interface (RS-232)**

The ADSP-CM408F processor has three built-in universal asynchronous transmitters (UARTs). UART0 is connected to a RS-232 line transmitter. UART0 has full RS-232 functionality via the Analog Devices ADM3252E isolated line driver and receiver (U36).

⚠️ The EZ-KIT Lite voltage isolation components are not intended for protecting external products. The isolated ICs are used to showcase Analog Devices product portfolio only. Adequate voltage isolation of any external devices/boards is the user responsibility.

Pin `PC_02/UART0_TX/TRACE_D03/SP10_RDY` of the processor is connected to the ADM3315 device directly and used for UART transmit.

Pin `PC_01/UART0_RX/SMCO_A05/TM0_AC15` is connected through SoftConfig by default and used for UART receive. (This can be changed using SoftConfig.)

By default, the UART0 CTS signal is not connected, and the UART0 RTS signal is connected to RS-232. Both connections can be changed through SoftConfig.
**UART1 Interface (RS-485)**

The SoftConfig switches also allow the loopback of CTS and RTS. The UART0 CTS can be added as an input to the reset circuit through SoftConfig. Refer to *Software-Controlled Switches (SoftConfig)* for more information.

For more information, refer to the UART0 example in the POST, which is included in the ADSP-CM40x Enablement Software. Note that the loopback of TX and RX data is done through an external connector.

**UART1 Interface (RS-485)**

UART1 is connected to a RS-485 line transmitter. UART1 has full RS-485 functionality via the Analog Devices ADM2682E isolated line driver and receiver (U39) that can transmit at 16 Mbps.

The EZ-KIT Lite is designed to be the end node in a network; therefore, it has a termination resistor (R44) installed with a value of 120 ohms. If the board is intended to be a middle node in the network, the resistor can be removed.

The EZ-KIT Lite voltage isolation components are not intended for protecting external products. The isolated ICs are used to showcase Analog Devices product portfolio only. Adequate voltage isolation of any external devices/boards is the user responsibility.

The UART1 transmit and receive signals are connected to the RS-485 transmitter directly from the processor. The ADM2682E device has driver enable and receiver enable signals, controlled by SoftConfig. The driver enable and receiver enable signals are disabled by default. Refer to *Software-Controlled Switches (SoftConfig)* for more information.

For more information, refer to the UART1 example in the POST, which is included in the ADSP-CM40x Enablement Software. Note that the loopback of the differential signals is done through an external connector.
CAN0 Interface

The Controller Area Network 0 (CAN0) interface of the EZ-KIT Lite is connected to the Analog Devices ADM3053 isolated CAN transceiver. The transceiver is attached to the CAN0 port of the ADSP-CM408F processor via an RJ-11 connector (J7). See CAN0 Connector (J7).

The EZ-KIT Lite voltage isolation components are not intended for protecting external products. The isolated ICs are used to showcase Analog Devices product portfolio only. Adequate voltage isolation of any external devices/boards is the user responsibility.

The CAN0 transmit and receive signals are connected through the SoftConfig switches and enabled by default. See Software-Controlled Switches (SoftConfig).

For more information, refer to the CAN0 example in the POST, which is included in the ADSP-CM40x Enablement Software.

CAN1 Interface

The Controller Area Network 1 (CAN1) interface of the EZ-KIT Lite is connected to the Analog Devices ADM3053 isolated CAN transceiver. The transceiver is attached to the CAN1 port of the ADSP-CM408F processor via an RJ-11 connector (J8). See CAN1 Connector (J8).

The EZ-KIT Lite voltage isolation components are not intended for protecting external products. The isolated ICs are used to showcase Analog Devices product portfolio only. Adequate voltage isolation of any external devices/boards is the user responsibility.

The CAN1 transmit and receive signals are connected through the SoftConfig switches and enabled by default. See Software-Controlled Switches (SoftConfig).
USB OTG FS Interface

For more information, refer to the CAN1 example in the POST, which is included in the ADSP-CM40x Enablement Software.

USB OTG FS Interface

The ADSP-CM408F processor has an integrated USB PHY; the EZ-KIT Lite provides a mini AB connector. The board only supports USB full speed mode.

The board allows 5V at 500 mA to a peripheral device by enabling the FET switch (U44). The USB controller controls the FET switch through the USB_VBC signal.

To learn about the processor's device and host modes, refer to the USB example in the POST, which is included in the ADSP-CM40x Enablement Software. For more information, refer to the ADSP-CM40x Mixed-Signal Control Processor Hardware Reference.

Ethernet Interface

The ADSP-CM408F processor features a Reduced Media Independent Interface (RMII), which connects to an external Ethernet PHY device (ETH0). The EZ-KIT Lite provides a Texas Instruments DP83848C, Auto-MDIX, fully-compliant PHY with IEEE 802.2/802.2u standards.

The PHY supports 10BASE-T and 100BASE-TX operations and is connected to a standard RJ-45 connector (J1). The IEEE 1588 time stamping signals can be probed on connector P8. For more information, see Ethernet Connector (J1) and IEEE 1588 Connector (P8). Link and activity LEDs are integrated into the RJ45 connector. The speed indication LED (LED6) is located next to the RJ45 connector. See Ethernet Speed LED (LED6).
Using ADSP-CM408F EZ-KIT Lite

The MAC address is printed on the back of the EZ-KIT Lite board; the address must be set in software to use the Ethernet.

The Ethernet PHY device is disabled via SoftConfig. Refer to Software-Controlled Switches (SoftConfig) for more information.

For more information, refer to the ethernet example in the POST, which is included in the ADSP-CM40x Enablement Software.

**Debug Interface**

The EZ-KIT Lite provides a JTAG/SWD/SWV connection via a connector (P1), which is a 0.1” header. A 4-bit trace connection also is available via a connector (P2). See JTAG/SWD Connector (P1) and TRACE and JTAG/SWD/SWV Connector (P2) for more information.

**Serial Liquid Crystal Display Module Interface**

Connector J5 mates with the Newhaven Display International NHD-0220D3Z-FL-GBW-V3, a 2-line by 20-character display with a yellow/green backlight.

The display is written using the TWI interface. The TWI address of the display is 0x50. The maximum clock rate for the display is 100 kHz. The display can be removed if the frequency limitation poses a problem.

For more information, refer to the serial liquid crystal display example in the POST, which is included in the ADSP-CM40x Enablement Software.
Power-On-Self Test

The Power-On-Self-Test Program (POST) tests all EZ-KIT Lite peripherals and validates functionality as well as connectivity to the processor. Once assembled, each EZ-KIT Lite is fully tested for an extended period of time with POST. All EZ-KIT Lite boards are shipped with POST pre-loaded into flash memory. The POST is executed by resetting the board and pressing the proper push button(s). The POST also can be used as a reference for a custom software design or hardware troubleshooting.

Note that the source code for the POST program is included in the ADSP-CM40x Enablement Software along with the readme.txt file that describes how the board is configured to run POST.

Expansion Interface

The expansion interface allows a custom-design daughter board to be tested across various hardware platforms that have the same expansion interface.

The expansion interface implemented on the ADSP-CM408F EZ-KIT Lite consists of three connectors: Asynch or Memory Connector (J4), PWM Connector (J6), and Analog Connector (J9). The connectors contain a majority of the processor’s signals. For pinout information, go to ADSP-CM408F EZ-KIT Lite Schematic.

Limits to current and interface speed must be taken into consideration when using the expansion interface. Current for extenders connected to J4 or J6 can be sourced from the EZ-KIT Lite; therefore, the current should be limited to 250 mA for 5V, and 200 mA from the 3.3V planes. If more current is required, a separate power connector and a regulator must be designed on the daughter card. Additional circuitry implemented on
extender cards can add extra loading to signals, decreasing their maximum effective speed.

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

**Power Architecture**

The ADSP-CM408F EZ-KIT Lite has two primary voltage domains: 3.3V and 1.2V. The main input is a 5V wall adaptor. The 5V source can be selected via JP2 to input from the PWM connector (J6) as an alternative to the wall power adaptor. Refer to PWM Connector (J6) and Power Select Jumper (JP2) for details.

The Analog Devices ADP2119 controller provides 3.3V for the VDD_EXT signal and the 3.3V power requirements of the board. The VDD_INT signal is delivered through either Analog Devices regulator ADP2119 (VR1) or a PNP transistor (Q1).

A FET switch (U44) controls the 5V to the USB devices over the USB_VBUS signal.

**Power Measurements**

Locations are provided for measuring the current draw from various power planes. Precision 0.05 ohm shunt resistors are available on the VDD_EXT, VDD_INT, USB_VBUS, and 3.3V and voltage domains. For current draw, the jumper is removed, voltage across the resistor can be measured using an oscilloscope, and the value of the resistor can be measured using a precision multi-meter. Once voltage and resistance are measured, the current can be calculated by dividing the voltage by the resistance. For the highest accuracy, a differential probe should be used for measuring the voltage across the resistor. For more information, refer to Power Jumpers (P4-7).
Example Programs

Example programs are provided with the ADSP-CM40x Enablement Software to demonstrate various capabilities of the product. The programs can be found in the CM403F_CM408F_EZ-KIT\examples folder. Refer to a readme file provided with each example for more information.

Reference Design Information

A reference design info package is available for download on the Analog Devices Web site. The package provides information on the design, layout, fabrication, and assembly of the EZ-KIT Lite.

The information can be found at:

http://www.analog.com/CM408FEZKit
This chapter describes the hardware design of the ADSP-CM408F EZ-KIT Lite board.

The following topics are covered.

- **System Architecture**
  Describes the board’s configuration and explains how the board components interface with the processor.

- **Software-Controlled Switches (SoftConfig)**
  Lists and describes the processor signals routed through the software-controlled switches.

- **Push Buttons and Switches**
  Shows the locations and describes the push buttons and switches.

- **Jumpers**
  Shows the locations and describes the configuration jumpers.

- **LEDs**
  Shows the locations and describes the LEDs.

- **Connectors**
  Shows the locations and provides part numbers for the on-board connectors. In addition, the manufacturer and part number information is provided for the mating parts.
This section describes the processor’s configuration on the EZ-KIT Lite board (Figure 2-1).

Figure 2-1. EZ-KIT Lite Block Diagram

This EZ-KIT Lite is designed to demonstrate the ADSP-CM408F processor’s capabilities. The ADSP-CM408F EZ-KIT Lite has a 30 MHz input clock and runs at 240 MHZ internally.

USB circuitry and a mini USB AB connector are provided for connecting to the EZ-KIT Lite as a host or a device. The frequency for the USB circuit is generated internally to the processor.
User I/O to the processor is provided in the form of two user push buttons and four LEDs. The software-controlled switches (SoftConfig) facilitate the switch multi-functionality by disconnecting the push buttons from their associated processor pins and reusing the pins elsewhere on the board. See ADSP-CM408F EZ-KIT Lite Schematic for more information.

**Software-Controlled Switches (SoftConfig)**

On the ADSP-CM408F EZ-KIT Lite, most of the traditional mechanical switches have been replaced by I2C software-controlled switches. The remaining mechanical switches are provided for the boot mode and push buttons. Reference any SoftConfig*.c file found in the installation directory for an example of how to set up the SoftConfig feature of the ADSP-CM408F EZ-KIT Lite through software.

The SoftConfig section of this manual serves as a reference to any user that intends to modify an existing software example. If software provided from ADI is used, there should be little need to reference this section.

Care should be taken when changing SoftConfig settings not to create a conflict with interfaces. This is especially true when connecting extender cards.

**Overview of SoftConfig**

In order to further clarify the use of electronic single FET switches and multi-channel bus switches, an example of each is illustrated and compared to a traditional mechanical switching solution. This is a generic example that uses the same FET and bus switch components that are on the EZ-KIT Lite.

After this generic discussion there is a detailed explanation of the SoftConfig interface specific to the ADSP-CM408F EZ-KIT Lite.
Figure 2-2 shows two individual FET switches (Pericom PI3A125CEX) with reference designators UA and UB. Net names ENABLE_A and ENABLE_B control UA and UB. The default FET switch enable settings in this example are controlled by resistors RA and RB which pull the enable pin 1 of UA and UB to ground (low). In a real example, these enable signals are controlled by the Microchip IO expander. The default pull-down resistors connects the signals EXAMPLE_SIGNAL_A and EXAMPLE_SIGNAL_B and also connects signals EXAMPLE_SIGNAL_C and EXAMPLE_SIGNAL_D. To disconnect EXAMPLE_SIGNAL_A from EXAMPLE_SIGNAL_B, the Microchip IO expander is used to change ENABLE_A to a logic 1 through software that interfaces with the Microchip. The same procedure for ENABLE_B would disconnect EXAMPLE_SIGNAL_C from EXAMPLE_SIGNAL_D.

Figure 2-2. Example of Individual FET Switches
Figure 2-3 shows the equivalent circuit to Figure 2-2 but utilizes mechanical switches that are in the same package. Notice the default is shown by black boxes located closer to the ON label of the switches. In order to disconnect these switches, physically move the switch to the OFF position.

Figure 2-3. Example of Mechanical Switch Equivalent to Figure 2-2

Figure 2-4 shows a bus switch example, reference designator UC (Pericom PI3LVD512ZHE), selecting between lettered functionality and numbered functionality. The signals on the left side are multiplexed signals with naming convention letter_number. The right side of the circuit shows the signals separated into letter and number, with the number on the lower group (eg. 0B1) and the letter on the upper group (eg. 0B2). The default setting is controlled by the signal CONTROL_LETTER_NUMBER which is pulled low. This selects the number signals on the right to be connected to the multiplexed signals on the left by default. In this example, the Microchip IO expander is not shown but controls the signal CONTROL_LETTER_NUMBER and allows the user to change the selection through software.

Figure 2-5 shows the equivalent circuit to Figure 2-4 but utilizes mechanical switches. Notice the default for reference designators SWC and SWD is illustrated by black boxes located closer to the ON label of the switches to enable the number signals by default. Also notice the default setting for reference designators SWE and SWF is OFF. In order to connect the letters instead of the numbers, the user physically changes all switches on SWC and SWD to the OFF position and all switches on SWE and SWF to the ON position.

Figure 2-4. Example of Bus Switch with Lettered and Numbered Functionality
Figure 2-4. Example of Bus Switch
SoftConfig on the ADSP-CM408F EZ-KIT Lite

Two Microchip MCP23017 GPIO expanders provide control for individual electronic switches. The TWI0 interface of the processor communicates with the Microchip devices. There are 33 individual switches with default settings that enable basic board functionality.

Table 2-1 lists the ADSP-CM408F processor and EZ-KIT Lite interfaces that are available by default. Note that only interfaces affected by software switches are listed in Table 2-1.
Software-Controlled Switches (SoftConfig)

Table 2-1. Default ADSP-CM408F Processor Interface Availability

<table>
<thead>
<tr>
<th>Interface</th>
<th>Availability by Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>UART0</td>
<td>RS-232 RX, TX and RTS enabled by default. SoftConfig required for other functionality.</td>
</tr>
<tr>
<td>UART1</td>
<td>RS-485 is connected by default but not enabled. SoftConfig is required to enable.</td>
</tr>
<tr>
<td>CAN0</td>
<td>Enabled</td>
</tr>
<tr>
<td>CAN1</td>
<td>Enabled</td>
</tr>
<tr>
<td>EMAC0</td>
<td>RMII interface, management data input/output and 50 MHz oscillator disabled by default.</td>
</tr>
<tr>
<td></td>
<td>PHYINT disconnected from processor by default.</td>
</tr>
<tr>
<td>Push buttons</td>
<td>Enabled (except for wake push button)</td>
</tr>
<tr>
<td>LEDs</td>
<td>Enabled</td>
</tr>
</tbody>
</table>

Programming SoftConfig Switches

On the ADSP-CM408F EZ-KIT Lite, two Microchip MCP23017 devices exist. Each of these devices have the following programming characteristics:

- Each switch has two programmable GPIO registers.

<table>
<thead>
<tr>
<th>GPIO Register</th>
<th>Register Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPIOA</td>
<td>0x12</td>
</tr>
<tr>
<td>GPIOB</td>
<td>0x13</td>
</tr>
</tbody>
</table>

- Each GPIO register controls eight signals (software switches).
• By default, the Microchip MCP23017 GPIO signals function as input signals.

The signals must be programmed as output signals to override their default values. The following table shows the Microchip register addresses and the values that must be written to them to program the signals as output signals.

<table>
<thead>
<tr>
<th>IODIR Register</th>
<th>IODIR Register Address</th>
<th>Value to be Written to Program Signals as Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>IODIRA</td>
<td>0x00</td>
<td>0</td>
</tr>
<tr>
<td>IODIRB</td>
<td>0x01</td>
<td>0</td>
</tr>
</tbody>
</table>

Each of the examples in the ADSP-CM40x Enablement Software include source files that program the soft switches, even if the default settings are being used. The README for each example identifies only the signals that are being changed from their default values. The code that programs the soft switches is located in the `SoftConfig_CM408F.c` file in each example.

The following tables (Table 2-2 and Table 2-3) outline the default values for each of the two Microchip MCP23017 devices.

**Table 2-2. I²C Hardware Address 0x40**

<table>
<thead>
<tr>
<th>GPIO</th>
<th>MCP23017 Register Address</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPIOA</td>
<td>0x12</td>
<td>0xE0</td>
</tr>
<tr>
<td>GPIOB</td>
<td>0x13</td>
<td>0x00</td>
</tr>
</tbody>
</table>

**Table 2-3. I²C Hardware Address 0x42**

<table>
<thead>
<tr>
<th>GPIO</th>
<th>MCP23017 Register Address</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPIOA</td>
<td>0x12</td>
<td>0xB9</td>
</tr>
<tr>
<td>GPIOB</td>
<td>0x13</td>
<td>0x3F</td>
</tr>
</tbody>
</table>
Software-Controlled Switches (SoftConfig)

The ADSP-CM408F EZ-KIT Lite Schematic shows how the two Microchip GPIO expanders are connected to the board’s ICs.

Table 2-4 and Table 2-5 show the output signals of the Microchip GPIO expander (U40), with a TWI address of 0100 001X, where X represents the read or write bit. The signals that control an individual FET have an entry under the FET column. The Component Connected column shows the board IC that is connected if the FET is enabled. The Microchip (U40) is controlling the enable signal of a FET switch. Also note that if a particular functionality of the processor signal is being used, it will be in **bold font** under the Processor Signal column.

Table 2-4. Output Signals of Microchip GPIO Expander (U40 Port A)

<table>
<thead>
<tr>
<th>Bit</th>
<th>Signal Name</th>
<th>Description</th>
<th>FET</th>
<th>Processor Signal (if applicable)</th>
<th>Component Connected</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>Not used</td>
<td></td>
<td></td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Not used</td>
<td></td>
<td></td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Not used</td>
<td></td>
<td></td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>UART0RTS_EN</td>
<td>UART0 RTS connected to RS-232</td>
<td>U13</td>
<td>PB_04/PWM2_SYNC/UART0_RTS/SPTO_ATDV/SMC0_D12/CNT1_UD</td>
<td>U36</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>transceiver</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>UART0RX_EN</td>
<td>UART0 RX connected to RS-232</td>
<td>U14</td>
<td>PC_01/UART0_RX/SMC0_A05/TM0_AC15</td>
<td>U36</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>transceiver</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>UART0CTS_EN</td>
<td>UART0 CTS disconnected from RS-232</td>
<td>U15</td>
<td>PB_05/PWM2_TRIP0/UART0_CTS/TM0_T-MR7/SMC0_D13/CNT1_DG</td>
<td>U36</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>by default</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2-4. Output Signals of Microchip GPIO Expander (U40 Port A) (Cont’d)

<table>
<thead>
<tr>
<th>Bit</th>
<th>Signal Name</th>
<th>Description</th>
<th>FET Processor Signal (if applicable)</th>
<th>Component Connected</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>UART0CTS_RTS_LPBK</td>
<td>UART0 CTS and RTS not connected; change to low for looping back RS-232 CTS and RTS signals</td>
<td>U16</td>
<td>U36</td>
<td>High</td>
</tr>
<tr>
<td>7</td>
<td>UART0CTS_RST_EN</td>
<td>UART0 CTS signal not connected to input of reset IC</td>
<td>U17</td>
<td>U36</td>
<td>High</td>
</tr>
</tbody>
</table>

Table 2-5. Output Signals of Microchip GPIO Expander (U40 Port B)

<table>
<thead>
<tr>
<th>Bit</th>
<th>Signal Name</th>
<th>Description</th>
<th>FET Processor Signal (if applicable)</th>
<th>Component Connected</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>CAN0_EN</td>
<td>Enables CAN 0, enabled by default</td>
<td>U18/ U19</td>
<td>U39</td>
<td>Low</td>
</tr>
<tr>
<td>1</td>
<td>PUSHBUTTON1_EN</td>
<td>PF_10 is used as GPIO input for push button 1, enabled by default</td>
<td>U31</td>
<td>U39</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>PUSHBUTTON2_EN</td>
<td>PE_08 is used as GPIO input for push button 2, enabled by default</td>
<td>U30</td>
<td>U39</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>LED1_GPIO_EN</td>
<td>PE_07 is used as GPIO output for LED1, enabled by default</td>
<td>U28</td>
<td>U5</td>
<td>Low</td>
</tr>
</tbody>
</table>
Table 2-5. Output Signals of Microchip GPIO Expander (U40 Port B) (Cont’d)

<table>
<thead>
<tr>
<th>Bit</th>
<th>Signal Name</th>
<th>Description</th>
<th>FET</th>
<th>Processor Signal (if applicable)</th>
<th>Component Connected</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>LED2_GPIO_EN</td>
<td>PE_06 is used as GPIO output for LED2, enabled by default</td>
<td>U27</td>
<td>PE_06/SMC0_A20</td>
<td>U5</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>LED3_GPIO_EN</td>
<td>PE_05 is used as GPIO output for LED3, enabled by default</td>
<td>U26</td>
<td>PE_05/SMC0_A19</td>
<td>U5</td>
<td>Low</td>
</tr>
<tr>
<td>6</td>
<td>LED4_GPIO_EN</td>
<td>PE_09 is used as GPIO output for LED4, enabled by default</td>
<td>U25</td>
<td>PE_09/ETH0_CRS/SMC0_A23/CNT2_UD</td>
<td>U5</td>
<td>Low</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Not used</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2-6 and Table 2-7 show the output signals of the Microchip GPIO expander (U41), with a TWI address of 0100 010X, where X represents the read or write bit. The signals that control an individual FET have an entry under the FET column. The Component Connected column shows the board IC that is connected if the FET is enabled. Note that some of the Microchip (U41) output signals are connected directly to components on the board. However, in most cases, the Microchip (U41) is controlling the enable signal of a FET switch. Also note that if a particular functionality of the processor signal is being used, it will be in **bold font** under the Processor Signal column.
Table 2-6. Output Signals of Microchip GPIO Expander (U41 Port A)

<table>
<thead>
<tr>
<th>Bit</th>
<th>Signal Name</th>
<th>Description</th>
<th>FET/ SWITCH</th>
<th>Processor Signal (if applicable)</th>
<th>Component Connected</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>RS485_RE</td>
<td>Controls RS-485 receiver enable</td>
<td></td>
<td></td>
<td>U39</td>
<td>High</td>
</tr>
<tr>
<td>1</td>
<td>RS485_DE</td>
<td>Controls RS-485 driver enable</td>
<td></td>
<td></td>
<td>U39</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>CAN1_EN</td>
<td>Enables CAN 1, enabled by default</td>
<td></td>
<td></td>
<td>U37</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>ETH0_MDIO_BUS_EN</td>
<td>Connects Ethernet management data input/output, disabled by default</td>
<td>U20/U21</td>
<td>PB_11/SINCO_D0/SPI0_D3/CAN1_TX/SINCO_CLK0/SMCO_AMSD/TMO_A-CLK1 and PB_10/ SINC0_CLK0/SPI0_D2/CAN1_RX/SMCO_AWE/TM0_ACI1</td>
<td>U43</td>
<td>High</td>
</tr>
<tr>
<td>4</td>
<td>ETHERNET_EN</td>
<td>Connects ETH0 to RMII interface of U32, by default disabled</td>
<td>U32</td>
<td>PF_00, PF_01, PE_12, PE_13, PE_14, PE_09</td>
<td>U43</td>
<td>High</td>
</tr>
<tr>
<td>5</td>
<td>PHYINT_EN¹</td>
<td>Connects Ethernet 0 interrupt signal to Ethernet PHY, not connected by default</td>
<td>U24</td>
<td>PC_06/SPI0_SEL1/PWM2_DL/SYS_D-SWAKE0</td>
<td>U43</td>
<td>High</td>
</tr>
<tr>
<td>6</td>
<td>RMII_CLK_EN</td>
<td>Enables 50 MHz oscillator, disabled by default</td>
<td>PE_15/ETH0_REF_CLK/CNT1_OUTB</td>
<td>PE_10/ETH_M-DIO/SMCO_AMS1/CNT2_DG</td>
<td>U35</td>
<td>Low</td>
</tr>
<tr>
<td>7</td>
<td>WAKE_PUSHBUTTON_EN</td>
<td>Connects processor to wake push button, disabled by default</td>
<td>U29</td>
<td>PC_06/SPI0_SEL1/PWM2_DL/SYS_D-SWAKE0ACLEK3</td>
<td></td>
<td>High</td>
</tr>
</tbody>
</table>

¹ This signal is actually active low.
Table 2-7. Output Signals of Microchip GPIO Expander
(U41 Port B)

<table>
<thead>
<tr>
<th>Bit</th>
<th>Signal Name</th>
<th>Description</th>
<th>FET/SWITCH</th>
<th>Processor Signal (if applicable)</th>
<th>Component Connected</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>DATA_LOW_EXP_EN</td>
<td>Connects signals to expansion interface connector J6, disconnected by default</td>
<td>U12</td>
<td>PC_08, PC_09, PC_10, PC_11, PC_12, PC_13, PC_14, PC_15</td>
<td>J6</td>
<td>High</td>
</tr>
<tr>
<td>1</td>
<td>DATA_HIGH_EXP_EN</td>
<td>Connects signals to expansion interface connector J6, disconnected by default</td>
<td>U11</td>
<td>PD_00, PD_01, PD_02, PD_03, PD_04, PD_05, PD_06, PD_07</td>
<td>J6</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>TRACE_EXP_EN</td>
<td>Connects signals to expansion interface connector J6, disconnected by default</td>
<td>U51, U52, U53, U54, U55</td>
<td>PE_12, PE_13, PE_09, PE_11, PE_10</td>
<td>J6</td>
<td>High</td>
</tr>
<tr>
<td>3</td>
<td>PB_08_09_EXP_EN</td>
<td>Connects signals to expansion interface connector J6, disconnected by default</td>
<td>U49/U50</td>
<td>PB_08/PWM2_BH/TM0_TMR1/ JARTI_RX/ SMC0_ARDY/TM0_ACI2 and PB_09/PWM2_BL/TM0_TMR2/JARTI_TX/SMC0_ARE</td>
<td>J6</td>
<td>High</td>
</tr>
<tr>
<td>4</td>
<td>ETH_EXP_EN</td>
<td>Connects signals to expansion interface connector J4, disconnected by default</td>
<td>U56, U57, U58, U59, U60</td>
<td>PE_12, PE_13, PE_09, PE_11, PE10</td>
<td>J4</td>
<td>High</td>
</tr>
<tr>
<td>5</td>
<td>SRAM_BYTE_EN</td>
<td>Connects SRAM ABE0/1 signals to SRAM</td>
<td>U4, U7</td>
<td>PE_12, PE_13</td>
<td>U2</td>
<td>High</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Not used</td>
<td></td>
<td></td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Not used</td>
<td></td>
<td></td>
<td></td>
<td>Low</td>
</tr>
</tbody>
</table>
Push Buttons and Switches

This section describes operation of the push buttons and switches. The push button and switch locations are shown in Figure 2-6.

Figure 2-6. Push Button and Boot Mode Switch Locations
Push Buttons and Switches

Boot Mode Select Switch (SW1)

The rotary switch (SW1) determines the boot mode of the processor. Table 2-8 shows the available boot mode settings. By default, the ADSP-CM408F processor boots from the internal SPI flash memory.

Table 2-8. Boot Mode Select Switch (SW1)

<table>
<thead>
<tr>
<th>SW1 Position</th>
<th>Processor Boot Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Boot – Idle</td>
</tr>
<tr>
<td>1</td>
<td>SPI master boot (internal SP12). Default boot mode.</td>
</tr>
<tr>
<td>2</td>
<td>SPI slave boot (SPI0)</td>
</tr>
<tr>
<td>3</td>
<td>UART boot (UART0)</td>
</tr>
</tbody>
</table>

Reset Push Button (SW2)

The reset push button (SW2) resets the following ICs: processor (U1), GPIO extender (U40), GPIO extender (U41), and Ethernet PHY (U43). The reset also is connected to the expansion interface via the SYS_HWRST signal.

GPIO Push Buttons (SW4-5)

The GPIO push buttons (SW4 and SW5) are connected to the processor’s signals PF_10/ETH0_PTPCLKIN and PE_08/ETH0_PTPPPS/SMCO_A22/CNT2_ZM, respectively. The signals are connected by default.
Wake Push Button (SW3)

The wake push button (SW3) is connected to the processor’s signal PC_06/SPI0_SELT/PWM2_DL/SYS_DSWAKE0. The signal is disconnected by default through SoftConfig.

Jumpers

This section describes functionality of the configuration jumpers. Figure 2-7 shows the jumper locations.

Figure 2-7. Jumper Locations
Jumpers

**VREF1 External Source Jumper (JP1)**

The VREF1 external source jumper (JP1) selects whether an internal or external voltage reference supplies the VREF1 signal of the processor. When a jumper on JP1 is not installed (default), the internal voltage reference supplies VREF1. When a jumper on JP1 is installed, the external Analog Devices ADR441 ultra-low noise voltage reference (U47) supplies VREF1. Configure the processor’s registers accordingly for the latter case.

**Power Select Jumper (JP2)**

The power select jumper (JP2) selects the wall power (5V) when a jumper is placed on positions 1 and 2. When a jumper is placed on positions 2 and 3, power from pins 177, 178, 179 and 180 of the PWM connector (J6) is supplied to the board. The default setting is positions 1 and 2, which selects wall power.

**Buffer Input Select Jumper (JP3)**

The buffer input select jumper (JP3) selects the input to the ADA4889 unity gain op amp buffer (U33). The processor’s internal input is selected by placing a jumper on pins 1 and 2 of JP3 (default).

The external VREF0 input, supplied by the Analog Devices ADR441 ultra-low noise voltage reference (U6), is selected by placing a jumper on pins 2 and 3 of JP3.
VREF0 External Source Jumper (JP4)

The VREF0 external source jumper (JP4) selects whether an internal or external voltage reference supplies the VREF0 signal of the processor. When a jumper on JP4 is not installed (default), the internal voltage reference supplies VREF0. When a jumper on JP4 is installed, the external Analog Devices ADR441 ultra-low noise voltage reference (U6) supplies VREF0. Configure the processor’s registers accordingly for the latter case.

Power Jumpers (P4-7)

Remove jumpers listed in Table 2-9 to measure the respective voltage across the adjacent sense resistor.

Table 2-9. Power Jumpers

<table>
<thead>
<tr>
<th>Power Jumper</th>
<th>Resistor</th>
</tr>
</thead>
<tbody>
<tr>
<td>P4</td>
<td>USB_VBUS</td>
</tr>
<tr>
<td>P5</td>
<td>VDD_EXT</td>
</tr>
<tr>
<td>P6</td>
<td>VDD_INT</td>
</tr>
<tr>
<td>P7</td>
<td>3.3V</td>
</tr>
</tbody>
</table>
This section describes the on-board LEDs. Figure 2-8 shows the LED locations.

Figure 2-8. LED Locations
GPIO LEDs (LED1–4)

Four LEDs are connected to the general-purpose I/O pins of the processor (see Table 2-10). The LEDs are active high and are ON (amber) by writing a 1 to the correct processor signal.

Table 2-10. GPIO LEDs

<table>
<thead>
<tr>
<th>LED Reference Designator</th>
<th>Processor Programmable Flag Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED1</td>
<td>PE_07</td>
</tr>
<tr>
<td>LED2</td>
<td>PE_06</td>
</tr>
<tr>
<td>LED3</td>
<td>PE_05</td>
</tr>
<tr>
<td>LED4</td>
<td>PE_09</td>
</tr>
</tbody>
</table>

Reset LED (LED5)

When LED5 is ON (red), it indicates that the master reset of all the major ICs is active. The reset LED is controlled by the Analog Devices ADM708 supervisory reset circuit. A master reset is asserted by pressing SW2 which activates LED5. For more information, see Reset Push Button (SW2).

Ethernet Speed LED (LED6)

The Ethernet speed LED (LED6) is a green LED that shows the connection speed when the Ethernet is enabled. When LED6 is ON, the speed is 100 Mb/s; when LED6 is OFF, the speed is 10 Mb/s. For more information, see Ethernet Interface.
**LEDs**

**Power LED (LED7)**

When LED7 is **ON** (green), it indicates that power is being supplied to the board properly. For more information, see *Power Architecture*.

**SYS_FAULT LED (LED8)**

When SYS_FAULT LED LED8 (red) is **ON**, it indicates a system fault. For more information, refer to the *ADSP-CM40x Mixed-Signal Control Processor Hardware Reference*. 
Connectors

This section describes connector functionality and provides information about mating connectors. The connector locations are shown in Figure 2-9.

Figure 2-9. Connector Locations

Connectors on the back of the board are noted with dotted lines.
## Connectors

### Ethernet Connector (J1)

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>RJ45</td>
<td>PULSE ELECTRONICS</td>
<td>J0011D21BNL</td>
</tr>
<tr>
<td>Mating Cable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard Ethernet cable</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### RS-485 Connector (J2)

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB9 female</td>
<td>NORCOMP</td>
<td>191-009-213-L-571</td>
</tr>
</tbody>
</table>

### DCE UART Connector (J3)

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB9 female</td>
<td>NORCOMP</td>
<td>191-009-213-L-571</td>
</tr>
</tbody>
</table>

### Asynch or Memory Connector (J4)

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>180-pin high speed socket</td>
<td>SAMTEC</td>
<td>QSH-090-F-D_A</td>
</tr>
<tr>
<td>Mating Connector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>180-pin high speed header</td>
<td>SAMTEC</td>
<td>QTH-090-01-F-D-A</td>
</tr>
</tbody>
</table>
Character Display Connector (J5)

The character display connector (J5) is a socket that mates with the 20 x 2 character display.

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDC 5x2 SMT</td>
<td>SAMTEC</td>
<td>SSW-105-22-F-D-VS</td>
</tr>
<tr>
<td>Mating Connector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20x2 character display with back-light</td>
<td>NEW HAVEN DISPLAY</td>
<td>NHD-0220D3Z-FL-GBW (requires header)</td>
</tr>
</tbody>
</table>

PWM Connector (J6)

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>180-pin high speed socket</td>
<td>SAMTEC</td>
<td>QSH-090-F-D_A</td>
</tr>
<tr>
<td>Mating Connector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>180-pin high speed header</td>
<td>SAMTEC</td>
<td>QTH-090-01-F-D-A</td>
</tr>
</tbody>
</table>

CAN0 Connector (J7)

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>RJ11 vertical</td>
<td>DIGIKEY</td>
<td>A31431-ND</td>
</tr>
<tr>
<td>Mating Connector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RJ11 cable</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Connectors

**CAN1 Connector (J8)**

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>RJ11 vertical</td>
<td>DIGIKEY</td>
<td>A31431-ND</td>
</tr>
</tbody>
</table>

Mating Connector

RJ11 cable

**Analog Connector (J9)**

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>120-pin high speed socket</td>
<td>SAMTEC</td>
<td>QSH-060-F-D_A</td>
</tr>
</tbody>
</table>

Mating Connector

120-pin high speed header

**JTAG/SWD Connector (P1)**

The JTAG/SWD/SWV header (P1) provides debug connectivity for the microprocessor. This is a 0.1” connector from SAMTEC (SHF-110-01-L-D-TH). For more information, see Debug Interface.

**TRACE and JTAG/SWD/SWV Connector (P2)**

The TRACE and JTAG/SWD/SWV Connector (P1) provides connectivity to the microprocessor’s trace interface. This is a 0.05” connector from TE Connectivity (5103308-5).

Pin 7 is cut to provide keying.

Refer to the SoftConfig tables for information on enabling the Trace signals, specifically the TRACE_EXP_EN signal.
USB Connector (P3)

USB FS only mode.

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB mini-B</td>
<td>MOLEX</td>
<td>56579-0576</td>
</tr>
</tbody>
</table>

IEEE 1588 Connector (P8)

P8 allows probing of Ethernet IEEE 1588 signals. P8 is a 0.1” header and the pinout can be found in ADSP-CM408F EZ-KIT Lite Schematic.

Power Connector (P9)

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.65 mm power jack</td>
<td>CUI</td>
<td>045-0883R</td>
</tr>
</tbody>
</table>

Mating Connector

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="mailto:5.0VDC@3.6A">5.0VDC@3.6A</a> power supply</td>
<td>GLOBETEK</td>
<td>GS-1750(R)</td>
</tr>
</tbody>
</table>

VREF Buffered Connector (P10)

The VREF buffered connector provides a means to measure the voltage of the voltage reference. There is an adjacent analog grounding point (TP13).
The bill of materials corresponds to ADSP-CM408F EZ-KIT Lite Schematic.

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Qty</th>
<th>Description</th>
<th>Reference Designator</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>ADM708SARZ SOIC8</td>
<td>U42</td>
<td>ANALOG DEVICES</td>
<td>ADM708SARZ</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>ADR441ARMZ MSOP8</td>
<td>U6,U47</td>
<td>ANALOG DEVICES</td>
<td>ADR441ARMZ</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>ADP2118ACPZ QFN65P400X400X80-17N</td>
<td>VR2</td>
<td>ANALOG DEVICES</td>
<td>ADP2118ACPZ</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>ADP2119ACPZ-R7 DFN50P300X300-11N</td>
<td>VR1</td>
<td>ANALOG DEVICES</td>
<td>ADP2119ACPZ-R7</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>ADA4899 SOIC8</td>
<td>U33</td>
<td>ANALOG DEVICES</td>
<td>ADA4899-1YRDZ-R7</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>ADM2682E SOIC127P1032X265-16N</td>
<td>U39</td>
<td>ANALOG DEVICES</td>
<td>ADM2682EBRIZ</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>ADM3252E BGA44C100P11X11_1 200X1200X103</td>
<td>U36</td>
<td>ANALOG DEVICES</td>
<td>ADM3252EABCZ</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>ADM3053 SOIC127P1032X265-20N</td>
<td>U37,U38</td>
<td>ANALOG DEVICES</td>
<td>ADM3053BRWZ</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>ADSP-CM408BSWZ LQFP176_EP</td>
<td>U1</td>
<td>ANALOG DEVICES</td>
<td>ADSP-CM408FBSWZENG</td>
</tr>
<tr>
<td>Ref.</td>
<td>Qty.</td>
<td>Description</td>
<td>Reference Designator</td>
<td>Manufacturer</td>
<td>Part Number</td>
</tr>
<tr>
<td>------</td>
<td>------</td>
<td>---------------------</td>
<td>----------------------</td>
<td>--------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>10</td>
<td>62</td>
<td>0.1UF 10V 10% 0402</td>
<td>C1,C5-C7,C1 7,C18,C22,C2 5,C26,C29,C3 1,C34-C36,C4 0,C43,C45,C48,C50,C54-C56,C59,C60,C62-C65,C67,C68,C72,C78,C79,C101,C102,C104,C109,C119,C120,C122-C125,C128-C130,C132,C135,C136,C138,C139,C143,C148-C150,C153-C157,C174,C179</td>
<td>AVX</td>
<td>0402ZD104KAT2A</td>
</tr>
<tr>
<td>11</td>
<td>74</td>
<td>0.01UF 16V 10% 0402</td>
<td>C2,C8,C9,C19-C21,C24,C30-C32,C33,C46,C47,C49,C51,C53,C61,C66,C69-C71,C73-C76,C80-C90,C92,C110-C118,C121,C131-C134,C141,C144,C151,C152,C158-C173,C175-C178,C180,C181</td>
<td>AVX</td>
<td>0402YC103KAT2A</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>4.7UF 25V 20% 0805</td>
<td>C142</td>
<td>AVX</td>
<td>0805ZD475KAT2A</td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>10UF 16V 10% 1210</td>
<td>C98</td>
<td>AVX</td>
<td>1210YD106KAT2A</td>
</tr>
<tr>
<td>14</td>
<td>2</td>
<td>1000PF 50V 5% 1206</td>
<td>C97,C99</td>
<td>AVX</td>
<td>12065A102JAT2A</td>
</tr>
</tbody>
</table>
### ADSP-CM408F EZ-KIT Lite Bill Of Materials

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Qty.</th>
<th>Description</th>
<th>Reference Designator</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>2</td>
<td>680 1/16W 1% 0402</td>
<td>R210,R211</td>
<td>BC COMPONENTS</td>
<td>2312 275 16801</td>
</tr>
<tr>
<td>16</td>
<td>1</td>
<td>1.5UH 20% IND003</td>
<td>L2</td>
<td>COIL CRAFT</td>
<td>DO1608C-152MLC</td>
</tr>
<tr>
<td>17</td>
<td>1</td>
<td>1.5UH 20% INDC4040X210N</td>
<td>L1</td>
<td>COIL CRAFT</td>
<td>XAL4020-152MEB</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>ROTARY SWT027</td>
<td>SW1</td>
<td>COPAL</td>
<td>S-8110</td>
</tr>
<tr>
<td>19</td>
<td>1</td>
<td>CY7C1041CV33 BGA48_75_810</td>
<td>U2</td>
<td>CYPRESS</td>
<td>CY7C1041DV33-10BVXI</td>
</tr>
<tr>
<td>20</td>
<td>1</td>
<td>PWR .65MM CON045</td>
<td>P9</td>
<td>DIGI-KEY</td>
<td>CP1-023-ND</td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>50MHZ OSC012</td>
<td>U35</td>
<td>DIGI-KEY</td>
<td>300-8264-2-ND</td>
</tr>
<tr>
<td>22</td>
<td>2</td>
<td>MCP23017 QFN65P600X600-29N</td>
<td>U40,U41</td>
<td>DIGI-KEY</td>
<td>MCP23017-E/ML-ND</td>
</tr>
<tr>
<td>23</td>
<td>2</td>
<td>1UF 16V 10% 0805</td>
<td>C95,C96</td>
<td>DIGI-KEY</td>
<td>399-1284-2-ND</td>
</tr>
<tr>
<td>24</td>
<td>2</td>
<td>GREEN LED_0603</td>
<td>LED6,LED7</td>
<td>DIGI-KEY</td>
<td>475-1409-2-ND</td>
</tr>
<tr>
<td>25</td>
<td>3</td>
<td>0.1UF 16V 10% 0402</td>
<td>C37-C39</td>
<td>DIGI-KEY</td>
<td>587-1451-2-ND</td>
</tr>
<tr>
<td>26</td>
<td>1</td>
<td>15KV ESDA6V1SC SOT95P280-6N</td>
<td>D4</td>
<td>DIGI-KEY</td>
<td>497-6637-1-ND</td>
</tr>
<tr>
<td>27</td>
<td>1</td>
<td>30MHZ OSC012</td>
<td>U34</td>
<td>DIGI-KEY</td>
<td>300-8257-1-ND</td>
</tr>
<tr>
<td>28</td>
<td>2</td>
<td>RED LED_0603</td>
<td>LED5,LED8</td>
<td>DIGI-KEY</td>
<td>475-2512-2-ND</td>
</tr>
<tr>
<td>29</td>
<td>4</td>
<td>YELLOW LED_0603</td>
<td>LED1,LED4</td>
<td>DIGI-KEY</td>
<td>475-2558-1-ND</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
<td>10UF 6.3V 20% 0402</td>
<td>C14</td>
<td>DIGI-KEY</td>
<td>445-8920-1-ND</td>
</tr>
<tr>
<td>31</td>
<td>1</td>
<td>SN74CB3Q3245 TSSOP20</td>
<td>U32</td>
<td>DIGI-KEY</td>
<td>296-19130-1-ND</td>
</tr>
<tr>
<td>32</td>
<td>1</td>
<td>MIC2025-1 SOIC8</td>
<td>U44</td>
<td>DIGI-KEY</td>
<td>576-1057-ND</td>
</tr>
<tr>
<td>33</td>
<td>1</td>
<td>STD2805T4 TO228P972X240-3N</td>
<td>Q1</td>
<td>DIGI-KEY</td>
<td>497-7465-1-ND</td>
</tr>
<tr>
<td>34</td>
<td>8</td>
<td>IDC 2PIN_ JUMPER_SHORT</td>
<td>SJ1-SJ8</td>
<td>DIGI-KEY</td>
<td>S9001-ND</td>
</tr>
<tr>
<td>Ref.</td>
<td>Qty.</td>
<td>Description</td>
<td>Reference Designator</td>
<td>Manufacturer</td>
<td>Part Number</td>
</tr>
<tr>
<td>------</td>
<td>------</td>
<td>-------------</td>
<td>---------------------</td>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>35</td>
<td>1</td>
<td>150UF 10V 10% D</td>
<td>CT2</td>
<td>DIGI-KEY</td>
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### ADSP-CM408F EZ-KIT Lite Bill Of Materials

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<th>Manufacturer</th>
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4Mb (256K x 16) SRAM

3.3V

TWI address 0100 000x
where x is the R/W bit. Read - 1, Write - 0

TWI address 0100 010x
where x is the R/W bit. Read - 1, Write - 0

ANALOG DEVICES
ADSP-CM408F EZ-KIT
MEMORY AND SOFTCONFIG

PH: 1-800-ANALOGD
Nashua, NH 03063
20 Cotton Road
20 X 2 Character Display

TWI address 1010 000x
where x is the R/W bit. Read - 1, Write - 0

BOOT MODE SWITCH (SW1)

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<tr>
<td>01</td>
<td>SPI Master Boot (internal SPI2)</td>
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<tr>
<td>10</td>
<td>SPI Slave Boot (SPI0)</td>
</tr>
<tr>
<td>11</td>
<td>UART Boot (UART0)</td>
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</tbody>
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BOOT MODE
Place between pins 6 and 7  
Place between pins 8 and 9  
Place between pins 11 and 12  
Place between pins 19 and 20
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