

# **ADSP-BF609 EZ-KIT Lite® Evaluation System Manual**

Revision 1.0, March 2012

Part Number  
82-000269-01

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## Regulatory Compliance

The ADSP-BF609 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-BF609 EZ-KIT Lite is currently being processed for certification that it complies 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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# PREFACE

Thank you for purchasing the ADSP-BF609 EZ-KIT Lite<sup>®</sup>, Analog Devices, Inc. low-cost evaluation system for the ADSP-BF60x Blackfin<sup>®</sup> processors.

The ADSP-BF609 processor is a member of the Blackfin family of products, incorporating the Analog Devices/Intel Micro Signal Architecture (MSA). Blackfin processors combine a dual-MAC state-of-the-art signal processing engine, the advantages of a clean, orthogonal RISC-like microprocessor instruction set, and single-instruction, multiple-data (SIMD) multimedia capabilities into a single instruction-set architecture.

ADSP-BF60x Blackfin processors embody a new type of embedded processor designed specifically to meet the computational demands and power constraints of today's automotive systems, embedded industrial, instrumentation, and power/motor control applications.

The evaluation board is designed to be used in conjunction with the CrossCore<sup>®</sup> Embedded Studio (CCES) development tools to test capabilities of the ADSP-BF60x Blackfin processors. The CCES 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

## Product Overview

- Read and write core and peripheral registers
- Plot memory

Access to the processor from a personal computer (PC) is achieved through a USB port (when a debug agent is mounted on the EZ-KIT Lite board) or an external JTAG emulator. The USB interface provides unrestricted access to the ADSP-BF609 processor and evaluation board peripherals. Analog Devices JTAG emulators offer faster communication between the host PC and target hardware. Analog Devices carries a wide range of in-circuit emulation products. To learn more about Analog Devices emulators and processor development tools, go to:

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

The ADSP-BF609 EZ-KIT Lite provides example programs to demonstrate the product capabilities.



The ADSP-BF609 EZ-KIT Lite software is part of the EZ-Board BSP (Board Support Package) for the Blackfin ADSP-BF60x family which needs to be installed after CrossCore Embedded Studio. The EZ-KIT Lite is a licensed product that offers an unrestricted evaluation license for 90 days after activation. For more information, refer to “[Evaluation License Restrictions](#)” on page 1-10 in this manual and the *Installation Quick Reference Card*.

## Product Overview

The board features:

- Analog Devices ADSP-BF609 Blackfin processor
  - 349-pin LFBGA package
  - 25 MHz CLKIN oscillator
  - 48 MHz USB CLKIN

- Double Data Rate SynchronousDynamic Random-Access Memory (DDR2 SDRAM)
  - Micron MT47H64M16HR-3
  - 64M x 16 bit (1 Gb)
- Burst flash memory
  - Micron PC28F128P33T85B
  - 16M x 16-bit (32 MB) flash memory
- Quad Serial Peripheral Interface (SPI)
  - Winbond W25Q32
  - 32 Mb serial flash memory
- Ethernet PHY
  - National Semiconductor
  - DP83848C 10/100 PHY
  - Two LEDs integrated into the RJ-45 connector: link/activity
- Universal Asynchronous Receiver/Transmitter (UART)
  - ADM3315 RS-232 line driver/receiver
  - DB9 female connector
- Temp sensor
  - On Semiconductor
  - ADM1032 two-wire sensor

## Product Overview

- Controller Area Network (CAN)
  - NXP TJA1041
  - RJ-11 connector
- Debug interface
  - JTAG header for use with ADI emulators
  - Standalone debug agent
- LEDs
  - Eight LEDs: one power (green), one board reset (red), one temperature limit (amber), Ethernet speed (green), and four general-purpose (amber)
- Push buttons
  - Four push buttons: one reset, one wake, and two IRQ/flag
- Expansion Interface 3 (EI3)
  - Next generation of the expansion interface design, provides access to most of the processor signals
- Power supply
  - CE approved
  - 5V @ 3.6 Amps
- Other features
  - Link port connectors
  - SD/MMC memory connector
  - Rotary encoder
  - MP JTAG in and out connectors
  - 0.05-ohm resistors for processor current measurement

- JTAG ICE 14-pin header
- USB cable

Traditional mechanical switches for changing the board's factory setup have been removed in favor of I<sup>2</sup>C controlled software switches. The only remaining mechanical switches are the JTAG switches, boot mode switch, and push buttons. The JTAG switches are provided for setting up single-processor JTAG communications or multiple-processor configurations.

For information about the hardware components of the EZ-KIT Lite, refer to [“ADSP-BF609 EZ-KIT Lite Bill Of Materials” on page A-1](#).

## Purpose of This Manual

The *ADSP-BF609 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-BF609 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 Analog Devices processors. This manual assumes that the audience has a working knowledge of the appropriate processor architecture, instruction set, and C/C++ programming languages.

Programmers who are unfamiliar with Analog Devices processors can use this manual, but should supplement it with other texts (such as the *ADSP-BF60x Blackfin Processor Hardware Reference* and *Blackfin Processor Programming Reference*) that describe your target architecture.

## Manual Contents

Programmers who are unfamiliar with CrossCore Embedded Studio should refer to the CCES online help.

## Manual Contents

The manual consists of:

- Chapter 1, [“Using ADSP-BF609 EZ-KIT Lite” on page 1-1.](#)  
Describes EZ-KIT Lite functionality from a programmer’s perspective and provides a simplified memory map of the processor.
- Chapter 2, [“ADSP-BF609 EZ-KIT Lite Hardware Reference” on page 2-1.](#)  
Provides information about the EZ-KIT Lite hardware components.
- Appendix A, [“ADSP-BF609 EZ-KIT Lite Bill Of Materials” on page A-1.](#)  
Provides a list of hardware components used to manufacture the EZ-KIT Lite board.
- Appendix B, [“ADSP-BF609 EZ-KIT Lite Schematic” on page B-1.](#)  
Lists the resources for board-level debugging.

## What’s New in This Manual

This is the first revision (Revision 1.0) of the *ADSP-BF609 EZ-KIT Lite Evaluation System 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](http://www.analog.com/processors/technical_support)
- E-mail tools questions to [processor.tools.support@analog.com](mailto:processor.tools.support@analog.com)
- E-mail processor questions to [processor.support@analog.com](mailto:processor.support@analog.com) (World wide support)  
[processor.china@analog.com](mailto: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:  
Analog Devices, Inc.  
One Technology Way  
P.O. Box 9106  
Norwood, MA 02062-9106  
USA

## Supported Processors

This evaluation system supports Analog Devices ADSP-BF609 Blackfin embedded processors.

# Product Information

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

## Analog Devices Web Site

The Analog Devices Web site, [www.analog.com](http://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](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](http://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](http://myAnalog.com) provides access to books, application notes, data sheets, code examples, and more.

Visit [myAnalog.com](http://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.

## Related Documents

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

Table 1. Related Processor Publications

| Title                                                                                               | Description                                                                   |
|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| <i>ADSP-BF606/ADSP-BF607/ADSP-BF608/ADSP-BF609 Blackfin Dual Core Embedded Processor Data Sheet</i> | General functional description, pinout, and timing of the processor           |
| <i>ADSP-BF60x Blackfin Processor Hardware Reference</i>                                             | Description of the internal processor architecture and all register functions |
| <i>Blackfin Processor Programming Reference</i>                                                     | Description of all allowed processor assembly instructions                    |

Table 2. Related CCES Publications

| Title                                                                                      | Description                                                                |
|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| <i>CrossCore Embedded Studio Assembler and Preprocessor Manual</i>                         | Description of the assembler functions and commands                        |
| <i>CrossCore Embedded Studio C/C++ Compiler and Library Manual for Blackfin Processors</i> | Description of the compiler functions and commands for Blackfin processors |
| <i>CrossCore Embedded Studio Linker and Utilities Manual</i>                               | Description of the linker functions and commands                           |
| <i>CrossCore Embedded Studio Loader and Utilities Manual</i>                               | Description of the loader/splitter functions and commands                  |

# Notation Conventions

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

| Example                                                                             | Description                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Close</b> command<br>( <b>File</b> menu)                                         | Titles in reference sections indicate the location of an item within the CCES environment's menu system (for example, the <b>Close</b> command appears on the <b>File</b> menu).                                                                                                                                                               |
| {this   that}                                                                       | Alternative required items in syntax descriptions appear within curly brackets and separated by vertical bars; read the example as <i>this</i> or <i>that</i> . One or the other is required.                                                                                                                                                  |
| [this   that]                                                                       | Optional items in syntax descriptions appear within brackets and separated by vertical bars; read the example as an optional <i>this</i> or <i>that</i> .                                                                                                                                                                                      |
| [this,...]                                                                          | Optional item lists in syntax descriptions appear within brackets delimited by commas and terminated with an ellipse; read the example as an optional comma-separated list of <i>this</i> .                                                                                                                                                    |
| .SECTION                                                                            | Commands, directives, keywords, and feature names are in text with letter gothic font.                                                                                                                                                                                                                                                         |
| <i>filename</i>                                                                     | Non-keyword placeholders appear in text with italic style format.                                                                                                                                                                                                                                                                              |
|  | <b>Note:</b> For correct operation, ...<br>A Note provides supplementary information on a related topic. In the online version of this book, the word <b>Note</b> appears instead of this symbol.                                                                                                                                              |
|  | <b>Caution:</b> Incorrect device operation may result if ...<br><b>Caution:</b> Device damage may result if ...<br>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 <b>Caution</b> appears instead of this symbol. |
|  | <b>Warning:</b> Injury to device users may result if ...<br>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 <b>Warning</b> appears instead of this symbol.                              |

# 1 USING ADSP-BF609 EZ-KIT LITE

This chapter provides information to assist you with development of programs for the ADSP-BF609 EZ-KIT Lite evaluation system.

The following topics are covered.

- “Package Contents” on page 1-2
- “ADSP-BF609 EZ-Board” on page 1-3
- “Default Configuration” on page 1-3
- “Supported Operating Systems ” on page 1-5
- “System Requirements” on page 1-5
- “EZ-KIT Lite Installation” on page 1-6
- “EZ-KIT Lite Session Startup” on page 1-7
- “Evaluation License Restrictions” on page 1-10
- “Memory Map” on page 1-10
- “DDR2 SDRAM” on page 1-12
- “SMC Interface” on page 1-13
- “Ethernet Interface” on page 1-13
- “USB OTG HS Interface” on page 1-14
- “CAN Interface” on page 1-14

## Package Contents

- “UART Interface” on page 1-15
- “Rotary Encoder Interface” on page 1-16
- “Temperature Sensor Interface” on page 1-17
- “Link Ports Interface” on page 1-17
- “General-Purpose I/O (GPIO)” on page 1-18
- “JTAG Interface” on page 1-18
- “Power-On-Self Test” on page 1-20
- “Expansion Interface III” on page 1-20
- “Power Architecture” on page 1-21
- “Power Measurements” on page 1-21
- “Example Programs” on page 1-22
- “Reference Design Information” on page 1-22

For information about the CCES graphical user interface (GUI), including the boot loading, target options, and other facilities of the EZ-KIT Lite system, refer to the online help.

For detailed information about the ADSP-BF609 Blackfin processor, see documents referred to as [Related Documents](#).

## Package Contents

Your ADSP-BF609 EZ-KIT Lite package contains the following items.

- ADSP-BF609 EZ-KIT Lite board
- Standalone debug agent (SADA2)

- USB cable
- 5 in 1 USB cable kit
- CE approved power supply
- Ethernet cable
- 2 GB memory card
- 4 nylon standoffs
- 4 nylon hex nuts



With the standalone debug agent removed, the board can connect to an Analog Devices emulator: USB, HP-USB, or ICE-100B.

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

## ADSP-BF609 EZ-Board

The product ADSP-BF609 EZ-KIT Lite with the Stand Alone Debug Agent removed is referred to as the ADSP-BF609 EZ-Board®.

The EZ-Board requires an Analog Devices USB-based emulator (USB, HP-USB, or ICE-100B).

## Default Configuration

The ADSP-BF609 EZ-KIT Lite board is designed to run as a standalone 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.

## Default Configuration

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.



Figure 1-1 shows the default jumper and switch settings and LED used in installation. There are four nylon standoffs in a bag included in the box. They can be installed in the four corner mounting holes (MH1, MH7, MH8, MH9) if desired. Place the nylon standoff in the hole and tighten a hex nut on each. Confirm that your board is in the default configuration before using the board.

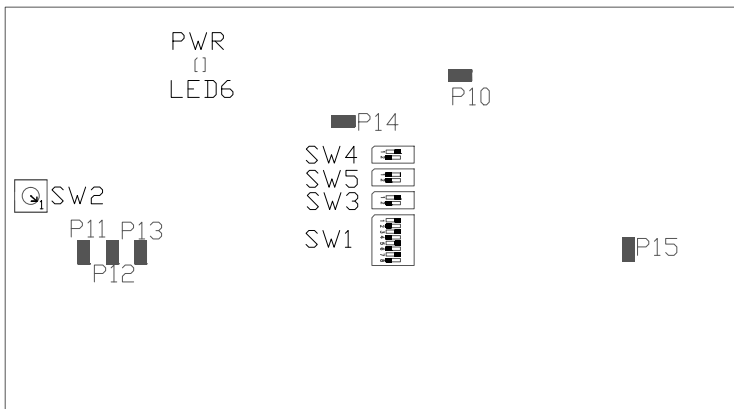


Figure 1-1. EZ-KIT Lite Hardware Setup

## Supported Operating Systems

CCES 1.0.0 is supported on the following operating systems:

- Windows<sup>®</sup> XP Professional SP3 (32-bit only)
- Windows Vista<sup>™</sup> Business, Enterprise, or Ultimate SP2 (32-bit only)
- Windows 7 Professional, Enterprise, or Ultimate (32- and 64-bit)



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

## System Requirements

Verify that your PC has these minimum requirements for the CCSE 1.0.0 installation:

- 2 GHz single-core processor
- 1 GB RAM
- 8 GB available disk space
- One open USB port



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

# EZ-KIT Lite Installation

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

**Step 1:** Attach the provided USB plugs (labeled `Mini` and `Male`) to the provided USB cable.

**Step 2:** Connect the EZ-KIT Lite board to a personal computer (PC) running CCES.

There are two connection options: using an Analog Devices emulator or using the standalone debug agent.

### Using an Emulator:

1. Plug one side of the assembled USB cable into the USB connector of the emulator. Plug the other side into a USB port of the PC running CCES.
2. Attach the emulator to the header connector `P1` (labeled `JTAG`) on the EZ-KIT Lite board.

### Using the Debug Agent:

1. Attach the standalone debug agent to connectors `P1` and `ZP1` of the EZ-KIT Lite board.
2. Plug one side of the provided USB cable into the USB connector of the debug agent `ZP1` (labeled `USB`). Plug the other side of the cable into a USB port of the PC running CCES.

**Step 3:** Attach the provided cord and appropriate plug to the 5V power adaptor.

1. Plug the jack-end of the assembled power adaptor into the power connector P18 (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 LED6) lights green when power is applied to the board.
3. Power the emulator. Plug the jack-end of the assembled power adaptor into the emulator and plug the other side of the power adaptor into a power outlet. The ENABLE/POWER indicator lights green.

**Step 4 (if connected through the debug agent):** Verify that the yellow USB monitor LED and the green powerLED on the debug agent are both on. This signifies that the board is communicating properly with the host PC and ready to run CCES.

## EZ-KIT Lite Session Startup

It is assumed that the CrossCore Embedded Studio software is installed and running on your PC.



Note: If you connect the board or emulator first (before installing CCES) to the PC, the Windows driver wizard may not find the board drivers.

1. Navigate to the CCES environment via the **Start** menu.

Note that CCES is not connected to the target board.

## EZ-KIT Lite Session Startup

2. Use a debug configuration to connect to the EZ-KIT Lite board.

If a debug configuration exists already, select the appropriate configuration and click **Apply and Debug** or **Debug**. Go to step 9.

To create a debug configuration:

- Click the down arrow next to the little bug icon, select **Debug Configurations**, or
  - Choose **Run > Debug Configurations**.
3. (To create a new debug configuration) Select **CrossCore Embedded Studio Application** and click  (New launch configuration).

The **Select Processor** page of the **Session Wizard** appears on the screen.

4. Ensure **Blackfin** is selected in **Processor family**. In **Processor type**, select **ADSP-BF609**. Click **Next**.

The **Select Connection Type** page of the **Session Wizard** appears on the screen.

5. Select one of the following:
  - For standalone debug agent connections, **EZ-KIT Lite** and click **Next**.
  - For emulator connections, **Emulator** and click **Next**.

The **Select Platform** page of the **Session Wizard** appears on the screen.

6. Do one of the following:

- For standalone debug agent connections, ensure that the selected platform is **ADSP-BF609 EZ-KIT Lite via Debug Agent**.
- For emulator connections, choose the type of emulator that is connected to the board.

7. Click **Finish** to close the wizard.

The new debug configuration is created and added to the program(s) to load list.

8. In the **Program(s) to load** section, choose the program to load when connecting to the board. If not loading any program upon connection to the target, do not make any changes.

Note that while connected to the target, there is no way to choose a program to download. To load a program once connected, terminate the session.

 To delete a configuration, go to the **Debug Configurations** dialog box and select the configuration to delete. Click  and choose **Yes** when asked if you wish to delete the selected launch configuration. Then **Close** the dialog box.

 To disconnect from the target board, click the terminate button (red box) or choose **Run > Terminate**.

To delete a session, choose **Target > Session > Session List**. Select the session name from the list and click **Delete**. Click **OK**.

# Evaluation License Restrictions

The ADSP-BF609 EZ-KIT Lite software is part of the EZ-Board BSP (Board Support Package) for the Blackfin ADSP-BF60x family. The EZ-KIT Lite is a licensed product that offers an unrestricted evaluation license for 90 days after activation. Once the evaluation period ends, the evaluation license becomes permanently disabled. If the evaluation license is installed but not activated, it allows 10 days of unrestricted use and then becomes disabled. The license can be re-enabled by activation.

An evaluation license can be upgraded to a full license. Licenses can be purchased from:

- Analog Devices directly. Call (800) 262-5645 or 781-937-2384 or go to:  
[http://www.analog.com/en/content/buy\\_online/fca.html](http://www.analog.com/en/content/buy_online/fca.html).
- Analog Devices, Inc. local sales office or authorized distributor. To locate one, go to:  
<http://www.analog.com/salesdir/continent.asp>.



The EZ-KIT Lite hardware must be connected and powered up to use CCES with a valid evaluation or full license.

## Memory Map

The ADSP-BF609 processor has a single unified 4G memory space for instructions and data storage. See [Figure 1-2](#). The processor's memory details can be found in the *ADSP-BF60x Blackfin Processor Hardware Reference*.

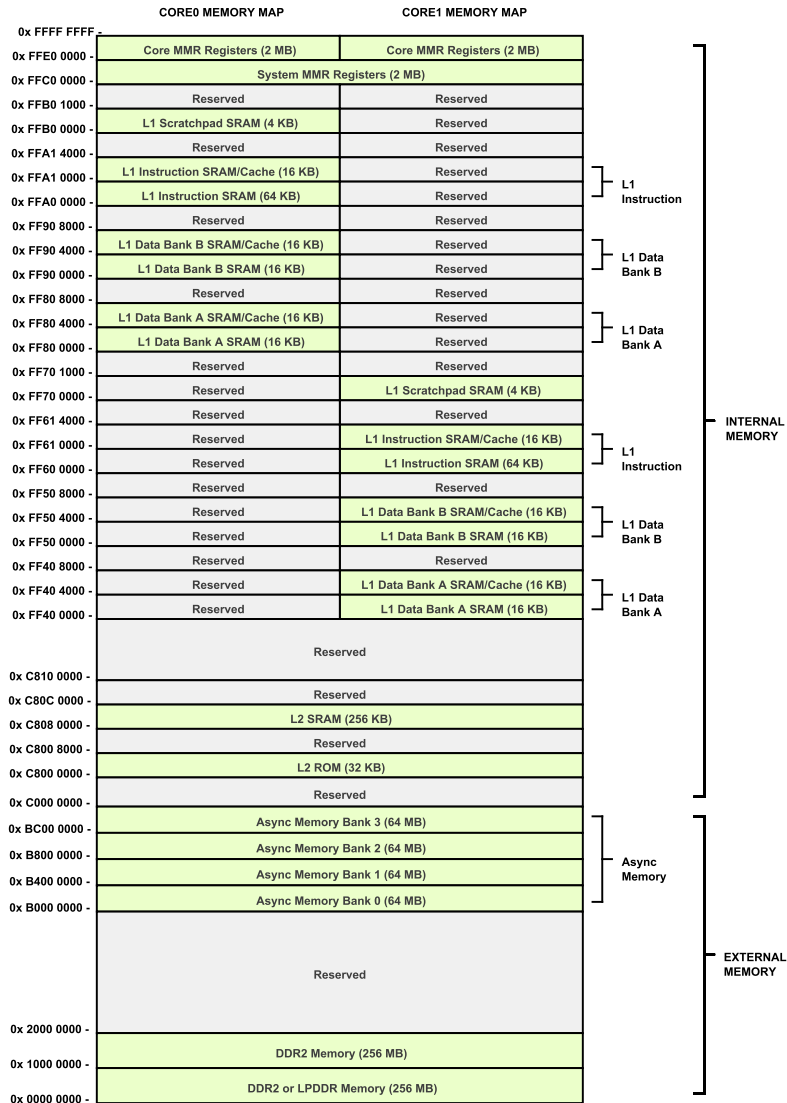


Figure 1-2. ADSP-BF609 Processor Memory Map

## DDR2 SDRAM

The board has a 16M x 16-bit burst flash memory connected to the processor's Static Memory Controller (SMC). The processor also is connected to a 32 Mb quad serial flash memory via the Serial Peripheral Interface (SPI). Both flash memories can be used for non-volatile data storage and processor boot.

## DDR2 SDRAM

The ADSP-BF609 processor connects to a 128 MB Micron MT47H64M16HR-3 chip through the Double Data Rate Synchronous Dynamic Random-Access Memory (DDR2 SDRAM) controller. The DDR2 memory controller on the processor and DDR2 memory chip are powered by the on-board 1.8V regulator. Data is transferred between the processor and DDR2 on both the rising and falling edges of the DDR2 clock. The DDR2 controller on the processor can operate at a maximum clock frequency of 250 MHz.

With a CCES session running and connected to the EZ-KIT Lite via the USB standalone debug agent, the DDR2 registers are configured automatically each time the processor is reset. The values are used whenever DDR2 is accessed through the debugger (for example, when viewing memory or loading a program).

To disable the automatic setting of the DDR2 registers, select **Target Options** from the **Session** menu in CCES and uncheck **Use XML reset values**.

An example program is included in the EZ-KIT Lite installation directory to demonstrate how to setup and access the DDR2 interface. For more information on how to initialize the registers after a reset, refer to the hardware reference manual.

## SPI Interface

The ADSP-BF609 processor has two SPI interfaces, SPI0 and SPI1. SPI0 is connected to a Winbond W25Q32BV 32 Mb serial flash memory with dual and quad SPI support.

Quad mode is enabled by default. The processor flag signals, PD00 and PD01 (SPI0 D2 and D3), can be disconnected by using SoftConfig. Refer to [“Software-Controlled Switches \(SoftConfig\)” on page 2-3](#) for more information. By default, the SPI0 chip select 1 is connected to the memory device. This can also be disconnected by using SoftConfig.

## SMC Interface

The Static Memory Controller (SMC) interface of the ADSP-BF609 EZ-KIT Lite contains a 32 MB (16M x 16) Numonyx PC28F128P33B parallel flash chip. Flash memory is connected to the 16-bit data bus and address lines 1-23. Chip enable is decoded by using  $\overline{\text{SMC0\_AMS0}}$ .

The flash memory is bottom boot and provides One-Time-Programmable (OTP) memory.

Flash memory is pre-loaded with boot code for the POST program. For more information, refer to [“Power-On-Self Test” on page 1-20](#).

## Ethernet Interface

The ADSP-BF609 processor has two Reduced Media Independent Interfaces (RMII), one of which connects to an external Ethernet PHY device. The EZ-KIT Lite provides a National DP83848C, Auto-MDIX, fully compliant PHY with IEEE 802.2/802.2u standards. The PHY supports 10BASE-T and 100BASE-TX operations. The PHY and processor support IEEE 1588 time stamping, available on the EZ-KIT Lite via a standard

## USB OTG HS Interface

RJ-45 connector. For more information, see [“Ethernet Connector \(J1\)” on page 2-27](#).

The MAC address is stored in parallel flash (U44) at address 0x0106 0000, and can be found on a sticker on the bottom side of the board.



If a program is written over this area of the flash, the MAC address will be lost.

Example programs are included in the EZ-KIT Lite installation directory to demonstrate how to use the Ethernet interface.

## USB OTG HS Interface

The ADSP-BF609 processor has an integrated USB PHY, and the EZ-KIT Lite provides a mini AB connector. A 48 MHz oscillator provides the clocking for the high-speed USB 2.0 On-the-Go (OTG) interface.

The board allows 5V at 500 mA to a peripheral by enabling the FET switch U50. The USB controller has native support for controlling the FET through the USB\_VBC signal.

A test point also is provided for the USB clock input of the processor. A user can remove the series resistor and feed an external clock from a function generator.

Use the example programs in the EZ-KIT Lite installation directory to learn about the processor's device and host modes. For more information, refer to the *ADSP-BF60x Blackfin Processor Hardware Reference*.

## CAN Interface

The Controller Area Network (CAN) interface of the EZ-KIT Lite is connected to the NXP TJA1041 high-speed CAN transceiver. The transceiver

is attached to the CAN0 port of the ADSP-BF609 processor via an RJ-11 connector. See [“CAN Connector \(J4\)” on page 2-27](#).

The PE02 programmable flag connects to the error and power on indication output of the CAN transceiver, CAN0. The transmit and receive pins of the transceiver are connected to the dedicated CAN0 transmit and receive pins of the processor.

To disconnect the CAN IC signals CAN0RX and CAN0\_ERR, change the appropriate settings via SoftConfig. See [“Software-Controlled Switches \(SoftConfig\)” on page 2-3](#).

Example programs are included in the EZ-KIT Lite installation directory to demonstrate CAN circuit operation.

## UART Interface

The ADSP-BF609 processor has two built-in universal asynchronous transmitters (UARTs), with only UART0 connected to a UART line transmitter. UART0 has full RS-232 functionality via the Analog Devices ADM3315 line driver and receiver (U39).

Pin PD07/UART0\_TX/TM0\_AC13 of the processor is connected to the ADM3315 device directly. Pin PD08/UART0\_RX/TM0\_AC10 is connected as well by the default setting of SoftConfig. (This can be changed by the SoftConfig switch).

By default, UART0 RTS and CTS signals are not connected (but can be through SoftConfig). The SoftConfig switches also allow the loopback of CTS and RTS. UART CTS can be added as an input to the reset circuit through SoftConfig. Pins 1, 4 and 6 of the UART connector (J2) can be enabled as an input to the on-board reset circuit through SoftConfig.

Refer to [“Software-Controlled Switches \(SoftConfig\)” on page 2-3](#) for more information.

## SD Interface

An example program demonstrating UART0 in POST is included in the EZ-KIT Lite installation directory. Note that the loopback of TX and RX data is done through an external connector.

## SD Interface

The ADSP-BF609 processor has a secure digital (SD) interface. The SD interface consists of a clock pin, command pin, card detect pin, write protect pin, and an 8-bit data bus. SoftConfig controls the connection of processor pins PG10 and PG13 to the card detect and write protect features of the SD interface. Refer to [“Software-Controlled Switches \(SoftConfig\)” on page 2-3](#) and [“SD Connector \(J5\)” on page 2-27](#) for more details.

An example program is included in the EZ-KIT Lite installation directory to demonstrate how to set up and access the SD interface.

## Rotary Encoder Interface

The ADSP-BF609 processor has a builtin, up-down counter with support for a rotary encoder. The three-wire rotary encoder interface connects to the rotary switch (SW9). The rotary encoder can be turned clockwise for the up function, counter clockwise for the down function, or can be pushed towards the center of the board to clear the counter.

The rotary switch is a two-bit quadrature (gray code) counter with detent, meaning that both the down signal (CNT0\_DG) and up signal (CNT0\_UD) toggle when the count register increases on a rotation to the right. Upon rotating to the left, CNT0\_DG and CNT0\_UD toggle, and the overall count decreases.

If the processor pins are needed on the expansion interface III, disconnect the rotary encoder switch via SoftConfig. See [“Software-Controlled Switches \(SoftConfig\)” on page 2-3](#) for details.

An example program is included in the EZ-KIT Lite installation directory to demonstrate how to set up and access the rotary encoder.

## Temperature Sensor Interface

Two external pins (SYS\_TDA and SYS\_TDK) of the processor are connected to an internal thermal diode. The EZ-KIT Lite uses ON Semiconductor ADM1032 digital thermometer and under/over temperature alarm to monitor the processor's temperature as well as the thermal diodes inside the ADM1032 device. The thermometer uses the I<sup>2</sup>C bus and flag pins of the processor. The following software-controlled signals are used for temperature monitoring.

- TEMP\_IRQ\_EN (programmable flag pin PG9)
- TEMP\_THERM\_EN (programmable flag pin PB15)

The thermal limit flag is connected to an LED (LED5) for a visual alarm if the temp exceeds the limit. The thermal limit flag and ADM1032 IRQ connect to flag pins of the processor, but are nonessential for temperature monitoring. Consequently, the software-controlled switches have these signals disconnected from the ADSP-BF609 processor by default.

See [“Thermal Limit LED \(LED5\)” on page 2-23](#) and [“Software-Controlled Switches \(SoftConfig\)” on page 2-3](#) for more information.

Example programs are included in the EZ-KIT Lite installation directory to demonstrate temperature sensor operations.

## Link Ports Interface

The ADSP-BF609 processor has four dedicated link ports. Each link port has a clock pin, an acknowledgment pin, and eight data pins. The ports can operate at up to 83 MHz and act as either a receiver or a transmitter.

## General-Purpose I/O (GPIO)

The ports are used to interface gluelessly to other ADSP-BF609 processors which also have the link ports pins brought out.

The EZ-KIT Lite enables access to link ports 0 and 1 (referred to as LP0 and LP1 in schematics) via connectors P8 and J3, respectively. Two ADSP-BF609 EZ-KIT Lites can mate gluelessly via the link port connectors. The processors communicate via the link ports, all while performing independent tasks on each of the EZ-KIT Lite. To loopback the link port connectors on one EZ-KIT Lite or connect three or more EZ-KIT Lites, obtain a standard, off the shelf connector from Samtec. For more information, see [“Link Port /JTAG Connectors \(J3 and P8\)” on page 2-25](#).

By default, the EZ-KIT Lite boots from the parallel flash memory. Link port 0 can be selected as the boot source by setting the boot mode select switch (SW2) to position 6. See [“Boot Mode Select Switch \(SW2\)” on page 2-19](#).

## General-Purpose I/O (GPIO)

Four LEDs are available via programmable pins PG14, PG15, PE14, and PB11. The connections are on by default and can be shut off through SoftConfig.

Two push buttons are available on programmable flags PB10 and PE01. The push buttons are connected to the processor by default. Use SoftConfig to disconnect the push buttons. Refer to [“Software-Controlled Switches \(SoftConfig\)” on page 2-3](#) for more information.

## JTAG Interface

The EZ-KIT Lite design enables a multi-processor JTAG session using connectors P8 and J3. By default, the board is set up in single-processor mode. In single-processor mode, create a CCES session based on a stand-alone debug agent or an external emulator. To use the EZ-KIT Lite in

multi-processor mode, install an external emulator. Only one external emulator is required for the main EZ-KIT Lite; other EZ-KIT Lites in the JTAG chain do not require an emulator. In this mode, create a CCES platform based on the number of JTAG devices in the JTAG chain using the CCES Target Configurator. Then create a session for the EZ-KIT Lite based on the newly created platform.

For a dual ADSP-BF609 EZ-KIT Lite session, connect two EZ-KIT Lites via connectors J3 and P8. Flip one of the two EZ-KIT Lites by 180 degrees to allow the boards to mate. To switch between single- and multi-processor modes, use DIP switches SW1 and SW3-5. The switch settings can be found in [“JTAG Interface Switches \(SW1, SW3-5\)” on page 2-18](#).

For three or more ADSP-BF609 EZ-KIT Lite sessions, connect each of the boards with JTAG cables. The cables connect JTAG pins of each board and put the EZ-KIT Lites in a JTAG serial chain. For three EZ-KIT Lites, three JTAG cables are required. Similarly, for four EZ-KIT Lites, four JTAG cables are required. Note that each respective EZ-KIT Lite board also requires its own power supply.

The standalone debug agent can be replaced by an external emulator, such as the Analog Devices high-performance USB-based emulator. Be careful not to damage the connectors when removing the debug agent. The emulator is connected to P1 on the top side of the board. See [“EZ-KIT Lite Installation” on page 1-6](#) for more information.

Part numbers for Samtec standard, off the shelf link port cables can be found in [“Link Port /JTAG Connectors \(J3 and P8\)” on page 2-25](#).

For more information about emulators, contact Analog Devices or go to: [http://www.analog.com/en/processors-dsp/software-and-reference-designs/content/tools\\_product\\_overview/fca.html](http://www.analog.com/en/processors-dsp/software-and-reference-designs/content/tools_product_overview/fca.html).

# 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 preloaded into one of their on-board flash memories. 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 EZ-KIT Lite installation directory along with the `readme.txt` file, which describes how the board is configured to run POST.

## Expansion Interface III

The Expansion Interface III (EI3) allows an Analog Devices EZ-Extender<sup>®</sup> or a custom-design daughter board to be tested across various hardware platforms that have the same expansion interface.

The EI3 implemented on the ADSP-BF609 EZ-KIT Lite consists of five connectors, P1A, P1B, P1C, P2A, and P3A. The connectors contain a majority of the processor's signals. For pinout information, go to “[ADSP-BF609 EZ-KIT Lite Schematic](#)” on page B-1. The mechanical dimensions of the expansion connectors can be obtained by contacting “[Technical or Customer Support](#)”.

For more information about daughter boards, visit the Analog Devices Web site at:

[http://www.analog.com/en/processors-dsp/Blackfin/processors/Blackfin\\_evaluation\\_kits/fca.html](http://www.analog.com/en/processors-dsp/Blackfin/processors/Blackfin_evaluation_kits/fca.html).

Limits to current and interface speed must be taken into consideration when using the EI3. Current for the EI3 can be sourced from the EZ-KIT

Lite; therefore, the current should be limited to 200 mA for 5V and 300 mA for the 3.3V planes. If more current is required, then a separate power connector and a regulator must be designed on the daughter card. Additional circuitry can add extra loading to signals, decreasing their maximum effective speed.



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

## Power Architecture

The ADSP-BF609 EZ-KIT Lite has three primary voltage domains: 3.3V, 1.25V and 1.8V.

The Analog Devices ADP1864 controller provides 3.3V for the `VDD_USB`, `VDD_EXT`, and the 3.3V power requirements of the board. The Analog Devices ADP1715 regulator provides 1.8V for `VDD_DMC`. The processor's `VDD_INT` is regulated to 1.25V by the ADP2119 controller.

## 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`, `VDD_DDR2`, `VDD_USB`, 3.3V, and `USB_VBUS` 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” on page 2-21](#).

# Example Programs

Example programs are provided with the ADSP-BF609 EZ-KIT Lite to demonstrate various capabilities of the product. The programs are installed with CCES and can be found in the CrossCore Embedded Studio directory. 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/en/processors-dsp/blackfin/processors/board-design-database/resources/index.html>.

# 2 ADSP-BF609 EZ-KIT LITE

## HARDWARE REFERENCE

This chapter describes the hardware design of the ADSP-BF609 EZ-KIT Lite board.

The following topics are covered.

- [“System Architecture” on page 2-2](#)  
Describes the board’s configuration and explains how the board components interface with the processor.
- [“Software-Controlled Switches \(SoftConfig\)” on page 2-3](#)  
Lists and describes the processor signals routed through the software-controlled switches.
- [“Push Buttons and Switches” on page 2-17](#)  
Shows the locations and describes the push buttons and switches.
- [“Power Jumpers” on page 2-21](#)  
Shows the locations and describes the configuration jumpers.
- [“LEDs” on page 2-22](#)  
Shows the locations and describes the LEDs.
- [“Connectors” on page 2-24](#)  
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.

# System Architecture

This section describes the processor's configuration on the EZ-KIT Lite board (Figure 2-1).

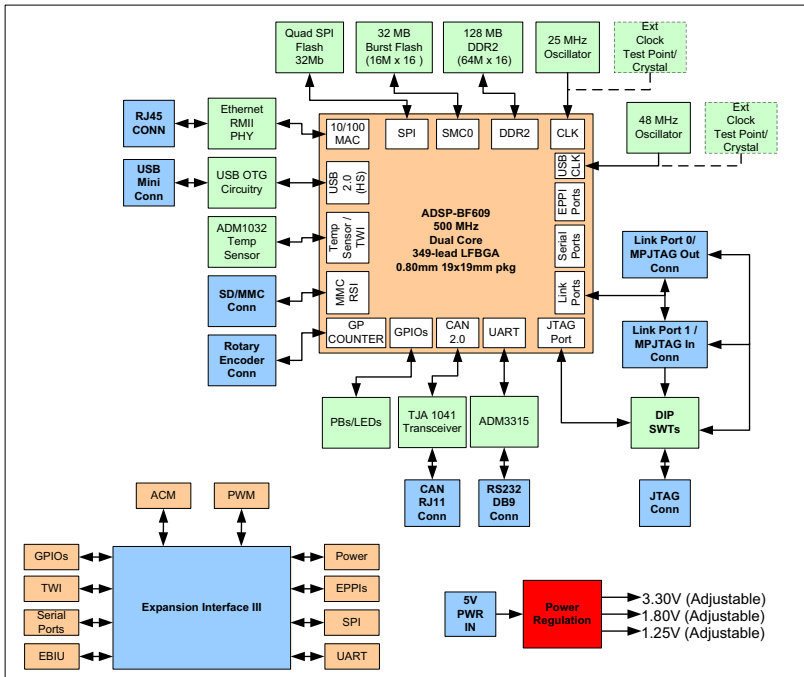


Figure 2-1. EZ-KIT Lite Block Diagram

The EZ-KIT Lite is designed to demonstrate the ADSP-BF609 Blackfin processor's capabilities.

The clock rate can be set up on the fly by the processor. The input clock is 25 MHz. The core clock runs at a maximum of 500 MHz. The default boot mode for the processor is parallel flash boot. See [“Boot Mode Select Switch \(SW2\)” on page 2-19](#) for information on how to change the default boot mode.

## Software-Controlled Switches (SoftConfig)

On the ADSP-BF609 EZ-KIT Lite, most of the traditional mechanical switches have been replaced by I<sup>2</sup>C software-controlled switches. The remaining mechanical switches are provided for setting up a single- or multiprocessor JTAG session, changing the boot mode, and push buttons. Reference any `SoftConfig*.c` file found in the installation directory of CCES for an example of how to set up the SoftConfig feature of the ADSP-BF609 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. There is one possible conflict on the EZ-KIT Lite when using SoftConfig—the wake push button must be disconnected when using the SD card interface. The wake push button is disabled by default, but if making changes, the signal `~WAKE_PUSHBUTTON_EN` must be set to high if the SD card function is desired.

## 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-BF609 EZ-KIT Lite.

## Software-Controlled Switches (SoftConfig)

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`.

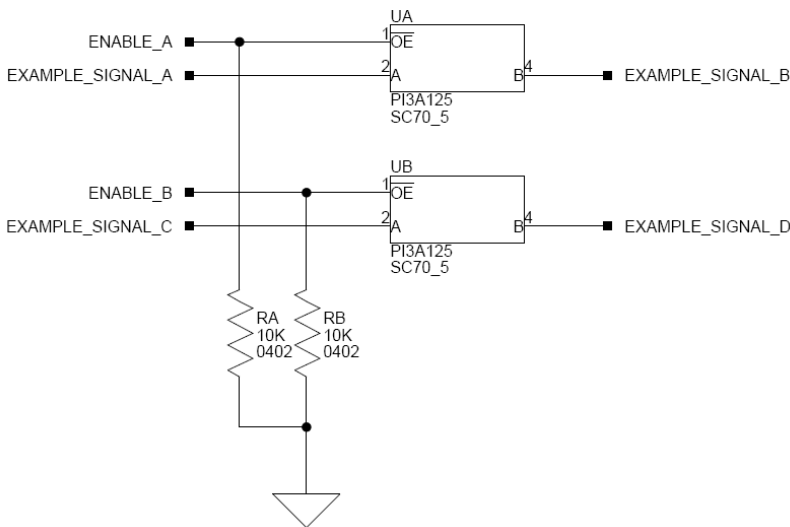


Figure 2-2. Example of Individual FET Switches

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.

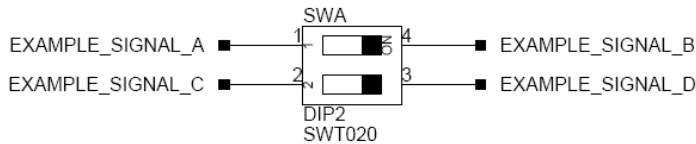


Figure 2-3. Example of Mechanical Switch Equivalent to [Figure 2-2](#)

[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.

## Software-Controlled Switches (SoftConfig)

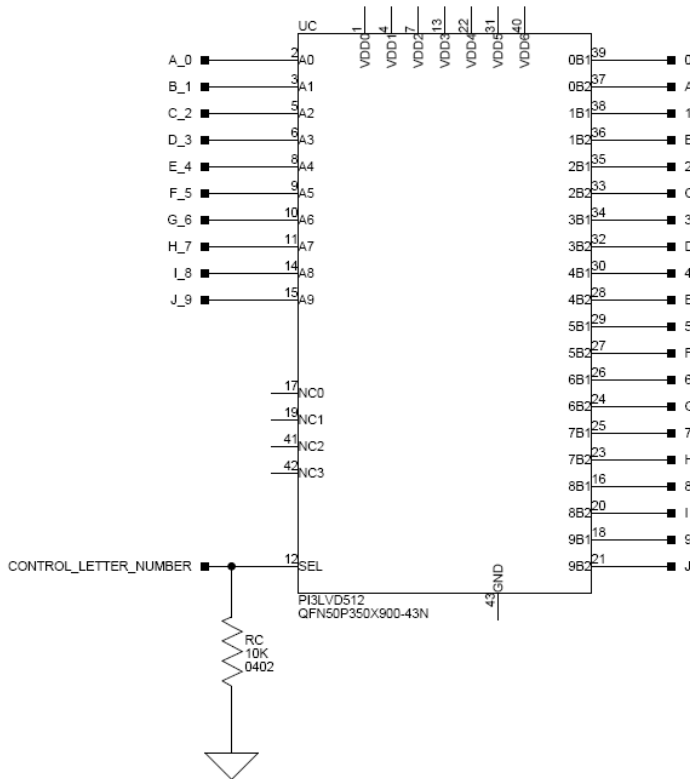


Figure 2-4. Example of Bus Switch

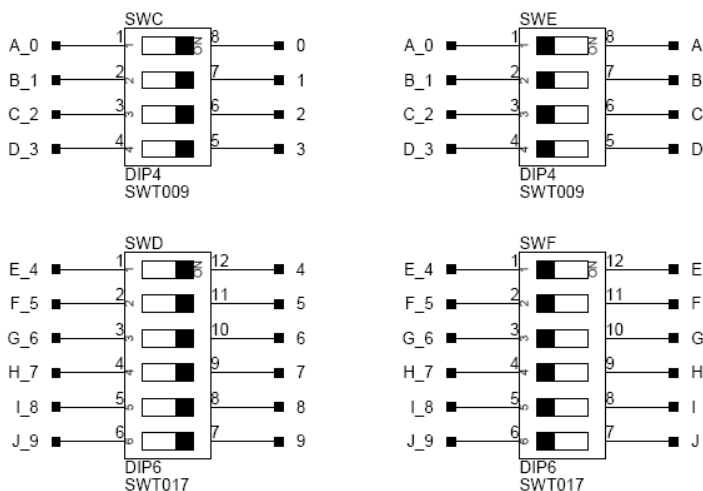


Figure 2-5. Example of Mechanical Switch Equivalent to [Figure 2-4](#)

## SoftConfig on the ADSP-BF609 EZ-KIT LITE

The Microchip MCP23017 GPIO expander provides control for individual and 10-bit electronic switches. The TWI0 interface of the processor communicates with the Microchip device. Two 10-bit switches, U40-41 are connected to the link port 1 and 0 interfaces, respectively. There are an additional 27 individual switches with default settings that enable basic board functionality.

[Table 2-1](#) lists the ADSP-BF609 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-BF609 Processor Interface Availability

| Interface            | Availability by Default                                                                                                                  |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| EMAC0                | Fully connected, need SoftConfig to enable RMII clock                                                                                    |
| Rotary encoder       | Enabled                                                                                                                                  |
| Link port 0          | Enabled with selection of the boot mode 6 setting, or by configuring SoftConfig                                                          |
| CAN                  | Enabled, the CAN0_ERR connection to the processor is disabled                                                                            |
| UART                 | TX, RX and RTS are enabled by default, use SoftConfig to enable other features listed in the UART0 section and <a href="#">Table 2-5</a> |
| SMC (parallel flash) | Enabled with selection of boot mode 1, can be changed with SoftConfig                                                                    |
| SPI Flash            | Fully connected for quad mode by default                                                                                                 |
| Temperature sensor   | Enabled, requires SoftConfig to connect interrupts                                                                                       |
| Push buttons         | Enabled (except for wake push button)                                                                                                    |
| LEDs                 | Enabled                                                                                                                                  |

## Programming SoftConfig Switches

On the ADSP-BF609 EZ-KIT Lite, three Microchip MCP23017 devices exist. Each of these devices have the following programming characteristics:

- Each switch has two programmable GPIO registers.

| GPIO Register | Register Address |
|---------------|------------------|
| GPIOA         | 0x12             |
| GPIOB         | 0x13             |

- 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.

| IODIR Register | IODIR Register Address | Value to be Written to Program Signals as Outputs |
|----------------|------------------------|---------------------------------------------------|
| IODIRA         | 0x00                   | 0                                                 |
| IODIRB         | 0x01                   | 0                                                 |

Each of the examples in Cross Core Embedded Studio 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_BF609.c` file in each example.

The following tables ([Table 2-2](#), [Table 2-3](#), and [Table 2-4](#)) outline the default values for each of the three Microchip MCP23017 devices.

Table 2-2. I<sup>2</sup>C Hardware Address 0x21

| GPIO  | MCP23017 Register Address | Default Value |
|-------|---------------------------|---------------|
| GPIOA | 0x12                      | 0x07          |
| GPIOB | 0x13                      | 0xFC          |

Table 2-3. I<sup>2</sup>C Hardware Address 0x22

| GPIO  | MCP23017 Register Address | Default Value |
|-------|---------------------------|---------------|
| GPIOA | 0x12                      | 0x0A          |
| GPIOB | 0x13                      | 0x00          |

## Software-Controlled Switches (SoftConfig)

Table 2-4. I<sup>2</sup>C Hardware Address 0x23

| GPIO  | MCP23017 Register Address | Default Value |
|-------|---------------------------|---------------|
| GPIOA | 0x12                      | 0x00          |
| GPIOB | 0x13                      | 0x00          |

Page 12 of the [“ADSP-BF609 EZ-KIT Lite Schematic” on page B-1](#) shows how the three Microchip GPIO expanders are connected to the board’s ICs.

U41, a 10-bit bus switch, connects the link port 0 processor interface to J3 (link port connector) when the select input signal (pin 12) is high. By default, the U41 select input is controlled by the boot mode switch (SW2). When the boot mode switch is set to 1 (parallel flash boot), the select line is high, enabling the system memory controller (SMC) signals, connected through pins PA0-7 and PB0-1 of the processor. Setting the boot mode switch to 6 (link port boot) drives the select line low and enables the link port 0 connection to the J3 connector.

The U41 output selection, which is based on the boot mode selection, can be overridden by the Microchip (U46) signal GPA0. This override is useful in a case where the application needs to boot from parallel flash but then use the link port 0 afterwards. After setting the signal high (to disable U29), use GPA3 to control the output of U41.

The processor signals connected to U41 can be disconnected from the link port to support other features. The selection line must be low in order to disconnect the signals from the link port connector J3. This allows the signals to connect to the on-board parallel flash memory and EI3 connectors. See [“ADSP-BF609 EZ-KIT Lite Schematic” on page B-1](#) for details.

U40, a 10-bit bus switch, controls the link port 1 connection to P8 (link port connector), EI3 (expansion interface), and SMC address signals. The default setting is high, which connects the SMC address bus to the parallel flash memory and connects the link port pins PA8-15 and PB2-3 to the expansion interface. The link port 1 can be selected by setting U46 signal GPA1 low.

Table 2-5 and Table 2-6 show the output signals of the Microchip GPIO expander (U45), 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. Note that some of the Microchip (U45) output signals are connected directly to components on the board. However, in most cases, the Microchip (U45) 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 2-5. Output Signals of Microchip GPIO Expander (U45 Port A)

| Bit | Signal Name  | Description                                             | FET | Processor Signal<br>(if applicable)               | Component<br>Connected | Default |
|-----|--------------|---------------------------------------------------------|-----|---------------------------------------------------|------------------------|---------|
| 0   | CAN_EN       | Enable CAN IC, enabled by default                       |     |                                                   | U55                    | High    |
| 1   | ~CAN_STB     | CAN standby control input                               |     |                                                   | U55                    | High    |
| 2   | ~CAN0_ERR_EN | GPIO PE02 for CAN0 error                                | U33 | <b>PE02</b> /SPI1_RDY/PPI0_D22/SPT1_ACLK          | U55                    | High    |
| 3   | ~CAN0RX_EN   | CAN0RX connected to CAN IC U55                          | U34 | PG04/SPT2_ACLK/TM0_TMR1/ <b>CAN0_RX</b> /TM0_ACI2 | U55                    | Low     |
| 4   | ~CNT0UD_EN   | Rotary counter 0 count up connected to rotary connector | U30 | PG11/SPT2_BD1/TM0_TMR6/ <b>CNT0_UD</b>            | SW9                    | Low     |

## Software-Controlled Switches (SoftConfig)

Table 2-5. Output Signals of Microchip GPIO Expander (U45 Port A) (Cont'd)

| Bit | Signal Name | Description                                               | FET | Processor Signal (if applicable)       | Component Connected | Default |
|-----|-------------|-----------------------------------------------------------|-----|----------------------------------------|---------------------|---------|
| 5   | ~CNTODG_EN  | Rotary counter 0 count down connected to rotary connector | U31 | PG12/SPT2_<br>BD0/TM0_<br>TMR7/CNT0_DG | SW9                 | Low     |
| 6   | ~CNTOZM_EN  | Rotary counter 0 count zero connected to rotary connector | U32 | PG07/SPT2_<br>BFS/TM0_<br>TMR5/CNT0_ZM | SW9                 | Low     |
| 7   | RMII_CLK_EN | RMII clock for EMAC0 disabled                             |     |                                        | U43                 | Low     |

Table 2-6. Output Signals of Microchip GPIO Expander (U45 Port B)

| Bit | Signal Name        | Description                                                                               | FET | Processor Signal (if applicable)            | Component Connected | Default |
|-----|--------------------|-------------------------------------------------------------------------------------------|-----|---------------------------------------------|---------------------|---------|
| 0   | ~UARTORTS_EN       | UART0 RTS connected to UART transceiver U39                                               | U21 | PD09/~SPI0_<br>SEL5/UART0_<br>RTS/SPI1_SEL4 | U39                 | Low     |
| 1   | ~UARTORX_EN        | UART0 RX connected to UART transceiver U39                                                | U20 | PD08/~UART0_<br>RX~/TM0_ACIO                | U39                 | Low     |
| 2   | ~UARTOCTS_EN       | UART0 CTS disconnected from UART transceiver U39 by default                               | U19 | PD10/SPI0_<br>RDY/~UART0_<br>CTS/SPI1_SEL3  | U39                 | High    |
| 3   | ~UARTOCTS_RTS_LPBK | UART0 CTS and RTS not connected. Change to low for looping back UART0 CTS and RTS signals | U18 |                                             |                     | High    |
| 4   | ~UARTOCTS_RST_EN   | UART0 CTS signal not connected to input of reset IC (U48)                                 | U17 |                                             |                     | High    |

Table 2-6. Output Signals of Microchip GPIO Expander (U45 Port B) (Cont'd)

| Bit | Signal Name      | Description                                                                                                                              | FET | Processor Signal (if applicable)  | Component Connected | Default |
|-----|------------------|------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------------------------------|---------------------|---------|
| 5   | ~UARTOCTS_146_EN | Allows pins 1, 4 and 6 of UART connector (J2) to be connected together and used as input to reset IC (U48). This is disabled by default. | U16 |                                   |                     | High    |
| 6   | ~TEMP_IRQ_EN     | PG09 can be used as TEMP interrupt, disconnected by default                                                                              | U9  | <b>PG09</b> /SPT2_AD0/TM0_TMR4    | U54                 | High    |
| 7   | ~TEMP_THERM_EN   | PB15 can be used as TEMP thermal limit, disconnected by default                                                                          | U10 | <b>PB15</b> /ETH0_PTPPPS/PPI1_FS3 | U54                 | High    |

Table 2-7 and Table 2-8 show the output signals of the Microchip GPIO expander (U46), 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 (U46) output signals are connected directly to components on the board. However, in most cases, the Microchip (U46) 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 2-7. Output Signals of Microchip GPIO Expander (U46 Port A)

| Bit | Signal Name            | Description              | FET | Processor Signal (if applicable) | Component Connected | Default |
|-----|------------------------|--------------------------|-----|----------------------------------|---------------------|---------|
| 0   | OVERRIDE_SMC0_LP0_BOOT | Overrides U41 select     | U29 |                                  |                     | Low     |
| 1   | SMC0_EPPI2_LP1_SWITCH  | Controls U40 select line | U28 |                                  |                     | High    |

## Software-Controlled Switches (SoftConfig)

Table 2-7. Output Signals of Microchip GPIO Expander  
(U46 Port A) (Cont'd)

| Bit | Signal Name   | Description                                                    | FET | Processor Signal<br>(if applicable)                              | Component<br>Connected | Default |
|-----|---------------|----------------------------------------------------------------|-----|------------------------------------------------------------------|------------------------|---------|
| 3   | SMC0_LPO_EN   | Controls U41 select if<br>Override High                        | U28 |                                                                  |                        | High    |
| 4   | ~LED1_GPIO_EN | PG14 is used as GPIO<br>output for LED1,<br>enabled by default | U27 | <b>PG14</b> /~UART1_<br>RX~/~SYS_<br>IDLE1~/TM0_AC11             | LED1                   | Low     |
| 5   | ~LED2_GPIO_EN | PG15 is used as GPIO<br>output for LED2,<br>enabled by default | U26 | <b>PG15</b> /~UART1_<br>TX/SYS_<br>IDLE0~/SYS_<br>SLEEP/TM0_AC14 | LED2                   | Low     |
| 6   | ~LED3_GPIO_EN | PE14 is used as GPIO<br>output for LED3,<br>enabled by default | U25 | <b>PE14</b> /ETH1_<br>RXERR/SPT2_<br>ATDV/TM0_TMR0               | LED3                   | Low     |
| 7   | ~LED4_GPIO_EN | PB11 is used as GPIO<br>output for LED4,<br>enabled by default | U24 | <b>PB11</b> /SMC0_<br>A25/SPT0_<br>BD0/TM0_ACLK3                 | LED4                   | Low     |

Table 2-8. Output Signals of Microchip GPIO Expander  
(U46 Port B)

| Bit | Signal Name     | Description                                                               | FET | Processor Signal<br>(if applicable)              | Component<br>Connected | Default |
|-----|-----------------|---------------------------------------------------------------------------|-----|--------------------------------------------------|------------------------|---------|
| 0   | ~PUSHBUTTON1_EN | PB10 is used as GPIO<br>input for push button 1,<br>enabled by default    | U23 | <b>PB10</b> /SMC0_<br>A24/SPT0_<br>BD1/TM0_ACLK0 | SW6                    | Low     |
| 1   | ~PUSHBUTTON2_EN | PE01 is used as GPIO<br>input for push button 2,<br>enabled by default    | U22 | <b>PE01</b> /SPI1_<br>D2/PPI0_<br>D19/SPT1_BD0   | SW7                    | Low     |
| 2   | ~SD_CD_EN       | SD memory card detect<br>connected to GPIO<br>PG10, enabled by<br>default | U15 | <b>PG10</b> /~UART1_<br>RTS~/SPT2_BCLK           | J5                     | Low     |

Table 2-8. Output Signals of Microchip GPIO Expander (U46 Port B) (Cont'd)

| Bit | Signal Name     | Description                                                                                              | FET | Processor Signal (if applicable)          | Component Connected | Default |
|-----|-----------------|----------------------------------------------------------------------------------------------------------|-----|-------------------------------------------|---------------------|---------|
| 3   | ~SD_WP_EN       | SD memory write protect connected to GPIO PG10, enabled by default                                       | U14 | <b>PG13</b> /~UART1_CTS~/TM0_CLK          | J5                  | Low     |
| 4   | ~SPIFLASH_CS_EN | SPI flash chip select SPI0SEL1 connection to U38 SPI flash, connected by default                         | U13 | PD11/~ <b>SPI0_SEL1</b> /SPI0_SS          | U38                 | Low     |
| 5   | ~SPIOD2_EN      | SPI flash data 2 connection to U38 SPI flash, connected by default. This is needed for quad access mode. | U12 | PD00/ <b>SPI0_D2</b> /PPI1_D16/~SPI0_SEL3 | U38                 | Low     |
| 6   | ~SPIOD3_EN      | SPI flash data 3 connection to U38 SPI flash, connected by default. This is needed for quad access mode. | U16 | PD01/ <b>SPI0_D3</b> /PPI1_D17/~SPI0_SEL2 | U38                 | Low     |

Table 2-9 and Table 2-10 show the output signals of the Microchip GPIO expander (U47), with a TWI address of 0100 011X, 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 (U47) output signals are connected directly to components on the board. However, in most cases, the Microchip (U47) 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.

## Software-Controlled Switches (SoftConfig)

Table 2-9. Output Signals of Microchip GPIO Expander (U47 Port A)

| Bit | Signal Name                          | Description                                                                | FET | Processor Signal (if applicable)     | Component Connected | Default |
|-----|--------------------------------------|----------------------------------------------------------------------------|-----|--------------------------------------|---------------------|---------|
| 0   | PHYINT_EN <sup>1</sup>               | Connects Ethernet 0 interrupt signal to Ethernet PHY, connected by default | U35 | PD06/~ETH0_PHYINT~/PPI1_FS2/TM0_AC15 | U49                 | Low     |
| 1   | PHY_PWR_DWN_INT <sup>2</sup>         | Controls power down of the Ethernet PHY if PHYINT_EN high                  |     |                                      | U49                 | High-Z  |
| 2   | PHYAD0 <sup>3</sup>                  | Allows the PHY to be placed in isolate mode                                |     |                                      | U49                 | High-Z  |
| 3   | ~ETHERNET_EN                         | Disconnects EMAC0 signals from U49                                         |     |                                      | U4/U5               | Low     |
| 4   | ~WAKE_PUSHBUTTON_EN                  | Enables push button input to processor                                     | U7  | PE12/~ETH1_PHYINT~/PWM1_CL/RSIO_D5   | U1                  | High    |
| 5   | ~PD0_SPI0D2_EPPI1D16_SPI0SEL3_EI3_EN | Connects processor signal to EI3 connectors, disabled by default           | U36 | PD00/SPI0_D2/PPI1_D16/~SPI0_SEL3     | EI3                 | High    |
| 6   | ~PD1_SPI0D3_EPPI1D17_SPI0SEL2_EI3_EN | Connects processor signal to EI3 connectors, disabled by default           | U51 | PD01/SPI0_D3/PPI1_D17/~SPI0_SEL2     | EI3                 | High    |
| 7   | ~PD2_SPI0MISO_EI3_EN                 | Connects processor signal to EI3 connectors, disabled by default           | U57 | PD02/SPI0_MISO                       | EI3                 | High    |

- <sup>1</sup> This is an active low signal but the signal name does not show this.
- <sup>2</sup> This signal defaults to an input setting, putting the signal in High-Z. Must be used in concert with PHYINT\_EN. Set PHYINT\_EN high first and then control PHY\_PWR\_DWN\_INT.
- <sup>3</sup> This signal defaults to an input setting, putting the signal in High-Z. There is a 2.21k resistor pull-up, which sets the PHY address appropriately. If isolate mode is desired, the signal needs to be set as an output and driven appropriately.

Table 2-10. Output Signals of Microchip GPIO Expander (U47 Port B)

| Bit | Signal Name          | Description                                                      | FET | Processor Signal (if applicable) | Component Connected | Default |
|-----|----------------------|------------------------------------------------------------------|-----|----------------------------------|---------------------|---------|
| 0   | ~PD3_SPI0MOSI_EI3_EN | Connects processor signal to EI3 connectors, disabled by default | U56 | PD03/SPI0_MOSI                   | EI3                 | High    |
| 1   | ~PD4_SPI0CK_EI3_EN   | Connects processor signal to EI3 connectors, disabled by default | U58 | PD04/SPI0_CLK                    | EI3                 | High    |

## 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](#).

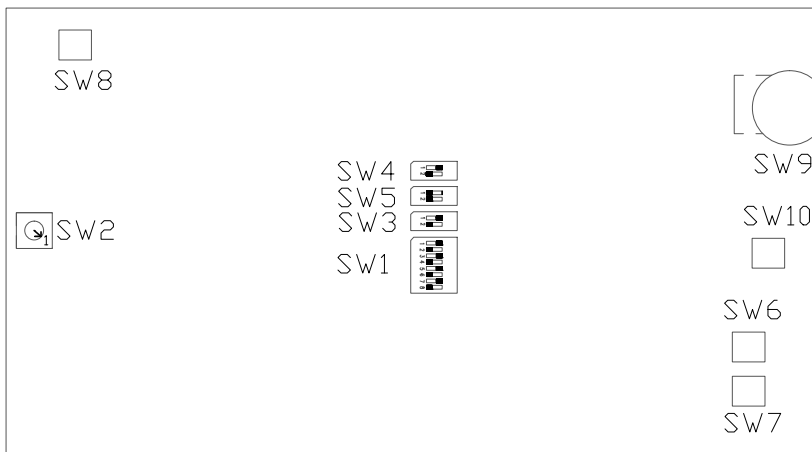


Figure 2-6. Push Button and Switch Locations

### JTAG Interface Switches (SW1, SW3–5)

The JTAG switches (SW1, SW3, SW4, and SW5) select between a single-processor (one board) and multi-processor (more than one board) configurations. By default, the four DIP switches are set up for a single EZ-KIT Lite configuration. See [Table 2-11](#).

The default configuration applies to either a debug agent or an external emulator, such as the Analog Devices high-performance USB-based emulator (HP-USB) or ICE-100B emulator.

To use an external emulator and multiple EZ-KIT Lites simultaneously in one CrossCore Embedded Studio (CCES) multi-processor session, set up the boards as shown in [Table 2-12](#). Attach the boards to each other via connectors J3 and P8. For two EZ-KIT Lites, no external cables are required. For three or more EZ-KIT Lites, obtain Samtec JTAG cables described in “[Link Port /JTAG Connectors \(J3 and P8\)](#)” on page 2-25.

Table 2-11. Single-Processor Configuration

| Switch Position | Single EZ-KIT Lite Use (Default) |
|-----------------|----------------------------------|
| SW1.1           | ON                               |
| SW1.2           | OFF                              |
| SW1.3           | ON                               |
| SW1.4           | OFF                              |
| SW1.5           | ON                               |
| SW1.6           | OFF                              |
| SW1.7           | ON                               |
| SW1.8           | OFF                              |
| SW3.1           | ON                               |
| SW3.2           | OFF                              |
| SW4.1           | ON                               |
| SW4.2           | OFF                              |

Table 2-11. Single-Processor Configuration (Cont'd)

| Switch Position | Single EZ-KIT Lite Use (Default) |
|-----------------|----------------------------------|
| SW5.1           | OFF                              |
| SW5.2           | OFF                              |

Table 2-12. Multiple-Processor Configuration

| Switch Position | Main EZ-KIT Lite Attached to Emulator | EZ-KIT Lite Not Attached to Emulator |
|-----------------|---------------------------------------|--------------------------------------|
| SW1.1           | ON                                    | OFF                                  |
| SW1.2           | ON                                    | ON                                   |
| SW1.3           | ON                                    | OFF                                  |
| SW1.4           | ON                                    | ON                                   |
| SW1.5           | ON                                    | OFF                                  |
| SW1.6           | ON                                    | ON                                   |
| SW1.7           | ON                                    | OFF                                  |
| SW1.8           | ON                                    | ON                                   |
| SW3.1           | ON                                    | OFF                                  |
| SW3.2           | OFF                                   | OFF                                  |
| SW4.1           | OFF                                   | OFF                                  |
| SW4.2           | ON                                    | ON                                   |
| SW5.1           | OFF                                   | ON                                   |
| SW5.2           | ON                                    | OFF                                  |

## Boot Mode Select Switch (SW2)

The rotary boot mode select switch (SW2) determines the boot mode of the processor. [Table 2-13](#) shows the available boot mode settings. By default, the ADSP-BF609 processor boots from 8-bit flash memory (parallel flash boot).

## Push Buttons and Switches

Table 2-13. Boot Mode Select Switch (SW2)

| SW2 Position | Processor Boot Mode           |
|--------------|-------------------------------|
| 0            | Idle—no boot                  |
| 1            | Parallel flash boot (default) |
| 2            | RSI master boot               |
| 3            | SPI0 master boot              |
| 4            | SPI0 slave boot               |
| 5            | Reserved                      |
| 6            | Link port 0 slave boot        |
| 7            | UART0 slave boot              |

### IRQ/Flag Enable Switches (SW6–7)

The IRQ/flag enable switches (SW6–7) are push buttons which provide a momentary low signal on processor signals PB10\_A24\_SP1D1 and PE1\_SPI1D2\_EPPI0D19\_SP3D0 when enabled through the software-controlled switch.

### Reset Switch (SW8)

The reset switch (SW8) is a push button which provides a reset pulse to the ADSP-BF609 processor (U1), Ethernet PHY (U49), GPIO extenders (U45–47), and the expansion interface (EI3) connectors.

### Rotary Encoder With Momentary Switch (SW9)

The rotary encoder (SW9) can be turned clockwise for an up count or counter-clockwise for a down count. The encoder also features a momentary switch, activated by pushing the switch towards the center of the board, that can be used to set the counter to zero. The rotary encoder is a two-bit quadrature (Gray code) encoder.

The rotary encoder can be disconnected from the processor by setting SoftConfig, see [“Software-Controlled Switches \(SoftConfig\)” on page 2-3](#) for more information.

## Wake Push Switch (SW10)

One of the wake input signals (PE12/~ETH1\_PHYINT/PWM1\_CL/RS10\_D5) is connected to a push button switch (SW10). This feature is disabled by default and can be enabled through SoftConfig. Refer to [“Software-Controlled Switches \(SoftConfig\)” on page 2-3](#) for more details.

## Power Jumpers

This section describes functionality of the power jumpers (P10-15). [Figure 2-7](#) shows the jumper locations.

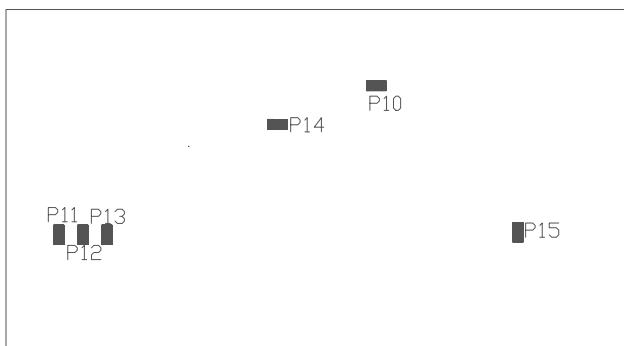


Figure 2-7. Configuration Jumper Locations

# LEDs

Remove jumpers listed in [Table 2-14](#) to measure the respective voltage domain.

Table 2-14. Power Jumpers (P10-15)

| Jumper | Power Domain |
|--------|--------------|
| P15    | VDD_DMC      |
| P14    | VDD_INT      |
| P13    | 3.3V         |
| P12    | VDD_EXT      |
| P11    | VDD_USB      |
| P10    | USB_VBUS     |

# LEDs

This section describes the on-board LEDs. [Figure 2-7](#) shows the LED locations.

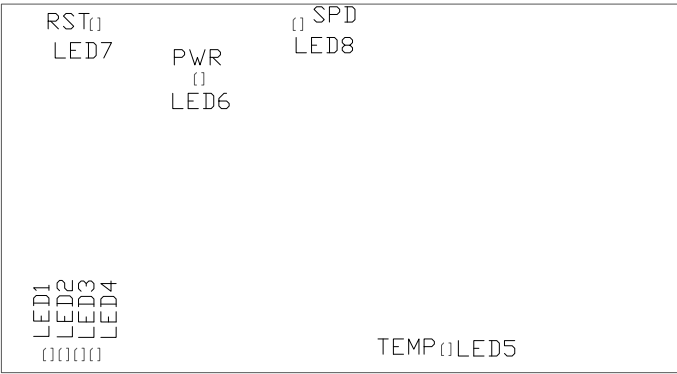


Figure 2-8. LED Locations

## GPIO LEDs (LED1–4)

Four LEDs (LED1, LED2, LED3, and LED4) are connected to four general-purpose I/O pins of the processor (see [Table 2-15](#)). The LEDs are active high and lit (amber) by writing a “1” to the corresponding programmable flag signal.

Table 2-15. GPIO LEDs

| LED Reference Designator | Processor Programmable Flag Pin |
|--------------------------|---------------------------------|
| LED1                     | PG14                            |
| LED2                     | PG15                            |
| LED3                     | PE14                            |
| LED4                     | PB11                            |

## Thermal Limit LED (LED5)

The thermal limit LED (LED5) reports the status of the thermal sensor, ADM1032 (U54). The thermal sensor monitors the processor’s temperature. When the high temperature limit set by the IC is violated, LED5 is turned on (amber) as a visual indicator. The ADM1032 device has built-in hysteresis, which causes the LED to de-activate only when the temperature is significantly within the limit. For more information, see [“Temperature Sensor Interface” on page 1-17](#).

## Power LED (LED6)

When LED6 is lit solid (green), it indicates that power is being supplied to the board properly.

## Connectors

### Reset LED (LED7)

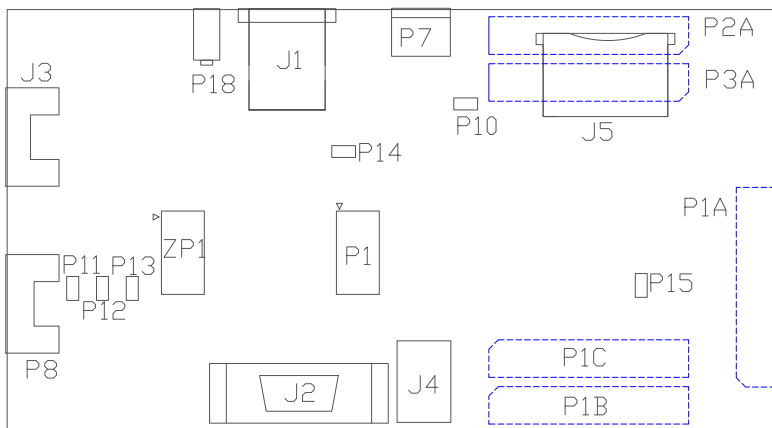
When LED4 is lit (red), it indicates that the master reset of the processor is active. The reset signal is controlled by the Analog Devices ADM13305 supervisory reset circuit.

### SPD LED (LED6)

SPD LED indicates the speed of the Ethernet port. When LED6 is lit (green), the speed is 100 Mb/s and when not lit, the speed is 10 Mb/s.

## Connectors

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



Components with a dotted outline are on the back side of the board

Figure 2-9. Connector Locations

## DCE UART Connector (J2)

The pinout of the J2 connector can be found in [“ADSP-BF609 EZ-KIT Lite Schematic” on page B-1](#).

| Part Description | Manufacturer | Part Number  |
|------------------|--------------|--------------|
| IDC header       | FCI          | 68737-410HLF |
| Mating Connector |              |              |
| IDC socket       | DIGI-KEY     | S4205-ND     |

## Link Port /JTAG Connectors (J3 and P8)

The J3 and P8 connectors provide access to the Link Port and JTAG signals of the ADSP-BF609 processor. J3 supports link port 0 and the P8 connector is for link port 1.

| Part Description           | Manufacturer | Part Number              |
|----------------------------|--------------|--------------------------|
| ERF8 10X2, RA female (J3)  | SAMTEC       | ERF8-010-01-S-D-RA-L     |
| ERM8 10x2, RA male (P8)    | SAMTEC       | ERM8-010-01-S-D-RA-TR    |
| Mating Cable               |              |                          |
| 6" cable ERF8 to ERM8 10X2 | SAMTEC       | ERCD-010-06.00-TBL-SBR-1 |

## JTAG Connector (P1)

The JTAG interface of the ADSP-BF609 processor is connected to the 14-pin 0.1" header, P1. Pin 3 is missing to provide keying. Pin 3 in the mating connector must have a plug. For more information, see [“JTAG Interface” on page 1-18](#).

Remove the standalone debug agent when an emulator is used with the board. Follow the installation instructions provided in [“EZ-KIT Lite Installation” on page 1-6](#), using P1 as the JTAG connection point.

## Connectors

### JTAG Connector (ZP1)

ZP1 is the connecting point for the SADA2 debug interface and is a 14-pin 0.1" header.

### Expansion Interface III Connectors (P1A–C, P2A, P3A)

Five board-to-board connectors (P1A, P1B, P1C, P2A, and P3A) provide signals from the SPI, TWI, UART, SPORT, and GPIO interfaces of the processor. The connectors are located on the bottom side of the board. For more information, see [“Expansion Interface III” on page 1-20](#).

| Part Description | Manufacturer | Part Number      |
|------------------|--------------|------------------|
| 120-pin, 0.6 mm  | HIROSE       | FX8-120P-SV1(91) |
| Mating Connector |              |                  |
| 120-pin, 0.6 mm  | HIROSE       | FX8-120S-SV(21)  |

### USB Connector (P7)

| Part Description | Manufacturer | Part Number |
|------------------|--------------|-------------|
| USB mini-Ab      | MOLEX        | 56579-0576  |

### Power Connector (P18)

| Part Description         | Manufacturer | Part Number |
|--------------------------|--------------|-------------|
| 0.65 mm power jack       | CUI          | 045-0883R   |
| Mating Connector         |              |             |
| 5.0VDC@3.6A power supply | GLOBETEK     | GS-1750(R)  |

## CAN Connector (J4)

| Part Description               | Manufacturer | Part Number |
|--------------------------------|--------------|-------------|
| RJ-11 4-pin modular jack       | TYCO         | 5558872-1   |
| Mating Cable                   |              |             |
| 4-conductor modular jack cable | L-COM        | TSP3044     |

## SD Connector (J5)

| Part Description | Manufacturer | Part Number    |
|------------------|--------------|----------------|
| SD 8-bit, 2 GB   | SANDISK      | MHC-W21-601    |
| Memory Card      |              |                |
| 2 GB             | SANDISK      | SDSDB-2048-A11 |

## Ethernet Connector (J1)

| Part Description        | Manufacturer   | Part Number    |
|-------------------------|----------------|----------------|
| RJ-45 Ethernet jack     | Pulse Engineer | PN J0011D21BNL |
| Mating Cable            |                |                |
| Standard Ethernet cable |                |                |

## Ethernet Connectors (P16-17)

P16 and P17 allow connection to the Ethernet port IEEE 1588 signals. They are 6-pin 0.1" headers. The pinout of the P16 and P17 connectors can be found in [“ADSP-BF609 EZ-KIT Lite Schematic” on page B-1](#).



# A ADSP-BF609 EZ-KIT LITE BILL OF MATERIALS

The bill of materials corresponds to “[ADSP-BF609 EZ-KIT Lite Schematic](#)” on page B-1.

| Ref. | Qty. | Description                           | Reference Designator | Manufacturer | Part Number        |
|------|------|---------------------------------------|----------------------|--------------|--------------------|
| 1    | 1    | ADM708SARZ SOIC8                      | U48                  | ADI          | ADM708SARZ         |
| 2    | 1    | ADM3315 TSSOP24                       | U39                  | ADI          | ADM3315EARUZ       |
| 3    | 1    | ADSP-BF609 BGA349C80P22X2 2_1900X1900 | U1                   | ADI          | ADSP-BF609-ENG     |
| 4    | 1    | ADP1864AUJZ SOT23-6                   | VR1                  | ADI          | ADP1864AUJZ-R7     |
| 5    | 1    | ADP1715 MSOP8                         | VR3                  | ADI          | ADP1715ARMZ-1.8-R7 |
| 6    | 1    | 74LVC14A SOIC14                       | U3                   | TI           | 74LVC14AD          |
| 7    | 1    | IDT74FCT3244AP Y SSOP20               | U8                   | IDT          | IDT74FCT3244APYG   |
| 8    | 2    | SN74LVC1G08 SOT23-5                   | U52-U53              | TI           | SN74LVC1G08DBVR    |
| 9    | 1    | TJA1041 SOIC14                        | U55                  | NXP          | TJA1041T/VM,512    |
| 10   | 1    | SN74LVC1G04 SOT23-5                   | U59                  | TI           | SN74LVC1G04DBVT    |
| 11   | 2    | SN74CB3Q3245 TSSOP20                  | U4-U5                | DIGI-KEY     | 296-19130-1-ND     |
| 12   | 1    | MIC2025-1 SOIC8                       | U50                  | DIGI-KEY     | 576-1057-ND        |

| Ref. | Qty. | Description                             | Reference Designator      | Manufacturer     | Part Number              |
|------|------|-----------------------------------------|---------------------------|------------------|--------------------------|
| 13   | 1    | MT47H64M16<br>FBGA84                    | U37                       | MICRON           | MT47H64M16HR-3 L         |
| 14   | 1    | ADM1032<br>SOIC_N8                      | U54                       | ON SEMI          | ADM1032ARZ               |
| 15   | 1    | DP83848 LQFP48                          | U49                       | NATIONAL<br>SEMI | DP83848CVV/NOPB          |
| 16   | 1    | 50MHZ OSC012                            | U43                       | DIGI-KEY         | 300-8264-2-ND            |
| 17   | 33   | PI3A125 SC70_5                          | U7,U9-U36,U51,<br>U56-U58 | PERICOM          | PI3A125CEX               |
| 18   | 3    | MCP23017<br>QFN65P600X600-2<br>9N       | U45-U47                   | DIGI-KEY         | MCP23017-E/ML-ND         |
| 19   | 2    | PI3LVD512<br>QFN50P350X900-4<br>3N      | U40-U41                   | PERICOM          | PI3LVD512ZHE             |
| 20   | 1    | BF609<br>PC28F128P33B<br>U44            | U44                       | MICRON           | PC28F128P33BF60D         |
| 21   | 1    | BF609 W25Q32<br>U38                     | U38                       | WINBOND          | W25Q32BVSSIG             |
| 22   | 1    | SI7403BDN ICS010                        | U6                        | VISHAY           | SI7403BDN                |
| 23   | 1    | 25MHZ OSC003                            | U42                       | DIGI-KEY         | SG-8002CA-SCB-ND         |
| 24   | 1    | 48MHZ OSC003                            | U2                        | DIGI-KEY         | SG-8002CA-SCB-ND(48.00M) |
| 25   | 1    | ADP2119ACPZ-R7<br>DFN50P300X300-1<br>1N | VR2                       | ANA00            | ADP2119ACPZ-R7           |
| 26   | 1    | DIP8 SWT016                             | SW1                       | C&K              | TDA08H0SB1               |
| 27   | 2    | IDC 3X2<br>IDC3X2_SMT                   | P16-P17                   | SAMTEC           | TSM-103-01-T-DV          |
| 28   | 1    | DB9 9PIN CON038                         | J2                        | NORCOMP          | 191-009-213-L-571        |

## ADSP-BF609 EZ-KIT Lite Bill Of Materials

| Ref. | Qty. | Description                         | Reference Designator | Manufacturer | Part Number             |
|------|------|-------------------------------------|----------------------|--------------|-------------------------|
| 29   | 1    | RJ11 4PIN CON039                    | J4                   | TYCO         | 5558872-1               |
| 30   | 3    | DIP2 SWT020                         | SW3-SW5              | C&K          | CKN9064-ND              |
| 31   | 6    | IDC 2X1 IDC2X1                      | P10-P15              | FCI          | 90726-402HLF            |
| 32   | 1    | 3A RESETABLE FUS004                 | F1                   | TYCO         | SMD300F-2               |
| 33   | 6    | IDC 2PIN_JUMPER_SHORT               | SJ1-SJ6              | DIGI-KEY     | S9001-ND                |
| 34   | 1    | PWR .65MM CON045                    | P18                  | DIG          | CP1-023-ND              |
| 35   | 1    | USB_MINI-AB 5PIN CON052             | P7                   | MOLEX        | 56579-0576              |
| 36   | 4    | MOMENTARY SWT024                    | SW6-SW8,SW10         | PANA-SONIC   | EVQ-Q2K03W              |
| 37   | 1    | ROTARY_ENC_EDGE SWT025              | SW9                  | PANA-SONIC   | EVQ-WKA001              |
| 38   | 2    | IDC 7x2 IDC7x2_SMTA                 | P1,ZP1               | SAMTEC       | TSM-107-01-T-DV-A       |
| 39   | 1    | ROTARY SWT027                       | SW2                  | COPAL        | S-8110                  |
| 40   | 1    | ERM8 10X2 ERM8_10X2_SMT             | P8                   | SAMTEC       | ERM8-010-01-S-D-RA-TR   |
| 41   | 1    | ERF8 10X2 ERF8_10X2_SMT             | J3                   | SAMTEC       | ERF8-010-01-S-D-RA-L-TR |
| 42   | 1    | RJ45 W/LEDS CON065                  | J1                   | PULSE ENG.   | J0011D21BNL             |
| 43   | 1    | SD_CONN 8-BIT CON067                | J5                   | MORETHA-NALL | MHC-W21-601-LF          |
| 44   | 5    | .6MM 120PIN HIROSE_FX8-120P-SV1(91) | P1A,P1B,P1C,P2A,P3A  | HIROSE       | FX8-120P-SV1(91)        |

| Ref. | Qty. | Description              | Reference Designator                                                                                                                                                                  | Manufacturer | Part Number      |
|------|------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------------|
| 45   | 1    | TEST LOOP<br>LOOP_2838   | GP1                                                                                                                                                                                   | KEystone     | 5016             |
| 46   | 5    | YELLOW LED001            | LED1-LED5                                                                                                                                                                             | DIGI-KEY     | P512TR-ND        |
| 47   | 3    | 600 100MHZ<br>500MA 1206 | FER1-FER3                                                                                                                                                                             | STEWART      | HZ1206B601R-10   |
| 48   | 2    | 1UF 16V 10% 0805         | C87-C88                                                                                                                                                                               | DIGI-KEY     | 399-1284-2-ND    |
| 49   | 2    | 0 1/8W 5% 0805           | R200,R211                                                                                                                                                                             | VISHAY       | CRCW08050000Z0EA |
| 50   | 1    | 190 100MHZ 5A<br>FER002  | FER4                                                                                                                                                                                  | MURATA       | DLW5BSN191SQ2    |
| 51   | 7    | 10UF 6.3V 10%<br>0805    | C39,C117-C118,<br>C163-C164,<br>C177-C178                                                                                                                                             | AVX          | 08056D106KAT2A   |
| 52   | 1    | 4.7UF 6.3V 10%<br>0805   | C90                                                                                                                                                                                   | AVX          | 08056D475KAT2A   |
| 53   | 40   | 0.1UF 10V 10%<br>0402    | C17-C18,<br>C41-C45,C84,<br>C95,C100,<br>C115-C116,<br>C135-C142,<br>C153-C162,<br>C173-C176,C186,<br>C188-C191,C200                                                                  | AVX          | 0402ZD104KAT2A   |
| 54   | 124  | 0.01UF 16V 10%<br>0402   | C1-C15,C19,<br>C22-C24,<br>C26-C38,C40,<br>C46-C61,<br>C64-C83,C94,<br>C96-C98,<br>C104-C107,<br>C111-C113,<br>C119-C134,<br>C143-C152,<br>C165-C172,<br>C179-C185,C192,<br>C198-C199 | AVX          | 0402YC103KAT2A   |

## ADSP-BF609 EZ-KIT Lite Bill Of Materials

| Ref. | Qty. | Description         | Reference Designator                                                                                                                                                                                                                                                                         | Manufacturer   | Part Number      |
|------|------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------|
| 55   | 102  | 10K 1/16W 5% 0402   | R9-R12,R17-R18,<br>R20-R33,R39-R48,<br>R50-R52,R56-R63,<br>R65-R67,R69-R72,<br>R80-R84,R89-R96,<br>R100-R101,R104-<br>R105,R107-R111,<br>R113,R118-R119,<br>R133-R135,R142,<br>R146,R148-R149,<br>R158-R160,R167,<br>R169-R170,R174,<br>R188,R205-R206,<br>R210,R218-R221,<br>R230-R235,R239 | VISHAY         | CRCW040210K0FKED |
| 56   | 1    | 4.7K 1/16W 5% 0402  | R64                                                                                                                                                                                                                                                                                          | VISHAY         | CRCW04024K70JNED |
| 57   | 13   | 0 1/16W 5% 0402     | R5-R6,R53,R120,<br>R136,R161-R162,<br>R165,R168,R228-<br>R229,R238,R240                                                                                                                                                                                                                      | PANA-<br>SONIC | ERJ-2GE0R00X     |
| 58   | 17   | 33 1/16W 5% 0402    | R8,R13,R34,R37-<br>R38,R54-R55,R85-<br>R86,R137-R138,<br>R140,R172-R173,<br>R227,R244-R245                                                                                                                                                                                                   | VISHAY         | CRCW040233R0JNEA |
| 59   | 1    | 1.5UH 20% IND003    | L2                                                                                                                                                                                                                                                                                           | COIL<br>CRAFT  | DO1608C-152MLC   |
| 60   | 1    | 150UF 10V 10% D     | CT1                                                                                                                                                                                                                                                                                          | DIGI-KEY       | 478-3321-2-ND    |
| 61   | 2    | 2.2UF 10V 10% 0805  | C99,C101                                                                                                                                                                                                                                                                                     | AVX            | 0805ZD225KAT2A   |
| 62   | 1    | 1A SK12 DO-214AA    | D8                                                                                                                                                                                                                                                                                           | DIODES<br>INC  | B120B-13-F       |
| 63   | 2    | 107.0 1/10W 1% 0805 | R190,R192                                                                                                                                                                                                                                                                                    | DIGI-KEY       | 311-107CRTR-ND   |

| Ref. | Qty. | Description         | Reference Designator                      | Manufacturer | Part Number      |
|------|------|---------------------|-------------------------------------------|--------------|------------------|
| 64   | 1    | 4.7UF 25V 20% 0805  | C25                                       | AVX          | 0805ZD475KAT2A   |
| 65   | 1    | 68PF 50V 5% 0603    | C91                                       | AVX          | 06035A680JAT2A   |
| 66   | 1    | 470PF 50V 5% 0603   | C92                                       | AVX          | 06033A471JAT2A   |
| 67   | 1    | 220UF 6.3V 20% D2E  | CT3                                       | SANYO        | 10TPE220ML       |
| 68   | 1    | 1M 1/10W 5% 0603    | R19                                       | VISHAY       | CRCW06031M00FNEA |
| 69   | 5    | 0.0 1/10W 1% 0603   | R129,R214-R217                            | PHYCOMP      | 232270296001L    |
| 70   | 3    | 10 1/10W 5% 0603    | R151-R152,R237                            | VISHAY       | CRCW060310R0JNEA |
| 71   | 1    | 4700PF 16V 10% 0603 | C110                                      | DIGI-KEY     | 311-1083-2-ND    |
| 72   | 2    | 100PF 50V 5% 0603   | C108-C109                                 | AVX          | 06035A101JAT2A   |
| 73   | 10   | 2.21K 1/10W 1% 0603 | R186-R187,R191, R199,R201-R204, R207-R208 | DIGI-KEY     | 311-2.21KHRTR-ND |
| 74   | 2    | 62.0 1/10W 1% 0603  | R153-R154                                 | DIGI-KEY     | 311-62.0HRTR-ND  |
| 75   | 3    | 1UF 6.3V 20% 0402   | C62-C63,C93                               | PANA-SONIC   | ECJ-0EB0J105M    |
| 76   | 3    | 100 1/16W 5% 0402   | R87-R88,R141                              | DIGI-KEY     | 311-100JRTR-ND   |
| 77   | 1    | 24.9K 1/10W 1% 0603 | R132                                      | DIGI-KEY     | 311-24.9KHTR-ND  |
| 78   | 3    | 10UF 10V 10% 0805   | C16,C114,C187                             | PANA-SONIC   | ECJ-2FB1A106K    |
| 79   | 6    | 0.05 1/2W 1% 1206   | R121,R124-R126, R144-R145                 | SEI          | CSF 1/2 0.05 1%R |
| 80   | 2    | 10UF 16V 10% 1210   | C86,C103                                  | AVX          | 1210YD106KAT2A   |

## ADSP-BF609 EZ-KIT Lite Bill Of Materials

| Ref. | Qty. | Description               | Reference Designator | Manufacturer | Part Number      |
|------|------|---------------------------|----------------------|--------------|------------------|
| 81   | 2    | GREEN LED001              | LED6,LED8            | PANA-SONIC   | LN1361CTR        |
| 82   | 1    | RED LED001                | LED7                 | PANA-SONIC   | LN1261CTR        |
| 83   | 2    | 1000PF 50V 5% 1206        | C85,C89              | AVX          | 12065A102JAT2A   |
| 84   | 1    | 255.0K 1/10W 1% 0603      | R130                 | VISHAY       | CRCW06032553FK   |
| 85   | 1    | 80.6K 1/10W 1% 0603       | R131                 | VISHAY       | CRCW060380K6FKEA |
| 86   | 3    | 5A MBRS540T3G SMC         | D5-D7                | ON SEMI      | MBRS540T3G       |
| 87   | 1    | VARISTOR V5.5MLA 30A 0603 | R1                   | LITTLE-FUSE  | V5.5MLA0603      |
| 88   | 1    | THERM 0.5A 0.4 1206       | R209                 | LITTLE-FUSE  | 1206L050-C       |
| 89   | 1    | 2.5UH 30% IND013          | L1                   | COIL-CRAFT   | MSS1038-252NL_   |
| 90   | 7    | 330.0 1/16W 1% 0402       | R73-R79              | DIGI-KEY     | 541-330LCT-ND    |
| 91   | 5    | 1.0K 1/16W 1% 0402        | R2-R3,R155-R157      | PANA-SONIC   | ERJ-2RKF1001X    |
| 92   | 3    | 1.50K 1/16W 1% 0402       | R15-R16,R175         | PANA-SONIC   | ERJ-2RKF1501X    |
| 93   | 13   | 0 1/16W 5% RNS005         | RN1-RN13             | PANA-SONIC   | EXB-28VR000X     |
| 94   | 3    | 22UF 16V 10% 1210         | C201-C203            | YAIYO YUDEN  | EMK325BJ226KM-T  |
| 95   | 1    | 33 1/16W 5% RNS003        | RN14                 | PANA-SONIC   | EXB-2HV330JV     |

| Ref. | Qty. | Description                     | Reference Designator | Manufacturer | Part Number     |
|------|------|---------------------------------|----------------------|--------------|-----------------|
| 96   | 1    | 100.0 1/16W 1% 0402             | R4                   | DIGI-KEY     | 541-100LCT-ND   |
| 97   | 2    | 0.036 1/2W 1% 1206              | R127-R128            | SUSUMU       | RL1632S-R036-F  |
| 98   | 1    | 30A GSOT05 SOT23-3              | D2                   | VISHAY       | GSOT05-GS08     |
| 99   | 2    | 30A GSOT03 SOT23-3              | D3-D4                | VISHAY       | GSOT03-GS08     |
| 100  | 1    | 40A ESD5Z2.5T1 SOD-523          | D1                   | ON SEMI      | ESD5Z2.5T1G     |
| 101  | 2    | 165.0 1/10W 1% 0603             | R197-R198            | DIGI-KEY     | P165HTR-ND      |
| 102  | 1    | 220.0 1/10W 1% 0603             | R185                 | DIGI-KEY     | P220HTR-ND      |
| 103  | 1    | 4.87K 1/10W 1% 0402             | R189                 | DIGI-KEY     | 541-4.87KHCT-ND |
| 104  | 13   | 49.9 1/16W 1% 0402              | R176-R184,R193-R196  | STACK-POLE   | RMCF0402FT49R9  |
| 105  | 1    | 15KV ESD7004 DFN50P250X100-1 0N | D10                  | ON SEMI      | ESD7004MUTAG    |
| 106  | 1    | 15KV ESDA6V1SC SOT95P280-6N     | D9                   | DIGI-KEY     | 497-6637-1-ND   |
| 107  | 1    | 30K 1/10W 1% 0402               | R242                 | PANA-SONIC   | ERJ-2RKF3002X   |
| 108  | 1    | 32.4K 1/10W 1% 0402             | R243                 | PANA-SONIC   | ERJ-2RKF3242X   |

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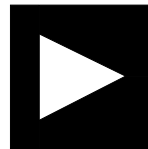
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4

4

# ADSP-BF609 EZ-Board

## SCHEMATIC

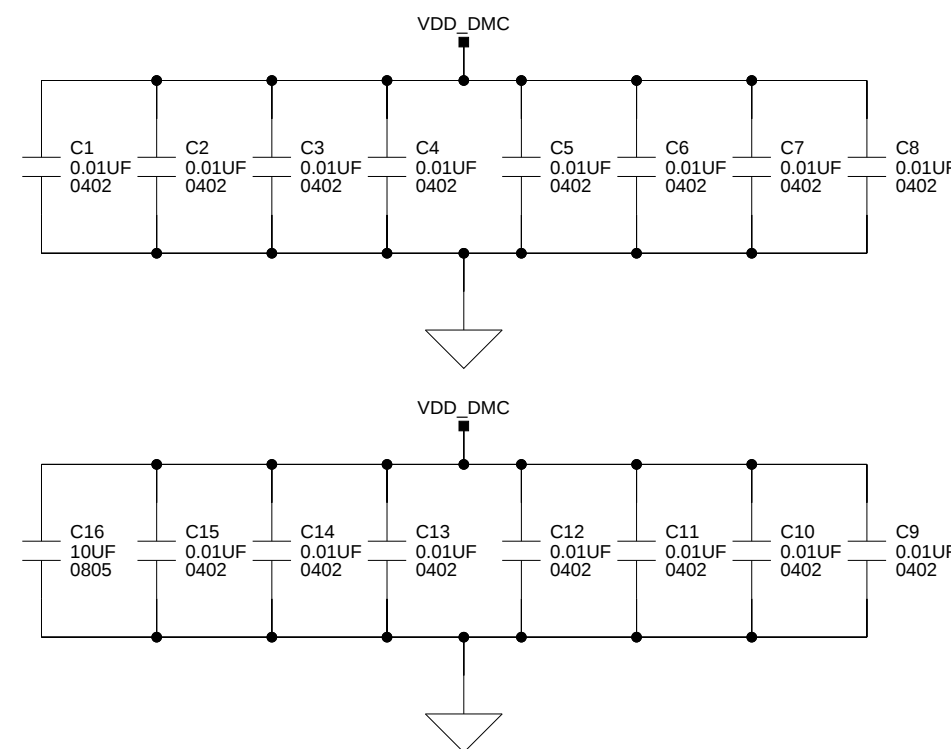
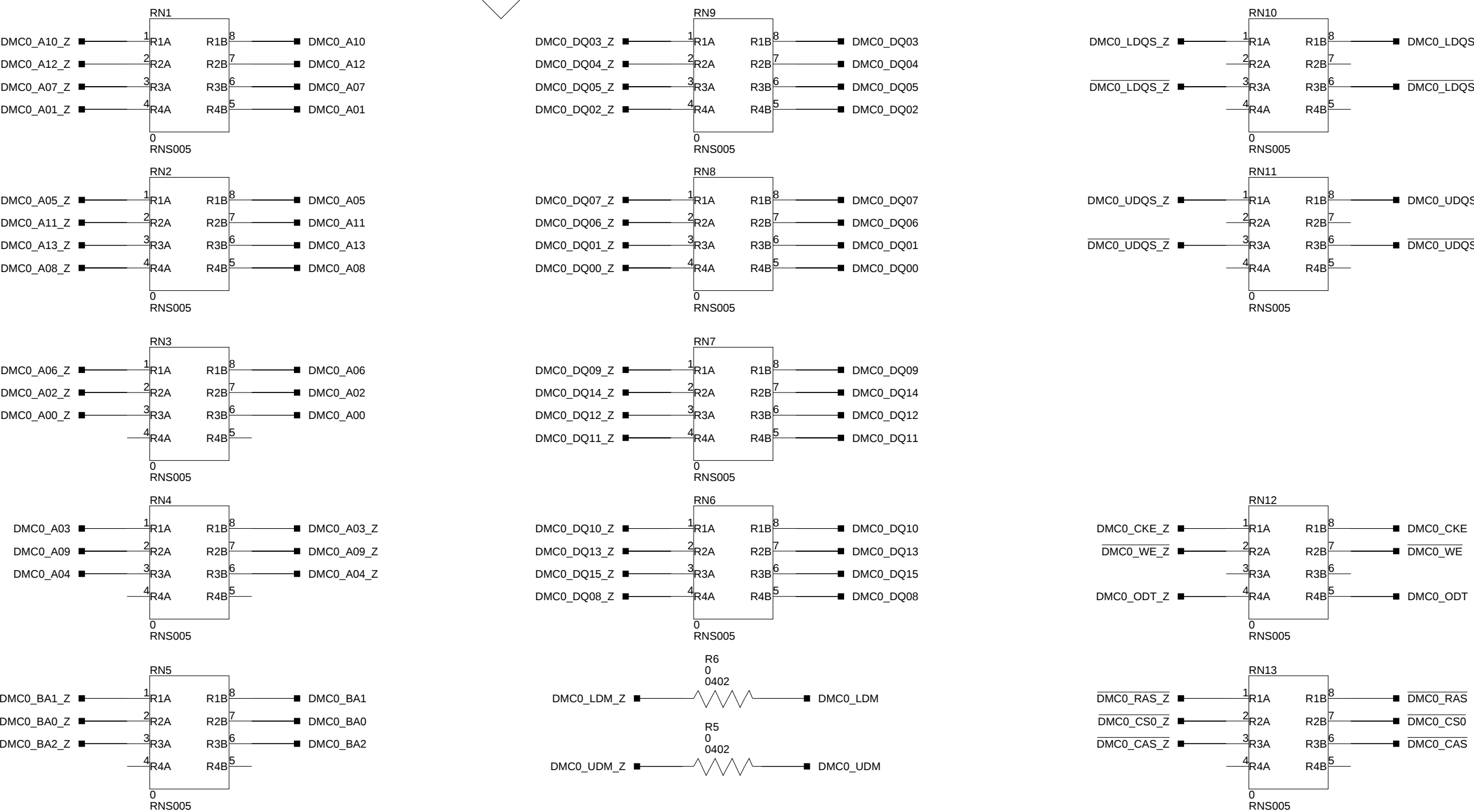
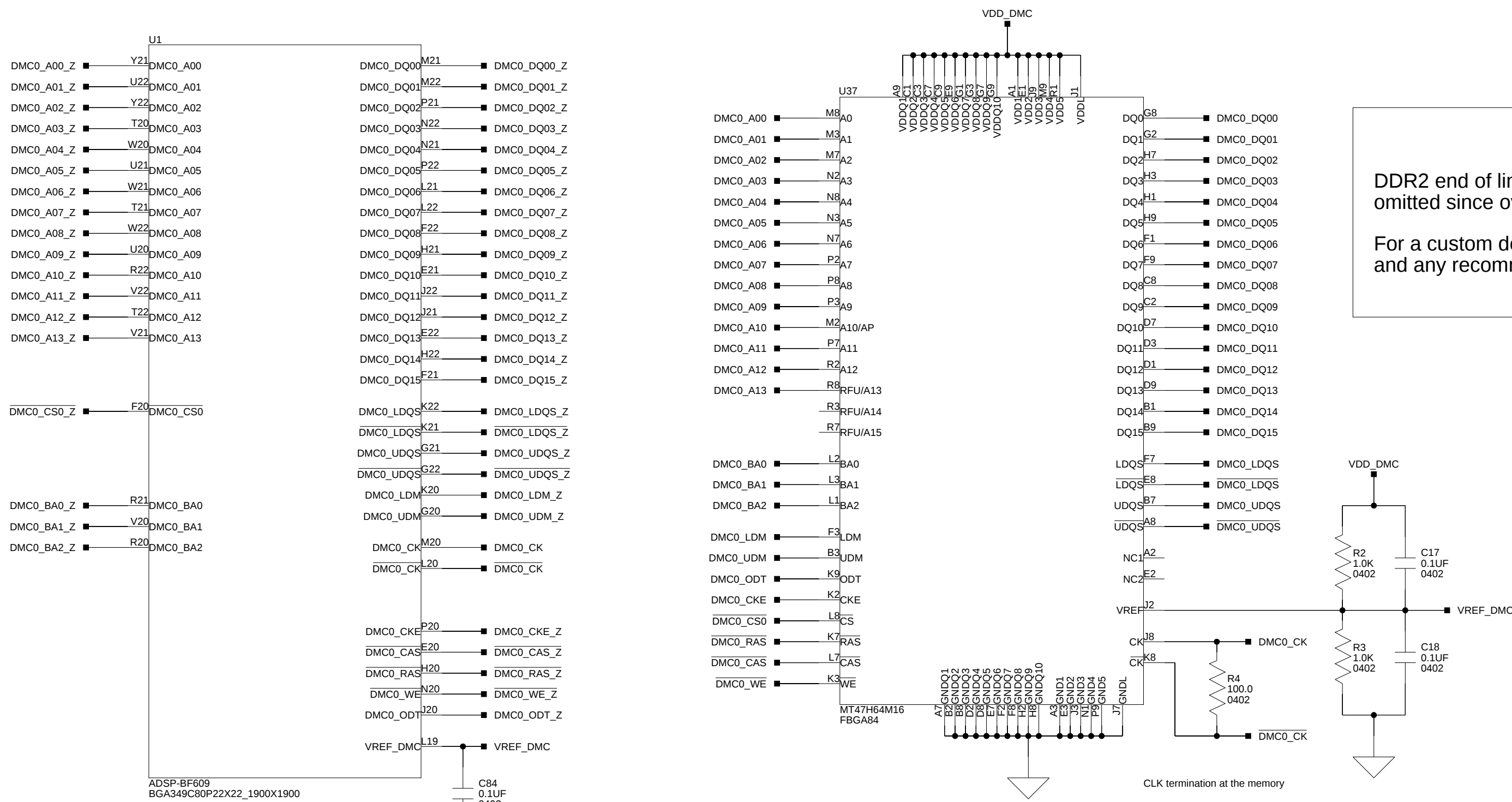
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|---------------------------------------------------------------------------------------|-----------|------------------------------------|------------|---------------------------------------------------------|-------------------|
|  |           | <b>ANALOG<br/>DEVICES</b>          |            | 20 Cotton Road<br>Nashua, NH 03063<br>PH: 1-800-ANALOGD |                   |
| Title                                                                                 |           | ADSP-BF609 EZ-Board<br>Title Block |            |                                                         |                   |
| Size<br><b>C</b>                                                                      | Board No. |                                    | A0269-2011 |                                                         | Rev<br><b>1.0</b> |
| Date                                                                                  |           | 1/5/12                             |            | Sheet 1 of 16                                           |                   |

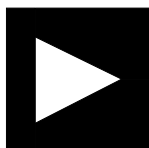
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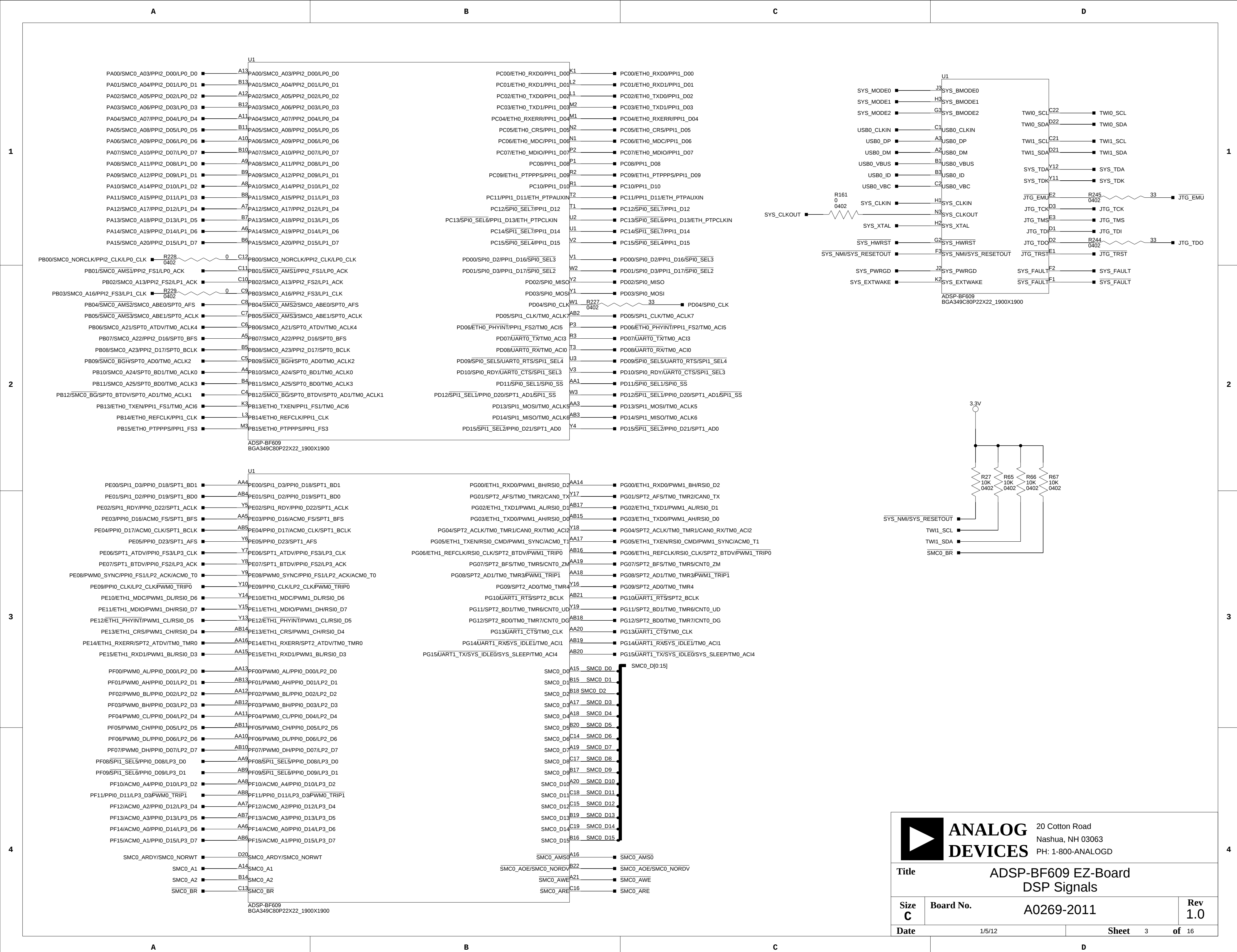
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|---------------------------------------------------------------------------------------|-----------|---------------------------------------------------------|------------|
|  |           | 20 Cotton Road<br>Nashua, NH 03063<br>PH: 1-800-ANALOGD |            |
| Title                                                                                 |           | ADSP-BF609 EZ-Board<br>DSP DDR2 Interface               |            |
| Size<br>C                                                                             | Board No. | A0269-2011                                              | Rev<br>1.0 |
| Date                                                                                  | 1/5/12    | Sheet 2 of                                              | 16         |



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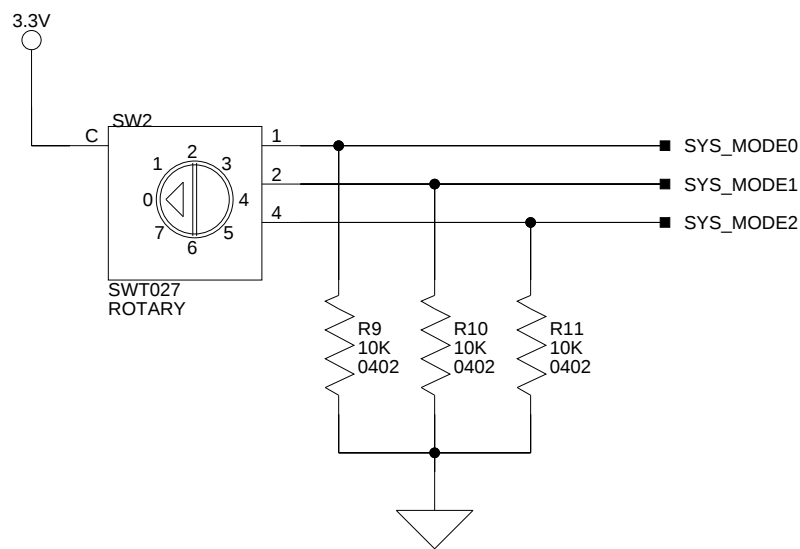
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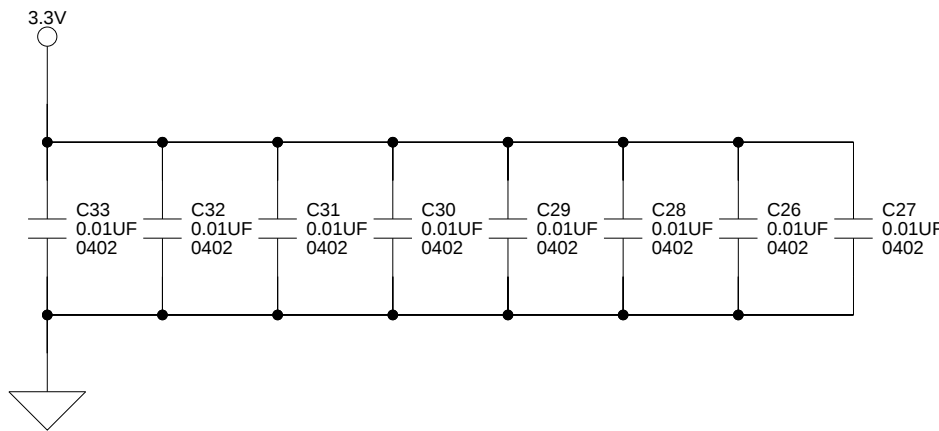
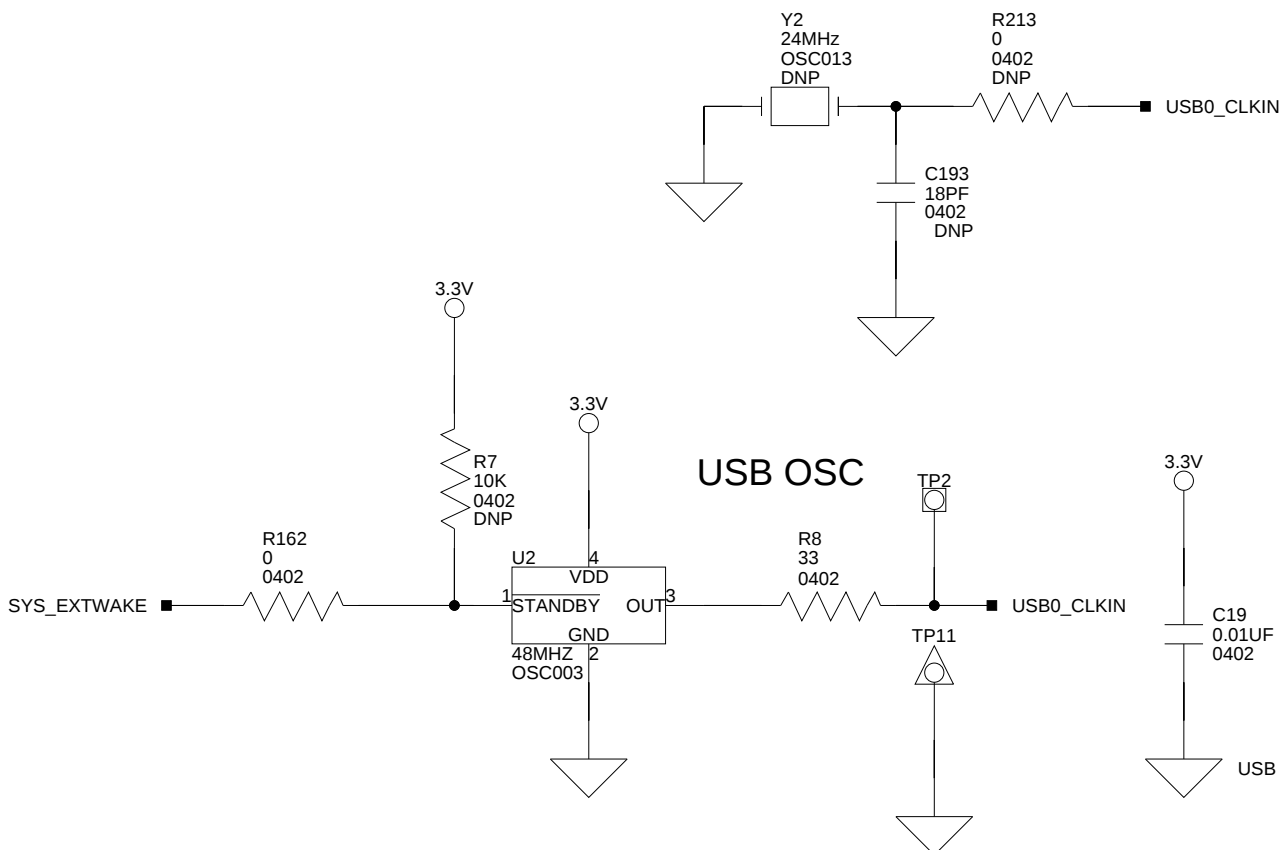
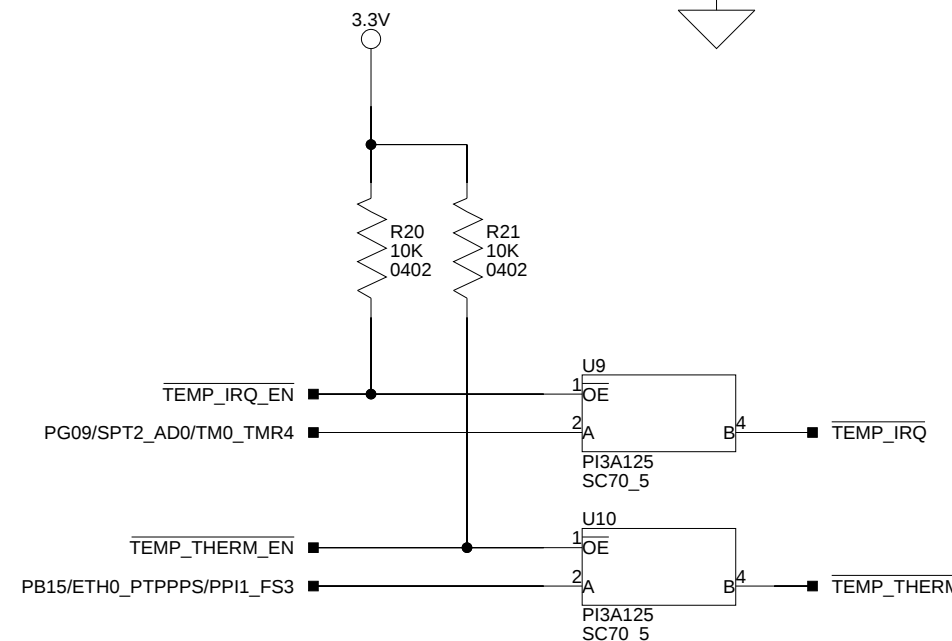
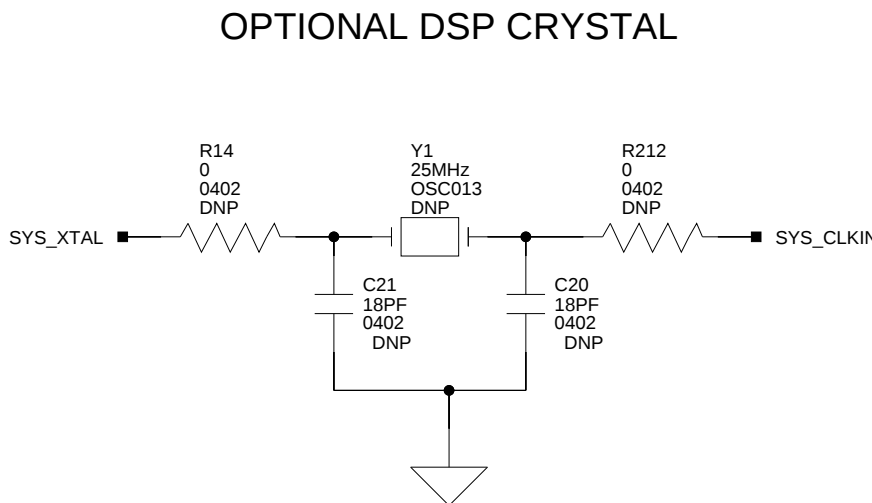
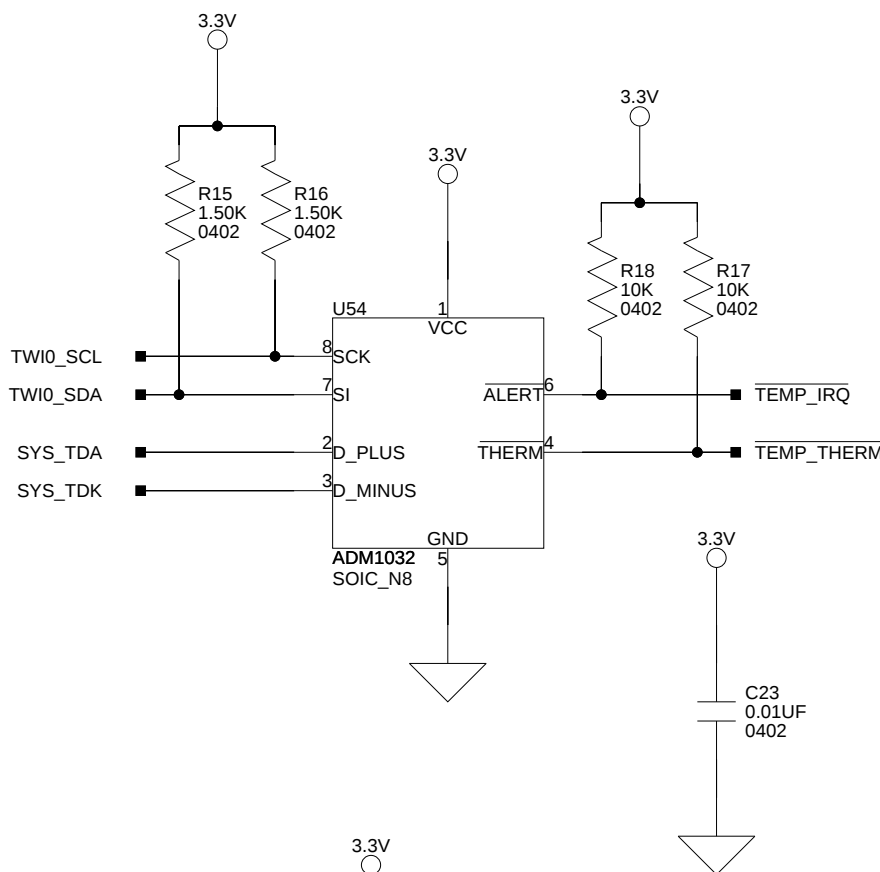
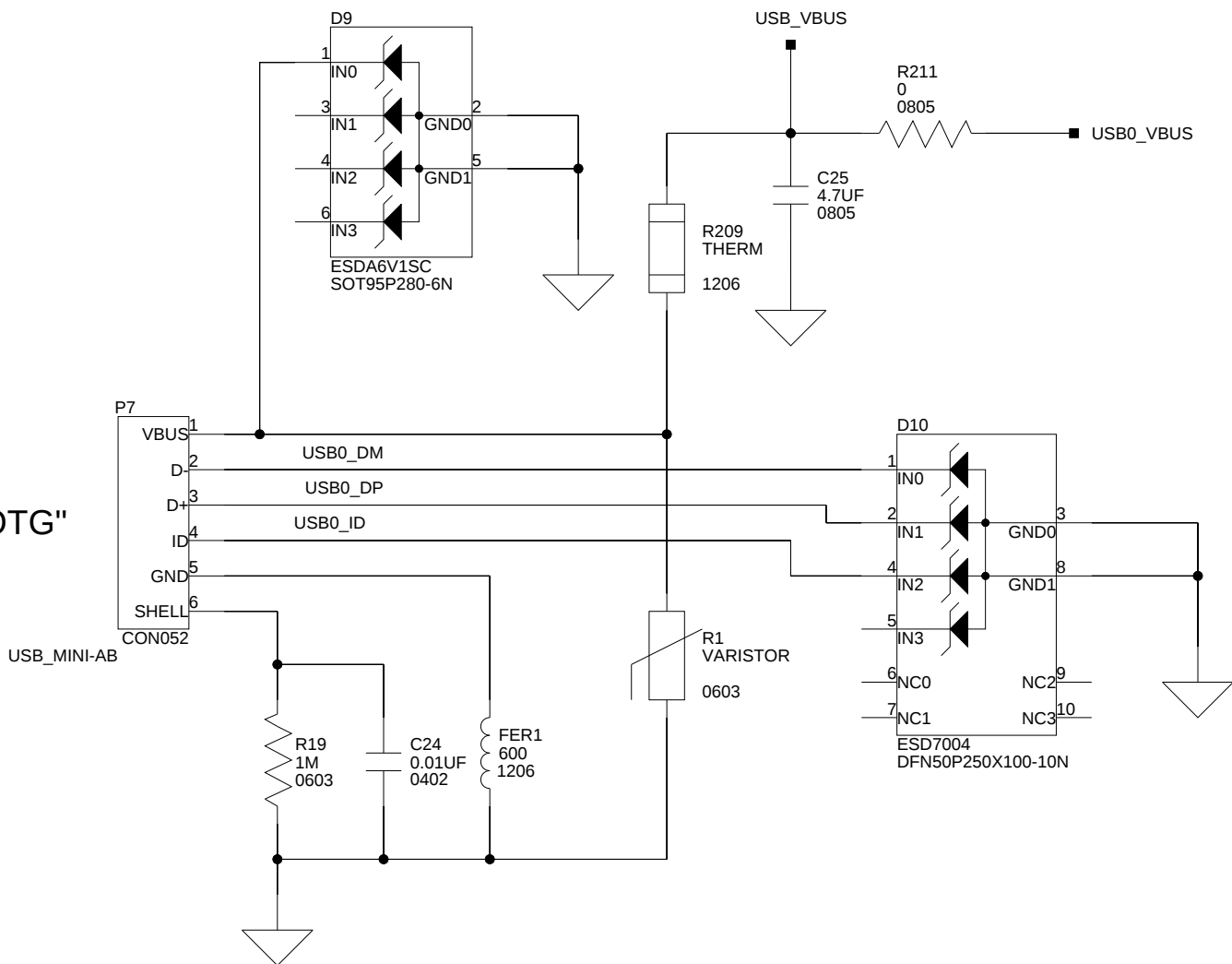
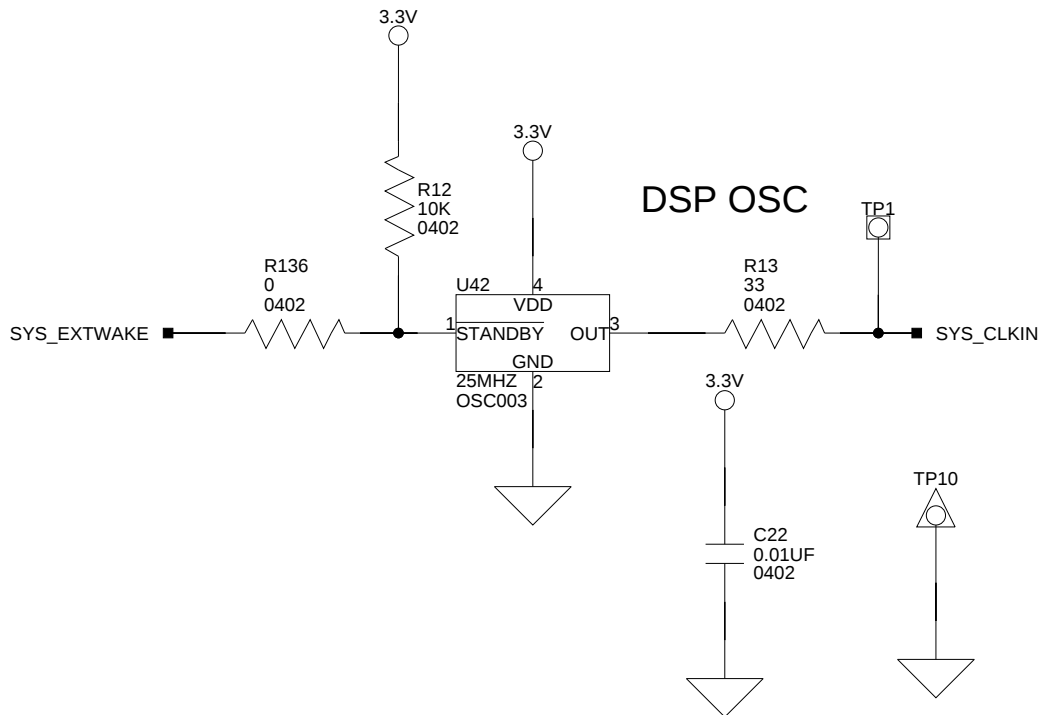
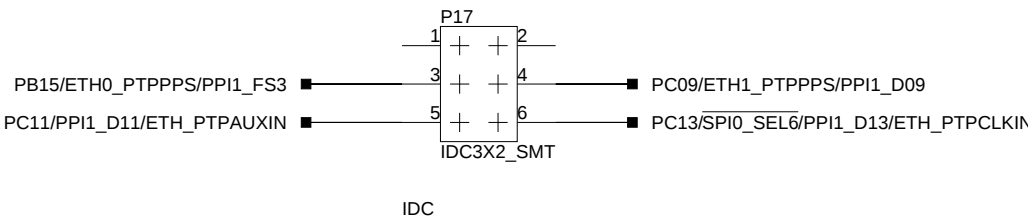
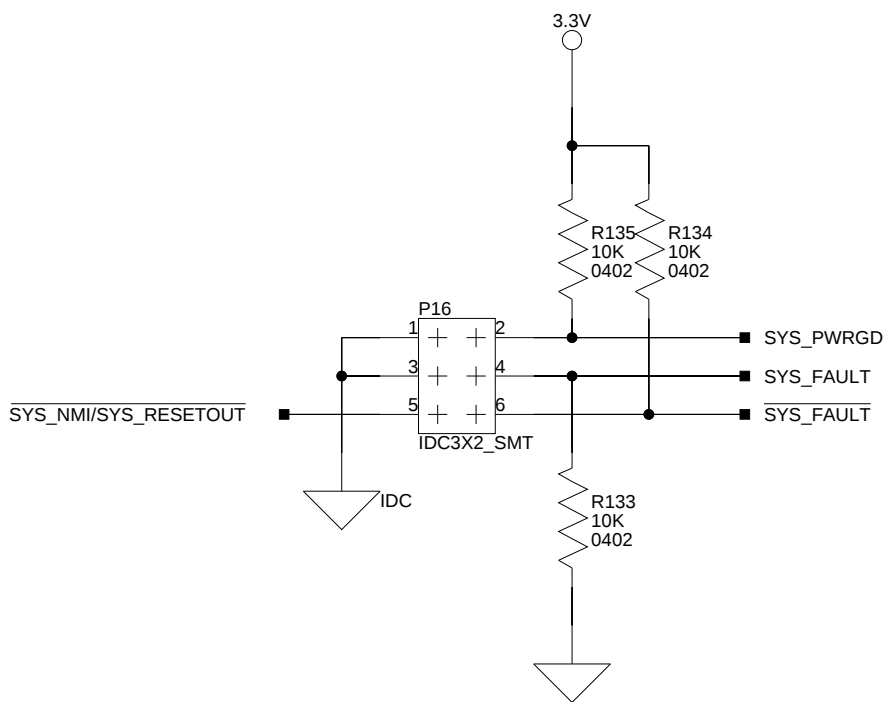
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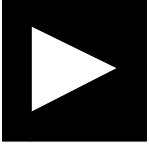


SW1: Boot mode selection switch

| BMODE[2:0] |                      |
|------------|----------------------|
| 000        | No-boot/Idle         |
| 001        | Parrallel Flash boot |
| 010        | RSI master boot      |
| 011        | SPI0 master boot     |
| 100        | SPI0 slave boot      |
| 101        | reserved             |
| 110        | LP0 slave boot       |
| 111        | UART0 slave boot     |

DEFAULT





**ANALOG  
DEVICES**

20 Cotton Road  
Nashua, NH 03063  
PH: 1-800-ANALOGD

Title

ADSP-BF609 EZ-Board  
Temp. Sensor, Boot Switch, DSP Clock, USB Conn

Size  
C

Board No.

A0269-2011

Rev  
1.0

Date

1/5/12

Sheet

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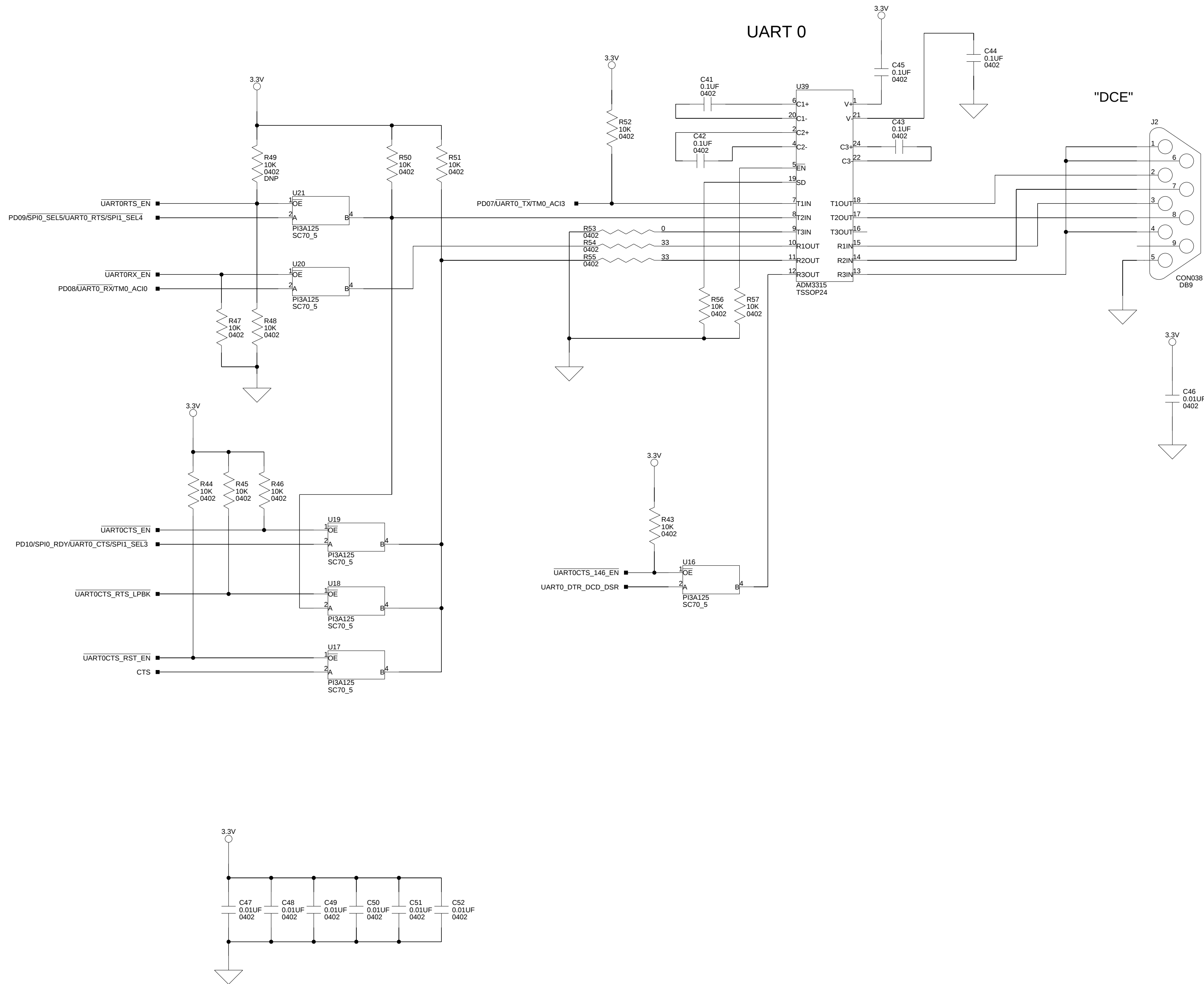
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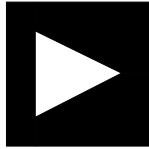
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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------|
|  <b>ANALOG DEVICES</b> 20 Cotton Road<br>Nashua, NH 03063<br>PH: 1-800-ANALOGD |                             |                   |
| Title <b>ADSP-BF609 EZ-Board<br/>UART0</b>                                                                                                                          |                             |                   |
| Size<br><b>C</b>                                                                                                                                                    | Board No. <b>A0269-2011</b> | Rev<br><b>1.0</b> |
| Date                                                                                                                                                                | 1/5/12                      | Sheet 7 of 16     |



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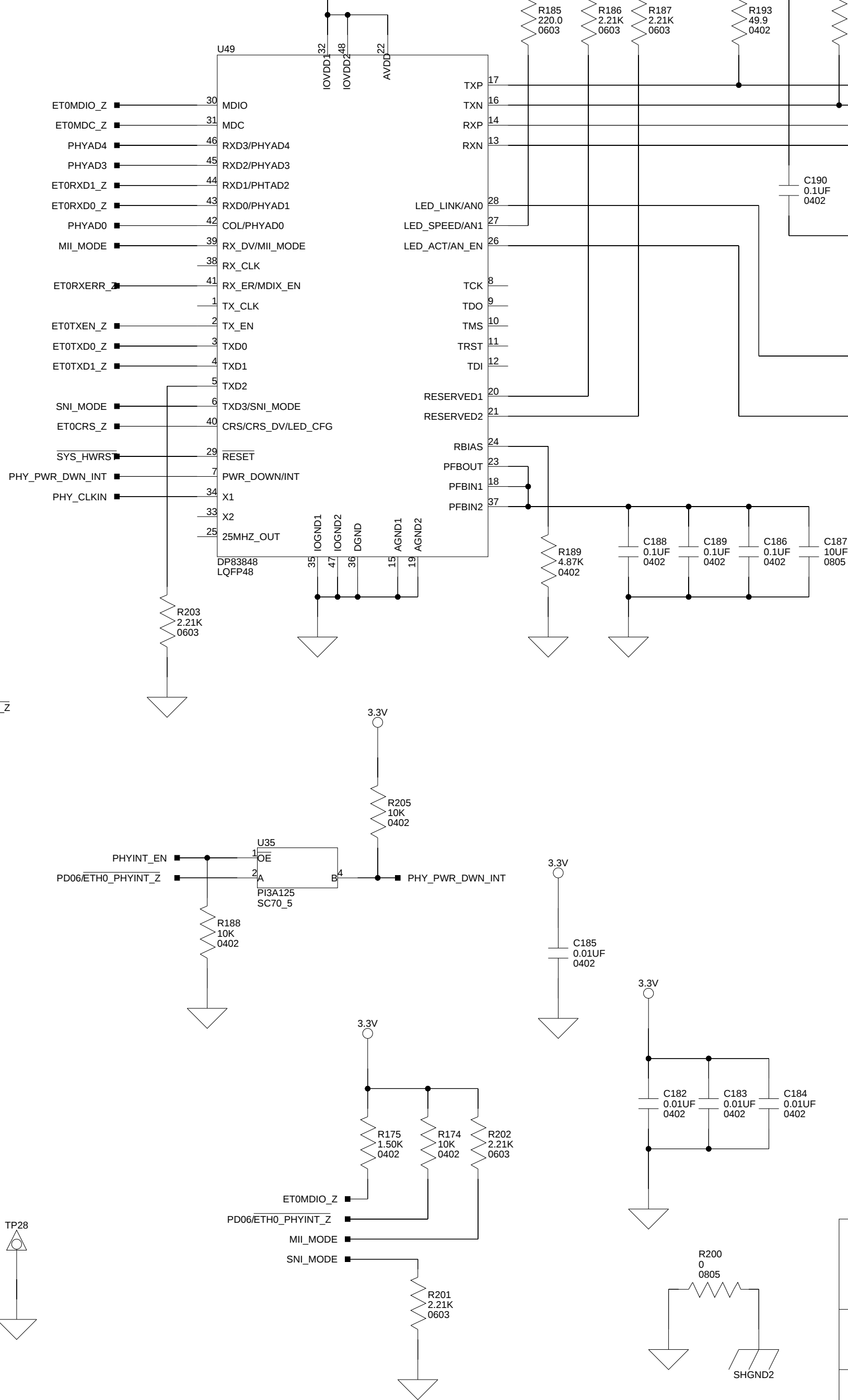
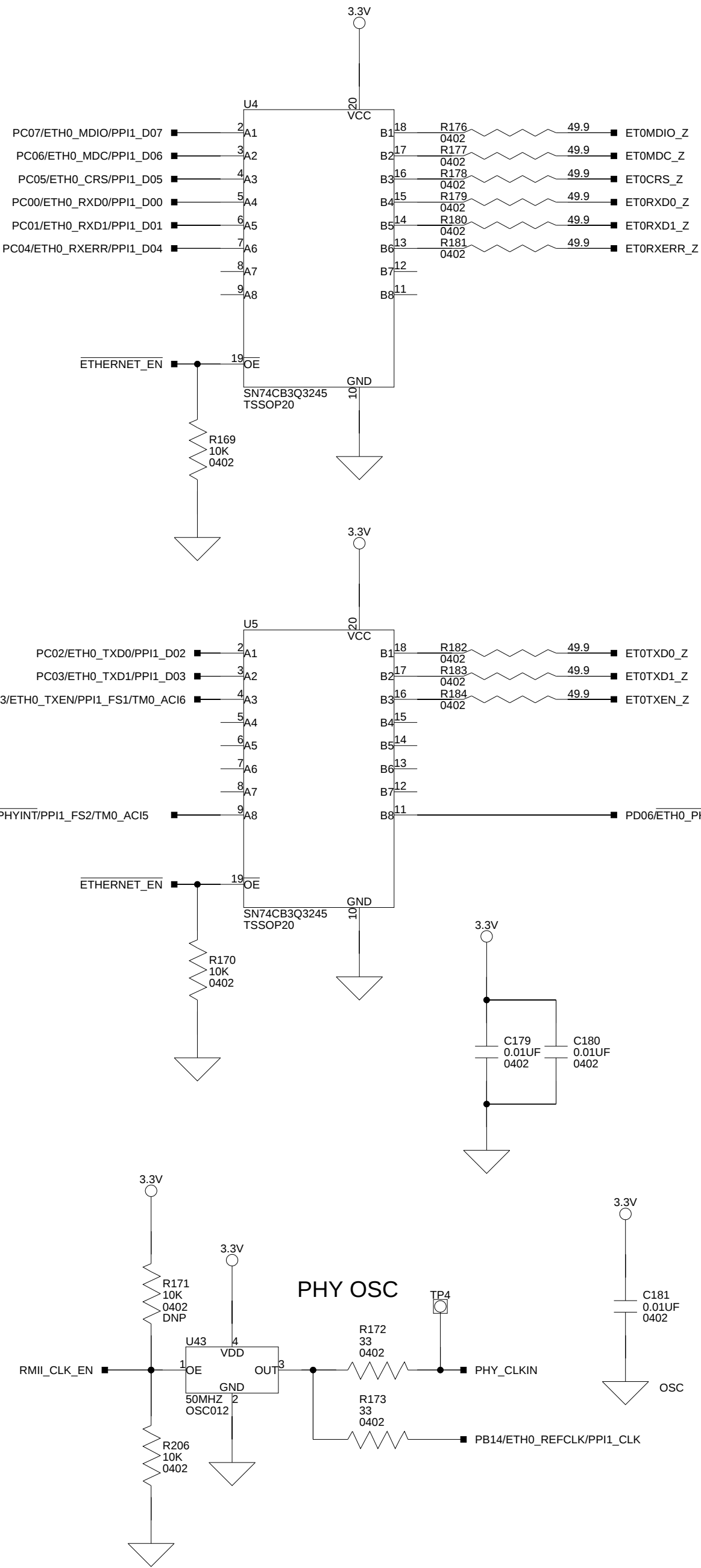
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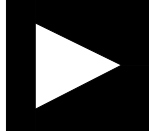
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|-------------------------------------------------------------------------------------------------------------|-----------------------------|---------------------------------------------------------|
|  <b>ANALOG DEVICES</b> |                             | 20 Cotton Road<br>Nashua, NH 03063<br>PH: 1-800-ANALOGD |
| Title <b>ADSP-BF609 EZ-Board Ethernet</b>                                                                   |                             |                                                         |
| Size <b>C</b>                                                                                               | Board No. <b>A0269-2011</b> | Rev <b>1.0</b>                                          |
| Date                                                                                                        | 1/5/12                      | Sheet 9 of 16                                           |

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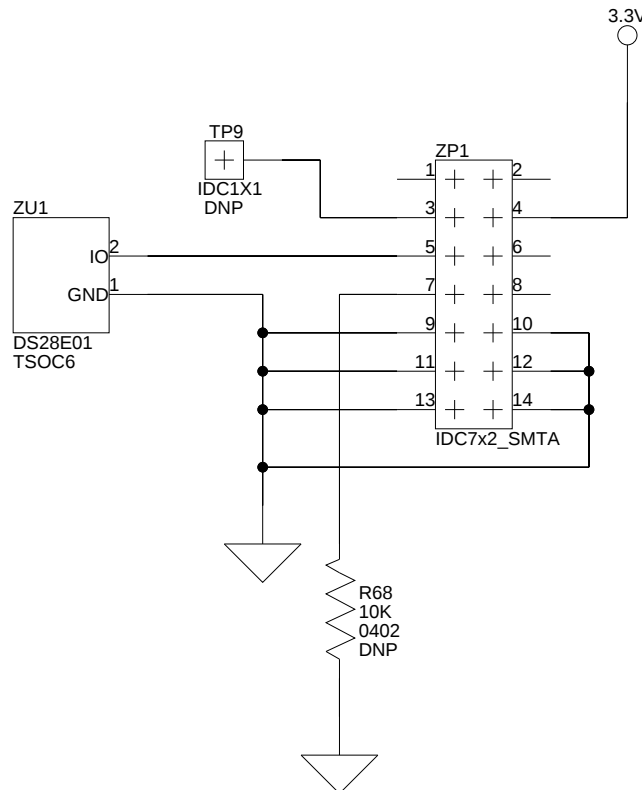
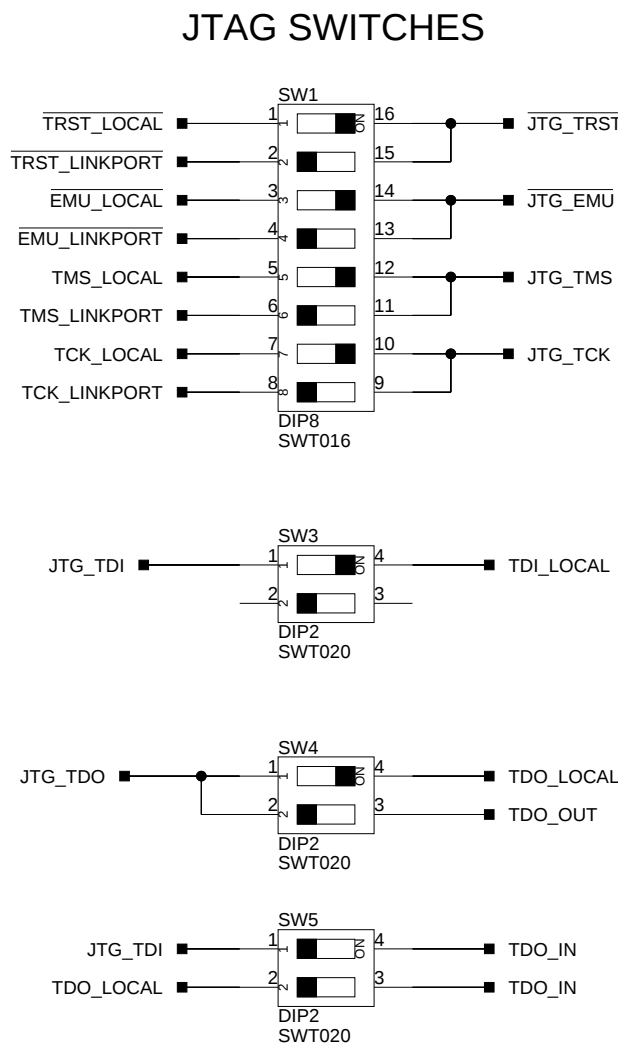
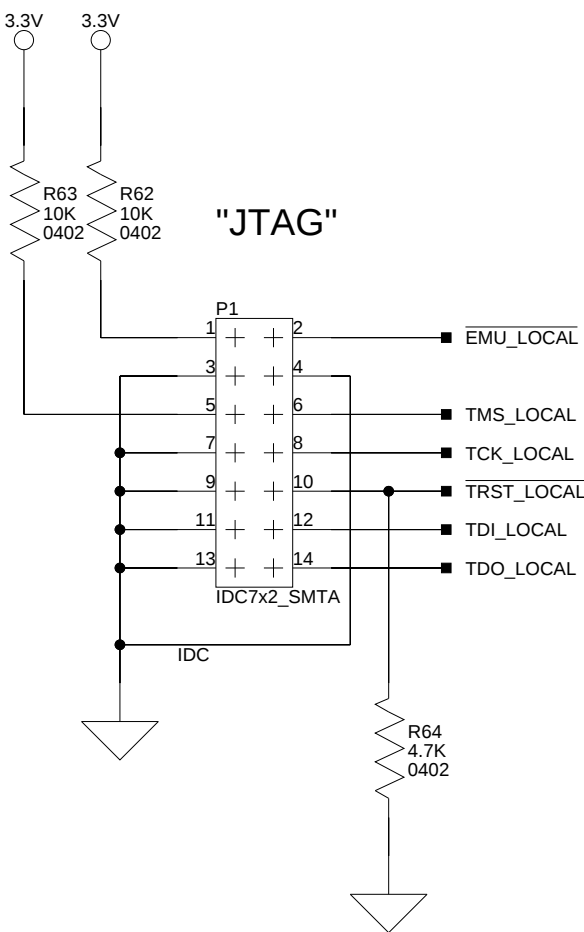
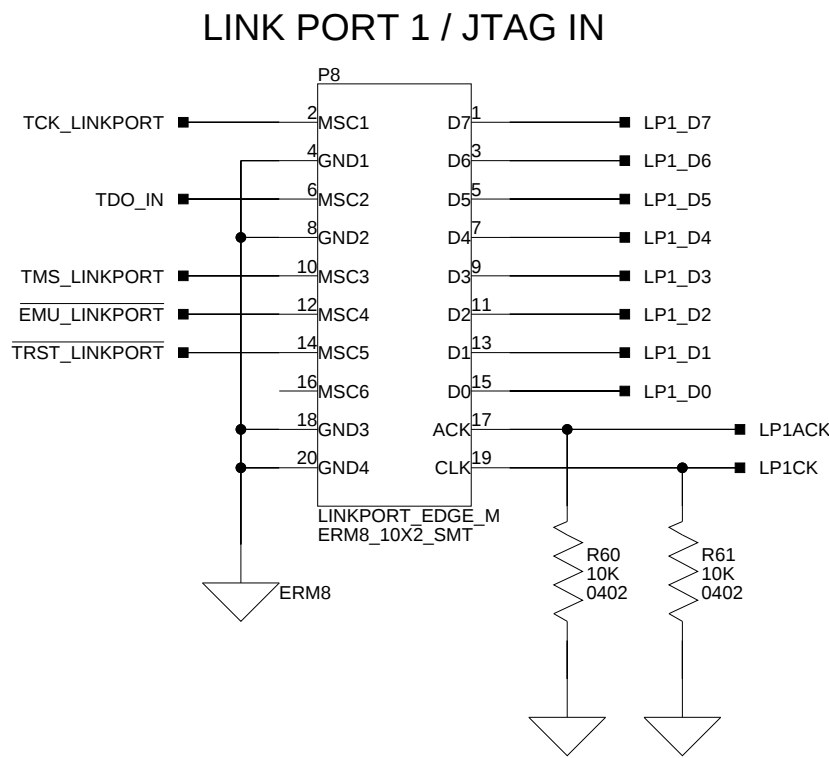
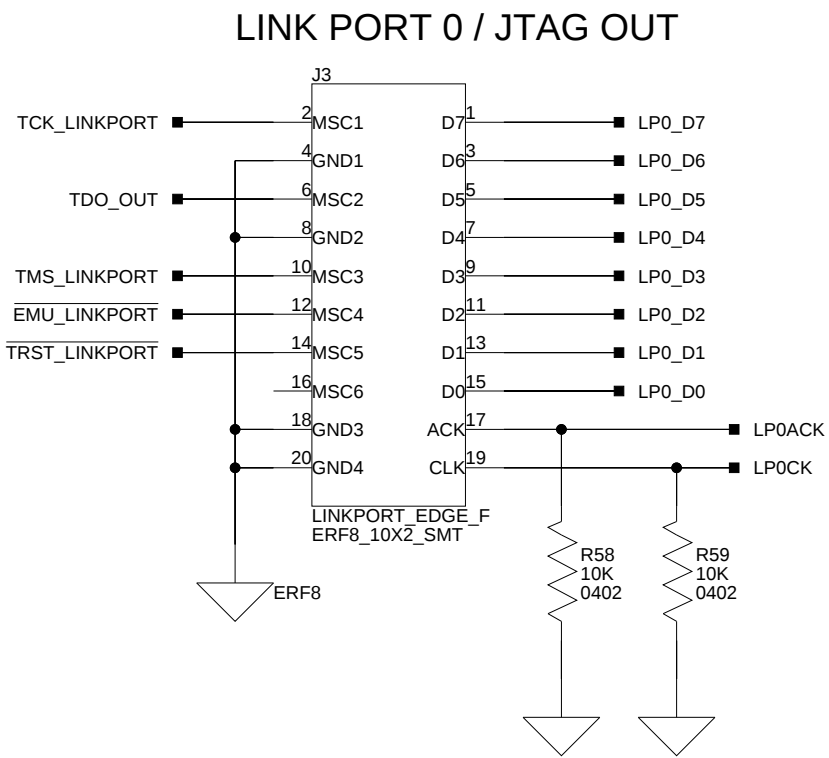
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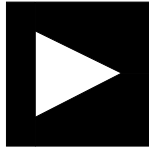


SINGLE PROCESSOR JTAG SETTINGS  
EMULATOR OR DEBUG AGENT (DEFAULT)

| SWITCH | BOARD ATTACHED<br>TO EMULATOR |
|--------|-------------------------------|
| SW1.1  | ON                            |
| SW1.2  | OFF                           |
| SW1.3  | ON                            |
| SW1.4  | OFF                           |
| SW1.5  | ON                            |
| SW1.6  | OFF                           |
| SW1.7  | ON                            |
| SW1.8  | OFF                           |
| SW3.1  | ON                            |
| SW3.2  | OFF                           |
| SW4.1  | ON                            |
| SW4.2  | OFF                           |
| SW5.1  | OFF                           |
| SW5.2  | OFF                           |

MULTI PROCESSOR JTAG SETTINGS VIA HP-USB EMULATOR  
USING TWO OR MORE EZ-BOARDS (LINK PORT CABLES  
REQUIRED FOR MORE THAN TWO BOARDS)

| SWITCH | BOARD ATTACHED<br>TO EMULATOR | BOARD(S) NOT ATTACHED<br>TO EMULATOR |
|--------|-------------------------------|--------------------------------------|
| SW1.1  | ON                            | OFF                                  |
| SW1.2  | ON                            | ON                                   |
| SW1.3  | ON                            | OFF                                  |
| SW1.4  | ON                            | ON                                   |
| SW1.5  | ON                            | OFF                                  |
| SW1.6  | ON                            | ON                                   |
| SW1.7  | ON                            | OFF                                  |
| SW1.8  | ON                            | ON                                   |
| SW3.1  | ON                            | OFF                                  |
| SW3.2  | OFF                           | OFF                                  |
| SW4.1  | OFF                           | OFF                                  |
| SW4.2  | ON                            | ON                                   |
| SW5.1  | OFF                           | ON                                   |
| SW5.2  | ON                            | OFF                                  |



**ANALOG  
DEVICES**

20 Cotton Road  
Nashua, NH 03063  
PH: 1-800-ANALOGD

|                                                        |                         |                |
|--------------------------------------------------------|-------------------------|----------------|
| Title<br>ADSP-BF609 EZ-Board<br>JTAG, Linkport 0 and 1 |                         |                |
| Size<br>C                                              | Board No.<br>A0269-2011 | Rev<br>1.0     |
| Date                                                   | 1/5/12                  | Sheet 10 of 16 |

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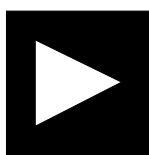
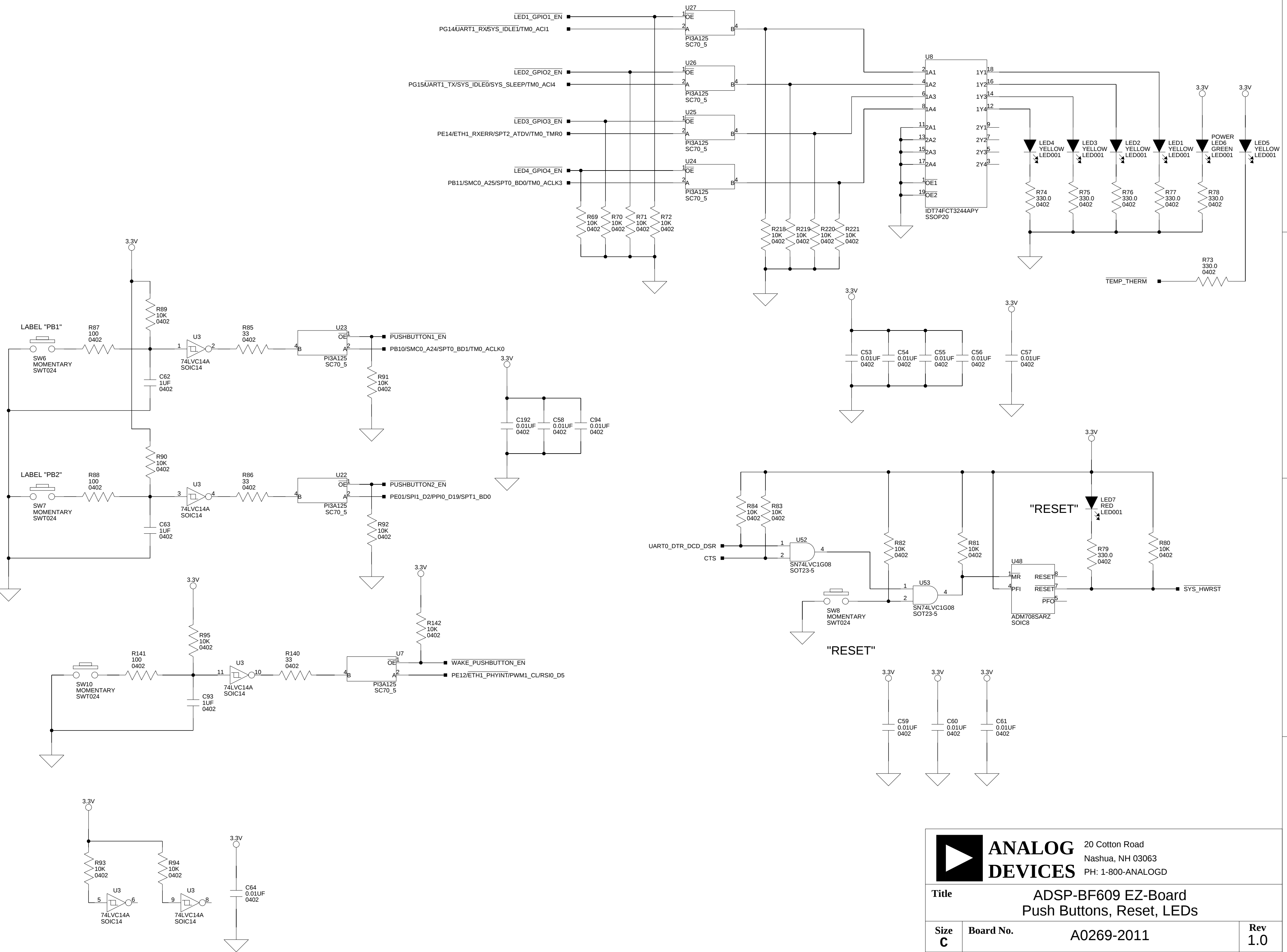
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**ANALOG  
DEVICES**

20 Cotton Road  
Nashua, NH 03063  
PH: 1-800-ANALOGD

Title **ADSP-BF609 EZ-Board  
Push Buttons, Reset, LEDs**

|                  |                                |                   |
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| Size<br><b>C</b> | Board No.<br><b>A0269-2011</b> | Rev<br><b>1.0</b> |
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| Date | 1/5/12 | Sheet | 11 | of | 16 |
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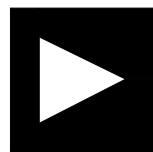
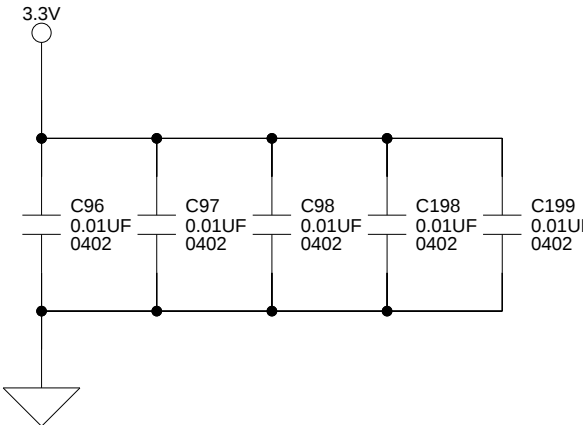
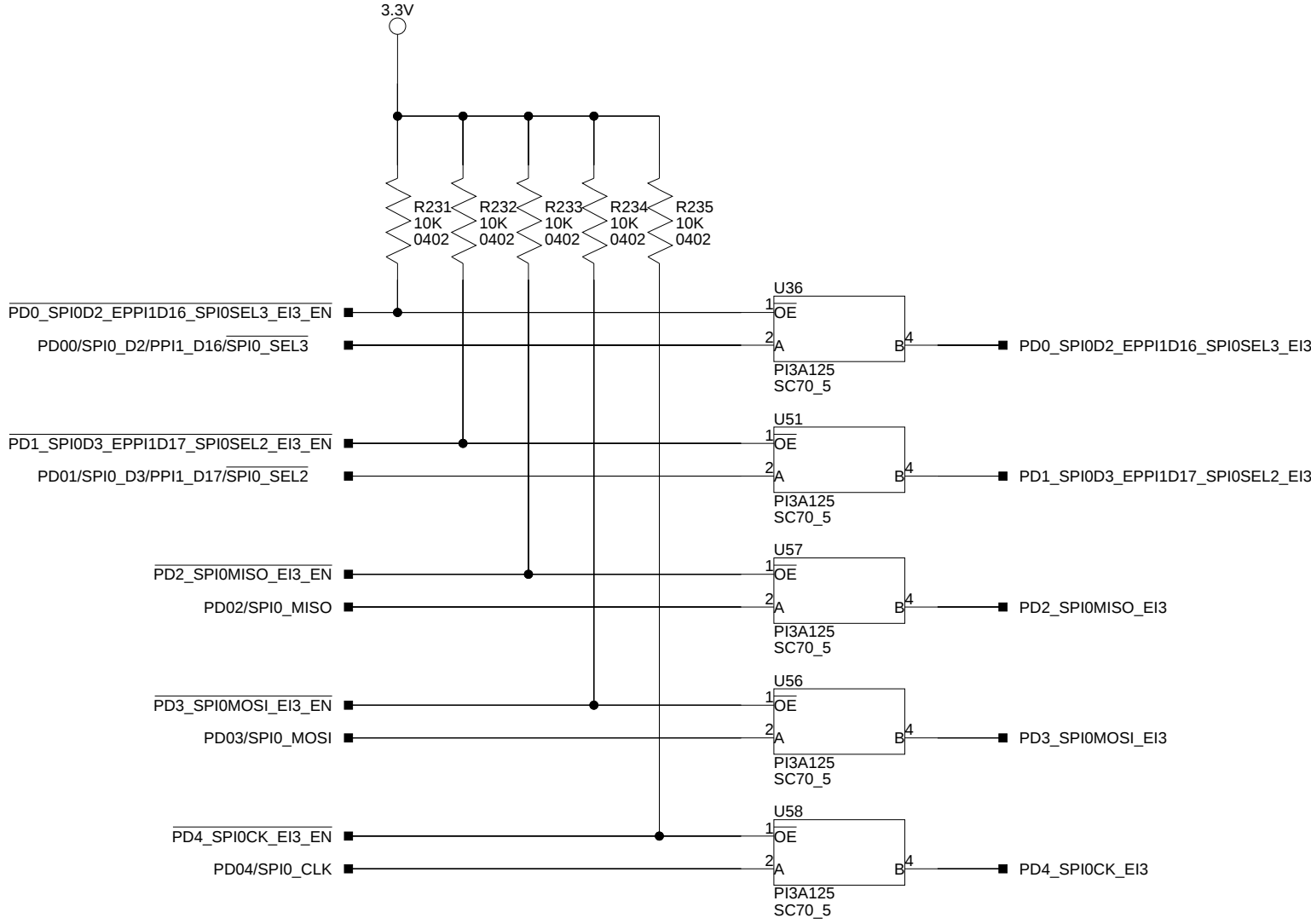
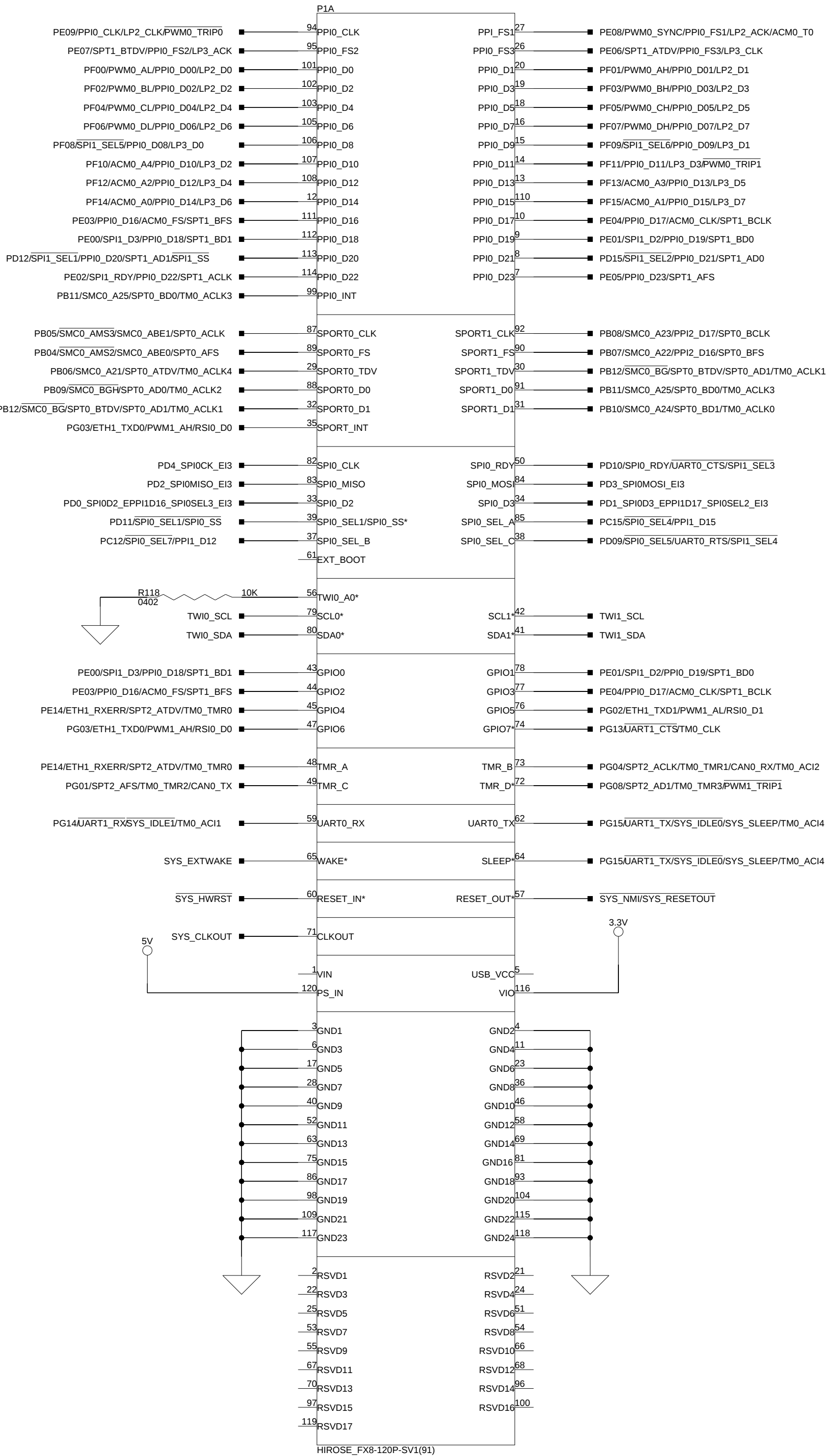
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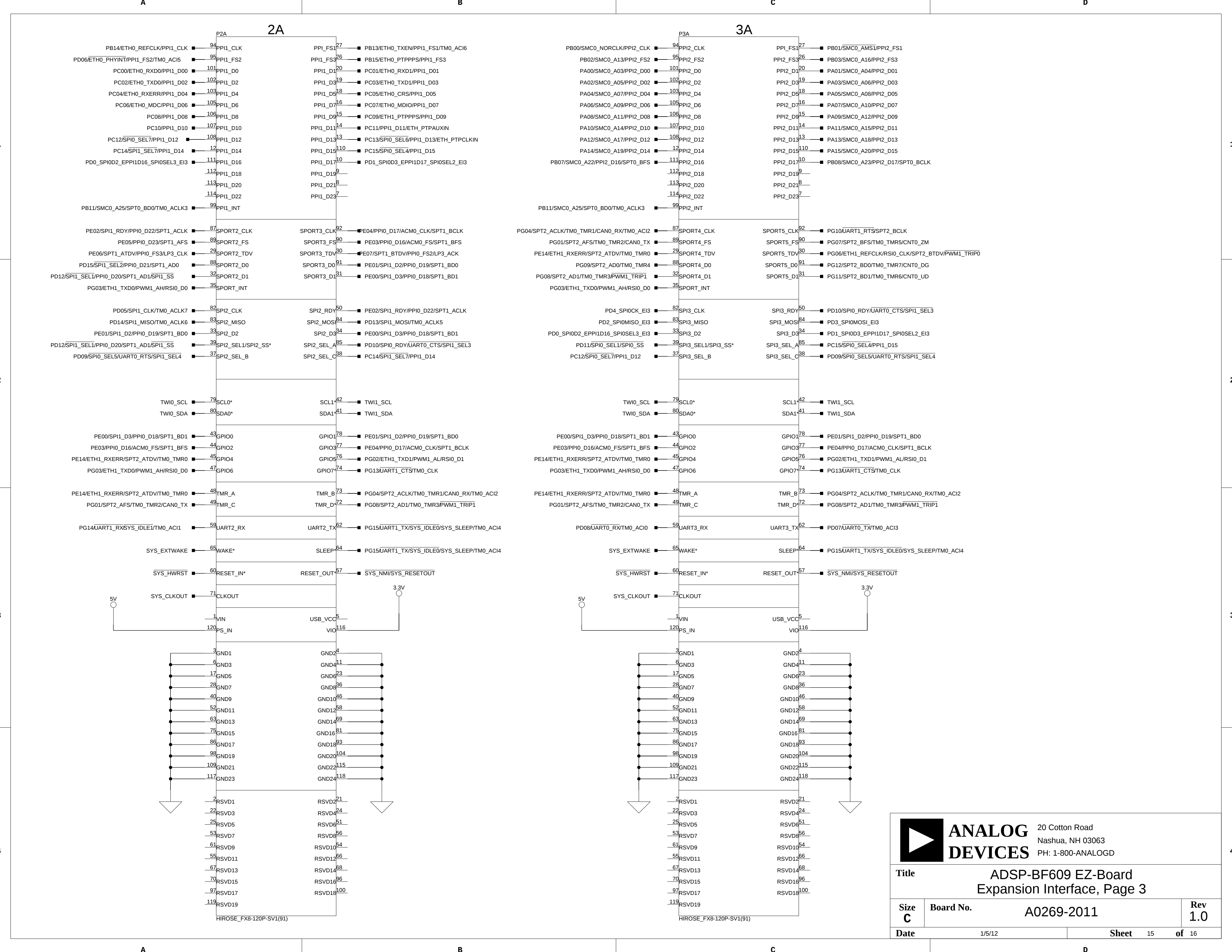
**ANALOG  
DEVICES**

20 Cotton Road  
Nashua, NH 03063  
PH: 1-800-ANALOGD

Title **ADSP-BF609 EZ-Board  
Expansion Interface, Page 1**

|                  |                                |                   |
|------------------|--------------------------------|-------------------|
| Size<br><b>C</b> | Board No.<br><b>A0269-2011</b> | Rev<br><b>1.0</b> |
| Date             | 1/5/12                         | Sheet 13 of 16    |





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