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User Manual for LPCXpresso812-MAX Board

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User Manual for
LPCXpresso812-MAX Board

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Contact information

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1. Introduction

The LPCXpresso family of boards provides a powerful and flexible development system for NXP's Cortex-M MCUs. They can be used with a range of development tools. The LPCXpresso812-MAX board is developed by NXP to enable evaluation of and prototyping with the LPC81x family of MCUs.

The LPCXpresso812-MAX includes a standard 10-pin JTAG/SWD connector plus analog/digital expansion headers, making it a highly extensible platform. Headers conforming to the LPCXpresso, Arduino UNO expansion connector standards give several options to developers wanting to leverage existing peripheral boards.

The LPCXpresso812-MAX can be configured to use external debug probes from Keil, IAR, Segger, P&E and other vendors that support CMSIS-DAP. Figure 1 shows the LPCXpresso812-MAX main board.

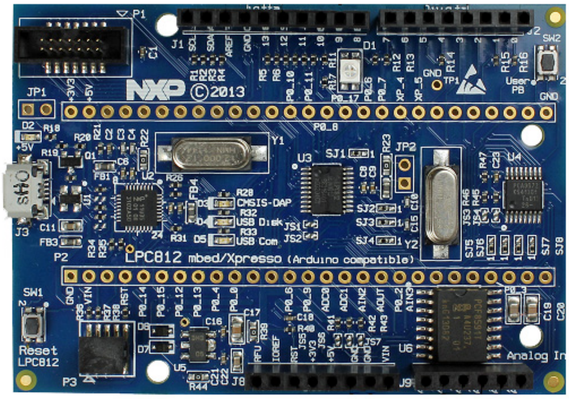


Fig 1. LPCXpresso812-MAX Board

The LPCXpresso812-MAX board includes the following features:

- Supports MCUXpresso IDE and other popular toolchains (incl. IAR and Keil).
- LPC812 Arm Cortex-M0+ MCU.
- On-board CMSIS-DAP (debug probe) based on LPC11U35 MCU.
- Debug connector to allow debug of target LPC812 MCU using an external probe.
- Target User and Reset buttons.
- Target pins available on ‘standard LPCXpresso/mbed’ expansion connector.
- Tri-color LED.
- On-board ADC.

2. Board Layout

Figure 2 below shows the layout of the LPCXpresso812-MAX board, indicating location of jumpers, buttons and connectors/expansion options.

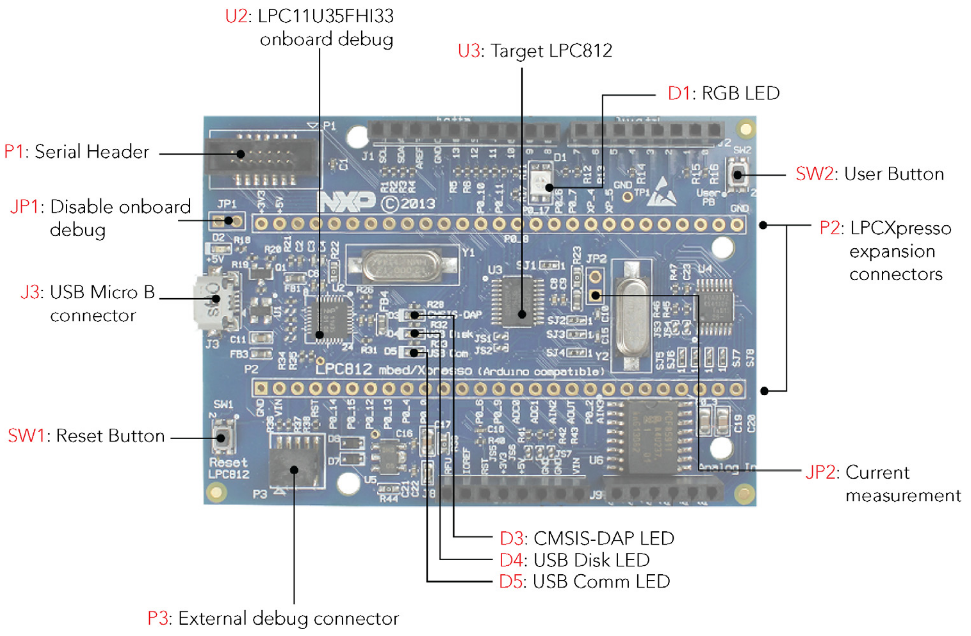


Fig 2. Board layout

Table 1 below shows the layout of the LPCXpresso812-MAX board, indicating location of jumpers, buttons, connectors/expansion options and MCU devices.

Table 1. Default jumpers, button and expansion connectors

Circuit reference	Description	Reference section
JP1	On-chip debug probe disable. Insert a jumper on this header to disable the on-board debug probe when using an external probe. JP1 is not factory fitted.	5.1.1
JP2	Current measurement. Insert an Ammeter across JP2 to measure current supply to the LPC812. Solder jumper R23 must be removed first. JP2 is not factory fitted.	5.1.2
J3	Micro USB connector	3.2
SW1	Reset button	5.2.1
SW2	User button	5.2.2
D1	Tri-color LED	5.3
D2	Power LED	5.3
D3	LED indicator for CMSIS-DAP	5.3
D4	LED indicator for USB Disk	5.3
D5	LED indicator for USB Com	5.3
P1	EA Serial Header	6.3
P2	LPCXpresso and mbed headers	6.1.2
P3	External SWD debug connector	4.1
J1, J2, J8, J9	Arduino Analog and Digital connectors	6.1.1
U2	On-board debug probe	4.1
U3	LPC812 MCU	2

3. Getting Started

This section describes the operation of the factory programmed demo program, and how to set up your board for code development with MCUXpresso IDE and/or third party tools.

3.1 Installing drivers and updating firmware

The virtual com (VCOM) port provided by the debug probe on the board requires drivers to be installed when using Windows host computers. These drivers are not required when using a Mac or Linux host. These drivers are available from http://nxp.com/demoboard/OM13055 under the Software and Tools tab (look under “Software” download for the LPC11U35 debug probe firmware). After downloading and unzipping the package, run the installer program provided to install the driver (see installation notes included in the package for further information.)

Some LPC boards are factory programmed with a CMSIS-DAP/MBED compatible firmware image. It is always recommended to update the debug probe firmware in order for the device to run properly.

For CMSIS-DAP, follow these steps to update the firmware:
1. Search “lpc11u35 debug probe firmware” and download the files on the NXP.com site.

Note: This is not required on other supported platforms (Linux and MacOS)

2. Unzip/extract the files on your PC and run the executable file.
3. Run the entire setup process for the driver installation.
4. Hold down the reset button on the board and connect the USB connector to your board and computer.
5. The board should appear on your system as a disk called CRP DISABLED.
6. Delete the file firmware.bin on that disk.
7. Drag and drop or copy the new binary image(firmware.bin) downloaded in step 1 to the disk.
8. Disconnect and re-connect USB.

For MBED, follow the steps mentioned on this site to download and update mbed firmware:

https://os.mbed.com/handbook/Firmware-LPC800-MAX

The CMSIS, DISK and COMM LEDs are connected to the LPC11U35 device. The behavior of the LEDs will vary depending on firmware used, typically the CMSIS LED will blink when debug communication is occurring, and the COM LED will blink when data is being transferred over the VCOM port.

3.2 Connecting your board to a PC

Start by connecting to a PC using the USB connector. The status LED (D2) light will come on, indicating it has power. After a few seconds of activity, the PC will recognize the board as a device. The board runs a factory programmed demo to blink user LED.

3.3 Running Example/Demos

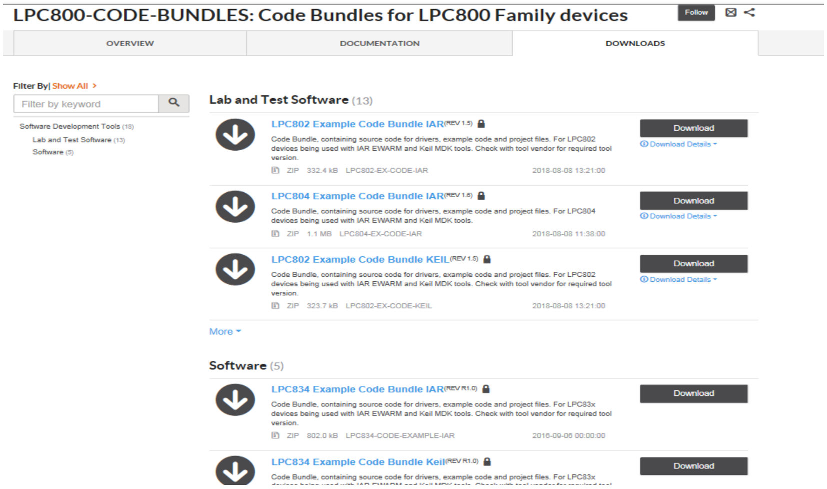
NXP provides various packages of drivers and examples for this board / device family - Code Bundles, LPCOpen and MCUXpresso SDK. It is recommended that either Code Bundles or MCUXpresso SDK are used by new users. LPCOpen support is built into MCUXpresso IDE; for more information on how to use LPCOpen please refer to the MCUXpresso IDE documentation.

The rest of this section explains how to run an example from each of the MCUXpresso SDK and Code Bundle options. Code Bundles are intended for users who prefer a lower level, register-like interface in a direct, driver-free approach. MCUXpresso SDK is intended for developers who prefer a more abstracted interface.

The LPCXpresso812-MAX board may also be used with the mbed development environment, but is currently limited to mbed 2.0. Please refer to the mbed developer site for more information https://os.mbed.com/platforms/NXP-LPC800-MAX/.

3.3.1 Using Code Bundles provided by MCUXpresso IDE.

1. Code Bundles for the LPC8xx family are included in the MCUXpresso IDE installation. These can also be downloaded from nxp.com (in case of any updates between IDE releases):
   http://www.nxp.com/products/software-and-tools/software-development-tools/software-tools/lpc800-code-bundles:LPC800-Code-Bundles.



LPC800-CODE-BUNDLES: Code Bundles for LPC800 Family devices

Lab and Test Software (13)

LPC802 Example Code Bundle IAR(REV 1.5)

Code Bundle, containing source code for drivers, example code and project files. For LPC802 devices being used with IAR EWARM and Keil MDK tools. Check with tool vendor for required tool version.

ZIP 332.4 kB LPC802-EX-CODE-IAR 2018-08-08 13:21:00

LPC804 Example Code Bundle IAR(REV 1.6)

Code Bundle, containing source code for drivers, example code and project files. For LPC804 devices being used with IAR EWARM and Keil MDK tools.

ZIP 1.1 MB LPC804-EX-CODE-IAR 2018-08-08 11:38:00

LPC802 Example Code Bundle KEIL(REV 1.5)

Code Bundle, containing source code for drivers, example code and project files. For LPC802 devices being used with IAR EWARM and Keil MDK tools. Check with tool vendor for required tool version.

ZIP 323.7 kB LPC802-EX-CODE-KEIL 2018-08-08 13:21:00

Software (5)

LPC834 Example Code Bundle IAR(REV R1.0)

Code Bundle, containing source code for drivers, example code and project files. For LPC83x devices being used with IAR EWARM and Keil MDK tools. Check with tool vendor for required tool version.

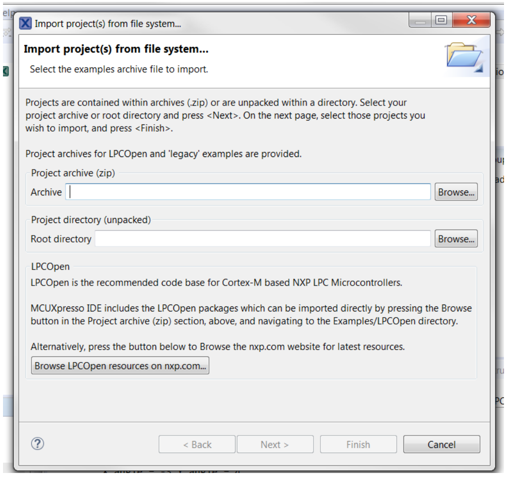
ZIP 802.0 kB LPC834-CODE-EXAMPLE-IAR 2016-09-06 00:00:00

LPC834 Example Code Bundle Keil(REV R1.0)

Code Bundle, containing source code for drivers, example code and project files. For LPC83x

2. Open a new workspace in the IDE.
3. In the Quickstart panel of the IDE, click in “Import a new project from the file system”

4. In the “Import project(s) from file system...” dialog box that opens



Import project(s) from file system...

Import project(s) from file system...

Select the examples archive file to import.

Projects are contained within archives (.zip) or are unpacked within a directory. Select your project archive or root directory and press <Next>. On the next page, select those projects you wish to import, and press <Finish>.

Project archives for LPCOpen and 'legacy' examples are provided.

Project archive (zip)

Archive

Project directory (unpacked)

Root directory

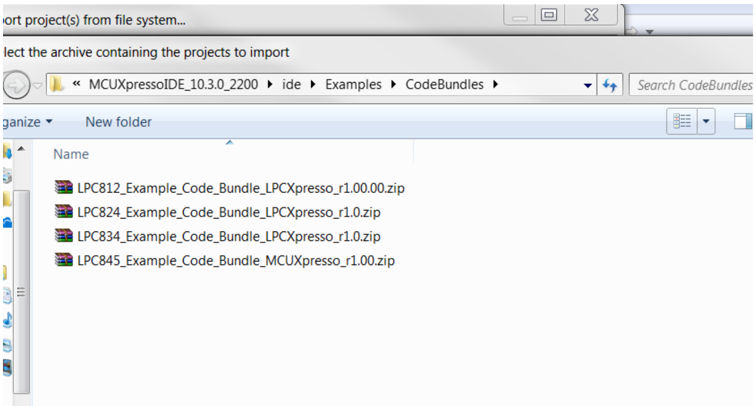
LPCOpen

LPCOpen is the recommended code base for Cortex-M based NXP LPC Microcontrollers.

MCUXpresso IDE includes the LPCOpen packages which can be imported directly by pressing the Browse button in the Project archive (zip) section, above, and navigating to the Examples/LPCOpen directory.

Alternatively, press the button below to Browse the nxp.com website for latest resources.

5. Click “Browse...” in the Project Archive (from zip) section, and select the LPC812 Example Code Bundle zip file from the IDE\Examples\CodeBundles directory in the MCUXpresso IDE installation (or select a version downloaded from nxp.com, as described in Step 1 above.)
6. Click “Next >” on the “Import project(s) from file system...” dialog to continue.
7. Select a project for LPC812 and click “Finish” to import the project.



ort project(s) from file system...

lect the archive containing the projects to import

« MCUXpressoIDE_10.3.0_2200 ▸ ide ▸ Examples ▸ CodeBundles ▸

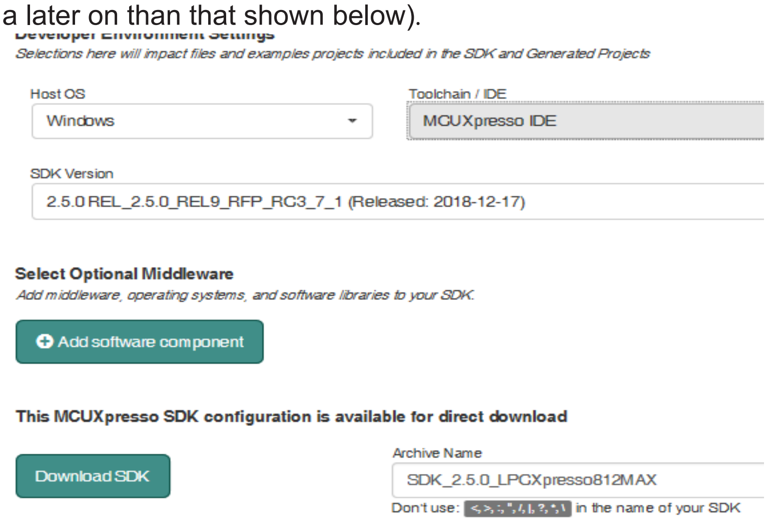
Name

LPC812_Example_Code_Bundle_LPCXpresso_r1.00.00.zip
LPC824_Example_Code_Bundle_LPCXpresso_r1.0.zip
LPC834_Example_Code_Bundle_LPCXpresso_r1.0.zip
LPC845_Example_Code_Bundle_MCUXpresso_r1.00.zip

8. The imported projects will be located in the Project tab at the upper left window of the IDE.
9. Click on Example_Multi_Timer_Blinky to select it, then select Build from the Quickstart panel. You will see the build processing in the Console window to the right of the Quickstart panel. The projects are set up to include dependency checking, so the build process will automatically build the utility and peripheral libraries as well as the example program.
10. Connect the LPCXpresso812-MAX board the host computer, click Debug in the Quickstart panel. The IDE will search for available debug probes. Select the debug probe that appears for your board, then click OK. Note that the IDE will remember your selection for the next time you debug this project, so will not prompt for this again, unless it cannot find the board.
11. The code will execute to main. Press F8 to resume and run the program. You will now see the User LEDs light, each color in turn.

3.3.2 Using NXP MCUXpresso Software Development Kit (SDK).

1. Go to the website https://mcuxpresso.nxp.com/en/welcome
2. Click on the "Select Development Board" option.
3. For the next page, you can either use the “search by name” field or you can select the board from the “Boards” list.
4. Click on the LPCXpresso812MAX, and on the right side of the page, click “Build MCUXpresso SDK”.
5. Select your Host OS and Toolchain/IDE from the drop down menu. (Optional) You can also create or edit the name of your SDK, for now we are using the default name.
6. Click “Download SDK” and save it to your PC. (Note that the SDK version number may be a later on than that shown below).



Developer Environment Settings

Selections here will impact files and examples projects included in the SDK and Generated Projects

Host OS: Windows

Toolchain / IDE: MCUXpresso IDE

SDK Version: 2.5.0 REL_2.5.0_REL9_RFP_RC3_7_1 (Released: 2018-12-17)

Select Optional Middleware

Add middleware, operating systems, and software libraries to your SDK.

This MCUXpresso SDK configuration is available for direct download

Archive Name: SDK_2.5.0_LPCXpresso812MAX

Don't use: <, >, :, ", /, |, ?, *, \ in the name of your SDK

7. Run MCUXpresso IDE. To get the latest version of MCUXpresso IDE, visit http://www.nxp.com/mcuxpresso/ide and click on download.
8. Once you have the IDE installed, create a workspace for you first project and click Launch.
9. Locate the SDK file you created.
10. To install the SDK, drag and drop the file to the Installed SDK view from MCUXpresso IDE and follow the prompts.
11. When the SDK installation is finished, click on “Import SDK example(s)” and select LPCXpresso812-MAX board for your project.
12. Click Next and select the “led_blinky” checkbox from the demo_apps list then finish when done.
13. Select “lpcxpresso812max_led_blinky” from the project explorer, then select **Build** from the Quickstart panel. You will see the build processing in the Console window to the right of the Quickstart panel.
14. Connect the LPCXpresso812-MAX board the host computer.
15. Click **Debug** in the Quickstart panel. The IDE will search for available debug probes. Select the debug probe that appears for your board, then click OK. Note that the IDE will remember your selection for the next time you debug this project, so will not prompt for this again, unless it cannot find the board.
16. The code will execute to main. Press F8 to resume and run the program.

3.4 Using LPCXpresso812-MAX with 3rd Party IDEs

This section explains using the LPCXpresso812-MAX board with other IDEs.

3.4.1 Using Code Bundles

Code Bundles, including sample projects for Keil MDK and IAR EWARM, are available from NXP's website at http://www.nxp.com/products/software-and-tools/software-development-tools/software-tools/lpc800-code-bundles:LPC800-Code-Bundles.

Refer to the readme files provided with each code bundle in order to build/debug.

3.4.2 Using SDK Builder

SDK Builder includes sample projects for MCUXpresso IDE, GCC ARM, IAR Embedded Workbench for ARM, and Keil MDK. These are available from the NXP website at https://mcuxpresso.nxp.com/en/welcome

Refer to the getting started guide from the page in order to build/download a customized SDK for a specific platform.

When using Keil MDK, install the Device Pack for the LPC812 (available for download from within the Keil IDE website) before attempting to use the board.

4. Debug Probe

LPCXpresso812-MAX is pre-programmed with CMSIS-DAP/mbed firmware and will work out of the box with the MCUXpresso IDE. The debug probe firmware also provides a virtual serial port (VCOM port) which will be called LPC11U3x CMSIS-DAP or mbed serial port. See Section 3 for details on how to update the debug probe firmware.

4.1 Using an external debug probe

An external debug probe that supports ARM's SWD interface, such as a SEGGER J-Link, LPC Link2 or PE Micro probe, can be used with the LPCXpresso812-MAX board. The external probe must be connected to header P5. When an external debug probe is used, a jumper shunt on JP1 must be installed before powering up the board in order to prevent the on-board debug contending with the external debug probe.

5. Jumpers, Buttons and LEDs

5.1 Jumpers

This section describes the function of the on-board jumpers.

5.1.1 JP1: on-board/off-board debug

When this jumper is open (default), the on-board debug probe (LPC11U35 device) is used as the debug interface. The debug probe boots from flash, enumerates as a CMSIS-DAP debug probe and virtual serial port.

When JP1 is closed (jumper fitted), the on-board debug probe is held in reset, and an external debug probe can be connected using the P5 connector.

5.1.2 JP2: Target power consumption

Insert an Ammeter across JP2 to measure current supply to the LPC812. Solder jumper R23 must be removed first.

5.2 Buttons

The LPCXpresso812-MAX has two push buttons available to control the operation of the LPC812 (target) MCU. Their functions are described in this sections.

5.2.1 Reset

This button is normally used to reset the LPC812. Holding down this button when the board is powered-up also places the LPC11U35 debug probe in device firmware update mode (see Section 4).

5.2.2 User

The User button (SW2) is for general purpose use by LPCXpresso812-MAX board applications.

5.3 LEDs

There are five LED devices on the board: one tricolor device (with red, green, and blue channels) for user programs, three discrete LEDs that indicate the activity of the debug probe, and a power LED.

The Tricolor LED is driven by PIO_7 (red), PIO_17 (green) and PIO_16 (blue), with the LEDs illuminating when those lines are driven low.

Note: The red tricolor LED channel is also controlled by PIO_7, so the tricolor LED turns red when ISP is depressed.

The status LEDs are connected to the LPC11U35 debug probe. They operate as follows:

- USB Disk LED (red): illuminates when the mbed disk device is being accessed.
- CMSIS-DAP (green): illuminates when debug activity (control of the target SWD port) is occurring.
- USB Comm (blue): illuminates when the mbed serial port device is active.

6. Expansion connectors/headers

The LPCXpresso812-MAX board provides an Arduino shield to add additional peripherals, sensors or other circuitry, including off-the-shelf expansion boards; this section describes these options. For further details please refer to the board schematics.

6.1 Expansion connectors

The LPCXpresso812-MAX board provides three options for expanding the capabilities of the board by adding hardware to it:

- Arduino UNO style headers
- LPCXpresso/mbed headers
- EA serial header

See the board schematics for more information.

6.1.1 Arduino UNO headers

Arduino is a popular hobbyist platform, with a standardized set of expansion connectors. The Arduino connectors on the LPCXpresso812-MAX board are compatible with the“Arduino UNO” platform. Several compatible expansion cards (shields) can be obtained from vendors such as Sparkfun, Adafruit, and others. Shield designs might vary in their implementation because the Arduino UNO platform is based on guidelines and is not a fully defined specification. See the LPCXpresso812-MAX schematics and those of the board(s) you are interfacing before attempting to connect the two together.

The Arduino UNO headers are factory installed on the LPCXpresso812-MAX.

6.1.2 LPCXpresso/mbed headers

The LPCXpresso headers on the LPCXpresso812-MAX are suitable for use with existing LPCXpresso compatible baseboards or breadboards, available from 3rd parties.

LPCXpresso expansion headers can be mounted on the bottom side of the PCB but are not factory fitted.

6.2 Arduino expansion connectors pin mappings

The Arduino compatible connectors provided on the LPCXpresso812-MAX board provide I^2C, SPI, UART, PWM and analog function connections to shield boards that are available from various 3rd part suppliers, or for customer use. The pin mappings are shown in the tables below.

Table 2. Arduino expansion connector pin mappings (J8)

Pin	Arduino signal	LPC812 pin
3	Reset (Active low)	Reset/PIO0_5
4	3.3V	Regulator output
5	5V	To board regulator inputs
6	GND	GND
7	GND	GND

Table 3. Arduino expansion analog connector pin mappings (J9)

Pin	Arduino signal	LPC812 pin
1	A0	PIO_0
2	A1	PIO_1
3	A2	PIO_2

Table 3. Arduino expansion analog connector pin mappings (J9)

Pin	Arduino signal	LPC812 pin
4	A3	PIO_3
5	A4	PIO0_10
6	A5	PIO0_11

Table 4. Arduino expansion connector pin mappings (J1)

Pin	Arduino signal	LPC812 pin
1	I2C SCL	PIO0_10
2	I2C SDA	PIO0_11
3	AREF	AREF/NC
4	GND	GND
5	SPI SCK	PIO0_12
6	SPI MISO	PIO0_15
7	SPI MOSI	PIO0_14
8	SPI SSEL	PIO0_13
9	PWM	PIO0_16
10	NC	PIO0_17

Table 5. Arduino expansion connector pin mappings (J2)

Pin	Arduino signal	LPC812 pin
1		PIO0_7
2	PWM	XP_4
3	PWM	XP_5
4		PIO0_9
5	PWM/INT	PIO0_8
6	INT	PIO0_7
7	UART TX	PIO0_6
8	UART RX	PIO0_0

6.3 EA Serial header

This is a standard serial header.

Table 6. EA Serial header pin mappings (P1)

Pin	Arduino signal	LPC812 pin
1	GND	
2	VDD	
3	SCK	PIO0_12
4	MOSI	PIO0_14
5	MISO	PIO0_15
6	SEL	PIO0_13
7	RXD	PIO0_0
8	TXD	PIO0_4
9	SCL	PIO0_11

Table 6. EA Serial header pin mappings (P1)

Pin	Arduino signal	LPC812 pin
10	SDA	PIO0_10
11	GPIO	PIO0_9
12	GPIO	PIO0_17
13	GPIO	PIO0_7
14	GPIO	PIO0_16

7. Board Specifications

Recommended operating conditions: 0 to 70C ambient temperature
Weight: 0.7 ounces
Size: 2.15 x 3.05 inches

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