

# UM10830

OM13071 LPCXpresso824-MAX Development board

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User manual

## Document information

Info	Content
<b>Keywords</b>	OM13071, LPC82x, development board, mbed, arduino
<b>Abstract</b>	This user manual describes the LPCXpresso824-MAX development board.



**Revision history**

Rev	Date	Description
1	20140929	Initial version

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## 1. Introduction

The LPCXpresso-MAX family of boards provides a powerful and flexible development system for NXP's low end Cortex-M0+ MCUs. They can be used with a range of development tools, including the LPCXpresso IDE, in addition to ARM's mbed online toolchain. The LPCXpresso824-MAX board is developed by NXP to enable evaluation of and prototyping with the LPC82x family of MCUs. [Fig 1](#) shows the LPCXpresso824-MAX Board.

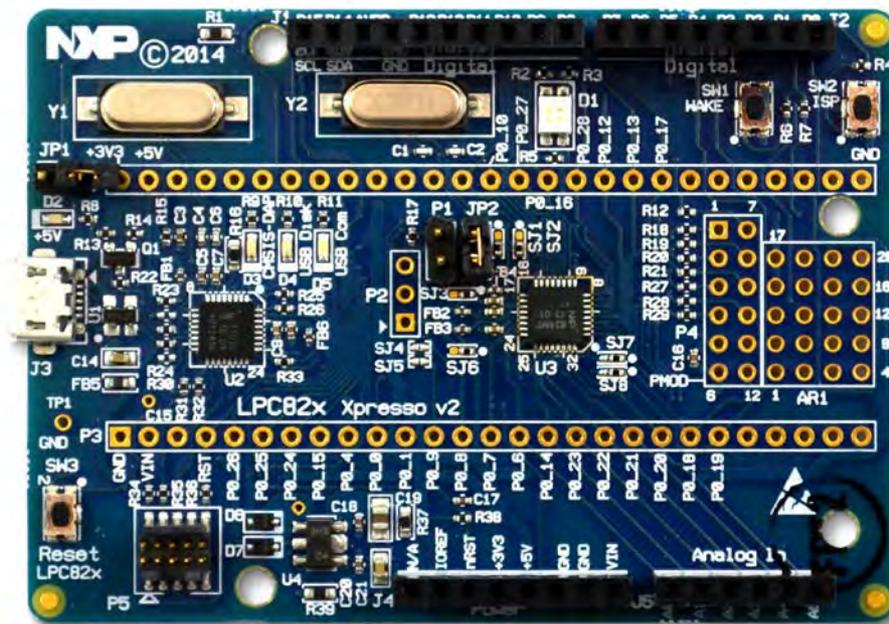


Fig 1. LPCXpresso824-MAX Board

### 1.1 Features

The LPCXpresso824-MAX board includes the following features:

- Compatible with LPCXpresso IDE, mbed, and other toolchains.
- On-board CMSIS-DAP (debug probe) with USB, based on LPC11U35 MCU.
- Debug connector to allow debug of target MCU through an external probe.
- Tri-color LED.
- Target ISP and WAKE buttons.
- Target Reset button.
- Target pins available on 'standard LPCXpresso/mbed' expansion connector.
- Arduino connectors compatible with the "Arduino UNO" platform.
- Pmod<sup>®</sup> expansion header.

- Prototyping area.
- Powering options from multiple sources.
- Options to allow measurement of current consumed by target MCU.

## 2. Board layout

The LPCXpresso824-MAX development board layout is shown in [Fig 2](#).

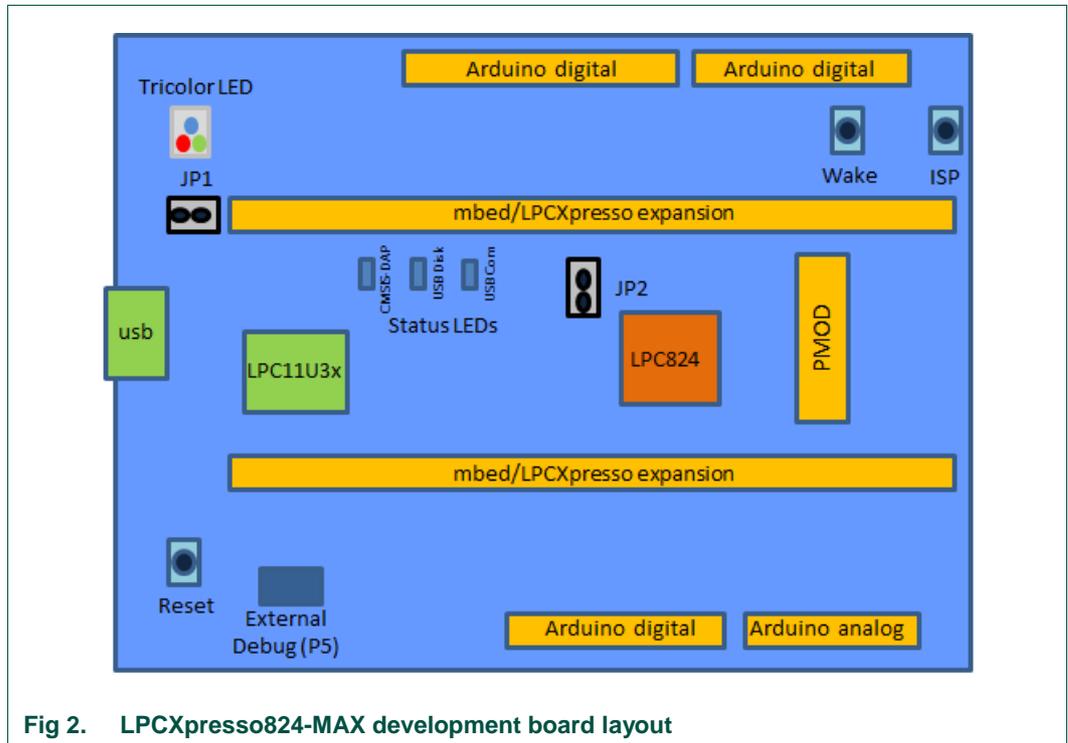


Fig 2. LPCXpresso824-MAX development board layout

## 2.1 Jumper settings

Jumpers on the LPCXpresso824-MAX board can be used to configure debug probe selection (on-board vs off-board) or to measure power consumption as described in sections [2.1.1](#) and [2.1.2](#).

### 2.1.1 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 JP1 header is not fitted during manufacture of the board. The debug probe boots from flash, enumerates as a CMSIS-DAP device, mbed mass storage device, and mbed serial port. See section [5](#) for more details on the serial port device.

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. The Reset button can also be held down at board power-up to prevent the LPC11U35 booting up as a CMSIS-DAP debug probe.

Note: The mbed serial device will not enumerate when using an external debug probe.

### 2.1.2 JP2: target current

The JP2 jumper is provided to enable supply current to the measuring board by placing an ammeter in line with JP2 pins. By default, the solder jumper (SJ2) bypasses the JP2 jumper. Header P1 can be installed to measure supply power (across a 2.43 ohm resistor on the board). [Fig 3](#) shows a close up of the board in the area where SJ2 and P1 are located. The IC below SJ2 is the LPC824.

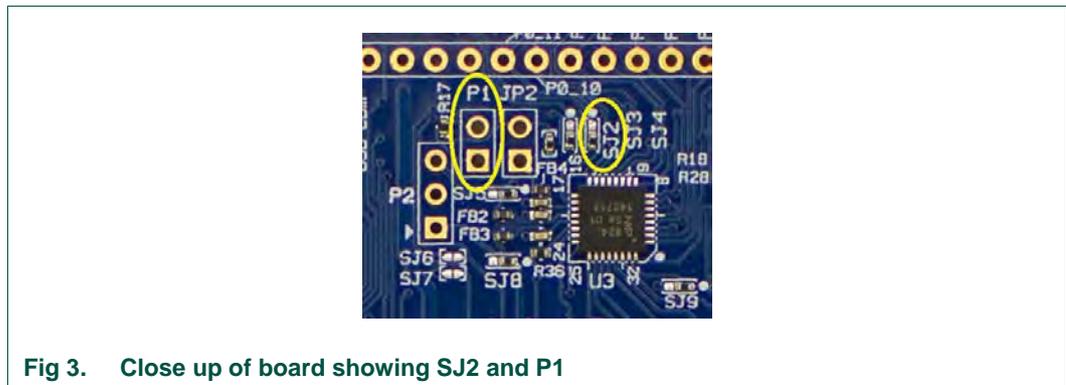


Fig 3. Close up of board showing SJ2 and P1

See the schematic, available at <http://www.lpcware.com/lpcxpresso-max-boards> for more information.

## 2.2 Buttons

The LPC824Xpresso-MAX has three push buttons available to control the operation of the LPC824 (target) MCU. Their functions are described in sections [2.2.1](#), [2.2.2](#), and [2.2.3](#).

### 2.2.1 Reset

This button is normally used to reset the LPC824. Holding down this button when the board is powered-up also prevents the LPC11U35 from booting. See section [2.1.1](#).

### 2.2.2 ISP

The ISP button connects to the LPC824 PIO\_12 pin and can be used to force the LPC824 into ISP boot mode. This can be useful when the LPC824 flash is programmed with code that disables the SWD debug pins or changes timing settings so that the debug probe has problems communicating with it. To force ISP boot, hold the ISP button down while pressing and releasing the reset button.

The ISP button can also be used to trigger an interrupt by configuring the PIO\_12 pin and associated interrupt controls within your application code.

### 2.2.3 Wake

Depressing this button triggers a wake interrupt by pulling-down the WAKEUP input (pin 4) of the LPC824.

## 2.3 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\_12 (red), PIO\_16 (green) and PIO\_27 (blue), with the LEDs illuminating when those lines are driven low.

Note: The red tricolor LED channel is also controlled by PIO\_12, so the tricolor LED turns red when ISP is depressed.

The status LEDs 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.

## 3. Expansion connectors

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The LPCXpresso824-MAX board provides four options for expanding the capabilities of the board by adding hardware to it:

- Arduino UNO style headers.
- LPCXpresso/mbed headers.
- Pmod header.
- Prototyping area.

See the board schematics, available at <http://www.lpcware.com/lpcxpresso-max-boards>, for more information.

### 3.1 Arduino UNO headers

Arduino is a popular hobbyist platform, with a standardized set of expansion connectors. The Arduino connectors on the LPCXpresso824-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 LPCXpresso824-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 LPCXpresso824-MAX.

### 3.2 LPCXpresso™ / mbed headers

The LPCXpresso headers on the LPCXpresso824-MAX are suitable for use with existing LPCXpresso compatible baseboards, available from 3rd parties such as Embedded Artists. Check the component clearance on any baseboard you are considering to ensure components on the baseboard will not interfere with the mounting of the LPCXpresso824-MAX because this board is wider than the original mbed and LPCXpresso™ boards.

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

### 3.3 Pmod™ header

Pmod support is available on the LPCXpresso824-MAX:

- Pins 1 – 6 (left side) will support Pmod™ Type 2 (SPI) or Type 1 (GPIO).
- Pins 7 – 12 (right side) design to support I<sup>2</sup>C. Will Pmod™ Type 1 (GPIO) interface.

Mount the Pmod connectors on the top side of the PCB.

Note: Connectors are not factory fitted for this interface.

## 4. Using development tools

### 4.1 LPCXpresso IDE

LPCXpresso IDE supports programming and debugging LPCXpresso-MAX boards using the on-board CMSIS-DAP debug interface, or with an external debug probe, such as LPC-Link2. Version 7.4 or later of the LPCXpresso IDE is required.

Download the IDE from: <http://www.lpcware.com/lpcxpresso>.

#### 4.1.1 Debugging via the built-in debug probe

LPCXpresso824-MAX is pre-programmed with CMSIS-DAP/mbed firmware and will work out of the box with the LPCXpresso IDE. The IDE can detect the board as a CMSIS-DAP probe when it is used for the first time and asks for confirmation that this is the correct target. For subsequent debug sessions, this target selection is made automatically.

If running on Windows, you will need to install the mbed Windows serial port driver so that the LPCXpresso824-MAX board's CMSIS-DAP debug link is visible to LPCXpresso. Download the drivers from:

<http://mbed.org/handbook/Windows-serial-configuration#1-download-the-mbed-windows-serial-port>

#### 4.1.2 Debugging with an external debug probe

JP1 should be closed (jumper fitted) to use the board with an external debug probe. See section [2.1.1](#) for more information.

### 4.2 mbed

The LPCXpresso824-MAX board implements the latest version of the mbed interface from ARM. When connected to a PC, the board enumerates as a mass-storage device. Firmware images placed on it are written to the target MCU after a power cycle, per other mbed boards. See <http://www.mbed.org/teams/NXP> for more information on downloading the mbed SDK for the board and the mbed development environment.

### 4.3 Using other toolchains

A number of other toolchains can be used since the LPCXpresso-MAX boards support the CMSIS-DAP protocol. Refer to the manuals from your development toolchain provider for more information on how to use CMSIS-DAP probes.

## 5. Example code and drivers

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The LPCOpen platform allows users to quickly and easily utilize NXP's extensive array of microcontroller software libraries to create and develop multifunctional products. The platform uses common APIs that work equally across all microcontroller families and can be built with Keil, IAR, and LPCXpresso toolchains. Detailed documentation and examples make it easy to integrate the necessary development tools into projects. For more information on LPCOpen, go to <http://www.lpcware.com/lpcopen>. For direct access to the LPCOpen drivers for the LPCXpresso824-MAX board, go to: <http://www.lpcware.com/lpcxpresso-max-boards>.

The LPCXpresso824-MAX enumerates an mbed serial port device when installed. This serial port is bridged from a LPC824 UART by the LPC11U35 to its USB port and is used by the mbed tools. This device can also be used by host computer applications (such as Tera Term) for debugging and application purposes when developing with other toolchains. Some of the UART examples in LPCOpen show you how to use this port (example, `periph_mrt`). However, other examples might use a different UART on the LPC824 that require external circuitry or cables to be connected using the expansion connectors.

## 6. Re-flashing the debug probe (LPC11U3x)

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The debug probe (LPC11U3x MCU) on the LPCXpresso824-MAX is programmed during manufacture and does not require any update. However, if a firmware update is required, follow these steps to re-program the flash:

1. Unplug the usb connector.
2. Hold down the reset button and plug in the usb connector.

3. The board will appear on your system as a disk called CRP DISABLD.
4. Delete the file called firmware.bin on this disk.
5. Drag and drop the new binary image to be programmed onto this disk.
6. Connect and re-connect usb.

## 7. Board specifications

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Recommended operating conditions: 0 to 70°C ambient temperature

Weight: 0.7 ounces

Size: 2.15 x 3.05 inches

The LPCXpresso824-MAX board is RoHS compliant.

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