

UM10890

LPCXpresso1125 Development Board

Rev. 1.01 — March 4th 2015

User manual

Document information

Info	Content
Keywords	LPCXpresso1125, LPC1125
Abstract	LPCXpresso1125 User Manual



Revision history

Rev	Date	Description
1.01	<20150304>	OM13080 User Manual release

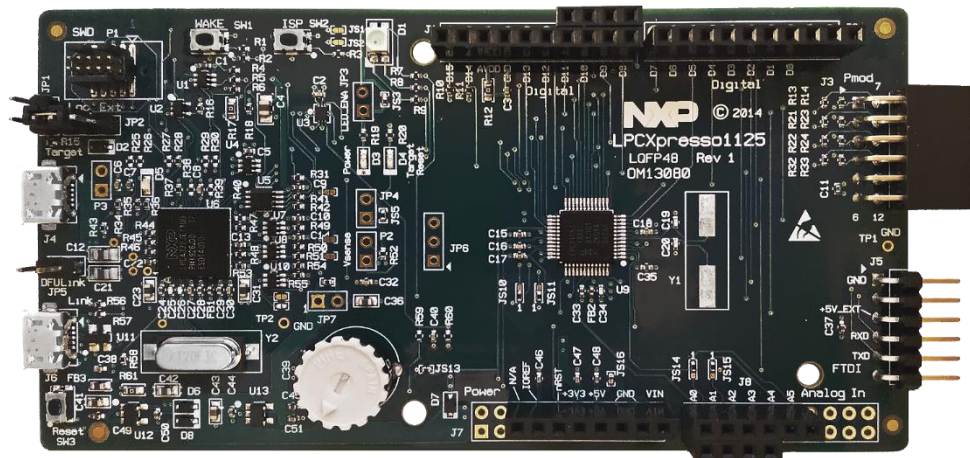
Contact information

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: salesaddresses@nxp.com

1. Introduction

The LPCXpresso™ family of boards provides a powerful and flexible development system for NXP's Cortex®-M family of MCUs. They can be used with a wide range of development tools, including the NXP's LPCXpresso IDE. The LPCXpresso1125 (OM13080) has been developed by NXP to enable evaluation of and prototyping with the LPC1124 and LPC1125 MCUs, and is based on the LPC1125J/303 versions of this device family.



This document describes the LPCXpresso1125. The target MCU term “Target MCU” is used to refer to the Target microcontroller (LPC1125). The following aspects of using the board are covered by this guide:

- Main board features
- Setup for use with development tools
- Supporting software drivers
- Jumper settings
- Powering the board
- Mechanical drawing

2. Feature summary

The LPCXpresso1125 board includes the following features:

- On-board, high-speed USB based, Link2 debug probe with support for ARM's CMSIS-DAP, LPCXpresso IDE Redlink and SEGGER J-Link OB protocol options
- Link2 probe can be used with on-board Target MCU or external target
- Support for external debug probes
- Tri-color LED

- Target Reset, ISP and WAKE buttons
- Expansion options based on Arduino UNO and PMod™, plus additional expansion port pins
- UART bridging from Target MCU to USB via the on-board debug probe
- FTDI UART connector
- Potentiometer

2.1 Board layout and settings

This section provides a quick reference guide to the main board components, configurable items, visual indicators and expansion connectors. The layout of the components on the LPCXpresso1125 board is shown in

Figure 1 below.

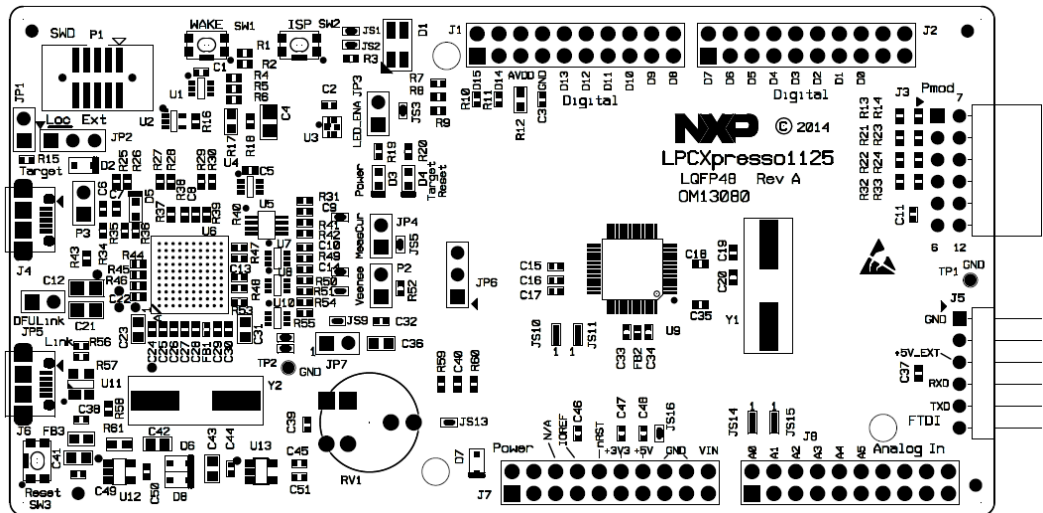


Figure 1 Board Layout

The function of each identified component is listed in Table 1.

Table 1 - Board interface components

Designator	Description	Reference section
D1	Tri-color LED – Driven by Target MCU. JP3 must be shunted for +3.3V to be applied to D1 anode. The default shunt for JP6 is a 0Ω resistor installed at JS3.	n/a
D5	Link2 MCU BOOT0_LED indicator. Reflects the state of Link2 MCU P1_1. When the boot process fails, D1 will toggle at a 1 Hz rate for 60 seconds. After 60 seconds, the Link2 MCU is reset. It will be ON when the Link2 MCU is Booting using DFU (See description for JP5).	n/a
D3	Target MCU Power LED.	n/a
D4	Target MCU Reset LED – LED is on anytime the Target RESETn is pulled low.	n/a

Designator	Description	Reference section
J1, J2, J7, J8	Expansion connectors, including Arduino UNO rev3 compatible connectivity.	7
J3	PMod™ (SPI / I²C) Bridge connector. An external Host or PMod™ peripheral may be connected to the Target MCU SSP0 and I2C0 via this connector.	7
J4	Target MCU Power. Connect this micro USB connector to a +5V power source when it is desired to power only the Target MCU, and leave the on-board Link2 debug probe unpowered. This is useful when an external debug probe is used to debug the Target MCU.	5
J5	FTDI serial header. In addition to provide a serial output from Target MCU, the Target side of the board can be powered from the FTDI header. CAUTION: Users must make sure the GND side of the FTDI cable is connected to PIN1, connecting it in the reverse might damage the MCU.	4.1
J6	Link2 micro USB B-type connector. Powers both the Link2 side of the board and Target MCU side of the board. Power the board from this connector when using the on-board debug probe to debug the Target MCU.	5
JP1	Target MCU SWD disable – 2-position jumper pins. 1) Jumper open (default) the Target MCU SWD interface enabled. Normal operating mode where the Target SWD is connected to either the on-board Link2 debug probe or an external debug probe. 2) Jumper shunted, the Target MCU SWD interface is disabled and the Target MCU is held in the reset state. Use this setting only when the on-board Link2 debug probe is used to debug an off-board Target MCU.	6
JP2	SWD VREF power selection – 3 position jumper pins. 1) Jumper 1 – 2 (default) when on-board Target MCU is connected to either the on-board Link2 debug probe or an external debug probe. 2) Jumper 2 – 3 when on-board Link2 debug probe is used to debug an off-board Target MCU.	5
JP3	JP3 is used to enable/disable the tricolor LED (D1). This jumper is in line with the anode of D1. By default, JP3 is shunted by a zero ohm resistor across JS3, so will have no effect until that resistor is removed.	n/a
JP4	A current meter may be installed across JP4 terminals to measure the Target MCU core current consumption. Pin 1 (square pad) is positive and pin 2 is negative. By default JP4 is shunted by a 0Ω resistor installed at JS5. Remove the resistor at JS5 to measure current at JP4.	5.1.2

Designator	Description	Reference section
JP5	Link2 force DFU boot – 2 position jumper pins. 1) Jumper open (default) for Link2 to follow the normal boot sequence. The Link2 will boot from internal flash if image is found there. With the internal flash erased the Link2 normal boot sequence will fall through to DFU boot. 2) Jumper shunted to force the Link2 to DFU boot mode. Use this setting to reprogram the Link2 internal flash with a new image or to use the LPCXpresso IDE with Redlink protocol.	2
JP6	JP6 provides a convenient connection point for alternative positive and negative reference voltages for the Target MCU on-board ADC. Pin 3 of JP6 can be connected to the positive reference of the Target ADC by moving the zero ohm resistor (JS10) from position 1-2 to position 2-3. Pin 1 of JP6 can be connected to the negative reference of the Target ADC by removing the zero ohm resistor (JS11) from position 1-2 and solder bridging position 2-3.	See LPC1125 Data Sheet
JP7	JP7 External Voltage Input allows for powering the Target MCU side of the board from a bench-top power supply. The external voltage should be applied Pin 2 (round pad) and the zero ohm resistor at JS9 removed to use this feature.	n/a
P1	10-pin SWD connector – The SWD connector is used to debug the Target MCU from an external debug probe. The same SWD connector can also be used to connect the on-board Link2 debug probe to an off-board Target MCU (for this JP2 must shunted 2–3, and JP1 must have a shunt installed).	6
P2	A voltmeter installed across P2 terminals may be used to measure the voltage across a sense resistor (R52, 8.2ohm) in order to determine current flow into the target MCU. Pin 1 (square pad) is positive and pin 2 is negative.	5.1.1
P3	+5V External Voltage Input allows for powering the Target MCU side of the board from a bench-top power supply (via the on-board 3.3V regulator). Pin 1 (square pad) is +5V and pin 2 is gnd.	n/a
SW1	Target MCU WAKEUP pushbutton. When pressed the WAKEUP switch will drive Target MCU WAKEUP to a low level, and will wake the part from various SLEEP/POWER_DOWN modes.	8.3
SW2	Target MCU ISP Bootload enable pushbutton. This switch drives Target MCU ISP_EN low. Holding SW2 pressed while powering up or resetting and the Target MCU will skip the image in internal flash and proceed with booting in ISP mode (over UART0).	8.2
SW3	Target MCU Reset pushbutton.	8.1
TP1, TP2	Ground terminal test points.	n/a
U6	Link2 MCU	n/a
U9	Target MCU	n/a

3. Getting Started

By default, the LPCXpresso1125 is configured to use the on-board debug probe (Link2) to debug the on-board target (Target MCU). The Link2 is unprogrammed at manufacture, so will boot into DFU mode. The LPCXpresso IDE (available for free download at <http://www.lpcware.com/lpcxpresso/home>) will automatically load the Redlink debug protocol via DFU, so can be used in the default configuration, i.e. with the Link2 flash unprogrammed. The Link2 On-board Debug Processor's flash memory can also be programmed with CMSIS-DAP or J-link OB protocols using the LPC-Link2 Configuration Tool (LCT) or LPCScript (see <http://www.lpcware.com/LPCUtilities> for more information.) To program the Link2 flash, a shunt must be installed at JP5. After programming the flash, remove JP5 and power cycle the board to force the Link2 to boot with that protocol. These alternate protocols enable the board to be used with tool chains from vendors such as Keil, IAR, Atollic, Rowley and SEGGER. Note that the board can also be used with LPCXpresso IDE when the CMSIS-DAP firmware has been programmed (note that it may be necessary to manually select SWD instead of JTAG from the debug configuration.)

Check with your toolchain vendor for availability of specific device support packs for the LPC1125 device.

Installation steps for use with LPCXpresso IDE:

- 1) Download and install the LPCXpresso IDE (version 7.6.2 or later) installer from <http://www.lpcware.com/lpcxpresso/download>.
- 2) Connect the LPCXpresso1125 board to the USB port of your host computer, connecting a micro USB cable to connector J6 ("Link").
- 3) Download the LPCOpen examples & drivers from <http://www.lpcware.com/content/nxpfile/lpcopen-platform>, selecting the version for the toolchain you are using; project files for LPCXpresso IDE, Keil and IAR tools are available.
- 4) Start the LPCXpresso IDE and import the LPCOpen zip file by clicking Import project(s) in the "Start here panel."
- 5) The simplest example is periph_blinky, which will blink the tricolor LED on the LPCXpresso1125. Click on the periph_blinky in the "Project Explorer" panel, then click Debug 'periph_blinky' in the "Start here" panel. This will build the project and then launch the debug session.

Note that if the jumper setting of JP5 is changed with the board powered then the USB connection must be removed and reconnected to J6 in order to force the Link2 to reset and enter DFU boot mode and force drivers to enumerate on the host computer running the tools.

Installation steps for use with Keil and IAR tool chains (using CMSIS-DAP or J-Link OB protocols):

- 1) Program the firmware of the Link2 using the LCT tool or LPCScript, following the instructions provided for those tools. Note that part of this process will involve

installing device drivers for the board on Windows platforms (these are installed automatically when installing LPCScript.)

- 2) Ensuring JP5 is not installed, unplug then reconnect the board to the USB port of your host computer, connecting a micro USB cable to connector J6 (“Link”).
- 3) Download the LPCOpen examples & drivers from <http://www.lpcware.com/content/nxpfile/lpcopen-platform>, selecting the version for the toolchain you are using; project files for LPCXpresso IDE, Keil and IAR tools are available.
- 4) Import the project file.

4. Target MCU Serial ports

By default the Target MCU UART0 is connected to the FTDI header at J5. This can be used for sending debug messages out to a host computer via a suitable cable. The Target MCU UART0 can also be connected through a virtual communication port (VCOM) UART bridge Link2 function to a host computer connected to the USB Link2 (J6).

The Redlink protocol firmware for the Link2 (downloaded by default by the LPCXpresso IDE) includes UART bridge functionality (VCOM support). A version of the CMSIS-DAP Link2 firmware is also available with this functionality (called “CMSIS-DAP with bridges”), and can be programmed into the Link2 using the LPC-Link2 Configuration Tool (LCT), available at <http://www.lpcware.com/LPCUtilities>. When running this firmware the default source of data to the Target MCU RXD (via a multiplexer) is the FTDI header. Once the Link2 receives any data via the VCOM port of a host computer it will select the Link2 UART0 data as the input to the Target MCU. Once the VCOM port has been used it is necessary to power cycle the board before FTDI connection can be used.

4.1 J5 FTDI header

The FTDI header J5 mates with FTDI cable TTL-232R-3V3. J5 interfaces the Target MCU UART0 to a Host PC virtual serial port. The location of J5 is shown in **Figure 2**. The pin out and a description of the signals at J5 are listed in

Table 2. By default there may be no header installed at J5.

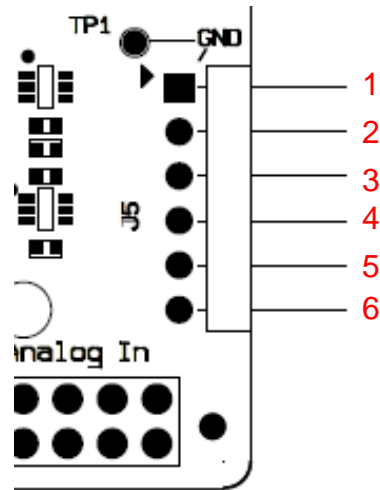


Figure 2 – FTDI (J5) Target MCU serial port

Table 2 – P4 FTDI interface

Target MCU Signal	FTDI Signal	Pin #	Direction
GND	GND	1	
No connect	CTS	2	
Board +5V	5V	3	
UART0_RXD	TXD	4	From host
UART0_TXD	RXD	5	To host
No connect	RTS	6	

5. Board power connections & measurement

The LPCXpresso1125 board requires +5V input to power the on-board voltage regulators which in turn power the Link2 debug probe and other +3.3V circuits, the Target MCU and the Arduino +5V and +3.3V power rails. When the main external power source is from the Link2 side USB micro B-type connector (J6), both the Link side and Target MCU sections of the board are powered. When the main external power is from the Target side USB micro B-type connector (J4) or FTDI header (J5) only the Target MCU section of the board is powered.

When the Target MCU is to be debugged from an external debug probe, instead of the on-board Link2 debug probe, the Link USB connector (J6) must be disconnected.

5.1 Target MCU current measurement

The Target MCU current can be measured by measuring the voltage across an 8.2Ω sense resistor in series with the supply, or a current meter. Each of these methods will be described in subsections below. There is no current monitoring of the Link section circuits on the board.

5.1.1 Target MCU current measurement using voltage sense resistor

The voltage across a series 8.2Ω resistor with the Target MCU Core VDD can be manually measured at P2 on the PCB. The voltmeter positive probe is applied to P2 pin 1 (square pad) and negative probe to P2 pin 2. Use Ohm's law to calculate the current (Target MCU current = measured voltage / 8.2).

5.1.2 Target MCU VDD and VDD I/O current measurement using a current meter

A current meter may be installed across JP4 to measure the Target MCU VDD input current. The 0Ω resistor at JS5 must be removed and the current meter connected at the positive input at JP4 pin 1 (square pad) and negative input at JP4 pin 2.

6. Debug Configurations

The LPCXpresso1125 board has a built-in debug probe known as Link2, implemented in an LPC43xx MCU. The Target MCU can be debugged by the on-board Link debugging probe, or from an external debug probe installed at P1. On-board jumpers JP1 and JP2 must be correctly positioned for each mode. The on-board Link debug probe is capable of debugging target MCU's with a VDDIO range 3.3V±10%. Check the sections below for the appropriate jumper settings and how to properly power the board.

6.1.1 Debugging on-board Target MCU using on-board debug probe

To use the on-board Link2 debug probe, the LPCXpresso1125 board must be powered from the Link2 USB connector J6, and jumper JP2 must be fitted in position pin 1 - 2 (Local Target). Jumper JP1 must be open to enable the target Target MCU. Connecting the micro USB J6 to a host computer will power the Link and Target sections of the board and provide the USB link to the debug tool software.

6.1.2 Debug on-board Target MCU using external debug probe

To use an external debug probe, connect the probe to the SWD (P1) connector, power the Target MCU section of the board from the Target power only micro USB connector J4, and fit a jumper to JP2 across pin 1 - 2 (Local Target) **Error! Reference source not found..** Jumper JP1 must be open to enable the target Target MCU. The on-board Link debug probe must be unpowered, by leaving J5 unconnected.

6.2 Using on-board Link2 to debug an off-board target LPC MCU

The LPCXpresso1125 board's Link2 debug probe may be used to debug an off-board target MCU. The on-board Link debug probe is capable of debugging target MCU's with a VDDIO range of 3.3V±10%. To keep the on-board Target MCU from interfering with the SWD interface, JP1 must be fitted. The Link2 debug probe SWD is connected by a ribbon cable between the P1 connector to the off-board target MCU SWD interface. Power the LPCXpresso1125 board from the Link USB connector J6, and jumper JP2 must be fitted across pins 2 - 3 (External Target.)

7. Expansion connectors

The LPCXpresso1125 board includes four expansion connectors plus a PMod™ compatible connector (J3). The expansion connectors (J1, J2, J7 and J8) incorporate an Arduino Uno revision 3 footprint in their inner rows. Not all connector locations are populated on the expansion connectors since the Target MCU does not have enough I/O to utilize all of the available connections (additional pin locations are provided for compatibility with future LPCXpresso boards.)

Table 3 Expansion Connectors

Reference	
J1	The odd number pins are compatible with Arduino Uno rev3 Digital 15:8, AREF, SDA & SCL connector. The even numbered pins are used for external access and expansion of Target MCU signals not used by the Arduino Uno rev3 compatible interface.
J2	The odd numbered pins 1 – 15 are compatible with Arduino Uno rev3 Digital 7:0 connector. The even numbered pins, and odd numbered pins 17 and 19, are used for external access and expansion of Target MCU signals not used by the Arduino Uno rev3 compatible interface.
J3	PMod™ connector. Connected to the Target MCU SPI0 and I2C0.
J7	The even numbered pins 6 – 20 are compatible with Arduino Uno rev3 Power connector. The odd number pins are used for external access and expansion of Target MCU signals not used by the Arduino Uno rev3 compatible interface.
J8	The even numbered pins 2 – 12 are compatible with Arduino Uno rev3 Analog connector. The odd numbered pins are used for external access and expansion of Target MCU signals not used by the Arduino Uno rev3 compatible interface.

8. Buttons

The LPCXpresso1125 board has 3 push buttons available to control the operation of the Target MCU (target) MCU. Their functions are as described below.

8.1 Reset

This button (SW3) is used to reset the Target MCU.

8.2 ISP

This button (SW2) connects to the Target MCU P0_1 pin and may be used to force the Target MCU into ISP boot mode. This can be useful when the Target MCU flash has been programmed with code that disables the SWD debug pins or changes timing settings such that the debug probe has problems communicating with it. It can also be used with tools such as Flash Magic (from Embedded Systems Academy) when programming the Target flash from outside of a software development tool chain. 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 P0_1 pin and associated interrupt controls within your application code.

8.3 WAKEUP

Depressing this button (SW1) triggers a wake interrupt by pulling down the WAKEUP input of the Target MCU.

9. Potentiometer

A potentiometer (RV1) is included on the board, and is connected between the Target VDD and ground, with the wiper connected to P1_10 (ADC8). The potentiometer wiper shares ADC8 with Arduino R3 analog A2 located at JP8 pin 6. The zero ohm resistor installed by default across solder jumper JS13 may be removed to disconnect RV1 from the Target MCU.

10. Legal information

10.1 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors accepts no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned

application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Evaluation products — This product is provided on an "as is" and "with all faults" basis for evaluation purposes only. NXP Semiconductors, its affiliates and their suppliers expressly disclaim all warranties, whether express, implied or statutory, including but not limited to the implied warranties of non-infringement, merchantability and fitness for a particular purpose. The entire risk as to the quality, or arising out of the use or performance, of this product remains with customer.

In no event shall NXP Semiconductors, its affiliates or their suppliers be liable to customer for any special, indirect, consequential, punitive or incidental damages (including without limitation damages for loss of business, business interruption, loss of use, loss of data or information, and the like) arising out of the use of or inability to use the product, whether or not based on tort (including negligence), strict liability, breach of contract, breach of warranty or any other theory, even if advised of the possibility of such damages.

Notwithstanding any damages that customer might incur for any reason whatsoever (including without limitation, all damages referenced above and all direct or general damages), the entire liability of NXP Semiconductors, its affiliates and their suppliers and customer's exclusive remedy for all of the foregoing shall be limited to actual damages incurred by customer based on reasonable reliance up to the greater of the amount actually paid by customer for the product or five dollars (US\$5.00). The foregoing limitations, exclusions and disclaimers shall apply to the maximum extent permitted by applicable law, even if any remedy fails of its essential purpose.

10.2 Trademarks

Notice: All referenced brands, product names, service names and trademarks are property of their respective owners.

LPCXpresso — is a trademark of NXP B.V.

11. List of figures

Figure 1 Board Layout4
Figure 2 – FTDI (J5) Target MCU serial port9

12. List of tables

Table 1 - Board interface components4
Table 2 – P4 FTDI interface.....9
Table 3 Expansion Connectors 11

13. Contents

1.	Introduction	3
2.	Feature summary	3
2.1	Board layout and settings.....	4
3.	Getting Started	7
4.	Target MCU Serial ports.....	8
4.1	P4 FTDI header.....	8
5.	Board power connections & measurement.....	10
5.1	Target MCU current measurement.....	10
5.1.1	Target MCU current measurement using voltage sense resistor.....	10
5.1.2	Target MCU VDD and VDD I/O current measurement using a current meter	10
6.	Debug Configurations.....	10
6.1.1	Debugging on-board Target MCU using on-board debug probe.....	10
6.1.2	Debug on-board Target MCU using external debug probe.....	11
6.2	Using on-board Link2 to debug an off-board target LPC MCU.....	11
7.	Expansion connectors	11
8.	Buttons.....	12
8.1	Reset.....	12
8.2	ISP	12
8.3	WAKEUP.....	12
9.	Potentiometer	12
10.	Legal information	13
10.1	Disclaimers.....	13
10.2	Trademarks	13
11.	List of figures.....	14
12.	List of tables	15
13.	Contents.....	16

Please be aware that important notices concerning this document and the product(s) described herein, have been included in the section 'Legal information'.

© NXP B.V. 2015.

All rights reserved.

For more information, please visit: <http://www.nxp.com>
For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: March 4th 2015
Document identifier: UM10890_OM13080.docm