AN14442

LPC845 hosting sensors

Rev. 1.0 — 5 November 2024 Application note

Document information

Information	Content
Keywords	LPC845, LPC MCU, I^2C, bus master, FLS8974, 3-axis, low G accelerometer, MPL3115
Abstract	This application note conveys basic knowledge to connect the NXP LPC MCU family to several sensors to help accelerate customer product development.

1 Overview

This reference design conveys the basic knowledge necessary to connect to the NXP LPC MCU family to a couple of different NXP Sensors. Specifically, the LPC845 (hosted atop LPC845-BRK) serves as an I^2C bus master, gathering data from FXLS8974 3-Axis Low-g Accelerometer and the MPL3115 Absolute Pressure Sensor.

This reference design includes some additional features to help accelerate product development, including: connections to Qwiic and mikroBUS standards, and connection to a commonly available low cost LCD display.

Copies of the LPC845-BRK board on which this design is based are available for purchase. Copies of the complete reference design are not presently available for sale.

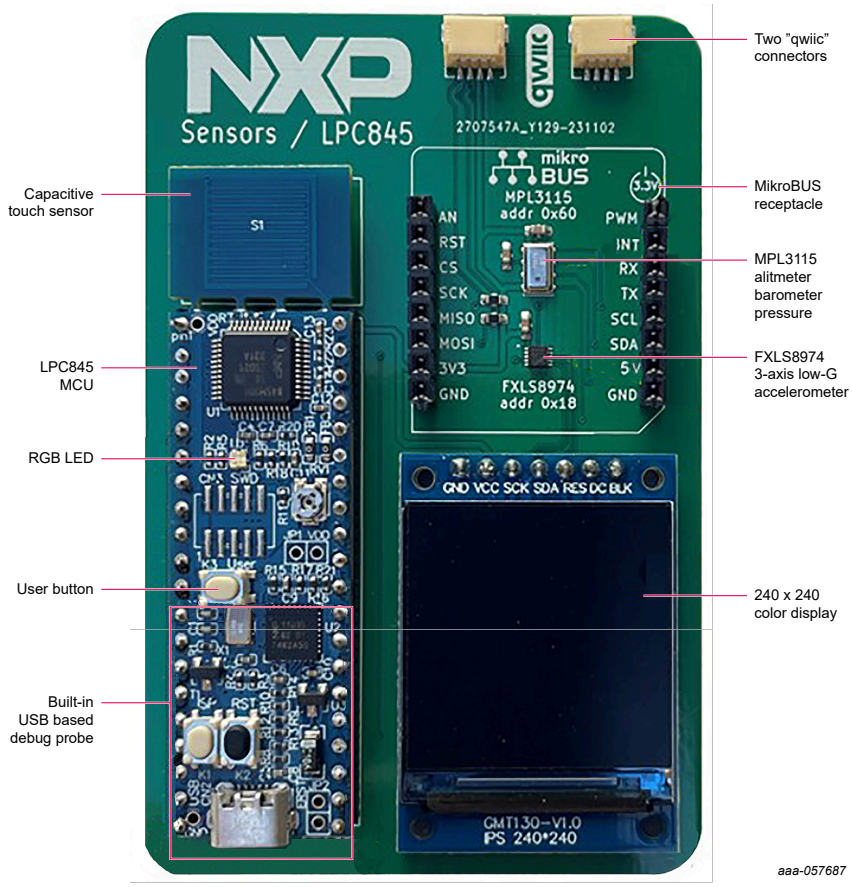

Figure 1. Primary features

2 Applicable parts

2.1 Qwicc connectors

Two Qwicc connectors are included in the design. The Qwiic bus is a simple one, containing only power, ground, and the I^2C signals SCL and SDA. Many Qwiic compatible peripheral function boards are available in the open market with useful functions to accelerate designs and rapid development. These connectors also serve as an external battery pack connection point.

2.2 mikroBUS receptacle

A mikroBUS compatible receptacle is included to accommodate user experimentation beyond the native functions of this design. There are hundreds of mikroBUS compatible peripheral function boards available in the open market to plug to connect with. A good candidate for plug-in is a wireless communication unit.

Note: *The mikroBUS standard dictates that the pullups associated with the I^2C bus SCL and SDA signals be hosted on the I^2C peripheral expansion card. This reference-only design contains no sensor expansion card, and as such violates that guidance; the SCL and SDA pullup resistors are mounted on the motherboard.*

2.3 MPL3115

The NXP MPL3115A2S Absolute Digital Pressure Sensor is hardwired to the I^2C bus. This device can be used as an absolute pressure sensor (barometer) or as a barometric pressure-based altimeter. Refer to the MPL3115 data sheet for additional information. Highlights include:

- Operating range 20 kPa to 110 kPa (calibrated operation from 50 kPa to 110 kPa)
- 1.95 V to 3.6 V operating range, -40 °C to +85 °C
- I^2C Interface (up to 400 kHz)
- 20-bit resolution (Pressure and Altitude)
- 12-bit resolution (Temperature)
- Data logging FIFO

2.4 FXLS8974

The NXP FXLS8974CF 3-Axis Low-g Accelerometer is also hardwired to the I^2C bus.

The FXLS8974 accelerometer finds frequent service as either a precision accelerometer/inclinometer or serves as a simpler “wake on shake” function.

As a precision accelerometer, the device has advanced features that can add value to your application:

- Sensor Data Change Detection (SDCD) block, which can be programmed to detect orientation changes or a free fall event. The SDCD block can generate an interrupt to the host processor – offloading the host from having to perform repeated queries and analyze acceleration data.
- AEC-Q100 qualified in the -40 °C to +105 °C range.
- < 1 µA IDD at 6 Hz sample rates, < 20 µA at 400 Hz sample rate.
- 0.78 Hz up to 3200 Hz sample rate selectable.
- 650 nA in Standby mode, 50 nA in Hibernate mode.
- I^2C interface (up to 1 MHz).
- SPI interface (up to 4 MHz).
- Orientation-independent self-test feature.
- 144 byte FIFO/LIFO data buffer, eases host burden.

The FXLS8974 also finds frequent application as a “wake on shake” device. For example, a portable/wearable electronic appliance can include an “always on” (when being worn or carried) radio transceiver. As a low current wake-on-shake device (<1 µA), the FXLS8974 allows the radio transceiver to remain powered down, becoming active only when the device is in motion. Wake-on-shake can significantly improve system battery life and the perceived value of the product design.

2.5 240 x 240 display

A color LCD display is included to facilitate demonstrations.

2.6 LPC845 breakout board

The design is based on the NXP LPC845-BRK breakout board. The LPC845 board provides more useful features including:

- Capacitive touch sensor/switch
- RGB LED
- User pushbutton switch
- Built-In USB debug probe
  - Supports user experimentation beyond the native functions of the design
  - The USB Port is also available to host a serial terminal session on a connected PC

The LPC845 Breakout Board is based on and is fully supported in the NXP MCUXpresso MCU development ecosystem. Dozens of programming examples for the LPC845 Breakout Board are available for installation into this ecosystem.

3 Schematic

Figure 2 shows the schematic connections. The display module resides on a SPI bus, but uses only the MOSI and SCK signal lines. There is no SPI bus select signal; the display is always listening to MOSI and SCK. There is no MISO line; the display unit does not support read transactions.

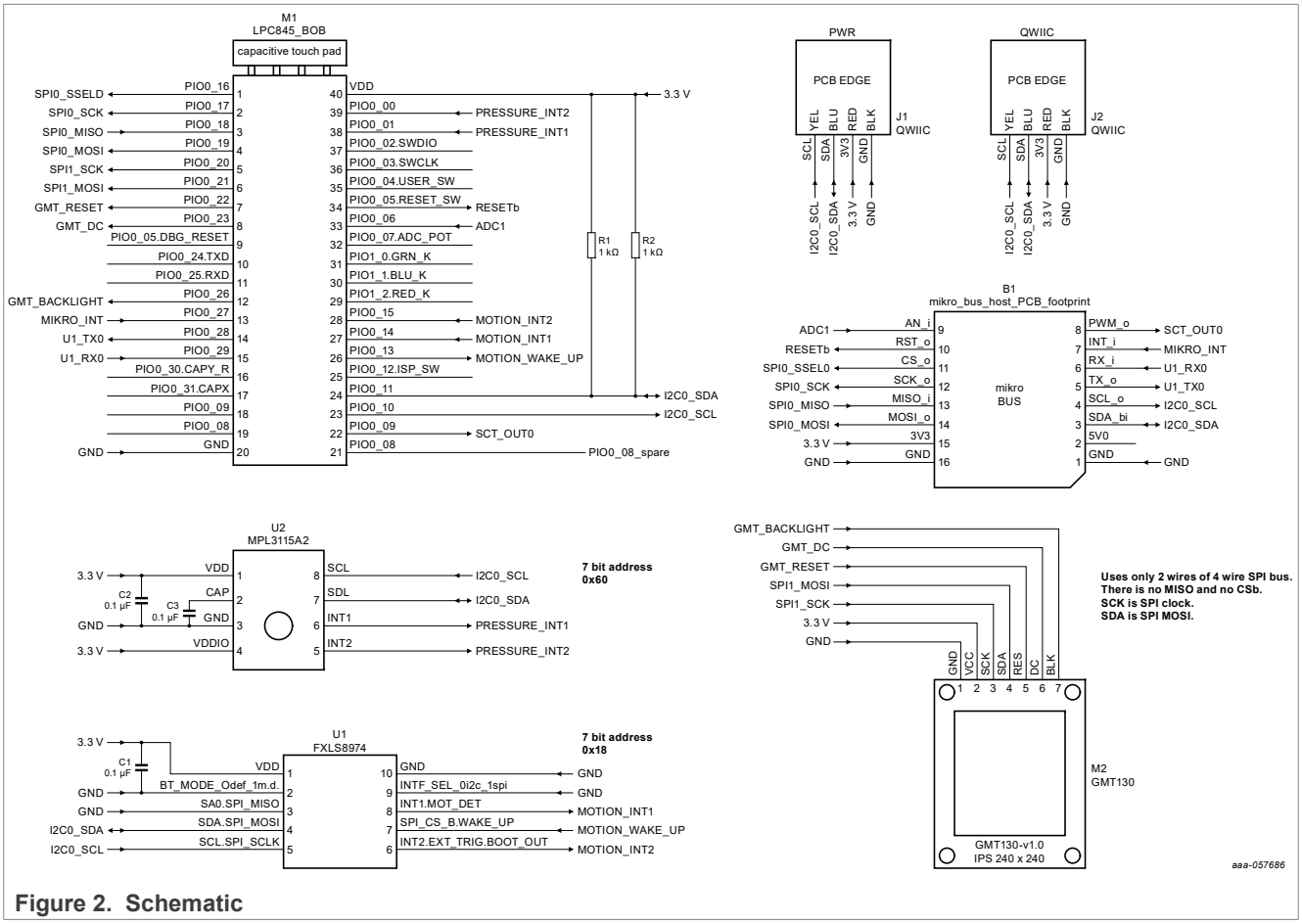

Figure 2. Schematic

Note: *The I²C bus is a shared bus used by multiple residents, including: FXLS8974 Accelerometer, the MPL3115 Pressure Sensor, the mikroBUS footprint, and both Qwicc connectors. To avoid potential I²C*

device address conflict issues, the MPL3115 and FXLS8974 sensor devices are hardwire attached. Their I^2C addresses are shown in Figure 2 and are printed on the PCB.

Note: *The PCB provides the necessary pullup resistors for the I^2C SCL and SDA bus lines. Standard compliant I^2C-based mikroBUS cards have their own local pullups. The resultant reduction in pullup impedance (the resultant increase in pullup strength) can cause a signal fidelity issue. Users can disable/remove one or the other set of pullup resistors as needed.*

4 Firmware

The source files for the factory loaded demonstration are not yet available on the NXP Application Code Hub (ACH). Since this complete reference design is not purchasable by the public, firmware distribution for it is disallowed on the ACH. For more information, contact the NXP support team for more information at https://www.nxp.com/support/support:SUPPORTHOME.

5 Revision history

Table 1. Revision history

Document ID	Release date	Description
AN14442 v.1.0	5 November 2024	• Initial version

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