

UM11863

BRKTSTBAPx7250 evaluation boards with FRDM7X- INTERFACE reference design

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User manual

Document information

Information	Content
Keywords	Automotive pressure sensor, BAP, barometric pressure, absolute pressure, MAP, manifold absolute pressure, intake manifold air/gas mixture, gas tank pressure, CNG, LPG
Abstract	This document introduces the BRKTSTBAPS7250 shield board and explains where to find resources, how to install, configure, and use the tools associated with the board.



Revision history

Rev	Date	Description
v.1	20221215	initial version

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1 Introduction

This document is intended to help the user set up, configure and operate the BRKTSTBAPx7250 series evaluation boards.

The BRKTSTBAPx7250 is a set of three evaluation boards with all of the necessary headers, jumpers, and test signals to quickly evaluate the FXPS7250DI4S, FXPS7250DS4S, and FXPS7250A4S absolute pressure sensors, Digital Barometric Absolute Pressure (DBAP), and Analog Manifold Absolute Pressure (AMAP).

In addition, the FRDM7X-INTERFACE board provides a common interface allowing all three BRKTSTBAPx7250 types to be paired with any NXP Freedom MCU for which MCUXpresso project-based software is provided.

A blank PCB provided is also provided, BRKFXPS7XXX-PCB, to accommodate other pressure ranges. Users can populate the board with the selected pressure sensor and passives accordingly.

Whether using any of the BRKTSTBAPx7250 boards as a standalone in your evaluation platform or using the breakout boards paired with the FRDM7X-INTERFACE board and an NXP Freedom MCU board allows complete sensor evaluation.

2 Finding kit resources and information on the NXP website

NXP Semiconductors provides online resources for these evaluation boards and the supported devices on <http://www.nxp.com>.

The FXPS7X family of pressure sensors has several variants including analog, I²C, and SPI interfaces as well as five pressure ranges to accommodate many types of applications. The variants can be found at:

https://www.nxp.com/LPG_CNG_GAS_15-400KPA

The sensors product page provides overview information, documentation, design resources, buy/parametrics, and other applicable content. The design resources tab has the necessary hardware and software information for **Getting Started**. The Getting Started tab provides quick-reference information applicable to using the BRKTSTBAPx7250 evaluation board, including the downloadable assets referenced in this document.

The information pages for the MAP/BAP sensors, FXPS7250X, and the BRKTSTBAPx7250 evaluation boards can be found at:

BRKTSTBAPA7250S, analog output breakout board	https://www.nxp.com/BRKTSTBAPA7250S
BRKTSTBAPDS7250, SPI protocol breakout board	https://www.nxp.com/BRKTSTBAPDS7250
BRKTSTBAPDI7250, I ² C protocol breakout board	https://www.nxp.com/BRKTSTBAPDI7250
BRKFXPS7XXX-PCB, blank PCB for use with any output protocol	https://www.nxp.com/BRKFXPS7XXX-PCB
FRDM7X-INTERFACE, breakout board to Freedom interface board	https://www.nxp.com/FRDM7X-INTERFACE

3 Getting ready

NXP provides all required hardware and software for BRKTSTBAPx7250 evaluation. The BRKTSTBAPx7250 breakout board can also be used as standalone hardware, however this document is intended to use the NXP provided hardware and software as a kit.

Working with the BRKTSTBAPx7250 breakout boards requires the FRDM7X-INTERFACE board and Freedom FRDM-KE15X MCU board. Additionally, software projects are available for easy evaluation.

As mentioned, the BRKTSTBAPx7250 can be used as a 'standalone', not requiring any additional boards, however the user manual is specific to the NXP combined software and MCU board ecosystem allowing users to quickly bring up and evaluate the sensor.

3.1 Kit contents

The BRKTSTBAPx7250 comes as a single board. The box contents include:

- Assembled and tested evaluation board in an antistatic bag
- Quick Start Guide (web based)

3.2 Additional hardware

The BRKTSTBAPx7250 can be paired with NXP MCU boards of your choice, however there is an example project provided targeted for the FRDM-KE15Z MCU and the FRDM-K64F Freedom boards for evaluation. Detailed information is provided in [Section 4 "Getting to know the hardware"](#).

- FRDM7X-INTERFACE board
- FRDM-KE15Z MCU Freedom board for both I²C and analog option
- FRDM-K64F MCU board for SPI options
- A Windows PC is also required with installed software.

3.3 Assumptions

All three boards are connected together for use with the example demo software.

3.4 Static handling requirements

CAUTION



This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling. You must use a ground strap or touch the PC case or other grounded source before unpacking or handling the hardware.

3.5 Minimum system requirements

This evaluation board requires a:

- Windows 10 PC workstation
- FRDM7X-INTERFACE board
- FRDM-KE15Z MCU Freedom board for both I²C and analog option
- FRDM-K64F MCU board for SPI options

3.6 Software

Installing software is necessary to work with this evaluation board. All listed software is available on the information page for the evaluation board information page at:

<https://www.nxp.com/BRKTSTBAPx7250>

4 Getting to know the hardware

4.1 Kit overview

The BRKTSTBAPx7250 breakout board incorporates an FXPS7250 fully integrated high-performance barometric absolute pressure (BAP) sensor consisting of a compact capacitive MEMS device coupled with a digital integrated circuit producing a fully calibrated digital output.

The BRKTSTBAPx7250 evaluation boards can be easily connected to an NXP Freedom MCU board via the Arduino headers for evaluation however they do require the FRDM7X-INTERFACE board for Arduino compatibility (See [Section 6 "Configuring the hardware"](#)). The following boards are recommended:

- FRDM7X-INTERFACE
- FRDM-KE15Z – For use with the Analog and I²C compatible breakout boards
- FRDM-K64F – For use with the SPI compatible breakout boards

The user interconnects the boards for evaluation of the FXPS7250x pressure sensor with a terminal program using the NXP provided Component Library firmware. See [Section 5 "Installing and configuring software tools"](#) "Installing and configuring software tools". In this case, the hardware combined with the software can help speed up development.

These evaluation boards provide an intuitive way to change between the sensor variants (pressure range) and communication protocols (I²C, SPI, or analog interfaces) for communication through switch position selections (FRDM7X-INTERFACE) as well as providing test points that can be used for evaluation. The FXPS7250x data sheets provide additional device information.

4.2 Board features

Each breakout board features its specific analog or digital output as described in [Section 4.2.1 "Block diagram"](#) through [Section 4.2.5 "Switches"](#).

4.2.1 Block diagram

Example application block diagrams of the FXPS7250A analog, FXPS7250DI I²C and FXPS7250DS SPI pressure sensors incorporated onto the BRKTSTBAPx7250 are shown in [Figure 1](#), [Figure 2](#), and [Figure 3](#).

[Figure 1](#) shows the analog circuit setup for the FXPS7250A where the output signals interface to the host ADC/MCU.

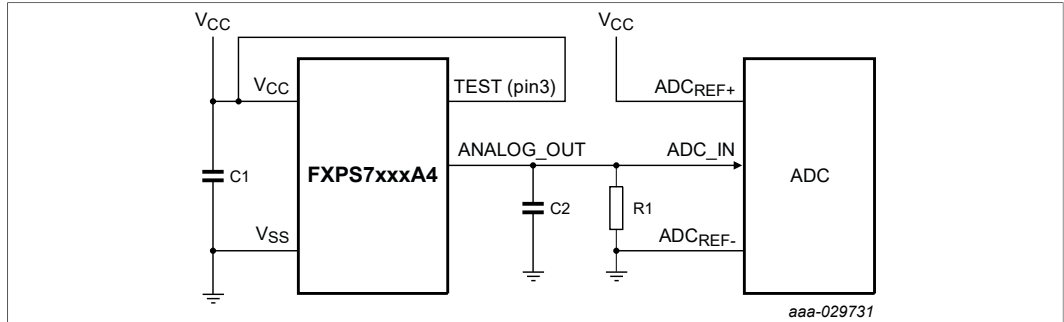


Figure 1. Analog block diagram

Figure 2 shows the I²C circuit setup for the FXPS7250DI where the output signals interface to the host MCU.

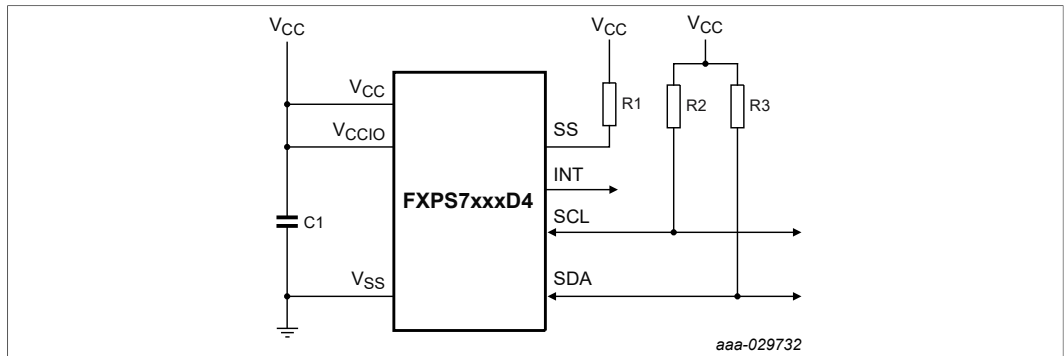


Figure 2. I²C block diagram

Figure 3 shows the SPI circuit setup for the FXPS7250DS where the output signals interface to the host MCU.

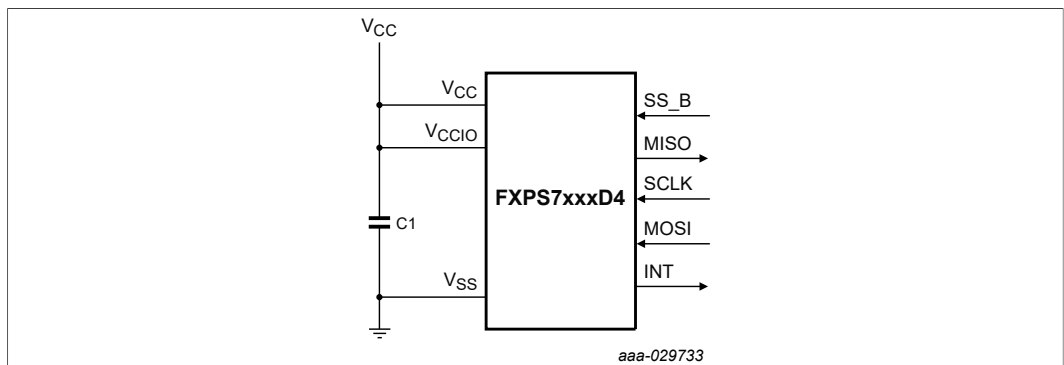


Figure 3. SPI block diagram

4.2.2 Kit featured components

Figure 4 identifies important components on the board and Table 1 provides additional details on these components.

BRKTSTBAPx7250 evaluation boards with FRDM7X-INTERFACE reference design

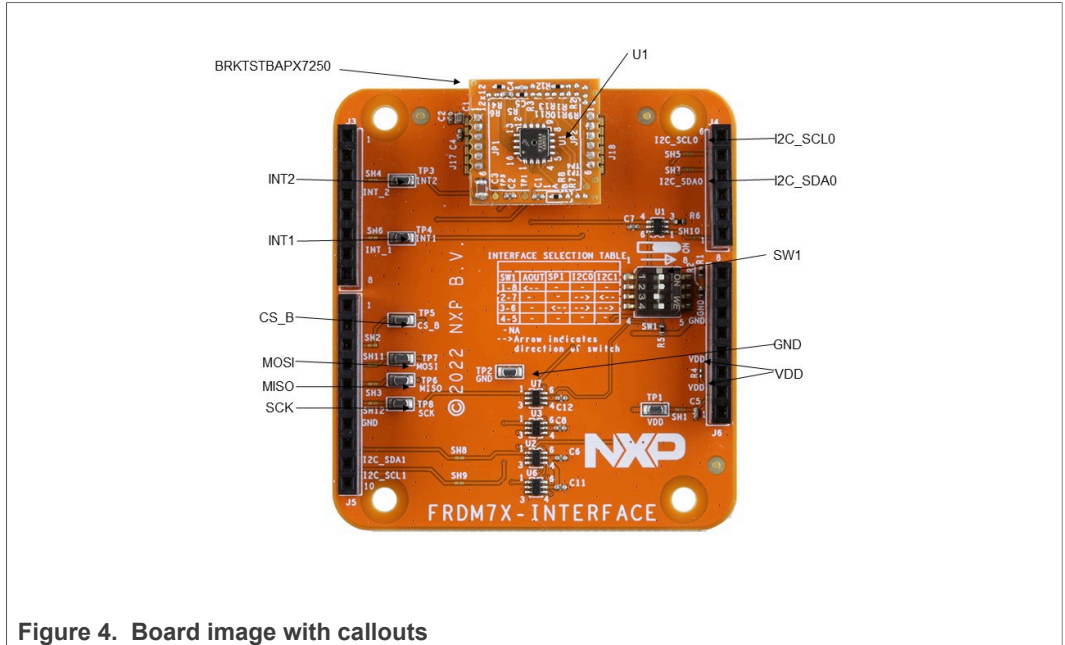


Figure 4. Board image with callouts

Table 1. Evaluation board featured components location

Number	Description
U1	FXPS7250A4ST1 barometric pressure sensor (BAP), analog output
U1	FXPS7250DI4ST1 barometric pressure sensor (BAP), I ² C protocol
U1	FXPS7250DS4ST1 barometric pressure sensor (BAP), SPI protocol

4.2.3 Connectors

Table 2. Evaluation board featured components location

Number	Description
JP1	6-pin signal header
JP2	6-pin signal header

4.2.4 Test points

The test points on the breakout boards are for NXP internal testing only and are not for customer use.

Table 3. Test point locations

Test point	Description
TP1	VDD
TP2	GND
TP3	INT2
TP4	INT1
TP5	CS_B
TP6	MISO

Table 3. Test point locations...continued

Test point	Description
TP7	MOSI
TP8	SCK

4.2.5 Switches

The FRDM7X-INTERFACE board consists of one, four position switch, SW1. SW1 is used to adapt the FRDM7X-INTERFACE board to any of the three BRKTSTBAPx7250 breakout boards communication protocols; analog, I²C, or SPI.

4.3 Schematic, board layout, and bill of materials

The schematic, board layout, and bill of materials for the BRKTSTBAPx7250 series breakout boards are available at their respective URLs as detailed in [Table 4](#).

Table 4. Breakout board URL locations

Breakout board	Type	URL
BRKTSTBAPA7250S	Analog	https://www.nxp.com/BRKTSTBAPA7250S
BRKTSTBAPDS7250	SPI	https://www.nxp.com/BRKTSTBAPDS7250
BRKTSTBAPDI7250	I ² C	https://www.nxp.com/BRKTSTBAPDI7250
BRKFXPS7XXX-PCB	Blank PCB	https://www.nxp.com/BRKFXPS7XXX-PCB
FRDM7X-INTERFACE	Interface	https://www.nxp.com/FRDM7X-INTERFACE

5 Installing and configuring software tools

NXP provides Component Library software examples for quick evaluation and prototyping. The demo projects are targeted to the FRDM-KE15Z (analog and I²C) and FRDM-K64F (SPI) and is located under Design Resources, Software, BSP, Drivers and Middleware at the following link:

<https://www.nxp.com/BRKTSTBAPx7250>

The link opens the "Sensor Drivers for NXP Sensors" page. To download the FXPS7xxx sensor driver with examples, scroll down to the "Downloads" section.

For additional information about Component Library, refer to [UM11516^{\[1\]}](#), Component Library – Sensor Drivers Component user manual and [UM11515^{\[2\]}](#), Component Library – Getting Started user manual.

6 Configuring the hardware

[Figure 5](#) presents the hardware configuration incorporating the BRKTSTBAPx7250 development board, the FRDM7X-INTERFACE board, the FRDM-KE15Z MCU board. The evaluation kit is then connected to a Windows PC with a USB cable.

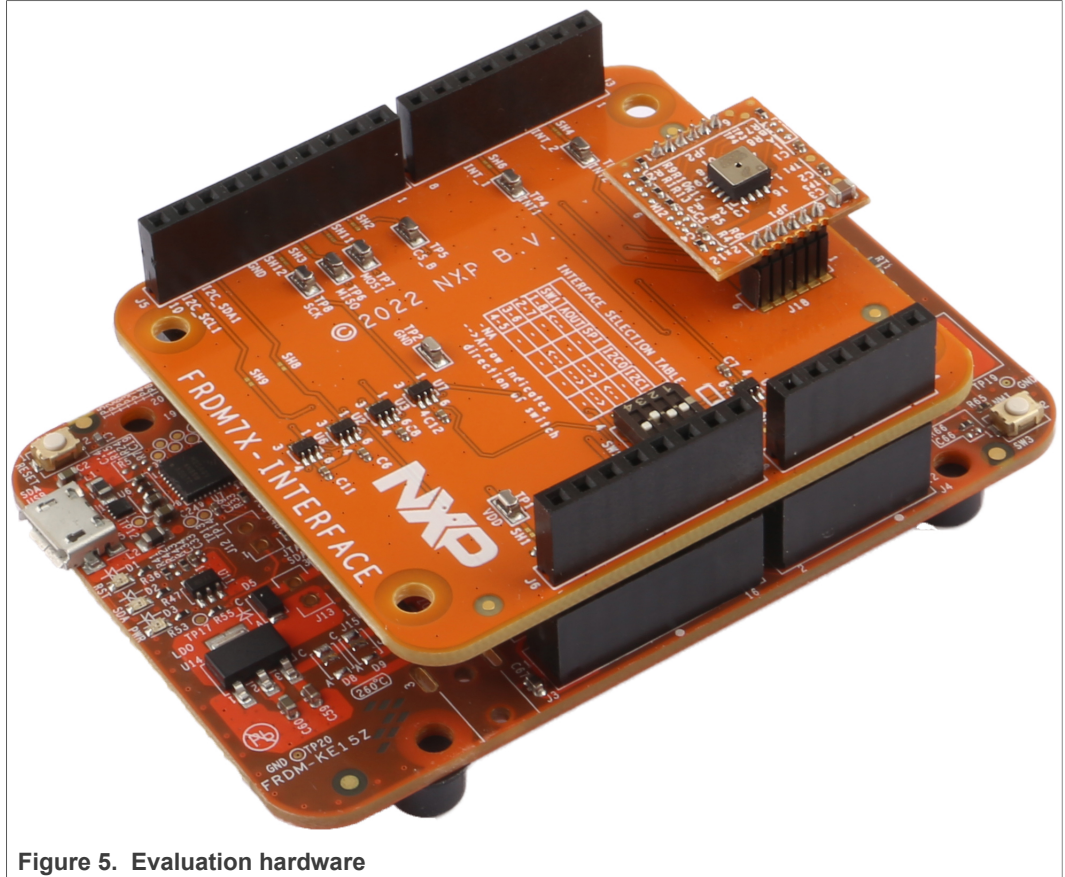


Figure 5. Evaluation hardware

The only development board configuration required are the settings of the four SW1 positions on the FRDM7X-INTERFACE board. The four SW1 positions are set to the protocol (analog, I²C, or SPI) of the corresponding BRKTSTBAPx7250 breakout board.

Table 5 shows each switch position relative to the development boards output protocol where they are defined as follows:

SW1: 0/1 positions

- 0 position is to the right (signal low)
- 1 position is to the left (signal high)
- – Don't care

Table 5. Typical initial configuration

SW1	Analog	SPI	I ² C
1	←	←	—
2	—	←	→
3	—	←	→
4	—	—	—

7 Tool interface (GUI) description

The software outputs data to a terminal program such as RealTerm or TeraTerm to display the pressure data. The settings required are ASCII display, 115,200 Baud, no parity, eight data bits, and one stop bit.

Once the project is compiled and running, the terminal program displays the pressure data.

8 References

- [1] UM11516 - Component Library – Sensor Drivers Component, <https://www.nxp.com/docs/en/user-guide/UM11516.pdf>
- [2] UM11515 - Component library – getting started user manual, <https://www.nxp.com/docs/en/user-guide/UM11515.pdf>

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