

UM11863

BRKTSTBAPx7250 evaluation boards with FRDM7X- INTERFACE reference design

Rev. 1 — 15 December 2022

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

IMPORTANT NOTICE**For engineering development or evaluation purposes only**

NXP provides the product under the following conditions:

This evaluation kit is for use of **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY**.

It is provided as a sample IC pre-soldered to a printed-circuit board to make it easier to access inputs, outputs and supply terminals. This evaluation board may be used with any development system or other source of I/O signals by connecting it to the host MCU computer board via off-the-shelf cables. This evaluation board is not a Reference Design and is not intended to represent a final design recommendation for any particular application. Final device in an application heavily depends on proper printed-circuit board layout and heat sinking design as well as attention to supply filtering, transient suppression, and I/O signal quality.

The product provided may not be complete in terms of required design, marketing, and or manufacturing related protective considerations, including product safety measures typically found in the end device incorporating the product. Due to the open construction of the product, it is the responsibility of the user to take all appropriate precautions for electric discharge. In order to minimize risks associated with the customers' applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards. For any safety concerns, contact NXP sales and technical support services.

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.

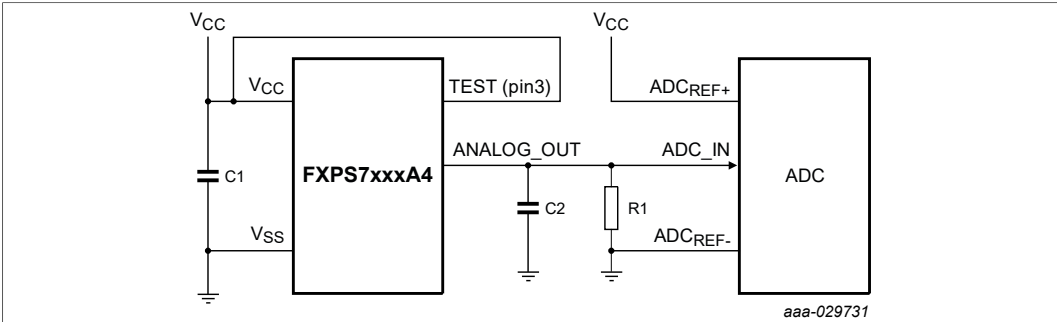


Figure 1. Analog block diagram

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

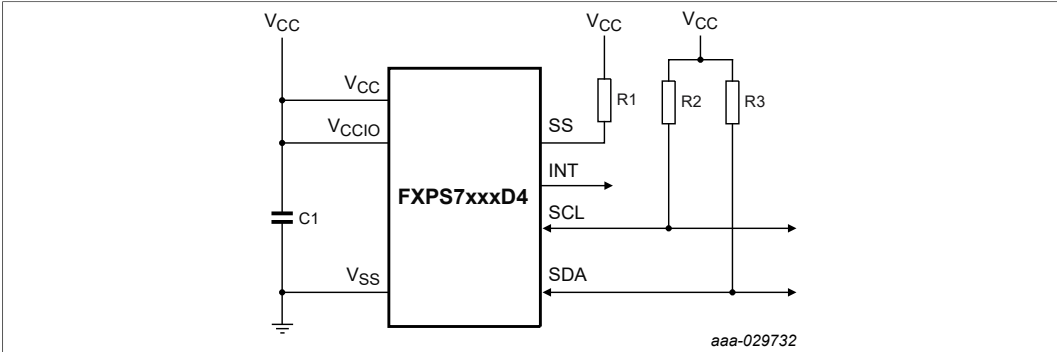


Figure 2. I²C block diagram

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

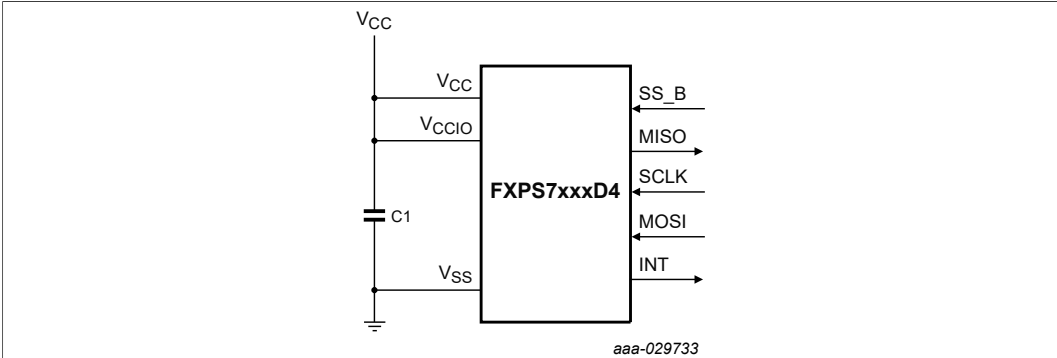


Figure 3. SPI block diagram

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

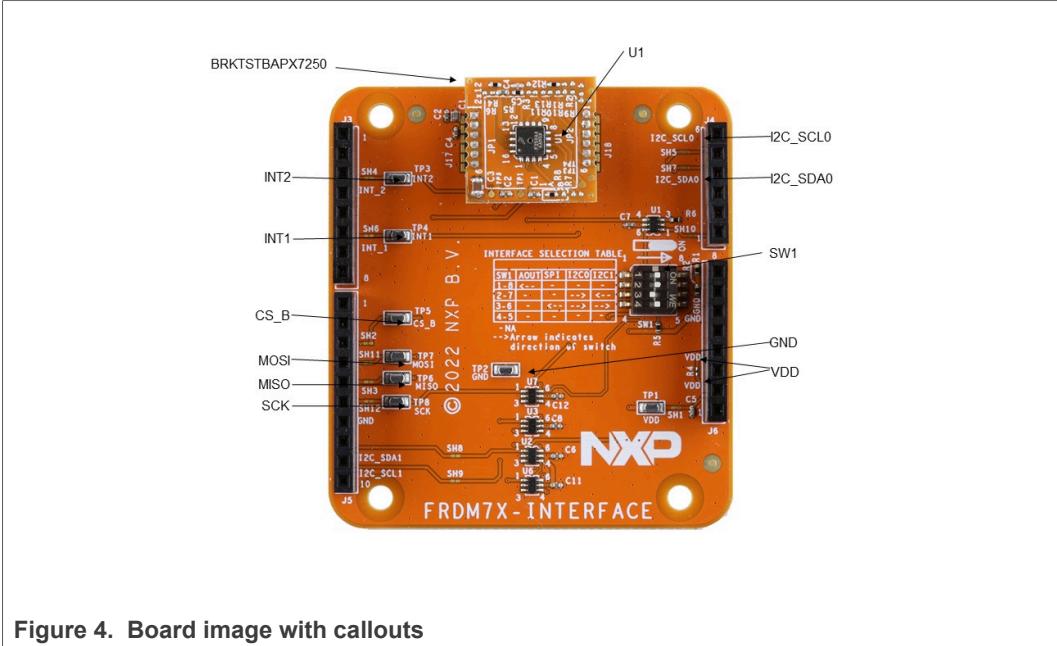


Figure 4. Board image with callouts

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.

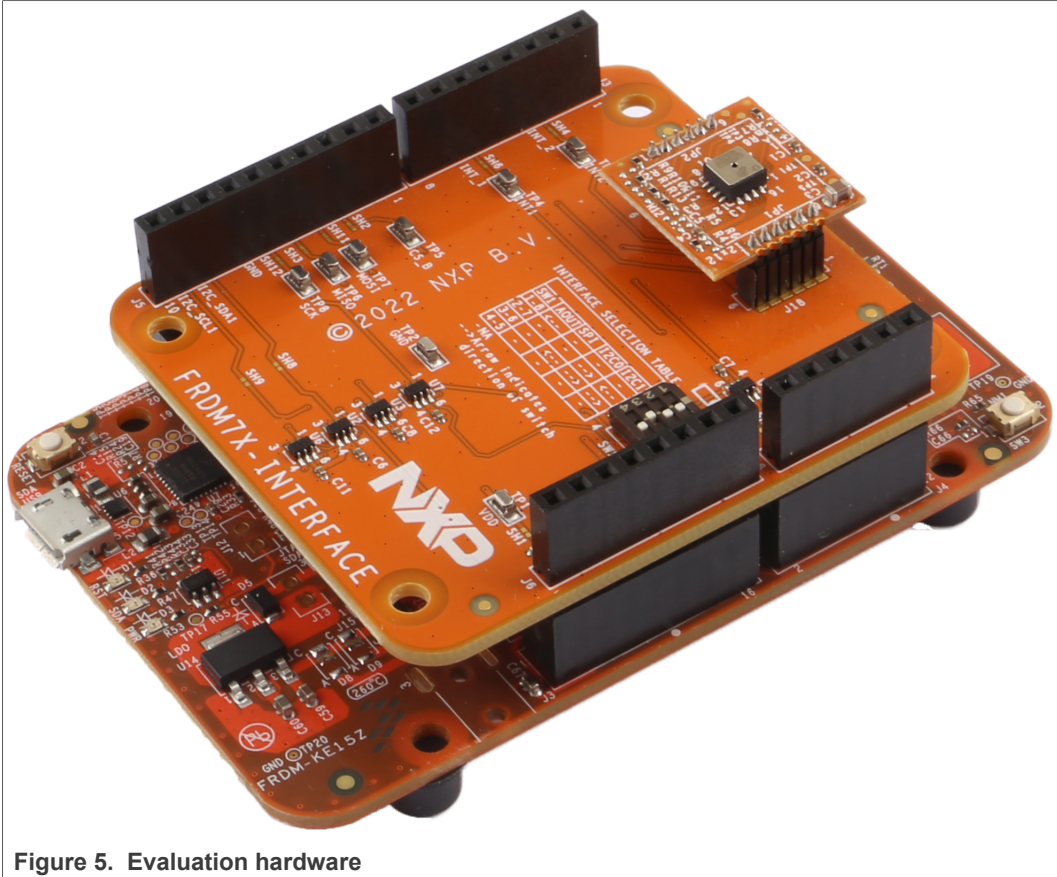


Figure 5. Evaluation hardware

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>

9 Legal information

9.1 Definitions

Draft — A draft status on a document indicates that the content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included in a draft version of a document and shall have no liability for the consequences of use of such information.

9.2 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. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

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.

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.

Terms and conditions of commercial sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.nxp.com/profile/terms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

Suitability for use in automotive applications — This NXP product has been qualified for use in automotive applications. If this product is used by customer in the development of, or for incorporation into, products or services (a) used in safety critical applications or (b) in which failure could lead to death, personal injury, or severe physical or environmental damage (such products and services hereinafter referred to as "Critical Applications"), then customer makes the ultimate design decisions regarding its products and is solely responsible for compliance with all legal, regulatory, safety, and security related requirements concerning its products, regardless of any information or support that may be provided by NXP. As such, customer assumes all risk related to use of any products in Critical Applications and NXP and its suppliers shall not be liable for any such use by customer. Accordingly, customer will indemnify and hold NXP harmless from any claims, liabilities, damages and associated costs and expenses (including attorneys' fees) that NXP may incur related to customer's incorporation of any product in a Critical Application.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Translations — A non-English (translated) version of a document, including the legal information in that document, is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

Security — Customer understands that all NXP products may be subject to unidentified vulnerabilities or may support established security standards or specifications with known limitations. Customer is responsible for the design and operation of its applications and products throughout their lifecycles to reduce the effect of these vulnerabilities on customer's applications and products. Customer's responsibility also extends to other open and/or proprietary technologies supported by NXP products for use in customer's applications. NXP accepts no liability for any vulnerability. Customer should regularly check security updates from NXP and follow up appropriately. Customer shall select products with security features that best meet rules, regulations, and standards of the intended application and make the ultimate design decisions regarding its products and is solely responsible for compliance with all legal, regulatory, and security related requirements concerning its products, regardless of any information or support that may be provided by NXP.

NXP has a Product Security Incident Response Team (PSIRT) (reachable at PSIRT@nxp.com) that manages the investigation, reporting, and solution release to security vulnerabilities of NXP products.

9.3 Trademarks

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

NXP — wordmark and logo are trademarks of NXP B.V.

Tables

Tab. 1.	Evaluation board featured components location	8	Tab. 3.	Test point locations	8
Tab. 2.	Evaluation board featured components location	8	Tab. 4.	Breakout board URL locations	9
			Tab. 5.	Typical initial configuration	10

Figures

Fig. 1.	Analog block diagram	7	Fig. 4.	Board image with callouts	8
Fig. 2.	I2C block diagram	7	Fig. 5.	Evaluation hardware	10
Fig. 3.	SPI block diagram	7			

Contents

1	Introduction	4
2	Finding kit resources and information on the NXP website	4
3	Getting ready	5
3.1	Kit contents	5
3.2	Additional hardware	5
3.3	Assumptions	5
3.4	Static handling requirements	5
3.5	Minimum system requirements	5
3.6	Software	6
4	Getting to know the hardware	6
4.1	Kit overview	6
4.2	Board features	6
4.2.1	Block diagram	6
4.2.2	Kit featured components	7
4.2.3	Connectors	8
4.2.4	Test points	8
4.2.5	Switches	9
4.3	Schematic, board layout, and bill of materials	9
5	Installing and configuring software tools	9
6	Configuring the hardware	9
7	Tool interface (GUI) description	11
8	References	11
9	Legal information	12

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

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

NXP:

[BRKTSTBAPA7250S](#) [BRKTSTBAPDI7250](#) [BRKTSTBAPDS7250](#) [FRDM7X-INTERFACE](#)