UM11909

P3S0210BQ-ARD evaluation board

Rev. 1.0 — 23 February 2024 **User manual**

Document information

Information	Content
Keywords	P3S0210, I3C switch, I3C Level Shifter, Level Translator, P3S0210 user manual, P3S0210BQ-ARD evaluation board
Abstract	The P3S0210 is a dual bidirectional I3C-bus 1:2 and 2:1 switch and voltage level translator with auto direction sensing, that enables bidirectional voltage level translation. This user manual describes the setup, configuration and operation of the P3S0210BQ-ARD evaluation board.

1 Introduction

The P3S0210 is a dual bidirectional I3C bus 1:2 and 2:1 switch and voltage level translator with auto direction sensing, that enables bidirectional voltage level translation. It includes a reference supply (VCCR), supplies for ports 1, 2, and S (VCCP1, VCCP2, and VCCS respectively), and a supply for OE and SEL pins (VCCE).

The supply voltage of VCCP1, VCCP2, VCCS, and VCCE is between 0.72 V to 3.63 V. The reference supply VCCR is between 1.62 V to 3.63 V and should be greater or equal to VCCP1, VCCP2, VCCS, and VCCE.

Pins A1 and B1 are referenced to VCCP1, pins A2 and B2 are referenced to VCCP2, and pins A and B are referenced to VCCS. The OE and SEL pins are defined for enable and port selection that are referenced to VCCE.

P3S0210BQ-ARD evaluation board can be used for both open-drain as well as push-pull application which allows for I3C-bus and other applications like I^2C-bus, SMBus and SPI protocols.

This document is intended to help the users to quickly set up, configure, and operate the evaluation board in the users' hardware platform.

2 Finding kit resources and information on the NXP web site

NXP Semiconductors provides online resources for this evaluation board and its supported device(s) on http://www.nxp.com.The information page for P3S0210BQ-ARD evaluation board is at http://www.nxp.com/P3S0210BQ-ARD. The information page provides overview information, documentation, software and tools, parametrics, ordering information and a **Getting Started** tab. The **Getting Started** tab provides quick-reference information applicable to using the P3S0210BQ-ARD evaluation board, including the downloadable assets referenced in this document.

2.1 Collaborate in the NXP community

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The NXP community is at http://community.nxp.com.

3 Getting ready

Working with the P3S0210BQ-ARD evaluation board requires the kit contents.

3.1 Kit contents

- Assembled and tested evaluation board in an anti-static bag
- Quick Start Guide

4 Getting to know the hardware

As default, P3S0210 Port1 and Port2 are configured to operate at 1.8 V while PortS is configured to operate at 3.3 V via jumper settings (see Table 2). Port1 and Port2 I2C/I3C interfaces are available at J21 and J50, while PortS I2C/I3C is available on J20.

Each of P3S0210 port has one one-board 8-bit I2C GPIO expander (PCA9538), and one I3C temperature sensor (P3T1755) connected to it. The user I2C/I3C controller can access these devices via the port I2C/I3C interface headers. The factory default I2C/I3C addresses for these devices are listed on Table 4. The user can also be able to connect their own I2C/I3C devices to the port I2C/I3C interface headers, and access these devices via the other I2C/I3C interface headers. GPIO0 and PGIO1 on each of the PCA9538 are connected to a pair of LEDs. The user can turn on, turn off, or blink the LED via the port I2C interface and the PCA9538.

P3S0210 can be enabled/disabled via J42. As factory default, P3S0210 is enabled.

P3S0210 Port1 or Port2 can be selected to connect to PortS via J44. As factory default, J44 is set to select Port1 to connect to PortS. Port2 can be selected to PortS as well by reposition the jumper on J44.

The P3S0210BQ-ARD evaluation board is powered via a USB micro-B connector, J51. There are on-board LDOs to convert 5 V from the micro-B connector to other power rails to provide power to P3S0210 VCCP1, VCCP2, VCCS, VCCE, VCCR and other components on the board. The voltage at each LDO output can be selected via the headers at the LDO FB pin. The output voltage is set with a resistor divider, and a jumper is used to select the lower resistor to set the LDO output voltage.

The P3S0210BQ-ARD evaluation board is also designed to be mated and controlled by a standard micro-controller board which equipped with standard Arduino headers. The P3S0210 is then powered by the available 5 V rail from the micro-controller board. Table 6 lists all interface signals the MCU needs to communicate with the P3S0210. If desires, there are test points at each of the I2C/I3C interface header that the user can jump wire the micro-controller I3C signals to these test points.

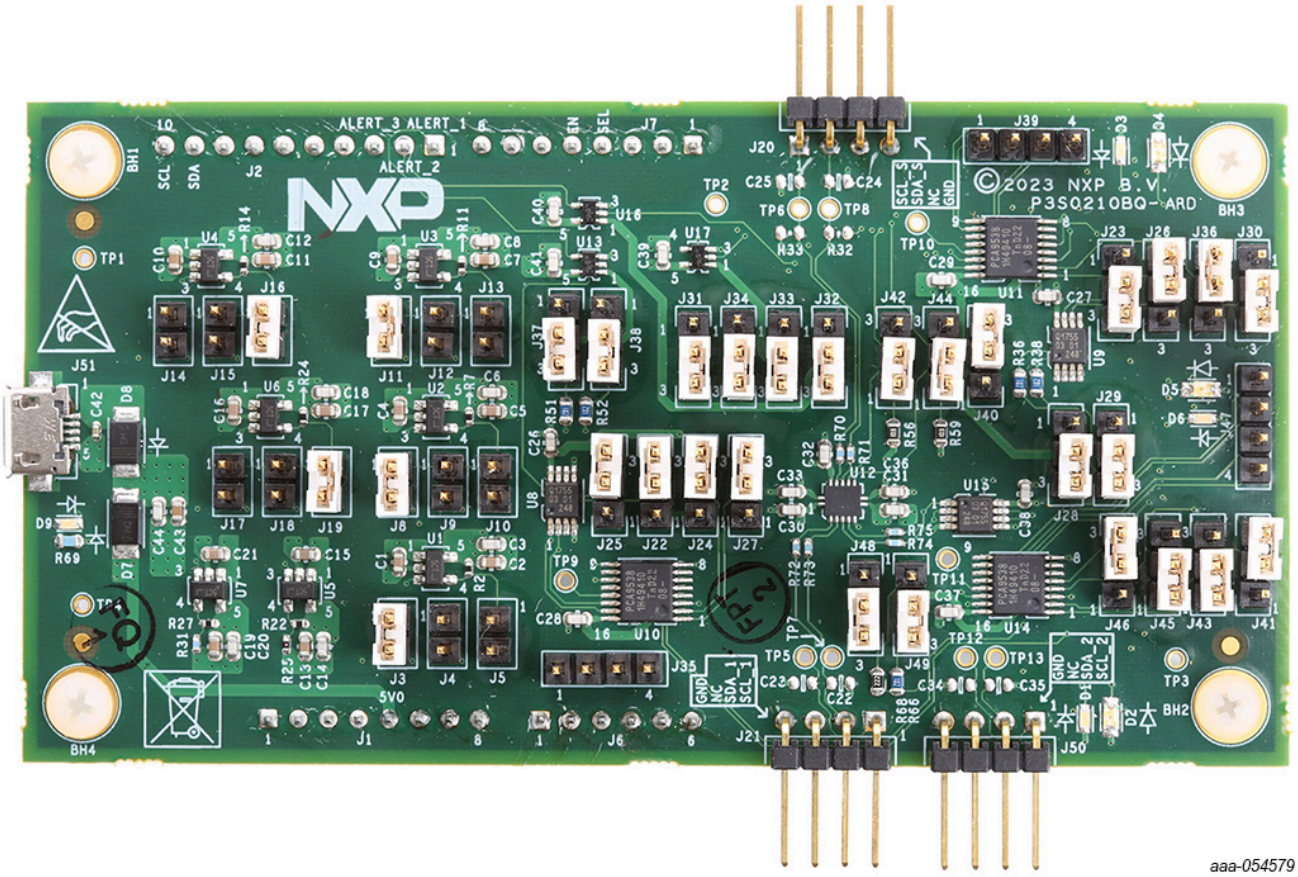

Figure 1. P3S0210BQ-ARD evaluation board

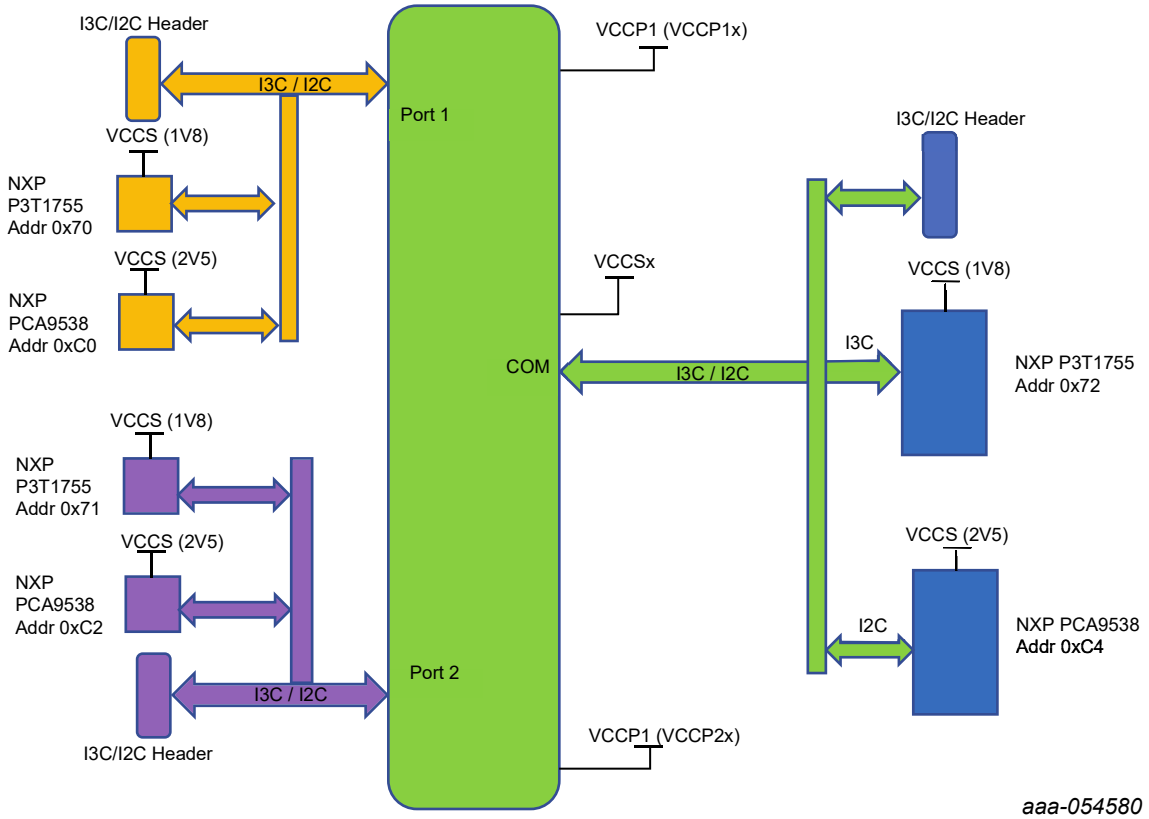

Figure 2. P3S0201 block diagram

4.1 Connectors and jumpers

Please refer to Figure 3 for the location of connectors and jumpers on the evaluation board.

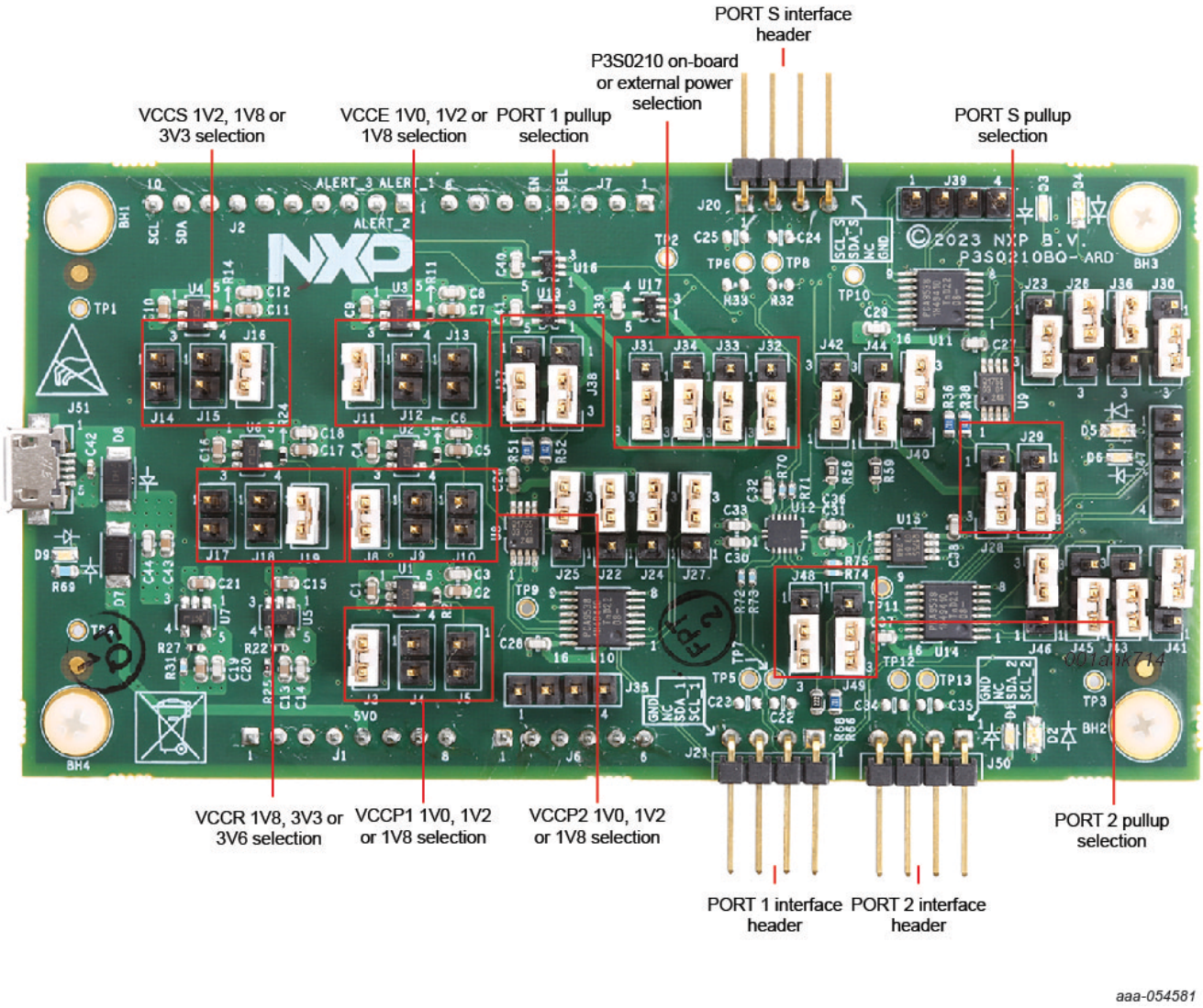

Figure 3. P3S0201BQ-ARD jumper locations

4.2 P3S0210 VCCP1, VCCP2, VCCS, VCCE, VCCR select jumper settings

As default, P3S0210 power rails are set as onboard power as shown in Table 1. External power rail can be used by removing the jumper from 2-3, and placing it on 1-2.

Table 1. VCCP1, VCCP2, VCCS, VCCE, VCCR select jumper settings

Header	Jumper on	Comment
JP31	1-2-3	1-2 external, 2-3 (default) onboard VCCP1
JP32	1-2-3	1-2 external, 2-3 (default) onboard VCCP2
JP33	1-2-3	1-2 external, 2-3 (default) onboard VCCS
JP34	1-2-3	1-2 external, 2-3 (default) onboard VCCR
JP40	1-2-3	1-2 external, 2-3 (default) onboard VCCE

4.3 P3S0210 VCCP1, VCCP2, VCCS, VCCE, VCCR default voltage jumper settings

P3S0210 power rail voltages can be changed according to Table 2.

Table 2. VCCP1, VCCP2, VCCS, VCCE, VCCR default voltage jumper settings

Voltage Rail	Header	Jumper on	Comment
VCCP1	J3 (1V8), J4 (1V2), J5 (1V0)	J3 (default)	VCCP1 is set to 1V8
VCCP2	J8 (1V8), J9 (1V2), J10 (1V0)	J8 (default)	VCCP2 is set to 1V8
VCCPS	J14 (1V2), J15 (1V8), J16 (3V3)	J16 (default)	VCCS is set to 3V3
VCCR	J17 (1V8), J18 (3V3), J19 (3V6)	J19 (default)	VCCR is set to 3V6
VCCE	J11 (1V8), J12 (1V2), J13 (1V0)	J11 (default)	VCCE is set to 1V8

4.4 P3S0210 enable and switch select jumper settings

P3S0210 enable and channel switch can be manually selected or be controlled by the external MCU via the Arduino extension headers.

Table 3. Enable and switch select jumper settings

Pin	Header	Jumper on	Comment
OE	J42	1-2-3	1-2 enable (default), 2-3 disable
SEL	J44	1-2-3	1-2 Port 2 connected PortS, 2-3 Port 1 connected PortS (default)

4.5 On-board I2C and I3C devices

Table 4. On-board I2C and I3C devices

Type	Device	Port1	Port2	PortS
I2C	PCA9538	U10 – Adr. 0xE0	U14 – Adr. 0xE2	U11 – Adr. 0xE4
I3C	P3T1755	U8 – Adr. 0x90	U15 – Adr. 0x92	U9 – Adr. 0x94

The I2C and I3C addresses in Table 4 are the factory default addresses. These addresses can be changed to other addresses via headers. Please see the green footnotes on the P3S0210BQ-ARD evaluation board schematic.

4.6 On-board I2C/I3C pull-up resistor selection

On each of the port I2C/I3C interface header, there are on-board pull up resistor on SCL and SDA signals. The jumpers can be used to select the on-board pull up of either 2.2K or 1K. The on-board pull up resistors can also be disconnected to use the off the board pull up. In this case, the jumpers should be removed from the headers listed below.

Table 5. On-board I2C/I3C pull-up resistor selection

	Header	Jumper on	On-board PU on	On-board PU off
Port1	JP37, JP38	1-2-3	1-2: 2.2K, 2-3:1K	Remove jumpers
Port2	JP48, JP49	1-2-3	1-2: 2.2K, 2-3:1K	Remove jumpers
PortS	JP28, JP29	1-2-3	1-2: 2.2K, 2-3:1K	Remove jumpers

4.7 Arduino headers

The P3S0210BQ-ARD evaluation board is also designed to be mated and controlled by a standard microcontroller board which equipped with standard Arduino headers. The four headers used for this purpose are J1, J2, J6 and J7.

Table 6. Arduino headers

Single	Header	Pin	Comment
5V0_uC	J1	5	5V supply from the MCU board
3V3_uC	J1	4	3V3 supply from the MCU board. Not used.
MCU_I2C_SCL	J2	10	MCU SCL
MCU_I2C_SDA	J2	9	MCU SDA
MCU_ALERT_3	J2	3	PortS P3T1755 alert
MCU_ALERT_2	J2	2	Port2 P3T1755 alert
MCU_ALERT_1	J2	1	Port1 P3T1755 alert
MCU_EN	J7	5	P3S0210 Enable
MCU_SEL	J7	4	P3S0210 Port 1/2 Select

4.8 Test points

There are a number of test points to allow the user to monitor and observe I2C/I3C signals that coming in and out Port1, Port2 and PortS.

Table 7. Test points

Signal	Test point	Alternative test point
Port1 SCL	TP5	J21 pin 1
Port1 SDA	TP7	J21 pin 2
Port2 SCL	TP12	J50 pin 1
Port2 SDA	TP13	J50 pin 2
PortS SCL	TP6	J20 pin 1
PortS SDA	TP8	J20 pin 2

4.9 Schematic, board layout and bill of materials

The schematic, board layout and bill of materials for the P3S0210BQ-ARD evaluation board are available at http://www.nxp.com/P3S0210BQ-ARD.

5 P3S0210 operation guide

1. Unpack the board and power it with the USB2 cable
2. Connect the 1.8V I3C controller to Port1 via J21, or PortS via J20 if 3V3 I3C controller. See schematic for wiring connection.
   Note: As default, Port1 has on-board 2.2K pull-up. If the pull-up is on the I3C controller, then the on-board pull-up can be disabled via J37 and J38 (see Table 5).
3. The I3C controller then can communicate with the 8-bit GPIO PCA9538 via I2C, or the temperature sensor P3T1755 via I3C on Port1. The 1.8 V I3C controller can also communicate with the 8-bit GPIO PCA9538 via I2C, or the temperature sensor P3T1755 via I3C on PortS as well. These devices are located at different I2C/I3C addresses, see Table 4 for their default factory addresses.

6 Errata list

Table 8. Errata

Date	Errata Description	Demo Impact	Solution
-	None	None	None

7 Revision history

Table 9. Revision history

Document ID	Release date	Description
UM11909 v.1.0	23 February 2024	• Initial version

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