AN12648

K32L2B Headset with NXH3670

Rev. 0 — 01/2020

Application Note

Contents

1 Introduction

This document provides the necessary information of K32L2B Headset in the **Bluetooth LE Audio System** as below.

The system contains a K32L2B_Dongle and a K32L2B_Headset.

- **K32L2B_Dongle**: The Dongle has a USB interface connected to the PC. It is responsible for creating a wireless audio link with one extra Headset.
- **K32L2B_Headset**: The Headset has a speaker, a microphone, and some User Interface (UI) components, such as, buttons, sliders, rotary switches and LED.

This document mainly described the hardware design and software architecture (top-level design) of K32L2B Headset in the **Bluetooth LE Audio System**. It provides audience with a systematic view of K32L2B Headset in the **Bluetooth Audio System**.

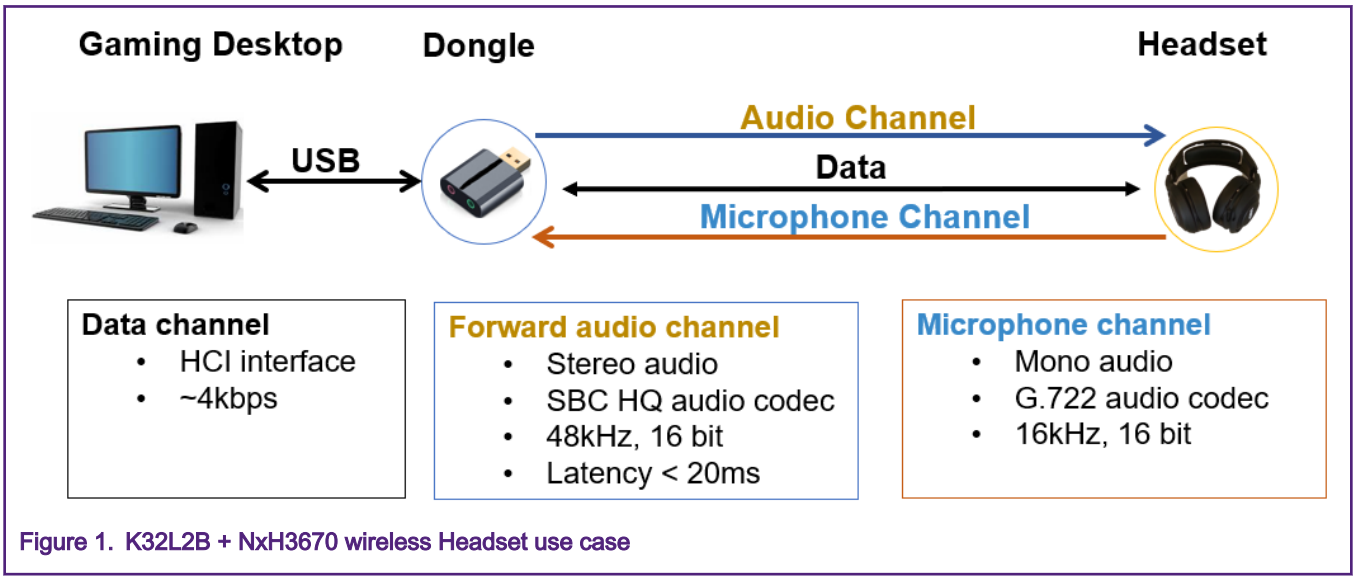

Figure 1. K32L2B + NxH3670 wireless Headset use case

2 Board overview

2.1 Block diagram

Figure 2 shows the block diagram of K32L2B_Headset.

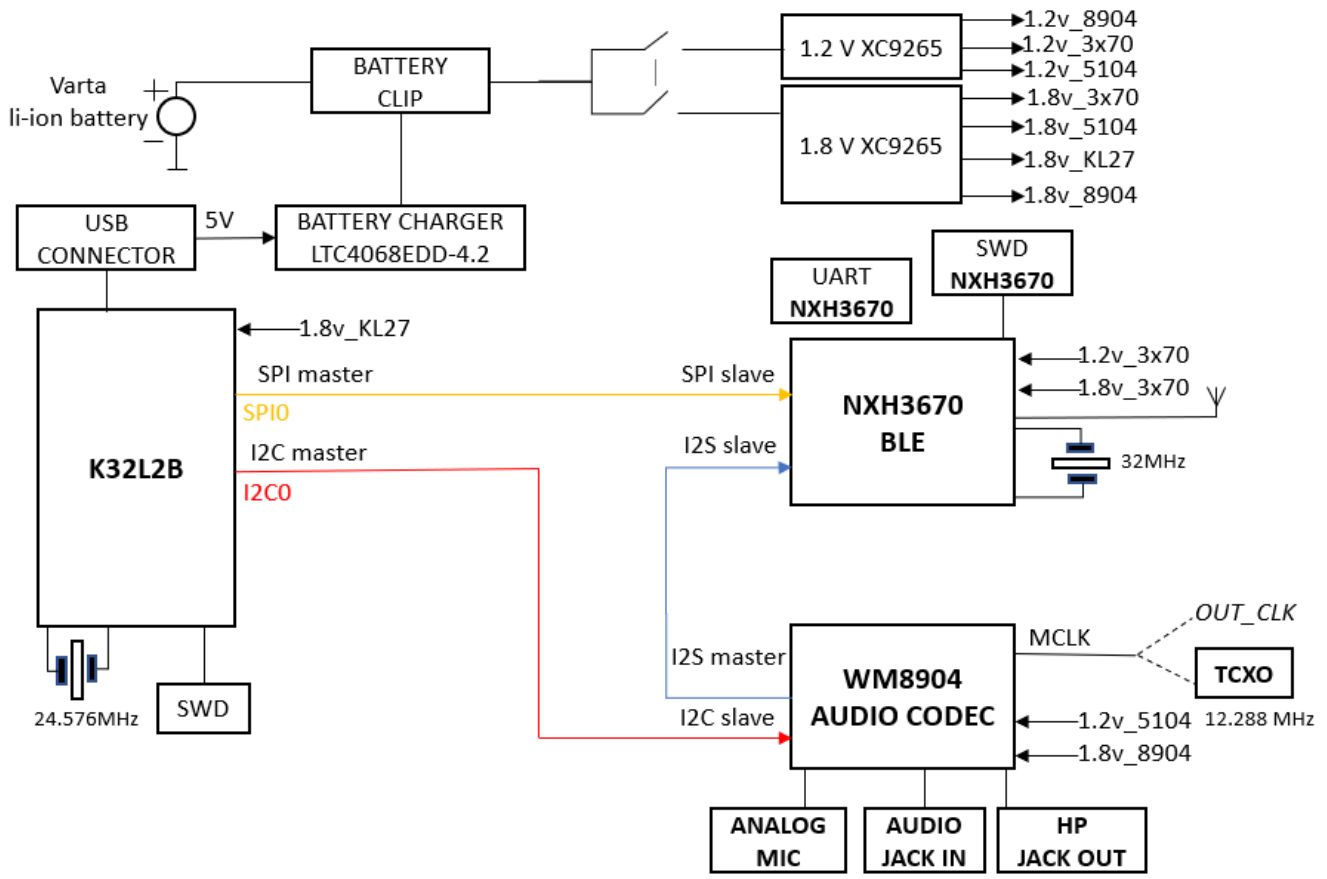

Figure 2. Block diagram of Headset configurations

As shown in Figure 2,

- Host Controller (K32L2B) is used to run Headset and OTA_Headset demos.
- CODEC (WM8904) is used to program for encoding or decoding a digital data stream or signal. In the software, the I^2C interface is used to configure the CODEC.

NOTE

NXH3670 (I^2S slave) communicates with CODEC (I^2S master) via the I^2S directly.

- NXH3670 communicates with K32L2B through the SPI interface.

2.2 USB headset software architecture

This document lists only the software design.

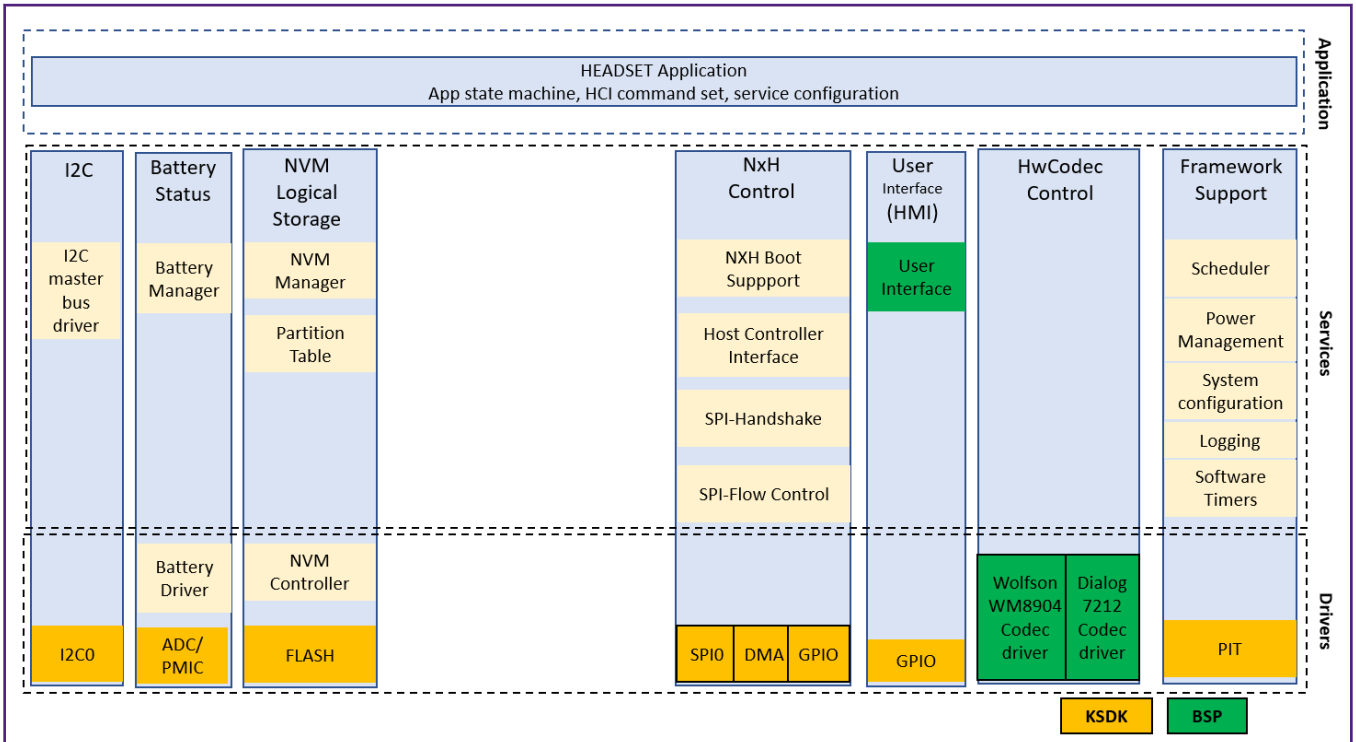

Figure 3. Headset application architecture

As shown in Figure 3, the Headset application contains NVM service, CODEC service, NXH service, and User Interface service. This document just lists the following functions:

1. **Nvm service**: To read **Partition Table**.
2. **NxH Control**: To boot, start and transfer data with K32L2B using the SPI interface.
3. **User Interface**: Buttons used to control the volume, start and pause.
4. **CODEC service**: To configure CODEC via the I^2C interface.

In the hardware design, NXH3670 and CODEC are connected via I^2S, so the audio data can be transmitted directly from NXH3670 to CODEC via I^2S (users need to initialize the I^2C peripheral instead of I^2S peripheral).

Figure 4 shows the audio transfer process.

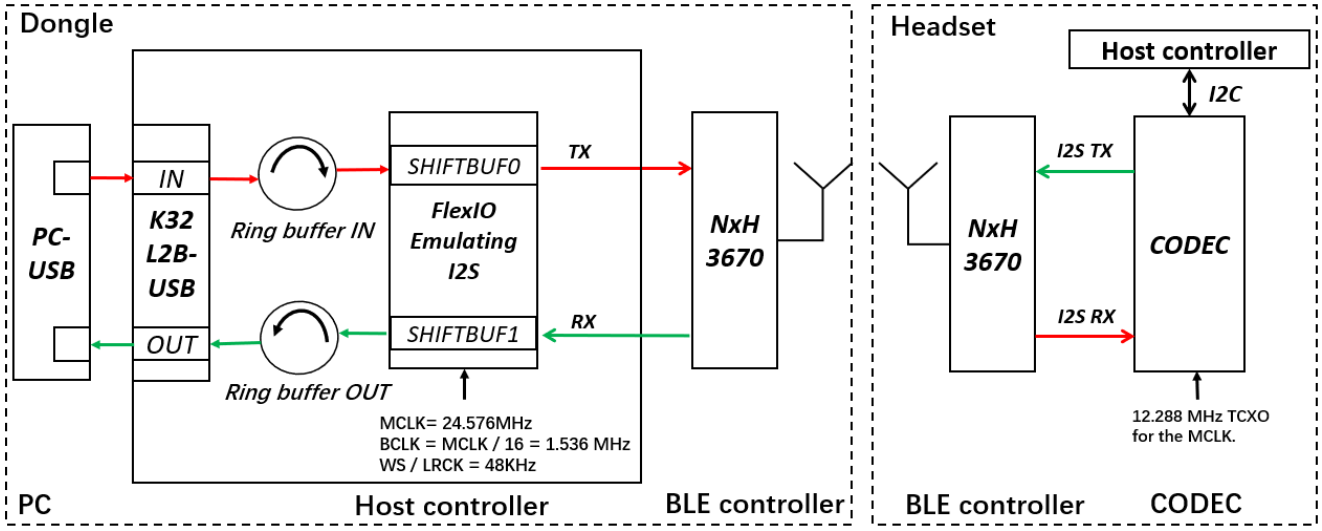

Figure 4. Audio path

: Playback (forward channel): The audio path is from the PC to the Headset.

: Record (backward channel): The audio path is from the Headset to the PC.

Users can download the demo for 48 KHz/16 bits down stream to test playback function and 48 KHz/16 bits up stream to test record function.

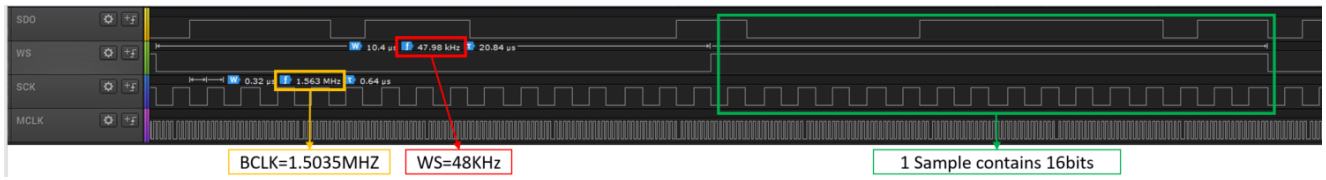

Figure 5. Sample of audio data

This document only introduces the audio transfer process of the Headset section. For more information on the Dongle section, refer to *K32L2B USB Dongle with NXH3670* (document AN12647).

3 Components of K32L2B Headset

3.1 K32L2B

3.1.1 Host controller

The device is highly-integrated, market leading ultra low-power 32-bit microcontroller based on the enhanced Cortex-M0+ (CM0+) core platform. **K32L2B Headset with NXH3670** uses the following features:

- Core platform clock up to 48 MHz, bus clock up to 24 MHz.
- Memory option is up to 256 KB flash and 32 KB RAM.
- Wide operating voltage ranges from 1.71–3.6 V with fully functional flash program/erase/read operations.

- Two SPI modules that support 16-bit data length.
- Two inter-integrated circuit (I^2C) modules.
- One FlexIO module.

3.1.2 Clock

Two crystals used on the board:

- 32 MHz crystal connected with the NxH3670.
- 12.288 MHz TCXO for the CODEC's MCLK, users can select their clock source via J10, as shown in Figure 6.

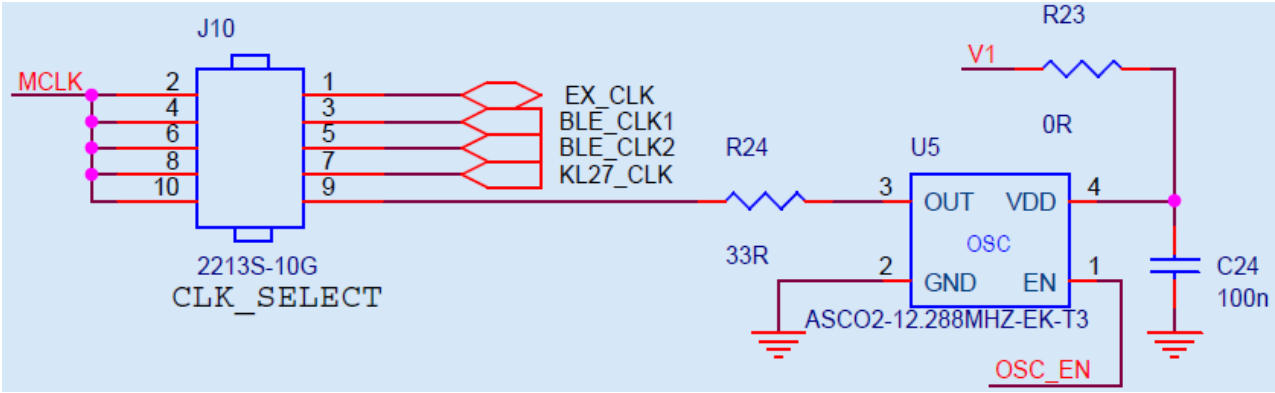

Figure 6. Selection of MCLK (CLK_SELECT)

3.1.3 Serial Wire Debug (SWD)

- A serial wire debug interface is provided on FRDM-K32L2B3 board.
- Users can also download or debug project to FRDM-K32L2B board using **CMSIS-DAP** or **JLINK** firmware.

3.1.4 Pin connections

Table 1 lists the connection information between K32L2B and other components.

Table 1. Connection information

Function	Jumper (K32L2B Headset)	Name	Jumper (NXH3670)	Name
I^2S (K32L2B have no I^2S peripheral)	—	CODEC_SDI	J12_1/9 (I2S_CONFIG)	BLE_SDO
	—	CODEC_SDO	J12_3/11 (I2S_CONFIG)	BLE_SDI
	—	CODEC_WS	J12_5/13 (I2S_CONFIG)	BLE_WS
	—	CODEC_SCK	J12_7/15 (I2S_CONFIG)	BLE_SCK
I2C0	J4-4 (PIN PTB1)	K32L2B_SDA	J11_2 (PERIPHERAL_I2C)	PH_SDA

Table continues on the next page...

Table 1. Connection information (continued)

Function	Jumper (K32L2B Headset)	Name	Jumper (NXH3670)	Name
	J4-2 (PIN PTB0)	K32L2B_SCL	J11_4 (PERIPHERAL_I2C)	PH_SCL
NXH Handshake	J1_2 (PIN PTA1)	BLE_SPIS_INTN	J16_9 (BLE_SPI)	SWM4 (- INTN)
	J1_8 (PIN PTA12)	BLE_SPIS_SRQ	J16_13 (BLE_SPI)	SRQ
SPI0	J1-11 (PIN PTC7)	BLE_SPIS_MISO	J16_1 (BLE_SPI)	SW0
	J1-9 (PIN PTC6)	BLE_SPIS_MOSI	J16_3 (BLE_SPI)	SW1
	J1-15 (PIN PTC5)	BLE_SPIS_SCLK	J16_5 (BLE_SPI)	SW2
	J1-7 (PIN PTC4)	BLE_SPIS_SSN	J16_7 (BLE_SPI)	SW3
NXH reset	J1_4 (PIN PTA2)	BLE_RESETN	J20_5 (BLE_SWD)	POR_RESETN

3.1.5 Schematic

1. Section 1: Audio transfer
   - **I²C**

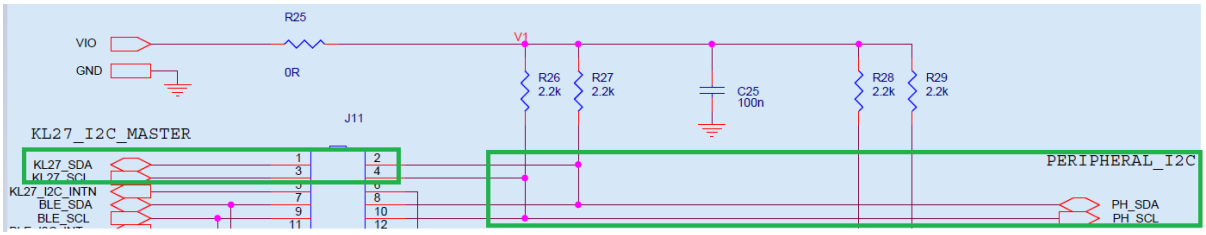

Figure 7. I²C interface connection

Audio data will be transmitted directly from NXH3670 to CODEC via I²S. For software,I²C peripheral needs to be initialized to configure CODEC instead of I²S peripheral.

   - **I²S**

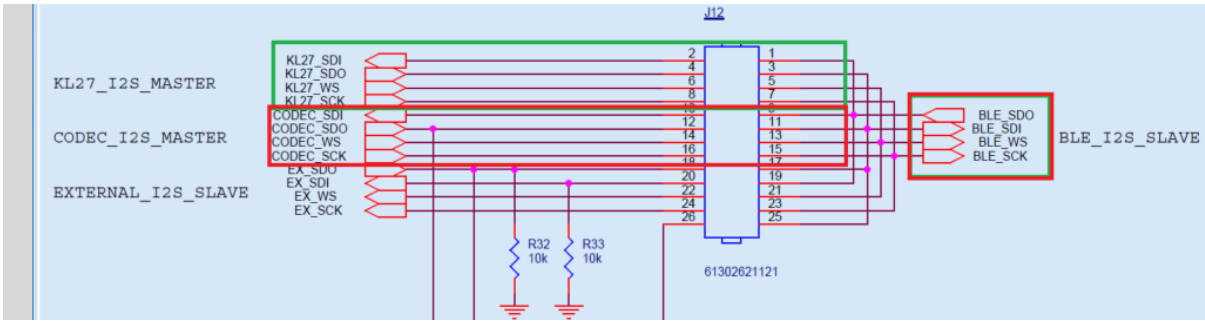

Figure 8. I²S interface connection

The NXH3670 is connected with CODEC instead of Host Controller (K32L2B) through I²S interface.

2. Section 2: NXH3670
   - **NXH Handshake pin**

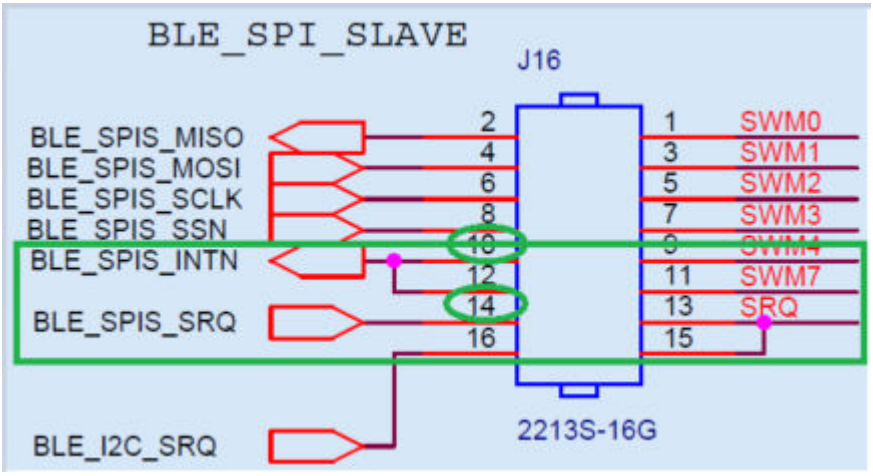

Figure 9. Handshake pins (SRQ and INTN) connection

- SPI

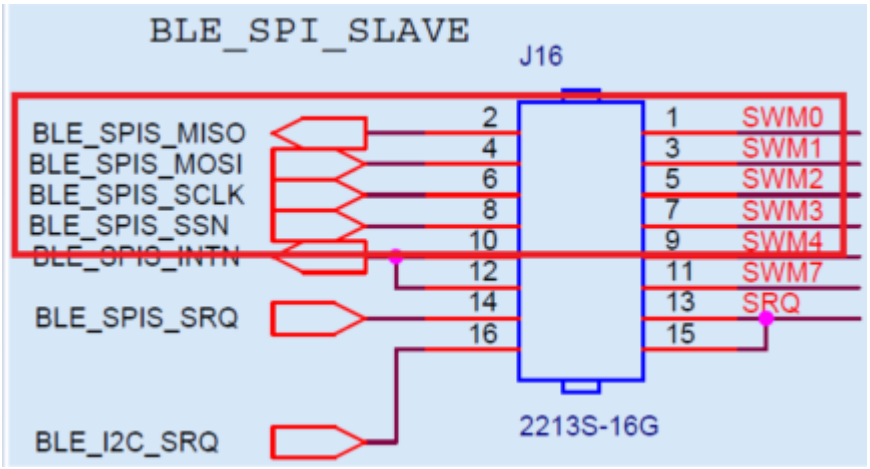

Figure 10. SPI interface connection

- POR

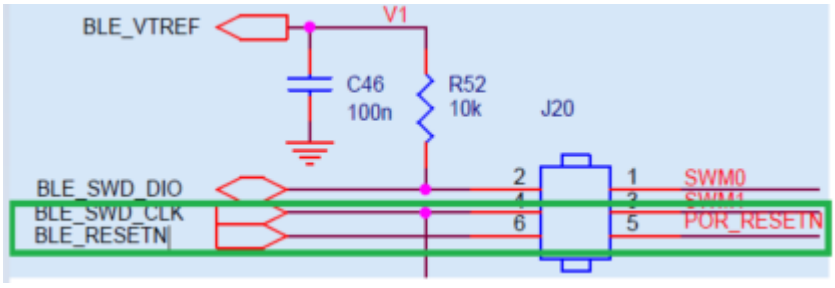

Figure 11. Power On Reset (POR) pin connection

3.1.6 Pin configurations

- SPI

  - Interface: SPI0.
  - Pins: CS (PTC4), SCK (PTC5), MISO (PTC7), MOSI (PTC6).
  - Polarity: Active-high SPI clock (idles low).
  - Phase: First edge on SPSCK occurs at the middle of the first cycle of a data transfer.
  - Baud Rate: Configure the value of Baud Rate for SPI to **8000000u**.
- I^2C
  - Interface: I2C0.
  - Pin: SCL (PB.0), SDA (PB.1)
  - Configure the value of I^2C Address to **0x1A**.
- NxH3670 relevant pins
  - INIT (PTA1): Configured as digital input.
  - SRQ (PTA12): Configured as digital output.
  - POR (PTA2): Configured as digital output.

3.2 NXH3670

For more information of NXH3670, refer to *K32L2B USB dongle with NXH3670* (document AN12647).

4 Conclusion

This document describes the hardware design and software architecture (top-level design) of K32L2B_Headset in the **Bluetooth LE Audio System**. It can be a reference for users to build their own demo.

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