

PTX105R Arduino Shield

The PTX105R Arduino Shield is designed to add NFC Reader functionality to IoT projects using the Arduino UNO R4 platform.

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1. Overview

The PTX105R Arduino Shield is designed to add NFC Reader functionality to IoT projects using the Arduino UNO R4 platform. It features communication with the Arduino UNO R4 using different interfaces. The interface selection is done via a jumper selection. The shield is powered by the Arduino UNO R4 and is operated at either 3.3V or 5.2V, depending on the read range requirements of the application.

The PTX105R Arduino Shield features the following components:

- PTX105RDQ56D13
- ISL9120IRTAZ

The complete name of the proof-of-concept board is WS031-NFCShield-REFZ PTX105R NFC Arduino Shield. The shield is designed to directly connect onto the Arduino Uno R4 Minima and WiFi variants.

2. Required Software and Tools

The Arduino library for each interface is available from the Arduino IDE's Library Manager, with the following names:

- PTX105R SDK for SPI
- PTX105R SDK for I2C
- PTX105R SDK for UART

Each library contains the same set of example sketches as described in the section [Example Sketches](#).

3. Default Jumper Configuration

The default jumper configuration is placed to enable SPI as interface between the Arduino Uno and the shield. [Figure 1](#) shows the jumper configuration. The interface selection JSIF needs to be open. The JSPI jumper pins need to be shorted to JHIF.

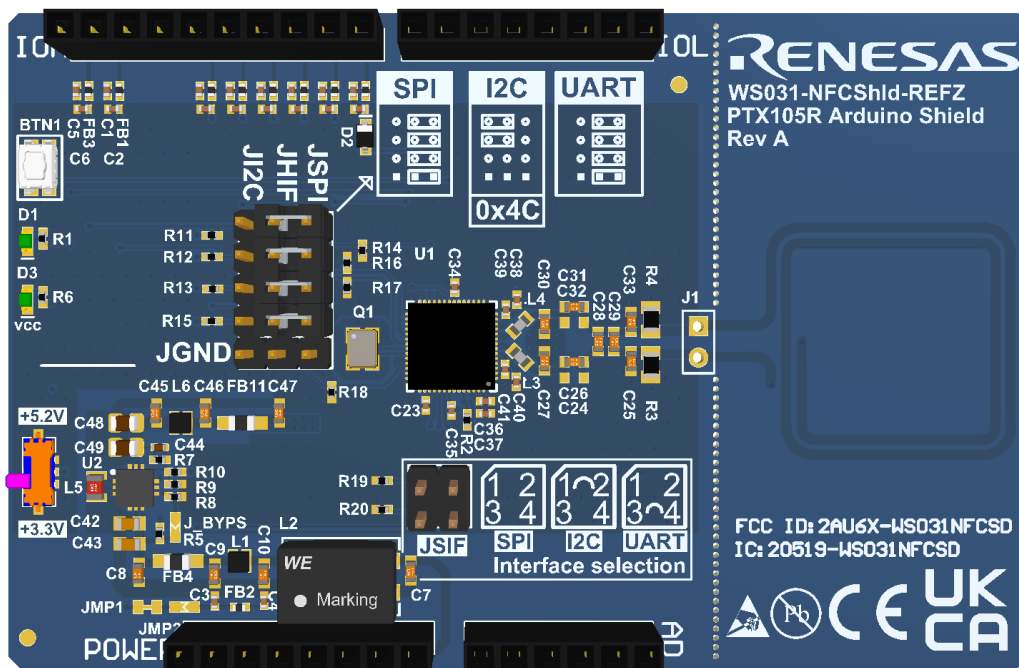


Figure 1. Default Jumper Configuration

4. Block Diagram

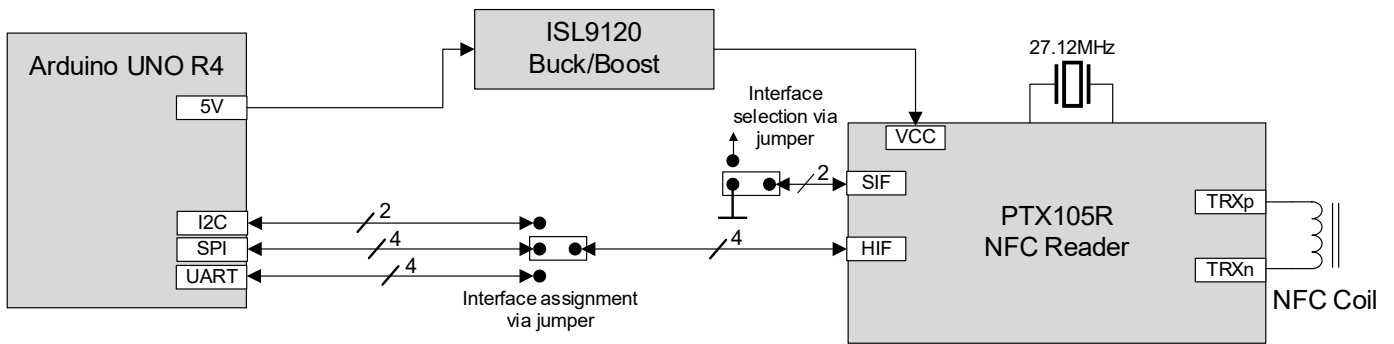


Figure 2. Block Diagram

5. Interface Selection

The PTX105R supports I²C, SPI and UART interfaces. All three interfaces are featured on the Arduino shield. To select an interface, remove power from the board initially. The interface selection for PTX105R is done via pin header JSIF. To select the desired interface, place the jumpers as detailed in the silkscreen and [Schematics](#).

Use the JHIF, JI2C and JSPI pin headers to connect the PTX105R interface to the correct Arduino Uno R4 pins (see the [Schematics](#) and silkscreen for a detailed description of the jumper placement). By default, I²C operates at the address 0x04.

Once all the jumpers have been placed, the board can be powered up again. [Example Sketches](#) are compatible with all three interfaces.

6. Power Supply

The PTX105R Arduino Shield is powered from the 5V supply provided by the Arduino UNO R4. A buck-boost is placed on the shield with the option to buck the 5V to 3.3V or boost it to 5.2V. The higher voltage allows a farther reading range at the cost of higher power consumption.

7. Antenna Design and Matching

The antenna design has a 20 x 20 mm footprint, with 4 turns in total on two layers. The trace width is 0.8mm with a gap of 0.2mm between traces. This results in the following electrical parameters in free air:

Format	Value
Real	595.86 mΩ
Imaginary	40.802 Ω
Magnitude	40.807 Ω
Magnitude (dB)	32.215 dB Ω
Phase (°)	89.163 °
Phase (rad)	1.556 rad

Series equivalent circuit Parallel equivalent circuit

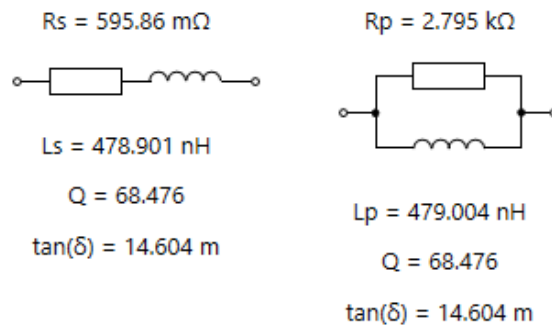


Figure 3. Antenna Electrical Parameters in Free Air

The target matching impedance at 13.56 MHz is $Z = 5 \text{ Ohm} + j*0 \text{ Ohm}$, with a quality factor in the range of 15. To achieve this, use the matching topology with the component values shown in Figure 4.

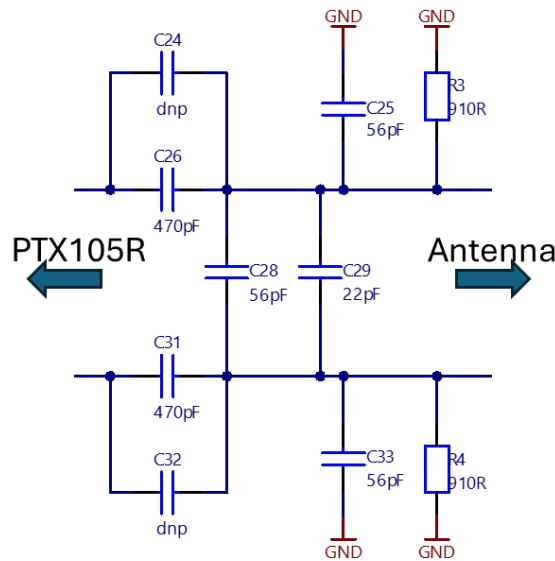


Figure 4. Matching Topology and Component Values

A low pass filter with a cut-off frequency of roughly 55.6MHz is placed in between the antenna matching and the PTX105R RF output/input. This is to prevent noise from coupling into the antenna being radiated via the antenna.

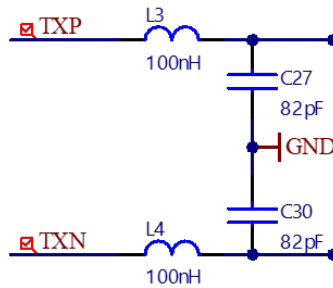


Figure 5. Low Pass Filter Schematic

8. Example Sketches

Example sketches are available for the following applications:

- Card Emulation
- NDEF Read
- NDEF Write
- Reader Demo

These example sketches can be used as a starting point for more elaborate implementations.

8.1 Card Emulation

The PTX105R is configured to operate like a contactless card of type 4. The sketch includes an example NDEF message that a Reader will receive when bringing the shield into its proximity.

8.2 NDEF Read

This example polls for type 2, type 3, type 4 and type 5 contactless cards. In case a card is detected, it will be read and some basic information will be printed on the IDE's serial monitor. If an NDEF message is present on the card, this will be read and printed on the console. In case multiple cards are detected, all but one must be removed. This example will read only NDEF formatted cards.

8.3 NDEF Write

This example polls for type 2, type 3, type 4 and type 5 contactless cards. In case a card is detected, it will be read and some basic information will be printed on the IDE's serial monitor. If the card has NDEF capability, an example web URL will be written to the card. In case multiple cards are detected, all but one must be removed. This example will write only NDEF formatted cards.

Important: Do not to remove the card from the field while the writing process is ongoing.

8.4 Reader Demo

This example runs the SDK's Reader demo. It polls for type 2, type 3, type 4 and type 5 cards. If a card is detected, it is activated and example data is exchanged depending on the protocol type. Information about the activated card is printed to the serial monitor. If multiple cards are detected, the first one that was detected will be activated.

9. Schematics

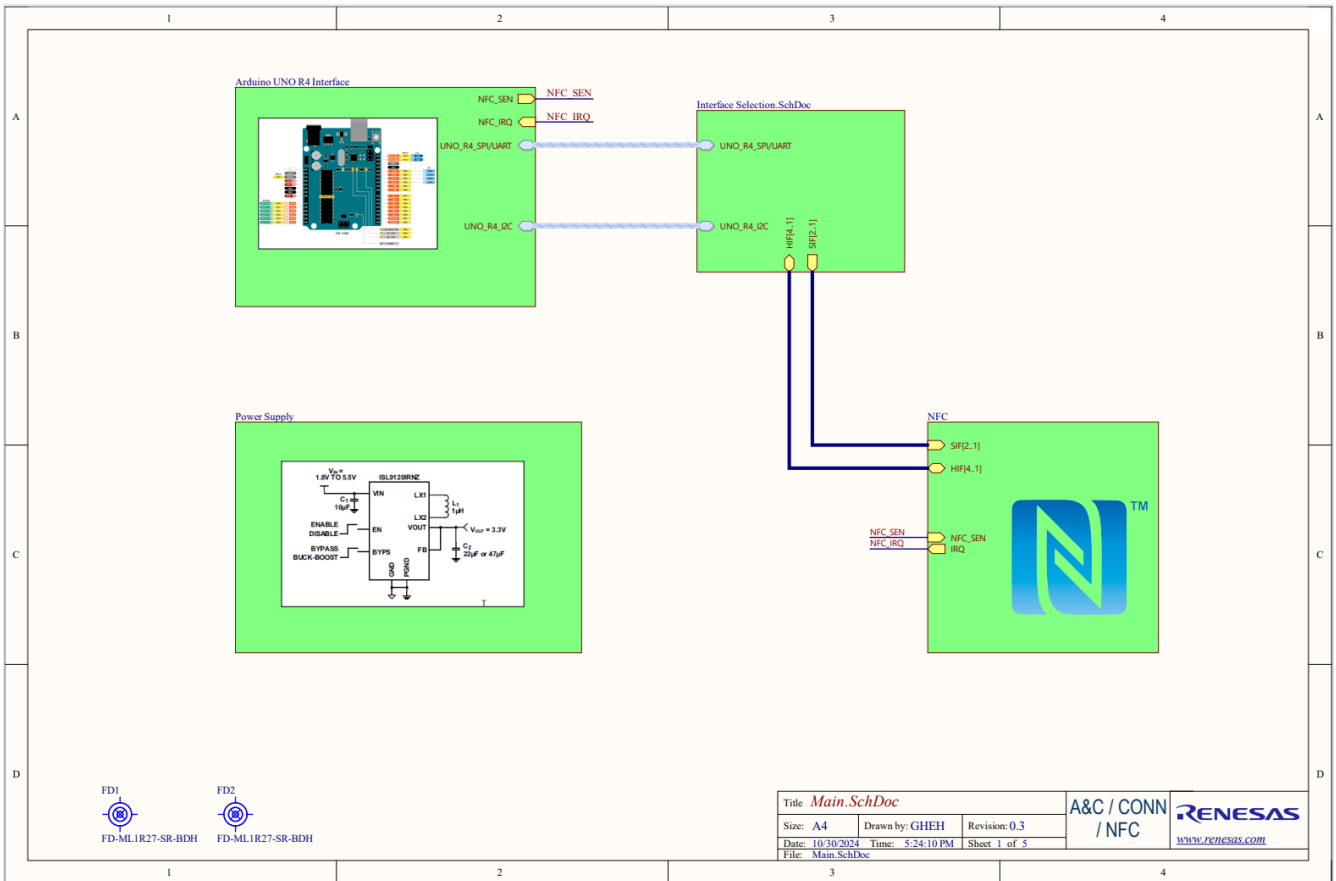
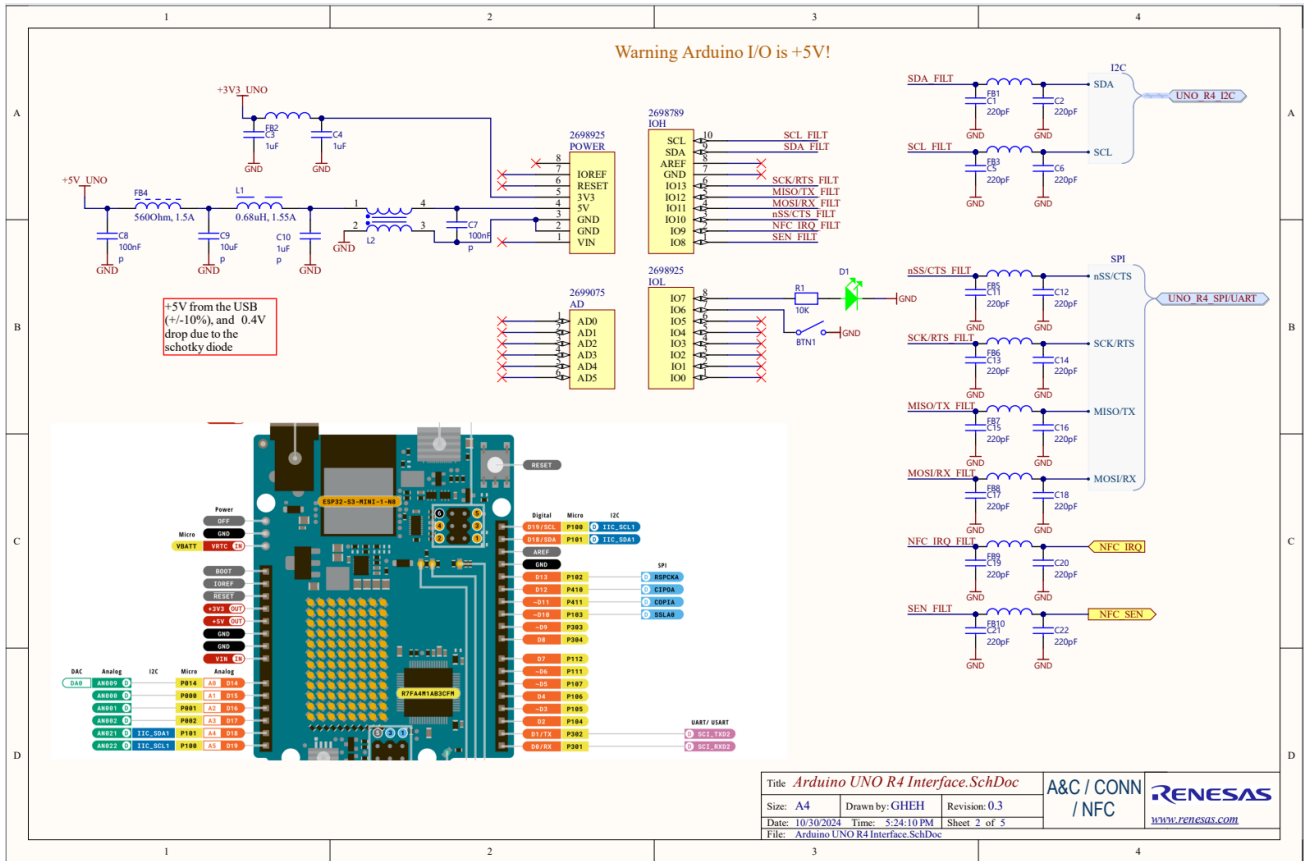


Figure 6. Schematic Sheet 1



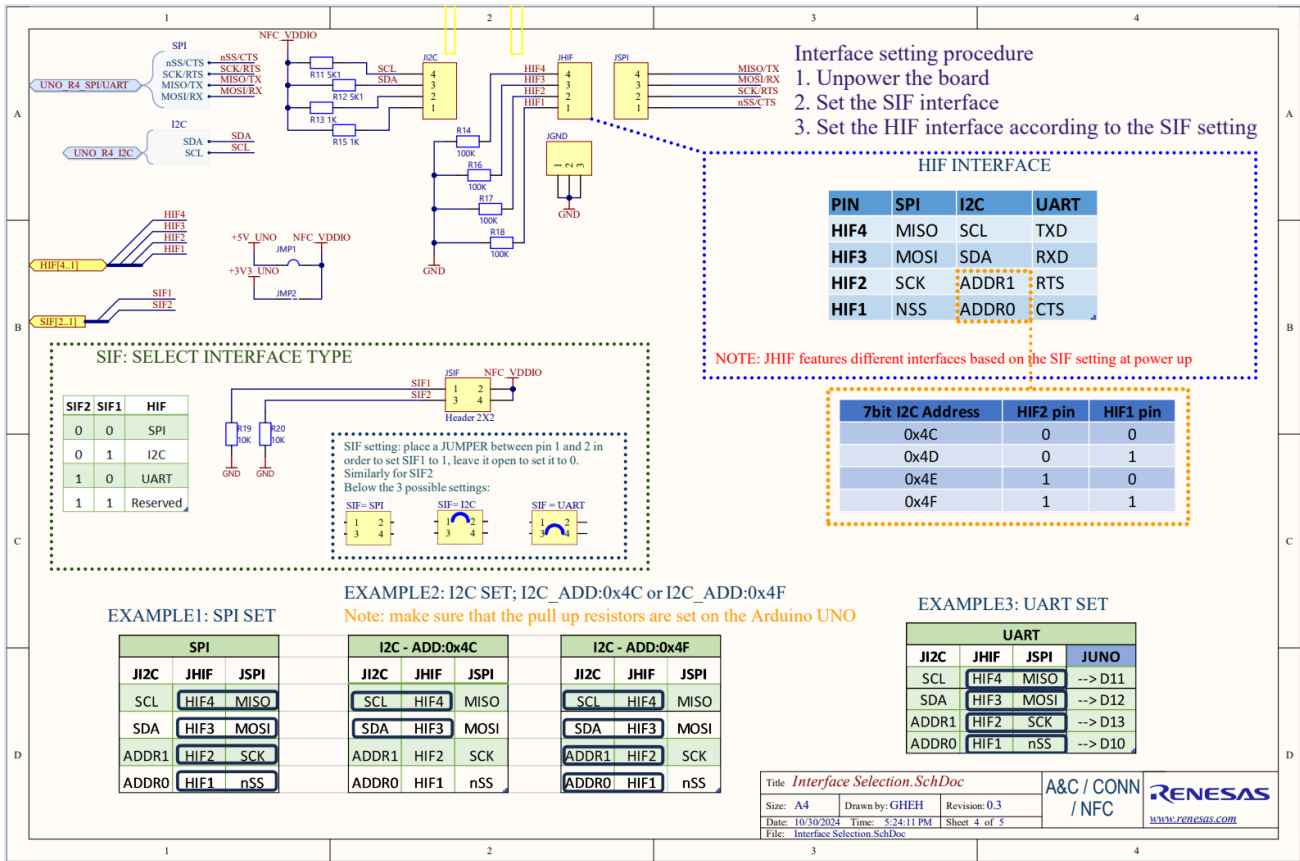


Figure 9. Schematic Sheet 4

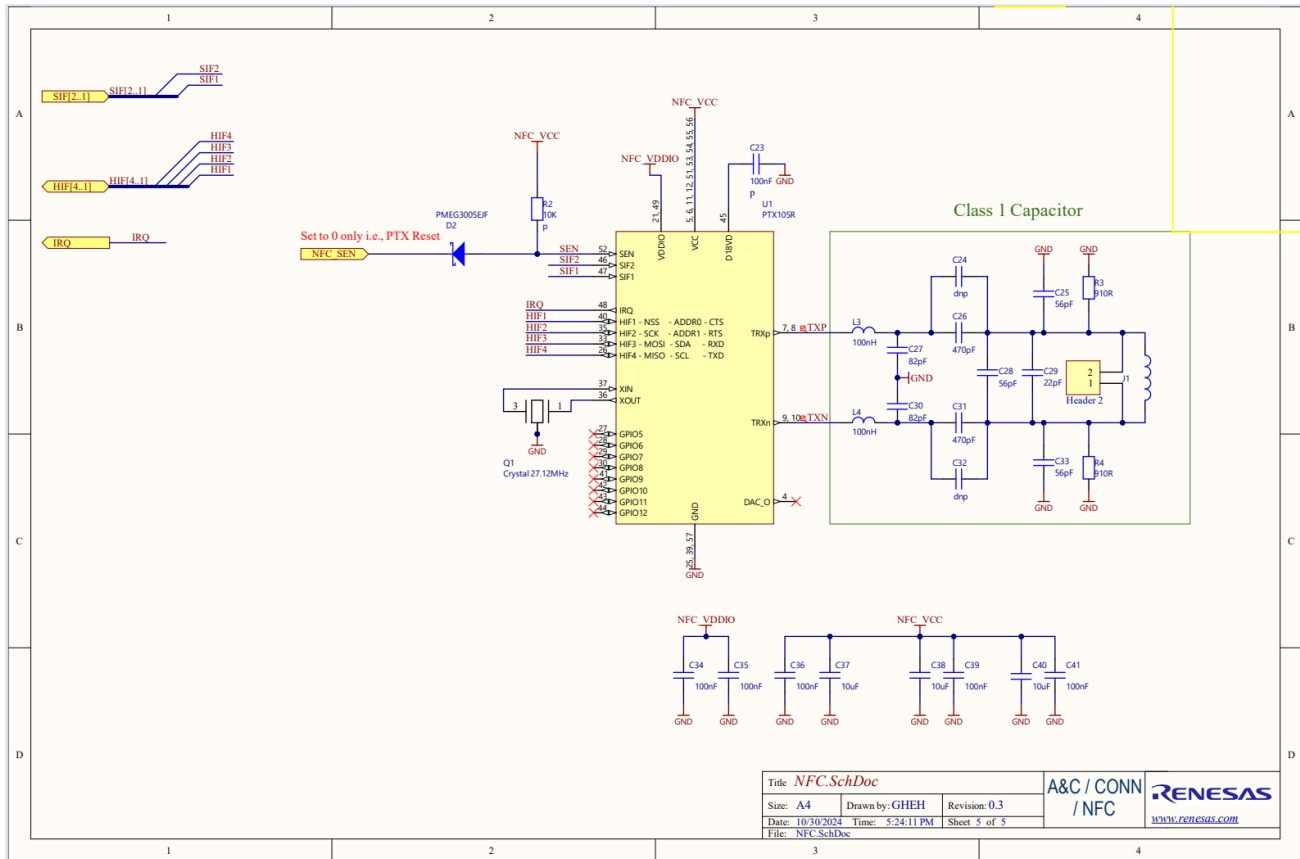


Figure 10. Schematic Sheet 5

10. PTX105R Arduino Board Images

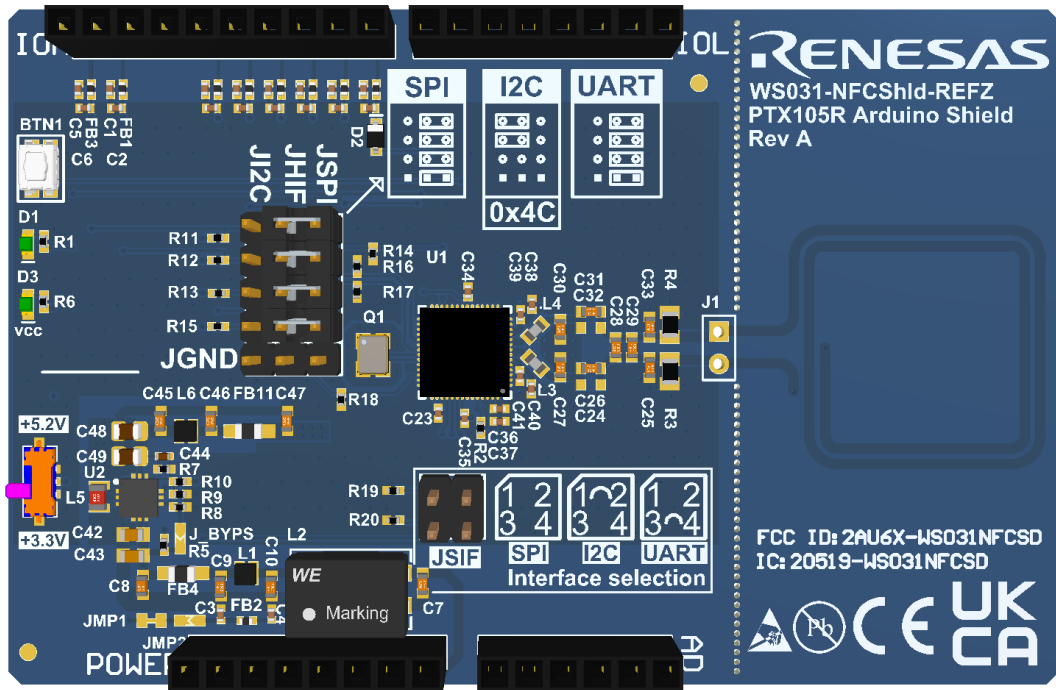


Figure 11. PTX105R Arduino Board – Top View

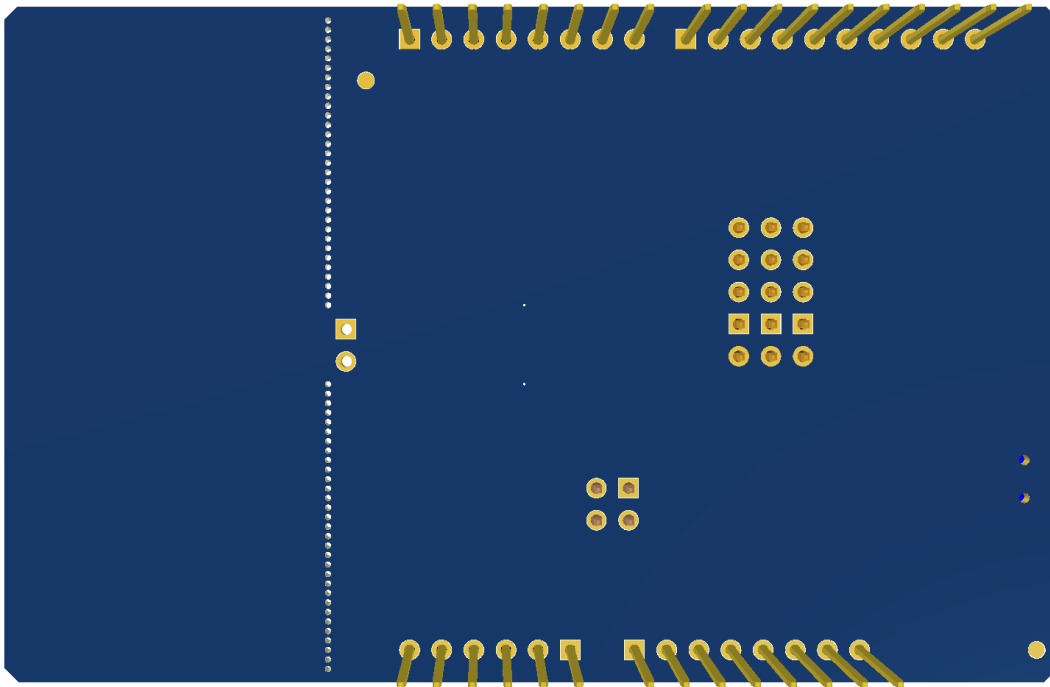


Figure 12. PTX105R Arduino Board – Bottom View

11. Regulatory Compliance

The NFC shield is tested for compliance together with the Arduino UNO R4 and an off the shelf type-A tag for a typical use case scenario. Since this is a development platform the user needs to be aware that changing settings, the antenna, matching components, the distance between shield and tag, and other modifications, may change the system's behavior and require re-certification. Unauthorized changes or modifications to this equipment may void compliance with FCC Rules. The user should maintain a separation distance of 20cm away from the human body during use to comply with RF Exposure requirements.

NOTE: THE PARTY RESPONSIBLE FOR COMPLIANCE IS NOT RESPONSIBLE FOR ANY CHANGES OR MODIFICATIONS BY THE USER NOT EXPRESSLY APPROVED.

SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

The user is assumed to be an industry professional experienced in the use of development platforms such as this shield and ensures proper ESD handling of the components and otherwise best practices used with development platforms.

This device complies with part 15 of the FCC rules and with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes:

1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

12. Revision History

Revision	Date	Description
1.01	Mar 20, 2025	<ul style="list-style-type: none"> ▪ Updated 1st paragraph in Overview. ▪ Added 27.12MHz to crystal in Figure 2.
1.00	Dec 9, 2024	Initial release.

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