

UM10878

PN7120 NFC Controller SBC Kit User Manual

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User manual
COMPANY PUBLIC

Document information

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| Keywords | OM5577, PN7120, Demo kit, Raspberry Pi, BeagleBone |
| Abstract | This document is the user manual of the PN7120 NFC Controller SBC kit |



Revision history

| Rev | Date | Description |
|-----|----------|---------------|
| 1.0 | 20150519 | First release |

Contact information

For more information, please visit: <http://www.nxp.com>

1. Introduction

The present document describes the OM5577/PN7120S demonstration kit, a flexible and easy-to-use Single Board Computer (SBC) Kit for the PN7120 NFC Controller.

It contains a PN7120 NFC Controller Board, a Raspberry Pi Interface Board, a BeagleBone Interface Board, as well as an NFC Forum Type 2 Tag in form of a MIFARE UL Card. It enables the development of an NFC solution based on PN7120 in a Linux or Android environment.

PN7120 is a full NFC controller solution with integrated firmware and NCI interface designed for contactless communication at 13.56 MHz.

This document presents first an overview of the kit.

Then, it gives printed circuit boards details.

Finally, it provides information for reuse of the kit in different environments.

2. Overview

2.1 Kit description

OM5577/PN7120S kit is a high performance fully NFC compliant expansion board for both Raspberry Pi (refer to [1] for more details) and BeagleBone (refer to [2] for more details). It meets compliance with Reader mode, P2P mode and Card emulation mode standards. The board features an integrated high performance RF antenna to insure high interoperability level with NFC devices.

2.2 Kit content

The kit is composed of 3 printed circuit boards and a MIFARE Ultralight EV1 card.



Fig 1. PN7120NFC Controller SBC Kit content

2.2.1 PN7120 NFC Controller Board

The PN7120 NFC Controller Board is the main board of the demonstration kit. It embeds the PN7120 and all related circuitry.

It also include an on-board RF antenna with related matching circuitry.

This main board has to be used in association with one of the 2 interface boards depending of the target user environment (Raspberry Pi or BeagleBone).

For this purpose it integrates dedicated connectors allowing boards assembly.

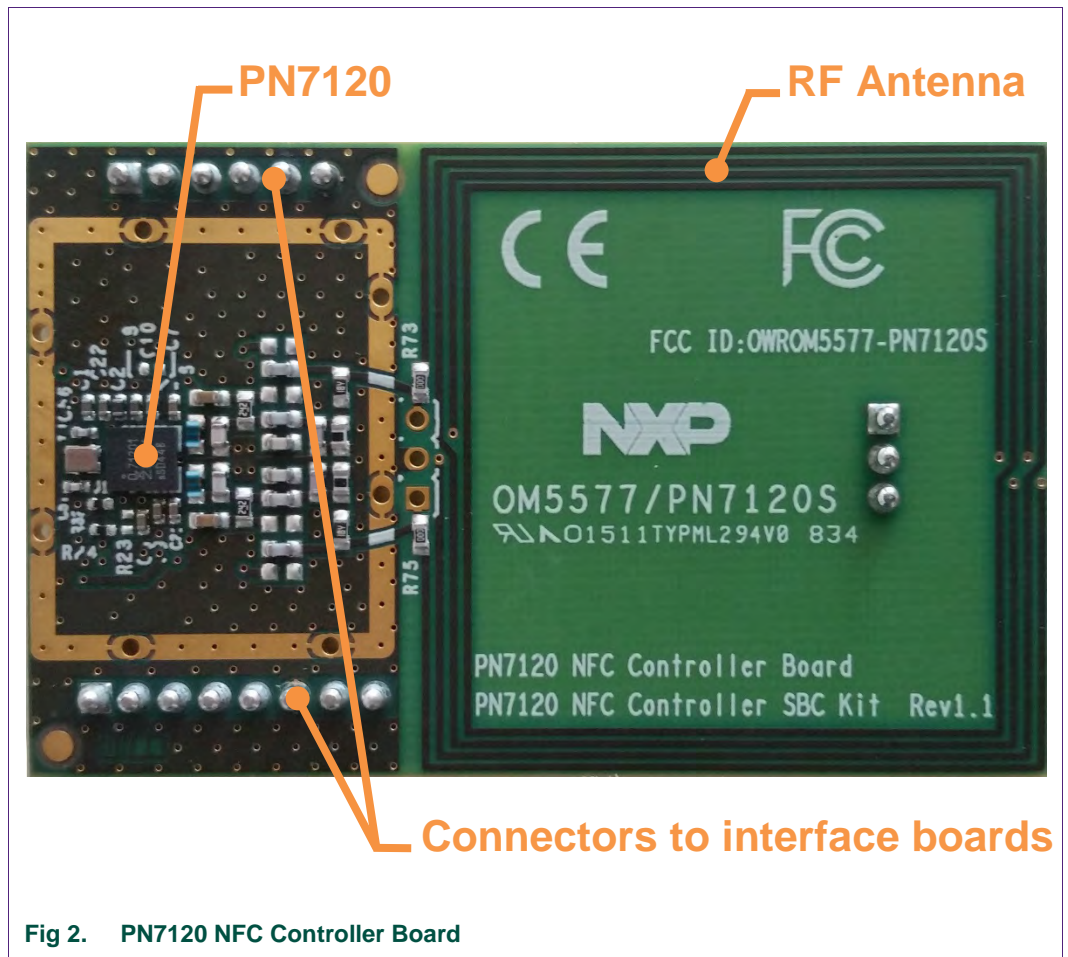


Fig 2. PN7120 NFC Controller Board

2.2.2 BeagleBone Interface Board

The BeagleBone Interface Board offers support for connection to BeagleBone board (refer to [2] for more details).

As such it integrate the connectors allowing the PN7120 NFC Controller Board to be plugged on it, as well as connectors to be assembled on top of the BeagleBone board.

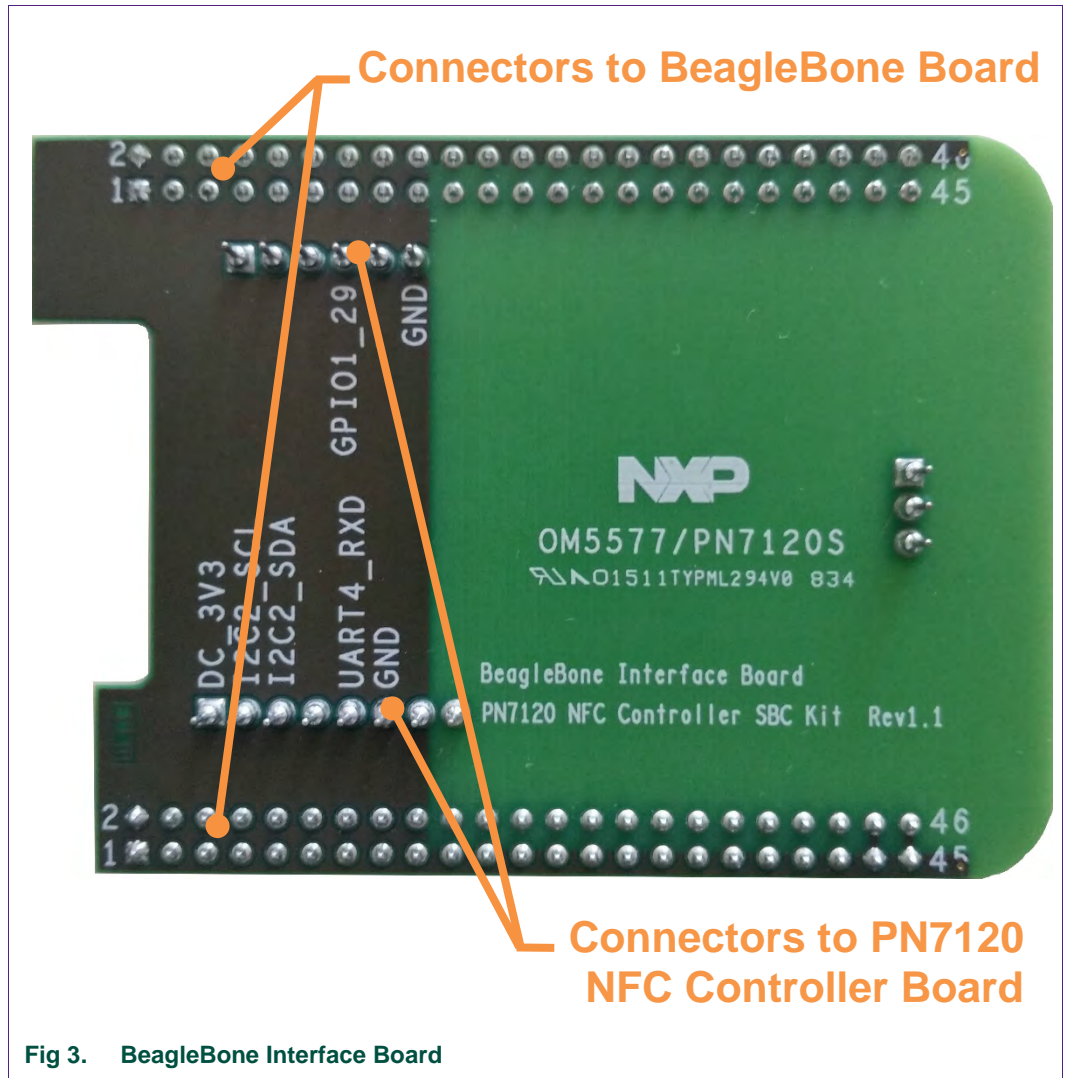


Fig 3. BeagleBone Interface Board

2.2.3 Raspberry Pi Interface board

The Raspberry Pi Interface board offers support for connection to Raspberry Pi board (refer to [1] for more details).

As such it integrate the connectors allowing the PN7120 NFC Controller Board to be plugged on it, as well as connector to be assembled on top of the Raspberry Pi board.

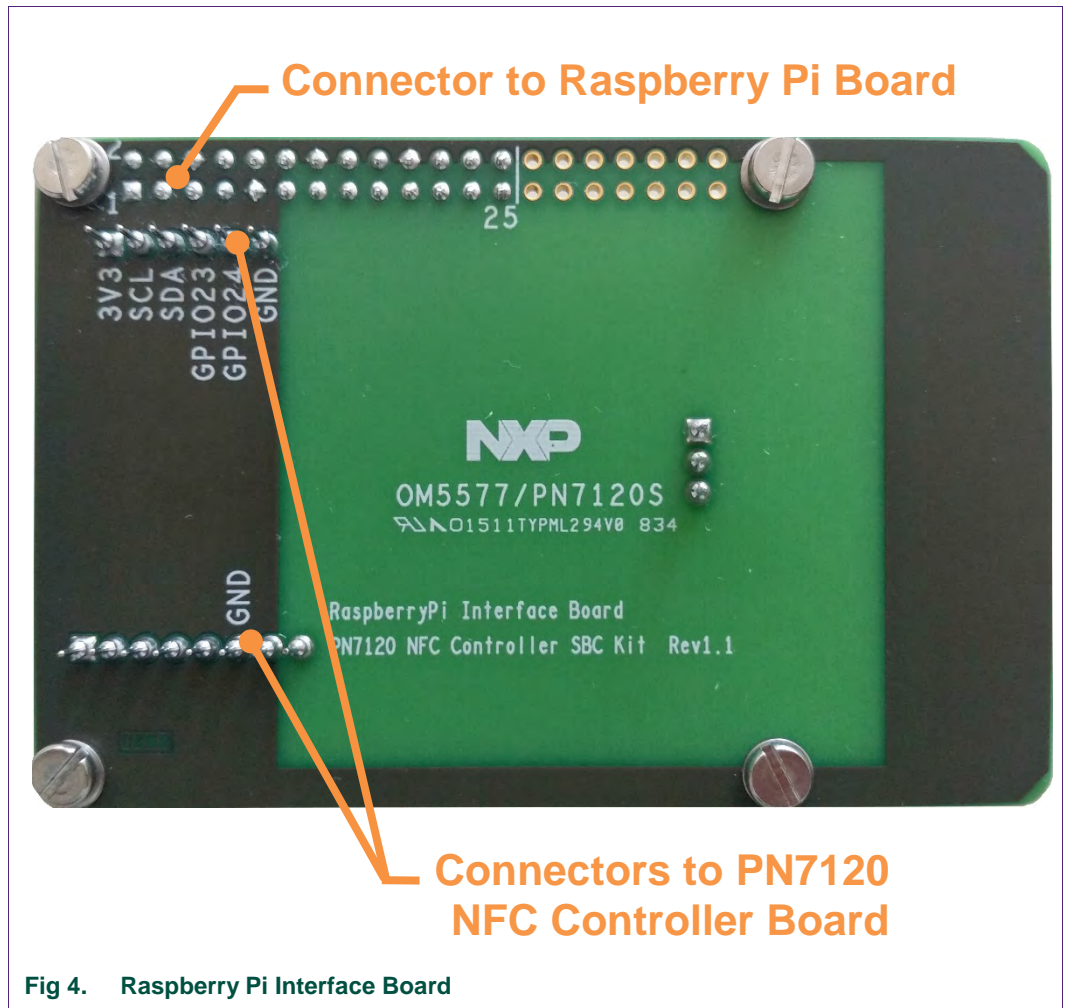


Fig 4. Raspberry Pi Interface Board

2.2.4 MIFARE Ultralight EV1 card

OM5577/PN7120S kit includes a MIFARE Ultralight EV1 card allowing to demonstrate NFC reader capabilities of PN7120 NFC Controller.

MIFARE Ultralight EV1 is the next generation of paper ticketing smart card IC for limited-use applications that offers solution developers and operators the maximum flexibility for their ticketing schemes and additional security options.

For the current purpose of PN7120 NFC Controller demonstration, the card has been set as NFC Forum Type 2 Tag, and pre-configured with NDEF URI type message "<http://www.nxp.com/demoboard/OM5577>".



Fig 5. MIFARE Ultralight EV1 card

3. Details

3.1 PN7120 NFC Controller Board

3.1.1 Schematics

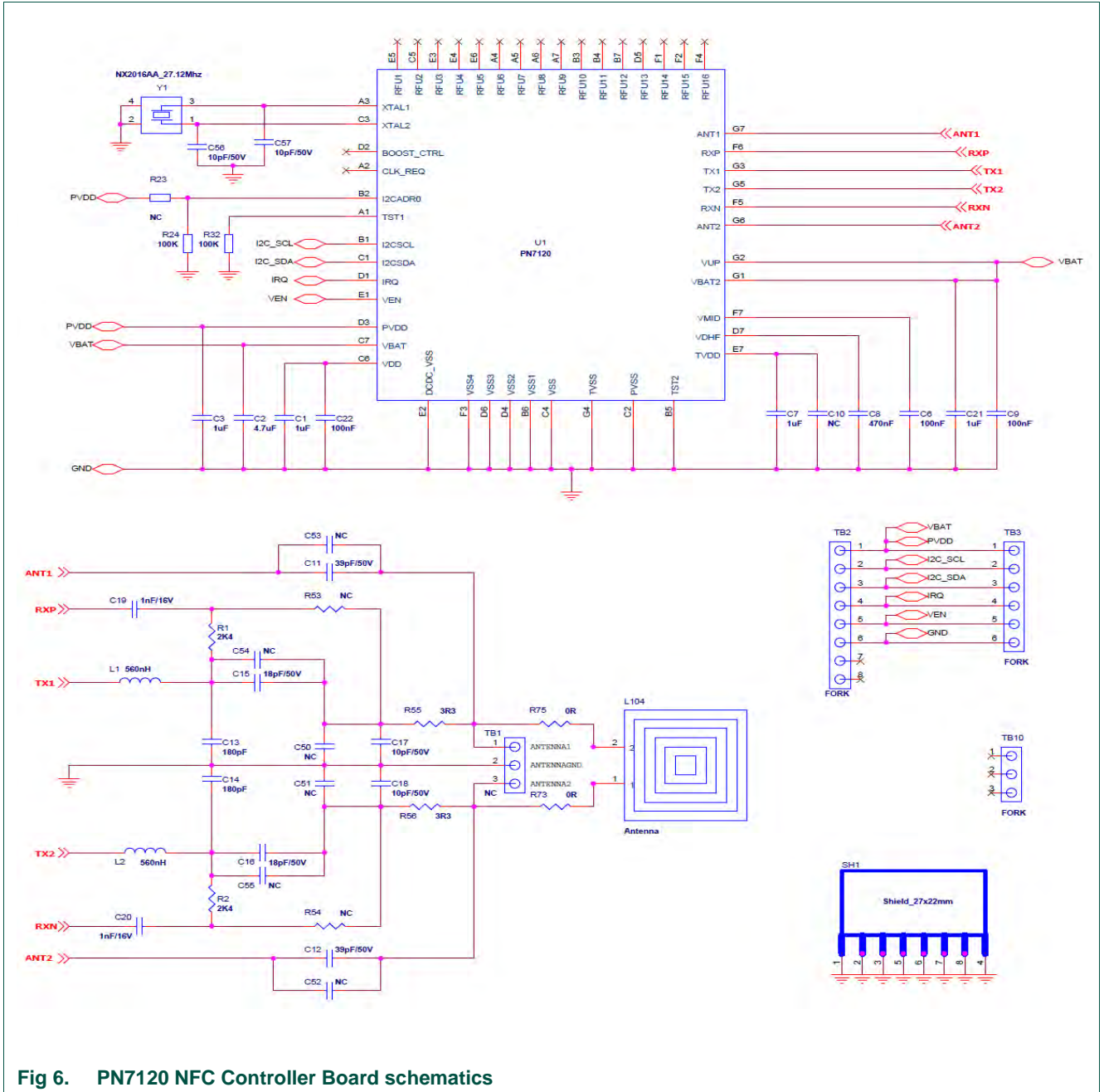


Fig 6. PN7120 NFC Controller Board schematics

3.1.2 Layout

3.1.2.1 Components layers

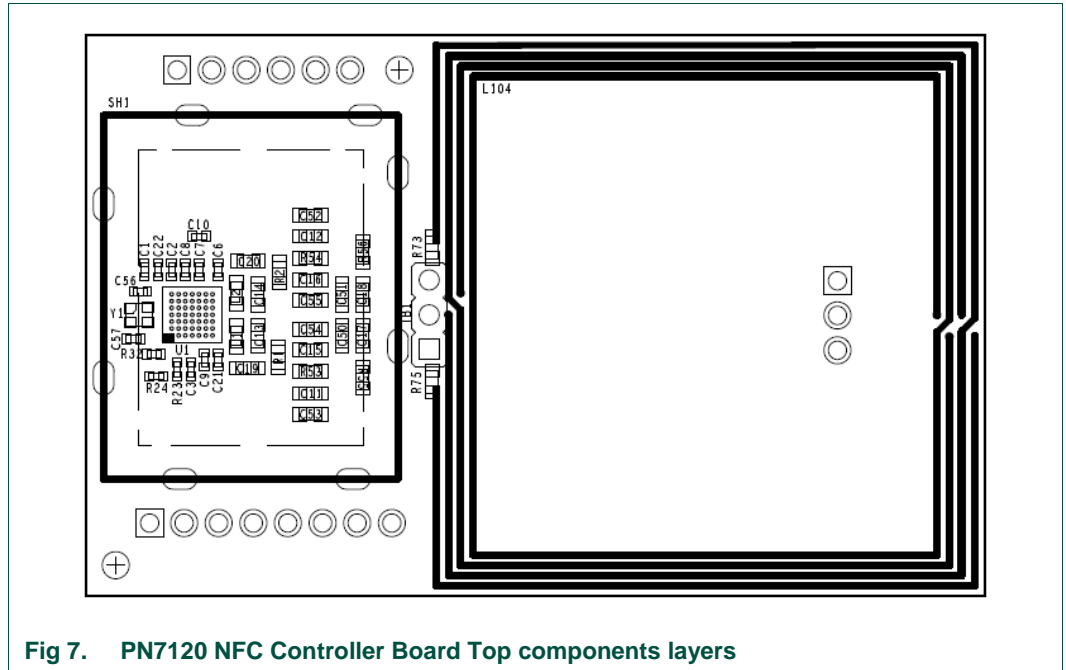


Fig 7. PN7120 NFC Controller Board Top components layers

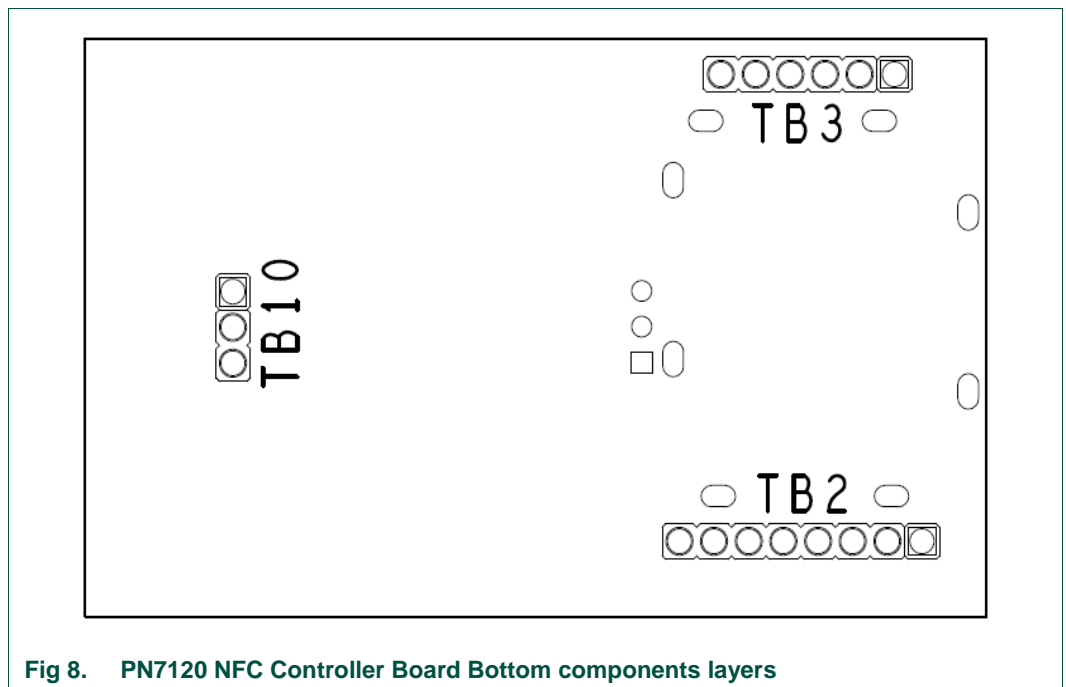
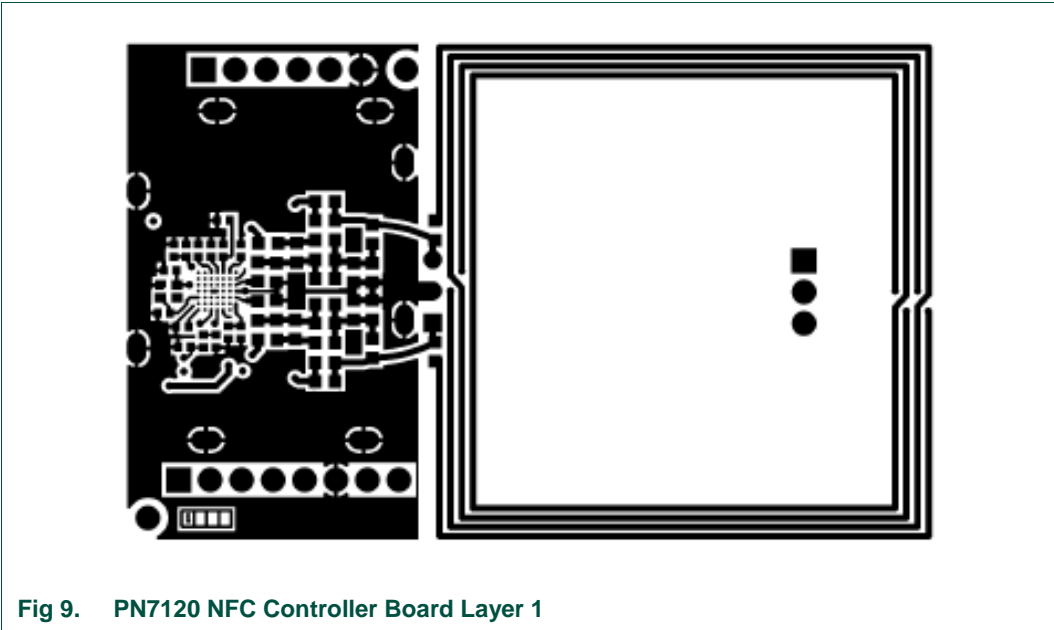
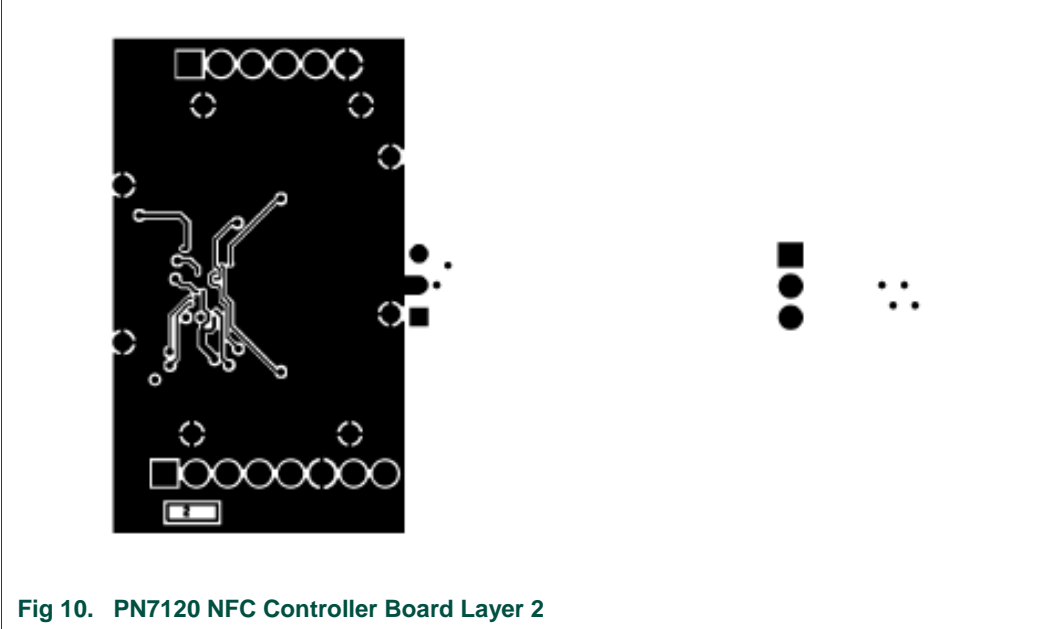


Fig 8. PN7120 NFC Controller Board Bottom components layers

3.1.2.2 Layer 1



3.1.2.3 Layer 2



3.1.2.4 Top Silkscreen layer

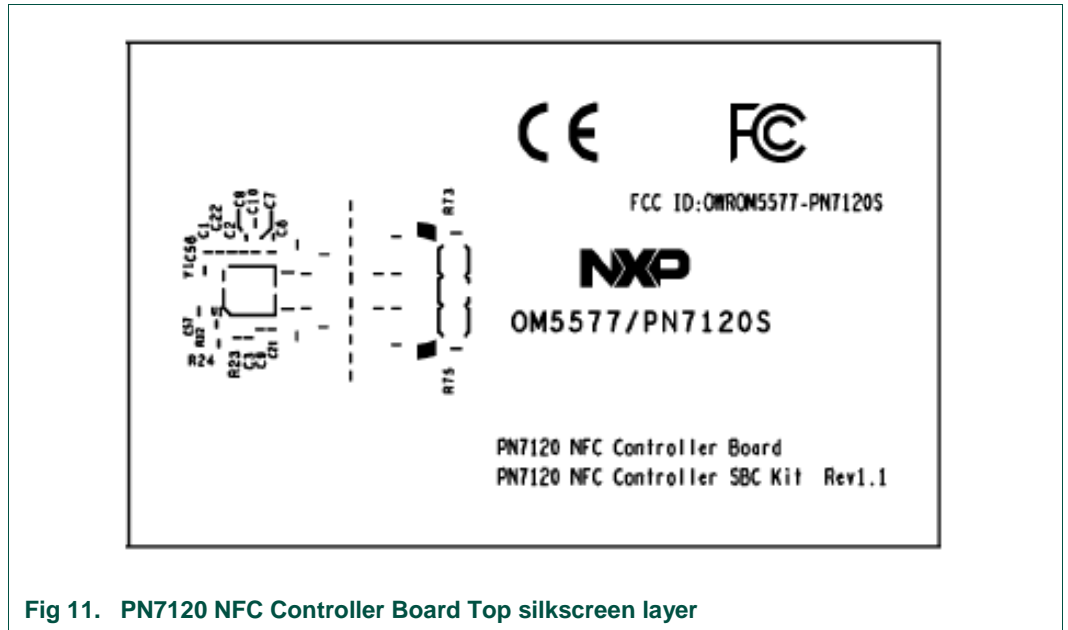


Fig 11. PN7120 NFC Controller Board Top silkscreen layer

3.2 BeagleBone Interface Board

3.2.1 Schematics

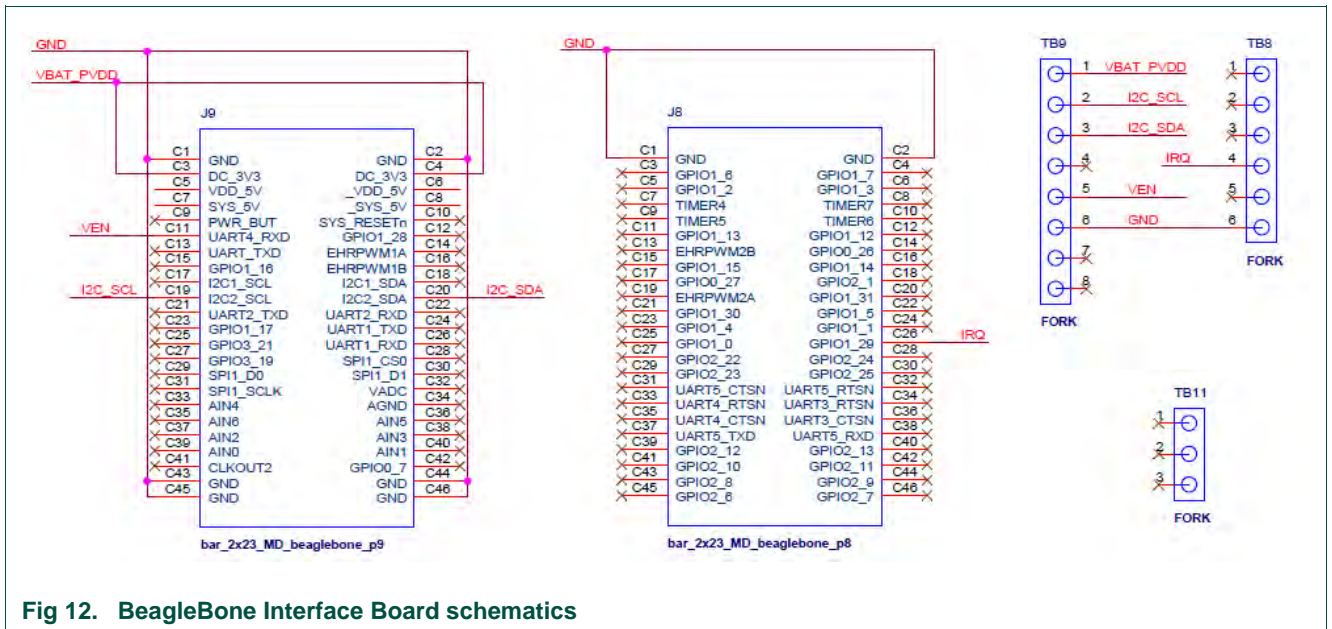


Fig 12. BeagleBone Interface Board schematics

3.2.2 Layout

3.2.2.1 Components layers

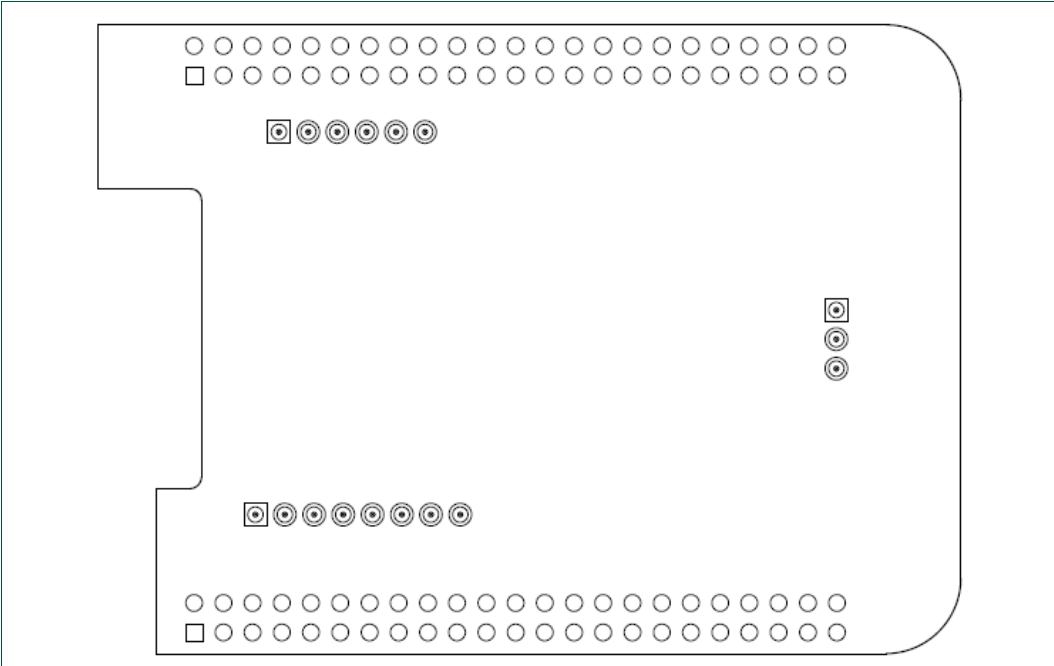


Fig 13. BeagleBone Interface Board Top components layers

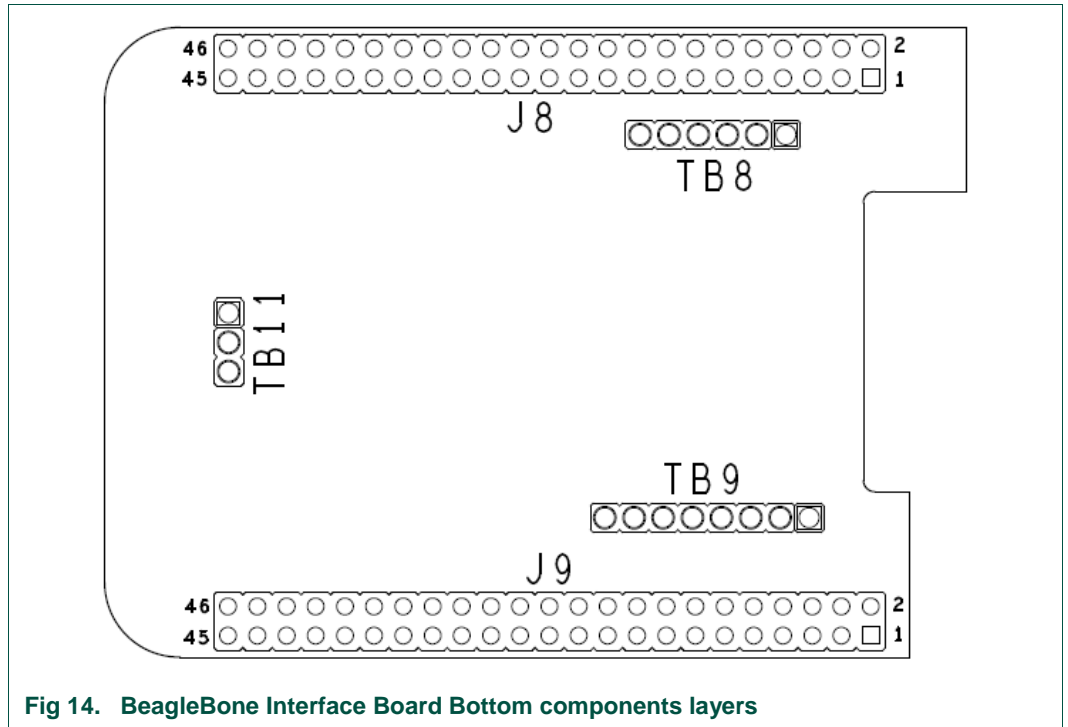


Fig 14. BeagleBone Interface Board Bottom components layers

3.2.2.2 Layers 1 & 2

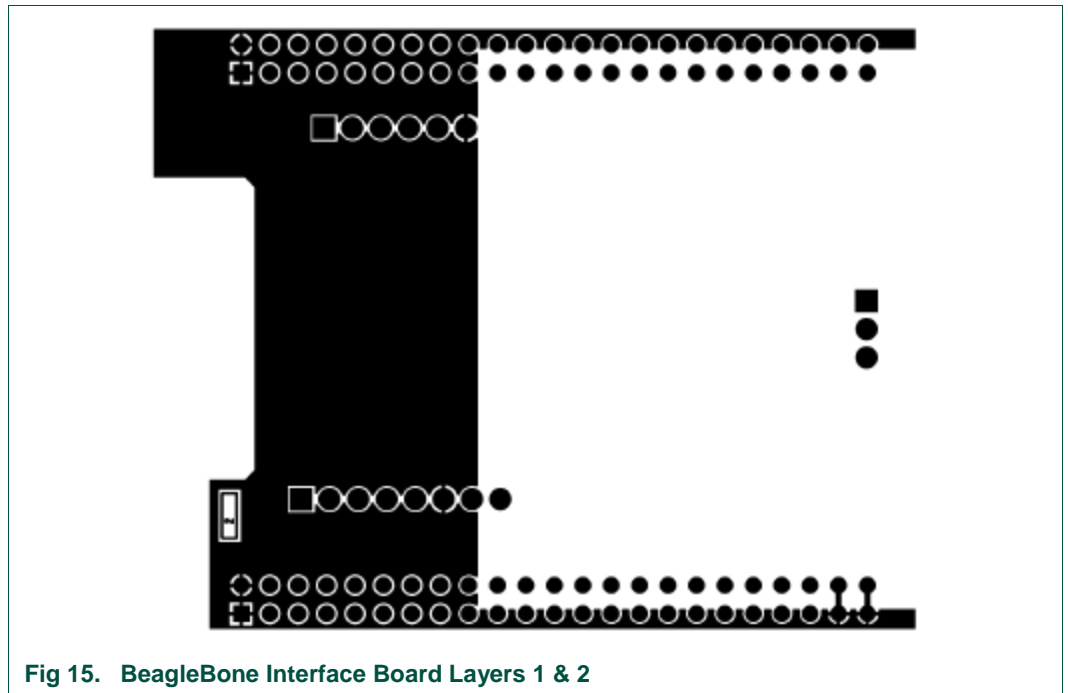


Fig 15. BeagleBone Interface Board Layers 1 & 2

3.2.2.3 Layer 3

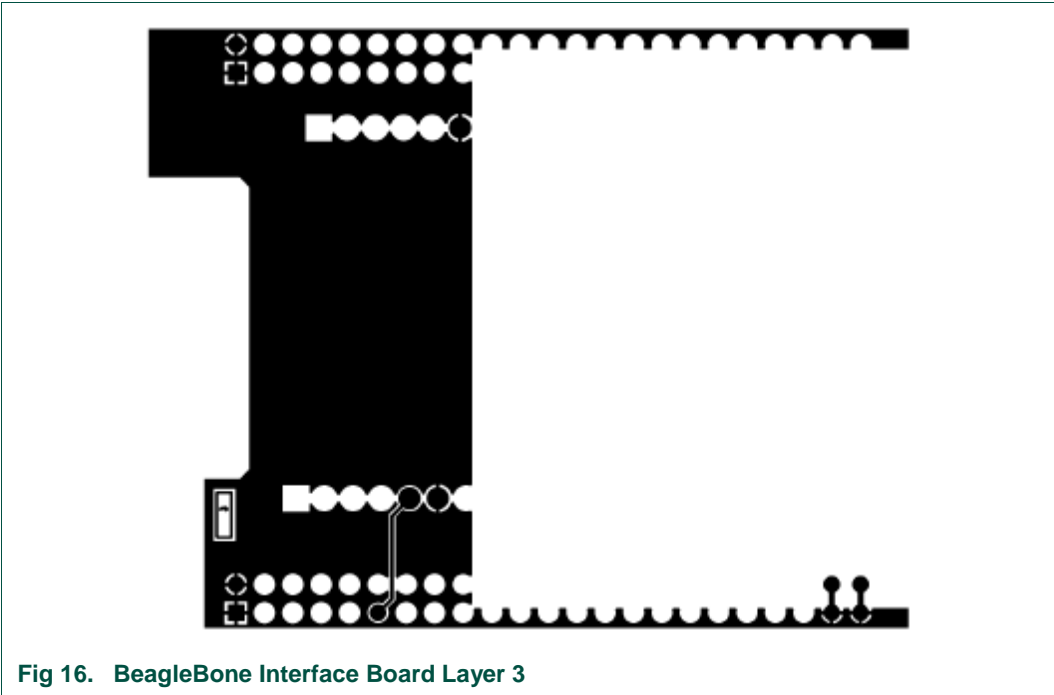


Fig 16. BeagleBone Interface Board Layer 3

3.2.2.4 Layer 4

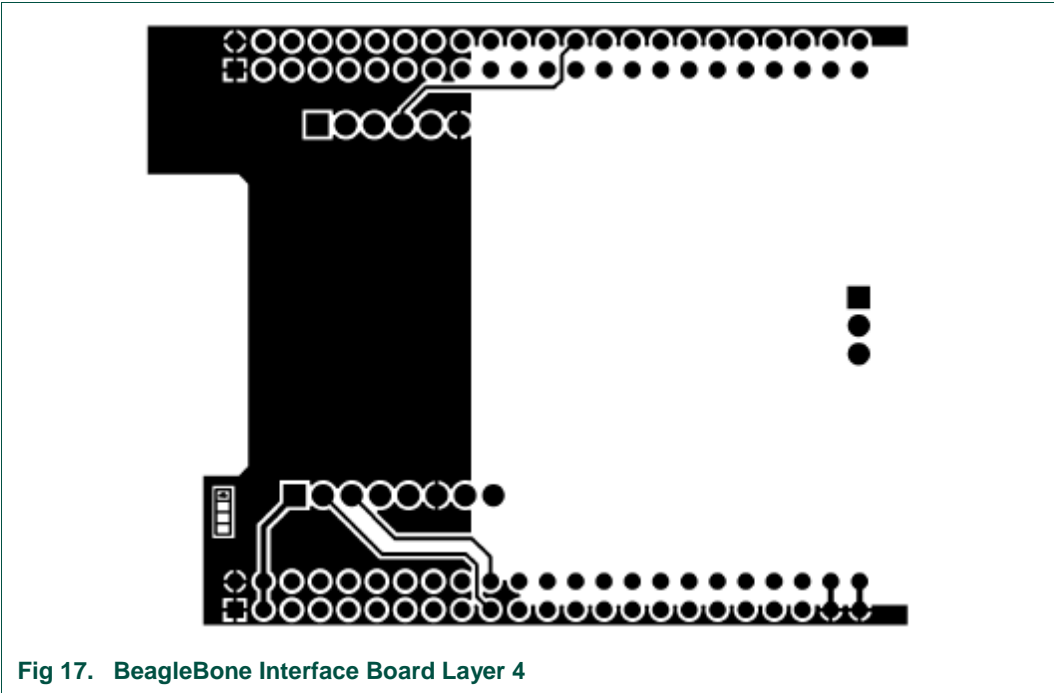


Fig 17. BeagleBone Interface Board Layer 4

3.2.2.5 Top Silkscreen layer

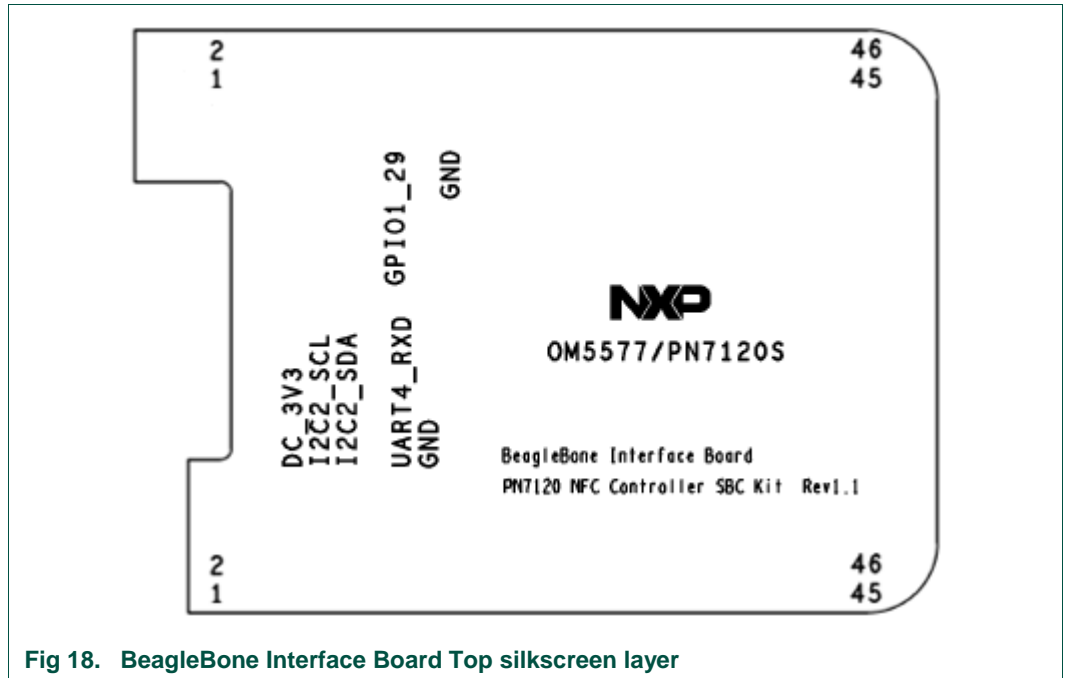


Fig 18. BeagleBone Interface Board Top silkscreen layer

3.3 Raspberry Pi Interface Board

3.3.1 Schematics

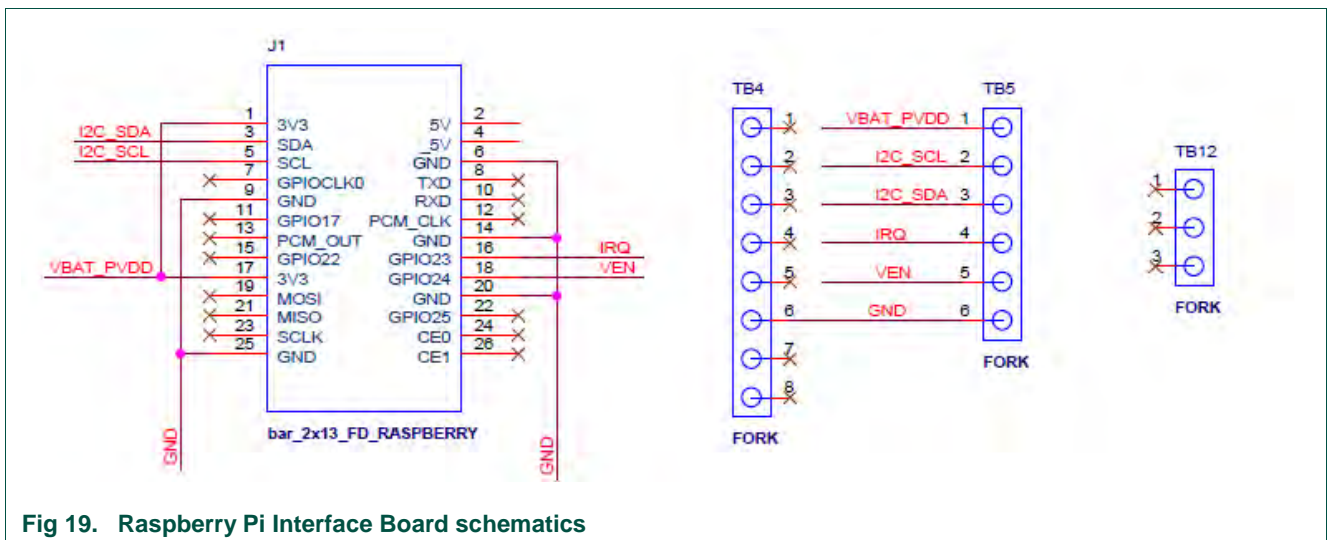


Fig 19. Raspberry Pi Interface Board schematics

3.3.2 Layout

3.3.2.1 Components layers

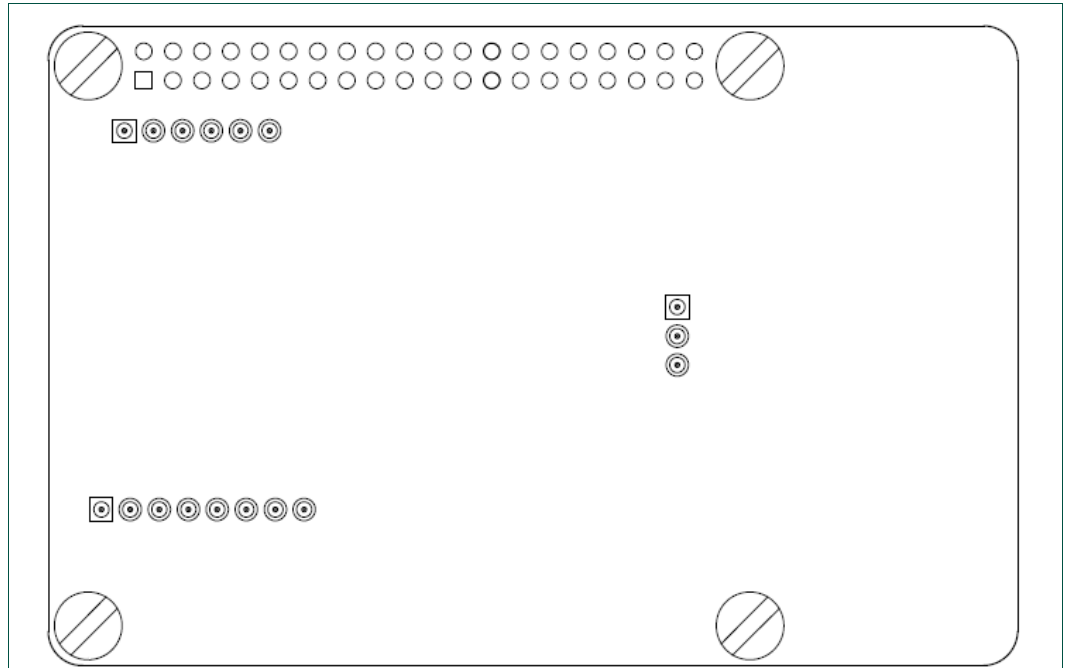


Fig 20. Raspberry Pi Interface Board Top components layers

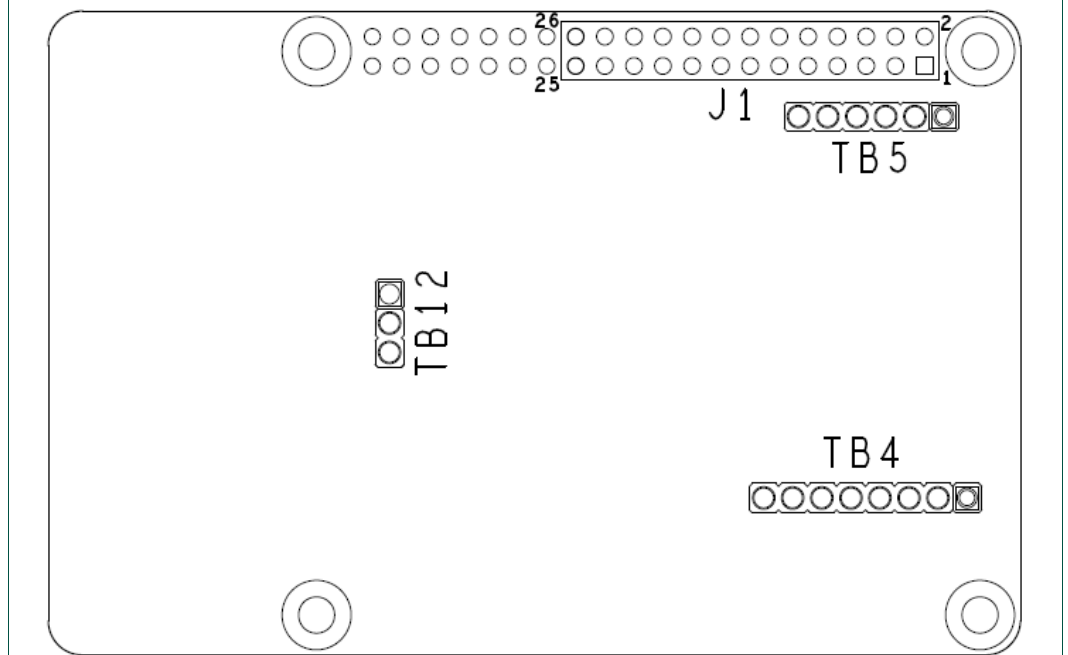


Fig 21. Raspberry Pi Interface Board Bottom components layers

3.3.2.2 Layers 1 & 2

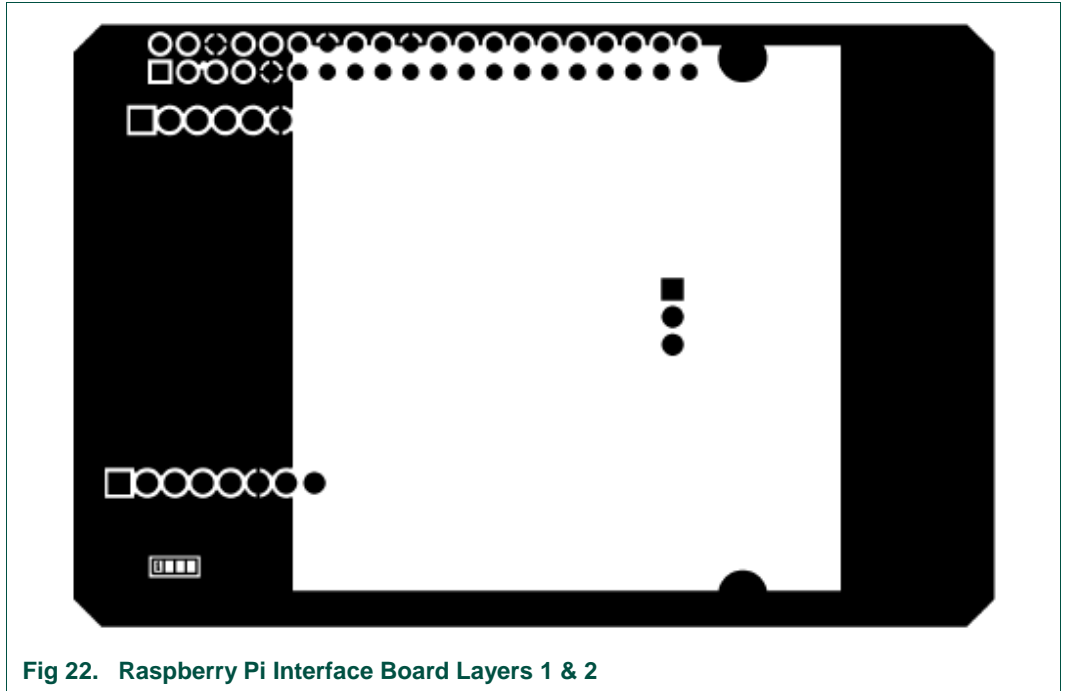


Fig 22. Raspberry Pi Interface Board Layers 1 & 2

3.3.2.3 Layer 3

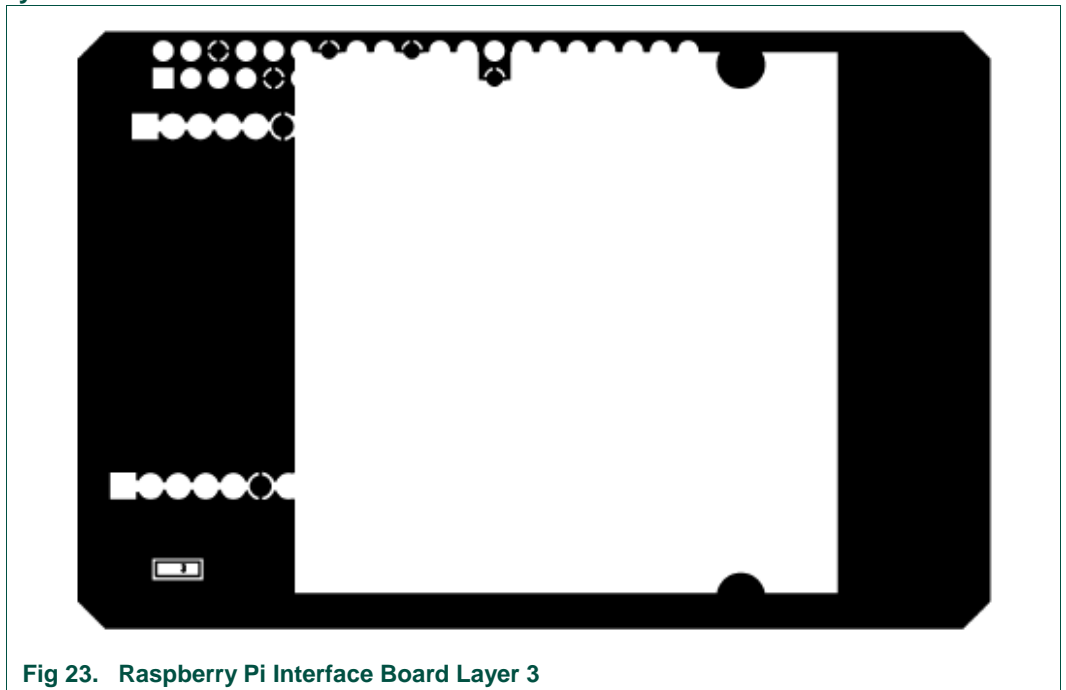


Fig 23. Raspberry Pi Interface Board Layer 3

3.3.2.4 Layer 4

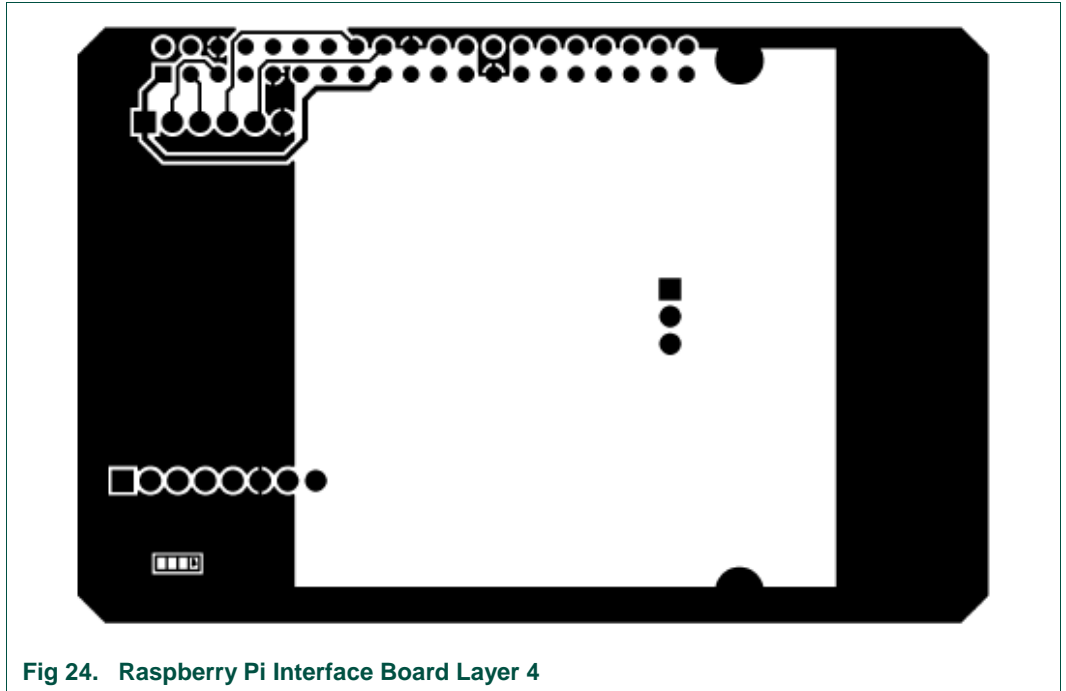


Fig 24. Raspberry Pi Interface Board Layer 4

3.3.2.5 Top Silkscreen layer

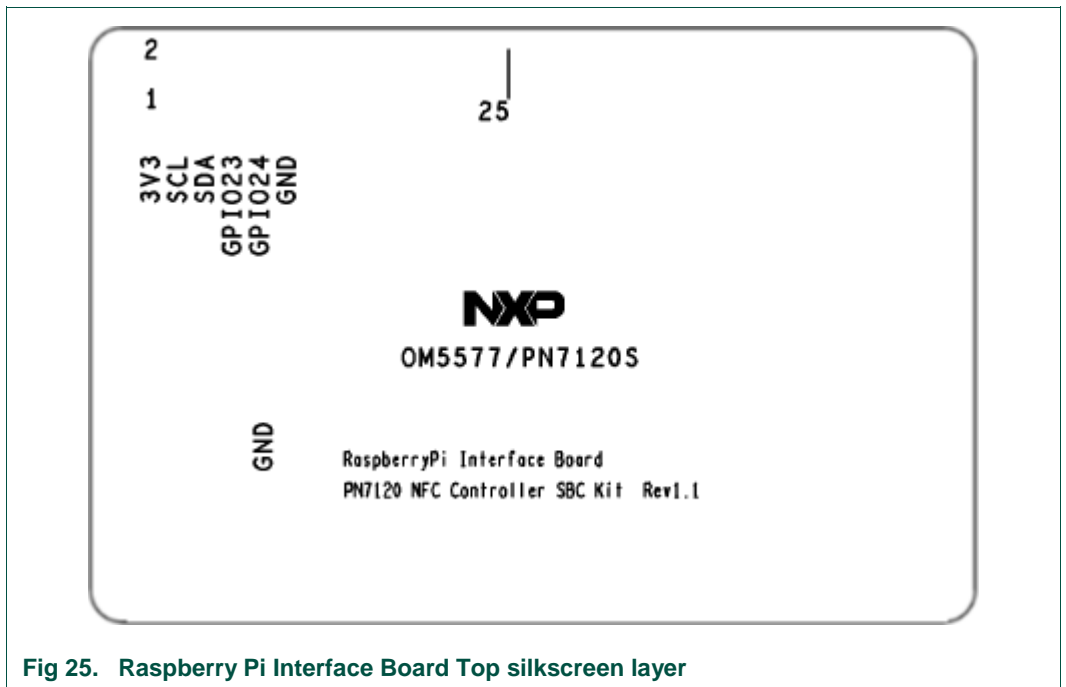


Fig 25. Raspberry Pi Interface Board Top silkscreen layer

4. Additional information

4.1 Using different Antenna

The OM5577/PN7120S kit provide a flexible way of connecting an external RF antenna to be used in place of the on-board one.

On the PN7120 NFC Controller Board, the dedicated 3 pins connector referenced as TB1 allows to connect your own antenna.

In this case the on-board antenna must be first disconnected, removing resistors R75 and R73.

Obviously matching circuitry must be adapted as described in related document “AN11564 - PN7120 Antenna and Tuning Design Guide” (can be downloaded from PN7120 Product Web Page [3]).

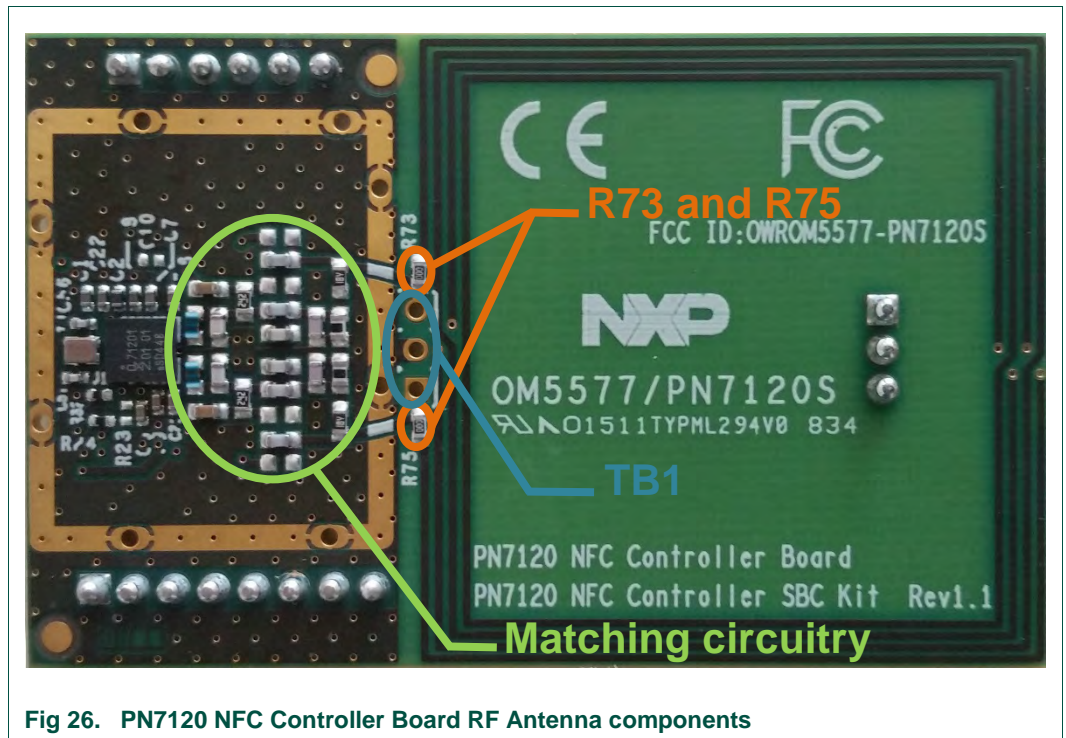


Fig 26. PN7120 NFC Controller Board RF Antenna components

Table 1. PN7120 NFC Controller Board TB1 connector pinout

| TB1 | PN7120 signal |
|-----|---------------|
| #1 | ANTENNA 1 |
| #2 | GND |
| #3 | ANTENNA 2 |

4.2 Using in another system

The OM5577/PN7120S demonstration kit can be reuse in another system than Raspberry Pi or BeagleBone.

Indeed, the PN7120 NFC Controller Board provides all required signal on TB2 and TB3 (signals are duplicated on both connectors) connectors to interface boards.

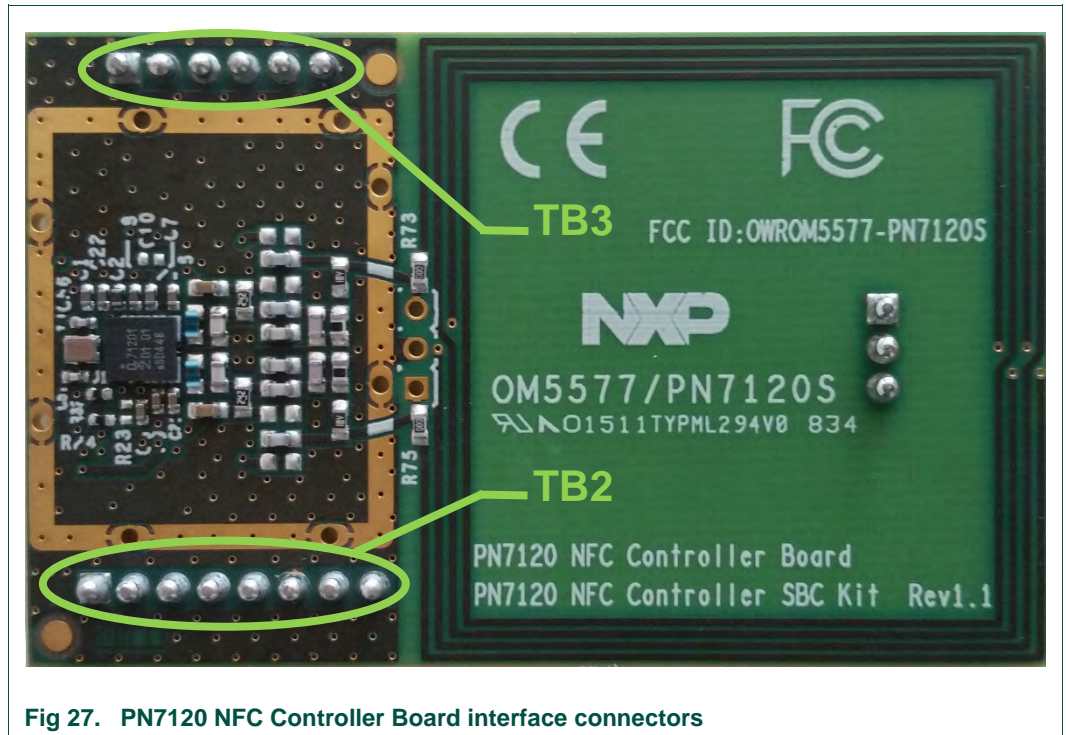


Fig 27. PN7120 NFC Controller Board interface connectors

Table 2. PN7120 NFC Controller Board TB2 connector pinout

| TB2 | PN7120 signal |
|-----|------------------------------------|
| #1 | VBAT/VDD(PAD): 3.3V supply voltage |
| #2 | I2CSCL: I2C-bus serial clock input |
| #3 | I2CSDA: I2C-bus serial data |
| #4 | IRQ: interrupt request output |
| #5 | VEN: reset pin |
| #6 | GND: ground |
| #7 | Not connected |
| #8 | Not connected |

Table 3. PN7120 NFC Controller Board TB3 connector pinout

| TB3 | PN7120 signal |
|-----|------------------------------------|
| #1 | VBAT/VDD(PAD): 3.3V supply voltage |
| #2 | I2CSCL: I2C-bus serial clock input |
| #3 | I2CSDA: I2C-bus serial data |
| #4 | IRQ: interrupt request output |
| #5 | VEN: reset pin |
| #6 | GND: ground |

5. References

- [1] The Raspberry Pi is a credit card sized computer. The initial idea behind it was to develop a small and cheap computer to be used by kids all over the world to learn programming. In the end it became very popular among developers all over the world.

The heart of the Raspberry Pi is a SoC (System on Chip). This contains an ARM11 running at 700 MHz and a graphics processor that is capable of BluRay quality playback, using H.264 at 40MBits/s. It has a fast 3D core accessed using the supplied OpenGL ES2.0 and Open VG libraries. In addition, the Model B has 512MB RAM included in its SoC.

To get started quickly, the Raspberry Pi Foundation provides several preconfigured Linux distributions.

For more information about it please visit <http://www.raspberrypi.org/>

- [2] BeagleBone is a low-power open-source hardware single-board credit-card-sized Linux computer that connects to the Internet and runs software such as Android and Ubuntu. With plenty of I/O and processing power for real-time analysis provided by a 720MHz ARM® processor based SoC (System on Chip), BeagleBone can be complemented with cape plug-in boards to augment functionality.

For more information about it please visit <http://www.beagleboard.org/bone>.

- [3] PN7120 Product Web Page:
http://www.nxp.com/products/identification_and_security/nfc_and_reader_ics/nfc_controller_solutions/PN7120A0EV.html

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