

NFC NUTSHELL KIT

NFC Modules

USER MANUAL

REVISION 1.3

Document information

Info	Content
Keywords	User Manual GMMC
Abstract	This document describes how to use NFC Modules of the GMMC's NFC Nutshell KIT

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NFC Nutshell NFC Modules

1.1 General Topology

The Kit consists of different types of modules, which can be connected application specific. Each module type has a different color.

- Interface
- MCU
- NFC
- Antenna

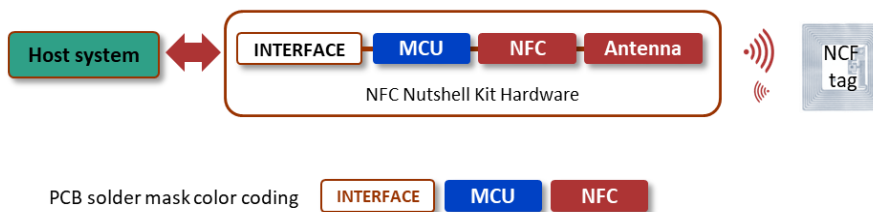


Fig 1. Kit modules and PCB solder mask color coding

1.2 Module interconnection concept

The Nutshell Kit can be operated in different configurations. The connection between the different modules is done via FFC cables and zero force sockets.

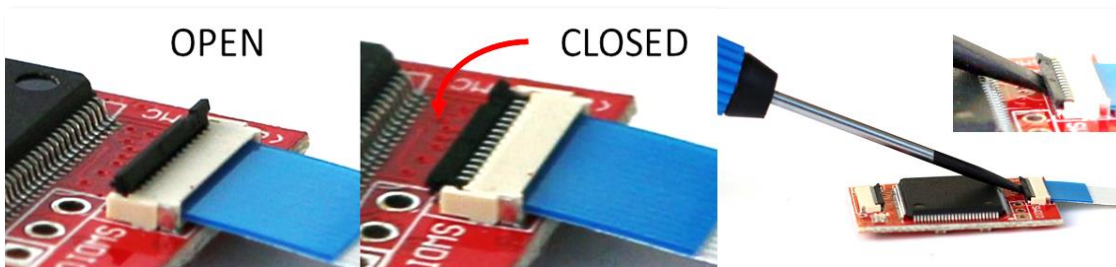


Fig 2. Kit modules interconnection via FFC cables

For ensuring a proper connection the cable must be inserted straight at any time



Fig 3. correct insertion of the FFC cable

The Kit modules can be connected to a host via different interface modules see details in the NFC Nutshell Kit interface module user manual.

Important Notes:

- *Open and close the connector **carefully***
- *Always **insert straight** – do not apply force*
- *Avoid cable/connector misalignment – potential short cut and damage*
- *If you observe communication issues over time, exchange the FFC cable with a spare one*
- *DO NOT disconnect, bend or move the Kit while modules are powered to avoid short circuits*

1.2.1 Module Connector Signal pin-out

The following figure describes the signal which can be analyzed using the Extender module.

Detailed information can be found in the user manual of the interface modules.

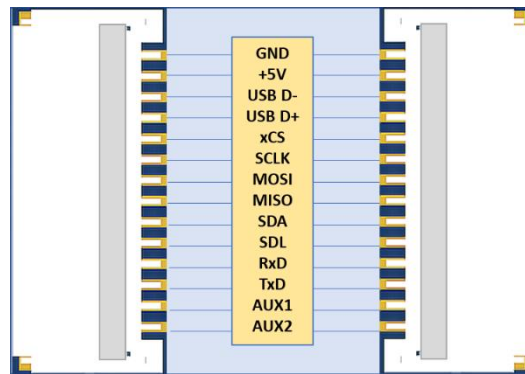


Fig 4. Module Zero Force FFC Connector Signal Pinout

1.3 Module power concept

The Kit requires a power supply of +5V DC. This can be applied using one of the following options:

- Using one of the interface module
 - USB supply voltage (4.75V to 5.25 V) is available on all connected modules using the USB plug.
- Using an external power supply and the Signal extender module
 - +5V is required

If other voltages than 5V are needed by the module, this is generated onboard with an LDO.

Important Note:

If using an external power supply, ensure the correct amplitude and polarity before power up of the Kit.

2. NFC Modules

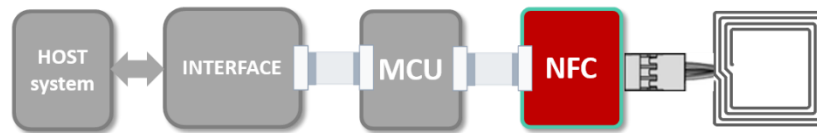


Fig 5. NFC Module

Different NFC Modules are available to cover most applications. Currently the NFC Nutshell KIT supports the following NFC ICs:

- **CLRC663, CLRC663plus** family members
- **PN5180**

2.1 CLRC663 Family

This High performance multi-protocol NFC frontend supports the following standards:

- Read/write mode supporting
 - ISO/IEC 14443A/MIFARE
 - ISO/IEC 14443B
 - JIS X 6319-4
 - ISO/IEC 15693
 - ICODE EPC UID/ EPC OTP
 - ISO/IEC 18000-3 mode 3/ EPC Class-1 HF
- Passive initiator mode according to ISO/IEC 18092

Several derivatives are available which allow cost efficient downgrade if only specific standards are needed. More details about the features can be found in the official datasheet.

This NFC module can be used for:

- **NXP ReaderLibrary Examples**
 - With LPC1769 MCU module
 - With LPC11U68 MCU module
- **PEGODA CCID Reader**
 - With LPC1769 MCU module
- **NFC Cockpit**
 - With LPC1769 MCU module

Important Note: Additional information about the use of the software tools can be found in the application notes of the NFC Nutshell Kit.

2.2 PN5180

This High-performance multi-protocol full NFC frontend supports all NFC Forum modes like:

- Reader/Writer mode supporting
 - ISO/IEC 14443-A up to 848 kBit/s, MIFARE
 - ISO/IEC 14443-B up to 848 kBit/s
 - JIS X 6319-4
 - ISO/IEC 15693
 - ISO/IEC 18000-3 Mode 3
 - ISO/IEC 18092 (NFC-IP1)
 - ISO/IEC 21481 (NFC-IP-2)
 - ISO/IEC 14443-type A Card emulation up to 848 kBit/s
- Supports reading of all NFC tag types (type 1, type 2, type 3, type 4A and type 4B)

It additionally also features functions like:

- Dynamic Power Control (DPC) for optimized RF performance, even under detuned antenna conditions
- Adaptive Waveform Control (AWC) automatically adjusts the transmitter modulation for RF compliancy
- Adaptive Receiver Control (ARC) automatically adjusts the receiver parameters for always reliable communication

More details about the capabilities can be found in the official Datasheet.

This NFC module can be used for:

- **NXP ReaderLibrary Examples**
 - With LPC1769 MCU module
- **NFC Cockpit**
 - With LPC1769 MCU module

Important Note:

Additional information about the use of the software tools can be found in the application notes of the NFC Nutshell Kit.

3. NFC Module hardware topology

The topology of the NFC modules is shown next:

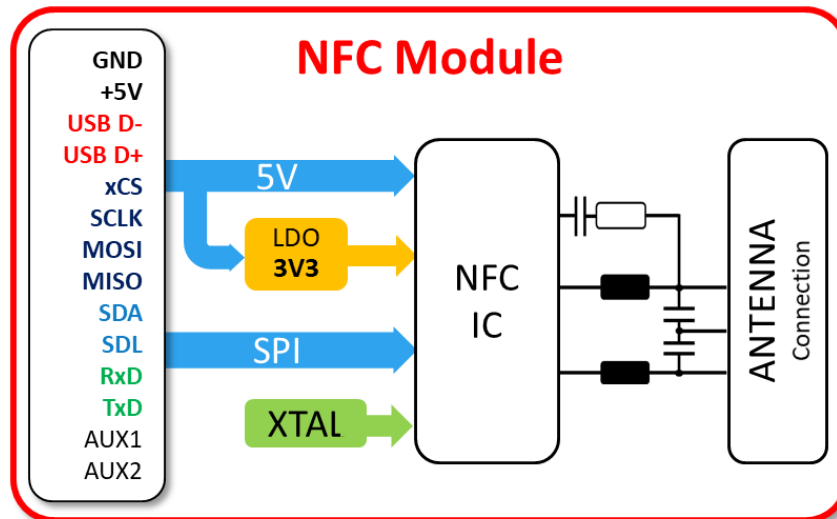


Fig 6. NFC Module interface MCU/HOST interface, power and antenna connection

As can be seen above, the NFC frontends are connected to the MCU via SPI interface. This allows the user to operate with the maximum performance.

The modules also features the EMC filter which is necessarily close to the output of the NFC front end. The modules also only require a single 5V supply. All other voltages are generated on the module.

Note: 3 pin antenna connection is symmetrical with no preferred direction

4. Standard Kit configuration

The primary use case of the NFC modules is shown next. The MCU is connected to one frontend using the FFC cable.



Fig 7. PC – Standard connection Interface - MCU- NFC

In this configuration the firmware of the MCU module implements the whole protocol handling. The communication is realized using SPI interface, IRQ and Reset control lines.

This topology allows to easily exchange different NFC frontends.

5. PC – NFC Direct Communication Mode

Besides using the Kit with an MCU Module connected, there is the possibility to connect the Modules directly.



This mode allows an easy implementation using the PC as direct communication interface.

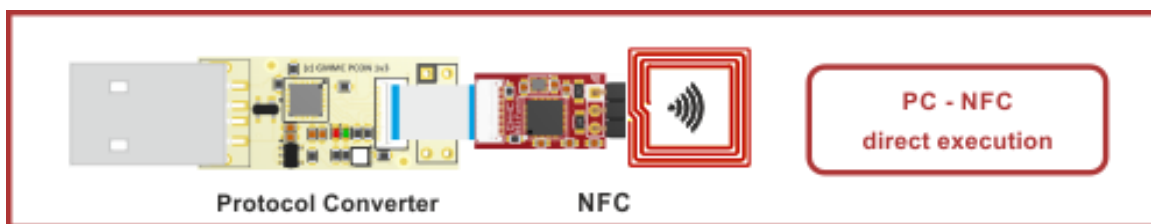


Fig 8. PC - NFC direct execution

For using the KIT without any MCU the kit has to be connected as shown above. Using the Protocol Converter Tool, the user has to choose the NFC Direct mode.

This changes the NFC interface to UART and allows easy access to the NFC front end using the converter module as USB to UART converter.

5.1 Use of the NXP Reader Library and Microsoft Visual Studio

For further development, the export controlled version of the NXP reader library can be used. This version features C++ based projects which can be used to communicate with the front end.

Important Note:

This works only with the export controlled version of the NXP reader library. A valid NXP Doc store account and access is needed.

More details can be found in the Interface User Manual of the Protocol Converter Module.

5.2 Use Direct Mode with RFID Discover

It is also possible to run the RFIDDiscover with the CLRC663 in UART Mode. The USB Protocol Converter must be set in the PC direct mode (white LED glowing) in order to be used with RFIDDiscover.

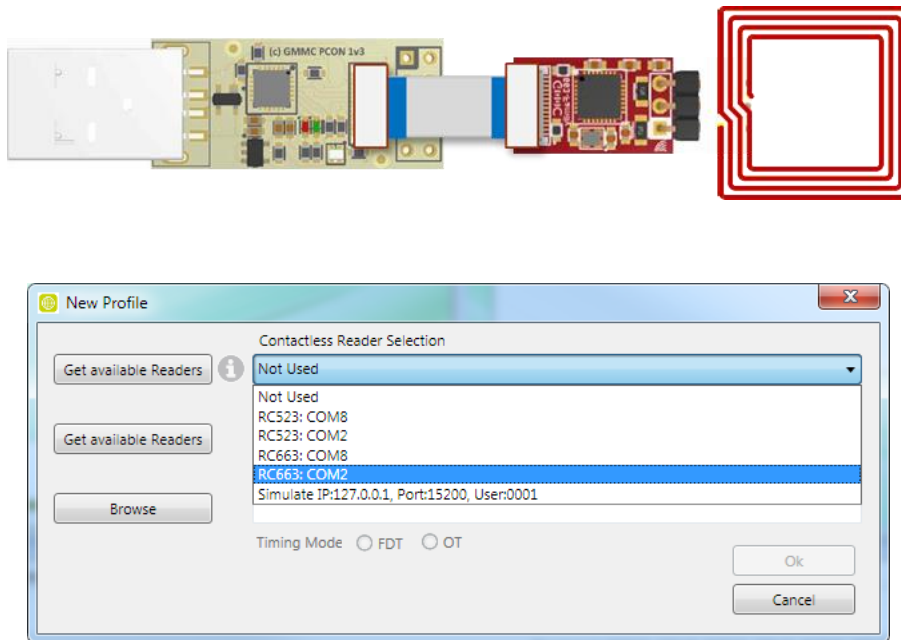


Fig 9. PC – CLRC663 COM reader direct PC connection setup with RFIDDiscover

Note: The reaction of the CLRC663 is slower when operated in this mode via COM port.

6. NFC Module Antenna connection

Different antennas are available which can be easily connected to the NFC Nutshell kit using a twisted 30cm 3 wire cable which is shown next.

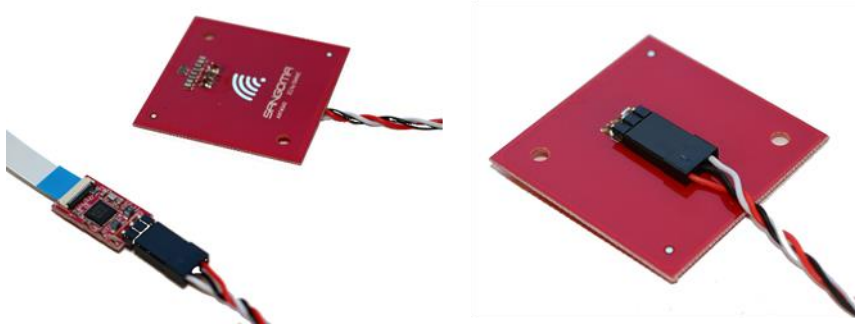


Fig 10. NFC Module – NFC Antenna connection

The matching of each antenna is optimized for using with all different featured NFC Modules.

Note: 3 pin antenna connection is symmetrical with no preferred direction

NFC NUTSHELL KIT

NFC Modules

REVISION 1.3 - 19-Nov-22



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Revision history

Rev	Date	Description
1.0	2018 Feb. 4 th	Initial version MGA
1.1	2018 Feb. 5 th	Updated Template TPI
1.2	2018 Mar. 10 th	Added features TPI
1.3	2018 Mar. 17 th	Added features TPI

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