

# NFC INTRODUCTION



# What is NFC?

Near Field Communication is a short-range wireless connectivity technology *standard*, designed for *intuitive* and *simple* communication between *two* electronic devices.



# NFC at a glance

- Contactless proximity technology
- Operating frequency: 13.56 MHz
- Operating range: 10 cm
- Maximum speed: 424 Kbps
- Standardized in ISO/IEC, ECMA and ETSI.
- Compatible with existing ISO/IEC 14443 and FeliCa contactless cards & reader infrastructure.
- Read/Write, Card Emulation and Peer-to-Peer modes possible in one device.
- Quick, seamless pairing with Bluetooth, WiFi.
- NFC Forum as a key standardization & interoperability group

**Card Emulation mode:** Behaves as a contactless card



**Read/Write mode:** Behaves as a contactless reader

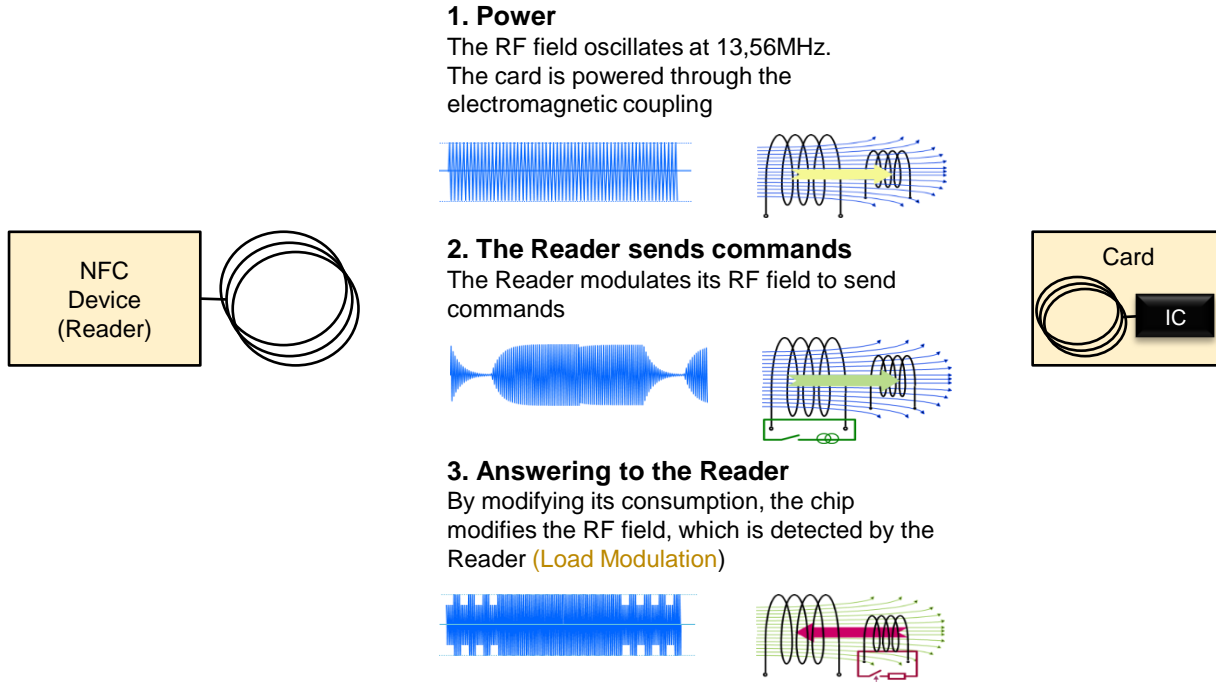


**Peer-to-Peer mode:** Data exchange between NFC devices



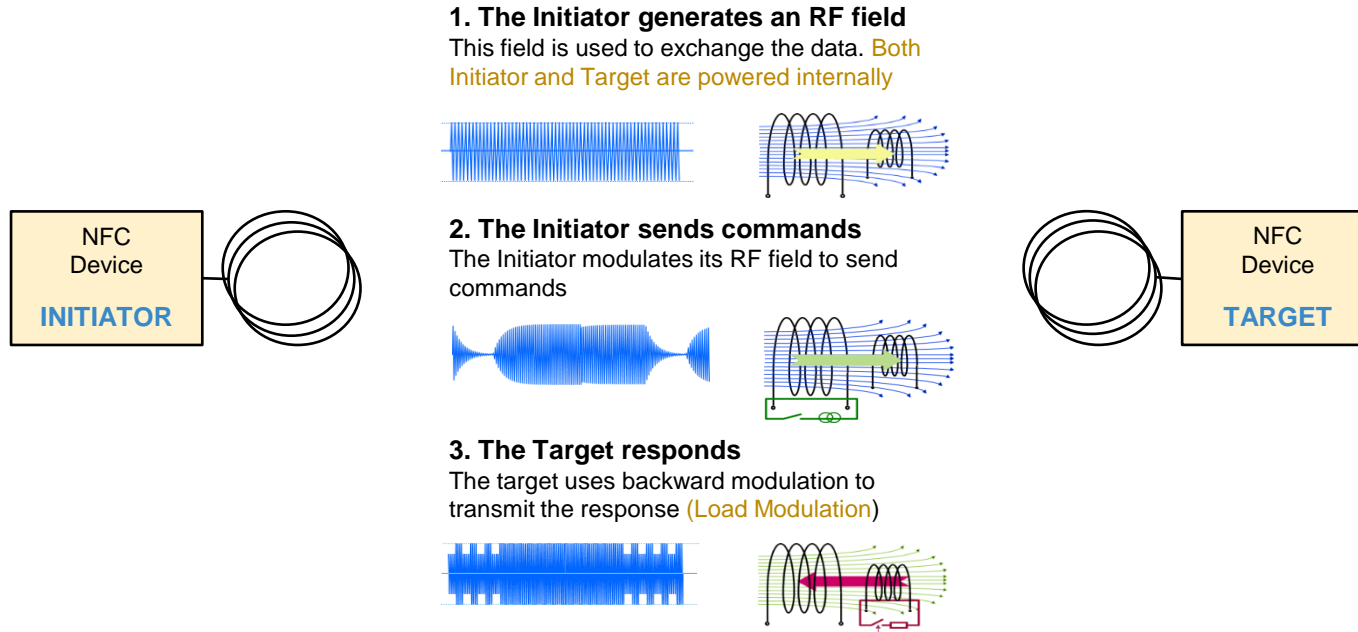
# NFC communication modes

## Reader/Card communication mode



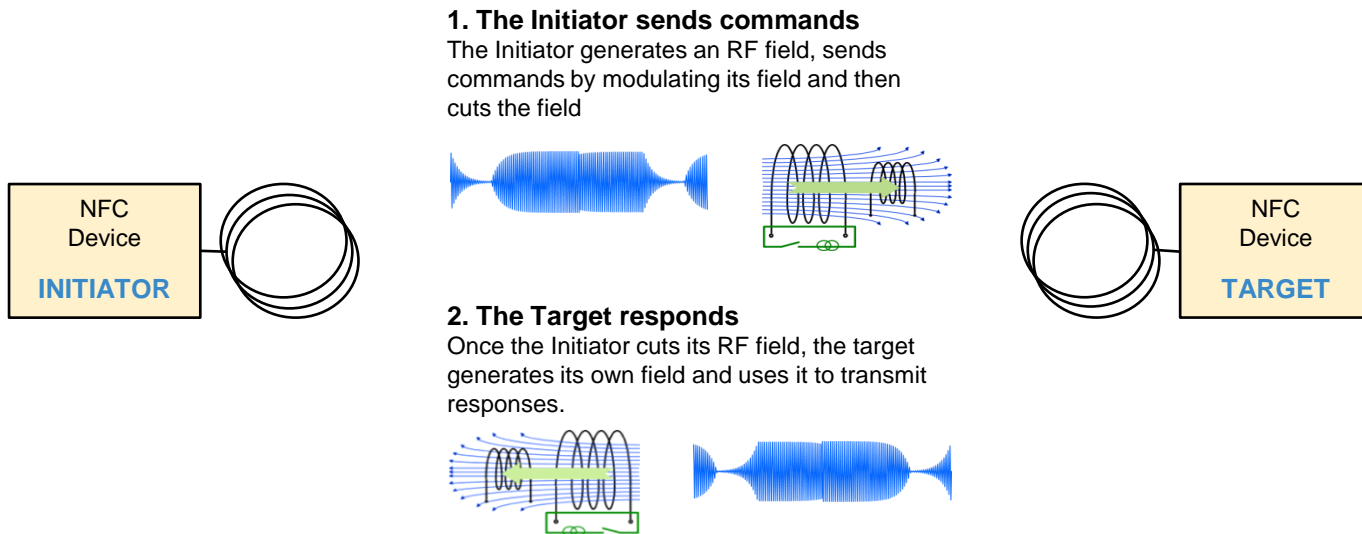
# NFC communication modes

P2P **passive** communication mode (**card emulation**)



# NFC communication modes

## P2P active communication mode



# NFC product families

Connected NFC tag, NFC frontend and NFC controller solutions

## Connected NFC Tag solutions

*A comprehensive portfolio of NFC Forum type 2 tags covering a broad range of use cases.*

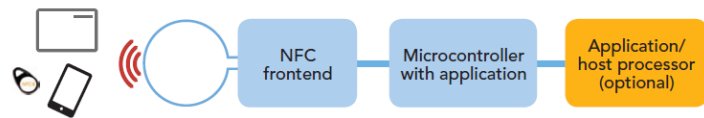
**Products:** NTAG21xF, NTAG I2C



## NFC frontend solutions

*The lowest-cost and most flexible way to add NFC to a system.*

**Products:** MFRC522, MFRC523, PN512, PN5180, CLRC663 family

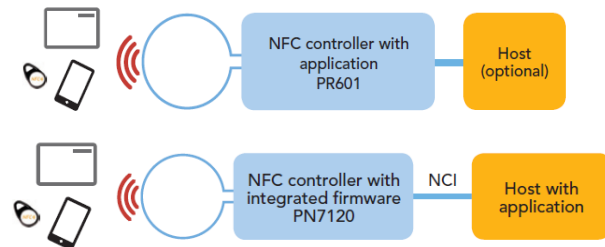


## NFC controller solutions

*Combination of NFC frontend with an advanced 32-bit microcontroller.*

*Options include integrated firmware or freely programmable microcontroller.*

**Products:** PR601, PN533, **PN7120**



# PN7120 (& PN7150)

## PLUG'N'PLAY NFC SOLUTION



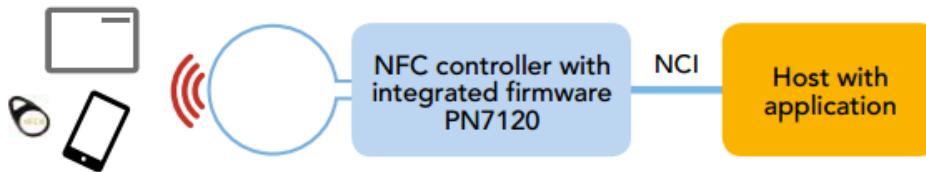


# PN7120 – Best plug'n'play full NFC solution

## Overview



- ▶ Full **NFC Forum-compliant** controller
- ▶ Support NFC card emulation, reader/writer and peer-to-peer modes
- ▶ Compatible with **ISO/IEC 14443-A&B**, **FeliCa** and **ISO/IEC 15693** cards
- ▶ **Integrated firmware** with **NCI** interface
- ▶ **Android, Linux and MCU** software drivers
- ▶ Low power operation mode



# PN7120

## Customer Benefits

- ▶ Low PCB footprint
- ▶ Low power consumption
- ▶ EMVCo 2.3.1a PCD analog and digital
- ▶ NFC Forum Device Requirements v1.3
- ▶ Full SW stack available for integration within Linux and Android 4.4.x and 5.x

## Features

### Ease of integration

- ▶ Direct connection to 5.5V device battery
- ▶ Flexible clock supply concept
- ▶ Supports both 1.8 and 3V connections to host controller
- ▶ Buffered output drivers to connect an antenna with minimum number of external components

### Flexibility in use case supports

- ▶ Fully configurable polling loop with low power modes for automated device discovery
- ▶ Autonomous mode when host is shut down (host can be in a deep sleep mode and be awakened **via IRQ pin** by PN7120 when entering RF field )

## RF communication modes

### Reader/Writer modes

- ▶ NFC Forum tags Type 1, 2, 3, 4 and 5
- ▶ ISO/IEC 14443 Type A & B, R/W up to 848 Kbps
- ▶ ISO/IEC 15693 Tags (ICODE)
- ▶ FeliCa tags up to 424 Kbps
- ▶ MIFARE 1K/4K
- ▶ MIFARE DESFire

### Card modes

- ▶ ISO/IEC 14443-A and B card emulation via host

### P2P modes

- ▶ Active and passive initiator and target according to ISO/IEC 18092 at all data rates (106 kbps to 424 kbps)

## Interfaces

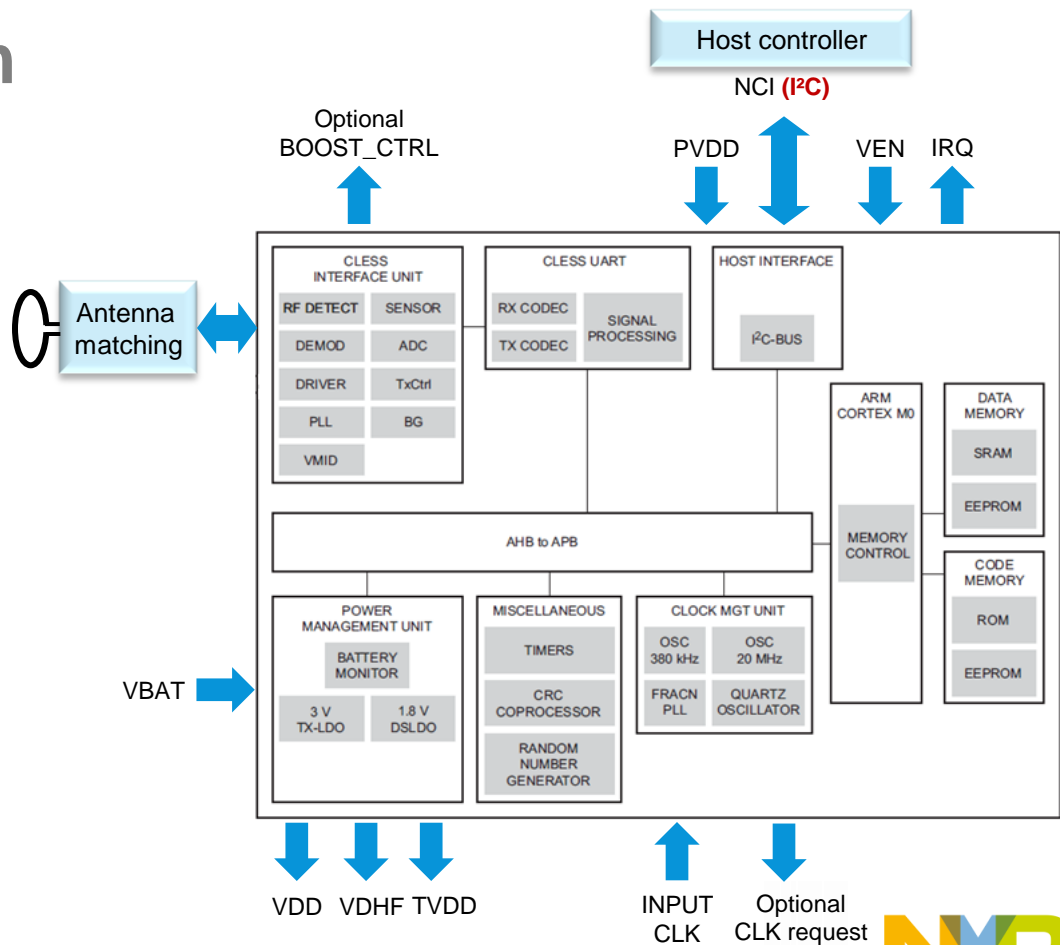
- ▶ I2C up to 3,4MBAud/s
- ▶ NFC Forum NCI 1.0 compliant protocol

## Package

- ▶ VFBGA49, HVQFN40 (PN7150)

# PN7120 Block diagram

- ▶ ARM Cortex-M0 for integrated firmware
- ▶ Host interface
  - Link with host controller (NCI over I2C)
- ▶ Clock interface
  - Clock source required when generating the RF field
- ▶ Power interface
  - Interface to power management unit (direct battery supply supported)
- ▶ Antenna interface
  - Link to an NFC antenna in order to enable communication with a remote contactless device



# SOFTWARE INTEGRATION

## LINUX



# NFC in Linux

## Way forward to implement your stack

### ► Option 1: Use Linux open source stack

- The stack will be maintained by the community
- NXP will not provide support. No more contribution from NXP to the stack in kernel.org.
  - ❖ For its NCI interface based products NXP participated in improvements of this Kernel based stack (v1.2.0 being up streamed into kernel.org)

### ► Option 2: Use Linux libnfc-nci stack from NXP (recommended)

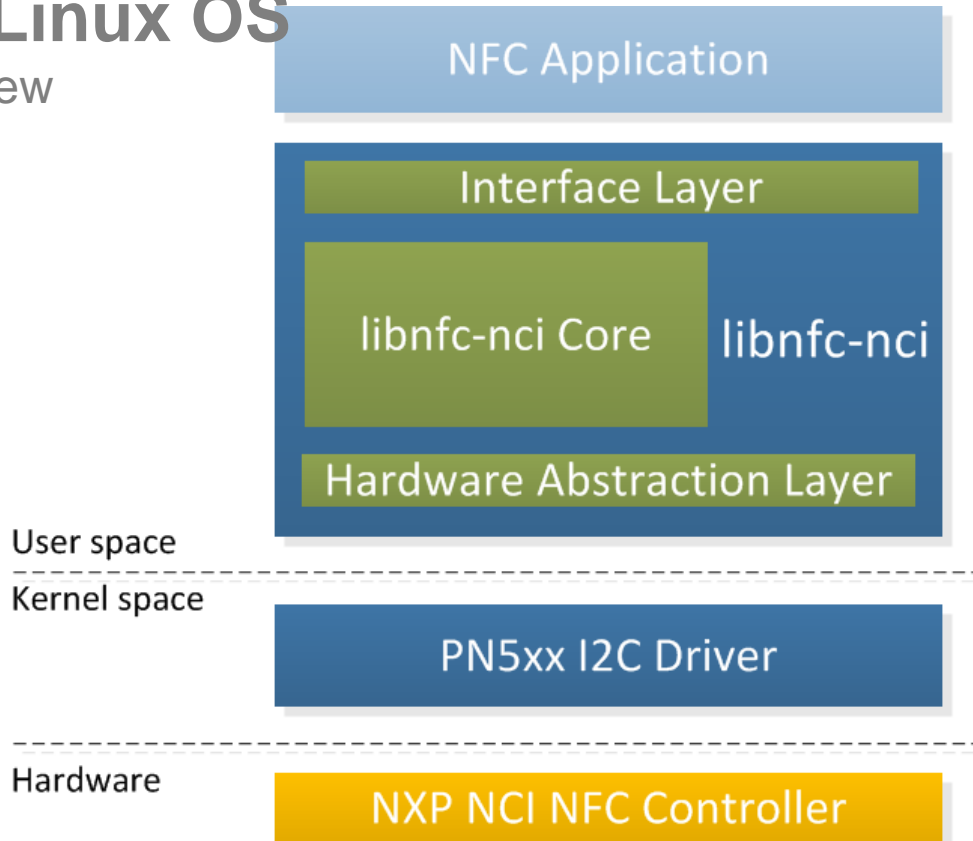
- NXP's SW product "Linux libnfc-nci stack" is derived from our available and proven Android stack
- From June 2015 onwards NXP provides and maintains the NFC driver in user mode and will be distributed through GitHub:
  - ❖ [https://github.com/NXPnfcLinux/linux\\_libnfc-nci](https://github.com/NXPnfcLinux/linux_libnfc-nci)
- Install PN5xx\_I2C kernel driver (without dependencies to kernel version)
- Install Linux libnfc-nci stack (full user mode)
- Port existing application on the Linux libnfc-nci stack (similar to neardal)



# PN7120 SW integration in Linux OS

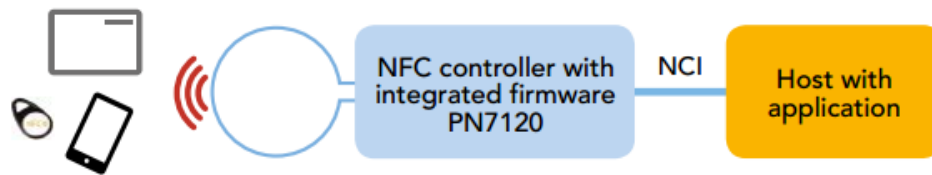
## Linux libnfc-nci stack: Architecture overview

- ▶ **Interface Layer:** exposes the library API
- ▶ **Core Layer:** implements NFC features (NCI, NDEF, Tag operations..)
- ▶ **Hardware abstraction layer:** provides connection to the kernel driver as well as basic functionalities like self-test or FW update
- ▶ List of features supported by Linux libnfc-nci stack:
  - NDEF tag support
  - MIFARE classic tag support
  - P2P, LLCP, SNEP
  - WiFi & Bluetooth handover
  - Raw tag command support
  - Proprietary NCI command support
  - Host Card Emulation



# PN7120 Key points

- ▶ Highly integrated and full NFC Forum controller solution
- ▶ Multiple target markets:
  - TVs, set-top boxes. Home automation, home appliances, wearable, printers, IP phones, gaming consoles, healthcare, wireless routers, etc.
- ▶ Multiple use cases:
  - Pairing, Personalization, User Interface, Maintenance, Logical access control, etc
- ▶ RF protocols:
  - R/W: ISO/IEC14443 Type A/B, ISO/IEC15693, FeliCa
  - P2P: ISO/IEC18092 (Active and Passive)
  - CE: ISO/IEC14443 Type A/B
- ▶ Ease of integration:
  - Pre-loaded FW, NCI interface, Linux and android drivers
- ▶ Low bill of materials :
  - Direct connection to application host, BGA package
- ▶ Low-power operation mode
- ▶ Demokit and support information available



# NTAG I<sup>2</sup>C PLUS

THE SIMPLEST & LOWEST BOM COST  
NFC SOLUTION





# NTAG I<sup>2</sup>C *plus* – Technical product features

## Characteristics

- Integrated 50pF resonance capacitor
- 888 or 1,912 bytes of user memory for NDEF message (based on EEPROM)
- 32-bit password protection to prevent unauthorized memory operations
- Protected Area access restriction from I<sup>2</sup>C perspective
- 64-byte SRAM memory buffer
- Data Pass Through Mode
- Energy harvesting output
- Supply voltage range: 1.67 V to 3.6V
- Fast Read and Fast Write commands
- ECC supported originality check
- Operating temperature: -40C, +105C

## Interface to Host

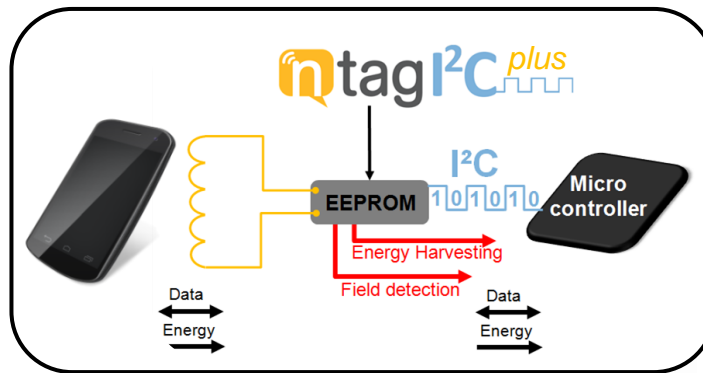
- I<sup>2</sup>C Slave 100/400 kbit/s
- Field detection pin

## Supported RF protocols

- ISO/IEC 14443 Type A
- NFC Forum Type 2 Tag

## Packages

- XQFN8
- TSSOP8
- SO8



November 8, 2017

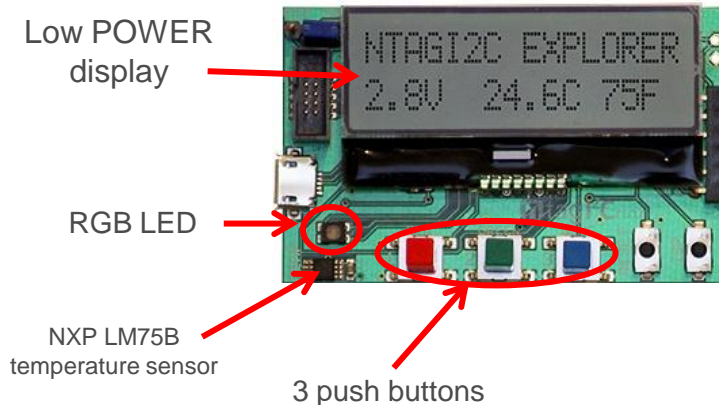
# Pass-through Mode

Based on Interrupt signal and registers, access to the SRAM buffer is handed over without breaking communication session (I<sup>2</sup>C or RF)

- **64-bytes SRAM buffer**
  - Rely on ultrafast memory to transfer data
  - No cycling and reliability limitations linked to EEPROM
- Can be combined with FAST READ and FAST WRITE command to read and write the full SRAM buffer at once
  - **FAST READ command**
    - Enables to read more than 16 bytes at once
  - **FAST WRITE command**
    - Enables to write the full SRAM Buffer (64 Bytes) at once
- **Typical throughput:** ~ 4kBytes/s

# NTAG I<sup>2</sup>C *plus* Explorer Kit

## Details



### • NTAG I<sup>2</sup>C explorer board

- 62\*37mm<sup>2</sup>
- Low power display
- Push buttons
- NXP Temperature sensor LM75B
- NXP MCU LPC11U24
- RGB LED
- Connection to PCB antenna board

NTAG I<sup>2</sup>C *plus* in XQFN8

### • Class 4 PCB antenna + NTAG I<sup>2</sup>C *plus*

- 70\*37mm<sup>2</sup>
- Class 4 PCB antenna
- NTAG I<sup>2</sup>C in XQFN8
- Connection to NTAG I<sup>2</sup>C Explorer board



SECURE CONNECTIONS  
FOR A SMARTER WORLD