

NTAG 5 SUPPORT PACKAGE

NTAG 5 WEBINAR SERIES

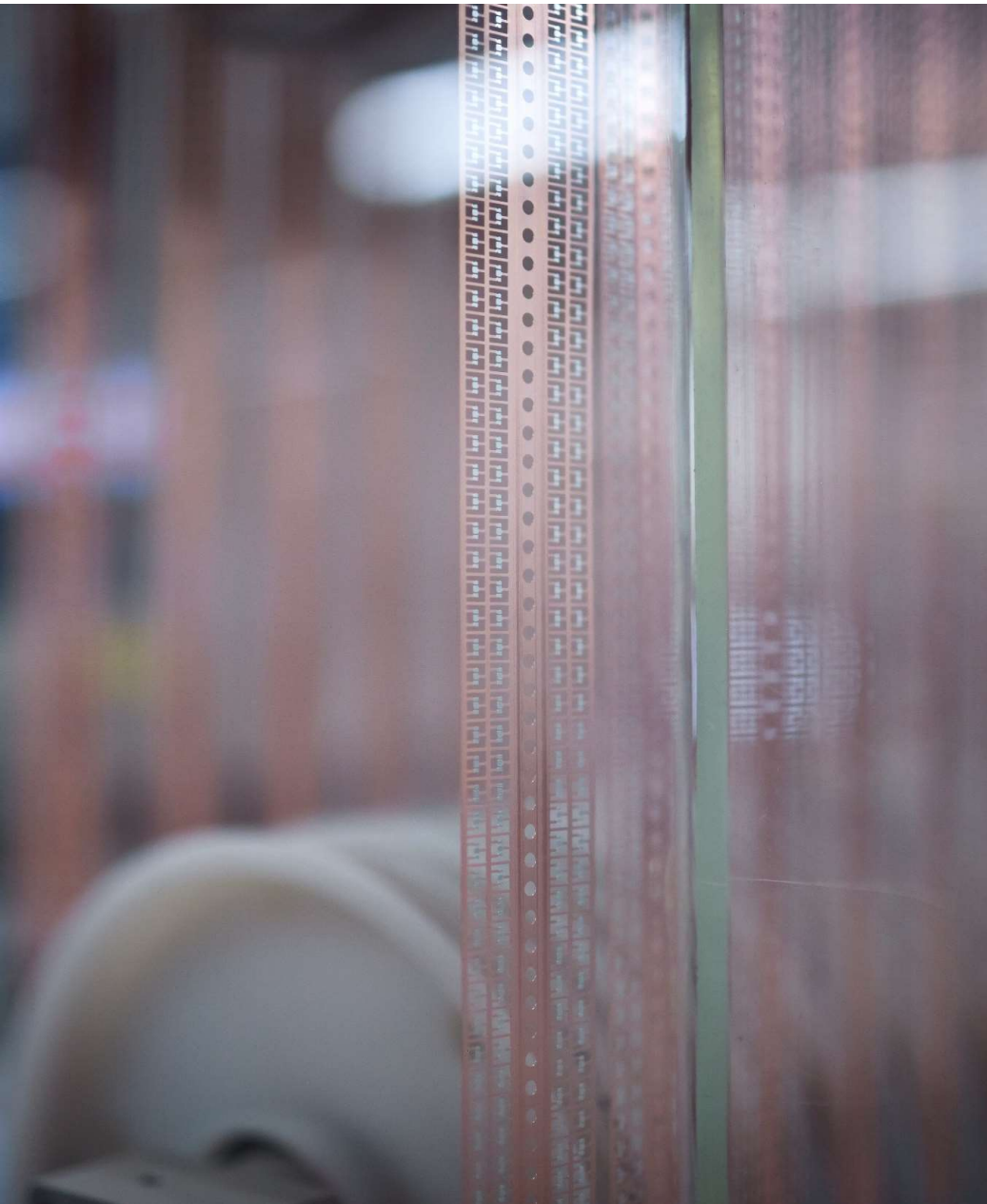
PABLO FUENTES
FEBRUARY 2020



PUBLIC



SECURE CONNECTIONS
FOR A SMARTER WORLD



Agenda

- NTAG 5 Family Overview
- NTAG 5 Product Support Package
- NTAG 5 Development kits
- NTAG 5 Support material
- NTAG 5 Demo boards
- Mobile applications
- Peek and Poke PC app
- NFC Cube
- More support

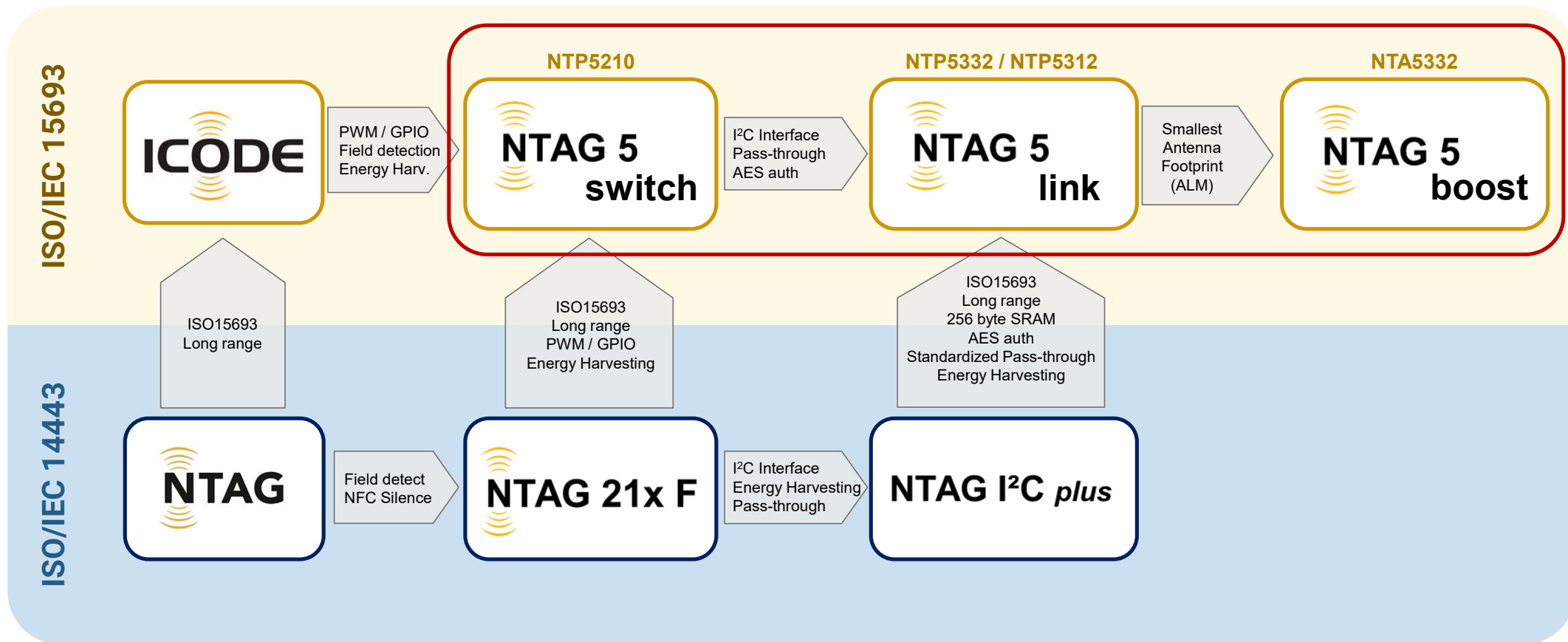


NTAG 5 Family Overview



NTAG 5 Family Overview

Positioning



NTAG 5 Family Overview

Main features

NTAG 5 switch

- NFC Forum compliant Type 5 tag
- ISO/IEC 15693 compliant
- 512 bytes user memory
- Configurable wired interfaces:
 - PWM / GPIO
 - NFC Field detection
- Energy harvesting with output up to 30mW
- 3 configurable user memory areas
 - 32/64-bit password protection
- ECC reprogrammable originality Signature
- Low power consumption
 - < 6 μ A Standby
 - < 0.25 μ A Hard power down

NTAG 5 link

- NFC Forum compliant Type 5 tag
- ISO/IEC 15693 compliant
- 2048 bytes user memory
- 256 bytes SRAM
- Configurable wired interfaces:
 - I²C master and slave*
 - PWM / GPIO
 - NFC Field detection
- Energy harvesting with output up to 30mW
- 3 configurable user memory areas
 - 32/64-bit password protection
 - 128-bit AES mutual authentication*
- ECC reprogrammable originality Signature
- NFC Silence
- Low power consumption
 - < 6 μ A Standby
 - < 0.25 μ A Hard power down

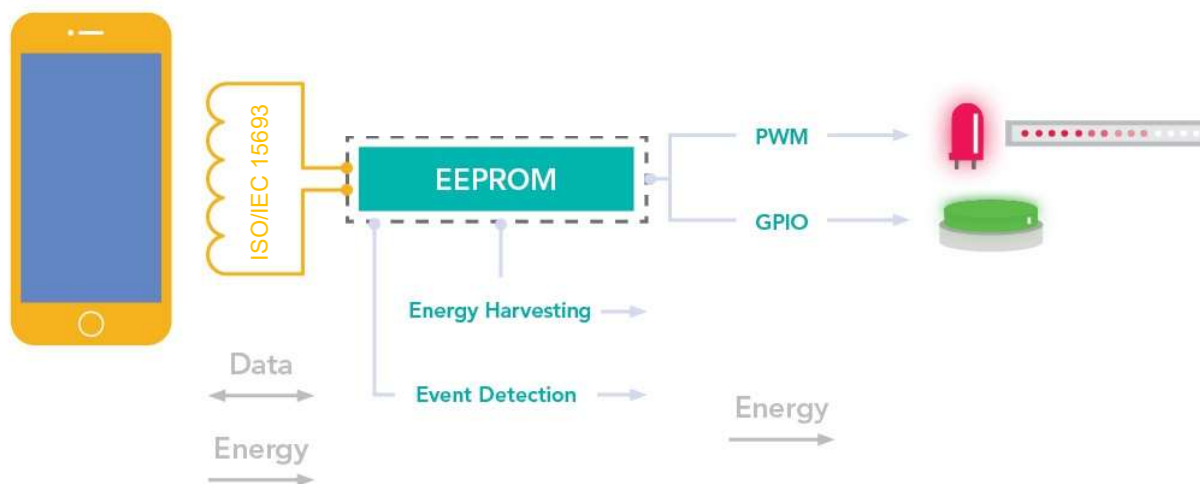
NTAG 5 boost

- NFC Forum compliant Type 5 tag
- ISO/IEC 15693 compliant
- Active Load Modulation feature for performance boost
- 2048 bytes user memory
- 256 bytes SRAM
- Configurable wired interfaces:
 - I²C master and slave
 - PWM / GPIO
 - NFC Field detection
- Energy harvesting with output up to 30mW
- 3 configurable user memory areas
 - 32/64-bit password protection
 - 128-bit AES mutual authentication
- ECC reprogrammable originality Signature
- NFC Silence
- Low power consumption
 - < 10 μ A Standby
 - < 0.25 μ A Hard power down

NTAG 5 switch

NFC Forum compliant PWM and GPIO bridge

- NTAG 5 switch supports operating with general-purpose I/O (GPIO) and pulse width modulation (PWM) signals which allows end-device manufacturers to use it as an MCU replacement in various gaming and lighting applications.



Control and dim LEDs



Calibrate reference current without MCU

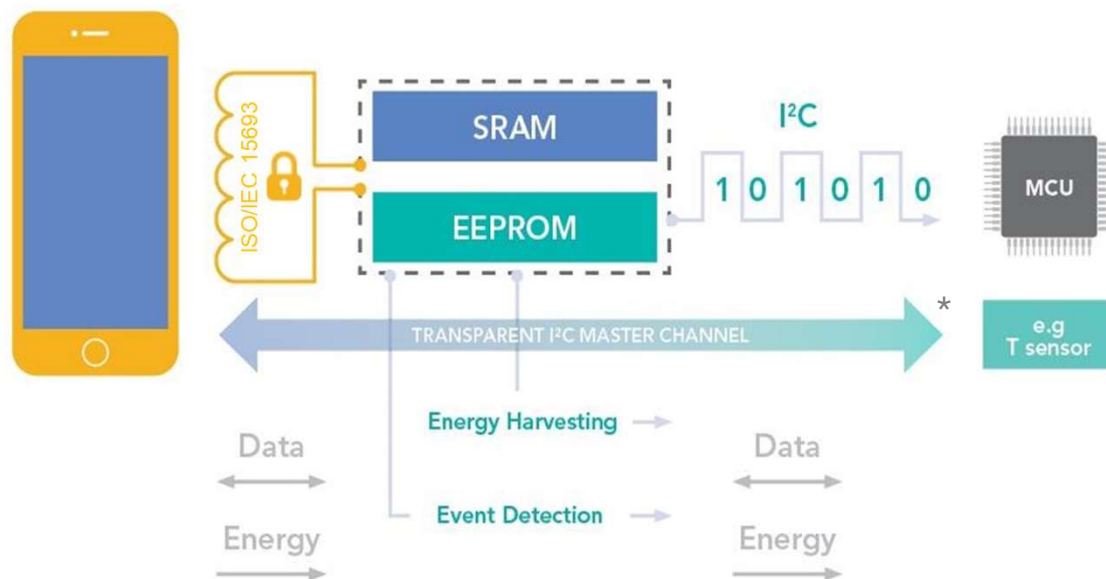


Verify authenticity of the device

NTAG 5 link

NFC Forum compliant I²C bridge

- NTAG 5 link is based on NTAG 5 switch, incorporating an I²C interface and a SRAM memory. It supports I²C master* / slave role, enabling the communication with a microcontroller or even directly reading from an I²C sensor.



Draw power from the NFC reader to supply sensors



Read out sensor information with and without an MCU



Verify authenticity of the device

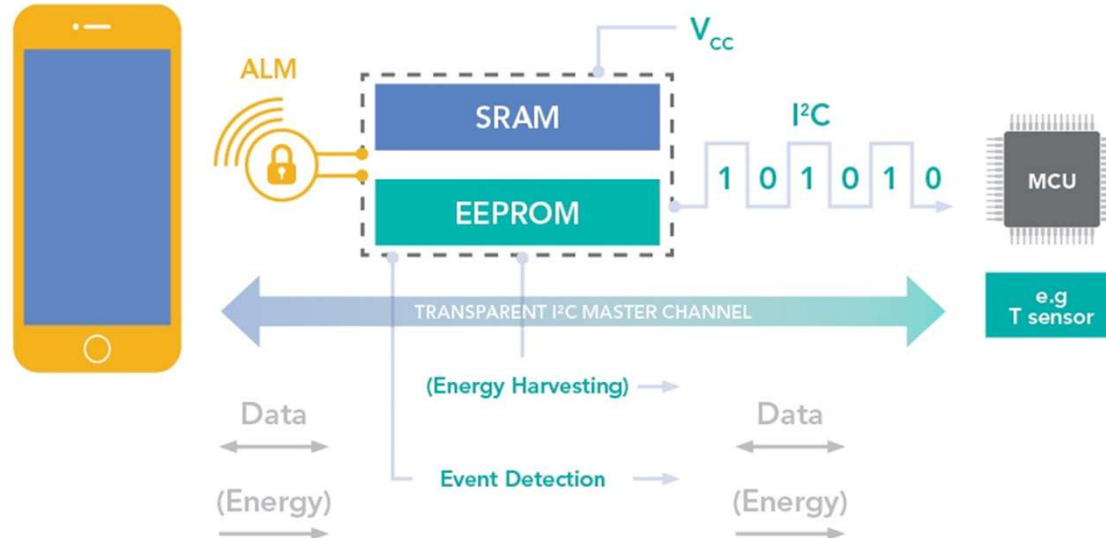


Secure sensor interaction

NTAG 5 boost

NFC Forum Compliant I²C Bridge for Tiny Devices

- NTAG 5 boost uses active load modulation (ALM) to deliver robust and reliable communication with NFC phones, helping in the design of ultra-compact devices for use in IoT, consumer and industrial applications.



Smallest footprint Antenna



Read out sensor information with and without an MCU



Verify authenticity of the device



Secure sensor interaction

NTAG 5

Product Support Package

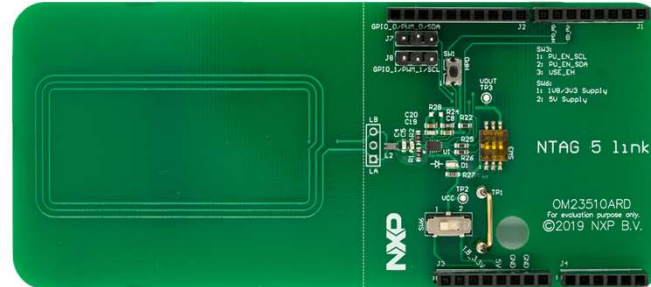


NTAG 5 PSP Components

NTAG 5 Development Kits¹

- NTAG 5 Link Evaluation board
- NTAG 5 Boost Evaluation board

NTAG 5 link eval. board



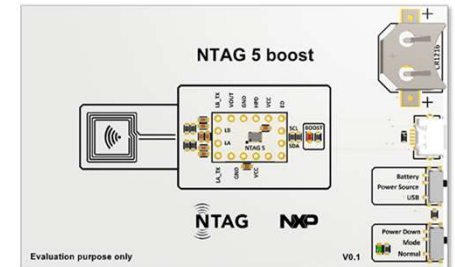
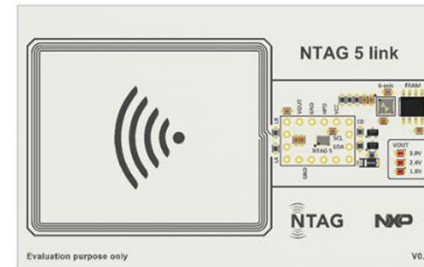
NTAG 5 boost eval. board



Available from mid February!

NTAG 5 demo boards²

- NTAG 5 switch demo board
- NTAG 5 link demo board
- NTAG 5 boost demo board



¹ Full support from CAS. Boards will be available from mid-February.

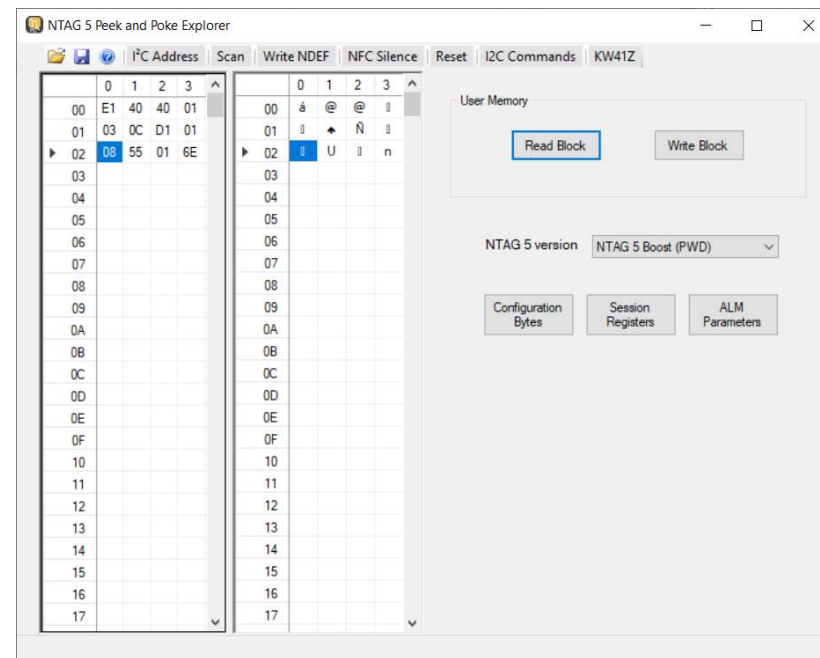
² No support from CAS on SW & HW. Dev kit shall be used as source.

NTAG 5 PSP Components

NTAG 5 Dev. kit application



Peek and Poke PC Application

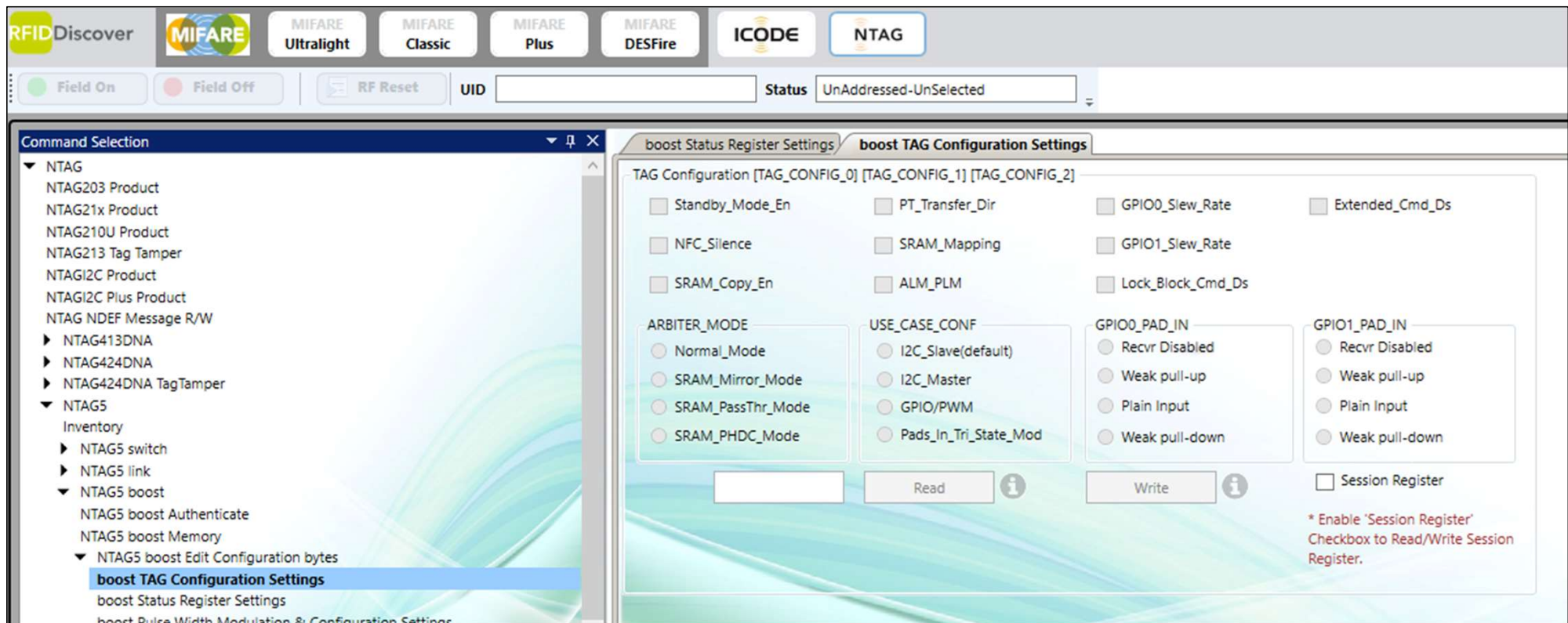


NFC Cube



NTAG 5 PSP Components

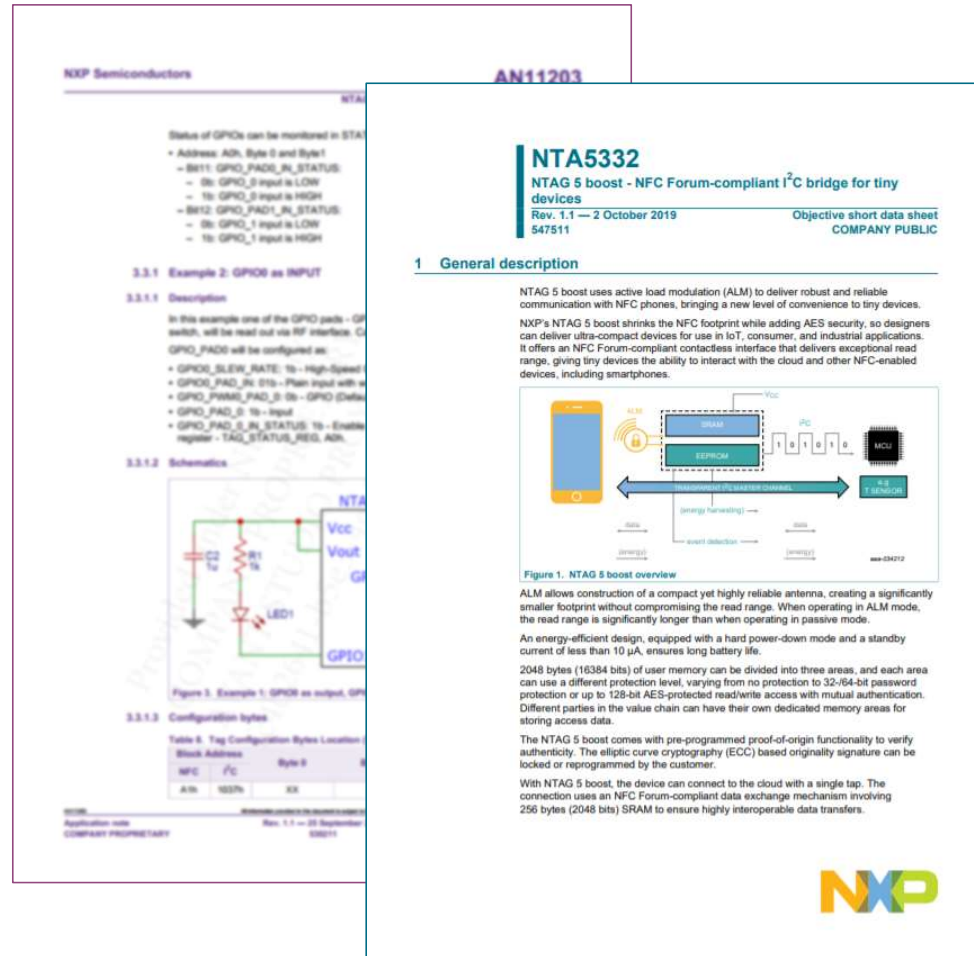
RFID Discover



NTAG 5 PSP Components

Support documentation

- NTAG Antenna design guide
- Memory configuration and scalable security
- How to use energy harvesting
- Bi-directional data exchange
- Originality signature validation
- I²C master mode
- Use of PWM, GPIO and event detection
- Design recommendations for FCC and CE certifications



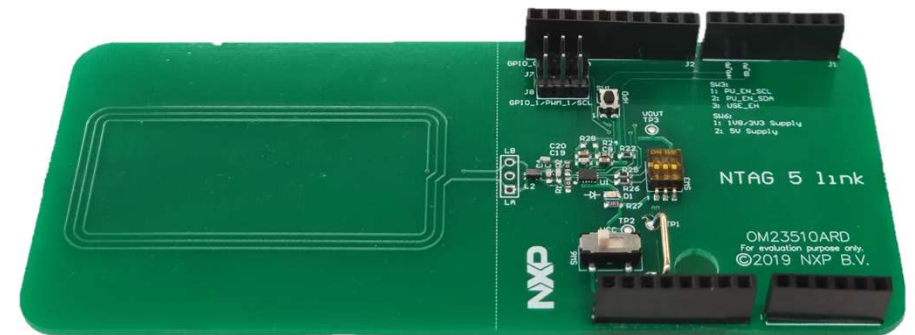
NTAG 5 Development kits



NTAG 5 Development kit

Components

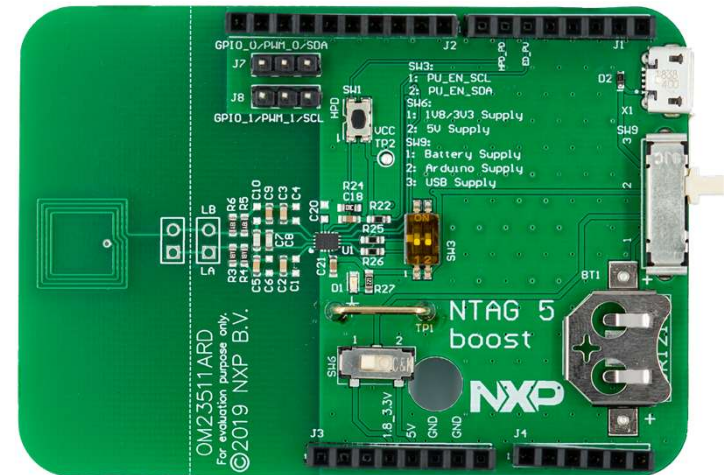
- **NTAG 5 link Evaluation board (OM2NTP5332)**
 - Integrating NTAG 5 link (NTP53321)
 - Integrating 50mm x 25mm antenna
 - Jumper to select between different supply voltages
 - Hard-power-down button
 - Arduino header
 - Easy to access wired interface signals through pins



NTAG 5 Development kit

Components

- **NTAG 5 boost Evaluation board (OM2NTA5332)**
 - Integrating NTAG 5 boost (NTA53321)
 - Integrating 10mm x 10mm antenna for evaluating ALM functionalities
 - Jumper to select between different supply voltages
 - Hard-power-down button
 - Arduino header
 - Easy to access wired interface signals through pins



NTAG 5 Development kit app



NTAG 5 Development kit app

Introduction

Mobile application designed to interact with NTAG 5 development kits to showcase product functionalities.

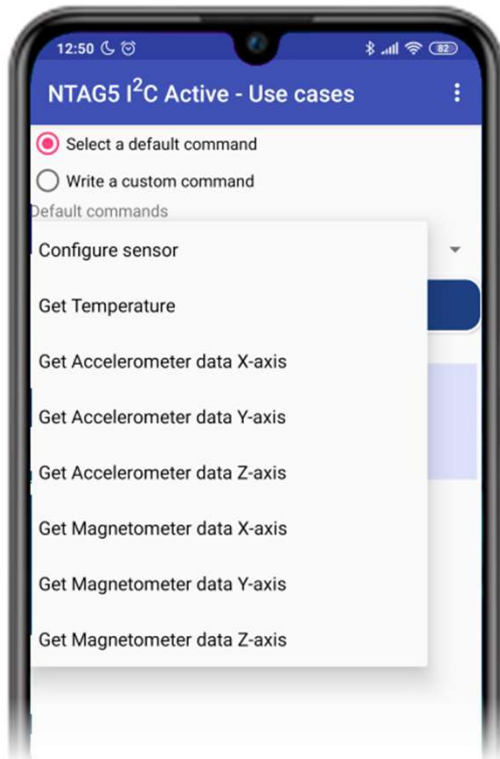
- Available for Android and iOS devices
- Developed to work with a demonstration setup including KW41Z development board
- Divided in four use cases:
 1. I²C master
 2. GPIO
 3. Pulse Width Modulation
 4. Pass-through
- Allows user to reconfigure NTAG 5 wired interface through NFC



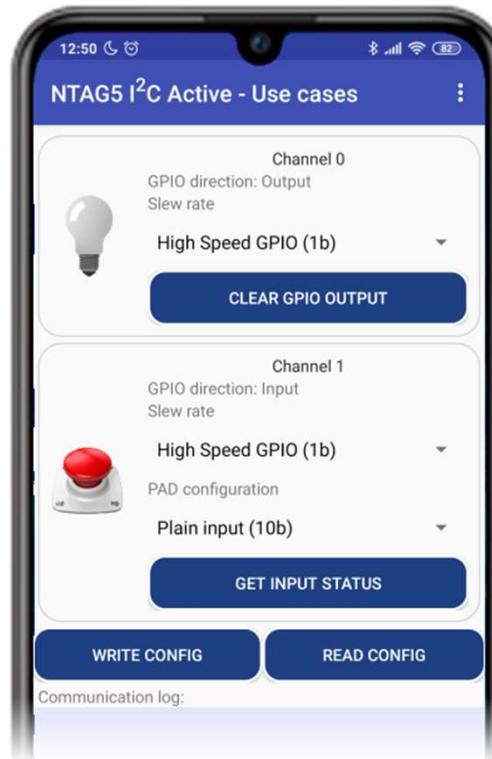
NTAG 5 Development kit app

Use cases supported

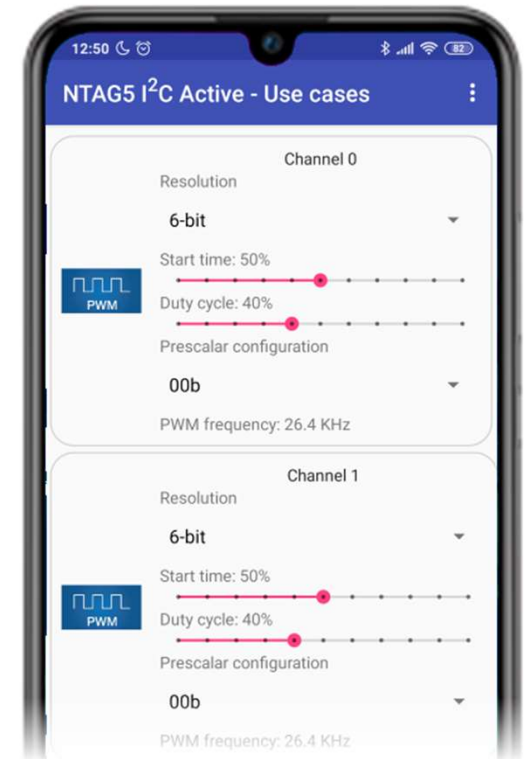
I²C Master Channel



GPIO



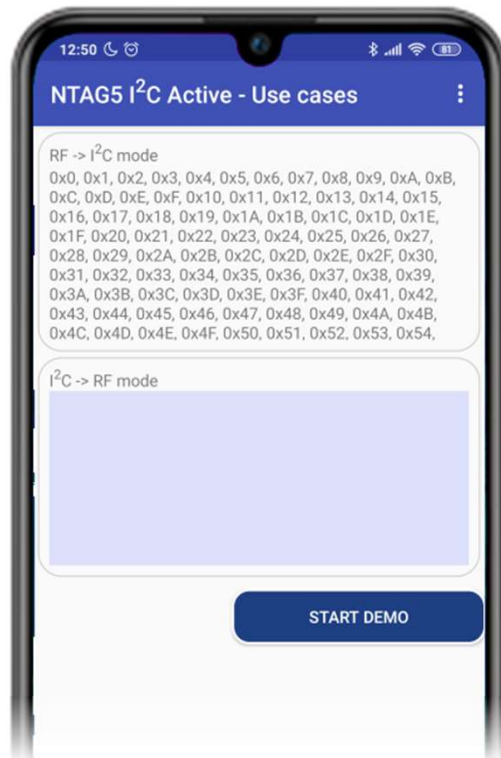
PWM



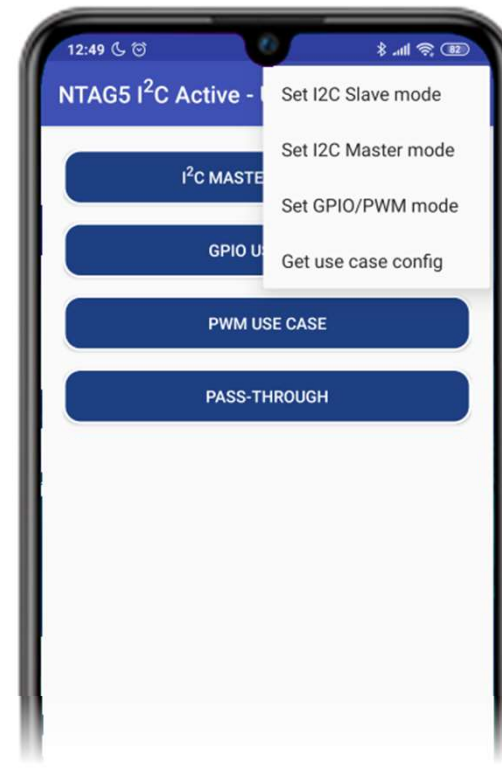
NTAG 5 Development kit app

Use cases supported

Pass-through



Setting NTAG5 wired interface



Peek and Poke application



Peek and Poke application

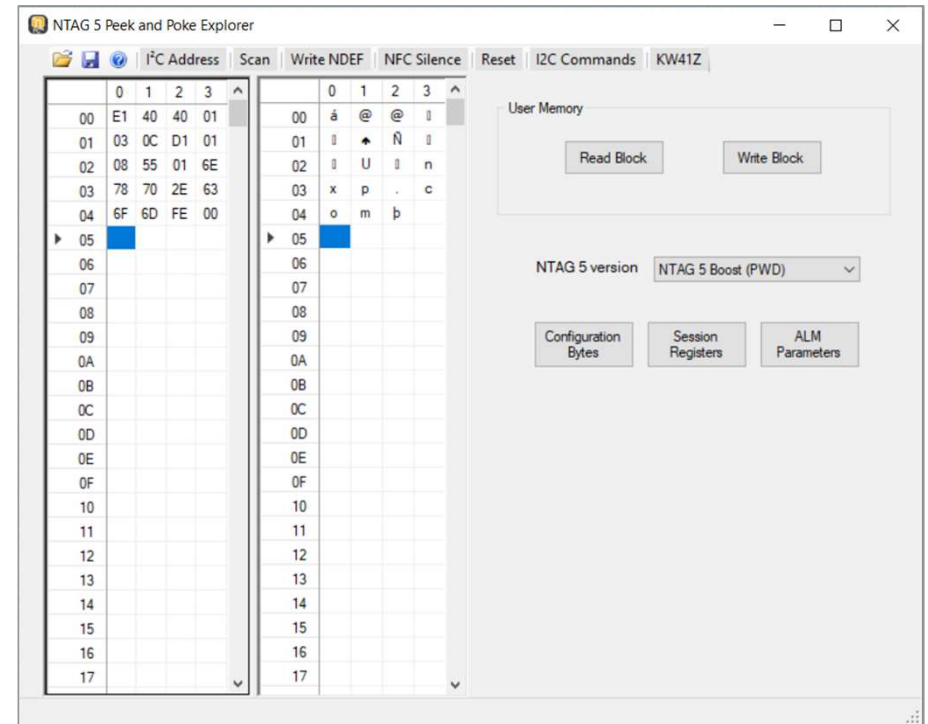
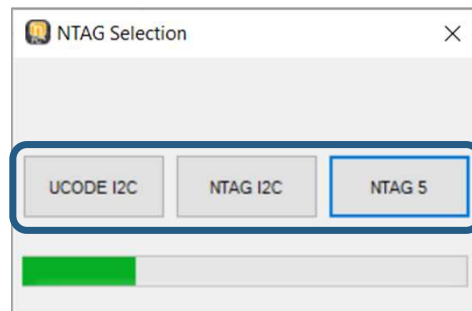
Introduction

Peek and Poke application

MS Windows application enabling communication with different NXP tag products through USB connection to explore registers and memory.

Updated to support communication with NTAG 5 development kits using FRDM-KW41Z* board as bridge.

- Compatible with [NTAG 5](#), [UCODE I2C](#) and [NTAG I2C](#) products
- Memory map for intuitive access to memory blocks



Peek and Poke application

Read/Write user memory

Peek and Poke application allows user to read and write blocks from user memory through its intuitive memory maps.

The screenshot shows the NTAG 5 Peek and Poke Explorer application. The interface includes a menu bar with options like I2C Address, Scan, Write NDEF, NFC Silence, Reset, I2C Commands, and KW41Z. Below the menu are two hex dump tables. The left table shows memory addresses 00 to 17 with corresponding hex values. The right table shows memory addresses 00 to 17 with corresponding ASCII values. A blue arrow points to the hex value '5F' at address 04 in the left table, labeled '2. Write data you want in respective bytes'. Another blue arrow points to the 'Read Block' button in the 'User Memory' section, labeled '3. Click on read / write block'. A third blue arrow points to the 'Write Block' button in the 'User Memory' section, also labeled '3. Click on read / write block'. Below the 'User Memory' section, there are three buttons: 'Configuration Bytes', 'Session Registers', and 'ALM Parameters'. Red circles highlight the 'Configuration Bytes' and 'Session Registers' buttons, with a red arrow pointing to them from the text 'To access: - Configuration bytes - Session registers'.

1. Select memory block

2. Write data you want in respective bytes

3. Click on read / write block

To access:

- Configuration bytes
- Session registers

Peek and Poke application

Access to configuration and session registers

User can easily navigate and explore the different configuration and session registers through specific menus available from main window.

Registers are organized in tabs depending on their functionality

Information displayed in checkboxes, drop-down list and textboxes for a user-friendly experience

The image displays two screenshots of the NTAG5 application interface. The left screenshot shows the 'NTAG5 - Configuration Bytes' window, which has tabs for 'NFC Security Control', 'I2C Security Control', 'TAG Configuration', and 'Memory Areas Security'. The right screenshot shows the 'NTAG5 - Session Registers' window, which has tabs for 'Tag Status', 'Tag Configuration', 'PWM & GPIO configuration', and 'Energy Harvesting'. Both windows contain various configuration options and status indicators. Arrows point from the text annotations to specific elements in the screenshots.

NTAG5 - Configuration Bytes

- Enable SRAM Copy ☐
- Enable Auto-standby ☐
- Energy Harvesting ☐ Energy optimized for high field strength ☐
- Use Case configuration I2C Slave
- Enable Active Load Modulation ☐
- Enable SRAM ☒
- Data transfer direction NFC -> I2C
- Arbiter Mode Normal mode
- Support Lock Block commands ☒
- Support extended commands ☒
- GPIO1_PAD_IN Receiver disabled
- GPIO0_PAD_IN Receiver disabled
- GPIO1 Slew Rate High speed GPIO
- GPIO0 Slew Rate High speed GPIO
- Read Write

NTAG5 - Session Registers

- EEPROM Busy not busy
- EEPROM Error No
- SRAM Data data not ready
- Data Written to SYNCH_BLOCK No
- Data Read to SYNCH_BLOCK Yes
- Passthrough direction NFC to I2C
- ALM RF not OK
- Vcc Supply not present
- Vcc Boot not done
- NFC Field no field present
- NFC Boot not done
- GPIO0 input LOW
- GPIO1 Boot LOW
- ALM Support Only PLM
- I2C Interface Locked by arbiter
- NFC Interface Locked
- Read Write

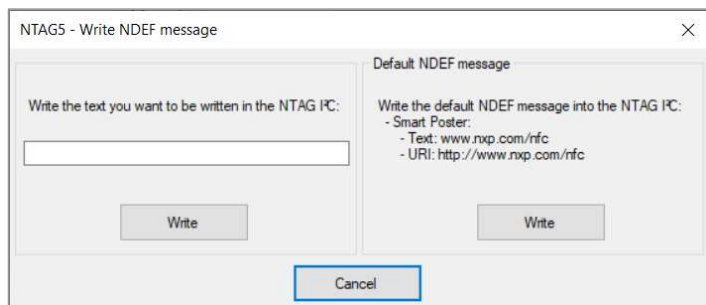
Read and Write parameters

Peek and Poke application

More options

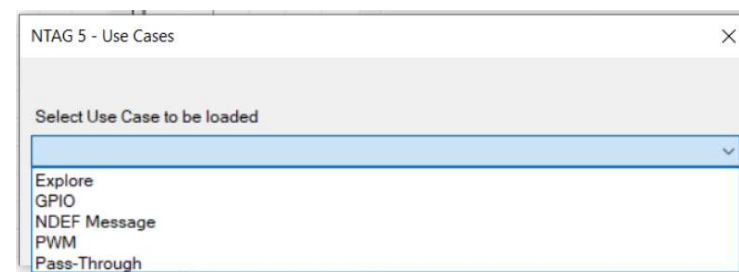
Write NDEF message in NTAG 5

Allows user to write a personalized NDEF message or a default message with a URI link



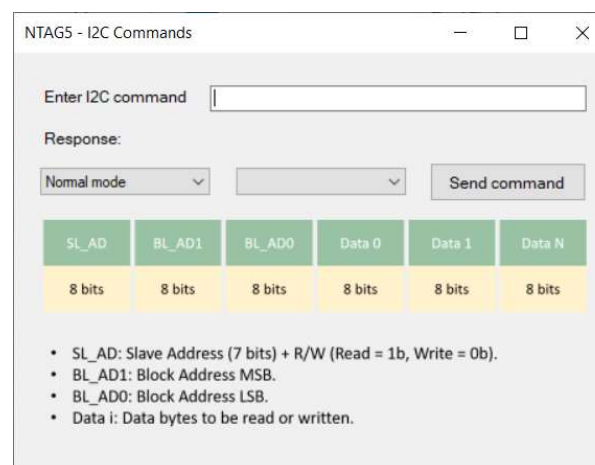
Flash other use cases in microcontroller board

Five different use cases available to showcase NTAG 5 functionalities



Send I²C commands

Allows user to send raw I²C commands to the NTAG 5. User can also configure I²C signal (mode and SCL period)



SL_AD	BL_AD1	BL_AD0	Data 0	Data 1	Data N
8 bits	8 bits	8 bits	8 bits	8 bits	8 bits

- SL_AD: Slave Address (7 bits) + R/W (Read = 1b, Write = 0b).
- BL_AD1: Block Address MSB.
- BL_AD0: Block Address LSB.
- Data i: Data bytes to be read or written.

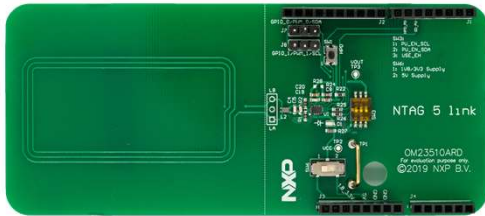
Development setup



Development setup

Components

NTAG 5 link / boost evaluation board



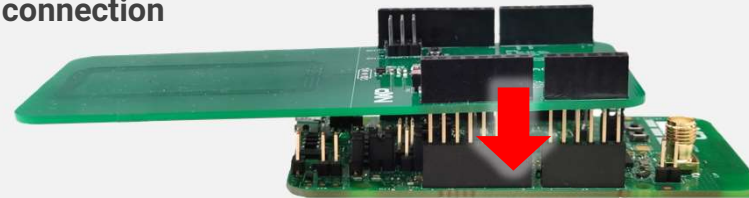
FRDM-KW41Z development board



KW41Z development board (FRDM-KW41Z)

- NXP's ultra-low-power KW41Z Wireless MCU
- Fully compliant Bluetooth v4.2 Low Energy
- 4-Mbit external serial flash memory for OTAP support
- 2 LED indicator and 2 push-button switches
- Arduino compatible header
- Not included in NTAG 5 development kit

Arduino header connection



FRSM-KW41Z can be easily replaced with any other Arduino compatible microcontroller board just by porting related FW to other platforms using NTAG 5 libraries.

Demonstration setup

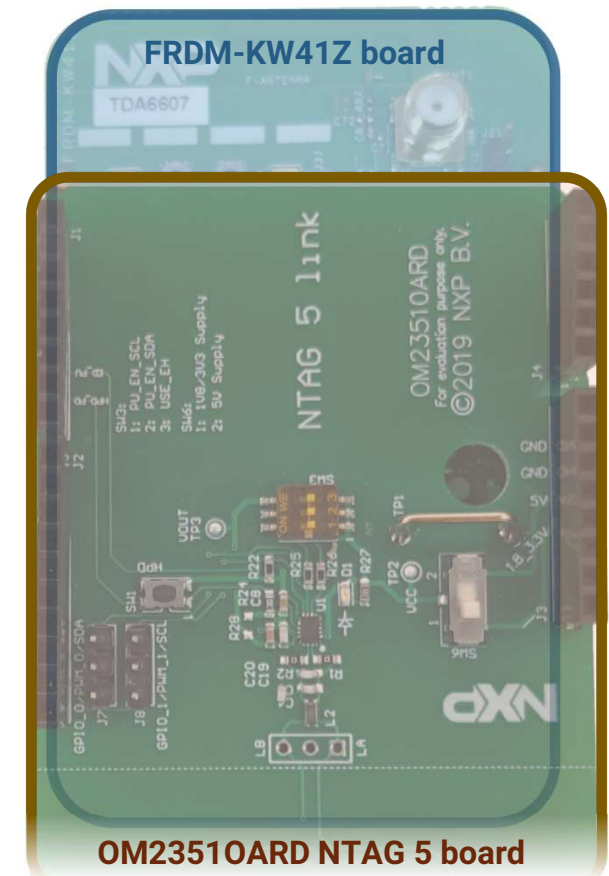
Use cases

NTAG 5 Demo application comes with five different use cases to showcase main functionalities of the NTAG 5.

For each use case, a specific FW shall be flashed to KW41Z. NTAG 5 shall be configured to operate with FRDM-KW41Z board accordingly.

Available use cases are:

- GPIO
- PWM
- I²C Master mode
- Explorer
- Pass-through
- NDEF message



Demonstration setup

Use cases

GPIO use case:

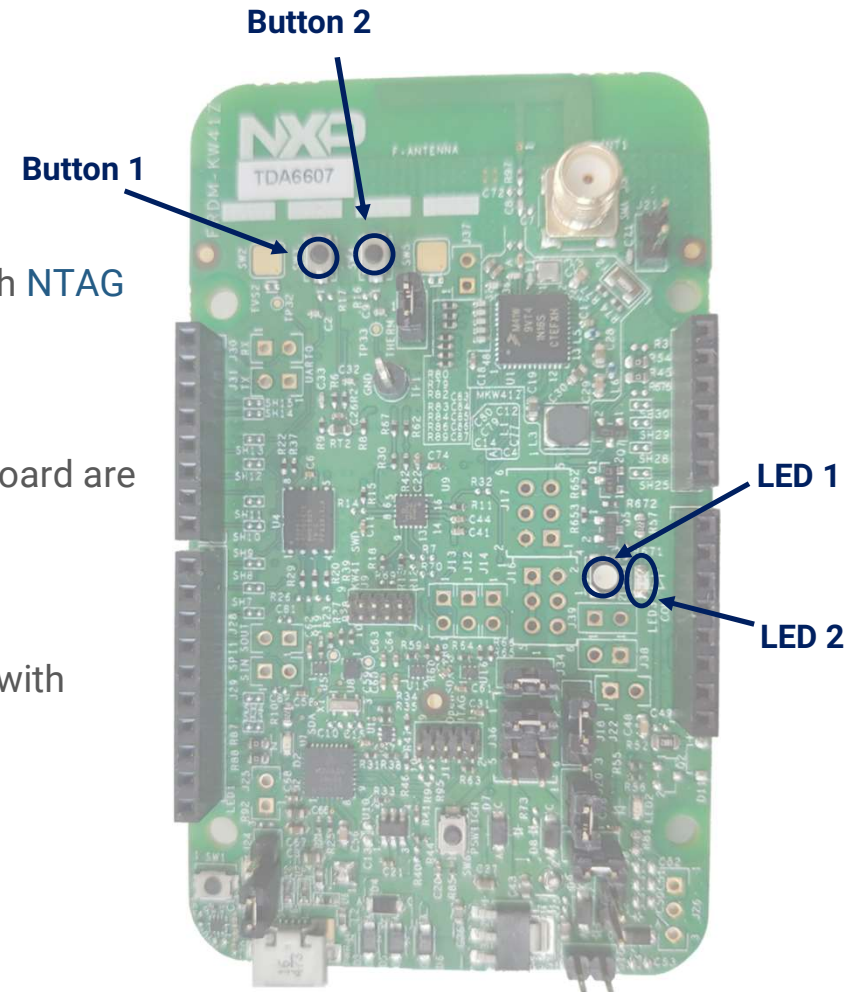
NTAG 5 pins configured as GPIO (One input, one output). Used along with [NTAG 5 Demo app](#).

- Output channel → Turn On/Off LED 1 from FRDM board
- Input channel → Used to monitor when buttons 1 and 2 from FRDM board are pressed

PWM use case:

NTAG 5 pins configured as Pulse Width Modulation signals. Used along with [NTAG 5 Demo app](#).

- Output channel 1 → Control light intensity of LED 1
- Output channel 2 → Control light intensity of LED 2



Demonstration setup

Use cases

I²C Master mode use case:

NTAG 5 wired interface configured as I²C master to control communication with FXOS8700CQ accelerometer and magnetometer sensor present in FRDM-KW41Z board.

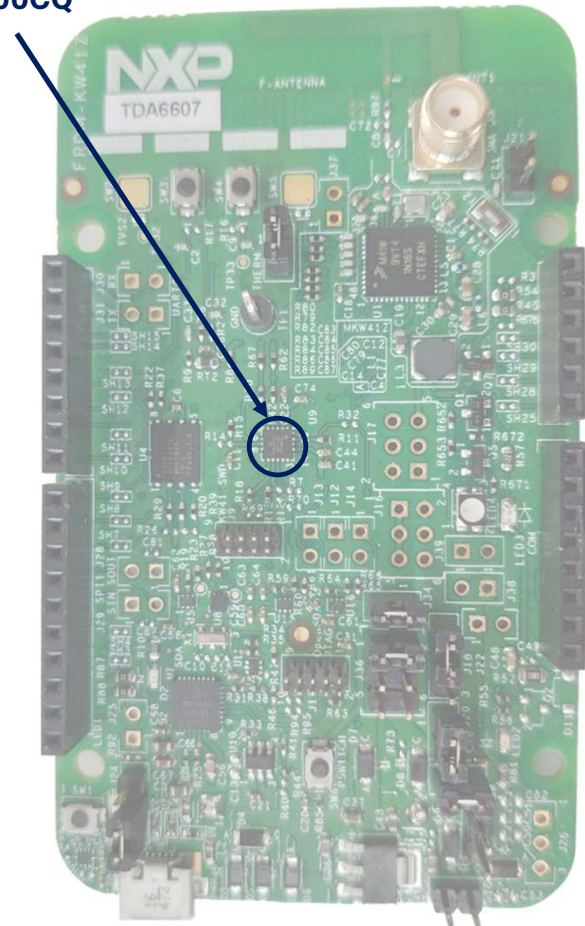
- [NTAG 5 Demo application](#) allows user to send I²C commands to read data from sensor.

Explorer use case:

NTAG 5 is configured as I²C slave to communicate with KW41Z, which is flashed to act as I²C master.

- Using [Peek and Poke PC application](#) user can access NTAG 5 memory, configuration and session registers.

FXOS8700CQ



Demonstration setup

Use cases

Pass-through use case:

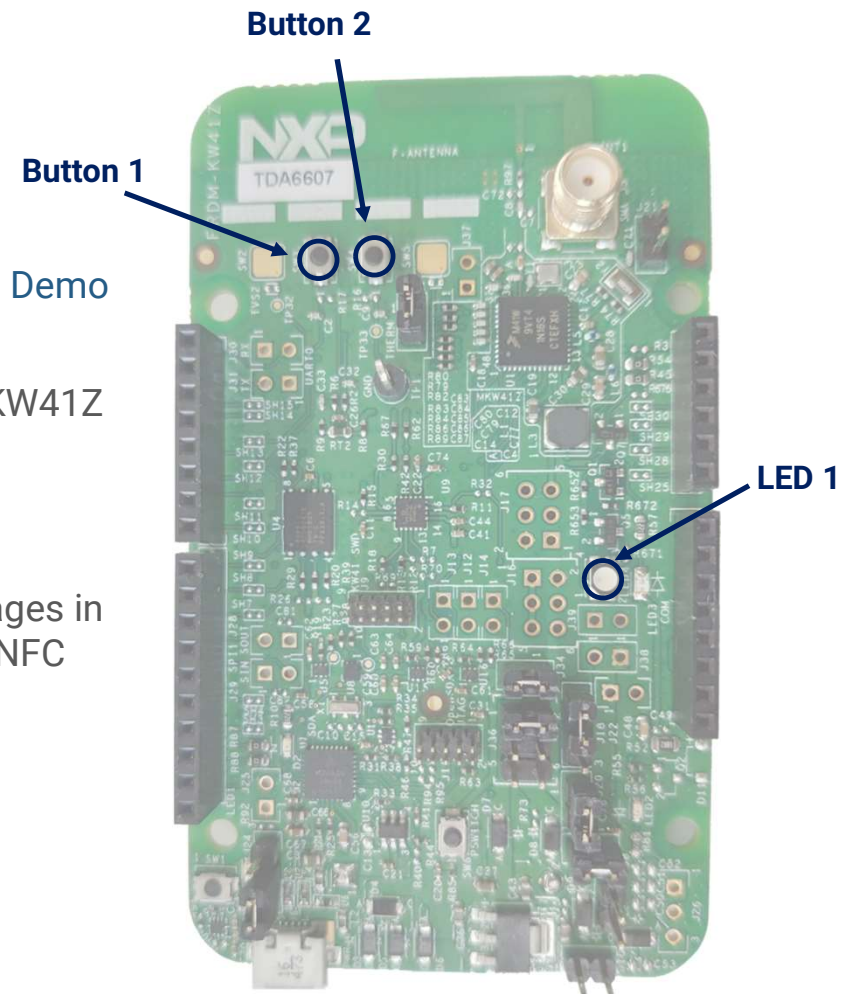
NTAG 5 wired interface configured as I²C slave. Used along with [NTAG 5 Demo app](#).

- It exchanges a pre-defined amount of data between NFC phone and KW41Z and vice versa using NTAG 5 pass-through functionality.

NDEF message use case:

KW41Z is flashed so user can choose to write two different NDEF messages in NTAG 5 memory. These NDEF messages can later be checked using an NFC phone.

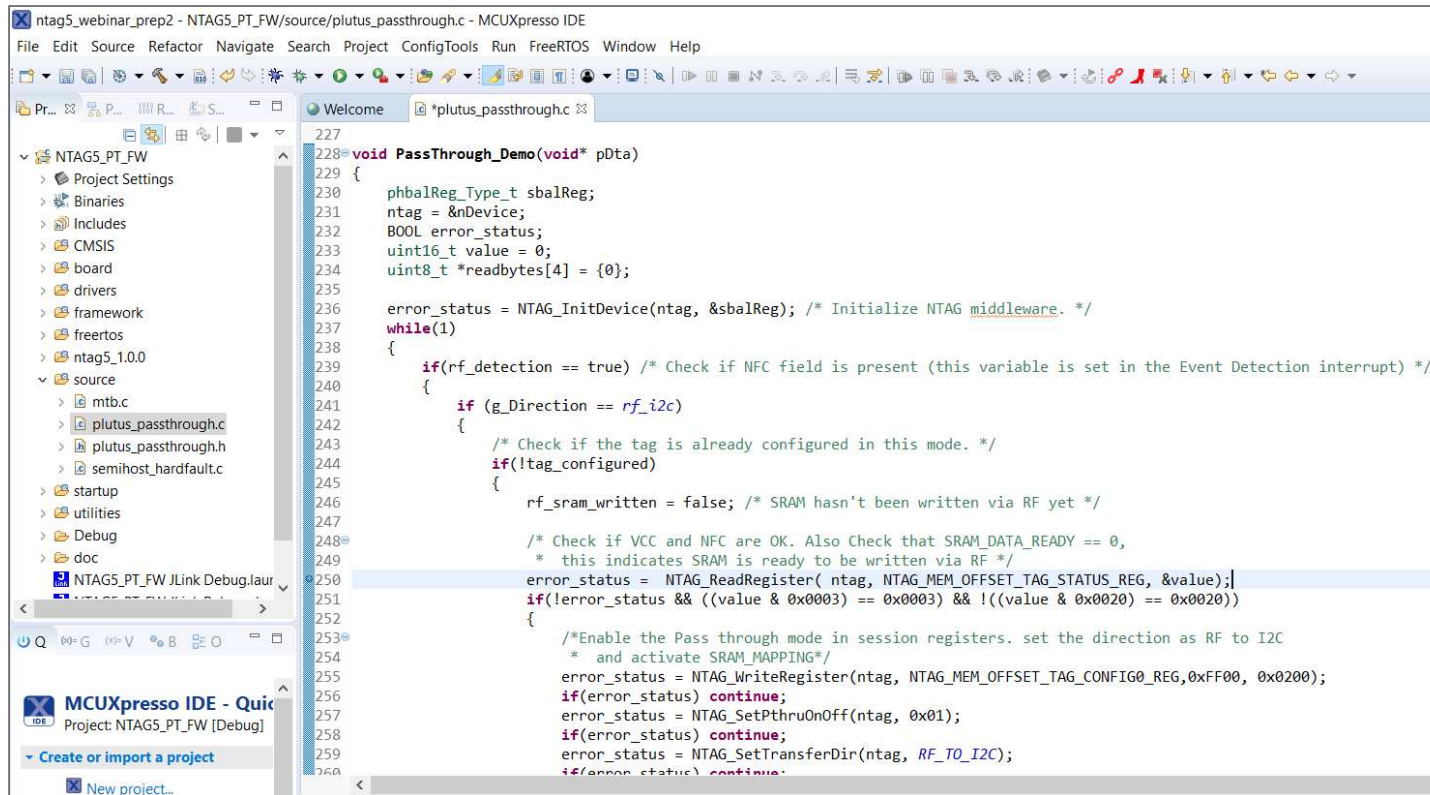
- Button 1 → KW41Z writes NDEF Message 1 on NTAG 5
- Button 2 → KW41Z writes NDEF Message 2 on NTAG 5



Demonstration setup

Pass-through mode example (1/2)

FW development:

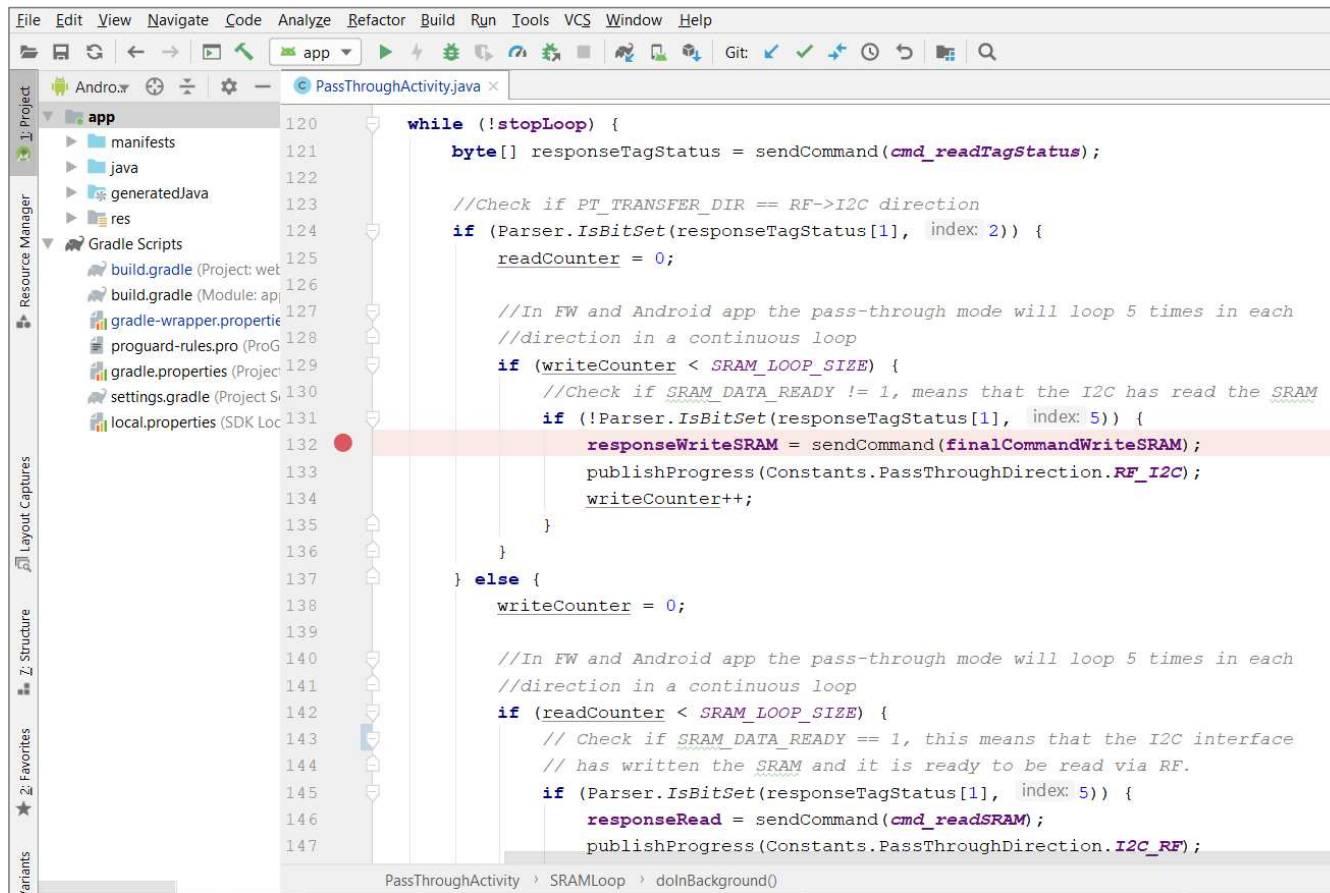


```
227
228 void PassThrough_Demo(void* pDta)
229 {
230     phba1Reg_Type_t sbalReg;
231     ntag = &nDevice;
232     BOOL error_status;
233     uint16_t value = 0;
234     uint8_t *readbytes[4] = {0};
235
236     error_status = NTAG_InitDevice(ntag, &sbalReg); /* Initialize NTAG middleware. */
237     while(1)
238     {
239         if(rf_detection == true) /* Check if NFC field is present (this variable is set in the Event Detection interrupt) */
240         {
241             if (g_Direction == rf_i2c)
242             {
243                 /* Check if the tag is already configured in this mode. */
244                 if(!tag_configured)
245                 {
246                     rf_sram_written = false; /* SRAM hasn't been written via RF yet */
247
248                     /* Check if VCC and NFC are OK. Also Check that SRAM_DATA_READY == 0,
249                      * this indicates SRAM is ready to be written via RF */
250                     error_status = NTAG_ReadRegister( ntag, NTAG_MEM_OFFSET_TAG_STATUS_REG, &value);
251                     if(!error_status && ((value & 0x0003) == 0x0003) && !((value & 0x0020) == 0x0020))
252                     {
253                         /* Enable the Pass through mode in session registers. set the direction as RF to I2C
254                          * and activate SRAM_MAPPING */
255                         error_status = NTAG_WriteRegister(ntag, NTAG_MEM_OFFSET_TAG_CONFIG0_REG, 0xFF00, 0x0200);
256                         if(error_status) continue;
257                         error_status = NTAG_SetPthruOnOff(ntag, 0x01);
258                         if(error_status) continue;
259                         error_status = NTAG_SetTransferDir(ntag, RF_TO_I2C);
260                         if(error_status) continue;
```


Demonstration setup

Pass-through mode example (2/2)

Mobile app development:



```
File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window Help
app
PassThroughActivity.java x
Project
  app
    manifests
    java
    generatedJava
    res
    Gradle Scripts
      build.gradle (Project: wet)
      build.gradle (Module: ap)
      gradle-wrapper.properties
      proguard-rules.pro (ProG
      gradle.properties (Project
      settings.gradle (Project S
      local.properties (SDK Loc
Resource Manager
Layout Captures
Z Structure
Favorites
Variants
120 while (!stopLoop) {
121     byte[] responseTagStatus = sendCommand(cmd_readTagStatus);
122
123     //Check if PT_TRANSFER_DIR == RF->I2C direction
124     if (Parser.IsBitSet(responseTagStatus[1], index: 2)) {
125         readCounter = 0;
126
127         //In FW and Android app the pass-through mode will loop 5 times in each
128         //direction in a continuous loop
129         if (writeCounter < SRAM_LOOP_SIZE) {
130             //Check if SRAM_DATA_READY != 1, means that the I2C has read the SRAM
131             if (!Parser.IsBitSet(responseTagStatus[1], index: 5)) {
132                 responseWriteSRAM = sendCommand(finalCommandWriteSRAM);
133                 publishProgress(Constants.PassThroughDirection.RF_I2C);
134                 writeCounter++;
135             }
136         }
137     } else {
138         writeCounter = 0;
139
140         //In FW and Android app the pass-through mode will loop 5 times in each
141         //direction in a continuous loop
142         if (readCounter < SRAM_LOOP_SIZE) {
143             // Check if SRAM_DATA_READY == 1, this means that the I2C interface
144             // has written the SRAM and it is ready to be read via RF.
145             if (Parser.IsBitSet(responseTagStatus[1], index: 5)) {
146                 responseRead = sendCommand(cmd_readSRAM);
147                 publishProgress(Constants.PassThroughDirection.I2C_RF);
```

Demo boards



NTAG 5 Demo boards

NTAG 5 switch demo board

The NTAG 5 switch demo board is a tool to demonstrate GPIO and PWM features through the LED and action button integrated in the demo board.

The demo board is controlled by the NTAG 5 demo board app:

- A slider changes the intensity of the LED
- Reading of GPIO button status



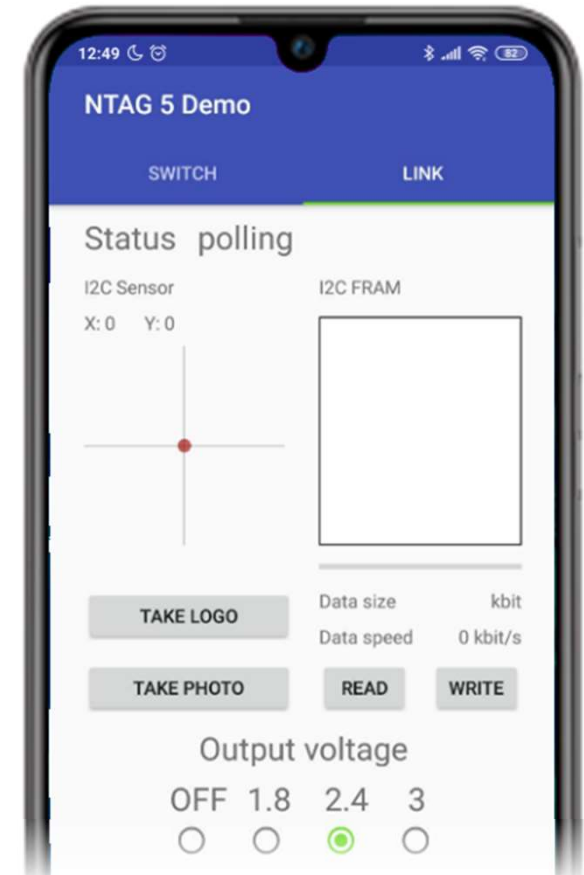
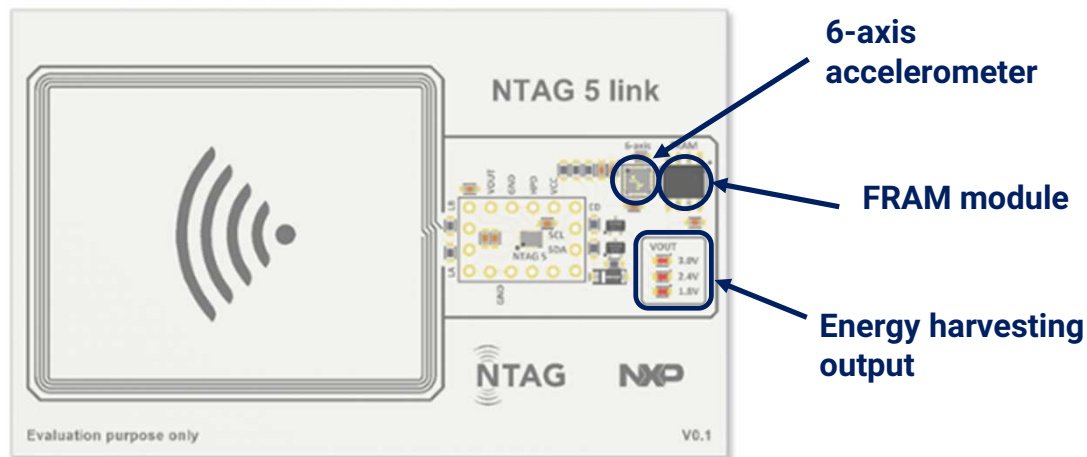
NTAG 5 Demo boards

NTAG 5 link demo board

The NTAG 5 link demo board is a tool to demonstrate I²C interface features.

The demo board is controlled by the NTAG 5 demo board app:

- 6 axis sensor is read out using I²C master channel and visualized in a graph
- External memory can be written from NFC without MCU with a logo or photo
- Configurable energy harvesting is shown with three indicators (1.8V, 2.4V, 3V)

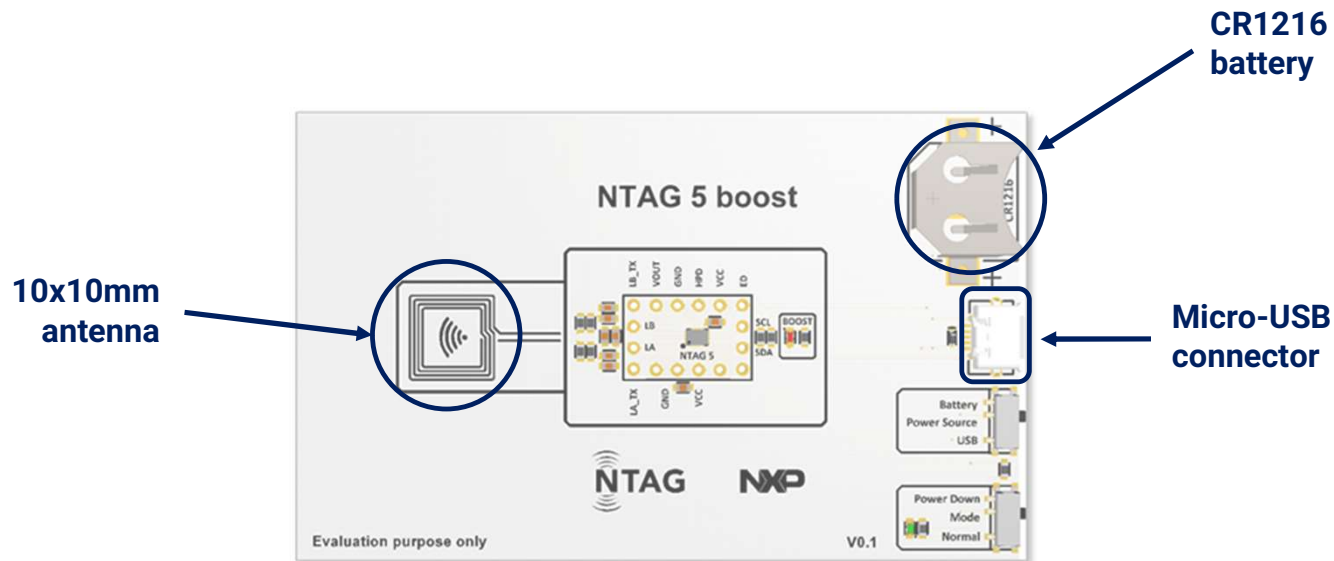


NTAG 5 Demo boards

NTAG 5 boost demo board

The NTAG 5 boost demo board is a tool to demonstrate ALM feature. It integrates a compact yet highly reliable antenna of 1x1 cm showing an extraordinary read range with ALM feature.

User can use an NFC-enabled mobile phone or NFC reader to compare the operating performance when chip is using active modulation (powered through battery or USB) and when it is working in passive mode (not powered).



Design and development resources



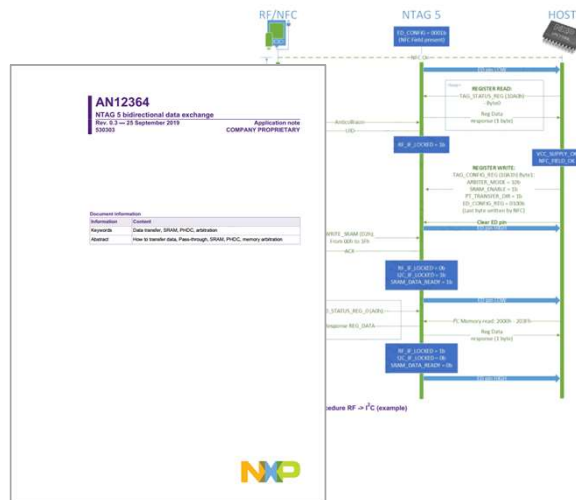
Design and development resources

Documentation

Datasheets

Complete datasheets are available through NXP docstore, providing information about the features each NTAG 5 version offers. Includes:

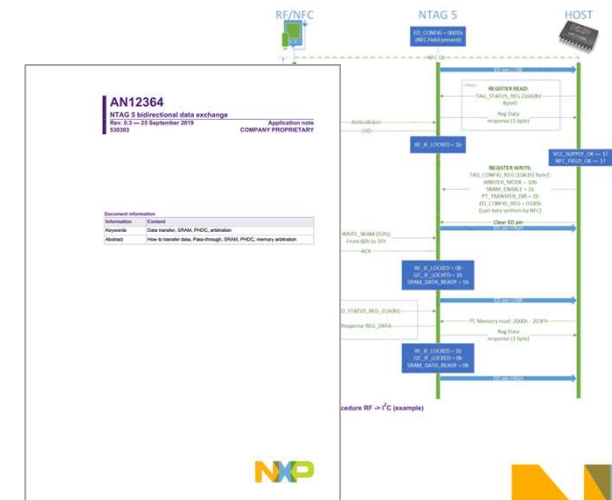
- Memory organization
- NFC Interface and supported commands
- I²C Interface and supported commands
- Block diagram



Bi-directional data exchange (AN12364)

Document describing how NTAG 5 link and boost chips can be used to exchange data between an NFC device and a device connected to the I²C interface.

- SRAM mirroring
- Interface arbitration for memory access
- Pass-through mode
- PHDC
- TNEP



Design and development resources

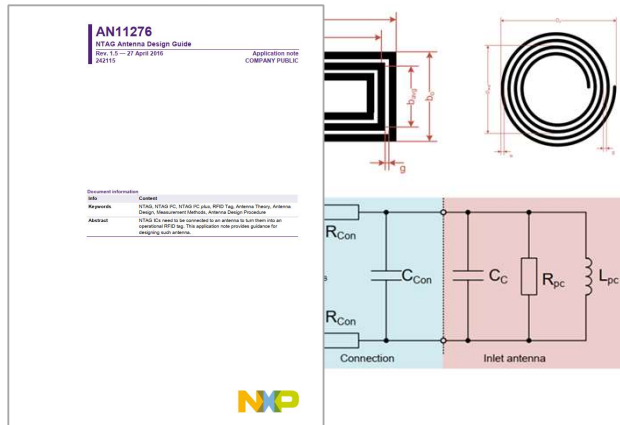
Documentation

Antenna design guides (AN12380 & AN12339)

Helps customers in the design, analysis and optimization of NFC antennas for their solutions integrating NTAG ICs.

The document describes and explains:

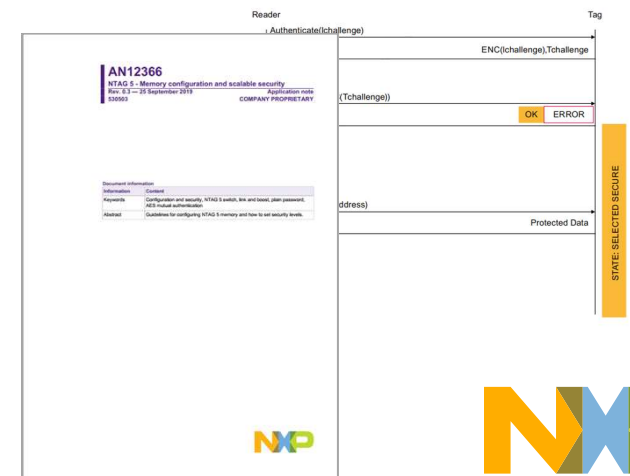
- Relevant concepts in antenna theory
- Measurement of antenna characteristics
- Procedure for antenna design
- Description of the different antenna classes



Memory configuration and scalable security (AN12366)

Describes recommended use of NTAG 5 data protection features in order to enhance security and privacy.

- Description of how to define memory areas for NFC and I²C perspectives
- Password and AES protection for memory areas
- Reprogrammable originality signature
- Examples of device security configuration for the field



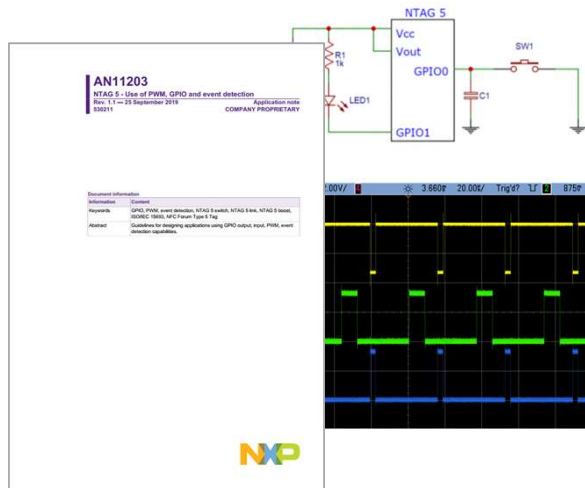
Design and development resources

Documentation

Use of PWM, GPIO and event detection (AN11203)

Description of GPIO and PWM capabilities of NTAG 5 family ICs.

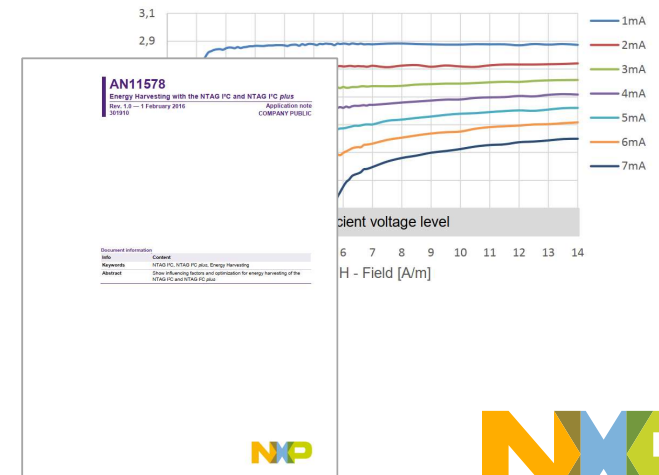
- GPIO pins configuration for input / output
- Setting up PWM signals (duty cycle, frequency...)
- Event detection pin configuration for peripheral devices notification



How to use energy harvesting (AN12365)

The document explains the energy harvesting feature and how it can be used to supply external circuits like microcontrollers with enough energy to operate.

- Influencing factors
- Recommendations for optimized efficiency
- Example energy harvesting data

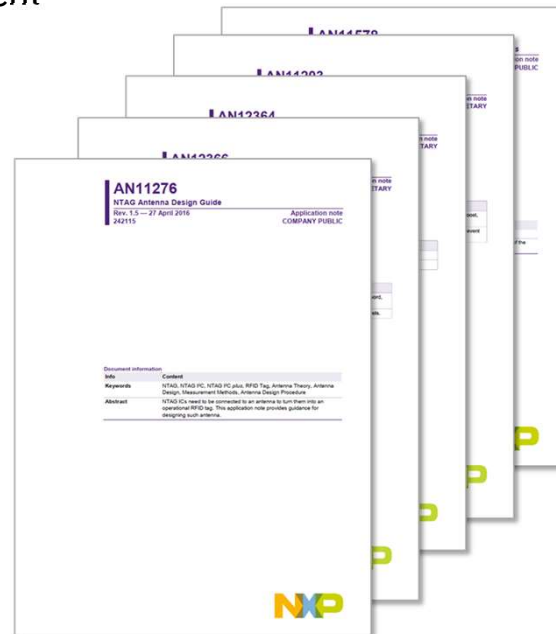


Design and development resources

Documentation

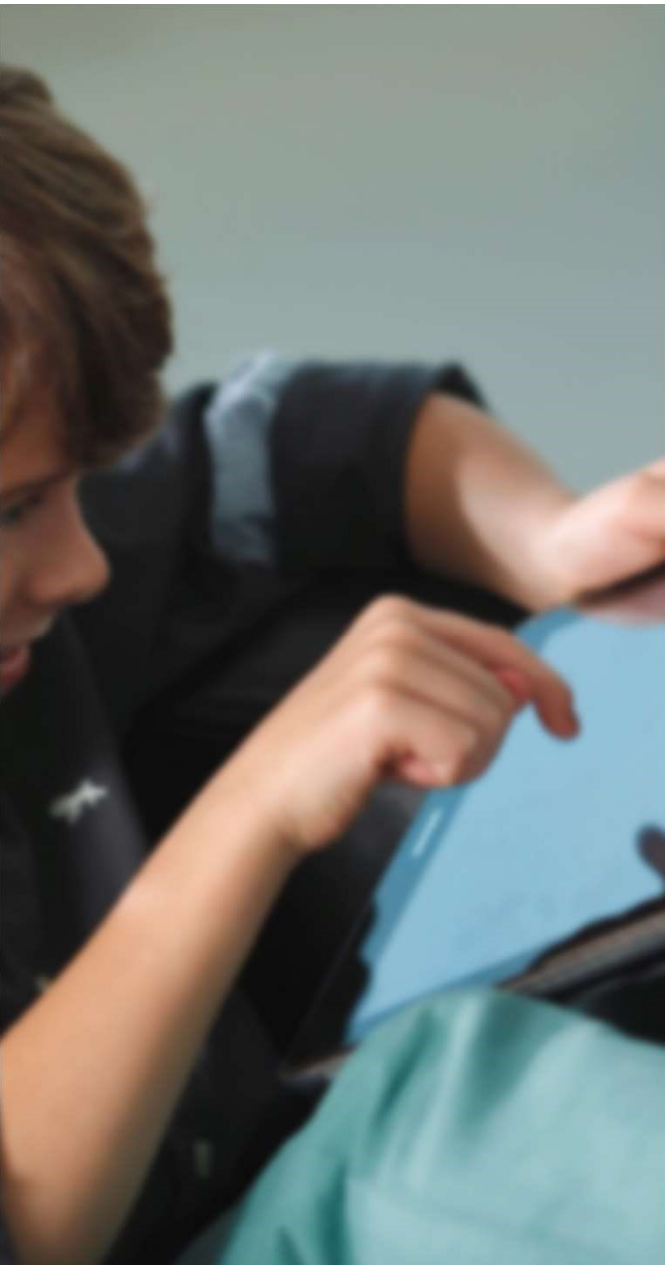
More documentation:

- AN12368 – NTAG 5 link I²C Master Mode
- AN11350 – NTAG Originality signature validation
- AN12428 – NTAG 5 design recommendations for FCC and CE certifications
- RM00221 – NTAG 5 Android application development
- RM00222 – NTAG 5 KW41Z firmware development
- Peek and Poke User manual
- NTAG 5 I²C Active with KW41Z



Other resources





Other resources

NFC Cube

The NFC Cube kit is a set of tools to demonstrate Near Field Communication (NFC) and the variety of use cases enabled by NXP's NFC solution, and the use cases offered by this standard and by NXP products.

- Support for NTAG 5 family *Latest FW available!*

For more information on how to acquire and upgrade NFC cube please visit:

<http://www.nxp.com/NFCcube>



Summary

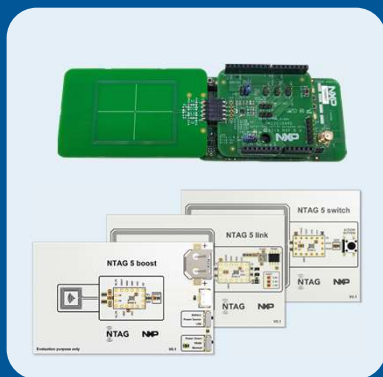


Summary

Product Support Package

Kits & demoboards

- Development kit
 - NTAG 5 Evaluation board
 - FRDM-KW41Z dev board
- NTAG 5 switch demo board
- NTAG 5 link demo board
- NTAG 5 boost demo board



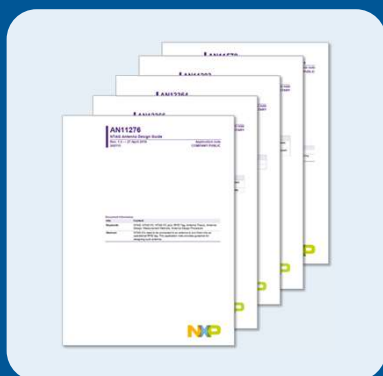
PC and mobile apps

- Peek and Poke PC application
- NTAG 5 demo apps
- NTAG 5 boards app



Documentation

- Datasheets
- Energy harvesting guide
- Bi-directional data exchange
- I2C master mode
- Antenna design guide
- ... *and more*



Others

- NFC Cube



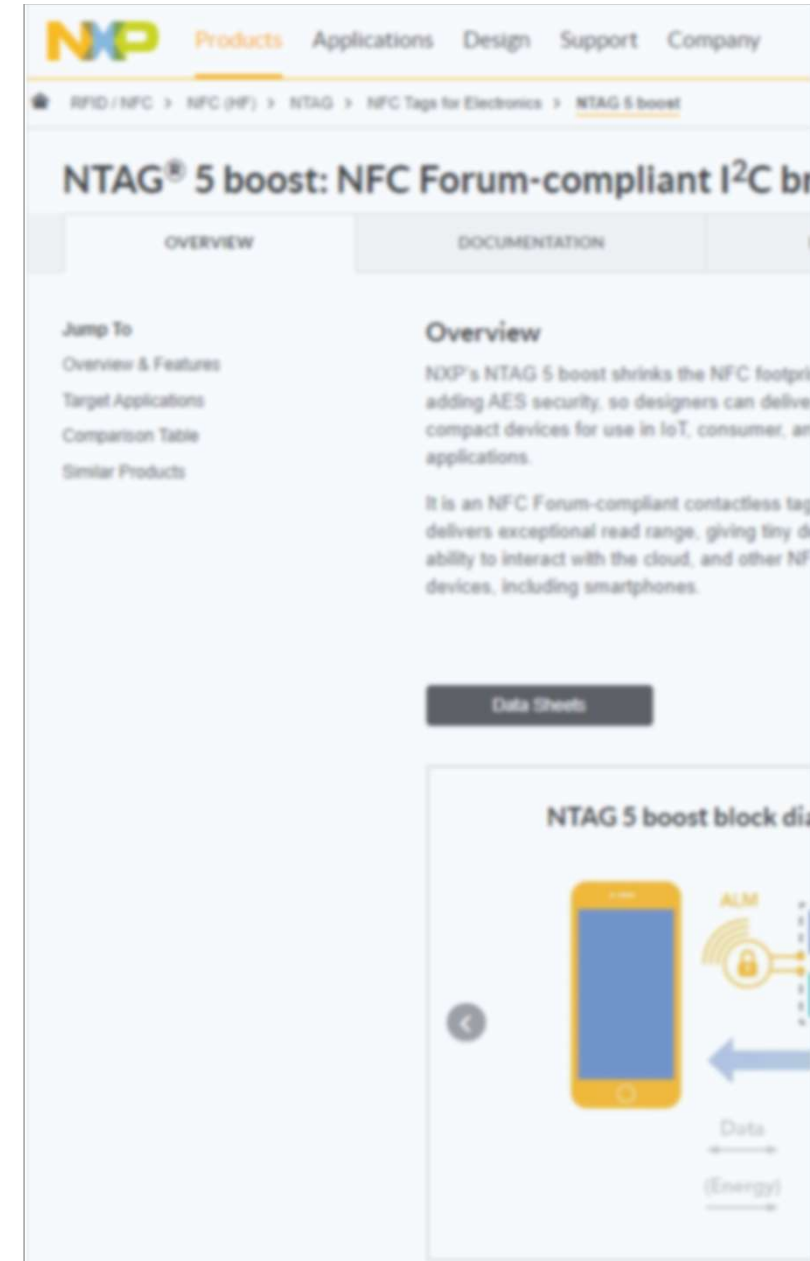
More support

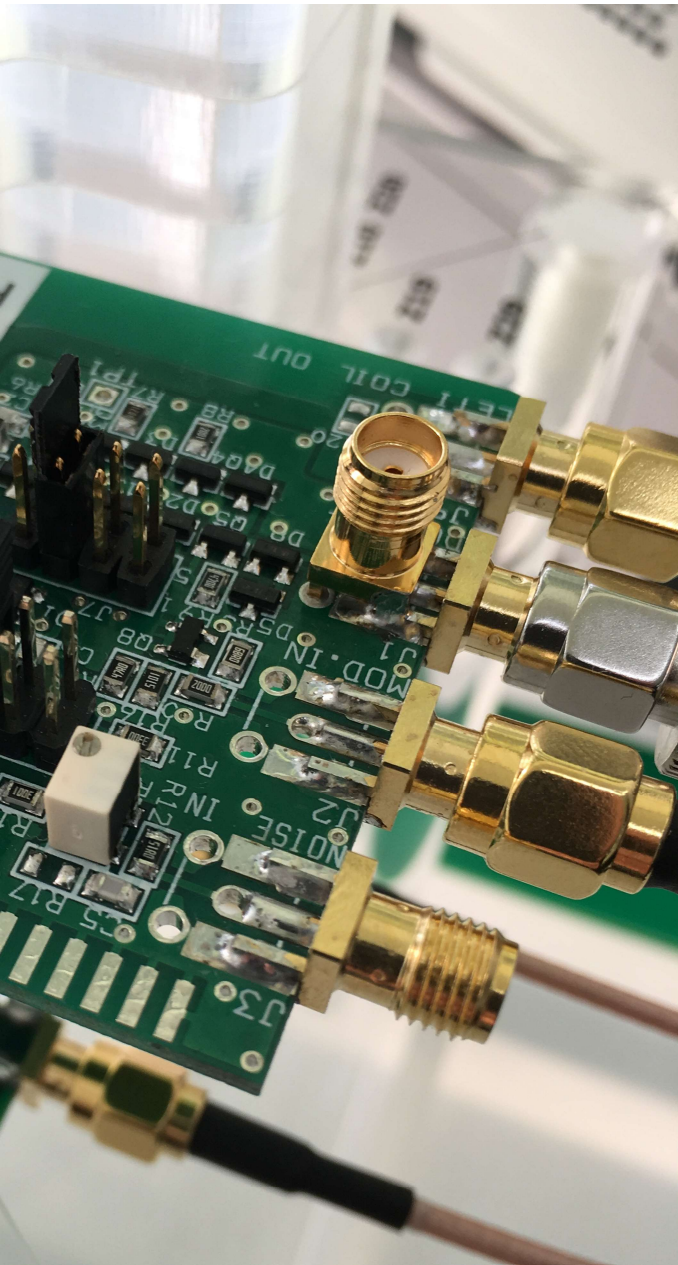


More support

Relevant resources regarding NTAG 5 family

- NTAG 5 switch website
<https://www.nxp.com/products/rfid-nfc/nfc-hf/ntag/nfc-tags-for-electronics/ntag-5-switch-nfc-forum-compliant-pwm-gpio-bridge-for-lighting-and-gaming:NTAG5-SWITCH>
- NTAG 5 link website
<https://www.nxp.com/products/rfid-nfc/nfc-hf/ntag/nfc-tags-for-electronics/ntag-5-link-nfc-forum-compliant-ic-bridge-for-iot-on-demand:NTAG5-LINK>
- NTAG 5 boost website
<https://www.nxp.com/products/rfid-nfc/nfc-hf/ntag/nfc-tags-for-electronics/ntag-5-boost-nfc-forum-compliant-ic-bridge-for-tiny-devices:NTAG5-BOOST>
- NTAG 5 development kit
<http://www.nxp.com/products/rfid-nfc/nfc-hf/ntag/ntag-5-development-kit:OM23510ARD>
- NXP Tech community
<https://www.nxp.com/support/support:SUPPORTHOME>





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- **NFC Wearable**
- **EMV L1 pre-certification support**
- **Mobile and cloud application development**
- **Secure e2e system design**

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NTAG 5 Webinar series – Product Support Package

Pablo Fuentes (Speaker)
Angela Gemio (Host)

Time for
Q & A





NTAG 5 Webinar series – Product Support Package

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