



Why NFC presents the answer to the IoT miniaturization wave

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NFC INFRASTRUCTURE & CONSUMER



PUBLIC



SECURE CONNECTIONS
FOR A SMARTER WORLD

NTAG 5 family introduction

- **What is new?**

- NXP has introduced the latest NTAG 5 family which is an extension to the Connected Tags product portfolio.
- They are based on NFC Forum Type 5 ISO15693 specifications.
- NTAG 5 family consists of 3 variants:
 - NTAG 5 switch
 - NTAG 5 link
 - NTAG 5 boost

- **How is it different from NTAG I²C *plus*?**

- NTAG I²C *plus* is based on ISO/IEC 14443 – NFC Forum Type 2 Tag and NTAG 5 family is based on ISO/IEC 15693 NFC Forum Type 5 Tag
- NTAG 5 family products are targeted to provide a better and more reliable read range with extended features like
 - General purpose I/O
 - Pulse Width Modulation
 - I²C master
 - AES mutual authentication
 - Active Load modulation

Use Cases



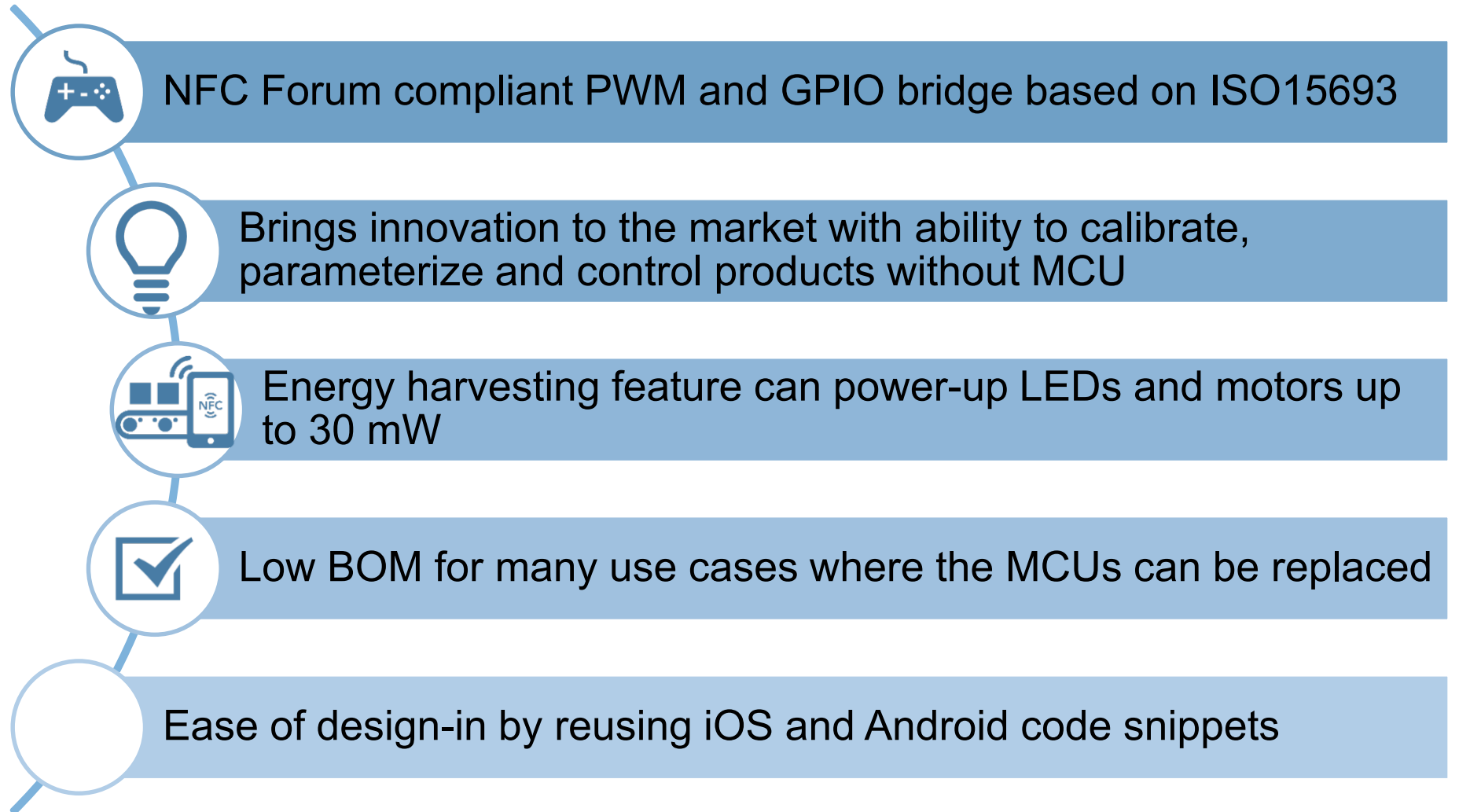
NXP NFC tags for electronics

Feature	NTAG 21xF	NTAG 1°C plus	NTAG 5 switch	NTAG 5 link	NTAG 5 boost
NFC interface	ISO/IEC14443	ISO/IEC14443	ISO/IEC15693	ISO/IEC15693	ISO/IEC15693
Max. interface speed - NFC/I ² C	106 kbps/-	106 kbps/400 kHz	53 kbps/-	53 kbps/400 kHz	53 kbps/400 kHz
Memory size	144 or 888 bytes	888 or 1912 bytes 64 bytes SRAM	512 bytes	2048 bytes 256 bytes SRAM	2048 bytes 256 bytes SRAM
Memory protection from NFC perspective	Read only locking and 32-bit PWD	Read only locking and 32-bit PWD	Read only locking and 32- or 64-bit PWD	Read only locking and 32- or 64-bit PWD	Read only locking and 32- or 64-bit PWD or AES mutual auth.
Memory protection from connected host	-	Restrict access to NFC password protected area	-	32-bit PWD	32-bit PWD
Memory areas	2	2	3	3	3
Originality Signature	fixed	fixed	re-programmable	re-programmable	re-programmable
GPO/Event detection	only NFC field	NFC field and interface arbitration	yes	yes	yes
Energy harvesting	-	yes up to 15 mW	regulated up to 30 mW	regulated up to 30 mW	when used as passive regulated up to 30 mW
GPIO + PWM	-	-	yes	yes	yes
I ² C interface	-	slave	-	slave / master	slave / master
Pass-through	-	proprietary	-	proprietary and standardized	proprietary and standardized
stand-by and hard-power-down	-	-	6µA/0.25µA	6µA/0.25µA	10µA/0.25µA
Active load modulation	-	-	-	-	yes, when V _{CC} supplied
Temperature range	-25°C to +70°C	-40°C to +105°C	-40°C to +85°C	-40°C to +85°C	-40°C to +85°C

NTAG 5 SWITCH



NTAG 5 switch – USPs



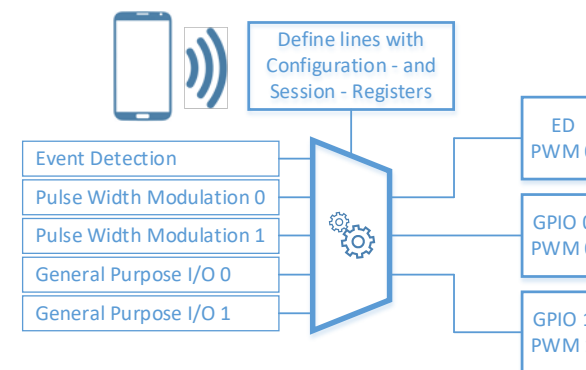
NTAG 5 switch – Technical product features

Main features

NFC Interface	NFC Forum Type 5 Tag compliant ISO/IEC 15693 compliant up to 53 kbps
Memory	512 byte user memory
Wired Interface	Pulse Width Modulation GPIO Event detection
Energy Harvesting	Configurable output 1.8 V, 2.4 V or 3 V with up to 30 mW output power
Security	32-bit or 64-bit password protection 3 configurable user memory areas ECC based reprogrammable originality signature
Temperature range	-40°C to +85°C

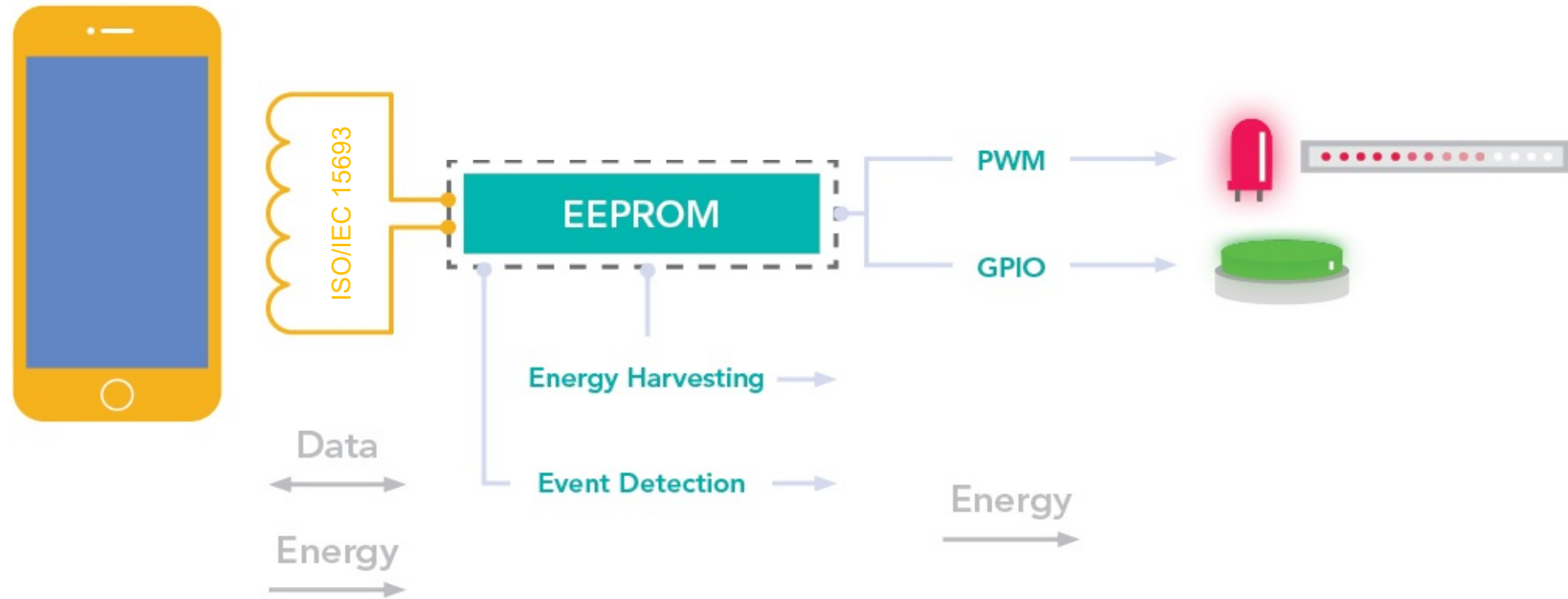
Wired Interface Details

Total number of lines	2 in/out (push/pull) 1 out (open drain) 1 Hard Power Down
Maximum number of GPIO's	2
Maximum number of PWM output	2
Event detection pin (e.g. field detection)	1



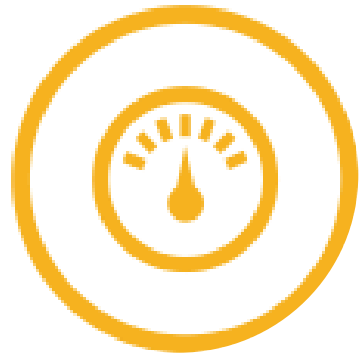
Product Type ID	12NC	Package	Dimensions	Packing	MOQ
NTP52101G0JT	9353 549 01431	SO8	3.6 x 6.2 x 1.35 mm (wave soldering compatible)	Reel 13"	2500
NTP52101G0JTT	9353 624 09431	TSSOP16	4.4 x 5.0 x 1.1 mm (wave soldering compatible)	Reel 13"	2500
NTP52101G0JHK	9353 547 31471	XQFN16	1.8 x 2.6 x 0.5 mm	Reel 7"	4000
NTP52101G0JUA	9353 859 92005	FFC	Bare die on wafer	Wafer	1

NTAG 5 switch: Schematics





Use Cases – Device Calibration



Parameterize devices using GPIO and PWM during and after production



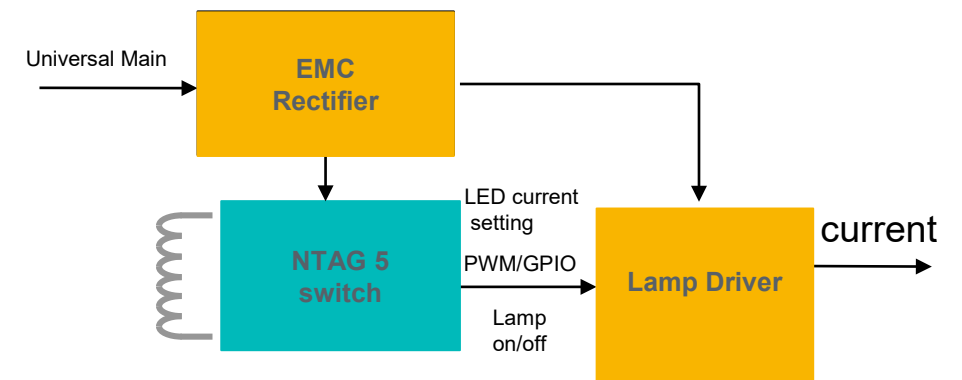
Calibrate the reference current without an MCU on production line



Verify authenticity of the device through the value chain

Relevant feature

- PWM to configure LED current
- GPIO to enable/disable LED
- Originality check of the product by reprogrammable ECC signature





Use Cases – Controlling LEDs and Motors



Control and dim LEDs



Control motor speeds e.g. gaming applications



Verify authenticity of the device

Relevant feature

- PWM to control LED brightness via smartphone
- PWM to control motor speed via smartphone
- GPIO to enable/disable LEDs via smart phone
- Originality check of the product by reprogrammable ECC signature



Gaming

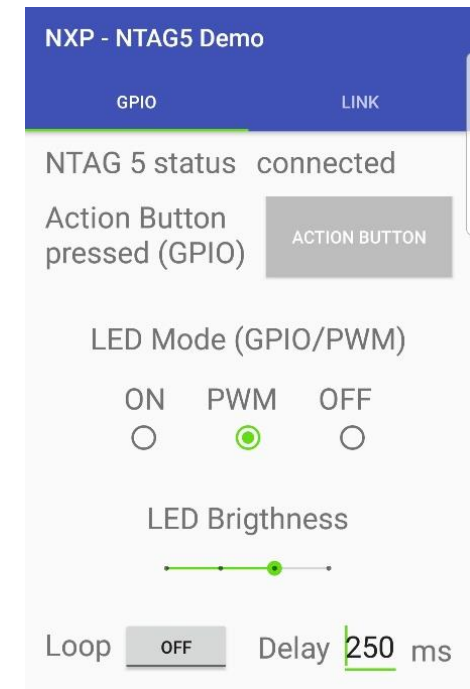
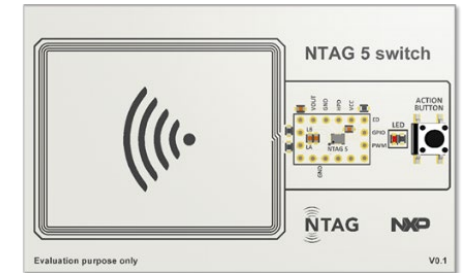


Lighting

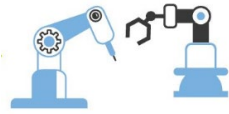
NTAG 5 switch demo board



- The demo board is a tool to demonstrate all the new features that our product offers.
- It can be ordered from NXP e-commerce, together with the demo board for NTAG 5 link and NTAG 5 boost.
- Demo can be operated with NTAG 5 demo app which is available for both android and iOS.
- Following demos can be seen with the apps:
 - Reading of GPIO-Status (Button pressed)
 - Changing the LED intensity with the slide
- As same use cases are implemented on the customer development board, schematics/SW shall be used from NTAG 5 development kit which are available for our customers.



NTAG 5 Development Kit



- This kit enables developers to do an easy and quick evaluation and development environment for NTAG 5 switch enabled applications. It is compatible with a FRDM-KW41Z development board and the software is provided by NXP. The following documentation is available for the use together with the kit:

Application Notes

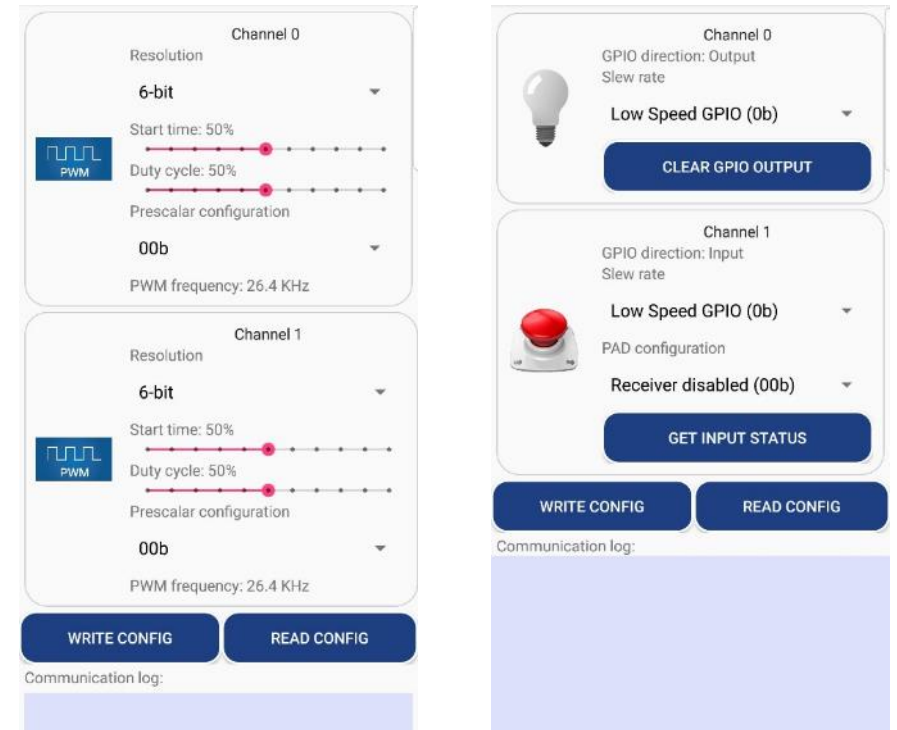
- Use of PWM and GPIO's, Event detection
- Memory Configuration
- How to customize the Originality Signature
- How to use energy harvesting
- Antenna Design Guide and Schematics

Software

- “RFID Discover” as a PC GUI
- Android and iOS application for interfacing with the demo board
- Code examples to configure PWM/GPIO and energy harvesting can be used from the NTAG 5 Development Kit

Training

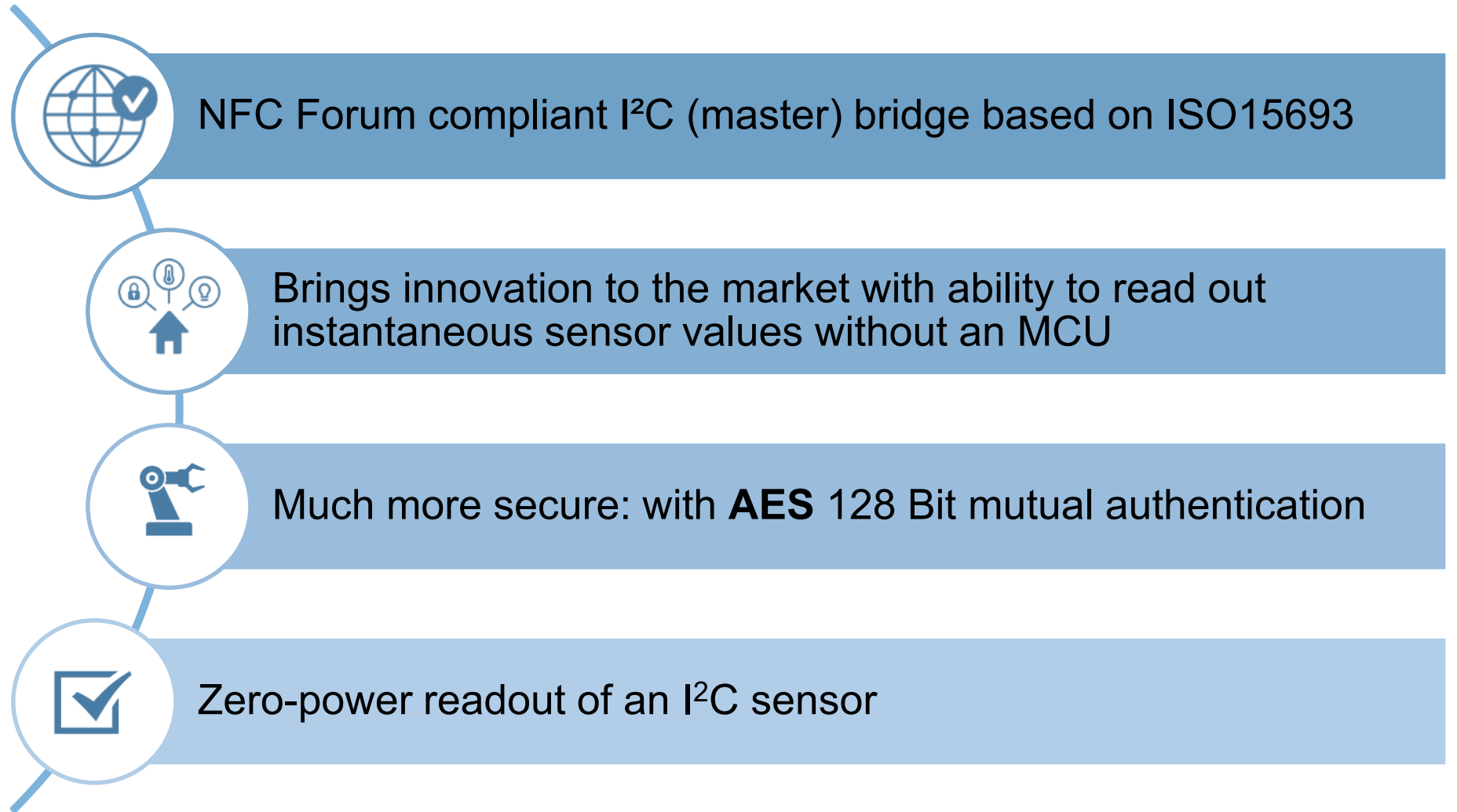
- Technical trainings with hands-on sessions



NTAG 5 LINK



NTAG 5 link - USPs



NTAG 5 link – Technical product features

Main features

NFC Interface	ISO/IEC 15693 compliant, up to 60 cm read range NFC Forum Type 5 Tag compliant
Memory	2048 byte user memory 256 byte SRAM
Wired Interface	I ² C slave (up to 400 kHz) or I ² C transparent master channel or Pulse Width Modulation/GPIO Event detection or PWM output Stand-by current < 6 μA @ RT Hard power down current < 0.25 μA @ RT
Energy Harvesting	Configurable output 1.8 V, 2.4 V or 3 V with up to 30 mW output power
Security	AES 128 bit mutual authentication or 32-bit or 64-bit password protection from NFC perspective 32-bit password from I ² C perspective 3 configurable user memory areas ECC based reprogrammable originality signature NFC and I ² C slience
Temperature range	-40°C to +85°C

Wired Interface Details

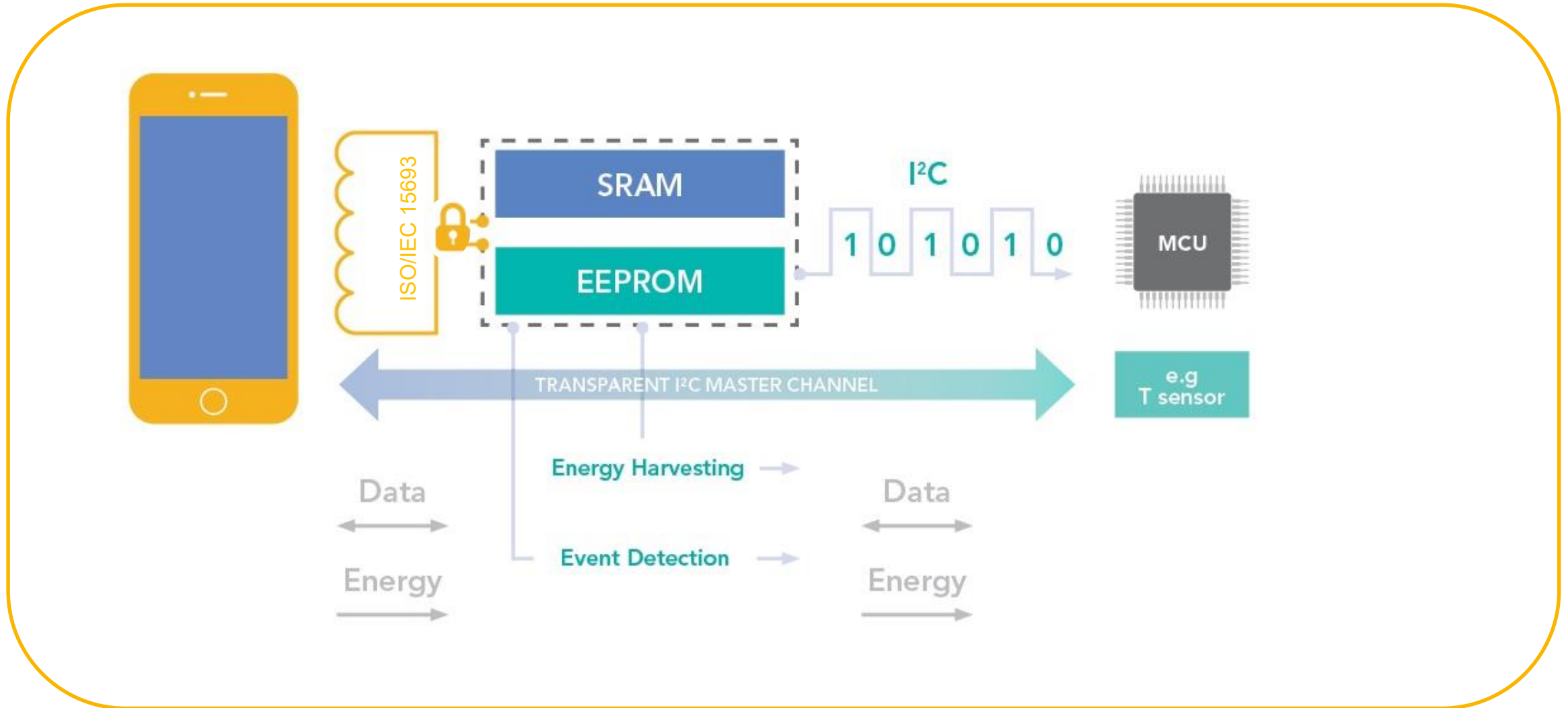
GPIO / PWM	I ² C lines maybe used as GPIO's or PWM lines
Event Detection	Multiple events can be used as trigger to the host, or use ED pin as PWM channel in parallel to I ² C
Transparent I ² C master channel	Attach and power any I ² C slave like sensor or external memory without MCU
I ² C slave	Standardized passthrough synchronization in addition to procedure from NTAG I ² C <i>Plus</i> passthrough mode

Product Type ID	12NC	Package	Dimensions	Packing	MOQ
NTP53121G0JUA*	9353 582 08005	FFC	Bare die on wafer	Wafer	Tbd
NTP53321G0JUA	9353 582 09005				
NTP53121G0JT*	9353 549 05431	SO8	3.6 x 6.2 x 1.35 mm No energy harv. hard power down	Reel 13"	2500
NTP53321G0JT	9353 549 11431				
NTP53121G0JTT*	9353 624 11431	TSSOP16	4.4 x 5.0 x 1.1 mm	Reel 13"	2500
NTP53321G0JTT	9353 624 96431				
NTP53121G0JHK*	9353 549 03115	XQFN16	1.8 x 2.6 x 0.5 mm	Reel 7"	4000
NTP53321G0JHK	9353 549 09471				

*no AES mutual authentication or I²C master available



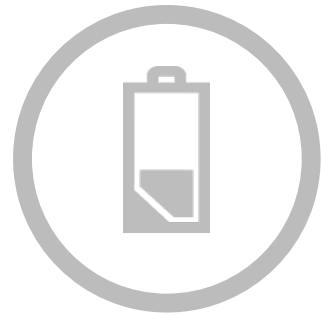
NTAG 5 link: Schematics



Use Cases – Secure Sensor Connection



Read out sensor information in a without an MCU



Draw power from the NFC reader to supply sensors



Secure sensor interaction

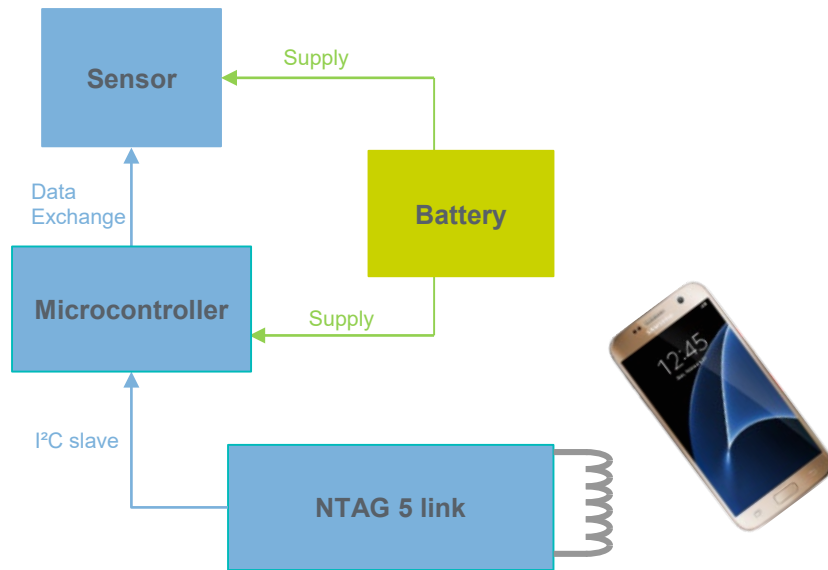


Verify authenticity of the device

Relevant feature

- I²C master interface
- Energy harvesting
- NFC Forum Tag 5 Type tag
- AES mutual authentication
- Originality check of the product by reprogrammable ECC signature

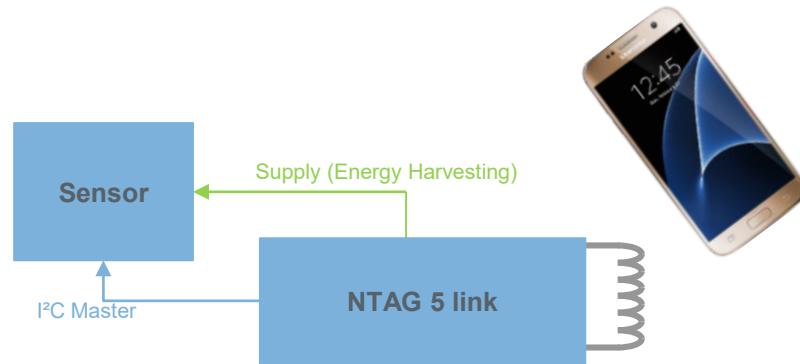
Constant monitoring of sensors



Benefits

- Device can be fully sealed
NFC communication possible through plastic, glass, wood, ...
- Save front-panel space
- Together with consumer mobile phone cost efficient IoT solution

Ad hoc read out of sensors



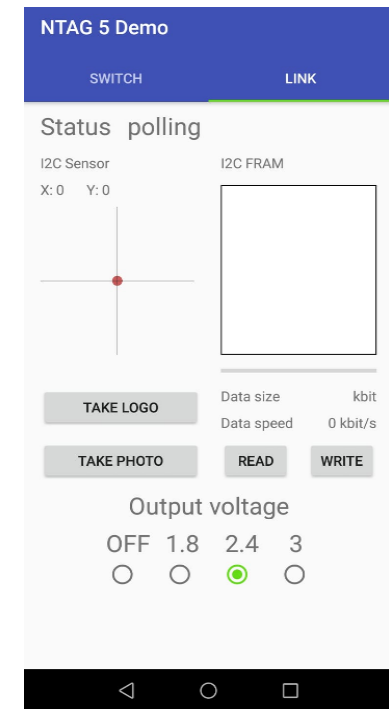
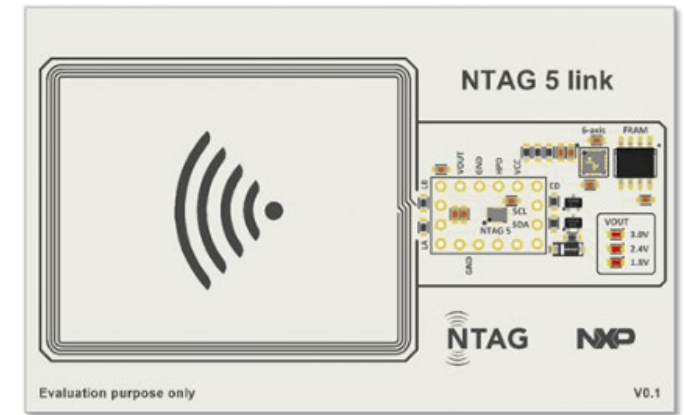
Benefits

- Overall BOM reduction:
 - **No Battery** needed
 - **No MCU** needed
data preparation in app or cloud
- Device can be fully sealed
NFC communication possible through plastic, glass, wood, ...
- Save front-panel space
- Especially for devices where power is an issue

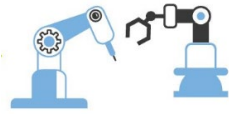
NTAG 5 link demo board



- The demo board is a tool to demonstrate all the new features that our product offers.
- It can be ordered from NXP e-commerce, together with the demo board for NTAG 5 switch and NTAG 5 boost.
- Demo can be operated with NTAG 5 demo app which is available for both Android and iOS.
- Following demos can be seen with the apps:
 - 6 axis Sensor read out using I²C master channel and visualized through a spirit level
 - External memory can be written from NFC without MCU with the logo or a photo
 - Configurable energy harvesting is shown with three indicators
- As same use cases are implemented on the customer development board, schematics/SW shall be used from NTAG 5 development kit which are available for our customers.



NTAG 5 Development Kit



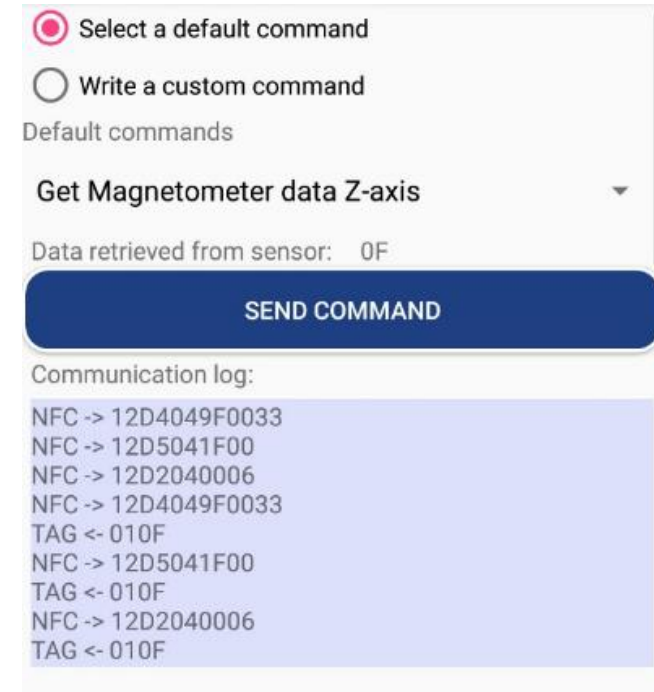
- This kit enables developers to do an easy and quick evaluation and development environment for NTAG 5 link enabled applications. It is compatible with a FRDM-KW41Z development board and the software is provided by NXP. The following documentation is available for the use together with the kit:

Application Notes

- Use of PWM and GPIO's, Event detection
- Transfer of Data, SRAM configuration, standardized pass-through, arbitration
- Memory Configuration and Scalable Security
- I2C Master Interface Handling
- How to customize the Originality Signature
- How to use energy harvesting
- Customer Development Board Schematic & Reference Design
- Customer Development board Quick-startup guide

Software

- "RFID Discover" as a PC GUI
- Android Application for interfacing with the demo board
- Code examples to configure PWM/GPIO and Energy Harvesting can be used from the NTAG 5 Development Kit

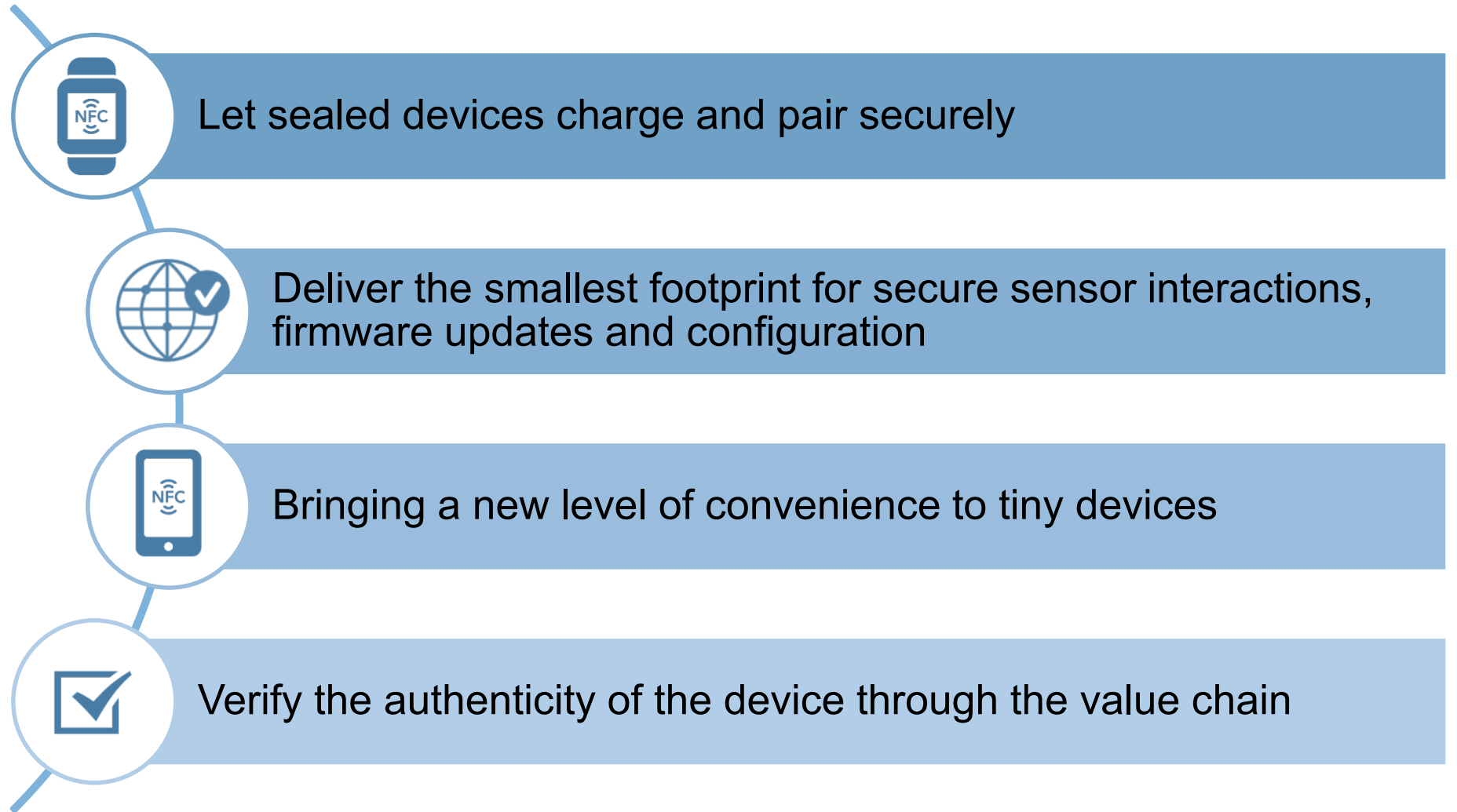


NTAG 5 BOOST





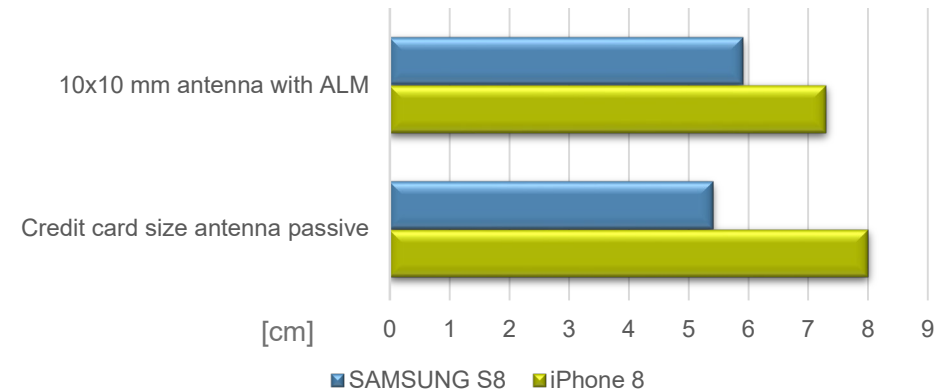
NTAG 5 boost - USPs



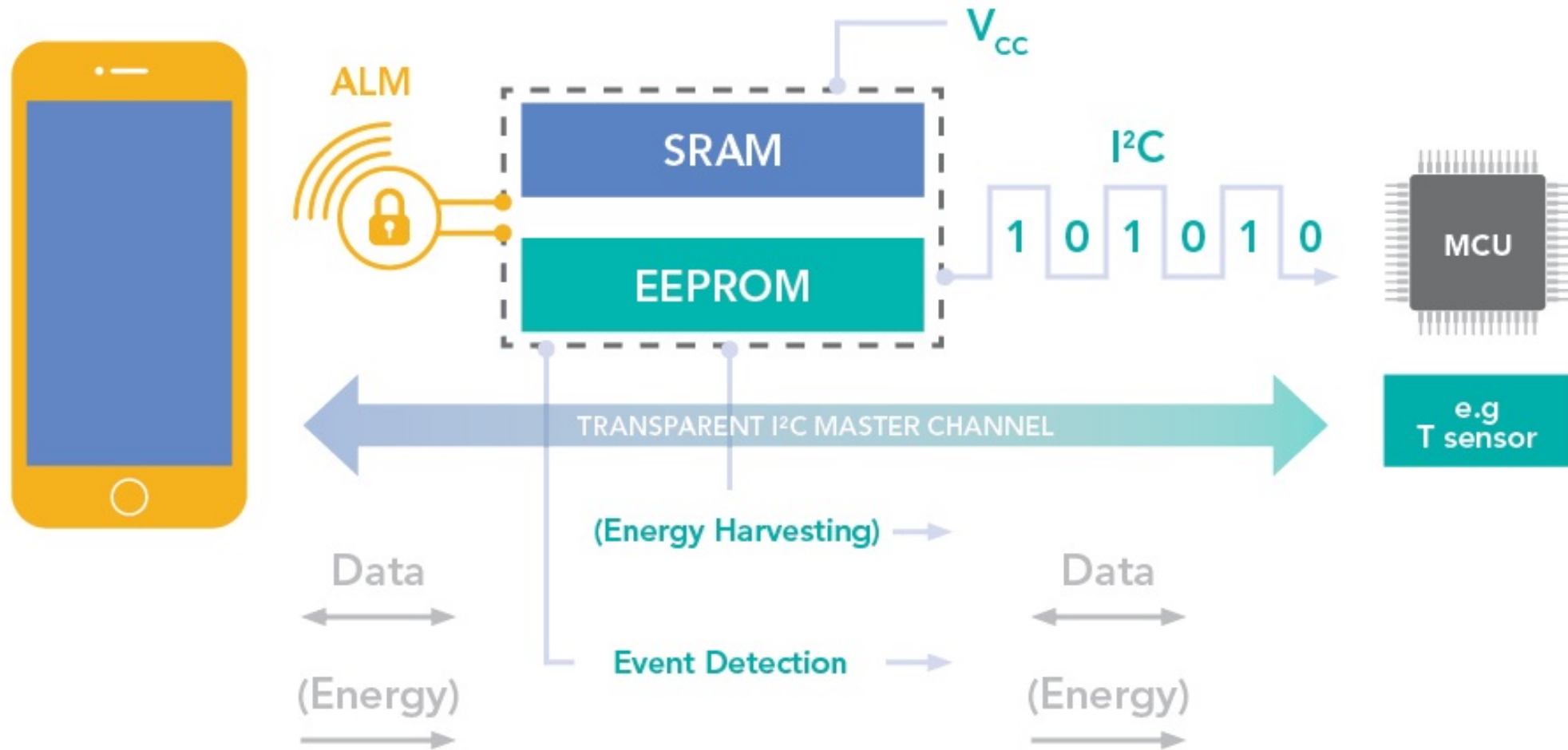
NTAG 5 boost – Technical product features

Main features	
RF Interface & protocols	NFC Forum Type 5 Tag Active Load Modulation for extra range and tiny antenna footprint
Memory	2048 Bytes user memory 256 byte SRAM
Wired Interface	I ² C slave (up to 400 kHz) or I ² C transparent master channel or Pulse Width Modulation/GPIO Event detection or PWM output Stand-by current < 10 μA @ RT Hard power down current < 0.25 μA @ RT 1.62 V to 5.5 V supply
Security	AES 128 bit mutual authentication or 32-bit or 64-bit password protection from NFC perspective 32-bit password from I ² C perspective 3 configurable user memory areas ECC based reprogrammable originality signature NFC and I ² C silence
Temperature range	-40°C to +85°C

Product Type	12NC	Package	Dimensions	Packing	MOQ
NTA53321G0FUA	9353 582 84005	FFC	Bare die on wafer	Wafer on FFC	Tbd
NTA53321G0FTT	9353 625 04431	TSSOP16	4.4 x 5.0 x 1.1 mm	Reel 13"	2500
NTA53321G0FHK	9353 549 13115	XQFN16	1.8 x 2.6 x 0.5 mm	Reel 7"	4000



NTAG 5 boost – NFC Forum compliant tag for tiny devices



Use Cases – Internet of Things



Smallest footprint antenna with same read range as standard payment card



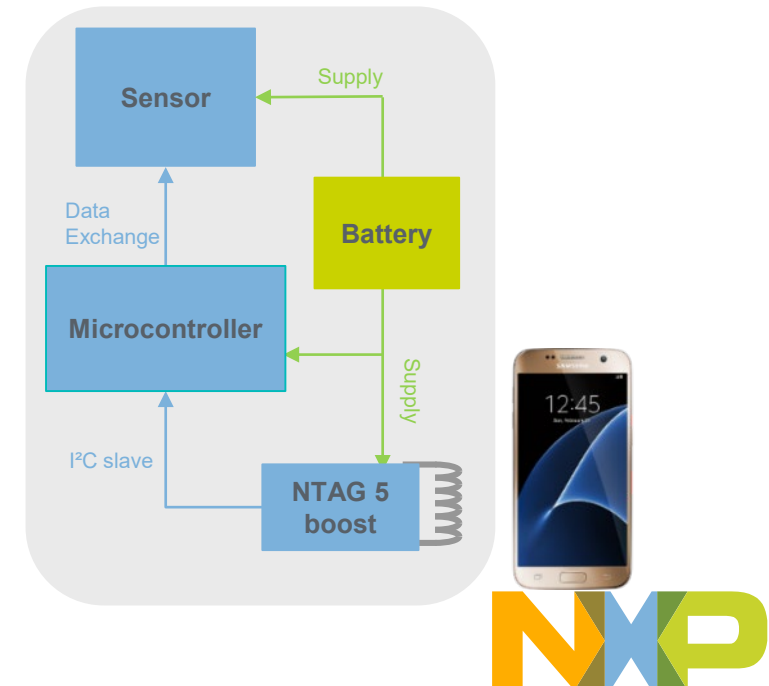
Read out sensor information without a MCU



Verify authenticity of the device

Relevant feature

- Active Load Modulation
- I²C master interface
- NFC Forum Tag 5 Type tag
- Adjustable security levels up to mutual AES authentication
- Originality check of the product by reprogrammable ECC signature



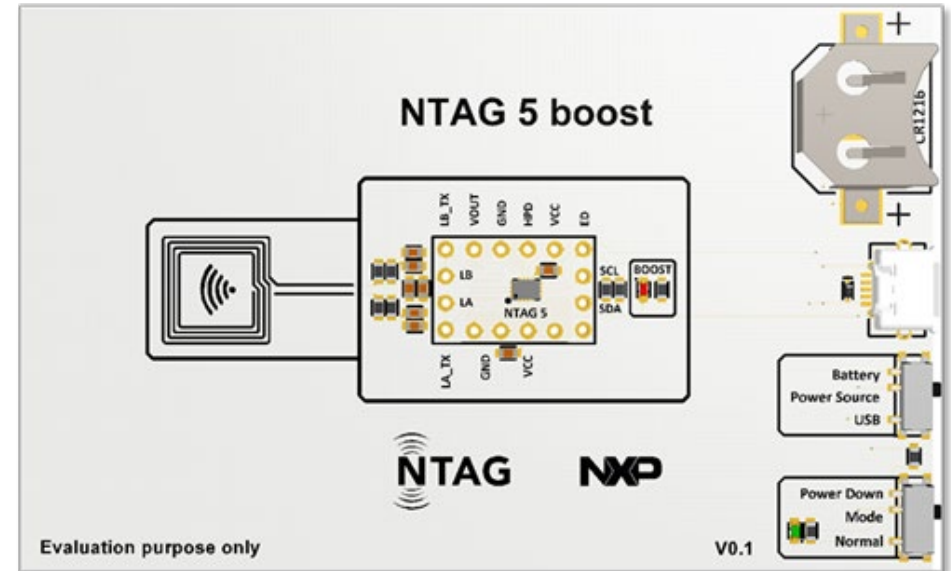


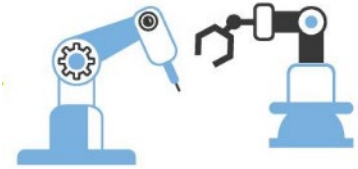
NTAG 5 boost Demoboard

The demoboard is a tool to demonstrate all the new features and as such seen as a sales tool. It can be only ordered together within the NTAG 5 Demoboards suite, together with the demoboard for NTAG 5 switch and NTAG 5 link.

The demoboard comes with a compact yet **highly reliable antenna of 1x1 cm** and shows extraordinary read range.

The read range can be experienced with a NFC enabled mobile phone using Tag Info (Android and iOS) or a standard NFC reader. It makes sense to experience the read range difference when powered (battery plugged in or powered through USB, it automatically uses the power for ALM) or unpowered (normal passive behaviour).





NTAG 5 Development Kit

This kit enables developers an easy and quick evaluation and development environment for NTAG 5 enabled applications and comes together with a FRDM-KW41Z. The following documentation is generated for the use together with the kit:

Application Notes and Software Examples

Application Notes:

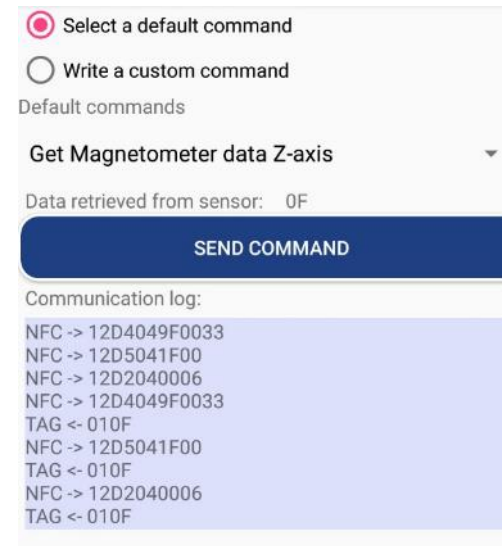
- Use of PWM and GPIO's, Event detection
- Transfer of Data, SRAM configuration, standardized pass-through, arbitration
- Memory Configuration and Scalable Security
- I2C Master Interface Handling
- How to customize the Originality Signature
- How to use energy harvesting
- Customer Development Board Schematic & Reference Design
- Customer Development board Quick-startup guide

Software:

- RFID discover as a PC GUI
- Android Application for interfacing with the demo board
- Several software examples running on KW41 and customer development board

Training

Technical trainings with hands-on sessions



NTAG 5 boost

The NFC performance enhancer

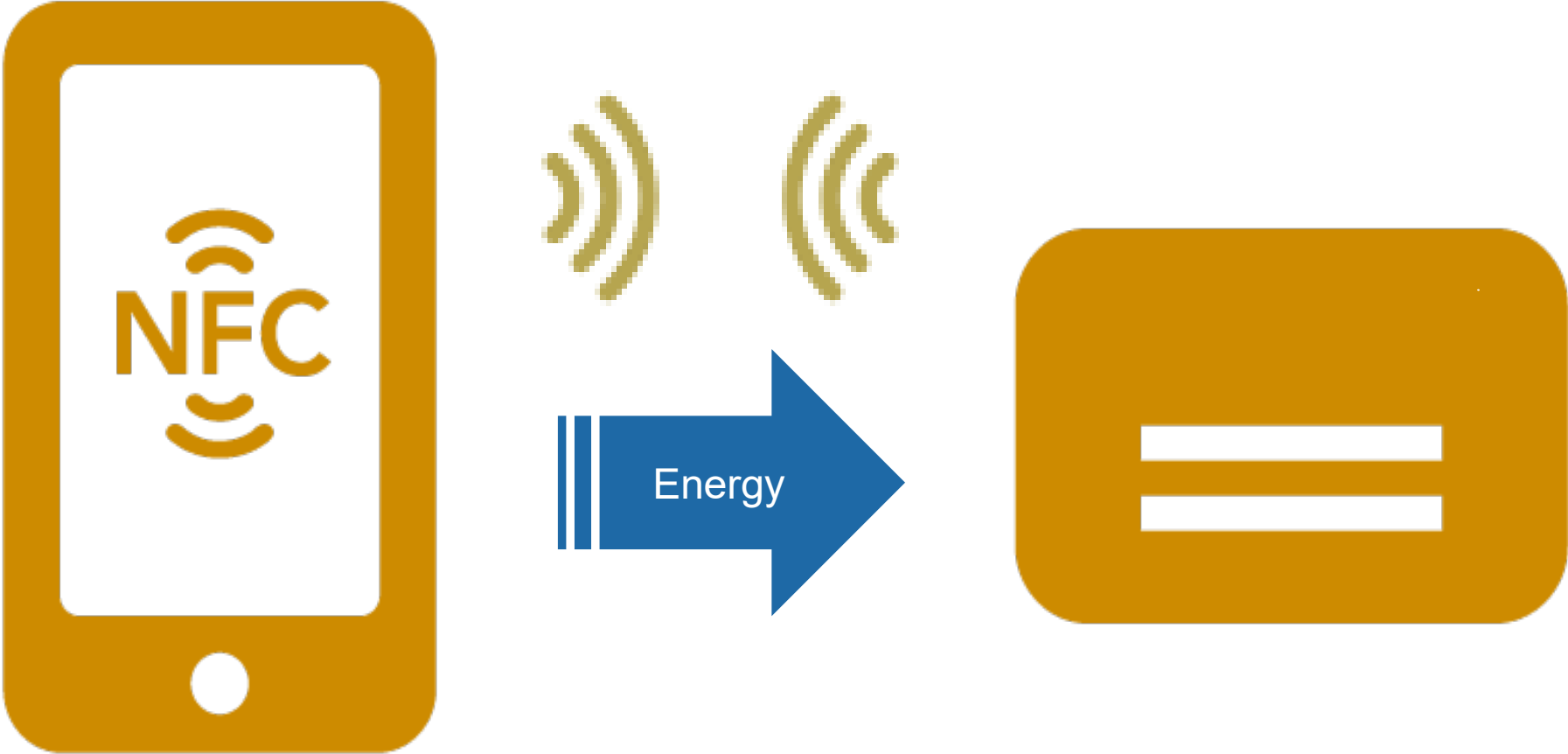


NTAG 5 brings NFC to tiny devices

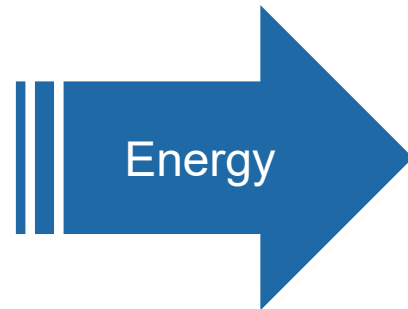
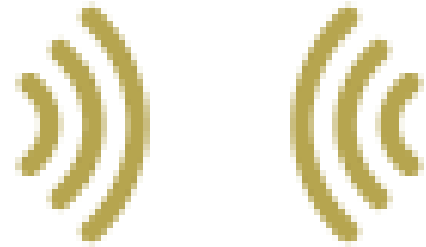
Active Load Modulation enables **same read range**
with an **antenna 40 times smaller**



NFC read range vs. antenna sizes



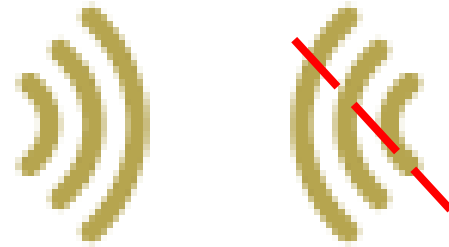
NFC read range vs. antenna sizes



 Read range is roughly the diameter of the card's antenna

Rule of thumb

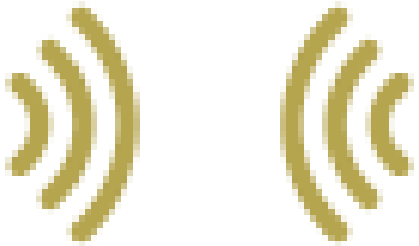
NFC read range vs. antenna sizes



The small antenna cannot drive enough energy to sufficiently back-modulate to the reader.



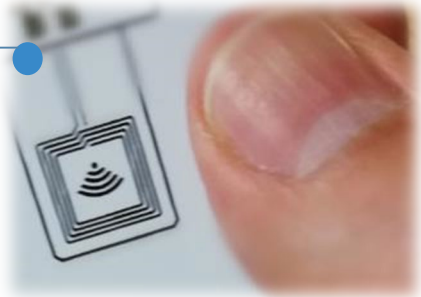
Active Load Modulation enabling NFC for tiny devices



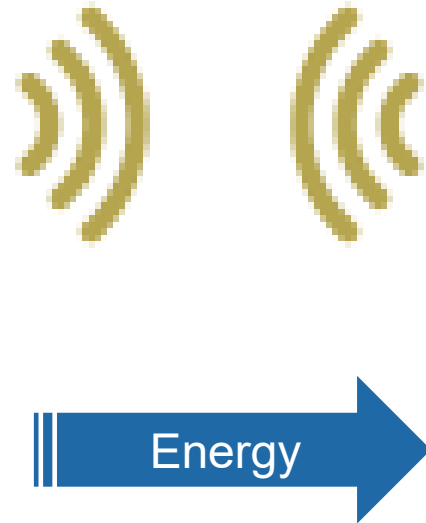
Powered through an external supply, active load modulation of the device is actively driving the modulation back to the reader.



V_{CC}

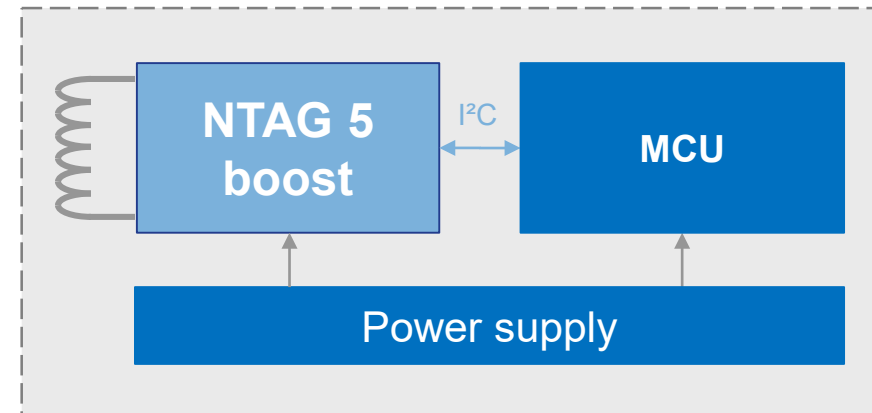


Active Load Modulation enabling NFC for tiny devices



Devices with small antenna:

- Hearables
- Wearables
- Small consumer electronics
- Industrial devices with narrow pitch
- **Any device** with limitations in **PCB size** or **front-panel space**

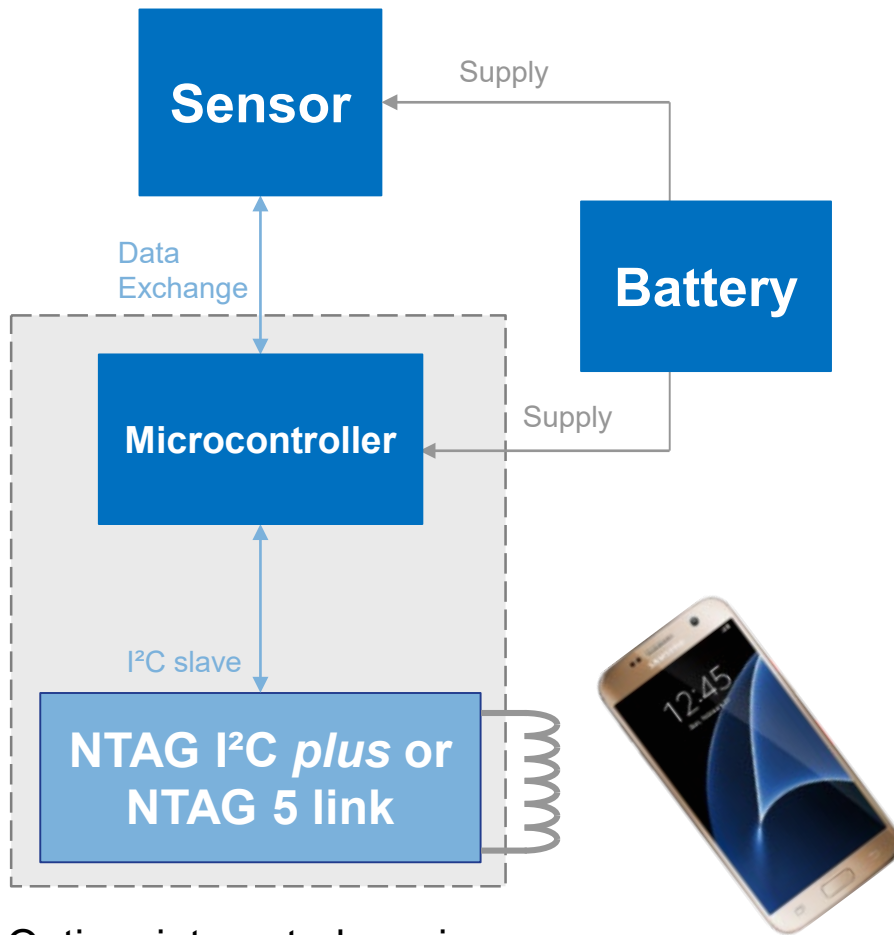


NTAG 5 brings NFC to MCU-less devices

I²C master mode enables controlling any I²C peripheral via NFC



Constant monitoring of sensors requires an MCU

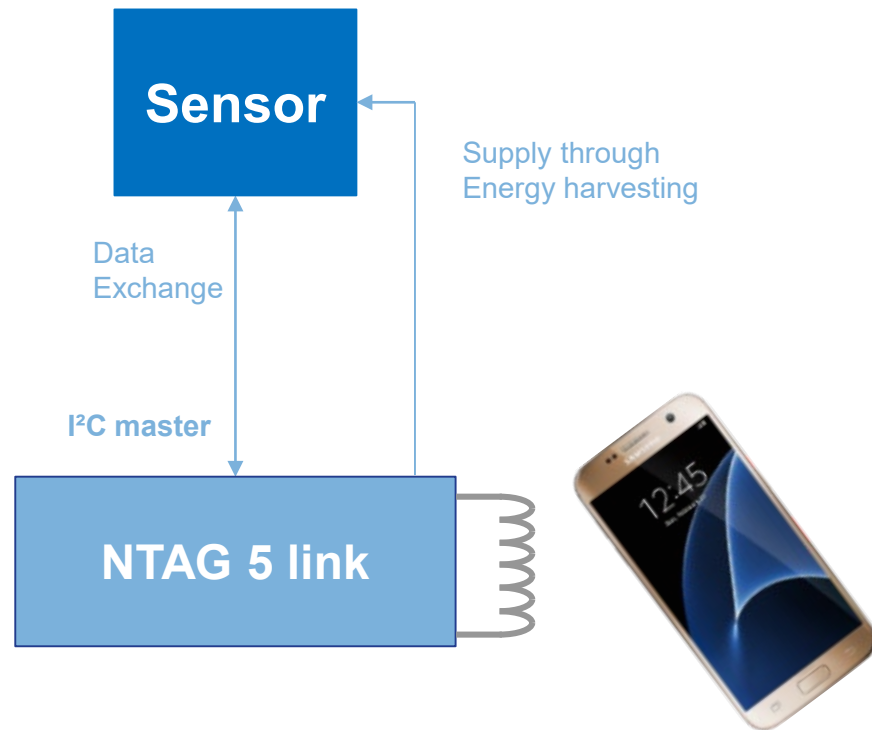


NFC Benefits

- Device can be fully sealed
NFC communication possible through plastic, glass, wood, ...
- Passive reading – no battery consumption
- Together with consumer mobile phone: cost efficient IoT solution

Option: integrated versions
LPC8N04 or NHS31xx

IoT on demand: direct NFC → I²C bridge



Benefits

- Overall BOM reduction:
 - **No Battery** needed
 - **No MCU** needed
 - data preparation in app or cloud
- Especially for devices where power is an issue
- Reading/writing to any I²C peripheral even when MCU is broken or non responsive



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FOR A SMARTER WORLD**