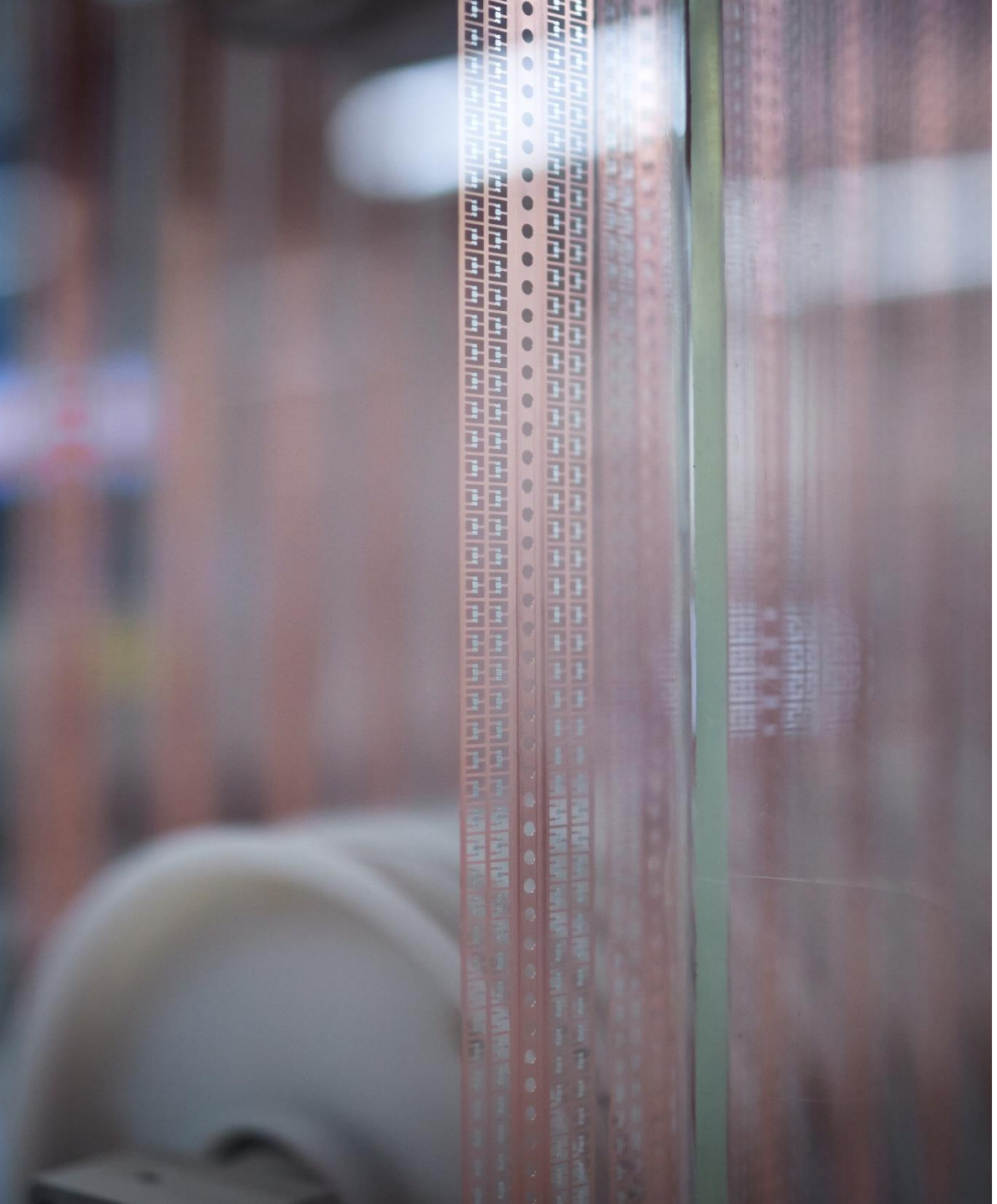
LEARN ALL ABOUT NFC

SESSION 3: NFC PRODUCT PORTFOLIO

JORDI JOFRE
NFC EVERYWHERE
MARCH 2018

SECURE CONNECTIONS
FOR A SMARTER WORLD



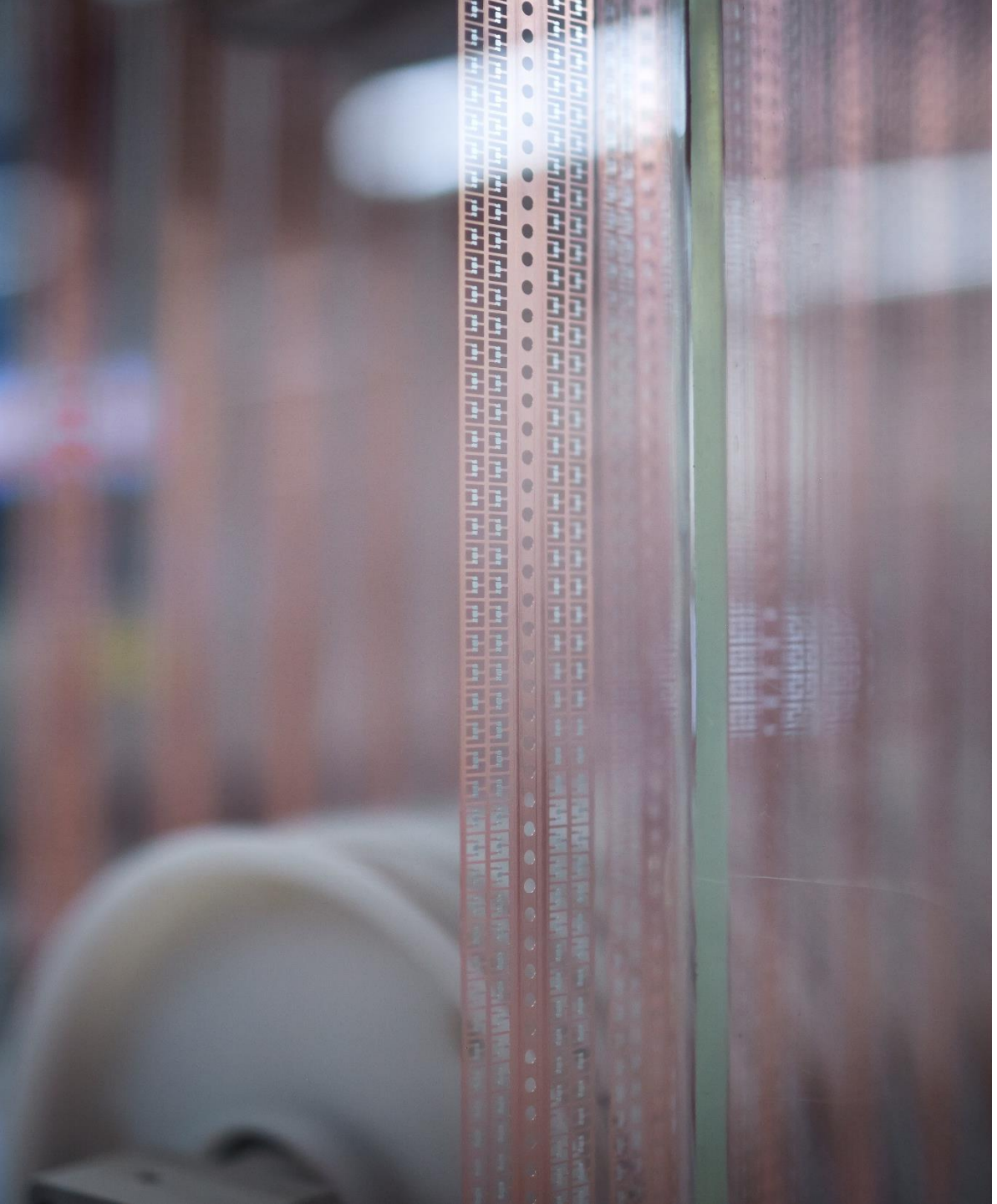
Learn all about NFC

Session I, 15th March
NFC applications and use cases
https://attendee.gotowebinar.com/rt/1059402932312036099

Session II, 22th March
NFC essentials
https://attendee.gotowebinar.com/rt/6461366231742998273

Session III, 28th March
NFC product portfolio
https://attendee.gotowebinar.com/rt/8452313508808186113

Session IV, 12th April
Product support package for NFC Readers and NFC Connected Tags
https://attendee.gotowebinar.com/rt/3965453945970616321



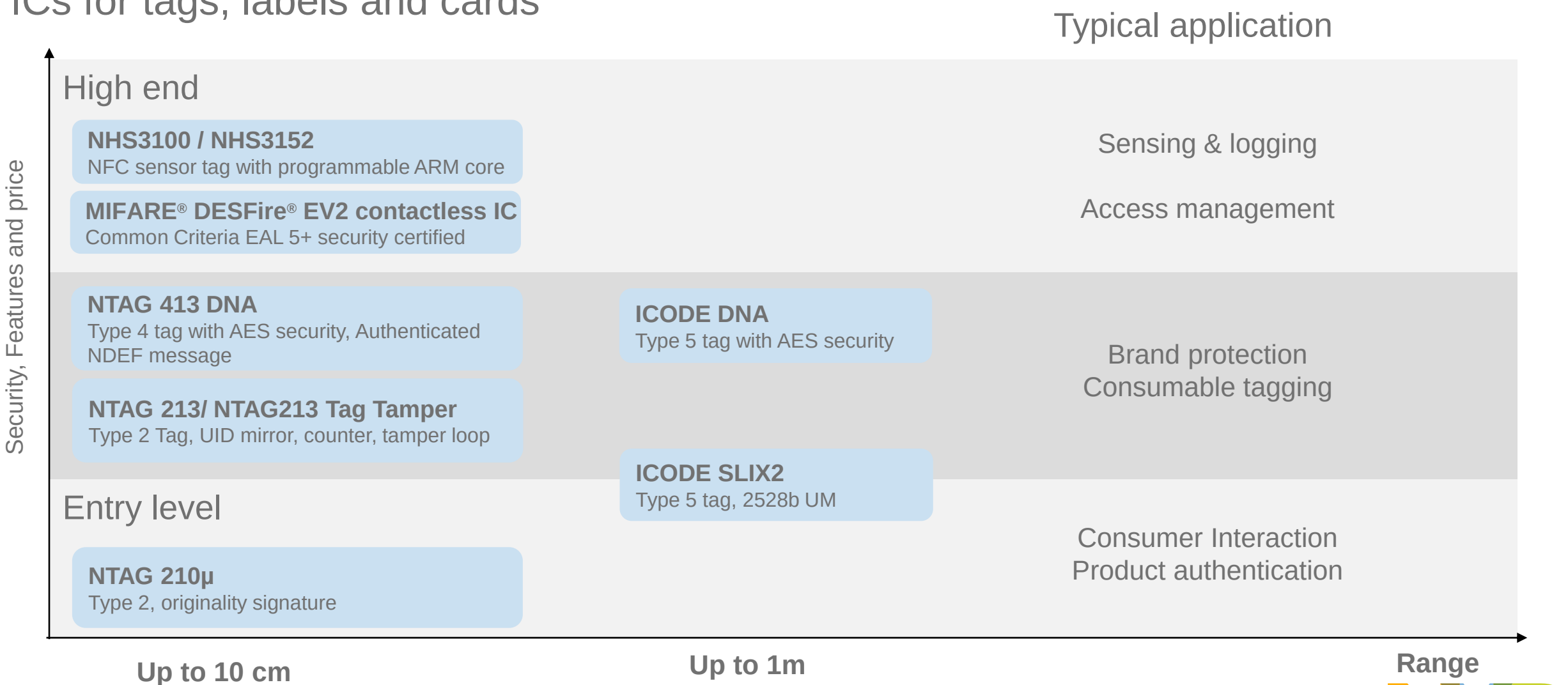
Agenda

- NFC product portfolio overview
- NTAG I^2C *plus*
- CLRC663 *plus*
- PN5180
- PN7462 family
- PN7150
- NFC product selection guide

NFC product portfolio snapshot

NFC focus products for each application need

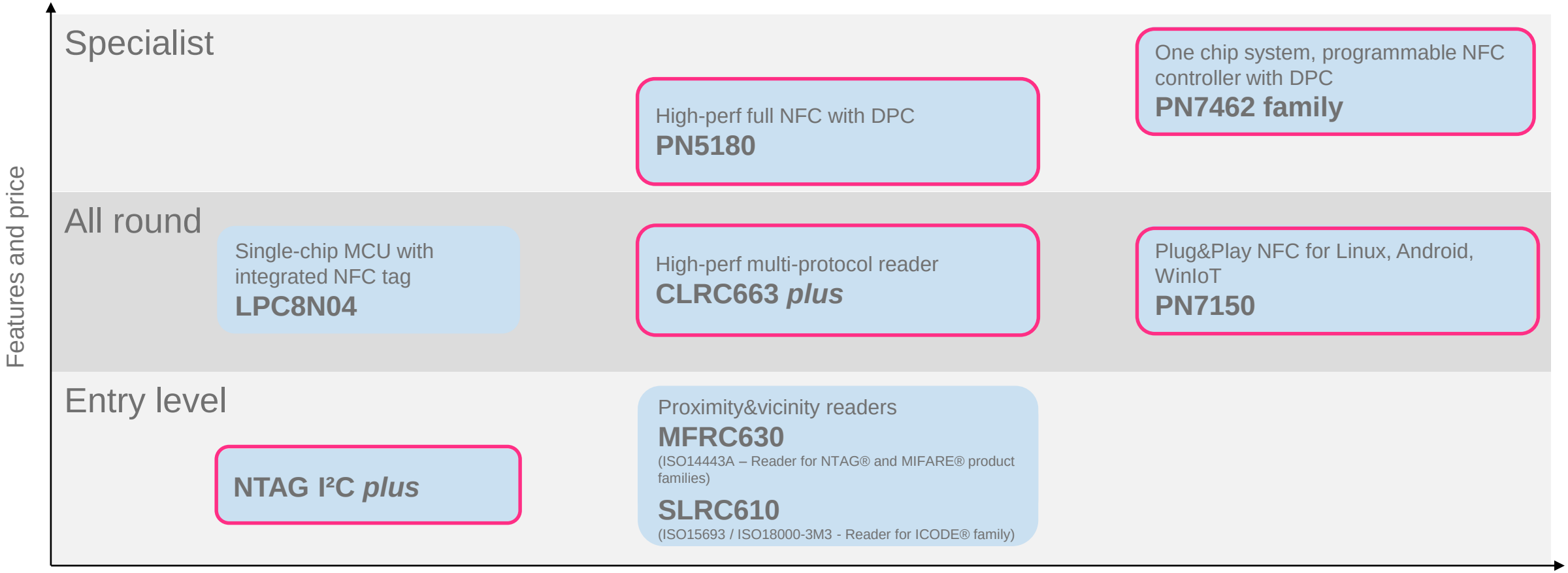
ICs for tags, labels and cards



Training Mobile Knowledge

NFC focus products for each application need

Readers/connected tags: for embedded electronics



NFC products explained in detail in this presentation

Training Mobile Knowledge

NTAG I²C *plus*

NTAG I²C *plus* – The simplest & lowest BoM NFC Solution

- Low Bill of Material
- Password authentication and originality signature
- Energy harvesting and field detection
- Fast & convenient data exchange via a 64 bytes SRAM buffer
- Full interoperability: NFC Forum and ISO/IEC 14443 compliant
- NTAG I²C *plus* Explorer Kit with design and software sources

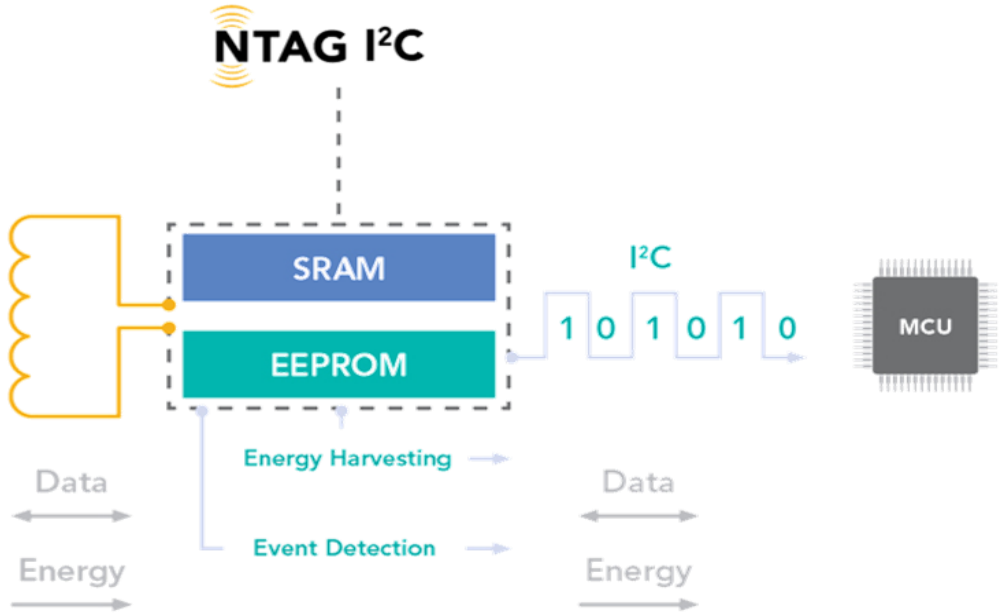
Training Mobile Knowledge

NTAG I²C *plus* product features

Features	
NFC interface	ISO/IEC 14443-3 Type A compliant NFC Forum Type 2 Tag
Memory	1912 or 888-bytes user memory area 64-bytes SRAM buffer for data transfer
Host interfaces	I²C slave 100/400 Kbit/s Field detection pin
Energy harvesting	Up to 15mW
Data transfer	Pass-through mode with 64-byte SRAM buffer FAST_WRITE and FAST_READ NFC commands for higher data throughput
Security	7-byte Unique Identifier One time programmable Capability Container Read-only locking Elliptic curve based originality signature Data access protection from NFC and I²C perspective
Temperature range	-40ºC, +105ºC

More info: http://www.nxp.com/products/:NT3H2111_2211

Packages	
XQFN8	1.8 x 2.6 x 0.5 mm
TSSOP8	3 x 3 x 1.1 mm
SO8	4.9 x 3.9 x 1.75 mm



Training Mobile Knowledge

NTAG I²C *plus* target markets

INDUSTRIAL

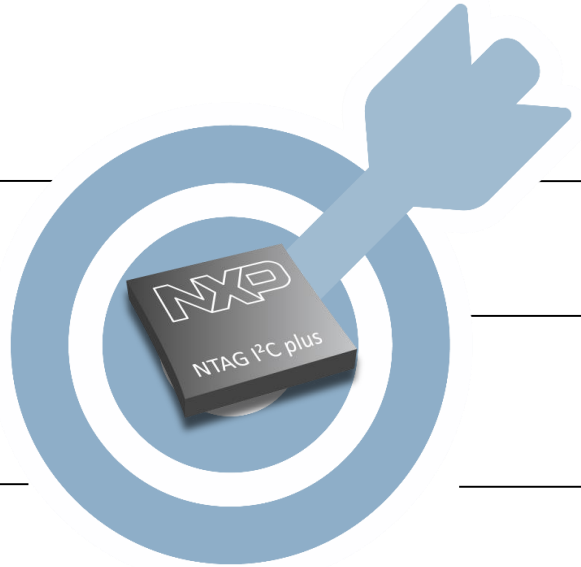
- Parametrization using NFC avoids opening the housing
- Full interoperability with NFC-enabled devices
- Non-volatile memory area to store application data.
- Energy harvesting allows operation without power supply/Battery

LOGISTICS

- Zero power operation with non-volatile data storage
- Password protection to prevent unauthorized data manipulation
- Unique ID optimizes inventory

INTERNET OF THINGS

- NFC for intentional and easy commission devices to a network
- Non-volatile memory area to store application data.



SMART METERS

- Meter maintenance via NFC avoids opening the housing.
- Full interoperability with NFC-enabled devices
- Password protection to prevent unauthorized data manipulation

ELECTRONIC SHELF LABEL

- De facto standard in ESLs used for maintenance or for more intuitive customer interaction
- Zero power operation with non-volatile data storage
- Password protection to prevent unauthorized access.

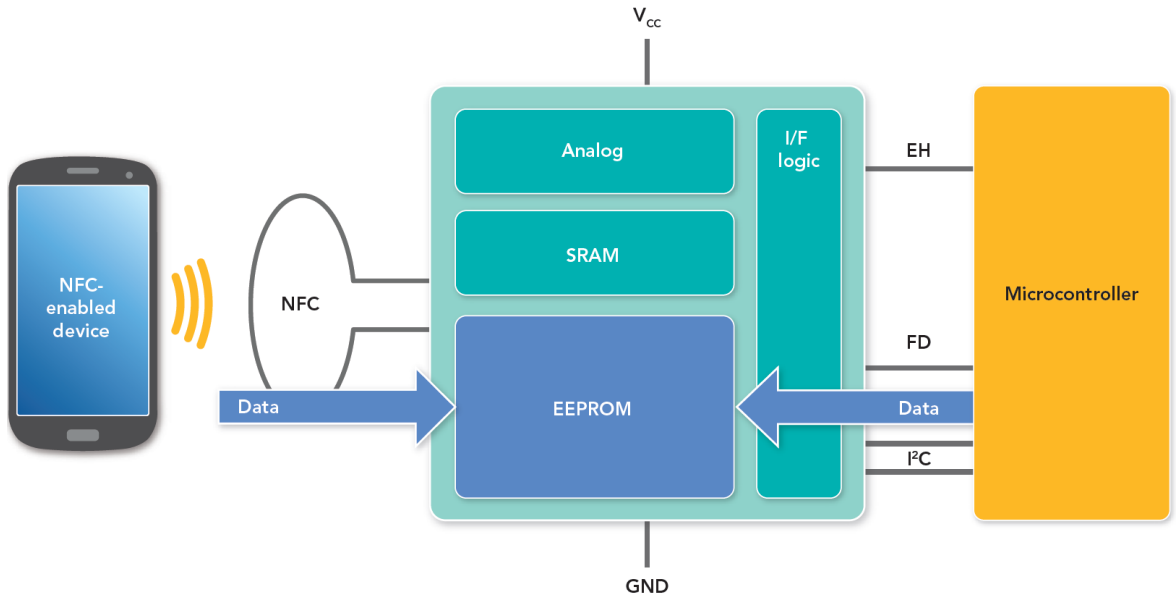
CONSUMER ELECTRONICS

- NFC for intentional and easy commission devices to a network
- Full interoperability with NFC-enabled devices
- Non-volatile memory area to store application data.

Training Mobile Knowledge

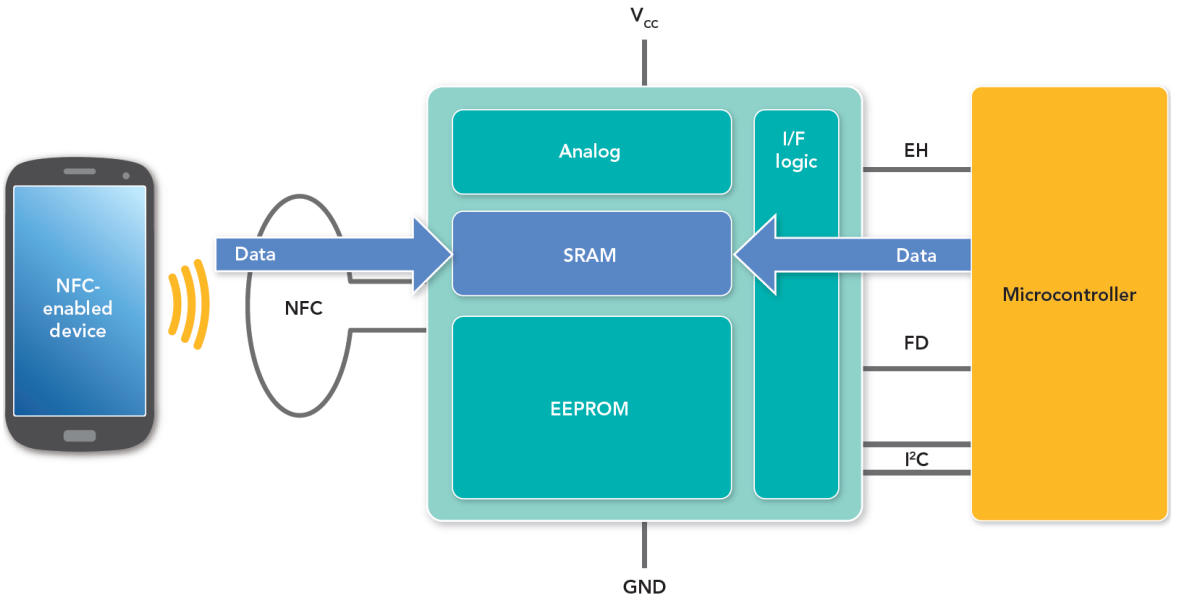
Zero power device and at the same time real time NFC modem

Write to EEPROM with zero power



- Even with an unpowered device, the NFC interface can still operate and write into the EEPROM.
- Later, when the device has power, the microprocessor can access the previously written data via the I²C interface.
- Similarly, the microprocessor can write data to the EEPROM while powered for later access via the NFC interface whether or not the device has power.

Data exchange from NFC to the MCU using the SRAM

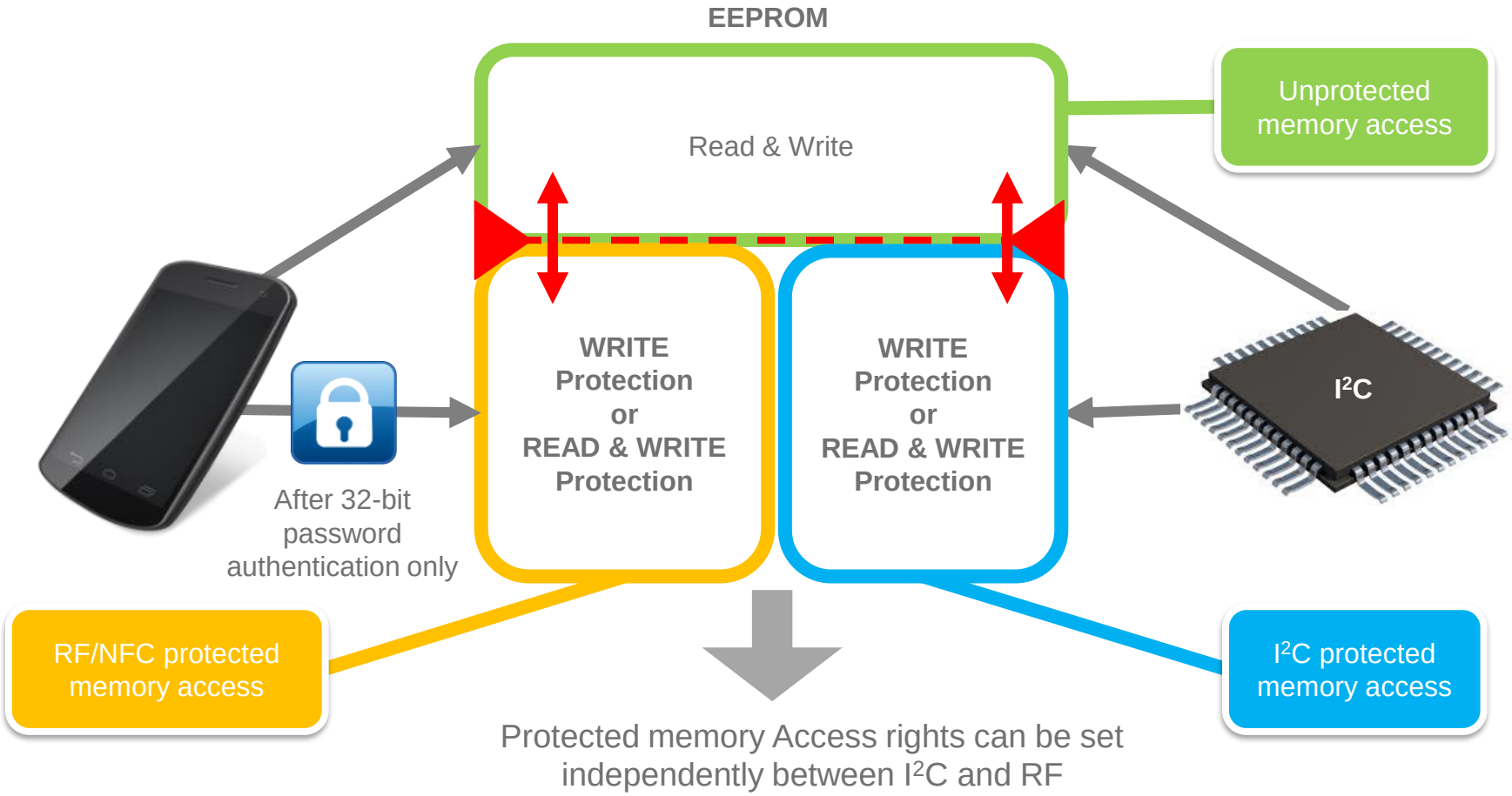


- The NTAG I²C *plus* tag chip operates like a modem when in this mode.
- Data flows from the NFC interface through an SRAM buffer to the I²C serial bus interface or vice versa.
- The on-chip, 64-byte SRAM buffer allows unlimited read and write cycles.

Training Mobile Knowledge

NTAG I²C *plus*: memory access configuration

Data access protection from NFC and I²C perspective



Training Mobile Knowledge

NFC Connected Tags comparison

Feature	NTAG213F	NTAG216F	NTAG I²C *plus*
User memory	144 bytes	888 bytes	888 / 1912 bytes
I²C interface	-	-	Yes
Baud rate	106 kbps	106 kbps	106 kbps
Fast read command	Yes	Yes	Yes
Fast write command	-	-	Yes
Originality signature	Yes	Yes	Yes
NFC Counter	Yes	Yes	-
Field detection	Yes	Yes	Yes
Memory access protection via RF interface	R/W	R/W	R/W
Memory access protection via I²C interface	-	-	R/W
Energy Harvesting	-	-	Yes
Pass-through mode	-	-	Yes
Delivery form	HXSON4	HXSON4	XQFN8, TSSOP8, SO8

CLRC663 *plus*

CLRC663 *plus* family - push your design faster

Best performance at lowest power consumption

Extended Low Power Card Detection range with new configuration options. Low supply voltage for battery support down to 2.5V

Design flexibility

Max. operating transmitter current of 350mA with limiting value of 500mA broad temperature range from -40°C to +105°C

Backward compatible to CLRC663

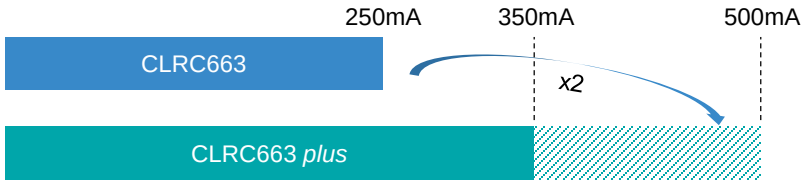
Pin-to-pin and software compatible to CLRC663

Faster time-to-market

Complete support package including EMVCo compliant NFC SW library and NFC Cockpit with VCOM interface and easy antenna configuration

Training Mobile Knowledge

CLRC663 *plus* vs CLRC663



Maximum operating transmitter current increases by 40% for CLRC663 *plus* with 2x the limiting value of the CLRC663

CLRC663 *plus* has new configuration options(2) enabling up-to 2.5x the detection range in LPCD(1) mode

CLRC663 *plus* has an automotive or industrial operating temperature range:
-40 to +105°C

CLRC663 *plus* enables better support for battery powered systems

Training Mobile Knowledge

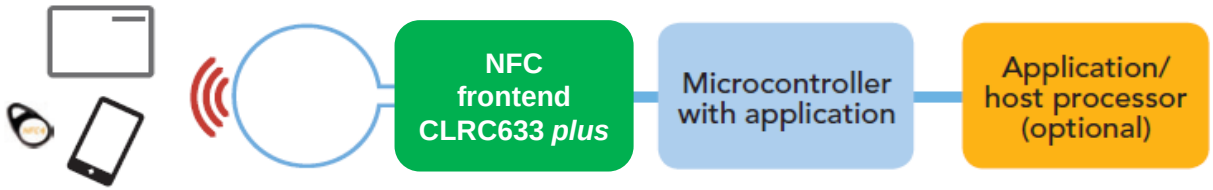
CLRC663 *plus* product features

Features	
NFC interface	Full RF standard compliance EMVCo 2.6 L1 analog & digital compliance
Host interfaces	I²C (1000Kbps), SPI (10Mbps), UART (1228.8Kbps) SAM interface in X-mode Up to 8 GPIO
RF transmitter supply voltage	2.5 to 5.5 V
Operating transmitter current	350 mA (max), 500 mA (Lim.)
Power management	Flexible and efficient power saving modes including hard power down, standby and LPCD
LPCD range (EMVCo RefPICC)	66 mm
Operating ambient temp. range	-40ºC, +105ºC
FIFO buffer	512 bytes
Waveform control	Yes
Integrated PLL	Integrated PLL provides external system clock from 27.12MHz RF crystal

More info: http://www.nxp.com/products/:CLRC66303HN

Supported RF protocols	
Read / Write mode	ISO/IEC 14443A (NTAG® and MIFARE® product family) ISO/IEC 14443B JIS X 6319-4 (comparable with FeliCa1 scheme) ISO/IEC 15693 (ICODE® SLIX, SLIX2, DNA) ISO/IEC 18000-3 mode 3/ EPC Class-1 HF (ICODE® ILT)
Peer-to-Peer mode	Passive-Initiator according to ISO/IEC 14443A (106kbit/s) and FeliCa (212 and 424kbit/s)

Packages	
HVQFN32 Wettable flanks	5 x 5 x 0.85 mm

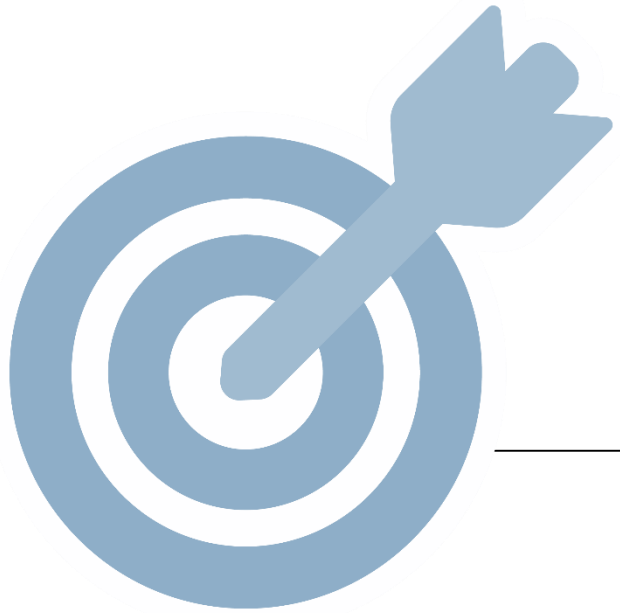


Training Mobile Knowledge

CLRC663 *plus* target markets

ACCESS CONTROL

- Broad temperature range -40ºC to +105ºC
- Pin-to-pin and SW compatible to CLRC663.



PAYMENT TERMINAL

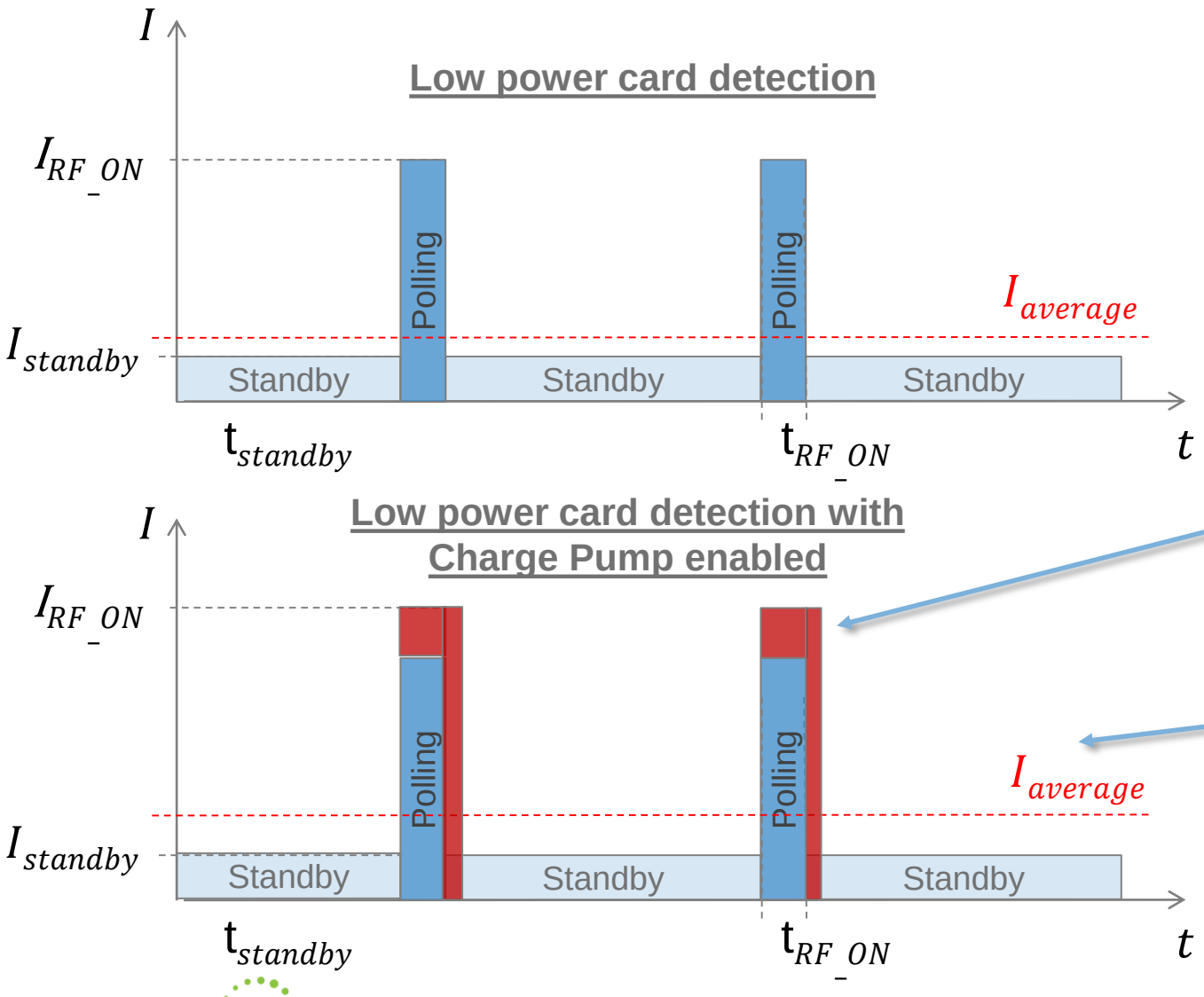
- Highest transmitter current.
- EMVCo 2.6 L1 analog and digital compliant.

GAMING

- Extended Low Power Card Detection range with new configuration options.
- Low supply voltage for battery support down to 2.5 V.

Training Mobile Knowledge

Low Power Card Detection – Charge Pump option



Ideal for applications where the detection range might be more important

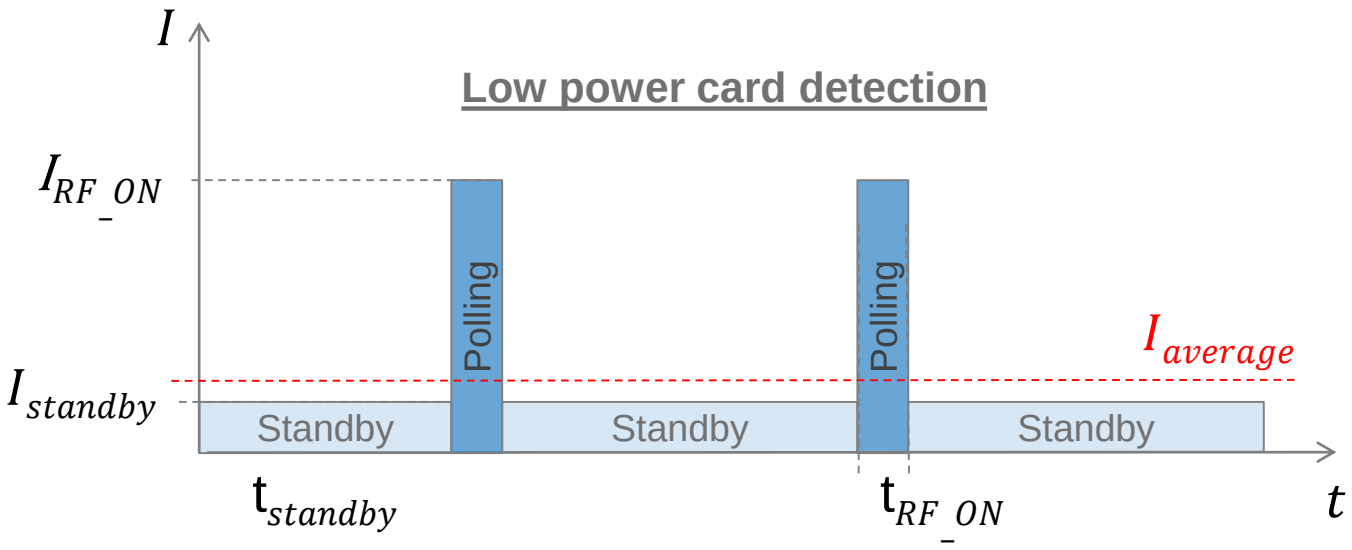
The charge pump increases the output power at TX pins (i.e RF field strength) during the RF on time.

Up to 2.5 higher detection range

Increase current consumption

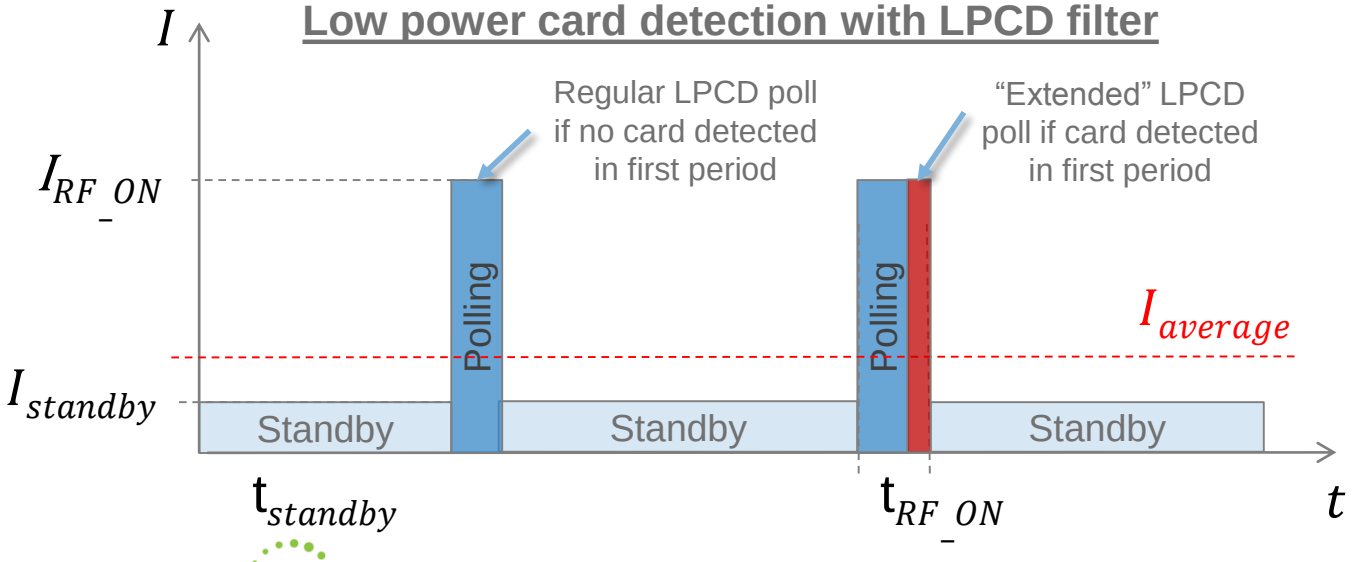
Training Mobile Knowledge

Low Power Card Detection – LPCD filter



First period	Second period	Third period	Duration	Result
No wake up	-	-	Rfon	Return to LPCD
Wake up detected	No wake up	-	Rfon + 32 tc	Return to LPCD
Wake up detected	Wake up detected	No wake up	Rfon + 64 tc	Return to LPCD
Wake up detected	Wake up detected	Wake up detected	Rfon + 64 tc	Wake up

tc = 1/13.56MHz → 32 tc ≈ 2.5µs



The LPCD filter improves the card detection robustness:

- Reduces the risk of fail detections, especially in the case of spike noise
- Increases average current consumption

Training Mobile Knowledge

CLRC663 *plus* family members

Feature	CLRC663 *plus*	MFRC630 *plus*	SLRC610 *plus*	MFRC630	SLRC610
ISO/IEC14443-A (MIFARE / NTAG)	Yes	Yes		Yes	
ISO/IEC14443-B	Yes				
JISX6319-4 - FeliCa	Yes				
ISO/IEC15693 – ICODE SLIX/DNA	Yes		Yes		Yes
ISO/IEC18000-3M3 – ICODE ILT	Yes		Yes		Yes
ISO/IEC18092 passive initiator	Yes				
Operating transmitter current	350 mA (max), 500 mA (lim)			250 mA (max)	
LPCD(1) range(2) (EMVCo RefPICC)	66 mm			26 mm	
Operating ambient temp. range	-40 ºC to +105 ºC			-25 ºC to +85 ºC	
RF transmitter supply voltage	2.5 to 5.5 V			3.0 to 5.5 V	
Package type	HVQFN32 with wettable flanks			HVQFN32	

- **MFRC630 *plus* and MFRC630** → (ISO14443A – Reader for NTAG® and MIFARE® product families)
- **SLRC610 *plus* and SLRC610** → ISO15693 and ISO18000-3M3 – Reader for ICODE® family
- All derivatives are pin-to-pin compatible

1. Low Power Card Detection
2. All detection ranges measured using the standard CLRC663 *plus* development board (CLEV6630B) operated with external power supply at room temperature

PN5180

PN5180 - The best full NFC frontend on the market

- Contactless high power NFC
- Dynamic Power Control - strong RF performance in harsh environments
- NFC Cockpit design-in tool
- NFC Forum, EMVCo and ISO/IEC compliant library
- NFC frontend development kit OM25180FDK

Training Mobile Knowledge

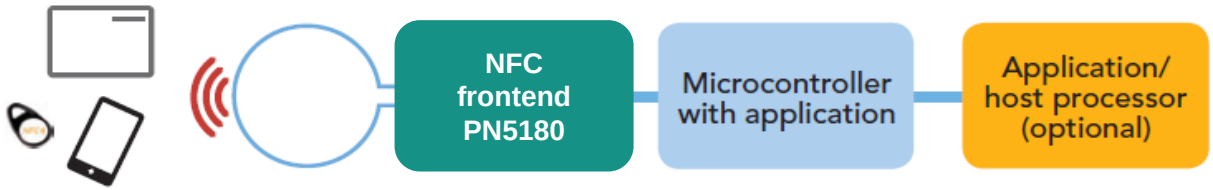
PN5180 product features

Features	
NFC interface	Full RF standard compliance EMVCo 2.6 L1 analog & digital compliance Automatic HW EMD handling
Host interfaces	SPI up to 7Mbps IRQ and BUSY signal for improved host communication Up to 7 outputs
RF transmitter supply voltage	2.7 to 5.5 V
Operating transmitter current	250 mA Dynamic Power Control (DPC)
Waveform control	Adaptive waveform control (AWC)
Operating ambient temp. range	-30ºC, +85ºC
Receiver control	Adaptive receiver control (ARC)

Packages	
HVQFN40	6 x 6 x 1 mm
TFBGA64	5.5 x 5.5 x 0.85 mm

More info: http://www.nxp.com/products/:PN5180

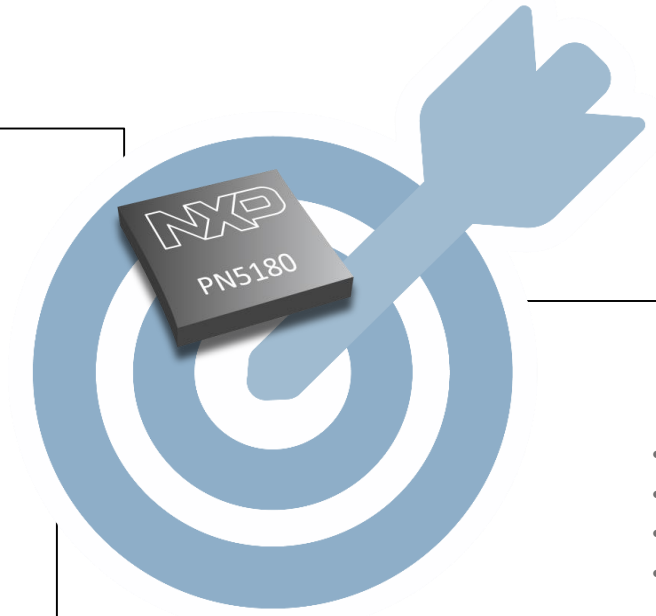
Supported RF protocols	
Read / Write mode	ISO/IEC 14443A (NTAG® and MIFARE® product family) ISO/IEC 14443B JIS X 6319-4 (comparable with FeliCa1 scheme) ISO/IEC 15693 (ICODE® SLIX, SLIX2, DNA) ISO/IEC 18000-3 mode 3/ EPC Class-1 HF (ICODE® ILT)
Peer-to-Peer mode	Passive-Initiator / Passive-Target Active-Initiator / Active-Target
Card emulation	ISO/IEC 14443A (up to 848 kbit/s) Active Load Modulation



PN5180 target markets

PAYMENT, POS & mPOS TERMINALS

- Full interoperability with NFC-enabled devices
- High RF field output power
- DPC simplifies operation in harsh environment
- TFBGA package eases PCI certification
- EMVCO L1 compliancy



PHYSICAL ACCESS CONTROL

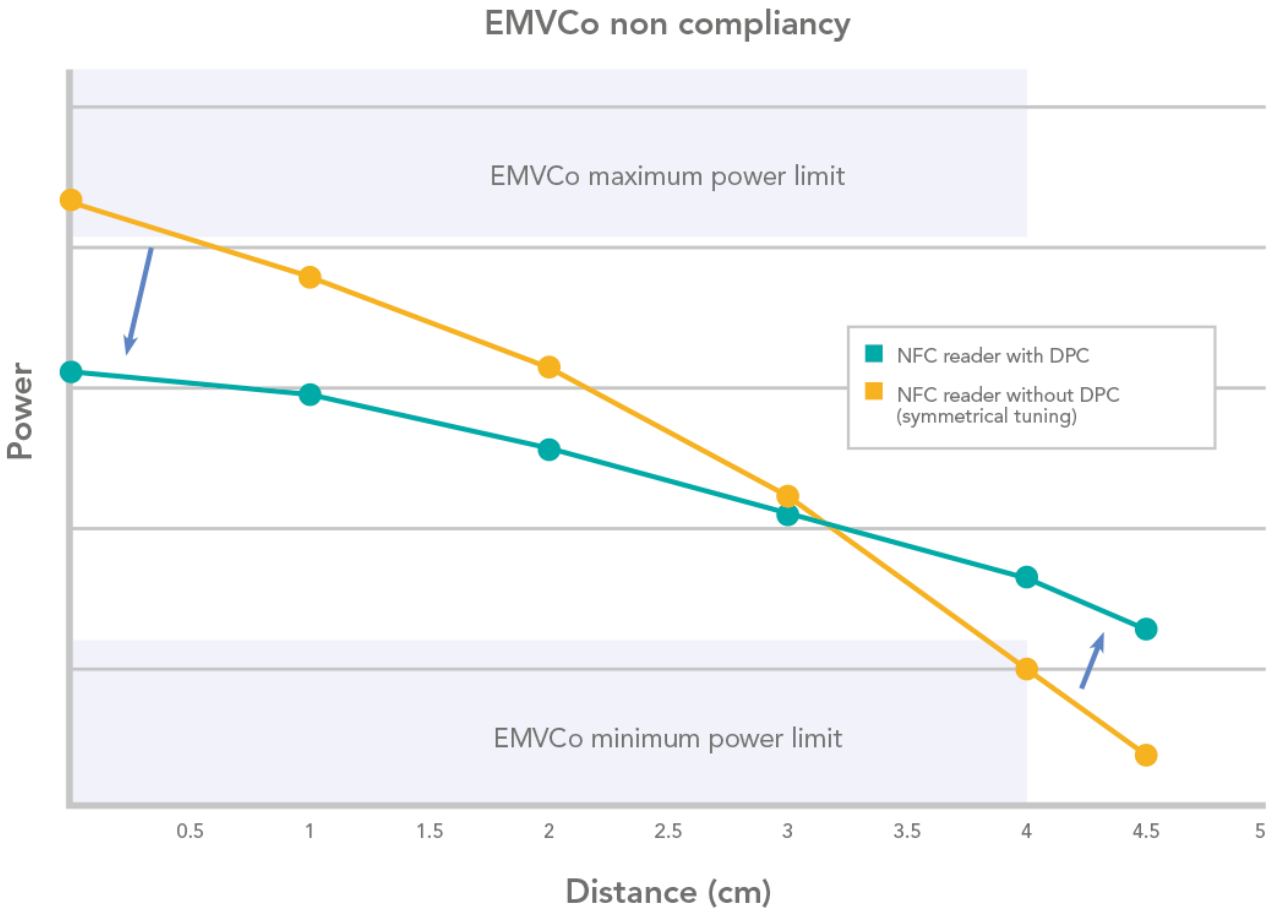
- Full interoperability with NFC-enabled devices
- Multi Card protocol supports any card reading
- DPC simplifies operation in harsh environment
- Low power card detection extends battery life

INDUSTRIAL AND eGOV

- High RF field output power
- DPC simplifies operation in harsh environment
- Integrated EMD handling for robust communication links
- Vicinity card standards support for industrial applications
- ISO/IEC 14443 compliant library reduces design in cycles

Training Mobile Knowledge

Dynamic Power Control feature (DPC)



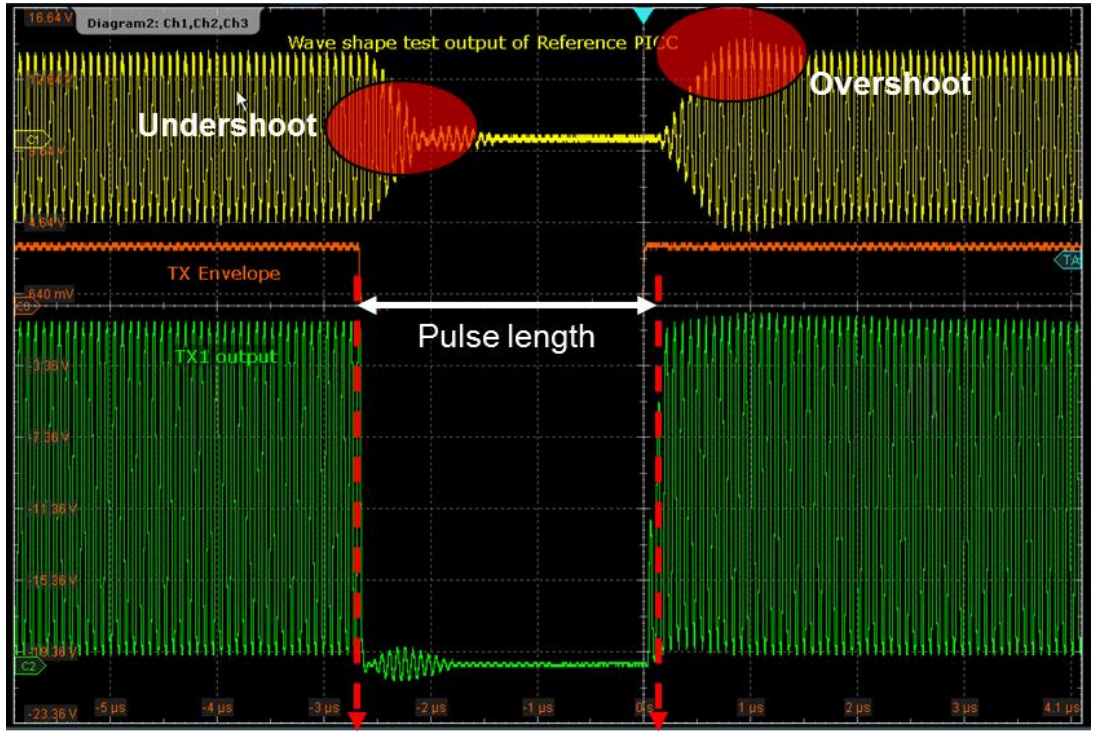
Dynamic Regulation of…	Transmitter current for detuning compensation
	H-Field within the operating volume
	Modulation index and rise/fall times

Dynamic Power Control enables up to 30% increase of the nominal driver current at same max driver spec

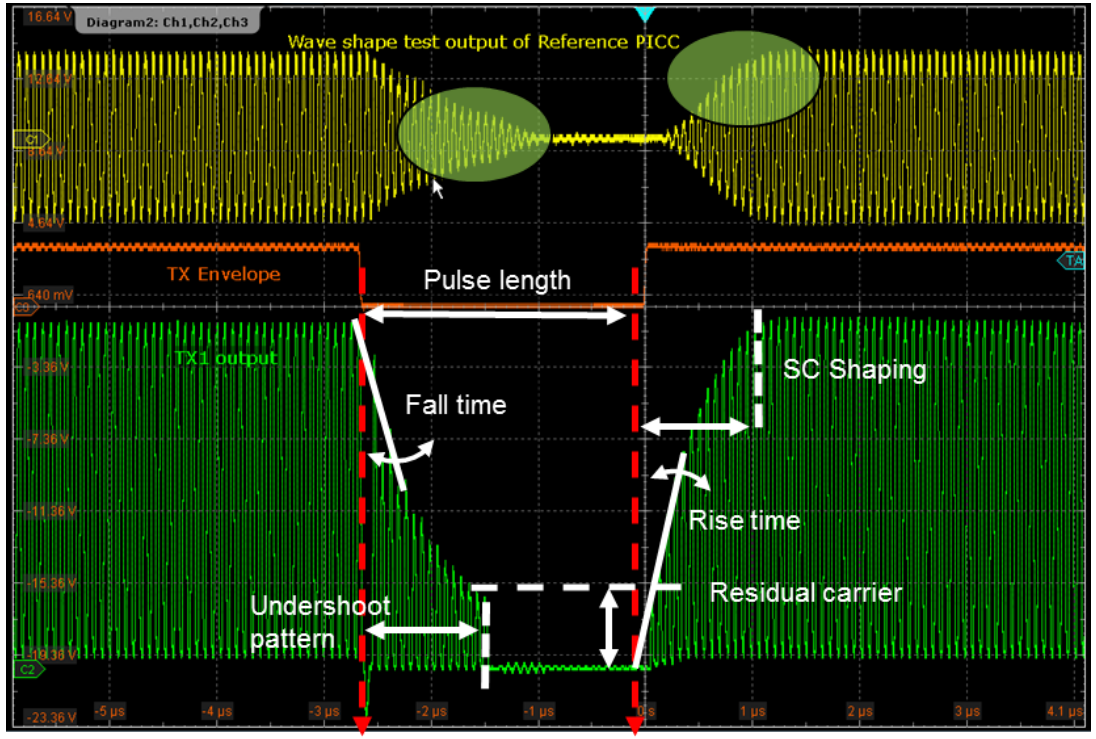
Training Mobile Knowledge

Adaptive waveform control (AWC) principle

- Using the specific register and settings, we can modify the rise and fall times, the undershoot pattern, the residual carrier and SC shaping.
- With the proper setting, we can eliminate the undershoot and overshoot issues, allowing us to easily pass the EMVCo L1 certification.



Standard Type A pulse without TX shaping



Standard Type A pulse with TX shaping

Training Mobile Knowledge

PN7462 family

PN7462 family – The first all-in-one full NFC solution

State-of-the-art reader solution on a single chip
Contact and contactless interfaces with full MIFARE family support powered by an ARM Cortex-M0 core

All integrated although highly customizable
160/80kB Flash memory, USB, GPIOs, various host and master interfaces

Faster time-to-market
Complete support package including NFC Forum compliant SW library and source code of typical applications

Smaller footprint at lower system BOM
Reducing system components and PCB by up to 50% in typical applications

NFC controller development kit OM27462CDKP

Training Mobile Knowledge

PN7462AU product features

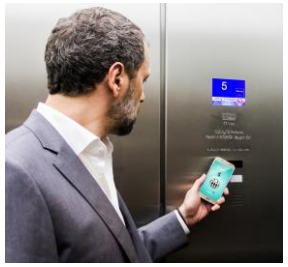
Features	
NFC interface	Full RF standard compliance EMVCo 2.6 L1 analog & digital compliance Automatic HW EMD handling
Contact interface	Class A, B, C card supported Contact EMVCo 4.3 compliance Fully integrated ISO/IEC 7816-3&4 UART Baud rate up to 1Mbit/s Capability to drive external frontend for SAMs
CPU core	Cortex M0 160kB flash, 12kB RAM, 4kB EEPROM, clock= 20MHz Freely programmable MCU (160KB)
Interfaces and GPIOs	One configurable host interface: I^2C (1000Kbps), SPI (7Mbps), USB, HSUART (1228.8Kbps) Two master interfaces: I^2C and SPI 12 to 21 GPIOs
RF transmitter supply voltage	2.7 to 5.5 V
Operating transmitter current	250 mA Dynamic Power Control (DPC)
Waveform control	Adaptive waveform control (AWC)
Operating ambient temp. range	-40ºC, +85ºC
Receiver control	Adaptive receiver control (ARC)

More info: http://www.nxp.com/products/:PN7462

Supported RF protocols	
Read / Write mode	ISO/IEC 14443A (NTAG® and MIFARE® product family) ISO/IEC 14443B JIS X 6319-4 (comparable with FeliCa1 scheme) ISO/IEC 15693 (ICODE® SLIX, SLIX2, DNA) ISO/IEC 18000-3 mode 3/ EPC Class-1 HF (ICODE® ILT)
Peer-to-Peer mode	Passive-Initiator / Passive-Target Active-Initiator / Active-Target
Card emulation	ISO/IEC 14443A (up to 848 kbit/s) Active Load Modulation

Packages	
HVQFN64	9 x 9 x 0.85 mm
VFBGA64	4.5 x 4.5 x 0.8 mm

PN7462 family target markets

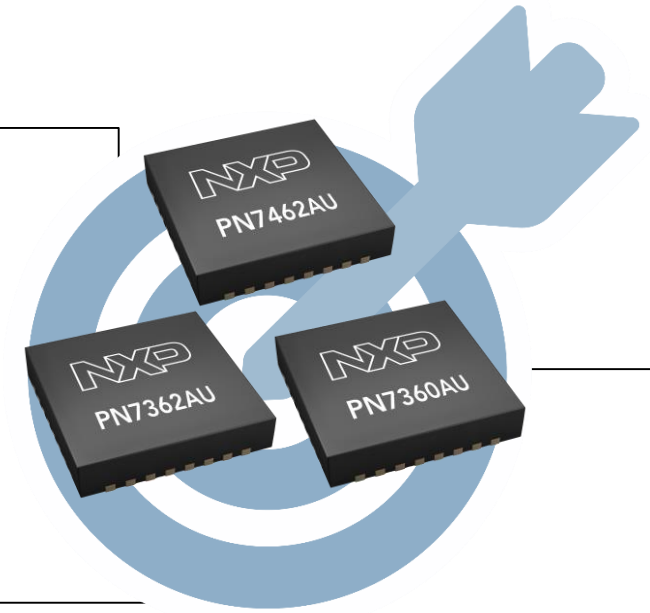


ACCESS CONTROL

- Single chip solution for standalone readers
- Broad temperature range from -40 to +85°C
- Full NFC-enabling communication with cards and phones

HOME BANKING & PAYMENT

- Single chip solution: USB, contact and contactless interfaces
- EMVCo L1 compliance for interoperability with payment cards

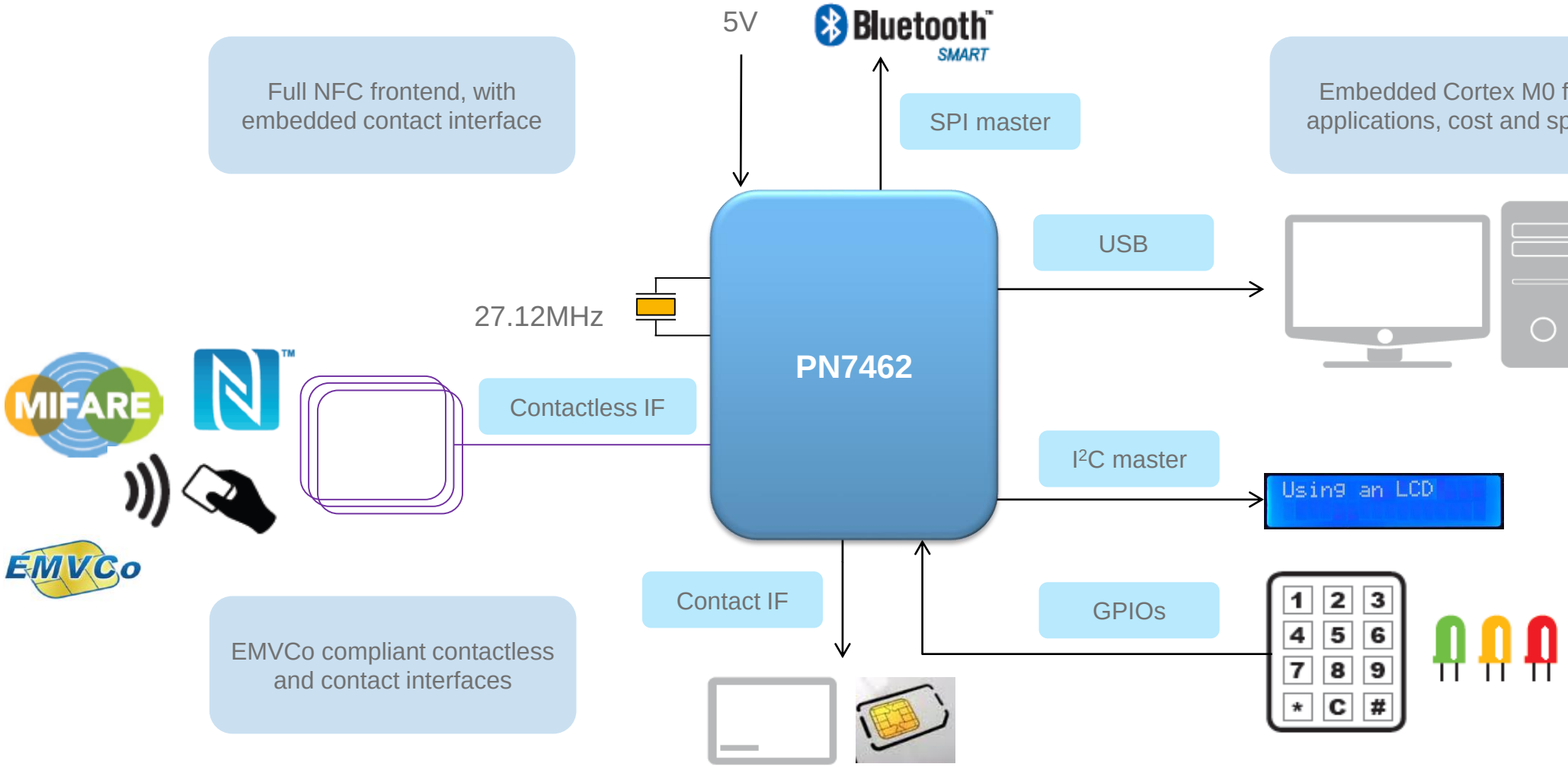


MULTI-MARKET USB READER

- Highly customizable interfaces
- Complete PSP with NFC Forum and EMVCo L1 SW
- Source code of typical applications

Training Mobile Knowledge

PN7462 all-in-one solution



Training Mobile Knowledge

PN7462 as a payment co-processor for a POS system

SAMs

TDA8026

PN7462 as EMVCo L1 co-processor

AUX I/O

I²C

27.12MHz

PN7462

SPI

PCI compliant CPU

USB

Contactless IF

ISO/IEC7816

EMVCo compliant contactless and contact interfaces

Using an LCD

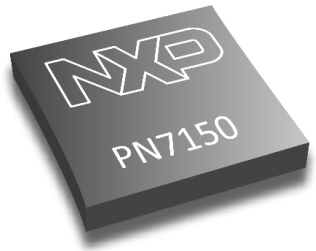
Training Mobile Knowledge

PN7462 family members

PN7462 family	PN7462AU		PN7362AU		PN7360AU	
Item reference	PN7462UHN	PN7462AUEV	PN7362UHN	PN7432AUEV	PN7360UHN	PN7360AUEV
Package type	HVQFN64	VFBGA64	HVQFN64	VFBGA64	HVQFN64	VFBGA64
NFC Forum compliance	Yes					
Reader / writer support	ISO/IEC 14443A (MIFARE/NTAG), 14443B, 15693 (ICODE SLIX/DNA), 18000-3m3 (ICODE ILT) and JIS X 6319-4 (FeliCa)					
Card emulation	ISO14443-4 Type A					
P2P (ISO18092)	Full passive and active initiator and target modes					
Operating transmitter current	250 mA (max.) with Dynamic Power Control, Adaptive Waveform Control and Adaptive Range Control					
Integrated MCU	20 MHz Cortex M0 Core with 12 kB RAM and 4 kB EEPROM					
Interfaces	GPIOs, master/slave SPI and I²C, host USB and HSUART					
Supply voltage	2.7 to 5.5 V					
Operating ambient temp. range	-40 to +85 °C					
Available flash memory	160 KB				80 kB	
ISO/IEC7816-3&4 UART	Yes		No			
General purposes I/O	12 up to 21		14 up to 21			
Contact interface	Class A, B and C		No			
Development kit	OM27462CDKP (12NC 9353 639 45598)					
Development board	PNEV7462C (12NC 9353 635 25598)					

PN7150

PN7150 – Plug-and-play NFC solutions



- Very easy to integrate thanks to embedded firmware and NCI standardized interface
- Complete, power-efficient NFC control.
  Active Load Modulation to enhance the card mode performances
- Linux, Android and Windows IoT drivers ease integration and reduce time to market
- Low cost Bill of Material, with HVQFN40 package enabling low cost PCB manufacturing package
- Full interoperable and NFC Forum-compliant controller
- Single Board Computer kits for easy integration into platforms such as RaspberryPi, BeagleBone Black and board with Arduino-compatible headers.

Training Mobile Knowledge

PN7150 product features

Features	
NFC interface	Full NFC Forum compliancy with small form factor antenna
CPU core	Cortex M0 with embedded firmware
Host interfaces	Direct connection to the main host or microcontroller, by I²C-bus physical and NCI 1.0 protocol I²C interface: 3.4 Mbit/s IRQ signal for improved synchronization Supply voltage host interface: 1.8V or 3.3V
Power management unit	Ultra-low power consumption in polling loop mode Highly efficient integrated power management unit (PMU) allowing direct supply from a battery
RF Transmitter	Supply voltage: 2.7V to 4.75V Supply current: 180 mA / 250 mA (max)
Temperature range	-30C, +85C

Packages	
HVQFN40	6 × 6 × 0.85 mm
WLCSP42	2.88 × 2.80 × 0.54 mm (backside coating included)

Supported RF protocols	
Read / Write mode	ISO/IEC 14443A (NTAG® and MIFARE® product family) ISO/IEC 14443B JIS X 6319-4 (comparable with FeliCa1 scheme) ISO/IEC 15693 (ICODE® SLIX, SLIX2, DNA)
Peer-to-Peer mode	P2P Active, Initiator and Target P2P Passive, Initiator and Target
Card emulation	NFC Forum T4T, ISO/IEC 14443A NFC Forum T3T, Felica

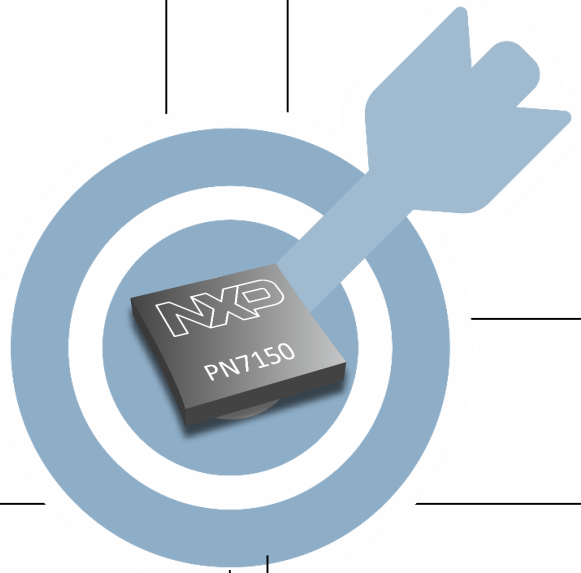
More info: http://www.nxp.com/products/:PN7150

PN7150 target markets

SET-TOP BOX, TV, BLU-RAY

GATEWAY, ROUTERS, WIRELESS ACCESS POINTS

REMOTE CONTROL, ACCESSORIES



HEALTHCARE, FITNESS, MEDICAL

HOME APPLIANCES

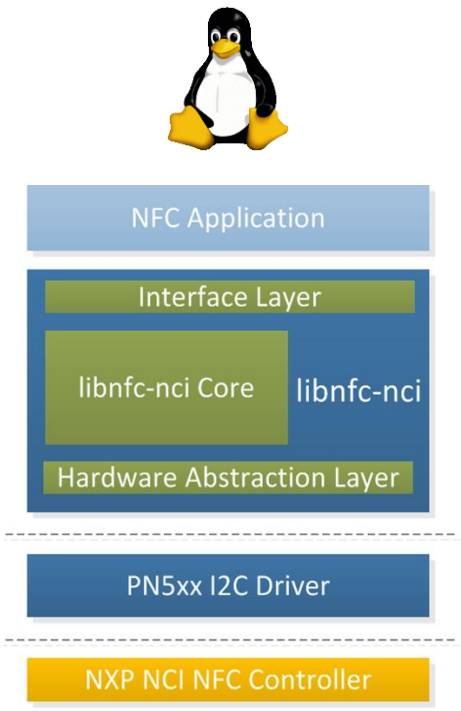
PRINTER

GAMING

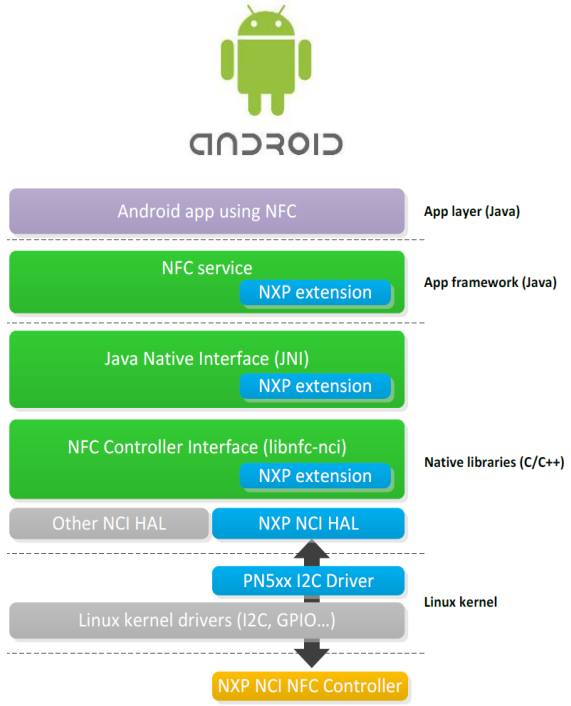
AUDIO

Training Mobile Knowledge

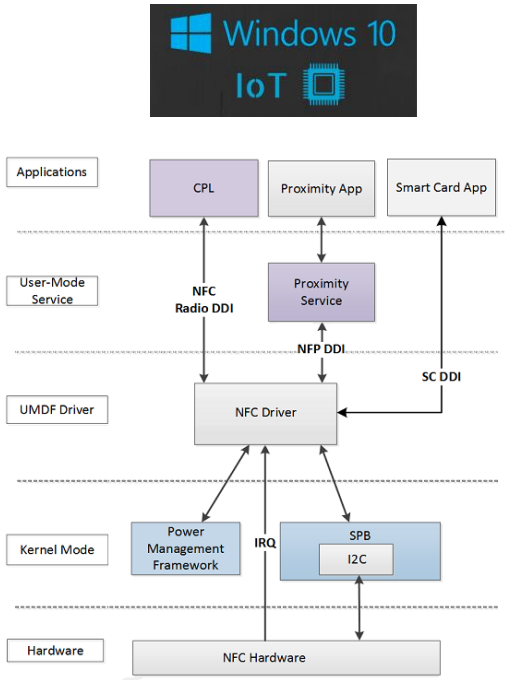
PN7150 software drivers for SW integration into any platform



Linux NFC architecture
Linux integration is offered through NXP's Linux libnfc-nci SW stack



Android NFC architecture
Android integration is offered through the Android AOSP SW stack for which NXP delivers dedicated patches.



Windows NFC architecture
Windows integration is offered through Microsoft Windows universal NFC device driver model,

NullOS/RTOS architecture
NullOS/RTOS integration is demonstrated with code examples running on NXP's LPC , Kinetis and i.MX MCUs

Training Mobile Knowledge

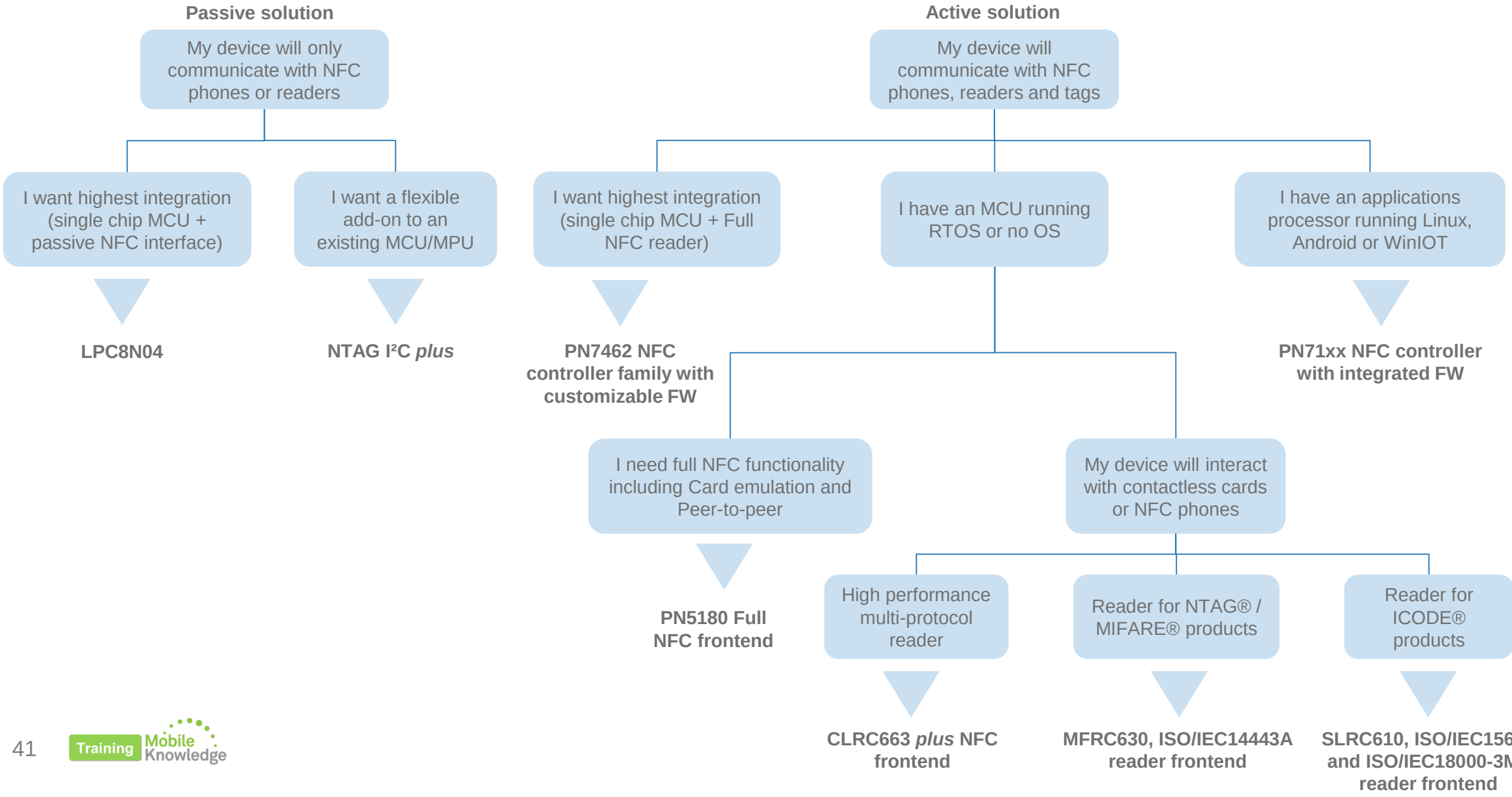
PN7150 family members

PN7150 family	PN7120	PN7150	
Package type	VFBGA49	HVQFN40	WLCSP42
NFC Forum compliance	Yes		
Reader / writer support	ISO/IEC 14443A (MIFARE/NTAG), 14443B, 15693 (ICODE SLIX/DNA), and JIS X 6319-4 (FeliCa)		
Card emulation	ISO14443-4 Type A	ISO14443-4 Type A, FeliCa	
P2P (ISO18092)	Full passive and active initiator and target modes		
RF driver supply voltage	2.7V or 3.3 V	2.7V to 4.75V	
Transmitter supply current	150 mA	180 mA	
Host interface	NCI interface over I^2C bus high speed mode		
Operating ambient temp. range	-30 ºC to +85 ºC		
Load modulation concept	Passive load modulation	Active and passive load modulation	

Training Mobile Knowledge

Product selection guide

NFC product selection path for embedded electronics



Training Mobile Knowledge

NFC product portfolio comparison

	Zero Power Access	Energy Harvesting	Embedded MCU	NFC Tag	Output Power	Card in host mode	Reader & Writer		P2P mode	DPC	ISO/IEC 7816 interface
NTAG I²C *plus*	Read& Write	Up to 15mW		Tag Type 2							
CLRC663 *plus*				Reader Tag Type 1,2,3,4,5	+++		ISO/IEC14443 FeliCa	ISO/IEC15693 ISO18000-3M3	Passive Initator		
PN5180				Reader Tag Type 1,2,3,4,5	++	ISO/IEC 14443A	ISO/IEC14443 FeliCa	ISO/IEC15693 ISO18000-3M3	Active& Passive	Yes	
PN7150			Yes, non Rewritable FW	Reader Tag Type 1,2,3,4,5	+	ISO/IEC 14443A&B FeliCa	ISO/IEC14443 FeliCa	ISO/IEC15693	Active& Passive		
PN7462AU			Yes, custom FW	Reader Tag Type 1,2,3,4,5	++	ISO/IEC 14443A	ISO/IEC14443 FeliCa	ISO/IEC15693 ISO18000-3M3	Active& Passive	Yes	Yes
						Card emulation	**Read & Write**		**Peer-to-Peer**		

Training Mobile Knowledge

Closure

Find out more about NFC

- Discover NFC Everywhere: https://www.nxp.com/nfc
- Get your technical NFC questions answered: https://community.nxp.com/community/identification-security/nfc
- List of Approved Engineering Consultants (AEC) for NFC: https://nxp.surl.ms/NFC_AEC
- NFC Everywhere Brochure: https://www.nxp.com/docs/en/brochure/NFC-EVERYWHERE-BR.pdf

NFC product portfolio

Thank you for your kind attention!

Please remember to fill out our **evaluation survey** (pop-up)

Check your email for **material download** and on-demand **video** addresses

Please check NXP and MobileKnowledge websites for **upcoming webinars** and **training sessions**

http://www.nxp.com/support/classroom-training-events:CLASSROOM-TRAINING-EVENTS

www.themobileknowledge.com/content/knowledge-catalog-0

MobileKnowledge

MobileKnowledge is a team of HW, SW and system engineers, experts in **smart, connected and secure** technologies for the IoT world. We are your ideal **engineering consultant** for any specific support in connection with your **IoT** and **NFC** developments. We design and develop secure HW systems, embedded FW, mobile phone and secure cloud applications.

Our services include:

- **Secure hardware design**
- **Embedded software development**
- **NFC antenna design** and **evaluation**
- **NFC Wearable**
- **EMV L1 pre-certification support**
- **Mobile** and **cloud application development**
- **Secure e2e system design**

We help companies leverage the secure IoT revolution