



# UNLOCK NFC EVERYWHERE.

NOW iOS AND  
ANDROID READY

**NXP**

# WHAT A DIFFERENCE A DAY MAKES.

## CAN THINGS REALLY CHANGE OVERNIGHT?

When it comes to **Near Field Communication**, the answer is definitely yes. Because that's exactly what happened on September 19, 2019, the day that **Apple iOS 13**, with support for full read/write NFC functionality, became available.

NFC was suddenly transformed. Having iOS join Android in its full support for NFC meant the smartphone infrastructure instantly became far more complete and widespread. In the blink of

an eye, just about every one of the two billion people worldwide with a smartphone now also had an NFC reader that could conduct two-way NFC interactions. One of the biggest obstacles in NFC's path to high-volume growth simply disappeared.

As a result, everyone with an interest in the technology – hardware designers, software developers, OEMs, ODMs, service providers – can now move ahead with confidence.

## A NEW TWIST

To make things even more interesting, NFC itself is heading in a new direction, with support for wireless charging. A recently introduced standard, issued by the NFC Forum, lets NFC use radio waves to send power and wirelessly charge devices that operate at or below 1 W.

NFC wireless charging lets us rethink the way we power battery-driven devices. Now, instead of hunting for a cord and an outlet, we can simply set a device down to initiate a recharge. What's more, this new twist on NFC functionality lets us create a whole new category of tiny products that don't use plugs or ports, so they're smaller, sleeker, and safer to use. It's taking convenience to new heights, and creating better electronic experiences for us all.

# 5 BIG REASONS TO CONSIDER NFC.



**1. You'll speak with intention**  
NFC involves only two devices at once, so there's no crosstalk. Plus, you avoid being overheard and keep secrets safe by getting close before you start to speak.



**2. You'll save energy**  
Since energy harvesting lets one device power another during an NFC transaction, the second device can save its battery for other tasks or not have a battery at all.



**3. You'll play well with others**  
NFC is a unifying technology that makes it easier to live in a wireless world. Pair and commission just about any wireless device with a single tap of your NFC-enabled device.



**4. You'll be welcome wherever you go**  
Fully supported by every Android and iOS 13 smartphone out there, NFC is an integral part of one of the largest infrastructures on the planet, and ready to work whenever you are.



**5. You'll Always Have a Remote Control in Hand**  
With your smartphone or tablet as the user interface, you'll be the master of any piece of equipment, be it a robot in a factory, a sensor in a storage room, or a new set of earbuds.

**6.925 BILLION**  
**NFC-ENABLED DEVICES**  
**WILL BE SHIPPED BY 2021**

Source: ABI 2019



## UNLIMITED POSSIBILITIES

NFC has never been stronger, and the opportunities for **NFC** have never been more compelling.

With the arrival of **iOS 13** and wireless NFC charging, it's not just a new day for NFC, it's the beginning of a whole new era.




## UNLIMITED FORWARD MOMENTUM

At NXP, we never stop moving ahead with NFC. Since 2002, when we co-invented the technology, we've been working to expand the ecosystem and improve the technology. We co-founded the NFC Forum, hold the number-one position in the market, and offer the broadest portfolio in the industry.

Yet we continue to push ahead, introducing new formats, including connected NFC tags for electronic systems, and delivering new approaches, such as wireless NFC charging for low-power devices. It's our way of ensuring that this remarkable technology maintains its forward momentum.



**2019** 

Apple announces new NFC services. e.g. NFC for Apple Card.


Apple expands NFC on **iOS 13** – including reading and writing of NFC NDEF Tags, but also ISO 7816, ISO15693, MIFARE and FelicCa protocols.

NFC Forum releases standard for NFC Wireless Charging.

Huawei x Gentle Monster launch the first eyewear line to use NFC charging.

Apple introduces background NFC NDEF tag reading in **iOS 12** on iPhones XS/XR.

**2018** 


**2017** 

Apple implements App-based **NFC NDEF tag** reading in iOS 11 for iPhones 7/8/X.

NFC Forum IoT working group introduces NFC tag certification ensuring predictable UEX.

Apple introduces **iPhone 7** which reads Felica cards (NFC Forum T3T) in Japan.

Apple is officially chairing the IoT working group at the NFC Forum.

**2016** 

**2015** 

NXP ships the 1Billionth chip to enable secure **NFC transactions** in smartphones.

NXP wins Prestigious European Inventor Award for NFC

Apple introduces iPhone 6 with **Apple Pay** using NFC technology.

**2014** 

**2002** 

NXP and Sony co-invent **NFC** technology.


NXP co-founds the **NFC Forum** to lead collaborations with industry stakeholders and help standardize the technology.


**2004** 

**2006** 

**Nokia 6131**  
Nokia launches the first NFC phone.

NFC Forum releases **Peer-to-Peer** standards.

**2009** 

**2010** 

**Nexus S**  
Google launches the first Android NFC phone.

Sony introduces **Smart Tags**, which use NFC to change modes and profiles on a Sony smartphone at close range.

**2012** 

## USE CASES

# ACCESS CONTROL

(Physical and Logical)



NFC brings mobility to the highest level of security for physical and logical access, so you can do more with your smartphone or a wearable. When you leave home, your phone or wristband can lock the door, and when you arrive at work, it can serve as your ID badge, your computer logon, and your authorization to use certain machines. Your device can also open your hotel room or be your event ticket. With NFC, you reduce waste, increase security, and gain the ability to grant or deny access, as needed, from a remote location.

- Log time and attendance for secure areas
- Manage key distribution remotely
- Set limits for access times, for temporary personnel, or rental homes
- Reduce maintenance and replacement costs, with fewer lost or damaged keys, cards, or badges

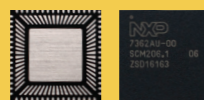
## WHICH PRODUCT?

### NFC Frontend CLRC663 *plus* Family



If you already have a microcontroller on board, and need the best NFC performance with the lowest power consumption, especially in a battery-operated system, use this NFC frontend to push your design further.

### NFC Controller with Customizable Firmware PN7462 / PN736x



If you need a small footprint, for a door lock perhaps, use these all-in-one solutions to execute a fully custom application.

No external MCU needed.

### Contactless Multi-application Smart Card MIFARE® DESFire® Family



If you're designing a card-based access system with MIFARE DESFire EV2, get the benefit of CC EAL5+ security – the same certification level bank cards and electronic passports use.

This NFC-compatible MIFARE solution is also available in multiple form factors from key-fobs to wristbands.

For single-application uses, MIFARE DESFire Light offers a cost-effective solution with CC EAL4 security.



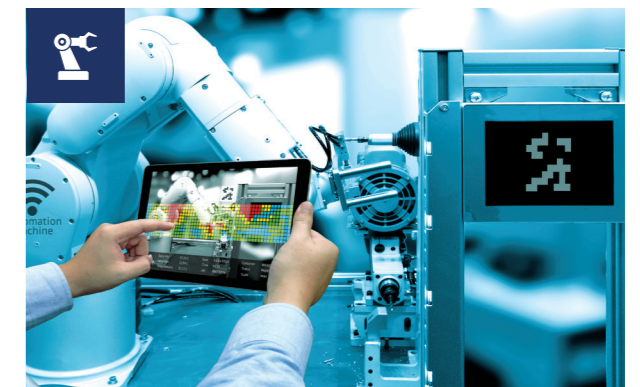
Use your phone to **open doors** at home, at work, or when you travel



Turn your wristband into a **special-access pass**



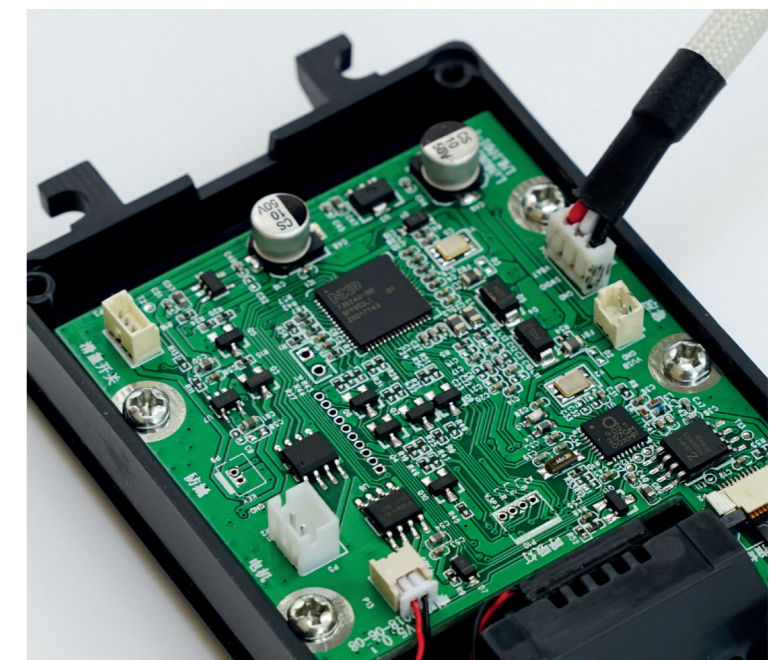
**Tap your way** into work or school using NFC



Increase productivity with **fast access** to specialized machinery

## RocketXS

A ready-to-produce design for the growing **smart lock** market in China that supports NFC card reading, Bluetooth LE, fingerprint reading, pinpad operation, and secure key sharing via WeChat.



## USE CASES

# PAIRING & COMMISSIONING

Just bringing two NFC-enabled devices close together is all it takes to create a connection. What's more, NFC can also trigger other protocols, like Bluetooth, ZigBee, or Wi-Fi. Pairing is practically instantaneous and, because NFC only works when you ask it to, there aren't any unintended device connections, and none of the device conflicts that can happen with Bluetooth.

It's also easier to commission new devices or expand your home network, even if you're adding devices that don't have a battery – and there's no need to search for a connection or type in a serial number.

- Enable two-way interactions with Peer-to-Peer mode
- Pair Bluetooth or Wi-Fi devices 20x faster with NFC
- Identify a device instantly, without entering codes or creating device conflicts
- Make devices easier to use and reduce tech-support costs
- Exchange credentials securely, just by tapping
- Use protocol-agnostic operations to trigger actions

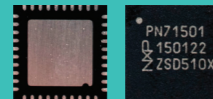
## WHICH PRODUCT?

### NFC Connected Tag NTAG<sup>®</sup> I<sup>2</sup>C *plus*



If you're working on a battery-powered design that already has a microcontroller, such as a speaker or IoT node, use this tag IC to wake the system and initiate Bluetooth or Wi-Fi pairing.

### NFC Controller with Integrated Firmware PN7150



If you're running an OS, like Android, Windows, or Linux, use the embedded NFC firmware and NCI interface in these controllers to quickly add fully compliant NFC functionality. The PN7150 is also a good choice for routers and gateways that will interact with NTAG-equipped nodes.

### NFC Connected Tag for Tiny Devices NTAG 5 *boost* and *link*

## NTAG 5 *boost*

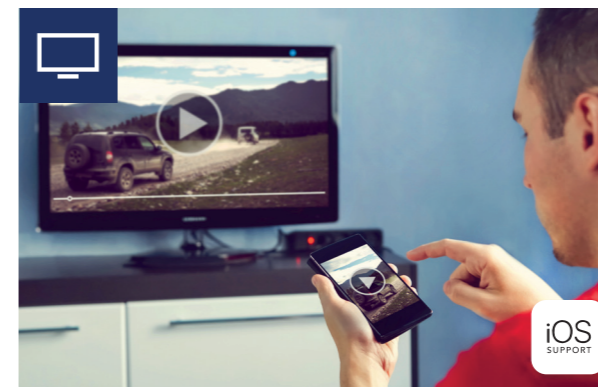
The NTAG 5 boost is a Type 5 Tag that delivers exceptional read range, giving tiny devices the ability to interact with the cloud and other NFC-enabled devices, including smartphones.



Pair with **Bluetooth** devices faster, without conflicts



Pair with **Wi-Fi** devices with just a tap



View **images** and **videos** on the big screen, with just a tap



Add **sensors** and **lights** to your home or office network in just seconds, without entering codes



## USE CASES

# AUTHENTICATION & IDENTIFICATION

NFC is the one technology that makes it easier and safer, at every point of ownership, to enjoy any type of electronic device. From using personal care items and household appliances to adjusting settings of smart gym equipment based on your very own profile, NFC can simplify configuration, increase personalization, enable reorders, enhance safety, and fight fakes.

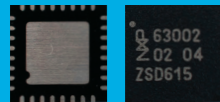
The same NFC operations increase automation in industrial settings, too, for greater efficiency.

- Authenticate replacement parts and automatically adjust settings of the main unit based on the accessory attached
- Identify users and immediately provide personalized settings and preferences
- Send notifications when accessories are nearing replacement, and make offers based on usage patterns

## WHICH PRODUCT?

### NFC Frontend MFRC630 *plus*

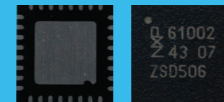
Tags  
NTAG21x,  
MIFARE Ultralight® C



Tags based on NTAG and MIFARE offer a wide range of security options and can be read by all NFC phones. Once you've chosen a tag, the MFRC630 *plus* is an ideal single-protocol reader for this use case.

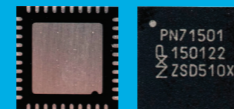
### NFC Frontend SLRC610 *plus*

Tags  
ICODE SLIX, ICODE DNA



If you need to support longer distances between the tag and its reader, then the SLRC610 *plus* reader, which works with ICODE tags, gives you the extra margin in read range.

### NFC Controller with Integrated Firmware PN71xx



If you're working with an OS, like Android, Windows, or Linux, use one of these controllers for plug-and-play functionality when reading NTAG, MIFARE, and ICODE tags.



Ensure safety with **branded replacements** that automatically adjust settings



Create experiences that are more **interactive** – and more personal



Order **branded replacements** and consumables with a single tap, using authenticated redirection



**Boost manufacturing** by automatically choosing the right tool every time

## XIAOMI AIR PURIFIER

The **Xiaomi Mi 2S** and **Mi 2Pro Air Purifiers** work with an NFC frontend in the actual purifier device and an NFC tag in the removable filter, protecting from counterfeit and ensuring good quality reputation. NFC does further allow to track the time a filter is in use and will help to reset the device automatically once you insert a new filter.



## USE CASES

# PARAMETRIZATION & DIAGNOSIS

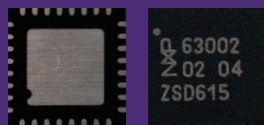
Any NFC-enabled phone or tablet can serve as a temporary touchscreen for your product, enabling sophisticated interactions and configurability at little additional cost. Your product can be smaller, lighter, more rugged, and less expensive to produce – yet easier to use. What’s more, NFC works with sealed devices, so sensors operating in difficult environments can easily interact with the control unit. Energy harvesting uses power from the active reader device, so unlike Bluetooth or Wi-Fi, with NFC the device doesn’t need a battery to send or receive information. Systems with a battery can even remain in sleep mode while being read.

NFC advantages over Bluetooth or Wi-Fi connection:

- Device can be unpowered
- No ambiguities - the device you tap is the device you connect to
- Inherent security due to short range and additional password and AES key option
- Very cost effective

## WHICH PRODUCT?

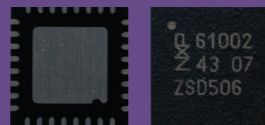
### MFRC630 + NTAG I<sup>2</sup>C *plus*



With the high-performance, energy-harvesting connected tag NTAG I<sup>2</sup>C *plus* on board, your device can be read, measured, or made interactive – even if it doesn’t have a power source.

To embed also the reader function into an electronic device, use the MFRC630 reader frontend to read data from or write data to the NTAG I<sup>2</sup>C *plus*.

### SLRC610 + NTAG 5 Family



NTAG 5 boost will give you a great read range with very small antennas. It can even work without an onboard MCU further reducing the BoM.

Select NTAG 5 link when you need an I<sup>2</sup>C master interface, for example when reading out sensors.

NTAG 5 switch which is designed to ease the configuration of GPIOs or PMW.

The SLRC610 NFC frontend creates a perfect match with the new NTAG 5 Family.



Let a fully sealed, batteryfree sensor unit **interact** with the meter housing



Avoid galvanic **connections** by letting machines talk without wires



Enable **interactions** with small, sealed devices that are not powered, for example configure the current of LED drivers



Get all the details, with complete control over every **setting and configuration**, even if the device is unpowered



When precision matters, **Schneider's Zelio Timer Relay** uses NFC to deliver 50 times the accuracy of conventional timer relays.

## LATE-STAGE CUSTOMIZATION

The **NTAG I<sup>2</sup>C *plus*** supports zero-power configuration, so you can save on logistics costs with late-stage customization. Limit production variants by producing a generic item that can be configured in its unpowered state, just before shipping, through the packaging. Or let installers and consumers do the customizing for you, with a quick tap of their NFC-enabled phones.

Energy harvesting uses power from the active reader device, so the device doesn’t need a battery to send or receive information.

## USE CASES

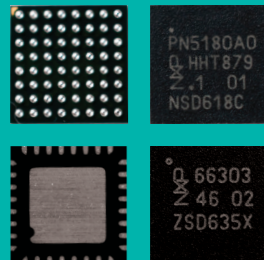
# PAYMENT

State-of-the-art contactless technology lets you do business with open systems like EMV, or with closed systems like MIFARE. You can count on full compatibility with every form factor, from smartcards and NFC-equipped mobile phones to wearables, tokens, and more. Using contactless technology also lets you increase consumer share-of-mind with value-added services, such as personalized messages, loyalty programs, and coupons based on recent purchases.

- Offer tap-and-pay convenience with enhanced security
- Accept EMV and MIFARE payments, and send paperless receipts
- Increase engagement with messages, loyalty, and couponing
- Use system-level solutions to save design and certification time
- Use protocol-agnostic operations to trigger actions

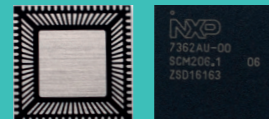
## WHICH PRODUCT?

### NFC Frontend PN5180 CLRC663 plus



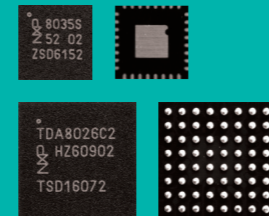
If you want your design to talk to any other NFC-enabled system, and you already have a microcontroller on board, use one of these EMVCo-compliant frontends to add secure payment functions.

### NFC Controller with Customizable Firmware PN7462



If you need a small footprint, use this single-chip solution to create a very compact design. You can easily add a coprocessor for time-critical functions in the EMVL1 protocol layer, for fast payment performance.

### Contact Reader Frontend TDA8035 TDA8026



If you want to support contact cards in your terminal, you can choose the single-slot TDA8035, or select the TDA8026 for use with multiple SAMs. Both offer full support for all classes of smartcard.



Offer new **kinds of loyalty** and couponing programs, with new levels of interaction



Let **micro-merchants** accept and confirm payments just like the mega-merchants



Use a **secure, protected connection** to access your bank or initiate transactions



Get a **snack or a drink**, even if you left your cash at home



Get **access** to any kind of energy through prepaid systems



Create **self-service kiosks** that attract attention while selling more tickets

## GET READY FOR EMV 3.0 CONTACTLESS LEVEL 1

This latest version of the payment standard improves interoperability between terminals and adds three new test targets (PICC) to support cards, mobiles, wearables, and other form factors that use antennas of different shapes and sizes. NXP is already there, with the PN5180, which includes advanced transmitter features, such as DPC, AWS, and ARC, and full compliance built into the NXP Reader Library.





# INTRODUCING OUR NFC PORTFOLIO

As the leading provider of **NFC solutions**, we offer the widest selection of form, fit, and function.



## CONNECTED TAGS

These small, passive tag ICs are the best, most cost-effective solution when you have an NFC reader or NFC phone on the other side of the transaction. They use an RF interface that's fully compliant with the FC Forum's specifications, and they support energy harvesting, so there's no need for a battery to power NFC interactions.



## NFC CONTROLLERS WITH CUSTOMIZABLE FIRMWARE

These highly integrated devices combine an NFC frontend with a freely programmable 32-bit Cortex-M0 microcontroller. They let you create a fully custom design, complete with NFC, in a very compact footprint. State-of-the-art options include support for both contactless and contact technologies, so you can deliver a system with maximum appeal and compatibility.



## NFC CONTROLLERS WITH INTEGRATED FIRMWARE

These plug-and-play solutions combine an NFC frontend with a 32-bit Cortex-M0 microcontroller equipped with integrated firmware, and are optimized for use with an OS. They come with Linux, Android, and WinIoT drivers, and include an NCI interface, so they're fully compliant with the NFC Forum's specifications.



## NFC FRONTENDS

These NFC devices are the most flexible way to add NFC connectivity to a system. All our NFC frontends are supported by our NFC Reader Library (see [p30](#)), so design-in is fast and easy.



## LONGEVITY

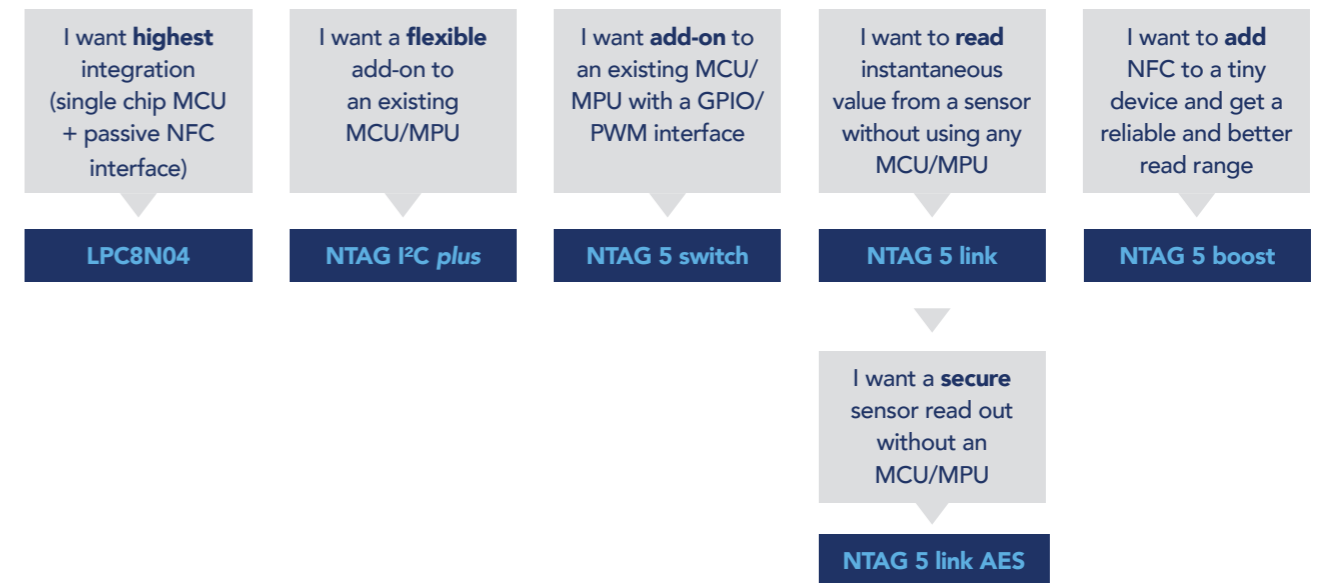
The **Product Longevity program** ensures a stable supply of products for your embedded designs. Longevity products remain in the program even if the manufacturing site changes. If we transfer a longevity product to another facility, we requalify the product to maintain its status. Supported products: CLRC663 plus, PN7150, NTAG I<sup>2</sup>C plus, and NTAG 5 family.



## NFC PRODUCT SELECTION PATH FOR EMBEDDED ELECTRONICS

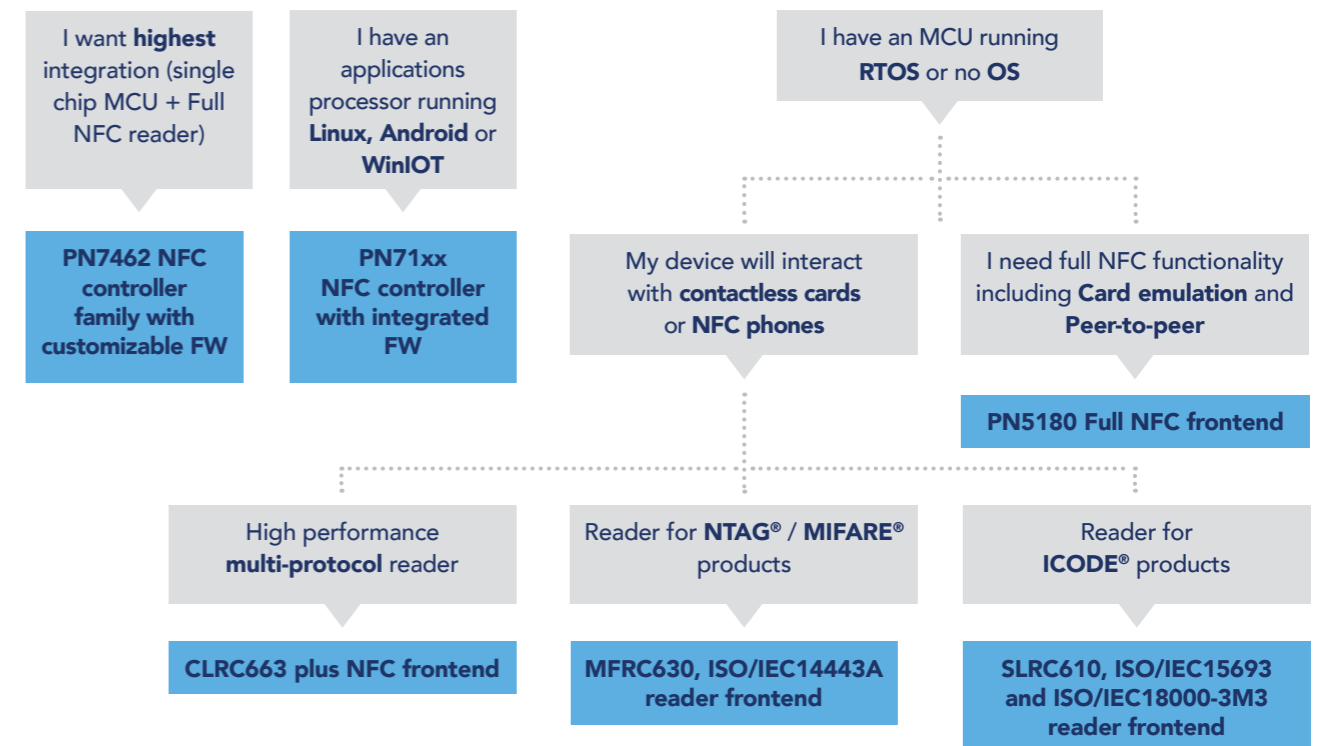
### PASSIVE SOLUTION

My device will only communicate with **NFC phones or readers**



### ACTIVE SOLUTION

My device will communicate with **NFC phones, readers and tags**



# WE MAKE NFC EASY

We reduce complexity, streamline tasks, and add flexibility at every point in development, so you can deliver a competitive advantage in record time. Links to the support tools listed below can be found on [nxp.com/nfc](https://www.nxp.com/nfc).



## TOOLS TO SUPPORT PRODUCT SELECTION



### Linecard NFC (print/online)

Complete NFC product listings, with detailed specs and side-by-side comparisons



### Parametric search

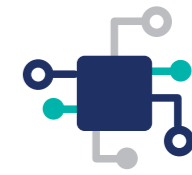
Online tool with parametric search features

## NFC DEVELOPMENT KITS



### NFC Development Kits

Full range of development kits for every NFCProduct, incl. design files and Gerber files



### MCU Compatibility Guide

Check compatibility with common MCU boards and single-board computers at [nxp.url.ms/nfcmcu](https://www.nxp.com/nfc)

## TOOLS AND APPLICATIONS



### NFC Cockpit

Intuitive GUI to configure and adapt NFC IC settings without coding



### NFC Antenna Design Hub

A comprehensive portal of resources and tutorials on NFC antenna design featuring the NFC Antenna Design Tool.



### NFC Library

Complete software support library for NFC Frontend ICs  
**Sample code** to speed up development  
**App notes** Detailed instructions on a broad range of applications



### EMVCo 3.0 compliance

EMVCo 3.0 (analog and digital) library in source code

## TRAINING AND SUPPORT



### NFC Training Catalog

Complete index of on-demand trainings and tutorials by industry experts



### Technical NFC Community

Online platform to ask and discuss NFC queries at <https://community.nxp.com/community/nfc>



### Design Partners

Independent Design Houses certified by NXP IDH Partners [www.nxp.com/partners](https://www.nxp.com/partners) select HW/SW engineering service

# NFC TAGS

Choose from a complete range of 13.56 MHz high-frequency (HF) ICs for inlays, tags, labels, and cards, featuring multiple security, memory storage, and interactivity options that address varied customer needs, from feature-light to feature-rich applications.



NFC tags can be read by all standard **NFC-enabled phones** and are available as bare bumped dies on wafers, intended for use in inlays, tags and labels, as well as modules.



NTAG is the ideal solution to add the benefits of contactless technology to high-security and/or high-volume applications. The NTAG family fully complies to ISO 14443A and NFC Forum Tag Type 2 and 4 specifications, ensuring universal interoperability with NFC devices and operating with and without apps. NFC tags enable a number of entirely new business applications:

- Consumable and accessory identification and authentication
- Direct 1:1 consumer engagement
- Brand protection and anti-counterfeiting
- Anti-tampering and anti-refilling
- Document authentication



ICODE® is the leading brand for smart, high-frequency (HF) label solutions with billions of ICs in the field. As the ideal vicinity solution, ICODE is ISO/IEC 15693 and ISO/IEC 18000-3 compliant, and follows NFC Forum Tag Type 5 specifications. An operating range of up to 1 m with long range readers, additional read range vs ISO/IEC 14443 with standard ISO/IEC 15693 readers for extra small form factors and NFC phone readability make ICODE an ideal solution for a range of applications:

- Library management,
- Consumable and accessory identification and authentication
- Brand protection and anti-counterfeiting
- Supply chain control
- Industrial

	ICODE SLIX 2	ICODE DNA
<b>NFC Forum type format</b>	Type 5	
<b>User Memory [bit]</b>	2528	2016
<b>RF Standard</b>	ISO/IEC 15693	
<b>UID (TID size)[bit]</b>	64	64
<b>Fast Inventory</b>	✓	✓
<b>Tag Authentication</b>	✓	AES – 128bit
<b>EAS/AFI</b>	✓	✓
<b>EAS/AFI Protection</b>	32bit password	AES – 128bit
<b>EAS Selective</b>	✓	✓
<b>AFI</b>	✓	✓
<b>AFI Protection</b>	32bit password	✓
<b>Memory write Lock</b>	✓	✓
<b>Memory access Protection</b>	32bit password	AES – 128bit
<b>Privacy Protection</b>	32bit password	AES – 128bit
<b>Destroy Protection</b>	32bit password	AES – 128bit
<b>Counter</b>	✓	✓
<b>Originality Signature</b>	✓	programmable
<b>Cres Capacitance [pF]</b>	23.5	

	NTAG 210µ	NTAG 21x	NTAG 413 DNA	NTAG424 DNA TagTamper
<b>NFC Forum Type format</b>	Type 2		Type 4	
<b>User memory [byte]</b>	48	48-888	416	
<b>RF Standard</b>	ISO/IEC 14443A			
<b>RF Baud Rate [Kbit/s]</b>	106		up to 848	
<b>UID [byte]</b>	7, cascaded			
<b>Access Keys</b>		32 bit	128-bit	
<b>Write Protection</b>		✓	✓	
<b>Password</b>		✓		
<b>Originality signature</b>	Programmable	32 bytes	56 bytes	
<b>UID ASCII mirror</b>		✓	✓	
<b>Fast Read</b>		✓		
<b>NFC counter with ASCII mirror</b>		✓	✓	
<b>Dynamic CMAC mirroring</b>			✓	
<b>Authentication</b>			3-pass mutual	
<b>Cres Capacitance [pF]</b>	17/50/70 depending on product		50	
<b>Special feature</b>			Tamper loop with once opened detection	
<b>Crypto processor</b>			AES 128	
<b>Certification</b>	NFC Forum		NFC Forum, CC EAL4	
<b>SUN – secure unique NFC message</b>			Tap unique NFC message generation	
<b>SAM support</b>			MIFARE SAM AV3	

## SOFTWARE

### TapLinX

SDK for the creation of Android-based NFC mobile apps. NXP's entire NFC smart objects portfolio in one open API.

### RFID Discover

Explore and deploy all the features of our MIFARE, NTAG, ICODE and MIFARE SAM AV2 13.56 MHz platforms.

### NFC TagWriter by NXP

Quickly and easily program contacts, bookmarks, geo location, Bluetooth pairing, email, and more.

### NFC TagInfo by NXP

Read out the complete tag memory layout, extract NDEF messages, use the value-checker function, and more.

# CONNECTED TAGS

These tags enable an easy link to the cloud by offering both, an RF and a host interface. The user memory can be configured for multiple rewrites or can be password protected, so data can't be manipulated.

NXP's Originality Signature, an algorithm that supports digital elliptic curve cryptography (ECC), adds an extra level of security and enables tag validation without a cloud connection.

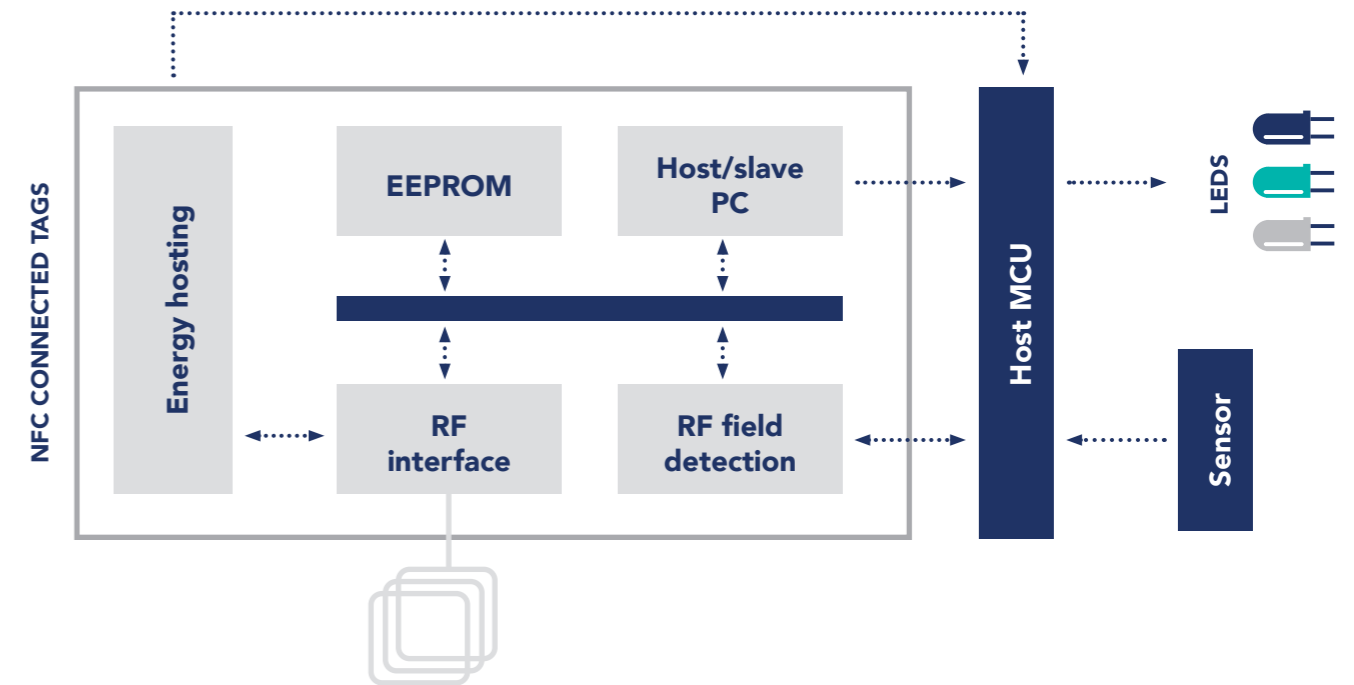
Field detection, which can be used to wake the tag when it senses an NFC interaction, helps save power. NTAG I<sup>2</sup>C *plus* can also use a pass-through mode (SRAM) to act as a modem for direct communication between the NFC device and the MCU.

The NTAG 5 boost uses active load modulation (ALM) to deliver robust and reliable communication with NFC phones, bringing a new level of convenience to tiny devices.



## NFC AS MCU REPLACEMENT

In some **lighting** and **gaming** applications, NTAG 5 switch enables simple and cost-effective designs without a microcontroller. It implements multiplexed pins, offering general-purpose I/O (GPIO) and pulse width modulation (PWM) as well as NFC field detection. The characteristics of the PWM or GPIO signal can be configured through the NFC interface. These features can be used to switch on/off and control motor speed or LED brightness.



## SOFTWARE

Software integration with the connected tags is easy. From the MCU side, the connected tag looks like an I<sup>2</sup>C memory, and from the phone side it looks like an NFC tag. There are no protocols to follow, and in many cases no specific timings, either. Here are the main steps for software integration.

### MCU/Embedded

- Download the sample MCU source code
- Adapt it to your application
- For static testing of the NFC device, use an NFC-enabled phone with the NTAG I<sup>2</sup>C Demo app or the USB reader from the OM5569-NT322ER demo kit, together with the "NTAG I<sup>2</sup>C Demo" software running on a Windows PC.

### Phone/NFC device

- Download the sample Android source code
- Write your app
- To test your NFC app with an NTAG I<sup>2</sup>C *plus* counterpart, use either your own board (with MCU + NTAG I<sup>2</sup>C *plus* + your firmware), or the NTAG I<sup>2</sup>C *plus* Explorer Kit, plugged via USB into your Windows PC, and the "Peek&Poke" software.

All source code and PC software can be downloaded from the NTAG I<sup>2</sup>C *plus* Explorer Kit webpage. Search for "**OM5569-NT322ER**" on [nxp.com](http://nxp.com).



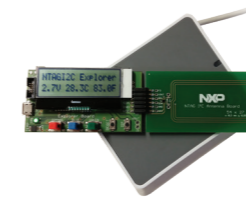
## SELECTION GUIDE

	NTAG I <sup>2</sup> C plus	NTAG 5 switch	NTAG 5 link	NTAG 5 boost
<b>NFC Forum type tag</b>	2	5	5	5
<b>Max. interface speed - NFC/I<sup>2</sup>C</b>	106 kbps/400 kHz	53 kbps/-	53 kbps/400 kHz	53 kbps/400 kHz
<b>Memory size</b>	888 or 1912 bytes 64 bytes SRAM	512 bytes	2048 bytes 256 bytes SRAM	2048 bytes 256 bytes SRAM-
<b>Memory protection from NFC perspective</b>	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 AES mutual auth*	Read only locking and 32- or 64-bit PWD or AES mutual auth.
<b>Memory protection from connected host</b>	Restrict access to NFC password protected area	-	32-bit PWD	32-bit PWD
<b>Memory areas</b>	2	3	3	3
<b>Originality Signature</b>	fixed	re-programmable	re-programmable	re-programmable
<b>Energy harvesting</b>	yes up to 15 mW	regulated up to 30 mW	regulated up to 30 mW	when used as passive regulated up to 30 mW
<b>Wired Interface</b>	I <sup>2</sup> C slave; Event Detect Pin	PWM, GPIO; Event Detect Pin	PWM; GPIO; I <sup>2</sup> C slave, I <sup>2</sup> C transparent master*; Event detection	PWM; GPIO; I <sup>2</sup> C slave, I <sup>2</sup> C transparent master; Event detection
<b>Typical stand-by and hard-power-down values</b>	-	6 μA/0,25 μA	6 μA/0,25 μA	10 μA/0,25 μA
<b>Active load modulation</b>	-	-	-	yes, when VCC supplied
<b>Temperature range</b>	-40°C to +105°C	-40°C to +105°C	-40°C to +105°C	-40°C to +105°C

\* Only available for NTP5332

## EVALUATE, PROTOTYPE & FINE-TUNE

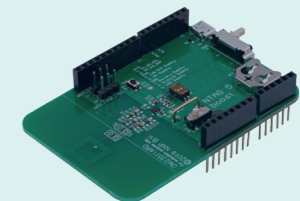
OM5569-NT322E  
OM5569-NT322ER



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

An all-in-one demonstration and development resource to evaluate the NTAG I<sup>2</sup>C plus in an electronic system. Use it to explore tag operation, the NFC RF communication link, and the I<sup>2</sup>C serial bus link. The OM5569-NT322ER provides an additional NFC reader, so you can explore reader and tag functionality without having to have an NFC-enabled phone.

OM23510ARD



### Development Kits for NTAG 5 family

The dedicated NTAG 5 switch/link and NTAG 5 boost Arduino®-compatible customer development boards are suitable for any boards featuring an Arduino header, including NXP LPCXpresso, Kinetis and i.MX boards. I<sup>2</sup>C access software for peek and poke as well as an Android application based on TapLinX is available from NXP.



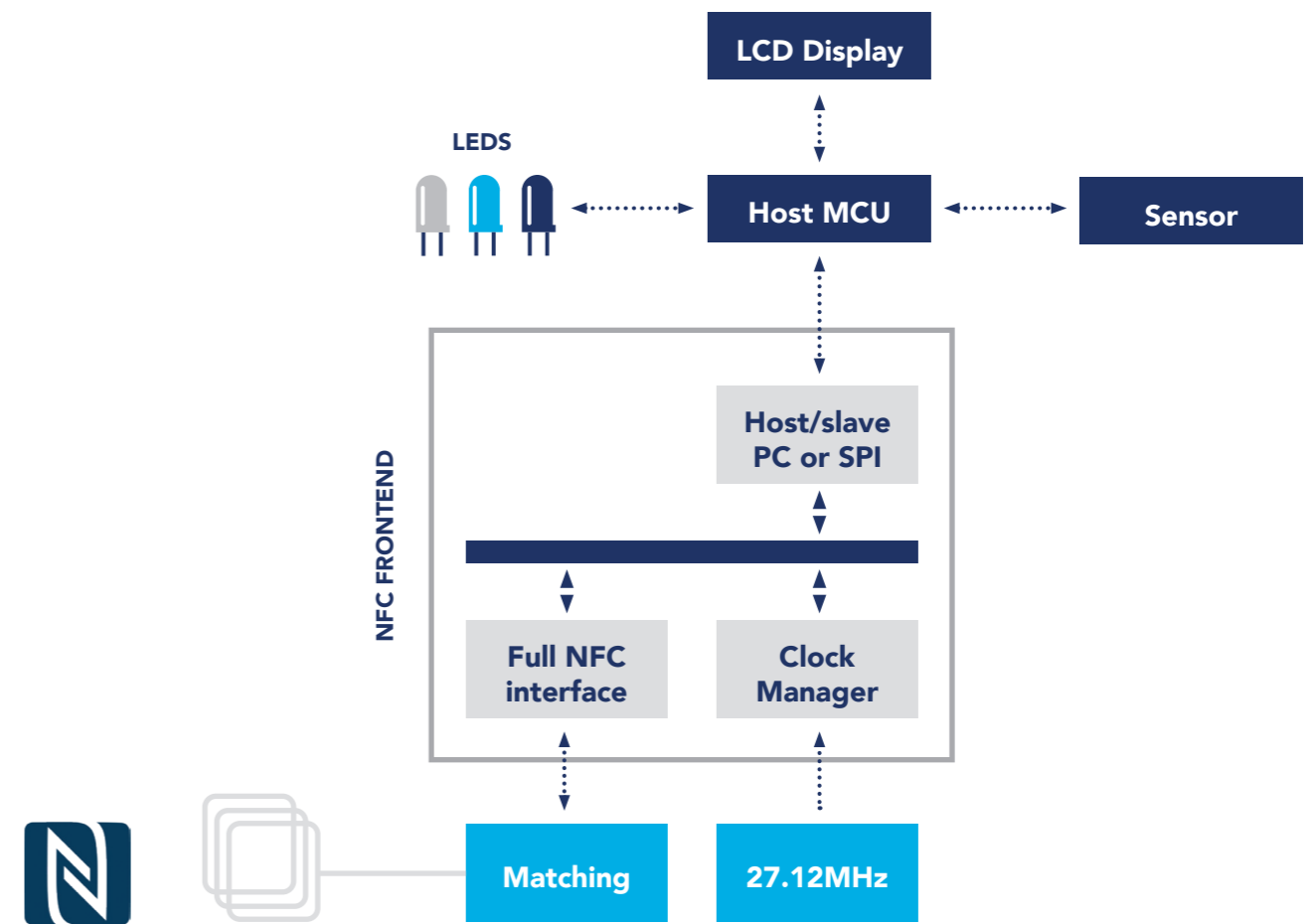
**DOWNLOAD THE  
NTAG I<sup>2</sup>C DEMOBOARD  
AND NTAG 5  
DEMOBOARD APPS  
ON ANDROID AND iOS**



# NFC FRONTENDS

Our frontends are the most flexible way to upgrade your design to NFC connectivity. The **CLRC663 plus** family is primarily intended for use with contactless smartcards and tags, while the **PN5180** is designed for broad-based applications, connecting with everything from smartcards to mobile handsets.

Libraries for embedded systems, fully compliant with ISO/IEC, EMV, and the NFC Forum, deliver reliable performance and simpler certification. Energy-saving features like low-power card detection extend battery life, and seamless integration with our NFC Reader Library means you can add or subtract functions with ease.



## GET READY FOR EMV 3.0

This new standard version for payment targets better interoperability between terminals and various payment form factors (like cards, mobiles, wearables) which come with different antenna sizes and shapes. EMV 3.0 defines 3 new test targets (PICC) to represent the variety of form factors. Due to its advanced transmitter features such as DPC, AWS, ARC, PN5180 is a perfect candidate to be used for EMV 3.0 certification. On top, NXP delivers a fully EMVCo 3.0 compliant NFC reader library.

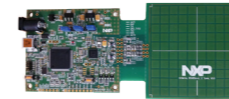


## SELECTION GUIDE

	PN5180	CLRC663 <i>plus</i>	CLRC661 <i>plus</i>	MFRC631 <i>plus</i>
<b>Reader/Writer</b>				
ISO/IEC 14443 A	✓	✓	✓	✓
ISO/IEC 14443 B	✓	✓		✓
FeliCa	✓	✓		
ISO/IEC 15693	✓	✓	✓	
ISO 18000-3M3	✓	✓	✓	
Tag Type	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 4A, 5	1, 2, 4
<b>Peer-to-Peer Support</b>				
Passive Initiator	✓	✓		
Active Initiator	✓			
<b>Card Emulation</b>				
Emulate NFC Forum Tag Types	4A			
<b>Other Features</b>				
EMVCo 3.0 compliancy	✓			
External Clock Support Eliminates 27.12-MHz Crystal	✓			
Autonomous Transmitter and Receiver Control	✓			
Best for Battery-Powered Designs		✓	✓	✓
Ambient Temperature Range	-30 to +85 °C	VFBGA -40 to +85 °C HVQFN -40 to +105 °C	-40 to +105 °C	-40 to +105 °C
Package	HVQFN, TFBGA	HVQFN, VFBGA	HVQFN	HVQFN

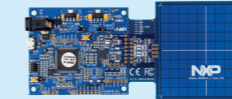
## EVALUATE, PROTOTYPE & FINE-TUNE

### OM25180 PN5180 Development Kit



This kit includes a PN5180 board optimized for reader and EMVCo applications, two different antenna boards (65 x 65 mm and 30 x 50 mm, equipped with matching components), three small matching boards for implementation of a custom antenna-matching circuit, an NFC sample card and ten PN5180 samples in HVQFN packages.

### OM26630 CLRC663 *plus* Development Kit



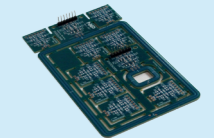
This kit includes a CLRC663 *plus* board demonstrating the extended Low Power Card Detection, with optimizations for access control applications, plus different antenna boards, an NFC sample card, and ten CLRC663 *plus* samples in HVQFN packages.

### CLEV6630ARD CLRC663 *plus* Arduino interface board



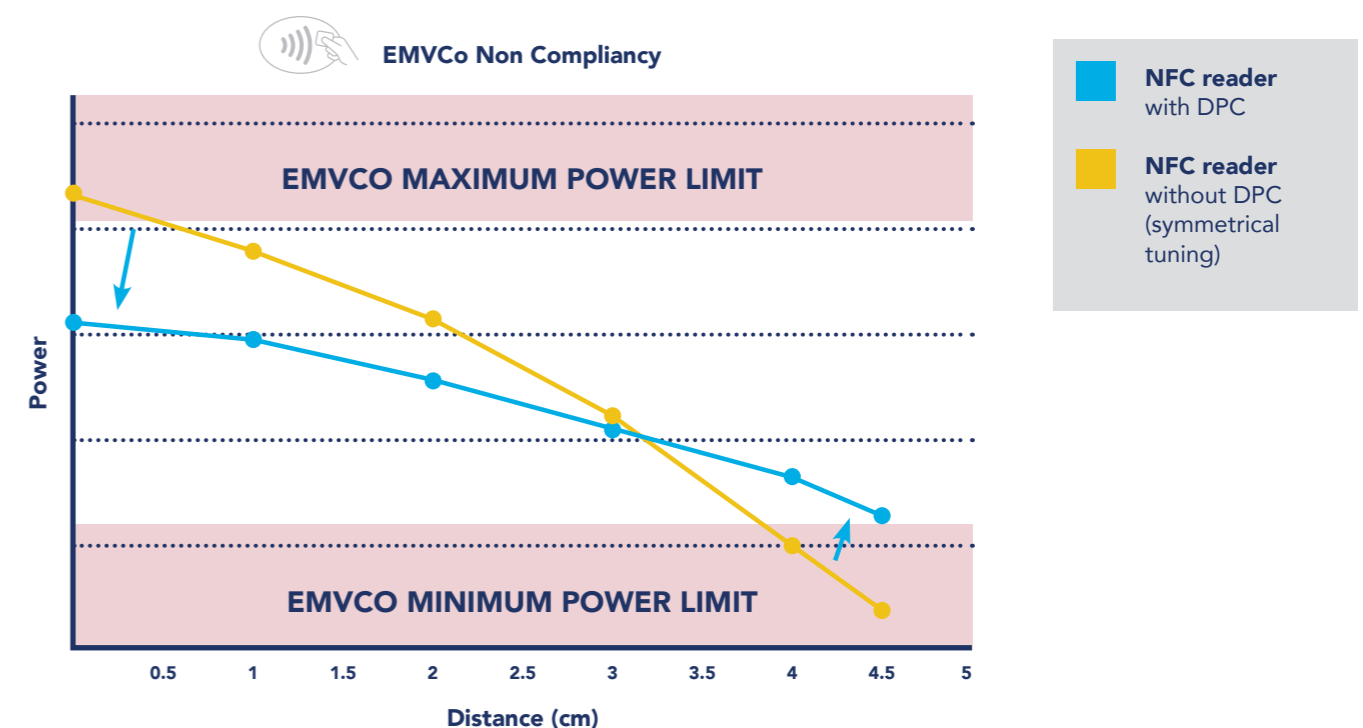
This board enables the CLRC663 *plus* integration with any board compatible with Arduino header, including most LPCXpresso, Kinetis and i.MX boards. Out of the box, it works perfectly with FRDM-K82F, the Freedom development platform for Kinetis® K82, K81, and K80 MCUs and is fully supported by the NFC Reader Library.

### OM29263ADK NFC Antenna Development Kit



This kit comes with various ready-to-use antennas in popular sizes. The included matchings enable immediate prototyping.

## PN5180: HOW DPC SOLVES POWER TRANSFER FOR EMVCO COMPLIANCY



# THE NFC READER LIBRARY

Everything you need to create your own **software stack** and **application** for a contactless reader – at no extra charge. Our NFC Reader Library is a modular, multi-layer software library that provides all the application programming interfaces (APIs) needed to complete a design and prepare it for certification.

Available for free download, written in C programming language, and capable of supporting multiple design environments and platforms, the Library includes all the latest features to ensure 100% standards compliance. It enables full interoperability with devices already deployed in the market, and saves time and money at every point in the design cycle.

## THE PROCESS



### 1 Focus on Scalability

The multi-layered software design ensures scalability of the software stack. Only the required software components and protocol implementations need to be enabled, so the final application has a smaller memory footprint.



### 2 Optimize Performance

Fine-tune your design with built-in MCU support, interrupt-based event handling, a full complement of host interfaces, free RTOS support, and compilers that produce highly compact, efficient code.



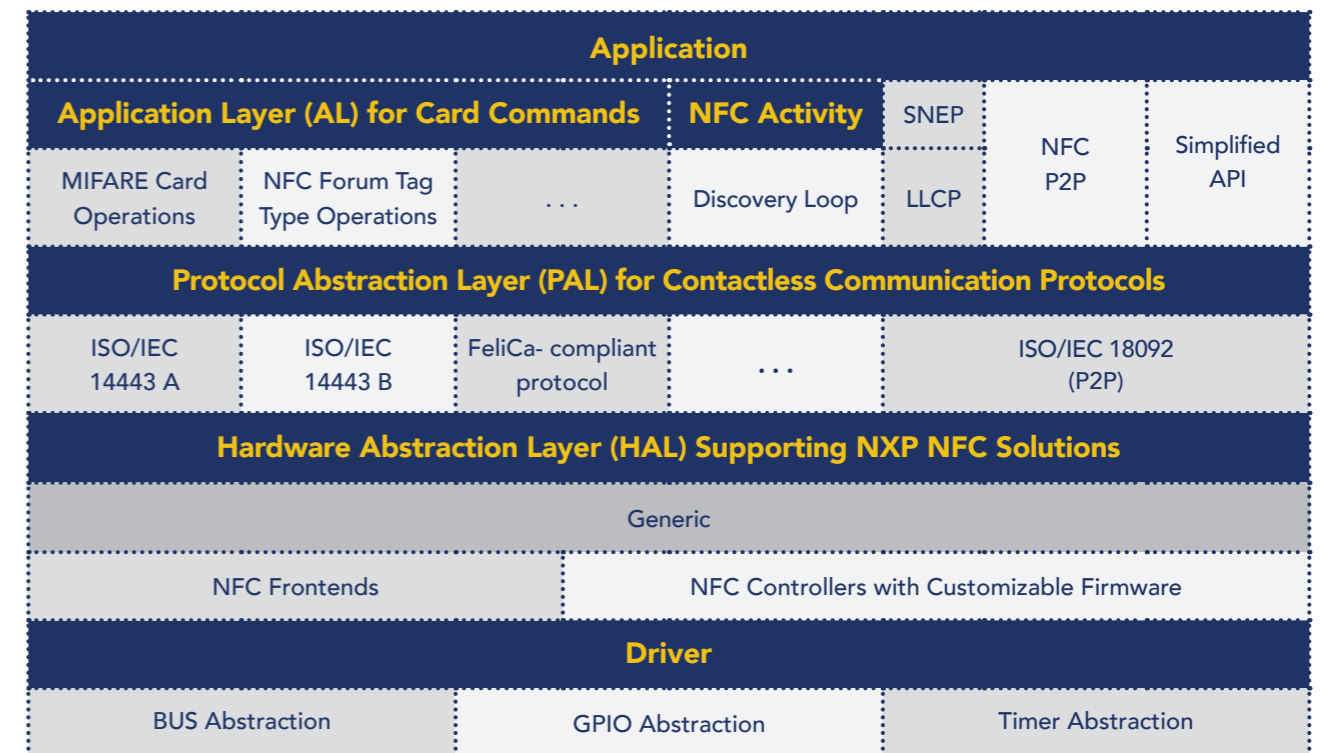
### 3 Simplify Test & Debug

Save time and effort by using a rich set of examples for all the most common functionalities, including call for inventory, polling, card emulation, application for EMVCo certification, low-power card detection, and dynamic power control.



### 4 Validate Interoperability

Get ready for certification with test apps that cover everything from payment and ID cards to automotive, EMVCo L1, NFC Forum, and ISO/IEC 10373-6 PiCC/PCD. Broaden compatibility with the MIFARE portfolio and LLCP/SNEP protocols for P2P mode.



## THE NFC COCKPIT

The CLRC663 *plus*, the PN5180, and the PN7462 family are supported by the NFC Cockpit, an intuitive graphical user interface (GUI) that lets you configure and adapt IC settings without writing a single line of software code.

- Let the hardware designers optimize antenna parameters, including wave shape, while the software designers work on other things
- Fine-tune the Dynamic Power Control and Low Power Card Detection settings
- Activate a contactless smartcard, including basic card communication, with options for APDU and EMVCo polling
- Implement firmware updates for the PN5180
- Access all EEPROM cells and registers



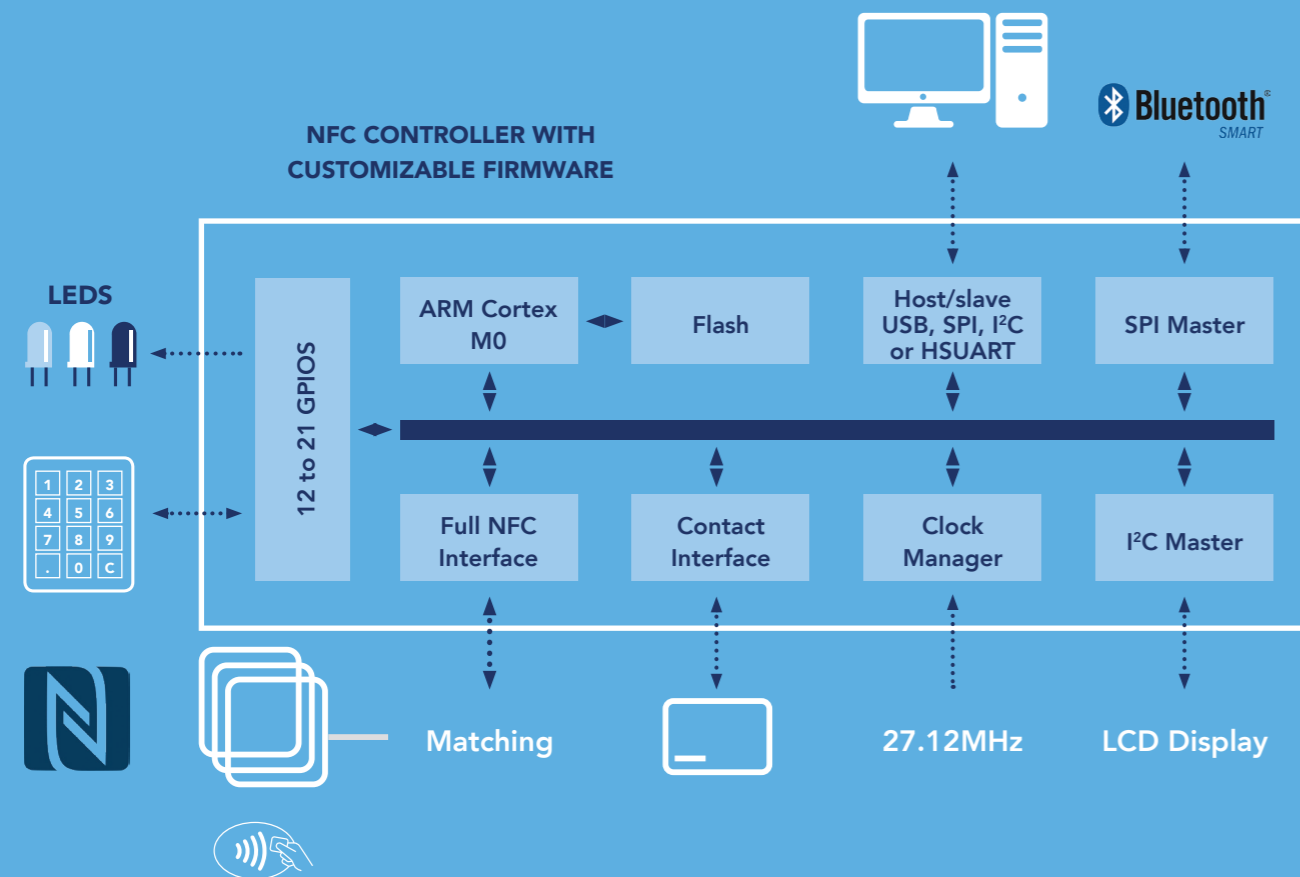
Join the **NFC Community** and browse projects, questions, and answers regarding the NFC Reader Library, or make your own case and interact with our NFC experts: <https://community.nxp.com/community/nfc>



# NFC WITH CUSTOMIZABLE FIRMWARE

By combining an **NFC frontend** with an advanced, power efficient 20-MHz ARM Cortex-M0 microcontroller, our all-in-one **NFC controllers with customizable firmware** are the best choice for compact systems, since they enable higher integration with fewer components.

The flash memory can be loaded with fully-custom applications, and the optimized antenna operation, in combination with low-power modes, delivers best-in-class performance. All the controllers are accompanied by extensive support tools, including sample source code and the NFC Reader Library (see [p30](#)).



## PN7462 FAMILY

The PN7462 Family extends the possibilities, with added features that make it easy to deliver the most advanced functionality. Ensure market interoperability with full MIFARE support. Full NFC Forum compliance, along with EMVCo for payments, saves time and gives you a shorter path to certification. Advanced power-management functions enable longer battery life, and DPC (see [p26](#)) delivers optimized antenna performance. Use the ISO/IEC 7816 interface to communicate with contact cards. This highly integrated device lets you design a complete system with just one small package.

Extensive host and peripheral interfaces include:

- Host/slave & master interfaces: I2C, SPI, USB, HSUART
- Contactless interface: NFC Forum compliant, EMVCo 3.0
- Contact interface: UART, ISO/IEC 7816, EMVCo 4.3c
- 12 to 21 GPIOs



## SOFTWARE

The **contactless** and **contact frontends** of the controller are supported by the freely downloadable NFC Reader Library (see [p30](#)).

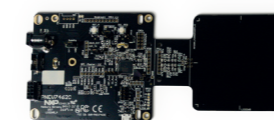
The frontend further supports **Dynamic Power Control** (see [p26](#)).

## SELECTION GUIDE

	PN7462AU	PN7412AU	PN7362AU	PN7360AU
Flash Memory (KB)	160	160	160	80
Contactless Interface	✓		✓	✓
Contact Interface	✓	✓		
HVQFN (9 x 9mm)	✓	✓	✓	✓
VFBGA (4.5 x 4.5mm)	✓		✓	✓

## EVALUATE, PROTOTYPE & FINE-TUNE

### OM27462CDKP



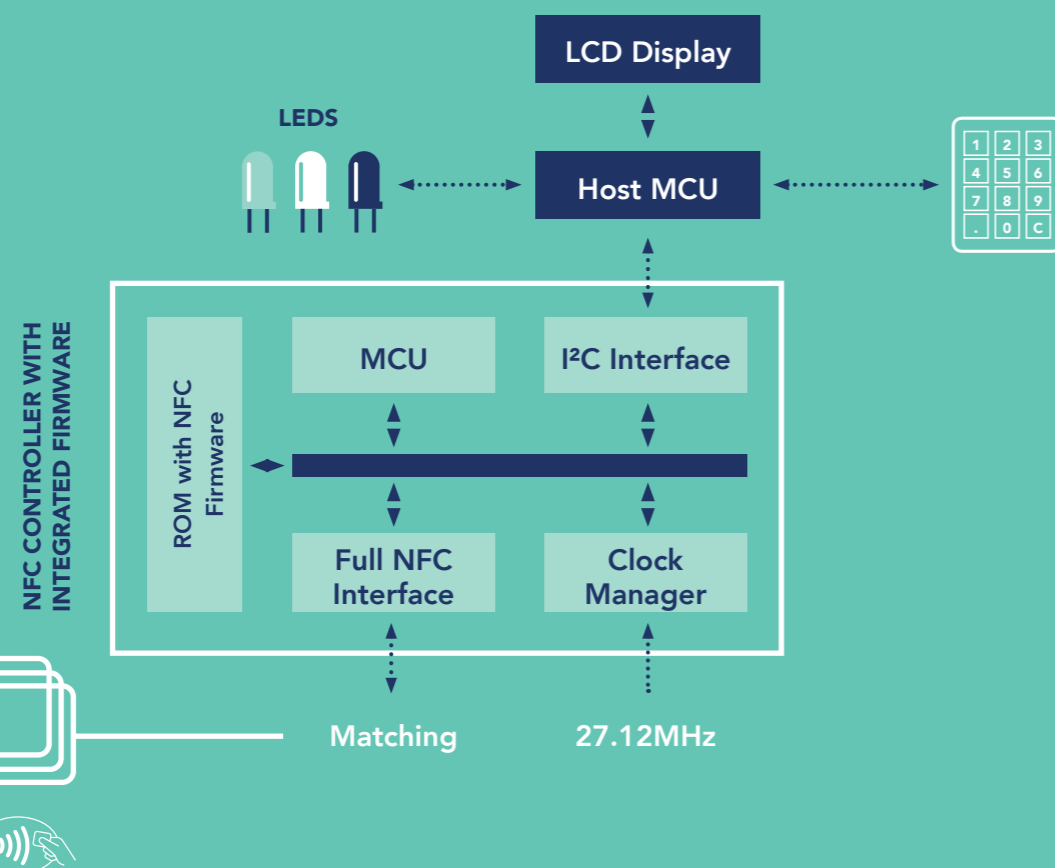
### PN7462 Family Development Kit

Designed for comprehensive application development, this kit contains a PN7462 board, two different antenna boards, three small antenna-matching boards for implementation of a custom antenna-matching circuit, a smartcard reader and ten PN7462 samples. Compatibility with the NFC Cockpit and PCB adaptors simplifies antenna matching. Full NFC Forum compliance and contact software libraries save time on code development.

# NFC CONTROLLERS WITH INTEGRATED FIRMWARE

Designed to save time when developing a system that uses an OS, our NFC controllers with **integrated firmware** combine an NFC frontend with an advanced, power-efficient 20-MHz ARM Cortex-M0 microcontroller, and come pre-loaded with drivers for Linux, Android, and WinIoT.

They communicate via the NCI interface, to conform with the NFC Forum's guidelines for interactions with the system's main application processor. You can move quickly from initial prototype to full production, since these controllers support the most popular development platforms, and are supported by sample applications and source code.



## SOFTWARE FOR EVERY OS INTEGRATION

Our NFC controllers with **integrated firmware** are the perfect fit for systems that use a large OS.



Our libnfc-nci library offers easy, smooth integration into **GNU Linux-based systems** and has a high-level API for NFC functionality.



Patches to **Android Open Source Project (AOSP)** are available for simple integration into Android-based systems. The solution benefits from all the NFC implementations already available with Android.



Our NFC controllers are natively supported as proximity platform devices, through the universal **NFC device driver model of the Win10 IoT OS.**



We provide code examples running on **NXP LPC, Kinetis, and i.MX MCUs**, for a full NFC experience with an RTOSbased system, or a system that doesn't use an OS.

## SELECTION GUIDE

	PN7150
ROM with NFC Firmware	✓
RF Driver Supply Voltage (V)	2.7 to 4.75
NFC Tag Type Emulation: Type 3 Tag (FeliCa) and Type 4	✓
Load Modulation Concept	Active
HVQFN40 (6 x 6 x 0.85 mm)	✓

## EVALUATE, PROTOTYPE & FINE-TUNE

OM5578/PN7150ARD	OM5578/PN7150RPI	OM5578/PN7150BBB
<b>PN7150 Board with Arduino-Compatible Header</b> A PN7150 controller board with an Arduino interface board (for use with LPCXpresso, Kinetis, i.MX, and more), plus an NFC Forum Type 2 Tag.	<b>PN7150 Board for Raspberry Pi</b> A PN7150 controller board with a Raspberry Pi interface board and an NFC Forum Type 2 Tag.	<b>PN7150 Board for BeagleBone Black</b> A PN7150 controller board with a BeagleBone Black interface board and an NFC Forum Type 2 Tag.

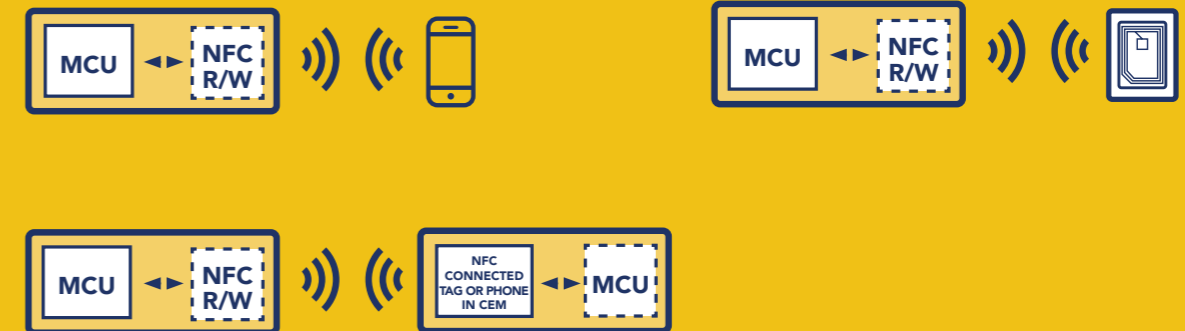


# NFC COMMUNICATION MODES

## THE THREE TYPES OF NFC INTERACTIONS

### Read/Write Mode

This is where NFC spends most of its time, with one NFC-enabled device interacting with another to get information or initiate an action. The initiating device can read data in from the second device or write data out to it.



### Peer-to-Peer Mode

Sometimes referred to as "P2P" mode, this is the one you can use to exchange files between smartphones, or receive loyalty points when making a purchase.



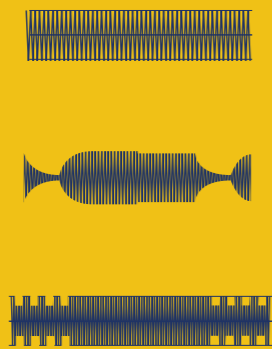
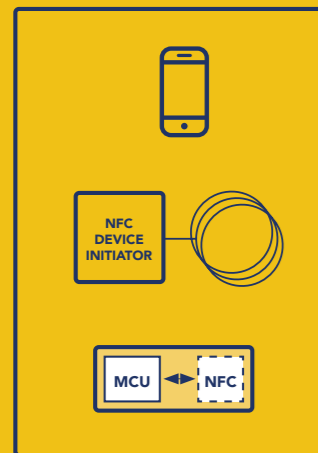
### Card Emulation Mode

This mode, used almost exclusively by NFC smartphones, lets the system behave as an ISO/IEC 14443-compliant contactless smartcard. That means your phone can be used in the existing contactless infrastructure, for things like ticketing, access control, transit, tollgates, and payments. The mode takes very little power, and can work even when the phone is off.



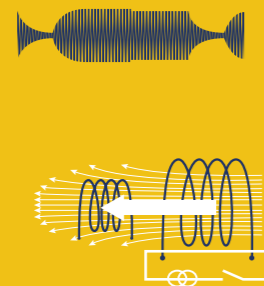
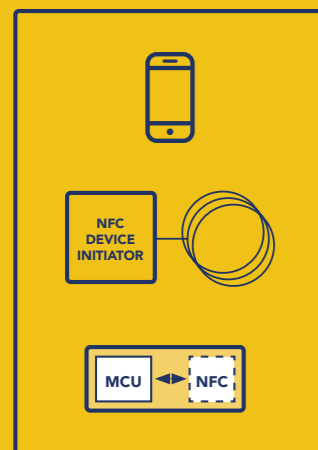
# PASSIVE OR ACTIVE COMMUNICATION?

## PASSIVE COMMUNICATION SCHEME



- 1 The initiator produces a 13.56 MHz carrier field**  
The field enables data exchanges and sends energy to the target.
- 2 The initiator sends commands**  
The initiator transfers data by directly modulating the field.
- 3 The target responds**  
The target transfers data by load-modulating the field.

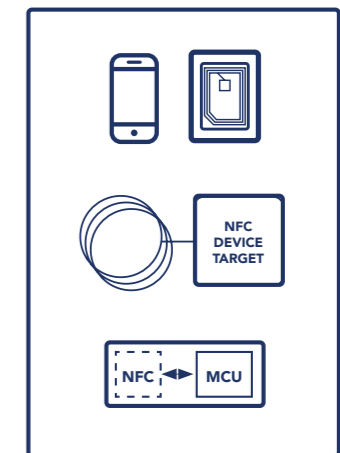
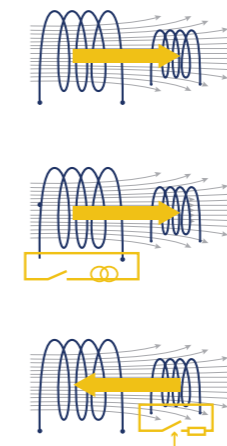
## ACTIVE COMMUNICATION SCHEME



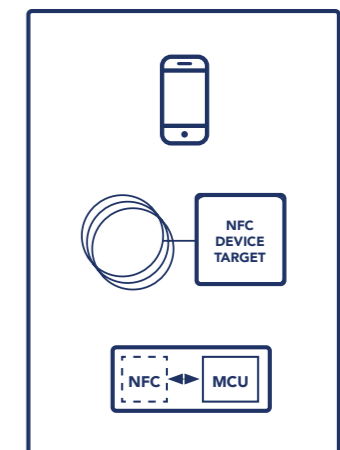
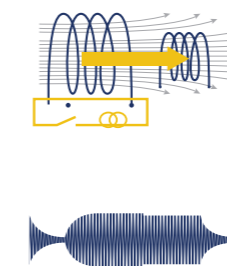
- 1 The initiator sends commands**  
The initiator generates a 13.56 MHz carrier field, uses Amplitude Shift Key (ASK) modulation to send commands, then cuts the field.
- 2 The target responds**  
Once the initiator cuts its field, the target generates its own and uses ask modulation to send responses.

WITH **PASSIVE COMMUNICATION**, THE TARGET USES THE RF FIELD GENERATED BY THE INITIATOR, BUT WITH **ACTIVE COMMUNICATION**, EACH SIDE GENERATES ITS OWN FIELD. WHICH METHOD YOU USE DEPENDS ON THE OPERATING MODE.

## READ/WRITE, PASSIVE PEER-TO-PEER, AND CARD EMULATION MODES



## ACTIVE PEER-TO-PEER MODE



To avoid collisions, only the sending device emits an electromagnetic field. The send/receive roles are reversed as needed to support the transaction.

# NFC TECH ESSENTIALS

## NFC FORUM TAG TYPES

The **NFC Forum** mandates that all their defined tag types be interoperable with **NFC devices**. All the tag types are based on existing contactless formats.

Type 1 and 2 tags provide a basic set of features and can be compared to the MIFARE Ultralight format. Type 3 and 4 tags offer higher memory capacity and more advanced features. Type 3 tags are based on Japan Industry Standard JIS X 6319-4 primarily used in Japan and can be compared to FeliCa formats. Type 4 tags can be compared to MIFARE DESFire formats. Type 5 tags are designed for communication over longer ranges (up to 1m). Type 5 tags are based on the ISO/IEC 15693 standard, which is also known as vicinity RFID, and can be compared to ICODE SLIX formats.

	TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5
ISO/IEC 14443 A	✓	✓			
JIS X 6319-4			✓		
ISO/IEC 14443 A or B				✓	
ISO/IEC 15693					✓

## COMMON NFC RECORD TYPES

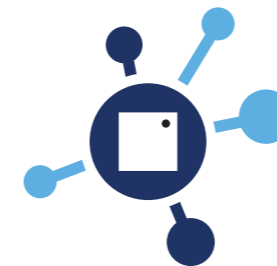
<b>Device Information (Di)</b>	Basic details about the device model and its identity, for use when the device acts as host
<b>Smart Poster (Sp)</b>	Text strings, such as URLs, SMS messages, or phone numbers stored in an NFC tag
<b>Text (T)</b>	Text strings in multiple languages
<b>URI (U)</b>	Universal Resource Identifiers (URIs), which include web addresses (URLs) and other network resources and files
<b>Connection Handovers (Hr/Hs/Hc)</b>	Pairing with Bluetooth, Wi-Fi, or other protocols. Includes record formats for handover request (Hr), select (Hs), and carrier (Hc).
<b>Signature (Sig)</b>	Provides an algorithm or certificate type for use as a digital signature



## FORMATS FOR DATA EXCHANGE (NDEF, RTD, SNEP)

All NFC Forum-compliant devices and tags support the same NFC Data Exchange Format (NDEF).

NDEF lets you encode data into the device or tag so it can share information with other NFC Forum-compliant devices and tags. The NDEF message sequence includes a series of records that contain data.



The record structure varies depending on the type of data conveyed. Record formats are specified in the NFC Record Type Definition (RTD). When NDEF messages are exchanged in Peer-to-Peer mode, the transaction follows the Simple NDEF Exchange Protocol (SNEP), which improves reliability by making use of the Logical Link Control Protocol (LLCP) connection-oriented transport mode.

FOR MORE ON THESE FORMATS,  
CHECK OUT [NFC-FORUM.ORG](https://nfc-forum.org)

## RELEVANT STANDARDS & SPECIFICATIONS

NFC is compatible with a number of industry-defined formats. Here's a quick rundown, in alphanumeric order, of the ones most relevant to system designers.

STANDARD	SUBJECT	RELATIONSHIP TO NFC
EMVCo	Payment	Provides guidelines for NFC systems that accept payments or act as payment cards.  Level 1 addresses the conformance of transport layer of contactless communication.
FeliCa	Contactless Smartcard	Developed by Sony and used primarily in Hong Kong, Japan, and Singapore, FeliCa is a contactless RFID smart card system that complies with JIS: X6319-4 and is also included as a condition for compliance with the NFC Forum specification.
GlobalPlatform	Secure Element	Specifies a multi-application architecture for the secure elements used to protect transactions in NFC systems.
ISO/IEC 7816	Contact smartcard	Defines the requirements for contact cards communication. ISO7816-4 layer is also used for the command set layer of most ISO14443-4 contactless cards..
ISO/IEC 10373-6	Proximity Card	Defines test methods specific to proximity cards and objects.
ISO/IEC 14443	Proximity Card	Defines the most widely used standard for proximity cards, objects, and readers in payment, transport, identification, and more. Type A and Type B cards use the same transmission protocol, but differ in their modulation methods, coding schemes, and procedures for protocol utilization. NFC Forum Type 2 and Type 4 Tags are based on the ISO/IEC 14443 series.
ISO/IEC 15693	Vicinity Card	Defines a contactless card that can be read at a range of up to 1 m, a longer distance compared to proximity cards. The NFC Forum Type 5 Tag is based on ISO/IEC 15693, and delivers an expected read range with mobile phones that is slightly longer than with Type 2 Tags.
ISO/IEC 18000-3M3	Item-level RFID	Defines an EPC Global Gen2 HF reader with an air interface at 13.56 MHz, the same operating frequency as NFC. Used for highly stackable tags with fast bulk reading.
ISO/IEC 18092	NFC Interface and Protocol	Defines Near Field Communication. Incorporates portions of ISO/IEC 14443 and FeliCa.
MIFARE	Contactless Smartcard	Refers to a contactless smartcard format compatible with NFC. Includes proprietary technologies based on various levels of the ISO/IEC 14443 A standard.
MISRA-C	Contactless Smartcard	Provides NFC developers with guidelines for C programming in automotive.  Developed by the Motor Industry Software Reliability Association.
NFC Forum Specification	NFC Devices	Defines an NFC implementation that enables interoperability across NFC applications.

# TAKE THE NEXT STEP



For more information on NFC Everywhere [www.nxp.com/nfc](http://www.nxp.com/nfc)

 everywhere