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NFC
a world of opportunities

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Introduction to NFC

ST, a leading provider of NFC technology

Based on the 13.56 MHz wireless communication protocol, Near Field Communication (NFC) uses contactless connectivity to build key enablers that greatly facilitate the adoption of new innovative applications.

NFC is a convenient, always-on radio link that is widely used in contactless payment, e-government (passports), access control, transport ticketing systems, and wireless contactless charging. NFC is driving the growth for simple pairing, diagnostic readout, parameter programming and much more.

NFC's unique features will have a positive impact on many of our activities in areas such as smart living, industrial, and mobile devices.

As a main provider of NFC technology, ST's complete product portfolio will help you build the most effective and secure solutions for all your applications.

OVERVIEW OF NFC TECHNOLOGY

NFC's main features make it ideal for everyday use:

- Fast and intuitive, no training required
- Already widely used in mobile, cards and tags
- Short operating distance guarantees privacy and security
- Perfect for secure transactions, such as payments or access control
- Greatly facilitates Bluetooth pairing and Wi-Fi hotspot registration

ST'S NFC OFFER

- NFC readers and tags
  - NFC reader ICs for embedded, payment, and automotive applications
  - NFC/HF RFID tag ICs for consumer engagement and products
  - Dynamic NFC tag ICs for consumer, industrial and logistics
- NFC controllers
  - Standalone or combined with an embedded secure element
  - Dedicated to smartphones, tablets, wearables, and connected PCs

ST's sophisticated technology ensures improved power consumption and an extended communication range

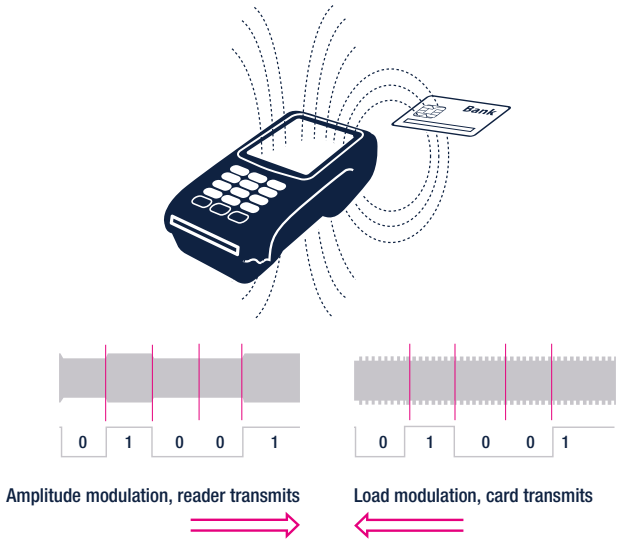
TECHNOLOGIES AND TAG TYPES

The NFC Forum defines technologies and tag types based on existing proximity and vicinity contactless standards.

Tag types	Type 1	Type 2	Type 3	Type 4	Type 5
NFC technology	NFC-A	NFC-A	NFC-F	NFC-A or B	NFC-V
Standards	ISO/IEC 14443A	ISO/IEC 14443A	ISO/IEC 18092 JIS X 6319-4 FeliCa®	ISO/IEC 14443A ISO/ IEC 14443B	ISO/IEC 15693
Memory size	96-bytes ÷ 2K-bytes	48-bytes ÷ 2K-bytes	2 K-bytes	32 K-bytes	64 K-bytes
Data rate (kbit/s)	106	106	212/424	106	26.5
Anti-collision	No	Yes	Yes	Yes	Yes
Capability	Read Re-write Read-only	Read Re-write Read-only	Read Re-write Read-only	Re-write Read-only Factory-configured	Read Re-write Read-only
Notes	Simple, cost effective	Simple, cost effective	Complex applications, targeting Japanese market	Complex applications	Vicinity area

NFC COMMUNICATION PRINCIPLE

The simplicity of the NFC technology relies on fast and simple communication steps. It always involves an initiator, typically an NFC reader or a mobile phone, and a target, typically a tag or mobile phone in card emulation mode.

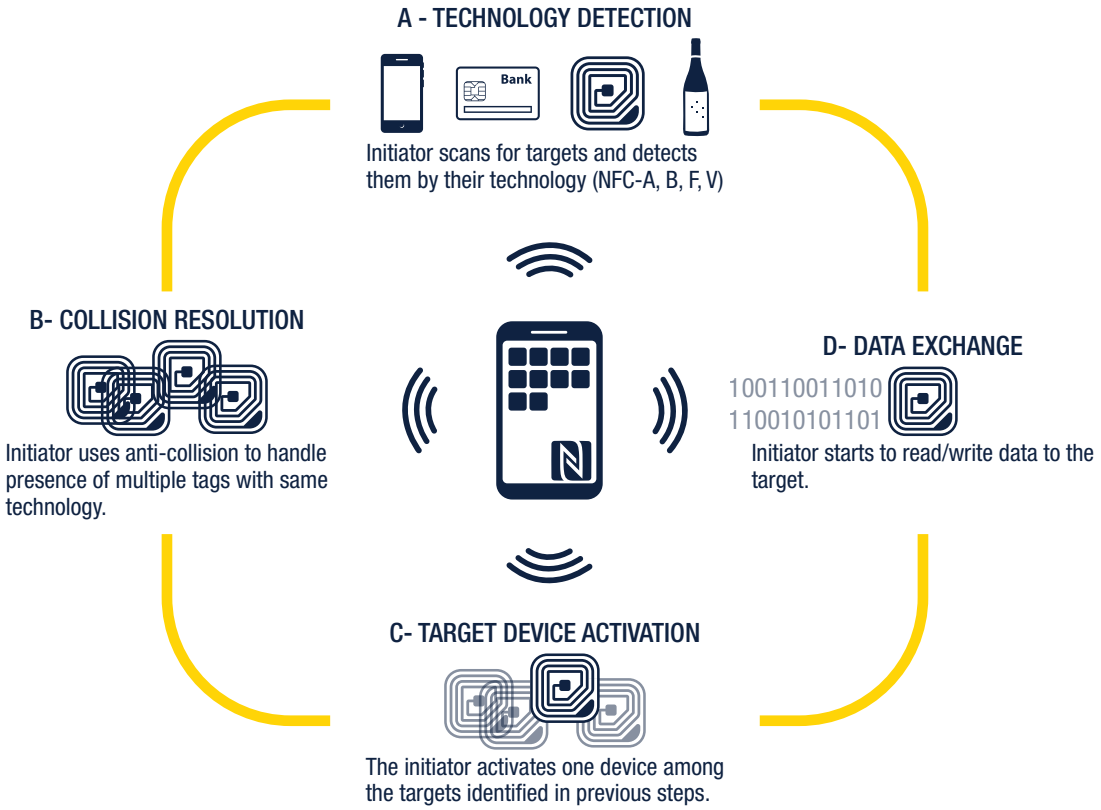


An initiator energizes an antenna with a 13.56 MHz signal to create an electromagnetic field. The near field is used to transfer energy to target. The initiator sends data to the target by modulating the field intensity.

The target sends back data to the initiator by load-modulating the field.

In the passive mode of operation, only the NFC initiator generates RF field. This mode is typically used for reading tags or smart cards.

In the active mode of operation, both NFC devices take turns to generate RF electromagnetic field. Typically, this mode might be used by two mobile devices during peer-to-peer communication.



NFC COMMUNICATION MODES

The NFC Forum defines three kinds of NFC devices: universal NFC Forum devices, reader devices and tag devices. These NFC devices can operate in four communication modes, which also categorize the type of use case. As a main provider of NFC technology, ST's comprehensive product portfolio will help you build the most effective and secure solutions for all your applications.

Reader/Writer
Communicate with contactless tags or devices in card emulation mode

Card Emulation
Use your device in a contactless infrastructure such as payment and transport ticketing systems

Peer-to-peer
Connect devices through physical proximity

Wireless Charging
Charge small devices using a limited power supply

READER/WRITER MODE

In Reader/Writer mode, NFC ICs can detect one or multiple tags and interrogate a tag to execute a transaction. The NFC Forum defines 5 types of tags, which cover a wide range of applications. The reader can be either a dedicated NFC reader, or a mobile device.

CARD EMULATION MODE

An NFC controller, typically present in mobile devices, emulates the behavior of a contactless card as defined by ISO/IEC 14443 or FeliCa® standards, for use in a contactless infrastructure such as payment, transport...

The NFC controller only handles the low-level communication, while the NFC secure application resides either in a SIM card, an embedded Secure Element (eSE), an embedded SIM (eSIM) or directly in the main application processor (HCE for Android).

PEER-TO-PEER MODE

This mode is designed for exchanging data such as contact information between two NFC devices like mobile phones.

Each peer can take a turn as a reader (transceiver) and tag for a complete exchange between both parties.

WIRELESS CHARGING

Ideal for small consumer devices such as smartwatches or headsets, this mode offers cable-free power, up to 1 W, over the NFC connection. Also called "induction charging", NFC offers the convenience of charging devices without the need for physical plugs.

NFC TECHNOLOGY IN EVERYDAY LIFE

A special communication technology

Complementary to other wireless technologies, NFC is designed to transfer data between two devices in close proximity.
Its features make it the ideal fit for a large number of use cases that cannot be achieved by other technologies.

NFC is ubiquitous

Found in all mobile devices based on Android (since v.4.0) and iOS (v. 11), NFC is also used to cover Banking transaction between banking card and POS terminals, transportation and eTicketing, digital access, passports, contactless digital identity and multiple other contactless applications.

NFC technology is also becoming widely adopted in industrial equipment, utility meters, gaming platforms, and access control for buildings and vehicles.

NFC MAIN FEATURES

- Simple adoption
  - Easy-to-use, tap-and-go solutions
  - Zero training required
  - No preliminary setup
- Security
  - Short operating distance
- Communication speeds
  - ISO/IEC 14443: From 106 up to 848 kbps and 6.8 Mbps with VHBR
  - ISO/IEC 15693: 26/53 kbps

No energy source needed to operate tags cards

NFC UNIQUE FEATURES

What's so special about NFC?

Triggered by a simple tap; NFC transactions are short, lasting just a fraction of a second, with no need for any preliminary steps. The result is a very intuitive gesture.

In NFC, only one device needs to be powered (except for Peer-to-peer mode). The possibility to have inexpensive, completely passive tags is a true enabler for IoE (Internet of Everything) scenarios.

NFC is a proximity technology based on an intentional action that makes obvious the NFC device is present and identifiable by its owner.

The NFC software stack is fully integrated into Android and iOS mobile operating systems that natively provide a number of services, creating the opportunity for many applications to use NFC without the need to install any specific software or application.

- Present in most mobile devices
  - Standard feature in all new smartphones
- Mobile OS support
  - Android (since 4.0)
  - iOS (since iOS11)
- Native NFC actions in mobile OSes
  - Sending text, mail
  - Placing calls
  - Launching applications
  - Browse to URLs
  - Wireless pairing (Bluetooth, Wi-Fi)
  - Sharing contacts and appointments
- NFC secure applications
  - Payment
  - Transport
  - Loyalty
  - Access control...

NFC: AREAS OF APPLICATION

Smart Things

- Contactless payment
- Pairing
- Anti-counterfeiting
- Extended user interface
- Gaming
- Access control
- Consumer engagement
- Wireless charging

Smart Homes & Cities

- Contactless payment
- Pairing
- Access control
- Authentication
- Ticketing
- Smart posters
- Commissioning

Smart Driving

- Car access
- Personalized driving experience
- Engine start
- Tethering
- Tap & navigate

Smart Industry

- Simplified diagnostics & maintenance
- Firmware upgrades
- Product personalization
- Traceability
- Advanced logistics
- Extended user interface
- Authentication

NFC in smart things

Simply more connected

The Internet of Things has opened the potential for billions of "Smart Things" to communicate with each other and improve daily life. NFC is the proximity technology that meets the needs of those smart things:

- **connectivity**
- **convenience**
- **security**
- **cost-effective implementation**

CONTACTLESS PAYMENT

The growth of contactless mobile transactions is driving the adoption of NFC and embedded secure element (eSE) solutions in consumer mobile devices such as smartphones and wearables but also the deployment of contactless interfaces in point-of-sale (POS) terminals.

Increasingly popular, payment and transport wallets are being deployed by OEMs and MNOs. It allows consumers to use their favorite payment and transport schemes directly with their mobile devices thanks to ST NFC controllers: ST21NFC standalone controller or ST54 NFC secure solution, which combines an NFC controller, an embedded Secure Element (eSE) and/or an embedded SIM (eSIM).

Thanks to the superior performance of the ST25R NFC readers, which are compliant with the latest EMVCo standard, POS terminal designers can guarantee a smooth and reliable experience for users who tap to pay.

BENEFITS
- Convenient
- Secure
- EMVCo pre-certified readers

PRODUCTS
- ST25R NFC reader IC
- ST21NFC NFC controller
- ST54 NFC secure solution

GAMING

NFC embedded in a gaming console enables contactless communication and peer-to-peer (P2P) data exchanges with gaming accessories. It allows players to add and customize characters in supported games, as well as enjoy bonus content.

Other use cases include transferring contact information, collecting information, or distributing promotional coupons for later use.

BENEFITS
- Fast, intuitive, and convenient
- Easy to exchange contact, calendar and other data
- Included in Android OS and RTOS for standard MCUs

PRODUCTS
- ST25TN & ST25TV NFC tag IC
- ST21NFC NFC controller
- ST54 NFC secure solution
- ST25R NFC reader IC

CONSUMER ENGAGEMENT

NFC tags are the ideal solution for increasing customer engagement while protecting against counterfeit, gray market or unauthorized distribution. Using an NFC-enabled smartphone, product authenticity can be checked throughout its lifecycle, from the manufacturing line to each stage of a product's journey. A unique digital signature from a ST25 NFC tag acts as an electronic certificate of authenticity. The non-volatile memory content of these NFC tags also enables tracking, enriched product information and direct access to end-users, thus enhancing consumer engagement.

BENEFITS

- Product identification with enriched information
- Brand protection
- Verification using digital signature

PRODUCTS

- ST25TA-E NFC tag IC
- ST25TN & ST25TV NFC tag IC
- ST25R NFC reader IC
- ST21NFC NFC controller
- ST25DV-I2C dynamic NFC tag IC
- ST54 NFC secure solution

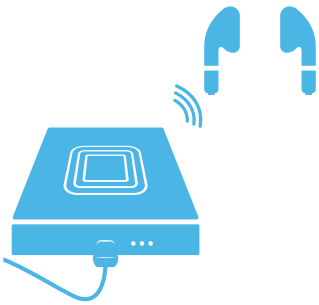
WIRELESS CHARGING

NFC is well known for its capability to exchange data. This contactless technology can also transfer energy, which can be used to wirelessly charge small battery-operated devices such as wearables and IoT devices. For example, NFC-enabled smartphones or other NFC charging devices can power smart rings, stylus pens, hearing aids, earbuds, wellness trackers, smart glasses, and more.

Based on the NFC Forum standard, NFC wireless charging can power small batteries, up to 1 W.

The charger, also called Poller, uses an NFC reader to deliver energy through an RF field.

The receiver, also known as Listener, can be either an NFC tag or a dynamic tag. These tags enable NFC communication, and can be integrated with rectifier and charger products



BENEFITS

- Lithium-ion battery charging, up to 1 W
- Fast, intuitive, and convenient
- High interoperability
- High reliability

PRODUCTS

- ST25DV-I2C dynamic NFC tag IC
- ST25TV NFC tag IC
- ST25R NFC reader IC
- ST21NFC/ST54

NFC in smart homes & cities

Challenges for smart homes & cities

With an increasing share of the world population moving to urban areas, cities and homes will need massive innovation to improve energy efficiency, communication and quality of life. A key enabler for the change will be a dense and complex architecture of sensors, actuators, and communication infrastructure, both inside and outside the house. With its reach in digital payments, access control and systems pairing, NFC is a key technology to help streamline some of the key processes of this transformation.

ACCESS CONTROL

Thanks to NFC, the traditional access control for entry gates and transport can now grow into a wider application footprint. Mobile phones with ST21NFC or ST54 can be used in place of dedicated contactless cards, enabling remote hotels check-in and time badging as well as room/apartment sharing applications. The truly low-power ST25R NFC reader family makes it possible to implement low power NFC solutions even in locks with metal housing. Thanks to the good performance of our ST25TN and ST25TV NFC tags, developers can also extend the offer in new innovative form factors, such as labels, buttons, as well as traditional plastic cards.

BENEFITS

- Mobile access control apps for remote hotel check-in, room-sharing apps
- New tag form factors for innovative marketing programs

PRODUCTS

- ST25TN & ST25TV NFC tag IC
- ST25R NFC reader IC
- ST21NFC NFC controller
- ST54 NFC secure solution

DEVICE COMMISSIONING

A need for simplified network commissioning has emerged due to the proliferation of IoT devices in smart homes. Standards like Matter, created by the Connectivity Standards Alliance (CSA), ensure interoperability between devices and platforms. Devices can be commissioned, or added, to a wide range of networks (including Wi-Fi, LoRa, Matter, Thread, and BLE) with the support of NFC technology. A simple tap is all it takes. NFC simplifies the commissioning process and improves the user experience.

BENEFITS
- Simple & convenient device commissioning
- Secure
- Improved user experience

PRODUCTS
- ST25TN & ST25TV NFC tag IC
- ST25DV-I2C Dynamic NFC tag IC

BLUETOOTH/WI-FI PAIRING

NFC lets you easily pair Bluetooth or Wi-Fi devices. A simple tap is enough to join a Wi-Fi network or connect a Bluetooth equipment device without having to enter a complex passcode. This method of pairing only takes a few seconds and is secure thanks to the strict proximity operation of NFC.

BENEFITS
- Simple & fast pairing
- Eliminates complex passcode entry
- Secure
- No need for a separate user interface

PRODUCTS
- ST25TN, ST25TA & ST25TV NFC tag IC
- ST25DV-I2C dynamic NFC tag IC
- ST25R NFC reader IC
- ST21NFC NFC controller
- ST54 NFC secure solution

SEAMLESS USER INTERFACE

Many Smart Home and Cities systems lack a user-friendly interface for easily adding new components. Thanks to NFC, the mobile phone screen becomes a rich interface, allowing even the most complex system to be easily configured through the NFC link. A system equipped with an ST25DV-I2C dynamic NFC tag can dialog with a mobile phone, equipped with an NFC controller, ST21NFC, or ST54 to configure parameters, and operate.

BENEFITS
- Easy configuration of complex systems
- Reduced cost, thanks to mobile devices acting as a user interface

PRODUCTS
- ST25DV-I2C dynamic NFC tag IC
- ST25R NFC reader IC
- ST21NFC NFC controller
- ST54 NFC secure solution

NFC
in smart driving

Making driving more connected

Smart Driving is about focusing on the driver and passengers. The automobile is being transformed by technology; improving security and enhancing the driver experience. As part of this new driving experience, NFC technology is bringing personalized entertainment and a connected experience into the car environment in a safe and easy-to- use manner following Car Connectivity Consortium (CCC) digital key requirements.

CAR START: MIDDLE CONSOLE

By placing a card or phone on the center console, it is possible to start the car and pair with its infotainment systems.

ST NFC chipsets work seamlessly with Qi charging technology and our unique automatic antenna tuning (AAT) technologies minimizes the impact of coins or other metallic objects placed close to, or even on top of the NFC antenna. Our futureproof ST25R NFC readers enable contactless EMVCo-certified payments for electric vehicle (EV) charging stations.

The STSAFE-VJ100-CCC secure solution combined with the ST25R NFC readers make the perfect solution for the digital car key.

BENEFITS

- Insensitive to metal objects
- Works seamlessly with Qi charging
- Fast reaction/interaction times
- Secure transactions
- Compliant to CCC Digital Key

PRODUCTS

- ST25R3920B & ST25R500/501 NFC reader IC
- STSAFE-VJ100-CCC Secure solution

CAR ACCESS: DOOR HANDLES AND B-PILLARS

By waving a Near Field Communication-enabled card or smartphone near the door handle or B (or center) pillar, the driver can lock and unlock the vehicle's doors. NFC covers the three most important requirements for such an access application: security, usability and costs.

Car keys become as slim as a credit card or are stored in smartphones while expensive traditional lock systems and key fobs are replaced by their cost-efficient NFC counter parts.

BENEFITS

- Cost-efficient
- More robust
- Increased safety
- High output power
- Automatic low-power field detection
- AEC-Q100
- Compliant to CCC Digital Key

PRODUCTS

- ST25R3920B & ST25R500/501 NFC reader IC
- ST54 NFC secure solution
- ST31P450 secure element use in key fob or smartcard
- STSAFE-VJ100-CCC secure solution

PERSONALIZED DRIVING EXPERIENCE

NFC is making driving a tailored experience. A simple tap with your smartphone will seamlessly configure your car's environment. The position of the steering wheel, car seats, seat belts, mirrors, ambient lights, or wireless connections are automatically adjusted to your profile.

BENEFITS

- Easy to design
- Seamless user experience
- Low power requirements
- Enhanced interoperability

PRODUCTS

- ST25TA & ST25TV NFC tag IC
- ST25DV-I2C dynamic NFC tag IC
- ST25R3920B & ST25R500/501

NFC in smart industry

Going beyond manufacturing

Smart industry reflects the digitization of manufacturing technologies resulting in improved productivity, cost and safety. This trend is accelerating thanks to a wide range of technologies including NFC which brings connectivity, flexibility, configurability and serviceability.

PRODUCT PERSONALIZATION: “IN THE BOX” PROGRAMMING

NFC technology makes it possible to interact with products at any stage of the manufacturing chain, even after packaging. The ST25DV-I2C dynamic NFC tag’s memory can store information such as languages, settings, and warranty registration information that is then retrieved at power up. This flexibility in software personalization brings great benefit for product manufacturing and simplifies logistics.

BENEFITS

- In-the-box product personalization
- Increased production flexibility
- Simplified logistics
- No power supply required

PRODUCTS

- ST25DV-I2C dynamic NFC tag IC
- ST25DV-PWM dynamic NFC tag IC
- ST25R NFC reader IC
- ST21NFC NFC controller
- ST54 NFC secure solution

SIMPLIFIED DIAGNOSTICS & MAINTENANCE

Embedded in almost all smartphones, NFC lets these ubiquitous devices become an advanced user interface for accessing diagnostics and maintenance information. Both end-users and maintenance teams can use mobile devices to monitor, troubleshoot or adjust equipment parameters thanks to the embedded NFC controller and secure element. Even if the equipment is not powered or operational, diagnostics can be performed thanks to tag's energy harvesting capabilities.

An ST25DV-I2C dynamic NFC tag embedded in electronic equipment can store in its non-volatile memory useful diagnostic information including model number, product configuration parameters, firmware and BOM versions, error codes, or use patterns. An ST25DV-PWM, included in your LED driver, or power unit, or even a motor, will bring convenience for its configuration by providing a flexible and easy way to set duty cycle and frequency

BENEFITS
- Flexibility
- Convenient maintenance
- Security with short operating distance
- On-site actions

PRODUCTS
- ST25DV-I2C dynamic NFC tag IC
- ST25DV-PWM dynamic NFC tag IC
- ST25R NFC reader IC
- ST21NFC NFC controller
- ST54 NFC secure solution

FIRMWARE UPGRADES

Dual interface tags such as ST25DV-I2C, having contactless and I2C interfaces, can act as a bridge to connect a smartphone to an electronic device to do firmware upgrade of the embedded microcontroller. All the process is achievable without having to do any physical action on the unit.

BENEFITS
- Fast and easy connection
- Cost-effective
- Built-in advanced user interface

PRODUCTS
- ST25DV-I2C dynamic NFC tag IC
- ST25R NFC reader IC
- ST21NFC NFC controller
- ST54 NFC secure solution

Product portfolio

ST is a leader in NFC technology and ecosystem

One of the early pioneers of RFID and NFC technologies, ST offers a comprehensive range of products and solutions covering all NFC application needs as well as rich development ecosystem.

Discover our extensive portfolio of NFC tags, dynamic NFC tags, NFC readers, NFC controllers and secure NFC solutions, including NFC controller and embedded secure element.

COMPREHENSIVE PORTFOLIO

ST25
NFC tag

ST25
Dynamic NFC tag

ST25
NFC readers

ST21NFC
NFC controller

ST54
Secure NFC

BENEFITS

- Comprehensive portfolio covers all NFC applications
- Best-in-class RF performance
- Rich ecosystem
- Long-proven expertise in adding security to NFC

ST is an active Sponsor Member of the NFC Forum.

ST NFC products are NFC Forum certified

NFC TAGS, DYNAMIC NFC TAGS & READERS

ST offers a comprehensive portfolio of NFC products, which operate at 13.56 MHz and are based on NFC and ISO standards:

- NFC tags, ideal for wireless pairing (Bluetooth or Wi-Fi) and product identification, feature counters, data protection (password) and able to wake-up the Host chip thanks to a general-purpose output
- Dynamic NFC tags, featuring a reliable EEPROM memory with data protection (password), an I^2C interface to connect to a MCU and a NFC tag interface, enabling multiple use-cases for Consumer, Industrial and IoT applications
- NFC readers, which support multiple NFC protocols in Reader or Peer-to-Peer modes, accessed via SPI interface and able to cope with the most challenging environments thanks to their high RF performance and advanced features.

ST also offers a large range of Discovery kits, Nucleo expansion boards, reference software and documentation in order to ease the design process.

BENEFITS

- Flexibility
- Convenient maintenance
- Security with short operating distance
- On-site actions

PRODUCTS

- ST25TN, ST25TA and ST25TV NFC tag IC
- ST25DV-I2C & ST25DV-PWM dynamic NFC tag IC
- ST25R NFC reader IC
- ST21NFC NFC controller
- ST54 NFC secure solution

NFC CONTROLLER

NFC technology is at the heart of an expanding spectrum of easy-to-use, intuitive, contactless applications. Mobile devices such as smartphones, tablets, wearables and connected PCs are increasingly integrating NFC technology to enable contactless payment as well as transport and access control features. For some of these use cases, securing the transaction with adequate components is mandatory to protect users' data. This is why ST offers a comprehensive range of NFC products and solutions to address secure mobile transaction applications:

- ST21NFC state-of-the-art NFC controller (possibly combined with a ST33 secure element)
- ST54 NFC with eSE and/or eSIM, which integrates the widely deployed ST33 Secure Element and ST21NFC controller

KEY FEATURES

- EMVCo and Common Criteria certified
- Multi-protocol (ISO/IEC 7816, ISO/IEC 14443 A/B/F, ISO/IEC 15693, VHBR)
- Support for multiple secure applications
- boostedNFC™ for tiny and metal cover antennaMinimizes footprint & eases integration
- Increases interoperability
- Low power consumption
- Enhanced user experience (improved reading distance)

ST25 NFC Tag ICs

NFC tag ICs with NFC Forum Type 2, 4 or 5 RF interface

ST25TN, ST25TA and ST25TV tag ICs provide certified NFC Forum Type 2, 4 or Type 5 RF interfaces with memory density which spans from 512 bits to 64 Kbits. These tag ICs cover a broad range of applications including consumer engagement, brand protection, access control, asset tracking and gaming.

SPECIAL FEATURES

The ST25TN, ST25TV, and ST25TA series deliver state-of-the-art RF performance and include TruST25 and Edge TruST25® Digital Signatures for operation with cloud management and a tamper-detect feature for open/short detection.

Its user-programmable digital output can be used to wake up a host MCU (microcontroller).

CERTIFIED NFC SOLUTION FOR SMART PACKAGING

BENEFITS

- Wide memory density options
- High-reliability EEPROM
- Built-in NDEF format support
- Strong password protection scheme
- TruST25® Digital Signature
- Read or write operation counter
- Tamper detection feature
- Untraceable and kill modes for GDPR compliancy
- NFC Type 2 and Type 5 options
- RFID and NFC compliance

AREA OF APPLICATIONS

- Smart things
  - Consumer engagement
  - Luxury
  - Wine & Spirits
  - Consumer packaged goods
  - Healthcare & wellness
  - Clothes & footwear
  - Authentication
- Smart city
  - Services
  - Access control
- Smart industry
  - Identification
  - Asset tracking




HARDWARE DEVELOPMENT BOARDS

ST25TV02KC-ASEAL
ST25TV-based NFC tag evaluation board

Product portfolio

Part number	RF Interface	NFC Forum certtification	Memory size	Data protection	Counter/Unique Tap Code	Special features	Package	RF Status output
ST25TN512	ISO14443/ NFC Forum Type 2	YES	512 bits	Lock block	24-bit	TruST25® Digital signature[1]	UFDFPN5, SBN075 and SBN12 (*)	-
ST25TA-E	ISO 14443-A/ NFC Forum Type 4	YES	2-Kbit	Password + lock file		Edge TruST25 digital signature[2] 24-bit GPO counter Augmented NDEF	SBN140 (*) SBN075 (*)	
ST25TN01K	ISO14443/ NFC Forum Type 2	YES	Up to 1.6 Kbits	Lock block	24-bit	TruST25® Digital signature	UFDFPN5, SBN075 and SBN12 (*)	-
ST25TV512C	ISO15693/ NFC Forum Type 5	YES	512 bits	32-/64-bit encrypted password	24-bit	TruST25® Digital signature	UFDFPN5, SBN075 and SBN12 (*)	-
ST25TV02KC	ISO15693/ NFC Forum Type 5	YES	2,5 Kbits	32-/64-bit encrypted password	24-bit	TruST25® Digital signature	UFDFPN5, SBN075 and SBN12 (*)	-
ST25TV02KC-TF	ISO15693/ NFC Forum Type 5	YES	2,5 Kbits	32-/64-bit encrypted password	24-bit	Tamper detect pin/ TruST25® Digital signature	UFDFPN5, SBN075 and SBN12 (*)	-
ST25TV04K-PE	ISO 15693/ NFC Forum Type 5	-	4 Kbits	64-bit password	-	Energy Harvesting	SBN12 (*)	YES (CMOS positive GPO)
ST25TV16KC	ISO15693/ NFC Forum Type 5	-	16 Kbits	64-bit password	-	-	SBN12 (*)	-
ST25TV64KC	ISO15693/ NFC Forum Type 5	YES	64 Kbits	64-bit password	-	-	SBN12 (*)	-
ST25TA02KB-P	ISO14443 Type A/ NFC Forum Type 4	YES	2 Kbits	128-bit password	20 bit	TruST25® Digital signature	UFDFPN5	YES (CMOS positive GPO)
ST25TA02KB-D	ISO14443 Type A/ NFC Forum Type 4	YES	2 Kbits	128-bit password	20 bit	TruST25® Digital signature	UFDFPN5	YES (Open Drain GPO)
ST25TA16K	ISO14443 Type A/ NFC Forum Type 4	-	16 Kbits	128-bit password	-	-	SBN12 (*)	-
ST25TA64K	ISO14443 Type A/ NFC Forum Type 4	-	64 Kbits	128-bit password	-	-	SBN12 (*)	-

(*) SBN075: Sawn and bumped wafer (die form), 75 µm thickness; SBN12: Sawn and bumped wafer (die form), 120µm thickness
1) TruST25 digital signature: off-chip signature generated inside HSM and stored into the tag IC; 2) Edge TruST25 digital signature: on-chip signature generated by the tag IC itself

ST25 Dynamic NFC Tag ICs

ISO15693/NFC Forum Type 5 dynamic NFC tag ICs with either I²C interface, fast transfer mode and energy harvesting, or PWM outputs

ST's Dynamic NFC tag ICs feature an RF ISO 15693 and NFC Forum Type 5 certified contactless interface operating at 13.56 MHz.

The ST25DV-I2C series feature from 4 Kbits to 64 Kbits of EEPROM which can be accessed through the RF contactless interface or by means of a low power I²C interface, while the ST25DV-PWM series features 2 Kbits of EEPROM and up to 2 PWM outputs as second interface. In addition, the ST25DV-I2C offer a broad range of features including energy harvesting and a 256-byte Fast Transfer Mode that ensures faster data transfer between the RF interface and the host microcontroller connected through the I²C. It also comes with best low power consumption values to ensure optimized energy management. Both the ST25DV-I2C and ST25DV-PWM series feature multiple 32/64-bit passwords to offer flexible data protection mechanism.

MAIN APPLICATIONS

By combining its Fast Transfer mode over ISO 15693 distances with NFC Forum Type 5 support as well as Energy Harvesting capabilities, the ST25DV-I2C series offers a unique set of features for a broad range of Internet of Things (IoT) and Industrial (Industry 4.0) applications. Perfectly suited to get instant read-outs of device status, usage and diagnostics, ST25DV-I2C tags give battery-free or power-conscious devices the ability to communicate, even if they are completely sealed. A common trademark is their ability to support multiple use-cases all along a product's lifetime: from product tracking and factory customization to black box tool at product end-of-life as well as providing a convenient interface for end-user or maintenance support in the field.

In addition, the ST25DV-I2C also offers NFC wireless charging supported by different standards, as well as network commissioning capabilities. The use cases described above can, of course, be combined in one product to deliver an improved user experience.

By combining ST's proven NFC technology with PWM logic, the ST25DV-PWM dynamic NFC tag ICs generate control signals using an embedded pulse-width/period mechanism based on settings received via the RF interface and stored in on-chip or a highly reliable EEPROM.

The ST25DV-PWM is suited for all applications featuring PWM (Pulse Width Modulation)-based controllers, such as lighting products, power supply units, motorized appliances, fans, and thermostats.

The ST25DV-PWM introduces an innovative contactless way to program presets for products on the production line or in-situ, and simplify setup or fine-tuning at the point of use.

Both the ST25DV-I2C and the ST25DV-PWM are NFC Forum certified. They are therefore able to fit more consumer-oriented application for home, fitness, or healthcare.

KEY FEATURES

- ST25DV-I2C
  - Ultra low-power modes
  - Up to 64-Kbit EEPROM
  - I²C interface (1 MHz)
  - Fast I²C write
  - Configurable output signal (GPO)
  - 256-byte buffer (Fast Transfer mode)
  - Energy harvesting
- ST25DV-PWM
  - 2-Kbit EEPROM
  - Up to 2 PWM outputs (up to 15-bit resolution)
  - TruST25® digital signature
- Common features
  - NFC Forum Type 5
  - High Reliability EEPROM
  - Power supply: 1.8 to 5.5 V
  - 32/64-bit password protection
  - Industrial temperature range

AREA OF APPLICATIONS

- Smart industry
  - Factor automation
  - Industrial lighting
- Motor control
- Smart home
  - Home automation
  - Security systems
- Smart city
  - Metering
  - Street lighting
- Smart life
  - Healthcare
  - Wellness

HARDWARE DEVELOPMENT BOARDS

X-NUCLEO-NFC07A1
ST25DV-I2C based NFC tag
Nucleo expansion board

ST25DV64KC-DISCO
ST25DV-I2C based NFC tag
discovery board

ANT7-T-25DV64KC
ST25DV-I2C based NFC tag
development board

ST25DV-PWM-eSET
ST25DV-PWM based NFC
tag discovery board

Product portfolio

Part number	RF Interface	NFC Forum Certification	Memory size	Clock frequency	Data protection	Supply (V)	Package	Temperature Range	Energy Harvesting output	RF status output (GPO/ PWM)
ST25DV02K-W1	ISO15693/NFC Forum Type 5	YES	2 Kbits	NA	64/32-bit password	1.8 to 5.5	SO8, TSSOP8	RF: -40 °C to +85 °C PWM: -40 °C to +105 °C	NO	1 PWM
ST25DV02K-W2	ISO15693/NFC Forum Type 5	YES	2 Kbits	NA	64/32-bit password	1.8 to 5.5	SO8, TSSOP8	RF: -40 °C to +85 °C PWM: -40 °C to +105 °C	NO	2 PWM
ST25DV04KC	ISO15693/NFC Forum Type 5	YES	4 Kbits	1 MHz	64-bit password	1.8 to 5.5	SO8, TSSOP8, FPN8, FPN12, WLCSP	RF: -40 °C to +105 °C I²C: -40 °C to +125 °C	YES	configurable GPO
ST25DV16KC	ISO15693/NFC Forum Type 5	YES	16 Kbits	1 MHz	64-bit password	1.8 to 5.5	SO8, TSSOP8, FPN8, FPN12	RF: -40 °C to +105 °C I²C: -40 °C to +125 °C	YES	configurable GPO
ST25DV64KC	ISO15693/NFC Forum Type 5	YES	64 Kbits	1 MHz	64-bit password	1.8 to 5.5	SO8, TSSOP8, FPN8, FPN12	RF: -40 °C to +105 °C I²C: -40 °C to +125 °C	YES	configurable GPO

Note: ST25DV-I2C temperature range depends on package and product version.

ST25 NFC Readers

High-performance HF Reader/NFC Initiators with 2.2 W, and advanced features for contactless applications

The ST25R reader series are a market-leading range of high performance NFC reader solutions offering unique features like automatic antenna tuning or active wave shaping and noise suppression functionality designed for noisy environments like antennas around LCD displays.

They provide multi-protocol support for 13.56 MHz NFC/RFID HF communications like ISO14443 type A or B, ISO15693, ISO18092, FeliCa following NFC Forum standards.

MAIN APPLICATIONS

The ST25R NFC reader covers a wide span of RF power requirements, and its combination of unique features makes it suited for a broad range of applications. In addition to a high output power, up to 2.2 W, ST25R offer a low-power capacitive sensor that can be used for ultra low-power wake-up functions without having to switch on the reader field to detect a card presence.

Combined with the inductive wake-up function the ST25R family is a perfect fit for applications like access control, door lock or gaming.

The top range of the ST25R family allows for EMVCo and PBOC certification, including EMVCo software code and hardware platforms following the newest standards, providing a convenient reference design for contactless payment solution/point-of-sale (POS) terminals.

ST25R3920B and ST25R500/501 readers are AEC-Q100 (automotive) qualified NFC reader ICs especially designed for CCC digital key and center console applications in cars.

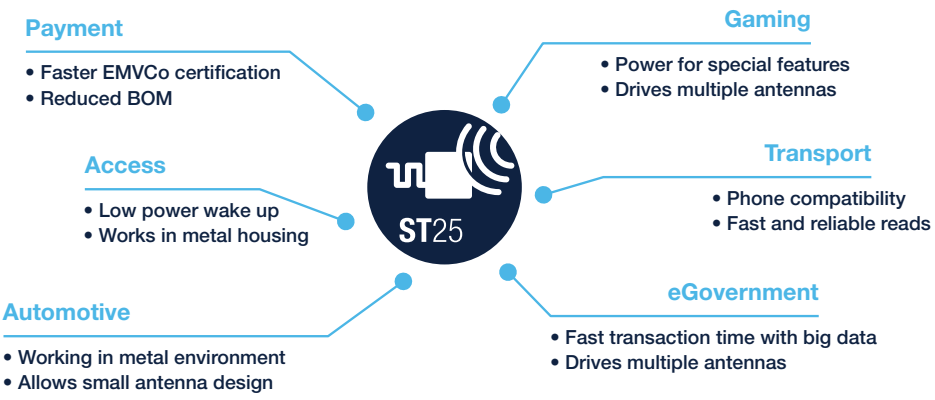
ST25 NFC readers for automotive applications offer market-leading low power card detection (LPCD) range to detect and start communication with devices like phones or cards, which host the digital car key.

Features like Very High Bit Rate (VHBR) technology allow for quick exchange of large amounts of data required for passport applications. Automatic Antenna

Tuning (AAT) is especially useful in ensuring a high read range in challenging and/or metal environments.

KEY FEATURES

- Compliant to CCC Digital Key
- Reader/Writer, P2P, Card Emulation
- Output power up to 2.2 W
- Automatic Antenna Tuning (AAT)
- Capacitive and inductive wake up
- Dynamic power output
- Active wave shaping
- Noise suppression receiver
- VHBR up to 6.8 Mbps
- Two single antennas or one differential antenna
- Enhanced wake-up range (LPCD)
- 10-year longevity program



HARDWARE DEVELOPMENT BOARDS

STEVAL-25R200
ST25R200-based NFC reader
Discovery kit

X-NUCLEO-NFC09A1
ST25R100 based NFC reader
Nucleo shield board

X-NUCLEO-NFC10A1
ST25R200 based NFC reader
Nucleo shield board

ST25R300-EMVCO
ST25R300 based EMVCo 3.x
reference design

Product portfolio

Part number	Mode	RF interface	RF speed	Serial interface	Advanced features	Output power	Temperature range	Package	Applications
ST25R300	Reader/Writer, Card Emulation, Passive P2P	ISO14443A,B/ ISO15693/FeliCa	848 Kbit/s	SPI	AAT, DPO, AWS, NSR, IWU	2.2 W	-40 to +105 °C (AMB)	32-pin QFN (5x5 mm)	Point of Sale (EMVCo) Access Control, NFC Charging, Ki Kitchen…
ST25R200	R&W	ISO 14443A/B, ISO 15693	106 Kbit/s	SPI	DPO, OSP, EMD, IWU, NSR	1.2 W	-40 to +85°C	TQFN-24 (4x4 mm)	Reader + Tag, Access control, smart home, Healthcare & Wellness, Beauty, Toys…
ST25R100	R&W	ISO 14443A/B, ISO 15693	106 Kbit/s	SPI	DPO, IWU	0.8 W	-40 to +85°C	TQFN-24 (4x4 mm)	Reader + Tag, Access control, smart home, Healthcare & Wellness, Toys, Beauty…
ST25R3916B	Reader/Writer, P2P, Card Emulation	SO14443A,B/ ISO15693/Felica	848 Kbit/s	SPI & I²C	AAT, DPO, IWU, AWS, NSR	1.6 W	QFN: -40 to +105 °C (AMB) WLCSP: -40 to +85 °C (AMB)	32-pin QFN (5x5 mm), WLCSP	Point of Sale (EMVCo), Industrial, Consumer, Access Control
ST25R3917B	Reader/Writer	ISO14443A,B/ ISO15693/Felica	848 Kbit/s	SPI & I²C	DPO, IWU, AWS, NSR	1.6 W	-40 to +105 °C (AMB)	32-pin QFN (5x5 mm)	Point of Sale (EMVCo), Industrial, Consumer, Access Control
ST25R3911B	Reader/Writer, P2P	ISO14443A,B/ ISO15693/Felica	6.8 Mbit/s (VHBR)	SPI	AAT, DPO, CIWU	1.4 W	-40 to +125 °C (JUN)	32-pin QFN (5x5 mm)	Ticketing, Access control, Passport, Industrial
ST25R3912	Reader/Writer, P2P	ISO4443A,B/ ISO15693/FeliCa	848 Kbit/s	SPI	DPO, WU	1.0 W	-40 to +125 °C (JUN)	32-pin QFN (5x5 mm), WLCSP	Gaming, Industrial, Access control
ST25R3914	Reader/Writer, P2P	ISO14443A,B/ ISO15693/FeliCa	848 Kbit/s	SPI	AAT, DPO, CIWU	1.0 W	-40 to +125 °C (JUN)	32-pin QFN (5x5 mm)	Automotive (AEC-Q100 Grade 1)
ST25R3915	Reader/Writer, P2P	ISO14443A,B/ ISO15693/FeliCa	848 Kbit/s	SPI	DPO, CIWU	1.0 W	-40 to +125 °C (JUN)	32-pin QFN (5x5 mm)	Automotive (AEC-Q100 Grade 1)
ST25R3920B	Reader/Writer, P2P, Card Emulation	ISO14443A,B/ ISO15693/Felica	848 Kbit/s	SPI & I²C	AAT, DPO, IWU, AWS, NSR	1.6 W	-40 to +105 °C (AMB)	32-pin QFN (5x5 mm), WLCSP	Automotive, CCC Digital key, Door lock, Center console
ST25R500	Reader/Writer, PP2P, Card Emulation	ISO14443A,B/ ISO15693/Felica	848 Kbit/s	SPI	AAT, DPO, IWU, AWS, NSR	2 W	-40 to +125 °C (AMB)	32-pin QFN (5x5 mm), WLCSP	Automotive, CCC Digital key, Door lock, Center console
ST25R501	Reader/Writer	ISO14443A,B/ ISO15693/Felica	848 Kbit/s	SPI	DPO, IWU, AWS, NSR	1.6 W	-40 to +125 °C (AMB)	24-pin QFN (4x4 mm), WLCSP	Automotive, CCC Digital key, Door lock

Note :
*: NFC Forum certification
VHBR: Very High Bit Rate
AAT: Automatic Antenna Tuning
DPO: Dynamic Power Output
NSR: noise suppression receiver
AWS: Active Wave Shaping
CIWU: Capacitive & Inductive Wakeup
IWU: Inductive Wakeup
AMB: Ambient temperature
JUN: Junction temperature

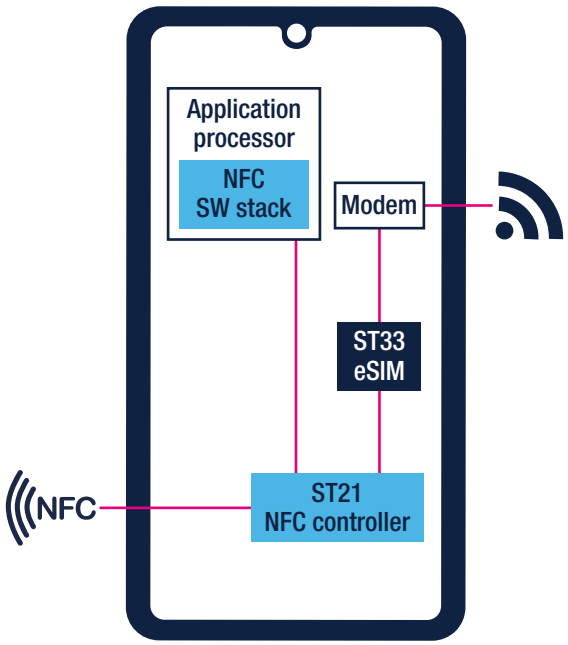
ST21NFC Controller

Standalone NFC controllers

Thanks to high output power and active load modulation, ST standalone NFC controllers (ST21NFC) guarantee reliable NFC transactions on mobile devices and wearables, even in challenging metallic environments, or with a very small antenna.

Key benefits include:

- Simplifies the hardware integration. Reference designs, expansion boards, design guidelines are available.
- Simplifies the software integration. ST lowers the cost for Android developers by providing multi-application support with optimized solutions including intuitive SDK platforms for integrating contactless services around any microcontroller architecture for wearables.



KEY FEATURES

- High output power and active load modulation to maximize performance in NFC readers and card emulation modes
- Stable card emulation performance regardless of the phone's state, thanks to in-frame synchronization
- Optimized low-power modes to maximize battery life
- Pin-to-pin compliant with ST54

HARDWARE DEVELOPMENT BOARD

ST21LL000D15DEMO
ST21NFCL Development kit
(contact your sales interface for more information)

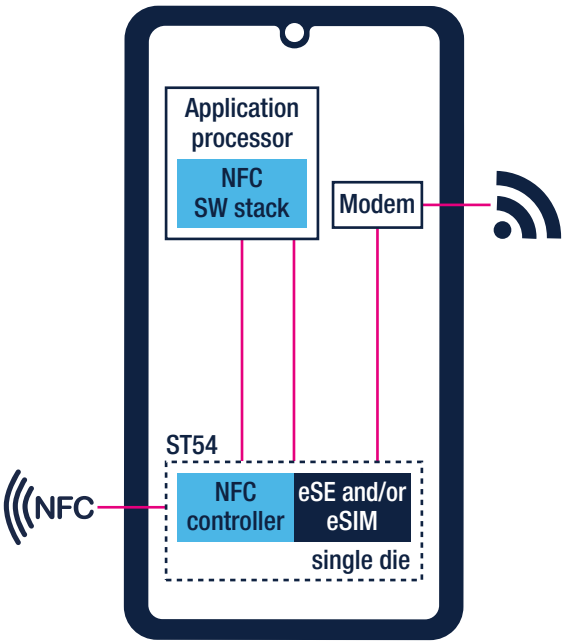
Product portfolio

Part number	Type	NFC modes	RF protocol	Interface	Key features	Package
ST21NFCD	NFC controller	Card emulation, Reader, P2P	ISO/IEC 14443A/B ISO/IEC 18092 ISO/IEC 15693	SWP, SPI, I^2C, UART	Active Load Modulation Optimized power consumption modes NCI 2.0 compliant Secure Firmware Update mechanism	BGA 4*4
ST21NFCL	NFC controller	Card emulation, Reader, P2P	ISO/IEC 14443A/B ISO/IEC 18092 ISO/IEC 15693	SWP, SPI, I^2C	Active Load Modulation Optimized power consumption modes NCI 2.0 compliant Secure Firmware Update mechanism	49-pin WLCSP 90-pin FOWLP

ST54 Integrated secure solutions

Integrated secure solutions

ST54, a single-die convergence solution combining an NFC controller and an embedded secure element, ensures the best possible user experience and protection for secure mobile applications such as embedded SIMs, transport ticketing, mobile payments, and digital car keys.



KEY FEATURES

- 32-bit Arm® Cortex® M35P CPU
- EMVCo and Common Criteria EAL6+ certified
- Interoperability: MIFARE®, FeliCa®, China Transit
- High output power and active load modulation to maximize performance in NFC reader and card emulation modes
- Stable card emulation performance regardless of the phone's state, thanks to in-frame synchronization
- Optimized low-power modes for battery saving
- eSIM supporting Multiple Enabled Profiles
- Secure ranging support in connection with an external UWB sub-system

Product portfolio

Part number	Type	Interfaces	eSE memory	NFC modes	RF protocol	Key features	Package
ST54J/K	NFC controller + eSE/eSIM	I2C, ISO7816, SWP, SPI	2-Mbytes Flash memory	Card emulation, reader, P2P	ISO/IEC 14443A/B ISO/IEC 18092 ISO/IEC 15693	Arm Cortex® M35P CC EAL6+, EMVCo, MIFARE®, FeliCa® eSIM with MEP support UWB chip interface	81-pin WLCSP
ST54L	NFC controller + eSE/eSIM	I2C, ISO7816, SWP, SPI	3.3-Mbytes Flash memory	Card emulation, reader, P2P	ISO/IEC 14443A/B ISO/IEC 18092 ISO/IEC 15693	Arm Cortex® M35P CC EAL6+, EMVCo, MIFARE®, FeliCa® eSIM with MEP support UWB chip interface	90-pin WLCSP

COMPLETE DEVELOPMENT ECOSYSTEM FOR SECURE SOLUTIONS

Available for ST54L (ST54LL900D15DEMO) platform, these reference starter kits provide all the necessary software and hardware reference design to help original equipment manufacturers (OEMs) easily integrate secure payment, NFC or multi-application services in their devices as well as evaluate and test the full NFC functionality.

- The hardware reference design for ST54 provides the schematics, layout and reference antenna matching.
- The ST21NFC/ST54 Software package includes :
  - NFC_explorer allowing Firmware update, Device configuration and the validation, demonstration of capabilities through the usage of basic scenario. Running on PC under Windows 7.
  - Software modules to ease the integration on Android, Windows10 and STM32.

For more information, please contact our sales office.

ST54L (ST54LL900D15DEMO)

Design support

Make it easy and make it fast

ST has a wide product portfolio for NFC applications and provides solution to ease and solve the most complex design challenge:

- **Single product evaluation boards**
- **Fast prototyping and development boards**
- **Solution evaluation boards**
- **Software Development Tools**

HARDWARE ECOSYSTEM

Product evaluation boards

ST proposes a wide range of evaluation boards that may be used to perform a comprehensive evaluation of ST's products reducing your development time. These evaluation boards help you evaluate the features and performance of selected products, all of them have published online fully tested schematics, BOMs and Gerber files to facilitate your hardware design. Many, where appropriate, also have demonstration software packages, including example code, available as well.

Antenna e-design tool

To help develop antennas for your NFC solution, ST provides an antenna design tool to compute rectangular antennas for 13.56-MHz signals.

After entering the parameters related to the PCB material and antenna dimensions, the tool estimates the antenna equivalent inductance by calculating the self-inductance and estimating the stray capacitance of the antenna to ensure the best fit for your design.

http://www.st.com/edesignsuite

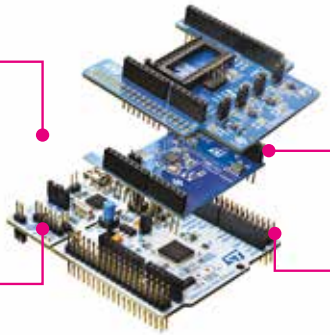
STM32 Nucleo
Development boards

- Set of boards based on STM32 microcontroller families
- Debugger/programmer functionality
- Expansion capabilities

STM32Cube
Development software

- SW libraries for each STM32 microcontroller family

STM32 Open Development Environment



X-NUCLEO
STM32 Nucleo expansion boards

- Set of boards with additional functions to STM32 Nucleo ones
- Pluggable boards on top of the STM32 Nucleo or stacked on another expansion board

X-CUBE
STM32Cube expansion software

- SW drivers of each X-NUCLEO

X-NUCLEO-NFC06A1

X-NUCLEO-NFC04A1

STM32 Open Development Environment

The STM32 Open Development Environment is a fast and affordable way to prototype and develop innovative applications with state-of-art ST components based on the STM32 32-bit microcontroller family and a comprehensive set of functions for sensing, connectivity, power, audio, motor control and more. The combination of a broad range of expandable hardware based on leading-edge commercial products and modular software, from driver to application level, enables fast prototyping of ideas that can be smoothly transformed into final designs.

The STM32 Open Development Environment is compatible with a number of IDEs including IAR EWARM, Keil MDK-ARM, ARM mbed™ and GCC-based environments.

http://www.st.com/stm32ode

SOFTWARE DEVELOPMENT TOOLS

STM32Cube software ecosystem

With STM32Cube, ST provides a comprehensive software tool, significantly reducing development efforts, time and cost. Libraries, snippets, middleware, codecs and protocol stacks, sample applications are provided in Firmware packages to assist in the development process. It permits software development with a certain level of abstraction from the register level of the hardware.

http://www.st.com/en/ecosystems/stm32cube.html

Software development kit

The ST25SDK is software library to be used in Java applications. It can be run by any platform supporting JVM (Windows, Android, and Linux) and some components can be re-used for iOS.

It allows to support several readers with the same application and it offers an easy-to-use model of RF tags, including ST's specific features.

http://www.st.com/st25sdk

Smartphone Apps and SDKs

Several Apps are available to evaluate quickly ST Solutions, multi-platform Software Development Kit for Android and iOS. Easy development thanks to the source code availability and application examples available for quick startup.

COMMUNITY

Connect with our community of ST users from around the world and:

- Ask questions, find answers, get advice;
- Help the community by answering community members' questions, write helpful content, and vote on polls;
- Share your projects, your events, your videos on ST products;
- Contribute your knowledge by writing tutorials, tips & tricks, and courses.

http://community.st.com

Glossary & references

Term	Definition
AAT	Automatic Antenna Tuning.
Card Emulation mode	NFC mobile device emulating a contactless card.
CCC	The Car Connectivity Consortium® (CCC) is developing Digital Key, an exciting new open standard to allow smart devices, like smartphones to act as a vehicle key.
EMV	Sets of specification issued by EMVCo to cover all different payment modes such as contactless card, mobile payment…
EMVCo	Association of leading company in payment industry.
FeliCa	Contactless IC card technology developed by Sony Corporation
ISO/IEC 14443	ISO specification defining behavior and protocols for proximity contactless cards and readers
ISO/IEC 15693	ISO specification defining behavior and protocols for vicinity contactless cards and readers
ISO/IEC 18092	ISO specification defining communication mode for near field communication
ISO/IEC 18000-3M3	ISO specification defining RFID 13.56 Mhz air interface standards for the item identification world
Inlay	Thin laminate containing antenna and NFC tag IC
NDEF	NFC Data Exchange Format. Specification defined by NFC Forum
SNEP	Simple NDEF exchange Protocol. Specification defined by NFC Forum
NFC Forum	Association of industry actors, that is specifying, certifying and promoting NFC technology. www.nfc-forum.com
P2P	Peer-to-Peer mode. Communication mode defined by NFC Forum, used to establish a link between two symmetric NFC devices.
POS	Point of Sale. All recent models include a NFC reader device
SWP	Single Wire Protocol. Used to connect SIM or eSE to the NFC controller in a mobile device. Specification defined by ETSI
Initiator	NFC Forum device that starts a NFC Communication
Target	NFC Forum device that is reached by the initiator
Universal device	NFC Forum device that is reader/writer, supports P2P and optionally card emulation mode
Tag device	NFC Forum device with which a Reader/writer can communicate and contain an NDEF
Reader device	NFC Forum device which can communicate with tag devices
LLCP	Logical Link Control Protocol. Specification defined by NFC Forum
RTD	Record type Definition. Specification defined by NFC Forum
VHBR	Very High Bit Rate
AEC-Q100	Specification established by the AEC Component Technical Committee to define common electrical component qualification requirements for automotive industry

At STMicroelectronics we create technology that starts with You

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