NFC
A World of Opportunities

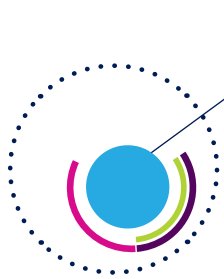# Content

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.

Currently found in contactless payment, e-government (passports), access control, public transport ticketing systems and e-government (passports), NFC is a convenient, always-on radio link that 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 / HF RFID 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 Mobile
  - NFC controllers for smartphones, tablets, wearables and connected PCs
  - Embeded Secure elements
- NFC combos (NFC controller & eSE)
- NFC Cards
  - Payment and ticketing applications
  - Certified solutions

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

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 the other technologies, creating a unique opportunity for product and services.

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 appications.
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 mod). 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, iOS and Windows® 10 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.

- Present in most mobile devices
  - Standard feature in all new smartphones
- Mobile OS support
  - Android (since 4.0)
  - iOS (since iOS11)
  - From Windows© 7

- 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

Smart Homes & Cities

Contactless payment

Pairing

Access control

Authentication

Ticketing

Smart posters

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 communication modes

Rich set of communication possibilities

The NFC Forum defines three kinds of NFC devices: universal NFC Forum device, reader device and tag device. These NFC devices can operate in three communication modes that also categorizes the type of use case.

Tag Reader/Writer
Connect the world of apps with the physical world

Card Emulation
Use your device as a Card

Peer to Peer
Connect devices through physical proximity

READER/WRITER MODE

In Reader/Writer mode, an NFC reader interrogates a tag to execute a transaction. 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. An NFC reader is capable of sensing the presence of more than one tag.

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 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). The Card emulation based on SWP-SIM, eSE & eSIM brings the benefit of remote provisioning (eSIM) and remote management with a high level of security.

PEER-TO-PEER MODE

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

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

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: it brings connectivity, convenience, security and a 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 in their mobile devices thanks to the ST21NFC NFC controller, ST54 NFC secure solution (NFC controller & eSE) or ST53G System-in-Package (NFC booster & eSE).

Thanks to the superior performance of the ST25R readers, POS terminal designers can guarantee a smooth and reliable user experience when tapping, being compliant to the latest EMVCo standard.

BENEFITS	PRODUCTS
• Convenient	• ST25R NFC / HF RFID Reader IC
• Secure	• ST21NFC NFC controller
• EMVCo pre-certified readers	• ST54 NFC secure solution (NFC controller & eSE)
	• ST53 NFC optimized secure solution (NFC booster & eSE)

GAMING

NFC embedded in a gaming console enables contactless communication and peer-to-peer data exchanges with gaming accessories. It makes it possible to add and customize characters in supported games, as well as deliver bonus content.

Other area of applications can also be transfer of contact information, collect information or promotional coupons for later use.
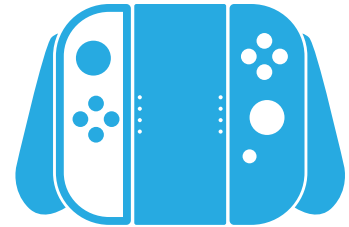
BENEFITS

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

PRODUCTS

- ST25TA NFC Forum Type 4 tag
- ST25TV NFC Forum Type 5 tag
- ST21NFC NFC controller
- ST54 NFC secure solution (NFC controller & eSE)
- ST25R NFC / HF RFID Reader IC

CONSUMER ENGAGEMENT

NFC tags are the ideal solution for increasing customer engagement while protecting against counterfeit, grey market or unauthorized distribution. Using smartphone, product authenticity can be checked from manufacturing line to end-user. A unique digital signature from a ST25TA or ST25TV tag acts as an electronic certificate of authenticity. Combined with its non-volatile memory content, the NFC tags also offer tracking, enriched product information and direct access to the end-user, thus enhancing consumer engagement.
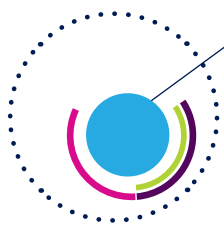
FRAUD PREVENTION

BENEFITS

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

PRODUCTS

- ST25TA NFC Forum Type 4 tag
- ST25TV NFC Forum Type 5 tag
- ST25R NFC / HF RFID Reader IC
- ST21NFC NFC controller
- ST25DV-I2C NFC Forum Type 5 Dynamic Tag

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 NFC secure SiP solution 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 reader family makes it possible to implement low power NFC solutions even in locks with metal housing. Thanks to the good performance of our ST25TA 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.

NFC

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

PRODUCTS
- ST25TA NFC Forum Type 4 tag
- ST25TV NFC Forum Type 5 tag
- ST25R NFC / HF RFID Reader IC
- ST21NFC NFC controller
- ST54 NFC secure solution (NFC controller & eSE)

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

- ST25TA, ST25TV tag
- ST25DV-I2C dynamic NFC tag
- ST25R NFC / HF Reader IC
- ST21NFC NFC controller

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 ST21NFC controller in order to be configured and put into operation.
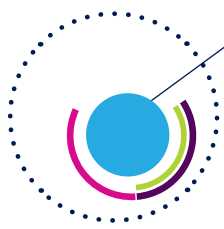
BENEFITS

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

PRODUCTS

- ST25DV-I2C dynamic NFC tag
- ST25R NFC / HF Reader IC
- ST21NFC NFC controller

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.

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 minimzes the impact of coins or other metallic objects placed close to, or even on top of the NFC antenna. Our futureproof ST25R NFC / HF RFID readers allows for contactless EMVCo-certified payments for electric vehicle (EV) charging stations.

The ST33 secure element combined with the ST25R reader 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

PRODUCTS

- ST25R3914/15 NFC / HF RFID reader
- ST33G1M2A Secure element

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 Grade1

PRODUCTS

- ST25R3914/15 NFC / HF RFID reader
- ST54 NFC secure solution (NFC controller & eSE)
- ST33G1M2A Secure element

PERSONALIZED DRIVING EXPERIENCE

NFC is making driving a tailored experience. A simple tap with your smartphone will seamlessly configure your car's environment. Chair, mirrors, ambient lights or wireless connections are automatically adjusted to your profile.
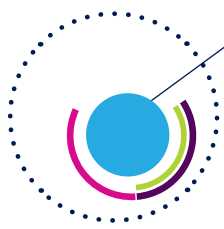
BENEFITS

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

PRODUCTS

- ST25TA, ST25TV tags
- ST25DV-I2C dynamic NFC tag
- ST25R3914/15 NFC / HF RFID reader

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 RFID / NFC tag
- ST25DV-PWM Dynamic RFID / NFC Tag
- ST25R NFC / HF RFID Reader IC
- ST21NFC NFC controller

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 & 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 RFID / NFC tag
- ST25DV-PWM dynamic RFID / NFC tag
- ST25R NFC / HF RFID Reader IC
- ST21NFC NFC controller
- ST54 NFC secure solution (NFC controller & eSE)

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 micro-controller. 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 RFID / NFC tag
- ST25R NFC / HF RFID Reader IC
- ST21NFC NFC controller
- ST54 NFC secure solution (NFC controller & eSE)

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 / RFID tags, Dynamic NFC tags, NFC /HF RFID readers, NFC controllers and Secure NFC solutions including NFC controller or NFC booster and embedded secure element.

COMPREHENSIVE PORTFOLIO

- ST25 NFC / RFID Tag
- ST25 Dynamic NFC Tag
- NFC / RFID Reader ST25
- NFC Controller ST21NFC
- NFC secure solutions ST31 / ST33 / ST53 / ST54
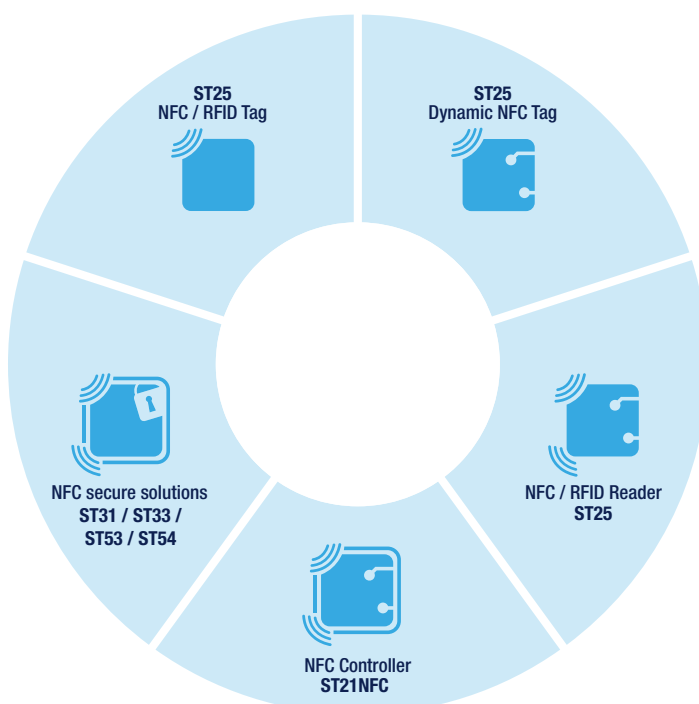
BENEFITS

- Comprehensive portfolio to cover 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.

ST25 NFC Tags and Dynamic Tags are NFC Forum certified

NFC / RFID TAGS, DYNAMIC TAGS & READERS

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

- NFC/RFID 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 RFID / NFC tags, featuring a reliable EEPROM memory with data protection (password), an I2C interface to connect to a MCU and a RFID/NFC tag interface, enabling multiple use-cases for Consumer, Industrial and IoT applications

- NFC / HF RFID 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.

KEY FEATURES

- Best-in-class RF performance
- 13.56 MHz frequency
- Highly reliable EEPROM with data protection
- I2C/SPI serial interface PWM output / GPO
- Energy harvesting capabilities
- Tamper detection feature
- Automatic Antenna Tuning
- High and Dynamic Power Output
- EMVCo compliant
- AEC-Q100 grade 1

NFC CONTROLLER, NFC BOOSTER AND SECURE ELEMENT

Near field communication (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.

ST provides an exhaustive offer of NFC products and solutions to address secure mobile transaction applications:

- ST21NFC state-of-the-art NFC Controller
- Embedded secure elements ST31/ST33
- ST53/ST54 NFC & eSE, integrating the widely deployed ST31/ST33 Secure Element combined with STS3922 booster / 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
- Allows ultra-small antennas
- Minimizes footprint & eases integration
- Increases interoperability
- Low power consumption
- Enhanced user experience (improved reading distance)
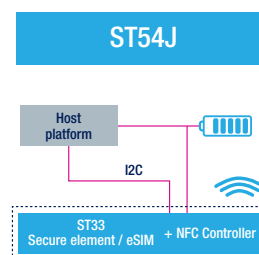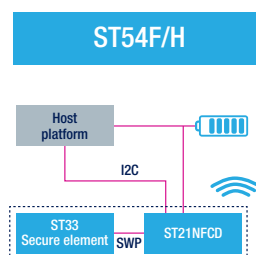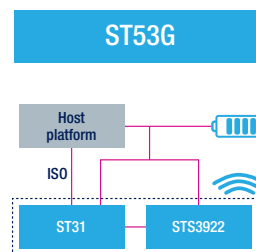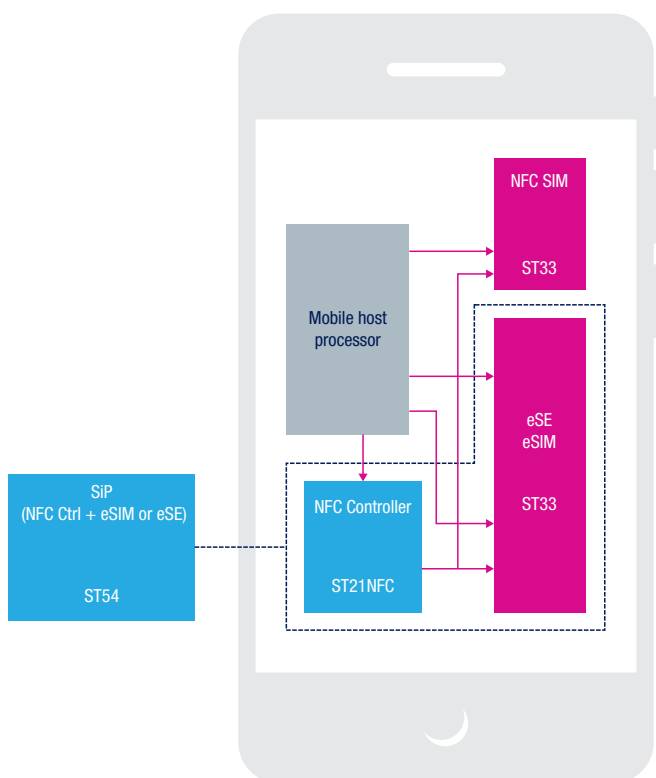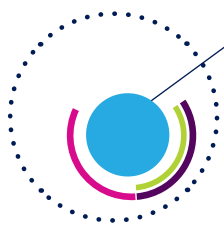
ST25 NFC/RFID Tag ICs

NFC / RFID Tag ICs with NFC Forum Type 4 or Type 5 RF interface

ST25TA and ST25TV tag ICs provide certified NFC Forum Type 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 based on cloud management, access control, asset tracking and gaming.

SPECIAL FEATURES

The ST25TA and ST25TV series deliver state-of-the-art RF performance and include 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 Detect
- Flexible user-programmable GPO
- NFC Type 5 combining long range HF RFID and NFC compliance

AREA OF APPLICATIONS

- Smart things
  - Consumer engagement
  - Authentification
- Smart city
  - Services
  - Library
  - Access control
- Smart industry
  - Identification
  - Asset tracking

HARDWARE DEVELOPMENT BOARDS

CLOUD-ST25TA02KB
ST25TA-based NFC tag evaluation board

ST25TV-eSEAL
ST25TV-based NFC tag evaluation board

PRODUCT PORTFOLIO

Part number	RF Interface	NFC Forum certtification	Memory size	Data protection	Counter	Special features	Package	RF Status output
ST25TV512	ISO15693 / NFC Forum Type 5	YES	512 bit	32- / 64-bit encrypted password	16- bit	TruST25® Digital signature	UFDFPN5, SBN075 and SBN12 (*)	NO
ST25TV02K	ISO15693 / NFC Forum Type 5	YES	2 Kbit	32- / 64-bit encrypted password	16-bit	TruST25® Digital signature	UFDFPN5, SBN075 and SBN12 (*)	NO
ST25TV02K-AD	ISO15693 / NFC Forum Type 5	YES	2 Kbit	32- / 64-bit encrypted password	16- bit	Tamper detect pin/ TruST25® Digital signature	UFDFPN5, SBN075 and SBN12 (*)	NO
ST25TV16K	ISO15693 / NFC Forum Type 5	YES	16 Kbit	64-bit password	NO	NO	SBN12 (*)	NO
ST25TV64K	ISO15693 / NFC Forum Type 5	YES	64 Kbit	64-bit password	NO	NO	SBN12 (*)	NO
ST25TA512B	ISO14443 Type A / NFC Forum Type 4	YES	512 bit	128-bit password	20-bit	TruST25® Digital signature	SBN12 (*)	NO
ST25TA02KB	ISO14443 Type A / NFC Forum Type 4	YES	2 Kbit	128-bit password	20-bit	TruST25® Digital signature	SBN12 (*)	NO
ST25TA02KB-P	ISO14443 Type A / NFC Forum Type 4	YES	2 Kbit	128-bit password	20-bit	TruST25® Digital signature	UFDFPN5	Yes (CMOS positive GPO)
ST25TA02KB-D	ISO14443 Type A / NFC Forum Type 4	YES	2 Kbit	128-bit password	20-bit	TruST25® Digital signature	UFDFPN5	YES (Open Drain GPO)
ST25TA16K	ISO14443 Type A / NFC Forum Type 4	YES	16 Kbit	128-bit password	NO	NO	SBN12 (*)	NO
ST25TA64K	ISO14443 Type A / NFC Forum Type 4	YES	64 Kbit	128-bit password	NO	NO	SBN12 (*)	NO

(*) SBN075: Sawn and bumped wafer (die form), 75 µm thickness;
 SBN12: Sawn and bumped wafer (die form), 120µm thickness

ST25 Dynamic NFC Tag ICs

Dynamic ISO/IEC 15693 NFC Forum Type 5 Tag ICs with either I2C Interface, Fast transfer mode and Energy Harvesting or PWM outputs

ST's Dynamic NFC / RFID tag ICs feature an RF ISO/IEC 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 innovative ST25DV-PWM series feature 2 Kbits of EEPROM and up to 2 PWM output 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. Both the ST25DV-I2C and ST25DV-PWM series offer multiple 32/64 bit passwrds to ensure flexible data protection mechanism.

MAIN APPLICATIONS

By combining its Fast Transfer mode over ISO/IEC 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.

By combining ST's proven NFC technology with PWM logic for the first time, the ST25DV-PWM dynamic 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 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
  - Up to 64-Kbit EEPROM
  - I2C interface (1MHz)
  - 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 5.5V
  - 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 things
  - Healthcare
  - Wellness

HARDWARE DEVELOPMENT BOARDS

X-NUCLEO-NFC04A1
ST25DV-I2C based NFC tag Nucleo expansion board

ST25DV-DISCOVERY
ST25DV-I2C based NFC Tag Discovery 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	Sypply (V)	Package	Temperature Range	Energy Harvesting output	RF status output (GPO/PWM)
ST25DV02K-W1	ISO15693 / NFC Forum Type 5	YES	2 Kbit	NA	64/32-bit password	1.8 to 5.5	SO8, TSSOP8	-40C +105C (PWM)	NO	1 PWM
ST25DV02K-W2	ISO15693 / NFC Forum Type 5	YES	2 Kbit	NA	64/32-bit password	1.8 to 5.5	SO8, TSSOP8	-40C +105C (PWM)	NO	2 PWM
ST25DV04K	ISO15693 / NFC Forum Type 5	YES	4 Kbit	1 MHz	64-bit password	1.8 to 5.5	SO8, TSSOP8, FPN8, FPN12, WLCSP	RF : 40°C / + 85°C or +105°C I2C : 40°C / 85°C or +105°C or +125°C	YES	configurable GPO
ST25DV16K	ISO15693 / NFC Forum Type 5	YES	16 Kbit	1 MHz	64-bit password	1.8 to 5.5	SO8, TSSOP8, FPN12,	RF : 40°C / + 85°C or +105°C I2C : 40°C / 85°C or +105°C or +125°C	YES	configurable GPO
ST25DV64K	ISO15693 / NFC Forum Type 5	YES	64 Kbit	1 MHz	64-bit password	1.8 to 5.5	SO8, TSSOP8, FPN12,	RF : 40°C / + 85°C or +105°C I2C : 40°C / 85°C or +105°C or +125°C	YES	configurable GPO

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

ST25 NFC / RFID HF Readers

High-performance HF Reader / NFC Initiators with 1.6W supporting VHBR and AAT for contactless applications

The ST25R reader series are a market leading range of high performance NFC/RFID HF 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 series 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 1.6W, 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.
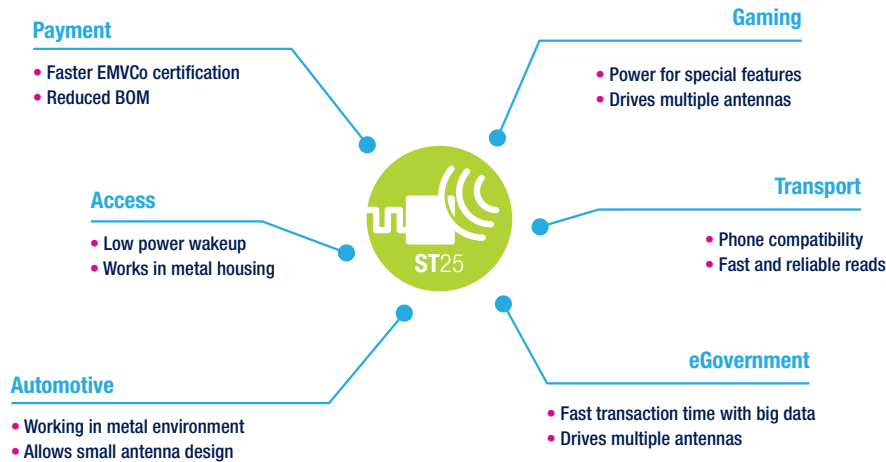
The top range of the ST25R family allow for EMVCo and PBOC certification, including EMVCo software code and hardware platforms following the newest standards, providing a convenient reference design for contactless payment solution / point-of-sale (POS) terminals.

ST25R3914/15 readers are AEC-Q100 Grade 1 (automotive) qualified making them ideal for digital key and immobilizer applications in cars.

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, and A2T) is especially useful in ensuring a high read range in challenging and/or metal environments.

KEY FEATURES

- Reader/Writer, P2P, Card Emulation
- Output power up to 1.6W
- Automatic Antenna Tuning (AAT, A2T)
- 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

Payment
- Faster EMVCo certification
- Reduced BOM

Gaming
- Power for special features
- Drives multiple antennas

Access
- Low power wakeup
- Works in metal housing

Transport
- Phone compatibility
- Fast and reliable reads

ST25

Automotive
- Working in metal environment
- Allows small antenna design

eGovernment
- Fast transaction time with big data
- Drives multiple antennas

HARDWARE DEVELOPMENT BOARDS

ST25R3911B-DISCO
ST25R3911B-based NFC Reader Discovery Board

X-NUCLEO-NFC05A1
ST25R3911B-based NFC Reader Nucleo expansion board

PRODUCT PORTFOLIO

Part number	Mode	RF interface	RF speed	Serial interface	Advanced features	Output power	Temperature range	Package	Applications
ST25R95	Reader / Writer, Card Emulation	ISO14443A,B / ISO15693	424kbps	SPI	-	0.23W	-25°C to +85°C	32-pin QFN (5x5mm)	Access Control, Gaming, Metering
ST25R3911B	Reader/Writer, P2P	ISO14443A,B / ISO15693/ FeliCa	6.8Mbit/s (VHBR)	SPI	AAT, DPO, CIWU	1.4W	-40°C to +125°C	32-pin QFN (5x5mm)	Points of Sale (EMVco),Passport, Industrial
ST25R3912	Reader/Writer, P2P	ISO4443A,B / ISO15693/ FeliCa	848Kbit/s	SPI	DPO, IWU	1.0W	-40°C to +125°C	32-pin QFN (5x5mm), WLCSP	Points of Sale (EMVco), Access Control
ST25R3913	Reader/Writer, P2P	ISO14443A,B / ISO15693/ FeliCa	848Kbit/s	SPI	AAT, DPO, IWU	1.0W	-40°C to +125°C	32-pin QFN (5x5mm)	Gaming, Access Control
ST25R3914	Reader/Writer, P2P	ISO14443A,B / ISO15693/ FeliCa	848Kbit/s	SPI	AAT, DPO, CIWU	1.0W	-40°C to +125°C	32-pin QFN (5x5mm)	Automotive (AEC-Q100 Grade 1)
ST25R3915	Reader/Writer, P2P	ISO14443A,B / ISO15693/ FeliCa	848Kbit/s	SPI	DPO, CIWU	1.0W	-40°C to +125°C	32-pin QFN (5x5mm)	Automotive (AEC-Q100 Grade 1)
ST25R3916	Reader / Writer, P2P, Card Emulation	ISO14443A,B / ISO15693 / Felica	848Kbit/s	SPI & I2C	A2T, DPO, CIWU, AWS, NSR	1.6W	-40°C to +125°C	32-pin QFN (5x5mm), WLCSP	Points of Sale (EMVco), Passport, Access Control

Note :

VHBR: Very High Bit Rate

AAT: Automatic Antenna Tuning (parallel matching capacitance)

A²T: 2D Automatic Antenna Tuning (serial and parallel matching capacitance)

DPO: Dynamic Power Output

NSR: noise suppression receiver

AWS: Active Wave Shaping

CIWU: Capacitive & Inductive Wakeup

IWU: Inductive Wakeup

ST31 / ST33 Secure Element

Secure Element for contactless & NFC applications

STMicroelectronics provides a global offer of products and solutions for NFC enablement. This includes best-in-class secure 32-bit Flash-based microcontrollers to address, embedded secure elements (SE) with or without software, SWP-SIM, and eSIM applications. Secure solutions are delivered as discrete ICs or systems-in-package for optimized solutions.

ST31 AND ST33 SECURE MICROCONTROLLERS

The ST31 secure microcontroller is intended for highly-secure applications including banking, identification, pay TV, and transport. ST31 dual-interface secure microcontrollers are designed to enable secure and fast contactless transactions . Additionally, it can be delivered with or without the STPay banking application, a fully certified SW solution for payment applications. Combined with the STS3922 NFC booster IC, it meets all the requirements to support wearable payment/ transport applications with very small antennas...

ST33 secure microcontrollers are designed to meet advanced security and performance requirements for secure mobile applications including NFC embedded secure element and advanced SIM with a large user Flash memory capability. Combined with the ST21NFC NFC controller, it meets all the requirements for integrating payment, transport or multi-application solutions in smartphones, tablets, wearables or connected PCs.

KEY FEATURES

- 32-bit ARM® SC000 CPU / SC300 CPU
- Multi-protocol (ISO/IEC 7816, ISO/IEC 144443A/B/F and VHBR)
- EMVCo and Common Criteria certified
- Multi-application support
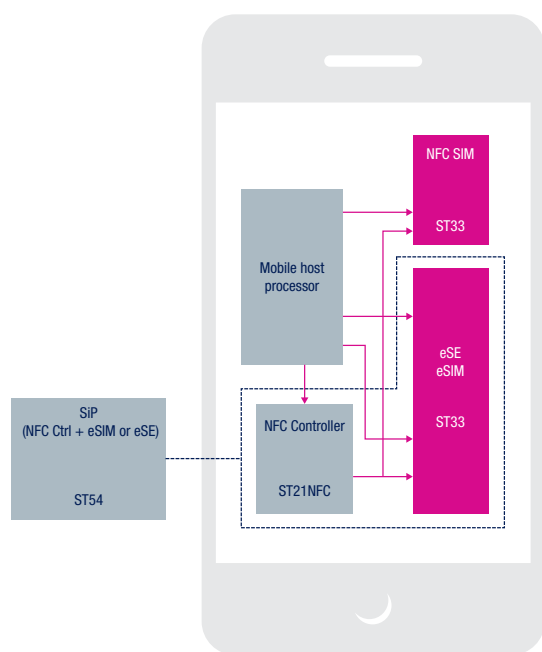
ST31 / ST33 FEATURES

With the ARM® SecurCore® SC000 processor and an architecture optimized for contactless performances, the ST31 platform offers multiple hardware interfaces and a wide range of libraries, including MIFARE Plus® and MIFARE®, DESfire® and certified cryptographic functions. The platform addresses the best-in-class security standards including Common Criteria up to EAL5+, EMVCo, and CUP.

With the latest ARM® SecurCore® SC300 32-bit RISC processor and an architecture optimized for high performance, the ST33 platform offers large memory capacity, multiple communication interfaces and certified cryptographic libraries in different form factors including wafers, SIM modules, DFN, and WLCSP packages. The ST33 platform addresses the highest security standards including Common Criteria up to EAL5+, EMVCo and CUP. To support MIFARE® technology on secure element applications, optional MIFARE® libraries (MIFARE® Classic and MIFARE® DESFire® EV1 libraries) are available on ST33 secure microcontrollers and are certified up to Common Criteria EAL5+.

TYPICAL APPLICATION BLOCK DIAGRAM

PRODUCT PORTFOLIO

Part number	Secure device	NFC mode	RF protocol	Interface	Key features	Package
ST31G480	eSE 480-Kbytes Flash memory	Card Emulation	ISO/IEC 14443 A, B, ISO/IEC 18092, VHBR	ISO/IEC 7816, ISO/IEC14443	32-bit ARM® SecurCore® SC000 CPU eSE for payment, transport, access control MIFARE® Classic & DESFire® Available with or without STPay Payment application Ideal for contactless payment integration in battery-less wearables	DFN Modules Wafers
ST33G1M2	eSE 1.2-Mbytes Flash memory	Card emulation / reader / P2P combined with NFC controllers	Managed by NFC controller	ISO/IEC 7816, SPI,SWP	32-bit ARM® SecurCore® SC300 CPU eSE for payment, transport, access control MIFARE® Classic & DESFire®	WLCSP DFN Wafers
ST33J2M0	eSE 2-Mbytes Flash memory	Card emulation / reader / P2P combined with NFC controllers	Managed by NFC controller	ISO/IEC 7816, SPI,I²C,SWP	32-bit ARM® SecurCore® SC300 CPU MIFARE® Classic & DESFire®, combining eSE and eSIM	WLCSP QFN20 Wafers

ST21NFC Controller
NFC booster

NFC booster and NFC controller solutions

Implementing Active Load Modulation technology, ST's NFC boosters (STS3921/22) and NFC controller (ST21NFCD) solutions guarantee 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: Compatible with most operating systems on the market (Linux, Android, RTOS, etc.). ST lowers the cost for developers by providing multi-application support with optimized solutions including intuitive SDK platforms for integrating contactless services around any microcontroller architecture for wearables

- Simplifies the deployment: Integration into the most popular TSMs and pre-certification services help reduce time to market as well as development costs

KEY FEATURES

- Enhanced user experience (reading distance)
- Allows ultra-small antenna
- Minimizes footprint
- Facilitates integration
- Increases interoperability
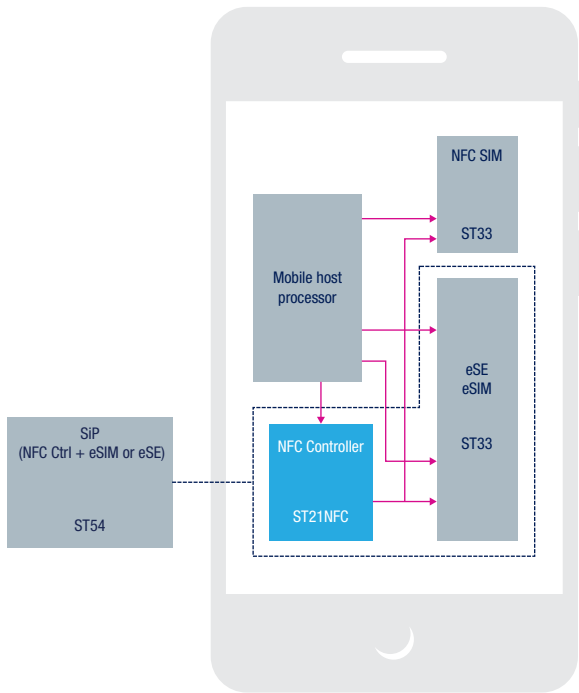- Helps ensure low power consumption

HARDWARE DEVELOPMENT BOARD
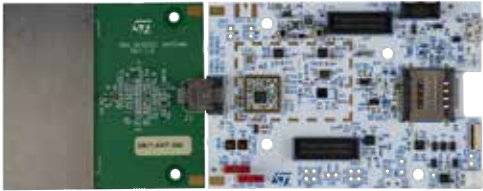
SCT-DB11G-NFCDS
ST21NFCD Development kit
(contact your sales interface for more information)

TYPICAL APPLICATION BLOCK DIAGRAM

PRODUCT PORTFOLIO

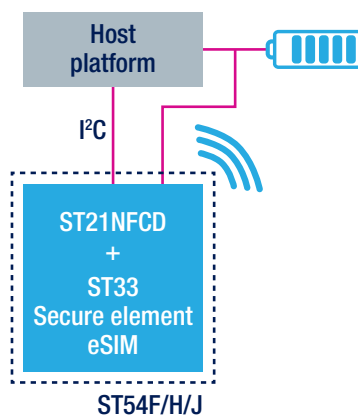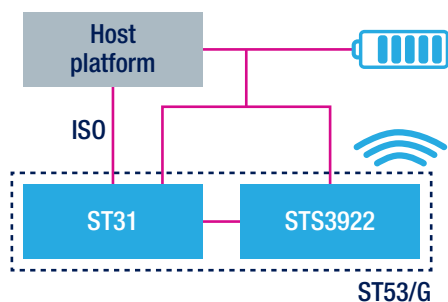| Part number	Type	NFC modes	RF protocol	Interface	Key features	Package
STS3921	NFC Booster	Card emulation	ISO/IEC 14443A	Contactless bridge to secure microcontroller SPI to Host	Active Load Modulation Q factor adjustment Automatic Power Control Automatic Gain Control Low-power field detection	WLCSP
STS3922	NFC Booster	Card emulation	ISO/IEC 14443A	Contactless bridge to secure microcontroller SPI to Host	Active Load Modulation Automatic Antenna Tuning Q factor adjustment Automatic Power Control Automatic Gain Control Low-power field detection	Wafer
ST21NFCD	NFC Controller	Card emulation, Reader, P2P	ISO/IEC 14443A/B ISO/IEC 18092 ISO/IEC 15693	SWP, SPI,I²C, UART	Active Load modulation Optimized power consumption modes NCI 2.0 compliant Secure Firmware Update mechanism	BGA 4*4
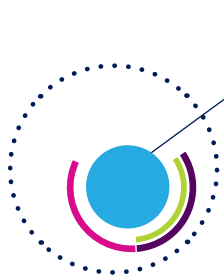
ST53 / ST54
Integrated secure solutions

Integrated secure solutions

From ST31 and ST33 secure MCU platforms, STPay software to a complete portfolio of NFC products based on ST53 and ST54 families, ST offers a complete range of turnkey solutions pre-certified for most payment and transit schemes including EMVCo, PBOC, VISA, MC, AMEX, Discover, and MIFARE®. STPay, ST secure payment solution is now avaialble with an over-the-air (OTA) personalization with third party partner.

ST53/G

| Host platform |
| ISO |
| ST31 | STS3922 |

ST54F/H/J

| Host platform |
| I²C |
| ST21NFCD + ST33 Secure element eSIM |

KEY FEATURES

- Enhanced user experience (reading distance)
- Allows ultra-small antenna
- Minimizes footprint
- Facilitates integration
- Increases interoperability
- Helps ensure low power consumption

PRODUCT PORTFOLIO

Part number	SE integrated	Contactless Front End	Targeted devices	Package
ST53G	ST31G480	STS3922	Ideal for single/dual contactless applications Ideal for low- and middle-end wearables Available with or without STPay ST secure payment application (STPay-Boost)	BGA (4* x 4)
ST54F	ST33G1M2	ST21NFCD	Supports multiple secure applications Ideal for middle- and high- end wearables	BGA (4* x 4)
ST54H	ST33J2M0	ST21NFCD	Supports multiple secure applications and eSIM Ideal to enable convergence of applications such as eSIM	BGA (4* x 4)
ST54J	Single die with ST33 2MB & NFC controller		Support multiple secure applications and eSIM. Ideal to enable convergence of application such as eSIM.	WLCSP

COMPLETE DEVELOPMENT ECOSYSTEM FOR SECURE SOLUTIONS

Available for ST54 (SCT-DB11G-54xx / SCT-NUCL-ST54E1) and ST53 (SCT-NUCLEO-ST53A) platforms, 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 and ST53 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

- The ST53 Tools package includes :
  - RF parameters adjustment
  - Application development
  - STPay banking application availaibility

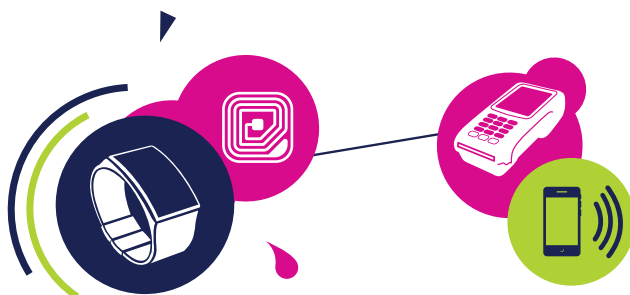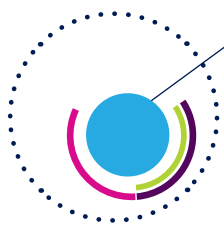For more information please contact your sales interface.

ST53G expansion board

SCT-DB11G-54xx
A nucleo adapter is available (SCT- DB11-2-NUCL)

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 f acilitate 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
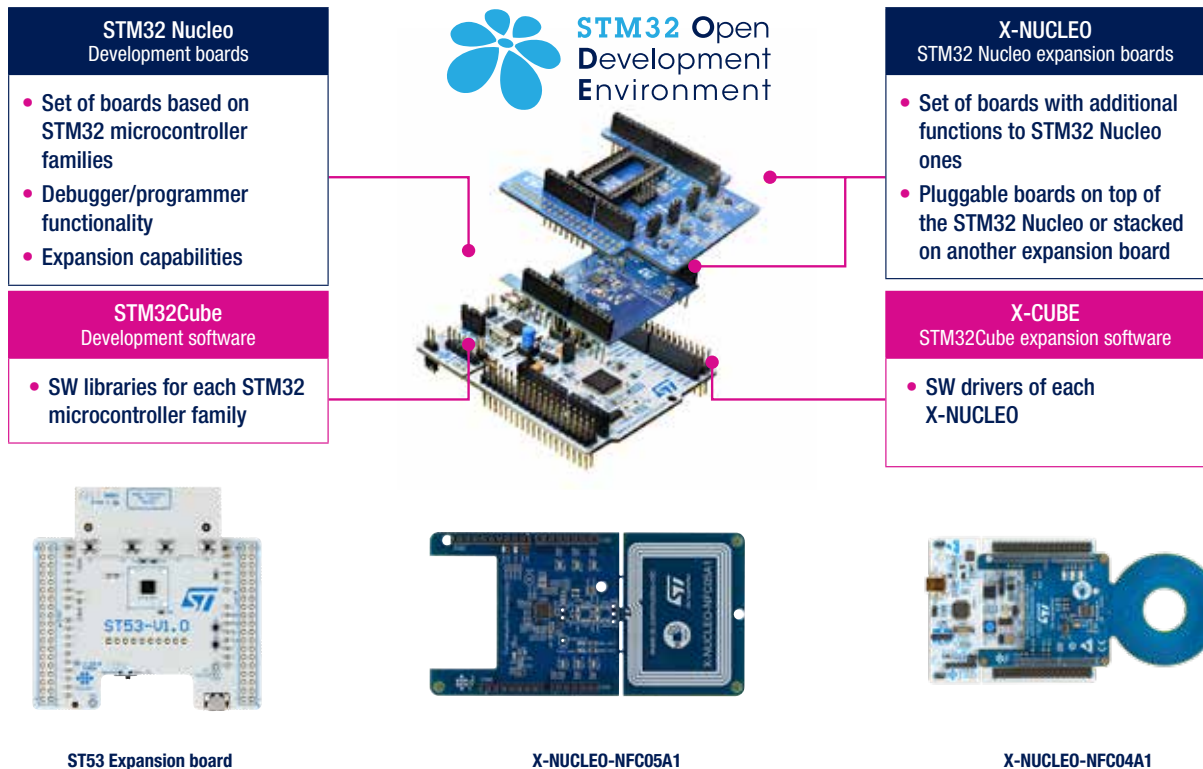
STM32 Open Development Environment

STM32 Nucleo Development boards	X-NUCLEO STM32 Nucleo expansion boards
• Set of boards based on STM32 microcontroller families • Debugger/programmer functionality • Expansion capabilities	• Set of boards with additional functions to STM32 Nucleo ones • Pluggable boards on top of the STM32 Nucleo or stacked on another expansion board

STM32Cube Development software	X-CUBE STM32Cube expansion software
• SW libraries for each STM32 microcontroller family	• SW drivers of each X-NUCLEO

ST53 Expansion board   X-NUCLEO-NFC05A1   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 advices;

• 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

NFC Technology
at a glance

NFC: proximity contactless technology

CONTACTLESS COMMUNICATION: PHYSICAL LAYER

NFC communication is based on contactless standards that use a 13.56MHz carrier, a worldwide license-free frequency.
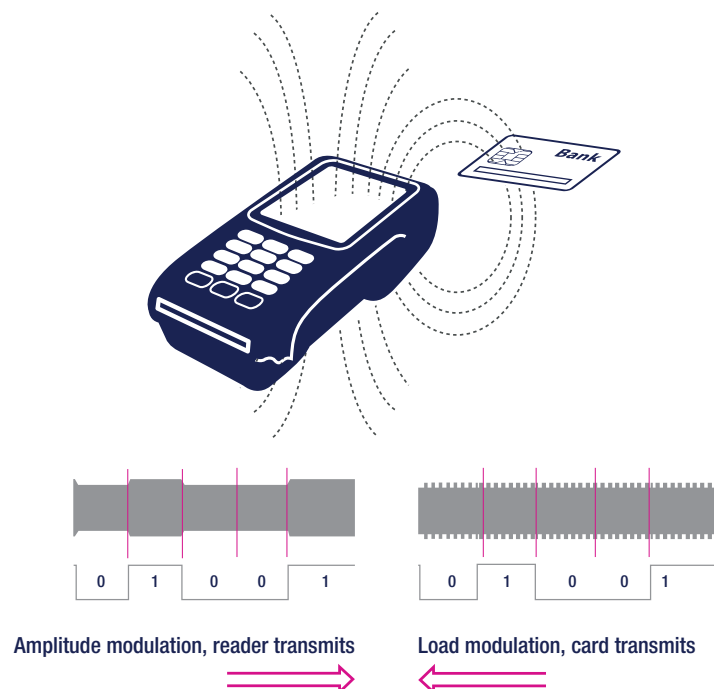An initiator energizes an antenna with a 13.56MHz signal to create an electromagnetic field. The near field is used to transfer energy to target.
The initiator sends data to the target by modulating the field intensity.
The target sends back data to the initiator by load-modulating the field.
In passive mode of operation, only the NFC initiator generates RF field. This mode is typically used for reading tags or smart cards.
In 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.
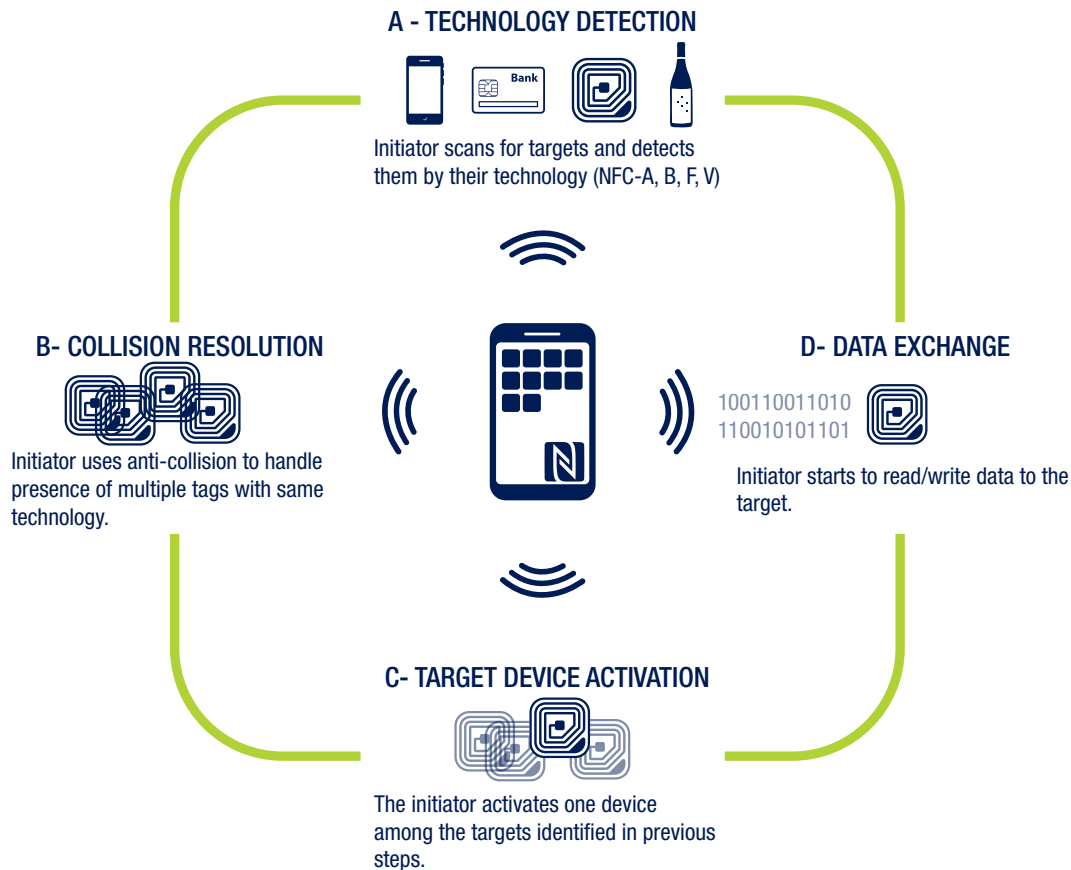
| 0 | 1 | 0 | 0 | 1 | | 0 | 1 | 0 | 0 | 1 |

Amplitude modulation, reader transmits   **Load modulation, card transmits**

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	2K-bytes	32K-bytes	64K-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. There are always an initiator, typically a NFC reader or a mobile one, and a target, typically a tag or mobile phone in card emulation mode.

A - TECHNOLOGY DETECTION

Initiator scans for targets and detects them by their technology (NFC-A, B, F, V)

B- COLLISION RESOLUTION

Initiator uses anti-collision to handle presence of multiple tags with same technology.

D- DATA EXCHANGE

100110011010
110010101101

Initiator starts to read/write data to the target.

C- TARGET DEVICE ACTIVATION

The initiator activates one device among the targets identified in previous steps.

DATA ORGANIZATION AND EXCHANGE
NDEF

The data in a NFC device are organized in records according to a structured format, known as the NFC Data Exchange Format (NDEF). The records contain information that is encoded according to the Record Type Definition (RTD) specification:

- "Device information", like firmware version
- "Text" strings
- "Universal Resource Identifiers", like web URL
- "Connection Handovers", used for pairing
- "Signature", used for authentication
- "Smart poster", text like SMS message

NDEF also defines how to encapsulate records into a message in order to transmit them to the other device. NDEF is supported by all NFC compliant devices regardless of their types.

For mobile, the NDEF message is interpreted by the built-in SW and it will trigger the appropriate action by the device itself like:

- Send an e-mail or SMS
- Open a web page
- Place a call
- Launch a specific application

The complete list of actions and RTD is defined and maintained by the NFC Forum.

SNEP

In peer-to-peer mode, more complex and larger amount of data are exchanged. The data exchange is done according to Simple NDEF Exchange Protocol (SNEP) to ensure an efficient, robust and fast transaction.

SNEP uses a reliable transport layer: Logical Link Control Protocol (LLCP).

NFC CERTIFICATION

The NFC Forum Certification Program confirms that your device, tag or reader is compliant with NFC Forum specifications. Conformance to the specifications provides consistency of behavior across NFC implementations and sets the foundation for interoperability.

Users – both commercial and consumer – will benefit through access to features such as program and firmware updates, inventory management and control, and access to information and pricing that improve convenience and productivity.

https://nfc-forum.org/certification-program-overview/
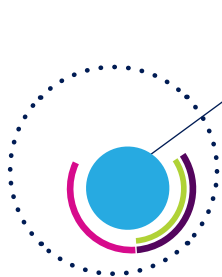
Glossary & references

Term	Definition
AAT	Automatic Antenna Tuning.
Card Emulation mode	NFC mobile device emulating a contactless card.
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 13.56Mhz 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

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