NFC / RFID
ST25 product overview

MMY division
May 2020
Solutions for NFC / RFID Tags & Readers

ST25 SIMPLY MORE CONNECTED
Microcontrollers & Digital ICs group (MDG) product lines

MMY
Serial EEPROM, NFC/RFID Tags & Readers
- High-performance & high-endurance EEPROM
- NFC / RFID Tags, Dynamic Tags and Readers
- Advanced packaging options → Wafer Level Chip Scale Package (WLCSP)
- Automotive grade

MCD
General Purpose Microcontrollers
- STM32 – 32-bit MCUs
- Ultra-low-power / High performance
- Broad choice of peripherals
- Broadest portfolio
- 10 years longevity for industrial applications

SMD
Secure Microcontrollers
- Mobile Security (SIM, eSIM, NFC ctrl and e-SE)
- Automotive grade Secure MCUs
- Banking, ID and transport
- Authentication for secure IoT & anti-counterfeiting
- Turnkey solutions including certified HW+SW

AMC
Aerospace, defense and mmWave Communication
- RF mmWave Connectivity: SPARCLink 60GHz Transceiver (ST60)
- Satellite Constellation: Galileo satellite & user terminals and Space & Defense ASICs
MDG Group at a glance key financial data by sub-group

<table>
<thead>
<tr>
<th>Group 2018 Revenue</th>
<th>FY18 vs FY17 Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>$2.94B</strong> Microcontrollers &amp; Digital ICs Group</td>
<td><strong>+11%</strong> MDG</td>
</tr>
<tr>
<td><strong>$2.29B</strong> MMS</td>
<td><strong>+11%</strong> MMS</td>
</tr>
<tr>
<td><strong>$0.65B</strong> Digital</td>
<td><strong>+11%</strong> Digital</td>
</tr>
</tbody>
</table>

MMS = Microcontrollers & Memories
Digital = Digital and Mixed ASICs, Aerospace, Defense and mmW Communication

mmW = millimeter Wave
2018 Revenues Split

- ~70% Revenues with Microcontrollers
- ~20% Revenues with Digital products
- ~10% Revenues with EEPROM memories

Three Year Target

Leadership on Embedded Processing (*)

Migration of Digital competences to Industrial (MPU/AI) & RF mmW, capitalizing on ST differentiated technologies & IP

Consolidate leadership in EEPROM Memories

(*) Excluding automotive MCUs
Source: IHS Markit
MMY product line at a glance

**Standard EEPROM**
-40 to +85°C Industrial
-40 to +105°C Industrial-Plus
Up to 2Mbits, also in Ultrathin WLCSP

**Automotive EEPROM**
-40 to +125°C AEC-Q100 grade 1
-40 to +145°C AEC-Q100 grade 0
Up to 2Mbits, SO8N, TSSOP8 and FPN8

**NFC Tags and Readers**
NFC / RFID Tags
Dynamic NFC Tags
NFC / RFID Readers
UHF Readers

Nb.1 WW EEPROM supplier thanks to complete portfolio at competitive price

Nb.1 WW automotive EEPROM supplier with more than 45% market share

Simply more connected with NFC / RFID Tags and Readers
NFC: a world of opportunities

**CONNECTED DEVICES**

17 billion by 2024

ABI Research estimation – April 2019

A massive increase with ~15 – 25% annual growth

**NFC ENABLED DEVICES**

1.6 billion by 2024

ABI Research estimation – April 2019

NFC adopted across all handsets
OEMs covering all OSS

**NFC MARKET VALUE**

$47 billion by 2024

ABI Research estimation – April 2019

NFC technology as the simplest way to create
User Interface and add other smart
functionalities in any ‘thing’

[Source: ABI Research]
## RFID technologies at a glance

<table>
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<th>RFID</th>
<th>LF</th>
<th>HF</th>
<th>UHF</th>
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<tr>
<td>Coupling mode</td>
<td>Inductive</td>
<td>Inductive</td>
<td>Electro-magnetic backscatter</td>
</tr>
<tr>
<td>Operating frequency</td>
<td>125kHz – 134kHz</td>
<td>13.56MHz</td>
<td>860MHz – 960MHz</td>
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<tr>
<td>Antenna</td>
<td>Coil</td>
<td>Coil</td>
<td>Dipole</td>
</tr>
<tr>
<td>Max operating distance</td>
<td>up to 1m</td>
<td>Vicinity: up to 1m</td>
<td>~10m</td>
</tr>
<tr>
<td>Proximity: up to 10cm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regulation</td>
<td>Worldwide harmonized</td>
<td>Worldwide harmonized</td>
<td>Different regulations per country</td>
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<tr>
<td>Standards</td>
<td>ISO14223</td>
<td>ISO14443 A/B</td>
<td>ISO18000-6 B/C</td>
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<tr>
<td></td>
<td>ISO18000-2</td>
<td>ISO15693</td>
<td>EPC Class 1 Gen 2</td>
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<td></td>
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<td>ISO18000-3</td>
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<td>NFC Forum</td>
<td>RAIN RFID</td>
</tr>
<tr>
<td>Environmental influences</td>
<td>Small influence on operating distance</td>
<td>Small influence on operating distance</td>
<td>Influence on operating distance by reflection and absorption (metal and liquids)</td>
</tr>
<tr>
<td>Works in metal and industrial environment</td>
<td>Works in metal and industrial environment</td>
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<tr>
<td>Applications</td>
<td>Animal tagging</td>
<td>Product identification</td>
<td>Pallets and container ID</td>
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<td></td>
<td></td>
<td>Public transport / Libraries</td>
<td>Retail / Logistics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Access control / Payment</td>
<td>Authentication</td>
</tr>
<tr>
<td>ST solutions</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
NFC technology at a glance

An interactive technology enabling engagement with IoT devices

- Near Field Communication, a **short range** wireless technology
  - Operating at **13.56MHz**
  - Based on the RFID HF standard (ISO14443 & ISO15693)

- **Interactive** and **zero power**, enabling convenient connection to the Internet of Things
  - **NFC-enabled mobile phone can engage with items by a simple tap**

- NFC is developed by the NFC Forum
  - **Interoperability** between devices
  - **Standardized** use cases (web link, Bluetooth handover,…)

- Fast growing deployment in Mobile phone
  - In 2020, more than two in three phones to come with NFC
  - NFC is used for Mobile payment (EMVco) like ApplePay
  - Apple added in 2017 support of NFC reader mode from iOS11 onward and support of NFC writer mode from iOS13 in September 2019
NFC is unique in the wireless spectrum: Short distance, Low data-rate & Zero power consumption for the application.
NFC forum standards

- NFC specification → Upper layer SW
- RFID HF ISO standards → HW/SW protocol

- NFC Forum
  - Type 2 and Type 4
  - Type 5

- ISO14443
  - Type A and Type B
  - "Short Range" 106kbps

- ISO15693
  - "Long Range" 26kbps

NDEF (NFC Data Exchange Format)
Typical NFC / RFID range

- ISO14443 (NFC Forum Type 2 & Type 4) is called "short range" standard while with higher RF speed
- ISO15693 (NFC Forum Type 5) is called "long range" standard
From factory to consumer bridging RFID and NFC

ISO 15693

1 meter

few feet

NFC Type 5
ST25 matching ST strategy

Making **driving** safer, greener and more connected

- Car access
- Car center console

Making **homes & cities** smarter, for better living, higher security, and to get more from available resources

- Smart cities
- Home appliance & automation

Enabling the evolution of **industry** towards smarter, safer and more efficient factories and workplaces

- Lighting & Metering
- Asset tracking

Making everyday **things** smarter, connected and more aware of their surroundings

- Wearable & Healthcare
- Gaming & Payment
ST NFC portfolio

Covering all NFC application needs and leveraging a rich ecosystem

www.st.com/nfc

NFC / RFID Tag
Dynamic NFC Tag
NFC / RFID Reader
Secure NFC ST54
NFC Controller

STMicroelectronics is Member of NFC Forum, RAIN Alliance and ISO organizations as well as Car Connectivity Consortium (CCC), Wireless Power Consortium (WPC) and Zhaga Consortium
A full range of NFC & secure elements and esim

To address multiple secure transactions in mobile

**ST33 eSIM, SIM, eSE**
- Up to 2MB Flash
- Multi-packages (WLCSP, MFF2, DFN8)
- GSMA SAS-UP certified flow
- EMVCo, CC EAL5+, MTPS

**ST21NFC controller**
- Boosted for tiny & metal cover antenna
- Reduced BOM
- Low Power mode
- Card emulation, Reader & P2P

**ST54 convergence**
- ST33 eSE, eSIM + ST21NFC
- SiP BGA and single chip WLCSP
- GSMA SAS-UP certified flow
- EMVCo, CC EAL5+, MTPS
- MIFARE® & FeliCa®

#1 eSIM > 300Mu sold
Best-in-class performances
All-in-one solution
The mobile convergence

embedded SIM, NFC controller & Secure Element for Mobile

**ST33 eSIM**
- #1 source Tier-1 OEMs
- #1 GSMA SAS-UP certification

**ST21 NFC Controller**
- Mediatek lead partner

**ST54H SiP (NFCD + ST33)**
- Excellent RF performances
- Fast transaction time for transit and payment

**ST54J single die**
- Improved performances
- 20% smaller PCB area and BOM
- NFC + eSE + eSIM
- NFC Wireless Charging
Wearables

From optimized to multi-application secure wearables

Optimized Passive
Card emulation only passive

ST31P450 secure MCU
- Cost optimized
- ARM® SecurCore® SC000 Secure element
- Card Emulation, ISO14443, types A
- MIFARE® (must be on a banking application)
- With or without STPay Payment application
- Class 1 - Class 6 antennas supported
- Mainly for banking & transport application

Advanced Active
Card Emulation
Reader/Writer
Peer to Peer

ST54x
- For middle & high-end wearables
- Combined SE (ST33) & NFC controller ST21NFC
- Payment, eSIM GSMA RSP v2.
- MIFARE for Mobile® v2.
- NFC Card Emulation ISO14443 A,B,F 106-848kb/s
- NFC Reader, P2P
- Typical antenna <100mm2 and metal cover
- Supports multiple secure applications
ST25 products family

Tags

Consumer engagement, Asset tracking, Ticketing, Gaming, Brand protection, Access control, …

STM32 microcontroller

ST25T

13.56MHz

NFC phone / RFID Reader

Dynamic tags

Industrial, Lighting, Consumer, Metering, Appliance, Healthcare, … (Fast Transfer Mode and SW upgrade)

STM32 microcontroller

ST25D

13.56MHz

NFC phone / RFID Reader

Readers

POS & mPOS Terminals, Automotive, Access control, Gaming, …

STM32 microcontroller

ST25R

13.56MHz

NFC phone

www.st.com/st25t

www.st.com/st25d

www.st.com/st25r
ST25 series enriching our lives!

Main Applications

- Consumer Home Appliance
- Healthcare Gaming
- Brand recognition Accessory
- Asset Tracking
- Transport
- Industrial
- Smart Home Smart City
- Access control
- Automotive
- Point of sales
iOS is ready for NFC!

2014
Apple Pay
GymKit NFC
Tag reading (NDEF)

2017
Apple Pay
GymKit NFC
Tag reading (NDEF)
On « App launch »

2018
Apple Pay
GymKit NFC
Tag reading (NDEF)
On « App launch »

2019
Apple Pay
GymKit NFC
CCC Digital Key for cars (iOS13.4)
Full Access ISO15693
Write, Read, Lock NDEF
ST25 proprietary commands
Read "VAS" tag
Hand-off home pod
Passport reading
NFC Siri Shortcut
Audio sharing (phone tap)

As well as Android…
## Certification & interoperability status

### Tags
- ST25TV
- ST25TA

### Dynamic Tags
- ST25DV-I2C
- ST25DV-PWM

### Readers
- ST25R3911B
- ST25R3916

### NFC Forum
- iOS app
- Android app

### NFC Forum
- RFAL SW
- Linux SW
Key use cases
URL link “tap & get web page”

Direct access to a Web page

Native support with NFC phone (NDEF)

Open a web page
thanks to URI information stored inside the ST25 tags

iOS and Android compatibility

ST solutions
- Tag
- Dynamic Tag
Direct access to download an app

Native support with NFC phone (NDEF)

Direct link to Google Play and Apple store to download an app

iOS and Android compatibility

ST solutions

- Tag
- Dynamic Tag

“Tap & get app”
E-warranty card & customer registration

Pre-program activation email with ST25 tags

To: customer.service@st.com
Subject: warranty activation #627123A58-A

Dear customer service,

I would like to activate the warranty card for item serial number #627123A58-A and apply for the 2-year program.

E-warranty card
Fast and convenient way to activate the product warranty

Customer registration & product re-order
Consumer services enablement

Native support with NFC phone (NDEF)

ST solutions

• Tag
• Dynamic Tag
Wireless pairing “tap & connect”

Easily pair your connected devices

Native support with NFC phone (NDEF)

- Ease Bluetooth / Wi-Fi pairing by simple tap
  Just wave your phone to pair

- Plug & play technology
  Built-in handover in Android & Windows

- Multi-user management
  Tap your phone to give or take control

- Zero impact on power budget
  zero power interface & and features field detect

ST solutions

- Tag
- Dynamic Tag
Tap & download the contact on your phone

Native support with NFC phone (NDEF)

Unlimited access to contact details with ID picture capabilities

Instant & safe new contact storage

iOS & Android compatibility

ST solutions
Tap & identify

Consumer engagement & brand recognition with Cloud management

- Branding and Consumer Engagement
- Product identification with enriched information
- Identity check using TruST25 digital signature
- Tamper detect for open-close detection

ST solutions • Tag
Transport

Contactless electronic ticketing

- Fast data transfer based on ISO14443
- Large and unique counting capability with anti-tearing feature
- Anti-collision mechanism
- Compatible with most popular contactless ticketing systems

ST solutions

- Tag
- HF Reader
Enhanced logistic operations

Add relevant information onto your NFC / RFID tag
Information will be protected by passwords

Up to date information
Up-date the electronic label whenever necessary

Combined benefits of RFID & NFC technologies

ST solutions
- Tag
- HF Reader
Parameters setting

Save time on your production lines

From DIP switch / resistor to contactless setting
Get rid of manual operation

In the Box “programming”
Simple & flexible

Upload new setting to powered off devices
Personalize your boxed devices on the production belt

ST solutions

• Dynamic Tag
Maintenance & service

Real-time communication and in application programming

Fast Transfer Mode with 256 Byte buffer for data synchronization and Firmware update

Manage your stock efficiently
With easy reconfiguration of boxed products

Convenient access to the embedded device
For diagnostic and re-programming

ST solutions

• Dynamic Tag
Seamless user interface simplicity

Provide any electronic device with remote display
Use your NFC-enabled Smartphone or Tablet

Several native operation options
Enhanced with a suited App

Let any object become Smart with a Tap
Exploit Smartphone processing power

ST solutions

• Dynamic Tag
Energy Harvesting to power low power devices

Energy harvesting from NFC RF Field

NFC connectivity
Enhanced with a suited App

Up to 5mA with NFC reader

ST one-stop-shop with low power MCU and sensors
with SmarTAG solution

ST solutions

• Dynamic Tag
Convenient data-logging

Data-log on the spot or off-line data access for consumer & industrial applications

**Convenient access to your monitored data**
Easy to do with a smartphone as display

**Broad range of application**
Logistics, Maintenance assistance, Consumer

**Data accessible even when system is powered off**
Tag acting as a “black box” tool

ST solutions
- Dynamic Tag
- HF Reader
Dynamic tag enabling multiple benefits during the entire product lifecycle

- Parameters setting in production
- Logistics / Asset tracking
- Wireless networks provisioning
- Remote programming / FW upgrade
- Data download / Data-log
- Servicing & Maintenance
- Consumer engagement
Payment & home banking

Payment made easy and secure

Payment & Home Banking
Full EMVCo POS and mobile POS (mPOS) for cashless transactions with minimal investment

Enhanced user experience
Quicker payment processing
Add new services like loyalty cards

ST solutions
• HF Reader
Automotive

Car access and console personalization

- **NFC for car access and ignition**
  Convenient and secure access to the car
  Distribution of keys online to your NFC smartphone

- **In-car personalization with secure pairing**
  Just sit in and the entire cockpit will fit the driver wish

- **NFC for car diagnostic**
  No physical connection required

**ST solutions**

- HF Reader
Connected homes

Second screen & remote UI

Use your NFC smartphone to Tap & configure, while authentication feature let you safely access your online accounts, gaming, or social media.

Quick and secure pairing to any connected device
Tapping a TV will turn your Phone into a second screen.

ST solutions
- Dynamic Tag
- HF Reader

life augmented
Enhance your gaming possibilities by using NFC

Figurines come to life, using NFC to connect to a gaming console

Player and figurine interaction without any external battery need

ST solutions

- Tag
- HF Reader
Smart access control

Access control made smart

**Smart locks**
NFC assisted lock configuration to grant temporary access rights (maintenance, friends…)

**Hotel Access**
with cards or NFC smartphones

**ST solutions**
- Tag
- HF Reader
Accessory recognition

Brand recognition and parameters setting

NFC for accessory identification
Convenient and reliable brand identification

Automatic System configuration
Upon accessory type recognition

Brand Recognition
Ensure only branded accessory are used

ST solutions
- Tag
- Dynamic Tag
- HF Reader
UHF reader for logistics

Ideal for battery operated handheld devices

UHF solution
Suitable for Hand-held readers, stationary readers, Embedded readers and mobile UHF RFID readers

Dense Reader Mode
for Battery Handheld

Fast Moving Consumer Goods

ST solutions
• UHF Reader
<table>
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<tr>
<th><strong>NFC use cases</strong></th>
<th><strong>ST strengths</strong></th>
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</thead>
</table>
| **Automotive**    | • Car access (digital key) for Door handle  
                    • Qi NFC card protection, Bluetooth pairing |
|                   | • Automotive grade and high performance NFC Readers |
| **Lighting**      | • Factory product settings  
                    • Field servicing, maintenance (w/ FW upgrade) |
|                   | • ST25DV industrial grade 8, high reliability EEPROM  
                    • STM32 and STM8 eco-system |
| **Payment terminals** | • Contactless Payment |
|                   | • ST25R3916 EMVco 3.0 NFC Reader  
                    • STM32U5 with TruSTM32 |
| **Industrial**    | • Factory programming, provisioning to wireless networks, servicing and maintenance |
|                   | • Strong portfolio of Tags, Dynamic Tags & Readers  
                    • 10 year longevity program  
                    • STM32 and STM8 eco-system |
| **Accessory recognition** | • Identification of accessory, parameter settings |
|                   | • Reader + Tag solution  
                    • STM32 eco-system |
| **Consumer**      | • Bluetooth and Wifi pairing, product configuration, datalogging |
|                   | • Strong portfolio of Tags, Dynamic Tags & Readers  
                    • STM32 eco-system |
| **Branding**      | • Consumer engagement and brand recognition  
                    • Authentication |
|                   | • ST25TV (& ST25TA) Tag solution  
                    • TruST25 digital signature with Cloud management |
ST25 tags & dynamic tags DNA

Comprehensive portfolio

**Standard Compliant**
- NFC Forum
- ISO14443A
- ISO14443B
- ISO15693

**Feature-rich**
- 13.56MHz
- I2C interface
- Energy Harvesting
- Fast Transfer Mode
- Digital Signature
- Counter

**Best-In-Class Memory**
- From 512-bit to 64-Kbit
- 1M erase-write cycles
- Up to 200 years retention
- 128-bit password

**High Volume & Quality**
- In-House manufacturing
- Leverage Automotive EEPROM quality
- Leverage Consumer EEPROM volume
ST25T tag – key messages

What it does

- ST25T is a passive and battery less product
- NFC Forum and RFID applications compatibility
- Communication with NFC enabled mobile phone (>70% adoption rate) for iOS or Android

NFC forum tags enabling consumer to experience a digital life and covering a wide spectrum of applications.

The ST25TV series delivers state-of-the-art RF performance together with advanced features such as tamper detect and encrypted passwords.

consumer
digital

Distribution

OEMs

55%

45%

Consumer engagement, asset tracking, ticketing, gaming, brand protection, access control, ...

www.st.com/st25t
ST25T tag - overview

Battery-less device, right fit for multi-applications

Use cases
✓ Ticketing
✓ Access Control
✓ Consumer engagement
✓ Asset tracking
✓ Accessory recognition
✓ Brand protection
✓ Parameter setting
✓ Gaming

Interoperability

Key features
✓ NFC Forum Type 5 (ISO/IEC 15693)
✓ Data protection with password
✓ Untraceable mode & kill mode
✓ TruST25 Digital Signature
✓ Tamper Detection
✓ Counter with anti-tearing
✓ Die form & DFN5 package

Performances
✓ Read range up to 1m
✓ NFC Forum certified
✓ Improved user experience

Market split
- Transportation 69%
- Asset tracking 24%
- Consumer 7%

Interoperability
- 13.56MHz

Use cases
- Ticketing
- Access Control
- Consumer engagement
- Asset tracking
- Accessory recognition
- Brand protection
- Parameter setting
- Gaming

Key features
- NFC Forum Type 5 (ISO/IEC 15693)
- Data protection with password
- Untraceable mode & kill mode
- TruST25 Digital Signature
- Tamper Detection
- Counter with anti-tearing
- Die form & DFN5 package

Performances
- Read range up to 1m
- NFC Forum certified
- Improved user experience
ST25 dynamic NFC tag – key messages

RF long range reading, thanks to NFC Forum type 5 certification, combined with fast transfer and low power modes, enable faster time to market and best customer experience by tapping a phone without any setup required.

What it does

- ST25DV-I2C is a EEPROM memory device with a wired I2C interface and a RF contactless NFC interface
- Communication with NFC enabled mobile phone (>70% adoption rate) for iOS or Android

Industrial, lighting, metering, consumer, appliance, healthcare, IoT...

www.st.com/st25d
**ST25D dynamic NFC tag - overview**

**Mass market device, right fit for industrial & consumer applications**

**Use cases**
- Parameters setting in production
- Servicing & maintenance
- Remote programming & FW upgrade
- Pairing & provisioning
- Convenient data-logging
- Asset tracking
- Battery less applications

**Interoperability**

**Key features**
- NFC Forum Type 5 / RFID tag
- I2C 1MHz
- EEPROM up to 64kb + Buffer 256B
- Energy Harvesting
- Ease of use (discovery kits…)
- Robustness (up to 105°C, 10 years)
- Easy integration (small packages)

**Performances**
- Reading range up to 7cm / 1m
- NFC Forum certified
- Low Power modes

**Market split**
- Lighting 50%
- Metering 15%
- Home appliance & automation 5%
- Consumer 4%
- OTP cards 3%
- Healthcare 3%
- Others (mass market) 20%
ST25 readers DNA

Comprehensive portfolio

**Standard Compliant**
- NFC Forum
- ISO14443A/B
- ISO15693
- ISO18092
- ISO18000

**High performing HF readers**
- 13.56 MHz
- Very High Bit Rate (6.8Mbit/s)
- Automatic Antenna Tuning
- High output power (1.6W)
- Low power wake-up modes
- Temperature -40°C to 105°C

**High performing UHF readers**
- 840-960 MHz
- High Rx Sensitivity (-90dBm)
- Low noise Voltage Controlled Oscillator
- Dense Reader Mode filters
- Tag movement detection

**Certification**
- EMVCo
- PBOC
- Automotive AEC-Q100
- FCC
- CE mark
ST25R reader – key messages

What it does

- ST25R is the Master device and provides power: phone readout with empty battery
- Communication with NFC enabled mobile phone (>70% adoption rate) for iOS or Android

2.5W power for excellent interaction range and smallest antenna sizes, combined with advanced features allow for flexible design

faster time to market and best customer experience by tapping a phone without any setup required.

Payment, access (Car, building...), gaming, consumables, authentication, interaction, data transfer...

www.st.com/st25r
ST25R reader - overview

Right fit for consumer & automotive applications

Use cases
- EMVCo 3.0 Payment Terminals
- CCC Digital Key Car Access
- Qi Charging Card Protection
- Access Control
- Gaming
- Consumables & Authentication
- Data transfer & Programming

Interoperability

Market split
- Payment 40%
- Consumer 30%
- Automotive 14%
- Industrial 9%
- Others (mass market) 7%

Key features
- 1.6W Highest Output Power
- Dynamic Power Control
- Noise Suppression Receivers
- Automatic Antenna Tuning
- AEC Q-100 Qualified
- NFC Forum Reader & Universal Device

Performances
- Up to 20cm (TA) / 1m (TV) read range
- NFC Forum certified
- Low Power modes

Use cases
- EMVCo 3.0 Payment Terminals
- CCC Digital Key Car Access
- Qi Charging Card Protection
- Access Control
- Gaming
- Consumables & Authentication
- Data transfer & Programming

Interoperability
On-board antenna

Off-board antenna

On-board inductor

Sticker tag (inlay)

Easy antenna integration
Antenna e-design and matching tools

Fast and easy prototyping

Antenna eDesign suite

ST25R antenna matching tool

Available in www.st.com/st25
ST25 eco-system DNA

Easy-to-use and customer-oriented

- STM32Nucleo hardware ecosystem
- Discovery kit STM32 based
- Antenna e-design tool
- Schematic, BOM, Gerber
- Mobile Apps ST25 SDK
- STM32Cube software ecosystem
- PC software Tool ST25 SDK
- Documentation
ST25 products family

**Tags**
- **ST25T**
  - 13.56MHz
  - NFC phone / RFID Reader
  - Consumer engagement, Asset tracking, Ticketing, Gaming, Brand protection, Access control, ...

**Dynamic tags**
- **STM32 microcontroller**
  - I2C
- **ST25D**
  - 13.56MHz
  - NFC phone / RFID Reader
  - Industrial, Lighting, Consumer, Metering, Appliance, Healthcare, ... (Fast Transfer Mode and SW upgrade)

**Readers**
- **STM32 microcontroller**
  - SPI
- **ST25R**
  - 13.56MHz
  - NFC phone
  - POS & mPOS Terminals, Automotive, Access control, Gaming, ...

www.st.com/st25t
www.st.com/st25d
www.st.com/st25r
<table>
<thead>
<tr>
<th>Tags</th>
<th>Dynamic Tags</th>
<th>NFC / HF Readers</th>
<th>UHF Readers</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEPROM 512b-64Kb 200 year retention 1M cycles</td>
<td>EEPROM 512b-64Kb 200 year retention 1M cycles</td>
<td>EEPROM 2Kb-64Kb 40 year retention 1M cycles</td>
<td>EEPROM 2Kb-64Kb 40 year retention 1M cycles</td>
</tr>
</tbody>
</table>

*: same as former CR95HF / ST95HF
For ST25 Tags and Dynamic tags, the 10 years longevity commitment starts from the following dates:
- ST25TA series, starting January 1st 2020
- ST25TB series, starting January 1st 2020
- ST25TV series, starting January 1st 2020
- ST25DV-I2C series, starting January 1st 2020
- ST25DV-PWM series, starting January 1st 2020

For the rest of ST25 products, it will be managed case by case after contacting division.

The 10 years longevity commitment includes the period of notification as set forth in the standard STMicroelectronics end-of-life notification policy (PTN).

In case of significant volume decrease, technology or manufacturing changes, a switch to a comparable product, another technology or a different manufacturing facility could be decided by STMicroelectronics who will notify customers using the standard STMicroelectronics product/process change policy (PCN).
ST25T product ID cards
ST25TV low density NFC tag

**Use cases**
- Consumer engagement, Gaming
- Asset tracking
- Tamper proof application, Privacy protection

**Key Features**
- ISO15693 and NFC Type V (long range operations, up to 53kb/s)
- TruST25 Digital Signature
- Counter 16-bit with anti-tearing
- Untraceable & Kill modes
- Tamper Detect pin for open / short detection

**Key Benefits**
- Cloning Protection with Digital Signature (Cloud management)
- 60 years data retention, 100k cycles erase/write
- Same RF tuning capacitor as LRI2K (23.5pF / 99.7pF)
ST25TV04K-PE
energy harvesting NFC tag

Use cases
- Asset tracking, Product identification
- Inventory management
- Gaming

Key Features
- ISO15693 and NFC Type V
- Long range operations, up to 53kb/s speed
- Energy Harvesting function through RF
- Configurable output GPO pin providing RF activity information

Key Benefits
- Temperature range -40°C to +85°C
- Enhanced protection with multiple 64-bit password
- 40 years data retention, 1M cycles erase/write

ST25TV04K-PE

<table>
<thead>
<tr>
<th>RF Tag</th>
<th>ISO 15693</th>
<th>NFC Type V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>26kb/s (53kb/s)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EEPROM</th>
<th>4K-bit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>01001101110000000110100100111010110001101110</td>
</tr>
</tbody>
</table>

Digital output (GPO)

Energy harvesting

SBN12
Die form, sawn and Bumped inkless 8” wafer, 120µm thickness
ST25TV high density NFC tag

**Use cases**
- Asset tracking, product identification
- Maintenance, repair and operations
- Gaming

**Key Features**
- ISO15693 and NFC Type V
- Long range operations, up to 53kb/s speed
- 16/64K-bit EEPROM density

**Key Benefits**
- Temperature range -40°C to +85°C
- Enhanced protection with multiple 64-bit password
- 40 years data retention, 1M cycles erase/write
- Same RF tuning capacitor as in M24LR / ST25DV-I2C (28.5pF)
ST25TA low density NFC tag

**ST25TA512B / 02KB**

**RF Tag**  
- ISO 14443-A  
- NFC Type 4  
- 106kb/s

**EEPROM**  
- 512 / 2K-bit
- NDEF
- 128-bit password
- 20-bit counter
- TruST25 Digital signature

**Use cases**
- NFC token, NFC tag, Smart poster
- Gaming
- NFC business card (name card, vcard)

**Key Features**
- ISO14443-A Type A and NFC type 4
- High speed operations (106kb/s)
- TruST25 digital signature
- Data protection thanks to **128-bit password**
- Counter 20-bit with anti-tearing

**Key Benefits**
- Optimized PCB footprint
- 50pF internal RF tuning capacitor allowing small antenna design
- **200 years** data retention, **1M cycles** erase/write

---

**SBN12 / SBN075**  
- Die form, sawn and Bumped inkless 8” wafer, 120µm/75µm thickness
ST25TA with GPO NFC tag

Use cases
- Convenient wireless pairing
  - Bluetooth pairing
  - Wi-Fi static pairing

Key Features
- **ISO14443-A Type A and NFC type 4**
- Data protection thanks to **128-bit password**
- **TruST25 Digital Signature**
- Digital output GPO feature (for MCU wake-up)
  - -P: CMOS_P GPO (active high, no external resistor)
  - -D: Open Drain GPO (active low, pull-up resistor)

Key Benefits
- Tiny **FPN5** package (1.7x1.4mm)
- 50pF internal RF tuning capacitor allowing small antenna design
- **200 years** data retention, **1M cycles** erase/write
ST25TA high density NFC tag

**Use cases**
- Smart poster, Gaming, NFC token
- NFC business card (name card, vcard) with ID picture, web-link and extra digital contents

**Key Features**
- ISO14443-A Type A and **NFC type 4**
- High speed operations (**106kb/s**)  
- NDEF memory format
- Data protection thanks to **128-bit password**

**Key Benefits**
- **Large memory size** (up to 64k-bit)
- Same RF antenna design as M24SR product
- **200 years** data retention, **1M cycles** erase/write
ST25TB RFID tag

Use cases
- Mass transit and transport
- Event ticketing
- Asset tracking
- Brand protection, identification

Key Features
- Fast data transfer (ISO14443-B)
- Large and flexible counting capability with anti-tearing feature
- ST25TB512-AT version dedicated to transport
- 2x counters 32-bit with anti-tearing

Key Benefits
- Temperature range -40°C to +85°C
- 40 years data retention, 1M cycles erase/write

ST25TB512 / 02K / 04K

<table>
<thead>
<tr>
<th>RF Tag</th>
<th>ISO 14443-B</th>
<th>EEPROM 512-bit / 2K / 4K-bit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>01001101110000 00110101001110 10110001101110</td>
<td>32-bit counter x2</td>
</tr>
<tr>
<td></td>
<td>106kb/s</td>
<td>64-bit UID</td>
</tr>
</tbody>
</table>

SBN12
Die form, sawn and Bumped inkless 8” wafer, 120µm thickness
# NFC / RFID tags product family

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contactless Interface</strong></td>
<td>ISO14443B</td>
<td>ISO14443A NFC Forum Type 4</td>
<td>ISO14443A NFC Forum Type 4</td>
<td>ISO15693 NFC Forum Type 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RF range</strong></td>
<td>Short range (up to 10cm)</td>
<td></td>
<td></td>
<td></td>
<td>Long range (up to 100cm)</td>
<td></td>
</tr>
<tr>
<td><strong>RF speed</strong></td>
<td>106kbps</td>
<td></td>
<td></td>
<td></td>
<td>26kbps (53kbps)</td>
<td></td>
</tr>
<tr>
<td><strong>Memory format</strong></td>
<td>EEPROM data</td>
<td>EEPROM (preformatted NDEF)</td>
<td>EEPROM (preformatted NDEF)</td>
<td>EEPROM data</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Memory size</strong></td>
<td>512-bit &amp; 2k / 4k-bit</td>
<td>512-bit / 2k-bit</td>
<td>16k / 64k-bit</td>
<td>512-bit / 2k-bit</td>
<td>4k-bit</td>
<td>16k / 64k-bit</td>
</tr>
<tr>
<td><strong>Data protection</strong></td>
<td>OTP bits</td>
<td>Password 128-bit</td>
<td>Password 128-bit</td>
<td>Password 64-bit</td>
<td>Password 64-bit</td>
<td>Password 64-bit</td>
</tr>
<tr>
<td><strong>Digital signature</strong></td>
<td>No</td>
<td>Yes, TruST25</td>
<td>No</td>
<td>Yes, TruST25</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Digital output</strong></td>
<td>No</td>
<td>GPO Field detect CMOS_P / Open-drain</td>
<td>No</td>
<td>Tamper Detect</td>
<td>GPO Field detect CMOS_P</td>
<td>No</td>
</tr>
<tr>
<td><strong>Counter</strong></td>
<td>32-bit (x2)</td>
<td>20-bit</td>
<td>No</td>
<td>16-bit</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Extra features</strong></td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Untraceable &amp; Kill modes</td>
<td>Energy Harvesting</td>
<td>No</td>
</tr>
<tr>
<td><strong>RF tuning capacitor</strong></td>
<td>64pF</td>
<td>50pF</td>
<td>25pF</td>
<td>23.5pF &amp; 99.7pF</td>
<td>28.5pF</td>
<td>28.5pF</td>
</tr>
<tr>
<td><strong>Temperature range</strong></td>
<td>-40°C to +85°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td><strong>Package</strong></td>
<td>SBN12* / SBN075²</td>
<td>SBN12* / SBN075²</td>
<td>SBN12* / SBN075²</td>
<td>SBN12* / SBN075²</td>
<td>SBN12*</td>
<td>SBN12*</td>
</tr>
</tbody>
</table>

* SBN12: Die form, sawn and Bumped wafer, 120µm thickness, inkless 8" wafer
² SBN075: Die form, sawn and Bumped wafer, 75µm thickness, inkless 8" wafer
ST25D product ID cards
M24SR dynamic NFC tag

**Use cases**
- Convenient wireless pairing (Bluetooth, Wi-Fi)
- Dynamic data exchange with NFC phone
  - User settings update, information log download,…

**Key Features**
- ISO14443-A Type A and NFC Type 4
- High speed operations (106kb/s)
- NDEF memory format
- Data protection thanks to 128-bit password

**Key Benefits**
- Easy of use (limited BOM, 8-pin package)
- Flexible interrupt pin (configurable GPO)
- 200 years data retention, 1M cycles erase/write
M24LR
dynamic NFC / RFID tag

Use cases

• Dynamic data exchange with NFC phone
• Battery-less applications
• Parameter upgrade with RFID readers

Key Features

• ISO15693
• Long range operations, up to 53kb/s speed
• Energy harvesting through RF (~2V / 5mA)

Key Benefits

• Easy of use (limited BOM, 8-pin package)
• Flexible interrupt pin for MCU wake-up
• Cost optimized discovery kit with Android app
• 40 years data retention, 1M cycles erase/write
ST25DV-I2C dynamic NFC tag

Use cases
- Fast data exchange with NFC phones / HF readers
  - Fast data transfer for MCU FW upgrade, fast data exchange
  - Parameters settings and update, with in the box programming
  - Datalog download

Key Features
- ISO15693 and NFC Type V
- Fast data transfer thanks to 256 Bytes buffer
- Low Power mode, < 1µA power consumption in Standby
- -40 to +125°C (I2C) industrial Grade 8 temperature range
- Energy harvesting function through RF

Key Benefits
- Smart applications using a flexible interrupt GPO
- Enhanced protection with multiple 64-bit passwords
- Same 28.5pF internal RF tuning capacitor, as in M24LR
ST25DV-PWM dynamic NFC tag

ST25DV02K-W1 / -W2

**RF Tag**

ISO 15693

NFC Type V

26kb/s

**EPPROM**

2K-bit

010011011011100000
00101101001110
0110001101110

32-bit / 64-bit passwords

TruST25 Digital signature

**PWM output**

SO8

TSSOP8

---

**Use cases**

- Targeted industrial applications such as Lighting LED driver, Motor control, Power supply unit

**Key Features**

- ISO15693 and NFC Type V
- 2K-bit memory
- Up to 2 PWM signal (push pull)
- Up to 15 bits resolution (62.5ns resolution step)
- Power Supply 1.8V - 5.5V
- -40°C to +105°C (PWM) temperature range
- TruST25 Digital Signature

**Key Benefits**

- 2 in 1 chip, putting NFC connectivity with PWM functionality
- Cost optimized solution to address low end Lighting market
  - Significant BOM reduction as no MCU is required to drive the system
## Dynamic NFC / RFID tags product family

<table>
<thead>
<tr>
<th></th>
<th>M24SR</th>
<th>M24LR</th>
<th>ST25DV-I2C</th>
<th>ST25DV-PWM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contactless Interface</strong></td>
<td>ISO14443A NFC Type 4</td>
<td>ISO15693 NFC compatible</td>
<td>ISO15693 NFC Type 5</td>
<td>ISO15693 NFC Type 5</td>
</tr>
<tr>
<td><strong>RF range</strong></td>
<td>Short range (up to 10cm)</td>
<td>Long range (up to 1m)</td>
<td>Long range (up to 1m)</td>
<td>Long range (up to 1m)</td>
</tr>
<tr>
<td><strong>RF speed</strong></td>
<td>106kbps</td>
<td>26kbps</td>
<td>26kbps</td>
<td>26kbps</td>
</tr>
<tr>
<td><strong>Serial Interface</strong></td>
<td>I2C @1MHz</td>
<td>I2C @400kHz</td>
<td>I2C @1MHz</td>
<td>No</td>
</tr>
<tr>
<td><strong>Fast Transfer mode</strong></td>
<td>No</td>
<td>No</td>
<td>Yes (256B buffer)</td>
<td>No</td>
</tr>
<tr>
<td><strong>Energy Harvesting</strong></td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Digital output</strong></td>
<td>Open-Drain GPO</td>
<td>Open-Drain GPO</td>
<td>OD or CMOS GPO</td>
<td>2x PWM</td>
</tr>
<tr>
<td><strong>Extra features</strong></td>
<td>RF Disable</td>
<td>-</td>
<td>Low Power mode</td>
<td>-</td>
</tr>
<tr>
<td><strong>Memory format</strong></td>
<td>EEPROM (preformatted NDEF)</td>
<td>EEPROM data</td>
<td>EEPROM data</td>
<td>EEPROM data</td>
</tr>
<tr>
<td><strong>Memory size</strong></td>
<td>2k / 4k / 16k / 64k-bit</td>
<td>4k / 16k / 64k-bit</td>
<td>4k / 16k / 64k-bit</td>
<td>2k-bit</td>
</tr>
<tr>
<td><strong>Data protection</strong></td>
<td>Password 128-bit</td>
<td>Password 32-bit</td>
<td>Password 64-bit</td>
<td>Password 64-bit Digital signature</td>
</tr>
<tr>
<td><strong>Temperature range</strong></td>
<td>-40°C to +85°C -40°C to +105°C (85°C RF)</td>
<td>-40°C to +85°C</td>
<td>-40°C to +85°C -40°C to +125°C (105°C RF)</td>
<td>-40°C to +85°C (105°C RF)</td>
</tr>
</tbody>
</table>

* SBN12: Die form, sawn and Bumped wafer, 120µm thickness, inkless 8” wafer
ST25R product ID cards
ST25R95
entry level NFC reader solution

Use cases
- Smart Locks, Card Readers
- Gaming and Toys
- Dynamic wireless pairing with hand-over

Key Features
- Reader-Writer (R/W) and Card Emulation (CE)
- All NFC modes supported (ISO14443, ISO15693, FeliCa)
- Fast data transfer (up to 424kb/s)

Key Benefits
- Simple implementation
- Easy-to-use evaluation with development kits
- Reference designs, application notes
- Cost effective solution
1.4W high power payment reader solution

Use cases
- Ideal for Payment applications
- Access Control, Gaming, eGovernment passport

Key Features
- All NFC modes supported (ISO14443, ISO15693, FeliCa) with P2P
- 1.4W output power at 5V with 2.5W peak current
- EMVCo 2.6 & PBOC certification without external power amplifier
- Automatic Antenna Tuning
- VHBR support up to 6.8Mb/s
- -40°C to 125°C junction temperature range

Key Benefits
- Low power operation & Stand-by mode (capacitive wake-up)
- 2 antennas operation at the same time
- Enhanced fast transfer rate for Passport application
### ST25R3912

**smallest footprint, high power reader solution**

#### Use cases
- Ideal for EMVCo 2.6 legacy Payment and small handheld mPOS
- Access Control
- Gaming

#### Key Features
- All NFC modes supported (ISO14443, ISO15693, FeliCa) with P2P
- 1W output power at 5V
- EMVCo & PBOC certification without external power amplifier
- Small 3x2.8 WLCSP package
- -40°C to 125°C junction temperature range

#### Key Benefits
- Small Footprint on PCB, Low power operation & Stand-by mode
- 2 antennas operation at the same time

<table>
<thead>
<tr>
<th>Reader Writer</th>
<th>ISO14443</th>
<th>ISO15693</th>
<th>FeliCa</th>
<th>RAM BUFFER</th>
<th>SPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP2P Initiator &amp; Target</td>
<td>NFC</td>
<td>848kb/s</td>
<td>96-Byte</td>
<td>2.4/5.5V</td>
<td></td>
</tr>
<tr>
<td>PP2P Initiator</td>
<td></td>
<td></td>
<td></td>
<td>6Mb/s</td>
<td></td>
</tr>
</tbody>
</table>

- QFN32 Wetable flank
- WLCSP

**DPO:** Dynamic Power Output  
**IWU:** Inductive Wake Up  
848kb/s  
96-Byte  
2.4/5.5V  
6Mb/s  
1W
### ST25R3914/15

**high power automotive reader solution**

#### Use cases
- Ideal for **Automotive** applications
  - Keyless entry and start according to **CCC Digital Key**
  - NFC enhanced Foreign Object Detection for Qi wireless charging

#### Key Features
- All NFC modes supported (ISO14443, ISO15693, FeliCa) with P2P
- **Automotive AEC-Q100** certified
- 1W output power at 5V with **2.5W** peak current
- Automatic Antenna Tuning (ST25R3914 only)
- -40°C to **125°C** junction temperature range

#### Key Benefits
- Low power operation & Stand-by mode (capacitive wake-up)
- 2 antennas operation at the same time
- Reliable performance even in metallic environment

<table>
<thead>
<tr>
<th>ST25R3914/15</th>
<th>Reader Writer</th>
<th>AP2P Initiator &amp; Target</th>
<th>PP2P Initiator</th>
<th>1W</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ISO14443</strong></td>
<td>ISO15693</td>
<td><strong>FeliCa</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NFC</strong></td>
<td></td>
<td><strong>848kb/s</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RAM BUFFER</strong></td>
<td><strong>96-Byte</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SPI</strong></td>
<td>2.4/5.5V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SPI</strong></td>
<td>6Mb/s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>AEC-Q100</strong></td>
<td>qualification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DPO:</strong></td>
<td>Dynamic Power Output</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CIWU:</strong></td>
<td>Capacitive &amp; Inductive Wake Up</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>AAT:</strong></td>
<td>Automatic Antenna Tuning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>QFN32</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>QFN32</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wettable flank</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ST25R3914/15**

**ISO14443**

**ISO15693**

**FeliCa**

**NFC**

**848kb/s**

**RAM BUFFER**

**96-Byte**

**SPI**

**2.4/5.5V**

**6Mb/s**

**AEC-Q100**

qualification

**DPO:** Dynamic Power Output

**CIWU:** Capacitive & Inductive Wake Up

**AAT:** Automatic Antenna Tuning

**QFN32**

**Wettable flank**
# ST25R3916

**high-perf. NFC universal device & EMVCo reader**

## Use cases
- Ideal for **Payment** applications
- Access Control, Gaming, IOT and pairing

## Key Features
- **NFC Forum Universal Device** (with CE mode)
- **1.6W** output power at 5V with **2.5W** peak current
- **EMVCo 3.0** certification without external power amplifier
- **Active Waveshaping, Noise Suppression Receiver**
- **Automatic Antenna Tuning**
- **-40°C to 105°C** ambient temperature range (QFN)

## Key Benefits
- Low power operation & Standby mode (capacitive wake-up)
- Works in challenging environment like noisy LCD displays
- **Ideal for passing newest EMVCo standards**

### ST25R3916

<table>
<thead>
<tr>
<th>Reader Writer</th>
<th>ISO14443</th>
<th>RAM BUFFER</th>
<th>SPI/PC</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP2P PP2P Card Emulation</td>
<td>ISO15693</td>
<td>512-Byte</td>
<td>2.4/5.5V</td>
</tr>
<tr>
<td></td>
<td>FeliCa</td>
<td></td>
<td>3.4Mb/s</td>
</tr>
<tr>
<td></td>
<td>NFC</td>
<td></td>
<td>10Mb/s</td>
</tr>
<tr>
<td></td>
<td>848kb/s</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 1.6W

- **RAM BUFFER**
  - DPO: Dynamic Power Output
  - CIWU: Capacitive & Inductive Wake Up
  - AWS: Active Wave shaping
  - NSR: Noise Suppression Receiver
  - AAT: Automatic Antenna Tuning
  - DSO: Driver Slope Adjustment
  - EMD: Automatic EMD Error Handling

**Reader**
- **AP2P**
- **PP2P**

**Writer**
- **ISO14443 ISO15693 FeliCa**

**Card Emulation**
- **NFC**

- **848kb/s**

**QFN32**
- Wettable flank

**WLCSP**

**ISO14443**
- **1024-byte RAM BUFFER**
- **1.6W**
- **848kb/s**

**ISO15693**
- **FeliCa**
- **1.6W**
- **848kb/s**

**NFC**
- **512-Byte**
- **2.4/5.5V**
- **3.4Mb/s**
- **10Mb/s**

**DPO:** Dynamic Power Output
**CIWU:** Capacitive & Inductive Wake Up
**AWS:** Active Wave shaping
**NSR:** Noise Suppression Receiver
**AAT:** Automatic Antenna Tuning
**DSO:** Driver Slope Adjustment
**EMD:** Automatic EMD Error Handling
ST25R3917
high-performance NFC & EMVCo reader

Use cases
• Ideal for Payment applications
• Access Control, Gaming, Consumer

Key Features
• NFC Forum Reader device
• 1.6W output power at 5V with 2.5W peak current
• EMVCo 3.0 certification without external power amplifier
• Active Waveshaping, Noise Suppression Receiver
• -40°C to 105°C ambient temperature range

Key Benefits
• Low power operation & Standby mode (capacitive wake-up)
• Works in challenging environment like noisy LCD displays
• Ideal for passing newest EMVCo standards
ST25R3920

high-perf. AEC-Q100 NFC universal device

Use cases
- Ideal for CCC Digital Key applications
- IOT and pairing in the car

Key Features
- NFC Forum Device
- 1.6W output power at 5V with 2.5W peak current
- Active Waveshaping
- Automatic Antenna Tuning
- Noise Suppression Receiver
- -40°C to 105°C ambient temperature range

Key Benefits
- Low power operation & Standby mode (capacitive wake-up)
- Works in challenging environment like small antennas
## ST25R NFC / HF readers product family

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Card emulation mode</td>
<td>Yes</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Yes</td>
<td>-</td>
<td>Yes</td>
</tr>
<tr>
<td>AP2P mode</td>
<td>-</td>
<td>Initiator &amp; Target</td>
<td>Initiator &amp; Target</td>
<td>Initiator &amp; Target</td>
<td>Initiator &amp; Target</td>
<td>Initiator &amp; Target</td>
<td>Initiator &amp; Target</td>
</tr>
<tr>
<td>PP2P mode</td>
<td>-</td>
<td>Initiator</td>
<td>Initiator</td>
<td>Initiator &amp; Target</td>
<td>Initiator &amp; Target</td>
<td>Initiator &amp; Target</td>
<td>Initiator &amp; Target</td>
</tr>
<tr>
<td>RF speed</td>
<td>424kbp</td>
<td>6.8Mbps  (VHBR)</td>
<td>848kbp</td>
<td>848kbp</td>
<td>848kbp</td>
<td>848kbp</td>
<td>848kbp</td>
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<tr>
<td>Market</td>
<td>Consumer</td>
<td>Payment EMVCo 2.6, Industrial</td>
<td>Access control, Metering, Consumer</td>
<td>Automotive AEC-Q100 grade 1</td>
<td>Payment EMVCo 3.0, Industrial, Consumer</td>
<td>Payment EMVCo 3.0, Industrial, Consumer</td>
<td>Automotive AEC-Q100 grade 1</td>
</tr>
<tr>
<td>Advanced features</td>
<td>IWU AAT, DPO, CMU</td>
<td>DPO, IWU AAT (3914), DPO, CMU</td>
<td>DPO, IWU AAT, DPO, NR, DSA, ATS, CMU, EMU</td>
<td>DPO, NR, DSA, ATS, CMU, EMU</td>
<td>DPO, NR, DSA, ATS, CMU, EMU</td>
<td>DPO, NR, DSA, ATS, CMU, EMU</td>
<td></td>
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<tr>
<td>HW interface</td>
<td>SPI 2Mbp</td>
<td>SPI 6Mbp</td>
<td>SPI 6Mbp</td>
<td>SPI 6Mbp</td>
<td>F/C &amp; SPI 10Mbp</td>
<td>F/C &amp; SPI 10Mbp</td>
<td>F/C &amp; SPI 10Mbp</td>
</tr>
<tr>
<td>SW interface</td>
<td>Unified Software Library for Frontends</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>2.7V - 5.5V</td>
<td>2.4V – 5.5V</td>
<td>2.4V – 5.5V</td>
<td>2.4V – 5.5V</td>
<td>2.4V – 5.5V</td>
<td>2.4V – 5.5V</td>
<td>2.4V – 5.5V</td>
</tr>
<tr>
<td>Output power</td>
<td>0.23W</td>
<td>1.4W</td>
<td>1.0W</td>
<td>1.6W</td>
<td>1.6W</td>
<td>1.6W</td>
<td>1.6W</td>
</tr>
<tr>
<td>Junction Temp range</td>
<td>-25°C to +85°C</td>
<td>-40°C to +125°C</td>
<td>-40°C to +125°C</td>
<td>-40°C to +125°C</td>
<td>-40°C to +125°C</td>
<td>-40°C to +125°C</td>
<td>-40°C to +125°C</td>
</tr>
</tbody>
</table>

### Key Features
- **VHBR:** Very High Baud Rate
- **P2P:** Peer to Peer mode
- **AAT:** Automatic Antenna Tuning
- **AWS:** Active Wave Shaping
- **EMD:** Automatic EMD suppression
- **DPO:** Dynamic Power Output
- **CIWU:** Capacitive & Inductive Wakeup
- **IWU:** Inductive Wakeup
- **NSR:** Noise Suppression Receiver
- **DS**: Drive Slope Adjustment
- **DAS**: Drive Slope Adjustement
- **EMD**: EMD suppression

### Output Power
- **ST25R95:** 0.23W
- **ST25R3911B:** 1.4W
- **ST25R3912:** 1.0W
- **ST25R3914/15:** 1.6W
- **ST25R3916:** 1.6W
- **ST25R3917:** 1.6W
- **ST25R3920:** 1.6W

### Package Options
- **ST25R95:** 32-pin QFN / Wafer
- **ST25R3911B:** 32-pin QFN / Wafer
- **ST25R3912:** 32-pin QFN / Wafer
- **ST25R3914/15:** 32-pin QFN / Wafer
- **ST25R3916:** 32-pin QFN / WLCSP-30
- **ST25R3917:** 32-pin QFN / WLCSP-30
- **ST25R3920:** 32-pin QFN / WLCSP-30

---

*Note: Peak output power values are the maximum output powers that a device can deliver.*
ST25RU product ID card
ST25RU3993
UHF RFID reader

Use cases
- Retail, Stationary readers
- Industrial PDA’s, Authentication
- Tablets / Smartphones, Dongles / Snap Ons, Handheld readers
- Portable Data Capture

Key Features
- Dense Reader Mode filtering on board
- Fixed Single ended Rx input & 0dBm output power
- Receive sensitivity of -90dBm
- Power consumption down to 65mA

Key Benefits
- Ideal for mobile applications
- Prolonging battery life & robust against poor antenna
- Works in a dense reader environment
### ST25RU3993

<table>
<thead>
<tr>
<th>Description</th>
<th>UHF RFID Reader for Mobile and Fast Moving Consumer Goods applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contactless interface</td>
<td>ISO18000-6c/b</td>
</tr>
<tr>
<td>Market certification</td>
<td>EPC Gen 2</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>-90dBm</td>
</tr>
<tr>
<td>Advanced features</td>
<td>Internal VCO, Dense Reader Mode, Linear RSSI &amp; Phase Bit, Automatic PSRR regulation, Auto ACK</td>
</tr>
<tr>
<td>Interface</td>
<td>SPI 5Mbps</td>
</tr>
<tr>
<td>Power supply</td>
<td>1.65V – 5.5V</td>
</tr>
<tr>
<td>Output power</td>
<td>0dBm / 20dBm</td>
</tr>
<tr>
<td>Temperature range</td>
<td>-40 to +85°C</td>
</tr>
<tr>
<td>Package</td>
<td>48-pin QFN (7x7mm)</td>
</tr>
</tbody>
</table>

**VCO**: Voltage Controlled Oscillator  
**RSSI**: Received Signal Strength Indicator  
**PSRR**: Power Supply Rejection Ratio  
**ACK**: ACKnowledge
Product part number
# ST25T NFC / RFID Tags

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
<th>512-bit</th>
<th>2k-bit</th>
<th>16k-bit</th>
<th>64k-bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST25TA512B</td>
<td>SBN075</td>
<td>ST25TA512B-AC6F5</td>
<td>ST25TA02KB-AC6F5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST25TA512B</td>
<td>UFDFPN5</td>
<td>ST25TA512B-AC6G6</td>
<td>ST25TA02KB-PC6H5</td>
<td>ST25TA02KB-DC6H5</td>
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<tr>
<td>ST25TA512B</td>
<td>UFDFPN5</td>
<td>ST25TA512B-AC6F6</td>
<td>ST25TA02KB-PC6H5</td>
<td>ST25TA02KB-DC6H5</td>
<td></td>
</tr>
</tbody>
</table>

### ST25T NFC / RFID Tags
- **ST25TA**
  - NFC Type 4 Tag ISO14443-A
  - Package: SBN12, SBN075
  - 2k-bit: ST25TA02KB-AC6G5, ST25TA02KB-AC6F5
  - 16k-bit: ST25TA16-AB6G3
  - 64k-bit: ST25TA64K-AB6G3

- **ST25TA-P / -D**
  - NFC Type 4 Tag ISO14443-A + GPO
  - Package: UFDFPN5
  - 2k-bit: ST25TA02KB-PC6H5, ST25TA02KB-DC6H5

- **ST25TB**
  - RFID Tag ISO14443-B
  - Package: SBN12, SBN075
  - 4k-bit: ST25TB04K-AC6G6

- **ST25TV**
  - NFC Type 5 Tag ISO15693
  - Package: SBN12, SBN075
  - 4k-bit: ST25TV04K-PE6G3

- **ST25TV-AD**
  - NFC Type 5 Tag ISO15693 + Tamper Detect
  - Package: UFDFPN5
## ST25D Dynamic NFC Tags

### M24SR
- **Package:**
  - SO8
  - TSSOP8
  - UFDFPN8
  - SBN12
  - SO8
  - TSSOP8
- **2k-bit:**
  - M24SR02-YMN6T/2
  - M24SR02-YDW6T/2
  - M24SR02-YMC6T/2
  - M24SR02-YSG12l/2
- **4k-bit:**
  - M24SR04-YMN6T/2
  - M24SR04-YDW6T/2
  - M24SR04-YMC6T/2
- **16k-bit:**
  - M24SR16-YMN6T/2
  - M24SR16-YDW6T/2
  - M24SR16-YMC6T/2
- **64k-bit:**
  - M24SR64-YMN6T/2
  - M24SR64-YDW6T/2
  - M24SR64-YMC6T/2

### M24LR
- **Package:**
  - SO8
  - TSSOP8
  - UFDFPN8
- **2k-bit:**
  - M24LR04E-RMN6T/2
  - M24LR04E-RDW6T/2
  - M24LR04E-RMC6T/2
- **4k-bit:**
  - M24LR16E-RMN6T/2
  - M24LR16E-RDW6T/2
  - M24LR16E-RMC6T/2
- **64k-bit:**
  - M24LR64E-RMN6T/2
  - M24LR64E-RDW6T/2
  - M24LR64E-RMC6T/2

### ST25DV-I2C
- **Package:**
  - SO8
  - SO8
  - TSSOP8
  - TSSOP8
  - UFDFPN8
  - UFDFPN8
  - UFDFPN12
  - UFDFPN12
  - WLCSP10
- **2k-bit:**
  - ST25DV04K-IER6S3
  - ST25DV04K-IER8S3
  - ST25DV04K-IER6T3
  - ST25DV04K-IER8T3
  - ST25DV04K-JFR6D3
  - ST25DV04K-JFR8D3
- **4k-bit:**
  - ST25DV14K-IER6S3
  - ST25DV16K-IER8S3
  - ST25DV16K-IER6T3
  - ST25DV16K-IER8T3
  - ST25DV16K-JFR6D3
  - ST25DV16K-JFR8D3
- **64k-bit:**
  - ST25DV64K-IER6S3
  - ST25DV64K-IER8S3
  - ST25DV64K-IER6T3
  - ST25DV64K-IER8T3
  - ST25DV64K-JFR6D3
  - ST25DV64K-JFR8D3

### ST25DV-PWM
- **Package:**
  - SO8
  - SO8
  - TSSOP8
  - TSSOP8
- **2k-bit:**
  - ST25DV02K-W1R8S3
  - ST25DV02K-W2R8S3
  - ST25DV02K-W1R8T3
  - ST25DV02K-W2R8T3

---

**ST25D part numbers**

- Dynamic NFC Type 4 Tag ISO14443-A
- I2C IF + GPO
- + RF disable
- + Extended Temperature

- Dynamic NFC Type 5 Tag ISO15693
- + I2C IF + GPO + EH
- + Fast Transfer Mode
- + Energy Harvesting
- + Extended Temperature

- Dynamic NFC Type 5 Tag ISO15693
- + 1x or 2x PWM IF
- + Extended Temperature
<table>
<thead>
<tr>
<th>ST25R HF NFC / RFID readers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ST25R95</strong></td>
</tr>
<tr>
<td>Entry-Level HF Readers</td>
</tr>
<tr>
<td>Package</td>
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<tr>
<td>QFN32</td>
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<tr>
<td><strong>ST25R3911B-12</strong></td>
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<tr>
<td>High-Perf HF Readers for Industrial and Consumer</td>
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<tr>
<td>Package</td>
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<tr>
<td><strong>ST25R3914-15</strong></td>
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<tr>
<td>High Power Readers for Automotive</td>
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<td>Package</td>
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<tr>
<td><strong>ST25R3916-17</strong></td>
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<tr>
<td>High-Perf NFC Universal Devices &amp; EMVCo Readers</td>
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<tr>
<td>Package</td>
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<tr>
<td><strong>ST25R3920</strong></td>
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<tr>
<td>High-Perf AEC-Q100 NFC Universal Device</td>
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<td>WF QFN32</td>
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## ST25RU UHF RFID readers

<table>
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<tr>
<th>ST25RU3993</th>
<th>Package</th>
<th>Features</th>
<th>Part Number</th>
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<tbody>
<tr>
<td>UHF Readers for Handheld devices</td>
<td>QFN48</td>
<td>Dense reader mode</td>
<td>ST25RU3993-BQFT</td>
</tr>
</tbody>
</table>
Evaluation boards
ST25TA evaluation board

Cloud ST25TA Eval Board

- ST25TA02KB-P NFC/RFID tag IC
- UDFPN5 package
- 18mm diameter 12 turns antenna
- 256-Byte (2-kbit) NDEF EEPROM
- Configurable GPO (Field Detection) with connector on PCB
ST25TV evaluation board

ST25TV eSeal board

- ST25TV02K NFC/RFID tag IC
- UDFPN5 package
- 48x39 mm 9-turn antenna
- Custom Fast read access up to 53 Kbit/s
- Featuring Tamper detect loop
ST25T tag bag kits

The ST25T tag bag kit is intended for evaluation of the ST25T product family, offering a wide range of NFC® RFID tags with memory according to the ST25T ECU (EMEA) and ST25TA64K Type A and E and tag range (EMEA/US/EMEA) products.

ST25TA Tag Bag US

ST25TA Tag Bag APAC

ST25TA Tag Bag EMEA
NFC sensor tag evaluation board

**NFC Sensor Tag**
- ST25DV64K dynamic NFC tag
- STM32L0 ultra-low-power MCU
- LIS2DW12 three-axis linear accelerometer
- LPS22HB piezo-resistive pressure sensor
- HTS221 humidity and temperature sensor
- 40x40mm 8 turns antenna
- Optional CR2032 battery
ST25DV-PWM evaluation board

ST25DV-PWM discovery kit

- ST25DV02K-W2 dynamic NFC tag IC
- 49x26mm 8 turns antenna
- PWM frequency and duty cycle through Android App or PC Software
- Duty cycle illustration with LED ramp
- Connector to ST25DV-DISCOVERY kit to monitor the PWM signal on display
ST25DV-I2C evaluation boards

**ST25DV-I2C discovery kit**
- **ST25DV04K** Dynamic NFC tag IC
- 40x24mm 10 turns antenna (ANT Class5)
- STM32F405 MCU
- 2.4” TFT LCD Touch screen
- I2C & SWIP connectors
- Daughter board connector
- 45x75mm (Class1) & 18x24 mm (Class6)

**ST25DV-I2C Nucleo shield**
- **ST25DV04K** Dynamic NFC tag IC
- Ø54mm 8 turns single layer antenna Energy harvesting, Low Power mode, GPO
- Compatible with STM32 Nucleo boards
- I2C interface to MCU & Powered through Arduino™ connector

**ST25DV-I2C Tiny Antenna**
- **ST25DV04K** Dynamic NFC tag IC
- Ready-to-use PCB including:
  - 14x14 mm, dual layer etched antenna
  - I2C test points
  - RF event configurable GPO
  - Analog energy harvesting (EH) output
M24SR evaluation boards

**M24SR discovery kit**
- M24SR64 Dynamic NFC Tag IC
- 30x30mm 5 turns double layer antenna
- STM32F1 MCU
- LCD Color display + Joystick + LEDs
- USB & JTAG connectors
- BT / Audio module with audio headset

**M24SR Nucleo Shield**
- M24SR64 Dynamic NFC Tag IC
- 31x30mm 5 turns double layer antenna
- Compatible with STM32 Nucleo boards
- I2C interface to MCU through Arduino™ connector
- Open drain output for MCU wake-up

**M24SR Tiny antenna**
- M24SR64 Dynamic NFC Tag IC
- 14x14mm dual layer antenna
- I2C test points to connect to MCU
- GPO open drain user configurable output to indicate an ongoing RF operation
M24LR evaluation boards

M24LR discovery kit
- M24LR04E Dynamic NFC/RFID tag IC
- 20x40mm 9 turns antenna
- STM8L152 micro-controller
- LCD display
- I2C & SWIP connectors
- Temperature sensor

M24LR Nucleo Shield
- M24LR04E Dynamic NFC/RFID tag IC
- 30x30mm 5 turns double layer antenna
- Energy harvesting feature
- Compatible with STM32 Nucleo boards
- I2C interface to MCU & Powered through Arduino™ connector

M24LR Tiny antenna
- M24LR04E Dynamic NFC/RFID tag
- 14x14mm dual layer antenna
- I2C test points to connect to MCU
- GPO RF WIP / RF BUSY (RF)
- Analog Energy Harvesting output (EH)
ST25R95 / CR95HF evaluation boards

**CR95HF demo board**
- CR95HF NFC multi-protocol reader IC
- 47x34 mm 2 turns double layer antenna on PCB and associated tuning circuit
- STM32F1 micro-controller
- USB & JTAG connectors

**CR95HF Nucleo shield**
- CR95HF NFC multi-protocol reader IC
- 47x34mm 4 turns antenna on PCB
- SPI (Slave interface) or UART
- Up to 528-byte command/reception buffer
- Optimized power management
- Powered through Arduino™ UNO R3 connector
ST25R3911B evaluation boards

ST25R3911B discovery kit
- ST25R3911B HF reader / NFC initiator IC
- 105x52mm 2 turns antenna and associated VHBR tuning circuit
- STM32L476RET6 32-bit MCU
- Micro-USB connector
- Additional UART / PC Host interfaces, as well as NFC SPI and JTAG/SWD points

ST25R3911B Nucleo shield
- ST25R3911B HF reader / NFC initiator IC
- 47x34mm 4 turns antenna
- Compatible with STM32 Nucleo boards
- Equipped with Arduino™ UNO R3 connector

ST25R3911B EMVCO kit
- ST25R3911B HF reader / NFC initiator IC
- 65x74mm 2 turns antenna etched on PCB
- STM32L476 32-bit MCU
- Micro-USB connector
- Comprehensive Device Test Environment (DTE) for EMVCo Level 1 FW control
- S-Touch controller

ST25R3911B discovery kit and Nucleo shield are also valid for ST25R3912, ST25R3914 and ST25R3915
ST25R3916 evaluation boards

**ST25R3916 discovery kit**
- **ST25R3916** High perf NFC universal device and EMVCo reader
- 66x66mm 2 turns antenna etched on PCB
- STM32L476 ULP 32-bit MCU
- Micro-USB connector
- Additional UART / I²C Host interfaces, as well as NFC SPI and JTAG/SWD points

**ST25R3916 Nucleo shield**
- **ST25R3916** High perf NFC universal device and EMVCo reader
- 47x34mm 4 turns antenna etched on PCB
- Compatible with STM32 Nucleo boards
- Equipped with Arduino™ UNO R3 connector

**ST25R3916 EMVCO kit**
- **ST25R3916** High perf NFC universal device and EMVCo reader
- 73x65mm 2 turns antenna etched on PCB
- STM32L476 ULP 32-bit MCU
- Micro-USB connector
- Comprehensive Device Test Environment (DTE) for EMVCo Level 1 FW control

ST25R3916 discovery kit and Nucleo shield are also valid for ST25R3917 and ST25R3920
Solutions for NFC / RFID Tags & Readers

ST25 SIMPLY MORE CONNECTED
Thank you
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