ST25 NFC Tags & Readers solutions
NFC Technology
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 a convenient connection to the Internet of Things
  - **NFC-enabled mobile phones 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, etc.)

- Fast growing NFC deployment in mobile phones
  - In 2024, more than 75% phones come with NFC
  - NFC is used for Mobile payment (EMVCo®) like Apple Pay or Google Pay
  - 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 and zero power for the application.
Typical NFC / RFID range

- ISO14443 (NFC Forum type 2 & type 4) is called "contactless short range" standard with higher RF speed
- ISO15693 (NFC Forum type 5) is called "contactless long range" standard

**NFC phones**

- ISO14443 (106kb/s) **Up to 5 cm (2in.)**
- ISO15693 (26kb/s) **Up to 7 cm (3in.)**

**RFID readers**

- ISO14443 (106kb/s) **Up to 10 cm (4in.)**
- ISO15693 (26kb/s) **Up to 1 m (3 ft)**
NFC Forum standards

NFC Forum
Type 2 and type 4

NFC Forum
Type 5

ISO14443
Type A and type B
« Short range »
106 kbps

ISO15693
« Long range »
26 kbps

RFID HF ISO standards
→ HW / SW protocol

NFC specification
→ Upper layer SW

NDEF (NFC Data Exchange Format)
From factory to consumer bridging RFID and NFC

ISO 15693

NFC Type 5
Introduction to the NFC Wayfinding Mark

- **N-Mark** is (still) the official logo of NFC Forum, used for certified products.
- **Wayfinding Mark** is made to ensure optimal NFC User eXperience.

**Directional**
- Occasional use
- Tapping point

**Simplified**
- Everyday use
- For NFC familiar users

**Instructional**
- Learning / one time use
- For guidance on how to tap

**Charging**
- Charging use
- Antenna location

More details: [https://nfc-forum.org/wayfinding-mark/](https://nfc-forum.org/wayfinding-mark/)
ST25 NFC Portfolio
ST NFC portfolio

Covering all NFC application needs and leveraging a rich ecosystem

www.st.com/nfc

STMicroelectronics is Member of
- NFC Forum
- ISO organizations
- Zhaga consortium
- LoRa alliance
- EMVCo® (Europay, Mastercard & Visa Consortium)
- WPC (Wireless Power Consortium)
- CSA (Connectivity Standards Alliance)
ST25 products family

Passive tag - EEPROM with contactless NFC interface

**Tags**

- **ST25T**
  - 13.56MHz
  - NFC phone or RFID reader

Passive connected tag – EEPROM with contactless NFC and wired I²C interfaces

**Dynamic tags**

- **STM32 microcontroller**
  - **ST25D**
  - 13.56MHz
  - NFC phone or RFID reader

Active reader – Provides power to NFC devices and initiates the communication as a master

**Readers**

- **STM32 microcontroller**
  - **ST25R**
  - 13.56MHz
  - NFC phone

[www.st.com/st25d](http://www.st.com/st25d)
[www.st.com/st25r](http://www.st.com/st25r)
# ST25 NFC / RFID Portfolio

One-stop-shop for tags and readers

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>EEPROM 512b - 64Kb 200-year retention 1M cycles</td>
<td>EEPROM 512b-4Kb 40-year retention 1M cycles</td>
<td>EEPROM 512b-1.6Kb 40-year retention 100k cycles</td>
<td>EEPROM 512b-64Kb 60-year retention 100k cycles</td>
<td>EEPROM 2Kb-64Kb 200-year retention 1M cycles</td>
<td>256b buffer EEPROM 4Kb-64Kb 40-year retention 100k cycles</td>
<td>EEPROM 2Kb 40-year retention 100k cycles</td>
<td>Reader/Writer Reader/Writer P2P EMVCo® &amp; PBOC Reader/Writer P2P Card Emulation EMVCo® &amp; PBOC Reader/Writer P2P Card Emulation</td>
<td></td>
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<tr>
<td>TruST25 digital signature 128b password 20b counter UID RF Field Detect</td>
<td>Augmented NDEF Edge TruST25 digital signature ECC crypto engine 4-digit UTC 24b counter UID</td>
<td>32b counter Lock OTP bits UID</td>
<td>Augmented NDEF TruST25 digital signature 64b password 24b UTC UID</td>
<td>128b password RF disable RF Detect UID</td>
<td>Fast X-fer Mode 64b password E-Harvesting RF Detect UID</td>
<td>TruST25 digital signature 64b password UID</td>
<td>Dynamic Power Out VHB R Antenna Tuning Dynamic Power Out Multi-antenna Active wave shaping v2 Auto Antenna Tuning Dynamic Power Out Multi-antenna Active wave shaping Dynamic Power Out Multi-antenna</td>
<td></td>
</tr>
</tbody>
</table>

*: successor of M24LR and ST25DV-I2C

April 2024
ST25 series enriching our lives!

Main applications of ST25 series

- Consumer Gaming
- Healthcare Medical, wellness
- Brand protection Accessory recognition
- Smart home Home appliance
- Industrial Lighting, metering
- Asset tracking
- Access control
- Point of sales
- Transport
Certification & interoperability status

**Tags**

- ST25TV
- ST25TA

**Dynamic tags**

- ST25DV-I2C
- ST25DV-PWM

**Readers**

- ST25R3911B
- ST25R3916B

**NFC Forum**

**iOS app**

**Android app**

**RFAL SW**

**Linux SW**
Growing contactless markets: 
ST25 NFC tags & readers pervasion

Comprehensive portfolio: 
Short range – Long range

ST25 Ecosystem
for easy adoption and fast development

Readers
ST25R

Tags
ST25T

Dynamic tags
ST25D

Best-in-class RF performance

- Payment
- Automotive
- Lighting
- Metering
- Healthcare
- Appliances
- Transportation
- Consumer electronics
- Consumer brands

Active member at standards

ST25 NFC tags & readers pervasion

Growing contactless markets:
> 10% CAGR 2020-2025*

* Source: ABI / NFC Forum
ST25 series
### ST25 tags & dynamic tags DNA

**Comprehensive portfolio**

<table>
<thead>
<tr>
<th>Standard compliant</th>
<th>Feature-rich</th>
<th>Best-in-class memory</th>
<th>High volume &amp; quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFC Forum</td>
<td>13.56 MHz</td>
<td>From 512-bit to 64-Kbit</td>
<td>In-house manufacturing</td>
</tr>
<tr>
<td>ISO14443A</td>
<td>Digital signature TruST25</td>
<td>1M erase-write cycles</td>
<td>Leverage automotive EEPROM quality</td>
</tr>
<tr>
<td>ISO14443B</td>
<td>Counter / Unique tap code</td>
<td>Up to 200 years retention</td>
<td>Leverage consumer EEPROM volume</td>
</tr>
<tr>
<td>ISO15693</td>
<td>ECC-based crypto</td>
<td>128-bit password OTP bits</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I2C interface</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fast transfer mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Energy harvesting</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Standard compliant

- NFC Forum
- ISO14443A/B
- ISO15693
- Felica

### High performing

- 13.56MHz
- Very high bit rate (6.8Mbit/s)
- High output power (1.6 W)
- Temperature -40°C to 105°C

### Advanced features

- Active wave shaping
- Automatic antenna tuning
- Low power wake-up modes
- Dynamic power output
- Noise suppression receiver

### Certification

- EMVCo®
- PBOC
- Automotive AEC-Q100
- FCC
- CE mark
Antenna e-design and matching tools

Fast and easy prototyping

Antenna eDesign suite

ST25R antenna matching tool

Available on www.st.com/st25
Ecosystem DNA

Easy-to-use and customer-oriented

- STM32 Nucleo HW ecosystem
- Discovery kit STM32 based
- Antenna e-design tool
- Schematic, BOM, Gerber
- Mobile apps ST25 SDK
- STM32Cube SW ecosystem
- PC software tool ST25 SDK
- Documentation
ST25T product ID cards
# NFC / RFID tags product family

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RF protocol</strong></td>
<td>ISO14443A NFC type 4</td>
<td>ISO14443A NFC type 4</td>
<td>ISO14443B NFC type 2</td>
<td>ISO14443A NFC type 2</td>
<td>ISO15693 NFC type 5</td>
<td>ISO15693 NFC type 5</td>
</tr>
<tr>
<td><strong>RF speed</strong></td>
<td>106 kbps</td>
<td>106 kbps</td>
<td>106 kbps</td>
<td>106 kbps</td>
<td>26kbs (53 kbps)</td>
<td>26kbs (53 kbps)</td>
</tr>
<tr>
<td><strong>Memory format</strong></td>
<td>EEPROM (preformatted NDEF)</td>
<td>Flash</td>
<td>EEPROM</td>
<td>EEPROM (preformatted NDEF)</td>
<td>EEPROM (preformatted NDEF)</td>
<td>EEPROM</td>
</tr>
<tr>
<td><strong>Memory size</strong></td>
<td>2k / 16k / 64k-bit</td>
<td>2k-bit</td>
<td>512-bit / 2k / 4k-bit</td>
<td>512-bit / 1.6k-bit</td>
<td>512-bit / 2k-bit</td>
<td>4k / 16k / 64k-bit</td>
</tr>
<tr>
<td><strong>Data protection</strong></td>
<td>Password 128-bit</td>
<td>Password 64-bit</td>
<td>OTP bits</td>
<td>Lock blocks</td>
<td>Password 64-bit</td>
<td>Password 64-bit</td>
</tr>
<tr>
<td><strong>Digital output</strong></td>
<td>GPO Field Detect CMOS_P / Open-drain (2k only)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Tamper Detect</td>
<td>GPO Field detect CMOS_P (4k only)</td>
</tr>
<tr>
<td><strong>Counter / UTC</strong></td>
<td>20-bit counter</td>
<td>24-bit counter</td>
<td>32-bit (x2) counters</td>
<td>24-bit UTC</td>
<td>24-bit UTC</td>
<td>-</td>
</tr>
<tr>
<td><strong>Extra features</strong></td>
<td>-</td>
<td>ECC-based crypto engine</td>
<td>Tag for transport ticket</td>
<td>Augmented NDEF</td>
<td>Augmented NDEF Untraceable mode</td>
<td>Energy harvesting (4k only)</td>
</tr>
<tr>
<td><strong>RF tuning capacitor</strong></td>
<td>50pF / 25pF</td>
<td>68pF</td>
<td>64pF</td>
<td>50pF</td>
<td>23.5pF &amp; 99.7pF</td>
<td>28.5pF</td>
</tr>
<tr>
<td><strong>Temperature range</strong></td>
<td>-40°C to +85°C</td>
<td>-25°C to +85°C</td>
<td>-40°C to +85°C</td>
<td>-40°C to +85°C</td>
<td>-40°C to +85°C</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td><strong>Package</strong></td>
<td>SBN12*</td>
<td>SBN14&quot; / SBN075²</td>
<td>SBN12* / SBN075²</td>
<td>SBN12* / SBN075² / FPN5</td>
<td>SBN12* / SBN075² / FPN5</td>
<td>SBN12*</td>
</tr>
</tbody>
</table>

* SBN14: Die form, Sawn and Bumped wafer, 140µm thickness, inkless 12” wafer
* SBN12: Die form, Sawn and Bumped wafer, 120µm thickness, inkless 8” wafer
* SBN075: Die form, Sawn and Bumped wafer, 75µm thickness, inkless 8” wafer
ST25TN
Entry level NFC type 2 tag

Use cases
- NFC consumer engagement, NFC token
- Product configuration, accessory recognition, smart poster, gaming

Key features
- ISO/IEC 14443-A and NFC type 2 Tag
- High speed operations (106kb/s)
- Memory configuration: 512-bit and 1280-bit (up to 1664-bit depending on features usage)
- 24-bit Unique Tap Code (UTC) with antitearing
- Customizable Augmented NDEF with UID and UTC
- TruST25 digital signature

Key benefits
- Tiny DFN5 package (1.7x1.4mm)
- 50pF internal RF tuning capacitor allowing small antenna design
- 40 years data retention, 100K cycles erase/write
- Cost effective applications
ST25TVC
NFC type 5 tag with Augmented NDEF

ST25TV512C / 02KC

<table>
<thead>
<tr>
<th>RF tag</th>
<th>ISO 15693</th>
<th>EEPROM 512-bit / 2K-bit</th>
<th>Augmented NDEF</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFC type V</td>
<td>26kb/s</td>
<td></td>
<td>64-bit “encrypted” passwords</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tamper Detect</th>
</tr>
</thead>
<tbody>
<tr>
<td>TruST25 Digital signature</td>
</tr>
<tr>
<td>24-bit counter</td>
</tr>
<tr>
<td>24-bit Unique Tap Code (UTC)</td>
</tr>
<tr>
<td>TruST25 Digital signature</td>
</tr>
</tbody>
</table>

Use cases
- Consumer engagement, product identification, accessory recognition, wireless pairing, asset tracking, access control, gaming
- Tamper proof application, brand protection

Key features
- ISO15693 and NFC type V (long range operations, 26kb/s)
- Memory configuration: 512-bit and up to 2560-bit
- TruST25 Digital Signature (can be used into ANDEF: 2K-bit only)
- 24-bit Unique Tap Code (UTC) with antitearing
- Untraceable (by default possible) & Kill modes
- Tamper Detect pin for open / short detection
- Augmented NDEF: UID, UTC, tamper status, signature, password counter…

Key benefits
- Configurable User Memory Area
- Cloning Protection with Digital Signature (Cloud management)
- 60 years data retention, 100k cycles erase/write

UFDFPN5
SBN12 / SBN075
Die form, sawn and Bumped inkless 8” wafer, 120µm/75um thickness
## ST25TV04K-PE

**Energy harvesting NFC type 5 tag**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RF Tag</strong></td>
<td>ISO 15693, NFC type V</td>
</tr>
<tr>
<td><strong>EEPROM</strong></td>
<td>4K-bit</td>
</tr>
<tr>
<td><strong>Operating Speed</strong></td>
<td>26kb/s (53kb/s)</td>
</tr>
<tr>
<td><strong>64-bit Password</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Digital output (GPO)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Energy harvesting</strong></td>
<td></td>
</tr>
</tbody>
</table>

### 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
**ST25TV**

High density NFC type 5 tag

**ST25TV16/64K**

<table>
<thead>
<tr>
<th>RF Tag</th>
<th>ISO 15693</th>
<th>EEPROM 16/64K-bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>26kb/s (53kb/s)</td>
<td>0100110111100000</td>
<td>00110101001110</td>
</tr>
<tr>
<td>010110001101110</td>
<td>64-bit password</td>
<td></td>
</tr>
</tbody>
</table>

**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)

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

**SBN12**
Die form, sawn and Bumped inkless 8” wafer, 120µm thickness
Secure Tag for product authentication

**ST25TA-E**

**Use cases**
- Product authentication, brand protection, anticloning, asset tracking

**Key features**
- ISO14443-A and NFC type 4
- Short-range operations, up to 106kb/s speed
- Data protection using password-based authentication
- **Cloning protection** thanks to Edge TruST25TM digital signature
- Configurable general-purpose counter
- **Privacy-enabled** communication modes
- Tag-related credential appended dynamically to NDEF for consumer engagement (ANDEF)

**Key benefits**
- **Strong product authentication** thanks to on-chip ECDSA signature
- Blockchain compatibility

---

**RF tag**
- ISO 14443-A
- NFC type 4
- 106kb/s

**MEMORY**
- Augmented NDEF
- Flash 2K-bit
- 64-bit password
- 24-bit counter
- Edge TruST25 Digital signature

**ECC-based crypto engine**

**SBN14 / SBN075**
- Die form, sawn and Bumped inkless 12” wafer, 140/75µm thickness
ST25TA
NFC type 4 tag with GPO

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
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 antitearing feature
- ST25TB512-AT version dedicated to transport
- 2x counters 32-bit with antitearing

Key benefits
- Temperature range -40°C to +85°C
- 40 years data retention, 1M cycles erase/write
ST25D product ID cards
## Dynamic NFC / RFID tags product family

<table>
<thead>
<tr>
<th>Feature</th>
<th>M24SR</th>
<th>M24LR</th>
<th>ST25DVC-I²C</th>
<th>ST25DV-PWM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RF protocol</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 speed</strong></td>
<td>106 kbps</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 Write 4-Byte page size</td>
<td>I²C @1MHz Write 16-Byte page size</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 +105°C</td>
<td>-40°C to +85°C</td>
<td>-40°C to +125°C</td>
<td>-40°C to +105°C</td>
</tr>
</tbody>
</table>

* SBN12: Die form, Sawn and Bumped wafer, 120µm thickness, inkless 8” wafer
Enhanced dynamic NFC type 5 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
- Data log download

Key features
- ISO15693 and NFC type V
- Fast data transfer thanks to 256 Bytes buffer
- I²C write on 16-Byte page
- Low Power mode, < 1µA power consumption in Standby
- -40 to +125°C (I²C) industrial Grade 8 temperature range
- Energy harvesting function through RF
- I²C enhanced features (write time improved, address configurable, access priority…)

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 ST25DV-I2C & M24LR
ST25DV-PWM
Dynamic NFC type 5 tag with PWM

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
## M24SR

### Dynamic NFC type 4 tag

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

#### 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

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### M24SR02 / 04 / 16 / 64

<table>
<thead>
<tr>
<th>RF Tag</th>
<th>ISO 14443-A</th>
<th>EEPROM</th>
<th>I²C</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFC Type 4</td>
<td>2K / 4K / 16K / 64K-bit</td>
<td>NDEF</td>
<td>2.4/5.5V</td>
</tr>
<tr>
<td></td>
<td>106kb/s</td>
<td>128-bit password</td>
<td>1MHz</td>
</tr>
</tbody>
</table>

**Digital output (GPO)**

**RF disable**

**Product variants:**

- **SO8**
- **TSSOP8**
- **UFDFPN8**
- **SBN12**

*Die form, sawn and Bumped Inkless 8" wafer, 120µm/ thickness*
### Dynamic NFC / RFID type 5 tag

**M24LR04E / 16E / 64E**

<table>
<thead>
<tr>
<th>RF Tag</th>
<th>ISO 15693</th>
<th>EEPROM 4K / 16K / 64K-bit</th>
<th>I²C 1.8/5.5V 1MHz</th>
<th>Digital output (GPO)</th>
<th>Energy Harvesting</th>
</tr>
</thead>
<tbody>
<tr>
<td>26kb/s (53kb/s)</td>
<td>01001101110000 00110101001110 10110001101110</td>
<td>32-bit password</td>
<td>SO8 UFDFPN8 TSSOP8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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 to 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
ST25R product ID cards
# ST25R NFC / HF readers product family

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Reader/Writer mode</th>
<th>Card emulation mode</th>
<th>AP2P mode</th>
<th>PP2P mode</th>
<th>RF speed</th>
<th>Market</th>
<th>Advanced features</th>
<th>HW interface</th>
<th>SW interface</th>
<th>Power supply</th>
<th>Output power</th>
<th>Temp range</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST25R95</td>
<td>Entry-level NFC reader</td>
<td>ISO14443A/B, ISO15693, Felica</td>
<td>Yes</td>
<td>-</td>
<td>-</td>
<td>424kbps</td>
<td>Consumer</td>
<td>IWU</td>
<td>SPI 2Mbps</td>
<td>Unified Software Library for NFC Front Ends</td>
<td>2.7V - 5.5V</td>
<td>0.22W</td>
<td>-25°C to +85°C</td>
<td>32-pin QFN</td>
</tr>
<tr>
<td>ST25R100</td>
<td>Entry-level NFC Reader</td>
<td>ISO14443A/B, ISO15693</td>
<td>-</td>
<td>-</td>
<td>Initiator &amp; target</td>
<td>106kbps</td>
<td>Reader+Tag, IoT, Gaming, Consumer</td>
<td>DPO, IWU</td>
<td>SPI 6 Mbps</td>
<td>2.4V – 5.5V</td>
<td>0.5W</td>
<td>-25°C to +85°C</td>
<td>24-pin TQFN</td>
<td></td>
</tr>
<tr>
<td>ST25R3911B/12</td>
<td>Mid-Range NFC Forum Reader</td>
<td>ISO14443A/B, ISO15693, FelicaCa</td>
<td>-</td>
<td>-</td>
<td>Initiator &amp; Target</td>
<td>6.8Mbps VHBR (11B)</td>
<td>Payment EMVCo® 2.6, Industrial, Consumer</td>
<td>AAT (11B), DPO, IWU</td>
<td>SPI 6 Mbps</td>
<td>2.4V – 5.5V</td>
<td>1.4 W (11B) / 1.0W (12)</td>
<td>-40°C to +125°C</td>
<td>(WF) 32-pin QFN / WLCS3-36</td>
<td></td>
</tr>
<tr>
<td>ST25R3916B/17B/19B</td>
<td>High-performance NFC &amp; EMVCo® Reader</td>
<td>ISO14443A/B, ISO15693, FelicaCa</td>
<td>-</td>
<td>-</td>
<td>Initiator &amp; Target</td>
<td>848kbps</td>
<td>Payment EMVCo® 3.1, Industrial, Consumer</td>
<td>AAT (16B), DPO, NSR, DSA, AWS, IWU, EMD</td>
<td>SPI 6 Mbps</td>
<td>2.4V – 5.5V</td>
<td>1.6 W</td>
<td>2.4V – 5.5V</td>
<td>-40°C to +105°C</td>
<td>(WF) 32-pin QFN / WLCS3-36</td>
</tr>
<tr>
<td>ST25R3918</td>
<td>Multi-purpose NFC transceiver</td>
<td>ISO14443A/B</td>
<td>-</td>
<td>Initiator &amp; Target</td>
<td>Initiator &amp; Target</td>
<td>848kbps</td>
<td>Reader+Tag, IoT, Gaming, Consumer</td>
<td>DPO, NSR, DSA, AWS, IWU, EMD</td>
<td>SPI 10 10 Mbps</td>
<td>2.4V – 5.5V</td>
<td>0.5W</td>
<td>-40°C to +105°C</td>
<td>(WF) 32-pin QFN / WLCS3-36</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- **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 wake-up
- **J:** Junction
- **NSR:** Noise Suppression Receiver
- **IWU:** Inductive wake-up
- **DF:** Drive Slope Adjustment

**Features:**
- **VHBR:** Very High Baud Rate
- **EMD:** Automatic EMD suppression
- **DSA:** Drive Slope Adjustment
- **J:** Junction
- **NSR:** Noise Suppression Receiver
- **IWU:** Inductive wake-up
ST25R100
Entry-level NFC reader

Use cases
- Ideal for Reader+Tag applications
- Consumer applications, Access control, Transportation
- Accessory recognition, Brand protection, Parameter setting

Key Features
- 0.5W dynamic output power
- Up to 165 mA via internal LDO
- Improved inductive wake-up function
- -25°C to 85°C ambient temperature
- Small 4x4mm TQFN package

Key Benefits
- Tiny package size for easy integration into applications
- Low power operation & great card detection range
- Optimized for cost conscious applications
ST25R95
Entry-level NFC reader

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)
• 0.23W output power

Key benefits
• Simple implementation
• Easy-to-use evaluation with development kits
• Reference designs, application notes
• Cost effective solution
ST25R3911B

1.4 W 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
- 1.4 W output power
- 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 & standby mode (capacitive wake-up)
- 2 antennas operation at the same time
- Enhanced fast transfer rate for passport application

Reader Writer
AP2P Initiator & Target
PP2P Initiator

<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>Writer</td>
<td>NFC</td>
<td>6.8Mb/s</td>
<td></td>
<td>96-Byte</td>
<td>2.4/5.5V</td>
</tr>
<tr>
<td>Writer</td>
<td>NFC</td>
<td>6.8Mb/s</td>
<td></td>
<td>96-Byte</td>
<td>6Mb/s</td>
</tr>
</tbody>
</table>

VHBR: Very High Baud Rate
DPO: Dynamic Power Output
CIWU: Capacitive & Inductive Wake Up
AAT: Automatic Antenna Tuning

5x5 QFN32
Wafer
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
  - 1 W output power
  - EMVCo® 2.6 & 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 & standby mode
  - 2 antennas operation at the same time
### Use cases

- Ideal for **payment** applications with CE mode for additional functions
- Apple ECP, access control, gaming, IOT, and pairing

### Key features

- **NFC Forum Universal Device (with CE mode)**
- **1.6 W** output power with **Dynamic Power Output**
- **EMVCo® 3.1a** certification without external power amplifier
- **Improved Active Waveshaping v2, Noise Suppression Receiver**
- **Automatic Antenna Tuning**
- **-40°C to 105°C** ambient temperature range (QFN)

### Key benefits

- Low power operation & standby mode (low power card detection)
- Works in challenging environment like noisy LCD displays
- Ideal for passing newest EMVCo® standards
**ST25R3917B**

Cost efficient - performant NFC & EMVCo® reader

**Use cases**
- Ideal for **payment** applications
- Apple ECP, Access Control, Gaming, Consumer

**Key features**
- NFC Forum Reader device
- **1.6 W** output power with **Dynamic Power Output**
- **EMVCo® 3.1a** certification without external power amplifier
- Improved **Active Waveshaping v2, Noise Suppression Receiver**
- **-40°C to 105°C** ambient temperature range

**Key benefits**
- Low power operation & standby mode (low power card detection)
- Works in challenging environment like noisy LCD displays
- Ideal for passing newest EMVCo® standards
ST25R3919B
Cost efficient and performant NFC reader

Use cases
- Ideal for payment applications
- Apple ECP, access control, gaming, consumer

Key features
- NFC Forum reader device
- 1.6 W output power with dynamic power output
- Improved active wave shaping v2, noise suppression receiver
- -40°C to 105°C ambient temperature range

Key benefits
- Low power operation & standby mode (low power card detection)
- Works in challenging environment like noisy LCD displays
- Ideal for passing the newest EMVCo® standards
ST25R3918
Multi-purpose NFC Transceiver

Use cases
- Ideal for Reader+Tag applications
- Access control, gaming, consumer
- Apple AppClip, Android InstantApp

Key features
- 0.5W output power
- Active Waveshaping
- Noise Suppression Receiver
- -40°C to 105°C ambient temperature range

Key benefits
- Low power operation & standby mode
- Works in challenging environment like noisy LCD displays
- Excellent performance for low power applications
ST25 ecosystem
ST25T tag bag kits

ST25 tag bag AME

ST25 tag bag APAC

ST25 tag bag EMEA

Manufactured by SAG
ST25TV02KC ASEAL board

- UDFPN5 package
- Class-6 18 turns single layer antenna
- 256-Byte (2-kbit) NDEF EEPROM
- Tamper detect capability
- TruST25 digital signature
- Augmented NDEF (ANDEF)
ST25DV-PWM evaluation board

ST25DV-PWM discovery kit

- 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

ST25 IC

ST25DV02K-W2 dynamic NFC tag IC
ST25DVC-I²C evaluation boards

### ST25DVC-I²C discovery kit
- **ST25DV64KC** dynamic NFC tag IC
- 49x37mm 8 turns antenna (ANT Class3)
- STM32F405 MCU
- 2.4” TFT LCD Touch screen
- I²C & SWIP connectors
- Daughter board connector
- 14.5x24mm 15 turns antenna (Flex antenna)
- 5 samples ST25DV64KC

### ST25DVC-I²C Nucleo shield
- **ST25DV64KC** 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

### ST25DVC-I²C tiny antenna
- **ST25DV64KC** 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
NFC sensor tag evaluation board

NFC Dynamic tag sensor and processing node

NFC sensor tag

- STM32L4 ultralow-power MCU
- LIS2DUXS12 ultralow-power 3-axis smart accelerometer
- H3LIS331DL low-power high-g 3-axis accelerometer
- LPS22DF nano pressure sensor
- VD6283TX ambient light sensor
- 40x40mm 8 turns antenna
- Optional CR2032 / LIR2032 battery

STEVAL-SMARTAG2

ST25 IC

ST25DV64KC dynamic NFC tag
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
ST25R95 / CR95HF evaluation boards

**CR95HF demo board**
- M24LR-DISCOVERY
  - CR95HF NFC multiprotocol reader IC
  - 47x34 mm 2 turns double layer antenna on PCB and associated tuning circuit
  - STM32F1 microcontroller
  - USB & JTAG connectors

CR95HF demo board is part of M24LR-DISCOVERY

**CR95HF Nucleo shield**
- X-NUCLEO-NFC03A1
  - CR95HF NFC multiprotocol 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 discovery kit

- ST25R3911B NFC reader IC
- 105x52mm 2 turns antenna and associated VHBR tuning circuit
- STM32L476RET6 32-bit MCU
- Micro-USB connector
- Additional UART / I²C Host interfaces, as well as NFC SPI and JTAG/SWD points

ST25R3911B Nucleo shield

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

ST25R3911B EMVCO® kit

- ST25R3911B NFC reader IC
- 65x74mm 2 turns antenna etched
- 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.
ST25R3916B evaluation boards

ST25R3916B discovery kit
- **ST25R3916B** NFC reader IC
- 66 x 66 mm 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

ST25R3916B Nucleo shield
- **ST25R3916B** NFC reader IC
- 47 x 34mm 4 turns antenna etched on PCB
- Compatible with STM32 Nucleo boards
- Equipped with Arduino® UNO R3 connector

ST25R3916B EMVCo® kit
- **ST25R3916B** NFC reader IC
- 51 x 27mm 3 turns antenna etched on PCB
- STM32L476 ULP 32-bit MCU
- Micro-USB connector
- Comprehensive device test environment (DTE) for EMVCo® Level 1 FW control

Discovery kit and Nucleo shield are also valid for ST25R3917B and ST25R3919B.
ST25T & ST25D software overview

SW supporting ST25 NFC tags and dynamic NFC tags

**ST25 Mobile apps**
- ST25 NFC Tap app for Android
- ST25 NFC Tap app for iOS
  - Based on ST25 SDK

**ST25 Webservice**
- Demo for ST25 NFC tags

**ST25 PC Software**
- ST25 PC Software for NFC readers
- Support of tags and dynamic tags functionalities including TruST25 services
  - Based on ST25 SDK

**Firmware for MCU**
- Firmware for STM32 microcontrollers
- SW driver for Dynamic NFC tags IC
- Including demos
ST25 Android mobile apps

ST25 NFC tap for Android

• Read/Write NDEF and user memory of ST25 Tags
• Support of specific functionalities of ST25 Tags (Tamper detect, Augmented NDEF, PWM output, TruST25 digital signature, etc.)
• Includes demos for Fast Transfer Mode (FTM), PWM and Wi-Fi or Bluetooth pairing
• Automatic launch of Android app
• ST25 NFC tap apk file (STSW-ST25001APK)
• ST25 NFC tap open-source code (STSW-ST25001SC)

ST solutions

• ST25 Dynamic Tags
• ST25 Tags
ST25 iOS mobile apps

ST25 NFC Tap for iOS

- App Clip for User Experience
- Read/Write NDEF and User memory of ST25 tags
- Support of specific functionalities of ST25 tags (PWM output, TruST25 digital signature…)
- Includes demos for Fast Transfer Mode (FTM), Bluetooth pairing and PWM
- Support of NFC background tag reading
- Automatic launch of iOS app
- ST25 NFC Tap open-source code (STSW-ST25IOS001SC)

ST solutions
- ST25 Dynamic Tags
- ST25 Tags
ST25 PC software

• Feature set support of ST25 NFC tags and dynamic tags
• PC SW for Windows
• Read/Write NDEF records on multiple tags
• Support of TruST25 digital signature feature
• Compatible with ST25R3916B, ST25R3911B & CR95HF demo boards and industrial readers (FEIG)
• Fast Transfer Mode (FTM) demo with ST25DV-Discovery board
• Free to use demo PC SW (**STSW-ST25PC001**) and open-source code (**STSW-ST25PC002**)
ST25 SDK

• SW library for Java™ applications development
• Multiplatform (Windows, Linux…)
• RF library used in Android & iOS ST25 NFC Tap apps as well as PC software
• Includes examples and readers reference implementations
• API documentation
• ST25 SDK SW package (STSW-ST25SDK001)
ST25D Firmware for MCU

Firmware for ST25D Discovery, Nucleo & ANT7 boards

- Complete set of source files to compile firmware for development boards (Discovery, Nucleo…)
- Includes Fast Transfer Mode (FTM) demo
- Read/store NDEF messages
- Supports specific features of ST25 dynamic tags IC (Energy harvesting, interrupts, states…)
- Compatible with any NFC Readers
- Compatible with any NFC smartphones, using the ST25 NFC Tap app
- ST25DV-I2C-EVO Discovery kit FW (STSW-ST25DV002) and Nucleo board FW (X-CUBE-NFC7)

ST solutions • ST25 Dynamic Tags
• Open-source webserver: www.myst25.com
• Compatible with ST25TV and ST25TN product series
• Augmented NDEF experience
• Native and automatic access to NDEF records
• Shared with customers on specific request and through MFT platform (SLA0085 process)
• Developed in HTML5 and PHP7.0 – Uses MySQL database
• Source code can be shared on request
ST25R software overview

Software development tools for ST25R HF Reader IC

Graphical User Interface (GUI)

- GUI for ST25R
  - PC software for Windows
  - On request: GUI for ST25R EMVCo®
    - PC software for Windows

Firmware

- DISCO board
  - DISCO // EMVCo® Firmware & source
  - RFAL Firmware & source
  - STM32
  - SPI
  - ST25R

- NUCLEO board
  - RFAL Firmware & source
  - NUCLEO Firmware & source
  - SPI
  - STM32

ST solutions

- ST25 HF reader
ST25R RFAL SW suite

ST NFC reader “RFAL” software suite

• Comprehensive device driver and middleware to build NFC enabled applications for reader devices based on ST25R NFC Readers
• Written in pure ANSI C
• Straightforward portability across different platforms (MCU/RTOS/OS) with non-blocking API
• Compliant with main HF/NFC standards (NFC Forum, ISO)
• Source code example implementations available: embedded (STM32, STM8 device, SPC5 on request) and Linux® (Raspberry Pi)
• Easy callback function for proprietary NFC technologies on application layer like Apple™ Mfi (delivered under Mfi conditions) and other technologies
• ST25R3916/16B RFAL SW (STSW-ST25RFAL002) and ST25R3911B RFAL SW (STSW-ST25RFAL01)

ST solutions

• ST25 HF reader
ST25R PC GUI software

ST NFC reader “Discovery” software suite

- Active P2P (peer-to-peer) according to ISO18092, including SNEP
- Card emulation in NFC-A (106 kbps) and NFC-F (212 and 424kbps)
- Wake-up feature, analog configuration and register access of ST25R3916B
- Support of Automatic Antenna Tuning (AAT) & Dynamic Power Output (DPO)
- Access to all ST25 tag features thanks to ST25PC NFC SW (STSW-ST25PC001)
- ST25R3916 PC GUI SW (STSW-ST25R010) and ST25R3911B PC GUI SW (STSW-ST25R001)

ST solutions

- ST25 HF reader
ST25R firmware for MCU

Firmware for ST25R discovery, Nucleo & EMVCo® boards

- Complete set of source files to compile firmware for development boards (discovery, Nucleo…).
- Reader / writer demonstration
  - Tag inventory, read, and write (all NFC standard protocols supported)
  - Dynamic power output
  - NFC Forum NDEF messages
- Card emulation demonstration
  - NFC type 4A tag emulation (all tag types supported in USB mode).
  - NFC Forum NDEF messages
  - Can be written by a reader or by a smartphone
- Peer to peer (P2P) demonstration
- EMVCo® Layer 1 support FW, on request
- STEVAL-25R3916B FW (STSW-ST25R018)
- ST25R3916B Nucleo board FW (X-CUBE-NFC6)
- ST25R3911B Disco kit FW (STSW-ST25R002)

ST solutions

- ST25 HF reader
ST25R antenna matching software kit

- Comprehensive antenna matching tool with GUI to find the right external component values for a chosen configuration
- Available for the entire ST25R HF Reader product line
- Allows configuration with or without AAT functionality
- Integrates circuit simulator (QUCS), automatic component value selection and generates the Smith Chart
- Standalone version for Windows PC and online tool available
- Antenna matching tool for ST25R NFC/HF Reader (STSW-ST25R004)

ST NFC reader “Antenna Matching” software kit

ST solutions

- ST25 HF reader
ST25R Linux software kit

• Provides a pure user space port of the RFAL onto Raspberry Pi 3 and 4
• Support ST25R HF Readers
• Sample applications demonstrating Poller (R/W-mode) and Listener (Card Emulation)
• Linux host communication through SPI
• Free, user-friendly license terms

ST NFC reader “Linux” software kit

Linux

• ST25 HF reader
ST provides EMV L1 firmware stack for contact-less products, as is
Stack accessible under NDA for usage with ST25R series and available as source code
Firmware accompanied by a GUI which allows easy configuration the device as well as active waveshaping and dynamic power output
Written in pure ANSI C based on RFAL
EMV L1 layer prevalidated (kept up to date)
Portable on various architectures thanks to the abstraction layers which are integrated in the delivery
Stack available with our POS demo kits on request

• ST25 HF reader
ST25R embedded NFC library software kit

ST NFC reader “NFC Lib” software kit

- Collection of middleware to build advanced NFC-enabled applications such as
  - NFC poller
  - NDEF reader / writer
  - FreeRTOS poller
  - Proprietary active peer-to-peer & Card emulation
- Support for ST25 Tag and Dynamic Tag features
- ST25 Fast Transfer Mode (for ST25 Readers and Dynamic Tags)
- Easy portability across different platforms (MCUs / RTOSs / OSs)
- Available for all ST25R HF readers, on request (free and user-friendly license terms)

ST solutions
- ST25 HF reader
Our technology starts with You

Find out more at www.st.com/st25