NFC / RFID
ST25 product overview
Solutions for NFC / RFID Tags & Readers

ST25 SIMPLY MORE CONNECTED
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 2022, more than 75% 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

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

- ISO15693
  - "Long Range" 26kbps

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

- NDEF (NFC Data Exchange Format)
Introduction to the NFC Wayfinding Mark

- N-Mark is (still) the official logo of NFC Forum and used for certified products.

- Wayfinding Mark is made for ensure optimal NFC User eXperience.

**Directional**
- Occasional use
- Tapping point

**Charging**
- Charging use
- Antenna location

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

**Instructional**
- Learning / one time use
- For guidance of tapping

More details on the webpage: [https://nfc-forum.org/wayfinding-mark/](https://nfc-forum.org/wayfinding-mark/)
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
Making **driving** safer, greener and more connected

- Car Digital Key
- 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
- Factory automation

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
NFC Controller

STMicroelectronics is Member of
- NFC Forum
- RAIN alliance
- ISO organizations
- Zhaga consortium
- CCC (Car Connectivity Consortium)
- WPC (Wireless Power Consortium)
- CSA (Connectivity Standards Alliance)
- LoRa alliance
ST25 products family

Tags
- ST25T
- 13.56MHz
- NFC phone / RFID Reader

Industrial, Lighting, Metering, Motor control, Consumer, Appliance, Healthcare...
- www.st.com/st25d

Dynamic tags
- STM32 microcontroller
- ST25D
- 13.56MHz
- NFC phone / RFID Reader

POS & mPOS terminals, Automotive, Access control, Gaming, Reader+Tag...
- www.st.com/st25r

Readers
- STM32 microcontroller
- ST25R
- SPI
- 13.56MHz
- NFC phone

Consumer engagement, Asset tracking, Ticketing, Brand protection, Access control, Gaming...
- www.st.com/st25t
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
## Certification & interoperability status

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<th>Readers</th>
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<td>ST25DV-I2C</td>
<td>ST25R3911B</td>
</tr>
<tr>
<td>ST25TA</td>
<td>ST25DV-PWM</td>
<td>ST25R3916B</td>
</tr>
</tbody>
</table>

### NFC Forum

- ST25TV
- ST25TA

### iOS app

- Apple

### Android app

- Android

### NFC Forum

- ST25R3911B
- ST25R3916B

### RFAL SW

- Down

### Linux SW

- Linux
ST25 series overview
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 TruST25
- Counter / Unique Tap Code

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

High Volume & Quality
- In-House manufacturing
- Leverage Automotive EEPROM quality
- Leverage Consumer EEPROM volume
ST25 readers DNA

Comprehensive portfolio

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

**High performing HF readers**
- 13.56MHz
- 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**
- 840-960MHz
- 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
Antenna e-design and matching tools

Fast and easy prototyping

Antenna eDesign suite

ST25R antenna matching tool

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

Easy-to-use and customer-oriented

- STM32Nucleo 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
## ST25 products family

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Links</th>
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</thead>
<tbody>
<tr>
<td>Tags</td>
<td>Consumer engagement, Asset tracking, Ticketing, Brand protection, Access control, Gaming…</td>
<td><a href="http://www.st.com/st25t">www.st.com/st25t</a></td>
</tr>
<tr>
<td>Readers</td>
<td>POS &amp; mPOS terminals, Automotive, Access control, Gaming, Reader+Tag…</td>
<td><a href="http://www.st.com/st25r">www.st.com/st25r</a></td>
</tr>
</tbody>
</table>
## ST25 NFC / RFID portfolio

**one-stop-shop for tags and readers**

<table>
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<th>Tags</th>
<th>Dynamic Tags</th>
<th>NFC / HF Readers</th>
<th>UHF Readers</th>
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<tbody>
<tr>
<td>EEPROM 512b-64kb 200-year retention 1M cycles</td>
<td>EEPROM 512b-1.6Kb 60-year retention 10k cycles</td>
<td>EEPROM 256b Buffer EEPROM 4Kb-64Kb 40-year retention 1M cycles</td>
<td>EEPROM 256b 40-year retention 100k cycles</td>
</tr>
<tr>
<td>TruST25 digital signature 128b password 20b counter UID RF Field Detect</td>
<td>Augmented NDEF TruST25 digital signature 64b password 24b UTC UID Tamper Detect</td>
<td>Fast X-fer Mode 64b password E-Harvesting RF Detect UID</td>
<td>TruST25 digital signature 64b password UID</td>
</tr>
</tbody>
</table>

*: successor of M24LR and ST25DV-I2C

**: same as former CR95HF / ST95HF
ST25T product ID cards
## ST25TN

**Entry level NFC type 2 tag**

### Use cases

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

### 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 anti-tearing
- **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

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**ST25TN512 / 01K**

<table>
<thead>
<tr>
<th>RF Tag</th>
<th>ISO/IEC 14443-A</th>
<th>EEPROM</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFC Type 2</td>
<td>Up to 1664-bit</td>
<td>Augmented NDEF</td>
</tr>
</tbody>
</table>

- **106kb/s**

**Augmented NDEF**

**TruST25** Digital signature

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**UFDFPN5**

- **SBN12 / SBN075**
- Die form, sawn and Bumped inkless 8" wafer, 120µm/75µm thickness

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**ST**

**life augmented**

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**ST25TN**

**Entry level NFC type 2 tag**

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**ST**

**life augmented**

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**ST25TN512 / 01K**

<table>
<thead>
<tr>
<th>RF Tag</th>
<th>ISO/IEC 14443-A</th>
<th>EEPROM</th>
</tr>
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<tbody>
<tr>
<td>NFC Type 2</td>
<td>Up to 1664-bit</td>
<td>Augmented NDEF</td>
</tr>
</tbody>
</table>

- **106kb/s**

**Augmented NDEF**

**TruST25** Digital signature

---

**UFDFPN5**

- **SBN12 / SBN075**
- Die form, sawn and Bumped inkless 8" wafer, 120µm/75µm thickness

---

**ST**

**life augmented**

---

**ST25TN**

**Entry level NFC type 2 tag**

---

**ST**

**life augmented**
ST25TV
NFC type 5 tag with Augmented NDEF

Use cases
- Product Identification, asset tracking, consumer engagement, 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 anti-tearing
- 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

ST25TV512C / 02KC
RF Tag
ISO 15693
NFC Type V
EEPROM
512-bit / 2K-bit
Augmented NDEF
64-bit “encrypted” passwords
24-bit counter
TruST25 Digital signature
26kb/s
Tamper Detect

FPN5
SBN12 / SBN075
Die form, sawn and Bumped inkless 8” wafer, 120µm/75um thickness
ST25TV04K-PE
Energy harvesting NFC type 5 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
ST25TV
High density NFC type 5 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 type 4 tag

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

ST25TA512B / 02KB

<table>
<thead>
<tr>
<th>RF Tag</th>
<th>ISO 14443-A</th>
<th>NFC Type 4</th>
<th>EEPROM 512 / 2K-bit</th>
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<tbody>
<tr>
<td></td>
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<td>106kb/s</td>
<td>NDEF</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>128-bit password</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20-bit counter</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TruST25 Digital signature</td>
</tr>
</tbody>
</table>

SBN12 / SBN075
Die form, sawn and Bumped inkless 8” wafer, 120µm/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

### Specifications
**ST25TA02KB-P / -D**

<table>
<thead>
<tr>
<th>RF Tag</th>
<th>ISO 14443-A</th>
<th>NFC Type 4</th>
</tr>
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<tbody>
<tr>
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<td>2K-bit</td>
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<tr>
<td></td>
<td>NDEF</td>
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</tr>
<tr>
<td></td>
<td>128-bit password</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20-bit counter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TruST25 Digital signature</td>
<td></td>
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</table>

**Digital output (GPO)**

<table>
<thead>
<tr>
<th>FPN5</th>
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<tr>
<td>SBN12 / SBN075</td>
</tr>
</tbody>
</table>

Die form, sawn and Bumped inkless 8” wafer, 120µm/75um thickness
ST25TA
High density NFC type 4 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

ST25TA16K / 64K

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

SBN12
Die form, sawn and Bumped inkless 8" wafer, 120µm thickness
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

RF Tag

ISO 14443-B

EEPROM
512-bit / 2K / 4K-bit

106kb/s

0100110111000000
0011010100111010110001101110

32-bit counter x2

64-bit UID

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

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<tbody>
<tr>
<td>ISO14443B</td>
<td>ISO14443A</td>
<td>ISO14443A</td>
<td>ISO15693</td>
<td>ISO15693</td>
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<tr>
<td>ISO14443A</td>
<td>NFC type 2</td>
<td>NFC type 4</td>
<td>NFC type 5</td>
<td>NFC type 5</td>
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<tr>
<td>ISO14443A</td>
<td>NFC type 2</td>
<td>NFC type 4</td>
<td>NFC type 5</td>
<td>NFC type 5</td>
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<td>RF range</td>
<td>Short range</td>
<td>Short range</td>
<td>Short range</td>
<td>Long range</td>
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<tr>
<td>RF speed</td>
<td>106kbps</td>
<td>106kbps</td>
<td>106kbps</td>
<td>26kbps (53kbps)</td>
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<tr>
<td>Memory format</td>
<td>EEPROM data</td>
<td>EEPROM (preformatted NDEF)</td>
<td>EEPROM (preformatted NDEF)</td>
<td>EEPROM (preformatted NDEF)</td>
<td>EEPROM data</td>
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<tr>
<td>Memory size</td>
<td>512-bit / 2k / 4k-bit</td>
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<td>512-bit / 2k / 16k / 64k-bit</td>
<td>512-bit / 2k-bit</td>
<td>4k / 16k / 64k-bit</td>
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<td>Data protection</td>
<td>OTP bits</td>
<td>Lock blocks</td>
<td>Password 128-bit</td>
<td>Password 64-bit</td>
<td>Password 64-bit</td>
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<tr>
<td>Digital signature</td>
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<td>Yes, TruST25</td>
<td>Yes, TruST25</td>
<td>Yes, TruST25</td>
<td>No</td>
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<tr>
<td>Digital output</td>
<td>No</td>
<td>No</td>
<td>GPO Field Detect CMOS_P / Open-drain (2k only)</td>
<td>Tamper Detect</td>
<td>GPO Field detect CMOS_P (4k only)</td>
</tr>
<tr>
<td>Counter</td>
<td>32-bit (x2)</td>
<td>UTC 24-bit</td>
<td>20-bit</td>
<td>UTC 24-bit</td>
<td>No</td>
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<tr>
<td>Extra features</td>
<td>-</td>
<td>Augmented NDEF</td>
<td>-</td>
<td>Augmented NDEF Untraceable mode</td>
<td>Energy Harvesting (4k only)</td>
</tr>
<tr>
<td>RF tuning capacitor</td>
<td>64pF</td>
<td>50pF</td>
<td>50pF / 25pF</td>
<td>23.5pF &amp; 99.7pF</td>
<td>28.5pF</td>
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<tr>
<td>Temperature range</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>
<td>-40°C to +85°C</td>
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<tr>
<td>Package</td>
<td>SBN12* / SBN075²</td>
<td>SBN12* / SBN075²</td>
<td>SBN12*</td>
<td>SBN12* / SBN075²</td>
<td>SBN12*</td>
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<tr>
<td></td>
<td>FPN5</td>
<td>FPN5</td>
<td>FPN5</td>
<td>FPN5</td>
<td>FPN5</td>
</tr>
</tbody>
</table>

* SBN12: Die form, sawn and Bumped wafer, 120µm thickness, inkless 8” wafer
* SBN075: Die form, sawn and Bumped wafer, 75µm thickness, inkless 8” wafer
ST25D product ID cards
### 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

ST25DV02K-W1 / -W2

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
ST25DV-12C
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
  - Parameter 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
# 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,…

## 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 type 5 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

### M24LR04E / 16E / 64E

<table>
<thead>
<tr>
<th>RF Tag</th>
<th>ISO 15693</th>
<th>EEPROM 4K / 16K / 64K-bit</th>
<th>I²C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>01001101110000 00110101001110 10110001101110</td>
<td>1.8/5.5V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>32-bit password</td>
<td>1MHz</td>
</tr>
</tbody>
</table>

- Digital output (GPO)
- Energy Harvesting

**Energy Harvesting**
- 32-bit password

**SO8**  **FPN8**  **TSSOP8**
## Dynamic NFC / RFID tags product family

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<tr>
<th></th>
<th>M24SR</th>
<th>M24LR</th>
<th>ST25DV-I2C</th>
<th>ST25DV-I2C EVO</th>
<th>ST25DV-PWM</th>
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</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>
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<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>
<td>Long range (up to 1m)</td>
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<td><strong>RF speed</strong></td>
<td>106kbps</td>
<td>26kbps</td>
<td>26kbps</td>
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<td><strong>Serial Interface</strong></td>
<td>I2C @1MHz</td>
<td>I2C @400kHz, Write 4-Byte page size</td>
<td>I2C @1MHz, Write 4-Byte page size</td>
<td>I2C @1MHz, Write <strong>16-Byte</strong> page size</td>
<td>I2C @1MHz</td>
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<tr>
<td><strong>Fast Transfer Mode</strong></td>
<td>No</td>
<td>No</td>
<td>Yes (256B buffer)</td>
<td>Yes (256B buffer)</td>
<td>No</td>
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<tr>
<td><strong>Energy Harvesting</strong></td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
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<td><strong>Digital output</strong></td>
<td>Open-Drain GPO</td>
<td>Open-Drain GPO</td>
<td>OD or CMOS GPO</td>
<td>OD or CMOS GPO</td>
<td>2x PWM</td>
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<td>-</td>
<td>Low Power mode</td>
<td>Low Power mode</td>
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<td><strong>Memory format</strong></td>
<td>EEPROM (preformatted NDEF)</td>
<td>EEPROM data</td>
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<td>EEPROM data</td>
<td>EEPROM data</td>
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<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>4k / 16k / 64k-bit</td>
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<td>Password 128-bit</td>
<td>Password 32-bit</td>
<td>Password 64-bit</td>
<td>Password 64-bit</td>
<td>Password 64-bit Digital signature</td>
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<td><strong>Temperature range</strong></td>
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<td>-40°C to +85°C</td>
<td>-40°C to +125°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
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**)
- 0.23W output power

## Key Benefits
- Simple implementation
- Easy-to-use evaluation with development kits
- Reference designs, application notes
- Cost effective solution

### ST25R95

<table>
<thead>
<tr>
<th>Reader Writer</th>
<th>ISO14443</th>
<th>ISO15693</th>
<th>FeliCa</th>
<th>RAM BUFFER</th>
<th>SPI</th>
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<tbody>
<tr>
<td>Card Emulation</td>
<td>424kb/s</td>
<td>528-Byte</td>
<td>2.7/5.5V</td>
<td>2Mb/s</td>
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</table>

**QFN32**
**ST25R3911B**

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
- **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

### ST25R3911B

<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>6.8Mb/s</td>
<td>96-Byte</td>
<td>2.4/5.5V</td>
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<td>PP2P Initiator</td>
<td>1.4W</td>
<td>6Mb/s</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

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

**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
- **1W** 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 & Stand-by mode
- 2 antennas operation at the same time
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
- 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

---

**ST25R3914/15**

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<thead>
<tr>
<th>Reader Writer</th>
<th>ISO14443</th>
<th>ISO15693</th>
<th>FeliCa</th>
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<th>SPI</th>
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<tr>
<td>AP2P Initiator &amp; Target</td>
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<td>6Mb/s</td>
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<tr>
<td>PP2P Initiator</td>
<td>AEC-Q100 qualification</td>
<td>Dynamic Power Output</td>
<td>Capacitive &amp; Inductive Wake Up</td>
<td>Automatic Antenna Tuning</td>
<td></td>
</tr>
<tr>
<td>1W</td>
<td>QFN32</td>
<td>Wettable flank</td>
<td>QFN32</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ST25R3916B

High-perf. NFC universal device & EMVCo reader

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)
- **1.6W** 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

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

**DPO:** Dynamic Power Output  
**IWU:** Inductive Wake Up (LPCD)  
**AWS:** Active Wave shaping  
**NSR:** Noise Suppression Receiver  
**AAT:** Automatic Antenna Tuning  
**DSO:** Driver Slope Adjustment  
**EMD:** Automatic EMD Error Handling

**QFN32 Wettable flank**  
**WLCSP**
## 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
- **1.6W** 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

### Specifications

<table>
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<tr>
<th>Feature</th>
<th>Specification</th>
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<tr>
<td>Reader Writer</td>
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<td>Reader Writer</td>
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<td>ISO15693, FeliCa</td>
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<tr>
<td>DPO</td>
<td>Dynamic Power Output</td>
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<tr>
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<td>Inductive Wake Up</td>
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<tr>
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<tr>
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</table>
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
ST25R3920B
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 with **Dynamic Power Output**
- Improved **Active Waveshaping v2**
- 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

<table>
<thead>
<tr>
<th>Reader Writer</th>
<th>ISO14443</th>
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<td>FeliCa</td>
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<td>PP2P Initiator &amp; Target</td>
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<td>1.6W</td>
<td>Dynamic Power Output</td>
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<tr>
<td>Card Emulation</td>
<td>512-Byte</td>
<td>ISO14443</td>
<td>ISO15693</td>
<td>FeliCa</td>
<td>RAM BUFFER</td>
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<tr>
<td>1.6W</td>
<td>2.4/5.5V</td>
<td>5Mb/s</td>
<td>3.4Mb/s</td>
<td>5Mb/s</td>
<td>3.4Mb/s</td>
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</tbody>
</table>

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

QFN32 Wettable flank
### ST25R NFC / HF readers product family

#### ST25R95
- **Description**: Entry-Level NFC Reader
- **Reader/Writer mode**: ISO14443A/B
- **Card emulation mode**: Yes
- **AP2P mode**: -
- **RF speed**: 424kbps
- **Market**: Consumer
- **Advanced features**: IWU
- **HW interface**: SPI 2Mbps
- **Power supply**: 2.7V - 5.5V
- **Output power**: 0.23W
- **Temp range**: -25°C to +85°C
- **Package**: 32-pin QFN

#### ST25R3911B
- **Description**: High-Performance NFC Forum Reader
- **Reader/Writer mode**: ISO14443A/B
- **Card emulation mode**: -
- **AP2P mode**: Initiator & Target
- **RF speed**: 6.8Mbps (VHBR)
- **Market**: Payment EMVCo 2.6
- **Advanced features**: IWU
- **SW interface**: Unified Software Library for NFC Front Ends
- **Power supply**: 2.4V – 5.5V
- **Output power**: 1.4W
- **Temp range**: -40°C to +105°C
- **Package**: 32-pin QFN / Wafer

#### ST25R3912
- **Description**: Mid-Range NFC Reader
- **Reader/Writer mode**: ISO14443A/B
- **Card emulation mode**: -
- **AP2P mode**: Initiator & Target
- **RF speed**: 848kbps
- **Market**: Payment EMVCo 2.6, Access control
- **Advanced features**: AAT, DPO, CIWU
- **SW interface**: Unified Software Library for NFC Front Ends
- **Power supply**: 2.4V – 5.5V
- **Output power**: 1.0W
- **Temp range**: -40°C to +105°C
- **Package**: 32-pin QFN

#### ST25R3914/15
- **Description**: Automotive Grade NFC Forum Reader
- **Reader/Writer mode**: ISO14443A/B
- **Card emulation mode**: Yes (16B)
- **AP2P mode**: Initiator & Target
- **RF speed**: 848kbps
- **Market**: Payment EMVCo 2.6, Access control, Metering
- **Advanced features**: AAT (14), DPO, CIWU
- **SW interface**: Unified Software Library for NFC Front Ends
- **Power supply**: 2.4V – 5.5V
- **Output power**: 1.0W
- **Temp range**: -40°C to +105°C
- **Package**: 32-pin QFN

#### ST25R3916B/17B
- **Description**: High-performance NFC & EMVCo Reader
- **Reader/Writer mode**: ISO14443A/B
- **Card emulation mode**: Yes (16B)
- **AP2P mode**: Initiator & Target (16B)
- **RF speed**: 848kbps
- **Market**: Payment EMVCo 2.6, Access control, Metering, Consumer
- **Advanced features**: AAT (16B), DPO, NSR, DSA, AWS, EMD
- **SW interface**: Unified Software Library for NFC Front Ends
- **Power supply**: 2.4V – 5.5V
- **Output power**: 1.6W
- **Temp range**: -40°C to +105°C
- **Package**: WF 32-pin QFN

#### ST25R3918
- **Description**: Multi-purpose NFC transceiver
- **Reader/Writer mode**: ISO14443A/B
- **Card emulation mode**: Yes
- **AP2P mode**: Initiator & Target
- **RF speed**: 848kbps
- **Market**: Payment EMVCo 2.6, Access control, Metering, Consumer
- **Advanced features**: AAT, DPO, NSR, DSA, AWS, EMD
- **SW interface**: Unified Software Library for NFC Front Ends
- **Power supply**: 2.4V – 5.5V
- **Output power**: 0.5W
- **Temp range**: -40°C to +105°C
- **Package**: WF 32-pin QFN

#### ST25R3920B
- **Description**: Automotive Grade NFC Forum Reader
- **Reader/Writer mode**: ISO14443A/B
- **Card emulation mode**: Yes
- **AP2P mode**: Initiator & Target
- **RF speed**: 848kbps
- **Market**: Payment EMVCo 2.6, Access control, Metering, Consumer
- **Advanced features**: AAT, DPO, NSR, DSA, AWS, EMD
- **SW interface**: Unified Software Library for NFC Front Ends
- **Power supply**: 2.4V – 5.5V
- **Output power**: 1.6W
- **Temp range**: -40°C to +105°C
- **Package**: WF 32-pin QFN
ST25RU3993
UHF RFID reader

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

Key Features
• Tuneable frequency 840MHz to 960MHz
• Dense Reader Mode filtering on board
• Single ended Rx and differential input
• Adjustable linear output 0dBm and internal power amplifier adjustable 20dBm
• Receive sensitivity of -90dBm
• Power consumption down to 65mA, Power Down Mode with 3.3µW
• 950 tags/s single tag read speed @ 2 bytes EPC length, 640 kHz, FM0

Key Benefits
• Ideal for mobile applications and works in a dense reader environment
• Prolonging battery life & robust against poor antenna
<table>
<thead>
<tr>
<th><strong>Description</strong></th>
<th>UHF RFID Reader for Mobile and Fast Moving Consumer Goods applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Protocols</strong></td>
<td>EPC Class1 Gen2, ISO18000-62 &amp; -63, ISO29143, GB/T 29768, transparent mode: custom protocols possible</td>
</tr>
<tr>
<td><strong>Modulation modes</strong></td>
<td>Double Side Band (DSB) transmit modulation, Phase Reversal Amplitude Shift Keying (PR-ASK) transmit modulation</td>
</tr>
<tr>
<td><strong>Tunable frequency</strong></td>
<td>840 to 960MHz</td>
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<tr>
<td><strong>Power supply</strong></td>
<td>1.65V – 5.5V</td>
</tr>
<tr>
<td><strong>Power consumption</strong> (normal / standby / power-down)</td>
<td>210mW / 9.9mW / 3.3µW</td>
</tr>
<tr>
<td><strong>Communication interface</strong></td>
<td>Serial Peripheral Interface (SPI) 5Mbps</td>
</tr>
<tr>
<td><strong>Sensitivity (IC)</strong></td>
<td>-90dBm</td>
</tr>
<tr>
<td><strong>Output power</strong> (linear for external PA / internal PA)</td>
<td>0dBm / 20dBm (1dB steps)</td>
</tr>
<tr>
<td><strong>Read speed</strong> (single / unique)</td>
<td>950 tags/s, 440 tags/s</td>
</tr>
<tr>
<td><strong>Advanced features</strong></td>
<td>Dense Reader Mode, Internal Voltage Controlled Oscillator (VCO), Linear Received Signal Strength Indication (RSSI) &amp; Phase Bit, Automatic Power Supply Rejection Ratio (PSRR) regulation, Auto Acknowledge (ACK), Transparent Mode</td>
</tr>
<tr>
<td><strong>Temperature range</strong></td>
<td>-40 to +85°C</td>
</tr>
<tr>
<td><strong>Package</strong></td>
<td>48-pin QFN (7x7mm)</td>
</tr>
</tbody>
</table>
ST25 product part numbers
## ST25T NFC / RFID Tags

### ST25TA
- **NFC Type 4 Tag**
  - ISO14443-A (+GPO)
- **Package**
  - SBN12
  - SBN075
  - UFDFPN5
- **512-bit**
  - ST25TA512B-AC6G5
  - ST25TA512B-AC6F5
- **2k-bit**
  - ST25TA02KB-AC6G5
  - ST25TA02KB-AC6F5
  - ST25TA02KB-PC6H5
  - ST25TA02KB-DC6H5
- **16k-bit**
  - ST25TA16K-AB6G3
- **64k-bit**
  - ST25TA64K-AB6G3

### ST25TB
- **RFID Tag**
  - ISO14443-B
- **Package**
  - SBN12
  - SBN075
- **512-bit**
  - ST25TB512-AC6G6
  - ST25TB512-AT6G6
  - ST25TB512-AT6F6
- **4k-bit**
  - ST25TB04K-AC6G6

### ST25TN
- **NFC Type 2 Tag**
  - ISO14443-A
- **Package**
  - SBN12
  - SBN075
  - UFDFPN5
- **512-bit**
  - ST25TN512-AGF5
- **1.6k-bit**
  - ST25TN01K-AGF5
  - ST25TN01K-AFF5
  - ST25TN01K-AFH5

### ST25TV
- **NFC Type 5 Tag**
  - ISO15693 (+ Tamper Detect)
- **Package**
  - SBN12
  - SBN075
  - UFDFPN5
- **512-bit**
  - ST25TV512C-AGF3
  - ST25TV512C-AFF3
  - ST25TV512-AP6G9
  - ST25TV512-AD6G9
  - ST25TV512-AP6F9
- **2k-bit**
  - ST25TV02KC-AGF3
  - ST25TV02KC-TFG3
  - ST25TV02KC-ACC3
  - ST25TV02KC-THF3
  - ST25TV02KC-AP6G9
  - ST25TV02KC-AD6G9
  - ST25TV02KC-AP6F9
  - ST25TV02KC-AD6H9
- **4k-bit**
  - ST25TV04K-PE6G3
- **16k-bit**
  - ST25TV16K-AP6G3
- **64k-bit**
  - ST25TV64K-AP6G3
## ST25D part numbers (1/2)

### ST25D Dynamic NFC Tags

#### ST25DV-I2C EVO
- **Package**
  - SO8
  - TSSOP8
  - UFDFPN8
  - UFDFPN12
  - WLCSP10
- **4k-bit**
  - ST25DV04KC-IE6S3
  - ST25DV04KC-IE8S3
  - ST25DV04KC-IE6T3
  - ST25DV04KC-IE8T3
  - ST25DV04KC-IE6C3
  - ST25DV04KC-IE8C3
  - ST25DV04KC-JF6D3
  - ST25DV04KC-JF8D3
- **16k-bit**
  - ST25DV16KC-IE6S3
  - ST25DV16KC-IE8S3
  - ST25DV16KC-IE6T3
  - ST25DV16KC-IE8T3
  - ST25DV16KC-IE6C3
  - ST25DV16KC-IE8C3
  - ST25DV16KC-JF6D3
  - ST25DV16KC-JF8D3
- **64k-bit**
  - ST25DV64KC-IE6S3
  - ST25DV64KC-IE8S3
  - ST25DV64KC-IE6T3
  - ST25DV64KC-IE8T3
  - ST25DV64KC-IE6C3
  - ST25DV64KC-IE8C3
  - ST25DV64KC-JF6D3
  - ST25DV64KC-JF8D3

#### ST25DV-I2C
- **Package**
  - SO8
  - TSSOP8
  - UFDFPN8
  - UFDFPN12
  - WLCSP10
- **4k-bit**
  - ST25DV04KC-IER6S3
  - ST25DV04KC-IER8S3
  - ST25DV04KC-IER6T3
  - ST25DV04KC-IER8T3
  - ST25DV04KC-IER6C3
  - ST25DV04KC-IER8C3
  - ST25DV04KC-JFR6D3
  - ST25DV04KC-JFR8D3
- **16k-bit**
  - ST25DV16KC-IER6S3
  - ST25DV16KC-IER8S3
  - ST25DV16KC-IER6T3
  - ST25DV16KC-IER8T3
- **64k-bit**
  - ST25DV64KC-IER6S3
  - ST25DV64KC-IER8S3
  - ST25DV64KC-IER6T3
  - ST25DV64KC-IER8T3
  - ST25DV64KC-JFR6D3
  - ST25DV64KC-JFR8D3

#### ST25DV-PWM
- **Package**
  - SO8
  - TSSOP8
- **2k-bit**
  - ST25DV02K-W1R8S3
  - ST25DV02K-W2R8S3
  - ST25DV02K-W1R8T3
  - ST25DV02K-W2R8T3
### ST25D Dynamic NFC Tags

#### M24SR
- Dynamic NFC Type 4 Tag
- ISO14443-A
- I2C IF + GPO
- + RF disable
- + Extended Temperature

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<tr>
<th>Package</th>
<th>2k-bit</th>
<th>4k-bit</th>
<th>16k-bit</th>
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<td>SO8</td>
<td>M24SR02-YNM6T/2</td>
<td>M24SR04-YNM6T/2</td>
<td>M24SR16-YNM6T/2</td>
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<td>TSSOP8</td>
<td>M24SR02-YDW6T/2</td>
<td>M24SR04-YDW6T/2</td>
<td>M24SR16-YDW6T/2</td>
<td>M24SR64-YDW6T/2</td>
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<td>UFDFPN8</td>
<td>M24SR02-YSG12T/2</td>
<td>M24SR04-YSG12T/2</td>
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<td>SBN12</td>
<td>M24SR02-YMC6T/2</td>
<td>M24SR04-YMC6T/2</td>
<td>M24SR16-YMC6T/2</td>
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<tr>
<td>SO8</td>
<td>M24SR02-YMN8T/2</td>
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#### M24LR
- Dynamic NFC Type 5 Tag
- ISO15693
- I2C IF + GPO + EH

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<td>M24LR04-RM6N6T/2</td>
<td>M24LR16-RMN6T/2</td>
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<tr>
<td>TSSOP8</td>
<td>M24LR04-RDW6T/2</td>
<td>M24LR16-RDW6T/2</td>
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<td>M24LR16-RMC6T/2</td>
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<tr>
<td>SO8</td>
<td>M24LR04-YSG12T/2</td>
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<td>M24LR16-YMN8T/2</td>
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<td>Entry-Level HF Readers</td>
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<td>High Power Readers for Automotive</td>
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<td>High-Perf NFC Universal Devices &amp; EMVCo Readers</td>
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<td>Features</td>
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<td>Features</td>
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<td>ST25R3920B</td>
<td>High-Perf AEC-Q100 NFC Universal Device</td>
<td>Package</td>
<td>Features</td>
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<td>WF QFN32</td>
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ST25RU UHF RFID Readers

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<th>ST25RU3993</th>
<th>Package</th>
<th>Features</th>
<th>Part Number</th>
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<td>UHF Readers for Handheld devices</td>
<td>QFN48</td>
<td>Dense reader mode</td>
<td>ST25RU3993-BQFT</td>
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</tbody>
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ST25 HW evaluation boards
ST25T tag bag kits

ST25 Tag Bag AME

ST25 Tag Bag APAC

ST25 Tag Bag EMEA
ST25TV-ANDEF evaluation board

ST25TV02KC ASEAL board

- ST25TV02KC NFC/RFID tag IC
- 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

- 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-PWM discovery kit
ST25DV-I2C-EVO evaluation boards

**ST25DV64KC-DISCO**
- **ST25DV64KC** Dynamic NFC tag IC
- 49x37mm 8 turns antenna (ANT Class3)
- STM32F405 MCU
- I2C & SWIP connectors
- 14.5x24mm 15 turns antenna (Flex)
- 5 samples ST25DV64KC

**ST25DV-I2C-EVO discovery kit**
- **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

**ST25DV-I2C-EVO Nucleo shield**
- **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

**ANT7-T-25DV64KC**
NFC sensor tag evaluation board

NFC Dynamic Tag sensor and processing node

NFC Sensor Tag

- ST25DV64KC dynamic NFC tag
- STM32L4 ultra-low-power MCU
- LIS2DUXS12 ultra-low-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
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
- 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

M24LR-DISCOVERY

X-NUCLEO-NFC03A1

CR95HF demo board is part of M24LR-DISCOVERY
ST25R3911B evaluation boards

ST25R3911B discovery kit
- ST25R3911B HF reader / NFC initiator IC
- 105x52mm 2 turns antenna and associated VHB 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 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
ST25R3916B evaluation boards

**ST25R3916B discovery kit**
- ST25R3916B High perf NFC universal device and EMVCo® reader
- 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 High perf NFC universal device and EMVCo® reader
- 47 x 34 mm 4 turns antenna etched on PCB
- Compatible with STM32 Nucleo boards
- Equipped with Arduino® UNO R3 connector

**ST25R3916B EMVCo® kit**
- ST25R3916B High perf NFC universal device and EMVCo® reader
- 51 x 27 mm 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 ST25R3920B.
ST25RU3993-HPEV evaluation board

**ST25RU3993-HPEV kit**

- ST25RU3993 UHF reader IC
- High Power EValuation board
- STM32L476 MCU based
- External PA with 30 dBm output power
- Internal PA with 18 dBm output power
- Max. sensitivity: -80 dBm

Kit content:

- 1 x ETSI far field antenna
- 1 x FCC far field antenna
- 1 x Near field antenna
- 2 x UHF RFID tag
ST25 SW ecosystem
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 PC Software
- ST25 PC Software for NFC Readers
- Support of Tags and Dynamic Tags functionalities including TruST25 services
  • Based on ST25 SDK

ST25 Webserver
- Demo for ST25 NFC Tags

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

- 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…)
- Includes demos for Fast Transfer Mode (FTM), PWM and Wifi or Bluetooth pairing
- Automatic launch of Android app
- ST25 NFC tap apk file (STSW-ST25001)
- ST25 NFC tap open-source code (STSW-ST25002)
ST25 iOS mobile apps

- 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-ST25IOS002)
- Support iOS14 & iOS15 beta

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

ST25 PC software for ISO15693, ISO14443-A/B & NFC readers

- 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](https://example.com)) and open-source code ([STSW-ST25PC002](https://example.com))

ST solutions

- ST25 Dynamic Tags
- ST25 Tags
ST25 SDK

ST25 Software Development Kit

- 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*)

Customer application

ST25 Library

Reader Interface

- Android RF reader
- ST25R readers
- FEIG readers
- Custom RF reader

ST solutions

- ST25 Dynamic Tags
- ST25 Tags
• 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)
ST25 Webserver

ST25 Webserver demo for ST25 NFC Tags

- Open-source webserver: [www.myst25.com](http://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

ST solutions

- ST25 Tags
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
  - SPI

- NUCLEO board
  - RFAL 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](#))
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 (106kbps) and NFC-F (212 and 424kbps)
- Wakeup 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
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
  - Possibility to be written by a reader or by a smartphone

- Peer to peer (P2P) demonstration

- EMVCo Layer 1 support FW, on request

ST25R antenna matching software kit

ST NFC Reader “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)
ST25R Linux software kit

ST NFC Reader “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 solutions

- ST25 HF Reader
ST25R EMVCo software kit

ST NFC Reader “EMVCo” software Kit

- 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 pre-validated (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

ST solutions

- 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
ST25RU3993 UHF software overview

Software development tools for ST25R UHF Reader IC

- **Graphical User Interface (GUI)**
  - STSW-ST25RU001
  - GUI for ST25RU3993
  - PC software for Windows

- **Software Development Kit (SDK)**
  - STSW-ST25RU-SDK
  - ST25RU Firmware of ST25RU3993-HPEV board
  - ST25RU UHF library
    - STUHFL
  - HAL
    - Hardware Application Layer
      - Device
        - Protocol
          - Bus
  - Standards
    - EPC Gen2V2
    - ISO 18000-63
    - GB/T 29768

- **Open source, free to use software resources on application, middleware and firmware level.**

  - **Software Development Kit (SDK)**
    - UHF Application
    - ST25RU UHF Library (STUHFL)
    - Board Firmware (ST25RU3993-HPEV)
  - **ST25RU3993 Graphical User Interface (GUI)**
    - PC software with implemented example use cases and direct register access to ST25RU3993 Reader IC

- **ST solutions**
  - ST25 UHF Reader
ST25RU3993 Graphical User Interface

- PC software for ST25RU3993-HPEV board allowing full control and low level access to ST25RU3993 RAIN® Reader device for product evaluation & test
- The software supports following feature
  - Wide range of example use cases and features
  - Export of tag data and time stamps
  - Inventory visualization and performance chart
  - Direct access to ST25RU3993 registers
  - Multi protocol support (ISO 18000-63, EPC Class 1 Gen2, GB/T 29763)
  - Inventory with auto acknowledge for MCU relief
  - RSSI display & mode and frequency profile selection
  - Carrier cancellation and Tag access with crypto support
- ST25RU3993 PC GUI SW (STSW-ST25RU001)

ST solutions
- ST25 UHF Reader
ST25RU3993 UHF application

- UHF application examples for quick implementation of individual GUI or other interfaces
- Examples allow development of own customized applications via copy & paste
- Available for operating systems
  - Windows
  - Linux
- Available for MCU native (FW)
  - Can be run directly on MCU (STM32L4)
- Included inside ST25RU3993 SDK (STSW-ST25RU-SDK)

**UHF application example (ST25RU3993 SDK)**

**Host based application**
- OS (Windows, Linux) or MCU native
  - ST25RU UHF library (STUHFL)
  - e.g. UART, ...

**Device/Reader module with e.g. STM32L476 MCU**
- ST25RU Board Firmware
- ST25RU3993

**Device embedded application**
- MCU native
  - ST25RU UHF library (STUHFL)
  - ST25RU Board Firmware
  - MCU

**Host**
- e.g. RPi 3B

**Device/Reader module**
- with e.g. STM32L476 MCU
- ST25RU3993

**ST solutions**
- ST25 UHF Reader
Comprehensive middleware to build RAIN® RFID enabled applications for reader devices based on ST25RU3993

- Written in pure ANSI C
- POSIX compliant
- Straightforward portability across different platforms (MCU/RTOS/OS)
- SW Wrappers for state-of-the-art programming languages: Java / C# / Python
- Compliant with main UHF standards: EPC Gen2v2, ISO18000-63 & GB/T29768
- Source code examples available
  - Windows®
  - Linux® (Raspberry Pi 3B & 4B)
  - Embedded (STM32L4 device)
- Included inside ST25RU3993 SDK (STSW-ST25RU-SDK)

ST solutions

- ST25 UHF Reader
ST25RU3993 Firmware for MCU

Firmware for ST25RU3993 Discovery board

- MCU with open-source firmware managing ST25RU3993 driver for various UHF RFID protocols and implementing a software interface to the ST UHF library (STUHFL)
- Reference based on STM32 MCU
- Included inside ST25RU3993 SDK (STSW-ST25RU-SDK)

Board Hardware with ST25RU3993

- ST25RU UHF library STUHFL
- Standards: EPC Gen2V2, ISO 18000-63, GB/T 29768
- HAL Hardware Application Layer: Device, Protocol, Bus

ST solutions
- • ST25 UHF Reader
Solutions for NFC / RFID Tags & Readers

ST25 SIMPLY MORE CONNECTED
Our technology starts with You

Find out more at www.st.com/st25