ST25TV product presentation

June 2018
ST25TV512 / 02K Product

• The ST25TV chip belongs to ST25 NFC / RFID Tags & Readers family
  • ST25TV is the natural evolution of LRI2K series

• The ST25TV512 / ST25TV02K main features:
  • NFC Forum Tag Type 5 / ISO15693 RF interface
  • Up to 2kbit EEPROM memory with Lock per memory blocks
  • 32-bit encrypted passwords / 64-bit encrypted passwords for data protection
  • 16-bit counter for 1st write access monitoring
  • Unique Identifier for each device (64-bit UID)
  • Kill & Untraceable modes
  • Tamper detect pin for open/short detection
  • TruST25 Digital Signature
  • Electrical Article Surveillance
  • 60-year data retention & 100Kcycles erase/write
  • SBN12 / SBN075 / DFN5 package versions
• The ST25TV64K chip belongs to ST25 NFC / RFID Tags & Readers family.

• The ST25TV64K main features:
  • **NFC Forum Tag Type 5** / ISO15693 RF interface
  • **Up to 64kbit** EEPROM memory with Lock per memory blocks
  • **Multiple 64-bit passwords** for data protection
  • Unique Identifier for each device (64-bit UID)
  • 40-year data retention & 1Mcycles erase/write
  • SBN12 package version
Main ST25TV Market Segments

- **Smart City**
  - Services: Library, Access control

- **Smart Industry**
  - Identification, Asset Tracking

- **Smart Things**
  - Consumer engagement, Authentication
ST25TV Use Cases

Consumer Engagement

Tamper detection

Detects if the bottle has been opened

Brand Protection / Anti-counterfeiting

Based on cloud management

Traceability / Product Identification


NFC figurines for gaming

Figurines configuration before stating the game

Access control

Device personalization in production

In-the-box quick personalization thanks to Long range
Typical RF Range

NFC Android phone

ISO15693 (26kb/s)
Up to 7 cm / 3in.

RFID reader

ISO15693 (26kb/s)
Up to 40cm / 1.3ft

ST25TV
EEPROM

Up to 1.0 m / 3ft

Reduce your antenna dimension and make your product more robust thanks to ISO15693
ST25TV Low Density NFC Tags

**ST25TV512 / 02K**

<table>
<thead>
<tr>
<th>RF Tag</th>
<th>ISO 15693</th>
<th>EEPROM 512-bit / 2K-bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFC Type V</td>
<td>Long range</td>
<td>NDEF</td>
</tr>
<tr>
<td></td>
<td>26kb/s (53kb/s)</td>
<td>64-bit “encrypted” password</td>
</tr>
<tr>
<td>Tamper Detect</td>
<td>16-bit counter</td>
<td>TruST25 Digital signature</td>
</tr>
</tbody>
</table>

**Use cases**
- Identification, access control, NFC tags, gaming
- Tamper proof application

**Key Features**
- **ISO15693 and NFC Type V**
- Long range operations, up to 53kb/s speed
- **Tamper Detect pin** for open / short detection
- **TruST25** digital signature
- Counter 16-bit with anti-tearing

**Key Benefits**
- **Specific Features** for Library Application
- Cloning Protection with **Digital Signature** in association with Cloud management
- Same RF tuning capacitor as LRI2K (23.5pF / 97pF)

**FPN5**
- **SBN12 / SBN075**
  - Die form, sawn and Bumped inkless 8" wafer, 120µm/75um thickness
# ST25TV High Density NFC Tags

## 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
- **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 (28.5pF)

### ST25TV64K

<table>
<thead>
<tr>
<th>RF Tag</th>
<th>ISO 15693</th>
<th>EEPROM 64K-bit</th>
<th>64-bit password</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFC Type V</td>
<td>Long range</td>
<td>01001101110000 00110101001110 10110001101110</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>26kb/s</strong> (53kb/s)</td>
</tr>
</tbody>
</table>

**SBN12**
- Die form, sawn and Bumped inkless 8” wafer, 120µm thickness
## Key Features

<table>
<thead>
<tr>
<th>ST25TV512</th>
<th>ST25TV512-AD</th>
<th>ST25TV64K</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST25TV02K</td>
<td>ST25TV02K-AD</td>
<td>SBN12*</td>
</tr>
</tbody>
</table>

### Contactless Interface
- **ISO15693 / NFC Forum Type 5 + annexes 3 & 4**

### RF range
- **Long range, up to 100cm**

### RF speed
- **up to 53kbps (26kbps standard)**

### Memory format
- **EEPROM (preformatted NDEF)**
- **EEPROM (preformatted NDEF)**
- **EEPROM data**

### Memory size
- **512-bit / 2k-bit**
- **512-bit / 2k-bit**
- **64k-bit**

### Data protection
- **1x 64-bit encrypted password or 2x 32-Bit encrypted passwords**
- **1x 64-bit encrypted password or 2x 32-Bit encrypted passwords**
- **Password 64-bit**

### Data protection
- **1x 64-bit encrypted password or 2x 32-Bit encrypted passwords**
- **1x 64-bit encrypted password or 2x 32-Bit encrypted passwords**
- **Password 64-bit**

### Extra Features
- **NA**
- **Tamper Detect**
- **NA**

### Counter
- **16-bit counter**
- **16-bit counter**
- **NA**

### RF tuning capacitor
- **23.5pF / 97pF**
- **23.5pF / 97pF**
- **28.5pF**

### Temperature range
- **-40°C to +85°C**
- **-40°C to +85°C**
- **-40°C to +85°C**

### Package
- **SBN12* / SBN075***
- **SBN12* / SBN075* / DFN5**
- **SBN12***

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* SBN12: Die form, sawn and Bumped wafer, 120µm thickness, inkless 8” wafer
* SBN075: Die form, sawn and Bumped wafer, 120µm thickness, inkless 8” wafer
ST25TV512/02K Memory Mapping

Customer choices

2K-bit User area

Area 1

Area 2

256-bit EAS
16-bit Counter
Configuration Zone
Digital Signature

Data Storage Family IDentifier used in the anticollision algorithm
Application Family Identifier
Unique IDentifier used during the anticollision sequence

Configuration
Access rights

00
Area (1 or 2) readable and writable

01
Area (1 or 2) protected in Write by password

10
Area (1 or 2) protected in Read and Write by password

11
Area (1 or 2) protected in Read. Area (1 or 2) disabled in Write
Memory Configuration (1/2)

Flexible User Memory Configuration Versus Use Cases

1 Zone

- USER MEMORY with 64-bit Password
  - Configuration Zone
  - 256-bit EAS
  - 16-bit Counter
  - 256-bit TruST25 Signature

2 Zones

- Using "memory partitioning by password" (Area1 & Area2)
  - USER MEMORY with 32-bit Password
    - Configuration Zone
    - 256-bit EAS
    - 16-bit Counter
    - 256-bit TruST25 Signature
  - USER MEMORY With 32-bit Password

3 Zones

- Combining "Block lock" + "memory partitioning by password" (Area1 & Area2)
  - USER MEMORY using Block Lock feature
    - Configuration Zone
    - 256-bit EAS
    - 16-bit Counter
    - 256-bit TruST25 Signature
  - USER MEMORY with 32-bit Password
  - USER MEMORY With 32-bit Password

Sized with URL length and Permanently locked by block of 4 bytes

NB: Block 0 is always readable (NFC Forum Capability Container)
Memory Configuration (2/2)

Block lock for permanent lock and Password for access rights

USER MEMORY

URL area
(permanent lock)
www.ST.com

AREA 1
(access right configuration
« 00 » or « 01 » only)

AREA 2
(any access rights configuration)

Using Lock Block feature

Memory Blocks (4 Bytes) that can be
Locked individually

Password protection
ST25TV512/02K Data Protection

- User memory Password protection
  - Readable, Writable, No Read, No Write combination on each area
  - Password presentation is encrypted (Password writing is unencrypted)

- Password encryption presentation in dedicated Application note: ANxxxx

- Each Block of 4 bytes can be Locked individually to prevent data to be modified

- Specific Features are password protected
  - Electrical Article Surveillance (EAS)
  - Kill
  - Untraceable
**ST25TV64K Memory & Data Protection**

- **High Density EEPROM**
  - 64-kbit
  - User EEPROM area configurable in flexible areas (up to 4, granularity 32 bytes)
    - Each area is individually read-/write- protected by password command → **64-bit password**
- **System EEPROM area**
  - Access protected by **64-bit password** (Write)
- **Specific block used to store a 64-bit UID**
  - Unique Identifier
  - Its value is written by ST on the production line
  - used during the anticollision sequence (Inventory)
- **5 additional 64-bit blocks that store**:
  - 1 RF configuration password (access from RF),
  - 3 RF area access password codes (access from RF)

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**ISO 15693**

- RF write access to system configuration can be locked by writing LockCFG register (from RF or I2C).
  - Cannot be unlocked by RF

**RF passwords**

- RF Password0
- RF Password1
- RF Password2
- RF Password3

**Data storage identifiers**

- 8 bit DSFID
- 8 bit AFI
- 64 bit UID

- **Unique IDentifier** used during the anticollision sequence
ST25TV512/02K Tamper Detect

Open or Close?

• Overview
  • The short impedance is under ~7.5 kΩ.
  • State of tamper detection (Open / Close) can be read in a dedicated register
    • No memory of history
    • User need to use EEPROM to log the different states of the Tamper detect register

• As tamper detect historic status is not memorized, Tamper detect function is considered as an indicator only and cannot be considered as a protection. Can be coupled to a physical protection
• Memorization of the tamper detect historic can be done with the use of the cloud
ST25TV512/02K Kill Mode

**Non Reversible**

1. **NFC phone**
   - **Kill command**

2. **NFC phone**
   - **Commands**

**PREREQUISITE**
- Kill Password has to be configured
- Kill Password must be locked

**ST25TV EEPROM**
- Non Reversible

**ST25TV EEPROM**
- No more RF Communication Available
ST25TV512/02K Untraceable Mode

To respect Privacy

1. **Untraceable Mode Enable**
   - EnableUntraceableMode cmd

2. **Only two Commands**
   - Get_random_number cmd
   - Present_Password cmd

**PREREQUISITE**
- Password has to be configured
- Same Password as Kill Mode

Can be Detected only by Reader with dedicated SW able to send specific commands and no Inventory commands
Electronic Article Surveillance

Overview

- Library management system such as advanced inventory goods
- Anti-theft protection
  - System can check anytime the presence of EAS telegram in tags as
- A telegram identifying the goods to protect (e.g. apparel..) is stored using write commands in User Memory. His length can be 32 Bits to 256 Bits.
- The EAS can be
  - Dis/Enable
  - Lock & Protected
  - Reset
TruST25™ for Digital Signature

Overview

• TruST25™ encompasses industrialization processes and tools deployed by STMicroelectronics to create and write Digital Signature in house and that benefits from Secure product environment (HSM FIPS140-2)

• Digital Signature allows applications to verify the authenticity of a product.

• A dedicated application note ANxxxx will describe the digital Signature and how to read and verify the TruST25™ Digital Signature. Distributed under NDA.

• Public Key will sent to customers
TruST25™ Signature Creation

ST in-Factory Digital Signature creation in secure environment

- **ST Private Key (KID)**
- **HSM (FIPS 140-2 compliant)**
- **In-factory signature creation and programming**
- **UID base**
- **ST25T**
  - **UID**
  - **TruST25™ Digital Signature + KID**
  - **Counter**
  - **User memory**

Same environment as secure products

**For higher protection**
Digital Signature protect ST customers (inlay makers) against copy. This is a protection in the supply chain. To protect consumer the SI has to embed the signature of applicative data.
TruST25™ Digital Signature Verification

Verify TruST25™ Digital Signature

Cloud Management

ST25T
- UID
- TruST25™ Digital Signature + KID
- Counter
- User memory

ST Public key (KID)
- UID
- Signature computation in cloud

TruST25 signature
- Compare

Cloud-based Clone verification (TRUST/ NO TRUST)

NO MATCH

MATCH
## RF Characteristics

<table>
<thead>
<tr>
<th>RFID and NFC specifications</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th>ST25TV512/02K</th>
<th>ST25TV64K</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard</strong></td>
<td>Based on ISO15693 + amendments 3 &amp; 4 NFC Forum type V</td>
<td></td>
</tr>
<tr>
<td><strong>Main carrier frequency</strong></td>
<td>13.56MHz</td>
<td></td>
</tr>
<tr>
<td><strong>Data sub-carrier frequency</strong></td>
<td>423kHz/484KHz</td>
<td></td>
</tr>
<tr>
<td><strong>Optimal frequency tuning</strong></td>
<td>13.6MHz – 14MHz</td>
<td></td>
</tr>
<tr>
<td><strong>Internal capacitor (measured at 2V peak to peak)</strong></td>
<td>23.5pF / 97pF</td>
<td>28.5pF</td>
</tr>
</tbody>
</table>
ST25TV Packages

Bump and FPN5 Packages

- **UFDFPN5 Package** – 1.7 x 1.4mm

  TD1 | 5 |
  --- | --- |
  NC  | 2 |
  AC1 | 4 |

  Bottom view

- **Sawn & Bumped for wafer**

  - **ST25TV512/02K**
  - **ST25TV64K**


<table>
<thead>
<tr>
<th>Bump</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AC0</td>
</tr>
<tr>
<td>2</td>
<td>AC1</td>
</tr>
<tr>
<td>3</td>
<td>NC or TDIN for -AD</td>
</tr>
<tr>
<td>4</td>
<td>NC or TDOUT for -AD</td>
</tr>
</tbody>
</table>

  - **SBN12/075**

  *: sawn and bumped inkless 8" wafer, 120µm/75um thickness

<table>
<thead>
<tr>
<th>Bump</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>AC0</td>
</tr>
<tr>
<td>3</td>
<td>AC1</td>
</tr>
<tr>
<td>7</td>
<td>Do not connect</td>
</tr>
</tbody>
</table>
ST25TV Eco-system DNA

Easy-to-use and customer-oriented

- Discovery kit
- Antenna e-design tool
- Schematic, BOM, Gerber
- Mobile Apps ST25 SDK
- PC software tool ST25 SDK
- Documentation
ST25TV Evaluation Board

ST25TV eSeal Board

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

ST25TV-eSeal
<table>
<thead>
<tr>
<th>ST25TV</th>
<th>Package</th>
<th>512-bit</th>
<th>2k-bit</th>
<th>64K-bit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SBN075*</td>
<td>ST25TV512-AP6F3</td>
<td>ST25TV02K-AP6F3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ST25TV512-AP6F9</td>
<td>ST25TV02K-AP6F9</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ST25TV512-AD6F3</td>
<td>ST25TV02K-AD6F3</td>
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<td>ST25TV512-AD6F9</td>
<td>ST25TV02K-AD6F9</td>
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<tr>
<td></td>
<td>FPN5</td>
<td>ST25TV02K-AD6H3</td>
<td></td>
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</table>

NFC / RFID tag
RF ISO15693 interface
Thank You!

Solutions for NFC / RFID Tags and Readers