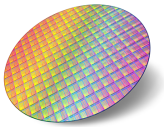
NFC Type 5 / RFID tag IC with up to 2-Kbit EEPROM, product identification and protection





Wafer

Product status link
ST25TV02K
ST25TV512

Features

Contactless interface

- Based on ISO/IEC 15693
- NFC Forum Type 5 tag certified by the NFC Forum
- Supports all ISO/IEC 15693 modulations, coding, subcarrier modes and data rates
- Custom Fast read access up to 53 Kbit/s
- Single and multiple block reads
- Single block writes
- Internal tuning capacitance: 23 pF, 99.7 pF
- Proprietary Inventory commands for speeding up the inventory process

Memory

- Up to 2 Kbits of EEPROM
- RF interface accesses blocks of four bytes
- Write time from RF: typical 5 ms for one block
- Data retention: 60 years
- Minimum endurance: 100 k write cycles
- 16-bit event counter with anti-tearing

Data protection

- User memory: two or three areas, read and/or write protected by two 32-bit encrypted passwords for three areas or one 64-bit encrypted password for two areas
- System configuration: write protected by a 32-bit encrypted password
- Permanent write locks at a block level

Product identification and protection

- Kill mode and untraceable mode
- Tamper detect capability (patent pending)
- TruST25 digital signature
- EAS (electronic article surveillance) capability

Privacy protection

- Consumer privacy can be protected through the following features:
  - Kill mode
  - Untraceable mode
- In association with:
  - Passwords with cover coding
  - Data and configuration locks (permanent or temporary)

Temperature range

- From - 40 to 85 °C

Package

- Sawn and bumped wafer, ECOPACK2 (RoHS compliant)
- 5-pin package, ECOPACK2 (RoHS compliant)

Compatibility ST25TV02K / LRI2K

- Full compatibility in terms of functionality and capacitances with two exceptions:
  - Kill command requires option_flag to be set to 0
  - Error codes and error generation can be different on a per command basis

1 Description

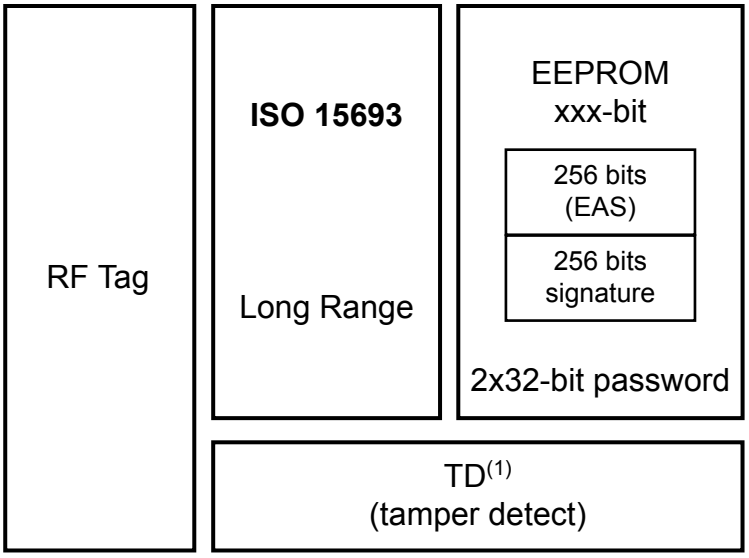
ST25TV02K and ST25TV512 are NFC/RFID tag ICs with a tamper-proof feature, and specific modes to protect tag access, such as Untraceable mode.

These devices feature a digital signature used to prove the origin of the chip in cloning detection, embed a configurable EEPROM with 60-year data retention, and can be operated from a 13.56 MHz long-range RFID reader or an NFC phone.

The contactless interface is compatible with the ISO/IEC 15693 standard and NFC Forum Type 5 tag.

1.1 ST25TV02K/512 block diagram (with tamper detect)

Figure 1. ST25TV02K/512 (with tamper detect) block diagram

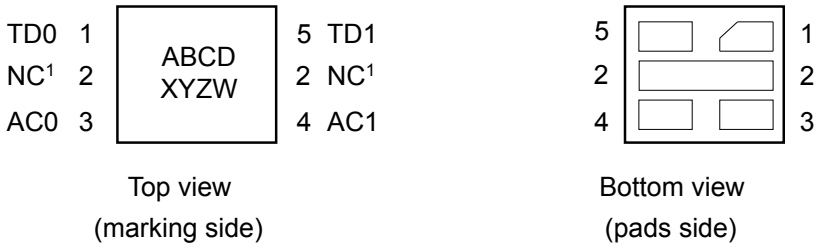


1. tamper detect is optional.

Table 1. Signal names

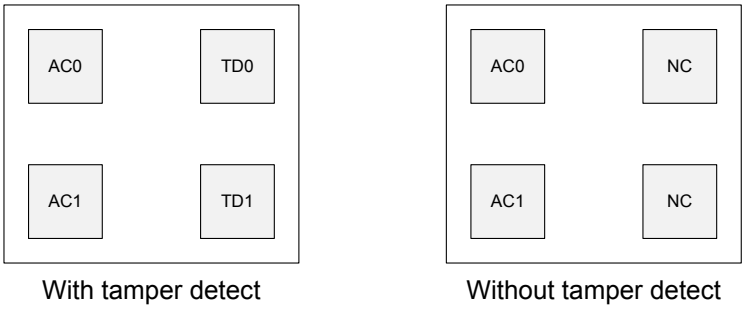
Signal name	Function	Direction
AC0	Antenna coil	I/O
AC1	Antenna coil	I/O
TD0	Tamper detect loop	I/O
TD1	Tamper detect loop	I/O

Figure 2. DFN5 package connections diagram (with tamper detect)



1: Not Connected

Figure 3. Die connections for sawn and bumped wafer (bottom view)



2 Description of signals

2.1 Antenna coil (AC0, AC1)

These inputs are used exclusively to connect the ST25TV02K/512 devices to an external coil. It is advised not to connect any other DC or AC path to AC0 or AC1.

When correctly tuned, the coil is used to power and access the device using the ISO/IEC 15693 and ISO 18000-3 mode 1 protocols.

2.2 Tamper detect (TD0, TD1)

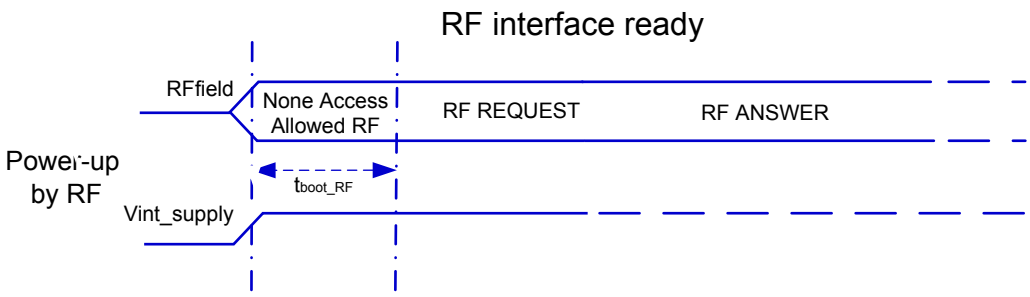
These inputs are used to connect a wire loop to the ST25TV02K/512 devices to detect an open or a short between the two pins TD0, TD1.

3 Power management

3.1 Device set

To ensure a proper boot of the RF circuitry, the RF field must be turned ON without any modulation for a minimum period of time t_{boot_RF}. Before this time, ST25TV02K/512 ignores all received RF commands. (See Figure 4. RF power-up sequence).

Figure 4. RF power-up sequence



3.2 Device reset

To ensure a proper reset of the RF circuitry, the RF field must be turned off (100% modulation) for a minimum t_{RF_OFF} period of time.

4 Memory management

4.1 Memory organization overview

The ST25TV02K/512 memory is divided in two main memory areas:

- User memory
- System configuration area

The ST25TV02K/512 user memory can be divided into two or three user areas. Area 0 starts at address 0, it has 1 block size, it is always readable, and it can be locked.

The rest of the user memory can be either configured as one single area (Area 1) and can be read - and/or - write-protected with one 64-bit password, or configured as two areas (Area 1 and Area 2), which can be individually read - and/or - write-protected with a 32-bit password each. When Area 2 exists, Area 2 starts at the block number corresponding to half the user memory.

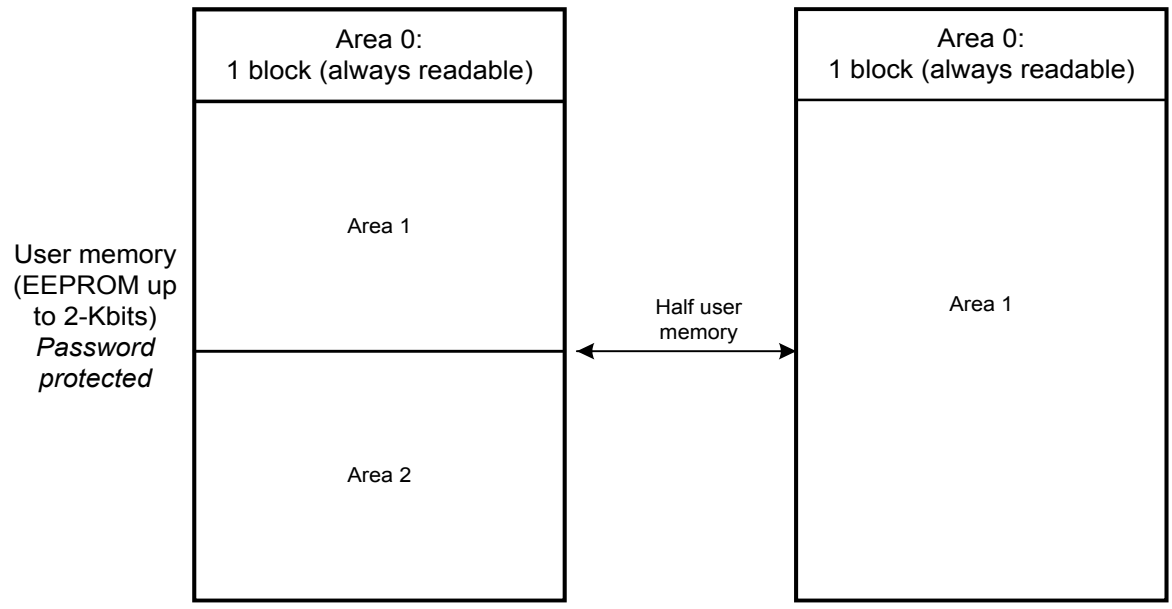
Furthermore, each block can be locked permanently and individually for larger flexibility in number of areas

The ST25TV02K/512 system configuration area contains registers to configure all ST25TV02K/512 features, which can be tuned by user. Its access is protected by a 32 bit configuration password.

This system configuration area also includes read only device information such as IC reference, memory size, as well as a 64-bit block that is used to store the 64-bit unique identifier (UID), the AFI (default 00h) and DSFID (default 00h) registers, the TruST25™ digital signature. The UID is compliant with the ISO 15693 description, and its value is used during the anticollision sequence (Inventory). The UID value is written by ST on the production line. The AFI register stores the application family identifier. The DSFID register stores the data storage family identifier used in the anticollision algorithm.

The system configuration area includes blocks that store up to two RF user area access passwords and a RF configuration password.

Figure 5. Memory organization



Note: Each block can be individually locked

4.2 User memory

User memory is addressed as blocks of 4 bytes, starting at address 0. Table 2. 2Kb user memory as seen by RF shows how memory is seen from RF interface.

Table 2. 2Kb user memory as seen by RF

RF command (block addressing)	User memory			
	RF block 00h			
	Byte 0003h	Byte 0002h	Byte 0001h	Byte 0000h
Read Single Block	RF block 01h			
Read Multiple Blocks	Byte 0007h	Byte 0006h	Byte 0005h	Byte 0004h
Fast Read Single Block				
Fast Read Multiple Blocks	RF block 02h			
Write Single Block	Byte 0011h	Byte 0010h	Byte 0009h	Byte 0008h
Inventory Read				
Fast Inventory Read	....			
	RF block 3Fh			
	Byte 03FFh	Byte 03FEh	Byte 03FDh	Byte 03FCh

4.2.1 User memory areas

The user memory can be split into two or three different areas as showed in Table 3. Memory Organization

Table 3. Memory Organization

Part Number	Three areas configuration			Two areas configuration	
	Area 0	Area 1	Area 2	Area 0	Area 1
ST25TV512	Block 0	Block 1 to 7	Block 8 to 15	Block 0	Block 1 to 15
ST25TV02K	Block 0	Block 1 to 31	Block 32 to 63	Block 0	Block 1 to 63

Each area has a distinct access privilege as explained below:

- Area 0 is always readable. It can be locked.
- Areas 1 and 2 can be protected in read and/or write access by password.

Each block of Areas 1 and 2 can be individually locked (see Section 5.2 Data protection).

4.3 System configuration area

In addition to the user memory, the ST25TV02K/512 include a set of registers located in the system configuration area memory (EEPROM nonvolatile registers). These registers are set during device configuration (i.e.: area extension), or by the application (i.e.: area protection)., their content is read during the boot sequence and defines basic ST25TV02K/512 behaviour.

The registers located in the system configuration area can be accessed via dedicated Read Configuration and Write Configuration commands, with a pointer acting as the register address.

The configuration security session must first be open, by presenting a valid configuration password, to grant write access to system configuration registers.

Table 4 shows the complete map of the system configuration area.

Table 4. System configuration memory map accessible through write_cfg and read_cfg commands

RF access		Static Register	
Address	Type	Name	Function
00h	RW (1)	Table 8. A1SS	Area 1 access protection
01h	RW(1)	Table 9. A2SS	Area 2 access protection
02h	RW(1)	Table 17. EAS_SEC	EAS Security
03h	RW(1)	Table 22. CNT_CFG	Counter Configuration
04h	RO	Table 23. CNT_VAL	Counter Value
05h	RO	Table 24. TAMPER_DETECT	Tamper Detect
06h	RW(1)	Table 10. LOCK_CFG	Configuration locked
07h	RO	Table 21. KID	Key identifier

1. *Write access is granted if RF configuration security session is open and configuration is not locked (LOCK_CFG register equals to 0).*

Table 5. System configuration memory map for registers accessed through dedicated commands

RF access		Static Register	
Address	Type	Name	Function
N/A	WO (1)	Table 25. LOCK_DSFID	DSFID lock status
N/A	WO (2)	Table 26. LOCK_AFI	AFI lock status
N/A	WO(1)	Table 27. DSFID	DSFID value
N/A	WO(2)	Table 28. AFI	AFI value
N/A	RO	Table 29. IC_REF	IC reference value
N/A	RO	Table 30. UID	Unique identifier, 8 bytes
N/A	WO (3)	Table 7. PWD_KILL	Kill or untraceable password, 4 bytes
N/A	WO (4)	Table 12. PWD_A1	User Area 1 security session password, 4 bytes
N/A	WO(3)	Table 13. PWD_A2	User Area 2 security session password, 4 bytes
N/A	WO(3)	Table 11. PWD_CFG	Configuration security session password, 4 bytes

1. *Write access if DSFID is not locked*
2. *Write access if AFI is not locked.*
3. *Write access only if not locked.*
4. *Write access only if corresponding security session is open.*

5 ST25TV02K/512 specific features

ST25TV02K/512 offer the data protection feature, both user memory and system configuration, a kill mode, and a untraceable mode.

Those features can be programmed by setting registers of the ST25TV02K/512. ST25TV02K/512 can be partially customized using configuration registers located in the EEPROM system area.

These registers are dedicated to:

- Data Memory organization and protection AiSS, LOCK_BLOCK.
- Kill mode, KILL
- The device's structure LOCK_CFG
- Electronic Article Surveillance (EAS)
- TruST25™ digital signature
- Counter
- Tamper Detect
- Random Number generation
- Untraceable mode

A set of additional registers allows to identify and customize the product (DSFID, AFI, IC_REF, etc.).

Dedicated commands Read Configuration and Write Configuration must be used to access the configuration registers. Update is only possible when the access right has been granted by presenting the configuration password (PWD_CFG), and if the system configuration was not previously locked (LOCK_CFG=1).

After any valid write access to the configuration registers, the new configuration is immediately applied.

5.1 Kill mode

5.1.1 Kill registers

Table 6. KILL

RF	Command	Kill (cmd code A6h) UID @00h	
	Type	WO if PWD_KILL is correctly presented in the Kill command.	
Bit	Name	Function	Factory value
N/A	KILL_MUTE	Status of the KILL feature	Inactive

Table 7. PWD_KILL

RF	Command	Write pswd (cmd code B1h) with pswd_id = 0h	
	Type	WO: only possible if PWD_KILL is not locked.	
Bit	Name	Function	Factory value
b31-b0	KILL_PSWD	Password value for kill feature or untraceable mode	00000000h

Note: Refer to Table 5. System configuration memory map for registers accessed through dedicated commands .

5.1.2 Kill mode description

KILL register allows the user to permanently kill the ST25TV02K/512 tag.

Two working modes are offered by ST25TV02K/512:

- Kill mute mode:
  - When KILL_MUTE is set with the Kill command code, the ST25TV02K/512 are killed. They can not be read or written and stays mute to any request. Kill mute mode is definitive.
- Normal mode:
  - In normal usage, KILL_MUTE is set to 0, ST25TV02K/512 will process the request and respond accordingly.

The Kill Password PWD_KILL must be presented in the Kill command for setting the Kill Mute mode.

Kill Password lock

By default, the Kill password is not write protected. The kill password can be locked with Lock kill (cmd code B2h). For safe operation, it is recommended to change the default value of the Kill Password and lock it even if not used in the final product

When not used in an end application, a random value should be written into the KILL_PWD and the KILL_PWD should be locked with Lock kill.

5.2 Data protection

ST25TV02K/512 provide a special data protection mechanism based on encrypted passwords that unlock security sessions.

User memory can be protected for read and/or write access and system configuration can be protected from write access. User memory can also be permanently locked. Each block can be independently locked from each other with the Lock block command (refer to Section 6.4.8 Lock block).

5.2.1 Data protection registers

Table 8. A1SS

RF	Command	Read Configuration (cmd code A0h) @00h Write Configuration (cmd code A1h) @00h	
	Type	R always, W if configuration security session is open and configuration not locked	
Bit	Name	Function	Factory value
b1-b0	RW_PROTECTION_A1	Area 1 access rights: 00: Area 1 access: Read is always allowed / Write always allowed 01: Area 1 access: Read is always allowed and if user security session is open (i.e. the proper area 1 password has been presented), write is allowed. 10: Area 1 access: Read and Write are allowed only if user security session is open (the proper area 1 password has been presented). 11: Area 1 access: Read is allowed only if user security session is open (the proper area 1 password has been presented). Write is always forbidden.	00b
b2	MEM_ORG	0: memory is split in three areas (Areas 0, 1 and 2) 1: memory is composed of two areas (Areas 0 and 1)	1b
b7-b3	RFU	-	00000b

Note: Refer to Table 4. System configuration memory map accessible through write_cfg and read_cfg commands

Table 9. A2SS

RF	Command	Read Configuration (cmd code A0h) @01h Write Configuration (cmd code A1h) @01h	
	Type	R always, W if configuration security session is open and configuration not locked	
Bit	Name	Function	Factory value
b1-b0	RW_PROTECTION_A2	Area 2 access rights: 00: Area 2 access: Read and write are always allowed 01: Area 2 access: Read is always allowed, and if the user security session is open (i.e. the proper Area 2 password has been presented), then write is allowed. 10: Area 2 access: Read and Write are allowed only if the user security session is open (the proper Area 2 password has been presented) 11: Area 2 access: Read is allowed only if user security session is open (the proper Area 2 password has been presented). Write is always forbidden.	00b
b7-b2	RFU	-	000000b

Note: Refer to Table 4. System configuration memory map accessible through write_cfg and read_cfg commands

Table 10. LOCK_CFG

RF	Command	Read Configuration (cmd code A0h) @06h Write Configuration (cmd code A1h) @06h	
	Type	R: always possible W: if RF configuration security session is open (configuration password has been presented before) and configuration not locked	
Bit	Name	Function	Factory value
b0	LCK_CFG	0: Configuration is unlocked (configuration registers can be written) 1: Configuration is locked (configuration registers are definitively locked)	0b
b7-b1	RFU	-	0000000b

Note: Refer to Table 4. System configuration memory map accessible through write_cfg and read_cfg commands

Table 11. PWD_CFG

RF	Command	Write pswd (cmd code B1h) with pswd_id = 3h	
	Type	WO: if RF configuration security session is open (configuration password has been presented before). If the configuration is locked, and the EAS configuration is protected by password, the new PWD_CFG value is only applicable to the EAS configuration.	
Bit	Name	Function	Factory value
b31-b0	CFG_PSWD	Password value for configuration area	00000000h

Note: Refer to Table 5. System configuration memory map for registers accessed through dedicated commands

Table 12. PWD_A1

RF	Command	Write pswd (cmd code B1h) with pswd_id = 1h	
	Type	WO: if RF area 1 security session is open (area 1 password has been presented before).	
Bit	Name	Function	Factory value
b31-b0	A1_PSWD	When MEM_ORG=0: Password value for user area 1 When MEM_ORG=1: 32 least significant bits of the 64-bit Password value for user area 1	00000000h

Note: Refer to Table 5. System configuration memory map for registers accessed through dedicated commands

Table 13. PWD_A2

RF	Command	Write pswd (cmd code B1h) with pswd_id = 2h	
	Type	WO: if RF area 2 security session is open (area 2 password has been presented before). Only applicable to the case of MEMORG=0	
Bit	Name	Function	Factory value
b31-b0	A2_PSWD	When MEM_ORG=0: Password value for user area 2 in case of three area memory setup When MEM_ORG=1: 32 most significant bits of area 1 password in case of two area memory setup (in this last case area 1 password is 64-bit long)	00000000h

Note: Refer to Table 5. System configuration memory map for registers accessed through dedicated commands .

5.2.2 Passwords and security sessions

ST25TV02K/512 provide protection of user memory and system configuration registers. The users can access those protected data by opening security sessions with the help of passwords. Access rights are more restricted when security sessions are closed, and less restricted when security sessions are open.

There are two types of security sessions, as shown in Table 14:

Table 14. Security session type

Security session	Open by presenting	Right granted when security session is open, and until it is closed
user	password Area 1, Area 2 (PWD_A1, PWD_A2)	user access to protect user memory as defined in AiSS registers user write access to password A1 or A2(1)
configuration	Configuration password (PWD_CFG)	user write access to configuration registers

1. *Write access to the password number corresponding to the password number presented.*

In a three areas set up (MEM_ORG set at 0), each of the User Area 1 and 2 passwords is 32-bits long, and default factory passwords value is 00000000h.

In a two areas setup (MEM_ORG set at 1), User Area 1 password is 64-bits long, and default factory password value is 0000000000000000h.

The ST25TV02K/512 passwords management is organized around dedicated set of commands to access the dedicated registers in system configuration area.

The dedicated password commands are:

- Write Password command (code B1h): See Section 6.4.20 Write Password.
- Present Password command (code B3h): See Section 6.4.21 Present Password

User possible actions for security sessions are:

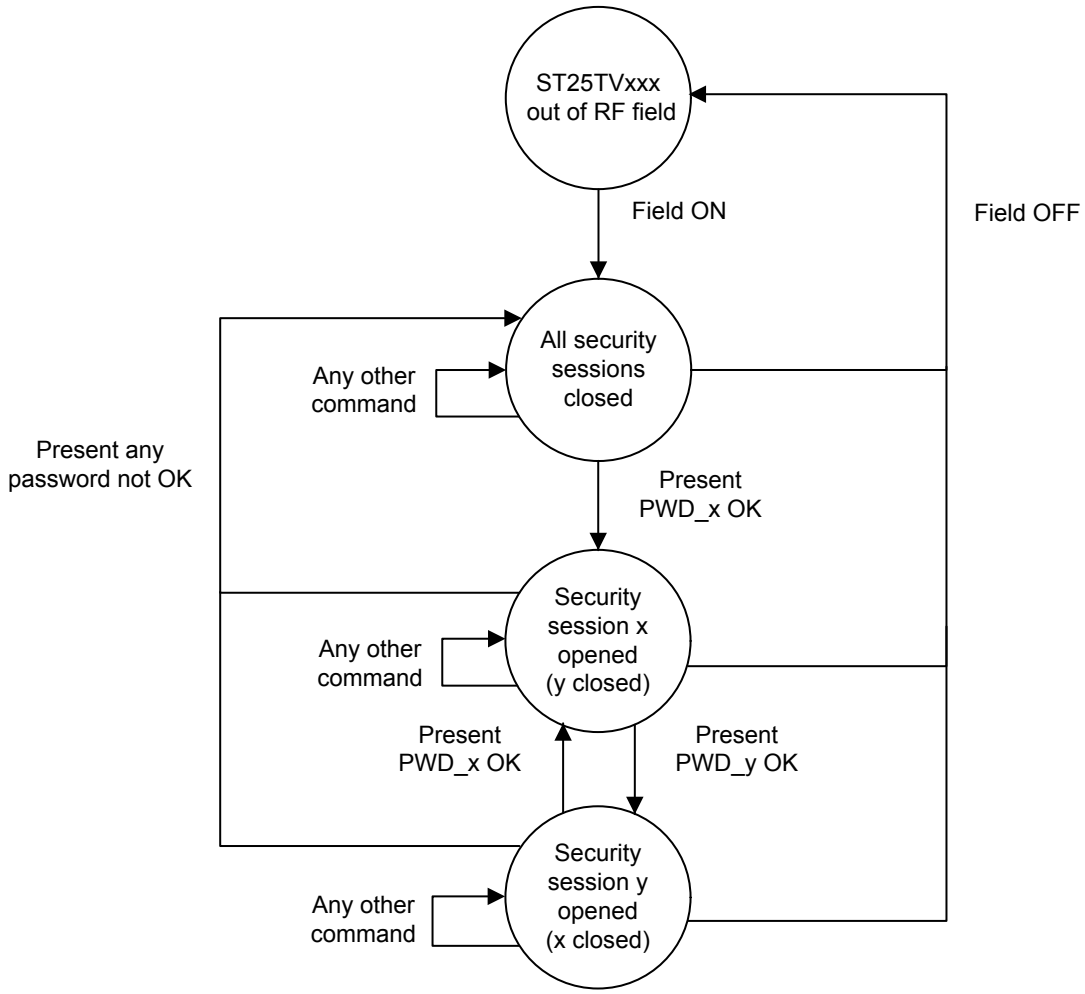
- **Open user security session**: Present Password command, with password identifier 1 for PWD_A1 and 2 for PWD_A2 for three areas configuration or identifier 1 for PWD_A1 for two areas configuration, and the valid corresponding password
- **Write password**:
  - When MEMORG=0:

    Present Password command, with password identifier 1 for PWD_A1 and 2 for PWD_A2 and the current valid corresponding password. Then Write Password command, with same password number (1 or 2) and the new corresponding password.
  - When MEMORG=1:

    present PWD_A1 (64 bits), then Write Password command with PWD_A1 and then PWD_A2
- **Close user security session**: Present Password command, with a different password number than the one used to open session or any wrong password. Or remove tag from RF field (POR).
- **Open configuration security session**: Present Password command, with password number 3 and the valid password PWD_CFG.
- **Close configuration security session**: Present Password command, with a password number different than 3, or password number 3 and wrong password PWD_CFG. Or remove tag from field (POR).

Opening any new security session (user or configuration) automatically close the previously open one (even if it fails).

Figure 6. Security sessions management



5.2.3 User memory protection

On factory delivery, areas are not protected.

Each area can be individually protected in read and/or write access.

Area 0 is always readable.

Furthermore, Area 0 can be independently write locked.

Each memory area can also have individual Read/Write access conditions.

For each area 1 and 2, an AiSS register is used to:

- Select the protection against read and write operations for this area

(See Table 8. A1SS, and Table 9. A2SS for details about available read and write protections).

When updating AiSS registers, the new protection value is effective immediately after the register write completion.

- Block 0 is an exception to this protection mechanism:
  - Block 0 can be individually write locked by issuing a Lock Single Block command. Once locked, it cannot be unlock.
  - User needs no password to lock block 0.
  - Locking block 0 is possible even if the configuration is locked (LOCK_CFG=1).
  - Unlocking Area 1 (through A1SS register) does not unlock block 0 if it has been locked though Lock Block command.
  - Once locked, the user cannot unlock block 0.
- Other blocks can be individually locked.

Retrieve the security status of a user memory block or byte

User can read a block security status by issuing following commands:

- Get Multiple Blocks Security Status command
- (Fast) Read Single Block with option flag set to 1
- (Fast) Read Multiple Blocks with option flag set to 1
- (Fast) Inventory Read

ST25TV02K/512 responds with a Block security status containing a Lock_bit flag as specified in ISO 15693 standard. This lock_bit flag is set to 1 if block is locked against write.

Lock_bit flag value may vary if corresponding user security session is open or closed.

5.2.4 System memory protection

By default, the system memory is write protected, except the kill password and the EAS settings.

Th system memory consists of all the registers defined in Table 4. System configuration memory map accessible through write_cfg and read_cfg commands. Some registers are read-only and can never be written.

To enable write access to system configuration registers, which have write capability, user must open the configuration security session (by presenting a valid password 3) and system configuration must not be locked (LOCK_CFG=00h).

By default, user can read all system configuration registers, except all passwords, LOCK_DSFID and LOCK_AFI.

Configuration lock:

- Write access to system configuration registers can be locked by writing 01h in the LOCK_CFG register.
- User cannot unlock system configuration if LOCK_CFG=01h, even after opening configuration security session (Lock is definitive).
- When system configuration is locked (LOCK_CFG=01h), it is still possible to change passwords (0 to 3).

Device identification registers:

- AFI and DFSID registers can be independently locked by user, issuing respectively a Lock AFI and a Lock DSFID command. Lock is definitive: once locked, AFI and DSFID registers cannot be unlocked.
- Other device identification registers (MEM_SIZE, BLK_SIZE, IC_REF, UID) are read only registers.

5.3 Untraceable mode

5.3.1 Untraceable mode register

Table 15. Untraceable mode register

RF	Command	Enable untraceable mode (cmd code BAh) with pswd_id = 0h	
	Type	WO : only possible if untraceable mode password has been written before, always writable otherwise	
Bit	Name	Function	Factory value
b31-b0	UNTRACEABLE _MODE_PSWD	Password value for feature untraceable mode	00000000h

Note: Refer to Table 5. System configuration memory map for registers accessed through dedicated commands for the untraceable mode register.

5.3.2 Untraceable mode description

With the **EnableUntraceableMode** command, the ST25TV02K/512 do not respond to any command except **Present Password** and **Get Random Number**, guaranteeing the untraceability to customer requests.

The **EnableUntraceableMode** command requires the untraceable access code (fixed value) and the crypted untraceable mode password to be presented for ST25TV02K/512 to enter into this mode.

To get out of the mode, the valid crypted untraceable mode password has to be transmitted to ST25TV02K/512 with the Present password command. The crypted untraceable mode password is obtained from the random number and the untraceable mode password as explained in AN5103 "*Password encryption for ST25TV512 and ST25TV02K devices*", available on www.st.com. When not used in an end application, a random value must be written into the KILL_PWD password, and the KILL_PWD must be locked with Lock kill.

5.4 Random number

5.4.1 Random number register

Table 16. Random number register

RF	Command	Get random number (cmd code B4h)	
	Type	RO: is only possible with Get random number command.	
Bit	Name	Function	Factory value
b15-b0	RANDOM_NUMBER	16-bit random number generated by ST25TV02K/512	N/A

Note: Refer to Table 5. System configuration memory map for registers accessed through dedicated commands for the random number register.

5.4.2 Random number description

The GET_RANDOM_NUMBER returns a 16-bit random number.

5.5 Electronic article surveillance (EAS)

5.5.1 EAS registers

Table 17. EAS_SEC

Command		Read Configuration (cmd code A0h) @02h Write Configuration (cmd code A1h) @02h	
Type		R: always possible W: if RF configuration security session is open (the proper configuration password has been presented before) and configuration not locked	
Bit	Name	Function	Factory value
b0	W_PROTECTION_EAS	EAS security write protection: 0: EAS parameters are always writable 1: EAS parameters are write protected by configuration password. In case of lock_EAS command has been previously used, this bit is don't care and EAS parameters are non-writable.	0b
b7-b1	RFU	-	0000000b

Note: Refer to Table 4. System configuration memory map accessible through write_cfg and read_cfg commands for the AES security activation register.

Table 18. EAS_TELEGRAM register

RF	Command	Enable EAS (cmd code A5h) with option flag set to 0 Enable EAS (cmd code A5h) with option flag set to 1 and mask length ≠ 00h and EAS_ID Write Single (cmd code 21h) to Blocks [248 to 255] (1) Read Single blocks at @248 to 255 returns an error.	
	Type	R: possible with enable EAS command only if set EAS command has been presented before W: possible under conditions set in the EAS_SEC configuration register and EAS configuration not locked	
Bit	Name	Function	Factory value
b255-b0	EAS_TELEGRAM	Electronic article surveillance telegram.	All bits = 0b

1. *Write Single Block at addresses 248 to 255 correspond to EAS blocks 1 to 8 respectively.*

5.5.2 EAS ID

Table 19. EAS_ID

RF	Command	Enable EAS (cmd code A5h) with option flag set to 1 and mask length set to 0h Write EAS ID (cmd code A7h)	
	Type	R: possible with enable EAS command only if set EAS command has been presented before W: possible under conditions set in the EAS_SEC configuration register and EAS configuration not locked	
Bit	Name	Function	Factory value
b15-b0	EAS_ID	Electronic article surveillance identifier value.	0000h

5.5.3 EAS configuration

Table 20. EAS_CFG

RF	Command	Enable EAS (cmd code A5h) with option flag set to 1 and mask length ≠ 00h and EAS_ID, or with option flag set to 0 Write EAS config (cmd code A8h)	
	Type	WO: possible under conditions set in the EAS_SEC configuration register and configuration not locked	
Bit	Name	Function	Factory value
b1-b0	EAS_CFG	Electronic article surveillance identifier configuration: 00: 256 bit payload (EAS block 1 to 8) 01: 128 bit payload (EAS block 1 to 4) 10: 64 bit payload (EAS block 1 to 2) 11: 32 bit payload (EAS block 1)	00h
b15-b2	RFU	-	000000b

The EAS parameters (ID, Telegram, mode (set/reset) can be definitely locked with the Lock EAS command (refer to Section 6.4.27 Lock EAS).

5.5.4 EAS description

The EAS (electronic article surveillance) feature is mainly used for library management, applications, requiring an anti-theft protection.

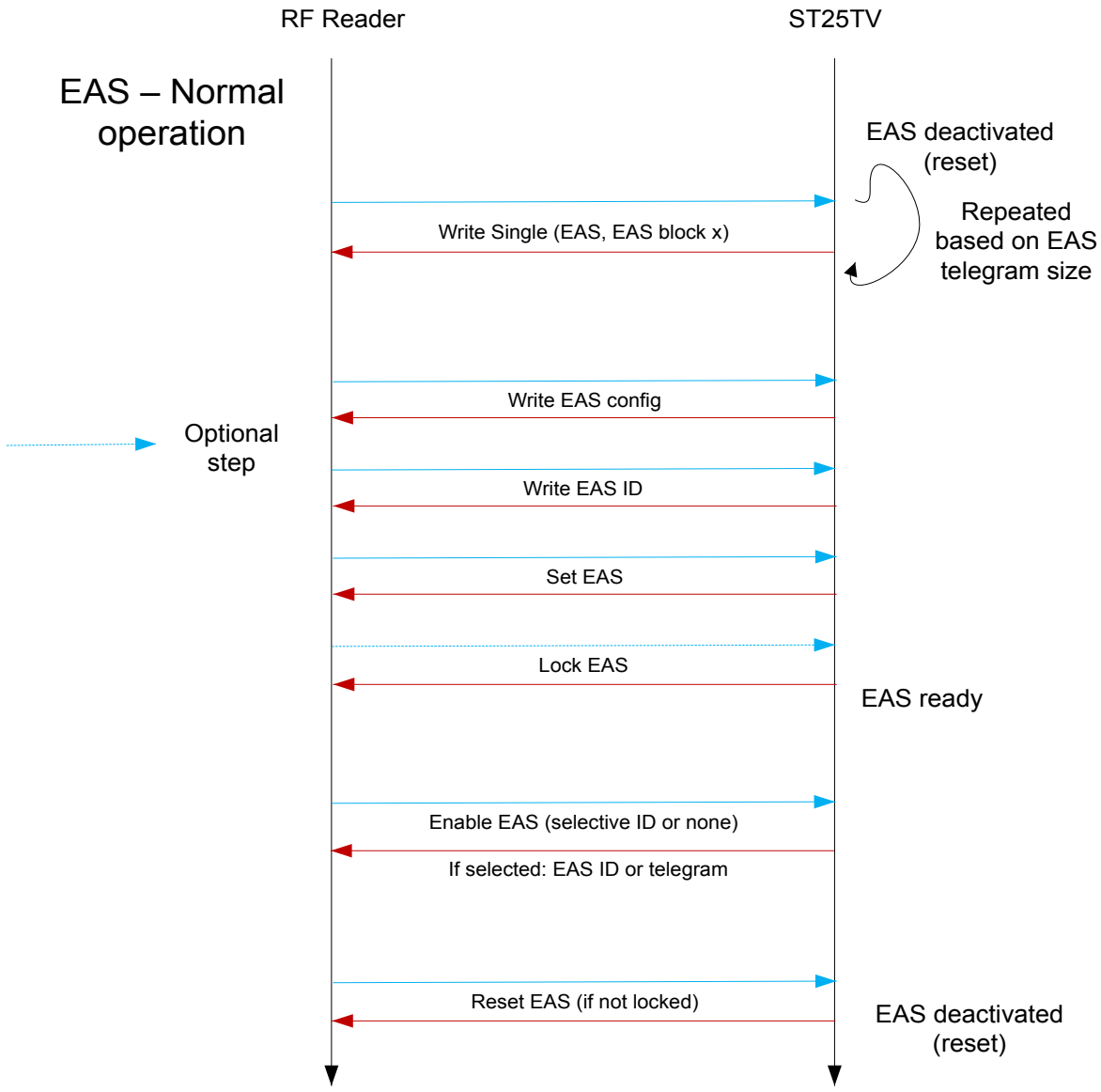
This is programmable and configured by custom commands and optionally protected by the configuration password (when programming EAS_SEC to 1) and can be locked.

A telegram can be stored using standard write command depending of its configured length (EAS block 1 – EAS Block 8).

The EAS feature can be activated, reset, locked using a set of custom commands (see Section 6.4.24 Set EAS, Section 6.4.25 Reset EAS, Section 6.4.26 Enable EAS, Section 6.4.27 Lock EAS, Section 6.4.28 Write EAS ID and Section 6.4.29 Write EAS CONFIG).

The EAS feature is reset (deactivated) by default.

Figure 7. Nominal EAS operation



By default, the EAS configuration (EAS telegram, EAS ID, EAS configuration, lock EAS, EAS mode) is not write protected.

The EAS configuration can be write protected by the configuration password (PWD_CFG) by writing 1b1 into the W_PROTECTION_EAS (EAS_SEC register). If W_PROTECTION_EAS bit is set, the EAS configuration can be changed only if the configuration password has been presented just before in the same RF session.

Write access to the EAS configuration can be locked by executing the lock_EAS command. User cannot unlock system configuration if the EAS configuration has already been locked earlier with the Lock_EAS command, even after opening configuration security session (Lock is definitive).

5.6 TruST25 digital signature

ST25TV02K/512 support TruST25 digital signature, a feature that allows to verify the authenticity of the device, based on a unique digital signature.

TruST25 solution encompasses secure industrialization processes and tools deployed by STMicroelectronics to generate, store and check the signature in the device.

Table 21. KID

Bit	Command	Read Cfg (cmd code A0h) @7h	
	Type	RO	
	Name	Function	Factory value
b7-b0	KID	Contains a key identifier used for TruST25 digital signature identification and possible revocation.	ST key number

Note: Refer to Table 4. System configuration memory map accessible through write_cfg and read_cfg commands for the KID register.

5.7 Counter

5.7.1 Counter registers

Counter configuration

Table 22. CNT_CFG

Bit	Command	Read Cfg (cmd code A0h) @3h Write Cfg (cmd code A1h) @3h	
	Type	R: always possible W: if RF configuration security session is open (the proper configuration password has been presented before) and configuration not locked.	
	Name	Function	Factory value
b0	CNT_EN	Counter enable 0: counter is disabled 1: counter is enabled on successful write operation (one increment per RF session)	0b
b1	CNT_CLR	Counter clear: 0: don't care 1: counter is cleared and automatically disabled (CNT_EN is put to 0) This bit is self-cleared	0b
b7-b2	RFU	-	000000b

Note: Refer to Table 4. System configuration memory map accessible through write_cfg and read_cfg commands for the CNT_CFG register.

Counter value

Table 23. CNT_VAL

Bit	Command	Read Cfg (cmd code A0h) @4h

Bit	Type	RO	
	Name	Function	Factory value
b15-b0	CNT_VAL	Counter value	0h

Note: Refer to Table 4. System configuration memory map accessible through write_cfg and read_cfg commands for the CNT_VAL register.

5.7.2 Counter description

A 16 bits counter can track the write events on the NDEF file.

It benefits from an anti-tearing mechanism that ensures the consistency of the counter, even if there is an electrical problem during its increment.

The value of the counter (CNT_VAL) can be checked by any application, by reading the Counter register.

If enabled (when CNT_EN = 1), the Write counter will be incremented on first successful Write event which is performed in the user area, inside an RF session (an RF session is entered when ST25TV02K/512 receive enough power from the RF field). After enabling the counter, the counter will not count until the next RF field on/off cycle.

The default configuration is with a counter disabled.

The counter cannot be locked. When the counter reach its maximum (2^{16}-1) the increment mechanism is blocked.

The counter is cleared and automatically disabled when CNT_CLR is set to 1.

Apart from these procedures, there is no way to act on the value of this counter.

The Read/Write counter can be configured through the Counter Configuration register.

This Counter Configuration register allows to:

- Enable or disable this counter (CNT_EN)
- Clear the counter (CNT_CLR)

The Counter Configuration register is protected by the configuration password.

5.8 Inventory Read

ST25TV02K/512 have the ability to perform in a single command Inventory Read (Refer to Section 6.4.37 Inventory read), an Inventory in accordance with the regular anticollision sequence followed by a Multiple Block Read, reducing the overall communication time. ST25TV02K/512 return the requested memory content if ST25TV02K/512 match the mask specified in the command.

When using the Fast Inventory Read (refer to Section 6.4.38 Fast inventory read), the response is twice the data rate.

5.9 Inventory Initiated

ST25TV02K/512 provide a special feature to improve the inventory time response of moving tags using the Initiate_flag value. This flag, controlled by the Initiate command (refer to Section 6.4.36 Initiate), allows tags to answer to Inventory Initiated commands (refer to Section 6.4.35 Inventory Initiated).

For applications where multiple tags are moving in front of a reader, it is possible to miss tags using the standard inventory command. The reason is that the inventory sequence has to be performed on a global tree search. For example, a tag with a particular UID value may have to wait the run of a long tree search before being inventoried. If the delay is too long, the tag may be out of the field before it has been detected.

Using the Initiate command, the inventory sequence is optimized. When multiple tags are moving in front of a reader, the ones which are within the reader field will be initiated by the Initiate command. In this case, a small batch of tags will answer to the Inventory Initiated command which will optimize the time necessary to identify all the tags. When finished, the reader has to issue a new Initiate command in order to initiate a new small batch of tags which are new inside the reader field.

It is also possible to reduce the inventory sequence time using the Fast Initiate (refer to Section 6.4.34 Fast Initiate), and Fast Inventory Initiated commands (refer to Section 6.4.33 Fast Inventory Initiated). These commands allow the ST25TV02K/512 to increase their response data rate by a factor of 2, up to 53 kbit/s.

5.10 Tamper detect

5.10.1 Tamper detect register

Tamper detection

Table 24. TAMPER_DETECT

Bit	Command	Read Cfg (cmd code A0h) @5h	
	Type	RO	
	Name	Function	Factory value
b0	TAMPER_DETECT	State of Tamper: 0: loop is open. Tamper is detected 1: loop is closed. No tamper is detected	0b
b7-b1	RFU	-	000000b

Note: Refer to Table 4. System configuration memory map accessible through write_cfg and read_cfg commands for the TAMPER_DETECT register.

5.10.2 Tamper detection description

The Tamper detection allows to check the shortage between the 2 TD0 and TD1 pins of the ST25TV02K/512.

This state TAMPER_DETECT is captured by ST25TV02K/512 each time that the ST25TV02K/512 are powered and available upon demand by the reader using the Read Cfg command with CFG_ID 5. (Tamper detection)

This information will be lost during power off. (No permanent storage of the status.)

This is the customer responsibility to check the register status and behave accordingly.

The short impedance should be less than 50 Ω.

The tamper detect feature is available for the ST25TV02K/512-AD devices only. On other configurations, a Read Cfg of the Tamper Detection register will return an error code.

If the two inputs pins TD0, TD1 are shorted with a wire at the time RF field is turned on, the tamper register will have a value “1”. If TD0, TD1 are not shorted at the time RF field is turned on, the tamper register will have a value “0”.

5.11 Device parameter registers

Table 25. LOCK_DSFID

Bit	Command	Lock DSFID (cmd code 2Ah)	
	Type	WO if DSFID not locked	
	Name	Function	Factory value
b0	LOCK_DSFID	0: DSFID is not locked 1: DSFID is locked	0b
b7-b1	RFU	-	0000000b

Note: Refer to Table 5. System configuration memory map for registers accessed through dedicated commands for the LOCK_DSFID register.

Table 26. LOCK_AFI

Bit	Command	Lock AFI (cmd code 28h)

Bit	Type	WO if AFI not locked	
	Name	Function	Factory value
b0	LOCK_AFI	0: AFI is not locked 1: AFI is locked	0b
b7-b1	RFU	-	0000000b

Note: Refer to Table 5. System configuration memory map for registers accessed through dedicated commands for the LOCK_AFI register.

Table 27. DSFID

Bit	Command	Inventory (cmd code 01h) Get System Info (cmd code 2Bh) Write DSFID (cmd code 28h)	
	Type	R always, W if DSFID not locked	
	Name	Function	Factory value
b7-b0	DSFID	ISO/IEC 15693 Data Storage Format Identifier	00h

Note: Refer to Table 5. System configuration memory map for registers accessed through dedicated commands for the DSFID register.

Table 28. AFI

Bit	Command	Inventory (cmd code 01h) Get System Info (cmd code 2Bh) Write AFI (cmd code 27h)	
	Type	R always, W if AFI not locked	
	Name	Function	Factory value
b7-b0	AFI	ISO/IEC 15693 Application Family Identifier	00h

Note: Refer to Table 5. System configuration memory map for registers accessed through dedicated commands for the AFI register.

Table 29. IC_REF

Bit	Command	Get System Info (cmd code 2Bh)	
	Type	RO	
	Name	Function	Factory value
b7-b0	IC_REF	ISO/IEC 15693 IC Reference	45h

Note: Refer to Table 5. System configuration memory map for registers accessed through dedicated commands for the IC_REF register.

Table 30. UID

Bit	Command	Inventory (cmd code 01h) Get System Info (cmd code 2Bh)	
	Type	RO	
	Name	Function	Factory value

b7-b0	UID	ISO/IEC 15693 UID byte 0 (LSB)	IC manufacturer serial number
b7-b0		ISO/IEC 15693 UID byte 1	
b7-b0		ISO/IEC 15693 UID byte 2	
b7-b0		ISO/IEC 15693 UID byte 3	
b7-b0		ISO/IEC 15693 UID byte 4	
b7-b0		ISO/IEC 15693 UID byte 5: ST Product code	23h
b7-b0		ISO/IEC 15693 UID byte 6: IC Mfg code	02h
b7-b0		ISO/IEC 15693 UID byte 7 (MSB)	E0h

Note: Refer to Table 5. System configuration memory map for registers accessed through dedicated commands for the UID register.

6 RF operations

Contactless exchanges are performed as specified by ISO/IEC 15693 and NFC Forum Type 5. The ST25TV02K/512 communicate via the 13.56 MHz carrier electromagnetic wave on which incoming data are demodulated from the received signal amplitude modulation (ASK: amplitude shift keying). The received ASK wave is 10% or 100% modulated with a data rate of 1.6 Kbit/s using the 1/256 pulse coding mode or a data rate of 26 Kbit/s using the 1/4 pulse coding mode.

Outgoing data are generated by the ST25TV02K/512 load variation using Manchester coding with one or two subcarrier frequencies at 423 kHz and 484 kHz. Data are transferred from the ST25TV02K/512 at 6.6 Kbit/s in low data rate mode and 26 Kbit/s in high data rate mode. The ST25TV02K/512 support the 53 Kbit/s data rate mode in one sub-carrier frequency at 423 kHz.

The ST25TV02K/512 follow ISO/IEC 15693 and NFC Forum Type 5 recommendation for radio-frequency power and signal interface and for anticollision and transmission protocol.

6.1 RF communication

6.1.1 Access to a ISO/IEC 15693 device

The dialog between the “reader” and the ST25TV02K/512 take place as follows:

These operations use the power transfer and communication signal interface described below (see Power transfer, Frequency and Operating field). This technique is called RTF (Reader talk first).

- Activation of the ST25TV02K/512 by the operating field of the reader,
- Transmission of a command by the reader (ST25TV02K/512 detect carrier amplitude modulation)
- Transmission of a response by the ST25TV02K/512 (ST25TV02K/512 modulate is load clocked at subcarrier rate)

Operating field

The ST25TV02K/512 operate continuously between the minimum and maximum values of the electromagnetic field H defined in Table 153. RF characteristics. The Reader has to generate a field within these limits.

Power transfer

Power is transferred to the ST25TV02K/512 by radio frequency at 13.56 MHz via coupling antennas in the ST25TV02K/512 and the Reader. The operating field of the reader is transformed on the ST25TV02K/512 antenna to an AC voltage which is rectified, filtered and internally regulated. During communications, the amplitude modulation (ASK) on this received signal is demodulated by the ASK demodulator.

Frequency

The ISO 15693 standard defines the carrier frequency (f_C) of the operating field as

13.56 MHz ± 7 kHz.

6.2 RF protocol description

6.2.1 Protocol description

The transmission protocol (or simply “the protocol”) defines the mechanism used to exchange instructions and data between the VCD (Vicinity Coupling Device) and the VICC (Vicinity integrated circuit card) in both directions. It is based on the concept of “VCD talks first”. The ST25TV02K/512 act as the VICC.

This means that a ST25TV02K/512 do not start transmitting unless it has received and properly decoded an instruction sent by the VCD. The protocol is based on an exchange of:

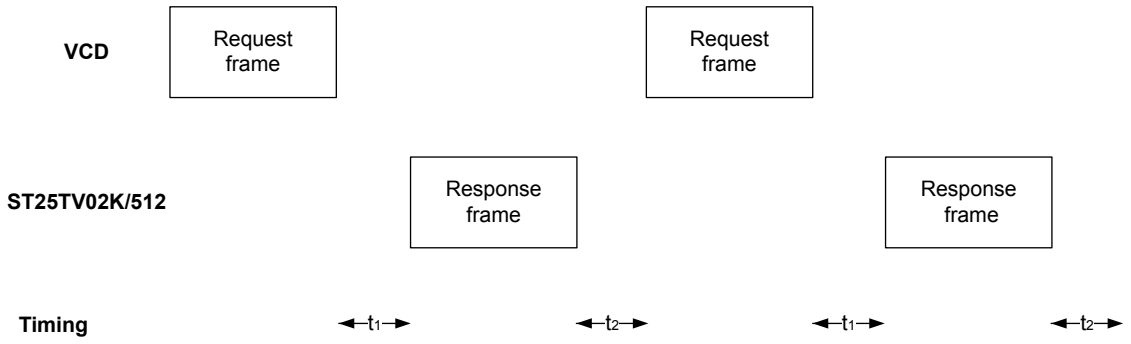
- a request from the VCD to the ST25TV02K/512,
- a response from the ST25TV02K/512 to the VCD.

Each request and each response are contained in a frame. The frames are delimited by a Start of Frame (SOF) and End of Frame (EOF).

The protocol is bit-oriented. The number of bits transmitted in a frame is a multiple of eight (8), that is an integer number of bytes.

A single-byte field is transmitted least significant bit (LSBit) first. A multiple-byte field is transmitted least significant byte (LSByte) first and each byte is transmitted least significant bit (LSBit) first.

Figure 8. ST25TV02K/512 protocol timing



6.2.2 ST25TV02K/512 states referring to protocol

The ST25TV02K/512 can be in one of four states:

- Power-off
- Ready
- Quiet
- Selected

Transitions between these states are specified in Figure 9. state transition diagram and Table 31. response depending on Request_flags.

Power-off state

The ST25TV02K/512 are in the power-off state when it does not receive enough energy from the VCD.

Ready state

The ST25TV02K/512 are in the Ready state when it receives enough energy from the VCD. When in the Ready state, the ST25TV02K/512 answer any request where the Select_flag is not set.

Quiet state

When in the Quiet state, the ST25TV02K/512 answer any request with the Address_flag set, except for Inventory requests.

Selected state

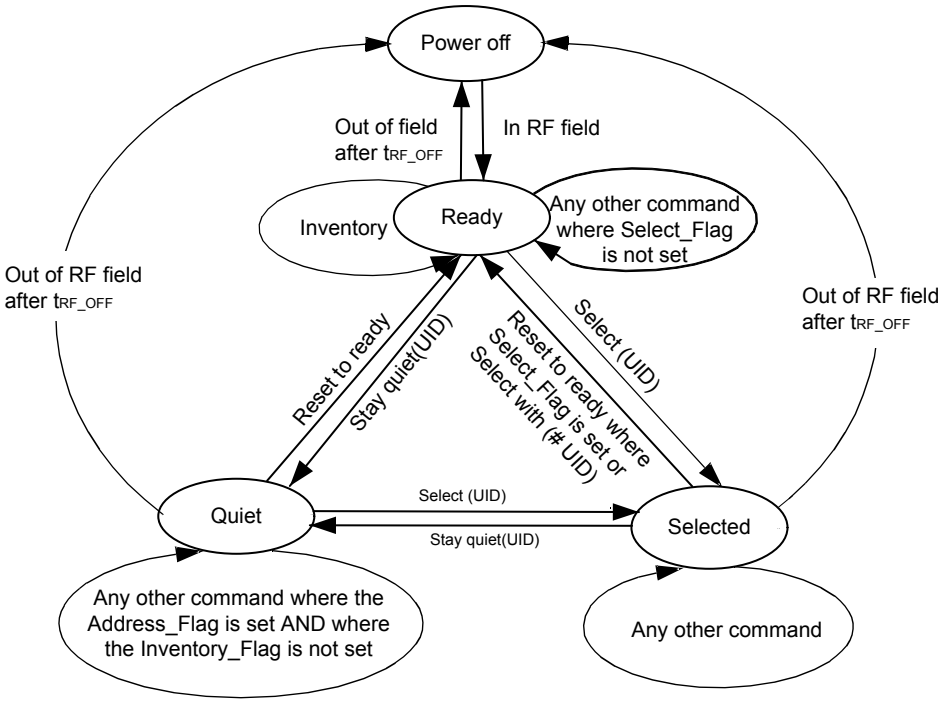
In the Selected state, the ST25TV02K/512 answer any request in all modes (see Section 6.2.3 Modes):

- Request in Select mode with the Select_flag set
- Request in Addressed mode if the UID matches
- Request in Non-Addressed mode as it is the mode for general requests

Table 31. response depending on Request_flags

Flags	Address_flag		Select_flag	
	1 Addressed	0 Non addressed	1 Selected	0 Non selected
ST25TV02K/512 in Ready or Selected state (Devices in Quiet state do not answer)	-	X	-	X
ST25TV02K/512 in Selected state	-	X	X	-
ST25TV02K/512 in Ready, Quiet or Selected state (the device which matches the UID)	X	-	-	X
Error (03h) or no response (command dependent)	X	-	X	-

Figure 9. state transition diagram



1. The ST25TV02K/512 return to the Power Off state if the tag is out of the field for at least t_{RF_OFF}.

The intention of the state transition method is that only one ST25TV02K/512 should be in the Selected state at a time.

When the Select_flag is set to 1, the request shall NOT contain a unique ID.

When the address_flag is set to 0, the request shall NOT contain a unique ID.

6.2.3 Modes

The term “mode” refers to the mechanism used in a request to specify the set of ST25TV02K/512 devices that shall execute the request.

Addressed mode

When the Address_flag is set to 1 (Addressed mode), the request contains the Unique ID (UID) of the addressed ST25TV02K/512.

Any ST25TV02K/512 that receive a request with the Address_flag set to 1 compares the received Unique ID to its own. If it matches, then the ST25TV02K/512 execute the request (if possible) and return a response to the VCD as specified in the command description.

If the UID does not match, then it remains silent.

Non-addressed mode (general request)

When the Address_flag is cleared to 0 (Non-Addressed mode), the request does not contain a UID.

Select mode

When the Select_flag is set to 1 (Select mode), the request does not contain a unique ID. The ST25TV02K/512 in the Selected state that receives a request with the Select_flag set to 1 executes it and returns a response to the VCD as specified in the command description.

Only the ST25TV02K/512 in the Selected state answers a request where the Select_flag is set to 1.

The system design ensures that only one ST25TV02K/512 can be in the Select state at a time.

6.2.4 Request format

The request consists of:

- an SOF
- flags
- a command code
- parameters and data
- a CRC
- an EOF

Table 32. General request format

SOF	Request_flags	Command code	Parameters	Data	2 byte CRC	EOF

6.2.5 Request flags

In a request, the “flags” field specifies the actions to be performed by the ST25TV16K/64K and whether corresponding fields are present or not.

The flags field consists of eight bits. Bit 3 (Inventory_flag) of the request flag defines the contents of the four MSBs (bits 5 to 8). When bit 3 is reset (0), bits 5 to 8 define the ST25TV16K/64K selection criteria. When bit 3 is set (1), bits 5 to 8 define the ST25TV16K/64K Inventory parameters.

Table 33. Definition of request flags 1 to 4

Bit No	Flag	Level	Description
Bit 1	Subcarrier_flag (1)	0	A single subcarrier frequency is used by the ST25TV16K/64K
		1	Two subcarriers are used by the ST25TV16K/64K
Bit 2	Data_rate_flag (2)	0	Low data rate is used
		1	High data rate is used
Bit 3	Inventory_flag	0	The meaning of flags 5 to 8 is described in Table 34. Request flags 5 to 8 when inventory_flag, Bit 3 = 0
		1	The meaning of flags 5 to 8 is described in Table 35. Request flags 5 to 8 when inventory_flag, Bit 3 = 1
Bit 4	Protocol_extension_flag	0	No Protocol format extension
		1	Protocol format extension. Reserved for future use.

1. *Subcarrier_flag refers to the ST25TV16K/64K-to-VCD communication.*
2. *Data_rate_flag refers to the ST25TV16K/64K-to-VCD communication.*

Table 34. Request flags 5 to 8 when inventory_flag, Bit 3 = 0

Bit nb	Flag	Level	Description
Bit 5	Select flag (1)	0	The request is executed by any ST25TV16K/64K according to the setting of Address_flag
		1	The request is executed only by the ST25TV16K/64K in Selected state
Bit 6	Address flag	0	The request is not addressed. UID field is not present. The request is executed by all ST25TV16K/64Ks.
		1	The request is addressed. UID field is present. The request is executed only by the ST25TV16K/64K whose UID matches the UID specified in the request.
Bit 7	Option flag	0	Option not activated.
		1	Option activated.
Bit 8	RFU	0	-

1. *If the Select_flag is set to 1, the Address_flag is set to 0 and the UID field is not present in the request.*

Table 35. Request flags 5 to 8 when inventory_flag, Bit 3 = 1

Bit nb	Flag	Level	Description
Bit 5	AFI flag	0	AFI field is not present
		1	AFI field is present
Bit 6	Nb_slots flag	0	16 slots
		1	1 slot
Bit 7	Option flag	0	-
Bit 8	RFU	0	-

6.2.6 Response format

The response consists of:

- an SOF
- flags
- parameters and data
- a CRC
- an EOF

Table 36. General response format

SOF	Response_flags	Parameters	Data	2-byte CRC	EOF

6.2.7 Response flags

In a response, the flags indicate how actions have been performed by the ST25TV02K/512 and whether corresponding fields are present or not. The response flags consist of eight bits.

Table 37. **Definitions of response flags 1 to 8**

Bit Nb	Flag	Level	Description
Bit 1	Error_flag	0	No error
		1	Error detected. Error code is in the “Error” field.
Bit 2	RFU	0	-
Bit 3	RFU	0	-
Bit 4	RFU	0	-
Bit 5	RFU	0	-
Bit 6	RFU	0	-
Bit 7	RFU	0	-
Bit 8	RFU	0	-

6.2.8 Response and error code

If the Error_flag is set by the ST25TV02K/512 in the response, the Error code field is present and provides information about the error that occurred.

Error codes not specified in Table 38. Response error code definition are reserved for future use.

Table 38. **Response error code definition**

Error code	Meaning
01h	Command is not supported.
02h	Command is not recognized (format error).
03h	The option is not supported.
0Fh	Error with no information given.
10h	The specified block is not available.
11h	The specified block is already locked and thus cannot be locked again.
12h	The specified block is locked and its contents cannot be changed.
13h	The specified block was not successfully programmed.
14h	The specified block was not successfully locked.
15h	The specified block is protected in read.
No response	It might indicate illegal programming

6.3 Timing definition

t_1: VICC response delay

Upon detection of the rising edge of the EOF received from the VCD, the ST25TV02K/512 wait for a t_{1nom} time before transmitting their response to a VCD request or switching to the next slot during an inventory process. Values of t_1 are given in Table 39. Timing values.

t_2: VCD new request delay

t_2 is the time after which the VCD may send an EOF to switch to the next slot when one or more ST25TV02K/512 responses have been received during an Inventory command. It starts from the reception of the EOF from the ST25TV02K/512s.

The EOF sent by the VCD may be either 10% or 100% modulated regardless of the modulation index used for transmitting the VCD request to the ST25TV02K/512.

t_2 is also the time after which the VCD may send a new request to the ST25TV02K/512, as described in Figure 8. ST25TV02K/512 protocol timing.
Values of t_2 are given in Table 39. Timing values.

t_3: VCD new request delay when no response is received from the VICC

t_3 is the time after which the VCD may send an EOF to switch to the next slot when no ST25TV02K/512 response has been received.
The EOF sent by the VCD may be either 10% or 100% modulated regardless of the modulation index used for transmitting the VCD request to the ST25TV02K/512.
From the time the VCD has generated the rising edge of an EOF:

- If this EOF is 100% modulated, the VCD waits for a time at least equal to t_{3min} for 100% modulation before sending a new EOF.
- If this EOF is 10% modulated, the VCD waits for a time at least equal to t_{3min} for 10% modulation before sending a new EOF.

Table 39. Timing values

	Minimum (min) values		Nominal (nom) values	Maximum (max) values
	100% modulation	10% modulation		
t_1	4320 / f_c = 318.6 µs		4352 / f_c = 320.9 µs	4384 / f_c = 323.3 µs(1)
t_2	4192 / f_c = 309.2 µs		No t_{nom}	No t_{max}
t_3	t_{1max}(2)+t_{SOF}(3)	t_{1max}(2)+t_{NRT} (4)+t_{2min}	No t_{nom}	No t_{max}

1. *VCD request will not be interpreted during the first milliseconds following the field rising.*
2. *t_{1max} does not apply for write-alike requests. Timing conditions for write-alike requests are defined in the command description.*
3. *t_{SOF} is the time taken by the ST25TV02K/512 to transmit an SOF to the VCD. t_{SOF} depends on the current data rate: High data rate or Low data rate.*
4. *t_{NRT} is the nominal response time of the ST25TV02K/512. t_{NRT} depends on VCD to ST25TV02K/512 data rate and sub-carrier modulation mode.*

Note: The tolerance of specific timing is ±32 / f_C.

6.4 RF commands

6.4.1 RF command code list

The ST25TV02K/512 support the following legacy and extended RF command set:

- **Inventory**, used to perform the anticollision sequence.
- **Stay Quiet**, used to put the ST25TV02K/512 in quiet mode, where it does not respond to any inventory command.
- **Select**, used to select the ST25TV02K/512. After this command, the ST25TV02K/512 process all Read/ Write commands with Select_flag set.
- **Reset To Ready**, used to put the ST25TV02K/512 in the ready state.
- **Read Single Block**, used to output the 32 bit of the selected block and its locking status.
- **Write Single Block**, used to write and verify the new content for an update of a 32 bit block, provided that it is not in a locked memory area.
- **Read Multiple Blocks**, used to read the selected 32 bit blocks and their locking statuses, and send back their value.
- **Write AFI**, used to write the 8-bit value in the AFI register.
- **Lock AFI**, used to lock the AFI register.
- **Write DSFID**, used to write the 8-bit value in the DSFID register.

- **Lock DSFID**, used to lock the DSFID register.
- **Get System information**, used to provide the standard system information values.
- **Write Password**, used to update the 32 or 64 bit of the selected areas or configuration password, but only after presenting the current one.
- **Lock Block**, used to lock any user blocks.
- **Present Password**, enables the user to present a password to open a security session.
- **Fast Read Single Block**, used to output the 32 bits of the selected block and its locking status at doubled data rate.
- **Fast Read Multiple Blocks**, used to output the selected blocks in one or multiple areas providing the access rights are granted at doubled data rate.
- **Get multiple block security status**, used to send the security status of the selected block.
- **Initiate**, used to trigger the tag response to the Inventory Initiated sequence.
- **Inventory Initiated**, used to perform the anti-collision sequence triggered by the Initiate command.
- **Fast Initiate**, used to trigger the tag response to the Fast Inventory Initiated sequence (fast commands are with higher data rate).
- **Fast Inventory Initiated**, used to perform the anti-collision sequence triggered by the Fast Initiate command.
- **Inventory read** performs anti-collision sequence then output selected blocks
- **Fast Inventory read** performs inventory command then execute a read with data returned at doubled data rate.
- **Lock Kill**, used to lock the Kill or untraceable mode password.
- **Kill**, used to definitively deactivate the tag.
- **Set EAS**, activates the EAS feature if the EAS feature is not locked. (Not protected by password or locked)
- **Reset EAS**, deactivates the EAS feature if the EAS feature is not locked. (not protected by password or locked)
- **Enable EAS**, ST25TV02K/512 answer to this command only if EAS state is set. Response will include the EAS Telegram (32 up to 256 bits depending on the EAS config)
- **Write EAS ID** writes a new EAS identifier Number. (Protected by configuration password).
- **Write EAS CONFIG**, used to configure the EAS telegram data length with 2bits 00 = 256 bits 01= 128 bits 10 = 64 bits 11= 32 bits (protected by configuration password).
- **Lock EAS** will lock EAS mode: (reset / set) and EAS ID and the EAS Telegram.
- **Read Configuration** used to read the counter values, the tamper detect status, and the number of Area.
- **Write Configuration** allows to enable the counter configuration, clear counter, set number of Area (1 or 2) and their access rights, and lock the configuration block.
- **Set Untraceable mode**: sets the untraceable mode.
- **Get Random Number**: generates a 16 bit number.

6.4.2 Command codes list

The ST25TV02K/512 support the commands described in this section. Their codes are given in Table 40. Command codes.

Table 40. Command codes

Command code standard	Function	Command code custom	Function
01h	Section 6.4.4 Inventory	A5h	Section 6.4.26 Enable EAS
02h	Section 6.4.5 Stay Quiet	A6h	Section 6.4.30 Kill
20h	Section 6.4.6 Read Single Block	A7h	Section 6.4.28 Write EAS ID
21h	Section 6.4.7 Write Single Block	A8h	Section 6.4.29 Write EAS CONFIG
22h	Section 6.4.8 Lock block	B1h	Section 6.4.31 Write Kill Password
23h	Section 6.4.9 Read Multiple Blocks		Section 6.4.20 Write Password
25h	Section 6.4.10 Select	B2h	Section 6.4.32 Lock Kill
26h	Section 6.4.11 Reset to Ready	B3h	Section 6.4.21 Present Password
27h	Section 6.4.12 Write AFI	B4h	Section 6.4.40 Get Random Number
28h	Section 6.4.13 Lock AFI	BAh	Section 6.4.39 Enable Untraceable mode
29h	Section 6.4.14 Write DSFID	C0h	Section 6.4.22 Fast Read Single Block
2Ah	Section 6.4.15 Lock DSFID	C1h	Section 6.4.33 Fast Inventory Initiated
2Bh	Section 6.4.16 Get System info	C2h	Section 6.4.34 Fast Initiate
2Ch	Section 6.4.17 Get Multiple Block Security Status	C3h	Section 6.4.23 Fast Read Multiple Blocks
A0h	Section 6.4.18 Read Configuration	D1h	Section 6.4.35 Inventory Initiated
A1h	Section 6.4.19 Write Configuration	D2h	Section 6.4.36 Initiate
A2h	Section 6.4.24 Set EAS	D3h	Section 6.4.37 Inventory read
A3h	Section 6.4.25 Reset EAS	D4h	Section 6.4.38 Fast inventory read
A4h	Section 6.4.27 Lock EAS	-	-

6.4.3 General Command Rules

In case of a valid command, the following paragraphs will describe the expected behavior for each command.

But in case of an invalid command, in a general manner, the ST25TV02K/512 will behave as follows:

1. If flag usage is incorrect, the error code 03h will be issued only if the right UID is used in the command, otherwise no response will be issued.
2. The error code 02h will be issued if the custom command is used with the manufacturer code different from the ST one

6.4.4 Inventory

Upon receiving the Inventory request, the ST25TV02K/512 run the anticollision sequence. The Inventory_flag is set to 1. The meaning of flags 5 to 8 is shown in .

The request parameters:

- Request flags
- AFI if the AFI flag is set
- Mask length
- Mask value if mask length is different from 0

The ST25TV02K/512 do not generate any answer in case of error.

Table 41. Inventory request format

Request SOF	Request_flags	Inventory	Optional AFI	Mask length	Mask value	CRC16	Request EOF
-	8 bits	01h	8 bits	8 bits	0 - 64 bits	16 bits	-

The response contains:

- the flags
- the Unique ID

Table 42. Inventory response format

Response SOF	Response_flags	DSFID	UID	CRC16	Response EOF
-	8 bits	8 bits	64 bits	16 bits	-

During an Inventory process, if the VCD does not receive an RF ST25TV02K/512 response, it waits for a time t_3 before sending an EOF to switch to the next slot. t_3 starts from the rising edge of the request EOF sent by the VCD.

- If the VCD sends a 100% modulated EOF, the minimum value of t_3 is:
- $t_3min = 4384/f_C$ (323.3µs) + t_{SOF}
- If the VCD sends a 10% modulated EOF, the minimum value of t_3 is:
- $t_3min = 4384/f_C$ (323.3µs) + t_{NRT} + t_{2min}

where:

- t_{SOF} is the time required by the ST25TV02K/512 to transmit an SOF to the VCD,
- t_{NRT} is the nominal response time of the ST25TV02K/512.

t_{NRT} and t_{SOF} are dependent on the ST25TV02K/512-to-VCD data rate and subcarrier modulation mode.

Note: In case of error, no response is sent by ST25TV02K/512.

6.4.5 Stay Quiet

On receiving the Stay Quiet command, the ST25TV02K/512 enter the Quiet state if no error occurs, and does NOT send back a response. There is NO response to the Stay Quiet command even if an error occurs.

When in the Quiet state:

- the ST25TV02K/512 do not process any request if the Inventory_flag is set,
- the ST25TV02K/512 process any request with Address_flag set.

The ST25TV02K/512 exit the Quiet state when:

- it is reset (power off),
- receiving a Select request. It then goes to the Selected state,
- receiving a Reset to Ready request. It then goes to the Ready state.

Request parameters:

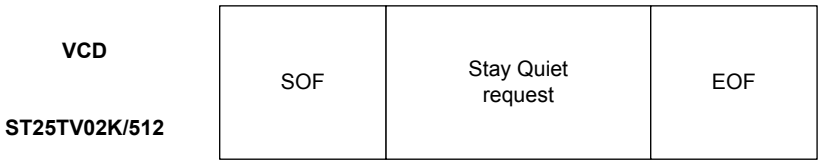
- request flags
- UID

Table 43. Stay Quiet request format

Request SOF	Request flags	Stay Quiet	UID	CRC16	Request EOF
-	8 bits	02h	64 bits	16 bits	-

The Stay Quiet command must always be executed in Addressed mode (Select_flag is reset to 0 and Address_flag is set to 1).

Figure 10. **Stay Quiet frame exchange between VCD and ST25TV02K/512**



6.4.6 Read Single Block

On receiving the Read Single Block command, the ST25TV02K/512 read the requested block and sends back its 32-bit value in the response. The Option_flag is supported, when set response include the Block Security Status.

Block number is coded on 1 Byte.

Table 44. **Read Single Block request format**

Request SOF	Request_flags	Read Single Block	UID (1)	Block number	CRC16	Request EOF
-	8 bits	20h	64 bits	8 bits	16 bits	-

1. *The field is optional.*

Request parameters:

- Request flags
- UID (optional)
- Block number

Table 45. **Read Single Block response format when Error_flag is NOT set**

Response SOF	Response_flags	Block security status (1)	Data	CRC16	Response EOF
-	8 bits	8 bits	32 bits	16 bits	-

1. *The field is optional.*

Response parameters:

- Block security status if Option_flag is set (see Table 46. Block security status)
- Four bytes of block data

Table 46. **Block security status**

b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
Reserved for future use. All at 0.							0: Current block not locked 1: Current block locked

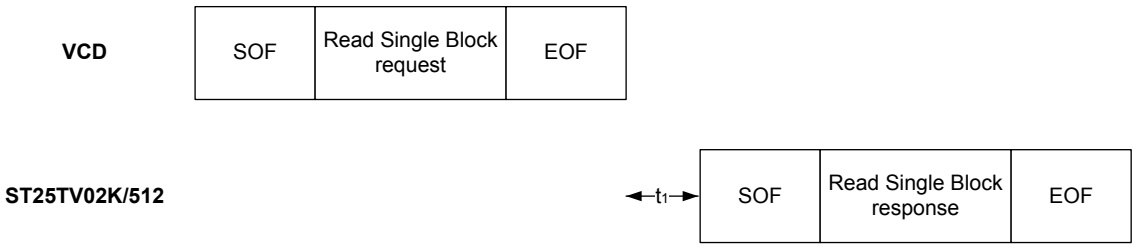
Table 47. **Read Single Block response format when Error_flag is set**

Response SOF	Response_flags	Error code	CRC16	Response EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set
  - 03h: command option not supported
  - 10h: the specified block is not available
  - 15h: the specified block is read-protected

Figure 11. Read Single Block frame exchange between VCD and ST25TV02K/512



6.4.7 Write Single Block

On receiving the Write Single Block command, the ST25TV02K/512 write the data contained in the request to the targeted block and reports whether the write operation was successful in the response. When the Option_flag is set, wait for EOF to respond.

During the RF write cycle W_t, there should be no modulation (neither 100% nor 10%), otherwise the ST25TV02K/512 may not program correctly the data into the memory. The W_t time is equal to t_{1nom} + N × 302 µs (N is an integer).

Block number is coded on 1 Byte and only first 256 blocks of ST25TV02K/512 can be addressed using this command.

Table 48. Write Single Block request format

Request SOF	Request_flags	Write Single Block	UID (1)	Block number	Data	CRC16	Request EOF
-	8 bits	21h	64 bits	8 bits	32 bits	16 bits	-

1. *The field is optional.*

Request parameters:

- Request flags
- UID (optional)
- Block number
- Data

Table 49. Write Single Block response format when Error_flag is NOT set

Response SOF	Response_flags	CRC16	Response EOF
-	8 bits	16 bits	-

Response parameter:

- No parameter. The response is sent back after the writing cycle.

Table 50. Write Single Block response format when Error_flag is set

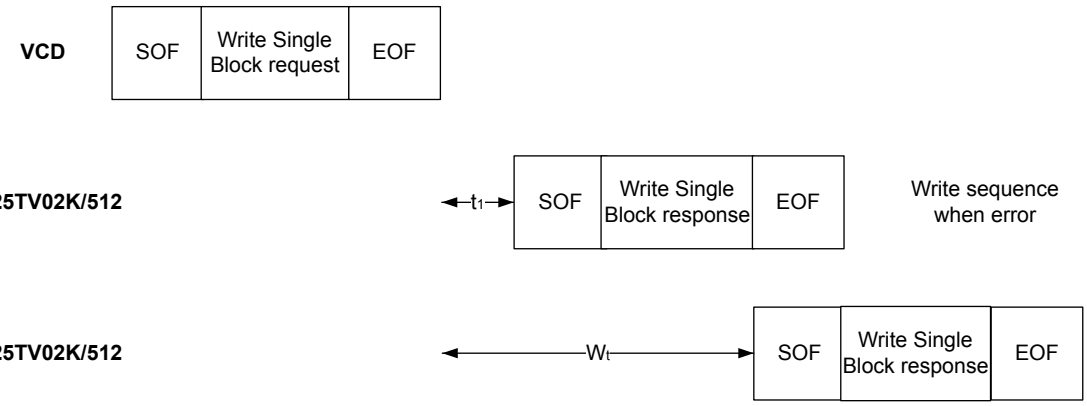
Response SOF	Response_flags	Error code	CRC16	Response EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set
  - 03h: command option not supported(1)
  - 10h: the specified block is not available
  - 12h: the specified block is locked or protected and its contents cannot be changed
  - 13h: the specified block was not successfully programmed

1. *For more details, see Figure 5. Memory organization*

Figure 12. Write Single Block frame exchange between VCD and ST25TV02K/512



When the Option_flag is set, wait for EOF to respond.

Block number is coded on 1 Byte.

6.4.8 Lock block

On receiving the Lock block request, the ST25TV02K/512 lock the single block value permanently and protects its content against new writing.

This command is applicable for all blocks of the user memory.

For a global protection of a area, update accordingly the AiSS bits in the system area. The Option_flag is supported, when set wait for EOF to respond.

During the RF write cycle W_t, there should be no modulation (neither 100% nor 10%), otherwise the ST25TV02K/512 may not lock correctly the single block value in memory. The W_t time is equal to t_{1nom} + N × 302 µs (N is an integer).

Table 51. Locking scheme

Area access description	Area x access rights RW_PROTECTION_Ax [1:0]	Lock feature behavior
Area readable and writable	00b	Lock possible
Area protected in write by password	01b	Lock only possible if security session is open Error = 14h if Security Session is closed
Area protected in read and write by password	10b	Lock only possible if security session is open

Area access description	Area x access rights RW_PROTECTION_Ax [1:0]	Lock feature behavior
		Error = 14h if Security Session is closed
Area protected in read. Area disabled in write (no matter if security session opened or not)	11b	No lock is possible Error = 11h (already locked)

Table 52. Lock block request format

Request SOF	Request_flags	Lock block	UID (1)	block number	CRC16	Request EOF
-	8 bits	22h	64 bits	8 bits	16 bits	-

1. *The field is optional.*

Request parameter:

- Request Flags
- UID (optional)
- Block number (only value 00h or 01h) are allowed to protect the CCfile in case of NDEF usage.

Table 53. Lock block response format when Error_flag is NOT set

Response SOF	Response_flags	CRC16	Response EOF
-	8 bits	16 bits	-

Response parameter:

- No parameter

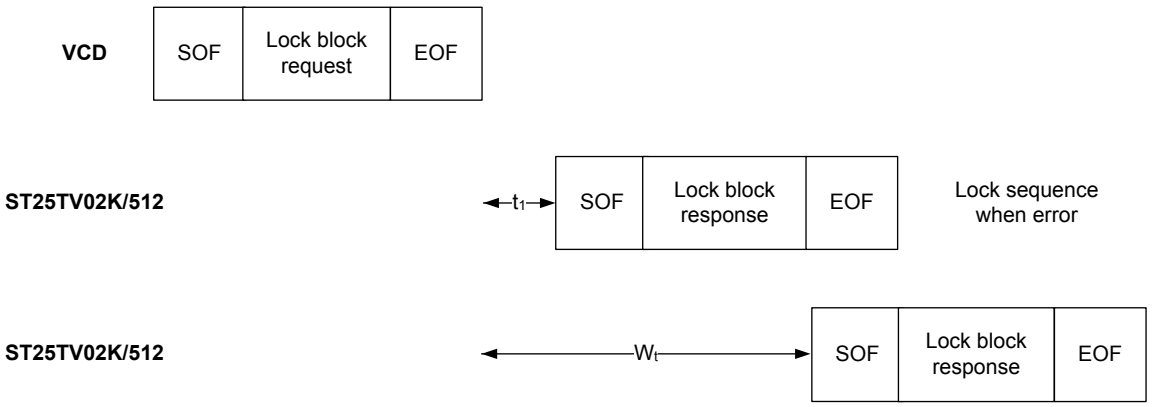
Table 54. Lock single block response format when Error_flag is set

Response SOF	Response_flags	Error code	CRC16	Response EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set
  - 03h: command option not supported
  - 10h: block not available
  - 11h: the specified block is already locked and thus cannot be locked again
  - 14h: the specified block was not successfully locked

Figure 13. **Lock single block frame exchange between VCD and ST25TV02K/512**



6.4.9 Read Multiple Blocks

When receiving the Read Multiple Block command, the ST25TV02K/512 read the selected blocks and sends back their value in multiples of 32 bits in the response. The blocks are numbered from 00h to 3Fh in the request and the value is minus one (-1) in the field. For example, if the “Number of blocks” field contains the value 06h, seven blocks are read. When the Option_flag is set, the response returns the Block Security Status.

When a read multiple starts in an area with read access authorized and finishes in an area without read access authorized, only the data available in the area with read access authorized is returned. When a read access starts in an area with no read access authorized, an error is returned.

Block number is coded on 1 Byte.

Table 55. **Read Multiple Block request format**

Request SOF	Request_flags	Read Multiple Block	UID (1)	First block number	Number of blocks	CRC16	Request EOF
-	8 bits	23h	64 bits	8 bits	8 bits	16 bits	-

1. *The field is optional.*

Request parameters:

- Request flags
- UID (optional)
- First block number
- Number of blocks

Table 56. **Read Multiple Block response format when Error_flag is NOT set**

Response SOF	Response_ flags	Block security status (1)	Data	CRC16	Response EOF
-	8 bits	8 bits (2)	32 bits(2)	16 bits	-

1. *The field is optional.*
2. *Repeated as needed.*

Response parameters:

- Block security status if Option_flag is set (see Table 57. Block security status)
- N blocks of data

Table 57. **Block security status**

b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
Reserved for future use. All at 0.							0: Current block not locked 1: Current block locked

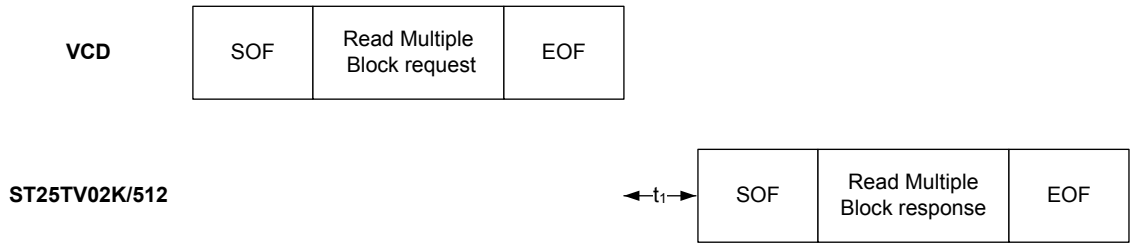
Table 58. **Read Multiple Block response format when Error_flag is set**

Response SOF	Response_flags	Error code	CRC16	Response EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set:
  - 03h: command option is not supported
  - 10h: the specified block is not available
  - 15h: the specified block is read-protected

Figure 14. **Read Multiple Block frame exchange between VCD and ST25TV02K/512**



6.4.10 Select

When receiving the Select command:

- If the UID is equal to its own UID, the ST25TV02K/512 enter or stay in the Selected state and sends a response.
- If the UID does not match its own UID, the selected ST25TV02K/512 return to the Ready state and does not send a response.

The ST25TV02K/512 answer an error code only if the UID is equal to its own UID. If not, no response is generated. If an error occurs, the ST25TV02K/512 remain in its current state.

Table 59. **Select request format**

Request SOF	Request_flags	Select	UID	CRC16	Request EOF
-	8 bits	25h	64 bits	16 bits	-

Request parameter:

- Request flags
- UID

Table 60. Select Block response format when Error_flag is NOT set

Response SOF	Response_flags	CRC16	Response EOF
-	8 bits	16 bits	-

Response parameter:

- No parameter

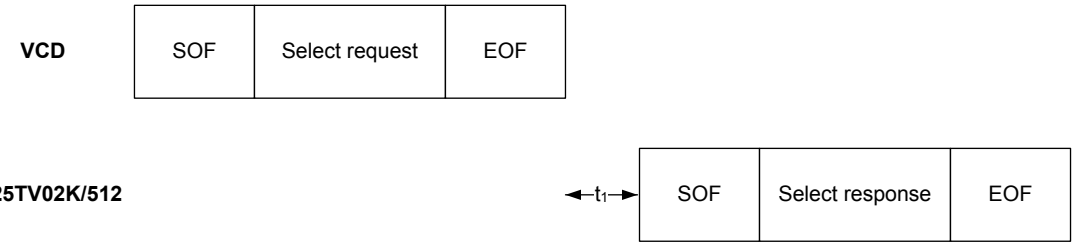
Table 61. Select response format when Error_flag is set

Response SOF	Response_flags	Error code	CRC16	Response EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set:
  - 03h: the option is not supported

Figure 15. Select frame exchange between VCD and ST25TV02K/512



6.4.11 Reset to Ready

On receiving a Reset to Ready command, the ST25TV02K/512 return to the Ready state if no error occurs. In the Addressed mode, the ST25TV02K/512 answer an error code only if the UID is equal to its own UID. If not, no response is generated.

Table 62. Reset to Ready request format

Request SOF	Request_flags	Reset to Ready	UID (1)	CRC16	Request EOF
-	8 bits	26h	64 bits	16 bits	-

1. *The field is optional.*

Request parameter:

- Request flags
- ID (optional)

Table 63. Reset to Ready response format when Error_flag is NOT set

Response SOF	Response_flags	CRC16	Response EOF
-	8 bits	16 bits	-

Response parameter:

- No parameter

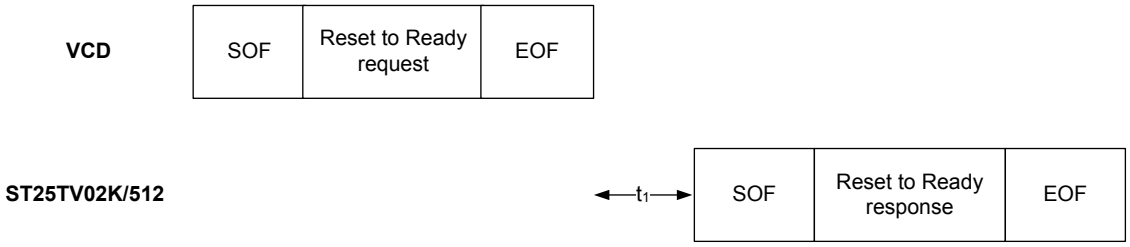
Table 64. **Reset to ready response format when Error_flag is set**

Response SOF	Response_flags	Error code	CRC16	Response EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set:
  - 03h: the option is not supported

Figure 16. **Reset to Ready frame exchange between VCD and ST25TV02K/512**



6.4.12 Write AFI

On receiving the Write AFI request, the ST25TV02K/512 program the 8-bit AFI value to its memory. When the Option_flag is set, wait for EOF to respond.

During the RF write cycle W_t, there should be no modulation (neither 100% nor 10%), otherwise the ST25TV02K/512 may not write correctly the AFI value into the memory. The W_t time is equal to t_{1nom} + N × 302 µs (N is an integer).

Table 65. **Write AFI request format**

Request SOF	Request_flags	Write AFI	UID (1)	AFI	CRC16	Request EOF
-	8 bits	27h	64 bits	8 bits	16 bits	-

1. *The field is optional.*

Request parameter:

- Request flags
- UID (optional)
- AFI

Table 66. **Write AFI response format when Error_flag is NOT set**

Response SOF	Response_flags	CRC16	Response EOF
-	8 bits	16 bits	-

Response parameter:

- No parameter

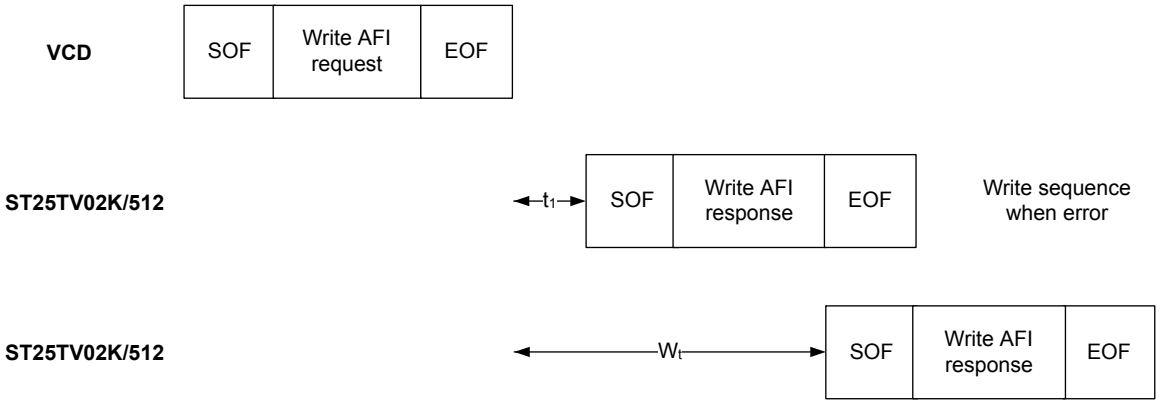
Table 67. **Write AFI response format when Error_flag is set**

Response SOF	Response_ flags	Error code	CRC16	Response EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set
  - 03h: command option is not supported
  - 0Fh: error with no information given
  - 12h: the specified block is locked and its contents cannot be changed
  - 13h: the specified block was not successfully programmed

Figure 17. **Write AFI frame exchange between VCD and ST25TV02K/512**



6.4.13 Lock AFI

On receiving the Lock AFI request, the ST25TV02K/512 locks the AFI value permanently. When the Option_flag is set, wait for EOF to respond.

During the RF write cycle W_t, there should be no modulation (neither 100% nor 10%), otherwise the ST25TV02K/512 may not lock correctly the AFI value in memory. The W_t time is equal to t_{1nom} + 18 × 302 µs.

Table 68. **Lock AFI request format**

Request SOF	Request_flags	Lock AFI	UID (1)	CRC16	Request EOF
-	8 bits	28h	64 bits	16 bits	-

1. *The field is optional.*

Request parameter:

- Request Flags
- UID (optional)

Table 69. **Lock AFI response format when Error_flag is NOT set**

Response SOF	Response_flags	CRC16	Response EOF
-	8 bits	16 bits	-

Response parameter:

- No parameter

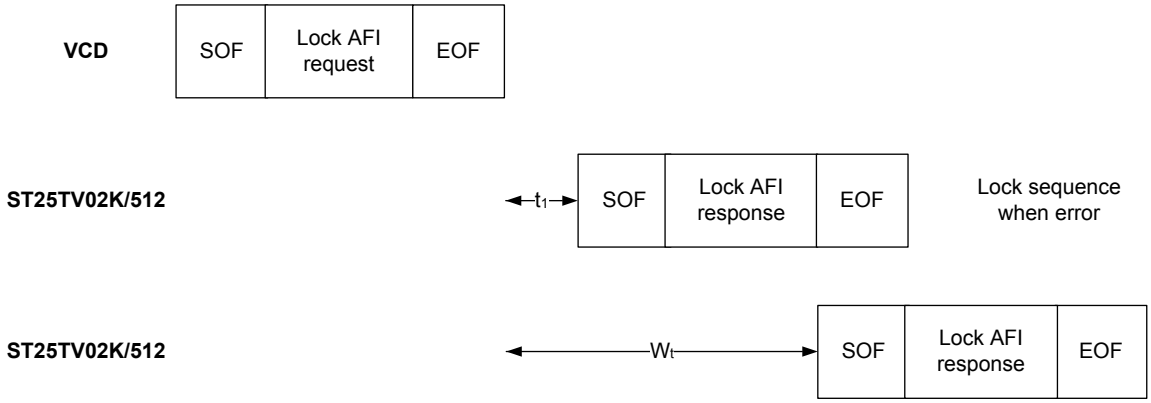
Table 70. Lock AFI response format when Error_flag is set

Response SOF	Response_flags	Error code	CRC16	Response EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set
  - 03h: command option is not supported
  - 11h: the specified block is already locked and thus cannot be locked again
  - 14h: the specified block was not successfully locked

Figure 18. Lock AFI frame exchange between VCD and ST25TV02K/512



6.4.14 Write DSFID

On receiving the Write DSFID request, the ST25TV02K/512 program the 8-bit DSFID value to its memory. When the Option_flag is set, wait for EOF to respond.

During the RF write cycle W_t, there should be no modulation (neither 100% nor 10%), otherwise the ST25TV02K/512 may not write correctly the DSFID value in memory. The W_t time is equal to t_{1nom} + N × 302 µs (N is an integer).

Table 71. Write DSFID request format

Request SOF	Request_flags	Write DSFID	UID (1)	DSFID	CRC16	Request EOF
-	8 bits	29h	64 bits	8 bits	16 bits	-

1. *The field is optional.*

MS60271V1Request parameter:

- Request flags
- UID (optional)
- DSFID

Table 72. Write DSFID response format when Error_flag is NOT set

Response SOF	Response_flags	CRC16	Response EOF
-	8 bits	16 bits	-

Response parameter:

- No parameter

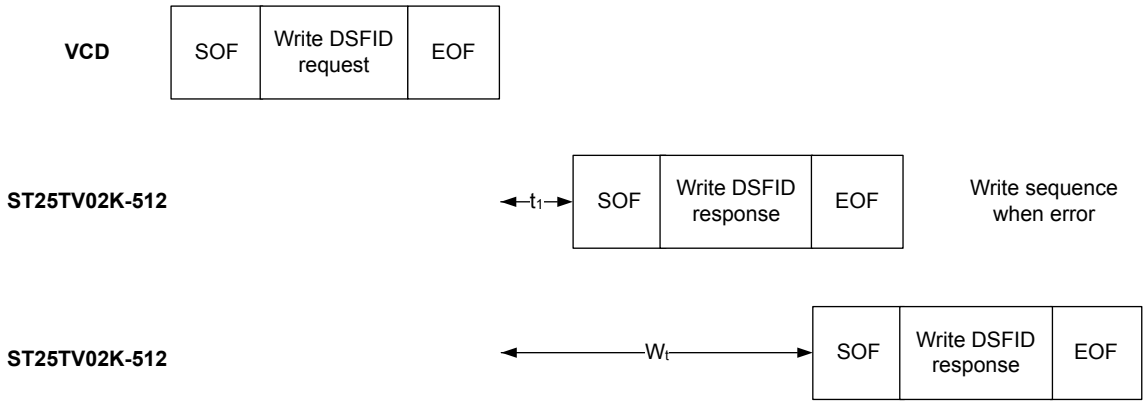
Table 73. Write DSFID response format when Error_flag is set

Response SOF	Response_flags	Error code	CRC16	Response EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set
  - 03h: command option is not supported
  - 12h: the specified block is locked and its contents cannot be changed
  - 13h: the specified block was not successfully programmed

Figure 19. Write DSFID frame exchange between VCD and ST25TV02K/512



6.4.15 Lock DSFID

On receiving the Lock DSFID request, the ST25TV02K/512 lock the DSFID value permanently. When the Option_flag is set, wait for EOF to respond.

During the RF write cycle W_t, there should be no modulation (neither 100% nor 10%), otherwise the ST25TV02K/512 may not lock correctly the DSFID value in memory. The W_t time is equal to t_{1nom} + N × 302 µs (N is an integer).

Table 74. Lock DSFID request format

Request SOF	Request_flags	Lock DSFID	UID (1)	CRC16	Request EOF
-	8 bits	2Ah	64 bits	16 bits	-

1. *The field is optional.*

Request parameter:

- Request flags
- UID (optional)

Table 75. Lock DSFID response format when Error_flag is NOT set

Response SOF	Response_flags	CRC16	Response EOF
-	8 bits	16 bits	-

Response parameter:

- No parameter.

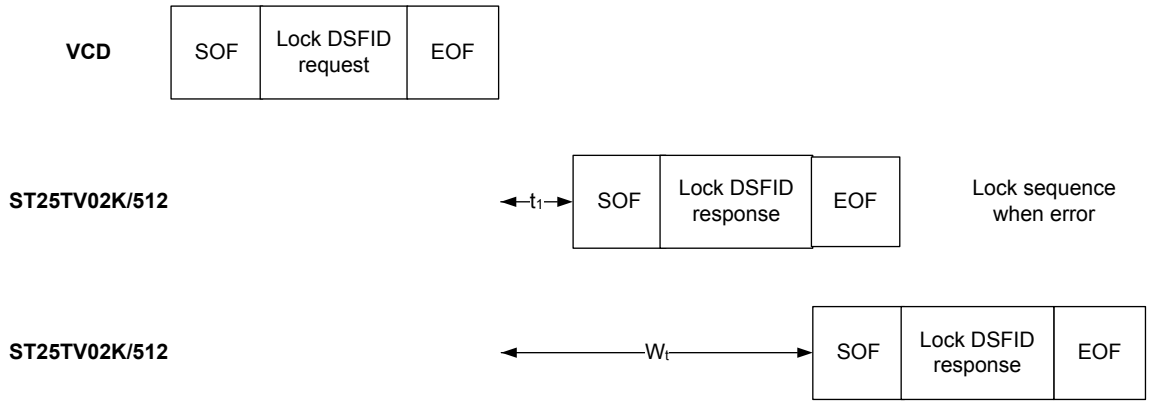
Table 76. Lock DSFID response format when Error_flag is set

Response SOF	Response_flags	Error code	CRC16	Response EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set:
  - 03h: command option is not supported
  - 11h: the specified block is already locked and thus cannot be locked again
  - 14h: the specified block was not successfully locked

Figure 20. Lock DSFID frame exchange between VCD and ST25TV02K/512



6.4.16 Get System info

When receiving the Get System Info command, the ST25TV02K/512 send back its information data in the response. The Option_flag is not supported. The Get System Info can be issued in both Addressed and Non Addressed modes.

Table 77. Get System info request format

Request SOF	Request_flags	Get System Info	UID (1)	CRC16	Request EOF
-	8 bits	2Bh	64 bits	16 bits	-

1. *The field is optional.*

Request parameter:

- Request flags
- UID (optional)

Table 78. Get System info response format Error_flag is NOT set

Response SOF	Response flags	Information flags	UID	DSFID	AFI	VICC memory size	IC ref.	CRC16	Response EOF
-	00h	0Fh	64 bits	8 bits	8 bits	16 bits	48h	16 bits	-

Response parameters:

- Information flags set to 0Fh. DSFID, AFI, VICC memory size (16 bits), and IC reference fields are present.
- VICC memory size - possible values are:
  - 033Fh for ST25TV02K
  - 030Fh for ST25TV512

Note: The first byte is in both cases 03h. It corresponds to a block size of 4 bytes. The 2nd byte is 3Fh when ST25TV has 64 blocks and 0Fh when ST25TV has 16 blocks.

- UID code on 64 bits
- DSFID value
- AFI value
- ST25TV02K/512 IC reference: the 8 bits are significant.

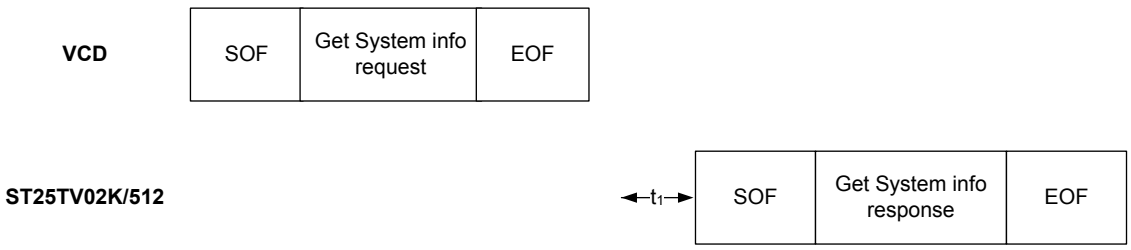
Table 79. Get System Info response format when Error_flag is set

Response SOF	Response_flags	Error code	CRC16	Response EOF
-	01h	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set:
  - 03h: Option not supported

Figure 21. Get System Info frame exchange between VCD and ST25TV02K/512



6.4.17 Get Multiple Block Security Status

When receiving the Get Multiple Block Security Status command, the ST25TV02K/512 send back its security status for each address block: 0 when block is writable else 1 when block is locked for writing. The blocks security status are defined by the area security status (and the lock block status). The blocks are numbered from 00h up to the maximum memory block number in the request, and the value is minus one (–1) in the field. For example, a value of “06” in the “Number of blocks” field requests will return the security status of seven blocks. This command does not respond an error if number of blocks overlap areas.

The number of blocks is coded on 1 Byte and only first 256 blocks of ST25TV02K/512 can be addressed using this command.

Table 80. Get Multiple Block Security Status request format

Request SOF	Request_flags	Get Multiple Block Security Status	UID (1)	First block number	Number of blocks	CRC16	Request EOF
-	8 bits	2Ch	64 bits	8 bits	8 bits	16 bits	-

1. *The field is optional.*

Request parameter:

- Request flags
- UID (optional)
- First block number
- Number of blocks

Table 81. Get Multiple Block Security Status response format when Error_flag is NOT set

Response SOF	Response_flags	Block security status	CRC16	Response EOF
-	8 bits	8 bits (1)	16 bits	-

1. *Repeated as needed.*

Response parameters:

- Block security status

Table 82. Block security status

b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
Reserved for future use All at 0							0: Current block not locked 1: Current block locked

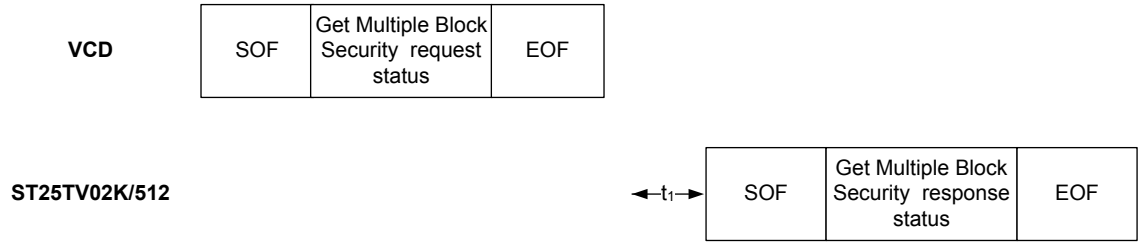
Table 83. Get Multiple Block Security Status response format when Error_flag is set

Response SOF	Response_flags	Error code	CRC16	Response EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set:
  - 03h: the option is not supported
  - 10h: the specified block is not available

Figure 22. Get Multiple Block Security status frame exchange between VCD and ST25TV02K/512



6.4.18 Read Configuration

On receiving the Read Configuration command, the ST25TV02K/512 read the static system configuration register at the Pointer address and sends back its 8-bit value in the response.

The Option_flag is not supported. The Inventory_flag must be set to 0.

Table 84. Read Configuration request format

Request SOF	Request_flags	Read Configuration	IC Mfg code	UID (1)	Pointer	CRC16	Request EOF
-	8 bits	A0h	02h	64 bits	8 bits	16 bits	-

1. *The field is optional.*

Note: Please refer to Table 4. System configuration memory map accessible through write_cfg and read_cfg commands for details on register addresses.

Request parameters:

- System configuration register pointer
- UID (optional)

Table 85. Read Configuration response format when Error_flag is NOT set

Response SOF	Response_flags	Register value	CRC16	Response EOF
-	8 bits	8 or 16 bits (1)	16 bits	-

1. *It depends on registers being accessed*

Response parameters:

- One or two bytes of data: system configuration register

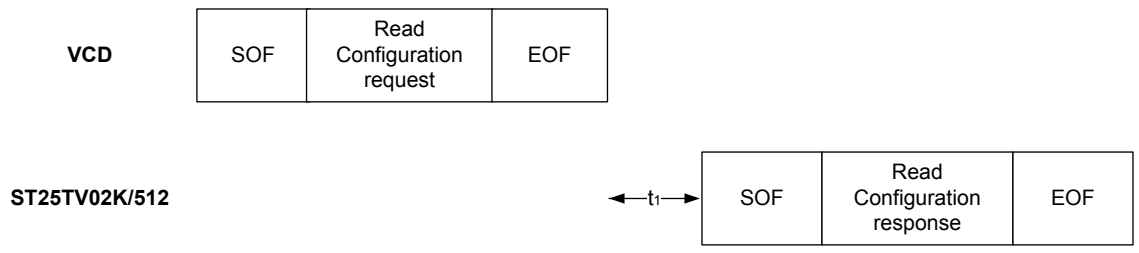
Table 86. Read Configuration response format when Error_flag is set

Response SOF	Response_flags	Error code	CRC16	Response EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set
  - 02h: command not recognized
  - 03h: the option is not supported
  - 10h: register not available

Figure 23. Read Configuration frame exchange between VCD and ST25TV02K/512



6.4.19 Write Configuration

The Write Configuration command is used to write system configuration register. The Write Configuration must be preceded by a valid presentation of the configuration password (PWG_CFG) to open the RF configuration security session.

On receiving the Write Configuration command, the ST25TV02K/512 write the data contained in the request to the system configuration register at the Pointer address and reports whether the write operation was successful in the response or not.

When the Option_flag is set, wait for EOF to respond. The Inventory_flag is not supported.

During the RF write cycle W_t, there should be no modulation (neither 100% nor 10%), otherwise the ST25TV02K/512 may not program correctly the data into the Configuration byte. The W_t time is equal to t_{1nom} + N × 302 µs (N is an integer).

Table 87. Write Configuration request format

Request SOF	Request_ flags	Write Configuration	IC Mfg code	UID (1)	Pointer	Register Value (2)	CRC16	Request EOF
-	8 bits	A1h	02h	64 bits	8 bits	8 bits	16 bits	-

1. *The field is optional.*
2. *Before updating the register value, check the meaning of each bit in previous sections.*

Request parameters:

- Request flags
- Register pointer
- Register value
- UID (optional)

Table 88. Write Configuration response format when Error_flag is NOT set

Response SOF	Response_flags	CRC16	Response EOF
-	8 bits	16 bits	-

Note: Please refer to Table 4. System configuration memory map accessible through write_cfg and read_cfg commands for details on register addresses.

Response parameter:

- No parameter. The response is sent back after the writing cycle.

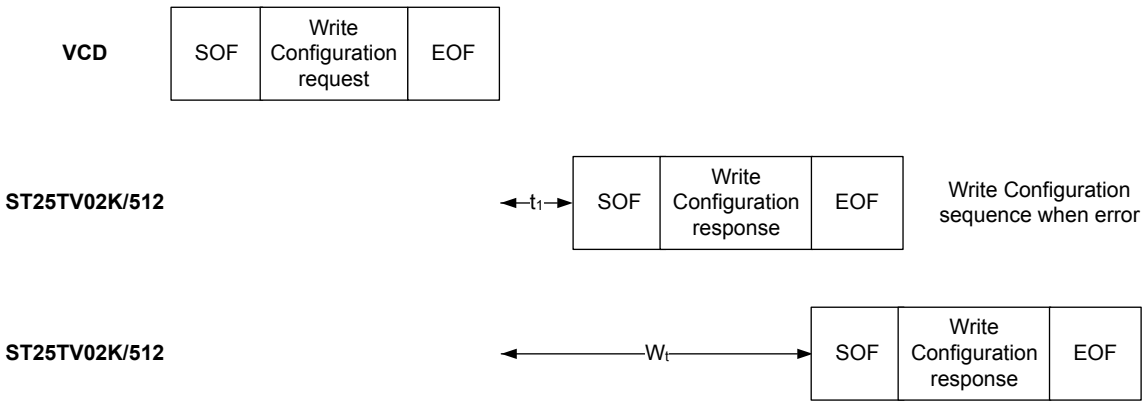
Table 89. Write Configuration response format when Error_flag is set

Response SOF	Response_flags	Error code	CRC16	Response EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set:
  - 02h: command not recognized
  - 03h: command option is not supported
  - 0Fh: error with no information given
  - 10h: not available
  - 12h: block already locked, content can't change
  - 13h: the specified block was not successfully programmed

Figure 24. **Write Configuration frame exchange between VCD and ST25TV02K/512**



6.4.20 Write Password

On receiving the Write Password command, the ST25TV02K/512 use the data contained in the request to write the password and reports whether the operation was successful in the response. It is possible to modify a Password value only after issuing a valid Present password command (of the same password number). When the Option_flag is set, wait for EOF to respond. Refer to Section 5.2 Data protection for details on password Management.

During the RF write cycle time, W_t, there must be no modulation at all (neither 100% nor 10%), otherwise the ST25TV02K/512 may not correctly program the data into the memory.

The W_t time is equal to t_{1nom} + N × 302 µs (N is an integer). After a successful write, the new value of the selected password is automatically activated. It is not required to present the new password value until the ST25TV02K/512 power-down.

There is no anti-tearing mechanism during Write_Password command. Command must be applied with stable RF field. Otherwise the write operation may not complete properly, and could imply a loss/corruption of password content with no recovery capability.

It is recommended to use Write_Password command in Addressed or Selected modes, in order to improve the system robustness. This allows to ensure that Password change is only applied to the concerned tag/UID.

Table 90. **Write Password request format**

Request SOF	Request_flags	Write password	IC Mfg code	UID (1)	Password number	Data	CRC16	Request EOF
-	8 bits	B1h	02h	64 bits	8 bits	32 bits	16 bits	-

1. *The field is optional.*

Request parameter:

- Request flags
- UID (optional)
- Password number:
  - 00h = PWD_KILL or PWD_UNTRACEABLE
  - 01h = PWD_1
  - 02h = PWD_2
  - 03h = PWD_CFG
  - other = Error
- Data

Table 91. Write Password response format when Error_flag is NOT set

Response SOF	Response_flags	CRC16	Response EOF
-	8 bits	16 bits	-

Response parameter:

- no parameter.

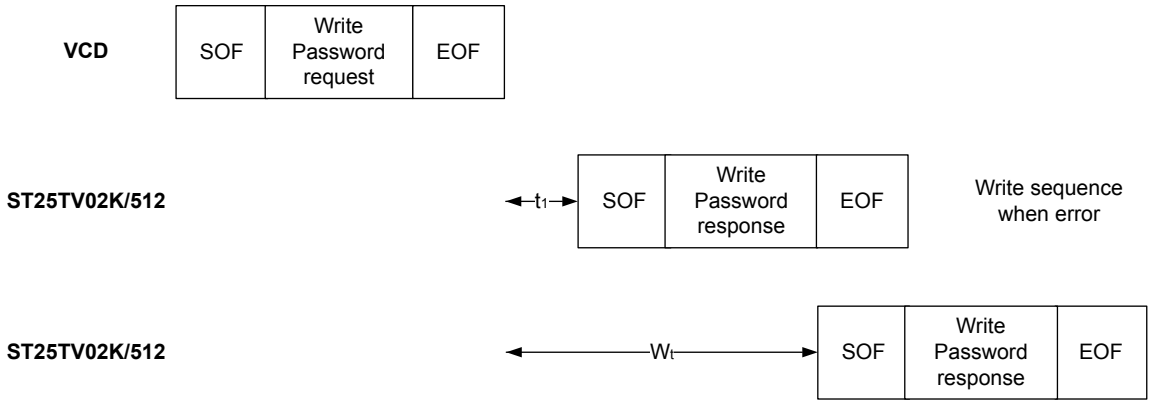
Table 92. Write Password response format when Error_flag is set

Response SOF	Response_flags	Error code	CRC16	Response EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set:
  - 02h: command not recognized
  - 03h: command option not supported
  - 10h: the password number is incorrect
  - 12h: update right not granted, Present Password command not previously executed or password locked
  - 14h: block was not successfully programmed

Figure 25. Write Password frame exchange between VCD and ST25TV02K/512



6.4.21 Present Password

On receiving the Present Password command, the ST25TV02K/512 compare the requested password with the data contained in the request and report if the operation has been successful in the response. Refer to Section 5.2 Data protection for details on password management. After a successful command, the security session associated to the password is open as described in Section 5.2 Data protection.

Table 93. Present Password request format

Request SOF	Request_flags	Present Password	IC Mfg code	UID (1)	Password number	Password	CRC16	Request EOF
-	8 bits	B3h	02h	64 bits	8 bits	32 or 64 bits	16 bits	-

1. *The field is optional.*

Request parameters:

- Request flags
- UID (optional)
- Password number (00h = Password KILL or UNTRACEABLE, 0x01 = PWD_A1, 0x02 = PWD_A2, 0x03 = PWD_CFG, other = Error)
- Password is 32-bit wide for all passwords, except for Area 1 if MEM_ORG = 1b1 (ST25TV02K/512 configured in two areas), when the password is 64-bit wide.

Table 94. Present Password response format when Error_flag is NOT set

Response SOF	Response_flags	CRC16	Response EOF
-	8 bits	16 bits	-

Response parameter:

- No parameter. The response is sent back after the write cycle.

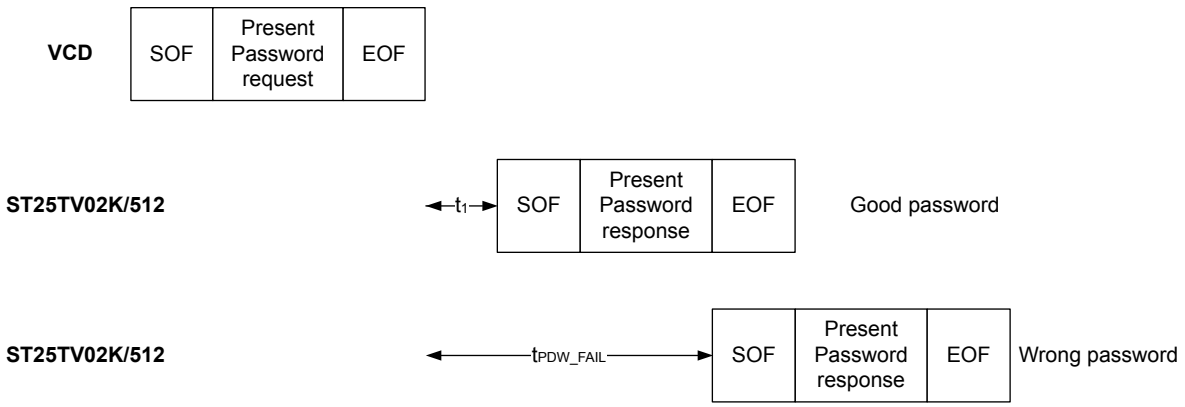
Table 95. Present Password response format when Error_flag is set

Response SOF	Response_flags	Error code	CRC16	Response EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set:
  - 02h: command not recognized
  - 03h: command option not supported
  - 0Fh: the present password is incorrect
  - 10h: the password number is incorrect

Figure 26. Present Password frame exchange between VCD and ST25TV02K/512



Present password command specificity

The passwords must be presented encrypted as explained in AN5103.

6.4.22 Fast Read Single Block

On receiving the Fast Read Single Block command, the ST25TV02K/512 read the requested block and sends back its 32-bit value in the response. When the Option_flag is set, the response includes the Block Security Status. The data rate of the response is multiplied by 2.

The subcarrier_flag should be set to 0, otherwise the ST25TV02K/512 answer with an error code.
Block number is coded on 1 Byte.

Table 96. Fast Read Single Block request format

Request SOF	Request_flags	Fast Read Single Block	IC Mfg code	UID (1)	Block number	CRC16	Request EOF
-	8 bits	C0h	02h	64 bits	8 bits	16 bits	-

1. *The field is optional.*

Request parameters:
- Request flags
- UID (optional)
- Block number

Table 97. Fast Read Single Block response format when Error_flag is NOT set

Response SOF	Response_flags	Block security status (1)	Data	CRC16	Response EOF
-	8 bits	8 bits	32 bits	16 bits	-

1. *The field is optional.*

Response parameters:
- Block security status if Option_flag is set (see Table 98. Block security status)
- Four bytes of block data

Table 98. Block security status

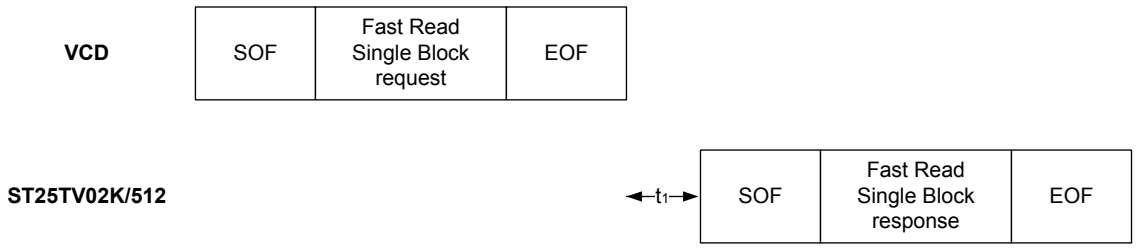
b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
Reserved for future use All at 0							0: Current Block not locked 1: Current Block locked

Table 99. Fast Read Single Block response format when Error_flag is set

Response SOF	Response_flags	Error code	CRC16	Response EOF
-	8 bits	8 bits	16 bits	-

Response parameter:
- Error code as Error_flag is set:
  - 02h: command not recognized
  - 03h: command option not supported
  - 10h: the specified block is not available
  - 15h: the specified block is read-protected

Figure 27. **Fast Read Single Block frame exchange between VCD and ST25TV02K/512**



6.4.23 Fast Read Multiple Blocks

On receiving the Fast Read Multiple Blocks command, the ST25TV02K/512 read the selected blocks and sends back their value in multiples of 32 bits in the response. The blocks are numbered from 00h up to the last block of user memory in the request, and the value is minus one (-1) in the field. For example, if the “Number of blocks” field contains the value 06h, seven blocks are read. If the number of blocks overlaps area, the ST25TV02K/512 return only the blocks that are readable assuming reading starts from an Area that is readable, and stops when reaching an Area that is not readable.

When the Option_flag is set, the response includes the Block Security Status. The data rate of the response is multiplied by 2.

The subcarrier_flag should be set to 0, otherwise the ST25TV02K/512 answer with an error code.

Block number is coded on 1 Byte.

Table 100. **Fast Read Multiple Block request format**

Request SOF	Request_flags	Fast Read Multiple Block	IC Mfg code	UID (1)	First block number	Number of blocks	CRC16	Request EOF
-	8 bits	C3h	02h	64 bits	8 bits	8 bits	16 bits	-

1. *The field is optional.*

Request parameters:

- Request flag
- UID (Optional)
- First block number
- Number of blocks

Table 101. **Fast Read Multiple Block response format when Error_flag is NOT set**

Response SOF	Response_flags	Block security status (1)	Data	CRC16	Response EOF
-	8 bits	8 bits (2)	32 bits(2)	16 bits	-

1. *The field is optional.*
2. *Repeated as needed.*

Response parameters:

- Block security status if Option_flag is set (see Table 102. Block security status if Option_flag is set)
- N block of data

Table 102. **Block security status if Option_flag is set**

b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0

Reserved for future use All at 0	0: Current not locked 1: Current locked

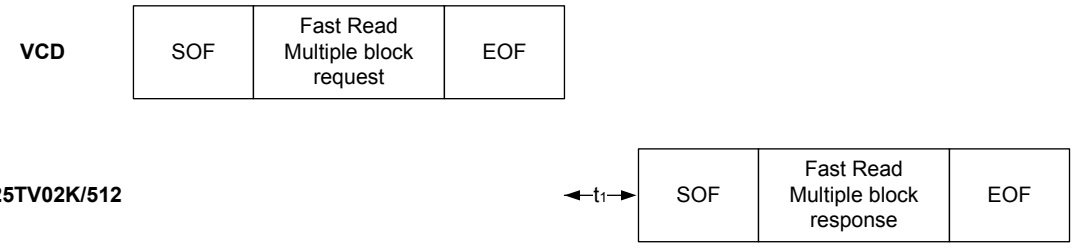
Table 103. Fast Read Multiple Block response format when Error_flag is set

Response SOF	Response_flags	Error code	CRC16	Response EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set:
  - 02h: command not recognized
  - 03h: the option is not supported
  - 10h: block address not available
  - 15h: block read-protected

Figure 28. Fast Read Multiple Block frame exchange between VCD and ST25TV02K/512



6.4.24 Set EAS

The set command will activate the function if the EAS feature is not locked nor protected by the configuration password.

If the EAS mode is locked, the Set EAS command will be ignored, and the ST25TV02K/512 respond with an error.

When the EAS mode is not locked:

- If the EAS mode is not protected by password, the Set EAS command will set the EAS mode.
- If the EAS mode is password protected, the configuration password has to be first transmitted with the PRESENT PASSWORD command. Then the set EAS command can be executed, and will set the EAS mode.
- If the EAS mode is password protected, but the PRESENT PASSWORD has not been transmitted before or not successful, the set EAS command is not executed and the ST25TV02K/512 respond with an error.

Table 104. Set EAS request format

Request SOF	Request_flags	Set EAS	IC Mfg code	UID (1)	CRC16 request	EOF
-	8 bits	A2h	02h	64 bits	16 bits	-

1. *The field is optional.*

Request parameters:

- Request flags
- UID (optional)

Table 105. Set EAS response when Error_flag is NOT set

Response SOF	Response flags	CRC16 request	EOF
-	8 bits	16 bits	-

Response parameter:

- No parameter

Table 106. Set EAS response when Error_flag is set

Response SOF	Response flags	Error code	CRC16 request	EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set
  - 03h: command option is not supported
  - 12h: the EAS configuration cannot be changed as eith the security session is closed, or locked
  - 13h: the EAS configuration was not successfully programmed

6.4.25 Reset EAS

The Reset EAS command is used to deactivate the EAS if the EAS feature is not locked nor protected by the configuration password.

If the EAS mode is locked, the Reset EAS command will be ignored, and the ST25TV02K/512 respond with an error.

When the EAS mode is not locked:

- If the EAS mode is not protected by password, the Reset EAS command will clear the EAS mode.
- If the EAS mode is password protected the configuration password has to be first transmitted with the PRESENT PASSWORD command. Then the reset EAS command can be executed, and will clear the EAS mode
- If the EAS mode is password protected, but the PRESENT PASSWORD has not been transmitted before or not successful, the reset EAS command is not executed and the ST25TV02K/512 respond with an error

Table 107. Reset EAS request format

Request SOF	Request_flags	Reset EAS	IC Mfg code	UID (1)	CRC16 request	EOF
-	8 bits	A3h	02h	64 bits	16 bits	-

1. *The field is optional.*

Request parameters:

- Request flags
- UID (optionfal)

Table 108. Reset EAS format when Error_flag is NOT set

Response SOF	Response_flags	CRC16 request	EOF
-	8 bits	16 bits	-

Response parameter:

- No parameter

Table 109. **Reset EAS format when Error_flag is set**

Response SOF	Response_flags	CRC16 request	EOF
-	8 bits	16 bits	-

Response parameter:

- • Error code as Error_flag is set
  - 03h: command option is not supported
  - 12h: the EAS configuration cannot be changed as eith the security session is closed, or locked
  - 13h: the EAS configuration was not successfully programmed

6.4.26 Enable EAS

ST25TV02K/512 will respond with the Telegram or the EAS ID contents when the Enable EAS command is received depending on the option flag bit, and the EAS ID in the command

- If the option flag of the Enable EAS command is set to “0”, the ST25TV02K/512 expect that the reader does not transmit the EAS ID Mask length and EAS ID value. The ST25TV02K/512 will respond with the EAS Telegram
- If the option flag of the EAS Enable command is set to “1”, the ST25TV02K/512 expect the reader transmits the EAS ID Mask length and EAS ID value, and will present the EAS ID or the Telegram depending on the mask length value
  - If Mask == 00h, the ST25TV02K/512 return its 16-bit EAS ID
  - If Mask != 00h, the Mask identifies how many bits of the EAS ID are valid. Only EAS Mask length values 0, 8 and 16 are supported. The ST25TV02K/512 will compare the EAS ID value of the reader’s command with its own EAS ID. If they match, the ST25TV02K/512 return its EAS telegram. If they mismatch the ST25TV02K/512 will ignore the command. This is a selective EAS.

The enable command is answered without error by ST25TV02K/512 only if the Set command has been executed before. Otherwise, the ST25TV02K/512 remain silent.

The EAS telegram is returned starting with the LSB, which is transmitted first, read from left to right.

Table 110. **Enable EAS request format**

Request SOF	Request_flags	Enable EAS	IC Mfg code	UID (1)	EAS ID Mask (2)	EAD ID(2)	CRC16 request	EOF
-	8 bits	A5h	02h	64 bits	8 bits	0, 8 or 16 bits	16 bits	-

1. *The field is optional.*
2. *Only if the option flag of the EAS Enable command is set to “1”*

Request parameters:

- Request flags
- UID (optional)

Table 111. **Enable EAS response format when Error_flag is NOT set**

Response SOF	Response_flags	EAS Telegram (1)	EAS ID(1)	CRC16 request	EOF
-	8 bits	2 up to 256 bits	16 bits	16 bits	-

1. *Available for the proper Option_flag and Mask settings.*

Response parameter:

- No parameter

6.4.27 Lock EAS

The EAS ID, the Telegram, the EAS telegram and EAS mode (reset/set) configuration can be locked definitively with the lock_EAS command. It is not possible to unlock these EAS states once locked (even if presenting the configuration password).

If the EAS configuration is password protected, the configuration password has to be first presented for the lock to be performed

The lock_single_block command is not authorized on the EAS telegram blocks and will return an error.

Table 112. Lock EAS request format

Request SOF	Request_flags	Lock EAS	IC Mfg code	UID (1)	CRC16 request	EOF
-	8 bits	A4h	02h	64 bits	16 bits	-

1. *The field is optional.*

Request parameters:

- Request flags
- UID (optional)

Table 113. Lock EAS response format when Error_flag is NOT set

Response SOF	Response_flags	CRC16 request	EOF
-	8 bits	16 bits	-

Response parameter:

- No parameter

Table 114. Lock EAS response format when Error_flag is set

Response SOF	Response_flags	Error code	CRC16	EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set
  - 03h: command option is not supported
  - 11h: the configuration is already locked and thus cannot be locked again
  - 12h: the configuration cannot be changed as either the security session is closed, or locked
  - 13h: the configuration could not be successfully programmed

6.4.28 Write EAS ID

This command writes a new EAS ID (16 bits words stored in the configuration area)

If the EAS parameters are protected by the configuration password then the command can be executed only if the configuration password has been successfully presented earlier in the same session.

If EAS is locked, the command is not authorized and the ST25TV02K/512 will return an error.

Table 115. Write EAS ID request format

Request SOF	Request_flags	Write EAS ID	IC Mfg code	UID (1)	EAS ID	CRC16 request	EOF
-	8 bits	A7h	02h	64 bits	16 bits	16 bits	-

1. *The field is optional.*

Request parameters:

- Request flags
- UID (optional)
- EAS ID

Table 116. Write EAS response format when Error_flag is NOT set

Response SOF	Response_flags	CRC16 request	EOF
-	8 bits	16 bits	-

Response parameter:
- No parameter

Table 117. Write EAS response format when Error_flag is set

Response SOF	Response_flags	Error code	CRC16 request	EOF
-	8 bits	8 bits	16 bits	-

Response parameter:
- Error code as Error_flag is set
  - 03h: command option is not supported
  - 12h: the EAS configuration cannot be changed as either the security session is closed, or locked
  - 13h: the EAS configuration could not be programmed successfully

6.4.29 Write EAS CONFIG

This command writes the telegram length in the EAS configuration register in the 2 following bits. It is protected by the configuration password if EAS_SEC = '1'

If EAS is locked, the command is not authorized and the ST25TV02K/512 will return an error.

Table 118. EAS configuration bits

bit 1	bit 0	EAS telegram length	Location
0	0	256 bits payload	EAS block 1 to 8
0	1	128 bits payload	EAS block 1 to 4
1	0	64 bits payload	EAS block 1to 2
1	1	32 bits payload	EAS block 1

Note: The bits from 7 to 2 are set to 0.

Table 119. Write EAS CONFIG request format

Request SOF	Request_flags	Write EAS CONFIG	IC Mfg code	UID (1)	EAS configuration	CRC16 request	EOF
-	8 bits	A8h	02h	64 bits	8 bits	16 bits	-

1. *The field is optional.*

Request parameters:
- Request flags
- UID (optional)
- EAS CONFIG

Table 120. **Write EAS CONFIG response format when Error_flag is NOT set**

Response SOF	Response_flags	CRC16 request	EOF
-	8 bits	16 bits	-

Response parameter:

- No parameter

Table 121. **Write EAS CONFIG response format when Error_flag is set**

Response SOF	Response_flags	Error code	CRC16 request	EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set
  - 03h: command option is not supported.
  - 12h: the EAS configuration cannot be changed as either the security session is closed, or is locked.
  - 13h: the EAS configuration is not successfully programmed

6.4.30 Kill

When ST25TV02K/512 receive the Kill command request with the proper parameters, the ST25TV02K/512 enter the Kill mute mode, and ST25TV02K/512 are killed. It can't be read or written and stays mute to any request. Kill mute mode is definitive.

On receiving the Kill command, in the Addressed mode only, the ST25TV02K/512 compare the kill code (sent unencrypted) with the data contained in the request and reports whether the operation was successful in the response.

The Option_flag is supported. If the command is received in the Non Addressed or the Selected mode, the ST25TV02K/512 return an error response.

During the comparison cycle equal to t_W, there should be no modulation (neither 100% nor 10%). Otherwise, the ST25TV02K/512 may not match the kill code correctly. The t_W time is equal to t1nom +18 x 302 µs. After a successful Kill command, the ST25TV02K/512 are deactivated and does not interpret any other command.

Table 122. **Kill request format**

Request SOF	Request_flags	Kill	IC Mfg code	UID	Kill password	Kill code	CRC16 request	EOF
-	8 bits	A6h	02h	64 bits	00h	32 bits	16 bits	-

Request parameters:

- Request flags
- UID (mandatory)
- Kill password

Table 123. **Kill response format when Error_flag is NOT set**

Response SOF	Response_flags	CRC16 request	EOF
-	8 bits	16 bits	-

Response parameter:

- N/A

Table 124. **Kill response format when Error_flag is set**

Response SOF	Response_flags	Error code	CRC16 request	EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set
  - 03h: command option is not supported
  - 0Fh: error with no information given
  - 10h: block address not available
  - 14h: Kill mute mode could not be locked successfully

6.4.31 Write Kill Password

On receiving the Write Kill command, the ST25TV02K/512 write the kill password (sent unencrypted) with the data contained in the request and reports whether the operation was successful in the response.

The Option_flag is supported. After a successful write, the kill code must be locked by a Lock Kill command to activate the protection.

During the write cycle t_W, there should be no modulation (neither 100% nor 10%).

Otherwise, the ST25TV02K/512 may not correctly program the data to the memory. The t_W time is equal to t1nom +18 x 302 µs.

Table 125. **Write Kill Password request format**

Request SOF	Request_flags	Write Kill Password	IC Mfg code	UID (1)	Kill access	Kill password	CRC16 request	EOF
-	8 bits	B1h	02h	64 bits	00h	32 bits	16 bits	-

1. *The field is optional.*

Request parameters:

- Request flags
- UID (optional)
- Kill password

Table 126. **Write Kill response format when Error_flag is NOT set**

Response SOF	Response_flags	CRC16 request	EOF
-	8 bits	16 bits	-

Response parameter:

- N/A

Table 127. **Write Kill response format when Error_flag is set**

Response SOF	Response_flags	Error code	CRC16 request	EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set
  - 03h: command option is not supported
  - 10h: block address not available
  - 12h: the Kill access code is locked
  - 13h: the Kill access code was not successfully programmed

6.4.32 Lock Kill

On receiving the Lock Kill command, the ST25TV02K/512 lock the Kill password permanently.
The Option_flag is supported.
During the write cycle tW, there should be no modulation (neither 100% nor 10%).
Otherwise, the ST25TV may not lock the memory block correctly. The tW time is equal to
t_{1nom} + 18 x 302 µs.

Table 128. Lock Kill request format

Request SOF	Request_flags	Lock Kill	IC Mfg code	UID (1)	Kill access	Protect status	CRC16 request	EOF
-	8 bits	B2h	02h	64 bits	00h	01h	16 bits	-

1. *The field is optional.*

Request parameters:
- Request flags
- UID (optional)
- Kill access code
- Protection status

Table 129. Lock Kill response format when Error_flag is NOT set

Response SOF	Response_flags	CRC16 request	EOF
-	8 bits	16 bits	-

Response parameter:
- No response: under unauthorized request flags and request parameters

Table 130. Lock Kill response format when Error_flag is set

Response SOF	Response_flags	Error code	CRC16 request	EOF
-	8 bits	8 bits	16 bits	-

Response parameter:
- Error code as Error_flag is set
  - 03h: command option is not supported
  - 0Fh: error with no information given
  - 10h: access code not available
  - 11h: the configuration is already locked and thus cannot be locked again
  - 14h: Kill mute mode could not be locked successfully

6.4.33 Fast Inventory Initiated

Before receiving the Fast Inventory Initiated command, the ST25TV02K/512 must have received an Initiate or a Fast Initiate command in order to set the Initiate_flag. If not, the ST25TV does not answer to the Fast Inventory Initiated command.

On receiving the Fast Inventory Initiated request, the ST25TV02K/512 run the anticollision sequence.
The Inventory_flag must be set to 1. The data rate of the response is multiplied by 2.
The ST25TV02K/512 do not generate any answer if an error occurs.

Table 131. Fast Inventory Initiated request format

Request SOF	Request_flags	Fast Inventory Initiated	IC Mfg code	AFI (1)	Mask length	Mask value	CRC16 request	EOF
-	8 bits	C1h	02h	8 bits	8 bits	0 -64 bits	16 bits	-

1. *The field is optional.*

Request parameters:
- Request flags
- Fast Inventory Initiated command code
- AFI if the AFI flag is set
- mask length
- mask value

Table 132. Fast Inventory Initiated response format when Error_flag is NOT set

Response SOF	Response_flags	DSFID	UID	CRC16 request	EOF
-	8 bits	8 bits	64 bits	16 bits	-

Response parameter:
- DSFID
- Unique ID

During an Inventory process, if the VCD does not receive an RF ST25TV02K/512 response, it waits t_3 time before sending an EOF to switch to the next slot. t_3 starts from the rising edge of the request EOF sent by the VCD.
- If the VCD sends a 100% modulated EOF, the minimum value of t_3 is:
  - $t_{3min} = 4384 / f_C$ (323.3 µs) + t_{SOF}
- If the VCD sends a 10% modulated EOF, the minimum value of t3 is:
  - $t_{3min} = 4384/f_C$ (323.3 µs) + t_{NRT}

where:
- t_{SOF} is the time required by the ST25TV02K/512 to transmit an SOF to the VCD.
- t_{NRT} is the nominal response time of the ST25TV02K/512.
- t_{NRT} and t_{SOF} are dependent on the ST25TV02K/512-to-VCD data rate and subcarrier modulation mode.

Note: In case of error, no response is sent by ST25TV02K/512.

6.4.34 Fast Initiate

On receiving the Fast Initiate command, the ST25TV02K/512 set the internal Initiate_flag and sends back a response. The command has to be issued in the Non Addressed mode only (Select_flag is reset to 0 and Address_flag is reset to 0). If an error occurs, the ST25TV02K/512 do not generate any answer. The Initiate_flag is reset after a power off of the ST25TV02K/512. The data rate of the response is multiplied by 2.

Table 133. Fast initiate request format

Request SOF	Request_flags	Fast initiate	IC Mfg code	CRC16 request	EOF
-	8 bits	C2h	02h	16 bits	-

Request parameters:

- Request flags
- Fast initiate command code

Table 134. Fast initiate response format when Error_flag is NOT set

Response SOF	Response_flags	DSFID	UID	CRC16 request	EOF
-	8 bits	8 bits	64 bits	16 bits	-

Response parameter:
- DSFID
- Unique ID

6.4.35 Inventory Initiated

Before receiving Inventory Initiated command, the ST25TV02K/512 must have received an Initiate or a Fast Initiate command in order to set the Initiate_flag. If not, the ST25TV02K/512 do not answer to the Inventory Initiated command.

On receiving the Inventory Initiated request, the ST25TV02K/512 run the anticollision sequence.

The Inventory_flag must be set to 1.

The ST25TV02K/512 do not generate any answer if an error occurs.

The request contains:

Table 135. Inventory Initiated request format

Request SOF	Request_flags	Inventory Initiated	IC Mfg code	AFI (1)	Mask length	Mask value	CRC16 request	EOF
-	8 bits	D1h	02h	8 bits	8 bits	0 -64 bits	16 bits	-

1. *The field is optional.*

Request parameters:
- Request flags
- Inventory Initiated command code
- AFI if the AFI flag is set
- Mask length
- Mask value

Table 136. Inventory Initiated response format when Error_flag is NOT set

Response SOF	Response_flags	DSFID	UID	CRC16 request	EOF
-	8 bits	8 bits	64 bits	16 bits	-

Response parameter:
- DSFID
- Unique ID

During an Inventory process, if the VCD does not receive an RF ST25TV response, it waits t_3 time before sending an EOF to switch to the next slot. t3 starts from the rising edge of the request EOF sent by the VCD.

- If the VCD sends a 100% modulated EOF, the minimum value of t3 is:

  $t_{3min} = 4384/f_C$ (323.3 µs) + t_{SOF}
- If the VCD sends a 10% modulated EOF, the minimum value of t_3 is:

  $t_{3min} = 4384/f_C$ (323.3 µs) + t_{NRT}

where:

- t_{SOF} is the time required by the ST25TV02K/512 to transmit an SOF to the VCD
- t_{NRT} is the nominal response time of the ST25TV02K/512

t_{NRT} and t_{SOF} are dependent on the ST25TV02K/512-to-VCD data rate and subcarrier modulation mode.

6.4.36 Initiate

On receiving the Initiate command, the ST25TV02K/512 set the internal Initiate_flag and sends back a response. The command has to be issued in the Non Addressed mode only (Select_flag is reset to 0 and Address_flag is reset to 0). If an error occurs, the ST25TV02K/512 do not generate any answer.

The Initiate_flag is reset after a power off of the ST25TV02K/512.

The request contains:

Table 137. Initiate request format

Request SOF	Request_flags	Initiate	IC Mfg code	CRC16 request	EOF
-	8 bits	D2h	02h	16 bits	-

Request parameters:

- Request flags
- Initiated command code

Table 138. Initiate response format when Error_flag is NOT set

Response SOF	Response_flags	DSFID	UID	CRC16 request	EOF
-	8 bits	8 bits	64 bits	16 bits	-

Response parameter:

- DSFID
- Unique ID

6.4.37 Inventory read

The Inventory read performs an inventory followed by a multiple block read.

If an error is detected, no matter if on the inventory or the read part, ST25TV02K/512 do not answer.

The request contains:

Table 139. Inventory read request format

Request SOF	Request_flags	Inventory Read	IC Mfg code	AFI (1)	Mask length	Mask value	First block number	Number of blocks	CRC16 request	EOF
-	8 bits	D3h	02h	8 bits	8 bits	0 -64 bits	8 bits	8 bits	16 bits	-

1. *The field is optional.*

Request parameters:

- Request flags. (The Nb_slots flag (bit 6) of the Request flags bits 5 to 8 described in , must be set to 1 for 1 slot inventory. 16 slot inventory is not supported in the inventory read command.
- Inventory read command code
- AFI if the AFI flag is set
- Mask length
- Mask value
- First block number

- Number of blocks

Table 140. Inventory read response format

Response SOF	Request_flags	DSFID	UID	Block security status (1)	Data	CRC16 request	EOF
-	8 bits	8 bits	64 bits	8 bits (2)	32 bits (2)	16 bits	-

1. *The field is optional.*
2. *The group of Block security status (if any), and its data are repeated if needed, for up to the number of blocks requested.*

Request parameter:

- Unique ID
- Block security status if Option_flag is set (see Table 46. Block security status)
- N blocks of data

Table 141. Block security status

b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
Reserved for future use. All at 0.							0: Current block not locked 1: Current block locked

During an Inventory Read process, if the VCD does not receive an RF ST25TV02K/512 response, it waits t_3 time before sending an EOF to switch to the next slot. t_3 starts from the rising edge of the request EOF sent by the VCD.

- If the VCD sends a 100% modulated EOF, the minimum value of t_3 is:
  $t_{3min} = 4384/fC$ (323.3 µs) + t_{SOF}
- If the VCD sends a 10% modulated EOF, the minimum value of t_3 is:
  $t_{3min} = 4384/f_C$ (323.3 µs) + t_{NRT}
- where:
  t_{SOF} is the time required by the ST25TV02K/512 to transmit an SOF to the VCD
  t_{NRT} is the nominal response time of the ST25TV02K/512

t_{NRT} and t_{SOF} are dependent on the ST25TV02K/512-to-VCD data rate and subcarrier modulation mode.

6.4.38 Fast inventory read

The Fast inventory read performs an inventory followed by a multiple block read.
The response is at twice the data rate.
If an error is detected, no matter if on the inventory or the read part, ST25TV02K/512 do not answer.
The request contains:

Table 142. Fast Inventory read request format

Response SOF	Request_flags	Fast inventory read	IC Mfg code	AFI (1)	Mask length	Mask value	First block number	Number of blocks	CRC16 request	EOF
-	8 bits	D4h	02h	8 bits	8 bits	8 bits	0 -64 bits	8 bits	16 bits	-

1. *The field is optional.*

Response parameter:

- Request flags. The Nb_slots flag (bit 6) of the Request flags bits 5 to 8 described in , must be set to 1 for 1 slot inventory. 16 slot inventory is not supported in the Fast Inventory read command
- Fast Inventory read command code

- AFI if the AFI flag is set
- Mask length
- Mask value
- First block number
- Number of blocks

Table 143. Fast Inventory read response format when Error_flag is NOT set

Response SOF	Request_flags	DSFID	UID	Block security status (1)	Data	CRC16 request	EOF
-	8 bits	8 bits	64 bits	8 bits (2)	32 bits(2)	16 bits	-

1. *The field is optional.*
2. *The group of Block security status (if any), and its data are repeated if needed, for up to the number of blocks requested.*

Response parameter:

- DSFID,
- Unique ID
- N blocks of block security status if Option_flag is set (see Table Table 46. Block security status)
- N blocks of data

Table 144. Block security status

b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
Reserved for future use. All at 0.							0: Current block not locked 1: Current block locked

During a Fast Inventory Read process, if the VCD does not receive an RF ST25TV02K/512 response, it waits t_3 time before sending an EOF to switch to the next slot. t_3 starts from the rising edge of the request EOF sent by the VCD.

- If the VCD sends a 100% modulated EOF, the minimum value of t_3 is:

  $t_{3min} = 4384/f_C$ (323.3 µs) + t_{SOF}
- If the VCD sends a 10% modulated EOF, the minimum value of t_3 is:

  $t_{3min} = 4384/f_C$ (323.3 µs) + t_{NRT}

where:

- t_{SOF} is the time required by the ST25TV02K/512 to transmit an SOF to the VCD
- t_{NRT} is the nominal response time of the ST25TV02K/512

t_{NRT} and t_{SOF} are dependent on the ST25TV02K/512-to-VCD data rate and sub-carrier modulation mode.

6.4.39 Enable Untraceable mode

With the Enable untraceable mode command the ST25TV02K/512 will not respond to any command except Present Password and Get Random Number.

The Enable_Untraceable command requires the untraceable access code (fixed value) and the crypted untraceable mode password to be presented for the command to be executed properly

Table 145. Enable untraceable mode request format

Response SOF	Request_flags	Enable untraceable mode	IC Mfg code	UID (1)	Password number	Crypted password	CRC16 request	EOF
-	8 bits	BAh	02h	64 bits	00h	32 bits	16 bits	-

1. *The field is optional.*

Request parameters:

- Request flags
- UID (optional)
- Password Number = 00h
- Crypted Password

Table 146. Enable untraceable mode response format when Error_flag is NOT set

Request SOF	Response_flags	CRC16 request	EOF
-	8 bits	16 bits	-

Response parameter:

No response: under unauthorized request flags and request parameters

Table 147. Enable untraceable mode response format when Error_flag is set

Request SOF	Response_flags	Error code	CRC16 request	EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set
  - 03h: command option is not supported
  - 0Fh: error with no information given
  - 10h: password number is not 00h
  - 13h: the EAS configuration was not successfully programmed

6.4.40 Get Random Number

When ST25TV02K/512 receive the Get Random Number command, ST25TV02K/512 return a 16 bit random number. A power on reset cycle (transition to RF field off, then RF field on, followed by t_{Boot_RF}) must be done just before sending the Get Random Number Request.

Table 148. Get random number request format

Request SOF	Request_flags	Get random number	IC Mfg code	UID (1)	CRC16 request	EOF
-	8 bits	B4h	02h	64 bits	16 bits	-

1. *The field is optional.*

Request parameters:

- Request flags
- UID (optional)

Table 149. Get random number response format when Error_flag is NOT set

Request SOF	Response_flags	Random number	CRC16 request	EOF
-	8 bits	16 bits	16 bits	-

Response parameter:

- Random number

Table 150. Get Random Number response format when Error_flag is set

Request SOF	Response_flags	Error code	CRC16 request	EOF
-	8 bits	8 bits	16 bits	-

Response parameter:

- Error code as Error_flag is set
  - 03h: command option is not supported

7 Unique identifier (UID)

The ST25TV02K/512 are uniquely identified by a 64-bit unique identifier (UID). This UID complies with ISO/IEC 15963 and ISO/IEC 7816-6. The UID is a read-only code and comprises:

- 8 bytes
- the MSB has a value of E0h
- the IC manufacturer code “ST 02h” on 8 bits (ISO/IEC 7816-6/AM1),
- a unique serial number on 48 bits

Table 151. UID format

MSB		LSB	
63 56	55 48	47 40	40 0
0xE0	0x02	ST product code (1)	Unique serial number

1. *See Table 30. UID for ST product code value definition.*

With the UID, each ST25TV02K/512 can be addressed uniquely and individually during the anticollision loop and for one-to-one exchanges between a VCD and an ST25TV02K/512.

8 Device parameters

8.1 Maximum ratings

Stressing the device above the ratings listed in Table 152. Absolute maximum ratings may permanently damage it. These are stress ratings only and operation of the device, at these or any other conditions above those indicated in the operating sections of this specification, is not implied. Exposure to absolute maximum rating conditions for extended periods may affect the device reliability. Refer also to the STMicroelectronics SURE Program and other relevant quality documents.

Table 152. Absolute maximum ratings

Symbol	Parameter		Min.	Max.	Unit
T_A	Ambient operating temperature		- 40	85	°C
T_{STG}	Storage temperature	UFDFPN5	-65	150	°C
		Sawn wafer on UV tape kept in its original packing form	15	25	°C
t_{STG}	Retain		-	9 (1)	months
V_{MAX_1} (2)	RF input voltage amplitude peak to peak between AC0 and AC1, V_{SS} pin left floating	V_{AC0} - V_{AC1}	-	11	V
V_{ESD}	Electrostatic discharge voltage (3)(human body model)	All pins	-	1500	V

1. *Counted from ST production date.*
2. *Based on characterization, not tested in production.*
3. *ANSI/ESDA/JEDEC JS-001-2012, C = 100 pF, R = 1500 Ω, R2 = 500 Ω*

8.2 RF electrical parameters

This section summarizes the operating and measurement conditions, and the DC and AC characteristics of the device in RF mode.

The parameters in the DC and AC characteristics tables that follow are derived from tests performed under the Measurement Conditions summarized in the relevant tables. Designers should check that the operating conditions in their circuit match the measurement conditions when relying on the quoted parameters.

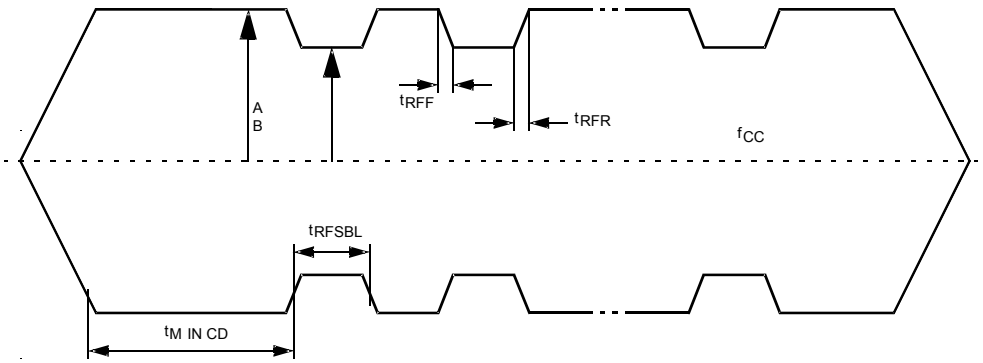
Table 153. RF characteristics

Symbol	Parameter	Condition(1)(2)	Min	Typ	Max	Unit
f_{CC}	External RF signal frequency		13.553	13.56	13.567	MHz
$MI_{CARRIER}$	10% carrier modulation index (3)		10	-	30	%
	100% carrier modulation index	-	95	-	100	
t_{Boot_RF}	RF Boot time (Minimum time from carrier generation to first data)	From H-field min	-	-	1	ms
f_{SH}	Subcarrier frequency high	$F_{CC}/32$	-	423.75	-	kHz
f_{SL}	Subcarrier frequency low	$F_{CC}/28$	-	484.28	-	kHz
t_1	VICC response delay	-	318.6	320.9	323.3	µs
t_2	VCD new request delay	-	309	311.5	314	µs
t_3	VCD new request delay when no response is received from the VICC	-	323.3	-	-	µs
W_t	Time for Write operation (including internal Verify) (4)	1 Block	-	5.2	-	ms

Symbol	Parameter	Condition(1)(2)	Min	Typ	Max	Unit
t_{PWD_FAIL} (5)	Waiting time in case of wrong password	-	5.12	-	-	ms
$C_{TUN_}$ 23.5pF	Internal tuning capacitor in SO8 (6)	f = 13.56 MHz	21.4	23	24.6	pF
$C_{TUN_}$ 99 pF	Internal tuning capacitor in SO8(6)	f = 13.56 MHz	92.7	99.7	106.7	pF
V_{BACK}	Backscattered level as defined by ISO test	-	10	-	-	mV
V_{MIN_1} (3)	RF input voltage amplitude between AC0 and AC1, V_{AC0}-V_{AC1} peak to peak(3)	Inventory and Read operations	-	4.8	-	Vpkpk
		Write operations	-	6	-	Vpkpk
t_{RF_OFF}	RF OFF time	Chip reset	2	-	-	ms
R_{closed}	Resistance of closed Tamper Detect Loop	TD0-TD1	-	-	50	Ω
R_{open}	Resistance of open Tamper Detect Loop	TD0-TD1	1	-	-	MΩ

1. *T_A =–40 to 85 °C. Characterized only.*
2. *All timing characterizations were performed on a reference antenna with the following characteristics:*
   - *ISO antenna class1*
   - *Tuning frequency = 13.7 MHz*
3. *Characterized on bench.*
4. *For VCD request coded in 1 out of 4 and ST25TV02K/512 response in high data rate, single sub carrier.*
5. *Applies from VCD request EOF to VICC response SOF.*
6. *The tuning capacitance value is measured with ST characterization equipment at chip Power On Reset. This value is used as reference for antenna design. Minimum and Maximum values come from correlation with industrial tester limits. For inlay implementation, the antenna design applied for LRI2K can be re-used as-is for ST25TV02K. The typical value for the ST25TV02K is equivalent to what was specified in the LRI2K data-sheet. This change is related to a different measurement methodology between LRI2K and ST25TV02K.*

Figure 29. ASK modulated signal



9 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

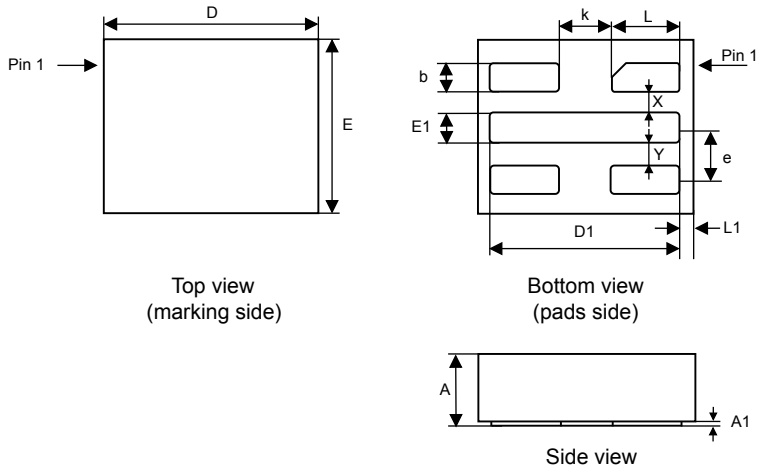
9.1 Sawn and bumped wafer

Contact your STMicroelectronics sales office to get the document with the detailed description.

9.2 UFDFPN5 (DFN5) package information

UFDFPN5 is a 5-lead, 1.7 × 1.4 mm, 0.55 mm thickness, ultra thin fine pitch dual flat package.

Figure 30. UFDFPN5 - Outline



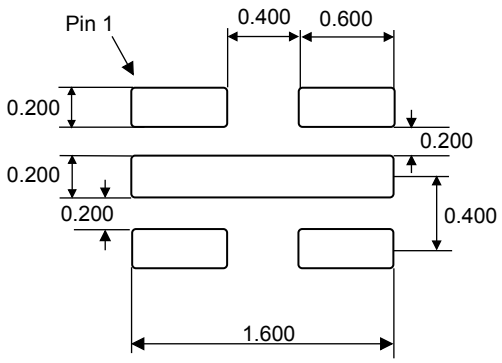
1. Maximum package warpage is 0.05 mm.
2. Exposed copper is not systematic and can appear partially or totally according to the cross section.
3. Drawing is not to scale.
4. On the bottom side, pin 1 is identified by the specific pad shape and, on the top side, pin 1 is defined from the orientation of the marking. When reading the marking, pin 1 is below the upper left package corner.

Table 154. UFDFPN5 - Mechanical data

Symbol	millimeters			inches[1]		
	Min	Typ	Max	Min	Typ	Max
A	0.500	0.550	0.600	0.0197	0.0217	0.0236
A1	0.000	-	0.050	0.0000	-	0.0020
b[2]	0.175	0.200	0.225	0.0069	0.0079	0.0089
D	1.600	1.700	1.800	0.0630	0.0669	0.0709
D1	1.400	1.500	1.600	0.0551	0.0591	0.0630
E	1.300	1.400	1.500	0.0512	0.0551	0.0591
E1	0.175	0.200	0.225	0.0069	0.0079	0.0089
X	-	0.200	-	-	0.0079	-
Y	-	0.200	-	-	0.0079	-
e	-	0.400	-	-	0.0157	-
L	0.500	0.550	0.600	0.0197	0.0217	0.0236
L1	-	0.100	-	-	0.0039	-
k	-	0.400	-	-	0.0157	-

1. *Values in inches are converted from mm and rounded to four decimal digits.*
2. *Dimension b applies to plated terminal and is measured between 0.15 and 0.30mm from the terminal tip.*

Figure 31. UFDFPN5 - Recommended footprint



Note: Dimensions are expressed in millimeters.

10 Ordering information

Table 155. Ordering information scheme

Example:	ST25TV	02K-	A	P	6	G	3
Device type							
ST25TV = NFC/RFID tag based on ISO 15693 and NFC T5T							
Memory size							
02K = 2 Kbits							
512 = 512 bits							
Interface							
A = None							
Features							
P = No tamper detect feature available							
D = Tamper detect feature available							
Device grade							
6 = Industrial device tested with standard test flow over - 40 to 85 °C							
Package							
F = 75 µm ± 10 µm bumped and sawn wafer							
G = 120 µm ± 15 µm bumped and sawn wafer							
H = UFDFPN5							
U = 725 µm ± 20 µm unsawn wafer							
Capacitance							
3 = 23 pF							
9 = 99.7 pF							

Note: Parts marked as “ES” or “E” are not yet qualified and therefore not approved for use in production. ST is not responsible for any consequences resulting from such use. In no event will ST be liable for the customer using any of these engineering samples in production. ST’s Quality department must be contacted prior to any decision to use these engineering samples to run a qualification activity.

Appendix A Bit representation and coding for fast commands

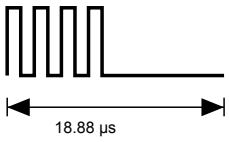
Data bits are encoded using Manchester coding, according to the following schemes. For the low data rate, same subcarrier frequency or frequencies is/are used. In this case, the number of pulses is multiplied by 4 and all times increase by this factor. For the fast commands using one subcarrier, all pulse numbers and times are divided by two.

A.1 Bit coding using one subcarrier

A.1.1 High data rate

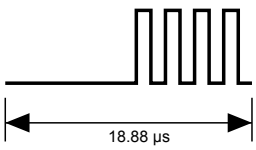
For the fast commands, a logic 0 starts with four pulses at 423.75 kHz (f_C / 32) followed by an unmodulated time of 9.44 µs, as shown in Figure 32.

Figure 32. Logic 0, high data rate, fast commands



For the fast commands, a logic 1 starts with an unmodulated time of 9.44 µs followed by four pulses of 423.75 kHz (f_C / 32), as shown in Figure 33 .

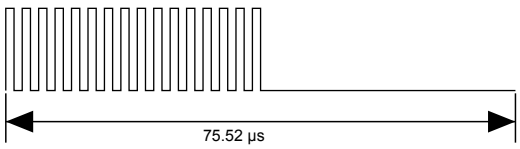
Figure 33. Logic 1, high data rate, fast commands



A.1.2 Low data rate

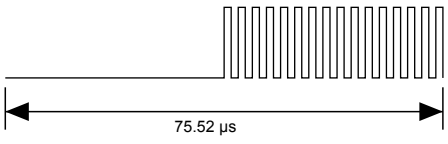
For the fast commands, a logic 0 starts with 16 pulses at 423.75 kHz (f_C / 32) followed by an unmodulated time of 37.76 µs, as shown in Figure 34.

Figure 34. Logic 0, low data rate, fast commands



For the fast commands, a logic 1 starts with an unmodulated time of 37.76 µs followed by 16 pulses at 423.75 kHz (f_C / 32), as shown in Figure 35.

Figure 35. Logic 1, low data rate, fast commands



Note: For fast commands, bit coding using two subcarriers is not supported.

A.2 VICC to VCD frames

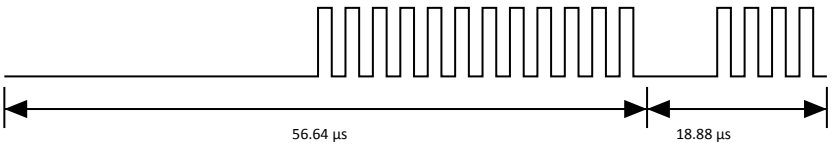
Frames are delimited by an SOF and an EOF. They are implemented using code violation. Unused options are reserved for future use. For the low data rate, the same subcarrier frequency or frequencies is/are used. In this case, the number of pulses is multiplied by 4. For the fast commands using one subcarrier, all pulse numbers and times are divided by two.

A.3 SOF when using one subcarrier

A.3.1 High data rate

For the fast commands, the SOF comprises an unmodulated time of 28.32 µs, followed by 12 pulses at 423.75 kHz (f_C / 32), and a logic 1 that consists of an unmodulated time of 9.44 µs followed by four pulses at 423.75 kHz, as shown in Figure 36.

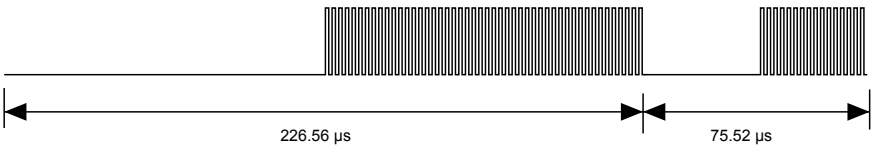
Figure 36. Start of frame, high data rate, one subcarrier, fast commands



A.3.2 Low data rate

For the fast commands, the SOF comprises an unmodulated time of 113.28 µs, followed by 48 pulses at 423.75 kHz (f_C / 32), and a logic 1 that includes an unmodulated time of 37.76 µs followed by 16 pulses at 423.75 kHz, as shown in Figure 37.

Figure 37. Start of frame, low data rate, one subcarrier, fast commands

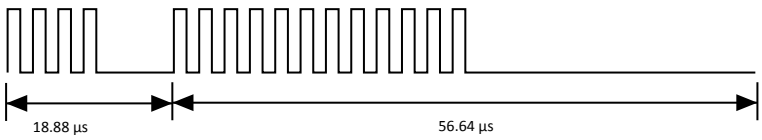


A.4 EOF when using one subcarrier

A.4.1 High data rate

For the Fast commands, the EOF comprises a logic 0 that includes four pulses at 423.75 kHz and an unmodulated time of 9.44 µs, followed by 12 pulses at 423.75 kHz (f_C / 32) and an unmodulated time of 37.76 µs, as shown in Figure 38.

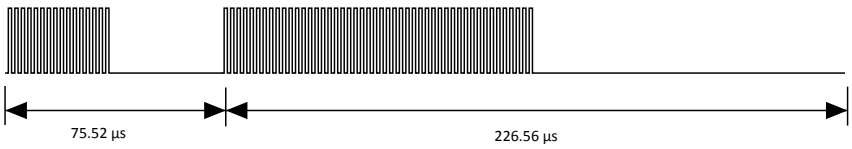
Figure 38. End of frame, high data rate, one subcarrier, fast commands



A.4.2 Low data rate

For the fast commands, the EOF comprises a logic 0 that includes 16 pulses at 423.75 kHz and an unmodulated time of 37.76 µs, followed by 48 pulses at 423.75 kHz (f_C / 32) and an unmodulated time of 113.28 µs, as shown in Figure 39.

Figure 39. End of frame, low data rate, one subcarrier, fast commands



Note: For SOF and EOF in fast commands, bit coding using two subcarriers is not supported.

Revision history

Table 156. **Document revision history**

Date	Revision	Changes
08-Jun-2017	1	Initial release.
09-Oct-2017	2	Changed the document scope from public to ST Restricted Updated: • Features • Section 1 Description • Section 5.6 TruST25 digital signature • Section 6.4.1 RF command code list • Section 6.4.16 Get System info • Table 79. Get System Info response format when Error_flag is set Added NFC certified logo Deleted: • Section 5.6.1: TruST25™ digital signature registers • Section 5.6.2: TruST25™ digital signature description • Section 6.4.30: Read Signature • Table 21: SIGNATURE • Table 122: Read Signature request format • Table 123: Read Signature response format when Error_flag is NOT set • Table 124: Write EAS CONFIG response format when Error_flag is set
24-Oct-2017	3	Updated: • Table 4. System configuration memory map accessible through write_cfg and read_cfg commands • Section 5.2.4 System memory protection • Section 5.3.2 Untraceable mode description • Section 5.4.2 Random number description • Section 6.4.21 Present Password • Section 6.4.40 Get Random Number • Table 155. Ordering information scheme Added Table 5. System configuration memory map for registers accessed through dedicated commands .
27-Nov-2017	4	Updated Features and Section 6.4.38 Fast inventory read. Updated Table 11. PWD_CFG, Table 15. Untraceable mode register, Table 140. Inventory read response format and Table 155. Ordering information scheme.
27-Mar-2018	5	Added: • Section 9 Package information • Figure 30. UFDFPN5 - Outline and Figure 31. UFDFPN5 - Recommended footprint • Table 154. UFDFPN5 - Mechanical data Updated: • Section Features • Table 78. Get System info response format Error_flag is NOT set • Table 110. Enable EAS request format • Table 111. Enable EAS response format when Error_flag is NOT set • Table 137. Initiate request format • Table 138. Initiate response format when Error_flag is NOT set • Table 152. Absolute maximum ratings • Table 153. RF characteristics • Figure 26. Present Password frame exchange between VCD and ST25TV02K/512 • Section 6.4.7 Write Single Block • Section 6.4.38 Fast inventory read

Date	Revision	Changes
17-Apr-2018	6	Updated Section 6.4.40 Get Random Number.
14-Jun-2018	7	Updated: • Section Features • Section 6.4.20 Write Password • Table 38. Response error code definition • Table 152. Absolute maximum ratings • Table 153. RF characteristics • Table 155. Ordering information scheme
08-Oct-2018	8	Updated: • Section A.2 VICC to VCD frames
16-Nov-2018	9	Updated: • Table 155. Ordering information scheme
29-Apr-2019	10	Updated Section Features. Added Figure 3. Die connections for sawn and bumped wafer (bottom view) and Section 9.1 Sawn and bumped wafer. Minor text edits across the whole document.
01-Feb-2021	11	Updated Section 5.3.2 Untraceable mode description and Section 6.4.21 Present Password. Minor text edits across the whole document.

Contents

1 **Description** . . . 3
1.1 ST25TV02K/512 (with tamper detect) block diagram . . . 3
2 **Signal descriptions** . . . 5
2.1 Antenna coil (AC0, AC1) . . . 5
2.2 Tamper Detect (TD0, TD1) . . . 5
3 **Power management** . . . 6
3.1 Device set . . . 6
3.2 Device reset . . . 6
4 **Memory management** . . . 7
4.1 Memory organization overview . . . 7
4.2 User memory . . . 8
4.2.1 User memory areas . . . 8
4.3 System configuration area . . . 8
5 **ST25TV02K/512 specific features** . . . 10
5.1 Kill mode . . . 10
5.1.1 Kill registers . . . 10
5.1.2 Kill mode description . . . 11
5.2 Data protection . . . 11
5.2.1 Data protection registers . . . 11
5.2.2 Passwords and security sessions . . . 13
5.2.3 User memory protection . . . 15
5.2.4 System memory protection . . . 15
5.3 Untraceable mode . . . 16
5.3.1 Untraceable mode register . . . 16
5.3.2 Untraceable mode description . . . 16
5.4 Random number . . . 16
5.4.1 Random number register . . . 16
5.4.2 Random number description . . . 16
5.5 Electronic article surveillance (EAS) . . . 17
5.5.1 EAS registers . . . 17

5.5.2 EAS ID . . . 17
5.5.3 EAS configuration . . . 18
5.5.4 EAS description . . . 18
5.6 TruST25 digital signature . . . 20
5.7 Counter . . . 20
5.7.1 Counter registers . . . 20
5.7.2 Counter description . . . 21
5.8 ST25TV16K/64K Inventory Read . . . 21
5.9 ST25TV02K/512 Inventory initiated . . . 21
5.10 Tamper detect . . . 22
5.10.1 Tamper detect register . . . 22
5.10.2 Tamper detection description . . . 22
5.11 Device parameter registers . . . 22
6 RF operations . . . 25
6.1 RF communication . . . 25
6.1.1 Access to a ISO/IEC 15693 device . . . 25
6.2 RF protocol description . . . 25
6.2.1 Protocol description . . . 25
6.2.2 ST25TV02K/512 states referring to protocol . . . 26
6.2.3 Modes . . . 27
6.2.4 Request format . . . 28
6.2.5 Request flags . . . 28
6.2.6 Response format . . . 29
6.2.7 Response flags . . . 29
6.2.8 Response and error code . . . 30
6.3 Timing definition . . . 30
6.4 RF commands . . . 31
6.4.1 RF command code list . . . 31
6.4.2 Command codes list . . . 33
6.4.3 General Command Rules . . . 33
6.4.4 Inventory . . . 33
6.4.5 Stay Quiet . . . 34

6.4.6 Read Single Block . . . 35
6.4.7 Write Single Block . . . 36
6.4.8 Lock block . . . 37
6.4.9 Read Multiple Blocks . . . 39
6.4.10 Select . . . 40
6.4.11 Reset to Ready . . . 41
6.4.12 Write AFI . . . 42
6.4.13 Lock AFI . . . 43
6.4.14 Write DSFID . . . 44
6.4.15 Lock DSFID . . . 45
6.4.16 Get System Info . . . 46
6.4.17 Get Multiple Block Security Status . . . 47
6.4.18 Read Configuration . . . 49
6.4.19 Write Configuration . . . 50
6.4.20 Write Password . . . 51
6.4.21 Present Password . . . 52
6.4.22 Fast Read Single Block . . . 53
6.4.23 Fast Read Multiple Blocks . . . 55
6.4.24 Set EAS . . . 56
6.4.25 Reset EAS . . . 57
6.4.26 Enable EAS . . . 58
6.4.27 Lock EAS . . . 59
6.4.28 Write EAS ID . . . 59
6.4.29 Write EAS CONFIG . . . 60
6.4.30 Kill . . . 61
6.4.31 Write Kill Password . . . 62
6.4.32 Lock Kill . . . 63
6.4.33 Fast Inventory Initiated . . . 63
6.4.34 Fast Initiate . . . 64
6.4.35 Inventory Initiated . . . 65
6.4.36 Initiate . . . 66
6.4.37 Inventory Read . . . 66
6.4.38 Fast Inventory Read . . . 67

6.4.39 Enable Untraceable mode . . . 68
6.4.40 Get Random Number . . . 69
7 Unique identifier (UID) . . . 71
8 Device parameters . . . 72
8.1 Maximum rating . . . 72
8.2 RF electrical parameters . . . 72
9 Package information . . . 74
9.1 Sawn and bumped wafer . . . 74
9.2 UFDFPN5 package information . . . 74
10 Ordering information . . . 76
Appendix A Appendice A . . . 77
A.1 Bit coding using one subcarrier . . . 77
A.1.1 High data rate . . . 77
A.1.2 Low data rate . . . 77
A.2 VICC to VCD frames . . . 78
A.3 SOF when using one subcarrier . . . 78
A.3.1 High data rate . . . 78
A.3.2 Low data rate . . . 78
A.4 EOF when using one subcarrier . . . 79
A.4.1 High data rate . . . 79
A.4.2 Low data rate . . . 79
Revision history . . . 80
Contents . . . 82
List of tables . . . 86
List of figures . . . 89

List of tables

Table 1. Signal names . . . 3
Table 2. 2Kb user memory as seen by RF . . . 8
Table 3. Memory Organization . . . 8
Table 4. System configuration memory map accessible through write_cfg and read_cfg commands . . . 9
Table 5. System configuration memory map for registers accessed through dedicated commands . . . 9
Table 6. KILL . . . 10
Table 7. PWD_KILL . . . 10
Table 8. A1SS . . . 11
Table 9. A2SS . . . 12
Table 10. LOCK_CFG . . . 12
Table 11. PWD_CFG . . . 12
Table 12. PWD_A1 . . . 13
Table 13. PWD_A2 . . . 13
Table 14. Security session type . . . 13
Table 15. Untraceable mode register . . . 16
Table 16. Random number register . . . 16
Table 17. EAS_SEC . . . 17
Table 18. EAS_TELEGRAM register . . . 17
Table 19. EAS_ID . . . 17
Table 20. EAS_CFG . . . 18
Table 21. KID . . . 20
Table 22. CNT_CFG . . . 20
Table 23. CNT_VAL . . . 20
Table 24. TAMPER_DETECT . . . 22
Table 25. LOCK_DSFID . . . 22
Table 26. LOCK_AFI . . . 22
Table 27. DSFID . . . 23
Table 28. AFI . . . 23
Table 29. IC_REF . . . 23
Table 30. UID . . . 23
Table 31. response depending on Request_flags . . . 27
Table 32. General request format . . . 28
Table 33. Definition of request flags 1 to 4 . . . 28
Table 34. Request flags 5 to 8 when inventory_flag, Bit 3 = 0 . . . 29
Table 35. Request flags 5 to 8 when inventory_flag, Bit 3 = 1 . . . 29
Table 36. General response format . . . 29
Table 37. Definitions of response flags 1 to 8 . . . 30
Table 38. Response error code definition . . . 30
Table 39. Timing values . . . 31
Table 40. Command codes . . . 33
Table 41. Inventory request format . . . 34
Table 42. Inventory response format . . . 34
Table 43. Stay Quiet request format . . . 34
Table 44. Read Single Block request format . . . 35
Table 45. Read Single Block response format when Error_flag is NOT set . . . 35
Table 46. Block security status . . . 35
Table 47. Read Single Block response format when Error_flag is set . . . 35
Table 48. Write Single Block request format . . . 36
Table 49. Write Single Block response format when Error_flag is NOT set . . . 36
Table 50. Write Single Block response format when Error_flag is set . . . 37
Table 51. Locking scheme . . . 37
Table 52. Lock block request format . . . 38

Table 53. Lock block response format when Error_flag is NOT set . . . 38
Table 54. Lock single block response format when Error_flag is set . . . 38
Table 55. Read Multiple Block request format . . . 39
Table 56. Read Multiple Block response format when Error_flag is NOT set . . . 39
Table 57. Block security status. . . . 40
Table 58. Read Multiple Block response format when Error_flag is set . . . 40
Table 59. Select request format . . . 40
Table 60. Select Block response format when Error_flag is NOT set . . . 41
Table 61. Select response format when Error_flag is set . . . 41
Table 62. Reset to Ready request format . . . 41
Table 63. Reset to Ready response format when Error_flag is NOT set. . . . 41
Table 64. Reset to ready response format when Error_flag is set . . . 42
Table 65. Write AFI request format. . . . 42
Table 66. Write AFI response format when Error_flag is NOT set . . . 42
Table 67. Write AFI response format when Error_flag is set. . . . 43
Table 68. Lock AFI request format . . . 43
Table 69. Lock AFI response format when Error_flag is NOT set . . . 43
Table 70. Lock AFI response format when Error_flag is set . . . 44
Table 71. Write DSFID request format . . . 44
Table 72. Write DSFID response format when Error_flag is NOT set. . . . 45
Table 73. Write DSFID response format when Error_flag is set . . . 45
Table 74. Lock DSFID request format. . . . 45
Table 75. Lock DSFID response format when Error_flag is NOT set . . . 46
Table 76. Lock DSFID response format when Error_flag is set. . . . 46
Table 77. Get System info request format . . . 46
Table 78. Get System info response format Error_flag is NOT set . . . 47
Table 79. Get System Info response format when Error_flag is set . . . 47
Table 80. Get Multiple Block Security Status request format . . . 48
Table 81. Get Multiple Block Security Status response format when Error_flag is NOT set. . . . 48
Table 82. Block security status. . . . 48
Table 83. Get Multiple Block Security Status response format when Error_flag is set . . . 48
Table 84. Read Configuration request format. . . . 49
Table 85. Read Configuration response format when Error_flag is NOT set . . . 49
Table 86. Read Configuration response format when Error_flag is set. . . . 49
Table 87. Write Configuration request format. . . . 50
Table 88. Write Configuration response format when Error_flag is NOT set . . . 50
Table 89. Write Configuration response format when Error_flag is set. . . . 50
Table 90. Write Password request format . . . 51
Table 91. Write Password response format when Error_flag is NOT set . . . 52
Table 92. Write Password response format when Error_flag is set . . . 52
Table 93. Present Password request format . . . 52
Table 94. Present Password response format when Error_flag is NOT set. . . . 53
Table 95. Present Password response format when Error_flag is set . . . 53
Table 96. Fast Read Single Block request format . . . 54
Table 97. Fast Read Single Block response format when Error_flag is NOT set . . . 54
Table 98. Block security status. . . . 54
Table 99. Fast Read Single Block response format when Error_flag is set . . . 54
Table 100. Fast Read Multiple Block request format . . . 55
Table 101. Fast Read Multiple Block response format when Error_flag is NOT set . . . 55
Table 102. Block security status if Option_flag is set. . . . 55
Table 103. Fast Read Multiple Block response format when Error_flag is set. . . . 56
Table 104. Set EAS request format . . . 56
Table 105. Set EAS response when Error_flag is NOT set . . . 57
Table 106. Set EAS response when Error_flag is set . . . 57

Table 107. Reset EAS request format . . . 57
Table 108. Reset EAS format when Error_flag is NOT set . . . 57
Table 109. Reset EAS format when Error_flag is set . . . 58
Table 110. Enable EAS request format . . . 58
Table 111. Enable EAS response format when Error_flag is NOT set . . . 58
Table 112. Lock EAS request format . . . 59
Table 113. Lock EAS response format when Error_flag is NOT set . . . 59
Table 114. Lock EAS response format when Error_flag is set . . . 59
Table 115. Write EAS ID request format . . . 59
Table 116. Write EAS response format when Error_flag is NOT set . . . 60
Table 117. Write EAS response format when Error_flag is set . . . 60
Table 118. EAS configuration bits . . . 60
Table 119. Write EAS CONFIG request format . . . 60
Table 120. Write EAS CONFIG response format when Error_flag is NOT set . . . 61
Table 121. Write EAS CONFIG response format when Error_flag is set . . . 61
Table 122. Kill request format . . . 61
Table 123. Kill response format when Error_flag is NOT set . . . 61
Table 124. Kill response format when Error_flag is set . . . 62
Table 125. Write Kill Password request format . . . 62
Table 126. Write Kill response format when Error_flag is NOT set . . . 62
Table 127. Write Kill response format when Error_flag is set . . . 62
Table 128. Lock Kill request format . . . 63
Table 129. Lock Kill response format when Error_flag is NOT set . . . 63
Table 130. Lock Kill response format when Error_flag is set . . . 63
Table 131. Fast Inventory Initiated request format . . . 64
Table 132. Fast Inventory Initiated response format when Error_flag is NOT set . . . 64
Table 133. Fast initiate request format . . . 64
Table 134. Fast initiate response format when Error_flag is NOT set . . . 65
Table 135. Inventory Initiated request format . . . 65
Table 136. Inventory Initiated response format when Error_flag is NOT set . . . 65
Table 137. Initiate request format . . . 66
Table 138. Initiate response format when Error_flag is NOT set . . . 66
Table 139. Inventory read request format . . . 66
Table 140. Inventory read response format . . . 67
Table 141. Block security status . . . 67
Table 142. Fast Inventory read request format . . . 67
Table 143. Fast Inventory read response format when Error_flag is NOT set . . . 68
Table 144. Block security status . . . 68
Table 145. Enable untraceable mode request format . . . 68
Table 146. Enable untraceable mode response format when Error_flag is NOT set . . . 69
Table 147. Enable untraceable mode response format when Error_flag is set . . . 69
Table 148. Get random number request format . . . 69
Table 149. Get random number response format when Error_flag is NOT set . . . 69
Table 150. Get Random Number response format when Error_flag is set . . . 70
Table 151. UID format . . . 71
Table 152. Absolute maximum ratings . . . 72
Table 153. RF characteristics . . . 72
Table 154. UFDFPN5 - Mechanical data . . . 75
Table 155. Ordering information scheme . . . 76
Table 156. Document revision history . . . 80

List of figures

Figure 1. ST25TV02K/512 (with tamper detect) block diagram . . . 3
Figure 2. DFN5 package connections diagram (with tamper detect) . . . 4
Figure 3. Die connections for sawn and bumped wafer (bottom view) . . . 4
Figure 4. RF power-up sequence . . . 6
Figure 5. Memory organization . . . 7
Figure 6. Security sessions management . . . 14
Figure 7. Nominal EAS operation . . . 19
Figure 8. ST25TV02K/512 protocol timing . . . 26
Figure 9. state transition diagram . . . 27
Figure 10. Stay Quiet frame exchange between VCD and ST25TV02K/512 . . . 35
Figure 11. Read Single Block frame exchange between VCD and ST25TV02K/512 . . . 36
Figure 12. Write Single Block frame exchange between VCD and ST25TV02K/512 . . . 37
Figure 13. Lock single block frame exchange between VCD and ST25TV02K/512 . . . 39
Figure 14. Read Multiple Block frame exchange between VCD and ST25TV02K/512 . . . 40
Figure 15. Select frame exchange between VCD and ST25TV02K/512 . . . 41
Figure 16. Reset to Ready frame exchange between VCD and ST25TV02K/512 . . . 42
Figure 17. Write AFI frame exchange between VCD and ST25TV02K/512 . . . 43
Figure 18. Lock AFI frame exchange between VCD and ST25TV02K/512 . . . 44
Figure 19. Write DSFID frame exchange between VCD and ST25TV02K/512 . . . 45
Figure 20. Lock DSFID frame exchange between VCD and ST25TV02K/512 . . . 46
Figure 21. Get System Info frame exchange between VCD and ST25TV02K/512 . . . 47
Figure 22. Get Multiple Block Security status frame exchange between VCD and ST25TV02K/512 . . . 48
Figure 23. Read Configuration frame exchange between VCD and ST25TV02K/512 . . . 49
Figure 24. Write Configuration frame exchange between VCD and ST25TV02K/512 . . . 51
Figure 25. Write Password frame exchange between VCD and ST25TV02K/512 . . . 52
Figure 26. Present Password frame exchange between VCD and ST25TV02K/512 . . . 53
Figure 27. Fast Read Single Block frame exchange between VCD and ST25TV02K/512 . . . 55
Figure 28. Fast Read Multiple Block frame exchange between VCD and ST25TV02K/512 . . . 56
Figure 29. ASK modulated signal . . . 73
Figure 30. UFDFPN5 - Outline . . . 74
Figure 31. UFDFPN5 - Recommended footprint . . . 75
Figure 32. Logic 0, high data rate, fast commands . . . 77
Figure 33. Logic 1, high data rate, fast commands . . . 77
Figure 34. Logic 0, low data rate, fast commands . . . 77
Figure 35. Logic 1, low data rate, fast commands . . . 77
Figure 36. Start of frame, high data rate, one subcarrier, fast commands . . . 78
Figure 37. Start of frame, low data rate, one subcarrier, fast commands . . . 78
Figure 38. End of frame, high data rate, one subcarrier, fast commands . . . 79
Figure 39. End of frame, low data rate, one subcarrier, fast commands . . . 79

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