Extending the user memory of ST25TN512 and ST25TN01K devices

Introduction

ST25TN512 and ST25TN01K (hereinafter referred to as ST25TN) devices are NFC Forum Type 2 tag IC with TruST25 digital signature, augmented NDEF, and privacy features.

ST25TN01K embeds 160 bytes (1280 bits) of EEPROM dedicated to user content. It is configured at manufacturing to present 160 bytes available for NDEF message to NFC Forum compatible devices.

Some parts of the EEPROM memory, usually used for feature configuration, may be used as user memory if the corresponding feature is not used. Accordingly, with an adequate initialization of the memory, ST25TN01K may expose up to 198 bytes available for NDEF message to NFC Forum compatible devices.

This document explains how to extend the memory of ST25TN available for NFC Forum NDEF message.

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1 T2T memory layout

1.1 Memory layout definition

NFC Forum T2T specification describes various memory elements to define a versatile memory layout scheme.

Those of interest for this application note are summarized below:

- T2T_AREA always starts at block 4.
- Byte 2 (CC_2) of the Capability Container (CC) defines the size of T2T_AREA.
- If DynLock_Area is not positioned just after T2T_AREA, there must be a "Lock Control TLV" at the beginning of T2T_AREA to define the position of DynLock_Area.
- A range of memory within T2T_AREA can be excluded from the memory available for TLVs (including NDEF TLVs). The position and size of this reserved area (Rsvd_Area) is defined by a "Memory Control TLV" at the beginning of TLVs_Area.
- TLVs_Area is the memory within T2T_AREA with the exclusion of DynLock_Area and Rsvd_Area. TLVs_Area may be split in several chunks, but should be considered as one area, with possibly a TLV starting in one chunk and ending in another one.
- NDEF message is written in a "NDEF message TLV" which takes place inside TLVs_Area

Thanks to these elements, the next sections show three possible ST25TN memory layouts:

1. The default layout (See Section 2)
2. The extended-1 layout (See Section 3)
3. The extended-2 layout (See Section 4)

1.2 Changing memory layout

To change the memory layout of ST25TN, the CC_2, the Lock control TLV and the Memory Control TLV must be written. Lock control TLV and Memory Control TLV are written in the user memory.

To prevent a change of the memory layout, CC_2 and user memory blocks may be locked in read-only as described in DS13433.
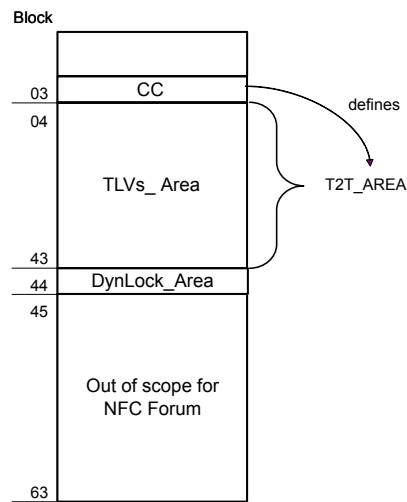

Warning:

According to T2T specification, CC bits are one-time-programmable (OTP). Consequently, the value of CC_2 defining the size of T2T_AREA can only be increased by a power of two, and never decreased.

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2 Default layout

The default layout showed in Figure 1 is the factory memory layout.

Figure 1. Default memory layout

In details:
- CC_2 = 20 = 0x14
- TLVs_Area is equal to T2T_AREA. There is no "Memory Control TLV".
- DynLock_Area is right after T2T_AREA, the "Lock Control TLV" is not required.

As a result, 160 bytes are available for a NDEF message TLV.

3 Extended-1 layout

The layout shown in Figure 2 spreads over TruST25 signature configuration fields while preserving Augmented NDEF configuration fields.

In this configuration, the TLVs_Area size is 192 bytes, in which there must be a "Lock Control TLV" to define the position of DynLock_Area, and a "Memory Control TLV" to define a Reserved Area. This leaves 182 bytes available to store a NDEF message TLV.
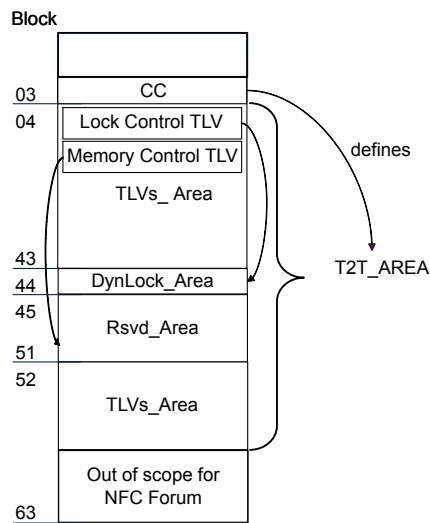
Figure 2. Extended-1 memory layout

Table 1. Configuration elements for Extended-1 layout

Byte#	Element	Field	Sub-field	Bit-fields	Meaning	Bit-field value	Byte value
12	CC[1]	CC_0	-	-	Magic Number	-	0xE1
13		CC_1		-	Version	-	0x10
14		CC_2	-	-	Size: T2T_Area_Size = Size × 8	-	0x1C
15		CC_3	-	-	Access Conditions	-	0x00
16	Lock Control	Type	-	-	Indicates the Lock Control TLV	-	0x01
17		Length	-	-	Length of the Lock Control TLV	-	0x03
18		Value	Position	NbrMajorOffsets[4]	DLA_FirstByteAddr = (NbrMajorOffsets × 2^{MOS_DLA}) + NbrMinorOffsets	11	0xB0
				NbrMinorOffsets[4]		0	
19			DLA_NbrLockBits		Number of bits inside the DynLock_Area	-	0x16
20			Control	BLPLB_Index[4]	BytesLockedPerLockBit = 2^{BLPLB_Index}	3	0x34
				MOS_DLA[4]	MOS_DLA is related to the Major Offset Size for the DynLock_Area	4	
21	Memory Control	Type	-	-	Indicates the Memory Control TLV	-	0x02
22		Length	-	-	Length of the Memory Control TLV	-	0x03
23		Value	Position	NbrMajorOffsets[4]	RA_FirstByteAddr = (NbrMajorOffsets × 2^{MOS_RA}) + NbrMinorOffsets	11	0xB4
				NbrMinorOffsets[4]		4	
24			Rsvd_ Area_ Size	-	Number of bytes of the Rsvd_Area		0x1C
25			Control	RFU	-	0	0x04
				MOS_RA[4]	MOS_RA is related to the Major Offset Size for the Rsvd_Area	4	

1. According to T2T specification, CC bits are one-time-programmable (OTP). Consequently, the value of CC_2 defining the size of T2T_AREA can only be increased by a power of two, and never decreased.

4 Extended-2 layout

The layout shown in Figure 3 spreads over TruST25 signature configuration fields and Augmented NDEF configuration fields.

In this configuration, the TLVs_Area size is 208 bytes, in which there must be a "Lock Control TLV" to define the position of DynLock_Area, and a "Memory Control TLV" to define a Reserved Area. This leaves 198 bytes available to store a NDEF message TLV.
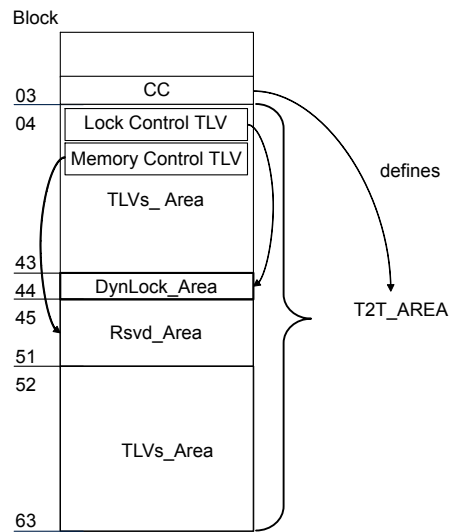
Figure 3. Extended-2 memory layout

Table 2. Configuration elements for Extended-2 layout

Byte#	Element	Field	Sub-field	Bit-fields	Meaning	Bit-field value	Byte value
12	CC[1]	CC_0	-	-	Magic Number	-	0xE1
13		CC_1	-	-	Version	-	0x10
14		CC_2	-	-	Size: T2T_Area_Size = Size×8	-	0x1E
15		CC_3	-	-	Access Conditions	-	0x00
16	Lock Control	Type	-	-	Indicates the Lock Control TLV	-	0x01
17		Length	-	-	Length of the Lock Control TLV	-	0x03
18		Value	Position	NbrMajorOffsets[4]	DLA_FirstByteAddr = (NbrMajorOffsets × 2^{MOS_DLA}) + NbrMinorOffsets	11	0xB0
				NbrMinorOffsets[4]		0	
19			DLA_NbrLockBits		Number of bits inside the DynLock_Area	-	0x18
20			Control	BLPLB_Index[4]	BytesLockedPerLockBit = 2^{BLPLB_Index}	3	0x34
				MOS_DLA[4]	MOS_DLA is related to the Major Offset Size for the DynLock_Area	4	
21	Memory Control	Type			Indicates the Memory Control TLV	-	0x02
22		Length			Length of the Memory Control TLV	-	0x03
23		Value	Position	NbrMajorOffsets[4]	RA_FirstByteAddr = (NbrMajorOffsets × 2^{MOS_RA}) + NbrMinorOffsets	11	0xB4
				NbrMinorOffsets[4]		4	
24			Rsvd_ Area_ Size	-	Number of bytes of the Rsvd_Area	-	0x1C
25			Control	RFU	-	0	0x04
				MOS_RA[4]	MOS_RA is related to the Major Offset Size for the Rsvd_Area	4	

1. According to T2T specification, CC bits are one-time-programmable (OTP). Consequently, the value of CC_2 defining the size of T2T_AREA can only be increased, and never decreased.

Revision history

Table 3. Document revision history

Date	Version	Changes
31-May-2021	1	Initial release.
10-Sep-2021	2	Changed the document scope from ST Restricted to public.

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