ST25DV04KC, ST25DV16KC and ST25DV64KC device limitations

Silicon identification

The ST25DV-I2C series is a dynamic NFC/RFID tag ICs with 4, 16 or 64-Kbit EEPROM and fast transfer mode capability.

Table 1 shows the full list of impacted part numbers (hereinafter referred to as ST25DVxxKC). These parts are identified physically by their marking or directly in the application by reading the I²C product revision byte.

Table 1. Device summary

References	Package	Ordering code	IC reference	Product code
ST25DV04KC	SO8N	ST25DV04KC-IE6S3	50h	50h
		ST25DV04KC-IE8S3		
	TSS0P8	ST25DV04KC-IE6T3		
		ST25DV04KC-IE8T3		
	UFDFPN8	ST25DV04KC-IE6C3		
		ST25DV04KC-IE8C3		
	UFDFPN12	ST25DV04KC-JF6D3		52h
		ST25DV04KC-JF8D3		
	WLCSP10	ST25DV04KC-JF6L3		
ST25DV16KC	SO8N	ST25DV16KC-IE6S3	51h	51h
		ST25DV16KC-IE8S3		
	TSS0P8	ST25DV16KC-IE6T3		
		ST25DV16KC-IE8T3		
	UFDFPN8	ST25DV16KC-IE8C3		
		ST25DV16KC-IE6C3		
	UFDFPN12	ST25DV16KC-JF6D3		53h
		ST25DV16KC-JF8D3		
ST25DV64KC	SO8N	ST25DV64KC-IE6S3	51h	51h
		ST25DV64KC-IE8S3		
	TSS0P8	ST25DV64KC-IE6T3		
		ST25DV64KC-IE8T3		
	UFDFPN8	ST25DV64KC-IE8C3		
		ST25DV64KC-IE6C3		
	UFDFPN12	ST25DV64KC-JF6D3		53h
		ST25DV64KC-JF8D3		

The IC reference (IC_REF register) is read from I²C at address 0017h (device select code E2 = 1) or from RF by issuing a *get system information* or an *extended get system information* command.

The product code is read from I²C at address 001Dh or from RF by issuing an *inventory*, a *get system information* or an *extended get system information* command.

The product revision (IC_REV register) is read from I²C at address 0020h (device select code E2 = 1).

1 Limitations

Table 2 gives quick references to all documented device limitations of ST25DVxxKC and their status:

- A = workaround available
- N = no workaround available
- P = partial workaround available
- '-' and grayed = fixed.

Applicability of a workaround depends on specific conditions of the target application. Adoption of a workaround may cause restrictions to the target application. Workaround for a limitation is deemed partial if it only reduces the rate of occurrence and/or consequences of the limitation, or if it is fully effective for only a subset of instances on the device or in only a subset of operating modes, of the concerned function.

Table 2. Summary of silicon limitations

Links to silicon limitations		Workaround
Power supply	Potential RF and I²C lock if V_{CC} gets disconnected then reconnected when RF field is present	A
Fast transfer mode limitation	RF_PUT_MSG bit wrongly cleared after I²C reading MB_LEN_Dyn if message is 256 bytes long	A
	MB_CTRL_Dyn and MB_LEN_Dyn can be corrupted if an I²C access occurs at a very specific time during RF access to the mailbox	A
Communication limitation	Communication limitation on a marginal portion of production parts (sub-carrier frequency drift)	A

1.1 Power supply limitations

1.1.1 Potential RF and I²C lock if V_{CC} gets disconnected then reconnected when RF field is present

Impacted devices: All ST25DVxxKC devices.

Description

When the device is powered both by V_{CC} and RF field, if V_{CC} pin gets disconnected and left floating (i.e. V_{CC} is connected to a microcontroller GPIO, and the GPIO configuration is changed from output to HiZ), the ST25DVxxKC enter an unexpected state where approximately 1.4 V is present on the floating V_{CC} pin.

Once the unexpected V_{CC} at 1.4 V state is reached, the ST25DV-I2C returns to its normal state in the following conditions:

- If RF field disappears (the ST25DV-I2C goes completely off and restarts in normal state when either RF field or V_{CC} power come back)
- If any RF command is received (V_{CC} then goes to 0 V)
- If V_{CC} rises again to its nominal value (>1.8 V).

Nevertheless, if during this unexpected V_{CC} at 1.4 V state, the V_{CC} is pulled down to 0 V and then to its nominal value (1.4 V, then 0 V, then above 1.8 V), the ST25DV-I2C can enter a deadlock state where all I²C accesses are not acknowledged and any RF command is answered with error 0Fh.

The trigger of the deadlock is dependent upon the duration of the negative pulse on V_{CC}.

The negative pulse is acting as a discharge of internal capacitors of the ST25DV-I2C. If the pulse is shorter than 1 ms, the capacitors are not fully discharged and correct internal reset is not occurring, setting the ST25DV-I2C in deadlock state.

Workaround

Several workarounds are available:

- Proper reset is done on V_{CC} side before disconnecting V_{CC} (before configuring the GPIO that controls V_{CC} to HiZ), with duration >1 ms
- Proper reset is done on V_{CC} side before connecting again V_{CC} (before configuring the GPIO that controls V_{CC} from HiZ to its nominal value), with duration >1 ms
- If the glitch to 0 V on V_{CC} that triggers the deadlock state is short enough, an additional capacitor on V_{CC} with time constant longer than the glitch can filter it
- On ST25DV-I2C versions with product codes 51h and 53h, it is possible to properly reset the device by setting the LPD pin high

1.2 Fast transfer mode limitations

1.2.1 RF_PUT_MSG bit wrongly cleared after I²C reading MB_LEN_Dyn if message is 256 bytes long

Impacted devices: All ST25DVxxKC devices.

Description

At the end of a valid RF Write Message command in mailbox, the RF_PUT_MSG flag is set in MB_CTRL_Dyn register. This flag must be cleared only if the mailbox is deactivated or if the I²C has read the complete message, or if the watchdog is triggered. But if the message is 256 bytes long, and if the first I²C command after the RF has written the message is a read of MB_LEN_Dyn register (user address 2007h), the RF_PUT_MSG flag is wrongly cleared.

Workaround

After the RF has written a message in the mailbox, it is recommended to check the MB_CTRL_Dyn register to verify if a message is present, before reading MB_LEN_Dyn to check its size. Therefore, it is recommended for the I²C host to read first MB_CTRL_Dyn, then MB_LEN_dyn, then the message in mailbox. This can be done in a single read sequential command, starting at address 2006h (MB_CTRL_Dyn) and ending at end of the mailbox (258 bytes are read). This sequentially reads the MB_CTRL_Dyn register, the MB_LEN_Dyn register and the full mailbox content.

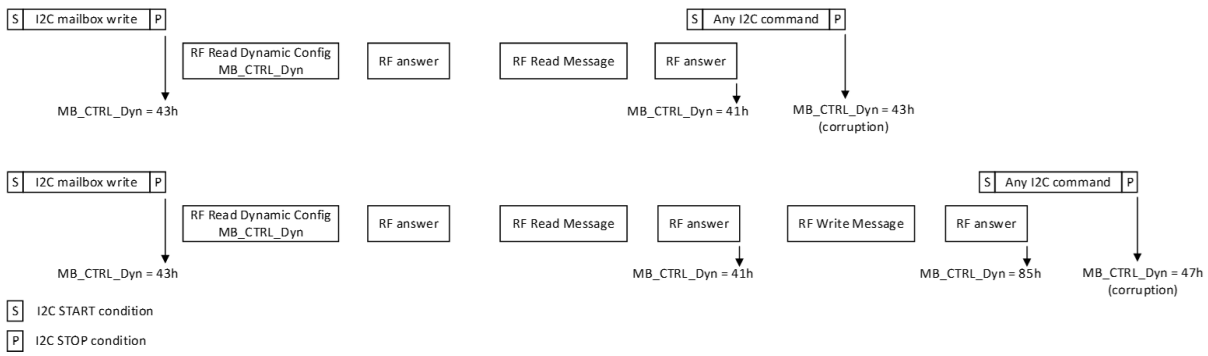
1.2.2 MB_CTRL_Dyn and MB_LEN_Dyn can be corrupted if an I²C access occurs at a very specific time during RF access to the mailbox

Impacted devices: All ST25DVxxKC devices.

Description

After the I²C controller has written a message into the mailbox, if the next I²C command starts (START condition) during the RF answer of an RF access (read or write) to the mailbox, and stops (STOP condition) after this RF answer, then the MB_CTRL_Dyn and MB_LEN_Dyn registers get corrupted.

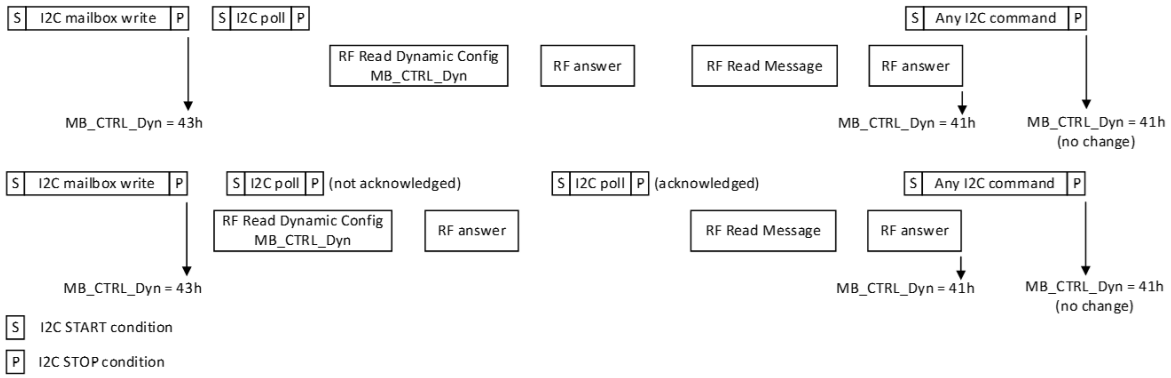
Figure 1. Corruption



Workaround

Each time the I²C controller has written a message in the mailbox, it should immediately send I²C polling commands until one is acknowledged. The I²C polling command consists of a START condition, followed by the user or system device address with RW bit set to 0, followed by a STOP condition (START/A6h/STOP).

Figure 2. Workaround



It is important that the RF reader does not try to read directly the mailbox before having first read the MB_CTRL_Dyn status register, otherwise the I²C polling, if not done fast enough, could come during the answer of the RF mailbox read.

1.3 Communication limitation

1.3.1 Communication limitation on a marginal portion of production parts (sub-carrier frequency drift)

Impacted device: All ST25DVxxKC devices.

Description

In a limited portion of the reading range, and on marginal portion of production parts, communications between some NFC readers and the ST25 products listed above may be lost (communication hole). The communication loss is more likely to occur as the ambient temperature decreases.

The reader and the tag antennas dimensions are impacting the distance where the communication hole happens. The failure mechanism is a loss of clock cycles during the tag back-scattering under some field conditions. Therefore, the tag response may be transmitted with a sub-carrier frequency drift and not be decoded properly by some readers.

Workarounds

- As the communication hole happens only at certain field strength, moving the tag closer or farther to the reader can allow communication with the tag. Applications where the ST25DV is in movement (“tap” gesture, moving parts in production line,…) are less likely to experience the communication loss, as the communication protocol includes retries
- As the temperature has an impact on the issue, using the tag in higher temperature can allow communication with the tag
- Replacing device with a ST25DVxxKC revision 13h (please contact your local ST sales office for availability on specific options).
- Some RF readers are not sensitive to a sub-carrier frequency drift. Reading hole is not seen when using those readers. Recommended readers: ST25R3916, ST25R3916B, ST25R3917, ST25R3917B, ST25R3918, ST25R3919B, ST25R3911B, ST25R3912, ST25R3914, ST25R3915, ST25R3920, and ST25R3920B

Revision history

Table 3. **Document revision history**

Date	Version	Changes
28-Jun-2023	1	Initial release.
03-Jul-2023	2	Removed former *Section 1.2.1: Fast transfer mode watchdog not started correctly after an I²C write message in mailbox* (product not impacted by this limitation).
04-Jan-2024	3	Updated Section Silicon identification
01-Oct-2025	4	Added Section 1.2.2: MB_CTRL_Dyn and MB_LEN_Dyn can be corrupted if an I²C access occurs at a very specific time during RF access to the mailbox

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