RFID MODULE

Mifare Reader / Writer

SL032
User Manual

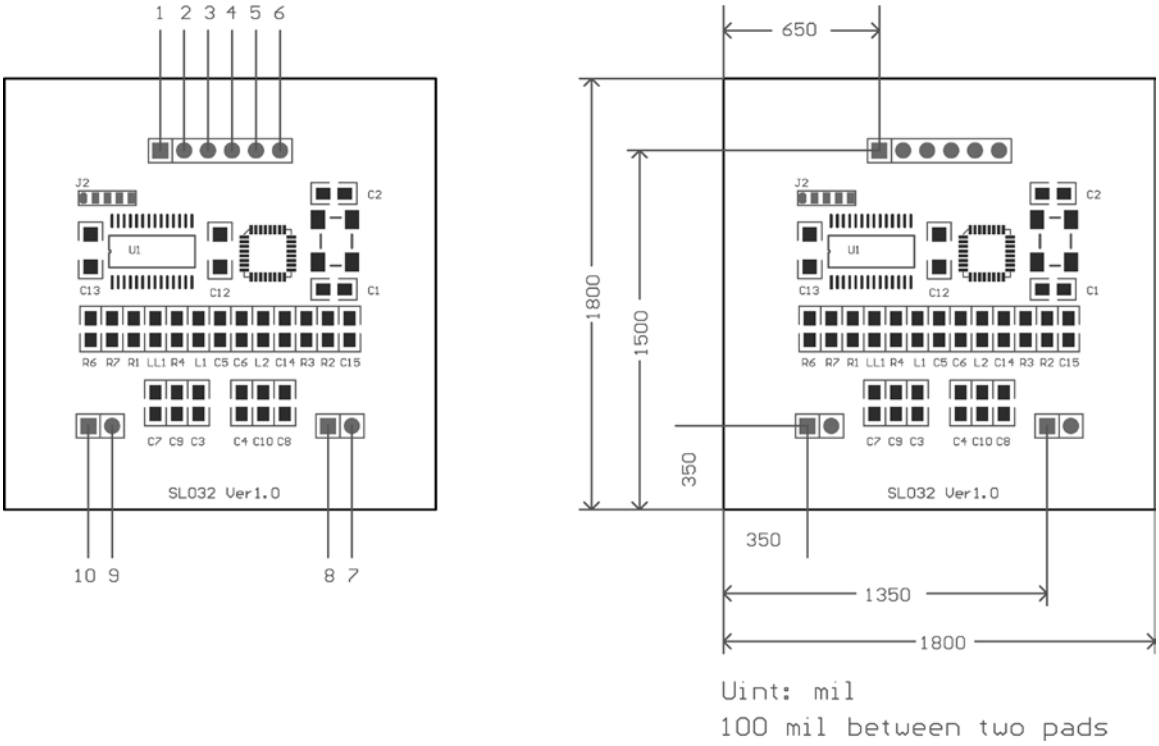
Version 1.4
Nov 2011
StrongLink

CONTENT

1. MAIN FEATURES

- Tags supported: Mifare 1k, Mifare 4k, UltraLight, DesFire
- Built-in antenna
- UART interface, baud rate 9,600 ~ 115,200 bps
- 2.5V to 3.6VDC power supply, I/O pins are 5V tolerant
- Work current less than 45mA @3.3V
- Power down current less than 10uA
- Operating distance: Up to 50mm, depending on tag
- Storage temperature: -40 ºC ~ +85 ºC
- Operating temperature: -25 ºC ~ +70 ºC
- Dimension: 46 × 46 × 3 mm

2. PINNING INFORMATION



PIN	SYMBOL	TYPE	DESCRIPTION
1	VDD	PWR	Power supply, 2.5 to 3.6VDC
2	IN	Input	Falling edge wake up SL032 from power down mode
3	TXD	Output	Serial output port
4	RXD	Input	Serial input port
5	NC		
6	GND	PWR	Ground
7	NC		
8	NC		
9	NC		
10	NC		

3. BAUD RATE SETTING

R6 & R7 are used for setting baud rate as follows sheet

	R6	R7	Baud rate bps
Assembled	no	no	9,600
	no	yes	19,200
	yes	no	57,600
	yes	yes	115,200 (default)

4. COMMUNICATION PROTOCOL

4-1. Communication Setting

The communication protocol is byte oriented. Both sending and receiving bytes are in hexadecimal format. The communication parameters are as follows,

Baud rate: 9,600 ~ 115,200 bps
Data: 8 bits
Stop: 1 bit
Parity: None
Flow control: None

4-2. Communication Format

Host to Reader:

Preamble	Len	Command	Data	Checksum

Preamble: 1 byte equal to 0xBA
Len: 1 byte, indicating the number of bytes from Command to Checksum
Command: 1 byte Command code, see Table 3
Data: Variable length depends on the command type
Checksum: 1 byte XOR of all the bytes from Preamble to Data

Reader to Host:

Preamble	Len	Command	Status	Data	Checksum

Preamble: 1 byte equal to 0xBD
Len: 1 byte indicating the number of bytes from Command to Checksum
Command: 1 byte Command code, see Table 3
Status: 1 byte Command status, see Table 4
Data: Variable length depends on the command type.
Checksum: 1 byte XOR of all the bytes from Preamble to Data

4-3. Command Overview

Table 3

Command	Description
0x01	Select Mifare card
0x02	Login to a sector
0x03	Read a data block
0x04	Write a data block
0x05	Read a value block
0x06	Initialize a value block
0x07	Write master key (key A)
0x08	Increment value
0x09	Decrement value
0x0A	Copy value
0x10	Read a data page (UltraLight)
0x11	Write a data page (UltraLight)
0x12	Download Key
0x13	Login sector via stored Key
0x20	Request for Answer to Select (ISO14443-4)
0x21	Exchange Transparent Data according to T = CL
0x40	Manage LED
0x50	Go to Power Down mode
0xF0	Get firmware version

Status Overview

Table 4

Status	Description
0x00	Operation success
0x01	No tag
0x02	Login success
0x03	Login fail
0x04	Read fail
0x05	Write fail
0x06	Unable to read after write
0x08	Address overflow
0x10	ATS failed
0x11	T = CL communication failed
0x0A	Collision occur
0x0D	Not authenticate
0x0E	Not a value block
0xF0	Checksum error
0xF1	Command code error

4-4. Command List

4-4-1. Select Mifare card

0xBA	Len	0x01	Checksum

Response:

0xBD	Len	0x01	Status	UID	Type	Checksum

Status: 0x00: Operation succeed
0x01: No tag
0x0A: Collision occur
0xF0: Checksum error

UID: The uniquely serial number of Mifare carde

Type: 0x01: Mifare 1k, 4 byte UID
0x02: Mifare Pro
0x03: Mifare UltraLight
0x04: Mifare 4k, 4 byte UID
0x05: Mifare ProX
0x06: Mifare DesFire
0x07: Mifare 1k, 7 byte UID [1]
0x08: Mifare 4k, 7 byte UID [1]
0x0A: Other

4-4-2. Login to a sector

0xBA	Len	0x02	Sector	Type	Key	Checksum

Sector: Sector need to login

Type: Key type (0xAA: authenticate with KeyA, 0xBB: authenticate with KeyB)

Key: Authenticate key, 6 bytes

Response:

0xBD	Len	0x02	Status	Checksum

Status: 0x02: Login succeed
0x03: Login fail
0xF0: Checksum error

4-4-3. Read a data block

0xBA	Len	0x03	Block	Checksum

Block: The block number to be read, 1 byte

Response:

0xBD	Len	0x03	Status	Data	Checksum

Status: 0x00: Operation succeed
0x04: Read fail
0x0D: Not authenticate
0xF0: Checksum error

Data: Block data returned if operation succeeds, 16 bytes.

4-4-4. Write a data block

0xBA	Len	0x04	Block	Data	Checksum

Block: The block number to be written, 1 byte.
Data: The data to write, 16 bytes.

Response:

0xBD	Len	0x04	Status	Data	Checksum

Status: 0x00: Operation succeed
0x05: Write fail
0x06: Unable to read after write
0x0D: Not authenticate
0xF0: Checksum error
Data: Block data written if operation succeeds, 16 bytes.

4-4-5. Read a value block

0xBA	Len	0x05	Block	Checksum

Block: The block number to be read, 1 byte.

Response:

0xBD	Len	0x05	Status	Value	Checksum

Status: 0x00: Operation succeed
0x04: Read fail
0x0D: Not authenticate
0x0E: Not a value block
0xF0: Checksum error
Value: Value returned if the operation succeeds, 4 bytes.

4-4-6. Initialize a value block

0xBA	Len	0x06	Block	Value	Checksum

Block: The block number to be initialized, 1 byte.
Value: The value to be written, 4 bytes.

Response:

0xBD	Len	0x06	Status	Value	Checksum

Status: 0x00: Operation succeed
0x05: Write fail
0x06: Unable to read after write
0x0D: Not authenticate
0xF0: Checksum error
Value: Value written if the operation succeeds, 4 bytes.

4-4-7. Write master key (key A)

0xBA	Len	0x07	Sector	Key	Checksum

Sector: The sector number to be written, 1 byte.
Key: Authentication key, 6 bytes

Response:

0xBD	Len	0x07	Status	Key	Checksum

Status: 0x00: Operation succeed
0x05: Write fail
0x0D: Not authenticate
0xF0: Checksum error
Key: Authentication key written if the operation succeeds, 6 bytes.

4-4-8. Increment value

0xBA	Len	0x08	Block	Value	Checksum

Block: The block number to be increased, 1 byte.
Value: The value to be increased by, 4 bytes.

Response:

0xBD	Len	0x08	Status	Value	Checksum

Status: 0x00: Operation succeed
0x05: Write fail
0x06: Unable to read after write
0x0D: Not authenticate
0x0E: Not a value block
0xF0: Checksum error
Value: The value after increment if the operation succeeds, 4 bytes

4-4-9. Decrement value

0xBA	Len	0x09	Block	Value	Checksum

Block: The block number to be decreased, 1 byte
Value: The value to be decreased by, 4 bytes

Response:

0xBD	Len	0x09	Status	Value	Checksum

Status: 0x00: Operation succeed
0x05: Write fail
0x06: Unable to read after write
0x0D: Not authenticate
0x0E: Not a value block
0xF0: Checksum error
Value: The value after decrement if the operation succeeds, 4 bytes

4-4-10. Copy value

0xBA	Len	0x0A	Source	Destination	Checksum

Source: The source block copy from, 1 byte
Destination: The destination copy to, 1 byte
The source and destination must in the same sector

Response:

0xBD	Len	0x0A	Status	Value	Checksum

Status: 0x00: Operation succeed

0x05: Write fail
0x06: Unable to read after write
0x0D: Not authenticate
0x0E: Not a value block (Source)
0xF0: Checksum error

Value: The value after copy if the operation succeeds, 4 bytes

4-4-11. Read a data page (UltraLight)

0xBA	Len	0x10	Page	Checksum

Page: The page number to be read, 1 byte

Response:

0xBD	Len	0x10	Status	Data	Checksum

Status: 0x00: Operation succeed
0x04: Read fail
0xF0: Checksum error

Data: Block data returned if operation succeeds, 4 bytes.

4-4-12. Write a data Page (UltraLight)

0xBA	Len	0x11	Page	Data	Checksum

Page: The page number to be written, 1 byte.
Data: The data to write, 4 bytes.

Response:

0xBD	Len	0x11	Status	Data	Checksum

Status: 0x00: Operation succeed
0x05: Write fail
0x06: Unable to read after write
0xF0: Checksum error

Data: page data written if operation succeeds, 4 bytes.

4-4-13. Download Key

0xBA	Len	0x12	Sector	Type	Key	Checksum

Sector: 0 - 39
Type: Key type (0xAA: KeyA, 0xBB: KeyB)
Key: 6 bytes, stored in SL032

Response:

0xBD	Len	0x12	Status	Checksum

Status: 0x00: Operation succeed
0x08: Address overflow
0xF0: Checksum error

4-4-14. Login sector via stored key

0xBA	Len	0x13	Sector	Type	Checksum

Sector: 0 - 39
Type: Key type (0xAA: KeyA, 0xBB: KeyB)

Response:

0xBD	Len	0x13	Status	Checksum

Status: 0x02: Login succeed
0x03: Login fail
0x08: Address overflow
0xF0: Checksum error

4-4-15. Request for Answer to Select (ISO14443-4)

0xBA	Len	0x20	Checksum

Response:

0xBD	Len	0x20	Status	ATS	Checksum

Status: 0x00: Operation succeed
0x10: Address overflow
0xF0: Checksum error
ATS: According to ISO14443-4 protocol
Len + T_0 + TA_1 + TB_1 + TC_1 + A_1 + A_K

4-4-16. Exchange Transparent Data (T = CL)

0xBA	Len	0x21	Data	Checksum

Data: COS command

Response:

0xBD	Len	0x21	Status	Data	Checksum

Status: 0x00: Operation succeed
0x11: Communicate with card failed
0xF0: Checksum error
Data: Response data from card

4-4-17. Manage Led

0xBA	Len	0x40	Code	Checksum

Code: 0 command red led turn off , other red led turn on, 1 byte

Return:

0xBD	Len	0x40	Status	Checksum

Status: 0x00: Operation succeed
0xF0: Checksum error

4-4-18. Power Down

0xBA	Len	0x50	Checksum

Response:

0xBD	Len	0x50	Status	Checksum

Status: 0x00: Operation succeed
0xF0: Checksum error

4-4-19. Get firmware version

0xBA	Len	0xF0	Checksum

Response: [2]

0xBD	Len	0xF0	Status	Data	Checksum

Status: 0x00: Operation success
0xF0: Checksum error
Data: firmware version.

Remark

[1] In order to supports 7 byte UID Mifare class, the firmware of SL032 has been updated to Ver1.9 in Mar 2011.
And older firmware version (such as Ver1.0, 1.5, etc) only supports 4 byte UID.
Please refer to NXP Customer Letter UID for detailed information of 4 byte & 7 byte UID of Mifare products.

[2] One sample of SL032 response

	Preamble	Len	Command	Status	Data (Firmware version)	Checksum
HEX	BD	0C	F0	00	53 4C 30 33 32 2D 312E 39	64
ASCII					“SL032-1.9”	