RFID MODULE

NFC Reader/Writer Module

SL060

User Manual

Version 1.1
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StrongLink

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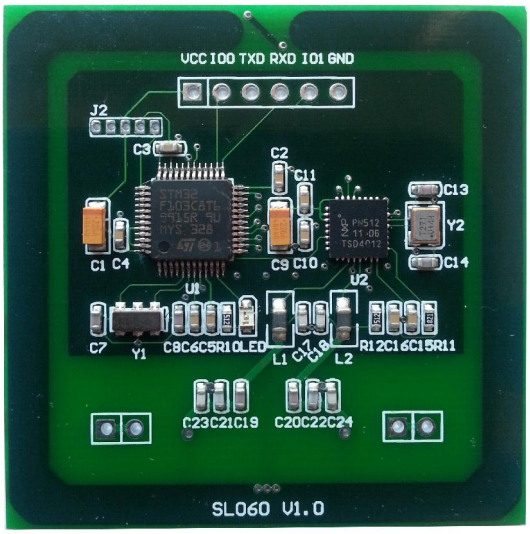
1. FEATURES



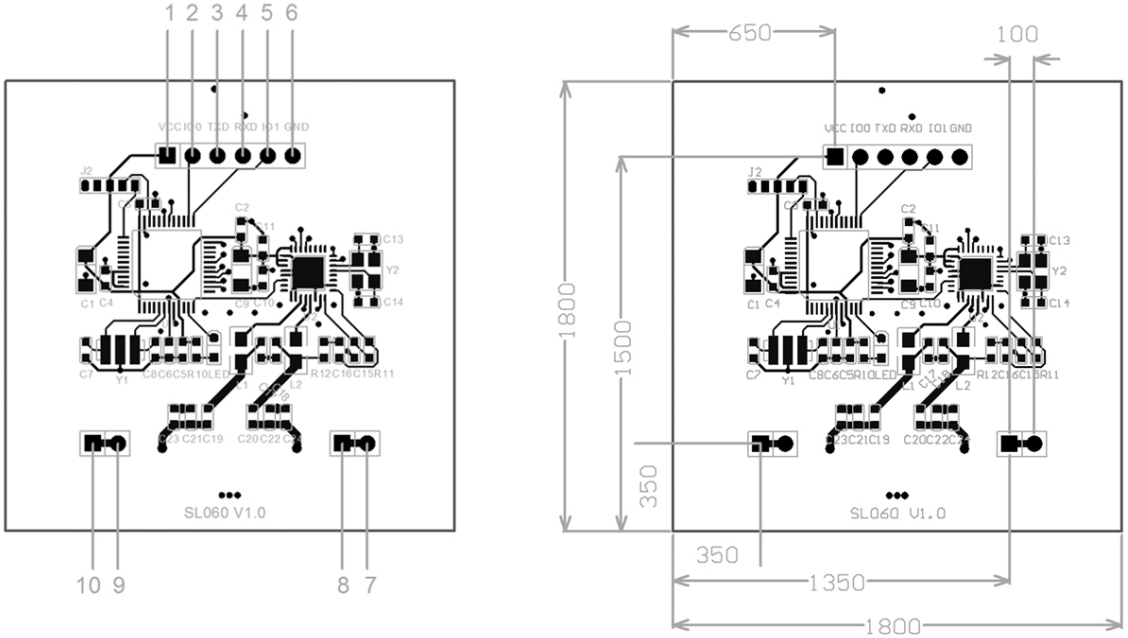
- Tags supported: Mifare 1k, Mifare 4k, Mifare UltraLight, Mifare UltraLight C and NTAG203
- Built-in antenna
- UART Interface, baud rate 9,600 ~ 115,200 bps(Default:9600bps)
- 13.56MHz RF Operating Frequency
- Protocol supported: ISO14443, ISO18092 NFCIP-1 mode(text&url)
- 2.5 ~3.6 VDC Operating, I/O supports 5.0 VDC
- Work current less than 50mA@3.3V
- Operating distance: Up to 50mm, depending on tag
- Storage Temperature Range: -40°C ~ +85°C
- Operating Temperature Range: -25°C ~ +70°C
- Dimension: 46 × 46 × 3 mm

2. DESCRIPTION

Being developed based on NXP's NFC transponder IC, NFC Module SL060 is a mini NFC reader/writer. This RFID module supports MIFARETM Classic 1K, MIFARE™ Classic 4K, MIFARE Ultralight™, MIFARE DESFire™ and NFC NFCIP-1 mode. The maximum working current is less than 50mA. It integrates all necessary components and antenna in the PCB.

SL060 can offer NFCIP-1 functions. Users can send NFC message to NFC device to open a web URL or display text words in the window.

3. PINNING INFORMATION



PIN	SYMBOL	TYPE	DESCRIPTION
1	VCC	PWR	Power supply, 2.5 to 3.6VDC
2	IO0	NA	Reserved for future use
3	TXD	Output	UART TX
4	RXD	Input	UART RX
5	IO1	NA	Reserved for future use
6	GND	PWR	GND

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: 9600bps(default)
Data: 8 bits
Stop: 1 bit
Parity: None
Flow control: None

4.2 Communication Format

Host to Reader:

Preamble	Len	DeviceID	Command	Data	Checksum

Preamble: 2 bytes equal to 0xAABB
Len: 2 bytes, indicating the number of bytes from DeviceID to Checksum

In this reader, the first byte is effective, the second byte keep 0

DeviceID: 2 bytes

Command: 2 bytes, Command code, see Table 3
Data: Variable length depends on the command code
Checksum: 1 byte, XOR of all the bytes from DeviceID to Data

Attention
If there is any byte equaling to AA occurs between Len and Checksum, one byte 00 will be added after this byte to differentiate preamble. However, the Len keeps unchanged.
Example, writing data (0x00112233445566778899AABBCCDDEEFF) to block 1
Host->SL060:AABB160000000902010011223344556677889 9AA**00**BBCCDDEEFF0A

Reader to Host:

Preamble	Len	DeviceID	Command	Status	Data	Checksum

Preamble: 2 bytes equal to 0xAABB
Len: 2 bytes, indicating the number of bytes from DeviceID to Checksum

In this reader, the first byte is effective, the second byte keep 0

DeviceID: 2 bytes

Command: 2 bytes
Status: 1 byte, 00 = success, Not 0 = fail
Data Range: Response data, may blank
Checksum: 1 byte, XOR of all the bytes from DeviceID to the last of the Command Sending data

Attention

If there is any byte equaling to AA occurs between Len and Checksum, one byte 00 will be added after this byte to differentiate preamble. However, the Len keeps unchanged.

Example, reading data (0x00112233445566778899AABBCCDDEEFF) from block 1

SL060 -> Host：ABB160000000902000011223344556677889 9AA**00**BBCCDDEEFF0B

4.3 Command Overview

Table 1

Command	Description
0x0101	Set baud rate
0x0201	Initialize the Device ID
0x0303	Get device ID
0x0401	Get hardware vision
0x0701	Set the LED
0x0C01	Set the RF field
0x0102	Request(Card A)
0x0202	Anticollision (Card A)
0x0302	Select card(Card A)
0x0402	Halt(Card A)
0x0702	Authenticate
0x0802	Read block
0x0902	Write block
0x0A02	Initialize electronic purse
0x0B02	Read purse value
0x0C02	Decrease purse value (including Transfer)
0x0D02	Increase purse value (including Transfer)
0x0E02	Restore purse value
0x0F02	Transfer
0x1002	Get ATS of CPU A
0x1102	Exchange data between PICC and PCD according with T = CL protocol
0x1202	Ultralight card Anticoll and Select
0x1302	Write a page of data into ultralight card
0x4002	Authenticate password of Ultralight_C
0x4102	
0x4202	Change password of Ultralight_C
0x2002	SHC1102 card check password
0x2102	Read data block of SHC1102 card
0x2202	Write data block of SHC1102 card
0x3002	Request DESFire and reset
0x0D01	Set the NFC field
0x0E01	Send the NFC command

Status Overview

Table 2

Status	Description
0x00	Operation successes
0x01	NFC connect fails
0x0A	Operation fails
0x0B	Command is not supported
0x0C	Parameter is error
0x0D	No cards
0x0E	RF base station is damaged
0x14	Searching card fails
0x15	Reset card fails
0x16	Verifying key fails
0x17	Reading fails
0x18	Writing fails

4-4. Command List

4-4-1 System Function Command

4-4-1-1. Set baud rate

0xAA	0xBB	Len	DeviceID	0x01	0x01	Data	Checksum

Data: 0x00: BaudRate = 4800
0x01: BaudRate = 9600(default)
0x02: BaudRate = 14400
0x03: BaudRate = 19200
0x04: BaudRate = 28800
0x05: BaudRate = 38400
0x06: BaudRate = 57600
0x07: BaudRate = 115200

After changing the BaudRate, further communication must be set as the new BaudRate.

Response:

0xAA	0xBB	Len	DeviceID	0x01	0x01	Status	Checksum

Status: 0x00: Operation succeed
0x0C: Parameter error

4-4-1-2. Initialize the Device ID

0xAA	0xBB	Len	DeviceID	0x02	0x01	Data	Checksum

Data: 2 bytes device ID

Response:

0xAA	0xBB	Len	DeviceID	0x02	0x01	Status	Checksum

Status: 0x00: Operation succeed

Remark: SL060 only response to the command that Device ID is in accord with itself, and broadcast command that DeviceID equals to 0x0000

4-4-1-3. Get device ID

0xAA	0xBB	Len	DeviceID	0x03	0x01	Checksum

Response:

0xAA	0xBB	Len	DeviceID	0x03	0x01	Status	Data	Checksum

Data: 2 bytes device ID

Status: 0x00: Operation succeed

4-4-1-4. Get hardware vision

0xAA	0xBB	Len	DeviceID	0x04	0x01	Checksum

Response:

0xAA	0xBB	Len	DeviceID	0x04	0x01	Status	Data	Checksum

Data: Hardware vision

Status: 0x00: Operation succeed

4-4-1-5. Set the LED

0xAA	0xBB	Len	DeviceID	0x07	0x01	Data	Checksum

Data: 0: turn off the led

1-3: turn on the led

Response:

0xAA	0xBB	Len	DeviceID	0x07	0x01	Status	Checksum

Status: 0x00: Operation succeed

0x0C: Parameter is error

4-4-1-6. Set the RF field

0xAA	0xBB	Len	DeviceID	0x0C	0x01	Data	Checksum

Data: 0: turn off the RF field

1: turn on the RF field

Response:

0xAA	0xBB	Len	DeviceID	0x0C	0x01	Status	Checksum

Status: 0x00: Operation succeed

0x0A: Operation fails

4-4-2 ISO14443A - Mifare Function Command

4-4-2-1. Request(Card A)

0xAA	0xBB	Len	DeviceID	0x01	0x02	Data	Checksum

Data: 0x26 or 0x52

Response:

0xAA	0xBB	Len	DeviceID	0x01	0x02	Status	Data	Checksum

Data: ATQA(0x26 or 0x52)

Status: 0x00: Operation succeed

0x0A: Searching card fails

4-4-2-2. Anticollision(Card A)

0xAA	0xBB	Len	DeviceID	0x02	0x02	Checksum

Data: None

Response:

0xAA	0xBB	Len	DeviceID	0x02	0x02	Status	Data	Checksum

Data: UID

Status: 0x00: Operation succeed

0x0A: Operation fails

4-4-2-3. Select card (Card A)

0xAA	0xBB	Len	DeviceID	0x03	0x02	Data	Checksum

Data: UID

Response:

0xAA	0xBB	Len	DeviceID	0x03	0x02	Status	Data	Checksum

Data: SAK

Status: 0x00: Operation succeed

0x0A: Operation fails

4-4-2-4. Halt (Card A)

0xAA	0xBB	Len	DeviceID	0x04	0x02	Checksum

Response:

0xAA	0xBB	Len	DeviceID	0x04	0x02	Status	Checksum

Data: None

Status: 0x00: Operation succeed

0x0A: Operation fails

4-4-2-5. Authenticate

0xAA	0xBB	Len	DeviceID	0x07	0x02	Data	Checksum

Data**:** 1 byte authenticate mode + 1 byte absolute block number + 6bytes key

authenticate mode: 0x60—KeyA 0x61—KeyB

Response:

0xAA	0xBB	Len	DeviceID	0x07	0x02	Status	Checksum

Status: 0x00: Operation succeed

0x16: Verifying key fails

4-4-2-6. Read block

0xAA	0xBB	Len	DeviceID	0x08	0x02	Data	Checksum

Data**:** 1 byte absolute block number

Response:

0xAA	0xBB	Len	DeviceID	0x08	0x02	Status	Data	Checksum

Data: 16 bytes data

Status: 0x00: Operation succeed

0x17: Reading fails

4-4-2-7. Write block

0xAA	0xBB	Len	DeviceID	0x09	0x02	Data	Checksum

Data**:** 1 byte absolute block number+16 bytes data

Response:

0xAA	0xBB	Len	DeviceID	0x09	0x02	Status	Checksum

Status: 0x00: Operation succeed

0x18: Writing fails

4-4-2-8. Initialize electronic purse

0xAA	0xBB	Len	DeviceID	0x0A	0x02	Data	Checksum

Data**:** 1 byte absolute block number+4 bytes data

Response:

0xAA	0xBB	Len	DeviceID	0x0A	0x02	Status	Checksum

Status: 0x00: Operation succeed
0x18: Writing fails

4-4-2-9. Read purse value

0xAA	0xBB	Len	DeviceID	0x0B	0x02	Data	Checksum

Data**:** 1 byte absolute block numbe

Response:

0xAA	0xBB	Len	DeviceID	0x0B	0x02	Status	Data	Checksum

Data**:** 4 bytes data (low bytes in the former)
Status: 0x00: Operation succeed
0x17: Reading fails

4-4-2-10. Decrease purse value (including Transfer)

0xAA	0xBB	Len	DeviceID	0x0C	0x02	Data	Checksum

Data**:** 1 byte absolute block number+ 4 bytes decrement value

Response:

0xAA	0xBB	Len	DeviceID	0x0C	0x02	Status	Checksum

Status: 0x00: Operation succeed
0x18: Writing fails

4-4-2-11. Increase purse value (including Transfer)

0xAA	0xBB	Len	DeviceID	0x0D	0x02	Data	Checksum

Data**:** 1 byte absolute block number+ 4 bytes decrement value

Response:

0xAA	0xBB	Len	DeviceID	0x0D	0x02	Status	Checksum

Status: 0x00: Operation succeed
0x18: Writing fails

4-4-2-12. Restore purse value

0xAA	0xBB	Len	DeviceID	0x0E	0x02	Data	Checksum

Data**:** 1 byte absolute block number

Response:

0xAA	0xBB	Len	DeviceID	0x0E	0x02	Status	Checksum

Status: 0x00: Operation succeed
0x17: Reading fails

4-4-2-13. Transfer

0xAA	0xBB	Len	DeviceID	0x0F	0x02	Data	Checksum

Data**:** 1 byte absolute block number

Response:

0xAA	0xBB	Len	DeviceID	0x0F	0x02	Status	Checksum

Status: 0x00: Operation succeed
0x18: Writing fails

4-4-2-14. Get ATS of CPU A

0xAA	0xBB	Len	DeviceID	0x10	0x02	Checksum

Response:

0xAA	0xBB	Len	DeviceID	0x10	0x02	Status	Data	Checksum

Data: ATS

Status: 0x00: Operation succeed
0x18: Writing fails

4-4-2-15. Exchange data between PICC and PCD according with T = CL protocol

0xAA	0xBB	Len	DeviceID	0x11	0x02	Data	Checksum

Data: COS command

Response:

0xAA	0xBB	Len	DeviceID	0x11	0x02	Status	Data	Checksum

Data: COS response
Status: 0x00: Operation succeed
0x0A: Operation fails

4-4-2-16. Ultralight card Anticoll and Select

0xAA	0xBB	Len	DeviceID	0x12	0x02	Checksum

Response:

0xAA	0xBB	Len	DeviceID	0x12	0x02	Status	Data	Checksum

Data: 7 bytes ultralight UID
Status: 0x00: Operation succeed
0x0A: Operation fails

4-4-2-17. Write a page of data into ultralight card

0xAA	0xBB	Len	DeviceID	0x13	0x02	Data	Checksum

Data: 1 byte page address + 4 bytes written date

Response:

0xAA	0xBB	Len	DeviceID	0x13	0x02	Status	Checksum

Status: 0x00: Operation succeed
0x18: Writing fails

4-4-2-18. Authenticate password of Ultralight_C

0xAA	0xBB	Len	DeviceID	0x40	0x02	Checksum

Response:

0xAA	0xBB	Len	DeviceID	0x40	0x02	Status	Data	Checksum

Data: ek(RndB)
Status: 0x00: Operation succeed
0x16: Verifying key fails

0xAA	0xBB	Len	DeviceID	0x41	0x02	Data	Checksum

Data: ek(RndB)

Response:

0xAA	0xBB	Len	DeviceID	0x41	0x02	Status	Checksum

Status: 0x00: Operation succeed
0x16: Verifying key fails

4-4-2-19. Change password of Ultralight_C

0xAA	0xBB	Len	DeviceID	0x42	0x02	Data	Checksum

Data: 16 byte new password

Response:

0xAA	0xBB	Len	DeviceID	0x42	0x02	Status	Checksum

Status: 0x00: Operation succeed

0x18: Writing fails

4-4-2-20. SHC1102 card check password

0xAA	0xBB	Len	DeviceID	0x20	0x02	Data	Checksum

Data: 4 bytes password

Response:

0xAA	0xBB	Len	DeviceID	0x20	0x02	Status	Checksum

Status: 0x00: Operation succeed

0x16: Verifying key fails

4-4-2-21. Read data block of SHC1102 card

0xAA	0xBB	Len	DeviceID	0x21	0x02	Data	Checksum

Data: 1 bytes block address

Response:

0xAA	0xBB	Len	DeviceID	0x21	0x02	Status	Data	Checksum

Data: 4 bytes data

Status: 0x00: Operation succeed

0x17: Reading fails

4-4-2-22. Write data block of SHC1102 card

0xAA	0xBB	Len	DeviceID	0x22	0x02	Data	Checksum

Data: 1 bytes block address +4 bytes written data

Response:

0xAA	0xBB	Len	DeviceID	0x22	0x02	Status	Checksum

Status: 0x00: Operation succeed

0x18: Writing fails

4-4-2-23. Request DESFire and reset

0xAA	0xBB	Len	DeviceID	0x30	0x02	Data	Checksum

Data: 0x26 = REQ_STD

0x52 = REQ_ALL

Response:

0xAA	0xBB	Len	DeviceID	0x30	0x02	Status	Data	Checksum

Data: 7 bytes CSN + ATS information

Status: 0x00: Operation succeed

0x18: Writing fails

4-4-3 NFC Function Command

4-4-3-1. Set the NFC field

0xAA	0xBB	Len	DeviceID	0x0D	0x01	Data	Checksum

Data: 0: turn off the NFC field

1: turn on the NFC field

Response:

0xAA	0xBB	Len	DeviceID	0x0D	0x01	Status	Checksum

Status: 0x00: Operation succeed

4-4-3-2. Send the NFC command

0xAA	0xBB	Len	DeviceID	0x0E	0x01	Data	Checksum

Data: NFC command, see Table 3

Table 3

Text :	0x54—'T'	Language: 0: N/A 1:English 2:German 3:French	String
Uri:	0x55—'U'	Protocol: 0:N/A 1:http://www. 2:https://www 3:http:// 4:https:// 5:tel: 6:mailto: 7:ftp:anonymous:anonymous@ 8:ftp://ftp 9:ftps:// 10:sftp:// 11:smb:// 12:nfs:// 13:ftp:// 14:dav:// 15:news: 16:telnet:// 17:imap: 18:rtsp:// 19:urn: 20:pop: 21:sip: 22:sips: 23:tftp: 24:btspp:// 25:btl2cap:// 26:btgoep:// 27:tcpobex:// 28:irdaobex:// 29:file:// 30:urn:epc:id: 31:urn:epc:tag: 32:urn:epc:pat: 33:urn:epc:raw: 34:urn:epc: 35:urn:nfc:	String

		36-255:RFU	

Example:

aabb1f0000000e015401534e4550207465737420737472696e6720504e2d3531320074 means sending the text' SNEP test string PN-512'.

Response:

0xAA	0xBB	Len	DeviceID	0x0E	0x01	Status	Checksum

Status: 0x00: Operation succeed

0x01: NFC connect fails

Remark: Uri must be lowercase letters.