RFID MODULE

Mifare Read/Write Module

CM030
User Manual

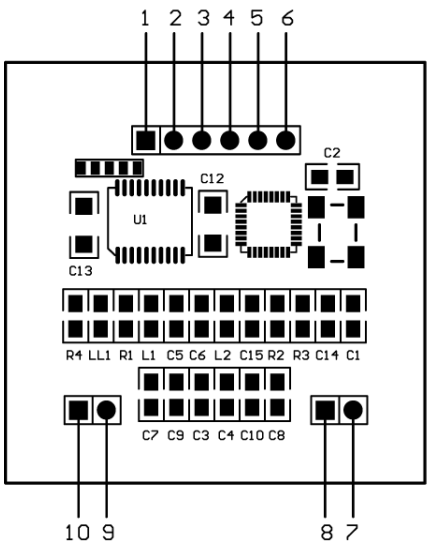
Version 2.1
Apr 2010
chenmingcard

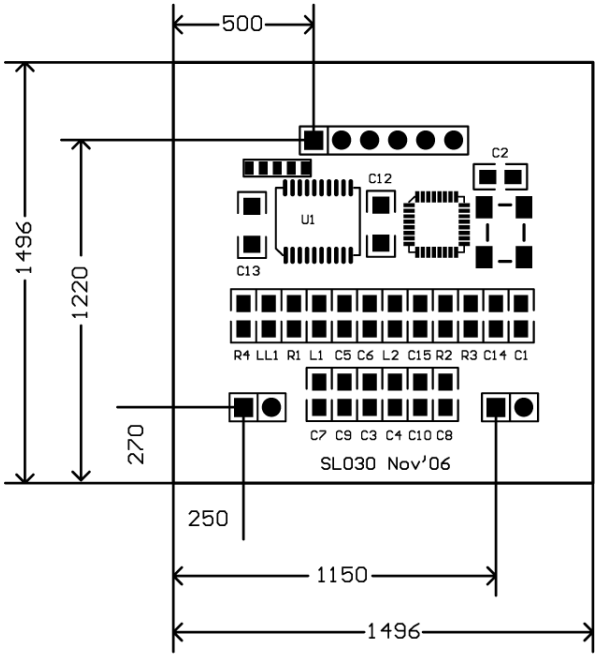
CONTENT

1. MAIN FEATURES

- Tags supported: Mifare 1k, Mifare 4k, Mifare UltraLight
- Auto-detecting tag
- Built-in antenna
- 0 to 400 KHz bit-wide I^2C-bus communication
- 2.5 ~ 3.6V VDC operating, I/O pins are 5V tolerant
- Work current less than 40mA @3.3V
- Power down current less than 10uA
- Operating distance: Up to 50mm, depending on tag
- Storage temperature: -40 ℃ ~ +85 ℃
- Operating temperature: -25 ℃ ~ +70 ℃
- Dimension: 38 × 38 × 3 mm
- The OUT pin at low level indicates tag in detective range, and high level indicating tag out

2. PINNING INFORMATION





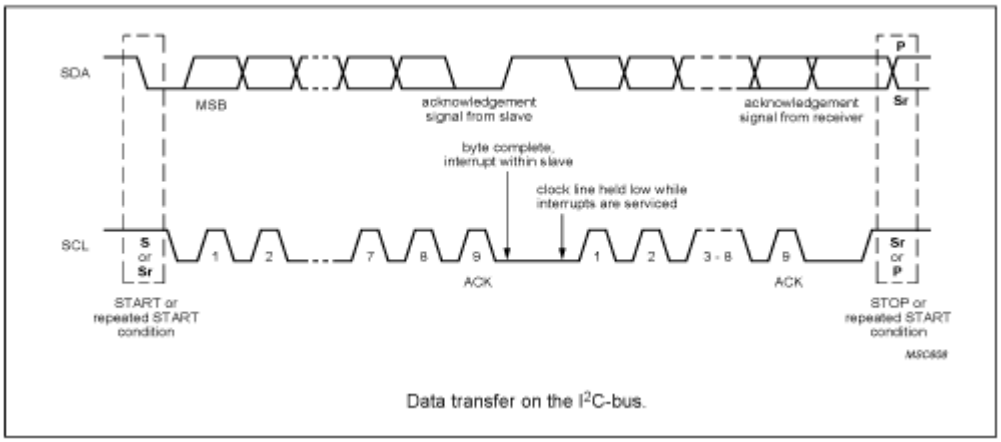
Uint: mil
100 mil between two pads

PIN	SYMBOL	TYPE	DESCRIPTION
1	VDD	PWR	Power supply, 2.5V to 3.6VDC
2	IN	Input	Falling edge wake up CM030 from power down mode
3	SDA	Input/Output	Serial Data Line
4	SLC	Input	Serial Clock Line
5	Out	Output	Tag detect signal low level indicating tag in high level indicating tag out
6	GND	PWR	Ground
7	NC		
8	NC		
9	NC		
10	NC		

3. DEVICE OPERATION

3-1. CLOCK AND DATA TRANSITIONS:

The SDA pin is normally pulled high with an external device. Data on the SDA pin may change only during SCL low time periods. Data changes during SCL high periods will indicate a start or stop condition as defined below.



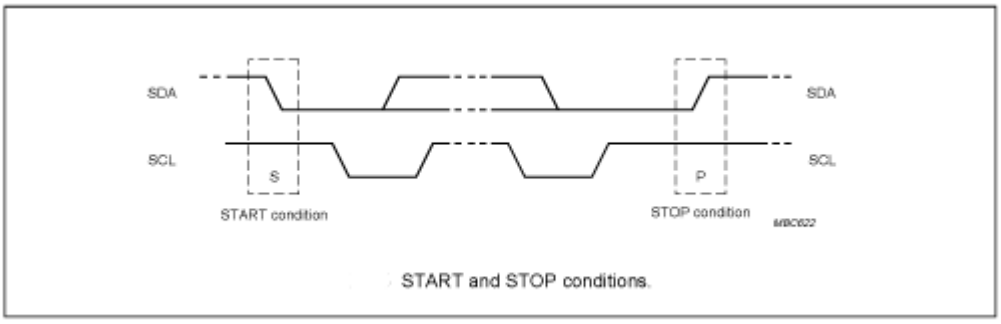
Data transfer on the I²C-bus.

3-2. START CONDITION

A high-to-low transition of SDA with SCL highis a start condition which must precede any other command

3-3. STOP CONDITION

A low-to-high transition of SDA with SCL high is a stop condition.



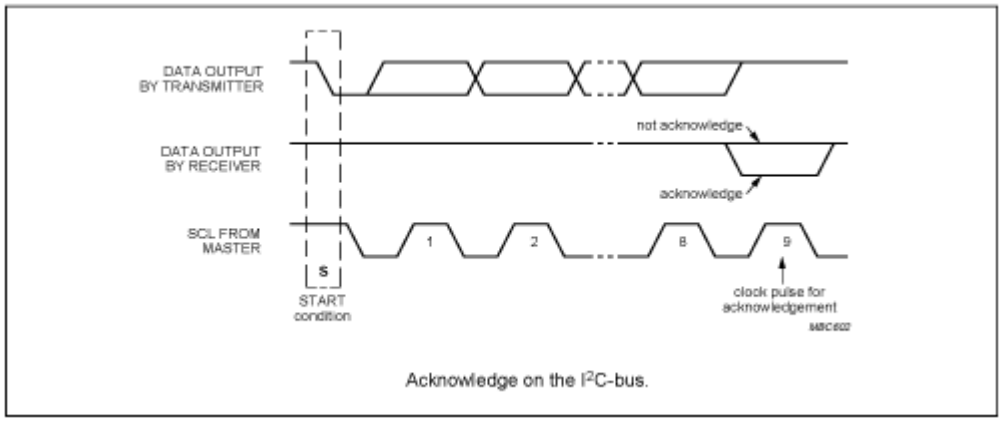
START and STOP conditions.

3-4. ACKNOWLEDGE

All addresses and data words are serially transmitted to and from the CM030 in 8-bit words. The CM030 sends a zero to acknowledge that it is not busy,and has received each word. This happens during the ninth clock cycle.

3-5. BUSY STATE

When the CM030 has received command, then don't acknowledge IIC bus until ends with the card communication.



Acknowledge on the I²C-bus.

3-6. Device Addressing

The CM030 devices require an 8-bit device address word following a start condition to enable the chip for a read or write operation.

The device address word consists of 7 bits addressing and 1 bit operation select bit.

The first 7 bits are the CM030 addressing, is 10100xx depend on JP1 and JP2 status as below table

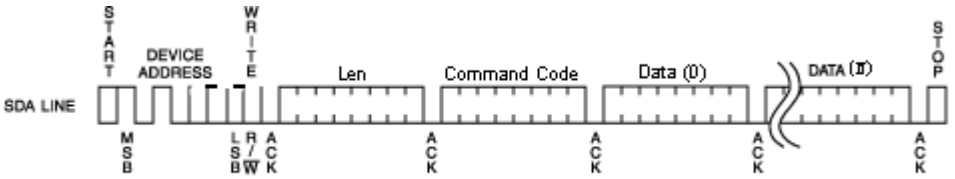
	JP1	JP2	Address
shorted	no	no	1010000 (default)
	yes	no	1010001
	no	yes	1010010
	yes	yes	1010011

The eighth bit of the device address is the read/write operation select bit. A read operation is initiated if this bit is high and a write operation is initiated if this bit is low.

The first byte after the START procedure.

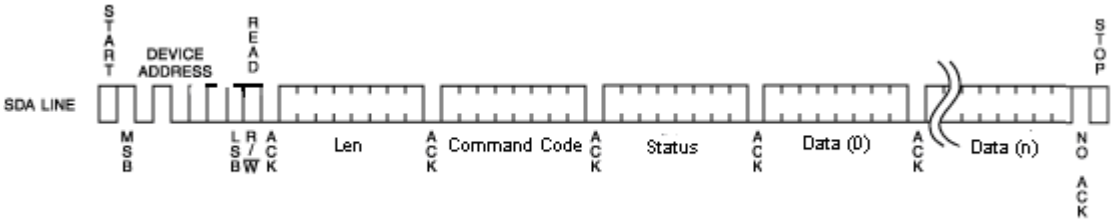
3-7. Write Operations

The host device send a command(refer chapter 4)to CM030 via write operation, then CM030 will carry out the order that receive. Finished time according to different order



3-8. Read Operations

The host device passes to read the operation gets the order carries out the result



4. COMMAND DESCRIPTION

4-1. FORMAT

Host Write Command to CM030:

Address	Len	Command	Data

Address: 1 byte, 0xA0
Len: Byte length counting from Command Code to the last byte of the data, 1 byte.
Command: Co mmand Code, 1 byte.
Data: Data, variable length depends on the command type.

Host Read The Result:

Address	Len	Command	Status	Data

Address: 1 byte, 0xA1
Len: Byte length counting from Command Code to the last byte of the data, 1 byte.
Command: Co mmand Code, 1 byte
Status: Command status, 1 byte
Data: Data, variable length depends on the command type.

4-2. COMMAND OVERVIEW

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
0x50	Go to Power Down mode

STATUS OVERVIEW

Status	Description
0x00	Operation succeed
0x01	No tag
0x02	Login succeed
0x03	Login fail
0x04	Read fail
0x05	Write fail
0x06	Unable to read after write
0x08	Address overflow
0x09	Download Key fail
0x0A	Collision occur
0x0C	Load key fail
0x0D	Not authenticate
0x0E	Not a value block

4-3. COMMAND LIST

4-3-1. Select Mifare card

Host Write:

Len	0x01

Host Read:

Len	0x01	Status	UID	Type

Status: 0x00: Operation succeed
0x01: No tag
UID: The uniquely serial number of Mifare card,
4 bytes for Mifare 1k & Mifare 4k, 7 bytes for UltraLight & DesFire
Type: 0x01: Mifare 1k
0x03: Mifare UltraLight
0x04: Mifare 4k
0x06: Mifare DesFire
0x0A: Other

4-3-2. Login to a sector

Host Write:

Len	0x02	Sector	Type	Key

Sector: Sector need to login, 0x00 – 0x27
Type: Key type (0xAA: authenticate with KeyA, 0xBB: authenticate with KeyB)
Key: Authenticate key, 6 bytes

Host Read:

Len	0x02	Status

Status: 0x02: Login succeed
0x01: No tag
0x03: Login fail
0x08: Address overflow

4-3-3. Download Key into CM030

Host Write:

Len	0x12	Sector	Type	Key

Sector: 0x00 – 0x27
Type: Key type (0xAA: KeyA, 0xBB: KeyB)
Key: 6 bytes, stored into CM030

Host Read:

Len	0x12	Status

Status: 0x00: Operation succeed
0x08: Address overflow
0x09: Download fail

4-3-4. Login sector via stored key

Host Write:

Len	0x13	Sector	Type

Sector: Sector need to login, 0x00 – 0x27

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

Host Read:

Len	0x13	Status

Status: 0x02: Login succeed

0x03: Login fail

0x08: Address overflow

4-3-5. Read a data block

Host Write:

Len	0x03	Block

Block: The absolute address of block to be read, 1 byte

Host Read:

Len	0x03	Status	Data

Status: 0x00: Operation succeed

0x01: No tag

0x04: Read fail

0x0D: Not authenticate

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

4-3-6. Write a data block

Host Write:

Len	0x04	Block	Data

Block: The absolute address of block to be written, 1 byte.

Data: The data to write, 16 bytes.

Host Read:

Len	0x04	Status	Data

Status: 0x00: Operation succeed

0x01: No tag

0x05: Write fail

0x06: Unable to read after write

0x0D: Not authenticate

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

4-3-7. Read a value block

Host Write:

Len	0x05	Block

Block: The absolute address of block to be read, 1 byte.

Host Read:

Len	0x05	Status	Value

Status: 0x00: Operation succeed

0x01: No tag

0x04: Read fail

0x0D: Not authenticate
0x0E: Not a value block
Value: Value returned if the operation succeeds, 4 bytes.

4-3-8. Initialize a value block

Host Write:

Len	0x06	Block	Value

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

Host Read:

Len	0x06	Status	Value

Status: 0x00: Operation succeed
0x01: No tag
0x05: Write fail
0x06: Unable to read after write
0x0D: Not authenticate
Value: Value written if the operation succeeds, 4 bytes.

4-3-9. Write master key (KeyA)

Host Write:

Len	0x07	Sector	Key

Sector: The sector number to be written, 0x00 – 0x27.
Key: Authentication key, 6 bytes

Host Read:

Len	0x07	Status	Key

Status: 0x00: Operation succeed
0x01: No tag
0x05: Write fail
0x08: Address overflow
0x0D: Not authenticate
Key: Authentication key written if the operation succeeds, 6 bytes.
Attention: Be sure KeyB is readable, otherwise KeyB will be change to 000000000000 after this command.

4-3-10. Increment value

Host Write:

Len	0x08	Block	Value

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

Host Read:

Len	0x08	Status	Value

Status: 0x00: Operation succeed
0x01: No tag
0x05: Write fail
0x06: Unable to read after write
0x0D: Not authenticate

0x0E: Not a value block
Value: The value after increment if the operation succeeds, 4 bytes

4-3-11. Decrement value
Host Write:

Len	0x09	Block	Value

Block: The absolute address of block to be decreased, 1 byte
Value: The value to be decreased by, 4 bytes
Host Read:

Len	0x09	Status	Value

Status: 0x00: Operation succeed
0x01: No tag
0x05: Write fail
0x06: Unable to read after write
0x0D: Not authenticate
0x0E: Not a value block
Value: The value after decrement if the operation succeeds, 4 bytes

4-3-12. Copy value
Host Write:

Len	0x0A	Source	Destination

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

Len	0x0A	Status	Value

Status: 0x00: Operation succeed
0x01: No tag
0x05: Write fail
0x06: Unable to read after write
0x0D: Not authenticate
0x0E: Not a value block (Source)
Value: The value after copy if the operation succeeds, 4 bytes

4-3-13. Read a data page (Mifare_UltraLight)
Host Write:

Len	0x10	Page

Page: The page number to be read, 1 byte
Host Read:

Len	0x10	Status	Data

Status: 0x00: Operation succeed
0x01: No tag
0x04: Read fail
0x08: Address overflow
Data: Block data returned if operation succeeds, 4 bytes.

4-3-14. Write a data Page (Mifare_UltraLight)

Host Write:

Len	0x11	Page	Data

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

Host Read:

Len	0x11	Status	Data

Status: 0x00: Operation succeed
0x01: No tag
0x05: Write fail
0x06: Unable to read after write
0x08: Address overflow
0xF0: Checksum error
Data: page data written if operation succeeds, 4 bytes.

4-3-15. Power Down

Host Write:

Len	0x50

Host Read:

No response until falling edge at PIN2 or repower