**GENERAL DESCRIPTION**

RhombusMF6801ST is a high performance internal antenna ISO14443 type B format IC card R/W engine module ,which is fit for the door lock identifying RFID card, it can also be widely used in office/family security, ID identification, access control system , "smart card " and various of RFID systems in the process of producing .

**FEATURE**

- Built-in internal antenna;
- Function distance up to 30mm;
- Typical time for reading and writing is no more than 2.5ms and 6ms ;
- Single power supply and low dissipation design
- Support TTL level serial interface;
- Completely support SR176 and the compatible cards of ST company ;
- Index form is compatible with 28PIC IC socket
- Mini outline designed

## Electrical and Mechanical Specification

**Absolute Maximum Ratings**

| ITEM | SYMBOL | VALUE | UNIT |
|---|---|---|---|
| Power Supply | VCC | 6 | V |
| Operating Temp. | T | 0~+70 | ℃ |
| Storage Temp. | $T_{STR}$ | -55~+125 | ℃ |

Specification

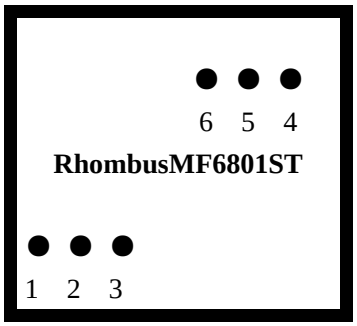
Under $T_A$= 25℃ and VCC=+5V unless specific statement

| ITEM | SYMBOL | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Power Supply | VCC | 3.3 | 5 | 5.5 | V |
| Current Supply | $I_C$（work）<br>$I_S$（wait） | | 70 | 120<br>2 | mA<br>uA |
| Operation Freq. | FREQ | | 13.56 | | MHz |
| Effective Distance* | DIS | 0 | 30 | 50 | mm |
| Operation time for reading | TRD | | 2.5 | | ms |
| Operation time for writing | TWR | | 6 | | ms |

Effective distance depends on related cards, antenna designed and operating environment

Not including the passing time of agreement.

# INTERFACE DESCRIPTION




BOTTOM VIEW

| NUMBER | SYNBOL | DESCRIPTION |
|---|---|---|
| 1 | IND | Operation led output* |
| 2 | TXD | Serial data output* |
| 3 | RXD | Serial data input |
| 4 | GND | Ground |
| 5 | VCC | +5V power supply |
| 6 | SW | Module operation control** |

*A symbol of working situation, high level indicates it is on working, low level indicates it is off working, the LED can connect the index directly.

**SW: A symbol of Module operation control. When it connects the ground, it is on working, hangs it or connects the high level, it is off working. The time for the module from off to on is 150ms (max).

# Related information

## Card information

SR176 comply with the standard of ISO14443-2&3 TYPE B

**1. Performance index**

- According to ISO14443-2 TYPE B RFID interface criterion
- According to ISO14443-3 TYPE B data frame format criterion
- Working frequency:13.56MHz
- Subcarrier 847KHz
- Date exchange rate: 106kbit/s
- 256bit data storage capacity
- 64bit exclusive serial number of cards, 8bit symbol of card chip, 8bit protect character

- 176bit can lock EEPROM in the range of user's data
- The times for data updating exceeds 100,000 times, it can be reserved for 10 years.

**2. Memory structure**

256bit memory area of SR176 consists of 8 groups, 16 blocks, there is 16bit in each block, and 16bit is basic unit for the data operation .The memory area structure is as follows:

| Block address | Group number | Top 16bit block data bottom<br>B15 b8 b7 b0 | | | description |
|---|---|---|---|---|---|
| 0 | 0 | UID0 | | | Unchangeable exclusive serial number of 64bit |
| 1 | | UID1 | | | |
| 2 | 1 | UID2 | | | |
| 3 | | UID3 | | | |
| 4 | 2 | User's data area | | | Can lock EEPROM |
| 5 | | User's data area | | | |
| 6 | 3 | User's data area | | | Can lock EEPROM |
| 7 | | User's data area | | | |
| 8 | 4 | User's data area | | | Can lock EEPROM |
| 9 | | User's data area | | | |
| 10 | 5 | User's data area | | | Can lock EEPROM |
| 11 | | User's data area | | | |
| 12 | 6 | User's data area | | | Can lock EEPROM |
| 13 | | User's data area | | | |
| 14 | 7 | User's data area | | | Can lock EEPROM |
| 15 | | Lock the controlled byte | reserved | Code of card chip | |

The first four blocks in the memory area is exclusive serial number of 64bit, it is unchangeable.

EEPROM user's data area can be rewritten when it is 176bit from the fourth block to the fourteenth block, used in the applied data memory.

The fifteenth block is control block, high 4bit of low byte is reserve bit, low 4bit is card chip code, it can be decided to implement the operation on a certain card by using the card chip code in the applied process, high byte 8bit is the locked one in the user's data area, each bit corresponds to lock state of memory area, 0 represents it can be written in the group, 1 represents it can not. The fifteenth block is one-off programmable, it means when one bit has been set as 1, it will be not allowed to reset as 0. The default of the byte is 0x03 when the card left factory, and it avoids to rewrite the card serial number.

## TWO serial interface agreements

**1. serial interface specification**

RhobmusMF6801ST transmit data through serial interface and host computer (SCM, MPU, controller, etc.), finish all the operations to the cards according to the host computer's order.

The specification of data frames for the serial interface is 9600bps at baud rate. One inception bit, eight data bit ,one stop bit, no odd and even checkout bit. In the communication process, the lowest effective byte is transmitted first, the lowest effective bit of the byte is transmitted first.

2. Control character

It defined 4 control characters, it shows the start , the end , the responsion and no responsion. The whole is as follows:

| Definition | Symbol | Value |
|---|---|---|
| Start symbol | STX | 0x02 |
| End symbol | ETX | 0x03 |
| Responsion | ACK | 0x06 |
| No responsion | NAK | 0x15 |

3. Agreement description

The communication process must engine the RHOMBUSMF6801ST through the orders and data that the host computer transmits. Then RHOMBUSMF6801ST return the result state and data that the order implemented to the host computer. The two parties who need communication start a communication by shaking the hands, then come to transmit the data.

The transmition process of the orders of the host computer as follows,

| Host computer | Data transmition direction | RHOMBUSMF6801ST | description |
|---|---|---|---|
| STX | → | | The host computer can resend the STX if it |
| | ← | ACK | |

| | | | |
|---|---|---|---|
| Oder data block+ETX | → | | didn't receive ACK or NAK; It comes to order the block transmit data 45ms when it receive ACK<br>The internal between two bytes must be less than 15ms. During the process ,if the host computer receive any messages that RHOMBUSMF6801ST sends, and it indicates host computer will lose the steps with RHOMBUSMF6801ST communication at the same time. The host computer can stop send the orders, and it will wait for15ms to restart the handshake. |

First the PC sends STX and wait for RHOMBUSMF6801ST back ACK to restart the data block transmition process. The PC can decide to resend STX or stop communication if it didn't receive ACK or NAK in 20ms. Then it comes to deal with the failure. When the PC receive ACK of RHOMBUSMF6801ST,

It will send the order data block which consists of operation order, operation data order, etc. to RHOMBUSMF6801ST, and it ends sending by sending ETX character, then waits for the return result from RHOMBUSMF6801ST.

4. Data block format

A. Order data block

| SeqNo | Cmd | Len | Data[] | BCC |
|---|---|---|---|---|

**SeqNo**: one character data package exchange serial number, the value range is 0~255， when the PC sends next order after a correct data exchange, it will plus 1 on serial number. RHOMBUSMF6801ST will back its current received data package serial number when it reacts the data block.. The PC program can strengthen then communication integrality by using the serial number, and ignore the serial number to predigest the communication process;

**Cmd**: operation order symbol of a character, it defined 8 orders;

**Len** : the order operation length of a character. The value range is 0~3, 0 is on behalf of no order operation;

**Data**[]: Len characters of the order operation data , when Len=0, the item is not existed;

**BCC**: check sum of a character, it is XOR of serial character of all data in the data block.

**BCC=SeqNo+Cmd+Len+Data[]**

**B. response data block**

| SeqNo | Status | Len | Data[] | BCC |
|---|---|---|---|---|

SeqNo: one character's current received data package exchange sequence number;
Status: one character's order implement result , 0 represents it succeeds in implement, other values represents wrong code;

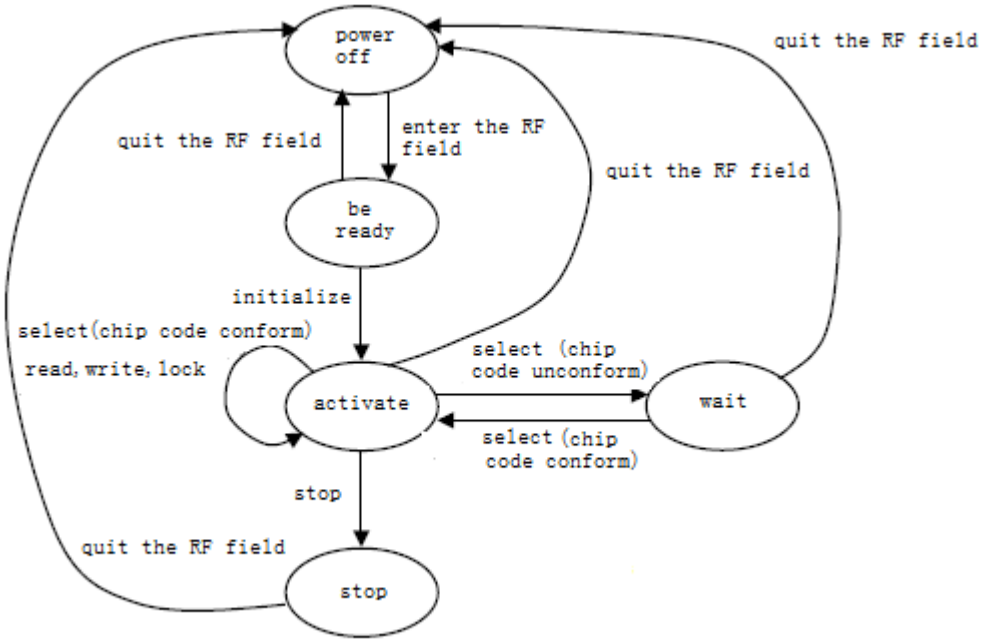
| Wrong code | description |
|---|---|
| 0x01 | Operation order symbol fault |
| 0x02 | Order operation length fault |
| 0x03 | Order data block check sum fault |
| 0x04 | No cards reaction |
| 0x05 | Cards data stream format fault |
| 0x06 | Cards data stream CRC fault |
| 0x07 | Read-write address slop over fault( read command operation address is 0~15, write command operation address is 4~14) |
| 0x08 | RF output doesn't start( when RF is close, RHOMBUSMF6801ST doesn't carry out any commands unless it starts or closes RF) |
| 0x09 | Write operation fault |
| 0x0A | Lock operation fault |

Len: one character's data reaction length, value range is0~2, if command implement is wrong, the value is 0;
Data[]:Len characters of reaction data , when Len=0, the item is not existed;
BCC: check sum of a character, it is XOR of serial character of all data in the data block.
**BCC=SeqNo+Cmd+Len+Data[]**

**5.operation command in detail**

RHOMBUSMF6801ST supports 8 operation commands, they are start RF, close RF, initialization , decision , read, write, lock, and stop commands. The first two commands are used to control the work situation of the RF transmition circurt inside RHOMBUSMF6801ST , other commands carry out the cards operation.

SR176 cards has 5 states, different states accept different operations and come to transform corresponding states, as follows:




The command format supported by RHOMBUSMF6801ST is as follows:

| Command | | | Response | | | Description |
|---|---|---|---|---|---|---|
| Command Notation | Data Length | Content | Result State | Data Length | Data Content | |
| 0x41 | 0 | - | 0 | 0 | - | Startup RF output, engine enter the normal working state. |
| | | | Error Code | 0 | - | |
| 0x54 | 0 | - | 0 | 0 | - | Close RF output, engine enter the standby state. |
| | | | Error Code | 0 | - | |
| 0x49 | 0 | - | 0 | 1 | Chip code | Initialization command choose one card from the IC cards in effective RF field and place it in activation state, and return its chip code (low 4bit effective) |
| | | | Error Code | 0 | - | |
| 0x53 | 1 | Chip code(low 4bit effective, high 4bit reserved as 0) | 0 | 1 | Chip code | Choose command Choose cards with specified chip code from the IC cards in effective RF field and place it in activation state. |
| | | | Error code | 0 | - | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0x52 | 1 | Block address | 0 | 2 | two-byte block data in the front of low byte row | Read command<br>The range of block Address 0~15,the 15th block is the control block of the card |
| | | | Error code | 0 | - | |
| 0x57 | 3 | Block address + two-byte block data in the front of low byte row | 0 | 0 | - | Write command<br>The range of block address 4~14 |
| | | | Error code | 0 | - | |
| 0x50 | 2 | Two-byte card control block data in the front of low byte row | 0 | 0 | | Lock command<br>The content actually written in is the logic or of the former control block data and the specified data in command |
| | | | Error code | 0 | - | |
| 0x48 | 0 | - | 0 | 0 | - | Stop command<br>Card will cease all responses after it receives stop command until the card is removed from and reenter the effective RF field |
| | | | Error code | 0 | - | |

2. Example

Read the content of the 5th block of one card(If RF output is started, the chip code is 0,and the data of the 5th block inside the card is 0X55AA, the following forms are the content of the communication between PC and RHOMBUSMF6801ST)

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The 1ST step: Initialization

| | | | | | |
|---|---|---|---|---|---|
| Command | PC | STX | | 0x00 0x49 0x00 0x49 | ETX |
| | | ↓ | ↑ | ↓ | ↓ |
| | RHOMBUSMF6801ST | | ACK | | |

| | | | | | |
|---|---|---|---|---|---|
| Response | PC | | ACK | | |
| | | ↑ | ↓ | ↑ | ↑ |
| | RHOMBUSMF6801ST | STX | | 0x00 0x00 0x01 0x00 0x01 | ETX |

The 2nd step: select(If operating directly after initialization, this step could be omitted)

| | | | | | |
|---|---|---|---|---|---|
| Command | PC | STX | | 0x01 0x53 0x01 0x00 0x53 | ETX |
| | | ↓ | ↑ | ↓ | ↓ |
| | RHOMBUSMF6801ST | | ACK | | |

| | | | | | |
|---|---|---|---|---|---|
| Response | PC | | ACK | | |
| | | ↑ | ↓ | ↑ | ↑ |
| | RHOMBUSMF6801ST | STX | | 0x01 0x00 0x01 0x00 0x00 | ETX |

The 3rd step: read

| | | | | | |
|---|---|---|---|---|---|
| Command | PC | STX | | 0x02 0x52 0x01 0x05 0x54 | ETX |
| | | ↓ | ↑ | ↓ | ↓ |
| | RHOMBUSMF6801ST | | ACK | | |

| | | | | | |
|---|---|---|---|---|---|
| Response | PC | | ACK | | |
| | | ↑ | ↓ | ↑ | ↑ |
| | RHOMBUSMF6801ST | STX | | 0x02 0x00 0x02 0xAA 0x55 0xFF | ETX |

**Note: Rhombus' products must work with linear regulated power supply, and other kinds of power supply are prohibited.**