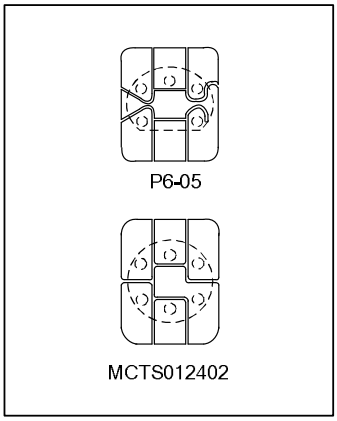
256-BYTE MEMORY CARD IC

DESCRIPTION

SC23M42 is a smart card module utilizing CMOS EEPROM technology. 256 bytes main memory, 32-bit protection memory, 3 bytes user password, and 3-bit password wrong counter (Value: 00000D2D1D0). And the periphery interface is compatible with ISO7816 agreement (synchronous propagation).



FEATURES

* 256 X 8 bit EEPROM
* Byte addressing
* Write-protect area (former 32 bytes) can execute the write-protect separately, and after the write-protect, the content cannot be changed.
* 32 X 1bit protect memory
* Serial two buses interface
* More than 100,000 times write endurance cycles
* Data retention of more than 10 years
* Contact definition and serial interface comply to ISO7816 specification (synchronous propagation)
* 3 Bytes user password, 3 bits(bit0-bit2) error counter
* Before the password is checked, all the data can be read; if the password is correct, you can write or amend the data and the password.
* Password error counter, and the initial value is 3. Checking the password once, subtracts 1, if the value of the counter is 0, the memory card will be locked automatically, and the data can only be read, the password cannot be checked again; When the value of the counter is not 0, if the password checking is correct for one time, the value comes back to initial value.
* Comply to SLE4442

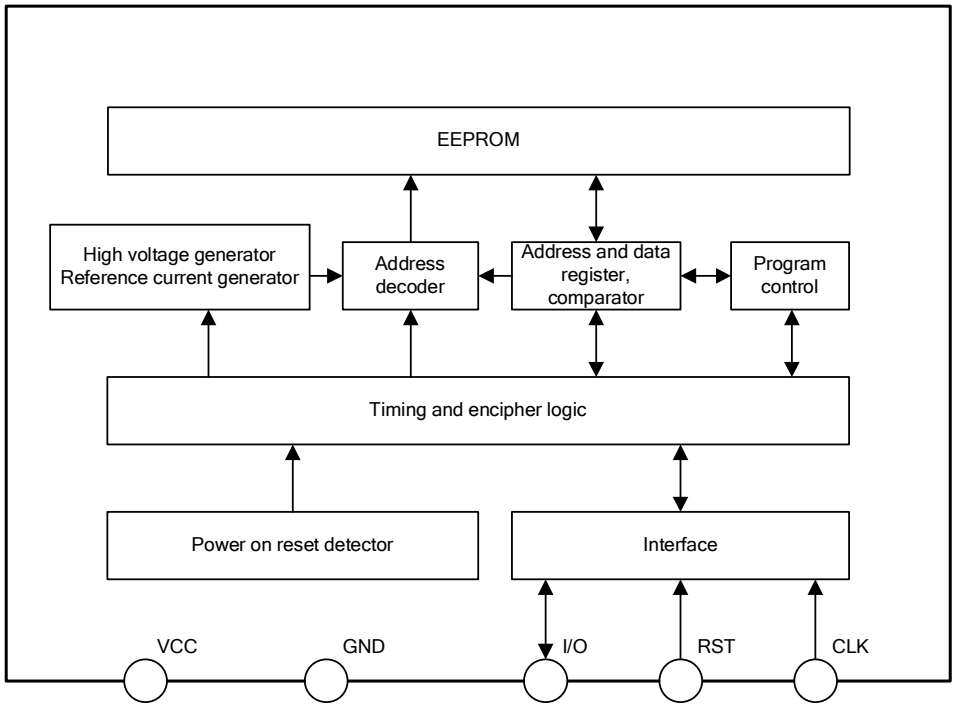
ORDERING INFORMATION

Device	Package
SC23M42A	P6-05
SC23M42B	MCTS012402

APPLICATIONS

* used for various IC memory cards.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Characteristics	Symbol	Ratings	Unit
Power Supply Voltage	V_{CC}	-0.3~6	V
Input Voltage	V_I	-0.3~6	V
Storage Temperature	T_{stg}	-40~125	°C
Power Dissipation	P_D	70	mW

DC ELECTRICAL CHARACTERISTICS (V_{CC}=5V, T_{amb} =25°C)

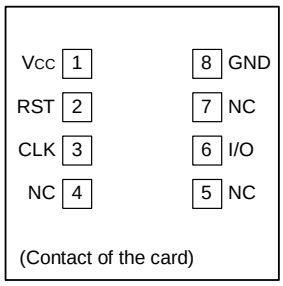
Characteristics	Symbol	Condition	Min.	Typ.	Max.	Unit
Power Supply Voltage	V_{CC}		2.4	--	5.5	V
Operating Current	I_{CC}		--	3	10	mA
H Input Voltage(I/O, CLK, RST)	V_{IH}		3.0	--	V_{CC}	V
L Input Voltage(I/O, CLK, RST)	V_I		0	--	1.2	V
H Input Current(I/O, CLK, RST)	I_H		--	3	5	μA
L Output Current(V_L=0.4V,Open-drain)	I_{OL}		0.5	1.0	--	mA
H Leakage Current(V_H=V_{CC}, Open-drain)	I_{OH}		--	--	1	μA
Input Capacitance	C_I		--	--	10	pF
Operating Frequency	F_{OSC}		7	20	50	kHz

AC ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{CC}=5.0V, T_{amb}=25°C, and testing frequency is 20 kHz)

Characteristics	Symbol	Condition	Min.	Typ.	Max.	Unit
Reset Time	t_{RE}		9	--	--	μs
CLK (High Level)	t_H		10	--	--	μs
CLK (Low Level)	t_L		10	--	--	μs
Write Time	t_W		5	--	--	ms
Erase Time	t_E		5	--	--	ms
Set-up Time(D/CLK)	t_{d1}		4	--	--	μs
Set-up Time (CLK/RST)	t_{d3}		4	--	--	μs
Set-up Time (RST/CLK)	t_{d4}		4	--	--	μs
Hold Time (D/CLK)	t_{d5}		4	--	--	μs
Delay Time (CLK/D)	t_{d2}		6	--	--	μs
Rise Time (I/O, CLK, RST)	t_R		--	--	1	μs
Fall Time (I/O, CLK, RST)	t_F		--	--	1	μs

PIN CONFIGURATION



PIN DESCRIPTIONS

Pin No.	Symbol	I/O	Description
1	V_{CC}	--	Power supply voltage is 5V
2	RST	I	Reset signal
3	CLK	I	Clock signal
4	NC	--	No connect
5	GND	--	Ground
6	NC	--	No connect
7	I/O	I/O	Data bus(open-drain output)
8	NC	--	No connect

FUNCTION DESCRIPTIONS

SC23M42 provides 256×8 bits EEPROM memory units and 32×1 protect units, and there is writing-protect for the former 32-bit bytes. Except PSC (Programmable Security Code) memory unit, all units are readable. The unit can be erased and written before the write-protect is active, or else the unit is only readable after the write-protect. The bit with write-protection can be programmed only once, and cannot be erased. The chip has one 3-bit (bit0-bit2)error register which provides 3 times continuous PSC authentication at most, after 3 times the chip cannot be erased and written.

Transmission Protocols

Transmit the data by serial two buses between IFD and IC memory cards.

The transmission protocols can be defined as four operation mathods

-Reset and reset acknowledge

-Command

-Output the data

-Process

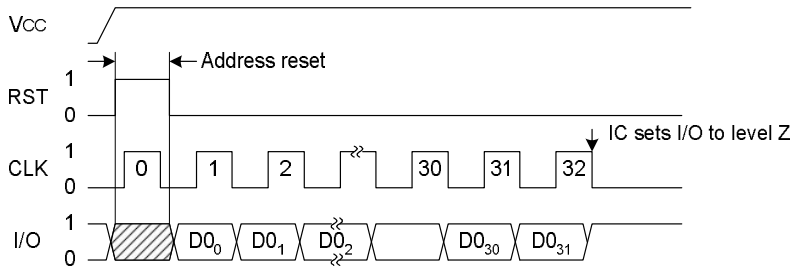
1. Reset and reset acknowledge

The chips enter the power on reset state when it is power on, and this state will be ended by the reset signal. The reset signal begins when RST changed from“0” to “1” and end when CLK changed from “0”to“1”. The reset signal can stop any active instruction. Read operation must be carried out first after power on reset, then the other operations.

The reset acknowledge complies to ISO7816-3 synchronous propagation. The address counter is set to “0” automatically and will send the first data to the I/O port. As the clock signal, the address data can be read serially. And the content of the former 4 EEPROM address units can be read after the continuous 32 clock pulses, and then the 33rd clock pulse will set I/O to H state. The details refer to the figure 1.

Figure 1 Reset and reset acknowledge

Reset acknowledge (Hex)	Byte 1	Byte2	Byte3	Byte4
	$DO_7…DO_0$	$DO_{15}…DO_8$	$DO_{23}…DO_{16}$	$DO_{31}…DO_{24}$

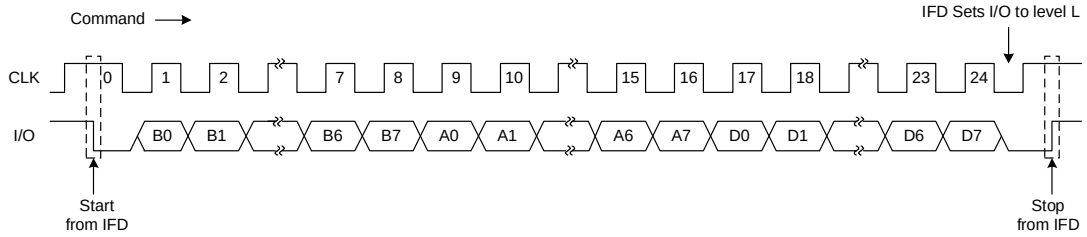


2. Instruction format

Instruction table

Byte1control		Byte2 Address	Byte3 Data	Operation	Method
B7B6B5B4	B3B2B1B0	A7-A0	D7-D0		
0 0 1 1	0 0 0 0	Address bit	invalid	Read the main memory	Output data
0 0 1 1	1 0 0 0	Address bit	Input data	Write the main memory	Process
0 0 1 1	0 1 0 0	invalid	invalid	Read protect memory	Output data
0 0 1 1	1 1 0 0	Address bit	Input data	Write protect memory	Process
0 0 1 1	0 0 0 1	invalid	invalid	Read password memory	Output data
0 0 1 1	1 0 0 1	Address bit	Input data	Amend password memory	Process
0 0 1 1	0 0 1 1	Address bit	Input data	Compare authentication data	Process

Figure 2 Command input time sequence

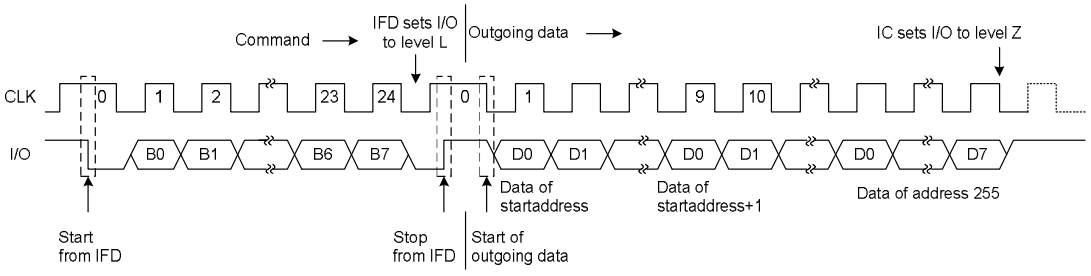


3. Instruction description

1) Read main memory

	Control								Address	Data
	B7	B6	B5	B4	B3	B2	B1	B0	A7… A0	D7…D0
Binary	0	0	1	1	0	0	0	0	Address	No effect
Hex	30H								00H…FFH	No effect

This command will read the data from current byte address N to the last address and the needed pulse number m=(256-N) ×8+1



2) Write main memory

	Control								Address	Data
	B7	B6	B5	B4	B3	B2	B1	B0	A7… A0	D7…D0
Binary	0	0	1	1	1	0	0	0	Address	Input data
Hex	38H								00H…FFH	Input data

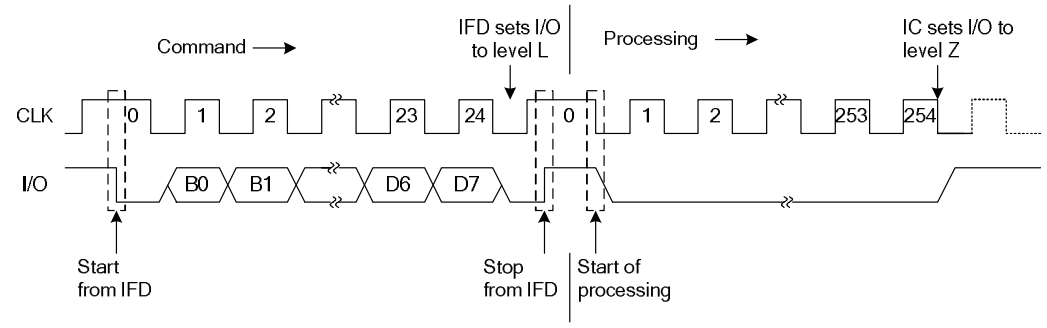
This command writes the main memory in bytes. According to the new and old data, carry out one of the operations below in process mode:

Erase and write (5ms) Corresponding pulse number m=245

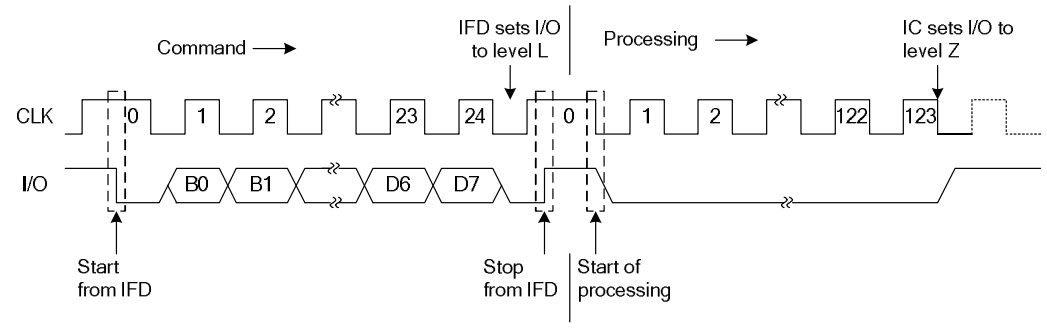
Only erase (2.5ms) Corresponding pulse number m=124

Only write (2.5ms) Corresponding pulse number m=124

(All the time value is calculated according to the 50 kHz clock frequency.)



Erase and write main memory

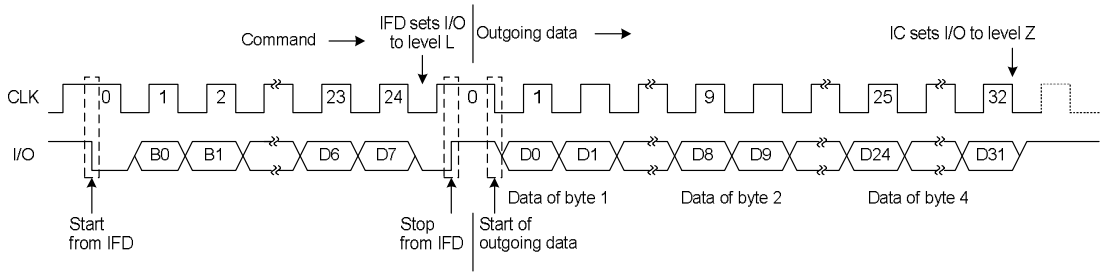


Erase or write main memory

3) Read protect memory

	Control								Address	Data
	B7	B6	B5	B4	B3	B2	B1	B0	A7… A0	D7…D0
Binary	0	0	1	1	0	1	0	0	No effect	No effect
Hex	34H								No effect	No effect

This command will read the content of all the protect memory (32bit), and display that whether the data of corresponding address unit can be changed.



4) Write protect memory

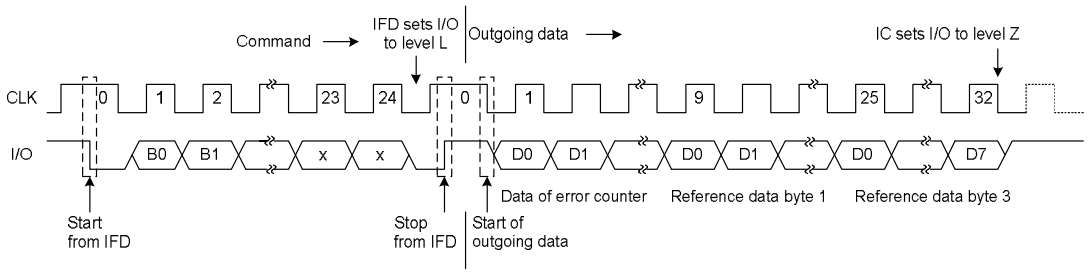
	Control								Address	Data
	B7	B6	B5	B4	B3	B2	B1	B0	A7... A0	D7...D0
Binary	0	0	1	1	1	1	0	0	Address	Input data
Hex	3CH								00H…1FH	Input data

Compare the command input data and the original data of this unit, if they are the same, then corresponding write-protect bit is active, and the unit is only readable.

5) Read password memory

	Control								Address	Data
	B7	B6	B5	B4	B3	B2	B1	B0	A7... A0	D7...D0
Binary	0	0	1	1	0	0	0	1	No effect	No effect
Hex	31H								No effect	No effect

Read the 4 bytes content of password memory.



6) Change password memory

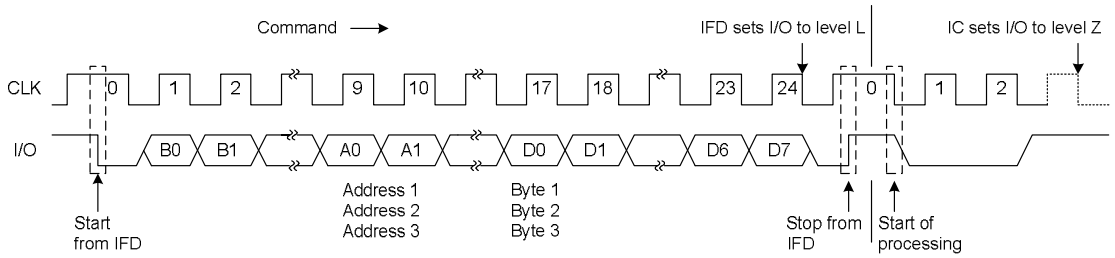
	Control								Address	Data
	B7	B6	B5	B4	B3	B2	B1	B0	A7... A0	D7...D0
Binary	0	0	1	1	1	0	0	1	Address	Input data
Hex	39H								00H…03H	Input data

The password memory can be changed after PSC authentication, or else some bit of error counter will change from “1” to “0”.

7) Compare authentication data

	Control								Address	Data
	B7	B6	B5	B4	B3	B2	B1	B0	A7… A0	D7…D0
Binary	0	0	1	1	0	0	1	1	Address	Input data
Hex	33H								00H…03H	Input data

Validate the appointed byte of PSC each time.



4. Password authentication

The SC23M42 is only readable without PSC authentication. The content of PSC cannot be read, if you try to read PSC, you will get “00”.

The authentication steps are as follows:

--Write to one bit of the error counter (EC) which has not been written, and the EC address is“00”;

--Input the first byte data of PSC code, and the address is“01”;

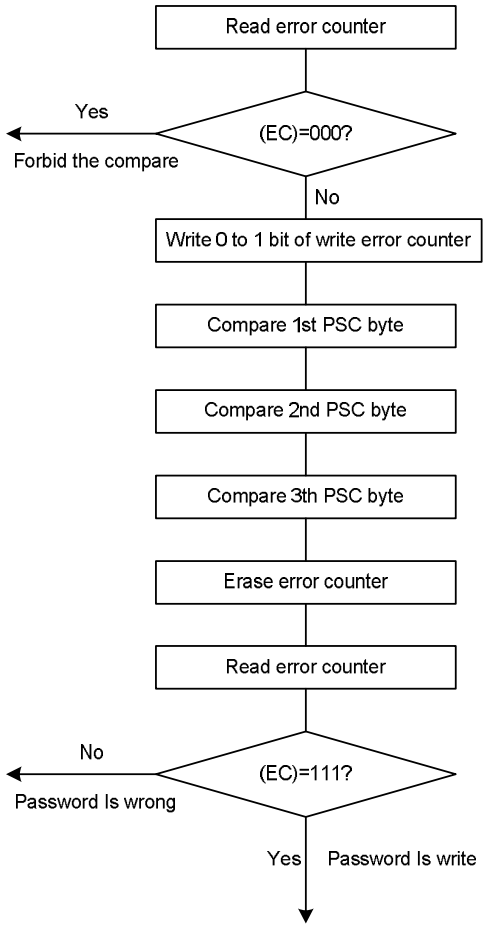
--Input the second byte data of PSC code, and the address is “02”;

-- Input the third byte data of PSC code, and the address is “03”;

--If pass the authentication, EC can be erased.

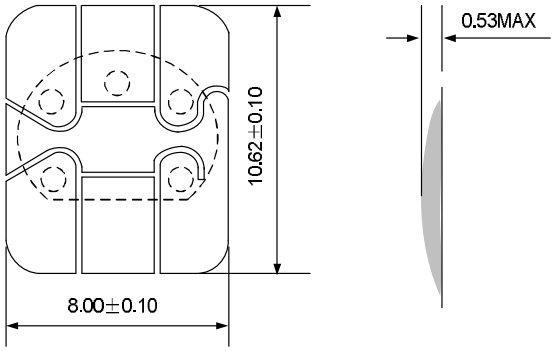
If the initial value of the error counter is “00”, the error counter cannot be written, and also cannot go through the password authentication. After the PSC authentication, I/O port will change from “1” to “0” at the raising edge of the second clock no matter pass the authentication or not. When RST changes from “0”to“1”，I/O port returns to “1”. The flow chart is as follows:

Figure8 PSC authentication flow chart

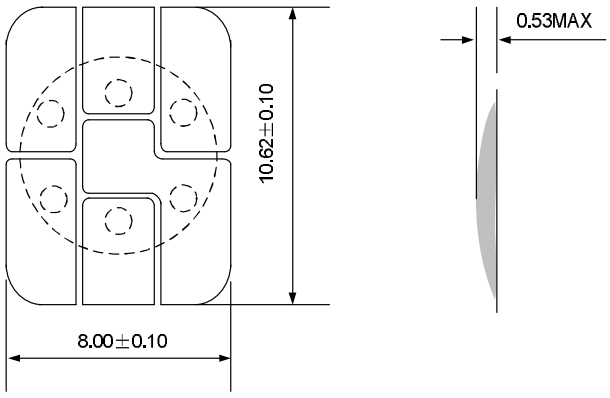


PACKAGE OUTLINE

P6-05 UNIT: mm



MCTS012402 UNIT: mm



HANDLING MOS DEVICES:

Electrostatic charges can exist in many things. All of our MOS devices are internally protected against electrostatic discharge but they can be damaged if the following precautions are not taken:

- Persons at a work bench should be earthed via a wrist strap.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed for dispatch in antistatic/conductive containers.