



复旦微电子

FM1216 SERIES CPUCARD CHIP

Datasheet

Sep. 2013

INFORMATION IN THIS DOCUMENT IS INTENDED AS A REFERENCE TO ASSIST OUR CUSTOMERS IN THE SELECTION OF SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD PRODUCT BEST SUITED TO THE CUSTOMER'S APPLICATION; THEY DO NOT CONVEY ANY LICENSE UNDER ANY INTELLECTUAL PROPERTY RIGHTS, OR ANY OTHER RIGHTS, BELONGING TO SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD OR A THIRD PARTY.

WHEN USING THE INFORMATION CONTAINED IN THIS DOCUMENTS, PLEASE BE SURE TO EVALUATE ALL INFORMATION AS A TOTAL SYSTEM BEFORE MAKING A FINAL DECISION ON THE APPLICABILITY OF THE INFORMATION AND PRODUCTS. PURCHASERS ARE SOLELY RESPONSIBLE FOR THE CHOICE, SELECTION AND USE OF THE SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD PRODUCTS AND SERVICES DESCRIBED HEREIN, AND SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD ASSUMES NO LIABILITY WHATSOEVER RELATING TO THE CHOICE, SELECTION OR USE OF THE SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD PRODUCTS AND SERVICES DESCRIBED HEREIN. UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD REPRESENTATIVE, SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE.

FUTURE ROUTINE REVISIONS WILL OCCUR WHEN APPROPRIATE, WITHOUT NOTICE. CONTACT SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD SALES OFFICE TO OBTAIN THE LATEST SPECIFICATIONS AND BEFORE PLACING YOUR PRODUCT ORDER. PLEASE ALSO PAY ATTENTION TO INFORMATION PUBLISHED BY SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD BY VARIOUS MEANS, INCLUDING SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD HOME PAGE ([HTTP://WWW.FMSH.COM](http://www.fms.com)).

PLEASE CONTACT SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD LOCAL SALES OFFICE FOR THE SPECIFICATION REGARDING THE INFORMATION IN THIS DOCUMENT OR SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD PRODUCTS.

Trademarks

Shanghai Fudan Microelectronics Group Co., Ltd name and logo, the “复旦” logo are trademarks or registered trademarks of Shanghai Fudan Microelectronics Group Co., Ltd or its subsidiaries in China.

Shanghai Fudan Microelectronics Group Co., Ltd, Printed in the China, All Rights Reserved.

1 Product Overview

1.1 Description

FM1216 is a dual interface CPU card chip designed by Fudan Microelectronics Group Co.,Ltd. It supports both ISO7816 and ISO14443A protocol.

FM1216 is targeting both contact-based and contactless-based smart card applications such like Electronics Wallet, existing Pulic Traffic RF Card, banking card based on PBOC2.0 Standard.

1.2 Features

- Compatible with FM11RF08 (Support M1)、FM11RF08SH、FM11RF32M、FM11RF32SH series contactless card
- ISO/IEC 7816 contact interface
- ISO/IEC 14443 A contactless interface
- MCU command set compatible with Turbo 8051
- Triple-DES/Single-DES processor (Anti-SPA/DPA)
- PKI coprocessor (2048 bit RSA)
- PLL: speed up the internal clock frequency up to 30Mhz(Contact interface)
- Program memory: 64K x 8bit ROM (56K x 8bit for customer)
- Data memory: 16K x 8bit EEPROM
- Contactless interface FIFO: 280x8bit
- 256x8bit iRAM
- 2048x8bit xRAM
- Low and high supply voltage sensor
- Low and high frequency sensors and filters
- Memory data encryption (ROM、EEPROM、RAM)
- ROM code reverse resistant
- EEPROM endurance: minimum 100,000
- EEPROM data retention: 10 years minimum

RSA Feature:

RSA-1024 digital signature @6.78M: 182ms

RSA-2048 digital signature @6.78M: 1070ms

1.3 Block Diagram

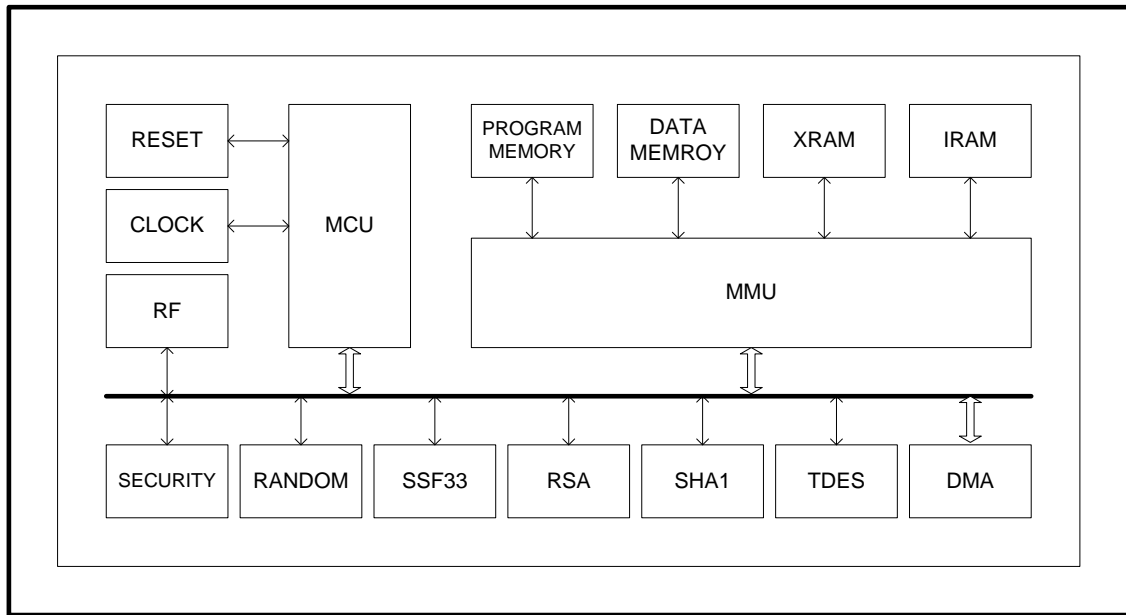


Figure 1-1 FM1216 Block Diagram

1.4 Pin Description

1.4.1 Contactless Module

Number	Symbol	Type	Function
1	IN1	inout	Coil connection pin 1
2	IN2	Inout	Coil connection pin 2

Table 1-1 FM1216 Contactless Module Pin Description

1.4.2 Contact Module

Number	Symbol	Type	Function
1	VCC	power	ISO7816 Power connection
2	RST	input	ISO7816 Reset signal
3	CLK	input	ISO7816 Clock signal
4	—	—	RFU
5	GND	ground	Ground line
6	—	—	RFU
7	IO	inout	ISO7816 input/output data line
8	—	—	RFU

Table 1-2 FM1216 Contact Module Pin Description

1.4.3 Dual interface Module

Number	Symbol	Type	Function
1	VCC	power	ISO7816 Power connection
2	RST	input	ISO7816 Reset signal
3	CLK	input	ISO7816 Clock signal
4	—	—	RFU
5	GND	ground	Ground line
6	—	—	RFU
7	IO	inout	ISO7816 input/output data line
8	—	—	RFU
—	IN1	inout	Coil connection pin 1
—	IN2	Inout	Coil connection pin 2

Table 1-3 FM1216 Dual Interface Module Pin Description

2 Operating Flow

2.1 Contactless typeA

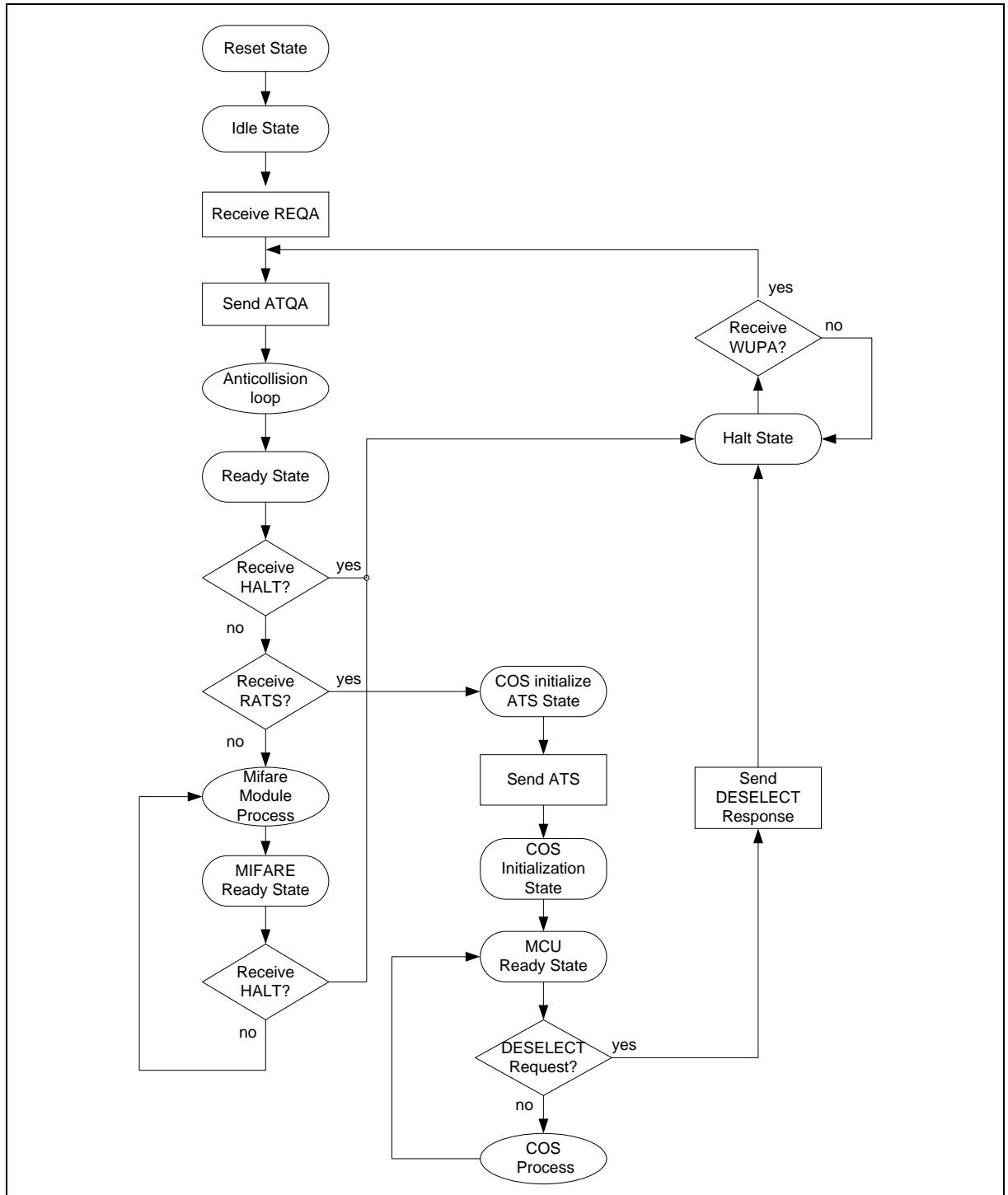


Figure 2-1 FM1216 Contactless TypeA Flow

2.2 Contact Interface

The contact interface only changed data with CPU by FIFO, and CPU program deal with all the command and data.

2.3 Dual Interface

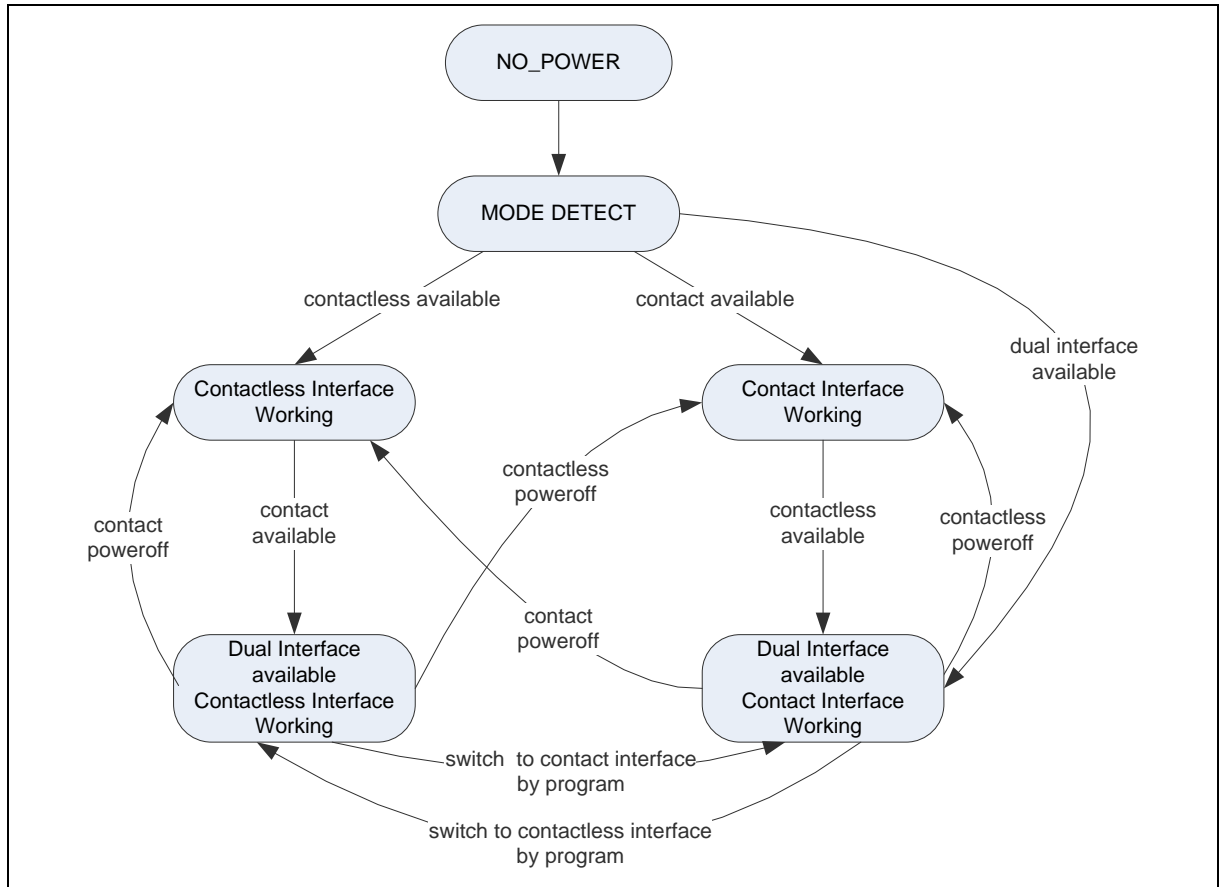


Figure 2-2 FM1216 Dual Interface Flow

3 Memory Organization

FM1216 include internal memory and external memory (according to CPU). External memory include program memory and data memory. The size of data memory is 16K byte.

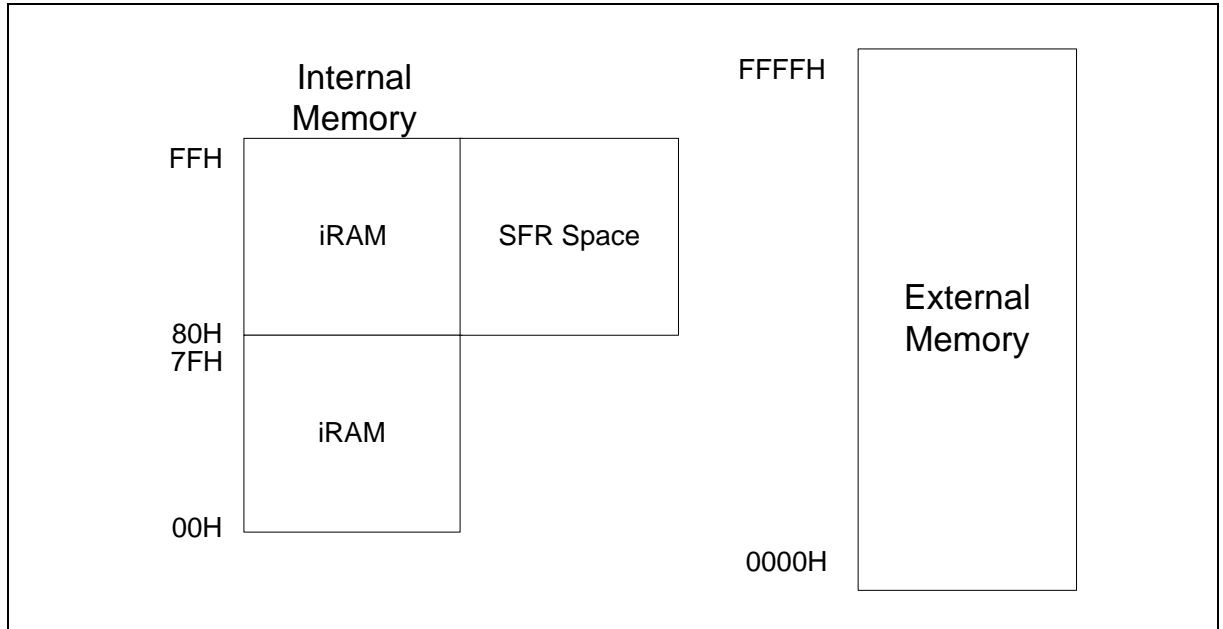


Figure 3-1 FM1216 Memory Organisation

3.1 Internal Memory

Internal memory include 256Byte iRAM and 128Byte SFR Space used by CPU.

3.2 Program Memory

Program memory include 64Kbyte ROM as program memory, 56Kbyte is offered to USER, 8K is used by internal self-test circuit

3.3 External Memory

External memory include data memory, xRAM and register.

External Memory Organization:

Number	Address	Size	Description
1	0000H ~ 7FFFH	32K	Data Memory
2	8000H ~ DFFFH	24K	Blank
3	E000H ~ EFFFH	4K	xRAM
4	F000H ~ FFFFH	4K	Registers

Table 3-1 FM1216 External Memory Organization

4 Command Set

CPU command compatible to Turbo51 command set.

FM1216 also supports Contactless Logic Encrypt Card protocol, and the hardware supports compatible Logic Encrypt Card commands set:

Commands	Code (HEX)	Description
request std	26	Answer to Request Look for card in operating area. 'Request Std' means looking for card which is not set to halt
request all	52	Answer to Request Look for card in operating area. 'Request All' means looking for all cards which are in operating area
Anti-collision	93	Anti-collision It means selecting only one card if there is one card or several cards in operating area.
Select Card	93	Select Card It means setting up the communication with the selected card after the anti-collision command.
Halt	50	Halt Card is set to halt.
Authentication.1a	60	Authentication (KeyA) : Before visiting memory, the user must verify if the operation is legal by coherence of cipher in RWD and cipher in card.
Authentication.1b	61	Authentication (KeyB) : Before visiting memory, the user must verify if the operation is legal by coherence of cipher in RWD and cipher in card.
Read	30	Read: Read 16 bytes of one block.
Write	A0	Write: Write data to one block.
Increment	C1	Increment: Increment a certain value to numerical block, store the result in register.
Decrement	C0	Decrement: Decrement a certain value to numerical block, store the result in register.
Restore	C2	Restore: Read contents of numerical block to register.
Transfer	B0	Transfer: Write contents of register to numerical block.

Table 4-1 FM1216 Contactless Logic Encrypt Card Command Set

5 ELECTRICAL CHARACTERISTICS

5.1 Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
-----------	--------	-----	-----	-----	------

Supply Voltage	Vcc	2.7		5.5	V
Ambient Temperature	Topr	-25		85	°C
Storage Temperature	Tstr	-55		125	°C
ESD (HBM mode)	Vesd	4000			V

5.2 DC electrical characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Supply Current	Idd			200	uA
Max Supply Current	Icc1			20	mA
	Icc2			5	mA

Idd: CLKSTOP mode (operation voltage 5.5V)

Icc1: Contact Interface

Icc2: Contactless Interface

5.3 AC electrical characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Capacitance (IN1 IN2)	Cin	14		20	fF
Input Frequency	Fin1	13.553	13.56	13.567	MHz
	Fin2	1	3	5	Mhz
Operating Frequency	Fsystem		3.39	30	Mhz
EEPROM Erace Program time	Tw	2	3.3	4	ms
EEPROM Endurance	Nwrite	100,000			cycles
EEPROM Data Retention	Tret	10			years

Fin1: Contactless Interface

Fin2: Contact Interface

6 Revision History

Version	Publication date	Pages	Paragraph or Illustration	Revise Description
Preliminary	June. 2010	12		Initial Release.
0.1	Apr. 2011	12		1. Updated the address of Beijing office.. 2. The company changed its name to Shanghai Fudan Microelectronics Group Co., Ltd.
0.2	Feb. 2012	12		1. Add electrical characteristics 2. Updated some descriptions
1.0	Jun.2012	12		1. Modified the Disclaimer. 2. Updated some descriptions
1.1	Sep.2013	12	Sales and service	1. Updated the legal disclaimer 2. Updated the address of sales and service

Sales and Service

Shanghai Fudan Microelectronics Group Co., Ltd.

Address: Bldg No. 4, 127 Guotai Rd,
Shanghai City China.

Postcode: 200433

Tel: (86-021) 6565 5050

Fax: (86-021) 6565 9115

Shanghai Fudan Microelectronics (HK) Co., Ltd.

Address: Unit 506, 5/F., East Ocean Centre, 98 Granville Road, Tsimshatsui East, Kowloon, Hong Kong

Tel: (852) 2116 3288 2116 3338

Fax: (852) 2116 0882

Beijing Office

Address: Room 423, Bldg B, Gehua Building,
1 QingLong Hutong, Dongzhimen Alley north Street,
Dongcheng District, Beijing City, China.

Postcode: 100007

Tel: (86-010) 8418 6608

Fax: (86-010) 8418 6211

Shenzhen Office

Address: Room.1301, Century Bldg, No. 4002, Shengtingyuan Hotel, Huaqiang Rd (North),
Shenzhen City, China.

Postcode: 518028

Tel: (86-0755) 8335 0911 8335 1011 8335 2011 8335 0611

Fax: (86-0755) 8335 9011

Shanghai Fudan Microelectronics (HK) Ltd Taiwan Representative Office

Address: Unit 1225, 12F., No 252, Sec.1 Neihu Rd., Neihu Dist., Taipei City 114, Taiwan

Tel : (886-2) 7721 1889

Fax: (886-2) 7722 3888

Shanghai Fudan Microelectronics (HK) Ltd Singapore Representative Office

Address : 237, Alexandra Road, #07-01 The Alexcier, Singapore 159929

Tel : (65) 6472 3688

Fax: (65) 6472 3669

Shanghai Fudan Microelectronics Group Co., Ltd NA Office

Address :2490 W. Ray Road Suite#2

Chandler, AZ 85224 USA

Tel : (480) 857-6500 ext 18

Web Site: <http://www.fmsm.com/>