SFM5520-OP5

Datasheet

Ver. 1.0

Revision History

Rev No.	Issued date	**Description**
1.0	SEP 30, 2014	Initial Release

Contents

Overview

The Suprema Fingerprint Module(SFM) are stand-alone fingerprint systems ideal for embedded system applications where biometric security is needed. The modules are designed for manufacturers searching for an inexpensive, reliable and easy-to-integrate biometric system. The SFM provide complete fingerprint solutions by incorporating fingerprint sensor interface and embedded fingerprint recognition algorithm into a half business card sized module.

The SFM5500 series is the latest module equipped with world's leading fingerprint authentication algorithm (ranked No. 1 in FVC2004, FVC2006 and FVC-on-going) and powerful DSP technology. Also, it supports wide range of fingerprint sensor interoperability giving you a freedom to select suitable sensor that most fits to your application. Furthermore, the fingerprint data for enrollment and verification are compatible among different sensors, even if they are based on different technologies. This feature of unification presents application manufacturers and system integrators with much more flexibility than ever before.

In addition to these features, the miniature sized SFM has a state-of-the-art low power design making it a perfect match in a wide range of applications from battery operated mobile equipments to network based security systems. The SFM stands ready to meet your requirements and adapt to your applications.

1. SFM5500 Series

Table 1 SFM5500 Series combinations

Model name	Supported sensors	Main board
SFM5520-OP5	**Suprema Optical Sensor OP5**	**SFM5520**
SFM5530-OC4	Suprema Optical Sensor OC4	
SFM5550-TC1	UPEK TouchChip TCS1C	SFM5550
SFM5550-TC2	UPEK TouchChip TCS2C	

2. Features

- World's most reliable fingerprint algorithm
- Powerful 533MHz DSP
- High speed fingerprint enrollment and authentication speed
- Compact size
- Low power consumption
- Fast power on time
- Various communication interfaces
- 256-bit AES fingerprint data encryption
- Various fingerprint sensor options
- Configurable I/O signals
- Operates with a single 5.0VDC power supply
- Supports various fingerprint output image including RAW, GRAY(4-bit and 8-bit gray) and WSQ compressed image (certified by FBI)

3. Fingerprint Authentication Specifications

3.1. Fingerprint Authentication Performance

EER*	<0.1%
Enrollment time	<0.55 sec
Verification time(1:1)	<0.55 sec
Identification time(1:1000)**	<0.70 sec

*EER is dependent on databases

** Average 1:1000 genuine identification time including feature extraction time

3.2. Fingerprint Sensor Specifications

Manufacturer	Suprema Inc.
Device Name	OP5
Sensor technology	Optical
Sensing area	16.0mm x 19.0mm
Image size(pixels)	272x320
Image resolution	500 dpi

3.3. Data storage

Template capacity	9,000 at 4M Flash (19,000 at 8M)
LOG capacity	12,800 event
User memory	256 Bytes

4. Hardware Specifications

4.1. Operating range

Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Supply voltage	V_{DD}	4.5	5.0	5.5	V
Operating temperature	T_{OP}	-15		50	°C

4.2. Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Units
Power supply voltage	V_{DD}	-0.3	6	V
Input voltage on signal pins	V_{IN}	-0.3	6	V

4.3. Electrical DC characteristics @ (V_{DD} = 5.0Vdc, T_{OP} = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Units
Supply current (idle)	I_{DD1}		155		mA
Supply current (scanning)	I_{DD2}	170		240	mA
Supply current (identifying)	I_{DD3}	170		240	mA
High level input voltage	V_{IH}	2.0		5.5	V
Low level input voltage	V_{IL}	-0.3		0.6	V

4.4. Interface

Type	Description
Host communication	RS-232C or RS422/485 level Baud rates up to 115.2kbps (factory default: 115.2kbps)
Aux communication	RS-232C or CMOS(0~5V) level Baud rates up to 115.2kbps (factory default: 115.2kbps)
Digital I/O	CMOS(0~5V) level 3 CMOS input, 3 CMOS output pins
LED driver	3 LED drivers. Common anode. Active low outputs.
Wiegand	CMOS(0~5V) level Input and output ports supported

4.5. Connector Specifications

Connector	Usage
J1	LED output port
J2	Digital I/O port. CMOS(0~5V), 3 Inputs, 3 Outputs
J3	Wiegand I/O port.

J4	Aux interface port
J5	Host interface port
J6	Battery connector for time keeping
J7	Internal use only
J8	Sensor interface port

1. Connectors J1 ~ J6 are Molex 53261-0890 compatible board-to-wire connectors.

2. Power can be supplied by one of J2, J3, J4 or J5 connectors.

4.5.1. LED port (J1) pin assignment

Name	pin #	Type	Functions
GND	1	Power	Power Ground
LED0	2	Output	Active low, Current sink up to 20mA Current limit resistors integrated (220 Ohm)
LED1	3	Output	
LED2	4	Output	
VCC	5	Power	Power Supply for LEDs. 5VDC

4.5.2. Digital I/O port (J2) pin assignment

Name	pin #	Type	Functions
GND	1	Power	Power Ground
IN0	2	Input	CMOS(0~5V), Active high input Internally pulled down with 47kOhm resistors
IN1	3	Input	
IN2	4	Input	
VCC	5	Power	Power Supply. 5VDC
OUT0	6	Output	CMOS(0~5V), Active high output
OUT1	7	Output	
OUT2	8	Output	
GND	9	Power	Power Ground

4.5.3. Wiegand I/O port (J3) pin assignment

Name	pin #	Type	Functions
GND	1	Power	Power Ground
WIN0	2	Input	CMOS(0~5V), Wiegand input, DATA0
WIN1	3	Input	CMOS(0~5V), Wiegand input, DATA1

NC	4	No connect	Reserved for future use
VCC	5	Power	Power Supply. 5VDC
WOUT0	6	Output	CMOS(0~5V), Wiegand output, DATA0
WOUT1	7	Output	CMOS(0~5V), Wiegand output, DATA1
NC	8	No connect	Reserved for future use
GND	9	Power	Power Ground

4.5.4. Aux interface port (J4) pin assignment

Name	pin #	Type	Functions
GND	1	Power	Power Ground
TX3	2	RS232C	Aux port transmit data
RX3	3	RS232C	Aux port receive data
VCC	4	Power	Power Supply. 5VDC
TX4C	5	CMOS	Aux port transmit data
RX4C	6	CMOS	Aux port receive data
GND	7	Power	Power Ground

4.5.5. Host interface port (J5) pin assignment

Name	pin #	Type	Functions
GND	1	Power	Power Ground
TX1	2	RS232C	Host port transmit data
RX1	3	RS232C	Host port receive data
TX2P	4	RS422/485	Host port non inverting transmit data
VCC	5	Power	Power Supply. 5VDC
RX2P	6	RS422/485	Host port non inverting receive data
TX2N	7	RS422/485	Host port inverting transmit data
RX2N	8	RS422/485	Host port inverting receive data
GND	9	Power	Power Ground

4.5.6. Battery connector (J6) pin assignment

Name	pin #	Type	Functions
GND	1	Power	Power Ground
VBATT	2	Power	RTC power supply. 3~3.6VDC
GND	3	Power	Power Ground

4.6. Physical Dimensions

Parameter	Values
Main board	63mm x 43mm x 10mm (LxWxH)
Sensor	20.5mm x 25mm x 52mm (LxWxH)

Figure 1: Main board dimensions

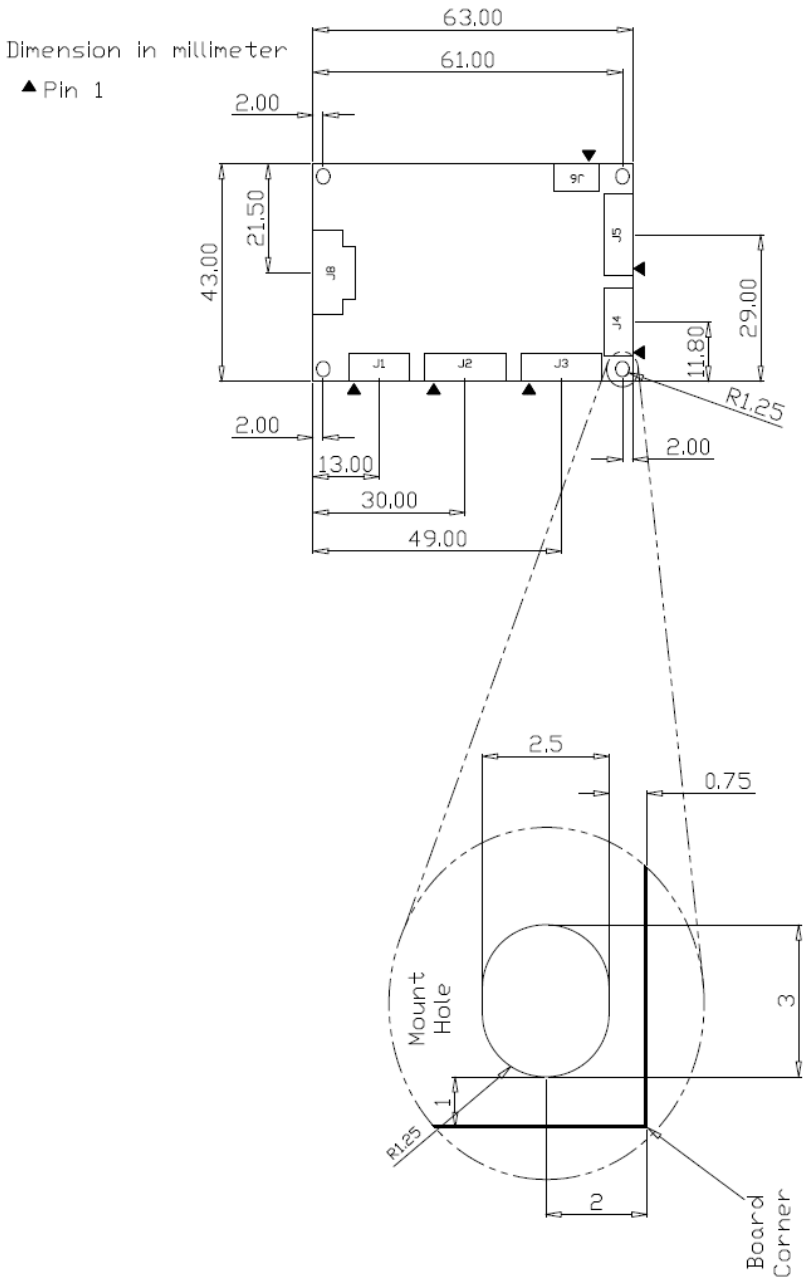
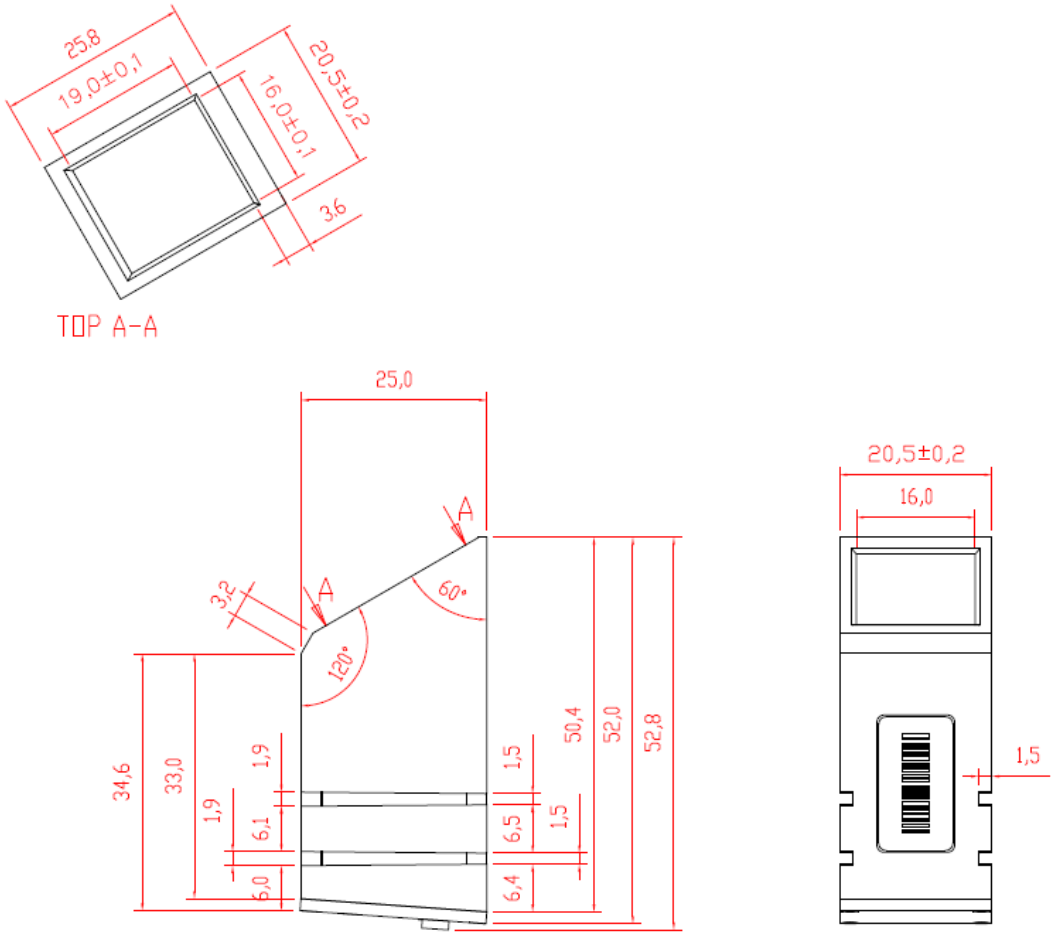


Figure 2: Sensor dimensions



Dimensions in millimeters

5. Communication Protocol Summary

The SFM provides a proprietary communication protocol for easy interface with most host systems. The protocol based on fixed sized packets. Only fingerprint image, template data, and user lists are transmitted as appended to the packet. Checksum functionality is supported to ensure consistency of transmitted data.

Please refer to *SFM Protocol Manual* for detailed information.

5.1. Packet Structure

Start code	Command	Param	Size	Flag	Checksum	End code
1byte	1byte	4bytes	4bytes	1byte	1byte	1byte

5.2. Command Summary

Command	Code	Description
SW	0x01	Write system parameter
SF	0x02	Save system parameter
SR	0x03	Read system parameter
CS	0x1A	Calibrate sensor
SS	0x04	Check system status
CA	0x60	Cancel
ES	0x05	Enroll by scan
ESA	0x70	ES with administrator verification
EI	0x06	Enroll by image
EIX	0x80	EI through data transfer protocol
ET	0x07	Enroll by template
EW	0x1C	Enroll by Wiegand ID
EWA	0x71	EW with administrator verification
VS	0x08	Verify by scan
VI	0x09	Verify by image
VIX	0x82	VI through data transfer protocol
VT	0x10	Verify by template
VW	0x1D	Verify by Wiegand ID

VH	0x22	Verify host template by scan
IS	0x11	Identify by scan
II	0x12	Identify by image
IIX	0x81	II through data transfer protocol
IT	0x13	Identify by template
DA	0x17	Delete all templates
DAA	0x74	DA with administrator verification
DT	0x16	Delete template
DS	0x1E	Delete by scan
DSA	0x72	DS with administrator verification
DW	0x1F	Delete by Wiegand ID
DWA	0x73	DW with administrator verification
LT	0x18	List user ID
CT	0x19	Check user ID
FP	0x23	Fix all provisional templates
DP	0x24	Delete all provisional templates
RI	0x20	Read image
RIX	0x84	RI through data transfer protocol
SI	0x15	Scan image
SIX	0x83	SI through data transfer protocol
RT	0x14	Read template
ST	0x21	Scan template
KS	0x35	Scan template with challenge data
KW	0x34	Write encryption key
ML	0x31	Get size of user memory
MW	0x32	Write to user memory
MR	0x33	Read from user memory
TW	0x3A	Write current time
TR	0x3B	Read current time
LN	0x3C	Get number of log data
LR	0x3D	Read log data
LD	0x3E	Delete log data
WW	0x41	Write Wiegand configuration

WR	0x42	Read Wiegand configuration
WG	0x43	Get Wiegand input
WS	0x44	Set Wiegand output
WM	0x68	Map Wiegand id to input function
WL	0x69	List Wiegand id mapping
WC	0x6A	Clear Wiegand id mapping
IW	0x47	Write input configuration
IR	0x48	Read input configuration
IG	0x49	Get input state
OW	0x4A	Write output configuration
OR	0x4B	Read output configuration
OL	0x4C	Read output configuration list
OS	0x4D	Set output state
GW	0x37	Write GPIO configuration
GR	0x36	Read GPIO configuration
GC	0x38	Clear GPIO configuration
GD	0x39	Set default GPIO configuration
AW	0x65	Write administration level
AR	0x66	Read administration level
AC	0x67	Clear administration level

6. System Parameter Summary

Please refer to *SFM Protocol Manual* for detailed information.

Name	Code	Description	Value (* denotes default value)
Timeout	0x62	Timeout period	0x30 : infinite 0x31 : 1 second … *0x3A : 10 seconds … 0x44 : 20 seconds

Template Size	0x64	Template size. When the Encryption Mode is on, it should be a multiple of 32.	Integer between 256 and *384[4]
Enroll Mode	0x65	Enroll mode	0x30 : 1 time 0x31 : 2 times (1 request command & 2 response commands) 0x32 : 2 times II (2 request commands & 2 response commands) *0x41 : 2 templates (1 request command & 2 response commands) 0x42 : 2 templates II (2 request commands & 2 response commands)
Security Level	0x66	Security level	0x30 : 1/10 FAR(False Acceptance Rate) 0x31 : 1/100 0x32 : 1/1,000 0x33 : 1/10,000 0x34 : 1/100,000 0x35 : 1/1,000,000 0x36 : 1/10,000,000 0x37 : 1/100,000,000 0x40 : 3/100 0x41 : 3/1,000 0x42 : 3/10,000 0x43 : 3/100,000 0x44 : 3/1,000,000 0x45 : 3/10,000,000 0x46 : 3/100,000,000 *0x50 : Automatic Normal 0x51 : Automatic Secure 0x52 : Automatic More Secure

Encryption Mode	0x67	Encryption mode	*0x30 : Encryption off 0x31 : Encryption on
Sensor Type	0x68	Sensor type	0x31: FC 0x33 : OP / OP2 / OP3 / OP4 / OP5 0x34 : TC1 / TC2 / TC1S / TC2S 0x38 : OC2 / OD/ OC4 / OH 0x39 : OL 0x3C: TS4
Image Format	0x6C	Image format	0x30 : Gray image *0x31 : Binary image 0x32 : 4 bit gray image 0x33 : WSQ image(9)
Module ID	0x6D	Module ID	Integer 0 ~ 65535
Firmware Version	0x6E	Firmware version	4 bytes character
Serial Number	0x6F	Module serial number	Integer (4 bytes)
Baudrate	0x71	Host baudrate setting	0x31 : 9600 bps 0x32 : 19200 bps 0x33 : 38400 bps 0x34 : 57600 bps *0x35 : 115200 bps
Baudrate2 (2)	0x72	Auxiliary baudrate setting	0x31 : 9600 bps 0x32 : 19200 bps 0x33 : 38400 bps 0x34 : 57600 bps *0x35 : 115200 bps
Enrolled Finger	0x73	Current number of fingerprints enrolled	Integer (4 bytes)
Available Finger	0x74	The available number of fingerprints that can be enrolled	Integer (4 bytes)

Send Scan Success	0x75	Enable sending SCAN_SUCCESS response	0x30 : No SCAN_SUCCESS message *0x31 : Send SCAN_SUCCESS message
ASCII Packet	0x76	Flag for packet exchange though HEX-ASCII format	*0x30 : Hexadecimal packet 0x31 : ASCII packet
Rotate Image	0x77	Flag for rotating sensor image in capture	*0x30 : Upright image 0x31 : Upside down image
Rotation	0x78	Maximum allowable rotation for matching	0x31: 15 degree * 0x32: 30 degree 0x33: 45 degree 0x34: 60 degree 0x35: 75 degree 0x36: 90 degree
Sensitivity	0x80	Parameter for sensor sensitivity	0x30 : Least sensitive … *0x37 : Most sensitive
Image Quality	0x81	Parameter for qualifying scanned image	0x30 : Weak qualification *0x31 : Moderate qualification 0x32 : Strong qualification 0x33 : Strongest qualification
Auto Response	0x82	Flag for sending automatic response as the result of GPIO input or FreeScan	*0x30 : No response command 0x31 : Send response command (host) 0x32 : Send response command (aux) (2) 0x33 : Send response command (both) (2)
Network Mode	0x83	Flag for default operation mode	*0x30 : Single mode 0x31 : Network mode (half duplex) 0x32 : Network mode (full duplex) (2)
Free Scan	0x84	Scan always fingerprint images for identification on idle state	*0x30 : Normal mode 0x31 : Free scan mode
Provisional Enroll	0x85	Save enrolled templates at flash	*0x30 : Permanent enrollment

		memory permanently or not	0x31 : Provisional enrollment
Pass When Empty	0x86	Pass or fail when fingerprint DB is empty	*0x30 : Fail when DB is empty 0x31 : Pass when DB is empty
Response Delay	0x87	Delay for response command	*0x30 : No delay 0x31 : 20 msec … 0x35 : 100 msec … 0x3A : 200 msec
Matching Timeout	0x88	Timeout period for matching in identification	0x30 : infinite 0x31 : 1 second … *0x33: 3 seconds … 0x3A : 10 seconds … 0x44 : 20 seconds
Build Number	0x89	Build number	4bytes character
Enroll Displacement	0x8A	Displacement between two fingerprints for enrollment in case EnrollMode parameter is 2 times or 2 templates	*0x30 : No check 0x31 : Above 1 mm away … 0x35 : Above 5 mm away … 0x3A : Above 10 mm away
Lighting Condition	0x90	Tune optical sensors based on lighting conditions	*0x30: Outdoor 0x31: Indoor
Free Scan Delay	0x91	Delay between consecutive identification processes in Free Scan Mode.	0x30: No delay *0x31: 1 second …

			0x40: 10 seconds
Fast Mode	0x93	Fast mode for 1:N matching	0x30: Normal 0x31: Fast mode 1 … 0x35: Fast mode 5(Fastest) *0x36: Automatic
Watchdog	0x94	Watchdog timer	0x30: Don’t use Watchdog timer *0x31: Use Watchdog timer
Template Type	0x96	Template type	*0x30: Suprema 0x31: ISO 19794-2 0x32: ANSI 378
Enhanced Privacy	0x97	Enhanced privacy mode	*0x30: Enhanced mode off 0x31: Enhanced mode on
Fake Finger Detection	0x98	Fake finger detection option	*0x30: Fake detection off 0x31: Fake detection on (Weak(8)) 0x32: Normal(8) 0x33: Strong(8)
Check Latent Fingerprint	0x9A	Latent fingerprint detection option	*0x30: Don’t check latent fingerprints when enrolling 0x31: Don’t check latent fingerprints 0x32: Check latent fingerprints always
Voltage Warning(7)	0x9B	Voltage warning threshold	*0: Don’t check voltage 1 ~ 12000: Threshold voltage in mV
Power Off Timeout(7)	0x9C	Timeout for automatic power off	*0: No timeout 1000~: Timeout in msec

(2) SFM3500/5500 series
(4) Reducing template size might affect authentication performance.
(7) SFM4000 Series
(8) SFM5060-OH only
(9) SFM5500 Series

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