FM-TS

Datasheet

Ver. 1.0.

Revision History

Rev No.	Issued date	**Description**
0.9	Mar 6, 2009	Preliminary draft
1.0	Mar 31, 2009	First Release. Modified GPIO indexing convention,

Contents

1. Overview

The SFM modules 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 modules provide complete fingerprint solutions by incorporating fingerprint sensor interface and embedded fingerprint recognition algorithm into a half business card sized module.

The SFM4000-TS4 is the latest SFM module equipped with world's leading fingerprint authentication algorithm 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 module 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 modules stands ready to meet your requirements and adapt to your applications.

With internal regulator, dual voltage configuration, power control features, the SFM4000-TS4 offers flexible configuration to maximize design simplicity and reduce time to market.

2. Features

- World best authentication performance
- High speed fingerprint verification
- Compact size
- Low power consumption
- Fast power on time
- Supports various communication interfaces
- Supports fingerprint data encryption
- Supports various fingerprint sensors
- Highly configurable I/O signals
- Operates with a single 3.3v dc supply, or unregulated power, such as batteries
- Integrated power control circuit

3. Fingerprint Authentication Specifications

3.1. Fingerprint Authentication Performance

EER*	<0.1%
Enrollment time	<1 sec
Verification time	<1 sec

*EER is dependent on databases

3.2. Fingerprint Sensor Specifications

Device Name	UPEK TCS4DA
Sensor technology	Capacitive
Sensing area	9.6mm x 0.2mm
Image size(pixels)	192 x 4
Image resolution	508 dpi

4. Hardware Specifications

4.1. Operating range

Parameter	Symbol	Min	Typ	Max	Units
Supply voltage (VDD)	V_{DD}	3.0	3.3	3.6	V
Supply voltage (BATT)	V_{BATT}	4.0	6	10	V
Operating temperature	T_{OP}	-20		70	°C
Storage temperature	T_{STO}	-40		85	°C

4.2. Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Units
Power supply voltage (VDD)	V_{DD}	-0.3	3.6	V
Power supply voltage (BATT)	V_{BATT}	-0.3	12	V
Input voltage on PWR_EN	V_{PWR_EN}	-0.3	12	V
Input voltage on signal pins	V_{IN}	-0.3	3.6	V

4.3. Electrical DC characteristics(V_{DD} = 3.3Vdc, T_{OP} = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Units
Supply current (idle)	I_{DD1}		60		mA
Supply current (scanning)	I_{DD2}		120		mA
Supply current (identifying)	I_{DD3}			150	mA
High level input voltage	V_{IH}	2.0		3.6	V
Low level input voltage	V_{IL}	-0.3		0.6	V
Power enable pulse width	t_{PWR_EN}	500			µs

4.4. Interface

Type	Description
UART	3.3V CMOS level Baud rates up to 115.2kbps RS232 supported via additional level converter
Digital I/O	3.3V CMOS level 8 ports independently configurable

4.5. Connector Specifications

Connector	Usage
J1	Sensor interface port, 15 pin FPC/FFC (pitch: 0.5mm)
J2	GPIO port
J3	Host interface port

4.5.1. GPIO port pin assignment (J2)

Pin #	Name	Functions
1	GND	Signal ground
2	GPIO0	Configurable input/output, or buzzer control output
3	GPIO1	Configurable input/output
4	GPIO2	Configurable input/output
5	GPIO3	Configurable input/output
6	GPIO4	Configurable input/output
7	GPIO5	Configurable input/output
8	GPIO6	Configurable input/output
9	GPIO7	Configurable input/output

4.5.2. Host interface port pin assignment (J3)

Pin #	Name	Functions
1	GND	Power Ground
2	POWER	Power pin. 4~10Vdc
3	PWR_EN	Power enable, active high
4	VDD	3.3Vdc Input/Output
5	GND	Power Ground
6	TX	Transmit Data, 3.3V CMOS, output only
7	RX	Receive Data, 3.3V CMOS, input only

4.6. Power supply voltage selection

The SFM4000's power can be supplied by regulated 3.3V source, or unregulated source ranging from 4V to 10V dc. The former is best suited for systems already providing 3.3V power. The latter is for systems without 3.3V or battery operated systems.

4.6.1. Regulated supply

Use VDD terminal (J3, terminal #4) to supply power from regulated supply.

The supply voltage range is 3.3 ± 0.3 V dc. The POWER terminal (J3, terminal #2) should be left unconnected in this configuration. The internal power can be switched on by PWR_EN signal explained later.

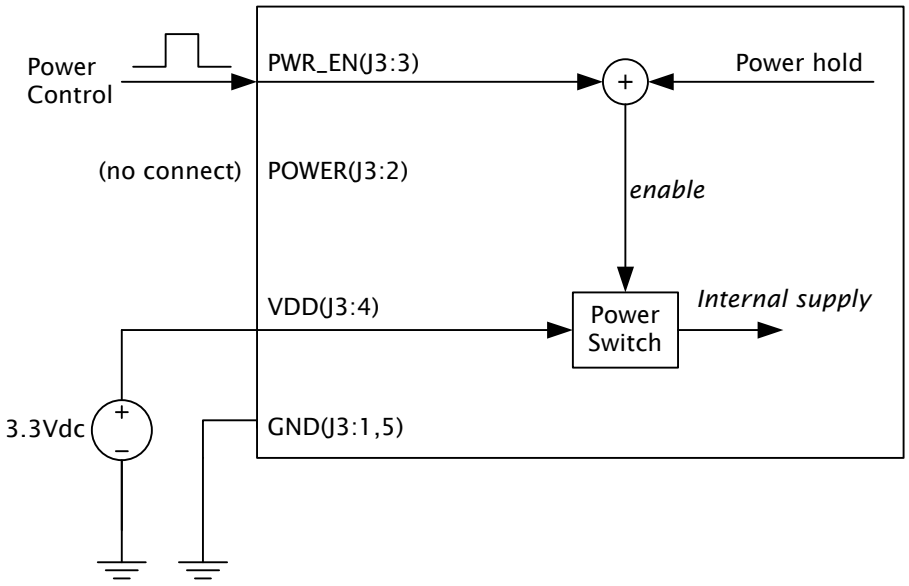


Figure 1. Regulated power

4.6.2. Unregulated supply

When using unregulated power source such as batteries, use POWER terminal (J3, terminal #2) to use internal linear regulator of the module. The module can supply regulated 3.3V power to light loads via VDD terminal. (J3, terminal #4)

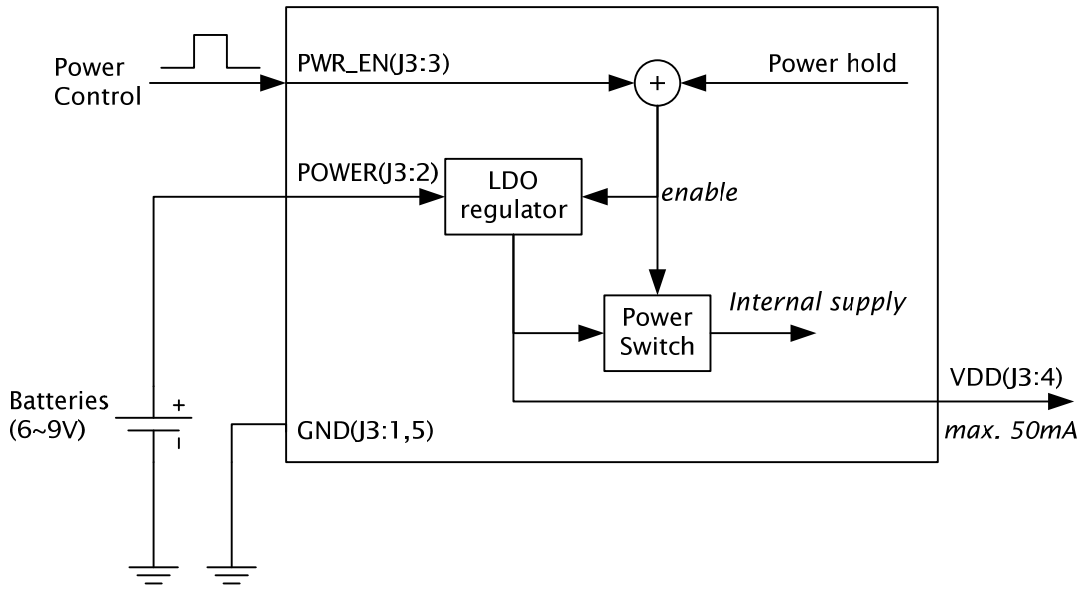


Figure 2. Unregulated power

4.7. Power control

For battery applications, it is crucial to keep operation current at minimum to extend battery life. These systems have very limited power budget for idle current – a few micro amperes are not uncommon – which is several decades smaller than a high performance DSPs consume. For these configurations, it is beneficial to cut power completely off from the fingerprint module while not in use, which requires extra components, buffers and switching devices.

To meet these limits, SFM4000 offer integrated power switch, which offers design simplicity and maximum power saves. It can also cut its own power off completely, by timeout event or a command.

The module's power supply can be controlled by PWR_EN signal. A logic high pulse is enough to engage the module to boot up, and sustain the power itself – that is, it generates a power hold signal – even after the

PWR_EN signal is deasserted. This feature helps simplify power control circuit design. (See Figure 1 and Figure 2)

The minimum pulse width (t_{PWR_EN}) is 500 micro seconds.

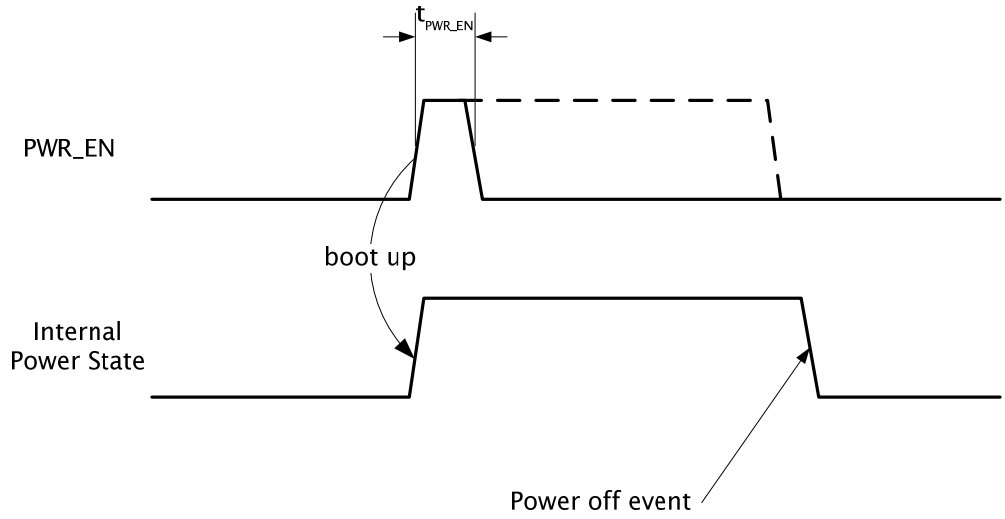


Figure 3. Boot up process after PWR_EN pulse

There are two methods to cut power off from the module.

4.7.1. Self power off

Once the module is powered up, it can be shut down by negating internally generated power hold signal illustrated at Figure 1 and Figure 2. This power off event can be either a command or automatic power off timeout.

4.7.2. External power off

If external power control is preferred, setting automatic power off timeout to very short period – 1ms for example – will make the module power to be dependent on PWR_EN signal. This will make the power off timeout event be triggered shortly after the module boots up, trying to shut itself down immediately. However, if the PWR_EN signal is kept active, which drives internal power hold signal, the power is supplied as long as this PWR_EN signal is active. Note that the module remains operational even it tries to shut itself down. Once the PWR_EN signal is deactivated, the module will be shut down immediately. (See Figure 4)

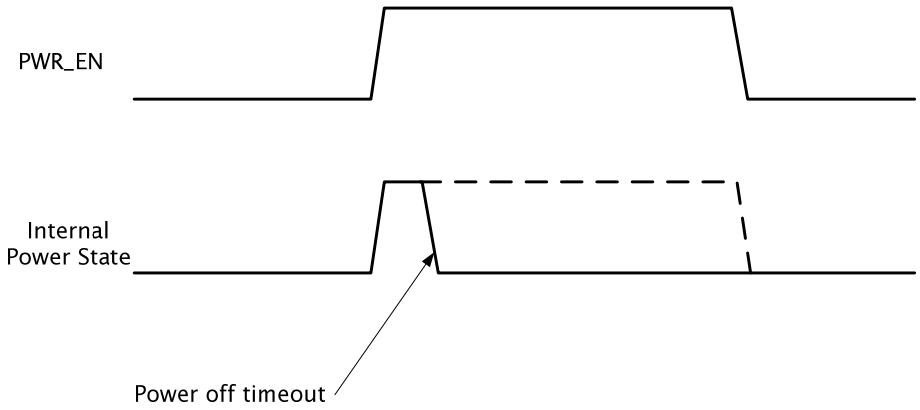


Figure 4. Overriding power off timeout by PWR_EN signal

4.7.3. Bypassing PWR_EN

For some configurations where the module is constantly powered or externally switched, the PWR_EN signal should be pulled up to logic high. For unregulated power configuration, tie this signal to POWER terminal. For regulated power configuration, tie it to VDD terminal.

4.8. Physical Dimensions

Parameter	Values
Main board	26mm x 26mm x 6.4mm (WxLxH)
Sensor	22mm x 20mm x 3.6mm (WxLxH)

** Dimensions in millimeters*

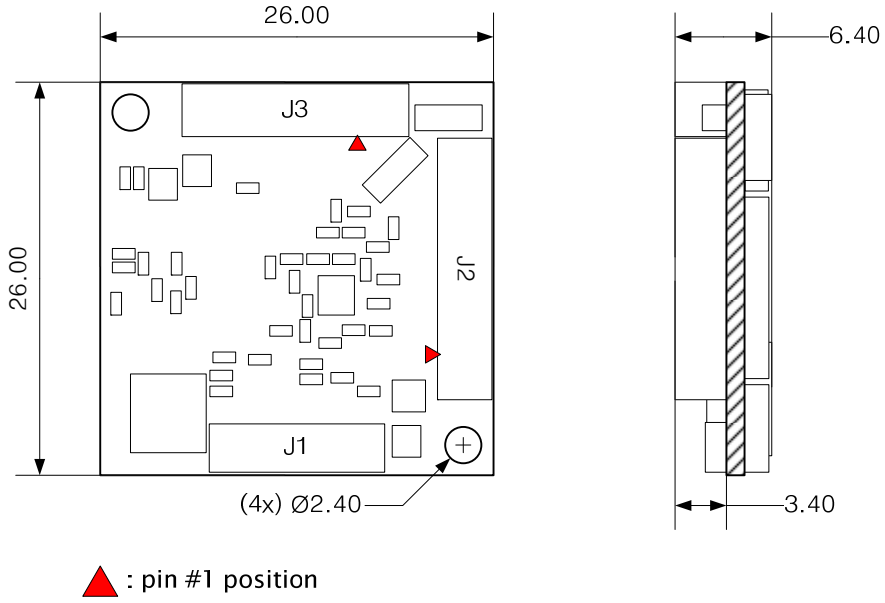
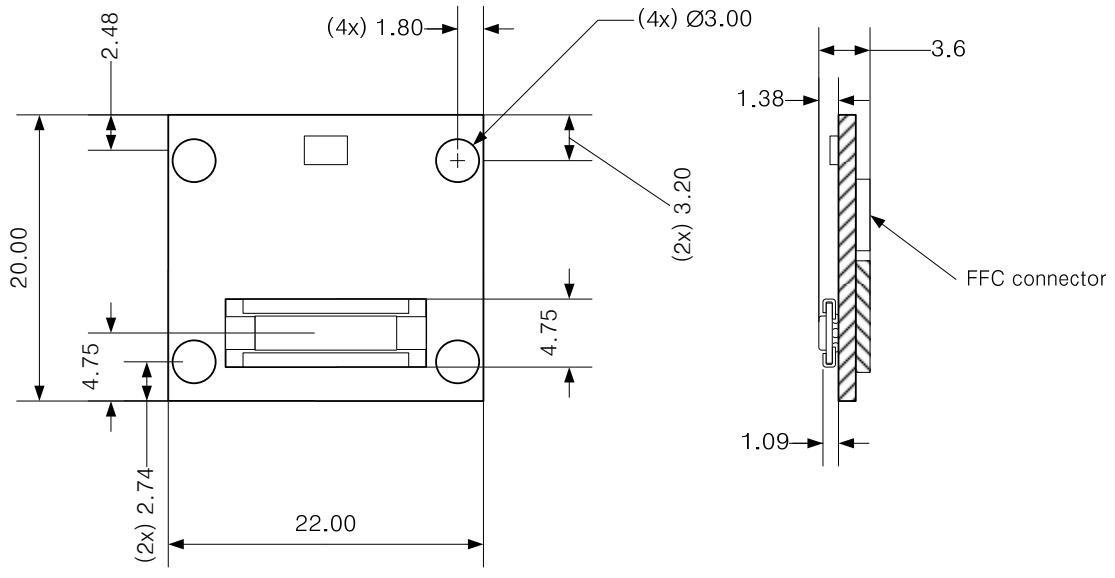


Figure 5. Main module dimensions



** Dimensions in millimeters*

Figure 6. Sensor board dimensions

5. Communication Protocol Summary

The SFM modules 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	System parameter write
SF	0x02	System parameter save
SR	0x03	System parameter read
SS	0x04	System status check
ES	0x05	Enroll by scan
EI	0x06	Enroll by image
ET	0x07	Enroll by template
VS	0x08	Verify by scan
VI	0x09	Verify by image
VT	0x10	Verify by template
VH	0x22	Verify host template by scan
IS	0x11	Identify by scan
II	0x12	Identify by image
IT	0x13	Identify by template
RI	0x20	Read image
RT	0x14	Read template
SI	0x15	Scan image
ST	0x21	Scan template
DT	0x16	Delete template

Command	Code	Description
DA	0x17	Delete all templates
LT	0x18	List user ID
CT	0x19	Check user ID
FP	0x23	Fix all provisional templates
DP	0x24	Delete all provisional templates
ML	0x31	Retrieves user memory size
MW	0x32	Write user memory
MR	0x33	Read user memory
KW	0x34	Encryption key write
KS	0x35	Scan template with challenge data
GR	0x36	Read GPIO configuration
GW	0x37	Write GPIO configuration
GC	0x38	Clear GPIO configuration
GD	0x39	Set default GPIO configuration
UG	0x62	Upgrade firmware
WSL	0x6B	Write security level
WSR	0x6C	Read security level
RS	0xD0	Reset the module
OFF	0xD2	Power off