



ZFS1670


Coating or Ceramics-covered Fingerprint Sensor

Preliminary

[Doc.No: ZP-HW-PS-0023 Doc. Type: Product Specification. Revision Number: 0.94]

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Document Title **ZFS1670 Product Specification**


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HISTORY


Version	Date	Purpose	Pages
0.94	14- Aug-17	Initial version	All

	Title: ZFS1670 Fingerprint Product Specification	Date Originated: 14-Aug-17
		Revision: 0.94
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ZFS1670 Fingerprint Features


ZFS1670 offers a capacitance fingerprint sensor for working with fingerprint biometric processors and modules by passive sensing method. You can use only ONE ZFS1670 to implement **coating or ceramics-covered fingerprint module** to acquiring high quality finger image with extreme robustness.

- **System operating voltage :**
2.6V ~ 3.6V AVDD
- **System operating temperature :**
-40 °C ~ 85 °C
- **Resolution:**
88 x 62 Pixel (508PPI)
- **High identification rate:**
FRR <3%
FAR < 1/50000
- **Coating or ceramics-covered :**
Up to 70um coating
Up to 120um ceramics cover
- **One chip solution with built-in MCU**
Passive sensing mode
Support Ring-less, Decorative ring or ring key.
- **Finger touch wake-up function.**
- **Swipe navigation**
--Left, Right, Up and Down
--Moving speed limit < 100mm/s
- **2 external and 1 on-chip touch keys supported**
--FPC key sensor
--Ring key sensor
--Force key sensor
- **Fast image capture rate :**
--Up to 50Hz/frame for image capture
--Support fast unlock <200ms
- **Interface supported :**
12Mbps SPI, INT, RSTb
- **Internal power-on reset and external or command reset control**
- **Easy to program fingerprint characters by ZeTouch App.**
- **Minimize current consumption :**
-- Active Operation Mode:
Image capture : 9mA (Typ)
3 keys detect : <1.2mA (Typ)
-- Sleep Mode : 30uA (Typ)
- **Environment variation insensitive**
-- Temperature Drift Compensation
-- Charger Noise Immunity
- **Electrostatic discharge noise :**
HBM ≥ ±4KV
- **Package features:**
LGA thickness A:0.65/B:0.5 mm
Square or Roundness
Square:
Min. 6.5 x 8.6 mm
Max. 12 x 12 mm
Roundness:
Min. 9-Φ
Max. 12-Φ

	Title: ZFS1670 Fingerprint Product Specification	Date Originated: 14-Aug-17
		Revision: 0.94
ZEITEC Semiconductor	Doc #: ZP-HW-PS-0023	Date Revised: 14-Aug-17

Contents

1	Product Information	- 5 -
1.1	Introduction	- 5 -
1.2	Technical Specifications	- 5 -
2	Functional Description	- 6 -
2.1	Block Diagram	- 6 -
2.2	Pin Definition	- 6 -
2.3	Application Schematic	- 9 -
2.3.1	Interface Design	- 10 -
2.3.2	Vendor ID Design	- 10 -
2.3.3	Ring-less Ring Key Design	- 12 -
2.3.4	Touch Key Design	- 12 -
2.4	Communication Protocol	- 13 -
2.4.1	Power-On Timing	- 13 -
2.4.2	SPI Timing	- 14 -
2.5	Operating Modes	- 15 -
2.5.1	ImageCapture Mode	- 15 -
2.5.2	FingerWakeUp Mode	- 16 -
2.5.3	TouchKeys Mode	- 16 -
2.5.4	Navigation mode	- 16 -
2.5.5	Idle mode	- 16 -
2.5.6	Sleep mode	- 16 -
3	Electrical Characteristics	- 17 -
3.1	Absolute Maximum Ratings	- 17 -
3.2	Recommended Operating Conditions	- 17 -
3.3	DC Electrical Characteristics	- 18 -
4	Package	- 19 -
4.1	Package Drawings	- 19 -
4.2	Marking Rule	- 21 -

	Title: ZFS1670 Fingerprint Product Specification	Date Originated: 14-Aug-17
		Revision: 0.94
ZEITEC Semiconductor	Doc #: ZP-HW-PS-0023	Date Revised: 14-Aug-17

1 Product Information

1.1 Introduction

ZFS1670 is designed for capacitive touch coating or ceramics-covered fingerprint sensor. It provide excellent fingerprint recognition, like 2% FRR and 1/50k FAR index, and fast identification less than 200ms. Flexible LGA package design, suitable 9~12Φ roundness or square shape module design. Passive mode, single chip architecture, without any external drive signal or chip, simplify the module design. It could be assembled as metal ring, decorative ring and ringless program.


For the front fingerprint design considerations, can be configured up to 3 soft keys, to achieve home, back, menu and other key functions. Support 360⁰ registration and identification reach the login user optimization experience. In addition gesture navigation can provide up, down, left and right identification. Built-in fingerprint stable detection, wakeup in the finger touch, dark screen unlock, to avoid mistakenly touch the frequent wake up of the host chip.

Chip is built-in hardware anti-noise architecture design. In charging mode, automatic frequency hopping mechanism, greatly enhance the experience if a charger is used.

1.2 Technical Specifications

Table 1.1 ZFS1670 Technical Specifications

Parameter	Description	Value	Unit
Package Dimesions	Max	12x12	mm
	Min	6.5x8.6	mm
	Thickness (1670A)	0.65	mm
	Thickness (1670B)	0.5	mm
SPI Transmission Rate	TYP	12	MHz
Interfaces	SPI+INT+RSTB+AVDD+GND	4+1+1+1+1	Pin
Resolution		508	ppi
Pixel Array		88x62	pts
Pixel Area		4.4x3.1	mm
Power Supply	AVDD	2.8~3.3	Volts
	VDDIO	1.8/AVDD	Volts
	DVDD18	1.8	Volts

 ZEITEC Semiconductor	Title: ZFS1670 Fingerprint Product Specification Doc #: ZP-HW-PS-0023	Date Originated: 14-Aug-17
		Revision: 0.94
		Date Revised: 14-Aug-17

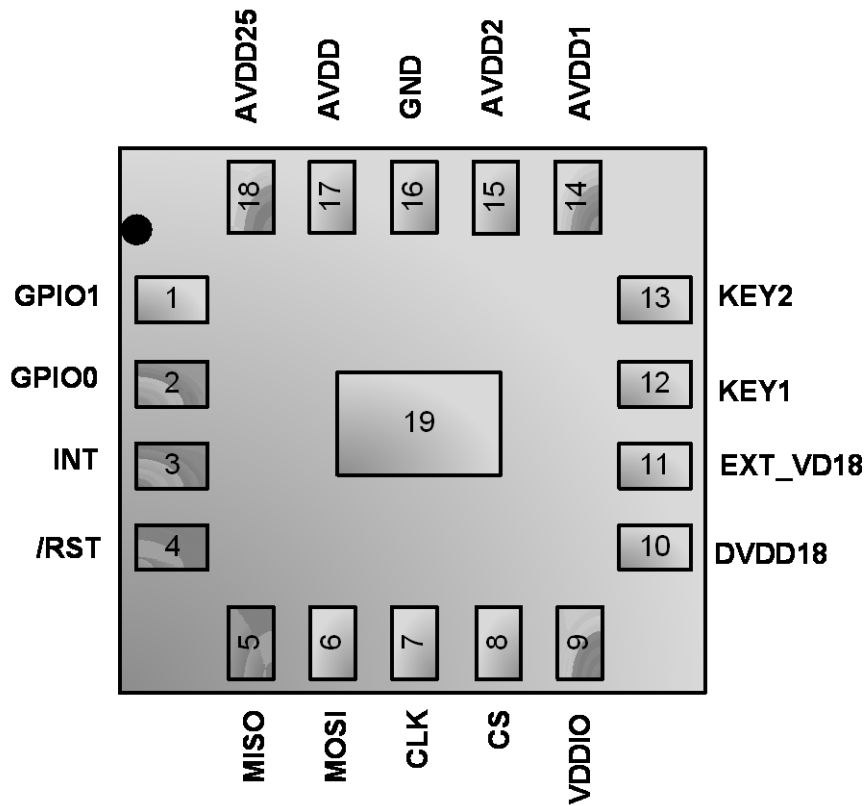




Figure 2.2 ZFS1670 Pin Assignments (Top View)

Table 2.1 ZFS1670 Pins Definition

Pin No.	Name	Type	Description
1	GPIO1	I/O	General propose I/O. Vendor ID check.
2	GPIO0	I/O	General propose I/O. Vendor ID check.
3	INT	I/O	Interrupt signal
4	RSTB	I	Reset input (active-low)
5	MISO	O	SPI data signal output (to Host)
6	MOSI	I	SPI data signal input
7	CLK	I	SPI clock signal
8	CS	I	SPI chip select signal

	Title: ZFS1670 Fingerprint Product Specification	Date Originated: 14-Aug-17
		Revision: 0.94
ZEITEC Semiconductor	Doc #: ZP-HW-PS-0023	Date Revised: 14-Aug-17

9	VDDIO	P	I/O power supply, external 1uF capacitor to GND; if VDDIO is connected to AVDD, the I/O supply voltage is AVDD; if VDDIO is left floating, the I/O supply voltage is 1.8V.
10	DVDD18	P	Internal power output, external 1uF capacitor to GND If EXT_VD18 is pulled to AVDD, DVDD18 need to be used external 1.8V power source.
11	EXT_VD18	I	DVDD18 source control If EXT_VD18 is pulled to AVDD, DVDD18 need to be used external 1.8V power source. If EXT_VD18 is pulled to GND or floating, DVDD18 would be internal regulator output.
12	KEY0	AI	Touch Key 0
13	KEY1	AI	Touch Key 1
14	AVDD1	P	Power input, external 1uF capacitor to GND.
15	AVDD2	P	Power input, external 1uF capacitor to GND.
16	GND	G	System ground
17	AVDD	P	Power input, external 1uF capacitor to GND.
18	AVDD25	P	Internal power output, external 1uF capacitor to GND
19	GND	G	System ground

 ZEITEC Semiconductor	Title: ZFS1670 Fingerprint Product Specification Doc #: ZP-HW-PS-0023	Date Originated: 14-Aug-17
		Revision: 0.94
		Date Revised: 14-Aug-17

2.3 Application Schematic

ZFS1670 application schematic diagram is as follows, in order to achieve the fingerprint sensor function, touch button function and confirm the module supplier mechanism.

Interface voltage level is controlled by the VDDIO setting. If connect VDDIO to AVDD, the level is same as AVDD. If VDDIO is floating, the interface voltage level is 1.8V potential.

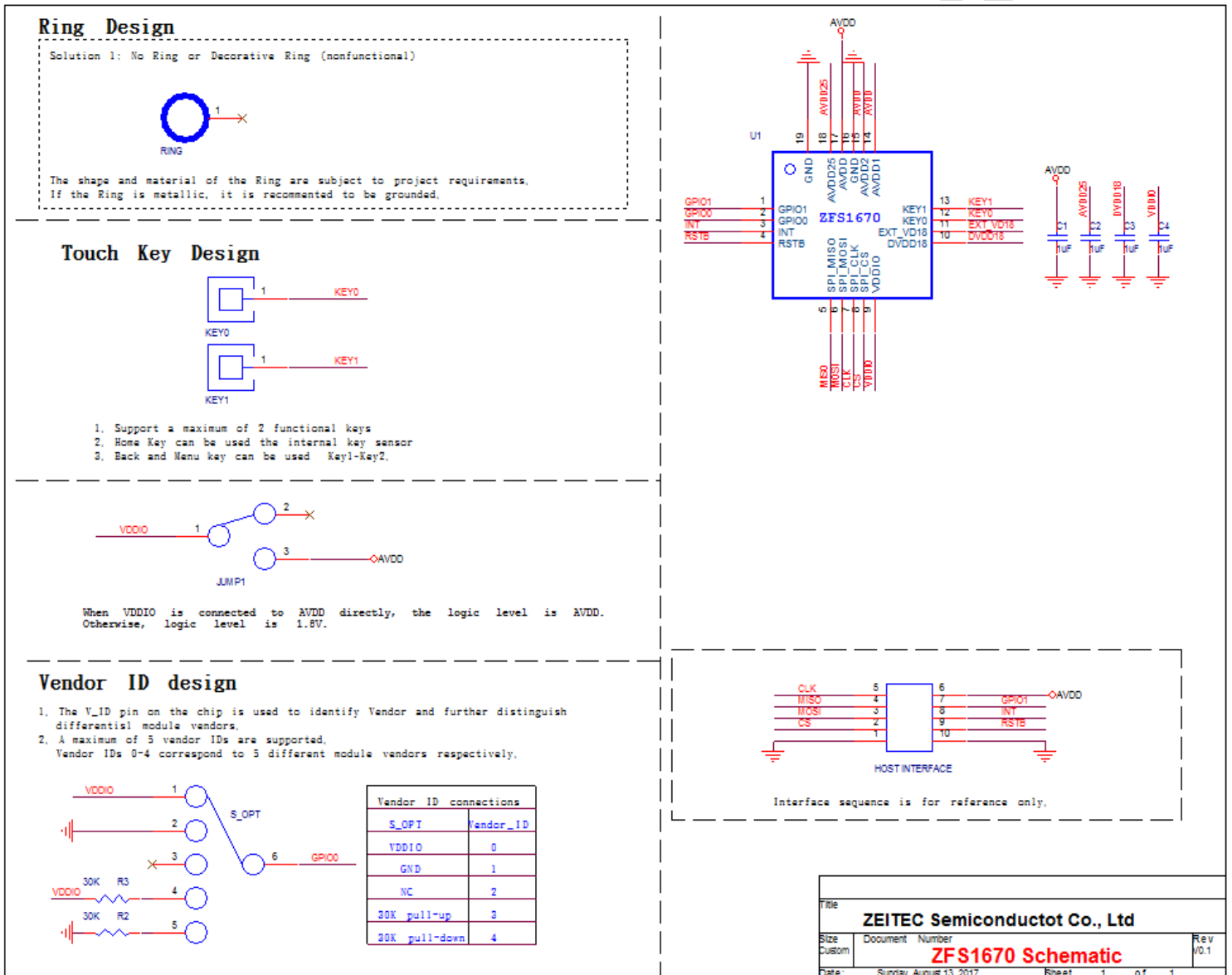



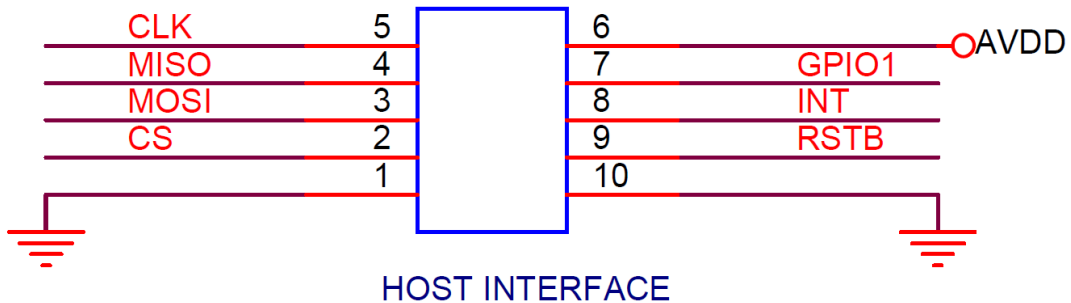
Figure 2.3 ZFS1670 Application Schematic

 ZEITEC Semiconductor	Title: ZFS1670 Fingerprint Product Specification Doc #: ZP-HW-PS-0023	Date Originated: 14-Aug-17
		Revision: 0.94
		Date Revised: 14-Aug-17

2.3.1 Interface Design

The interface circuit between ZFS1670 and the Host is shown in Figure 2.4 and the interface sequence is through SPI bus, INTB, RSTB and single voltage source for reference only.

With the SPI serial port can ZFS1670 program updates, instructions to convey, data transmission function. And can provide additional GPIO ZFS1670 to control other devices, such as LED or motor start and so on. The following figure shows a serial design range, the actual use of the design to make adjustments.



Interface sequence is for reference only.

Figure 2.4 Interface between ZFS1670 and Host

2.3.2 Vendor ID Design

Figure 2.5 illustrates the Vendor ID design of ZFS1670. The CPIO0 on the chip is used to identify Vendor IDs and further distinguish different module vendors. A maximum of 5 Vendor IDs are supported and they will be generated by the register. Each Vendor ID corresponds to one of the 5 different module vendors, and thus the host can identify the vendor of the current module by reading the ID through SPI interface.

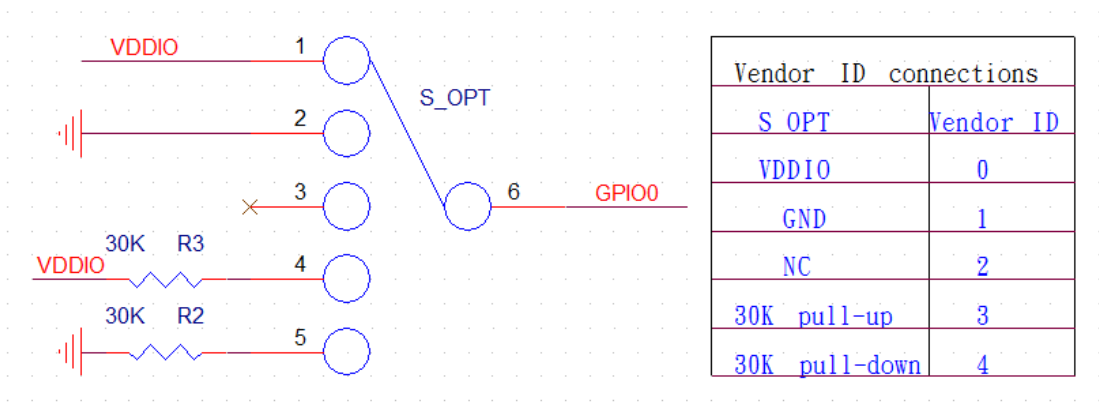



Figure 2.5 ZFS1670 Vendor ID Design

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 ZEITEC Semiconductor	Title: ZFS1670 Fingerprint Product Specification Doc #: ZP-HW-PS-0023	Date Originated: 14-Aug-17
		Revision: 0.94
		Date Revised: 14-Aug-17

2.3.3 Ring-less 、 Ring Key Design

ZFS1670 can be Ring-less or with decorative ring. The shape and material of the decorative ring is subject to specific project requirements. If the ring is made of metallic material, it is recommended to be grounded.

In addition, the ring can serve as part of the touch key. The major function of the ring key is to expand the active area of the touch key so that both the ring and the pixel area can respond to the touch-up and touch-down events.

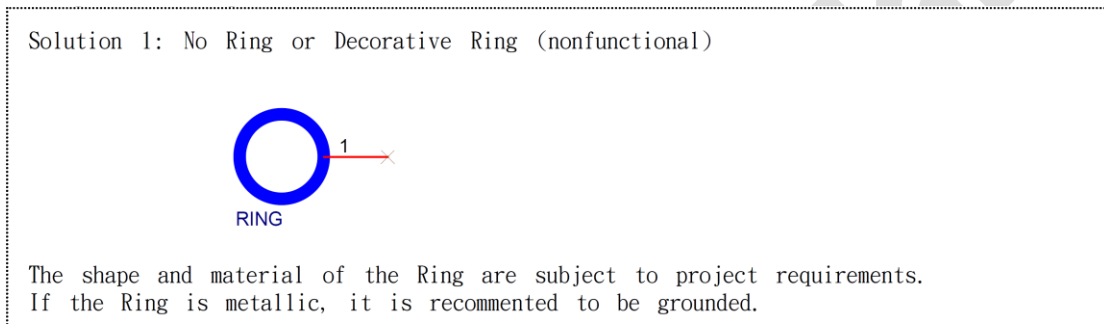


Figure 2.6 ZFS1670 Ring design

2.3.4 Touch Key Design

ZFS1670 support a total of two touch buttons, you can use FPC to achieve Back, Menu button function, the home can be selected by the Sensor built-in Key to achieve.

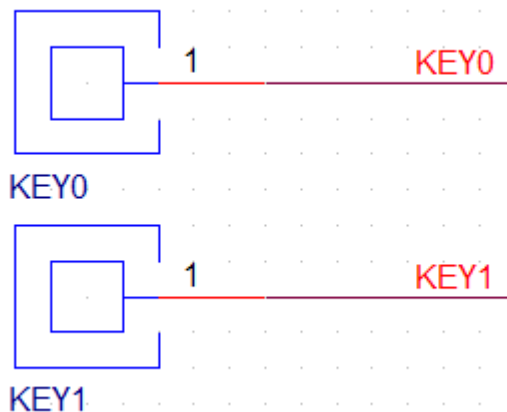



Figure 2.7 ZFS1670 Touch Key Design

 ZEITEC Semiconductor	Title: ZFS1670 Fingerprint Product Specification Doc #: ZP-HW-PS-0023	Date Originated: 14-Aug-17
		Revision: 0.94
		Date Revised: 14-Aug-17

2.4 Communication Protocol

ZFS1670 communicates with the Host via SPI interface which only supports CPOL=0 and CPHA=0. Communication with the Host is performed by MOSI (SPI interface slave data in), MISO (SPI interface slave data out), CLK (SPI clock) and CS (SPI chip select). ZFS1670 always serves as the slave device, with all communication being initialized by the Host. The length of the transmission will be controlled by the software within the flexible control, the longest can be transferred to 4K bytes of data length.

2.4.1 Power-On Timing

After power on, the Host needs to control the pins of ZFS1670, such as AVDD, RSTB, INT and SPI bus, according to the timing diagram shown in Figure 2.8.

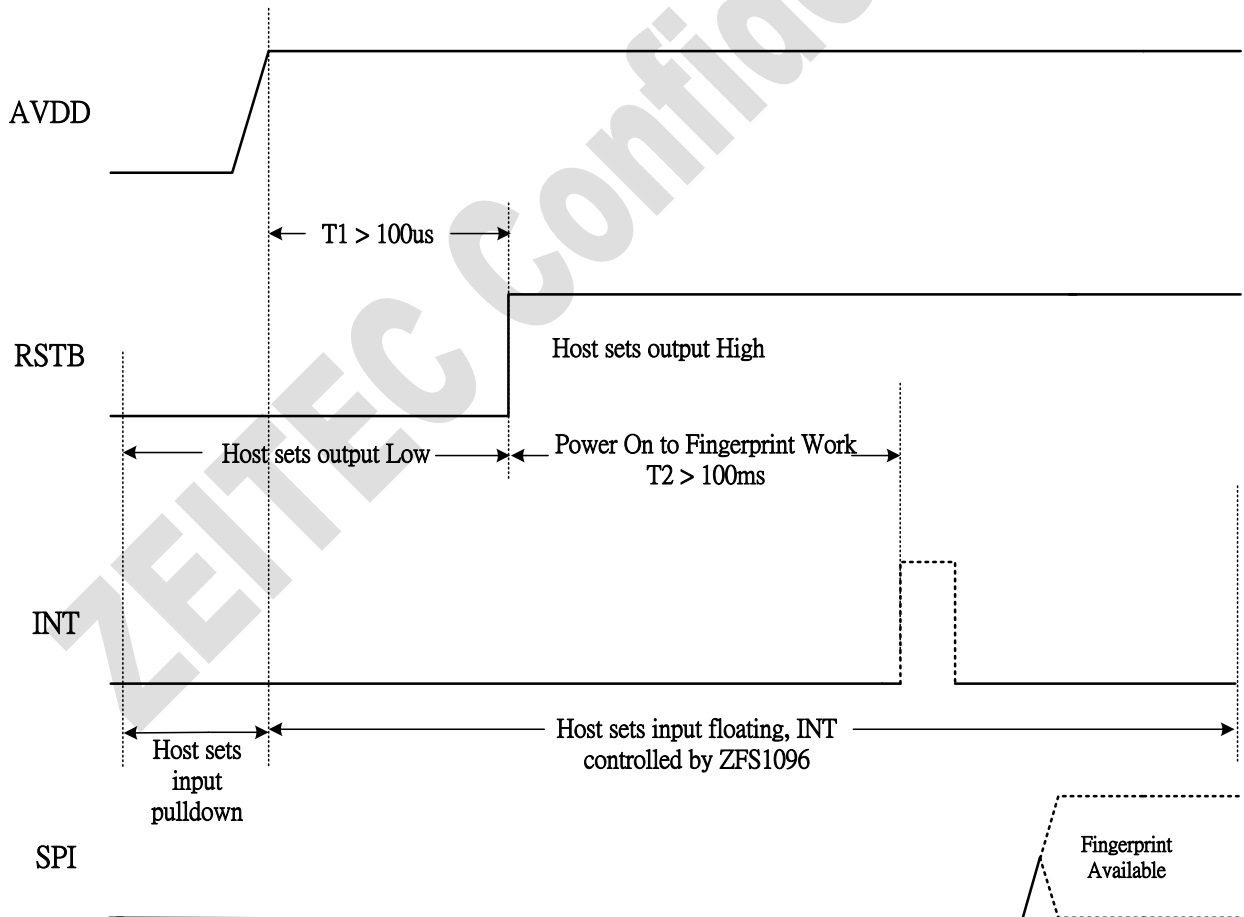



Figure 2.8 ZFS1670 Power-On Timing

 ZEITEC Semiconductor	Title: ZFS1670 Fingerprint Product Specification Doc #: ZP-HW-PS-0023	Date Originated: 14-Aug-17
		Revision: 0.94
		Date Revised: 14-Aug-17

2.4.2 SPI Timing

ZFS1670 can communicate with the host at high speed or at low speed. After receiving interrupt form the fingerprint module, the host can communicate with ZFS1670 at a high speed, typically, 12Mbps. Plase note the SPI bus can implement high-speed transmission only when host is reading fingerprint raw data or registers.

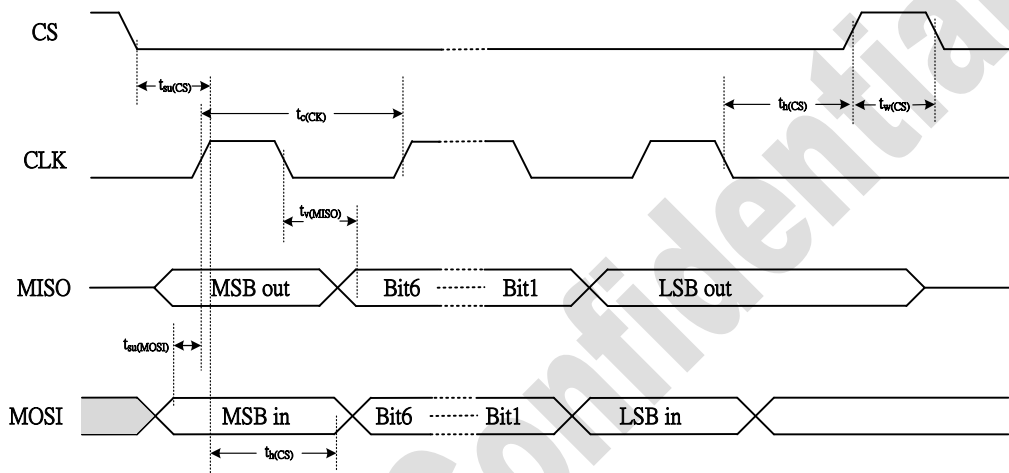



Figure 2.9 ZFS1670 SPI Timing Diagram

Table 2.1 ZFS1670 SPI Timing

Symbol	Description	Min.	Typ.	Max.	Unit
$1/t_c$ (CLK)	SPI clock speed		12	16	MHz
$t_{su}(CS)$	SPI CS setup time	40			ns
$t_h(CS)$	SPI CS hold time	10			ns
$t_w(CS)$	SPI CS idle time	320			ns
$t_{su}(MOSI)$	MOSI setup time	30			ns
$t_h(MOSI)$	MOSI hold time	30			ns
$t_v(MISO)$	MISO valid time			30	ns

 ZEITEC Semiconductor	Title: ZFS1670 Fingerprint Product Specification Doc #: ZP-HW-PS-0023	Date Originated: 14-Aug-17
		Revision: 0.94
		Date Revised: 14-Aug-17

2.5 Operating Modes

ZFS1670 offers a variety of modes that can be optimized for different degrees of performance, including ImageCapture、FingerWakeUp、TouchKey、Navigation、Idle and Sleep modes. Host can control the ZFS1670 to enter different modes by means fo the SPI instruction. In addition, ZFS1670 will be in the appropriate time to automatically switch mode. Mode switching concept diagram is as follows, you can further understand the function of the mode cut.

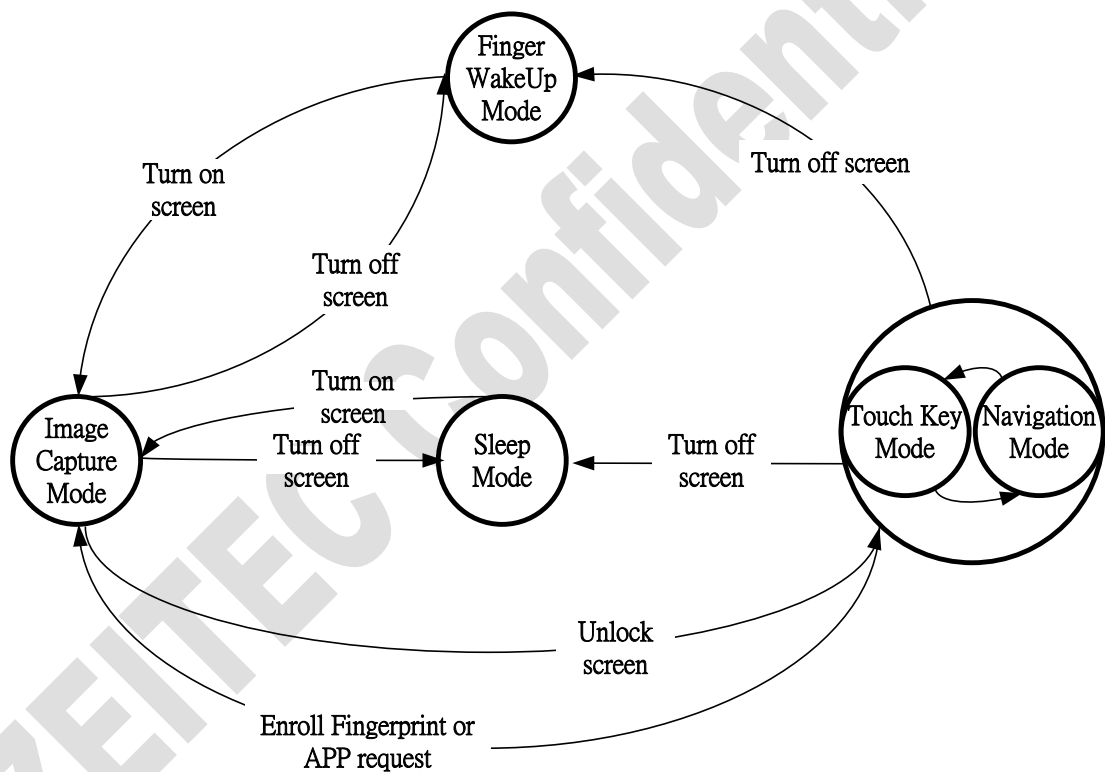



Figure 2.10 ZFS1670 Mode Transition Diagram

2.5.1 ImageCapture Mode

ImageCapture Mode is the main function of ZFS1670, used to obtain fingerprints and transmission of data. This mode is to maintain the highest performance to capture fingerprint sensing data, with other modes of control, optimize the overall system power consumption.

	Title: ZFS1670 Fingerprint Product Specification	Date Originated: 14-Aug-17
		Revision: 0.94
ZEITEC Semiconductor	Doc #: ZP-HW-PS-0023	Date Revised: 14-Aug-17

2.5.2 FingerWakeUp Mode

ZFS1670 design while turn-off screen, enter the FingerWakeUp Mode, to maintain a low spend and low power consumption, does not require any Host resources. When the finger down and keep stable, ZFS1670 INT will notify Host, if identified as correct finger, the phone will wake up. If not correct finger, ZFS1670 will re-enter the power saving mode.

2.5.3 TouchKeys Mode

ZFS1670 for the front design, in the absence of fingerprint demand, you can enter the Touch keys Mode, in the case of power, to achieve Home, Back, Menu button functions.

2.5.4 Navigation mode


ZFS1670 can detect the upper, lower, left and right sliding gestures, and return the corresponding indicators to the Host. It is also compatible with the function of the button at the same time. However, it should be noted that Navigation mode can only provide the direction of gestures, can not accurately locate the moving distance and speed. ZFS1670 support the maximum moving speed is 100mm / sec.

2.5.5 Idle mode

In the Power-On or sensing state is completed, enter Idle mode, then most of the features off to reduce power consumption, waiting for Host to send a variety of modes of instructions, out of idle mode, the implementation of sensing behavior.

2.5.6 Sleep mode

In Sleep mode, the ZFS1670 maintains the lowest power consumption and all functions are turned off. Can only wake up by SPI instruction or RSTB, wake up after the instructions need to wait about 1ms reply to the normal sensing action, if RSTB wake up still have to wait for the same time as Power on.

	Title: ZFS1670 Fingerprint Product Specification	Date Originated: 14-Aug-17
		Revision: 0.94
ZEITEC Semiconductor	Doc #: ZP-HW-PS-0023	Date Revised: 14-Aug-17

3 Electrical Characteristics

3.1 Absolute Maximum Ratings

Table 3.1 ZFS1670 Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
AVDD/AVDD1/AVDD2	-0.3	4.2	V
VDDIO	-0.3	4.2	V
DVDD18	-0.3	1.98	V
Voltage on digital I/O	-0.3	4.2	V
Storage temperature	-40	+125	°C
ESD susceptibility (HBM)	-4	+4	KV

3.2 Recommended Operating Conditions


Table 3.2 ZFS1670 Recommended Operating Conditions

Parameter	Min.	Typ	Max.	Unit
AVDD	2.65	2.8/3.0/3.3	3.6	V
DVDD18	1.71	1.8	1.89	V
Operating temperature	-40	+25	+85	°C

Note:

Power supply ripple (Vpp) < 200mV @ Typical operating voltage;

Power supply ripple (Vpp) < 50mV @ Max. or Min. operating voltage.


	Title: ZFS1670 Fingerprint Product Specification	Date Originated: 14-Aug-17
		Revision: 0.94
ZEITEC Semiconductor	Doc #: ZP-HW-PS-0023	Date Revised: 14-Aug-17

3.3 DC Electrical Characteristics

Table 3.3 ZFS1670 Electrical Characteristics

Operating Conditions: AVDD=2.8V, VDDIO=1.8V, 25°C

Parameter	Min.	Typ	Max.	Unit
ImageCapture Mode average current@10Hz		9		mA
FingerWakeUp Mode average current@ 20Hz		0.8		mA
Touchkeys Mode average current@ 60Hz		1.2		mA
Navigation Mode average current@ 60Hz		2.0		mA
Idle Mode average current		0.5		mA
Sleep Mode average current		25		uA
Digital input low voltage VIL		-	0.25*VDDIO	V
Digital input high voltage VIH	0.75*VDDIO	-		V
Digital output low voltage VOL		-	0.15*VDDIO	V
Digital output high voltage VOH	0.85*VDDIO	-		V
RSTB active low voltage@ IO=AVDD		1.35		V
RSTB active low voltage@ IO=1.8V		0.6		V

 ZEITEC Semiconductor	Title: ZFS1670 Fingerprint Product Specification Doc #: ZP-HW-PS-0023	Date Originated: 14-Aug-17
		Revision: 0.94
		Date Revised: 14-Aug-17

4 Package

4.1 Package Drawings

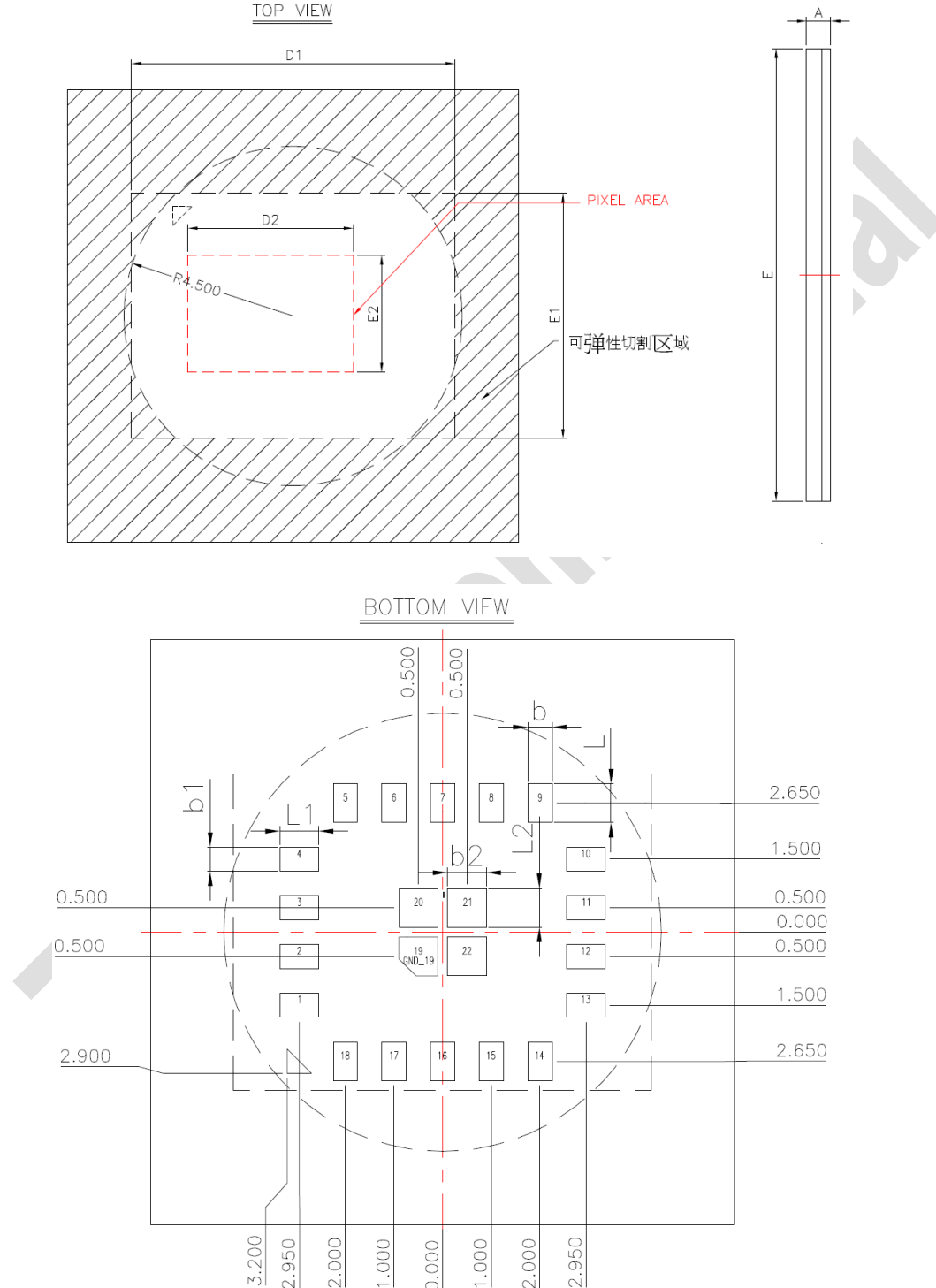


Figure 4.1 ZFS1670 Package Drawing



	Title: ZFS1670 Fingerprint Product Specification	Date Originated: 14-Aug-17
		Revision: 0.94
ZEITEC Semiconductor	Doc #: ZP-HW-PS-0023	Date Revised: 14-Aug-17

Table 4.1 ZFS1670 Package Dimensions

SYMBOL	DIMENSION(mm)			REMARK
	MIN.	NOM.	MAX.	
A	0.6	0.65	0.7	ZFS1670A
A	0.45	0.5	0.55	ZFS1670B
D	11.9	12	12.1	
D1	8.55	8.6	8.65	
D2	--	4.4	--	
E	11.9	12	12.1	
E1	6.45	6.5	6.55	
E2	--	3.1	--	
b	0.45	0.5	0.55	
b1	0.45	0.5	0.55	
b2	0.75	0.8	0.85	
L	0.75	0.8	0.85	
L1	0.75	0.8	0.85	
L2	0.75	0.8	0.85	

 ZEITEC Semiconductor	Title: ZFS1670 Fingerprint Product Specification Doc #: ZP-HW-PS-0023	Date Originated: 14-Aug-17
		Revision: 0.94
		Date Revised: 14-Aug-17

4.2 Marking Rule

The products within the same batch feature the same marking information.

The definition of the marking information is provided below:

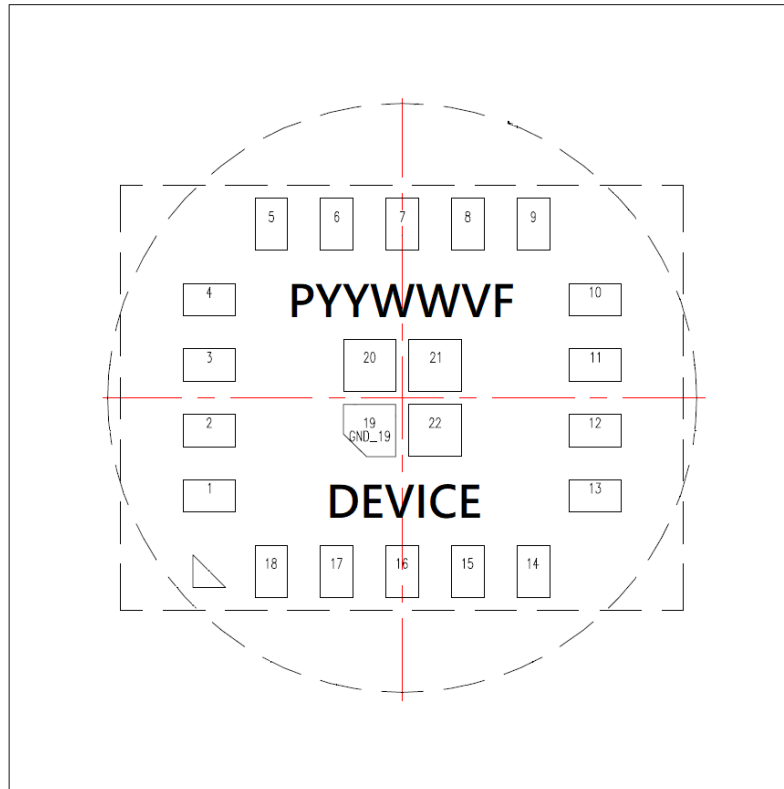



Figure 4.2 Marking Rule

Table 4.2 Marking Information

	Code	Definition
Line 1	Device	IC Part Number: (Eg.: ZFS1670A, ZFS1670B, etc.)
Line 2	P	Package house ID is represented by an English letter (B, T or A)
	YY	Package Date(Year), 2-digit code (Eg.: "17" indicates the IC is packaged in the 2017.)
	WW	Package Date(Week), 2-digit code
	V	IC Version
	F	Lot NO.
Mark		Device and PYYWWVF . PIN 1 is located in the top left corner of the marking front side

	Title: ZFS1670 Fingerprint Product Specification	Date Originated: 14-Aug-17
		Revision: 0.94
ZEITEC Semiconductor	Doc #: ZP-HW-PS-0023	Date Revised: 14-Aug-17

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