

Area Silicon-based Fingerprint Sensor AFS116N (A116N) Specification

Ver. 0.2

MICROARRAY

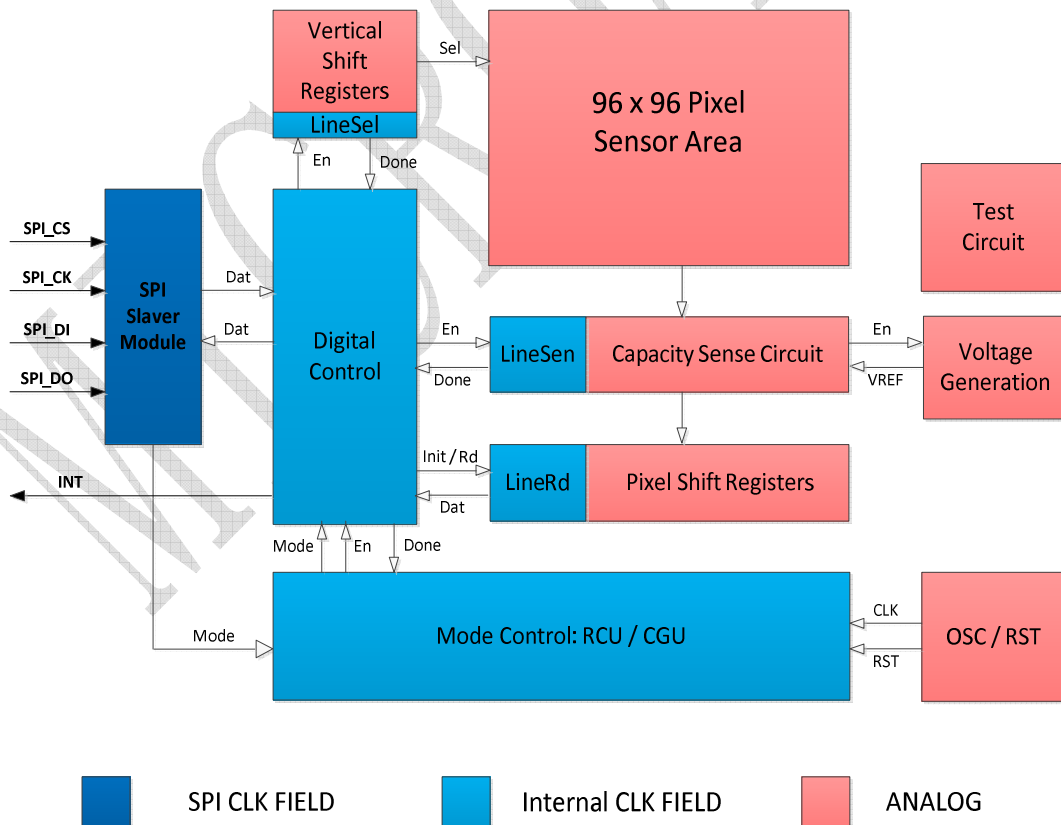
Rev	Date	Author	Description	
V0.1	2016/08/05	Alex	Add AFS116N(A116N) Module	Document
V0.2	2017/02/21	Alex	Modify FPC Circuit	Document

MICROARRAY

1. Technical indexes

- 96×96 @ 508dpi Sense Array
- 4.8mm×4.8mm Sensor Size
- ≥8.5mm×8.5mm Square LGA Package Size
- ≥φ9.4 Circle LGA Package Size
- A116N thickness 0.60mm and 0.65mm
- Each pixel has 8bit grey depth
- SPI Slaver Interface, Maximum baud rate @ 10MHz
- Typical frame rate: 90fps (96×96@8MHz)
- ±15KV air discharge protection, ±8KV contact discharge protection
- Cover with 50um Coating
- Internal 12MHz system OSC
- Internal 4KHz low power OSC
- Internal POR/BOR
- 2.6V-3.63V Core Voltage
- 8mA typical dynamic power consumption
- 70uA typical power consumption in finger detect mode
- 30uA power consumption in power down mode
- FAR < 1/50000, FRR < 2%

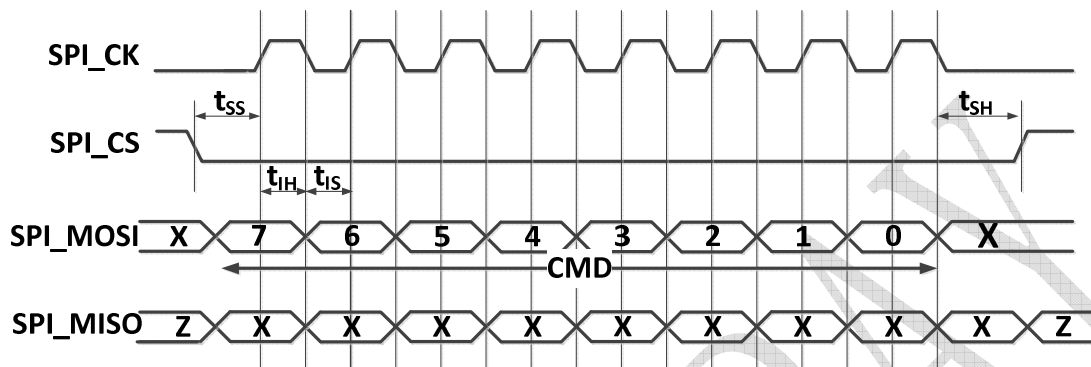
2. Architecture



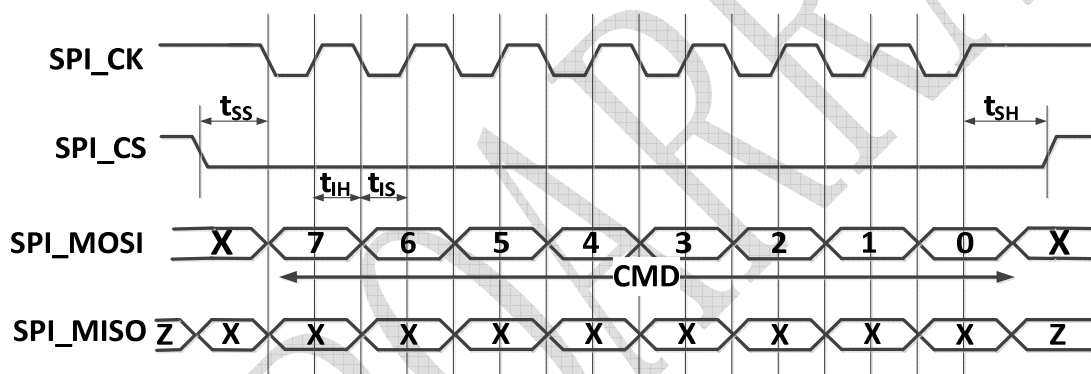
3. SPI Timing

3.1. Mode CMD

SPI_CK initial value is 0, rising edge capture value



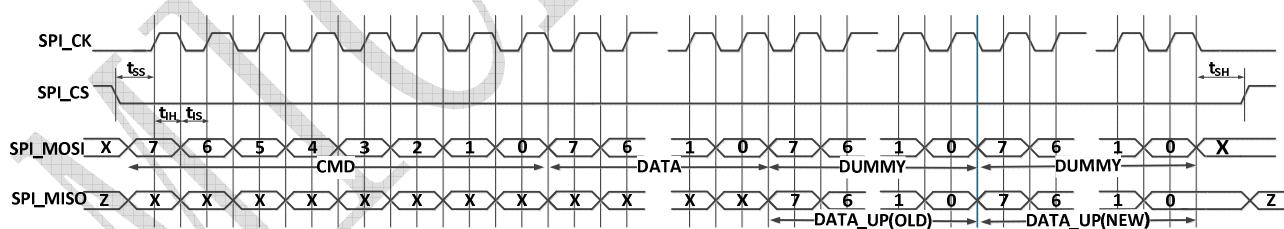
SPI_CK initial value is 1, rising edge capture value



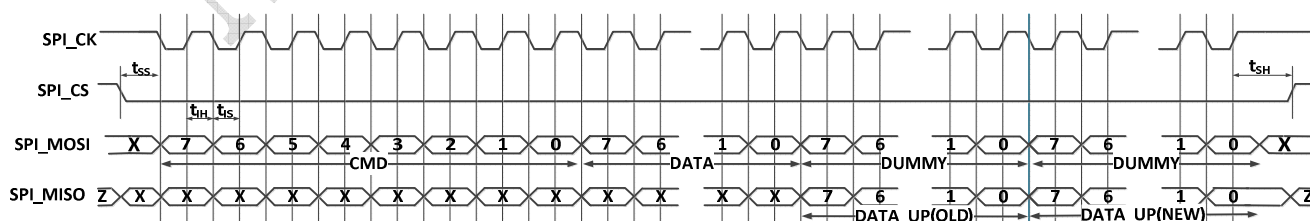
3.2. Register R/W CMD:

CMD + DATA_DOWN + DATA_UP(old) + DATA_UP(new)

SPI_CK initial value is 0, rising edge capture value



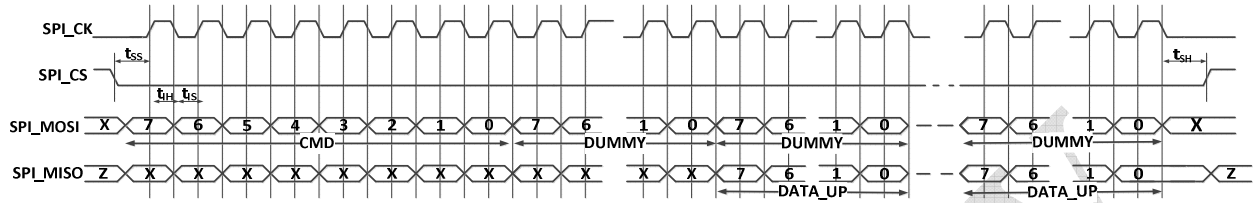
SPI_CK initial value is 1, rising edge capture value



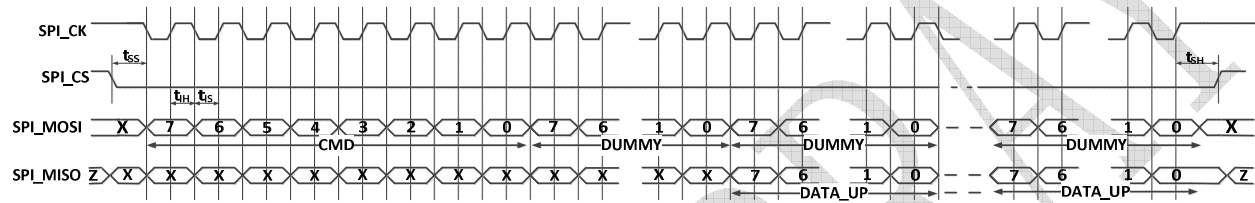
3.3. Read Image CMD:

CMD + DUMMY + DATA_UP * n

SPI_CK initial value is 0, rising edge capture value



SPI_CK initial value is 1, rising edge capture value



3.4 Timing request

parameter	Attribute	min	Max	Unit
t _{ss}	SPI_CS setting time	64	/	ns
t _{sh}	SPI_CS retention time	64	/	ns
t _{is}	SPI_MOSI setting time	64	/	ns
t _{ih}	SPI_MOSI retention time	64	/	ns

4. SPI CMDs

Production Code, Register R/W CMD(read only)		
CMD	Function	Description
0x00	Production Code 1 st Byte 0x41, ASII'A', area sensor	Production Code 96×96 pixel matrix, A116
0x04	Production Code 2 nd Byte 0x74, 116	
0x08	Company Code 1 st Byte ASII'M', 0x4d	Company Code MA is short for "MicroArray"
0x0C	Company Code 2 nd Byte ASII'A', 0x41	

Mode, Mode CMD		
CMD	Function	Description
0x80	Power Down Mode	Leave Power Down mode by Reset.
0x84	Detect Mode	Detect finger in Detect Mode;
0x88	Capture Mode	Read Image in Capture Mode;
0x8c	Reset	Enter Capture Mode after Reset;

Read Image, Read Image CMD			
CMD	Parameter	Function	Description
0x70	1Byte Dummy	Read 1 line	Read 1 Line stored in buf1;
	97 Byte Data Dummy	Sense 1 line	In the same time, Sense 1 Line and store in buf0; After read & Sense, Copy the new Sensed Line from buf0 to buf1.
0x78	Loop:	Loop:	Read & Sense & Copy in Loop, for Capturing image.
	1Byte Dummy	Read 1 line	
	81 Byte Data Dummy	Sense 1 line	
CMD	Function	Description	
0x10	Enable	See Grey Expansion in 0x2x registers;	
R/W	Default = 0x00	See Finger Detect in 0x4x registers;	
	[7] Grey Expansion En	See Window in 0x3x registers;	
	[6] Finger Detect En	When CurLine Set disable, 0x50 is read only.	
	[5] Window En		
	[4] CurrentLnSet En		
	[3:0] reserved		
0x14	RefSel	RG_CAPSEL:	
R/W	Default = 0x00	0x0: min	
	[7:6]RG CAPSEL	0x3: max	
	[5:0]RG REF SEL	RG_REF_SEL:	

		0x0: min 0x3f: max
0x18 R/W	RefAnaEn Default = 0xdc [7:0]reserved	
0x1c R/W	RefCTRL Default = 0x00 [7:0]RG INTDRV CTRL	RG INTDRV CTRL: 0x00: lowest 0xff: highest

CMD	Function	Description
0x20	RefDMY Default = 0x00 [7]N/A [6]reserved [5:0]RG INTDRV DMY IN	
0x24	RefOSC Default = 0x00 [7:0]reserved	
0x28	Offset Default = 0x00	Offset Real = {Offset_Extend_H,Offset}; Offset Real decrease 1 at quantized step.
0x2c	Ref Extend Default = 0x40 [7:2]reserved [1:0] Offset Extend H	Offset Real > 0 , Sensor keep 0xff, Offset Real <= 0 Sensor begin quantization.

CMD	Function	Description
0x30 R/W	Start line Default 0x00	Automate update Current Line after each Read Line CMD: If $\text{CurrentLn} + \text{Step} \leq \text{endLn}$ $\text{CurrentLn} = \text{CurrentLn} + \text{Step}$ Else $\text{Current} = \text{StartLn}$
0x34 R/W	End line Default 0x71	
0x38 R/W	Line Step Default 0x01	
0x3c R/W	FrameRows Default 0x01	

CMD	Function	Description
0x40 R/W	FingerDetect N Default = 0x00	Threshold Cross: If $((\sum (\text{pixel}[i] - \text{pixelT} - \text{FingerDetect A})) \div 64) > \text{FingerDetect N}$ at FrameRows point, Interrupt IO pull high, else Interrupt IO pull down.
0x44 R/W	FingerDetect A Default = 0x00	
0x48 R/W	DetectPeriod Default = 0x00 [7:4]N/A [3:0]Par CK Period	Finger Detect once in 1 period under Detect Mode: 0x0 1*16 Clk@4KHz 0x1 2*16 Clk@4KHz 0xf 16*16 Clk@4KHz
0x4c R	PIXELs Cnt Eff Default = 0x00 [7:0]reserved	

CMD	Function	Description
0x50 R/W	CurrentLine Default = 0x00 [7:0]reserved	The ID of the line captured in next Read Line CMD.
0x54 R/W	RefDFT Default = 0x00 [6:0]reserved	

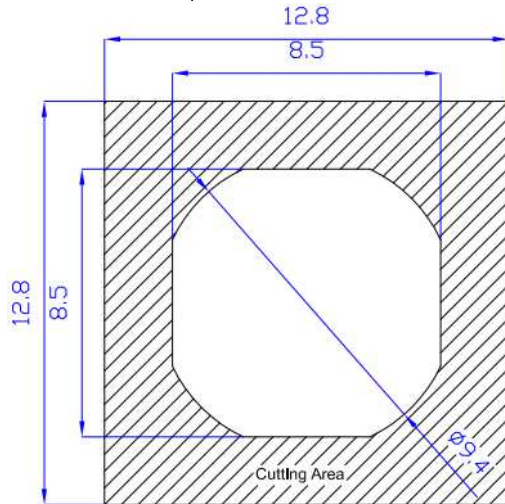
CMD	Function	Description
0x60 R/W	Interrupt Default = 0x00 [7] Interrupt En [6]FingerDetect Thres Mod [5]FingerDetect Thres En [4] reserved [3] Int [2:0] N/A	Interrupt_En enable Interrupt CMD; Interrupt CMD can set or clear IO_INT; Each reset will set IO_INT; See detailed “Finger Detect” in 0x4x registers
0x64 R/W	Frames_Cnt_L Default = 0x00 [7:0] reserved	
0x68 R/W	Frames_Cnt_H Default = 0x00 [6:0] reserved	

5. Package Mechanical Drawing and Package Dimension

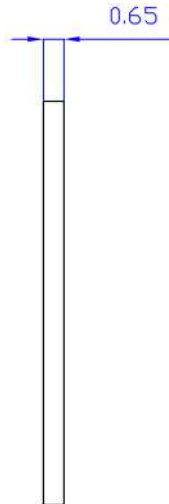
5.1 LGA Package Size

$8.5\text{mm} \times 8.5\text{mm} \leq \text{Square Size} \leq 12.8\text{mm} \times 12.8\text{mm}$

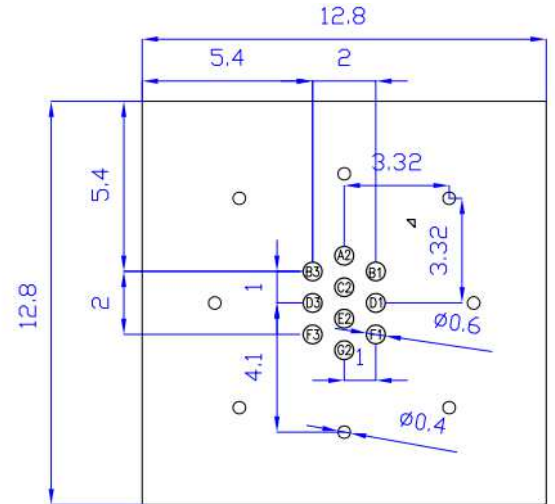
$\phi 9.4\text{mm} \leq \text{Circle Size} \leq \phi 12.8\text{mm}$



TOP VIEW

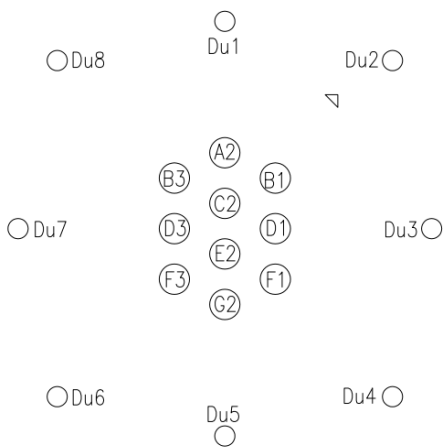


SIDE VIEW



BOTTOM VIEW

5.2 LGA Package Pad List

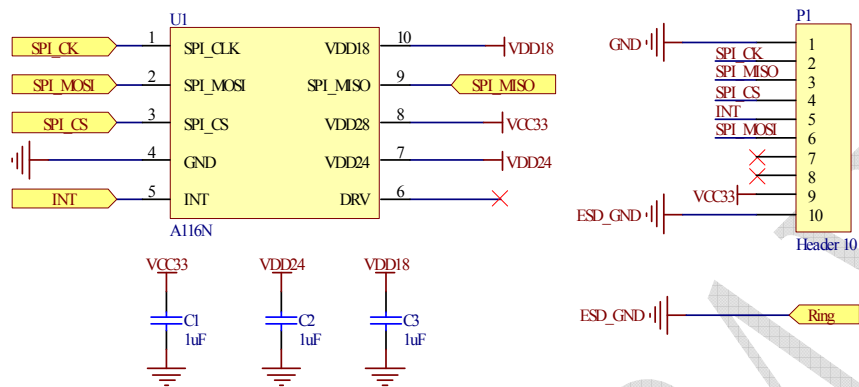


Bottom View

	3	2	1
A	/	VDD28	/
B	VDD24	/	SPI_CLK
C	/	SPI_MISO	/
D	DRV	/	SPI_MOSI
E	/	VDD18	/
F	INT	/	SPI_CS
G	/	GND	/
Du1~Du8	Dummy Pads for SMT		

6. Module Reference Circuit for 10 Pin Module

6.1 FPC Circuit



6.2 BOM List

Comment	Designator	Footprint	Quantity
Ceramic Chip Capacitor 1uF	C1,C2,C3	0201	3
A116N	U1	LGA10+8	1