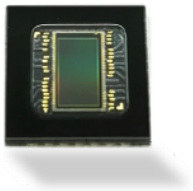


datasheet

PRODUCT SPECIFICATION

1/4" color CMOS 720P(1280×720)HD image sensor
with OmniPixel3-HS™ technology

OV9732

OV09732

color CMOS 720P(1280×720) HD image sensor with OmniPixel3-HS™ technology

applications

- IP cameras
- life style camera
- surveillance
- motion camera

ordering information

- OV09732 (color, Lead-free) 28-Pin PLCC

features

- FSIN
- programmable controls for frame rate, mirror and flip, gain/exposure, and windowing
- image quality control: defect pixel correction (DPC) and automatic black level calibration (ABLC)
- support for output formats: 10-bit RAW output with 1-Lane MIPI and DVP
- support for horizon and vertical sub-sampling
- support for image sizes: full size (1280x720), VGA (640x480), 2x2 RGB binning (640x360)
- low power mode (LPM) function
- standard SCCB interface
- capable of maintaining register values at software power down
- on-chip phase lock loop (PLL)
- GPIO tri-state configurability and programmable polarity

key specifications (typical)

- **active array size:** 1280 x 720
- **power supply:**
  core: 1.7~1.9V (1.8V normal)
  analog: 2.7 ~ 2.9V (2.8V normal)
  I/O: 1.7V~ 1.9V (1.8V normal)
- **power requirements:**
  active: 99mW
  standby: 36 µW
- **temperature range:**
  operating: -30°C to 70°C junction temperature
  stable image: 0°C to 50°C junction temperature
- **output formats:** 10-bit RAW RGB
- **lens size:** 1/4"
- **lens chief ray angle:** 9°
- **dynamic range:** 72dB @ 8x gain
- **input clock frequency:** 6~27 MHz
- **max S/N ratio:** 39 dB
- **maximum image transfer rate:** 30fps full resolution
- **sensitivity:** 2.066mV/Lux-sec
- **shutter:** rolling shutter
- **scan mode:** progressive
- **maximum exposure interval:** 798 x t_{ROW}
- **pixel size:** 3 µm x 3 µm
- **dark current:** 5 mV/s @ 60°C junction temperature
- **image area:** 3888 µm x2208 µm
- **package dimensions:** 8.0 mm x 8.0 mm

table of contents

1. signal descriptions

table 1-1 lists the signal descriptions and their corresponding pin numbers for the OV09732 image sensor. The package information is shown in **section 4**.

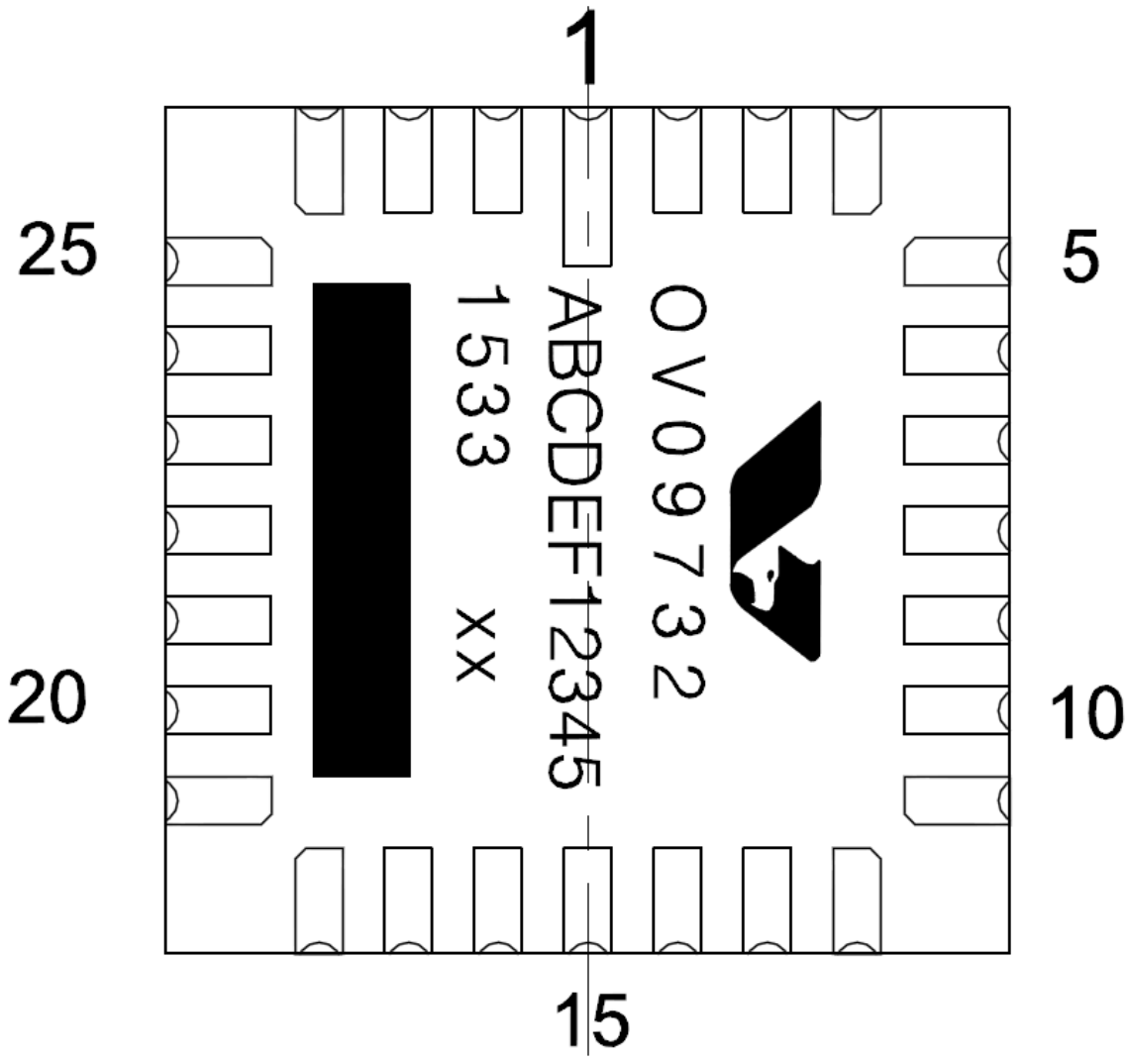
table 1-1 signal descriptions (sheet 1 of 2)

Pad numbe	signal name	pad type	description	default SCCB status
01	HREF	I/O	DVP HREF output	
02	SDA	I/O	SCCB data	
03	SCL	input	SCCB input clock	
04	FSIN/VSYNC	input	FSIN/VSYNC output	
05	DVDD	power	power for digital circuit	
06	DOGND	ground	digital logic ground	
07	XVCLK	input	system input clock	
08	PCLK	input	DVP PCLK	
09	DOGND	ground	digital logic ground	
10	DOVDD	powe	power for I/O circuit	
11	DOGND	ground	digital logic ground	
12	D0/MCN	I/O	DVP data bit 0 output /MIPI TX clock lane negative output	
13	D1/MCP	I/O	DVP data bit 1 output /MIPI TX clock lane positive output	
14	D2/MDN	I/O	DVP data bit 2 output /MIPI TX data lane 0 negative output	
15	D3/MDP	I/O	DVP data bit 3 output /MIPI TX data lane 0 positive output	
16	D4	I/O	DVP data bit 4 output	
17	D5	I/O	DVP data bit 5 output	
18	D6	I/O	DVP data bit 6 output	
19	D7	I/O	DVP data bit 7 output	
20	D8	I/O	DVP data bit 8 output	
21	D9	I/O	DVP data bit 9 output	
22	AGND	ground	ground for analog circuit	
23	AVDD	power	power for analog circuit	
24	DOGND	ground	digital logic ground	
25	VN	reference	internal analog reference	

table 1-1 signal descriptions (sheet 2 of 2)

Pad number	signal name	pad type	description	default SCCB status
26	DVDD	power	power for digital circuit	
27	XSHUTDN	input	reset and power down (active low with internal pull down resistor)	
28	SID	input	SCCB address selection	

figure 1-1 pin diagram bottom view



2. system level description

2.1 overview

The OV9732 color image sensor is a low voltage, high-performance 1/4-inch 720P CMOS image sensor that provides the full functionality of a single chip 720P (1280x720) and VGA (640x480) camera using OmniPixel3-HS™ technology. It provides full-frame, sub-sampled, and cropped images in various formats via the control of the Serial Camera Control Bus (SCCB) interface.

The OV9732 has an image array capable of operating at up to 30 frames per second (fps) in 720p resolution and 45 fps in VGA resolution with complete user control over image quality, formatting and output data transfer. Some image peocessing functions, such as exposure control, defective pixel canceling are programmable through the SCCB interface. In addition, OmniVision image sensors use proprietary sensor technology to improve image quality by reducing or eliminating common lighting/electrical sources of image contamination, such as fixed pattern noise, smearing, etc., to produce a clean, fully stable, color image.

2.2 architecture

The OV9732 sensor core generates streaming pixel data at a constant frame rate.

The timing generator outputs clocks to access the rows of the imaging array, precharging and sampling the rows of the array sequentially. In the time between precharging and sampling a row, the charge in the pixels decreases with exposure to incident light. this is the exposure time in rolling shutter architecture.

The exposure time is controlled by adjusting the time interval between precharging and sampling. After the data of the pixels in the row has been sampled, it is processed through analog circuitry to correct the offset and multiply the data with corresponding gain. Following analog processing is the ADC which outputs 10-bit data for each pixel in the array.

figure 2-1 OV9732 block diagram

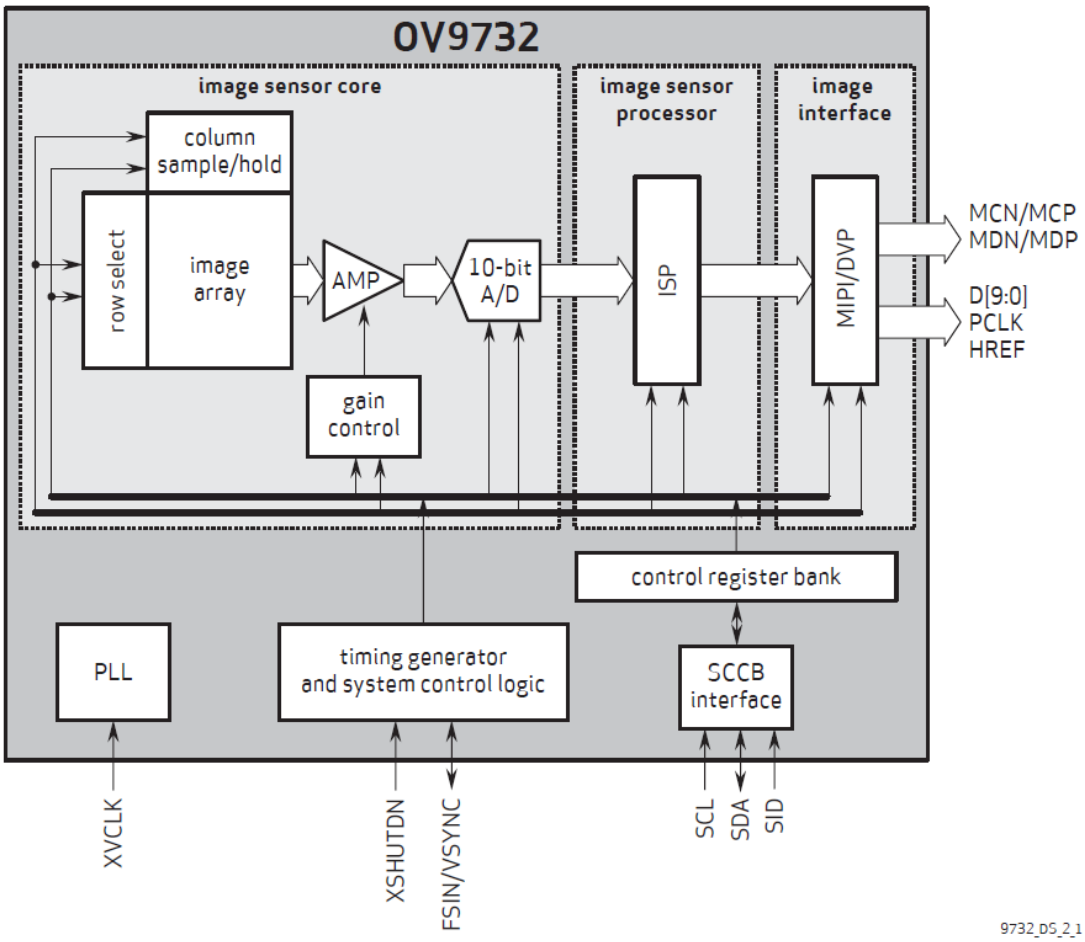
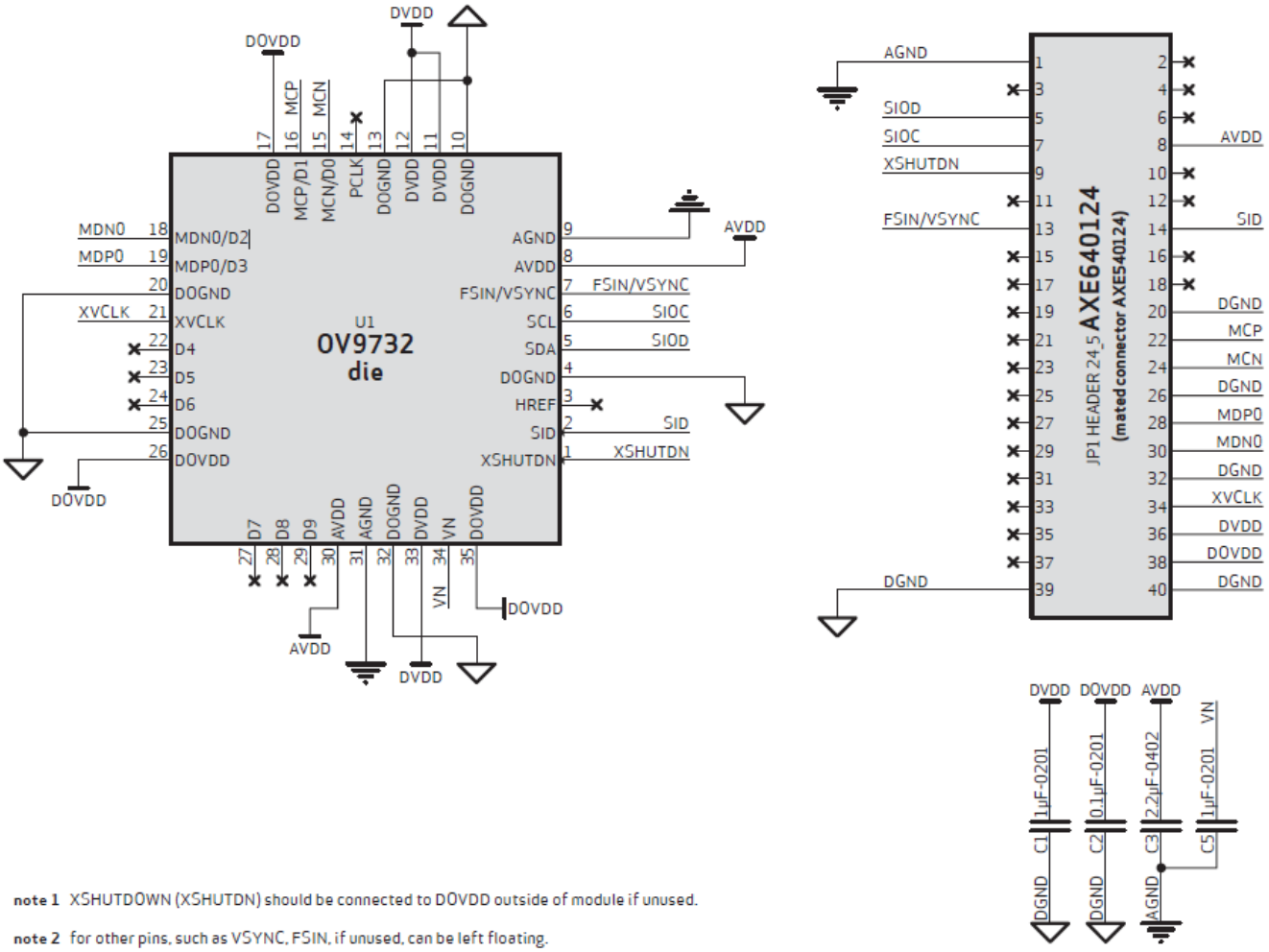


figure 2-2 reference design schematic



note 1 XSHUTDOWN (XSHUTDN) should be connected to DOVDD outside of module if unused.

note 2 for other pins, such as VSYNC, FSIN, if unused, can be left floating.

note 3 AVDD is 2.8V of sensor analog power (clean).
for better performance, place a 10 µF or bigger capacitor for AVDD LDO and place a 2.2 µF or bigger capacitor for AVDD pin (C3) inside module or very close to sensor.

note 4 DOVDD is 1.8V of sensor digital IO power (clean).

note 5 DVDD is 1.8V of sensor digital power and needs to be provided externally.

note 6 sensor AGND and DGND should be separated and connected to a single point outside PCB (do not connect inside module).

note 7 capacitors should be close to their related sensor pins.

note 8 traces of MCP, MCN, MDPx, and MDNx should have the same or similar length.
differential impedance of clock pair and data pair transmission lines should be controlled at 100 Ohm.

note 9 SID pin should be pulled low for device address 0x6C and pulled high for device address 0x20.

note 10 all NC pins can be left floating or connected to GND if needed.

9732_Wafer_DS_2_2

3. format and frame rate

The OV9732 supports the following formats: RAW8, RAW10 through MIPI.

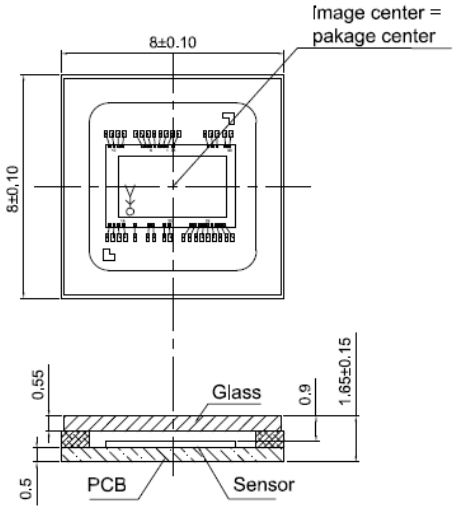
table 3-1 frame and frame rate

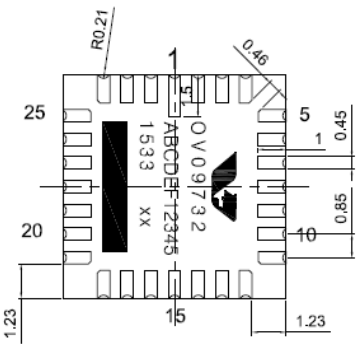
format	resolution	frame rate	methodology	MIPI speed	pixel clock
full, 10-bit	(1280+8) x (720+8)	30 fps	full resolution	360Mbps	36Mhz
VGA, 10-bit	(640+8) x (480+8)	45 fps	crop from full	360Mbps	36Mhz
2x2 binning RGB	(640+4) x (360+4)	60 fps	vertical /horizontal digital binning	180Mbps	36MHz
2x2 binning BW	(640+4) x (360+4)	60 fps	vertical neighbor pixels; horizontal neighbor pixels	180Mbps	36MHz

4 mechanical specifications

4.1 physical specifications

4-1figure package specifications





Signal Table			
Pin	Signal	Pin	Signal
1	HREF	15	D3/MDP
2	SDA	16	D4
3	SCL	17	D5
4	FSIN/VSYNC	18	D6
5	DVDD	19	D7
6	DOGND	20	D8
7	XVCLK	21	D9
8	PCLK	22	AGND
9	DOGND	23	AVDD
10	DOVDD	24	DOGND
11	DOGND	25	VN
12	D0/MCN	26	DVDD
13	D1/MCP	27	XSHUTDN
14	D2/MDN	28	SID

NOTE:
1.Sensor：OV09732
2.Glass T=0.55mm ,T>90% (spectral range 420-1100nm)
M: Noncotting Schott D263T
3.PCB 0.5mm M:BT Tg>195℃
4.Materials and processes are accordance with RoHs

Note1 all exposed metallized areas shall be gold-plate 0.05um min. thickness over nickel plate unless otherwise specified in purchase order

Note2 seal area and die attach area shall be without metallization

table 4-1 package dimensions (sheet 1 of 2)

dimensions	millimeters	inches
Package size	8.0±0.10 sq	0.3149±0.004 sq
Package height	1.65±0.15	0.065±0.006
Substrate base height	0.5±0.05	0.0197±0.002
Cavity size	6.0±0.20 sq	0.236±0.008 sq
Castellation height	0.6±0.05	0.0236±0.002
Pin 1# pad size	0.45 x 1.50	0.0177 x 0.059
Pad size	0.45 x 1.00	0.0177 x 0.0394
Pad pitch	0.85±0.05	0.0334±0.002
Package edge to first lead side	1.23±0.10	0.048±0.004
Glass size	7.80±0.10 sq	0.307±0.004 sq
Glass height	0.55±0.05	0.0216±0.002
Die thickness	0.25±0.015	0.0098±0.0006
Top of glass to image plane	0.90±0.10	0.035±0.004
Substrate height	1.10±0.10	0.043±0.004

4.2 IR reflow specifications

figure 4-2 IR reflow ramp rate requirements

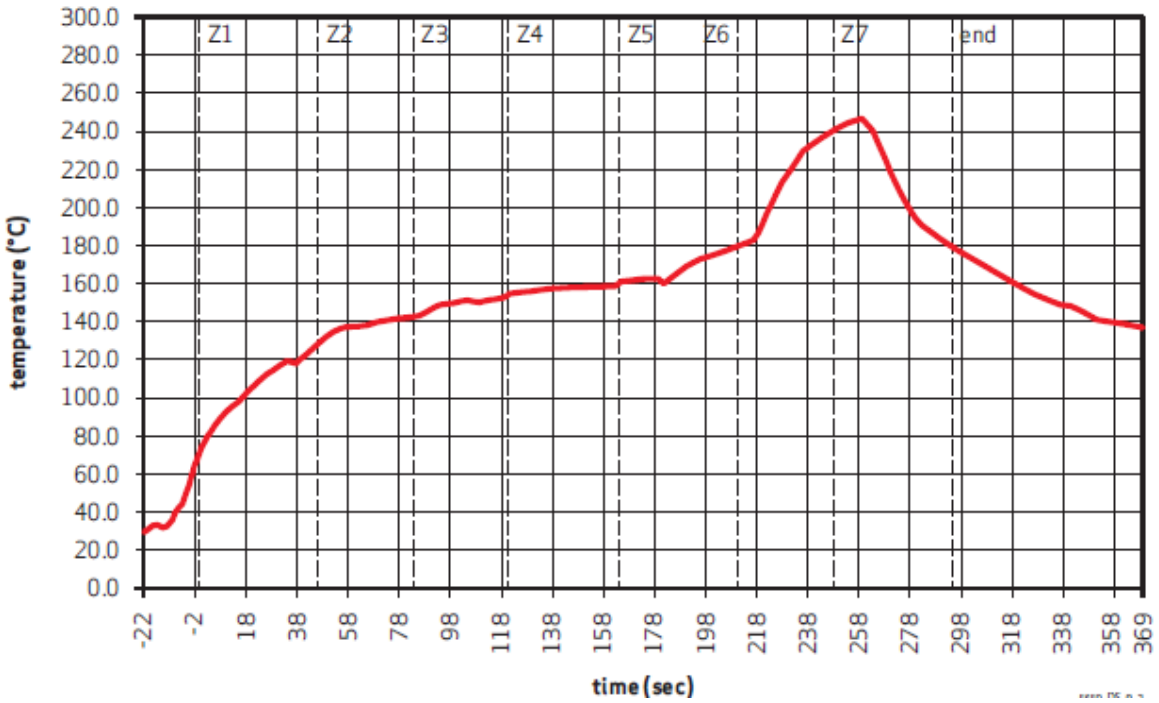


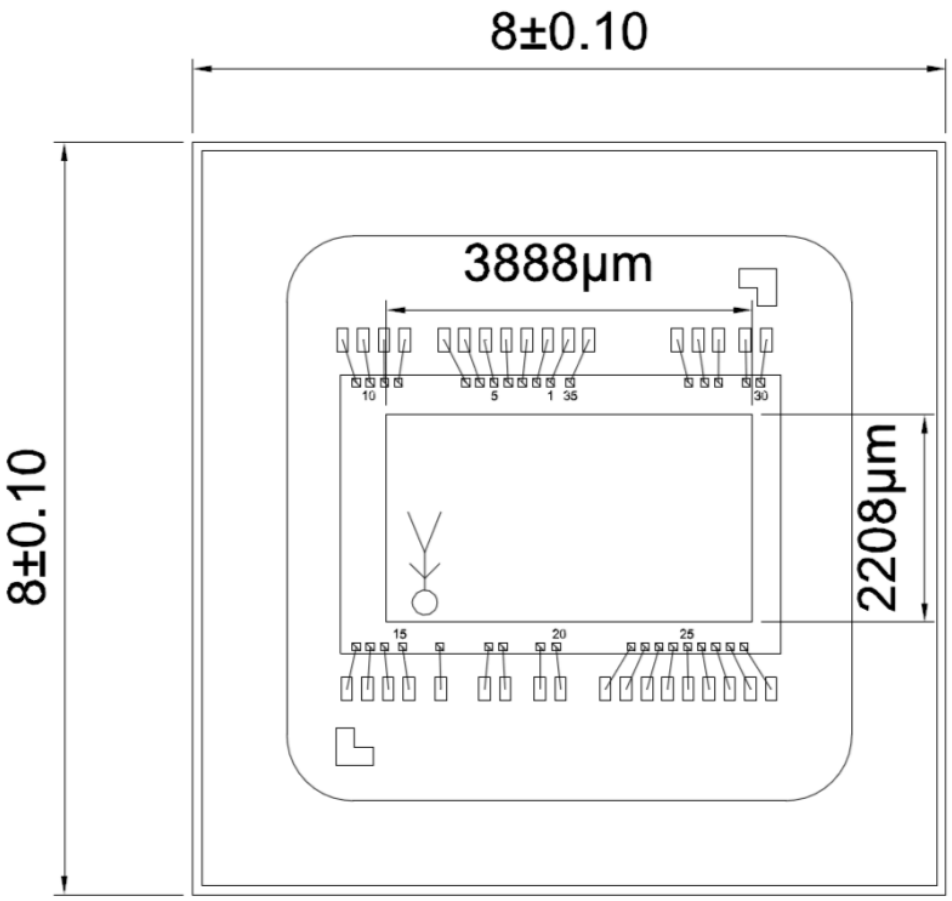
table 4-2 reflow conditions

condition	exposure
Average ramp-up rate (30℃ to 217℃)	Less than 3℃per second
> 100℃	Between 330 – 600 seconds
> 150℃	At least 210 seconds
> 217℃	At least 30 seconds (30 ~ 120 seconds)
Peak temperature	245℃
Cool-down rate (peak to 50℃)	Less than 6℃ per second
Time from 30℃ to 245℃	No greater than 390 seconds

5 optical specifications

5.1 sensor array center

figure 5-1 sensor array center



Array center = package center
(0um, 0um)

5.2 lens chief ray angle (CRA)

figure 5-2 chief ray angle (CRA)

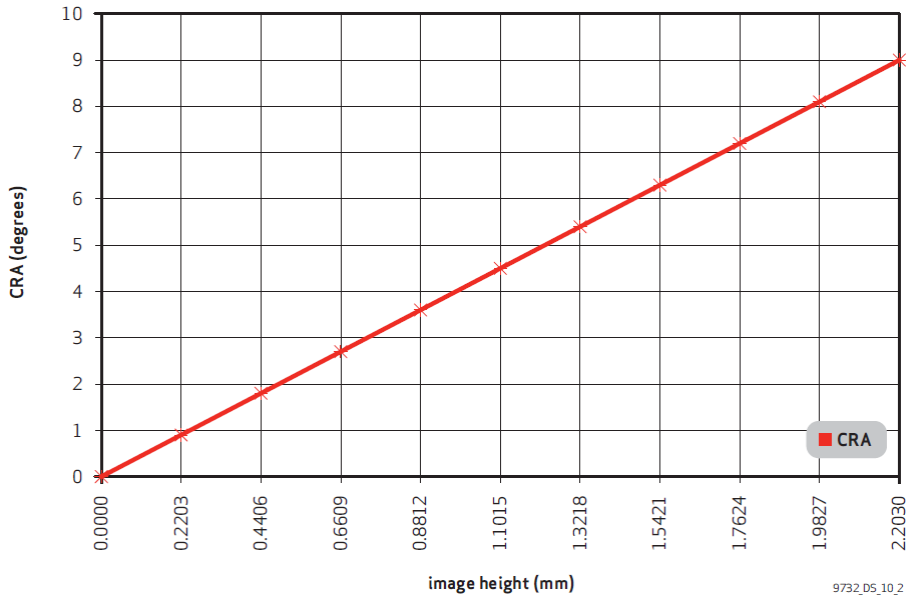
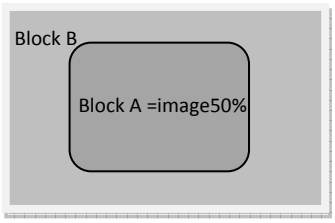
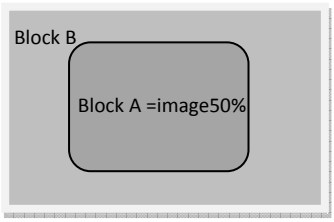
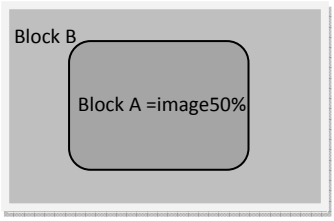
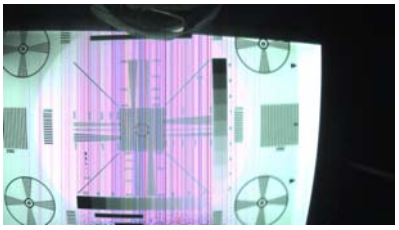


table 5-1 CRA versus image height plot

field (%)	image height (mm)	CRA (degrees)
0	0	0
0.1	0.2203	0.9
0.2	0.4406	1.8
0.3	0.6609	2.7
0.4	0.8812	3.6
0.5	1.1015	4.5
0.6	1.3218	5.4
0.7	1.5421	6.3
0.8	1.7624	7.2
0.9	1.9827	8.1
1	2.203	9

6. shipping specification

6.1 Image quality criteria

Test item	Description	Passing Criteria
Blemish		Block A: Depth → 15%, Block B: Depth → 25%. Block A: Size → 1 x 2 Pixel, Block B: Size → 2 x 3 Pixel
Black Pixel		Block A: Size → 1 x 1 Pixel, Block B: Size → 1 x 2 Pixel. A: Block A = 1 Block B≦ 2 B: Block A = 1 Block B≦ 4 C: Block A = 1 Block B≦ 8 D: Block A = 1 Block B≦ --
White Pixel		Block A: Size 1 x 1 Pixel, Block B: Size 1 x 2Pixel. A: Block A = 1 Block B≦ 2 B: Block A = 1 Block B≦ 4 C: Block A = 1 Block B≦ 8 D: Block A = 1 Block B≦ ---
Loss Bit		Not accepted
Dead Line		Not accepted

6.1.1 Blemish Test:

- ☐ Chart: Light Panel For Inspection
- ☐ Fixture: Standard lamp box
- ☐ Program: Camera Test
- ☐ Test Distance: 0

Block A: Depth 15%, Block B: Depth 20%.

Block A: Size 1 x 2 Pixel, Block B: Size 2 x 3 Pixel.

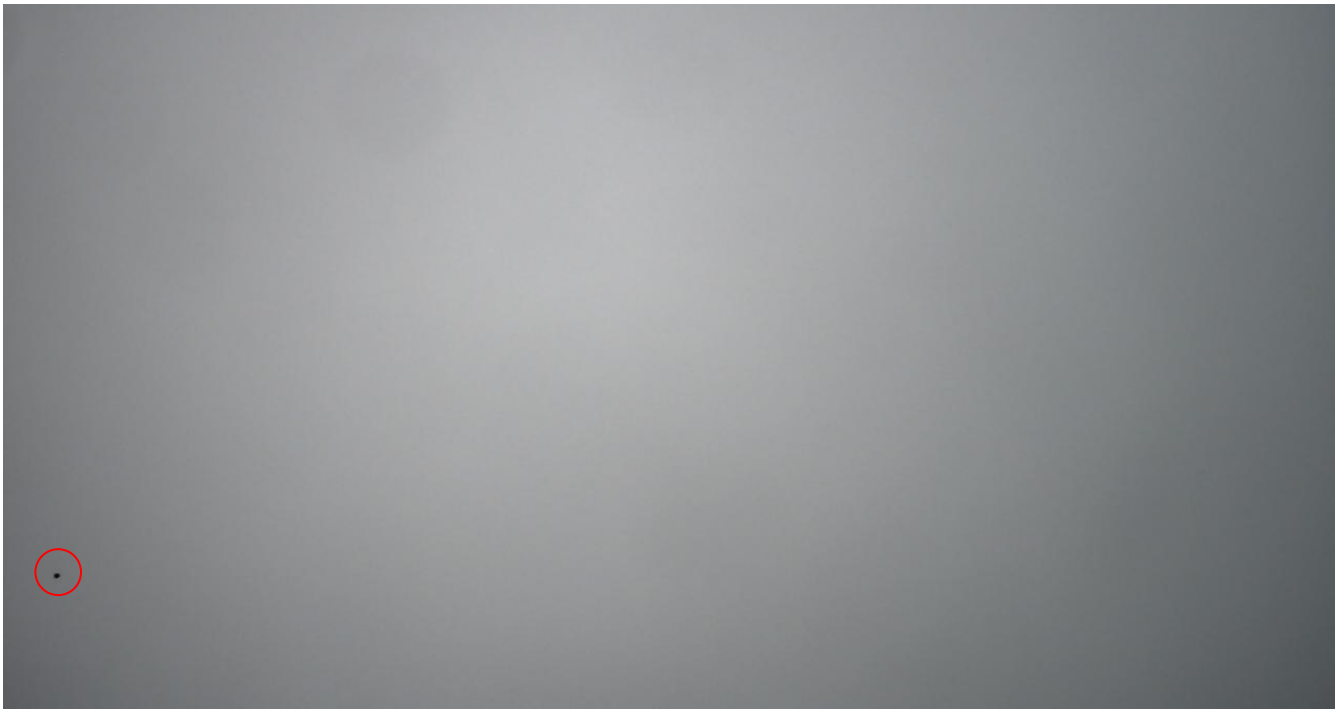
6.1.2 Black Pixel Test:

☐ Chart: Light Panel For Inspection

☐ Fixture: Standard lamp box

☐ Program: Camera Test

☐ Test Distance: 0



Block A: Size 1 x 1 Pixel, Block B: Size 1 x 2 Pixel.

6.1.3 White Pixel Test:

☐ Chart: Light Panel For Inspection

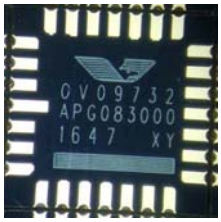
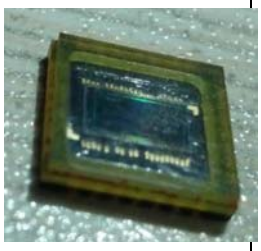
☐ Fixture: Standard lamp box

☐ Program: Camera Test

☐ Test Distance: 0

Block A: Size 1 x 1 Pixel, Block B: Size 1 x 2 Pixel.

6.2 appearance specifications

NO.	Item	Description	Judge		Inspection method and equipment
			ACC	REJECT	
1	Scratch	Surface and back	wide< 0.05mm NO.<2	over	visual /test tool
2	Glass chipping	Surface galss	Length <0.3mm Width <0.2mm	over	visual /test tool
3	Goden finger	Non oxidation and residual gum, Do not scratch more than 1/3Pad			visual /test tool
4	Mark & text	1, visual identification of text content (English and digital); 2, the content cannot be wrong.			visual /test tool
5	Glass shift	not over the PCB side			visual /test tool