



PRODUCT SPECIFICATIONS

Module Name: P5V04A

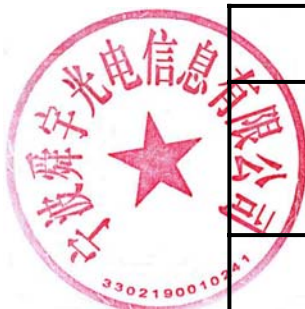
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Customer			
Approved	Checked	In charge	

These specifications are composed of 21 pages, including this title page.



NingBo Sunny Opotech Co.,Ltd		
Approved	Checked	In charge



Revise History

Rev	Date	Description
Ver1.0	2013-05-17	Draft

1. Scope

This approval sheet contains the general information of P5V04A QSXGA CMOS camera module designed for NINGBO SUNNY OPOTECH CO., LTD. It contains the key features of the module as well as the information for the quality inspection and reliability test purposes.

2. Features

- 1.4 μm x 1.4 μm pixel with OmniBSI technology for high performance (high sensitivity, low crosstalk, low noise)
- optical size of 1/4"
- automatic image control functions: automatic exposure control (AEC), automatic gain control (AGC), automatic white balance (AWB), automatic band filter (ABF), automatic 50/60 Hz luminance detection, and automatic black level calibration (ABLC)
- programmable controls for frame rate, AEC/AGC 16-zone size/position/weight control, mirror and flip, cropping, windowing, and panning
- image quality controls: lens correction, defective pixel canceling
- support for output formats: 8-/10-bit raw RGB data
- support for video or snapshot operations
- support for LED and flash strobe mode
- support for internal and external frame synchronization for frame exposure mode
- support for horizontal and vertical sub-sampling
- standard serial SCCB interface
- digital video port (DVP) parallel output interface
- MIPI interface (two lanes)
- 32 bytes of embedded one-time programmable (OTP) memory
- on-chip phase lock loop (PLL)
- embedded 1.5V regulator for core power
- programmable I/O drive capability, I/O tri-state configurability
- support for black sun cancellation

Applications

- Cellular phones
- toys
- PC multimedia
- digital still cameras



2.1 General Description

2.1.1 Camera Module Specification

No.	Item	Specification
1	Sensor	OV05647
2	Lens Size	1/4 Inch
3	Pixel array number	2592×1944
4	Power Supply	Core = 1.5V±5%; Analog = 2.6-3.0V; I/O = 1.7-3.0V
5	Power requirements	Active:96mA; Standby:20μA
6	Output formats	8-/10-bit RGB Raw output
7	Input clock frequency	6-27MHz
8	maximum image transfer rate	QSXGA (2592x1944): 15 fps 1080p: 30 fps 960p:45fps 720p:60 fps VGA (640x480): 90 fps QVGA (320x240): 120 fps
9	Max S/N ratio	34dB
10	Dynamic range	67dB@8×gain
11	Sensitivity	600mV/lux-sec
12	Dark current	8mV/s@ 50°C junction temperature
13	Maximum exposure interval	1968×tROW
14	Pixel size	1.4μm×1.4μm
15	Image area	3673.6μm×2738.4μm

2.1.2 Camera Lens Specification

No.	Item	Specification
1	Lens Size	1/4"
2	Lens Construction	4 P
3	Focal Length	3.57mm
4	F/NO.	2.8
5	Field of View Angle (Diagonal)	65°
6	Focusing Range	0.69M—∞ (AT 1.38M)
7	Image Quality	Center≥1200 LW/PH,Edge≥1000LW/PH

2.2 Camera Module Sensor Electrical Specification

2.2.1 Sensor Absolute Maximum Ratings

parameter		absolute maximum rating ^a
ambient storage temperature		-40°C to +125°C
supply voltage (with respect to ground)	V _{DD-A}	4.5V
	V _{DD-D}	3V
	V _{DD-IO}	4.5V
electro-static discharge (ESD)	human body model	2000V
	machine model	200V
all input/output voltages (with respect to ground)		-0.3V to V _{DD-IO} + 1V
I/O current on any input or output pin		±200 mA

- a. exceeding the absolute maximum ratings shown above invalidates all AC and DC electrical specifications and may result in permanent damage to the device. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

2.2.2 Timing characteristics

symbol	parameter	min	typ	max	unit
oscillator and clock input					
f _{OSC}	frequency (XCLK)	6	24	27	MHz
t _r , t _f	clock input rise/fall time			5 (10 ^a)	ns

- a. if using the internal PLL



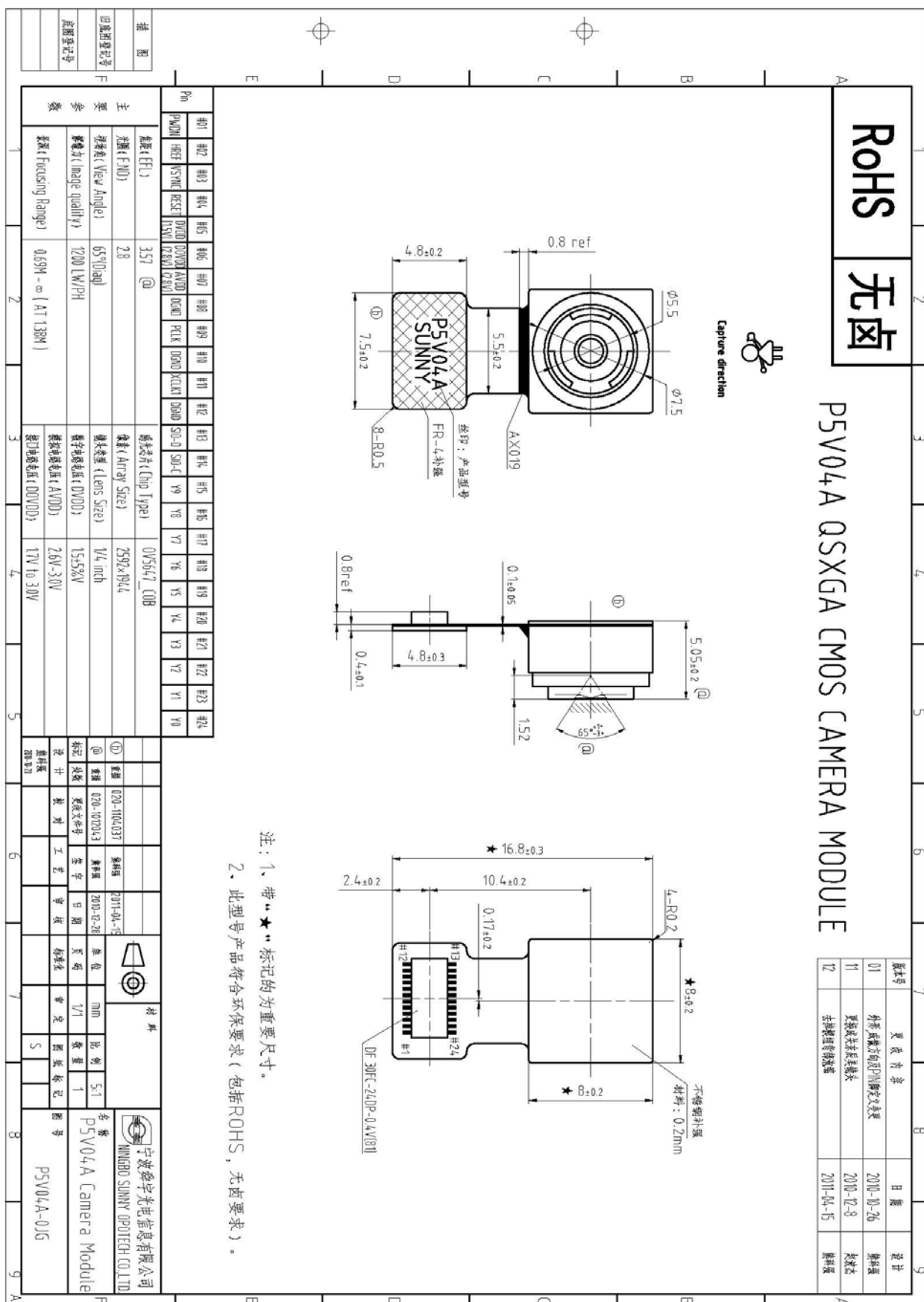
2.2.3 DC Characteristics

symbol	parameter	min	typ	max	unit
supply					
V _{DD-A}	supply voltage (analog)	2.6	2.8	3.0	V
V _{DD-DO}	supply voltage (digital I/O)	1.7	1.8	3.0	V
V _{DD-D}	supply voltage (digital core) ^a	1.425	1.5	1.575	V
V _{DD-E}	supply voltage (MIPI)	1.425	1.5	1.575	V
internal DVDD, EVDD short to DVDD, DVP output, AVDD = 2.8V, DOVDD = 2.8V					
I _{DD-A}	active (operating) current 2592 x 1944 @ 15 fps ^b		31	45	mA
I _{DD-DO}			65	85	mA
I _{DD-A}	active (operating) current 1080p @ 30fps		32	45	mA
I _{DD-DO}			60	78	mA
I _{DD-A}	active (operating) current 720p @ 60fps		34	45	mA
I _{DD-DO}			58	75	mA
I _{DD-A}	active (operating) current 720p @ 30fps		34	45	mA
I _{DD-DO}			35	48	mA
I _{DD-A}	active (operating) current VGA @ 60fps		34	45	mA
I _{DD-DO}			32	44	mA
I _{DD-A}	active (operating) current VGA @ 30fps		34	45	mA
I _{DD-DO}			20	28	mA
internal DVDD, EVDD short to DVDD, MIPI output, AVDD = 2.8V, DOVDD = 2.8V					
I _{DD-A}	active (operating) current 2592 x 1944 @ 15 fps ^c		31	45	mA
I _{DD-DO}			60	78	mA
I _{DD-A}	active (operating) current 1080p @ 30fps		32	45	mA
I _{DD-DO}			56	73	mA
I _{DD-A}	active (operating) current 720p @ 60fps		34	45	mA
I _{DD-DO}			56	74	mA
I _{DD-A}	active (operating) current 720p @ 30fps		34	45	mA
I _{DD-DO}			32	44	mA
I _{DD-A}	active (operating) current VGA @ 60fps		34	45	mA
I _{DD-DO}			32	44	mA
I _{DD-A}	active (operating) current VGA @30fps		34	45	mA
I _{DD-DO}			20	28	mA

symbol	parameter	min	typ	max	unit
standby current					
$I_{\text{DDS-SCCB}}^{\text{d}}$	standby current		20	50	μA
$I_{\text{DDS-PWDN}}$			20	50	μA
digital inputs (typical conditions: AVDD = 2.8V, DVDD = 1.5V, DOVDD = 1.8V)					
V_{IL}	input voltage LOW			0.54	V
V_{IH}	input voltage HIGH	1.26			V
C_{IN}	input capacitor			10	pF
digital outputs (standard loading 25 pF)					
V_{OH}^{e}	output voltage HIGH	1.62			V
V_{OL}^{e}	output voltage LOW			0.18	V
serial interface inputs					
V_{IL}^{e}	SCL and SDA	-0.5	0	0.54	V
V_{IH}^{e}	SCL and SDA	1.26	1.8	2.3	V

- when internal regulator is bypassed
- using internal regulator for DVDD and short DVDD with EVDD; DOVDD = 2.8V. The currents are for DVP output. MIPI output will results 5%-10% lower active current on $I_{\text{DD-DO}}$
- using internal regulator for DVDD and short DVDD with EVDD; DOVDD = 2.8V. The currents are for DVP output. MIPI output will results 5%-10% lower active current on $I_{\text{DD-DO}}$
- external clock is stopped during measurement
- based on DOVDD = 1.8V

3. Camera Module Configuration Specification




4. Camera Module PIN Description

Pin Number	Name	Pin type	Function/Description
Pin 1#	PWDN	Function	Power Down Mode Selection
Pin 2#	HREF	Output	HSYNC output
Pin 3#	VSYNC	Output	Vertical sync output
Pin 4#	RESET	Input	Clears all registers and resets them to their default values.
Pin 5#	DVDD	Power	Power supply for digital logic core
Pin 6#	DOVDD	Power	Digital power supply for I/O
Pin 7#	AVDD	Power	Analog power supply
Pin 8#	DGND	Ground	Digital ground
Pin 9#	PCLK	Output	Pixel clock output
Pin 10#	DGND	Ground	Digital ground
Pin 11#	XCLK1	Input	System clock input
Pin 12#	DGND	Ground	Digital ground
Pin 13#	SIO_D	I/O	SCCB serial interface data I/O
Pin 14#	SIO_C	Input	SCCB serial interface clock input
Pin 15#	Y9	Output	Data output bit[9]
Pin 16#	Y8	Output	Data output bit[8]
Pin 17#	Y7	Output	Data output bit[7]
Pin 18#	Y6	Output	Data output bit[6]
Pin 19#	Y5	Output	Data output bit[5]
Pin 20#	Y4	Output	Data output bit[4]
Pin 21#	Y3	Output	Data output bit[3]
Pin 22#	Y2	Output	Data output bit[2]
Pin 23#	Y1	Output	Data output bit[1]
Pin 24#	Y0	Output	Data output bit[0]



5. Dead Pixel and Stain Test Standard

Items	Test method		
<div>Dead pixel</div> <div></div>	<div>Test condition:</div> <div>Color temperature: 5000~6000K</div> <div>Luminance: 300~600lux</div> <div>Test distance: 1-3CM</div> <div>Test method: (Test by software)</div> <div>To choose a 10*10 area around the test pixel.</div> <div>To calculate the average luminance of that area AVR(Y) and luminance of test pixel Pix(Y).</div> <div>One. Calculation standard of black and white dead pixel, black and white damaged pixel</div> <div>Black pixel test: formula $\Delta = (AVR(Y) - Pix(Y))/AVR(Y)$;</div> <div>1、$\Delta > \text{black dead pixel standard}$, it is black dead pixel</div> <div>2、$\text{Black dead pixel standard} > \Delta > \text{black damaged pixel standard}$, it is black damaged pixel.</div> <div>White pixel test: formula $\Delta = Pix(Y) - AVR(Y)$。</div> <div>1、$\Delta > \text{white dead pixel standard}$, it is white dead pixel</div> <div>2、$\text{white dead pixel standard} > \Delta > \text{white damaged pixel standard}$, it is white damaged pixel.</div> <div>Two. Definition of group pixels</div> <div>1、Group of dead pixels:</div> <div>greater than 5 dead pixels in a row called Group of dead pixels.</div> <div>2、Group of damaged pixels:</div> <div>greater than 12 damaged pixels in a row called Group of damaged pixels .</div> <div>Three. Standard:</div> <div>Group of dead pixels and damaged pixels cannot be allowed at center and corners.</div>		
Standard			
Pixel	P5V04A	Pixel	P5V04A
1. White dead pixel standard: (Unit: DN)	50	4.Black damaged pixel standard: (Unit: %)	20%
2.White damaged pixel standard : (Unit: DN)	40	5.The smallest pixel of Group of dead pixels:	6
3.Black dead pixel standard: (Unit: %)	40%	6.The smallest pixel of Group of damaged pixels:	13

Stain Pixel



Test condition:

Light source color temperature: 5000~6000K

Uniform light source illuminance: 300~600lux

Testing distance: 1-3CM

Test method:

Choose surrounding 20X20 area of the tested pixel. Calculate the area average brightness AVR(Y) and the brightness of the tested pixel Pix(Y)。

One. Calculation standard of dark and light stain

Formula delta = (AVR(Y)- Pix(Y)):

1、Delta>deep stain pixel standard, it is deep stain pixel;

2、deep stain pixel standard>Delta>slight stain pixel standard, it is slight stain pixel

Two. Definition of stain lump

1、Deep stain pixel lump:

greater than 80 dark stain pixels in a low

2、Slight stain pixel lump:

greater than 128light stain lump pixels in a low.

Three. Standard:

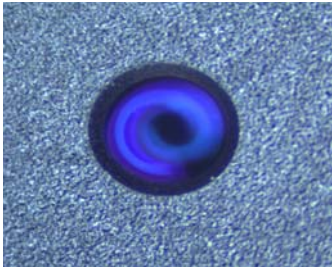
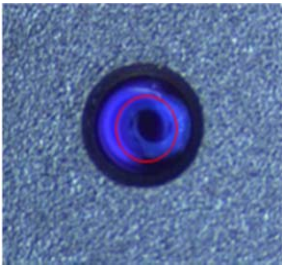
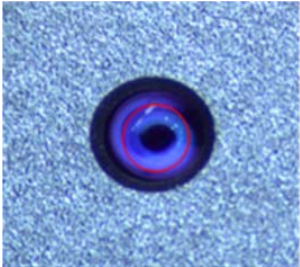
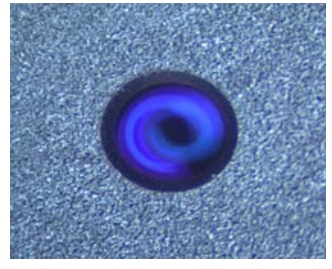
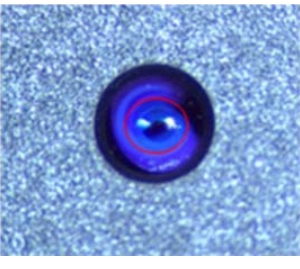
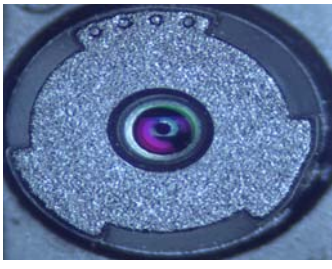
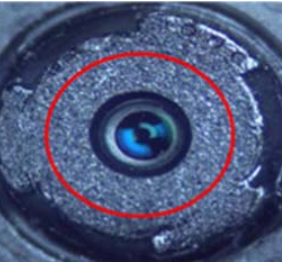
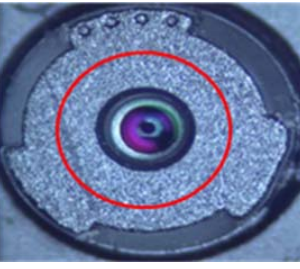
Deep and slight stain pixel lump cannot be allowed at center and corners.

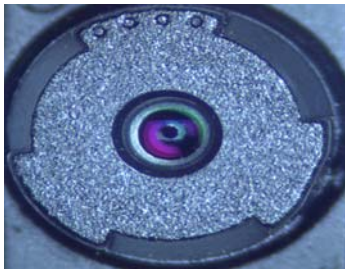
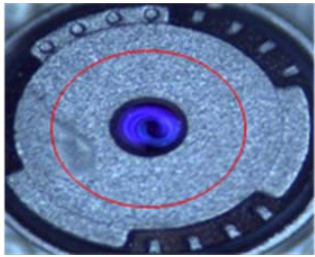
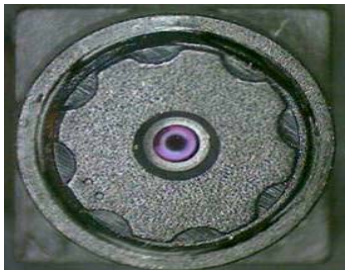
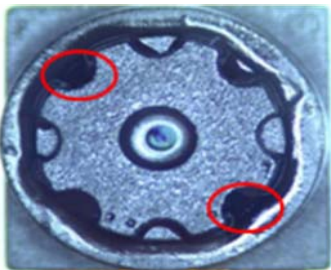

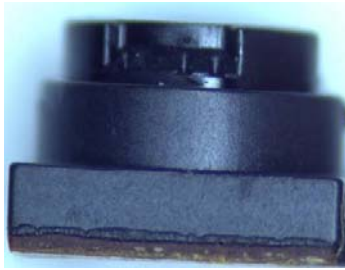
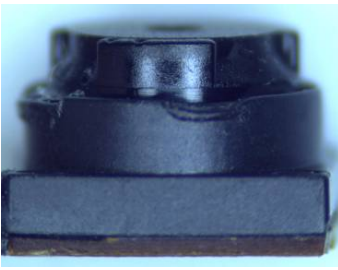
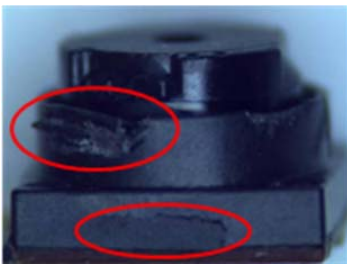
Standard

Pixel	P5V04A		Pixel	P5V04A
1.Deep stain pixel standard (Unit: DN)	3.5		3.The smallest pixel of dark stain pixel lump::	81
2.Slight stain pixel standard (Unit: DN)	2		4.The smallest pixel of light stain pixel lump:	129



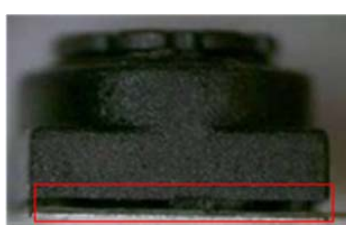
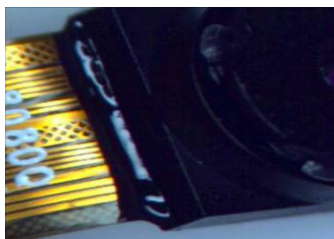
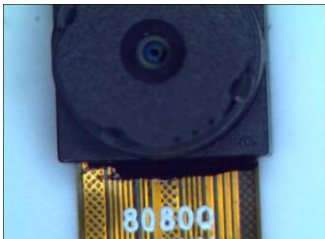
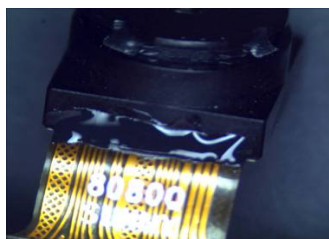
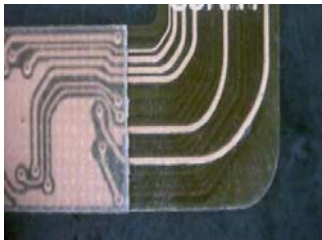
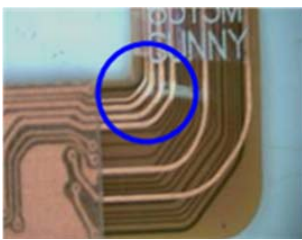
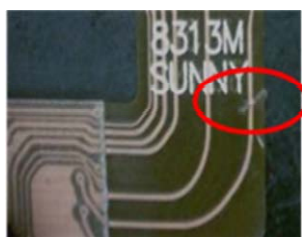


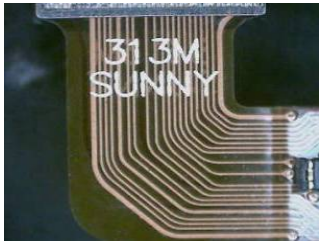
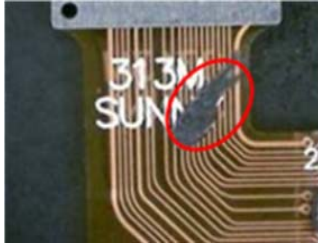



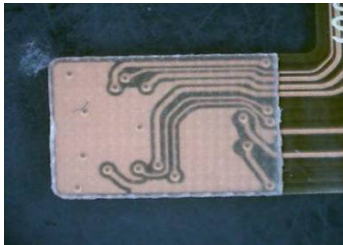
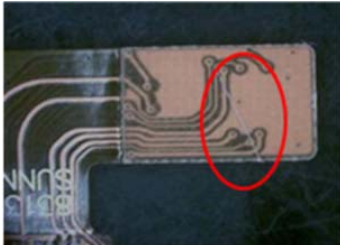
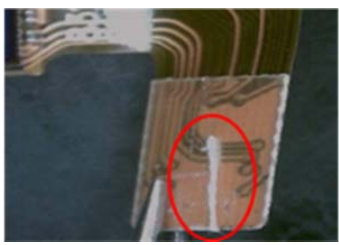

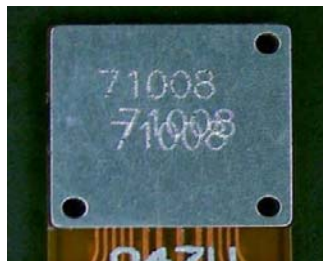

6. Inspection Items and Standard

SN	Insp. Item	Sample Picture	Acceptance level	Reject level
1	lens element No.01 damage			
		The surface of lens element No.01 should be clean without any scratches and damage.	Slight scratches in the margin of lens element NO.1. width \leq 0.2mm、length \leq 0.2mm	Scratches in the centre of lens element NO.1, width $>$ 0.2mm、length $>$ 0.2mm
2	lens element No.01 contamination		/	
		The surface of lens element No.01 should be clean without any contamination and foreign materials.	/	The surface of element No.01 should not have obvious glue, water stain, fingerprints, dust, scratch and so on.
3	Lens surface damage			
		The lens surface should be complete with no damage, injury and scratches.	The 1/2 surface of the lens center should be without deep scratch or injury that width $<$ 0.1mm and length $<$ 3mm. There is slight injury that does not affect flatness and could not be visually distinguished	The 1/2 surface of the lens are with scratches or injury that width $>$ 0.1mm and length $>$ 3mm. There are injury that will affect flatness and could be visually distinguished

4	Lens surface contamination		/	
		The lens surface should be clean without glue, contamination and whitening phenomenon	/	The 1/2 surface of the lens barrel have visually distinguished glue, contamination, leading to massive whitening phenomenon
5	UV glue dispensing of lens			
		The dispensing location is right. Dispense uniformly without glue overflow and missing.	There are glue overflow within the lens petal and the height of overflow is not higher than the lens.	UV glue is higher than the lens surface or spill the external ring of holder. There are miss dispensing or fall of UV glue.
6	Holder damage			
		The holder should be in good condition, without damage and debris.	There are slight scratches or damage in the margin of lens holder and can not be visually distinguished.	There are massive scratches or injury.



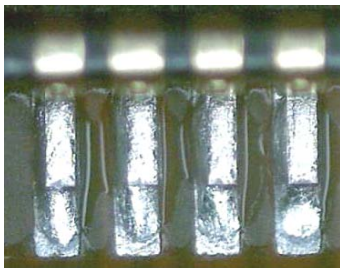
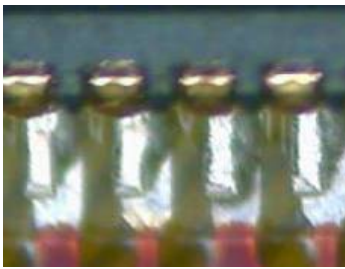
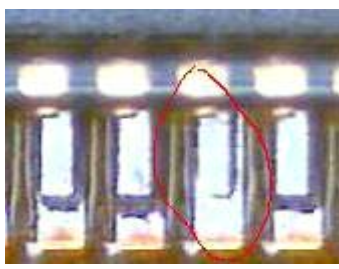
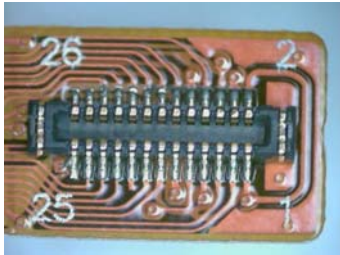
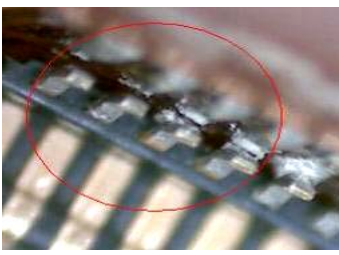
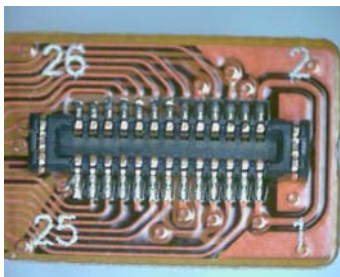
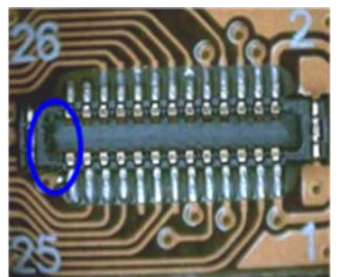
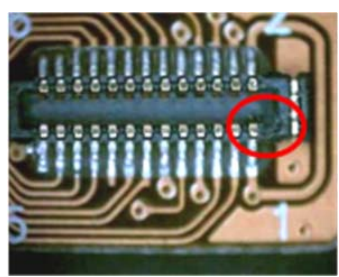
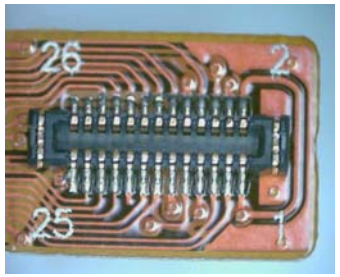
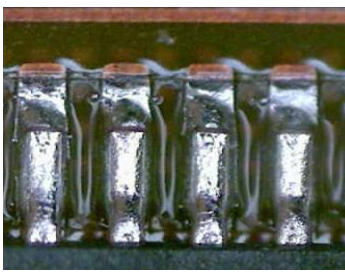
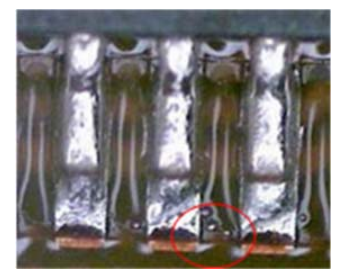
7	Opening between holder and FPC			
		FPC and substrate are connected closely without opening	There are slight cracking in the connecting place of holder and semi-finished product without visually distinguished.	There are obvious cracking in the connecting place of holder and semi-finished product
8	Final product dispensing / reinforcing glue			
		The dispensing location should comply with electronic drawing requirements, with moderate amount of glue and uniform width.	Slight nonuniform dispensing with dispensing width between 0.8~1.2mm and length > 3/4FPC width.	Miss dispensing, glue width not within 0.8~1.2mm, length ≤ 3/4FPC. The glue height is > 1/2 holder. nonuniform dispensing and gule dislocation.
9	FPC Injury			
		FPC should be in good condition with no injury.	There is slight scratch and not leading to FPC breakage or outleakage. The linkbelt margin damage depth should not bigger than 50% of the distance between margin and closest conducting wire and not affect module performance.	There are obvious mark, scratch or tear by visual inspection which has injured FPC. There is DART or acute angle in the linkbelt b ucking area or the linkbelt margin damage depth should not bigger than 50% of the distance between margin and closest conducting wire which will affect module formance.

10	FPC contamination		/	
		The FPC surface should be clean with no contamination	/	There is obvious glue which will affect the flatness and thickness of FPC by visually inspection
11	The silkscreen quality of FPC			
		The silkscreen mark is clear and in good condition	There is slight disappear of the silkscreen mark in the condition that not affect distinguishing information	All information in the silkscreen disappear and can not be distinguished.
12	Stiffening plate /SUS Plate			
		Stiffening plate /SUS Plate should be clean without contamination, injury, tilt and deformation	There is slight scratch in stiffening plate /SUS plate	There is serious scratch or obvious glue in stiffening plate or sus plate deformation.
13	FPC laser marking			
		The script of marking date should be clear and distinguished with consistent direction and upright location	There is tilt less than 30° or visual distinguished double image	Inversion, incomplete or double image which can not been distinguished by visula inspection

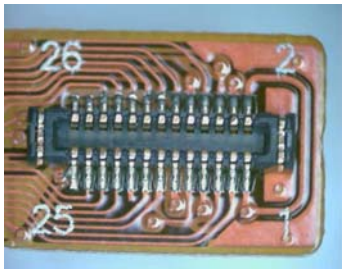
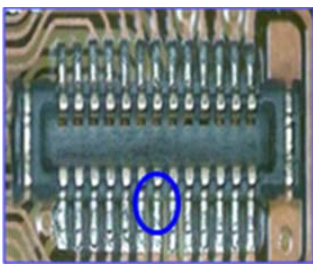
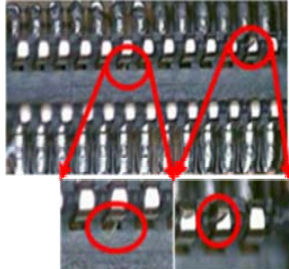
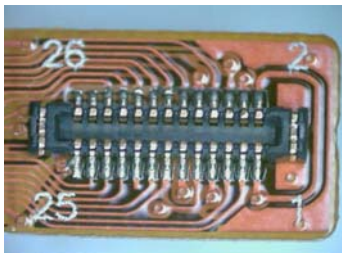
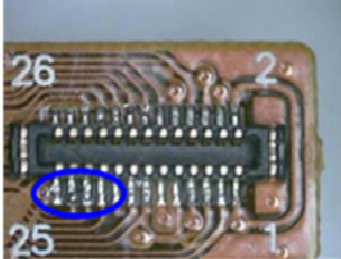
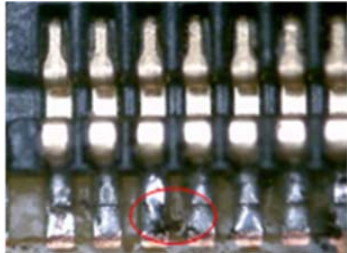


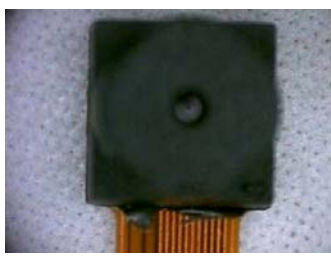




14	Connector shift- Portrait			
		The pins of the connector stand the center of the pads, no shift.	The connector shift does not exceed 1/2 pad in portrait.	The connector shift exceeds 1/2 pad in portrait.
15	Connector shift- landscape			
		The pins of the connector stand the center of the pads, no shift.	There is slight shift of connector and the landscape shift does not exceed 1/3W pad.	The connect shift is very serious and exceeds 1/3W in landscape.
16	sticking solder paste of connector			
		The pins of connector have good connecting with solder paste without bridge or sticking tin paste.	There is slight sticking solder paste and the distance is less than 2/3L (L refers to the distance between bottom bent and upper bent. The angle is less than 90°.	There is serious sticking solder paste in connector pins and the distance is more than 2/3L while the angle is less than 90°, which can be easily distinguished by microscope.



17	Insufficient solder paste of connector			
		The pins of connector have good connecting with solder paste and welding spot is round while the welding length is longer than pin lead length.	The welding length should be not shorter than pin lead L and there is solder stream in the side face of pins.	The welding length D is shorter than the pin lead length L and there is no solder stream in the side face of pins.
18	Connector tilt		/	
		The connector is welding flatly without tilt.	/	The pin floating is bigger than 0.2MM
19	Plastic parts scald of the connector			
		The connector is in good condition without injury.	There is no scald which will affect appearance, assembly and function.	There is scald which will affect appearance, assembly and function.
20	Solder ball of connector			
		There connector should be clear without residues within connector pins.	The diameter of residue solder ball could not exceed 50% of the min width of the connector and quantity should be less than 3.	The diameter of residue solder ball exceeds 50% of the min width of the connector and quantity is more than 3.



21	Connector blur			
		There connector should be clear without blur	There is blur between connect pins (not joint point) and plastic parts of two sides which will not affect performance.	There is blur in the connecting point between connector pins and mating connector.
22	Soldering flux of connector			
		There connector should be clear without visible residue.	There is some flux in the non contact area.	There is some flux in the contact area.
23	Final product glue overflow			
		There should be no glue overflow phenomenon at the junction between the holder and the FPCB board.	There is glue overflow of which the width is less than 0.8mm	Do not allow glue overflow more than 0.8mm.
24	Module key dimension measurement		/	
		The key dimensions marked "★" should be within tolerance range.	/	Key dimensions is out of tolerance range.

7. Reliability Test

No.	Test Item	Test Conditions	Judge Standard
1	Constant Temperate and Humidity Storage Test	Temperate: $60 \pm 3^{\circ}\text{C}$; Humidity: $90 \pm 3\%\text{RH}$; Test duration: 96H	No image distort and good color rendition.
2	High Temperate Storage Test	Temperate: $80 \pm 3^{\circ}\text{C}$; Test duration: 96H	No image distort and good color rendition.
3	Low Temperate Storage Test	Temperate: $-40 \pm 3^{\circ}\text{C}$; Test duration: 96H	No image distort and good color rendition.
4	High and Low Temperate Shock Test	High Temp.: $80 \pm 3^{\circ}\text{C}$; Low Temp.: $-40 \pm 3^{\circ}\text{C}$; Each Place Time: 30min; Number of Cycles: 30	No image distort and good color rendition.
5	High Temperate Function Test	Temperate: $60 \pm 3^{\circ}\text{C}$; Test Duration: 24H; Max Work Voltage	No image distort and good color rendition.
6	Low Temperate Function Test	Temperate: $-20 \pm 3^{\circ}\text{C}$; Test Duration: 24H; Max Work Voltage	No image distort and good color rendition.
7	Constant Temperate and Humidity Function Test	Temperate: $55 \pm 3^{\circ}\text{C}$; Humidity: 85%RH; Test Duration: 24H; Max Work Voltage	No image distort and good color rendition.
8	Vibration Test	Frequency Range: 10- 55-10Hz; Amplitude: 2mm; Test All 3 Axes (X, Y, Z); Duration 30min for Each Axis	No image distort and good color rendition.
9	ESD TEST	8KV Contact Discharge 12KV Air Discharge 10 Times for Second	No image distort and good color rendition.
10	Package Test	Floor: Concrete; Height: 100cm; Positions: 1corner, 3edge, 6 Surface; Each Surface Drop 3 Times	No image distort and good color rendition.
11	Drop Test	Floor: Concrete; Height: 150cm; Clamp Weight: 100g; Positions: 6 Surface; Each Surface Drop 3 Times	No image distort and good color rendition.



8. Packaging

8.1. Packaging Process

1. Every module is placed into a tray until all empty slots of a tray are filled. Each tray contains no more than 70 modules.
2. Each tray uses an anti-static bag to prevent the module from moisture by partially sucking out the air from the stack.
3. A stack has 10 trays.
4. Insert three stacks into a outside box. Then attach the label onto the outside box.

8.2. Labeling

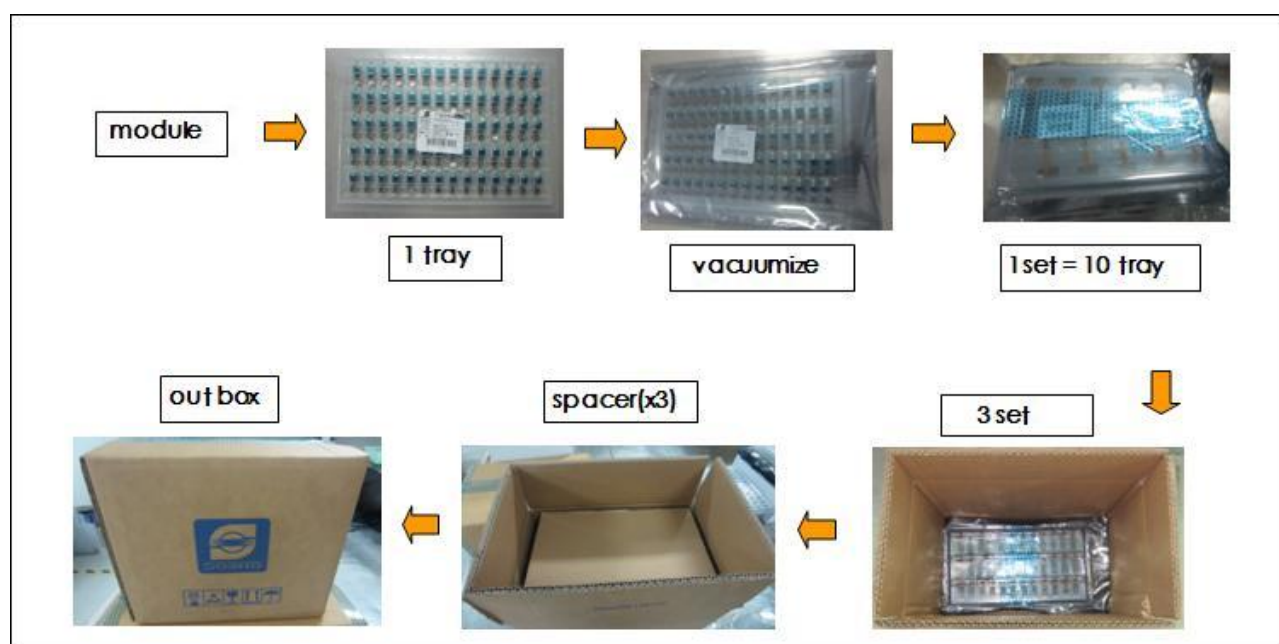
8.2.1 External box label

	宁波舜宇光电信息有限公司
物料编码:	_____
产品型号:	_____
订单号:	_____ 送货单号: _____
合格标记:	_____ 数量: _____
送货日期:	_____ XX-XX-XX
箱数及箱号:	共 X 箱 ; 第 X 箱
客户名称:	_____
备 注:	_____

8.2.2 internal case label

	产品合格证 RoHS
物料编号:	_____
产品型号:	_____
生产批号:	_____
检验工号:	_____ 数量: _____
日期:	_____ XXXX-XX-XX
* 2 3 0 9 5 4 0 - 1 *	

8.3. Sketch Map of Packing Process



9. Precautions

9.1. Storage and Operating Conditions

To keep the product and packaging material in good condition, care must be taken to control temperature and humidity in the storage area.

Recommended conditions:

Ambient temperature: 0~+40℃

Humidity: 30~70%RH

No rapid change on temperature and humidity.

The products listed in this catalog are not designed for use under the following conditions. Storage and/or usage under following conditions is prohibited.

- 1). Exposure to corrosive gas such as chlorine, hydrogen sulfide, ammonia, sulfur dioxide, nitrogen oxide, etc.
- 2). Exposure to direct sunlight.
- 3). Exposure to dust.
- 4). Exposure to excessive moisture or wet locations.
- 5). Exposure to salt water or sea breezes.
- 6). Exposure to strong static electricity or electromagnetic waves.

9.2. Transportation and Handling

1). Minimize any mechanical vibration or shock and avoid dropping of the product during transportation or dropping the product that contains the substrate.

2). Since the application of static electricity or over voltage may cause defect in the product or deterioration of its reliability, caution must be taken against exposure to any static electricity generated by electrified items such as workbenches, soldering irons, tools, carrying containers, etc.

3). Caution shall be taken to avoid overstress to the product.

– END –