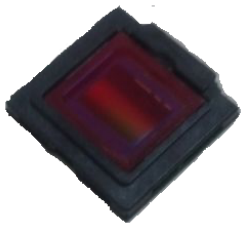


datasheet

PRODUCT SPECIFICATION

1/4” CMOS QSXGA(5 MEGA)image sensor with OmniBSI™ technology

OV5647

Content

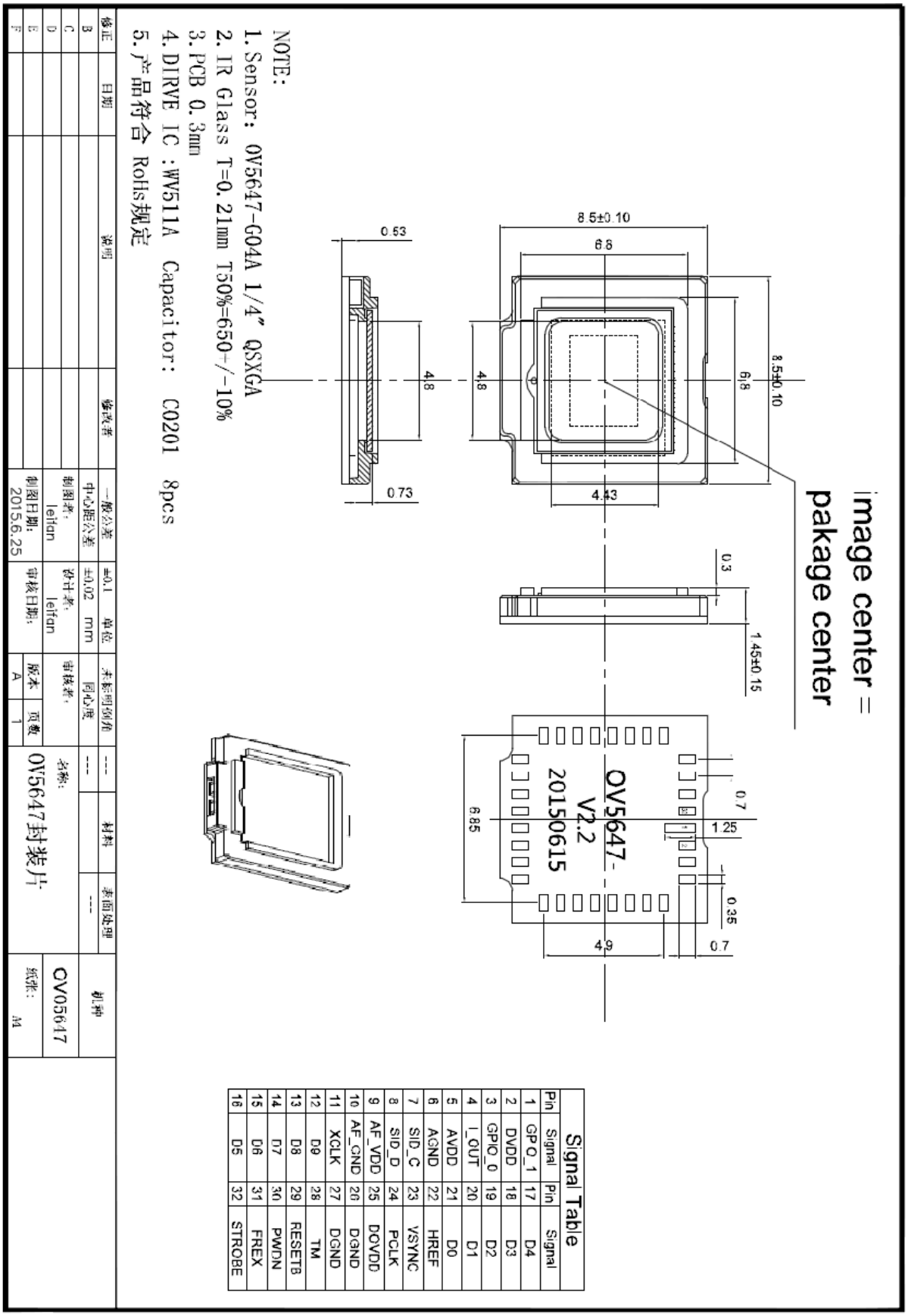
1. General Description

The OV5647 is a low voltage, high performance,5 megapixel CMOS image sensor that provides 2592x1944 video output using OmniBSI technology. It provides multiple resolution raw images via the control of the serial camera control bus or MIPI inter face.

The OV5647 has an image array capable of operating up to 15 fps in 2592x1944 resolution with user control of image quality, data transfer, camera functions through the SCCB interface. The OV5647 uses innovative OmniBSI technology to improve the sensor performance without the physical and optical trade-off.

For customized application, the OV5647 includes a one-time programmable (OPT) memory.

2. Mechanical Specifications (unit： mm)



3. Features

1. 1.4umx1.4um pixel with OmniBSI technology for high performance (high sensitivity, low crosstalk, low noise)
2. Optical size of 1/4”
3. Automatic image control functions: automatic exposure control (AEC), automatic 50/60 Hz luminance detection, and automatic

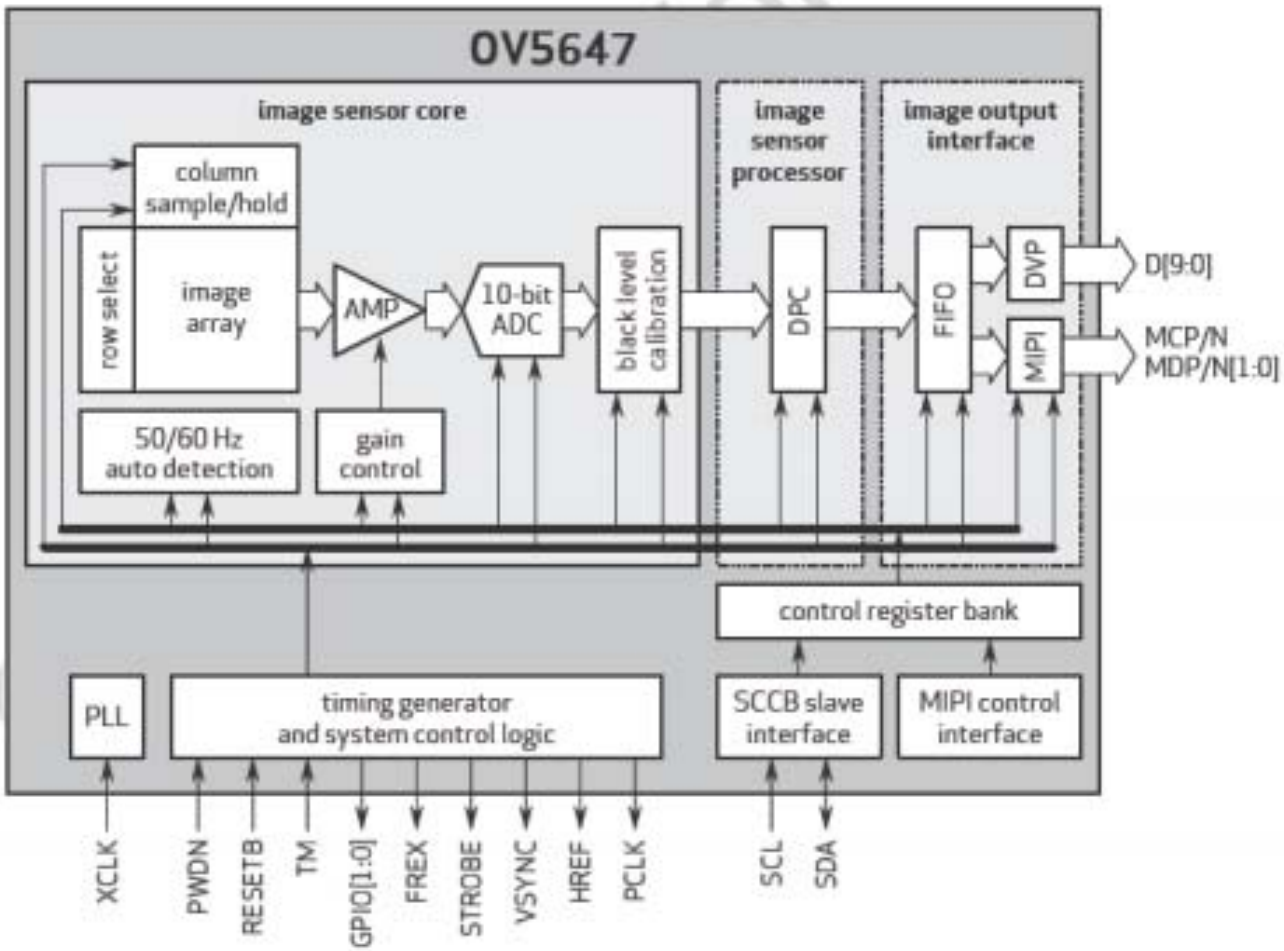
black level calibration (ABLC)

4. Programmable controls for frame rate, AEC/AGC 16-zone size/position/weight control, mirror and flip, cropping, windowing,

and panning.

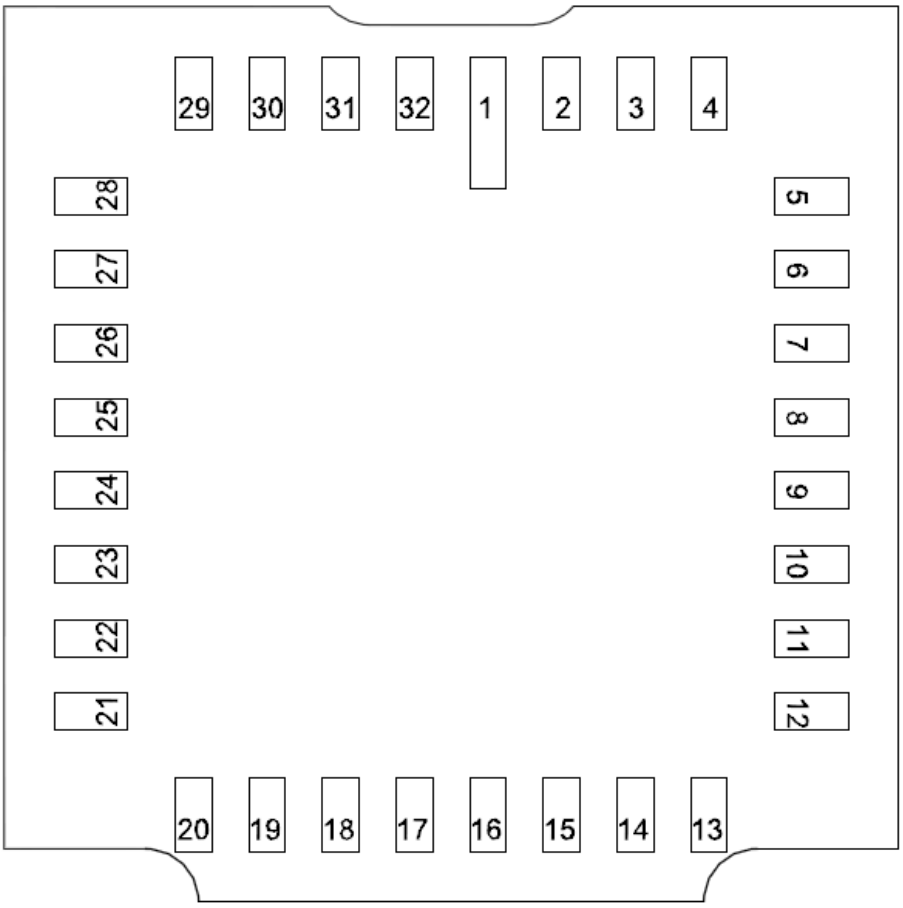
5. Image quality controls: lens correction, defective pixel canceling.
6. Support for output formats: 8-/10-bit raw RGB data.
7. Support for video or snapshot operations.
8. Support for LED and flash strobe mode.
9. Support for internal frame synchronization for frame exposure mode.
10. Support for horizontal and vertical sub-sampling.
11. Standard serial SCCB interface.
12. Digital video port (DVP) parallel output interface.
13. MIPI interface (two lanes).
14. 32 bytes of embedded one-time programmable (OTP) memory.
15. On-chip phase lock loop (PLL).
16. Embedded 1.5V regulator for core power.
17. Programmable I/O drive capability, I/O tri-state configurability.
18. Support for black sun cancellation.

4. LOGICAL SYMBOL DIAGRAM



5. Signal Description

5.1 Pin Assignment (Bottom View)



5.2 Pin Signal Description

Pin No	Pin Name	I/O	Description
1	GPIO1	I/O	GPIO1
2	DVDD	power	Power for digital core circuit, 1.5V (connect to 0.1uF capacitor to ground)
3	GPIO0	I/O	GPIO0
4	I_OUT	out	DRIVE IC I_out
5	AVDD	power	Power for analog circuit, 2.8V
6	AGND	power	Ground for analog circuit
7	SIO_C	input	SCCB clock input
8	SIO_D	I/O	SCCB data I/O
9	AF_VDD	power	Power supply (for Actuator driver 2.8V)
10	AF_GND	I/O	Connected to AF ground.
11	XCLK	input	System input clock
12	D9/MDN0	I/O	DVP data bit 9/MIPI data lane0 negative output
13	D8/MDP0	I/O	DVP data bit 8/MIPI data lane0 positive output
14	D7/MCN	I/O	DVP data bit 7/MIPI clock negative output
15	D6/MCP	I/O	DVP data bit 6/MIPI clock positive output
16	D5/MDN1	I/O	DVP data bit 5/MIPI data lane1 negative output
17	D4/MDP1	I/O	DVP data bit 4/MIPI data lane1 positive output
18	D3	I/O	DVP data bit 3
19	D2	I/O	DVP data bit 2
20	D1	I/O	DVP data bit 1
21	D0	I/O	DVP data bit 0
22	HREF	I/O	DVP HREF output
23	VSYNC	I/O	DVP VSYNC output

24	PCLK	I/O	DVP PCLK output
25	DOVDD	powe	Power for digital I/O, 1.7~3.0V
26	DGND	powe	Ground for digital I/O
27	DGND	powe	Ground for digital I/O
28	DGND	powe	Ground for digital I/O
29	RESETB	input	Hardware reset (active low with internal pull-up resistor)
30	PWDN	input	Power down control Normal version (active high with internal pull-down resistor) AC version (active low with internal pull-down resistor)
31	FREX	I/O	Frame exposure control
32	STROBE	I/O	Strobe output

6. Electrical 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					
$I_{DDS-SCCB}$[d]	standby current[e]		20	50	µA
$I_{DDS-PWDN}$			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}[f]	output voltage HIGH	1.62			V
V_{OL}[f]	output voltage LOW			0.18	V
serial interface inputs					
V_{IL}[f]	SCL and SDA	-0.5	0	0.54	V
V_{IH}[f]	SCL and SDA	1.26	1.8	2.3	V

a. when internal regulator is bypassed

b. 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_{DD-DO}

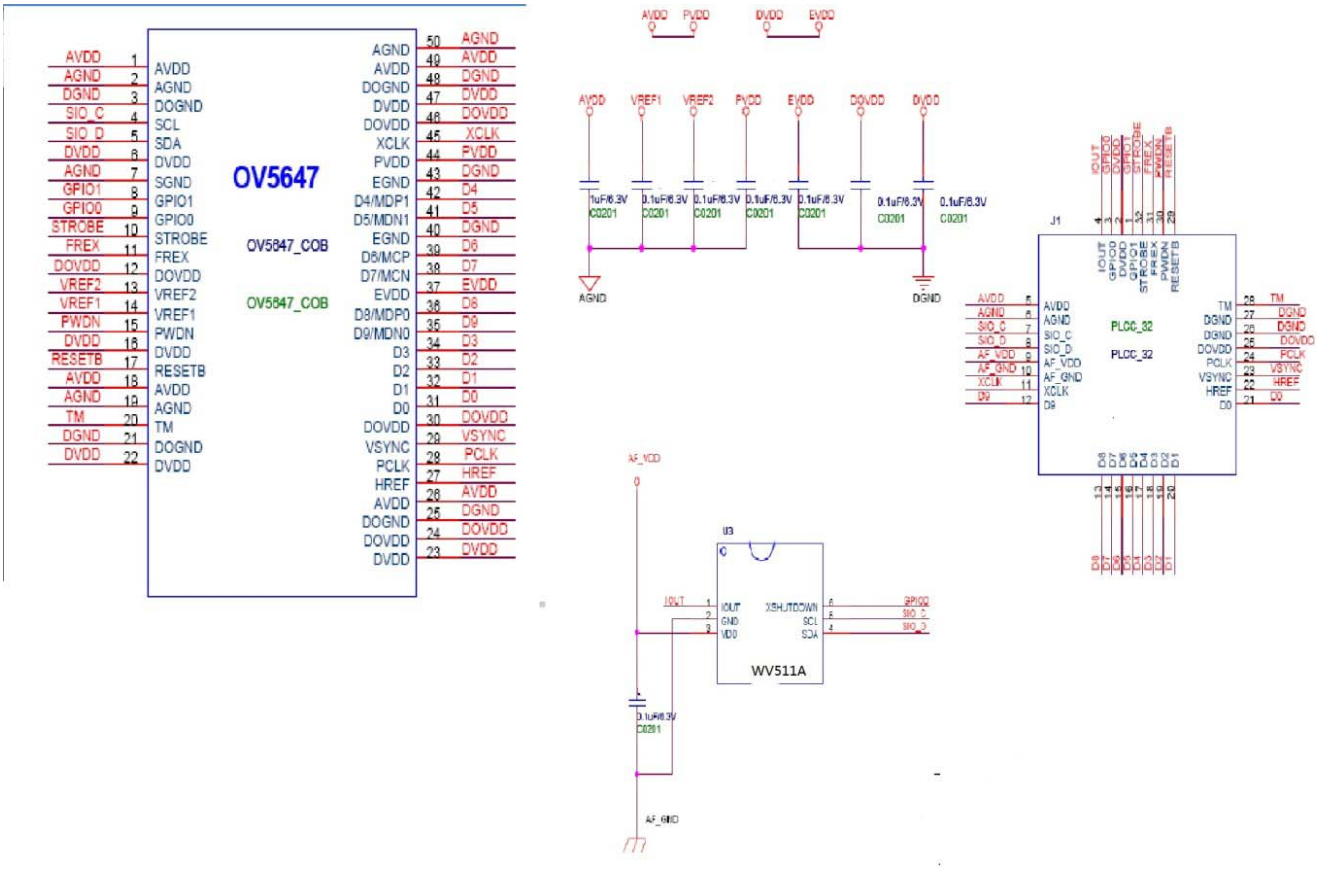
c. using internal regulator for DVDD and short DVDD with EVDD; DOVDD = 2.8V. The currents are for DVP output. MIPI output will results 5%-10% lower active current on I_{DD-DO}

d. external clock is stopped during measurement

e. standby current is based on room temperature

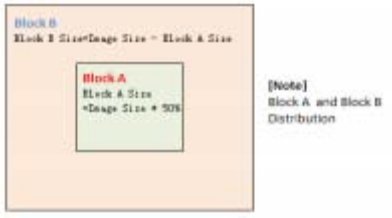
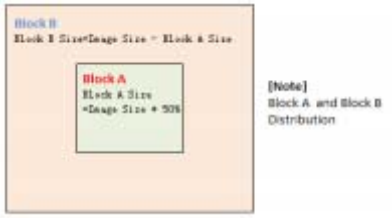
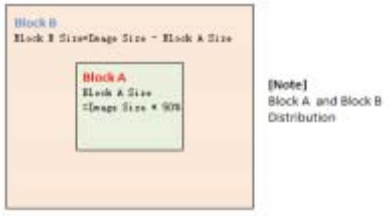
f. based on DOVDD = 1.8V

7. Internal Schematic



8. Test Specification

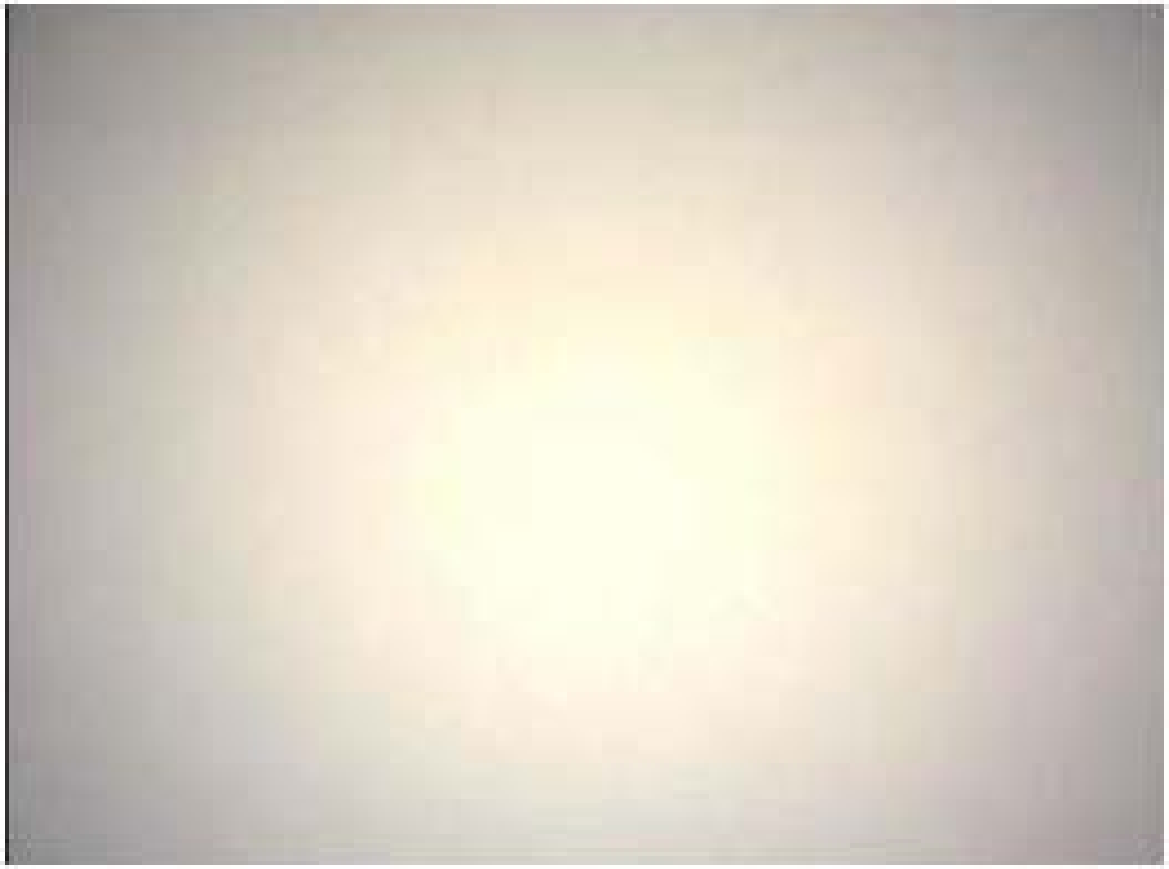
8.1 Image Quality Criteria

Test item	Description	Passing Criteria
Blemish		Block A: Depth → 15%, Block B: Depth → 25%. Block A: Size → 2 x 2 Pixel, Block B: Size → 3 x 3 Pixel
Black Pixel		Block A: Offset → 80, Block B: Offset → 120. Block A: Size → 1 x 1 Pixel, Block B: Size → 1 x 1 Pixel. A+: Block A = 0 Block B= 0 A: Block A = 0 Block B ≦ 2 B: Block A = 0 Block B ≦ 8 C: Block A = 0 Block B ≦ 15 D: Block A = 0 Block B ≦ 30 E: Block A ≧ 1 Block B ≧ 31
White Pixel		Block A: Offset → 50, Block B: Offset → 80. Block A: Size → 1 x 1 Pixel, Block B: Size → 1 x 1 Pixel. A+: Block A = 0 Block B= 0 A: Block A = 0 Block B ≦ 2 B: Block A = 0 Block B ≦ 8 C: Block A = 0 Block B ≦ 15 D: Block A = 0 Block B ≦ 30 E: Block A ≧ 1 Block B ≧ 31
Loss Bit		Not accepted
Dead Line		Not accepted

8.2 Function test

8.2.1 Blemish Test:

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

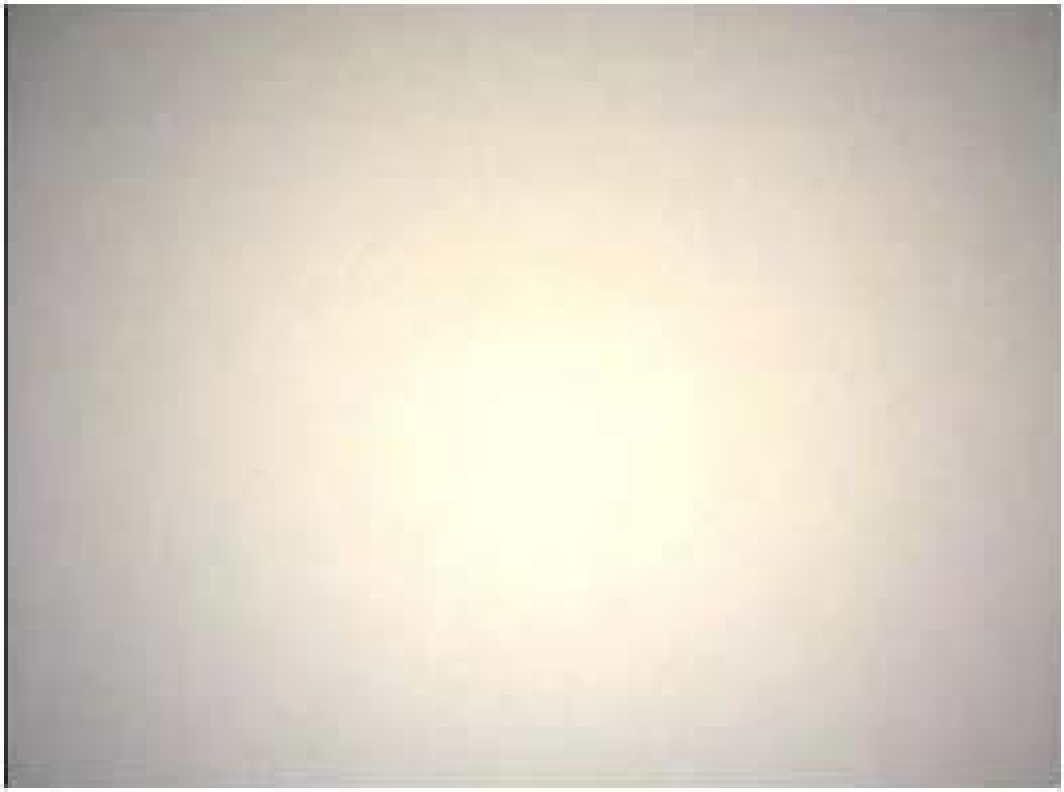


Block A: Depth → 15%, Block B: Depth → 25%.

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

8.2.2 Black Test:

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



Block A: Offset → 80,

Block A: Size → 1 x 1 Pixel,

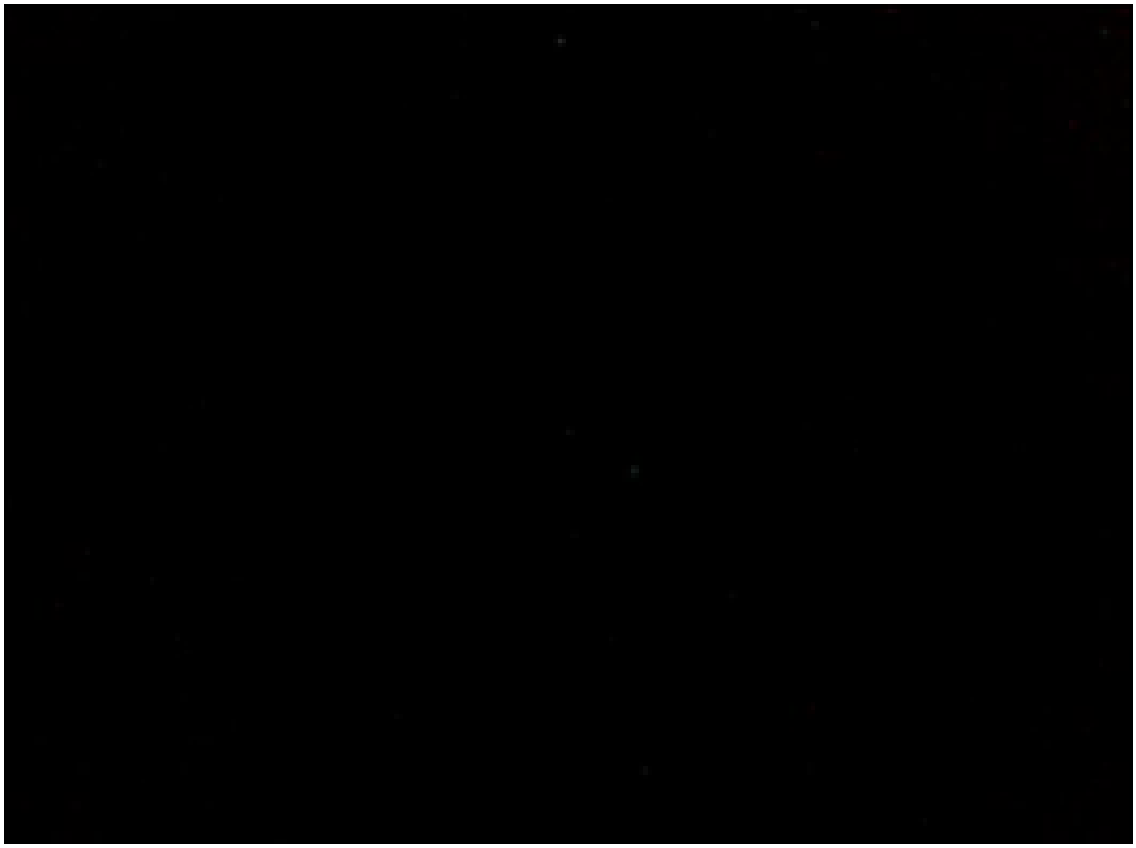
Block B: Offset → 120.

Block B: Size → 1 x 1 Pixel.

A+:	Block A = 0	Block B= 0
A:	Block A = 0	Block B ≦ 2
B:	Block A = 0	Block B ≦ 8
C:	Block A = 0	Block B ≦ 15
D:	Block A = 0	Block B ≦ 30
E:	Block A ≧ 1	Block B ≧ 31

8.2.3 White Pixel Test:

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



Block A: Offset → 50, Block B: Offset → 80.

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

A+: Block A = 0 Block B= 0

A: Block A = 0 Block B≦ 2

B: Block A = 0 Block B≦ 8

C: Block A = 0 Block B≦ 15

D: Block A = 0 Block B≦ 30

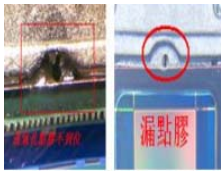
E: Block A ≧ 1 Block B≧ 31

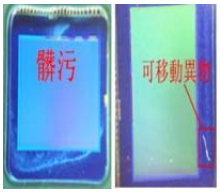
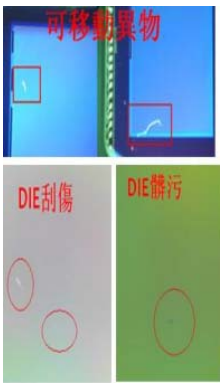
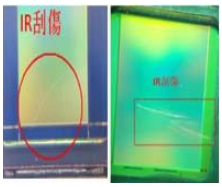
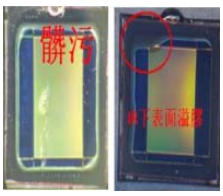
9. Inspection SPEC

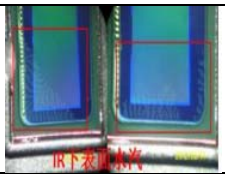
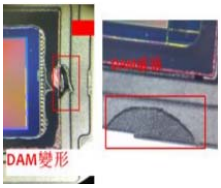
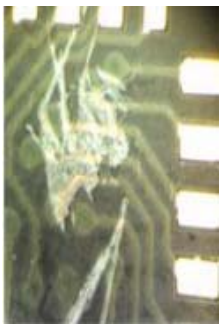
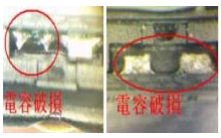
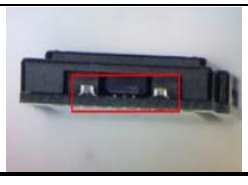
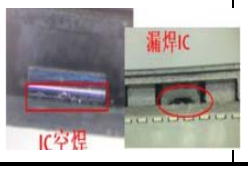
9.1 功能性测试：

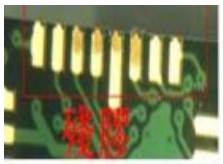
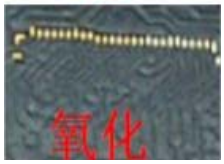
序号	项目	检验要求	缺陷等级	检验方式		图例说明		检验方法及设备
				Ⅱ	AQL	标准	拒收	
1	电流值检测	100～150	CR	抽检	0.4			目视/测试工具
2	功能影像检测	1、依据功能测试程序判定之结果，并分等级A+、A、B、C、D、E级； 2、影像画面不可以有黄斑、胶印、线条、水纹。	CR	抽检	0.4		  	目视/测试软件

9.2 外观检验：

序号	项目	检验要求	缺陷等级	检验方式		图例说明		检验方法及设备
				Ⅱ	AQL	标准	拒收	
1	进气孔漏点或点胶不完全	不可有	CR	抽检	0.1			10～15倍显微镜

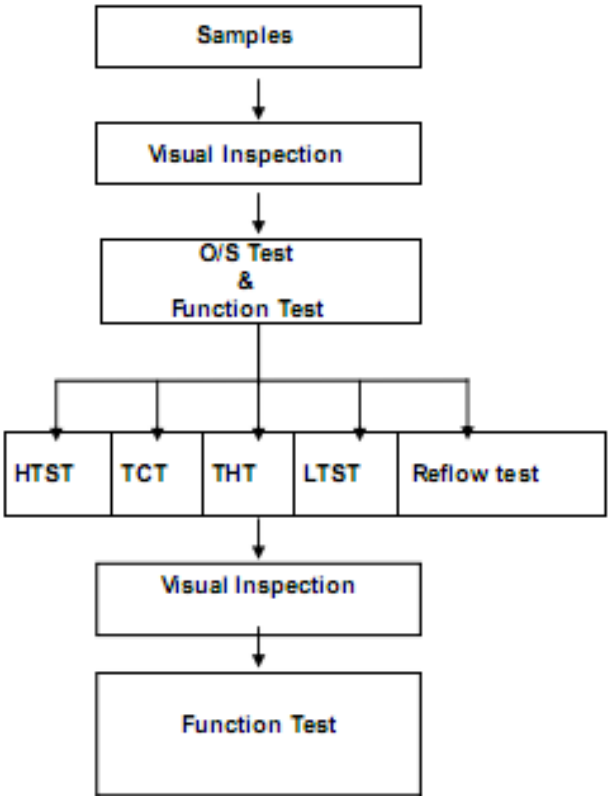
2	Sensor 刮伤，脏点（非感光区）	依功能影像测试程式判定结果为准，若有脏点，轻轻敲击 3 次后不可移动，可判为良品。	MA	抽检	1.0			10～15 倍显微镜及测试工具
3	Sensor 刮伤，脏点（感光区）	依功能影像测试程式判定结果为准。	MA	抽检	1.0			10～15 倍显微镜及测试工具
4	IR 刮伤	功能影像测试程式判定结果为准（无感刮伤以功能判定结果为准，有感刮伤不允收）。	MA	抽检	1.0			10～15 倍显微镜
5	IR 溢胶	1、IR 内溢胶不可到感光区； 2、IR 小表面不允许有可擦拭脏污； 3、IR 下表面残胶以功能判定结果为准； 4、IR 下不可移动毛刺且数目视可见者 NG。	MA	抽检	0.1			10～15 倍显微镜
	IR 翘起，破损，断胶	1、IR 上翘超出 DAM 最高边沿不允收。(若是的 DAM 的 4 角有壹楷，以壹楷下的边沿为准） 2、IR 边缘破损长度不可超过边缘总长的1/4，宽度不可超过点胶道； 3、IR 缺角在 DAN 内圆坐标外可允收； 4、肩碎、破损，已经产生缝隙，裂痕不允许，破损超过点胶区不允许；	MA	抽检	0.1			10～15 倍显微镜

		5、IR 断胶不允许。						
	IR 内水汽	不允许	MA	抽检	0.1			10～15 倍显微镜
	DAM	DAM 破损不允收	CR	抽检	0.1			10～15 倍显微镜
		1、DAM 表面溢胶影响组装者 NG； 2、DAM 熔伤不可超出整体平面的平整度。	MA	抽检	1.0			10～15 倍显微镜
	基板裸铜、破损、刮伤	基板的刮痕不可造成露铜，且不可造成组装或造成影像不良。	MA	抽检	1.0			10～15 倍显微镜
	Pad 裸铜、破损	不允许	MA	抽检	1.0			10～15 倍显微镜
	Pad 刮伤	刮伤不可超过2/3Pad 的宽度且不可造成露铜或影像不良。	MA	抽检	1.0			10～15 倍显微镜
	电容	电容不可有损伤，掉落。	CR	抽检	0.1			10～15 倍显微镜
	IC	IC 不可有空焊及漏焊	CR	抽检	0.1			10～15 倍显微镜

	Pad 残胶、氧化	不可有	MA	抽检	1.0		 	10～15 倍显微镜
	文字打印	1、目视可以辨认文字内容（英文及数字）； 2、内容不可有错误。	MI	抽检	0.1			10～15 倍显微镜
	尺寸	尺寸检验	CR	抽检	0.1	依据图纸	/	卡尺

10. Reliability and Environmental Test Specifications

10.1 Test Flow



10.2 Test Item

Item	Ref.Spec	Test	Condition	Criteria
HTST	IEC 60068-2-1	Temp : 85℃ Time : 48 hrs	Function Test	0/1
TCT	IEC60068-2-1 IEC60068-2-2 IEC60068-2-14	Temp : －20℃~+60℃ Dwell : 45min Frequency 27 cycles	Function Test	0/1
THT	MIL-STD-883E 1004	Temp : 40℃ Humidity : 95%RH Time : 120 hrs	Function Test	0/1
LTST	IEC60068-2-1	Temp : -40℃ Time : 48 hrs	Function Test	0/1
Reflow	JEDEN C020B	Spec : Reflow Profile Time : 3 cycles	Function Test	0/1

10.3 Classification Reflow Profile

Classification Reflow Profile		
Profile Feature	Pb-Free Assembly	
	Large Body	Small Body
Preheat -Temperature Min(Ts min) -Temperature Max(Ts max) -Time(min to max) (ts)	150℃ 200℃ 60 -180 seconds	
Tsmax to TL -Ramp-up Rate	3℃/second max	
Time maintained above: -Temperature(TL) -Time(TL)	217℃ 60-150 seconds	
Peak Temperature(Tp)	245+0/-5℃	245+0/-5℃
Time within 5℃ of actual Peak Temperature(Tp)	10-30 seconds	10-30 seconds
Ramp-down Rate	6℃/second max.	
Time 25℃to Peak Temperature	8 minutes max.	

Note: 1. All temperatures refer to topside of the package, measured on the package body surface.

2.The baking is required, devices may be baked for 2 hours at 125+-5℃.