



# Darling Camera Module Specification

Module No: DC-080301A

## Revision history

Version	Item	Cause	Author	Date
A	第一版	新发行	孙晓慧	2008-12-03

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## 1. Scope

This approval sheet contains the general information of DC-080301A camera module. It contains the key features of the module as well as the information for the quality inspection and reliability test purposes.

## 2. General Description

The OV7670 is a sensor on-board camera and lens module designed for mobile applications where low power consumption and small size are of utmost importance.

Proprietary sensor technology utilizes advanced algorithms to cancel Fixed Pattern Noise (FPN), eliminate smearing, and drastically reduce blooming. All required camera functions are programmable through the serial SCCB interface.

## 3. Features

- Improved sensor sensitivity and image quality
- Low-profile socket with lock
- 8\*8\*4 mm compact module dimensions
- Optional EMI top shield available
- Easy to extract for rework purposes
- Function controls via SCCB interface:
  - Exposure control
  - White balance
  - Color saturation
  - Windowing
  - Gamma
  - Color matrix
  - Hue control

## 4. Applications

- Smart Phones
- Toys
- PC Multimedia
- Digital Still Cameras

## 5. Component Specifications

### 5.1 Sensor Head Characteristic

Active Array Size		640 x 480
Power Supply	Digital Core	1.8VDC±10%
	Analog	2.45V to 3.0V
	I/O	1.7V to 3.0V
Power Requirements	Active	TBD
	Standby	<20 μA
Temperature Range	Operation	-30°C to 70°C
	Stable Image	0°C to 50°C
Output Formats(8-bit)		YUV/YCbCr 4:2:2
		RGB 565/555/444
		GRB 4:2:2
		Raw RGB Data
Maximum Image Transfer Rate		30 fps for VGA
Sensitivity		1.1 V/(lux.sec)
S/N Ratio		40 dB
Dynamic Range		TBD
Scan Mode		Progressive
Electronics Exposure		Up to 510:1 (for selected fps)
Pixel Size		3.6 μm x 3.6 μm
Dark Current		12 mV/s at 60°C
Well Capacity		17K e
Image Area		2.36 mm x 1.76 mm

Note: I/O power should be 2.45V or higher when using the internal regulator for Core (1.8v); otherwise, it is necessary to provide an external 1.8V for the Core power supply.

### 5.2 Optical Specification

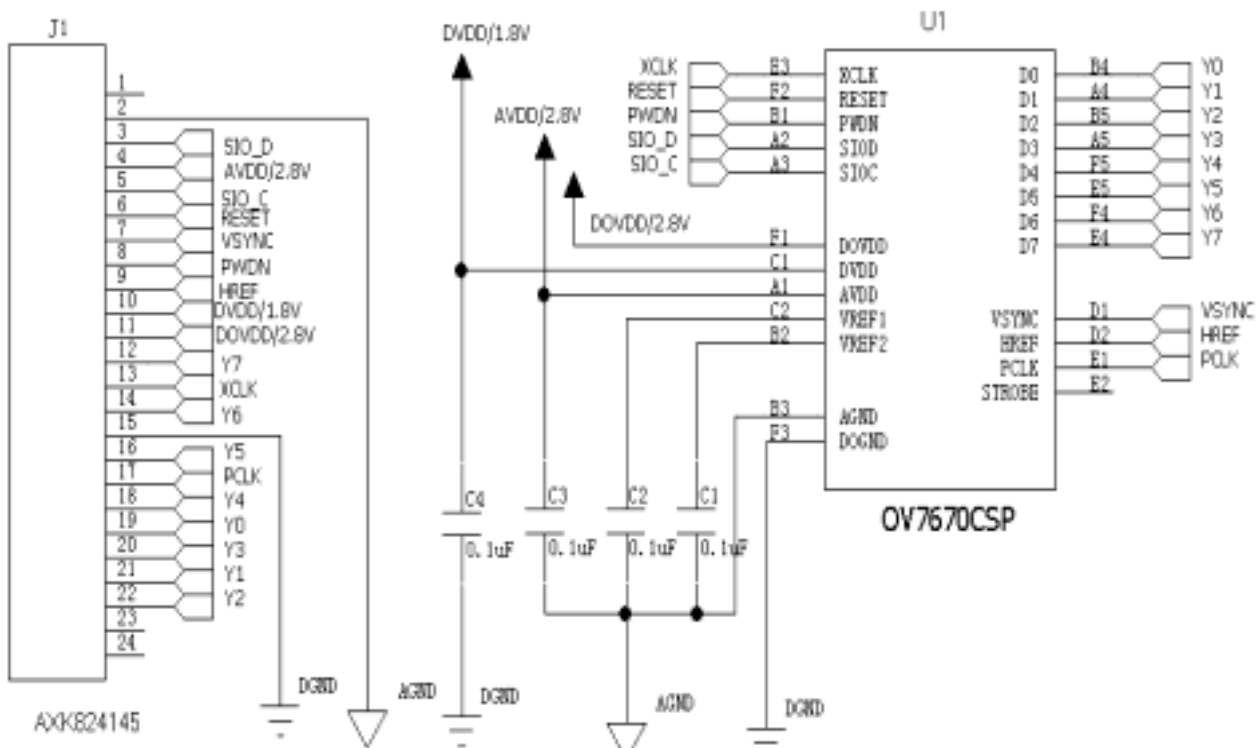
Lens Focus Type	Fixed
Lens size	1/6 Inch
F.NO	2.80±5%
IR filter cut off frequency	650 ±10nm
TV Distortion (Horizontal and Vertical)	< -1%
IR	Require
Chief Ray Angle	27.1°
FOV	65.5°
EFL	2.45mm
Depth Of Field	20cm-infinity
Lens Construction	2P+IR

## 6. Electrical Specifications

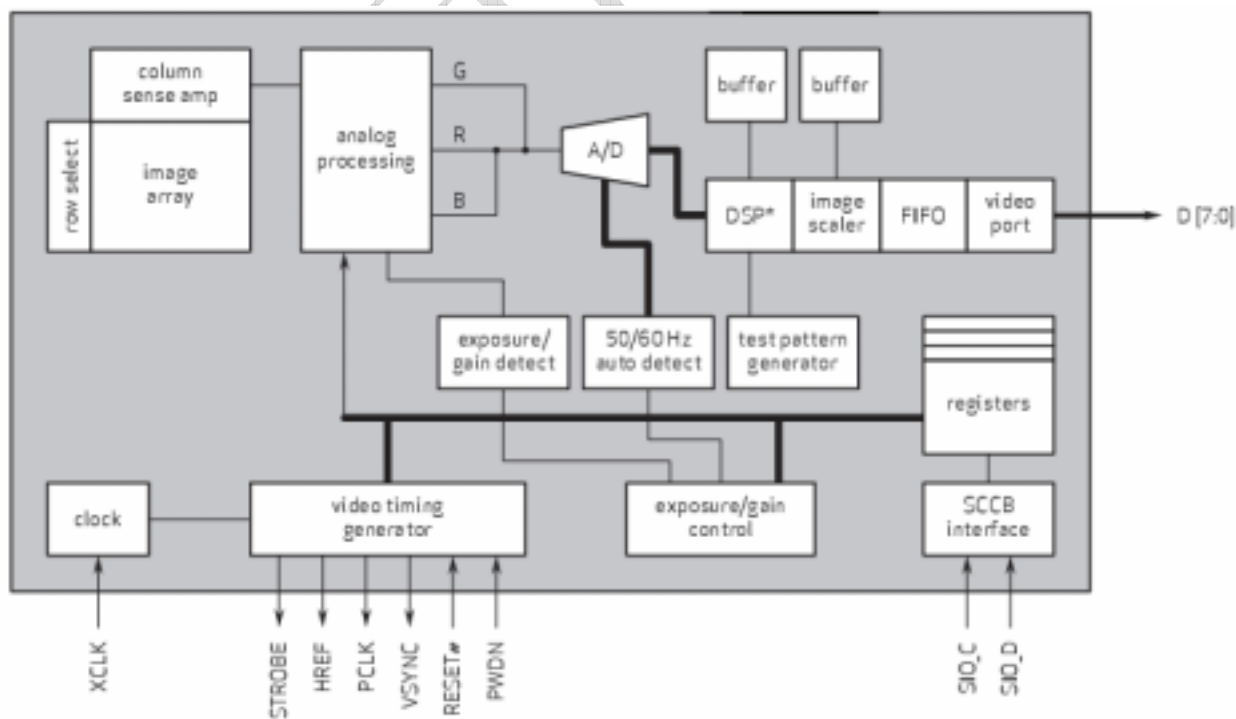
### 6.1 Module Pin Assignment

Pin Location	Name	Pin Type	Function/Description
01	NC	---	No connection
02	AGND	Power	Analog ground
03	SIO_D	I/O	SCCB serial interface data input and output
04	AVDD	Power	Analog power ( $V_{DD-A} = 2.45$ to $3.0$ VDC)
05	SIO_C	Input	SCCB serial interface clock input
06	RESET	Function (default=0)	Chip reset, with active high.
07	VSYNC	Output	Vertical sync output
08	PWDN	Function (default=0)	Power Down Mode Selection 0: Normal mode 1: Power down mode
09	HREF	Output	HREF output
10	DVDD	Power	Digital core power ( $V_{DD-C} = 1.8$ VDC $\pm 10$ %)
11	DOVDD	Power	Digital power I/O ( $DOV_{DD} = 1.7$ V to $3.0$ V)
12	Y9	Output	Video component output bit[9]
13	XCLK	Input	Clock input
14	Y8	Output	Video component output bit[8]
15	DGND	Power	Digital ground
16	Y7	Output	Video component output bit[7]
17	PCLK	Output	Pixel clock output
18	Y6	Output	Video component output bit[6]
19	Y2	Output	Video component output bit[2]
20	Y5	Output	Video component output bit[5]
21	Y3	Output	Video component output bit[3]
22	Y4	Output	Video component output bit[4]
23	NC	---	No connection
24	NC	---	No connection

### 6.2 Circuit Schematic



### 6.3 Functional Block Diagram



note 1 DSP\* (lens shading correction, de-noise, white/black pixel correction, auto white balance, etc.)

### 6.4 Absolute Maximum Ratings

Ambient Storage Temperature		-40 to + 95
Supply Voltages (with respect to Ground)	$V_{DD-A}$	4.5V
	$V_{DD-C}$	3V
	$V_{DD-IO}$	4.5V
All Input/Output Voltages (with respect to Ground)		-0.3V to $V_{DD-IO} + 0.5V$
Lead-free Temperature, Surface-mount process		245
ESD Rating , Human Body model		2000V

NOTE: Exceeding the Absolute Maximum ratings shown above invalidates all AC and DC electrical specifications and may result in permanent device damage.

### 6.5 DC Characteristics (-20 < $T_A$ < 70 )

Symbol	Parameter	Min	Type	Max	Unit
$V_{DD-A}$	DC supply voltage – Analog	2.45	2.5	3.0	V
$V_{DD-C}$	DC supply voltage – Digital Core	1.62	1.8	1.98	V
$DOV_{DD}$	Supply I/O power	1.7	-	3.0	V
$I_{DD2}$	Supply current(1.8V $V_{DD-C}$ ,2.5V $V_{DD-A}$ ,2.5V $DOV_{DD}$ at 7.5fps YUV without digital I/O loading )		18		mA
$I_{DD3}$	Standby supply current		10		$\mu$ A

Digital Inputs

$V_{IH}$	Input voltage HIGH	$0.7 \times V_{DD-IO}$			V
$V_{IL}$	Input voltage LOW			$0.3 \times DOV_{DD}$	V
$C_{IN}$	Input capacitor			10	pF

Digital Outputs(standard loading 25pF, 1.2 K $\Omega$  to 2.5V)

$V_{OH}$	Output voltage HIGH	$0.9 \times DOV_{DD}$			V
$V_{OL}$	Output voltage LOW			$0.1 \times DOV_{DD}$	V

SCCB Inputs

$V_{IL}$	SIO_C and SIO_D ( $DOV_{DD}=2.5V$ )	-0.5	0	1	V
$V_{IH}$	SIO_C and SIO_D ( $DOV_{DD}=2.5V$ )	2.5	3	$DOV_{DD}+0.5$	V

6.6 Functional AC Characteristics ( $T_A=25$  ,  $V_{DD}=2.5V$ )

Symbol	Parameter	Min	Type	Max	Unit
RGB/YcbCr Output					
$I_{So}$	Sourcing current		15		mA
$V_Y$	DC level at zero signal YPP 100% amplitude(without sync) Sync amplitude		0.4		V
			0.7		V
			0.4		V
ADC Parameters					
DLE	DC differential linearity error		0.5		LSB
ILE	DC integral linearity error		1		LSB



## 7. Timing Specifications

Figure 1: SCCB Timing Diagram

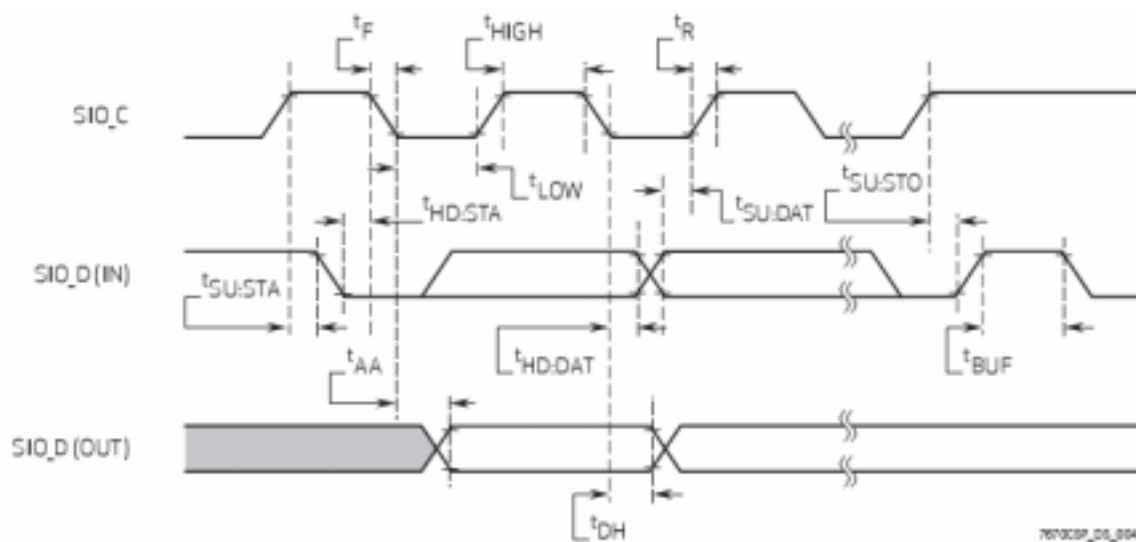


Figure 2: Horizontal Timing

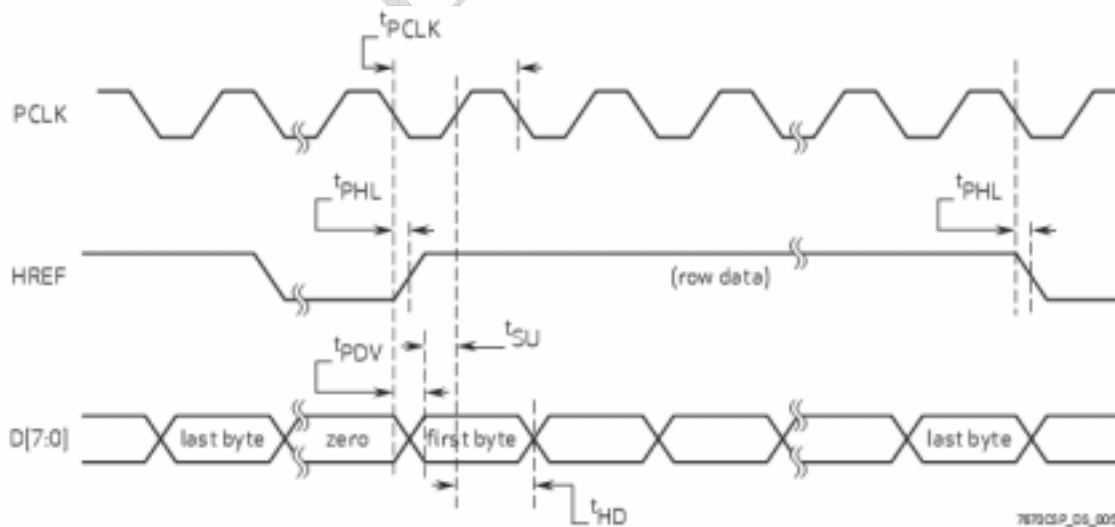


Figure 3: VGA Frame Timing

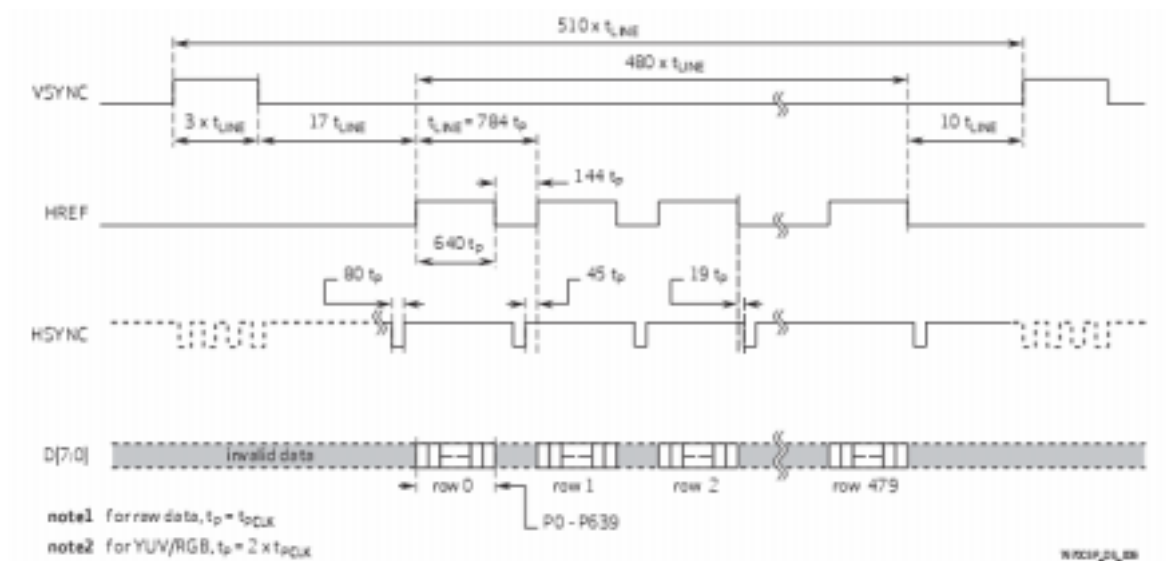
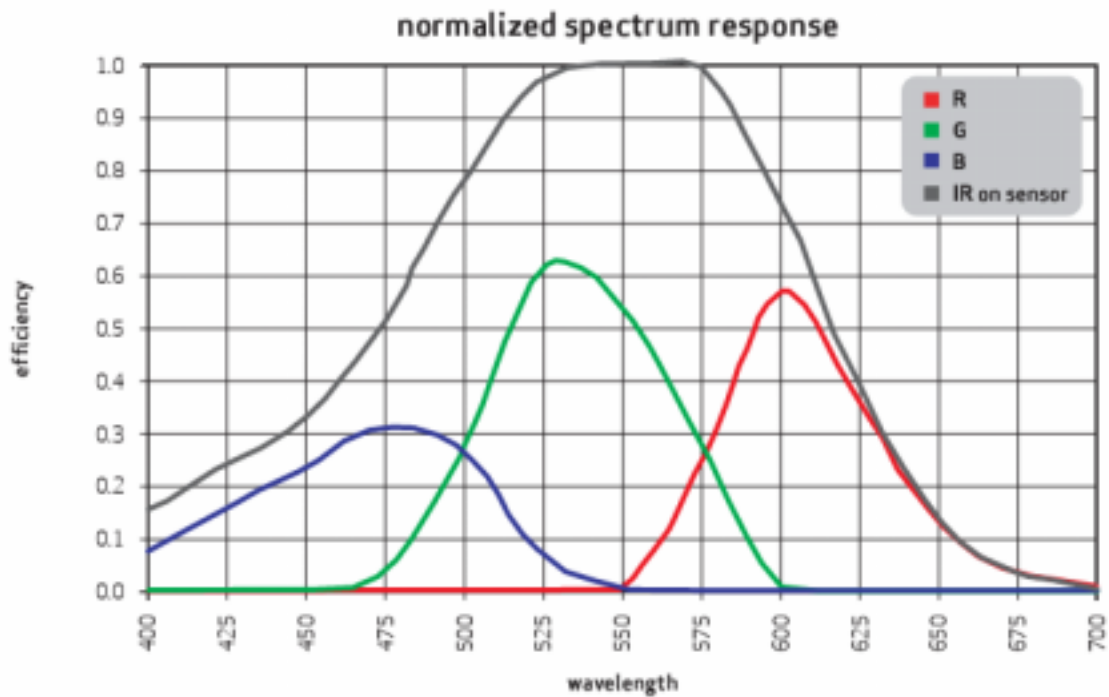


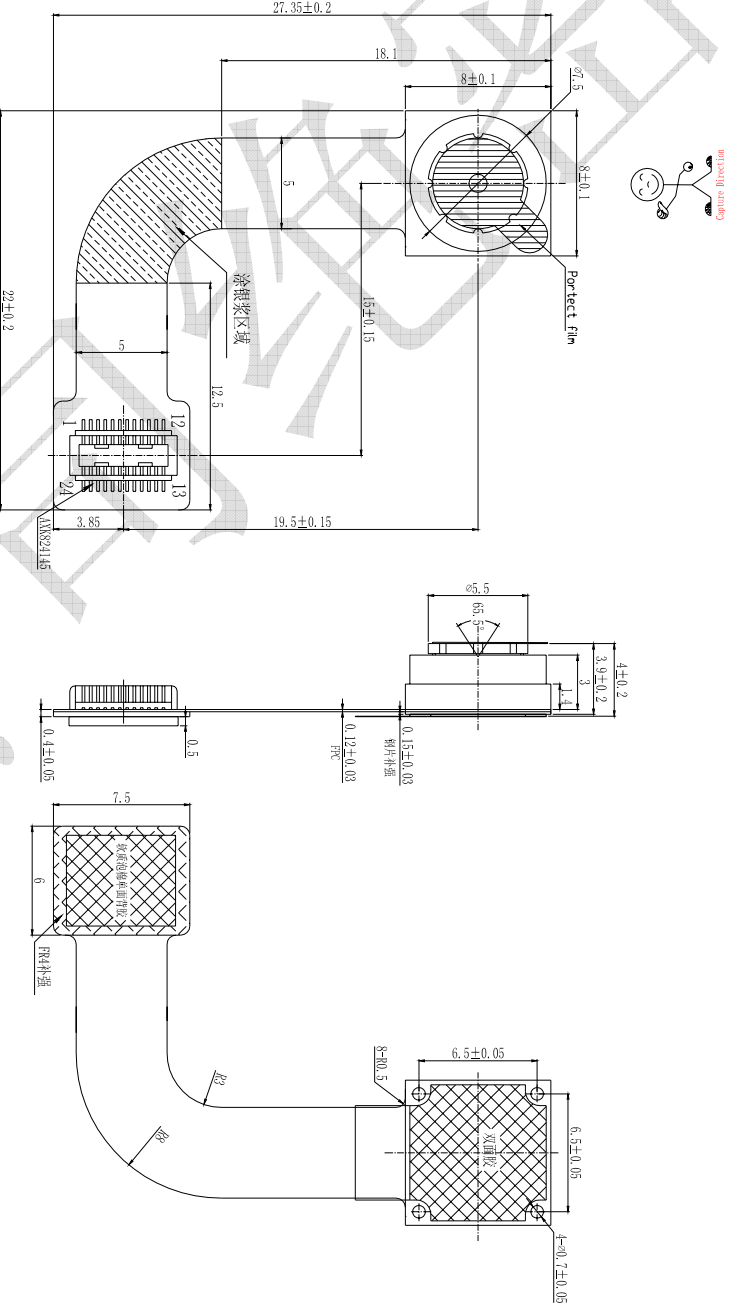
Figure 4: Light Response



### 8. Module Drawing

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CONNECTOR	
NO.	SYMBOL
1	NC
2	ACND
3	S10D
4	AVDD (2.8V)
5	S10C
6	RESET
7	VSYNC
8	PWDN
9	HREF
10	DVDD (1.8V)
11	DOVDD (2.8V)
12	D9
13	XCLK
14	D8
15	DGND
16	D7
17	PCLK
18	D6
19	D2
20	D5
21	D3
22	D4
23	NC
24	NC

Lens parameter			
焦距 (f/F)	2.45mm	像素 (Array Size)	640X480
光圈 (F/NO)	2.8±5%	镜头类型 (Lens Size)	1/6inch
视场角 (View Angle)	65.5°	数字电路电压 (DVDD)	1.8±10%V
畸变 (Distortion)	< -1%	模拟电路电压 (AVDD)	2.45V±0.2, 80V
感光芯片 (Chip Type)	OV7670 SENSOR	接口电路电压 (DOVDD)	2.50V±0.3, 30V

REV	DATE	EC NO.	APP BY

TITLE	PART NAME	DWG NO.	QTY	MATERIAL	REMARK
DL030-C238	摄像头模组	DL030-C238		FR4增强	

未注公差为: ±0.1mm

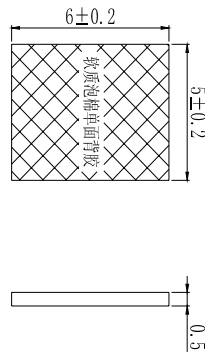
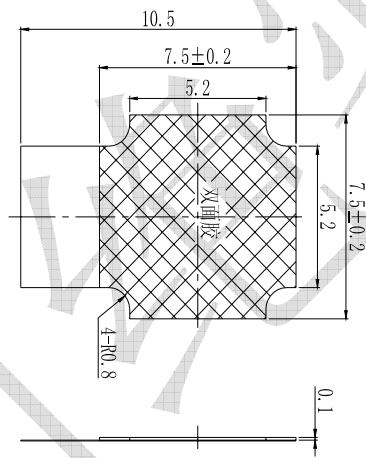
DESIGNED BY:	DRAWN BY:	DATE:	PROJECT NO.:
Linda	Linda	08/11/20	

CHECK BY:	DATE:	DWG NO.:

APP BY:	DATE:	CAD NO.:

ALL DIMENSION IN MM	REMOVE ALL BURS	DO NOT SCALE	SHEET OF
			P/1 A4

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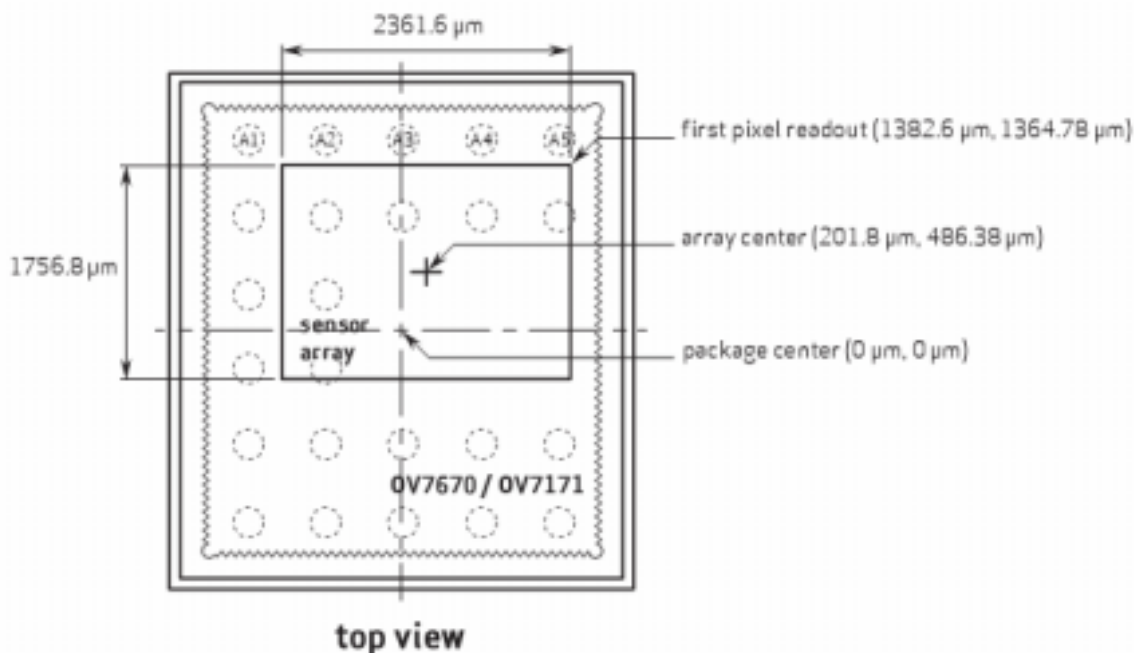


未注公差为：±0.1mm

ITEM	PART NAME	DWG NO.	QTY	MATERIAL	REMARK
	广州大凌实业有限公司 GUANGZHOU DARLING INDUSTRIAL CO.,LTD.				
TITLE : D1030-C238		TREATMENT :			
MATERIAL :		PREPARATION :			
UNSPECIFIED TOL: DIM.BY: Linda 08/11/25 PROJECT NO.:					
xxx ± 0.05	CHK.BY: / /	DWG NO.:			
xx ± 0.05	APP.BY: / /	CAD NO.:			
x ± 0.1					
∠ ± 0.05					
ALL DIMENSION IN MM		REMOVE ALL BURRS BREAK SHARP EDGES		DO NOT SCALE	
				SHEET OF PI/1	
				A4	

REV.	DATE	EC NO.	APP BY

Figure 1: Sensor Array Center



note 1 this drawing is not to scale and is for reference only.

note 2 as most optical assemblies invert and mirror the image, the chip is typically mounted with pins A1 to A5 oriented down on the PCB.

## 9. Quality Control

### 9.1 Image Quality

#### 9.1.1 Resolution

**Illumination:** 500 $\pm$ 50 Lux;

**Color temperature:** 5000 $\pm$ 500 degree;

**Characteristics:** The length to width=4:3;

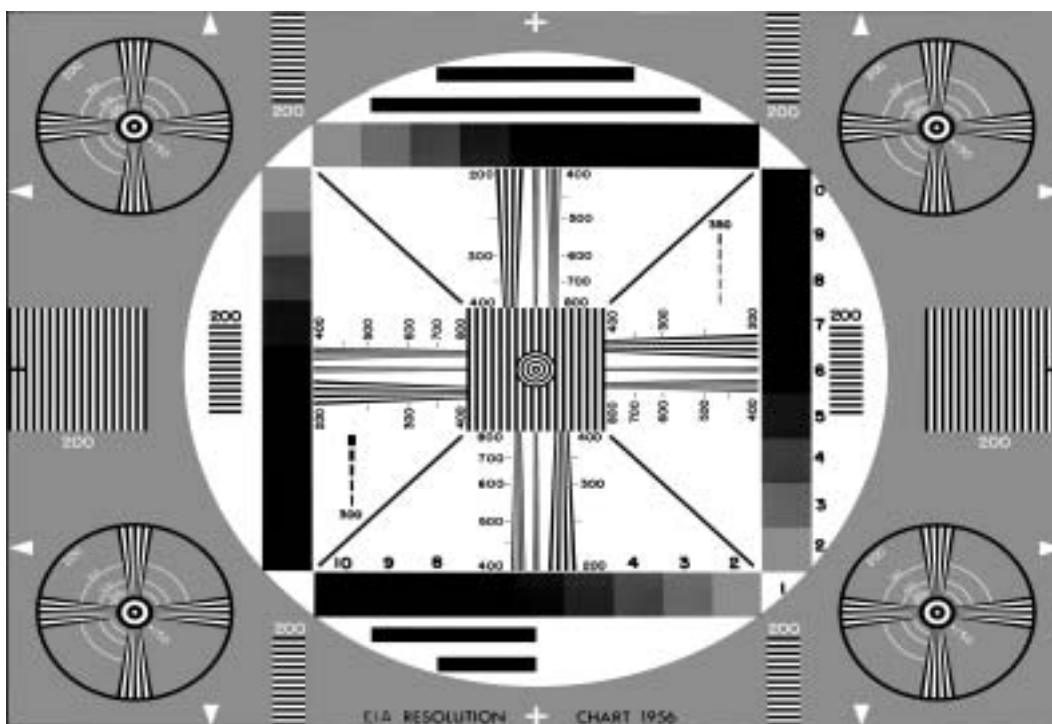
**Test method:** capture the image, make the chart is full screen in the image;

**MTF Specification:**

Center :> 400 TV Lines

Corner :> 250 TV Lines

The test chart is showed as below:



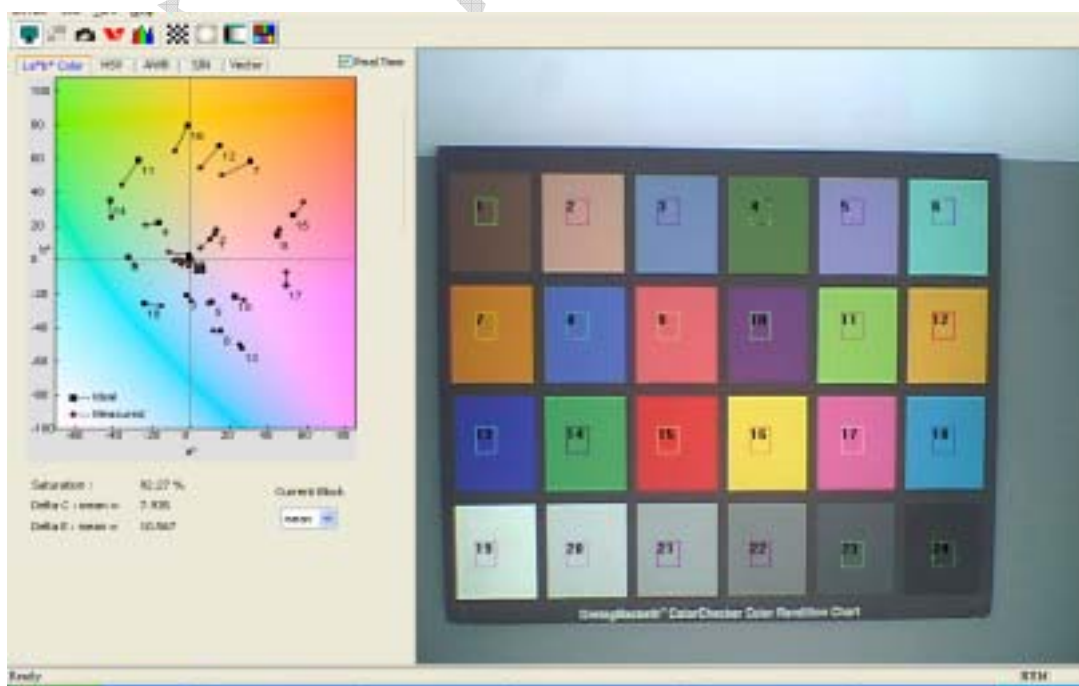
### 9.1.2 Color Difference

**Illumination:** 500+/-50 Lux;

**Color temperature:** 5000+/-500 degree;

**Test Method:** Use the AMCAP observation image up each Color, compare with each color of the standard Chart to have no obvious difference.

The test chart is showed as below:



### 9.1.3 Shading

**Illumination:** 500+/-50 Lux;

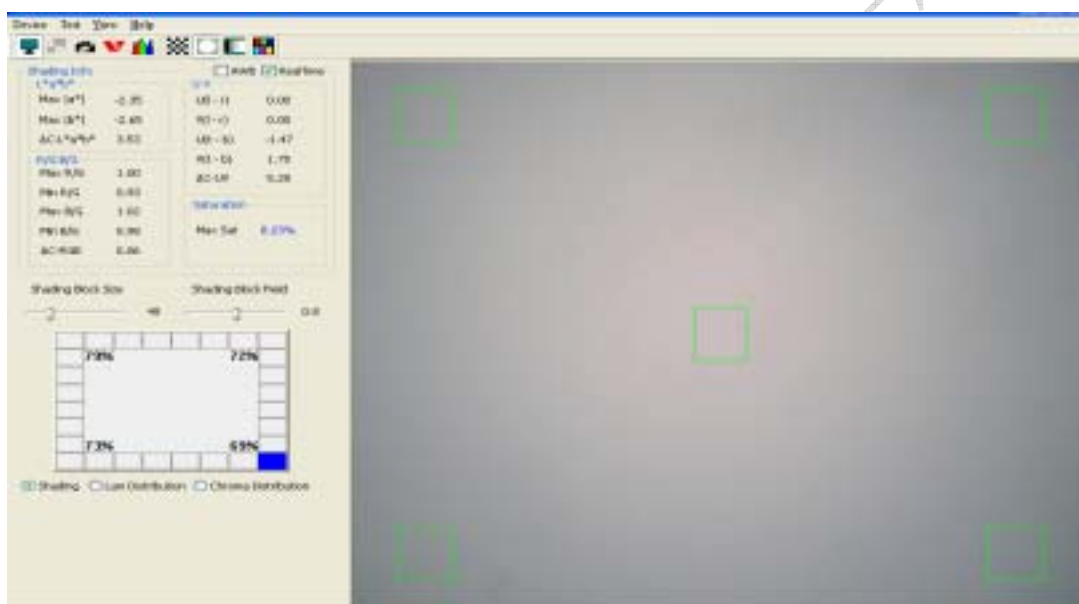
**Color temperature:** 5000+/-500 degree;

**Test Method:** Use the test software to capture the image covered by white acrylic board, and then calculates the ratio of the corner to center.

$$\text{Shading} = 1 - (\text{Lcorner} / \text{Lcenter}) * 100\%$$

**Shading < 30% is OK.**

The test chart is showed as below:



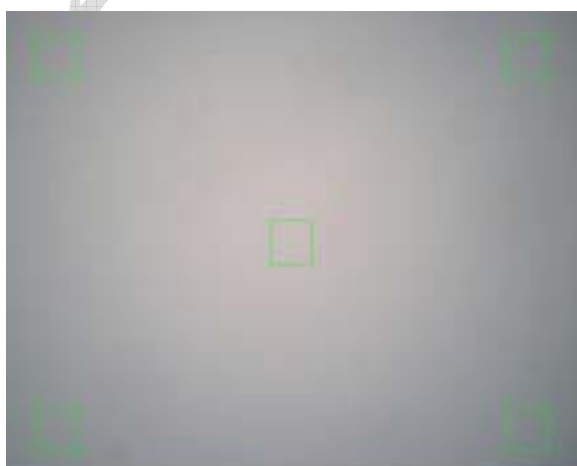
### 9.1.4 Foreign Material/Particle/dirt/Watermark

**Illumination:** 500+/-50 Lux;

**Color temperature:** 5000+/-500 degree;

**Test Method:** Use the test software to capture the image covered by white acrylic board, and then inspect if there are foreign material/particle/bad pixels.

The test chart is showed as below:





## 9.2 The external appearance examination standard

Test Item	The content and inspection requirements
The surface of lens	The surface should be uniform color; clean; no scratches, oil and mechanical scratched phenomenon.
Printing	Printing clear and easily knows the content correct, consistent with the samples.
The connecting of lens and FPC	Connecting Department should closely connect without dehiscence and phenomena such as loose.
Lens	Lens need clockwise rotation into and not tilt.
Holder	The distribution between Holder and PCB is good, seamless.
FPC	FPC point there is no dirt, UV glue, crease, fracture, scratches, defects, and other undesirable phenomena.
FPC line	No short circuit, open circuit phenomenon.

## 9.3 Reliability Test

### 9.3.1 Test Requirement

Each test item should use a new module unless specified.

### 9.3.2 Test Opportunity

**Qualification:** During the product development and before the mass production;

**Maintenance:** when a design change can influence the function test and when the production place is changed.



### 9.3.3 Test Item

Test Item	Condition/Spec	Number
High Temperature Storage	70 ;72 hours	10PCS
Low Temperature Storage	-20 ;72 hours	10PCS
High Temperature Operation	70 ;24 hours	10PCS
Low Temperature Operation	-20 ;24 hours	10PCS
Thermal Shock	-20 /0.5h ~ 65 /0.5h;24 hours	10PCS
High Temperature & Humidity Storage	70 ;93%RH;60 hours	10PCS
Vibration	50Hz,2mm XYZ,each 15 min	10PCS
Drop Test	135cm,26 times	10PCS
ESD	2K_V.100pf.1500KΩ	10PCS
Draught Test	28 ,75%;F>2Kg;20 times	10PCS
Switch Test	15S alternation,2000 times	10PCS

1. All product be shipped has through 100% inspection resolution specification and sampling inspection of Darling Q.A. plan
2. AQL standard of Darling Q.A. plan is based on contract between customer and Darling
3. Darling will offer the inspection report per lot for ref.
4. Working temperature of product:0 ~+50

## 10. Packaging

1. Every module is placed into a tray until all empty slots of a tray are filled. Each tray contains 50 modules.





2. Each tray uses an anti-static bag to prevent the module from moisture by partially socking out the air from the stack.

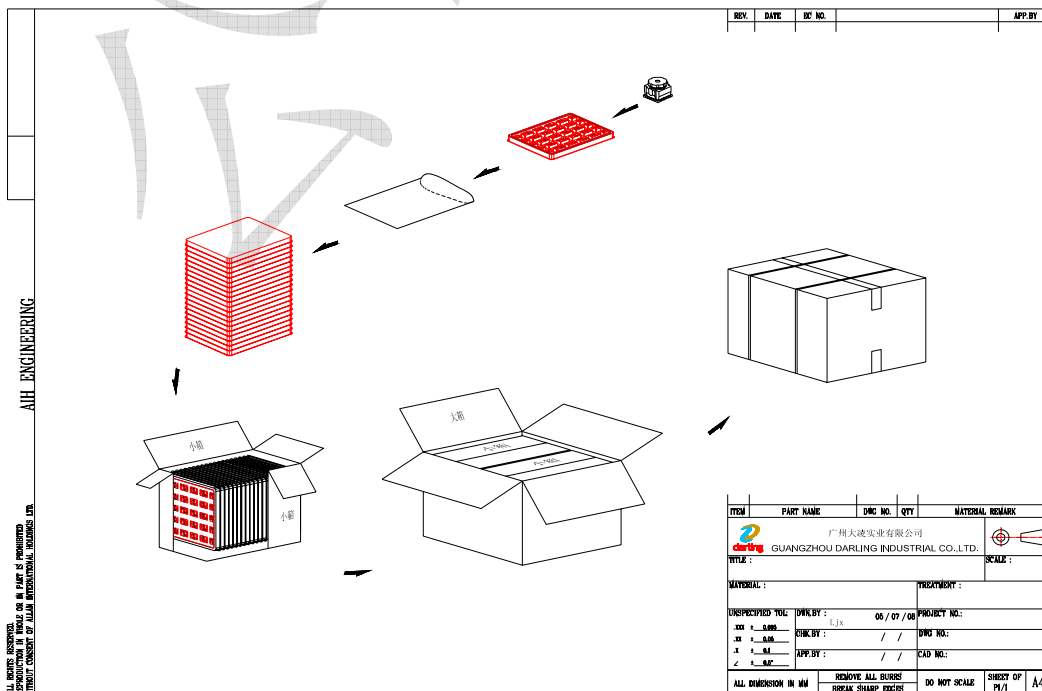




3. A stack has ten trays.
4. Insert a stack into an inner box.



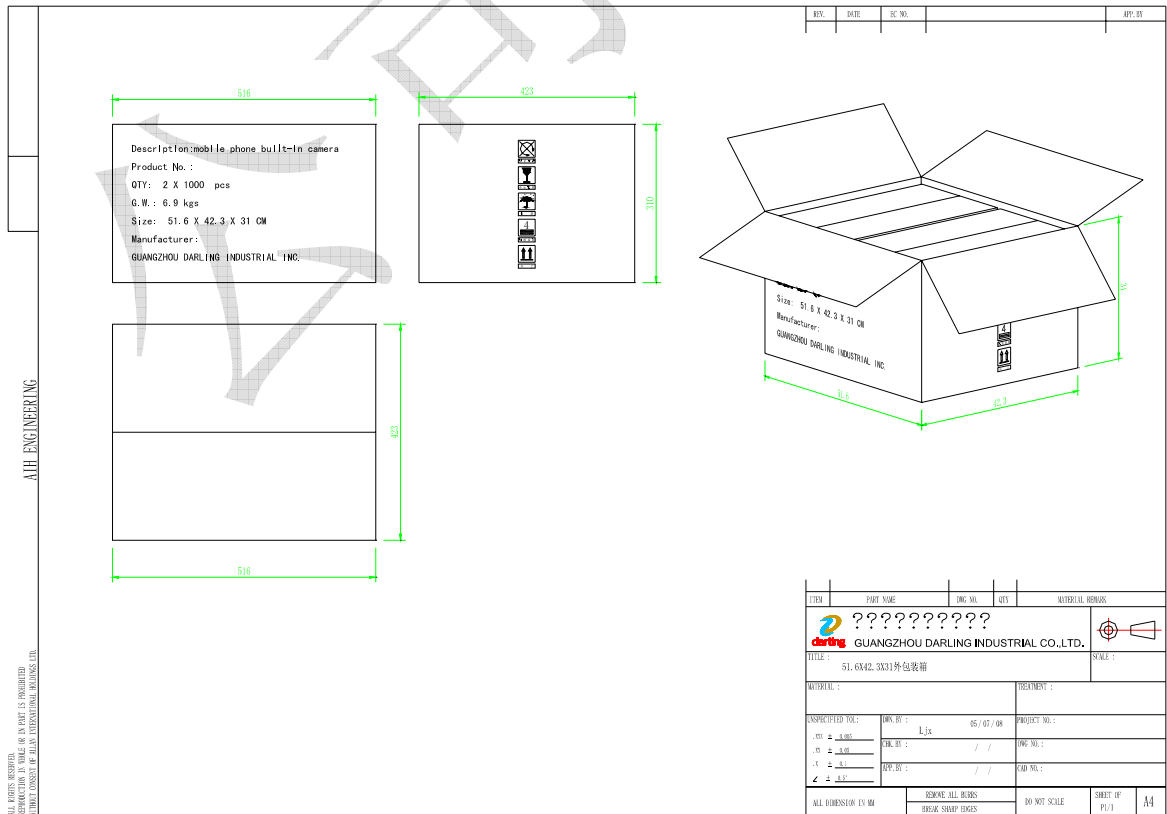
5. Insert two inner boxes into an outside box. Then attach the label onto the outside box.



### 11. Precaution and Handling

1. Please take extra care when handling module because module is composed of precise electronic parts and optical parts.
2. Care should be taken to when handling module to prevent module from being damaged by static electricity.
3. After the protected layer on the lens has been removed, one should prevent The finger prints from contaminating the lens and cause image noise.
4. One should prevent optical parts from being damaged by a mechanical impact and so on.
5. Never shot at direct sunlight since intensive light exposure can damage
6. The procedure for module installation:  
Align and install the module head lightly into the assigned position without pressing on the FPC.  
Load the connector into its matching connector.
7. Since EMI is system dependent, agency approval is to be obtained by customer.
8. Series regulator or LDO is recommended. In case of using a switching regulator, make sure that regulator does not cause noise in CMOS sensor or in the display.
9. Module is designed to be used in cell phone under normal use by customer.  
We do not guarantee performance under extreme condition such as moving constant vibration.

Figure 1:

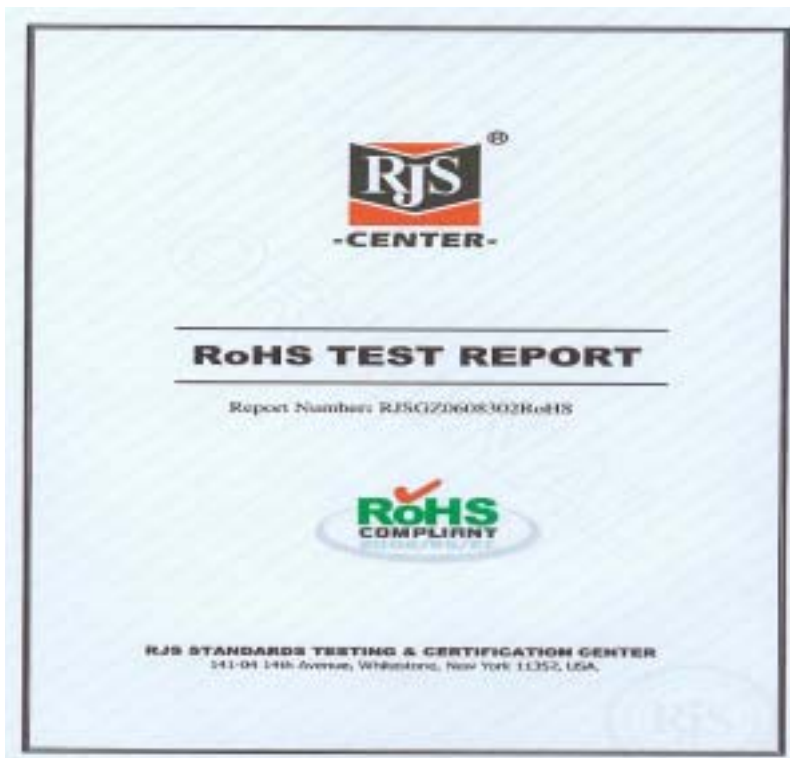




## 12. Honor certificates

RoHS standards

The darling's products and production equipment, production environment standards are in line with RoHS standards.



RJS Standards Testing & Certification Center Report No.: RJSIGZ0608302RoHS

### I. TEST REPORT

Applicant:	GUANGZHOU DARLING INDUSTRIAL INC
Address:	NO.1 XINDA ROAD, YUNPU INDUSTRIAL ZONE, HUANGPU, GUANGZHOU, CHINA
Product:	CAMERA
Model No.:	/
Test Lab:	RJS-SEPT LAB
Test Engineer:	Sherry
Test Date:	July 27, 2008 to August 08, 2008

### 2. TEST CONCLUSION

Test Standards	Test Results
RoHS 2002/95/EC RoHS 2006/12/CE RoHS 2002/95/EC RoHS 2006/12/CE	The sample complied with RoHS directive.

**Declaration:**  
This test report is performed by the RJS Standards Testing & Certification Center, or the subcontractor laboratory.  
The test report is issued by the company subject to its GENERAL CONDITIONS OF TESTING printed overleaf or attached. Attention is drawn to the limitations of liability, indemnification and professional policies defined therein.  
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Reviewed by:  Date: August 15, 2008  
Emma Liu  
Chief Operation Officer



Page 1 of 2



global sources  
**中国出口企业成就奖**  
2003表彰中国最佳出口企业

## Guangzhou Darling Industrial Inc.

### Rising Star Winner – Digital Still Cameras 中国出口明日之星 – 数码相机

“拥有十年资深经验的数码相机专业制造商。90%的产品出口至日本、新加坡、欧洲及美国等国家及地区。与美国硅谷OV公司(全球最大的CMOS图像传感器供应商)通力合作,为国内手机研发及生产厂商提供手机相机方案和最终产品。其研发的单反数码相机将弥补国内该领域内的空白”

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