



产 品 承 认 书

SPECIFICATIONS

品 名 (Module Name): 8016E

客户型号 (Cust.P/N):

文档接受时间 (Received):

DATE: / /

客 户 名 称 (Customer)		
批 准 (Approved)	审 核 (Checked)	担 当 (In charge)

产品承认书 共 12 页

(These specifications are composed of 12 pages, including this title page.)

宁 波 舜 宇 光 电 信 息 有 限 公 司		
批 准 (Approved)	审 核 (Checked)	担 当 (In charge)



1. Scope

This approval sheet contains the general information of 8016E VGA 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. Specification

The Camera Module includes: CMOS sensor, lens, holder, connector and FPC. The sensor is a low voltage CMOS image sensor that provides the full functionality of a single-chip VGA camera and image processor in a small footprint package. The sensor provides full-frame, sub-sampled or windowed 8-bit images in a wide range of formats, controlled through the Serial Camera Control Bus (SCCB) interface.

This product has an image array capable of operating at up to 30 frames per second (fps) in VGA with complete user control over image quality, formatting and output data transfer. All required image processing functions, including exposure control, gamma, white balance, color saturation, hue control and more, are also programmable through the SCCB interface. In addition, the sensor use proprietary sensor technology to improve image quality by reducing or eliminating common lighting/electrical sources of image contamination, such as fixed pattern noise (FPN), smearing, blooming, etc., to produce a clean, fully stable color image.

Features

- High sensitivity for low-light operation
- Low operating voltage for embedded portable applications
- Standard SCCB interface
- Supports VGA, QVGA, and windowed outputs with Raw RGB, RGB(4:2:2), YUV (4:2:2) and YCbCr (4:2:2) formats
- Automatic image control functions including: Automatic Exposure Control (AEC), Automatic Gain Control (AGC), Automatic White Balance (AWB), Automatic Brightness Control (ABC), Automatic Band Filter (ABF), Automatic Black-Level Calibration (ABLC)
- Image quality controls including: color saturation, hue, gamma, sharpness (edge enhancement), anti-blooming.

Applications

- Cellular and Picture Phones
- Toys
- PC Multimedia
- Digital Still Cameras



2.1 Specification

2.1.1 Camera Module Sensor Specification

No.	Item	Specification
1	Sensor	OV7670
2	Lens Size	1/6 Inch
3	Pixel Array Number	640×480
4	Power Supply	Core = 1.8VDC; Analog = 2.45-3.0V; I/O = 1.7-3.0V
5	Power Consumption	60mW (Active)
6	Standby	<20 μA
7	Output Format (8bit)	YUV/YCbCr 4:2:2; RGB565/555/444; RGB 4:2:2; Raw RGB Data
8	Video Format	VGA / QVGA / QQVGA/CIF/QCIF /QQCIF
9	Image Processing	Automatic image control functions including: Automatic Exposure Control (AEC); Automatic Gain Control (AGC); Automatic White Balance (AWB); Automatic Band Filter (ABF); and Automatic Black-Level Calibration (ABLCL)
10	Interface	Serial Interface (SCCB)
11	Sensitivity	1.3V/Lux.sec
12	S/N Ratio	46dB
13	Dynamic Range	52dB
14	Pixel Size	3.6um×3.6um
15	Image Area	2.36mm×1.76mm

2.1.2 Camera Lens Specification

No.	Item	Specification
1	Lens Size	1/6 Inch
2	Lens Construction	2 Plastic + 1 IR Filter
3	Focal Length	2.83mm
4	F/NO.	2.8
5	Field of View Angle (Diagonal)	55°
6	Distortion	<2.0%
7	Focus Distance	0.4M
8	Focusing Range	0.2M - ∞
9	Image Quality	≥200LW/PH



2.2 Camera Module Electrical Specification

2.2.1 Absolute Maximum Ratings

Supply voltages (with respect to ground)	VDD-A	4.5V
	VDD-D	3.0V
	VDD-IO	4.5V
All input /output voltages (with respect to ground)		-0.3V to VDD-IO +0.5V
Lead-free Temperature, Surface Mount Process		+245°C
ESD Rating, Human body model		2000V

2.2.2 DC Characteristics

Symbol	Parameter	Condition	Min	Typical	Max	Unit
VDD-A	DC Supply Voltage -Analog	-	2.45	2.5	3.0	V
VDD-D	DC Supply Voltage -Core	-	1.62	1.8	1.98	V
VDD-IO	DC Supply Voltage -I/O Power	-	1.7		3.3	V
iDDA	Active operating current		-	20	-	mA
iDDS-SCCB	Standby current		-	1	-	mA
iDDS-PWDN	Standby current		-	10	20	uA
VIH	Input voltage high	CMOS	$0.7 \times$ VDD-IO			V
VIL	Input voltage low				$0.3 \times$ VDD-IO	V
VOH	Output voltage high	CMOS	$0.9 \times$ VDD-IO			V
VOL	Output voltage low				$0.1 \times$ VDD-IO	V
IOH	Output current high		8			mA
IOL	Output current low		15			mA
IL	Input/Output leakage	GND to VDD-IO			± 1	uA

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.



2.2.3 AC Characteristics

Symbol	Parameter	Min	Typical	Max	Unit
Inputs (PWDN, CLK, RESET)					
fCLK	Input clock frequency	10	24	48	MHz
tCLK	Input clock period	21	42	100	ns
fCLK:DC	Clock duty cycle	45	50	55	%
tS:RESET	Setting time after software/hardware reset			1	ms
tS:REG	Setting time for register change (10 frames required)			300	ms
SCCB Timing (see Figure1)					
fSIO-C	Clock frequency			400	KHz
tLOW	Clock low period	1.3			us
fHIGH	Clock high period	600			us
tAA	SIO-C low to data out valid	100		900	ns
tBUF	Bus free time before new start	1.3			us
tHD:STA	Start condition Hold time	600			ns
tSU:STA	Start condition Setup time	600			ns
tHD:DAT	Data-in Hold time	0			us
tSU:DAT	Data-in Setup time	100			ns
tSU:STO	Stop condition setup time	600			ns
tR,F	SCCB rise or fall time			300	ns
tDH	Data out Hold time	50			ns
Outputs (VSYNC, HREF, PCLK, and D[7:0] (see Figure2)					
tPDV	PCLK[↓] to data out valid			5	ns
tSU	D[7:0] setup time	15			ns
tHD	D[7:0] hold time	8			ns
tPHH	PCLK[↓] to HREF[↑]	0		5	ns
tPHL	PCLK[↓] to HREF[↓]	0		5	ns



Figure 1. SCCB Timing Diagram

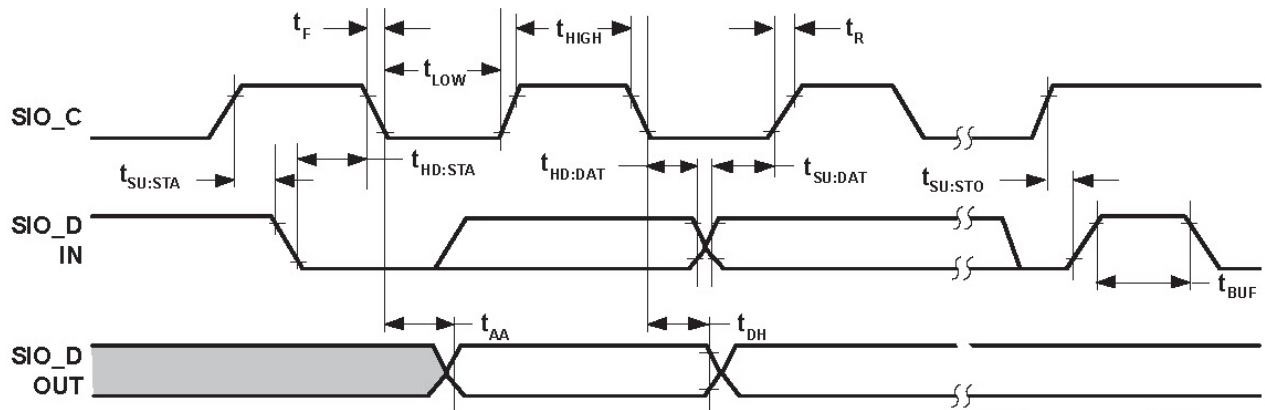


Figure 2. Horizontal Timing

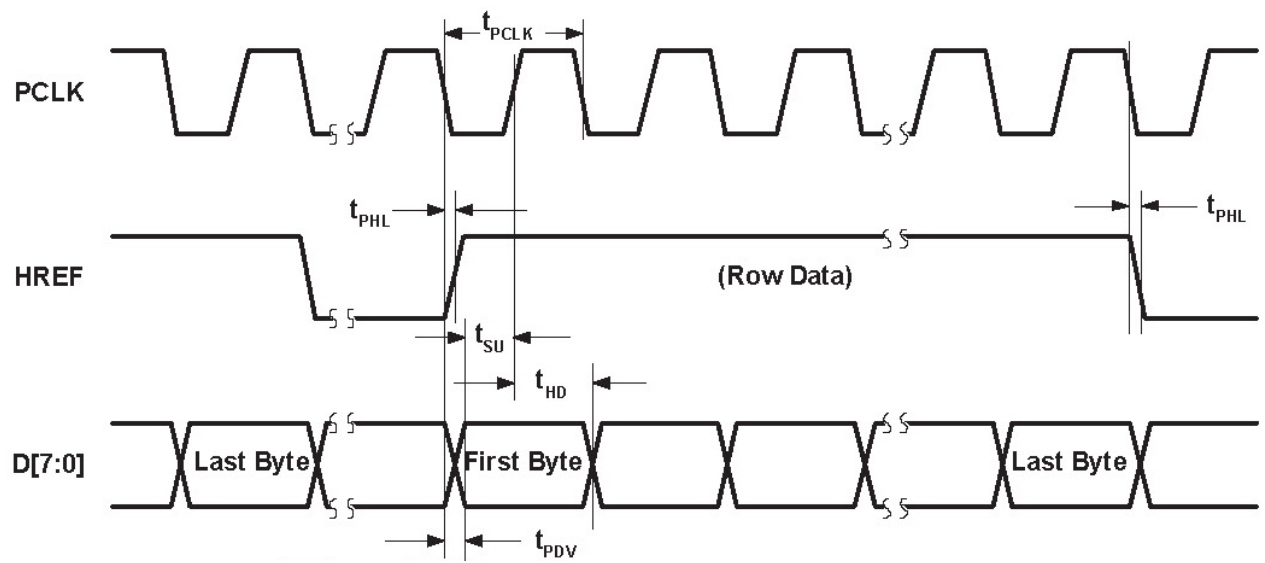
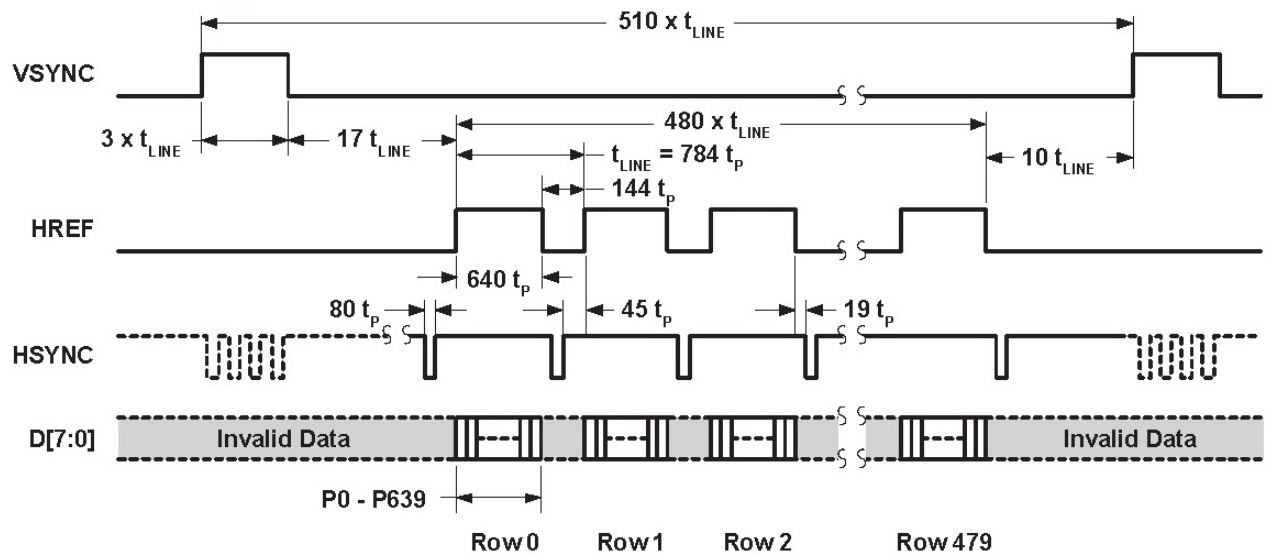


Figure 3. SXGA Frame Timing



NOTE:

For Raw data, $t_p = t_{PCLK}$

For YUV/RGB, $t_p = 2 \times t_{PCLK}$



4. Camera Module PIN Description

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



5. Reliability Test

No.	Test Item	Test Conditions	Judge Standard
1	Constant Temperate and Humidity Storage Test	Temperate: $65\pm 3^{\circ}\text{C}$; Humidity: $95\pm 3\%\text{RH}$; 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: 60	No image distort and good color rendition.
5	High Temperate Function Test	Temperate: $70\pm 3^{\circ}\text{C}$; Test Duration: 96H; Max Work Voltage	No image distort and good color rendition.
6	Low Temperate Function Test	Temperate: $-20\pm 3^{\circ}\text{C}$; Test Duration: 96H; 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: 96H; 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 15min for Each Axis	No image distort and good color rendition.
9	Drop Test	Floor: Concrete; Height: 100cm; Clamp Weight: 100g; Positions: 6 Surface; Each Surface Drop 3 Times	No image distort and good color rendition.
10	ESD TEST	2KV Contact Discharge 4KV Air Discharge 10 Times for Second	No image distort and good color rendition.



6. Packaging

6.1. 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 55 modules.
2. Each tray use an anti-static bag to prevent the module from moisture by partially sucking out the air from the stack.
3. A stack have 15 trays.
4. Insert a stack into a inner box.
5. Insert two inner boxes into a outside box. Then attach the label onto the outside box.

6.2. Labeling

The default label for each outside box should have the following information:

Customer:

Customer Part Number:

P.O Number:

Total Quantity:

Sunny Part Number:

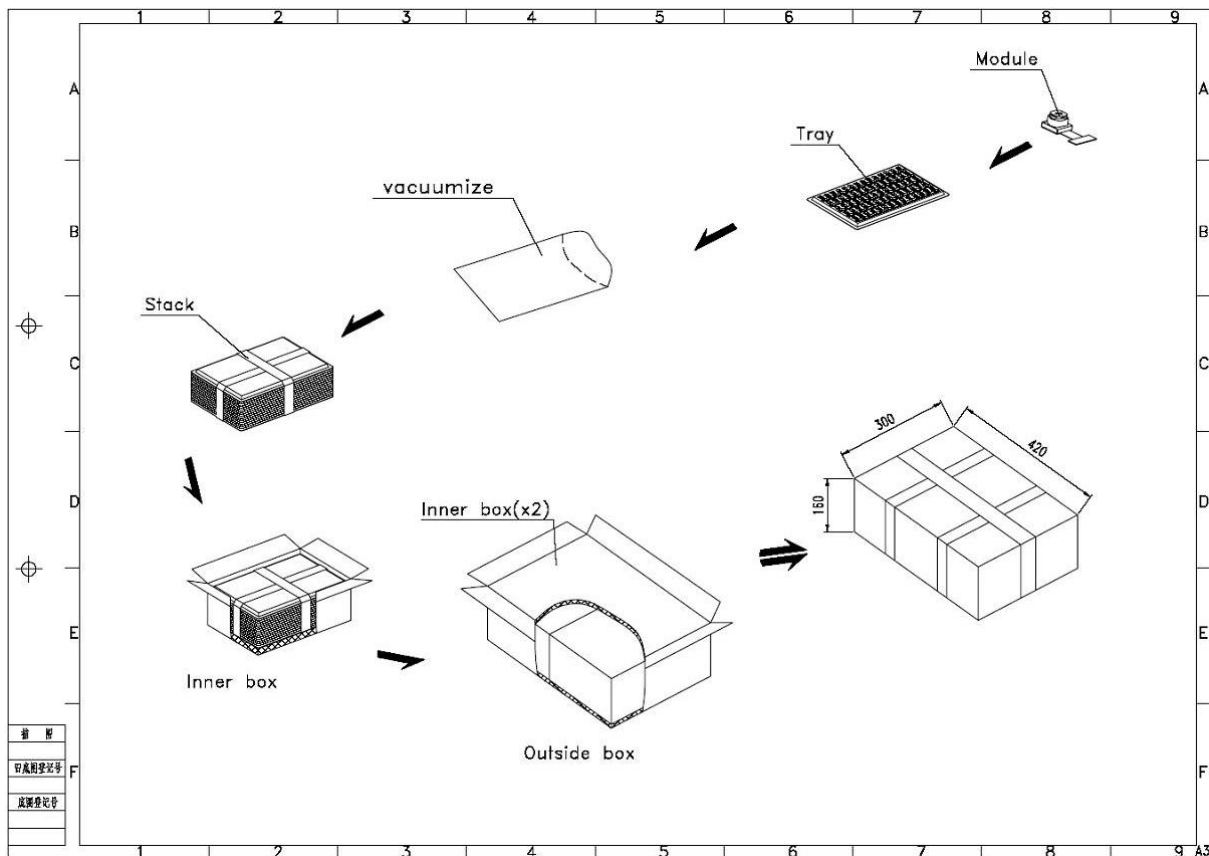
Date Code:

Lot Number:

Pack Date:

Remark:

6.3. Sketch Map of Packing Process





7. Precautions

7.1. 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°C

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.

7.2. 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 –