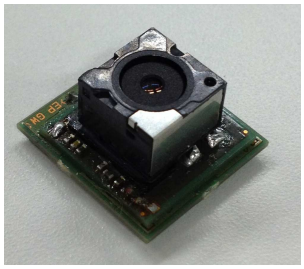
SONY

FCB-MA130

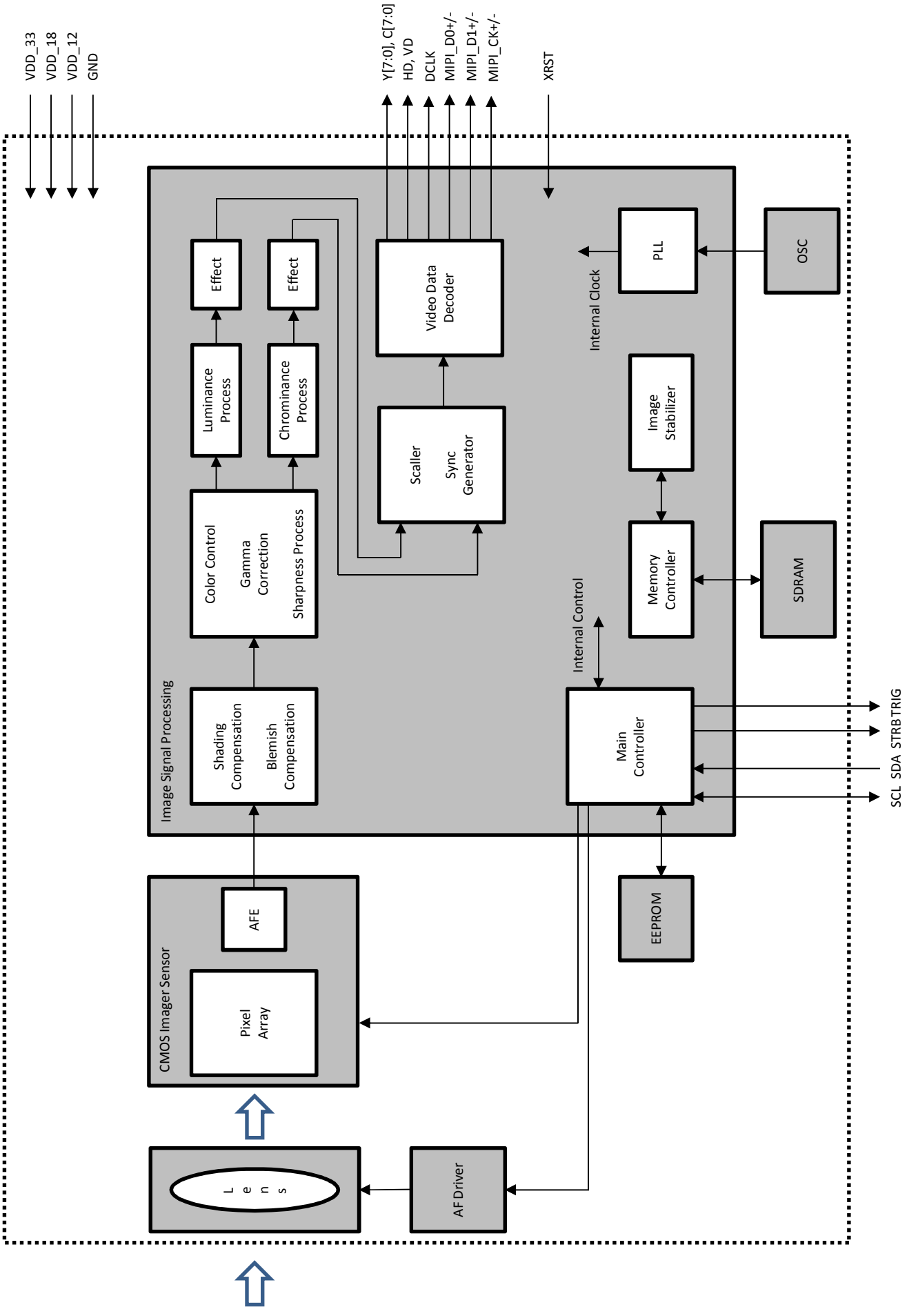
13 Mega Pixels Digital Camera Module - Specification

Version 1.0 4th Mar, 2013

1 Cover Page and Summary of Specification

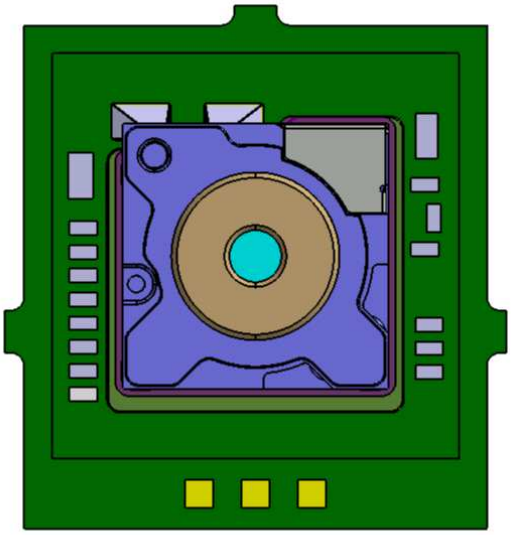
Image sensor	Progressive scan CMOS image sensor		 Outline Image
	Number of total pixels	4216 (H) x 3160 (V)	
	Image size	Diagonal 7.33mm (Type 1/2.45)	
	Color filter	Primary color Bayer arrangement	
	Unit cell size	1.4um(H) x 1.4um(V)	
Lens	Horizontal angle of view	Movie Mode: 53° Still Capture Mode : 58°	
	F value	1:2.8	
Focus Control	Focus Range	100mm to infinity (in horizontal posture)	
	Mechanics	Piezo actuator motor	
Focus Control	One Push Focus, Manual Focus		
Expose Control	Auto, Hold, Manual, Shutter Priority, Gain Priority		
White Balance	Auto, Hold, ATW, Fixed(6Mode)		
Image Signal Function	Face Detection(On/Off)		
	Image Stabilizer(On/Off)		
	Noise Reduction : 3DNR(On/Off)		
	Wide Dynamic Range : ATR(On/Off)		
Output Image format	YCbCr422		
	Still Capture Mode : Maximum Image Size: 4192(H) x 3104(V)		
	Movie Mode : 30.0fps/25.0fps / Maximum Image Size 1920(H) x 1080(V)		
I/O pins	Image signal I/O	CMOS Clock 81MHz, Parallel 16bit(YCbCr422 / SAV, EAV selectable) / Sync Signal (HD, VD)	
		MIPI D-PHY Clock 324MHz, Data 2lane CSI-2 (YCbCr422)	
	Control signal I/O	I2C Serial Bus	
Power, others	Power supply	Multiple DC : 3.3±0.1[V], 1.8±0.1[V], 1.2-0.05/+0.1[V]	
	Power consumption	700mW (Typ. at Movie Mode)	
	Storage temperature	-20 to +60 degrees	
	Operating temperature	-5 to +50 degrees	
	Module dimensions	W16.5[mm] x D18.0[mm] x H10.3[mm] (without projection)	
	Module mass	2.2gram	

2 Block Diagram

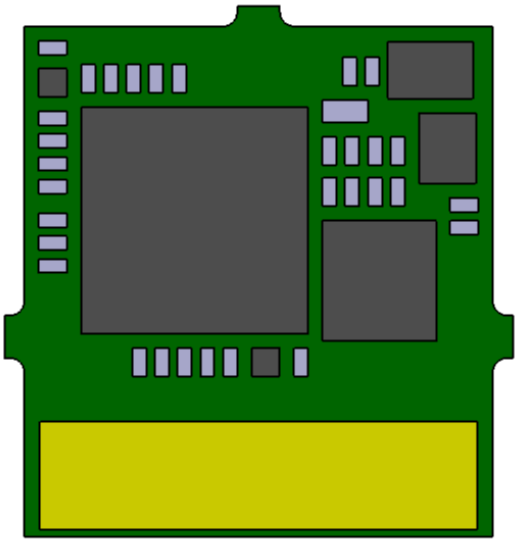


3 Module Dimension

3.1 Outline

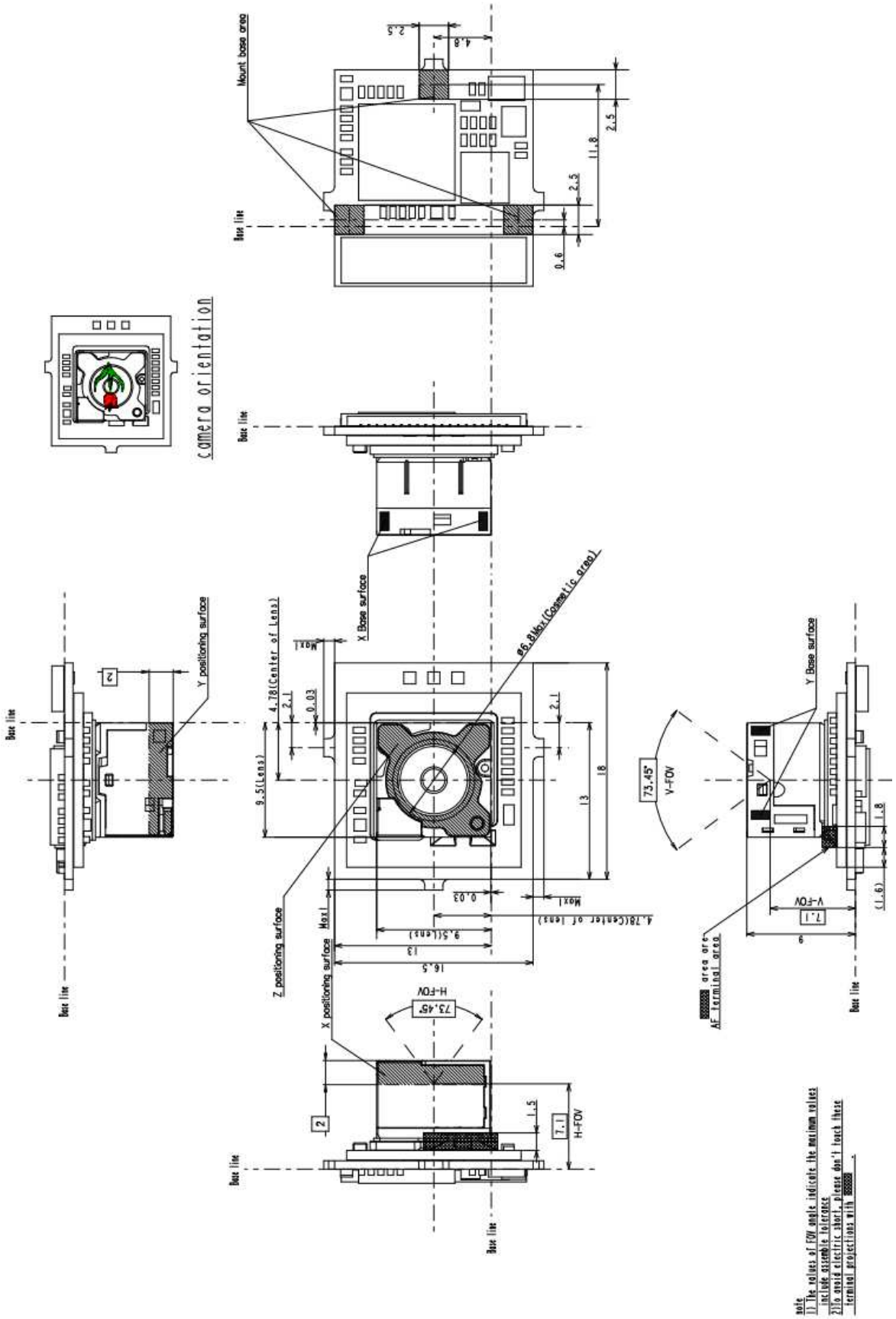


< Top View >



< Bottom View >

3.2 Dimension



4 Pin Description

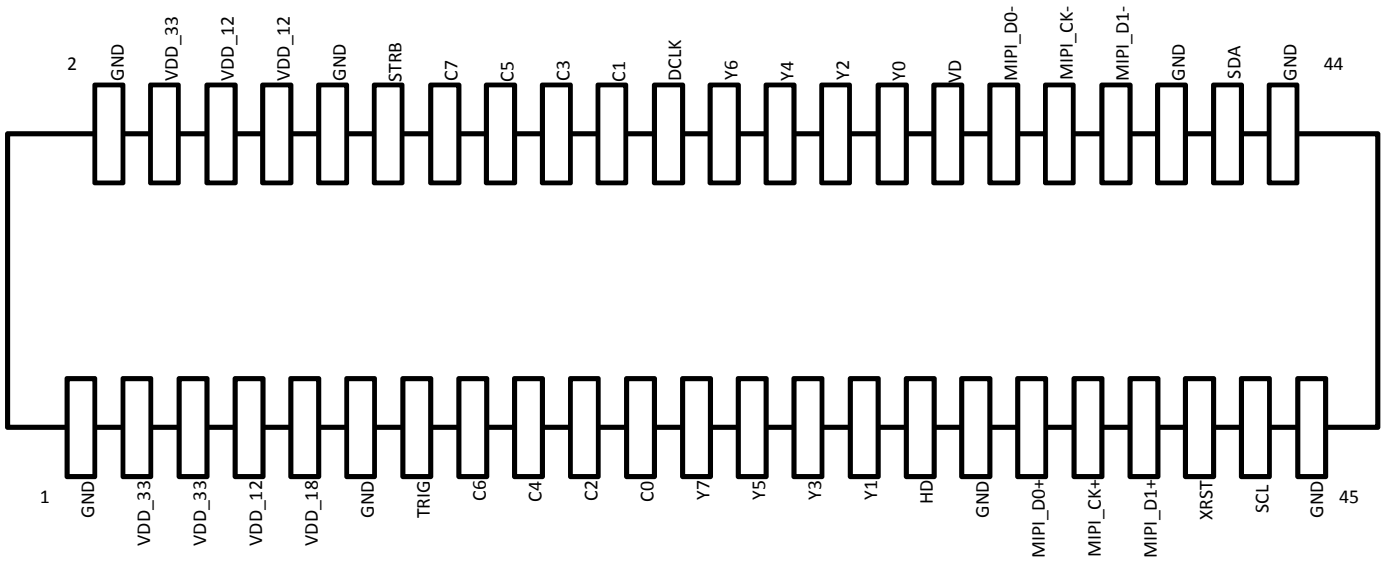
4.1 Table of Pin Assignment

Pin No.	Symbol	I/O	Type of Power Supply	Description
1	GND(AF)	-	-	Ground (*1)
2	GND(AF)	-	-	Ground (*1)
3	VDD_33(AF)	-	-	Power Supply (3.3V) (*1)
4	VDD_33(AF)	-	-	Power Supply (3.3V) (*1)
5	VDD_33	-	-	Power Supply (3.3V)
6	VDD_12	-	-	Power Supply (1.2V)
7	VDD_12	-	-	Power Supply (1.2V)
8	VDD_12	-	-	Power Supply (1.2V)
9	VDD_18	-	-	Power Supply (1.8V)
10	GND	-	-	Ground
11	GND	-	-	Ground
12	STRB	O	V_{DD_18}	Camera Strobe Signal
13	TRIG	O	V_{DD_18}	Mode Transition Signal
14	C7	O	V_{DD_33}	Digital Video Data (Chroma Parallel Data 7)
15	C6	O	V_{DD_33}	Digital Video Data (Chroma Parallel Data 6)
16	C5	O	V_{DD_33}	Digital Video Data (Chroma Parallel Data 5)
17	C4	O	V_{DD_33}	Digital Video Data (Chroma Parallel Data 4)
18	C3	O	V_{DD_33}	Digital Video Data (Chroma Parallel Data 3)
19	C2	O	V_{DD_33}	Digital Video Data (Chroma Parallel Data 2)
20	C1	O	V_{DD_33}	Digital Video Data (Chroma Parallel Data 1)
21	C0	O	V_{DD_33}	Digital Video Data (Chroma Parallel Data 0)
22	DCLK	O	V_{DD_33}	Digital Video Clock
23	Y7	O	V_{DD_33}	Digital Video Data (Luminance Parallel Data7)
24	Y6	O	V_{DD_33}	Digital Video Data (Luminance Parallel Data6)
25	Y5	O	V_{DD_33}	Digital Video Data (Luminance Parallel Data5)
26	Y4	O	V_{DD_33}	Digital Video Data (Luminance Parallel Data4)
27	Y3	O	V_{DD_33}	Digital Video Data (Luminance Parallel Data3)
28	Y2	O	V_{DD_33}	Digital Video Data (Luminance Parallel Data2)
29	Y1	O	V_{DD_33}	Digital Video Data (Luminance Parallel Data1)
30	Y0	O	V_{DD_33}	Digital Video Data (Luminance Parallel Data0)
31	HD	O	V_{DD_33}	Digital Video H-Active Signal
32	VD	O	V_{DD_33}	Digital Video V-Active Signal
33	GND	O	-	Ground
34	MIPI_D0-	O	(*3)	MIPI Output Data Lane0(-)
35	MIPI_D0+	O	(*3)	MIPI Output Data Lane0(+)
36	MIPI_CK-	O	(*3)	MIPI Output Clock(-)
37	MIPI_CK+	O	(*3)	MIPI Output Clock(+)
38	MIPI_D1-	O	(*3)	MIPI Output Data Lane1(-)
39	MIPI_D1+	O	(*3)	MIPI Output Data Lane1(+)
40	GND	O	-	Ground
41	XRST	I	V_{DD_18}	System Reset, or not connected
42	SDA	IO	V_{DD_18}	I2C Serial Bus Data I/O (*2)
43	SCL	I	V_{DD_18}	I2C Serial Bus Clock (*2)
44	GND	O	-	Ground
45	GND	O	-	Ground

Note)
(*1) Pin No.1 to 4 are for AF driver power & ground.
(*2) An external pull-up resistor(10kΩ) is recommended.
(*3) MIPI is based on D-PHY

4.2 Connector and Pin Assignment

Pin Assign (BOTTOM VIEW)



4.3 Connector Information (Manufacturer and Parts Number)

For the matching connector, refer to KYOCERA Connector Products Corporation, parts number 6296 (0.3mm pitch RA SMT Dual-sided contact one touch lock ZIF connecter)

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5 Detailed Specifications

5.1 Sensor Specifications

Image sensor	Progressive scan CMOS image sensor
Image size	Diagonal 7.33 mm (Type 1/2.45)
Number of total pixels	4216(H) x 3160(V)
Scan method	Progressive scan
Color filter	Primary color Bayer arrangement
Unit cell size	1.4um(H) x 1.4um(V)

5.2 Optical Specifications (* Design Specification)

Configuration		4 groups, 4elements
Angle of view	Horizontal	Movie Mode : 53°, Still Capture Mode : 58°
F value		2.8
Focal length (35 mm equivalent)		5.3 mm (31 mm)
TV distortion (100 mm)		±1.0%
Focal range		100 mm to infinity (in the horizontal posture)
AR coating		On all lens surface
Mechanics (Actuator)		Piezo actuator motor

5.3 Signal Processing (Function Specification)

Digital zoom	Variable: x1 to x16, 60 Step		
AE mode	Auto, Hold, Manual, Shutter priority, Gain priority		
Exposure correction	-2 EV to +2 EV, 1/3 EV Step		
Backlighting correction	Supported only when AE mode are Auto, Shutter priority and Gain priority		
Shutter speed	1/25s to 1/5000s, 24Step		
White balance	Auto, Hold, ATW, Fixed(Light Bulb, Daylight Color Fluorescent Light, Clear Sky, Cloudy Sky, Neutral Color Fluorescent Light, Light Bulb Color Fluorescent Light)		
Image stabilization	Supported		
Focus	AF mode	One Push Focus, Manual Focus	
	Focal range	100 mm to infinity	
Picture Adjustment	Brightness Adjustment		Supported, 16 Step
	Contrast Adjustment		Supported, 17 Step
	Sharpness Adjustment		Supported, 17Step
	Color Gain Control		Supported, 65 Step
	Color Hue Control		Supported, 256 Step
	Noise Reduction		3DNR, off
	Wide Dynamic Range(ATR)		Supported
Mirror Image	Side by side reverse, Up and down reverse		
Flicker less operation	Auto detection, 50/60 Hz selectable, off		
Face Detection	Supported (the maximum number of detecting face : 8)		

6 Electrical Characteristics

6.1 Absolute Maximum Ratings

Item	Signal	Min.	Typ.	Max.	Unit
Supply voltage	V_{DD_33}	-0.5	-	3.6	V
	V_{DD_18}	-0.3	-	2.5	
	V_{DD_12}	-0.3	-	2.0	
Storage temperature	T_{stg}	-20	-	+60	Celsius

6.2 Recommended Operating Conditions

Item	Signal	Min.	Typ.	Max.	Unit
Supply voltage	V_{DD_33}	3.2	3.3	3.4	V
	V_{DD_18}	1.7	1.8	1.9	
	V_{DD_12}	1.15	1.2	1.3	

6.3 DC Characteristics

Item	Pin	Symbol	Min.	Typ.	Max.	Unit
Output voltage	Y[7:0], C[7:0], DCLK, HD, VD	V_{OL1}	-	-	0.15 * V_{DD_33}	V
		V_{OH1}	0.85 * V_{DD_33}	-	-	
	TRIG, STRB, SDA	V_{OL2}	-		0.4	V
		V_{OH2}	V_{DD_18} -0.4		-	
Input voltage	XRST, SCL, SDA	V_{IL}	0	-	0.3 * V_{DD_18}	V
		V_{IH}	0.7 * V_{DD_18}	-	V_{DD_18}	
Leak current	XRST	I_{L1}	-250		250	uA
	Others	I_{L2}	-10	-	10	uA

6.4 Power and Current Consumption

(Measured conditions: Room temperature, typical voltage, Movie Mode 30fps Full HD as stable operation)

Item	Signal	Min	Ave	Max	Unit
Power Supply Current	V_{DD_33}	-	90	-	mA
	V_{DD_18}	-	25	-	
	V_{DD_12}	-	285	-	

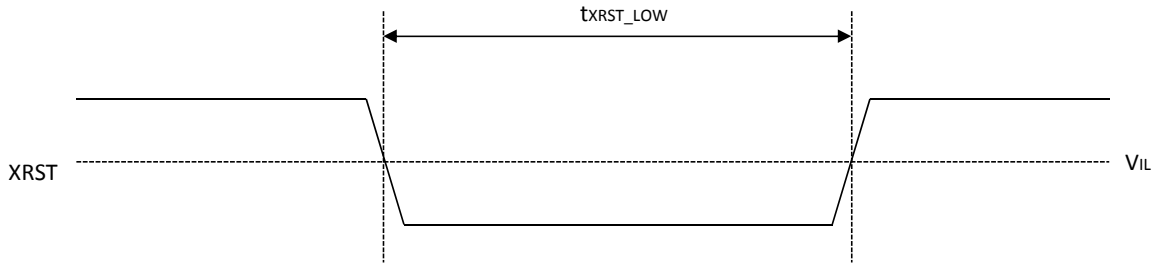
(Measured conditions: Room temperature, typical voltage, Still Capture Mode 5fps 13M as stable operation)

Item	Signal	Min	Ave	Max	Unit
Power Supply Current	V_{DD_33}	-	90	-	mA
	V_{DD_18}	-	20	-	
	V_{DD_12}	-	275	-	

6.5 AC Characteristics

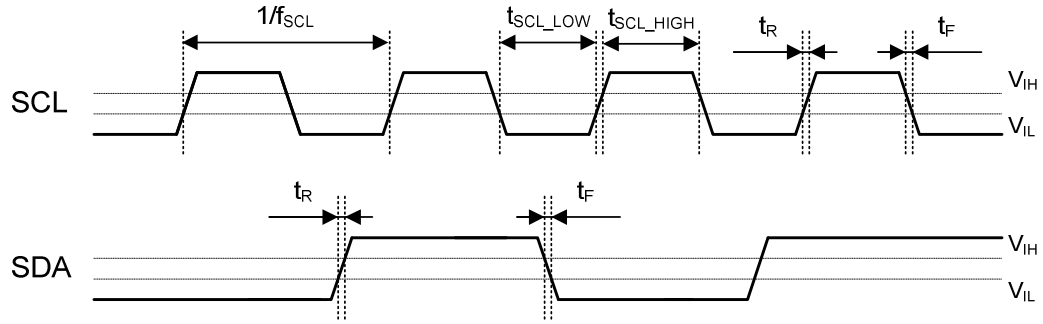
6.5.1 Reset Timing

Fulfill the timing requirement shown below in order to reset the camera module certainly. As for the start-up sequence of XRST, refer to “the power-on sequence”.



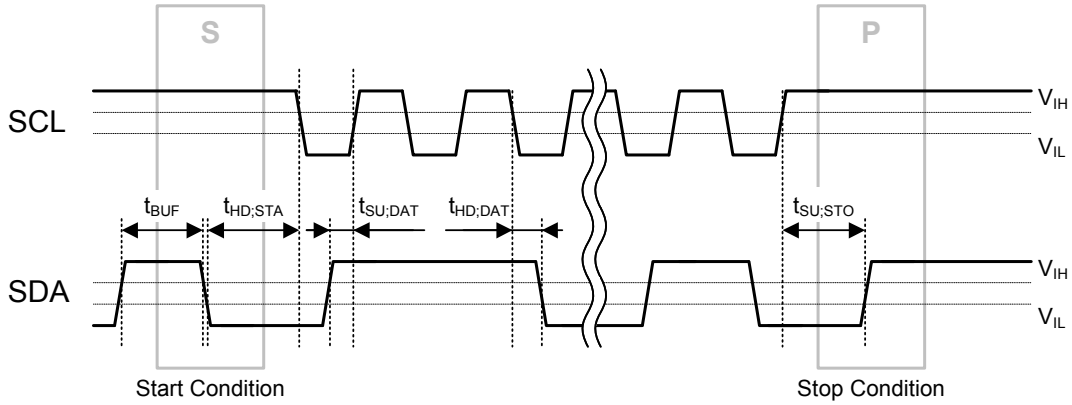
Item	Pin	Symbol	Min.	Typ.	Max.	Unit
Low period of XRST	XRST	t_{XRST_LOW}	1	-	-	ms

6.5.2 I2C Bus Timing



Item	Symbol	Pin	Min.	Max.	Unit
SCL clock frequency	f_{SCL}	SCL	0	400	kHz
Low period of SCL	t_{SCL_LOW}	SCL	1.3	-	us
High period of SCL	t_{SCL_HIGH}	SCL	0.6	-	us
Rise time of SDA and SCL	t_R	SDA, SCL	-	300	ns
Fall time of SDA and SCL	t_F	SDA, SCL	-	300	ns

Note) The camera may force the SCL level to be low level in order to notify the host that the camera module is not ready to receive the I2C data.



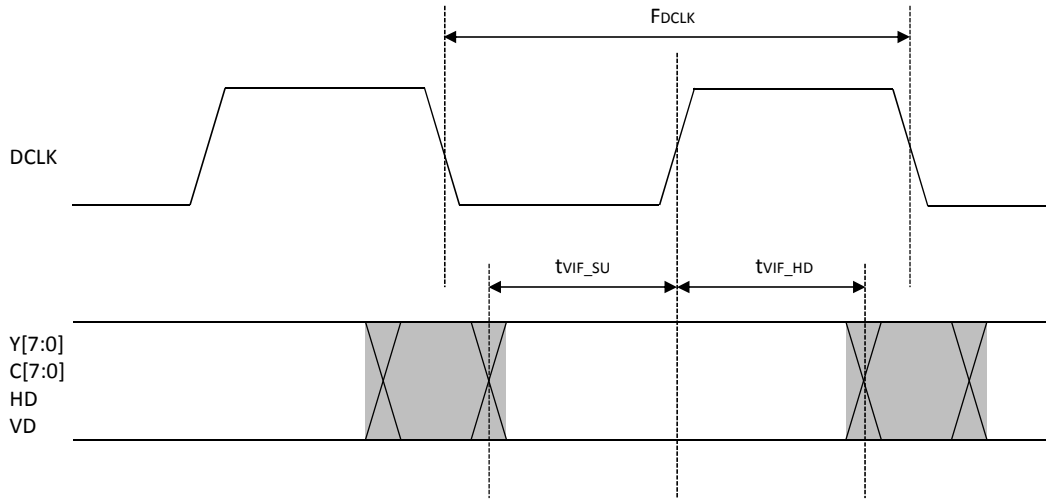
Item	Symbol	Pin	Min.	Max.	Unit
Bus free time before transmission	t_{BUF}	SDA, SCL	1.3	-	us
Hold time for START condition	$t_{HD;STA}$	SDA, SCL	0.6	-	us
Data hold time	$t_{HD;DAT}$	SDA, SCL	0*1	-	us
Data set-up time	$t_{SU;DAT}$	SDA, SCL	100	-	ns
Set-up time for STOP condition	$t_{SU;STO}$	SDA, SCL	0.6	-	us

*1 Data hold time should be more than 300 ns considering the fall time of SCL (Max. 300 ns)

Note) At the camera start-up, no I2C communication is allowed until the camera initialization is finished. The camera module notifies the completion of the initialization. For the details, refer to *the User Interface Control Specification*.
Note) The disturbance of the I2C bus by the camera module might occur at the camera start-up. It is preferable to refrain from communicating with the other devices on the I2C bus at the camera start-up.
Note) "Repeated start condition" is not supported.

6.5.3 Video Interface Timing

6.5.3.1 CMOS Output



Note) D[7:0],C[7:0], HD and VD should be sampled at the rising edge of DCLK.

Item	Condition	Symbol	Min.	Typ	Max.	Unit
Output Clock Frequency	-	F_{DCLK}	-	81	-	MHz
Output Clock Frequency Duty	-	D_{CLKDU}	45	50	55	%
Data Setup Time	Load = 30pF	t_{VIF_SU}	3		-	ns
Data Hold Time	Load = 30pF	t_{VIF_HD}	3		-	ns

6.5.3.2 MIPI Output

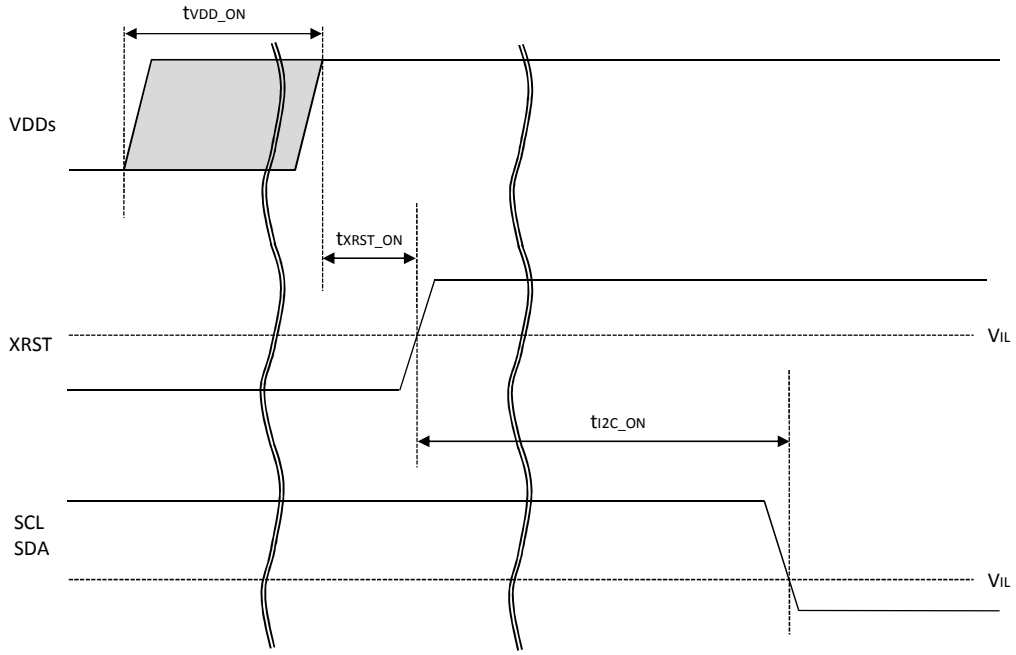
This Module is compliant with following MIPI specification :

- CSI-2 Ver1.00.00
- D-PHY Ver1.00 or later

- Data Rate 648Mbps/lane

7 Power-on/off Sequence

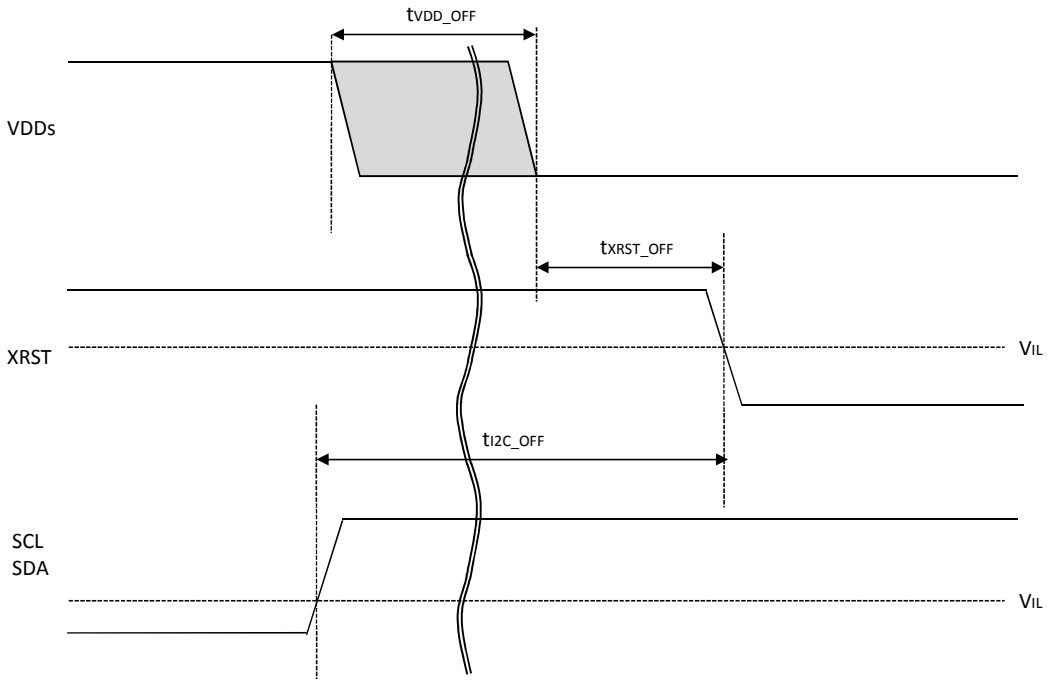
7.1 Power-on Sequence



Note) VDDs : VDD_33, VDD_18, VDD_12

Item	Symbol	Pin	Min.	Max.	Unit
VDDs start-up allowance period	t_{VDD_ON}	VDD_33, VDD_18, VDD_12	-	100	ms
Time from MCK on to XRST high	t_{XRST_ON}	XRST	1	-	ms
Time from XRST high to I2C communication start	$t_{I2C\_\_ON}$	SDA, SCL	400	-	ms

7.2 Power-off Sequence



Note) VDDs : VDD_33, VDD_18, VDD_12

Item	Symbol	Pin	Min.	Max.	Unit
VDDs start-up allowance period	t_{VDD_OFF}	VDD_33, VDD_18, VDD_12	-	100	ms
Time from last I2C communicaton to XRST low	t_{I2C_OFF}	SDA, SCL	0	-	ns
Time from VDDs off to XRST low	t_{XRST_OFF}	XRST	512	-	ns

8 Image Size

8.1 Image Sizes

8.1.1 Movie Mode

H Valid Pixels	V Valid Pixels	-	Frame Rate
1920	1080	Full HD(16:9)	30.0fps / 25.0fps
1600	1200	UXGA(4:3)	30.0fps / 25.0fps
1280	960	SXGA(4:3)	30.0fps / 25.0fps
1280	720	HD(16:9)	30.0fps / 25.0fps
1024	768	XGA(4:3)	30.0fps / 25.0fps
800	480	WVGA	30.0fps / 25.0fps
640	480	VGA	30.0fps / 25.0fps

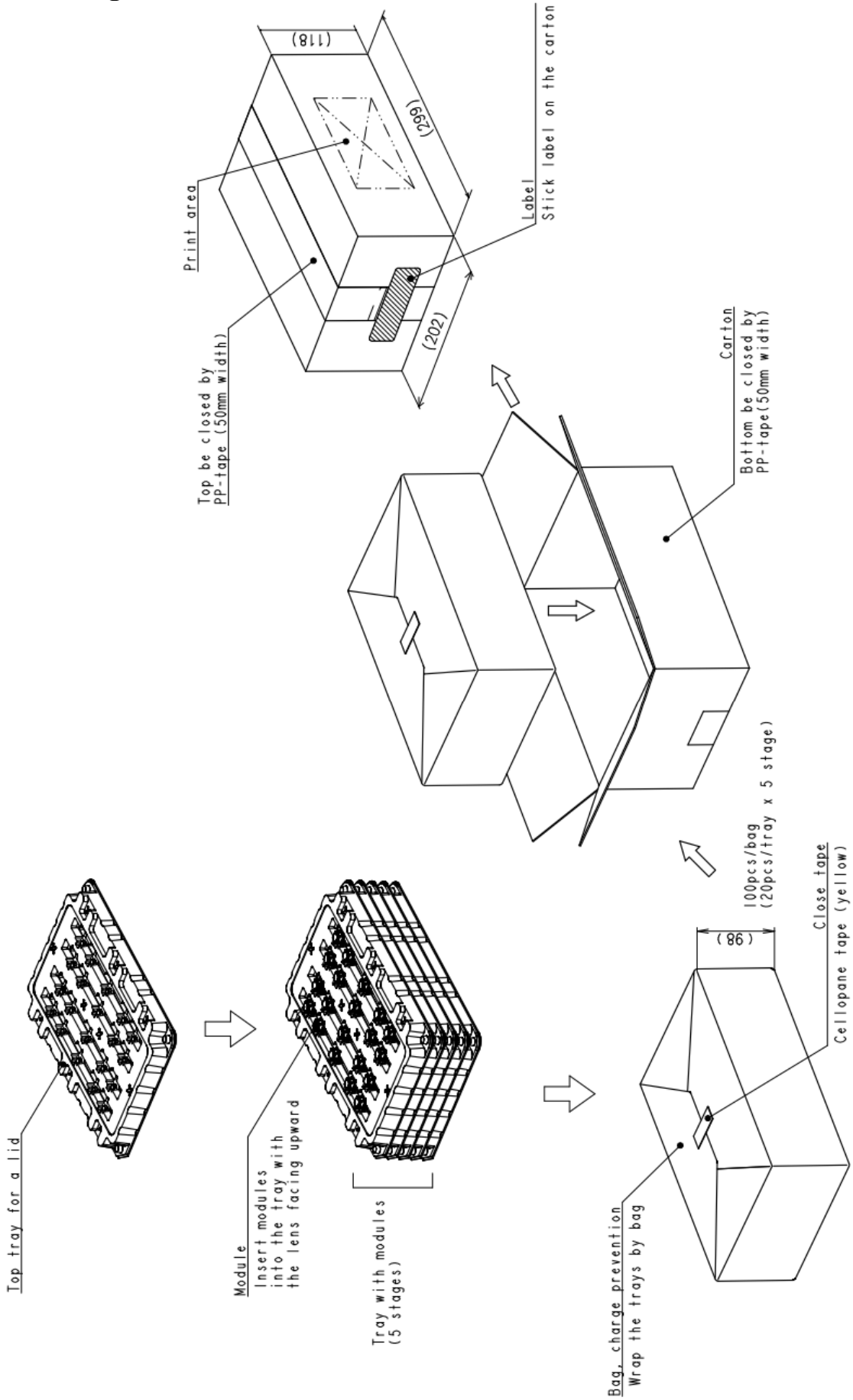
Note) Not Supported ITU-R BT.1120

8.1.2 Still Capture Mode

H Valid Pixels	V Valid Pixels	-	Frame Rate
4192	3104	13M(Not 4:3)	5.0fps
4128	3096	13M(4:3)	5.0fps
3264	2448	8M	5.0fps
2592	1944	5M	5.0fps
1920	1080	Full HD(16:9)	5.0fps
1280	960	SXGA(4:3)	5.0fps
1280	720	HD(16:9)	5.0fps
640	480	VGA	15.0fps

Note) In Still Capture Mode, the camera module outputs repeatedly same picture according to above frame rate.

9 Packing



* Note : Dimensions in millimeters

10 Handling Precautions

10.1 Operating Temperature

Make sure that the temperature inside the equipment does not exceed the recommended operating temperature.

10.2 ESD Protection

Anti-ESD measures should be taken for this camera module in the same manner as semiconductor devices.

(1) Either handle bare handed or use non-chargeable gloves, cloth or material. Also use conductive shoes.
(2) When handling directly use a wrist strap.
(3) Install grounded conductive mats on the floor and working table to prevent the generation of static electricity.
(4) Discharge using ionized air or other means is recommended when handling this camera module.

10.3 Storage and Operating Environment

Avoid storage or use under high temperature, high humidity and dusty conditions.

10.4 Mechanical Strength

This camera module is a precision optical part, so care should be taken not to apply excessive mechanical shock or force.

10.5 Remodeling

Any remodeling or process at customers should be avoided. No product warranty will be granted if the product is once remodeled or processed.

10.6 EEPROM

The data in the EEPROM should not be modified or overwritten. Once they are modified or overwritten, no product warranty may be able to be given.

10.7 White Pixels

The image-sensing device is vulnerable to natural radiation such as cosmic radiation that may cause incidental defect resulting in white pixel. Although these white pixels are corrected during the final inspection and adjustment process of the camera module production, a minor number of the product might be affected during the storage and shipment, and “white pixel” may appear on incoming stage at customer production site. As the occurrence of white pixels is due to natural behavior, it’s beyond supplier’s control.

10.8 Safety Standards

This product is manufactured as an unfinished product and no particular safety standard is applicable to this product alone. Users should ensure that finished products using this camera module conform to applicable safety standards.

Revision History

Version	Date	Page	Description
1.0	04/Mar/2013	-	Initial