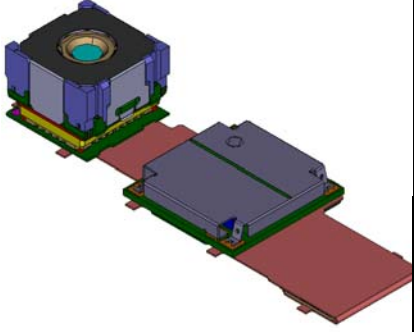
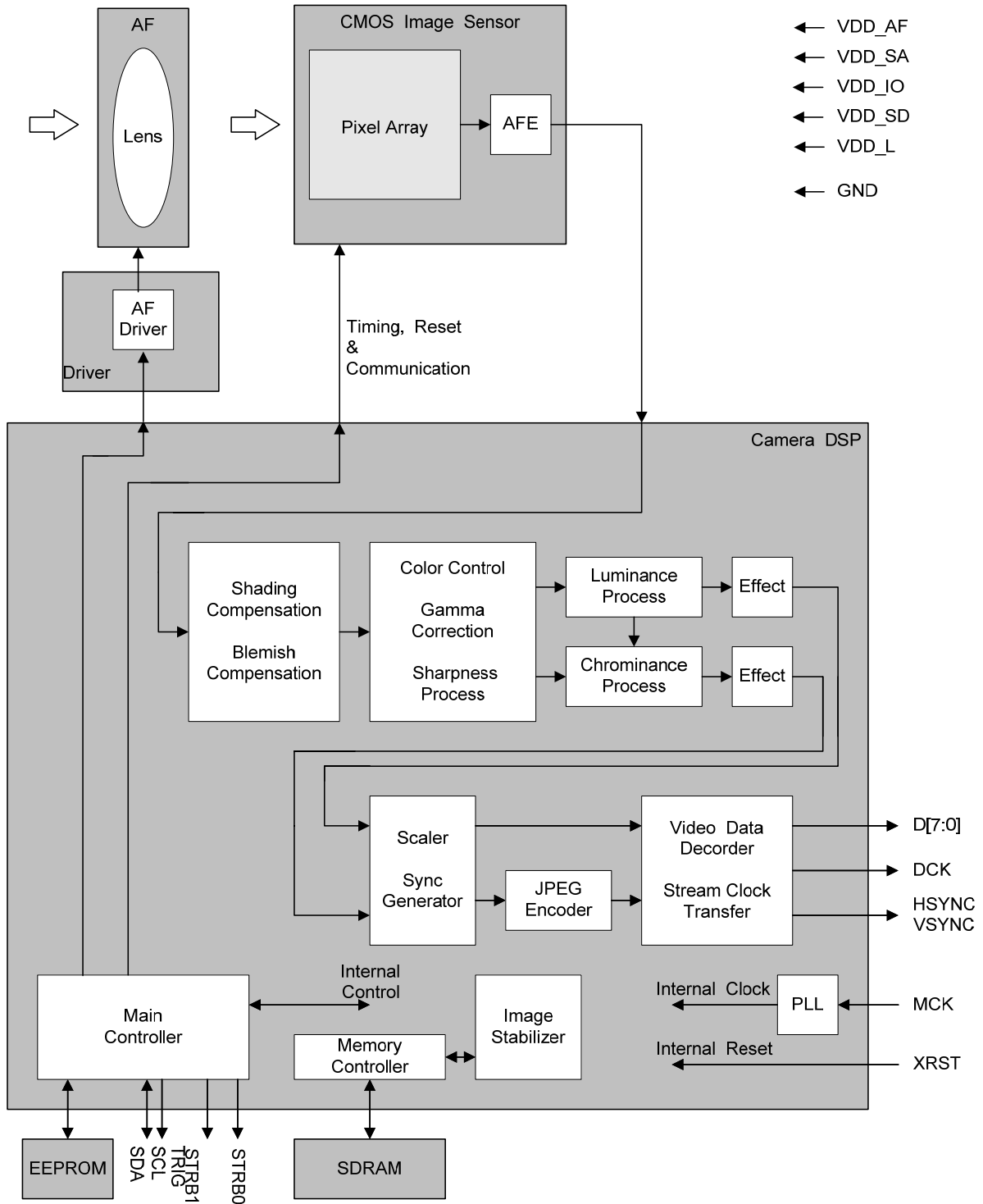


1 Cover page and Summary of Specification

Image sensor	Progressive scan CMOS image sensor		Outline image 
	Number of total pixels	3320 (H)x2500 (V)	
		8.30 M pixels	
	Number of effective pixels	3280 (H)x2464 (V)	
8.08 M pixels			
Lens	Horizontal angle of view	52.7 degrees	
	F value	1:2.8	
Auto focus	Focus range	100 mm ~ infinity with auto focus	
	Mechanics	Linear motor	
Exposure control	Automatic, Hold, Manual, Shutter speed priority and ISO sensitivity priority (Long exposure supported)		
White balance	Automatic, Pull-in and Preset (8 modes)		
Image stabilization	Electronic method, Still capture and movie support		
Output format	YCbCr:4:2:2 and JPEG, Maximum image size: 3264(H) x 2448 (V) 7.99M pixels		
	Frame rate @ MCK = 13 MHz	Draft mode: 30 fps (up to 720p)	
		Still capture mode (YCbCr output) :1.875 fps(up to 8Mpixels)	
		Still capture mode (JPEG output):15fps(up to 8M pixels)	
I/O pins	Image signal I/O	YCbCr / 8 bit / 4:2:2 (SAV, EAV not supported)	
		JPEG 4:2:2 stream data without header	
		I2C bus fast mode (400kbps), Interruption line signal, Fill light synchronization signal	
Power, others	Power supply	VDD_L: 1.2+/- 0.1 V, VDD_SD: 1.8 V +/- 0.1 V, VDD_SA: 2.8V+/- 0.1 V VDD_AF: 2.7-3.0V(Typ. 2.8V), VDD_IO: 1.8V +/- 0.1 V,	
	Power consumption	TBD	
	Storage temperature	-30 to +80 degrees	
	Operating temperature	-10 to +60 degrees	
	Recommended op. temp.	-10 to +45 degrees	
	Package dimensions	9.5mm(W) x 9.5mm(L) x 7.1mm(H) (Camera Head Block)	
	Package mass	TBD grams	

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2 BlockDiagram



3 Pin Description

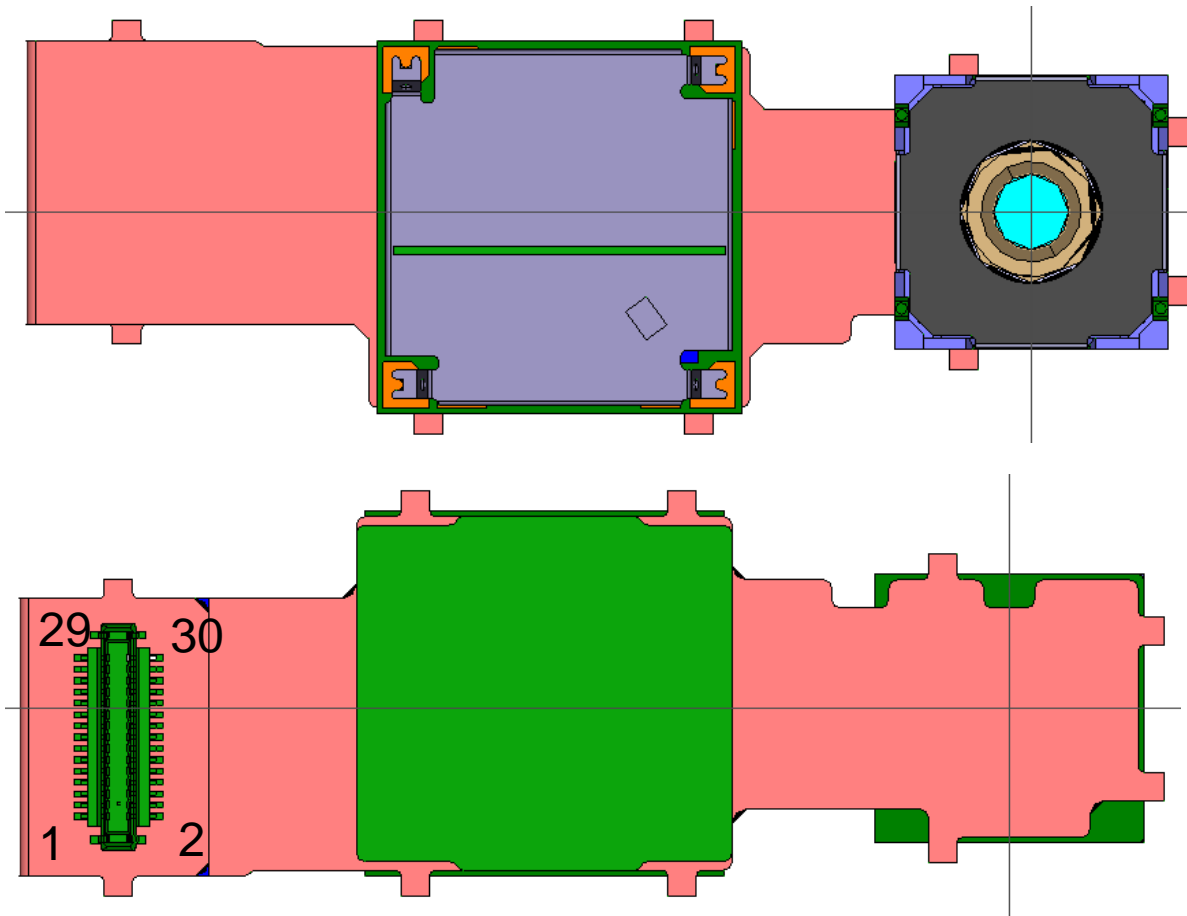
3.1 Table of Pin Assignment

Pin No.	Symbol	I/O	State at reset	State at power save	State at power off	Description
1	GND_AF	-	-	-	-	Ground (Auto Focus)
2	GND_AF	-	-	-	-	Ground(Auto Focus)
3	VDD_AF	-	-	-	-	Voltage Supply (Auto Focus)
4	SCL	I/O	Hi Z	Active	Hi Z	I2C Serial Bus Clock *1
5	SDA	I/O	Hi Z	Active	Hi Z	I2C Serial Bus Data I/O *1
6	STRB1	OD	Hi Z	Hi Z	Hi Z	Sync Signal for Fill Light Support
7	VDD_SA	-	-	-	-	Voltage Supply (Sensor Analog)
8	VS	O	Hi Z	Hi Z	Hi Z	Vertical Synchronization Signal
9	GND_AF	-	-	-	-	Ground(Auto Focus)
10	HS	O	Hi Z	Hi Z	Hi Z	Horizontal Synchronization Signal
11	VDD_IO	-	-	-	-	Voltage Supply(I/O and DSP Digital)
12	XRST	I	-	-	-	System Reset
13	TRIG	O	Low	Low	Hi Z	Interrupt Line Signal
14	STRB0	O	Low	Low	Hi Z	Sync Signal for Fill Light Support
15	D7	O	Hi Z	Hi Z	Hi Z	Digital Video Data (MSB)
16	D6	O	Hi Z	Hi Z	Hi Z	Digital Video Data
17	D5	O	Hi Z	Hi Z	Hi Z	Digital Video Data
18	D4	O	Hi Z	Hi Z	Hi Z	Digital Video Data
19	D3	O	Hi Z	Hi Z	Hi Z	Digital Video Data
20	D2	O	Hi Z	Hi Z	Hi Z	Digital Video Data
21	D1	O	Hi Z	Hi Z	Hi Z	Digital Video Data
22	D0	O	Hi Z	Hi Z	Hi Z	Digital Video Data (LSB)
23	GND	-	-	-	-	Ground
24	MCK	I	-	-	-	System Clock Input
25	VDD_SD	-	-	-	-	Voltage Supply (Sensor Digital)
26	GND	-	-	-	-	Ground
27	DCK	O	Hi Z-	Hi Z-	Hi Z-	Digital Video Data Clock
28	GND	-	-	-	-	Ground
29	VDD_L	-	-	-	-	Voltage Supply (DSP Core)
30	VDD_L	-	-	-	-	Voltage Supply (DSP Core)

*1 An external pull-up resistor (4.7 kΩ) is recommended.

Note: When VDD_IO is ON and the other power supplies are OFF, the state of the pin is same with the state at power off as shown above.

3.2 Connector and Pin Assignment



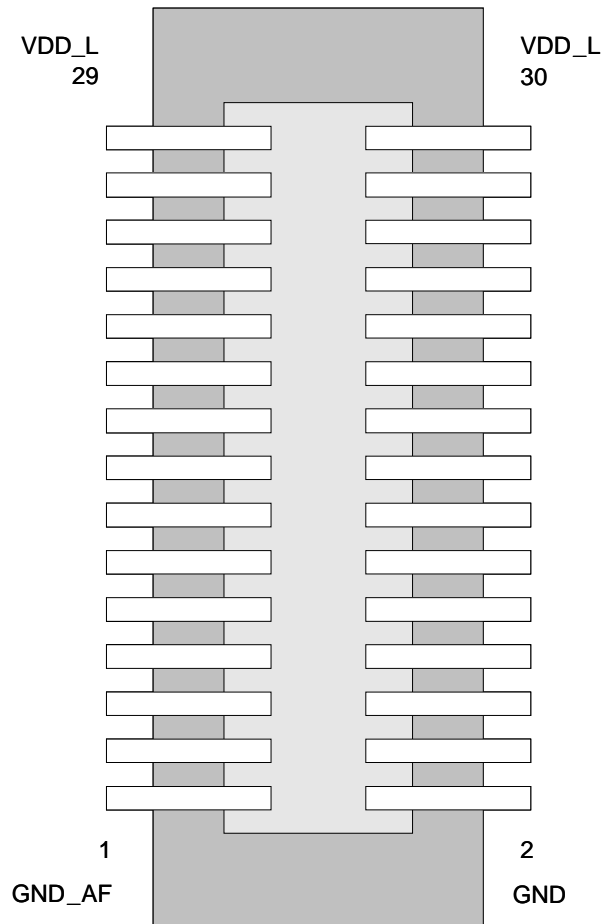
Pin Assign (TOP VIEW)

29	VDD_L	VDD_L	30
27	DCK	GND	28
25	VDD_SD	GND	26
23	GND	MCK	24
21	D1	D0	22
19	D3	D2	20
17	D5	D4	18
15	D7	D6	16
13	TRIG	STRB0	14
11	VDD_IO	XRST	12
9	GND	HS	10
7	VDD_SA	VS	8
5	SDA	STRB1	6
3	VDD_AF	SCL	4
1	GND_AF	GND_AF	2

3.3 Connector Information (Maker and Parts Number)

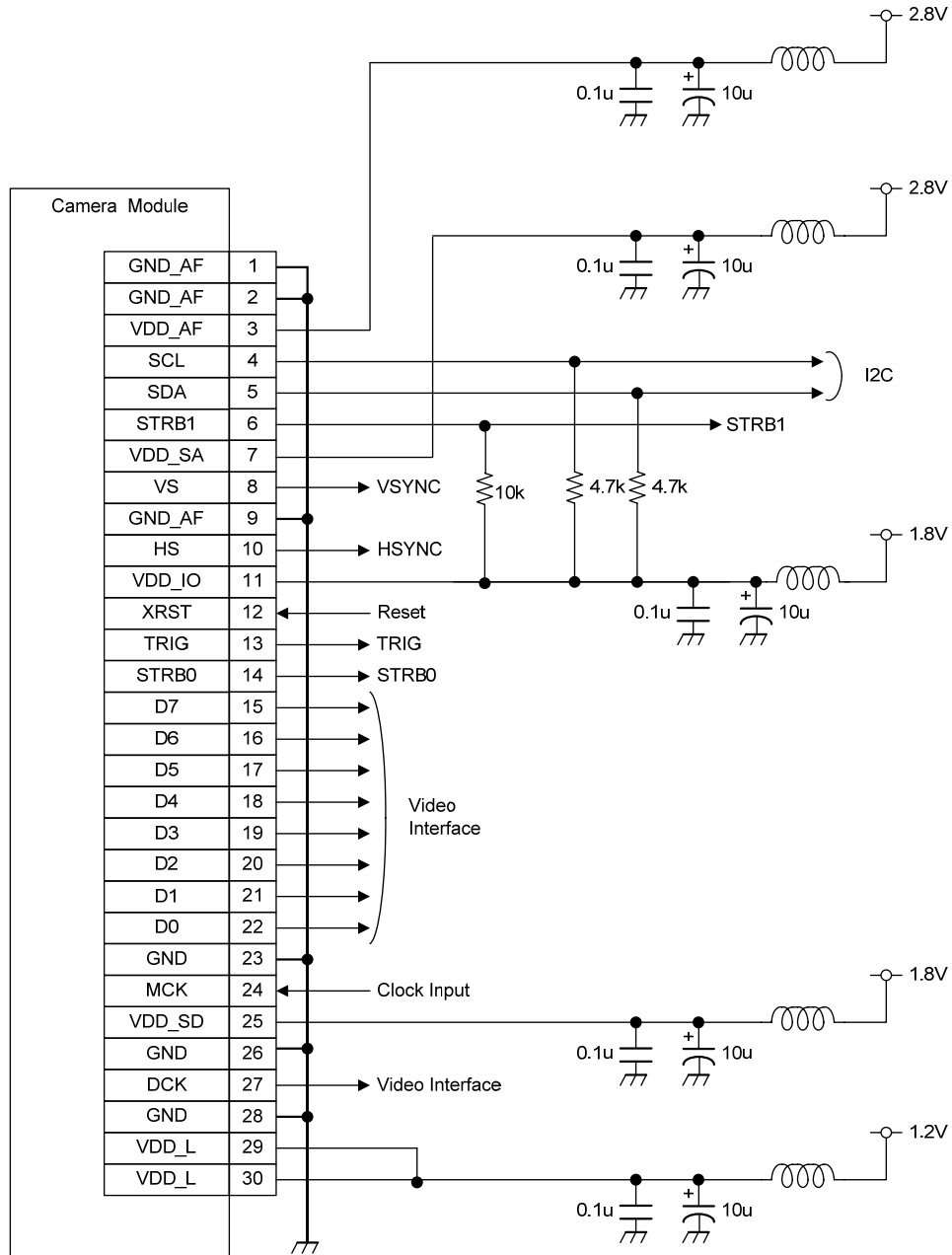
The 30 pins circuit board-to-board connector is manufactured by Tyco Electronics AMP K.K. (Parts number: 3-1871566-0)

Connector Top View



(For the mating connector, refer to Tyco Electronics AMP K.K.' parts number 3-1747769-0)

3.4 Example of Application Circuit



The application circuit is a typical example illustrating the operation of the devices. Sony cannot assume responsibility for any problems arising out of the use of this circuit.

4 Detailed Specifications

4.1 Sensor Specifications

Image sensor	Progressive scan CMOS image sensor	
Optical size	Diagonal 5.7 mm (Type 1/3.2)	
Aspect ratio	4:3	
Number of total pixels	3320(H) x 2500(V)	8.30 M pixels
Number of effective pixels	3280(H) x 2464(V)	8.08 M pixels
Scan method	Progressive scan	
Color filter	Primary color Bayer arrangement	

4.2 Optical Specifications (* Design Specification)

Configuration	3 groups, 3 lenses	
Angle of view	Horizontal	52.7 degrees
	Vertical	40.7 degrees
	Diagonal	63.4 degrees
F value	2.8	
TV distortion	/- 0.4% / +0.6%	
Focal range	100 mm to infinity	
AR coating	On all lens surface	
Mechanics (Actuator)	Linear motor	

4.3 Signal Processing (Function Specification)

Scaling	Automatically selected according to the output format	
Digital zoom	Variable: x1 to x16	
Scene selection	Portrait, Beach/Snow, Party, Night, Sport, Landscape, Auto, For Image Stabilization	
AE mode	Automatic, Hold, Manual, Shutter speed priority and ISO sensitivity priority (Long exposure supported)	
Photometry method	Center weighted average photometry, Spot photometry	
Exposure correction	-2 EV to +2 EV, 1/3 EV Step	
ISO sensitivity	Auto, Fixed: 100 to TBD	
Shutter speed	1/30 (Max. 2 s) to 1/5000 s	
ISO range	Up to ISO800	
White balance (Color control)	Automatic (Range: 3000 K to 7500 K), Pull in, Preset (8 Modes)	
Image stabilization	Electronic method, Still capture and movie support	
High Sensitivity Mode	4 pixels Sensor binning reading. Draft(up to 720p) and Capture(up to 2M) mode support	
Quad Speed Mode	120 fps recording support (up to QVGA)	
Focus	AF method	Scan AF, Multiple AF supported AF window selectable (9 AF windows)
	AF optional	Under low illumination Brightness adjustment Frame rate control Assist LED control
	MF	Available
	Focal range	100 mm to Infinity
Video signal level	Scale (Y): 1 to 254: prohibit levels: 0 and 255	
Control signal interface	I2C bus fast mode (400k bit/s), Interruption line signal, Fill light synchronization signal	
Picture information	ISO sensitivity Color control mode (Light source color temperature) Exposure time (Shutter speed)	
Gamma correction	Pre-fixed	
Shading compensation	Supported	
Flicker less operation	Auto detection, 50/60 Hz selectable, off	
Suppress function	Sharpness suppress, Chroma suppress	
Effects	Monochrome, Sepia, Negative, Posterization	
Mirror image	Side by side reverse, Up and down reverse	
Fill light support function	LED mode, Xenon flash mode	

4.4 Absolute Maximum Ratings

Item	Signal	Min.	Typ.	Max.	Unit
Supply voltage	V_{DD_AF}	-0.5	-	3.6	V
	V_{DD_SA}	-0.3	-	3.3	
	V_{DD_IO}	-0.5	-	2.5	
	V_{DD_SD}	-0.3	-	2.5	
	V_{DD_L}	-0.5	-	1.6	
Input voltage @Power On	V_{IN}	-0.5	-	$V_{DD_IO}+0.5$ and 3.6	V
Input voltage @Power Off		-0.5	-	3.6	
Storage temperature	T_{stg}	-30	-	+80	degrees

4.5 Recommended Operating Conditions

Item	Signal	Min.	Typ.	Max.	Unit
Supply voltage	V_{DD_AF}	2.70	2.8	3.0	V
	V_{DD_SA}	2.7	2.8	2.9	
	V_{DD_IO}	1.7	1.8	1.9	
	V_{DD_SD}	1.7	1.8	1.9	
	V_{DD_L}	1.1	1.2	1.3	

4.6 Power and Current Consumption

TBD

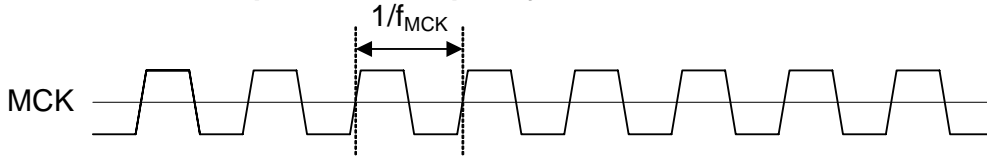
5 Electrical Characteristics

5.1 DC Characteristics

Item	Pin	Symbol	Condition	Min.	Typ.	Max.	Unit
Output voltage	D[7:0], DCK, HSYNC, VSYNC, STRB, TRIG xSTL_EXP	V _{OL}	I _{OL} = 0mA	-	-	0.10	V
		V _{OH}	I _{OH} = 0mA	V _{DD_IO} -0.10	-	-	
Input voltage	MCK	V _{IL}	-	0	-	0.4	V
		V _{IH}		0.8	-	V _{DD_IO}	
Input voltage	XRST	V _{IL}	-	0	-	0.7	V
		V _{IH}	V _{DD_IO} =1.80V	1.07	-	V _{DD_IO}	
Input voltage	SCL, SDA	V _{IL}	-	0	-	0.7	V
		V _{IH}	V _{DD_IO} =1.80V	1.07	-	V _{DD_IO}	
Output voltage		V _{OL}	I _{OL} = -2mA	0	-	0.4	
Input current leakage	MCK	I _{L1}	Power-on	-	-	250	μA
		I _{L2}	Power-off	-	-	10	μA
	SCL, SDA, XRST	I _{L3}	Power-on	-10	-	10	μA
		I _{L4}	Power-off	-	-	50	μA

5.2 AC Characteristics

5.2.1 Input Clock Frequency

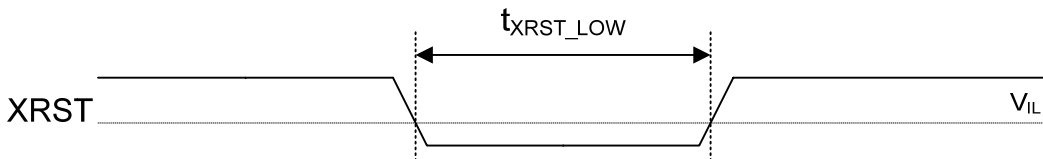


Item	Pin	Symbol	Min.	Typ.	Max.	Unit
Clock frequency	MCK	f_{MCK}	12.87 (-1.0%)	13.00	13.13 (+1.0%)	MHz
Duty cycle	MCK	f_{DUTY}	45	50	55	%

Note) Dithered clock input and sine wave clock input are not supported.

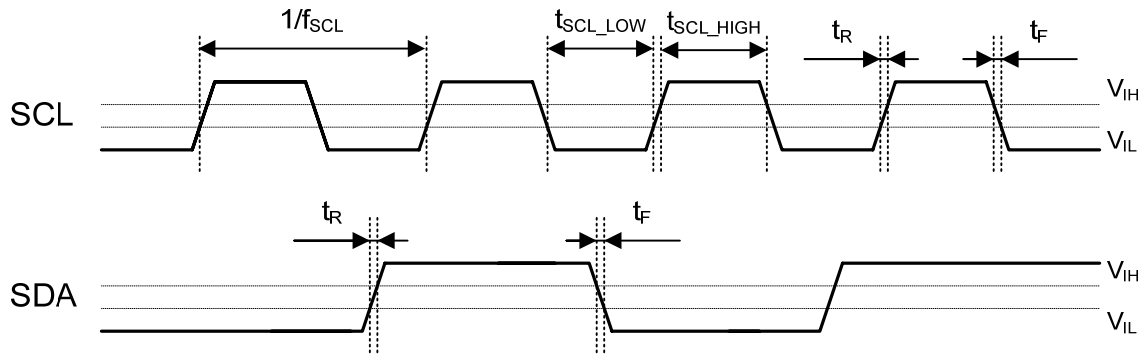
5.2.2 Reset Timing

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”.



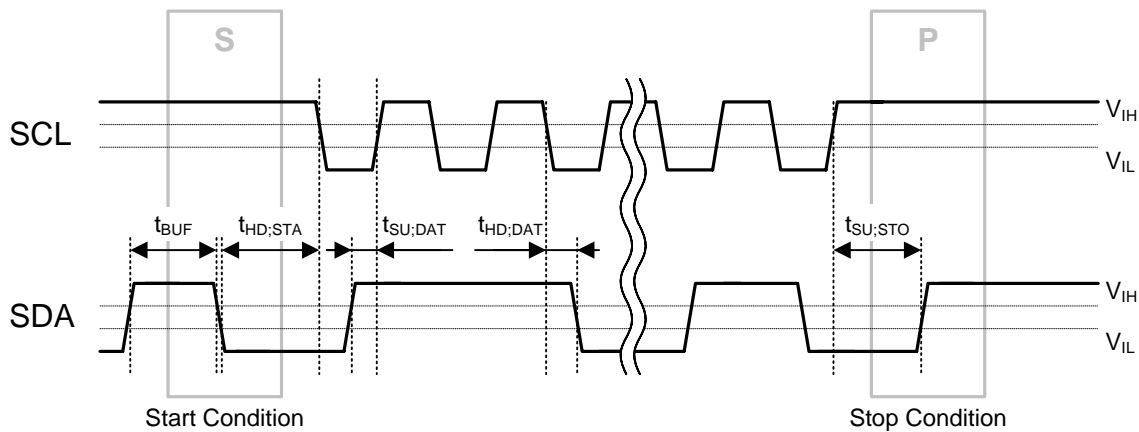
Item	Pin	Symbol	Min.	Typ.	Max.	Unit
Low period of XRST	XRST	t_{XRST_LOW}	1	-	-	ms

5.2.3 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

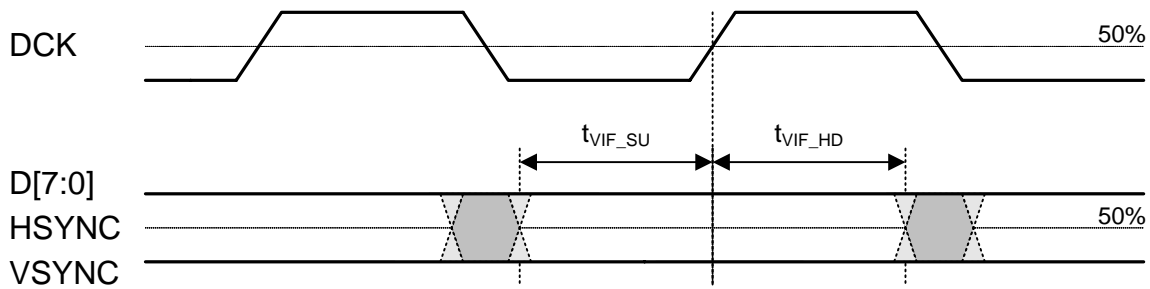
*1 Data hold time should be more than 300 ns considering the fall time of SCL (Max. 300 ns)

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.

5.2.4 Video Interface Timing



(Capacitive load = 50 pF, drivability: high, under the recommended operating conditions)

Item	Condition	Symbol	Min.	Max.	Unit
Setup time	-	t_{VIF_SU}	8	-	ns
Hold time	-	t_{VIF_HD}	8	-	ns

(Capacitive load = 20 pF, drivability: middle, under the recommended operating conditions)

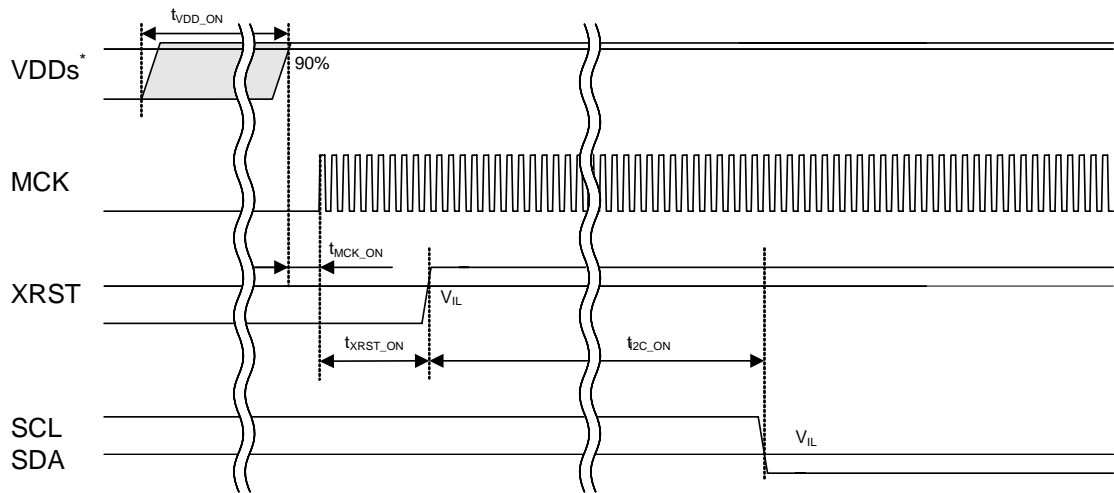
Item	Condition	Symbol	Min.	Max.	Unit
Setup time	-	t_{VIF_SU}	10	-	ns
Hold time	-	t_{VIF_HD}	10	-	ns

Note) D[7:0], HSYNC and VSYNC should be sampled at the rising edge of DCK.

Note) The frequency of DCK differs depending on the image output mode.

6 Power-on/off Sequence

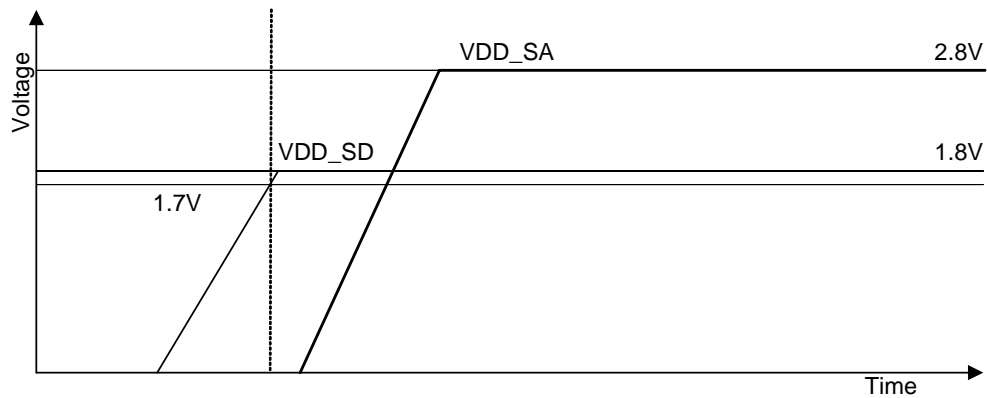
6.1 Power-on Sequence



* VDDs: VDD_SA, VDD_SD, VDD_L and VDD_AF

Note) All power lines except VDD_IO should achieve 90% level within 100 ms (VDDs start-up allowance period) satisfying the other timing requirements.

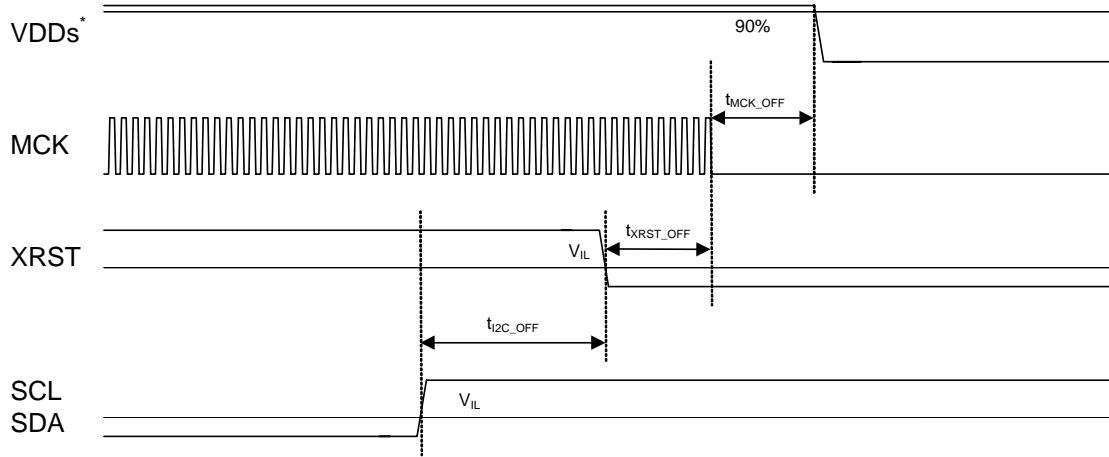
Note) VDD_IO can be kept on when other power supplies are off.



Note) VDD_SA should start to rise after VDD_SD achieves 1.7V level.

Item	Symbol	Pin	Min.	Max.	Unit
VDDs start-up allowance period	t_{VDD_ON}	VDD_SA, VDD_SD, VDD_L, VDD_AF	-	100	ms
Time from VDDs on to MCK on	t_{MCK_ON}	MCK	0	-	ns
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	500	-	ms

6.2 Power-off Sequence

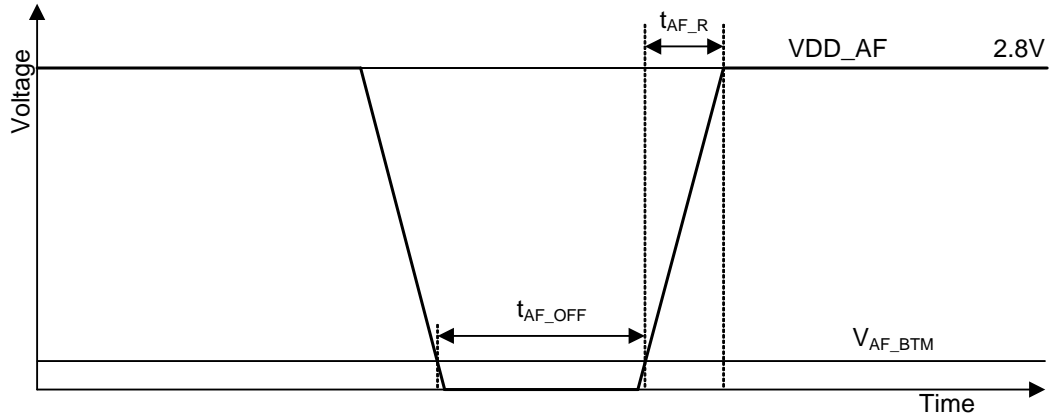


* VDDs: VDD_SA, VDD_SD, VDD_L and VDD_AF

Item	Symbol	Pin	Min.	Max.	Unit
Time from last I2C communication to XRST low	t_{I2C_OFF}	SDA, SCL	0	-	ns
Time from XRST low to MCK off	t_{XRST_OFF}	XRST	0	-	ns
Time from MCK off to VDDs off	t_{MCK_OFF}	VDD_SA, VDD_SD, VDD_L, VDD_AF	0	-	ns

6.3 Note for the Quick Restart

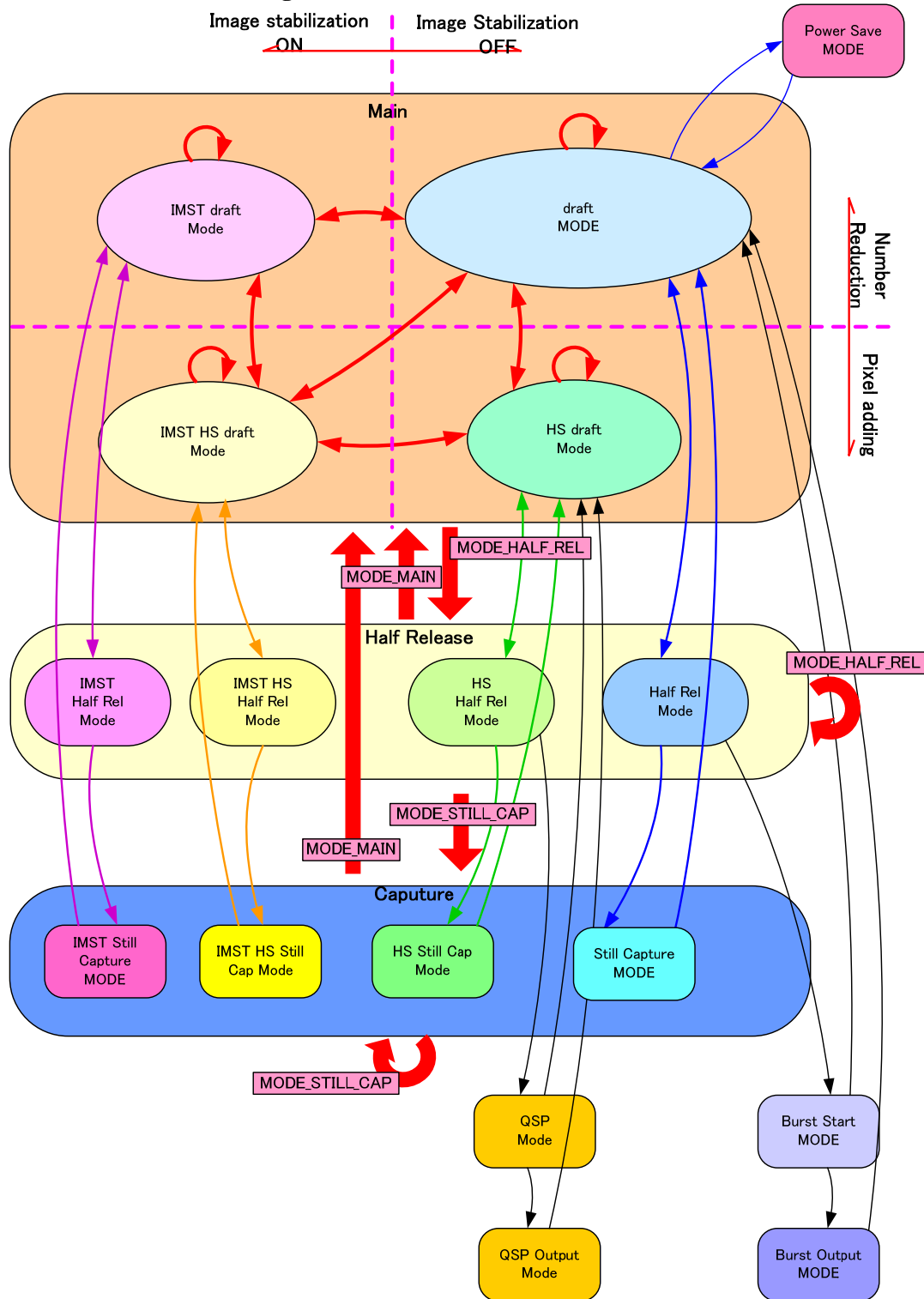
The following requirements of power supply should be satisfied to prevent the data damage in the EEPROM and the operation failure of the EEPROM.



Item	Symbol	Pin	Min.	Max.	unit
Low period of VDD_AF	t_{AF_OFF}	VDD_AF	10	-	ms
Rise time of VDD_AF	t_{AF_R}	VDD_AF	-	100	ms
Low level input voltage of VDD_AF	V_{AF_BTM}	VDD_AF	-	0.2	V

6.4 Transition Status Diagrams

6.4.1 Mode Transition Diagram

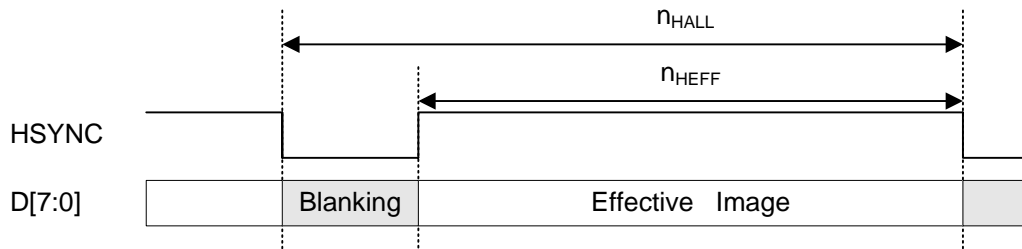


7 Video Interface

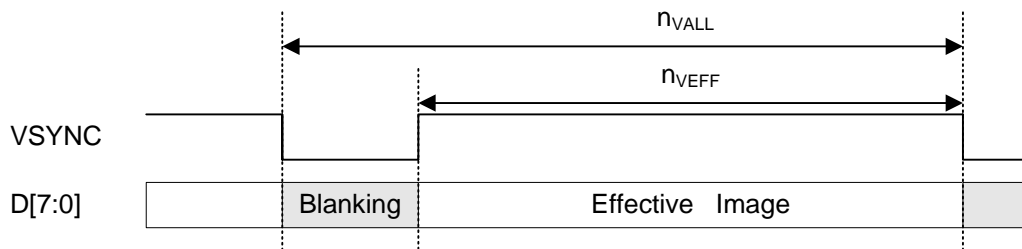
7.1 Modes , Image Sizes and Output Format(for R3 firmware)

The period (the total number of pixel clocks or lines) of the HSYNC and VSYNC signals is different depending on the image output mode.

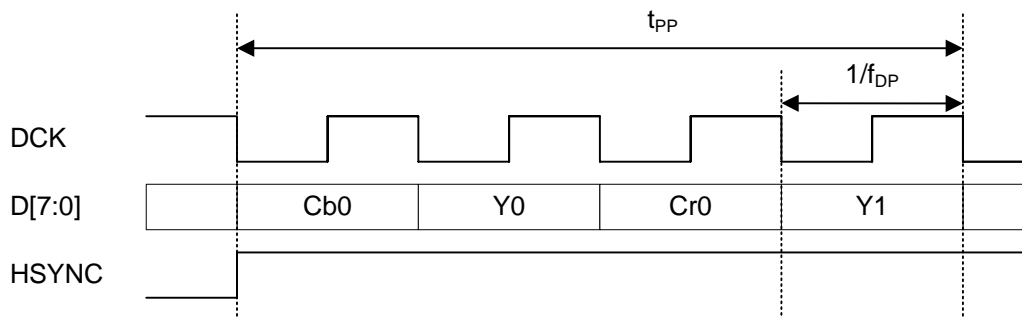
Horizontal Cycle



Vertical Cycle



Pixel Cycle (YCbCr output)



7.2 Modes , Image Sizes and Output Format

The period (the total number of pixel clocks or lines) of the HSYNC and VSYNC signals is different depending on the image output mode.

7.2.1 Draft Mode, IS Draft Mode, HS Draft Mode, IS HS Draft Mode

Size		DCK f_{DP} [MHz]	Horizontal Effective Period n_{HEFF} [clocks]	Horizontal Period n_{HALL} [clocks]	Vertical Effective Period n_{VEFF} [lines]	Vertical Effective Period n_{VALL} [lines]	Frame Rate [fps]
1280x720	HD(16:9)	65	2560	2924	720	735	30
960x540		32.5	2560	2924	540	552	30
960x480		32.5	1920	1950	480	490	30
864x480	WVGA	32.5	1728	2194	480	490	30
800x480	WVGA	32.5	1600	2194	480	490	30
640x480	VGA	32.5	1280	2194	480	490	30
640x360	VGA 16:9	16.25	1280	1462	360	368	30
432x240	WQVGA	8.125	864	1098	240	245	30
400x240	WQVGA	8.125	800	1098	240	245	30
352x288	CIF	8.125	704	914	288	294	30
288x352	CIF(portrait)	8.125	576	748	352	359	30
320x240	QVGA	8.125	640	1098	240	245	30
320x213	QVGA 3:2	8.125	640	1236	213	217	30
320x180	QVGA 16:9	4.063	640	732	180	183	30
240x320	QVGA(portrait)	8.125	480	824	320	326	30
176x144	QCIF	2.031	352	458	144	146	30
144x176	QCIF(vertical)	2.031	288	374	176	179	30
160x120	QQVGA	2.031	320	550	120	122	30
128x96	sQCIF	2.031	256	686	96	98	30
96x128	sQCIF(portrait)	2.031	192	514	128	130	30
96x80		2.031	192	824	80	82	30
88x72		2.031	176	914	72	74	30

7.2.2 Still Capture Mode, IS Still Capture Mode, Burst Output(YCbCr)

Size		DCK f_{DP} [MHz]	Horizontal Effective Period n_{HEFF} [clocks]	Horizontal Period n_{HALL} [clocks]	Vertical Effective Period n_{VEFF} [lines]	Vertical Effective Period n_{VALL} [lines]	Frame Rate [fps]
3264x2448	8M	32.5	6528	6880	2448	2497	1.875
3264x2176	8M 3:2	32.5	6528	7740	2176	2220	1.875
3264x1836	8M 16:9	32.5	6528	9174	1836	1873	1.875
3264x1632		32.5	6528	10320	1632	1665	1.875
2592x1944	5M	32.5	5184	8664	1944	1983	1.875
2048x1536	3M	16.25	4096	5484	1536	1567	1.875
1920x1080	HD(16:9)	8.125	3840	3900	1080	1101	1.875
1632x1224	2M	32.5	3264	3440	1224	1248	7.5
1280x960	SXGA	32.5	2560	4386	960	979	7.5
1280x720	HD(16:9)	16.25	2560	2924	720	734	7.5
960x540		8.125	1920	1950	540	550	7.5
960x480		8.125	1920	2194	480	489	7.5
864x480	WVGA	8.125	1728	2194	480	489	7.5
800x480	WVGA	8.125	1600	2194	480	489	7.5
640x480	VGA	8.125	1280	2194	480	489	7.5
640x360	VGA 16:9	4.0625	1280	1462	360	367	7.5
432x240	WQVGA	2.03125	864	1098	240	244	7.5
400x240	WQVGA	2.03125	800	1098	240	244	7.5
320x213	QVGA 3:2	2.03125	640	1236	213	217	7.5
352x288	CIF	2.03125	704	914	288	293	7.5
288x352	CIF(portrait)	2.03125	576	748	352	358	7.5
320x240	QVGA	2.03125	640	1098	240	244	7.5
320x180	QVGA 16:9	2.03125	640	1462	180	183	7.5
240x320	QVGA(portrait)	2.03125	480	824	320	325	7.5
176x144	QCIF	2.03125	352	1828	144	146	7.5
144x176	QCIF(vertical)	2.03125	288	1496	176	179	7.5
160x120	QQVGA	2.03125	320	2194	120	122	7.5
128x96	sQCIF	2.03125	256	2742	96	98	7.5
96x128	sQCIF(portrait)	2.03125	192	2056	128	130	7.5

7.2.3 HS Still Capture Mode, IS HS Still Capture Mode (YCbCr Output)

Size		DCK f_{DP} [MHz]	Horizontal Effective Period n_{HEFF} [clocks]	Horizontal Period n_{HALL} [clocks]	Vertical Effective Period n_{VEFF} [lines]	Vertical Effective Period n_{VALL} [lines]	Frame Rate [fps]
1920x1080	HD(16:9)	32.5	3840	3900	1080	1104	7.5
1632x1224	2M	32.5	3264	3440	1224	1251	7.5
1280x960	SXGA	32.5	2560	4386	960	981	7.5
1280x720	HD(16:9)	16.25	2560	2924	720	735	7.5
960x540		32.5	1920	1950	540	552	30
860x480		32.5	1920	2194	480	490	30
864x480	WVGA	32.5	1728	2194	480	490	30
800x480	WVGA	32.5	1600	2194	480	490	30
640x480	VGA	32.5	1280	2194	480	490	30
640x360	VGA 16:9	16.25	1280	1462	360	368	30
432x240	WQVGA	8.125	864	1098	240	245	30
400x240	WQVGA	8.125	800	1098	240	245	30
352x288	CIF	8.125	704	914	288	294	30
288x352	CIF(portrait)	8.125	576	748	352	359	30
320x240	QVGA	8.125	640	1098	240	245	30
320x213							
320x180	QVGA 16:9	4.0625	640	732	180	183	30
240x320	QVGA(portrait)	8.125	480	824	320	326	30
176x144	QCIF	2.03125	352	458	144	146	30
144x176	QCIF(vertical)	2.03125	288	374	176	179	30
160x120	QQVGA	2.03125	320	550	120	122	30
128x96	sQCIF	2.03125	256	686	96	98	30
96x128	sQCIF(portrait)	2.03125	192	514	128	130	30

7.2.4 Burst Capture Mode (YCbCr Output)

Size		DCK f_{DP} [MHz]	Horizontal Effective Period n_{HEFF} [clocks]	Horizontal Period n_{HALL} [clocks]	Vertical Effective Period n_{VEFF} [lines]	Vertical Effective Period n_{VALL} [lines]	Frame Rate [fps]
1280x720	HD(16:9)	32.5	2560	2924	720	734	15
864x480	WVGA	16.25	1728	2194	480	489	15
800x480	WVGA	16.25	1600	2194	480	489	15
640x480	VGA	16.25	1280	2194	480	489	15
640x360	VGA 16:9	8.125	1280	1462	360	367	15
432x240	WQVGA	4.0625	864	1098	240	244	15
400x240	WQVGA	4.0625	800	1098	240	244	15
352x288	CIF	4.0625	704	914	288	293	15
288x352	CIF(portrait)	4.0625	576	748	352	358	15
320x240	QVGA	4.0625	640	1098	240	244	15
320x180	QVGA 16:9	4.0625	640	1462	180	183	15
240x320	QVGA(portrait)	4.0625	480	824	320	325	15
176x144	QCIF	4.0625	352	1828	144	146	15
144x176	QCIF(vertical)	4.0625	288	1496	176	179	15
160x120	QQVGA	4.0625	320	2194	120	122	15
128x96	sQCIF	4.0625	256	2742	96	98	15
96x128	sQCIF(portrait)	4.0625	192	2056	128	130	15

7.2.5 Still Capture Mode, IS Still Capture Mode, Burst Output (JPEG Output Compression 1/8 or smaller)

Size		DCK f_{DP} [MHz]	Horizontal Effective Period n_{HEFF} [clocks]	Horizontal Period n_{HALL} [clocks]	Vertical Effective Period n_{VEFF} [lines]	Vertical Effective Period n_{VALL} [lines]	Frame Rate [fps]
3264x2448	8M	32.5	1664	1720	1224	1236	15
3264x2176	8M 3:2						
3264x1836	8M 16:9						
3264x1632							
2592x1944	5M						
2048x1536	3M						
1920x1080	HD(16:9)						
1600x1900							
1632x1224	2M						
1280x960	SXGA						
960x540							
960x480							
1280x720	HD(16:9)						
864x480	WVGA						
800x480	WVGA						
640x480	VGA						
640x360	VGA 16:9						
432x240	WQVGA						
400x240	WQVGA						
352x288	CIF						
288x352	CIF(portrait)						
320x240	QVGA						
320x213	QVGA 3:2						
320x180	QVGA 16:9						
240x320	QVGA(portrait)						
176x144	QCIF						
144x176	QCIF(vertical)						
160x120	QQVGA						
128x96	sQCIF						
96x128	sQCIF(portrait)						

7.2.6 Still Capture Mode, IS Still Capture Mode, Burst Output e (JPEG Output Compression up to 1/1)

Size		DCK f_{DP} [MHz]	Horizontal Effective Period n_{HEFF} [clocks]	Horizontal Period n_{HALL} [clocks]	Vertical Effective Period n_{VEFF} [lines]	Vertical Effective Period n_{VALL} [lines]	Frame Rate [fps]
3264x2448	8M	32.5	3264	3440	4896	4908	1.875
3264x2176	8M 3:2						
3264x1836	8M 16:9						
3264x1632							
2592x1944	5M						
2048x1536	3M						
1920x1080	HD(16:9)						
1600x1900							
1632x1224	2M						
1280x960	SXGA						
960x540							
960x480							
1280x720	HD(16:9)						
864x480	WVGA						
800x480	WVGA						
640x480	VGA						
640x360	VGA 16:9						
432x240	WQVGA						
400x240	WQVGA						
352x288	CIF						
288x352	CIF(portrait)						
320x240	QVGA						
320x213							
320x180	QVGA 16:9						
240x320	QVGA(portrait)						
176x144	QCIF						
144x176	QCIF(vertical)						
160x120	QQVGA						
128x96	sQCIF						
96x128	sQCIF(portrait)						

7.2.7 HS Still Capture Mode, IS HS Still Capture Mode (JPEG Output Compression 1/4 or smaller)

Size		DCK f_{DP} [MHz]	Horizontal Effective Period n_{HEFF} [clocks]	Horizontal Period n_{HALL} [clocks]	Vertical Effective Period n_{VEFF} [lines]	Vertical Effective Period n_{VALL} [lines]	Frame Rate [fps]
1632x1224	2M	32.5	1664	1720	612	624	30
1280x960	SXGA						
1280x720	HD(16:9)						
960x540							
960x480							
864x480	WVGA						
800x480	WVGA						
640x480	VGA						
640x360	VGA 16:9						
432x240	WQVGA						
400x240	WQVGA						
352x288	CIF						
320x213	QVGA 3:2						
288x352	CIF(portrait)						
320x240	QVGA						
320x180	QVGA 16:9						
240x320	QVGA(portrait)						
176x144	QCIF						
144x176	QCIF(vertical)						
160x120	QQVGA						
128x96	sQCIF						
96x128	sQCIF(portrait)						

7.2.8 HS Still Capture Mode, IS HS Still Capture Mode (JPEG Output Compression up to 1/1)

Size		DCK	Horizontal Effective Period	Horizontal Period	Vertical Effective Period	Vertical Period	Frame Rate [fps]
1632x1224	2M	32.5	1664	1720	2448	2460	7.5
1280x960	SXGA						
1280x720	HD(16:9)						
960x540							
960x480							
864x480	WVGA						
800x480	WVGA						
640x480	VGA						
640x360	VGA 16:9						
432x240	WQVGA						
400x240	WQVGA						
352x288	CIF						
320x213							
288x352	CIF(portrait)						
320x240	QVGA						
320x180	QVGA 16:9						
240x320	QVGA(portrait)						
176x144	QCIF						
144x176	QCIF(vertical)						
160x120	QQVGA						
128x96	sQCIF						
96x128	sQCIF(portrait)						

7.2.9 QSP Capture Mode(120fps Recorded)

Size		DCK f_{DP} [MHz]	Horizontal Effective Period n_{HEFF} [clocks]	Horizontal Period n_{HALL} [clocks]	Vertical Effective Period n_{VEFF} [lines]	Vertical Effective Period n_{VALL} [lines]	Frame Rate [fps]
320x240	QVGA	32.5	640	1108	240	249	118
320x213	QVGA 3:2						
320x180	QVGA 16:9	16.25	640	738	180	186	118
176x144	QCIF	8.125	352	462	144	149	118
160x120	QQVGA	8.125	320	554	120	124	118
144x176	QCIF(vertical)	8.125	288	378	176	182	118
128x96	sQCIF	4.0625	256	346	96	99	118
88x72	QQCIF	2.03125	176	232	72	74	118

7.2.10 QSP Capture Mode(30fps YCbCr Output)

Size		DCK f_{DP} [MHz]	Horizontal Effective Period n_{HEFF} [clocks]	Horizontal Period n_{HALL} [clocks]	Vertical Effective Period n_{VEFF} [lines]	Vertical Effective Period n_{VALL} [lines]	Frame Rate [fps]
320x240	QVGA	32.5	640	1108	240	249	30
320x180	QVGA 16:9	16.25	640	738	180	186	30
176x144	QCIF	8.125	352	462	144	149	30
160x120	QQVGA	8.125	320	554	120	124	30
144x176	QCIF(vertical)	8.125	288	378	176	182	30
128x96	sQCIF	4.0625	256	346	96	99	30
88x72	QQCIF	2.03125	176	232	72	74	30

8 Handling Precautions

8.1 Operating Temperature

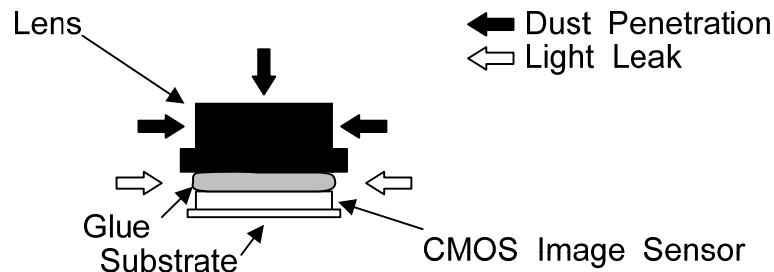
Make sure that the temperature inside the equipment does not exceed the recommended operating temperature

8.2 Durability of the Image Sensor

The on-chip color filter of the sensor may be decolorized if a large amount of light enters into the sensor. Such conditions of use should be avoided as no product warranty is given for decolorization. Be sure to take protective measurements against continuous exposure to intense light.

8.3 Dust Control and Light Shielding

This product does not have a dustproof or waterproof structure. There is a layer of transparent glue between the image sensor package and the lens holder, and there are some possibilities that leaked light break into the module which may cause damage or flare. Be sure to take countermeasure for dust and leakage light when mounting.



The protective optical window over the lens is not targeted to be exposed to external environment and does not tolerate direct scratches. Therefore, it is advised to use protective cover to protect the window while not in use. The anti-scratch hard coating over the window is targeted to minimize the possible scratches, may a user tries to clean it. To secure minimum degradation of image, it is recommended to notify the end product user to minimize such possible cleaning.

8.4 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.

8.5 Storage and Operating Environment

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

8.6 Mechanical Strength

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

8.7 Remodeling

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

8.8 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.

8.9 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.

8.10 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.

8.11 Dismounting method

The camera module should be dismounted with the direction shown below, otherwise the connector may be broken.

8.12 Management of Chemical substances

8.12.1 Halogenated flame retardants

Halogenated flame retardants are not used in the printed wiring boards.

9 Revision Histories

Version	Date	Page	Description
0.01	29/July/2008		1 st Released