
PE1005 DATA SHEET (English)

Version : 3.0.0.3

Date : 2012/02/10



Precautions

Since the definitions of features in this specification are in progress, the contents of this document may change without prior notice.

Index

1 Summary	3
1.1 Features	3
1.2 Primary Specifications.....	4
2 Structure.....	5
2.1 Block diagram	5
2.2 Exterior View	6
2.2.1 Dimensional Outline Drawing	7
2.2.2 Product Packaging View	8
3 Electrical Specifications.....	9
3.1 Terminal Specifications	9
3.2 Terminal definition	10
3.3 Power On/Off Specification	12
3.4 Inter Host Communication	13
3.4.1 Command communication via 2Wire Serial Interface	13
3.4.2 Communication via IO port.....	13
3.5 Image data output timing	14
3.5.1 Image data output format	14
3.5.2 Image data output timing	14
3.6 Electric characteristics	16
3.6.1 Operating temperature range.....	16
3.6.2 Performance Guaranteed Temperature Range	16
3.6.3 Storage Temperature Range	16
3.6.4 Absolute Maximum Rating.....	16
3.6.5 Recommended Rating for Operation	16
3.6.6 DC characteristics	17
3.6.7 AC characteristics.....	17
(2) 2-wire serial interface	18
3.7 Electrical treatment	19
3.7.1 Electrostatic	19
3.7.2 Latch up	19
3.7.3 Treatment of input terminal.....	19
3.7.4 Output terminal treatment.....	19
3.7.5 Power terminal treatment	19
3.7.6 Power ON/OFF	19
3.7.7 Other.....	19
4 Camera feature specification	20
4.1 Detailed function definition.....	24
4.1.1 System function.....	24
4.1.2 Exposure function.....	28
4.1.3 Focus function	31
4.1.4 Optical zoom function.....	33
4.1.5 White balance function	34
4.1.6 Image quality setup function.....	35
4.1.7 Image effect function	36
4.2 Several sequence	37

1 Summary

1.1 Features

- Full HD (1920x1080 30p) video
- Variety of 25 settings video mode (1920x1080 30p (EIS not available), 1920x1080 24p(EIS not available), 1920x1080 15p(EIS available), 1280x720 60p(EIS not available), 1280x720HR 30p(EIS available), 1280x720HR 24p(EIS available) , 1280x720HR 15p(EIS available), Cinema 1680x720 30p(EIS not available), Cinema 1680x720 24p(EIS not available), 525-HS 30p(EIS available), 525-HS 15p(EIS available), 525-HR 30p(EIS available), 525-HR 15p(EIS available), 625-HS 25p(EIS available), 625-HS 10p(EIS available), 625-HR 25p(EIS available), 625-HR 10p(EIS available), VGA-HS 30p(EIS available), VGA-HS 15p(EIS available), VGA-HR 30p, (EIS available) VGA-HR 15p(EIS available))
*HR: hyper resolution mode, HS: high sensitivity mode
*EIS: Electric Image Stabilizer
- High resolution video with Progressive Scan
- 2.1 M high resolution still image capture
- Light source estimated color correction
- Focus preset function
- Light and sharp optical x10 zoom lens, F1.8 – 2.2, with mechanical shutter
- 1 cm wide macro
- High sensitivity image capture functionality
- Provided with HOST I/F (2Wire Serial Interface)
- Digital image output using multiplexed 16-bit parallel interface
- Low power consumption, 800 mW at 1080 30p video input and output
- Built-in EIS (Electronic Image stabilizer for movie)

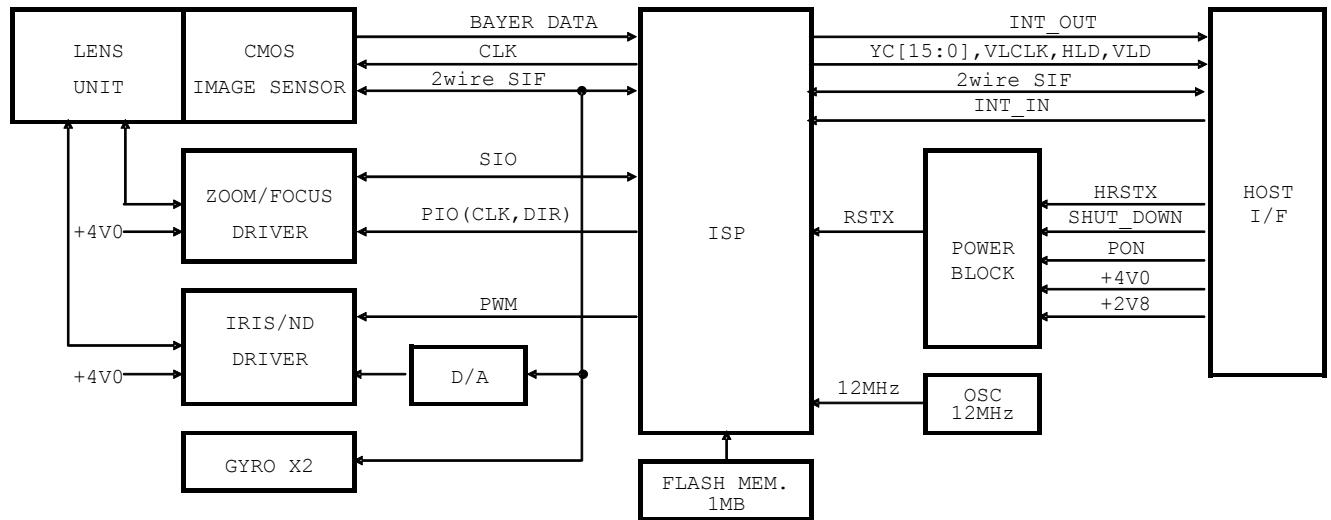
* This camera module is not equipped with microphone

1.2 Primary Specifications

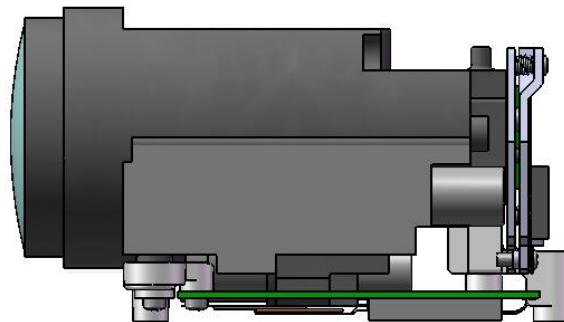
Image pickup device	1/2.5 model, primary color CMOS, 2.1 M compatible		
	Movie	Aspect 4:3	Approximately 0.39 M pixels
		Aspect 16:9	Approximately 2.07 M pixels
	Still	Aspect 4:3	Approximately 2.00 M pixels
		Aspect 16:9	Approximately 2.07 M pixels
Lens	1/3.6 model f = 4.5 – 45.0 mm F1.8 – 2.2		
Equivalent to 135 film	Movie	Aspect 4:3	54mm – 540mm
		Aspect 16:9	40mm – 400mm
	Still	Aspect 4:3	43mm – 430mm
		Aspect 16:9	40mm – 400mm
White balance	auto/daylight/cloudy/shade/fluorescent lamp W (white)/fluorescent lamp N (Natural)/fluorescent lamp D (daylight) / tungsten /custom/manual		
Distance of the shortest an object	Wide limit: 1cm , Tele limit: 100cm (From the top of front lens)		
Minimum luminance	6 Lux(F1.8/50IRE/TV=1/30sec, 1920×1080movie) 0.35 Lux(F1.8/50IRE/TV=1/8sec, 720×480movie High Sensitivity mode		
External dimensions	L=61.8mm, H=34.7mm, D=30.9mm		
Power supply	2.8 V and 4.0 V external supply		
Power consumption	About 800mW @1080/30p movie output(measured in house)		
Body weight (including ISP port)	About 57g		
Operating temperature	-10°C- +60°C		
Image output type	Digital image output, 8-bit, YPbPr 4:2:2		
Still image resolution in pixels	L 2.0M (1600×1200) WL 2.1M (1920×1080) (16:9) M 1.2M (1280× 960) MS 0.5M (800× 600) MS 0.5M (800× 600) high sensitivity mode S 0.3M (640× 480) S 0.3M (640× 480) high-sensitivity mode		
Motion picture frame mode	1920 x 1080 30/24/15 frame per sec (Progressive) 1680 x 720 30/24 frame per sec (Progressive) 1280 x 720 60 frame per sec (Progressive) 1280 x 720 30/24/15 frame per sec (Progressive) hyper resolution mode 720 x 480 30/15 frame per sec (Progressive) high sensitivity mode 720 x 480 30/15 frame per sec (Progressive) hyper resolution mode 720 x 576 25/10 frame per sec (Progressive) high sensitivity mode 720 x 576 25/10 frame per sec (Progressive) hyper resolution mode 640 x 480 30/15 frame per sec (Progressive) high sensitivity mode 640 x 480 30/15 frame per sec (Progressive) hyper resolution mode		
Shutter speed	At movie shooting mode: 1/5 ~ 1/4000sec At still shooting mode: 1/5 ~ 1/2000sec		

2 Structure

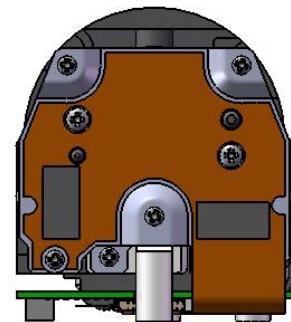
2.1 Block diagram



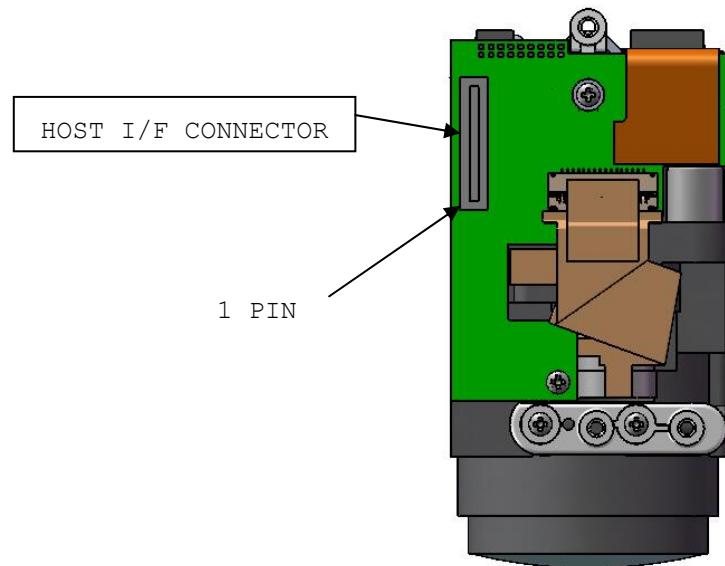
2.2 Exterior View



< SIDE >



< REAR >

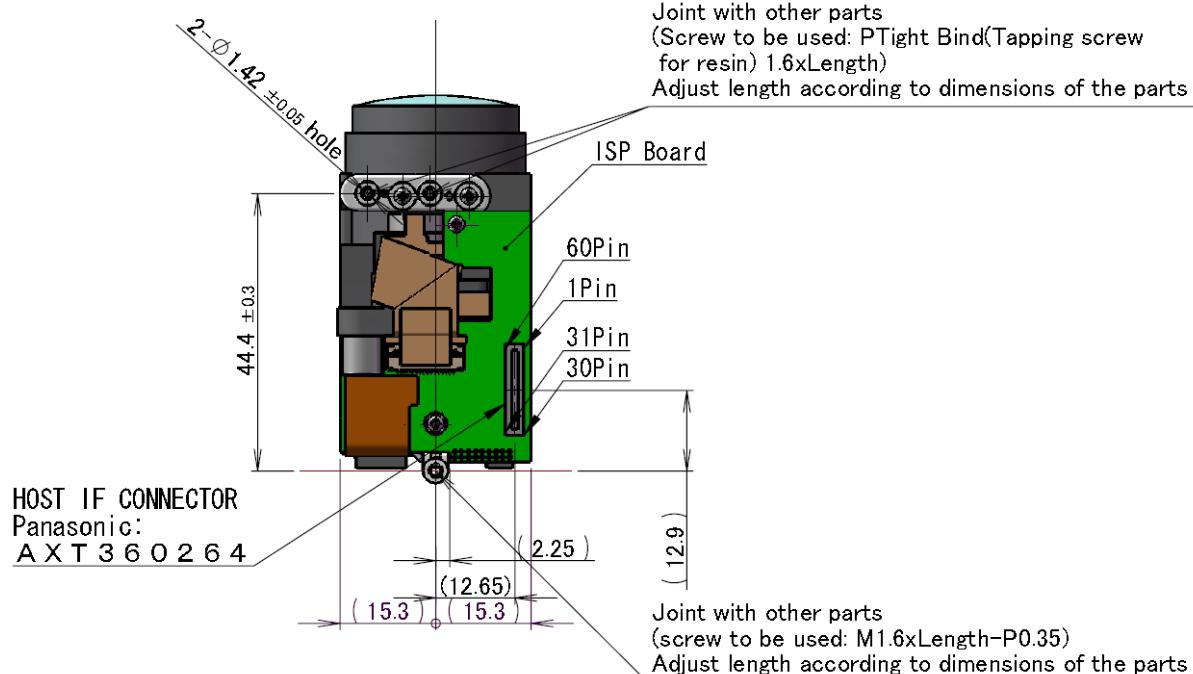
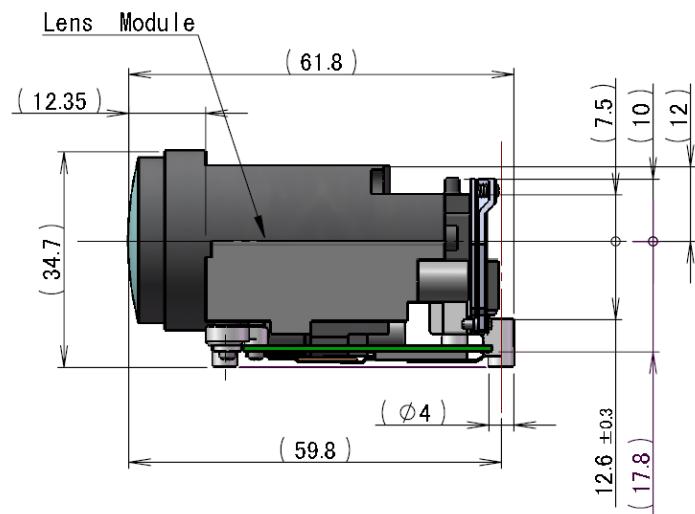
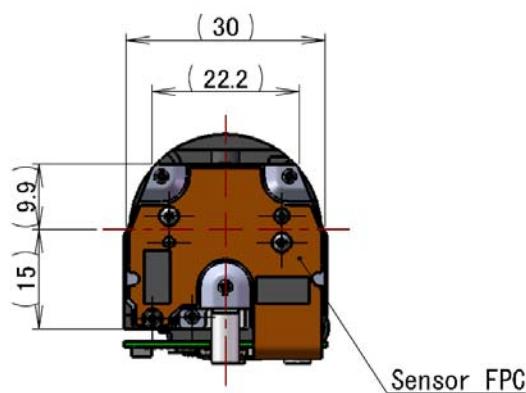
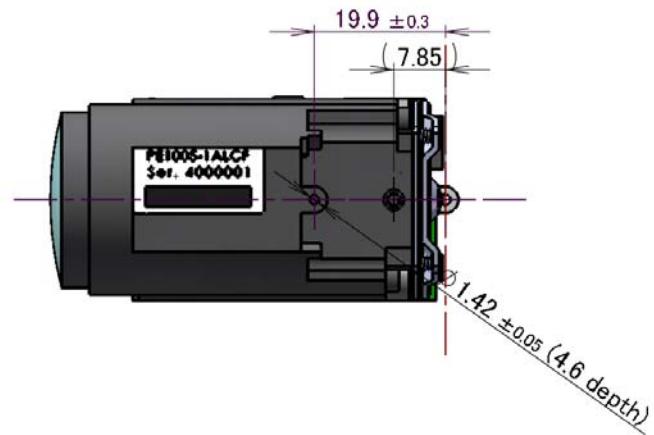
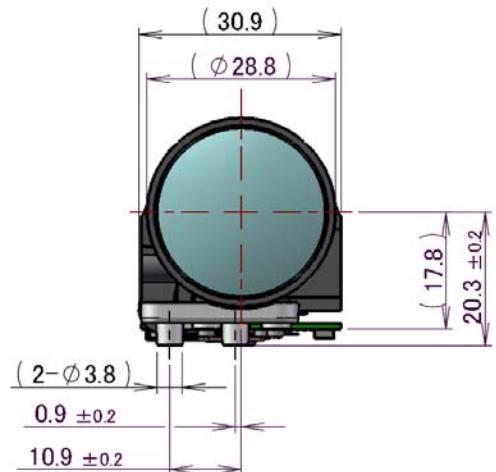


< UNDERSIDE >

*See separate information sheet for external dimension

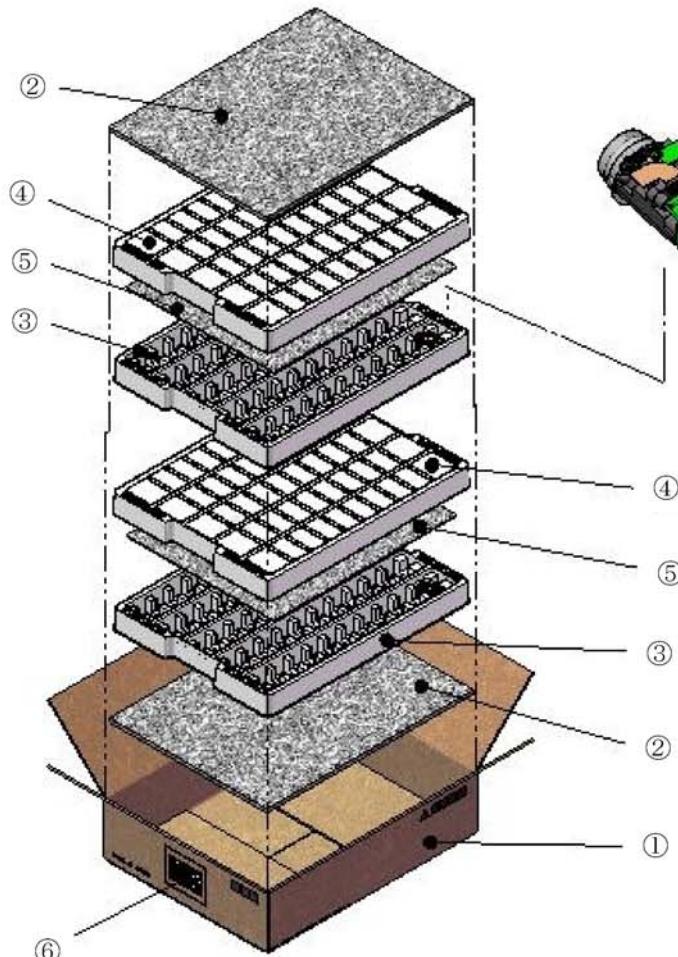
2.2.1 Dimensional Outline Drawing

【The numerical value without the dimensions tolerance is reference value.】

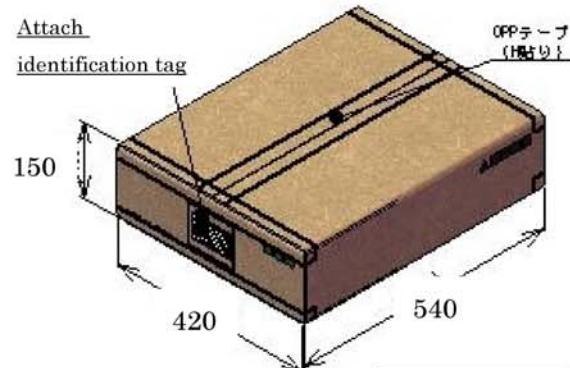


※The installation by Board to Board is not recommended.

2.2.2 Product Packaging View

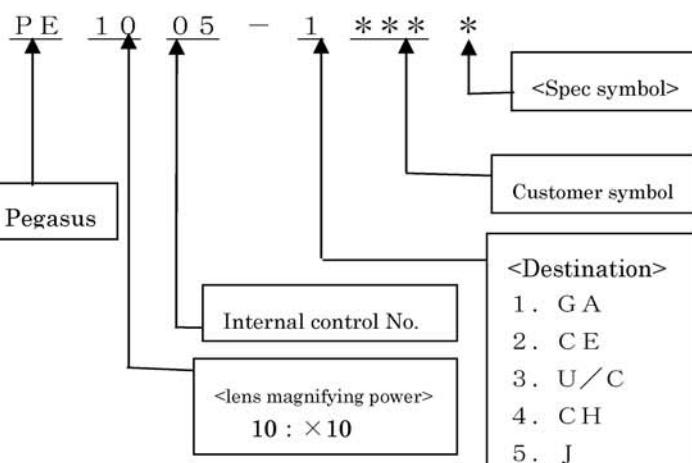


Part No.	Part Name	Q'ty
①	Master Carton	1/100
②	AirCap 30mm (for PE1005)	1/50
③	Tray	1/50
④	Tray (cover)	1/50
⑤	AirCap 10mm (for PE1005)	1/50
⑥	Identification tag	1/100



weight : 7.5kg
(± 0.5)

Mark of a model name



Product Name	HD Camera Module
Model Name	(Model name/Destination)
Factory shipping day	(xxxx/yy/zz)
Destination	SHENZHEN
Quantity	100 *may not contain full q'ty
Number of boxes	(y/x)
Origin	MADE IN CHINA
Shenzhen Leadcctv Electronic Co., Ltd.	

Details of Identification Tag

3 Electrical Specifications

3.1 Terminal Specifications

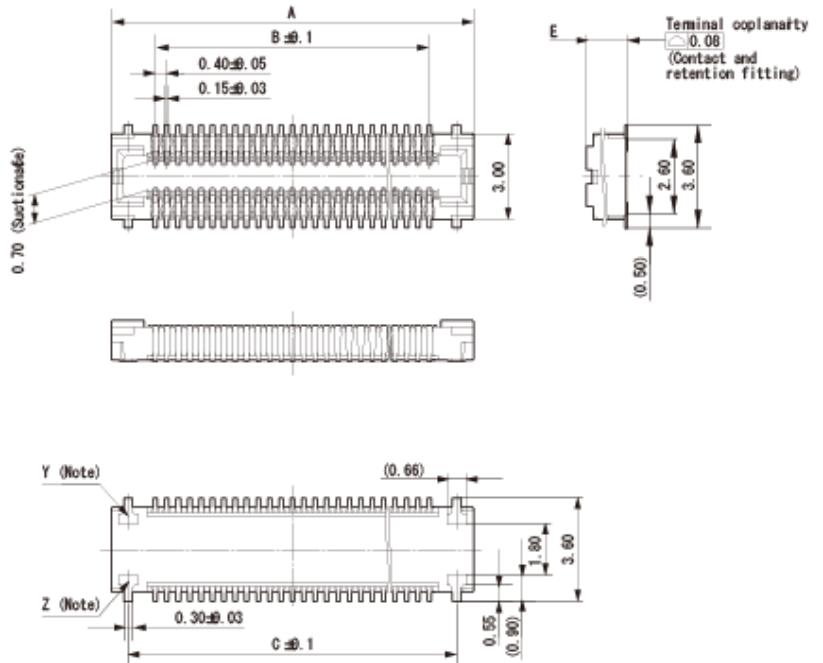
No.	Signal	I/O	Note	No.	Signal	I/O	Note
1	HRSTX	I	Board reset signal (Low active)	31	4V0	P	4.0V power source
2	GND	G	Ground	32	4V0	P	4.0V power source
3	VLCLK	O	Pixel clock output 66MHz	33	GND	G	Ground
4	GND	G	Ground	34	GND	G	Ground
5	YC0	O	YPbPr picture data Y[0]	35	2V8	P	2.8V power source
6	YC2	O	YPbPr picture data Y[2]	36	2V8	P	2.8V power source
7	YC4	O	YPbPr picture data Y[4]	37	2V8	P	2.8V power source
8	YC6	O	YPbPr picture data Y[6]	38	GND	G	Ground
9	YC8	O	YPbPr picture data C[0]	39	PON	I	Power on (High active)
10	YC10	O	YPbPr picture data C[2]	40	INT_OUT	O	Output interrupt (Rise edge sense)
11	YC12	O	YPbPr picture data C[4]	41	TP3	O	Open
12	YC14	O	YPbPr picture data C[6]	42	TP4	O	Open
13	HLD	O	Horizontal sync.(Low active)	43	STRB_REQ	O	Open
14	GND	G	Ground	44	TP5	O	Open
15	ISCL	IO	2Wire Serial Interface clock	45	SHUTT	O	Open
16	ISDA	IO	2Wire Serial Interface data	46	STRB	O	Open
17	GND	G	Ground	47	GND	G	Ground
18	INT_IN	I	Input interrupt (Rise edge sense)	48	TP7	I	Ground
19	TP1	O	Open	49	VLD	O	Vertical sync. (Low active)
20	STRB_READ_Y	I	Ground	50	YC15	O	YPbPr picture data C[7]
21	TP2	O	Open	51	YC13	O	YPbPr picture data C[5]
22	TP6	I	Open	52	YC11	O	YPbPr picture data C[3]
23	SHUT_DOWN	I	Standby mode (Low active)	53	YC9	O	YPbPr picture data C[1]
24	2V8	P	2.8V power source	54	YC7	O	YPbPr picture data Y[7]
25	2V8	P	2.8V power source	55	YC5	O	YPbPr picture data Y[5]
26	2V8	P	2.8V power source	56	YC3	O	YPbPr picture data Y[3]
27	GND	G	Ground	57	YC1	O	YPbPr picture data Y[1]
28	GND	G	Ground	58	GND	G	Ground
29	4V0	P	4.0V power source	59	TP8	I	Ground
30	4V0	P	4.0V power source	60	GND	G	Ground

3.2 Terminal definition

Terminal	Pin	Qty.	Polarity	I/O	Function / Application
4V0	29,30,31,32	4	-	P	4.0V power source
2V8	24,25,26,35,36,37	6	-	P	2.8V power source
GND	2,4,14,17,27,28, 33,34,38,47,58,60	12	-	G	GND terminal
PON	39	1	Positive	I	Power ON signal from host. After supplying 4V0 and 2V8, enter 'H' level. Pull-up from module side to 2V8 at 10KΩ.
SHUT_DOWN	23	1	Negative	I	Shutdown signal. While input is ongoing at 'L' level, power is supply only to the interface section of the Host of this module.
HRSTX	1	1	Negative	I	Initialization signal of this module. After the entire power supply is stabilized, apply 'H' level to SHUT_DOWN, and then apply 'H' level here.
YC[7-0]	5,57,6,56,7,55,8,54	8	-	O	Brightness (Y) data of the image output signal in YC4:2:2 formats. 10Ω of damping resistance is inserted to the signal output.
YC[15-8]	9,53,10,52,11,51,12,50	8	-	O	Image output signal color difference (Pr, Pb) data in YC4:2:2 formats. 10Ω of damping resistance is inserted to the signal output.
VLCLK	3	1	-	O	Outputs YC data output (YC[15-0]) and synchronized clock for horizontal and vertical synchronization signal (HLD,VLD) at 66 MHz frequency start-up reference. 10Ω of damping resistance is inserted to the signal output.
VLD	49	1	Negative	O	Image output vertical synchronization signal. 10Ω of damping resistance is inserted to the signal output.
HLD	13	1	Negative	O	Image output horizontal synchronization signal. 10Ω of damping resistance is inserted to the signal output.
ISCL	15	1	-	IO	2Wire Serial Interface clock IO terminal that supports 400 kbps. Pull-up (2.8V) at 1.5kΩ.
ISDA	16	1	-	IO	2Wire Serial Interface clock IO terminal that supports 400 kbps. Pull-up (2.8V) at 1.5kΩ.
INT_OUT	40	1	-	O	Interrupt notification signal from module to Host. Set interrupt reception at L to H.edge.
INT_IN	18	1	-	I	Interrupt notification signal from Host to module. Interrupt signal is received at L to H.edge.
STRB_REQ	43	1	-	O	Leave open .
STRB_READY	20	1	-	I	Please connect to GND .

Terminal Name	Pin	Qty.	Polarity	I/O	Function / Application
STRB	46	1	-	O	Leave open.
SHUTT	45	1	-	O	Leave open.
TP1,2,3,4,5	19,21,41,42,44	5	-	-	Leave open.
TP6	22	2	-	I	Leave open. Pull-up is executed at the module side.
TP7,8	48,59	1	-	I	Assign this as GND.

Connector Socket View of AXT360264 (by Panasonic Electric Works)



General Tolerance +/- 0.2

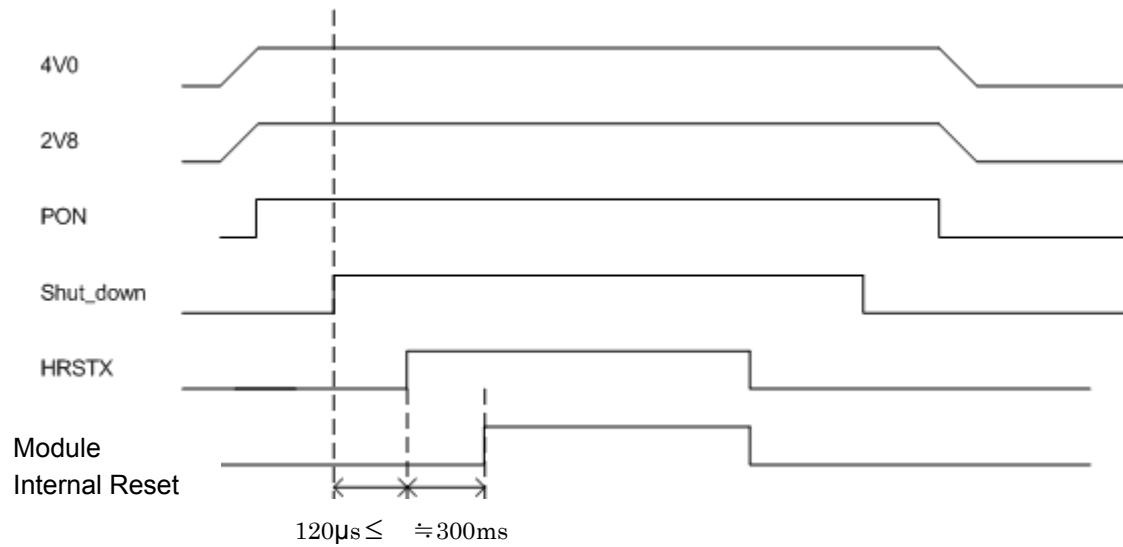
Note: Since retention fittings are fitted into the body Y and Z parts are connected electrically

Where, Number of contacts: 60

Mated height: 2.5mm

Dimension: A=14.7mm, B=11.6, E=2.45

3.3 Power On/Off Specification



Signal	Note
4.0V, 2.8V	Power supplied from Host
PON	Power On signal from Host
Shut down	Signal that indicates Shutdown mode H: Wake-up, L: Shutdown
HRSTX	Board reset signal from Host Release reset, H, after more than $120\mu s$ from SHUT_DOWN is H status, and the power is supplied in to the module.
Internal module RESET	Reset signal in the module Internal circuit turns to active 300 m sec after HRSTX is released.

3.4 Inter Host Communication

3.4.1 Command communication via 2Wire Serial Interface

It performs as a slave device on 2Wire Serial Interface. Max speed is 400Kbps. ISCL and ISDA need to Pull-Up with 1.5Kohm.

Please see “PE1005 Command Communication Specification” about the details.

3.4.2 Communication via IO port

3.4.2.1 INT_OUT

Interrupt signal from PE1005 to the Host system. Detect the interrupt request by the rising edge, L→H. PE1005 asserts INT_OUT when specified state that is configured by command communication is achieved. The timing of changing to L is when PE1005 defects INT_IN becomes active.

3.4.2.2 INT_IN

Interrupt signal from the Host system to PE1005. Detect the interrupt request by the rising edge, L→H. Assert INT_IN interrupt when specified situation has met. Please give the width of Pulse to it as 100μsec or more.

3.4.2.3 SHUTT

Keep it open.

3.4.2.4 STRB_REQ

Strobe charge request signal from PE1005 to the Host system. Keep it OPEN when not used.

3.4.2.5 STRB_READY

Strobe charge complete notification signal from host system to PE1005. Keep it GND when not used.

3.4.2.6 STRB

Indicate strobe timing signal from PE1005 to the Host system. Keep it OPEN when not used.

3.5 Image data output timing

3.5.1 Image data output format

16bit bus is used to provide YPbPr 4:2:2 formatted image data multiplexed as follows.

YC[15:8]	Pb0	Pr0	Pb1
YC[7:0]	Y0	Y1	Y2



Color cording is based on SMPTE 274M. it is using color difference data as 128 centers.

$$\begin{aligned} Y &= 0.2126R' + 0.7152G' + 0.0722B' \\ Pb &= 0.500B' - 0.1146R' - 0.3854G' + 128 \\ Pr &= 0.500R' - 0.4542G' - 0.0458B' + 128 \end{aligned}$$

R', G', B' shows the original signals of non-linear domain after gamma correction.

3.5.2 Image data output timing

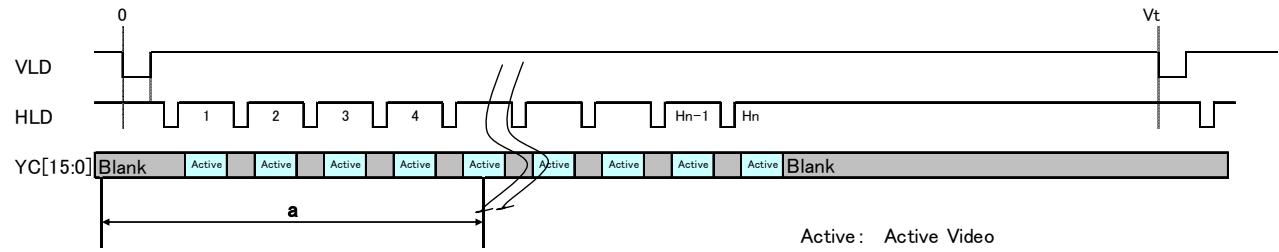
This module provides the image data output based on the timing due to the VLCLK rising edge, VLD and HLD.

[<Caution> The output is not defined from the end of effective data to the next HLD due to the internal circuitry.](#)

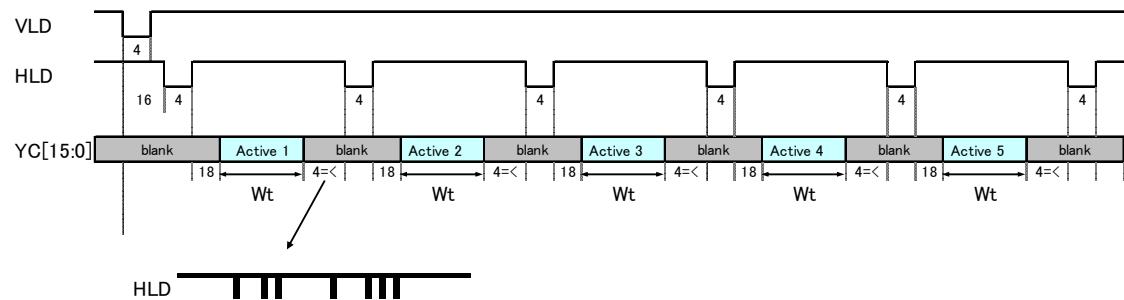
About the invalid line output

After the effective line number is output by all the shooting modes, two invalid lines are output. Electric characteristics

TIMING CHART



Enlarged a



NOTE: HLD SPAN = Don't care

No	Size	F-rate	(Note2)	(Note3)	(Note2)
			66MHz:counter	Line No	1 Line CLK Count
1	1920 × 1080	30	2,199,318	1,082	1,920
2		24	2,747,458 or 2,749,489	1,082	1,920
3		15	4,398,966	1,082	1,920
4	1680 × 720	30	2,199,318	722	1,680
5		24	2,749,458 or 2,749,459	722	1,680
6		60	1,099,890	722	1,280
7	1280 × 720	30	2,199,318	722	1,280
8		24	2,749,458 or 2,749,459	722	1,280
9		15	4,398,966	722	1,280
10	720 × 480HR	30	2,197,368 or 2,197,369	482	720
11		15	4,396,392	482	720
12		30	2,197,368 or 2,197,369	482	720
13	720 × 480HS	15	4,396,392	482	720
14		25	2,639,063 or 2,639,064	578	720
15		10	6,591,675 or 6,591,676	578	720
16	720 × 576HS	25	2,639,063 or 2,639,064	578	720
17		10	6,591,675 or 6,591,676	578	720
18		30	2,197,368 or 2,197,369	482	640
19	640 × 480HR	15	4,396,392	482	640
20		30	2,197,368 or 2,197,369	482	640
21	640 × 480HS	15	4,396,392	482	640

(Note2) Timming : 66MHz main clock

(Note3) 2Line of Last count is Don't care

3.6 Electric characteristics

3.6.1 Operating temperature range

-10 to 60 deg Celsius

3.6.2 Performance Guaranteed Temperature Range

0 to 50 deg Celsius

3.6.3 Storage Temperature Range

-25 to 70 deg Celsius

3.6.4 Absolute Maximum Rating

It is 6V against 4V supply voltage.

It is 3.1V against 2.8V supply voltage.

3.6.5 Recommended Rating for Operation

Parameter	Condition	min.	Typ.	Max.	Unit
4V0 Supply Voltage	With respect to Ground	3.9	4.0	4.1	V
4V0 Supply Current	$4V0 = +4.0V$	-	300	450	mA
2V8 Supply Voltage	With respect to Ground	2.7	2.8	2.9	V
2V8 Supply Current	$2V8 = +2.8V$	-	180	270	mA

3.6.6 DC characteristics

2V8=2.8V 4V0=4.0V

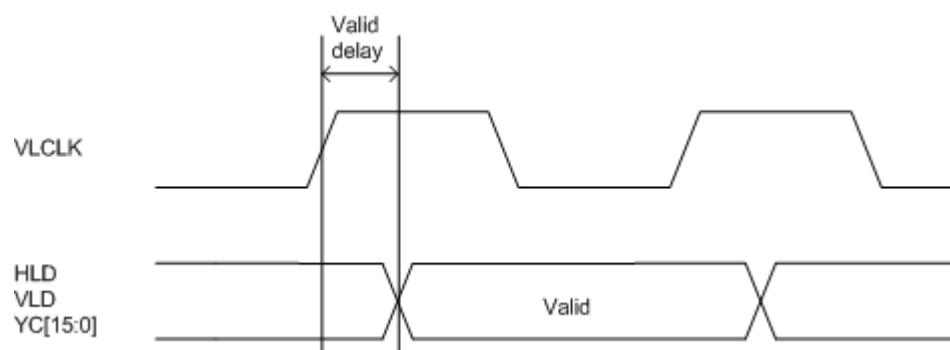
Terminal	Parameter	Value		Unit
		Min.	Max.	
INT_IN,STRB_READY	VIH	2.24	3.1	V
	VIL	-0.3	0.56	V
SHUT_DOWN	VIH	2.24	-	V
	VIL	-	0.56	V
HRSTX	VIH	2.1	3.1	V
	VIL	-0.3	0.56	V
PON	VIH	2.0	3.1	V
	VIL	-0.3	0.4	V
ISCL,ISDA	VIH	1.96	3.1	V
	VIL	-0.3	0.56	V
VLCLK,HLD,VLD YC[15:0],STRB INT_OUT	VOH(IOH=-4mA)	2.4	-	V
	VOL(IOL=4mA)	-	0.4	V
SHUTT	VOH(IOH=-100μA)	2.6	2.8	V
	VOL(IOL=100μA)	0	0.2	V
ISDA	VOH(IOH=-100μA)	2.4	-	V
	VOL(IOL=100μA)	-	0.4	V

3.6.7 AC characteristics

(1) Video Output

2V8=2.8V 4V0=4.0V

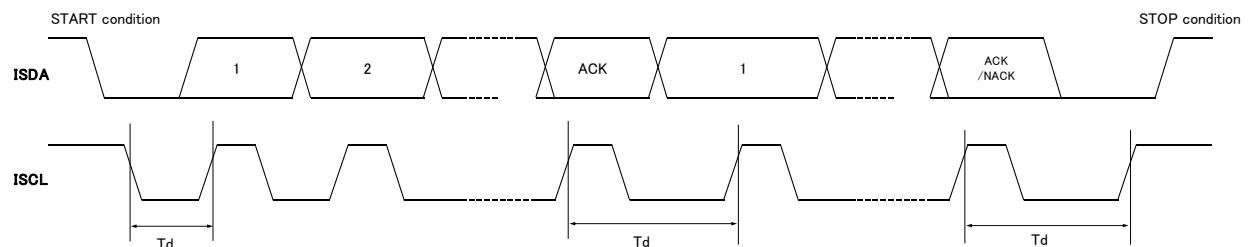
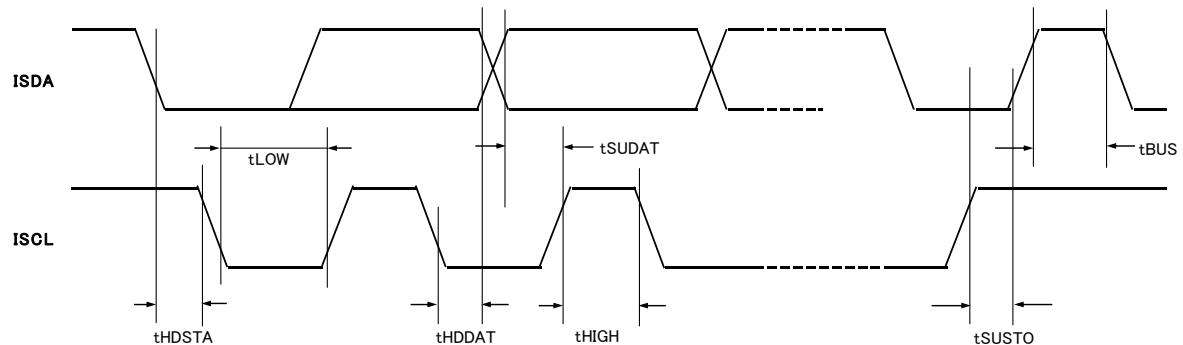
Terminal	Parameter	Value		Unit
		Min.	Max.	
VLCLK	Period	-	66	MHz
HLD, VLD, YC[15:0]	Valid delay	0	6	ns



(2) 2-wire serial interface

2V8=2.8V

Terminal	Parameter	Value		Unit
		Min.	Max.	
ISCL	-	10	400	kHz
ISDA	t_{HDSTA}	0.6	-	μs
	t_{HDDAT}	0	-	μs
	t_{SUDAT}	100	-	ns
ISCL	t_{SUSTO}	0.6	-	μs
	t_{LOW}	1.3	-	μs
	t_{HIGH}	0.6	-	μs
ISDA	t_{BUS}	1.3	-	μs
ISCL	T_d	-	250	μs



3.7 Electrical treatment

3.7.1 Electrostatic

Since this camera module consists of VLSI chip and high density circuit board, care for electrostatic hazard is strongly recommended.

3.7.2 Latch up

If higher than power voltage or lower than ground voltage is applied to the signal ports or if higher than rating power voltage is supplied to power and ground, so called latch up can occur. If latch up occurs, big current flows to the circuitry and destroy the parts permanently. Please be careful to not to make the above situation happens.

3.7.3 Treatment of input terminal

If unused input terminal is left open, the state of unconnected input terminal is unstable causing malfunction. Please terminate pull-up or pull down even the terminal is not used. However, please follow the direction if it is specified how to terminate at the terminal description.

3.7.4 Output terminal treatment

If output terminal touch to the power or other output terminal, or if big load is connected, big current flows to the circuitry. If this situation is continuously kept, parts could be destroyed permanently. Please be careful to avoid the above situation happens.

3.7.5 Power terminal treatment

The same power terminal should be connected outside of the module even though they are connected inside the module. This is because to avoid unnecessary parasitic emissions, ground voltage level rise that might cause the malfunctions.

In addition to the above, keep the impedance low to supply the power to this module. De-coupling capacitor and power noise reduction filter should be equipped.

3.7.6 Power ON/OFF

Since two different types of powers are used, devices in the module can be malfunctioned or destroyed because of voltage imbalance before they become stable. In order to avoid such a situation, use PON signal to turn ON/OFF power.

3.7.7 Other

- Do not touch module interface connector terminals. It cause to malfunctions.
- Since the module consists of dense parts and very precise, avoid applying strong stress to the circuit board.

4 Camera feature specification

The following table shows the list of camera features of this module

Default setup is specified by 

Category	Function	Setup items			
System setup	Power save	ON			
		OFF			
	Image capture mode	Movie capture mode			
		Still image shooting mode			
	Defect pixel correction	AUTO only			
	Backlight correction	ON			
		OFF			
	Vertical/horizontal flip	Vertical flip ON			
		Vertical flip OFF			
		Horizontal flip ON			
		Horizontal flip OFF			
Movie capture mode related function	List of movie shooting mode (Image size and frame rate) All are progressive scan	1920 x 1080	Special mode		Frame rate
					EIS
			30 fps	x	
		1680 x 720 (Progressive)	24 fps	x	
			15 fps	x	
		EIS mode		15 fps	○
		1280 x 720			30 fps
					24 fps
					60 fps
		720 x 480	High resolution mode(720-HR)		30 fps
					24 Fps
					15 fps
		720 x 576	High resolution EIS mode (720-HR)		30 fps
					24 Fps
		640 x 480	15 fps		○
			High sensitivity mode(525-HS)		30 fps
			15 fps		○
		640 x 480	High resolution mode(525-HR)		30 fps
			15 fps		○
		640 x 480	High sensitivity mode(625-HS)		25 fps
			10 fps		○
		640 x 480	High resolution mode(625-HR)		25 fps
			10 fps		○
		640 x 480	High sensitivity mode(VGA-HS)		30 fps
			15 fps		○
		640 x 480	High resolution mode(VGA-HR)		30 fps
			15 fps		○
	Movie output image format	YPbPr 422 format only			

Category	Function		Setup items		
System setup	Motion image stabilizer		ON		
			OFF		
	Still capture mode related function	Still image drive mode	Single shot		
			Continuous shot		
			AEB		
		Still image output size	L 2.0M (1600×1200)		
			WL 2.1M (1920×1080)		
			M 1.2M (1280× 960)		
			MS 0.5M (800× 600)		
			MS 0.5M (800× 600) High sensitivity mode		
			S 0.3M (640× 480)		
			S 0.3M (640× 480) High sensitivity mode		
	Still image preview mode		640x480/30 fps		
			640x480/15 fps		
Exposure setup	Still output image format		YPbPr422 format only		
	Continuous capture speed setup		Shooting speed at continuous shutter		Low speed Middle speed High speed
	AEB setup		Number of pages for AE bracket shoot		3
			Amount of exposure correction step		1/3
	Notify shaking alert for still image		ON		
			OFF		
	Flicker reduction		ON (AUTO)		
			OFF		
			50Hz (Fixed)		
			60Hz (Fixed)		
	Metering mode		Evaluative metering		
			Center weighted metering		
			Spot metering		
	Exposure mode		Programmed AE		
			AV priority AE		
			TV priority AE		
			Manual		
	EV correction		-2.0 EV		
			-1.6 EV		
			-1.3 EV		
			-1.0 EV		
			-0.6 EV		
			-0.3 EV		
			0.0 EV		
			+0.3 EV		
			+0.6 EV		
			+1.0 EV		
			+1.6 EV		
			+2.0 EV		
	ISO sensitivity		AUTO		
			MANUAL(80/100/200/400/800/1250)		

Category	Function	Setup items
	AE lock	AE
		FREE
	Exposure condition report	Report EV / TV / AV / SV value
	Auto slow shutter	ON OFF
Focus setup	Movie capture mode	AUTO
		MANUAL
		FULL
		NORMAL
		MACRO
		Fix to infinity
		Fix to pan focus
		Fix to closest normal
		Fix to closest macro
	Evaluation window	AUTO
		MAMUAL(Select 1 of 9)
	Still capture mode	ONE SHOT AF
		MANUAL
		FULL
		NORMAL
		MACRO
		Fix to infinity
		Fix to pan focus
		Fix to closest normal
		Fix to closest macro
	Evaluation window	AUTO
		MANUAL (Select 1 of 9)
	Focus lock	LOCK
		FREE
	Report result	Report Focus/Out of focus (for each evaluation window)
Optical Zoom	Report zoom position	Report current zoom position
	Zoom tracking	ON OFF
White balance setup	AWB mode	AUTO
		Daylight
		Cloudy
		Shade
		Fluorescent light (white)
		Fluorescent light (normal)
		Fluorescent light (day)
		tungsten
		Custom

Category	Function	Setup items
		Manual (specify x, y)
Image quality setup	Sharpness	HIGH
		MIDDLE
		LOW
	Noise reduction	HIGH
		MIDDLE
		LOW
		OFF
	Chroma	HIGH
		MIDDLE
		Low
	Hue	-2
		-1
		0
		+1
		+2
Effect setup	Digital effect (Still/Movie)	OFF
		Sepia
		Monochromatic
		Posterization
		Solarization
		Negative

4.1 Detailed function definition

This chapter describes functions that are listed in the feature list table.

4.1.1 System function

4.1.1.1 Power save

Controls power for camera system

The timing to perform power save depends on user setup.

- 1) Power save ON
Performing power saving. Move to power saving state by sending command to make it IDLE mode.
- 2) Power save OFF
Cancel power saving. Move back from power saving state to normal state, specified mode, by sending command to make it other then IDLE mode.

4.1.1.2 Image capture mode

The following shows image capture modes.

- 1) Motion image capture mode
Mode for motion image capture. Provides image output depending on the ‘Motion image output mode’ that is described later chapter.
- 2) Still image capture mode
Mode to capture still image together with mechanical shutter. Provides image output depending on the ‘Still image output mode’ that is described later chapter.

4.1.1.3 Still image drive mode

Valid only at still image capture mode. The following shows the selection of mode.

- 1) Single shot
Triggered by single command and then capture/output single still image data.
- 2) Continuous shot
Triggered by single command and then capture/output multiple still image data. Interval between each image is setup by ‘continuous shutter setup’ that is described in the later chapter.
- 3) AEB
Triggered by single command and then capture/output n page still image data while exposure value is changed. The way to setup number of capture pages, n, and to change exposure value is described in ‘AEB setup’ in the later chapter.

4.1.1.4 Movie output mode

- 1) 1920x1080
Can select frame rate from 30/24/15 fps. Aspect ratio is 16:9, full HD output.
- 2) 1680x720
Can select frame rate from 30/24 fps. Aspect ratio is 21:9, cinema mode output.
- 3) 1280x720
60 fps output at aspect ratio of 16:9. Telephoto image is expected compared to other modes.
- 4) 1280x720 High image resolution mode
Can select frame rate from 30/24/15 fps. Aspect ratio is 16:9; image quality is improved compared to the normal modes.
- 5) 720x480 High sensitivity mode
Can select frame rate from 30/15 fps. Image is stretched 9/8 times to the horizontal direction adjusting for NTSC's aspect ratio. Good result is expected when image is captured with high sensitivity at low illumination.
- 6) 720x480 High image resolution mode
Can select frame rate from 30/15 fps. Image is stretched 9/8 times to the horizontal direction adjusting for NTSC's aspect ratio. The image quality is improved compared to the normal modes.
- 7) 720x576 High sensitivity mode
Can select frame rate from 25/10. This mode is prepared for PAL format. Good result is expected when image is captured with high sensitivity at low illumination.
- 8) 720x576 High image resolution mode
Can select frame rate from 25/10. This mode is prepared for PAL format. The image quality is improved compared to the normal modes.
- 9) 640x480 High sensitivity mode
Can select frame rate from 30/15. Good result is expected when image is captured with high sensitivity at low illumination.
- 10) 640x480 High image resolution mode
Can select frame rate from 30/15. As a result of image processing, image quality is improved compared to usual.

4.1.1.5 Still image output mode

4.1.1.5.1 Still image output mode

Can select from the following seven modes

- 1) L 2.0M (1600x1200)
- 2) WL 2.1M (1920x1080)
- 3) M 1.2M (1280x960)
- 4) MS 0.5M (800x600)
- 5) MS 0.7M (800x600) High sensitivity mode
- 6) S 0.3M (640x480)
- 7) S 0.3M (640x480) High sensitivity mode

4.1.1.5.2 Still image preview mode

Can select from the following two modes

- 1) 640x480/30fps (if WL mode: 640x360/30fps)
- 2) 640x480/15fps (if WL mode: 640x360/15fps)

4.1.1.6 Continuous shooting speed setup

It is for continuous shooting speed setup. Three speeds are available among low, medium, or high. It may show no difference on continuous shooting speed depending on the selection of shutter speed. There is no limitation on the number of frames for continuous shooting. When continuous shooting is active, focus, exposure, and white balance are decided by measuring the very first frame and they are locked.

Please refer to “PE1005 Command Communication Specification” about continuous shooting sequence.

4.1.1.7 AEB setup

Set up the number of continuous shooting when AE bracketing and step of exposure compensation (EV). It follows the continuous speed setting about continuous shooting speed.

Maximum number of frames is five. **CAUTION! Only odd number frames can be selected.** If even number is specified, number – 1 is used for actual setup.

The step of exposure compensation and be setup from 1/3 EV to 2 EV with 1/3 EV step. The method of exposure compensation is decided depending on the capture compensation. See the example below. Images are captured from dark to bright by taking 0 EV as a center value.

If ‘EV correction’ setup is active, it is performed AE bracket shooting to the center of exposure value compensated EV.

It limits ± 2 EV of exposure compensation. If the exposure compensation hit to the limitation, the compensation amount is clipped ± 2 EV.

Example 1: Number of frames 3 pages, Exposure correction amount 1/3 EV

-1/3EV、0EV、1/3EV

Example 2: Number of frames 5 pages, Exposure correction amount 3/3 EV

-2EV、-1EV、0EV、1EV、2EV

Example 3: Number of frames 5 pages, Exposure correction amount 5/3 EV (Case of clipping takes place)

-2EV、-5/3EV、0EV、5/3EV、2EV

4.1.1.8 Defected pixel correction

CMOS image sensor’s defected pixels are automatically corrected. Both defected pixels at product shipping and defected pixels after the product shipping are able to be corrected.

4.1.1.9 Motion image stabilizer

Motion image stabilizer performs the correction at real time.

- 1) ON
Motion image stabilize active always
- 2) OFF
Motion image stabilizer inactive always

4.1.1.10 Still image shaking alert reporting

Reports image shaking alert

This reporting function is activated when shutter speed is slower than $1/f > ss[\text{SEC}]$

Where, * f is a focus distance that changes depending on zoom position.

* ss is a shutter speed.

4.1.1.11 Back light correction

Adjust exposure at back light. The following setup is possible.

- 1) ON
Back light correction is active always
- 2) OFF
Does not perform back light correction.

4.1.1.12 Vertical/horizontal flip image capture

Captured image is flipped vertical/horizontal.

- 1) Vertical flip ON/OFF
Setup vertical image flip
- 2) Horizontal flip ON/OFF
Setup horizontal image flip

4.1.2 Exposure function

4.1.2.1 Flicker reduction

Reduce the flicker problem due to fluorescent light at 50/60Hz.

CAUTION ! This is valid only when programmed AE, '4.1.2.3 Exposure mode', is active.

- 1) ON (AUTO)
automatically detects power frequency of fluorescent light, and then perform flicker reduction.
- 2) OFF
Does not perform flicker reduction.
- 3) ON (50Hz fixed)
For 50Hz power frequency of fluorescent light, perform flicker reduction.
- 4) ON (60Hz fixed)
For 60Hz power frequency of fluorescent light, perform flicker reduction.

4.1.2.2 Metering mode

The metering to decide exposure setup, the following setup is possible.

- 1) Evaluative metering
Decide exposure, aperture, shutter speed, sensitivity, as a result of whole frame metering evaluation.
- 2) Center weighted metering
Perform metering on whole frame average by putting weight at image center.
- 3) Spot metering
Decide exposure, aperture, shutter speed, sensitivity, as a metering evaluation result of frame center of narrow region which is about 1.6% for the whole frame.

4.1.2.3 Exposure mode

The following setup is available for method to control 3elements (Aperture, Shutter speed, Sensitivity) that decides exposure.

- 1) Programmed AE
Camera decides to 3elements based on the programmed chart.
- 2) Aperture priority AE
User setup the aperture at first and then camera adjust shutter speed and sensitivity.
Aperture values that can be set are F1.8, F2.0, F2.8, F4.0, F5.6, F8, or F11.

3) Shutter priority AE

Shutter speed is specified by user and then the aperture and the sensitivity are set by camera.

Available shutter speeds depend on the deciding of camera mode and the frame rate.

Please refer to the following table to find the available shutter speeds.

Shooting Speed	DVC			DSC	
	Frame Rate				
	24	25,10	60,30,15		
1/5	-	○	-	-	
1/6	○	-	-	-	
1/8	-	-	○	○	
1/10	-	○	-	-	
1/12	○	-	-	-	
1/15	-	-	○	○	
1/24	○	-	-	-	
1/25	-	○	-	-	
1/30	-	-	○	○	
1/48	○	-	-	-	
1/50	-	○	-	-	
1/60	-	-	○	○	
1/100	○	○	○	○	
1/125	○	○	○	○	
1/250	○	○	○	○	
1/500	○	○	○	○	
1/1000	○	○	○	○	
1/2000	○	○	○	○	
1/4000	○	○	○	-	

4) Manual

Mode to which user can freely set three all.

4.1.2.4 EV correction

Correct exposure at EV unit which can setup maximum range ± 2 EV with 1/3EV step.

4.1.2.5 ISO sensitivity

Setup image capture sensitivity.

1) AUTO

AE function automatically decides appropriate ISO sensitivity based on programmed chart.

2) MANUAL

User can select sensitivity from among, ISO80, ISO100, ISO200, ISO400, ISO800 or ISO1250.

Exposure is decided depend on the sensitivity that user select.

4.1.2.6 AE lock

Save the current exposure setup conditions.

- 1) LOCK
Keep the current exposure setup
- 2) FREE
Negate AE lock

4.1.2.7 Report exposure status

Reports current exposure status according to APEX notation, reporting items are EV, AV, TV and SV. The number of significant digits is second decimal fraction, the hundredth place.

4.1.2.8 Auto slow shutter

Select whether or not use slow shutter that reduces the frame rate when capture the dark object.

- 1) ON
Use slow shutter
- 2) OFF
Not use slow shutter

4.1.3 Focus function

4.1.3.1 Movie capture mode

4.1.3.1.1 Focus mode

The following focus mode is available

1) Auto

Automatically achieve the focus.

2) Manual

Move from the current focus location to the any focus location. It is possible to move to the location where is out of focus range. It can move to preset location, 4.1.3.1.3 as well.

4.1.3.1.2 Range

Range specifies the range of searching the optimal focus position. The following setup is available.

1) FULL

When at wide limit: from about 1cm to infinity range.

When at telephoto limit: from 100cm to infinity range.

2) NORMAL

When at wide limit: from about 20cm to infinity range.

When at telephoto limit: from 100cm to infinity range.

3) MACRO

When at wide limit: from about 1cm to infinity range.

When at telephoto limit: from 100cm to infinity range.

4.1.3.1.3 Preset position

Fix to focus to the preset position. The following setup is available

Valid only when focus mode is set to manual.

1) Fix to infinity

Adjust focus to the infinity distance

2) Fix to Pan focus

Fix focus to the pan focus position

3) Fix to Normal closest

Fix the focus to the closest position, which automatically achieve the focus within the normal range. See '4.1.3.1.2 Range' for about normal range.

4) Fix to closest macro

Fix the focus to the closest position, which automatically achieve the focus within the macro range. See '4.1.3.1.2 Range' for about normal range.

4.1.3.1.4 Evaluation window

Setup focus evaluation window.

- 1) Auto
Achieve focus as a result of evaluating nine point candidate.
- 2) Manual
Select one from nine point candidate

4.1.3.2 Still image capture mode

4.1.3.2.1 Focus mode

The following shows the focus modes.

- 1) One shot AF
Search for the best focus position to the subject within the whole region of specified area that is set by 'range setup'.
- 2) Manual
Move from the current position to the specified focus position. Focus can move to the preset position as well.

4.1.3.2.2 Range

Range specifies the region to search for the optimal focus position. The following setup is available.

- 1) FULL
When at wide limit: from about 1cm to infinity range.
When at telephoto limit: from 100cm to infinity range.
- 2) NORMAL
When at wide limit: from about 20cm to infinity range.
When at telephoto limit: from 100cm to infinity range.
- 3) MACRO
When at wide limit: from about 1cm to infinity range.
When at telephoto limit: from 100cm to infinity range.

4.1.3.2.3 Preset position

Fix the focus to the predefined position. The following setup is available

Valid only when focus mode is set to manual.

- 1) Fix to infinity
Set the focus to the infinite distance
- 2) Pan focus
Fix the focus to the pan focus position
- 3) Fix to Normal closest
Fix to the closest position, which automatically achieve the focus within the normal range.
- 4) Fix to Macro closest
Fix to the closest position, which automatically achieve the focus within the full range

4.1.3.2.4 Evaluation window

Specify the window location for focus evaluation.

- 1) Auto
Achieve focus as a result of evaluating nine candidates.
- 2) Manual
Select one point from nine candidate points.

4.1.3.2.5 Focus lock

Keep the focus to the current position

- 1) Focus lock
Keep the current focus position
- 2) Free
Negates focus lock

4.1.3.2.6 Report result

Reports AF result, whether or not achieved focus, for each evaluation window.

4.1.4 Optical zoom function

4.1.4.1 Report zoom position

Reports the current zoom position, which is between wide 0 to telephoto 1023.

4.1.4.2 Zoom tracking

Adjust focus according to the zoom position. With this function is inactive, current focus turned to be out of focus when zoom position moves.

- 1) ON
Currently achieved focus is kept even zoom position is changed.
- 2) OFF
Currently achieved focus is not guaranteed to maintain when zoom position is changed.
It is available only for the camera mode is DVC and the focus mode is manual.

4.1.5 White balance function

4.1.5.1 AWB mode

Performs white balance control that fit to the light source.

1) Auto

Apply to the wide range of light source, color temperature between 3000 and 7000K.

2) Daylight

Under the sun light, color temperature 5000K.

3) Cloudy

Cloudy out door, color temperature 6500K.

4) Shade

Under the shade out door, color temperature 7000K.

5) Fluorescent light (white)

Fluorescent light W in the room, color temperature 4000K.

6) Fluorescent light (normal)

Fluorescent light N in the room, color temperature 5000K.

7) Fluorescent light (day)

Fluorescent light D in the room, color temperature 6500K.

8) Tungsten

Tungsten in the room, color temperature 3000K.

9) Custom

Adjust white balance manually.

Set the white balance based on user selected white object.

10) Manual

Express the used light source with xy chromaticity diagram, and specify the x and y.

Please meet the following requirements about the value set to x,y.

- x range 0.25 \leq x \leq 0.54
- y range 0.25 \leq y \leq 0.49
- x + y should be less than 1.0.

4.1.6 Image quality setup function

4.1.6.1 Sharpness

The following setup is available for image sharpness.

- 1) High
- 2) Middle
- 3) Low

4.1.6.2 Noise reduction

The following setup is available for the noise reduction.

- 1) High
- 2) Middle
- 3) Low
- 4) Off

4.1.6.3 Chroma

Image chroma can be set for Pr and Pb independently.

- 1) High
- 2) Middle
- 3) Low

4.1.6.4 Hue

Image hue can be set for Pr and Pb independently between -2 and +2 in five levels.

4.1.7 Image effect function

4.1.7.1 Digital effect

Performs digital effect, it valid for both still and motion picture capturing.

- 1) OFF
- 2) Sepia
- 3) Monochromatic
- 4) Posterization
- 5) Solarization
- 6) Negative

4.2 Several sequence

Please see “PE1005 Command Communication Specification” for the detail of startup sequence and mode change sequence.