BOPIXEL JAPAN ボゾンジャパン株式会社

High Resolution

12.3M CMOS

Monochrome / Color CameraLink

BC-SM12MCL (Monochrome)
BC-SC12MCL (Color)

Product Specifications

BOPIXEL Corporation

Safety precautions

- This product is not designed and manufactured for applications that may cause damage to the human body, so do not use it for that purpose.
- This product is not waterproof. Do not use this product in an environment where it will be directly exposed to liquid or in a humid place.
- Do not use the camera in an environment with flammable liquids or gases. It may cause a fire or an explosion.
- In environments where the temperature changes drastically, use the camera and lens after taking measures to prevent condensation. Condensation inside the camera may cause a malfunction.
- Use the camera in the environment described in the specifications. It may cause malfunction or malfunction.
- The housing temperature is high while the camera is in use. In particular, the camera labeled  may have a housing temperature of more than 60°C depending on the environment in which it is used. Do not touch the camera during use or immediately after use. Doing so may cause burns or injuries.
- Use the supply voltage and the I/O signal to the camera within the range described in the specifications. It may cause malfunction or malfunction.
- When wiring to the camera connector, follow the pin assignments described in the specifications and be careful not to stress the wiring or camera connection. It may cause malfunction or malfunction.
- Do not disassemble the camera.

Precautions for use

- Do not subject the camera to shock or static electricity.
- When not using the camera, use a lens mount cap or protective sheet to prevent dust from adhering to the CMOS sensor imaging surface.
- Blow off any dirt on the glass surface with an air duster or similar tool and be careful not to scratch the glass surface.
- If there is a noise source such as a motor near the camera or wiring cable, the image may be distorted, or communication failure may occur. Keep the camera and wiring cables away from noise sources.
- Due to the inherent characteristics of CMOS sensors, pixel defects may occur during transportation and storage.

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1 Overview

This document describes the specification of the following cameras.

BC-SM12MCL / BC-SC12MCL

2 Features

- High resolution and High Speed
  - ✧ The camera has Sony Pregius 12.3 Mega pixels global shutter CMOS sensor to achieve the maximum 66.6 fps at 10TAP 8bits output.
- Camera Link standard (PoCL)
  - ✧ The camera is supported with the Camera Link standard configuration as follows.
  - ✧ 10Tap(8bits),8Tap(10bits,8bits),4,3,2Tap(12bits,10bits,8bits).
- Global shutter
- High speed shutter time
  - ✧ The minimum 1μseconds shutter time is supported with the Fast Trigger Mode.
- External Trigger operation (CC1 or GPIO signal connector).
- ROI (Region Of Interest)
  - ✧ The frame rate can be increase by the ROI (eight regions) function.
- Decimation
  - ✧ The horizontal and vertical thinning(2x2 sub-sampling) image is supported.
- Binning *only for the monochrome model
  - ✧ The brightness of two vertical pixels are summing into one pixel. (No horizontal brightness summing) The twice
  - ✧ brighter, half resolution and twice faster frame rate image can be obtained by the binning function.
- Selectable Camera Link clock speed
  - ✧ The camera is selectable clock speed with 84.857MHz, 66MHz or 39.6MHz.

3 Specifications

3.1 Electronic Specifications

3.1.1 BC-SM12MCL / BC-SC12MCL

Model Number		BC-SM12MCL	BC-SC12MCL
Image Sensor		1.1" 12.3 Mega pixels Monochrome CMOS (Sony: IMX253)	1.1" 12.3 Mega pixels Color CMOS (Sony: IMX253)
Shutter Type		Global	
Effective Picture Resolution		4,096 (H) x 3,000 (V)	
Pixel Size		3.45 (H) µm x 3.45 (V) µm	
Sync System		Free-run (continuous) / External Trigger (hardware / software)	
Maximum Frame Rate (@ Full resolution)		66.6 fps (10Tap CL Config.)	
ADC Resolution		12bits	
Video Format		Mono8,10,12	BayerRG8,10,12
Noise Level		Less than 2.4 (@Gain 0 dB,8bits)	
Exposure time		1 µseconds to 16.777 seconds	
Gain	Analog Gain	0 dB to 18 dB	
	Digital Gain	0 dB to 24 dB	
Black Level		0 to 63 digits(@8bits)	
Sensitivity		510Lux	1040Lux
White Balance Gain		N/A	-40 dB to 12 dB
ROI	Position	Horizontal: 0 to 4095 / Vertical: 0 to 2996	
	Size	Horizontal: 2 to 4096 / Vertical: 4 to 3000	
Image Flip		Horizontal / Vertical / Horizontal and Vertical / Off	
Pixel Defect Correction		Up to 256 points	
Operational Mode		Free-run (Trigger Mode : Off) / Edge-preset Trigger(Trigger Mode :On , Exposure Mode :Timed) / Pulse width Trigger (Trigger Mode : On , Exposure Mode : Pulse Width)	
User Setting Storage		Support	
Device Tap Geometry		1X10_1Y,1X8_1Y,1X4_1Y,1X3_1Y,1X2_1Y	
CI Configuration		Full, 80Bit	
CameraLink Clock		84.857 / 66 / 39.6 MHz	
Communication		CameraLink UART	
Interface		CameraLink Connector SDR x 2	
Protocol		GenICam Standard Version (SFNC 2.5) compliant	
Input / Output		4 x GPIO,	
Power	Input Voltage	+12V (typ.) (±10%)	
	Consumption	Maximum: 3.6 W, Typical: 3.0 W	

*1 Sensitivity is measured under below conditions.
F5.6 of Lens, Gain:0dB, Exposure time:1/30sec., Light source: Light box(5100K)

3.2 Mechanical Specifications

Model Number	BC-SM12MCL	BC-SC12MCL
Dimensions	35 (W) x 35 (H) x 40.7 (D) mm (*1)	
Material	Aluminum alloy	
Lens Mount	C Mount	
Interface Connectors	CameraLink Connector SDR x 2 GPIO Connector: HR10A-7R-6PB (Hirose) or equivalent	
Camera Mounting	M3 screws holes (4 on top, 4 on bottom)	
Weight	Approximately 75g	

(*1) excluding the connectors

3.3 Environmental Specifications

Model Number	BC-SM12MCL / BC-SC12MCL
Operational Temperature / Humidity	Environmental Temperature：0 to +40 deg.C (with C MOUNT LENS) LENS SIZE：φ30 x L40 mm Camera housing temperature when the environmental temperature is 40deg.C：64 deg.C (*2) (Camera housing measuring point：Fig3.3-1) Environmental Humidity: 0 to 85%RH (No condensation)
Storage Temperature / Humidity	Environmental Temperature: -20 to +75 deg. C Environmental Humidity: 0 to 85%RH (No condensation)
Vibration	20 Hz to 200 Hz to 20 Hz (5 min. / cycle), acceleration 10G, XYZ 3 directions 30 min. each
Shock	Acceleration 38 G, half amplitude 6 ms, XYZ 3 directions 3 times each
Standard Compliancy	EMI: EN55032:2015, EN61000-3-2:2014, EN61000-3-3:2013 EMS: EN55035:2017, EN61000-4-2:2009, EN61000-4-3:2006+A1:2008+A2:2010, EN61000-4-4:2012
RoHS	RoHS Compliant

(*2) If use in an environment that exceeds 40deg.C, or if attach a small lens, take measures to dissipate heat so that the camera housing temperature will be less than 64deg.C.

Camera housing measuring point

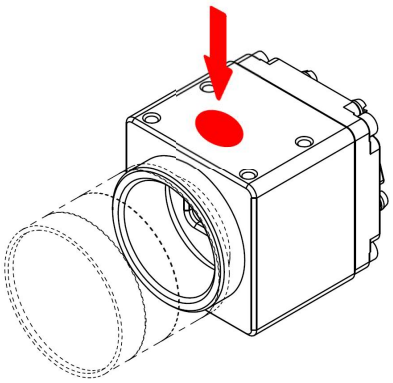
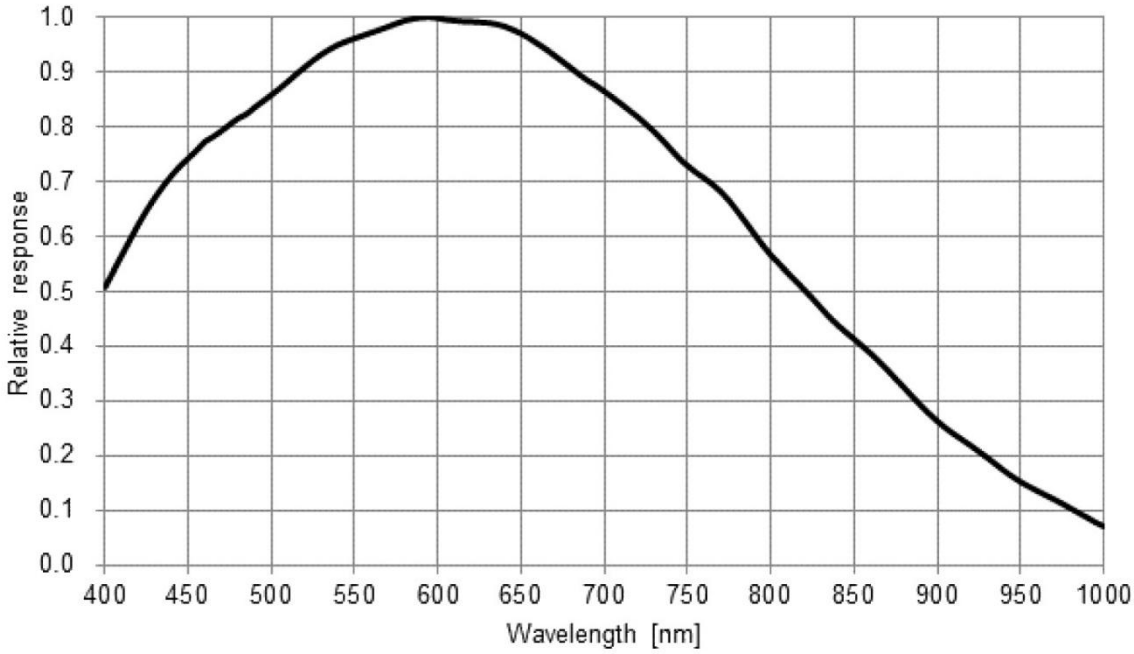


Fig 3.3-1

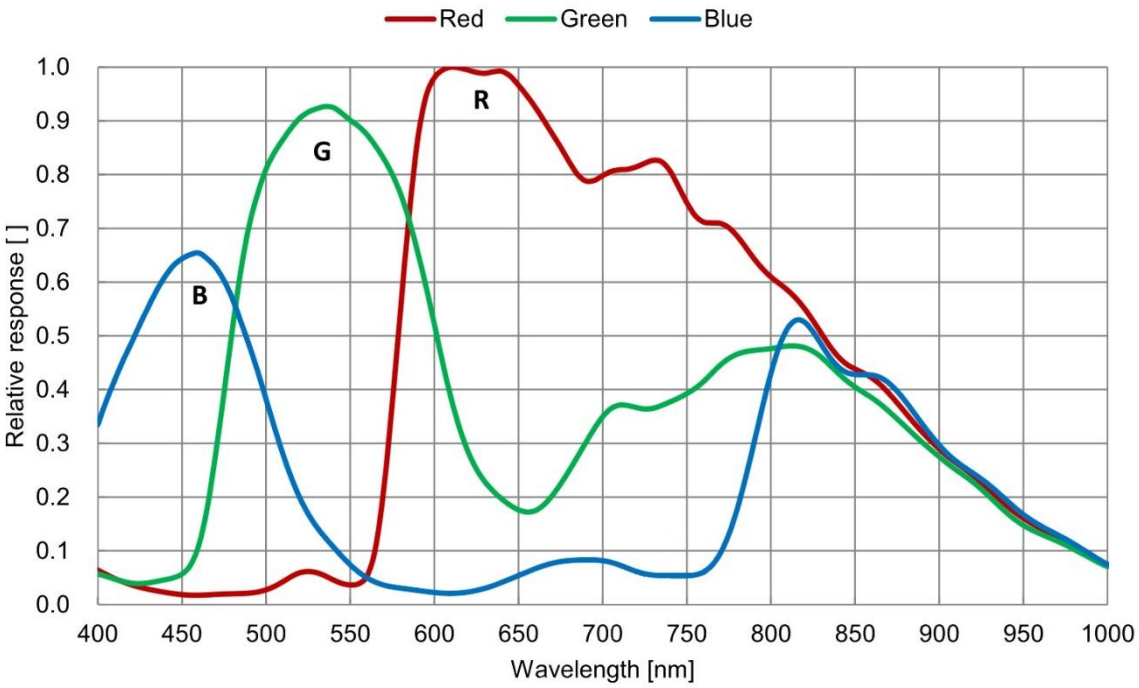
4 CMOS information

4.1 Spectral Sensitivity Characteristics

BC-SM12MCL

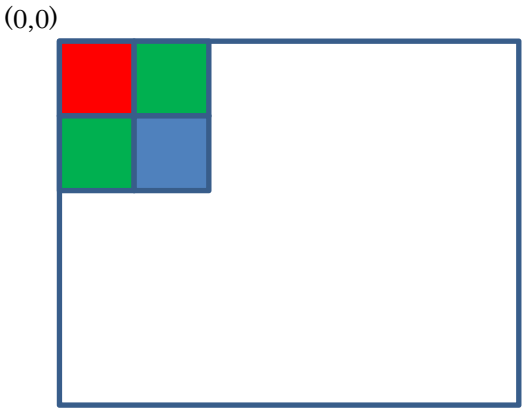


BC-SC12MCL



4.2 Color Filter Array

BC-SC12MCL(Color)

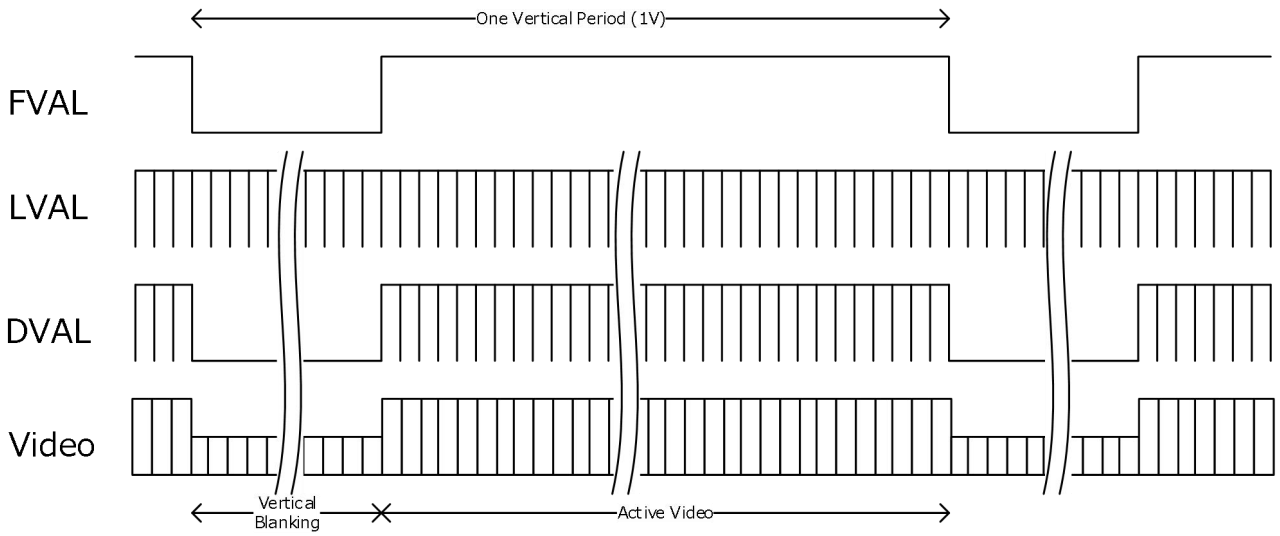


4.3 Full Image scan frequency for each camera operation

Camera Link Tap Configration	Camera Link Clock Frequency(MHz)	Horizontal Scan Frequency(kHz)	Frame Rate(Hz)
10Tap(8bit)	84.857	203.9835	66.6177
	66	158.6538	51.8138
	39.6	95.1923	31.0883
8Tap(10/8bit)	84.857	163.1868	53.2942
	66	127.1404	41.5220
	39.6	76.1538	24.8706
4Tap(12/10/8bit)	84.857	81.8633	26.7352
	66	63.6792	20.7966
	39.6	38.2141	12.4801
3Tap(8bit)	84.857	61.3636	20.0404
	66	34.4069	11.2367
	39.6	23.2540	7.5944
2Tap(12/10/8bit)	84.857	40.9542	13.3750
	66	31.8396	10.3983
	39.6	19.1071	6.2401

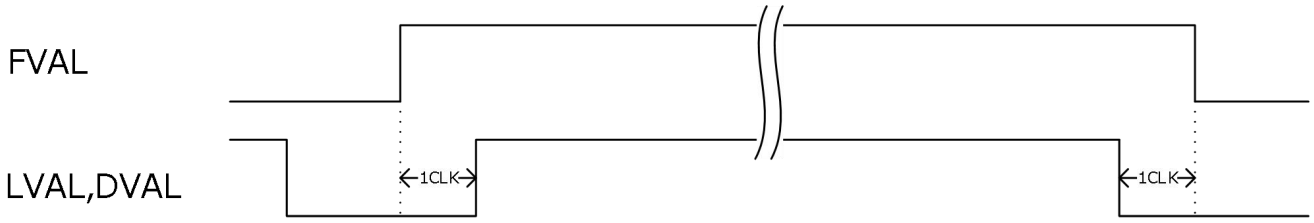
4.4 CameraLink Output Format

4.4.1 Vertical Timing



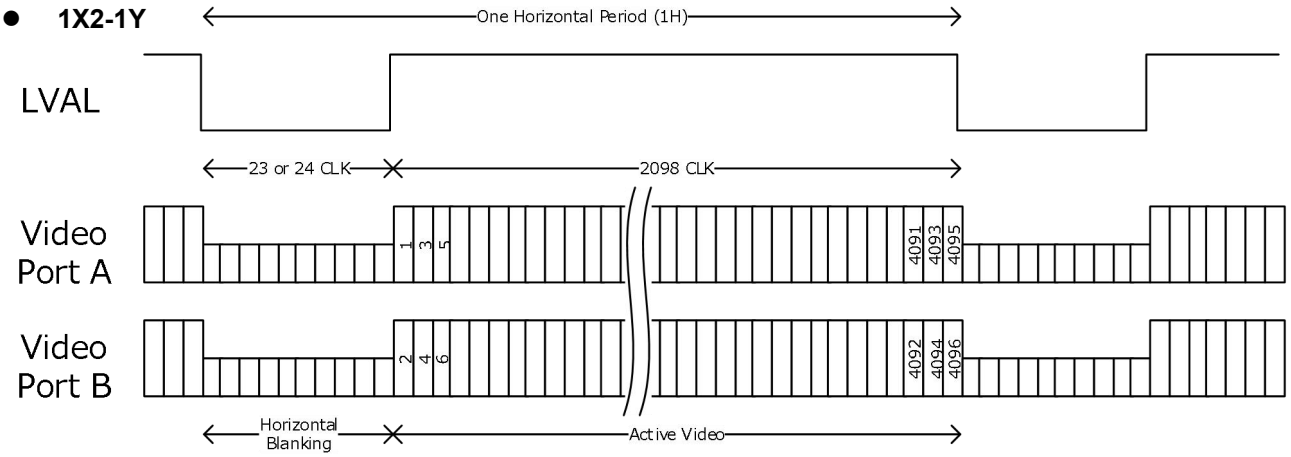
Vertical Blanking = 62H

- **Detail Vertical Timing**

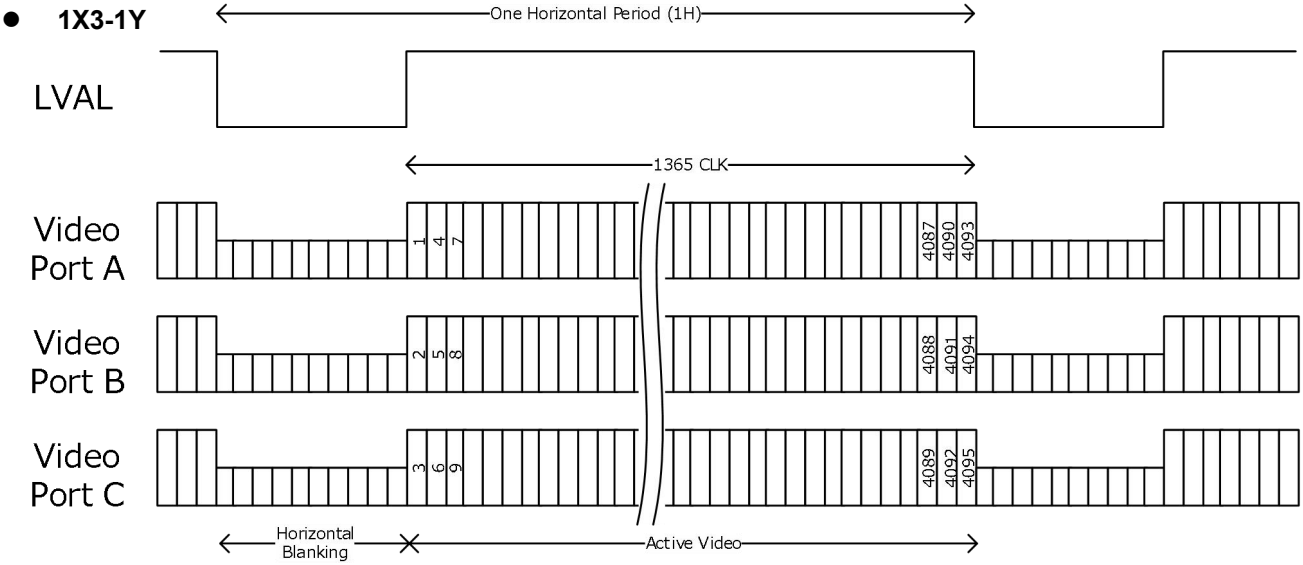


4.4.2 Horizontal Timing

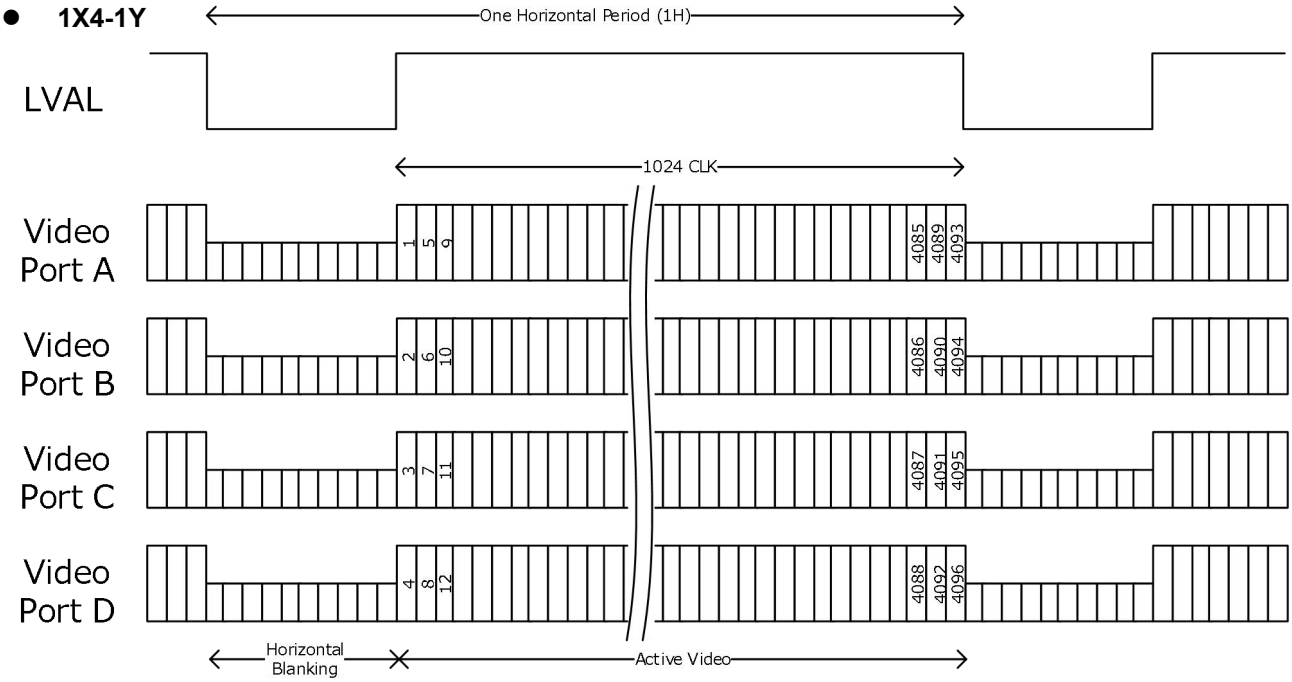
- **1X2-1Y**



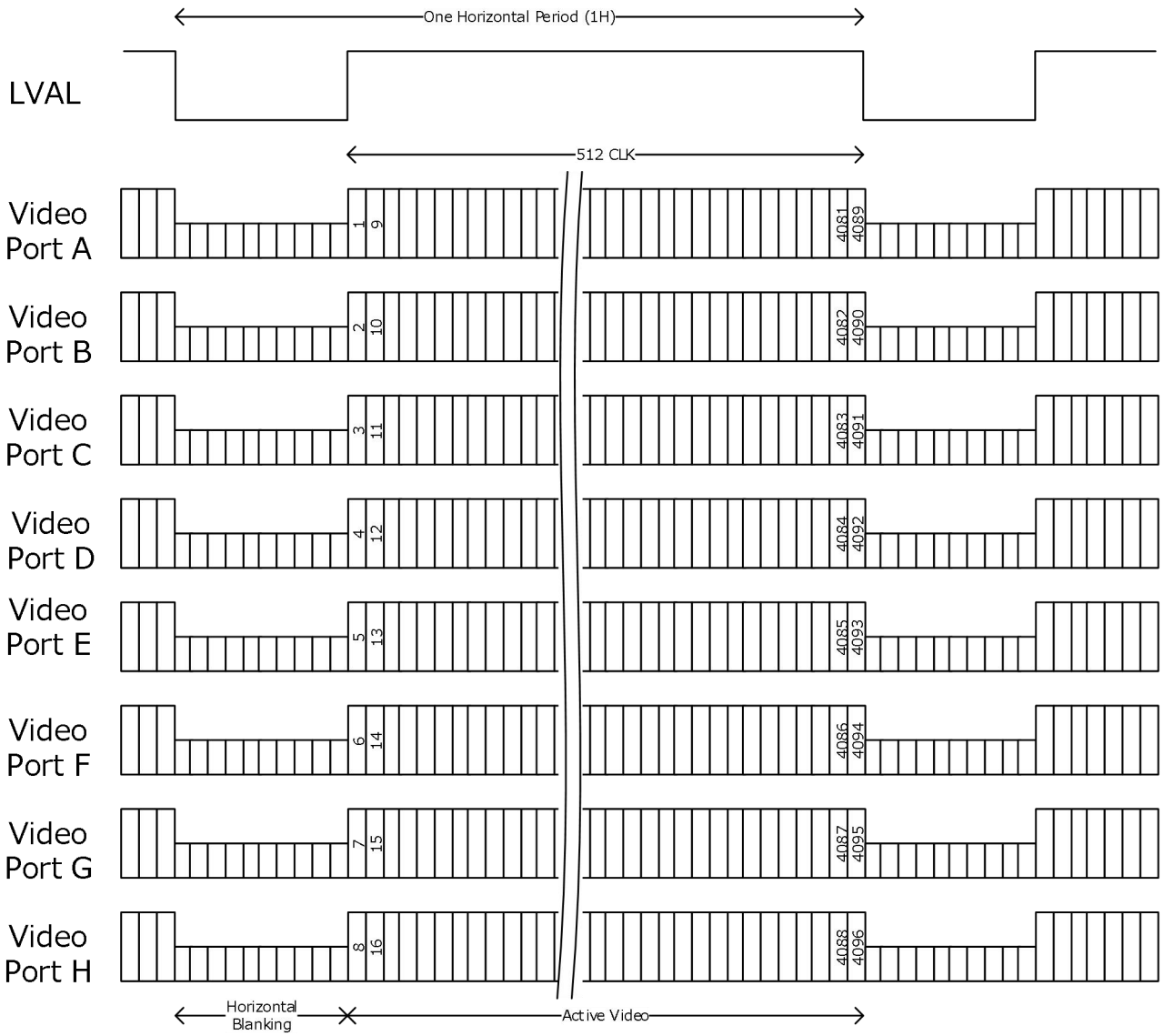
- **1X3-1Y**



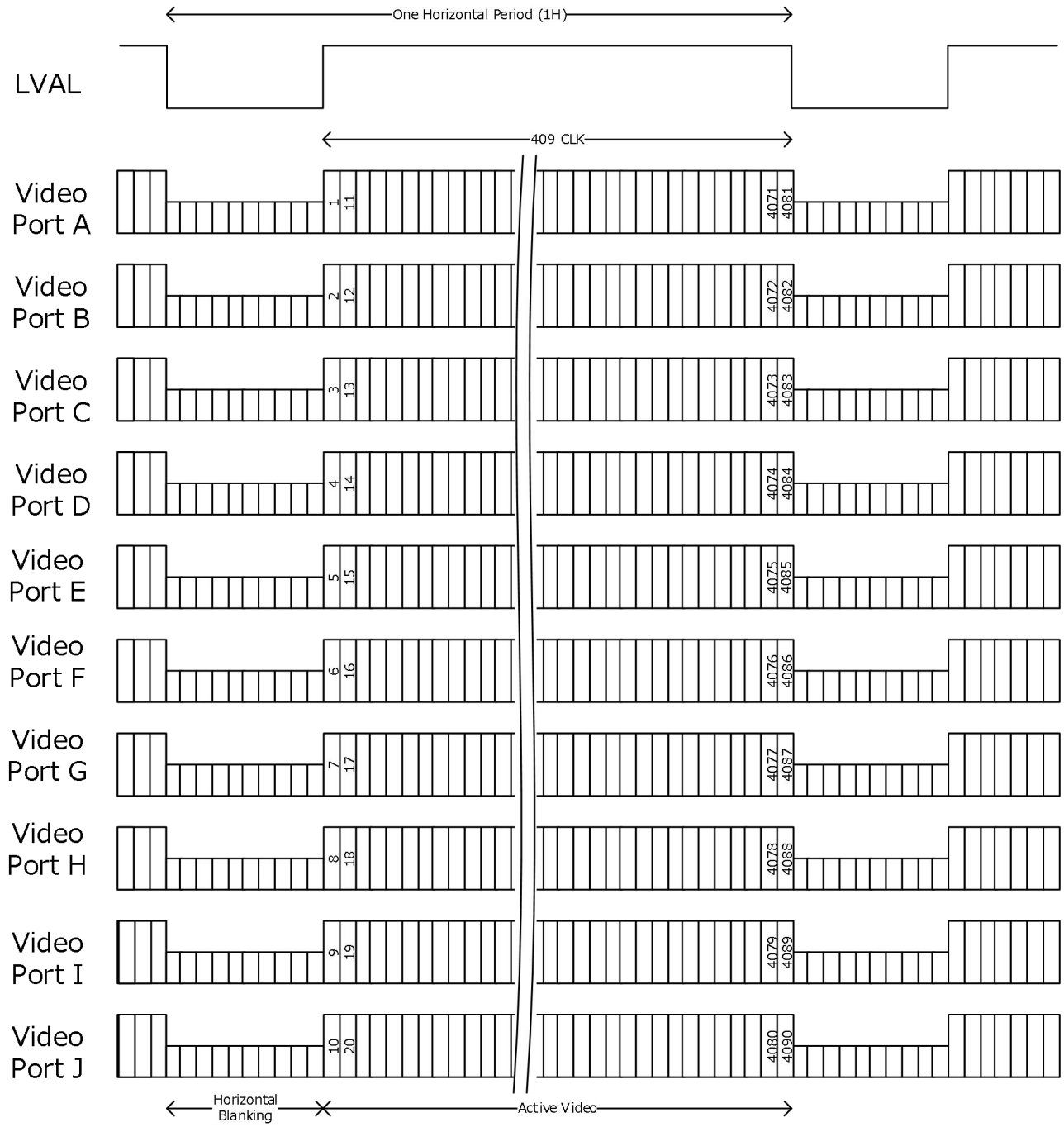
- **1X4-1Y**



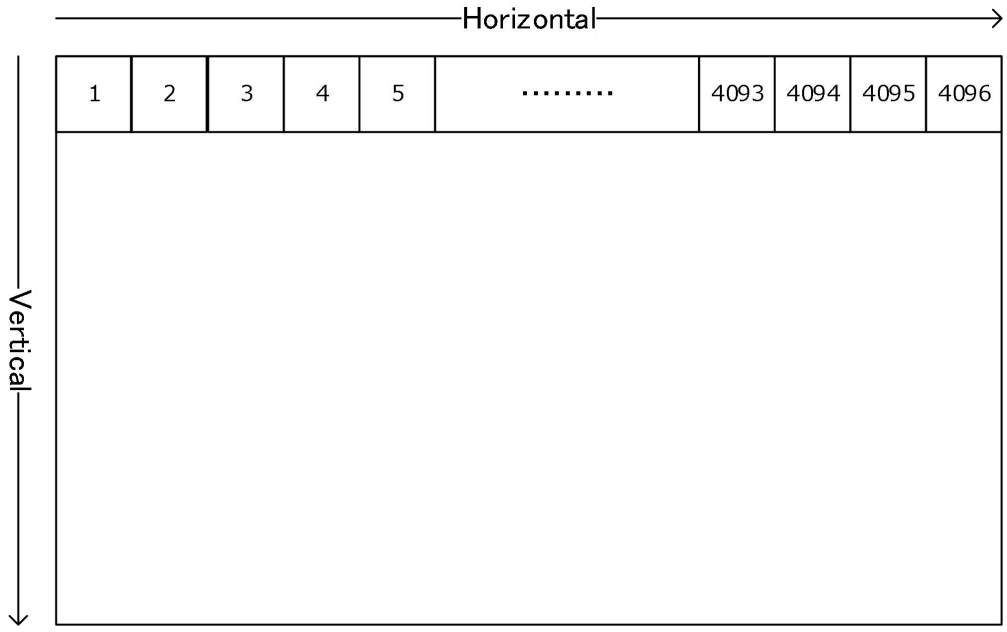
- **1X8-1Y**



- **1X10-1Y**

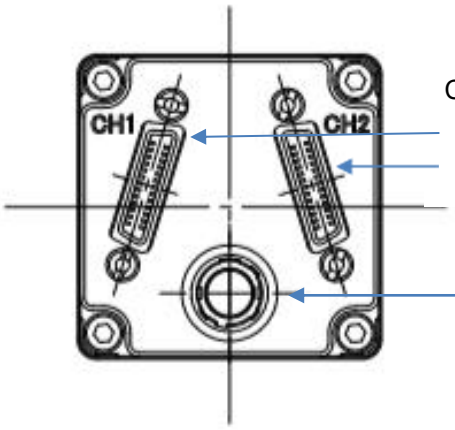


4.4.3 Image Output Direction



5 Camera Hardware information

5.1 Interface



Camera Link Connector (SDR)
CH1: Base
CH2: Medium/Full

GPIO Connector
Power(+12V) and GPIO (Line0 - Line3)

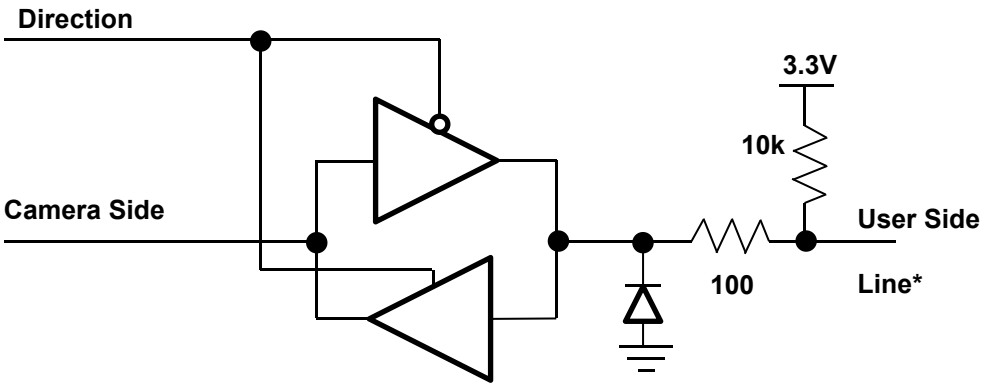
5.2 IO Connector

- HR10A-7P-6S (Hirose) or equivalent can be used.
- GPIO can select input and output by camera setting.

Pin assignment And DC characteristics

Pin No.	Signal Name	Function	DIR	Voltage	
				Low Voltage	High Voltage
1	12V	Power			
2	Line0	GPIO	IN	Less than+0.8V	+2.0 to +5.5V
			OUT	Less than+0.4V	+3.3
3	Line1	GPIO	IN	Less than+0.8V	+2.0 to +5.5V
			OUT	Less than+0.4V	+3.3
4	Line2	GPIO	IN	Less than+0.8V	+2.0 to +5.5V
			OUT	Less than+0.4V	+3.3
5	Line3	GPIO	IN	Less than+0.8V	+2.0 to +5.5V
			OUT	Less than+0.4V	+3.3
6	GND	GND	-		

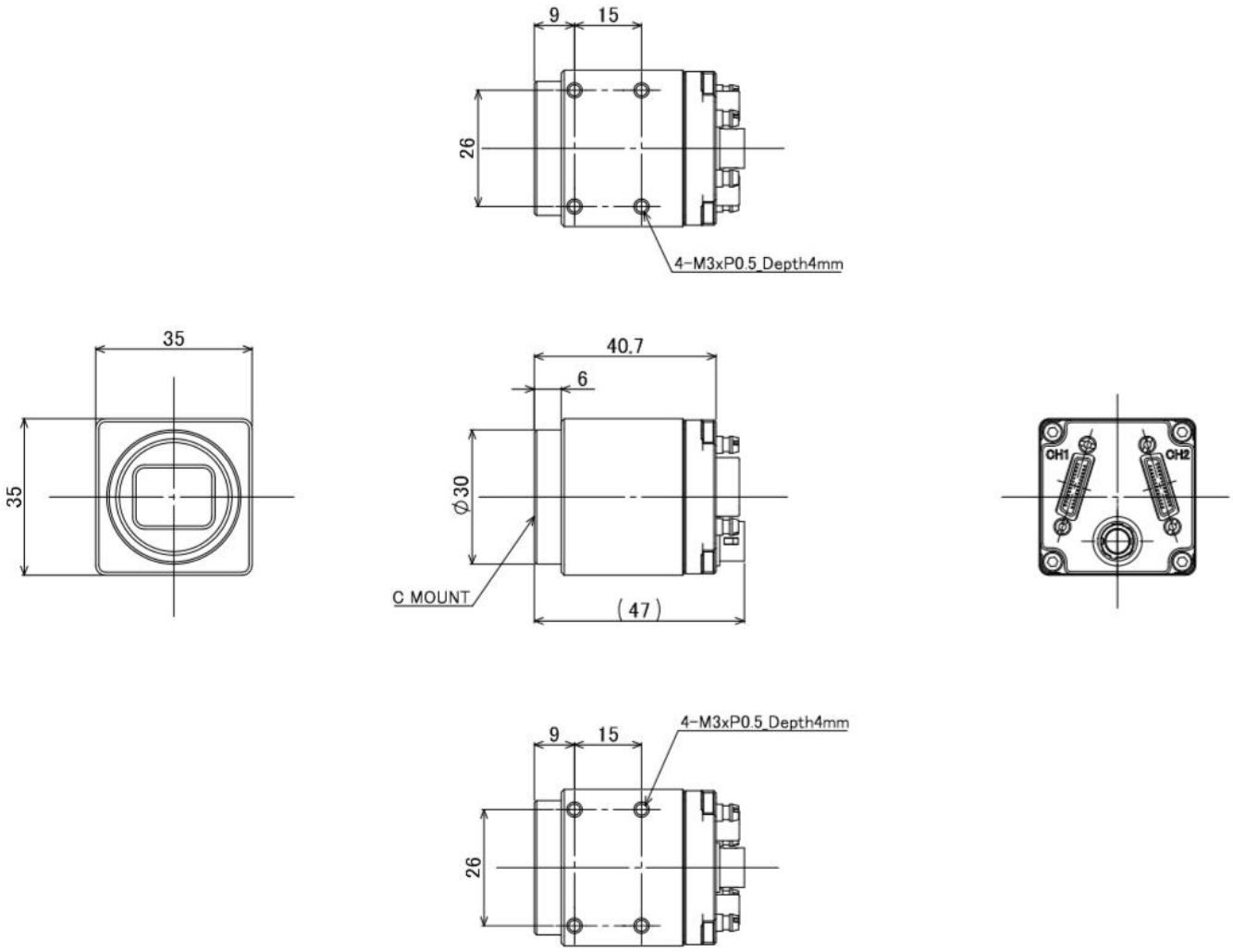
5.3 Camera Line Circuit



SN74LVC2G241

5.4 Camera Dimensions

Unit: mm



6 Camera Operation

6.1 GenICam Command Reference Table

The setting items of the camera conform to SNFC of GenICam Standard Version.
The items implemented in the camera are as follows.
Please refer to SNFC of GenICam for details of the function except the original functions of BOPIXEL.

6.1.1 Standard functions

GenICam command	Default
DeviceVendorName	BOPIXEL-
DeviceModelName	BC-SM12MCL/BC-SC12MCL-
DeviceSerialNumber	-
DeviceUserID	-
DeviceFirmware	-
DeviceTemperature	-
DeviceSerialPortBaudRate	Baud38400
Width	4096 (pixel)
Height	3000 (pixel)
OffsetX	0-
OffsetY	0-
TestPattern	Off
ReverseX	False
ReverseY	False
PixelFormat	MonochromeModel: Mono8 / ColorMode : BayerRG8
TestPatternGeneratorSelector	FPGA
AcquisitionBurstFrameCount	1
AcquisitionFrameRate	Refer to [FrameRate calucurate]
TriggerSelector	FrameStart
TriggerMode	Off
TriggerDelay(Frame Start)	0
TriggerSource(Frame Start)	Software-
TriggerSoftware(Frame Start)	-
TriggerMode(Frame Start)	Off
TriggerDelay(Frame Burst Start)	0
TriggerSource(Frame Burst Start)	Software
TriggerSoftware(Frame Burst Start)	-
TriggerMode(Frame Burst Start)	-

GenICam command	Default
ExposureMode	Off
ExposureTimeSelector	0
ExposureTime	DigitalAll
GainSelector	0
Gain	All
BlackLevelSelector	40
BlackLevel	Red (ColorMode Only)
BalanceRatioSelector	2048 (ColorMode Only)
BalanceRatioSelector	Line0
LineSelector	Input
LineMode	False
LineInverter	-
LineStatus	UserOutput0
LineSource	UserOutput0
UseroutputSelector	False
UserOutputValue	Geometry_1X8_1Y
DeviceTapGeometry	Full
CIConfiguration	Default
UserSetSelector	-
UserSetLoad	Default-
UserSetSave	-
UserSetDefault	Off

6.1.2 Original functions of BOPIXEL

GenICam command	Default
EnablePixelCorrection	True
PixelCorrectionHighlight	False
PixelCorrectionIndex	0
PixelCorrectionX	65535
PixelCorrectionY	65535
LineDebounceTime	1
TriggerAcquisitionModeSelector	Fast

7 Image Acquisition and Camera Trigger Modes

7.1 Trigger Source

7.1.1 Software

A trigger is input by a communication command from the camera.
When software trigger is used, the timing of trigger input to the camera may not be guaranteed because it depends on the operating status of the host PC.

7.1.2 Line0-Line3

A trigger is input from the 6-pin connector (GPIO) of the camera.
When using the Line trigger, it is necessary to keep the voltage input range to the IO pin.

7.1.3 CC1

A trigger is input from the CC1 line of the grabber board.
The trigger input method from CC1 depends on the grabber board specifications.

7.2 Trigger Acquisition Mode

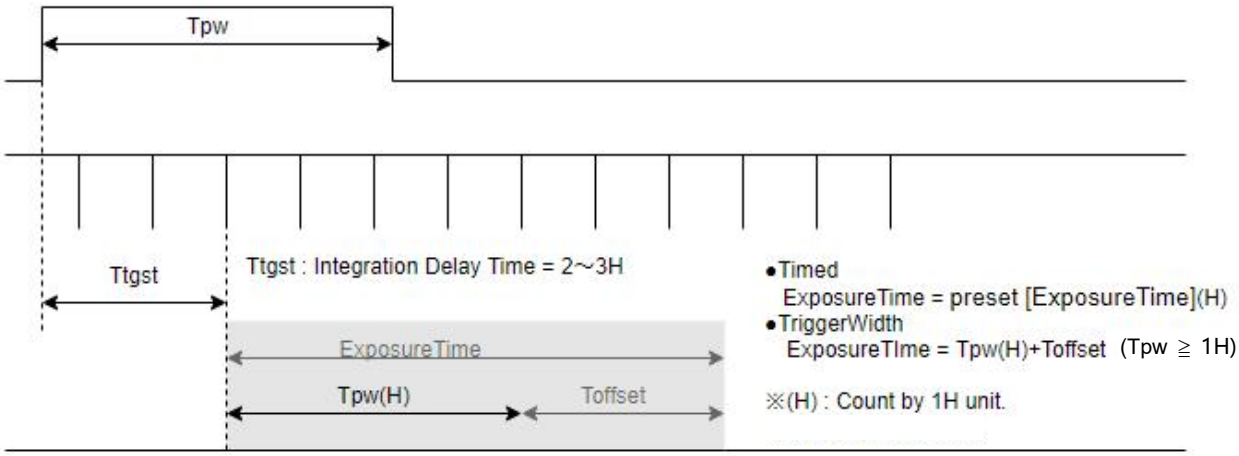
7.2.1 Overlap Mode

In this mode, Next trigger can be input during the sensor image read out.
However, exposure start timing is delayed 2～3 horizontal sensor drive term.

- **The Detail Timing**

a) Exposure Time > 1H

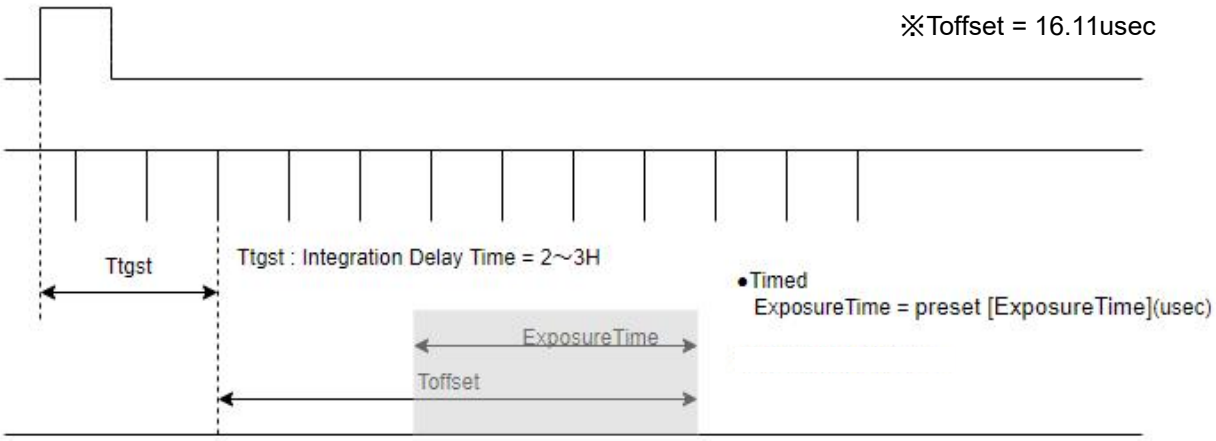
※Toffset = 14.26usec



※1H: Refer to 4.3 Full Image scan frequency for each camera operation.

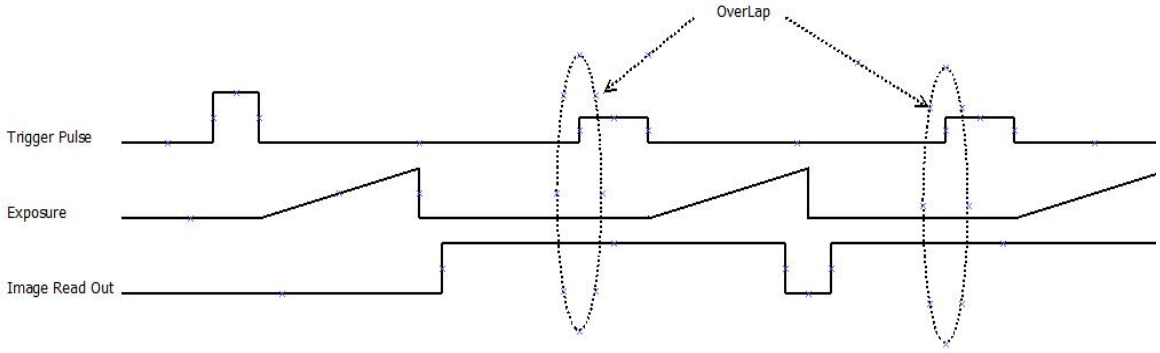
b) Exposure Time ≦ 1H (Active : Trigger mode is Timed only.)

※Toffset = 16.11usec



7.2.2 Fast Trigger Mode

In this mode, exposure starts immediately (delayed < 50nsec.) against the trigger signal input without the jitter. However, when the next trigger is input during the sensor image read out, some noise may be appeared with trigger input timing.

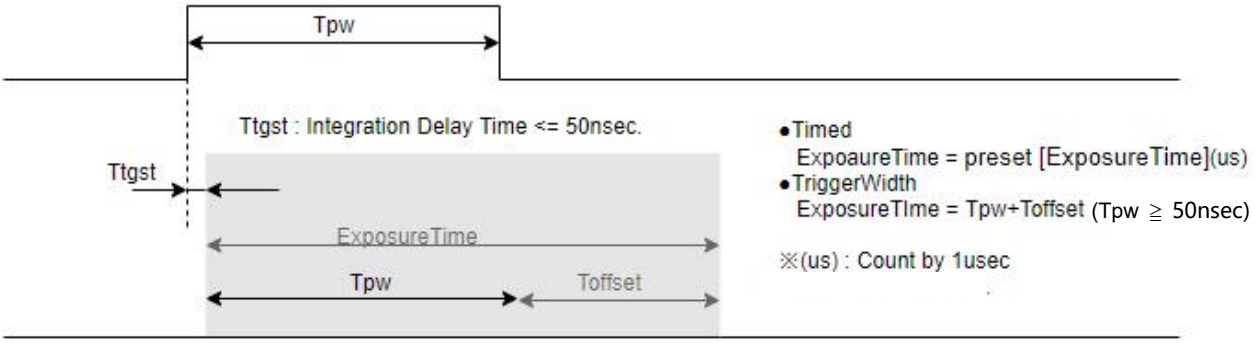


Immediately after changing the Trigger Acquisition Mode, it takes time to change the mode inside the camera. Do not enter a trigger to camera during that period.

- **The Detail Timing**

a) Exposure Time > 15usec

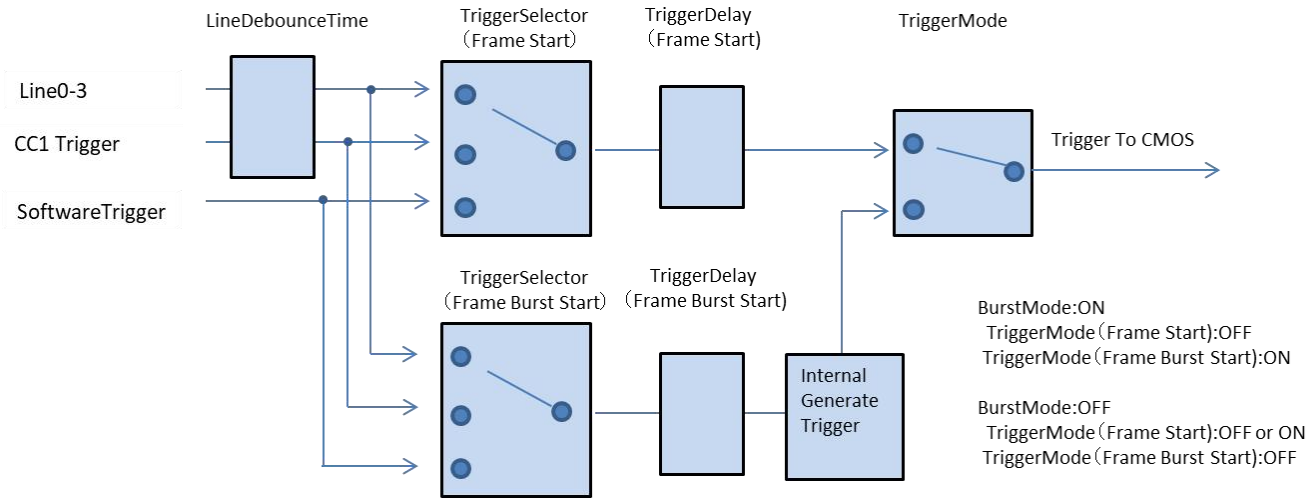
※Toffset = 14.26usec



b) Exposure Time ≦ 15usec (Active : Trigger mode is Timed only.)

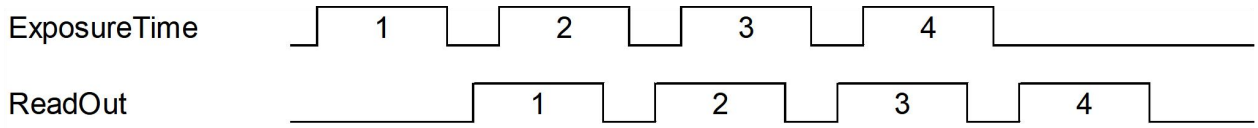
※Toffset = 16.11usec

7.3 Trigger Input Block Diagram



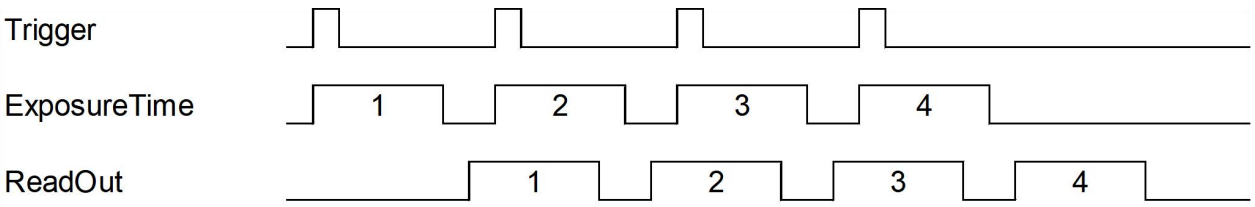
7.4 Trigger Mode

7.4.1 Trigger Mode : OFF(Free-Run)



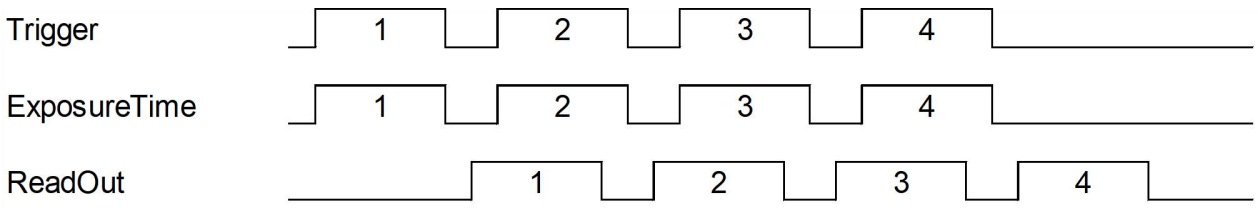
When this mode is set, camera outputs video image continuously.
The camera is exposed and outputs video image at the set [Acquisition framerate].
The exposure time is set to a maximum value within a preset [Acquisition framerate].

7.4.2 Trigger Mode : Timed



The camera is exposed within a preset [ExposureTime] and outputs video image from an external trigger.
The camera recognizes at the rising edge of the trigger signal.
There is an upper limit to the timing at which a trigger can be input.
When inputting a trigger from Line*, user can select whether the trigger signal is recognized as a rising or a falling edge using the [LineInverter] setting.

7.4.3 Trigger Mode : Pulse Width



The camera is exposed for the same period as the external trigger and outputs the video image.
There is an upper limit to the timing at which a trigger can be input.

8 Revision Information

Rev	Date	Changes
0.0	2021/06/01	Released of Engineering Sample.
1.0	2021/11/15	Released for Official. Add Safety precautions Add 4.4 Camera Link format.

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