BOPIXEL JAPAN ボゾンジャパン株式会社

CoaXPress Camera

Monochrome / Color CMOS 16.1Mpixel

BC-SM16M10X4 (Monochrome)
BC-SC16M10X4 (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.

Table of Contents

1 Specifications

1.1 Electronic Specifications

Model Number		BC-SM16M10X4	BC-SC16M10X4
Image Sensor		Sony: IMX532 Monochrome CMOS	Sony: IMX532 Color CMOS
Shutter Type		Global	
Active Pixel		5312 (H) x 3040 (V): 16.1MPixel	
Pixel Size		2.74 (H) x 2.74 (V) μm	
Sync System		Free run / External trigger (Hardware / Software) / LinkTrigger (use of coax cable)	
Maximum Frame Rate		158.8 fps (CXP10_X4, CMOS8bit) / 152.5 fps (CXP19_X4, CMOS10bit)	
Video Output Format		CXP10 (_X4, _X2, _X1), CXP6 (_X4, _X2, _X1), CXP3 (_X4, _X2, _X1)	
Video Format		8 bits (Mono8)	8 bits (Mono8)
Noise Level		Less than 2.6 (@Gain 0 dB, CMOS10bits)	
Sensitivity (*1)		230Lux(@CMOS8bit) / 920Lux(@CMOS10bit)	230Lux(@CMOS8bit) / 920Lux(@CMOS10bit)
Exposure time		Overlap Mode: 4μ seconds to 16.777 seconds Fast Trigger Mode: 1H to 16.777 seconds	
Gain	0 to 18dB	0 to 18dB	
	0 to 24dB	0 to 24dB	
Black Level		0 to 80 DN 8bit	
White Balance Gain		N/A	Formula1: 1 to 5 Times Formula2: 1 to 8 Times
ROI		Width (Horizontal): 16 to 5312 / Height (Vertical): 16 to 3040 Adjustable Steps for size: 16 pixels in width direction / 16 lines in height direction Adjustable Steps for offset: 16 pixels in width direction / 16 lines in height direction	
Image Flip		Reverse X / Reverse Y (Default: OFF)	
Binning		2x2 FD binning	N/A
Decimation		V/H 1/2subsampling	
Pixel Defect Correction		Up to 1024 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: Trigger Width)	
User Setting Storage		Support	
Communication		CoaXPress Standard Ver1.1	
Protocol		GenICam Standard Version (SFNC 2.5) compliant	
Input / Output		GPIO x 2, Isolated Input x 1	
Power	Input Voltage	PoCXP or External 24V±10%	
	Consumption	Typical: 6.2W, Maximum: 6.8W	

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

1.2 Mechanical Specifications

Model Number	BC-SM16M10X4(-AN) / BC-SC16M10X4(-AN)
Dimensions	60 (W) x 60 (H) x 38 (D) mm: Straight Type (*1) 60 (W) x 60 (H) x 49.5 (D) mm: Angle Type(-AN) (*1)
Material	Aluminum alloy
Lens Mount	C Mount
Interface Connectors	Micro-BNC Connector I/O Connector: HR10A-7R-6PB (Hirose) or equivalent
Camera Mounting	M5 screws holes (Four on front. Two on top, bottom and both side plate)
Weight	Approximately 188 g : Straight Type Approximately 233 g : Angle Type(-AN)

(*1) excluding the connectors

1.3 Environmental Specifications

Model Number	BC-SM16M10X4(-AN) / BC-SC16M10X4(-AN)
Operational Temperature / Humidity	a). Environmental Temperature: 0 to +44deg. C (with C MOUNT LENS) LENS SIZE：φ35 x L45 mm Camera housing temperature when the environmental temperature is 44deg.C：66 deg.C (*2) (Camera housing measuring point：Fig1.3-1) b). Device Temperature : 70deg.C or less (*3) Environmental Humidity: 0 to 85%RH (No condensation)
Storage Temperature / Humidity	Environmental Temperature: -25 to +70 deg.C Environmental Humidity: 0 to 85%RH (No condensation)
Vibration	20 Hz to 200 Hz to 20 Hz (5 min. / cycle), acceleration 10 G, XYZ 3 directions 30 min. each
Shock	Acceleration 38 G, half amplitude 6ms, XYZ 3 directions 3 times each
Standard Compliancy	EMI: EN55032:2015+A1:2020, EN61000-3-2:2019+A1:2021, EN61000-3-3:2013+A1:2019 EMS: EN55035:2017+A11:2020, EN61000-4-2:2009, EN61000-4-3:2020, EN61000-4-4:2012
RoHS	RoHS Compliant

(*2) If use in an environment that exceeds 44deg.C, or if attach a small lens, take measures to dissipate heat so that the camera housing temperature will be less than 66deg.C.

(*3) If there is a heat radiation effect depending on the installation condition of the camera, it may be possible to use it in an environment the temperature exceeds 44deg.C. It can be used if the [Device Temperature] (value of the temperature sensor inside the camera) read by communication is 70deg.C or less.

Camera housing measuring point

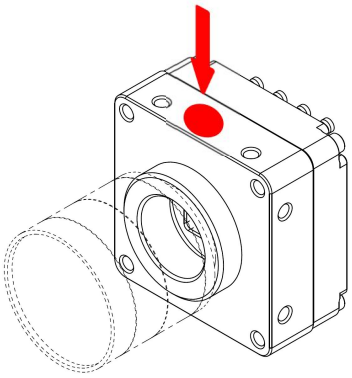
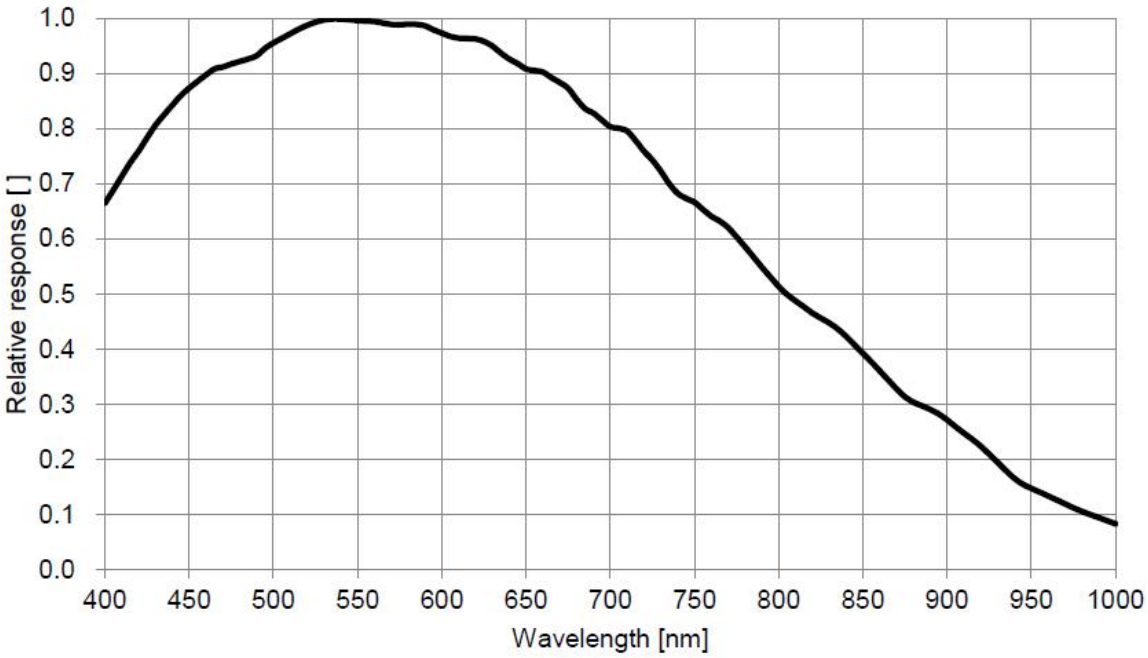


Fig 1.3-1

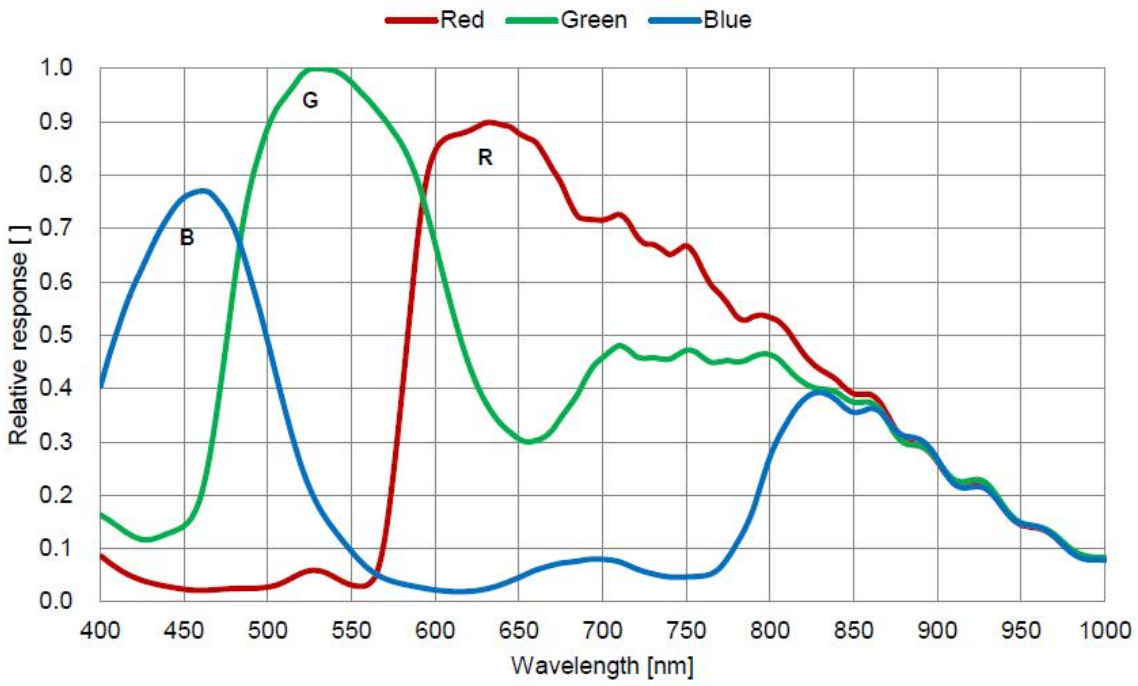
2 CMOS information

2.1 Spectral Sensitivity Characteristics

BC-SM16M10X4

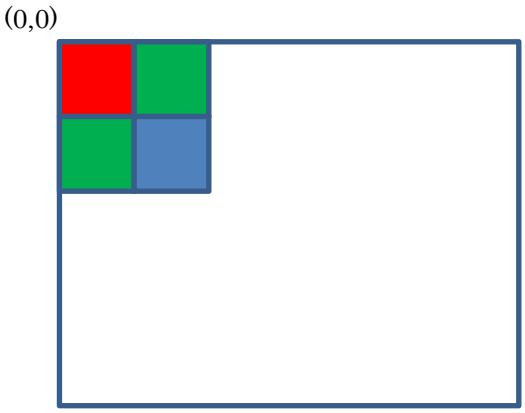


BC-SC16M10X4



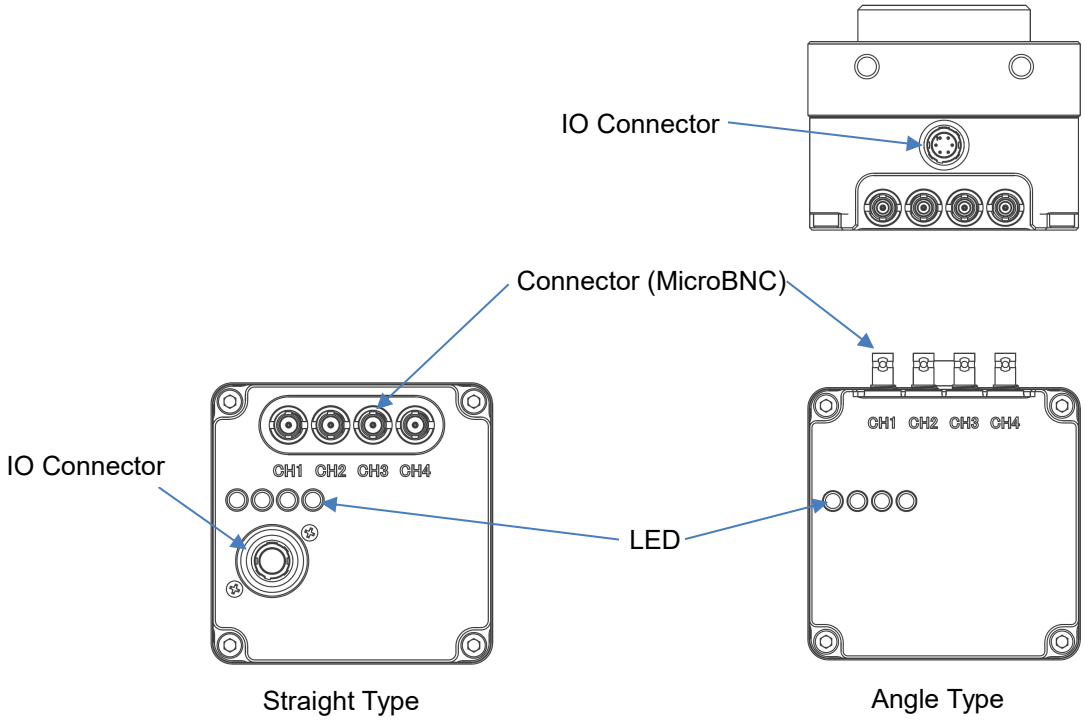
2.2 Color Filter Array

BC-SC16M10X4



3 Camera Hardware Information

3.1 Interface



3.2 IO Connector

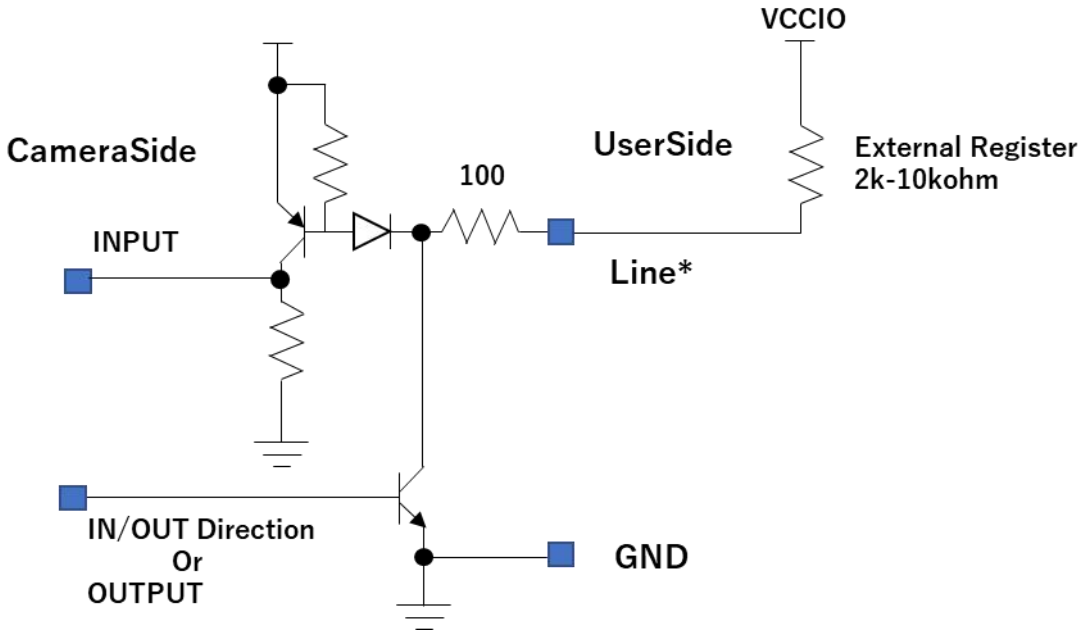
- HR10A-7P-6S (Hirose) or equivalent can be used.
- GPIO can select input and output by camera setting.

Pin assignment And DC characteristics

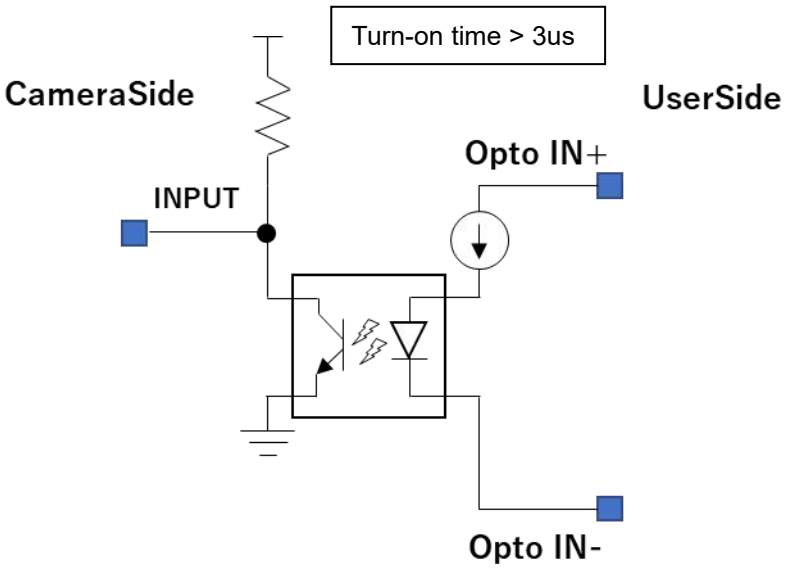
Pin No.	Signal Name	Function	DIR	電圧	
				Low Voltage	High Voltage
1	DC24V	POWER	IN	DC24V±10%	
2	Line0	GPIO	IN	≦1.0V	Open or External Pull Up (3.0 to 26.4V)
			OUT	≦1.0V	Open or External Pull Up (3.0 to 26.4V)
3	Line1	GPIO	IN	≦1.0V	Open or External Pull Up (3.0 to 26.4V)
			OUT	≦1.0V	Open or External Pull Up (3.0 to 26.4V)
4	Opto IN+	IN	(Opto IN+) – (Opto IN-)	≦1.0V	3.0 to 26.4V
5	Opto IN-	IN			
6	GND	GND	-		

3.3 GPIO Line Circuit

3.3.1 Line0, Line1



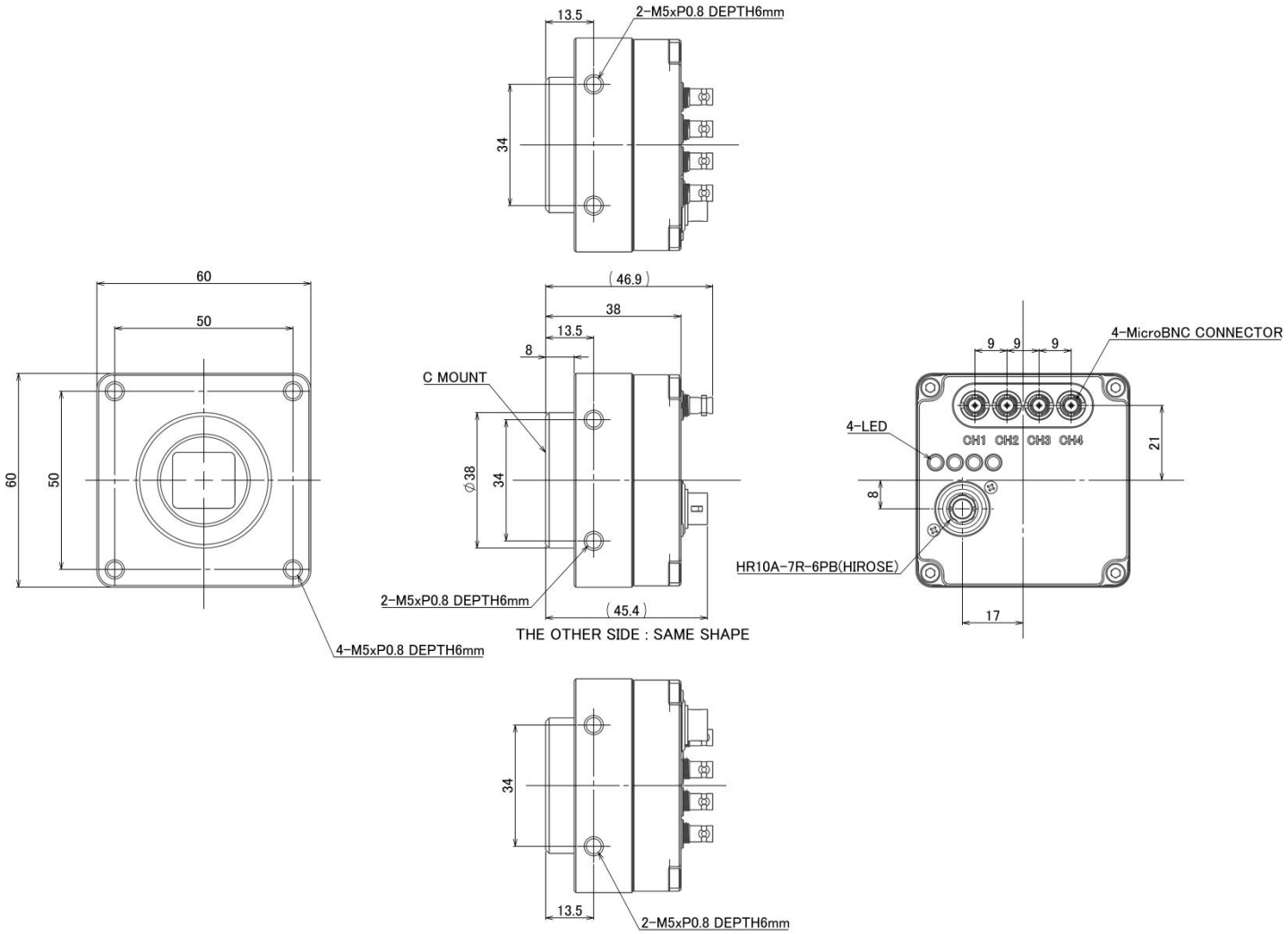
3.3.2 Optical Input



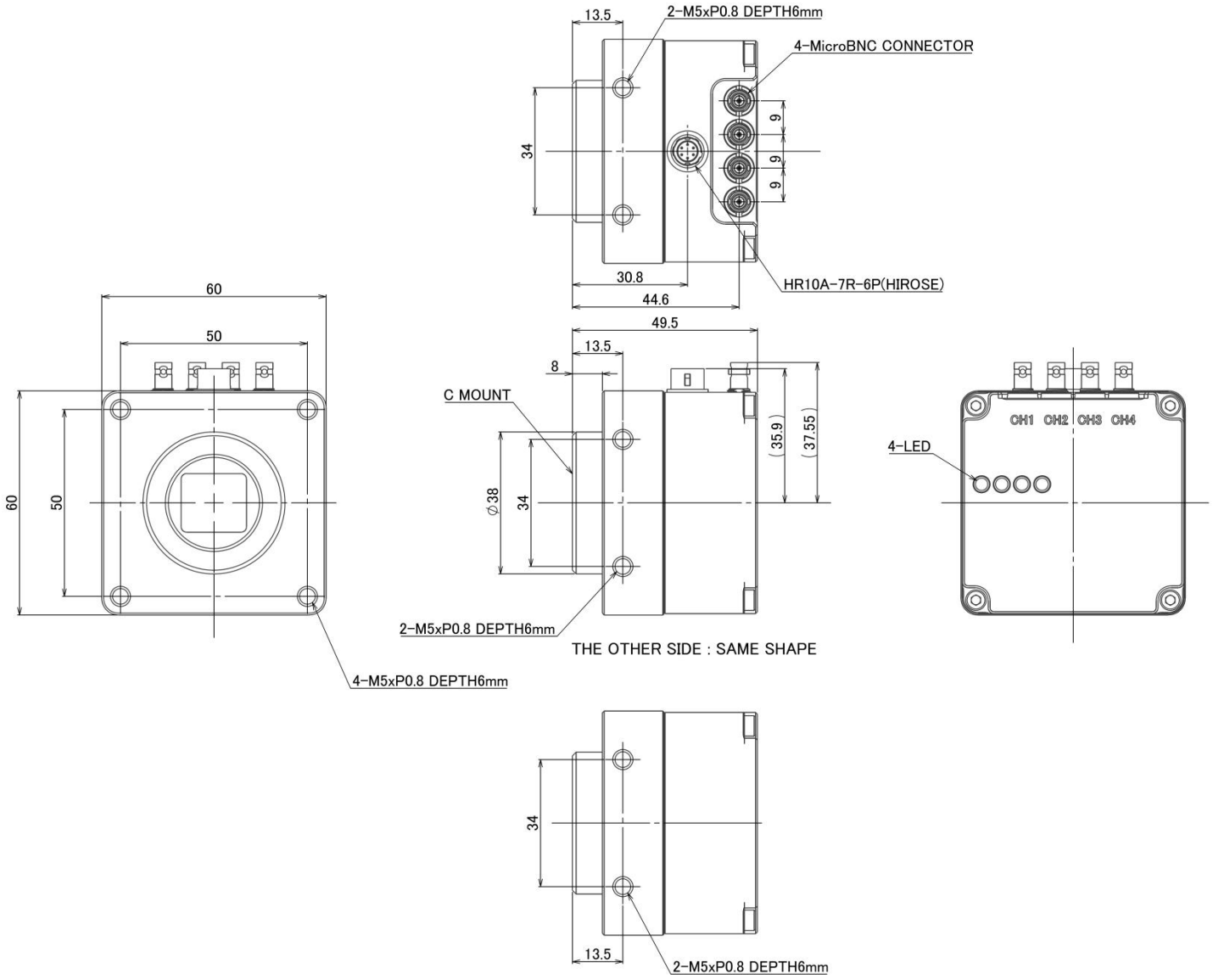
4 CAMERA DIMENSIONS

Unit: mm

【STRAIGHT TYPE】



【ANGLE TYPE】 Unit: mm



5 Camera Operation

5.1 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.

5.1.1 Standard functions

GenICam command	Default
DeviceVendorName	BOPIXEL
DeviceModelName	BC-SM16M10X4 / BC-SC16M10X4
DeviceManufacturerInfo	www.BOPIXELjapan.com
DeviceVersion	-
DeviceSerialNumber	-
DeviceUserID	00000000
DeviceTemperature	-
DeviceClockFrequency	74250000
SensorWidth	5312
SensorHeight	3040
WidthMax	5312
HeightMax	3040
Width	5312
Height	3040
OffsetX	0
OffsetY	0
ReverseX	False
ReverseY	False
PixelFormat	MonochromeModel: Mono8 / ColorMode : BayerRG8
TestPatternGeneratorSelector	FPGA
TestPattern	Off
BinningVerticalMode	Sum
BinningVertical	1
DecimationVerticalMode	Discard
DecimationVertical	1
ImageSensorBitSize	CIS_10Bit

GenICam command	Default
AcquisitionFrameRate	Refer to [FrameRate calcurate]
TriggerMode	Off
TriggerSource	Software
TriggerSoftware	-
TriggerDelay	0
ExposureMode	Off
ExposureTime	-
GainSelector	AnalogAll
Gain[AnalogAll] (*1)	0
Gain[DigitalAll] (*1)	0
BlackLevelSelector	All
BlackLevel	10
BalanceRatioSelector	0 (ColorMode Only)
BalanceRatio[Red]	0 (ColorMode Only)
BalanceRatio[GreenR]	0 (ColorMode Only)
BalanceRatio[GreenB]	0 (ColorMode Only)
BalanceRatio[Blue]	0 (ColorMode Only)
WhiteBalanceFunctionMode(*2)	Formula1
LineSelector	Line0
LineMode	Input
LineInverter	False
LineStatus	-
LineSource	UserOutput0
UseroutputSelector	UserOutput0
UserOutputValue	False
	-
DeviceTapGeometry	Geometry_1X_1Y
PayLoadSize	16148480
CxpLinkConfigurationStatus	-
CxpLinkConfiguration	CXP6_X4
CxpLinkConfigurationPreferred	CXP6_X4
TestMode	Off
TestErrorCountSelector	0
TestErrorCount	0
UserSetSelector	Default

GenICam command	Default
UserSetLoad	-
UserSetSave	-
UserSetDefault	Default

Original functions of BOPIXEL

GenICam command	Discription	Default
ImageSensorBitSize	Select the ADC bit size of the CMOS sensor. When set to CIS_8Bit, the image will be the image with the CMOS gain multiplied by 4.	CIS_10Bit
TriggerAcquisitionModeSelector	Selects the trigger acquisition mode. (Overlap / Fast) Refer to [TriggerAcquisitionMode]	Overlap
EnablePixelCorrection	When set to ON, Activates pixel correction.	True
PixelCorrectionHighlight	When set to ON, the pixel of the coordinate to be corrected is highlighted.	False
PixelCorrectionIndex	Index for Pixel Correction Data.This can be set for 1024 points.	0
PixelCorrectionX	Set the X position. The pixel to be corrected is written at the factory. Users can be added.	65535
PixelCorrectionY	Set the Y position. The pixel to be corrected is written at the factory. Users can be added.	65535
LineDebounceTime	Specifies the delay in microseconds (us) to apply after receiving IO[Line*] signal and before activating it.	1

(*1)Gain : AnalogAllGain / 10 + DigitalGainAll / 10 [dB]

(*2)White Balance Function Mode:
1) Formula1: OutValue = InValue + (InValue-BlackLevel)*BalanceRatio/64 (Set 0 for 0dBGain)
2) Formula2: OutValue = (InValue-BlackLevel)*BalanceRatio/2048+BlackLevel (Set 2048 for 0dBGain)

6 Image Acquisition and Camera Trigger Modes

6.1 Trigger Source

6.1.1 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.

6.1.2 Line0-Line2

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.

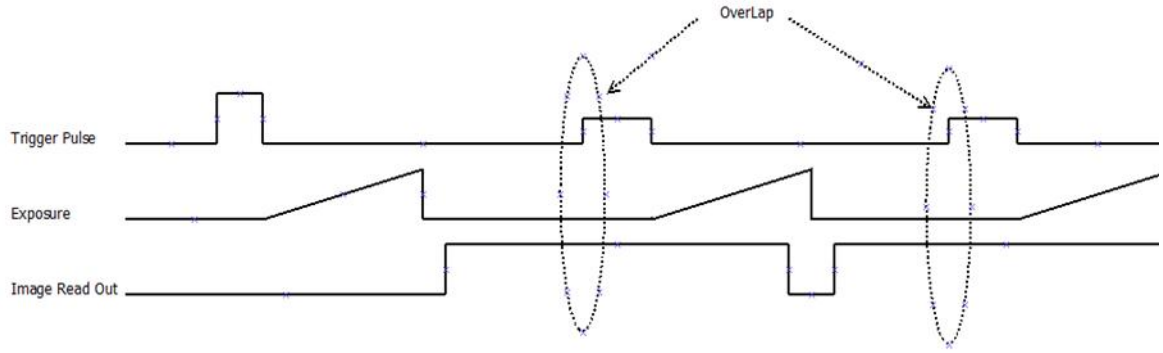
6.1.3 LinkTrigger

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

6.2 Trigger Acquisition Mode

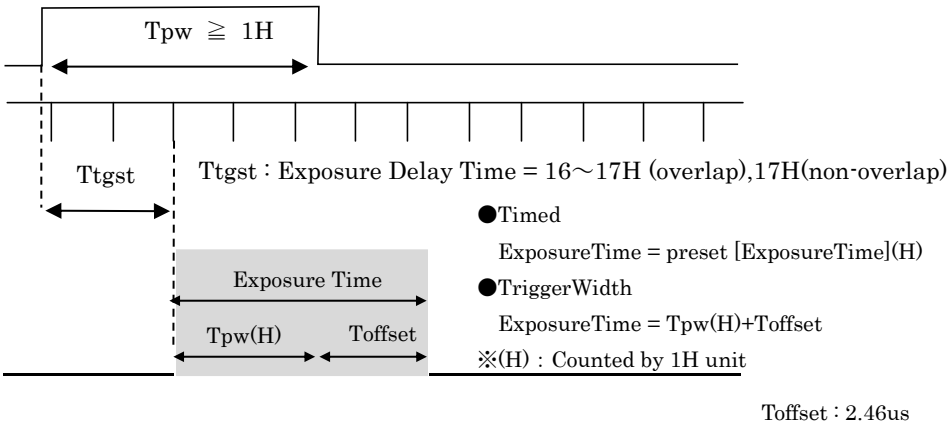
6.2.1 Overlap Mode

In this mode, Next trigger can be input during the sensor image read out (overlap).
However, exposure start timing is delayed 16～17 horizontal period with overlap.
If when non-overlap, exposure start timing is17 horizontal period fixed.



- **The Detail Timing**

a) Exposure Time > 1Horizontal Period

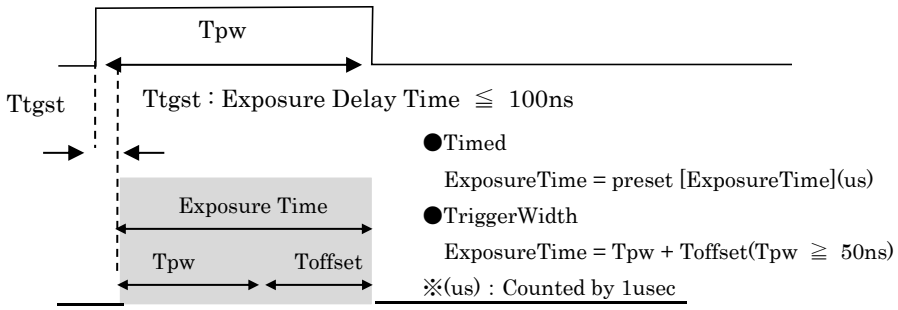


※The Horizontal Period depends on the camera settings.
6.2.3 Refer to [Horizontal Period depending on camera settings]

6.2.2 Fast Trigger Mode

In this mode, exposure starts immediately (delayed < 100nsec.) 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.

- **The Detail Timing**



・When exposure Mode is Timed, the minimum exposure time is 12H time. (1H: Horizontal Period)
ExposureTime = preset [ExposureTime](us)

・When exposure mode is Trigger Width, Toffset(12H) time is added to the trigger width time.
ExposureTime = Tpw + Toffset(Tpw ≧ 50ns)

※The Horizontal Period depends on the camera settings.
6.2.3 Refer to [Horizontal Period depending on camera settings]

6.2.3 Horizontal Period depending on camera setting.

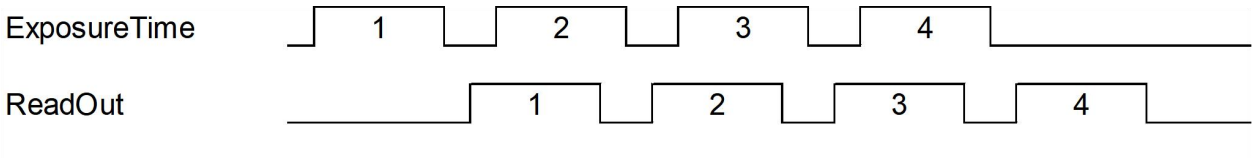
CXP Link Configuration	Horizontal Period(usec)	
	CMOS8bit	CMOS10bit
CXP10X4	1.953	2.034
CXP10X2	2.761	
CXP10X1	5.522	
CXP6X4	2.209	
CXP3X4 / CXP6X2	4.418	
CXP3X2 / CXP6X1	8.848	
CXP3X1	17.697	

6.2.4 Trigger input prohibition period when changing operation mode

Immediately after switching the camera operation mode, the trigger input prohibition period occurs. Be sure to receive the ACK response from the camera before inputting the trigger.

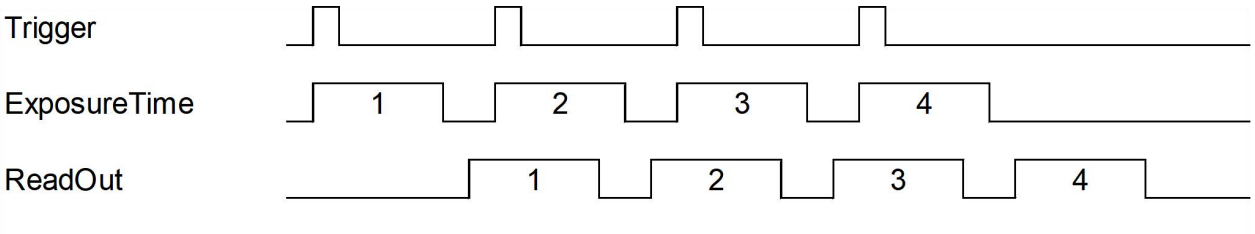
6.3 Exposure Mode

6.3.1 Exposure 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].

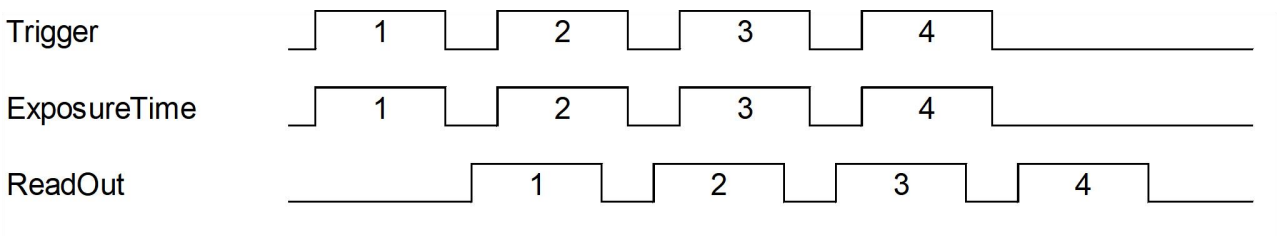
6.3.2 Exposure Mode : Timed



The camera is exposed within a preset [ExposureTime] and outputs video image from an external trigger.
There is an upper limit to the timing at which a trigger can be input.
Refer to [Trigger prohibition time] and [FrameRate calcurate].

When inputting a trigger from [LinTrigger] , the camera recognizes at the rising edge of the trigger signal.
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.

6.3.3 Exposure Mode : Trigger Width



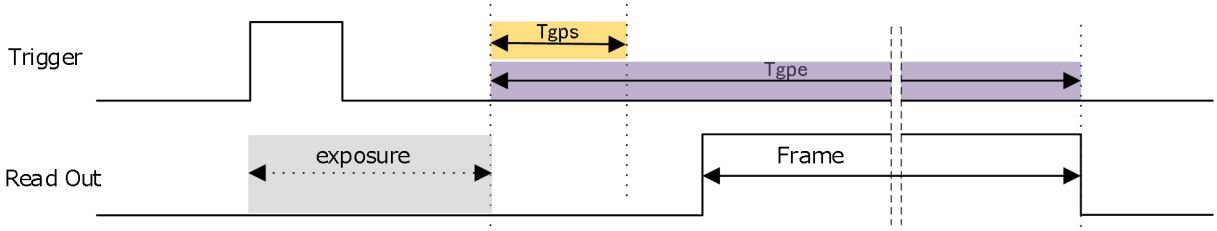
The camera is exposed for the same period as the external trigger and outputs the video image.
There is an upper limit to the timing at which a trigger can be input.

6.3.4 Trigger prohibition Time

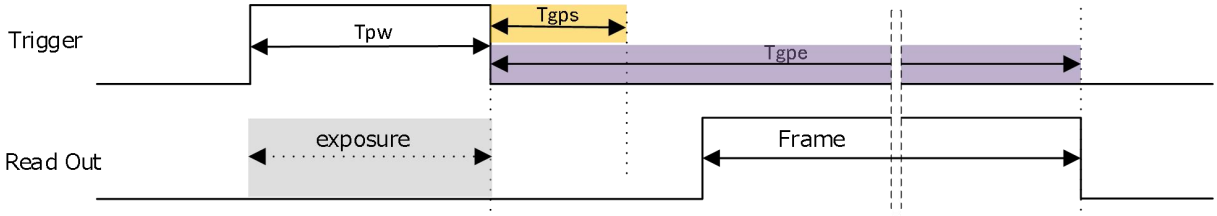
When inputting next trigger, there is a trigger prohibition time at trigger start and end.
Do not enter the next trigger to camera during this period.

Tgps: Trigger prohibit start time
Tgpe: Trigger prohibit end time

- **Timed**



- **Trigger Width**

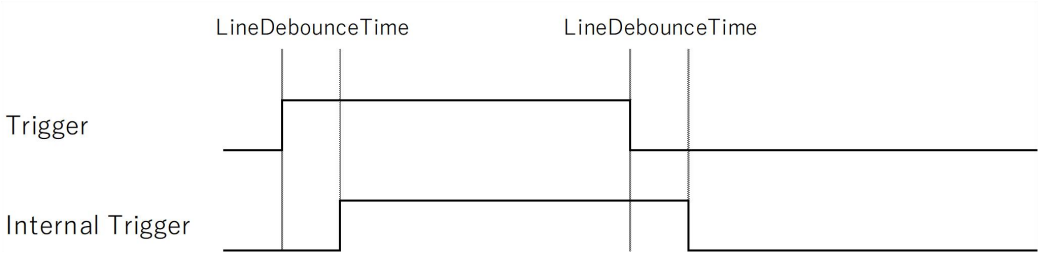


Trigger prohibition time

Tgps(H)	Tgpe(H)
47	Frame+144

※The Horizontal Period depends on the camera settings.
6.2.3 Refer to [Horizontal Period depending on camera settings]

6.3.5 Trigger LineDebounce Time



Generates an internal trigger after the time set in LineDebounceTime elapses after the trigger is detected.
LineDebounceTime is added to the internal trigger.
It can be used as a trigger signal filtering function.

7 Frame Rate calculation

1000000/ Horizontal Period / (Height + 184) [fps]

※The Horizontal Period depends on the camera settings.
6.2.3 Refer to [Horizontal Period depending on camera settings]

8 Revision Information

Rev	Date	Changes
1.0	2021/10/26	Released

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