

# Driver circuit for CCD linear image sensor



C15361 series

## For CCD linear image sensors (S15351-2048, S15254/S15257-2048)

The C15361 series is a driver circuit developed for Hamamatsu CCD linear image sensors (S15351-2048, S15254/S15257-2048). It consists of a CCD driver circuit, an analog video signal processing circuit (16-bit A/D converter), timing generator, control circuit, and power supply, and converts analog video signals received from an image sensor into digital signals and outputs them. By connecting USB 3.1 Gen 1 connector to a PC, it is possible to control the C15361 series and obtain data. The C15361 series has an SMA connector for external trigger input and an SMA connector for pulse output that can be used to synchronize with external devices. In addition, this product comes with application software that runs on Windows® 10 (32-bit, 64-bit). It can be used to easily operate the C15361 series from the PC.

### Features

- Built-in 16-bit A/D converter
- Interface: USB 3.1 Gen 1
- Power supply: USB bus powered (DC +5 V)
- External synchronization operation capable
- Compatible with sensor with high-speed electronic shutter function

### Applications

- Spectrophotometry (LIBS, etc.)
- Spark discharge spectrophotometry

Note: Windows is a registered trademark of Microsoft Corporation in the United States and/or other countries.

### Selection guide

The C15361 series is compatible with the following CCD linear image sensors.  
Note that the C15361 series does not include a sensor. Please purchase it separately.

Type no.	CCD linear image sensors					
	Type no.	Structure	Number of pixels	Number of effective pixels	Pixel size (μm)	Image size [mm (H) × mm (V)]
C15361-1105	S15351-2048	Front-illuminated type	2092 × 1	2048 × 1	14 × 200	28.672 × 0.2
C15361-2105	S15254-2048	Back-thinned type	2102 × 1		14 × 200	28.672 × 0.2
	S15257-2048		2160 × 1		14 × 2500	28.672 × 2.5

### Structure

Parameter	Specification	Unit
Output type	Digital	-
A/D converter	16	bit
Interface	USB 3.1 Gen 1 (Micro USB Type-B)	-
Weight*1	Approx. 60	g

\*1: Including the flexible cable but not the image sensor.

### ➤ Absolute maximum ratings

Parameter	Symbol	Condition	Value	Unit
Supply voltage	Vdd	Ta=25 °C	0 to +6.0	V
Input signal voltage*2	Vi	Ta=25 °C	0 to +6.5	V
Operating temperature	Topr	No dew condensation*3	0 to +50	°C
Storage temperature	Tstg	No dew condensation*3	-20 to +70	°C

\*2: External trigger input

\*3: When there is a temperature difference between a product and the surrounding area in high humidity environment, dew condensation may occur on the product surface. Dew condensation on the product may cause deterioration in characteristics and reliability.

Note: Exceeding the absolute maximum ratings even momentarily may cause a drop in product quality. Always be sure to use the product within the absolute maximum ratings.

### ➤ Recommended operating conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	Vdd	+4.75	+5	+5.25	V
External trigger input voltage	High level	+2	-	-	V
	Low level	-	-	+0.8	V

### ➤ Electrical and optical characteristics (Ta=25 °C, unless otherwise noted)

Parameter	Symbol	C15361-1105			C15361-2105			Unit	
		Min.	Typ.	Max.	Min.	Typ.	Max.		
Readout frequency*4	fop	-	5	-	-	5	-	MHz	
Line rate*5	-	-	-	2.32	-	-	2.34 (S15254-2048)	kHz	
					-	-	1.87 (S15257-2048)		
Conversion gain	Gc	-	6.2	-	-	3.1	-	e <sup>-</sup> /ADU	
Current consumption	USB bus powered	Ic	-	460	510	-	460	510	mA
	DC +5 V		-	400	500	-	670	770	
Integration time	Texp	10	-	10,000,000	5 (S15254-2048)	-	10,000,000	μs	
					100 (S15257-2048)	-			
Readout noise	Nread	-	8	12	-	12	22	ADU rms	
Saturation output*6	Dsat	-	-	65535	-	-	65535	ADU	
Dynamic range*7	Drange	5400	8000	-	2900	5400	-	-	
Charge reset time using ARG	Tar	1	-	-	1 (S15254-2048)	-	-	μs	
					100 (S15257-2048)	-	-		

\*4: The readout frequency is fixed.

\*5: Theoretical line rate value determined by the internal operation timing of the driver circuit. This is different from the line rate defined in the sensor specifications.

This value is also different from the overall processing line rate of acquiring data from the circuit into the PC via the USB 3.1 Gen 1 port of the PC.

\*6: The data bit is 16-bit.

\*7: Drange = Dsat/Nread

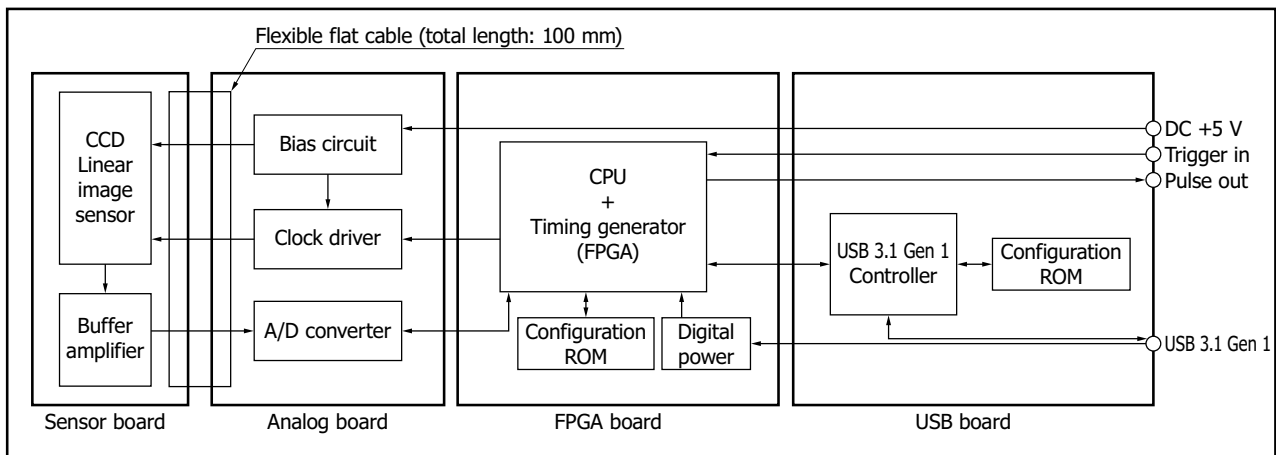
**Function**

Parameter		Specification
Synchronization mode*8	Internal synchronization mode ("INT" mode)	Data is acquired according to the trigger timing from the application software.
	External synchronization mode 1 ("EXT.EDGE" mode)	Data is acquired according to the trigger timing from the application software and the external trigger timing from external devices through an SMA cable.
	External synchronization mode 2 ("EXT.LEVEL" mode)	
Offset adjustment		It can be set to any integer in the range of "0 to 511". The default value is "0".
MPP operation*9	MPP mode	REGH and REGL are set to low during the integration time.
	Non-MPP mode	REGH and REGL are always fixed to high

\*8: External synchronization mode 2 ("EXT.LEVEL" mode) cannot be used when the electronic shutter is turned off.

\*9: C15361-2105 only

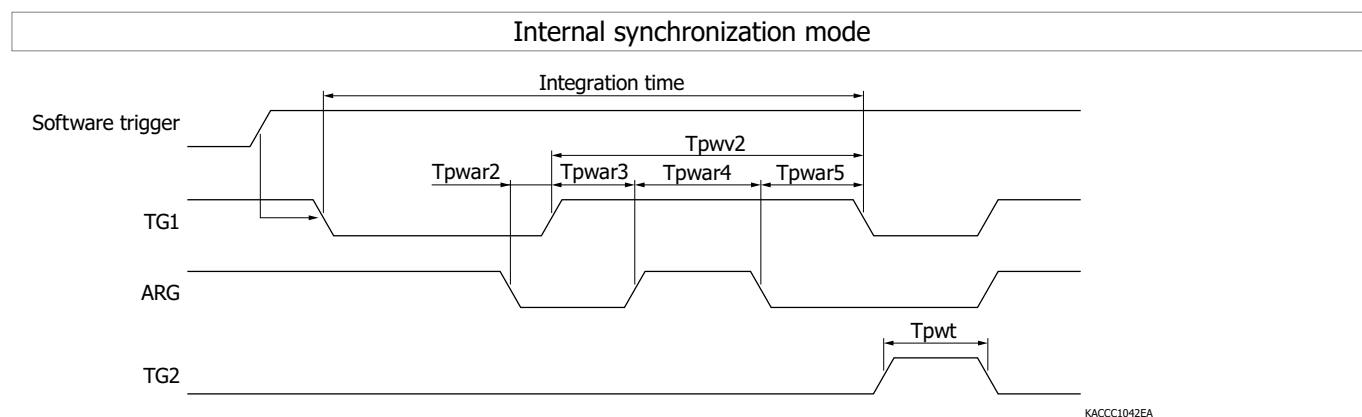
**Block diagram**



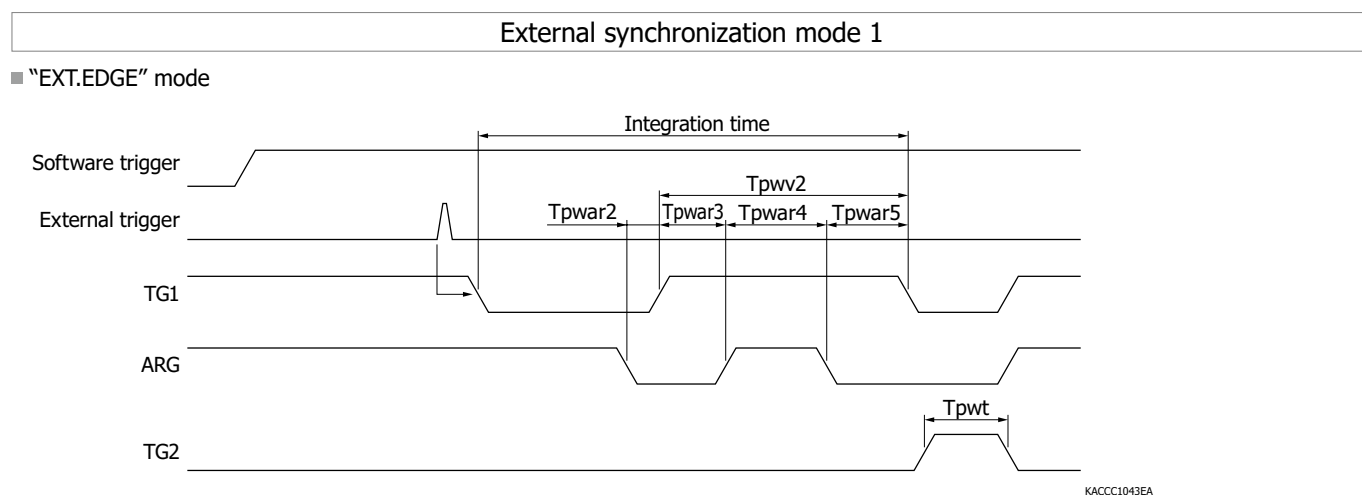
C15361 series

KACCC1052EB

Timing chart (S15351-2048)



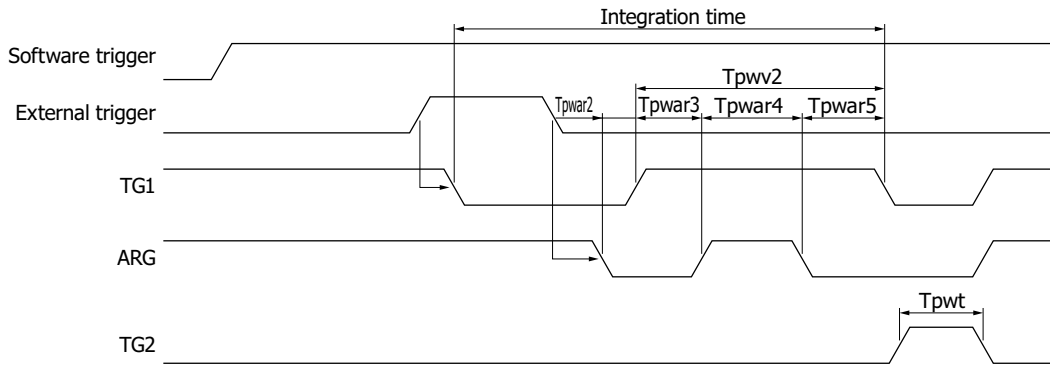
In this mode, sensor integration starts at the timing when a software trigger is input. The integration time is set using application software.



In this mode, sensor integration starts at the timing when an external trigger is input. External triggers input before software triggers are input are ignored. The integration time is set using application software.

External synchronization mode 2

■ "EXT.LEVEL" mode



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In this mode, sensor integration starts at the timing when an external trigger is input. External triggers input before software triggers are input are ignored.

Integration time is set according to the pulse width of the external trigger.

Integration time = Pulse width of external trigger +  $T_{pwar2}$  +  $T_{pwar3}$  +  $T_{pwar4}$  +  $T_{pwar5}$

$T_{pwar2}$  = 1  $\mu$ s

$T_{pwar3}$  = 3  $\mu$ s

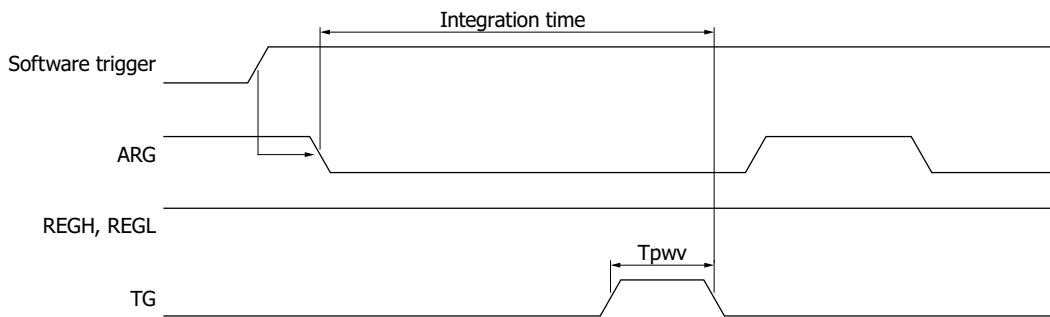
$T_{pwar4}$  = 4  $\mu$ s

$T_{pwar5}$  = 1  $\mu$ s

■ Timing chart (S15254/S15257-2048)

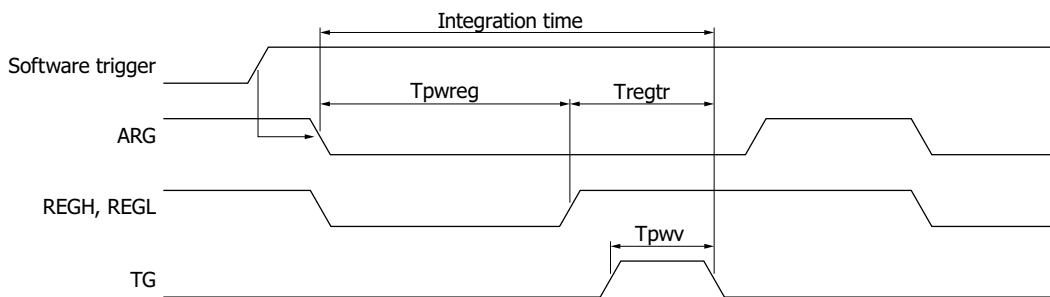
Internal synchronization mode

■ Non-MPP mode



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■ MPP mode

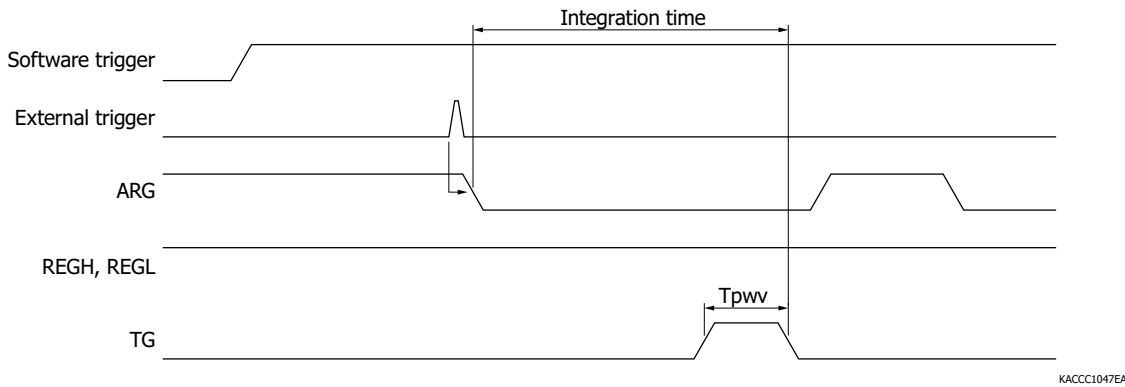


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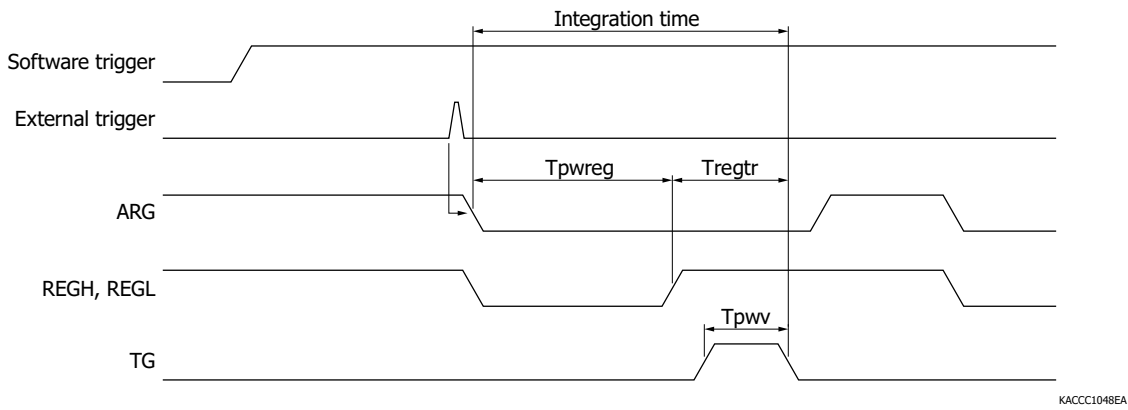
In this mode, sensor integration starts at the timing when a software trigger is input. The integration time is set using application software.

External synchronization mode 1 ("EXT.EDGE" mode)

■ Non-MPP mode



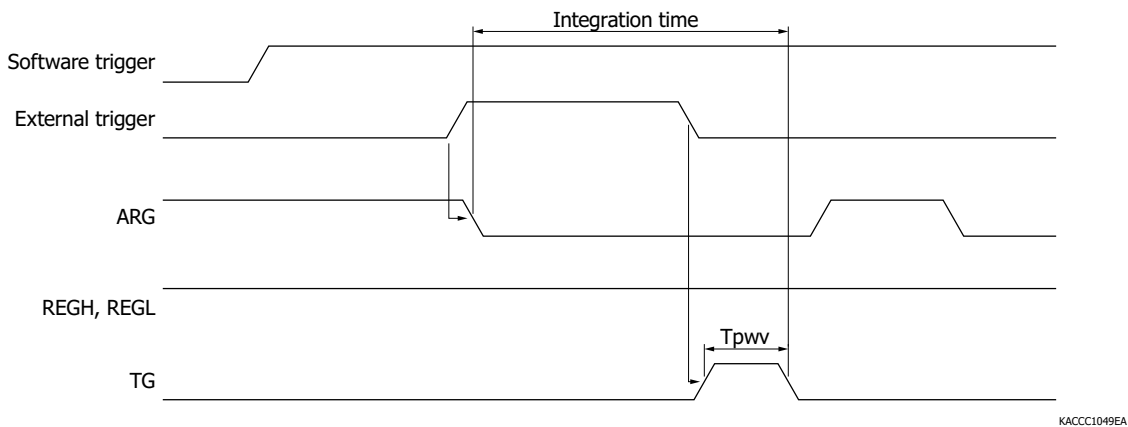
■ MPP mode



In this mode, sensor integration starts at the timing when an external trigger is input. External triggers input before software triggers are input are ignored. The integration time is set using application software.

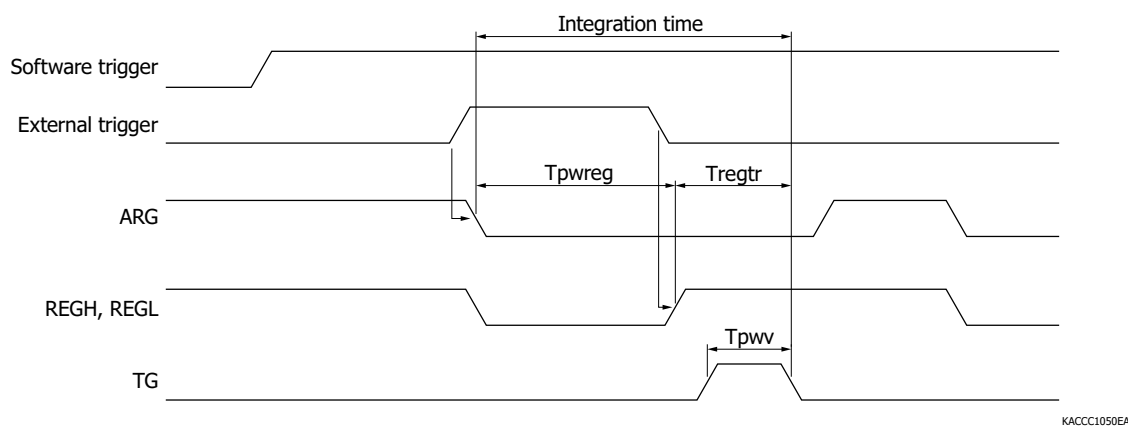
External synchronization mode 2 ("EXT.LEVEL" mode)

■ Non-MPP mode



In this mode, sensor integration starts at the timing when an external trigger is input. External triggers input before software triggers are input are ignored. Integration time is set according to the pulse width of the external trigger. Integration time = Pulse width of external trigger +  $T_{pww}$   
 $T_{pww}$ : 2  $\mu$ s

■ MPP mode

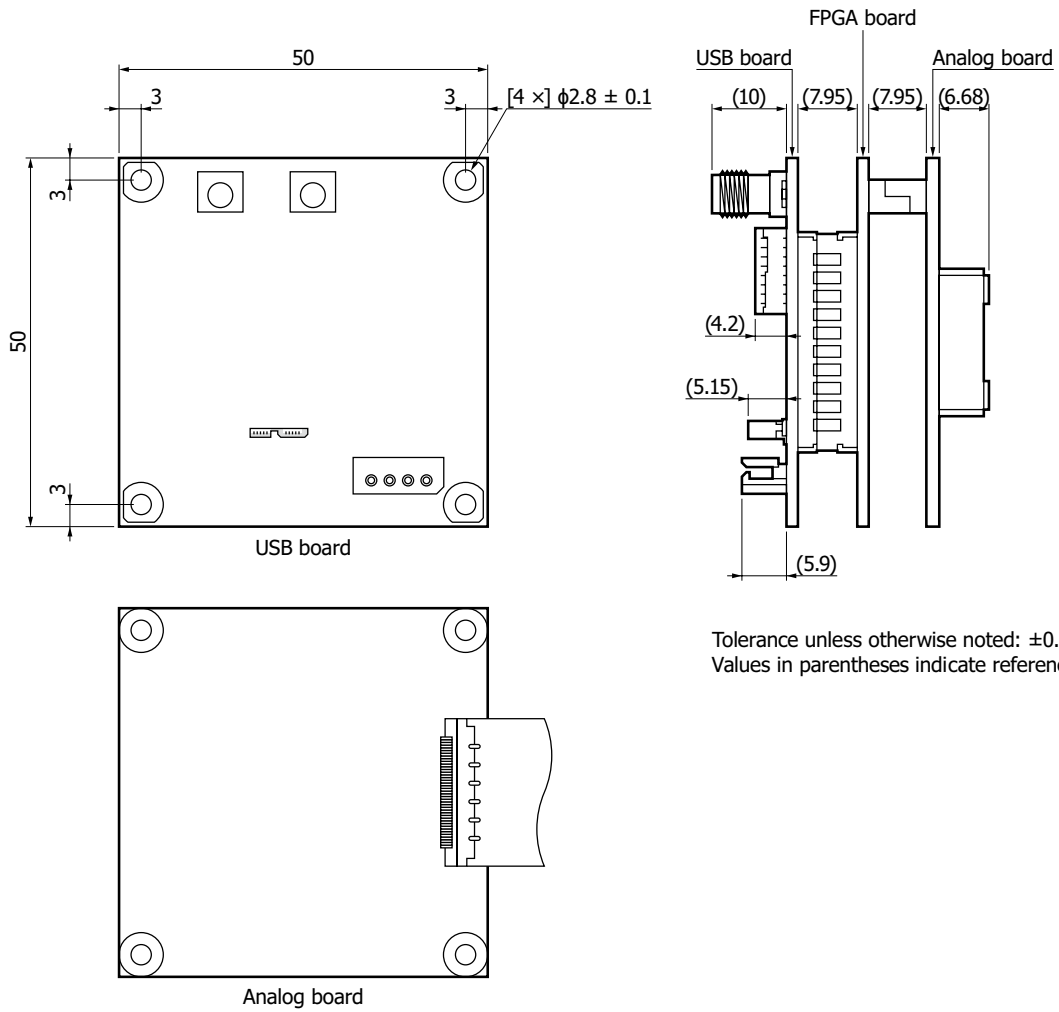


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Basic operation is the same as non-MPP mode.  
 Integration time = Pulse width of external trigger + Tregtr  
 S15254-2048: Tregtr=2 μs  
 S15257-2048: Tregtr=100 μs

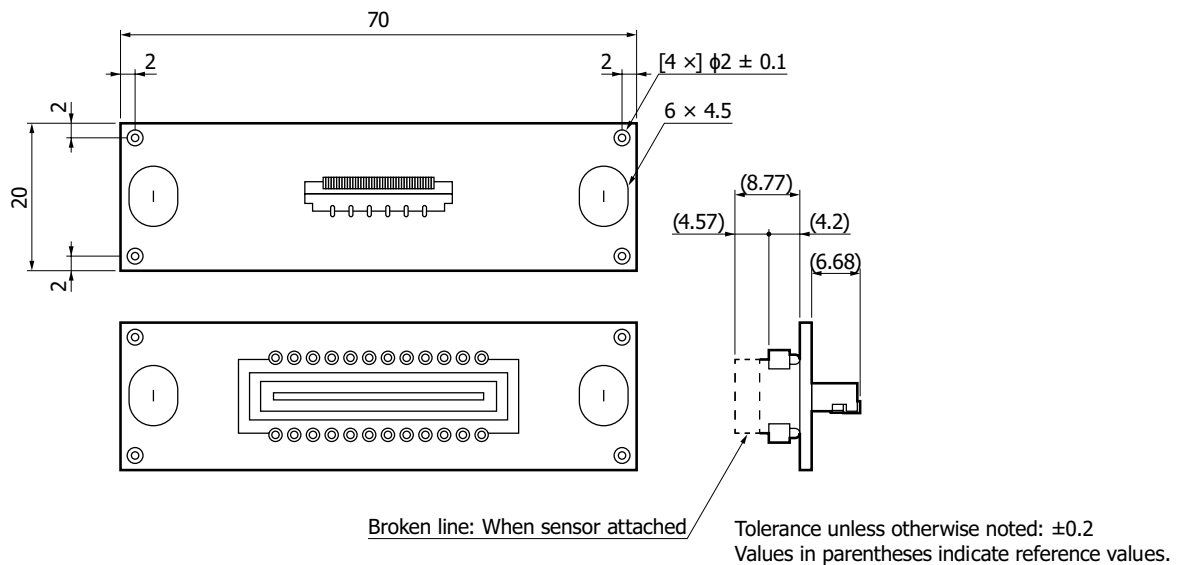
**Dimensional outline (unit: mm)**

Control board



KACCA0463EA

Sensor board

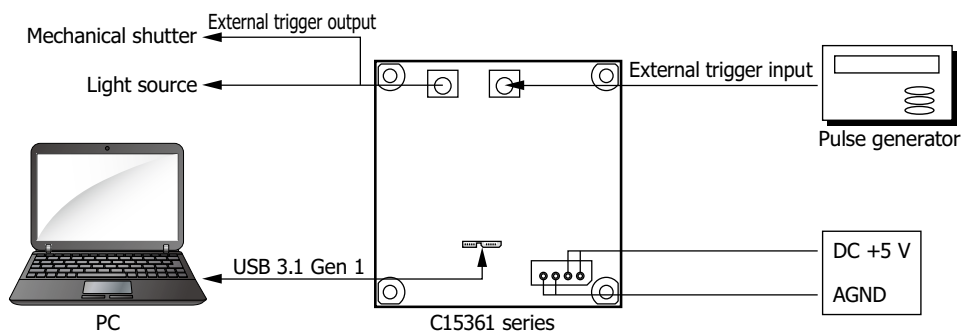


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### Connection example

See the figure below for connection with peripheral devices.



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### Accessories

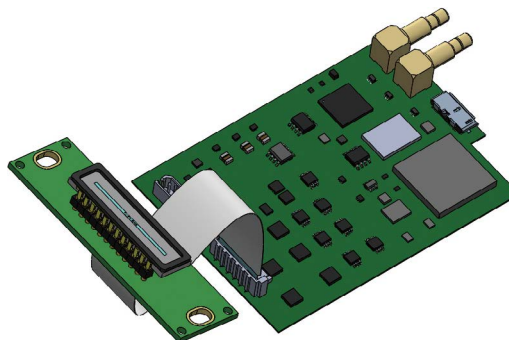
- CD-ROM (includes instruction manual and application software)
- Power cable (total length: 2 m, with half strip)
- Flexible flat cable for connecting the sensor board / control board (total length: 100 mm)

## Customization

Hamamatsu offers customization for your application. Please feel free to consult us.

### Example of customization

- Board size, shape, quantity
- Type of input/output trigger connector
- Length of flexible flat cable, etc.



Example of changed board quantity

## Related information

[www.hamamatsu.com/sp/ssd/doc\\_en.html](http://www.hamamatsu.com/sp/ssd/doc_en.html)

- Precautions
- Disclaimer
- Image sensors

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