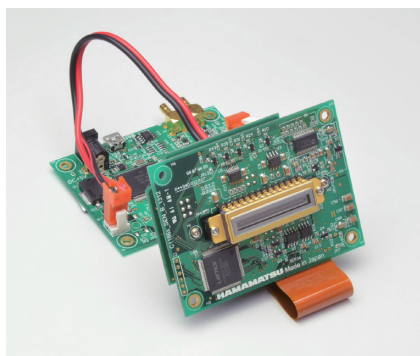


# Driver circuit for CCD image sensor



C11860

## For CCD image sensor S11850-1106, S11511/S14651 series

The C11860 is a driver circuit developed for CCD image sensors S11850-1106 and S11511/S14651 series. By connecting the C11860 to a PC through the USB 2.0 interface, you can use the PC to convert the sensor's analog video signal into digital output and acquire the result into the PC. The C11860 consists of (1) a sensor circuit board that drives the sensor, (2) an interface circuit board that drives the sensor circuit board and performs data communication with the PC, and (3) a temperature control circuit board for controlling the sensor cooling. The sensor circuit board and interface circuit board are connected using a flexible cable. The sensor circuit board is compact, making it easy to be installed in optical systems. The interface circuit board has an external trigger I/O connector that can be used to synchronize with external devices. This product comes with application software (DcIc-USB) that runs on Microsoft® Windows® 7 (32-bit, 64-bit)/10 (32-bit, 64-bit). It can be used to easily control the C11860 from the PC. The product also includes a DLL that the user can use to create original C11860 control programs.

### Features

- Built-in 16-bit A/D converter
- The sensor circuit board and interface circuit board are connected using a flexible cable.
- Interface: USB 2.0
- External synchronization capable
- Single power supply: +5 VDC
- Sensor cooling control (approx. +5 °C)

Note) Microsoft and Windows are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

### Applications

- Spectrometers
- Control and data acquisition of CCD linear image sensor (S11850-1106, S11511/S14651 series)

The C11860 is compatible with the following CCD image sensor. Note that the C11860 does not include the sensor.

Type no.	Number of pixels	Number of effective pixels	Pixel size (μm)	Image size [mm (H) × mm (V)]
S11850-1106	2068 × 70	2048 × 64	14 × 14	28.672 × 0.896
S11511-1006	1044 × 70	1024 × 64		14.336 × 0.896
S11511-1106	2068 × 70	2048 × 64		28.672 × 0.896
S14651-1024	1044 × 198	1024 × 192		14.336 × 2.688
S14651-2048	2068 × 198	2048 × 192		28.672 × 2.688

### Structure

Parameter	Specification	Unit
Output type	Digital	-
A/D resolution	16	bit
Interface	USB 2.0	-

### ▣ Absolute maximum ratings

Parameter	Symbol	Condition	Value	Unit
Supply voltage	Vdd	Ta=25 °C	0 to +6.0	V
Input signal voltage*1	Vi	Ta=25 °C	0 to +Vdd	V
Operating temperature	Topr	No dew condensation*2	0 to +50	°C
Storage temperature	Tstg	No dew condensation*2	-20 to +70	°C

\*1: Trigger input

\*2: 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.

### ▣ Electrical characteristics (Ta=25 °C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Readout frequency*3	fop		-	250	-	kHz
Line rate*4	S11850-1106	LR	-	-	106	Hz
	S11511-1006				188	
	S11511-1106				106	
	S14651-1024				135	
	S14651-2048				87	
Conversion gain	Gc	Gain=2	-	5	-	e <sup>-</sup> /ADU
Trigger output voltage	High level	Vdd=+5 V	+3.8	-	Vdd	V
	Low level		-	-	+0.6	V
Trigger input voltage	High level	Vdd=+5 V	+3.5	+5.0	+5.5	V
	Low level		-0.2	0	+1.5	V
Current consumption	Ic	Cooling off	-	400	500	mA
		Cooling on	-	-	1200	mA
Line period*5 *6	-		3000	-	16777215	clock*7

\*3: The readout frequency is fixed.

\*4: 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 is also different from the overall processing rate (system rate) of acquiring data into the PC via the USB 2.0 port.

\*5: Since the S11850-1106 and S11511/S14651 series do not have an electronic shutter function, the exposure time is adjusted using the light source and optical system.

\*6: The maximum value of a line period exists when the synchronization mode is set to Internal.

\*7: 1 clock=1/fop

### ▣ Electrical and optical characteristics (Ta=25 °C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Readout noise	Nr	-	10	-	ADU rms
Saturation output	Dsat	-	-	65535	ADU
Dynamic range*8	DR	-	6500	-	-
Operating voltage	-	+4.75	+5.0	+5.25	V

\*8: DR=Dsat/Nr

### ▣ Temperature controller specification (Ta=25 °C)

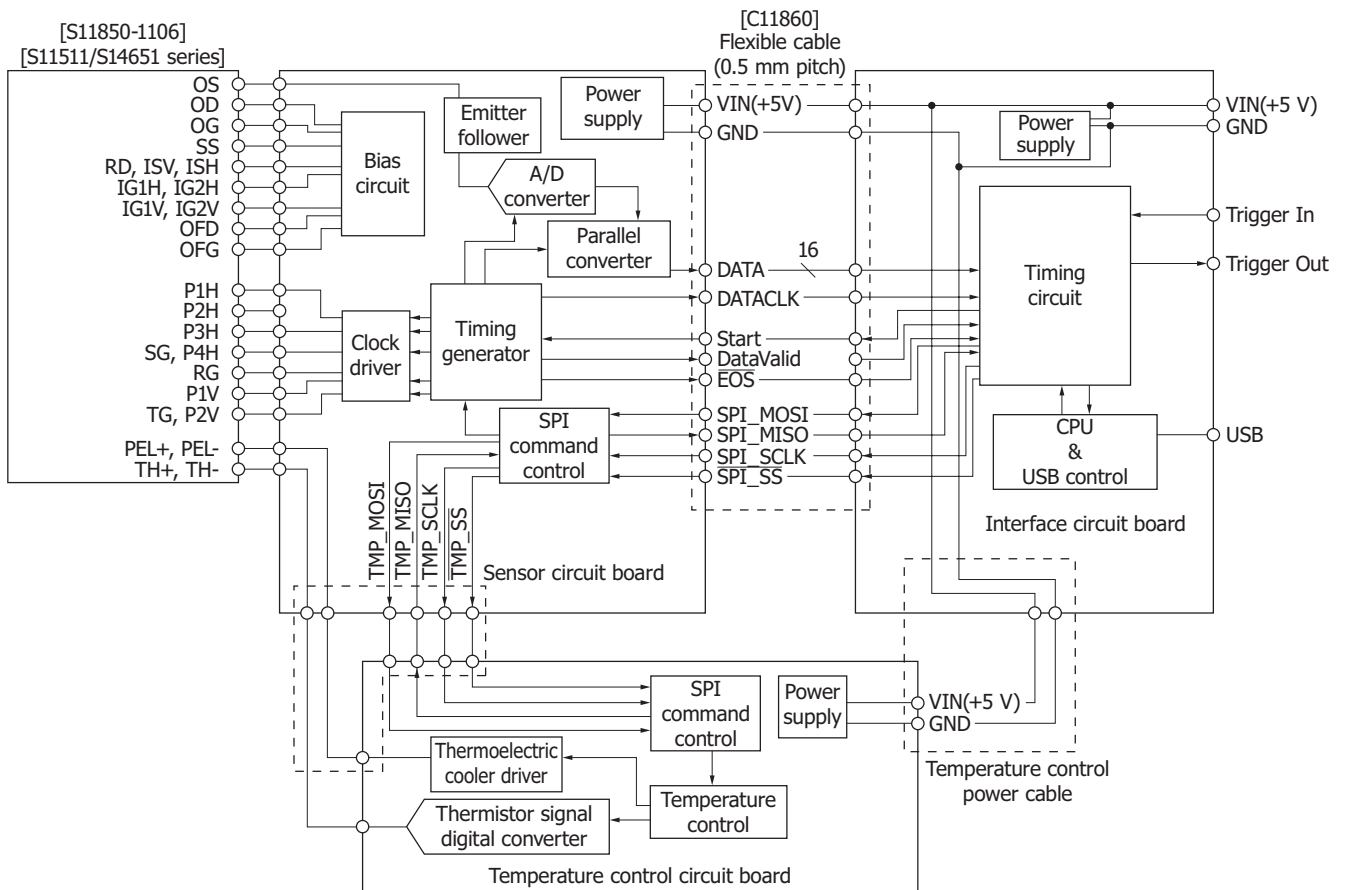
Parameter	Symbol	Min.	Typ.	Max.	Unit
Cooling temperature*9	Ts	-	+5	-	°C

\*9: Approximate temperature when sensor cooling control is turned on and the heat sink is externally air-cooled to a sufficient level.

**Functions**

Function	Description
Trigger mode change	The following trigger modes are available. For the detailed timing of each mode, see "Trigger mode" in "Timing chart" (P.4). · Internal mode · External edge mode
Gain adjustment	The gain can be set in the range of 1 to 6. It is calculated by the following equation. The default gain is 2. $\text{Gain} = \frac{6}{1 + 5 \left( \frac{63 - G}{63} \right)}$ G: 6-bit value ranging from 0 to 63
Offset adjustment	The offset can be set in the range of -255 to +255. The offset increment per step is approximately 1.2 mV. The offset is set by writing a 9-bit value to the C11860 internal register. If the most significant bit (MSB) of the 9-bit value is zero, the offset is positive. Otherwise, the offset is negative. The value expressed by the bits other than the MSB is the magnitude of the offset. Note that because the offset circuit is arranged before the amplifier stage, the actual offset is equal to the offset value set above × gain.
Line period change	The maximum value exists in Internal mode.
Sensor cooling control	The sensor's thermoelectric cooler can be switched on and off. The cooling temperature is fixed at +5 °C.

**Block diagram**

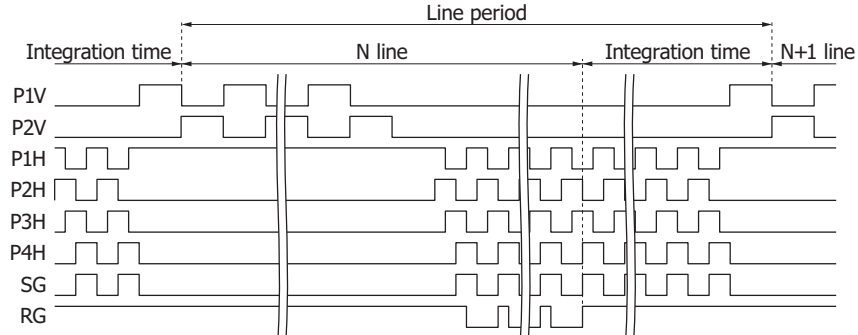


KACC0787EC

**Timing chart**

Sensor drive timing

The integration time is controlled by changing the C11860 start pulse period. The C11860 sensor drive timing is based on full line binning operation.

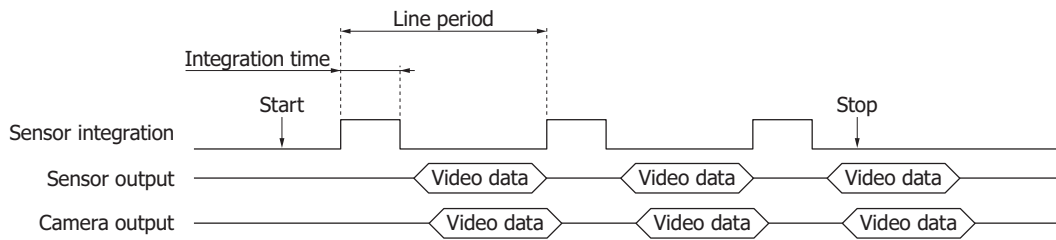


KACCC0785EA

Trigger mode

■ Internal mode

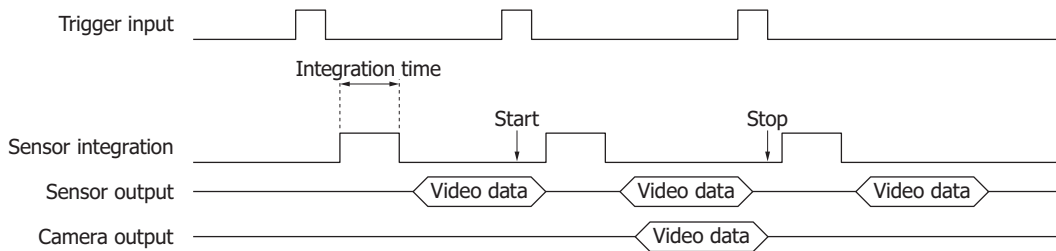
When a Start command is received from the PC, the C11860 starts sensor integration and outputs acquired image data.



KACCC0783EA

■ External edge mode

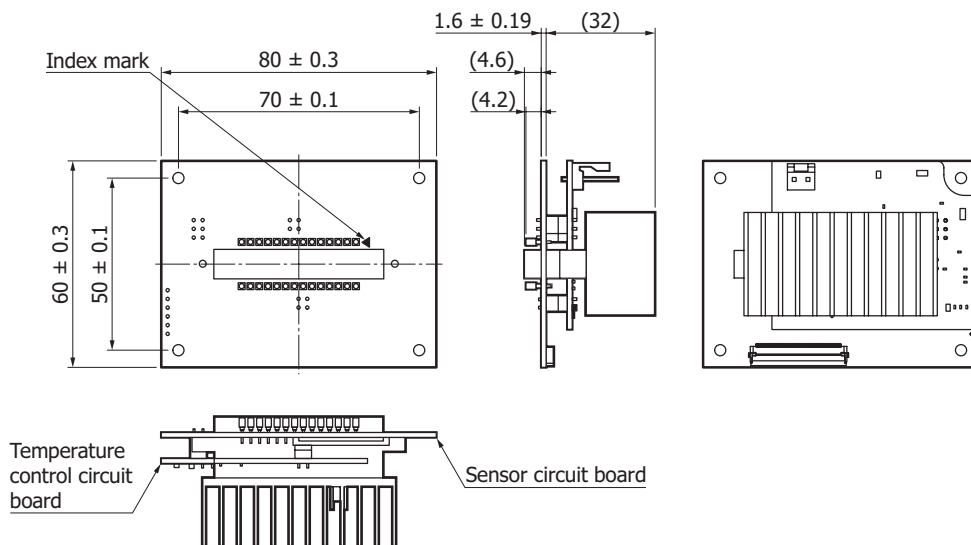
The sensor integration is synchronized to the edges of an external input trigger signal. When the circuit receives an external trigger after having received a Start command, the circuit sends the image data output from the sensor to the PC.



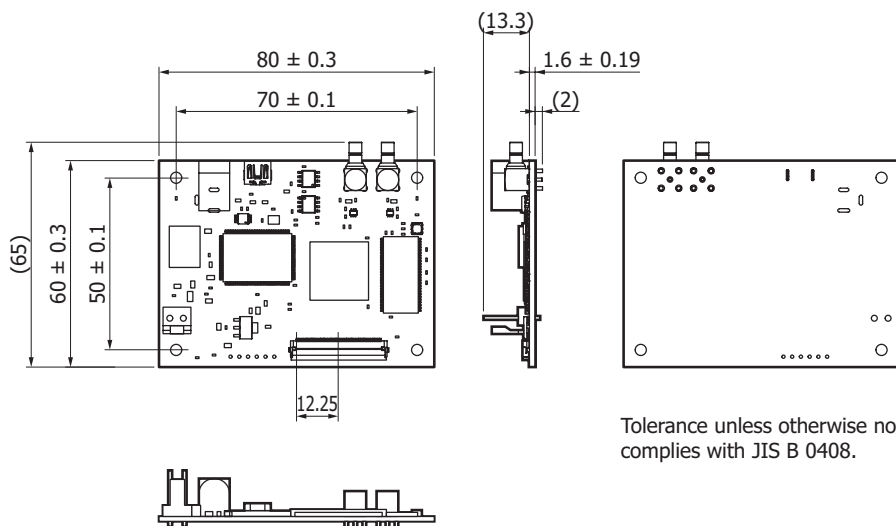
KACCC0784EA

**Dimensional outline (unit: mm)**

■ Sensor circuit board/temperature control circuit board



■ Interface circuit board

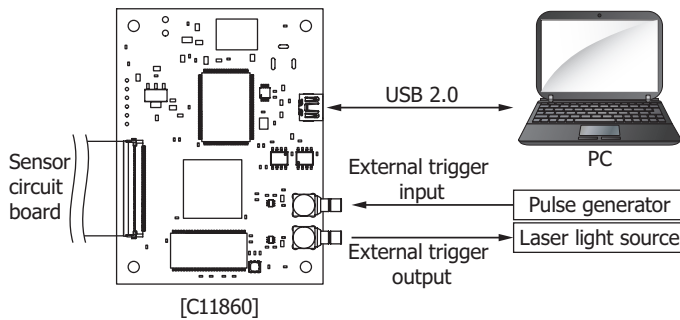


Tolerance unless otherwise noted complies with JIS B 0408.

KACCA0361EA

Weight: approx. 130 g (including the flexible cable but not the sensor)

### Connection example



KACCC0786EA

### Accessories

- CD-ROM (includes the instruction manual, application software, and DLL file)
- DC power cable (φ2.1 mm positive core wire DC jack cable)
- Power cable for interface circuit board/temperature control circuit board
- USB (Mini B) cable
- Flexible cable for connecting the sensor circuit board/interface circuit board (length: 100 mm)

### Precautions

- This product has a function for turning on and off the sensor's built-in thermoelectric cooler, but it does not have a cooling fan. To maintain stable cooling temperature, apply sufficient cooling to the heat sink mounted on the temperature control circuit board.

### Related information

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

#### ■ Precautions

- Disclaimer
- Image sensors

### Related product datasheet

Available at our website ([www.hamamatsu.com](http://www.hamamatsu.com))

- CCD image sensor S11850-1106, S11851-1106
- CCD image sensor S11511 series
- CCD image sensor S14651/S14661 series

Information described in this material is current as of May 2018.

Product specifications are subject to change without prior notice due to improvements or other reasons. This document has been carefully prepared and the information contained is believed to be accurate. In rare cases, however, there may be inaccuracies such as text errors. Before using these products, always contact us for the delivery specification sheet to check the latest specifications.

The product warranty is valid for one year after delivery and is limited to product repair or replacement for defects discovered and reported to us within that one year period. However, even if within the warranty period we accept absolutely no liability for any loss caused by natural disasters or improper product use. Copying or reprinting the contents described in this material in whole or in part is prohibited without our prior permission.

# HAMAMATSU

[www.hamamatsu.com](http://www.hamamatsu.com)

HAMAMATSU PHOTONICS K.K., Solid State Division

1126-1 Ichino-cho, Higashi-ku, Hamamatsu City, 435-8558 Japan, Telephone: (81) 53-434-3311, Fax: (81) 53-434-5184

U.S.A.: Hamamatsu Corporation: 360 Foothill Road, Bridgewater, N.J. 08807, U.S.A., Telephone: (1) 908-231-0960, Fax: (1) 908-231-1218, E-mail: [usa@hamamatsu.com](mailto:usa@hamamatsu.com)

Germany: Hamamatsu Photonics Deutschland GmbH: Arzbergerstr. 10, D-82211 Herrsching am Ammersee, Germany, Telephone: (49) 8152-375-0, Fax: (49) 8152-265-8, E-mail: [info@hamamatsu.de](mailto:info@hamamatsu.de)

France: Hamamatsu Photonics France S.A.R.L.: 19, Rue du Saule Trapu, Parc du Moulin de Massy, 91882 Massy Cedex, France, Telephone: 33-(1) 69 53 71 00, Fax: 33-(1) 69 53 71 10, E-mail: [infos@hamamatsu.fr](mailto:infos@hamamatsu.fr)

United Kingdom: Hamamatsu Photonics UK Limited: 2 Howard Court, 10 Tewin Road, Welwyn Garden City, Hertfordshire AL7 1BW, United Kingdom, Telephone: (44) 1707-294888, Fax: (44) 1707-325777, E-mail: [info@hamamatsu.co.uk](mailto:info@hamamatsu.co.uk)

North Europe: Hamamatsu Photonics Norden AB: Torshamnsgatan 35 16440 Kista, Sweden, Telephone: (46)8-509 031 00, Fax: (46)8-509 031 01, E-mail: [info@hamamatsu.se](mailto:info@hamamatsu.se)

Italy: Hamamatsu Photonics Italia S.r.l.: Strada della Moia, 1 int. 6, 20020 Arese (Milano), Italy, Telephone: (39)02-93 58 17 33, Fax: (39)02-93 58 17 41, E-mail: [info@hamamatsu.it](mailto:info@hamamatsu.it)

China: Hamamatsu Photonics (China) Co., Ltd.: B1201, Jiaming Center, No.27 Dongsanhuan Beilu, Chaoyang District, Beijing 100020, China, Telephone: (86) 10-6586-6006, Fax: (86) 10-6586-2866, E-mail: [hpc@hamamatsu.com.cn](mailto:hpc@hamamatsu.com.cn)

Taiwan: Hamamatsu Photonics Taiwan Co., Ltd.: 8F-3, No. 158, Section2, Gongdao 5th Road, East District, Hsinchu, 300, Taiwan R.O.C. Telephone: (886)03-659-0080, Fax: (886)03-659-0081, E-mail: [info@hamamatsu.com.tw](mailto:info@hamamatsu.com.tw)