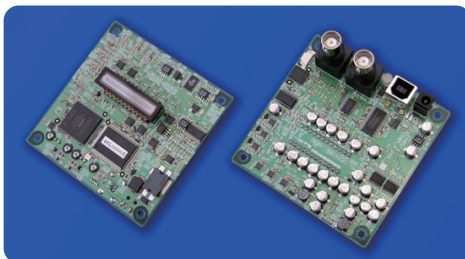


C11160/C11165 Driver Circuit for CCD Linear Image Sensor

Version 1.00

Instruction Manual

- Be sure to read the operation manual carefully before the product is used.
- If operated differently from the standard procedure in the manual, a serious accident may occur.
- Keep this manual for future reference.



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HAMAMATSU

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Handling Precautions

Please follow without fail.

Please follow the following safety notes when you operate this product to use this product correctly and safely.

Our company cannot assume the responsibility and the guarantee about the trouble caused by use in contradiction to these warnings.

1) Avoid using or storing this product in the following locations:

- a) where ambient temperature drops below 0°C or rises above 50°C
- b) subject to large changes in temperature
- c) exposed to direct sunlight or near heaters
- d) place for condensation
- e) near strong magnetic sources or radio frequency generators
- f) subject to vibration
- g) where corrosive gases are present (such as chlorine or fluorine)
- h) exposed to excessive dust

2) This product is a high precision device. Handle it with extreme care.

- a) Do not disassemble or modify any part of this product. Malfunctions might otherwise occur.
- b) Be careful not to drop, bump or apply excessive impacts to this product. Drop impacts or bumps may damage the product.
- c) The CCD Linear image sensor is at risk for destruction or deterioration by static electricity or surge. Be careful when installing the sensor in this product.

Table of contents

1. Overview	1
2. Setup	2
2.1 Parts description	2
2.2 Hardware setup	4
3. Operation	5
4. Functions	6
5. Specifications	8
5.1 Specifications	8
5.2 Data acquisition timing charts	10
5.3 Pulse output timing chart	15
5.4 Pin arrangement	16
5.5 Dimensional outlines	17
6. Warranty and Service	18
6.1 Warranty	18
6.2 Service	18

Overview

The C11160/C11165 CCD Driver Circuit is signal processing circuit for Hamamatsu CCD Linear Image Sensor. Combining the Driver Circuit with those CCD image sensors creates the ideal tool for the application that used a spectroscope.

The Driver Circuit consists of a CCD driver, analog video processor (16bit ADC), timing pulse generator, control circuit and power supply circuit. When an analog signal is input from the CCD Linear image sensor, the Driver Circuit converts that analog signal to a digital signal and outputs it to an external device such as a PC (personal computer). The Driver Circuit easily connects to the PC through a USB connector (conforming to USB2.0) provided on the rear panel of the Driver Circuit, allowing control and data acquisition by the PC.

The BNC connector for the external trigger input, the connector for the pulse output, and DC Jack for the power supply are installed in the Driver Circuit. Even with all these functions, the Driver Circuit still offers compact size, light weight, and easy use.

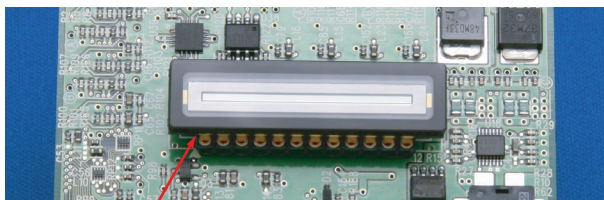
The Driver Circuit has three data acquisition modes. One is an internal sync mode (Internal mode) that acquires data with a trigger signal generated by the application software. The other two are external sync modes (External Trigger modes) in which data is acquired while synchronized with a trigger signal generated from an external device. Select the data acquisition mode that best suits your application.

Besides external trigger modes, the Driver Circuit has versatile functions like gain and offset adjustment.

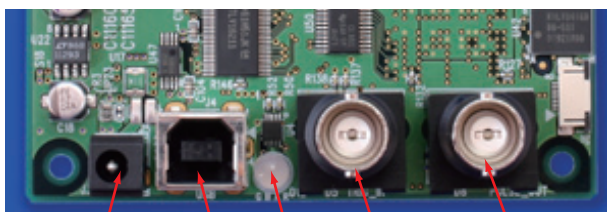
The Driver Circuit has 3 operating modes ("Suspend" , "Standby" , "Data Transfer") to make the Driver Circuit easier to use. The LED display on the Driver Circuit lets you know which operating mode is currently selected.

The Driver Circuit comes with application software that runs on Windows® 2000 or XP and is specifically programmed to operate the Driver Circuit from the PC. The application software also includes a function library exclusively for the Driver Circuit, allowing you to develop your own software more efficiently.

2.1 Parts description



(1) Sensor Side



(6) (2) (3) (4) (5)
Component Side

(1) CCD Image Sensor

CCD Driver Circuit	Accept Image Sensor
C11160	S11150-2048, S11151-2048
C11165	S11155-2048, S11156-2048

(2) USB

This is an industrial standard USB connector for connecting to a PC. This connector interface conforms to USB2.0. Various Driver Circuit settings can be made from the PC through this interface. Data converted to digital signals are sent to the PC.

(3) LED display

Indicates the current status of the Driver Circuit. The LED display indicates the following status modes.

LED display	Mode
Off	Suspend mode
White	Standby mode
Green	Internal Operation mode
Cyan	External Edge Operation mode
Blue	External Level Operation mode
Red	Device Error



It is possible to set this LED to OFF Mode (Always turned Off) by controlling from the PC.

(4) EXT.TRIG_IN connector

An industrial standard BNC connector used to input external trigger signals when the Driver Circuit is operated in the External Trigger mode. The input signal should be an H-CMOS level pulse. The internal circuits are optically isolated.

(5) PULSE_OUT connector

It is an industry standard BNC Connector, which outputs the Pulse from the Driver Circuit. The output signal is H-CMOS level pulse and it is possible to output the pulse, which is synchronized with the accumulation time of CCD and can be used as timing signal for UV-Lazer or Mechanical-Shutter. It is not insulated from an internal circuit.

(6) DC5V

It is a power supply connector from the external source to the module.

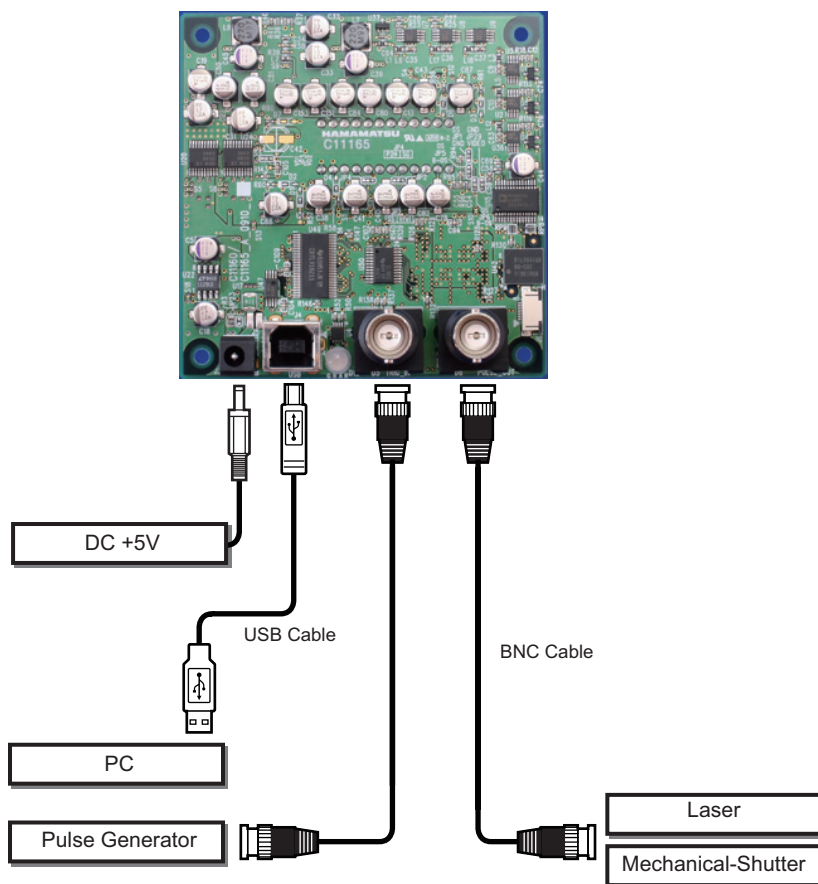
It is DC power supply Jack of the industry-wide standard (the EIAJ RC5320A standard, the voltage division "2"). Please use a AC adapter (+5V, more than 1A) for power supply. When use a DC power supply, please use with the +5.0V power supply. The center of the terminal of the connector is positive terminal and the surroundings is the negative terminal.

2.2 Hardware setup

Use these drawings to connecting the hardware for use with the Driver Circuit.
Please use pan head screw of M3, when you install the Driver Circuit to device etc.



Please use the flat washer of less or equal 6mm diameter, when you install the Driver Circuit to device etc.



The Driver Circuit comes with dedicated application software (DCam-USB). Use this software for control of the Driver Circuit and data acquisition.

For information on how to use the DCam-USB software, refer to the separate "DCam-USB_APL_InstructionManual" that also comes with the Driver Circuit.

The Driver Circuit has the following functions operable from the C10785DCamAPL software.

■ Operating mode setting

The Driver Circuit can be set 3 operating mode. And LED indicate the current mode.

(1) "Suspend mode" (LED-Off)

The power is turned OFF. Driver Circuit can be safely disconnected from PC.

(2) "Standby mode" (LED-White)

It is Standby state, in which the data acquisition is possible. At this moment, the CCD image sensor is sweeping out dark current, by performing so called dummy scan operation. Usually, This mode is set when the Power supply is connected.

(3) "Data Transfer Mode"(LED-Green, Aqua, Blue)

In this mode the Driver Circuit sends the data to PC. Colour of LED changes depending upon the data acquisition mode.

■ Selectable data acquisition modes

This Function allows you to set the required mode for data acquisition. There are two basic modes of data acquisition, namely "Internal synchronous mode" which basically operates on the Software Trigger, and "External synchronous mode " which operates in synchronization with an external signal.

Moreover, "External synchronous mode" is divided into two modes of operation depending upon the input method of external synchronization signal. Default mode is, Internal synchronous mode.

(1) Internal synchronous mode("INT" Mode)

Data is acquired on the basis of the trigger timing generated by application software. The CCD Image Sensor operates repeatedly after each specific interval of Accumulation time, which is set inside the driver circuit beforehand.

(2) External synchronous mode1 ("EXT.EDGE" Mode)

Data is acquired in synchronization with the external trigger signal input from the built in BNC Connector. CCD Image Sensor performs dummy scan until external trigger signal is received. In Synchronization with the Edge of the external trigger signal, it accumulates the data for the definite Accumulation time and then outputs it after that. In this case, similar to the Internal synchronous mode("INT" Mode), the accumulation time is set to the Driver Circuit beforehand. Input Signal Level is H-CMOS compatible. Polarity of the External trigger signal edge can be selected through the software to either Positive(+ve) or Negative(-ve) polarity.

(3) External synchronous mode2 ("EXT.LEVEL" Mode)

Data is acquired in synchronization with the external trigger signal input from the built in BNC Connector. In this Mode also, CCD Image Sensor performs dummy scan until external trigger signal is received. Immediately after receiving the input external trigger, CCD Image sensor accumulates the data in the time interval that is same as the external signal pulse width and then outputs it after that. Input Signal Level is H-CMOS compatible. Polarity of trigger signal can be selected through the software o either Positive(+ve) or Negative(-ve) polarity.

■ MPP mode

MPP(Multi Pinned Phase) is also called inversion operation because it reduces the dark current. It is possible to implement MPP operation if it makes the inverse state of all the gates of MOS structure, which composes the electrode of CCD. This mode is exclusive for C11165.

■ Gain Adjustment

This is Hardware Gain Adjustment Function using which the gain value can be varied in the range of [1 to 3] with the step of 1.Default value is "1".

■ Offset Adjustment

This is Hardware Offset Adjustment Function using which the offset value can be varied in the range of [-255 to 255] with the step of 1.Default value is "0".

■ Pulse Output Signal Setting

It is possible to perform the timing setup of the "Pulse Output Signal (PULSE-OUT)" outputted from the BNC connector used as PULSE_OUT of the Driver Circuit. Independent of the Data acquisition mode of CCD, This Signal can be outputted in synchronization with the accumulation start time of CCD and It is possible to set Pulse polarity, Output start time Delay and Pulse Width.

5.1 Specifications

■ C11160

Parameter	Specifications	
CCD	S11150-2048	S11151-2048
Total number of pixels	2068(H)x1(V)	
Effective number of pixels	2048(H)x1(V)	
Pixel size	14 (H) x 50 (V) μm	14 (H) x 250 (V) μm
Effective active area	28.672 (H) x 0.050 (V) mm	28.672 (H) x 0.250 (V) mm
Line scanning rate	6MHz	
Line readout time	377.5usec(@TG=30usec)	
Data transfer time	344.67usec	
Total cycle time	722.17usec(@TG=30usec)	
AD conversion resolution	16 bit (65,535 ADU)	
Conversion gain	3.6 ⁻ e/ADU	
Readout noise	20 ADU (TBD)	
Dynamic range	3,276	
Interface	USB2.0	
Supply voltage	DC+4.5 to 5.5 V (950 mA typ@5.0V)	
Storage temperature	-20°C to +70°C (no condensation)	
Operating temperature	0°C to +50°C (no condensation)	
Dimensions(only PC board)	80 mm (H) x 80 mm (V)	
Weight	Approx. 65 g	

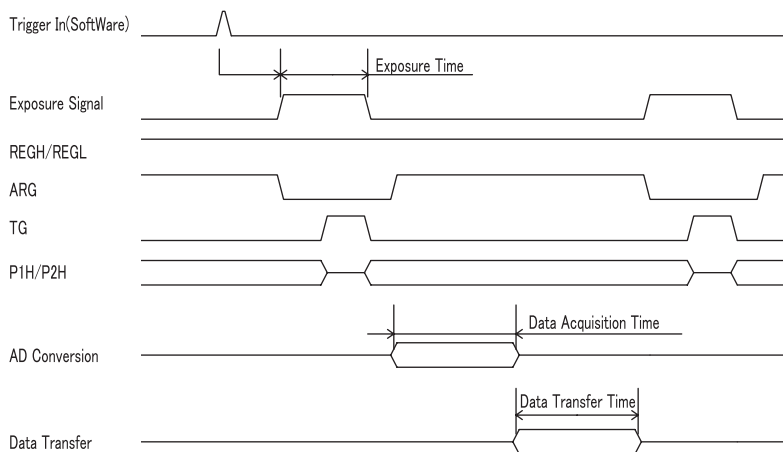
■ C11165

Parameter	Specifications	
CCD	S11155-2048	S11156-2048
Total number of pixels	2068(H)x1(V)	
Effective number of pixels	2048(H)x1(V)	
Pixel size	14 (H) x 50 (V) μm	14 (H) x 250 (V) μm
Effective active area	28.672(H) x 0.500(V) mm	28.672(H) x 1.000(V) mm
Line scanning rate	6MHz	
Line readout time	377.5usec(@TG=30usec)	
Data transfer time	344.67usec	
Total cycle time	722.17usec(@TG=30usec)	
AD conversion resolution	16 bit (65,535 ADU)	
Conversion gain	3.6 ⁻ e/ADU	
Readout noise	20 ADU (TBD)	
Dynamic range	3,276	
Interface	USB2.0	
Supply voltage	DC+4.5 to 5.5 V (950 mA typ@5.0V)	
Storage temperature	-20°C to +70°C (no condensation)	
Operating temperature	0°C to +50°C (no condensation)	
Dimensions(only PC board)	80 mm (H) x 80 mm (V)	
Weight	Approx. 65 g	

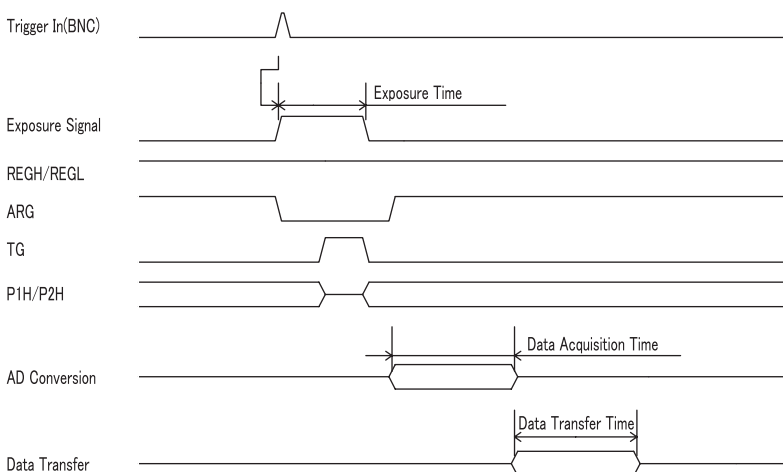
5.2 Data acquisition timing charts

5.2.1 C11160

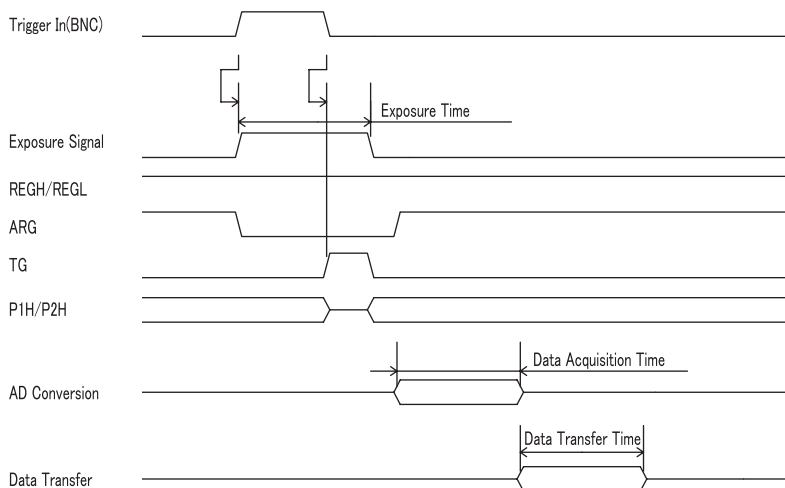
■ Internal synchronous mode("INT" Mode)



■ External synchronous mode 1("EXT.EDGE" Mode)

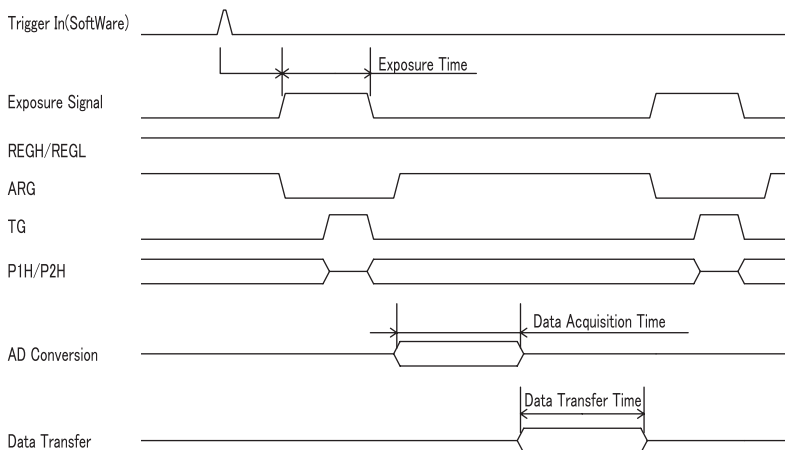


■ External synchronous mode 2("EXT.LEVEL" Mode)

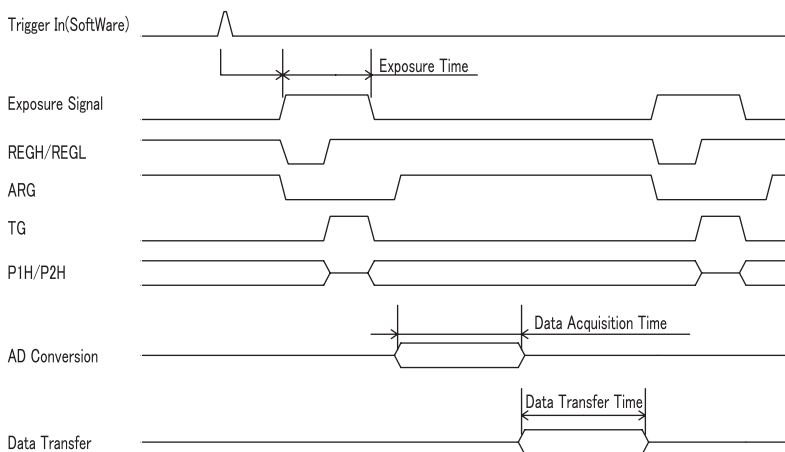


5.2.2 C11165

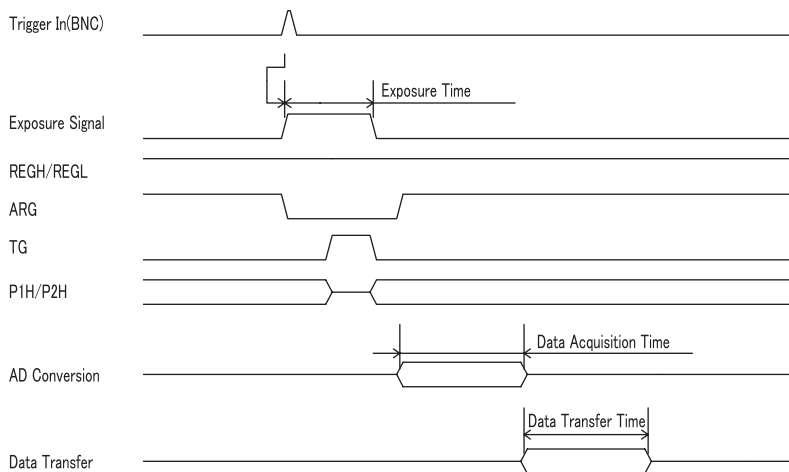
■ Internal synchronous Non-MPP mode ("INT" Mode)



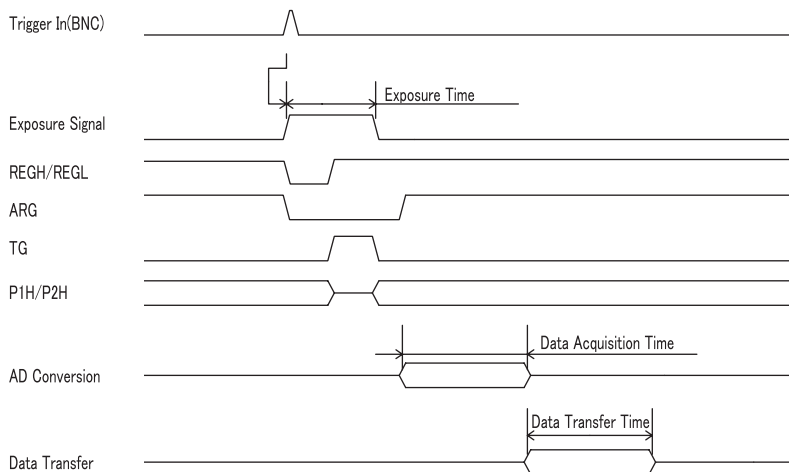
■ Internal synchronous MPP mode ("INT" Mode)



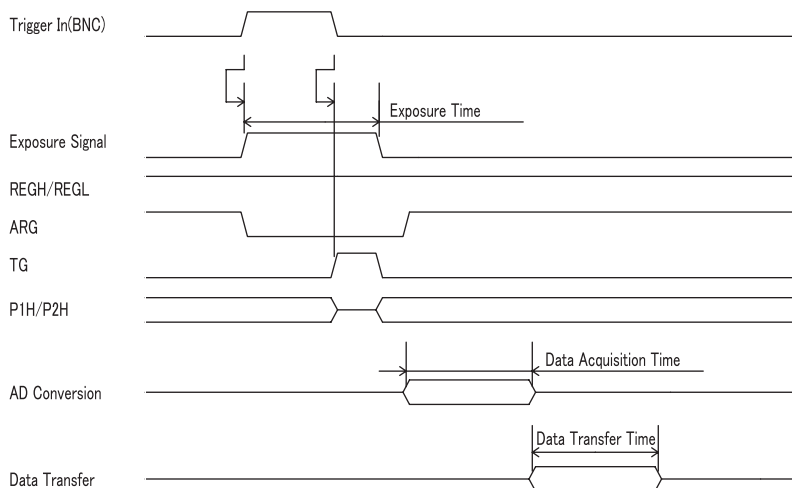
■ External synchronous Non-MPP mode 1 ("EXT.EDGE" Mode)



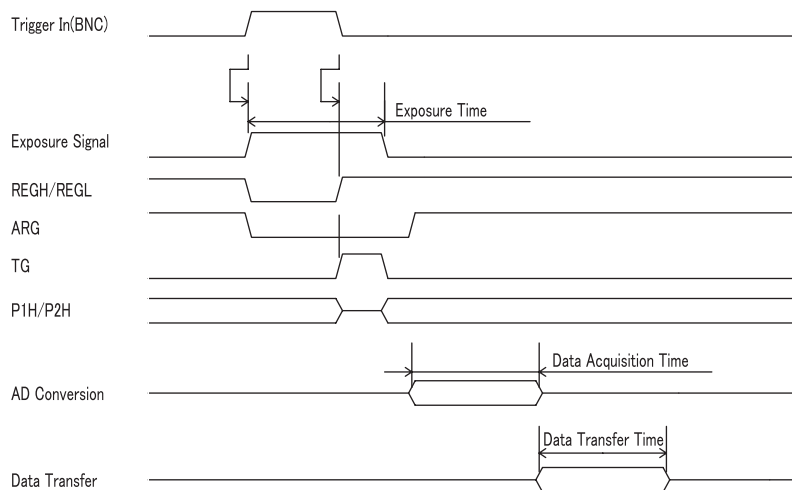
■ External synchronous MPP mode 1 ("EXT.EDGE" Mode)



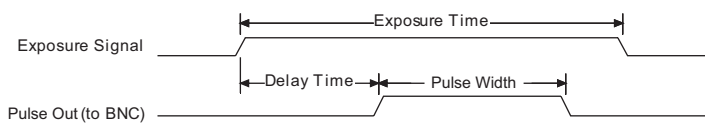
■ External synchronous Non-MPP mode 2 ("EXT.LEVEL" Mode)



■ External synchronous MPP mode 2 ("EXT.LEVEL" Mode)



5.3 Pulse output timing chart



5.4 Pin arrangement

■ CCD Linear Image Sensor (S11150 / S11151)

(TBD)

Pin No.	Signal name	Voltage (amplitude)	Pin No.	Signal name	Voltage (amplitude)
1	OS	+16V	24	RG	0/+14V
2	OD	+23V	23	TG	0/+16V
3	OG	+11V	22	-	-
4	SG	0V/+14V	21	-	-
5	Vret	+9V	20	STG	+8V
6	RD	+23V	19	-	-
7	-	-	18	RD	+23V
8	-	-	17	SS	+8V
9	P2H	0/+14V	16	-	-
10	P1H	0/+14V	15	ISH	+23V
11	IG2H	0V	14	ARD	+20V
12	IG1H	0V	13	ARG	+7/+16V

■ CCD Linear Image Sensor (S11155 / S11156)

Pin No.	Signal name	Voltage (amplitude)	Pin No.	Signal name	Voltage (amplitude)
1	OS	+16V	24	RG	+3/+14V
2	OD	+23V	23	TG	+1/+17V
3	OG	+13V	22	-	-
4	SG	+3/+14V	21	-	-
5	Vret	+9V	20	STG	+8V
6	RD	+23V	19	-	-
7	REGL	0/+2.5V	18	RD	+23V
8	REGH	0/+5V	17	SS	+8V
9	P2H	+3/+14V	16	-	-
10	P1H	+3/+14V	15	ISH	+23V
11	IG2H	0V	14	ARD	+20V
12	IG1H	0V	13	ARG	+6.5/+16V



With this Product, SS-terminal is biased to +8V.

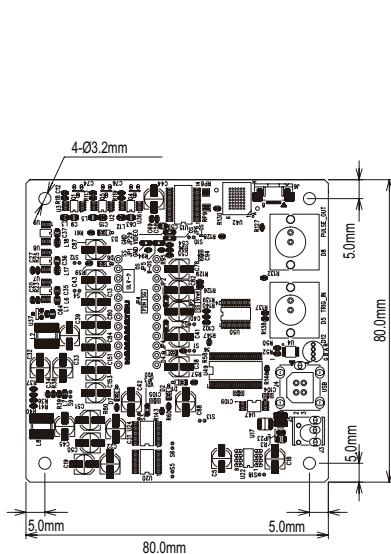
For other terminals, setting is done as per the standard voltage corresponding to that SS-terminal.

■ Power supply connector

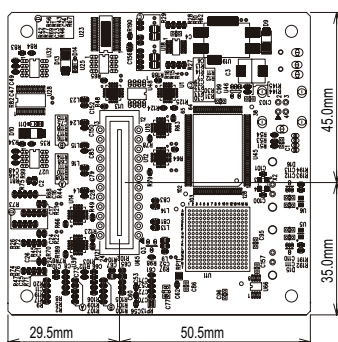
DC power supply Jack, the EIAJ RC5320A standard, the voltage division "2"



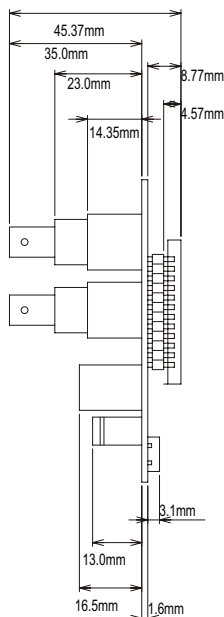
5.5 Dimensional outlines



Component Side



Sensor Side



Side View

6.1 Warranty

- Please follow the maximum rating and notes etc, before the use of the product of this material. Our company does not give warranty the completeness of this product though have tried to improve the quality and reliability. Especially, if measures of an appropriate safe design etc. that consider the trouble that can usually occur are not followed then it is dangerous to use the equipment that might violate person's life, body or property.

For such use, if not with our consent in writing of the specifications in advance, we hope that we assume no responsibility for the note.

- For ultimate user operation guidance, we would like you to consider it to explain the material used for this product, performance or handling, appropriate warnings and enough cautions for the display, etc.
- The warranty of this product, after delivery if the defects are discovered within one year, and if our company is notified of the same, will be limited to repair or substitute delivery of this product. However, even within the warranty period, the loss caused due to a natural disaster or an improper use (reconstruction, and environment, Application Area, Usage, storage, scrapping that contrary to the terms and conditions described in this document) we hope that our company assume no responsibility.
- Applications of this material is intended to illustrate typical examples of products used in this document, including the success or failure of commercial use and includes specific adaptability to use , and is not warranted. Moreover, it does not give warranty or give permission to do execution of the intellectual property. If you encounter problems with third parties concerning intellectual property rights for the use of this product, we do not take any responsibility for that.
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- Please do not reprint or do not reproduce the content described in this material without our permission.

6.2 Service

If it is noticed abnormally, please contact our solid sales department and give the details of type name, the production number (serial no.) , and the symptom. The repair work will be completed as soon as possible, and please note that for following cases we may refuse to repair or you have to pay the cost of it.

- If long time has elapsed since the purchase
- If manufacturing of repair part is discontinued
- If the modifications have been made
- If it is found that significant damage
- When the anomalous phenomenon is not reproduced by our company
- By the influence of the equipment used at the same time

Document History

Date	Document Revision	Contents
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19.Apl.2010	1.01	Add TG width setting

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