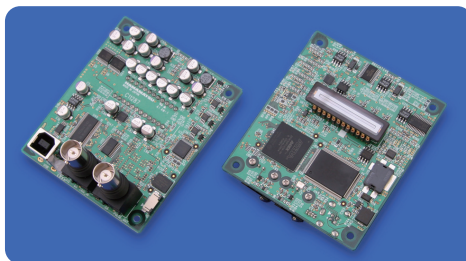# C11287/C11288
Driver Circuit for CCD Area Image Sensor

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

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) where humidity exceeds 70% or product is exposed to moisture
   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 area 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

The C11287/C11288 CCD Driver Circuit is signal processing circuit for Hamamatsu CCD Area 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 (14bit ADC), timing pulse generator, control circuit and power supply circuit. When an analog signal is input from the CCD area 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. In cases of C11287, power to the Driver Circuit is supplied through the USB connector, eliminating the need for an external power supply. The Driver Circuit has a BNC connector for input of external trigger signals. 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.
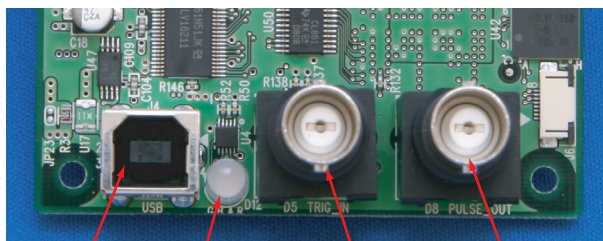
The Driver Circuit comes with application software that runs on Windows XP® or 7 and is specifically programmed to operate the Driver Circuit from the PC. The application software also includes a function library exclusively for the Driver Circuit, allowing you to develop your own software more efficiently.

2 Setup

2.1 Parts description
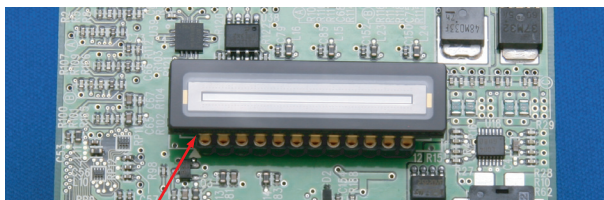
Sensor Side
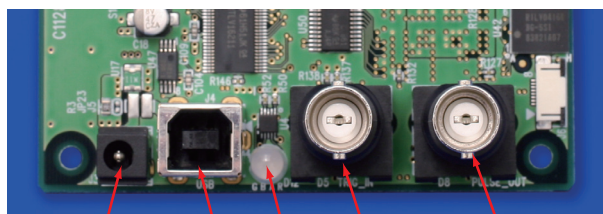
(1)

(2)　　　(3)　　　　　　　(4)　　　　(5)

Component Side (C11287)

(6)　　　　(2)　(3)　　(4)　　　(5)

Component Side (C11288)

(1) CCD Image Sensor

CCD Driver Circuit	Accept Image Sensor
C11287	S10420-1004-01, S10420-1006-01, S10420-1104-01, S10420-1106-01
C11288	S11071-1004, S11071-1006, S11071-1104, S11071-1106

(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.
Moreover, in cases of C11287, the power to Driver Circuit is supplied by bus powered from USB connector of PC. Be careful and check the maximum current value supplied by the PC.

NOTE

Please confirm the maximum current value which can supply from PC(500mA typ.).

(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

NOTE

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 (C11288 only)

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.
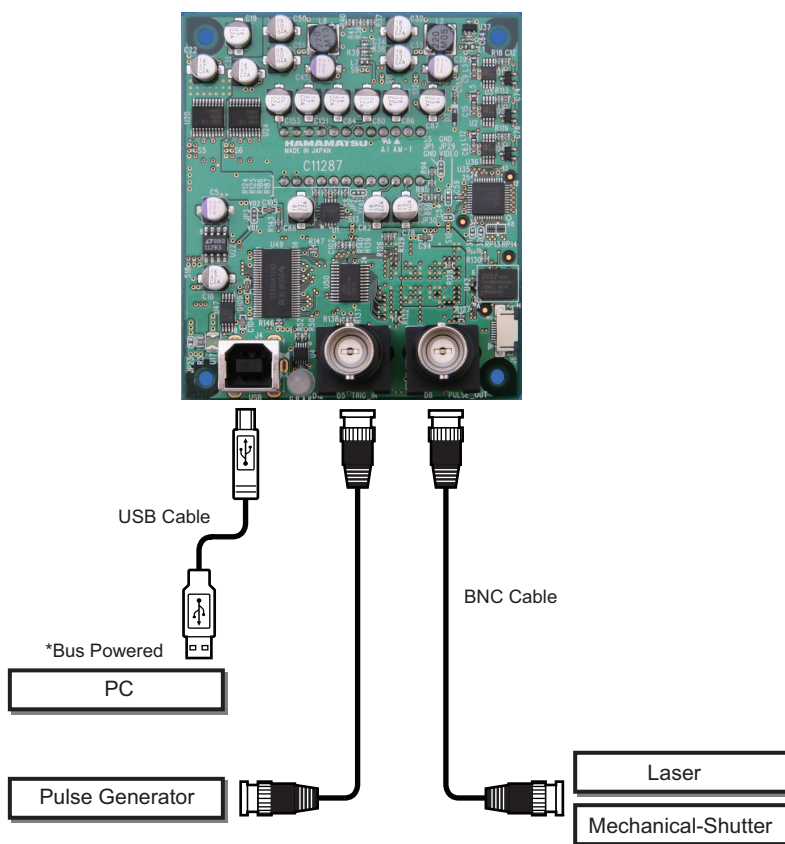
2.2 Hardware setup

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.
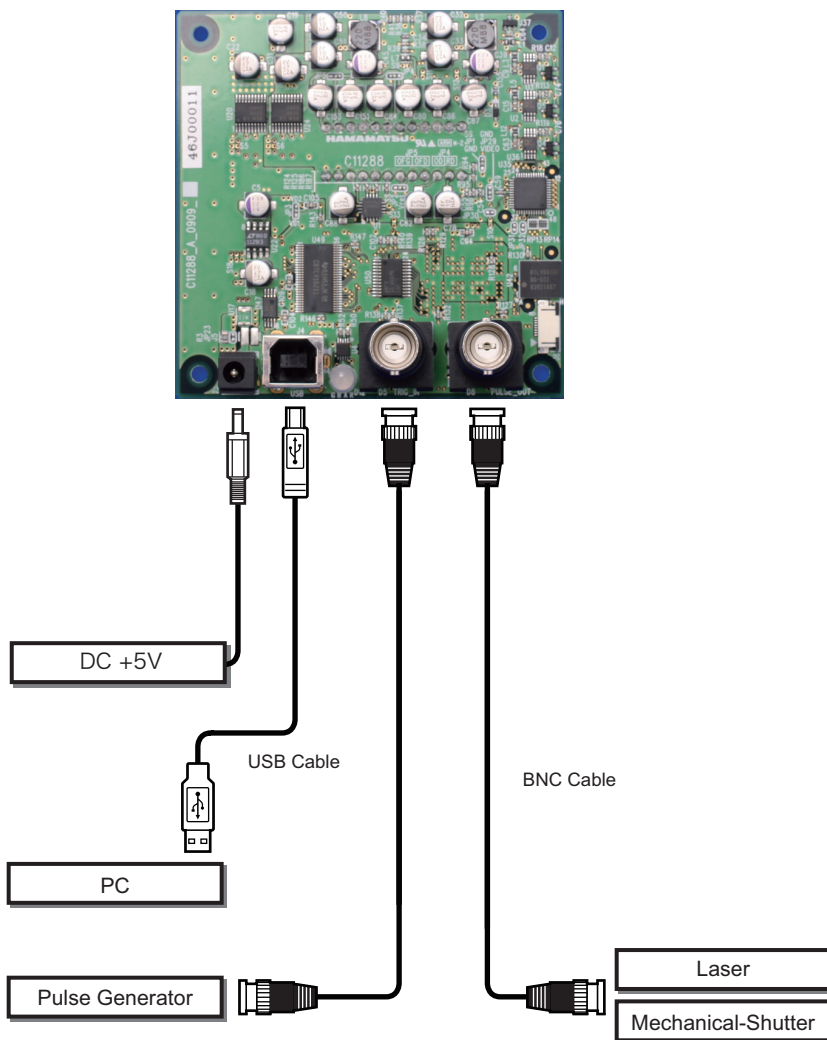
NOTE

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

C11287

C11288

3 Operation

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.

4 Functions

The Driver Circuit has the following functions operable from the DCamAPL 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 supply from the USB connector of PC 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 acqisition, 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 devided 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 accoumulates 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.

■ **Gain Adjustment**

This is Hardware Gain Adjustment Function using which the gain value can be varied in the range of [1 to 10] 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 [0 to 1020] with the step of 4.Default value is "40".

■ **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 Specifications

5.1 Specifications

■ C11287

Parameter	Specifications			
CCD	S10420-1004-01	S10420-1006-01	S10420-1104-01	S10420-1106-01
Total number of pixels	1044(H) x 22(V)	1044(H) x 70(V)	2068(H) x 22(V)	2068(H) x 70(V)
Effective number of pixels	1024(H) x 16(V)	1024(H) x 64(V)	2048(H) x 16(V)	2048(H) x 64(V)
Pixel size	14 x 14 μm			
Effective active area	14.336(H) x 0.224(V) mm	14.336(H) x 0.896(V) mm	28.672(H) x 0.224(V) mm	28.672(H) x 0.896(V) mm
Line scanning rate	250 kHz			
Line readout time	4.8 mSec	5.7 mSec	8.9 mSec	9.8 mSec
Data transfer time	4.3 mSec	4.3 mSec	8.4 mSec	8.4 mSec
Total cycle time	4.8 mSec	5.7 mSec	8.9 mSec	9.8 mSec
AD conversion resolution	14bit (16,383ADU)			
Conversion gain	12.2e$^-$/ADU			
Readout noise	3.0ADU			
Dynamic range	5,461			
Interface	USB2.0			
Supply voltage	DC+4.5 to 5.5V(360mA 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 70 mm(V)			
Weight	Approx. 65g			

■ C11288

| Parameter	Specifications			
CCD	S11071-1004	S11071-1006	S11071-1104	S11071-1106
Total number of pixels	1044(H)x22(V)	1044(H)x70(V)	2068(H)x22(V)	2068(H)x70(V)
Effective number of pixels	1024(H)x16(V)	1024(H)x64(V)	2048(H)x16(V)	2048(H)x64(V)
Pixel size	14 x 14 μm			
Effective active area	14.336(H) x 0.224(V) mm	14.336(H) x 0.896(V) mm	28.672(H) x 0.224(V) mm	28.672(H) x 0.896(V) mm
Line scanning rate	4MHz			
Line readout time	0.62 mSec	1.58 mSec	0.79 mSec	1.75 mSec
Data transfer time	0.22 mSec	0.22 mSec	0.44 mSec	0.44 mSec
Total cycle time	0.84 mSec	1.80 mSec	1.23 mSec	2.19 mSec
AD conversion resolution	14bit (16,383ADU)			
Conversion gain	12.2e$^-$/ADU			
Readout noise	7.0ADU			
Dynamic range	2730.5			
Interface	USB2.0			
Supply voltage	DC+4.5 to 5.5V(650mA 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 70 mm(V)			
Weight	Approx. 65g			

5.2 Data acquisition timing charts

5.2.1 C11287

■ Internal synchronous mode ("INT" Mode)
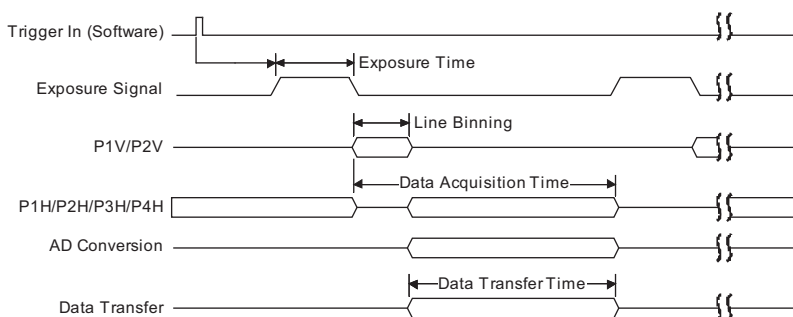
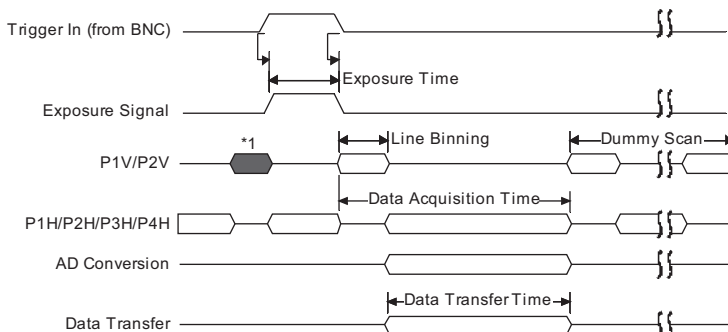

■ External trigger mode 1 ("EXT.EDGE" Mode)
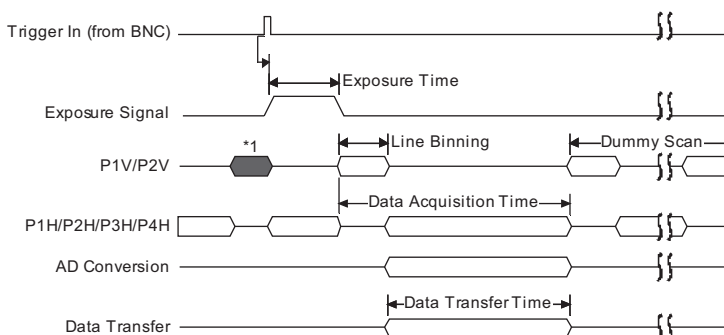
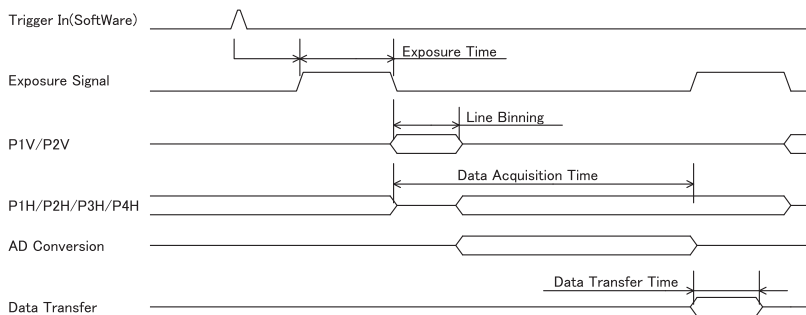*1: When an external trigger signal is input, accumulation is started immediately.

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

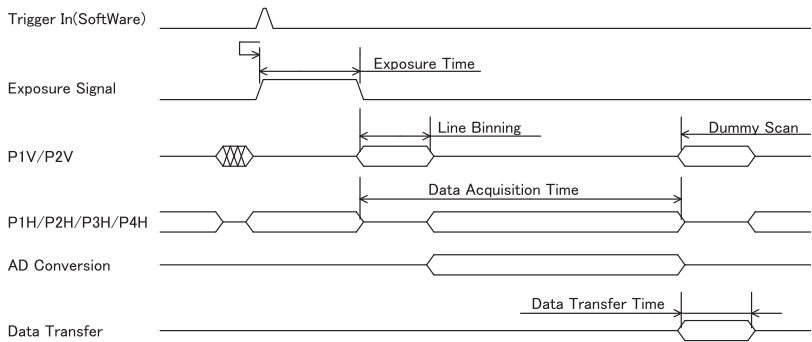*1: When an external trigger signal is input, accumulation is started immediately.

5.2.2   C11288

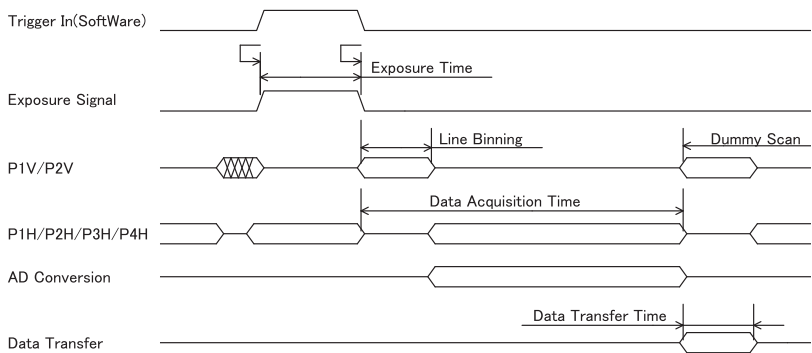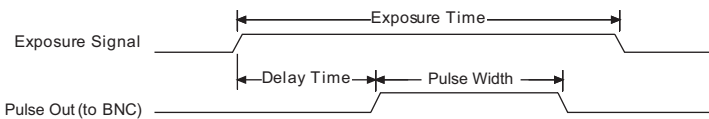## ■ Internal synchronous mode("INT" Mode)

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

Trigger In(SoftWare)

Exposure Signal

Exposure Time

P1V/P2V

Line Binning   Dummy Scan

P1H/P2H/P3H/P4H

Data Acquisition Time

AD Conversion

Data Transfer

Data Transfer Time

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

Trigger In(SoftWare)

Exposure Signal

Exposure Time

P1V/P2V

Line Binning   Dummy Scan

P1H/P2H/P3H/P4H

Data Acquisition Time

AD Conversion

Data Transfer

Data Transfer Time

5.3   Pulse output timing chart

Exposure Signal

Exposure Time

Pulse Out (to BNC)

Delay Time   Pulse Width

5.4 Pin arrangement

■ CCD Linear Image Sensor S10420-01 Series

Pin No.	Signal name	Voltage (amplitude)	Pin No.	Signal name	Voltage (amplitude)
1	OS	+26V	24	RG	+3V/+14V
2	OD	+32V	23	TG	0V/+14V
3	OG	+13V	22	P1V	0V/+14V
4	SG	+3V/+14V	21	P2V	0V/+14V
5	SS	+8V	20	IG1V	0V
6	RD	+20V	19	IG2V	0V
7	P4H	+3V/+14V	18	RD	+20V
8	P3H	+3V/+14V	17	SS	+8V
9	P2H	+3V/+14V	16	ISV	+20V
10	P1H	+3V/+14V	15	ISH	+20V
11	IG2H	0V	14	OFD	+20V
12	IG1H	0V	13	OFG	+20V

■ CCD Linear Image Sensor S11071 Series

Pin No.	Signal name	Voltage (amplitude)	Pin No.	Signal name	Voltage (amplitude)
1	OS	+17V	24	RG	+3V/+14V
2	OD	+23V	23	TG	0V/+14V
3	OG	+13V	22	P1V	0V/+14V
4	SG	+3V/+14V	21	P2V	0V/+14V
5	Vret	+9V	20	IG1V	0V
6	RD	+23V	19	IG2V	0V
7	P4H	+3V/+14V	18	RD	+23V
8	P3H	+3V/+14V	17	SS	+8V
9	P2H	+3V/+14V	16	ISV	+23V
10	P1H	+3V/+14V	15	ISH	+23V
11	IG2H	0V	14	OFD	+20V
12	IG1H	0V	13	OFG	+21V

⚠ NOTE

With this Product, SS-terminal is biased to +8V.
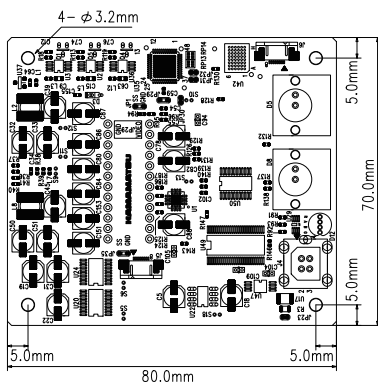**For other terminals, setting is done as per the standard voltage correspond-ing to that SS-terminal.**

■ Power supply connector (C11288 only)

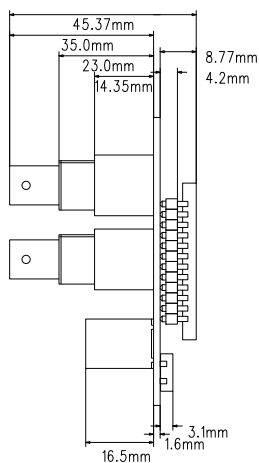DC power supply Jack, the EIAJ RC5320A standard, the voltage division "2"
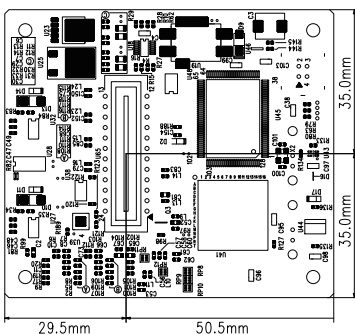
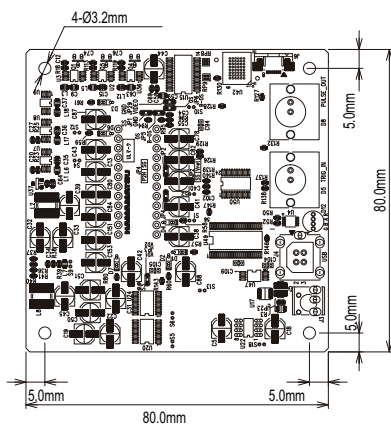## 5.5 Dimensional outlines

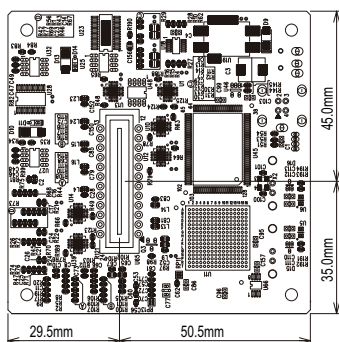■ **C11287**

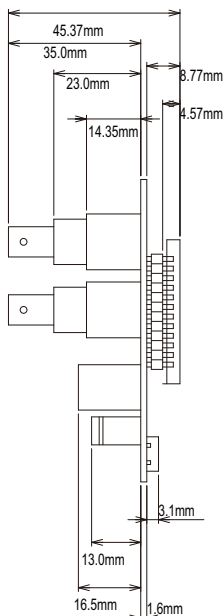Component Side

Side View

Sensor Side

■ **C11288**

Component Side

Sensor Side

Side View

6 Warranty and Service

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.
- Please take the permission for exportation of the Japanese national administration prefecture based on this law is needed when you export the restriction goods based on the foreign currency exchange and Foreign Trade Law among products of this material, and apply and follow a procedure.
- 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
01.Jun.2009	1.00	First Edition
01.Sep.2009	1.01	Changed the following contents. • "2.2 Hardware Setup" • "5.1 Specifications" • "6 Warranty and Service"
10.Nov.2009	1.02	Updated the following contents by the power supply improvement of "C11288". • "1 Overview" • "2.1 Parts description" • "2.2 Hardware Setup" • "5.1 Specifications" • "5.4 Pin arrangement" "CCD Linear Image Sensor S11071 Series" • "5.5 Dimensional outlines"
01.Nov.2010	1.03	Application software supported Windows7.
01.Sep.2011	1.04	Remove model "C10785"

C11287/C11288 Driver Circuit for CCD Area Image Sensor Instruction Manual

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