



C13938

Signal processing unit for X-ray detection photodiode module C14093

The C13938 is a signal processing unit for the photodiode modules C14093 series. This product has a CameraLink connector for data output and command communications.

Features

- ➔ A long and narrow X-ray sensor can be put in a structure in combination with the multiple photodiode modules C14093 (sold separately)
- ➔ Controllable from a PC (CameraLink interface)

Applications

- ➔ X-ray non-destructive inspection (baggage inspection, etc.)

Structure

Parameter	Specification	Unit
Output type	Digital	-
A/D converter resolution	16	bit
Interface	CameraLink (Base configuration)	-
Number of ports for photodiode modules	2	-

Absolute maximum ratings (Ta=25 °C)

Parameter	Symbol	Value	Unit
Supply voltage	Vdd	-0.3 to +13.2	V
Digital input signal terminal voltage	Vi	-0.3 to +3.6	V
Operating temperature*1	Topr	0 to +50	°C
Storage temperature*1	Tstg	-20 to +70	°C

*1: No dew condensation

When there is a temperature difference between a product and the surrounding area in high humidity environments, 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.

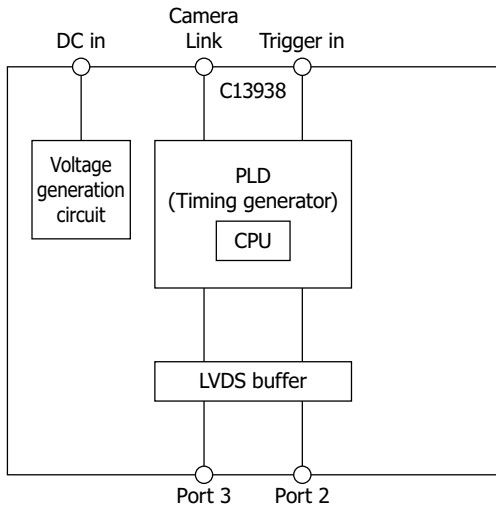
Recommended operating conditions (Ta=25 °C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	Vdd	11.5	12.0	12.5	V
Integration time	-	1	-	100	ms

Electrical characteristics (Ta=25 °C)

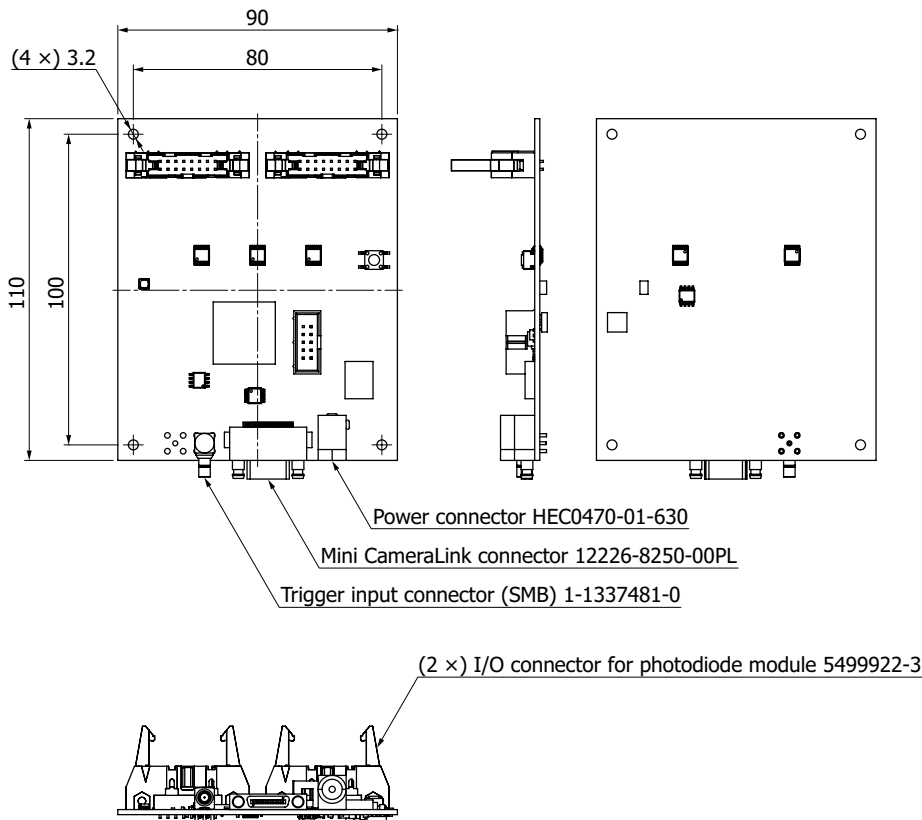
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Trigger input voltage	-		-	3.3	-	V
CameraLink clock	-		-	40	-	MHz
UART baud rate	-		-	9600	-	bps
Power consumption	-	Vdd=12 V	-	60	-	mA

Block diagram



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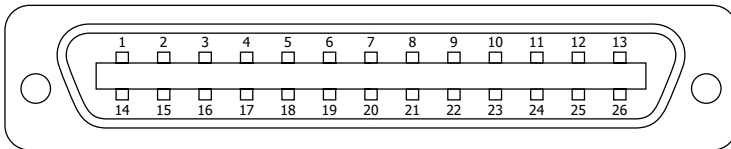
Dimensional outline (unit: mm)



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Pin connections

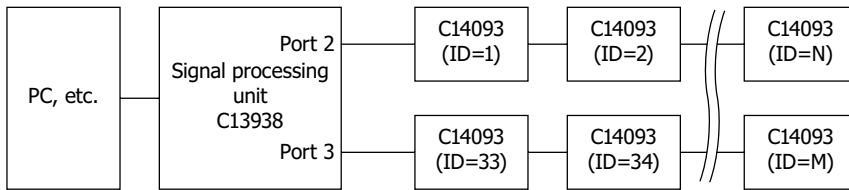
Pin no.	Name	Function	Remark
1	Shield line	GND	
2	X0-	LVDS output	Video data output
3	X1-	LVDS output	Video data output
4	X2-	LVDS output	Video data output
5	Xclk-	LVDS output	Video data clock output
6	X3-	LVDS output	Video data output
7	SerTC+	LVDS input	Differential pair for serial communication with frame grabber (for reception)
8	SerTFG-	LVDS output	Differential pair for serial communication with frame grabber (for transmission)
9	CC1-	LVDS input	Camera control 1 (CC1)
10	CC2+	LVDS input	Camera control 2 (CC2)
11	CC3-	LVDS input	Camera control 3 (CC3)
12	CC4+	LVDS input	Camera control 4 (CC4)
13	Shield line	GND	
14	Shield line	GND	
15	X0+	LVDS output	Video data output
16	X1+	LVDS output	Video data output
17	X2+	LVDS output	Video data output
18	Xclk+	LVDS output	Video data clock output
19	X3+	LVDS output	Video data output
20	SerTC-	LVDS input	Differential pair for serial communication with frame grabber (for reception)
21	SerTFG+	LVDS output	Differential pair for serial communication with frame grabber (for transmission)
22	CC1+	LVDS input	Camera control 1 (CC1)
23	CC2-	LVDS input	Camera control 2 (CC2)
24	CC3+	LVDS input	Camera control 3 (CC3)
25	CC4-	LVDS input	Camera control 4 (CC4)
26	Shield line	GND	



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Connection diagram

A maximum of 32 of the C14093 per port can be connected in series to the port 2 and port 3 of the C13938 (for a maximum of 64 in total for the two ports).



Note: N=32 max., M=64 max.

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Timing Chart

■ Command protocol

Uses CameraLink's serial protocol to send command data. The command protocol is compliant with CameraLink.

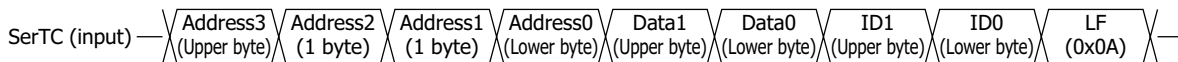
- Baud rate: 9600 bps (fixed)
- Start bit: 1-bit
- Data bit: 8-bit
- Parity bit: No parity
- Stop bit: 1-bit
- Hand shake: No hand shaking

Hexadecimal command data is converted to ASCII. Send a command from the software and wait for the response, then send the next command. If sending a write command, then set ID=0. If sending a read command, then set ID=0 except for 0x200.

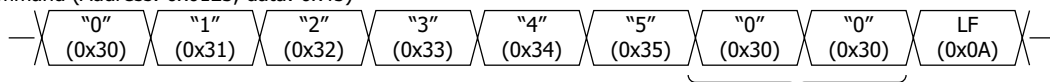


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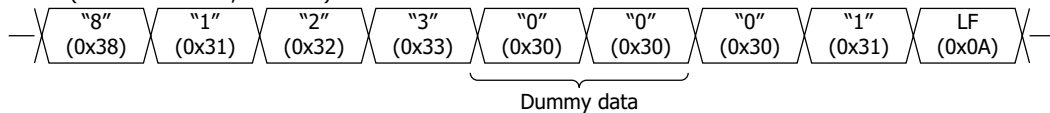
■ Command structure



eg., Write command (Address: 0x0123, data: 0x45)

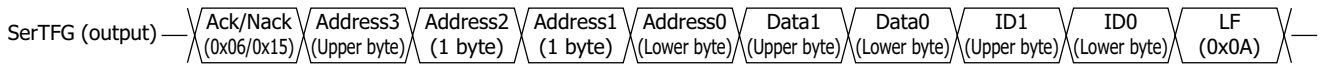


eg., Read command (Address: 0x0123, ID: 0x01)



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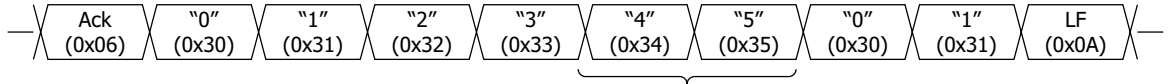
■ Response structure



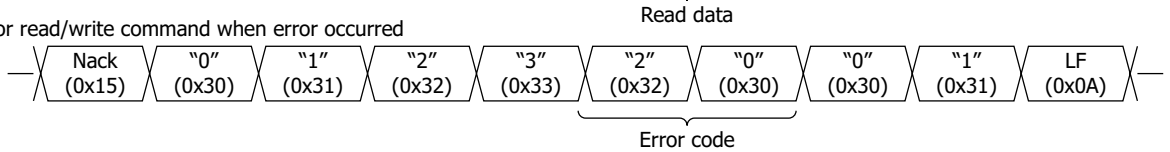
eg., Response for write command (0x0123)



eg., Response for read command (0x0123, ID: 0x01)



eg., Response for read/write command when error occurred



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■ Error code

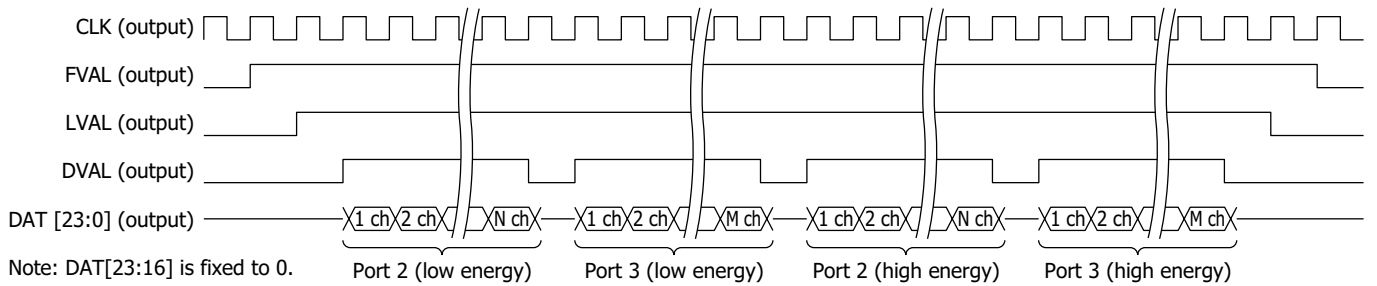
When there is a command error, the C13938 sends the error code to a PC or other device.

Code	Status	Description
0x80	Write protect	An attempt was made to write to a protected register.
0x40	Illegal access	An attempt was made to write to a readout-only register.
0x20	Illegal address	An address was used that is not in the register map.
0x10	Illegal data	An attempt was made to write data outside the setting range.

■ Image data output timing

The C13938 outputs in the order of the data below.

- ① Low energy data of photodiode module connected to port 2
- ② Low energy data of photodiode module connected to port 3
- ③ High energy data of photodiode module connected to port 2
- ④ High energy data of photodiode module connected to port 3



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Register map

Address	Name	Access	Description
0x0000	HW revision	R	Hardware version of C13938
0x0001	FW revision	R	Firmware version of C13938
0x0010-0x001F	SID	R	Serial no. of C13938
0x0020-0x002F	CID	R	Type no. (C13938)
0x0100	Parameter control	W	Bit 2: Load initial setting parameters Bit 1: Save user set parameters Bit 0: Load user set parameters
0x0102	Photodiode module configuration	W	Bit 4: Initialize the photodiode module Bit 5: Correct the photodiode module After power-on, does initialization and correction first. Keep it in the dark state while making corrections.
0x0200	Photodiode module gain	R/W	Select the analog input range (see the C14093 datasheet)
0x0300	Trigger mode	R/W	Bit 4 Internal trigger mode (free run): 0 External trigger mode: 1
0x0310	Data acquisition control	W	Bit 4: Start data acquisition Bit 0: Stop data acquisition
0x0404-0x0407	Frame cycle	R/W	Frame period [ns] = Setting value × 50 The minimum value of the frame period: 1 ms
0x0408-0x0409	Port 2 number of elements	R/W	Total number of elements in all photodiode modules connected to port 2
0x0418-0x0419	Port 3 number of elements	R/W	Total number of elements in all photodiode modules connected to port 3

Accessories

- Power cable (for connecting C13938 to external power supply)
- Power cable (for connecting C14093 to external power supply)
- I/O cable (for connecting C14093 and C13938)
- CD-ROM (instruction manual, application software, DLL function, and sample software)

Related information

www.hamamatsu.com/sp/ssd/doc_en.html

- Precautions
- Disclaimer

Information described in this material is current as of July 2021.

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