

Image sensor module

C7040/C7041 series

Modules with a built-in back-thinned CCD image sensor

C7040/C7041 series are image sensor modules with a built-in back-thinned CCD area image sensor (S7030/S7031/S1600X series, etc.). A low-noise driver circuit is built in, allowing operation by applying simple external signals.

C7041 series has a built-in highly stable temperature control circuit, which cools the sensor to the predetermined temperature ($T_{chip} = -10\text{ }^{\circ}\text{C}$) as soon as the power is supplied. They are designed with a safety feature that automatically turns off the power via a protective circuit in the event of overheating caused by a cooler failure. The main unit has a highly effective heat dissipation structure despite its compact exterior, and is equipped with mounting holes on its front surface for attaching a spectrometer or other devices.

A controller (C7557-01) for operating these image sensor modules is also available separately. The dedicated software allows you to control the module and collect data from it via the PC.

Features

- **Built-in back-thinned CCD area image sensor^{*1}**
C7040 series: Non-cooled CCD
C7041 series: Thermoelectrically cooled CCD
- **Selectable line binning^{*2} / area scanning operation**
- **Built-in dedicated driver circuit**
- **Highly stable temperature control method adopted (C7041 series)**
- **Operation via simple signal inputs**
- **Compact exterior**

^{*1}: In a conventional front-illuminated CCD, the photosensitive area is covered with transparent electrodes for charge transfer. These transparent electrodes block ultraviolet light, which reduces the quantum efficiency. In contrast, a back-thinned CCD is structured such that the backside of the photosensitive area is thinned and light enters from the backside. Therefore, it is not affected by the transparent electrodes, achieving high UV sensitivity and quantum efficiency.

^{*2}: By adding all vertically transferred charges to the corresponding horizontal register (line binning), it can operate like a linear image sensor with a large photosensitive area.

Applications

- **Fluorescence spectroscopy**
- **Raman spectroscopy**
- **Other low-light-level detection**

Selection guide

The following CCD area image sensors are built in.

The circuit is also available for purchase separately. Contact us for detailed information.

Type no.	Built-in CCD area image sensors				
	Type no.	Cooling	Total number of pixels	Number of effective pixels	Photosensitive area [mm (H) × mm (V)]
C7040A	S7030-0906	Non-cooled type	532 × 64	512 × 58	12.288 × 1.392
C7040B	S7030-0907		532 × 128	512 × 122	12.288 × 2.928
C7040C	S7030-1006		1044 × 64	1024 × 58	24.576 × 1.392
C7040D	S7030-1007		1044 × 128	1024 × 122	24.576 × 2.928
C7040E	S16000-1007		1044 × 128	1024 × 122	24.576 × 2.928
C7041A	S7031-0906S	TE-cooled type	532 × 64	512 × 58	12.288 × 1.392
C7041B	S7031-0907S		532 × 128	512 × 122	12.288 × 2.928
C7041C	S7031-1006S		1044 × 64	1024 × 58	24.576 × 1.392
C7041D	S7031-1007S		1044 × 128	1024 × 122	24.576 × 2.928
C7041E	S16001-1007S		1044 × 128	1024 × 122	24.576 × 2.928

Absolute maximum ratings

Parameter		Symbol	Min.	Typ.	Max.	Unit
Supply voltage (digital)		VD1	-0.5	-	+7	V
Supply voltage (analog)		VA1+	-	-	+18	
		VA1-	-	-	-18	
		VA2	-	-	+30	
Supply voltage*3		VD2	-	-	+7	
		Vp	-	-	+7	
		VF	-	-	+14	
Digital input voltage		-	-	-	VD (1, 2)	°C
Operating temperature*4	C7040 series	Topr	0	-	+50	
	C7041 series		+10	-	+30	
Storage temperature*4	C7040 series	Tstg	-20	-	+70	
	C7041 series		0	-	+50	

*3: C7041 series

*4: No dew condensation

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, VD1=+5 V, VA1+=+15 V, VA1=-15 V, VA2=+24 V, VD2=+5 V, Vp=+5 V, VF=+12 V, unless otherwise noted)

Parameter		Symbol	Min.	Typ.	Max.	Unit
Digital input	High level	VIH	+2.0	-	VD (1, 2)	V
	Low level	VIL	-0.5	-	+0.8	V
CLK frequency			-	-	1	MHz
Video signal readout frequency			-	-	fCLK/4	Hz
Start pulse width			1/fCLK	-	-	s
Digital output	High level (Io=-6 mA)	VIH	+2.0	-	-	V
	Low level (Io=+6 mA)	VIL	-	-	+0.8	V
Operating power supply conditions						
Voltage	Digital*5	VD1	+4.75	+5.0	+5.25	V
	Analog	VA1+	+14.75	+15.0	+15.25	V
		VA1-	-14.75	-15.0	-15.25	V
		VA2	+23.75	+24.0	+24.25	V
	Others*5	VD2	+4.75	+5.0	+5.25	V
		Vp	+4.75	+5.0	+5.25	V
		VF	+11.75	+12.0	+12.25	V
Current	VD1 (+5 VDC)	-	-	-	+200	mA
	VA1+ (+15 VDC)	-	-	-	+100	mA
	VA1- (-15 VDC)	-	-	-	-100	mA
	VA2 (+24 VDC)	-	-	-	+30	mA
	VD2 (+5 VDC)*5	-	-	-	+30	mA
	Vp (+5 DC)*5	-	-	-	+2.5	A
	VF (+12 VDC)*5	-	-	-	+150	mA

*5: C7041 series

❖ **Electrical and optical characteristics [Ta=25 °C, Tchip= -10 °C (Tchip=25 °C for C7040 series), V_{D1}=+5 V, V_{A1+}=+15 V, V_{A1-}= -15 V, V_{A2}=+24 V, V_{D2}=+5 V, V_p=+5 V, V_F=+12 V, unless otherwise noted]**

Parameter		Symbol	Min	Typ.	Max.	Unit
Spectral response range		λ	-	200 to 1100		nm
Saturation charge	Vertical	Fw	240	320	-	ke ⁻
			200* ⁶	280* ⁶	-	
	Horizontal		800	1000	-	
Conversion gain* ⁷		Sv	-	15	-	$\mu\text{V}/\text{e}^-$
Saturation output voltage		Vsat	10	-	-	V
Dark current* ⁸	C7040 series	DS	-	100	1000	e ⁻ /pixel/s
			-	200* ⁹	1000* ⁹	
	C7041 series		-	3	30	
			-	6* ¹⁰	30* ¹⁰	
Readout noise		Nread	-	20	-	e ⁻ rms
Dynamic range		Drange	-	50000* ¹¹	-	-
Photoresponse nonuniformity* ¹²		PRNU	-	±3	±10	%

*6: C7040E, C7041E

*7: Including circuit gain.

*8: In MPP mode. Due to the binning operation, the actual value is the sum of the vertical pixels.

*9: C7040E

*10: C7041E

*11: During line binning

*12: Measured at half of the saturation charge

❖ **Temperature controller specifications (C7041 series)**
(Ta=25 °C, V_{D1}=+5 V, V_{A1+}=+15 V, V_{A1-}= -15 V, V_{A2}=+24 V, V_{D2}=+5 V, V_p=+5 V, V_F=+12 V)

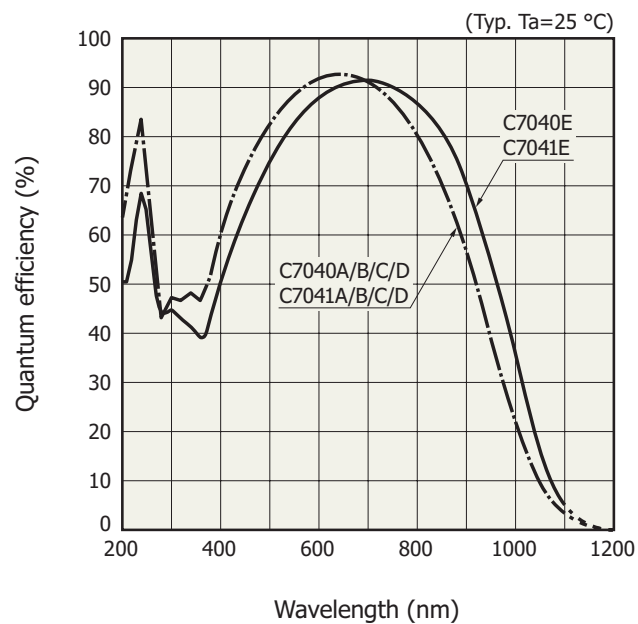
Parameter* ¹³	Symbol	Min.	Typ.	Max.	Unit
Cooling temperature	Ts	-11.5	-10	-8.5	°C
Control temperature range	ΔTs	-0.05	-	+0.05	°C
TE-cooler power dissipation	Pp	-	-	7	W
Setting temperature achievement time	to	-	-	5	minutes
Sensor overheat protection setting temperature* ¹⁴	To	-	+45	-	°C

*13: In addition, the following functions are included:

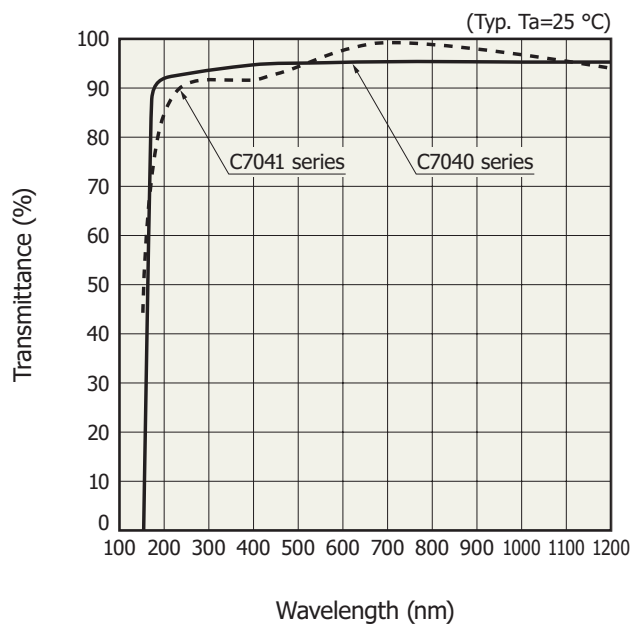
Error display, automatic power-off, detection of open or short in the temperature sensor

*14: Temperature at the back of the case (fan mounting area)

Spectral response (without window, typical example)

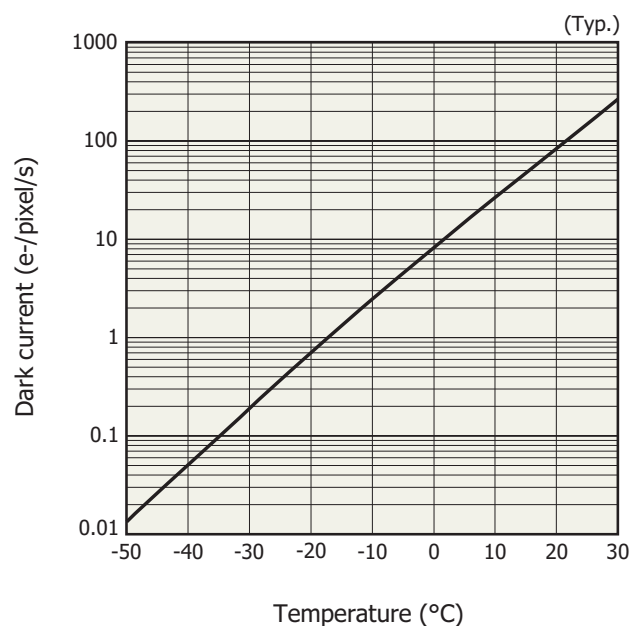


Spectral transmittance characteristics of window material

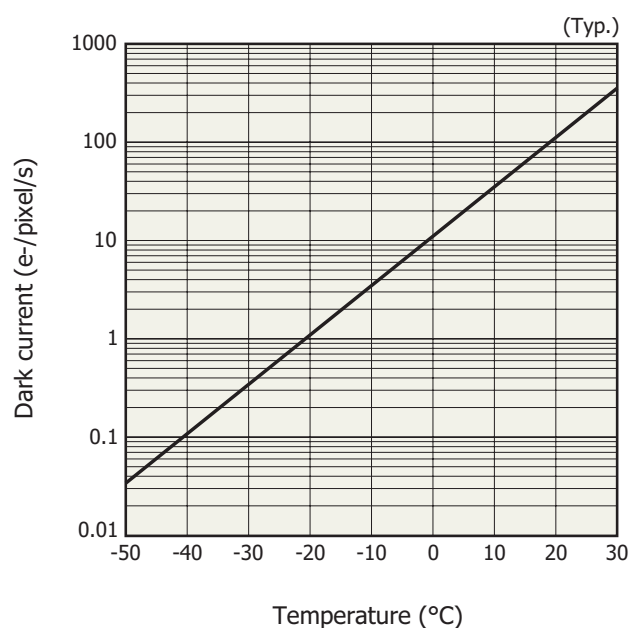


Dark current vs. temperature

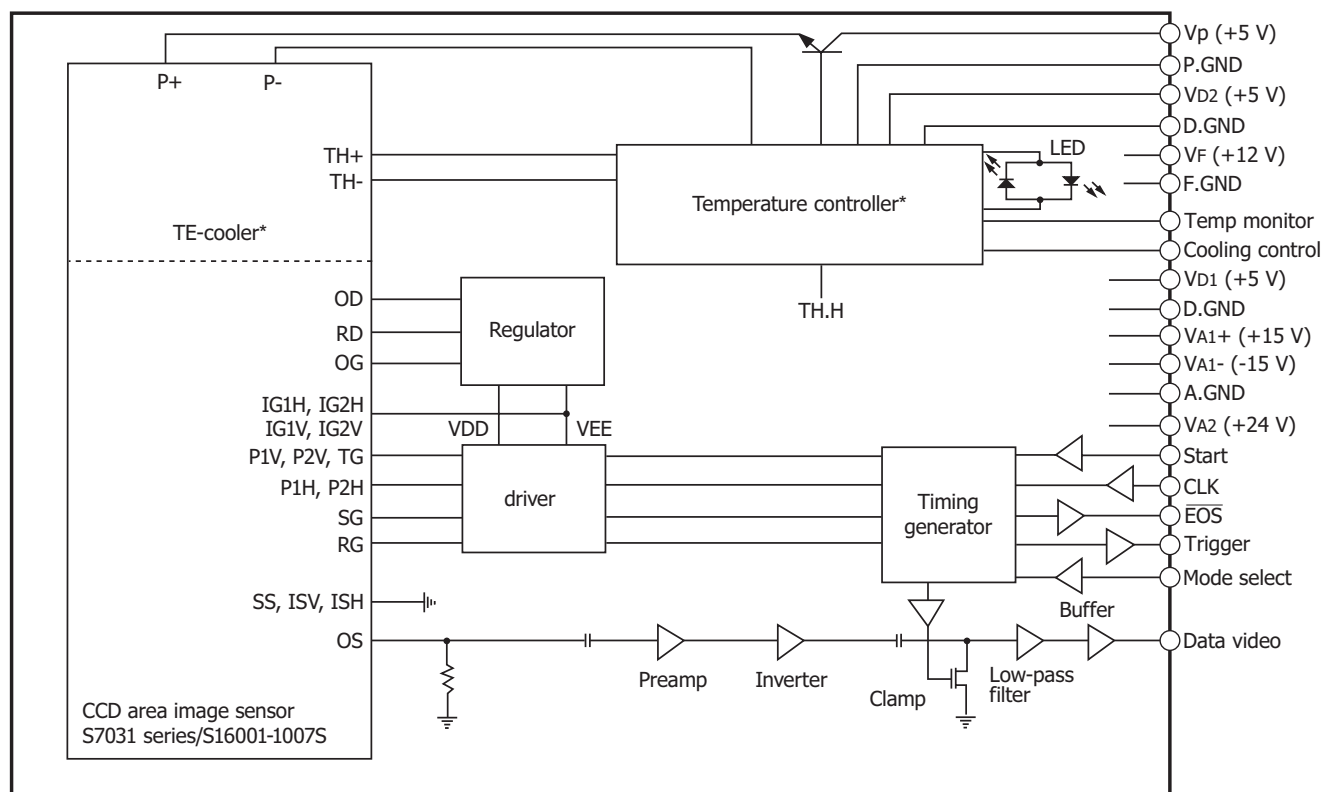
C7040A/B/C/D, C7041A/B/C/D



C7040E, C7041E



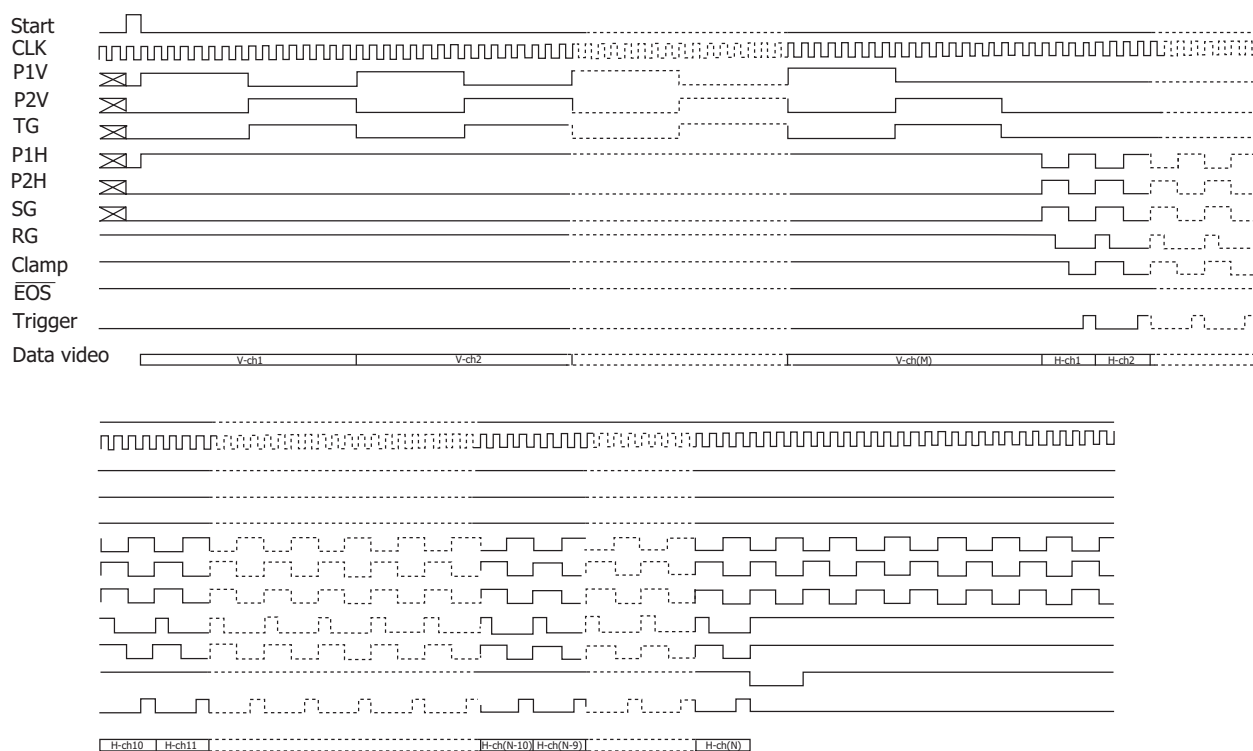
Block diagram (C7041 series)



* C7040 series does not have a temperature controller or a TE-cooler.

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Timing chart (line binning operation)

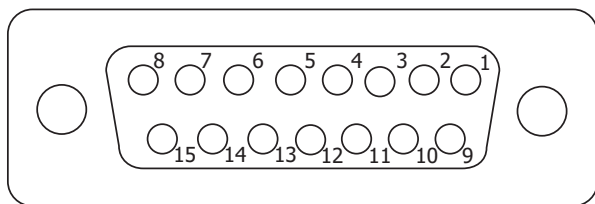


M=64, 128 N=532, 1044
 V-ch1--V-ch2, V-ch (M-3)--V-ch (M): Bevel pixels
 H-ch1--H-ch4, H-ch (N-3)--H-ch (N): Blank pixels
 H-ch5--H-ch10, H-ch (N-9)--H-ch (N-4): Bevel pixels

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Signal I/O connector pin connections

15-pin D-sub connector

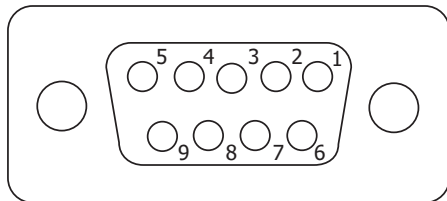


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Pin no.	Terminal name	Description
1	Mode select	Digital input signal for switching between binning and area scanning operations HCMOS compatible High level or open: Binning operation Low level: Area scanning operation
2	Data video	Analog video output signal, positive polarity
3	VA1+ (+15 V)	Analog power supply
4	VA1- (-15 V)	Analog power supply
5	VD1 (+5 V)	Digital power supply
6	Start	Digital input signal for circuit initialization HCMOS compatible, positive logic This pulse interval corresponds to the sensor's integration time.
7	CLK	Digital input signal for defining circuit operation HCMOS compatible, operates on the rising edge
8	EOS	Digital output signal indicating the end of CCD image sensor sweep HCMOS compatible, negative logic
9	A. GND	Analog ground
10	A. GND	Analog ground
11	VA2 (+24 V)	Analog power supply
12	D. GND	Digital ground
13	D. GND	Digital ground
14	D. GND	Digital ground
15	Trigger	Digital output signal for A/D conversion, HCMOS compatible, positive logic

TE-cooling controller I/O connector pin connections (C7041 series)

9-pin D-sub connector



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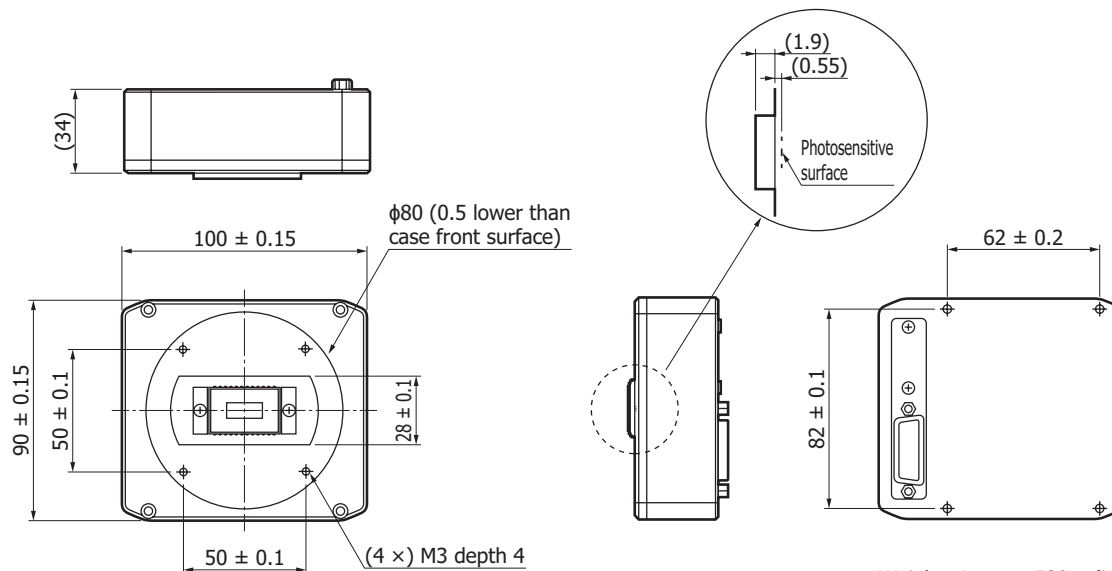
Pin no.	Terminal name	Description
1	V _{D2} (+5 V)	Digital power supply
2	Temp monitor	Analog signal output of the CCD image sensor temperature
3	Cooling control	Digital input signal for cooling start, HCMOS compatible High level or open: Cooling Low level: Standby
4	V _p (+5 V)	Power supply for the TE-cooler inside the CCD image sensor (please use AWG 18 wire).
5	V _F (+12 V)	Power supply for cooling fan
6	D. GND	Ground
7	D. GND	Ground
8	P. GND	Power supply return for the TE-cooler inside the CCD image sensor (please use AWG 18 wire).
9	F. GND	Power supply return for the cooling fan

"V_{D2}" and "V_p" can be used with the same power supply (+5 V).

Warning: Do not connect "V_{D2}" and "V_p" on the back of the 9-pin D-sub connector. Shorting them on the power supply side is acceptable.

Dimensional outline (unit: mm)

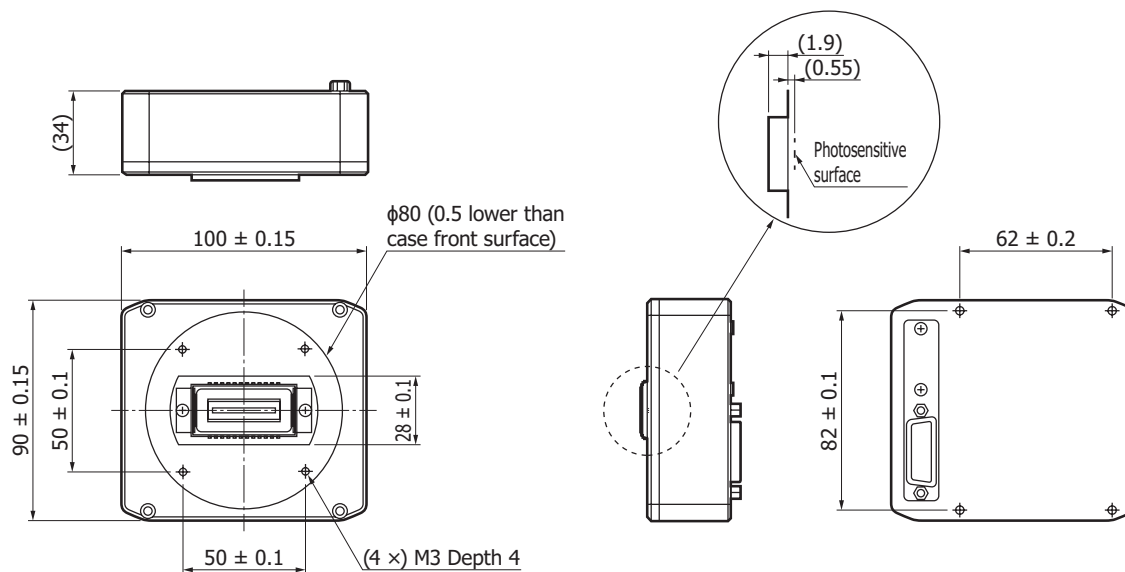
C7040A, C7040B



Weight: Approx. 530 g (including the sensor)

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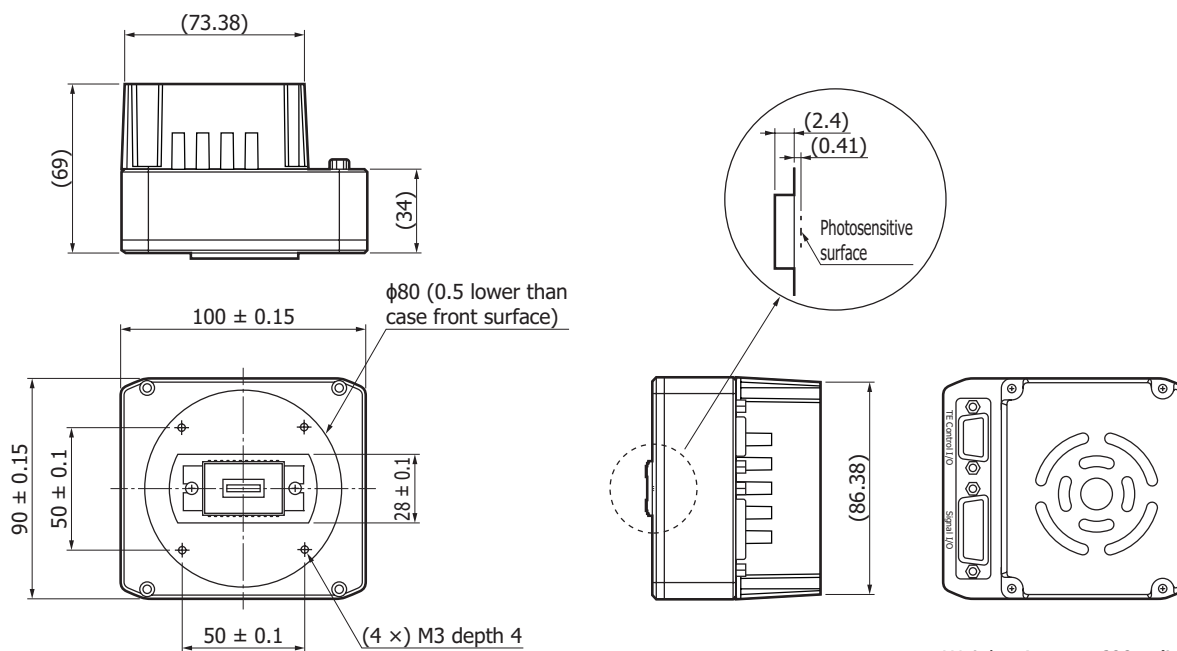
C7040C, C7040D, C7040E



Weight: Approx. 530 g (including the sensor)

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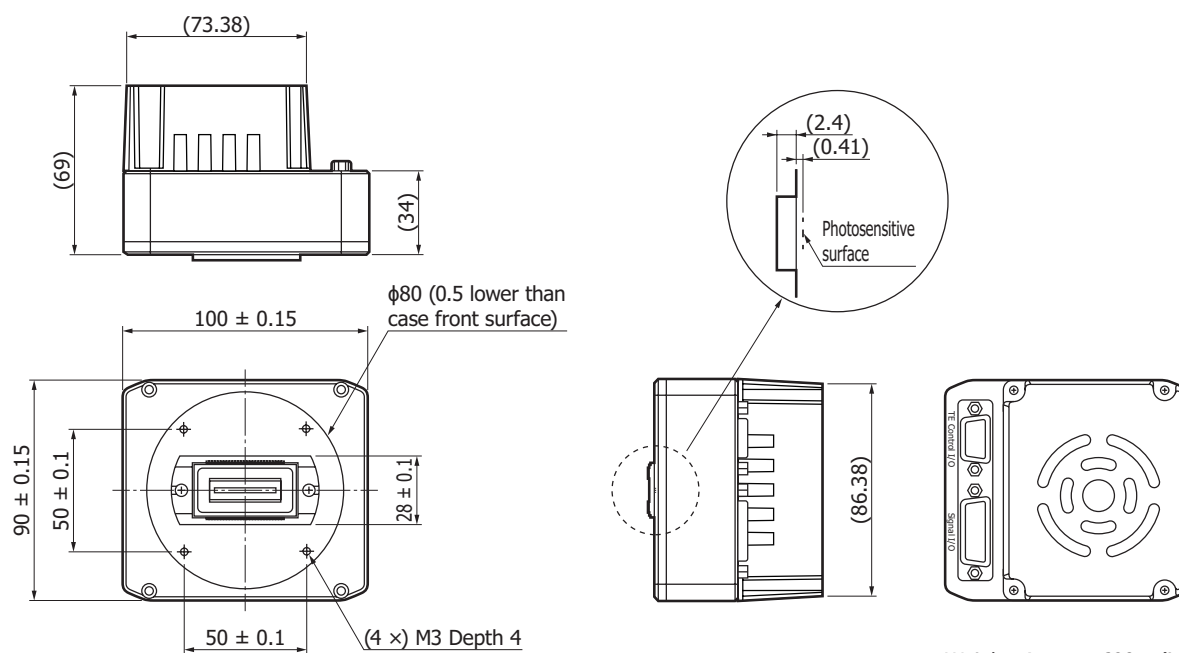
C7041A, C7041B



Weight: Approx. 690 g (including the sensor)

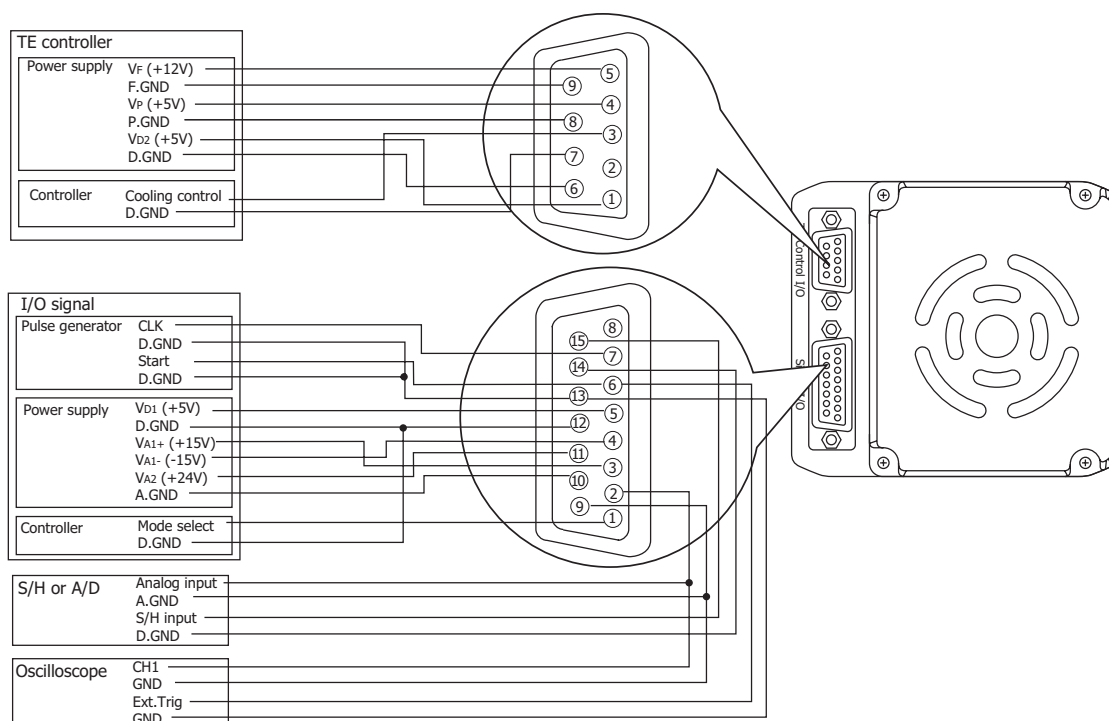
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C7041C, C7041D, C7041E



KACCA0518EA

Connection example (C7041 series)



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Related information

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

- Precautions
- Disclaimer

Image sensor module controller C7557-01

By connecting it to a Hamamatsu image sensor module and a PC, you can easily control the module and acquire data via the USB interface using the dedicated software.

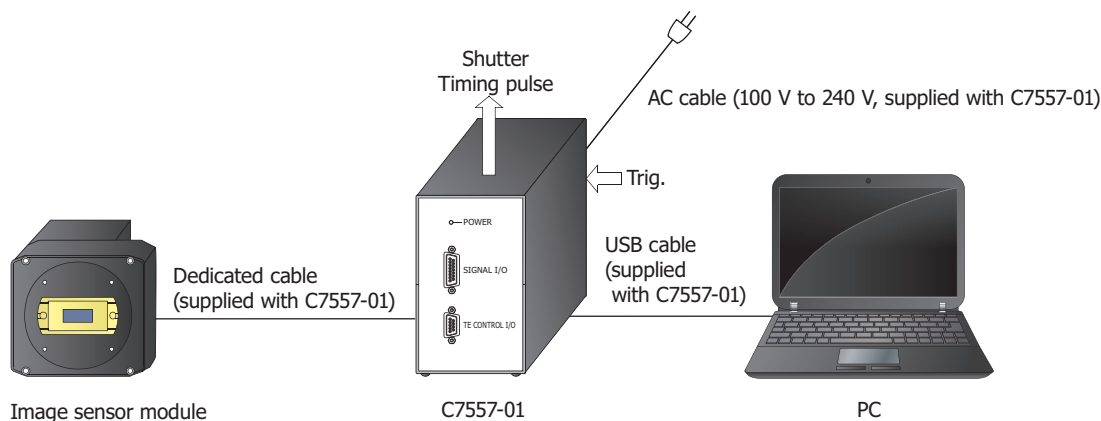
C7557-01 accessories

- Spare fuse (2.5 A)*15
- AC cable
- USB cable
- Dedicated connection cable
(for the "SIGNAL I/O" and "TE CONTROL I/O" terminals of the image sensor module)
- CD-ROM (MCD USB driver, software, instruction manual)

*15: It is built in above the AC cable inlet of the C7557-01 main unit.



Connection diagram



Note: Shutters are not available.

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Information described in this material is current as of March 2026.

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.

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