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InGaAs linear image sensor

G16823/G16824/G16825 series

Non-cooled type, single video line (128/256 pixels) Near infrared image sensor (0.9 to 1.7/1.9/2.1 µm)

The G16823/G16824/G16825 series is a compact InGaAs linear image sensor designed for near infrared multichannel spectrophotometry. It consists of an InGaAs photodiode array and a CMOS chip that contains charge amplifiers, offset compensation circuits, shift registers, and a timing generator. Charge amplifiers are configured with CMOS transistor arrays and are connected to each pixel of the InGaAs photodiode array. Since the signal from each pixel is read in charge integration mode, high sensitivity and stable operation are attained in the near infrared region. The signal processing circuit on the CMOS chip enables the selection of an optimum conversion efficiency (CE) for your application from the available two types using external voltage.
This product is smaller than previous products and uncooled. Previous long-wavelength types required TE cooling to reduce dark current. This product achieves lower dark current while being uncooled by zero bias operation compared to previous products.

Features

- **Single video line**
- **Selectable from two conversion efficiency types (CE=16 nV/e^-, 160 nV/e^-)**
- **Pixel size: 50 µm × 250 µm (G16823-128DB)**
  25 µm × 250 µm (G16823/G16824/G16825-256DG)
- **Low dark current**
- **Low power consumption**
- **Drive voltage: 3.3 V**

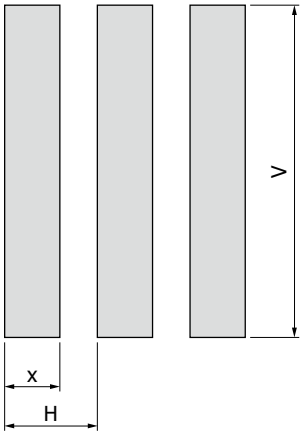
Applications

- **Near infrared multichannel spectrophotometry**
- **Process analysis device**
- **Portable analytical instruments**

Structure

Parameter	G16823-128DB	G16823/G16824/G16825-256DG	Unit
Image size	6.4 × 0.25		mm
Pixel size (H × V)	50 × 250	25 × 250	µm
Pixel pitch	50	25	µm
Number of total pixels	128	256	Pixel
Number of effective pixels	128	256	Pixel
Package	22-pin ceramic		-
Window material	Borosilicate glass with anti-reflective coating		-
Cooling	Non-cooled		-

Enlarged view of photosensitive area (unit: μm)



Type no.	x	H	V
G16823-128DB	30	50	250
G16823/G16824/G16825-256DG	10	25	250

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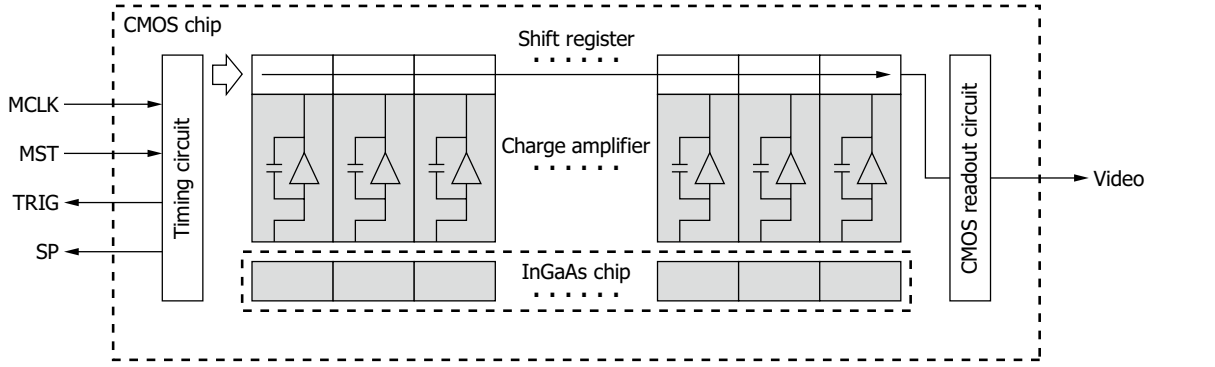
Block diagram



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Absolute maximum ratings

Parameter	Symbol	Condition	Value			Unit
			Min.	Typ.	Max.	
Supply voltage*1	Vs	Ta=25 °C	-0.3 to +4.2			V
Digital input signal voltage*2	Vi	Ta=25 °C	-0.3 to +4.2			V
Operating temperature	Topr	No dew condensation*3	-10 to +60			°C
Storage temperature	Tstg	No dew condensation*3	-20 to +70			°C

*1: Vdd, Vpdn, Vinp, Vrst, SELcf
*2: MCLK, MST
*3: 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 terminal voltage (Ta=25 °C)

Parameter		Symbol	Min.	Typ.	Max.	Unit
Power supply voltage		Vdd	3.0	3.3	3.6	V
Video line reset voltage		Vrst	2.4	2.5	2.6	V
Charge amplifier reset voltage		Vinp	2.4	2.5	2.6	V
Photodiode cathode voltage		Vpdn	2.4	2.5	2.6	V
Digital input signal voltage*4	High	Vi	Vdd-0.25	Vdd	Vdd+0.25	V
	Low		-	0	0.25	
Ground		GND	-	0	-	V

*4: MCLK, MST

Electrical characteristics (Ta=25 °C)

Parameter		Symbol	Min.	Typ.	Max.	Unit
Power supply current	128 pixel	Ivdd	-	15	25	mA
	256 pixel		-	20	30	
Video line reset current		Ivrst	-	-	1	mA
Charge amplifier reset current		Ivinp	-	-	1	mA
Photodiode cathode bias current		Ivpdn	-	-	1	mA
Master clock frequency		f(MCLK)	0.1	1	2	MHz
Data rate		DR	-	f(MCLK)	-	MHz
Video output voltage		Video(dark)	-	2.5	2.9	V
		Video(sat)	0.2	0.3	-	
Output offset voltage		Voffset	-	Vrst	-	V
Trigger/Start pulse voltage	High	Vtrig, Vsp	-	-	Vdd	V
	Low		-	-	GND	
Output impedance		Zo	-	6	-	kΩ

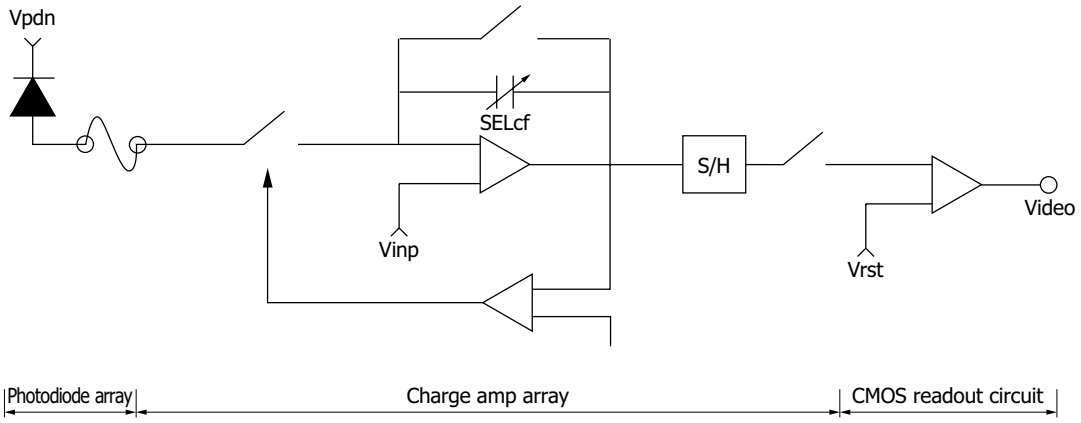
Electrical and optical characteristics [Ta=25 °C, Vdd=3.3 V, Vinp, Vpdn, Vrst=2.5 V, f(MCLK)=1 MHz]

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit
Spectral response range	G16823-128DB/-256DG	λ			0.9 to 1.7		μm
	G16824-256DG				0.9 to 1.9		
	G16825-256DG				0.9 to 2.1		
Peak sensitivity wavelength	G16823-128DB/-256DG	λp		-	1.55	-	μm
	G16824-256DG			-	1.70	-	
	G16825-256DG			-	1.85	-	
Photosensivity	G16823-128DB/-256DG	S	λ=λp	0.9	1.0	-	A/W
	G16824-256DG			1.0	1.1	-	
	G16825-256DG			1.0	1.1	-	
Conversion efficiency*5		CE	Cf=10 pF	-	16	-	nV/e⁻
			Cf=1 pF	-	160	-	
Saturation charge		Csat	CE=16 nV/e⁻	125	137.5	-	Me⁻
			CE=160 nV/e⁻	12.5	13.75	-	
Saturation output voltage*6		Vsat	CE=16 nV/e⁻	2.0	2.2	-	V
Photoresponse nonuniformity*7	G16823-128DB	PRNU	CE=16 nV/e⁻	-	±1	±5	%
	G16823-256DG			-	±1	±5	
	G16824-256DG			-	±2	±10	
	G16825-256DG			-	±3	±10	
Dark current	G16823-128DB	ID	CE=16 nV/e⁻	-3	±0.3	3	pA
	G16823-256DG			-1	±0.1	1	
	G16824-256DG			-2	±0.2	2	
	G16825-256DG			-5	±0.5	5	
Dark output	G16823-128DB	VD	CE=16 nV/e⁻	-0.3	±0.03	0.3	V/s
	G16823-256DG			-0.1	±0.01	0.1	
	G16824-256DG			-0.2	±0.02	0.2	
	G16825-256DG			-0.5	±0.05	0.5	
Readout noise	G16823-128DB	Nread	CE=16 nV/e⁻, t=10 ms	-	150	400	μVrms
			CE=160 nV/e⁻, t=1 ms	-	300	600	
	G16823-256DG		CE=16 nV/e⁻, t=10 ms	-	150	400	
			CE=160 nV/e⁻, t=10 ms	-	300	500	
	G16824-256DG		CE=16 nV/e⁻, t=100 μs	-	150	400	
			CE=160 nV/e⁻, t=100 μs	-	300	500	
	G16825-256DG		CE=16 nV/e⁻, t=100 μs	-	150	400	
			CE=160 nV/e⁻, t=100 μs	-	300	800	
Dynamic range	G16823-128DB	Drange	CE=16 nV/e⁻	5000	14600	-	-
			CE=160 nV/e⁻	3300	7300	-	
	G16823-256DG		CE=16 nV/e⁻	5000	14600	-	
			CE=160 nV/e⁻	4000	7300	-	
	G16824-256DG		CE=16 nV/e⁻	5000	14600	-	
			CE=160 nV/e⁻	4000	7300	-	
	G16825-256DG		CE=16 nV/e⁻	5000	14600	-	
			CE=160 nV/e⁻	2500	7300	-	
Defective pixels*8	G16823-128DB/-256DG	-		-	-	0	%
	G16824/G16825-256DG			-	-	2	

*5: CE=16 nV/e⁻; SELcf=0 V, CE=160 nV/e⁻; SELcf=3.3 V
*6: Vsat = |Video(sat) - Video(dark)|
Video(sat): Saturation output signal, Video(dark): Dark output signal
*7: Measured at 50 % saturation and 10 ms integration time after subtracting the dark output, excluding the first and last pixels.
*8: Pixels whose photoresponse nonuniformity, readout noise, or dark current is outside the specifications

Equivalent circuit

G16823/G16824/G16825-256DG



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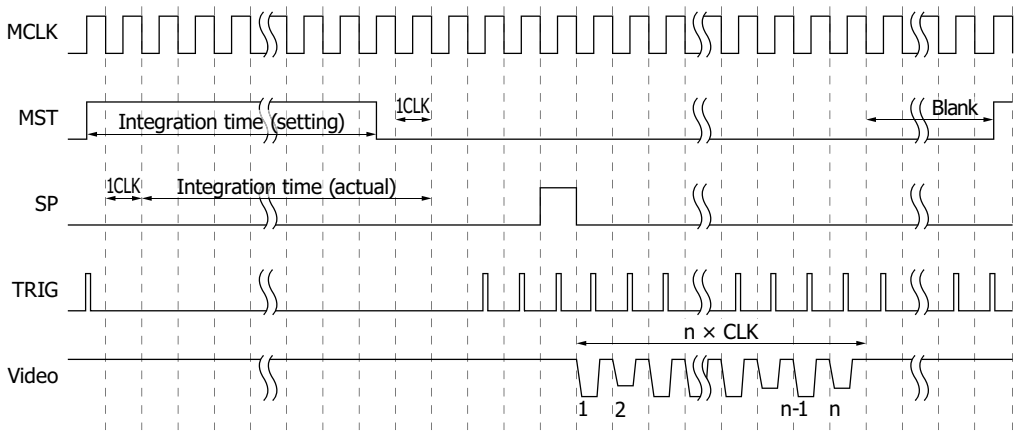
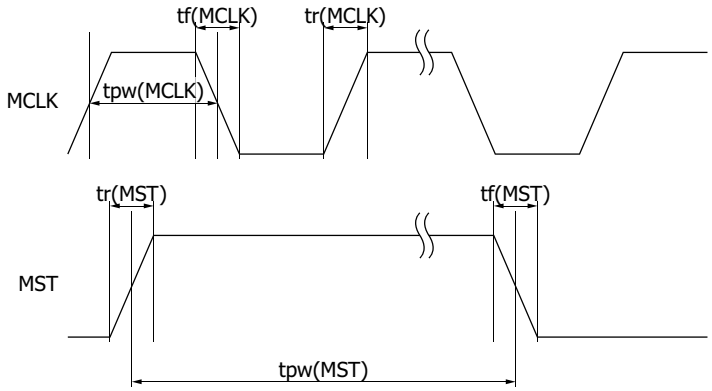
Timing chart



Note: n=number of channels



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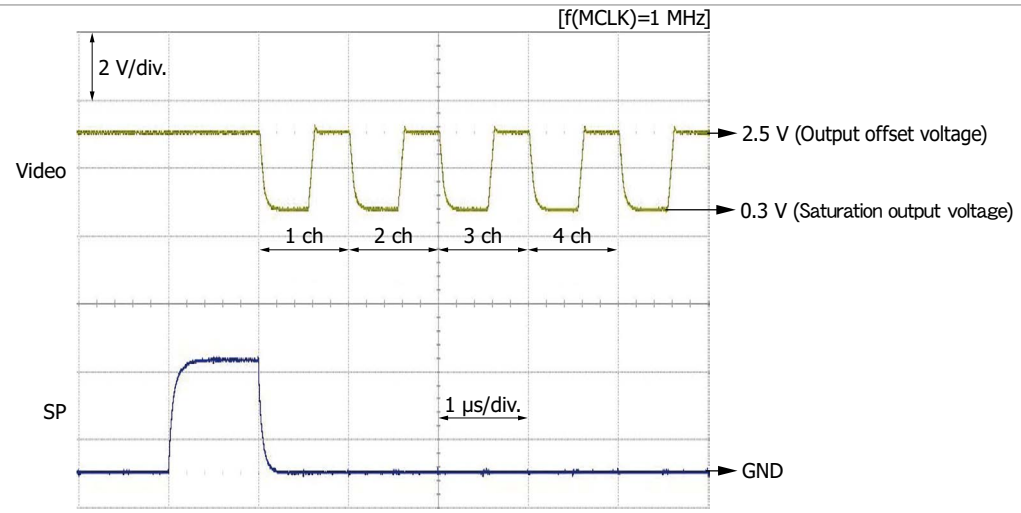
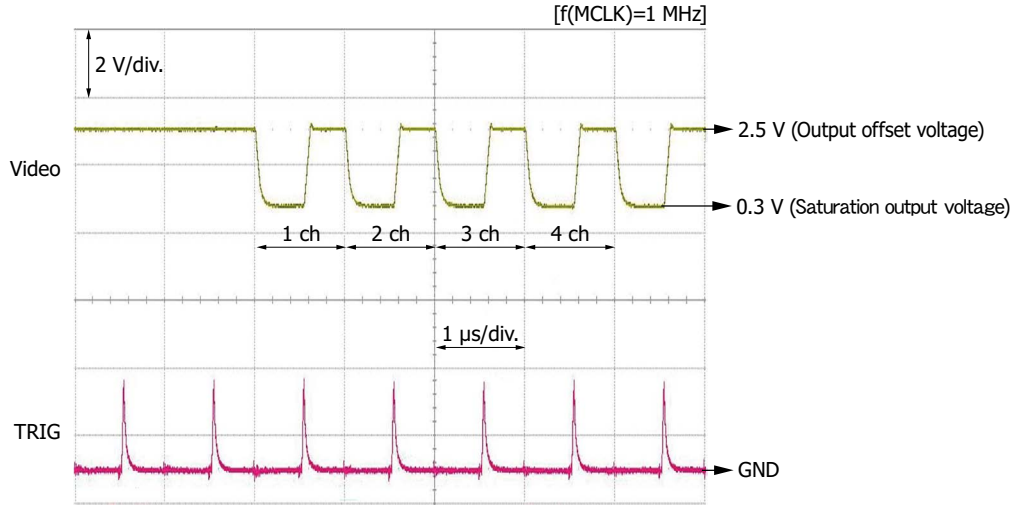
Parameter		Symbol	Min.	Typ.	Max.	Unit
Master clock frequency		f(MCLK)	0.1	1	2	MHz
Master clock width		tpw(MCLK)	150	-	5000	ns
Master clock rise and fall times		tr(MCLK), tf(MCLK)	-	20	30	ns
Master start pulse width	High	tpw(MST)	2	-	-	clocks
	Low		Number of pixels+16	-	-	
Master start pulse rise and fall times		tr(MST), tf(MST)	-	20	30	ns

Output waveform of a pixel

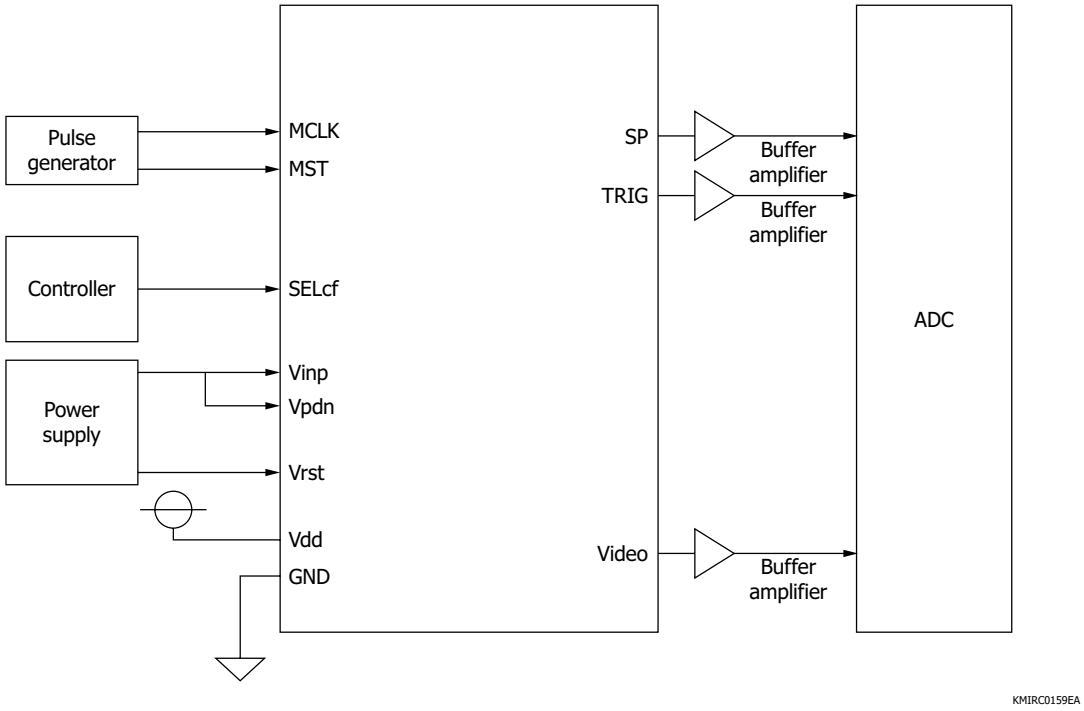
Video & SP



Video & TRIG



Connection example



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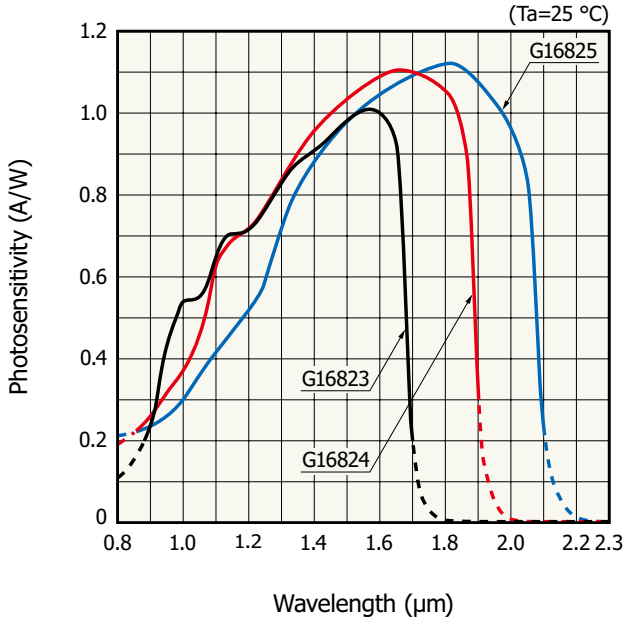
Spectral response (typical example)



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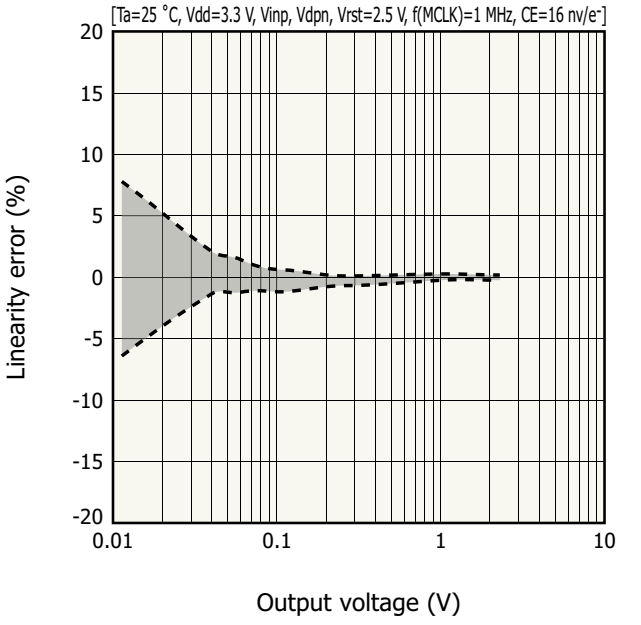
Linearity error



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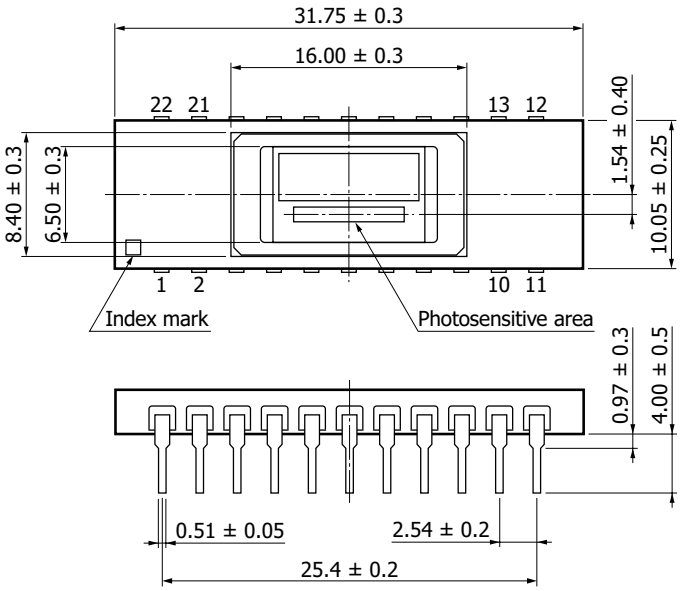
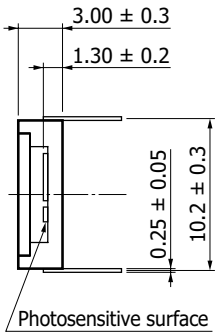
Dimensional outline (unit: mm)





Package material: Ceramic
Lead processing: Ni/Au plating
Lead material: FeNi alloy
Window material: Borosilicate glass
Window refractive index: 1.47
Window thickness: 0.75 ± 0.05
AR coating: Coated (1.55 µm peak)
Window sealing method: Resin adhesion
Center position accuracy of photosensitive area:
-0.3 ≤ X ≤ +0.3
-0.3 ≤ Y ≤ +0.3
Angle accuracy of photosensitive area:
-5° ≤ θ ≤ +5°

Pin no.	Pin connections	Pin no.	Pin connections
1	SP	12	NC
2	TRIG	13	Video
3	NC	14	NC
4	NC	15	NC
5	NC	16	GND
6	NC	17	Vdd
7	NC	18	NC
8	SELcf	19	NC
9	Vpdn	20	NC
10	Vinp	21	MST
11	Vrst	22	MCLK

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Pin connections

Pin no.	Symbol	Input/output	Function	Note
1	SP	Output	Digital start signal for A/D conversion	-
2	TRIG	Output	Sampling sync signal for A/D conversion	-
3	NC	-	-	*9
4	NC	-	-	*9
6	NC	-	-	*9
7	NC	-	-	*9
8	SELcf	Input	Gain selection signal	*10
9	Vpdn	Input	Photodiode cathode bias voltage	2.5 V*11
10	Vinp	Input	Charge amplifier reset voltage	2.5 V*11
11	Vrst	Input	Video line reset voltage	2.5 V
12	NC	-	-	*9
13	Video	Output	Video output	2.5 V to 0.3 V (Typ.)
14	NC	-	-	*9
15	NC	-	-	*9
16	GND	-	Ground	
17	Vdd	Input	Power supply (3.3 V)	3.3 V
18	NC	-	-	*9
19	NC	-	-	*9
20	NC	-	-	*9
21	MST	Input	Master start signal	-
22	MCLK	Input	Master clock signal	-

*9: No connection (Leave NC pins open; do not connect to GND.)
*10: The conversion efficiency is determined by the supply voltage to the SELcf terminal as follows.

Conversion efficiency (CE)	SELcf
16 nV/e$^-$	Low
160 nV/e$^-$	High

Low: 0 V (GND), High: 3.3 V (Vdd)
*11: Set Vpdn and Vinp to the same potential.
It is recommended to use the same power supply when supplying voltage to Vpdn and Vinp, and to short between pins.

Precautions

(1) Electrostatic countermeasures
This device has a built-in protection circuit against static electrical charges. However, to prevent destroying the device with electrostatic charges, take countermeasures such as grounding yourself, the workbench, and tools to prevent static discharges. Also protect this device from surge voltages which might be caused by peripheral equipment.

(2) Input window
If dust or stain adheres to the surface of the input window glass, it will appear as black spots on the image. When cleaning, avoid rubbing the window surface with dry cloth, dry cotton swab or the like, since doing so may generate static electricity. Use soft cloth, paper, a cotton swab, or the like moistened with alcohol to wipe off dust and stain. Then blow compressed air so that no stain remains.

(3) Soldering
Soldering temperature: 260 °C max. (10 s or less, once)
Solder the leads at a point at least 1 mm away from the package body.
Note: When you set soldering conditions, check that problems do not occur in the product by testing out the conditions in advance.

(4) Operating and storage environments
Use the device within the rated temperature range.
Operating or storing the device at an excessively high temperature and humidity may cause variations in performance characteristics and must be avoided.

Related information

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

■ Precautions
· Disclaimer
· Safety consideration
· Image sensors

■ Catalogs
· Selection guide / InGaAs image sensors
· Technical note / InGaAs linear Image sensors

Information described in this material is current as of November 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.
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.
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