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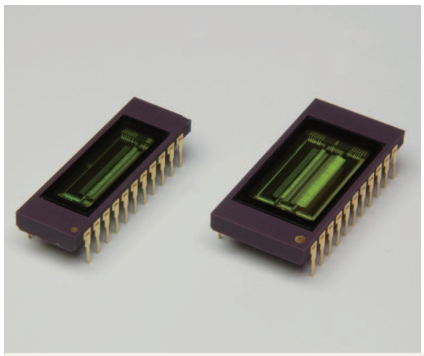
InGaAs linear image sensors



G9203-256D G9204-512D

Near infrared (0.9 to 1.7 µm) image sensors

The G9203-256D and G9204-512D are InGaAs linear image sensors that deliver high sensitivity and stability in the near infrared region. A charge amplifier array comprised of CMOS transistors, a shift register and a timing generator, etc. are assembled with an InGaAs photodiode array. Low cost is also achieved by using inexpensive ceramic packages. Feedback capacitance for the signal processing circuit formed on the CMOS chip can be selected from 10 pF or 0.5 pF by external voltage.

Features

- **Pixel pitch**
  G9203-256D: 50 µm
  G9204-512D: 25 µm
- **Low dark current**
- **Room temperature operation**
- **Selectable feedback capacitance (Cf): 10 pF or 0.5 pF**

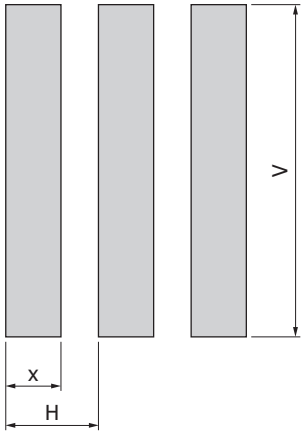
Applications

- **Near infrared spectroscopy**
- **Foreign matter detection monitors**
- **DWDM monitors**

Structure

Parameter	G9203-256D	G9204-512D	Unit
Cooling	Non-cooled		-
Image size	12.8 × 0.5		mm
Number of total pixels	256	512	pixels
Number of effective pixels	256	512	pixels
Pixel size (H × V)	50 × 500	25 × 500	µm
Pixel pitch	50	25	µm
Package	22-pin ceramic DIP (See dimensional outlines.)		-
Window material	Borosilicate glass with anti-reflective coating		-

Details of photosensitive area (unit: µm)



Type no.	x	H	V
G9203-256D	30	50	500
G9204-512D	10	25	500

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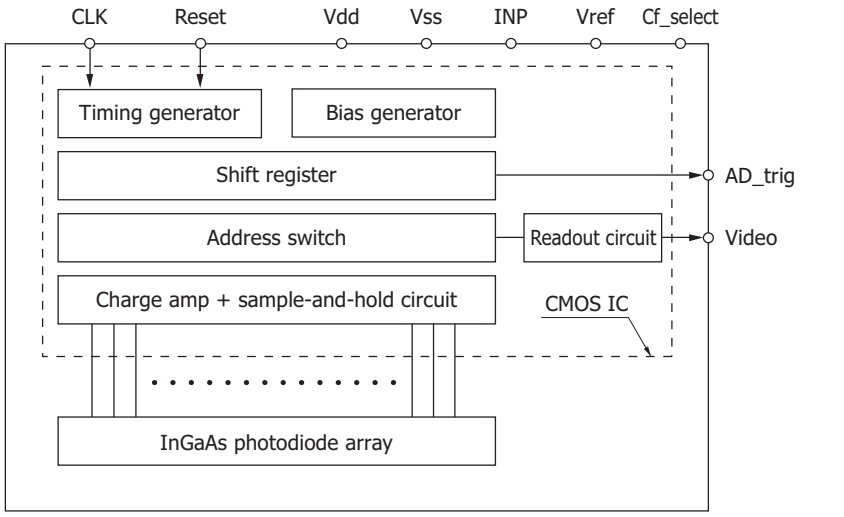
Block diagram



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Absolute maximum ratings

Parameter	Symbol	Condition	Value	Unit
Operating temperature	Topr	Chip temperature, No dew condensation*1	-40 to +70	°C
Storage temperature	Tstg	Chip temperature, No dew condensation*1	-40 to +85	°C
Soldering conditions	-		260 °C, heating time: within 5 seconds	-
Supply voltage	Vdd, INP, Vref	Ta=25 °C	-0.3 to +6	V
Clock pulse voltage	Vϕ	Ta=25 °C	-0.3 to +6	V
Reset pulse voltage	V(RES)	Ta=25 °C	-0.3 to +6	V
Gain selection terminal voltage	Vcsel	Ta=25 °C	-0.3 to +6	V

*1: 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.

Recommended terminal voltage

Parameter		Symbol	Min.	Typ.	Max.	Unit
Supply voltage		Vdd	4.9	5.0	5.1	V
		Vref	-	1.26	-	V
Element bias		INP	3.5	4.5	4.6	V
Ground		Vss	-	0	-	V
Clock pulse voltage	High	Vϕ	Vdd - 0.5	Vdd	Vdd + 0.5	V
	Low		-	0	0.4	
Reset pulse voltage	High	V(RES)	Vdd - 0.5	Vdd	Vdd + 0.5	V
	Low		0	0	0.4	

Electrical characteristics (Ta=25 °C)

Parameter		Symbol	G9203-256D			G9204-512D			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Current consumption		I(vdd)	-	45	50	-	90	100	mA
		I(Vref)	-	-	1	-	-	1	mA
		I(INP)	-	-	1	-	-	1	mA
Clock frequency		f	0.1	-	4	0.1	-	4	MHz
Video data rate		fV	0.0125	f/8	0.5	0.0125	f/8	0.5	MHz
Output voltage	High	V_H	-	4.5	INP	-	4.5	INP	V
	Low	V_L	Vref	1.26	-	Vref	1.26	-	V
Output offset voltage		Vos	-	Vref	-	-	Vref	-	V
Output impedance		Zo	-	2	-	-	2	-	kΩ

Electrical and optical characteristics (Ta=25 °C, Vdd=5 V, INP=4.5 V, Vref=1.26 V, Vf=5 V, CE=16 nV/e^-, f=250 kHz)

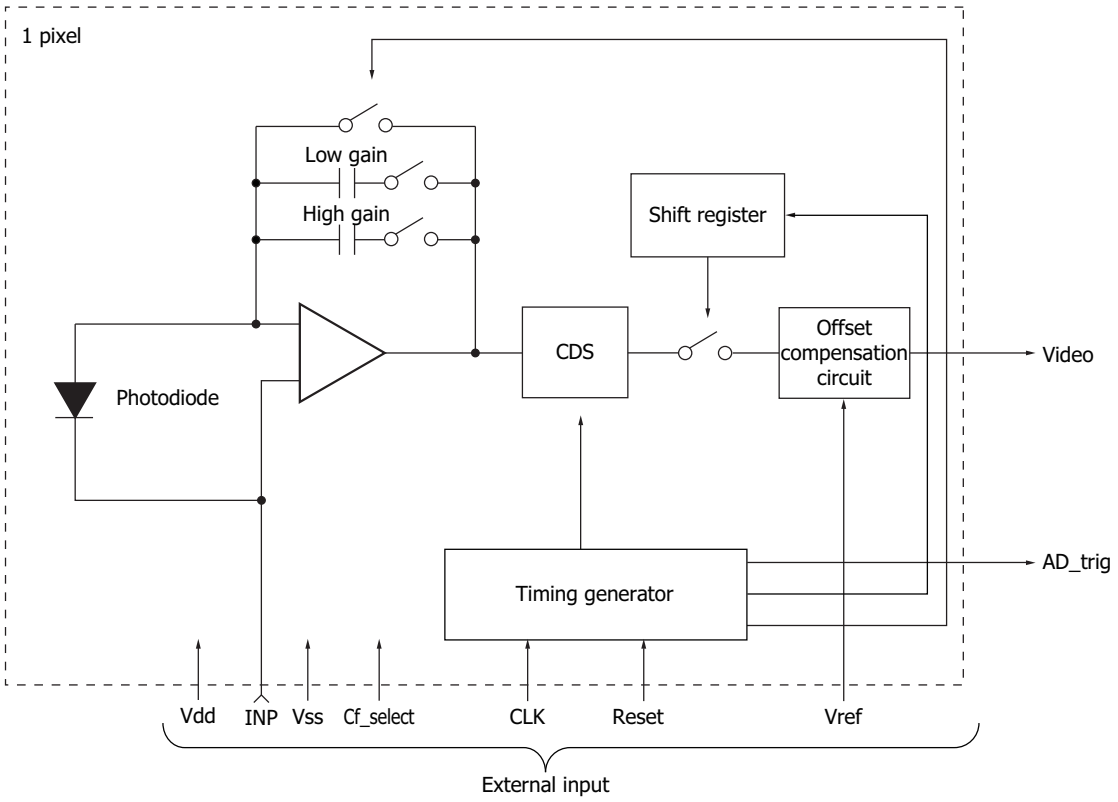
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Spectral response range	λ		-	0.9 to 1.7	-	μm
Peak sensitivity wavelength	λp		-	1.55	-	μm
Photosensitivity	S	λ=λp	0.85	0.95	-	A/W
Conversion efficiency	CE		-	16	-	nV/e^-
Photoresponse nonuniformity*2	PRNU	Integration time: 10 ms	-	±2	±5	%
Saturation output voltage	Vsat		-	3	-	V
Saturation charge	Qsat		-	187.5	-	Me^-
Readout noise	N	Integration time: 10 ms	-	180	300	μV rms
Dynamic range	D		-	16666	-	-
Defective pixels*3	-		-	-	0	%

*2: 50% of saturation, after dark output subtraction, excluding first and last pixels
*3: Pixels with photoresponse nonuniformity, readout noise or dark current higher than the maximum value

Dark output characteristics (Ta=25 °C, CE=16 nV/e^-)

Parameter	Symbol	G9203-256D			G9204-512D			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Dark output (dark output nonuniformity)	V_D	-2	0.4	2	-0.5	0.1	0.5	V/s
Dark current	I_D	-20	4	20	-5	1	5	pA

Equivalent circuit



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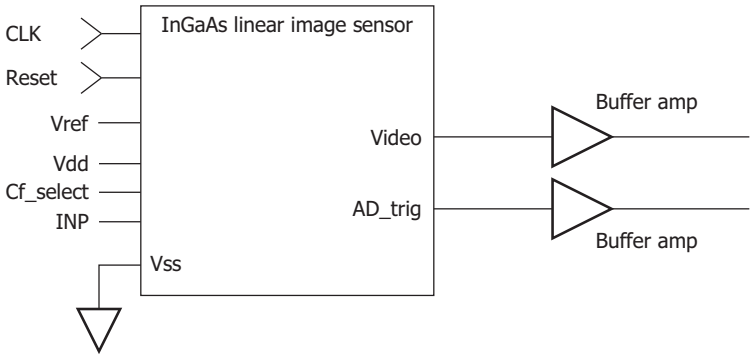
Connection example



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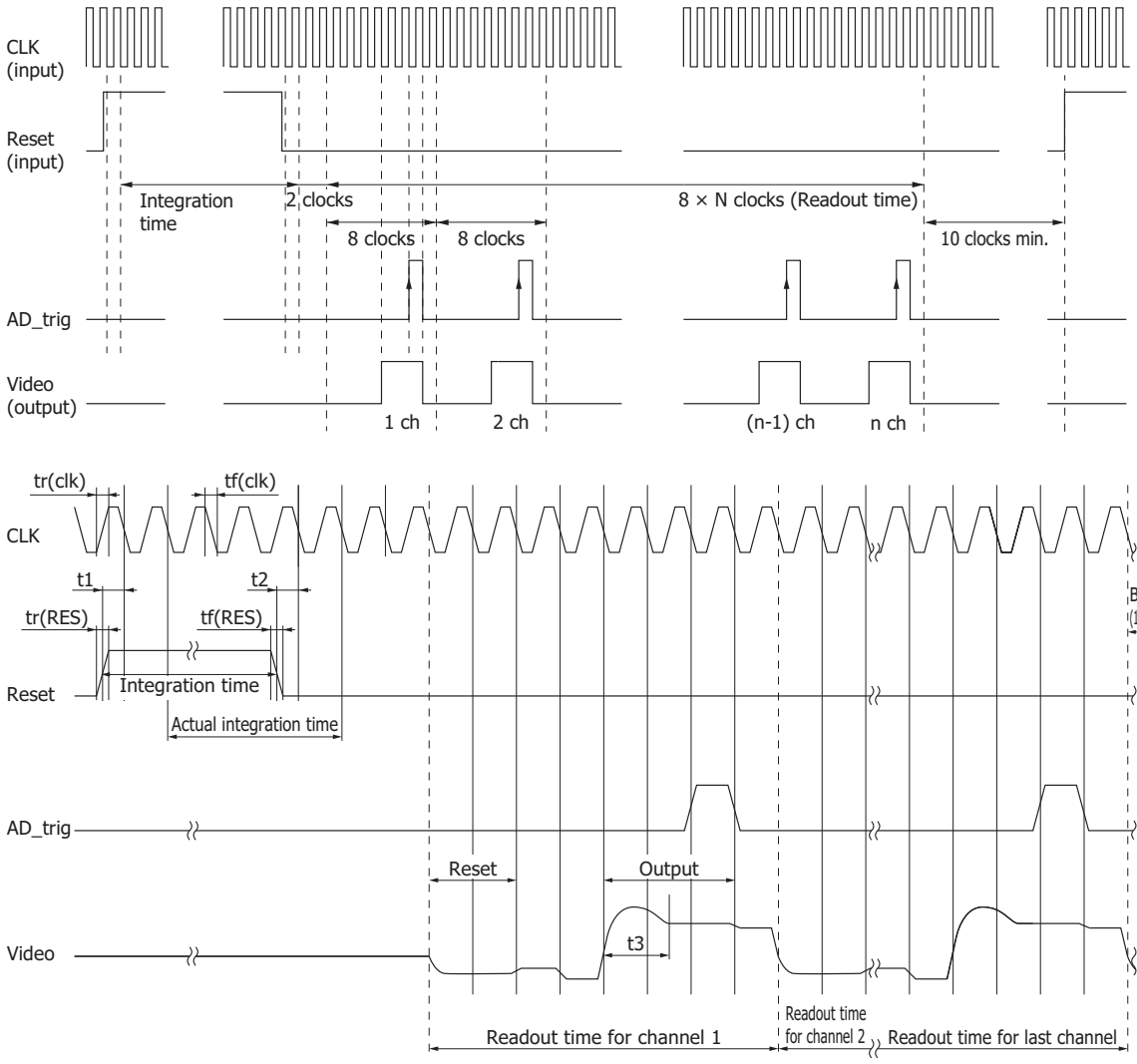
Timing chart



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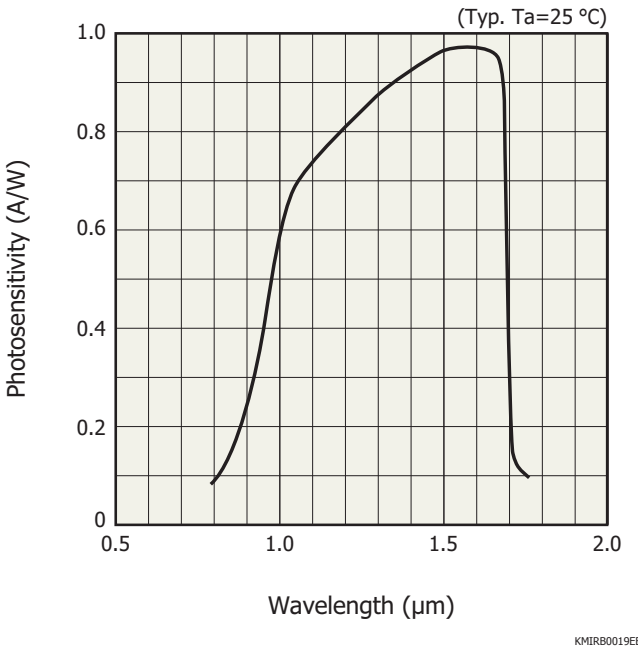
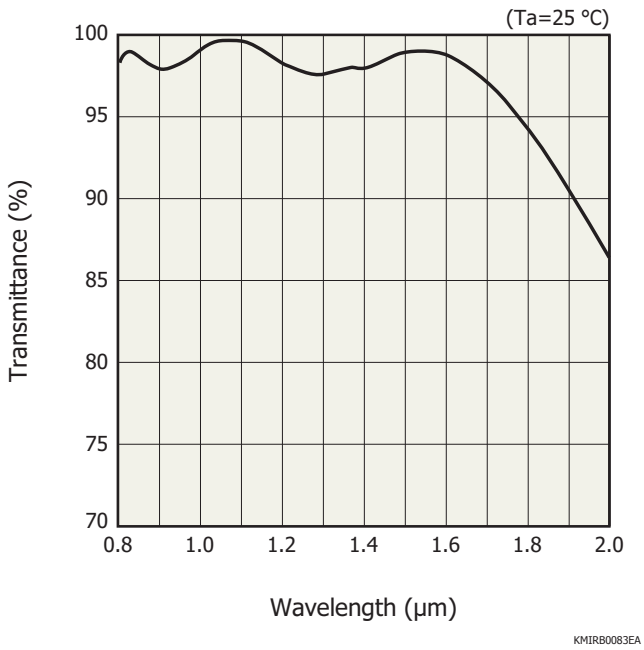
Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock pulse frequency	-	0.1	-	4	MHz
Clock pulse width	tpw(clk)	100	-	-	ns
Clock pulse rise/fall times	tr(clk), tf(clk)	0	20	100	ns
Reset pulse width	tpw(RES)	6000	-	-	ns
Reset pulse rise/fall times	tr(RES), tf(RES)	0	20	100	ns
Reset (rise) timing	t1	50	-	-	ns
Reset (fall) timing	t2	50	-	-	ns
Output settling time	t3	-	-	600	ns

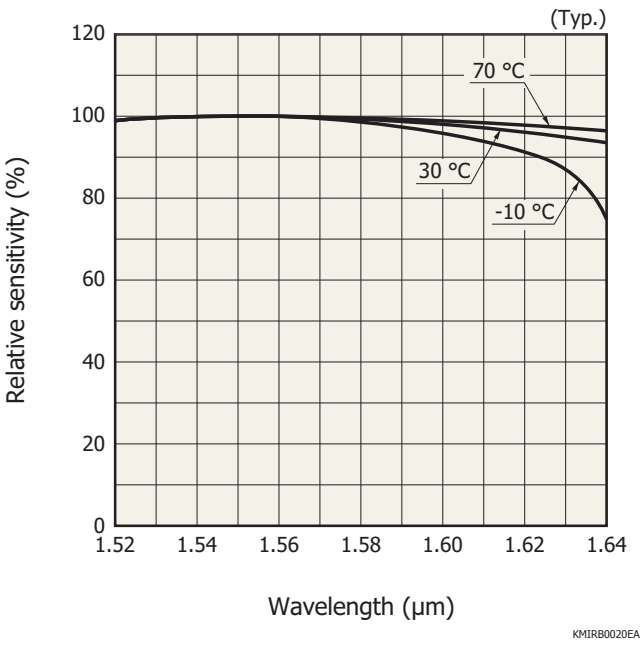
Spectral response



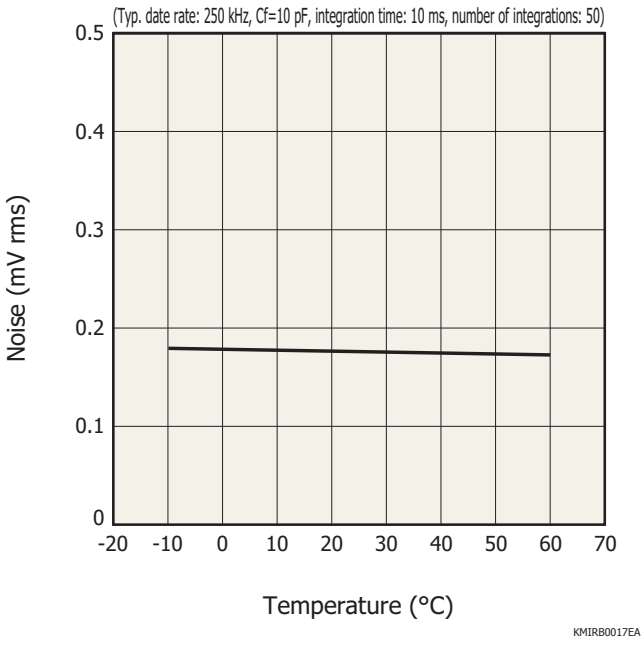
Spectral transmittance characteristics of window material (typical example)



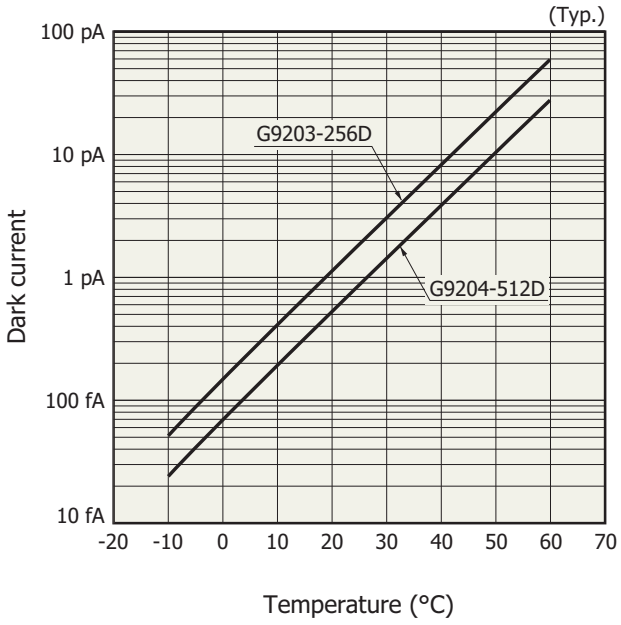
Photosensitivity temperature characteristics



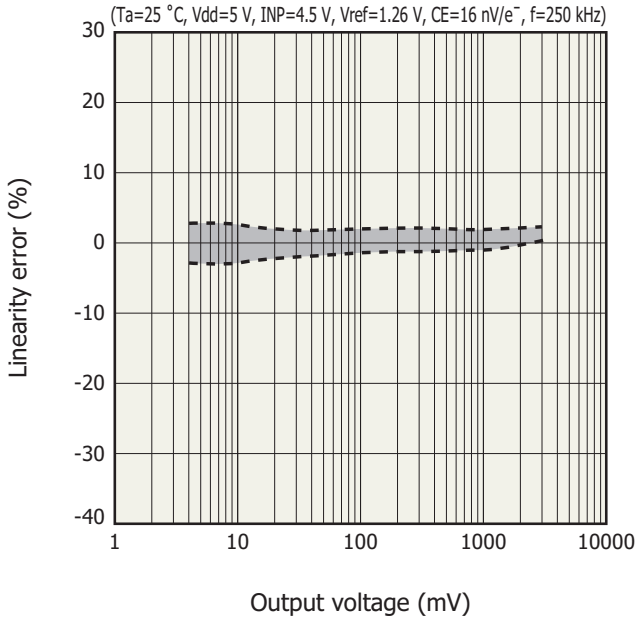
Noise vs. temperature



Dark current vs. temperature



Linearity error (G9204-512S)



Pin connections

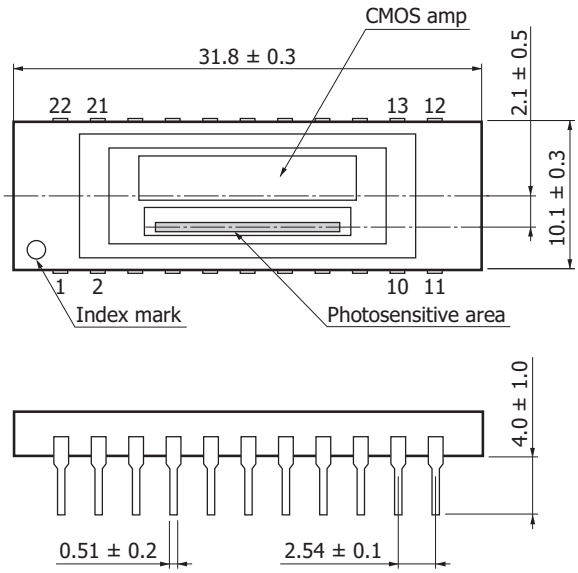
Terminal name	Input/Output	Function
CLK	Input (CMOS logic)	Clock pulse for operating the CMOS shift register
Reset	Input (CMOS logic)	Reset pulse for initializing the feedback capacitance in the charge amplifier formed in the CMOS chip. The width of the reset pulse determines integration time.
Vdd	Input	Supply voltage for operating the signal processing circuit in the CMOS chip
Vss	-	Ground for the signal processing circuit in the CMOS chip
INP	Input	Reset voltage for the charge amplifier array in the CMOS chip
Cf_select	Input	Voltage that determines the conversion efficiency in the CMOS chip. Low gain (CE=16 nV/e⁻) at 0 V, and high gain (CE=320 nV/e⁻) at 5 V.
Vref	Input	Reset voltage for the offset compensation circuit in the CMOS chip
AD_trig	Output	Digital signal for A/D conversion; positive polarity
Video	Output	Analog video signal; positive polarity

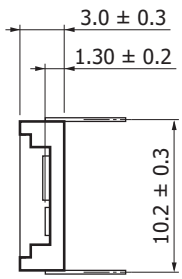
Conversion efficiency	Cf-SELECT
16 nV/e⁻ (Cf=10 pF)	High
320 nV/e⁻ (Cf=0.5 pF)	Low

Low: 0 V (GND), High: 5 V (Vdd)

Dimensional outlines (unit: mm)

G9203-256D





Lead treatment: Ni/Au plating
Lead material: FeNi alloy
Refractive index of window material: 1.47
Window material thickness: 0.75 ± 0.05
AR coat: coated (1.55 µm peak)
Window sealing method: resin bonding
Center accuracy of photosensitive area: -0.3≤X≤+0.3
-0.5≤Y≤+0.5
Rotation accuracy of photosensitive area: -5°≤θ≤+5°

Pin no.	Pin connection	Pin no.	Pin connection
1	NC	12	Video
2	NC	13	Vref
3	NC	14	CLK
4	NC	15	NC
5	NC	16	INP
6	NC	17	Vss
7	NC	18	Vdd
8	NC	19	NC
9	NC	20	AD_trig
10	NC	21	Reset
11	NC	22	Cf_select

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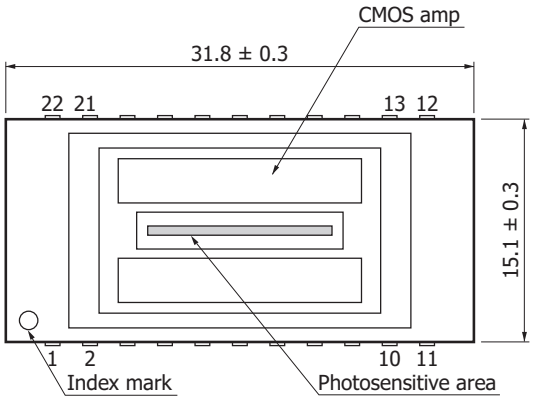
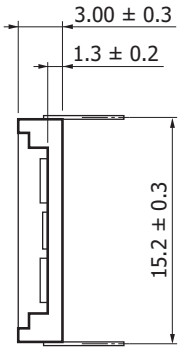
G9204-512D





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-0.3≤Y≤+0.3
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Pin no.	Pin connection	Pin no.	Pin connection
1	NC	12	Video_odd
2	Reset_even	13	Vref
3	AD_trig_even	14	CLK_odd
4	NC	15	NC
5	NC	16	INP
6	NC	17	Vss
7	NC	18	Vdd
8	NC	19	NC
9	CLK_even	20	AD_trig_odd
10	NC	21	Reset_odd
11	Video_even	22	Cf_select

"_even" for even no. pixels
"_odd" for odd no. pixels

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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.

Related information

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

■ Precautions

· Disclaimer
· Image sensors

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