CMOS linear image sensor **S9226**

Built-in timing generator and signal processing circuit; single 3.3 V supply operation



S9226 is a small CMOS linear image sensor designed for image input applications. The signal processing circuit has a charge amplifier with excellent input/output characteristics.

Features

- Pixel pitch: 7.8 μm
 Pixel height: 125 μm
- Number of pixels: 1024 ch
- Single 3.3 V power supply operation available
- High sensitivity, low dark current, low noise
- On-chip charge amplifier with excellent input/output characteristics
- Built-in timing generator allows operation with only start and clock pulse inputs
- Video data rate: 200 kHz Max.
- Spectral response range: 400 to 1000 nm
- 8-pin DIP, 16-pin surface mount type also available

Applications

- Analytical equipment
- Position detection
- Image reading

■ Absolute maximum ratings

Parameter	Symbol	Value	Unit
Supply voltage	Vdd	-0.3 to +6	V
Gain selection terminal voltage	Vg	-0.3 to +6	V
Clock pulse voltage	V (CLK)	-0.3 to +6	V
Start pulse voltage	V (ST)	-0.3 to +6	V
Operating temperature *1	Topr	-5 to +60	ŷ
Storage temperature	Tstg	-10 to +70	°C

^{*1:} No condensation

■ Shape specifications

Shape specifications		
Parameter	Value	Unit
Number of pixels	1024	-
Pixel pitch	7.8	μm
Pixel height	125	μm
Active area length	7.9872	mm
Window material	TEMPAX	_



■ Recommended terminal voltage

Parameter		Symbol	Min.	Тур.	Max.	Unit
Supply voltage		Vdd	3.3	5	5.25	V
Gain selection	High gain	Va	-	0	-	V
terminal voltage	Low gain	Vg	Vdd-0.25	Vdd	Vdd+0.25	V
Clock pulse voltage	High	V (CLK)	Vdd-0.25	Vdd	Vdd+0.25	V
	Low		-	0	-	V
Start pulse voltage	High	V/(CT)	Vdd-0.25	Vdd	Vdd+0.25	V
	Low	V (ST)	-	0	-	V

■ Electrical characteristics [Ta=25 °C, Vdd=5 V, V (CLK)=V (ST)=5 V]

Parameter		Symbol	Min.	Typ.	Max.	Unit
Clock pulse frequency		f (CLK)	10	-	800	kHz
Video data rate		VR	-	f (CLK)/4	-	kHz
Power consumption		Р	-	25	30	mW
Conversion efficiency	Low gain	CE	-	1.6	-	μV/e ⁻
High gain		CE	ı	3.2	-	μν/e
Output impedance *2		Zo	-	185	-	Ω

■ Electrical and optical characteristics [Ta=25 °C, Vdd=5 V, V (CLK)=V (ST)=5 V]

Parameter		Symbol	Min.	Тур.	Max.	Unit
Spectral response range		λ	400 to 1000			nm
Peak sensitivity wavele	ngth	λр	-	700	-	nm
Dark current		ΙD	-	3	30	fA
Dark output valtage *3	High gain	Vd	-	0.6	6	mV
Dark output voltage *3	Low gain		-	0.3	3	
Saturation output voltage *4		Vsat	2	3	-	V
Doodout noice	High gain	NI.	-	0.6	2	mV rms
Readout noise	Low gain	Nr	-	0.3	1	mv ms
Offset output voltage		Vo	-	0.3	0.6	V
Photo response non-uniformity *5 *6		PRNU	-5	-	+5	%

^{*2:} An increased current consumption at the video terminal rises the sensor chip temperature causing an increased dark current. Connect a buffer amplifier for impedance conversion to the video terminal so that the current flowing to the video terminal is minimized.

Use a JFET or CMOS input, high-impedance input op amp as the buffer amplifier.

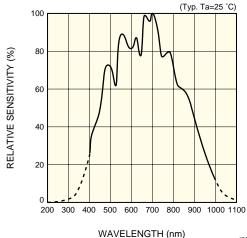
- *3: Storage time Ts=100 ms
- *4: Voltage difference with respect to Vo, Ts=10 ms
- *5: Uniformity is defined under the condition that the device is uniformly illuminated by light which is 50 % of the saturation exposure level and using 1022 pixels excluding both ends pixels as follows:

 PRNU= \(\Delta X/X \times 100 \) (%)

Where X is the average output of all pixels and ΔX is the difference between X and maximum or minimum output and X.

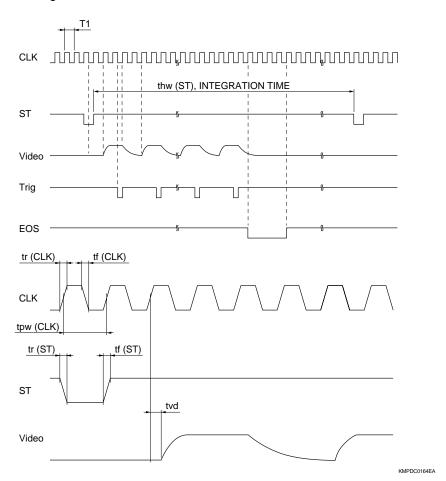
*6: Measured with a tungsten lamp of 2856 K

■ Spectral response (typical example)



KMPDB0229EC

■ Timing chart

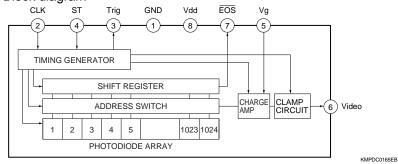


Parameter	Symbol	Min.	Тур.	Max.	Unit
Start pulse high time	thw (ST)	T1 × 4102	-	-	μs
Start pulse rise and fall time	tr (ST), tf (ST)	0	20	30	ns
Clock pulse width	tpw (CLK), T1	1.25	-	100	μs
Clock pulse rise and fall time	tr (CLK), tf (CLK)	0	20	30	ns
Video delay time	tvd	10	20	30	ns

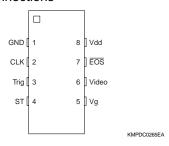
Note: The CLK pulse should be set from high to low just once when the ST pulse is low. The internal shift register starts operating at this timing.

The storage time is determined by the start pulse intervals. However, since the charge storage of each pixel is carried out between the signal readout of that pixel and the next signal readout of the same pixel, the start time of charge storage differs depending on each pixel. In addition, the next start pulse cannot be input until signal readout from all pixels is completed.

■ Block diagram

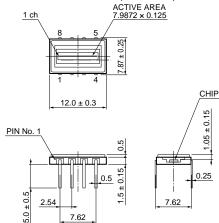


■ Pin connections



Pin No.	Symbol	Name of pin	I/O
1	GND	Ground	I
2	CLK	Clock pulse	1
3	Trig	Trigger pulse	0
4	ST	Start pulse	
5	Vg	Gain selection voltage	I
6	Video	Video output	0
7	EOS	End of scan	0
8	Vdd	Supply voltage	l

■ Dimensional outline (unit: mm)



KMPDA0172FA

■ Precautions during use

(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) Incident window

If dust or dirt gets on the light incident window, it will show up as black blemishes on the image. When cleaning, avoid rubbing the window surface with dry cloth or dry cotton swab, since doing so may generate static electricity. Use soft cloth, paper or a cotton swab moistened with alcohol to wipe dust and dirt off the window surface. Then blow compressed air onto the window surface so that no spot or stain remains.

(3) Soldering

To prevent damaging the device during soldering, take precautions to prevent excessive soldering temperatures and times. Soldering should be performed within 5 seconds at a soldering temperature below 260 °C.

(4) Operating and storage environments

Always observe the rated temperature range when handling the device. Operating or storing the device at an excessively high temperature and humidity may cause variations in performance characteristics and must be avoided.

Information furnished by HAMAMATSU is believed to be reliable. However, no responsibility is assumed for possible inaccuracies or omissions. Specifications are subject to change without notice. No patent rights are granted to any of the circuits described herein. ©2007 Hamamatsu Photonics K.K.

HAMAMATSU PHOTONICS K.K., Solid State Division

1126-1 Ichino-cho, Higashi-ku, Hamamatsu City, 435-8558 Japan, Telephone: (81) 53-434-3311, Fax: (81) 53-434-5184, www.hamamatsu.com
U.S.A.: Hamamatsu Corporation: 360 Foothill Road, P.O.Box 6910, Bridgewater, N.J. 08807-0910, U.S.A., Telephone: (1) 908-231-0960, Fax: (1) 908-231-1218
Germany: Hamamatsu Photonics Deutschland GmbH: Arzbergerstr. 10, D-82211 Herrsching am Ammersee, Germany, Telephone: (49) 08152-3750, Fax: (49) 08152-2658
France: Hamamatsu Photonics France S.A.R.L.: 19, Rue du Saule Trapu, Parc du Moulin de Massy, 91882 Massy Cedex, France, Telephone: 33-(1) 69 53 71 00, Fax: 33-(1) 69 53 71 00
United Kingdom: Hamamatsu Photonics UK Limited: 2 Howard Court, 10 Tewin Road, Welwyn Garden City, Hertfordshire AL7 1BW, United Kingdom, Telephone: (44) 1707-294888, Fax: (44) 1707-325777
North Europe: Hamamatsu Photonics Norden AB: Smidesvägen 12, SE-171 41 Solna, Sweden, Telephone: (46) 8-509-031-00, Fax: (46) 8-509-031-01
Italy: Hamamatsu Photonics Italia S.R.L.: Strada della Moia, 1/E, 20020 Arese, (Milano), Italy, Telephone: (39) 02-935-81-733, Fax: (39) 02-935-81-741