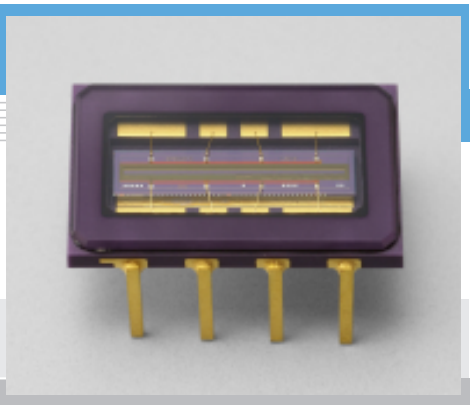
CMOS linear image sensor
S9226



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	°C
Storage temperature	Tstg	-10 to +70	°C

*1: No condensation

■ 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	-

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■ Recommended terminal voltage

Parameter		Symbol	Min.	Typ.	Max.	Unit
Supply voltage		Vdd	3.3	5	5.25	V
Gain selection terminal voltage	High gain	Vg	-	0	-	V
	Low gain		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 (ST)	Vdd-0.25	Vdd	Vdd+0.25	V
	Low		-	0	-	V

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

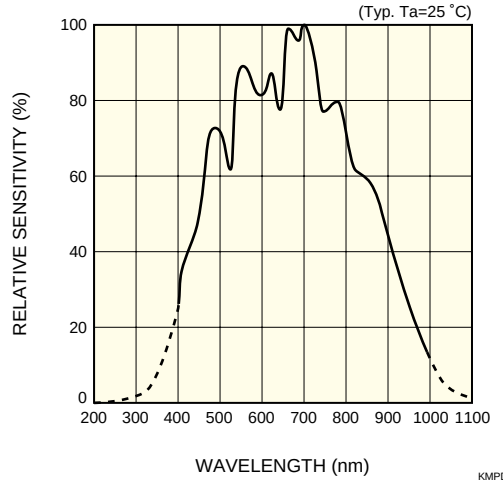
Parameter		Symbol	Min.	Typ.	Max.	Unit
Clock pulse frequency		f (CLK)	10	-	800	kHz
Video data rate		VR	-	f (CLK)/4	-	kHz
Power consumption		P	-	25	30	mW
Conversion efficiency	Low gain	CE	-	1.6	-	μV/e⁻
	High gain		-	3.2	-	
Output impedance *2		Zo	-	185	-	Ω

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

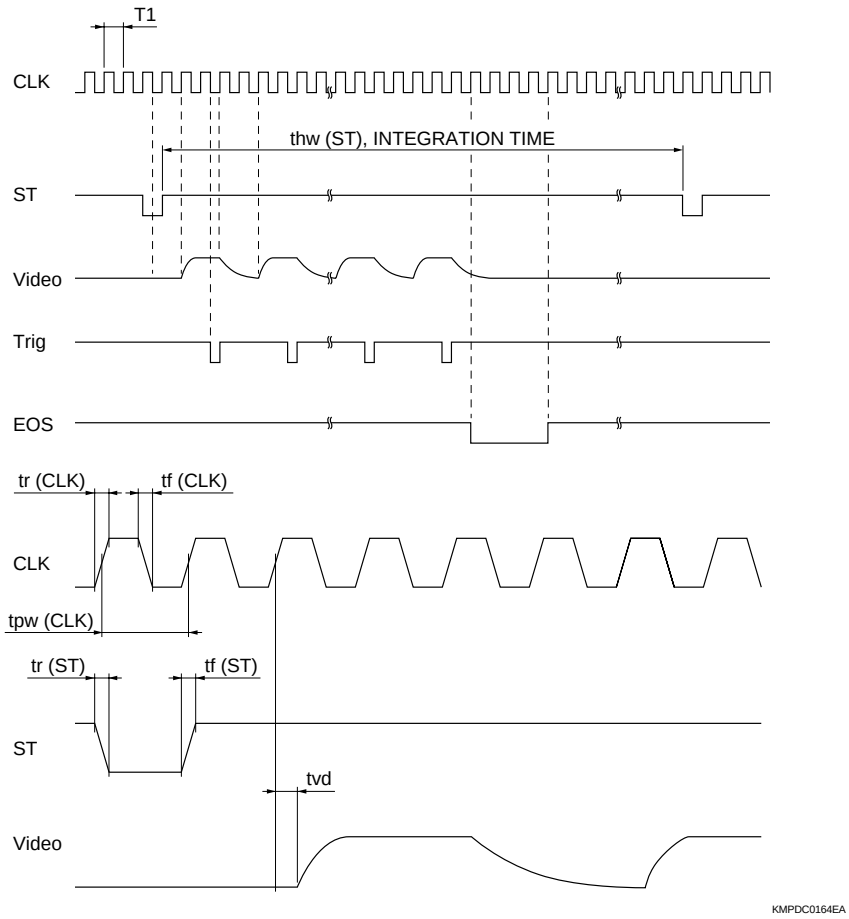
Parameter		Symbol	Min.	Typ.	Max.	Unit
Spectral response range		λ	400 to 1000			nm
Peak sensitivity wavelength		λp	-	700	-	nm
Dark current		ID	-	3	30	fA
Dark output voltage *3	High gain	Vd	-	0.6	6	mV
	Low gain		-	0.3	3	
Saturation output voltage *4		Vsat	2	3	-	V
Readout noise	High gain	Nr	-	0.6	2	mV rms
	Low gain		-	0.3	1	
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= ΔX/X × 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)



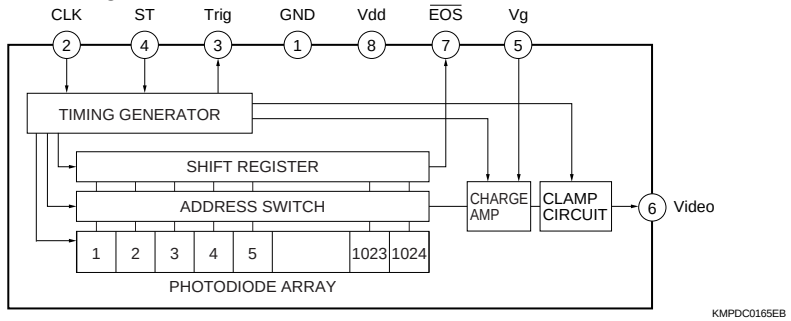
■ Timing chart



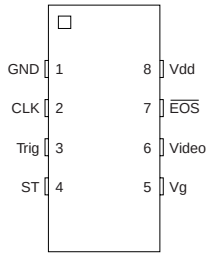
Parameter	Symbol	Min.	Typ.	Max.	Unit
Start pulse high time	thw (ST)	T1 × 4102	-	-	µs
Start pulse rise and fall time	tr (ST), tf (ST)	0	20	30	ns
Clock pulse width	tpw (CLK), T1	1.25	-	100	µs
Clock pulse rise and fall time	tr (CLK), tf (CLK)	0	20	30	ns
Video delay time	tvd	10	20	30	ns

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



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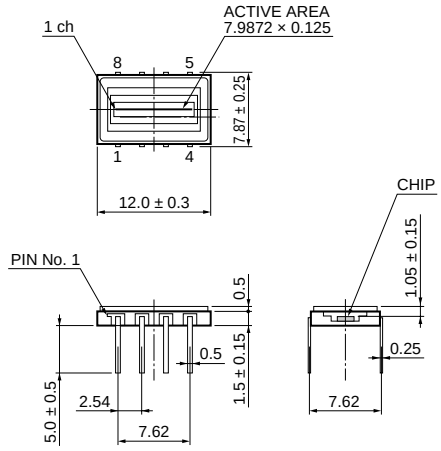
Pin No.	Symbol	Name of pin	I/O
1	GND	Ground	I
2	CLK	Clock pulse	I
3	Trig	Trigger pulse	O
4	ST	Start pulse	I
5	Vg	Gain selection voltage	I
6	Video	Video output	O
7	$\overline{EOS}$	End of scan	O
8	Vdd	Supply voltage	I

■ Dimensional outline (unit: mm)



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■ 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.

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