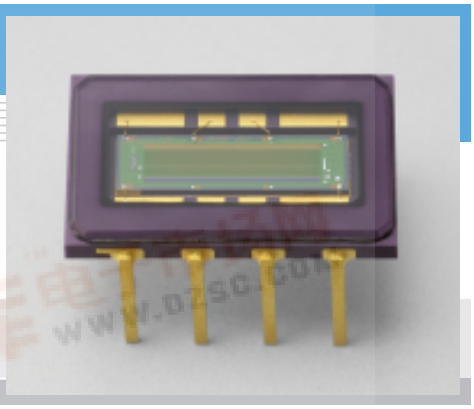
IMAGE SENSOR

CMOS linear image sensor
S9227



High-speed readout, simultaneous integration

S9227 is a small CMOS linear image sensor designed for image input applications. Signal charge is integrated on all pixels simultaneously and then read out at high speeds of 5 MHz.

Features

- Pixel pitch: 12.5 µm
  Pixel height: 250 µm
- Number of pixels: 512 ch
- Single 5 V power supply operation
- Video data rate: 5 MHz Max.
- Simultaneous charge integration
- Shutter function
- High sensitivity, low dark current, low noise
- Built-in timing generator allows operation with only start and clock pulse inputs
- Spectral response range: 400 to 1000 nm
- 8-pin DIP, 16-pin surface mount type also available

Applications

- Position detection
- Image reading

■ Absolute maximum ratings

Parameter	Symbol	Value	Unit
Supply voltage	Vdd	-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

■ Mechanical specifications

Parameter	Value	Unit
Number of pixels	512	-
Pixel pitch	12.5	µm
Pixel height	250	µm
Active area length	6.4	mm
Window material	TEMPAX	-

■ Recommended terminal voltage

Parameter		Symbol	Min.	Typ.	Max.	Unit
Supply voltage		Vdd	4.75	5	5.25	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]

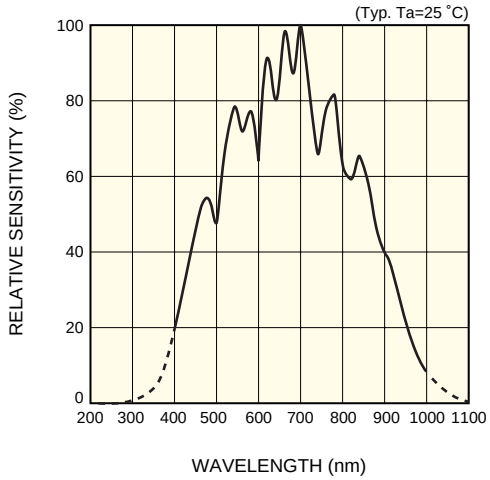
Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock pulse frequency	f (CLK)	0.05	-	5	MHz
Video data rate	VR	-	f (CLK)	-	MHz
Power consumption	P	-	150	180	mW
Conversion efficiency	CE	-	1.6	-	μV/e^-
Output impedance *2	Zo	-	50	200	Ω

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

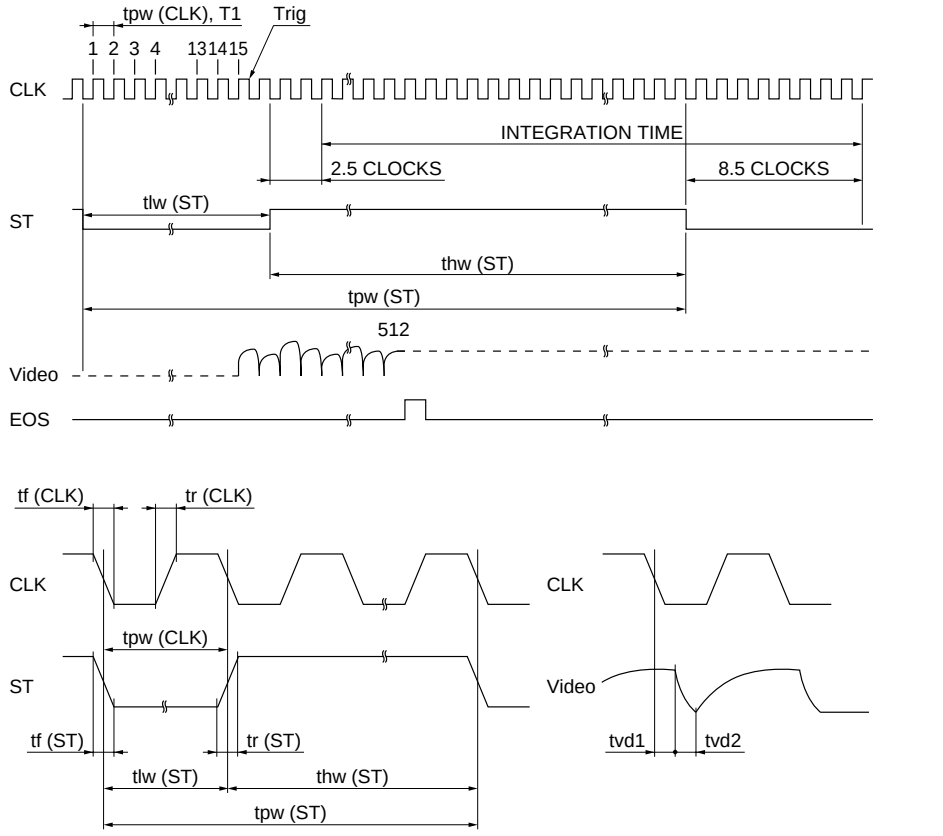
Parameter	Symbol	Min.	Typ.	Max.	Unit
Spectral response range	λ		400 to 1000		nm
Peak sensitivity wavelength	λp	-	700	-	nm
Dark current	ID	-	5	50	fA
Saturation charge	Qsat	320	420	-	fC
Dark output voltage *3	Vd	-	0.5	5	mV
Saturation output voltage *4	Vsat	3.2	4.2	-	V
Readout noise	Nr	-	0.4	1.0	mV rms
Offset output voltage	Vo	-	0.6	1.0	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=10 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 510 pixels excluding both ends pixels as follows:
PRNU= ΔX/X × 100 (%)
X: the average output of all pixels, ΔX: difference between X and maximum or minimum output.
*6: Measured with a tungsten lamp of 2856 K.

■ Spectral response (typical example)



■ Timing chart



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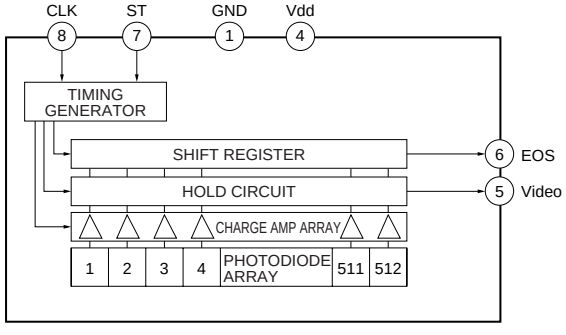
Parameter	Symbol	Min.	Typ.	Max.	Unit
Start pulse width	tpw (ST)	T1 × 530 ns	-	1100 ms	-
Start pulse high width	thw (ST)	T1 × 8 ns	-	1000 ms	-
Start pulse low width	tlw (ST)	T1 × 15 ns	-	100 ms	-
Start pulse rise and fall time	tr (ST), tf (ST)	0	20	30	ns
Clock pulse width	tpw (CLK), T1	200	-	20000	ns
Clock pulse rise and fall time	tr (CLK), tf (CLK)	0	20	30	ns
Video delay time 1	tvd1	32	40	48	ns
Video delay time 2	tvd2	40	50	60	ns

Note: The internal circuit starts operating at the rise of CLK pulse immediately after ST pulse sets to low.
The integration time equals the high period of ST pulse plus 6 CLK cycles.
· The output from 1st channel appears 14 clocks plus 100 ns after the falling edge of ST pulse.
· The EOS pulse is output 25 ns after the falling edge of CLK pulse.
· The output after reading the last pixel (512 ch) is indefinite.

■ Block diagram



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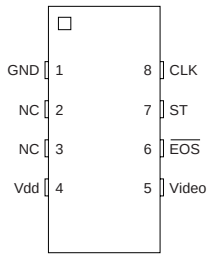
■ Pin connections



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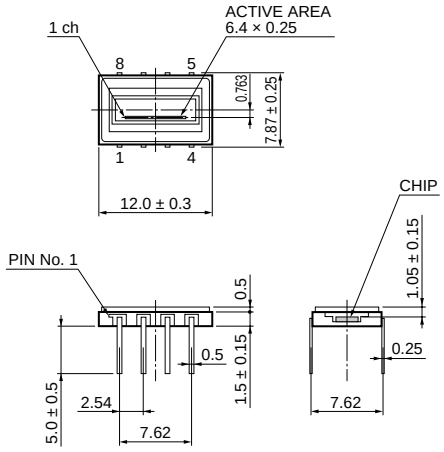
Pin No.	Symbol	Name of pin	I/O
1	GND	Ground	I
2	NC		Open
3	NC		Open
4	Vdd	Supply voltage	I
5	Video	Video output	O
6	$\overline{EOS}$	End of scan	O
7	ST	Start pulse	I
8	CLK	Clock pulse	I

■ 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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