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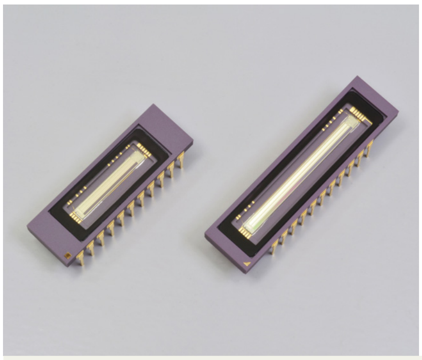


CMOS linear image sensors

S12198 series (-01)

Smoothly varying spectral response characteristics in UV region

The S12198 series are CMOS linear image sensors using a vertically long pixels (25 × 500 μm). They have smoothly varying spectral response characteristics in UV region and employ a gain switch function.

Features

- **Pixel size: 25 × 500 μm**
- **512 pixels (S12198-512Q-01)**
  1024 pixels (S12198-1024Q-01)
- **Effective photosensitive area length: 12.8 mm (S12198-512Q-01)**
  25.6 mm (S12198-1024Q-01)
- **Gain switch function**
- **Smoothly varing spectral response characteristics in UV region (spectral response range: 200 to 1000 nm)**
- **Simultaneous charge integration for all pixels**
- **Variable integration time function (electronic shutter function)**
- **5 V single power supply operation**
- **Built-in timing generator allows operation with only start and clock pulse inputs.**

Applications

- **Spectrophotometers**
- **Image reading**

Structure

Parameter	S12198-512Q-01	S12198-1024Q-01	Unit
Number of pixels	512	1024	-
Pixel size	25 × 500		μm
Photosensitive area length	12.8	25.6	mm
Package	Ceramic		-
Window material	Quartz		-

Absolute maximum ratings

Parameter	Symbol	Condition	Value	Unit
Supply voltage	Vdd	Ta=25 °C	-0.3 to +6	V
Clock pulse voltage	V(CLK)	Ta=25 °C	-0.3 to +6	V
Start pulse voltage	V(ST)	Ta=25 °C	-0.3 to +6	V
Gain selection terminal voltage	Vg	Ta=25 °C	-0.3 to +6	V
Operating temperature	Topr	No dew condensation*1	-5 to +65	°C
Storage temperature	Tstg	No dew condensation*1	-10 to +85	°C

*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 (Ta=25 °C)

Parameter		Symbol	Min.	Typ.	Max.	Unit
Supply voltage		Vdd	4.75	5	5.25	V
Clock pulse voltage	High level	V(CLK)	Vdd - 0.25	Vdd	Vdd + 0.25	V
	Low level		0	-	0.4	V
Start pulse voltage	High level	V(ST)	Vdd - 0.25	Vdd	Vdd + 0.25	V
	Low level		0	-	0.4	V
Gain selection terminal voltage	High gain	Vg	0	-	0.4	V
	Low gain		Vdd - 0.25	Vdd	Vdd + 0.25	V

Input terminal capacitance (Ta=25 °C, Vdd=5 V)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock pulse input terminal capacitance	C(CLK)	-	5	-	pF
Start pulse input terminal capacitance	C(ST)	-	5	-	pF
Gain selection input terminal capacitance	C(Vg)	-	5	-	pF

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)	200 k	-	10 M	Hz
Video data rate		DR	-	f(CLK)	-	Hz
Line rate	S12198-512Q-01	LR	-	-	18450	lines/s
	S12198-1024Q-01		-	-	9487	
Output impedance		Zo	-	80	-	Ω
Current consumption*2	S12198-512Q-01	Ic	-	32	40	mA
	S12198-1024Q-01		-	46	61	

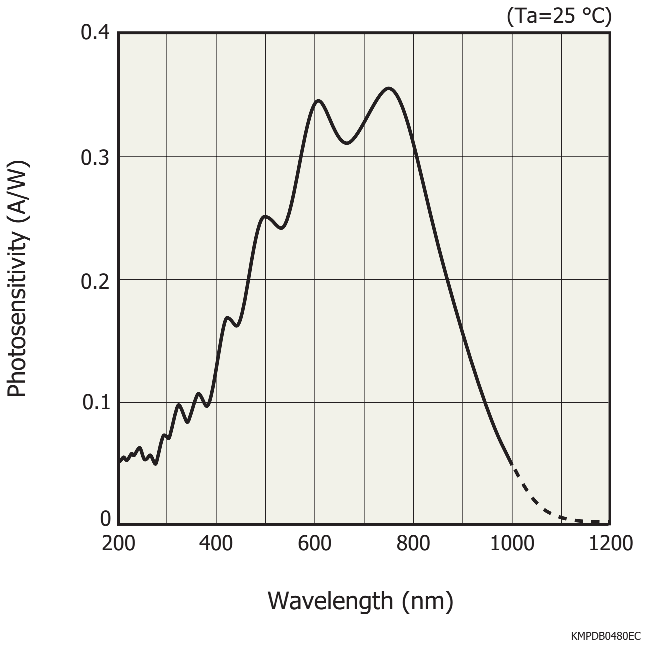
*2: f(CLK)=10 MHz, dark state

Electrical and optical characteristics [Ta=25 °C, Vdd=5 V, V(CLK)=V(ST)=5 V, f(CLK)=10 MHz]

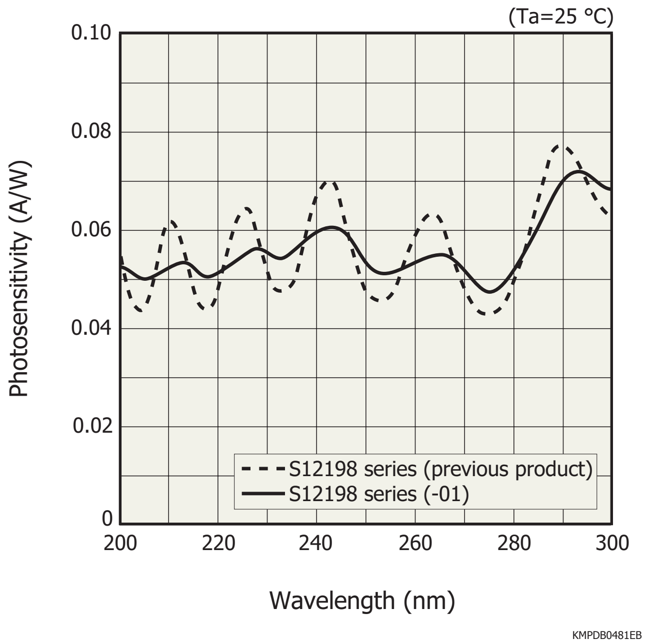
Parameter		Symbol	Min.	Typ.	Max.	Unit
Spectral response range		λ	200 to 1000			nm
Peak sensitivity wavelength		λp	-	750	-	nm
Photosensitivity*3	High gain	Sw	-	189	-	V/(lx·s)
	Low gain		-	42	-	
Conversion efficiency*4	High gain	CCE	-	0.56	-	μV/e-
	Low gain		-	0.13	-	
Dark output voltage*5	High gain	V_D	-	2.6	26	mV
	Low gain		-	0.6	6	
Saturation output voltage*6		Vsat	2.7	3.3	-	V
Readout noise	High gain	Nread	-	1.1	1.3	mV rms
	Low gain		-	0.6	0.7	
Dynamic range*7	High gain	DR	-	3000	-	-
	Low gain		-	5500	-	
Output offset voltage		Voffset	0.3	0.6	0.9	V
Photoresponse nonuniformity*3 *8		PRNU	-	-	±10	%

*3: Measured with a 2856 K tungsten lamp
*4: Output voltage generated per one electron
*5: Integration time=10 ms
*6: Voltage difference from Voffset
*7: DR=Vsat/Nread
*8: Photoresponse nonuniformity (PRNU) is the output nonuniformity that occurs when the entire photosensitive area is uniformly illuminated by light which is 50% of the saturation exposure level. PRNU is measured using pixels excluding pixels each at both ends, and is defined as follows:
PRNU = ΔX/X × 100 [%]
X: average output of all pixels, ΔX: difference between X and maximum output or minimum output

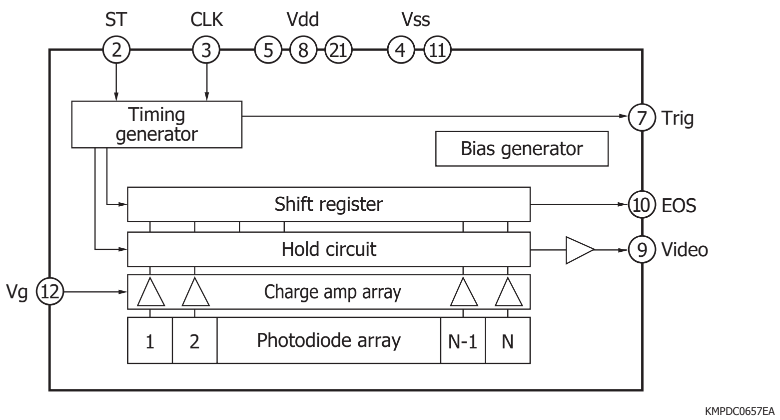
Spectral response (typical example)



Spectral response in UV region (typical example)



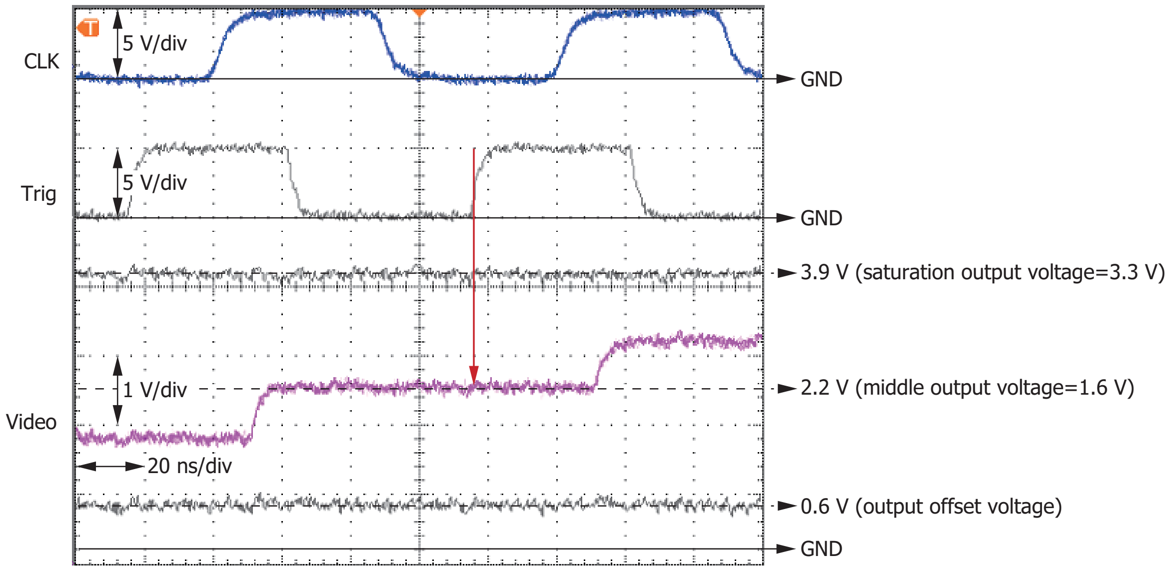
Block diagram



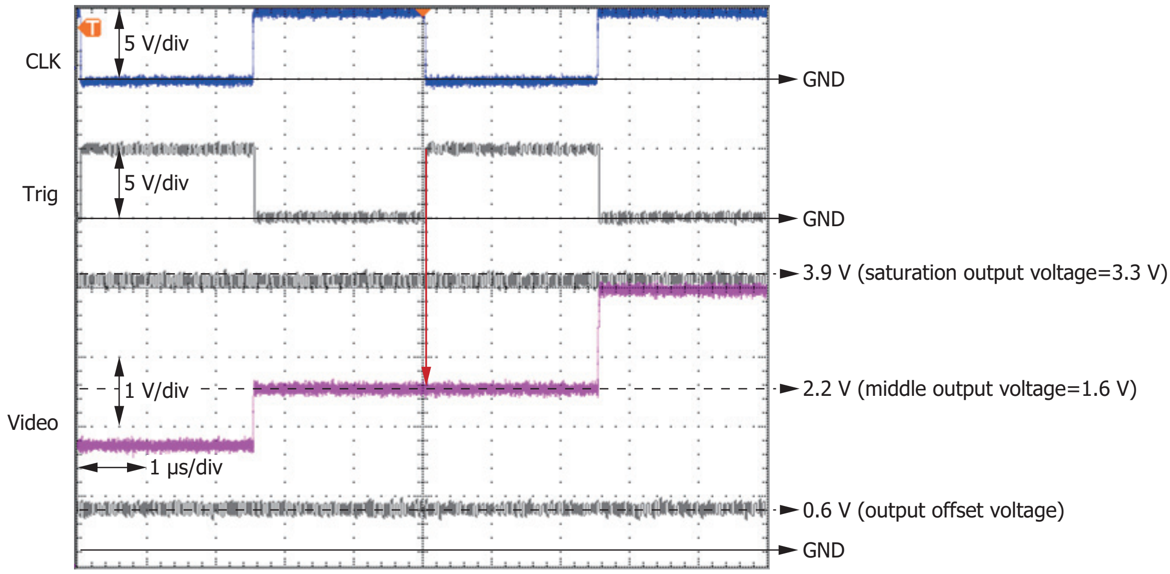
Output waveform examples of one pixel

The timing for acquiring the Video signal is synchronized with the rising edge of a trigger pulse (see red arrows below).

CLK=10 MHz

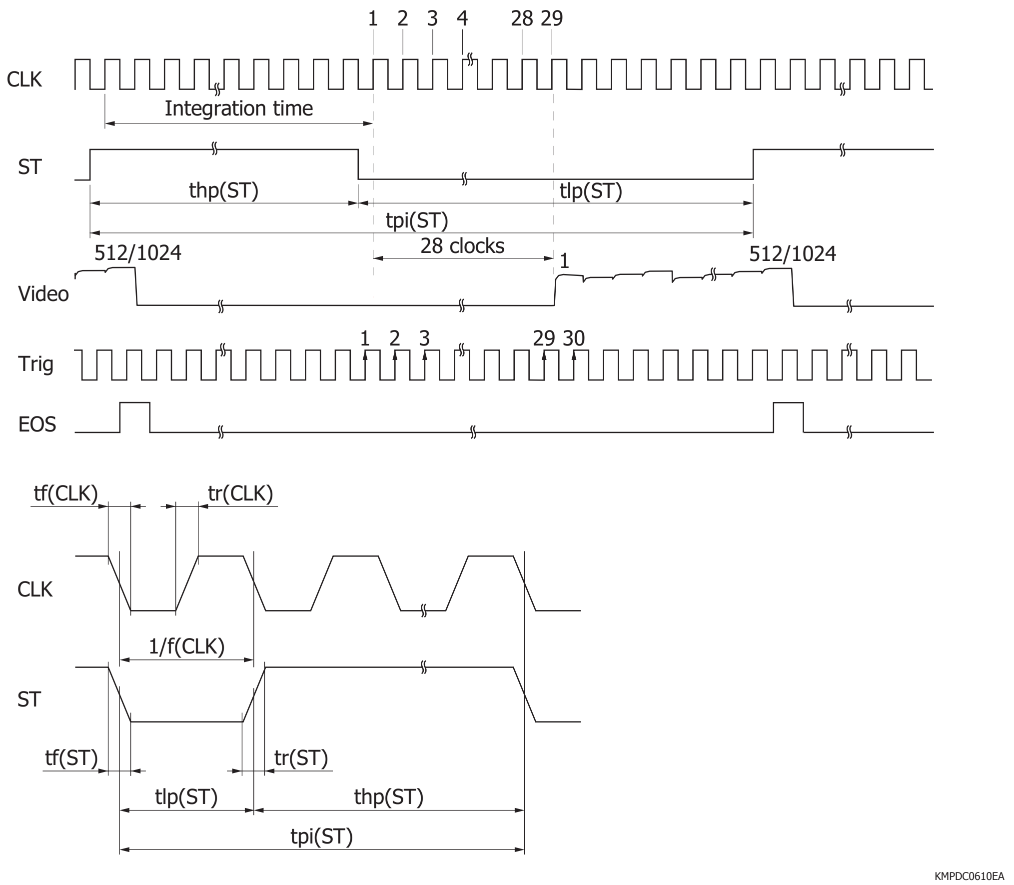


CLK=200 kHz



Note: On the waveform of the middle output voltage shown above, in order to make it easier to identify the output of each pixel, the light was input so that the outputs of the adjacent pixels appeared in a step form.

Timing chart



Parameter	Symbol	Min.	Typ.	Max.	Unit
Start pulse period*9	tpi(ST)	37/f(CLK)	-	-	s
Start pulse high period*9 *10	thp(ST)	8/f(CLK)	-	-	s
Start pulse low period	tlp(ST)	29/f(CLK)	-	-	s
Start pulse rise and fall times	tr(ST), tf(ST)	0	10	30	ns
Clock pulse duty	-	45	50	55	%
Clock pulse rise and fall times	tr(CLK), tf(CLK)	0	10	30	ns

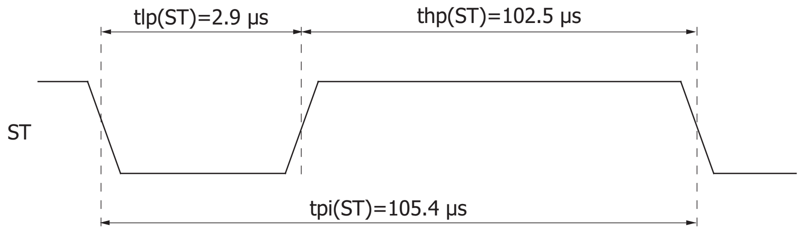
*9: If the start pulse period or the start pulse high period is increased, dark output increases.

*10: The integration time equals the high period of ST.
The shift register starts operation at the rising edge of CLK immediately after ST goes low.
If the first Trig pulse after ST goes low is counted as the first pulse, the Video signal of the first pixel is acquired at the rising edge of the 30th Trig pulse.
The integration time can be changed by changing the ratio of the high and low periods of ST.

Operation examples

S12198-1024Q-01

When the clock pulse frequency is maximized (video data rate is also maximized), the time of one scan is minimized, and the integration time is maximized.
Clock pulse frequency = Video data rate = 10 MHz
Start pulse cycle = 1054/f(CLK) = 1054/10 MHz = 105.4 μs
High period of start pulse = Start pulse cycle - Start pulse's low period min.
= 1054/f(CLK) - 29/f(CLK) = 1054/10 MHz - 29/10 MHz = 102.5 μs
Integration time is equal to the high period of start pulse, so it will be 102.5 μs.



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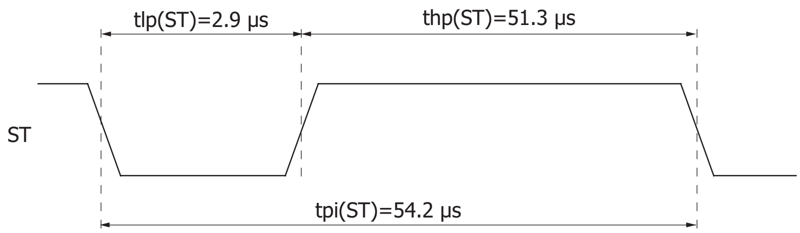
S12198-512Q-01

When the clock pulse frequency is maximized (video data rate is also maximized), the time of one scan is minimized, and the integration time is maximized.
Clock pulse frequency = Video data rate = 10 MHz
Start pulse cycle = 542/f(CLK) = 542/10 MHz = 54.2 μs
High period of start pulse = Start pulse cycle - Start pulse's low period min.
= 542/f(CLK) - 29/f(CLK) = 542/10 MHz - 29/10 MHz = 51.3 μs
Integration time is equal to the high period of start pulse, so it will be 51.3 μs.



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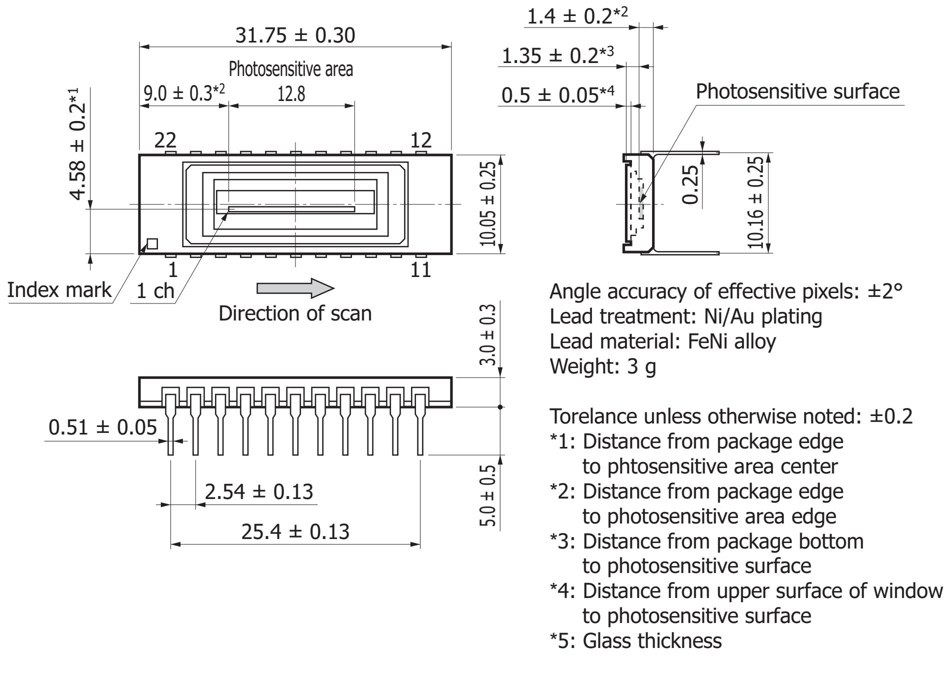
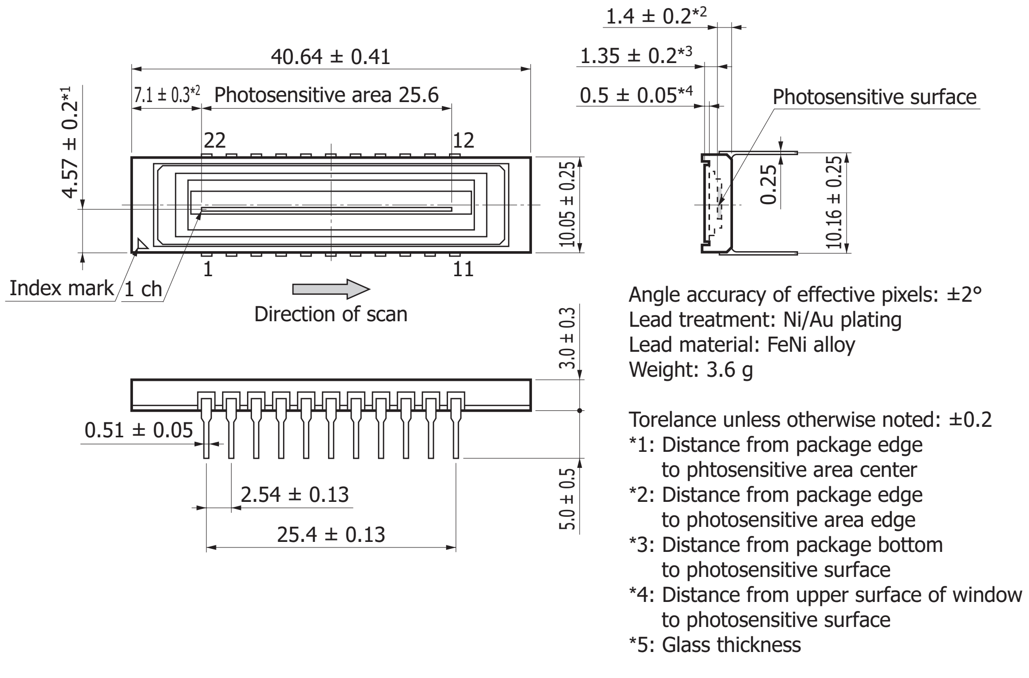
Dimensional outlines (unit: mm)

S12198-512Q-01



S12198-1024Q-01

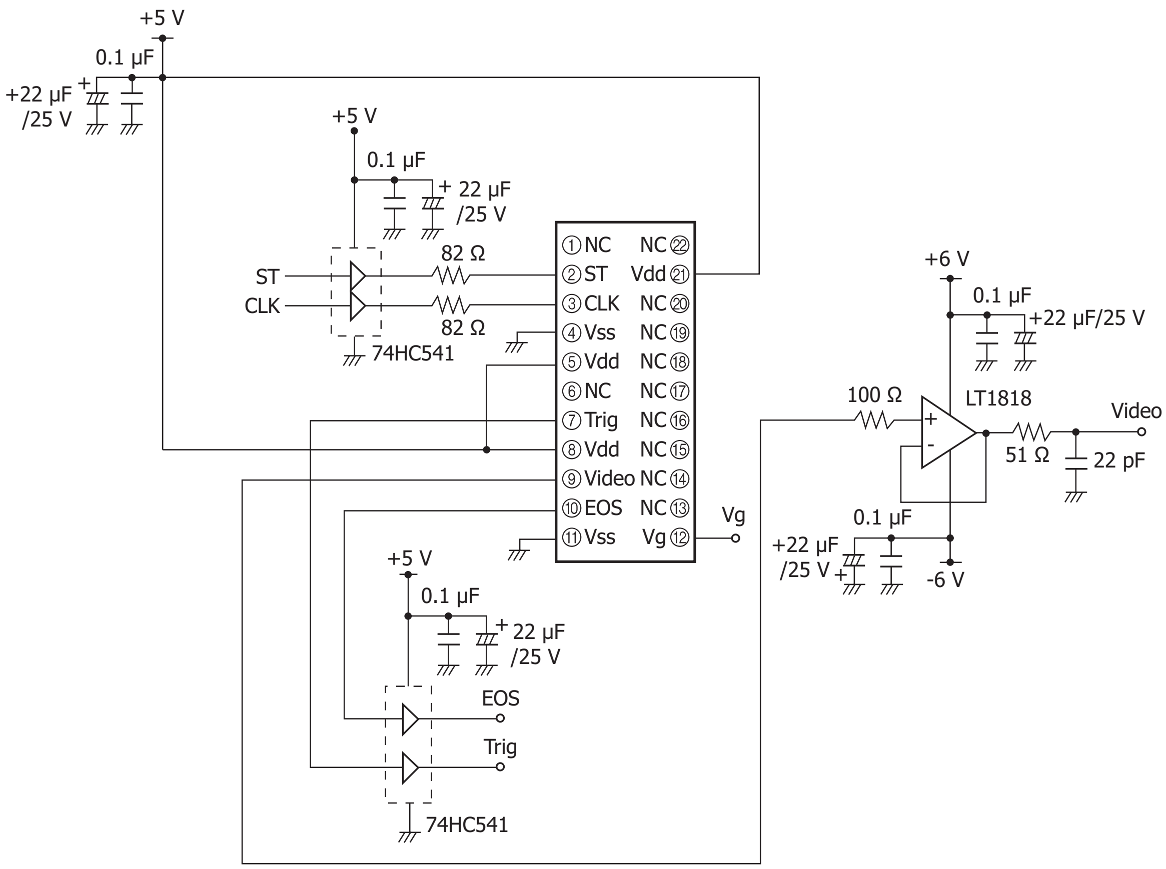


Pin connections

Pin no.	Symbol	I/O	Pin name
1	NC		No connection
2	ST	I	Start pulse
3	CLK	I	Clock pulse
4	Vss		GND
5	Vdd	I	Supply voltage
6	NC		No connection
7	Trig	O	Trigger pulse for video signal acquisition
8	Vdd	I	Supply voltage
9	Video	O	Video signal*11
10	EOS	O	End of scan
11	Vss		GND
12	Vg	I	Gain selection terminal
13	NC		No connection
14	NC		No connection
15	NC		No connection
16	NC		No connection
17	NC		No connection
18	NC		No connection
19	NC		No connection
20	NC		No connection
21	Vdd	I	Supply voltage
22	NC		No connection

*11: Connect a buffer amplifier for impedance conversion to the video output terminal so as to minimize the current flow.
Note: Leave the "NC" terminals open and do not connect them to GND.

Application circuit example



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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) Light input window

If dust or dirt gets on the light input window, it will show up as black blemishes 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 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

Operate and store the product within the temperature range defined by the absolute maximum ratings. Operating or storing the device at an excessively high temperature and humidity may cause variations in performance characteristics and must be avoided.

(5) UV exposure

This device is designed to suppress performance deterioration due to UV exposure. Even so, avoid unnecessary UV exposure to the device. Also, be careful not to allow UV light to strike the sealed portion of the glass.

Related information

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

■ Precautions

· Disclaimer
· Image sensors

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