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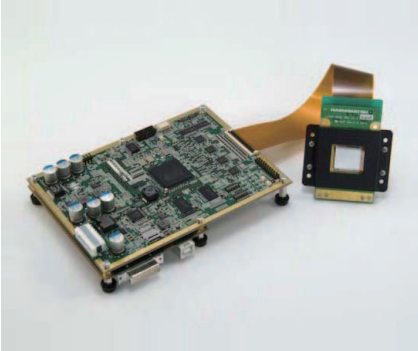
PHOTON IS OUR BUSINESS

LCOS-SLM modules

X11840/X13268/X13139 series



Embedded LCOS-SLM module for easy integration into OEM and other instruments

The Hamamatsu LCOS-SLM X10468 series is used widely in the field of research and industry, but its large size and high price are of concern in industrial applications. To overcome these issues, Hamamatsu has developed the integratable LCOS-SLM module X11840/X13268/X13139 series. Comparatively smaller than the X10468 series, this product is expected to be popular in industrial applications. The small head module is connected to the driver circuit via flexible cable. Moreover, it is easy to integrate a cooling function to the head module.
This product makes it possible to easily integrate a spatial light modulator, which modulates only the phase of light, into industrial devices. The driver circuit supports a variety of interfaces to meet your system requirements. The product also comes with a DVI interface circuit for evaluation. The product can be customized to meet your needs. For details, consult with your nearest Hamamatsu sales office.

Features

- **Compact, low price**
- **Easy to integrate cooling function to the head module**
- **Modulates only the phase of light**
- **High light utilization efficiency**
- **High diffraction efficiency**
- **High power handling capability**
- **Reflective type**

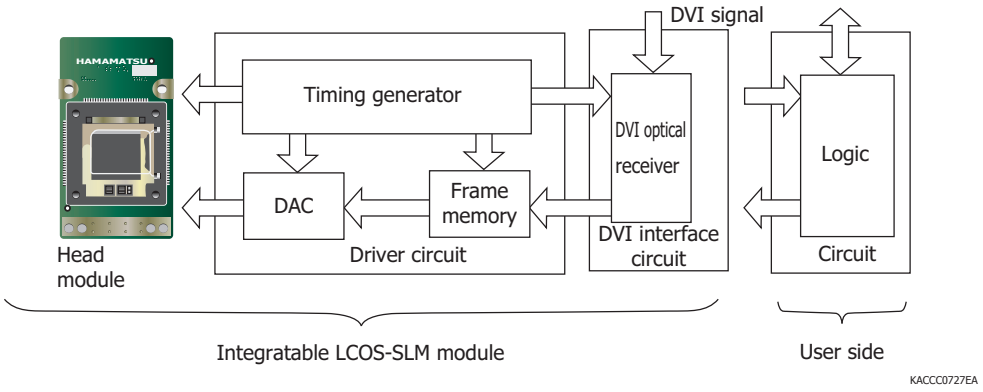
Applications

- **Laser material processing**
- **Optical manipulation**
- **Wavefront correction**
- **Pulse shaping**
- **Optical testing**

Accessories (included)

- **Dedicated software (OS: Microsoft® Windows® XP/7)**
- **DVI interface circuit for evaluation**

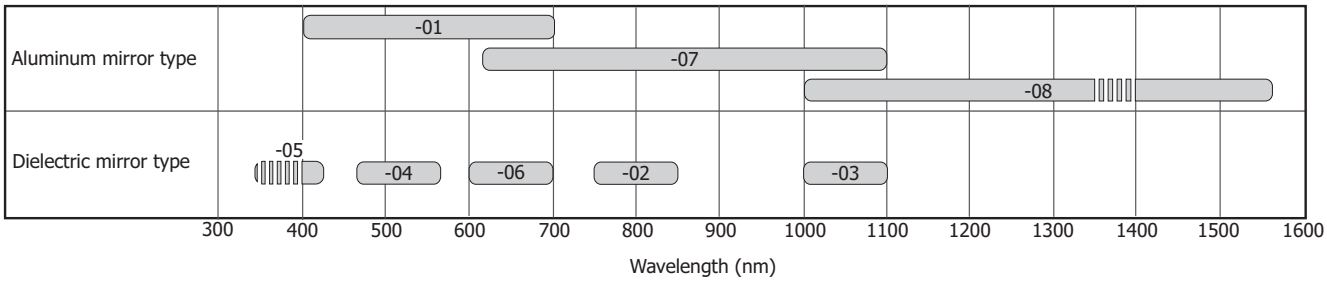
Block diagram



Selection guide

There are eight types each in the X11840/X13268/X13139 series, which cover different wavelengths of light sources. They can be grouped into dielectric mirror types (-02/-03/-04/-05/-06) and aluminum mirror types (-01/-07/-08). To enhanse the reflectivity of the device, dielectric mirror types have dielectric mirrors corresponding to different wavelengths of laser light source. [-02: titanium sapphire laser (800 nm band), -03: YAG laser (1064 nm), -04: YAG laser 2nd harmonic (532 nm), -05: LD (405 nm), -06: He-Ne laser (633 nm)]. The increased reflectivity achieved by the dielectric mirror decreases the internal absorption rate. This allows accommodation for high powered lasers, but the covered wavelength range is narrowed. Aluminum mirror types use reflections from the aluminum electrodes on the CMOS chip. The reflectivity is inferior to that of the former, but the reflection wavelength range is wider, covering a range of 400 nm to 1550 nm with just three types. For the wavelength band between 1350 and 1400 nm on the -08 type, the reflectance degrades about 5% due to the absorption by the glass substrate.

[Figure 1] Spectral Response



Structure

Parameter	Number of pixels (pixels)	Pixel pitch (µm)	Effective area size (mm)	Fill factor (%)	Input signal
X11840 series	792 × 600	20	15.8 × 12	98	Digital Video Interface (DVI-D)
X13268 series	792 × 600	12.5	9.9 × 7.5	96	
X13139 series	1272 × 1024		15.9 × 12.8		

Absolute maximum ratings

Parameter	Supply voltage (V)	Operating temperature*1 (°C)	Storage temperature*1 (°C)
X11840 series	20	+10 to +40	-20 to +55
X13268 series			
X13139 series			

*1: No condensation. Humidity can cause deterioration of characteristics, so be careful with the humidity.
The characteristics of this product depend on temperature. Using this product at an ambient temperature of about 25 °C is recommended.

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.

Electrical characteristics (DVI-I/F circuit)

Parameter	DVI signal format (pixels)	Input signal level (levels)	DVI frame rate		Input voltage (DC)			Power consumption (VA)
			Typ. (Hz)	Max. (Hz)	Min. (V)	Typ. (V)	Max. (V)	
X11840 series	800 × 600	256	60	120	14.5	15.0	15.5	35
X13268 series	800 × 600				15.5	16.0	16.5	
X13139 series	1280 × 1024							

Electrical and optical characteristics

Parameter	Readout light wavelength (nm)	Light utilization efficiency typ. (%)	Rise time*2 (ms)	Fall time*2 (ms)
X11840-01	400 to 700	79 (633 nm)	5 (633 nm)	25 (633 nm)
X11840-02	800 ± 50	95 (785 nm)	30 (785 nm)	80 (785 nm)
X11840-03	1050 ± 50	95 (1064 nm)	20 (1064 nm)	80 (1064 nm)
X11840-04	510 ± 50	94 (532 nm)	10 (532 nm)	25 (532 nm)
X11840-05	410 ± 10	92 (405 nm)	10 (405 nm)	20 (405 nm)
X11840-06	650 ± 50	95 (633 nm)	10 (633 nm)	30 (633 nm)
X11840-07	620 to 1100	82 (1064 nm)	10 (1064 nm)	80 (1064 nm)
X11840-08	1000 to 1550	82 (1550 nm)	30 (1550 nm)	140 (1550 nm)
X13268-01	400 to 700	76 (633 nm)	5 (633 nm)	25 (633 nm)
X13268-02	800 ± 50	98 (785 nm)	30 (785 nm)	80 (785 nm)
X13268-03	1050 ± 50	98 (1064 nm)	20 (1064 nm)	80 (1064 nm)
X13268-04	510 ± 50	98 (532 nm)	10 (532 nm)	25 (532 nm)
X13268-05	410 ± 10	92 (405 nm)	10 (405 nm)	20 (405 nm)
X13268-06	650 ± 50	98 (633 nm)	10 (633 nm)	30 (633 nm)
X13268-07	620 to 1100	80 (1064 nm)	10 (1064 nm)	80 (1064 nm)
X13268-08	1000 to 1550	80 (1550 nm)	30 (1550 nm)	140 (1550 nm)
X13139-01	400 to 700	76 (633 nm)	5 (633 nm)	25 (633 nm)
X13139-02	800 ± 50	98 (785 nm)	30 (785 nm)	80 (785 nm)
X13139-03	1050 ± 50	98 (1064 nm)	20 (1064 nm)	80 (1064 nm)
X13139-04	510 ± 50	98 (532 nm)	10 (532 nm)	25 (532 nm)
X13139-05	410 ± 10	92 (405 nm)	10 (405 nm)	20 (405 nm)
X13139-06	650 ± 50	98 (633 nm)	10 (633 nm)	30 (633 nm)
X13139-07	620 to 1100	80 (1064 nm)	10 (1064 nm)	80 (1064 nm)
X13139-08	1000 to 1550	80 (1550 nm)	30 (1550 nm)	140 (1550 nm)

*2: Time required to change from 10% to 90% for 2π modulation (typical value)

Operating characteristics

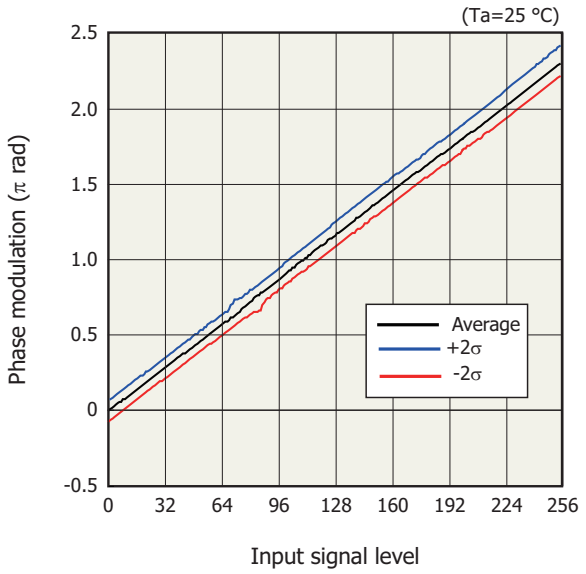
Light utilization efficiency

The X11840/X13268/X13139 series have high light utilization efficiency, which is defined as a ratio of the 0th order diffraction light level to the input light level. This high light utilization efficiency mainly depends on reflectivity, and the amount of diffraction loss caused by the pixel structure. We adopted advanced CMOS technology to make the diffraction loss smaller. As a result, the diffraction loss is less than 5%. The -02/-03/-04/-05/-06 types have a dielectric mirror which has high reflectivity. The -01/-07/-08 types have relatively low reflectivity compared to the ones with the dielectric mirror but have wide spectral response characteristics and high linearity.

High phase modulation

The X11840/X13268/X13139 series can achieve phase modulation of more than 2π radians over the 400-1550 nm readout wavelength range. The X11840 series comes pre-calibrated from the factory for a specified wavelength range to have more than 2π radians of phase modulation and high linear characteristics. Figure 2 shows typical phase modulation characteristics. A phase modulation of 2π radians or more and a linear phase response are achieved. The phase modulation curves for 95% pixels lies within ±2σ.

[Figure 2] Phase modulation (typical example)



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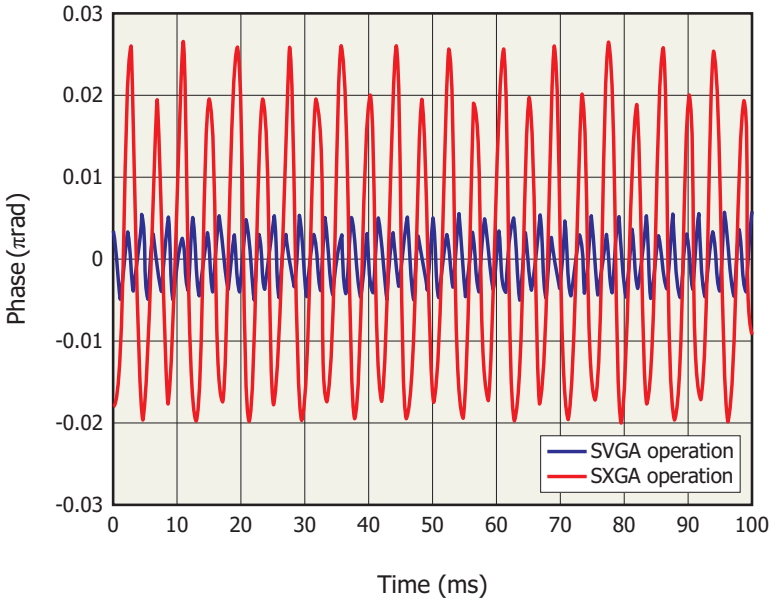
Phase fluctuation

As the LCOS-SLM is driven by AC power, the output light will fluctuate according to the drive frequency even when a uniform pattern is displayed over the entire surface. Figure 4 shows an example of the phase fluctuation for the -04 types. The drive frequency is 120 Hz for SXGA operation (X13139-04) and 240 Hz for SVGA operation (X11840/X13268-04). In SXGA operation, which operates at low frequency, the phase fluctuation is about four times greater than that in SVGA operation.

[Figure 4] Phase stability (typical example)



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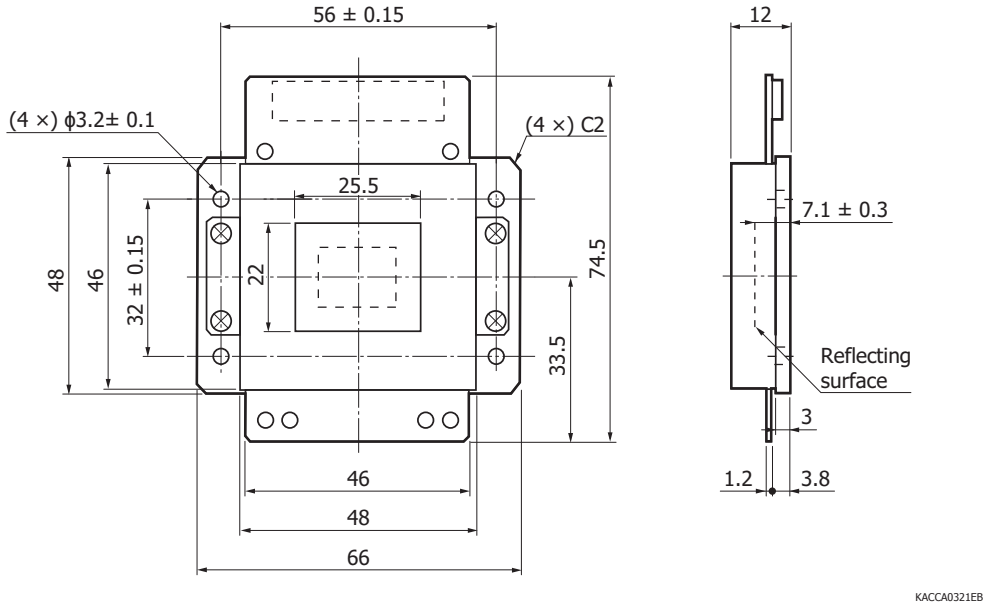
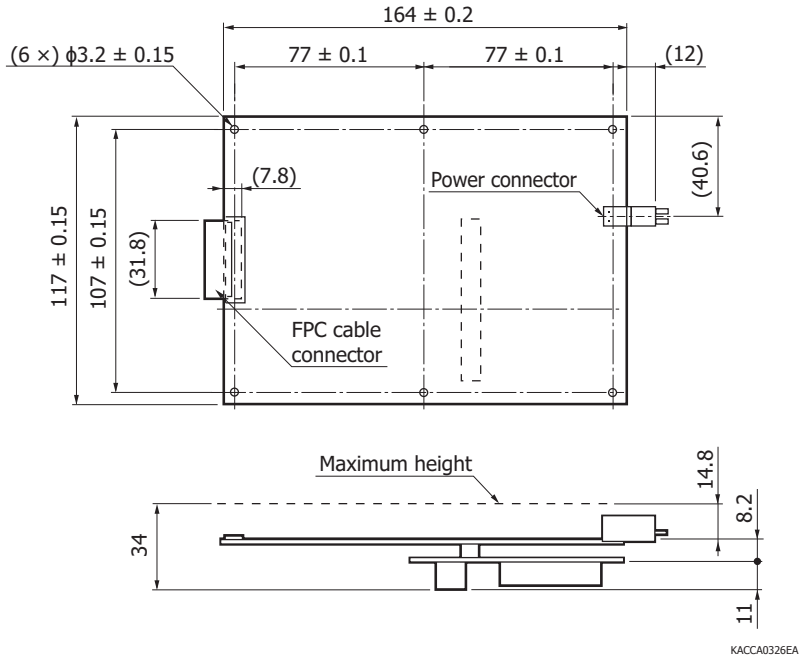
Dimensional outlines (unit: mm, tolerance unless otherwise noted: ±1)

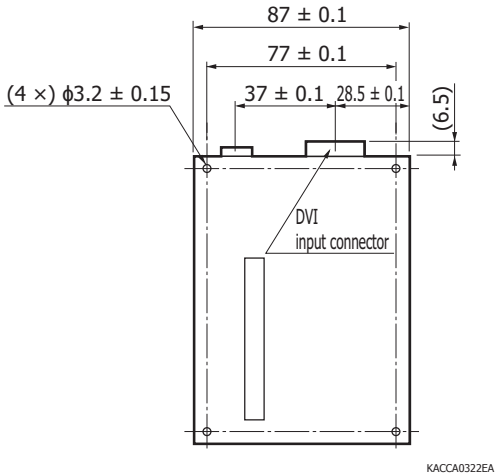
Head



Controller



DVI interface circuit



Related information

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

■Precautions
· Disclaimer

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