

Image sensor module



C16006

Built-in CMOS linear image sensor, CameraLink supported

The C16006 is an image sensor module with a built-in CMOS linear image sensor. This product consists of a driver circuit, controller, etc. It outputs video signals from the CMOS linear image sensor as digital signals. From a PC connected via CameraLink interface, various settings can be made, and images can be acquired.

Features

- Line rate: 20 × 4 klines/s max.
- Number of pixels: 8192 × 4 lines
- Simultaneous output of Red/Green/Blue/NIR
- With heatsink
- CameraLink interface

Applications

- Semiconductor inspection
- Food screening

Built-in sensor

Product name	Pixel pitch (μm)	Pixel height (μm)	Effective photosensitive area length (mm)	Number of effective pixels H × V (pixels)	Gap between lines (μm)	A/D converter	A/D resolution (bit)
CMOS linear image sensor	5	5	40.96	8192 × 4	15	Column-parallel type	10

Structure (Typ. Ta=25 °C, unless otherwise noted)

Parameter	Specification	Unit
Interface	CameraLink	-
CameraLink transfer clock	85	MHz
Line rate max.	20 × 4	klines/s
Input signal	External trigger	-
Cooling method	Air cooling	-
Case temperature max.*1	65	°C
Lens mount	M52	-
Size (W × H × D)*2	100 × 100 × 79	mm
Weight	900	g

*1: Ambient temperature Ta=40 °C

*2: Excluding protrusions

The case of this product becomes hot while it is in use. Be careful not to touch the case for a long time when it is hot, as this may cause burns.

▣ Absolute maximum ratings (Typ. Ta=25 °C, unless otherwise noted)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage (DC)	Vs		-0.3	-	+15	V
External trigger input voltage	Vtpn		0	-	24	V
Operating temperature	Topr	No dew condensation*3 *4	0	-	40	°C
Storage temperature	Tstg	No dew condensation*3 *4	-10	-	70	°C

*3: When there is a temperature difference between a product and the surrounding area in high humidity environments, dew condensation may occur on the product surface. Dew condensation on the product may cause deterioration in characteristics and reliability.

*4: Humidity 85%RH or less

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 operating conditions (Ta=25 °C, unless otherwise noted)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage (DC)	Vs		11	12	13	V
External trigger input voltage	Vtpn		3.3	5	10	V
Pulse width of external triggers	TRGpw	Connector edge waveform	1	-	-	µs

▣ Electrical and optical characteristics (Ta=25 °C, unless otherwise noted)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Spectral response range	λ		-	400 to 1000	-	nm
Saturation output	Vsat		800	920	-	DN
Readout noise	Nread	Dark state	-	0.88	4.7	DN rms
Dynamic range	Drange	*5	-	1000	-	-
Photoresponse nonuniformity	PRNU	*6	-	±10	±15	%
External trigger input delay	TRGd	For connector edge waveform	-	-	5	µs
Power consumption	P	Vs=+13 V Maximum line rate	-	13.7	14.5	W

*5: Saturation output value divided by readout noise
 $Drange = Dsat/Nread$

*6: Photoresponse nonuniformity is defined as follows when uniform light with an exposure of 50% of saturation entered.

$$PRNU = (\Delta X/X) \times 100 [\%]$$

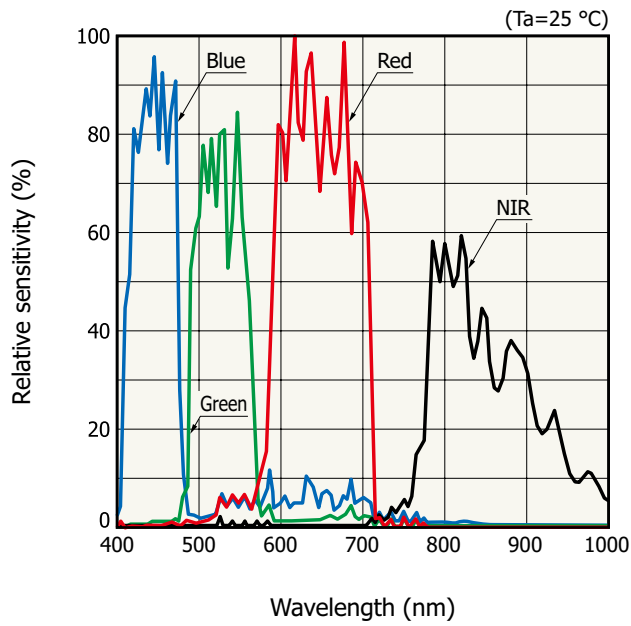
X: average of the outputs of 8186 pixels excluding the 3 pixels at each end of the sensor

ΔX: difference between X and the maximum or minimum output of 8186 pixels excluding the 3 pixels at each end of the sensor

▣ Functions

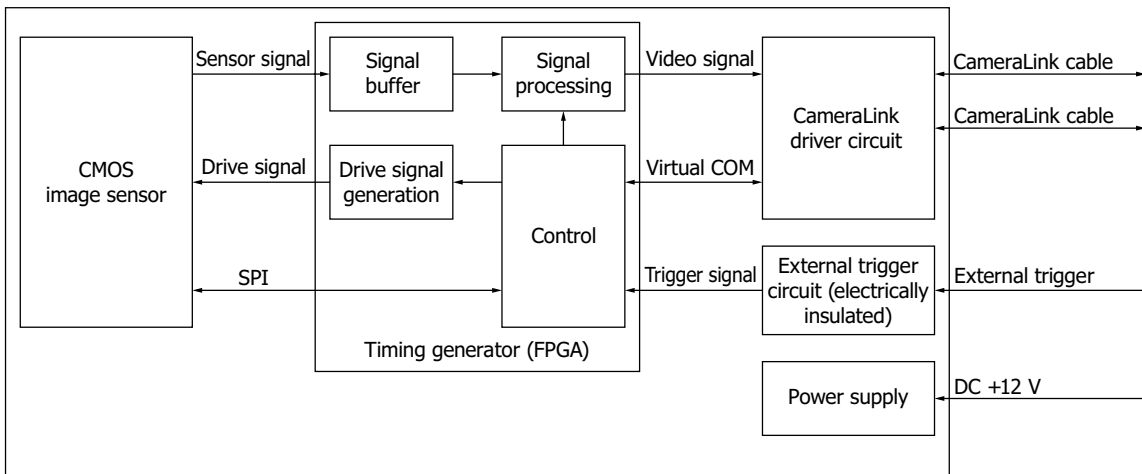
Parameter	Description
Binning	The outputs of two adjacent pixels on each line are added together and read out. The number of pixels is halved during binning.
Gain setting	The gain can be set in the range of 0 to 511. The gain shifts 0.043 dB per setting value.
Dark offset settings	Adds an offset from -256 to +255 to the dark level.
Flip display	Flips the output image in the direction of each line.
Line delay correction	Corrects for blurring in the movement direction of the subject caused by differences in the positions of each line.
Keystone correction	Corrects the detection width caused by the difference in distance between the detection target and each line.
DSNU (dark signal nonuniformity) correction	Corrects variations in the dark output of each pixel.
PRNU correction	Corrects output nonuniformity of each pixel when applying uniform light equivalent to approximately 50% to 80% of saturation.
Shading correction	Corrects nonuniformity of incident light, as well as shading caused by differences in transmitted light level between the center and periphery of the lens.
White balance correction	Corrects the color tone of the image determined by color temperature of light source.
Gamma correction	Corrects the contrast of an image to make it easier to see.

Spectral response (typical example)



KMPDB0675EA

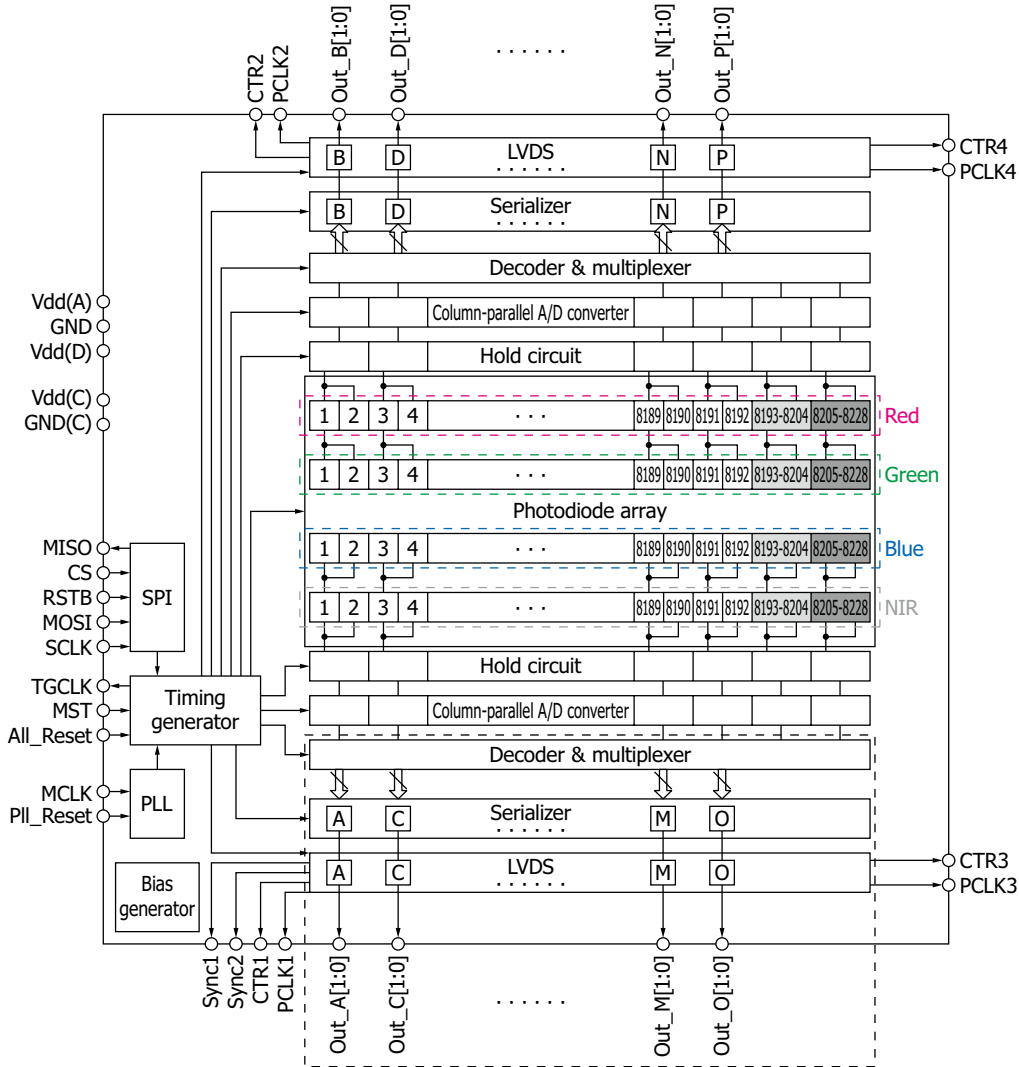
Block diagram (C16006)



KACCC1113EA

Block diagram (CMOS linear image sensor)

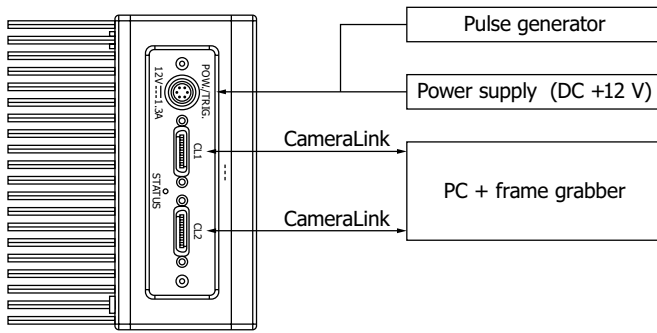
The video output signal is divided and output through 16 ports (A to P). Data for 1024 pixels × 2 lines is output from each port. However, from port O and port P, data is output for 1060 pixels × 2 lines, including boundary pixels and light-shielding pixels. [Pixel no. output from each port: A=1 to 1024 (blue, NIR), B=1 to 1024 (red, green), C=1025 to 2048 (blue, NIR), ...O=7169 to 8228 (blue, NIR), P=7169 to 8228 (red, green)]



- Photodiode array
- Effective pixels (each line: 8192 pixels)
 - Boundary pixels (each line: 12 pixels)
 - Light-shielding pixels (each line: 24 pixels)

KMPDC0997EA

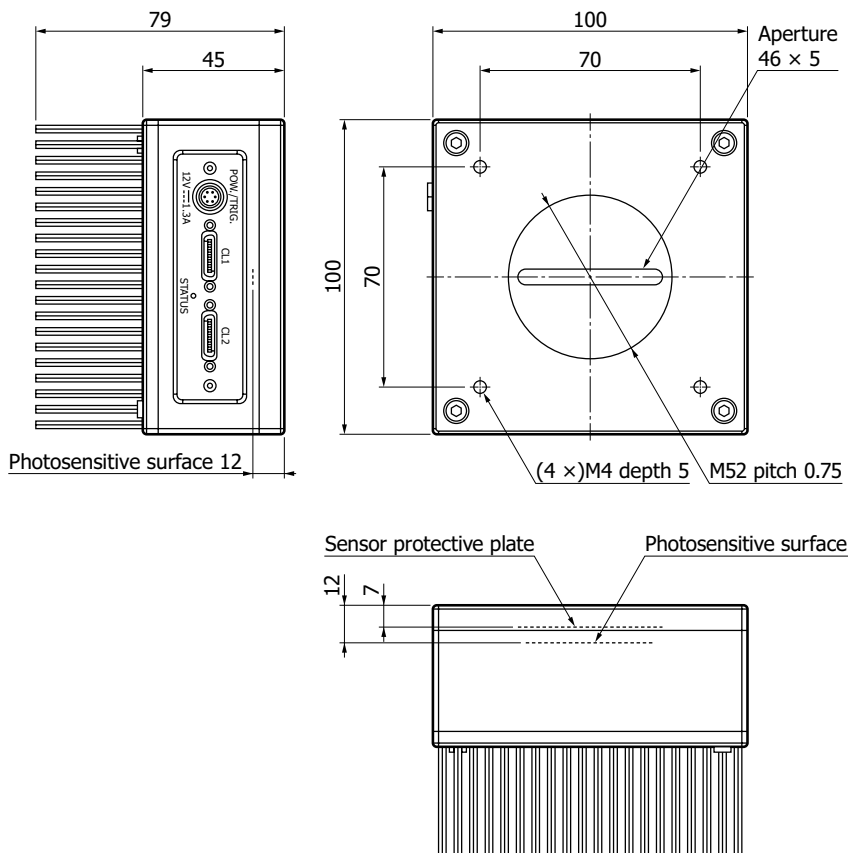
Connection example



KACCC114EA

- Connect the power cable according to the pin arrangement.
- To realize EMC, use shielded cables as power cables and connect the shield to an electrical ground.
- Do not connect or disconnect various cables with the power supply turned on.
- Use a frame grabber board that supports the CameraLink transfer clock frequency of 85 MHz.
- We recommend the following CameraLink cables for connection to PCs.
Cable length: 2 m or shorter, connector shape (module side): SDR
If the CameraLink cable is too long, its waveform may be blunted, making it impossible to obtain normal data.
- The following CameraLink cables are used for operation verification of this product. There is no warranty for operational integrity with other cables.
1SF26-L120-00C-200 (3M)

Dimensional outline (unit: mm)

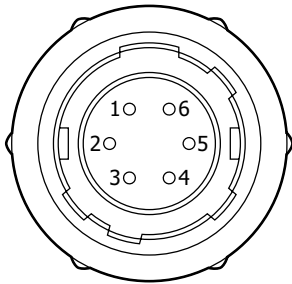


Tolerance unless otherwise noted: ± 0.5

KACCA0486EA

Pin layout

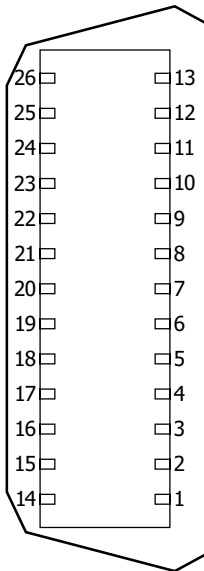
· Power/trigger connector (POW./TRIG.) Hirose HR10A-7R-6P(73)



KACCC1120EA

Pin no.	Symbol
1	+12 V
2	GND
3	+12 V
4	GND
5	Trigger_P
6	Trigger_N

· CameraLink (CL1, CL2) connector 3M 12226-5150-00FR



KACCC1121EA

[CL1]

Pin no.	Symbol	Pin no.	Symbol
1	NC	14	GND
2	X0-	15	X0+
3	X1-	16	X1+
4	X2-	17	X2+
5	Xclk-	18	Xclk+
6	X3-	19	X3+
7	SerTC+	20	SerTC-
8	SerTFG-	21	SerTFG+
9	CC1-	22	CC1+
10	CC2+	23	CC2-
11	CC3-	24	CC3+
12	CC4+	25	CC4-
13	GND	26	NC

[CL2]

Pin no.	Symbol	Pin no.	Symbol
1	NC	14	GND
2	Y0-	15	Y0+
3	Y1-	16	Y1+
4	Y2-	17	Y2+
5	Yclk-	18	Yclk+
6	Y3-	19	Y3+
7	100 Ω	20	terminated
8	Z0-	21	Z0+
9	Z1-	22	Z1+
10	Z2-	23	Z2+
11	Zclk-	24	Zclk+
12	Z3-	25	Z3+
13	GND	26	NC

Related information

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

- Precautions
- Disclaimer

The content of this document is current as of April 2023.

Product specifications are subject to change without prior notice due to improvements or other reasons. This document has been carefully prepared and the information contained is believed to be accurate. In rare cases, however, there may be inaccuracies such as text errors. Before using these products, always contact us for the delivery specification sheet to check the latest specifications.

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