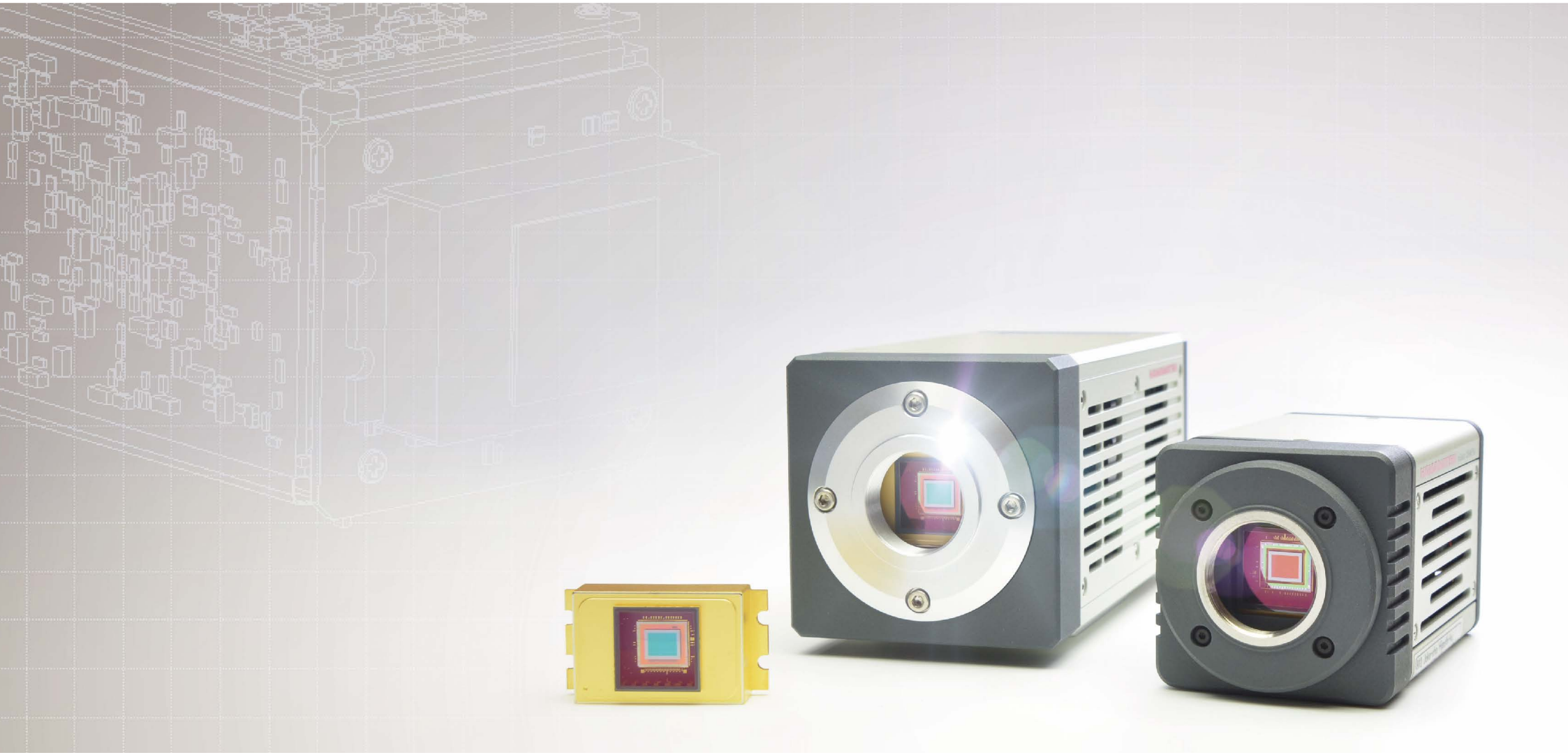
Jan. 2024

HAMAMATSU
PHOTON IS OUR BUSINESS

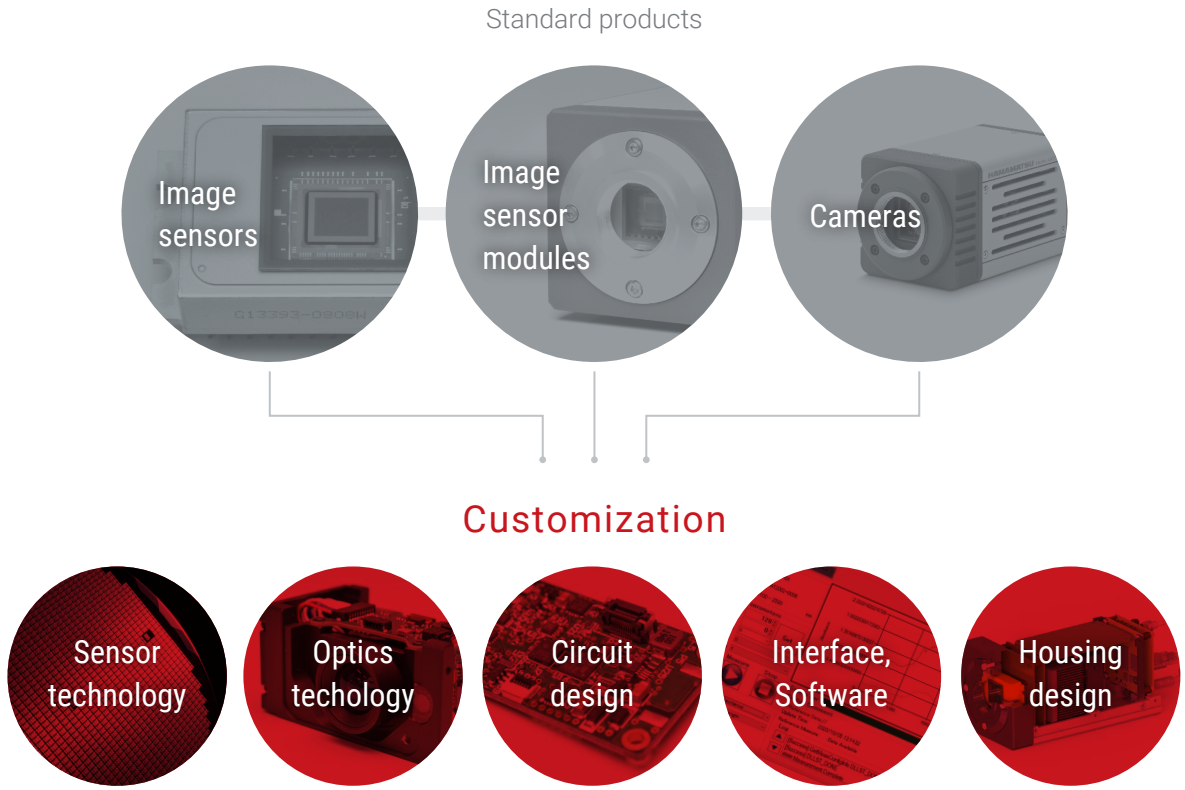
Custom Solutions of Image Sensors / Modules / Cameras

Suggesting Custom Solutions According to Customer Requirements



Overview

Hamamatsu offers standard products of image sensors, image sensor modules and cameras.
In addition to the standard products, we design and manufacture custom products to meet customers' specifications in a wide range with various technologies.



Applications

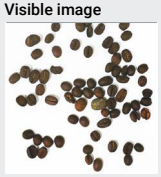
Hamamatsu image sensors, modules and cameras are widely used for applications such as industry, life science / medical and UAV / Monitoring system.

Industry

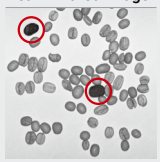
Food / beverage inspection

Small stones mixed in coffee beans are detected.

Visible image



Near-infrared image

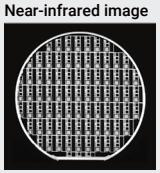


Semiconductor inspection

The pattern formed on the backside of the Si wafer is observed.

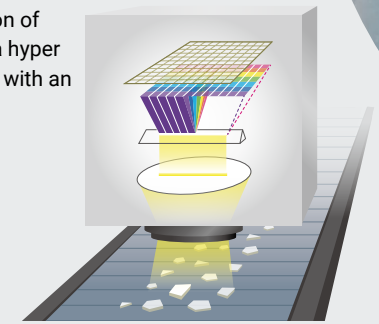
Visible image

Near-infrared image

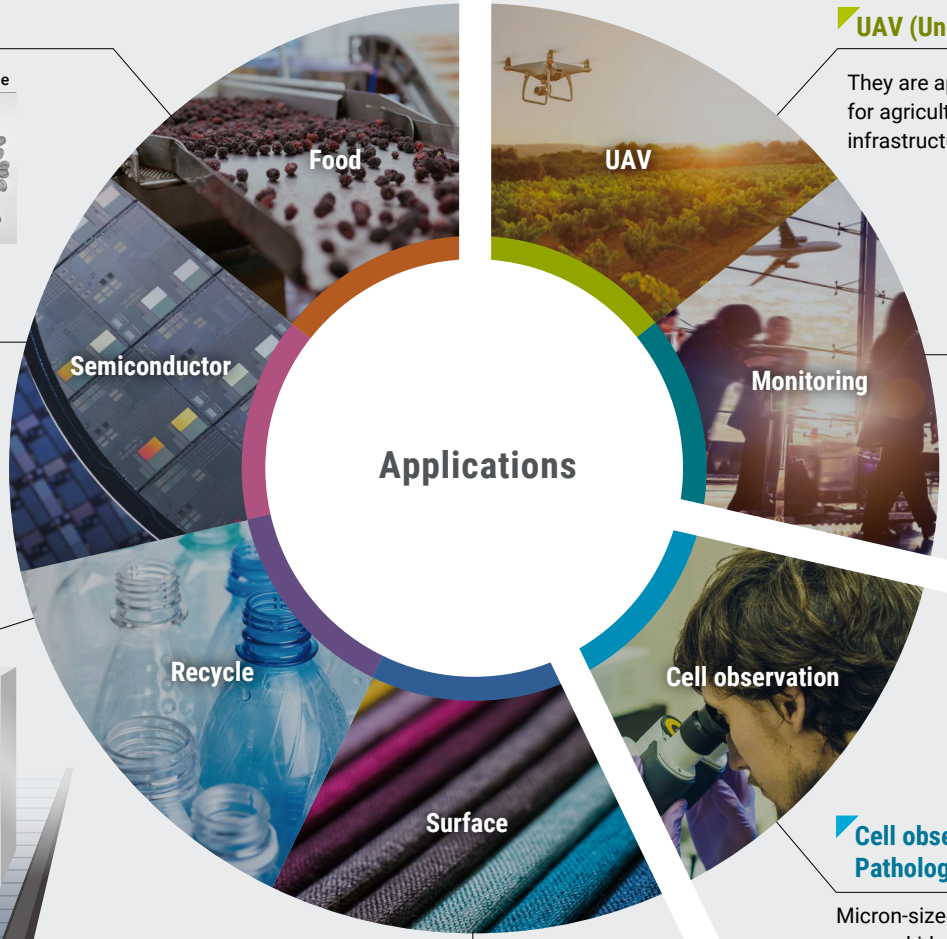


Recycle, Raw material inspection

Highly accurate identification of plastic is realizes by using a hyper spectrum camera equipped with an InGaAs image sensor.



Plastic sorting using hyper spectral imaging.



UAV / Monitoring system

UAV (Unmanned aerial vehicle)

They are applied for UAV remote sensing for agriculture, forest management, infrastructure inspection.

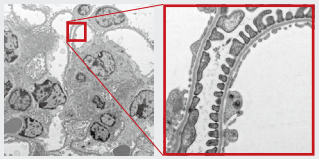
Monitoring system

They are used for monitoring system of obstacles and shape recognition for safety and security.

Life science / Medical

Cell observation by electron microscope / Pathological diagnosis

Micron-sized mouse kidney cells are observed under an electron microscope.

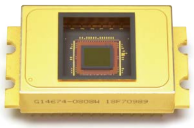


Surface inspection

In-line inspection detects holes and scratches on the surface of the fabric.

Differences of Image Sensors / Modules / Cameras

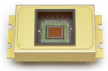
Following table shows differences of Hamamatsu standard image sensors, image sensor modules and cameras from the view point of the hardware and software.

		Image sensors	Image sensor modules	Cameras
				
Hardware	Image sensor	✓	✓	✓
	Driver circuit		✓	✓
	Interface		✓	✓
	Lens mount		✓	✓
	Housing	✓*1	✓	✓*2
	Cooling	✓*2	✓*2	✓*2
	CE marking		✓	✓*2
	Calibration function			✓
Software	DCAM-API®		✓ (C15853/C16090/C16091 series)	✓*3
	DCAM-SDK		✓ (C15853/C16090/C16091 series)	✓*3
	HCImage		✓ (C15853/C16090/C16091 series)	✓*3
Note		Driver circuits (sold separately) are also available to easily evaluate and test Hamamatsu image sensors. It is also available for our original evaluation software (image aquisition only).  		

*1: Including some products
*2: Excluding some products
*3: Including customer support

Standard Products

These are examples of modules and cameras which incorporate a Hamamatsu image sensor.

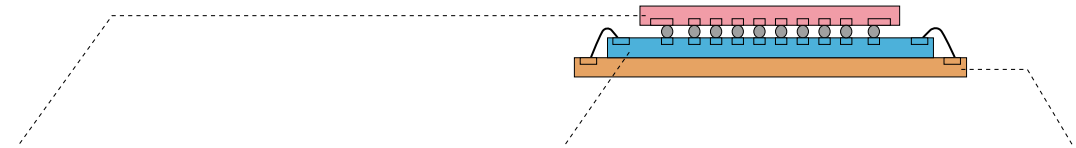
			Image sensors	Image sensor modules	Cameras
Area	InGaAs (QVGA)	950 nm to 1700 nm*1	G13393-0808W 		C14041-10U 
		950 nm to 1690 nm*2	G14671-0808W*4 	C16090-01 C16090-02 C16090-03 C16090-04 	
		1120 nm to 1850 nm*3	G14672-0808W*4		
		1300 nm to 2150 nm*3	G14673-0808W*4		
		1700 nm to 2550 nm*3	G14674-0808W*4		
	InGaAs (VGA)	950 nm to 1700 nm*1	G13393-0909W 		C12741-03  C12741-11 
Linear	InGaAs (high-speed)	950 nm to 1700 nm*1	G14714-1024DK*5 	C15853-02*5 	C15333-10E 
	InGaAs	900 nm to 1850 nm*2	G11475 series*6 	C16091-01/-02*6 	
		900 nm to 2550 nm*2	G11478 series*6	C16091-06/-07*6	
	CMOS	400 nm to 1000 nm (RGB + NIR readout)	(Under development)	C16006	
	CCD (TDI)	200 nm to 1100 nm*1	S10201-04-01 		C10000-801  C10000-A01 

*1: Ta=25 °C *2: Ta=15 °C *3: Ta=-20 °C
*4: Improved types G16561 to G16564-0808T are also available (image sensor module is being prepared).
*5: Image sensor module C15853-01 integrating the InGaAs linear image sensor G14714-512DE is also available.
*6: InGaAs linear image sensors G11475 to G11478 series and image sensor modules C16091-01 to -07 having various types of spectral response range from 900 nm to 2550 nm are prepared.
For details, please refer to the datasheet.

Image Sensor Customization

Hamamatsu offers the sensor chip customization in addition to hundreds of standard image sensor products. Sensors and wafers are built from the ground up in our foundry in Hamamatsu, Japan. We have full control over the sensor design, wafer fabrication process, chip assembly, and packaging. Hamamatsu can provide the customization in many aspects including the photosensitive area pixel format, spectral response, readout ASIC, and packaging.

Customizable specifications (InGaAs image sensors)



Photodiode array

- Photosensitive area size (linear / area)
- Number of pixels, pixel pitch
- Spectral resnponse range

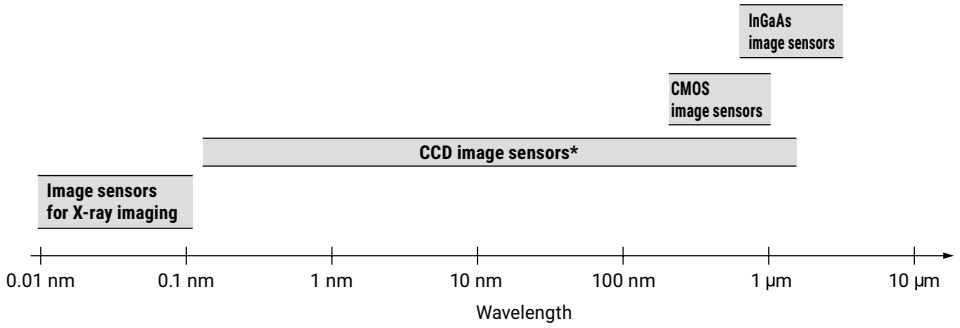
CMOS ROIC

- Line rate / Frame rate
- A/D converter
- I/O interface

Package

- Ceramic / Metal
- SMD (surface mount device)
- Built-in TE-cooler

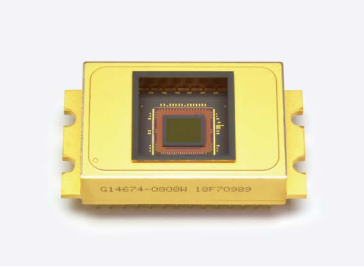
Detectable spectral response range



* Including windowless type

Package types

Ceramic

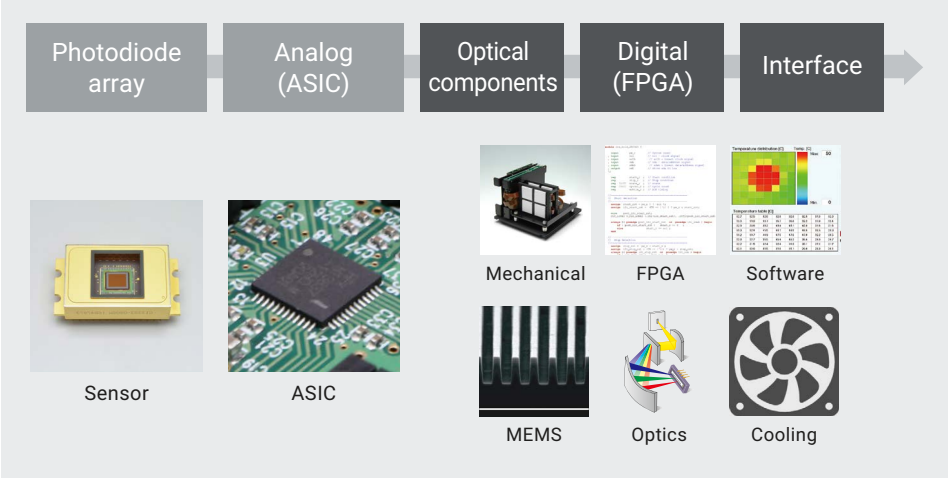


Metal, TE-cooled

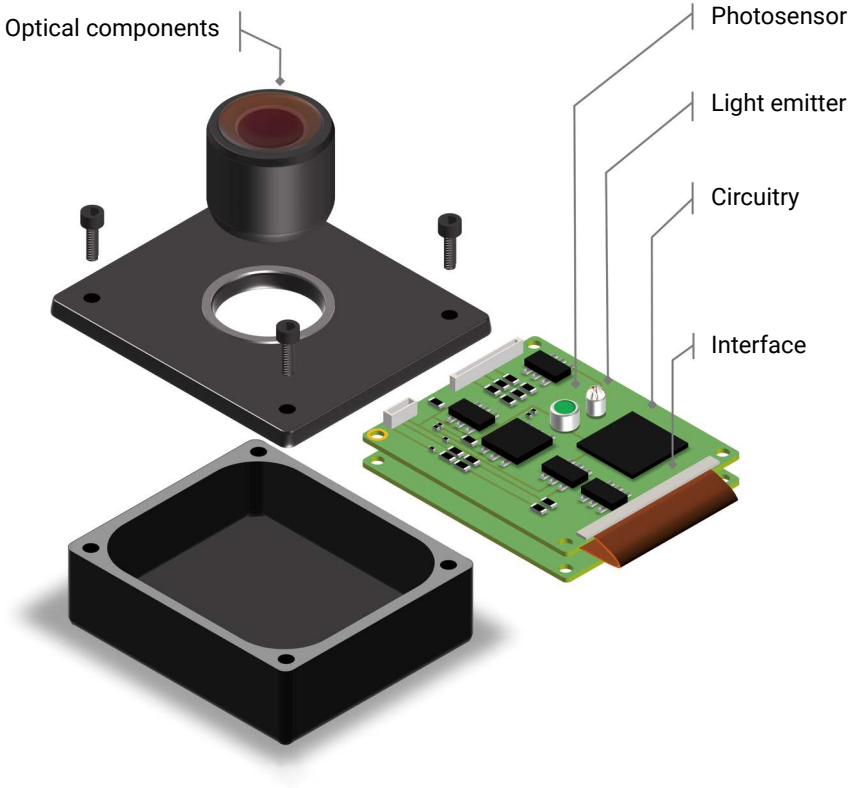
Image Sensor Module / Camera Customization

Hamamatsu not only offers the sensor components but also offers the module solutions featuring our image sensor and other opto-semiconductor products. Customized modules can be designed, simulated, and assembled to customers' specifications by utilizing Hamamatsu's expertise in ASIC design, as well as in opto-mechanics, digital and software design.

Hamamatsu technologies for modularization



Configuration example

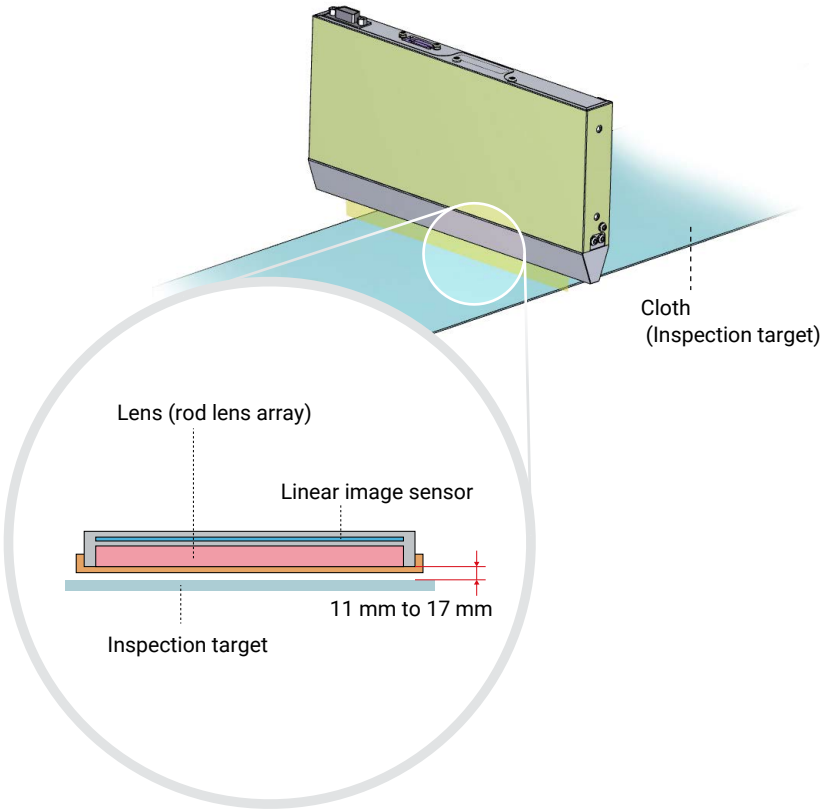


Solution Example

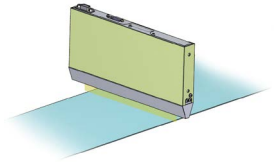
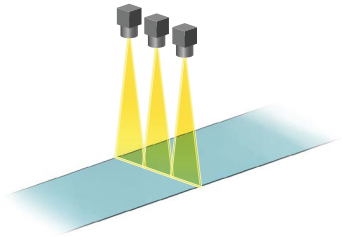
Contact line camera

This is an example of a customized contact line camera that supports in-line inspection of apparel fabrics for defects, appearance, etc.
Its compact housing that integrates lenses and a linear image sensor allows for a short operating distance from inspection targets, which enables a single camera to cover a large scan width without causing distortion in acquired images.

System configuration

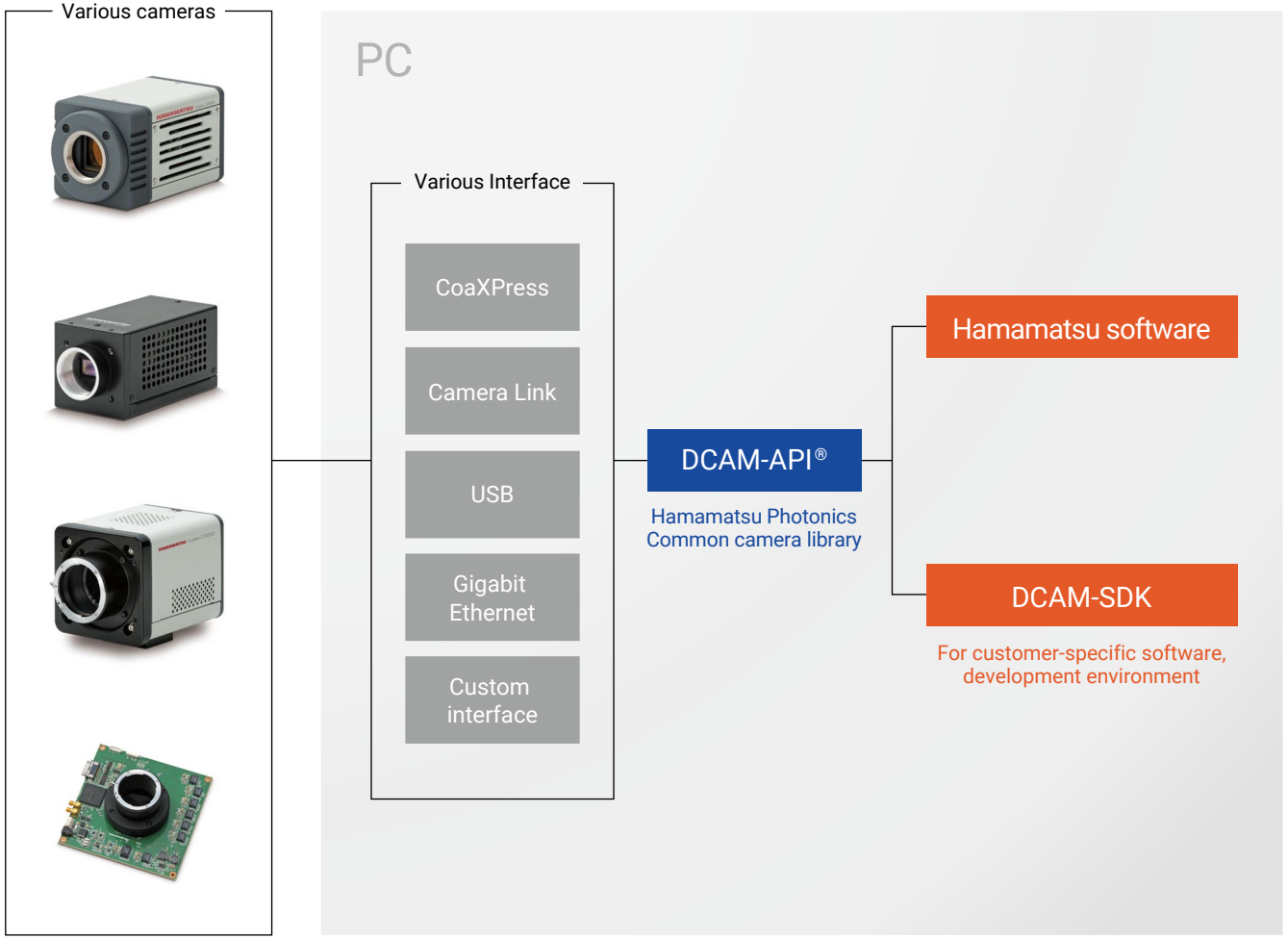


Comparison with reduced optical camera

Parameter	Contact line camera	Reduced optical camera
Image of usage		
Distance to the inspection target	Close	Far
Scan width	Wide	Narrow
Resolution	Low	High
Required radiant intensity	Low	High
Scan speed	Fast	Slow
Image distortion	None	Occurs at the edge of the image

DCAM-API® / DCAM-SDK Support

We provide a common camera library “DCAM-API®,” Hamamatsu Photonics software that can maximize the characteristics of your camera, and a tool “DCAM-SDK,” that allows you to build your own control software. Through DCAM-API®, even if the camera or interface is changed, the software modification / change can be minimized.



HAMAMATSU
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Main Products

Opto-semiconductors

- Si photodiodes
- APD
- MPPC®
- Photo IC
- Image sensors
- PSD
- Infrared detectors
- LED
- Optical communication devices
- Automotive devices
- X-ray flat panel sensors
- MEMS devices
- Mini-spectrometers
- Opto-semiconductor modules

Electron Tubes

- Photomultiplier tubes
- Photomultiplier tube modules
- Microchannel plates
- Image intensifiers
- Xenon lamps / Mercury-xenon lamps
- Deuterium lamps
- Light source applied products
- Microfocus X-ray sources
- X-ray imaging devices

Imaging and Processing Systems

- Scientific cameras
- Spectroscopic and optical measurement systems
- Ultrafast photometry systems
- Life science systems
- Medical systems
- Non-destructive inspection products
- Semiconductor manufacturing support systems
- Material research systems

Laser Products

- Single chip laser diodes
- Laser diode bar modules
- Quantum cascade lasers
- Applied products of semiconductor lasers
- Solid state lasers / Fiber lasers
- Laser related products

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Cat. No. CAFP1007E02 JAN. 2024