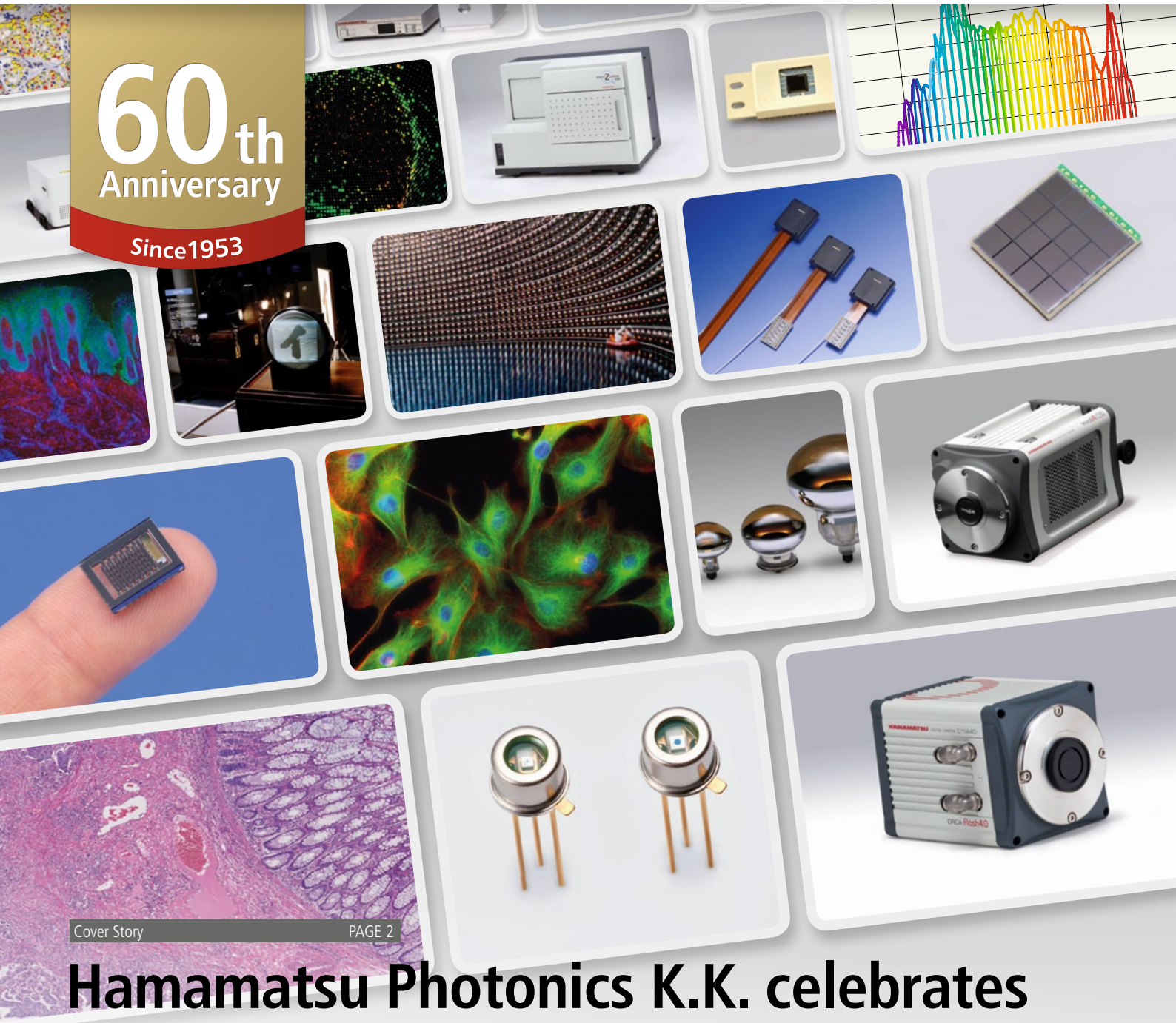
HAMAMATSU
PHOTON IS OUR BUSINESS
NEWS 2013 02



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Cover Story

Akira Hiruma, President of Hamamatsu Photonics K.K.

Hamamatsu Photonics K.K. celebrates 60 years of excellence in Photonics

We are very proud to announce our Company's 60th anniversary. We could not have achieved this milestone without our stakeholders, so we greatly appreciate your support.

Our company began as a tiny venture company in 1953, in an old warehouse with little money, but full of dreams. Our founders were greatly influenced by the work and the spirit of Dr. Kenjiro Takayanagi, who independently developed a television system. He always taught us the importance of doing something nobody had done before.

Like a dream of reaching for the stars, we vigorously pursue the thorough understanding of photons. We call ourselves a research and development company and our mission is to understand "what is a photon?", and how it can benefit humankind.

However, our research and development is not just the result of scientific research, but arises from our daily work. For us, the daily efforts of how to improve our products are an essential part of R&D. Such improvements often require empirical knowledge and our factory floors are full of such knowledge.

As time went by, our knowledge and our sales grew. In 1996, our stock went public and today, Hamamatsu Photonics are considered to be one of the world's leading companies in photonic devices. Today, we are still a long way towards understanding the full potential of the photon, but we will continue to pursue the challenge.

Every 5 years since 1980, we have held our own exhibition called "Photon Fair" in Japan. This year, we are delighted that the Photon Fair will coincide with our 60th Anniversary. The Photon Fair will be held from the 7th to 9th November in Hamamatsu City.

This exhibition will show our guests both our vision of how new photonics technologies can contribute to humankind, and to introduce our very latest product developments. At the event we also have many seminars on the latest photonic technologies. We hope this exhibition will be a steady step forward towards the next 60 years of our pursuit to find the potential of the photon.

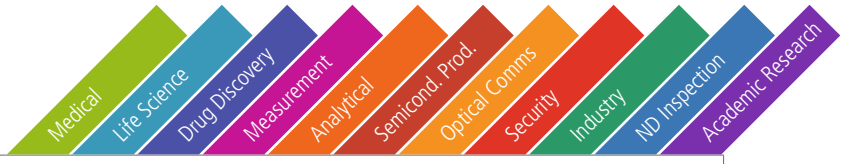
We are growing ever closer to finding new methods of controlling photons. Utilising these technologies we can see devices becoming smaller and more advanced, thereby enabling photonic devices to be used in a wider range of applications. When the seeds of such new technologies meet innovative thinking, new industries will emerge.

Hamamatsu Photonics will continue to improve ourselves to satisfy the needs of a rapidly changing world. But yet, we firmly commit ourselves to the research and understanding of the photon and its full potential.

With your continuing support, we hope to get ever closer to our dream.

Akira Hiruma
President, Hamamatsu Photonics K.K.

Content



		Medical	Life Science	Drug Discovery	Measurement	Analytical	Semicond. Prod.	Optical Comms	Security	Industry	ND Inspection	Academic Research
OPTO-SEMICONDUCTOR PRODUCTS												
14	MPPC (Multi-Pixel Photon Counter)	■	■	■	■	■			■	■	■	■
15	MPPC Modules	■	■	■	■	■			■	■	■	■
16	Infrared LED L11913				■					■		
17	Color/Proximity Sensor P12347-01CT				■					■		
18	CMOS Linear Image Sensor S11639				■	■				■		
19	InGaAs Area Image Sensor G12460-0606S				■	■			■	■		
20	Thermopile T12471-01				■	■						
ELECTRON TUBE PRODUCTS												
21	Compact Excimer Light Source L12530						■			■		
22	UV-VIS S2D2 Fiber Light Source UV enhanced type L12515	■	■	■	■	■	■			■		■
23	PhotoIonBar L12536						■			■		
24	150 kV sealed type Microfocus X-ray Source L12161-07				■					■	■	
SYSTEMS PRODUCTS												
25	Electron multiplying CCD Camera ImagEM X2 C9100-23B		■		■					■		■
26	Digital Camera ORCA-Flash4.0 V2 C11440-22CU		■		■					■		■
27	Scientific CMOS Board-Level Camera C11440-52U		■		■					■		■
LASER PRODUCTS												
28	4.53 µm CW Type Quantum Cascade Laser L12004-2209H-C				■	■						■
29	10 µm Pulsed Type Quantum Cascade Laser L12020-0993T-C				■	■						■

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Hamamatsu Photonics K.K. takes part in the new program to establish Hamamatsu City into a "Photonics City"

Establishing Hamamatsu as a Preeminent Photonics City: Photonics Declaration 2013 in Hamamatsu

Photonics science and photonics industries

The development of photonics science and the resulting expansion of photonics industries throughout the 21st century will usher in an era of photonics, when light will play an even greater role for mankind.

This challenge is the driving force for evolving both photonics science and photonics industries.

Photonics science, photonics industry and Hamamatsu

In 1926, television was born in the city of Hamamatsu. It was a great achievement that set off the prosperity of the electronics industry in the 20th century and heralded the rise of the photonics industry in the 21st century. The technology evolved into the photonics industry in Hamamatsu, where the research of photonics science was continued, fulfilling a major role in social development.

If light has no limitations, the industrial application of light should expand further to make even greater contributions to the happiness of mankind. If that is the case, what can Hamamatsu do as we approach the centenary of the development of television?

Preeminent Photonics City, Hamamatsu

Hamamatsu is an ordinary regional city, which is neither a political nor economic center of Japan. Yet, the world knows "Hamamatsu". The world's attention is upon the city. Why?

That is because Hamamatsu is home to people who identify unlimited potential in the industrial application of light and continue to test the limits of photonics technology. Hamamatsu has numerous organizations that have made a number of achievements in research and development involving light. However, given the amount of issues faced by the Earth and human race, light should offer greater benefits, which we must take advantage of. This is why we wish to give a "new mission" to Hamamatsu and turn it into reality.

Declaration

Establish Hamamatsu into a Preeminent Photonics City, where brilliant minds from around the world would want to study and engage in R&D even just once.

The signing ceremony in Hamamatsu City

Establish Hamamatsu into a Preeminent Photonics City that creates innovative photonics science and industries for the world:

- Wherein researchers explore how to weave and use light;
- Wherein fundamental and applied photonics research of the world's highest level is carried out;
- Wherein photonics products/technologies that the world desires are developed;
- Wherein students, researchers, doctors, engineers, citizens, entrepreneurs, businesses, universities and research institutes seeking to identify the essence of light and gain the ability to freely manipulate it, gather from around the world to inspire each other;
- Wherein venture businesses and small/medium-sized businesses will play a leading role in developing applied photonics industries and engage in energetic activities;
- Wherein the intriguing nature and limitless potential of light are communicated and educated to younger generations.

Shizuoka University, Hamamatsu University School of Medicine, the Graduate School for the Creation of New Photonics Industries, and Hamamatsu Photonics K.K. will work in close partnership in all actions that could lead to establishing Hamamatsu as a Preeminent Photonics City.

Photonics West

By Koji Takemiya, Leo Kohyama

Photonics West is one of the largest and most influential events in the photonics industry. In February 2013, more than 20,000 visitors from around the world came to the Moscone Center in San Francisco to hear the thousands of conference papers on topics in biophotonics, optoelectronics, industrial lasers, microfabrication, and more. They also viewed the exhibits of more than 1,200 participating companies, including the booth of Hamamatsu Photonics.

For Hamamatsu, Photonics West is one of the most important events at which to present some of our newest products (including those still under development), as well as to tell the story of how our technology has benefited our customers, their users, and society in general. This year, among the products which we highlighted were the Micro PMT, a next-generation photomultiplier for portable instruments; MEMS micromirrors for use in heads-up displays in cars; a MEMS FTIR detector designed for handheld spectrometers; and Scientific CMOS cameras that provide high sensitivity, high speed, high resolution, and large field of view for fluorescence microscopy and other applications.

As for communication, every year Photonics West gives us a unique chance to improve the way we present our value to customers – not only because it is our biggest and most well-staffed exhibit in the United States, but also because attendees are extremely interested in seeing something new. So in addition to putting a large number of samples on display, over the years we have included things such as a moving model of a race car to demonstrate high-speed TDI imaging (a demo borrowed from our European colleagues), personalized tours of our entire exhibit, and seminars at our booth to describe Hamamatsu's newest technology. In 2013, we added a large interactive touch screen to help visitors easily find what products we have for their specific applications. Next year, we want to include some spectacular items from Hamamatsu's Photon Fair exhibition – a special event to be held in November 2013 to celebrate the 60th anniversary of our parent company's founding.

Photonics West

Company News



9th European Functional Drug Screening Symposium

9th European Functional Drug Screening Symposium

This year's meeting was held on the 13th of June at the Institut de Recherches Servier's facilities, with the invaluable support and contribution of Olivier Nosjean, Denis Guédin and their teams (from Servier Laboratories).

The 9th FDSS Users Meeting once again reached its goal: the promotion of our system being used in different applications by our long term customers and the sharing of their experiences with our new potential customers.

After a general introduction of Hamamatsu Photonics, the new options (hardware and software) of the FDSS series were presented. Furthermore the new application of the ion sensitive dye on stem cells was introduced. All of these presentations were followed by the participants who considered all subjects useful, pragmatic and technically informative.

Many interesting questions arose from the scientific presentations covering diverse applications as varied as new screening methods for GPCRs, ion channels and cell-based assays. All of these speeches were welcomed by the attendees who appreciated the scientific high level content.

To briefly describe the event's successful outcome, according to the participants' feedback (42 people, Hamamatsu not included), it was concluded that this event was a good opportunity for users to have their questions answered and to meet the Japanese experts, who can help them in their projects. It was agreed that the subjects focused on were very interesting, of high level and well varied. The good atmosphere and warm welcome were also nicely highlighted.

This year's after-meeting event was a visit to the Musée d'Orsay, which was appreciated by all of our customers and colleagues: "it was a great pleasure to walk in between the pieces of art and learn the background of their history with the help of the guided speech tour", commented one of our customers. Finally, we closed the event dining at the Museum, surrounded by the stunning decor and atmosphere of the restaurant and the refined taste of the menu.

ACTELION

We have already scheduled the 10th European Functional Drug Screening Symposium, on the 12th of June 2014 at the facilities of Actelion Pharmaceuticals, Switzerland.

Save the date.
If you have any questions concerning this meeting, please contact: Jean Marc D'Angelo, **jmdangelo@hamamatsu.fr**

For the 3rd time, this European conference brings together experts in the field of Whole Slide Imaging

Whole Slide Imaging (WSI) is turning biomarker analysis in tissues into a spatial and quantitative discipline. As a key technology it launches the era of digital pathology, generates new spatial data sets in fundamental research, and sets the future standards of biomarker evaluation in routine clinical therapeutic decision making. After two successful past conferences in Heidelberg, the 3rd conference on Whole Slide Imaging serves again as a unique forum welcoming experts working at the crossroad of these disciplines to discuss recent developments. In addition to the poster exhibition, a number of free talks are available and we await your submissions.

Heidelberg

Topics

- Pathology becoming digital
- Spatial patterns in biomarker development
- Quantitative imaging in oncology
- Novel datasets for systems biology
- Improving clinical studies
- Novel image analysis algorithms
- Transforming clinical routine diagnostics
- The industry perspective: chances and challenges

Confirmed Speakers

- Gerd Binnig
  Nobel Prize Laureate and CTO Definiens
- Michael Grunkin
  CEO Visiopharm
- Fredrik Ponten
  Human Protein Atlas, Uppsala University
- Nicolas Wentzensen
  Epidemiology, National Cancer Institute (NCI)
- Mogens Vyberg
  NordiQC, Aalborg University Hospital
- Paul van Diest
  Pathology Department, UMC Utrecht
- Daniel Racoceanu
  National University of Singapore and Sorbonne Universities
- Sven Lindemann
  Merck Serono, Darmstadt
- Akiro Saito
  NEC Corporation, Tokyo
- Florian Markowetz
  Cancer Research UK Cambridge Institute
- Janke Dittmer
  Gilde HealthCare Partners, Utrecht
- Peter Schirmacher
  Institute of Pathology, University Hospital Heidelberg

TIGA TISSUE IMAGING & ANALYSIS CENTER

BioQuant MODEL base of LIFE

UniversitätsKlinikum Heidelberg

NCT NATIONALES CENTRUM FÜR TUMORERKRANKUNGEN HEIDELBERG

IPH Institute of Pathology Heidelberg

Online Registration is now open.
Please submit your abstracts at:
www.wsi-conference.com

Company News

HPUK 25th Anniversary

Hamamatsu Photonics UK opened its doors for business back in September 1988 and today we celebrate 25 years of operation. The new UK office was established in line with Hamamatsu Photonics KK's policy of providing the best local sales support to customers through a network of European sales offices. Hamamatsu Photonics UK (HPUK) has grown from a company of 6 employees to an organisation of 40 people built on the establishment of strong, long-standing relationships with both our OEM and Research customers. Our initial base of providing technical, sales and logistical support to our customers in the United Kingdom and Ireland has today expanded geographically to include Southern Africa and India, as well as providing support to our business throughout the Middle East region.

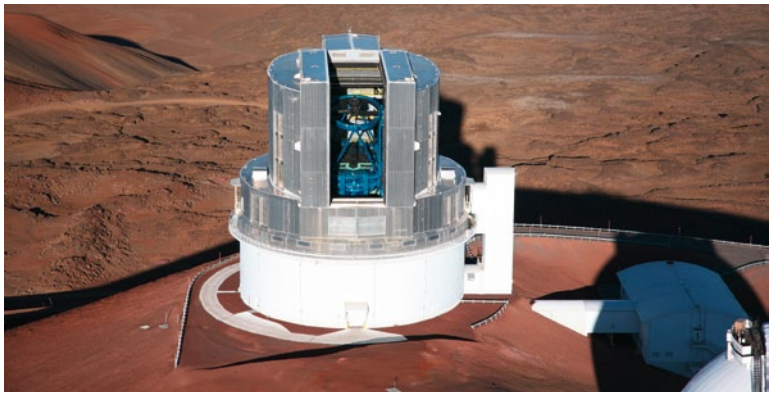
Tim Stokes, Managing Director

Tim Stokes, Managing Director comments "At this 25 year milestone we would like to express our sincerest thanks to all of our customers and other stakeholders, without whom our success could not have been achieved. Our focus for the future remains on further improving our customer service and support. As technology develops and products become ever more complex, with more integrated functionality, we see the need to provide even greater levels of technical support and to collaborate ever more closely with our clients and their design teams to ensure the success of their next generation of products.

We have many successful relationships where HPUK "partner" with our OEM customers and working together over many years have established a mutual trust. This allows us to share more sensitive information relating to future technological and market developments, which benefits both supplier and customer alike when endeavouring to develop and bring to market new products.

Of course, as well as our loyal customers, our success would not be possible without our excellent and committed team of employees at HPUK. We have a core team of very experienced and knowledgeable people who have been with Hamamatsu for many years, several since the company's foundation some 25 years ago. This experience is invaluable to negotiate through the day to day issues that inevitably arise in any business and the technical knowledge of our sales force is, we believe, our most important asset when discussing new opportunities and future applications with our prospective clients.

The future for Photonics and Opto-electronic products and technologies is very bright within the UK, and HPUK are determined to maintain our market leadership within this field in the coming years."



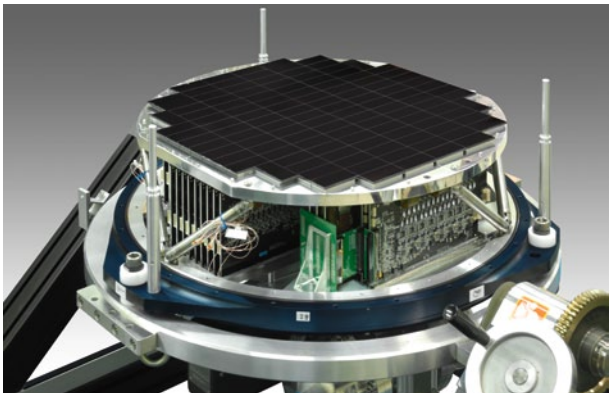
By courtesy of National Astronomical Observatory of Japan

CCD image sensors installed in the Hyper-Suprime Cam

Hamamatsu develops CCD image sensors for the Subaru Telescope's Hyper-Suprime Cam

Hamamatsu Photonics K.K., in conjunction with the National Astronomical Observatory of Japan (NAOJ), Osaka University, and Kyoto University, has developed CCD image sensors for use in the Hyper-Suprime Cam, an ultra-wide field of view prime focus camera installed in the Subaru Telescope at the summit of Mauna Kea, Hawaii. Compared to the CCD image sensors used in the first generation Suprime-Cam, the new CCD image sensors additionally provide extended sensitivity in the near-infrared region and highly uniform product quality. Hamamatsu mass produced 116 of these large-area (3 cm x 6 cm) back-illuminated deep-depletion CCD image sensors for this project. Visit http://www.naoj.org/j_index.html

Scientists and researchers expect the sensors to play an important role in cutting-edge fields, among them dark energy research; distant space research, through which the first celestial bodies made in space are to be discovered; and observational astronomy.



CCD area image sensors lined up in a tile configuration

For further information, visit:
www.hamamatsu.com
and to find out more about the Subaru Telescope's Imaging Discovery visit:
http://www.naoj.org/j_index.htm

Scientific CMOS Camera
Versatile by design and changing the game in scientific imaging

DIGITAL CAMERA
ORCA®-Flash4.0 V2

A game changer from inception and a proven performer since its initial release, the ORCA-Flash4.0 V2 offers unrivalled flexibility across a wide range of imaging applications

The development project of the ORCA-Flash4.0 spanned more than one and a half years. Since the start of the preliminary specification stage, Hamamatsu worked closely with researchers around the world including Japan, Europe, North America and China to identify their application needs and demands for a scientific camera. The feedback from the researchers was given to our development team and the versatile ORCA-Flash4.0 V2 was the result.

To learn more about how this development was accomplished, please see the following interview with the Project Team responsible.

Now researchers have already shown that the ORCA-Flash4.0 helps them to overcome barriers and challenges – read the Bench stories in our new site dedicated to celebrating life science imaging – **http://thelivingimage.hamamatsu.com**




Interviewees (from the left)

Tokuhiro Koike *(Camera Designer):*
System Division, R & D Group #1, Dept. 14
Eiji Toda *(Project Manager):*
System Division, R & D Group #1, Dept. 14
Masayuki Koide *(Sales Promoter):*
System Division, Business Promotion Dept., Overseas Group
Jiro Yamashita *(Product Manager):*
System Division, R & D Group #1

Pursuit of developing a CMOS camera with performance that matches EM-CCD cameras

What exactly is a scientific camera?

Toda: One example would be cameras developed for applications to view dark objects while coupled to a microscope. For the past 10 years or so, EM-CCD cameras (electron-multiplying CCD cameras) have been usually used in this application. However, they were only in limited use due to their high price and large camera size required for cooling the sensor.

Koide: When I visited customers, I received a lot of comments and requests such as "EM-CCD cameras are difficult to use" and "Is there a more inexpensive camera that still has sensitivity equivalent to the EM-CCD?" So we felt there is need for a product that answers customer requests.

Koike: It was once thought that CMOS cameras were not fundamentally suited for scientific measurement applications. However, swift advances in technology came one after another since their use began in consumer applications, and CMOS cameras have now reached a level where their performance nearly equals that of EM-CCD cameras.

So you then started developing CMOS cameras for scientific work?

Toda: Yes, that period was around the end of 2010. We first started out by narrowing down what specifications were required for making CMOS camera performance equivalent to EM-CCD cameras. EM-CCD cameras have extremely high sensitivity and their high-end performance required by a very narrow range of applications cannot be covered by CMOS cameras. To put it another way, except for an extremely tiny high-end area, CMOS cameras can serve as a good substitute for EM-CCD cameras.

Koide: We also found that not all of the EM-CCD camera users were utilizing their camera performance to its extreme limits.

Image simulator that drew the same response from Japanese, European, US and Chinese researchers

So you discovered trends among EM-CCD camera users?

Toda: Mr. Yamashita was in charge of that task. While serving as product manager, he visited users and amassed information on their needs starting from the initial development stage.

Yamashita: I participated in this project from about the summer of 2011. This was the period when provisional specifications for the ORCA-Flash4.0 were ready. We started investigating all fields matching this product, finding researchers in these fields all over the world, and began taking action some time before that product was released.

What kind of response did you obtain?

Yamashita: We visited about 30 persons who were researchers inside Japan, the US, Europe and China. Before visiting those researchers, we designed and built an "image simulator." After showing them with the image simulator how images taken with the CMOS camera stacked up against images taken with an EM-CCD camera, most researchers were eager to try using our new camera. Thanks to this image simulator, our comment of "See how much more accurate the data in your research field is when using our CMOS camera" had a lot of persuasiveness. Some researchers voiced doubts about the simulation but most researchers judged that the CMOS camera would prove a great benefit to their research.

Toda: Besides higher resolution, we also succeeded in demonstrating other advantages of our CMOS cameras, such

as a higher frame rate and a wider field-of-view than EM-CCD cameras[*1]. This approach was the first time we attempted. Up until now, our product development in most cases started with a rough assessment of the market and evaluation of product specifications, and then shifted to open up the market after the product was pretty much completed. In the case of the ORCA-Flash4.0, however, we ventured into the market before making the product, and then found a market simultaneous with product release.

Yamashita: After getting a direct feel for customer opinions and needs, and providing feedback to product design as necessary, we released a product that was as close to market needs as we could make it. This was done with a view to expanding its potential market.

And then, Mr. Koike, you made the product reflect these collected user needs, didn't you?

Koike: I was given the task of developing the actual product that would achieve the required performance within a target price and size. Our goal was a price half that of EM-CCD cameras and about one-third of the EM-CCD camera size.

Toda: After incorporating the required specifications into the determined size, we gradually found tradeoff conditions for sensor cooling versus size, and assessed the device structure while keeping an eye on costs. There were at most about 30 people taking part in this project. Usually about 20 members met once a week voicing their opinions from a variety of different standpoints.

Some 30 members debated the project points over one year

How long did all of this continue?

Toda: It continued for one year. To be honest, in the period where the project had just been launched I was worried about whether we could actually arrive at a consensus from everyone's opinions. Each one advocated his own design as the scheme offering minimal risk. If we incorporated all these designs the product would vastly exceed the target size. This was unacceptable, so we once again made an effort to return to the drawing board to unify opinions while keeping our attention centered on the product goals.

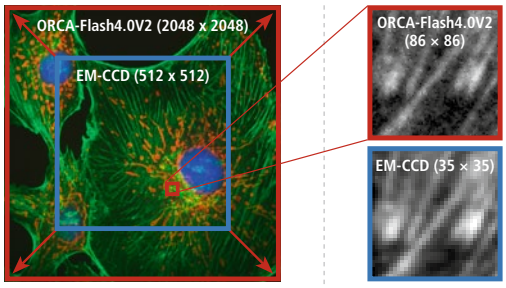
Koide: Anyhow, getting everyone to agree on these issues was a tough job.

What field was it that you regarded as the target market?

Toda: It was the field of super-resolution imaging where EM-CCD cameras were absolutely used. Yamashita's assessment revealed that this area was better suited to our CMOS camera than EM-CCD cameras.

Yamashita: In a simulation where we substituted the CMOS camera for EM-CCD cameras, we found that resolution was

CMOS camera delivers high resolution 2.46 times higher than that of typical EM-CCD cameras.



Comparing field-of-view
Delivers a wide field-of-view 2.64 times that of typical EM-CCD cameras.

Comparing resolution
The high resolution given by the 4 million pixels allows sharply and clearly showing detailed cell information that is impossible for an EM-CCD camera to capture.

Observation of embryonic development of *Drosophila*. (3D image captured with light-sheet microscope)

Courtesy of Dr. Philipp J. Keller, Howard Hughes Medical Institute, Janelia Farm Research Campus, Ashburn, VA 20147, USA

improved 20 percent in super-resolution imaging. After the ORCA-Flash4.0 appeared on the market, we asked for actual data from researchers and found that results did in fact match that simulation.

It first appeared on the market in December 2011 and the V2 upgraded model was announced in February 2013, correct?

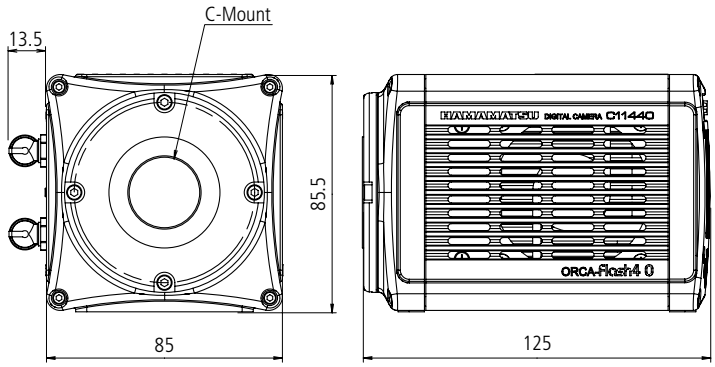
Toda: Three or four months after the release of the first model (V1), we got an opportunity for a product review meeting with representatives of overseas subsidiaries. The "wish list" of customer needs for the V1 at that time was some 20 items, so we picked out high priority items with functions having appeal on the market and incorporated these into the V2 we released.

Koike: One of the functions we added at that time was the light-sheet readout mode*2. This is essentially a readout function ideal for the light-sheet microscopy used in 3D imaging and after the release of the V1 this was a "must-have" feature especially for researchers.

Koide: There was only a mere one year period from the release of the V1 to the release of the V2. This was a development speed surpassing all the normal rules at our company. It also reflects the high product assessment received by market users and shows an aggressive stance toward sales while continually enhancing camera functions and maintaining product value.

ORCA-Flash4.0 V2

Size is only one-third that of EM-CCD cameras. **Unit: mm**



*1: ORCA-Flash4.0 has 2.46 times the resolution, 2.64 times the field-of-view, and 3 times the frame rate of typical EM-CCD cameras.

*2: Light-sheet readout mode delivers seamless and accurate readout by synchronizing the camera readout timing with the movement of the excitation light.

Camera directly provides information the user needs

In what direction do you think Hamamatsu scientific cameras are heading?

Toda: Our next aim is achieving a so-called "Intelligent Camera" having a certain amount of "smarts" to make it capable of delivering what the user wants. This is called the PROCAM Project under its current development code. The PRO stands for "professional" and also for "programmable."

Yamashita: Until now the main function of the camera was imaging and we weren't terribly concerned about how the user processed or handled those images. However, the volume of image data has recently been steadily increasing so that handling the data has itself become a required skill. Yet some persons don't like handling the data itself. If you think about it, what the user wants to do is extract the information from the image and does not want to process the data.

Koide: So our approach is that if we can output the camera information the user wants as is, then we would be a step closer to meeting market needs.

Koike: In order to freely extract the results the user wants without worrying about the camera, we need to develop a user interface along with the usual camera development work.

What kind of future vision do you have for that goal?

Toda: One goal to aim for is a CMOS camera capable of detecting single photons. EM-CCD cameras are capable of detecting single photons. But they are designed to capture an image by multiplying the photons and so the resultant fluctuation prevents them from detecting photon behavior. Our CMOS camera performance is now very close to that of EM-CCD cameras and might even surpass the weak points of EM-CCD cameras to provide a better product.

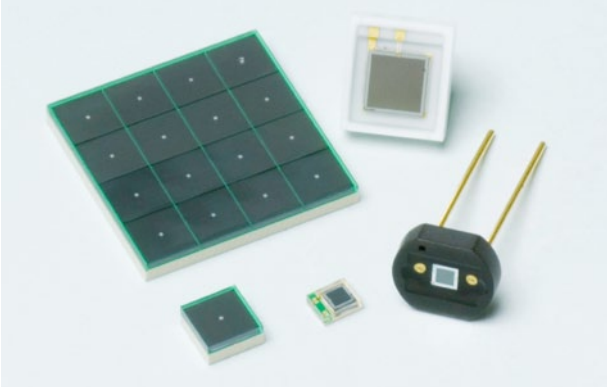
Koide: If we could accomplish this, it would take us one step closer to achieving our corporate slogan "Photon is our Business." So I really want to see us try for that goal.

For the detailed information, refer to the digital camera "ORCA-Flash4.0 V2". (P26)

MPPC (Multi-Pixel Photon Counter)

Photon-counting device with low afterpulse and wide dynamic range

The MPPC (Multi-Pixel Photon Counter) is a photon-counting device made up of multiple APD (avalanche photodiode) pixels operated in Geiger mode. The MPPC is essentially an opto-semiconductor device with excellent photon-counting capability and which also possesses great advantages such as low voltage operation and insensitivity to magnetic fields.



MPPC

Differences from previous types

- All types drastically reduced afterpulse.
- High-speed, wide dynamic range type offers reduced pixel size and enhanced photon detection efficiency.
- For precision measurement MPPC drastically reduces crosstalk.

Features

- Low afterpulse
- Wide dynamic range
- High detection efficiency
- Low crosstalk

Applications

- Fluorescence measurement
- Medical equipment
- Distance measurement
- Radiation measurement
- Particle diameter measurement
- Low-light-level detection

Line-up

Type	Type No.	Photosensitive area	Pixel pitch	Package
For general measurement NEW	S12571-025, -050, -100C/P	1 × 1 mm	25/50/100 µm	Ceramic/ Surface mount type
	S12572-025, -050, -100C/P	3 × 3 mm		
High-speed, wide dynamic range NEW	S12571-010, -015C/P	1 × 1 mm	10/15 µm	
	S12572-010, -015C/P	3 × 3 mm		
For very low light level measurement NEW	S12576-050	1 × 1 mm	50 µm	Metal (Two-stage TE-cooled)
	S12577-050	3 × 3 mm		
For precision measurement PRELIMINARY (low crosstalk)	S12651-050C, -100C	1 × 1 mm	50/100 µm	Ceramic
	S12652-050C, -100C	3 × 3 mm		
	S12671-050, -100	1 × 1 mm	50/100 µm	Metal (Two-stage TE-cooled)
	S12672-050, -100	3 × 3 mm		
Buttable type PRELIMINARY	S12641-050	3 × 3 mm	50 µm	Surface mount type
	S12642-050	3 × 3 mm (4 × 4 ch array)		
Large area arrays PRELIMINARY	S12657, S12658, S12659, S12660-050	3 × 3 mm (4 × 4 ch array)	50 µm	PWB/Surface mount type/with FPC
	S12573-025C, -050C, -100C	3 × 3 mm (2 × 2 ch array)	25/50/100 µm	Ceramic

NEW

MPPC Modules

Photon-counting modules integrating a new type of MPPC

Hamamatsu MPPC modules are optical measurement modules capable of measuring light over a wide range of light levels (10 orders of magnitude) from the photon-counting region up to the nW (nanowatt) region. MPPC modules contain a signal amplifier circuit, a high-voltage power supply circuit, and other components needed for MPPC operation. MPPC modules operate just by connecting them to a power supply (±5 V, etc).

MPPC modules

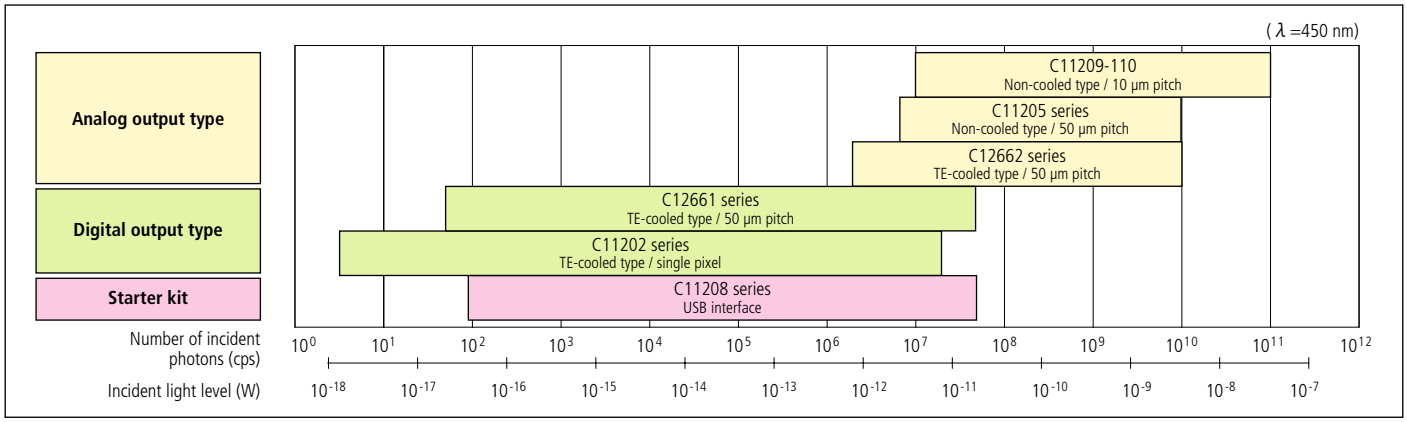
Differences from previous types

Use of MPPC with improved characteristics ensures low afterpulse, wide dynamic range, and high photon detection efficiency.

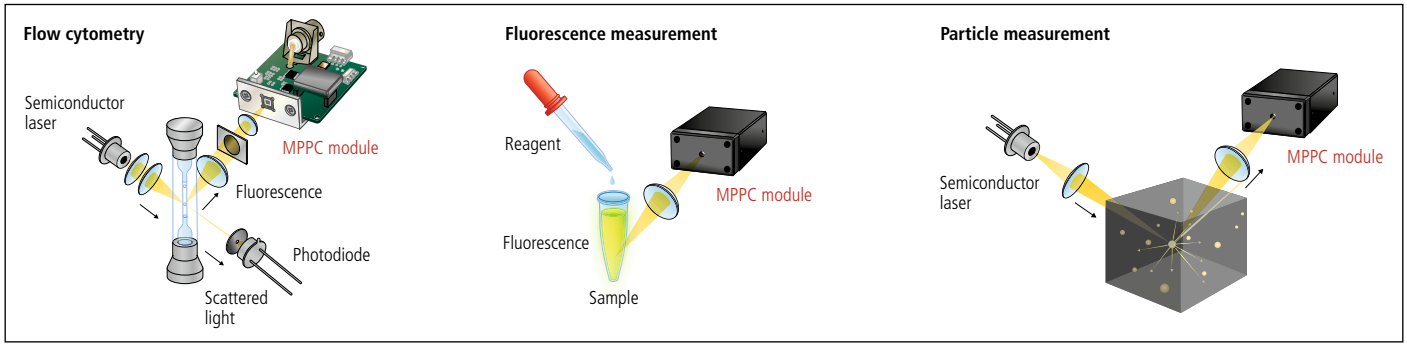
Features

- Includes circuits necessary for MPPC operation.
- Both analog output and digital output types are available.
- Starter kits for initial evaluations and high-voltage power supply module for MPPC are also provided.

Measurable light level range



Application examples



Infrared LED
L11913

PRELIMINARY

LED emitting collimated light for optical encoder

The L11913 is an infrared LED developed for optical encoders. By improving the LED chip and optical alignment, the L11913 emits a highly collimated light beam with high output intensity more than 2.5 times the current product.

L11913

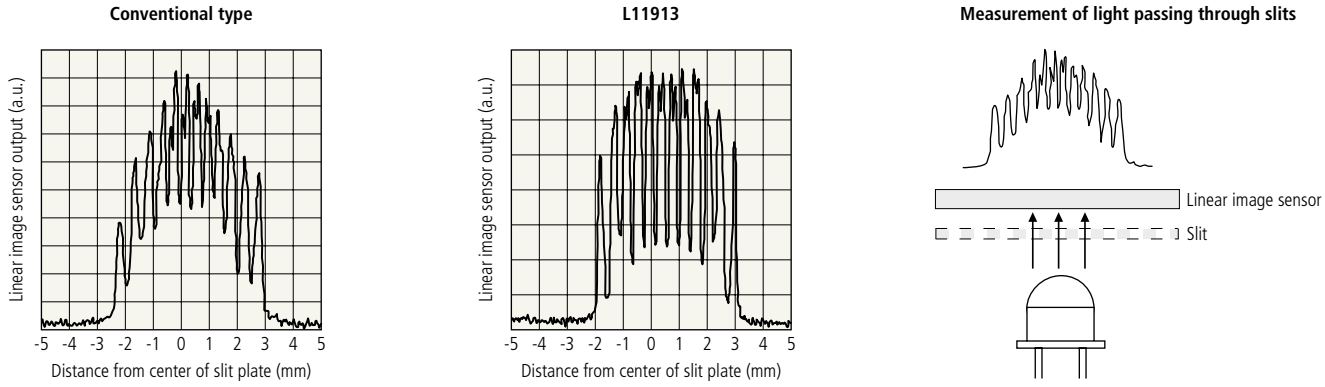
Features

- High output power (more than 2.5 times the current product)
- High collimated light beam
- Uniform light spot
- Narrow directivity
- High reliability

Application

- Optical encoder

Signal output by light passing through slits (Typ. Ta = 25 deg. C.)



Specifications

Parameter	Specification	Min.	Typ.	Max.	Unit
Peak emission wavelength	I_F = 20 mA	820	850	880	nm
Spectral half width	I_F = 20 mA	-	25	-	nm
Optical output *1	I_F = 20 mA	2.2	3.0	-	mW
Forward voltage	I_F = 20 mA	-	1.45	1.70	V
Reverse voltage	V_R = 5 V	-	-	5	µA
Light spot size *2	I_F = 20 mA ± 10 mA, X,Y directions	-	4.3	-	mm
Cutoff frequency	I_F = 20 mA ± 1 mAp-p	10	20	-	MHz

*1 Measured with a photodiode (photosensitive area: ϕ 8 mm) installed 25 mm away from LED stem undersurface
*2 FWHM of beam spot measured with an image sensor installed 13 mm away from stem undersurface

Color/Proximity Sensor P12347-01CT

NEW

Integrating a color sensor, a proximity sensor and a 3-color LED

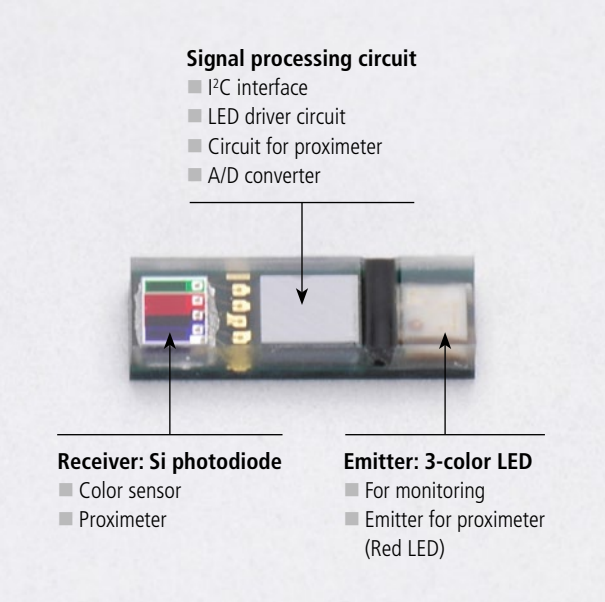
The P12347-01CT is a multi-function sensor that integrates a color sensor, a proximity sensor, and a 3-color LED into one small package (5.5 × 1.7 × 1.0 mm). The P12347-01CT can be used in smartphones to perform tasks such as display image quality adjustment, touch screen on/off control, and incoming call indication. Besides detecting an RGB ratio of the surrounding light, the color sensor can also be used as an illuminance sensor to allow fine adjustment to the image quality. The proximity sensor detects a face when it comes close to the smartphone and turns off the touch screen function and LCD backlight.

Features

- I²C interface: 400 kHz (Fast mode)
- Low power supply voltage: Vdd = 2.25 V to 3.6 V
- I²C bus voltage: 1.65 V compatible
- Low current consumption
- Small package: 5.5 × 1.7 × 1.0 mm
- Applicable to lead-free solder reflow

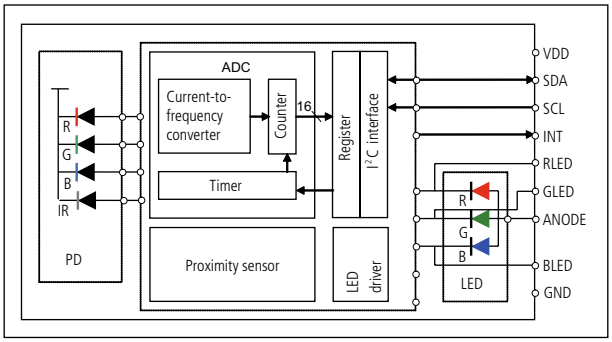
Application

- Smartphones, TV/PC display, tablet computers, etc. (image quality adjustment, touch screen on/off control, incoming call indication)



P12347-01CT

Block diagram



CMOS Linear Image Sensor S11639

NEW

High sensitivity photosensitive area with vertically long pixels

The S11639 is a high sensitivity CMOS linear image sensor using a photosensitive area with vertically long pixels (14 x 200 µm). Other features include high sensitivity and high resistance in the UV region.

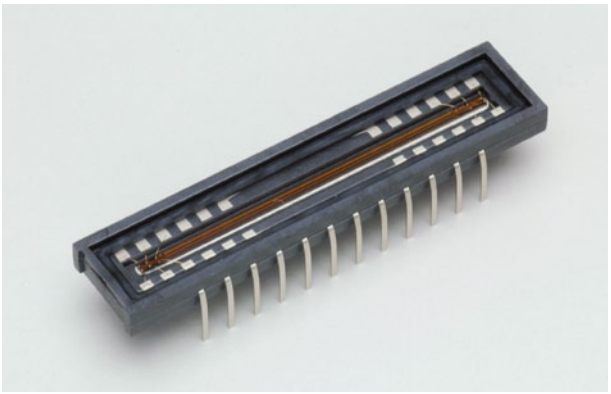
The S11639 operates from a single 5 V supply making it suitable for use in low cost spectrometers.

Features

- High sensitivity: 1,300 V/(lx · s)
- Electronic shutter
- Single 5 V supply operation
- Conversion efficiency: 25 µV/e⁻
- High sensitivity in UV to NIR region
- Video data rate: 10 MHz

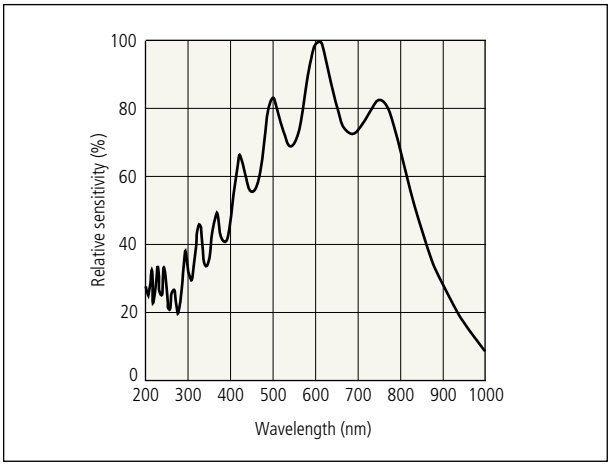
Applications

- Spectrophotometry
- Position detection
- Image reading
- Encoders



S11639

Spectral response (Typ. Ta = 25 deg. C.)



Specifications

Parameter	Specification	Unit
Number of pixels	2,048	-
Pixel pitch	14	µm
Pixel height	200	µm
Photosensitive area length	28.672	mm
Spectral response range	200 to 1,000	nm

NEW

InGaAs Area Image Sensor G12460-0606S

Two-dimensional image sensor with spectral response up to 1.9 µm

The G12460-0606S is a near-infrared two-dimensional image sensor with 64 × 64 pixels developed for near-infrared imaging in measurement and industrial applications. It has a hybrid structure consisting of a CMOS readout circuit (ROIC: readout integrated circuit) and back-illuminated InGaAs photodiodes. Each pixel is made up of an InGaAs photodiode and a ROIC electrically connected by an indium bump.

Additional feature

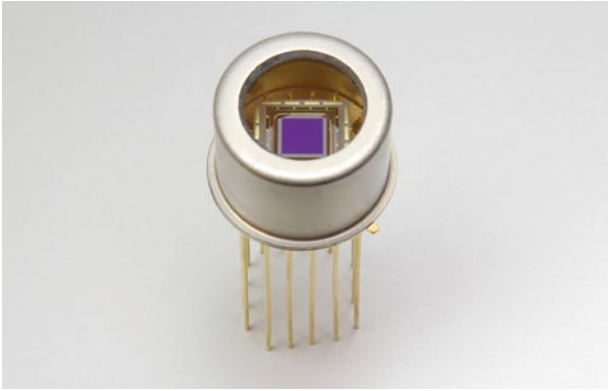
Spectral response range extending up to 1.9 µm

Features

- Spectral response range: 1.12 to 1.9 µm
- Excellent linearity by offset compensation
- High sensitivity: 1,600 nV/e-
- Simultaneous charge integration for all pixels (global shutter mode)
- Simple operation (built-in timing generator)
- One-stage TE-cooled
- Low cost

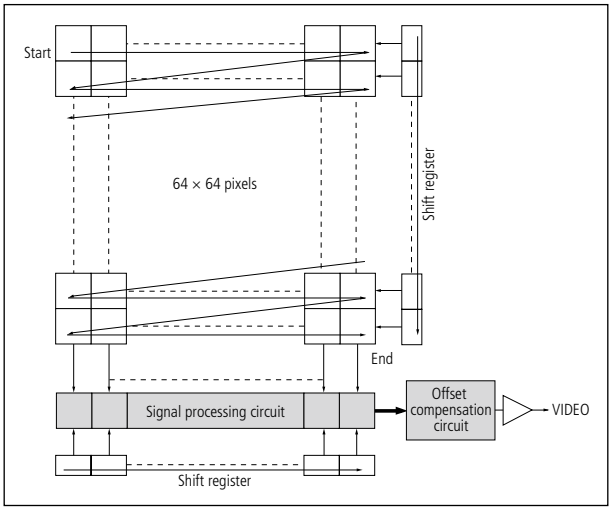
Applications

- Gas monitor
- Recycled material sorter
- Moisture monitor



G12460-0606S

Block diagram

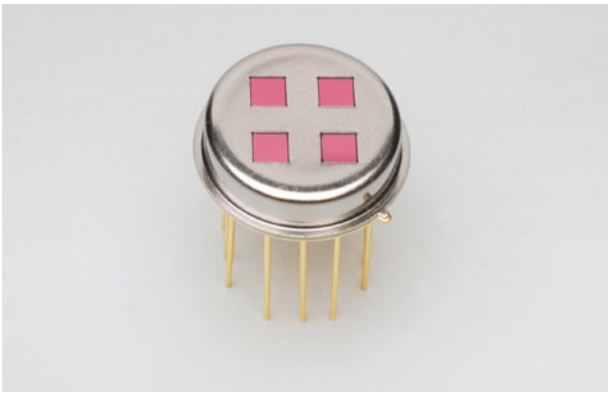


Thermopile T12471-01

NEW

Quadrant type

The T12471-01 is a quad-element type thermopile ideal for gas analysis applications. It contains high-sensitivity thermopile chips, each of which is covered with an anti-reflection film coated Si window (with high transmittance from 3 to 5 µm). Even four different gases can be detected simultaneously by placing relevant IR band-pass filters in front of each window. (Infrared band-pass filter should be arranged by a user.)



T12471-01

Newest addition to our range of thermopiles

Quad-element type developed and added to our range of thermopiles (single, dual, and array types)

Features

- Photosensitive area: 2 × 2 mm (4 elements)
- Spectral response range: 3 to 5 µm (AR coated Si)
- High sensitivity: 28 V/W typ.
- Low temperature coefficient of element resistance

Application

- Gas analysis, etc.

Specifications

Parameter	Condition	Min.	Typ.	Max.	Unit
Photosensitive area (per one element)	Infrared absorption layer	-	2 × 2	-	mm
Spectral response range	Si window with AR coat		3 to 5		µm
Photosensitivity	1 Hz, 500 K	20	28	36	V/W
Element resistance		70	90	110	kΩ
Noise voltage	Johnson noise	-	38	43	$nV/Hz^{1/2}$
Noise equivalent power		-	1.4	2.2	$nW/Hz^{1/2}$
Detectivity		0.9×10^8	1.4×10^8	-	$cm \cdot Hz^{1/2}/W$
Rise time	0 to 63 %	-	25	35	ms
Temperature coefficient of element resistance		-	±0.1	-	%/deg. C.

Compact Excimer Light Source L12530

Easy testing and evaluation of surface modification and cleaning – all-in-one hand-carry light source

The EX-mini is a compact excimer lamp light source ideal for R&D work. In the EX-mini the light source and the irradiation box are integrated into a single body to reduce size and weight while still offering the high performance of our other excimer lamp light sources designed for production line use. The EX-mini can easily test and evaluate excimer lamp light sources before mounting onto production lines. An optional ozone decomposition unit eliminates the need for exhaust ducts.

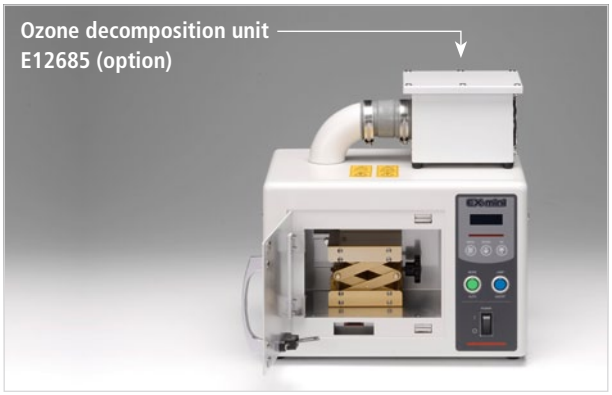
Features

- Light source integrated with irradiation box
- Compact and light enough to carry
- Ozone decomposition unit (option) can discharge exhaust to indoor locations.
- High output yet uniform irradiation
- Programmable irradiation time

Applications

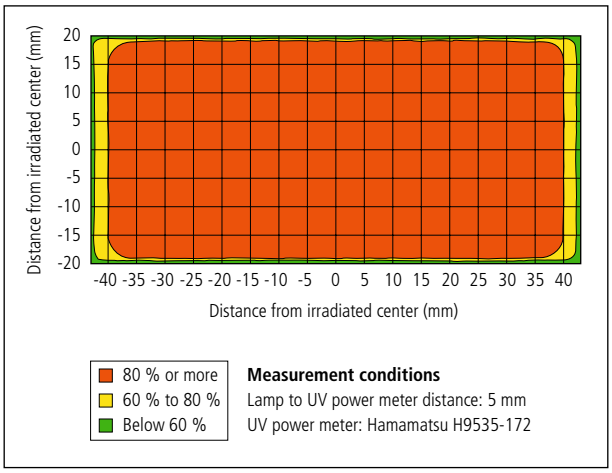
- Surface modification
  - Pretreatment for adhesives (adhesive strength improvement)
  - Coating adhesion improvement
  - Printing adhesion improvement
- Material dry cleaning
  - Silicon wafer and glass substrate cleaning
  - Removal of organic films
  - Removal of adhesive residues

L12530



Sample stage (jack, etc.) is not supplied with the EX-mini

Uniformity characteristics



Specifications

Parameter	Specification	Unit
Irradiance *1	50 or more	mW/cm^2
Emission wavelength	172	nm
Irradiation area size (W x H)	86 x 40	mm
Duct suction air flow rate *2	0.25 to 0.35	m^3/min
Outer dimensions (W x H x D) *3	344 x 233 x 230	mm
Inside dimensions (W x H x D)	204 x 118 x 139	mm
Weight	Approx. 3.5	kg

*1 Measured with Hamamatsu H9535-172 UV power meter.
*2 Prepare ozone suction ducts or use ozone decomposition unit (option) that does not require ducts.
*3 Not including projecting parts and duct connection port.

Compact UV-VIS S2D2 Fiber Light Source UV enhanced type L12515

Compact UV-VIS fiber light source with enhanced intensity in UV region

The L12515 is a UV-VIS fiber light source that contains the world's smallest*1 deuterium lamp point light source suitable for use in various portable instruments requiring a UV-VIS light source. The use of an optimized optical system allows the L12515 to provide a high output that is 3 times larger at 200 nm than conventional types and also extends the D2 lamp service life up to 1,500 hours.

Features

- Compact size
- Long life: 1,500 hours guaranteed*2
- High output: 3 times higher light output at 200 nm than conventional types
- High stability: Fluctuation 0.005 % p-p (typ.)

Applications

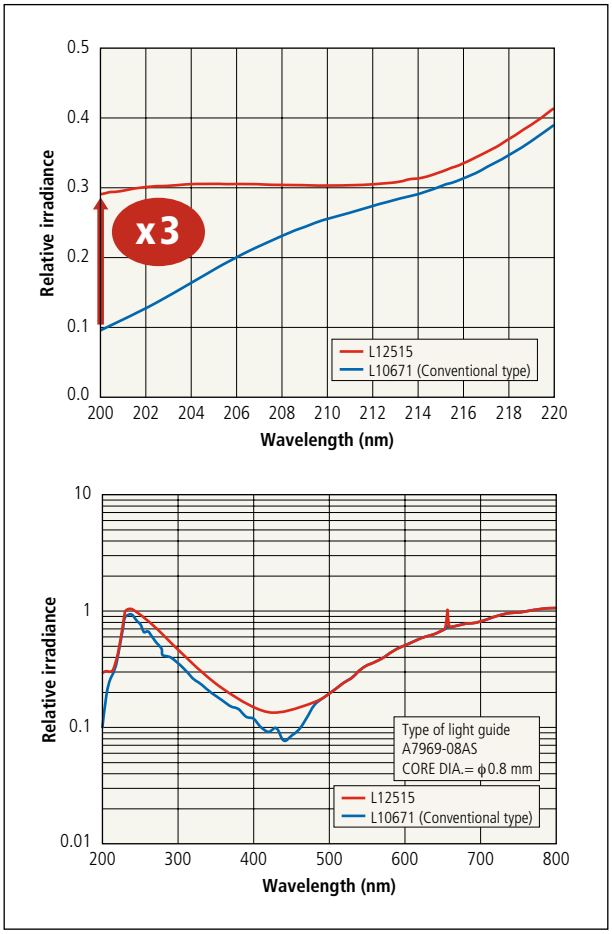
- Spectrophotometry
- Environmental analysis
- Biological measurement
- Semiconductor inspection
- UV detection (LC, etc.)

*1 As of Dec. 2012, based on our research

*2 Life end is defined as the time when the light output intensity at 230 nm falls to 50 % of its initial value or when output fluctuations exceed 0.05 % (p-p).

L12515

Spectral distribution



PhotoIonBar L12536

Electrostatic charge remover that solves all problems of corona discharge ionizers

Hamamatsu now offers a new photoionizer called the "PhotoIonBar" whose compact, rectangular ionizer heads allow free and flexible installation nearly anywhere. Just like our other photoionizers, the PhotoIonBar instantaneously removes static charges on objects by "photoionization" that generates an equal number of positive and negative ions by emitting weak soft X-rays. Photoionization needs no air flow to carry the generated ions toward charged objects, which has been a big problem with corona discharge ionizers. Photoionization also generates no dust, electromagnetic noise and ozone and so ensures clean neutralization of static charges. What's more, it needs no maintenance such as cleaning or replacement of the electrodes.

Low energy soft X-rays used with the PhotoIonBar can be completely blocked by acrylic plate shielding (only 3.3 mm thick) which is only about 1/7th the shielding required by other photoionizers. The PhotoIonBar output window contains no hazardous beryllium making it eco-friendly and easy to handle.

Features

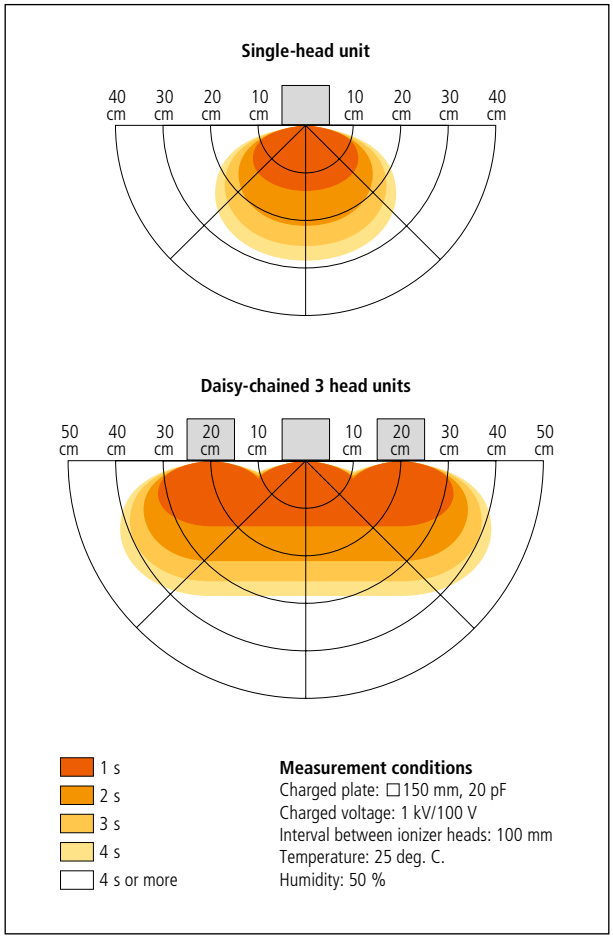
- Comes with DIN rail attachment for easy installation and removal
- Low energy soft X-rays can be completely shielded with acrylic plate (3.3 mm thick)
- Operates without using a controller
- Static charge neutralization area can be changed to match the production line layout. Maximum of 10 ionizer heads can be daisy-chained to cover areas up to 2 meters wide (recommended)
- Easy disposal since no hazardous beryllium is used

Applications

- Removing static charges on production lines
  - Liquid crystal
  - Organic EL
  - Solar cell
  - Semiconductor
  - Film
  - Powder printing
  - Drugs, etc.

L12536

Charge neutralization effect



150 kV sealed type Microfocus X-ray Source L12161-07

Faster rise in tube voltage and tube current – shorter measurement and inspection times

The L12161-07 is a high-output microfocus X-ray source with a maximum output of 75 W. Its small focal spot size of 5 µm minimum allows capturing clear, sharp magnified X-ray images without the edge blur usually seen when an X-ray image is enlarged. A high voltage power supply integrated into the X-ray tube unit eliminates the need for awkward high-voltage cable connections.

The improved control unit provides a faster rise in tube voltage and tube current about 3 times that of the current product (L8121-03).

L12161-07

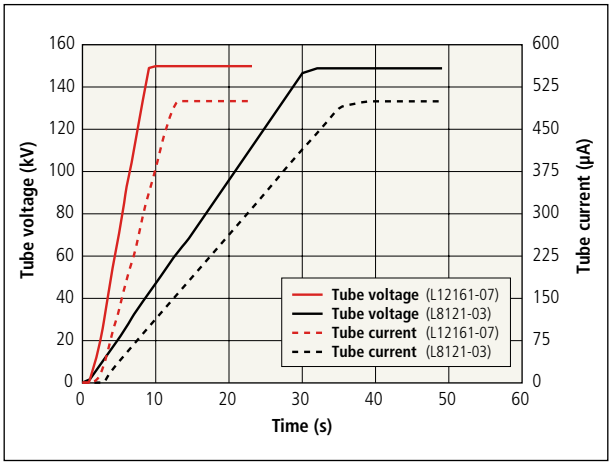
Features

- High output: 75 W
- Small focal spot size: 5 µm*1
- No high-voltage cable required
- RS-232C external control

Applications

- Non-destructive inspection
- X-ray CT
  - Electronic part
  - Printed circuit board
  - Metallic part
  - Plastic part

Rise time comparison



Specifications

Parameter	Specification	Unit
Tube voltage	40 to 150	kV
Tube current	10 to 500	µA
Max. output	75	W
Min. focal spot size (nominal value) *1	5	µm
X-ray beam angle	Approx. 43	degrees
FOD (Focus to object distance)	17	mm

*1 at 4 W

NEW

Electron multiplying CCD Camera ImagEM X2 C9100-23B

New generation EM-CCD camera with faster frame rate and lower noise

The ImagEM X2 is an extremely versatile camera that quietly delivers 70 frames/s at full frame and up to 1076 frames/s with analog binning and regions of interest. With very high signal to noise in near dark conditions and extremely low dark current, the ImagEM X2 enables quantitative ultra-low light imaging both for long integration times and at high speed. With EM gain off, the extremely deep full well capacity can extract information from the lowest contrast bright images. Additional new features allow for optimized camera triggering, on-board for EM gain protection, streamlined connectivity through IEEE1394b, improved overall signal to noise and increased non-EM dynamic range. Hamamatsu has taken the beloved 512 × 512 EM-CCD sensor and created a masterfully redesigned camera that delivers maximum speed and precision performance.

Features

- High speed
- High sensitivity
- Low noise
- Great stability

Applications

- Protein-protein interaction
- Calcium waves in cell networks and intracellular ion flux
- Real time spinning disk confocal microscopy
- Single molecule imaging with TIRF microscopy
- Fluorescence in-vivo blood cell microscopy
- Gene expression imaging using luminescence

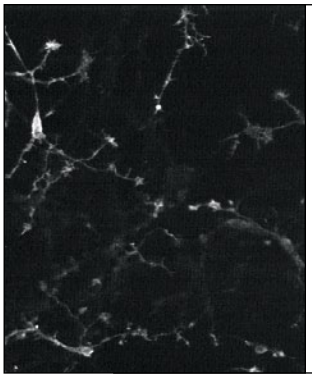
ImagEM X2 C9100-23B

Readout speed

Clock: 22 MHz **(Unit: frames/s)**

Binning	Effective vertical width (Sub-array)					
	512	256	128	64	32	16
1 x 1	70.4	133	241	405	613	820
2 x 2	131	238	400	606	813	981
4 x 4	231	389	588	794	962	1,076

Image example: Real time confocal imaging



Fast imaging of mouse brain cell with Cy3 imaged with confocal scanner unit

- EM gain: 150x
- Exposure time: 10 ms
- Effective number of pixels: 512 x 512
- Binning: 1 x 1
- Objective lens: 40x
- Confocal unit: CSU-W1
- Excitation laser: 561 nm

Digital Camera ORCA-Flash4.0 V2 C11440-22CU

NEW

Scientific CMOS camera with improved versatility and new functions

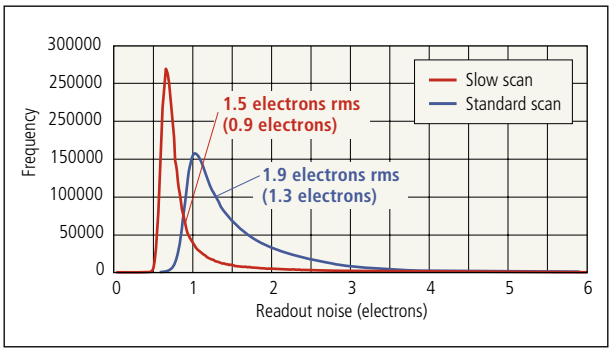
A game changer from inception and a proven performer since its initial release, the ORCA-Flash4.0 V2 offers unrivaled flexibility across a wide range of imaging applications. Easily change from USB to Camera Link connectivity. Switch from a blazing fast scan to a virtually noiseless slow scan by a simple click in software. Use our Lightsheet Readout Mode for seamless integration with light sheet microscopy systems. Robust triggering allows the ORCA-Flash4.0 V2 to drive other devices or be driven by them. And then there's the highest QE of any sCMOS camera on the market.

ORCA-Flash4.0 V2 C11440-22CU

New functions

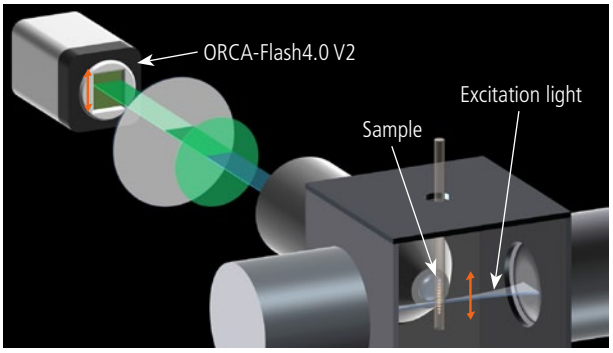
Two Scan Speeds

While the read noise at standard scan is only 1.9 electrons rms (1.3 electrons median), there are some experiments for which even lower noise is more important than raw speed. New in the ORCA-Flash4.0 V2 is an additional slow scan readout mode with read noise of just 1.5 electrons rms (0.9 electrons median). Both the USB and Camera Link configurations of the camera have this low noise capability.



Lightsheet Readout Mode

To enable the best speeds and synchronization for light sheet microscopy, the ORCA-Flash4.0 V2 configured with the Camera Link interface can be read out in one sweep across the sensor from top to bottom or bottom to top using our new Lightsheet Readout Mode.



Global Exposure Flexibility

By adding a Global Reset function to the ORCA-Flash4.0 V2, users can acquire global exposures and choose to have either an external source or the camera be master of the timing.

NEW

Scientific CMOS Board-Level Camera C11440-52U

A compact board type camera with a scientific CMOS image sensor

The C11440-52U is a compact and high-speed board type camera with a Gen II scientific CMOS sensor. The camera has over 70 % quantum efficiency at 600 nm. The camera runs at 30 frames/s at full resolution and it can reach up to 25,655 frames/s (512 x 8 ROI).

The C11440-52U has low camera noise of 2.3 electrons (rms) at 30 frames/s. Its compact (90 mm x 90 mm) and light weight design allows it to be built into various measurement and analytical instruments. In addition the camera has USB 3.0 interface for convenience.

Features

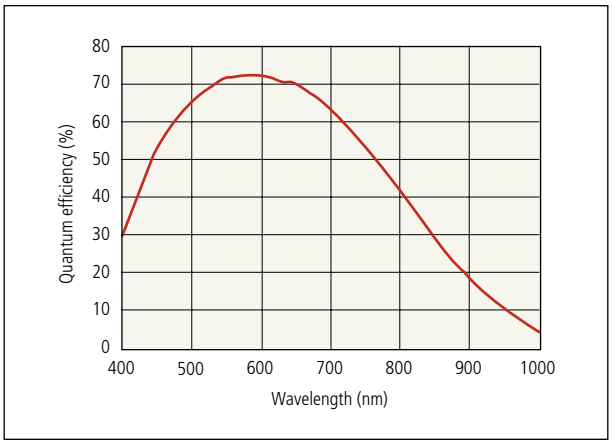
- Resolution: 4.0 megapixels
- Camera noise:
  - 2.3 electrons (rms)
  - 1.6 electrons (median)
- Frame rate:
  - 30 frames/s (2,048 x 2,048)
- Quantum efficiency:
  - Over 70 % at peak (at 600 nm)

Applications

- DNA sequencing
- Gene expression
- Imaging cytometry
- High content screening
- Live cell imaging
- Wafer inspection
- X-ray I.I., X-ray scintillator readout

Scientific CMOS Board-Level Camera C11440-52U

Spectral response



4.53 µm CW Type Quantum Cascade Laser L12004-2209H-C

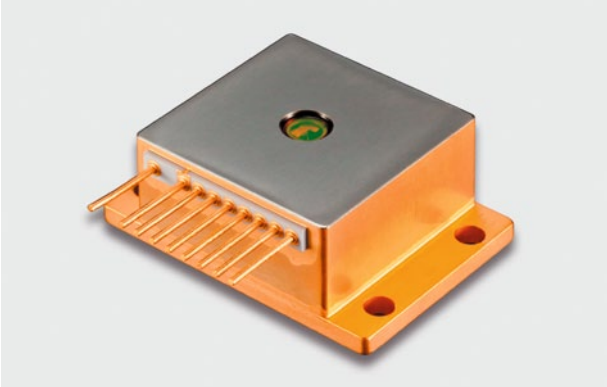
PRELIMINARY

An optimum mid-infrared CW laser for molecular gas analysis

Quantum Cascade Lasers are semiconductor lasers that offer peak emission in the mid-IR range (4 µm to 10 µm). They have gained considerable attention as a new light source for mid-IR applications such as molecular gas analysis. L12004-2209H-C is a CW type 4.53 µm laser.

Newest addition to our range of quantum cascade lasers

There is a short wavelength laser in the DFB-CW type.



L12004-2209H-C

Features

- Emission wavelength 4.53 µm (typ.)
- Output power 20 mW (min.)
- Threshold current 1.0 A (max.)

Application

- IR molecular spectroscopy (N_2O)

Specifications

Parameter	Specification	Unit
Wavelength	4.53 (typ.)	µm
Wave number	2,209	cm^{-1}
Output power	20 (min.)	mW
Threshold current	1.0 (max.)	A

DEVELOPMENTAL

10 µm Pulsed Type Quantum Cascade Laser L12020-0993T-C

An optimum mid-infrared pulsed laser for molecular gas analysis

Quantum Cascade Lasers are semiconductor lasers that offer peak emission in the mid-IR range (4 µm to 10 µm). They have gained considerable attention as a new light source for mid-IR applications such as molecular gas analysis. This product is a pulsed type 10 µm laser.

Newest addition to our range of quantum cascade lasers

There is more longer wavelength in the DFB-pulsed type.

L12020-0993T-C

Features

- Emission wavelength 10.07 µm (typ.)
- Output power 25 mW (min.)
- Threshold current 1.5 A (max.)

Applications

- Measuring instruments
- IR molecular spectroscopy (NH_3)

Specifications

Parameter	Specification	Unit
Wavelength	10.07 (typ.)	µm
Wave number	993	cm^{-1}
Output power	25 (min.)	mW
Threshold current	1.5 (max.)	A

Global Exhibitions 2013 and 2014

USA

October 2013

ADDC
Oct 9-11 2013, Nashville TN, USA

CAP
Oct 13-14 2013, Kissimee, FL, USA

November 2013

ISTFA
Nov 5-6 2013, San Jose, CA, USA

Neuroscience
Nov 9-13 2013, San Diego, CA, USA

December 2013

RSNA
Dec 1-5 2013, Chicago, IL, USA

MRS
Dec 3-5 2013, Boston, MA, USA

Cell Biology
Dec 14-18 2013, New Orleans, LA, USA

January 2014

SLAS
Jan 18-22 2014, San Diego, CA, USA

February 2014

BiOS
Feb 1-2 2014, San Francisco,CA, USA

Photonics West
Feb 4-6 2014, San Francisco, CA, USA

MDM West
Feb 11-13 2014, Anaheim CA, USA

BioPhysical Annual Meeting
Feb 15-19 2014, San Francisco CA, USA

EUROPE

October 2013

Elkom
Oct 1-3 2013, Helsinki, Finland

Pathologie 2.13
Oct 3 2013, Utrecht, Netherlands

EMBL Seeing is Believing
Oct 3-6 2013, Heidelberg, Germany

Belgian Week of Pathology
Oct 4-5 2013, Ghent, Belgium

EACTS Annual Meeting
Oct 6-9 2013, Vienna, Austria

Opto
Oct 8-10 2013, Paris, France

54th Annual Meeting of the European Society for Paediatric Research
Oct 10-14 2013, Porto, Portugal

RadTech
Oct 15-17 2013, Basel, Switzerland

Photonex
Oct 16-17 2013, Coventry, England

Oxford Biomedical Imaging Festival
Oct 29 2013, Oxford, England

The Violent Universe
Oct 31-Nov 1 2013, London, England

November 2013

Labtechnology
Nov 6-7 2013, Utrecht, Netherlands

Colloque RX et Matière
Nov 12-15 2013, Nantes, France

Auto Electronics Show
Nov 12-13 2013, Birmingham, England

Carrefour Pathologie
Nov 18-22 2013, Paris, France

Compamed
Nov 20-22 2013, Duesseldorf, Germany

Nov2K
Nov 21-23 2013, Stockholm, Sweden

December 2013

Recent Advances in Molecular & Cellular Pathology
Dec 6 2013, London, England

January 2014

Bamberger Morphologietage
Jan 24-26 2014, Bamberg, Germany

February 2014

43. Jahrestagung der Deutschen Gesellschaft für Thorax-, Herz- und Gefäßchirurgie
Feb 9-12 2014, Freiburg, Germany

ICT - Conference on Industrial Computed Tomography
Feb 25-28 2014, Wels, Austria

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