

NEWS RELEASE

Hamamatsu Photonics has developed a subminiature, low-cost, high sensitivity and fast-response detector with built-in preamplifier

January 19, 2023

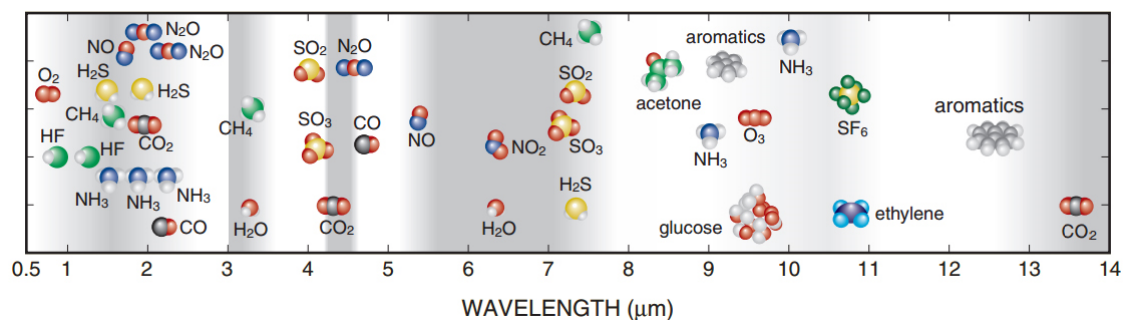
Hamamatsu Photonics K. K.

Headquarters: 325-6, Sunayama-cho,
Naka-ku, Hamamatsu City, Japan

President and CEO: Tadashi Maruno

We have developed a new InAsSb photovoltaic detector (P16702-011MN) with preamp offering high sensitivity to mid-infrared light, up to 11 micrometers (μm) in wavelength. We achieved this by combining the latest InAsSb (indium arsenide antimonide) mid-infrared detector with our unique circuit design technology. Compared to our previous detector modules with same level of sensitivity, the P16702-011MN size and cost is drastically reduced, and it exhibits fast response time. This makes it an ideal choice for portable gas analyzers able to immediately analyze exhaust gas components at measurement sites around factories.

Sales of the P16702-011MN will begin on Wednesday February 1, 2023 to domestic and overseas manufacturers of environmental measurement and analysis equipment. We will also have the P16702-011MN on show at the "SPIE Photonics West 2023", an international conference on photonics and related technologies, held in San Francisco, California, USA from Tuesday, January 31 to Thursday, February 2, 2023.



Wavelengths of light absorbed by molecules

Product overview

The P16702-011MN is a compound semiconductor photodetector with built-in preamplifier for electrical signal amplification.

Each molecule has its own vibration and absorbs infrared light at a specific wavelength determined by its energy. This property can be used to analyze and identify the type and quantity of chemical components contained in a sample. Therefore, mid-infrared light is widely utilized in the analysis of nitrogen oxides and sulfur oxides contained in exhaust gases from factories, etc.

To meet needs in applications such as gas analysis and monitoring of processing laser equipment, we develop and sell InAsSb mid-infrared detectors and detector module products with enhanced sensitivity, by integrating these with electronic circuits and components including preamplifiers. To keep up with the growing market demand of further downsizing equipment, we have been working on a subminiature, low-cost mid-infrared detector device that also offers high-speed response.

In designing this new device, we adopted the latest back-illuminated type InAsSb mid-infrared detector with a sensitivity 1.5 times higher than the regular type. We encapsulated it into a small cylindrical package with a diameter of approximately 9 mm. The device was drastically downsized to about 1/200th the volume of our module products, yet it still offers the same level of sensitivity capable of detecting mid-infrared light at wavelengths up to 11 μm . What's more, the wiring in the package is optimized to increase the response speed up to 100 megahertz, which is twice as high as our module products, thus improving measurement accuracy. It also has a lower manufacturing cost since we reduced the number of required components.

The P16702-011MN will speed up the replacement of mercury-cadmium-telluride (MCT) infrared detectors which is currently the mainstream in high-precision mid-infrared spectroscopy but contains toxic substances restricted by the RoHS Directive^(*1). Hamamatsu Photonics is one of the few companies in the world that manufacture both photodetectors and light sources. Using the P16702-011MN in conjunction with a quantum cascade laser or QCL^(*2), which we also manufacture, allows making measurements at even higher speeds, resolution, and sensitivity.

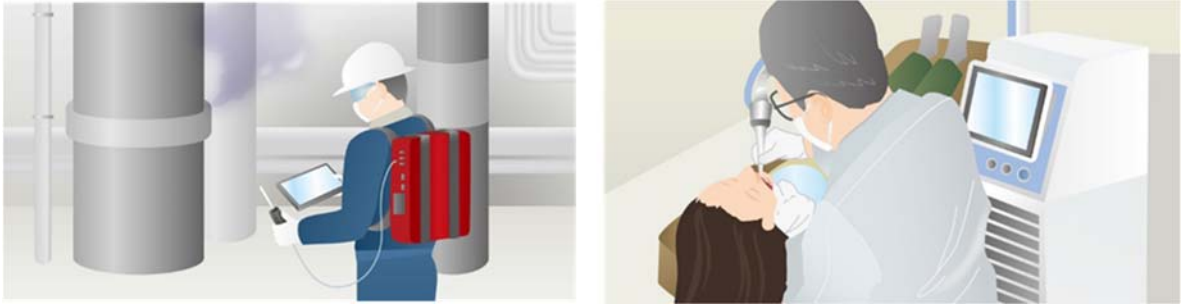
We will continue designing and developing cooled-type detectors that remain unaffected by ambient temperature changes and in this way, increase the reliability of measurement results.

*1: RoHS Directive is an EU directive that restricts the use of specified hazardous substances in electrical and electronic equipment. It was enacted to prohibit the sale of electrical and electronic equipment containing restricted substances in concentrations above a specified level on the European market.

*2: Quantum cascade laser or QCL is a semiconductor light source utilizing a special structure for the light-emitting layers. Unlike conventional lasers, it can generate high output power in the mid to far-infrared spectral range.

● Main specifications

Parameter	P16702-011MN	Unit
Package	TO-5	-
Effective area size	0.7 × 0.7	mm
Cut-off wavelength	11.0	μm
Noise equivalent power (NEP)	2.5×10^{-9}	$\text{W/Hz}^{1/2}$
High cutoff frequency	100	MHz



Application example of mid-infrared spectroscopy using P16702-011MN



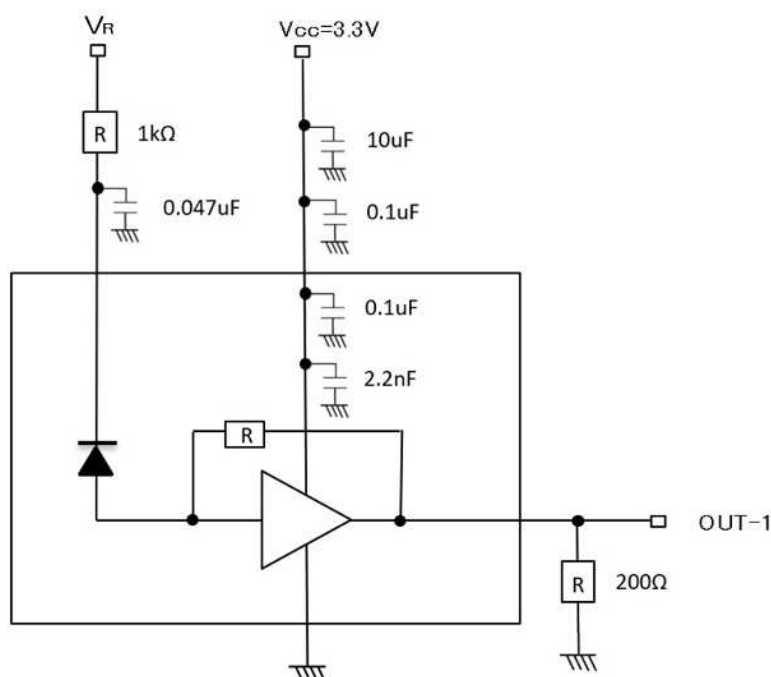
InAsSb photovoltaic detector with preamp P16702-011MN

InAsSb PD with preamp (P16702-011MN)Purchase at shop.boselec.com**1. Absolute maximum ratings**

Parameter	Symbol	Value	Unit	Remarks
Supply voltage	V _{cc}	4.5	V	
Reverse voltage	V _R	1.0	V	
Operating temperature	T _{opr}	-30 to +60		No dew condensation
Storage temperature	T _{str}	-30 to +60		No dew condensation

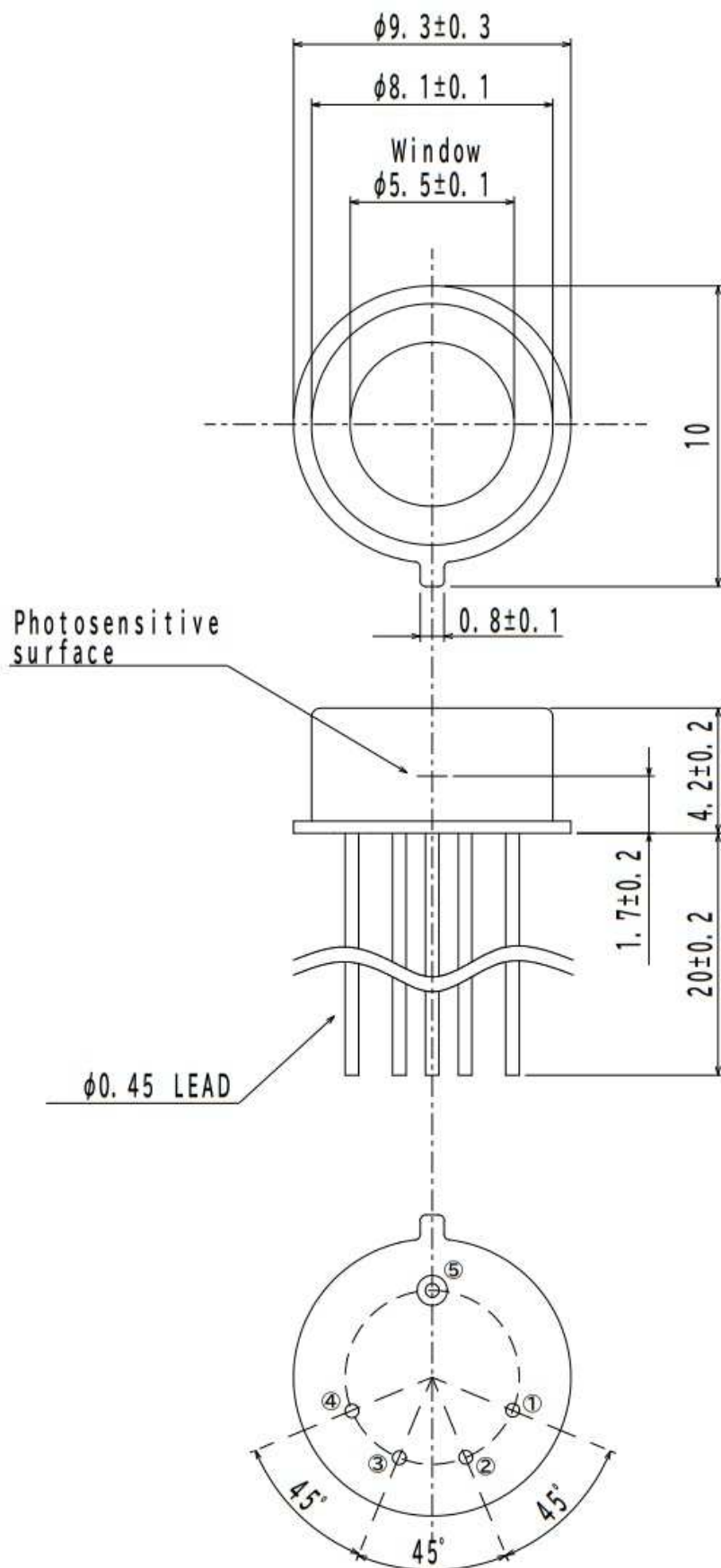
2. Electrical and optical characteristics (T_{chip}=25 °C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Peak sensitivity wavelength	p		-	5.6	-	μm
Cutoff wavelength	c		9.7	11.0	-	μm
Photosensitivity	S	= p	-	10	-	V/W
Reverse voltage	V _R		-	0.7	-	V
Noise equivalent power	NEP	= p	-	2.5×10^{-9}	-	W/Hz ^{1/2}
Frequency response	f _{CL}		-	DC	-	-
	f _{CH}		80	100	-	MHz
Output voltage level	-		0.6	0.9	1.2	V
Maximum output voltage amplitude	V _{p-p} max		-	-0.5	-	V
Supply voltage	V _{cc}		3.2	3.3	3.4	V

3 . Block Diagram

4 . Dimensional outline (unit : mm)

Purchase at shop.boselec.com



Pin conection

VR
OUT-1
OUT-2
Vcc
GND