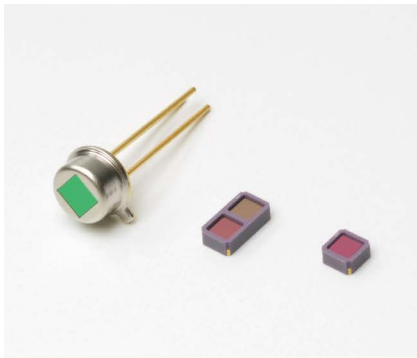


# InAsSb photovoltaic detectors

[ With band-pass filter ] | P16112/P16612/P16849 series



## Back-illuminated type infrared detectors with band-pass filter (3.3 μm, 3.9 μm, 4.26 μm, 4.45 μm)

These are InAsSb photovoltaic detectors that use a band-pass filter for the window material. By using a back-illuminated structure, we greatly improved the sensitivity temperature coefficient compared to the front-illuminated type. Types using a band-pass filter with a center wavelength of 3.3 μm, 3.9 μm, or 4.26 μm are suitable for gas measurement, and a type using a band-pass filter of 4.45 μm is suitable for flame monitoring. These are environmentally friendly infrared detectors and do not use lead, mercury, or cadmium, which are substances restricted by the RoHS directive. A two-element type that can detect two wavelength is also available.

### Features

- High sensitivity
- High-speed response
- High shunt resistance
- Compact, surface mount ceramic package
- Compatible with lead-free solder reflow (ceramic package)

### Applications

- Gas measurement (CH<sub>4</sub>, CO<sub>2</sub>)
- Flame monitors (CO<sub>2</sub> resonance radiation)

### Option (sold separately)

- Amplifier for infrared detector **C4159-01**

### Structure

Type no.	Number of elements	Photosensitive area (mm)	Window material*1	Package	Cooling	Field of view FOV (degrees)		
P16112-033MF	1	0.7 × 0.7	BPF (3.3 μm)	TO-46	Non-cooled	87		
P16112-039MF			BPF (3.9 μm)					
P16112-043MF			BPF (4.26 μm)					
P16112-045MF			BPF (4.45 μm)					
P16612-033CF	2		BPF (3.3 μm)	Ceramic		Non-cooled	86	
P16612-039CF			BPF (3.9 μm)					
P16612-043CF			BPF (4.26 μm)					
P16612-045CF			BPF (4.45 μm)					
P16849-011CF	2	BPF (3.3 μm)						
P16849-012CF		BPF (3.9 μm)						
		BPF (3.9 μm)						

\*1: BPF: Band-pass filter. For windowless and AR coating types, refer to the P16612-011CN datasheet.

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

Type no.	Reverse voltage V <sub>R</sub> (V)	Operating temperature*2 T <sub>opr</sub> (°C)	Storage temperature*2 T <sub>stg</sub> (°C)	Incident light level (W/mm <sup>2</sup> )	Soldering temperature T <sub>sol</sub> (°C)
P16112-033MF	1	-40 to +85	-40 to +85	1	-
P16112-039MF					
P16112-043MF					
P16112-045MF					
P16612-033CF					
P16612-039CF					
P16612-043CF					
P16612-045CF					
P16849-011CF					
P16849-012CF					
					240 (once)*3

\*2: No dew condensation

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 may cause deterioration in characteristics and reliability.

\*3: Reflow soldering, JEDEC J-STD-020 MSL 2, see P.8

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.

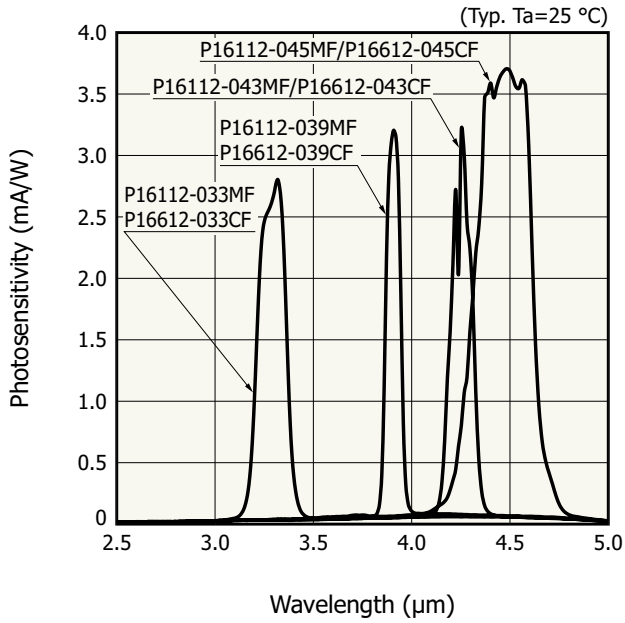
### ➤ Electrical and optical characteristics (Typ. Ta=25 °C, unless otherwise noted)

Type no.	Center wavelength CWL			Spectral response half width FWHM		Photosensitivity S λ=CWL (mA/W)	Shunt resistance R <sub>sh</sub> V <sub>R</sub> =10 mV (kΩ)	Detectivity D* (CWL, 1200, 1)		Noise equivalent power NEP λ=λ <sub>p</sub>		Rise time t <sub>r</sub> *4 (ns)	Terminal capacitance C <sub>t</sub> *5 (pF)
	Min. (nm)	Typ. (nm)	Max. (nm)	Typ. (nm)	Max. (nm)			Min. (cm·Hz <sup>1/2</sup> /W)	Typ. (cm·Hz <sup>1/2</sup> /W)	Typ. (W/Hz <sup>1/2</sup> )	Max. (W/Hz <sup>1/2</sup> )		
P16112-033MF	3270	3300	3330	160	180	2.8	180	3.2 × 10 <sup>8</sup>	6.5 × 10 <sup>8</sup>	1.1 × 10 <sup>-10</sup>	2.2 × 10 <sup>-10</sup>	15	0.5
P16112-039MF	3820	3900	3980	90	110	3.2		3.7 × 10 <sup>8</sup>	7.4 × 10 <sup>8</sup>	9.5 × 10 <sup>-11</sup>	1.9 × 10 <sup>-10</sup>		
P16112-043MF	4217	4260	4303	140	160	3.2		3.7 × 10 <sup>8</sup>	7.4 × 10 <sup>8</sup>	9.5 × 10 <sup>-11</sup>	1.9 × 10 <sup>-10</sup>		
P16112-045MF	4400	4450	4500	350	400	3.7		4.3 × 10 <sup>8</sup>	8.6 × 10 <sup>8</sup>	8.2 × 10 <sup>-11</sup>	1.6 × 10 <sup>-10</sup>		
P16612-033CF	3270	3300	3330	160	180	2.8		3.2 × 10 <sup>8</sup>	6.5 × 10 <sup>8</sup>	1.1 × 10 <sup>-10</sup>	2.2 × 10 <sup>-10</sup>		
P16612-039CF	3820	3900	3980	90	110	3.2		3.7 × 10 <sup>8</sup>	7.4 × 10 <sup>8</sup>	9.5 × 10 <sup>-11</sup>	1.9 × 10 <sup>-10</sup>		
P16612-043CF	4217	4260	4303	140	160	3.2		3.7 × 10 <sup>8</sup>	7.4 × 10 <sup>8</sup>	9.5 × 10 <sup>-11</sup>	1.9 × 10 <sup>-10</sup>		
P16612-045CF	4400	4450	4500	350	400	3.7		4.3 × 10 <sup>8</sup>	8.6 × 10 <sup>8</sup>	8.2 × 10 <sup>-11</sup>	1.6 × 10 <sup>-10</sup>		
P16849-011CF	3270	3300	3330	160	180	2.8		3.2 × 10 <sup>8</sup>	6.5 × 10 <sup>8</sup>	1.1 × 10 <sup>-10</sup>	2.2 × 10 <sup>-10</sup>		
	3820	3900	3980	90	110	3.2		3.7 × 10 <sup>8</sup>	7.4 × 10 <sup>8</sup>	9.5 × 10 <sup>-11</sup>	1.9 × 10 <sup>-10</sup>		
P16849-012CF	4217	4260	4303	140	160	3.2		3.7 × 10 <sup>8</sup>	7.4 × 10 <sup>8</sup>	9.5 × 10 <sup>-11</sup>	1.9 × 10 <sup>-10</sup>		
	3820	3900	3980	90	110	3.2		3.7 × 10 <sup>8</sup>	7.4 × 10 <sup>8</sup>	9.5 × 10 <sup>-11</sup>	1.9 × 10 <sup>-10</sup>		

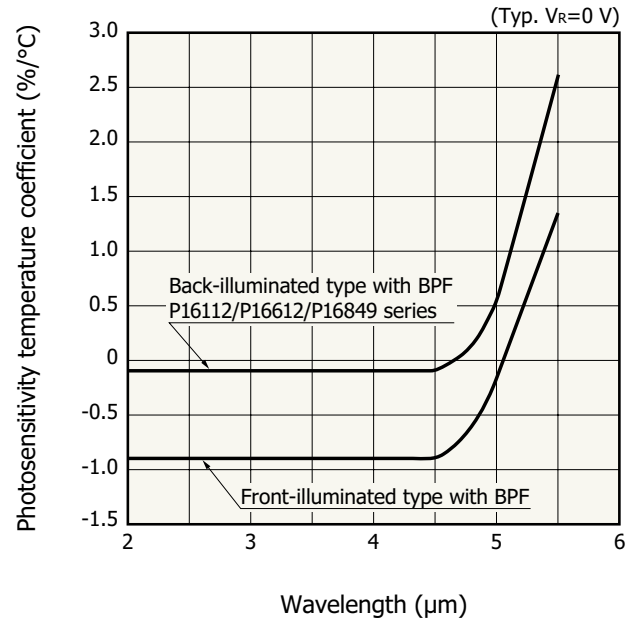
\*4: V<sub>R</sub>=0 V, R<sub>L</sub>=50 Ω, 10 to 90%

\*5: V<sub>R</sub>=0 V, f=1 MHz

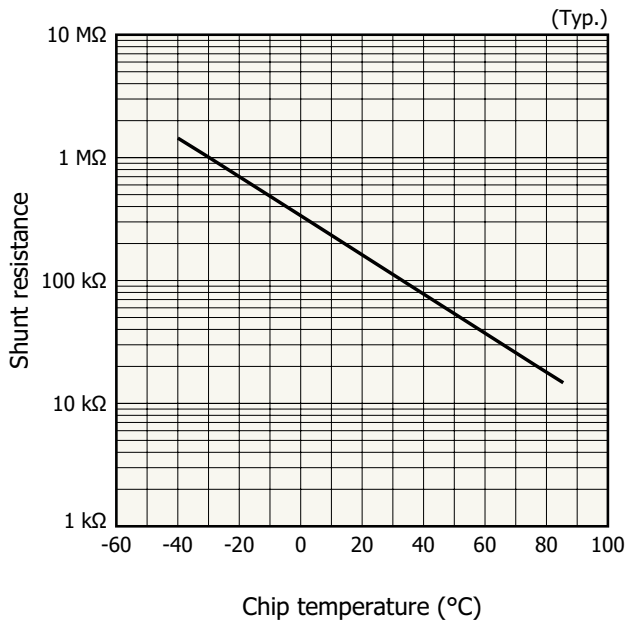
**Spectral response**



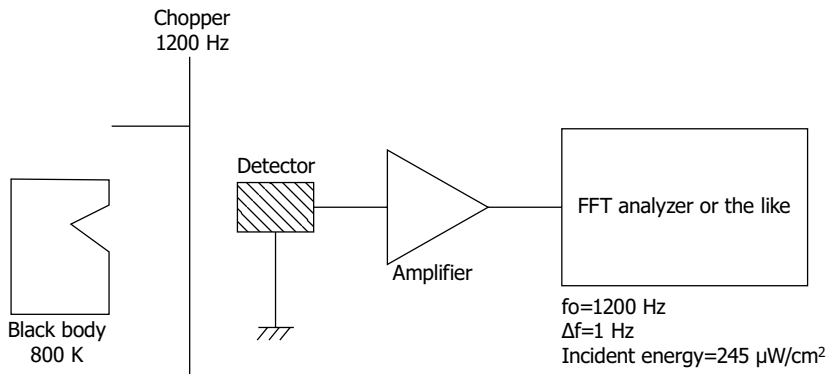
**Photosensitivity temperature characteristics**



**Shunt resistance vs. chip temperature**



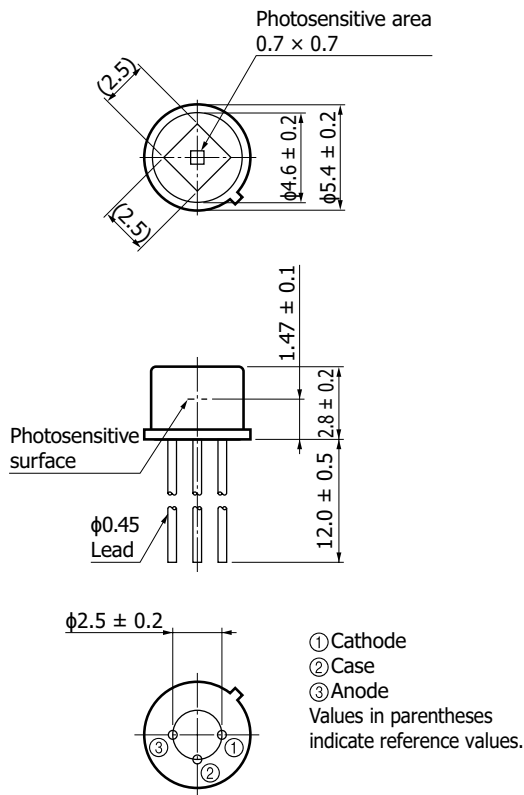
**Measurement circuit example**



KIRD0127EA

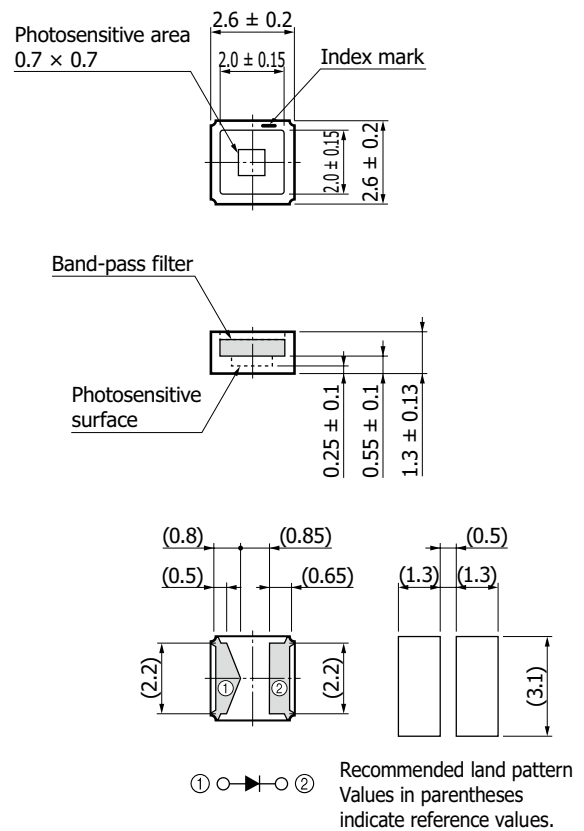
**Dimensional outlines (unit: mm)**

P16112-033MF/-039MF/-043MF/-045MF



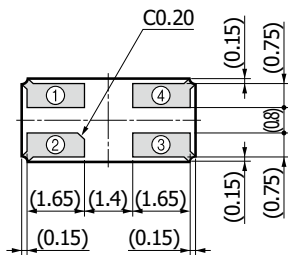
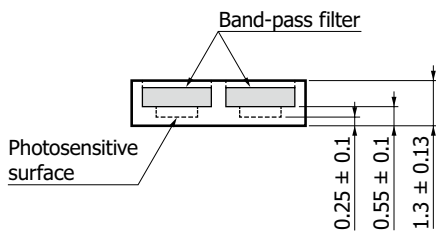
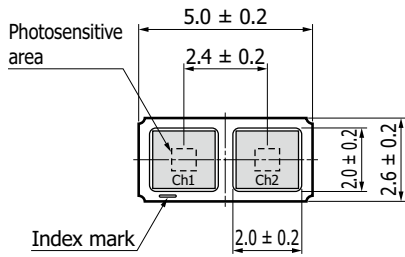
KIRDA0284EA

P16612-033CF/-039CF/-043CF/-045CF

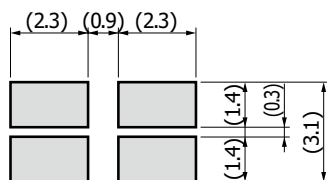


KIRDA0288EA

P16849-011CF/-012CF



- ① Cathode (Ch1)
  - ② Anode (Ch1)
  - ③ Anode (Ch2)
  - ④ Cathode (Ch2)
- Values in parentheses are not guaranteed, but for reference.



Recommended land pattern

Type no.	Ch1	Ch2
P16849-011CF	3.3 μm	3.9 μm
P16849-012CF	4.26 μm	3.9 μm

KIRDA0287EA

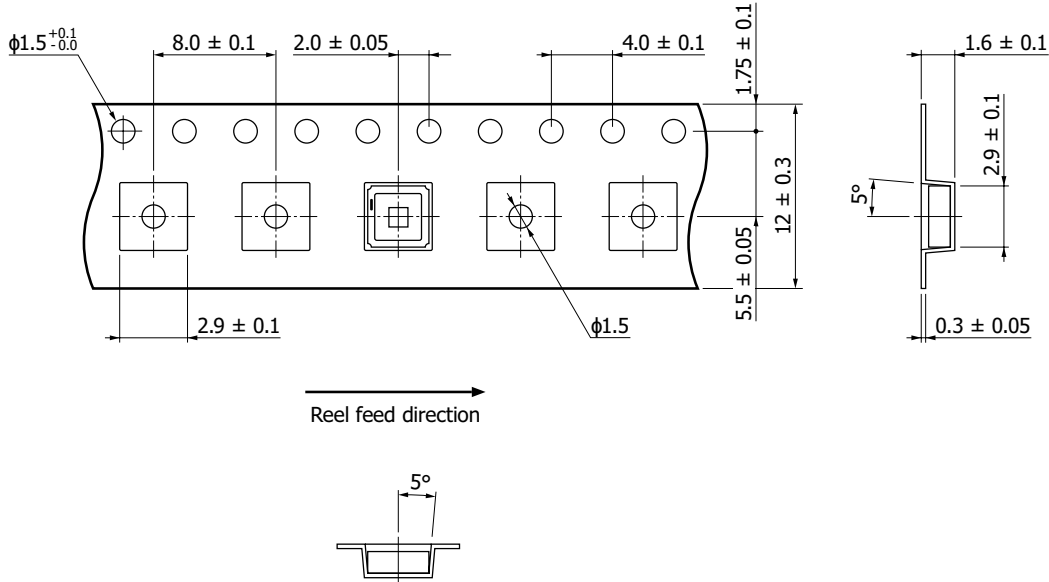
**Standard packing specifications**

P16612-033CF/-039CF/-043CF/-045CF

■ Reel (conforms to JEITA ET-7200)

Outer diameter	Hub diameter	Tape width	Material	Electrostatic characteristics
φ180 mm	φ60 mm	12 mm	PS	Conductive

■ Embossed tape (unit: mm, material: PS, conductive)



KLED0143EA

■ Packing quantity

500 pcs/reel

■ Packing state

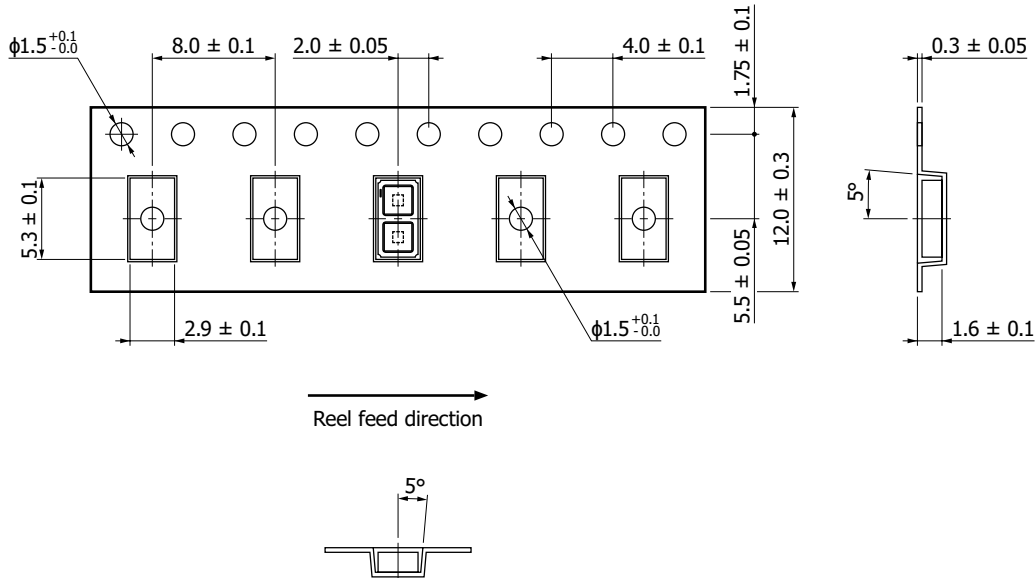
Reel and desiccant in moisture-proof packaging (vacuum-sealed)

P16849-011CF/-012CF

■ Reel (conforms to JEITA ET-7200)

Outer diameter	Hub diameter	Tape width	Material	Electrostatic characteristics
φ180 mm	φ60 mm	12 mm	PS	Conductive

■ Embossed tape (unit: mm, material: PS, conductive)



KIRDC0146EA

■ Packing quantity

100 pcs/reel

■ Packing state

Reel and desiccant in moisture-proof packaging (vacuum-sealed)

### Recommended soldering conditions

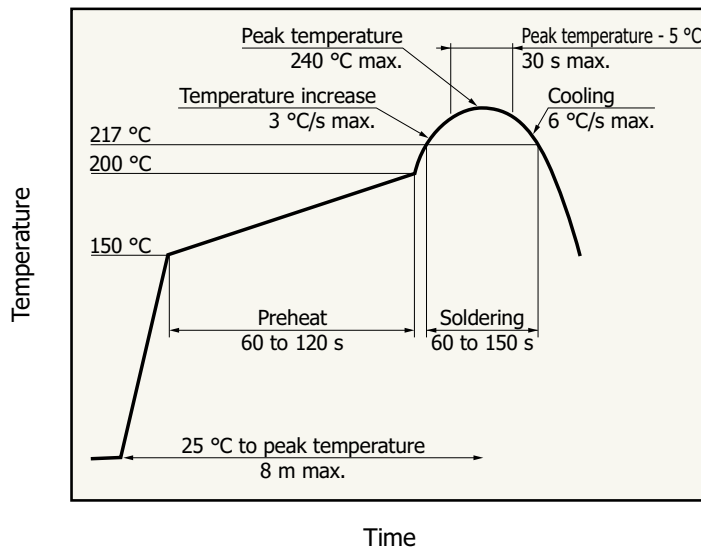
P16112-033MF/-039MF/-043MF/-045MF

· Solder temperature: 260 °C (10 s or less, once)

Solder the leads at a point at least 1 mm away from the package body.

Note: When you set soldering conditions, check that problems do not occur in the product by testing out the conditions in advance.

P16612-033CF/-039CF/-043CF/-045CF, P16849-011CF/-012CF



· After unpacking, store the device in an environment at a temperature range of 5 to 30 °C and a humidity of 60% or less, and perform reflow soldering within 1 year.

· The effect that the product receives during reflow soldering varies depending on the circuit board and reflow oven that are used. When you set reflow soldering conditions, check that problems do not occur in the product by testing out the conditions in advance.

KSPD80418EA



## Related products

### Evaluation kits M16607 series for InAsSb photovoltaic detector



The M16007 series are evaluation kits with an amplifier incorporating Hamamatsu's InAsSb photovoltaic detector (ceramic package with band-pass filter). These can detect infrared light transmitted through a band-pass filter simply by connecting a power supply ( $\pm 15$  V). Two-element type that can detect two wavelengths is also available.

### Specifications

- **Gain: 30 V/V**
- **Frequency characteristics: DC to 80 kHz**
- **Recommended drive voltage:  $\pm 15$  V**
- **Built-in sensor: InAsSb photovoltaic detector  
(ceramic package with band-pass filter)**

Type no.	Built-in sensor	Center wavelength ( $\mu\text{m}$ )
M16607-033CF	P16612-033CF	3.3
M16607-039CF	P16612-039CF	3.9
M16607-043CF	P16612-043CF	4.26
M16607-015CF	P16849-011CF	3.3, 3.9
M16607-016CF	P16849-012CF	4.26, 3.9

### Evaluation kit M16615 for mid infrared LED



Note: LED sold separately

The M16615 is a driver for mid infrared LED (TO-46 package). The LED can be pulse-driven simply by connecting a power supply (+15 V). This is used in combination with the evaluation kit M16607 series for InAsSb photovoltaic detector.

### Specifications

- **Applicable LED: Mid infrared LED (TO-46 package)**
- **Output current: 400 mA**
- **Output pulse: 10  $\mu\text{s}$**
- **Output cycle: 1000  $\mu\text{s}$**
- **Recommended drive voltage: +15 V**

## Related information

[www.hamamatsu.com/sp/ssd/doc\\_en.html](http://www.hamamatsu.com/sp/ssd/doc_en.html)

### ■ Precautions

- Disclaimer
- Safety consideration
- Surface mount type products
- Compound opto-semiconductors (photosensors, light emitters)

### ■ Technical note

- Compound semiconductor photosensors

Information described in this material is current as of August 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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