

InAsSb photovoltaic detectors



P13894 series

High-speed response and high sensitivity in the spectral band up to 11 μm , infrared detectors

The P13894 series are photovoltaic type detectors that have achieved high sensitivity in the spectral range up to 11 μm using Hamamatsu unique crystal growth technology and process technology. These products are environmentally friendly infrared detectors and do not use mercury or cadmium, which are substances restricted by the RoHS Directive. They are replacements for previous products that contain these substances. A compact surface mount type has been added to the easily handled non-cooling type.

Features

- High sensitivity
- High-speed response
- High shunt resistance
- Non-cooled (P13894-011CN/-011NA/-011MA)
- Compact, surface mount ceramic package (P13894-011CN)
- Compatible with lead-free reflow soldering (P13894-011CN)

Applications

- Gas detection (CH₄, CO₂, CO, NH₃, O₃, etc.)
- Radiation thermometers

Options (sold separately)

- Heatsink for two-stage TE-cooled type **A3179-01**
- Temperature controller for TE-cooled type **C1103-04**
- Amplifier for infrared detector **C4159-01**

Structure

Parameter	NEW P13894-011CN	P13894-011NA	P13894-011MA	P13894-211MA	Unit
Window material	None	None	Ge with AR coating	Ge with AR coating	-
Package	Ceramic	TO-5		TO-8	-
Cooling	Non-cooled			Two-stage TE-cooled	-
Photosensitive area	1 × 1				mm
Field of view (FOV)	102	97		113	degrees

Absolute maximum ratings

Parameter	Symbol	Condition	NEW P13894-011CN	P13894-011NA	P13894-011MA	P13894-211MA	Unit
Reverse voltage	V _R		1				V
Operating temperature	T _{opr}	No dew condensation*1	-40 to +85		-40 to +60		°C
Storage temperature	T _{stg}	No dew condensation*1	-40 to +85		-40 to +60		°C
Soldering conditions			*2	260 °C or less, within 10 s			-

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

*2: Peak temperature: 240 °C max. See P7. JEDEC J-STD-020 MSL 2

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.

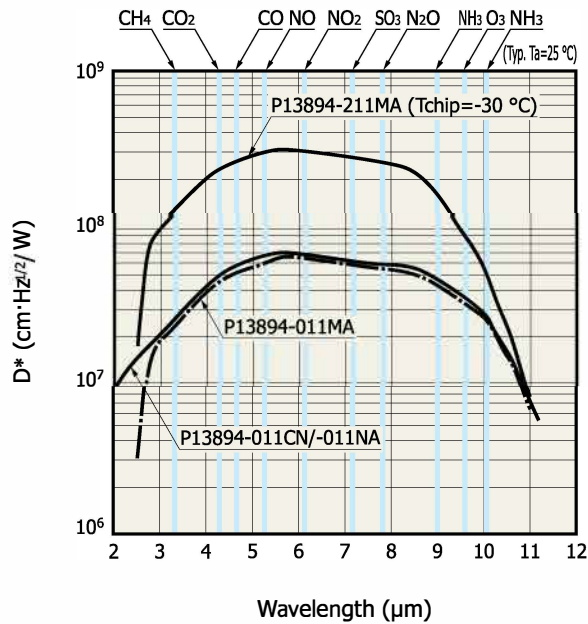
Electrical and optical characteristics (Ta=25 °C)

Parameter	Symbol	Condition	P13894-011CN/-011NA			P13894-011MA			P13894-211MA			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Chip temperature	Tchip		25			25			-30			°C
Peak sensitivity wavelength	λ_p		-	5.6	-	-	5.6	-	-	5.6	-	μm
Cutoff wavelength	λ_c		9.7	11.0	-	9.7	11.0	-	8.9	10.2	-	μm
Photosensitivity	S	$\lambda = \lambda_p^{*3}$	1.4	2.0	-	1.3	1.9	-	2.8	3.8	-	mA/W
Shunt resistance	Rsh	$V_R = 10 \text{ mV}$	1.5	2.0	-	1.5	2.0	-	7.5	10.0	-	$\text{k}\Omega$
Detectivity	D*	($\lambda_p, 1200, 1$)	4.0×10^7	7.0×10^7	-	3.8×10^7	6.5×10^7	-	1.8×10^8	3.2×10^8	-	$\text{cm}\cdot\text{Hz}^{1/2}/\text{W}$
Noise equivalent power	NEP	$\lambda = \lambda_p$	-	1.4×10^{-9}	2.5×10^{-9}	-	1.5×10^{-9}	2.6×10^{-9}	-	3.1×10^{-10}	5.6×10^{-10}	$\text{W}/\text{Hz}^{1/2}$
Terminal capacitance	Ct	$V_R = 0 \text{ V}, f = 1 \text{ MHz}$	-	0.6	-	-	0.6	-	-	0.6	-	pF
Rise time	tr	10 to 90%, no window, $\lambda = 1.55 \mu\text{m}$	-	3	10	-	3	10	-	3	10	ns

*3: Uniform irradiation on the entire photosensitive area

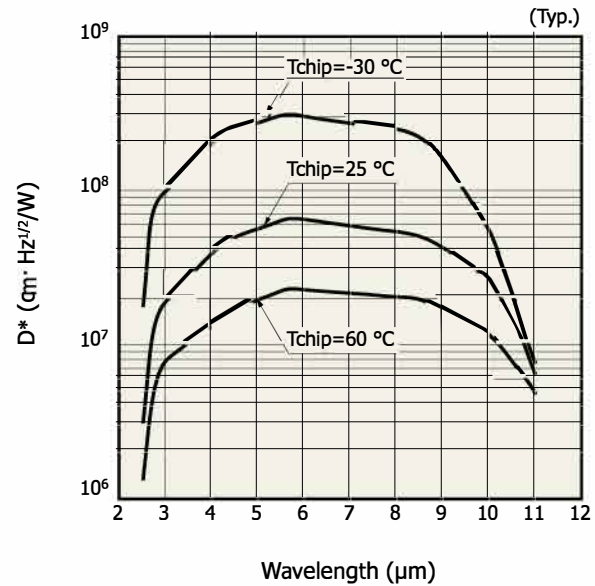
Note: Uniform irradiation must be applied to the entire photosensitive area during use.

Spectral response (D*)



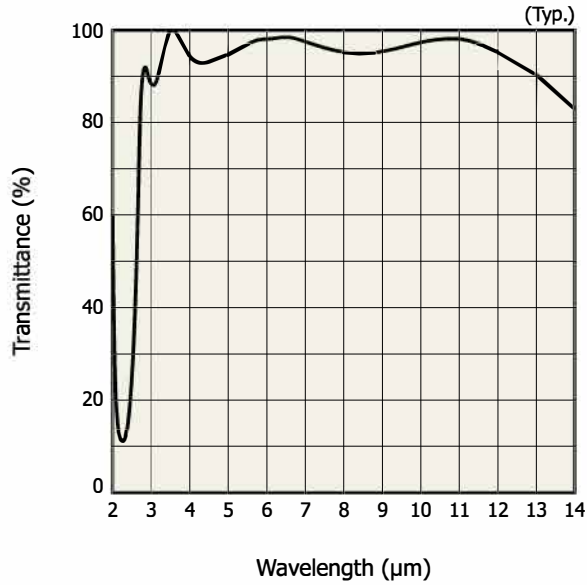
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Sensitivity temperature characteristics (P13894-011MA/-211MA)

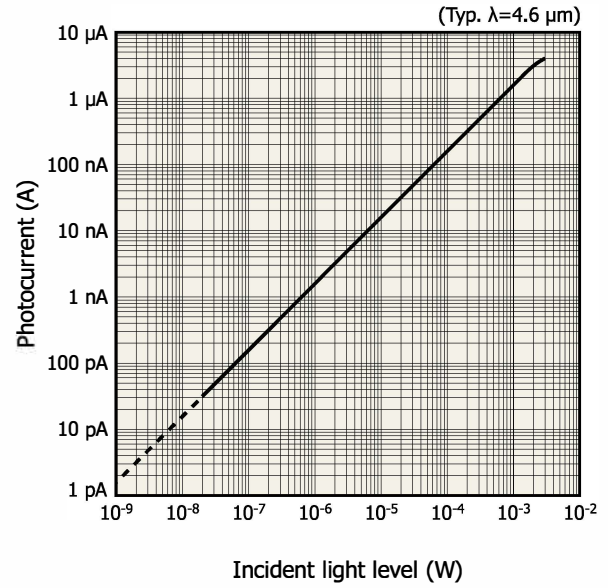


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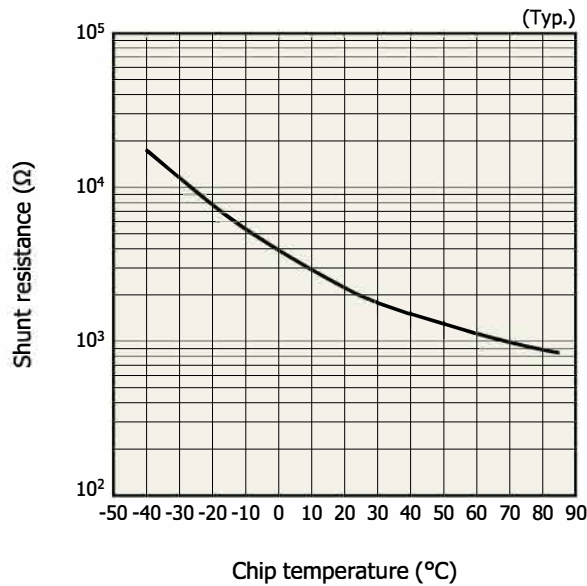
▣ Spectral transmittance of window material



▣ Linearity (P13894-011CN/-011NA)



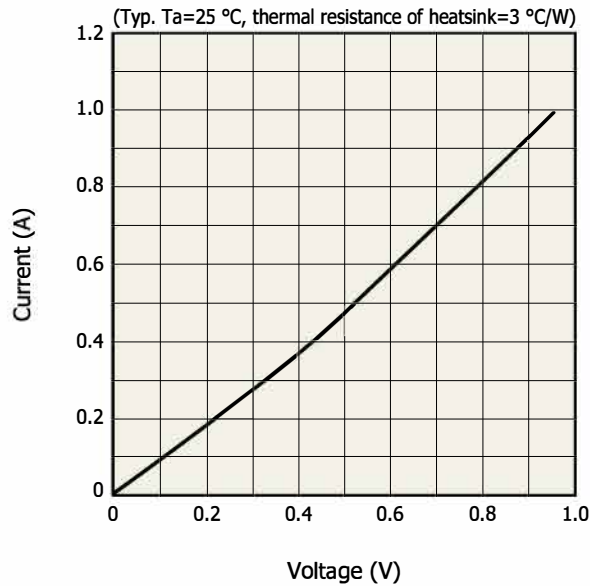
▣ Shunt resistance vs. chip temperature



▣ Specifications of two-stage TE-cooler (Ta=25 °C)

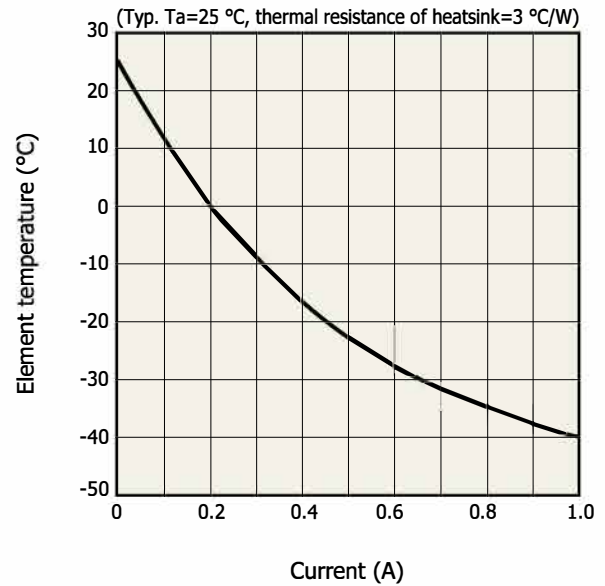
Parameter	Symbol	Min.	Typ.	Max.	Unit
Allowable current	Ic	-	-	1.0	A
Allowable voltage	Vc	-	-	0.95	V
Thermistor resistance	Rth	8.1	9.0	9.9	kΩ
Thermistor power dissipation	Pth	-	-	0.2	mW

▣ Current vs. voltage characteristics of TE-cooler



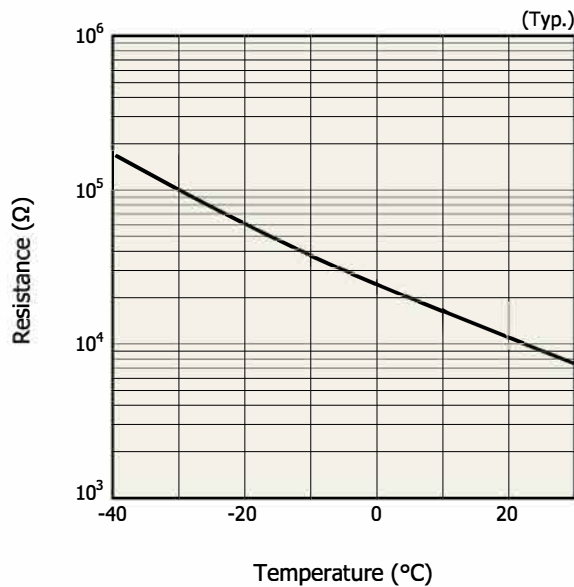
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▣ Cooling characteristics of TE-cooler



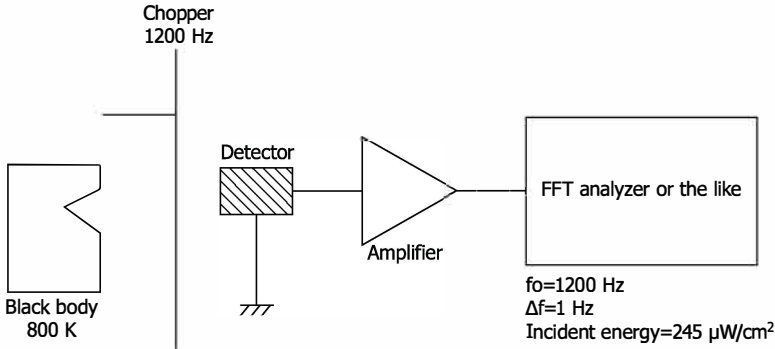
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▣ Thermistor temperature characteristics



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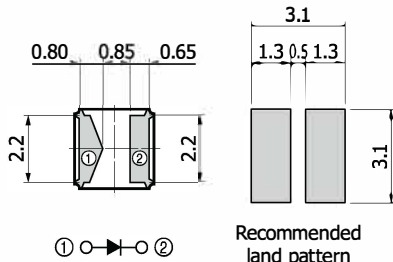
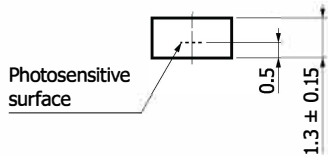
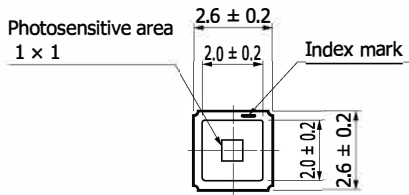
Measurement circuit example



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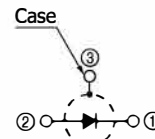
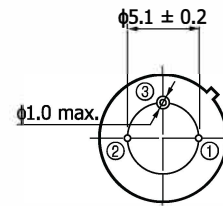
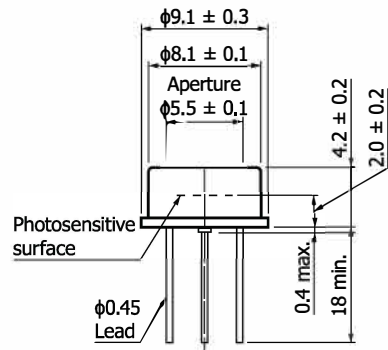
Dimensional outline (unit: mm)

P13894-011CN



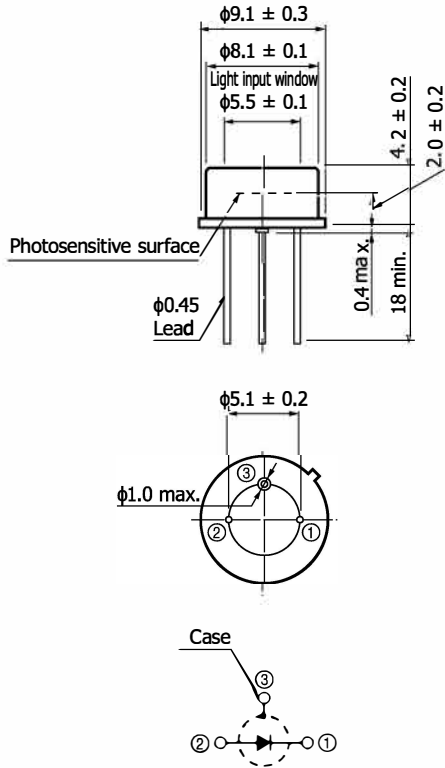
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P13894-011NA

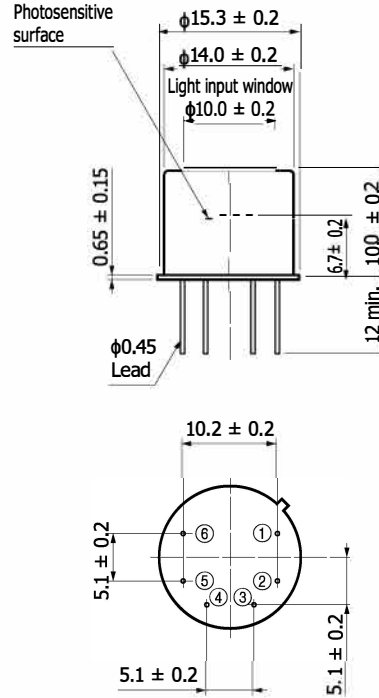


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P13894-011MA



P13894-211MA

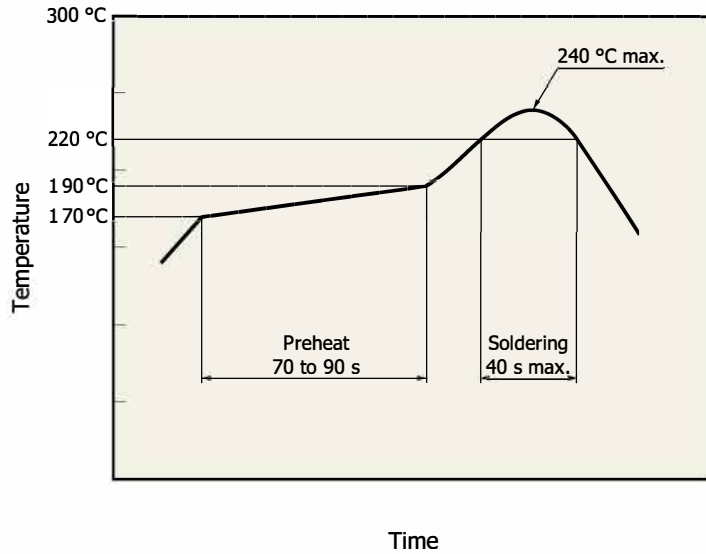


- ① Detector (anode)
- ② Detector (cathode)
- ③ TE-cooler (-)
- ④ TE-cooler (+)
- ⑤⑥ Thermistor

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KIRDA0257EA

Recommended reflow soldering conditions



KIRD0648EB

- 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.

Related information

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

- Precautions
- Disclaimer



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Information described in this material is current as of September 2019.

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