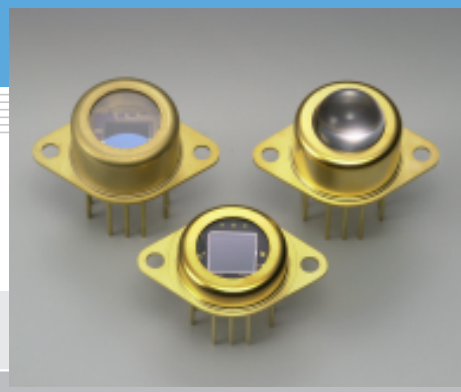


Si photodiode with preamp S6204 series

Large area photodiode integrated with op amp and TE-cooler



S6204 series is a thermoelectrically cooled Si photodiode developed for low-light-level detection. A large area photodiode, op amp, TE-cooler and feedback resistor (10 GΩ) are integrated into a single package. A thermistor is also included in the same package for temperature control so that the photodiode and I-V conversion circuit can be cooled for stable operation. S6204 series also features low noise and low NEP, and is especially suitable for NOx detection.

Features

- Large active area size
S6204/-01: 10 × 10 mm
S6204-03 : φ15.6 mm (lens)
- UV to NIR Si photodiode optimized for precision photometry
- Compact hermetic package with sapphire window
- High precision FET input operational amplifier
- High gain: $R_f=10\text{ G}\Omega$
- Low noise and NEP
- High cooling efficiency
S6204/-03: $\Delta T=50\text{ }^\circ\text{C}$
S6204-01 : $\Delta T=30\text{ }^\circ\text{C}$
- High stability with thermistor

Applications

- NOx detection
- Low-light-level measurement

S6204 series may be damaged by Electro Static Discharge, etc. Please see Precautions for use in the last page.

Absolute maximum ratings

Parameter	Symbol	Value
Supply voltage (preamp)	Vcc	±18 V
Reverse voltage (S6204-03, photodiode)	V _R	30 V
Operating temperature	T _{opr}	-30 to +60 °C
Storage temperature	T _{stg}	-40 to +80 °C
Operating temperature (photodiode)	T _{dopr}	-30 to +60 °C
TE-cooler allowable voltage *1	V _{te}	5 V
TE-cooler allowable current	I _{te}	1 A
Thermistor power dissipation	P _{th}	0.2 mW

*1: Max ripple: 10 %

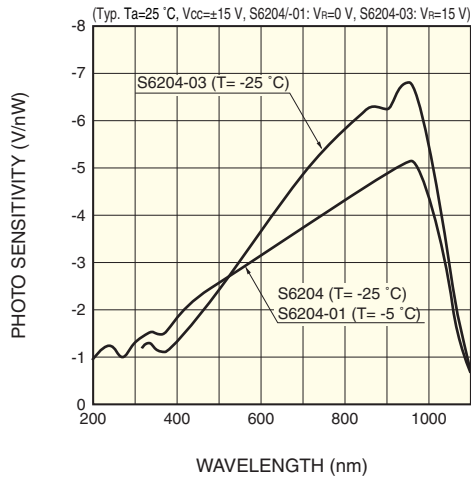
Recommended operating conditions

Parameter	Symbol	S6204/-01	S6204-03
Supply voltage (preamp)	Vcc	±5 to ±15 V	
Reverse voltage (photodiode)	V _R	0 V	15 V
TE-cooler current	I _{te}	0.8 A Max.	
Thermistor power dissipation	P _{th}	0.03 mW Max.	
Load resistance	R _L	100 kΩ Min.	

Electrical and optical characteristics (Typ. T_a=25 °C, V_{cc}=±15 V, R_L=1 MΩ)

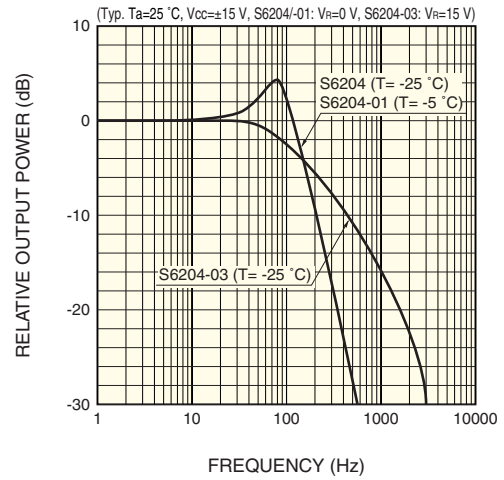
Parameter	Symbol	Condition	S6204	S6204-01	S6204-03	Unit
			T= -25 °C V _R =0 V	T= -5 °C V _R =0 V	T= -25 °C V _R =15 V	
Spectral response range	λ		190 to 1100		320 to 1100	nm
Peak sensitivity wavelength	λ _p		960			nm
Feedback resistance	R _f		10			GΩ
Photo sensitivity	S	λ=200 nm	-0.9	-0.9		V/nW
		λ=λ _p	-5.1	-5.1	-6.5	
Output noise voltage	V _n	Dark state, f=10 Hz	42	50	13	μVrms/Hz ^{1/2}
Noise equivalent power	NEP	λ=λ _p , f=10 Hz	9	10	2	fW/Hz ^{1/2}
Output offset voltage	V _{os}	Dark state	±2	±2	±3	mV
Cut-off frequency	f _c	-3 dB	130			Hz
Output voltage swing	V _o		-13			V
Supply current	I _{cc}	Dark state	0.6			mA
Thermistor resistance	R _{th}		86	30	86	kΩ

Spectral response



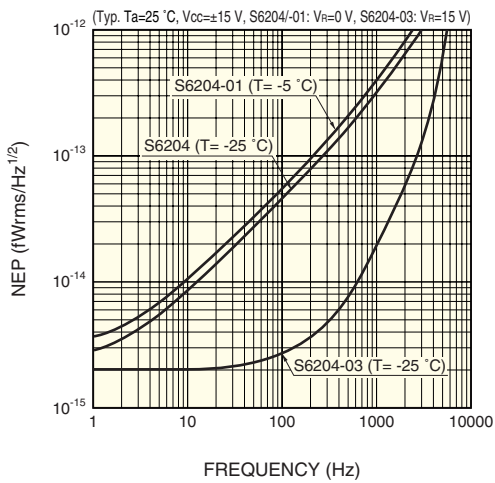
KSPDB0147EA

Frequency response



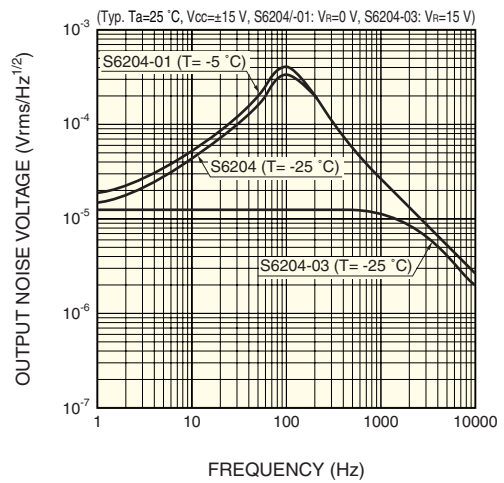
KSPDB0148EA

NEP vs. frequency



KSPDB0149EB

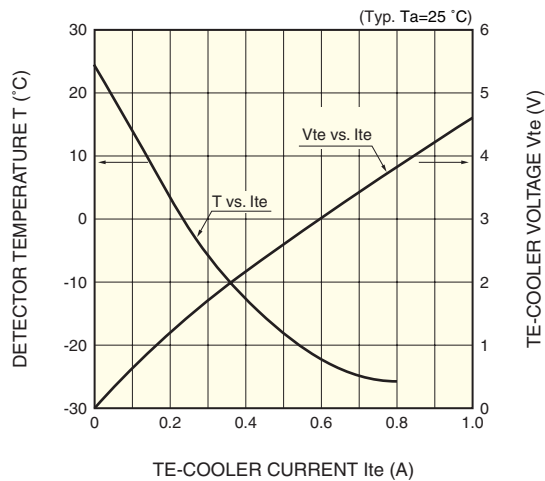
Output noise voltage vs. frequency



KSPDB0150EC

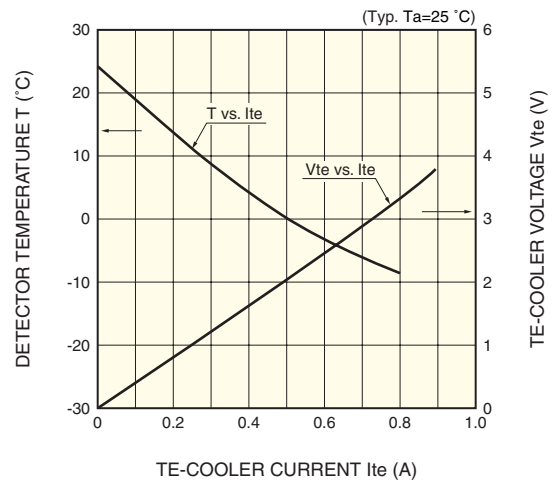
Detector temperature vs. TE-cooler current

S6204/-03



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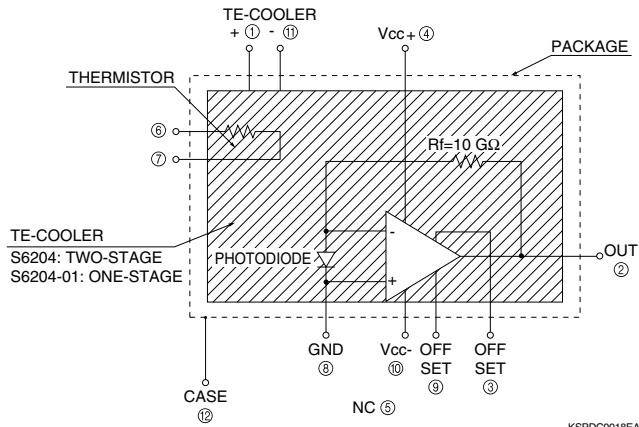
S6204-01



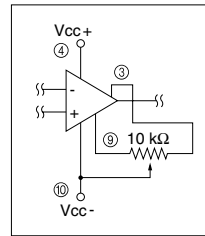
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External connection

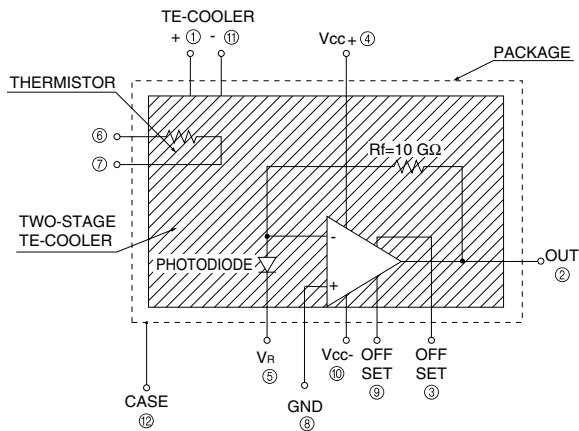
S6204/-01



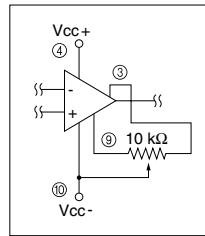
OFFSET VOLTAGE NULLING



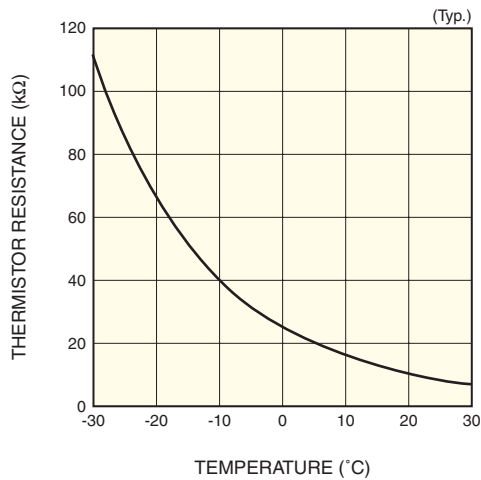
S6204-03



OFFSET VOLTAGE NULLING

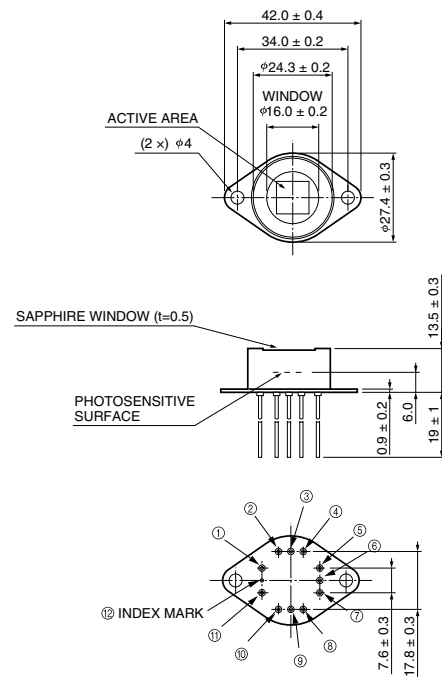


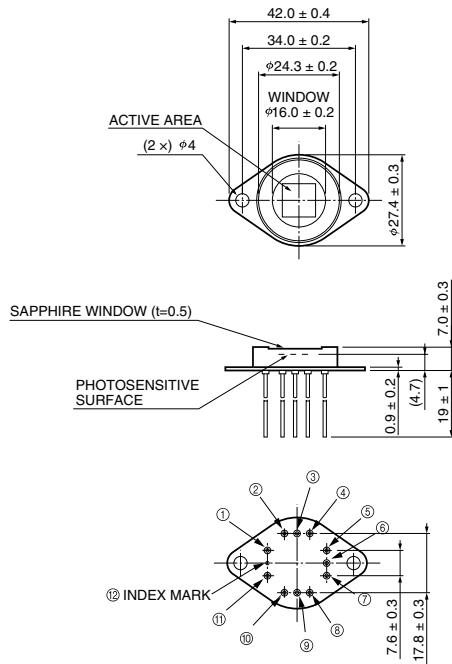
Thermistor resistance vs. temperature



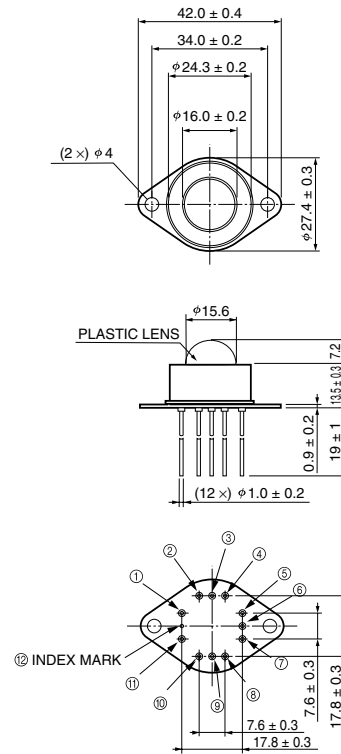
Dimensional outlines (unit: mm)

S6204



S6204-01

KSPDA0079EA

S6204-03

KSPDA0088EB

A tantalum or ceramic capacitor of 0.1 to 10 μF must be connected to the supply voltage leads (pins ④ and ⑩) as a bypass capacitor used to prevent the device from oscillation.

Precautions for use

■ ESD

S6204 series may be damaged or their performance may deteriorate by such factors as electro static discharge from the human body, surge voltage from measurement equipment, leakage voltages from soldering irons and packing materials. As a countermeasure against electro static discharge, the device, operator, work place and measuring jigs must all be set at the same potential. The following precautions must be observed during use:

- To protect the device from electro static discharge which accumulate on the operator or the operator's clothes, use a wrist strap or similar tools to ground the operator's body via a high impedance resistor (1 M Ω).
- A semiconductive sheet (1 M Ω to 10 M Ω) should be laid on both the work table and the floor in the work area.
- When soldering, use an electrically grounded soldering iron with an isolation resistance of more than 10 M Ω .
- For containers and packing, use of a conductive material or aluminum foil is effective. When using an antistatic material, use one with a resistance of 0.1 M Ω/cm^2 to 1 G Ω/cm^2 .

■ Strength

Thermoelectrically-cooled devices may be damaged if subjected to shock, for example drop impact. Take sufficient care when handling these devices.

■ Lead forming

When forming the leads, take care not to apply excessive force to the lead sealing glass. Excessive force may impair the hermetic sealing, possibly degrading the cooling capacity.

To form the leads, hold the roots of the leads securely with a pair of pliers and bend them.

■ Heatsink

Use a heatsink with thermal resistance less than 1.3 $^{\circ}\text{C}/\text{W}$. Apply thermal grease between the heatsink and detector package, and then fasten them with the screws. Be careful not to give any excessive force or mechanical stress to the detector package at this point.

■ Wiring

Be careful not to misconnect the plus and minus leads of the thermoelectric cooler or preamplifier. Supplying a voltage or current while these connections are reversed may damage the device.

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