



PRELIMINARY

Cooled Negative Feedback Avalanche Diodes (NFAD)

PNA-208-32u

1. Product Features

- **Single photon sensitivity**
- **SWIR (1000 – 1700nm) response**
- **High gain and low noise**
- **Fast response with precise timing**

RMY's PNA-208-32u NFAD (transferred technology from previous Princeton Lightwave Inc.) is a new type of photon-counting device in a standard three-stage cooled 6 pin TO-8 can, consisting of InGaAs/InP avalanche diode chip with monolithically integrated negative feedback. This integration approach of negative feedback resistor provides stable high-performance single photon response in Geiger mode operation, Leveraging the best-in-class performance of RMY's single photon avalanche diode (SPAD) technology. RMY's NFAD has excellent photon-counting capability in the shortwave infrared (SWIR) band, with high internal gain (10^5 to 10^6) and low dark count rate. The detector also has fast response coupled with excellent time resolution.

2. Applications

- **Laser Radar (LADAR) and Ranging**
- **Optical communications**
- **Fluorescence measurements**
- **Environmental analysis**
- **Biomedical devices**

3. Typical Performance Specifications

Operating conditions: device temperature $T = 240$ K; reverse-biased

Parameter Description	Symbol	PNA-208-32u	Units
Detection area dimensions		Ø32	µm
Spectral response range		1020 - 1650	nm
Photon detection efficiency	PDE	Min 10	%
Operating voltage	V_{op}	70 - 90	V
Dark count rate (PDE 10%)	DCR	Max 50	kHz
Terminal capacitance	C_t	0.4	pF
Timing jitter [1]	TJ	300 - 400	ps
Temperature coefficient of V_{op}	γ	0.1	V/K
Output pulse amplitude [2]	V_{out}	0.5 - 1.5	mV

Note: Typical value achieved by design, not tested on shipped product.

[1] Single photon level, FWHM

[2] 50Ω termination, depends on PDE

4. Absolute Maximum Ratings

Parameter	Conditions	Max	Units
Forward Current	Continuous Bias	+1	mA
Forward Voltage	Continuous Bias	+1	V
Optical Power	Continuous Wave (CW)	1	mW
Reverse Current	Continuous Bias	-1	mA
Reverse Voltage	Continuous Bias	-(V _b +5)	V
Reverse Voltage	Pulsed (gated operation)	-(V _b +10)	V

Operation beyond maximum ratings may cause permanent device damage.

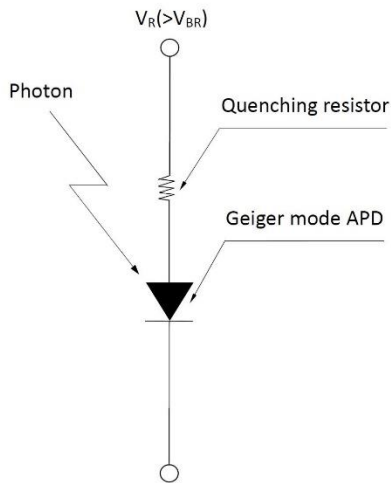
5. TEC Specifications

Parameter	Conditions	Max	Units
TEC Current		1.5	A
TEC Voltage		1.9	V
TEC deltaT	Device case at 298K	77	°C

Thermistor = 2.20KΩ at 298K, 291.75KΩ at 223K

Steinhart-Hart Thermistor Constants: A=1.629E-03; B=2.242E-04; C=4.316E-09

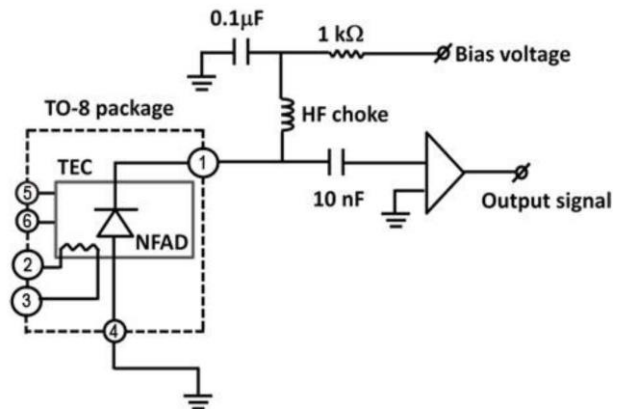
6. Principle Of Operation



V_R : Reverse voltage

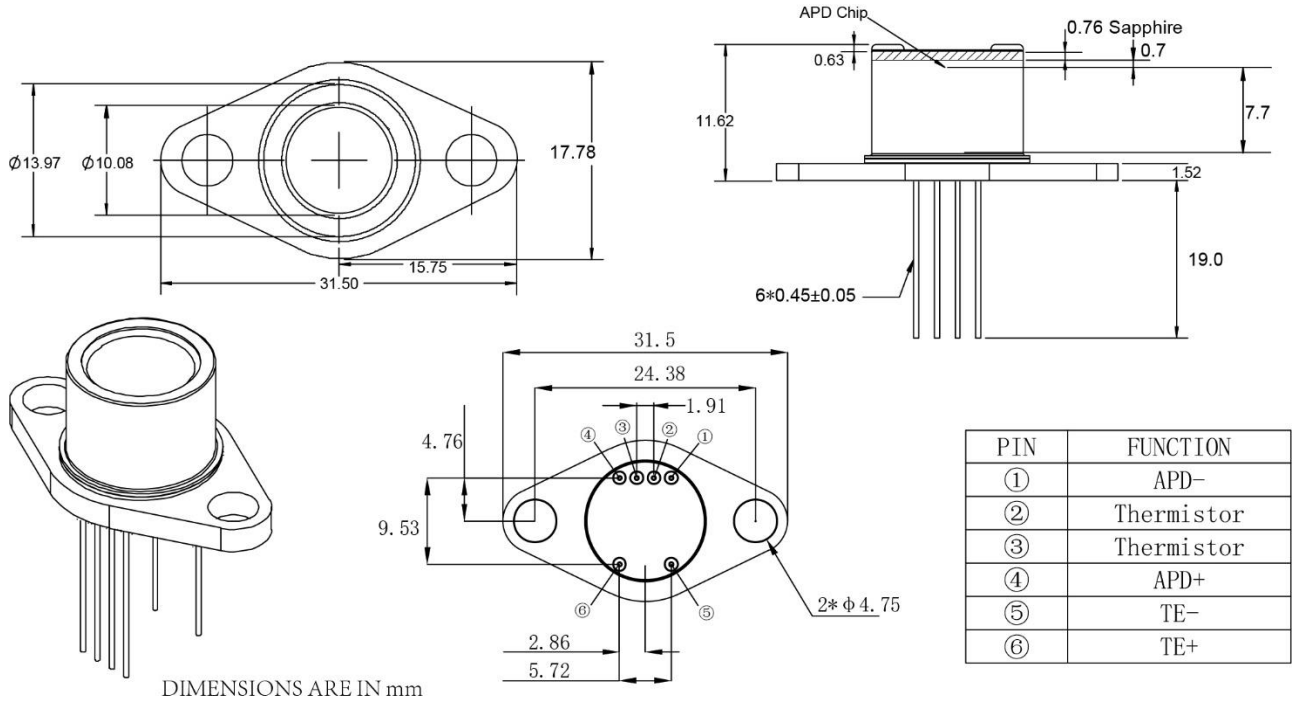
V_{BR} : Breakdown voltage

Typical Application Circuit: PNA-208-32u



7. Mechanical Specifications: PNA-208-32u

The PNA-208-32u is packaged in a standard 6 pin TO-8 header with a three stage thermo-electric cooler capable of cooling the APD from package temperature of 25°C to -50°C (223K).



8. Product Handling

Avalanche photodiodes are sensitive to electrostatic discharge (ESD) and should be handled with appropriate caution, including the use of ESD protective equipment such as grounding straps and anti-static mats.

Beijing RMY Electronics Ltd.
RMY Electronics (Hong Kong) Ltd.
www.RMYelectronics.com/english

RMY Electronics Limited
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