



# PRELIMINARY

## Cooled Negative Feedback Avalanche Diodes (NFAD) – MMF Fiber Pigtailed PNA-308-MM

### 1. Product Features

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

RMY's PNA-308-MM NFAD (transferred technology from previous Princeton Lightwave Inc.) is a new type of photon-counting device in a standard three-stage TEC cooled 6 PIN TO-8 package, 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. The pigtail is GI 62.5/125 $\mu$ m multi-mode fiber.

### 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-308-MM	Units
Detection area dimensions		Ø22	$\mu$ m
Spectral response range		1020 - 1650	nm
Photon detection efficiency	PDE	Min 10	%
Operating voltage (10% PDE)	V <sub>op</sub>	70 - 85	V
Dark count rate [1]	DCR	Max 30	kHz
Terminal capacitance	C <sub>t</sub>	0.4 typical	pF
Timing jitter [2]	T <sub>J</sub>	300 typical	ps
Temperature coefficient of V <sub>op</sub>	$\gamma$	0.1 typical	V/K
Output pulse amplitude [3]	V <sub>out</sub>	0.5 typical	mV

[1] At PDE = 10%

[2] Single photon level, FWHM

[3] 50 $\Omega$  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 <sub>b</sub> +5)	V
Reverse Voltage	Pulsed (gated operation)	-(V <sub>b</sub> +10)	V

Operation beyond maximum ratings may cause permanent device damage.

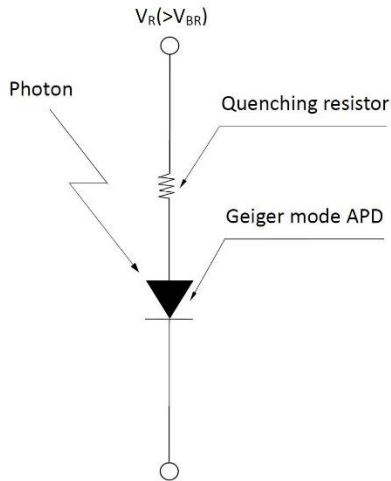
#### 5. TEC Specifications

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

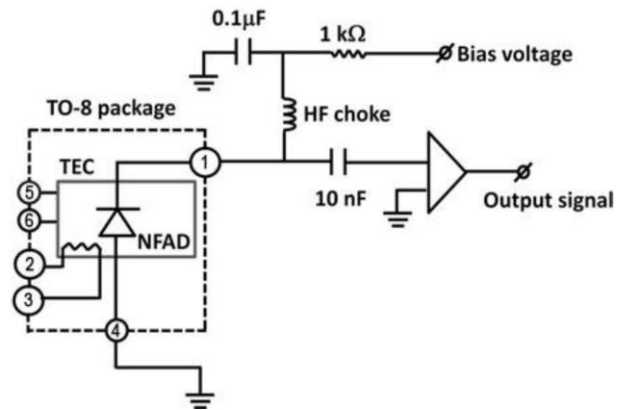
Steinhart-Hart Thermistor Constants: A=1.629E-03; B=2.242E-04; C=4.316E-09

#### 6. Principle Of Operation



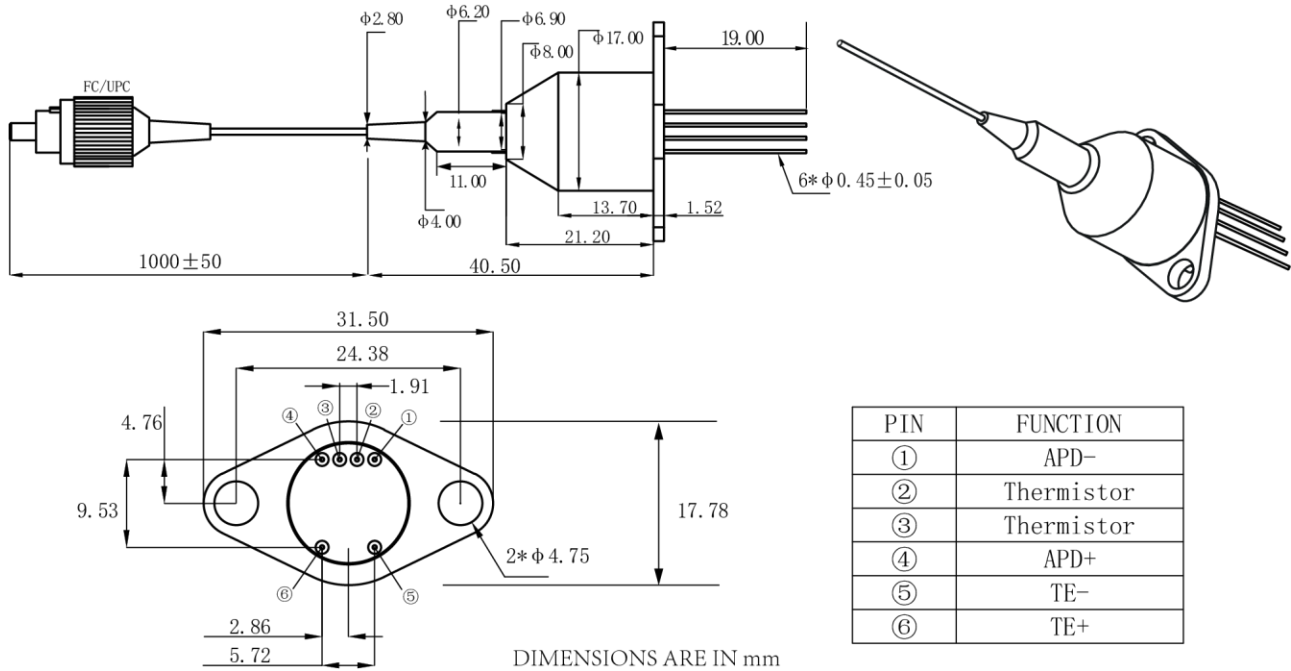
V<sub>R</sub> : Reverse voltage  
V<sub>BR</sub> : Breakdown voltage

#### Typical Application Circuit: PNA-308-MM



## 7. Mechanical Specifications: PNA-308-MM

The PNA-308-MM 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). A 62.5/125μm GI multi-mode fiber pigtail with an FC/UPC connector is coupled to the APD. Fiber length: 1.0±0.05m.



## 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.

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