

# ***SPAD with TEC***

***(Pigtailed 6 pin TO-8 Single Photon Avalanche Diode)***



Distributor



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## General Description

This InGaAs/InP APD device was specially designed and fabricated for the use of single photon avalanche detection (SPAD) with **internal cooling systems**. It can be operated at the voltage above breakdown for short period, which is called by “Geiger-mode” or “Gated mode” operation. Ultra low noise operation is possible at the temperature of  $-40^{\circ}\text{C}$ . It can be used for quantum key distribution (QKD) receiver.

## Features

- Low capacitance less than 0.3 pF and high speed
- Operation between 1100 nm and 1600 nm
- Coaxial type pigtail
- Low noise
- 6-pin TO-8 package
- Built in 3-stage cooling system

## Applications

- Special application such as QKD, OTDR etc, which requires single photon counting application.

## Absolute Maximum Ratings

| Parameter           | Conditions               | Max              | Unit       |
|---------------------|--------------------------|------------------|------------|
| Forward Current     | Continuous bias          | + 1              | mA         |
| Forward Voltage     | Continuous bias          | + 1              | V          |
| Reverse Current     | Continuous bias          | - 1              | mA         |
| Reverse Voltage     | Continuous bias          | $- V_{BR}$       | V          |
|                     | Pulsed bias (gated mode) | $-(V_{BR} + 10)$ | V          |
| Optical Input Power | Continuous wave          | 1                | mW         |
| TEC Current         |                          | 2.4              | A          |
| TEC Voltage         |                          | 1.9              | V          |
| Thermistor          | @ $23^{\circ}\text{C}$   | 2.2              | k $\Omega$ |

Table 1. Absolute Maximum Ratings

## Electro-Optical Characteristics

Inspection sheet shall be appended to products when they are delivered. Test report shall be submitted in papers and in electronic media. It shall contain the major in following items.

### Optical Characteristics (Tc=25°C)

| Parameter                           | Symbol    | Test Condition                 | Min  | Typ. | Max  | Unit |
|-------------------------------------|-----------|--------------------------------|------|------|------|------|
| Breakdown Voltage                   | $V_{BR}$  | $I_D=100\mu A$                 | 50   | 70   | 90   | V    |
| Total dark current                  | $I_D$     | $V_R = 0.98V_{BR}$             |      | 0.1  | 0.3  | nA   |
| Capacitance                         | $C_{PD}$  | f = 1MHz,<br>$V_{PD} = 0.9V_B$ |      | 0.25 |      | pF   |
| Quantum efficiency                  | $\eta$    | M=1, 1550nm                    |      | 70   |      | %    |
| Optical Wavelength Range            | $\lambda$ | -                              | 1100 |      | 1600 | nm   |
| Responsivity                        | R         | $\lambda = 1550nm, M=1$        | 0.7  | 0.8  |      | A/W  |
| Temperature coefficient of $V_{BR}$ | $\Gamma$  | $\Delta V_{BR}/\Delta T$       |      | 0.11 |      | V/°C |

Table 2. Optical Characteristics

### Optical Characteristics (Tc= -40°C) (P: Premium Grade/ S: Standard Grade)

| Parameter              | Symbol | Test Condition                                    | Min | Typ.             | Max | Unit |
|------------------------|--------|---|-----|------------------|-----|------|
| AfterPulse Probability | APP    | 10MHz Gate Frequency<br>2ns Gate Pulse<br>20% PDE |     |                  | 10  | %    |
| Dark Count Rate        | DCR    | 10MHz Gate Frequency<br>2ns Gate Pulse<br>20% PDE |     | 0.5(P)<br>2.0(S) |     | KHz  |
| Detection Efficiency   | PDE    | 10MHz Gate Frequency<br>2ns Gate Pulse            |     | 20               |     | %    |

Table 3. Optical Characteristics at GM operation

**Mechanical Dimension & Pin Layout**

(Unit : mm)

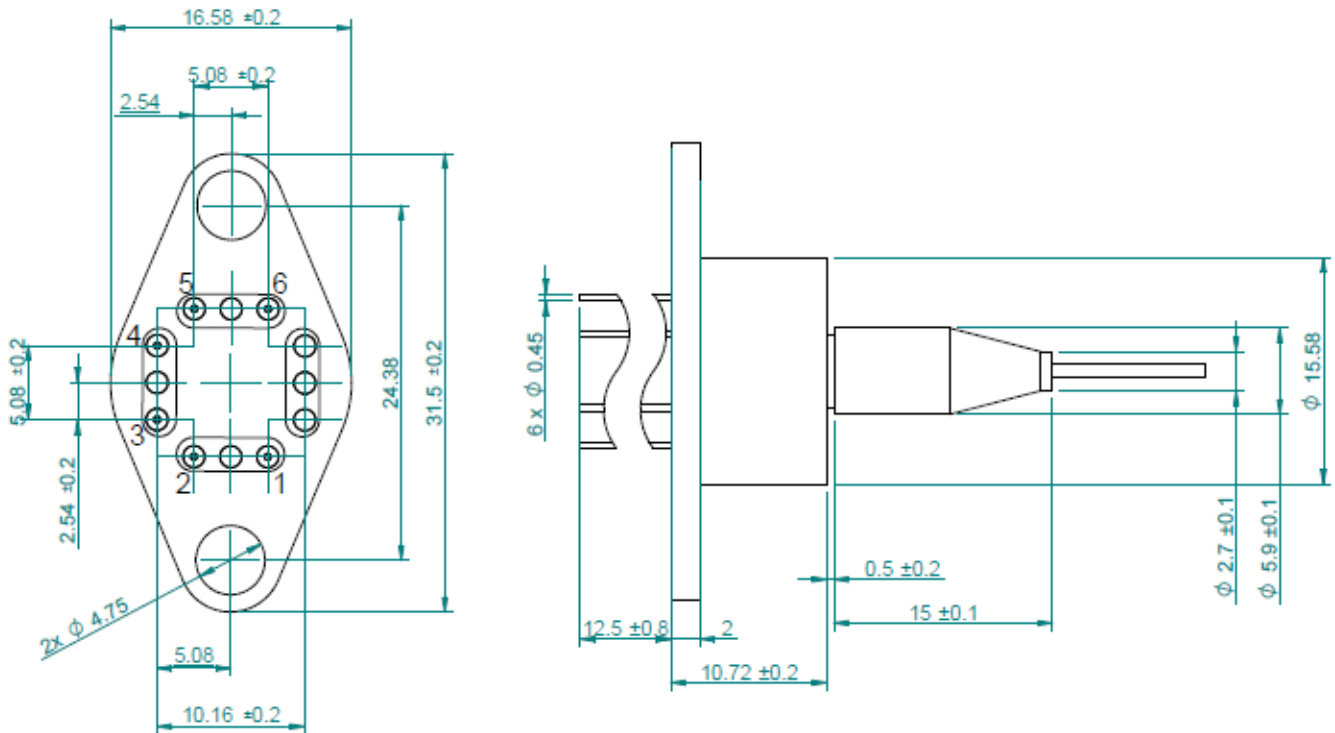


Figure 1. Mechanical Dimension

\* Fiber length : 1m (standard) , Connector : FC-PC (Standard)

| No. | Symbol | I/O | Description (Bottom View) |
|-----|--------|-----|---------------------------|
| 1   | TEC    | -   | TEC(-)                    |
| 2   | TEC    | -   | TEC(+)                    |
| 3   | A      | -   | APD Anode                 |
| 4   | C      | -   | APD Cathode               |
| 5   | TH     | -   | Thermistor1               |
| 6   | TH     | -   | Thermistor2               |

Table 4. PIN Configuration

**Other Requirements**

**Precautions for use**

This device is susceptible to damage as a result of ESD(electrostatic discharge). Use of ground straps, anti static mats, and other standard ESD protective equipment is recommended when handling or testing an InGaAs PIN/APD or any other junction photodiode. Soldering temperature of the leads should not exceed 350°C for more than 3 seconds.

## ORDERING INFORMATION

WPACPGMTKSFPN (SPAD with TEC TO-8 Type Standard DCR Grade)

WPGSPGMTKSFPFP (SPAD with TEC TO-8 Type Premium DCR Grade)

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