# SPD6514S InGaAs 4×4 Array

# Single-Photon Detector Module




## Description

The SPD6514S InGaAs 4×4 single-photon array detector module (hereinafter referred to as the "detector") consists of an InGaAs avalanche photodiode 4×4 array chip, active-passive fast quenching circuit, refrigeration circuit, signal control circuit, and other components.

The detector array has a 4×4 element configuration, with a pixel center spacing of 100 micrometers, operating in the near-infrared wavelength range of 1.0–1.65 μm. The detector features high detection sensitivity, capable of detecting weak optical signals (single-photon signals). Each pixel of the detector operates freely within an adjustable pulse width, and each pixel independently outputs detection signals and processes the output electrical signals, with minimal noise interference.

The detector module is characterized by high sensitivity and a simple system structure, and can be applied in fields such as long-distance laser ranging, long-distance spatial optical communication, and photoelectric radar.

# Specifications

## Main Specification

| Characteristic parameters | Sign | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Detector Specifications and Configuration Parameters | | | | | | |
| Array Scale | M | — | 4×4 | | | — |
| Target Size | Ts | — | 0.4×0.4 | | | mm |
| Pixel Center Distance | D | — | — | 100 | — | μm |
| Pixel Gap | DG | — | — | — | 20 | μm |
| Operating Wavelength | λ | — | 1000 | — | 1650 | μm |
| Output Signal Amplitude | Vout | | 2.5 | 3.3 | | V |
| Serial Port Baud Rate | Baud | — | — | 115200 | — | Baud/s |
| Power Consumption | PDC | VIN =5V ，Tth=-30℃±5℃ | — | 15 | — | W |
| Input Voltage | VIN | — | — | 5.0 | — | V |
| Input Current | IIN | VIN =5V ，Tth=-30℃±5℃ | | 3.0 | | A |
| Operating Ambient Temperature | TA | — | -40 | — | 55 | ℃ |
| Weight | Wt | — | — | 180 | — | g |

| Characteristic parameters | Sign | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Detector Dimensions | SC | — | 75×50 ×28 | | | mm |
| Optoelectronic Performance Parameters | | | | | | |
| Photon Efficiency | PDE | TA=25±5℃, Tth=-30℃±5℃, λ=1570±50nm, τ=0.8 μs±0.1 μs | 10 | 15 | — | % |
| Dark Count Rate | DCR(PDE=10%) | | — | — | 10 | kHz |
| After pulse Probability | APP(PDE=10%) | | | | 20 | % |

Operating wavelength: Standard narrowband filters can be selected within the operating wavelength range.

Tth: Operating temperature of the InGaAs avalanche photodiode 4×4 array chip.

τ : Dead time.

Ambient temperature for the above parameter tests: TA = 25 ± 5℃.

## Parameter Setting Range and Recommended Operating Conditions

| No. | | Parameters | Rated Values |
|---|---|---|---|
| Parameter Setting Range | 1 | Detector operating temperature | -30℃~30℃, min. step value: 0.1℃ |
| | 2 | Dead time adjustment | 0.1μs～2.0μs, step value: 0.025μs |
| | 3 | Avalanche voltage threshold adjustment | 50.0V～85.0V, step value: 0.1V |
| | 4 | Geiger avalanche comparison voltage setting | 0.35V～1.10V, step value: 0.01V |
| | 5 | Detector operating gate width and operating cycle adjustment | Operating gate width: ≥0.1μs; operating cycle: ＞0.1μs; step value: 0.01μs |

| No. | | Parameters | Rated Values |
|---|---|---|---|
| Recommended Operating Conditions | 1 | Detector operating temperature | -30℃~0℃ |
| | 2 | Dead time value | 0.80μs |
| | 3 | Avalanche voltage threshold adjustment | See the test report for details |
| | 4 | Geiger avalanche comparison voltage setting | 0.45V～0.90V |

## Typical Characteristic Curves

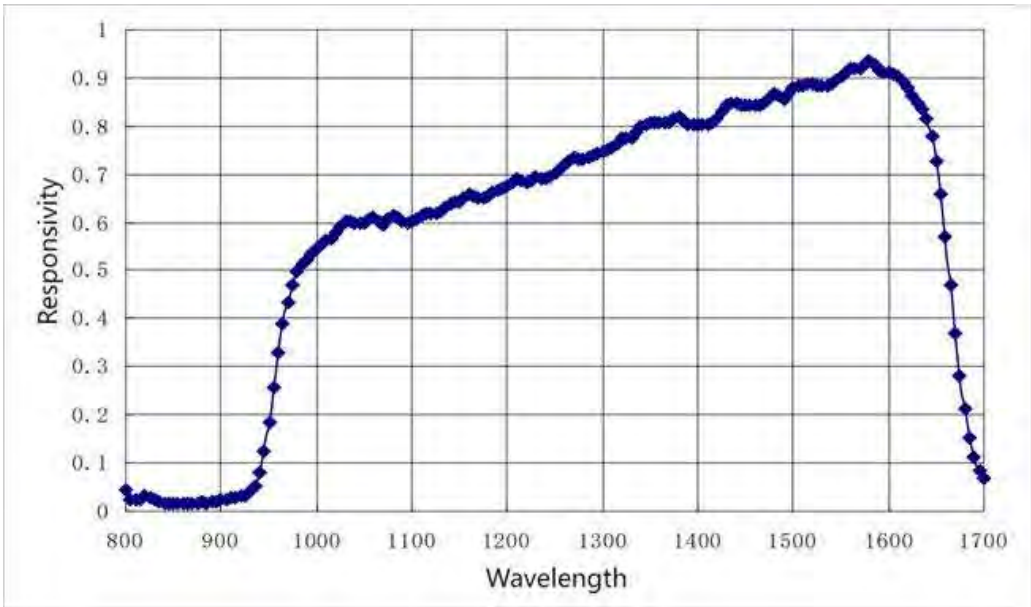



Figure 1 InGaAs Spectral Response Characteristic Curve

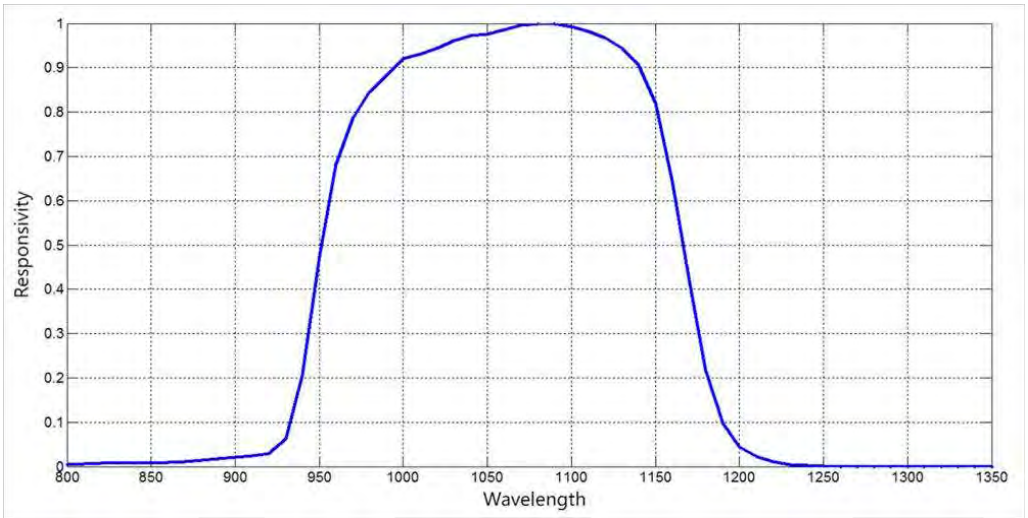
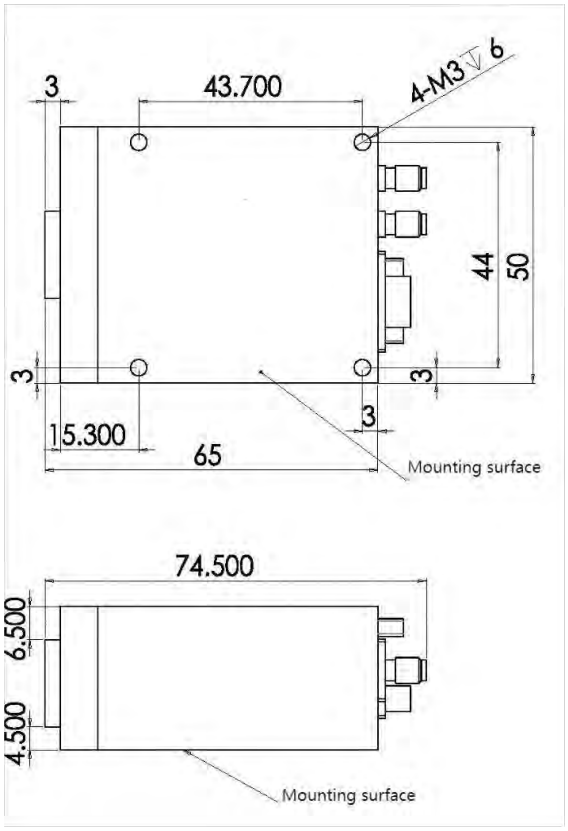



Figure 2 InGaAsP Spectral Response Characteristic Curve

## Dimensions and Pin definitions

Outline, Dimensions and Definition of Lead-out Ports (Unit: mm)

Outline dimension parameters



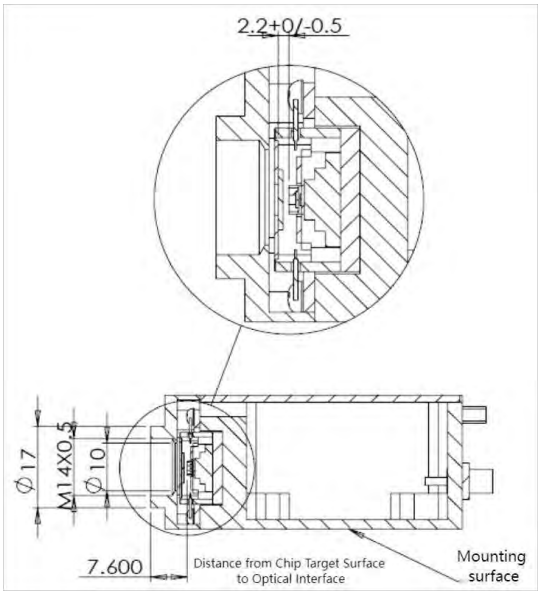




Figure 3 Outline Dimension Drawing

Figure 4 Dimension Drawing of Distance from Chip Target Surface to Optical Interface

Definition of Lead-out Ports

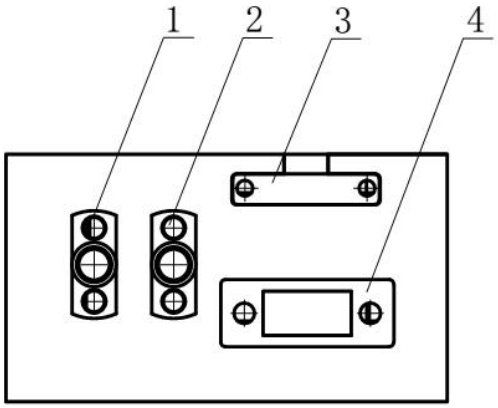



Figure 5 Arrangement and Numbering of Electrical Connectors

| Electrical Connector Number | Electrical Connector Type | Function |
|---|---|---|
| 1 | SSMA | Synchronous signal output port |
| 2 | SSMA | Synchronous signal input port |
| 3 | J63A-31 | UART and 16-channel pixel signal output |
| 4 | J30J-2 | +5.0 V single power supply |

The port numbering of J31J-2 is shown in Figure 9.

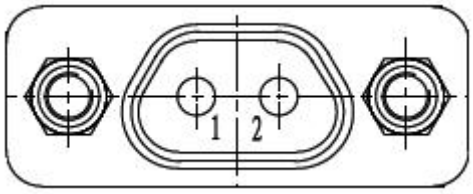



Figure 6 Port Numbering of J31J-2

| PIN No. | Name | Function | Pin Number | Name | Function |
|---|---|---|---|---|---|
| 1 | GND | Ground Port | 2 | POWER +5V | +5V power supply positive input port |

**Notes**

(1) Before power supply, carefully check whether the voltage of the power supply meets the requirements;

(2) Pay attention to electrostatic protection when using in a dry environment;

(3) The recommended operating ambient temperature shall not exceed 40℃;

(4) Be careful not to use excessive force when plugging or unplugging interfaces;

(5) Pay attention to the sequence of switching power supply and parameter setting.

(6) Good heat dissipation shall be ensured during use.