



# AK9730AJF21

## IR Sensor for NDIR Gas Sensing

### 1. General Description

The AK9730AJF21 is a small mid-infrared quantum photo diode made of AlInSb. It can work at room temperature by AKM unique compound semiconductor technology, which realizes the high sensitivity, high speed response, and high reliability. This sensor is optimized to NDIR flammable gas sensing application.

### 2. Features

- High Sensitivity  
Signal-to-noise ratio is three times higher than conventional thermopiles.
- High Speed Response (~100kHz)
- High Reliability
- No bias voltage needed
- Built in an Optical Band Pass Filter (CWL: 3.32 $\mu$ m)
- 3mm x 3mm small surface mount type plastic package

### 3. Applications

- NDIR gas sensor  
CH<sub>4</sub>, R32 etc.

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**5. Block Diagram and Functions**

**5.1. Block Diagram**

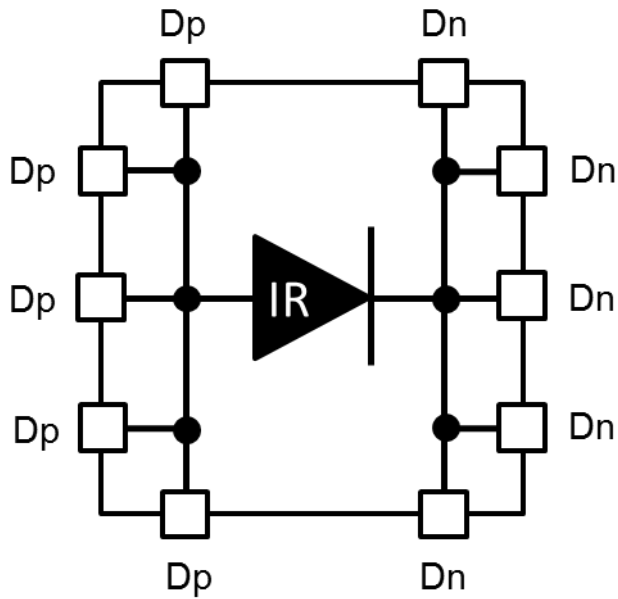


Figure 5.1 Block Diagram

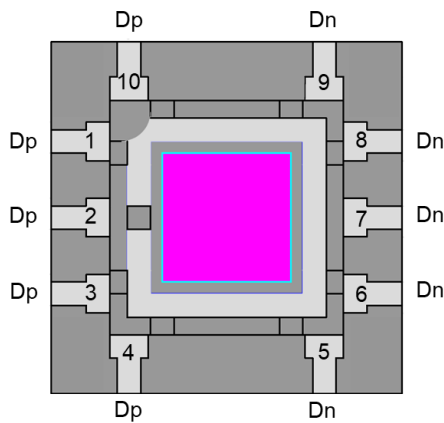
**5.2. Functions**

Table 5.1 Block Functions

| Block | Function                 |
|-------|--------------------------|
| IR    | Mid-infrared photo diode |

**6. Pin Configurations and Functions**

**6.1. Pin Configurations**



Top View

Figure 6.1 Pin Configurations

## 6.2. Functions

Table 6.1 Pin Functions

| Pin No.        | Name | I/O | Functions         |
|----------------|------|-----|-------------------|
| 1, 2, 3, 4, 10 | Dp   | —   | p-type output pin |
| 5, 6, 7, 8, 9  | Dn   | —   | n-type output pin |

## 7. Absolute Maximum Ratings

Table 7.1 Absolute Maximum Ratings

| Parameter                  | Symbol | Min. | Max. | Unit |
|----------------------------|--------|------|------|------|
| Operating Temperature (*1) | Ta     | -40  | 85   | °C   |
| Storage Temperature        | Tstg   | -40  | 85   | °C   |

### Notes

Operation exceeding the absolute maximum ratings may result in permanent damage to the device.

Normal operation is not guaranteed at these extremes.

\*1: Non-condensing

## 8. Recommended Operating Conditions

Table 8.1 Recommended Operating Conditions

| Parameter     | Symbol | Min. | Typ. | Max. | Unit |
|---------------|--------|------|------|------|------|
| Input Voltage | Vin    | -10  | 0    | 10   | μV   |

## 9. Electrical Characteristics

Table 9.1 Electrical Characteristics

Unless otherwise specified, Ta = 25°C

| Parameter                | Symbol | Min. | Typ. | Max. | Unit |
|--------------------------|--------|------|------|------|------|
| Output Current (*2)      | Ip     | 2.9  | 7.5  | 14.2 | nA   |
| Internal Resistance (*3) | Ro     | 15   | 97   | 250  | kΩ   |

### Notes

\*2: The calibrated lamps are used as the light source in the final test.

The lamp is calibrated so that the following specifications can be confirmed in the final test.

Measurement conditions:

- Light source

Blackbody furnace with diameter = 22.2mm

Surface temperature = 500°C

- Distance

AK9730AJF21 to blackbody = 10cm.

- The soda glass is placed between the sensor and the blackbody furnace.

- Measured by a 10Hz lock-in amplifier.

\*3: Measurement conditions:

- Average value at ±500nA output.

**10. Optical Filter Specification**

Table 10.1 Optical Filter Specification

Ta = 25°C, Angle of incidence = 0°

| Parameter                   | Symbol | Min  | Typ  | Max  | Unit |
|-----------------------------|--------|------|------|------|------|
| Center wavelength           | CWL    | 3.28 | 3.32 | 3.36 | μm   |
| Full width at half maximum  | FWHM   | 0.17 | 0.19 | 0.21 | μm   |
| Peak transmission intensity | Tpeak  | 80   | -    | -    | %    |

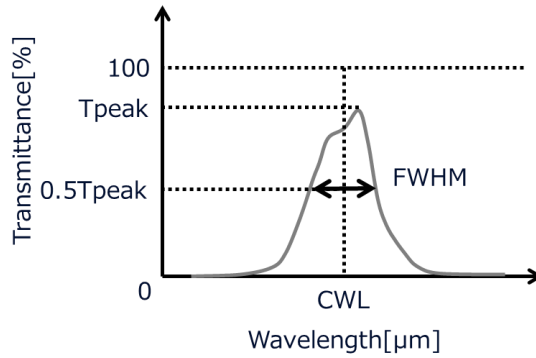


Figure 10.1 Definition of CWL, FWHM and Tpeak

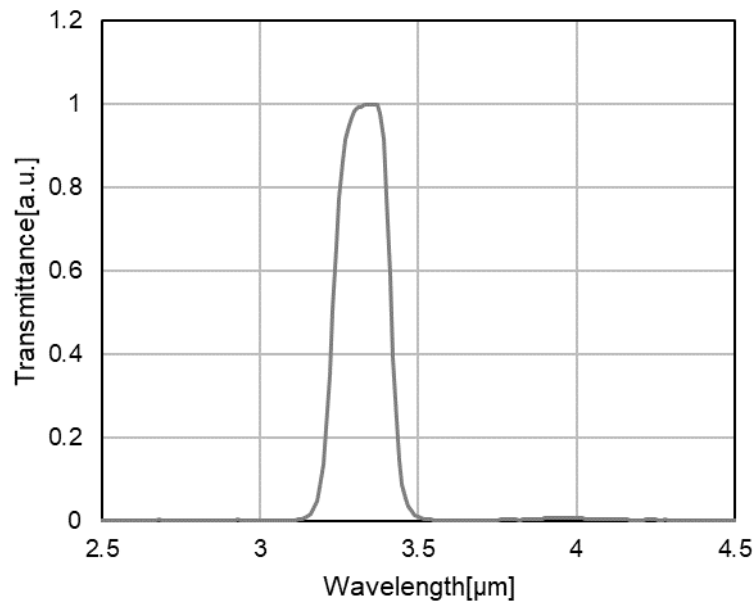


Figure 10.2 Optical filter transmittance (Reference)

**11. Recommended External Circuits**

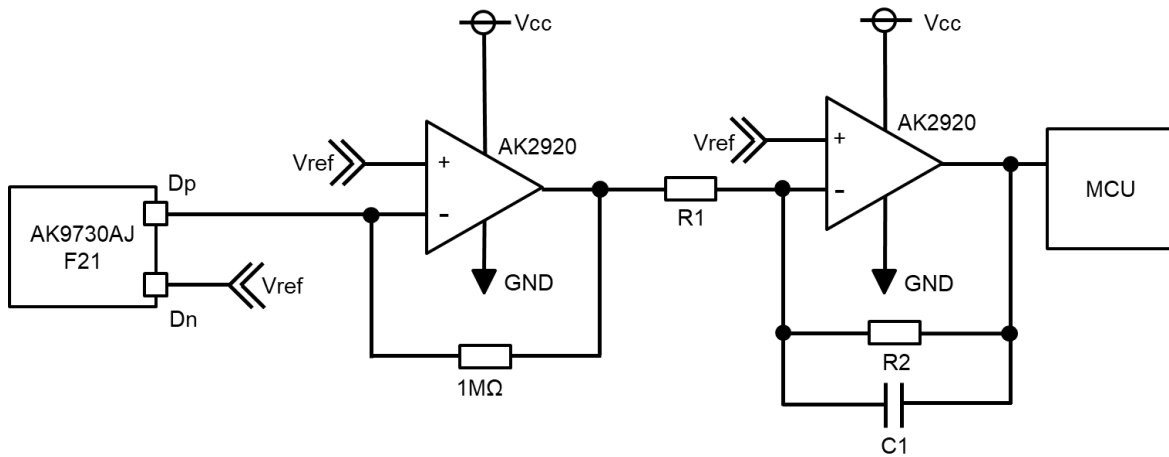


Figure 11.1 Recommended external circuits

\*Vref level is between Vcc level and GND level.

\*R1, R2, and C1 should be optimized for the application.

**12. Package**

**12.1. Outline Dimensions**

Unit: mm

Unless otherwise specified:  $\pm 0.1$ mm

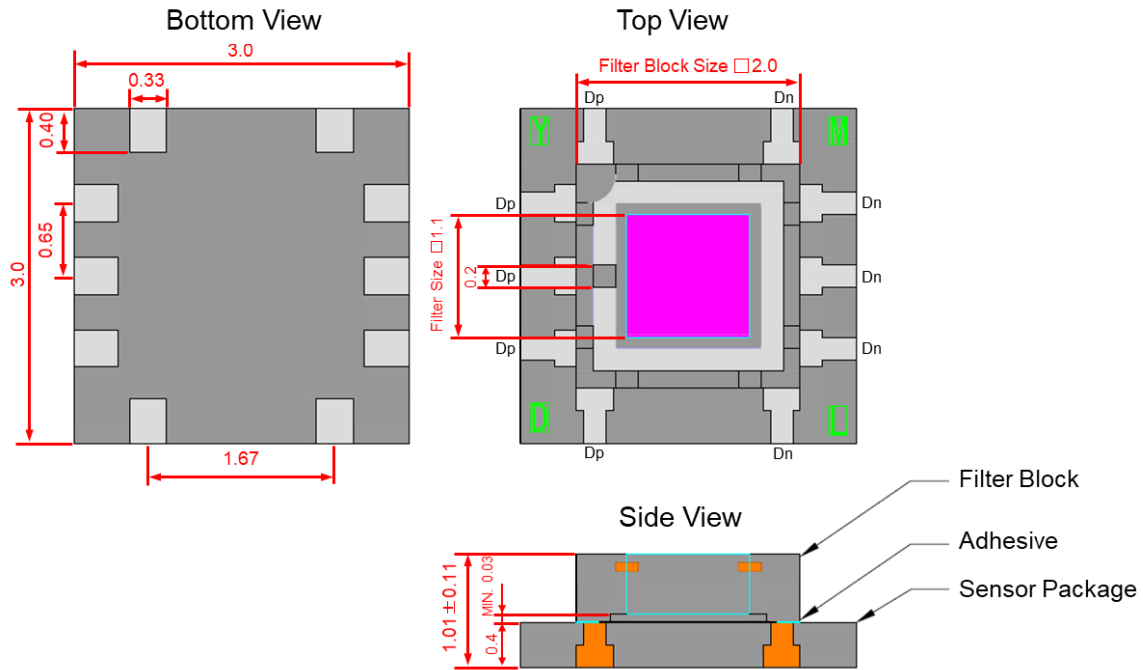


Figure 12.1 Outline Dimensions

**12.2. Pad Dimensions**

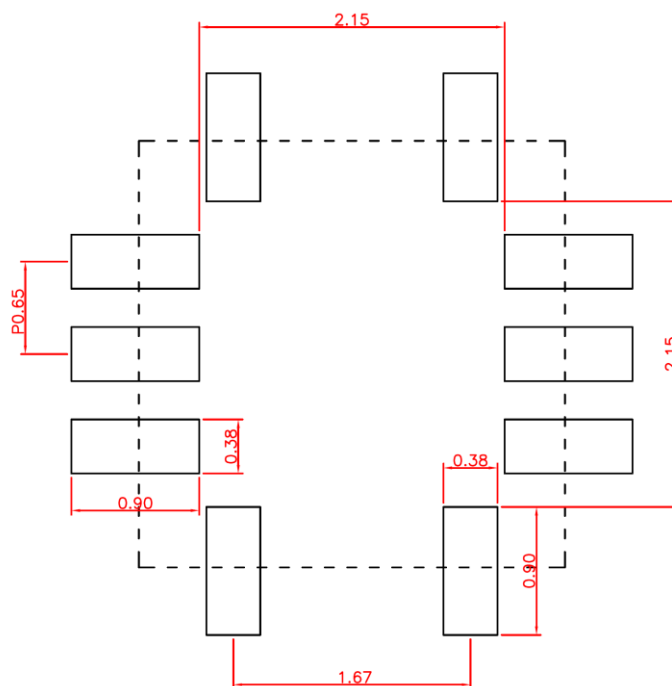
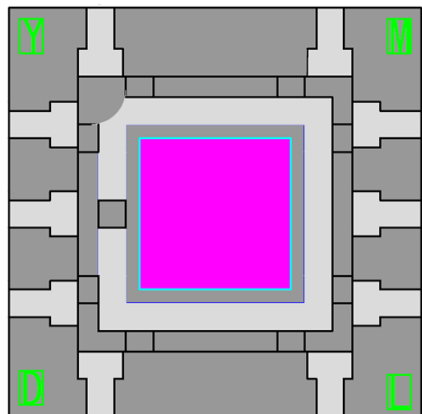


Figure 12.2 Pad Dimensions

12.3. Marking



| Y (Year) |      | M (Month) |       | D (Day) |     | L (Lot) |     |
|----------|------|-----------|-------|---------|-----|---------|-----|
| Mark     | Year | Mark      | Month | Mark    | Day | Mark    | Lot |
| 0        | 2020 | C         | Jan.  | 1       | 1   | 1       | 1   |
| 1        | 2021 | D         | Feb.  | 2       | 2   | 2       | 2   |
| 2        | 2022 | E         | Mar.  | 3       | 3   | 3       | 3   |
| 3        | 2023 | F         | Apr.  | 4       | 4   | 4       | 4   |
| 4        | 2024 | G         | May.  | 5       | 5   | 5       | 5   |
| 5        | 2025 | H         | Jun.  | 6       | 6   | 6       | 6   |
| 6        | 2026 | J         | Jul.  | 7       | 7   | 7       | 7   |
| 7        | 2027 | K         | Aug.  | 8       | 8   | 8       | 8   |
| 8        | 2028 | L         | Sep.  | 9       | 9   | 9       | 9   |
| 9        | 2019 | M         | Oct.  | 0       | 10  | 0       | 10  |
|          |      | N         | Nov.  | A       | 11  | A       | 11  |
|          |      | P         | Dec.  | B       | 12  | B       | 12  |
|          |      |           |       | C       | 13  | C       | 13  |
|          |      |           |       | D       | 14  | D       | 14  |
|          |      |           |       | E       | 15  | E       | 15  |
|          |      |           |       | F       | 16  | F       | 16  |
|          |      |           |       | G       | 17  | G       | 17  |
|          |      |           |       | H       | 18  | H       | 18  |
|          |      |           |       | J       | 19  | J       | 19  |
|          |      |           |       | K       | 20  | K       | 20  |
|          |      |           |       | L       | 21  | L       | 21  |
|          |      |           |       | N       | 22  | M       | 22  |
|          |      |           |       | P       | 23  | N       | 23  |
|          |      |           |       | R       | 24  | P       | 24  |
|          |      |           |       | S       | 25  | R       | 25  |
|          |      |           |       | T       | 26  | S       | 26  |
|          |      |           |       | U       | 27  | T       | 27  |
|          |      |           |       | V       | 28  | U       | 28  |
|          |      |           |       | W       | 29  | V       | 29  |
|          |      |           |       | X       | 30  | W       | 30  |
|          |      |           |       | Y       | 31  | X       | 31  |
|          |      |           |       |         |     | Y       | 32  |
|          |      |           |       |         |     | Z       | 33  |



### 13. Precautions

#### <Electrostatic Discharge (ESD)>

This product is sensitive to Electrostatic Discharge (ESD). When handling the product, please be careful about the following matters.

- When you handle the product, please work in the environment to protect against static electricity (ex. more than 40%RH).
- Always use an ESD wrist strap and wear antistatic clothes.
- Please take electrostatic measures of the container etc. where the product touches directly.

#### <Storage Environment>

Please avoid exposed to direct sunlight. Please keep it as much as possible at room temperature and normal humidity. The desirable condition is 5 ~ 35 °C and 40 ~ 85%RH. In addition, please keep the product away from the chlorine gas and the causticity gas. When this product is kept in inappropriate environment, it may influence product properties.

#### <Other Precautions>

As Gallium Arsenide (GaAs) and Aluminum Indium Antimonide (AlInSb) are used for this product, please be careful about the following matters.

- 1) Please do not take this product to burning and melting and destroys, chemical processing etc..
- 2) When you discard this product, please handle it according to related laws and your regulations on waste disposal.

Please be careful not to damage and pollute the sensor surface because the sensor properties may change.

### 14. Ordering Guide

AK9730AJF21                      -40 ~ 85°C                      10-pin SON                      Industrial Grade

### 15. Revision History

| Date (Y/M/D) | Revision | Reason        | Page | Contents |
|--------------|----------|---------------|------|----------|
| 19/3/18      | 00       | First Edition |      |          |
|              |          |               |      |          |