AK9710ADF01
IR Sensor for NDIR CO_2 Sensing

1. General Description

The AK9710ADF01 is a small mid-infrared quantum photo diode made of InSb. It can work at room temperature by AKM unique compound semiconductor technology, which realizes the high sensitivity, high speed response, and high reliability. The AK9710ADF01 has a built in an optical band pass filter. This sensor is optimized to NDIR CO_2 Sensing application for automotive.

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 for CO_2 Sensing
- ☐ 3mm x 3mm small surface mount type plastic package
- ☐ AEC-Q101 qualified
- ☐ Application
  HVAC for automotive
  CO_2 refrigerant leakage detection for automotive
  Flame detection

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4. Block Diagram and Functions

4.1. Block Diagram

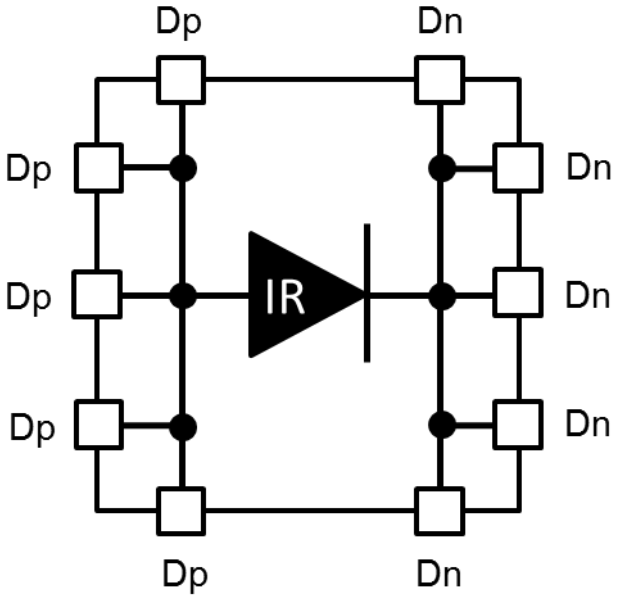


Figure 4.1 Block Diagram

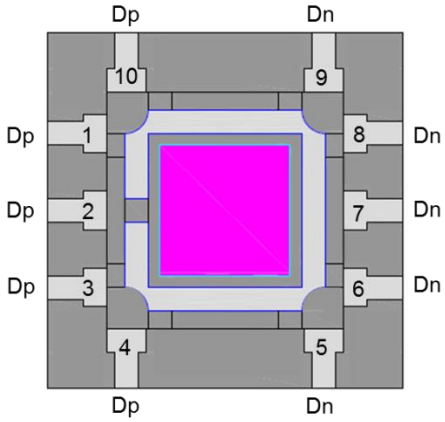
4.2. Functions

Table 4.1 Block Functions

Block	Function
IR	Mid-infrared quantum photo diode

5. Pin Configurations and Functions

5.1. Pin Configurations



Top View

Figure 5.1 Pin Configurations

5.2. Functions

Table 5.1 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

6. Absolute Maximum Ratings

Table 6.1 Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Operating Temperature	Ta	-40	90	°C
Storage Temperature	Tstg	-40	110	°C

Notes

Operation exceeding these ratings may cause permanent damage to device.
Do not apply a bias voltage.

7. Recommended Operating Conditions

Table 7.1 Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Input Voltage (*1)	Vin	-10	0	10	μV
Operating Temperature	Ta	-40		90	°C

Note

*1: Do not apply a bias voltage between Dp and Dn.
Refer to the recommended external circuits.

8. Electrical Characteristics

Table 8.1 Electrical Characteristics

Unless otherwise specified, Ta = 25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit
Output Current (*2)	Ip	1.04	2.97	4.90	nA
Internal Resistance (*3)	Ro	75		188	kΩ

Notes:

*2: Measurement conditions:
The final test is done by the equivalent light source as below.
- Light source
  Blackbody furnace with diameter = 22.2mm
  Surface temperature = 500°C
- Distance
  AK9710ADF01 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.

9. Optical Filter Specification

Table 9.1 Optical Filter Specification

Angle of incidence = 0°
Ta = 25°C

Parameter	Symbol	Min	Typ	Max	Unit
Center wavelength	CWL	4240	4280	4320	nm
Full width at half maximum	FWHM	243	270	297	nm
Peak transmission intensity	Tpeak	75			%

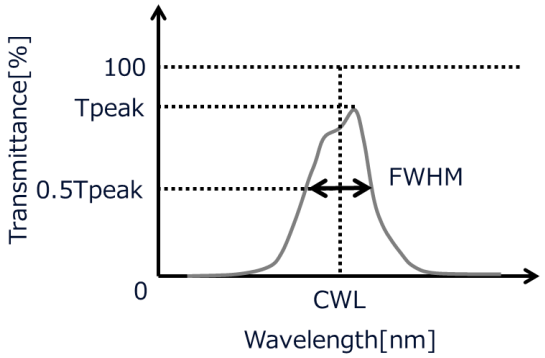


Figure 9.1 Definition of CWL, FWHM and Tpeak

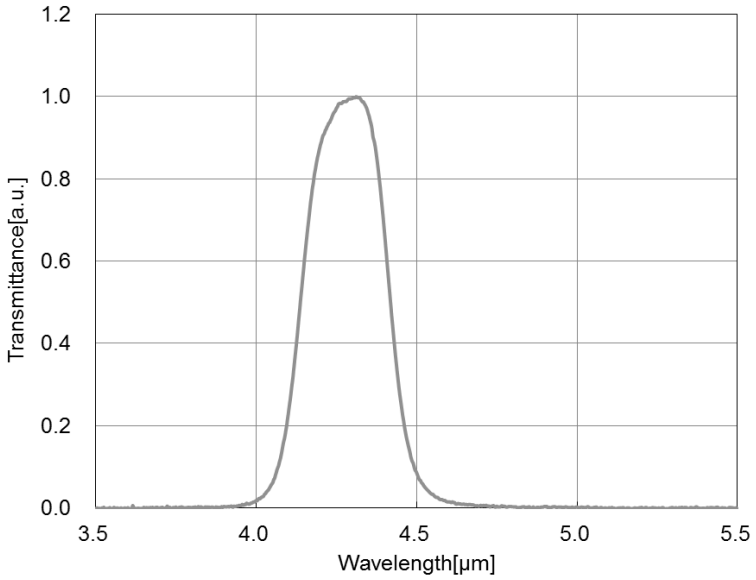


Figure 9.2 Optical filter transmittance (Reference)

10. Field of view (Reference)

Ta = 25°C

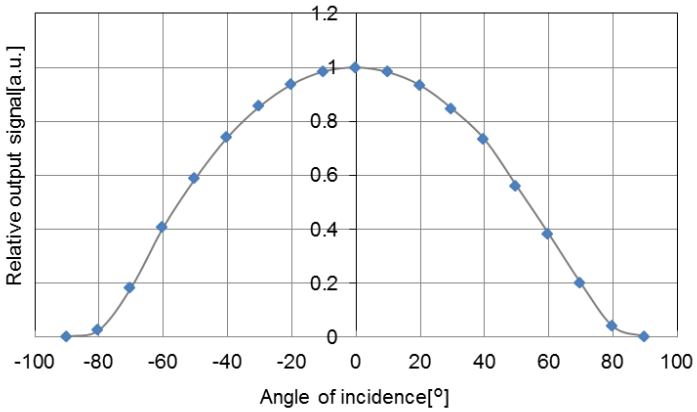


Figure 10.1 Field of view

Measurement conditions: Distance between AK9710ADF01 and light source is 10cm.
Light source: Blackbody diameter=22.2mm, Surface temperature=550°C

11. Recommended External Circuits

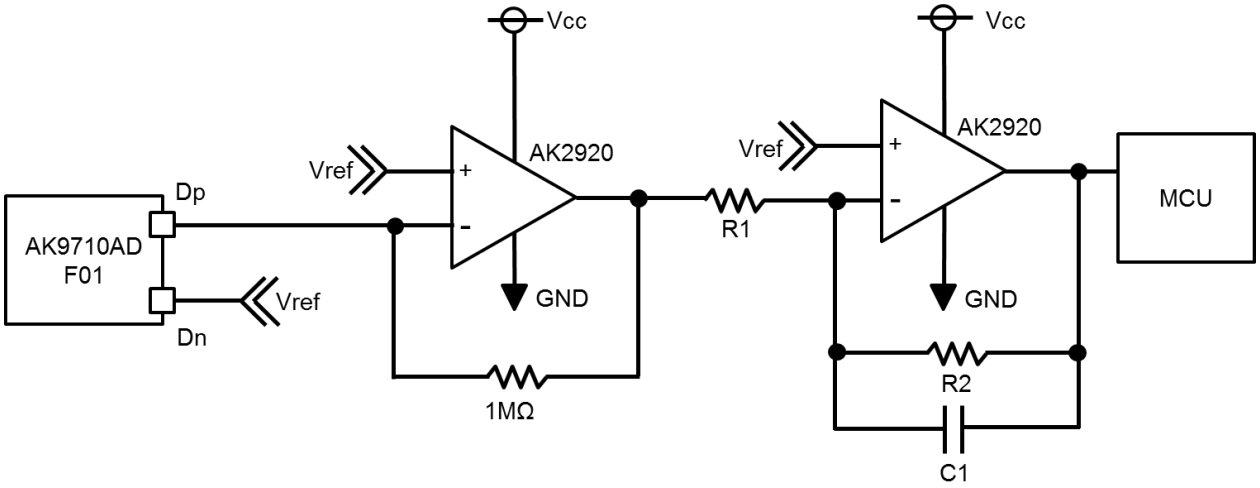


Figure 11.1 Recommended external circuits

*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: ± 0.1mm

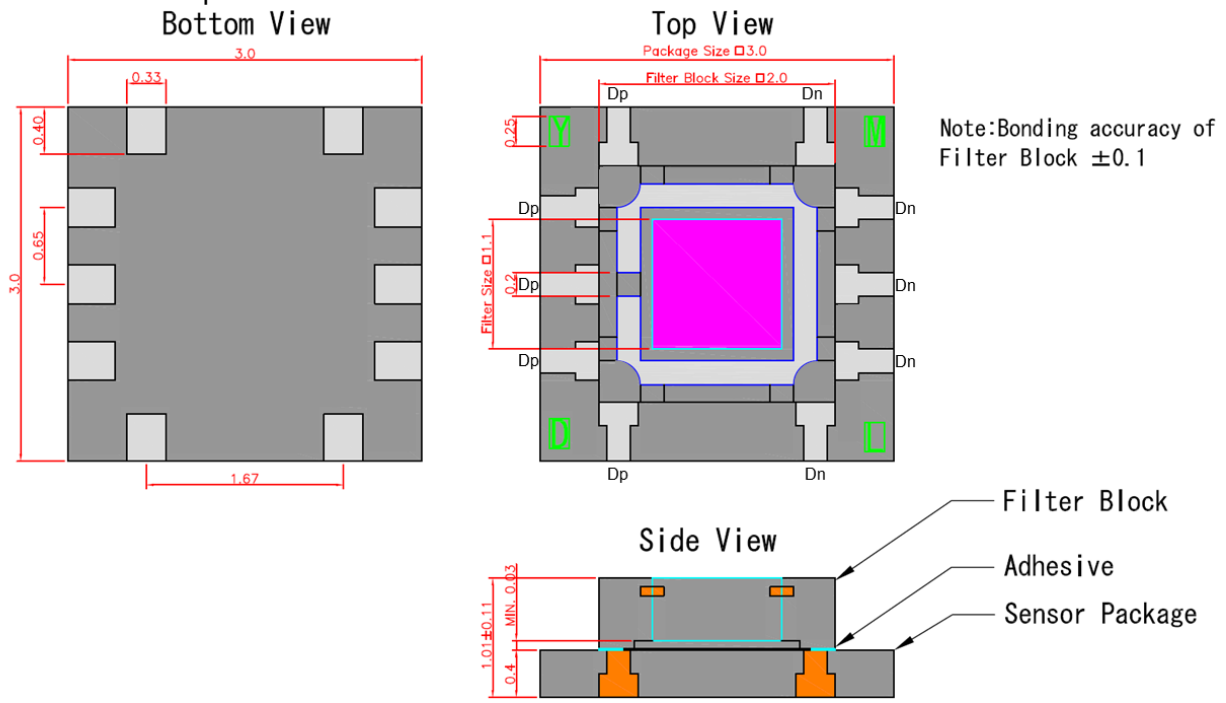


Figure 12.1 Outline Dimensions

12.2. Pad Dimensions

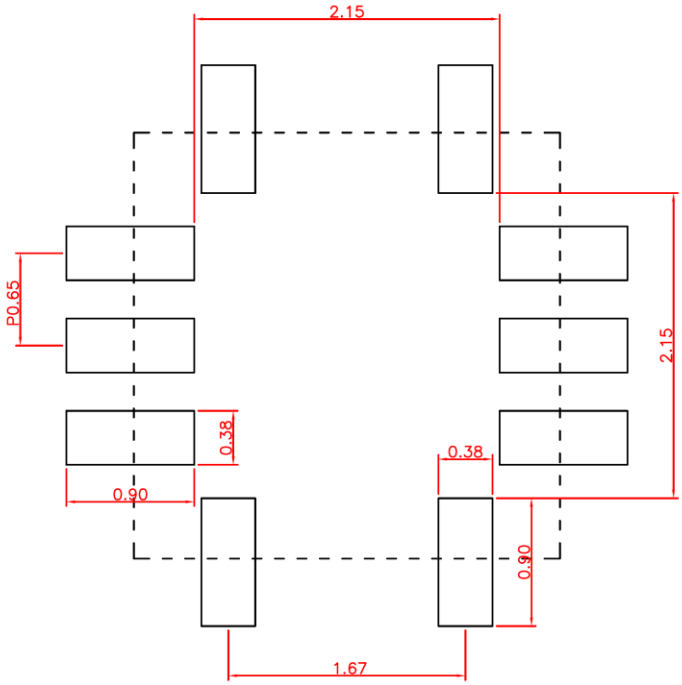
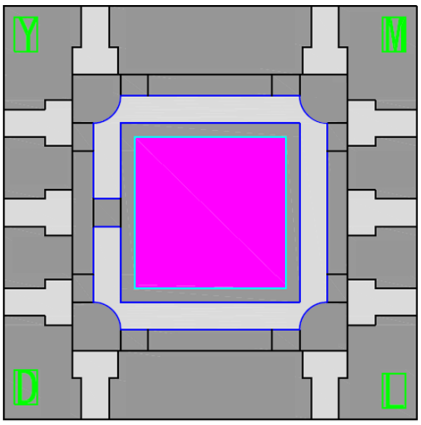


Figure 12.2 Pad Dimensions

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	2015	H	Jun.	6	6	6	6
6	2016	J	Jul.	7	7	7	7
7	2017	K	Aug.	8	8	8	8
8	2018	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 Indium Antimonide (InSb) 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

AK9710ADF01	-40 ~ 90ºC	10-pin SON	AEC-Q101 Qualified
AKD9710	Evaluation Board		

15. Revision History

Date (Y/M/D)	Revision	Reason	Page	Contents
17/2/15	00	First Edition		