



AK9700AE

IR LED for NDIR Gas Sensing

1. General Description

The AK9700AE is a small mid-infrared light emitting diode made of AlInSb and optimized for NDIR gas sensing applications. It uses AKM's unique compound semiconductor technology which realizes, at room temperature operation, high radiant intensity, high speed response, and high reliability. AK9700AE also includes an internal mid-infrared photo diode for thermal compensations purposes.

2. Features

- ☐ High Radiant Intensity
- ☐ Peak Wavelength: $\lambda_p = 4.3\mu\text{m}$
- ☐ Angle of Half Intensity: $\Phi = 60^\circ$
- ☐ Suitable for High Speed Pulse Current Operation
- ☐ High Reliability
- ☐ 2.6mm x 1.9mm x 0.4mm Small surface mount type package
- ☐ Application
 - HVAC
 - CO₂ refrigerant leakage detection

3. Table of Contents

1. General Description	1
2. Features	1
3. Table of Contents	2
4. Block Diagram and Functions	3
4.1. Block Diagram	3
4.2. Functions	3
5. Pin Configurations and Functions	4
5.1. Pin Configurations	4
5.2. Functions	4
6. Absolute Maximum Ratings	5
7. Recommended Operating Conditions	5
8. Electrical Characteristics	6
9. Recommended External Circuits	7
10. Package	8
10.1. Outline Dimensions	8
10.2. Pad Dimensions	8
10.3. Marking	9
11. Precautions	10
12. Ordering Guide	10
13. Revision History	10
IMPORTANT NOTICE	11

4. Block Diagram and Functions

4.1. Block Diagram

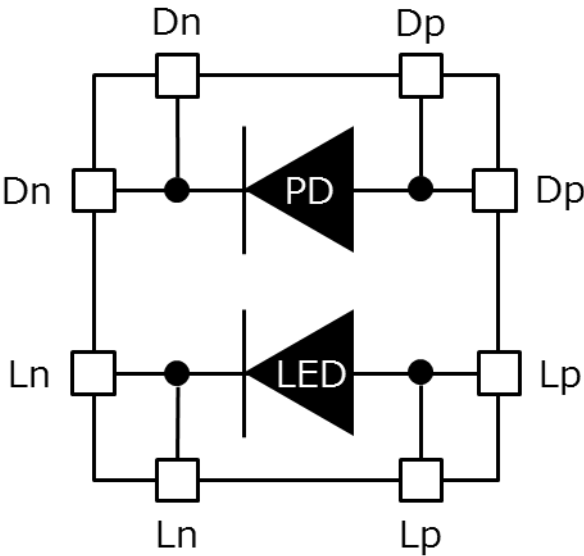


Figure 4.1 Block Diagram

4.2. Functions

Table 4.1 Block Functions

Block	Function
LED	Mid-infrared quantum light emitting diode
PD	Mid-infrared quantum photo diode

5. Pin Configurations and Functions

5.1. Pin Configurations

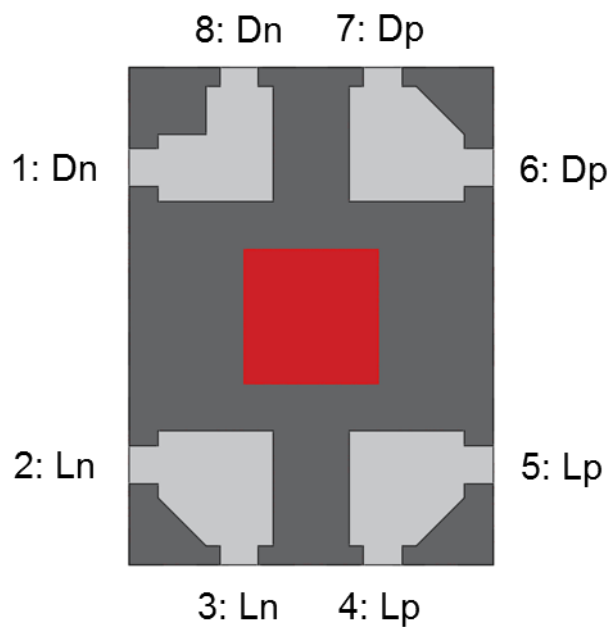


Figure 5.1 Pin Configurations

5.2. Functions

Table 5.1 Pin/Functions

Pin No.	Name	I/O	Functions
1, 8	Dn	O	n-type output pin of PD
2, 3	Ln	I	n-type input pin of LED
4, 5	Lp	I	p-type input pin of LED
6, 7	Dp	O	p-type output pin of PD

6. Absolute Maximum Ratings

Table 6.1 Absolute Maximum Ratings

Unless otherwise specified, Ta = 25°C

Parameter	Symbol	Min.	Max.	Unit	Note
Reverse voltage	VR		1	V	
Forward current (Pulse mode)	IF		0.5	A	Pulse width: 1ms Duty cycle < 1%
Power dissipation	P		110	mW	
Storage temperature	Tst	-40	85	°C	

Note

Operation exceeding these ratings may cause permanent damage to device.

7. Recommended Operating Conditions

Table 7.1 Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	IF		100	125	mA	Duty cycle = 0.13% Pulse width: 0.32ms
Operating Temperature	Ta	0		50	°C	

8. Electrical Characteristics

Table 8.1 Electrical Characteristics

Unless otherwise specified, Ta = 25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Radiant intensity	I _e	0.46	0.89	2.52	nA	Distance between AK9700AE and the sensor: 2mm (*1)
Forward voltage	V _F	1.03	1.3	1.82	V	I _F = 100mA Pulse width: 1ms
Reverse current	I _R		2300	7638	μA	V _R = 1V
Temperature coefficient of I _e	T _{cI_e}		0.9		%/K	
Angle of half intensity	Φ		60		°	
Peak wavelength	λ _p		4.3		μm	
Spectral half width	Δλ		1.0		μm	
Temperature coefficient of λ _p	T _{cλ_p}		0.0022		μm/K	
Rise time	T _r		2		μs	I _F = 100mA 10%I _F ~90%I _F
Fall time	T _f		2		μs	I _F = 100mA 90%I _F ~10%I _F
Internal resistance of PD	R ₀	3.9	23	69	kΩ	(*2)
Output current of PD	I _p	928	2800	7705	nA	I _F = 100mA Pulse width: 1ms

Notes:

*1: Radiant intensity is measured by the calibrated infrared sensor whose electrical characteristic written in table 8.2.

*2: Measurement conditions:

-Average value at ±500nA output.

Table 8.2 Electrical Characteristics of Calibrated Infrared Sensor

Ta = 25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit
Output Current (*3)	I _p	1.56	1.61	1.66	nA

Notes:

Calibrated infrared sensor has a built in an optical band pass filter with the following features.

- Center wavelength: 4260nm
- Full width at half maximum: 150nm

*3: Measurement conditions:

The test is done by the equivalent light source as below.

- Light source
 - Blackbody furnace with diameter = 22.2mm
 - Surface temperature = 500°C
- Distance
 - The sensor to blackbody = 100mm.
- The soda glass is placed between the sensor and the blackbody furnace.
- Measured by a 10Hz lock-in amplifier.
- CO₂ Concentration: 300ppm to 1000ppm
- Humidity: Don't Care
- Atmospheric Pressure: Don't Care

9. Recommended External Circuits

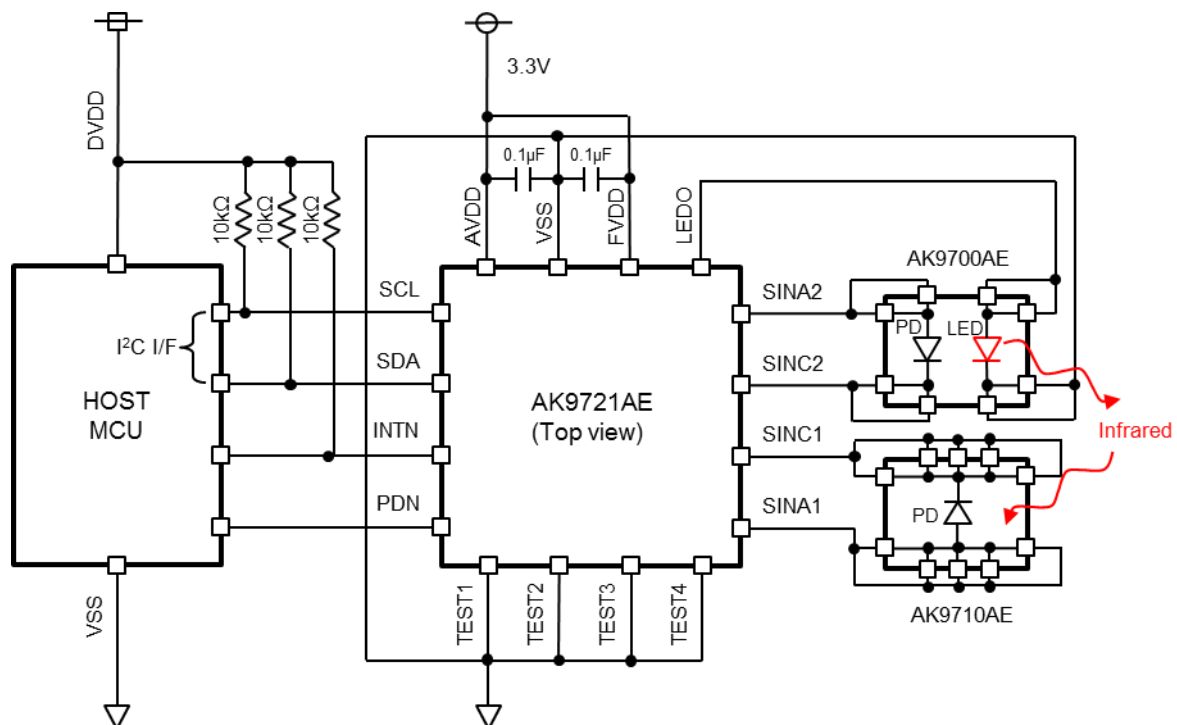


Figure 9.1 Recommended External Circuits

10. Package

10.1. Outline Dimensions

Unit: mm
Unless otherwise specified: ± 0.1 mm

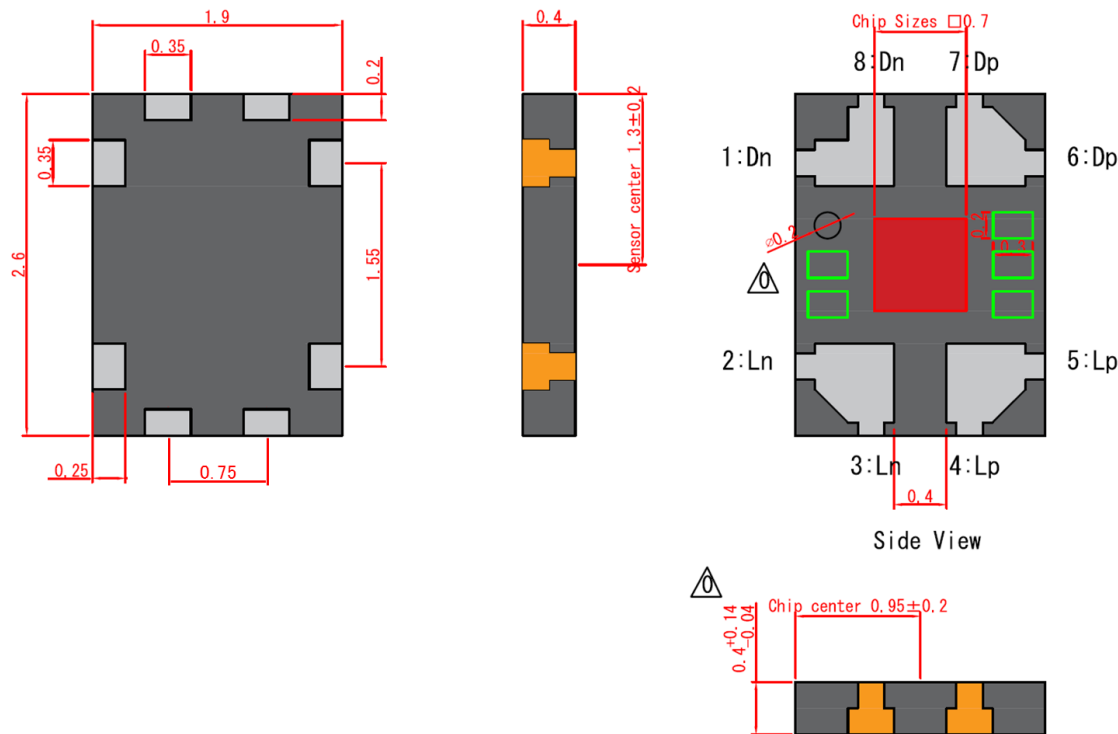


Figure 10.1 Outline Dimensions

10.2. Pad Dimensions

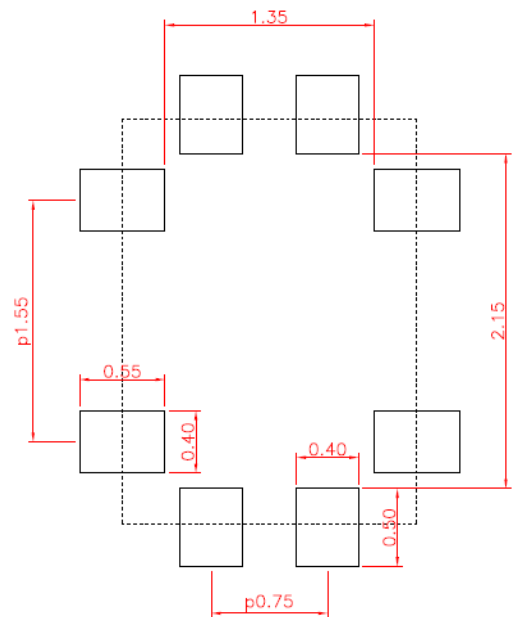
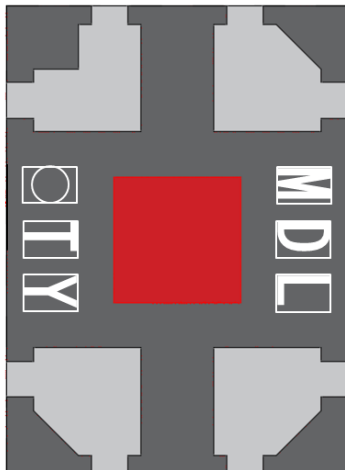


Figure 10.2 Pad Dimensions

10.3. Marking

T (Product ID)		Y (Year)		M (Month)		D (Day)		L (Lot)	
Mark	Product ID	Mark	Year	Mark	Month	Mark	Day	Mark	Lot
1	AK9700AE	0	2020	C	1	1	1	1	1
		1	2021	D	2	2	2	2	2
		2	2022	E	3	3	3	3	3
		3	2023	F	4	4	4	4	4
		4	2024	G	5	5	5	5	5
		5	2025	H	6	6	6	6	6
		6	2016	J	7	7	7	7	7
		7	2017	K	8	8	8	8	8
		8	2018	L	9	9	9	9	9
		9	2019	M	10	0	10	0	10
				N	11	A	11	A	11
				P	12	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



11. 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.

12. Ordering Guide

AK9700AE

0~50°C

8-pin SON

Consumer Grade

13. Revision History

Date (Y/M/D)	Revision	Reason	Page	Contents
17/7/13	00	First Edition		

IMPORTANT NOTICE

0. Asahi Kasei Microdevices Corporation ("AKM") reserves the right to make changes to the information contained in this document without notice. When you consider any use or application of AKM product stipulated in this document ("Product"), please make inquiries the sales office of AKM or authorized distributors as to current status of the Products.
1. All information included in this document are provided only to illustrate the operation and application examples of AKM Products. AKM neither makes warranties or representations with respect to the accuracy or completeness of the information contained in this document nor grants any license to any intellectual property rights or any other rights of AKM or any third party with respect to the information in this document. You are fully responsible for use of such information contained in this document in your product design or applications. **AKM ASSUMES NO LIABILITY FOR ANY LOSSES INCURRED BY YOU OR THIRD PARTIES ARISING FROM THE USE OF SUCH INFORMATION IN YOUR PRODUCT DESIGN OR APPLICATIONS.**
2. The Product is neither intended nor warranted for use in equipment or systems that require extraordinarily high levels of quality and/or reliability and/or a malfunction or failure of which may cause loss of human life, bodily injury, serious property damage or serious public impact, including but not limited to, equipment used in nuclear facilities, equipment used in the aerospace industry, medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, devices related to electric power, and equipment used in finance-related fields. Do not use Product for the above use unless specifically agreed by AKM in writing.
3. Though AKM works continually to improve the Product's quality and reliability, you are responsible for complying with safety standards and for providing adequate designs and safeguards for your hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of the Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption.
4. Do not use or otherwise make available the Product or related technology or any information contained in this document for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). When exporting the Products or related technology or any information contained in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. The Products and related technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
5. Please contact AKM sales representative for details as to environmental matters such as the RoHS compatibility of the Product. Please use the Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. AKM assumes no liability for damages or losses occurring as a result of noncompliance with applicable laws and regulations.
6. Resale of the Product with provisions different from the statement and/or technical features set forth in this document shall immediately void any warranty granted by AKM for the Product and shall not create or extend in any manner whatsoever, any liability of AKM.
7. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of AKM.

Rev.1

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Asahi Kasei Microdevices:](#)

[AK9700AE](#)