



# 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
  - CO<sub>2</sub> 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**

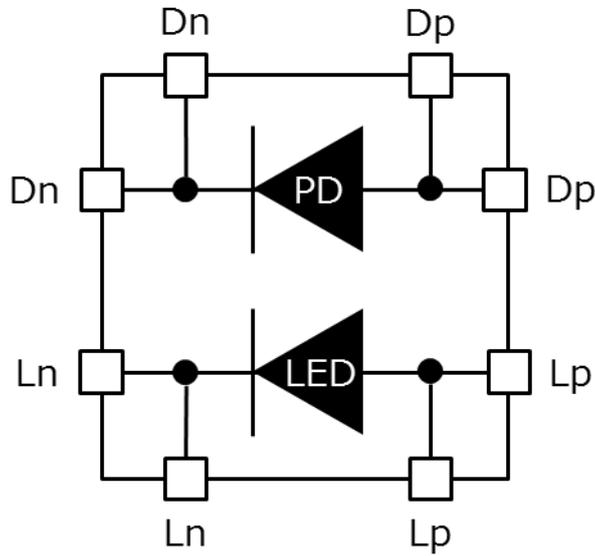


Figure 4.1 Block Diagram

**4.2. Functions**

Table 4.1 Block Functions

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



## 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	

<b>8. Electrical Characteristics</b>
--------------------------------------

Table 8.1 Electrical Characteristics

Unless otherwise specified, Ta = 25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Radiant intensity	I <sub>e</sub>	0.46	0.89	2.52	nA	Distance between AK9700AE and the sensor: 2mm (*1)
Forward voltage	V <sub>F</sub>	1.03	1.3	1.82	V	I <sub>F</sub> = 100mA Pulse width: 1ms
Reverse current	I <sub>R</sub>		2300	7638	μA	V <sub>R</sub> = 1V
Temperature coefficient of I <sub>e</sub>	T <sub>cI<sub>e</sub></sub>		0.9		%/K	
Angle of half intensity	Φ		60		°	
Peak wavelength	λ <sub>p</sub>		4.3		μm	
Spectral half width	Δλ		1.0		μm	
Temperature coefficient of λ <sub>p</sub>	T <sub>cλ<sub>p</sub></sub>		0.0022		μm/K	
Rise time	T <sub>r</sub>		2		μs	I <sub>F</sub> = 100mA 10%I <sub>F</sub> ~90%I <sub>F</sub>
Fall time	T <sub>f</sub>		2		μs	I <sub>F</sub> = 100mA 90%I <sub>F</sub> ~10%I <sub>F</sub>
Internal resistance of PD	R <sub>0</sub>	3.9	23	69	kΩ	(*2)
Output current of PD	I <sub>p</sub>	928	2800	7705	nA	I <sub>F</sub> = 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 <sub>p</sub>	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.
- CO<sub>2</sub> Concentration: 300ppm to 1000ppm
- Humidity: Don't Care
- Atmospheric Pressure: Don't Care

**9. Recommended External Circuits**

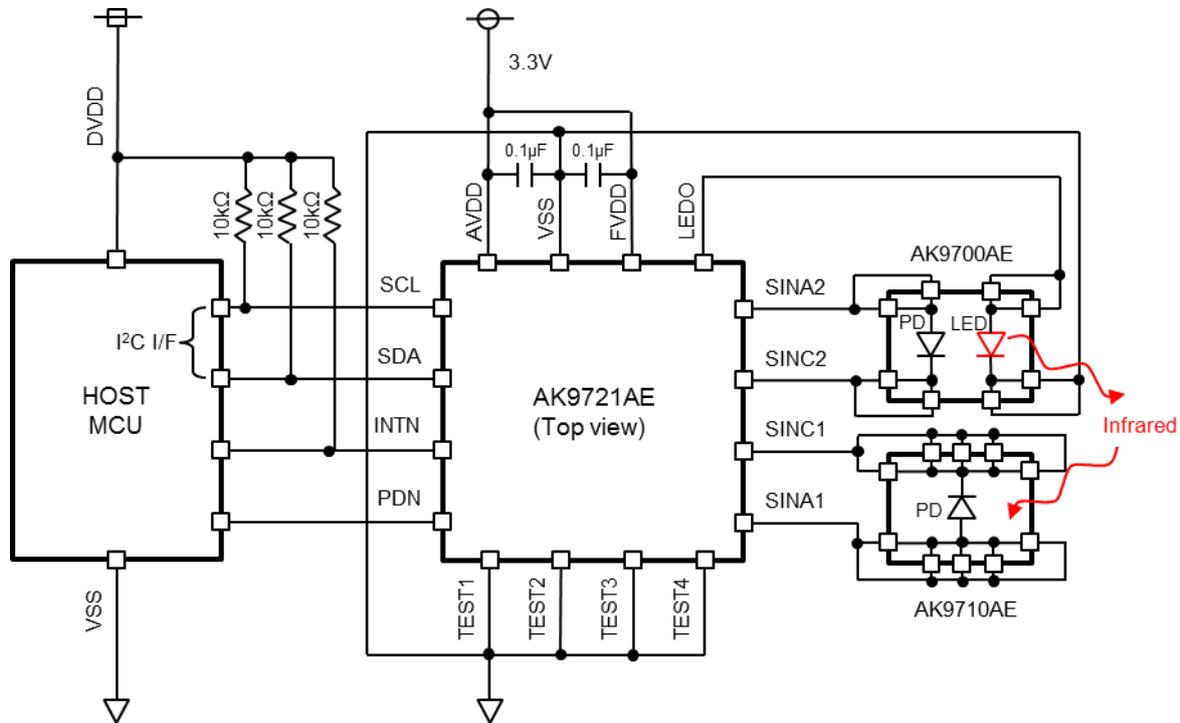
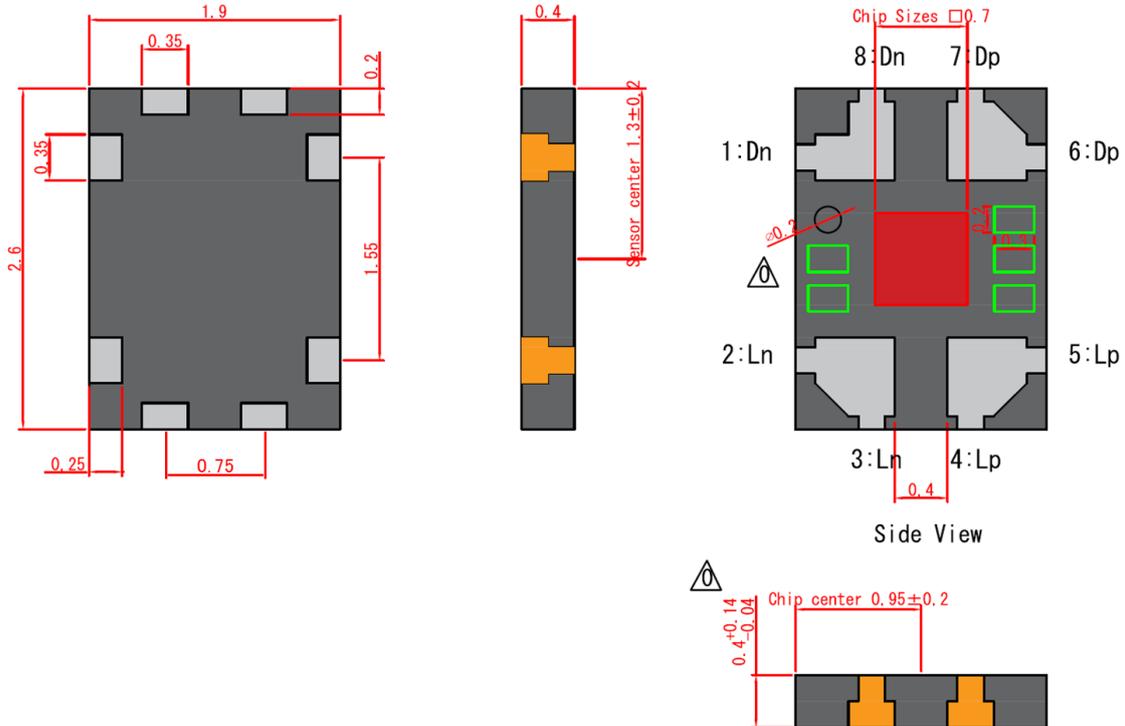


Figure 9.1 Recommended External Circuits

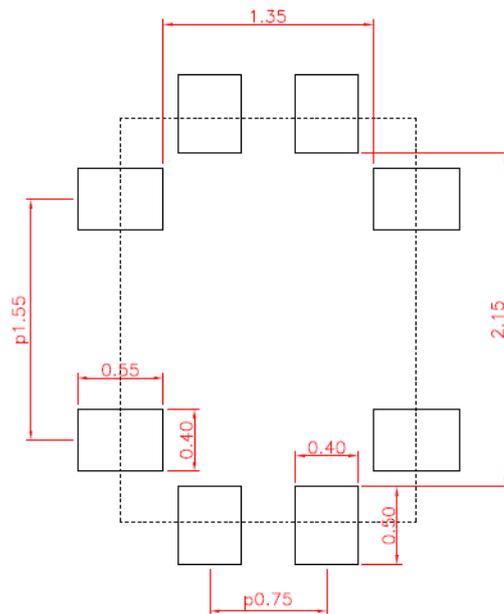
**10. Package**

**10.1. Outline Dimensions**

Unit: mm  
 Unless otherwise specified:  $\pm 0.1$  mm

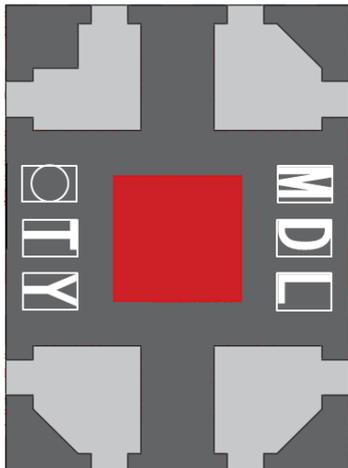


**10.2. Pad Dimensions**



**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

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**Rev.1**