AK9703AJ
IR LED for NDIR Gas Sensing

1. General Description

The AK9703AJ is a miniaturized 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. AK9703AJ also includes an internal mid-infrared photo diode for thermal compensations purposes.

2. Features

- High Radiant Intensity
- Peak Wavelength: λp = 3.6μm
- Angle of Half Intensity: Φ = 60°
- Suitable for High Speed Pulse Current Operation
- High Reliability
- 2.6mm x 1.9mm x 0.4mm Small surface mount type package

3. Applications

- NDIR gas sensor
  CH_4, R32 etc.

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5. Block Diagram and Functions

5.1. Block Diagram

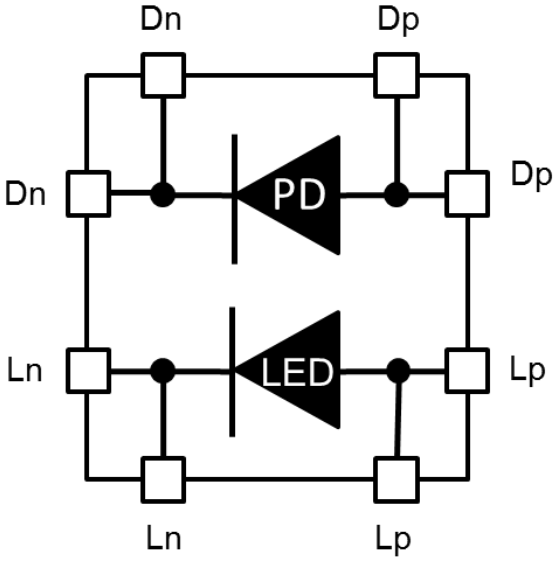


Figure 5.1 Block Diagram

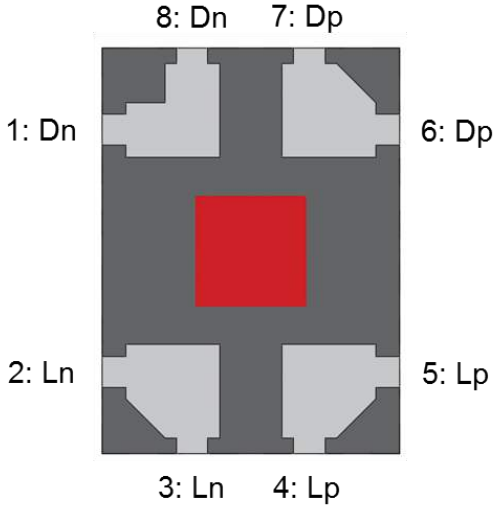
5.2. Functions

Table 5.1 Block Functions

Block	Function
LED	Mid-infrared light emitting diode
PD	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, 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

7. Absolute Maximum Ratings

Table 7.1 Absolute Maximum Ratings

Unless otherwise specified, Ta = 25°C

Parameter	Symbol	Min.	Max.	Unit	Note
Reverse Voltage	VR	-	1	V	
Forward Current	IF	-	0.5	A	
Power dissipation	PV	-	110	mW	
Operating Temperature	Ta	-40	85	°C	Non-condensing
Storage Temperature	Tst	-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.

8. Recommended Operating Conditions

Table 8.1 Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	IF	-	100	125	mA	Duty cycle: 0.15% Pulse width: 0.25ms

9. Electrical Characteristics

Table 9.1 Electrical Characteristics

Unless otherwise specified, Ta = 25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Radiant intensity	Ie	1.71	6.34	12.08	nA	Distance between AK9703AJ and the sensor: 2mm (*1)
Forward voltage	VF	1.48	1.79	2.05	V	IF = 100mA Pulse width: 1ms
Reverse current	IR	-	287	1222	μA	VR = 1V
Internal resistance of PD	R0	18	180	589	kΩ	(*2)
Output current of PD	Ip	0.7	4.1	8.5	μA	IF = 100 mA

Notes

*1: Radiant intensity is measured by the calibrated infrared sensor whose electrical characteristic written in table 9.2

*2: Measurement conditions:

- Average value at ±500nA output.

Table 9.2 Electrical Characteristics of Calibrated Infrared Sensor

Ta = 25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit
Output Current (*3)	Ip	1.43	3.58	5.73	nA

Notes

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

-Center wavelength: 3370nm

-Full width at half maximum: 400nm

*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.
- CH_4 Concentration: Out of control
- Humidity: Out of control
- Atmospheric Pressure: Out of control

Table 9.3 Electrical Characteristics (Reference)

Unless otherwise specified, Ta = 25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Temperature coefficient of Ie	TKIe	-	-1.2	-	%/K	
Angle of half intensity	Φ	-	60	-	°	
Peak wavelength	Λp	-	3.6	-	μm	
Spectral bandwidth	Δλ	-	0.7	-	μm	FWHM
Temperature coefficient of λp		-	0.002	-	μm/K	
Rise time	Tr	-	2	-	μs	IF = 100mA 10%IF ~ 90%IF
Fall time	Tf	-	2	-	μs	IF = 100mA 90%IF ~ 10%IF

Note

Pre-shipment inspection is not performed.

10. Recommended External Circuits

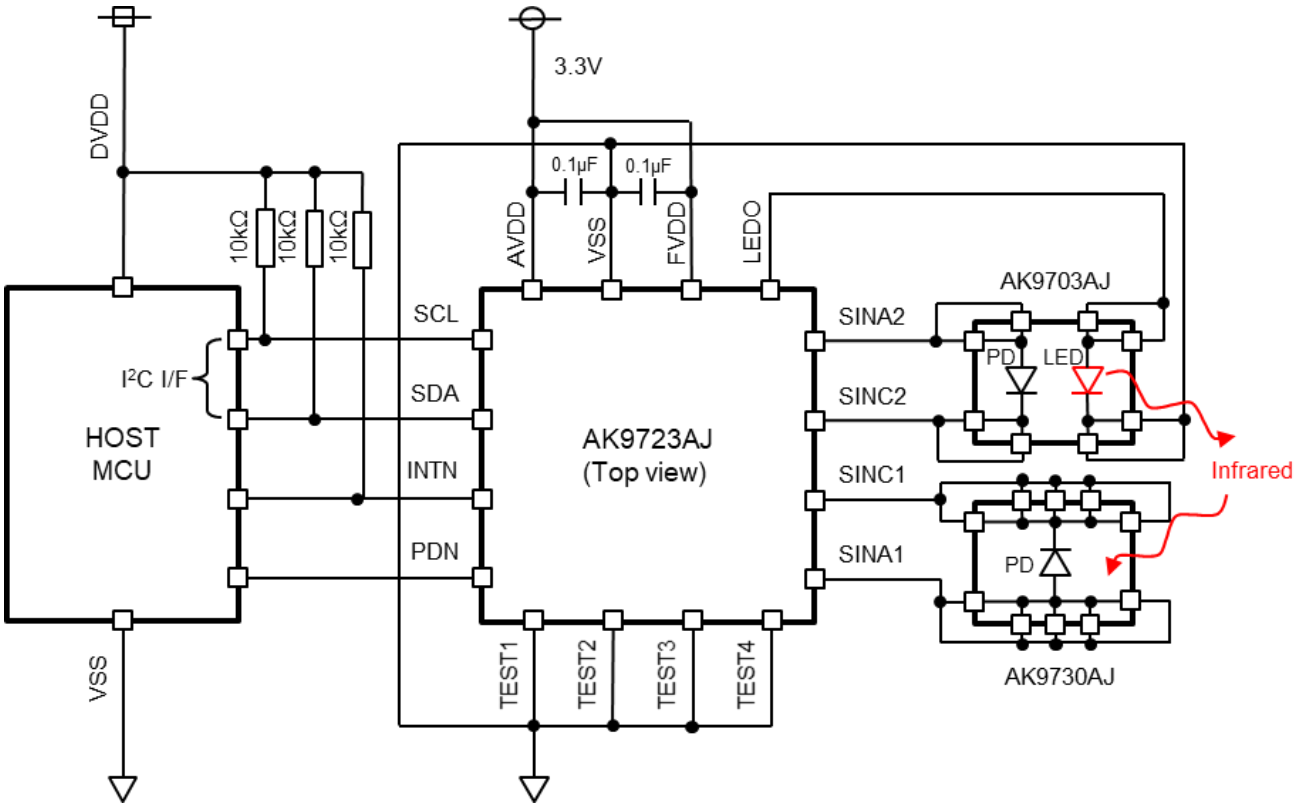


Figure 10.1 Recommended External Circuits

11. Package

11.1. Outline Dimensions

Unit: mm
Unless otherwise specified: +/- 0.1mm

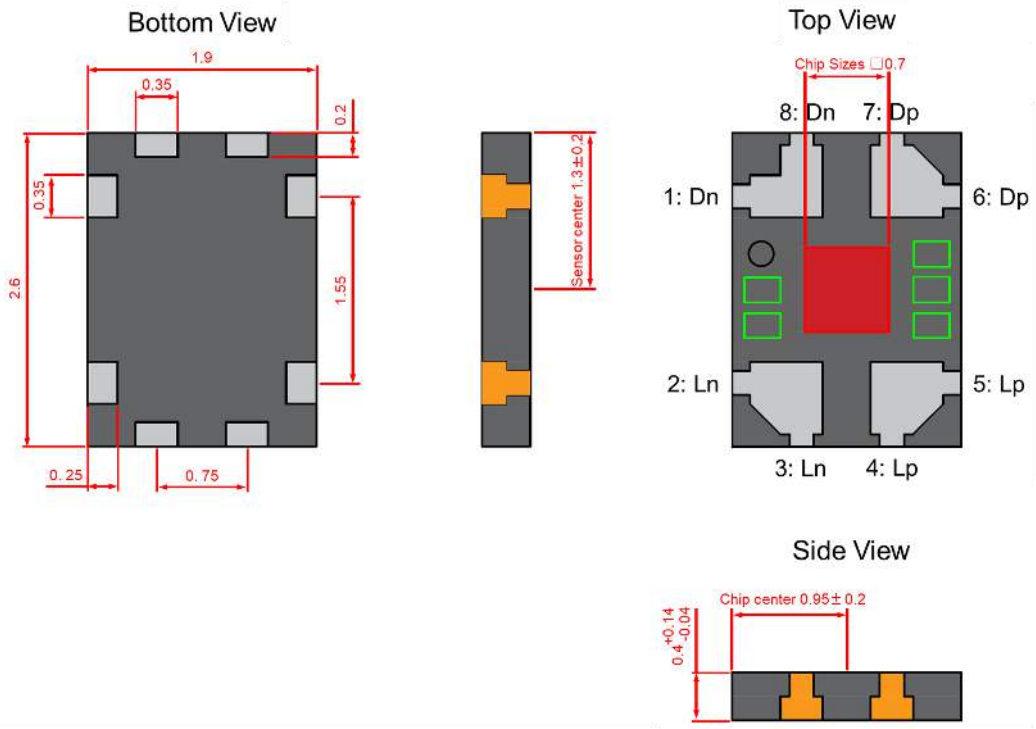


Figure 11.1 Outline Dimensions

11.2. Pad Dimensions

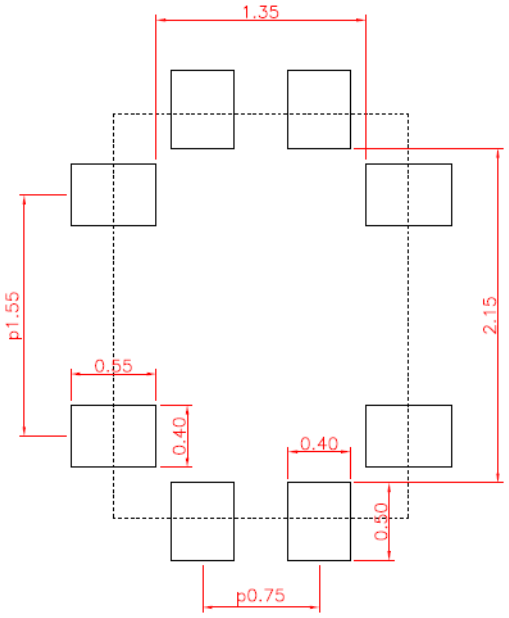
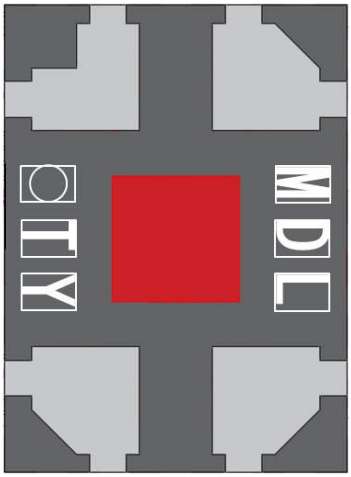


Figure 11.2 Pad Dimensions

11.3. 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
2	AK9700AD	1	2021	D	2	2	2	2	2
3	AK9703AJ	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	2026	J	7	7	7	7	7
		7	2027	K	8	8	8	8	8
		8	2028	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



12. 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.

13. Ordering Guide

AK9703AJ	-40 ~ 85°C	8-pin SON	Industrial Grade

14. Revision History

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

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