ZMOTION® Pyroelectric Sensors

Product Specification

PS033604-0418

www.zilog.com

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Revision History

Each instance in the revision history table reflects a change to this document from its previous revision. For more details, refer to the corresponding pages or appropriate links provided in the table below.

Date	Revision Level	Description	Page
Apr 2018	04	Added the ZSFG469711 pyroelectric sensor to Table 1; Updated the Pyro Sensor Specifications section to include ZSFG469711 configuration and characteristics.	2, 15
Jan 2018	03	Added dimensions to the Side view drawing in Figure 4.	9
Sep 2017	02	Updated drawings for the ZSBG323671 and ZSBG446671 pyro sensors.	9, 13
Dec 2014	01	Original issue, split into its own document from the former ZMOTION Lens and Pyroelectric Sensor Product Specification (PS0286), which is now titled ZMOTION Lenses Product Specification.	All

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Overview

Zilog's ZMOTION Detection and Control and Intrusion Detection product families provide integrated and flexible solutions for Passive Infrared (PIR)-based motion detection applications. These product families are based on the ZMOTION MCU, a high-performance microcontroller featuring integrated PIR motion detection algorithms. Each family includes a selection of lenses and PIR sensors to fit a wide range of application requirements. Each lens and sensor combination is optimized for its intended application by configuration settings loaded into the ZMOTION MCU ensuring the best possible performance while significantly reducing development risk and minimizing time to market. Zilog's PIR Motion Detection Technology provides a dramatic improvement in both sensitivity and stability over traditional designs and is scalable to many market segments including Security/Intrusion Detection, Lighting Control, HVAC, Access Control, Vending, Display, Proximity, Power Management, Occupancy Sensing and many others.

This document provides the optical, electrical, and mechanical specifications for the Zilog-supported pyroelectric sensors included in the ZMOTION Family. Each supported lens and pyroelectric sensor combination is provided with an associated configuration file for the ZMOTION MCU. For more information on configuration files for specific lens and sensor combinations, refer to WP0018 ZMOTION Detection Lens and Pyro Electric Sensor Configuration Guide. It is possible to use other lenses and pyroelectric sensors not directly supported by Zilog by developing the appropriate configuration settings based on one of the existing files.

All pyroelectric sensors listed in this document are available from Zilog or from their associated manufacturers. Because Zilog is regularly adding new sensor support to these ZMOTION product families, please obtain the latest version of this document from our website at zilog.com/ZMOTION.

ZMOTION Pyroelectric Sensor Selection Guide

Table 1 presents a short list of available pyroelectric sensors that support applications that employ ZMOTION Detection and Control and ZMOTION Intrusion Detection MCUs. Select your pyroelectric sensor from this table based on your intended application.

Table 1. ZMOTION Pyroelectric Sensors

Part Number	Description	Recommended Applications	Recommended PIR Lens Type(s)
ZRE200GE	Basic dual-element sensor • Two sensitive areas, 1.0mm x 2.0mm, spaced 1.0mm apart • Low cost	• Occupancy/Vacancy sensors • HVAC/energy management sensors • Intrusion motion detectors • Smart appliances	Narrow- to wide-angle wall-mount Fresnel lenses
ZSBG323671	Premium dual-element sensor • Two sensitive areas, 1.0mm x 2.3mm, spaced 1.0mm apart • Internal EMI protection	• Intrusion motion detectors • Occupancy/Vacancy sensors • HVAC/energy management sensors • Smart appliances	Narrow- to wide-angle wall-mount Fresnel lenses
ZSBG446671	Premium quad-element sensor • Four sensitive areas, 1.0mm x 1.0mm, spaced 1.0mm apart • Symmetrical sensor organization, optimized for ceiling-mount applications • Internal EMI protection	• Occupancy/Vacancy sensors • HVAC/energy management sensors • Intrusion motion detectors	Circular ceiling-mounted Fresnel lenses
ZSFG469711	Premium dual-element sensor with circular pattern • Two sensitive areas in a tapered circular shape • Optimized for ceiling mount applications • Internal EMI protection	• Occupancy/Vacancy sensors • Ceiling mount 360 degree motion detectors • Lighting control • HVAC	Circular 360 degree lenses

ZMOTION Pyroelectric Sensor Specifications

This chapter presents specifications for the pyroelectric sensors selected for the ZMOTION family of products. To see the specifications for lenses used in Zilog's ZMOTION Detection and Control and Intrusion Detection applications, refer to the ZMOTION Lenses Specification (PS0286).

ZRE200GE Sensor Specification

This section describes the specifications for the ZRE200GE passive infrared pyroelectric sensor.

Type of Sensor

Balanced differential (series-opposed type.)

Physical Configuration

Package	TO-5 nickel-plated metal can with dimensions; see Side View, Figure 1 on page 5.
Element geometry	Two sensitive areas 2.0mm long, 1.0mm wide and spaced 1.0mm apart.
Element orientation	See Top View, Figure 1 on page 5.
Lead configuration	See Side and Base views, Figure 1 on page 5.

Electrical Characteristics @ 25 ±5°C

Circuit configuration	Three-terminal sensor with source follower; see Figure 2 on page 6.
Operating voltage	3–10V DC (Rs = 47KΩ).
Source voltage	0.3–1.5V; V_D = 5V, Rs = 47KΩ.
Signal output	Minimum 2.5V_{P-P}; typically 4.0V_{P-P}. Signal output is measured at a chopper frequency of 1Hz when connected to an amplifier with a gain of 72.5dB at 1Hz and submitted to an infrared energy emission of 13microW/cm^2 from a 420K black body. See Figure 3 on page 6.

Noise output	Max. 250 mV_{P-P}; typically 90 mV_{P-P}. Noise output should be measured for 20 seconds when connected to an amplifier with a gain of 72.5 dB at 1 Hz and shielded from infrared energy. See Figure 3 on page 6.
Balance output	Max. 15%. [BO / |SA+SB| ≤ 0.15, in which: BO = Balance output SA = Signal output on Element A SB = Signal output on Element B Balance output is measured at a chopper frequency of 1 Hz when connected to an amplifier with a gain of 72.5 dB at 1 Hz and submitted to an infrared energy emission of 13 microW/cm2 from a 420 K black body. See Figure 3 on page 6.
Frequency response	0.3 Hz to 3.0 Hz / ±10 dB.

Optical Characteristics

Field of view	138° from center of element on Axis X. 125° from center of element on Axis Y. See Field of View, Figure 1.
Filter substrate	Silicon.
Cut on (5 %T ABS)	5.0 ±0.5 µm.
Transmission	≥ 70%; average 7–14 µm.

Environmental Requirements

Operating temperature	–30°C to +70°C.
Storage temperature	–40°C to +80°C.
Relative humidity	The sensor operates without an increase in noise output when continuously exposed to 90–95% RH at 30°C.
Hermetic seal	The sensor must be sealed to withstand a vacuum of 21.28 kPa.

RoHS Compliance

The ZRE200GE Sensor conforms to the RoHS directive in force at the date of issuance of this specification.

Figures 1 and 2 present mechanical drawings of the ZRE200GE pyroelectric sensor.

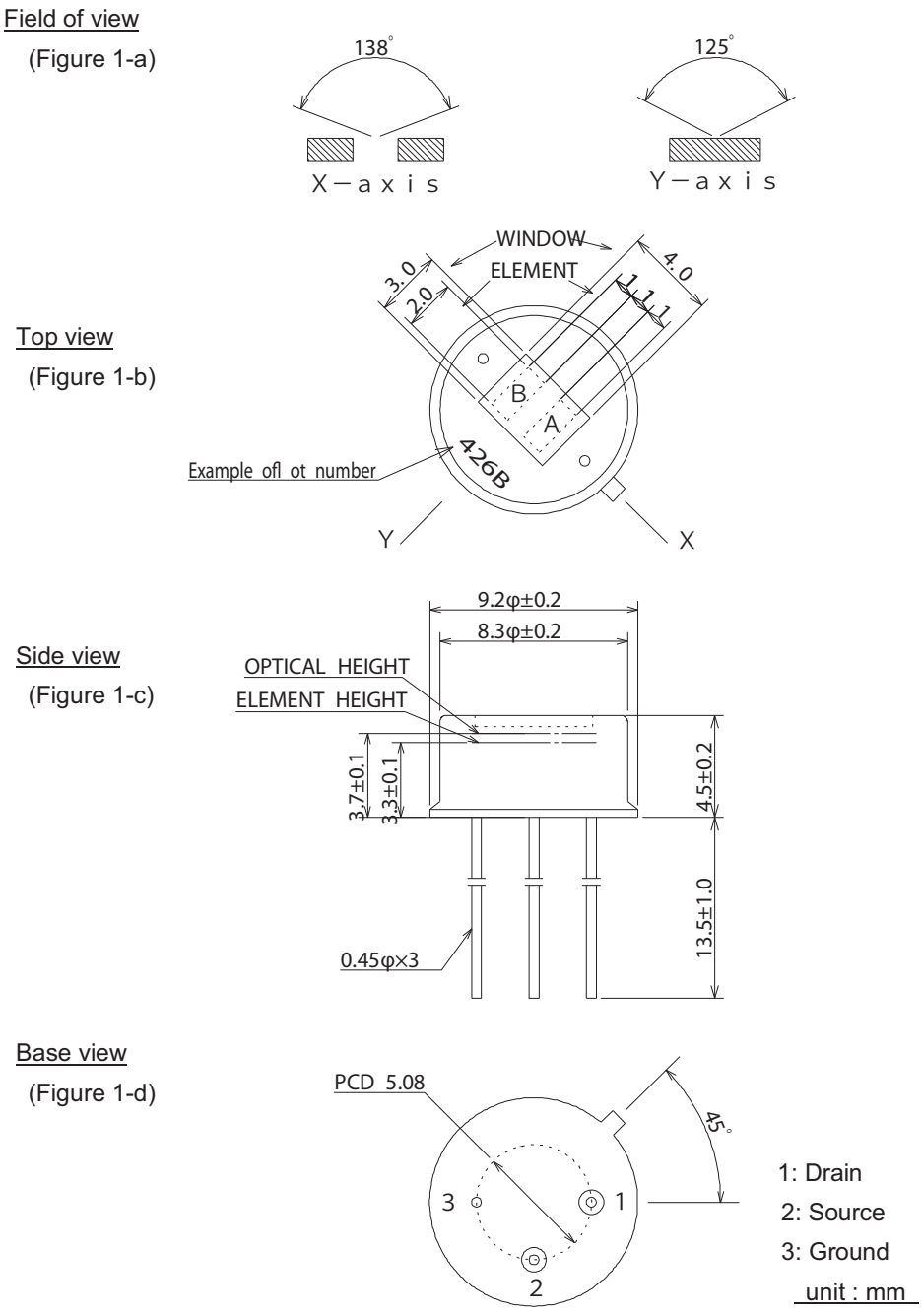
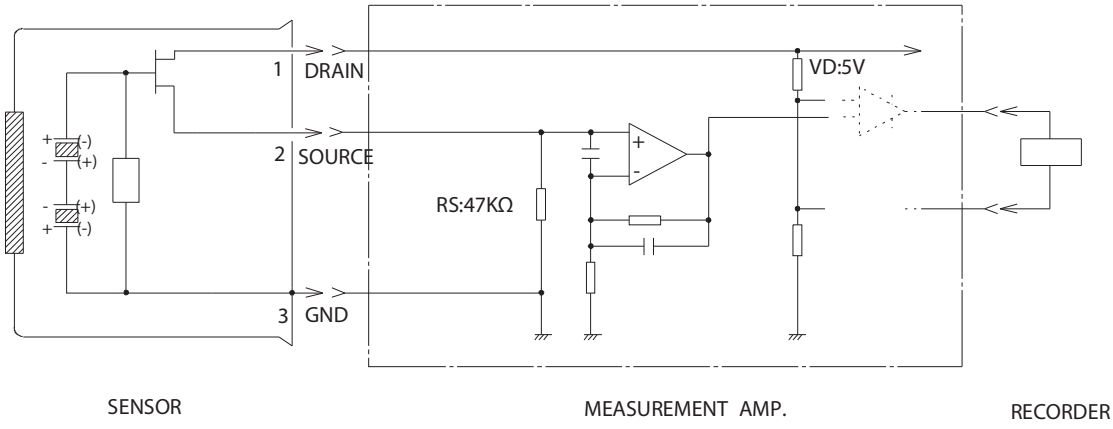


Figure 1. ZRE200GE Mechanical Configuration



Measurement Amp.: Non-inverted type, gain 72.5 dB at 1 Hz , 0.4 to 2.7 Hz／-3 dB

Figure 2. ZRE200GE Circuit Configuration

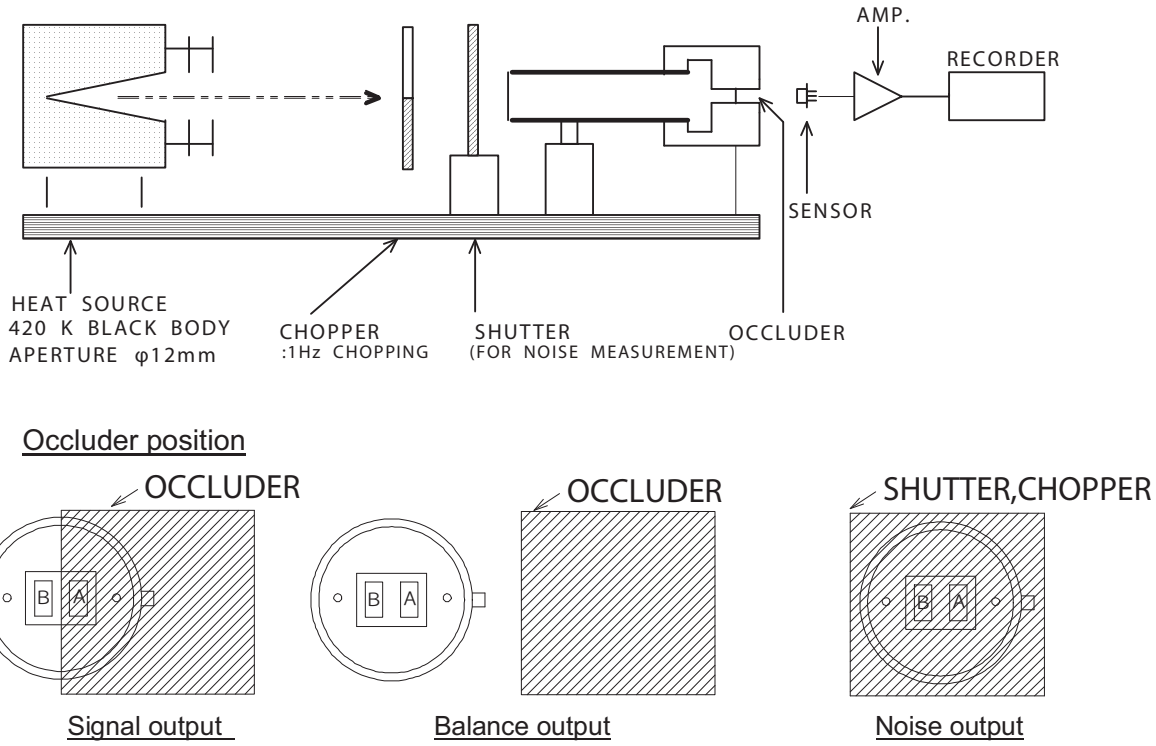


Figure 3. ZRE200GE Test Setup Block Diagram

ZSBG323671 Sensor Specification

This section describes the specifications for the ZSBG323671 passive infrared pyroelectric sensor.

Type of Sensor

Balanced differential (series-opposed type.)

Physical Configuration

Package	TO-5 nickel-plated metal can with dimensions as shown in Side View, Figure 4 on page 9.
Element geometry	Two sensitive areas 2.3 mm long, 1.0 mm wide and spaced 1.0 mm apart.
Element orientation	See Top View, Figure 4 on page 9.
Lead configuration	See Side and Base views, Figure 4 on page 9.

Electrical Characteristics @ 25 ±5°C

Circuit configuration	Three-terminal sensor with source follower; see Figure 5 on page 10.
Operating voltage	3–10 V DC (Rs: 470 KΩ).
Source voltage	0.35–1.4 V (V_D: 5 V vs. 470 KΩ).
Signal output	Minimum 2.6 V_{P-P}; typically 4.0 V_{P-P}. Signal output is measured at a chopper frequency of 1 Hz when connected to an amplifier with a gain of 72.5 dB at 1 Hz and submitted to an infrared energy emission of 13 microW/cm^2 from a 420 K black body. See Figure 6 on page 10.
Noise output	Max. 250 mV_{P-P}; typically 90 mV_{P-P}. Noise output should be measured for 20 seconds when connected to an amplifier with a gain of 72.5 dB at 1 Hz and shielded from infrared energy. See Figure 6 on page 10.

Balance output	Max. 10%. [BO / |SA+SB| ≤ 0.10, in which: BO = balance output SA = signal output on Element A SB = signal output on Element B Balance output is measured at a chopper frequency of 1 Hz when connected to an amplifier with a gain of 72.5 dB at 1 Hz and submitted to an infrared energy emission of 13 microW/cm2 from a 420 K black body. See Figure 6 on page 10.
Frequency response	0.3 Hz to 3.0 Hz / ±10 dB.

Optical Characteristics

Field of view	134° from center of element on Axis X. 120° from center of element on Axis Y. See Field of View, Figure 4.
Filter substrate	Silicon.
Cut on (5 %T ABS)	5.5 ±0.5 µm.
Transmission	≥ 70%; average 8–13 µm.

Environmental Requirements

Operating temperature	–30°C to +70°C.
Storage temperature	–40°C to +80°C.
Relative humidity	The sensor operate without an increase in noise output when continuously exposed to 90–95% RH at 30°C.
Hermetic seal	The sensor must be sealed to withstand a vacuum of 21.28 kPa.

RoHS Compliance

The ZSBG323671 Sensor conforms to the RoHS directive in force at the date of issuance of this specification.

Mechanical Drawings

Figures 4 through 6 present mechanical drawings of the ZSBG323671 pyro sensor.

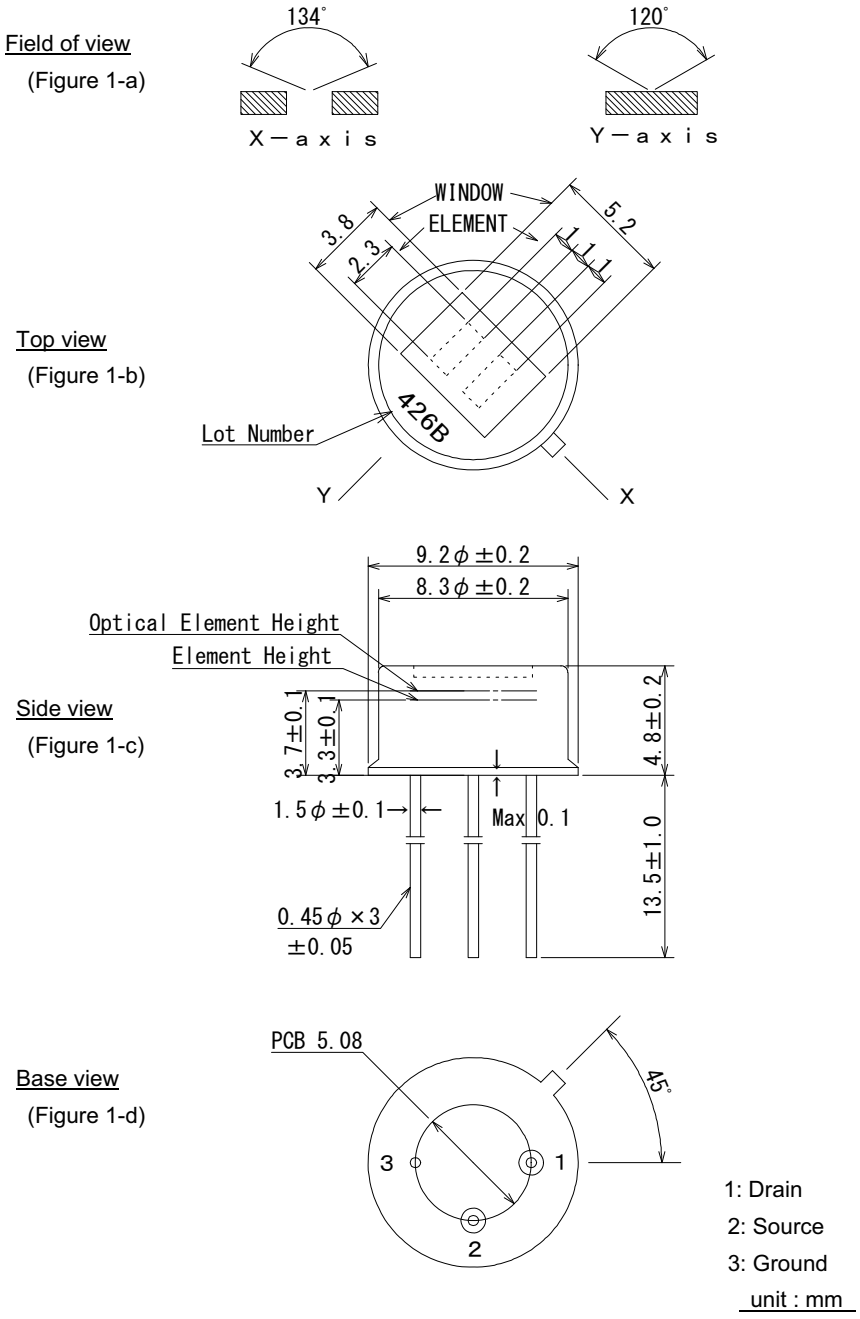
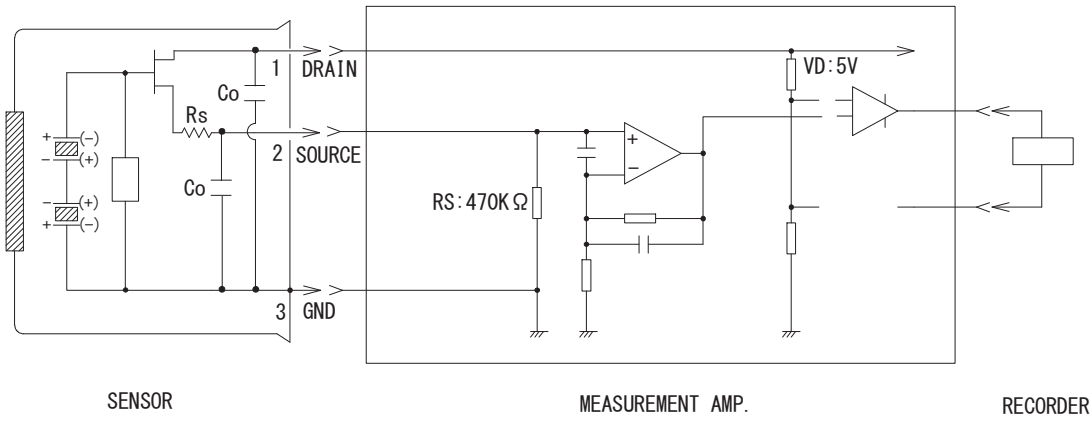


Figure 4. ZSBG323671 Mechanical Configuration



Measurement Amp.: Non-inverted type, gain 72.5 dB at 1 Hz, 0.4 to 2.7 Hz ／ –3 dB

Figure 5. ZSBG323671 Circuit Configuration

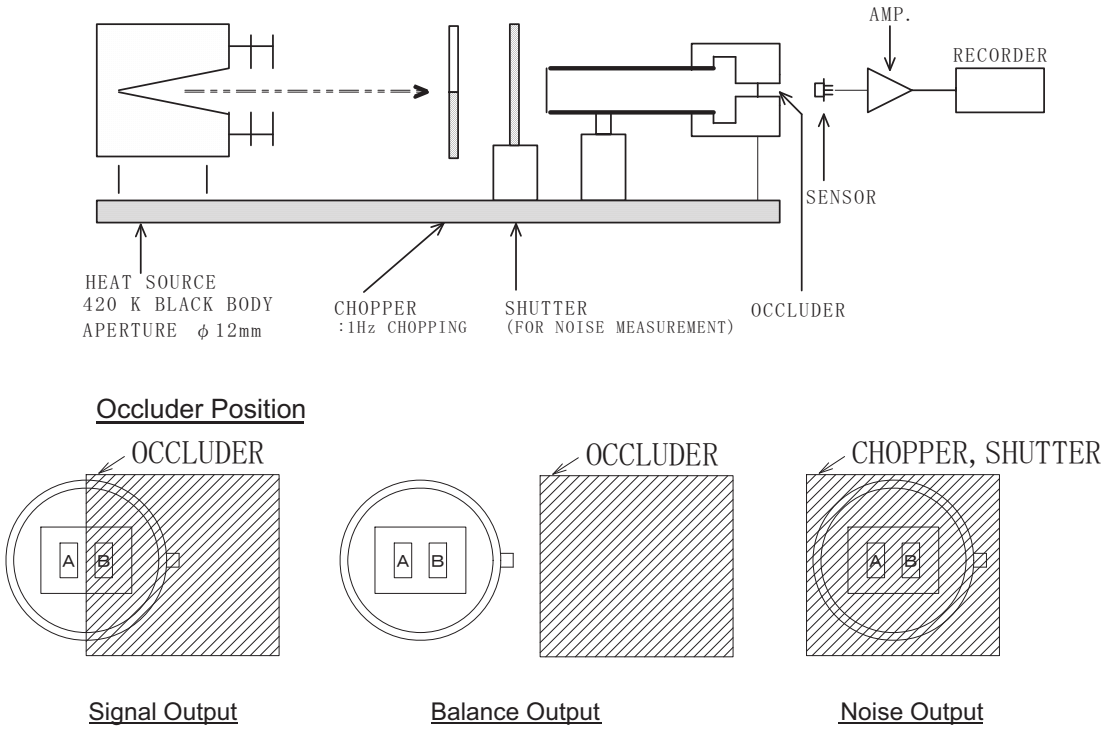


Figure 6. ZSBG323671 Test Setup Block Diagram

ZSBG446671 Sensor Specification

This section describes the specifications for the ZSBG446671 passive infrared pyroelectric sensor.

Type of Sensor

Balanced differential (series-opposed type.)

Physical Configuration

Package	TO-5 nickel-plated metal can with dimensions as shown in Side View, Figure 7 on page 13.
Element geometry	Four sensitive areas 1.0 mm * 1.0mm and spaced 1.0mm apart.
Element orientation	See Top View, Figure 7 on page 13.
Lead configuration	See Side and Base views, Figure 7 on page 13.

Electrical Characteristics @ 25 ±5°C

Circuit configuration	Three-terminal sensor with source follower; see Figure 8 on page 14.
Operating voltage	3–10V DC (Rs: 470KΩ).
Element polarity	Element A,C:(+) B,D:(–) or A,C:(–) B,D:(+).
Source voltage	0.35–1.4V (Vd: 5V vs. 470KΩ).
Signal output	Min. 4.5Vp-p; typically 6.5 Vp-p. (S1, S2) signal output is measured at a chopper frequency of 1Hz when connected to an amplifier with a gain of 72.5dB at 1Hz and submitted to an infrared energy emission of 13microW/cm^2 from a 420K black body; see Figure 9 on page 15.
Noise output	Max. 250 mV_{P-P}; typically 90mV_{P-P}. Noise output should be measured for 20 seconds when connected to an amplifier with a gain of 72.5dB at 1Hz and shielded from infrared energy; see Figure 9 on page 15.

Balance output	Max. 15%. [|S1–S2| / |S1+S2| ≤ 0.15 S1 = signal output on Elements A + C S2 = signal output on Elements B + D Balance output is measured at a chopper frequency of 1 Hz when connected to an amplifier with a gain of 72.5 dB at 1 Hz and submitted to an infrared energy emission of 13 microW/cm2 from a 420 K black body. See Figure 9 on page 15.
Frequency response	0.3 Hz to 3.0 Hz / ±10 dB.

Optical Characteristics

Field of view	132° from center of element on Axis X. 146° from center of element on 45°. See Field of View, Figure 4.
Filter substrate	Silicon.
Cut on (5 %T ABS)	5.5 ±0.5 µm.
Transmission	≥ 70%; average 8–13 µm.

Environmental Requirements

Operating temperature	–30°C to +70°C.
Storage temperature	–40°C to +80°C.
Relative humidity	The sensor operate without an increase in noise output when continuously exposed to 90–95% RH at 30°C.
Hermetic seal	The sensor must be sealed to withstand a vacuum of 21.28 kPa.

RoHS Compliance

The ZSBG446671 Sensor conforms to the RoHS directive in force at the date of issuance of this specification.

Mechanical Drawings

Figures 7 through 9 present mechanical drawings of the ZSBG446671 pyro sensor.

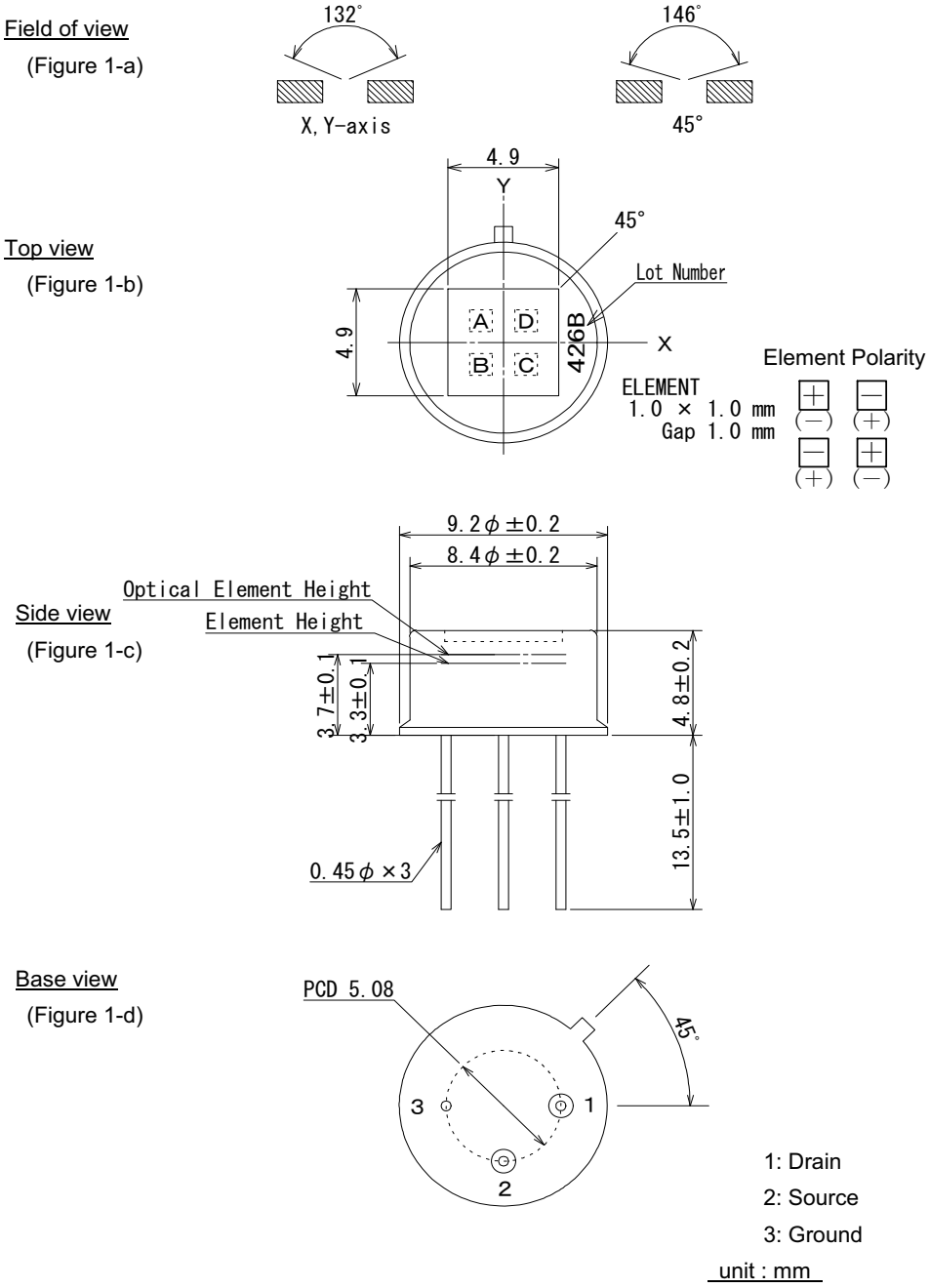
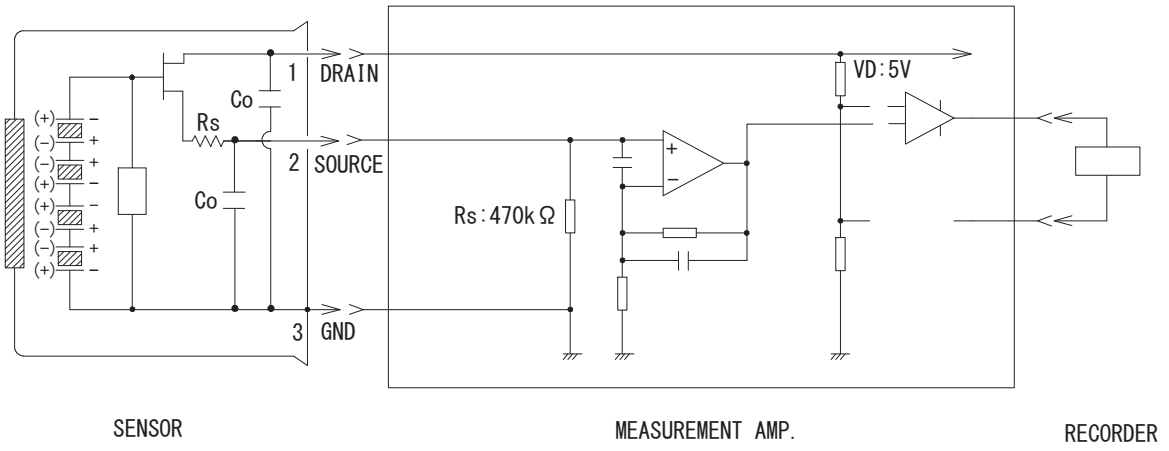


Figure 7. ZSBG446671 Mechanical Configuration



Measurement Amp.: Non-inverted type, gain 72.5 dB at 1 Hz , 0.4 to 2.7 Hz ／–3 dB

Figure 8. ZSBG446671 Circuit Configuration

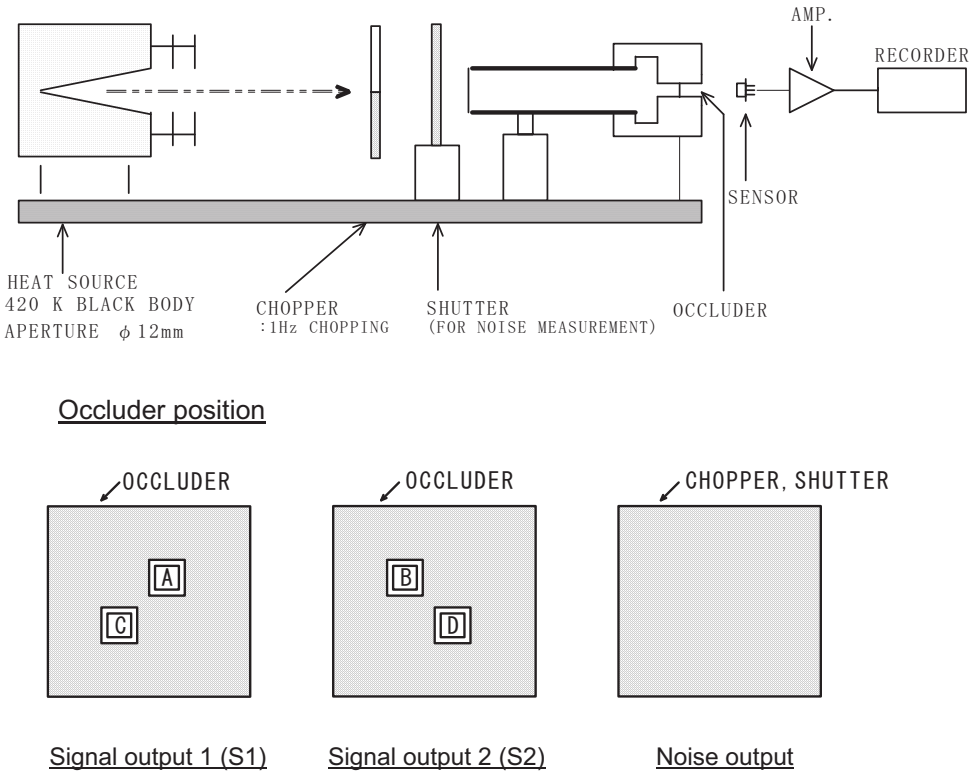


Figure 9. ZSBG446671 Test Setup Block Diagram

ZSFG469711 Sensor Specification

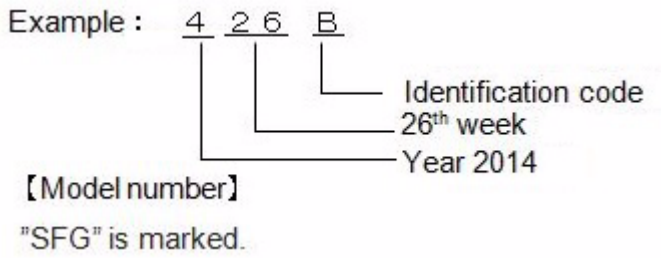
This section describes the specifications for the ZSFG469711 passive infrared pyroelectric sensor.

Type of Sensor

Balanced differential (series-opposed type).

Physical Configuration

Package	TO-5 metal can with dimensions shown in Figure 1-c (Ni-plated).
Element geometry	Two sensitive areas 7.24 mm2.
Element orientation	See Figure 10 on page 18.
Lead configuration	See Figure 10 on page 18.
Code	Lot number is marked on top surface of detector. To show last one digit of the A.D. year and week of the year of an inspection completion Identification code.



Electrical Characteristics @ 25 ±5°C

Circuit configuration	Three-terminal sensor with source follower. See Figure 11 on page 19.
Operating voltage	1 ~ 15 V dc (Rs: 470kohm).
Source voltage	0.3 ~ 1.4 V (Vd: 5V, Rs: 470kohm).
Signal output	Min. 3.0 Vp-p (Typ. 5.0 Vp-p). Signal output is measured at chopper frequency of 1 Hz when connected to the amplifier of gain 72.5 dB (at 1 Hz) and submitted to the emission of Infrared energy of 13 microW/cm2 from 420 K Black Body. See Figure 12 on page 20.

Noise output	Max. 200 mVp-p (Typ. 60 mVp-p). Noise output shall be measured for 20 seconds when connected to the amplifier of gain 72.5 dB (at 1 Hz) and shut out from Infrared energy. See Figure 12 on page 20.
Balance output	Max. 20 % [Bo / |SA+SB| ≤ 0.20. Bo : Balance output. SA : Signal output on Element A. SB : Signal output on Element B. Balance output is measured at chopper frequency of 1 Hz when connected to the amplifier of gain 72.5 dB (at 1 Hz) and submitted to the emission of Infrared energy of 13 microW/cm2 from 420 K Black Body. See Figure 12 on page 20.
Frequency response	0.3 Hz to 3.0 Hz / (+/-) 10 dB.

Optical Characteristics

Field of view	132° from center of element on axis X. 146° from center of element on axis Y. See Figure 10 on page 18.
Filter substrate	Silicon.
Cut on (5 %T ABS)	5 (+/-) 1 micron.
Transmission	≥ 70 % average 8 to 13 micron.

Environmental Requirements

Operating Temperature	–40°C to +85°C.
Storage Temperature	–40°C to +85°C.
Relative Humidity	The sensor shall operate without increase in noise output when exposed to 90 ~ 95 % RH at 30°C continuously.
Hermetic Seal	The sensor shall be sealed to withstand a vacuum of 21.28 kPa.

RoHS Compliance

The ZSFG469711 Sensor conforms to the RoHS directive in force at the date of issuance of this specification.

Mechanical Drawings

Figures 10 through 12 present mechanical drawings of the ZSFG469711 pyro sensor.

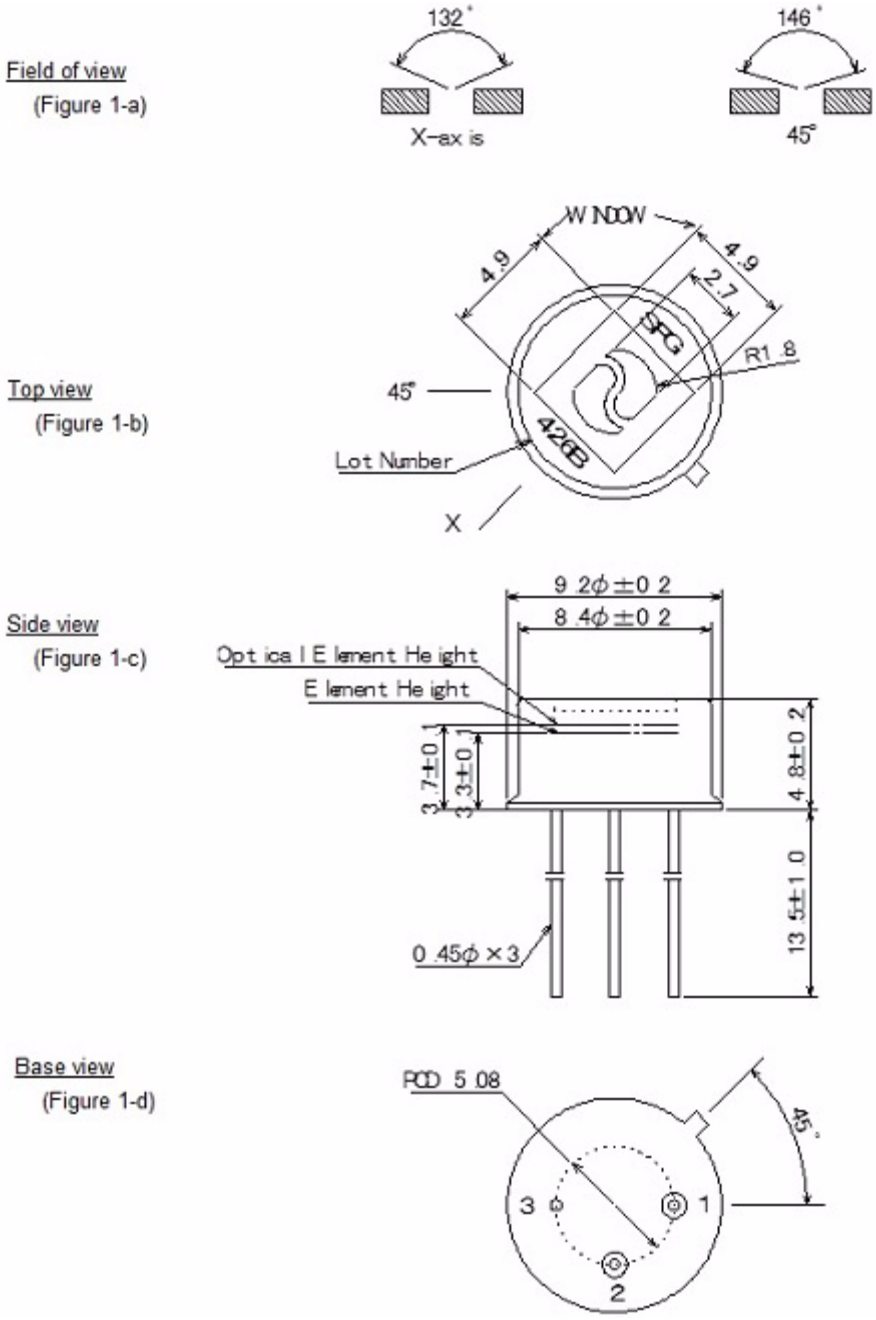
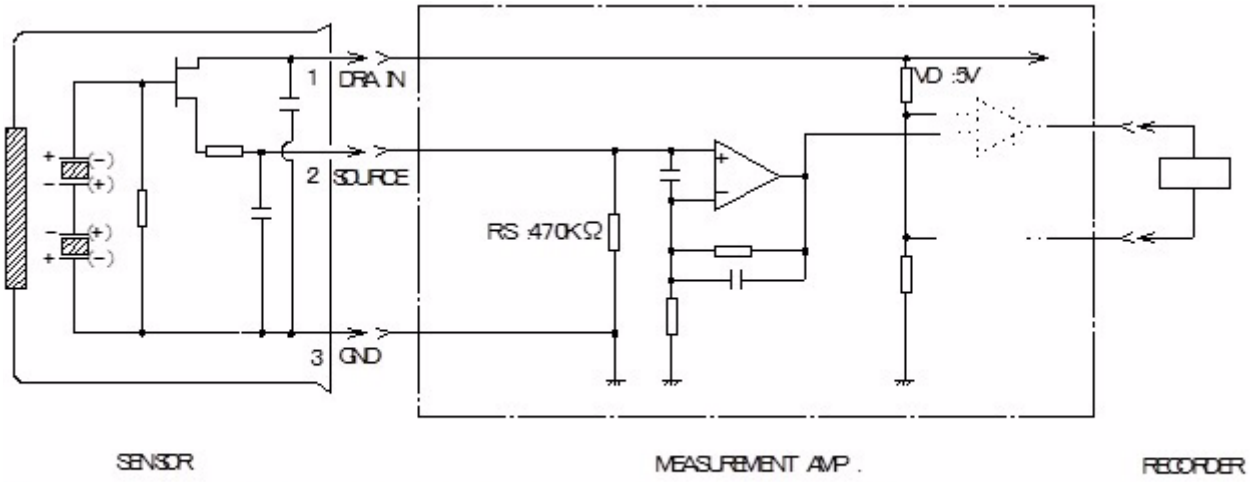


Figure 10. ZSFG469711 Mechanical Configuration



Measurement Amp.: Non-inverted type, gain 72.5 dB at 1 Hz , 0.4 to 2.7 Hz／–3 dB

Figure 11. ZSFG469711 Circuit Configuration

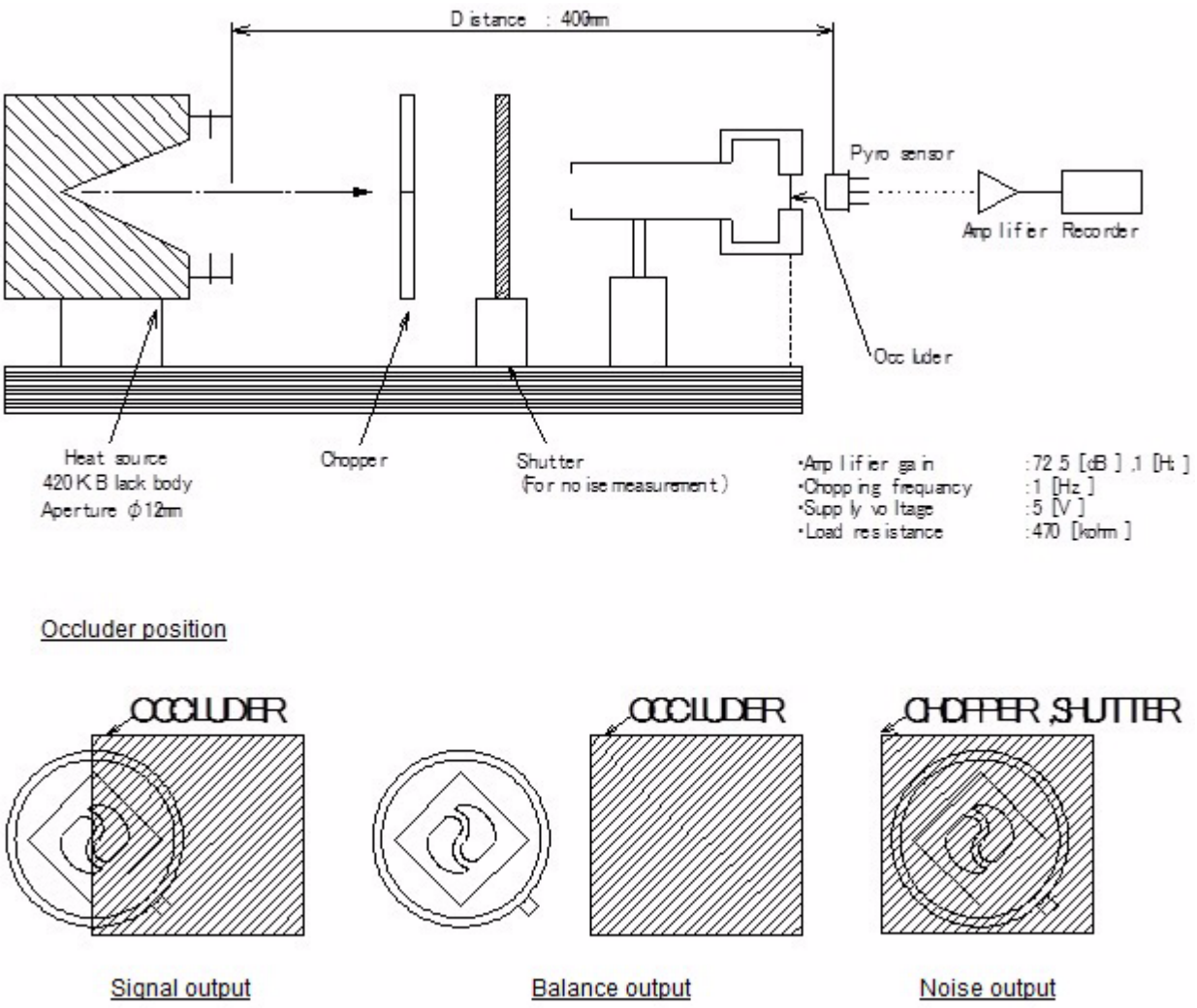


Figure 12. ZSFG469711 Test Setup Block Diagram

Precautions

This chapter presents restrictions and precautions that apply to ZMOTION pyroelectric sensors.

Design Restrictions and Precautions

This sensor is designed for indoor purposes in which secondary accidents due to operation failure or malfunctions can be anticipated; therefore, add appropriate fail-safe functionality to your design. If these sensors are intended for outdoor applications, be sure to apply suitable supplementary optical filters and design with drip-proof, anti-dew construction materials.

Usage Restrictions and Precautions

To prevent sensor malfunctions, operational failure, or any deterioration of their characteristics, do not operate these ZMOTION sensors under the following, or similar, conditions:

- Rapid environmental temperature changes
- Strong shocks or vibrations
- In places where there are obstructing materials (glass, fog, etc.) through which infrared rays cannot pass within the detection area
- In fluids, corrosive gases, and sea breezes
- Under continual high-humidity atmospheric conditions
- When exposed to direct sunlight or automobile headlights
- When exposed to directly to forced-air currents from a heater or air conditioner

Assembly Restrictions and Precautions

Soldering:

- Use soldering irons when soldering
- Avoid extended durations of heat on the sensors' pins, because excessive heat may cause deterioration of the sensor (e.g., durations beyond 5 seconds at 350°C)

Washing:

- Be sure to wash out all flux after soldering, because remaining solder materials may cause malfunctions

- Use a brush when washing; washing with an ultrasonic cleaner may cause operational failure

Handling and Storage Restrictions and Precautions

To prevent sensor malfunctions, operational failure, appearance damage, or any deterioration of their characteristics, do not expose these sensors to the following, or similar, handling and storage conditions:

- Vibrations over extended periods
- Strong shocks
- Static electricity or strong electromagnetic waves
- High temperature and humidity over extended periods
- Corrosive gases or sea breezes
- Dirty and dusty environments that may contaminate the optical window

Restrictions on Product Use

The products described in this document shall not be used or embedded into any downstream products for which their manufacture, use, and/or sale are prohibited under any applicable laws and regulations.

Sensor troubles resulting from misuse and/or inappropriate handling or storage are not the manufacturer's responsibility.

Related Documents

Additional information about the ZMOTION Families of Motion Detection MCUs can be found in the following documents, which are available from the Zilog website at www.zilog.com.

Document Number	Description
PB0225	ZMOTION Detection and Control Family Product Brief
PB0230	ZMOTION Intrusion Detection Product Brief
PS0228	Z8 Encore! XP® F082A Series Product Specification
PS0285	ZMOTION Detection and Control Family Product Specification
PS0286	ZMOTION Lenses Product Specification
PS0288	ZMOTION Intrusion Detection Product Specification
AN0307	ZMOTION Detection Module Application Walkthrough
AN0309	ZMOTION High Brightness White LED Lighting Application Note
WP0017	A New PIR Motion Detection Architecture White Paper
WP0018	ZMOTION Detection Lens and Pyro Sensor Configuration Guide
Other ZMOTION Family Products	
PB0244	ZMOTION Detection Module II Product Brief
PS0305	ZMOTION Detection Module II Product Specification

Customer Support

To share comments, get your technical questions answered, or report issues you may be experiencing with our products, please visit Zilog's Technical Support page at http://support.zilog.com.

To learn more about this product, find additional documentation, or to discover other facets about Zilog product offerings, please visit the Zilog Knowledge Base at http://zilog.com/kb or consider participating in the Zilog Forum at http://zilog.com/forum.

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