



KXSD9 Series

Accelerometers and Inclinometers

FEATURES

- Ultra-Small Package - 3x3x0.9mm LGA
- Digital SPI/I²C Output
- User-programmable g-Range
- User-programmable Low Pass Filter
- Power Management with Wake-up Function
- Ultra Low Power Consumption
- Lead-free Solderability
- High Shock Survivability
- Auxiliary Input for A/D Conversion
- Self-test Function

PROPRIETARY TECHNOLOGY

These high-performance silicon micromachined linear accelerometers and inclinometers consist of a sensor element and an ASIC packaged in a 3x3x0.9mm Land Grid Array (LGA). The sensor element is fabricated from single-crystal silicon with proprietary Deep Reactive Ion Etching (DRIE) processes, and is protected from the environment by a hermetically-sealed silicon cap at the wafer level.

The **KXSD9** series is designed to provide flexibility. These sensors can accept supply voltages between 1.8V and 3.6V. Sensitivity is user selectable at 2g, 4g, 6g, and 8g. Several user-programmable internal low pass filters eliminate the need for external filter capacitors. The auxiliary input provides access to the embedded A/D converter.

The sensor element functions on the principle of differential capacitance. Acceleration causes displacement of a silicon structure resulting in a change in capacitance. An ASIC, using a standard CMOS manufacturing process, detects and transforms changes in capacitance into a digital output voltage, which is proportional to acceleration. The sense element design utilizes common mode cancellation to decrease errors from process variation and environmental stress. The voltage is digitized by an on-board A/D converter and is accessed via an inter-integrated circuit (I²C) or a serial peripheral interface (SPI).

MARKETS

APPLICATIONS

- Cell Phones and Handheld PDAs*
 - Gesture Recognition and User Interface Function
- Game Controllers & Computer Peripherals*
 - Inclination and Tilt Sensing
- Ultra-Mobile PCs/Laptops/Hard Disk Drives*
 - Free-fall Detection
- Cameras and Video Equipment*
 - Image Stabilization
- Sports Diagnostic Equipment/Pedometers*
 - Static or Dynamic Acceleration



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PERFORMANCE SPECIFICATIONS

The performance parameters below are programmed and tested at 2.6V and 3.3 volts. However, the device can be factory programmed to accept supply voltages from 1.8V to 3.6V. Performance parameters will change with supply voltage variations.

PERFORMANCE SPECIFICATIONS				
PARAMETERS	UNITS	KXSD9-1026	KXSD9-2050	CONDITION
Range	g	±2.0, ±4.0, ±6.0, ±8.0		User-selectable full-scale output range
Sensitivity ¹	Counts/g	819, 410, 273, 205 typical		
0g Offset vs. Temp.	mg/°C	±0.5 (xy) ±3.0 (z) typical		
Sensitivity vs. Temp	%/°C	±0.01 (xy) ±0.04 (z) typical		
Noise Density	$\mu\text{g} / \sqrt{\text{Hz}}$	350 typical	750 typical	
Mechanical Resonance ²	Hz	4000 (xy) 2000 (z)		-3dB
LPF Bandwidth	Hz	50 default 100, 500, 1000, 2000, no filter (available settings)		User programmable
Non-Linearity	% of FS	0.1 typical		% of full scale output
Ratiometric Error	%	±0.4 typical	±0.3 typical	Vdd ± 5%
Cross-axis Sensitivity	%	2.0 typical		
A/D Conversion Time	μs	200 typical		
SPI Communication Rate ³	MHz	1 max		
I ² C Communication Rate	KHz	400 max		
Power Supply	V	2.6 typical (3.6 max)	3.3 typical (3.6 max)	Standard
Current Consumption	μA	220 typical		Operating (full power)
	μA	50 typical		Operating (low power)
	μA	0.1 typical		Standby
ENVIRONMENTAL SPECIFICATIONS				
PARAMETERS	UNITS	KXSD9-1026	KXSD9-2050	CONDITION
Operating Temperature	°C	-40 to 85		Powered
Storage Temperature	°C	-55 to 150		Un-powered
Mechanical Shock	g	5000, 0.5 msec 10,000, 0.2 msec		Powered or un-powered, halversine
ESD	V	2000		Human body model

NOTES

¹ User selectable from CTRL_REGC.

² Resonance as defined by the dampened mechanical sensor.

³ SPI communication rate can be optimized for faster communication. See SPI timing diagram, page 4 of Product Specifications.

ORDERING GUIDE

Product	Output	Axis(es) of Sensitivity	Range (g)	Sensitivity (counts/g)	Offset	Operating Voltage (V)	Temperature (°C)	Package
KXSD9-1026	Digital SPI/I ² C	XYZ	2, 4, 6, 8	819, 410, 273, 205	2048	2.6	-40 to +85	3x3x0.9mm LGA
KXSD9-2050	Digital SPI/I ² C	XYZ	2, 4, 6, 8	819, 410, 273, 205	2048	3.3	-40 to +85	3x3x0.9mm LGA