



# KXSS5 Series

## Accelerometers and Inclinometers

### FEATURES

- Very Small Package - 3x5x0.9mm LGA
- I<sup>2</sup>C/SPI Interface and Analog Outputs
- Free-fall Interrupt Output
- High-g Motion Interrupt Output
- Low Noise
- Lead-free Solderability
- Excellent Temperature Performance
- High Shock Survivability
- Low Power Consumption
- Selectable Power Reduction Modes
- User Definable Bandwidth
- Factory Programmable Offset and Sensitivity
- 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 3x5x0.9mm 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.

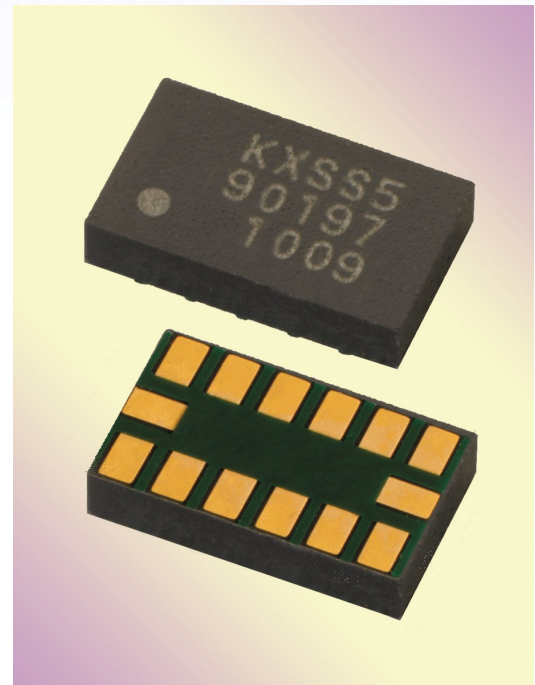
The KXSS5 series is designed to provide a high signal-to-noise ratio with excellent performance over temperature. These sensors can accept supply voltages between 1.8V and 3.6V. Sensitivity is factory programmable allowing customization for applications requiring from  $\pm 2.5g$  to  $\pm 8.0g$  ranges. Sensor bandwidth is user-definable. Interrupts can be generated for acceleration on any axis above a threshold value (Motion Interrupt) or for acceleration on all three axes below a threshold value (Free-fall Interrupt).

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 an analog output voltage, which is proportional to acceleration. This voltage is digitized by an on-board A/D converter and is accessed via an inter-integrated circuit (I<sup>2</sup>C) bus or serial peripheral interface (SPI).

### MARKETS

#### APPLICATIONS

- Hard Disk Drives/Laptops*
  - Free-fall Detection
- Cell Phones and Handheld PDAs*
  - Gesture Recognition
- Game Controllers and Computer Peripherals*
  - Inclination and Tilt Sensing
- Cameras and Video Equipment*
  - Image Stabilization
- Sports Diagnostic Equipment/Pedometers*
  - Static or Dynamic Acceleration
- Personal Navigation Devices*
  - Inertial Navigation and Dead Reckoning



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### PERFORMANCE SPECIFICATIONS

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

PERFORMANCE SPECIFICATIONS			
PARAMETERS	UNITS	KXSS5-2057	CONDITION
Range <sup>1</sup>	g	±3.0	Factory programmable
Sensitivity	counts/g	546 typical (562 max)	12 bit operation
0g Offset vs. Temp.	mg/°C	±0.6 typical	
Sensitivity vs. Temp	%/°C	0.01 (xy) 0.03 (z)	
Noise	$\mu\text{g} / \sqrt{\text{Hz}}$	175 (typical)	
Bandwidth <sup>2</sup>	Hz	1000	-3dB
Non-Linearity	% of FS	0.1 typical	% of full scale output
Ratiometric Error	%	0.3 typical	3.3V ± 5%
Cross-axis Sensitivity	%	2.0 typical	
A/D Conversion Time	μS	200 typical	
SPI Communication Rate <sup>3</sup>	MHz	1 typical	
I <sup>2</sup> C Communication Rate	KHz	400 typical	
Power Supply	V	3.3	Standard
Current Consumption	μA	800 typical (1000 max)	Operating
	μA	0.0012 typical	Standby
ENVIRONMENTAL SPECIFICATIONS			
PARAMETERS	UNITS	KXSS5-2057	CONDITION
Operating Temperature	°C	-40 to 85	Powered
Storage Temperature	°C	-55 to 150	Un-powered
Mechanical Shock	g	5000	Powered or un-powered, 0.5 msec halversine
ESD	V	2000	Human body model

### NOTES

<sup>1</sup> Custom ranges from 2.5g to 8g available.

<sup>2</sup> Internal 1 kHz low pass filter. Lower frequencies are user definable with external capacitors.

<sup>3</sup> SPI communication rate can be optimized for faster communication.

### ORDERING GUIDE

Product	Axis(es) of Sensitivity	Range (g)	Sensitivity (counts/g)	Offset (counts)	Operating Voltage (V)	Output	Temperature (°C)	Package
<b>KXSS5-2057</b>	XYZ	3	546	2048	3.3	Digital I <sup>2</sup> C, SPI, Analog	-40 to +85	3x5x0.9 LGA
<b>KXSS5-3028</b>	XYZ	3	546	2048	2.8	Digital I <sup>2</sup> C, SPI, Analog	-40 to +85	3x5x0.9 LGA
<b>KXSS5-4457</b>	XYZ	3	546	2048	1.8	Digital I <sup>2</sup> C, SPI, Analog	-25 to +70	3x5x0.9 LGA