



KXPS5 Series

Accelerometers and Inclinometers

FEATURES

- Very Small Package - 3x5x0.9mm LGA
- I²C/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 KXPS5 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 5.25V. Sensitivity is factory programmable allowing customization for applications requiring from $\pm 1.5g$ to $\pm 6.0g$ 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 (I²C) 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 5.25 V. Performance parameters will change with supply voltage variations.

| PERFORMANCE SPECIFICATIONS | | | |
|-------------------------------------|------------------|----------------------------|-----------------------------------------------|
| PARAMETERS | UNITS | KXPS5-3157 | CONDITION |
| Range ¹ | g | ±3.0 | Factory programmable |
| Sensitivity | mV/g | 440 typical (449 max) | 12 bit operation |
| 0g Offset vs. Temp. | mg/°C | ±60 max | |
| Sensitivity vs. Temp | %/°C | ±2.0 max | |
| Noise | mg / \sqrt{Hz} | 175 (typical) 250 (max) | |
| Bandwidth ² | Hz | 1000 | -3dB |
| Non-Linearity | % | 0.1 typical (0.5 max) | % of full scale output |
| Ratiometric Error | % | 0.4 typical (1.5 max) | 3.3V ± 5% |
| Cross-axis Sensitivity | % | 2.0 typical (3.0 max) | |
| A/D Conversion Time | μS | 200 typical | |
| SPI Communication Rate ³ | MHz | 1 typical | |
| I ² C Communication Rate | KHz | 400 typical | |
| Power Supply | V | 3.3 | Standard |
| Current Consumption | mA | 0.8 typical (1.0 max) | Operating |
| | nA | 1.2 typical | Standby |
| ENVIRONMENTAL SPECIFICATIONS | | | |
| PARAMETERS | UNITS | KXPS5-3157 | 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

¹ Custom ranges from 1.5g to 6g available.

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

³ SPI communication rate can be optimized for faster communication.

ORDERING GUIDE

| Product | Axis(es) of Sensitivity | Range (g) | Sensitivity (mV/g) | Offset (V) | Operating Voltage (V) | Temperature (°C) | Package |
|------------|-------------------------|-----------|--------------------|------------|-----------------------|------------------|-------------|
| KXPS5-1050 | XYZ | 2 | 560 | 1.40 | 2.8 | -40 to +85 | 3x5x0.9 LGA |
| KXPS5-2050 | XYZ | 2 | 660 | 1.65 | 3.3 | -40 to +85 | 3x5x0.9 LGA |
| KXPS5-3157 | XYZ | 3 | 440 | 1.65 | 3.3 | -40 to +85 | 3x5x0.9 LGA |
| KXPS5-4457 | XYZ | 3 | 240 | 0.90 | 1.8 | -20 to +70 | 3x5x0.9 LGA |