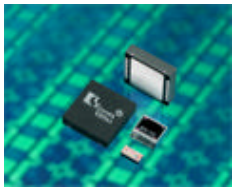
KXP84 Series Summary Data Sheet

Accelerometers and Inclinometers
I²C/SPI Interface
Free-fall and High-g Motion Interrupts
Tri-Axis XYZ



APPLICATIONS

Free-fall Detection

Gesture Recognition

Inclination and Tilt Sensing

Image Stabilization

Sports Diagnostics

Vibration Analysis

Static or Dynamic Acceleration

Inertial Navigation and Ded(uctive) Reckoning

HDD Protection

Cell Phones and Handheld PDAs

Universal Remote Controls

Theft and Accident Alarms

GPS Recognition Assist

Gaming and Game Controllers

Pedometers

Computer Peripherals

Cameras and Video Equipment

FEATURES

Ultra-Small Package — 5x5x1.2mm DFN

Precision Tri-axis Orthogonal Alignment

I²C/SPI Interface

Free-fall Interrupt Output

High-g Motion Interrupt Output

Low Noise

Lead-free Solderability

Excellent Temperature Performance

High Shock Survivability

Very 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 consists of a sensor element and an ASIC packaged in a 5x5x1.2mm Dual Flat No-lead (DFN). 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 wafer at the wafer level.

The KXP84 series is designed to provide a high signal-to-noise ratio with excellent performance over temperature. These sensors can accept supply voltages between 2.7V and 5.25V. Sensitivity is factory programmable allowing customization for applications requiring ±1.5g to ±6.0g ranges. Sensor bandwidth is user-definable.

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). The sense element design utilizes common mode cancellation to decrease errors from process variation and environmental stress.

Precision in Motion
Kionix®

36 Thornwood Dr. - Ithaca, NY 14850 USA tel: 607-257-1080 - fax: 607-257-1146 - www.kionix.com - info@kionix.com

KXP84 Series Summary Data Sheet

PRODUCT SPECIFICATIONS

PERFORMANCE SPECIFICATIONS [1]			
PARAMETERS	**UNITS**	**KXP84**	**CONDITION**
Range [2]	g	±2.0	Factory programmable
Sensitivity	Counts/g	819 (typical)	12 bit operation
0g Offset vs. Temp.	mg	±150	-40 to 85 °C
Sensitivity vs. Temp	%	±2.0 typical (±3.0 max)	
Noise	$mg/\sqrt{Hz}$	175 (typical) 250 (max)	
Bandwidth [3]	Hz	0 to 3300 max (x and y) 0 to 1700 max (z)	-3dB
Non-Linearity	%	±0.1 typical (±0.5 max)	% of full scale output
Ratiometric Error	%	±0.4 typical (±1.5 max)	
Cross-axis Sensitivity	%	±2.0 typical (±3.0 max)	
Resolution	mg	1.22 typical	
A/D Conversion Time	us	200 typical	
Digital Communication Speed	MHz	1 typical	
Power Supply	V	3.3	Standard
I/O Pads Supply Voltage	V	1.7 to Vdd	
Current Consumption	mA	1.0 typical [4]	Operating
	µA	10 max	Standby—over temperature
ENVIRONMENTAL SPECIFICATIONS			
PARAMETERS	**UNITS**	**KXP84**	**CONDITION**
Operating Temperature	°C	-40 to 85	Powered
Storage Temperature	°C	-55 to 150	Un-powered
Mechanical Shock	g	4600	Powered or un-powered, 0.5 msec halversine
ESD	V	3000	Human body model

Notes

[1] The performance parameters are programmed and tested at 3.3 volts. However, the device can be factory programmed to accept supply voltages from 2.7 V to 5.25 V. Performance parameters will change with supply voltage variations.

[2] Custom ranges from 1.5g to 6g available.

[3] The bandwidth is determined by the external capacitors: C_2 , C_3 , and C_4 (see application circuit).

[4] Actual current consumption during operation depends on user selected sampling and interrupt speeds.

Application Design Equations

The bandwidth is determined by the filter capacitors connected from pins 5, 6 and 7 to ground. The response is single pole. Given a desired bandwidth, f_{BW}, the filter capacitors are determined by:

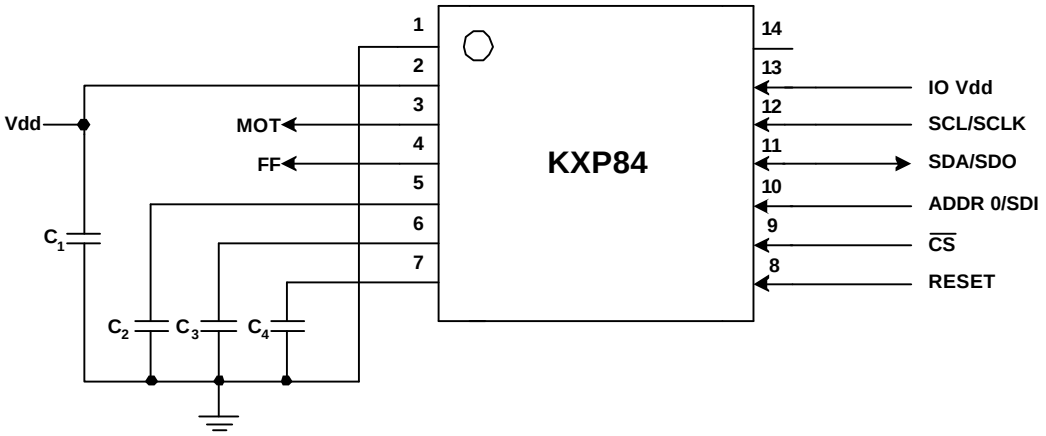
$$C_2 = C_3 = C_4 = \frac{4.97\ x10^{-6}}{f_{BW}}$$

Notes

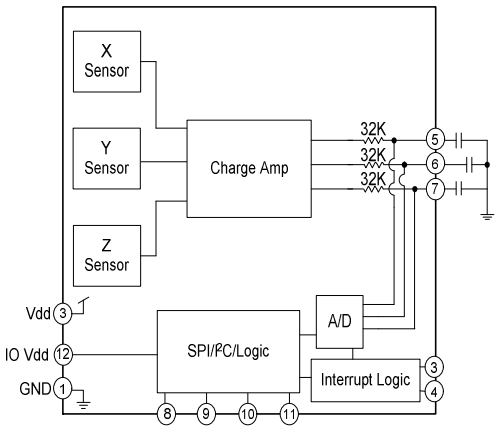
Self-test and standby modes are enabled through the control registers.

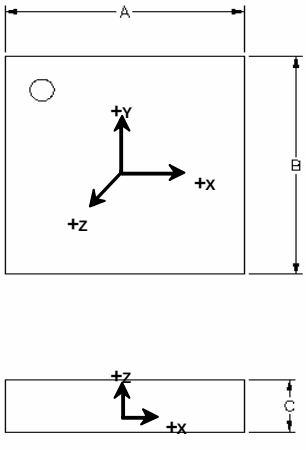
KXP84 Series Summary Data

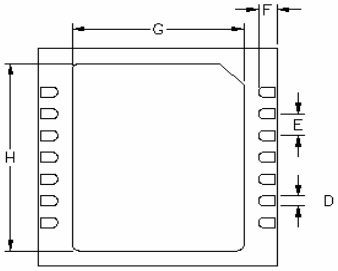
APPLICATION SCHEMATIC & PIN FUNCTION TABLES



Pin	Name	Description
1	GND	Ground
2	Vdd	The power supply input. Decouple this pin to ground with a 0.1uF ceramic capacitor (C_1).
3	MOT	Motion interrupt
4	FF	Free-fall interrupt
5	X Output	Analog output of the x-channel. Optionally, a capacitor (C_2) placed between this pin and ground will form a low pass filter.
6	Y Output	Analog output of y-channel. Optionally, a capacitor (C_3) placed between this pin and ground will form a low pass filter.
7	Z Output	Analog output of z-channel. Optionally, a capacitor (C_4)placed between this pin and ground will form a low pass filter.
8	Reset	Reset clears all KXP84 registers
9	nCS	SPI Chip Select and I^2C/SPI mode selection: (1 = I^2C mode, 0 = SPI mode)
10	ADDR0/SDI	I^2C programmable address bit/SPI Serial Data Input
11	SDA/SD0	I^2C Serial Data/SPI Serial Data Output
12	SCL/SCLK	I^2C Serial Clock/SPI Serial Clock
13	IO Vdd	The power supply input for the I/O pads
14	NC	Not Connected Internally







Dimension	Inches	Millimeters
A	.197	5.00
B	.197	5.00
C	.047	1.20
D	.009	0.23
E	.020	0.50
F	.016	0.40
G	.142	3.60
H	.169	4.30

Note

[1] When device is accelerated in +X, +Y, or +Z direction, the corresponding output will increase.

KXP84 Series Summary Data

KXP84 INTERRUPT FEATURES

The KXP84 features a high-g motion interrupt (MOT) and a free-fall interrupt (FF). Each interrupt is user definable and features a customizable debounce timer.

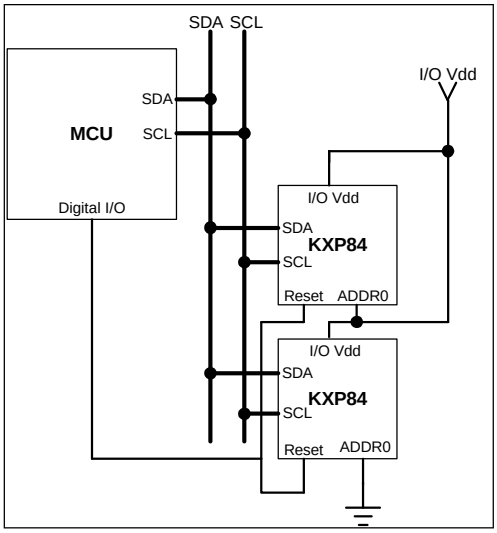
High-g Motion Interrupt - The high-g motion interrupt goes high when a high-g event is detected. A high-g event occurs when the acceleration sensed on any axis exceeds an acceleration threshold for a certain amount of time. The acceleration threshold and debounce time are set by the user.

Free-fall Detection Interrupt - The free-fall interrupt goes high when a free-fall event is detected. A free-fall event occurs when all three accelerometer axes simultaneously fall below an acceleration threshold for a certain amount of time. The acceleration threshold and debounce time is set by the user.

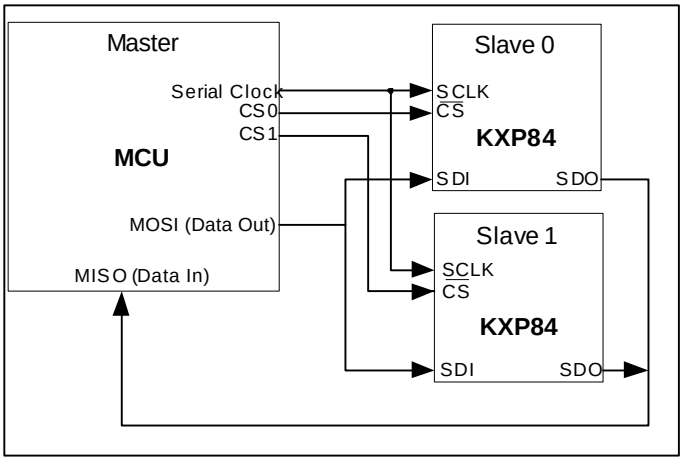
The user has the flexibility to customize the KXP84 to best suit their application.

KXP84 DIGITAL INTERFACES

The Kionix KXP84 digital accelerometer has the ability to communicate on both I^2C and SPI digital serial interface busses. This flexibility allows for easy system integration by eliminating analog-to-digital converter requirements and by providing direct communication with system micro-controllers



KXP84 I^2C Connections



KXP84 SPI Connections

ORDERING GUIDE

Product	Axis(es) of Sensitivity	Range (g)	Span (counts)	Sensitivity (mg/count)	Offset (counts)	Operating Voltage (V)	Temperature (°C)	Package
KXP84-1050	XYZ	2	+/- 1638	1.22	2048	2.8	-40 to +85	5x5x1.2mm DFN
KXP84-2050	XYZ	2	+/- 1638	1.22	2048	3.3	-40 to +85	5x5x1.2mm DFN

An evaluation board is available upon request.