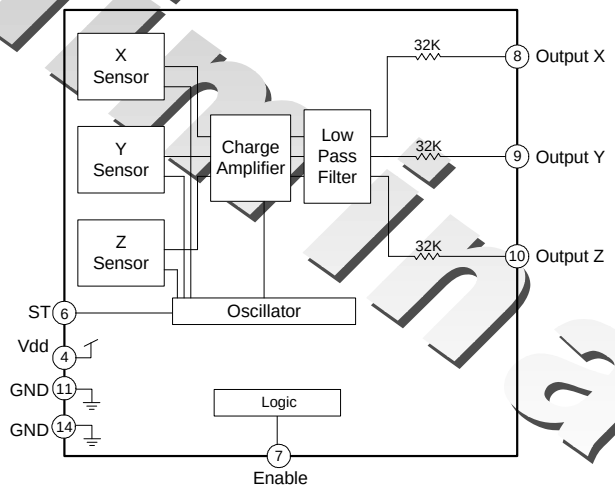
Kionix®	**± 2 g Tri-Axis Analog PRELIMINARY Specifications**	**PART NUMBER: KXPC4 Rev 0.1 Mar 07**

Product Description

The KXPC4 is a tri-axis, analog output, silicon micromachined accelerometer with a full-scale output range of ±2g (19.6 m/s^2). The sense element is fabricated using Kionix's proprietary plasma micromachining process technology. Acceleration sensing is based on the principle of a differential capacitance arising from acceleration-induced motion of the sense element, which further utilizes common mode cancellation to decrease errors from process variation, temperature, and environmental stress. The sense element is hermetically sealed at the wafer level by bonding a second silicon lid wafer to the device using a glass frit. A separate ASIC device packaged with the sense element provides signal conditioning and self-test. The accelerometer is delivered in an 5 x 5 x 1.2mm Dual Flat No-lead (DFN) plastic package operating from a 1.8 - 5V DC supply.

Functional Diagram



Preliminary

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Product Specifications

Table 1. Mechanical

(specifications are for operation at V_{dd} = 2.8V and T = 25ºC unless stated otherwise)

Parameters	Units	Min	Typical	Max
Operating Temperature Range	ºC	-40	-	85
Zero-g Offset	V	1.316	1.40	1.484
Zero-g Offset Variation from RT over Temp.	mg/ºC		±1.0	
Sensitivity	mV/g	543	560	577
Sensitivity Variation from RT over Temp.	%/ºC		±0.015	
Offset Ratiometric Error (V_{dd} = 2.8V ± 5%)	%	-	0.3	1.5
Sensitivity Ratiometric Error (V_{dd} = 2.8V ± 5%)	%	-	0.5	1.5
Non-Linearity	% of FS		0.1	
Cross Axis Sensitivity	%		2.0	
Self Test Output change on Activation	g	1.6 (xy) 0.4 (z)	2.0 (xy) 0.7 (z)	2.4 (xy) 1.0 (z)
Mechanical Resonance (-3dB)[1]	Hz		3300 (xy) 1700 (z)	
Noise Density (on filter pins)	µg / √Hz		175	

Notes:

1. Resonance as defined by the dampened mechanical sensor.

Table 2. Electrical

(specifications are for operation at V_{dd} = 2.8V and T = 25ºC unless stated otherwise)

Parameters		Units	Min	Typical	Max
Supply Voltage (V_{dd})	Operating	V	1.8	2.8	5.25
Current Consumption	Operating	µA	150	175	200
	Standby	nA	-	-	100
Analog Output Resistance(R_{out})		kΩ	24	32	40
Power Up Time[1]		ms	-	8	-
Bandwidth (-3dB)[2]		Hz	-	100	-

Notes:

1. For default filter frequency. Power up time can also be determined by 5 times the RC time constant of the optional user defined low pass filter.

2. Factory programmable to have a switched capacitor low pass filter at 2kHz, 1kHz, 500Hz, 100Hz, 50Hz or no low pass filter. Optionally, the user can define with external capacitors. Maximum defined by the frequency response of the sensors.

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Table 3. Environmental

Parameters		Units	Min	Typical	Max
Supply Voltage (V_{dd})	Absolute Limits	V	-0.3	-	6.0
Operating Temperature Range		ºC	-40	-	85
Storage Temperature Range		ºC	-55	-	150
Mech. Shock (powered and unpowered)		g	-	-	5000 for 0.5ms
ESD	HBM	V	-	-	3000

Caution: ESD Sensitive and Mechanical Shock Sensitive Component, improper handling can cause permanent damage to the device.

The 14-pin DFN package conforms to European Union Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS).

Soldering

Soldering recommendations available upon request or from www.kionix.com.

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Application Schematic

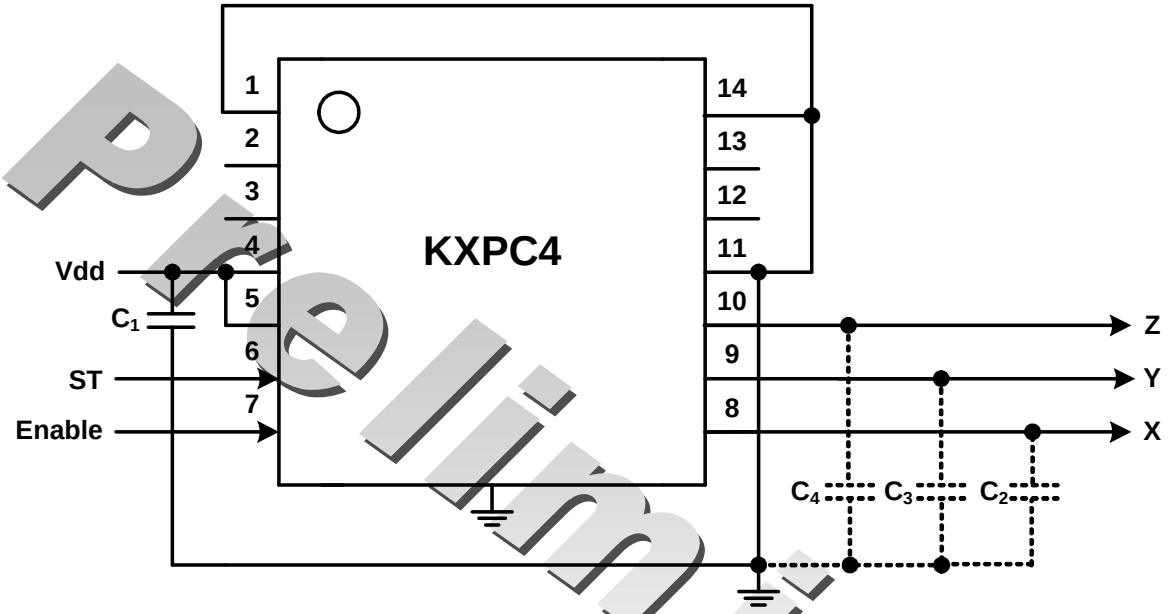

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Table 4. KXPC4 Pin Descriptions

Pin	Name	Description
1	GND	Ground
2	NC	Not Connected Internally
3	NC	Not Connected Internally
4	Vdd	The power supply input. Decouple this pin to ground with a 0.1uF ceramic capacitor (C_1).
5	SDA	Pin must be held at Vdd for normal operation.
6	ST	Self Test. Ground: Normal mode; VDD: Self Test mode.
7	Enable	Enable pin. Pin must be held at Vdd for normal operation.
8	X Output	Analog output of the x-channel (Optional filter capacitor, C_2, shown).
9	Y Output	Analog output of y-channel (Optional filter capacitor, C_3, shown).
10	Z Output	Analog output of z-channel (Optional filter capacitor, C_4, shown).
11	GND	Ground
12	NC	Not Connected Internally
13	NC	Not Connected Internally
14	GND	Ground
	Center Pad	Ground

Application Design Equations

The bandwidth is determined by a factory programmable switched capacitor filter. The default setting is 100Hz. The filter can also be set at 2kHz, 1kHz, 500Hz, and 50Hz. Alternatively, bandwidth can be reduced by addition of a capacitor on the output pins 8, 9, and 10 according to the equation:

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

Note:
When the enable pin is connected to GND or left floating, the KXPC4 is in low power mode. When the enable pin is tied to Vdd, the unit is fully functional.

Test Specifications

***Special Characteristics**:*

These characteristics have been identified as being critical to the customer. Every part is tested to verify its conformance to specification prior to shipment.

Table 5. Test Specifications

Parameter		Specification	Test Conditions
Zero-g Offset @ RT		1.40 ± 0.084 V	25ºC, V_{dd} = 2.8V
Sensitivity @ RT		560 ± 17 mV/g	25ºC, V_{dd} = 2.8V
Current Consumption	Operating	0.6 <= I_{dd} <= 1.5 mA	25ºC, V_{dd} = 2.8V

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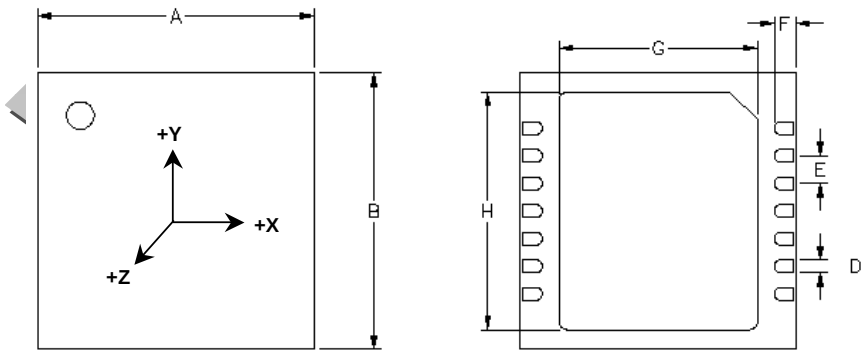
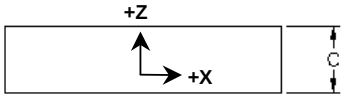
Package Dimensions and Orientation

5 x 5 x 1.2 mm DFN





Dimension	mm			inch		
	Min	Nom	Max	Min	Nom	Max
A		5.00			0.197	
B		5.00			0.197	
C	1.10	1.20	1.30	0.043	0.047	0.051
D	0.18	0.23	0.28	0.007	0.009	0.011
E		0.50			0.020	
F	0.35	0.40	0.45	0.014	0.016	0.018
G	3.50	3.60	3.70	0.138	0.142	0.146
H	4.20	4.30	4.40	0.165	0.169	0.173

All dimensions and tolerances conform to ASME Y14.5M-1994

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

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Static X/Y/Z Output Response versus Orientation to Earth's surface (1-g):

Position	1	2	3	4	5	6
Diagram					Top Bottom	Bottom Top
X	1.40 V	1.96 V	1.40 V	0.84 V	1.40 V	1.40 V
Y	1.96 V	1.40 V	0.84 V	1.40 V	1.40 V	1.40 V
Z	1.40 V	1.40 V	1.40 V	1.40 V	1.96 V	0.84 V
X-Polarity	**0**	**+**	**0**	**-**	**0**	**0**
Y-Polarity	**+**	**0**	**-**	**0**	**0**	**0**
Z-Polarity	**0**	**0**	**0**	**0**	**+**	**-**

Earth's Surface

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