# Tri (X,Y,Z) Axis Accelerometer Specifications

**PART NUMBER:**

**KXM52-8100**

**Rev. -**
**Mar 07**


Room 1206,The Pavilion Hotel,
Huaqiang Road North,ShenZhen,China
Tel: 0755-25325461
Fax: 0755-25325460
www.fuanda.com


| PPROVED BY | | DATE |
|---|---|---|
| PROD. MGR. | S. Miller | 3/30/07 |
| TECH. MGR. | K. Foust | 3/30/07 |
| TEST MGR. | J. Chong | 3/30/07 |
| VP ENG. | T. Davis | 3/30/07 |

| ECN # | REV | PG # | REVISION DESCRIPTION | DATE | REV'D BY |
|---|---|---|---|---|---|
| | - | | Initial Release | 3/30/07 | K. Foust |
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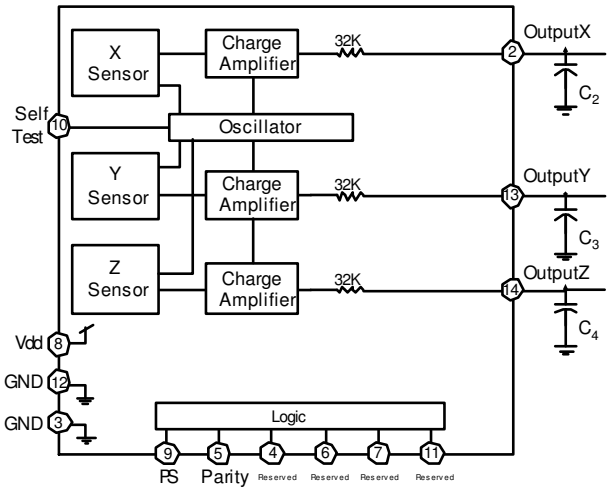
## Product Description

The KXM52-8100 is a three axis, analog output silicon micromachined accelerometer with a full-scale output range of ±1.0g (9.8 m/s$^2$) in the x and y directions, ±1.5g (14.7 m/s$^2$) in the z direction. Plasma micromachining is used to fabricate the sense element using Kionix's proprietary deep reactive ion etch processes. Kionix linear accelerometers function on the principle of differential capacitance; acceleration causes displacement of a silicon structure resulting in a capacitance change. Common mode cancellation is used to decrease errors from process variation, temperature, and environmental stress. The sense element is hermetically sealed at the wafer level by bonding a silicon lid wafer to the device using glass frit. A separate ASIC device packaged with the sense element provides signal conditioning and self-test. The accelerometer is delivered in a 5 x 5 x 1.8 mm Dual Flat No-lead (DFN) package.

## Functional Diagram



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## Product Specifications

### Table 1. Mechanical

(specifications are for operation at $V_{dd}$ = 3.3V and T = 25ºC unless stated otherwise)

| Parameters | Units | Min | Target | Max |
|---|---|---|---|---|
| Operating Temperature Range | ºC | -40 | - | 85 |
| Zero-g Offset | V | 1.600 | 1.650 | 1.700 |
| Zero-g Offset Variation from RT over Temp. | mg | -150 | - | 150 |
| Sensitivity | mV/g (xy)<br>mV/g (z) | 1280<br>854 | 1320<br>880 | 1360<br>906 |
| Sensitivity Variation from RT over Temp. | % | -2 | 0 | +2 |
| Offset Ratiometric Error ($V_{dd}$ = 3.3V ± 5%) | % | - | 0.4 | 1.5 |
| Sensitivity Ratiometric Error ($V_{dd}$ = 3.3V ± 5%) | % | - | 0.4 | 1.5 |
| Non-Linearity | % of FS | - | 0.1 | 0.5 |
| Cross Axis Sensitivity | % | - | 2.0 | 3.0 |
| Self Test Output change on Activation | g | 0.5 (xy)<br>0.1 (z) | 0.6 (xy)<br>0.2 (z) | 0.7 (xy)<br>0.3 (z) |
| Bandwidth (-3dB)[1] | Hz | - | - | 3100 (XY)<br>1300 (Z) |
| Noise Density (on filter pins) | µg / √Hz | - | 35 (xy)<br>65 (z) | 100 |

Notes:

1. User definable with external capacitors. Maximum defined by the frequency response of the sensors.

### Table 2. Electrical

(specifications are for operation at $V_{dd}$ = 3.3V and T = 25ºC unless stated otherwise)

| Parameters | | Units | Min | Target | Max |
|---|---|---|---|---|---|
| Supply Voltage ($V_{dd}$) | Operating | V | 2.5 | 3.3 | 5.5 |
| Current Consumption | Operating[1] | mA | 1.3 | 1.7 | 2.3 |
| | Standby | µA | - | - | 10 |
| Analog Output Resistance($R_{out}$) | | kΩ | 24 | 32 | 40 |
| Power Up Time[1] | | ms | | $5*R_{out}*C$ | |

Notes:

1. Power up time is determined by 5 times the RC time constant of the user defined low pass filter.

**Table 3. Environmental**

| Parameters | | Units | Min | Target | Max |
|---|---|---|---|---|---|
| Supply Voltage ($V_{dd}$) | Absolute Limits | V | -0.3 | - | 7.0 |
| Operating Temperature Range | | ºC | -40 | - | 85 |
| Storage Temperature Range | | ºC | -55 | - | 150 |
| Mech. Shock (powered and unpowered) | | g | - | - | 4600 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).

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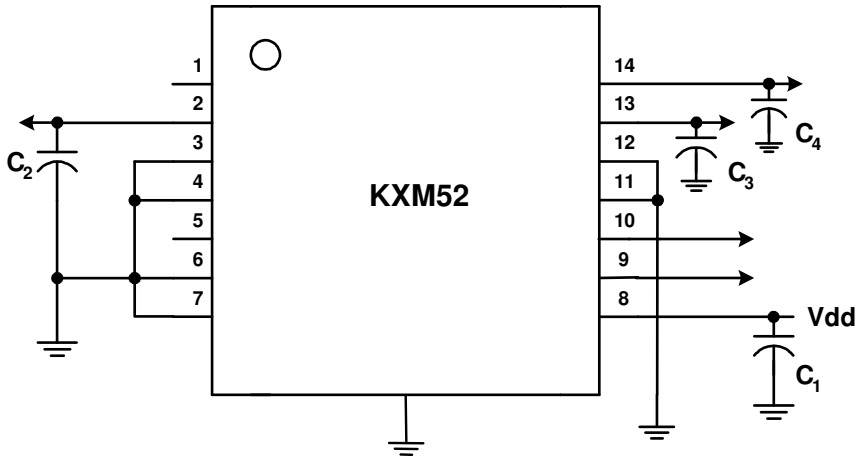
## Application Schematic and Pin Function Table




### Table 4. KXM52 Pin Descriptions

| Pin | Name | Description |
|---|---|---|
| 1 | NC | Not Connected Internally. |
| 2 | 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. |
| 3 | GND | Ground |
| 4 | Reserved | Factory reserved. Connect this pin to ground. |
| 5 | Parity | Checks EEPROM for parity error. Float if not used. |
| 6 | Reserved | Factory reserved. Connect this pin to ground. |
| 7 | Reserved | Factory reserved. Connect this pin to ground. |
| 8 | Vdd | The power supply input. Decouple this pin to ground with a 0.1uF ceramic capacitor ($C_1$). |
| 9 | PS | Power shutdown: **Low** – Normal operation; **High** – Device is in self-test mode. |
| 10 | ST | Self Test. **Low** - Normal operation; **High** – Device is in self-test mode. |
| 11 | Reserved | Factory reserved. Connect this pin to ground. |
| 12 | GND | Ground |
| 13 | Y Output | Analog output of y-channel. Optionally, a capacitor ($C_3$) placed between this pin and ground will form a low pass filter. |
| 14 | DNC | Do Not Connect |
| | Center Pad | Ground |

## Application Design Equations

The bandwidth is determined by the filter capacitors connected from pins 2, 13 and 14 to ground. The response is single pole. Given a desired bandwidth, $f_{BW}$, the filter capacitors are determined by:

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

## ! *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.

| Parameters | | Specification | Test Conditions |
|---|---|---|---|
| Zero-g Offset @ RT | | 1.650 ± 0.200 V | 25ºC, $V_{dd}$ = 3.3V |
| Sensitivity @ RT | | 1320 ± 30 mV/g<br>880 ± 20 mV/g | 25ºC, $V_{dd}$ = 3.3V |
| Cross Axis Sensitivity | | < 3% | 25ºC, $V_{dd}$ = 3.3V |
| Current Consumption | Operating | 1.3 <= $I_{dd}$ <= 2.0 mA | 25ºC, $V_{dd}$ = 3.3V |

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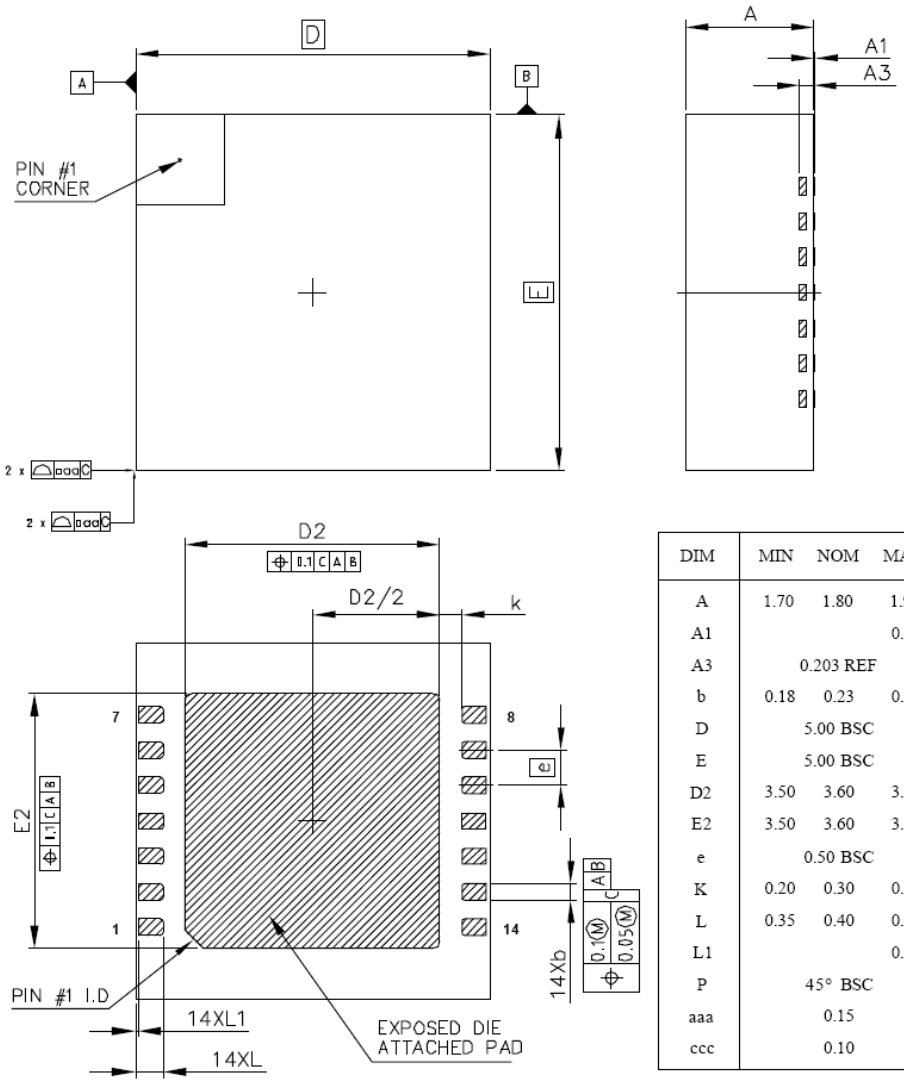
## Package Dimensions




| DIM | MIN | NOM | MAX |
|---|---|---|---|
| A | 1.70 | 1.80 | 1.90 |
| A1 | | | 0.05 |
| A3 | | 0.203 REF | |
| b | 0.18 | 0.23 | 0.28 |
| D | | 5.00 BSC | |
| E | | 5.00 BSC | |
| D2 | 3.50 | 3.60 | 3.70 |
| E2 | 3.50 | 3.60 | 3.70 |
| e | | 0.50 BSC | |
| K | 0.20 | 0.30 | 0.40 |
| L | 0.35 | 0.40 | 0.45 |
| L1 | | | 0.10 |
| P | | 45° BSC | |
| aaa | | 0.15 | |
| ccc | | 0.10 | |

NOTES

1.0 DIMENSIONING & TOLERANCEING CONFIRM TO ASME Y14.5M-1994.

2.0 ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.

3.0 DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.25mm AND 0.30mm FROM TERMINAL TIP. DIMENSION L1 REPRESENTS TERMINAL FULL BACK FROM PACKAGE EDGE UP TO 0.1mm IS ACCEPTABLE.

4.0 COPLANARITY APPLIES TO THE EXPOSED HEAT SLUG AS WELL AS THE TERMINAL.

5.0 RADIUS ON TERMINAL IS OPTIONAL.

## Package Orientation