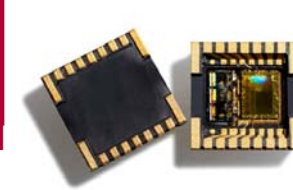


Data Sheet



SCA3000-E04 3-AXIS ULTRA LOW POWER ACCELEROMETER WITH DIGITAL SPI INTERFACE

Features

- 2.35 V – 3.6 V supply voltage, 1.7 – 3.6 V digital I/O voltage
- ± 6 g measurement range
- SPI digital interface
- Selectable frequency response
- Ultra low power consumption (2.5 V, 120 μ A typ)
- 64 samples/axis buffer memory for output acceleration data and advanced features enable significant power and resource savings at system level
- Interrupt signal triggered by motion and free fall
- Size 7x7x1.8 mm
- Proven capacitive 3D-MEMS technology
- High shock durability
- RoHS compliant / lead free soldering

Applications

- SCA3000-E04 is targeted to battery operated wrist and hand-held devices. Typical applications are but not limited
- Motion activated functions in mobile terminals and antitheft systems
 - Pedometers and activity monitors

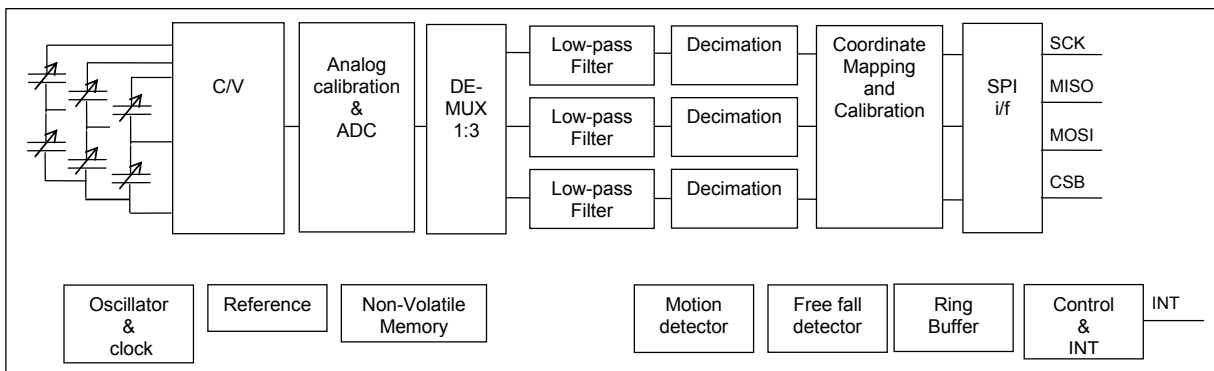


Figure 1 SCA3000-E04 Block Diagram

Performance Characteristics ¹⁾

| Parameter | Condition | Typical supply range 2.35 – 2.7 V | | | Extended supply range 2.7 – 3.6 V | | | Units |
|--|------------------------------|--------------------------------------|-------------------|------|--------------------------------------|-------------------|-----|---------|
| | | Min | Typ ²⁾ | Max | Min | Typ ²⁾ | Max | |
| Analog and digital Vdd | | 2.35 | 2.5 | 2.7 | - | 3.3 | - | V |
| Digital I/O Vdd | Vdd ≥ Digital I/O Vdd | 1.7 | 1.8 / 2.5 | 2.7 | - | 3.3 | - | V |
| Operating temperature ** | | -40 | - | 85 | -40 | - | 85 | °C |
| Current consumption * | Reset ³⁾ | - | <7 | 12 | - | <9 | - | μA |
| | Active | - | 120 | 145 | - | 150 | - | μA |
| | Motion Detection mode | - | 120 | 145 | - | 150 | - | μA |
| Acceleration range * ⁴⁾ | Nominal | -6 | - | 6 | - | ± 6 | - | g |
| Offset calibration error * | Z-axis +1g position | -80 | - | 80 | - | ± 200 | - | mg |
| Offset temperature error ** ⁵⁾ | -40 ... +85 °C | -9 | ±1.6 | 9 | - | ±1.6 | - | mg/°C |
| Sensitivity * ⁶⁾ | | - | 500 | - | - | 500 | - | Count/g |
| Sensitivity calibration error * | | -3 | - | +3 | - | ± 3 | - | % |
| Sensitivity temperature error ** ⁷⁾ | -40 ... +85 °C | -0.05 | ±0.015 | 0.05 | - | ±0.015 | - | %/°C |
| Non-Linearity ** ⁸⁾ | | -3 | ±1 | 3 | - | ±1 | - | % FS |
| Cross-Axis sensitivity ** ⁹⁾ | | - | ±4 | - | - | ±4 | - | % |
| Bandwidth ** ¹⁰⁾ | Measurement mode | 30 | 38 | 46 | - | 38 | - | Hz |
| | Narrow band measurement mode | 7 | 9 | 11 | - | 9 | - | Hz |
| | Wide band measurement mode | 50 | 70 | 100 | - | 70 | - | Hz |
| Noise ** ¹¹⁾ | Measurement mode | - | 18 | 36 | - | 18 | - | mg RMS |
| | Narrow band measurement mode | - | 10 | 20 | - | 10 | - | mg RMS |
| | Wide band measurement mode | - | 30 | 60 | - | 30 | - | mg RMS |
| Output data rate ** | Measurement mode | 80 | 100 | 120 | - | 93 | - | Hz |
| | Narrow band measurement mode | 40 | 50 | 60 | - | 45 | - | Hz |
| | Wide band measurement mode | 320 | 400 | 480 | - | 400 | - | Hz |
| Turn on time ** ¹²⁾ | Measurement mode | - | 35 | 70 | - | 35 | - | ms |
| | Narrow band measurement mode | - | 200 | 400 | - | 200 | - | ms |
| | Wide band measurement mode | - | 20 | 40 | - | 20 | - | ms |
| Output load ** | | - | - | 35 | - | - | 35 | pF |
| SPI clock rate ** | | - | - | 325 | - | - | 325 | kHz |

* 100% tested in production

** Qualified during product validation

1) The product is factory calibrated at 2.5 V in room temperature.

2) Typical values are not guaranteed.

3) Includes the current through the internal 400 kΩ pull-up resistor connected to digital I/O Vdd.

4) Range defined as $\sqrt{x^2+y^2+z^2} \leq 6g$. The measuring range is tested on sensing element level. FS = 6g.

5) Offset temperature error = {Count(0g)-Offset} / Sensitivity [g]. Sensitivity = Calibrated sensitivity. Offset= Calibrated offset.

6) Sensitivity = {Count(+1g) - Count(-1g)}/2 [Count/g].

7) Sensitivity temperature error = {[Count(+1g)-Count(-1g)]/2 - Sensitivity} / Sensitivity x 100% [%]. Sensitivity = Calibrated sensitivity.

8) Best fit straight line.

9) The cross-axis sensitivity determines how much acceleration, perpendicular to the measuring axis, couples to the output. The total cross-axis sensitivity is the geometric sum of the sensitivities of the two axes which are perpendicular to the measuring axis. The angular alignment error between X, Y and Z axis is included into the cross axis sensitivity.

10) Frequency responses according to Figure 3, Figure 4 and Figure 5.

- 11) Average noise/axis over the measurement bandwidth defined as $\sqrt{\frac{1}{3}(n_x^2 + n_y^2 + n_z^2)}$, where n_x , n_y and n_z are the measured signal's standard deviation due to noise in x, y and z directions.
- 12) Settling error less than 1% of FS.

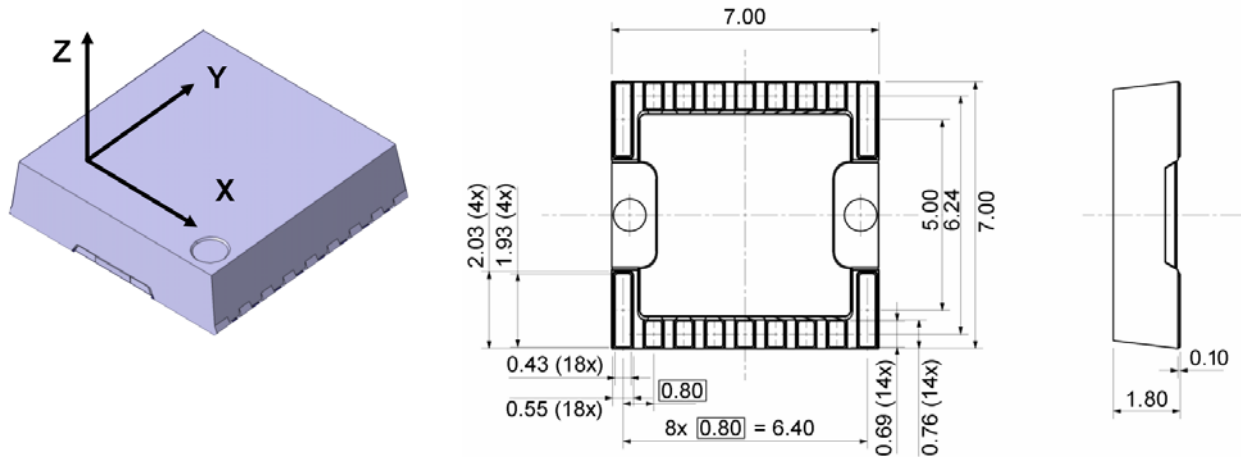


Figure 2 Sensing directions and package dimensions in mm with $\pm 50 \mu\text{m}$ tolerance.

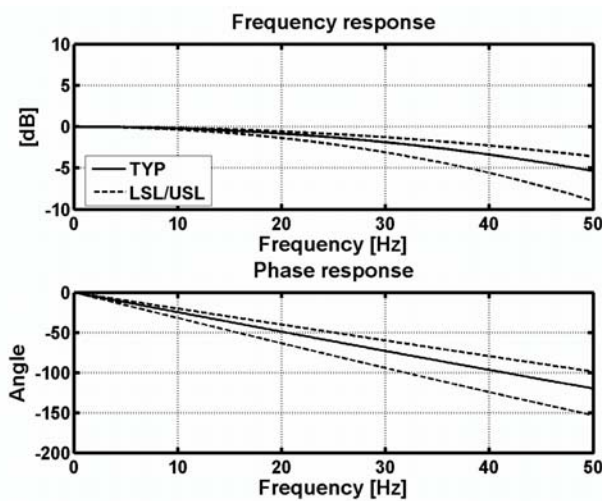


Figure 3 Frequency response of SCA3000-E04 in measurement mode

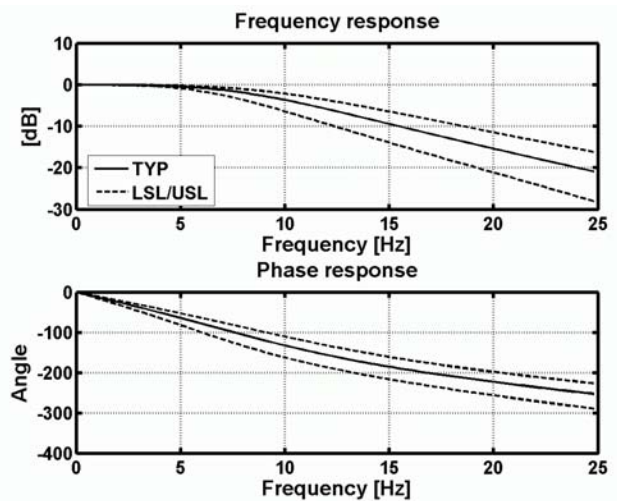


Figure 4 Frequency response of SCA3000-E04 in narrow band measurement mode

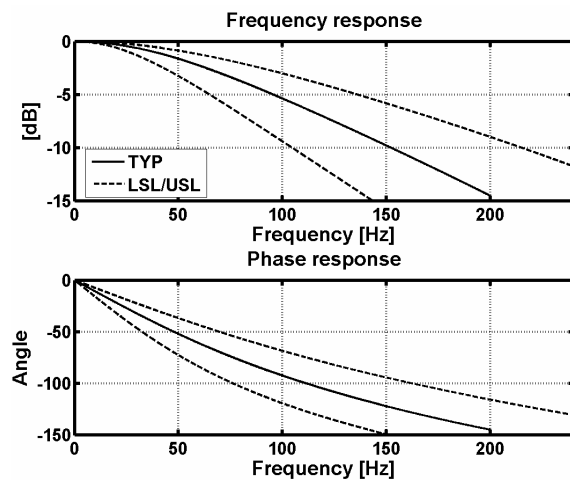


Figure 5 Frequency response of SCA3000-E04 in wide band measurement mode

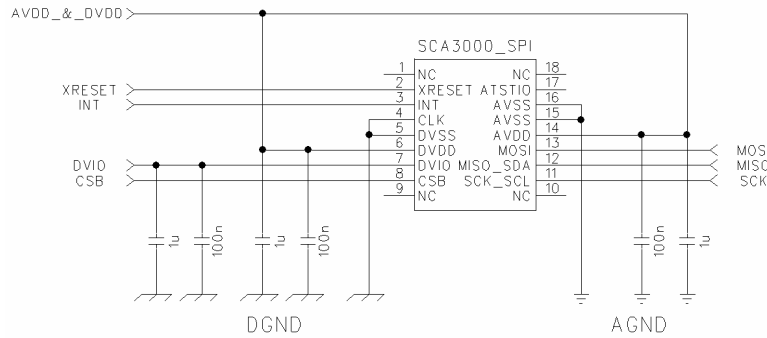


Figure 6 Application schematic

| Pin # | Name | Function |
|-------|----------|----------------------------|
| 1 | NC | Not connected |
| 2 | XRESET | External reset, active low |
| 3 | INT | Interrupt output |
| 4 | CLK | Digital ground |
| 5 | DVSS | Digital ground |
| 6 | DVDD | Digital supply |
| 7 | DVIO | Digital I/O supply |
| 8 | CSB | Chip select |
| 9 | NC | Not connected |
| 10 | NC | Not connected |
| 11 | SCK_SCL | SPI serial clock (SCK) |
| 12 | MISO_SDA | SPI data out (MISO) |
| 13 | MOSI | SPI data in (MOSI) |
| 14 | AVDD | Analog supply |
| 15 | AVSS | Analog ground |
| 16 | AVSS | Analog ground |
| 17 | ATSTIO | Not connected |
| 18 | NC | Not connected |

Table 1 Pin descriptions

Document Change Control

| Rev. | Date | Change Description |
|------|-----------|---|
| 0.3 | 21-Apr-06 | New template |
| 0.4 | 13-Jun-06 | Dimensions updated |
| 0.5 | 01-Sep-06 | Bandwidth in measurement mode, definition and value of non-linearity, cross axis sensitivity updated Figures 3 and 4 updated |
| A | 15-Sep-06 | First official release. Typos corrected. |
| A.01 | 26-Oct-06 | Wide band mode added. |
| A.02 | 04-Jan-07 | Wide band mode noise and turn-on time added. |
| A.03 | 31-Oct-07 | Figure 2 updated |
| B | 28-Aug-08 | Performance characteristics updated |