

# Data Sheet



## CMA3000-A01 3-AXIS LOW POWER ANALOG OUTPUT ACCELEROMETER

### Features

- 1.7 V – 3.6 V supply voltage
- Ratiometric analog voltage output for x, y and z acceleration
- User selectable  $\pm 2$  g and  $\pm 8$  g measurement ranges
- Low current consumption
  - Active 180  $\mu$ A
  - Power down < 0.1  $\mu$ A
- Size 2x2x0.95 mm<sup>3</sup>
- Proven capacitive 3D-MEMS technology
- High shock durability
- RoHS compliant / lead free soldering

### Applications

CMA3000-A01 is targeted to battery operated devices. Typical applications are but not limited

- Gaming input devices
- Computer peripherals
- Free fall detection
- Activity monitoring

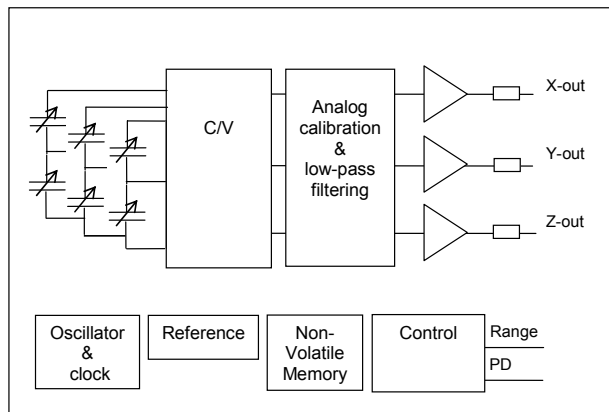


Figure 1 CMA3000-A01 Block Diagram

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## Performance Characteristics Targets <sup>1)</sup>

| Parameter                                      | Condition                   | Typical supply range<br>1.7 – 2.7 V |                   |      | Extended supply<br>range 2.7 – 3.6 V |                   |     | Units  |
|--|-----------------------------|-------------------------------------|-------------------|------|--------------------------------------|-------------------|-----|--------|
|  |                             | Min                                 | Typ <sup>2)</sup> | Max  | Min                                  | Typ <sup>2)</sup> | Max |        |
| Vdd  |                             | 1.7                                 | 2.5               | 2.7  | 2.7                                  | 3.3               | 3.6 | V      |
| Operating temperature **                       |                             | -40                                 | -                 | 85   | -40                                  | -                 | 85  | °C     |
| Current consumption *                          | Power down                  | -                                   | <0.1              |      | -                                    | <0.1              | -   | μA     |
|  | Active                      | -                                   | 180               |      | -                                    | 200               | -   |        |
| Acceleration range *                           | Range pin set to "1"        | -2                                  | -                 | 2    | -2                                   | -                 | 2   | g      |
|  | Range pin set to "0"        | -8                                  | -                 | 8    | -8                                   | -                 | 8   |        |
| Offset * <sup>3)</sup>                         | X and Y axis                | -                                   | Vdd/2             | -    | -                                    | Vdd/2             | -   | V      |
|  | Z axis                      | -                                   | Vdd/2<br>+sens    | -    | -                                    | Vdd/2<br>+sens    | -   |        |
| Offset calibration error * <sup>3)</sup>       | Full scale=2 g,<br>T=+25 °C | -100                                | ±25               | +100 | -                                    | ±100              | -   | mg     |
| Offset temperature error ** <sup>4)</sup>      | -40 ... +85 °C              |                                     |                   |      |                                      |                   |     |        |
|  | X and Z axis                |                                     | ±1                |      | -                                    | ±1                | -   | mg/°C  |
|  | Y axis                      |                                     | ±2.5              |      | -                                    | ±2.5              | -   |        |
| Sensitivity * <sup>5)</sup>                    | Full scale=2 g              | -                                   | Vdd/6             | -    | -                                    | Vdd/6             | -   | V/g    |
|  | Full scale=8 g              | -                                   | Vdd/24            | -    | -                                    | Vdd/24            | -   | V/g    |
| Sensitivity calibration error *                | T=+25 °C                    | -10                                 | -                 | +10  | -                                    | ±10               | -   | %      |
| Sensitivity temperature error ** <sup>6)</sup> | -40 ... +85 °C              |                                     | ±0.02             |      |                                      | ±0.02             |     | %/°C   |
| Non-Linearity ** <sup>7)</sup>                 |                             | -                                   | 1.5               | 3    | -                                    | 1.5               | -   | % FS   |
| Cross-Axis sensitivity ** <sup>8)</sup>        |                             | -                                   | 1                 | -    | -                                    | 1                 | -   | %      |
| Bandwidth** <sup>9)</sup>                      | C <sub>L</sub> =100 nF      | 30                                  | 50                | 70   | 30                                   | 50                | 70  | Hz     |
|  | C <sub>L</sub> =0 nF        |                                     |                   |      |                                      |                   |     |        |
|  | X and Z axis                |                                     | 120               |      | -                                    | 120               | -   | Hz     |
| Noise ** <sup>10)</sup>                        | Y axis                      |                                     | 200               |      | -                                    | 200               | -   |        |
|  | Full scale=2 g              | -                                   | 300               | 600  | -                                    | 300               | 600 | μg/√Hz |
|  | Full scale=8 g              | -                                   | 300               | 600  | -                                    | 300               | 600 | μg/√Hz |
| Output resistance                              |                             | 28                                  | 32                | 36   | 28                                   | 32                | 36  | kΩ     |

\* 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) Z-axis +1g position. Soldering process can cause offset shift which is typically less than 130 mg. Please see TN68\_CMA3000\_Assembly\_Instructions for further details.

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

5) Sensitivity = {Vout(+1g) - Vout(-1g)}/2 [V/g] .

6) Sensitivity temperature error = {[Vout(+1g)-Vout(-1g)]/2 - Sensitivity} / Sensitivity x 100% [%].

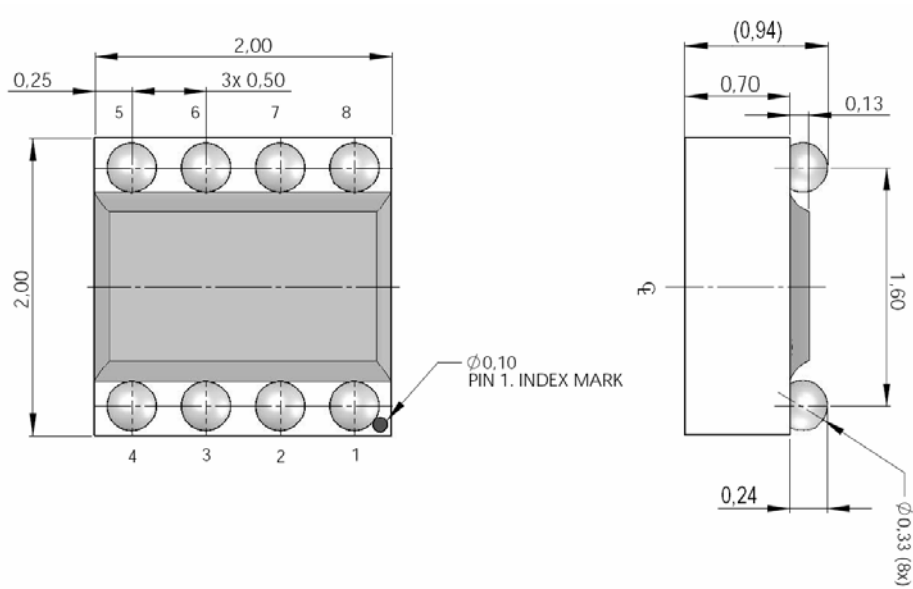
Sensitivity = Calibrated sensitivity.

7) Best fit straight line.

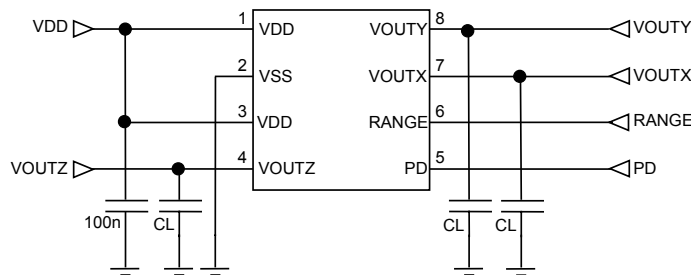
8) The cross-axis sensitivity determines how much acceleration, perpendicular to the measuring axis, couples to the output. The total cross-axis sensitivity is the geometric sum of the sensitivities of the two axes which are perpendicular to the measuring axis. The angular alignment error between X,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

9) Frequency response -3dB roll off frequency =  $1/(2\pi \cdot 32k\Omega \cdot C_L)$ , when  $C_L \geq 50$  nF.

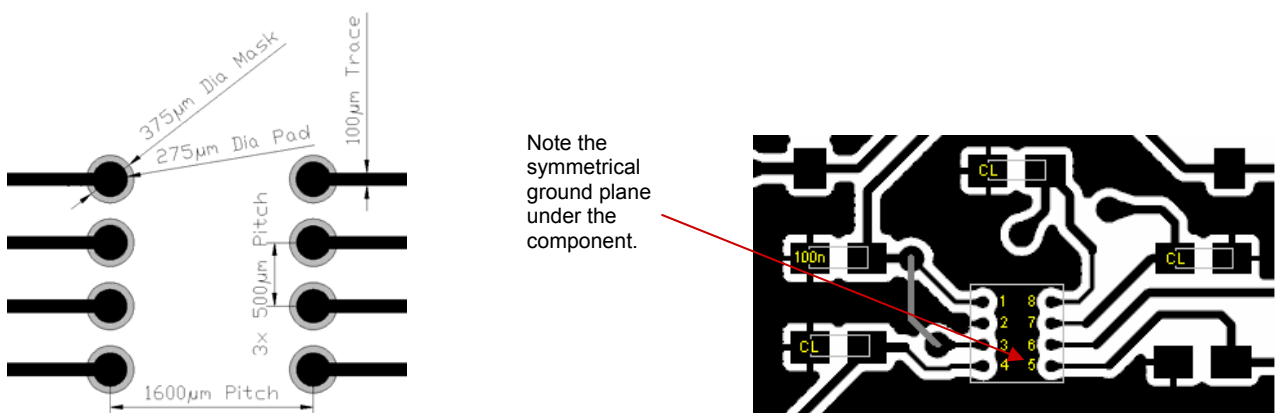
10) Average noise/axis over the measurement bandwidth defined as  $\sqrt{\frac{1}{3}(n_x^2 + n_y^2 + n_z^2)}$ , where  $n_x$ ,  $n_y$  and  $n_z$  are the measured signal's standard deviation due to noise in x, y and z directions.



**Figure 2** Package dimensions in mm with  $\pm 50 \mu\text{m}$  tolerance.



**Figure 3** Application schematic



**Figure 4** Recommended layout pattern (not actual size, for reference only)

**Table 1** Pin descriptions

| Pin # | Name  | Function                     |
|-------|-------|------------------------------|
| 1     | VDD   | Supply voltage               |
| 2     | VSS   | Ground                       |
| 3     | VDD   | Supply voltage               |
| 4     | VOUTZ | Output voltage Z-channel     |
| 5     | PD    | Power Down                   |
| 6     | RANGE | Acceleration Range selection |
| 7     | VOUTX | Output voltage X-channel     |
| 8     | VOUTY | Output voltage Y-channel     |

### Document Change Control

| Rev. | Date      | Change Description   |
|------|-----------|--|
| 0.1  | 15-May-07 | 1 <sup>st</sup> version  |
| 0.2  | 22-May-07 | Application schematic added  |
| 0.3  | 24-Aug-07 | Pin order updated, component layout pattern added  |
| 0.4  | 10-Sep-07 | Block diagram updated  |
| 0.5  | 11-Jan-08 | Acceleration range control polarity updated  |
| 0.6  | 16-Jan-08 | Offset level added, package drawing, pad layout updated  |
| 0.7  | 14-Feb-08 | Performance characteristics update   |
| 0.8  | 03-Jun-08 | Target values updated. Figure 2 updated.   |
| 0.9  | 04-Jul-08 | Figure 2 updated.  |
| 0.10 | 28-Aug-08 | Current consumption, sensitivity and sensitivity temperature error, non-linearity, cross axis sensitivity and noise updated. |
| 0.11 | 10-Dec-08 | Performance characteristics and notes updated. Figure 2 updated.   |



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