DUAL AXIS INCLINOMETER MODULE

SAS121T-D09

PRODUCT SPECIFICATION
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1. **General description**
This document describes an inclination module, suitable for various industrial applications. The sensor used inside is the muRata 3D-MEMS based inclinometer component. Output interface is analog voltage output.

1.1. **Block diagram**
Products are based on SCA100T components, mounted on PCB. Electronics is encapsulated in a robust metal housing, with pigtail.

![Block diagram]

1.2. **Inclinometer Features**
- Accurate ± 90° measurement, single or dual axis
- DC response with low sensing element frequency response
- Easy to use and design in
- High resolution analog output
- Wide temperature range

**Benefits**
- Excellent long term stability
- Sensing element controlled frequency
- Outstanding shock durability
- Harsh environment robustness
2. Electrical specifications

2.1. Absolute maximum ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Comment</th>
<th>Min.</th>
<th>Typ</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td></td>
<td>4,5</td>
<td>5</td>
<td>5,5</td>
<td>V</td>
</tr>
<tr>
<td>Reverse polarity protection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current consumption</td>
<td></td>
<td>4</td>
<td>6</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Output load</td>
<td>resistive</td>
<td>10</td>
<td></td>
<td></td>
<td>kΩ</td>
</tr>
<tr>
<td></td>
<td>capacitive</td>
<td></td>
<td></td>
<td>10</td>
<td>nF</td>
</tr>
<tr>
<td>Storage temp</td>
<td></td>
<td>-40</td>
<td>90</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>Operating temp</td>
<td></td>
<td>-25</td>
<td>85</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>Mechanical shock</td>
<td>1m drop on concrete</td>
<td>20,000</td>
<td></td>
<td></td>
<td>g</td>
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</table>

2.2. Electrical Specifications

<table>
<thead>
<tr>
<th>T / Q 1)</th>
<th>Parameter</th>
<th>Condition</th>
<th>SAS121T-D09</th>
<th>Units</th>
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<tbody>
<tr>
<td>T</td>
<td>Measurement range 2)</td>
<td>± 90</td>
<td></td>
<td>°</td>
</tr>
<tr>
<td>T</td>
<td>Measurement axis</td>
<td>(see &quot;Directions&quot;)</td>
<td>X-Y</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>Offset 3)</td>
<td>Output at 0°</td>
<td>2,5</td>
<td>V</td>
</tr>
<tr>
<td>T</td>
<td>Offset calibration error</td>
<td>Max. deviation</td>
<td>±1</td>
<td>°</td>
</tr>
<tr>
<td>Q</td>
<td>Offset temperature error</td>
<td>0...70°C (@0° pos.)</td>
<td>±0,3</td>
<td>°</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-25...85°C</td>
<td>±0,8</td>
<td>°</td>
</tr>
<tr>
<td>T</td>
<td>Sensitivity 4)</td>
<td>@ 0° (offset position)</td>
<td>35</td>
<td>mV/°</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>V/g</td>
</tr>
<tr>
<td>T</td>
<td>Sensitivity calibration accuracy</td>
<td></td>
<td>±1</td>
<td>%</td>
</tr>
<tr>
<td>Q</td>
<td>Sensitivity temperature error</td>
<td>0...70°C</td>
<td>-0,8...0,3</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-25...85°C</td>
<td>-1,5...0,5</td>
<td>%</td>
</tr>
<tr>
<td>Q</td>
<td>Angular nonlinearity</td>
<td>Arcsine function of acc.</td>
<td>N / A</td>
<td>°</td>
</tr>
<tr>
<td>Q</td>
<td>Acceleration nonlinearity</td>
<td>Best fit FS straight line</td>
<td>±10</td>
<td>mg</td>
</tr>
<tr>
<td>Q</td>
<td>Frequency response –3dB 5)</td>
<td>18 ±10</td>
<td>Hz</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>Cross-axis sensitivity 5)</td>
<td></td>
<td>4</td>
<td>%</td>
</tr>
<tr>
<td>Q</td>
<td>Short term stability</td>
<td>Drift after 2min warm-up</td>
<td>0,01</td>
<td>°</td>
</tr>
<tr>
<td>Q</td>
<td>Ageing (offset drift)</td>
<td>200 cycles @ 0...70°C</td>
<td>0,03</td>
<td>°</td>
</tr>
</tbody>
</table>

Supply voltage +5V and room temperature, unless otherwise specified

Note 1. T=Tested during production, Q = Parameter is qualified during product validation
Note 2. Measurement range is limited by sensitivity and offset
Note 3. Frequency response is determined by the sensing element’s internal gas damping. Output has true DC response
Note 4. Cross-axis sensitivity determines how much inclination perpendicular to the measurement axis couples to the output
Note 5. Position should be calibrated during/after mounting. See “Measurement directions”
2.3. Electrical Connection

Highly flexible PUR cable, no connector

<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
<th>Wire color</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td>Ground white</td>
</tr>
<tr>
<td>2</td>
<td>VDD</td>
<td>Power supply +5VDC input brown</td>
</tr>
<tr>
<td>3</td>
<td>Out X</td>
<td>Output SCA121T, X-direction green</td>
</tr>
<tr>
<td>4</td>
<td>Out Y</td>
<td>Output SCA121T, Y-direction yellow</td>
</tr>
</tbody>
</table>

2.4. Measuring Directions

**X-axis**

<table>
<thead>
<tr>
<th>Alternative 1</th>
<th>Alternative 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative incl., Zero position, Positive incl.</td>
<td></td>
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</table>

**Y-axis**

<table>
<thead>
<tr>
<th>Alternative 2</th>
<th>Alternative 2</th>
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</thead>
<tbody>
<tr>
<td>Positive incl., Zero position, Negative incl.</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 1. Positions**

3. Mechanical specification

- Cable length: 1500 ± 20 mm
- Cable type: IGUS CHAINFLEX CF2.01.04, PUR grey
- Cable diam.: 6 ± 0,2mm
- Leads: 4 x 0,14mm²
- Total weight: approx. = 0,07 kg
- Protection class: IP66
- Metal part: Zinc casting, trivalent passivation (RoHS compliant)

**Figure 2**

4. Mounting

The sensor module is mounted with 2 screws, dimension M4. Mounting torque 5 ± 1Nm. Mounting alignment is critical as errors will decrease the sensor performance.
We are here for you. Addresses and Contacts.

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<table>
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<tr>
<th>Postcode 00000 – 31999</th>
<th>Postcode 32000 – 37999</th>
<th>Geometrical sensors</th>
<th>Sensor elements</th>
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<tr>
<td>Austria</td>
<td></td>
<td></td>
<td></td>
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</table>

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<table>
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<tr>
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<th>Postcode 1000 – 2999</th>
<th>Sales International Key Accounts</th>
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<tbody>
<tr>
<td>Basil Frei</td>
<td>Christian Mohrenstecher</td>
<td>Peter Felder</td>
</tr>
</tbody>
</table>

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