Angular Rate Sensors (ENC Series)  
ENC-03R

This product is an angular rate sensor that uses the phenomenon of Coriolis force, which is generated when a rotational angular rate is applied to the vibrator. Murata’s original, small ceramic bimorph vibrator and simple Cap-Base structure realize their ultra-small size, under 0.1cc. Their small shape and light weight increase flexibility of installment and help to downsize your equipment. This surface mountable device can be mounted by an automatic surface mounter.

Features
1. Ultra-small and ultra-lightweight
2. Quick response
3. Low driving voltage, low current consumption
4. Lead type : SMD
5. Reflow soldering (standard peak temp. 250°C)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Resonance Frequency (kHz)</th>
<th>Supply Voltage</th>
<th>Maximum Angular Velocity (deg./sec.)</th>
<th>Output (at Angular Velocity=0)</th>
<th>Scale Factor</th>
<th>Linearity (% FS)</th>
<th>Response (Hz)</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENC-03RC-R</td>
<td>30.8</td>
<td>2.7-5.25V</td>
<td>±300</td>
<td>1.35Vdc</td>
<td>0.67mV/deg./sec.</td>
<td>±5</td>
<td>50</td>
<td>0.2</td>
</tr>
<tr>
<td>ENC-03RD-R</td>
<td>32.2</td>
<td>2.7-5.25V</td>
<td>±300</td>
<td>1.35Vdc</td>
<td>0.67mV/deg./sec.</td>
<td>±5</td>
<td>50</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Operating Temperature Range: -5°C to 75°C  
Storage Temp. Range: -30°C to 85°C
**Sample Amplifier Circuit**

![Sample Amplifier Circuit Diagram]

The high-pass filter's cut-off frequency in this circuit is approx. 0.3Hz. The low-pass filter's cut-off frequency in this circuit is approx. 1kHz.

**Application**

1. One sensor detects rotation on one axis. If two axes are to be detected in the same equipment, two different types of sensors (EMC-03RC and EMC-03RD) should be used.
2. To reduce the effect of temperature drift (due to change in ambient temperature), a high-pass filter must be connected to sensor output to eliminate the DC component.
3. To suppress the output noise component at around 30-33kHz (resonant frequency of sensor element), a low-pass filter that has a higher cut-off frequency than the required response frequency must be connected to the sensor output.

**Dimensions of Land Pattern**

![Dimensions of Land Pattern Diagram]
Note: Please read rating and CAUTION (for storage, operating, rating, soldering, mounting and handling) in this catalog to prevent smoking and/or burning, etc.

This catalog has only typical specifications because there is no space for detailed specifications. Therefore, please review our product specifications or consult the approval sheet for product specifications before ordering.

### Dimensions of Reel

![Dimensions of Reel Diagram](image)

### Dimensions of Plastic Tape

![Dimensions of Plastic Tape Diagram](image)
Notice

Storage and Operating Conditions
1. Incorrect handling may affect sensor characteristics. Please note the following precautions:
   A. Do not subject the sensor to shock or vibration that exceeds the rated limit.
   B. Do not install or store the sensor in a location where condensation is likely to form on it.
   C. Do not install or store the sensor in a location where water may splash directly on it.
   D. Do not install or store the sensor in a location in which it is likely to be exposed to salt water or corrosive vapor.

2. Do not use or store the products in a corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. Also avoid exposure to moisture. Store the products where the temperature and relative humidity do not exceed 5 to 40°C and 20 to 75% R.H. Store the products in a sealed bag and use within 6 months.

Soldering and Mounting
1. Do not mount the sensor on an electric circuit line arranged on the circuit board, because the sensor has an electric circuit on its back.
2. Please ensure that the interference between the resonance frequency of the gyro and any other signals.
3. This product does not support flow soldering.

Handling
1. Precision electronic parts, such as ICs, are used for the sensor; therefore, it is necessary to take anti-electrostatic precautions when handling.
2. Do not wash the sensor, as it is not water-resistant.
3. Do not disassemble.
4. Do not touch the terminal directly.
Angular Rate Sensors (ENC Series)

ENC-03W

This product is an angular rate sensor that uses the phenomenon of Coriolis force, which is generated when a rotational angular rate is applied to the vibrator.

Their small shape and light weight increase flexibility of installment and help to downsize your equipment. This surface mountable device can be mounted by an automatic surface mounter.

**Features**

1. 2 axes in 1 package!
2. High performance with calibration function in ASIC
   - Improvement of zero-rate level drift
   - The reduction of zero-rate level (bias)
   - Reduction of change of the sensitivity - temperature characteristic
3. Built in amplifier (AMP2)
   - Can set an amplifier gain and the filter characteristic in external CR freely.
4. Built in charge switch (HPF reset)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Supply Voltage</th>
<th>Maximum Angular Velocity (deg./sec.)</th>
<th>Output (at Angular Velocity=0)</th>
<th>Scale Factor</th>
<th>Linearity (%FS)</th>
<th>Response (Hz)</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENC-03WB-R</td>
<td>2.7-3.6V</td>
<td>330°</td>
<td>1.35Vdc</td>
<td>0.67mV/deg./sec.</td>
<td>±5</td>
<td>50</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Operating Temperature Range: -5°C to 75°C  
Storage Temp. Range: -30°C to 85°C

* NC: No Connect (Do not connect to any other circuit line.)
**Sample Amplifier Circuit**

- Reference voltage (Vref) is grounded with capacitor of 0.1µF.
- You can set LPF/HPF and Gain of the Amp2 with external parts freely (X1 to X100).
- EN-C SW includes a charge switch to reset the external high-pass filter (C1).
- When you do not use Amp2, please short circuit in AFB and APO, and connect AIN to Vref.

**Timing Chart for Charge SW**

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>3V</td>
</tr>
<tr>
<td>ON</td>
<td>Vcc</td>
</tr>
</tbody>
</table>

**X-axis:**
- 1: APO X -> AFB X (shorted)
- 2: AIN X -> Vref (shorted)
- 3: AFB X -> APO Y (shorted)
- 4: APO Y -> AFB Y (shorted)

**Y-axis:**
- 5: AIN Y -> Vref (shorted)
- 6: AFB Y -> APO Y (shorted)
- 7: APO Y -> AFB Y (shorted)

Continued on the following page.
Continued from the preceding page.

### Dimensions of Land Pattern

The Land Pattern Dimensions for SMD (1st layer)

- **Electro Circuit Pattern Prohibition Area** (*)
- **PIN 1**
- Dimensions: 15 – 1.0 mm
- 16 – 0.4 mm
- 1.8 mm

(*): Do not make the electric circuit pattern in the prohibition area to prevent contact with the central terminals of product's back side and to prevent interference with the other signal.

(Prohibition area: the central hatching area of 1st layer)

(*2): Please make the GND pattern for electric shield (2nd layer) to reduce interference with the other signal.

- Mechanical stress to the mounted board, such as bending and pushing, affects the zero rate level of the product. Zero rate level can change slightly at the moment when mechanical stress is being changed.
- When hardness of mounted board is high, the zero rate level changes very little, and the influence of the zero rate level is changed by the condition of fixed position and shape of the mounted board.

Therefore, please ensure that your product has been evaluated in one of your specifications with our product being mounted to your product.

### Reflow Chart

- **Reflow Chart**
- **250°C max.**
- **220°C max.**
- **140°C max.**
- **120°C max.**
- **100°C max.**
- **90°C max.**
- **80°C max.**
- **60°C max.**
- Preheating
- Reflowing
- Cooling
Note • Please read rating and CAUTION (for storage, operating, rating, soldering, mounting and handling) in this catalog to prevent smoking and/or burning, etc.
• This catalog has only typical specifications because there is no space for detailed specifications. Therefore, please review our product specifications or consult the approval sheet for product specifications before ordering.

Packaging

■ Dimensions of Reel

■ Dimensions of Plastic Tape

Emboss carrier tape material: PS (Black)
Top cover tape material: PS (semi-transparent)
Reel material: PS (Black)
Storage and Operating Conditions
1. Incorrect handling may affect sensor characteristics.
   Please note the following precautions:
   A. Do not subject the sensor to shock or vibration that exceeds the rated limit.
   B. Do not install or store the sensor in a location where condensation is likely to form on it.
   C. Do not install or store the sensor in a location where water may splash directly on it.
   D. Do not install or store the sensor in a location in which it is likely to be exposed to salt water or corrosive vapor.

Soldering and Mounting
1. Do not mount the sensor on an electric circuit line arranged on the circuit board, because the sensor has an electric circuit on its back.
2. Please ensure that the interference between the resonance frequency of the gyro and any other signals.
3. This product does not support hand soldering.
4. This product does not support flow soldering.

Handling
1. Precision electronic parts, such as ICs, are used for the sensor; therefore, it is necessary to take anti-electrostatic precautions when handling.
2. Do not wash the sensor, as it is not water-resistant.
3. Do not disassemble.
4. Do not touch the terminal directly.

2. Do not use or store the products in a corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. Also avoid exposure to moisture. Store the products where the temperature and relative humidity do not exceed 5 to 40°C and 20 to 75% R.H. Store the products in sealed bag and use with in 6 months. In addition, this product should be treated as MSL3 of JEDEC J-STD-020D.1. After unsealing the bag, at less than 30°C/80% R.H, do reflow soldering on this product within 7 days.
**Minimum Quantity**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Ø330mm Reel</th>
<th>Ø254mm Reel</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENC-03R</td>
<td>2000 pcs</td>
<td>–</td>
</tr>
<tr>
<td>ENC-03W</td>
<td>–</td>
<td>1500 pcs</td>
</tr>
</tbody>
</table>

**Part Numbering**

Angular Rate Sensors (ENC Series)

(Part Number) | EN | C-03RC | - | R |

1. Product ID
2. Type
3. Individual Specification Code
4. Packaging

**EU RoHS Compliant**

· All the products in this catalog comply with EU RoHS.
· EU RoHS is "the European Directive 2011/65/EU on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment."
· For more details, please refer to our website ‘Murata’s Approach for EU RoHS’ (http://www.murata.com/info/rohs.html).
Note:

1. Export Control
   "For customers outside Japan"
   No Murata products should be used or sold, through any channels, for use in the design, development, production, utilization, maintenance or operation of, or otherwise contributing to (1) any weapons (Weapons of Mass Destruction (nuclear, chemical or biological weapons or missiles) or conventional weapons) or (2) goods or systems specially designed or intended for military end-use or utilization by military end-users.
   "For customers in Japan"
   For products which are controlled items subject to the "Foreign Exchange and Foreign Trade Law" of Japan, the export license specified by the law is required for export.

2. Please contact our sales representatives or product engineers before using the products in this catalog for the applications listed below, which require especially high reliability for the prevention of defects which might directly damage a third party's life, body or property, or when one of our products is intended for use in applications other than those specified in this catalog:
   ① Aircraft equipment
   ② Aerospace equipment
   ③ Undersea equipment
   ④ Power plant equipment
   ⑤ Medical equipment
   ⑥ Transportation equipment (vehicles, trains, ships, etc.)
   ⑦ Traffic signal equipment
   ⑧ Data-processing equipment
   ⑨ Disaster prevention / crime prevention equipment
   ⑩ Application of smaller complexity and/or reliability requirements to the applications listed above
   ⑪ Product specifications in this catalog are as of May 2011. They are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering. If there are any questions, please contact our sales representatives or product engineers.
   ⑫ Please read rating and CAUTION (for storage, operating, rating, soldering, mounting and handling) in this catalog to prevent smoking and/or burning, etc.
   ⑬ This catalog has only typical specifications because there is no space for detailed specifications. Therefore, please review our product specifications or consult the approval sheet for your product specifications before ordering.
   ⑭ No ozone-depleting substances (ODS) under the Montreal Protocol are used in our manufacturing process.

Murata Manufacturing Co., Ltd.
http://www.murata.com/

Head Office
1-18-1, Higashi-Kotani, Nagakakyo-ku, Kyoto 617-8555, Japan
Phone: 81-75-805-9111

International Division
3-35-17, Shibuya, Shibuya-ku, Tokyo 150-2002, Japan
Phone: 81-3-5469-6123 Fax: 81-3-5469-8150 E-mail: info@murata.co.jp