MEMS gyro sensor for navigation using an inclined detection axis. The inclination of the unit can be changed. This microsensor has high precision and reliability due to the sealing around the bear chip IC and MEMS silicone based tuning fork, formed with piezo-electric thin film directly on the surface.

**Features**

- Compact, Low-height 5.0 mm max., Low-profile 4.3 mm
- SMD type
- 5.0 V.DC operating voltage
- Detection axis 0 deg / 20 deg inclination (Refer to the diagram on the right)
- Analog Output (Ratio-metric output)
- RoHS compliant

**Recommended Applications**

- Detects the direction of movement for car-navigation
- Detects the posture control for robot

**Ratings**

<table>
<thead>
<tr>
<th><strong>Electrical Characteristics</strong></th>
<th><strong>Environmental Characteristics</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Voltage Range</td>
<td>5.0 V.DC±0.25 V.DC</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>−40 °C to +85 °C</td>
</tr>
<tr>
<td>Zero Point Output (−40 °C to +85 °C)</td>
<td>2.5 V.DC ± 0.4 V.DC</td>
</tr>
<tr>
<td>Sensitivity (Z axis) (−40 °C to +85 °C)</td>
<td>25 mV/°C/s</td>
</tr>
<tr>
<td>Dynamic Range</td>
<td>±60 °/s</td>
</tr>
<tr>
<td>Frequency Response</td>
<td>−4.0 dB to 0 dB</td>
</tr>
<tr>
<td>Output Noise</td>
<td>&lt; 10 mV</td>
</tr>
</tbody>
</table>
Gyro Sensors for General-Purpose/ EWTS8RN/ EWTS8RK

Dimensions in mm (not to scale)

Tolerance: ±0.2 mm

Terminal

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reserved 1</td>
</tr>
<tr>
<td>2</td>
<td>Reserved 2</td>
</tr>
<tr>
<td>3</td>
<td>Vout</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
</tr>
<tr>
<td>5</td>
<td>REG</td>
</tr>
<tr>
<td>6</td>
<td>Vcc</td>
</tr>
<tr>
<td>7</td>
<td>Reserved 3</td>
</tr>
<tr>
<td>8</td>
<td>Reserved 4</td>
</tr>
<tr>
<td>9</td>
<td>CAP</td>
</tr>
<tr>
<td>10</td>
<td>CAP</td>
</tr>
</tbody>
</table>

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.

Aug. 2015
### Safety Precautions (Gyro sensor of General-Purpose/ EWTS8R□□□□)

1. **Soldering**
   1. Thickness of Solder Paste (Recommendation) : 0.12 mm to 0.15 mm
   2. Flux : Use non-corrosive rosin, and alcohol based solvent with little chemical reaction.
   3. Pre-heat : Control the temperature on PWB to be under 180 °C and no longer than 120 s
   4. Reflow Soldering condition : The Maximum temperature on PWB is 260 °C
   5. Atmospheric Temperature : The atmospheric temperature should be under 300 °C
   6. Cooling : To avoid deterioration of the sensor due to heat, immediately cool the sensor with blown air.
   7. Number of times it can be Reflow Soldered : Once
   8. Hand soldering (recommendation) : a) Use a 20 W or less soldering iron at less than 350 °C
      b) Soldering time: within 3 s

2. **Washing**
   Do not wash.

3. **Handling**
   1. Handle with care. Do not drop or apply any strong impact to the sensor this may degrade some performances.
   2. Do not store under the following conditions, they may degrade some performances and solderability.
      a) Relative humidity of more than 85 %
      b) Atmospheres of corrosive gas (Cl₂, H₂S, NH₃, NOₓ, SO₂ etc.)
      c) Long term storage of over 3 months after delivery
      Do not store the package under severe load and stress.

4. **Pattern layout of the circuit board**
   See the following recommended pattern design. (mm)

5. **Layout**
   The sensor has a little zero point temperature drift due to surrounding conditions. Take this into consideration when determining the location of the sensor.

   1. Do not locate the sensor close to heat radiating objects such as power transistors.
   2. Do not locate the sensor where it can be affected by heat convection.

   ![Sensor Diagram](image)

6. **Vibration from outside**
   To prevent the PWB's (mounted sensor) from resonating with external vibration, please consider following these guides for the design of your PWB.
   1. Take into consideration the location of other parts which may cause vibration.
   2. Do not allow the screws, which fix the circuit board to become loose.
      * Do a vibration test and carefully check the condition of the sensor attached to the unit.
7. Recommended Circuit

(1) EWTS8RD□□□/EWTS8RS□□□

C1: Design chip capacitor with good high frequency characteristic about 0.1 μF near the terminals of the sensor as possible in parallel as measure for EMS.

C2: Since the sensor does not have a power supply back up, insert a backup capacitor as an instantaneous power failure.

C3: Design chip capacitor 0.1 μF near the terminals of the sensor as possible.

✽ NC terminal of the sensor connects with nowhere on your PWB.

(2) EWTS8RN□□□/EWTS8RK□□□

C1: Design chip capacitor with good high frequency characteristic about 0.1 μF near the terminals of the sensor as possible in parallel as measure for EMS.

C2: Since the sensor does not have a power supply back up, insert a backup capacitor as an instantaneous power failure.

C3: Design chip capacitor 0.1 μF near the terminals of the sensor as possible.

C4: Design chip capacitor 0.1 μF near the terminals of the sensor as possible.

✽ NC terminal of the sensor connects with nowhere on your PWB.

(3) If the noise of the frequency near the integral multiple (especially odd times) of the vibrator drive frequency and detuning frequency (drive frequency-sense frequency) are impressed to a power supply line, the low frequency wave noise of the difference of the frequency of a power supply noise and the frequency of the integral multiple of the vibrator drive frequency will be amplified and outputted ten times by signal processing of an gyro sensor. Please avoid the connection which contains high frequency noises, such as LCD, in the same power supply.

Drive frequency: 42.8 kHz±1 kHz
Detuning frequency: 300 Hz to 1500 Hz

(4) Since it may be influenced by the radiation noise from the line containing many high frequency noises, such as a digital power supply and digital GND, please give me consideration of wiring.

8. Limited Warranty

(1) Customer acknowledges that the gyro Sensor (“Product”) delivered to Customer by Panasonic Corporation (“Panasonic”) is designed and manufactured by Panasonic, or its affiliates, only for the purpose of incorporation into Customer’s car navigation system (hereinafter called “Purpose”). Accordingly, Customer understands that Panasonic, or its affiliates, shall only guarantee the performance of the Product under the Product Specification for information to the extent such Product is used by Customer for the Purpose defined in this paragraph.

(2) Customer agrees that it shall, at its sole cost and responsibility, test and evaluate the performance of Customer’s system which incorporates the Product (hereinafter called “System”).

(3) Customer acknowledges that some failure mode, such that Product does not comply with this Specification in terms of Zero Point Output and/or Sensitivity or shows any unstable performance, should be observed depending on the characteristics of the System, or the environment at which such System is installed. Therefore, Customer shall design the System taking into account such influences.

(4) Customer agrees that Panasonic shall not be responsible for any loss or damage due to defective Product, including, but not limited to, economic loss, bodily injury or property damage, as far as Customer utilizes the Product for any purpose other than the Purpose defined in the above paragraph 8-1. Therefore, Customer shall ensure the “fail-safe” design of the System, if it deems necessary, to mitigate any such loss or damage.
Gyro Sensors for General-Purpose
SMD, Inclined Detection Axis Type

Type: EWTS8RD/ EWTS8RS

MEMS gyro sensor for navigation using an inclined detection axis. The inclination of the unit can be changed. This microsensor has high precision and reliability due to the sealing around the bear chip IC and MEMS silicone based tuning fork, formed with piezo-electric thin film directly on the surface.

Features
- Compact, Low-height 5.0 mm max., Low-profile 4.3 mm
- SMD type
- 3.3 V.DC operating voltage
- Detection axis 0 deg / 20 deg inclination (Refer to the diagram on the right)
- Digital Output : SPI communication
- RoHS compliant

Recommended Applications
- Detects the direction of movement for robot-cleaner
- Detects the direction of movement for car-navigation
- Detects the posture control for robot

Ratings

<table>
<thead>
<tr>
<th>Electrical Characteristics</th>
<th>Environmental Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Voltage Range</td>
<td>Low Temperature Operation</td>
</tr>
<tr>
<td>3.3 V.DC±0.165 V.DC</td>
<td>–40 °C for 72 h</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>High Temperature Operation</td>
</tr>
<tr>
<td>–40 °C to +85 °C</td>
<td>+85 °C for 120 h</td>
</tr>
<tr>
<td>Zero Point Output</td>
<td>Thermal Shock</td>
</tr>
<tr>
<td>(–40 °C to +85 °C)</td>
<td>–40 °C to +85 °C for 25 cycles</td>
</tr>
<tr>
<td>32768±800 LSB</td>
<td>Heat and Damp Cycling Test</td>
</tr>
<tr>
<td>Sensitivity (Z axis)</td>
<td>–40 °C to +60 °C</td>
</tr>
<tr>
<td>(–40 °C to +85 °C)</td>
<td>90 %RH for 5 cycles</td>
</tr>
<tr>
<td>50 LSB/°/s</td>
<td>Life (Operating Durability)</td>
</tr>
<tr>
<td>Dynamic Range</td>
<td>2 Hz, 1×10⁷ cycles</td>
</tr>
<tr>
<td>±150 %/s</td>
<td></td>
</tr>
<tr>
<td>Frequency Response</td>
<td></td>
</tr>
<tr>
<td>–4.0 dB to 0 dB</td>
<td></td>
</tr>
<tr>
<td>Output Noise</td>
<td></td>
</tr>
<tr>
<td>&lt; 20 LSB</td>
<td></td>
</tr>
</tbody>
</table>
Gyro Sensors for General-Purpose/ EWTS8RD/ EWTS8RS

Dimensions in mm (not to scale)

Tolerance: ±0.2 mm

Terminal

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CSB</td>
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<td>2</td>
<td>SCLK</td>
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<tr>
<td>3</td>
<td>Reserved 1</td>
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<tr>
<td>4</td>
<td>GND</td>
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<tr>
<td>5</td>
<td>REG</td>
</tr>
<tr>
<td>6</td>
<td>Vcc</td>
</tr>
<tr>
<td>7</td>
<td>MISO</td>
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<tr>
<td>8</td>
<td>MOSI</td>
</tr>
<tr>
<td>9</td>
<td>CAP</td>
</tr>
<tr>
<td>10</td>
<td>CAP</td>
</tr>
</tbody>
</table>

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.

Jul. 2015
Safety Precautions (Gyro sensor of General-Purpose/EWTS8R□□□□)

1. Soldering
   (1) Thickness of Solder Paste (Recommendation) : 0.12 mm to 0.15 mm
   (2) Flux : Use non-corrosive rosin, and alcohol based solvent with little chemical reaction.
   (3) Pre-heat : Control the temperature on PWB to be under 180 °C and no longer than 120 s
   (4) Reflow Soldering condition : The Maximum temperature on PWB is 260 °C
   (5) Atmospheric Temperature : The atmospheric temperature should be under 300 °C
   (6) Cooling : To avoid deterioration of the sensor due to heat, immediately cool the sensor with blown air.
   (7) Number of times it can be Reflow Soldered : Once
   (8) Hand soldering (recommendation) : a) Use a 20 W or less soldering iron at less than 350 °C
                                          b) Soldering time: within 3 s

2. Washing
   Do not wash.

3. Handling
   (1) Handle with care. Do not drop or apply any strong impact to the sensor this may degrade some performances.
   (2) Do not store under the following conditions, they may degrade some performances and solderability.
       a) Relative humidity of more than 85 %
       b) Atmospheres of corrosive gas (Cl₂, H₂S, NH₃, NOₓ, SO₂ etc.)
       c) Long term storage of over 3 months after delivery
          Do not store the package under severe load and stress.

4. Pattern layout of the circuit board
   See the following recommended pattern design. (mm)

5. Layout
   The sensor has a little zero point temperature drift due to surrounding conditions. Take this into consideration when determining the location of the sensor.
   (1) Do not locate the sensor close to heat radiating objects such as power transistors.
   (2) Do not locate the sensor where it can be affected by heat convection.
   (3) Do not locate two or more sensors on the same PWB, otherwise periodical drift of zero point output may occur due to mutual interference by the vibration of each tuning fork in the sensor.

6. Vibration from outside
   To prevent the PWB's (mounted sensor) from resonating with external vibration, please consider following these guides for the design of your PWB.
   (1) Take into consideration the location of other parts which may cause vibration.
   (2) Do not allow the screws, which fix the circuit board to become loose.
   * Do a vibration test and carefully check the condition of the sensor attached to the unit.

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.
Should a safety concern arise regarding this product, please be sure to contact us immediately.
7. Recommended Circuit

(1) EWTS8RD□□□/EWTS8RS□□□

C1: Design chip capacitor with good high frequency characteristic about 0.1 μF near the terminals of the sensor as parallel as measure for EMS.
C2: Since the sensor does not have a power supply back up, insert a backup capacitor as an instantaneous power failure.
C3: Design chip capacitor 0.1 μF near the terminals of the sensor as possible.
* NC terminal of the sensor connects with nowhere on your PWB.

(2) EWTS8RN□□□/EWTS8RK□□□

C1: Design chip capacitor with good high frequency characteristic about 0.1 μF near the terminals of the sensor as parallel as measure for EMS.
C2: Since the sensor does not have a power supply back up, insert a backup capacitor as an instantaneous power failure.
C3: Design chip capacitor 0.1 μF near the terminals of the sensor as possible.
C4: Design chip capacitor 0.1 μF near the terminals of the sensor as possible.
* NC terminal of the sensor connects with nowhere on your PWB.

(3) If the noise of the frequency near the integral multiple (especially odd times) of the vibrator drive frequency and detuning frequency (drive frequency–sense frequency) are impressed to a power supply line, the low frequency wave noise of the difference of the frequency of a power supply noise and the frequency of the integral multiple of the vibrator drive frequency will be amplified and outputted ten times by signal processing of an gyro sensor. Please avoid the connection which contains high frequency noises, such as LCD, in the same power supply.

Drive frequency : 42.8 kHz±1 kHz
Detuning frequency 300 Hz to 1500 Hz

(4) Since it may be influenced by the radiation noise from the line containing many high frequency noises, such as a digital power supply and digital GND, please give me consideration of wiring.

8. Limited Warranty

(1) Customer acknowledges that the gyro Sensor (“Product”) delivered to Customer by Panasonic Corporation. (“Panasonic”) is designed and manufactured by Panasonic, or its affiliates, only for the purpose of incorporation into Customer’s car navigation system (hereinafter called “Purpose”). Accordingly, Customer understands that Panasonic, or its affiliates, shall only guarantee the performance of the Product under the Product Specification for information to the extent such Product is used by Customer for the Purpose defined in this paragraph.

(2) Customer agrees that it shall, at its sole cost and responsibility, test and evaluate the performance of Customer’s system which incorporates the Product (hereinafter called “System”).

(3) Customer acknowledges that some failure mode, such that Product does not comply with this Specification in terms of Zero Point Output and/or Sensitivity or shows any unstable performance, should be observed depending on the characteristics of the System, or the environment at which such System is installed. Therefore, Customer shall design the System taking into account such influences.

(4) Customer agrees that Panasonic shall not be responsible for any loss or damage due to defective Product, including, but not limited to, economic loss, bodily injury or property damage, as far as Customer utilizes the Product for any purpose other than the Purpose defined in the above paragraph 8-1. Therefore, Customer shall ensure the “fail-safe” design of the System, if it deems necessary, to mitigate any such loss or damage.
MEMS Gyro Sensors for Rollover Detection
SMD type
Type: EWTS64G

This sensor is a gyro sensor for rollover detection which adopts the SMD type. A ceramic package contains a bare chip IC and a MEMS silicon tuning fork whose surface is formed directly by PZT elements. Moreover, self-diagnostic functions are embedded to achieve high reliability.

Features
● Compact, Low height 5 mm
● SMD type
● High durability against the crash impact or vibration
● 5 V operating voltage (Ratio-metric output)
● Built-in self diagnosis
● RoHS compliant

Recommended Applications
● Automotive rollover detection
● Various types of motion controls for industrial equipment

Ratings
● Electrical Characteristics
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature Range</td>
<td>–40 °C to +95 °C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>–40 °C to +105 °C</td>
</tr>
<tr>
<td>Operating Voltage Range</td>
<td>5±0.25 V</td>
</tr>
<tr>
<td>Zero Point Voltage (–40 °C to +95 °C)</td>
<td>2.5±0.15 V</td>
</tr>
<tr>
<td>Sensitivity (–40 °C to +95 °C)</td>
<td>6±0.3 mV/ (° ·s⁻¹)</td>
</tr>
<tr>
<td>Dynamic Range</td>
<td>±300 °/s</td>
</tr>
<tr>
<td>Frequency Response (–3 dB)</td>
<td>31 Hz to 61 Hz</td>
</tr>
<tr>
<td>Cross Axis Sensitivity</td>
<td>±5 %</td>
</tr>
<tr>
<td>Output Noise</td>
<td>&lt; 20 m Vp-p</td>
</tr>
</tbody>
</table>

● Environmental Characteristics
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Temperature Operation</td>
<td>–40 °C for 1000 h</td>
</tr>
<tr>
<td>High Temperature Storage</td>
<td>+105 °C for 1000 h</td>
</tr>
<tr>
<td>High Temperature Operation</td>
<td>+95 °C for 1000 h</td>
</tr>
<tr>
<td>Thermal Shock</td>
<td>–40 °C to +95 °C for 1000 cycles</td>
</tr>
<tr>
<td>Mechanical Shock</td>
<td>19600 m/s², 0.5 ms</td>
</tr>
</tbody>
</table>
Dimensions in mm (not to scale)

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.
△ Safety Precautions (MEMS Gyro Sensors for Rollover detection/EWTS64G)

1. Soldering
   (1) Thickness of Solder Paste (Recommendation) : 0.15 mm to 0.20 mm
   (2) Flux : Use non-corrosive rosin, and alcohol-based solvent with little chemical reaction.
   (3) Pre-heat : Control the temperature on PWB to be under 180°C and no longer than 120 s
   (4) Reflow Soldering condition : The Maximum temperature on PWB ≤ 260°C
   (5) Atmospheric Temperature : The atmospheric temperature should be under 300°C
   (6) Cooling : To avoid deterioration of the sensor due to heat, immediately cool the sensor with blown air.
   (7) Number of times it can be Reflow Soldered : Once
   (8) Hand soldering (recommendation) : a) Use a 2W or less soldering iron at less than 350°C.
                               b) Soldering time : within 3 s

2. Washing
   Do not wash.

3. Handling
   (1) Handle with care. Do not drop or apply any strong impact to the sensor this may degrade some performances.
   (2) Do not store under the following conditions, they may degrade some performances and solderability.
       a) Relative humidity of more than 85 %
       b) Atmospheres of corrosive gas (Cl₂, H₂S, NH₃, NOₓ, SO₂ etc.)
       c) Long-term storage of over 3 months after delivery.
   Do not store the package under severe load and stress.

4. Pattern layout of the circuit board
   See the following recommended pattern design (mm)

5. Layout
   The sensor has a slight zero point temperature drift due to surrounding conditions. Locate the sensor with care of the following items.
   (1) Do not locate the sensor close to heat radiating objects such as power transistors.
   (2) Do not locate the sensor where it will be affected by heat convection.

6. The application method of a coating agent.
   Please apply by the spray system about a coating agent. (Recommendation)
   Dip coating of a coating agent is disapproval.

7. Vibration from outside
   If the PWB with the sensor is resonant to frequencies caused by external vibrations, take the following items into consideration.
   (1) Rigid glass-epoxy circuit board is recommended. Locate the sensor close to the mounting screws of the PWB. (Since tuning fork part has a resonating point (detuning frequency) between 300 to 900 Hz, vibration evaluation in actual use is necessary.)
   (2) Locate other parts so that they will not touch the sensor directly due to external vibration.
   (3) Do not allow the mounting screws in the circuit board to become loose.
   * Perform a vibration test and carefully check the condition of the sensor attached to the unit.

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.
Should a safety concern arise regarding this product, please be sure to contact us immediately.

02 Jul. 2015
8. Recommended circuit

![Circuit Diagram]

(1) Be sure to use 100 kΩ load resistors.
(2) The sensor does not have a power-supply backup capacitor. Insert a backup capacitor in the powersupply line close to the sensor when power supply is far or the power is supplied through connectors. In case of instant power break, vibration of the tuning fork stops and takes 0.5 second to reboot.
(3) Reverse voltage or over-voltage of more than 6.3 V may destroy the sensor.
(4) When the sensor signal goes to an A/D converter, use the same 5 V power supply for both the sensor and the A/D converter.
(5) EMC characteristics depend on whether the shield case is power grounded or case grounded. Choose which one after evaluating the assembled set.

9. Limited Warranty

Great attention has been paid to the quality of this sensor. As a failure mode, however, zero point output, sensitivity error, instability, or the like may occur. For a single failure of the sensor, study the influence of the whole circuit in advance.

(1) Install the following systems for a failsafe design to ensure safety if these products are to be used in equipment where a defect in these products may cause the loss of human life or other significant damage, such as damage to vehicles (automobile, train, vessel), traffic lights, medical equipment, aerospace equipment, electric heating appliances, combustion/gas equipment, rotating equipment, disaster/crime prevention equipment, nuclear apparatus, and machine tools.
  - Systems equipped with a protection circuit and a protection device
  - Systems equipped with a redundant circuit or other system to prevent an unsafe status in the event of a single fault
(2) If questions about the safety of this product arise, please do not hesitate to contact our company and be sure to perform the technical assessment.
MEMS Gyro Sensors for Consumers
2 shafts in a package, SMD type

Type: EWTS9P □□□□

This sensor is an SMD-type two-axis integrated gyro sensor for consumer products. The ultra-miniature body is achieved by integrating two MEMS silicon tuning forks on which a piezoelectric thin film is directly formed, a bare IC chip, and other components into a single ceramic package. In addition to analog output as a replacement for the existing model, digital output is also available with this series. Therefore, this series is ideal for image stabilizers of DSCs and DVCs.

Features
- 2 shafts in a package, SMD type
- Compact, Low-height 4.6 mm×3.8 mm×0.9 mm (T)
- Capable of both analog and digital output
- RoHS compliant

Recommended Applications
- For image stabilizers (DSCs, DVCs, and Cellular phones)

Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Type EWTS9P Series (Analog Output)</th>
<th>Type EWTS9P Series (Digital Output)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Voltage Range</td>
<td>2.7 to 3.3 V</td>
<td></td>
</tr>
<tr>
<td>Rated Voltage</td>
<td>3 V</td>
<td></td>
</tr>
<tr>
<td>Absolute max. Rating</td>
<td>4.4 V</td>
<td></td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>–40 °C to +85 °C</td>
<td></td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>–10 °C to +75 °C</td>
<td></td>
</tr>
<tr>
<td>Operating Humidity Range</td>
<td>35 to 85 %RH</td>
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</tr>
</tbody>
</table>

Electrical Characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>EWTS9P Series (Analog Output)</th>
<th>EWTS9P Series (Digital Output)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic Range</td>
<td>±300 °/s</td>
<td>±300 °/s</td>
</tr>
<tr>
<td>Current Consumption</td>
<td>8 mA max.</td>
<td>9 mA max.</td>
</tr>
<tr>
<td>Sleep Mode Current Consumption</td>
<td>1 mA max.</td>
<td>1 mA max.</td>
</tr>
<tr>
<td>Zero Point Voltage : Outa/b</td>
<td>0.95±0.1 V</td>
<td>32768±4000 LSB</td>
</tr>
<tr>
<td>Reference Voltage : Vref</td>
<td>0.95±0.05 V</td>
<td>–</td>
</tr>
<tr>
<td>Output Voltage Range</td>
<td>0.05 to 1.85 V</td>
<td>11500 to 54000 LSB</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>2 mV/ (° · s⁻¹) ±5 %</td>
<td>50 LSB/ (° · s⁻¹) ±5 %</td>
</tr>
<tr>
<td>Sensitivity Drift</td>
<td>±4 %</td>
<td>±4 %</td>
</tr>
</tbody>
</table>

(1) Current consumption in sleep mode: Current consumption in standby mode when the SL terminal is set to H.

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.
**Dimensions in mm (not to scale)**

**EWTS9P Series**

![Diagram of EWTS9P Series](image)

**Table:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Number</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Base</td>
<td>1</td>
<td>90 alumina</td>
</tr>
<tr>
<td>2</td>
<td>IC</td>
<td>1</td>
<td>Silicon</td>
</tr>
<tr>
<td>3</td>
<td>Tuning fork</td>
<td>2</td>
<td>PZT on silicon</td>
</tr>
<tr>
<td>4</td>
<td>Au wire</td>
<td>12</td>
<td>Au</td>
</tr>
<tr>
<td>5</td>
<td>Cap</td>
<td>1</td>
<td>90 alumina</td>
</tr>
<tr>
<td>6</td>
<td>Underfill</td>
<td></td>
<td>Epoxy resin</td>
</tr>
<tr>
<td>7</td>
<td>T.F. glue</td>
<td></td>
<td>Epoxy resin</td>
</tr>
<tr>
<td>8</td>
<td>Cap glue</td>
<td></td>
<td>Epoxy resin</td>
</tr>
</tbody>
</table>

**Characteristics:**

- **Power Supply for Analog Block:** 3 V ± 0.3 V
- **Ground:** Connect to ground (0 V)
- **Reference Voltage/Capacitor for Oscillator:** Connect to analog ground (0 V) through a 0.1 µF capacitor
- **Power Supply for Digital Interface:** Connect to ground (0 V)
- **Chip Select (for Digital Output Mode):** NC or Vdd
- **Serial Clock (for Digital Output Mode):** NC or Vdd
- **Serial Data Output (Master In Slave Out):** NC
- **Serial Data Input (Master Out Slave In):** NC
- **Regulator for Analog Block:** Connect to GND through a 0.1 µF capacitor
- **Regulator for Digital Block:** Connect to digital GND through a 0.1 µF capacitor
- **Analog Output Mode:**
  - **OUT A:** min. 2.6 V
  - **OUT B:** min. 2.6 V
- **Digital Output Mode:**
  - **OUT A:** min. 0.4 V
  - **OUT B:** min. 0.4 V

**Design and Specifications:**

- Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.
- Should a safety concern arise regarding this product, please be sure to contact us immediately.

Panasonic Part No. (The 5 th to 7 th digit) for Panasonic

Date (01 to 31)

Month (1 to 9, X, Y, Z)

End digit of Year

Direction A

Terminal No. Recognition Mark

X axis

Y axis

Z axis

CCW

CW

Terminal Cross Section

Layer (1)

Layer (2)

Layer (3)

Sensor Cross Section

Output Detection axis

OUT A around Y axis

OUT B around X axis

**Table:**

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>Character</th>
<th>Function</th>
<th>Analog output mode spec</th>
<th>Digital output mode spec</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vcc</td>
<td>Power supply for analog block</td>
<td>3 V ± 0.3 V</td>
<td>3 V ± 0.3 V</td>
</tr>
<tr>
<td>2</td>
<td>GND1</td>
<td>Ground</td>
<td>Connect to ground (0 V)</td>
<td>Connect to analog ground (0 V)</td>
</tr>
<tr>
<td>3</td>
<td>V1</td>
<td>Internal reference voltage</td>
<td>Connect to GND through capacitor (0.1 µF)</td>
<td>Connect to analog GND through capacitor (0.1 µF)</td>
</tr>
<tr>
<td>4</td>
<td>GND2</td>
<td>Ground</td>
<td>Connect to ground (0 V)</td>
<td>Connect to analog ground (0 V)</td>
</tr>
<tr>
<td>5</td>
<td>Vref/COSR</td>
<td>Reference voltage/Capacitor for oscillator</td>
<td>Connect to external amp circuit</td>
<td>Connect to analog ground (0 V)</td>
</tr>
<tr>
<td>6</td>
<td>GND3</td>
<td>Ground</td>
<td>Connect to ground (0 V)</td>
<td>Connect to analog ground (0 V)</td>
</tr>
<tr>
<td>7</td>
<td>Vdd</td>
<td>Power supply for digital interface</td>
<td>3 V ± 0.3 V</td>
<td>3 V ± 0.3 V</td>
</tr>
<tr>
<td>8</td>
<td>CSB</td>
<td>Chip Select (for Digital output mode)</td>
<td>NC or Vdd</td>
<td>Chip Select</td>
</tr>
<tr>
<td>9</td>
<td>SCLK</td>
<td>Serial Clock (for Digital output mode)</td>
<td>NC or Vdd</td>
<td>Serial Clock</td>
</tr>
<tr>
<td>10</td>
<td>MOSI/OUT A</td>
<td>Serial Data Output (Master Out Slave In)</td>
<td>Out A output</td>
<td>Serial Data Output (Master Out Slave Out)</td>
</tr>
<tr>
<td>11</td>
<td>MOSI/OUT B</td>
<td>Serial Data Output (Master Out Slave In)</td>
<td>Out B output</td>
<td>Serial Data Input (Master Out Slave In)</td>
</tr>
<tr>
<td>12</td>
<td>SL</td>
<td>Control terminal of sleep mode (for Analog output mode)</td>
<td>Sleep mode: min. 2.5 V (to Vcc±0.3)</td>
<td>Normal mode: Open or max. 0.5 V NC</td>
</tr>
<tr>
<td>13</td>
<td>OUT MODE</td>
<td>Control terminal that select Analog output mode or Digital output mode</td>
<td>Analog output mode: min. 2.6 V</td>
<td>Digital output mode: max. 0.4 V</td>
</tr>
<tr>
<td>14</td>
<td>Vreg A</td>
<td>Regulator for analog block</td>
<td>Connect to GND through capacitor (0.1 µF)</td>
<td>Connect to analog GND through capacitor (0.1 µF)</td>
</tr>
<tr>
<td>15</td>
<td>NC</td>
<td>The terminal for internal adjustment Those with pull down resistance</td>
<td>Connect to ground (0 V)</td>
<td>Connect to analog ground (0 V)</td>
</tr>
<tr>
<td>16</td>
<td>Vreg D</td>
<td>Regulator for digital block</td>
<td>Connect to GND through capacitor (0.1 µF)</td>
<td>Connect to digital GND through capacitor (0.1 µF)</td>
</tr>
</tbody>
</table>
Safety Precautions (MEMS Gyro Sensors for Consumers/EWTS9P)

1. Soldering

(1) Thickness of Solder Paste (Recommendation) : 0.10 mm to 0.15 mm
(2) Flux : Use non-corrosive rosin, and alcohol based solvent with little chemical reaction
(3) Pre-heat : Control the temperature on PWB to be under 180 °C and no longer than 120 s
(4) Reflow Soldering condition : The Maximum temperature on PWB under 260 °C, Soldering time of the Maximum temperature within 10 s
(5) Atmospheric Temperature : The atmospheric temperature should be under 300 °C
(6) Number of times it can be Reflow Soldered : 2 time as the limit
(7) Hand soldering : Do not apply Hand soldering or correction of soldering

2. Washing

Since this sensor package is not sealed, do not apply any flux washing. And at the set assembly process, please do not let oil etc. adhered because it may interfere with the sensor behavior.

3. Handling

(1) Handle with care. Do not drop or apply any strong impact to the sensor as it may degrade some performances.
(2) Static Electricity
   Since CMOS IC is used, there is a possibility of static electricity destruction. Handle with care against static electricity.
(3) Storage under the following condition should be avoided as it degrades the performance and solderability.
   a) Relative humidity more than 85 %, or outside of storage temp. range.
   b) Exposure to the direct rays of the sun.
   c) Atmospheres of corrosive gas (Cl2, H2S, NH3, NOx, SO2 etc.)
   d) Long term storage of over 3 months after delivery
   Do not store the package under severe load and stress.

4. Recommendation item on the circuit composition

(1) Place a chip capacitor (0.01 µF to 0.1 µF) near Vdd terminal across GND.
(2) Load of terminal OUTa and OUTb
   Load Resistor (OUTa & OUTb to GND) : 100 kΩ min. or none.
   Load Capacitor (OUTa & OUTb to GND with series resistor 1kΩ) : 0.01 µF max.
(3) When the sensor signal goes to an A/D converter, use the same 3 V power supply both for the sensor and for A/D converter.
(4) Misconnection
   As misconnection causes a failure, do not reuse the sensor if once misconnected.

5. Caution of sensor layout

(1) Do not locate the sensor close to heat radiating objects such as power transistors. Since the sensor has a little temp. drift by surrounding condition, carefully consider the location of the sensor.
(2) Do not locate two or more sensors on the same PWB because periodical drift of zero point output may occur due to mutual interference by the vibration of each tuning fork of the sensor.

6. Caution of vibration from outside

To prevent the PWB’s (mounted sensor) from resonating with external vibration, please follow the instructions below when designing PWB.
(1) Rigid glass epoxy circuit board is recommended. Locate the sensor near the screws which fix the circuit board.
(2) Place parts to avoid possible contacts with the sensor by external vibrations.
(3) Since the tuning fork may be damaged by the impact of cutting a mother board or a router, please check carefully.
(4) This sensor has oscillators (tuning forks), which have some resonant frequencies. Since the sensor may cause a malfunction by incoming frequencies similar to the sensor (41 kHz to 46 kHz), carefully check frequencies and locations of DC/DC converters.
(5) Avoid screw loose of the circuit board.
(6) Conduct vibration tests and carefully check the condition of sensor when attached to the system. If the location of the sensor is far from the screws of the circuit board, or the screws become loose, vibrations and temperature change may degrade the performance.
7. Recommended pattern design
See the following recommended pattern design. (mm)

8. Limited Warranty
(1) Customer acknowledges that the Gyro Sensors (“Product”) delivered to Customer by Panasonic Corporation. (“Panasonic”) is designed and manufactured by Panasonic, or its affiliates, only for the purpose of incorporation into Customer's Digital Still Camera and Digital Video Camera system (hereinafter called “Purpose”). Accordingly, Customer understands that Panasonic or its affiliates, shall only guarantee the performance of the Product under this Product Specification for Information (this “Specification”) to the extent such Product is used by Customer for the Purpose defined in this paragraph.
(2) Customer agrees that it shall, at its sole cost and responsibility, test and evaluate the performance of Customer's system which incorporates the Product.
(3) Customer agrees that Panasonic shall not be responsible for any loss or damage due to defective Product, including, but not limited to, economic loss, bodily injury or property damage, as far as Customer utilizes the Product for any purpose other than the Purpose defined in the above paragraph (1).