



MURATA MANUFACTURING CO., LTD

Customer

Specification No. JMZ06V-024

Messrs. Delphi China Technical Center Co., Ltd.

Date: JUL 1, 2008

SPECIFICATION

Products Name Gyro sensor

Customer Part Number

Murata Part Number MEV-50A-R

Receipt

Customer

We have received that the attached documents.

Approved by _____

Checked by _____

Received date _____

Sales Office
MURATA MFG. CO., LTD.

_____ Manager _____

Issued Section

Product engineering section
Sensor products department
Sensor products division
Device Unit
MURATA MFG. CO., LTD.

Approved by _____
T. Kodama

Checked by _____
T. Kurihara

Issued by _____
K. Myochin



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Please return this "SPECIFICATION" to us with your signature or stamp.
If it should not be returned until Oct. 1, 2008, we regard it as being received.

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Manager

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Device Unit
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Approved by T. Kodama
T. Kodama

Checked by T. Kurihara
T. Kurihara

Issued by K. Myochin
K. Myochin

SPECIFICATION for MEMS GYRO SENSOR				
1st Jul. 2008	Product Engineering Section Sensor Products Department Sensor Products Division	Approved by T. Kodama <i>T. Kodama</i>	Confirmed by T. Kurihara <i>T. Kurihara</i>	Issued by K. Myochin <i>K. Myochin</i>

1. Scope

This product specification is applied to MEMS gyro sensor used for car-navigation systems. Please contact us before using any of the products in the applications not described above.

2. Description

Murata Production part number : MEV-50A-R

3. Structurally characteristics

3-1 External dimension

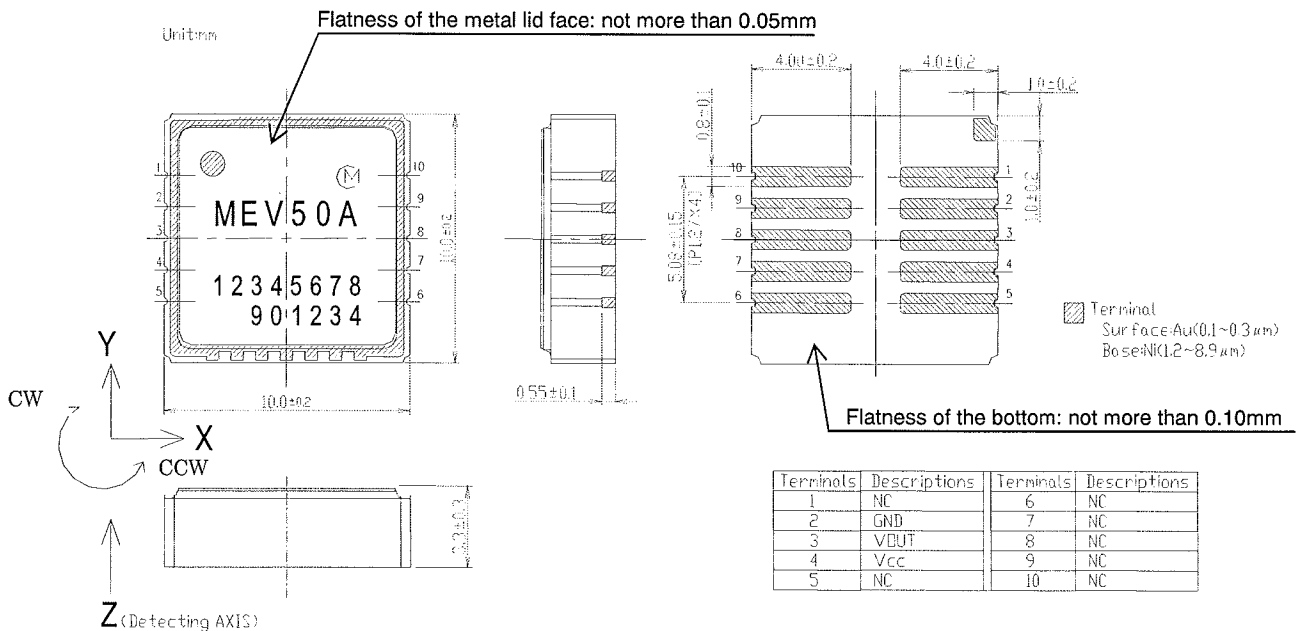


Figure 1

(Note 1) The upper right-hand electrode in the corner of bottom view is only for orientation purpose, so please note that soldering is not allowed onto any pad patterns. That electrode is internally connected to GND, therefore no line-patterns are allowed to prevent interference. See Figure 5 in 7-6 Pad pattern for more details.

(Note 2) Do not connect NC terminals to any circuits nor signal lines. If connected, it may result in operation error or degradation to EMI (Electro Magnetic Interference) performance.

3-2 Marking

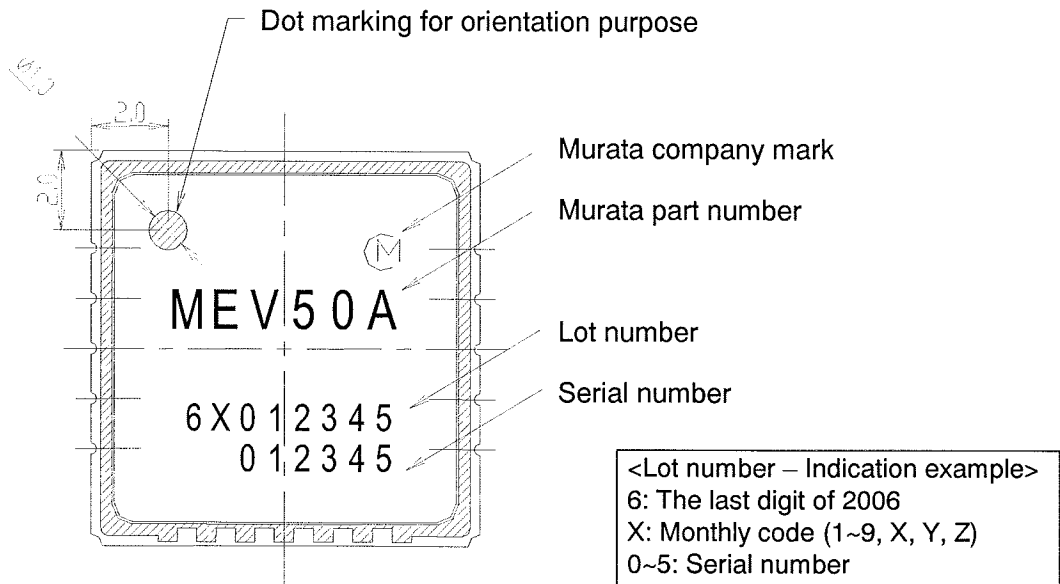


Figure 2

3-3 Weight : 1.5g max

4. Rating

4-1 Absolute maximum ratings

Item	MIN.	MAX.	Unit	Remarks
Supply voltage(Vcc)	-0.3	6.5	V	
Storage temp. range	-40	95	°C	

(Note 1) Do not use the gyro sensor of deviating from the above mentioned ratings.

4-2 Recommended operating conditions

Item	MIN	TYP	MAX	Unit	Conditions
Operating range of angular velocity	-70		70	deg/s	
Supply voltage	4.75	5.00	5.25	V	
Current consumption			8	mA	see Note 2
Operating temp. range	-40		85	°C	

(Note 2) Non-load condition to the sensor output.

5. Electrical characteristics

Unless otherwise specified, ambient temperature $T_a = 25 \pm 5^\circ\text{C}$, $V_{cc} = 5.0\text{ VDC}$

Use the load resistor of 100k ohm or more, connecting to the sensor output terminal.

Item	Symbol	Condition	MIN.	STD.	MAX.	Unit
Zero point output	V_o	at $-40 \sim 85^\circ\text{C}$	2.20	2.50	2.80	V
Scale factor	S_v	at $-40 \sim 85^\circ\text{C}$	23.25	25.0	26.75	mV/(deg/s)
Maximum output voltage			$V_{cc}-0.3$			V
Minimum output voltage					0.3	V
Linearity-error			-0.5		0.5	%FS
Output noise					10	mVp-p
Startup time		(see Note1)			1	s
Start up drift		1s ~ 5minutes	-0.4		0.4	deg/s
		1s ~ 15minutes	-0.8		0.8	deg/s
Temp. drift		at $-40 \sim 85^\circ\text{C}$			6	deg/s
Temp. drift gradient		at $-40 \sim 85^\circ\text{C}$	-0.5 -1.0		0.5 1.0	(deg/s)/ 2°C (deg/s)/ 8°C
Temp. coefficient Scale factor		reference : T_a at $-40 \sim 85^\circ\text{C}$	-4		4	%
Frequency response (Frequency vs. Gain)		gain at 7Hz	-4.0		-1.0	dB
Cross axis sensitivity		on each X,Y axis	-5		5	%
Ratiometric for zero point output	R_{vo}	at 4.75~5.25V (Note2)	0.8		1.2	
Ratiometric for scale factor	R_{sv}	at 4.75~5.25V (Note3)	0.8		1.2	
Acceleration sensitivity under the vibrational condition (Note 4)		at 10~2,000Hz, 21.56m/s ² (2.2G) X, Y, Z axis	-1		1	deg/s

(Note1) After the power on, monitor a time that zero point output has been within $\pm 12.5\text{mV}$ against zero point output value of being steady.

(Note2) Ratiometric of zero point output (R_{vo}) is prescribed as follow formula,

$$R_{vo} = V_o \text{ variation} / V_{cc} \text{ variation}$$

$$V_o \text{ variation} = \{V_o(5.25) - V_o(4.75)\} / V_o(5.0)$$

$$V_{cc} \text{ variation} = (5.25 - 4.75) / 5.0 = 0.1$$

(Note3) Ratiometric of scale factor (R_{sv}) is prescribed as follow formula,

$$R_{sv} = S_v \text{ variation} / V_{cc} \text{ variation}$$

$$S_v \text{ variation} = \{S_v(5.25) - S_v(4.75)\} / S_v(5.0)$$

$$V_{cc} \text{ variation} = (5.25 - 4.75) / 5.0 = 0.1$$

(Note 4) Measurement errors, such as output noise, angular velocity unexpectedly generated by vibration machine, should not be considered to be acceleration sensitivity. Only DC voltage level, which does not contain the measurement errors, should be measured in this specification.

6. Reliability test

6-1. Test condition

Standard test condition: ambient temp. = 25±5°C, relative humidity = 10 to 85 %

6-2 Mechanical test

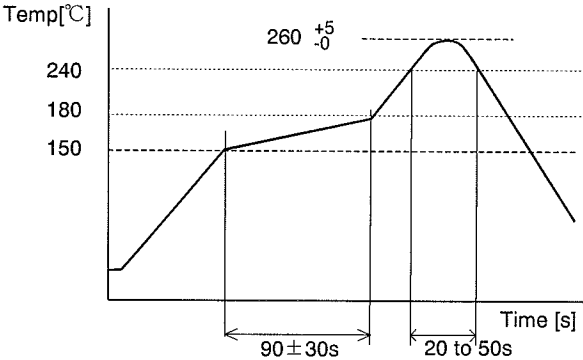
Item	Condition	Judgment criteria
Vibration test	Acceleration: 98 m/s ² (10G) Maximum swing: 1.5mmp-p Frequency: 10 ~ 500Hz Sweeping period: 11minutes (log sweep) Test cycle: 24 cycles to each direction (X, Y, and Z axis) (total 13.5hrs)	To satisfy "5. Electrical characteristics"
Shock test	Acceleration: 14,700 m/s ² (1,500G) Operating time: 0.5ms(Half sine wave) Number of shocks: 3 times for each 6 directions of X,Y,Z axis.	
Drop test	Height: 1m Object to drop: Maple or similar wooden plate Number of drops: one time	

6-3 Environment test

Item	Condition	Judgment criteria														
Low temperature exposing test	Temperature: -40°C+/-4°C Exposing time: 1,000hours	To satisfy "5. Electrical characteristics" (see Note 1)														
Low temperature operating test	Temperature: -40°C+/-4°C Supply voltage: 5.0V Operating time: 1,000hours															
High temperature exposing test	Temperature: 95°C+/-4°C Exposing time: 1,000hours															
High temperature operating test	Temperature: 85°C+/-4°C Supply voltage: 5.0V Operating time: 1,000hours															
High temperature and High humidity exposing test	Temperature: 85°C+/-4°C Humidity: 85%RH Exposing time: 1,000hours															
High temperature and High humidity operating test	Temperature: 85°C+/-4°C Humidity: 85%RH Supply voltage: 5.0V Operating time: 1000hours															
Heat shock test	Heat shock cycles: 1000cycles Temperature profile <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>STEP</th> <th>Temperature(°C)</th> <th>Time(minute)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Room temp.</td> <td>< 5</td> </tr> <tr> <td>2</td> <td>85°C</td> <td>30</td> </tr> <tr> <td>3</td> <td>Room temp.</td> <td>< 5</td> </tr> <tr> <td>4</td> <td>-40°C</td> <td>30</td> </tr> </tbody> </table>		STEP	Temperature(°C)	Time(minute)	1	Room temp.	< 5	2	85°C	30	3	Room temp.	< 5	4	-40°C
STEP	Temperature(°C)	Time(minute)														
1	Room temp.	< 5														
2	85°C	30														
3	Room temp.	< 5														
4	-40°C	30														

(Note 1) After testing, being placed at ambient conditions for 2hours or more, then to be measured.

(6-3 is following to next page)

Item	Condition	Judgment criteria
Durability for reflow soldering profile	Reflow cycles: 3cycles Reflow profile (under atmospheric condition): 	To satisfy "5. Electrical characteristics" (see Note 2)
Solderability	Terminals are immersed in rosin for 5 to 10 seconds and immersed in soldering bath (Sn-3Ag-0.5Cu) of 245+/-3°C for 5+/-0.5 seconds.	75% min. of end terminals shall be wet with solder.

(Note 2) After testing, being placed at ambient conditions for 2hours or more, then to be measured.

7. Standard mounting conditions

- 7-1. Composition of solder : Sn-3Ag-0.5Cu (lead-free solder)
- 7-2. Thickness of a solder-print mask : 0.15mm
- 7-3. Reflow soldering profile : see Figure 4 (under atmospheric condition)
- 7-4. Maximum times of reflow soldering : 3times

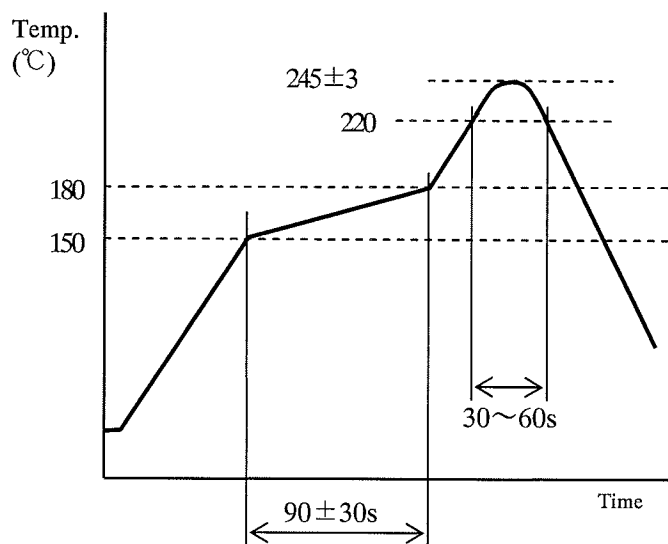


Figure 4

7-5. Soldering Iron

If soldering iron is needed, use iron (3mm diameter or less, 45W max.) that temperature of iron should be 380+/-10°C with 5+/-0.5 seconds at each of the terminals. Please be careful not to touch the soldering iron to the gyro sensor body directly.

7-6. Pad pattern:

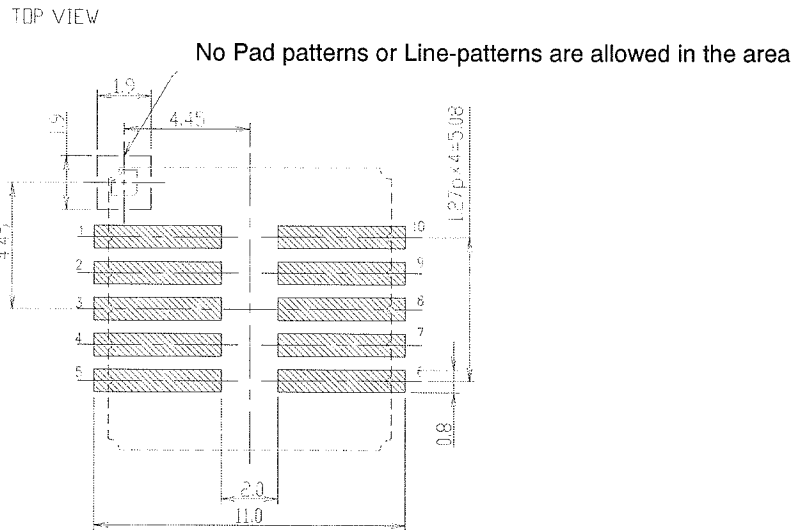


Figure 5

7-7. Washing

Wash is prohibited.

7-8. Recommendable circuit example for use of the gyro sensor

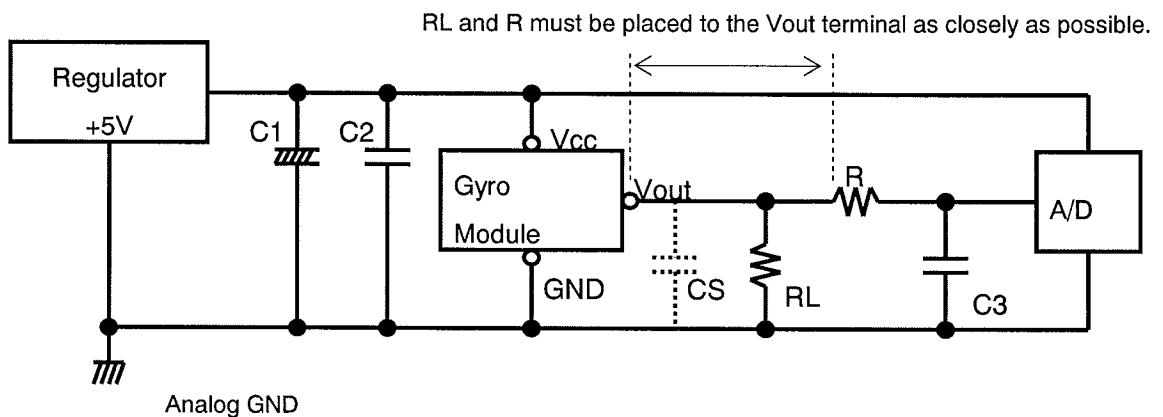


Figure 6

- C1, C2:** C1 and/or C2 is for noise elimination purpose on a power supply line used in the system. Please choose appropriate value for that.
- RL:** RL must be used as a load resistor of 100k ohm (or over).
- Cs:** Please do NOT connect a parallel capacitor "Cs" to the VOUT terminal of gyro. In case Cs is necessarily used, please make sure that the total capacitance never exceed 15pF, that may include stray capacitance possibly appeared on a signal line in between VOUT and A/D converter.
- R:** The stray capacitance might relatively increase, as the line-distance in between VOUT and A/D gets longer. If it will be totally 15pF or over, a series resistor "R" should be used to effectively reduce such a stray capacitance. R should better be mounted as closely as possible to VOUT, and must be one thousandth or less of input impedance of A/D. For the reference, R=2k ohm is recommended.
- C3:** C3 may be used to eliminate a high frequency noise, but please note that a low-pass filter, which is made by a combination of R and C3, causes phase delay, in other words, delay on response characteristic.

8. Packing style

Product is contained in plastic tape package. Package is prescribed as follows.

8-1. Taping method

The tape for the gyro sensor shall be reeled clockwise. The feeding holes shall be on the right side when pulling the tape toward the user.

8-2. Number of quantity per reel

A reel shall contain 200pcs of gyro sensors and be clearly marked with part number, quantity, inspection number.

8-3. Dimension of plastic tape (unit: mm)

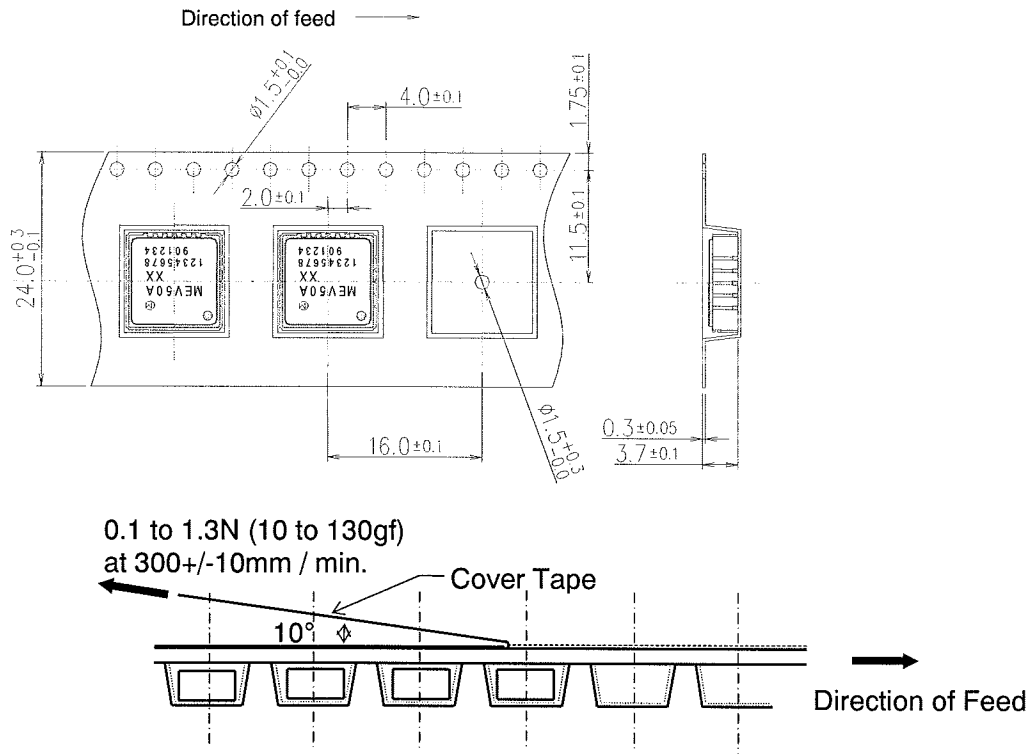


Figure 7

8-4. Dimension of plastic reel

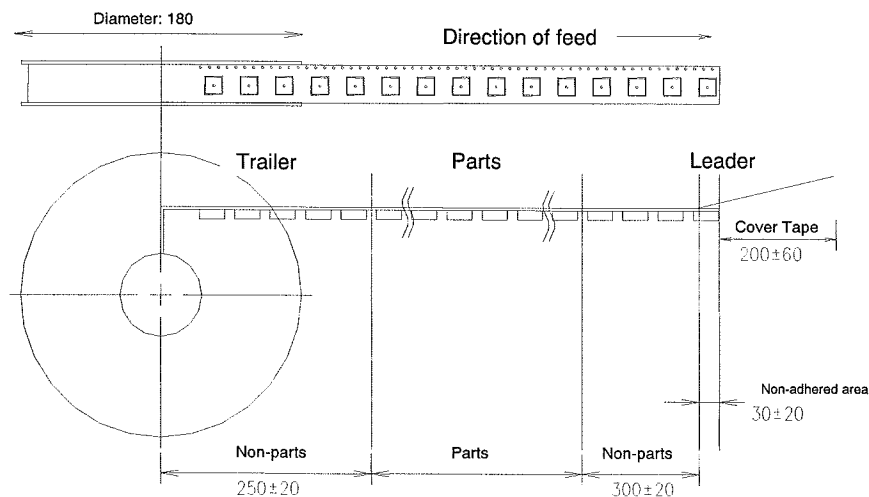


Figure 8

9. ⚠ CAUTION

9-1. Incorrect handling may affect the sensor characteristics. Please note the following precautions;

- A. Do not subject the sensor to shocks that exceed 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.

9-2. Precision electronic parts, such as ICs, are used for the sensor; therefore, it is necessary to take anti-static precautions when handling.

9-3. Do not disassemble.

9-4. Limitation of Applications

Please contact us before using our products for the applications listed below which require especially high reliability for the prevention of defects that might directly cause damage to the third party's life, body or property.

- 1) Aircraft equipment
- 2) Aerospace equipment
- 3) Undersea equipment
- 4) Power plant control equipment
- 5) Medical equipment
- 6) Traffic signal equipment
- 7) Disaster prevention / crime prevention equipment
- 8) Data-processing equipment
- 9) Application of similar complexity and/or reliability requirements to the applications listed in the above.

9-5. Fail-safe

Be sure to provide an appropriate fail-safe function on your product to prevent a secondary damage that may be caused by the malfunction or the failure of this product.

10 ⚠ Note

10-1. Please make sure that your product has been evaluated and confirmed against your specifications when our product is mounted to your product.

10-2. All the items and parameters in this approval sheet for product specification have been prescribed on the premise that our product is used for the purpose, under the condition and in the environment agreed upon between you and us.

You are requested not to use our product deviating from such agreement.

10-3. Please return one duplicate of this approval sheet for product specification to us upon approval.

If the duplicate is not returned by 3 months after our submission, this approval sheet for product specification will be deemed to have been approved by you.

10-4. We consider it not appropriate to include other terms and conditions for transaction warranty in product specifications, drawings or other technical documents. Therefore, if your technical documents as above include such terms and conditions as warranty clause, product liability clause, or intellectual property infringement liability clause, we will not be able to accept such terms and conditions unless they are based on the governmental regulation or they are stated in a separate contract agreement.