Panasonic INDUSTRY

6DoF Automotive Inertial Sensor

6in1 Sensor

EWTS5G series

The 6in1 sensor is a 6DoF inertial sensor with functional safety standard ISO26262 compliance for automotive applications. The sensing elements consists 3 Accelerometers and 3 Gyroscopes in single MEMS chip.
The MEMS, ASIC and Cap are directly bonded at wafer level and packaged.
This enables the 6in1 sensor to be compact, highly accurate, easy to install, and highly reliable.

Feature

- Functional Safety compliance (ISO26262) for automotive safety systems
  ・Compatible with ASIL-D functional safety system development
- 6DoF sensors on one single MEMS chip with high accuracy for more system design flexibility
  ・Orthogonality : ≦0.5° between Gyro and Acceleration axis
- Enable compact and simple ECU system design
  ・6in1 sensor package size : 4.5 x 4.5 x 1.1 mm
- RoHS compliance

Rating

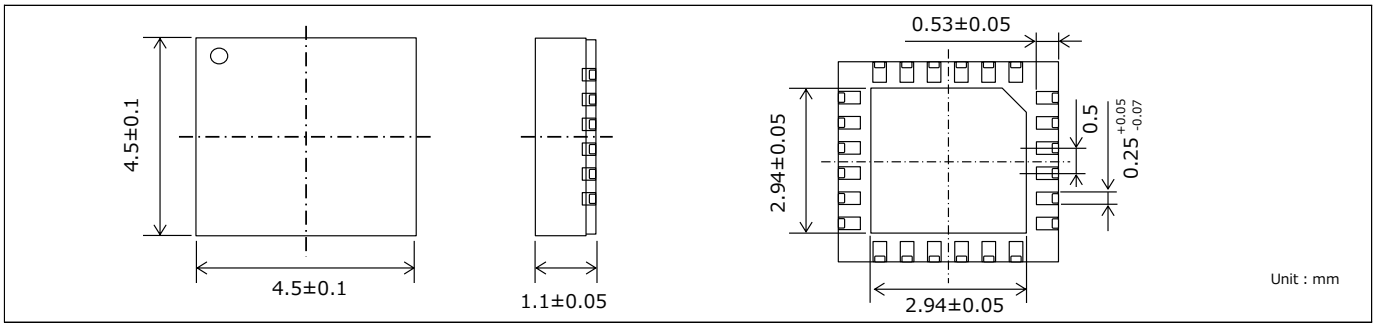
- Characteristics

Size (mm)		4.5 x 4.5 x 1.1
Operation temperature		-40 ℃ to +105 ℃
Storage temperature		-40 ℃ to +105 ℃
Operation voltage [DC]		3.3 ± 0.3 V
Current consumption		≦ 10 mA
Data interface		SPI
Gyro	Axis	X, Y, Z
	Zero point error	≦ ± 2.0 dps
	Scale factor error	≦ ± 3.0 %
	Full scale range	± 300 dps, ± 150 dps, ± 120 dps, ± 60 dps, ± 30 dps (Selectable)
	Frequency response	10 Hz, 12.5 Hz, 27 Hz, 30 Hz, 46 Hz, 60 Hz (Selectable)
	Cross axis sensitivity	≦ ± 2.0 %
	Output noise	≦ 0.1 dps rms (LPF : 60 Hz)
	Orthogonality	≦ 0.5°
Acceleration	Axis	X, Y, Z
	Zero point error	≦ ± 50 mG (X, Y), ≦ ± 84 mG (Z)
	Scale factor error	≦ ± 3.0 %
	Full scale range	± 16 G, ± 8 G, ± 2 G, ± 1 G (Selectable)
	Frequency response	10 Hz, 46 Hz, 60 Hz, 250 Hz, 300 Hz, 400 Hz (Selectable)
	Cross axis sensitivity	≦ ± 2.0 %
	Output noise	≦ 4 mG rms (LPF : 60 Hz)
	Orthogonality	≦ 0.5°

- Reliability test conditions (AEC-Q100 compliance)

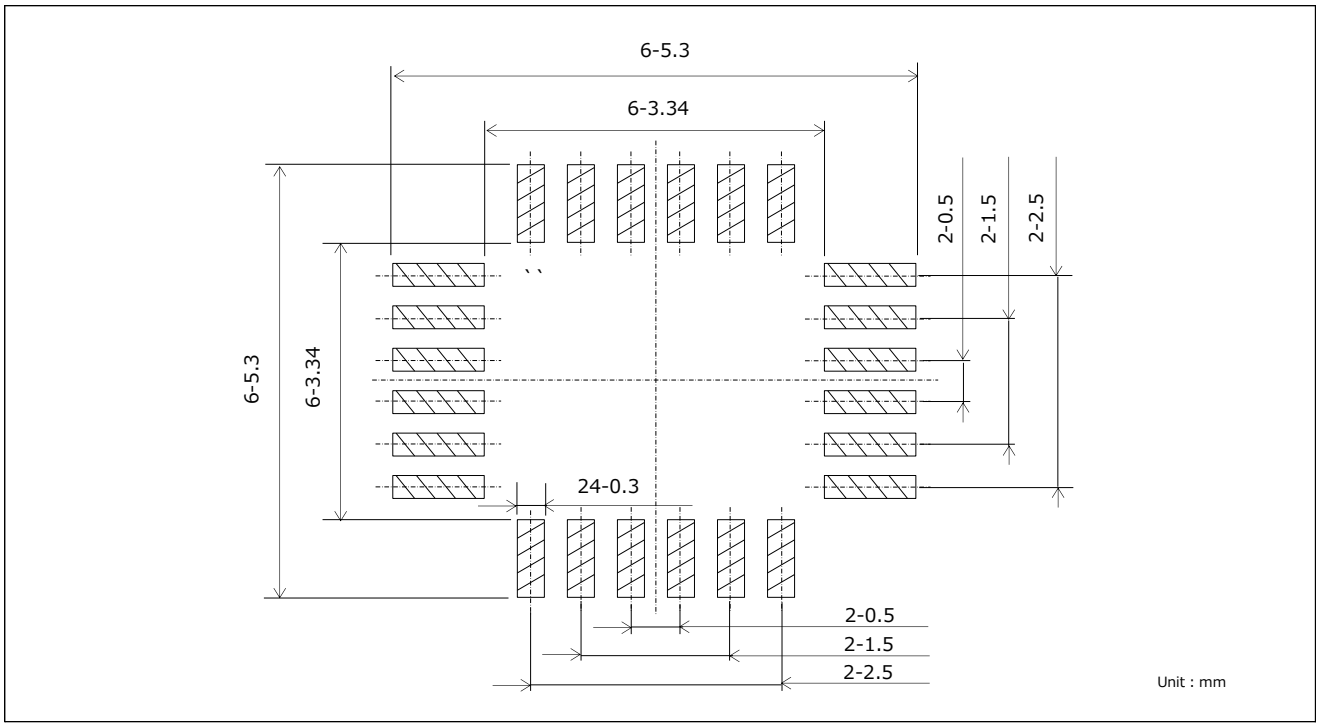
Temperature humidity bias (THB)	85 ℃ / 85 %RH / 3.6 V / 1000 h
High temperature storage life (HTSL)	125 ℃ / 1000 h
High temperature operating life (HTOL)	125 ℃ / 3.6 V / 1000 h
Temp cycling (TC)	-55 ℃ to 125 ℃ / 1000 cycles
Mechanical shock (MS)	1500 G / 0.5 ms / 5 times for each axis
Variable frequency vibration (VFV)	50 G / 20 Hz to 2 kHz / 4 times for each axis

Dimension

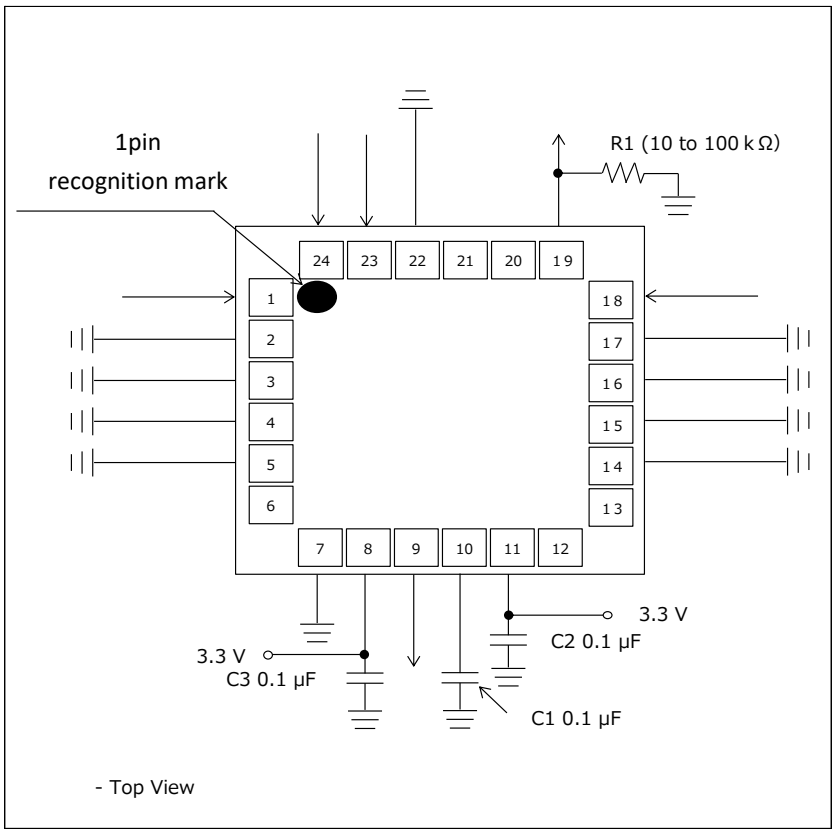


MSD Pad Design

・Recommended land pattern (to reduce mounting stress, recommend to use exact pads design)



Electrical connection and Pin-out



No.	Abbreviations
1	MOSI
2	GND3 (MEMS cap)
3, 4, 5	NC
6	TP3
7	GND
8	VDDIO
9	MISO
10	REGOUT
11	VDD
12	TP1
13	TP2
14, 15, 16	NC
17	GND4 (MEMS cap)
18	RESETN
19	TP0 / ALARMB
20	VPP
21	DVDD
22	GND2 (duplicate)
23	NCS
24	SCLK

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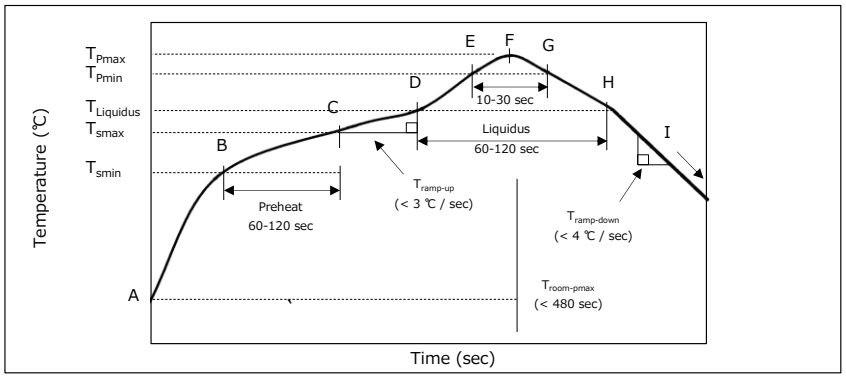
⚠ Application guidelines (6in1 sensor)

1. Soldering

1.1 Reflow soldering Profile

: To avoid the sensor damage, do not apply above 265 ℃ to the top surface of sensor.
The reflow conditions are recommended as below.



Step	Setting	constraint's		
		Temp (℃)	Time (sec)	Max.Rate (℃/sec)
A	Troom	25	-	-
B	TSmin	150	-	-
C	TSmax	200	60 < tBC < 120	-
D	TLiquidus	217	-	r(TLiquidus-TPmax) < 3
E	TPmin [255℃, 260℃]	255	-	r(TLiquidus-TPmax) < 3
F	TPmax [260℃, 265℃]	260	tAF < 480	r(TLiquidus-TPmax) < 3
G	TPmin [255℃, 260℃]	255	10 < tEG < 30	r(TPmax-TLiquidus) < 4
H	TLiquidus	217	60 < tPH < 120	-
I	Troom	25	-	-

1.2 Reflow soldering cycle : Two reflow solder cycle maximum

1.3 Solder mask specification : No special mask design.

1.4 Center solder pad : Soldering of center pad is not recommended.
Bottom of sensor's center pad and PCB should not be touched.
Temperature characteristics may fluctuate.

1.5 Terminal connection : Solder NC (Non-connect terminal) to improve the mountability.

2. Cleaning

Do not use ultrasonic cleaning system to the sensor. MEMS may be overstressed due to its resonances.
Refrain from the cleaning after sensor mounting.

3. Handling

3.1 Do not apply excessive shock(>10,000G) to the sensor.

3.2 Do not use any dropped sensor.

3.3 Storage, sensor package at ≦ 40℃, 90%R.H. and must be used within 12 months from the packing date.
After opening the package, mount the sensor within 168 h at ≦ 30℃, 60%R.h.(MSL 3)

3.4 This sensor is not designed for the extreme environment, so do not use under the following specific environment.
Extreme environmental condition, such as listed below, might degrade the sensor performance.
(1) Under any liquid, such as water, oil, chemical solution and organic solvent
(2) In direct sunlight, outdoor exposure, or dust
(3) In sea breeze or corrosive gas like CI2, H2S, NH3, SO2, NOx
(4) In static electricity, electromagnetic wave, or radiation
(5) Flux cleaning by solvent, water or aqueous solution
(6) Condensation
(7) Polluted environment

3.5 Usage of underfill, side fill material (adhesive etc.) and potting processing are not recommended.

4. Sensor placement in PCB

4.1 Do not mount the sensor near the substrate edge or the screw mounting location. The distortion applied to the sensor should be 500με or less. Place the sensor at least 15mm from the PCB edge.

4.2 Do not mount the sensor near parts generates heat to avoid affecting sensor characteristics.
Do not exceed the guaranteed operating temperature range.
The sensor should not be mounted near the power control circuit nor high voltage source.

4.3 Do not mount the sensor near high voltage power supply and its control circuit.

4.4 Do not mount parts such as a switch and a connector on the direct opposite side of PCB where the sensor was mounted.

4.5 Do not place any signal trace underneath the sensor.

4.6 Sensor mounted on PCB should not be interfere, physically contacting, with any surrounding components and / or any object, even under vibration.

4.7 PCB substrate resonance by external vibration might damage MEMS. After installing the sensor to the system unit, evaluate and ensure with vibration test.

5. Compliance for sensor usage

5.1 Although we are making every effort to ensure the quality of this sensor, there are life-time failure mode risks that could result in specifications such as Zero point voltage, sensitivity, instability, etc. to be out of range. Therefore, consider the consequences of a malfunction of this sensor beforehand when you design the system. Consider this in case that could lead to serious trouble relating human life or other serious damage for products related to transportation equipment (train, automobile, traffic signal equipment, etc.), medical equipment, aviation, space equipment, electric heating, combustion and gas equipment, rotating equipment, fire prevention equipment, crime prevention equipment, nuclear power related equipment, machine tools, etc. Use best practice and assume full responsibility for fail-safe design by considering the following guides to ensure safety:

(1) Design protection circuits and functionality to ensure safety as a system

(2) Design redundant circuits to ensure safety as a system so that it will be safe under malfunction.

5.2 If there is any concern related to the sensor and securing safety of application, please notify us promptly. Engineering level evaluation of use of the sensor must be conducted.

■ AEC-Q100 compliant

The products are tested based on all or part of the test conditions and methods defined in AEC-Q100.
Please consult with Panasonic for the details of the product specification and specific evaluation test results, etc., and please review and approve Panasonic's product specification before ordering.