OMRON

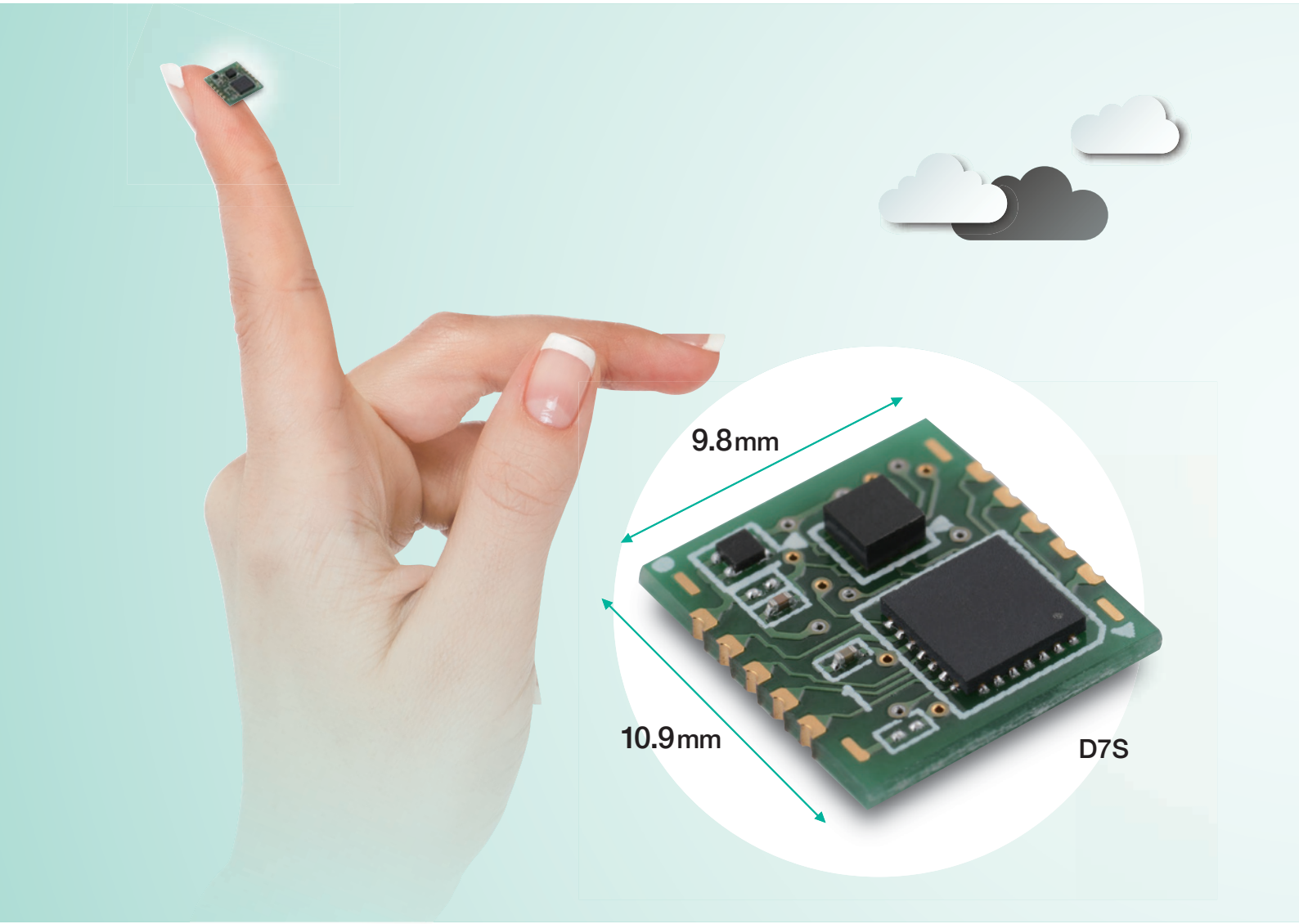
Vibration Sensors

D7S



Compact & High-precision Seismic Sensors

- Reducing Secondary Disasters from Earthquakes -



What Is an SI Value?

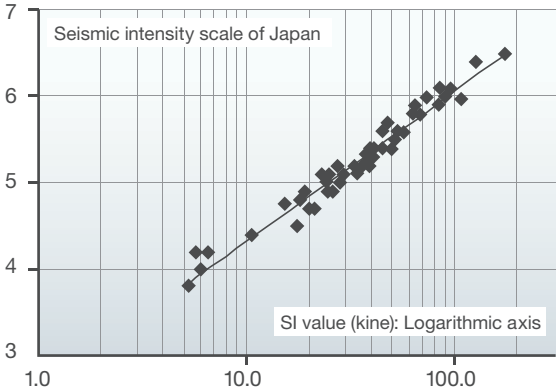
The SI value (or spectral intensity) is equivalent to the magnitude of the destructive energy imposed by seismic motion on structures.

The SI value, which is the average value of the integrated velocity response spectrum, is an index that expresses the destructive force of seismic motion and is highly correlated with the damage to structures.

SI value formula

$$SI = \frac{1}{2.4}\int_{0.1}^{2.5} Sv(T,h)dT$$

Relationship between SI Value and Measured Seismic Intensity Equivalent Value



New earthquake detection sensors with high detection precision and low electricity consumption through 3-axis acceleration sensors and a unique SI value calculation algorithm. Superior cost performance.

Ultra Compact

The Best for Embedding in Equipment

The D7S can be embedded in essentially any device thanks to its ultra-small size and ultra-low consumption to contribute to package downsizing.

High Precision

Rejects Impulse Vibration Noise

Spectral intensity (SI) high-precision earthquake indicator, which correlates highly with damage to structures.

IoT Friendly

Earthquake Maps and Rescue Maps

Internal memory and I^2C interface enable the creation of original applications.

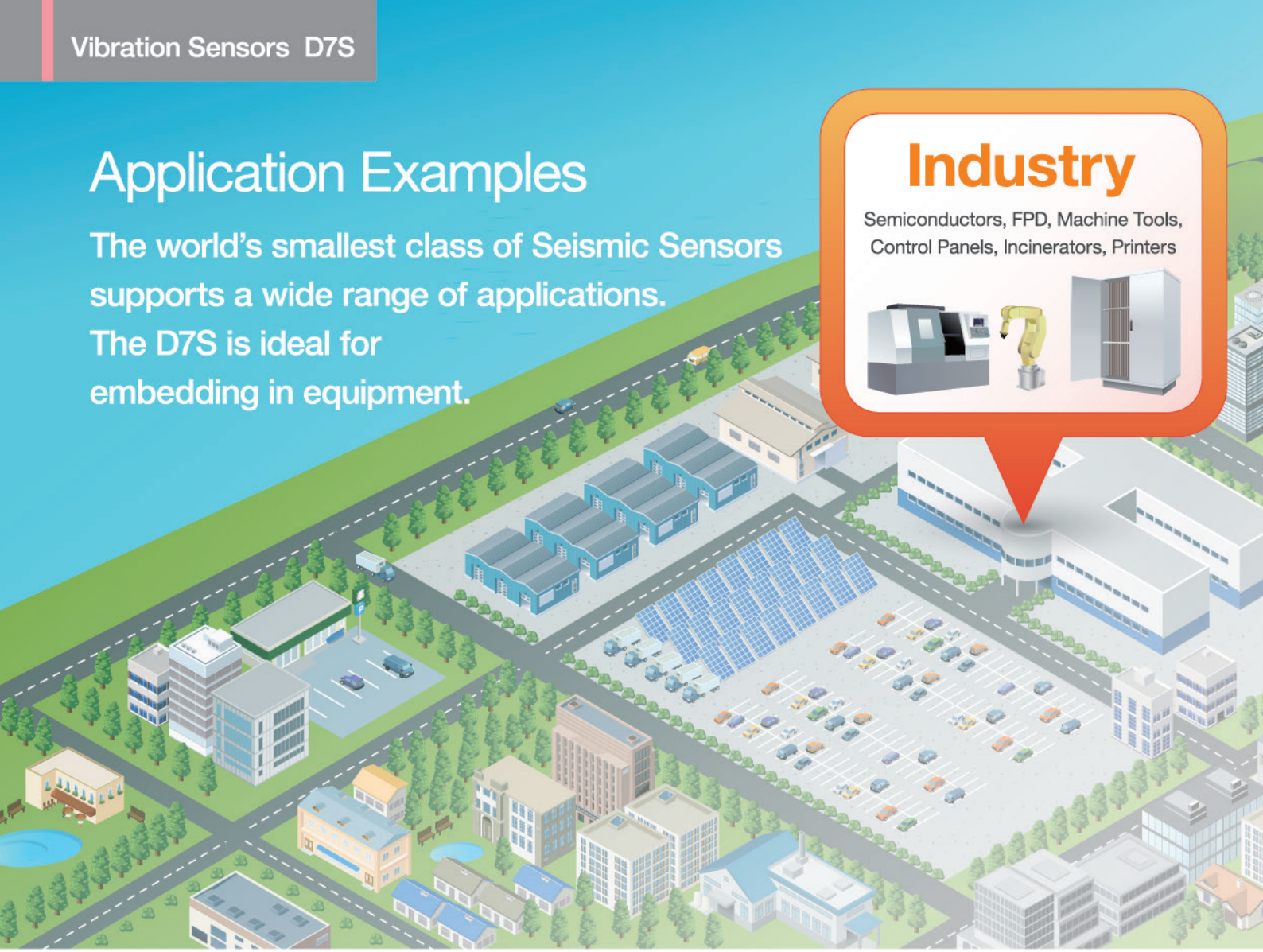
Comparison of SI Values and Acceleration

As an index, the SI value has a higher correlation with the seismic intensity scale of Japan than the maximum acceleration does. This makes it possible to make judgments that accurately reflect structural damage.

	Maximum acceleration	Seismic intensity scale of Japan	SI value
Overview	Maximum acceleration value	Calculated from the acceleration	**Average value of the shaking velocity**
Calculation load	Small	Large	**Small to medium**
Correlation with structural damage	△	◎	◎
Correlation with the Japan Meteorological Agency's earthquake level	△	Empirical formula set by the Japan Meteorological Agency	○
Others		Introducing this measurement method involves cost because Japan Meteorological Agency certification is required.	**The SI value correlates highly with the measured seismic intensity and can be calculated easily, so it is used by major gas companies and railroads too.**

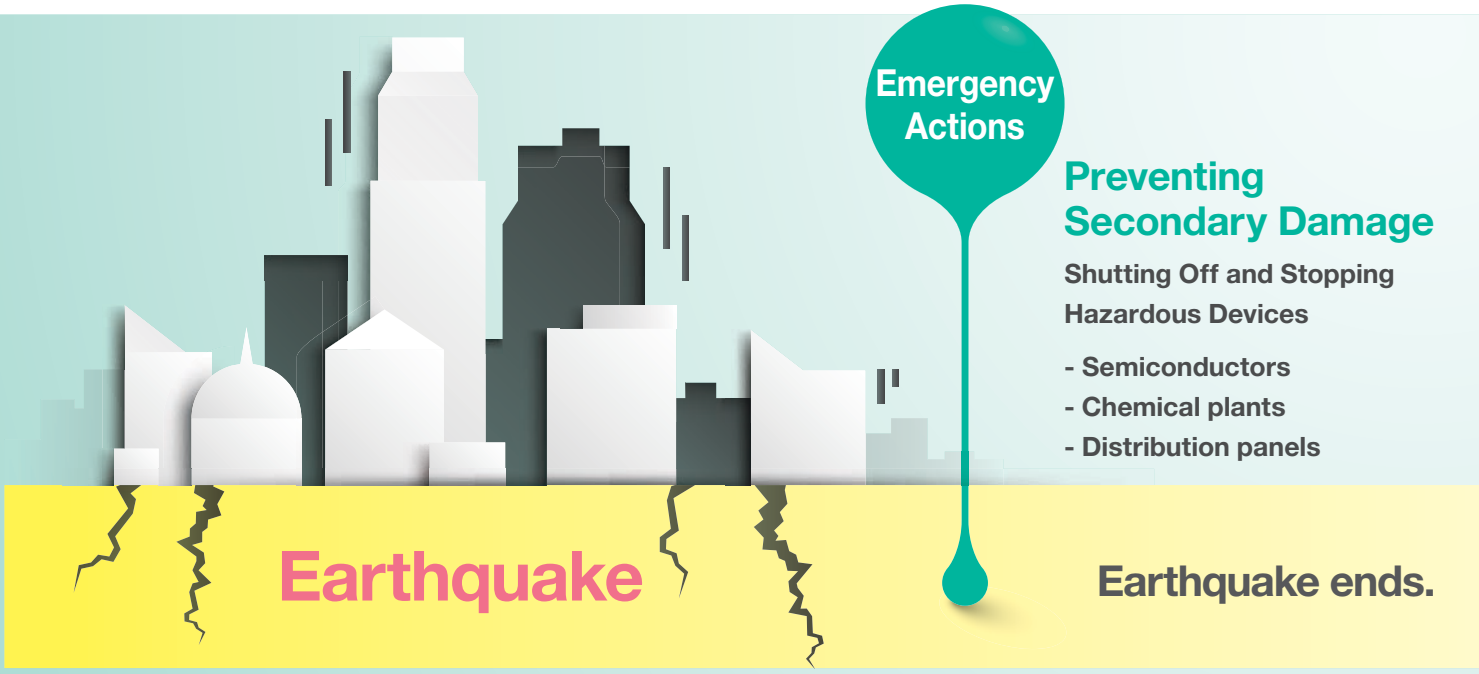
Application Examples

The world's smallest class of Seismic Sensors supports a wide range of applications. The D7S is ideal for embedding in equipment.



Examples of Vibration Sensor Applications

With their high detection accuracy, these Sensors help with measures to prevent secondary damage after earthquakes in a variety of settings.



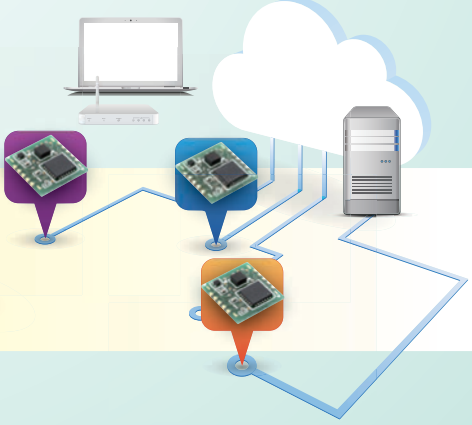


Rescue

Determining Damage

Mapping seismic intensity and building collapse information
Vibration Sensor communications enable the collection of earthquake information to map damage conditions by area.

- Creating suitable restrictions for traffic and train operation



Restoration

- Disaster map creation

Prevention

D7S
Vibration Sensor

Helps Prevent Fire and Other Secondary Disasters after an Earthquake. The World's Smallest Class Size Seismic Sensor.



- **Using the SI value, which has a high correlation with the seismic intensity scale that indicates the magnitude of an earthquake, provides higher-precision judgment of seismic intensity scales.**
- **The 3-axis acceleration Sensor and OMRON's unique SI value calculation algorithm achieve surface-mountable compact modules and low power consumption.**
- **Higher degree of freedom for incorporation into devices and prolonged operation on battery power.**
- **Shutoff output terminal (INT1) operates equivalent to a conventional mechanical vibration sensor and ensures compatibility with mechanical vibration sensors.**
- **I²C interface is able to obtain earthquake-related information from the Sensor with communications from external devices.**

RoHS Compliant

Refer to the *Safety Precautions* on page 9.

Ordering Information

Type	Appearance	Power supply voltage	Model	Minimum packing unit *
Surface-mounting Vibration Sensor		2.1 to 5.5 V	**D7S-A0001**	1,000 pcs.
			D7S-A0001-R100	100 pcs.

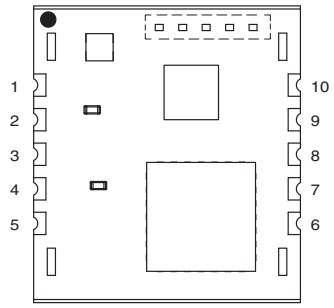
* Products are packed with embossed tape.

Characteristics/Performance

Item / Model	D7S-A0001
Power Supply Voltage	2.1 to 5.5 V
Current consumption	During standby: 90 μA or less Processing (average): 300 μA or less
Operating Temperature	–30 to 70°C (with no condensation or icing)
Storage Temperature	–40 to 80°C (with no condensation or icing)
Ambient Humidity	25% to 95% (with no condensation or icing)
Storage Humidity	25% to 95% (with no condensation or icing)
Acceleration Detection Range	–2,000 to 2,000 gal
Shutoff Output (INT1)	Output at seismic intensity level 5 or higher.
Communications Interface	I²C
Dimensions	10.9 × 9.8 mm
Installation angle	±5°

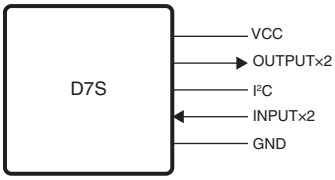
Connections

● Terminal Arrangement

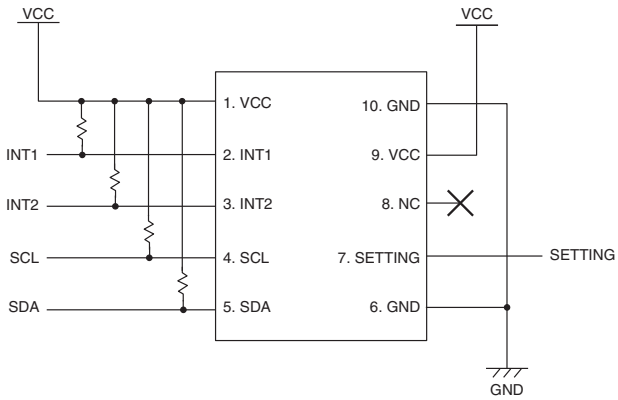


No.	Signal	Function	Direction	Description
1	VCC	Power supply voltage	---	
2	INT1	Shutoff output	OUT	An open-drain output. Goes active (ON) when the shutoff judgment condition and collapse detection condition are met.
3	INT2	Processing notification output	OUT	An open-drain output. Goes active (ON) during earthquake calculations, offset acquisition, and self-diagnostic processing.
4	SCL	I²C clock	IN	Pull up the voltage to VCC even when you do not use I²C.
5	SDA	I²C data	IN/OUT	Pull up the voltage to VCC even when you do not use I²C.
6	GND	Power supply ground	---	
7	SETTING	Initial setting input	IN	Changes the Sensor to Initial Installation Mode for an input from an external device. Normal Mode: High Initial Installation Mode: Low
8	NC	Not connected	---	Completely floating and cannot be connected to another line.
9	VCC	Power supply voltage	---	
10	GND	Power supply ground	---	

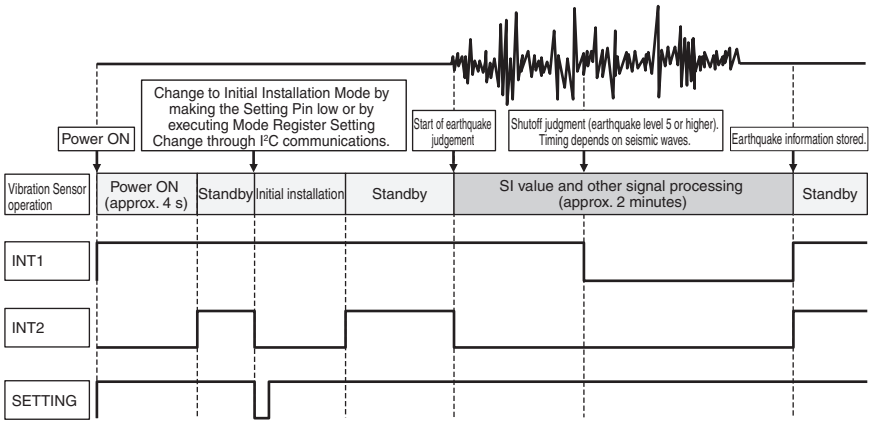
● Block Diagram



● Circuit Diagrams

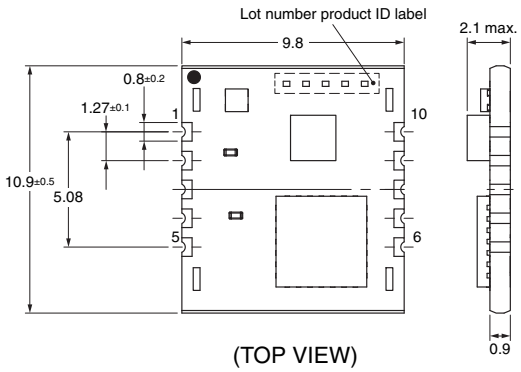


● **Operation Chart**

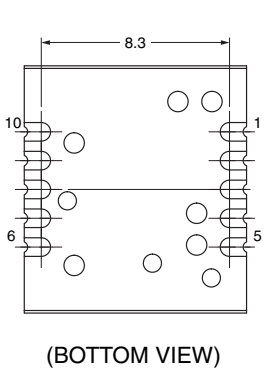


Dimensions (Unit: mm)

D7S-A0001

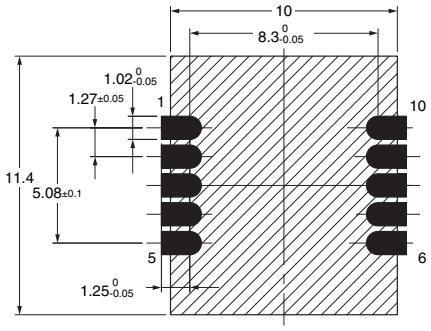


(TOP VIEW)



(BOTTOM VIEW)

Recommended Mounting Pattern
(TOP VIEW)



Note. Do not mount other components or place wiring patterns in the area marked with diagonal lines.

Recommended Mounting Conditions
Peak mounting temperature: 245°C min. (260°C max.)
Reflow time: 64 to 80 s (220°C)
Reflow repetitions: Up to 2

Safety Precautions

⚠ Caution

This Sensor is a precision device. Do not drop it or subject it to excessive shock or force. Doing so could break it or change its characteristics. Do not use the Sensor if it has been dropped.

Precautions for Correct Use

● Operating Environment

- Do not use the Sensor in locations with volatile, flammable, or corrosive gas (organic solvent vapor, sulfite gas, chlorine, sulfide gas, ammonia gas, etc.) or other toxic gases. They may cause the Sensor to break down.
- Do not use the Sensor in locations subject to fresh water, salt water, water drops, or splattering oil.
- Do not use the Sensor in an environment where condensation or icing may occur. Moisture freezing on the Sensor may cause output to fluctuate or may cause the Sensor to break down.
- Do not use the Sensor in locations subject to direct sunlight. Doing so may cause the Sensor to break down.
- Do not use the Sensor in locations subject to direct radiant heat from heating equipment. Doing so may cause the Sensor to break down.
- Do not use the Sensor in locations with severe temperature changes. Doing so may cause the Sensor to break down.
- Do not use the Sensor in environments with excess mechanical stress. Doing so may cause the Sensor to malfunction or break down.
- Do not use the Sensor in locations with large vibration or shock. These may cause the Sensor to break down.
- Do not use the Sensor in locations with strong electrical or magnetic fields. These may cause the Sensor to break down.

● Countermeasures against Noise

- The Sensor does not contain any protective circuits. Never allow the electrical load to exceed the absolute maximum ratings. Such loads may damage the circuits. If required, install protective circuits so that absolute maximum ratings are not exceeded.
- Allow as much space as possible between the Sensor and devices that generate surges or high frequencies (such as high-frequency welders and high-frequency sewing machines). Attach a surge protector or noise filter on nearby noise-generating devices (in particular, motors, transformers, solenoids, magnetic coils, or other devices that have an inductance component).
- Wire the Sensor away from high-voltage and large-current power lines in order to prevent inductance noise. It is also helpful to separate conduits and ducts and to use shielded cables.
- When using a switching regulator, power supply switching noise may cause malfunctions, so check this before use.

● Handling

- Static electricity can destroy the Sensor. Take countermeasures including grounded work benches, floors, and other charged objects and workers.
- Do not handle the Sensor in locations with excessive vapor, dust, dirt, etc.
- Do not hold the Sensor with pliers, tweezers, or similar tools, and do not subject components to damage or excessive shock due to inadequate adjustment of the mounter.
- When placing components near the edge of the PCB or near a connector, make sure that stress is not applied to the Sensor when the device is assembled or when the connector is connected or disconnected.
- Do not apply any external force to components after soldering until everything has cooled off and do not allow mechanical stress due to PCB warping or other factors.
- Under some usage conditions, ultrasound may cause the Sensor to resonate and be destroyed. OMRON cannot specify the detailed conditions under which the Sensor will be used, so we assume no responsibility if the Sensor is used in environments where ultrasound is used. If the Sensor must be used in an environment with ultrasound, check its performance in the actual environment beforehand.
- Stress due to plastic hardening may change Sensor characteristics. Do not mold seal the Sensor after mounting.
- When applying a moisture preventing coating or other coating after mounting the Sensor, select a coating with minimal stress and check operation carefully.
- Do not attempt to disassemble or modify the Sensor.
- Do not use the Sensor in safety devices or for applications in which Sensor operation would directly affect human life.
- Carefully read the precaution in the *Instruction Manual* before using the Sensor.
- In addition, if you use the Sensor under conditions other than those in these specifications, check Sensor operation under those conditions beforehand.

● Shipping and Storage

- Do not store the Sensor in locations with harmful corrosive gas (organic solvent vapor, sulfite gas, sulfide gas, etc.)
- The Sensor is not drip proof, so do not store it anywhere that water might get on it.
- Store the Sensor within appropriate temperature and humidity ranges.
  * Before storing the Sensor in an environment other than the environment recommended by OMRON, evaluate the results in the actual storage environment and judge whether or not storage there is appropriate.
- Do not store the Sensor in locations with excessive vapor, dust, dirt, etc.

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