White Paper
MEMS Non-Contact Temperature Sensor

OMRON

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INTRODUCTION

OMRON's MEMS non-contact temperature sensor is an infrared temperature sensor that can measure target surface temperature without touching, by receiving radiant heat from the object with thermopile element(s).

To support embedded applications, OMRON has implemented thermopile element(s) and ASIC into one package of MEMS non-contact temperature sensor using its unique MEMS technology, materializing an ultra-small module.

Digital output of temperature data detected by the MEMS non-contact temperature sensor through I2C communications can reduce both processing load of the master-end microcontroller and the development period.

With its non-contact measurement of target surface temperature, MEMS non-contact temperature sensors can contribute to energy saving, better amenity, productivity improvement by detecting a human or an object or abnormal heat generation of equipment in a various places including a home, building, and/or factory. We have lineup of different number of thermopile elements and viewing angles so that you can select one according to your application. For details, refer to the datasheet and user's manual.

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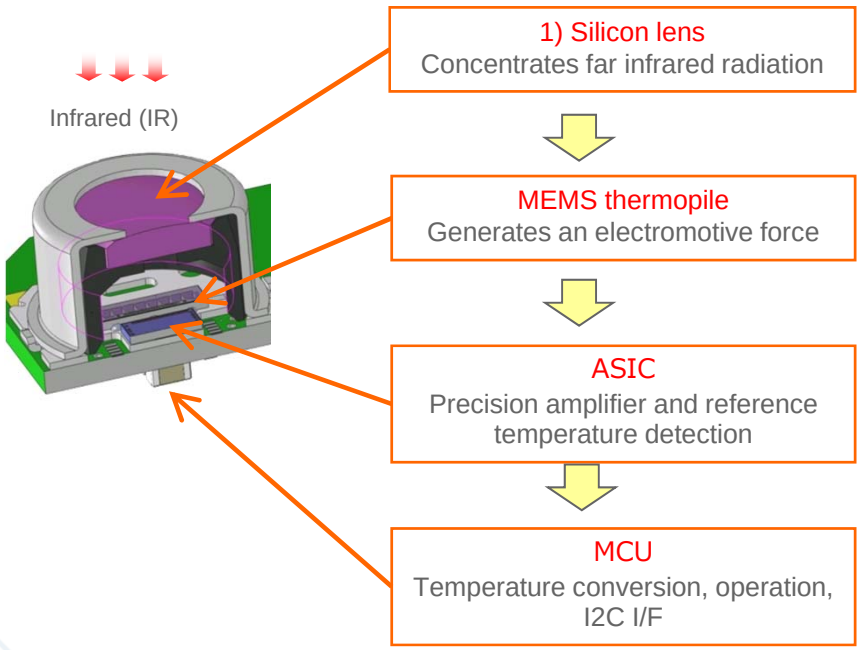
Feature of MEMS Non-Contact Temperature Sensor (D6T)

MEMS non-contact temperature sensor D6T series is a module product that allows connection with only one connector, integrating silicon lens, MEMS thermopile sensor, dedicated analog circuit, and logic circuit for conversion into digital temperature data on a small circuit board.
Described below is an overview of measurement by the non-contact temperature sensor:

1) The silicon lens concentrates the radiant heat (far infrared rays) generated by the object on the thermopile sensor in the module.
2) The concentrated radiant heat (far infrared rays) generates an electromotive force through the thermopile sensor.
3) The electromotive force value and internal temperature sensor value are measured and the measured value (object temperature) is calculated by interpolation using the built-in lookup table based on those values.
4) The measured value is loaded from an upstream system via the I2C bus.



Cross-Sectional Image and Functions

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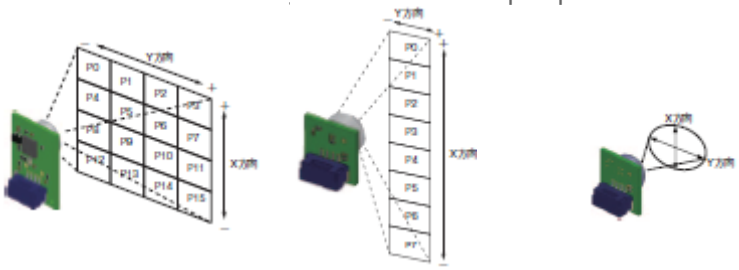
Viewing Angle and Number of Elements

MEMS non-contact temperature sensor D6T series has various viewing angles based on its thermopile element layout and OMRON's unique optical design. An area that can be detected by an MEMS non-contact temperature sensor depends on its viewing angle and distance, meaning that the larger the distance, the larger the detectable area.
If an object to measure is smaller than the viewing range, background temperature around the object affects the measurement.
The number of thermopile elements can be 16 (4x4), 8 (1x8), or 1 (1x1). If the number of elements is 16 or 8, the sensor can detect temperature transition (e.g. movement from right to left), meaning that it can be used as a motion sensor or for counting the number of people.



Direction	4x4 Type	1x8 type	1x1 type
X	44.2°	54.5°	58°/26.5°
Y	45.7°	5.5°	58°/26.5°

Temperature Range

MEMS non-contact temperature sensor D6T series has a detectable temperature range from -40 to +80 degrees C. It allows measurement of food inside a freezer and detection of abnormal heat generation of equipment.

-40(℃)
-40(°F)

80(℃)
176(°F)

Freezing room in refrigerator

Cold water tank in refrigerator

Living space/ Working environment

Heat detection

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Applications

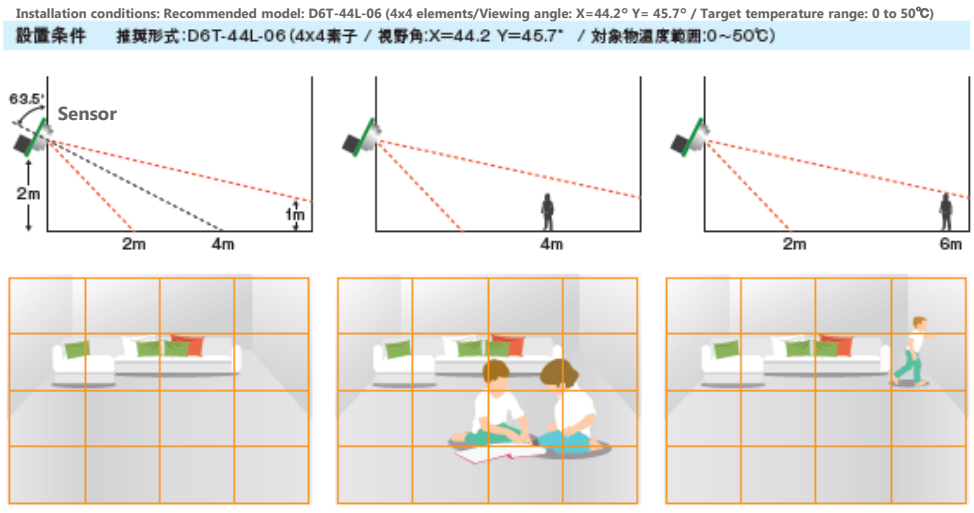
Human detection

A MEMS non-contact temperature sensor using thermopiles can be used for human detection.

A MEMS non-contact temperature sensor can solve the problem of pyroelectric sensors that are used as traditional infrared human sensors. Due to its principle of detecting change components of infrared radiation, a pyroelectric sensor can detect movement of a human while it loses measurement signals when he/she does not move. On the contrary, an MEMS non-contact temperature sensor using thermopiles can retain measurement signals even if the human does not move.

By making full use of this feature, we can realize human detection in the living room, office, and conference room, which was previously considered to be unsuitable, contributing to energy saving and better amenity through feedback to air conditioning and lighting control.

Shown below are concept images of human detection in a living room with a 16-element (4x4) type sensor. Based on a temperature difference between human body surface and the background, the sensor can recognize not only presence of a human but also his/her position and movement.



Temperature distribution detection result

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Applications

Food detection

A MEMS non-contact temperature sensor can detect temperature of food in refrigerator or microwave oven, materializing energy saving and better high functionality through feedback to control.

Abnormal heat generation detection

A MEMS non-contact temperature sensor can detect abnormal heat generation of FA equipment and power board. Through constant monitoring and daily checkup, an error of equipment can be recognized beforehand to notify a maintenance timing. It can contribute to reduce part replacement cost and minimize impact of a failure on production.

Also, attaching a thermometer or thermistor inside the equipment to monitor temperature can solve the problem that limits the number of simultaneous monitoring points due to wiring and space restriction.

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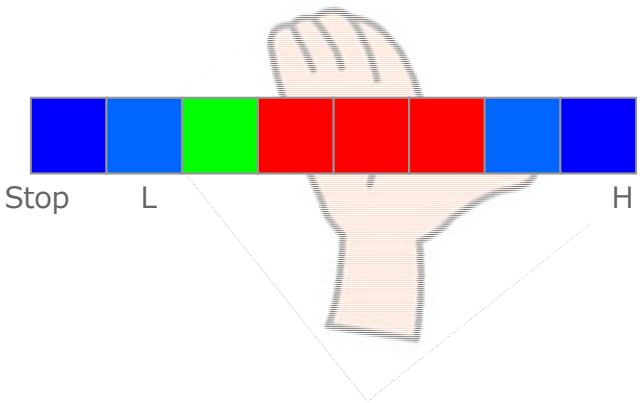
Applications

Motion sensing

If the number of elements is 16 or 8, the sensor can detect temperature transition in the field of view and be used as a motion sensor to operate equipment.

In the kitchen, for instance, equipment can be operated without touching by a hand when the hand is dirty, such as adjusting the amount of water from the faucet or adjusting the power of the gas stove, which is sanitary.



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