D6T Product training

OMRON's MEMS IR Sensor

Features

Measure the surface temperature of the material by detecting intensity of the infrared radiation.

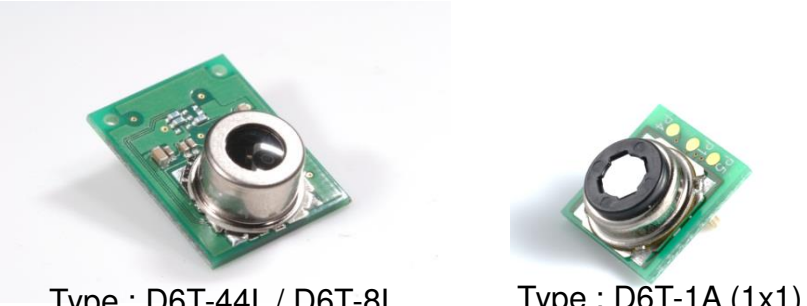
Best fit for human detection and non-contact temperature measurement.

Technology

Incorporate state-of-the-art MEMS thermopile, custom designed sensor ASIC and signal processing micro processor and algorithm into tiny package.

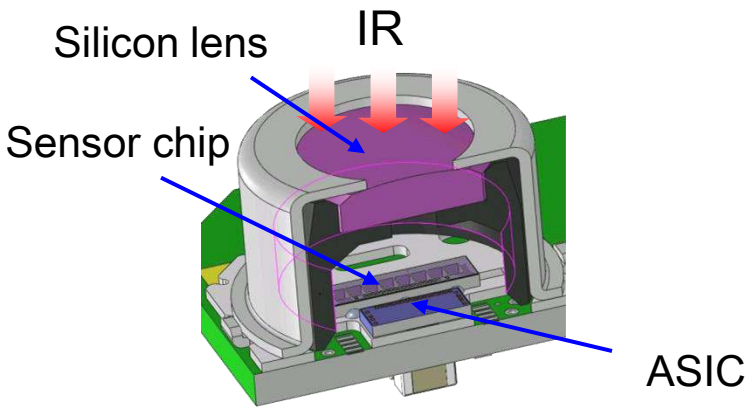
●Small	14.0x18.0mm , 12.0x11.6mm
●Digital temperature output	I2C
●High sensitivity and Low Noise	*NETD=0.14℃

*NETD:Noise Equivalent Temperature Difference



Type : D6T-44L / D6T-8L　　Type : D6T-1A (1x1)

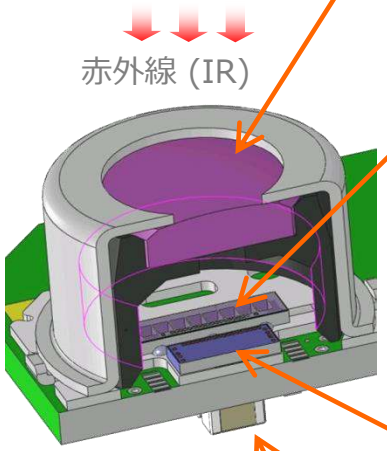
Product appearance



Cross-section image

MEMS:Micro Electro Mechanical Systems

Structure of D6T

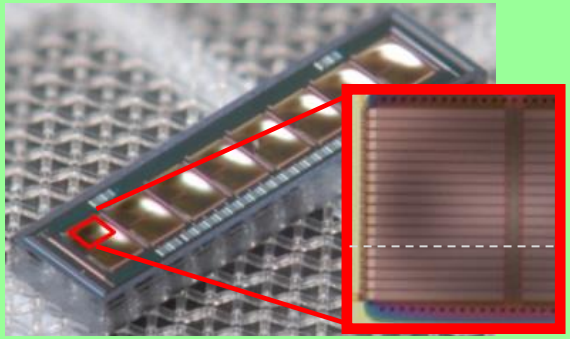


Silicon Lens
Gather radiated infrared in the thermopile

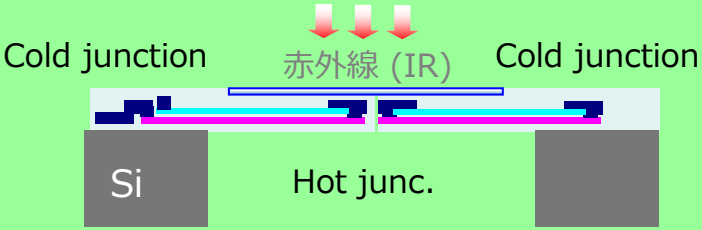
MEMS Thermopile Array
Transduce infrared light into electrical signal

ASIC
Low noise amplification and detection of chip temperature.

MCU
A/D conversion ,
Calculation and I2C I/F.



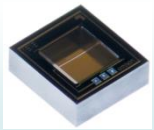
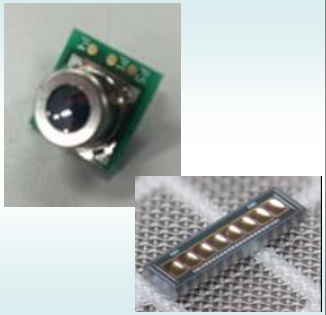
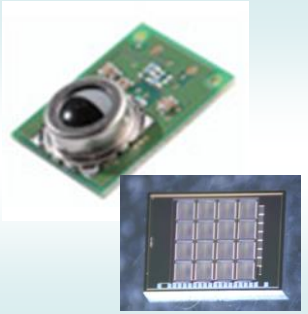
Thermopile (1x8 type)



By the Seebeck effect, an electromotive force is output according to the temperature difference between the hot and cold junctions.

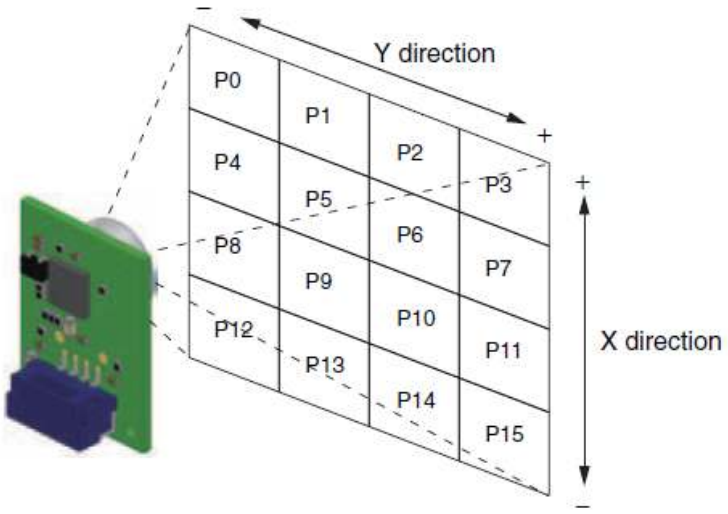
Object temperature is output in digital.

Lineup and main specifications

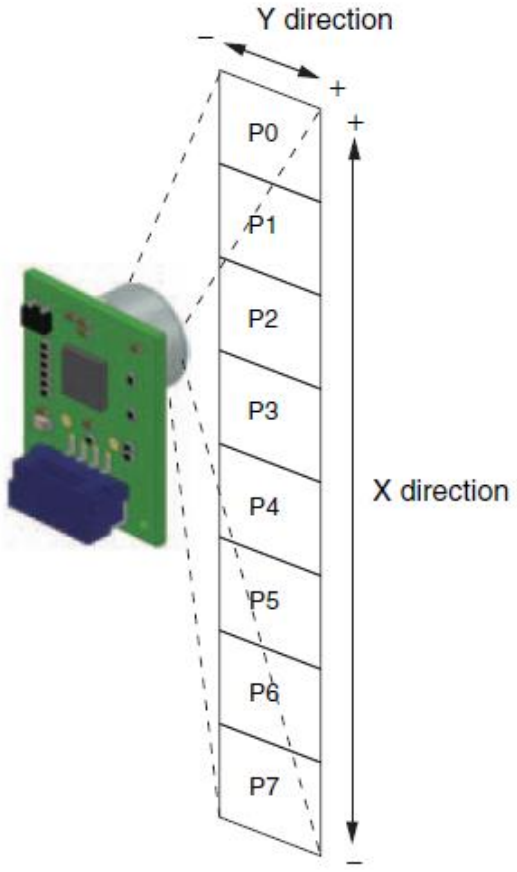
Model	1x1 : D6T-1A-02	1x1 : D6T-1A-01	1x8 : D6T-8L-09	4x4 : D6T-44L-06
Element type	1x1		1x8	4x4
Outline	L:12.0mm x W:11.6mm x H:9.2mm		L:12.0mm x W:11.6mm x H:10.7mm	L:18.0mm x W:14.0 mm x H:8.8mm
Appearance				
Object temperature detection range	-40℃ ～ +80℃	+5℃ ～ +50℃	+5℃ ～ +50℃	+5℃ ～ +50℃
Operating temperature range	-40℃ ～ +80℃	0℃ ～ +60℃	0℃ ～ +60℃	0～ +50℃
View angle X = X direction Y = Y direction	X = 26.5° Y = 26.5°	X = 58.0° Y = 58.0°	X = 54.5° Y = 5.5°	X=44.2° Y=45.7°
Power supply voltage	DC5.0V ±0.5V			
Communication form	Digital (I2C)			

Detection area for each pixel

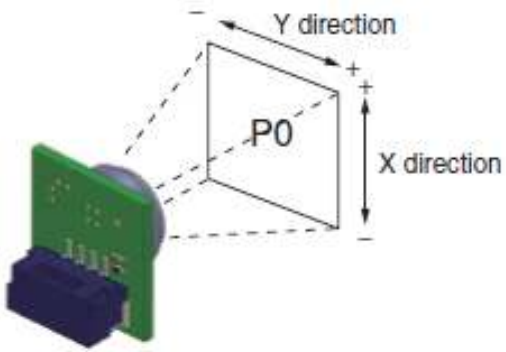
Image of field of view



4x4 Type



1x8 Type



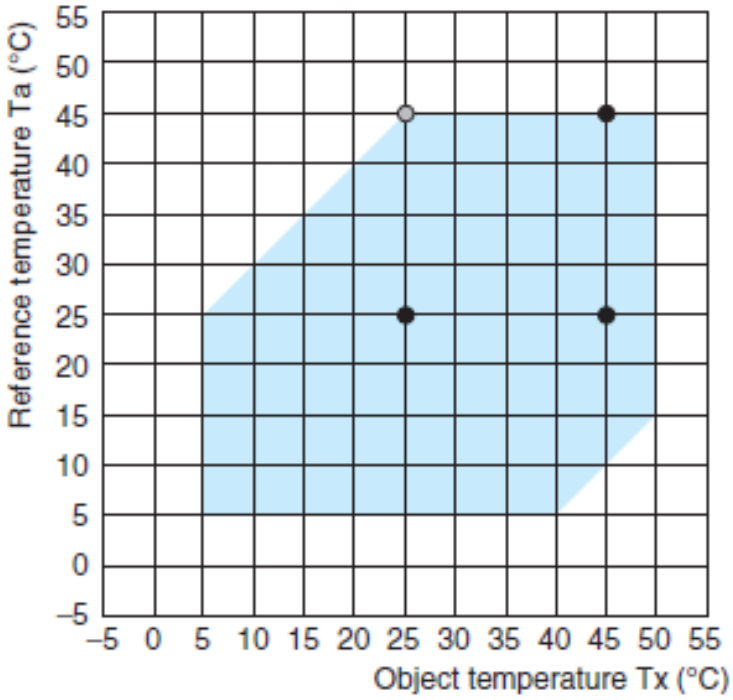
1x1 Type

Object temperature output accuracy

● Accuracy 1	±1.5 ℃ max. (1) Tx = 25° C, Ta = 25° C (2) Tx = 45° C, Ta = 25° C (3) Tx = 45° C, Ta = 45° C	Adjustment point
○ Accuracy 2	±3.0 ℃ max. (4) Tx = 25° C, Ta = 45° C	Inspection point

Object Temperature Detection Range

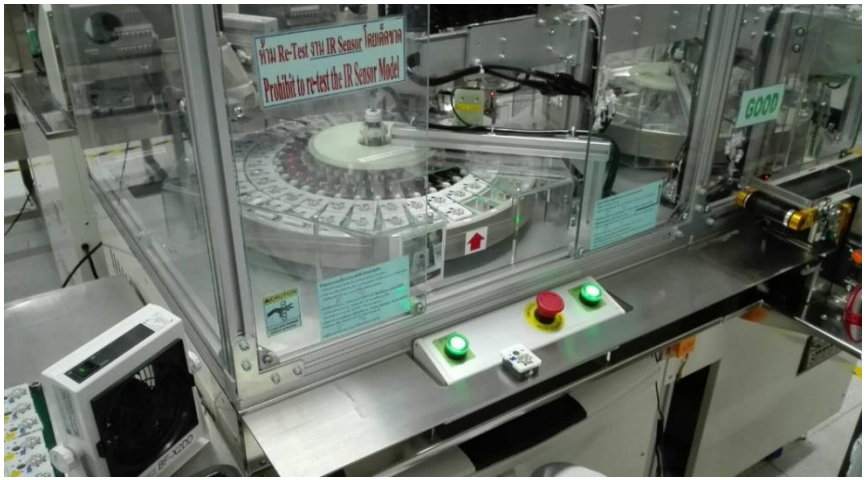
D6T-44L-06, D6T-8L-06, D6T-8L-09, D6T-1A-01



Tx：Object temperature
Ta： Ambient temperature

Adjustment method

For mass production equipment

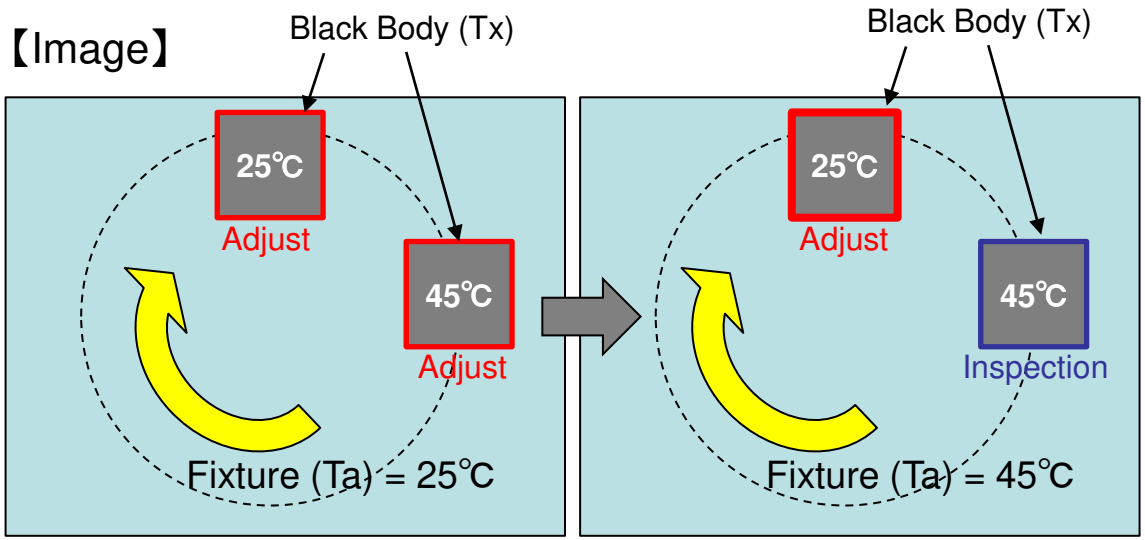


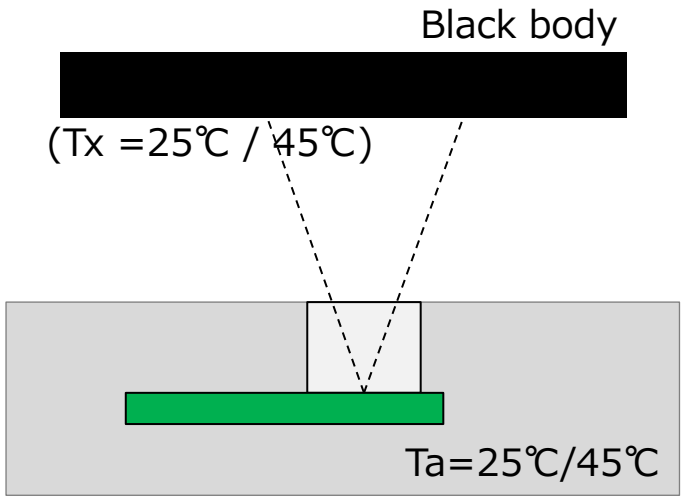
Based on the adjustment data, write the sensor temperature correction value.

Accuracy of the sensor is dependent on the adjustment.

If temperature accuracy of Ta and Tx can improve, accuracy of the sensor is improved.

【Image】

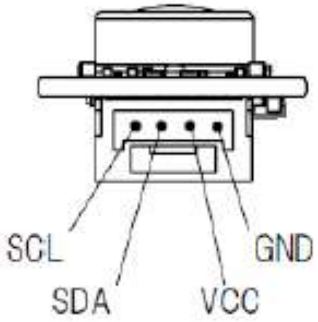




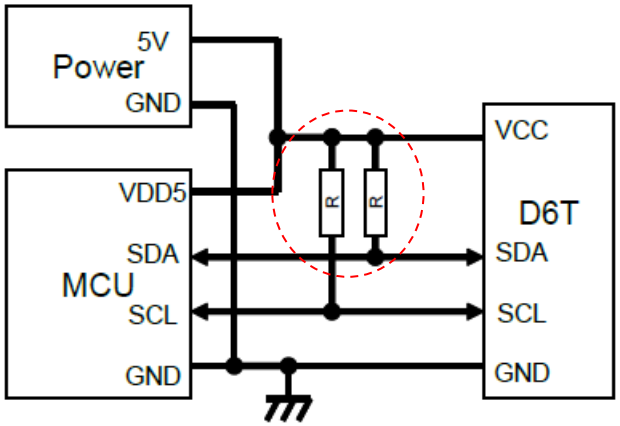
I2C port setting

Connector pin

1	GND	Ground
2	VCC	Power source (5V +/-10%)
3	SDA	I2C(5V) Data line
4	SCL	I2C(5V) Clock line



Use the specified connector (GHR-04 from JST) .



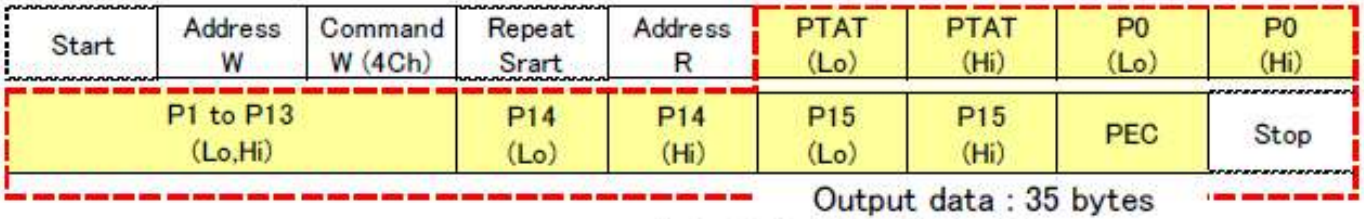
Connect the open-drain SDA / SCL terminal to a pull-up resistor. (Most case : About 3k to 10kΩ)

I2C port parameters

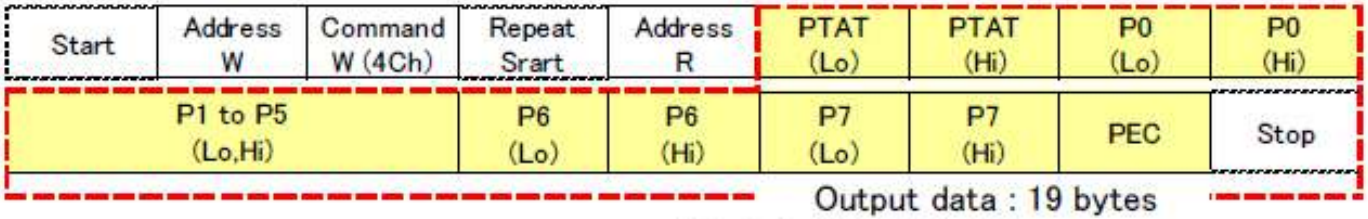
Device Address	7bit : 0001_010b 8bit (with R/W bit) Read : 15h , Write : 14h
Data bit width	8bit (MSB-first)
Clock Frequency	max 100kHz

Slave address can not be changed.
If the customer is connecting multiple sensors, use the I2C bus switch IC.

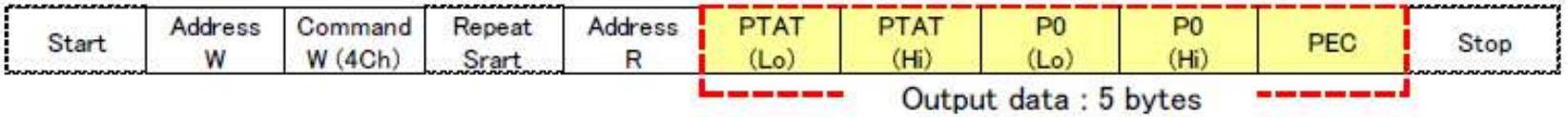
I2C port data chart



(a) 16ch (D6T-44L-06)



(b) 8ch (D6T-8L-06)



(c) 1ch (D6T-1A-01/D6T-1A-02)

PTAT	: The value of the reference temperature, inside the sensor module.
Pn	: Measured value. (Object temperature)
PEC	: Pocket error check

※ For other each term, please see the I2C specification.

Applications

Non-contact temperature sensing

Refrigerator	Cooling the warm foods rapidly for keeping the fresh foods.
Air-Conditioner	Temperature control for floor temperature.
Machine	Detecting the Abnormal heat. (over heat)

Human detection

BEMS (PAC, Lighting)	Detecting the human body for saving energy and comfortable.
TV/PC	Detecting the human body for Screen Saving.
Security	Detecting the human body at dark area.

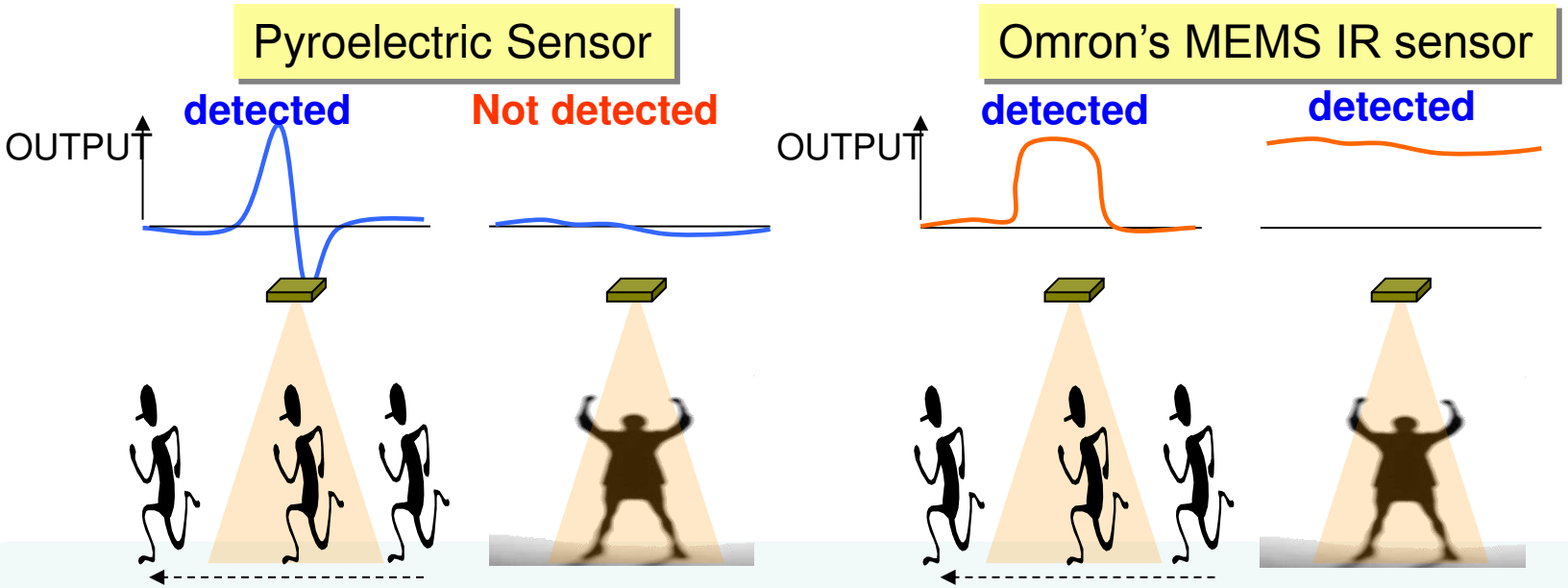
Motion control • • • It can operate with dirty hands.

Kitchen	Water/Fan level control.
Home Appliance	Non-contact display operation. (Refrigerator, microwave oven)

Human detection

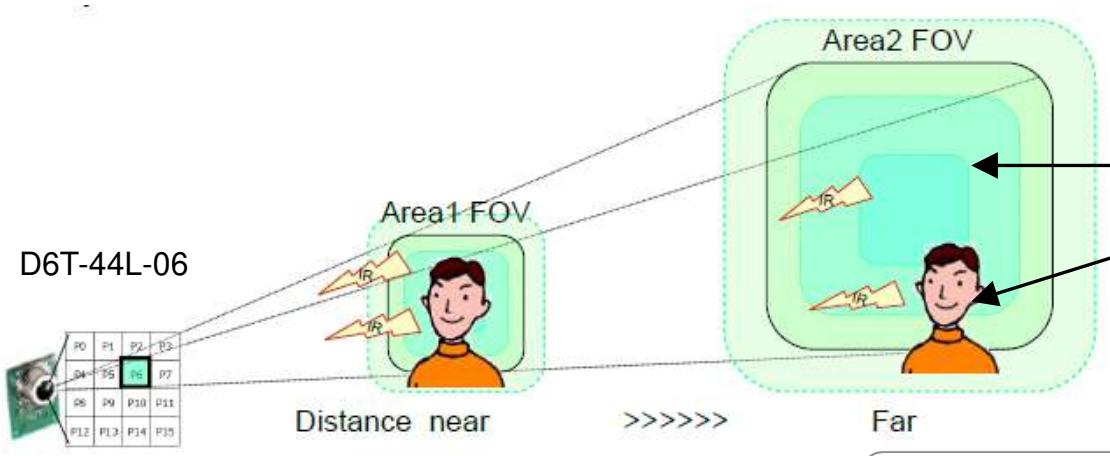
Advantage of Omron MEMS IR Sensor

D6T can also be used for detecting the presence of human beings. Omron's non-contact temperature sensor can solve the shortcomings of a conventional pyroelectric sensor, which cannot catch the signal of a stationary person because the sensor detects the change of signal.



Changing factor of measurement by distance

When the distance is far, the ratio of the object is small.

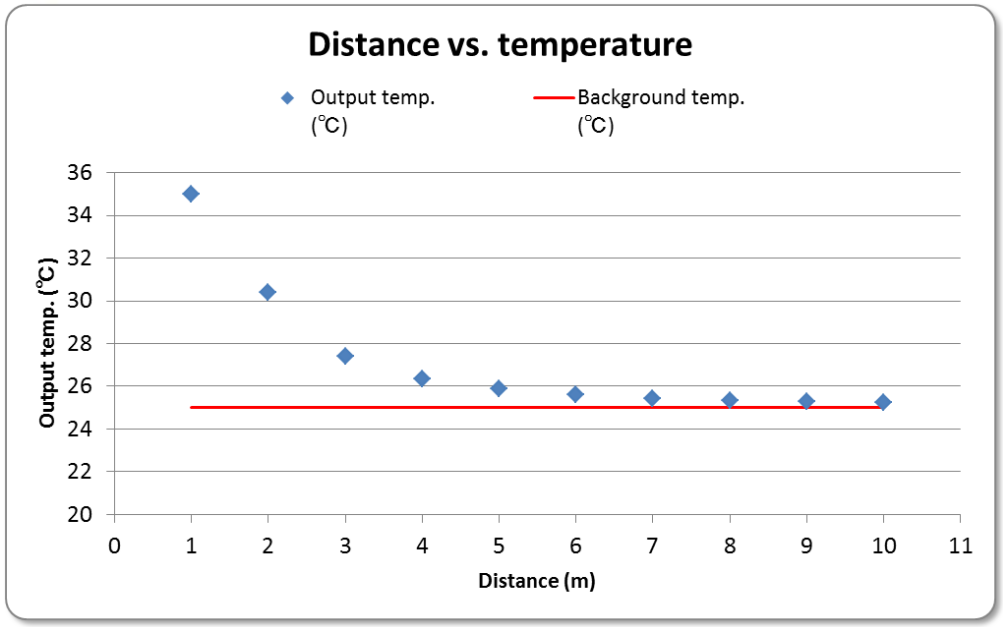


Example

Background	25℃
Surface of the face	35℃

For the human detection applications, the detection distance is dependent on the distance and the background temperature.

When the background temperature is high, the human detection is very difficult.



Sensor output

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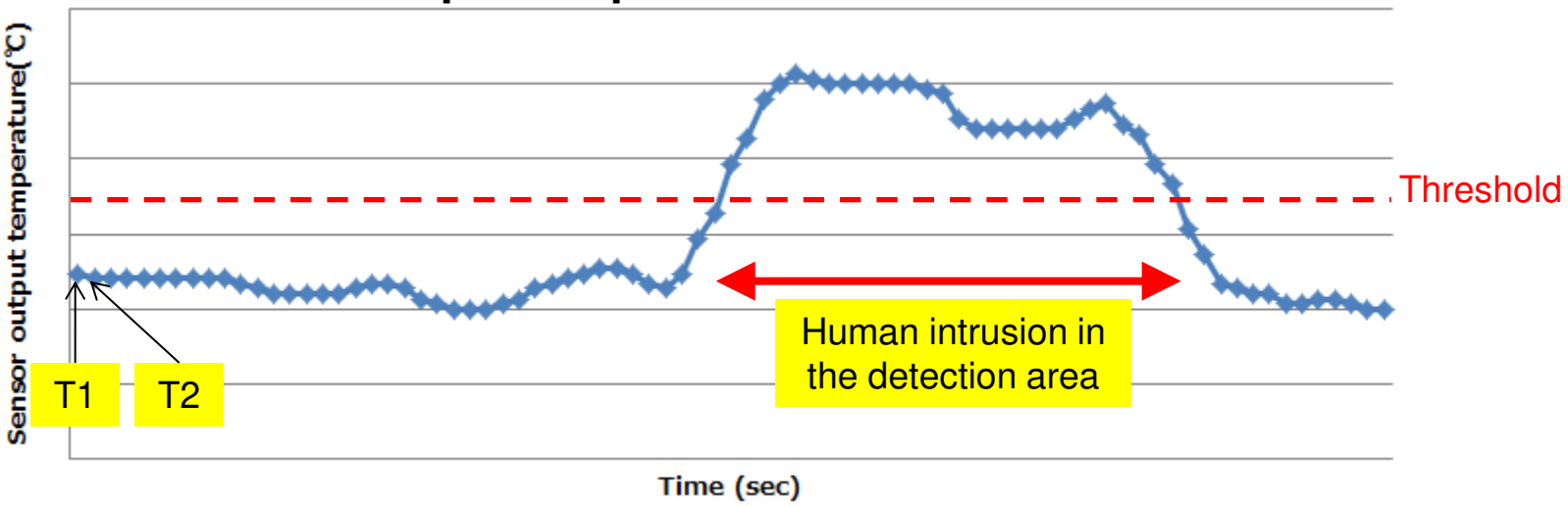
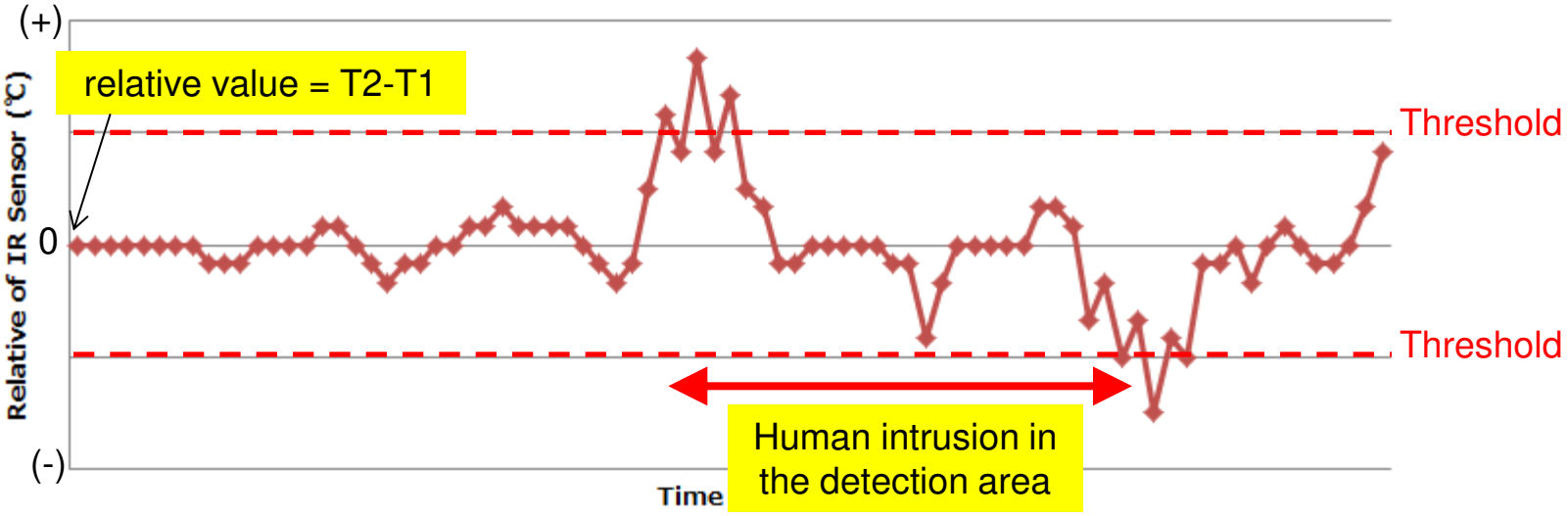
Examples of human detection by each pixel

1) Threshold of the sensor output temperature.



2) Judgment of the relative temperature difference.



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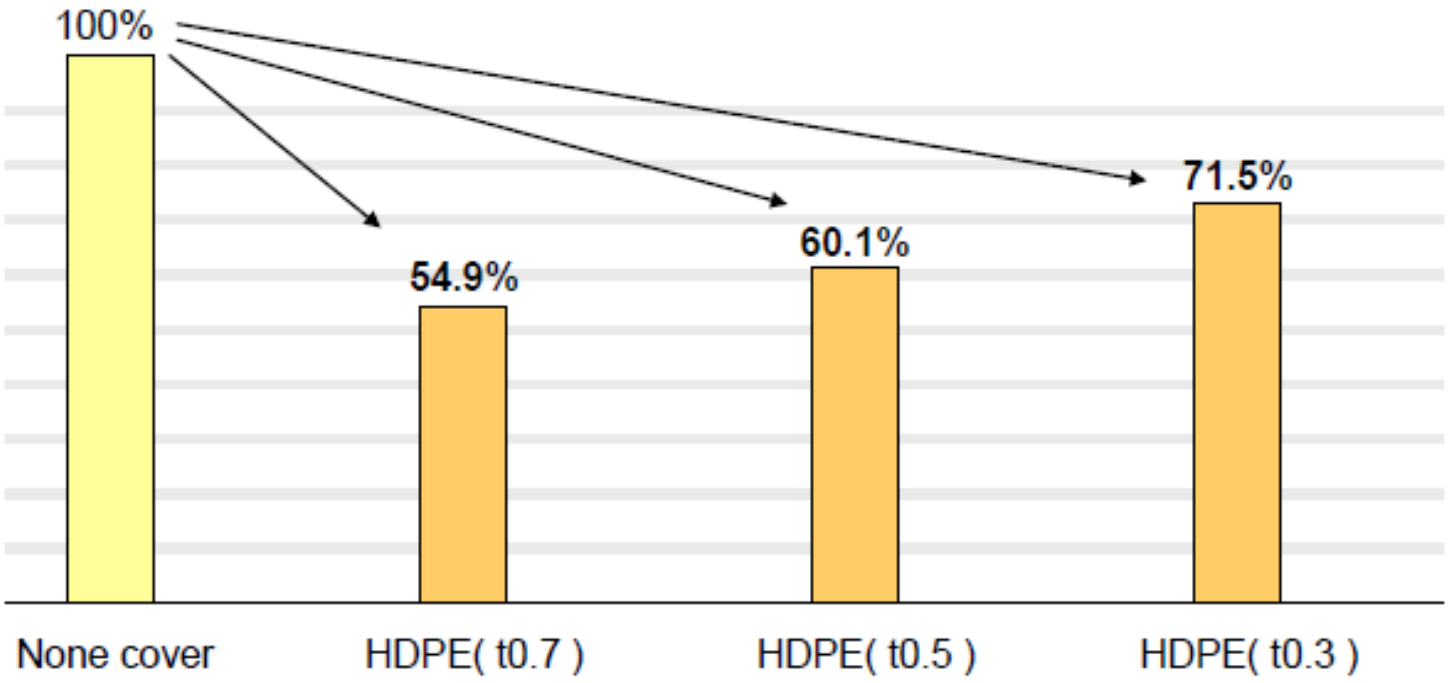
Cover Material

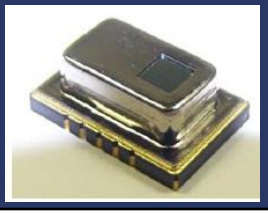
If you opt to put a cover over the sensor, High-density polyethylene (HDPE, grade far infrared transmission) is a good cover material option.

If the cover is thick, the transmittance decreases. (as shown in the pictured below)



HDPE thickness vs. Transmittance (reference)

Comparison with Grid-Eye

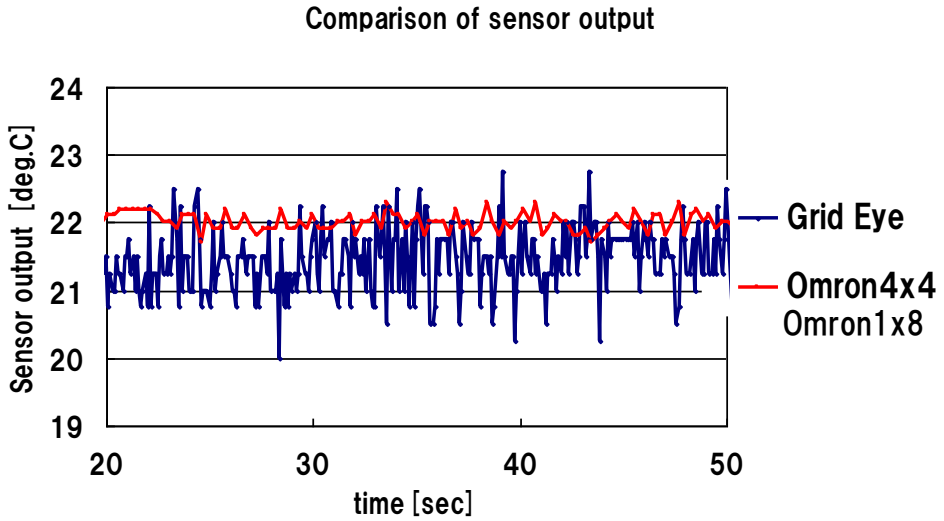
	Omron(4x4)	Omron(1x8)	Grid-Eye(8x8)
			
Size	18.0×14.0×8.0mm		11.6×8.0×4.3mm
Number of pixel	16(4x4)	8(1x8)	64(8x8)
Viewing angle	44deg..	3deg x 32deg.	60deg..
Interface	I2C(Standerdl mode -100kHz)		I2C(Fast mode -400kHz)
Output mode	Temperature data		Temperature data
Detection Temperature range	0 to 50deg.C		-20 to 100deg.C
Temperature output resolution	0.1deg.C		0.25deg.C
Frame rate	4Hz		10Hz
External interface	I2C		I2C

Comparison of detectable distance

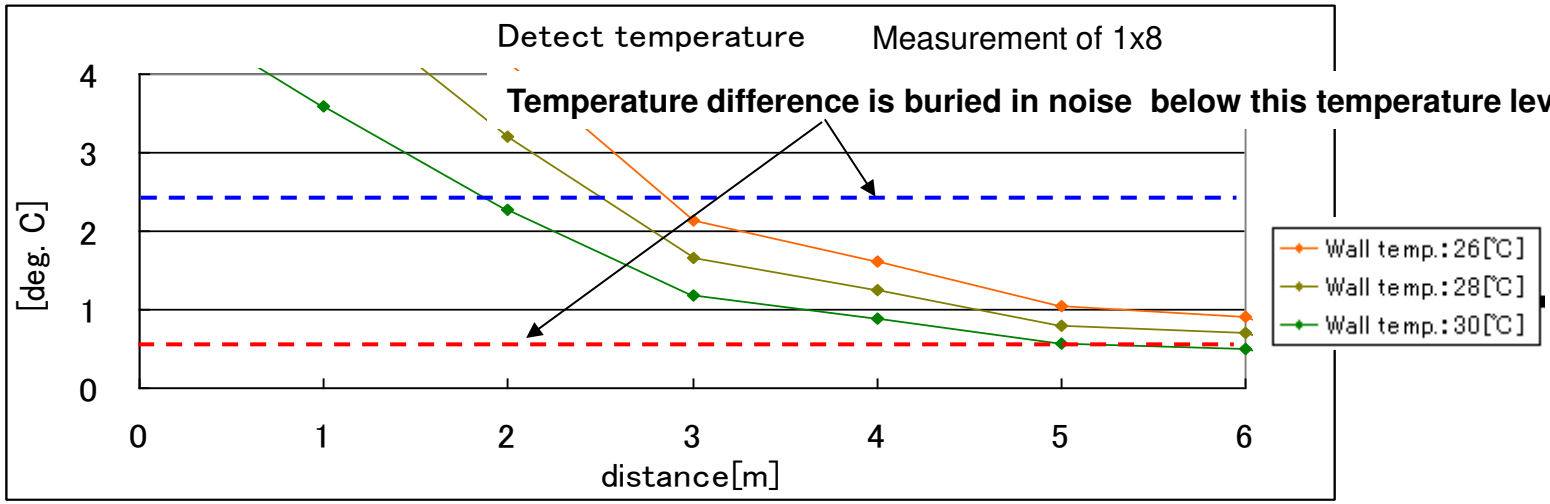
NETD (**noise equivalent temperature difference**)

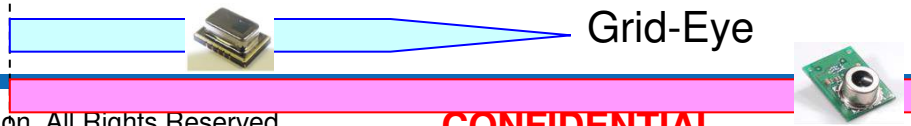
Omron	Grid-eye
0.3deg.C	1.2deg.C

※NETD is the Minimum temperature difference which is not buried in the noise of the sensor.



Actually it is possible to detect the person in the case that temperature difference of whether or not person is more than double NETD.
The diagram below indicates **temperature difference of whether or not person in a view area** and **detectable distance**.





Detectable distance

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