



Thermopile Temperature Sensor

BM43THA-T1

Bestow Mascot

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1. Description

1.1 General Description

BM43THA is a thermopile temperature sensor based on micro-electromechanical systems technology. This thermopile detector consists of thermopile MEMS chip, 5-14um infrared band pass filter, a NTC thermistor for temperature compensation and a small size TO Package.

1.2 Features and Benefits

- High accuracy
- High sensitivity
- Fast response time
- Small size
- Low cost
- Wide working temperature: -40~+125℃

1.3 Applications

- High precision non-contact temperature measurements
- Home appliances with temperature control (Smart Home)
- Healthcare
- Safety management
- Automatic induction equipment
- Industrial temperature control



2. Pin Configuration

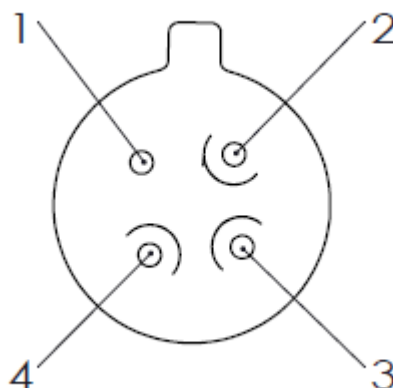


Figure 1 Bottom View

Table 1 Pin Configuration

Pin	Function	Description
1	GND	GND
2	Thermopile+	Output DC voltage+ pin
3	Thermistor	Ambient temperature compensation resistance+ pin
4	Thermopile-	Output DC voltage- pin

3. Characteristics

3.1 Physical Characteristics

Table 2 Thermopile Parameter

Parameter	Specification	Unit	Condition
Chip Size	1.2X1.2	mm	-
Active Area	0.9X0.9	mm	-
Sensitivity	52	V/W	Black body=500K @temp=25°C
Detectivity	9.55E07	cm·Hz ^{1/2} /W	
NEP	1.05	nW·Hz ^{1/2}	
Voltage Response	64	V·mm ² /W	
Thermopile Res	180±10%	kΩ	@temp=25°C
TC of Thermopile	0.05	%/°C	-
Noise Voltage	54	nV/Hz ^{1/2}	@temp=25°C
Time Constant	5.2	ms	-
Field of View	62	°	Degree at 50% signal level
Operating Temp	-40~125	°C	-
Storage Temp	-40~125	°C	-
Thermistor for Temperature Compensation			
Thermistor Resistance	100	kΩ	+2% Tolerance, @temp=25°C
TC of Thermistor	3950	K	±0.6% Tolerance, defined at 25/50°C

3.2 Electrical Characteristics

3.2.1 Thermopile Output Characteristics

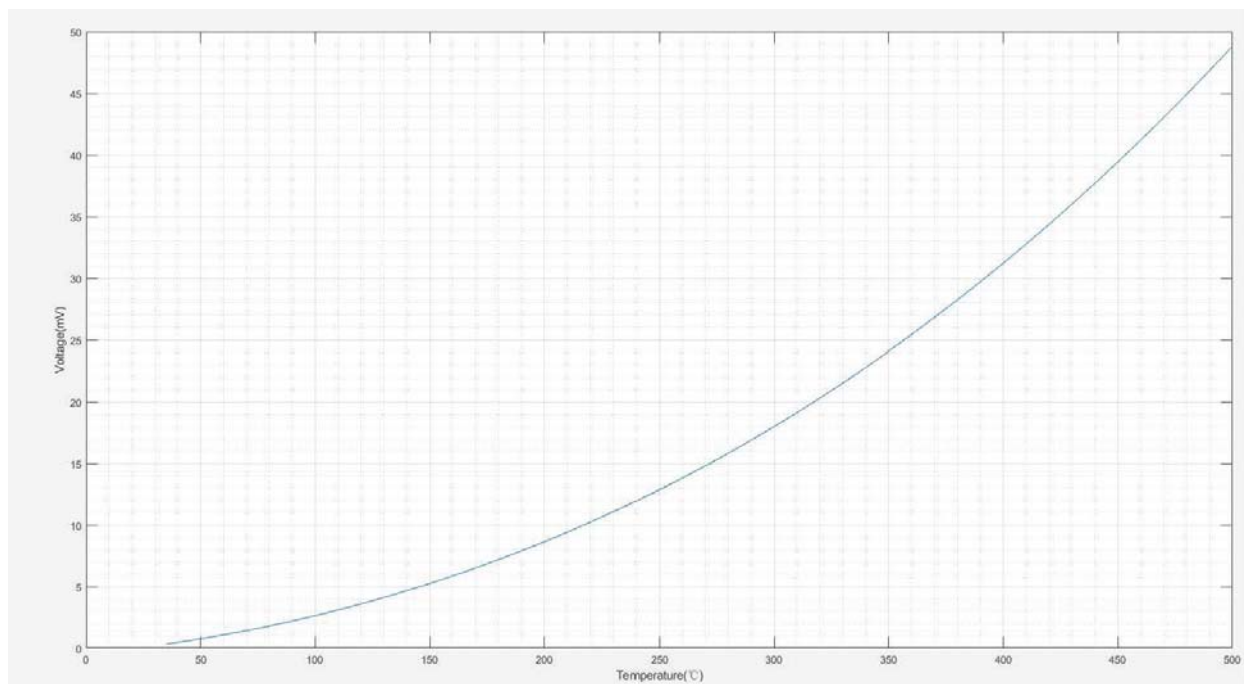


Figure 2 Voltage VS Temperature

Val(x) = $p_1 \cdot x^4 + p_2 \cdot x^3 + p_3 \cdot x^2 + p_4 \cdot x + p_5$	Coefficients (with 95% confidence bounds): $p_1 = 2.112\text{e-}11 (-1.173\text{e-}10, 1.595\text{e-}10)$ $p_2 = 6.186\text{e-}08 (-2.186\text{e-}08, 1.456\text{e-}07)$ $p_3 = 1.254\text{e-}04 (1.078\text{e-}04, 1.430\text{e-}04)$ $p_4 = 0.01775 (0.01625, 0.01925)$ $p_5 = -0.4464 (-0.4886, -0.4042)$
Goodness of fit	SSE:0.04943 R ² :0.9999 Adjusted R ² :0.9999 RMSE:0.01476
Note: Thermopile temperature@25°C	

3.2.2 Thermistor Output Characteristics

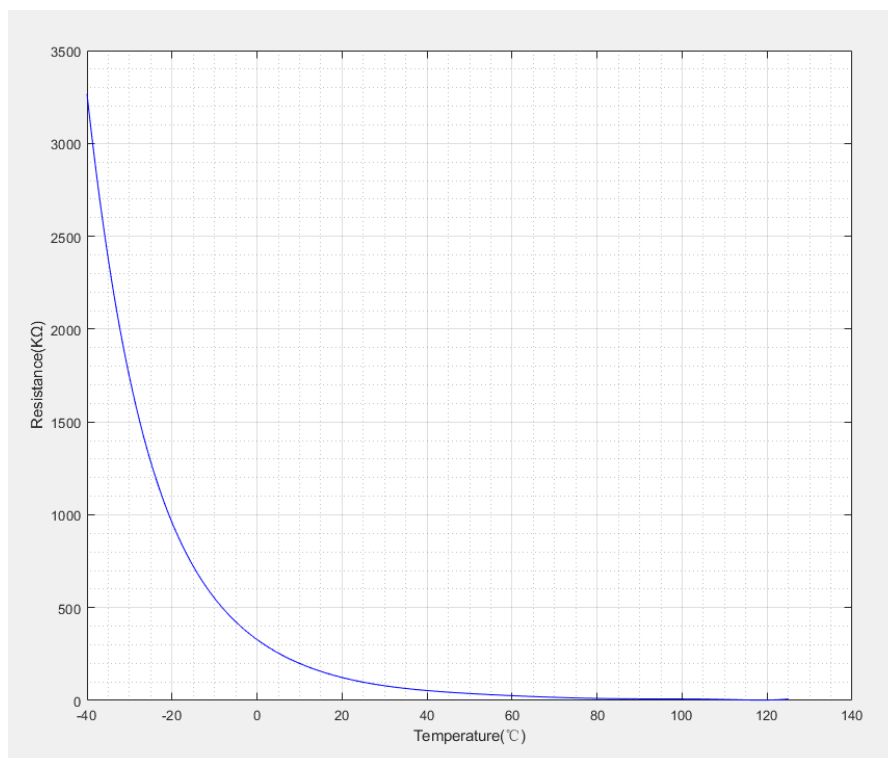


Figure 3 Resistance VS Temperature

$Val(x)=p1*x^8+p2*x^7+p3*x^6+p4*x^5+p5*x^4+p6*x^3+p7*x^2+p8*x+p9$	Coefficients (with 95% confidence bounds): $p1=3.554e-13$ (3.485e-13, 3.624e-13) $p2=-1.598e-10$ (-1.621e-10, -1.574e-10) $p3=2.908e-08$ (2.880e-08, 2.935e-08) $p4=-2.841e-06$ (-2.852e-06, -2.830e-06) $p5=1.781e-04$ (1.775e-04, 1.786e-04) $p6=-0.009117$ (-0.009145, -0.00909) $p7=0.436$ (0.4354, 0.4366) $p8=-16.03$ (-16.05, -16.02) $p9=319$ (318.9, 319.2)
Goodness of fit	SSE: 3668 R^2 : 0.9999 Adjusted R^2 : 0.9999 RMSE: 1.495
Note: $B_{25/50}=3950K \pm 0.6\%$, $R_{25}=100K\Omega \pm 2\%$	

3.3 Optical Characteristics

3.3.1 Filed of View

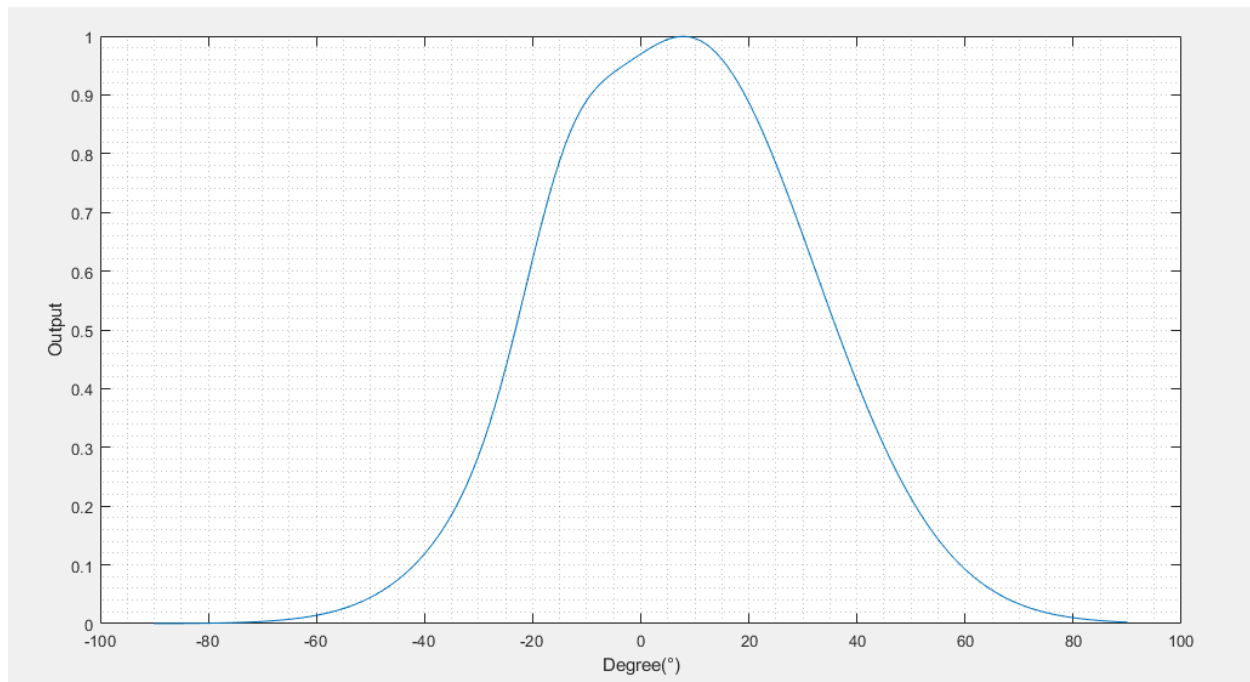


Figure 4 Typical Filed of View

3.3.2 Filter Transmission Curve

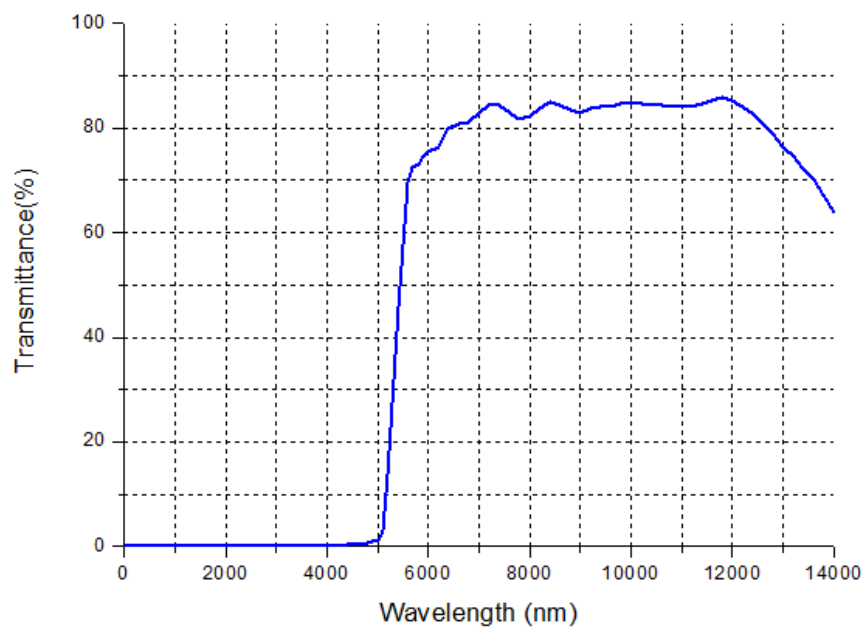


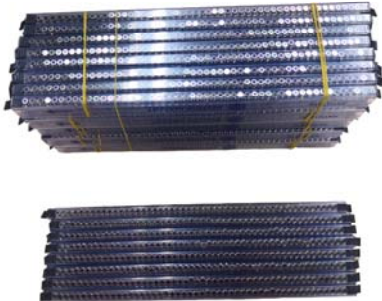
Figure 5 Filter Transmission Curve

4. Ordering Information

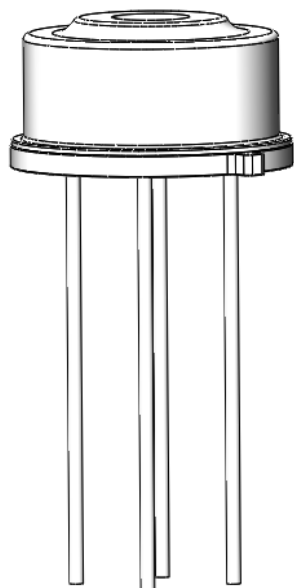
4.1 Naming Scheme

Part No.	Option Code	Package
BM43THA	-X X	-X X X (1)(2)(3)
BM: Company Prefix 43T: Series Name H: Version A: Signal Type		(1) Package options: T1/T2/T3 (2) Packing(see 4.2) (3) Reserved
Example: BM43THA-EX-T1TG BM43THA-T1TG		

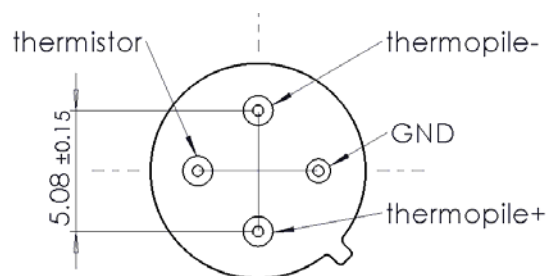
4.2 Packing Information

Container	Tube
Quantity	2000 pcs
Direction of feed	Direction of products is fixed in a container tray
 50pcs in a tube  40 tube in a ESD bag MOQ=2000pcs	

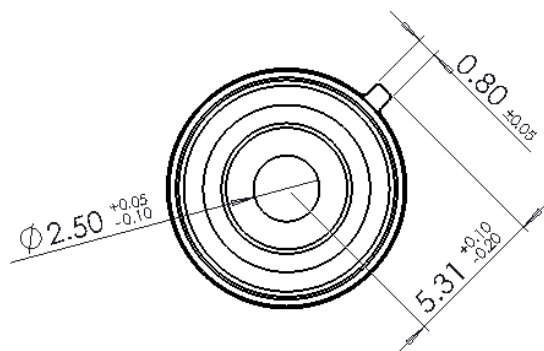
4.3 TO Package Type1 Outline Information



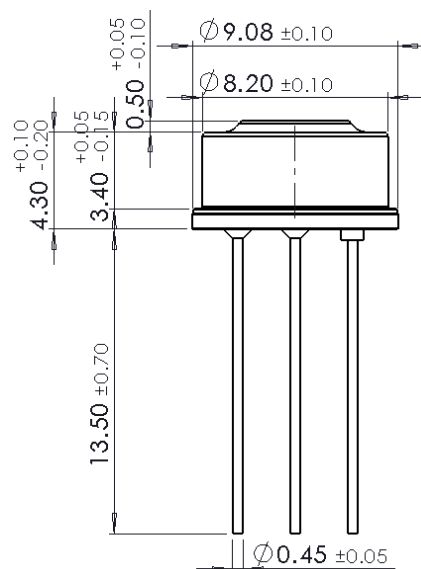
Bottom



Top



Front



5. Reliability Test

Table 3 Typical Reliability Test Items

No.	Tested Item	Condition	Result (N/F ¹)
1	High Humidity Test	+85±2℃, 85±3%RH 72h	20/0
2	Low Temperature	-40±2℃ 72h	20/0
3	High Temperature	+125±2℃ 72h	20/0
4	Thermal Shock	(-40℃→+125℃)×20Cycle 2h	20/0
5	Vibration	Frequency sweep: 10~55Hz/min → 2h Direction : X, Y, X (1.5mm distance for each direction)	20/0

Note1: N for amount of sample, F for amount of failure after test

6. Notice

●General Precaution

- 1) Before you use our Products, you are requested to carefully read this document and fully understand its contents. BM shall not be in any way responsible or liable for failure malfunction or accident arising from the use of any BM's Products against warning, caution or note contained in this document.
- 2) All information contained in this document is current as of the issuing date and subject to change without any prior notice. Before purchasing or using BM's Products, please confirm the latest information with BM sales representative.

●Precaution on using BM Products

1) Our Products are designed and manufactured for application in ordinary electronic equipments (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment, transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with BM sales representative in advance. Unless otherwise agreed in writing by BM in advance, BM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any BM's Products for Specific Applications.

2) BM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:

[a] Installation of protection circuits or other protective devices to improve system safety

[b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

3) Our Products are designed and manufactured for use under standard conditions and not under any special or extraordinary environments or conditions, as exemplified below. Accordingly, BM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any BM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:

[a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents

[b] Use of our Products outdoors or in places where the Products are exposed to direct

sunlight or dust

[c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl₂, H₂S, NH₃, SO₂, and NO₂

[d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves

[e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items

[f] Sealing or coating our Products with resin or other coating materials

[g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering

[h] Use of the Products in places subject to dew condensation

4) The Products are not subject to radiation-proof design.

5) Please verify and confirm characteristics of the final or mounted products in using the Products.

6) In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse) is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7) De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.

8) Confirm that operation temperature is within the specified range described in the product specification.

9) BM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

●Precaution for Mounting / Circuit board design

1) When a highly active halogen us (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2) In principle, the reflow soldering method must be used; if flow soldering method is preferred, please consult with the BM representative in advance. For details, please refer to BM Mounting specification.

●Precautions Regarding Application Examples and External Circuits

1) If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2) You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in

case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. BM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

●**Precaution for Electrostatic**

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

●**Precaution for Storage / Transportation**

1) Product performance and soldered connections may deteriorate if the Products are stored in the places where:

- [a] the Products are exposed to sea winds or corrosive gases, including Cl₂, H₂S, NH₃, SO₂, and NO₂
- [b] the temperature or humidity exceeds those recommended by BM
- [c] the Products are exposed to direct sunshine or condensation
- [d] the Products are exposed to high Electrostatic

2) Even under BM recommended storage condition, solder ability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solder ability before using Products of which storage time is exceeding the recommended storage time period.

3) Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4) Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

●**Precaution for Product Label**

QR code printed on BM Products label is for BM's internal use only.

●**Precaution for Disposition**

When disposing Products please dispose them properly using an authorized industry waste company.

●**Precaution for Foreign Exchange and Foreign Trade act**

Since our Products might fall under controlled goods prescribed by the applicable foreign exchange and foreign trade act, please consult with BM representative in case of export.

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7. Revision History

Version	Publication Date	Pages	Revise Description
1.0	Nov.2014	10	Initial Document Release
2.0	Jul. 2016	16	Update Product Parameters
3.0	Sep. 2021	17	Update Product Parameters
4.0	Jan.2022	14	Update Thermopile and Thermistor Output Characteristics; Update Naming Scheme