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# Temperature Sensor

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BM43PHA

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Bestow Mascot

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## 1. Description

### 1.1 General Description

The BM43PHA is a pyroelectricity temperature sensor based on MEMS (micro-electromechanical systems) technology.

### 1.2 Features

- High sensitivity and superior SNR(signal-to noise ratio)
- High stability for temperature change
- High anti-interference ability (For example: vibration, radio frequency interference)
- Balanced differential type of sensor (Series opposed type)

### 1.3 Applications

- Security
- Luminaire
- Family and other fields

### 1.4 Package



TO-5 Package A Type



TO-5 Package B Type



TO-5 Package C Type



TO-5 Package D Type



TO-5 Package E Type



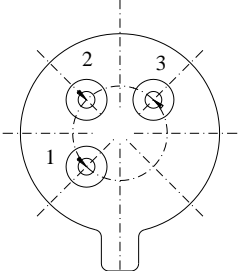
TO-5 Package F Type



TO-5 Package G Type

**2 Pin Descriptions**

Table1 Pin Descriptions

 <p>Bottom View</p>	Pin	Function	Description
	1	D	Drain
	2	S	Source
	3	G	Ground

### 3 Characteristics

#### 3.1 Electrical Characteristics( at 25°C )

Table 2 Thermopile Parameter

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Signal Output*	3	3.5		Vp-p	Black Body temperature: 420K Chopping Frequency: 1HZ, 0.3~ 3.5HZ $\Delta f$ Vd=5V, Rs=47K $\Omega$ , the amplifier of Gain 72.5dB
Noise Output*		80	80	mVp-p	Chopping Frequency: 1HZ, 0.3~ 3.5HZ $\Delta f$ Vd=5V, Rs=47K $\Omega$ , the amplifier of Gain 72.5dB
Balance output**	$ VA-VB /(VA+VB) \times 100\% \leq 10\%$				Black Body temperature: 420K Chopping Frequency: 1HZ, 0.3 ~ 3.5HZ $\Delta f$ Vd=5V, Rs=47K $\Omega$ , the amplifier of Gain 72.5dB
Operating Voltage	2~15			V	Single power supply, RS=47K $\Omega$
Source Voltage	0.4~1.0			V	VD=5V, RS=47K $\Omega$
Warm-up Time	40			s	After it conneted, it with the measurement amplifier for Fig.3 description that turns on the power supply beforehand, the amplification output is time until stabilizing.
Circuit Configuration	-				See Fig.3

\* Measurement method shown in 4.1.

\*\* : Measurement method shown in 4.1 and 4.2

VA = A Element sensitivity (Vp-p), VB = B Element sensitivity (Vp-p)

3.2 Optical Characteristics

Table3 Optical Characteristics

Parameter	Rating
Field of View	138 degrees from center of Element on Axis X. 125 degrees from center of Element on Axis Y See Fig 5
Induction of wavelength	Filter substrate:Silicon Induction of wavelength :5~14 μ m Transmission:7~14 μ m ≥75%
Transmission Characteristics of filter	See Fig 6

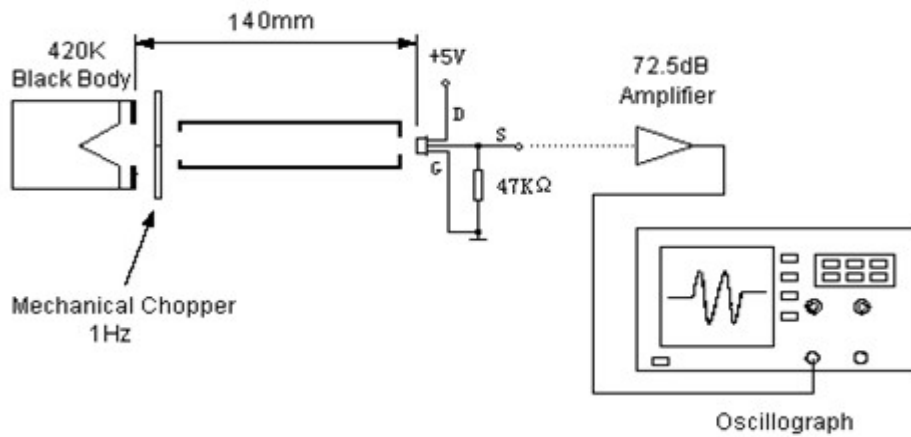
3.3 Environmental Requirements

Table4 Environmental Requirements

Parameter	Rating
Operating Tmeperature	-30~70 °C
Storage Temperatur	-40~80 °C
Relative Humidity	The sensor shall operate without increase in Noise Output when exposed to 90 to 95% RH at 30°C continuously
Hermetic Seal	No bubbles visible in the 125±5°C fluorocarbon bath(FC-40) for 20sec
Reliability Test	Specified in 《Appendix》 1 ( page13~14 )

4 Measurement Method

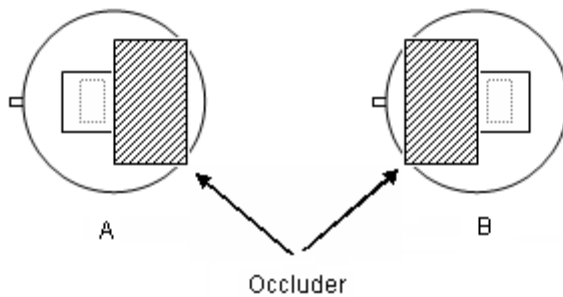
4.1 Sensor Measurement Method



Environmental temperature: 25°C  
 Black Body temperature: 420K  
 Chopping Frequency: 1HZ, 0.3~ 3.5HZ Δf  
 the amplifier of Gain 72.5dB

Fig.1 Pyroelectric Passive Infrared Sensor Measurement Method

4.2 Balance Measurement Method



Pyroelectric Passive Infrared sensor sensitivity balance is measured by testing the single unit sensitivity, and using the following equation.

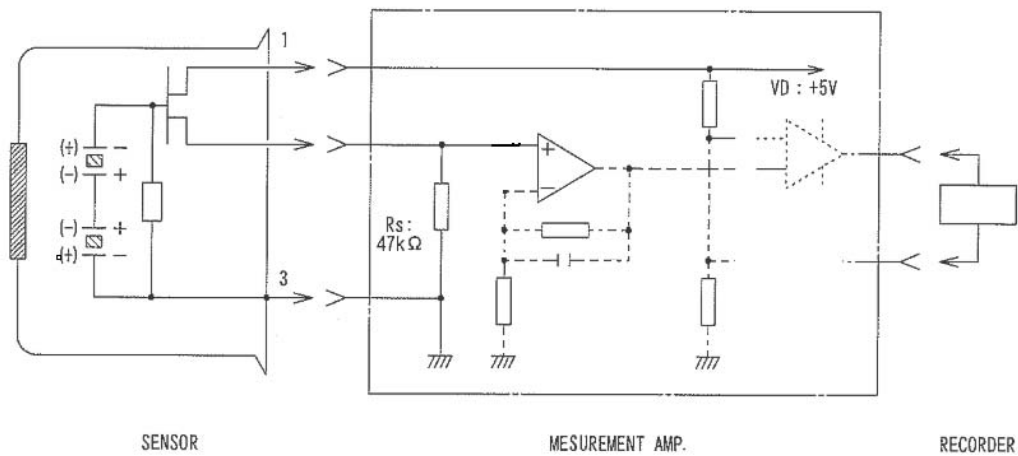
$$\text{Balance} = |V_A - V_B| / (V_A + V_B) \times 100\%$$

$V_A$  = A Element sensitivity (Vp-p)

$V_B$  = B Element sensitivity (Vp-p)

Fig.2 Balance Measurement Method

4.3 Test Circuit Configuration



1. Drain
2. Source
3. Groud

Fig.3 Test Circuit Configuration

4.4 Fiel of view

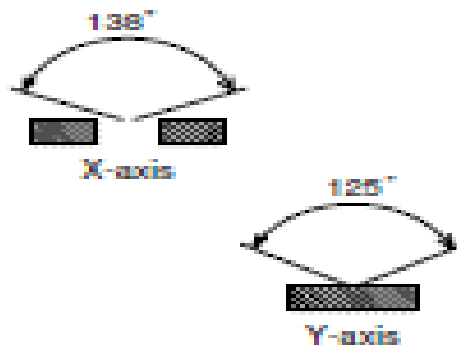


Fig.4 Fiel of View



4.5 Typical Transmission Characteristics of Filter

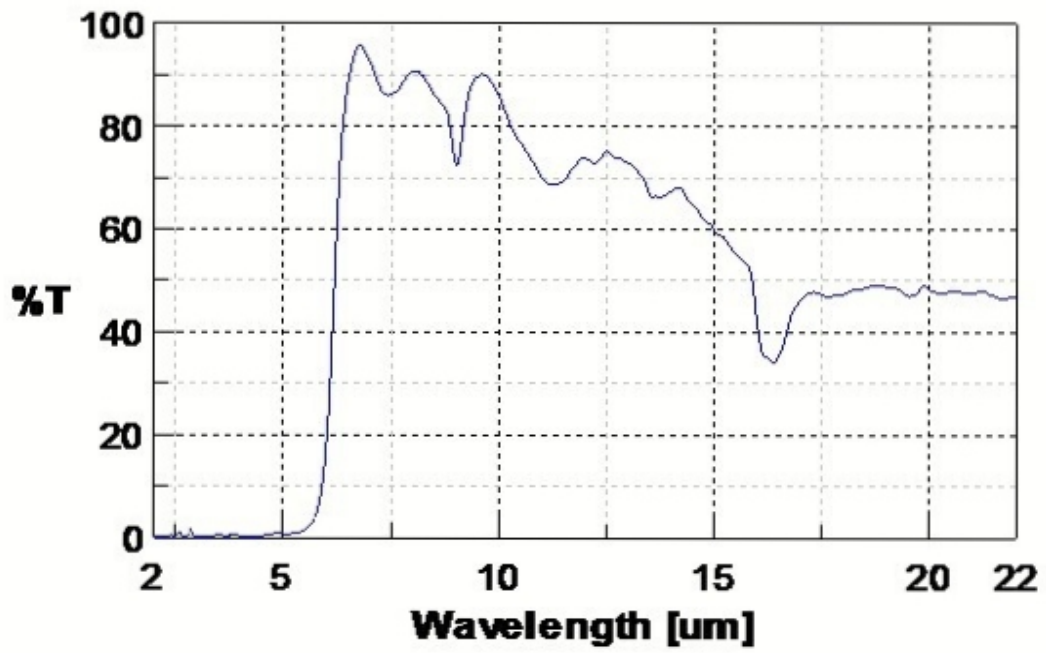
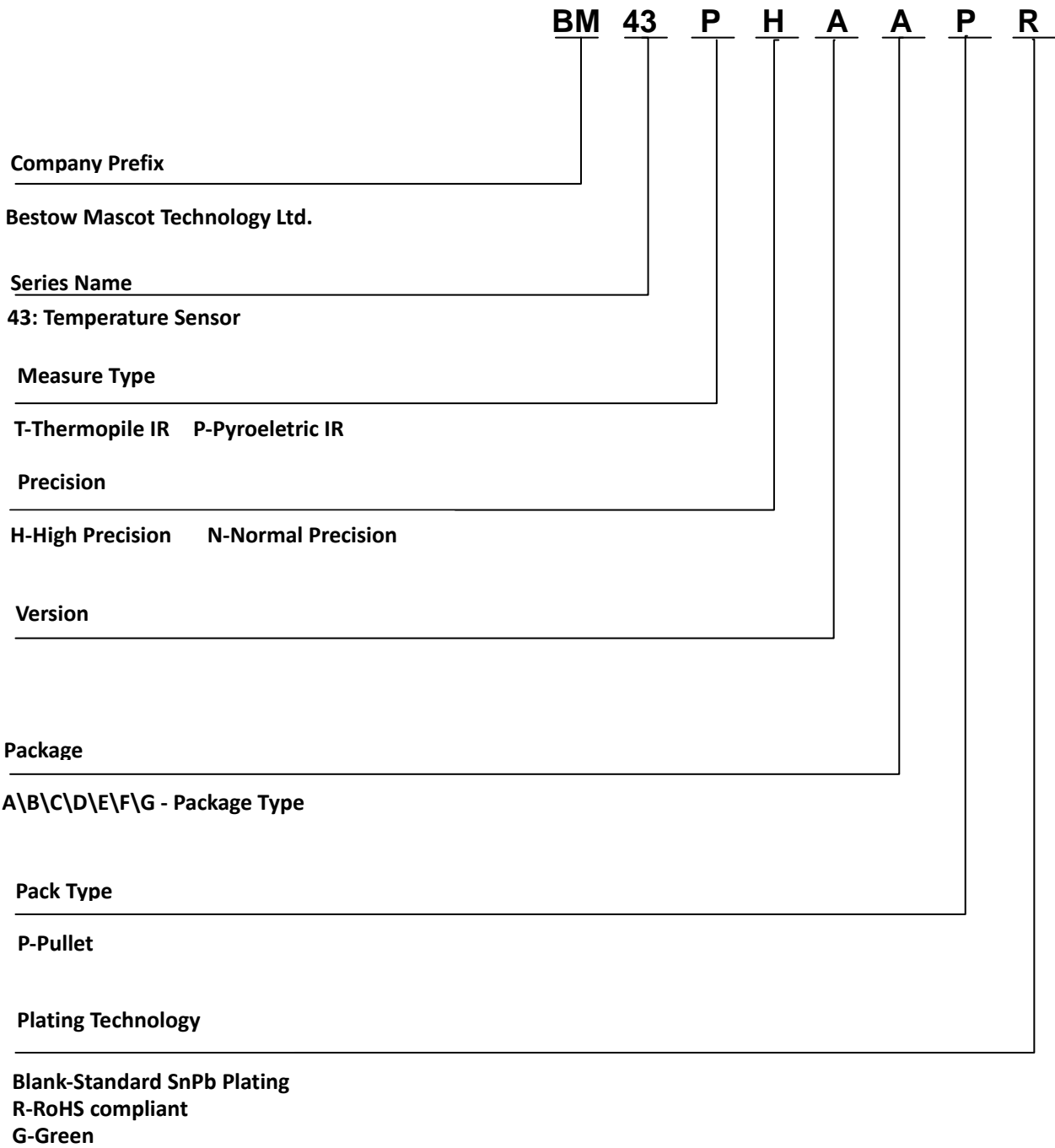


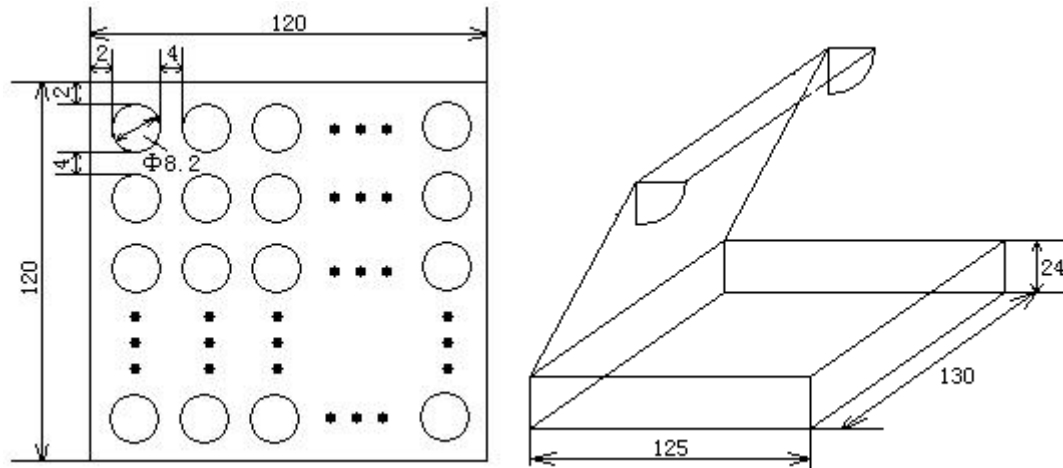
Fig.5 Transmission Characteristics of Filter

**5. Ordering Information**

**5.1 Part Numbering**



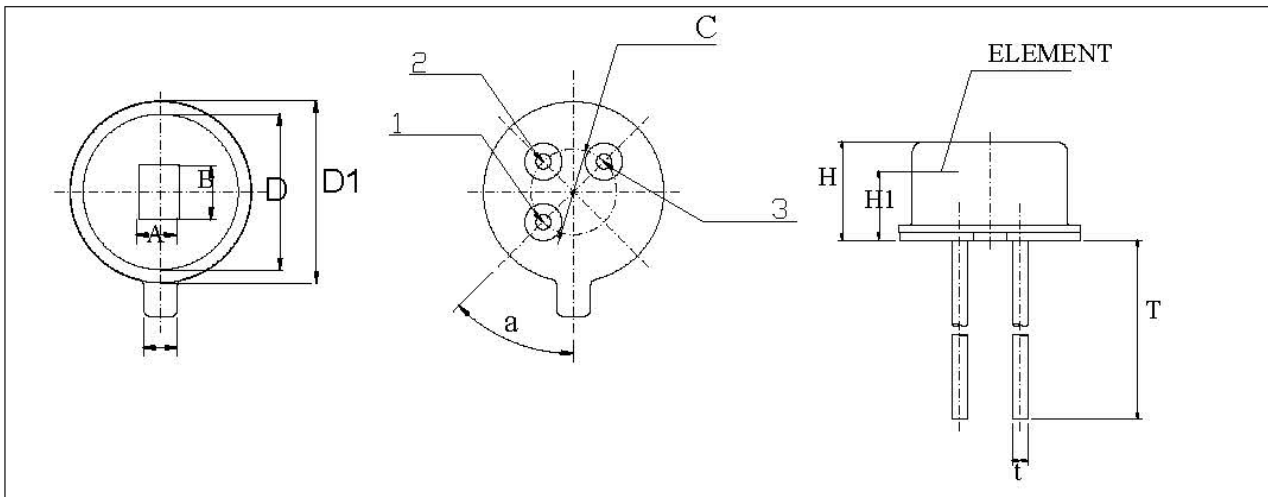
5.2 Pack Information



100 pcs in each box

Fig.6 Pullet Information

**6. Package Information**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	Different from Package Type		Different from Package Type	
B	Different from Package Type		Different from Package Type	
D	9.3	9.1	0.366	0.358
D1	8.5	8.1	0.335	0.319
e	0.7	0.9	0.028	0.035
H	4.3	4.7	0.168	0.185
H1	3.2	3.4	0.126	0.134
T	Different from Package Type		Different from Package Type	
t	0.45 (BSC)		0.018 (BSC)	
C	5.08 (BSC)		0.200 (BSC)	
α	45°		45°	
window size and pin length of package type				
Package Type	A(mm)	B (mm)	T (mm)	
A	4.9	4.9	13.5	
B	5	3.8	13.5	
C	4	3	13.5	
D	3	2	13.5	
E	4.9	4.9	20	
F	5	5	20	
G	4	4	20	

## 7. 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.

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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 the 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 Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>

[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 Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>
- [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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**8. Revision History**

<b>Version</b>	<b>Publication date</b>	<b>Pages</b>	<b>Revise Description</b>
1.0	Jul. 2015	15	Initial Document Release