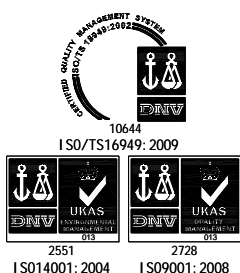


# Specification of MEMS Microphone (RoHS Compliance & Halogen Free)

Customer Name :  
Customer Model :  
Goermicro Model : SD28OB341-015

Goermicro	CUSTOMER APPROVAL
<p><b>DESIGN</b>    <u>Enoch Wu</u>    <u>2023.03.02</u></p> <p><b>CHKD</b>    <u>Pauline Zhao</u>    <u>2023.03.02</u></p> <p><b>STANDARD</b>    <u>Angela Kong</u>    <u>2023.03.02</u></p> <p><b>APVD</b>    <u>Roy Wang</u>    <u>2023.03.02</u></p>	



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## Restricted

### 1 Security Warning

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### 2 Publication History

Version	Description	Date	Author	Approved
1.0	New Design	2021.11.04	Pauline	Roy
2.0	Add 7.9&7.10 Performance	2023.03.02	Enoch	Roy

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## 1 Introduction:

MEMS MIC which is able to endure reflow temperature up to 260°C for 50 seconds can be used in SMT process. It is widely used in telecommunication and electronics device such as mobile phone, laptop computers, and other portable electronic devices etc.

## 2 Test Condition ( $V_{DD}=1.8V$ , $f_{CLK}=3.072MHz/1.536MHz/768kHz$ , $L=50$ cm)

StandardConditions (As IEC 60268-4)	Temperature	Humidity	Air pressure
Environment Conditions	+15°C ~ +35°C	25%RH ~ 75%RH	86kPa ~ 106kPa
Basic Test Conditions	+20°C ± 2°C	60%RH ~ 70%RH	86kPa ~ 106kPa

## 3 Acoustic and Electrical Characteristics

### 3.1 Standard Mode

(Test Condition:  $V_{DD}=1.8V$ ,  $f_{CLK}=3.072MHz$ , Decimation=64X)

Item	Symbol	Test Conditions	Min	Typ	Max	Unit
Sensitivity	S	94dBSPL @ 1kHz	-35	-34	-33	dBFS (Note 1)
Current Consumption (Note 2)	I	$f_{CLK}=3.072MHz$	-	800	1000	μA
S/N Ratio	SNR	94dBSPL @ 1kHz A-Weighting	-	69	-	dB
Distortion	THD	THD < 1% @ 1kHz	-	122	-	dB SPL
Acoustic Overload Point	AOP	10% THD @ 1kHz, S=Typ	-	127	-	dB SPL
Power Supply Rejection	PSR	100mVpp Squarewave @ 217Hz A-weighting	-	-101	-	dBFS
Power Supply Rejection Ratio	PSRR	200mVpp Sinewave @ 1KHz	-	89	-	dB V/FS
Low Frequency Roll-off	LFRO	-3dB corner reference to 1kHz sensitivity	-	45	-	Hz
High Frequency Flatness		+3dB reference to 1kHz sensitivity	-	13	-	KHz

(Test Condition:  $V_{DD}=1.8V$ ,  $f_{CLK}=1.536MHz$ , Decimation=32X)

Item	Symbol	Test Conditions	Min	Typ	Max	Unit
Sensitivity	S	94dBSPL @ 1kHz	-35	-34	-33	dBFS (Note 1)
Current Consumption (Note 2)	I	$f_{CLK}=1.536MHz$	-	540	800	μA
S/N Ratio	SNR	94dBSPL @ 1kHz A-Weighting	-	67	-	dB
Distortion	THD	THD < 1% @ 1kHz	-	122	-	dB SPL
Acoustic Overload Point	AOP	10% THD @ 1kHz, S=Typ	-	127	-	dB SPL
Power Supply Rejection	PSR	100mVpp Squarewave @ 217Hz A-weighting	-	-100	-	dBFS
Power Supply Rejection Ratio	PSRR	200mVpp Sinewave @ 1KHz	-	91	-	dB V/FS
Low Frequency Roll-off	LFRO	-3dB corner reference to 1kHz sensitivity	-	45	-	Hz
High Frequency Flatness		+3dB reference to 1kHz sensitivity	-	13	-	KHz

### 3.2 Low Power Mode

(Test Condition:  $V_{DD}=1.8V$ ,  $f_{CLK}=768kHz$ , Decimation=48X)

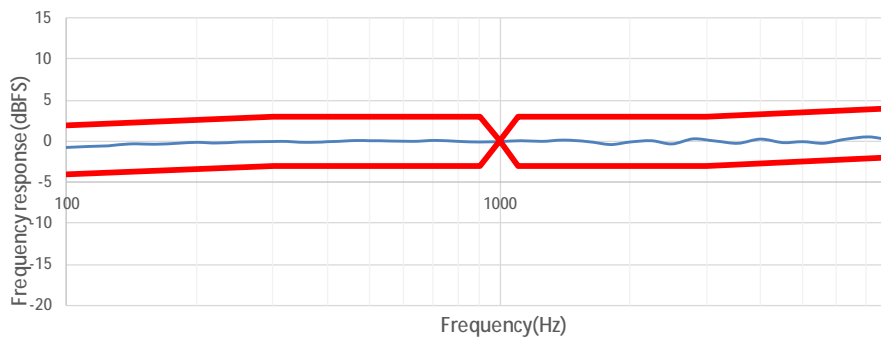
Item	Symbol	Test Conditions	Min	Typ	Max	Unit
Sensitivity	S	94dB SPL @ 1kHz	-35	-34	-33	dBFS (Note 1)
Current Consumption (Note 2)	I	$f_{CLK}=768kHz$	-	250	350	$\mu A$
S/N Ratio	SNR	94dB SPL @ 1kHz A-Weighting	-	64	-	dB
Distortion	THD	THD < 1% @ 1kHz	-	120	-	dB SPL
Acoustic Overload Point	AOP	10% THD @ 1kHz, S=Typ	-	120	-	dB SPL
Power Supply Rejection	PSR	100mVpp Squarewave @ 217Hz A-weighting	-	-92	-	dBFS
Power Supply Rejection Ratio	PSRR	200mVpp Sinewave @ 1kHz	-	91	-	dB V/FS

### 3.3 DC offset Performance

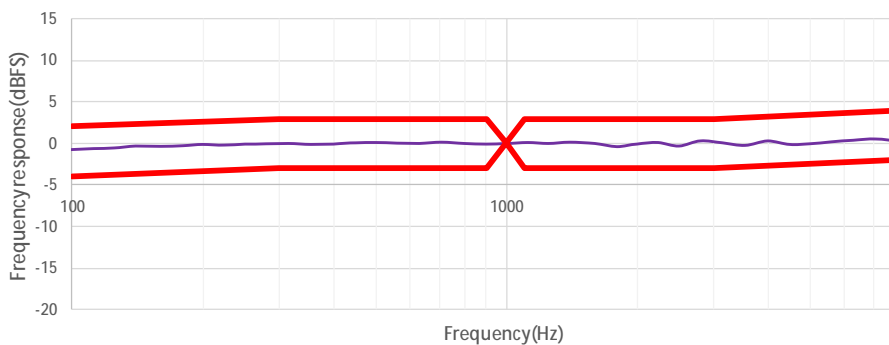
Disabled DC offset when L/R=VDD @ 3.072MHz/1.536MHz/768kHz

### 3.4 Frequency Response Curve and Limits

**Typical Free Field Response**  
 Normalized to 1kHz  
 Standard Mode  $V_{DD}=1.8V$ ,  $f_{CLK}=3.072MHz$ , Decimation Rate=64x



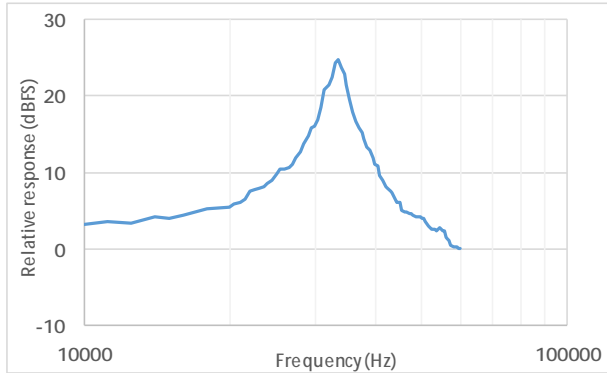
**Typical Free Field Response**  
 Normalized to 1kHz  
 Low Power Mode  $V_{DD}=1.8V$ ,  $f_{CLK}=768kHz$ , Decimation Rate=48x



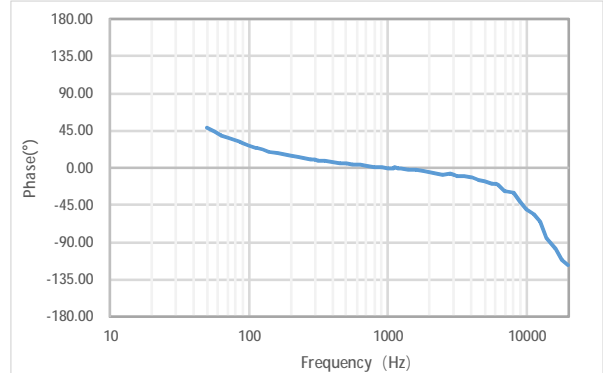
Frequency(Hz)	100	300	500	900	1100	3000	8000
Upper Limit(dBFS)	2	3	3	3	3	3	4
Lower Limit(dBFS)	-4	-3	-3	-3	-3	-3	-2

### 3.5 Performance Curve

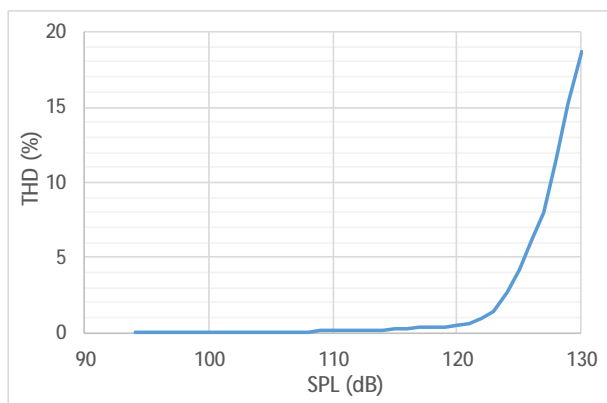
**Typical Free Field Ultrasonic Response  
Normalized to 1kHz  
Standard Mode  $V_{DD}=1.8V$ ,  $f_{CLK}=3.072MHz$**



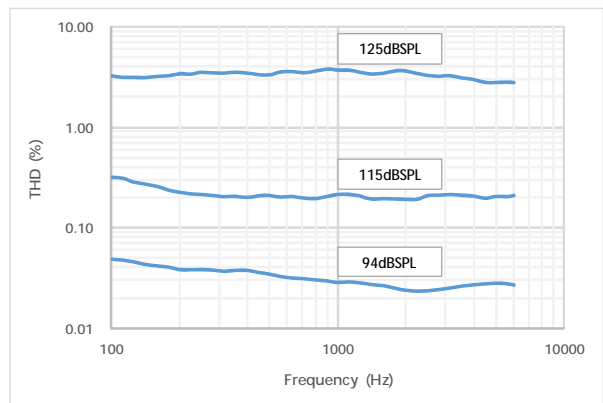
**Typical Phase  
Normalized to 1kHz  
Standard Mode  $V_{DD}=1.8V$ ,  $f_{CLK}=3.072MHz$**



**Typical THD vs SPL  
Standard Mode  $V_{DD}=1.8V$ ,  $f_{CLK}=3.072MHz$**



**Typical THD vs Frequency  
Standard Mode  $V_{DD}=1.8V$ ,  $f_{CLK}=3.072MHz$**



### 3.6 Microphone Interface Specifications

Item	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Logic High Level	$V_{IH}$		$0.65 \times V_{DD}$	-	$V_{DD} + 0.3$	V
Input Logic Low Level	$V_{IL}$		-0.3	-	$0.35 \times V_{DD}$	V
Output Logic High Level	$V_{OH}$		$0.7 \times V_{DD}$	-	-	V
Output Logic Low Level	$V_{OL}$		-	-	$0.3 \times V_{DD}$	V
Clock Duty Cycle			40	-	60	%
Clock Rise/Fall Time			-	-	13	nS
Delay Time for Data Driven	$t_{DD}$	Delay time from CLOCK edge (50% $V_{DD}$ ) to DATA driven.	40	-	80	nS
Delay Time for Data High-Z	$t_{HZ}$	Delay time from CLOCK edge (50% $V_{DD}$ ) to DATA high impedance state.	5	-	30	nS
Delay Time for Data Valid	$t_{DV}$	Delay time from CLOCK edge ( $0.50 \times V_{DD}$ ) to DATA valid ( $<0.30 \times V_{DD}$ or $>0.70 \times V_{DD}$ )	-	-	100	nS

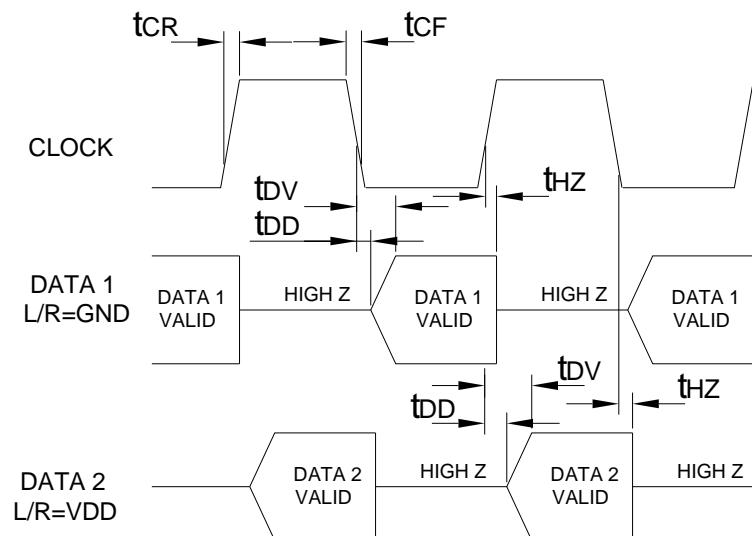
3.7 General Microphone Specifications

Item	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage	$V_{DD}$		1.62	-	3.6	V
Clock Frequency Range	Standby Mode		-	-	350	kHz
	Low Power Mode		450	768	850	kHz
	Standard Mode		1.38	1.536	1.7	MHz
			2.2	2.4	2.6	MHz
			2.9	3.072	3.3	MHz
Directivity			Omni-directional			
Polarity		Increasing Sound	Increasing density of 1's			
Data Format			$\frac{1}{2}$ Cycle PDM 1bit			
Short Circuit Current	$I_{sc}$	Grounded Data Pin	1	-	20	mA
Output Load Capacitance on DATA	$C_{load}$		-	-	100	pF
Start-up Time		Time to start up in either modes (Low Power- and Normal Mode) after $V_{DD}$ and CLOCK have been applied.	-	-	50	ms
Mode-Change Time		Time to switch between modes (Clock Off-, Low Power-, and Normal Mode). $V_{DD}$ remains on during the mode switch.	-	-	50	ms

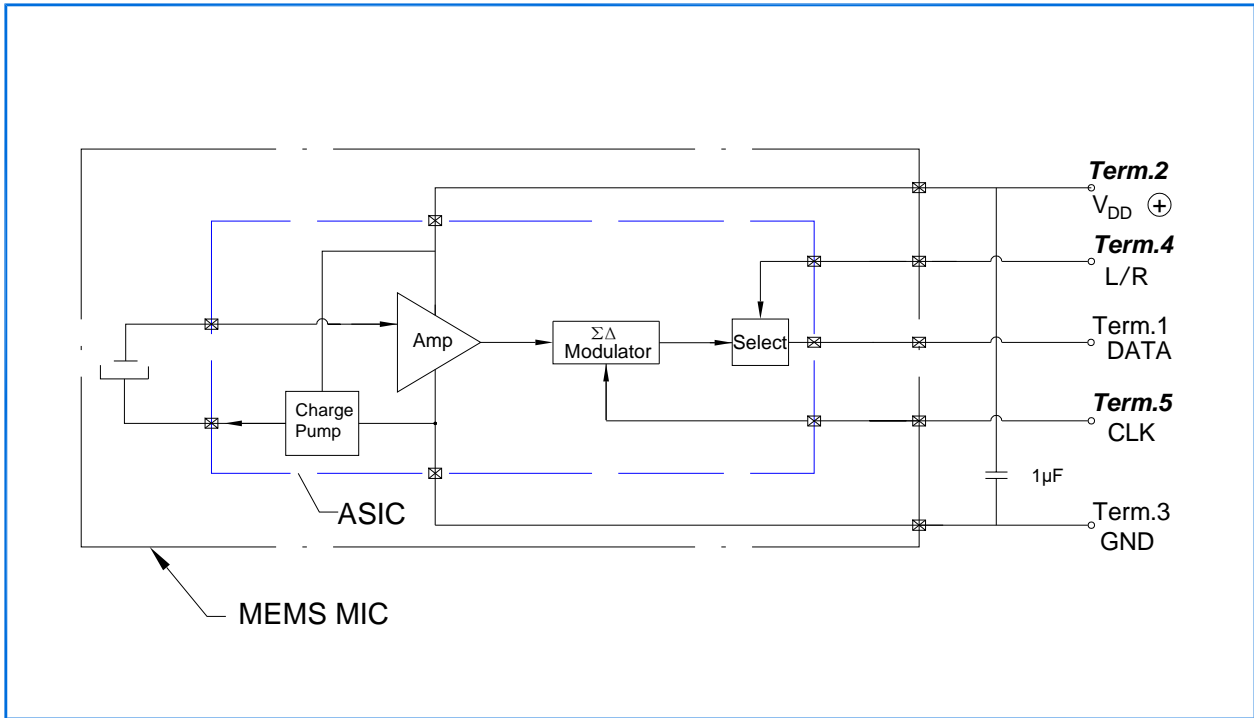
Note 1.  $dBFS = 20 \times \log(A/B)$  where A is the level of the signal, B is the level that corresponds to Full-scale level.

Note 2. The current consumption depends on the applied Clock Frequency and the load on the DATA output.

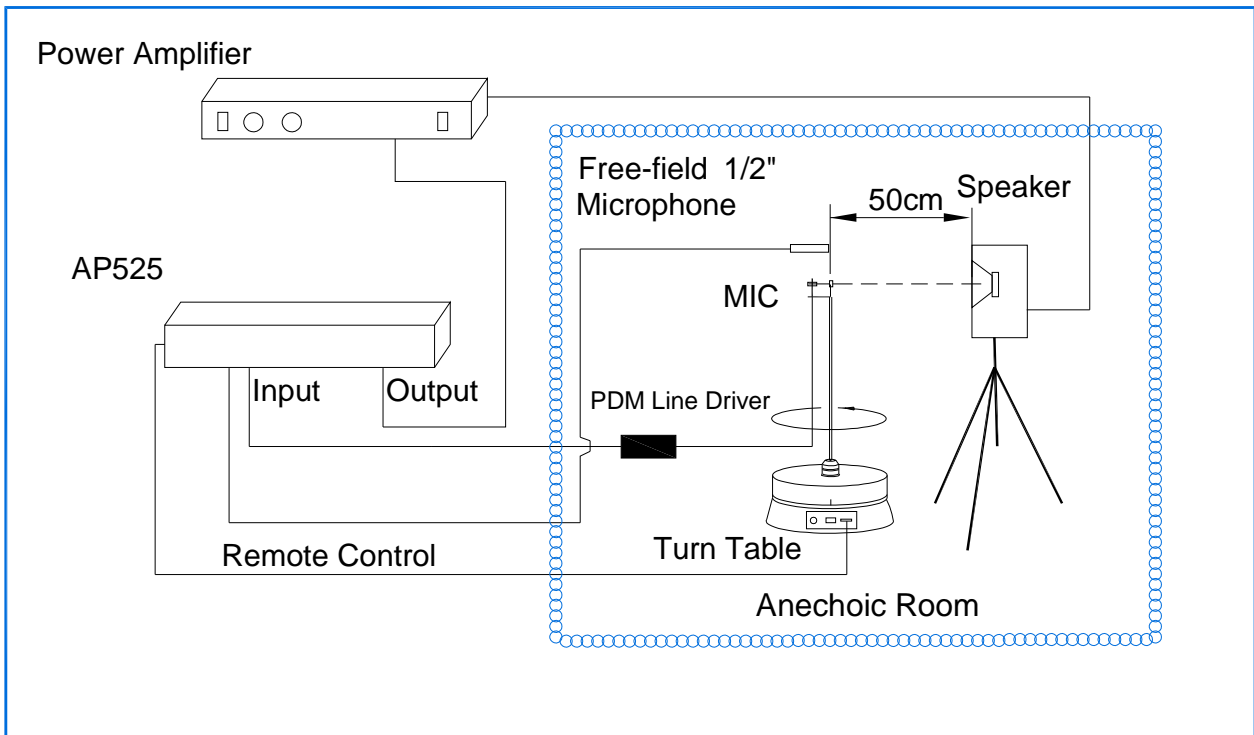
Note 3. Timing



### 4 Measurement Circuit



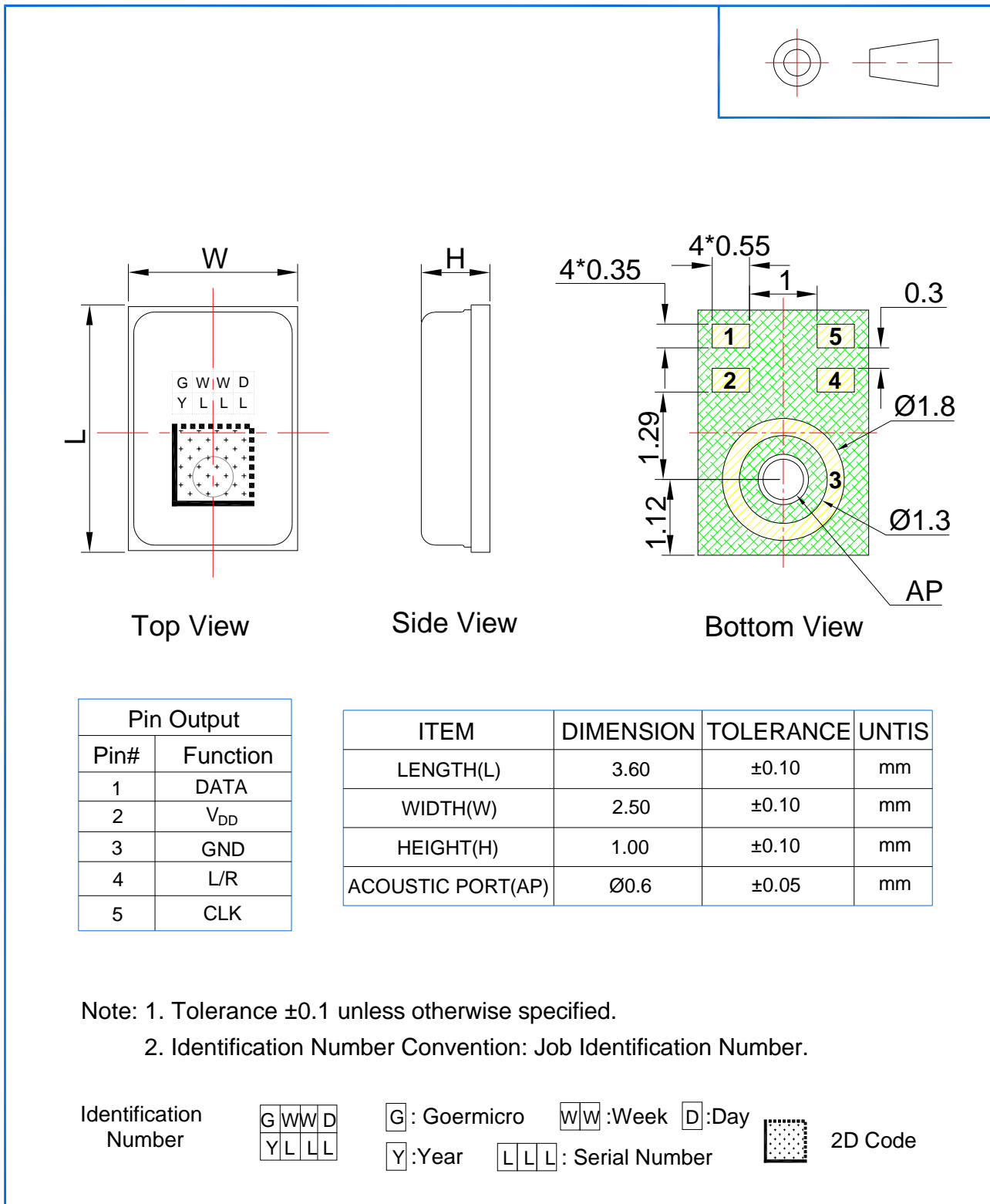
### 5 Test Setup Drawing





## 6 Mechanical Characteristics

### 6.1 Appearance Drawing (Unit: mm)



### 6.2 Weight

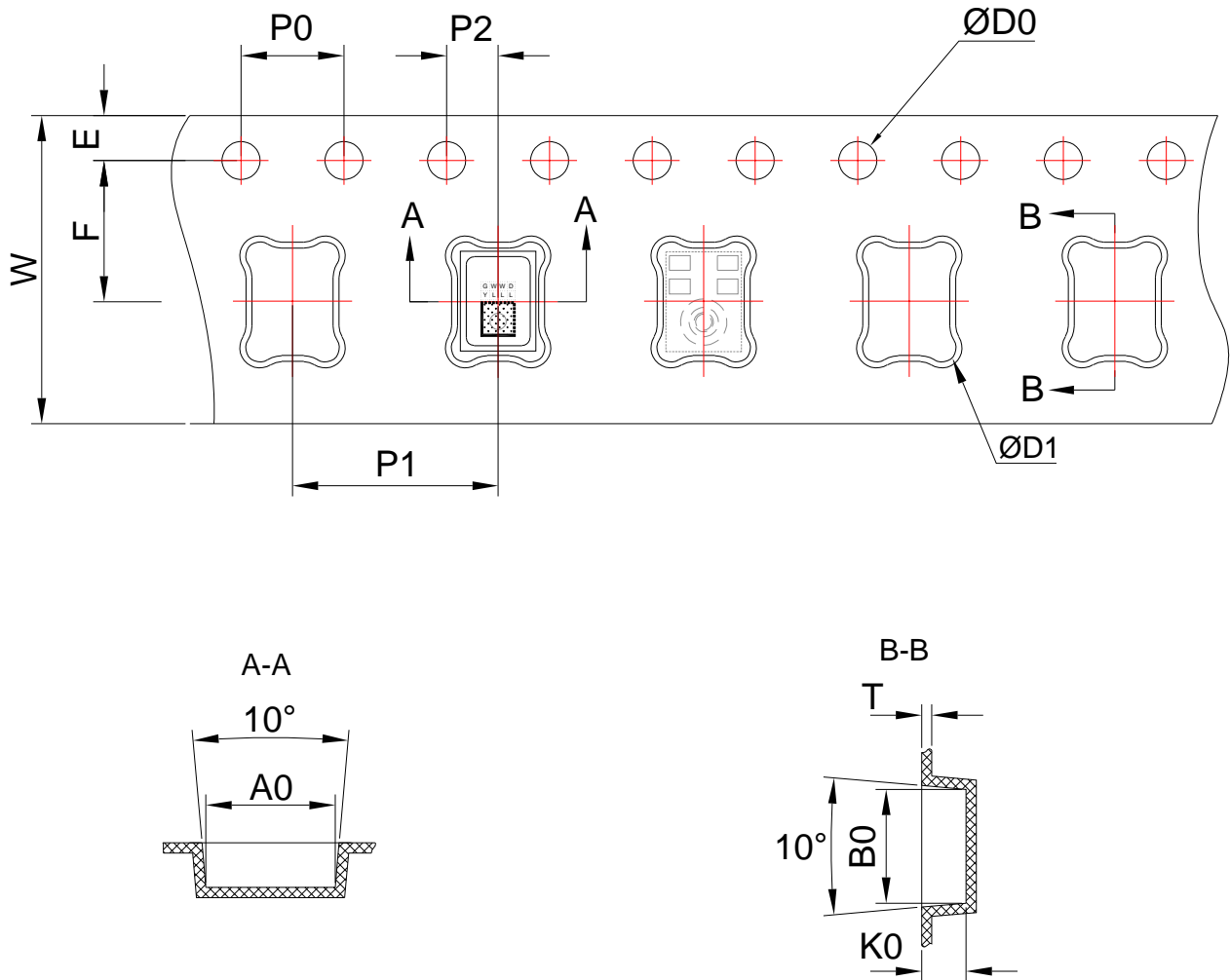
The weight of the MIC is Less than 0.04g.

7 Reliability Test

<p>7.1 Vibration Test</p>	<p>To be no interference in operation after vibrations, 4 cycles, from 20 to 2,000Hz in each direction(X,Y,Z), 48 minutes, using peak acceleration of 20g, sensitivity should vary within <math>\pm 3</math>dBFS from initial sensitivity. (The measurement to be done after 2 hours of condition at 15°C-35°C, R.H. 25%~75%)</p>
<p>7.2 Drop Test</p>	<p>To be no interference in operation after dropped to 1.0cm steel plate 12 times from 1.5 meter height in state of JIG,JIG weight of 100g, sensitivity should vary within <math>\pm 3</math>dBFS from initial sensitivity. (The measurement to be done after 2 hours of condition at 15°C-35°C, R.H. 25%~75%)</p>
<p>7.3 Temperature Test</p>	<p>a) After exposure at +125°C for 200 hours, sensitivity should vary within <math>\pm 3</math>dBFS from initial sensitivity. (The measurement to be done after 2 hours of condition at 15°C-35°C, R.H. 25%~75%)  b) After exposure at -40°C for 200 hours, sensitivity should vary within <math>\pm 3</math>dBFS from initial sensitivity. (The measurement to be done after 2 hours of condition at 15°C-35°C, R.H. 25%~75%)</p>
<p>7.4 Humidity Test</p>	<p>After exposure at +85°C and 85% relative humidity for 200 hours, sensitivity should vary within <math>\pm 3</math>dBFS from initial sensitivity. (The measurement to be done after 2 hours of condition at 15°C-35°C, R.H. 25%~75%)</p>
<p>7.5 Mechanical Shock Test</p>	<p>Then subject samples to three one-half sine shock pulses (3000 g for 0.3 milliseconds) in each direction (for six axes in total) along each of the three mutually perpendicular axes for a total of 18 shocks, sensitivity should vary within <math>\pm 3</math>dBFS from initial sensitivity. (The measurement to be done after 2 hours of condition at 15°C-35°C, R.H. 25%~75%)</p>
<p>7.6 Thermal Shock Test</p>	<p>After exposure at -40°C for 30 minutes, at +125°C for 30 minutes (change time 20 seconds) 32 cycles, sensitivity should vary within <math>\pm 3</math>dBFS from initial sensitivity. (The measurement to be done after 2 hours of condition at 15°C-35°C, R.H. 25%~75%)</p>
<p>7.7 Reflow Test</p>	<p>Adopt the reflow curve of item 12.3, after three reflows, sensitivity should vary within <math>\pm 2</math>dBFS from initial sensitivity. (The measurement to be done after 2 hours of condition at 15°C-35°C, R.H. 25%~75%)</p>
<p>7.8 Electrostatic Discharge Test</p>	<p>Under C=150pF, R=330ohm. Air discharge to case with<math>\pm 8</math>kV and contact discharge to I/O terminals with<math>\pm 2</math>kV , 10 times, Grounding. Sensitivity should vary within <math>\pm 3</math>dBFS from initial sensitivity.</p>
<p>7.9 <b>IP5X Test</b></p>	<p>GLASS9 DUST, Test time: 30min, Standing time: 30min Sensitivity should vary within <math>\pm 3</math>dB from initial sensitivity</p>
<p>7.10 <b>IPX7 Test</b></p>	<p>Exposure at static DI water and 1m water depth for half an hour, Wipe dry MICs, Function test after finish IPX7 24H, Sensitivity should vary within <math>\pm 3</math>dB from initial sensitivity.</p>

8 Package

8.1 Tape Specification



The Dimensions as Follows:

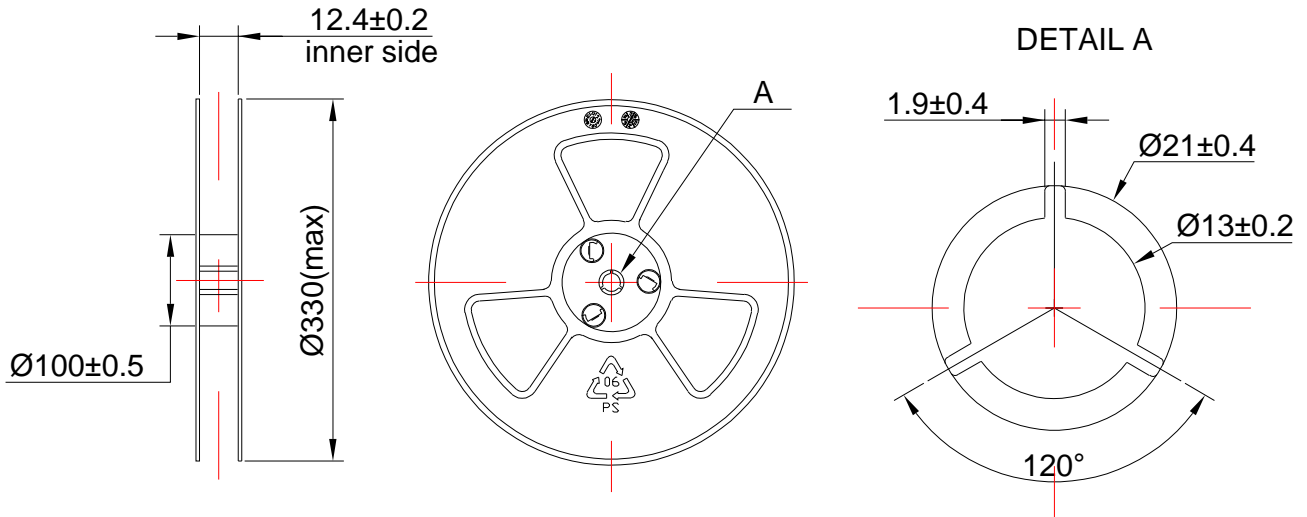
ITEM	W	E	F	ØD0	K0
DIM(mm)	12.0±0.30	1.75±0.10	5.50±0.05	1.50 <sup>+0.10</sup> <sub>0</sub>	1.20±0.10
ITEM	P0	10P0	P1	A0	B0
DIM(mm)	4.00±0.10	40.00±0.20	8.00±0.10	2.70±0.05	3.80±0.05
ITEM	P2	T			
DIM(mm)	2.00±0.05	0.30±0.05			

8.2 Reel Dimension

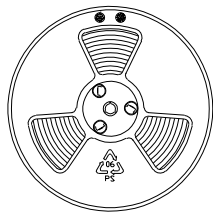
7" reel for sample stage

13" reel will be provided for the mass production stage

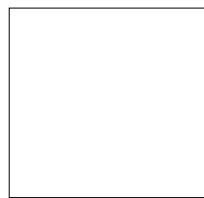
The following is 13" reel dimensions (unit:mm)



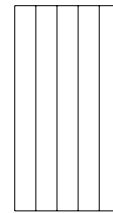
8.3 The Content of Box(13" reel)



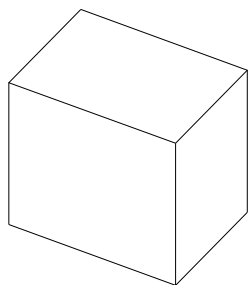
Packing (5,000PCS)



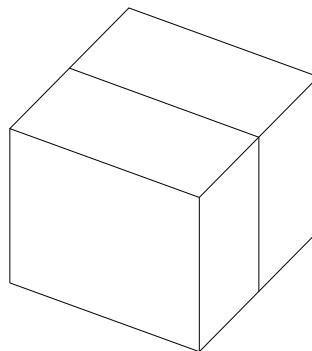
Antistatic bag(5,000PCS)



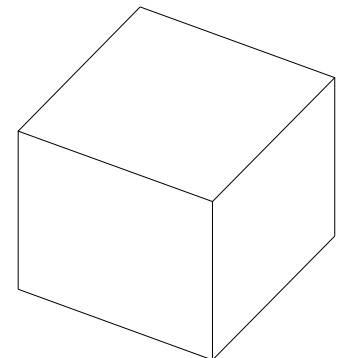
Five Antistatic bag(25,000PCS)



Inner Box(25,000PCS)  
(355mm×130mm×345mm)



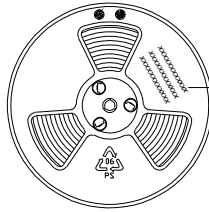
Two Inner Box(50,000PCS)



Outer Box(50,000PCS)  
(365mm×295mm×380mm)

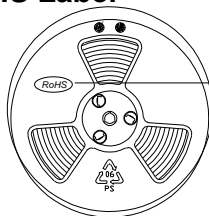
## 8.4 Packing Explain

### 8.4.1 The Label Content of the Reel



The Content Includes:  
Product type, Lot, Customer P/N;  
and other essential information such as  
Quantity, Date etc.

### 8.4.2 The RoHS Label



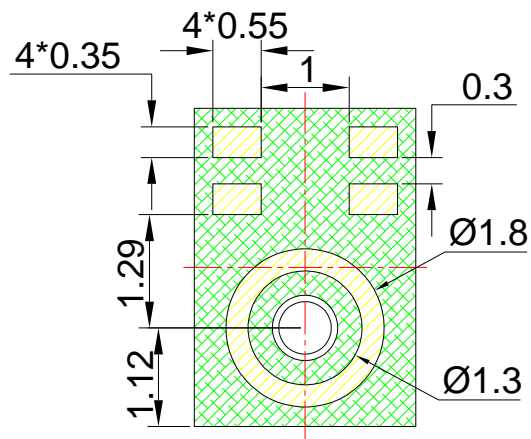
RoHS HF  
Compliance Mark

## 9 Storage and Transportation

- 9.1 Keep MEMS MIC in warehouse with less than 75% humidity and without sudden temperature change, acid air, any other harmful air or strong magnetic field. Recommend storage period no more than 1 year and floor life(out of bag) at factory no more than 4 weeks.
- 9.2 The MEMS MIC with normal pack can be transported by ordinary conveyances. Please protect products against moist, shock, sunburn and pressure during transportation.
- 9.3 Storage Temperature Range:  $-40^{\circ}\text{C} \sim +70^{\circ}\text{C}$
- 9.4 Operating Temperature Range:  $-40^{\circ}\text{C} \sim +70^{\circ}\text{C}$

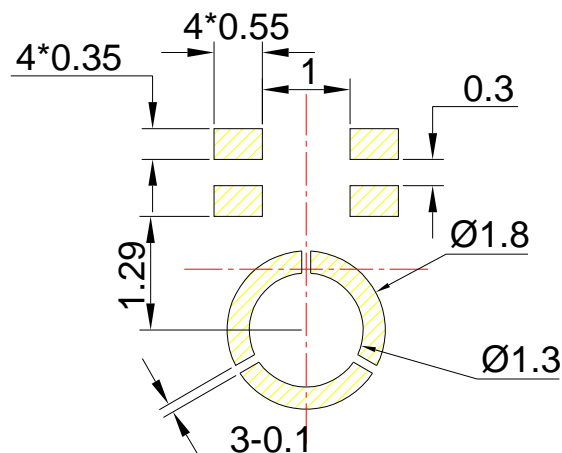
## 10 Land Pattern Recommendation

### 10.1 The Pattern of MIC Pad(Unit:mm)



### 10.2 Recommended Soldering Surface Land Pattern (Unit:mm)

Recommended the size of solder stencil pattern area is  $>80\%$  of MIC pads, as below, and the stencil thickness suggestion is  $0.1\text{mm}$ .

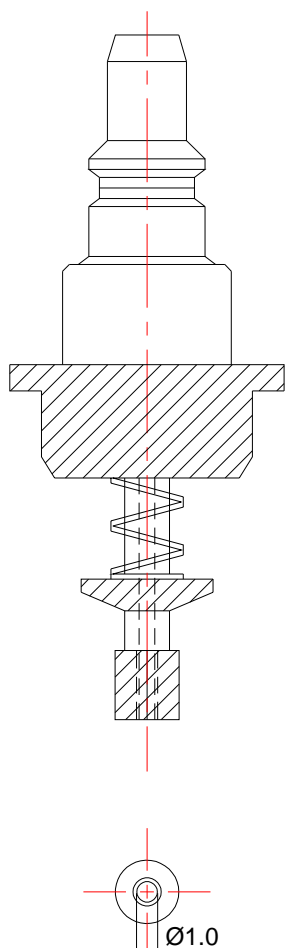


## 11 Soldering Recommendation

### 11.1 Soldering Machine Condition

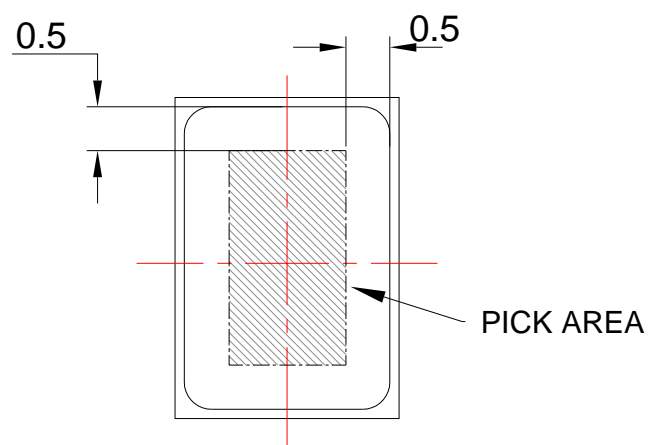
Temperature Control	8 zones
Heater Type	Hot Air
Solder Type	Lead-free

### 11.2 The Drawing and Dimension of Nozzle

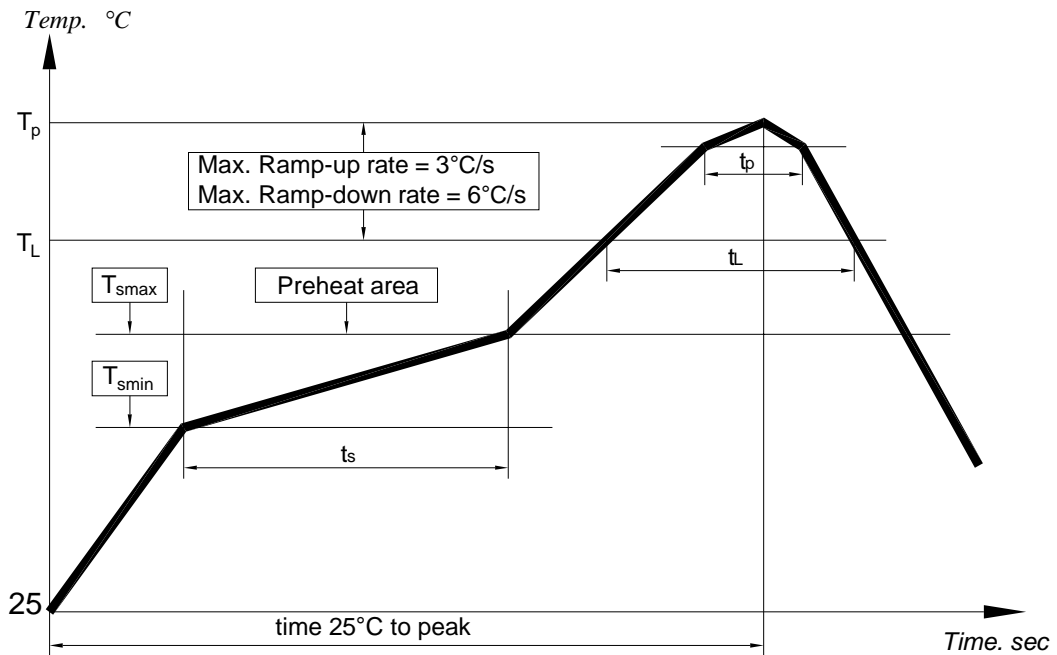


Inside Diameter:  $\varnothing 1.0\text{mm}$ ;  
Acoustic Port:  $\varnothing 0.6\text{mm}$ ;

Please don't vacuum over the acoustic port directly.  
Please don't blow the acoustic port directly.



11.3 Reflow Profile



Key Features of The Profile:

Average Ramp-up rate( $T_{smax}$ to $T_p$ )	3°C/s max.
Preheat : Temperature Min( $T_{smin}$ ) Temperature Max( $T_{smax}$ ) Time( $T_{smin}$ to $T_{smax}$ )( $t_s$ )	150°C 200°C 60~180s
Time maintained above : Temperature( $T_L$ ) Time( $t_L$ )	217°C 60~150s
Peak Temperature( $T_p$ )	260°C
Time within 5°C of actual Peak Temperature( $t_p$ ) :	30~40s
Ramp-down rate( $T_p$ to $T_{smax}$ )	6°C/s max
Time 25°C to Peak Temperature	8min max

When MEMS MIC is soldered on PCB, the reflow profile is set according to solder paste and the thickness of PCB etc.



## 12 Cautions

### 12.1 Board Wash Restrictions

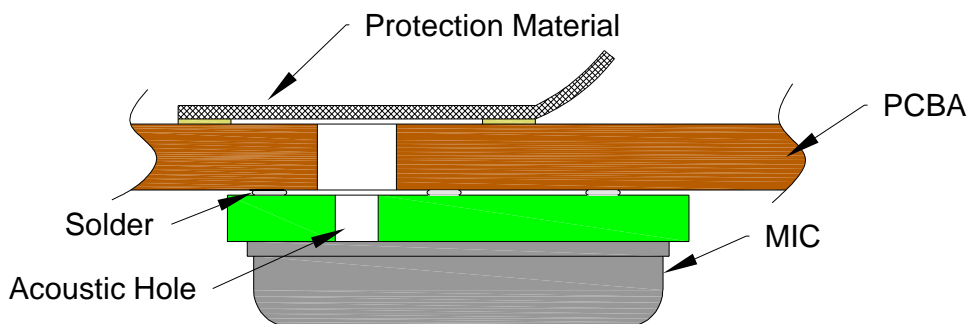
It is very important not to wash this microphone, otherwise this could damage the microphone.

### 12.2 Ultrasonic Restrictions

It is very important not to use ultrasonic process. otherwise this could damage the microphone.

### 12.3 Acoustic Port Protection

It is very important not to operate vacuum and air blow into acoustic port(without any covering over acoustic port), otherwise this could damage the microphone. And it is necessary to be careful about foreign substances into acoustic port .Please add protection material (e.g. PET ) on the acoustic hole to protect it after SMT , refer to below pictures, take it away before test, then attach it again until the end of assembly.



## 13 Output Inspection Standard

Output inspection standard is executed according to <<ISO2859-1:1999>>.