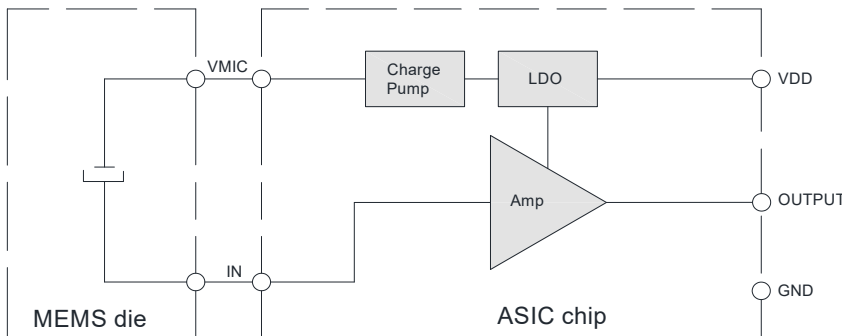


## Description

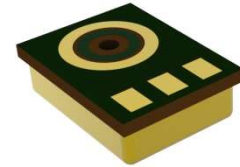
The **MA-DRA381-H13** is a high SNR, high AOP, and single output bottom port analog MEMS microphone, consists of a MEMS sensor and a low noise level ASIC.



**Fig. 1 Microphone block diagram**



**Top View**



**Bottom View**

## Key Features

- ✧ 4.0x3.0x1.2mm Bottom Port
- ✧ Narrow Sensitivity +/-1dB
- ✧ High SNR of 70dBA
- ✧ High AOP of 130dBSPL
- ✧ RF Shielded
- ✧ Compatible with Standard SMD Reflow Technology
- ✧ RoHS Compliance & Halogen Free

## Typical Applications

- ✧ Mobilephones
- ✧ Wireless Headsets
- ✧ Smart Speakers
- ✧ Wearable Electronics
- ✧ Portable Electronics
- ✧ Smart Home Electronics

## Maximum Ratings

Stresses at the maximum ratings shown in Table 1 may cause permanent damage to the device. These are stress ratings only at which the device may not function when an operation at these or any other condition beyond those specified under "Electro-Acoustic Specifications".

**Table 1 Maximum Ratings**

Parameter	Maximum Ratings	Unit
Supply voltage	3.6	V
Supply current	1	mA
Output current	1	mA
Operation temperature range	-40~85	°C
Storage temperature range	-40~100	°C

## Electro-Acoustic Specifications

**Table 2 Normal Mode Electrical Specifications**

Test condition: +25±2°C, 60%~70% RH, 86~106Kpa, Vdd=2.75V, no load, unless otherwise specified.

No.	Parameter	Symbol	Condition	Min.	Nom.	Max.	Unit
1	Sensitivity	S	f=1KHz, Pin=1Pa, 0dB=1V/Pa	-39	-38	-37	dB
2	Operating Voltage	V <sub>DD</sub>		2.4	2.75	3.3	V
3	Directivity			Omni-directional			
4	Polarity		Sound pressure increase	Output voltage increase			
5	Sensitivity vs. Voltage	ΔS	Vs= 3.3V to 2.4V	<0.5			dB
6	Output Impedance	Z <sub>OUT</sub>	f=1KHz			400	Ω
7	Current Consumption	I	3.3V to 2.4V		110	200	μA
8	S/N Ratio	S/N	20-5KHz Bandwidth, A-Weighted		72		dBA
			20-8KHz Bandwidth, A-Weighted		71		dBA
			20-20KHz Bandwidth, A-Weighted		70		dBA
9	Total Harmonic Distortion	THD	94dB SPL @1KHz		0.1	0.5	%
			124dBSPL @1KHz		1		
10	Acoustic Overload Point	AOP	THD 10%@1KHz		130		dB SPL
11	Power Supply Rejection	PSR	100mVpp Squarewave @217Hz, A-weighted		-103	-90	dB
12	Power Supply Rejection Ratio	PSRR	200mVpp Sinewave @1KHz	60	71		dB
13	DC output	VDC			1.30		V
14	Low Frequency Roll-off	LFRO				20	Hz
15	Output load	C <sub>load</sub>				150	pF
		R <sub>load</sub>		0.01		10	MΩ

Note: Frequency response, sensitivity and current consumption are tested by 100% on product line.

## Performance Curves

All curves are tested under 2.75V unless otherwise noted.

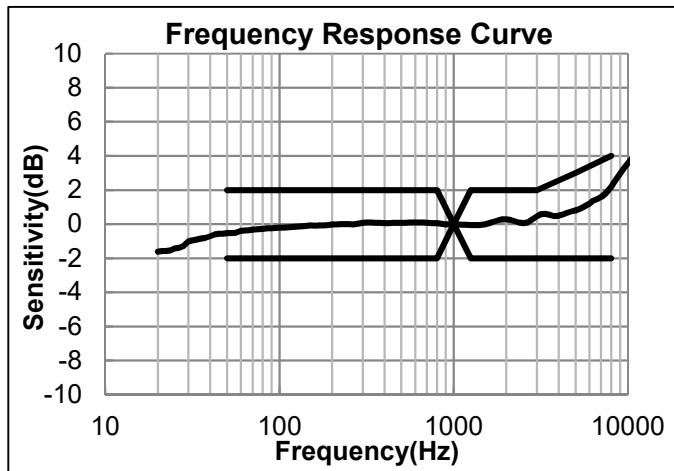


Fig. 2 Frequency response curve normalized to 1kHz

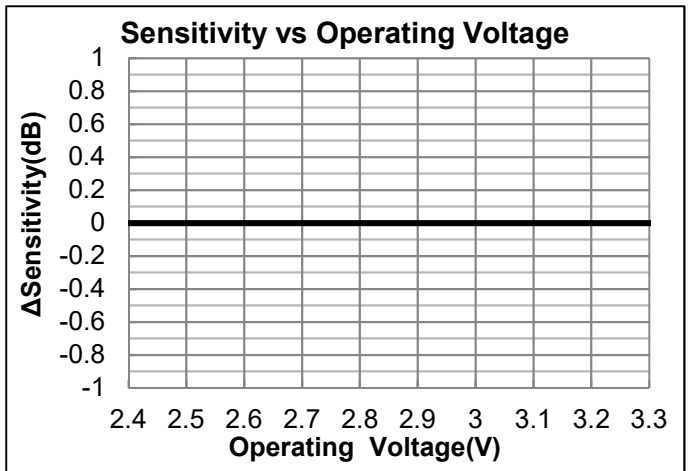


Fig. 3 Sensitivity vs Operating Voltage

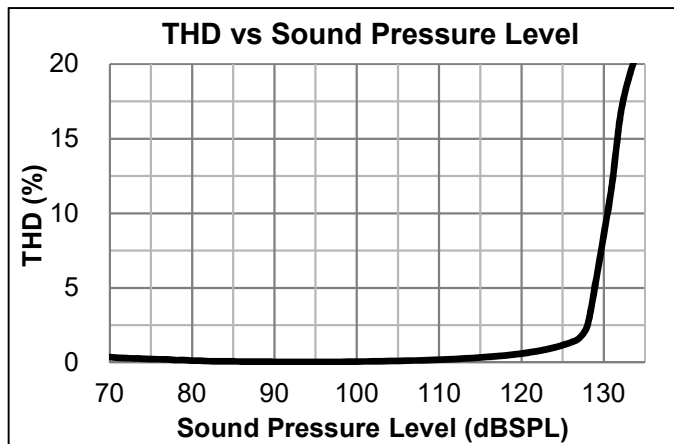


Fig. 4 Typical THD vs Sound Pressure Level

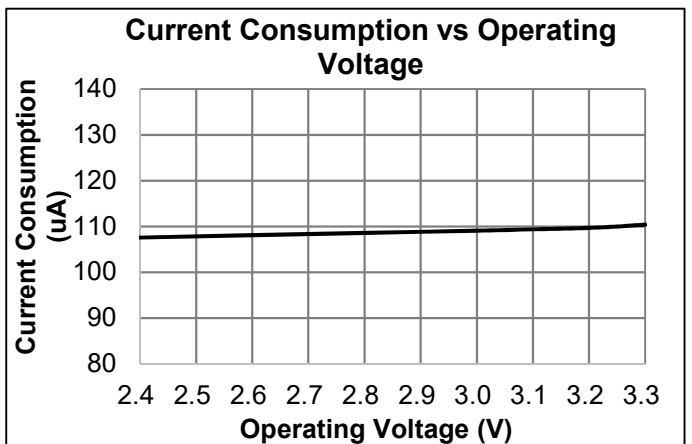


Fig. 5 Typical Current vs Operating Voltage

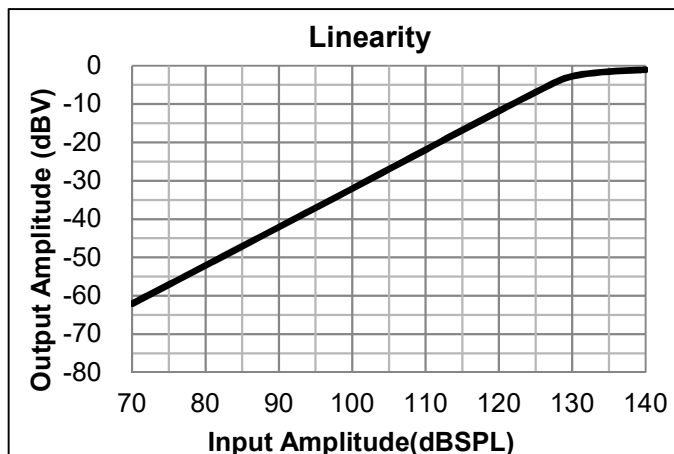


Fig. 6 Linearity

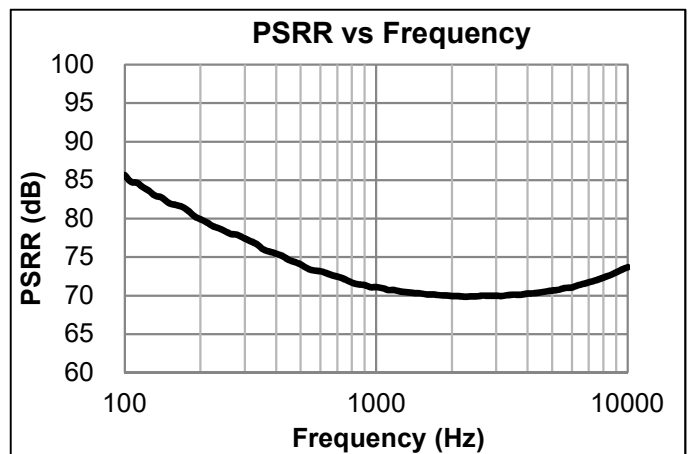
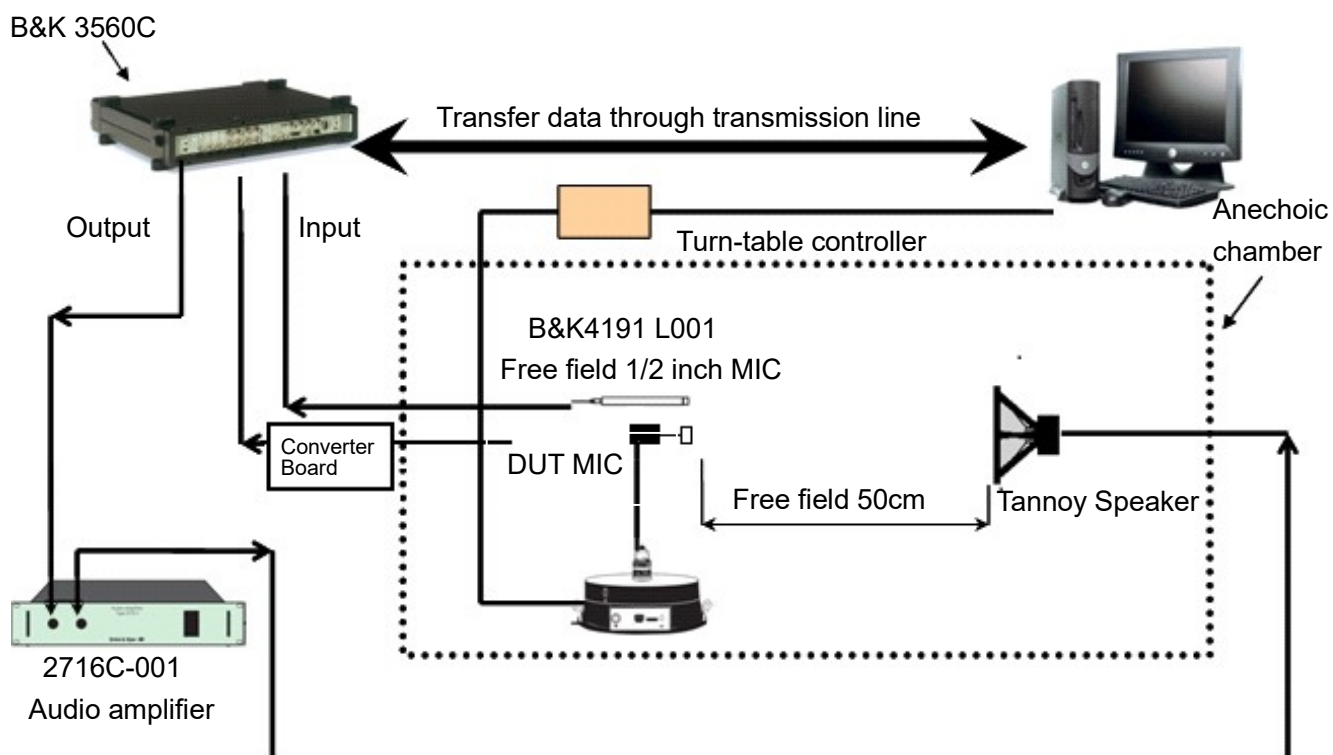


Fig. 7 Typical PSRR curve

## Measurement System Setup

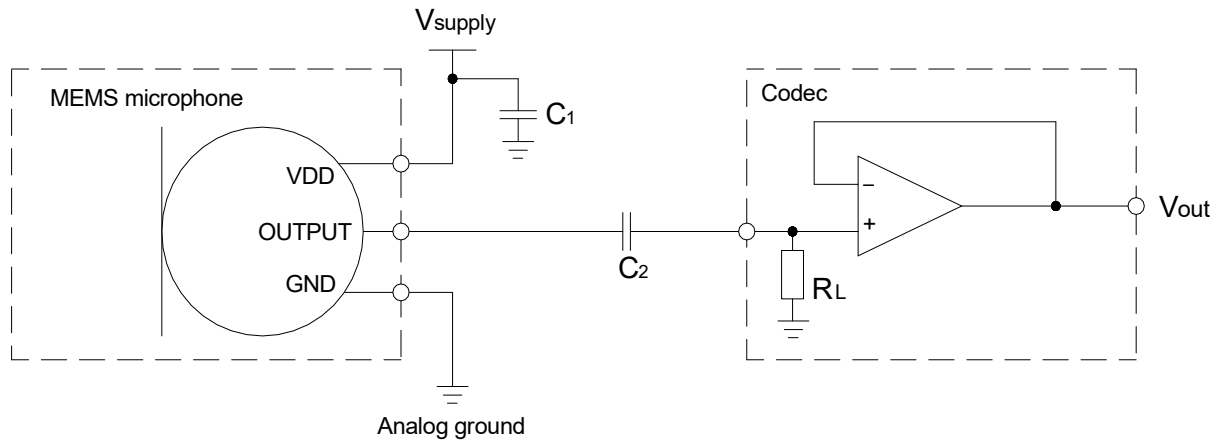
**Test signal:** Sinusoid, Sweep,

**Step:** 1/12 octave



**Fig. 8 Measurement System Setup**

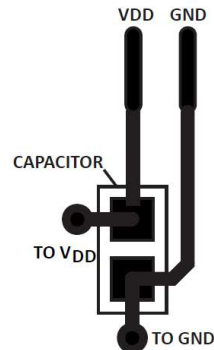
## Typical Application Circuit



**Fig. 9 Typical Application Circuit**

### Power supply decoupling:

A 0.1uF ceramic type decoupling capacitor  $C_1$  is strongly recommended for every microphone and it should be placed as close to the VDD pad to reduce the noise on power supply;  
The trace connected to each pad of capacitor should be as short as possible, and should stay on one layer of PCB without via. For the best performance, recommend to place the capacitor equidistance from power and ground pins of microphone, or slightly closer to the power pin if space not allowed. System ground should connect to far side of the capacitor, as shown in fig.10.



**Fig. 10 Recommended Power Supply Decoupling Capacitor Layout**

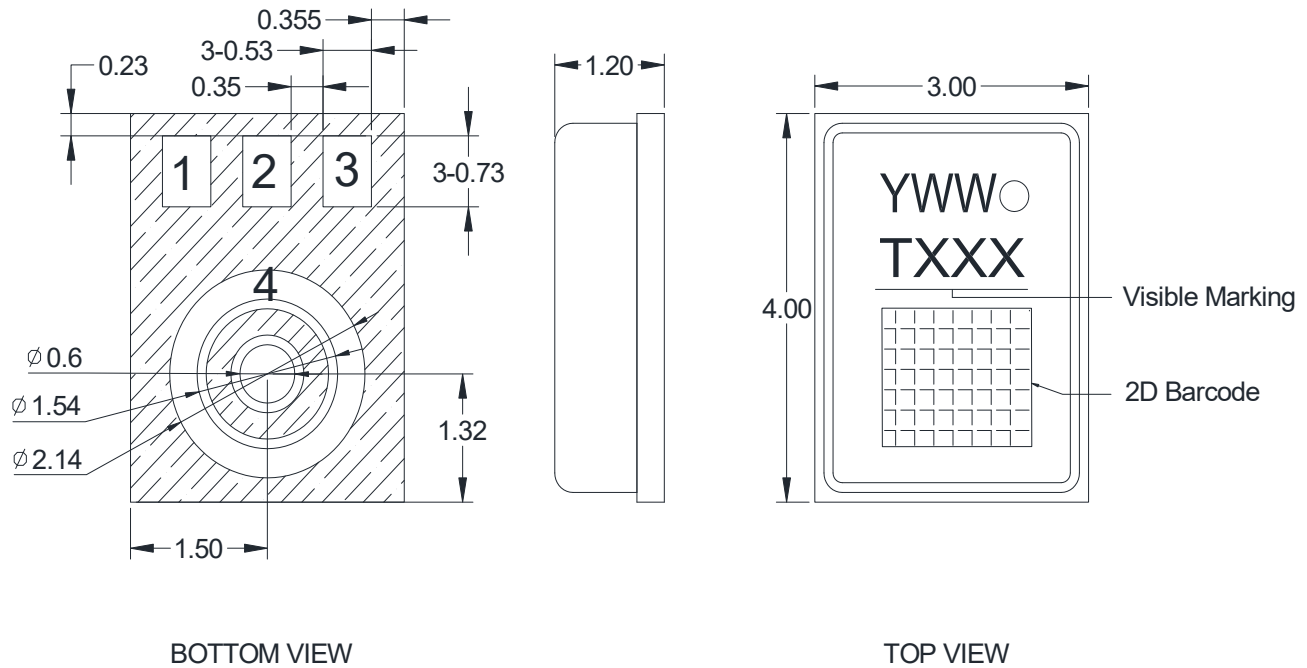
### Low frequency roll-off:

DC-blocking capacitor  $C_2$  is required on the output signal line. The 3-dB cut-off frequency can be calculated using follow equation which is related to DC-blocking capacitor  $C_2$  and input resistance of the amplifier.

$$3\text{dB cut-off frequency} = 1/2\pi R_L C_2$$

In order to get a cut-off frequency below 20 Hz, minimum 1uF value of  $C_2$  and minimum 20KΩ value of input resistance of the amplifier is recommended.

## Mechanical Specifications



Unit: mm Unmarked Tolerance:  $\pm 0.1$  (mm)

**Fig. 11 Dimension**

Item	Dimension	Tolerance
Length	4.0	$\pm 0.1$
Width	3.0	$\pm 0.1$
Height	1.2	$\pm 0.1$
Acoustic Port	0.6	$\pm 0.05$

PIN	Definition	Description
1	VDD	Power Supply
2	N/A	No connect
3	Output	Signal Output
4	GND	Ground

Note:

- All Ground Pin must be connected to the ground in end application
- Identification Marking  
Y: Year WW: Week ○: Polarity sign  
T: GETTOP XXX: Serial Number



2D Barcode

## Reliability Specifications

After conducting any of the following tests, the sensitivity change of DUT shall be less than  $\pm 3\text{dB}$  from its initial value unless otherwise noted, and shall keep its initial operation and appearance.

**Table 3 Reliability Specifications**

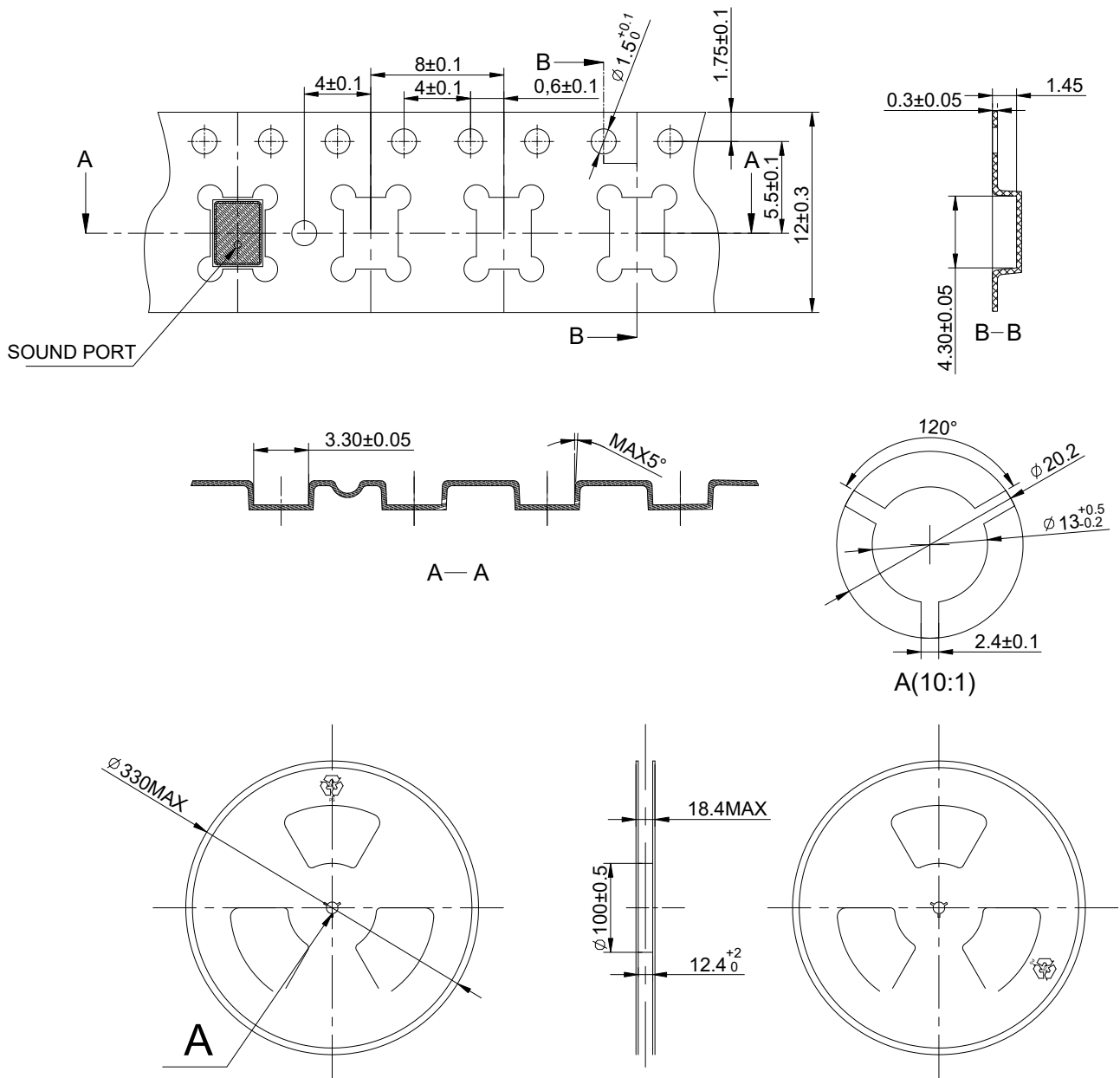
No.	Item	Test condition
1	Preconditioning	24 hour bake at $125^{\circ}\text{C}$ , followed by 168 hours at $85^{\circ}\text{C}$ , 85%RH, followed by 3 passes solder reflow only for the following three tests: High Humidity & High Heat operating Test High Humidity & High Heat operating Test Thermal Shocking Test
2	Hi-Temperature Storage Test	$105\pm 3^{\circ}\text{C}$ , 1000h, recover for two hours
3	Hi-Temperature operating Test	$105\pm 3^{\circ}\text{C}$ , under upper limit bias, 1000h, recover for two hours
4	Low-Temperature storage Test	$-40\pm 3^{\circ}\text{C}$ , 1000h, recover for two hours
5	Low-Temperature operating Test	$-40\pm 3^{\circ}\text{C}$ , under upper limit bias, 1000h, recover for two hours
6	High Humidity & High Heat operating Test	$85\pm 3^{\circ}\text{C}$ , 85%RH, under upper limit bias, 1000h, recover for two hours, there should be no corrosion and deformation inside of microphone after testing
7	High Humidity & High Heat operating Test	$65\pm 3^{\circ}\text{C}$ , 95%RH, under upper limit bias, 168h, recover for two hours, there should be no corrosion and deformation inside of microphone after testing
8	Thermal Shocking Test	Double-Case Method, $-40^{\circ}\text{C}$ for 15mins $\rightarrow$ $125^{\circ}\text{C}$ for 15 mins, 100 cycles, recover for two hours
9	Vibration Test	Each 12mins for X, Y and Z axes, Frequency: 20~2000Hz, Peak Acceleration 20g, recover for two hours
10	Drop Test	Height: 1.5m Fixture Weight: 150g (Sound Hole Diameter in the fixture is $\geq 0.8\text{mm}$ ) Reference Surface: slippery marble floor Duration: 4 corners*4 times, 6 faces*4 times The sensitivity change should be less than 1dB after testing
11	Tumbling Test	Height: 1.0m Fixture Weight: 150g (Sound Hole Diameter in the fixture is $\geq 0.8\text{mm}$ ) Duration: 300 times Recommended Time: 10-11times/Min The sensitivity change should be less than 1dB after testing

12	ESD Test 1	<p>a. HMB  Discharge Position: I/O pins  Charge Voltage: <math>\pm 3000V</math>  Discharge Network: 100pF &amp; 1500<math>\Omega</math></p> <p>b. CDM  Discharge Position: I/O pins  Charge Voltage: <math>\pm 250V</math></p>
13	ESD Test 2	<p>The tests are performed acc. to IEC61000-4-2 level 3:</p> <p>a. Contact Discharge  Discharge Position: Output of Microphone  Charge Voltage: <math>\pm 6000VDC</math>  Discharge Network: 150pF &amp; 330<math>\Omega</math></p> <p>b. Air Discharge  Discharge Position: Sound Hole  Charge Voltage: <math>\pm 8000VDC</math>  Discharge Network: 150pF &amp; 330<math>\Omega</math></p>
14	Structure Shock Test	10000g, Duration: 0.1ms, each 3 shocks for X/Y/Z 3 axes, The sensitivity change should be less than 1dB after testing
15	Reflow	3 reflow cycles with peak temperature of +260 $^{\circ}C$ according to reflow profile

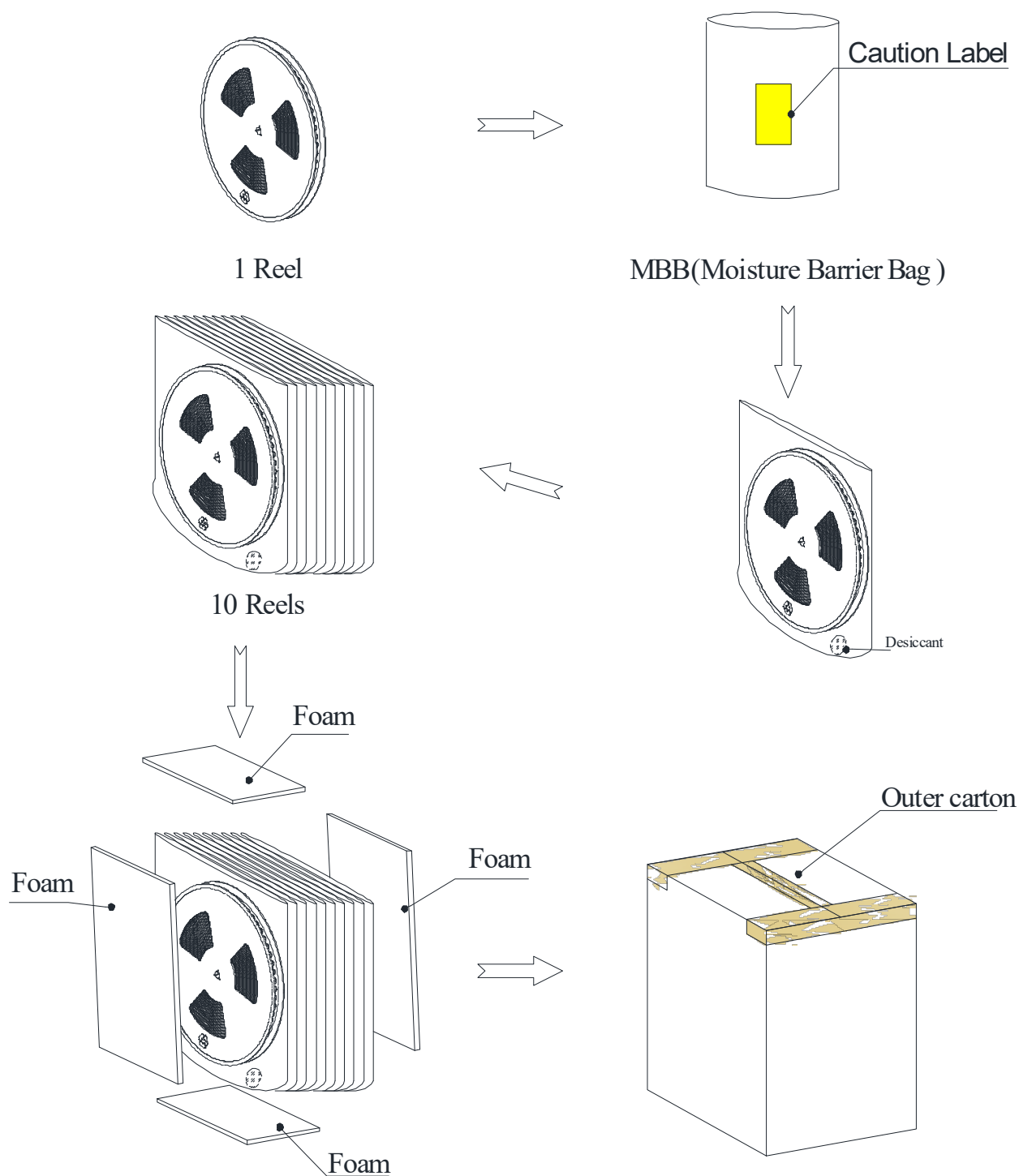


## Packaging Details

- \* Use ESD reel and tape for microphone packaging.
- \* Anti-static measures should be applied during packaging operation.



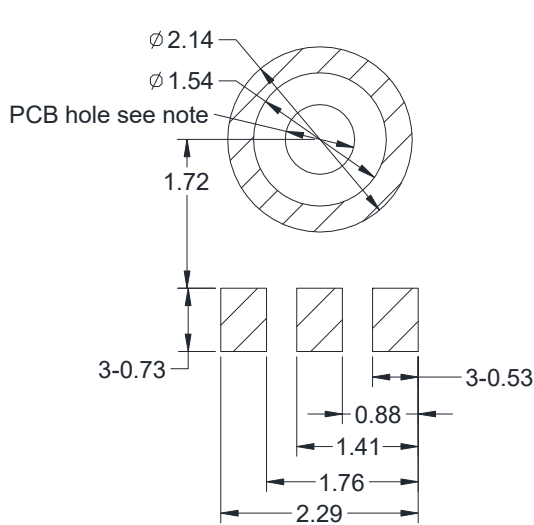
**Fig. 12 Packaging**



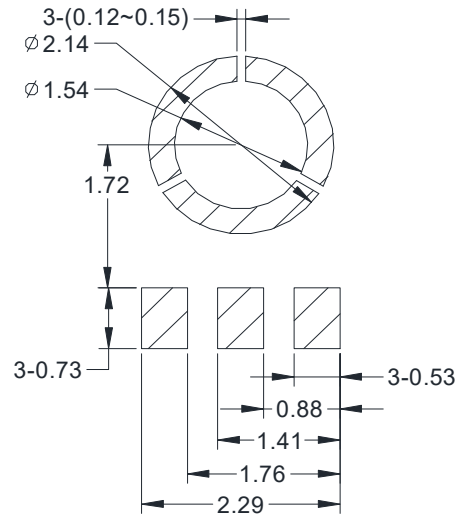
Tape and Reel	φ330mm	4,500PCS×1=4,500PCS
Shipping Box	215mm*370mm*370mm	4,500PCS×10=45,000PCS

## Application Design Suggestions

### Recommended PCB and Stencil Design Pattern



**Example Land Pattern**



**Example Solder Stencil Pattern**

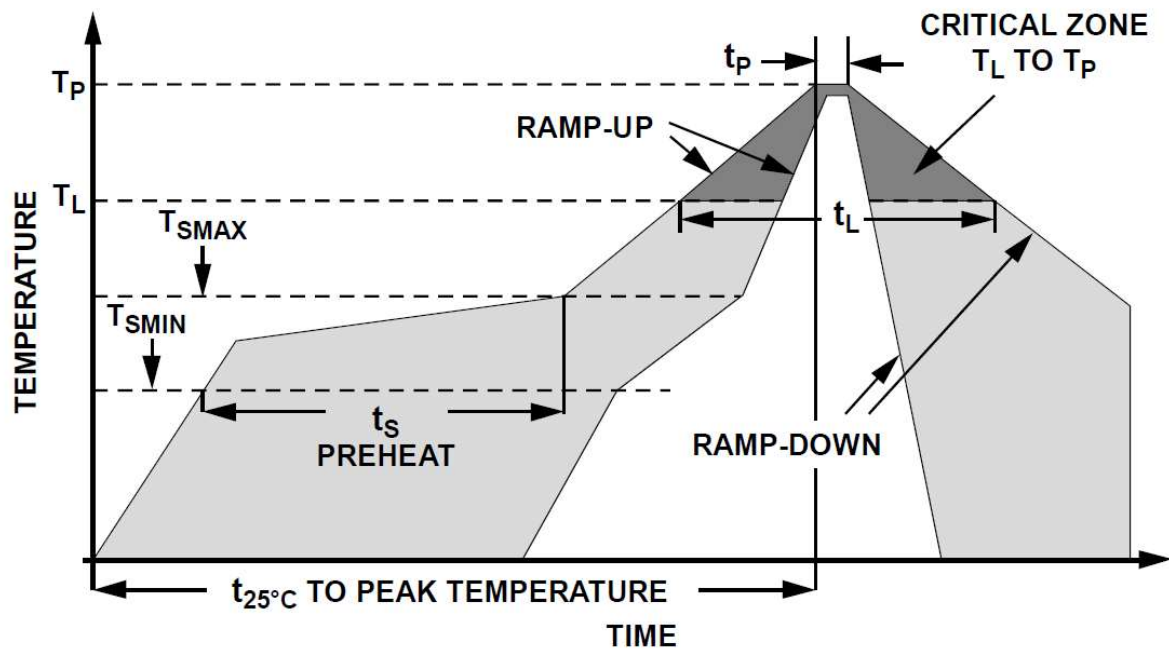
#### Notes:

- Dimensions are in millimeters unless otherwise specified.
- Tolerance is  $\pm 0.1\text{mm}$  unless otherwise specified.
- The recommended non-plated hole diameter of PCB is 0.9-1.2mm.

### Temperature Profile during Reflow Process

**Table 4 Temperature Profile during Reflow Process**

Parameter		Reference	Specification
Average Ramp Rate		$T_L$ to $T_P$	3°C/sec max
Preheat	Minimum Temperature	$T_{SMIN}$	150°C
	Maximum Temperature	$T_{SMAX}$	200°C
	Time $T_{SMIN}$ to $T_{SMAX}$	$t_s$	60 sec to 180 sec
Ramp-Up Rate		$T_{SMAX}$ to $T_L$	1.25°C/sec
Time Maintained Above Liquidous		$t_L$	60 sec to 150 sec
Liquidous Temperature		$T_L$	217°C
Peak Temperature		$T_P$	260°C
Time Within +5°C of Actual Peak Temperature		$t_P$	20 sec to 40 sec
Ramp-Down Rate		$T_P$ to $T_{SMAX}$	6°C/sec max
Time +25°C ( $t_{25^\circ\text{C}}$ ) to Peak Temperature			8 min max



**Fig. 13 Reflow Profile**

**Additional Notes:**

- Mic should cool to room temp before next flow cycle if more reflow is needed.
- No more than 3 times reflow is recommended.
- Do not board wash by liquid or ultrasonic after the reflow process.
- Do not pull a vacuum over port hole of the microphone.
- Do not insert any object in port hole of device at any time.
- Suggest SMT the microphone at last time if double side PCBA used.
- Do not seal sound port during reflow .
- If there is any leakage risk, the peak temperature should be set to less than 240°C or more than 255°C.

### Recommended nozzle for reflow MIC

External diameter is  $\Phi 1.8\text{mm}$

Inside diameter is  $\Phi 1.2\text{mm}$

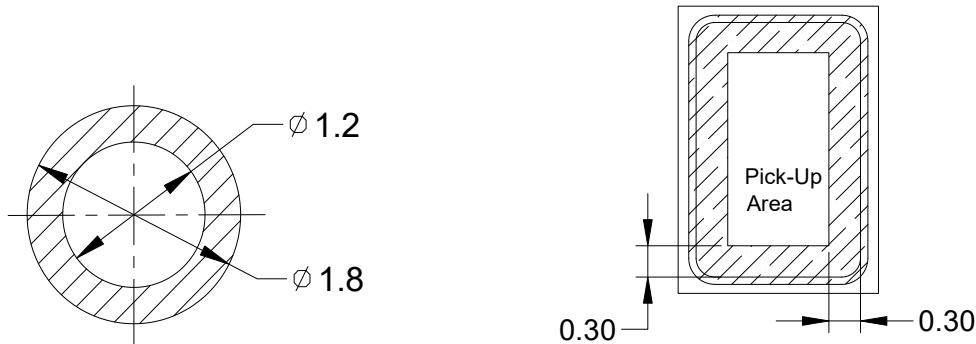


Fig. 14 Recommended nozzle for reflow MIC and Pick-up Area

## Special Cautions

### Air Rifle Cleaning Restriction

Do not bring air rifle to the port hole directly.

Recommended Condition:

Air pressure < 0.3MPa;

Distance > 5cm;

Time < 5 sec.

### Package

Do NOT vacuum seal unused material for storage. Vacuum Sealing can cause mic damage.

### Storage

The component needs to meet the requirement of MSL(Moisture Sensitivity Level) class 1. Please keep MICs in warehouse with humidity less than 75% and without sudden temperature change, acid air, and any other harmful air or strong magnetic field.

Please protect products against moist, shock, sunburn and pressure.

Please take proper measures against ESD in the process of assembly and transportation.

Please use the shipping package for long-term storage.

### Discard

For microphones to be wasted, customer shall follow the regulation of Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC).

*Notes: More application suggestions can be found in the latest "MEMS Microphone Application Notes".*

## Specification Revisions

Date	Version	Description
12-15-2023	V1.0	Initial release
04-30-2024	V2.0	Updated product description
08-16-2024	V3.0	Updated AOP performance
02-19-2025	V4.0	Updated LFRO
04-28-2025	V5.0	Updated output load
05-23-2025	V6.0	Updated mechanical spec
07-31-2025	V7.0	Updated Gettop information

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