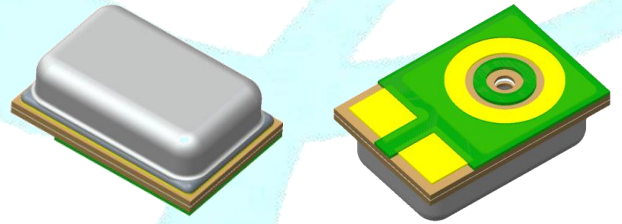


F4-(S)MOE-N090R38-3P

Little Compact
/ Narrow Sensitivity

OMNI-DIRECTIONAL
Bottom PORT



Best sound electronics

Value no1. Micro sound provider

Creative technology starts from respecting of life
of the individuals

Creative technologies to respect human life

Best sound electronics

Value no1. Micro sound provider

We offer you happiness with our excellent technology
beyond an ordinary sound what you expect

Superior technology to deliver happiness

Best sound electronics

Value no1. Micro sound provider

Keep basic fundamentals to fill sound with
new innovations

Creative technologies to respect human life



1. INTRODUCTION

- Analog MEMS Microphone
- Single Mode
- Bottom Port Type - Sensitivity is Typical -38dBV/Pa
- **Narrow Sensitivity – +/-1dB**
- Omni-directional
- RF Shielded - with embedded Ground
- Compatible with Sn/Pb and Halogen-free solder process
- RoHS compliant
- SMD reflow temperature of up to 260°C for over 30 seconds

2. APPLICATIONS

- Smartphones
- Ear-sets, Bluetooth Headsets
- Smart Speaker, Set Top Box
- Tablet Computers
- Wearable Devices
- Electrical Appliances
- Voice Recognition Systems of Appliances

3. MODEL NO.

F4-(S)MOE-N090R38-3P

4. ABSOLUTE MAXIMUM RATINGS

Parameter	Absolute maximum rating	Units
Vdd to Ground	3.6	V
OUT to Ground	-0.3 to Vdd+0.3	V
Input Current to Any Pin	1	mA

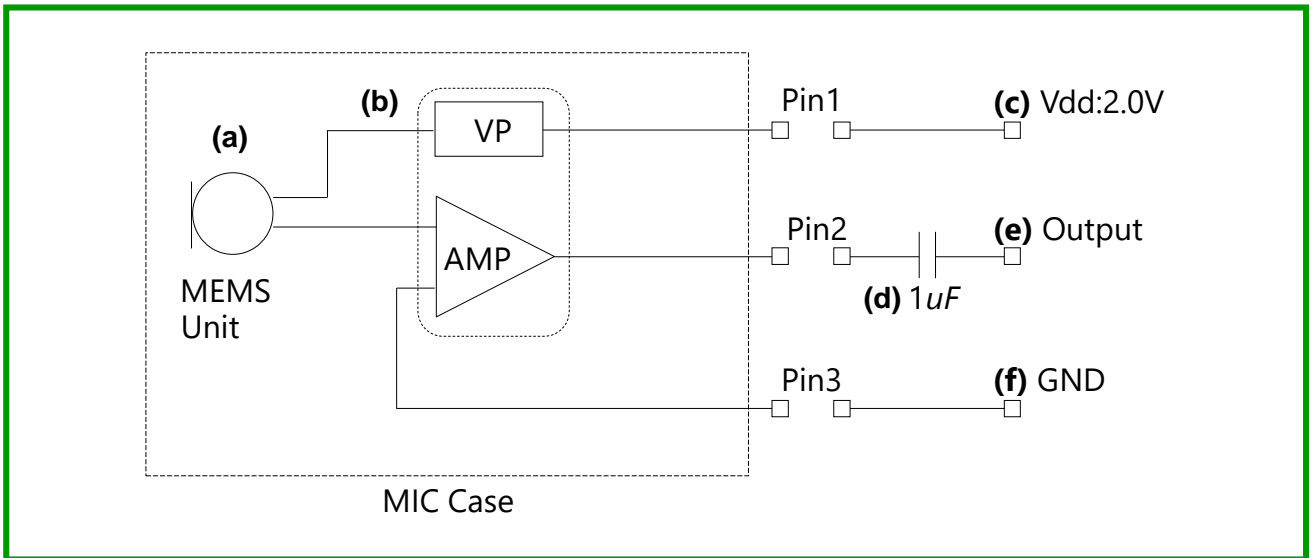
Caution : Stresses above those listed in “Absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only. Functional operation at these or any other conditions beyond those indicated under “ELECTRO-ACOUSTIC CHARACTERISTICS” is not implied. Exposure beyond those indicated under “ELECTRO-ACOUSTIC CHARACTERISTICS” for extended periods may affect device reliability.

5. ELECTRO-ACOUSTIC CHARACTERISTICS

Test Condition : 23 ± 2°C, Room Humidity = 55 ± 20 %, VDD=2.0V

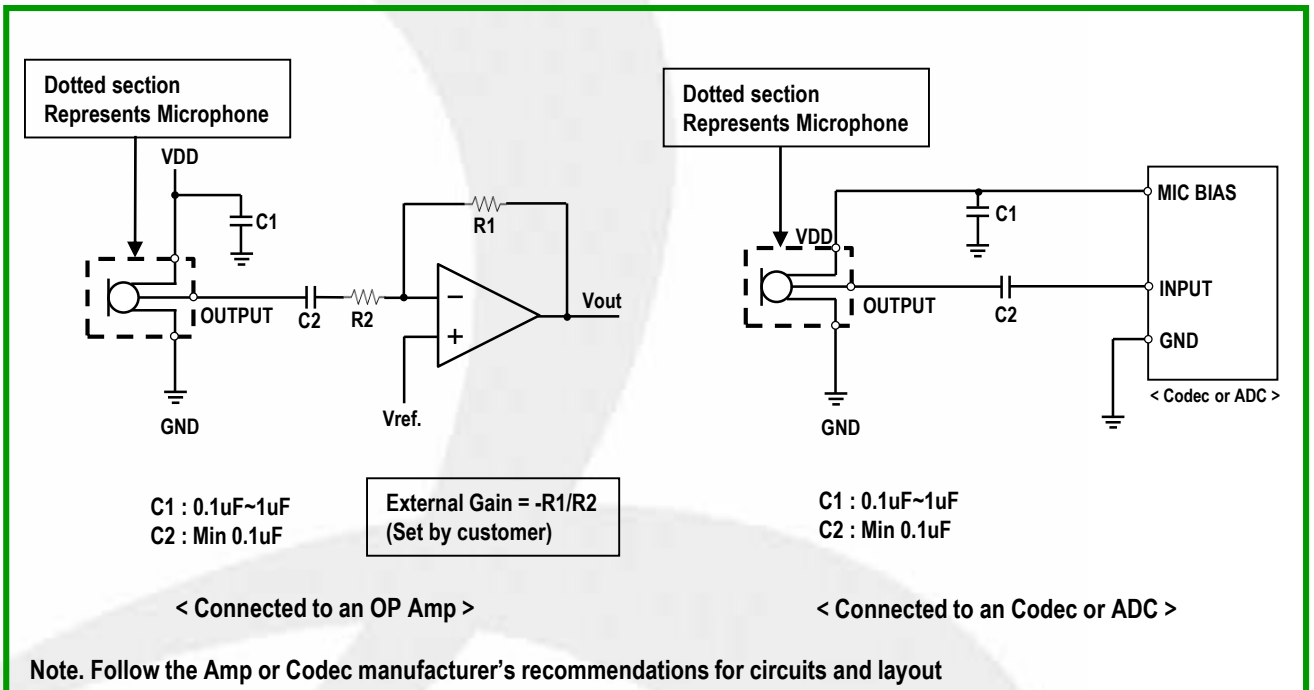
Parameter	Conditions	Min	Typ	Max	Units
Directivity		Omni-directional			
Operating Voltage (Vdd)		1.6	-	3.6	V
Sensitivity Change across Voltage	Vdd=1.6V ~ 3.6V	No Change			dB
Sensitivity (S)	94dB SPL at 1kHz, 0dB=1V/Pa	-39	-38	-37	dBV/Pa
Low Frequency Roll Off (LFRO)	-3dB relative to 1kHz	-	100	-	Hz
Output Impedance (Zout)	94dB SPL at 1kHz	-	-	200	Ω
Current Consumption	Vdd=1.6 ~ 3.6V	60	-	160	μA
Signal to Noise Ratio (SNR)	94dB SPL at 1kHz, A-weighted (20Hz~20kHz)		63		dB(A)
Equivalent Input Noise (EIN)	94dB SPL at 1kHz, A-Weighted (20Hz ~20kHz)	-	31.5	-	dB(A)SPL
Power Supply Rejection (PSR)	100mVp-p square wave at 217Hz, Vdd=1.8V, A-weighted	-	-95	-	dBV(A)
Power Supply Rejection Ratio (PSRR)	200mVp-p sine wave at 1kHz, Vdd=1.8V	-	60	-	dB
Total Harmonic Distortion (THD)	94dB SPL at 1kHz	-	0.2	0.5	%
	110dB SPL at 1kHz	-	-	1.0	
	118dB SPL at 1kHz	-	-	3.0	
	120dB SPL at 1kHz	-	-	5.0	
Acoustic Overload Point (AOP)	THD>10% at 1kHz	121	124	-	dB SPL
DC Output Voltage	Vdd=1.6 ~ 3.6V	-	0.86	-	V
Start-up time		0.1	-	100	ms

6. MEASUREMENT CIRCUIT



- (a) **MEMS Unit** : Membrane & Back Plate (transmit the electric signal modified from sound signal to ASIC)
- (b) **ASIC** : Impedance converter (Mechanical Signal → Electric Signal)
- (c) **Vdd** : Power Supply (Operation of ASIC)
- (d) **Rectifier Capacitor** : Removed Direct Current Factor
- (e) **Output** : Output Signal of Microphone's Sensitivity
- (f) **GND** : Ground

7. RECOMMENDED INTERFACE CIRCUIT



8. TYPICAL FREQUENCY RESPONSE CURVE(FAR FIELD)

Far Field Measurement Condition

Temperature : 23 ± 2 °C

Supply Voltage : 2.0V

Acoustic stimulus : 1Pa (94dB SPL at 1kHz) at 50 cm from the loud-speaker.

The loud-speaker must be calibrated to make a flat frequency response input signal.

Position : The frequency response of microphone unit measured at 50cm from the loud-speaker.

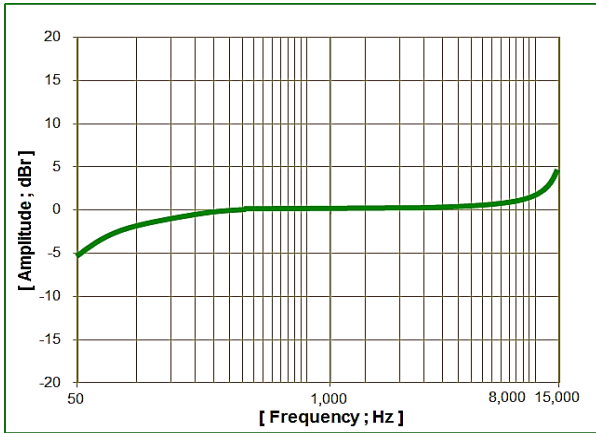


Figure 1. Typical Frequency Response, Normalized to 1 kHz

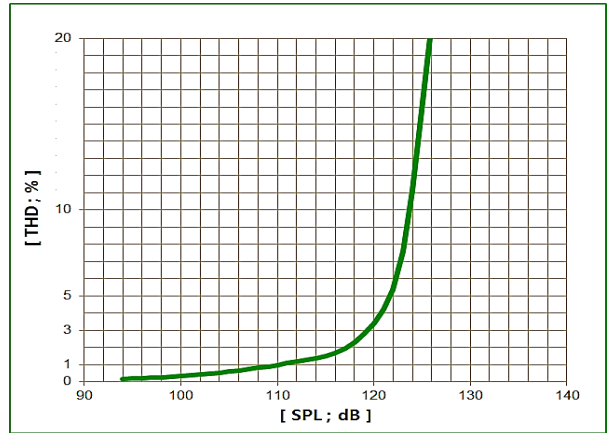


Figure 2. THD vs. Input Level

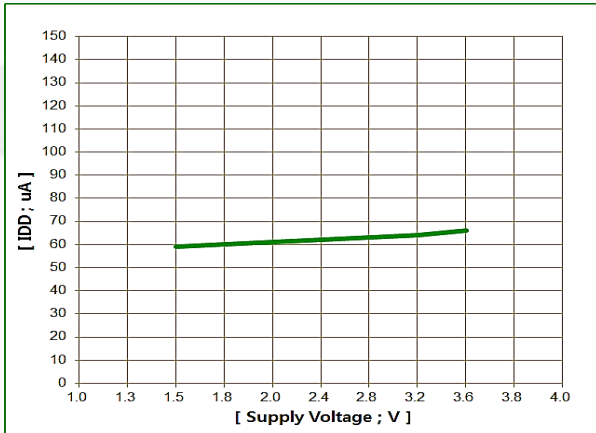


Figure 3. Typical IDD vs VDD

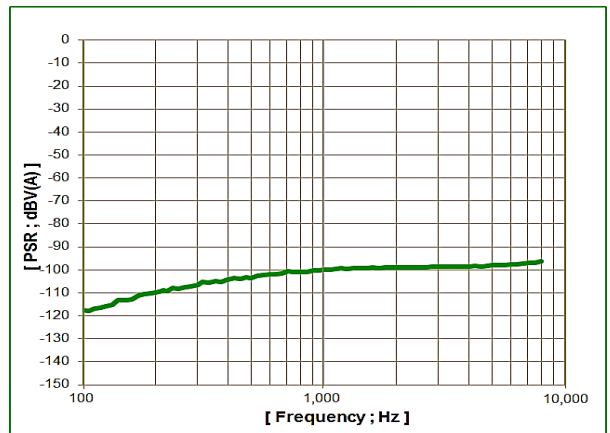


Figure 4. Typical Power Supply Rejection (PSR) vs. Frequency

■ Frequency Mask Specification

Frequency [Hz]	100	200	400	900	1000	1200	5000	10000	Note
Lower Limit [dBr]	0	+2	+3	+3	0	+3	+4	+4	0dBr = dBV/Pa at 1kHz
Upper Limit [dBr]	-6	-4	-3	-3	0	-3	-2	-2	

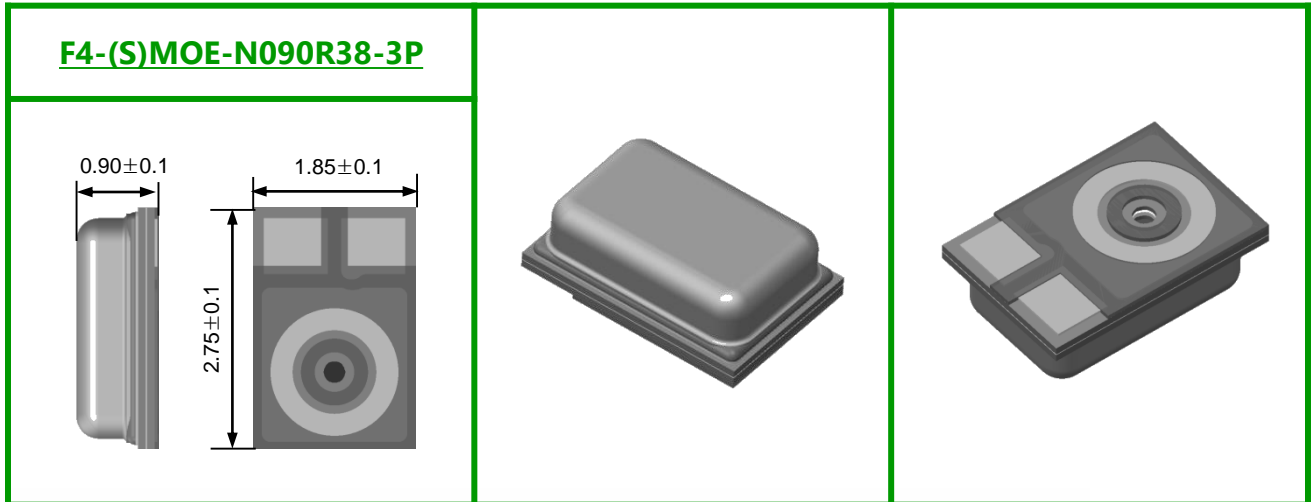
Note : Band Frequency Range

- 1. Narrow Band : 300Hz ~ 3.4kHz
- 2. Wide Band : 100Hz ~ 7kHz
- 3. Super Wide Band : 50Hz ~ 14kHz

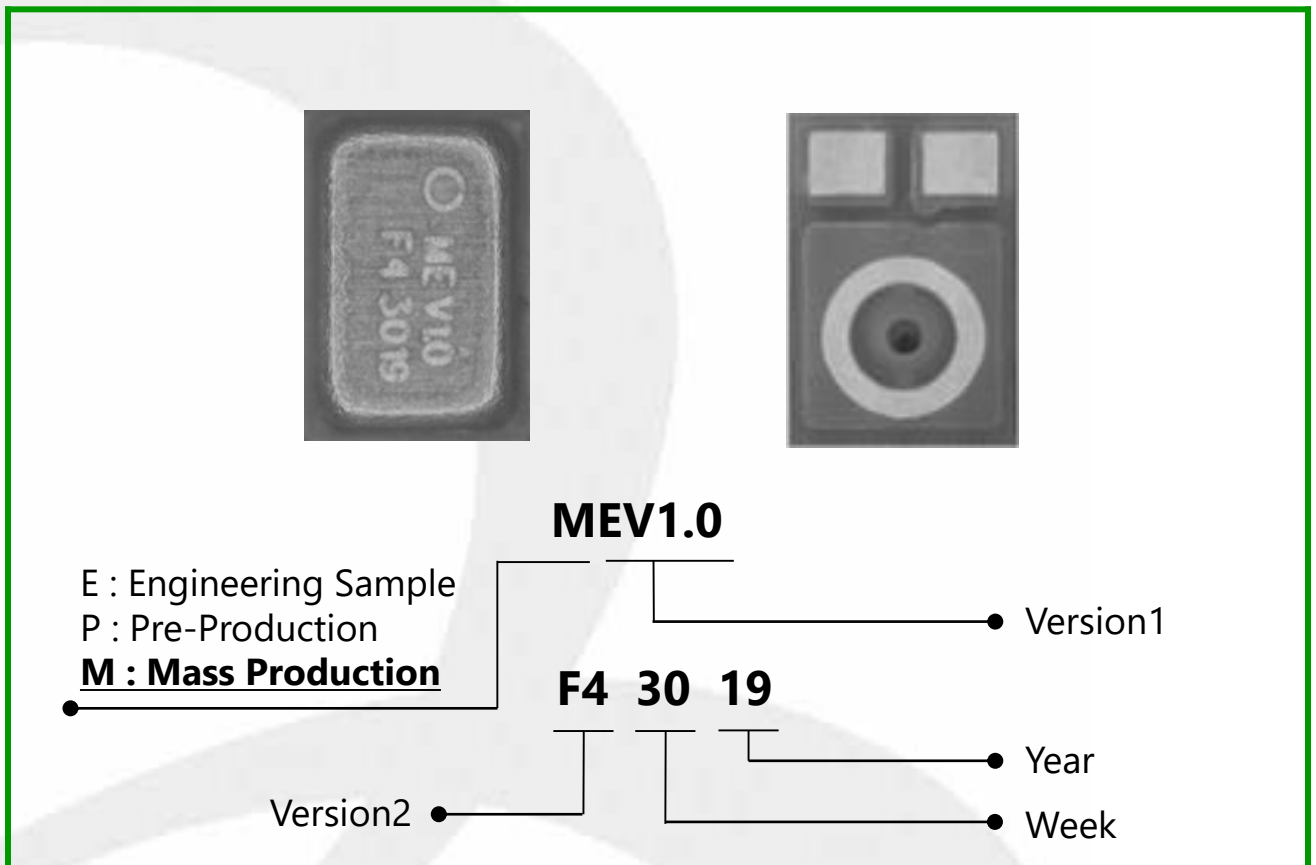
9. MECHANICAL CHARACTERISTICS

※ PCB design & Pin size can be changed by model No.

SMD Type



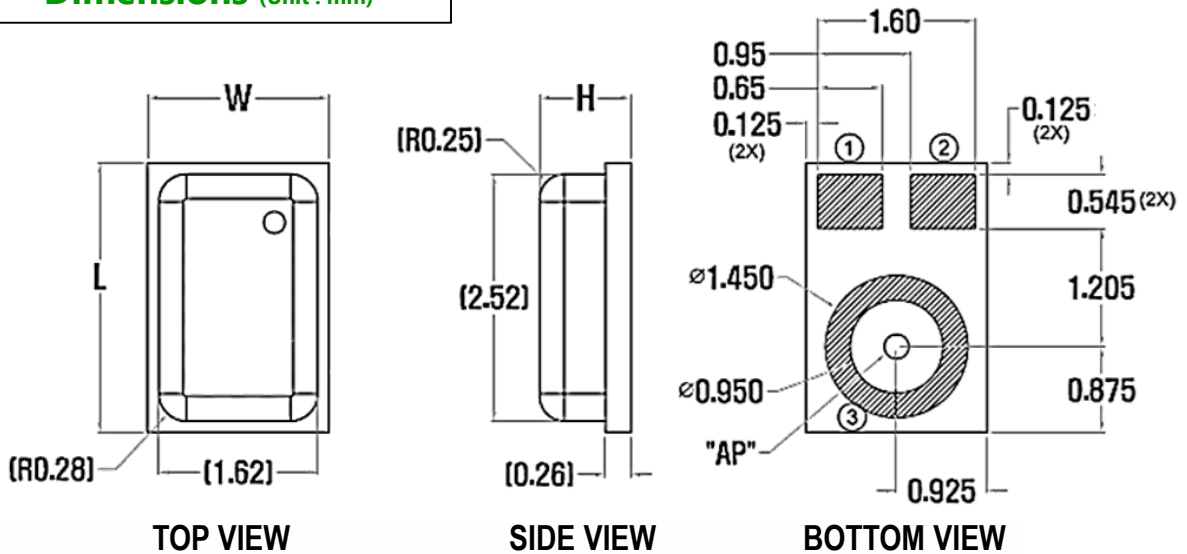
Lettering



9. MECHANICAL CHARACTERISTICS

- Mechanical dimensions & Pad Lay-out

Dimensions (Unit : mm)



Item	Dimension	Tolerance (+/-)	Units
Length (L)	2.75	0.10	mm
Width (W)	1.85	0.10	mm
Height (H)	0.90	0.10	mm
Acoustic Port (AP)	$\phi 0.25$	0.05	mm

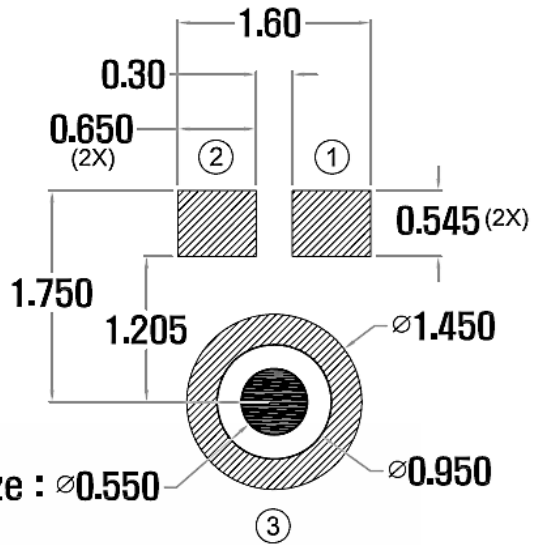
Pin #	Pin Name	Type	Description
1	Power (VDD)	Power	Power Supply
2	Output (Vout)	Signal	Output Signal
3	GND	Ground	Ground

Note : All ground Pins must be connected to ground.
"3" Pin must be sealed by solder paste on the phone PWB.
General Tolerance ± 0.08 mm.

9. MECHANICAL CHARACTERISTICS

- Recommended Land Pattern & Stencil Pattern

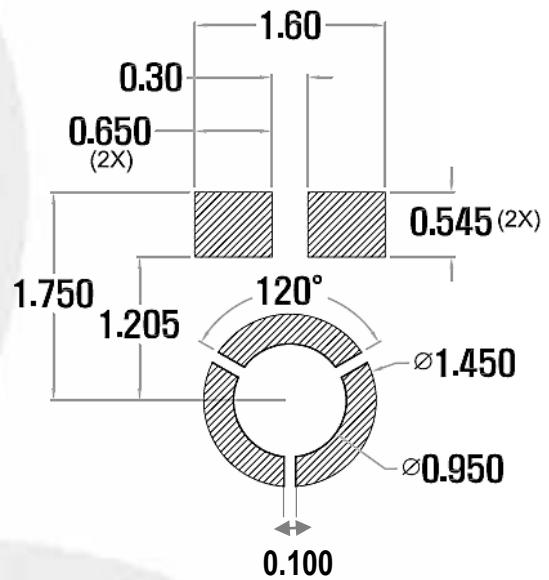
**Recommended
PCB land pattern**
(Unit : mm)



PCB Through Hole Size : $\varnothing 0.550$

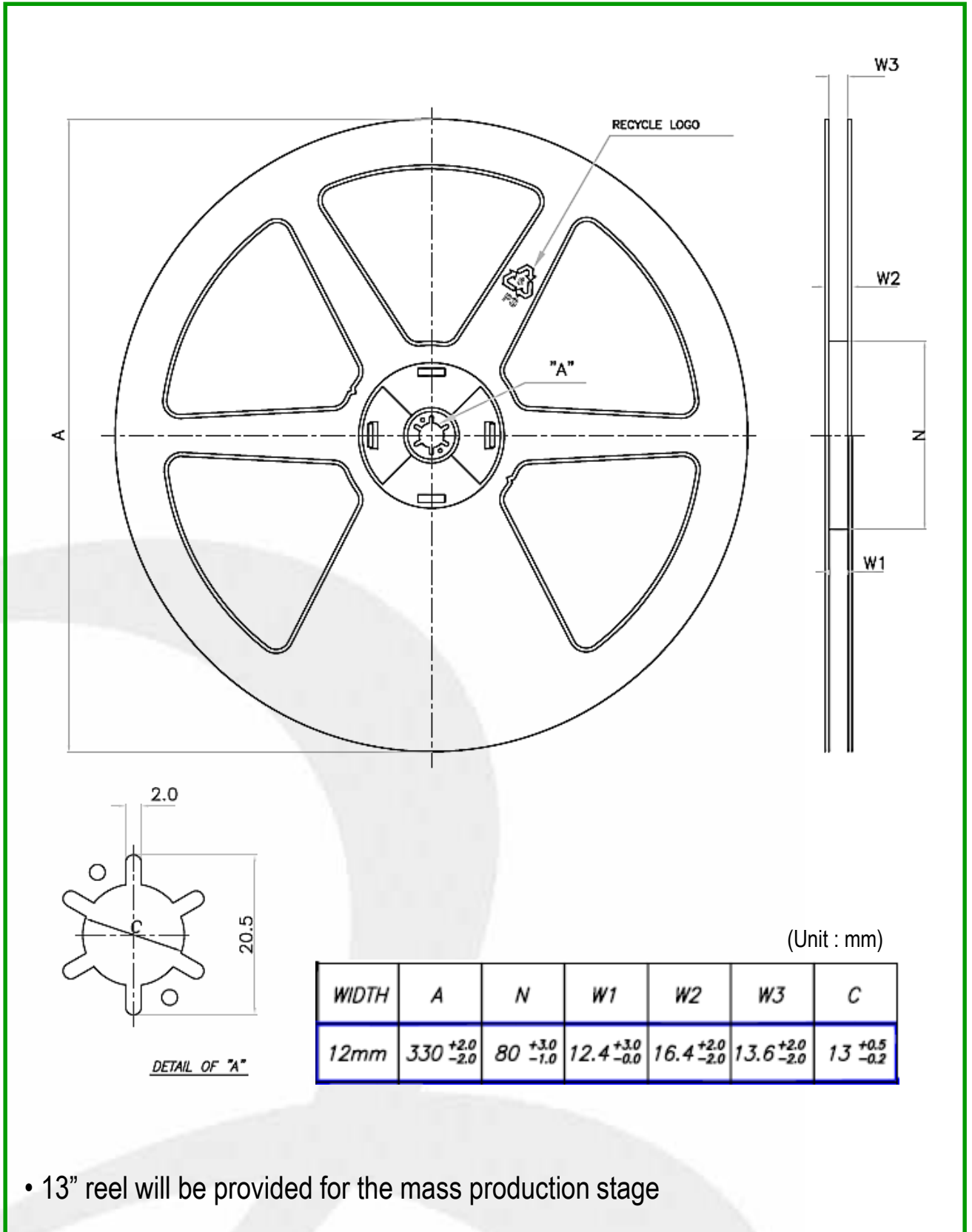
**Recommended
solder stencil pattern**
(Unit : mm)

(thickness of metal mask: 0.10T)



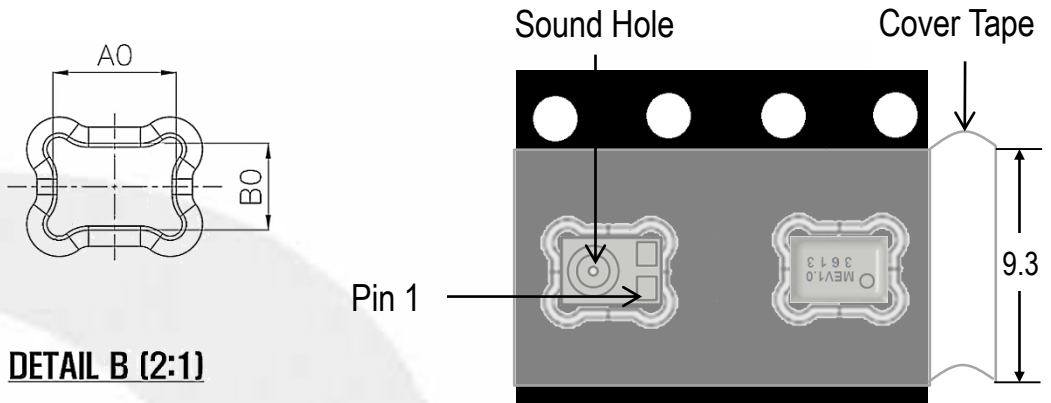
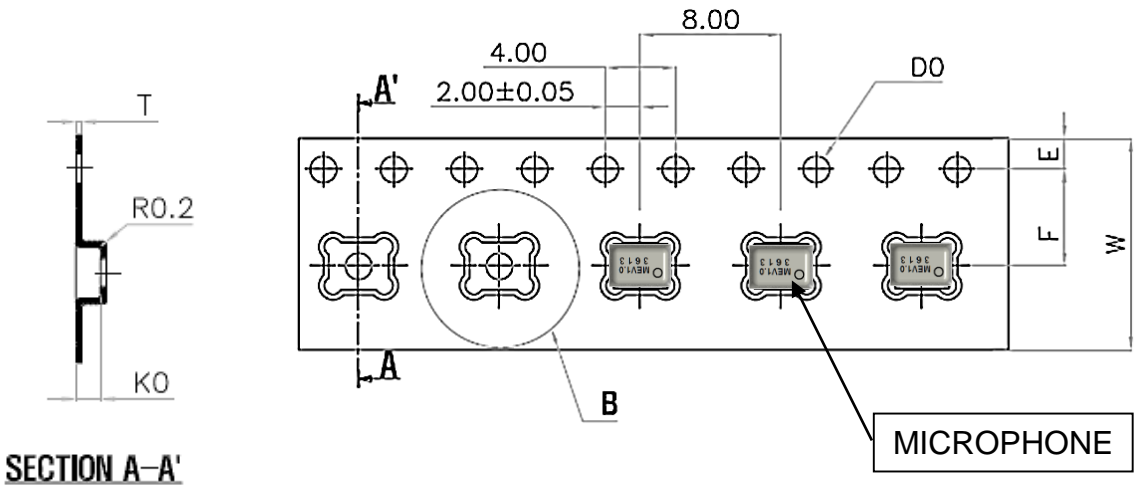
10. PACKAGING SPECIFICATION

- Reel



10. PACKAGING SPECIFICATION

- Taping



- [Note]
1. Direction of parts : See above pictures.
 2. Microphone total quantity (13" Reel) : 5,700pcs
 3. Carrier Tape ESD : $10^2 \sim 10^{10} \Omega$
 4. Cover Tape Inside ESD : $10^2 \sim 10^{10} \Omega$
 5. Carrier Tape Material & Color : PS, Black
 6. Thermo Compression Bonding

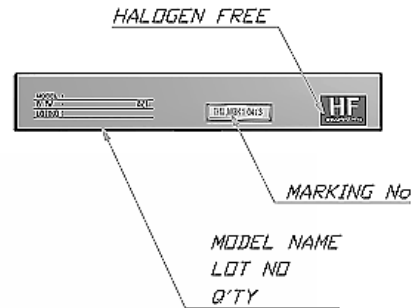
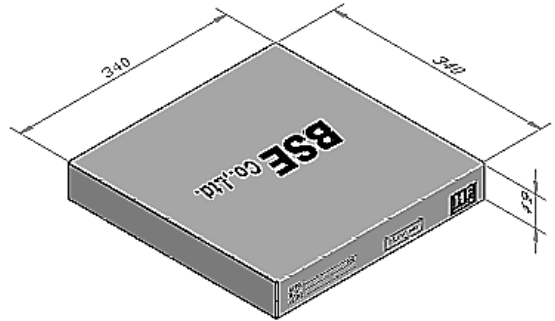
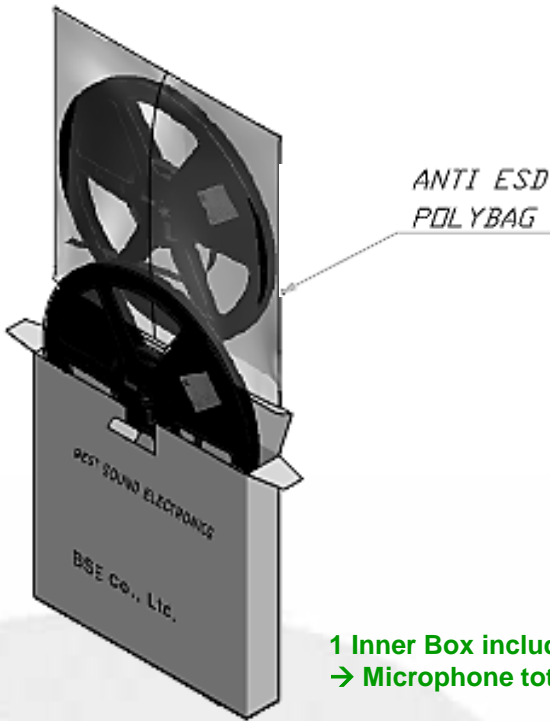
Unit : mm

A0	2.95±0.05	E	1.75±0.10
B0	2.05±0.05	F	5.50±0.05
K0	1.10±0.05	T	0.30±0.05
D0	1.50±0.10	W	12.00±0.30

10. PACKAGING SPECIFICATION

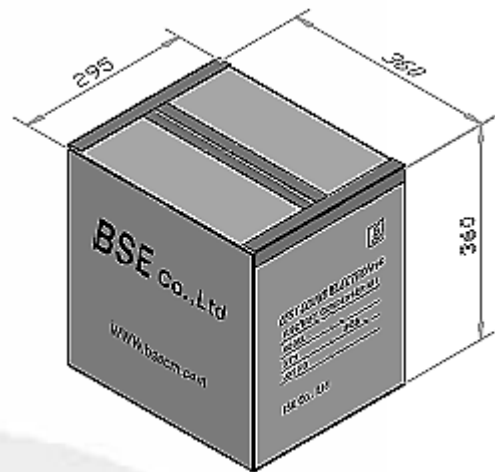
- Packing

Inner Box spec.



1 Inner Box included 2 reels
→ Microphone total quantity : 11,400 pcs

Outer Box Spec.



1 Outer Box included 5 Inner Boxes
→ Microphone total quantity : 57,000 pcs

11. RELIABILITY TEST CONDITIONS

Note : After test conditions are performed, the sensitivity of the microphone shall not deviate more than $\pm 3\text{dB}$ from its initial value.

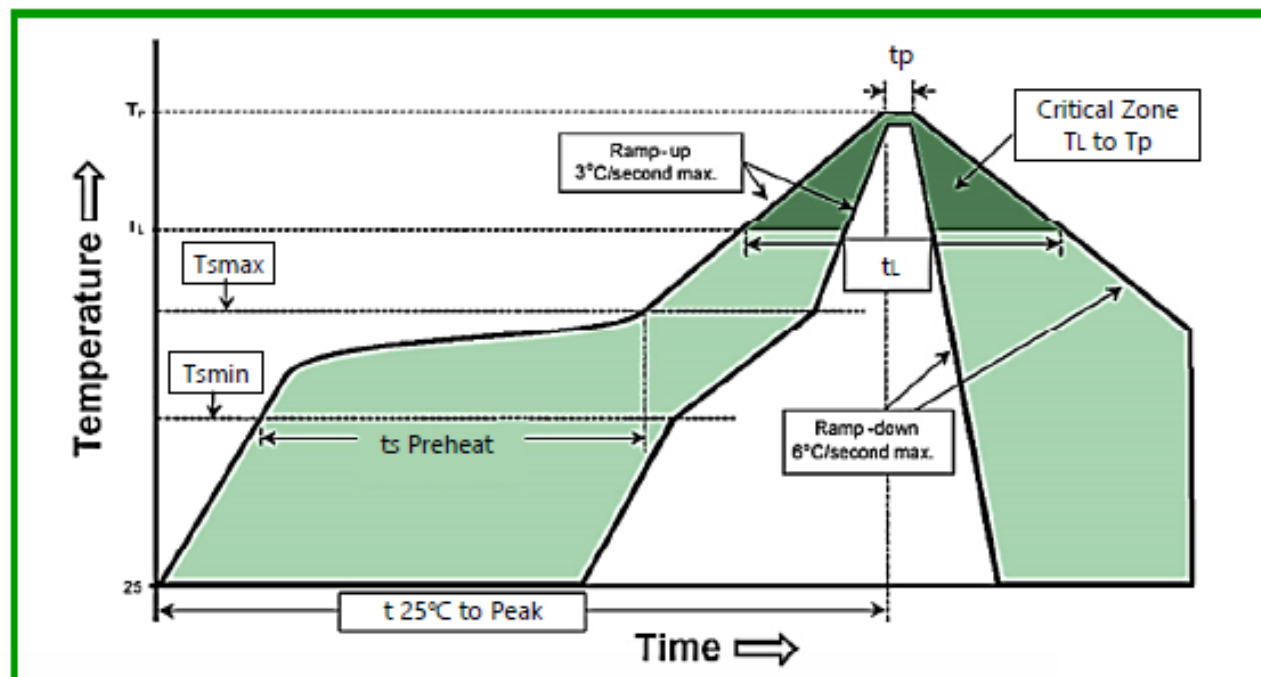
TEST	DESCRIPTION
TEMPERATURE STORAGE	[High Temperature Storage] +80°C \pm 3°C x 200hrs (The measurement to be done after 2 hours of conditioning at room temperature)
	[Low Temperature Storage] -30°C \pm 3°C x 200hrs (The measurement to be done after 2 hours of conditioning at room temperature)
TEMPERATURE CYCLE	(-25°C \pm 2°C x 30min -> +20°C \pm 2°C x 10min -> +70°C \pm 2°C x 30min -> +20°C \pm 2°C x 10min) x 5cycles (The measurement to be done after 2 hours of conditioning at room temperature)
THERMAL SHOCK	(+85°C \pm 2°C -> -40°C \pm 2°C Change time : 20sec) x 96cycles Maintain : 30min (The measurement to be done after 2 hours of conditioning at room temperature)
HIGH TEMPERATURE AND HUMIDITY	+85°C \pm 2, 85 \pm %RH, Bias(3.6V) x 200hrs (The measurement to be done after 2 hours of conditioning at room temperature)
	+70°C \pm 2, 95 \pm %RH x 200hrs (The measurement to be done after 2 hours of conditioning at room temperature)
ESD (Electrostatic Discharge)	Air discharge : $\pm 8\text{kV}$, $\pm 10\text{kV}$, $\pm 12\text{kV}$, $\pm 15\text{kV}$ Vdd, Data, CLK, L/R, GND Pad each 5 times (Non-ground)
	Contact discharge : $\pm 2\text{kV}$, $\pm 4\text{kV}$, $\pm 6\text{kV}$, $\pm 8\text{kV}$ Vdd, Data, CLK, L/R, GND Pad each 5 times (Non-ground)
VIBRATION	Signal 5Hz to 500Hz, acceleration spectral density of 0.01g ² /Hz in each of 3 axes, 120 min in each axis (360min in total)
DROP	To be no interference in operation after dropped to steel floor 18 times from 1.52 meter height in state of packing
REFLOW SENSITIVITY	5 reflow cycles. Refer to reflow profile from specification item 14.

12 . TEMPERATURE CONDITIONS (Maximum Ratings)

12.1 STORAGE TEMPERATURE : -40°C ~ +100°C

12.2 OPERATING TEMPERATURE : -40°C ~ +100°C

13. SOLDER REFLOW PROFILE



Profile Feature	Pb-Free Assembly
Preheat/Soak	
Temperature Min (T _{sm})	150°C
Temperature Max (T _{sm})	200°C
Time(t _s) from (T _{sm} to T _{sm})	60 ~ 120 seconds
Ramp-up rate (TL to Tp)	3°C/second max.
Liquidous temperature(TL)	217°C
Time(t _L) maintained above TL	60 ~ 150 seconds
Peak package body temperature (Tp)	260°C
Time(tp) within 5°C of the specified classification Temperature(Tc)	20 ~ 40 seconds
Ramp-down rate (Tp to TL)	6°C/second max.
Time 25°C to peak temperature	8 minutes max.

[Notes]

1. Solder Reflow Profile based on IPC/JDEC J-STD-020 Revision D.
2. Do not pull a vacuum over the port hole of the microphone. Pulling a vacuum over the port hole can damage the device.
3. Do not board wash after the reflow process. Board washing and cleaning agents can damage the device. Do not expose to ultrasonic processing or cleaning.
4. Recommend no more than 5 cycles.
5. Shelf life : Twelve(12) months when devices are to be stored in factory supplied, unopened ESD moisture sensitive bag under maximum environmental condition of 30°C, 70% R.H.
6. Exposure : Devices should not be exposed to high humidity, high temperature environment. MSL (Moisture sensitivity level) Class 1.
7. Out of bag : Maximum of 90 days of ESD moisture sensitive bag, assuming maximum conditions of 30°C, 70% R.H.