WMM7040DTHN0

Top port digital silicon Microphone

Http//:www.willsemi.com

Descriptions

WMM7040DTHN0 is a Silicon Microphone with digital output and top inlet for sound input. It consists of a MEMS sensor and an encoder IC. It converts sensor analog output signal into 1-bit digital PDM data. The digital output format eliminates AC coupling capacitor, reduces RF noise coupling and eases PCB layout requirement.

WMM7040DTHN0 is a cost-effective alternative to traditional electret condenser microphone (ECM). Provided on tap-and-reel, it is ideally suited for high volume applications and it can be processed directly to customer's PCB using standard automatic pick-and-place equipment and surface mounted via standard solder reflow equipment.

WMM7040DTHN0 can be used to implement the array microphones. Speech quality can be significantly improved by combining two microphones.
The WMM7040DTHN0 is manufactured in a compact 4.00mm*3.00mm*1.00mm, 8-pin package.

Features

- PDM Output
- High SNR
- Multiple performance modes
- Ultra-Stable Performance
- Standard SMD Reflow
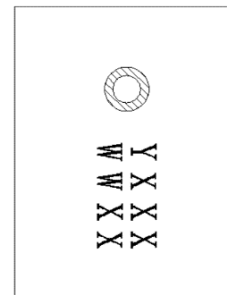- RoHS/Halogen free compliant
- Omnidirectional

Applications

- Smart phones
- Smart speakers
- Portable communication device
- Notebook and desktop
- Digital still cameras
- Portable music recorders
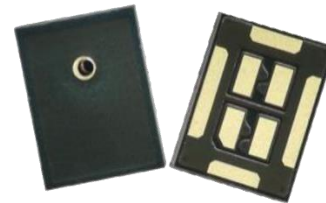
Product appearance
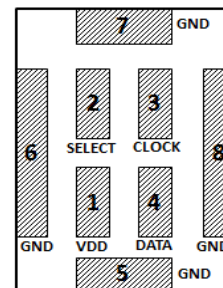
Pin configuration (Bottom view)

Marking (Top view)

Y = Year code

WW = Week code

X X X

  X X= Data code

Order information

Device	Package(mm)	Shipping
WMM7040DTHN0-8/TR	4.00*3.00*1.00	5000/Reel&Tape

Absolute maximum ratings

Parameter	Conditions	Min	Typ	Max	Unit
Supply voltage	VDD to GND	-0.3	-	6.5	V
	L/R,CLOCK,DATA Voltage to GND	-0.4	-	VDD+0.4V	V
Operating Temperature		-40	-	+85	℃
Storage Temperature	Solder on PCB	-40	-	+125	℃
	In Tape and Reel	-10	-	+50	℃

Stresses exceeding these "Absolute Maximum Ratings" could cause permanent damage to the microphone. These are stress rating only. Functional operation at these or any other conditions beyond those indicated under "Absolute and Electrical Characteristics" is not implied. Exposure beyond those indicated under "Acoustic and Electrical Characteristics" for extended periods may affect microphone reliability.

ACOUSTIC & ELECTRICAL SPECIFICATIONS

TEST CONDITIONS: 23 ±2°C, 55±20% R.H., VDD=1.8V, Fclock=2.048MHz, Duty Cycle=50%, SELECT pin grounded, no load, unless otherwise indicated.

Parameter		Symbol	Conditions	Min	Typ	Max	Units
Supply Voltage		V_{DD}		1.6	-	3.6	V
Supply Current		I_{DD}	Normal operation, Fclk(1MHz~4.8MHz)	-	640	-	uA
		I_{low_power}	Low power mode, Fclk(350kHz~800KHz)	-	300	-	uA
		I_{sleep}	Sleep mode, Fclk(<250KHz)	-	42	-	uA
Clock Frequency Rang	Sleep mode			0	-	250	KHz
	Low power mode			350	-	800	KHz
	Standard Performance Mode			1	-	4.8	MHz
Sensitivity		Sense	94dB SPL @1KHz	-27	-26	-25	dBFS
Signal to Noise Ratio		SNR	Normal mode 94dB SPL @1KHz, A-weighted	-	65	-	dB(A)
			Low power mode 94dB SPL @1KHz, A-weighted	-	64	-	dB(A)
Total Harmonic Distortion		THD	94dB SPL @1KHz, S=Typ	-	0.15	-	%
Acoustic Overload Point		AOP	< 10%THD @1KHz, S=Typ	-	125	-	dB SPL
Power Supply Rejection		PSR+N	100 mVpp square wave @ 217Hz, A-weighted	-	-86	-	dBFS(A)
Power Supply Rejection Ratio		PSRR	200 mVpp sinewave @ 1 kHz	-	65	-	dBv/FS
DC Output		ZOUT	DC fullscale=±100	-	1	-	%FS
Directivity				Omnidirectional			
Data Format				1/2 Cycle 1 bit PDM			
Logic Input High		V_{ih}		0.65x V_{DD}	-	VDD+0 .3	V
Logic Input Low		V_{il}		-0.3	-	0.35x VDD	V
Logic Output High		V_{oh}		VDD-0.45	-	-	V
Logic Output Low		V_{ol}		-	-	0.45	V
Output Load		C_{LOAD}		-	-	140	pF
Short Circuit Output Current			94dB SPL @1KHz	1		20	mA
Clock Duty Cycle				40		60	%
Clock Rise/Fall Time		T_{EDGE}		-	-	15	ns

1. 100% tested.

2. IDD varies with CLOAD according to: $\Delta IDD = 0.5*VDD*\Delta CLOAD*FCLOCK$.

3. Maximum specifications are measured at maximum VDD. Typical specifications are measured at standard test Conditions .

4. Valid microphones states are: Power Down Mode (mic off), Low Power Mode (mic clock speed), Sleep Mode (low current, DATA = high-Z, fast startup), and Normal Mode (normal operation).

5. Time from FCLOCK <250 kHz to ISLEEP specification is met when transitioning from Normal Mode to Sleep Mode.

6. Time from FCLOCK $\geq$ 1 MHz to all applicable specifications are met when transitioning from Sleep Mode to Normal Mode.
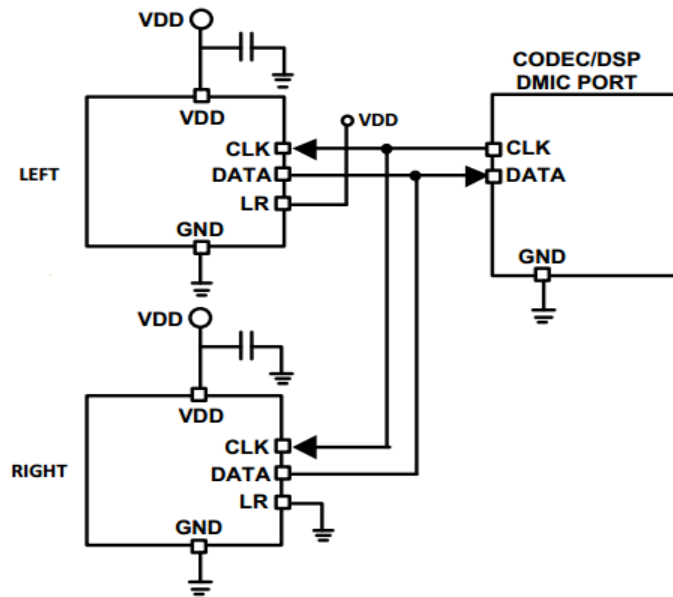
MICROPHONE STATE DIAGRAM
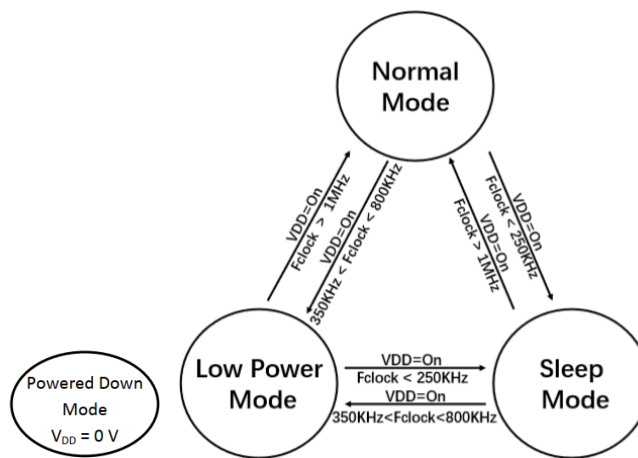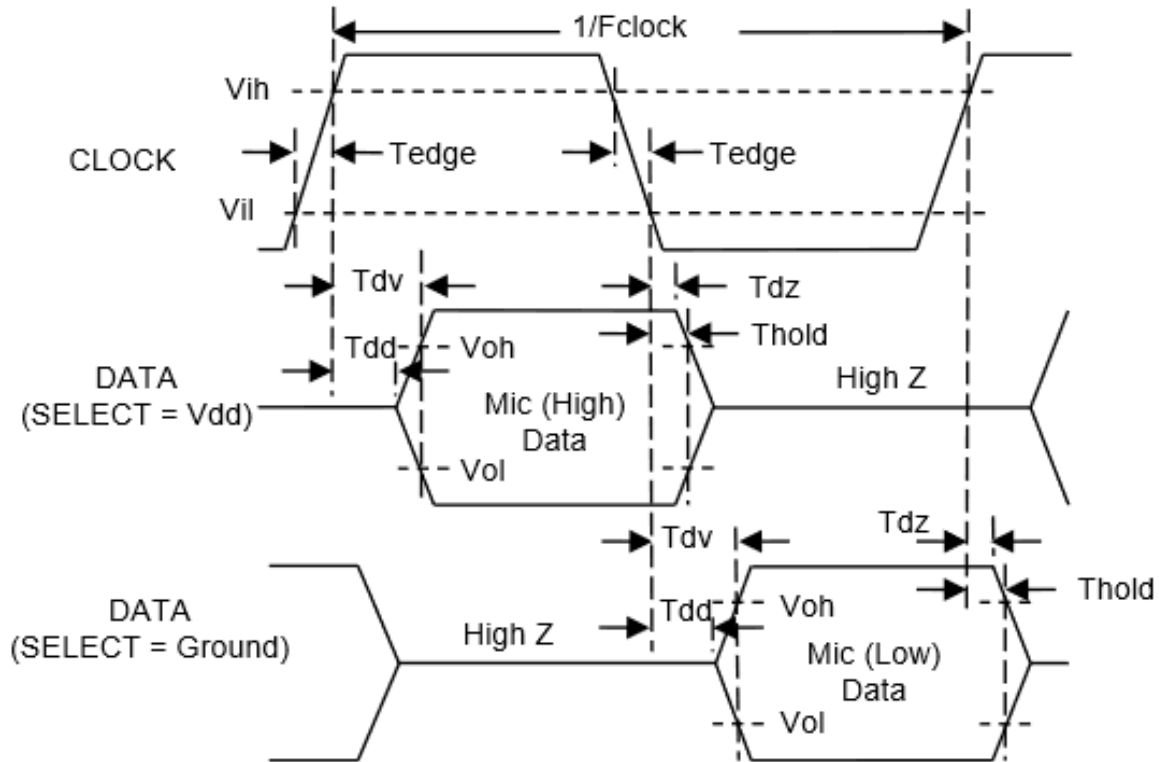

Frequency response curve
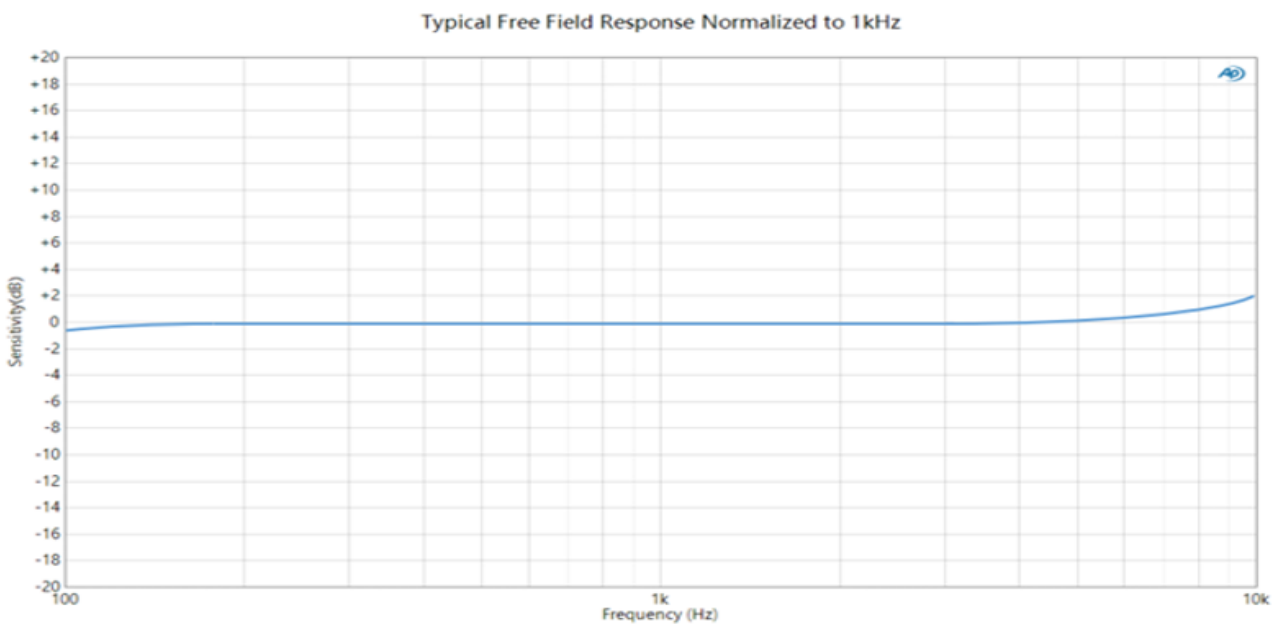
Application informations

| Microphone	SELECT	Asserts DATA On	Latch DATA On
Mic (High)	V_{DD}	Rising Clock Edge	Falling Clock Edge
Mic (Low)	GND	Falling Clock Edge	Rising Clock Edge

Note:

• All GND pins must be connected to ground.

• Capacitors near the microphone should not contain Class 2 dielectrics.

Clock Timing Diagram

Timing Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Comments
Low to High Threshold	VI-h	0.65*VDD		VDD+0.3	V	
High to Low Threshold	Vh-I	-0.3		0.35*VDD	V	
DATA into Hi Z Time	Tdz	0		20	ns	RL=1MΩ，CL=12pF
DATA Valid Time	Tdv	24	36	48	ns	RL=1MΩ，CL=12pF
Clock Jitter				0.5	ns	Period jitter in RMS
Clock Duty Cycle		40	50	60	%	
Clock Frequency		350	2400	4800	KHZ	

MECHANICAL SPECIFICATIONS
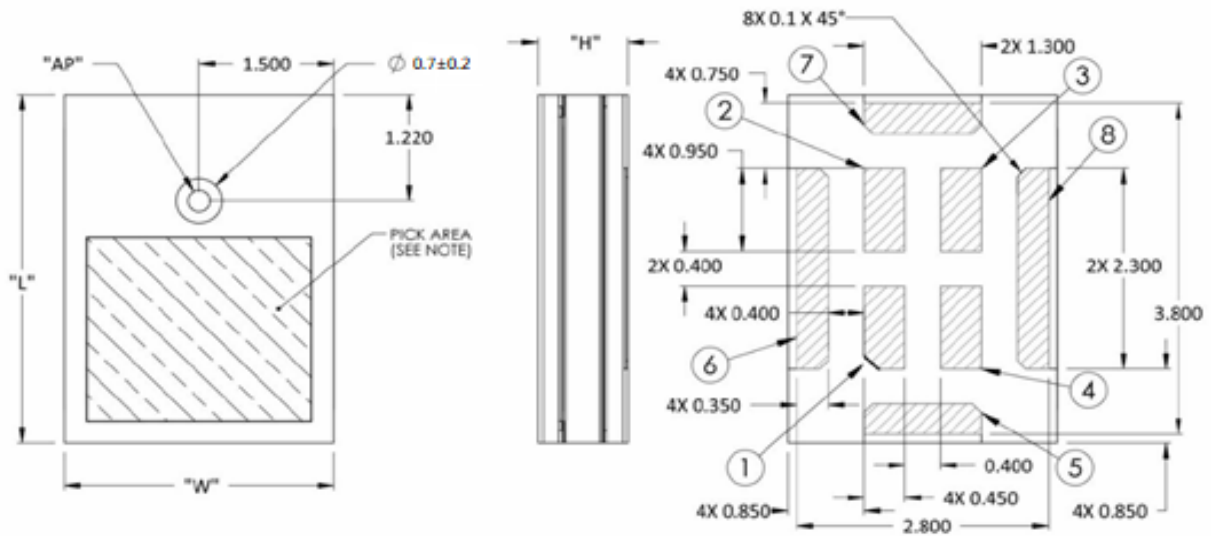
Item	Dimension	Tolerance
Length(L)	4.00	±0.10
Width(W)	3.00	±0.10
Height(H)	1.00	±0.10
Acoustic Port (AP)	Ø0.35	±0.10

Pin#	Pin Name	Description
1	VDD	Power Supply
2	SELECT	Lo/Hi (L/R) Select This pin is internally pulled low
3	CLOCK	Clock input
4	DATA	PDM Output
5	GND	GND
6	GND	GND
7	GND	GND
8	GND	GND

Notes:
- Dimensions are in millimeters unless otherwise specified.
- Tolerance is ±0.10mm unless otherwise specified.
- Pick Area only extends to 0.25 mm of any edge or hole unless otherwise specified.
- Suggestion to use the same date code microphone in one array microphone module.
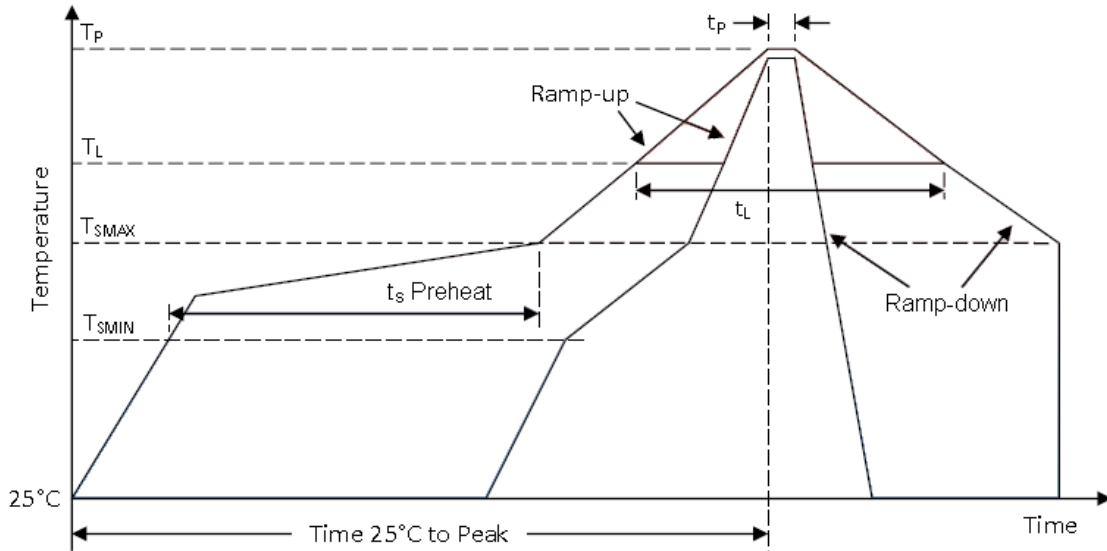
PACKAGING & MARKING DETAIL

SECTION A—A DETAIL B 4:1

Pin 1
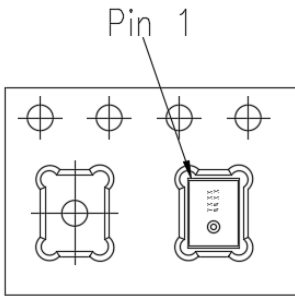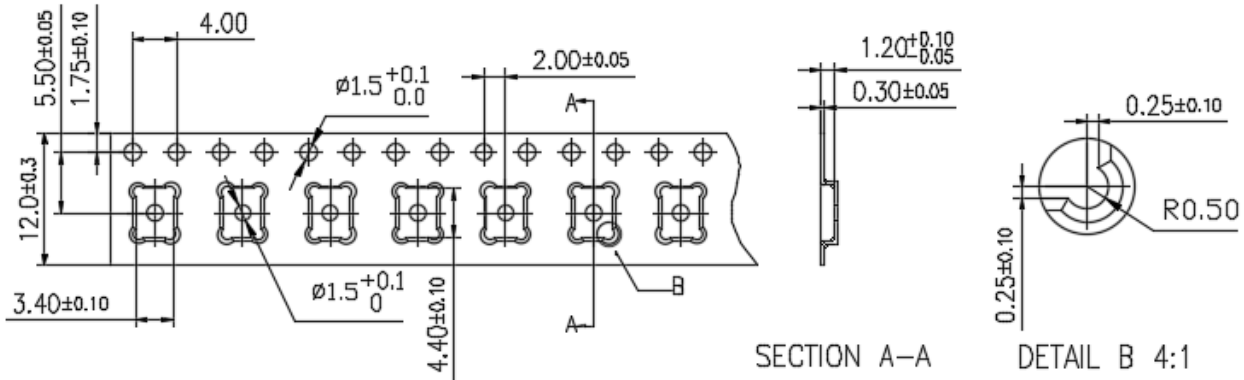
Model Number	Reel Diameter	Quantity Per Reel
WMM7040DTHN0	13"	5,000

Notes:

- Dimensions are in millimeters unless otherwise specified.
- Vacuum pickup only in the pick area indicated in Mechanical Specifications.
- Tape & reel per EIA-481.
- Labels applied directly to reel and external package.

REFERENCED REFLOW PROFILE

Profile Feature	Pb-Free
Average Ramp-up rate (T$_{SMAX}$ to T$_P$)	3°C/second max.
Preheat • Temperature Min (T$_{SMIN}$) • Temperature Max (T$_{SMAX}$) • Time (T$_{SMIN}$ to T$_{SMAX}$) (t$_S$)	150°C 200°C 60-180 seconds
Time maintained above: • Temperature (T$_L$) • Time (t$_L$)	217°C 60-150 seconds
Peak Temperature (T$_P$)	260°C
Time within 5°C of actual Peak Temperature (t$_P$)	20-40 seconds
Ramp-down rate (T$_P$ to T$_{SMAX}$)	6°C/second max
Time 25°C to Peak Temperature	8 minutes max

Note:

All temperatures refer to topside of the package, measured on the package body surface.

ADDITIONAL NOTES

(A) MSL (moisture sensitivity level) Class 1.

(B) Maximum of 3 reflow cycles is recommended.

(C) In order to minimize device damage:

- Do not board wash or clean after the reflow process.
- Do not brush board with or without solvents after the reflow process.
- Do not directly expose to ultrasonic processing, welding, or cleaning.
- Do not insert any object in port hole of device at any time.
- Do not apply over 30 psi of air pressure into the port hole.
- Do not pull a vacuum over port hole of the microphone.
- Do not apply a vacuum when repacking into sealed bags at a rate faster than 0.5 atm/sec.

MATERIALS STATEMENT

Meets the requirements of the European RoHS and Halogen-Free.

RELIABILITY SPECIFICATIONS

Test	Description
Thermal Shock	100 cycles air-to-air thermal shock from -40°C to +125°C with 15 minute soaks. (IEC 68-2-4)
High Temperature Storage	1000 hours at +105°C environment. (IEC 68-2-2 Test Ba)
Low Temperature Storage	1000 hours at -40°C environment. (IEC 68-2-2 Test Aa)
High Temperature Bias	1000 hours at +105°C under bias. (IEC 68-2-2 Test Ba)
Low Temperature Bias	1000 hours at -40°C under bias. (IEC 68-2-2 Test Aa)
Temperature / Humidity Bias	1000 hours at +85°C /85% R.H. under bias. (JESD22-A101A-B)
Vibration	4 cycles of 20 to 2,000 Hz sinusoidal sweep with 20g peak acceleration lasting 12 minutes in X, Y, and Z directions. (Mil-Std-883E, method 2007.2 A)
ESD-HBM	3 discharges of ±3.5kV direct contact to I/O pins. (ESD STM5.2)
ESD-LID/GND	3 discharges of ±8 kV direct contact to lid while unit is grounded. (IEC 61000-4-2)
ESD-MM	3 discharges of ±200V direct contact to I/O pins. (ESD STM5.2)
Reflow	5 reflow cycles with peak temperature of +260°C.
Mechanical Shock	3 pulses of 10000g in the X, Y, and Z direction. (IEC 68-2-27, Test Ea)
Drop Test	To be no interference in operation after dropped to marble or 1.0cm steel plate 18 times from 1.5 meter height.
Salt mist	(50 ± 5)g/L, pH is 6.5 to 7.2, with 96 hours.(GB/T 2423.17-2008) (note 2)

Note:

1. After reliability tests are performed, the sensitivity of the microphones shall not deviate more than 3 dB from its initial value. (The measurement to be done after 2 hours of conditioning at 20±2 °C, R.H 60%～70%)

2. The salt mist do not evaluate performance.