NSM0410DT-Top-Inlet Digital Silicon Microphone Specification

Rev. 1.4

1.GENERAL DESCRIPTION

NSM0410DT 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.

NSM0410DT 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.

NSM0410DT can be used to implement the array microphones. Speech quality can be significantly improved by combining two microphones and Fortemedia's SAM^{TM} technology.

NSM0410DT can be used in (but not limited to) the following applications:

1. Portable communication device

2. Notebook and desktop

3. Headphone and headset accessories

2.ABSOLUTE   MAXIMUM   RATINGS

Supply voltage: VDD to GND…………-0.3V～5V

L/R,CLOCK,DATA Voltage to GND…-0.3V~(VDD+0.3V)

ESD Tolerance

The Lid Mode   ……………………8kV

The I/O Pin Mode ………………….4kV

TEMPERATURE CHARACTERISTICS					
Parameter	Conditions	Min	Typ	Max	Unit
Operating Temperature		-40		+85	℃
Storage Temperature	Solder on PC board	-40		+105	℃
	In Tape and Reel	-10		+50	℃

3.ACOUSTIC & ELECTRICAL SPECIFICATIONS

Unless otherwise specified, test conditions are:
Supply voltage V_{DD} = 3.3V
Clock Frequency = 2.048MHz,Duty Cycle = 50%,No Load
Input sound pressure P_{IN} = 94dB SPL@1kHZ
Test room temperature Ta = 25℃,Room Humidity = 50%
SNR & noise floor measurement is based on 100 – 8KHz pass band with A-Weighting filter applied

PERFORMANCE					
Parameter	Conditions	Min	Typ	Max	Unit
Directivity		Omni-Directional			
Sensitivity	@1KHz (0 dB = 1V/Pa)	-25	-22	-19	dBFS
Signal-to-Noise Ratio	@1KHz (0 dB = 1V/Pa)		61		dB(A)
Total Harmonic Distortion (THD) @ 100dB SPL	@1KHz		0.2	0.5	%
Total Harmonic Distortion (THD) @ 115dB SPL	@1KHz		0.5	1	%
Max Input Sound Pressure	@1KHz, THD < 10%		130		dB SPL
Power Supply Rejection (PSR)	217Hz,100m Vpp square wave		-70	-65	dBFS
INPUT CHARACTERISTICS					
Operating Frequency		1.024	2.048	3.072	MHz
Clock Duty Cycle		40	50	60	%
Power supply Voltage		1.6		3.6	V
Sensitivity Loss Across Power Supply Voltage	Change in sensitivity from 1.6V to 3.6V power supply voltage	No change			dB
Total Operation Current	1.6V-3.6V power supply voltage No load on DATA		850	1000	uA
Standby Current	1.6V-3.6V power supply voltage, Clock off			2	uA
OUTPUT CHARACTERISTICS					
LOAD Capacitance				100	pF
Short Circuit Output Current	@1KHz (0 dB = 1 V/Pa)	1		10	mA
Data Format		1/2 Cycle 1-bit PDM			
Lid to Ground Resistance				100	Ω

NeoMEMS Technologies, Inc.

4.FREQUENCY RESPONSE CURVE
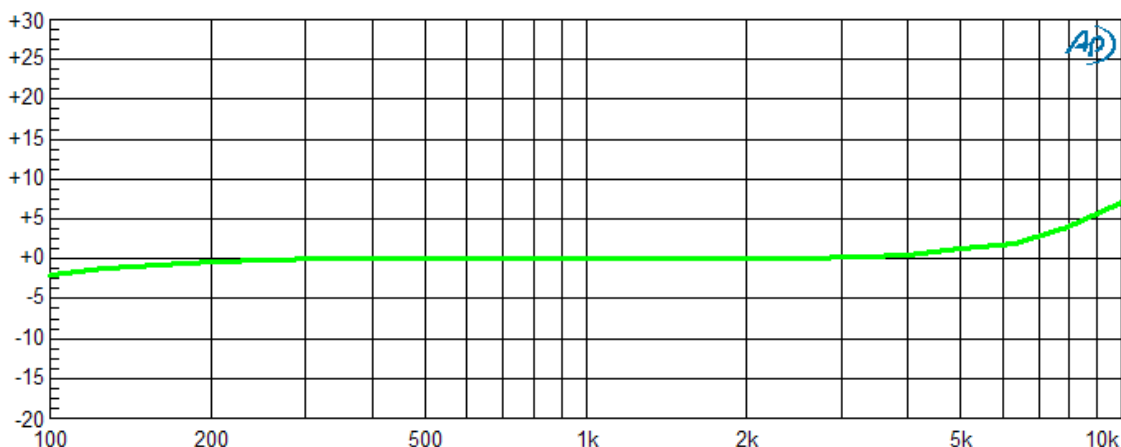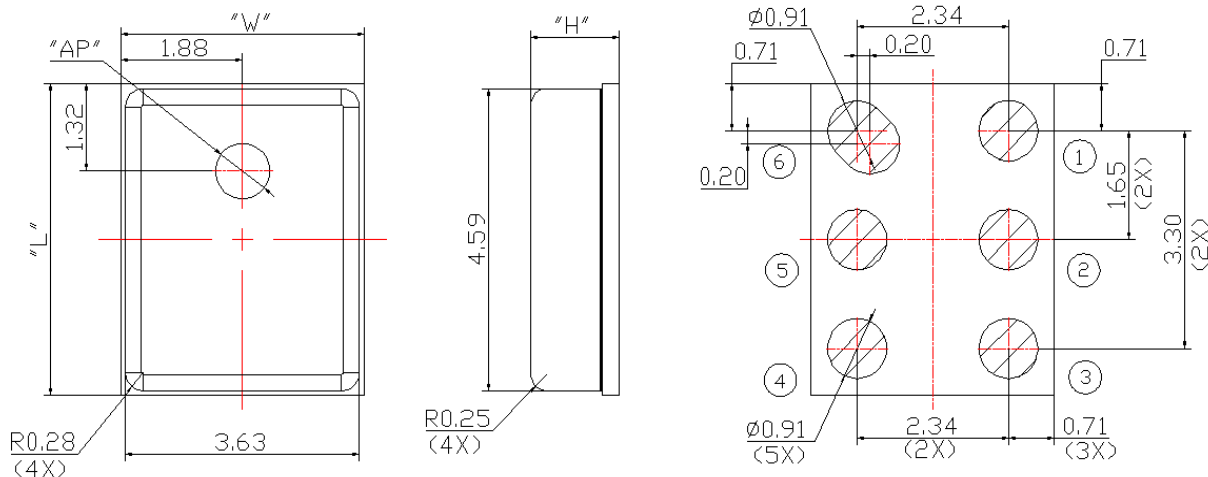

Figure 1. Typical free field frequency response (Normalized to 1 KHz)

5.MECHANICAL SPECIFICATIONS

ITEM	DIMENSION	TOLERANCE	UNITS
LENGTH(L)	4.72	±0.10	mm
WIDTH(W)	3.76	±0.10	mm
HEIGHT(H)	1.25	±0.10	mm
ACOUSTIC PORT(AP)	Φ0.84	±0.10	mm

PIN OUTPUT	
PIN#	FUNCTION
1	ENHANCE
2	CS
3	GROUND (GND)
4	CLOCK (CLK)
5	DATA
6	POWER (VDD)

Note :
Dimensions are in millimeters unless otherwise specified.
Tolerance ±0.15mm unless otherwise specified

Figure 2. Detailed mechanical drawings

6.RECOMMENDED CUSTOMER LANDING PATTERN
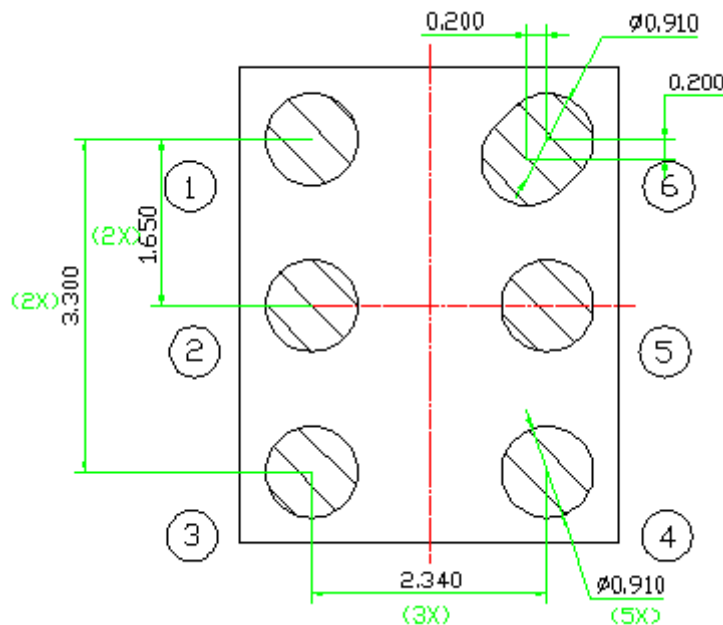

Figure 3. Recommended landing pattern on customers' PCB

7.RECOMMENDED INTERFACE CIRCUIT

The Enhance pin must connect to VDD. Main microphone and Reference microphone Shares the pin of CLK,VDD&GND. The data pin of the Reference microphone connects to The CS pin of the Main microphone. The CS pin of the Reference microphone connects to Ground. The data pin of Main microphone connect to the module output pin "DATA".

Output PDM data

The output format of NSM0410DT is 1-bit PDM. Oversampling ratio is 64 in typical case. It is comprised of low frequency input signal and high frequency out of band noise. To convert bit PDM into PCM format, a low pass filter is required to remove the out of band noise. This can be done by several 3 parties CODEC or Fortemedia's FM3X chip.

If input voltage is in the mid-level, the output will change alternatively between "zero" and "one". If input voltage is higher than mid-level, the output data stream will contain more "ones" Than "zeros".

Power down mechanism:

NSM0410DT will begin to operate when clock applied. It will enter power down mode when clock stops (no matter stops at high or low). Recommended minimum operation dock frequency is 1.024 MHz to avoid any un-wanted malfunction.
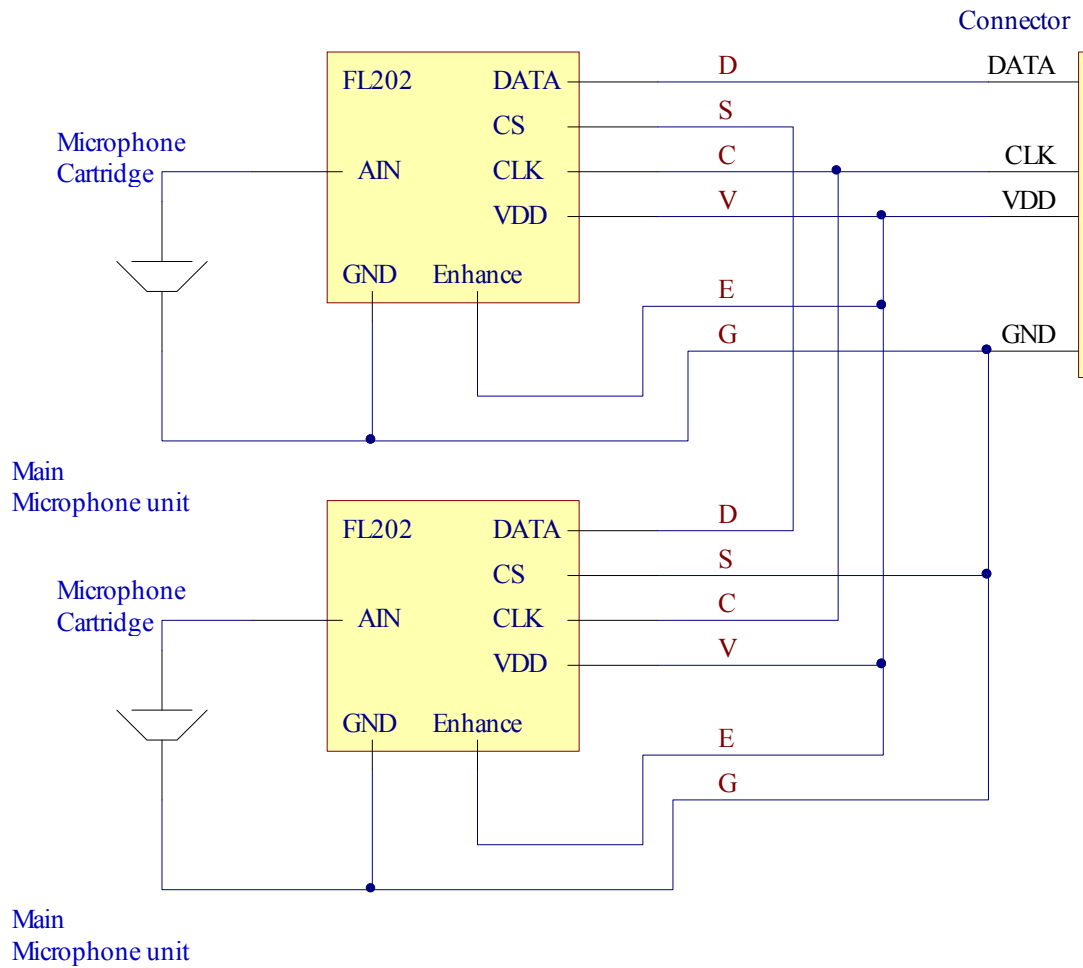
Figure 4 Schematic of NSM0410DT iSAM enhance array configuration (2 microphones array)
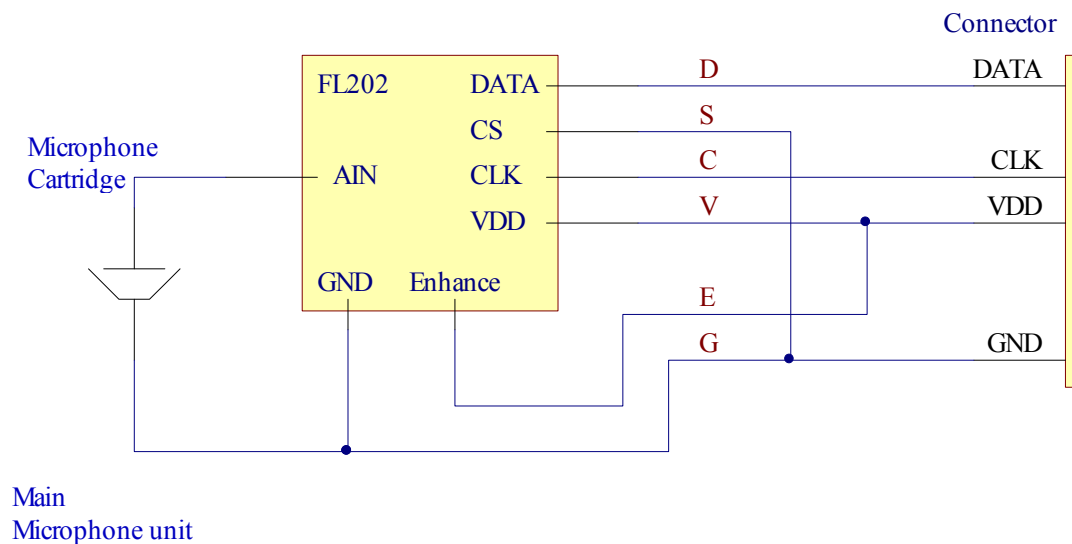
Figure 5. Schematic of NSM0410DT iSAM enhance configuration (1 microphone)

8.TIMING DIAGRAM

Digital Logic Characteristics

*under no loading condition

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OH}	Output Logic High Level		$V_{DD}*0.9$			V
V_{OL}	Output Logic Low Level				$V_{DD}*0.1$	V

Timing Characteristics

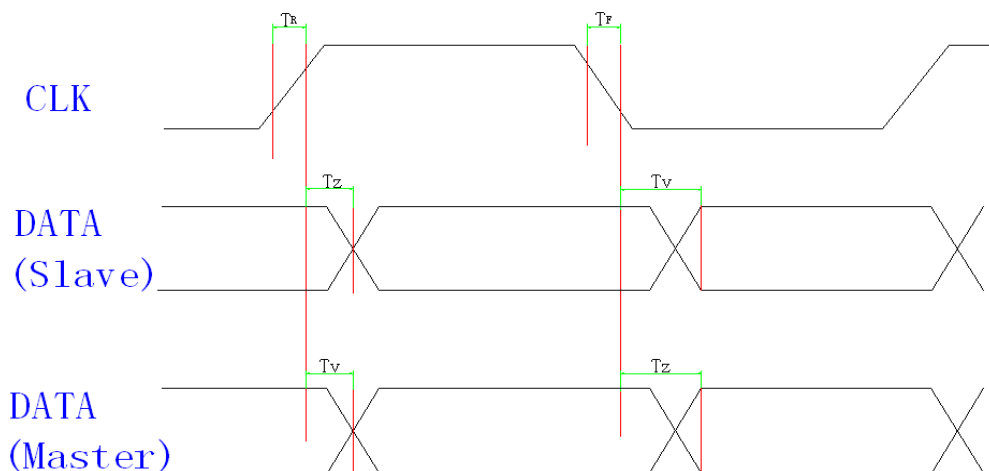| Parameter	Symbol	Min	Typ	Max	Unit	Comments
Clock Rising Time	T_R			10	ns	$R_L=1M\Omega$，$C_L=12pF$
Clock Falling Time	T_F			10	ns	$R_L=1M\Omega$，$C_L=12pF$
DATA into Hi Z Time	T_Z	0		15	ns	$R_L=1M\Omega$，$C_L=12pF$
DATA Valid Time	T_V	18		40	ns	$R_L=1M\Omega$，$C_L=12pF$
Clock Jitter				0.5	ns	Period jitter in RMS
Clock Duty Cycle		40	50	60	%	
Clock Frequency		1.024	2.048	3.072	MHZ	

Figure 6. Timing Diagram for NSM0410DT

Note：

1. Slave is defined as CS = constant (GND).Master is defined as CS = toggle (CS input toggles in complimentary fashion).
2. Normally, Enhance mode only applies to two microphones application with Slave's CS Input tied to GND, while Master's CS input is connected to Slave's DATA output. Final PDM data is available from Master's DATA output.
3. If one microphone is used in Enhance mode, the DATA waveform will be waveform of The slave microphone.
4. Please refer to reference schematic in Section 7.

9. PACKAGING SPECIFICATIONS
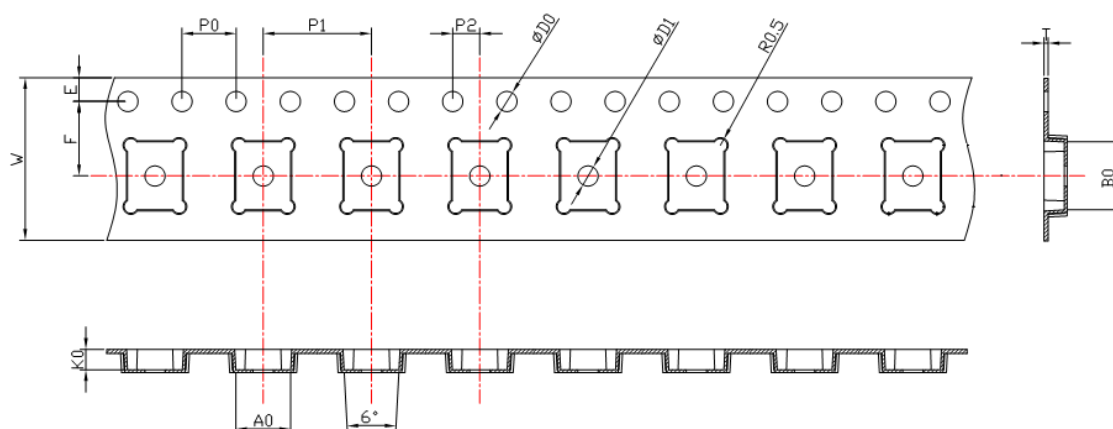
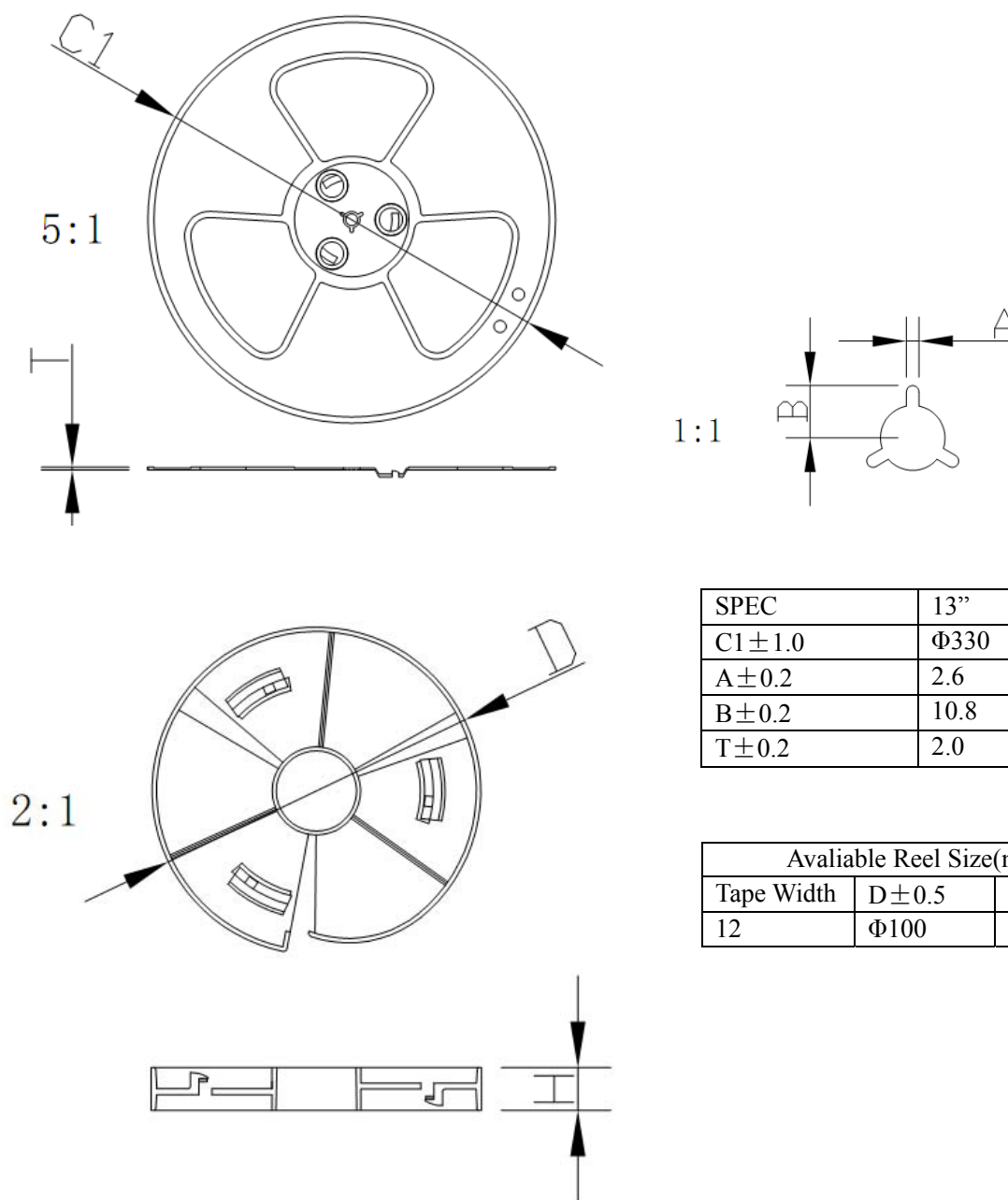|				
D0	1.5±0.1	W	12.0±0.30
D1	1.5±0.1	E	1.75±0.10
A0	4.06±0.10	F	5.50±0.10
B0	5.02±0.10	P0	4.00±0.10
K0	1.50±0.10	P1	8.0±0.10
T	0.3±0.05	P2	2.00±0.10

Notes:
(1) Tape & Reel Per EIA-481 standard;

(2) Label applied to external package and direct to reel

Order Part Number	Reel Diameter	Qty Per Reel
NSM0410DT	13"	4,500

Figure 7. Tape Specification

5:1

1:1

2:1

SPEC	13"
C1±1.0	Φ330
A±0.2	2.6
B±0.2	10.8
T±0.2	2.0

Avaliable Reel Size(mm)		
Tape Width	D±0.5	H+1
12	Φ100	12.5

4,500PCS PRODUCTS/1 reel

Figure 8. Reel Specification

PE bag

Reel
4500PCS/one reel

foam board

10 layers

PE bag

foam board

carton

235

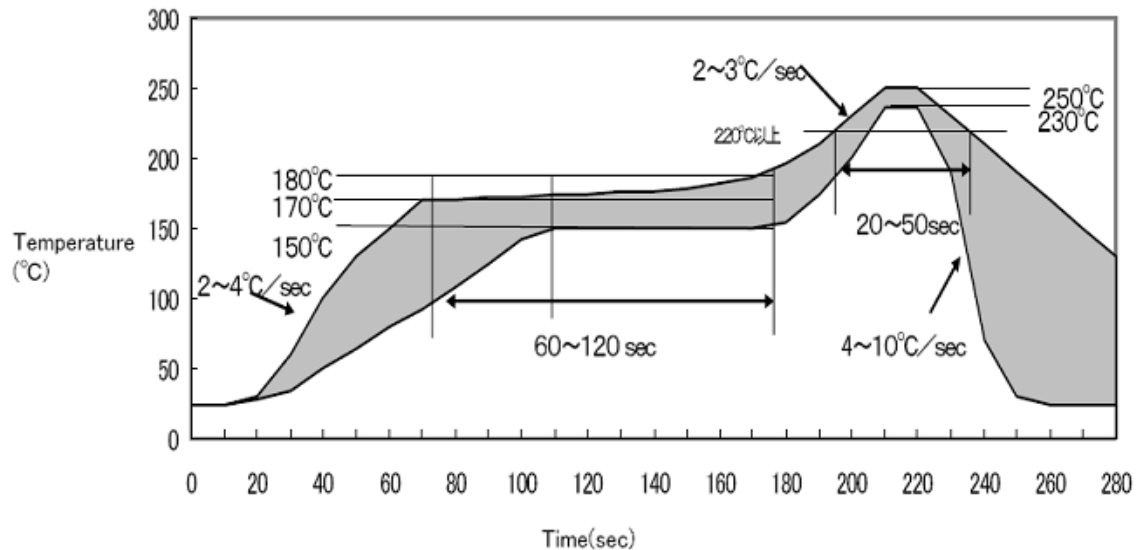VOLUME 39＊39＊23.5CM

390

390
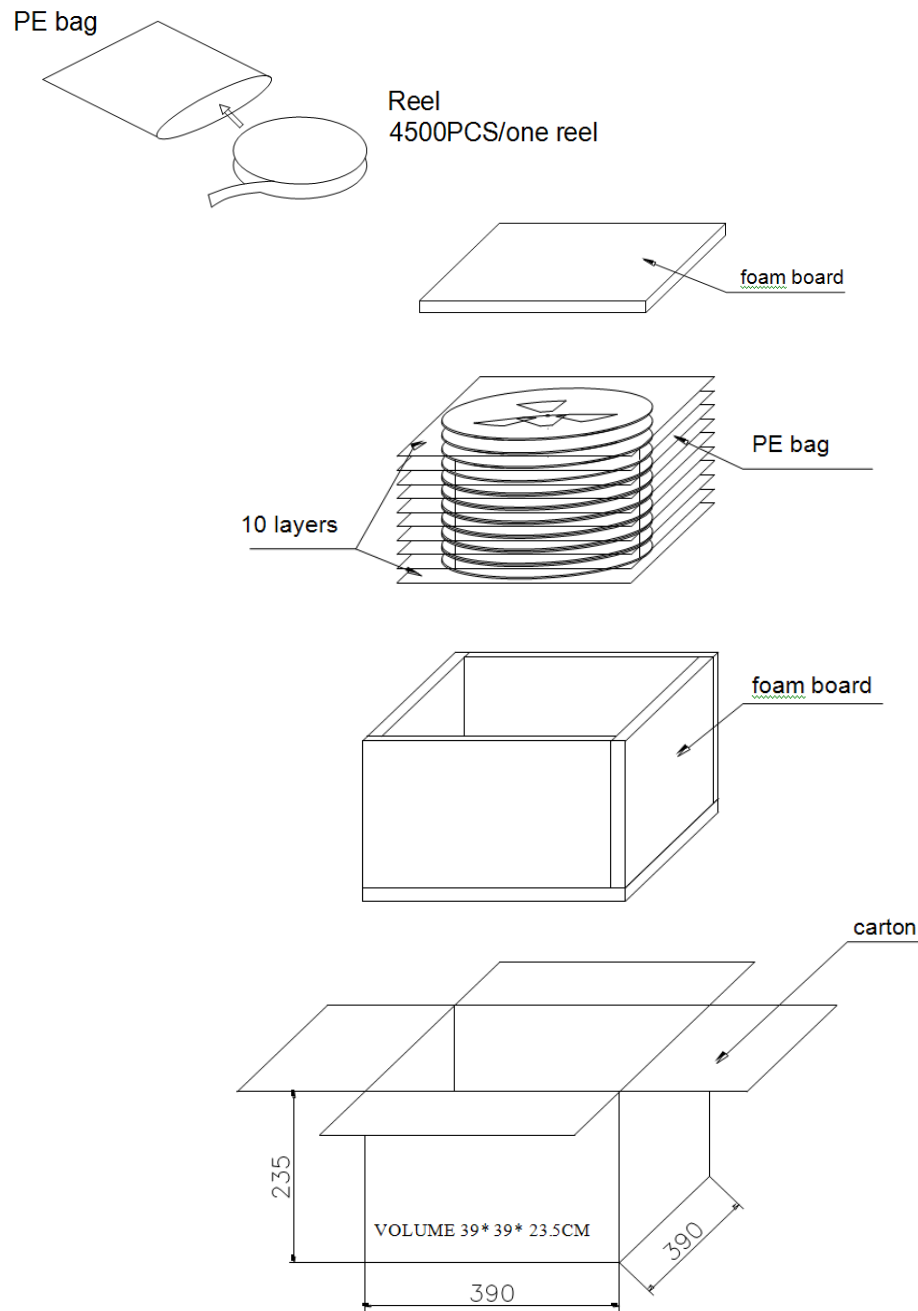
45,000 Pieces of Products per Carton

Figure 9. Packaging Specification

10. SOLDER REFLOW PROFILE

Stage	Temperature Profile	Time (Maximum)
Pre-heat	150-180℃	60-120 sec.
Soldering	Above 220℃	50 sec
Peak	250℃（Max）	20 sec

Figure 10 . Typical leadless solder reflow temperature profile

Notes:
1. Vacuuming over acoustical hole of the microphone is not allowed, because the device can be damaged by vacuum.
2. Washing the board after reflow process is not allowed, because board washing and Cleaning agents can damage the device. A device should not be exposed to ultrasonic processing or cleaning.
3. Recommended number of reflow is no more than 5 times.

11. RELIABILITY SPECIFICATIONS

Test item	Detail	standard
Reflow Simulation	Refer to Sec.9 for solder reflow profile, total 5 times	/
Low Temperature Bias	Conditions:-40℃ Duration:168 hours while under bias	IEC 60068-2-2 Test Aa
High Temperature Bias	Conditions: 105℃ Duration:168 hours while under bias	IEC 60068-2-2 Test Ba
Thermal Shock	Conditions: 100 cycles of air-air thermal shock from -40℃ to 125℃ with 15-minute soaks	IEC 60068-2-4
Temperature/Humidity Bias	Conditions: 85 ℃/85%RH environment while under bias for 168 hours	JESD 22-A101A-B
Mechanical Shock	Conditions:3 pulses of 10,000g in the X,Y and Z direction	IEC 60068-2-27 Test Ea
Vibration Test	Test axis: X，Y，Z Conditions: 2~400Hz 1 oct/min Test time : 15 mins per axis Use fixture during the testing	IEC 60068-2-6
Drop Test	Conditions: For each sample, drop by all corner, edges, surfaces respectively. Steel floor. Drop height: 1800mm.	IEC 60068-2-32
ESD	Conditions: ±8KV direct contact to the lid when unit is grounded ,±4KV direct contact to the I/O pins.10 times	IEC 61000-4-2

Note: Immediately after reliability test, the samples shall be stored under climatic conditions such as that normally exists in ordinary rooms or laboratories. Unless otherwise noted, the recovery period shall be 2 hours at least before performance testing. After test condition is performed, the sensitivity of the microphone shall not deviate more than 3dB from its initial value.

12. REVISION HISTORY:

Version	Date	Description	Change from	Change to
1.0	24/07/2012	Initial release		
1.1	20/08/2012	Updated Vibration test		
1.2	10/10/2012	Updated absolute maximum ratings		
1.3	27/10/2012	Updated the height dimension		
1.4	27/02/2013	Updated general description; Units of Sensitivity、SNR and PSR change to dBFS、dB(A)、dBFS .(Section3);Updated mechanical specifications; Delete the dimension not related to the specifications marked in packaging; Updated Drop Test. Updated Mechanical Shock	JEC 60068-2-27	IEC 60068-2-27

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