NSM0411DT-Top-Inlet Digital Silicon Microphone Specification

Rev. 1.0

1. GENERAL DESCRIPTION

NSM0411DT 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.

NSM0411DT 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.

NSM0411DT can be used to implement the array microphones. Speech quality can be significantly improved by combining two microphones and Fortemedia's SAM^{TM} technology.

NSM0411DT 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

4. FREQUENCY RESPONSE CURVE

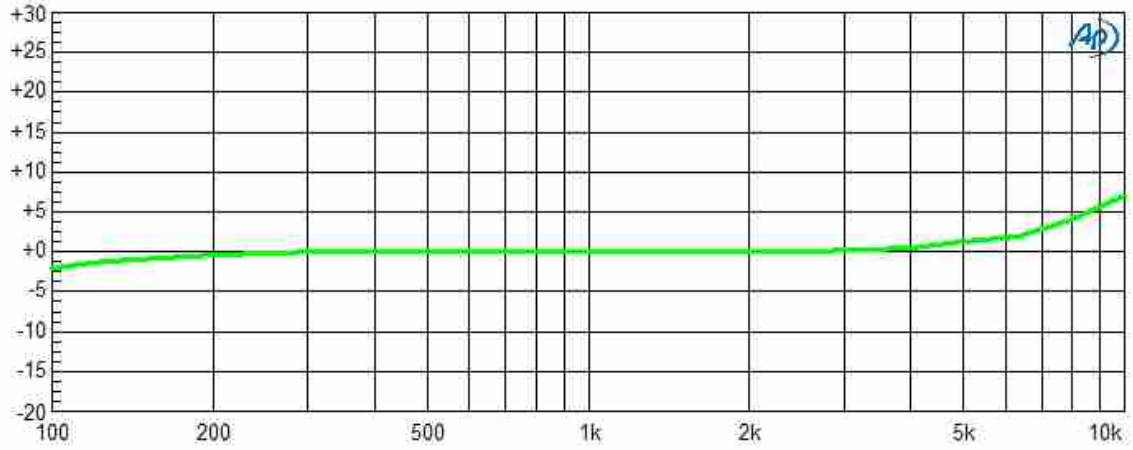
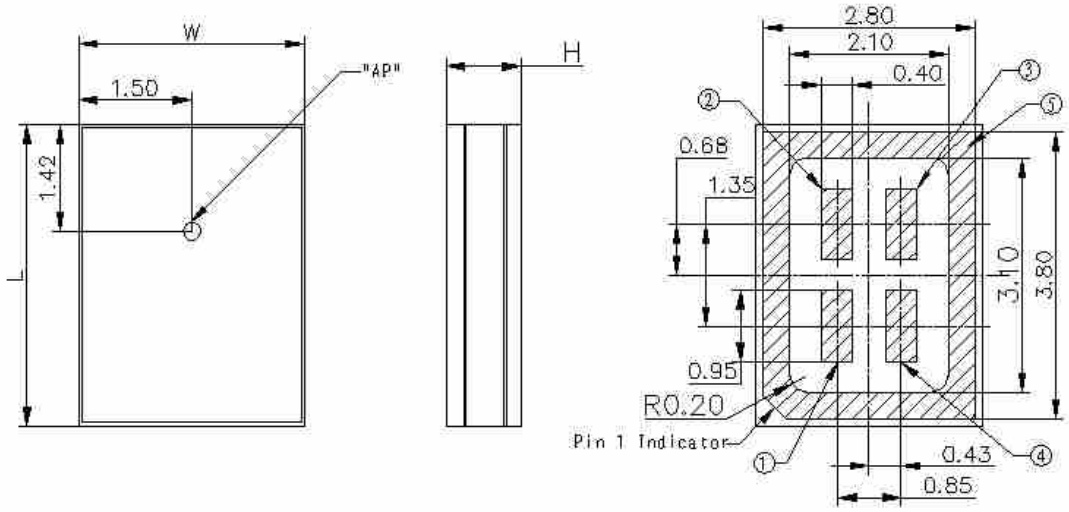


Figure 1. Typical free field frequency response (Normalized to 1 KHz)

5. MECHANICAL SPECIFICATIONS



ITEM	DIMENSION	TOLERANCE	UNITS
LENGTH(L)	4.00	±0.10	mm
WIDTH(W)	3.00	±0.10	mm
HEIGHT(H)	1.00	±0.10	mm
ACOUSTIC PORT(AP)	Φ0.25	±0.10	mm

PIN OUTPUT	
PIN#	FUNCTION
1	POWER(V_{DD})
2	SELECT
3	CLOCK
4	DATA
5	GROUND

Note :

Dimensions are in millimeters unless otherwise specified.

Tolerance ±0. 15mm unless otherwise specified

Figure 2. Detailed mechanical drawings

6. RECOMMENDED CUSTOMER LAND PATTERN

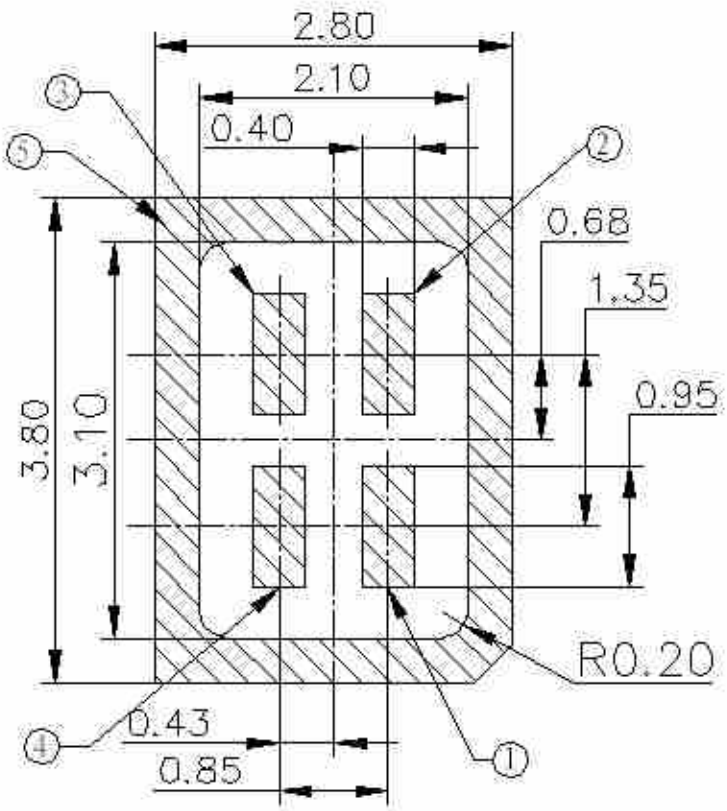


Figure 3. Recommended land pattern on customers' PCB

7. RECOMMENDED INTERFACE CIRCUIT

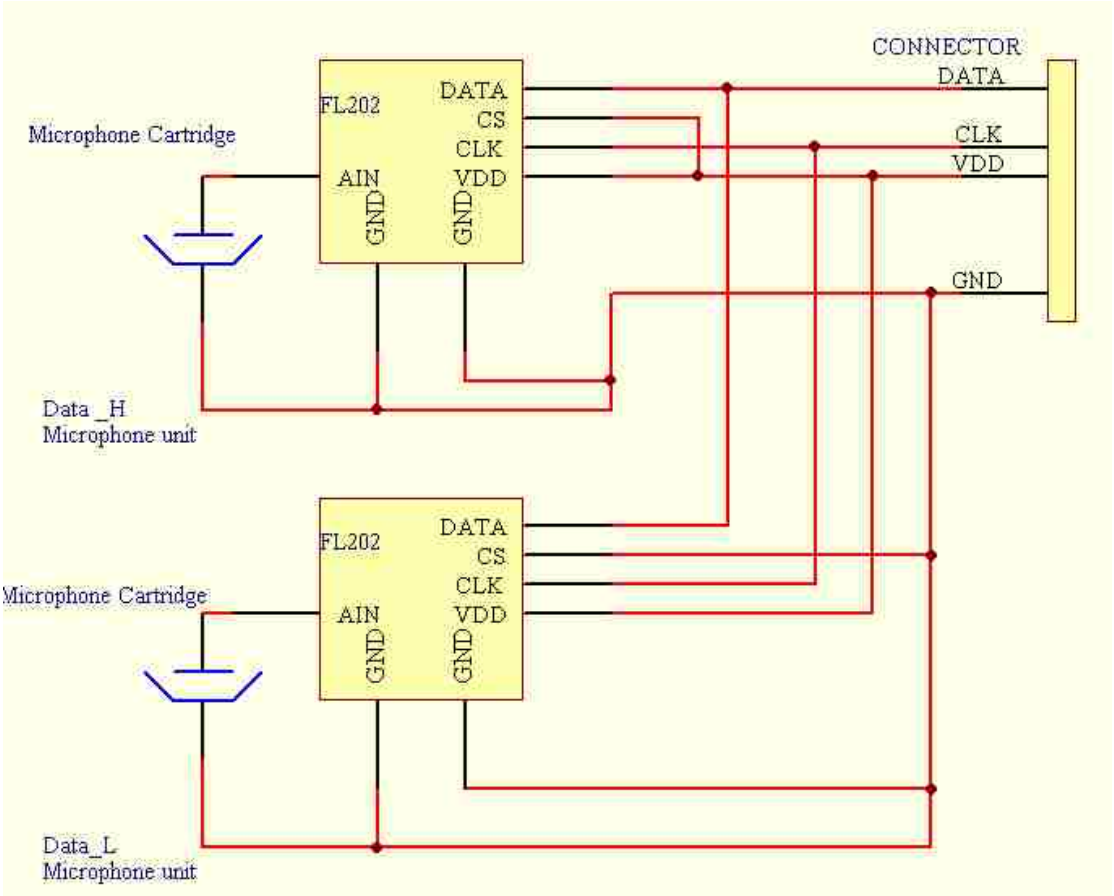


Figure 4 Schematic of NSM0411DT Non-iSAM enhance array configuration (2 microphones array)

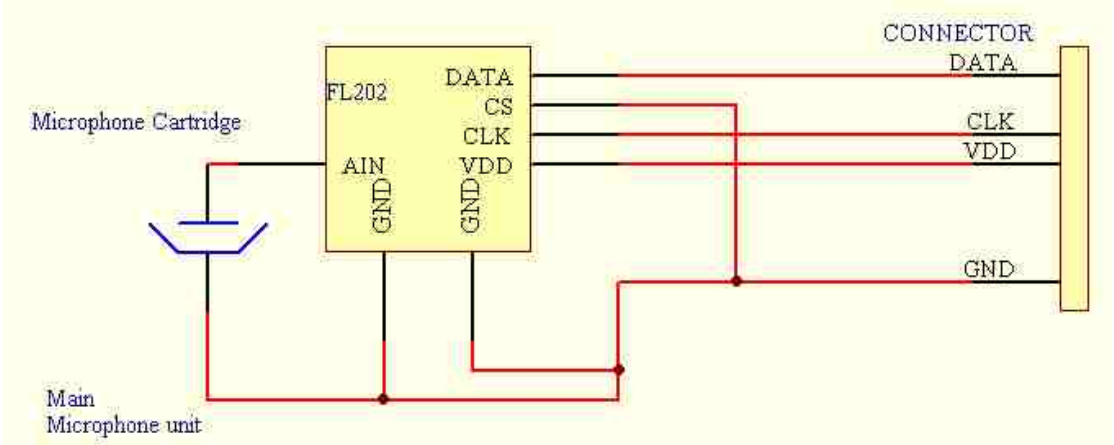


Figure 5. Schematic of NSM0411DT Non-iSAM enhance configuration (1 microphone)

Power down mechanism:

NSM0411DT 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.

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=1MΩ，C_L=12pF
Clock Falling Time	T_F			10	ns	R_L=1MΩ，C_L=12pF
DATA into Hi Z Time	T_Z	0		15	ns	R_L=1MΩ，C_L=12pF
DATA Valid Time	T_V	18		40	ns	R_L=1MΩ，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	

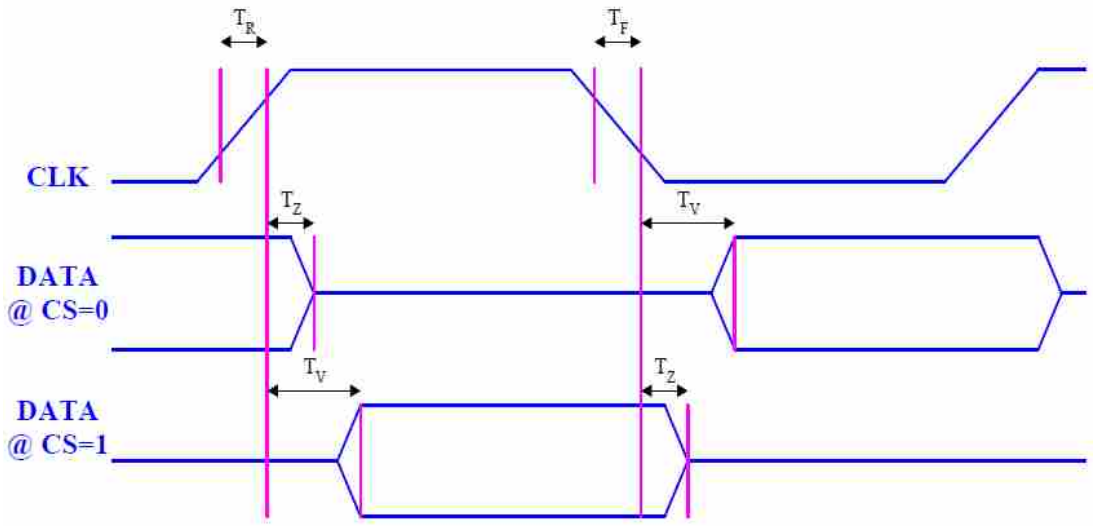
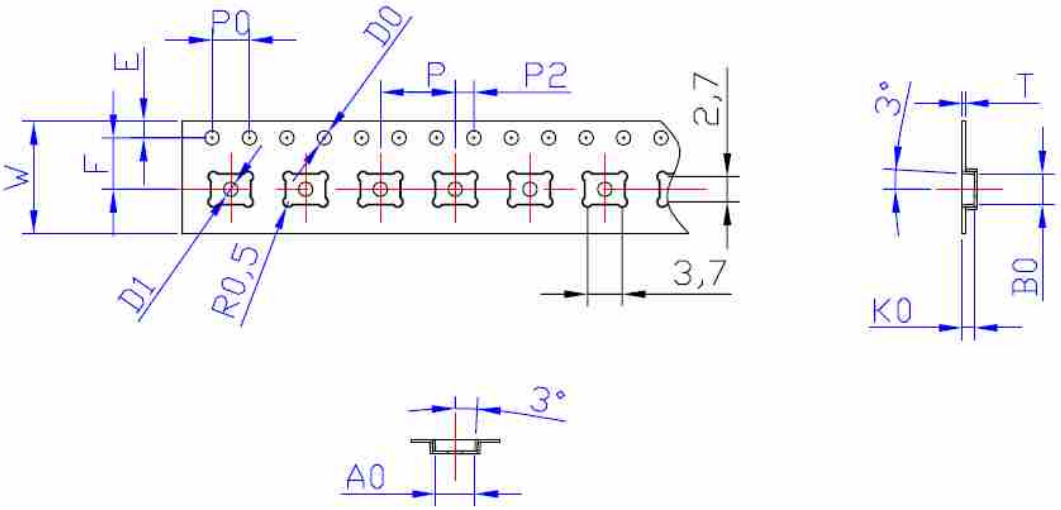


Figure 6. Timing Diagram for NSM0411DT

Note：

1. For one-microphone application, the DATA waveform will be @CS=0.
2. For two-microphone application, system needs to set CS=0&1 for two microphone respectively.
3. please refer to the recommended interface circuit in Section7

9. PACKAGING SPECIFICATIONS



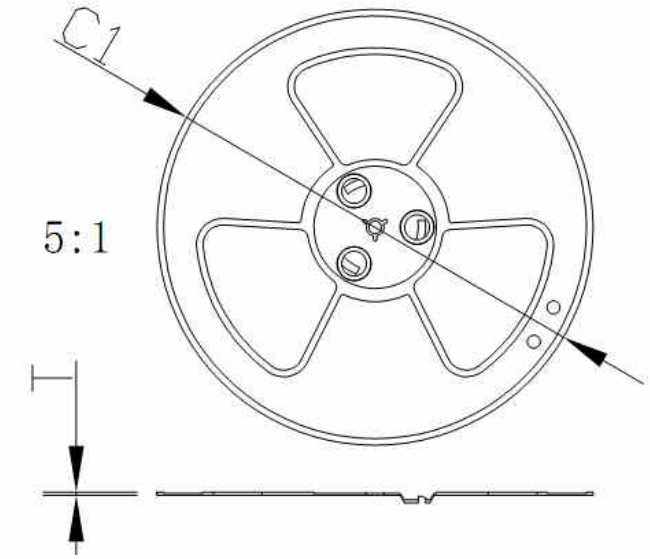
D0	1.50±0.1	W	12.0±0.30
D1	1.50±0.1	E	1.75±0.10
A0	4.20±0.10	F	5.50±0.10
B0	3.20±0.10	P0	4.00±0.10
K0	1.20±0.10	P	8.0±0.10
T	0.3±0.05	P2	2.00±0.10

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

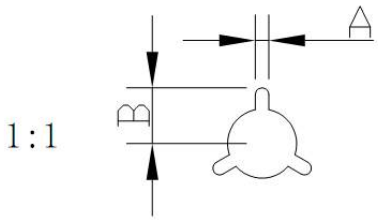
(2) Label applied to external package and direct to reel

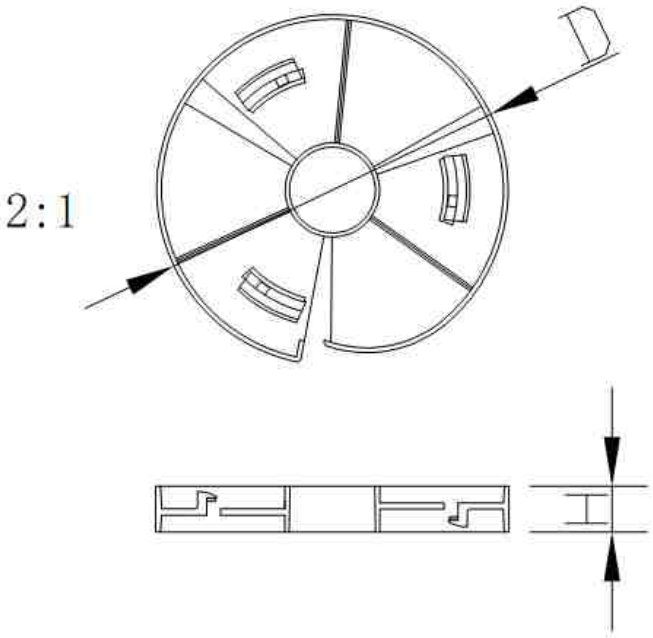
Order Part Number	Reel Diameter	Qty Per Reel
NSM0411DT	13”	4,500

Figure 7. Tape Specification



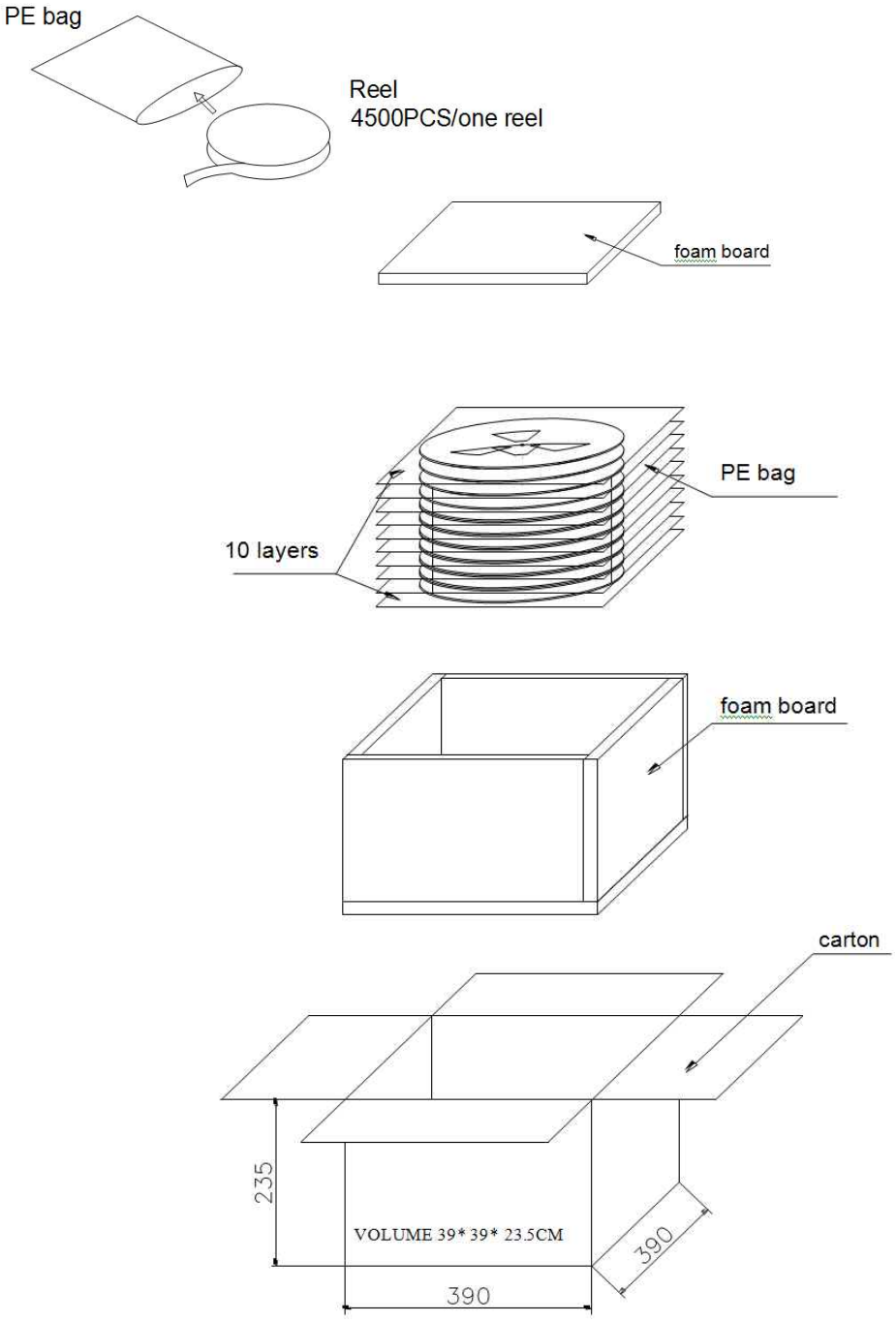
SPEC	13”
C1±1.0	Φ330
A±0.2	2.6
B±0.2	10.8
T±0.2	2.0





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

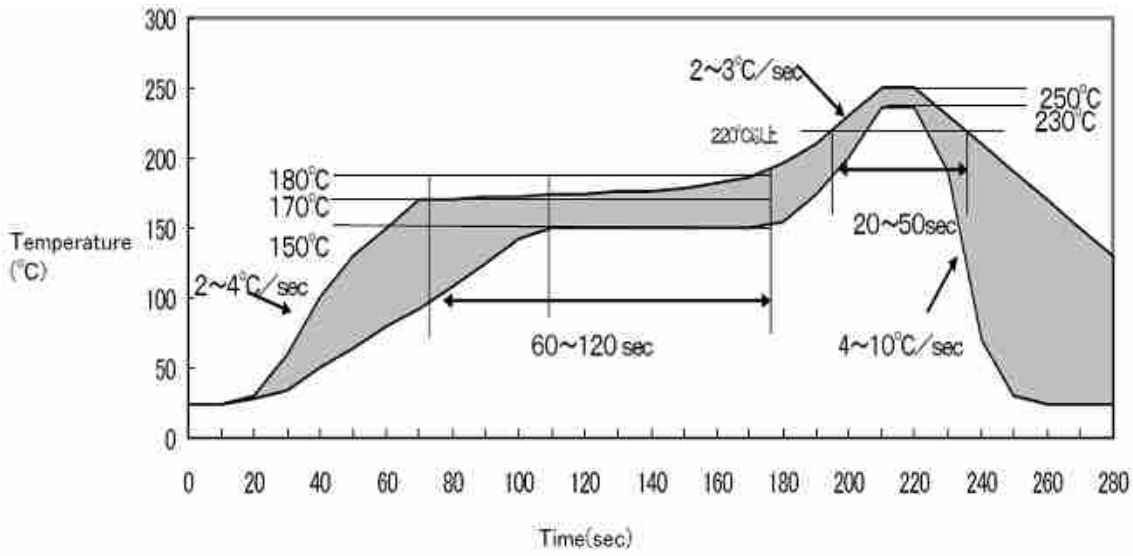
Figure 8. Reel Specification



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.