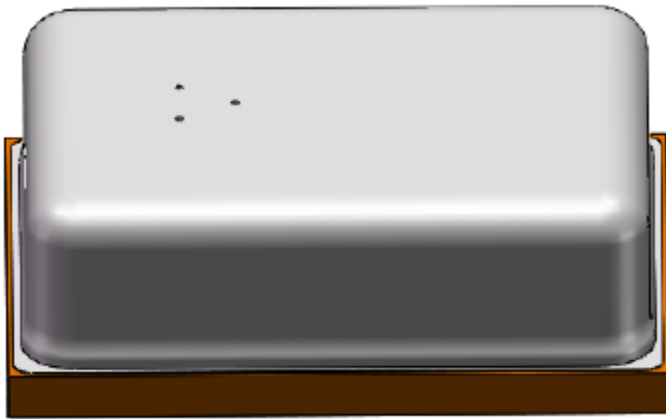


# SDV01-003

## Bone/VPU Sensor

Product Datasheet



# Restricted

## 1. Security warning

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## 2. Publication history

Version	Date	Description
1.0	2022.03.28	Preliminary datasheet
1.1	2022.06.05	Update performance parameters

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## 1. Introduction

SDV01-003 is a small size, high performance, digital vibration pick-up sensor optimized for picking-up people's voice through bone vibration, which achieves a better signal with high SNR and shields the normal ambient sound noise.

### Key features

- Package: 6-pin LGA package, 3.5mm x 2.65mm x 1.3mm
- Pb-free, halogen-free and RoHS compliant

### Performance

- PDM digital signal output
- Supply voltage: 1.6 ... 3.6V (VDD)
- Low Current: 125  $\mu$ A
- High sensitivity:  $-15 \pm 2$  dBFS/g
- Low Noise: Noise Density  $\leq 2 \mu\text{g}/\sqrt{\text{Hz}}$
- Reflow Solderable

### Applications

- Wearable/hearable devices
- Communication in noisy/challenging types of environments
- Hearing aids
- Bone Joint Monitor in health prediction field
- Mechanical Joint Monitor and device conditioning
- Structure Health Monitor

## 2. Testing Conditions

Table 1: Testing Condition (Vent Hole Sealed)

Test Conditions	Temperature	Humidity	Air Pressure
Standard Conditions	+15~+35°C	25%RH~75%RH	860hPa~1060hPa
Judgment Conditions	+20±2°C	40%RH~50%RH	860hPa~1060hPa

## 3. Characteristics

### 3.1 Electrical specification parameter table

Testing Conditions: VDD=1.8V, f<sub>clock</sub>=768kHz (D.C.=50%), Decimation Rate =64x, No-load test of working current.

Table 2: Parameter List

Parameters	Symbol	Condition	Min	Typical	Max	Unit
Supply Voltage	V		1.6	1.8	3.6	V
Current	I <sub>dd</sub>	VDD =1.8V, CLK=2.4MHz, Output load <5pF		485		μA
		VDD =1.8V, CLK=768kHz, Output load <5pF		125		μA
		VDD =1.8V, 150kHz≤CLK≤ 310kHz, Standby Mode		25	50	μA
		CLK=0kHz I <sub>clock_off</sub>		1	10	uA
Short Circuit Current		Grounded DATA pad,	1		20	mA
Polarity			Increasing density of 1's			
Sensitivity	S	1g acceleration, @1kHz,	-17	-15	-13	dBFS/g
Signal to noise ratio	SNR	BW=100~4kHz, A-weighted		77		dB(A)
Noise Density	N-Density	@250Hz			6	ug/√Hz
		@1kHz			3	ug/√Hz
		@2kHz			2	ug/√Hz
Sound Sensitivity		94dB SPL, @100Hz		-93		dBFS
		94dB SPL, @1kHz		-73		dBFS
Acceleration Level		<10% THD @ 1kHz		±6		g
Anti-TDD interference ability	PSR+N	100mVpp square wave@217Hz VDD=1.8V,A-weighted			-80	dBFS(A)

### 3.2 Digital interface specification

Testing Conditions: TA=23°C, Room Humidity = 60±5%, VDD=1.8V, No-load test of digital sequence.

**Table 3: Parameter List**

Parameters	Symbol	Min	Typical	Max	Unit	Remarks
Data Format	1/2 Cycle PDM					
Clock Frequency Range	f <sub>clock</sub>	1.17	3.072	3.1	MHz	Normal Mode
		380		980	kHz	Low Power Mode
		150		310	kHz	Standby Mode
			0		kHz	Clock-off mode
Clock Duty Cycle		40		60	%	
Clock Rise/Fall Time	t <sub>CR</sub> /t <sub>CF</sub>			13	ns	10% to 90% of the VDD
Input Logic High	V <sub>IH</sub>	0.65×VDD		VDD+0.3	V	
Input Logic Low	V <sub>IL</sub>	-0.3		0.35×VDD	V	
Output Logic High	V <sub>OH</sub>	0.7×VDD			V	
Output Logic Low	V <sub>OL</sub>			0.3×VDD	V	
Delay Time For Data Driven	t <sub>DD</sub>	40		80	ns	Delay time from CLOCK edge (50% VDD) to DATA driven.
Delay Time For Data Valid	t <sub>DV</sub>			100	ns	Delay time from CLOCK edge (0.50 x VDD) to DATA valid (<0.30 x VDD or >0.70 x VDD)
Delay Time for Data High-Z	t <sub>HZ</sub>	5		30	ns	Delay time from CLOCK edge (50% VDD) to DATA high impedance state.
Output load capacitance on DATA	C <sub>load</sub>			200	pF	

Remark 1. Current consumption depends on the clock frequency applied to the CLK terminal and the load of the DATA output terminal.

Remark 2. dBFS = 20xlog (A/B) Where A is the signal level and B is the level corresponding to the full-scale level.

Remark 3. Clock: input port related interface characteristics, chip design to ensure that meet;

● Digital interface timing specifications

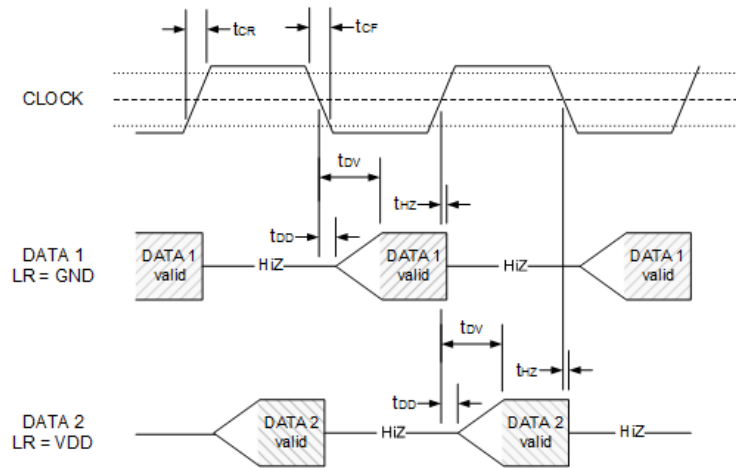


Figure 1:Timing Diagram

● PDM channel configuration

Table 4: PDM channel configuration using L/R pin.

Channel	Data driven	Data high-Z	L/R connection
DATA1	Falling clock edge	Rising clock edge	GND
DATA2	Rising clock edge	Falling clock edge	VDD

● Frequency response curve

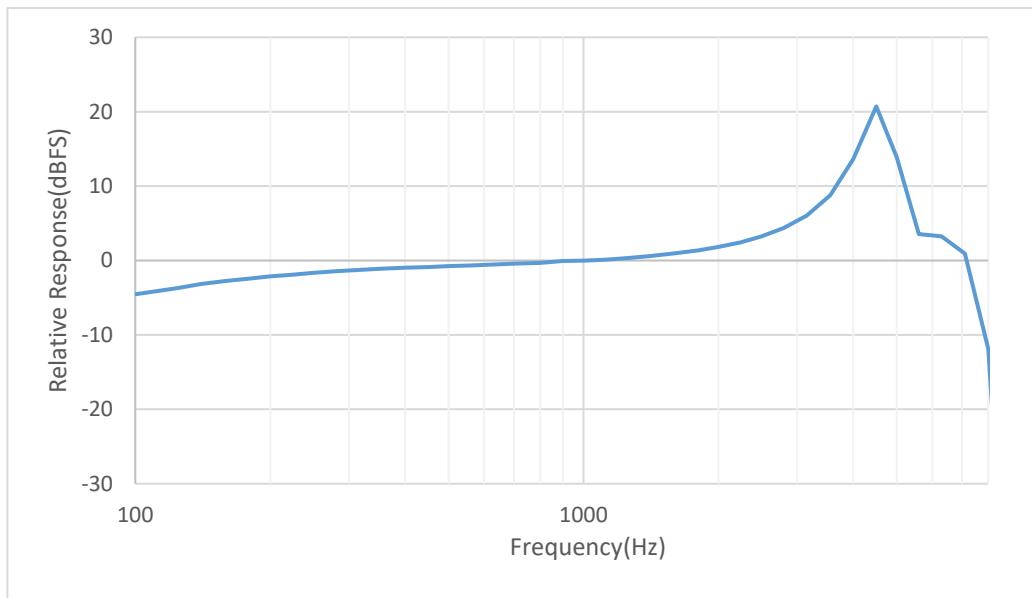


Figure 2: Frequency Response Curve

## 4. Mechanical Parameters

### 4.1 Pin Configuration

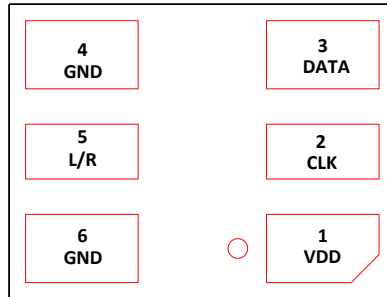


Figure 3: Layout pin configuration SDV01-003 (Top View, PAD not visible)

Table 5: SDV01-003 Pin Configuration

Pin	Name	Function
1	VDD	Power supply voltage
2	CLK	Digital clock signal
3	DATA	Digital PDM signal
4	GND	Ground
5	L/R	Left/Right channel select
6	GND	Ground

### 4.2

### Outline Dimensions

The sensor housing is a 6 Pin LGA package with metal lid. Its dimensions are 3.5mm ( $\pm 0.1$  mm) x 2.65mm ( $\pm 0.1$  mm) x 1.3mm ( $\pm 0.1$ mm). Tolerance is  $\pm 0.1$ mm unless otherwise specified.

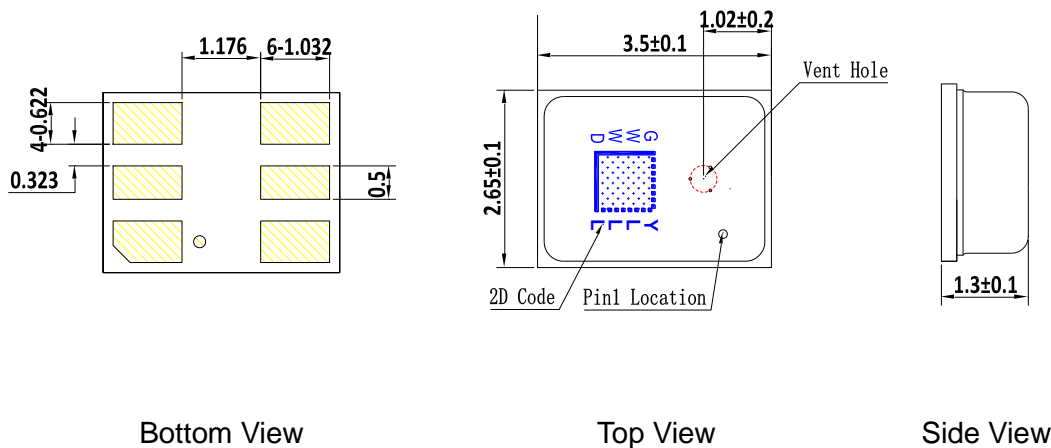


Figure 4: SDV01-003 outline and size



## 5. Maximum rated parameters

**Table 6: Absolute maximum rating**

Parameters	Condition	Min	Max	Unit
Storage Temperature		-40	+85	°C
Supply Voltage	All Pins	-0.3	+3.6	V
ESD level	HBM,R=1.5kohm,C=100pF		±3	kV
Maximum impact acceleration	All Directions From JESD22-B110B		3000	g

## 6. Storage and Transportation

- Keep in warehouse with less than 75% humidity and without sudden temperature change, acid air, any other harmful air or strong magnetic field.
- The sensor with normal pack can be transported by ordinary conveyances. Please protect products against moist, shock, sunburn and pressure during transportation.
- Storage Temperature Range: -40°C ~ +80°C
- Operating Temperature Range: -30°C ~ +70°C

## 7. Cautions

- **Vent Hole Protection**

During reflow soldering, it is forbidden to block the vent holes of the product, so as to avoid damage to the product packaging caused by high temperature during the reflow process; After reflow process, it is recommended to seal the vent hole with Mylar membrane or UV glue, to prevent particle and improve sensitivity loss;

Products that block the vent are not recommended for high temperature processing to avoid internal gas expansion, which affects the plugging effect and internal air pressure.

- **Liquid Washing Restriction**

It is forbidden to wash the device with liquid, such as water, alcohol etc., otherwise this could damage the device.

- **Nozzle Restriction**

It is very important not to pull a nozzle over the vent hole, otherwise this could damage the device.

## 8. PCB Design and Reflow Soldering

- Land Pattern Recommendation

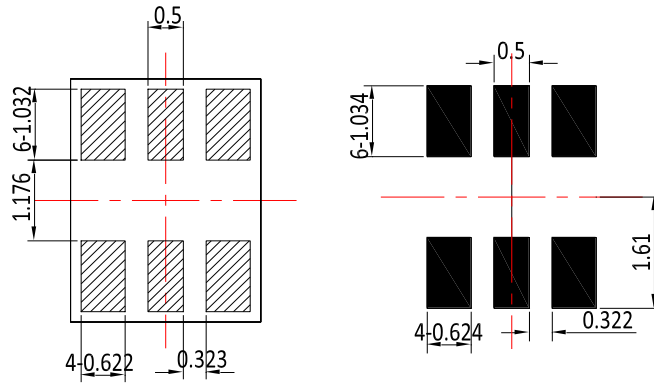


Figure 4: PCB Layout Pattern (Left), Solder Paste Stencil Pattern (Right)

- Nozzle and Picking Area

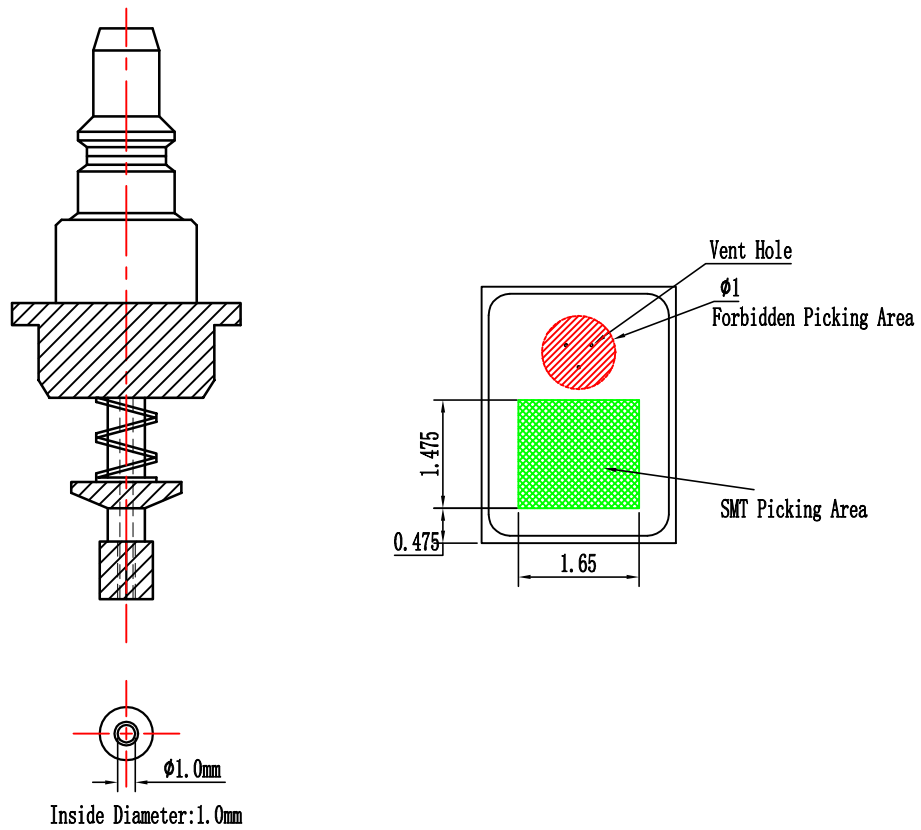
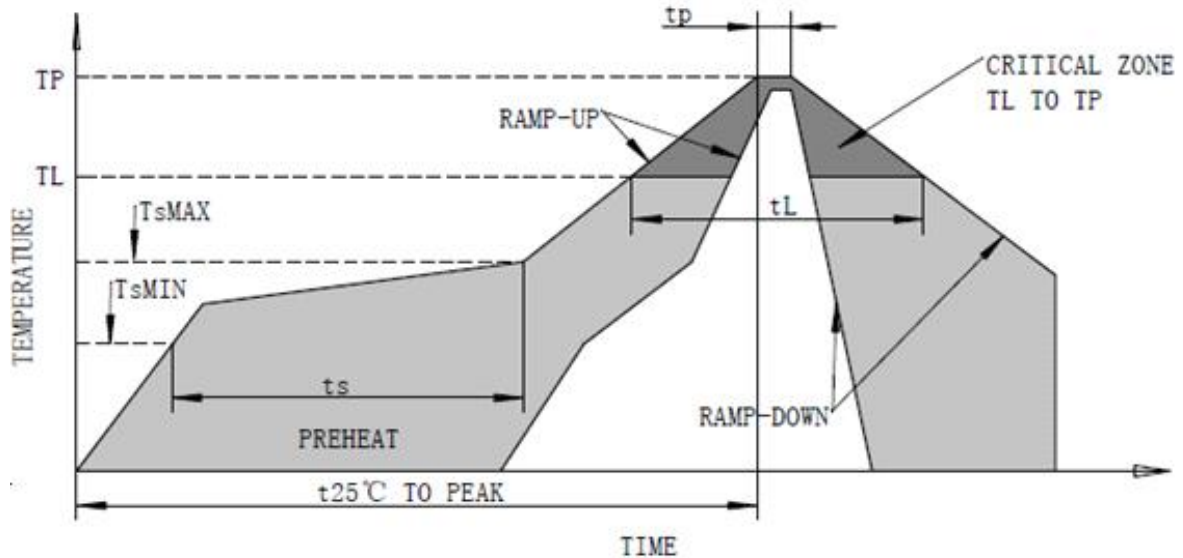


Figure 5: SMT Nozzle Dimension (Left), Picking Area Drawing (Right)

- Soldering Recommendation**

Temperature Control	8 zones
Heater Type	Hot Air
Solder Type	Lead-free

- Soldering Profile**



Profile Feature	Pb-Free Assembly
Average ramp-up rate( $T_{sMAX}$ to $T_P$ )	2.5°C/seconds max.
Preheat	
-Temperature Min.( $T_{sMIN}$ )	150°C
-Temperature Max.( $T_{sMAX}$ )	200°C
-Time( $T_{sMIN}$ to $T_{sMAX}$ )( $T_s$ )	120~180 seconds
Time maintained above:	
-Temperature( $T_L$ )	217°C
-Time( $t_L$ )	Max 80 seconds
Peak temperature( $T_P$ )	260°C
Time within 5°C of actual peak temperature( $T_P$ ) <sup>2</sup>	Max 50 seconds
Ramp-down rate	-5°C/seconds max.
Time 25°C to peak temperature	8 minutes max.

## 9. Package Specifications

### 9.1 Tape Specifications

Quantity per reel: 4000pcs.

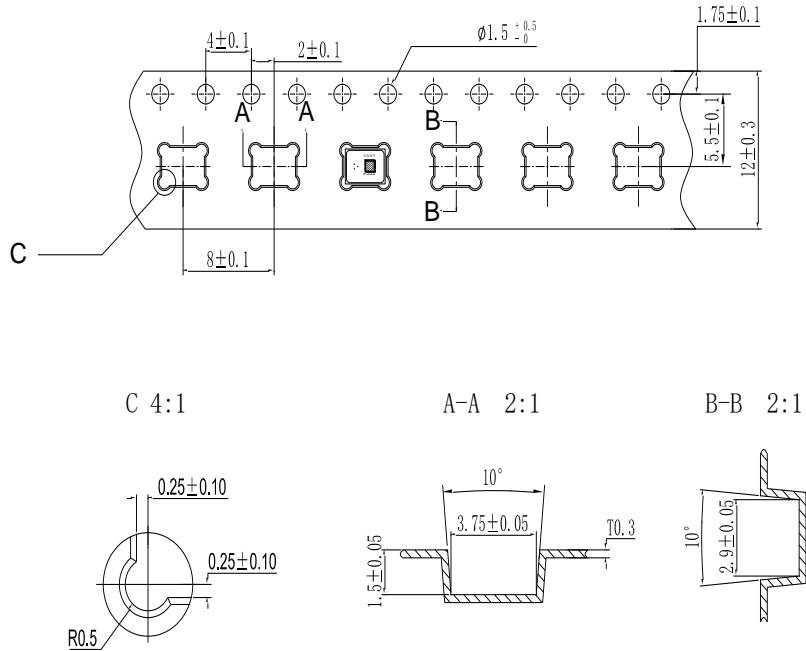


Figure 6: Tape Information (Unit: mm)

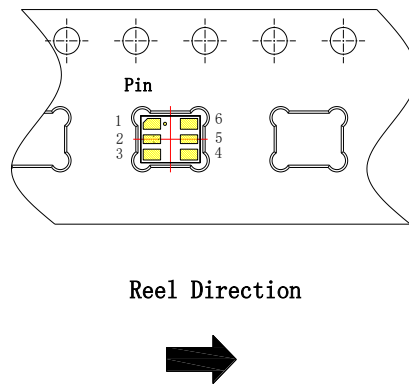
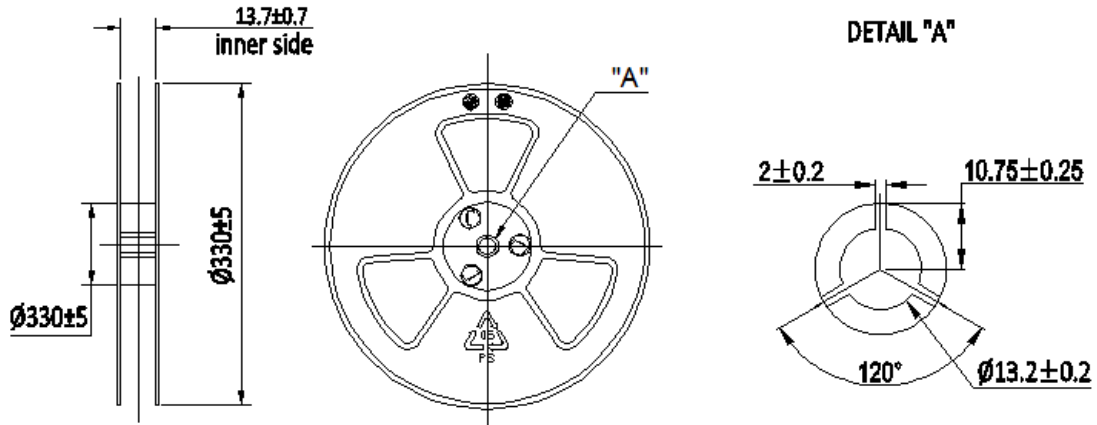


Figure 7: Pin Information

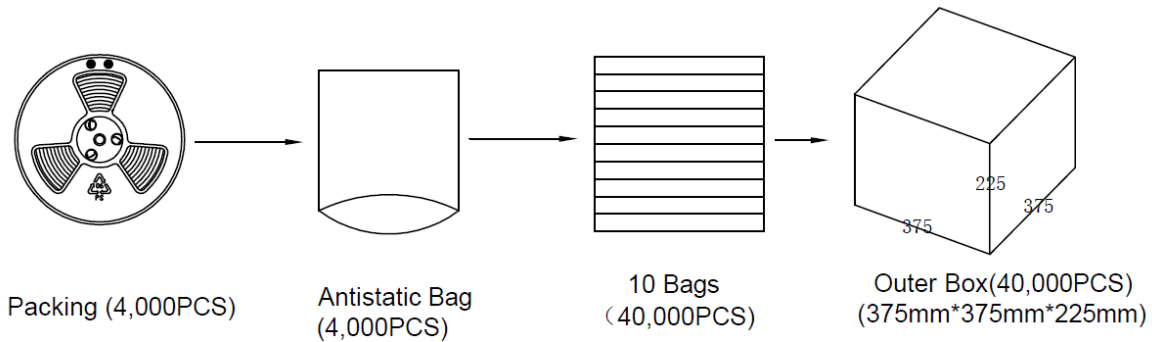
## 9.2 Reel Specification

13" reel will be provided for mass production stage and sample stage more than 1000pcs

### 13" Reel Specification (Unit: mm)

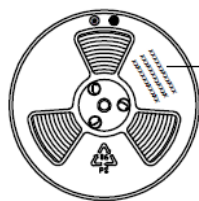


## 9.3 The content of Box



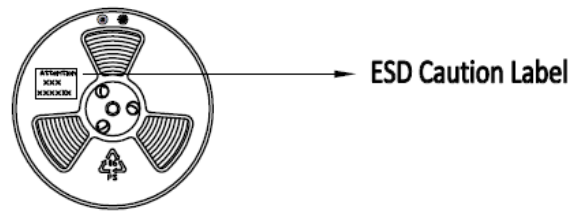
## 9.4 Packing Explain

### The Label Content of the Reel



The Content Includes:  
 RoHS+HF, MSL: ;  
 Product type, Lot, Customer P/N;  
 and other essential information such as  
 Quantity, Date etc.

The Label Content of ESD Caution



The Label Content of Moisture Caution

