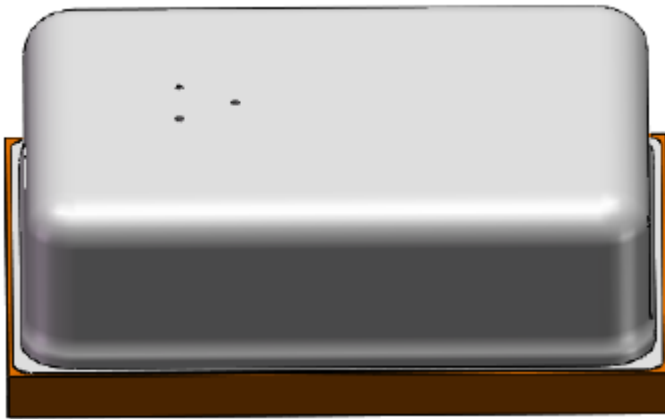


# SDV01-003

## Bone/VPU Sensor

Product Datasheet





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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,<br>Output load <5pF     |                           | 485     |     | μA      |
|                               |                 | VDD =1.8V, CLK=768kHz,<br>Output load <5pF     |                           | 125     |     | μA      |
|                               |                 | VDD =1.8V, 150kHz≤CLK≤<br>310kHz, Standby Mode |                           | 25      | 50  | μA      |
|                               |                 | CLK=0kHz<br>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

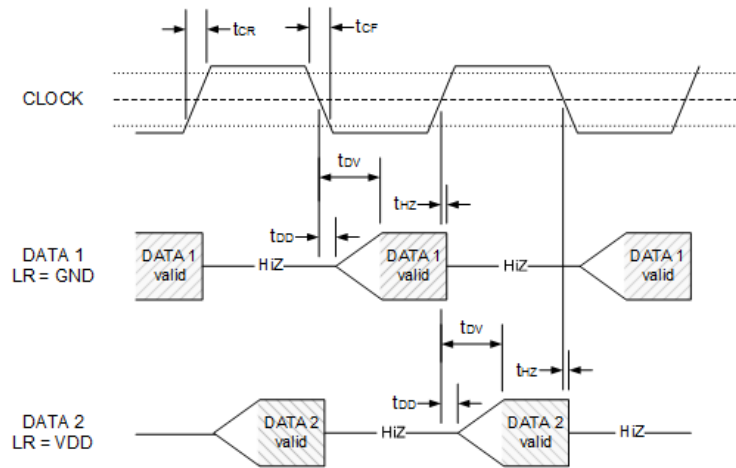


Figure 1:Timing Diagram

● 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

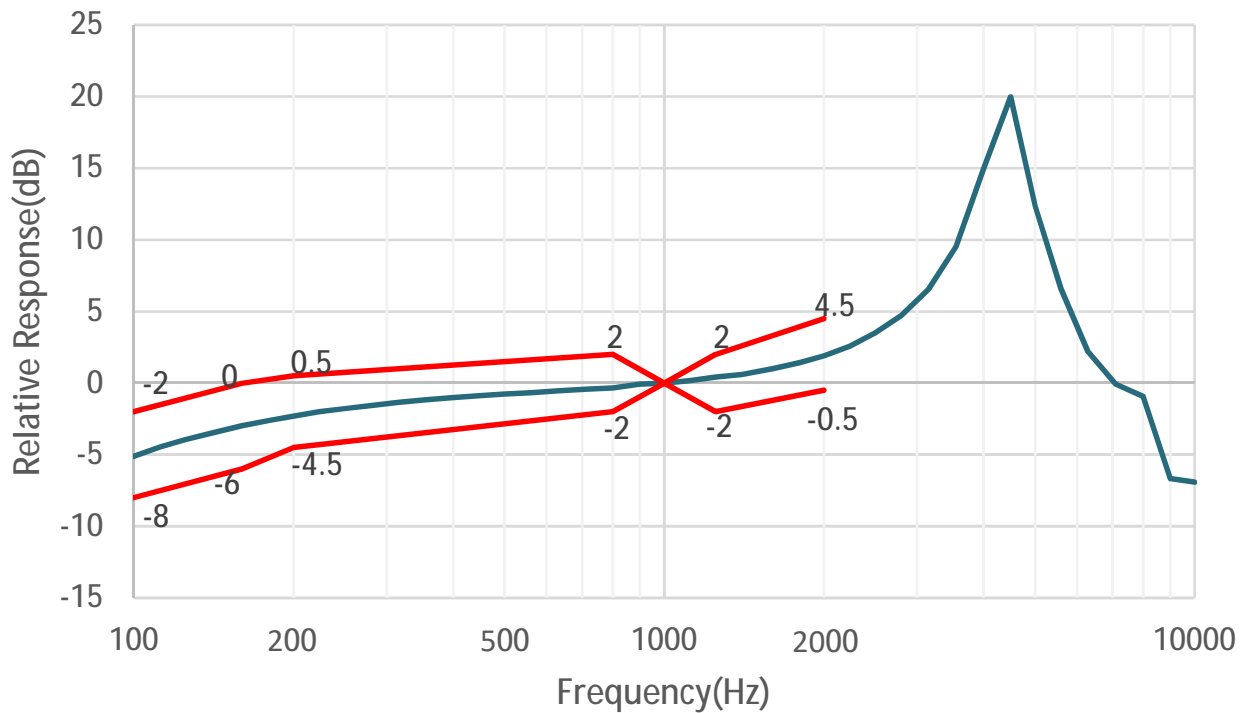


Figure 2: Frequency Response Curve

## 4. Mechanical Parameters

### 4.1 Pin Configuration

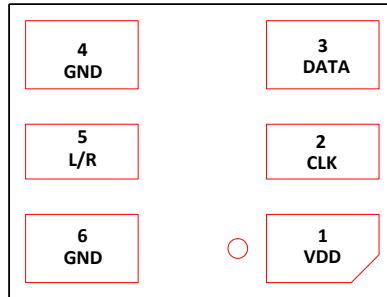


Figure 3: Layout pin configuration SDV01-003 (Top View, PAD not visible)

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.

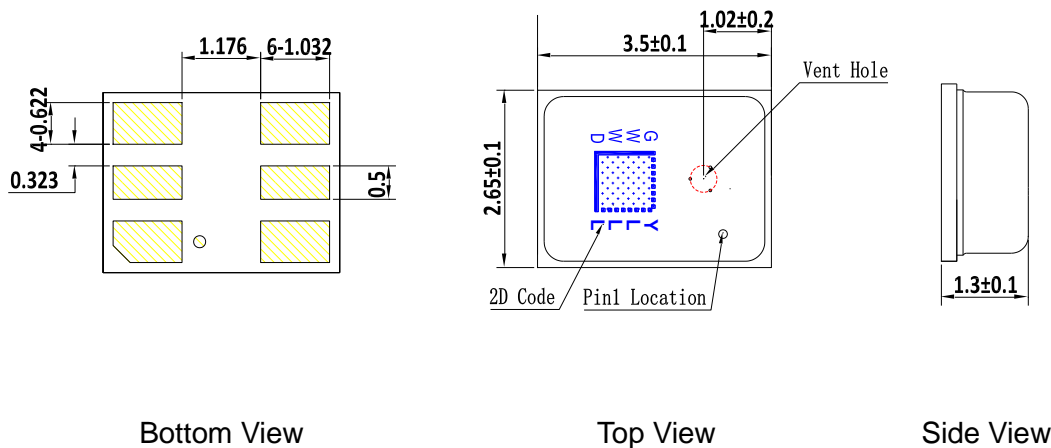


Figure 4: SDV01-003 outline and size



## 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

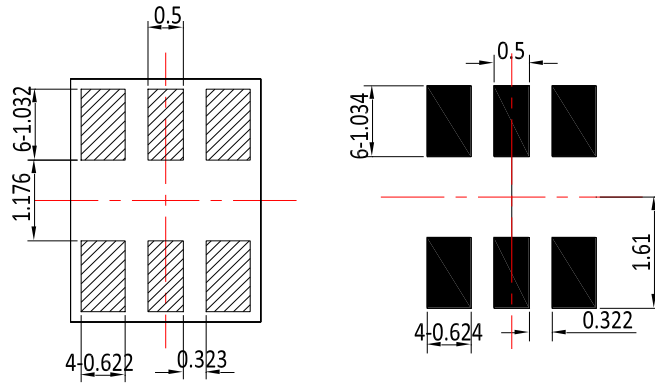


Figure 4: PCB Layout Pattern (Left), Solder Paste Stencil Pattern (Right)

- Nozzle and Picking Area

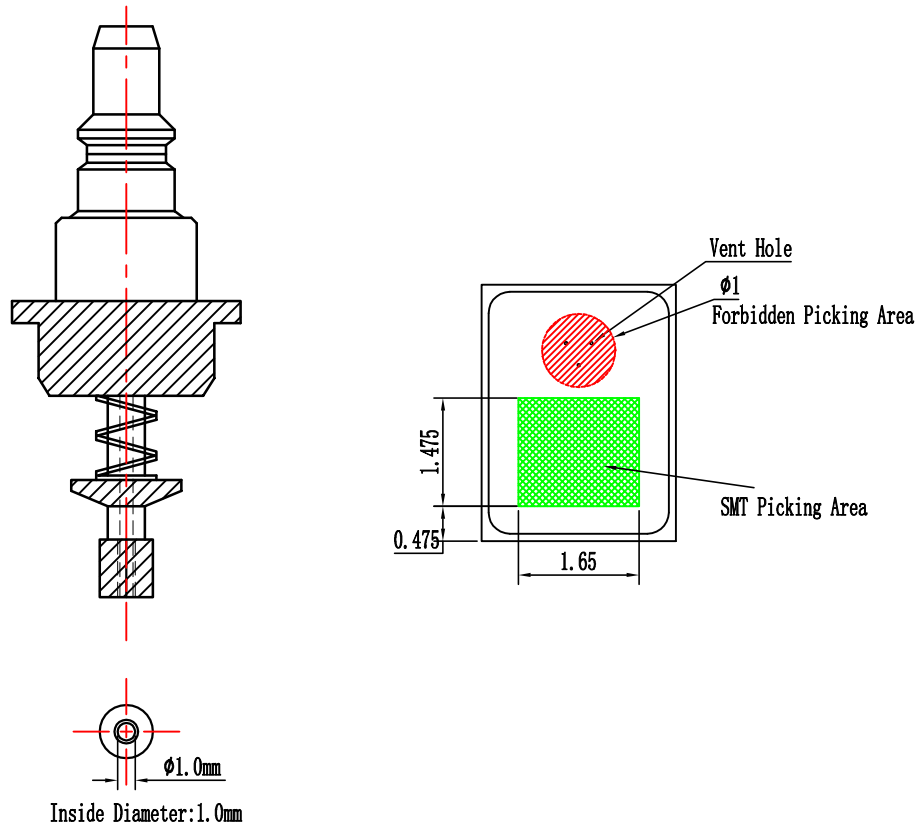
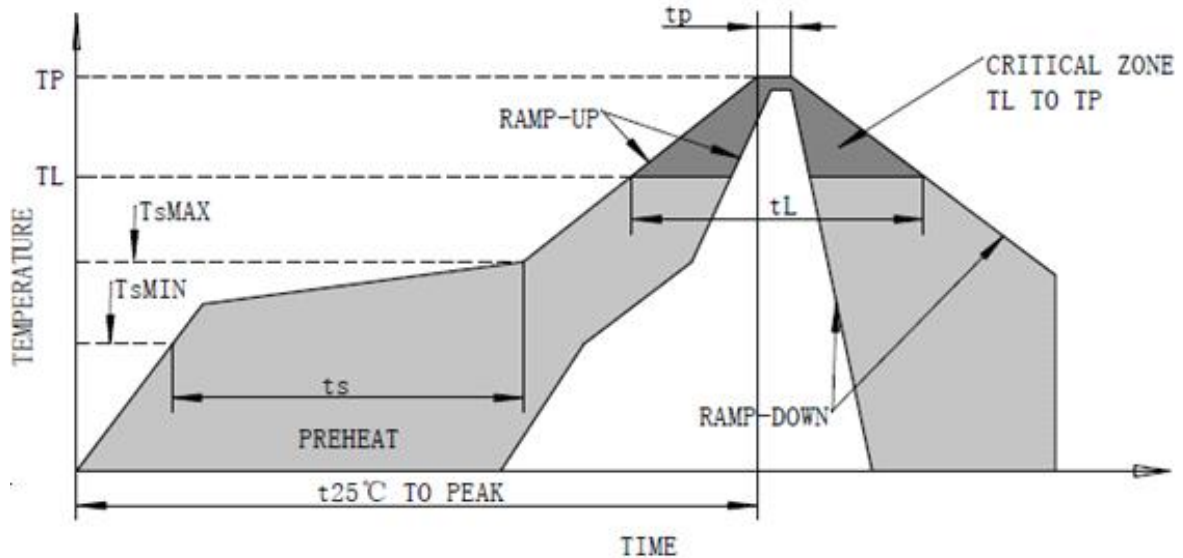


Figure 5: SMT Nozzle Dimension (Left), Picking Area Drawing (Right)

- 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.

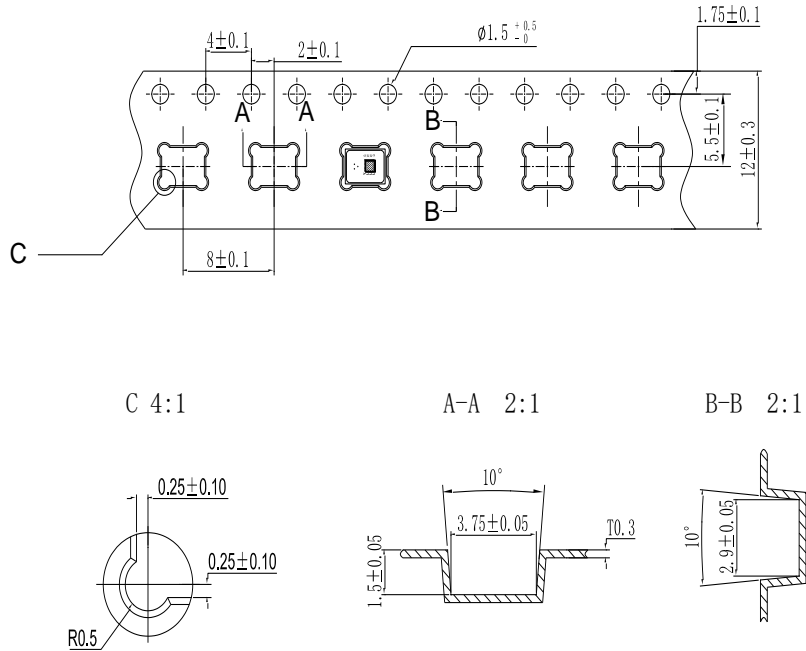


Figure 6: Tape Information (Unit: mm)

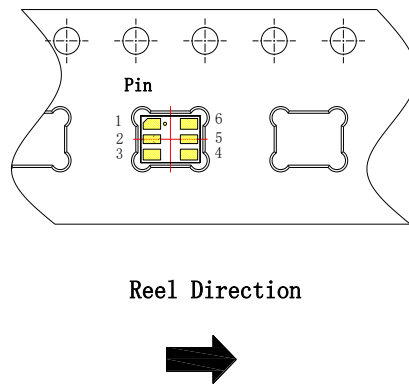
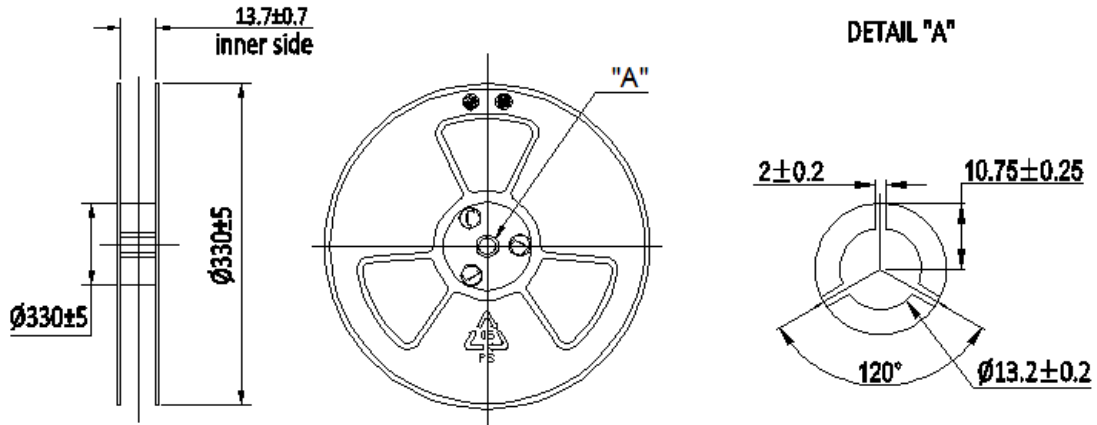


Figure 7: Pin Information

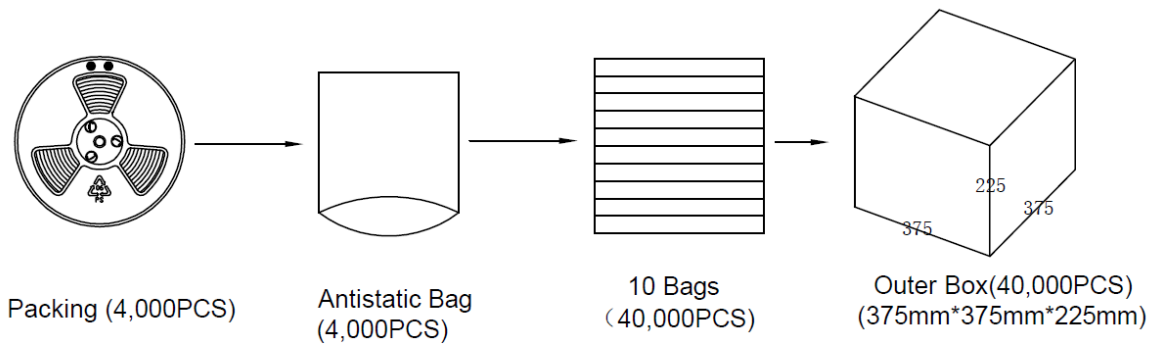
## 9.2 Reel Specification

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

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

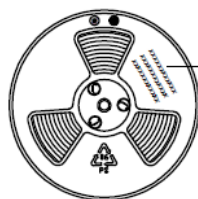


## 9.3 The content of Box



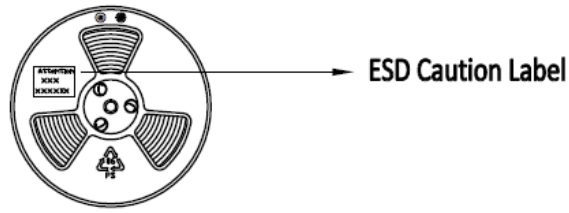
## 9.4 Packing Explain

### 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

