

## Precision Ultralow Noise Microphone with Top Port and Analog Output

### DESCRIPTION

The ZTS6015 is a high quality, low cost, low power analog output top-ported omni-directional MEMS microphone. ZTS6015 consists of a MEMS microphone element and an preamplifier. ZTS6015 has a high SNR and flat wideband frequency response, resulting in natural sound with high intelligibility. Extra EMI filter for RF noise attenuation is built inside. Due to the built-in filter, ZTS6015 shows high immunity to EMI.

The ZTS6015 is available in a thin 3.76mm × 2.24mm × 1.1mm surface-mount package. It is reflow solder compatible with no sensitivity degradation. The ZTS6015 is halide free.

### APPLICATIONS

- Mobile telephones
- PDAs
- Digital video cameras
- Portable media devices with audio input

### ORDERING INFORMATION

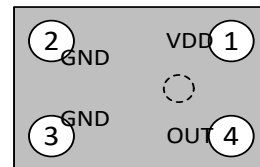
| PART    | RoHS | Ship, Quantity      |
|---------|------|---------------------|
| ZTS6015 | Yes  | Tape and Reel, 5.2K |

### FEATURES

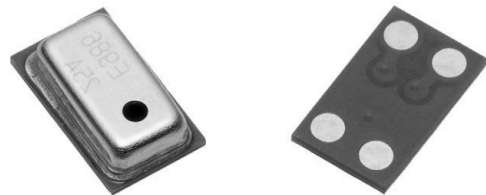
- 3.76mm×2.24mm×1.1mm surface-mount package
- Stable sensitivity over power supply range of 1.5V-3.6V
- SNR of 59dBA
- Sensitivity of -42dBV
- Low current consumption of <100μA
- Multi Chip Module (MCM) Package

### Pins Configuration and Description

Bottom View



Top Metal Cover is GND.



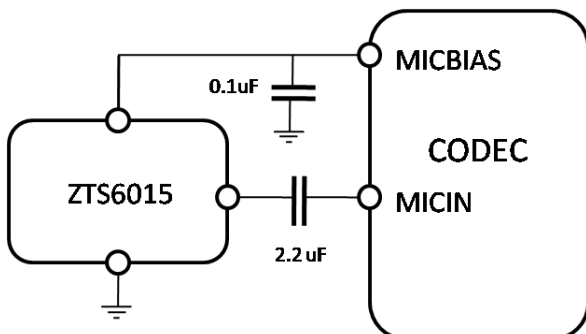
Top

Bottom

Isometric Views of ZTS6015 Microphone Package

### Typical Applications

The ZTS6015 output can be connected to a codec microphone input or to a high input impedance gain stage. A dc-blocking capacitor is required at the output of the microphone.



Connect to Audio Codec

### Absolute Maximum Ratings

Supply Voltage ..... -0.5V to +4V  
 Sound Pressure Level ..... 160dB  
 Mechanical Shock ..... 10000g  
 Vibration ..... Per MIL-STD-883 Method  
 2007, Test Condition B  
 Temperature Range ..... -40°C to +100°C

**CAUTION:** Stresses above those listed in “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

### Electro-Static Discharge Sensitivity

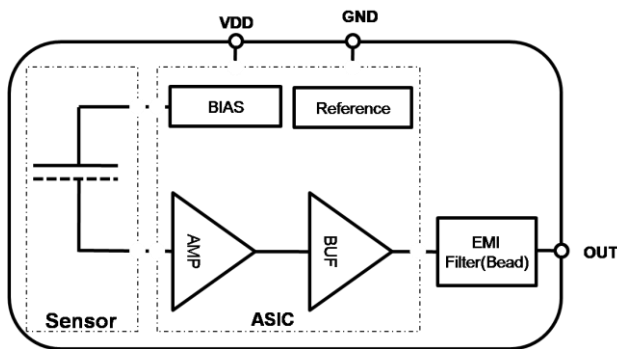


This integrated circuit can be damaged by ESD. It is recommended that all integrated circuits be handled with proper precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure.

### Pins Description

| Pin | Symbol | Description           |
|-----|--------|-----------------------|
| 1   | VDD    | Power Supply.         |
| 2,3 | GND    | Ground.               |
| 4   | OUT    | Analog output signal. |

### Functional Block Diagram



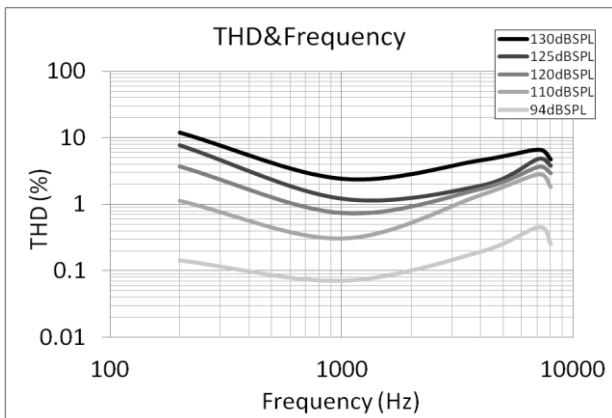
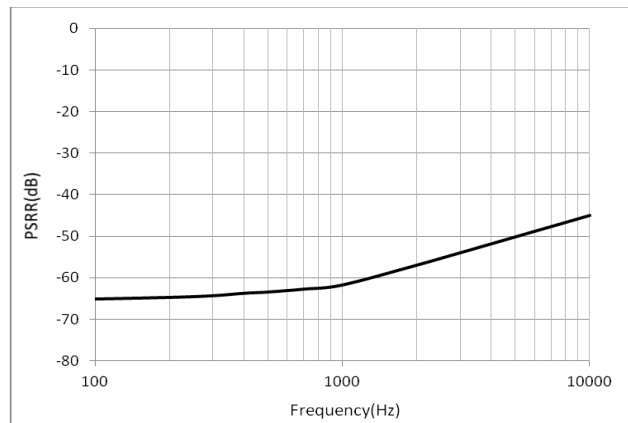
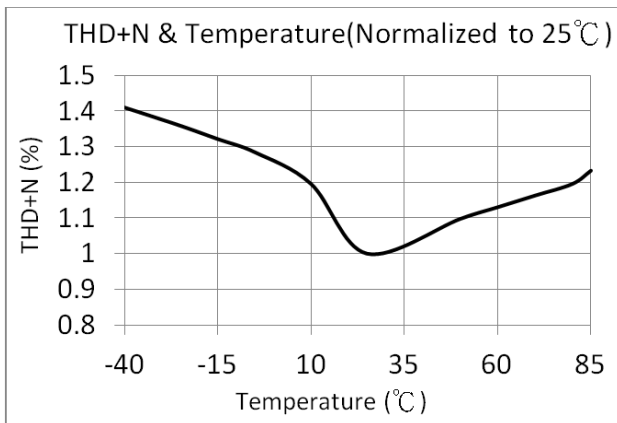
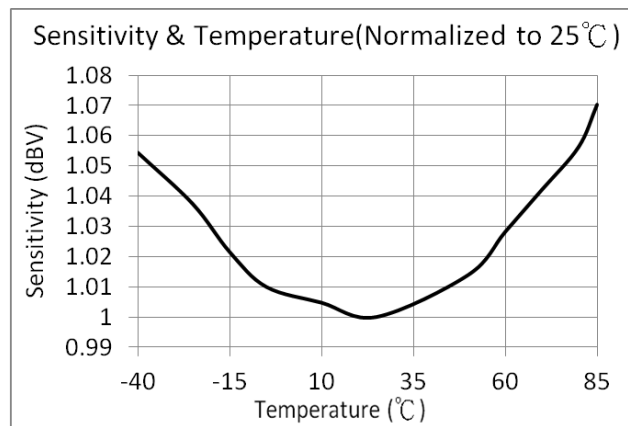
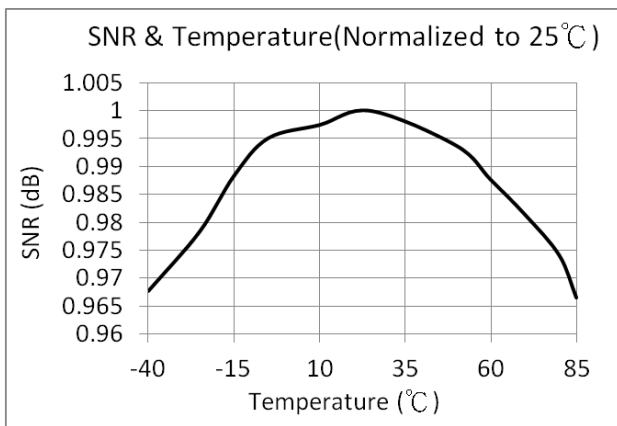
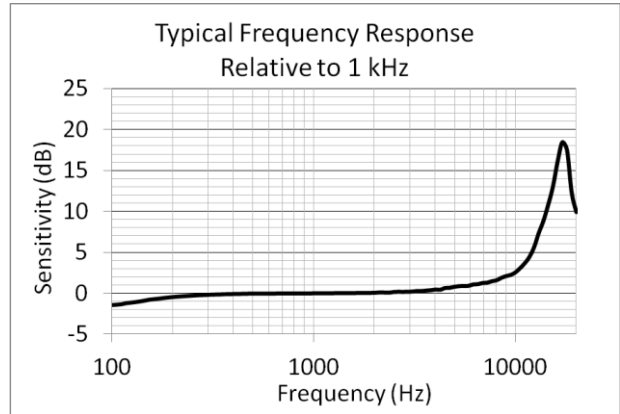
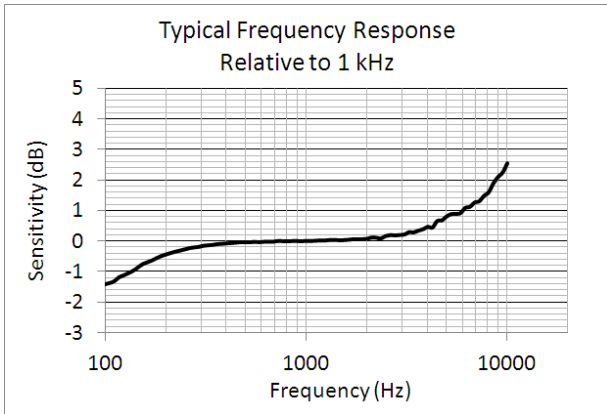
## Specifications

(T<sub>A</sub> = +15°C ~+25°C, V<sub>DD</sub> = +1.8V, unless otherwise noted.)

| PARAMETER                 | Symbol           | TEST CONDITIONS  | MIN                       | TYP  | MAX | UNIT   |
|---------------------------|------------------|--|---------------------------|------|-----|--------|
| Directivity               |                  |  |                           | Omni |     |        |
| Supply Voltage            | V <sub>DD</sub>  |  | 1.5                       |      | 3.6 | V      |
| Current Consumption       | I <sub>DD</sub>  | VDD=1.8V   |                           | 70   | 100 | μA     |
| Sensitivity (Note)        |                  | 1kHz, 94dB SPL   | -45                       | -42  | -39 | dBV    |
| Signal-to-Noise-Ratio     | SNR              | 94dB SPL@1KHz,<br>A-weighted                               |                           | 59   |     | dB     |
| Equivalent Input Noise    | EIN              |  |                           | 35   |     | dB SPL |
| Total Harmonic Distortion | THD              | 94dB SPL @ 1KHz  |                           | 0.1  | 0.2 | %      |
| Acoustic Overload Point   | AOP              | 10% THD @ 1KHz   |                           | 132  |     | dB SPL |
| Power Supply Rejection    | PSR              | 200mVpp sinewave @<br>1KHz, VDD=1.8V                       |                           | 60   |     | dB     |
| Power Supply Rejection    | PSR              | 100mV Vp-p, square<br>wave @217Hz,<br>VDD=1.8V, A-Weighted |                           | -90  |     | dB     |
| Output Impedance          | Z <sub>out</sub> |  |                           | 200  | 450 | Ω      |
| Output DC Offset          |                  |  |                           | 0.70 |     | V      |
| Output Current Limit      |                  |  |                           | 90   |     | μA     |
| Polarity                  |                  | Increasing sound<br>pressure                               | Decreasing output voltage |      |     |        |

Note: Base on BK sound test system.

**Typical Performance Characteristics**



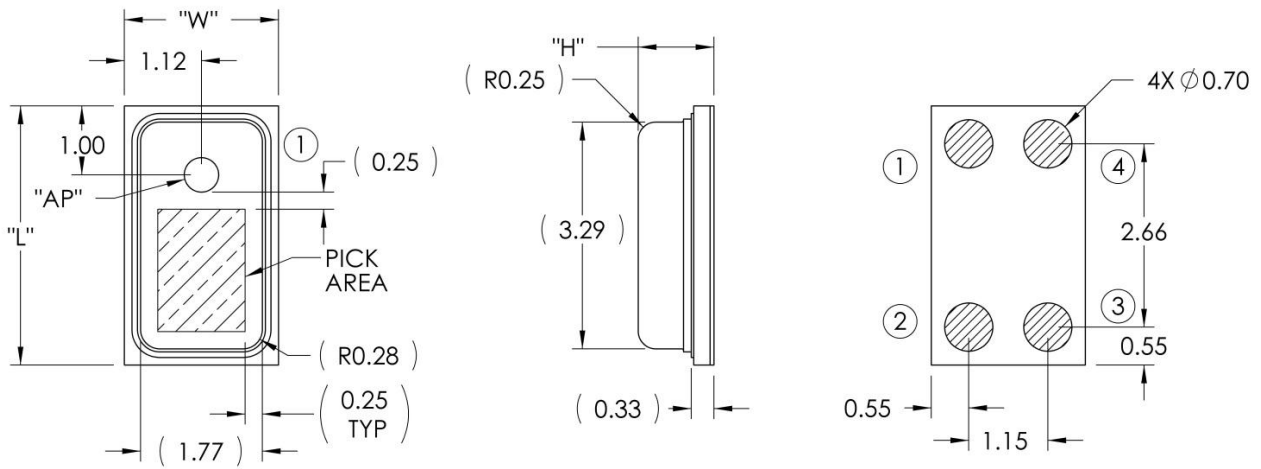
## Reliability Tests

The microphone sensitivity after stress must deviate by no more than  $\pm 3\text{dB}$  from the initial value.

|  |   |
|--|---|
| 1.Heat Test, Operational               | Temperature: $85\pm 3^{\circ}\text{C}$<br>Humidity: $85\pm 5\%\text{RH}$<br>Duration: 12 hours<br>Voltage: Applied  |
| 2.Cold Test, Operational               | Temperature: $-40\pm 3^{\circ}\text{C}$<br>Duration: 12 hours<br>Voltage: Applied   |
| 3.Heat Test, Non-Operational           | Temperature: $85\pm 3^{\circ}\text{C}$<br>Humidity: $50\pm 5\%\text{RH}$<br>Duration: 96 hours<br>Voltage: Not Applied  |
| 4.Cold Test, Non-Operational           | Temperature: $-40\pm 3^{\circ}\text{C}$<br>Duration: 96 hours<br>Voltage: Not Applied   |
| 5.Condensation Test, Non-Operational   | Temperature: $25\pm 3^{\circ}\text{C}$ and $55\pm 3^{\circ}\text{C}$<br>Humidity: $95\pm 5\%\text{RH}$<br>Duration: 1 hours each, during 10 minutes ramp, 45 cycles<br>Voltage: Not applied   |
| 6.Temperature Cycling, Non-Operational | Temperature: $-40\pm 3^{\circ}\text{C}$ and $85\pm 3^{\circ}\text{C}$<br>Humidity: $50\pm 5\%\text{RH}$<br>Duration: 2 hours each, during 6 hours ramp, 5 cycles<br>Voltage: Not applied  |
| 7.Thermal Shock Test, Non-Operational  | Temperature: $-40\pm 3^{\circ}\text{C}$ and $85\pm 3^{\circ}\text{C}$<br>Duration: 30 minutes each, during 5 minutes ramp, 256 cycles<br>Voltage: Not applied   |
| 8.Free Fall Test 1.5m                  | Placed inside test fixture and dropped on concrete from height 1.5m.<br>(1)3 times by 6 surfaces<br>(2)1 times by 12 edges<br>(3)1 times by 8 corners   |
| 9.Random Vibration                     | Temperature: $23\pm 5^{\circ}\text{C}$<br>Humidity: $35\sim 70\%\text{RH}$<br>Duration: 2 hours each axis(X,Y,Z)<br>Power Spectral Density:<br>5Hz $0.10\text{m}^2/\text{s}^3(=1.0391*10^{-3}\text{g}^2/\text{Hz})$<br>12Hz $2.20\text{m}^2/\text{s}^3(=22.8602*10^{-3}\text{g}^2/\text{Hz})$<br>20Hz $2.20\text{m}^2/\text{s}^3(=22.8602*10^{-3}\text{g}^2/\text{Hz})$<br>200Hz $0.04\text{m}^2/\text{s}^3(=0.41534*10^{-3}\text{g}^2/\text{Hz})$<br>200Hz $0.04\text{m}^2/\text{s}^3(=0.41564*10^{-3}\text{g}^2/\text{Hz})$ |
| 10.Repeated Low Level Free Fall Test   | Placed inside test fixture and dropped on rubber mat from height of 10cm.<br>Each face 2500 times(Total 6 faces, 15000times)  |
| 11.1m Repeated Rotating Free Fall      | Placed inside test fixture and dropped on steel sheet from height of 1.0m.<br>100 times(all faces)<br>Rotation speed of barrel: 10~12 falls/minute  |
| 12.Free Fall Test for master box       | Corner drop: Each Corner 1 time<br>Edge drop: Each Edge 1 time<br>Face drop: Each Face 1 time   |

|                                     |  |
|-------------------------------------|--|
| 13. Random Vibration for master box | Sinusoidal wave vibration<br>Frequency: 5~50Hz<br>Acceleration: 7.4m/s <sup>2</sup> (0.76G)<br>Sweep speed: 9Hz/min(5~50Hz, one way 5 min)<br>Test duration: Direction of Face 1-3 20min<br>Direction of Face 2-4 20min<br>Direction of Face 5-6 20min<br>Sample and direction of vibration : 1 direction for 1 sample<br>Package on vibrating table: Free |
| 14. Substrate bending Test          | Deflection: 3mm<br>Rate: 0.5mm/sec   |
| 15. Adhesion                        | Load: 10 N<br>Duration: 10 seconds   |
| 16. Electrostatic Discharge Test    | Capacitance: 150pF<br>Resistance: 330Ω<br>Duration: 10 times<br>Air Discharge: Level 3(+/-8kV)<br>Direct contact discharge: Level 1 (+/-2kV)   |
| 17. ESD-Human Body Model            | 3 discharges of ±2 kV direct contact to I/O pins.<br>(100pF, 1500Ω)  |
| 18. ESD-Charged Device Model        | 3 discharges of ± 500V direct contact to I/O pins.   |
| 19. ESD-Machine Mode                | 3 discharges of ±200 V direct contact to I/O pins.   |
| 20. Self alignment effect           | Displacement: 0.15mm   |

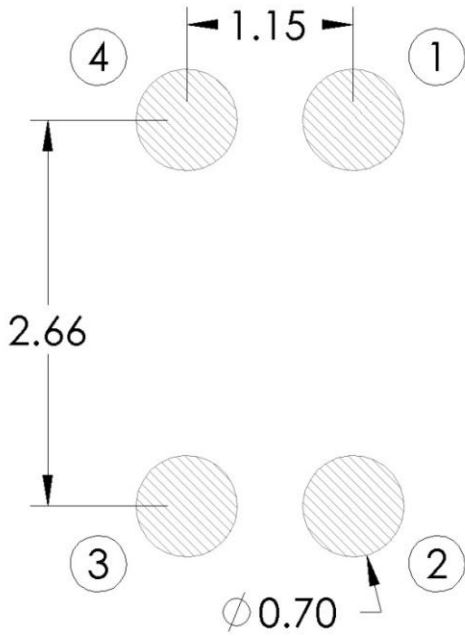
**MECHANICAL SPECIFICATION**



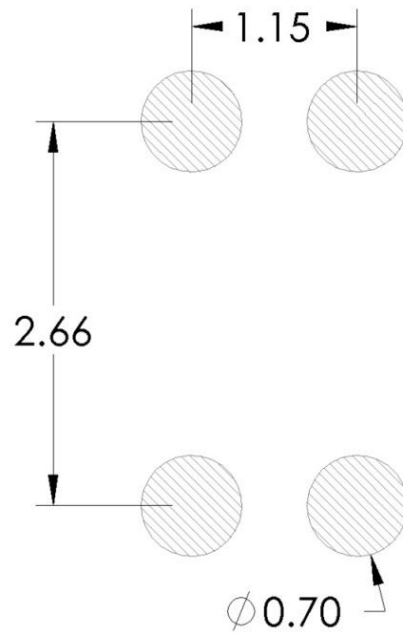
| ITEM               | DIMENSION | TOLERANCE | UNITS |
|--------------------|-----------|-----------|-------|
| Length (L)         | 3.760     | ±0.100    | mm    |
| Width (W)          | 2.240     | ±0.100    | mm    |
| Height (H)         | 1.100     | ±0.100    | mm    |
| Acoustic Port (AP) | Ø0.500    | ±0.050    | mm    |

**RECOMMENDED CUSTOMER LAND PATTERN**

The recommended PCB land pattern for the ZTS6015 should have a 1:1 ratio to the solder pads on the microphone package. Care should be taken to avoid applying solder paste to the sound hole in PCB. The dimensions of suggested solder paste pattern refer to the land pattern **which should be shrunk by 0.025 per side**.



EXAMPLE LAND PATTERN

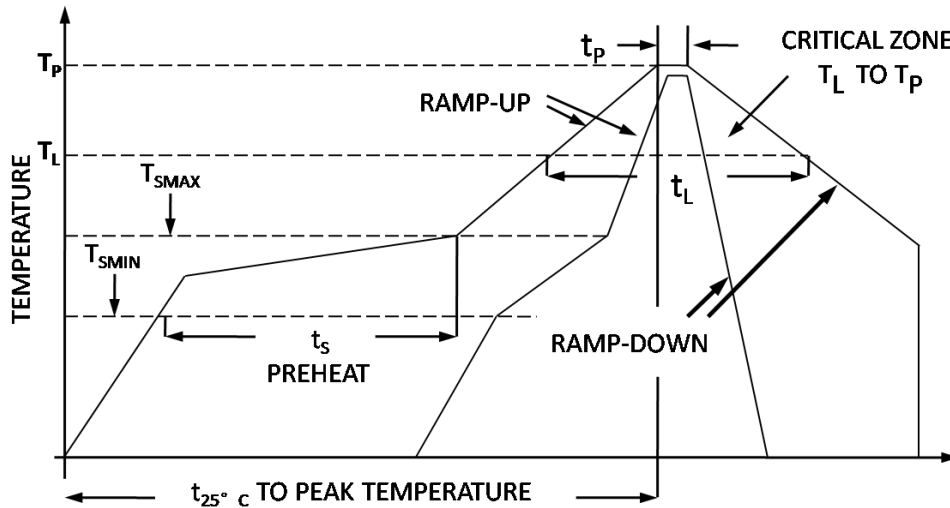


EXAMPLE SOLDER STENCIL PATTERN



**SOLDER FLOW PROFILE**

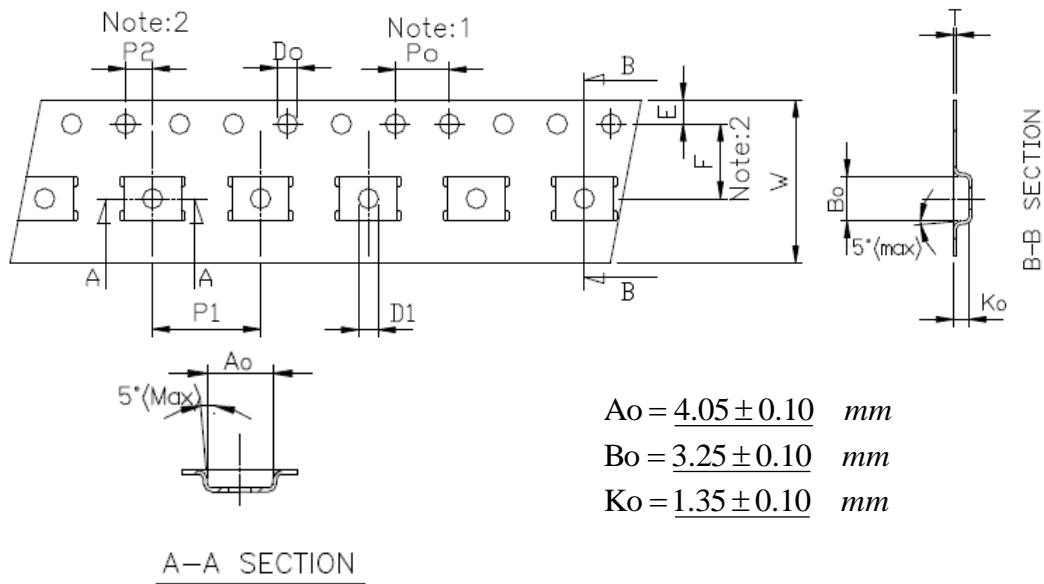
The reflow profile specified in this section describes expected maximum heat exposure of components during the reflow process of NMP product PWBs. Temperature is measured on top of component. All components have to tolerate at least this profile five times (5x) without affecting electrical performance, mechanical performance or reliability.



Pb-free and Sn63/Pb37 reflow profile requirements for soldering heat resistance:

| Parameter   | Reference                            | Pb-Free                                  | Sn63/Pb37        |
|---|--------------------------------------|--|------------------|
| Average Ramp Rate                                   | T <sub>L</sub> to T <sub>P</sub>     | 1.25°C/sec max                           | 1.25°C/sec max   |
| Prehear   | Minimum Temperature                  | T <sub>S</sub> MIN                       | 100°C            |
|   | Maximum Temperature                  | T <sub>S</sub> MAX                       | 200°C            |
|   | Time                                 | T <sub>S</sub> MIN to T <sub>S</sub> MAX | 60sec to 75sec   |
| Ramp-Up Rate  | T <sub>S</sub> MAX to T <sub>L</sub> | 1.25°C/sec                               | 1.25°C/sec       |
| Time Maintained Above Liquidous                     | t <sub>L</sub>                       | 50sec                                    | 60sec to 75sec   |
| Liquidous Temperature                               | T <sub>L</sub>                       | 217°C                                    | 183°C            |
| Peak Temperature                                    | T <sub>P</sub>                       | 260°C +0°C/-5°C                          | 215°C +3°C/-3°C  |
| Time Within +5°C of Actual Peak Temperature         | t <sub>P</sub>                       | 20 sec to 30 sec                         | 20 sec to 30 sec |
| Ramp-Down Rate                                      | T <sub>peak</sub>                    | 3°C/sec max                              | 3°C/sec max      |
| Time +25°C (t <sub>250C</sub> ) to Peak Temperature |                                      | 5 min max                                | 5 min max        |

**PACKAGING**

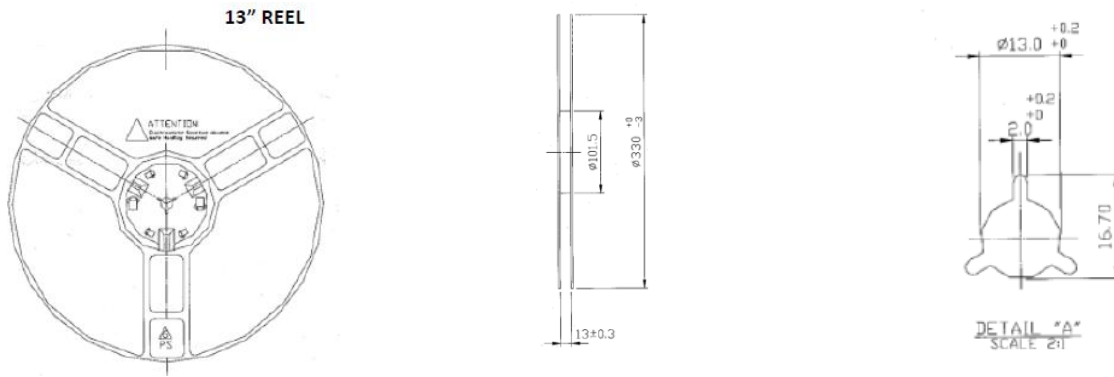


Unit : mm

| Symbol | Spec.       |
|--------|-------------|
| K1     | -           |
| Po     | 4.0 ± 0.10  |
| P1     | 8.0 ± 0.10  |
| P2     | 2.0 ± 0.05  |
| Do     | 1.55 ± 0.05 |
| D1     | 1.50 (MIN)  |
| E      | 1.75 ± 0.10 |
| F      | 5.50 ± 0.05 |
| 10Po   | 40.0 ± 0.10 |
| W      | 12.0 ± 0.20 |
| T      | 0.30 ± 0.05 |

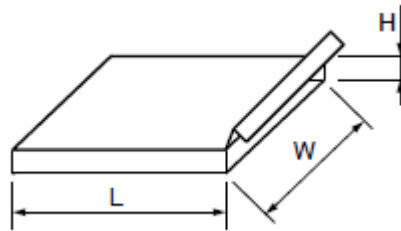
**Notice :**

- 1 . 10 Sprocket hole pitch cumulative tolerance is ± 0.1mm.
- 2 . Pocket position relative to sprocket hole measured as true position of pocket not pocket hole.
- 3 . Ao & Bo measured on a place 0.3mm above the bottom of the pocket to top surface of the carrier.
- 4 . Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
- 5 . Carrier camber shall be not that 1mm per 100mm through a length of 250mm.



| Part NO. | Reel Diameter | Quantity Per Reel | Quantity Per Inner Box | Quantity Per Outer Box |
|----------|---------------|-------------------|------------------------|------------------------|
| ZTS6015  | 13"           | 5,200             | 5,200                  | 46,800                 |

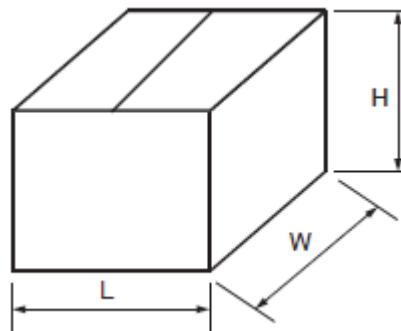
**Dimensions for Inner Box**



Unit : mm

| L   | W   | H  |
|-----|-----|----|
| 335 | 339 | 45 |

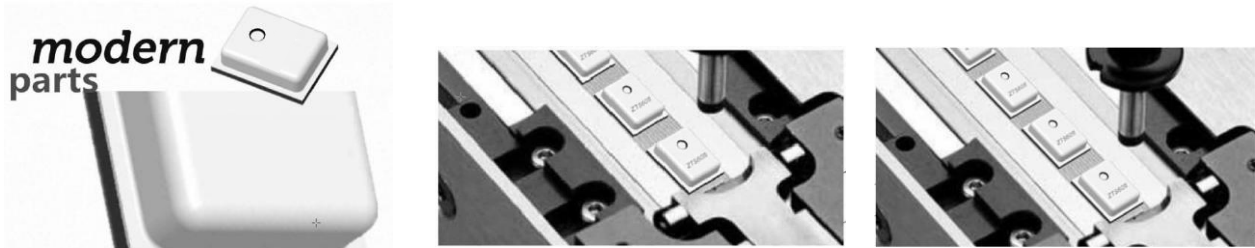
**Dimensions for Outer Box**



Unit : mm

| L   | W   | H   |
|-----|-----|-----|
| 445 | 360 | 372 |

**Pick and place guidelines of process**



**Rules of cleaning**

Due to Clean the PCBA gap will make MEMS Mic. unit work improperly, please do not clean it by way of ultrasonic or use any cleaning solution to wash the soldered MEMS Mic. unit. If the PCB need to be cleaned, please seal with a tape on the both side of the acoustic hole to avoid foreign material and liquid invaded.

MEMS Mic. is a electro-acoustic component which rely on its diaphragm vibrate in response to sound pressure, so that the sound pressure can be converted to electrical signals; Base on the above , If any cleaning liquid inject the Mic. unit, the vibrate spacing of the diaphragm would be constrained. As a result of that, if the diaphragm cannot vibrate well, it will make the output signal smaller or even no output.

**Rules of the pressure of vacuum nozzle**

If the Vacuum nozzle pressure is much more on the metal cap, it will directly affect the displacement of the diaphragm structure. When the displacement pressure is greater than the Max input sound pressure, the diaphragm will be damaged or cracked.

Note that Vacuum nozzle pressure cannot greater than 7PSI.

1K Pa = 0.145 pounds (lb / in2) = 0.0102 KGF / CM2 = 0.0098 atm.

**Rules of protection measurement**

- 1 · Please do not let the vacuum nozzle suck the microphone acoustic hole.
- 2 · Do not vacuum the anti-static bag when repackaging the MEMS Mic..
- 3 · Do not blow the acoustic hole when cleaning the PCBA with air gun.

**Rules of the placement of vacuum nozzle**

When pick and place the Mic. unit, the SMT Vacuum Tube should be placed in the center of the left and right sides of Mic. unit and keeps 0.5mm from the edge of the acoustic hole.

This pick and place guidelines can apply to all series of ZillTek Top-Port MEMS Mic. products.

