Precision Ultralow Noise Microphone with Top Port and Analog Output

DESCRIPTION

The ZTS6011E is a high quality, low cost, low power analog output top-ported omni-directional MEMS microphone. ZTS6011E consists of a MEMS microphone element and an preamplifier. ZTS6011E 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, ZTS6011E shows high immunity to EMI.

The ZTS6011E is available in a thin 3.76mm × 2.95mm × 1.1mm surface-mount package. It is reflow solder compatible with no sensitivity degradation. The ZTS6011E is halide free.

APPLICATIONS

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

ORDERING INFORMATION

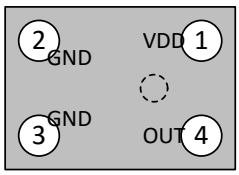
PART	RoHS	Ship, Quantity
ZTS6011E	Yes	Tape and Reel, 5.2K

FEATURES

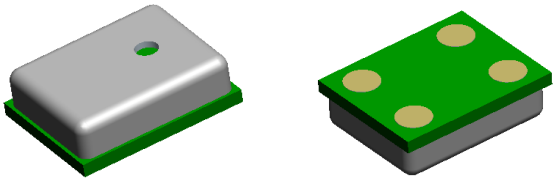
- 3.76mm×2.95mm×1.1mm surface-mount package
- Stable sensitivity over power supply range of 1.5V-3.6V
- SNR of 59dBA
- Sensitivity of −42dBV
- Low current consumption of <100μA
- Multi Chip Module (MCM) Package

Pins Configuration and Description

Bottom View



Top Metal Cover is GND.

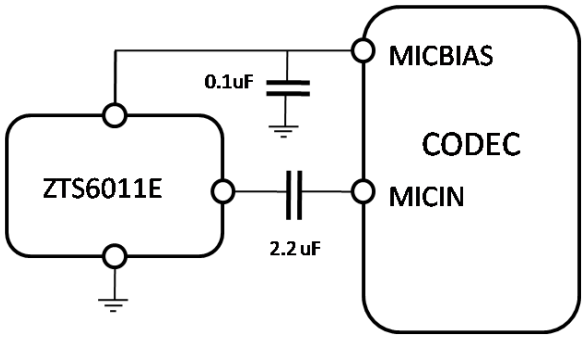


Top Bottom

Isometric Views of ZTS6011E Microphone Package

Typical Applications

The ZTS6011E 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

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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.

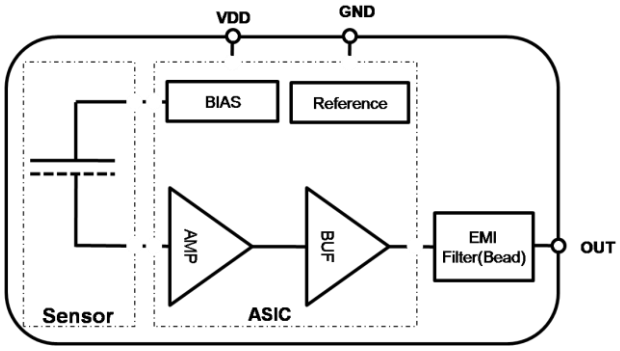
Electro-Static Discharge Sensitivity

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_A = +15°C ~+25°C, V_{DD} = +1.8V, unless otherwise noted.)

PARAMETER	Symbol	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Directivity				Omni		
Supply Voltage	V_{DD}		1.5		3.6	V
Current Consumption	I_{DD}	VDD=1.8V		65	90	µA
	I_{DD}	VDD=3.6V		70	100	µA
Sensitivity (Note)		1kHz, 94dB SPL	−43	−42	−41	dBV
Signal-to-Noise-Ratio	SNR			59		dBA
Equivalent Input Noise	EIN			35		dBA SPL
Total Harmonic Distortion	THD	94dB SPL @ 1KHz		0.1	0.2	%
Acoustic Overload Point	AOP	10% THD @ 1KHz		130		dBSPL
Power Supply Rejection Ratio	PSRR	217Hz, 100mV Vp-p, square wave on V_{DD}		65		dB
Output Impedance	Zout			200	450	Ω
Output DC Offset				0.70		V
Output Current Limit				90		µA
Polarity				Noninverting		

Note: Base on BK sound test system.

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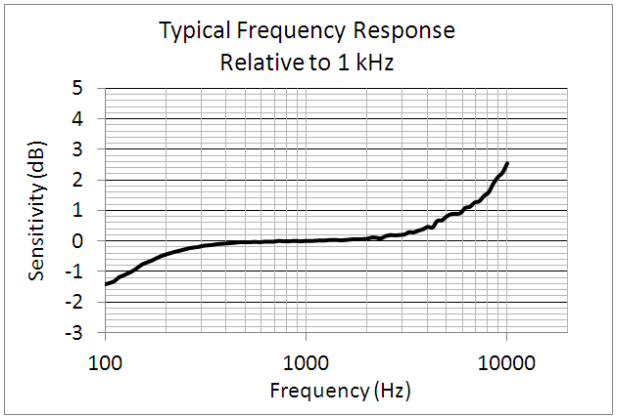
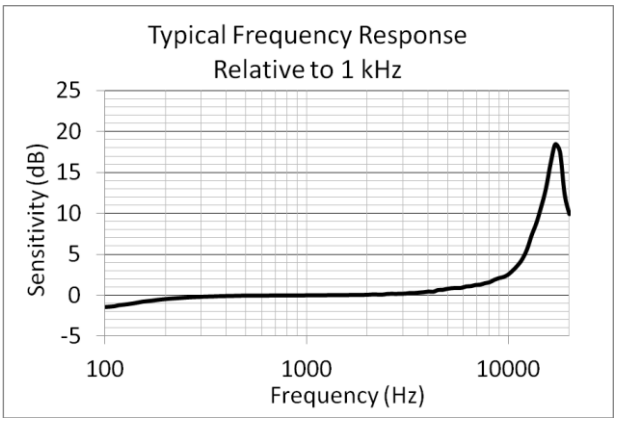
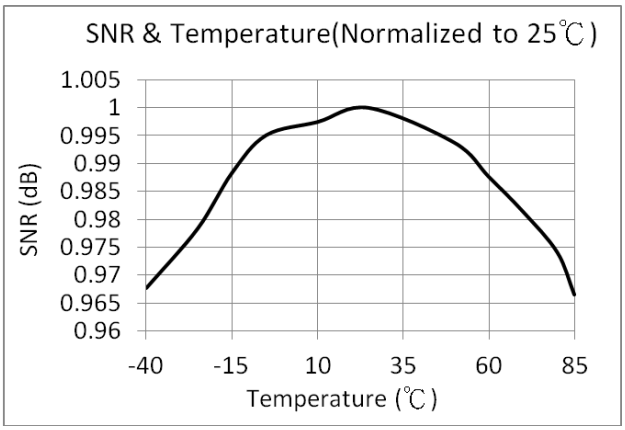
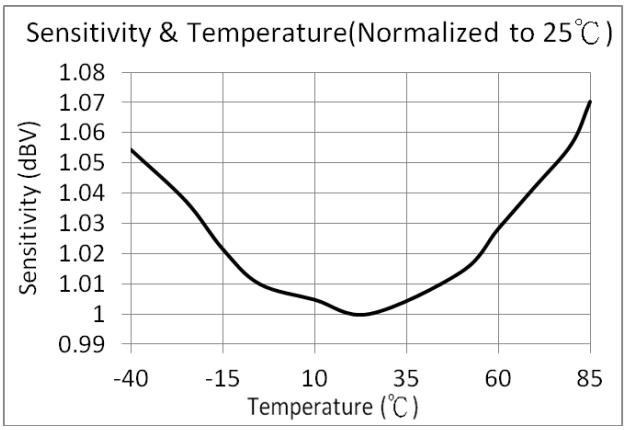
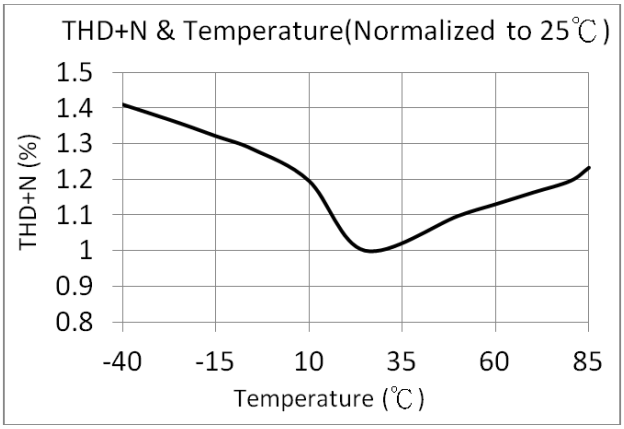
Typical Performance Characteristics

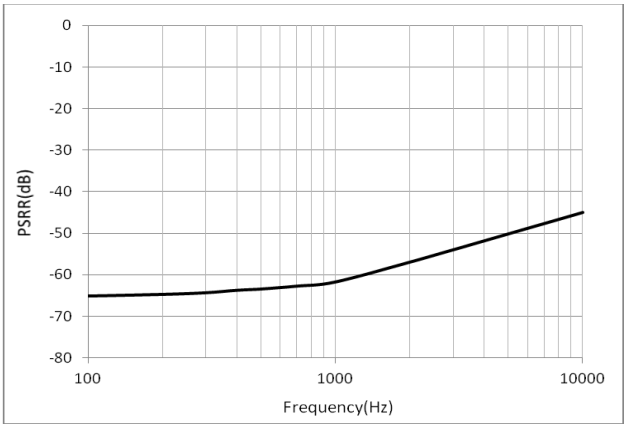


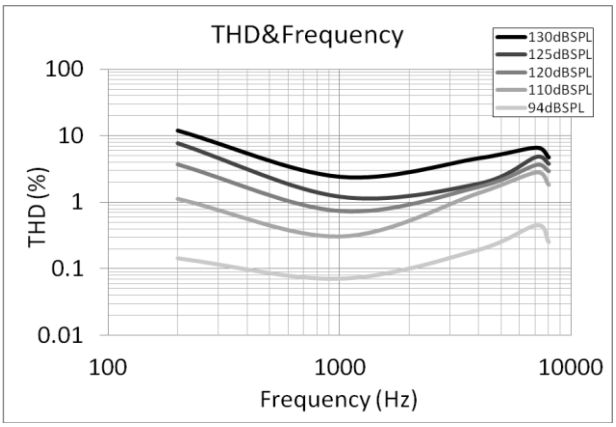












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TDMA Disturbance Immunity

- 65 dB Max @500～2500MHz (Direct RF injection test according to set figure , this set figure is based on below block diagram.)

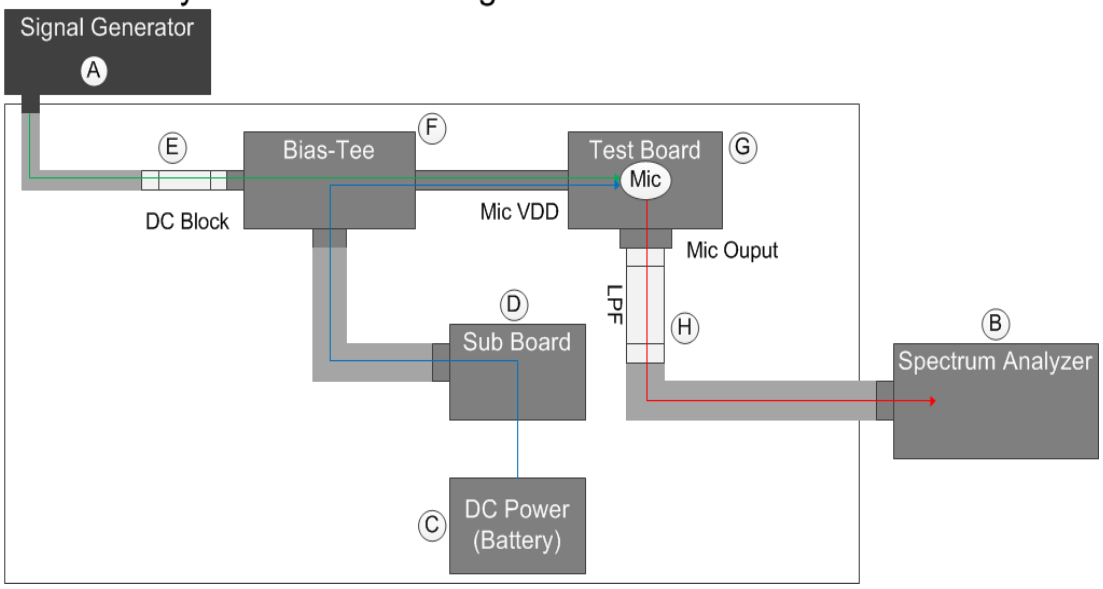
Instrument settings

Signal Generator

- modulation: 1 kHz, AM, depth 80%
- test frequency and amplitude from frequency/amplitude table

MHz	dBm	MHz	dBm	MHz	dBm	MHz	dBm	MHz	dBm
100	-4.08	600	-2.85	1100	-1.64	1600	-0.52	2100	0.05
200	-3.68	700	-2.61	1200	-1.33	1700	-0.29	2200	0.12
300	-3.31	800	-2.39	1300	-1.25	1800	-0.11	2300	0.27
400	-3.24	900	-2.11	1400	-1.08	1900	-0.04	2400	0.31
500	-3.09	1000	-1.84	1500	-0.86	2000	-0.01	2500	0.45

RF Immunity Measurement Diagram



A	Signal Generator	Rode & Schwarz SMIQ 03B
B	Spectrum Analyzer	Audio Precision APx525
C	DC Power	Battery 3V
D	Sub Board with RL & Capacitor	C: 0.1uF
E	DC block	Agilent 11742A
F	Bias-Tee	Mini-Circuits ZFBT-6GW
G	Test Board	ZTS6011E EVB
H	Low pass filter (Pass band 5M~2.5GHz)	Mini-Circuits SLP-2.5, SLP-5, SLP-150, SLP-450, SLP-1200,SLP-1650

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Production Test

Frequency Response

Frequency / Hz	Lower limit	Upper limit	Unit
50 … 100	-3	+3	
100 … 8000	-2	+2	
8000 …10 000	-5	+5	

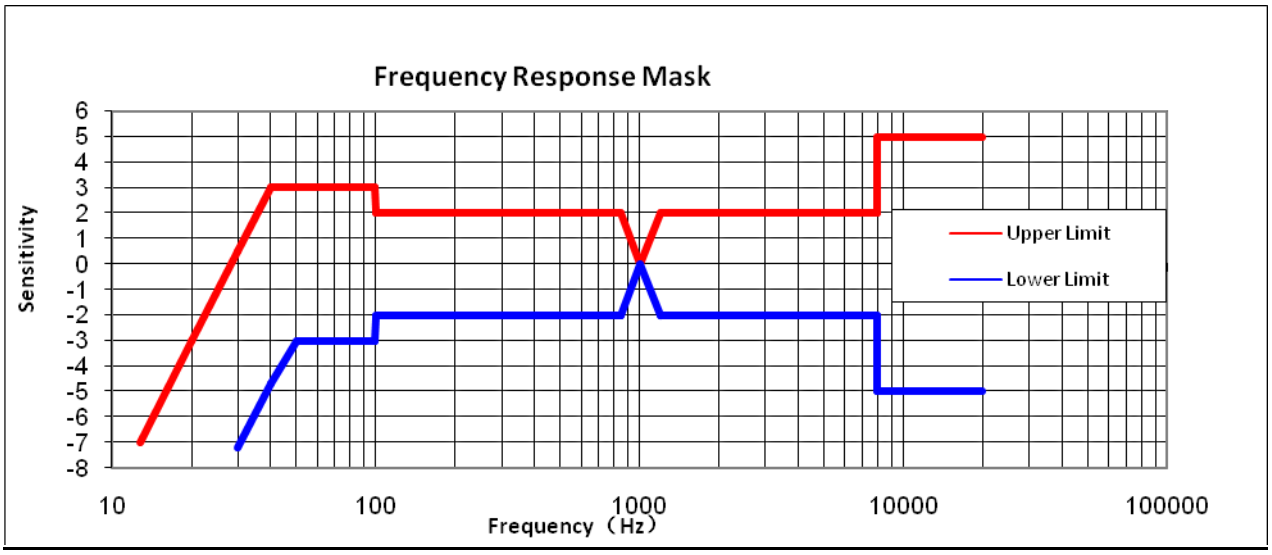

Figure 1: Frequency Response Mask

Distortion Test

Table 1.6: Distortion Requirements for the 120 dB Channel

	Requirement	Test Conditions	
		Acoustic signal	Position & Speaker
Distortion at 105 dB SPL	<3% THD+N	1 KHz sinusoidal. 105 dB SPL at test position.	Near Field Speaker
Distortion at 120 dB SPL	<10% THD+N	1 KHz sinusoidal. 120 dB SPL at test position.	Near Field Speaker

Noise Floor Test

Microphone should be measured in a silent anechoic chamber. Decimated idle channel noise output is analyzed with FFT, autocorrelation and sonogram. In addition to this, a very low frequency (~1 Hz) low-level sine signal is used to excitate the ADC input and an FFT spectrum of the audio band vs. sine level is plotted. The audio band has to be free from any idle tones and low-level noise-modulation. These can be tested, for example with power spectra and coherent spectra averaging, very low frequency excitation, auto correlation analysis

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Reliability Tests

The microphone sensitivity after stress must deviate by no more than ±3dB from the initial value.

1.Heat Test, Operational	Temperature: 85±3°C Humidity: 85±5%RH Duration: 12 hours Voltage: Applied
2.Cold Test, Operational	Temperature: -40±3°C Duration: 12 hours Voltage: Applied
3.Heat Test, Non-Operational	Temperature: 85±3°C Humidity: 50±5%RH Duration: 96 hours Voltage: Not Applied
4.Cold Test, Non-Operational	Temperature: -40±3°C Duration: 96 hours Voltage: Not Applied
5.Condensation Test, Non-Operational	Temperature: 25±3°C and 55±3°C Humidity: 95±5%RH Duration: 1 hours each, during 10 minutes ramp, 45 cycles Voltage: Not applied
6.Temperature Cycling, Non-Operational	Temperature: -40±3°C and 85±3°C Humidity: 50±5% RH Duration: 2 hours each, during 6 hours ramp, 5 cycles Voltage: Not applied
7.Thermal Shock Test, Non-Operational	Temperature: -40±3°C and 85±3°C Duration: 30 minutes each, during 5 minutes ramp, 256 cycles Voltage: Not applied
8.Free Fall Test 1.5m	Placed inside test fixture and dropped on concrete from height 1.5m. (1)3 times by 6 surfaces (2)1 times by 12 edges (3)1 times by 8 corners
9.Random Vibration	Temperature: 23±5°C Humidity: 35~70% RH Duration: 2 hours each axis(X,Y,Z) Power Spectral Density: 5Hz 0.10m2/s3(=1.0391*10-3g2/Hz) 12Hz 2.20m2/s3(=22.8602*10-3g2/Hz) 20Hz 2.20m2/s3(=22.8602*10-3g2/Hz) 200Hz 0.04m2/s3(=0.41534*10-3g2/Hz) 200Hz 0.04m2/s3(=0.41564*10-3g2/Hz)
10.Repeated Low Level Free Fall Test	Placed inside test fixture and dropped on rubber mat from height of 10cm. 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. 100 times(all faces) Rotation speed of barrel: 10~12 falls/minute
12.Free Fall Test for master box	Corner drop: Each Corner 1 time Edge drop: Each Edge 1 time Face drop: Each Face 1 time

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13.Random Vibration for master box	Sinusoidal wave vibration Frequency: 5~50Hz Acceleration:7.4m/s2(0.76G) Sweep speed:9Hz/min(5~50Hz, one way 5 min) Test duration: Direction of Face 1-3 20min Direction of Face 2-4 20min Direction of Face 5-6 20min Sample and direction of vibration : 1 direction for 1 sample Package on vibrating table: Free
14.Substrate bending Test	Deflection: 3mm Rate: 0.5mm/sec
15.Adhesion	Load: 10 N Duration: 10 seconds
16.Electrostatic Discharge Test	Capacitance: 150pF Resistance: 330Ω Duration: 10 times Air Discharge: Level 3(+/-8kV) Direct contact discharge: Level 1 (+/-2kV)
17.ESD-Human Body Model	3 discharges of ±2 kV direct contact to I/O pins. (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

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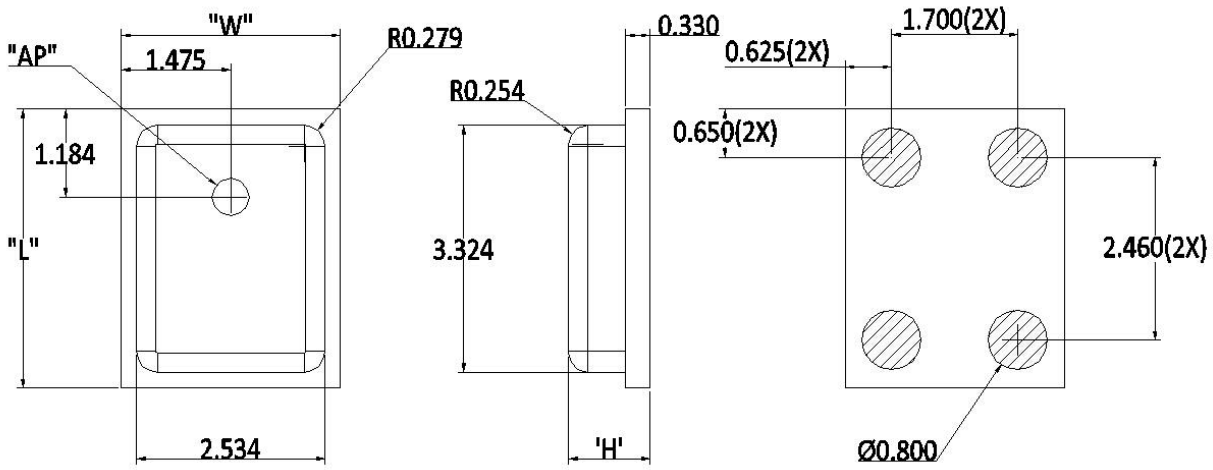
MECHANICAL SPECIFICATIOPNS



ITEM	DIMENSION	TOLERANCE	UNITS
Length (L)	3.760	±0.100	mm
Width (W)	2.950	±0.100	mm
Height (H)	1.100	±0.100	mm
Acoustic Port (AP)	Ø0.500	±0.050	mm

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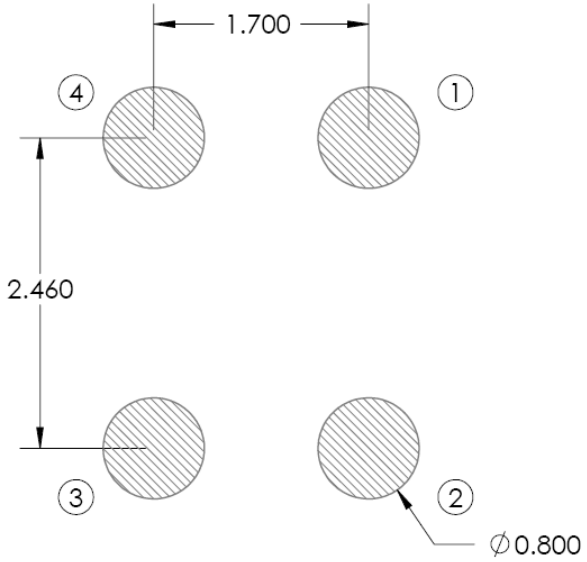
RECOMMENDED CUSTOMER LAND PATTERN

The recommended PCB land pattern for the ZTS6011E 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**.



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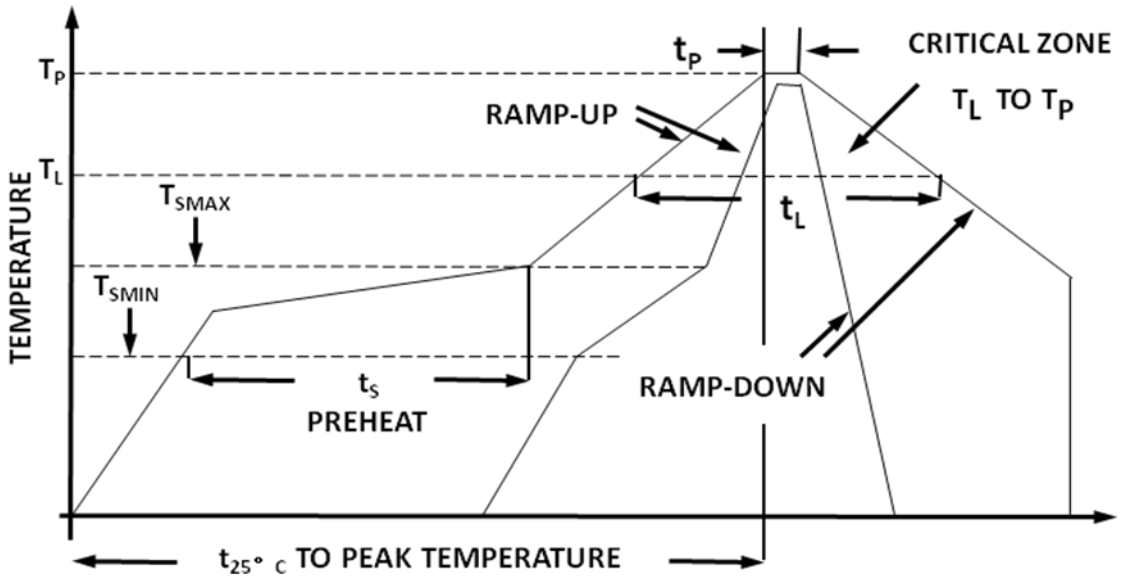
SOLDER FLOW PROFILE

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_L to T_P	1.25°C/sec max	1.25°C/sec max
Prehear	Minimum Temperature	T_{SMIN}	100°C	100°C
	Maximum Temperature	T_{SMAX}	200°C	150°C
	Time	T_{SMIN} to T_{SMAX}	60sec to 75sec	60sec to 75sec
Ramp-Up Rate		T_{SMAX} to T_L	1.25°C/sec	1.25°C/sec
Time Maintained Above Liquidous		t_L	50sec	60sec to 75sec
Liquidous Temperature		T_L	217°C	183°C
Peak Temperature		T_P	260°C +0°C/-5°C	215°C +3°C/-3°C
Time Within +5°C of Actual Peak Temperature		t_P	20 sec to 30 sec	20 sec to 30 sec
Ramp-Down Rate		T_{peak}	3°C/sec max	3°C/sec max
Time +25°C (t_{25OC}) to Peak Temperature			5 min max	5 min max

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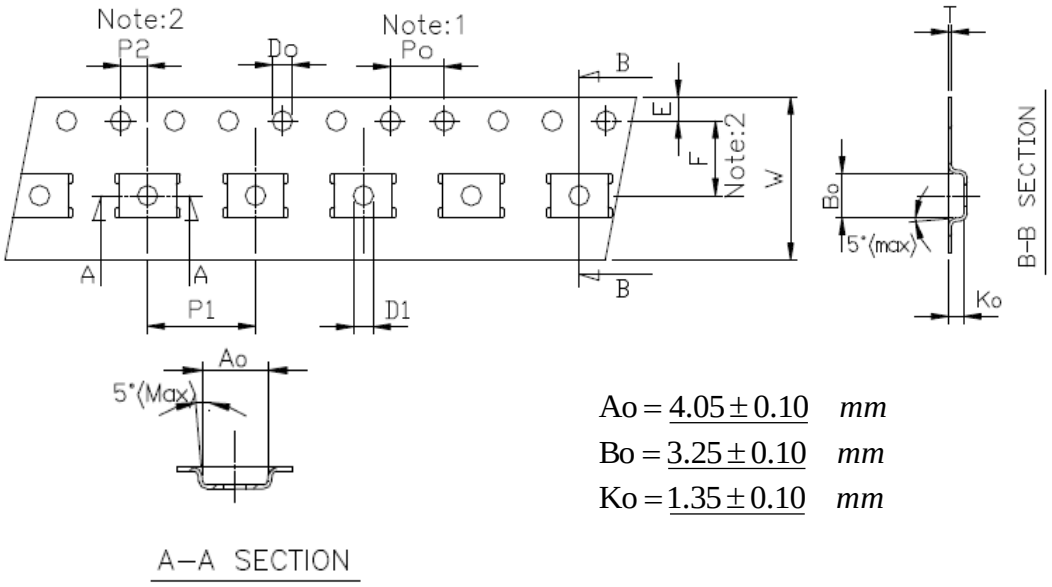
PACKAGING



$$Ao = \underline{4.05 \pm 0.10} \quad mm$$
$$Bo = \underline{3.25 \pm 0.10} \quad mm$$
$$Ko = \underline{1.35 \pm 0.10} \quad mm$$

Unit：mm

Symbol	Spec.
K1	-
P_O	4.0 ± 0.10
P1	8.0 ± 0.10
P2	2.0 ± 0.05
D_O	1.55 ± 0.05
D1	1.50 (MIN)
E	1.75 ± 0.10
F	5.50 ± 0.05
$10P_O$	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．A_O & B_O measured on a place 0.3mm above the bottom of the pocket to top surface of the carrier.

4．K_O 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.

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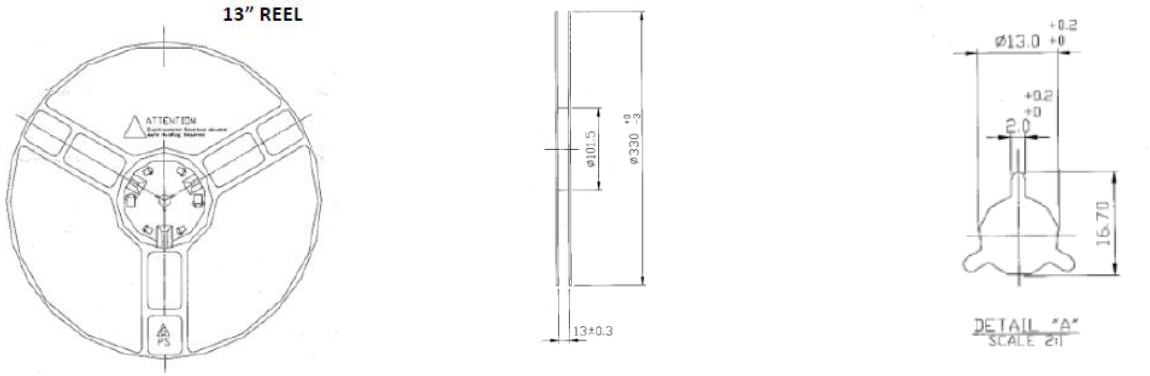
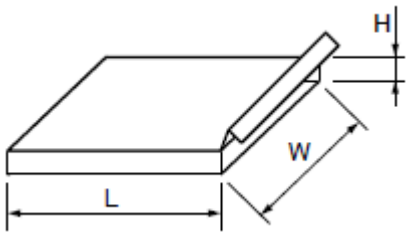


Part NO.	Reel Diameter	Quantity Per Reel	Quantity Per Inner Box	Quantity Per Outer Box
ZTS6011E	13"	5,200	5,200	46,800

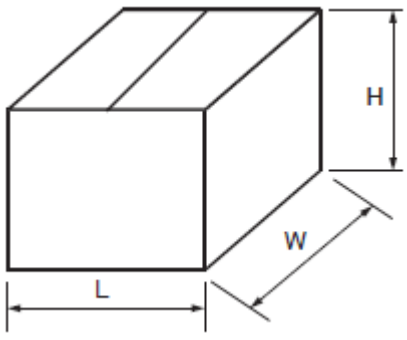
Dimensions for Inner Box



Unit：mm

L	W	H
335	339	45

Dimensions for Outer Box



Unit：mm

L	W	H
445	360	372

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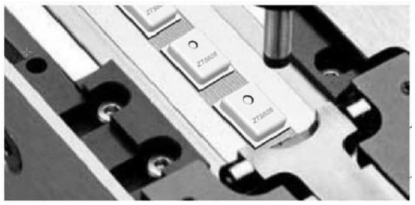
Pick and place guidelines of process



Rules of cleaning

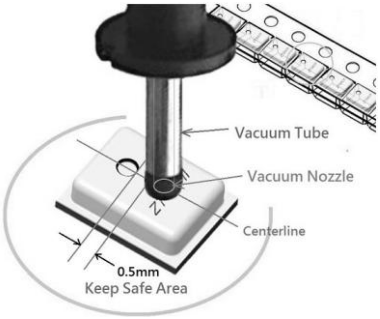
Due to Clean the PCBA gap will make MEMS Mic. unit work improperly, please do not clean it by way of ultrasonic or use any cleaning solution to wash the soldered MEMS Mic. unit. If the PCB need to be cleaned, please seal with a tape on the both side of the acoustic hole to avoid foreign material and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

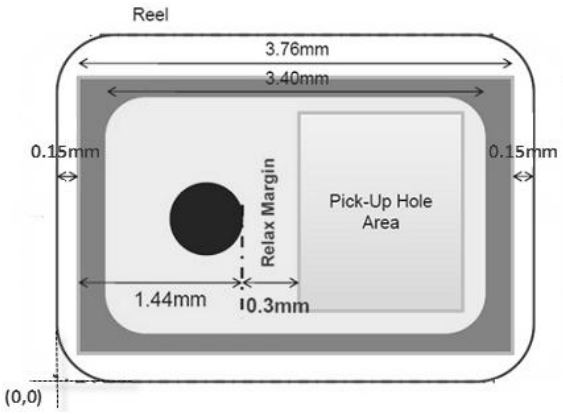
Rules of protection measurement

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.



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