Omni-directional Microphone with High SNR Digital Output (Top Port)

DESCRIPTION

The ZTS6031 is a high quality, low cost, low power digital output top-ported omni-directional MEMS microphone. ZTS6031 consists of a MEMS microphone element and a preamplifier. ZTS6031 has a high SNR and flat wideband frequency response with ±2dB in 7KHz. Sensitivity is a single tone distribution in a narrow window with under ±1dB, resulting in natural sound with high intelligibility. Due to built-in filter, ZTS6031 shows high immunity to EMI.

The ZTS6031 is available in a thin 4.00mm × 3.00mm × 1.06mm surface-mount package. It is reflow solder compatible with no sensitivity degradation. The ZTS6031 is Halogen and Lead free.

APPLICATIONS

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

ORDERING INFORMATION

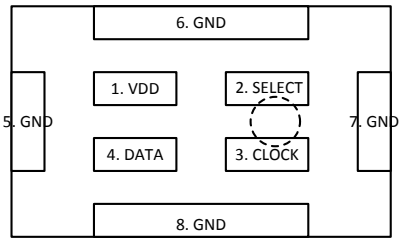
PART	RoHS	Ship, Quantity
ZTS6031	Yes	Tape and Reel, 5.2K

FEATURES

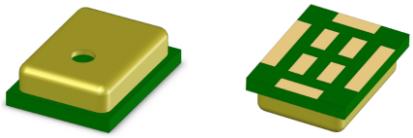
- 4.00mm×3.00mm×1.06mm surface-mount package
- Stable sensitivity over power supply range of 1.65V-3.63V
- SNR of 61dB(A)
- Sensitivity of −26dB FS
- Multi Chip Module (MCM) Package

Pins Configuration and Description

Bottom View



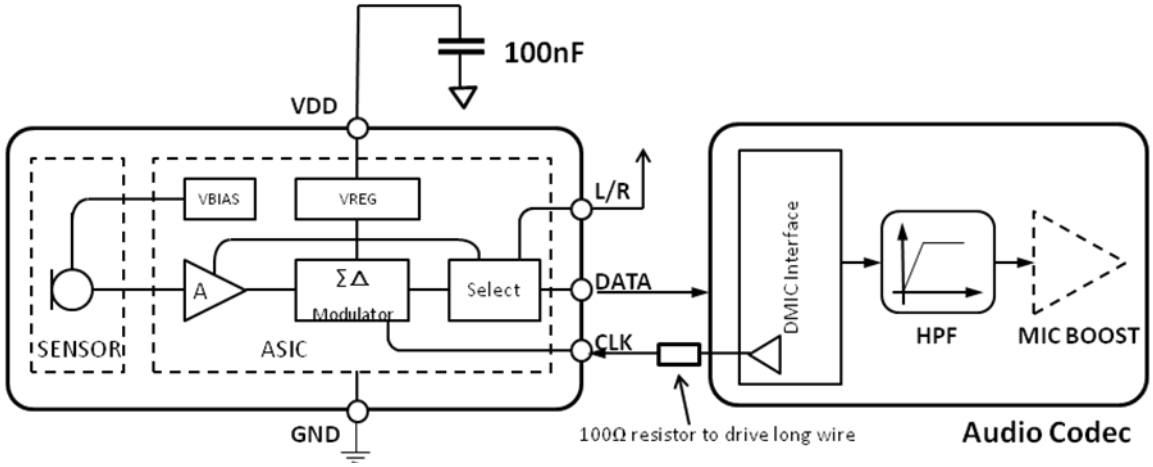
Top Metal Cover is GND.



Top Bottom

Isometric Views of ZTS6031 Microphone Package

Typical Applications



Label	Select	Drives Data After	High-Z After
Data_H	High	Rising Clock Edge	Falling Clock Edge
Data_L	Low (default)	Falling Clock Edge	Rising Clock Edge

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Absolute Maximum Ratings

CLOCK to Ground ..... –0.3V to +6.0V
SELECT, V_{DD}, DATA to Ground ..... –0.3V to +6.0V
Input Current ..... ±5mA
Operating Temperature Range ..... –40°C to +100°C
Storage 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.

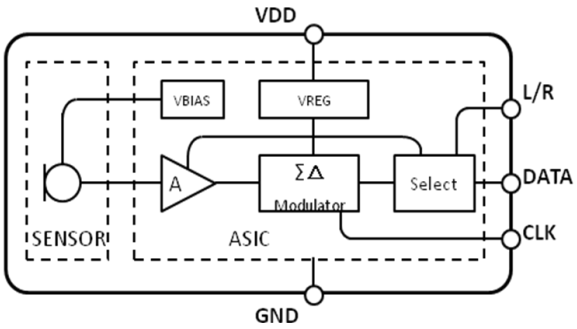
Electro-Static Discharge Sensitivity

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.

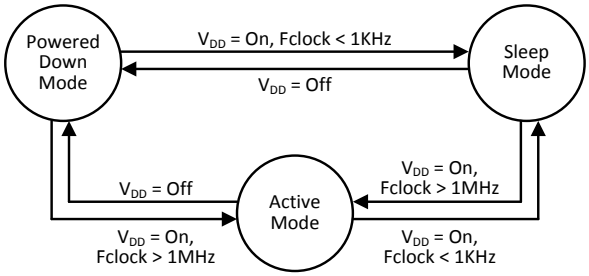
Pins Description

Pin	Symbol	Description
1	VDD	Power Supply (V_{DD}).
2	SELECT	Select.
3	CLOCK	Clock.
4	DATA	Output.
5,6,7,8	GND	Ground

Microphone Block Diagram



Microphone State Diagram



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Specifications

(T_A = +15°C ~+25°C, V_{DD} = +1.8V, f_{clock} = 3.072MHz, R.H. = 60%~70%, no load, unless otherwise noted.)

PARAMETER	Symbol	TEST CONDITIONS			MIN	TYP	MAX	UNIT
Supply Voltage (Note 1)	V_{DD}				1.65		3.63	V
Current Consumption (Note 1,6)	I_{DD}					800		µA
Standby Current (Sleep Mode) (Note 5,6)	$I_{STANDBY}$	f_{clock} < 1KHz				5	15	µA
Directivity					Omni-directional			
Sensitivity (Note 1)	S	94dB SPL @ 1KHz			−27	−26	−25	dB FS
Signal to Noise Ratio	SNR	94dB SPL @ 1KHz, A-weighted				61		dB(A)
Total Harmonic Distortion	THD	100dB SPL @ 1KHz					1	%
		120dB SPL @ 1KHz					10	%
Power Supply Rejection	PSR	217Hz, 100mV Vp-p, square wave on V_{DD}	V_{DD} =1.8V			-65		dB FS
			V_{DD} =3.3V			-71		
Polarity		Increasing sound pressure			Increasing density of 1's			
Fall-Asleep Time (Note 2,3)		V_{DD} = On, f_{clock} < 1KHz					10	ms
Wake-Up Time (Note 2,4)		V_{DD} = On, f_{clock} ≥ 1MHz					10	ms
Short Circuit Output Current	I_{SC}	Grounded output pin				1	10	mA
Output Load	C_{LOAD}						100	pF
Data Format					1/2 cycle PDM			
Clock Frequency	f_{clock}				1.0		3.25	MHz
Clock Duty Cycle					40		60	%
Clock Rise Time	t_{cr}						10	ns
Clock Fall Time	t_{ct}						10	ns
Logic Input/Output Low	V_{IOL}	I_{out} = 1mA			−0.3		0.35×V_{DD}	V
Logic Input/Output High	V_{IOH}	I_{out} = 1mA			0.65×V_{DD}		V_{DD}+0.3	V
Delay Time for Valid Data	t_{dv}	CLK = 3.072MHz, Oscilloscope: APx525 (probe Cin = 24pF)	Data Transition High	1.8V	43		190	ns
				3.3V	33		129	
			Data Transition Low	1.8V	44		189	
				3.3V	34		130	
Delay Time for High Z	t_{dz}	CLK = 3.072MHz, Oscilloscope: APx525 (probe Cin = 24pF)	Data Transition High	1.8V		27		ns
				3.3V		9		
			Data Transition Low	1.8V		22		
				3.3V		18		
Maximum Acoustic Input						120		dB SPL
Settling time	t_s			1.8V		2.65	5.5	ms
				3.3V				
Startup Time		Powered Down →Active Mode		1.8V		2.65	5.5	ms
				3.3V		2.45	5.3	

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(T_A = +15°C ~+25°C, V_{DD} = +1.8V, f_{clock} = 2.4MHz, R.H. = 60%~70%, no load, unless otherwise noted.)

PARAMETER	Symbol	TEST CONDITIONS			MIN	TYP	MAX	UNIT
Supply Voltage (Note 1)	V_{DD}				1.65		3.63	V
Current Consumption (Note 1,6)	I_{DD}					780		µA
Standby Current (Sleep Mode) (Note 5,6)	$I_{STANDBY}$	f_{clock} < 1KHz				5	15	µA
Directivity					Omni-directional			
Sensitivity (Note 1)	S	94dB SPL @ 1KHz			−27	−26	−25	dB FS
Signal to Noise Ratio	SNR	94dB SPL @ 1KHz, A-weighted				61.2		dB(A)
Total Harmonic Distortion	THD	100dB SPL @ 1KHz					1	%
		120dB SPL @ 1KHz					10	%
Power Supply Rejection	PSR	217Hz, 100mV Vp-p, square wave on V_{DD}	V_{DD} =1.8V			-65		dB FS
			V_{DD} =3.3V			-71		
Polarity		Increasing sound pressure			Increasing density of 1's			
Fall-Asleep Time (Note 2,3)		V_{DD} = On, f_{clock} < 1KHz					10	ms
Wake-Up Time (Note 2,4)		V_{DD} = On, f_{clock} ≥ 1MHz					10	ms
Short Circuit Output Current	I_{SC}	Grounded output pin				1	10	mA
Output Load	C_{LOAD}						100	pF
Data Format					1/2 cycle PDM			
Clock Frequency	f_{clock}				1.0		3.25	MHz
Clock Duty Cycle					40		60	%
Clock Rise Time	t_{cr}						10	ns
Clock Fall Time	t_{ct}						10	ns
Logic Input/Output Low	V_{IOL}	I_{out} = 1mA			−0.3		0.35×V_{DD}	V
Logic Input/Output High	V_{IOH}	I_{out} = 1mA			0.65×V_{DD}		V_{DD}+0.3	V
Delay Time for Valid Data	t_{dv}	CLK = 3.072MHz, Oscilloscope: APx525 (probe Cin = 24pF)	Data Transition High	1.8V	43		190	ns
				3.3V	33		129	
			Data Transition Low	1.8V	44		189	
				3.3V	34		130	
Delay Time for High Z	t_{dz}	CLK = 3.072MHz, Oscilloscope: APx525 (probe Cin = 24pF)	Data Transition High	1.8V		27		ns
				3.3V		9		
			Data Transition Low	1.8V		22		
				3.3V		18		
Maximum Acoustic Input						120		dB SPL
Settling time	t_s			1.8V		3.4	6	ms
				3.3V				
Startup Time		Powered Down →Active Mode		1.8V		3.4	6	ms
				3.3V		3.2	5.6	

Note 1: 100% tested.

Note 2: Valid microphone states are: Power Down Mode (mic off), Sleep Mode (low current, no output, fast start-up), and Active Mode (normal operation).

Note 3: Time from f_{clock} < 1KHz to sleep current specification is met when transitioning from Active to Sleep Mode.

Note 4: Time from f_{clock} ≥ 1MHz to all applicable specifications when transitioning from Sleep to Active Mode.

Note 5: $\Delta I_{DD} = 0.5 \times V_{DD} \times C_{LOAD} \times f_{clock}$

Note 6: Specified max values are measured at V_{DD} = +3.6V.

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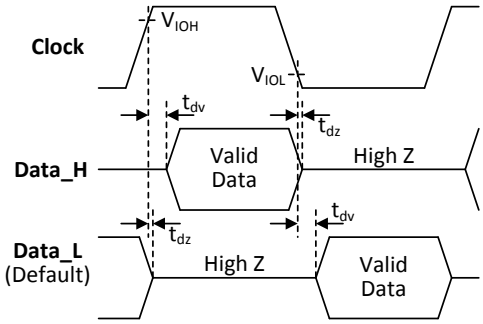
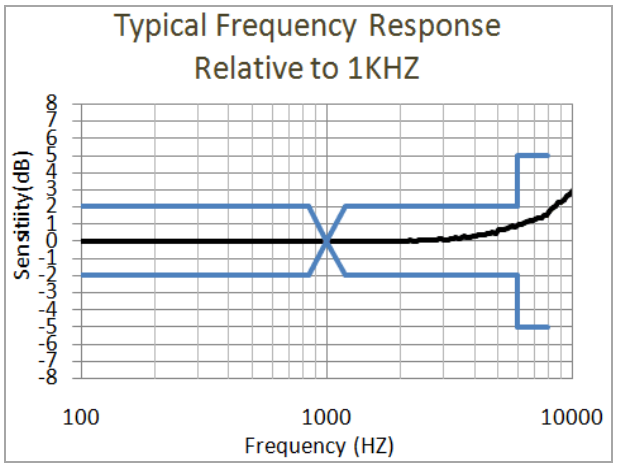
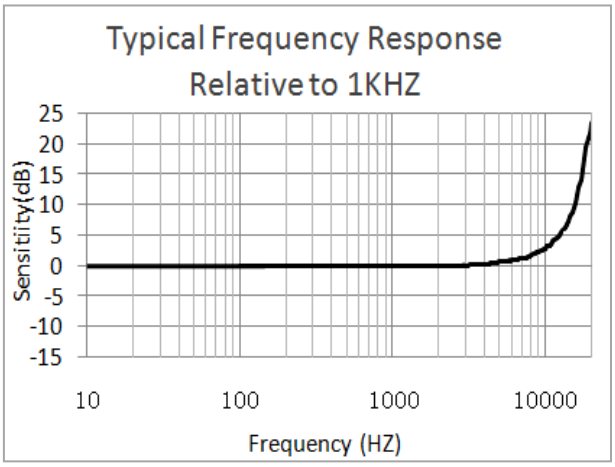
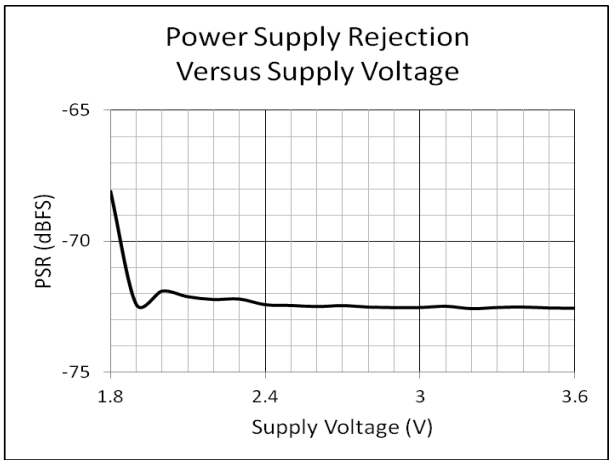
Timing Diagram

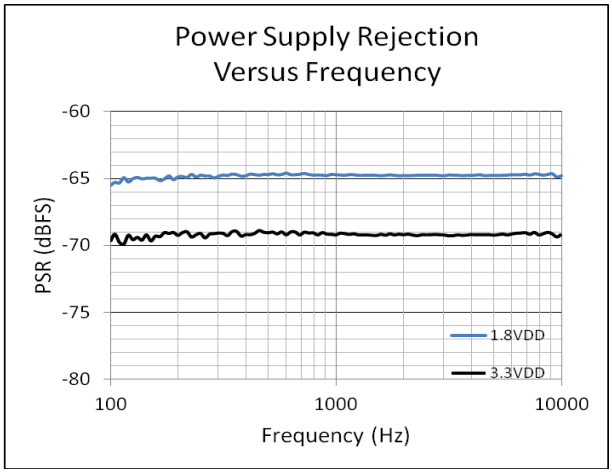


Typical Performance Characteristics









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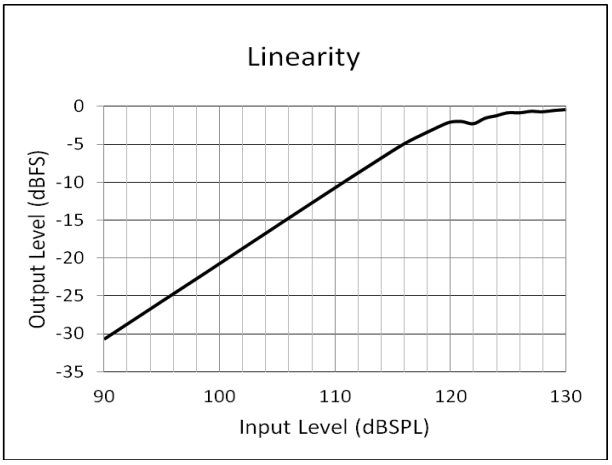

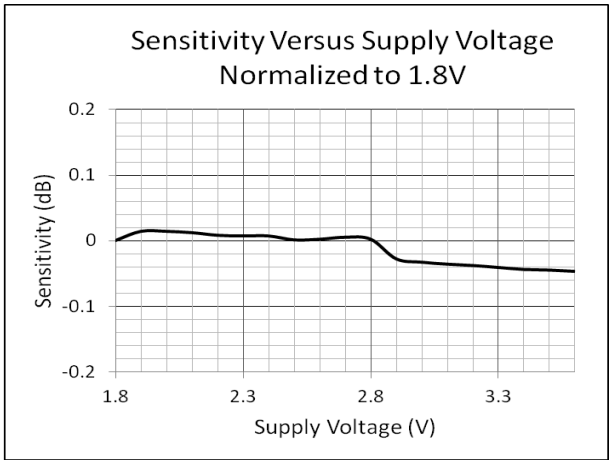

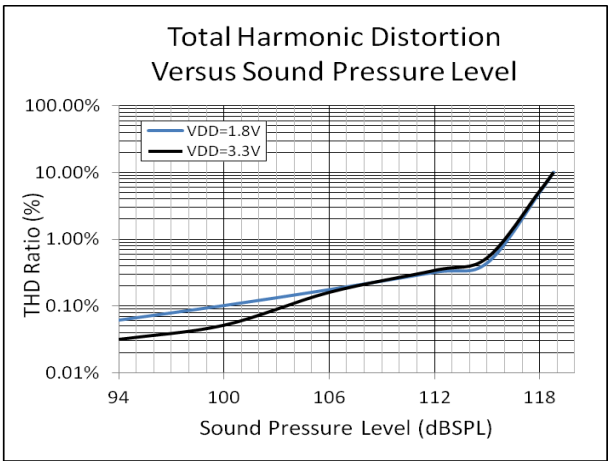

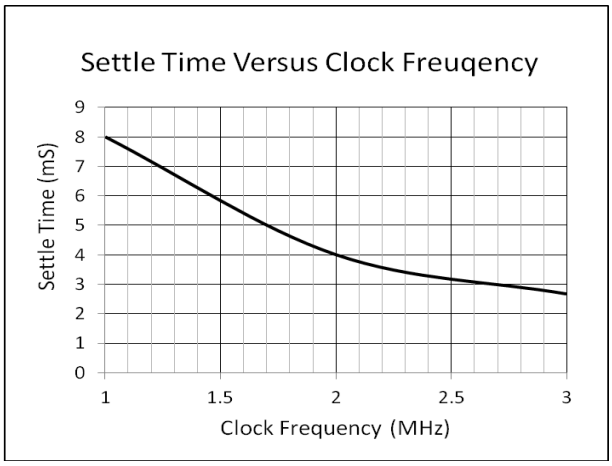

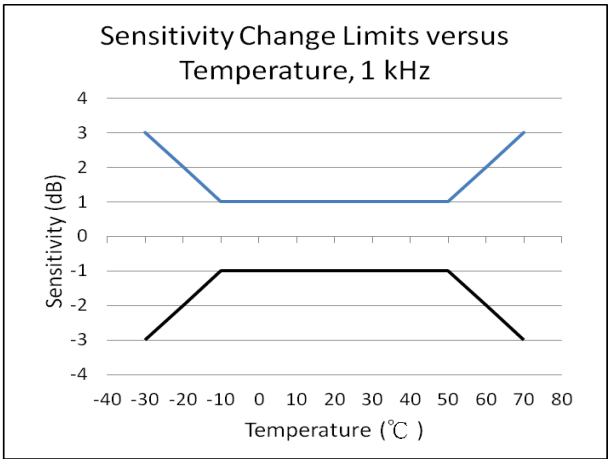

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Reliability Tests

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

1. Heat Test, Operational	Temperature: 125±3 °C Duration: 1000 hours Voltage: Applied
2. Cold Test, Operational	Temperature: -40±3°C Duration: 1000 hours Voltage: Applied
3. Heat Test, Non-Operational	Temperature: 125±3°C Duration: 1000 hours Voltage: Not Applied
4. Cold Test, Non-Operational	Temperature: -40±3°C Duration:1000 hours Voltage: Not Applied
5. Thermal Shock Test, Non-Operational	Temperature: -40±3°C and 125±3°C Duration: 30 minutes each, during 5 minutes ramp, 256 cycles Voltage: Not applied
6. Temperature humidity storage	Temperature: 85±3°C Humidity: 85±3%RH Duration: 1000 hours
	Temperature: 65±3°C Humidity: 95±3%RH Duration: 168 hours
7. Free Fall Test 1.5m	Placed inside test fixture and dropped on concrete from height 1.5m. 4 times by each surface and corner
8. Vibration	4 cycles of 20 to 2000 Hz sinusoidal sweep with 20G peak acceleration lasting 12 minutes in X, Y, and Z directions
9. Mechanical Shock	5 pulses of 10000g in each of the ±X, ±Y, and ±Z directions
10. Electrostatic Discharge Test	Capacitance: 150pF Resistance: 330Ω Duration: 10 times Air Discharge: Level 4(+/-15kV) Direct contact discharge: Level 4 (+/-8kV)
11. Human Body Mode	±2000 Volt
12. Charged-Device Model	±250 Volt
13. Reflow	5 reflow cycles with peak temperature of 260℃
14. Solderability	245±5 °C ,5sec, 95% Tin on pad surface
15. Tumble test	300 tumbles from a height of 1m onto a steel base.
16. HAST	Temperature: 130±3°C Humidity: 85±3%RH Duration: 96 hours Voltage: Applied
17. Air Blow	0.45MPa, distance 3cm, time 10s

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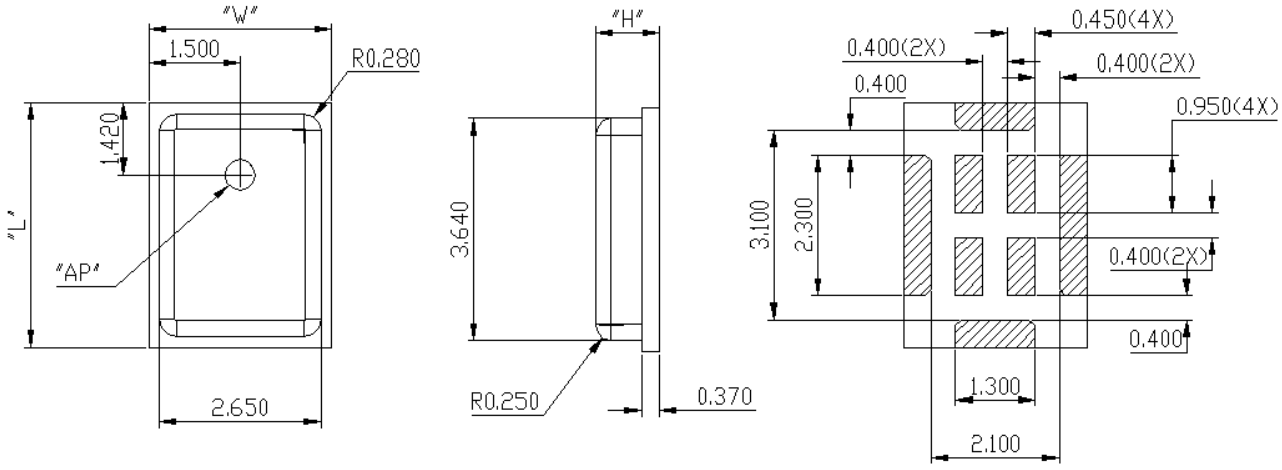
MECHANICAL SPECIFICATIONS



ITEM	DIMENSION	TOLERANCE	UNITS
Length (L)	4.00	±0.10	mm
Width (W)	3.00	±0.10	mm
Height (H)	1.06	±0.10	mm
Acoustic Port (AP)	Ø0.65	±0.08	mm

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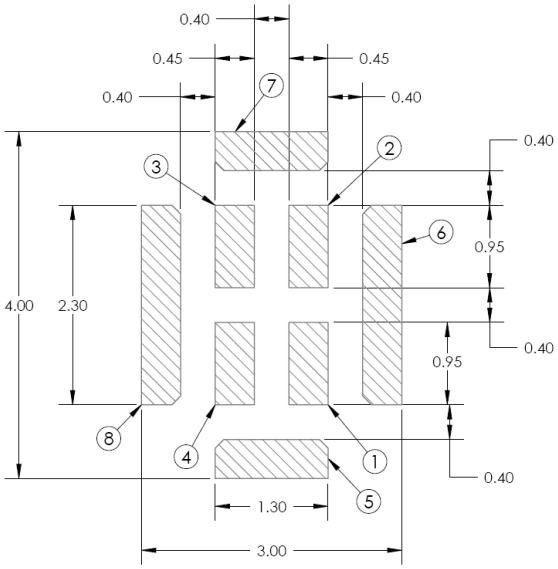
RECOMMENDED CUSTOMER LAND PATTERN

The recommended PCB land pattern for the ZTS6031 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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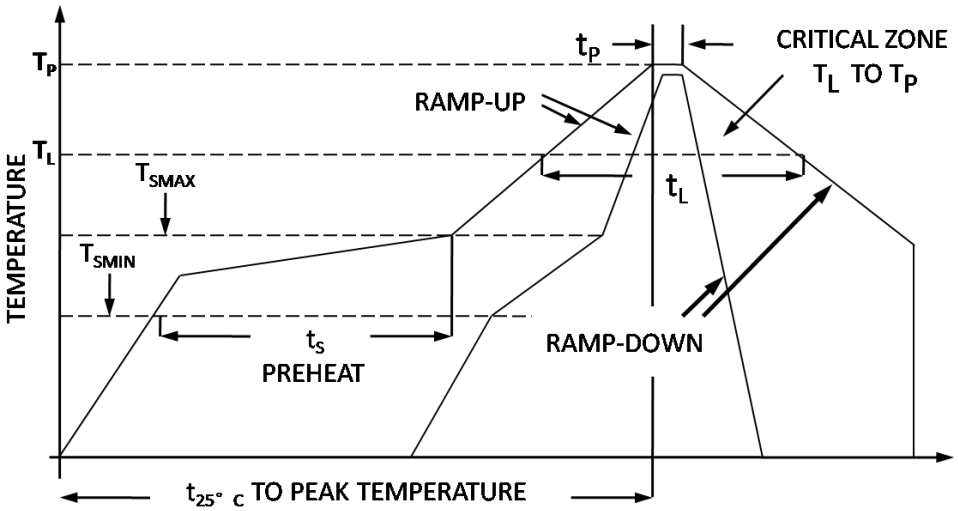
SOLDER FLOW PROFILE

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 120sec	60sec to 120sec
Ramp-Up Rate		T_{SMAX} to T_L	1.25°C/sec	1.25 °C /sec
Time Maintained Above Liquidous		t_L	60sec to 150sec	60sec to 150sec
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}	6°C/sec max	6 °C /sec max
Time +25°C (t_{25OC}) to Peak Temperature			8 min max	6 min max

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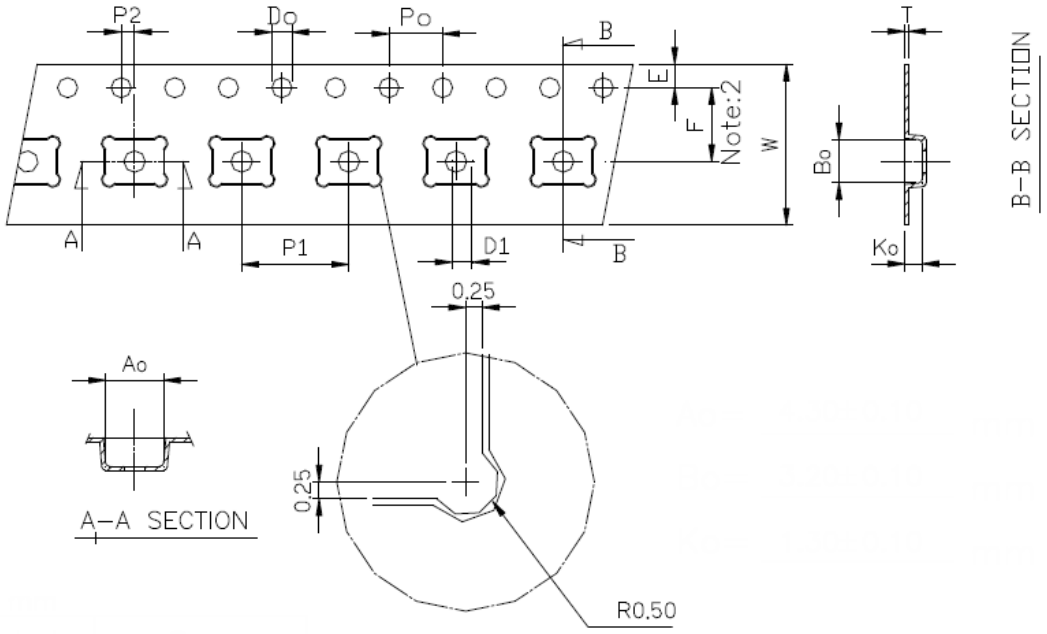
PACKAGING



$$Ao = 4.30 \pm 0.10 \quad mm$$
$$Bo = 3.20 \pm 0.10 \quad mm$$
$$Ko = 1.30 \pm 0.10 \quad mm$$

Unit：mm

Symbol	Spec.
Po	4.0 ± 0.10
P1	8.0 ± 0.10
P2	1.0 ± 0.10
Do	1.55 ± 0.05
D1	1.50 (MIN)
E	1.75 ± 0.10
F	5.50 ± 0.10
10Po	40.0 ± 0.10
W	12.0 ± 0.30
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.

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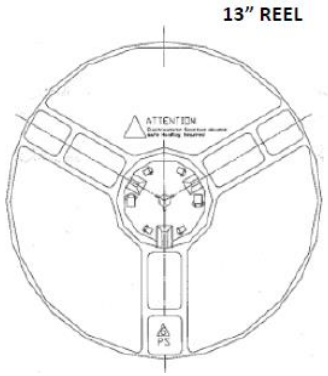
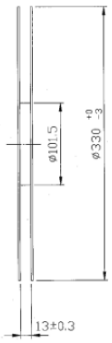
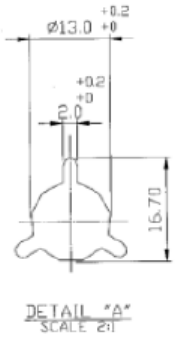
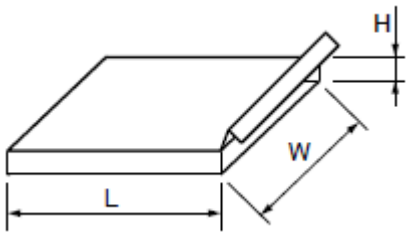






Part NO.	Reel Diameter	Quantity Per Reel	Quantity Per Inner Box	Quantity Per Outer Box
ZTS6031	13"	5200	5200	46800

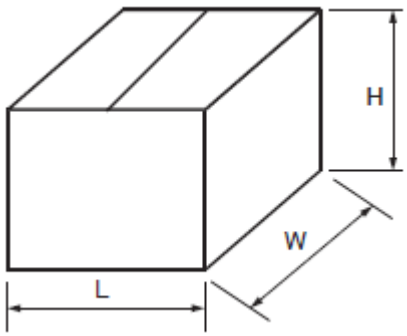
Dimensions for Inner Box



Unit：mm

L	W	H
335	339	45

Dimensions for Outer Box



Unit：mm

L	W	H
445	360	372

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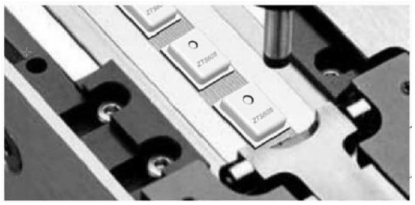
Pick and place guidelines of process



Rules of cleaning

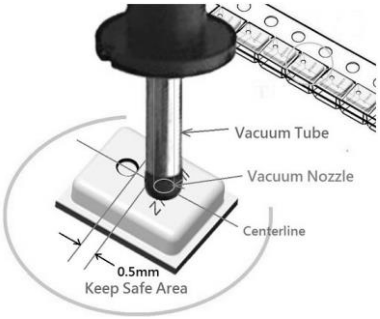
Due to Clean the PCBA gap will make MEMS Mic. unit work improperly, please do not clean it by way of ultrasonic or use any cleaning solution to wash the soldered MEMS Mic. unit. If the PCB need to be cleaned, please seal with a tape on the both side of the acoustic hole to avoid foreign material and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

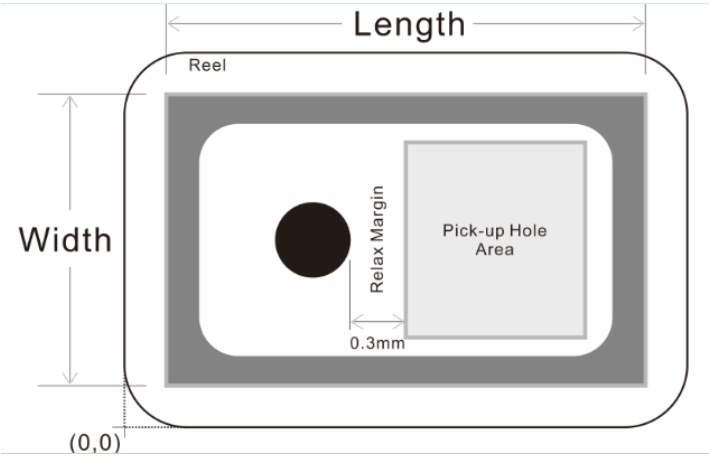
Rules of protection measurement

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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