

# Bestar Electronics Industry Co., Ltd.

Manufacturing various kinds of acoustic components like buzzer, speaker, receiver, alarm and specially of latest technology of SMD buzzer, mini receiver for mobile phone. Products widely used in telecommunication, automotive industry, household application, security system, music device and so on. Manufacturing various kinds of acoustic components like buzzer, speaker, receiver, alarm and specially of latest technology of mini receiver for mobile phone. Products widely used in telecommunication, automotive industry, household application, security system, music device and so on. Manufacturing various kinds of acoustic components like buzzer, speaker, receiver, alarm and specially of latest technology of SMD buzzer, mini receiver for mobile phone. Products widely used in telecommunication, automotive industry, household application, security system, music device and so on. Manufacturing various kinds of acoustic components like buzzer, speaker, receiver, alarm and specially of latest technology of SMD buzzer, mini receiver for mobile phone. Products widely used in telecommunication, automotive industry, household application, security system, music device and so on. Manufacturing various kinds of acoustic components like buzzer, speaker, receiver, alarm and specially of latest technology of SMD buzzer, mini receiver for mobile phone. Products widely used in telecommunication, automotive industry, household application, security system, music device and so on.

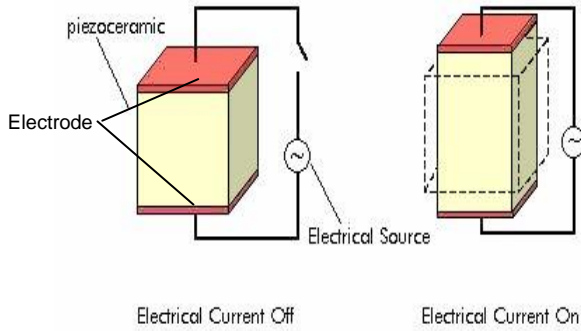


Piezoelectric Acoustic Generators



# Introduction

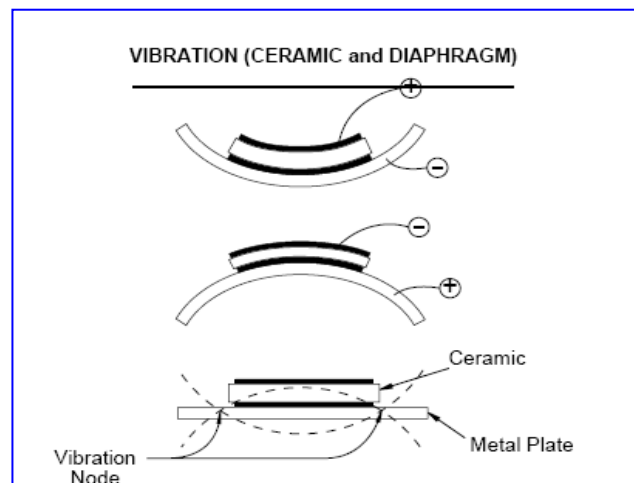
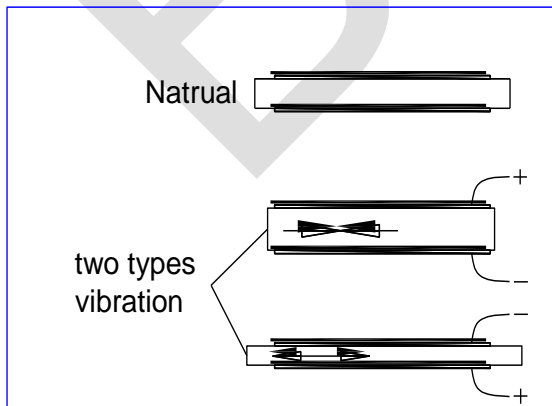
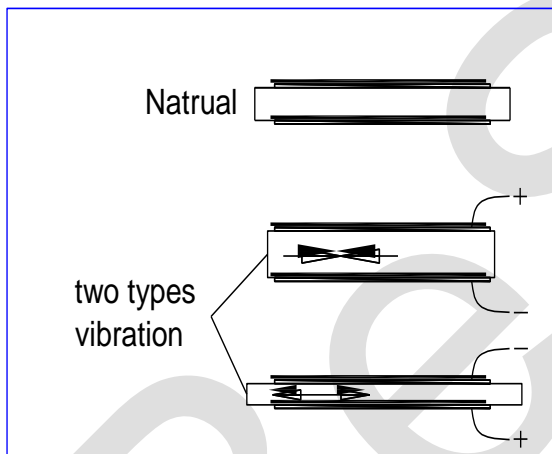
## 1. The piezoelectric effect



The piezoelectric effect describes the relation between a mechanical stress and an electrical voltage in solids. It is reversible: an applied mechanical stress will generate a voltage and an applied voltage will change the shape of the solid by a small amount (up to a 4% change in volume). In physics, the piezoelectric effect can be described as the link between electrostatics and mechanics.

### The Piezoelectric Materials

The piezoelectric effect occurs only in non conductive materials. Piezoelectric materials can be divided in 2 main groups: crystals and ceramics. The most well-known crystal piezoelectric material is quartz ( $\text{SiO}_2$ ), and the ceramic piezoelectric material is Lead Zirconate Titanate (PZT). PZT is the best piezoceramics, but the pure PZT usually is not perfect, by doping the PZT material, its piezoelectric characteristics can be modified: especially the hardness or softness of the material, for example, doping the  $\text{Sb}_2\text{O}_3$ ,  $\text{Nb}_2\text{O}_5$ ,  $\text{BaCO}_3$  and so on.



### The Working method of the Piezoelectric Acoustic Generator Element

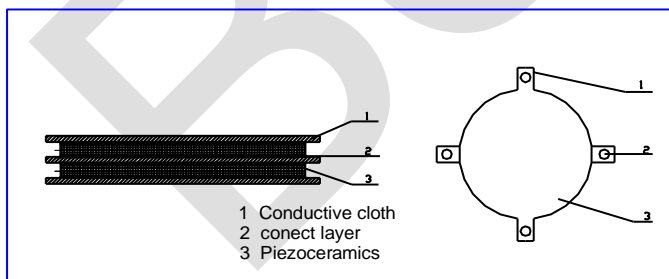
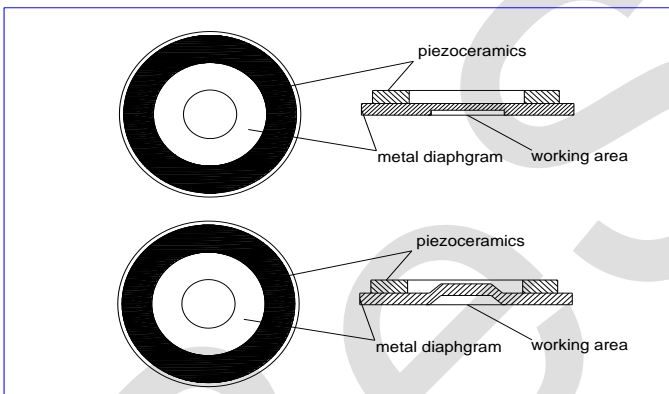
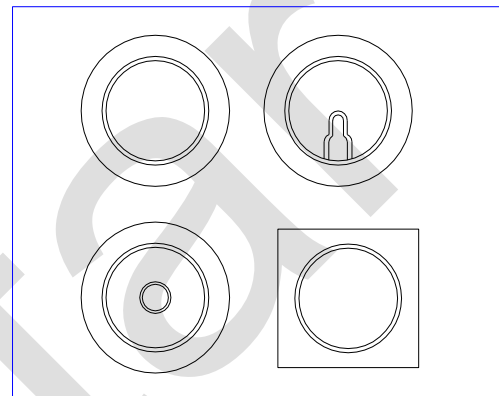
The basic element in all of these is a piezoelectric ceramic mounted on a metal diaphragm. When AC voltage is applied across the electrodes of the piezoelectric ceramic it expands and contracts at the frequency applied. This causes the metal diaphragm

bend, producing sound waves (Figures 1 and 2). The metal diaphragm is usually brass, stainless steel or nickel alloy, thickness less than 0.5 mm. PZT ceramic material is used as the piezoelectric element. This element is designed so that the mechanical resonant frequency matches the frequency of the driving signal.

## 2. Types are available in BeStar

### Used for buzzer:

1. two-terminal circle type
2. three-terminal circle with brim feedback
3. three-terminal circle with centre feedback
4. two-terminal square type

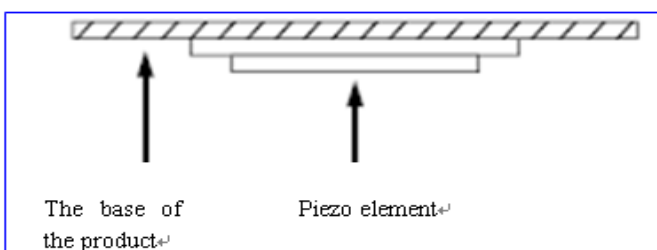


### Used for ultrasonic atomization:

The shape of the piezoceramics in this configuration is annular, the centre is the working area, and there are about 1 hundred micro holes with a 0.007-0.01 mm diameter.

### Used for voice talking and alarm:

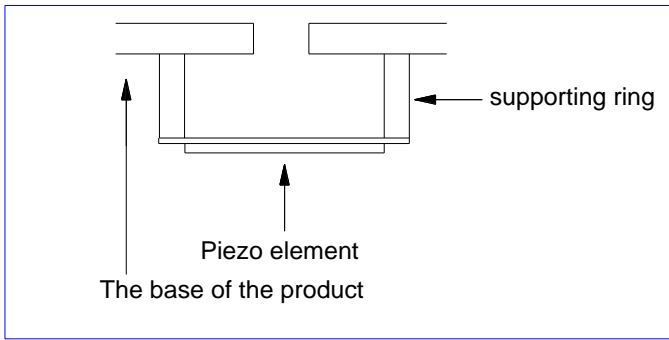
3 conductive clothes and piezoceramics plates and included in this configuration, the totally thickness is no more than 0.5mm.



### Method of Installing

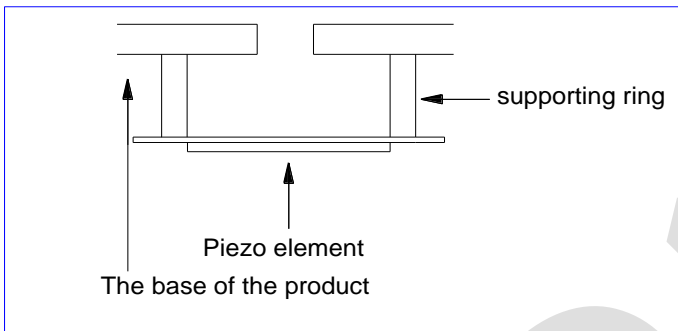
#### Simplest Mounting Method

The simplest method is to stick the piezo element to the plate using double-sided adhesive tape or other glue, for example, the ultrasonic sensor for parking using this method is ok.



#### Circumference Fixing Method

This method is to fix outside circumference of the element to the supporting ring of the plate, considerable sound pressure can be obtained covering a wide frequency range around the resonant frequency.



#### Nodal Mounting Method

This method is to fix the nodal diameter of the element to the supporting ring of the plate. Loud sound pressure can be obtained at the resonant frequency. The sound pressure will drastically drop when the frequency is shifted from the resonant frequency

### 3. Specification

- Free from RF noise and contact sparking
- Simple, compact and light weight
- Consume little power and have long life
- Generate various timbres of pitches

#### For buzzer

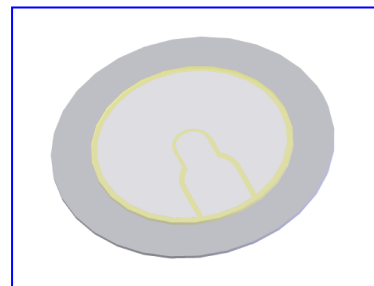
#### Name of Piezo Plate

#### FT-20 T-2.0 A1

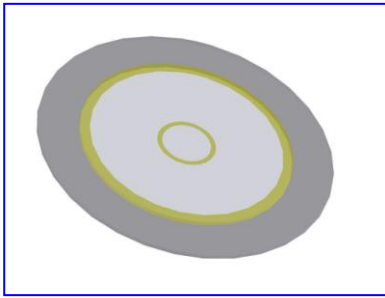
- ① ② ③ ④ ⑤
- ① Piezoceramics element
  - ② Diameter, eg. 20mm
  - ③ Material of the metal
  - ④ Resonant frequency in KHz



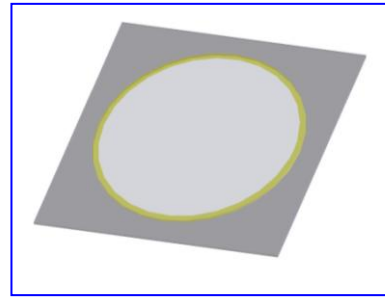
A1 – two-terminal circle type, the metal is Stainless Steel, Brass and Nickle Alloy.



B1 – three-terminal circle with brim feedback, the metal is brass and Stainless Steel



C1 – three-terminal circle with centre feedback, the metal is Brass and Stainless Steel



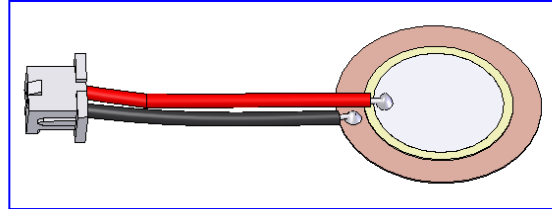
D1 – two-terminal square type, the metal is Nickel Alloy

Specification table

Model No.	Resonant Frequency KHz	Resonant Impedance Ω	Static Capacitance nF	Dimensions(mm)					Metal disc material
				Metal disc	Ceramic disc	Electr -ode	Total thickness	Metal thick ness	
FT-11T-9.0A1	9±1	3000	12±30	11	8	7	0.15	0.1	Brass
FT-11.2H-6.5A1	6.5±0.5	300	16±30	11.2	8.9	8	0.12	0.05	42-Alloy
FT-12H-6.5A1	6.5±0.5	300	16±30%	12	10	8.5	0.12	0.05	42-Alloy
FT-13T-6.5A1	6.5±0.5	500	12±30%	13	9	8	0.19	0.1	Brass
FT-13.8H-4.7D1	4.7±0.5	500	15±30%	13.8	13.1	12	0.2	0.1	42-Aloy
FT-14.2H-4.2D1	4.2±0.5	500	20±30%	14.2	12	11	0.2	0.1	42-Alloy
FT-15T-4.1A1	4.1±0.5	500	8±30%	15	8.4	7	0.23	0.1	Brass
FT-15H-5.3A1	5.3±0.5	300	15.5 ±30%	15	12	10.5	0.15	0.05	42-Alloy
FT-15T-6.0A1	6.0±0.5	350	10±30%	15	10	9	0.22	0.1	Brass
FT-15T-6.6A1	6.6±0.5	400	14±30%	15	11	10	0.2	0.1	Brass
FT-20T-2.0A1	2.0±0.5	300	90±30%	20	15	13.8	0.1	0.05	Brass
FT-20T-3.9A1	3.9±0.5	300	30±30%	20	15	13.8	0.22	0.12	Brass
FT-20T-4.5A1	4.5±0.5	500	24±30%	20	15	13.8	0.2	0.1	Brass
FT-21N-3.4A1	3.4±0.5	100	126±30%	21	19.7	18.5	0.27	0.1	Brass
FT-23G-3.5A1	3.5±0.5	1500	10±30%	22.75	14.8	13.6	0.25	0.1	Stainless Steel
FT-23G-3.5B1	3.5±0.5	1500	10±30%	22.75	14.8	13.6	0.25	0.1	Stainless Steel
FT-23G-3.7A1	3.7±0.5	300	38±30%	23	20	18.8	0.25	0.1	Stainless Steel
FT-27T-2.3A1	2.3±0.5	500	45±30%	27	20	18.8	0.2	0.1	Brass
FT-27T-2.7A1	2.3-2.6	300	45±10	27	20	18.8	0.22	0.1	Brass
FT-27T-3.5A1	3.5±0.5	500	40±30%	27	20	18.8	0.37	0.2	Brass
FT-27T-4.0A1	4.0±0.5	1500	24±30%	27	20	18.8	0.4	0.2	Brass
FT-27T-4.3A1	4.3±0.5	500	20±30%	27	21	19.8	0.45	0.25	Brass
FT-28T-2.7A1	2.7±0.5	3000	40±30%	28	20	18.8	0.33	0.2	Brass
FT-31T-1.3A1	1.3±0.5	500	50±20%	31	20	18.8	0.2	0.1	Brass

FT-32G-2.9A1	2.9±0.5	600	40±30%	31.75	25	23.4	0.38	0.15	Stainless Steel
FT-32G-3.0B1	3±0.5	500	30±30%	31.7	25	23.4	0.4	0.15	Stainless Steel
FT-32G-3.5B1	3.5±0.5	600	3.5±30%	31.75	25	23.4	0.38	0.15	Stainless Steel
FT-35H-1.5B1	1.5±0.2	300	40±30%	35	25	23.4	0.4	0.2	42-Alloy
FT-35G-2.9A1	2.9±0.5	200	30±30%	35	25	23.4	0.53	0.25	Stainless Steel
FT-35G-2.9C1	2.9±0.5	300	35±30%	34.7	25	23.4	0.5	0.3	Stainless Steel
FT-35G-3.1B1	3.1±0.5	250	M-G26±30% F-G3.5±30%	34.7	25	23.4	0.55	0.25	Stainless Steel
FT-35G-3.1C1	3.1±0.5	300	35±30%	35	25	23.4	0.53	0.35	Stainless Steel
FT-35G-3.2B1	3.2±0.5	250	M-G30±30% F-G5±30%	35	25	23.4	0.6	0.35	Stainless Steel
FT-35G-3.3A1	3.3±0.5	3000	60±30%	35	25	23.4	0.55	0.35	Stainless Steel
FT-35T-2.6A1	2.6±0.5	200	33±30%	35	25	23.4	0.47	0.25	Brass
FT-35T-2.9B	2.9±0.5	250	M-G23±30% F-G1.7±30%	35	25	23.4	0.53	0.25	Brass
FT-35T-3.1B1	3.1±0.5	250	M-G27±30% F-G1.7±30%	35	25	23.4	0.6	0.35	Brass
FT-35G-3.8B1	3.8±0.5	250	M-G20±30% F-G3.5±30%	35	25	23.4	0.82	0.45	Stainless Steel
FT-39H-0.4A1	0.4±0.15	300	600±35%	39	25	23.4	0.15	0.05	42-Alloy
FT-39T-2.5B1	2.5±0.3	300	30±30%	39	25	23.4	0.6	0.4	Brass
FT-41T-1.1A1	1.1±0.3	300	70±20%	41	25	23.4	0.25	0.13	Brass
FT-41T-1.2A1	1.2±0.3	300	70±20%	41	25	23.4	0.3	0.15	Brass
FT-42.8T-1.3A1	1.3±0.2	300	65±30%	42.8	29	27.4	0.34	0.18	Brass
FT-47T-0.7A1	0.7±0.2	1500	120±30%	47	25	23.4	0.28	0.14	Brass
FT-50G-1.5A1	1.2~1.5	1000	40±30%	50	30	28.4	0.4	0.15	Stainless Steel
FT-50G-1.8A1	1.5~1.8	1000	40±30%	50	30	28.4	0.6	0.3	Stainless Steel
FT-50G-3.1A1	2.95~ 3.35	300	50±30%	50	25	23.4	0.36	0.2	Stainless Steel
FT-50T-0.87A1	0.87±0.25	3000	40±30%	50	25	23.4	0.44	0.2	Brass
FT-50T-2.7A1	2.7±0.3	250	35±30%	50	35	33.4	1.1	0.5	Brass
FT-50T-2.7B1	2.7±0.3	250	M-G18±30% F-G0.7±30%	50	35	33.4	1.06	0.53	Brass
FT-50T-3.3A1	3.3±0.5	300	30±30%	50	25	23.4	0.5	0.25	Brass
FT-55G-3.2A1	3±0.5	350	40±30%	55	25	23.4	0.45	0.22	Stainless Steel

All the types of above products can be attached a connector with two or three wires according the customer's requirement, we also can produce some other dimensions piezo plate if customers can't find out the exact dimension he or she require from the above table.



### For Ultrasonic Atomization

Ultrasonic atomization represents a very specialized type of atomizing nozzle. Very fine droplets are generated without the use of high pressure or atomizing air. The droplets leave the nozzle with no feed velocity and their fall is affected only by gravity and ambient air conditions. Air assisted units are available which have no function in the atomization but solely in assisting with control of the spray pattern. The atomization of liquids with ultrasonic nozzles is based on the effect of producing capillary waves on the surface of a liquid on a vibrating surface. Contrary to gravitational waves, like in the oceans where gravity causes the restoring forces, in capillary waves the surface tension of the liquid is responsible for the development of waves.

These special waves occur in the range of a small wave length and a high frequency. That is why the surface tension has a significant influence on the atomization characteristic of ultrasonic nozzles.

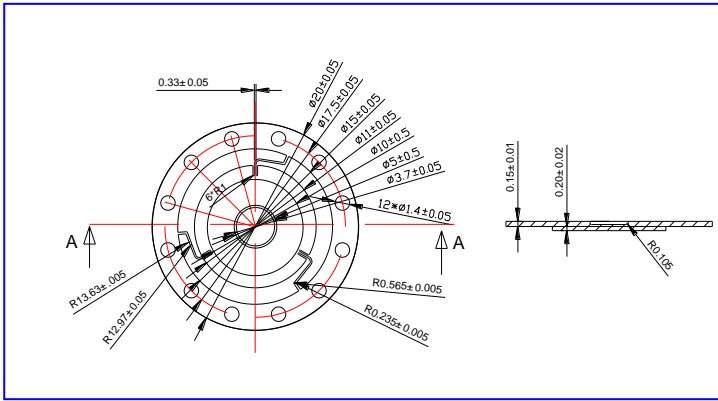
During atomization capillary waves are transformed into droplets by increasing the amplitude until the peak of the wave is cut into a droplet. Each of these droplets then becomes part of the spray.

Since the wave length is a function of the vibration frequency, the droplet size is determined by the frequency, which means that a high vibration frequency of the ultrasonic nozzle leads to fine droplets and a low frequency results in coarser droplets.

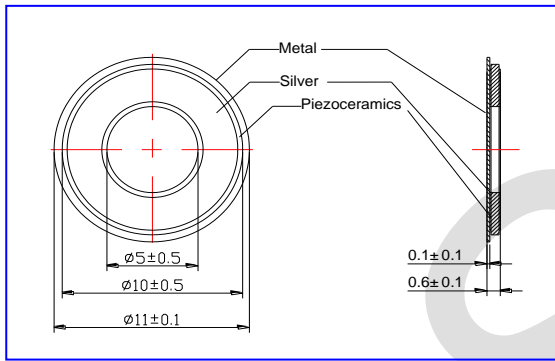
The atomization process has a limited efficiency, which depends mainly on the viscosity of the liquid.

We offer different capacity ultrasonic nozzles covering a diameter of 0.006 to 0.01mm of the holes.

The high frequency sound waves that atomize the fluid being sprayed are beyond the range of human hearing. The wetted portions of ultrasonic nozzles are constructed of Stainless steel because it has very good acoustical properties, and it is superior on corrosion resistance.



Type	FT-20G-93A1
Resonant Frequency	90±10 KHz
Operating Voltage	Max.25Vp-p
Resonant Impedance	Max.70Ω
Stastic Capacitance	6.8±30%nF
Insulation Resistance	Min.200MΩ
Operation Temperature	-30~60℃
Storage Temperature	-40~70℃

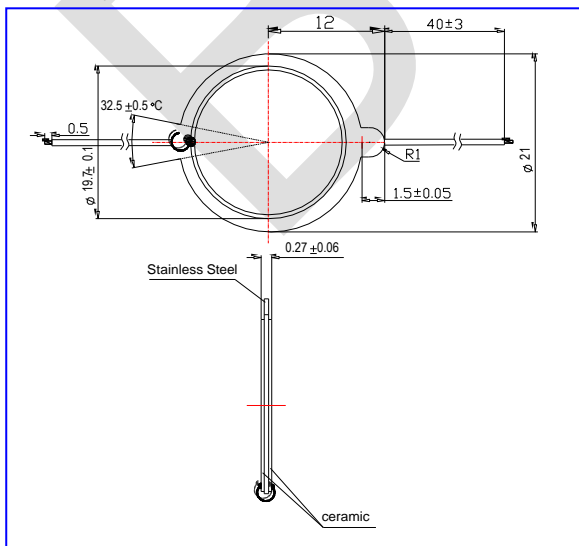


Type	FT-10G-145A1
Resonant Frequency	145±10 KHz
Operating Voltage	Max.30Vp-p
Resonant Impedance	Max.150Ω
Stastic Capacitance	2.0±30%nF
Insulation Resistance	Min.200MΩ
Operation Temperature	-30~60℃
Storage Temperature	-40~70℃

### For Siren and Voice Talking

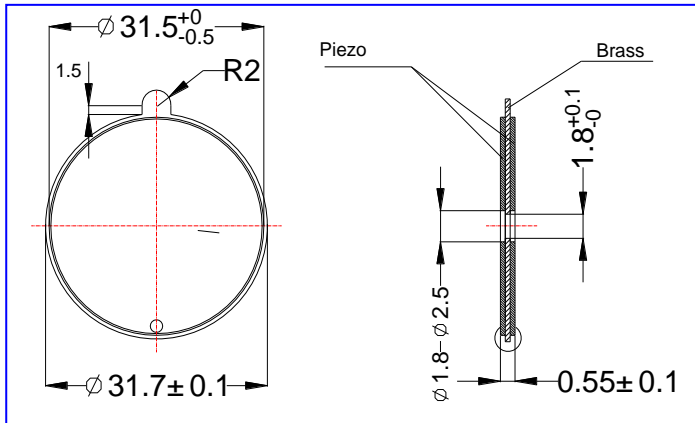
#### For siren

We use double-sided piezo plate to driver the siren, the piezo plate have two layer piezoceramics, with a high capacitance, using this piezo element, the customer can easily get a more high SPL compare with the one layer piezoceramics, the middle layer metal is stainless steel or brass. The two mainly types are listed.

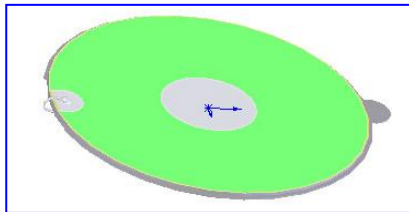


Type	FT-21N-3.4A1
Resonant Frequency	3.4±0.68 KHz
Operating Voltage	Max.30Vp-p
Resonant Impedance	Max.150Ω
Stastic Capacitance	136±30%nF
Insulation Resistance	Min.200MΩ
Operation Temperature	-20~80℃
Storage Temperature	-30~90℃

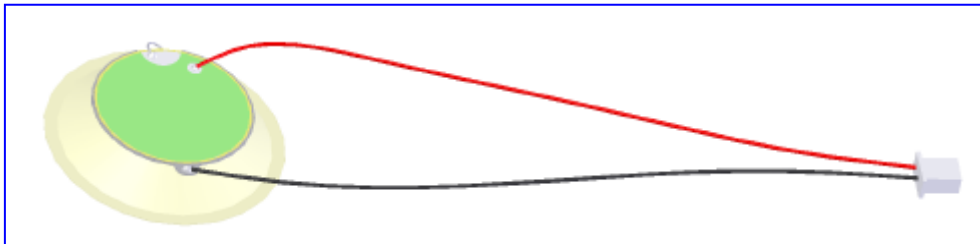




Type	FT-32N-2.9A1
Resonant Frequency	2.9±0.3KHz
Operating Voltage	Max.30Vp-p
Resonant Impedance	Max.150Ω
Static Capacitance	150±30%nF
Insulation Resistance	Min.200MΩ
Operation Temperature	-20~80℃
Storage Temperature	-30~90℃



The following product is the double-sided piezo plate attached with a film, the film's material usually is the PBT, PEI, and PET, and we can design whatever customer requires. Using a film, it is easy to get a higher SPL and low frequency.

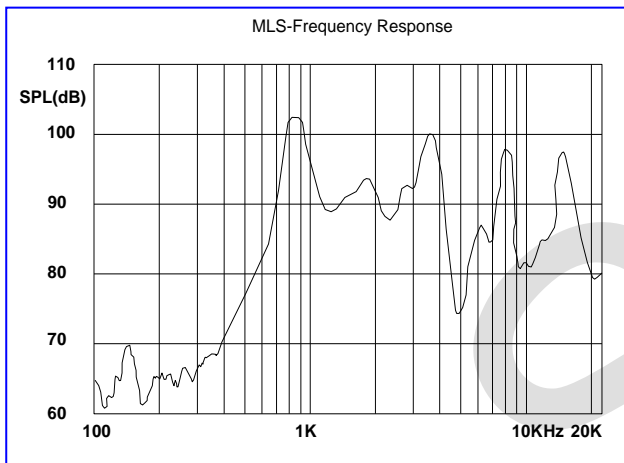
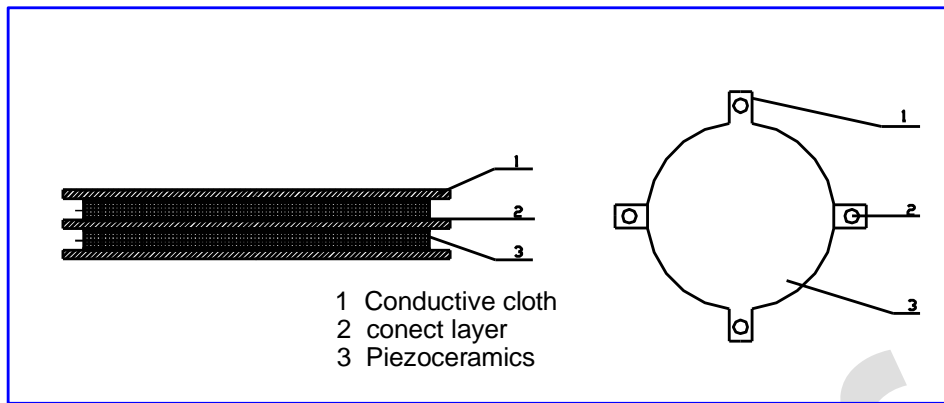


#### For voice talking

This product could be called speaker, but it should not be confused with a moving coil speaker that uses ceramic instead of iron magnetic core material that is often mistakenly called a ceramic speaker. Piezoelectric speakers can be made very thin – less than 1mm thickness – which is helpful to voice talking siren market. Since piezoelectric speakers are essentially capacitive (20nF to as high as 3000nF depending upon the particular design), they have far less dissipation losses than resistive type moving coil speakers, therefore, promise improvements in system power efficiency. As expected, the effective impedance also varies with frequency.

The frequency response of piezoelectric speakers is similar to small geometry moving coil speakers up to 4 KHz bandwidth. The 4 KHz bandwidth is quite sufficient for voice. Currently however, the piezoelectric speakers require voltages higher than the handset battery voltage and some of the system efficiency is lost by boosting the battery voltage to the required amplifier operating levels. Typical driving voltage requirements are 10Vp-p to as much as 30Vp-p, depending upon the individual speaker design, achieving output sound pressure levels of 85db to 95db. The audio amplifiers must be designed to drive the high capacitance loads, which, at the power on stage, are effectively short circuit loads.

We design three layer conductive clothes (as the drawing show) instead of metal to reduce the frequency, and get the idea frequency below 1 KHz which is possible to voice talking.



Type	FT-40N-1.0A1
Resonant Frequency	1.0±0.25 KHz
Operating Voltage	Max.30Vp-p
Resonant Impedance	Max.150Ω
Stastic Capacitance	250±30%nF
Insulation Resistance	Min.200MΩ
Operation Temperature	-20~80℃
Storage Temperature	-30~90℃



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