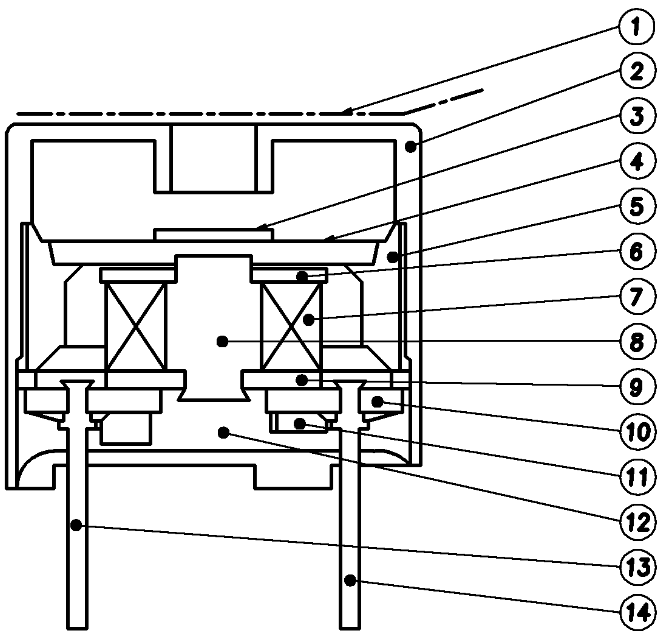
Construction of Magnetic Buzzer

Operation principles and construction

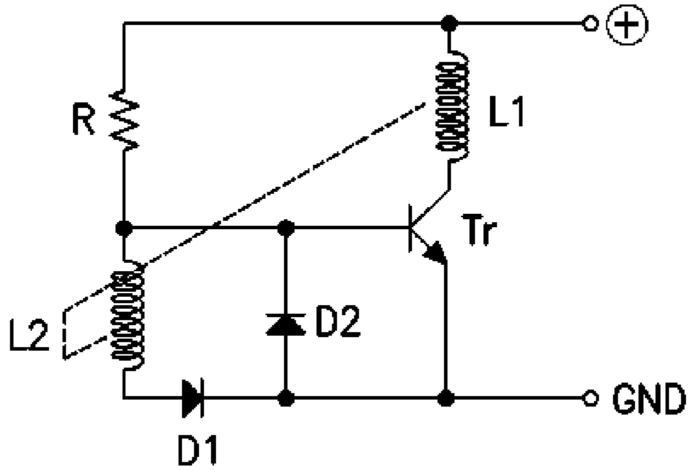
These types of electro magnetic transducer（as Fig.1）contain coils which are would in such a manner to produce L1 for driving, and L2 for feedback purpose（as shown in Fig.2）. When current flows through coil L1 and the diaphragm begins to vibrate, coil L2 detects Its vibration, providing feedback to the base of the transistor so that the oscillation becomes synchronized with the vibration of the diaphragm.

Fig.1 Cross Section



No.	Description
1	Masking Label
2	Housing
3	Magnet piece
4	Diaphragm
5	Plastic magnet
6	Washer
7	Coil
8	Yoke
9	Base
10	P.C. Board
11	Electronic parts
12	Potting material
13	- Pin
14	+ Pin

Fig.2 Circuit diagram of MB12B series



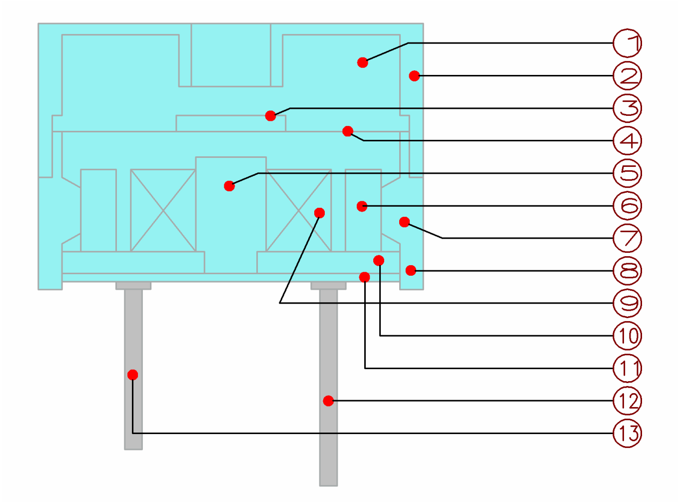
Construction of Magnetic Transducer

With reference to the below drawing which shows the condition of MT12 type magnetic transducer, the operation principle of MT miniature sound transducers can be explained as:

As shown in the drawing, the metal vibrating disk Located in between two covers oscillates and makes sound by the magnetic field, which attracts the vibrating disk being affected by the imposed magnetic flux.

This movement is generated by the current through the coil which is located in the magnetic circuits consisting if permanent and iron core.

Construction of MT12 type



No.	Description
1	Cavity
2	Cover housing
3	Vibrating weight
4	Vibrating disk
5	Pole
6	Magnet
7	Magnet holder
8	Housing
9	Coil
10	Yoke plate
11	P.C. Board
12	Pin long
13	Pin short

Basic Point for Adequate Uses

1.Frequency Characteristics

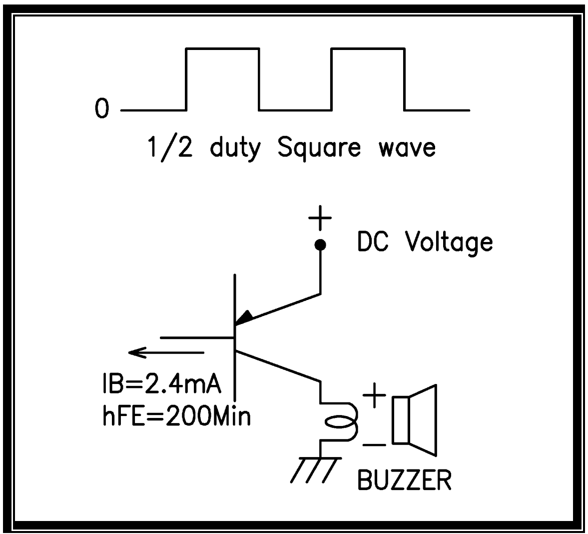
Magnetic transducer is driven by an input frequency. The given frequency characteristics can be obtained Only when applying square wave（V_0-p）.

The end-users must know the facts that the characteristics of frequency may be quite changed in different shapes with the applied various waves. Like sine wave, square wave （V_0-p）or the wavers.

2.Rated Voltage

When other voltage is applied than our recommended one, the characteristics of frequency will be also changed. To have best performance, the recommended voltage had better be used always.

Standard driving circuit for transducer



The Technology and Operation of Piezo Sounder

Basic Principles

A piezoelectric ceramic element is a sintered body of many crystals (Poly-crystals).Distortion of this Crystal occurs when a stress is applied to the element, either thermally, mechanically or electrically. These distortions create many possible uses including alarm and sensor applications.

In using piezoelectric elements in audible output an application, a metal plate is attached to the ceramic element because the resonant frequency of the ceramic is too high to produce an audible tone by itself. This metal plate vibrates as shown in Fig.1 due to the contraction and expansion of the Piezo ceramic, and an audible signal is produced.

Impedance Characteristics

The equivalent circuit for piezoelectric elements is shown in Fig.3. The mechanical resonance of the element is show by R, L, C where L and C determine the Resonant frequency (Fig.3).

$$Fo=\frac{1}{2\pi\sqrt{L1C1}}$$

Because the shunt capacitor is larger than the series combination the total impedance is capacitive.

Modes of vibration and supporting methods for the sound element

Three principal modes of vibration can be created in the element depending on the style of mounting. This is illustrated in Fig.2.

Mounting

(1) Node support
The sound element shown in Fig.2 (a) is node mounted, allowing it to vibrate in a free state. The node, a circumference where no vibration takes place, is created as shown by the broken line Fig. 1.

Mounting at the node causes the least mechanical suppression of vibration, thus allowing the greatest amplitude. Hence this mounting method, as illustrated in Figure 5(a), gives the highest sound pressure output and the most stable stable oscillation frequency of the three choices. As a result, this is the most appropriate design for high output, self-drive applications.

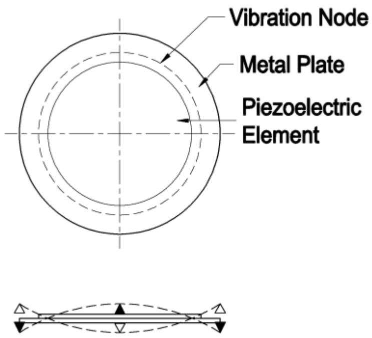


Fig. 1.
Bending Vibration Node

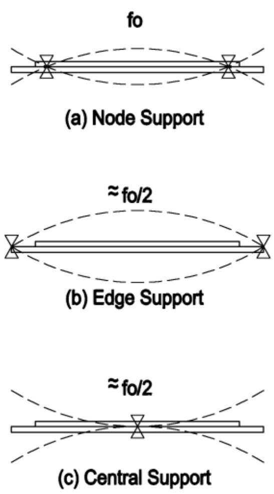


Fig. 2.
Vibrating Mode of Piezo sounder

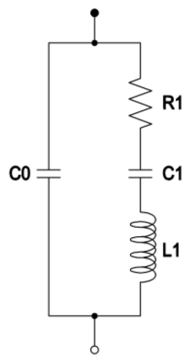


Fig.3.

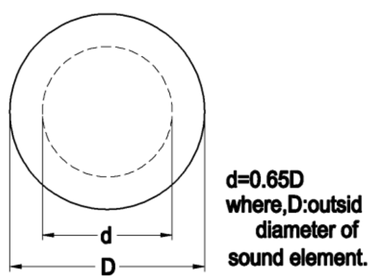


Fig. 4.

(2) Edge support

Fig. 2(b) shows the mode of vibration when the sound element is supported at the edges. In this mounting configuration, the whole sound plate vibrates up and down as is illustrated by the broken line in the diagram. Hence, the edge method as illustrated in fig.5(b), suppresses the fundamental resonant frequency by moving the node. This offers the possibility of a wide frequency response, and is most advantageously used with external drive.

(3) Center Support

Fig.2(c) shows the mode of vibration when the sound element is supported at the center. As the main vibration area is forcefully supported, large sound pressure levels are not possible when this method is used. This too is appropriate for external drive but due to design difficulties center support is not useful as and alarm.

Circuit design considerations

1. Driving Wave

The Piezo elements may be driven by sinusoidal, pulsed, or square wave, depending upon the particular application. If a sine wave is used, the device will operate at a frequency lower than the resonant frequency (Fo) with a lower sound pressure level. The reason for this is the loss of energy, through the time lag between peak Deflections as shown in Fig. 7. It is important that a clean sinusoidal signal be provided, as any clipping of the waveform can result in frequency instability. If square waves or pulsed waves are used to drive the elements, a higher acoustic output will be realized, along with an increase in harmonic levels. A parallel capacitor can reduce these harmonics.

2. Driving Frequency

For maximum output, a Frequency of between 500Hz and 4KHz should be used, as recommended by the specific part chosen.

3. DC Precaution

In order to prevent depolarization of the ceramic elements it is necessary that every precaution be taken to prevent them from being subjected to direct current.

4. High voltage Precautions

Voltage higher than those recommended by specification can damaged the ceramic, even if applied for short durations. Due to the strength of the piezoelectric effect, high voltage can cause the crystals to break the sintered bonds, resulting impermanent damage. Significantly higher sound pressure levels will not be achieved by voltages higher than those recommended by specification.

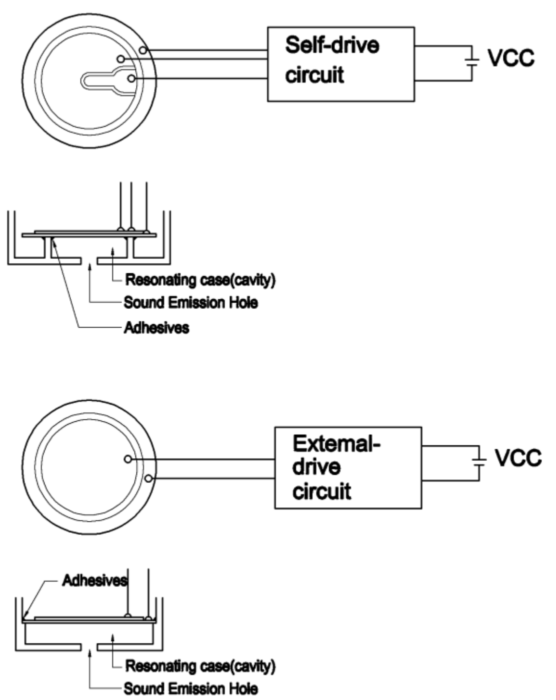


Fig. 5. Oscillation System of Pizo Buzzer and Sounder

5.Booster coil Applications：

When using a booster coil, do not exceed voltage recommendations, as the coil will heat up, passing too much current to the transistor.

6.Shock：

Mechanical impact on buzzers or elements can generate high voltages that can seriously harm drive circuitry. Suitable diode protection is advisable in applications where mechanical shock is possible. Zener diode shown as Figure 7a; Schottky diode shown as Figure 7b.

7.Mounting Glue：

Proper application of mounting glue is necessary to produce adequate sound pressure levels.

8.Design of resonating Case：

When an element is supported and has no case, the sound pressure level is small. This is because the acoustical impedance of the elements does not match that of any open air loading. However, by building a resonating Case, the acoustical impedance of the acoustical impedance of the element and encased air can be matched. This case can be designed using the following (*Helmholtz's equation*)

$$Fo=\frac{C}{2\pi}\sqrt{\frac{4a^2}{d^2h(t+ka)}}$$

fo=Resonant frequency of Cavity (Hz)
c=Sound velocity $34.4*10^3$ cm/sec@24℃
a=Radius of sound emitting hole (cm)
d=Diameter of support
h=height of cavity (cm)
t=Thickness of cavity
k=Constant ≒1.3

9.Electrostatic Capacitance

It is necessary to match the output impedance of the oscillator with the transducer impedance in order to get maximum sound pressure level from the transducer. The actual electrostatic capacitance can be calculated from the following formula.

$$C=\frac{132.064D^2}{t}\ pF$$

D=diameter of electrode (cm)
t=Thickness of ceramic (cm)

10.Soldering Recommendations

The desired location for soldering lead wires on an element is the point nearest to edge of the silver surface. The desired location for soldering a lead to the metal plate is the area between the end of the plate and the end of the ceramic. Below are the conditions for soldering.

	Ceramic (AG)	Metal plate
Soldering Iron	25W	25W
Temp.	330℃±30℃	
Time	0.5sec Max.	2～4 sec.
Solder	As solder	

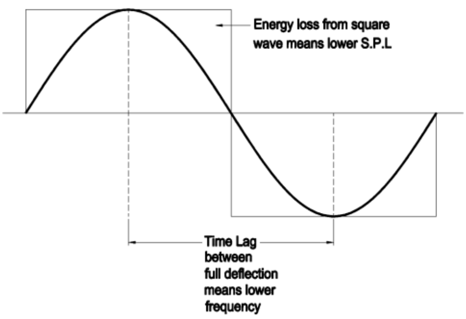


Fig. 6.

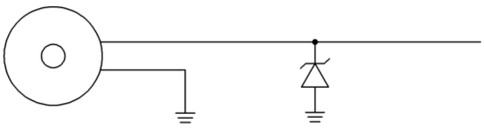


Fig.7 (a).

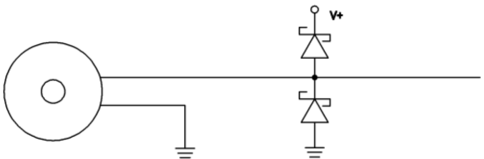
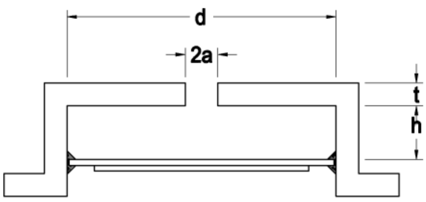
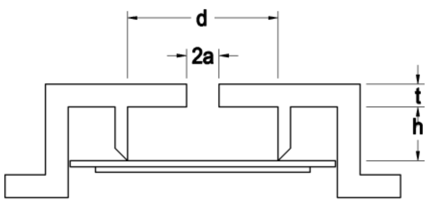


Fig. 7(b).



(a) Edge Mount

Fig. 8



(b) Node Mount

Recommend Circuit for Piezo sounder