



Murata Amplifies Advantages of Piezoelectric Speakers

In recent years, the trend toward adding new functions to mobile devices has been growing at a fast pace. This is conspicuous with mobile phones and similar devices, which have carried an increasing number of new capabilities, like the Global Positioning System (GPS) or the digital terrestrial one-segment digital broadcasting or the Os-aifu-Keitai of NTT DoCoMo, Inc. Meanwhile, the needs for design-focused thin terminals have been rising on the back of ultra-thin mobile phones' coming out as a huge hit worldwide. In addition, battery life to support music reproduction or TV viewing has been called upon to become longer and longer.

Piezoelectric speakers are making use of the mechanical resonance phenomena inherent to piezoelectric ceramics. The thickness of dynamic speakers, which are in widespread use today, ranges from 2 to 4mm, while that of piezoelectric speakers can be as thin as 0.5 to 1.2mm. Moreover, as piezoelectric speakers are of capacitive load, they can dramatically reduce power consumption specifically in the voice band.

With market needs' giving a boost to piezoelectric speakers, expectations placed on them have been growing, as they can make their sets thinner and realize low power consumption.

Murata Manufacturing Co., Ltd. has released in the market the VSLBP1913E

Series rectangular piezoelectric speaker intended for use in mobile devices. In this article, the company describes the features and advantages of piezoelectric speakers, and their technology trends.

Piezoelectric Speaker Feature

Murata Manufacturing employed roughly three main elemental technologies in developing the VSLBP1913E Series rectangular piezoelectric speaker.

A rectangular piezoelectric diaphragm

The frequency of resonance inherent to piezoelectric ceramics will be determined according to their shape. With the conventional round diaphragms, the basic resonance to be determined by a diameter of a disc and its odd-order resonance are used. There occurs an area where the sound pressure declines between different resonant frequencies.

With this as a backdrop, the company employed a rectangular diaphragm to generate the oscillation mode resulting from the long and short sides, to optimally place as many resonances on the frequency axis as possible.

In this case, the company was able to gain flat sound pressure-frequency characteristics (See Fig. 1). Furthermore, the product can be laid out without generating a dead space because it is rectangular in itself.



Fig. 2: External appearance of the VSLBP1913E Series rectangular piezoelectric speaker

A resin film diaphragm

In conventional technology, the general structure of the diaphragms is composed of piezoelectric ceramics glued together on both sides of a metal plate. With this new speaker, piezoelectric ceramics that produce flexural vibrations are mounted on a soft and flexible resin film. This film reduces primary resonant frequency and damps resonance characteristics of the piezoelectric ceramics, thereby contributing to flattening frequency characteristics. In addition, the ceramic elements are mounted on only one side of a diaphragm, making it possible to streamline the manufacturing process as well.

Multilayered ceramics

The piezoelectric speaker is a voltage-driven-type device, and a high voltage needs to be applied to gain a high sound pressure. In order to bring such applied voltage into a practical range, the company needs to apply a multilayered piezoelectric body as a drive element. Therefore, by applying multilayer technology for ceramics that it has built to date through developing capacitors and other products, Murata Manufacturing has succeeded in coming up with a diaphragm with a large displacement, thereby enabling it to gain a large sound pressure albeit small in size.

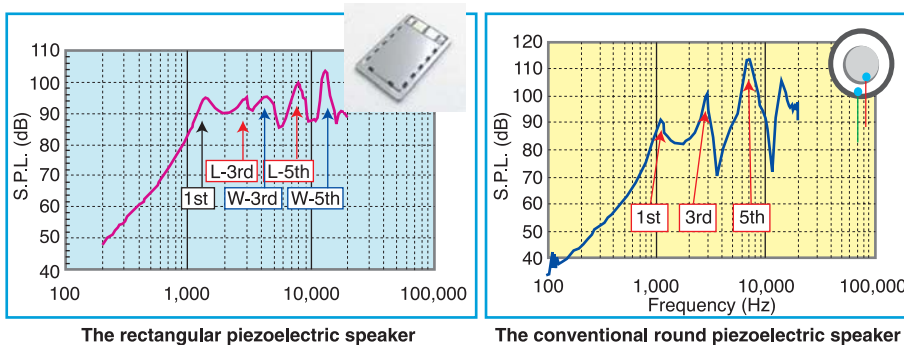


Fig. 1: Sound pressure – frequency characteristics comparison

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The Advantages of Piezoelectric Speakers

Thanks to the introduction of the unique technology as mentioned above, the company was able to market the VSLBP1913E Series piezoelectric speaker with high sound pressure and high sound quality that cannot be achieved by conventional piezoelectric speakers (See Fig. 2). It takes the form of a 19×13 mm rectangle, with a thickness of 1.2mm (See Fig. 3). It is housed in a robust metal case for ease of handling. To meet the needs for even thinner speakers, an optional type with a thickness of 0.5mm, which comes without the metal panels both on the front and rear sides, is also available.

The biggest advantage of piezoelectric speakers against dynamic speakers is that they can be mounted in a small and thin space. Generally, the product thickness of dynamic speakers cannot be thinner than 2mm, imposing limitations on the volume and thickness of a space needed when they are mounted on sets. As opposed to this, for the piezoelectric speakers with a product thickness of 1.2mm, as air holes normally placed behind the speakers are placed on the side, it can be placed as long as there is a space of about 1.4mm in thickness. Furthermore, the optional type with a thickness of 0.5mm can be mounted even in a space with a thickness of around 0.75mm.

If a dynamic speaker is used in a small space like these, sound pressure or quality may decline depending upon condi-

tions. With a piezoelectric speaker, however, sufficient sound pressure and quality can be ensured in such a small and thin space.

Future Issues, Technical Trends, Initiatives

Building on its technical expertise, Murata Manufacturing has achieved an unparalleled level of high sound pressure and quality with this speaker. On a practical standpoint, there is still room for improvement in terms of sound pressure generated in a small and thin space, and the reproduction capacity in the bass. The company therefore aims to develop materials for piezoelectric ceramics that generate even greater displacements, pursue even more efficient vibration principles, and improve lamination and thin-layer technologies down the road in an effort to further improve the acoustic performance of its piezoelectric speakers.

Piezoelectric speakers need to be driven by a high voltage to ensure a high sound pressure, thus a sufficient acoustic performance cannot be attained when the amplifiers designed to drive dynamic speakers are used. To address this problem, an additional booster circuit and other items will be needed. Murata Manufacturing has joined hands with semiconductor manufacturers in building a collaborative system to come out with total solutions from the development phase.

About This Article:

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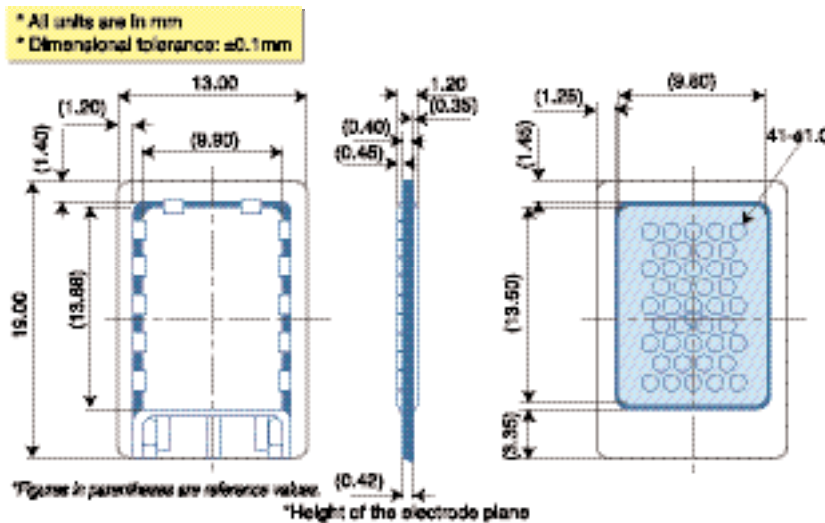


Fig. 3: Dimensional outline drawing of the VSLBP1913E Series rectangular piezoelectric speaker