



***New Generation of Multi-layer
Piezo Ceramic Speaker***

***BeStar Acoustics Co.,Ltd
Jan.9th,2012***

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About BeStar- Company Presentation

- **BeStar Acoustics Co.,Ltd is the joint-venture company which to R&D, produce and sell acoustic product. It was founded in 1996, it mainly run: Chip broadband Internet voice processor, Voice control module and circuit ,the new chip speech components manufacturing, sales production products. BeStar is one of High-tech enterprises of Jiangsu province.**
- **BeStar has strong technical strength and perfect testing methods and can be provided with high design development ability for new product, won many patent technologies, among these patents, two patents has the leading level in China.**
- **BeStar invest lots of funds into technology improvement every year, buy the latest testing equipments internationally and full-automatic production equipment by machine, design by computer, manufacture and manage, explore the development road with unified production, study and research: cooperation, innovation, new product development, industrialization achievement.**

About BeStar- Company Presentation

- **BeStar has complete quality management system, passed the certificates of ISO14001 Environmental Management System in 2004, ISO9001 quality management system in 2005, ISO/TS16949 quality management system in 2006,ISO13485 medical devices quality management system in Feb,2011.**
- **Products produced by BeStar have high reliability and stability. Because of strong R&D team and professional hardware capacities.**

About BeStar- Company Presentation

- *Company Quality Policy: Technology Innovation, Quality Excellence, Management of Science, Commitment To Continuous Improvement*
- *Company Talent Mindset: Respect every personnel, cultivate and encourage them, let them give full play to their intelligence, experience and skills and provide the successful opportunities in their career.*
- *Company Operation Principle: Continuously improve quality, decrease cost and satisfy customer's request from multi-level.*



Latest production equipments for multi-layer piezo ceramic

Product Introduction---New Generation for ultrathin multi-layer piezo ceramic speaker

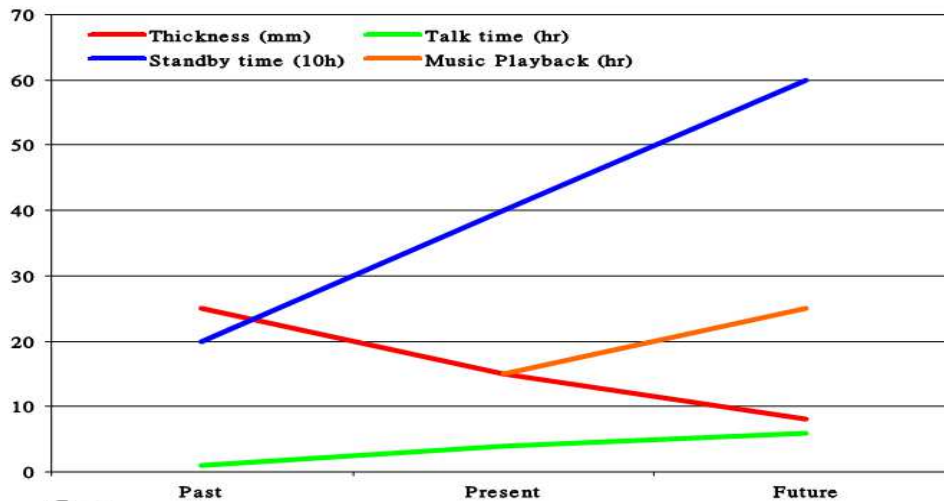
● **Development tendency for consumer electronics: large totalization and Small integration are two development orientation for electrical information products, as represented as mobile telephone, PPC kinds of mobile communication end devices will be developed to light in weight, thin in height and small in size.**

● **Development strategy for international electronics giants: NOKIA, APPLE, MOTOROLA, Samsung, Sony Ericsson, Philips have definitely presented that mobiles will develop to small size and thin height. Speaker is the indispensable component in mobile, currently the height for latest and thinnest speaker is 4mm. So speaker will become the core component of small size and thin height for mobile communication.**

Product Introduction--New Generation for ultrathin multi-layer piezo ceramic speaker

- Tendency for new generation of handheld product(thin shape, but long lifetime for battery)

新一代便携式产品的趋向 (外型纤薄但电池寿命长)



Product Introduction---New Generation of Multi-layer Piezo Ceramic Speaker

Size

PS1522

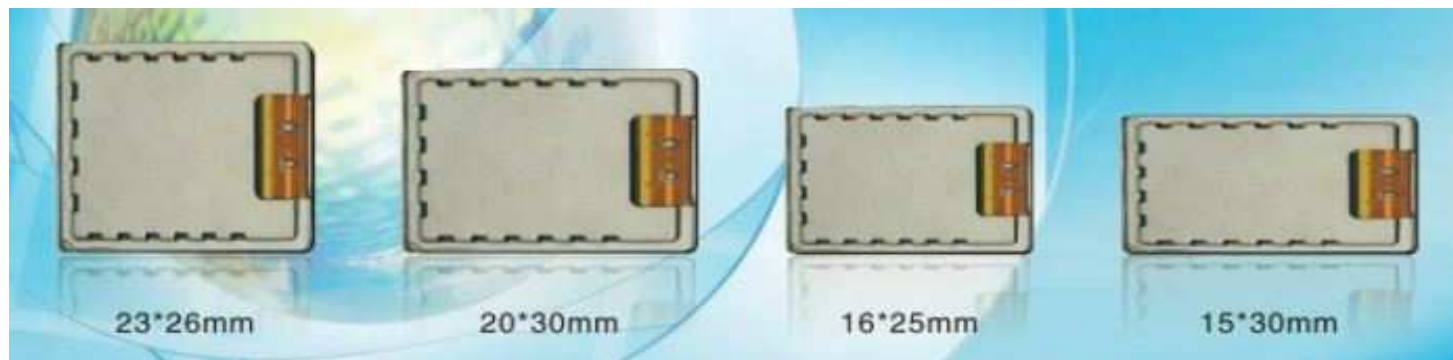
PS1625

PS2326

PS1530

PS2030

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Application Industry for New Generation of Multi-layer Piezo Ceramic Speaker

Mainly used in Mobile Phones, Flat Terminal Devices, MID(Mobile Internet Device), handheld Music Player, Digital Camera、 IC Recorder and other handheld devices.



Product Introduction--Characteristics for New Generation of Multi-layer Piezo Ceramic Speaker

Ultrathin, Ultralight and Layout Flexibility

1. Ultrathin, ultralight design for product shape (height is less than 1.3-1.7mm, weight is about 1.6g), it can decrease the final height and weight for mobile.
2. Shape design of square(rectangle) can layout flexible and min. blind side, it can save space.
3. Even if assembled in very narrow space, it also can issue the sound quality pure and clear.



Product Introduction-Characteristics for New Generation of Multi-layer Piezo Ceramic Speaker

High quality of sound and High S.P.L

1. Bidirectional vibration mode drive soft membrane mode can produce a smooth frequency resonant curve.
2. Multi-layer structure will produce a powerful sound.



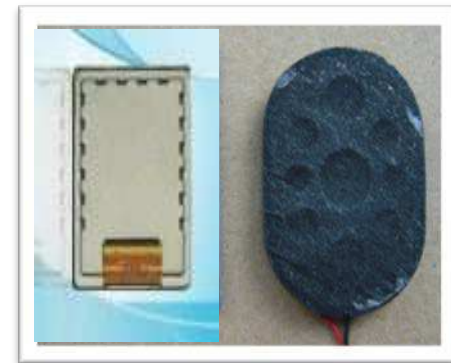
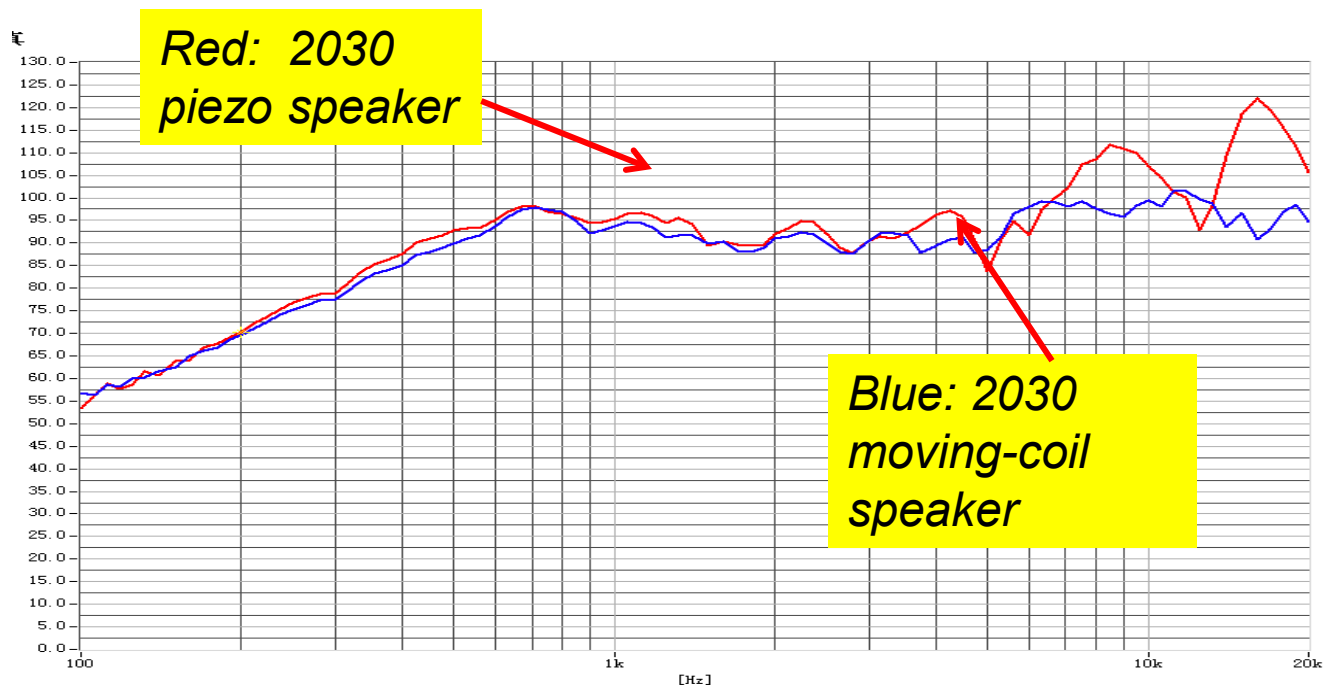
Other Characteristics

1. High Electro-acoustic conversion efficiency, save power 40-60%.
2. No magnet-it can not happen the inhaled problem of free metal particles.
3. No wire-it will not happen disturbance of EMI.
4. Good atmospheric exposure as Salt mist resistant, waterproof and mildew prevent.



Technical Performance Compare New Generation of Multi-layer Piezo Speaker with Moving-coil Speaker

Product Type	L (mm)	W (mm)	H (mm)	SPL (1. 0K, 1. 4K, 1. 6K, 2K)	F0 (Hz)
2030 Piezo speaker	30	20	1. 6	96. 0dB/5cm/5v	700
Moving-coil speaker	30	20	4. 0	94. 6db/5cm/1v	680



Structure Compare Piezo Speaker with Moving-coil Speaker

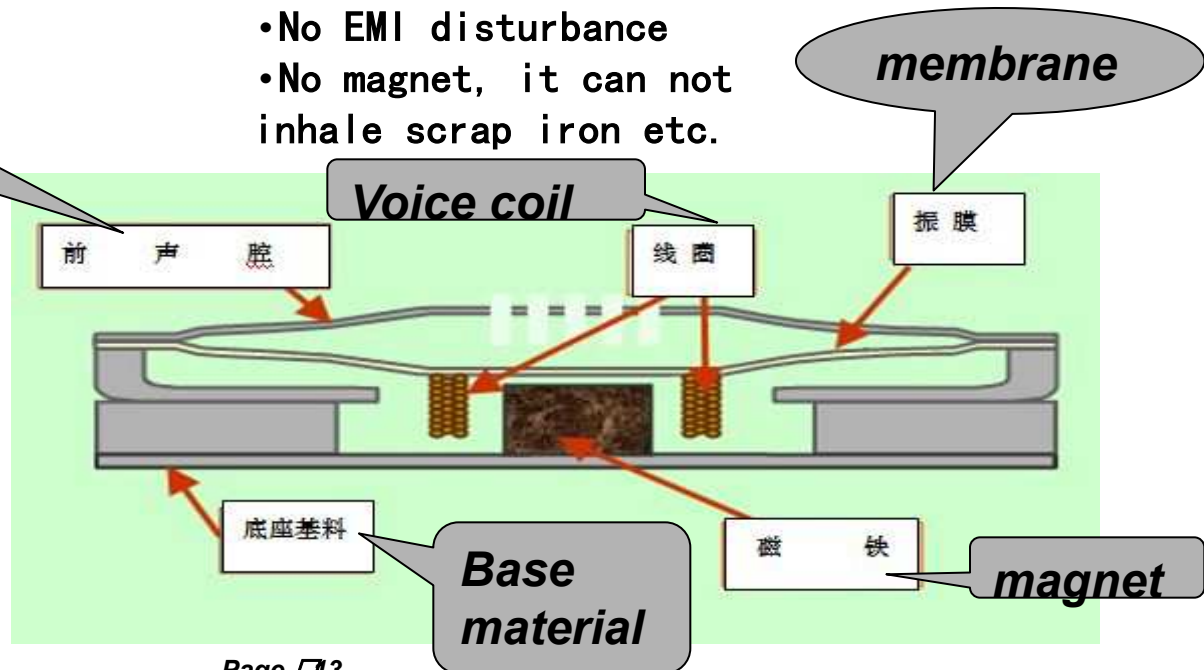
Structure of Piezo Speaker



- Structure simple, ultrathin
- No EMI disturbance
- No magnet, it can not inhale scrap iron etc.

Front sound chamber

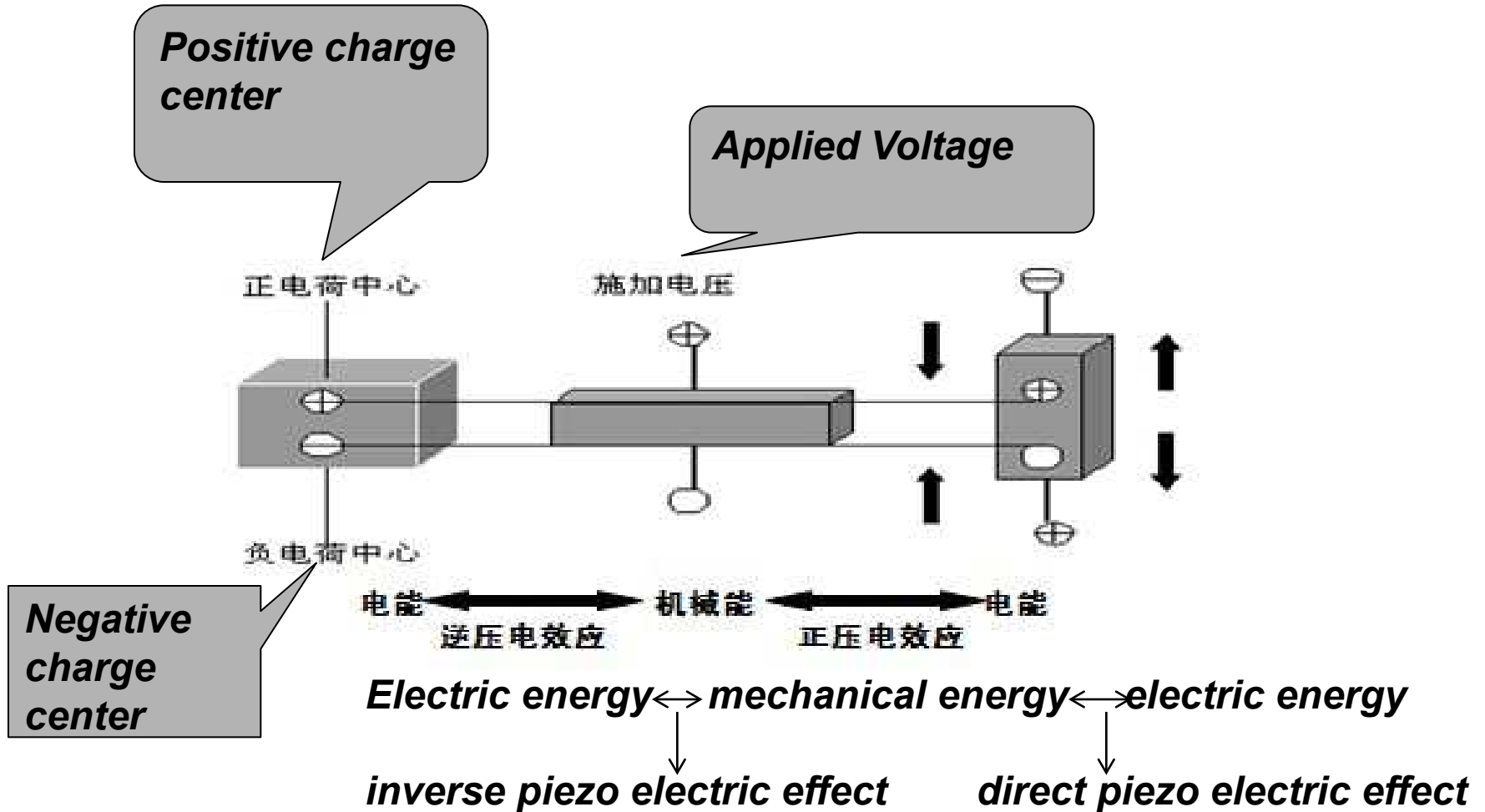
Structure of moving-coil speaker



Technology Level- Technique Principle

- **Piezo Ceramic:** one kind of functional ceramics materials which could make interconversion between mechanical energy and electrical energy, it belongs to inorganic nonmetallic materials, this material have piezo electric effect.
- **Piezo electric effect:** dielectric crystal with some special structure will produce the deformation after the effect of external force at the fixed direction. Medium internally will produce the polarization phenomena, cause the appearance of medium with electricity, this is direct piezo electric effect. On the contrary, place incentive electric field, medium internally will produce elastic deformation, it is inverse piezo electric effect.

Technology Level- Technique Principle

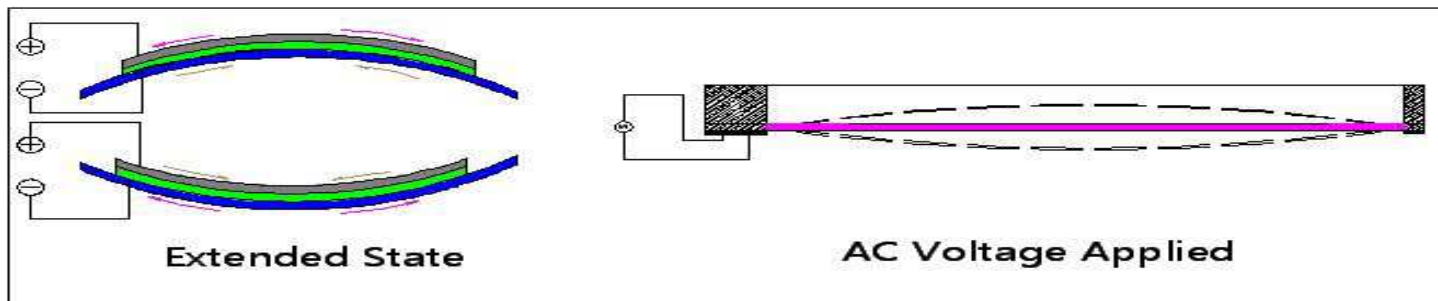


Technique Principle-Multi-layer Piezo Ceramic Speaker

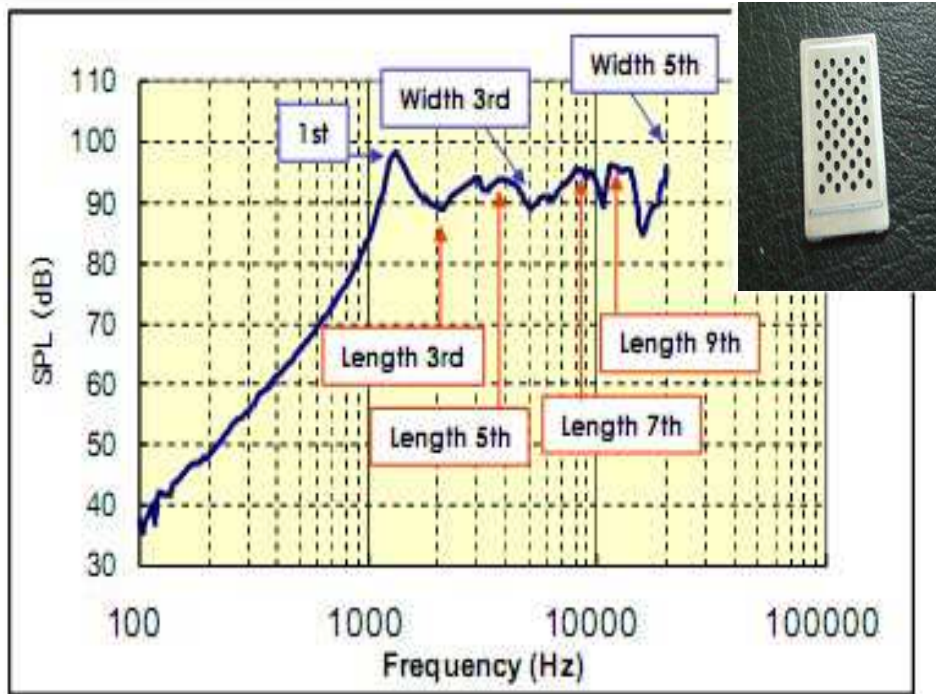
The basic structure for piezo speaker is as showed in below picture: a very thin piezo film attach on a very thin metal film(or mantle), combined together called vibration film.



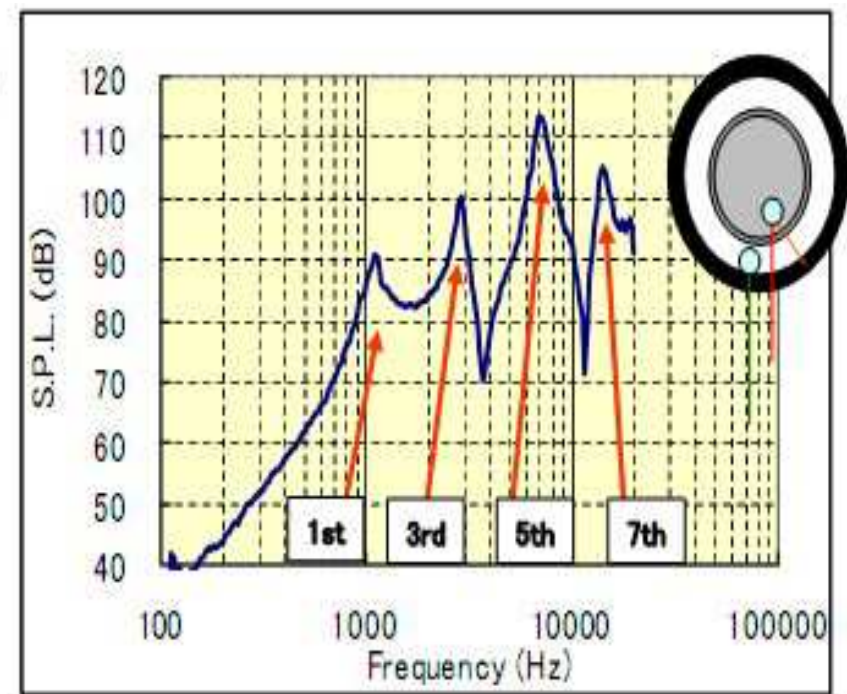
When piezo extend, the vibration film will upswEEP; when piezo contract, the vibration film will downwarping, so when applied a crossfade voltage to vibration film, it will keep bending up and down according to voltage change, then it will drive air and make sound.



Technical Performance Compare Piezo Speaker with Piezo Buzzer



Piezo Speaker



Piezo Buzzer

SPL curve for piezo speaker is more smooth, more resonance point, sound more abundant.

Key Technology 1

❖ **Develop the formula of ultralow temperature multi-layer piezo ceramic material , achieve low-cost technology of inner electrode materials based on silver pulp.**

Feature is energy conservation, environmental protection(the sintering temperature for multi-layer piezo ceramic material is around 1150°C, during the production, the volatilization of lots of lead will pollute the environment, this sintering of ultra-low temperature has no volatilization of lead), meanwhile using pure pulp replaced silver –palladium pulp as the inner electrode, save lots of noble metal.

Content	Product	Foreign Countries	Domestic Counterparts
Sintering Temperature	930° C以下	>1150° C	980-1050° C
Pulp materials as inner electrode	100% Ag	30% Ag—Pd	10% Ag—Pd
Price RMB/Kg	5000.00	40000.00	16000.00

Key Technology 1

- **During the multi-layer piezo ceramic products, the cost of inner electrode material accounted 70% of total cost.**
- **This project use pure silver pulp replaced silver- palladium pulp as the inner electrode material, the cost for multi-layer piezo ceramic is only 1/8 compared with foreign countries and 1/3 of domestic counterparts. The cost advantage is very obvious and has competitive advantage.**

Key Technology 2

- ❖ **Develop the productive technology of low-temperature, multi-layer ceramic.**
- ❖ **Using cast way can produce piezo film with height of 20-30 μm , on the surface of film print pure silver pulp as the inner electrode multi-layer superposition, finally electrode and piezo film sintering together. The multi-layer piezo ceramic produced like this way, can decrease the driving voltage, produce high SPL and smooth curve, meanwhile enhance the reliability of products compared with single layer.**

Key Technology 3

- ❖ **Develop the wing damper of multi-layer piezo speaker, achieve high fidelity of multi-layer speaker.**

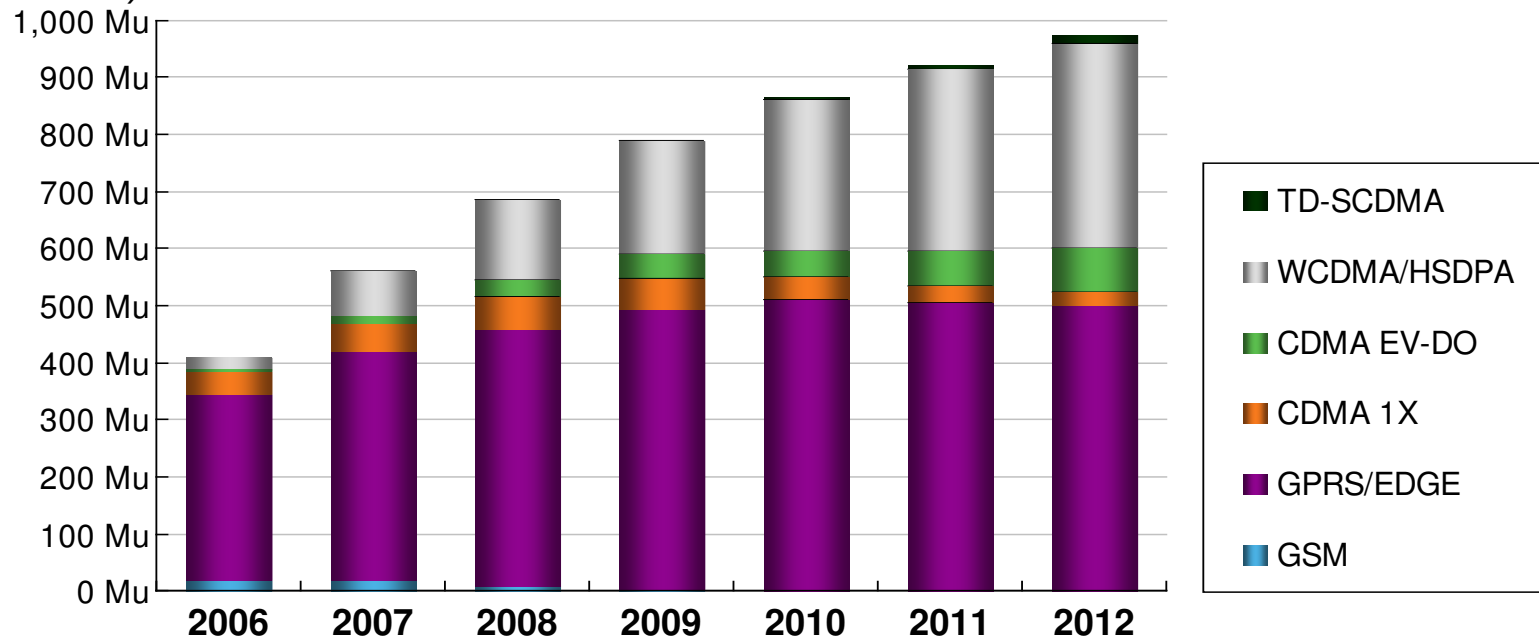
Compared with common multi-layer piezo speaker, the put audio section is 1KHZ to 20KHZ, at the side of high frequency, sound quality has better performance. But for the request of high fidelity, put audio at lower frequency(below 1KHZ) is indispensable. Using wing damper can achieve better performance below 1KHZ, it can make this product reach the level of moving-coil speaker from sound-quality side.

Product Market and Request Analysis

This product is mainly used in consumer electronics industry: mobile telephone, flat terminal devices, MID, handheld music player, digital camera, IC recorder and other handheld devices. It is newly developed product, has enormous market volume.

■ Mobile Market

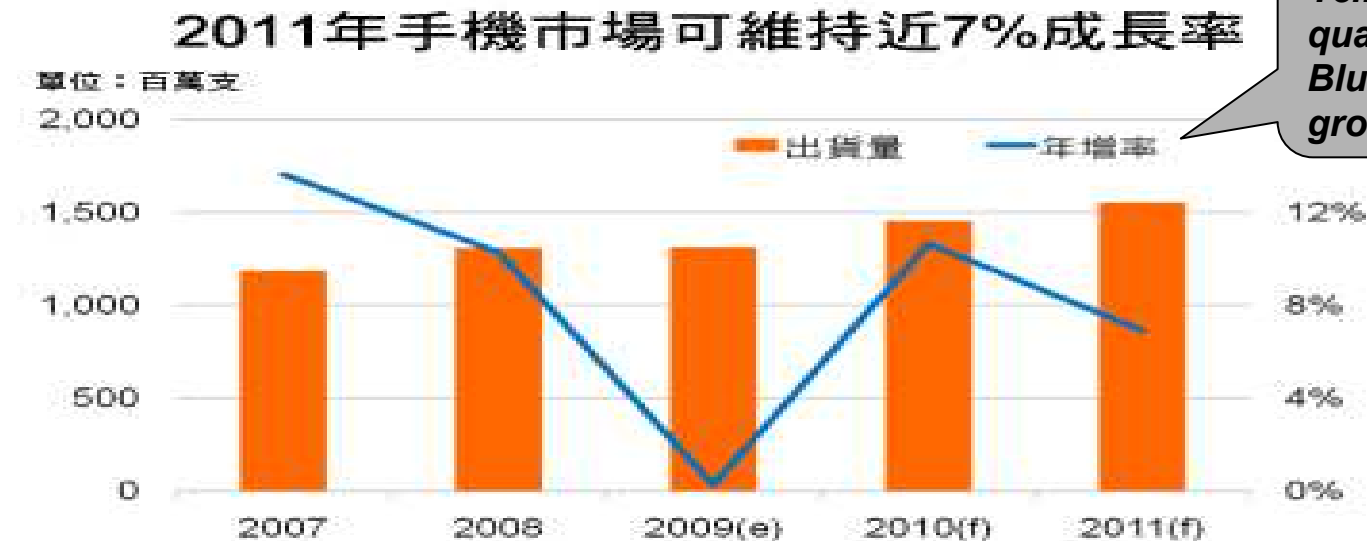
Domestic mobile market volume (including international company's OEM/ODM in domestic)



Product Market and Request Analysis

■ Survey for Global mobile market 2011

The market size of global mobile market in 2010 is 1,454,000,000pcs, it increased 60,000,000pcs compared 2009. The main reason is the market of Smartphone over expected and the mobile demand in emerging countries is buoyant. In 2011 the estimated market size for mobile is about 1,554,000,000, the yearly growth rate is 6.9%, it is higher that 2009, but compared other years it was lower, the main reason is that market became mature.



註：納入白牌手機出貨量
資料來源：DIGITIMES + 2010/11

Thank You!!

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