



Emo Labs

Edge Motion™ Audio Technology

Changing the Way Speakers Make Sound

Overview

For 85 years, the electronics industry has been learning how to make better sounding speakers. As tube televisions and displays have given way to sleek LCD panels, the industry focus has shifted to smaller speakers. Unfortunately, it has not been easy to combine these attributes in a single, affordable package that works well when embedded in a display-based Consumer Electronics (CE) product. Today's rich, multimedia content deserves to be experienced with natural, full-range sound that is directed at the listener and fits into a streamlined flat panel display enclosure. That is where Emo Labs and Edge Motion™ technology can help.

Emo Labs addresses this need by enabling leading electronics manufacturers to deliver products that offer a vastly improved listening experience for home entertainment, desktop and portable use. Using patented *Edge Motion™* audio technology, Emo Labs' audio solutions literally disappear into the enclosures of a wide variety of display-based consumer electronics products such as TVs, monitors, notebook PCs and more. These speaker systems significantly enhance today's streamlined CE products and revolutionize the way multimedia content is enjoyed by combining the video content with high-quality audio that radiates directly off the display.

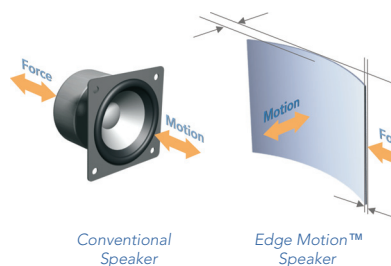
Traditional Speaker Technologies

Most loudspeakers produced today use one or more dynamic drivers that consist of a rigid cone (or dome) and a magnetic motor, working together as a linear piston. The cone or dome acts as a diaphragm and produces sound waves as it moves back and forth in the manner of a piston. Sometimes called "point source" speakers, these dynamic drivers can be both very efficient and affordable. Often, a loudspeaker system will combine different sizes of dynamic drivers – woofers, midranges, tweeters – in an effort to: 1) attain the desired sound quality across the full musical spectrum, and 2) enhance the apparent sound field by distributing sound waves in a more pleasing way. These dynamic drivers require a chamber of air to operate efficiently and are typically used in box-type loudspeaker systems; they could also be built into the larger cabinets of old style CRT TVs. More recently, highly space constrained versions of these dynamic speakers have produced very mixed results when used as the embedded system in LCD display-based CE products, including TVs, laptops and monitors.

In contrast to the dynamic speakers described above, many audiophiles favor the sonic characteristics of high-end loudspeaker systems that employ various "flat panel" style drivers. The most prevalent designs are planar speaker systems, in which a large surface area made up of one or more very thin, flat membranes is pushed and pulled within a magnetic or static field. The entire surface of the membrane moves in a "dipole" configuration, generating sound waves into free air towards both the front and rear of the panel assembly. Considered particularly listenable and easy on the ears, full-range planar speakers are typically very precise (or detailed) and they produce a large and very pleasing sound field. However, when designed to produce sufficient output across a wide range of frequencies, the resulting speaker systems are large, inefficient, and too costly to be used in mass-produced consumer electronics.

Edge Motion™ Audio Technology

The speaker systems developed by Emo Labs use a revolutionary new technology capable of efficiently delivering superior sound quality and providing excellent imaging characteristics. Perhaps just as important, the entire radiating surface of Emo Labs speaker systems can be optically transparent, enabling the ideal integration of video display and speaker.



Emo Labs patented *Edge Motion™* speaker systems use a very different mechanical principle to generate sound. Instead of pushing from behind in the manner of a traditional dynamic speaker, *Edge Motion™* speakers use miniature motors along the side to actuate a thin membrane (or diaphragm) in a manner that creates an extremely efficient, piston-like motion in front. The resultant speaker system is thin, virtually flat and lightweight; yet it produces full, natural sound across the audio range.



With *Edge Motion™* technology, pressure along the side generates perpendicular sound waves

In traditional speaker systems, the motors are linear pistons that are designed to push and pull in the same direction as the surface that generates the sound. With *Edge Motion™* audio technology, the direction of the force is actually *perpendicular* to the working motion of a radiating surface that is producing natural and coherent sound waves. This method of "micro-flexing" a nearly flat membrane is highly efficient since the leverage of an extremely small amount of sideward force produces greatly amplified movement of the diaphragm surface. The flexion that creates this powerful mechanical leverage is generated by a precisely controlled array of tiny ceramic motors that operate with incredible exactness and accuracy.

Comparisons between *Edge Motion™* audio technology and either dynamic or planar speaker systems highlight some interesting differences and similarities. Sonically, *Edge Motion™* speaker systems provide the kind of big, uncontained, precise and easy-to-listen-to sound that is typical of high-end planar systems. Other characteristics such as power efficiency, manufacturing costs and the ability to perform well in a relatively small enclosure are similar to the more common dynamic speaker systems. As a result, *Edge Motion™* audio technology radically changes what is possible in terms of form factor. These systems are designed to be thin and flat since they do not require a big box of air to operate efficiently. They also provide full, natural acoustic output across the musical range from a single transducer of modest size.

But the differences do not end there...

The Difference is Clear

Edge Motion™ audio systems do much more than simply produce exceptional sound in a completely new way. They also enable manufacturers to transform the screen of a flat panel display product into a fully-integrated, high-fidelity stereo loudspeaker. Using optically transparent materials for the membrane (the radiating part of the speaker), the entire speaker system can be made invisible by building it around a display panel. This unique ability to effectively integrate a zero-footprint, high-quality audio solution with flat panel displays actually unifies the video and stereo audio content. This unification of sound and image places the speakers precisely where they sound best – and it dramatically enhances the multimedia experience.

The virtually flat transparent membrane sits very close to the surface of the display panel so the speaker virtually disappears into the display housing. Although these thin and lightweight speaker systems produce rich, full-range audio, the optically transparent material is moving so fast over an imperceptible distance that the sound-producing motion of the micro-flexing membranes is not visible. Although you can feel this movement by touching the membrane, the images on the display actually look the same whether or not audio content is being played.

Architecture & Design Considerations

Embedded *Edge Motion™* audio solutions have the ability to deliver excellent acoustic performance while also giving designers the freedom to create smaller, lighter and more attractive products. Amazingly, these systems have the unique ability to integrate separate Left and Right stereo audio speakers into a single transducer assembly that shares a common radiating surface. Although they are not visible, there are two separate motor assemblies driving specific segments of the membrane while other areas are stabilized in order to isolate the two independent speakers.



An EMO™ speaker assembly includes a transparent membrane, motor arrays and a frame that nests tightly around a display panel.

depend on the design parameters of the specific application. For comparable acoustic output, most *Edge Motion™* speaker systems require power that is comparable to what is demanded by most quality speaker systems. Like most speakers, the highest performance can be

Benefits of *Edge Motion™* technology

- ☑ True “zero footprint” form factor for smaller, more streamlined products
- ☑ Natural, full-range, high-fidelity sound and stereo imaging
- ☑ Optimal integration of audio and video for multimedia playback
- ☑ Easy to use with no setup and no additional boxes or wires
- ☑ Cost-effective for mass-produced consumer electronics products

achieved by designing a fully integrated system where the characteristics of the amplifier are perfectly matched to the characteristics of the speakers and the desired usage.

Edge Motion™ speaker systems can use a variety of different

optically transparent material for the membrane; these can be coated to provide the most appropriate optical properties for a given CE product application. These systems also scale up or down in size and will still deliver the best sound quality and consumer experience for a given product size. The actual speaker assemblies are designed to fit tightly around a display panel, making them easy to install during assembly of the finished product.

Applications

The advent of flat panel displays has resulted in a wide range of new products, the majority of which incorporate sound. The true “zero-footprint” design of an *Edge Motion™* speaker system makes it easier for designers to create a variety of display-based CE products that deliver better multimedia performance in a smaller, lighter and more attractive package. In addition to monitors, TVs and notebook computers, potential future applications include: netbooks, mobile phones, game machines, Portable DVD players, GPS units, digital picture frames, and many other consumer, automotive and industrial applications.

Other “Flat” Speaker Technologies

There have been other attempts to develop affordable panel-type speaker systems, some versions of which were designed to integrate with displays. However, the more streamlined and contemporary designs result in significant tradeoffs in acoustic performance. In the best-known version of this technology, one or more moving coil transducers are attached to one side of a lightweight rigid panel, essentially using the panel in the form of a flattened speaker cone. Unfortunately, this design causes the speaker to constantly operate in “breakup” mode, reducing the speaker’s precision and detail and producing a more scattered and less realistic sound field.

This type of system performs at its best with the transducer(s) located near the middle of the panel. Adaptations have been produced in which stereo pairs of transducers have been attached to the panel towards one side. By replacing the lightweight panel with a sufficiently stiff transparent material that has the transducers near the sides or the bottom, the modified panel speaker can be placed in front of a display screen. Although some of the sound is generated in breakup mode by the transparent portion of the panel, this compromised design significantly impacts the quality of sound and stereo imaging. Historically, form factor limitations and the quality of acoustic output have reduced the practicality of this system.

More information about Emo Labs and Edge Motion™ audio technology is available at www.emolabs.com.

Emo Labs, Inc.

186 Third Avenue
Waltham, MA 02451 USA
Tel 781-487-0000
Fax 781-487-0001



Contacts:

Marketing
Marcom@emolabs.com

Partnerships
BusinessDevelopment@emolabs.com
781-487-0000 ext. 113