

## Sandy's Place - GoldenEar's High Velocity Folded Ribbon

For a very long time, most high quality high fidelity speaker systems have used some variation on the dome tweeter for high frequency reproduction. Through generations of refinement these ubiquitous drivers became the gold standard for HF sound. And although they certainly can produce reasonable high frequency output they do exhibit several limitations. Here are some of the important issues and how our High Velocity Folded Ribbon (HVFR) masters them:

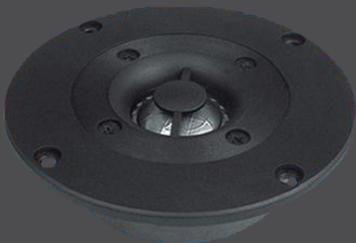
### A Tweeter Moves How Fast?????

1 - Moving mass - You want the tweeter to have extremely low mass for accurate signal tracing. Its diaphragm (dome, cone, panel or in our case, folded ribbon) has to move extremely fast to keep up with the sound frequency it's reproducing. For example, when a woofer is generating 60Hz its cone must move back and forth 120 times a second (60 positive pressure pulses and 60 negative pressure pulses). When a tweeter is creating 16kHz its diaphragm has to move back and forth (or, with our HVFR, squeeze together and expand apart) 32,000 times in a second!! Only a diaphragm with exceedingly low mass like the HVFR can respond that fast, with any hope of real accuracy.



### And It's Supposed to Move Without Flexing or Ringing

2 - True pistonic response - Most tweeters use some form of dome or cone diaphragm. In order to create low distortion sound they must move like a pure piston without any flexing or "break up modes" (reflecting waves or ringing within the diaphragm itself). Unfortunately, it's practically impossible to create such a pistonic radiator, so manufacturers try to control these modes as best as possible, either by material choices, damping the diaphragm or pushing the break up modes higher in frequency, with a goal of pushing them beyond the range of human hearing.



**A Typical Metal Dome Tweeter**

Dome tweeters are typically made from plastic, fabric, or metal. The soft fabric domes are often treated with a damping compound to attempt to reduce ringing and resonance issues. These soft diaphragms are prone to flexing and bending, which dramatically reduces their ability to operate like a pure piston.

Metal domes are likewise often coated with different materials, sometimes very exotic and expensive. And some designs may use tweeter domes of exotic low mass and high stiffness, making them prohibitively expensive, all in an attempt to raise the break-up frequency. But, no matter what the material or the “treatment”, all dome tweeters still break-up at some frequency, causing audible distortion that adds a “zinginess” to the sound, especially as you play them louder. Although this may at first seem attractive, it is not “right” and always becoming fatiguing over time.

### **Spread the Sound, Spread the Joy ...**

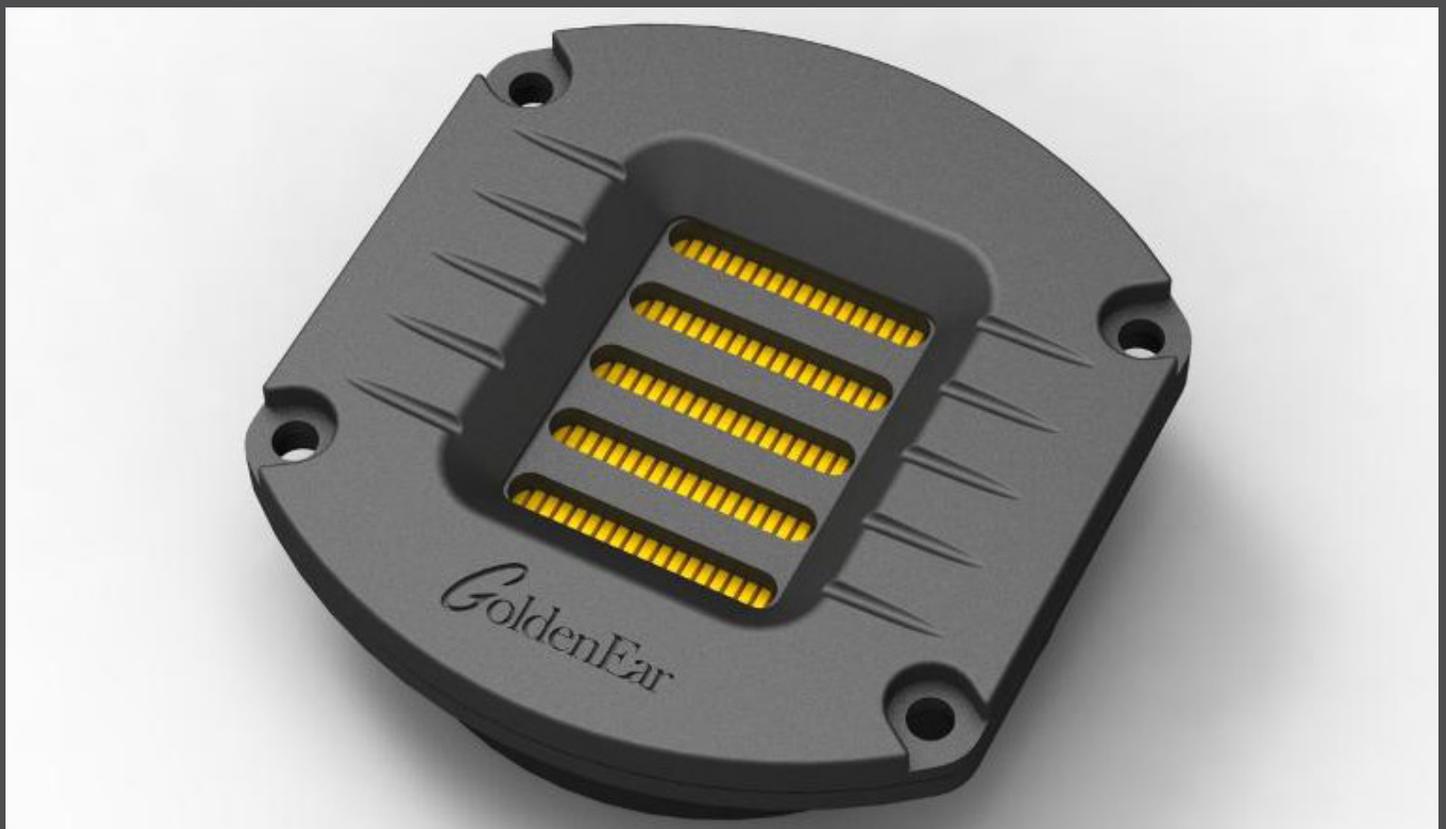
3 - The higher the frequency a driver is producing the smaller its diaphragm needs to be in order to create good coverage across the listening area. This is called dispersion and it's absolutely critical to true high fidelity speaker performance. Why? Because in any room you're not only hearing the direct sound produced by the speaker system, you're also hearing the sound reflected from the walls, floor and ceiling. Simply put, in order to get excellent fidelity you need to have a speaker that gives you great on axis response combined with smooth off axis performance. Some tweeters have acoustic “lenses” in front of their diaphragm or are mounted within a shaped horn formed into the front baffle to help enhance or control the driver's dispersion characteristics.

### **The GoldenEar HVFR Tweeter**

The GoldenEar solution is a totally different kind of high frequency reproducer.

#### **Extremely Low Mass**

The High Velocity Folded Ribbon (HVFR) tweeter's diaphragm doesn't move back and forth like typical drivers at all. It looks and performs very differently from a typical tweeter because it's an



**The GoldenEar HVFR**

almost mass-less ribbon. Its formed of a heat resistant film that's been folded into an accordion-like pleated shape and imprinted with an electrically conductive coating. This diaphragm is embedded in an extremely powerful focused magnetic field created by a bank of rare-earth Neodymium magnets. Rather than pulsing back and forth, the motor system of the HVFR causes the ribbon's folds to squeeze together and pull apart when the alternating current (AC) amplifier signal passes through the diaphragm.

The HVFR's moving mass is really that of each individual pleat, which is infinitesimally less than the mass of the entire diaphragm, so the HVFR is almost mass-less compared to a typical tweeter dome, cone or ribbon. It responds instantaneously and accurately to the input signal from the amplifier, all the way up to 35kHz!

### **High Efficiency, High Reliability**

The HVFR makes a far more efficient "air pump" than typical tweeter diaphragms so it's dramatically more efficient than other tweeter designs. It actually moves air at over a 5 to 1 ratio compared to an equivalent dome or cone tweeter! In part because of this efficiency and the fact that it's essentially resonance and break-up mode free, it produces high output with much lower levels of distortion than other tweeter designs. Another benefit of this high efficiency is the HVFR's reliability, which is exceptional because it doesn't take lots of power to make it "sing".

### **Linear is Where it's at ...**

Additionally, the HVFR produces an almost perfectly linear frequency response within its operating range, and its electrical characteristics make it an ideal "load" for your amplifier to drive efficiently. And unlike typical domes and cones, the HVFR is "loafing along" at high output levels without any form of diaphragm breakup or resonance distortion, making the sound silky smooth at even the highest listening volumes.

### **Great Sound No Matter Where You Sit**

The HVFR doesn't need the lenses or baffle tweaks most dome or cone tweeters use to produce great off axis response because its small size diaphragm naturally has excellent dispersion without any modification. Its dispersion characteristics create a broad, wide horizontal spread of sound with good vertical dispersion. This helps to deliver excellent imaging throughout the listening area with limited floor and ceiling reflections. As always, the best reproduction will be found when the tweeter is approximately at seated ear level.

The HVFR's exceptional high frequency performance, both on and off axis, throughout the listening area is one of the primary reasons every GoldenEar speaker sounds so clear, natural and lifelike, producing a huge and well defined soundstage, no matter where you sit to listen!

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