



Piezo Ceramic Speakers

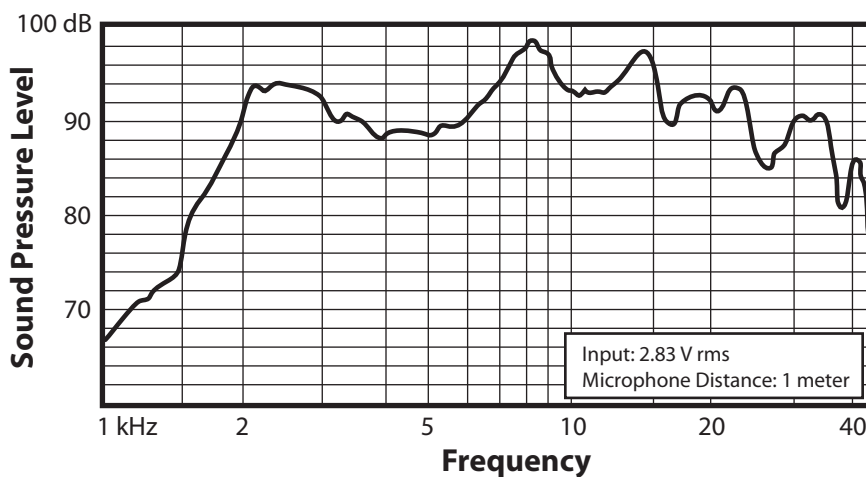
POWERLINE Series

2x6 Wide Dispersion Horn - Model KSN 1141A

The POWERLINE series of speakers developed by Motorola incorporate protection circuitry which allows them to be used safely with amplifiers rated as high as 400 watts. This results in a product that is practically blowout proof. The KSN 1141A speaker was designed to provide smooth response over the 2 kHz to 30 kHz range.



Frequency Response



KSN 1141A Specifications

Frequency Response:	1.8 kHz to 30 kHz
Average Sensitivity:	92 dB at 1m/2.83V (1 watt @ 8Ω)
Maximum Power Handling Capacity:	400 Watts
Maximum Temperature:	80°C
Typical Impedance:	Appears as a 0.3 μF capacitor



www.piezosource.com

250 East Gish Rd
San Jose, CA 95112
Phone: 408-487-1700
Fax: 408-487-1707
Email: sales@piezosource.com



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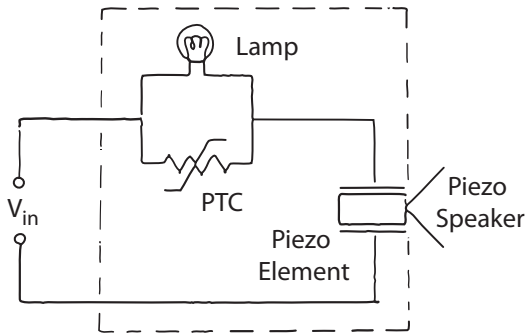


Figure 1. Electrical Circuit.

POWERLINE Series Principle of Operation

The KSN 1140A and 1142A POWERLINE horn drivers are unique and distinct in their operation and how they work. Referring to Figure 1, the protection circuit is actually a parallel combination (U.S. Patent #4,864,624) of a miniature lightbulb and a positive temperature coefficient resistor (PTC). In a music system in which there is excessive clipping at high power or very heavy high frequency signal content, the piezo drive element sees very large currents and will heat up due to dissipation losses. In order to limit the temperature to 150°C (302°F), a PTC is chosen with a “turn-on” temperature of 120°C. Below this temperature, it appears as a simple 20 ohm resistor, and doesn’t affect the speaker response. When the amplifier power level reaches several hundred watts *continuous*, the PTC heats up and increases its resistance dramatically as shown in Figure 2. This has the immediate effect of lowering the power into the driver and, if no other work had been done, significantly lowering the speaker SPL. To avoid this sudden shift and to make the power control practically imperceptible, the miniature lamp is wired in parallel with the PTC.

A tungsten lamp exhibits a very low resistance when cold and a much higher resistance when warm. The lamp specifications are carefully chosen such that the speaker will continue to play even after the PTC has opened up, drawing its current now through the lamp. As the power increases further, the lamp lights up, increasing its temperature and resistance, thereby limiting the power to the speaker. The lamp is essentially a very fast acting PTC (very low thermal mass, high heat radiation) and responds to music peaks rather than RMS heating as does the PTC. The audible effect is similar to that produced by a level compressor. In this way, the driver temperature is held just below the critical 150°C temperature.

The resulting speaker performance is then as follows:

- Under normal operating conditions, the speaker performs in its normal mode, faithfully reproducing the applied signal at a proportional volume.
- Under temporary extreme high power surges (even in excess of 400 watts), the speaker will still perform in its normal expected mode.
- However, if subjected to a *continuous* high power, high frequency signal, the PTC temporarily opens up, allowing the speaker to continue to play, drawing its power through the lightbulb at a somewhat compressed power level. The transition is smooth, and at the power levels being played at the time, barely perceptible to the human ear. When the speaker cools off, the PTC automatically resets, and conditions return to normal.

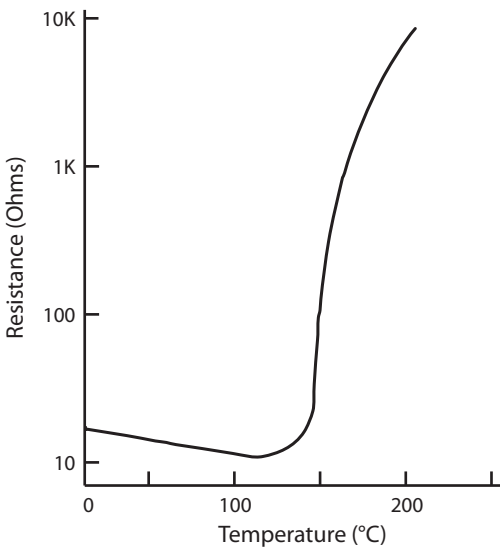
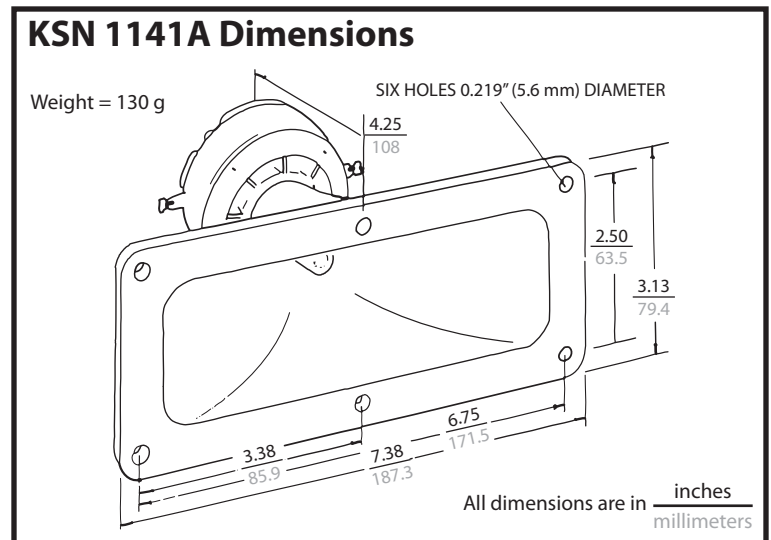
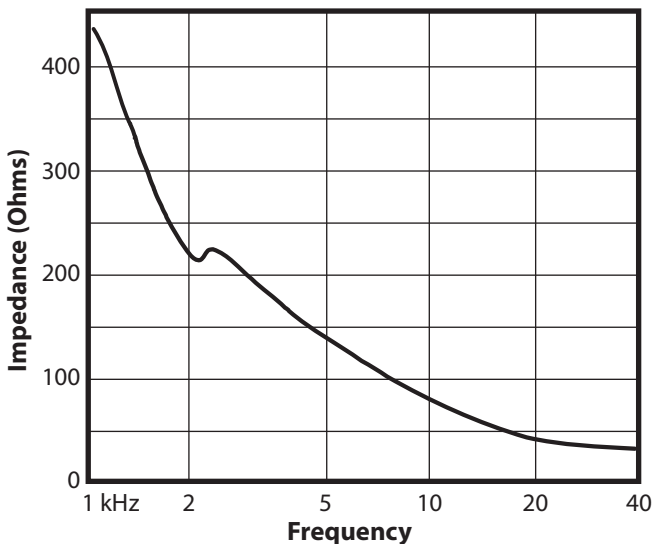


Figure 2. Resistance/temperature characteristic of a PTC resistor.



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