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Perspectives On Miniaturization (Part II) 4-7-2008

In last month's *Perspectives*, the experiences of industry experts in facing the challenges of miniaturization of medical devices and their components was shared. Due to the overwhelming response to this question, *MDT* is pleased to present a "Part II" to the topic, extending the coverage of this obviously very hot topic.

Q: In the effort to make medical devices smaller, what has been the most challenging obstacle you have faced, and how were you able to resolve it?

Ely Zofan, Director of Engineering, Challenge Electronics

As with many high-tech trends, miniaturization spawns great innovation. However, it often involves great challenge. This is particularly evident in the area of audible alarms where design challenges magnify as open real estate on end products shrinks.

Often, the barriers are physical. To output significant volume, an alarm needs to move air across a desired distance. Smaller devices move less air and do not generate the desired effect or signal strength. Human hearing is another consideration. Sonic reception deteriorates with age, particularly within higher octaves. Since smaller piezoelectric transducers or alarms produce higher signal frequencies, their sound may go unheeded, which can have dire consequences in a healthcare application. Sound vibration also increases kinetic stress on SMD solder connections, which can prevent the device from sounding properly—an equally serious issue in many healthcare settings.

We at Challenge Electronics have resolved these issues by enhancing the sound pressure level at the manufacturing level. This requires careful tuning of the sound chamber, followed by higher-fidelity adjustment and testing. Sound output is also optimized by controlling the driving circuit of the transducer, or, in the case of piezoelectric alarms, by raising the output voltage of the diaphragm with coils or transformers. In such instances, coils or transformers need to match the impedance of the piezoelectric element at resonant frequency which can be ten times lower than any other frequency.

To reduce resonant frequency, our engineers in some products mount the sound diaphragm on its edges instead of the traditional Nodal mount. This conserves premium space and reduces resonant frequency anywhere from 100 to 800 Hz. Other options include the use of larger, thinner diaphragms made with softer metals such as nickel alloy vs. the traditional brass or stainless steel variations.

To ensure long-term reliability, certain manufacturers will recommend that SMD audible devices be glued and soldered to the printed circuit board. This alleviates vibration-related stress on the SMT solder pad.

For applications where loudness is a factor, end-product engineers should consult with a specialist who is fully equipped with the knowledge necessary to ensure quality and reliability. Sounding devices may be easily categorized as commodity products, yet not all parts are equal in terms of performance and compliance.