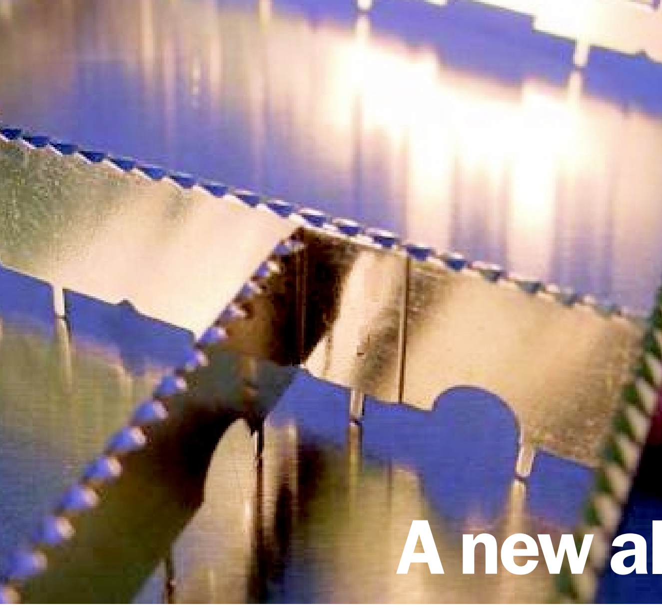

A new alternative to EMI shielding

Multicavity circuit board shields save space, weight, and time-to-market.

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FOR YEARS, INDIVIDUAL SHIELDS HAVE BEEN used to isolate several circuits and to reduce crosstalk on a circuit card. The number of shielded circuits per card has increased, but fortunately, today, contemporary circuits require less board area. Now, with more and smaller shields, the shield-to-shield spacing and the shield-to-circuit card footprints consume a significant percentage of the surface area on the circuit card. An innovation called multicavity circuit board shielding can reduce footprint and circuit-to-circuit distance. It can save space, weight, manufacturing time, and ultimately, time-to-market—while improving circuit performance (Figure 1). EMI designers, as well as manufacturing and purchasing managers appreciate the one-part multicavity shield versus the multiple part approach. These designers realize that one-part multicavity shielding means—fewer parts, less inventory to stock, less assembly, and lower design costs—thus creating significant financial and operational economies.

Multicavity economies and performance enhancements are significant. Combining multiple shields into a one-part multicavity shield reduces the amount of footprint (solder land) area by 25–65%. Consider two shields in close proximity—if combined into a multicavity shield—the footprint of one wall and the distance between the two shields is eliminated (Photo above, close-up of interior walls). Repeat this process with six or more shields and the savings add up. The cavity-to-cavity (circuit lead lengths) distance is now reduced to about .1 inch. Multicavity shields use less material and weigh 5–20% less than individual shields. Additionally, the reduced circuit lead lengths of multicavity shields also improve overall circuit performance.

What is a multicavity shield? It is composed of a group of Faraday cages that share interconnecting walls. Customers need one-part multicavity designs that drop into circuit cards, solder seamlessly, and

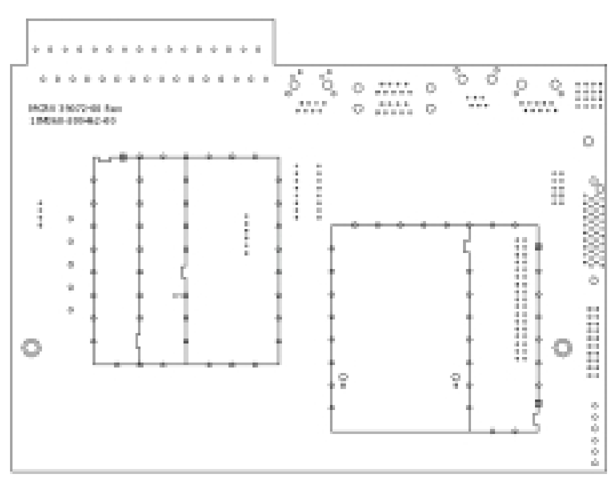

Figure 1.

provide complete Faraday cage shields. The optimum multicavity shield has a 100% shield-to-board solder connection, a good EMI contact between the inner walls, and a cover without any apertures between cavities.

Until recently, multicavity shields were created by designing covers, custom frames, and interconnecting walls, which were photo etched or stamped metal using custom tooling. One-part multicavity shields can be designed and photo etched from one piece of metal. However, this type of shield was always a unique design offering no economies of scale. These designs often required forming and difficult alignment of the inner walls. Etched designs usually had undesirable apertures between cavities, while stamped designs required multiple pieces that required assembly by the customer. These approaches required the customer to design every detail of the circuit board to the shield mounting area. Consequently, costs, especially for hard tooling, could be prohibitive at the design startup level. Moreover, these costs did not include the learning curve and design time necessary for the shield itself. It isn't practical to expect an engineer to design a perfect EMI shield before the electronic design is completed and tested. During research and development, electronic circuits change and often force modification of the shields. Modifications of etched or stamped designs require repeating the expensive custom tooling process.

The key question is how does one design a multicavity shield cost effectively? Designing a multicavity shield is a collaborative effort between the shielding supplier and the customer. The initial steps are critical. First, the shield style is established. Second, the overall size (height is paramount); attachment method (surface mount, through-hole, and solder requirements); inter-cavity circuit connections (notches, feed-through components); EMI environment; ventilation requirements; material requirements; and plating finish are determined. At this point, the mechanical part of the design can begin by using standard fencing material (Figure 2), forming it into an outside perimeter, then connecting the inner partition walls to the outside perimeter (Figure 3). The best place to begin is with a block sketch of the shield shape with gross dimensions based on the standard pitch of the fence. For example, the shield shown in Figure 4 can be described as a 2.0 inch x 2.25 inch shield with 2 inner walls that run from outside wall to outside wall across the longer length of the shield. This creates a 3-cavity shield, one large cavity approximately 1.0 inch x 2.25 inch, and two small cavities approximately 0.5 inch x 2.25 inch. Using these gross dimensions, the shield supplier can provide the customer with a layout for the exact pin pattern the customer desires. Next, the customer sends the board layout drawing to the supplier for checking. The shield supplier collaborates with the customer to define or to resolve any problems in the layout before order placement. All fences will stretch when bent at right angles. Using a typical bend stretch of .006 inch for the fence (NOTE: 0.006 inch in the X and Y directions each time the fence is bent), the outer pin pattern (Figure 4) dimensions are 2.012 x 2.262 inches.

Finally, the advantages of multicavity shielding are readily available. However, one-part multicavity designs can present some difficulties because of their potential complexity and high cost of customization. The key to a successful implementation of multicavity shields is finding the right shielding supplier. A supplier with the right experience—in cover retention, inner wall attachment, EMI gasket placement, ventilation holes, locating pins, anti-vibration dimples, etc. A supplier should offer custom solutions using standard off-the-shelf modular components, easily modified and properly assembled to yield a truly custom multicavity design. A custom design, but without the need for expensive etching or stamping tools. The ideal multicavity shielding supplier will have developed the necessary manufacturing techniques, fixtures, and craftsmanship for creating, holding, and joining the interconnecting pieces with the same precision associated with the manufacture single shields.

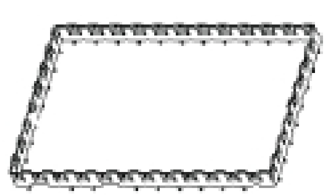

Figure 2.

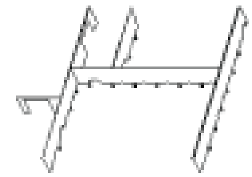

Figure 3.

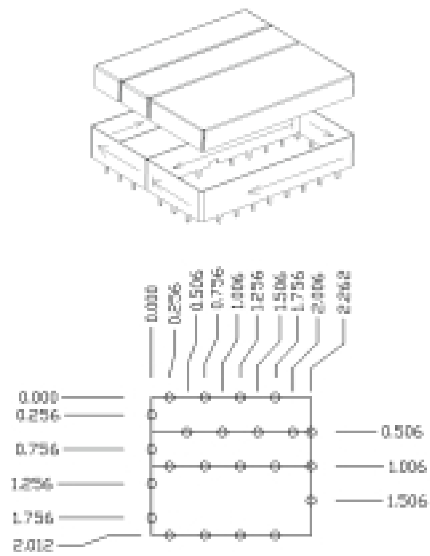

Figure 4. 3-cavity small shield.

DARRELL YARBROUGH, Leader Tech Engineering Manager, has been a driving force in the circuit board shielding industry and has specialized in MulticavityCBS™ shields. His experience includes the design and manufacture of microwave communications and electronic warfare systems. ■

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