# Some Practical Suggestions for Solder Preform Design

APPLICATION NOTE

Solder preforms are manufactured solder shapes that come in standard forms such as squares, rectangles, discs, washers, and frames. They can also be manufactured with custom geometries. Preforms provide consistent part-to-part dimensions that result in constant solder volumes, thereby ensuring consistency in solder assembly. Because preforms are made with a uniform shape and size, automation of the assembly process can be easily implemented, resulting in faster production and reduced costs.

Tooling design changes can increase costs rapidly, especially when experimenting with multiple shapes and sizes. A "trial and error" approach in determining the best preform geometry for an application that includes solders containing precious metals can also create unnecessary expenditures. It is best to do all the preform design homework before committing to final tooling. This application note will explore some simple ways to arrive at the optimum preform size and shape while reducing costs. The principles below can be used in conjunction with one another.

1. **Avoid using solder alloys that contain precious metals when determining the optimum preform geometry** — Determining the best geometry can be done using a less expensive alloy. For example, if the application calls for AuSn solder, use 90Pb/10Sn or another lower cost alloy to optimize preform dimensions in determining the required solder volume for the joint. Higher lead-containing alloys are preferred since the density of lead is closer to that of gold rather than that of tin. If the application restricts the 2-dimensional shape of the preform, varying the thickness is a good way to arrive at the appropriate volume of solder required.
2. **Cut preforms by hand from solder ribbon or sheet when prototyping** — Changes to tooling design can add cost and impact the overall total cost of preforms. Manually fabricating small volumes of preforms can be an economic method of arriving at the optimum preform shape and size.

   Standard alloys and many specialty solder alloys can be purchased in ribbon or sheet form in widths close to one dimension of the preform. Using a sharp cutting instrument, such as an X-Acto knife, cut the experimental shape from the ribbon or sheet.
3. **Begin evaluations using thin solder materials** — If the proper preform thickness is in question, it is best to begin with the thinnest preform possible. If the appropriate volume is not immediately achieved with one preform, they can be stacked. Multiple preforms will flow together and function as one.

   For example, after attempting to use a preform that is .002" thick, it is evident that the volume of solder provided by the preform is insufficient. The amount of solder can be doubled by stacking two preforms, which would equate to having one preform that is .004" thick. The solder volume can be tripled, and even quadrupled until the proper volume is achieved. This allows for the appropriate thickness of a single production preform to be determined.
4. **Use the simplest preform geometry possible** — Engineering charges for intricate designs can cost substantially more than less complex designs. Design the solder locations so that they can be adequately bonded using simple preform geometries such as washers, frames, discs, rectangles, etc.
5. **Determine from the solder supplier the sizes and shapes for which tooling exists** — An important issue in any soldering application is the resultant volume of solder at the joint after reflow. The size and shape of the preform are generally secondary considerations. Often, existing tooling that yields slightly different *x* and *y* dimensions from the ideal size can be utilized if the thickness of the preform is adjusted accordingly to produce the same solder volume.

   For example, the design of an application calls for a solder preform in the shape of a 1.2" x 1.2" square. The solder supplier does not have tooling for this size but has existing tooling for a 1.0" x 1.0" preform. To avoid additional tooling costs the 1.0" x 1.0" size is selected and the preform thickness is increased to yield the same solder volume.



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