TECHtips

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Electronics Manufacturing Insights from ACI Technologies, Inc.

Product Design and Early Manufacturing Involvement

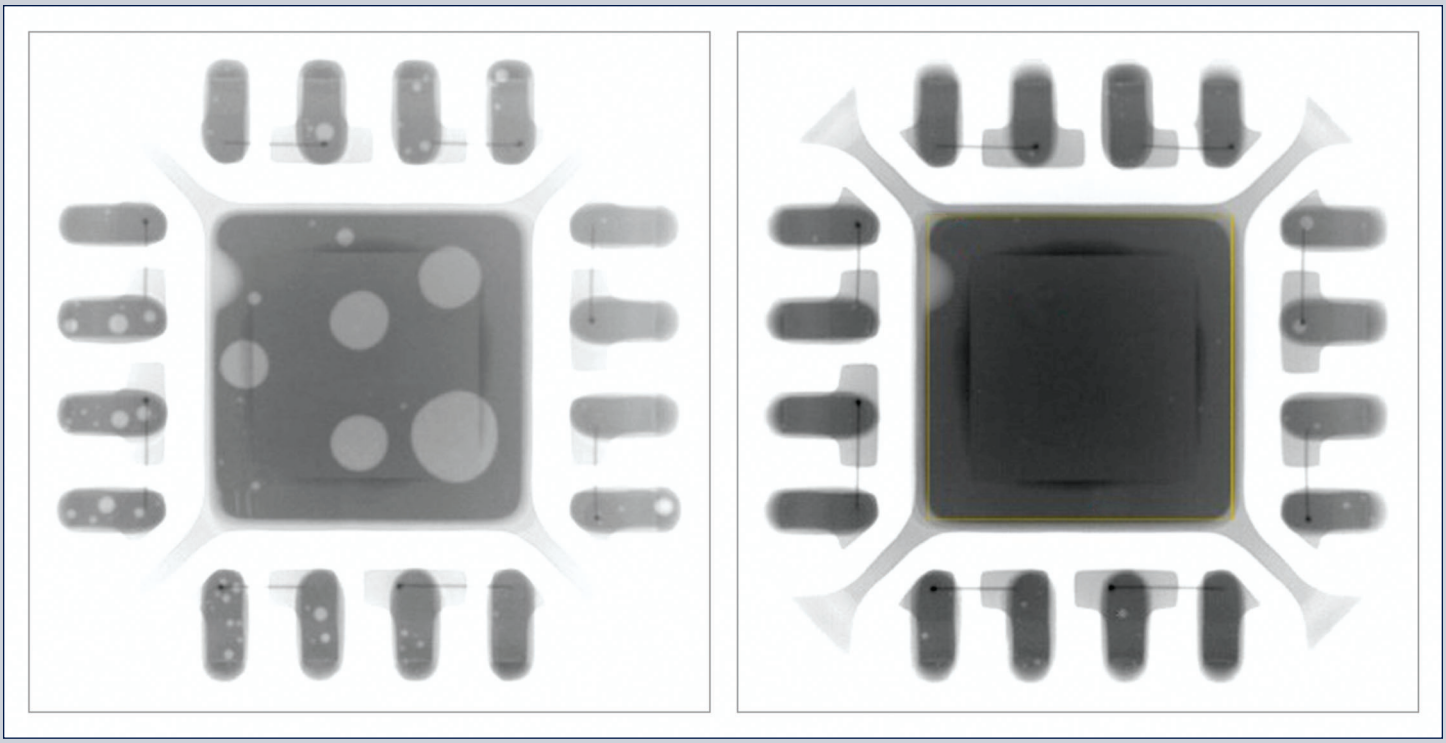

Figure 1: MLF 16 – 10mm: No Vacuum vs. Vacuum

It happens much too often; manufacturing engineers are brought into a NEW product design phase at the very end of a design and are asked to provide input that should have been provided much earlier. One needs to understand how the circuit board design and quality of the manufacturing process not only effects assembly yield and product reliability, but how it could also affect the results of any testing that is done to circuit packs during prototyping. It is important that any circuit pack (including prototypes) that will be used in reliability, performance and functional testing be designed with the proper features and assembled with a manufacturing process that has been developed to produce a high-quality assembly. If not, the results of any testing might not represent the actual characteristics of the design and provide miss-guidance to future changes.

Three factors that must be considered in determining the reliability of a product are its inherent reliability, the circuit board design and the quality of the manufacturing process that will be used to manufacture the product.

1. The inherent reliability involves selection of high-quality components that will operate well within their specifications and far outlast the life expectancy of the product (MTTF).

2. A circuit board design should follow standards such as IPC-2220-FAM: Design Standards for Printed Boards and IPC-7351 Generic Requirements for Surface Mount Land Pattern and Design Standard. IPC-2220-FAM covers material and final finish selection, current carrying capacity and minimum electrical clearances, and

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test specimen design guidelines. IPC-7351 provides information on land pattern geometries used for the surface attachment of electronic components to ensure enough area for the appropriate solder fillet to meet the requirements of IPC/EIA J-STD-001: Requirements for Soldered Electrical and Electronic Assemblies.

3. The manufacturing process used for assembling the circuit pack should be developed to produce a quality product. This includes optimizing reflow oven profile to meet pre-heat and soak, reflow and cool-down thermal profile for the board being assembled. The process might also need a stepped stencil to ensure the proper amount of solder is used to produce an acceptable solder joint.

Just because a product has an inherently reliable design does not mean it will be reliable in the field. The reliability may be unsatisfactory if the design has an incorrect footprint, too little solder in a solder joint or a poor quality, un-characterized manufacturing process is used. As an example, a poor thermal profile may produce a cold solder joint that could pass visual inspection and work initially. After time, thermal cycling and vibration the solder joint could fail. Another result of a poor thermal profile is large voiding of BGA solder joints or thermal joints underneath an MLF (MicroLeadFrame®) type package (see Figure 1). If the BGAs were thermal cycled they could produce early solder joint failures. Not having a good thermal path under the MLF could impact both thermal and electrical performance of the design. In the two examples cited above, the failure did not occur because of a poor component selection, but rather it failed because of an inferior manufacturing process.

Remember, a chain is only as strong as its weakest link. Three links to address early on in the design phase for a highly reliable product are the inherent reliability, circuit board design of the product and the overall quality of the manufacturing process.

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