Abstract

"The Application of PEMs (Plastic Encapsulated Microcircuits) in Space"

By
Joseph J Fabula, Xilinx

This paper will enumerate many of the common misconceptions and myths that have generally prevented the widespread use of plastic encapsulated microcircuits in space applications. It will point out those key parameters and limitations that must be understood (and therefore controlled) before accepting such devices in critical applications. It will dispel the fallacies that are often quoted to preclude the use of plastic encapsulated microcircuits in space. Finally, it will present qualification and reliability data supporting the use of PEMs in space.

The areas that will be addressed include various moisture effects ("popcorn", moisture intrusion, ionic impurities, etc), weight differences between ceramic and plastic devices, shock and vibration effects, outgassing from common plastic encapsulation materials, the possible existence of material synergistic radiation effects, package and vendor qualification requirements, and board assembly reliability testing. Cost will not be addressed as the cost of plastic encapsulated microcircuits suitable for space is not dominated by the cost of the package, but by qualification and data requirements. Data will be presented that show that high quality plastic encapsulated microcircuits, when properly understood and used within their capabilities, exhibit advantages over hermetic ceramic packaging, and do so with (at least) equivalent reliability.

Both hermetic ceramic packages and plastic encapsulated microcircuits have limitations that must be understood and observed. Both hermetic ceramic packages and plastic encapsulated microcircuits can be procured with good quality or with poor quality. Screening-in of reliability into devices manufactured on a poorly controlled line is not an option anymore than failure was an option to Apollo 13. Quality and reliability must be built into the hermetic ceramic assemblies and/or the plastic encapsulated microcircuits during manufacture. This paper will address the data requirements of a plastic encapsulated microcircuit supplier that are necessary to demonstrate that this is being accomplished.

Finally this paper will address some futures. Hermetic ceramic packaging is reaching the end of its life. Future generations of products are demanding packages with over 1,000 I/Os. Decreasing bond pad pitch on the die has exceeded the ability of the equipment manufacturers to do wire bonding. Flip chip alternative assembly of packages requires the application of an organic underfill, which itself is incompatible with the sealing process temperatures of hermetic assemblies. A progression of future packaging technologies which will support the types of ICs being designed in this new millenium will be presented.