Parametric Assessment for Board-Level Solder Ball Reliability of A HFC-BGA Package

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Abstract

A FC-BGA family package with thermal performance enhancement, denoted the HFC-BGA package, was adopted to perform the parametric assessment of board-level package reliability. Solder ball fatigue failure is the major studied subject in this research. A 3D nonlinear slice model was created to conduct the finite element analysis with a developed two-stage methodology. Both the plasticity and creep behaviors of the solder material were involved in the numerical computation. This methodology can be applied to low-cycle or high-cycle temperature conditions. The Modified Coffin-Manson law was used to predict the solder fatigue life study by transforming the determined inelastic strain from the physical domain into a mathematical solution. After the essential baseline thermo-mechanical verification analysis, the geometrical and material parameters of the underfill, heat spreader, substrate and PCB were adopted to continue the parametric studies. The heat spreader CTE is identified as the most important parameter affecting solder fatigue life and early failure. The pad opening on the PCB side has a significant effect upon fatigue life prediction.

Keyword：board-level reliability, HFC-BGA, finite element analysis