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Flip chip thermal test vehicle design: requirements, evaluations, and validations

Abstract

This paper reviews the design of a flip chip thermal test vehicle. Design requirements for different applications such as thermal characterization, assembly process optimization, and product burn-in simulation are outlined. The design processes of different thermal test chip structures including the temperature sensor and passive heaters are described in detail. In addition, the design of fireball heater, a novel test chip structure used for evaluating the effectiveness of heat spreading of advanced thermal solutions, is also illustrated. The design considerations and processes of the package substrate and printed circuit board with special emphasis on the physical routing of the thermal test chip structures are described. These design processes are supported with thermal data from various finite-element analyses (FEA) carried out to evaluate the capability and limitations of thermal test vehicle design. Design optimization as the outcome of these analyses is also elaborated. Lastly, the validation and calibration procedures of the thermal test vehicle are presented in this paper.

Keywords — And finite-element analysis, flip chip thermal test vehicle, thermal characterization