Thermal Simulation of FCBGA Package with Heat Sink

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Introduction: In a modern IC design, the capability of predicting the temperature profile is critically important as well as cooling and related thermal problems are the principal challenges. To address these challenges, thermal analysis must be embedded within IC synthesis. This paper presents thermal analysis of the FCBGA chip with a 4mm × 4mm × 0.3mm silicon die. The silicon die dissipate heat flux of different power from 1W to 5W. The aluminum heat sink is provided for convective cooling over the chip. Epoxy glue layer is provided to attach the heat sink with a 4 layer FCBGA substrate. The results are analyzed in COMSOL Multiphysics® by selecting the heat transfer physics. The heat sink provides the best thermal performance of FCBGA Chip package. The silicon die temperature is less than 325K for 2W power and analyzed temperature profile of the FCBGA heat sink

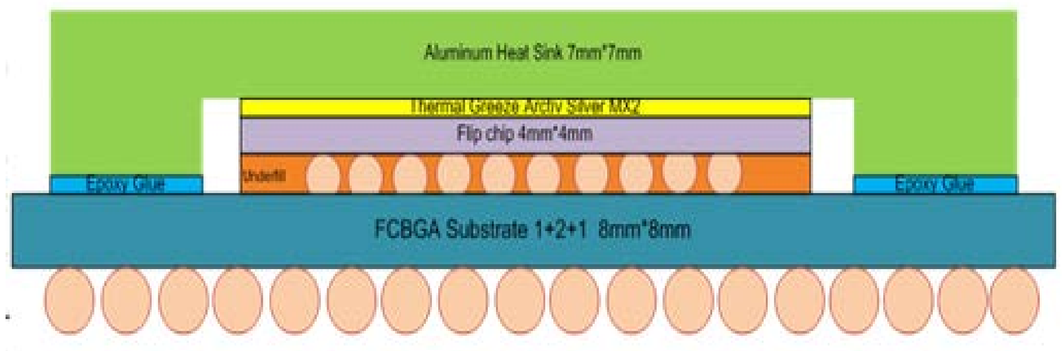
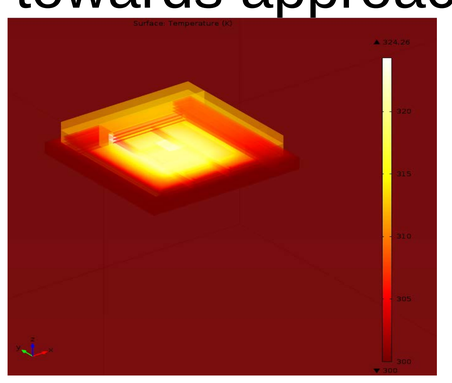


Figure 1. Package Construction

SIMULATION MODEL

Simulation was performed using COMSOL Multiphysics® software tool. By considering the heat transfer physics. The model consist of Aluminium heat sink for the cooling of an electronic component. A 4 layer FCBGA 8mm * 8mm substrate was taken and in between the substrate 4 thin copper layers of 12µm. Aluminium heat sink, Air box around a deviceis considered according to JEDEC standards in order to model convective cooling .

Results: Thermal analysis of flip chip BGA package was carried out with heat source varying from1W to 5W power and results are found corresponding that maximum heat generated at the silicon die and it has been absorbed by heat sink by natural convection process. The figure3 shows the temperature profile of the package. It has the temperature 324.26K at the region were has power supplied and gradually temperature decreases towards approaching to the heat sink.



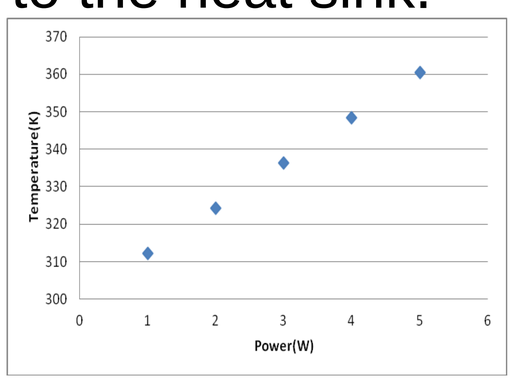


Figure 4. Power v/s Temperature

Figure 3. Temperature profile

Conclusions: From the results it is found that the temperature is increasing with at an interval of provided heat source. To obtain a good thermal résistance of FCBGA package it is required to select a low power heat source. If the heat source is constant and required to minimize the temperature it is essential to redesign the FCBGA package.

References:

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