THERMAL MEASUREMENT AND SIMULATION OF THE COMPONENT REWORK PROFILE TEMPERATURE

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Abstract

In this paper the known methods of electronics component rework temperature measurement and corresponding transient temperature simulation method is presented. According to the temperature measurement and rework profile parameter settings, the numerical temperature transient simulation method was developed for the FloTHERM thermal simulation software. The feasibility of the use of transient simulation in solder joint temperature estimation was clarified and the results was compared against the measured temperature values.

Keywords: profile parameter, rework, temperature profile, thermal simulation, thermo couple

Introduction

The most used temperature measurement method uses thermo couples to measure rework and reflow temperatures in electronics production. This method is well known and widely used but the drawback of the method is repeatability and sensitivity to the thermo couple placement, which are effecting to the measurement results.

The newer temperature measurement method is based on diode measurement, where diode’s forward biasing voltage is measured and converted to the temperature readings. When the diode is integrated inside of the component package the temperature measurement is done in systematic way and it will also take care of the thermal mass effect of the used printed wiring board and the package type.

With the thermal simulation of the rework profile it is possible to validate the temperature differences of the package which is very difficult with the use of thermo couples. Simulation also enables easy access to temperature profiles of adjacent component temperatures and solder joint temperatures under the component.

Simulation model development

The simulation model was developed started from steady state model of the measurement board and the corresponding environmental settings of the true measurement situation. The simulation model was build for the Flotherm V10 thermal simulation software which is the most commonly used thermal simulation CFD tool in the electronics engineering.

Results and Discussion

The thermal simulation model was developed and thermal transient simulations was performed to clarify the temperature difference between the package topside and solder joints and the diode inside of the package.

The results of the simulation indicates good correlation between component die temperature and solder joint temperature as the temperature difference was only ~1-2 °C. The simulated temperature difference between the solder joint and the component top side was ~6 °C.

Conclusions

According the simulation results, the die temperature can be used to estimate component solder joint temperatures. Also component top side temperature can be used to estimate solder temperature in simulations, but the accuracy is not as good as in die temperature measurement.

In the case of true thermo couple measurement, the thermo couple positioning and attachment on the component top side surface is the key issue on measurement result correctness.

The more challenging top side thermo couple measurement can be replaced with the use of die temperature measurement which is more robust and repeatable method.

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