Thermal Management Method for Chip-Scale Package Light-Emitting Diodes During Reliability Tests

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Thermal resistance model in light-emitting diode (LED) packages is useful to estimate the junction temperature. Until now, the solder point, located on the surface of printed circuit board (PCB), has been widely used as the temperature-sensing region in the LED industry. By measuring the temperature at the solder point and using the thermal resistance between the junction point and the solder point (Rjs), we could estimate the junction temperature roughly during the reliability tests.

Recently, chip-scale package (CSP) LEDs have been widely adopted in display application in order to maintain the cost competitiveness. However, in case of the CSP LEDs, it is very difficult to determine the solder-points because of their small package size. And this problem has led to the measurement inaccuracy of the LED junction temperature.

Instead of the inaccurate solder-point temperature (Ts) in the LED packages, we propose the reproducible board temperature (Tb) and the thermal resistance (Rjb) between the junction and the bottom of the PCB for the CSP LED application. By using a thermal-transient tester like T3Ster, we can extract the thermal resistance (Tjb) precisely. And we can maintain the junction temperature by setting the board temperature during reliability tests such as a high-temperature test and a high-temperature and high-humidity test. In addition, we compared the junction temperatures, measured from the conventional Rjs method and our proposing Rjb method.

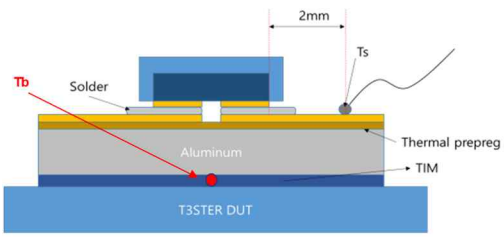

Fig.1 Solder point and board point of CSP LED.

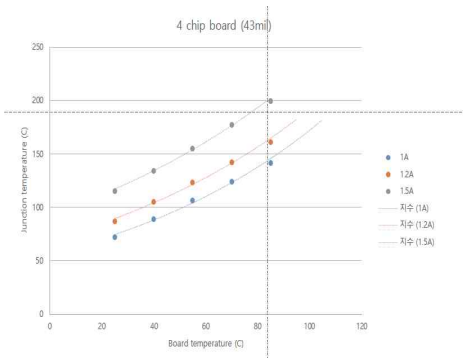

Fig. 2 Example of relation between Tj and Tb