

Junction Temperature of High-Power LED Packages with Diamond film

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Abstract

A simple, fast, and reliable characterization of thermal properties method to determine junction temperature (T_j) in high power GaN-based light emitting diodes (LED) was presented in this study. Thermal characteristics of high power Light-emitting-diode have been analyzed by using a three-dimensional thermal conduction model. Maximum operation temperature has also been calculated. The induced thermal behaviours of the best package processes for LED device with diamond film were investigated by finite element analysis (FEA) and by experimental measurement. The large change of forward operation voltage with temperature in light emitting diodes is advantageously used to measure junction temperature. Using this method, junction temperatures (T_j) of a LED under various structures and chip mounting methods were measured. It was found that the junction temperature can be reduced considerably by diamond film substrates. For diamond film substrates LED, as much as two-fold reduction in junction temperature can be achieved compared to other structures. In this study, we will report how we can achieve the junction temperature had to decrease about 10 percent for more than 1.5W- power dissipation for 1mm square die. It was found that the thermal resistance using diamond film structure is measured to be $17^\circ\text{C}/\text{W}$ which is the lowest than other structures.

Keyword : Junction Temperature, LED, Diamond film