Thermal Characteristics of High-Power LED Packages with Dissipation Film

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Abstract

A simple, fast, and reliable characterization method for measuring junction temperature(Tj) on 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 behaviors 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 temperature (Tj) of LED under various structures
and chip mounting methods was measured. It was found that the junction temperature can be reduced considerably by using diamond film substrates to replace sapphire substrate. In this study, the junction temperature can be decreased by about 14.3% under 1.5W power and decreased by about 15.9% under
1W power for 1mm square die. The thermal resistance (RT) can be measured to be 14.8˚C/W under 1.5W power and 16.6˚C/W under 1.W power.

Keyword：Junction temperature, diamond film, Light-emitting-diode