

Introduction to Arima's Flip Chip LED (FCLED)

For the conventional AlInGaN LEDs, the epi structures are grown on the sapphire substrate. Sapphire has a low thermal conductivity of about 30 W/m-K. While a conventional LED is packaged by the encapsulation material to a lead frame, the low thermal conductivity of sapphire become a critical factor of creating high serial thermal resistance of a LED lamp. It is not suitable for the high power or high current density LED applications due to the internal quantum efficiency of a LED chip is strongly affected by the thermal effect at the active region. It is generally accepted that good reliability performance will only comes from good thermal design of the chip as well as the package when it comes to power application. One of the approaches to resolve this issue is to introduce a thermally conductive substrate to the major thermal path toward ambient condition. In principle, heat is removed from active layers to the ambient by two paths as indicated by figure 1. For a conventional LED, a considerable amount of heat will be transferred from the front surface of LED. The design of flip chip LED manage to re-direct the most of the heat flux to pass the submount and then into the package. Heat is conducted more efficiently by this way.

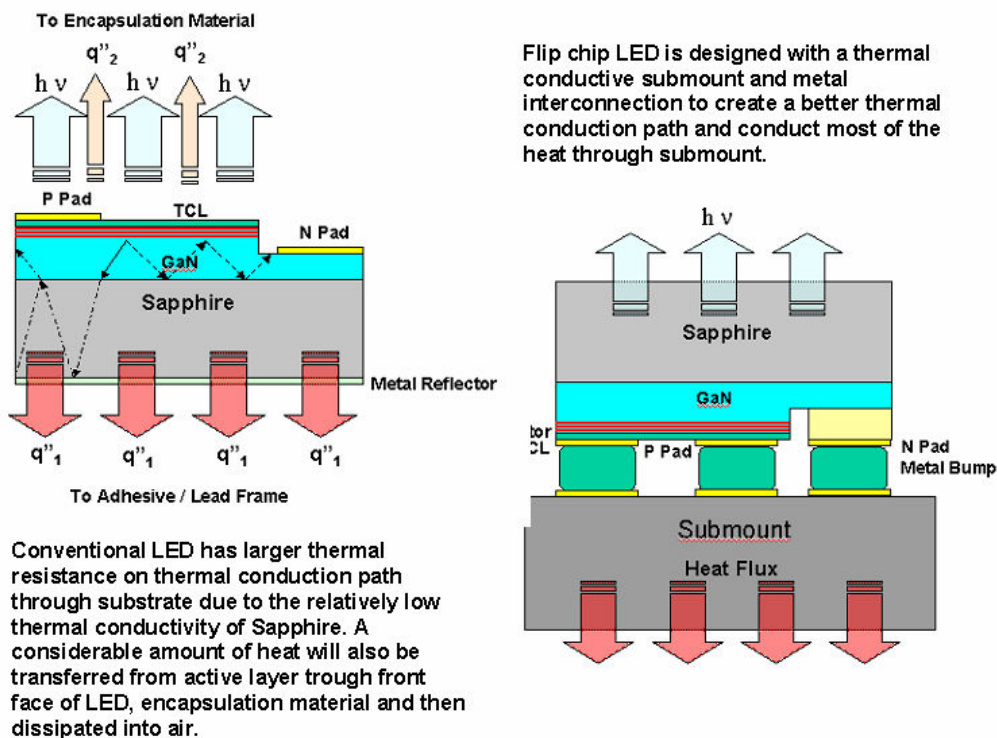


Figure 1. Comparison of thermal design concept between the conventional face up LED and the flip chip LED

Arima initiated the flip chip development project several years ago. Several design

iterations have been done through before the current design. Main effort has been concentrated on developing flip chip bonding technology as well as on the increment of external quantum efficiency. The new epi structure is optimized such that the absorption by epi structure can be minimized. Improvement on reflecting mechanism is also one of the major factors to improve the light extraction. A carefully designed chip structure is to guarantee better current spreading and reliability performance than conventional InGaN LED.

Demanding by the market, Arima introduced 14 mils and 40 mils product in 2005 to satisfy customer's requirement. (Figure 2 and 3) Currently, 24 mils are also in design and will be available shortly.

The Arima FCLED is to be sorted into either 2.5 nm or 5 nm per bin depending on customer's requirement. The irradiation power of this FCLED while driving at 350 mA, ranges from 120 mW to 180 mW by bare-chip-on-TO-can measurement. The nominal forward voltage for a 40-mil FCLED after bonding is around 3.6V while working current is 350 mA. For 14-mil FCLED, the irradiation power ranges from 8 to 10 mW by bare-chip-on-TO-can measurement at 20 mA. The nominal forward voltage for 14-mil chip is about 3.1~3.2V.

For more information regarding with this product, please contact Arima marketing personnel.

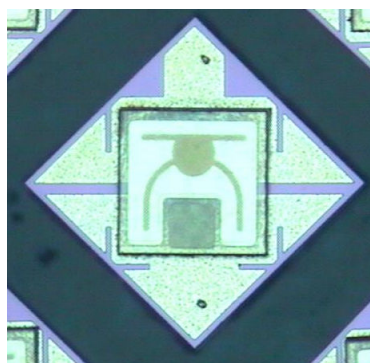


Figure 2. Photo of a 14-mil flip chip with submount. The submount size is about 22.5 mils x 22.5 mils.

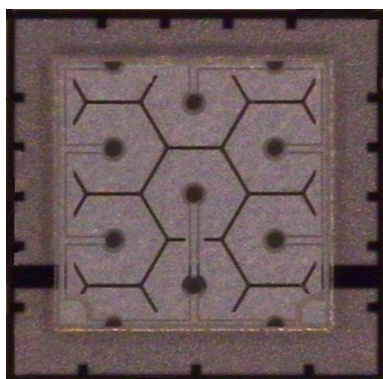


Figure 3. Photo of a 41-mil flip chip with submount. The submount size is about 57 mils x 57 mils.