INTRODUCTION

In the past decade, Light emitting diode (LED) has shown the powerful potential in solid-state lighting filed. It is a simple junction semiconductor emits continuous light when current flows through its junction at a low voltage. However, based on a given luminous output, LED light sources are typically smaller than their conventional lighting counterparts. Due to their compact size, LEDs are an excellent option where size or weight is a concern. In addition to these major benefits, there are many other advantages. LED lamps are robust and non-toxic. LEDs are semiconductor devices and usually do not use any glass and filament, while incandescent, fluorescent, and high-intensity discharge (HID) lamps do. Also, LEDs do not contain mercury, unlike fluorescent lamps. Directional light emission of LEDs reduces wasted light. LEDs emit light hemi-spherically, while other light sources emit light in all directions. Optics and reflectors can be used to make directional light sources, but they cause light losses and additional cost. In spite of many advantages, the high price of LEDs is the main obstacle in using LEDs as a light source. LEDs are currently more expensive, price per lumen, on an initial cost basis, than other light sources. However, considering the total cost which includes energy and maintenance costs, LEDs are competitive enough at present and continues to improve.

LED is p-n junction devices constructed of semiconductor materials like gallium arsenide (GaAs), gallium arsenide phosphide (GaAsP), or gallium phosphide (GaP). Silicon and germanium are not suitable because those junctions produce heat and no appreciable IR or visible light. The junction in a LED is forward biased and when electrons cross the junction from the n-type to the p-type material, the electron holes recombination process produces some photons in a process called electro-luminescence. An exposed semiconductor surface can then emit light for illumination. The wavelength is related to energy gap of material, larger energy gap produced shorter wavelength [3]. For white LED, there’s two main ways to get white light from LED. The first method is to combine light from red, green, and blue colored LEDs. White formed this way can be “tuned” to look warm or cool by adjusting the amounts of colors in the mix. The second method uses a blue LED with a phosphor coating. The coating emits a yellow light when the blue light from the LED shines...
on it. The mix of the yellow light with the blue light forms a white light. Inefficiency in the phosphor conversion is one reason that a white LED is less efficient overall than a colored LED. Some of the light energy is lost in the conversion to yellow.

The light-emitting diode (LED) as lighting faced a critical problem of heat dissipation. LED only has 20%~30% photoelectric conversion efficiency, and the rest about 70% of the total energy is converted into heat, creating a thermal problem. If the chip’s heat of the LEDs can’t be dissipated effectively, it will make the PN junction temperature too high. Furthermore, this will result in chip luminous efficiency reduced, emission spectrum red shift, colour temperature drop, lifetime shortens, even can led to LED permanent failures.

A good packaging technology is the way to solve the heat dissipation problem, but it is a challenge to develop this technology in the limited space of LED. Heat removal in packaged high-power LED chips is critical to device performance and reliability. The purpose of heat dissipating technology for LED is to decrease the working temperature of LED’s chip. It is necessary to reduce the thermal resistance of LED package. For example, we could design a package with low thermal resistance. Optionally, lower thermal resistance can enable increased brightness operation without exceeding the maximum allowable junction temperature for a given lifetime. The dimension of chip is tiny, so the high heat dissipating technology of LED has to be developed in micro scale.

Therefore thermal management is a key enabling technology in the development of advance electronics. Though the new tool and technology are employed for cooling, there is no remarkable change in the constrained and design requirements.

Recently, LED cooling methods can be divided into two categories: passive cooling and active cooling. Such as natural convection, heat pipe technology, plate technology, loop heat pipe technologies are passive cooling solutions; wind cooling, micro channel heat convection, semiconductor refrigeration, phase changed cooling and other methods are belong to active cooling methods. The passive cooling systems are not assisted by mechanical equipments.

Air cooling is the simplest and principal method of thermal control most widely used for
variety of electronics systems. The advantages of air cooling are its ready availability and ease of applications. Fins are often used to enhance the rate of heat transfer from heated surfaces to environment. They can be placed on the plane surfaces, tubes, or other geometries. These surfaces have been used, to augment heat transfer by adding additional surface area. When an array of fins is used to enhance heat transfer under convection conditions, the optimum geometry of fins should be used, provided this is compatible with available space and financial limitations.

Therefore, controlling the heat is the core issue needed to be solved by the power LED packaging and LED application design. It is also the subject concerned by LED lighting designers how to optimize the thermal design of LED lighting devices to improve the thermal structure of the internal flow field and lower the temperature of the surface of the LED lamps and the chip. Researcher has obtained optimal heat dissipation by using numerical methods and experimenting with optimizing germanium film quantity, structure, arrangement; With a high power LED lighting being the model, gave a thermal analysis using ANSYS software; On the LED lighting heat issues, conducted a detailed numerical simulation by the ANSYS software; and performed thermal analysis in the temperature and heat flow field of the heat radiation structure of two typical LED lighting.

On the optimal design of LED heat lamps, experiments and a method of Thermal resistance calculation will be used, which need higher research costs. It may be shorten the design cycle, reduce research costs and improve efficiency by using computer simulation software to optimize the design. In this study, a 60W LED lighting model will set up; by using the thermal analysis software for simulation, the issue how the chip maximum junction temperature is influenced by cooling fins degrees, width and number will be studied; and the cooling fins structures have will been optimized.