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A Review on thermal behavior of Heat sink with effect of optimized configurations

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***Abstract*: Here in this work, it review the different performance parameters of heat sink and also reviews the used of different use of heat sink A heat sink is a passive heat exchanger that transfers heat. Heat sink is an electronic component or a device of an electronic circuit which disperses heat from other components (mainly from the power transistors) of a circuit into the surrounding medium and cools them for improving their performance, reliability and also avoids the premature failure of the components. The device transfersheat to the heat sink by conduction. The heat sink is typically a metallic part which can beattached to a device releasing energy in the form of heat, with the aim of dissipating that heat to a surrounding fluid in orderto prevent the device overheating. The primary mechanism of heat transfer from the heat sink is convection, although radiation also has a minor influence.**

***Keywords*: Heat sink, Review, heat transfer, performance parameters.**

1. Introduction

The most common method for cooling packages is the use of passive heat sinks or active heat sinks. Passive heat sinks used in natural convection applications where normal heat dissipation load is about 5 – 30 W, which are relatively simple, and their usage does not require external power. The continuing increase of power densities in microelectronics and the simultaneous drive to reduce the size and weight of electronic products have led to the increased importance of thermal management issues in these applications. Over the time, the size and costof typical electronic device has drastically decreased while the required functionality, reliability and operating temperatures have significantly increased. In addition, day by day the rate of automation is increasing significantly in all the fields; for example, today's average new automobile content is about 40% of electronics. The temperature at the junction of an electronics package (chip temperature) has become the limiting factor determining the lifetime of the package.

2. Need for Cooling of Integrated Circuits

Electronic equipment relies on the flow and control of electrical current to perform a fantastic variety of functions, in virtually every major industry throughout the world. As the heat builds up, the temperature of the resistive element starts to rise, unless the heat can find a flow path that carries it away from the element. If the heat flow path is poor, the temperaturemay continue to rise until the resistive element is destroyed and the current stops flowing. Whenever electrical current flows through a resistive element, heat is generated in that element. An increase in the current or resistance produces an increase in the amount of heat that is generated in the element. The heat continues to be generated as long as the current continues to flow.

3. Heat Sink

For the cooling intention, it comes with a fan or chilling device. It is a passive heat exchanger which usually exchanges the heat provided by an electronic or a mechanical deviceto actually a fluid medium, quite often air or a liquid coolant, just where it is dissipated aside from the gadget, therefore permittingcontrol of the device's temperature at best variants. Heat sink is an electronic digital component or simply a device of an electronic circuit which usually disperses heat via other parts(primarily coming from the power transistors) of a circuit into the neighbouring medium and so cools them for enhancing their very own effectiveness, consistency and also eliminates the early failure of the elements. In largely computer systems, heat sinks are applied to cool central processing units as well as graphics processors.

4. Existing Research Work

In later past years, the usage of various heat sinks has expanded the interest of engineers and researchers to simulate their issues with computational, experimental and numerical methods.

[1] Yoon et.al (2018) In this experimental paper, they have tested and analysed the radiative heat efficiency, depending on the position of the partial hot areaBased on this analysis, it is suggested that a relation would be developed by experiments to determine the best location for the heat. Therefore, it is possible to reduce the heat resistance of heat by 30% by finding the best position of the partial heating. The thermal efficiency is expected to be improved by changing themounting position of the heating element on the radiation to make the electronics efficient. . Numerical modelling simulations for forced convection were used to analyse the heat transfer between heatsink and the surrounding air. The best location of partial heat, which is discussed in terms of the impact of the total rate of heat transfer, air velocity, the ratio of total length of heat sink to the hot width surface of the heat sink, the thermal conductivity of the heat sink and the thickness of the base of heatsink.

[2] Hussain et.al (2019) In this paper, the investigation develops a computational fluid dynamics (CFD) model, validated through comparison with an experimental data from the literature, which demonstrates the effect of flow direction and fillet profile on the thermal performance of plate-fin heat sinks. Therefore, the developed approach has strong potential to be used to improve the thermal performance of heat sinks and hence to develop more advanced effective cooling technologies. In particular, a plate-fin heat sink with fillet profile subject to parallel flow has been compared with the conventional design (plate-fin heat sink without fillet profile subject to an impinging flow) and satisfactory results have been perceived. The results of this study show that the base temperature along with the thermal resistance of the heat sink is lower for the proposed design.

[3] Hasan et.al (2018) In this paper using of the phase change materials (PCMs) in a micro-channel heat sink (MCHS) is numerically investigated. The results showed that, using of the phase change materials in micro-channels heat sink with different configurations lead to enhance the cooling performance of micro heat sink. The air is first used in heat sink and then four phase change materials (paraffin wax, neicosane, p116 andRT41) have been used as cooling mediums in different types and different configurations at different ambient temperatures. Constant heat flux is applied on the base of heat sink and mixed (convection and radiation) boundary condition is applied at the topsurfaces of heat sink. The phase change material should be selected accordingto its melting temperature according to the certain application as different phase change materials caused different values of reduction in heat sink temperature in range of ambient temperature due to difference in melting temperatures of PCMs. The cost ofmaterials depends on the classification of the PCM (organic and inorganic) and quantity of PCMs used in a certain application

[4] Liao et.al (2017) In this paper, the thermal conductivity of the pin fin heat sink with the delta winglet vortex generators in the cross flow was tested numerically along with experimental setup. Impact of the Reynolds flow, the angle of attack of the vortex machine, the shortest distance between the vortex machine between the distance between each vortex generator and the heat sink of the vortex engine and the configuration of the vortex machine on the effect of radiation had been tested. The results suggest that the heat resistance decreases with increased Reynolds, but the size of the reduction decreases with Reynolds.

[5] Jeon et.al (2016) numerous studies on heat transfer from natural convectors with radial heat sinks having perforated ring were applied here. Impact of the number of perforations (0-6), hole diameter (0-3 mm) and length of holes (1.5-6 mm) and directional angle (0-180) on the thermal efficiency were studied. The results revealed that radial heat sinks having a perforated ring undergone best thermal performance as compared with heat sink having imperforated rings. In case of the thermal resistance, the radial heat sink with reduced mass by 37% having optimized perforated ring had shown 17% decrement than that of imperforated ring. This can be set to unobstructed natural convective flow through the perforation.

[6] Sudhakar et.al (2016) In this paper, researcher had used the three-dimensional temporary pattern of the geometric structure of the substrate of the chip to predict the degree of imbalance in temperature and mass temperature, which diffuses through the base of heat sink from the heat source to the cold side. This model incorporates heat, which can absorb from any source, temporarily heating easily by many asteroids. The level of the same is mapped as a function of geometry and a boundary state. This analysis established in this work is useful in evaluating the same heat load conditions, not entirely dirty, but instead of being distributed on radiation to the cold side.

[7] Anbumeenakshi et.al (2016) In this study, they had investigated through series of experiments on the common effects of nanofluids and uneven heat on the cooling effect of microchannel sinks. The microscopic radiation that is considered in this study distributes 30 rectangles with a 0.727 millimetre diameter. In the experimental experiments, three machines of the same size were used. Uneven heat is provided by opening two of three heaters at the same time. The maximum temperature of the pulse rays is lowest when the chipper is placed above the flow.

[8] Soni et.al (2016) The work here examined the changes in the heat transfer in the equilibrium state in the variation in heat energy and the heat efficiency between the rectangular shaped fin heat sink and pin fin heat sink from the vertical orientation base plate. After creating and confirming the existing analytical results for continuous fins, a systematic study of the effect of the elliptical fin is performed. ANSYS and SOLIDWORKS design software were used to create three-dimensional digital models to investigate the different fins geometry effects. The results showed that the changes in the fins geometry to the vertical oriented base plate fins increase the thermal efficiency of the fins and reduce the weight of the fins array, resulting in lower production costs. The optimum distance for the maximum heating efficiency of the grid is limited. The study shows that the most important geometric parameters that affect the thermal transfer are the ratio of diameter of the fin by the centre gap.

[9] Wan et.al (2016) in this work, here are four different types of micro pin fin heat sink (square, diamond, circular and streamline) had been produced by a microscopic milling process for two-stage cooling system. Experiments with boiling water were performed to demonstrate the two-stage boiling point of these different shapes micro pin fins. As a result, the reduction of the pressure of four micro-microbes increases when the heat fluxes increases. This diamond shape showed a slight drop of pressure, then by square and circular shaped fins. Square shaped rings have the greatest pressure for general use. Experimental results suggested that pin with square shaped fins have the best proportion and should be selected for the heat absorption in micro pin fins during a bifurcation process in two flows. Micro pin fins with circular shape is also a good choice when pumping power is not worried.

[10] Park et.al (2015) In this study, a cooling system incorporating a hollow cylinder and a radial shaped heat sink that could be applied to LED (light-emitting diode) were proposed. The energy change of natural convection is simulated by digital samples and is validated by experiment. The airflow pattern around the heat sink with fin in radial direction is just same like chimney and going to the side of the heat sink and moving to the top. When the hollow cylinder is mounted, the large air velocity to the fins of heat sink enhances, resulting in increased thermal performance of heatsink. The effect of the height and the material of the hollow cylinder has been investigated and the efficiency of the heat sinks with the various types is calculated. The results showed that the heat efficiency of the heat sink was improved up to 43% after installation of the coil layer.

[11] Duangthongsuk et.al (2015) In this article, they had tested the thermal conductivity and flow characteristics of the heat sinks with shapes like circular and square pin (MCFHS and MSFHS) with SiO2, dispersed in DI water having fractional volumes of 0.2, 0.4 and 0.6% of the sound strength. The description is the impact of needle structure, particle concentration, and flow rate of heat exchanger and pressure drop across the test site. It is assumed that the coefficient of heat emission increases with increasing the concentration of particles and Reynolds numbers. Finally, it would suggest that the use of square shaped heat sinks should be avoided when case comes to circular shaped structure of fins.

[12] Ho. et.al (2014) speaks about the alumina and microencapsulated phase change material as the working fluid. Experimental results obtained reveal that the heat dissipation effectiveness of the nanoÀuid and PCM suspension depends signifcantly on their flow rates through the heat sink. For the nano fluid, the highest enhancement of 57% in the averaged heat transfer coefficient was detected under the highest flow rate; while for the PCM suspension, the highest enhancement of 51% under the lowest flow rate. For the hybrid water-based suspensions, the effect of simultaneous dispersion of the nanoparticles and MEPCM particles in water appears to be supplementary with added benefit of simultaneous increases in the effective thermal conductivity and specific heat such that the heat transfer effectiveness could be further increased up to 56% with little dependence on the flow rate.

[13] Jang et.al (2014) This article optimized a radial heat sink pin–fin having a fin-height profile. Natural convection and heat transfer from radiation have been taken into account and experiments are conducted to confirm digital models. Among the different height patterns, the outer field shows the best cooling. The variability of the various parameters is studied to determine the design variables, the outer height of the shaft, the difference between the height of the lens and the number of bars. Efficiency is optimized to reduce heat and mass resistance. In total, the cold radiation efficiency of rounded rays with a needle-height profile shows an improvement of more than 45%, while maintaining a mass that is comparable to plate heat.

[14] Sharma et.al (2013) They have detailed analysis of heat transfer using a microchannel heat source for cooling electronics. Cleaning the heating and heating of the fans with reusable water to cool the waxy electronics has been studied. To disguise the complex flow conditions, three-dimensional heat transfer models (3D) have been developed. The microchannel structure for heat transfer is environmentally-modelled with parameter parameters derived from the 3D model for a single microchannel. X-ray energy characteristics are analysed for the effectiveness of Law 2 and the most devastating sources are determined by a detailed analysis of Reynolds's low and high entropy generation of 2400 and 11200, respectively. This analysis shows that the generation of entropy due to Heat transfer dominates the generation of pure entropy in radiation for both conditions.

[15] Nielsen et al. (2012) investigated the effect of flow mal-distribution on the performance of micro-channel parallel plate heat exchangers using an established single blow numerical model and cyclic steady-state regenerator experiments. They found that as the variation of the individual channel thickness in a particular stack (heat exchanger) increases the actual performance of the heat exchanger decreases significantly, deviating from the expected nominal performance. They attributed the reason to both the varying fluid flow velocities in each individual channel and the thermal cross talk between the channels transverse to the direction of the flow.

5. Conclusion

Through literature survey, it is concluded that the performance of heat sink depends on the different parameters of heat sink. The performance of heat sink is mainly depends on material used for the manufacturing of heat sink, types of fins used, turbulence flow in between the channel, arrangement of fin. Heat sink is an important device used to maintain temperature of different equipment which generates heat.

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