

A REVIEW ON HEAT SINK HAVING DIFFERENT SHAPES OF FINS

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Abstract: Heat sinks are used to extract the heat from heat generation devices which is mainly electronic devices. With the development of new technologies, the size of the electronic devices decreases which results in the reduction of size for each and every component inside the device. With decrease in size, the heat generation inside the components get increases which results in degrade in life cycle of components. So in order to maintain device as an optimum temperature heat sink were used. Here in this work a complete review of heat sink with different shapes of fins was done.

Keywords: heat sink, baffles, heat transfer, method

1. Introduction

A heat sink also commonly spelled heat sink is a passive heat exchanger that carry the heat produced by an automated or a power-driven manoeuvre to a fluid medium, over and over again air or a fluid lubricant, where it is dissipated away as of the system, thus permitting instruction of the apparatus hotness at maximum intensities. In workstations, heat bowls are utilized to cool central processing units or graphics processors. Heat sinks are utilized with high potential semiconductor mechanism like power transistors and optical electronics likewise lasers as well as diodes (LEDs), where the heat indulgence aptitude of the constituent with in is laughable to reasonable its hotness. A heat sink is intended to make best use of their external part in interaction with the refrigerating standard nearby it, like as the different fluid. Heat sink accessory approaches as well as current edge resources too distress the die temperature of the joined trip. Thermal epoxy resin or thermal blubber recover the heat span presentation by satisfying air breaches amongst the heat sink with the heat communicator on the expedient. A heat sink is frequently completed out of Cu or Al. metallic copper is utilized since it has numerous needed belongings for thermally effective as well as strong heat exchangers. This thing defines that copper is having high thermal conductivity which permits warmth to overcome into it rapidly. Al heat sinks were utilized as a low-cost, frivolous substitute to Cu heat sinks that has a lesser thermal conductivity compare to copper.

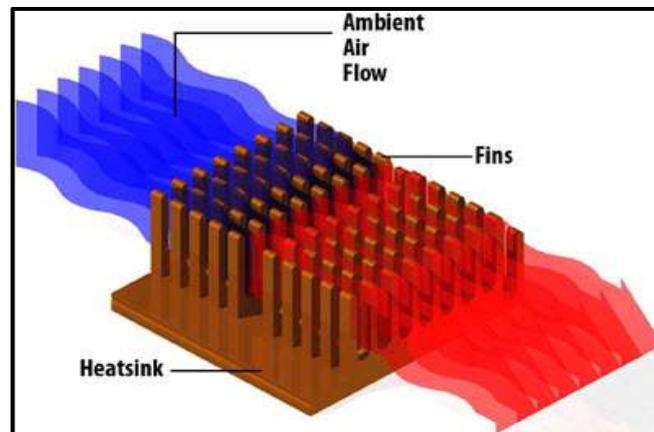


Fig.1 shows the diagram of heat sink.

2. Heat transfer principle

A heat sink changing thermal energy from a higher temperature apparatus to a lower heated liquid media. The gaseous media is normally air, but could be water too, lubricants or oil. If the unsolidified media is water, the heat sink is normally known as a cold slab. In thermal science a heat sink is a heat basin which may capture an uninformed expanse of hotness other than suggestively varying temperature. Experimental heat sinks for microelectronic apparatus always had a temperature greater than the atmospheres to allocation of heat by three modes of heat transfer as convection, radiation, as well as conduction. The power deliveries of microelectronics were not cent percent competent, so further heat is fashioned that might be disadvantageous to the purpose of the expedient. As further, a heat sink is comprised in the proposal to dissolve heat.

3. Existing Research work

For increasing the heat transfer rate of heat sink researchers have work on different parameters and optimize the things. Different design and parameters on which researcher have work recently are concluded here. Some of the recent work is included in this chapter.

1. **Karami et.al (2019)** In the present analysis, a micro pin fin heat sink using a baffle wherever gives the detailing of untainted water runs over and are pretend as well as analysed in three dimension using ANSYS Fluent in the laminar limit of $52 \leq Re \leq 252$. At this point we have taken to alter the baffle's nature as well as extents for inspecting the influence of perplex on the transfer

of heat. The outcomes are associated through micro pin fin thermal descend devoid of baffle. The consequences displays the utilization of baffle in bit limbs in such dimensionless number like Reynolds number upsurgers the rate of heat transfer. Though, by raising the Reynolds number the drop in pressure upsurgers. The heat sink with 22% overlays dual patterned perplex having the maximum degree of heat transfer. Their consequences with lesser Reynolds number is inconsequential as well as upsurgers through greater Reynolds. The mean fluid pace has been tested to discover the cause of some modification. The pressure descent is additional constraint which were essential in microchannels as well as micro pin fin thermal descends likewise look over in such analysis.

2. **Prajapati et.al (2019)** In this analysis, transfer of heat as well as flow of fluid behaviour were calculated mathematically in quadrangular equalised microchannel heat sinks through variable length of fin. Seven diverse conditions were measured by changing the fin length around 0.3 to 1.0 mm. Fully surrounded heat sink predictable conformation of 1.0 mm fin length has one of the circumstances though left out six heat sink conformations kept exposed to the area amid fin uppermost sides as well as shield wall. Three dimensional mathematical replications are passed out to the kind of working limits wherever heat instability changing around 100 to 400 kW/m² with Reynolds number around 100 to 500. Solo segment fluid currents like coolant under heat sink to eliminate hotness. Maximization of fin length would be completed to attain extreme rate of heat transfer as well as thermal enactment of the heat sink throughout. It had been perceived that planned proposal of the heat sinks assist different heat intemperance potential with fluid flow features. When fin length raised, it empowers the heat transfer augmentation into the heat sink, though, away from 0.7 mm of fin length, such development not at all continues.
3. **Chiu et.al (2017)** This paper mathematically as well as practically examined the liquefied refrigerating proficiency of heat sinks comprising micro pin fins. Aluminium models of heat sink through micro pin fin are contrived to discover the stream with thermal enactment. The leading mathematical constraints involved the radius of micro pin fin as well as permeability of fin arrangement. The properties of the mathematical constraints with descent in pressure on the heat transfer enactment of the heat sinks are considered. The stream speed has amplified by mutually growing permeability of micro pin fin arrangement with pin radius. Nonetheless, the consequence of permeability has been improved once bigger than 0.6 meanwhile it display little involvement on stream confrontation. The heat transfer enhancement is reliant on the permeability of micro pin fin selection on the pin span. For meagre strategies, arrangements of reduced pin span shows extra surface for transfer of heat with outcome in inferior operative thermal restraints. Defiantly, higher pin span displays extra favourable outcomes for heavier arrangements cause of profitable current rate.
4. **Ghani et.al (2017)** In this paper, the consumption of reflexive systems to boost transfer of heat in microchannel heat sink devises acknowledged accumulative consideration due to intensifying claim for enhanced thermal supervision in present automated projects. Though, various trainings focused on the practice of unique nature of submissive systems which emphases merely on single feature of its presentation which has moreover procure greater heat transfer speed through advanced drop in pressure, and making little drop in pressure at truncated proportion of heat transfer. In place of added augmentation of hydrothermal enactment in microchannel heat sink, such enquiry shared dual methods to feat structures of maximum transfer of heat in lesser drop in pressure. This is destined to transmit the existing delinquent of limits that obstruct the heat transfer augmentation in microchannel by determination of present analysis. In addition, the problematic testimonial, purposes with possibility of work could be obtainable thoroughly.
5. **Ghani et.al (2017)** In this analysis, the discharge of fluid with transfer of heat features to microchannel heat sink by subordinate slanted networks in irregular trend as well as four-sided ribs were considered mathematically for Reynolds number varying as of 100 to 600. The properties of subordinate networks with ribs on the Nusselt number in addition to roughness aspect were examined. A proportional scrutiny have been shown to the presentation of the planned scheme by connected figures like microchannel by four-sided ribs that is microchannel ribs with array of subordinate slanted networks. The consequences highlighted the advantage of complete presentation of microchannel by four-sided ribs above all of microchannel quadrangle ribs and slanted networks. The cross operation structures of mocks with subordinate networks has been reviewed by relative with allied figures like microchannel with four-sided ribs becoming quadrangle with microchannel with subordinate networks having arrays in irregular manner.
6. **Ghani et.al (2017)** In this paper, a three dimensional mathematical imitation has been showed to analyse the features of liquefied flow with transfer of heat in new-fangled scheme of microchannel heat sink by wavy fissures with quadrilateral mocks for Reynolds number varying around 100 to 700. A reasonable investigation is accompanied to the presentation of the planned scheme with connected figures like microchannel with four-sided ribs as well as microchannel by wavy openings. The consequences displayed that thermal presentation of microchannel through slanted networks is greater above all of microchannel rectangular ribs and microchannel wavy openings. The fresh strategy of microchannel slanted networks has showed the aptitude to syndicate amid two significant structures; outsized stream surfaces which meaningfully lessens the drop in pressure with great stream instabilities which affected the presence of ribs in the essential areas of network. The amalgamation of ribs with voids donated in dropping the large drop in pressure which affects the ribs in microchannel rectangular ribs through placing greater current surfaces. Moreover, this arrangement has donated to eradicate the inactivity zone which happened in microchannel sinusoidal cavities with controlling the stream near the crater region.
7. **Huang et.al (2017)** In this research paper, the summary of dints to surface of heat transfer could efficiently advance the enactment of heat transfer of a microchannel heat sink with impinging jets. Microchannel heat sink with impinging jets by dissimilar dint assemblies, containing curved, arched, as well as diverse dints, were linked with microchannel heat sink with impinging jets other than dints by mathematical imitation with the submission of the turf interaction attitude. Consequences designate that microchannel heat sink with impinging jets with curved dints displayed the finest chilling enactment, carrying that of other than dints, with assorted dints, The usual hotness of the warm exterior exempting dints is inferior than that of the

arrangement with assorted dints with curved dints through a bigger range lesser than the microchannel heat sink with impinging jets with arched dints. The motive is that arched dints moreover restraining the previously present boundary film, affecting the disturbances to strengthen throughout the current with transfer of heat; in tallying, the deceased region in the curved dints hinders the external stream of the liquid, which is the main element obstructing transfer of heat. Correlating with the microchannel heat sink with impinging jets other than dints that with dints could upsurge the space of transfer of heat.

8. **Lu et.al (2017)** In this analysis, a new design of undulating microchannel heat sink with permeable fins is planned to lessen concurrently drop in pressure and thermal confrontation. A three-dimensional solid-fluid combined prototype by seeing transfer of heat with stream in permeable medium is accepted to legalize the efficiency of the different proposal. The outcomes displays that the undulating microchannel heat sink through permeable fins diminish concurrently drop in pressure with thermal confrontation likened with conservative undulating microchannel heat sinks with dense fins. The noticeable drop in pressure falling in the undulating microchannel with permeable fins originates from the blend of infusion influence with the slide conclusion of the coolant liquids. In totalling, the viability of new scheme is authenticated by numerous microchannel heat sink strategies by diverse figures constraints. The innovative strategy with undulating network as well as permeable fin decrease the concurrently drop in pressure and thermal conflict. The notion of undulating microchannel heat sink with permeable fins could be smeared for numerous microchannel heat sink proposals with dissimilar wavy generosity, wavelength, network breadth with network length, which specifies the extensive variety of applicability of the novel microchannel perception.
9. **Prajapati et.al (2017)** Bubble evolution manners with heat transfer features throughout subcooled stream blistering in fragmented finned micro networks have mathematically being inspected. Recreations has been achieved for a particular row of portion finned with microchannel then anticipated fallouts were associated with investigational analysis. Commencement of nucleation, development of fizzes, and its evolution with arrangements has been examined for dissimilar standards of functional heat flux. Device of fizz growth other than blockage subsequent in improved transfer of heat in particularly finned microchannel have been clarified. It's been perceived that occurrence of subordinate networks effects in the efficient progression manners. The swift fizz growing rate grasping near congestion of stream opening which is being arrested by togetherness of investigational and mathematical analysis. The congestion permitted fizz enlargement with improved mingling of lubricating movement because of the occurrence of subordinate network were clarified. Original hotness with compression instabilities throughout subcooled stream blistering has been seized by mathematical mockups.
10. **Chai et.al (2016)** In this analysis, a three dimensional mathematical system have been accompanied to tackle the heat transfer individualities of laminar stream in microchannel heat sinks with dissimilar symmetrical fan formed ribs on lateral barriers for Reynolds number varying from 186 to 716. The mathematical system deliberates appearance consequence, with combined transfer of heat, viscid warming as well as temperature reliant on thermal somatic parameters. The water as well as silicon were utilized as liquid with solid for the mathematical dominion. The calculations are completed on the predetermined measurements technique by executing the SIMPLEC procedure. The microchannel haing the breadth of 0.2mm and deepness of 0.3 mm in the continual surface section. On behalf of the analysis of Reynolds number assortment with calculated figures factors of fan-shaped mocks, having around 5–100% upsurge in aggregate Nusselt number with a 4–50% reduction in entire current confrontation for the microchannel heat descend with united fan designed mocks, although a 3–102% upsurge in typical Nusselt number with a 1–41% reduction in entire thermal confrontation for the microchannel heat descend by counterbalance fan designed spars, associating through the flat kind of things. The elevation as well as arrangement of fan fashioned spars devise an important inspirations on the heat transfer features, though the thickness of mocks confirmations fewer at all.
11. **Huang et.al (2016)** This research paper, targeting at emerging the assemblies of microchannel heat sinks for crumb chilling methods, three kinds of positioned microchannel heat sinks with metallic head inlet caption are mathematically analysed on stream with heat transfer features, which are correspondingly Rectangular Parallel-Slot Microchannel Heat Sink, Rectangular Stagger-Slot Microchannel Heat Sink, as well as Trapezoidal Stagger-Slot Microchannel Heat Sink. The quadrangular aperture breadth b then the base angle α of four sided aperture has been calculated correspondingly varying from 0.3 to 1 mm and 67° to 86° . Mathematical outcomes demonstration clarify that the heat transfer enactment in microchannel heat sink might be upgraded subsequently slit assembly has been established. Moreover, the worth of quadrilateral aperture extent as well as trapezoidal vile approach has excessive influences on stream than features of heat transfer. The heat transfer enactment in microchannel heat descend be able to enhanced after slit construction established. The space extent having an excessive encouragement on the current than heat transfer features, Then again in rapports of inclusive hear transfer competence with thermal enactment by continual driving force, Trapezoidal Stagger-Slot Microchannel Heat Sink is the finest one, that grasps lowermost drop in pressure with best heat transfer significances.
12. **Li et.al (2016)** A newangled microchannel heat sink through trilateral craters with quadrilateral ribs is obtainable as well as the features of liquid stream with transfer of heat were considered mathematically for Reynolds number varying from 172 to 634. The properties of craters with mocks on the Nusselt number as well as roughness element were examined. The method of entropy generation minimization is also adopted to analysis the thermal performance of the micro heat sink and the mechanism of heat transfer enhancement. The complete presentation of the fresh micro heat descend is measured constructed on thermal improvement reason with intensification entropy compeer's numeral. The mixture of openings with mocks is cooperative to heat transfer enrichment because of the disruption as well as renovation of the hydrated active with thermal limit films, the drastic flow disturbance and the chaotic advection. Associated to the microchannel other than craters or mocks, the microchannel projected in the existing rag demonstrations extra unbroken with lesser infection at the forum of the heat sink and gets better heat transfer performance. The entropy generation rate of heat transfer decreases, and the entropy generation rate of flow friction increases with the increase of Re for all cases.
13. **Wang et.al (2016)** Numerical simulations are carried out to investigate the influence of geometric parameters on the flow and heat transfer characteristics of rectangular, trapezoidal and triangular shaped microchannel heat sinks. A good agreement is

found between numerical results and experimental data when the variation of water viscosity with temperature is taken into account. The microchannel with high aspect ratio, long wetted perimeter and small hydraulic diameters usually have low thermal resistance and high pressure drop. The same cross section area of rectangular microchannel heat sinks with high aspect ratio, long wetted perimeter and small hydraulic diameter usually have low thermal resistance and high pressure drop, and the similar rules apply equally to triangular and trapezoidal cross section microchannel heat sinks. When the porosity, number of channels, cross section area and hydraulic diameter of rectangular, triangular and trapezoidal shaped microchannel have the same values, respectively, their flow and heat transfer characteristics are different. An increase in channel number reduces the thermal resistance, but at the expense of high pressure drop. Under the condition of the same power consumption, the channel number has an optimum range.

14. **Yadav et.al (2016)** In the existing mathematical analysis, microchannel heat sinks were presently expected as modern era cooling elucidation. Heat transfer enrichment in microchannel utilizing prolonged area have been taking into account. Quadrilateral microchannel with tubular micro members were cast-off in existing analysis. Various diverse formations of prolonged area microchannel; as stream finned microchannel, distorted stream finned microchannel as well as comprehensive finned microchannel were likened by bare quadrilateral microchannel. It has been initiated as heat transfer enactment of very first one is improved in nature than second one. Drop in pressure in event of prolonged area microchannels is greater always related to unadorned microchannel. However, pressure drop penalty is lower in comparison to heat transfer gain. Overall thermal performance of extended surfaces is found to be much superior in comparison to plain microchannel. Performance of enhanced surface microchannel increases with decrease in pitch of fins and increase in height of fins.
15. **Yang et.al (2016)** In this analysis, the heat transfer presentations of the microchannel heat sinks through various dissimilar pin member conformations are examined mathematically as well as practically. Three sided, four sided, five sided, six sided and ring figures are preferred as the cross segments of the pin members. Altogether microchannel heat descends are intended as the similar complete proportions. Pin fins are amazed in the equivalent manner. A constant heat instability has been functional at the upper area of the microchannel passion descend. Deionized water has been utilized as a lubricant. The numerical liquid diminuendos recreations exhibited that the bit member profile vagaries the thermo liquid features of the microchannel heat descend making the lowermost thermal confrontation with consistency of the chip topmost area with six sided areas across pin members with the lowermost drop in pressure by the spherical area of pin members. The lubricants stream everywhere giving the spherical pin members demonstration of the least obstructive defects due to the stations circulation with the greatest steady disparity, this offers incessant as well as steady stream. The respective macroscopic parameters is the lowermost drop in pressure of 14782.16Pa with recreation. The pin members through six sided with the globular cross segments were the individual circumstances which is being at sympathetic of stream conducted buildings.
16. **Yeom et.al (2016)** In this paper, the transfer of heat as well as drip in pressure properties of micro pin member arrangements in a slender four-sided network through a midcourse towards the stream were calculated by diverse rates of flow varying from laminated to blustery stream. Metallic micro pin members 160–500 μm elongated with 76–800 μm in span were contrived by methods called microfabrication. Concert fractions that associate transfer of heat to drop in pressure properties were assessed to examine presentation of the micro pin member areas where all transfer of heat with drop in pressure were significant. The outcomes designate that liquid lively causing procured everywhere micro pin member's yield a further leading part for heat transfer augmentation compare to the spaces upsurge because of micro pin members. The core involvement to the improvement lies in fluid changing aspects consequences, relatively compare through the space upsurgings. The fluid dynamics effects enhance heat transfer performance more significant at higher Reynolds numbers. The H400D250 case, with the largest area increase of 103%, shows the second highest heat transfer rate enhancement. A pattern was found regarding the heat transfer coefficients calculated based on the actual heat transfer area.
17. **Khan et.al (2015)** In this analysis, the microchannel heat sinks by vaulted networks in numerous formations were examined mathematically by utilizing the Navier Stokes equivalences which is three dimensional. Six conformations of vaulted microchannels that is four sided, half globular, three sided, six-sided, shapes are verified with a immovable breadth with distance of mocks, and compared to smooth channels in a Reynolds number range of 100–500. It was found from the results that heat transfer performance is improved considerably by introducing ribs in the microchannels, and thus the thermal resistance of the MCHS is reduced. Among the tested configurations of ribbed channels, triangular ribs show the smallest thermal resistance over the whole Reynolds number range, and rectangular ribs show the largest thermal resistance at a similar level to those of the other ribbed channels. The proportion of the Nusselt number in corrugated networks to those in the plane network mostly upsurgings by growing the thermal presentation features were lower than singular thing for each of the grooved networks as well as reduction in growing Reynolds number in maximum aspects. Triangular–circular ribs show the highest thermal performance factor up to a Reynolds number of 300, but for Reynolds numbers larger than 300, triangular ribs give the best thermal performance.
18. **Lee et.al (2015)** in this study, improved microchannel heat sink through segmented slanting member is utilized to curb the movement in disparity to incessant traditional member. The re-valuation of thermal edge deposit at the important brink of each slanting plane because of cracking of unremitting member addicted to slanting segments with the inferior stream because of these slanting slashes occasioned in improved transfer of heat and an equivalent drop in pressure. Widespread investigational calculations were passed out through silicon experiment automobile through hydraulic diameter of 200 μm as well as 300 μm with de-ionized liquid as elegant liquid. Lesser member field allows advanced existence of thermal edge deposit expansion as well as subordinate movement group, therefore additional progress of the heat transfer presentation. Amongst all the conformations verified, arrangement 26°–NP is the supreme operative microchannel heat descend from side to side of grouping of trivial hydraulic distance minor slanting angle 26° and small slanting member pitch 500 μm . On the additional hand,

improved microchannel heat basins shows 100 μ m insignificant network thickness validate the competence to moreover equivalent or augment the thermal confrontation of conservative microchannel by 200 μ m small network breadth.

19. **Prajapati et.al (2015)** In this work, an investigational examined is being completed to associate the stream boiling features of deionized water in three changed arrangements of microchannel. The examined network outlines are unchanging areas, deviating cross-sides with sectioned finned microchannel. Tests has been directed with subcooled fluid state-run at the item through coolant physique which heat changes fluctuate in the variety 200–340 kg/m² s as well as 10–250 kW/m², separately. Qualified upon the heat uncertainty through coolant movement ratio different commands of binary chapter sweltering devour remained experimental. The judgement of three conformations has been completed in relations of coefficient of heat transfer, drop in pressure features and empathy concerning backflow or current problem in the frequencies. Effervesces underlying forces and their character in movement setback of current variability consume remained deliberated for all three categories of networks. Heat transfer enactment of deviating frequency is improved in all compliments associated with unvarying areas frequencies. Though, they underperform associated with sectioned finned networks. Supreme drop in pressure in segmented frequencies is 5.1% sophisticated than that of unchanging areas frequencies and 3.4% sophisticated than that of swerving frequencies. Fizz obstruction as stream reverse difficult is poorest in unchanging areas conduits.
20. **Karale et.al (2012)** Serpentine channels are often used in microchannel reactors and heat exchangers. These channels offer better mixing, higher heat and mass-transfer coefficients than straight channels. In the present work, flow and heat transfer experiments were carried out with a serpentine channel plate comprising of 10 units (single unit dimensions: 1 \times 1.5 mm² in cross section, length 46.28 mm, Dh 1.2 mm) in series. Pressure drop and heat-transfer coefficients were experimentally measured. Flow and heat transfer in the experimental set-up were simulated using computational fluid dynamics (CFD) models to understand the mechanisms responsible for performance enhancement. The CFD methodology, thus, developed was applied to understand the effect of various geometrical parameters on heat transfer enhancement. Configuration showing highest heat transfer enhancement need not be the best when compared on the basis of unit pumping power. For example, for Cases 1 and 2 from Table 2 (cases with sharp bends, straight length before bends, and curvatures), the highest heat transfer enhancement was obtained for 90° bend angle. However, serpentine channel with 50° bend angle was found to be better when compared with unit pumping power basis.

4. Conclusion

Many of researcher have optimize the different process parameters of heat sink. With the enhancement of research, specific heat transfer of heat sink is increasing day by day. With decrease in size of the component heat generation rate get increases, so to counter this high specific heat transfer device is required.

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