Design of Heat Sink and Thermal Analysis for Electronics Applications

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Abstract: The now days electronics compound very important of human life its high temperature generated during operating, it is problem take in account in this paper, so overcome this problem need to thermal management. When the increase the temperature due to reduce the compound life time. In this paper to analysis using Finite element analysis focuses on the passive cooling of electronics devices by using pin configuration, different heat flux, and materials like aluminum (6062), Copper, Tungsten to ensure lower temperature compare with maximum operating temperature, all electronic components generate heat during of their operation. To ensure best working of the electronics component, the produced heat needs to be removed using thermal management techniques. Finally more heat dissipated material with design aspect Tungsten suitable material for high input power for electronic compounds because the thermal conductivity high and low thermal gradient.

Keywords: heat dissipation, electronics compound, high thermal conductivity materials.

I. INTRODUCTION

The electronic compound working at power of 1~100 W and more than based on the specific applications [1]. The increased heat flux due to electrical current [2], all electronic compound produced high heat, in this problem to reduce of life time of compound, so in order to remove the heat using various techniques such round fin heat sink, forced convection [3]. The finite element analysis of is very powerful approximate method, like weighted residual methods, Rayleigh Riz method. The essential target of the balance is to improve the warmth vitality move rate per unit surface region between the base surface and its convective, emanated and convective-irradiative condition. Today, because of the expanding request of elite parametric qualities yet at the equivalent time thickness in warmth bearing structures, the balances of different geometries and material properties are observed to be utilized in a wide scope of general just as jazzy designing applications which incorporate cooling, aviation, vehicle.

A. Finite Element Method

The Finite Element Method (FEM) could be a numerical powerful approximate technique to get associate degree approximate value using polynomial equation to a category of issues ruled by elliptic PDF. FEA main objectives is are to obtain stress distribution, temperature distribution, natural frequencies, crack progress, enduring. The essential hot surface. This expansion is called expanded warmth evacuation turns down. In such circumstances, the warmth move is the expansion of surface territory. Be that as it may, essentially, the material, working and geometric properties can be upgraded up to a specific point of confinement and thus the target of the vital measure of warmth evacuation turns down. In such circumstances, the option is to raise the surface zone by joining an expansion to the essential hot surface. This expansion is called expanded surface or blade.

II. MODELING ON FINED HEAT SINK

In this work design and analysis with consists of rectangular mm² with thickness of 5mm, height of fins 20 mm shown in figure1. The number of fins 196 with diameter of fin 3mm. The bottom side attached the IC is dimension of 20mm and 1mm thickness made of metallic material like aluminum 6062, Copper heat sink with circular Pin fins consists of 70x70, Tungsten 14 and IC made of silicone ceramic composite it has thermal conductivity is 8 W/m K. The above selected material properties and natural convention values shown in the Table 1. From the figure 2. Represent the Discretization process that called subdivide smaller convenient number of elements and assembles it is called Meshing with element of SOLID87 for thermal analysis.
The fined heat sink first apply free convection on all fins face and four side of heat sink base, second surface between the IC and heat sink base apply heat flux 16000W/m$^2$, 24000W/m$^2$, 32000W/m$^2$ respectively. However bottom of IC zero heat flux applied. Free natural convection with steady state thermal analysis are followed.

### III. RESULTS AND DISCUSSION

Heat transfer analysis carried out the three different and input power are 20 Watts, 30 Watts, 40 Watts are corresponding heat flux 16000 W/m$^2$, 24000 W/m$^2$, 32000 W/m$^2$ respectively. Shown in figure Case 1: Aluminum (6062) with Thermal conductivity 170 (W/m K)

![Fig. 3. Nodal Temp. at heat flux 16000 W/m$^2$](image3)

![Fig. 4. Nodal Temp. at heat flux 24000 W/m$^2$](image4)

![Fig. 5. Nodal Temp. at heat flux 32000 W/m$^2$](image5)

Case 2: Copper with Thermal conductivity 400 (W/m K)

![Fig. 3. Nodal Temp. at heat flux 16000 W/m$^2$](image3)

![Fig. 4. Nodal Temp. at heat flux 24000 W/m$^2$](image4)

![Fig. 5. Nodal Temp. at heat flux 32000 W/m$^2$](image5)
Case 3: Tungsten with Thermal conductivity 1440 (W/m K)

IV. CONCLUSIONS

The present Finite element analysis using three different materials the important material properties of thermal conductivity due to change nodal temperature and thermal gradient vector sum. The analysis conclusions are discretized as following:

1. **Nodal temperature**: The aluminum material less heat dissipated because less thermal conductivity compared with Tungsten, however compare with copper significant changes for high heat flux (40 W).

2. **Thermal gradient vector sum**: The Tungsten material very less value of thermal gradient compare with aluminium. Finally conclude this study for high power electronics compound suitable for Tungsten heat sink.

| Material       | Aluminium (6063) | Copper | Tungsten |
|----------------|------------------|--------|----------|
| Thermal conductivity | 170              | 400    | 1440     |
| Convection coefficient | 59               | 50     | 50       |
| Temperature     | 300              | 300    | 300      |
| Heat flux       | 16,000 24,000 32,000 | 16,000 24,000 32,000 | 16,000 24,000 32,000 |
| Nodal temp      | 391              | 391    | 488      |
| Thermal gradient vector sum | 1210          | 1210   | 2421     |

The Table 2 show the values of thermal gradient vector sum, nodal temperature for different materials that has been considered in the present analysis.
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