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Design of heat sink and simulation of electronic cooling of power transistor circuit

L. M. Gunasinghe[1*], W. J. M. Samaranayake[1] and W. P. T. Hansameenu[2]

[1]Department of Physics and Electronics, Faculty of Science, University of Kelaniya, Sri Lanka
[2]Department of Mathematics, Faculty of Science, University of Kelaniya, Sri Lanka
lakshanmadukagunasinghe@gmail.com*

Heat sinks are utilized in industrial equipment to disperse surplus heat from heat-generating components to the surrounding environment. In recent years, efforts have been made to develop mechanical or electronic devices that are lighter, smaller, and more affordable. Heat dissipation from the heat sink is a major issue that many researchers are attempting to address. In this work, a traditional heat sink design technique of computer power supplies, which is extending fin topology, is used with four power transistors. This study attempts to improve the cooling of power transistor circuits by designing a new heat sink attached to four power transistors and seeing how the joule heating profile of the power transistor circuit and heat sink are changed. *COMSOL Multiphysics* version 5.6 software is used to graphically design the heat sink, four-transistor circuit and simulate the heat profile of the design. An electric currents interface and a heat transfer in solids interface are included in the Multiphysics interface. The multiphysics couplings add electromagnetic power dissipation as a heat source and investigate the joule heating and the temperature distribution on power transistors without the heat sink and with the heat sink. Transistors without the new heat sink get heated more than the transistors with the new heat sink with the same applied current density to the circuit board. It shows that joule heating is minimized with the new heat sink design. Here, the results of several studies of a new geometrical 3D model that focus on four power transistors attached to an aluminium heat sink are discussed. The results show the impact of the heat sink area and surface-to-ambient radiation to the power transistors and the circuit board. Based on the simulation results, four transistors become very cooled with the new heat sink design. How the heat-sink thermal performance is affected by shapes and space between fins is also reviewed. It could be observed that in the proposed design, the joule heating was reduced remarkably.

Keywords: COMSOL multiphysics, Joule heating, Heat sink, Power dissipation, Power transistor circuit