

# Proposal of man-hour in experiments reduction by utilizing MBD in cooperation with Tier 1 and Tier 2

- Modeling of passive components compatible with VHDL-AMS and the utilization of the model -

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In-vehicle electrical equipment is becoming smaller and more sophisticated. For the thermal design of these devices, it is important to consider not only the semiconductors, which are the main heat source, but also the passive components (resistors, capacitors, etc.) used in the peripheral circuits. In this paper, we propose a passive component model compatible with VHDL-AMS, which has been widely used for multi-domain analysis of circuits and heat.

Most passive components are surface-mount components, which have a small surface area and little heat dissipation capability by themselves. Therefore, the temperature rise of a component is greatly affected by the heat dissipation capability of the printed circuit board (PCB). For these reasons, it is necessary to model not only the components but also the PCB.

Figure 1 shows an example of a thermal model of a chip resistor and a printed circuit board. Separating the component and the PCB for thermal modeling makes it easier to examine when the component and the PCB are changed respectively. The component temperature can be referenced to the temperature of the component's terminal part by using the temperature of the node at the connection between the component and the PCB.

Two methods of modeling the PCB are proposed: one is based on the results of CFD analysis, and the other is based on algebraic equations to calculate thermal resistance.

The results of the analysis using 1D models of the component and the PCB prove the effectiveness of the proposed model.

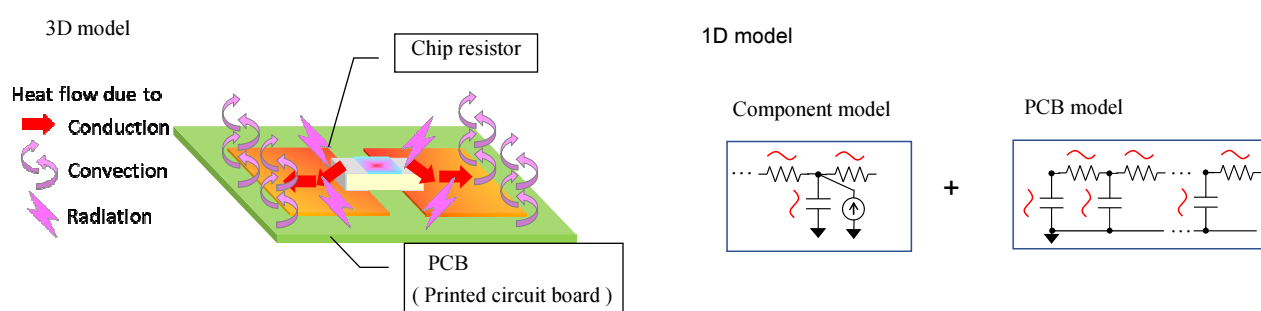


Fig. 1 Thermal model of a chip resistor and a PCB