

Simulation tasks for the thermal laboratory

1. A 2x2x0.35mm Si substrate of an integrated circuit is soldered to a 1mm thick Cu plate. The bottom of the Cu is at constant 25 °C. Place a 5W dissipating transistor on the chip.
¹Try three different cases: put the dissipator in the center of the substrate, put it in the center of at one edge and place it in the corner. Compare the results, summarize the experiences!

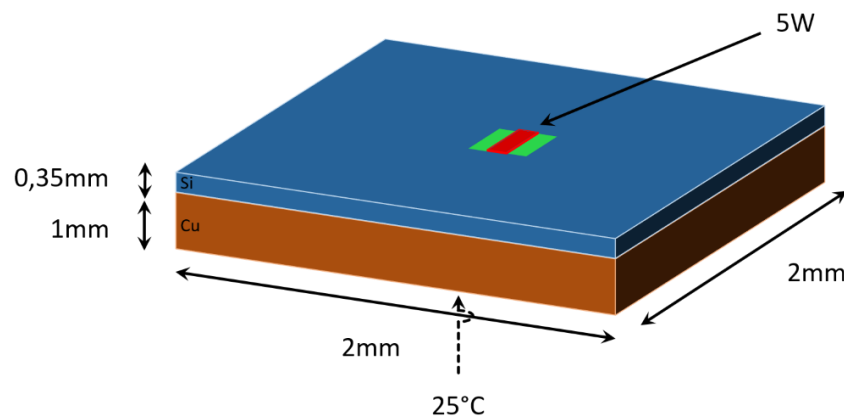


Figure 1.

2. The dimensions of the substrate of an operational amplifier chip are 1x1x0.3 mm. The bottom side of the chip is cooled to some extent that can be accounted by setting the heat transfer of the lower side of the substrate to convection with a heat transfer coefficient $h=2000\text{W/m}^2\text{K}$. The transistor of the output stage ($P=0.1\text{W}$) is $400\times 50\text{ }\mu\text{m}$, the transistors of the input differential amplifier are $25\times 25\text{ }\mu\text{m}$ ($P=0.001\text{W}$)². Position the three transistors so that the dissipation of the output transistors does not cause a temperature difference between the transistors of the input differential amplifier. Provide the adequate layout topology and explain it.

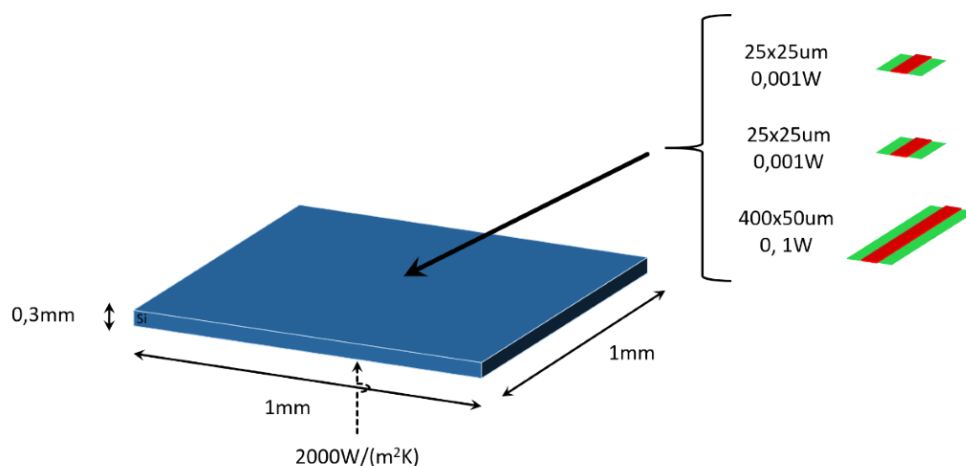


Figure 2.

¹ Transistors can be modeled with a rectangular dissipator.

² Please refer to the document titled Laboratory Practice: Thermal Issues of Integrated Circuits, where phenomenon is discussed in detail