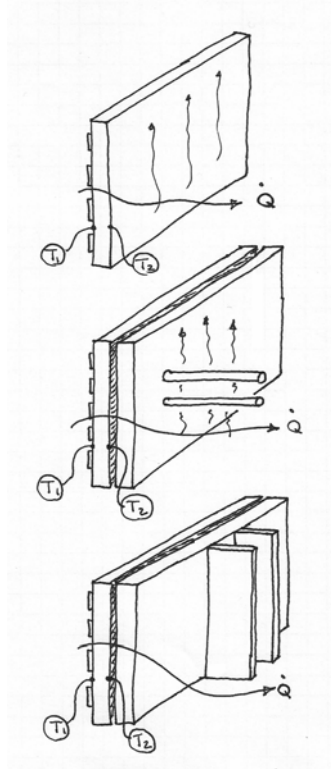


mech 262 - Assignment 2

Heat Sink Selection, Finned Cooling

Question 1



8-148 A 0.3-cm-thick, 12-cm-high, and 18-cm-long circuit board houses 80 closely spaced logic chips on one side, each dissipating 0.04 W. The board is impregnated with copper fillings, and has an effective thermal conductivity of $20 \text{ W}/(\text{m} \cdot ^\circ\text{C})$. All the heat generated in the chips is conducted across the circuit board, and is dissipated from the back side of the board to a medium at 40°C , with a heat transfer coefficient of $50 \text{ W}/(\text{m}^2 \cdot ^\circ\text{C})$. (a) Determine the temperatures on the two sides of the circuit board. (b) Now a 0.2-cm-thick, 12-cm-high, and 18-cm-long aluminum plate [$k = 237 \text{ W}/(\text{m} \cdot ^\circ\text{C})$] with 864 2-cm-long aluminum pin fins of diameter 0.25 cm is attached to the back side of the circuit board with a 0.02-cm-thick epoxy adhesive [$k = 1.8 \text{ W}/(\text{m} \cdot ^\circ\text{C})$]. Determine the new temperatures on the two sides of the circuit board.

8-149 Repeat Prob. 8-148 using a copper plate with copper fins [$k = 386 \text{ W}/(\text{m} \cdot ^\circ\text{C})$] instead of aluminum ones.

Note on problem 8-149

In problem 8-149 make the fins they refer to rectangular shapes, as shown in the figure on the left. The fins are similar to the pin fins described in 8-148 in that they are 2-cm-long and 0.25-cm wide but they extend from the top edge to the bottom edge. The space between fins is 0.75-cm creating a total of 19 fins. Just as is suggested in the original 8-149, the material of this new fin arrangement is to be copper.

Question 2 & 3

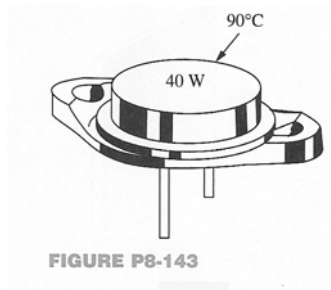


FIGURE P8-143

8-142 The case-to-ambient thermal resistance of a power transistor that has a maximum power rating of 15 W is given as $25^\circ\text{C}/\text{W}$. If the case temperature of the transistor is not to exceed 80°C , determine the power at which this transistor can be operated safely in an environment at 30°C .

8-143 A 40-W power transistor is to be cooled by attaching it to one of the commercially available heat sinks shown in Table 8-6. Select a heat sink that will allow the case temperature of the transistor not to exceed 90°C in the ambient air at 20°C .

Note on problem 8-143

Problem 8-143 says you should look at Table 8-6. This is an error. Look instead at the Fin Reference provided in week 2's calendar listing and look at Table 10-6.