Hw #10

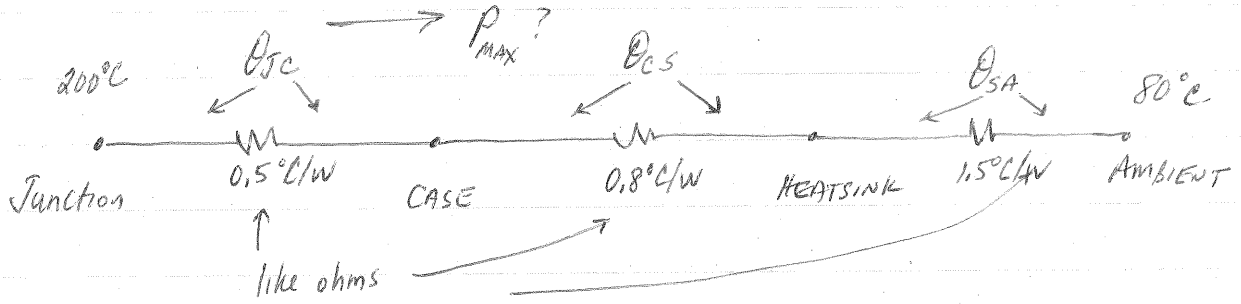
Chapter 12 #'s 23-25

(23) Determine the maximum dissipation allowed for a 100W silicon transistor (rated @ 25°C) for a derating factor of 0.6 W/°C at a case temperature of 150°C.

$$P_{D_{MAX}} = P_{rated} - (T_C - T_L)(\text{derating factor})$$

$$P_{D_{MAX}} = 100W - (150 - 25)(0.6\ W/^\circ C) = \boxed{25W = P_{D_{MAX}}}$$

(24) A 160W silicon power transistor operates with a heat sink ($\theta_{SA} = 1.5\ ^\circ C/W$) has $\theta_{JC} = 0.5\ ^\circ C/W$ and a mounting insulator of $\theta_{CS} = 0.8\ ^\circ C/W$. What maximum power can be handled by the transistor at an ambient temperature of 80°C. (The junction temperature should not exceed 200°C)



(notice format of thermal resistance $\theta_{\text{FROM TO}}$ ex. $\theta_{\text{FROM CASE TO SINK}} = 0.8\ ^\circ C/W$)

Temperatures are like voltages, power like current & thermal resistance like resistance.

($V_T = I R_T$)

$$P_{MAX} (200 - 80\ ^\circ C) = P_{MAX} (0.5\ ^\circ C/W + 0.8\ ^\circ C/W + 1.5\ ^\circ C/W)$$

(like voltage drop; total resistance)

$$\boxed{P_{MAX} = 42.86\ W}$$

16-23-25

(25) What maximum power can a silicon transistor ($T_{J_{MAX}} = 200°C$) dissipate into free air at an ambient temperature of 80°C.

Using typical 40°C/W as the thermal resistance.

$(V = IR)$

$\Delta T = P\theta$ $\qquad P_{MAX} = \frac{\Delta T}{\theta} = \frac{200 - 80}{40°C/W} =$ **3 Watts.**