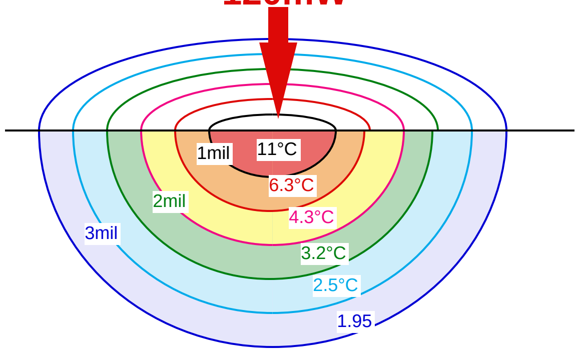
Thermal Gradients

apply 120mW



Shell model for thermal gradients in Silicon
Si conductance = 1.5W/cm°C
Expect Rthermal to be about 91°C/Watt

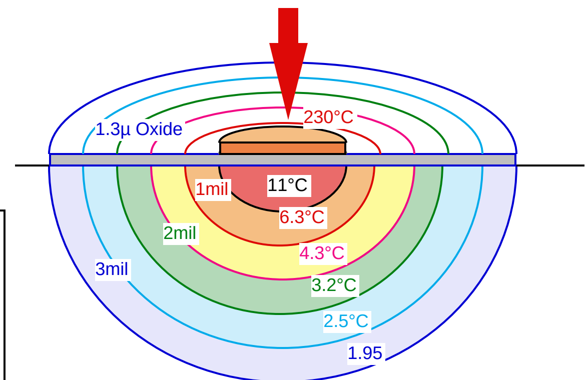
Note!! Al conductance = 2.14W/cm°C

Temperature vs Distance for 120mW

Discoveries

The drop in temperature with distance appears to be due to the heat being spread out evenly over a larger area of silicon.

apply 120mW to Poly



Si02 conductance = .014W/cm°C
Expect Rthermal to be about 1800°C/Watt

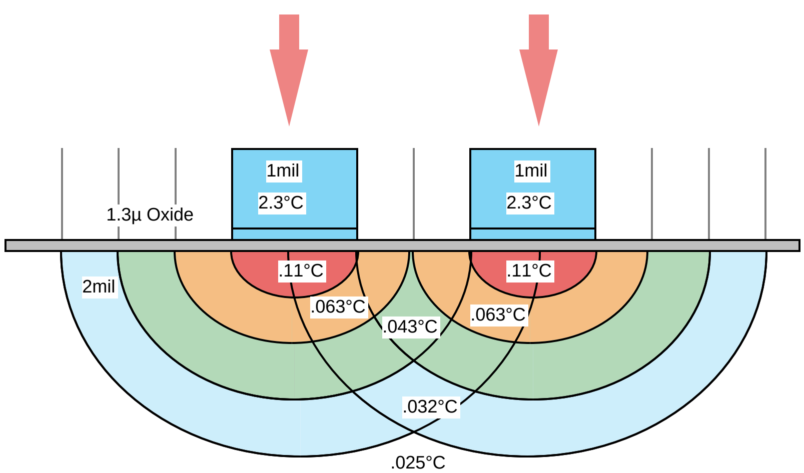
[1/(.014W/cm°C)][1.3µ/(π*([(25.4µ/mil)(.5mils)]^2)]
=71.14(.00256)°C/W(cm/µ)=1825°C/W

Discoveries

The temperature gradient in the silicon is when 120mWs are applied to a 1 mil circle of poly. But Silicon Oxide is a good thermal insulator and the temperature of the ploy is much high.

This means it should not be too hard to over heat a poly resistor.

apply 1mW to 1mil squares of 1K SiChrome (1V/1KΩ -> 1mW)



Self Heating % = (300ppm)(2.3°C) = 0.07%
Cross Heating % = (300ppm)(.03°C) = 0.001%

Discoveries

A Sichrome Resistor appears to be more sensitive to the effects of self heating rather than cross heating.

The oxide thermal insulation tends to isolate the Sichrome. Because Sichrome is about 1KΩ per square, it tends to dissipate less energy per area.

While the cross heating may set a limit as to the linearity of a 16bit DAC, both the effects of self heating and cross heating may be too low to affect offset in an Opamp.