GIVEN: Si DIE 20 x 20 mm AL INTERCONNECTION LINE RUNNING DIAGONALLY

FIND: A) RESISTANCE OF LINE IF IT IS 1 μm THICK & 5 μm WIDE

B) REPEAT IF 0.5 μm THICK

SOLN: $\sigma = 2.82\ \mu\Omega \cdot cm$ FOR AL

A) $R = \rho \frac{L}{A} = 2.82 \left(\frac{2\sqrt{2}}{0.1m(0.5m)} \right)$

$= 159.5\ \Omega$

B) $R = 2.82 \left(\frac{2\sqrt{2}}{0.05m(0.5m)} \right)$

$= 319\ \Omega$

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GIVEN: $v_d = 10^7$ cm/s $\quad Q = 0.4$ C/cm^3

FIND: j

SOLN: $j = Q v_d = 10^7 \frac{cm}{s} (0.4 \ C/cm^3)$

$= 4 \frac{mA}{s\,cm^2}$

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GIVEN: $10\mu m$ LENGTH OF Si w/ 5V APPLIED

FIND: A) E

B) V IF MAX E IS 10^5 V/cm

SOLN: A) $E = \frac{V}{\ell} = \frac{5}{10\mu m} = \underline{\underline{500\ kV/m}}$

B) $10^5\ V/cm = \frac{V}{10\mu m}$

$V = \underline{\underline{100V}}$

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GIVEN: TABLE 2.1 & $\mu_n = 100\ cm^2/Vs$

$\mu_p = 50\ cm^2/Vs$

FIND: TEMP FOR Si TO BE A CONDUCTOR.

SOLN: $\sigma = q(\mu_n n_i + \mu_p n_i) \geq 1000\ (\Omega \cdot cm)^{-1}$

$$n_i = \frac{\sigma}{q(\mu_n + \mu_p)} = \frac{1000}{1.602\times10^{-19}(100+50)} = 4.16\times10^{19}\ \frac{}{cm^3}$$

AND

$$n_i^2 = BT^3 e^{-E_g/KT}$$

NOW $B = 1.08\times10^{31}\ K^{-3}\ cm^{-6}$ FOR Si

$K = 8.62\times10^{-5}\ eV/K$

AND $E_g = 1.12\ V$

USE AN ITERATIVE SOLUTION APPROACH...

LIKE SOLVER OR GOAL SEEK IN EXCEL

$T \geq 2701\ K$

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