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الفصل الدراسى الأول

Sheet (1) : Semiconductor Devides
IC_Fabrication

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1. **Find approximately how many 25-mm^2 integrated-circuit chips can be obtained from a slice of silicon crystal 12 cm in diameter.**
2. **Using the data given in the attached graphs, determine by calculation whether successful n-pocket isolation is obtained by an error-function Boron diffusion through a 3-μm-thick n-type silicon epitaxial layer containing 5×10^{15} donor impurity atoms/cm^3 grown onto a p-tye silicon substrate, if the diffusion takes place.**
   - **a- at 1200^{o}C for 1h.**
   - b- **at 1100^{o}C for 1.5h**

(**Hint: For successful isolation diffusion the density of Boron impurities which penetrate the 3-μm-thick epitaxial layer must be greater than the density of n-type impurities everywhere in the penetrated region of that layer, where conversion to p-type is necessary.)**

3. **Determine the depth below the surface of a p-n junction produced by the Gaussian diffusion of Boron into the n-type epitaxial layer of problem (2). The drive-in diffusion is carried out at 1100^{o}C for 30 minutes after a Boron surface deposition of 1×10^{12} /cm^2.**
4. **Determine the depth below the surface of a p-n junction produced by the ion implantation of Boron into the epitaxial layer of problem (2) at an implant energy of (a)- 100 keV and (b)- 200keV**

Boron Ion Energy keV	Range R_p μm	Straggle ΔR_p μm
100	0.30	0.07
200	0.50	0.09

The incident Boron flux is 1.5×10^{15} ions/cm^2.

5. **The average resistivity of the diffused p-layer used to fabricate a monolithic integrated resistor is 0.1$\Omega.cm$ and the depth of this layer is 1.5μm. Assuming the width of the diffused resistor is limited to no less than 2.0μm by the ability to etch a narrow line in the oxide (caused by the basic resolution of the photoresist)**
   - **a- Calculate the length of the resistor line required to produce 10^4-Ω resistor.**
   - **b- If the change of this diffused resistor value with temperature is 3000ppm/^{o}C by what percentage will the resistor value change for a temperature rise of 10^{o}C.**