

Semiconductor Process (EB68684)

Report 1 Assignment

Oct. 1, 2019

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■ How & When to submit your report :

1. Submit your report in PDF via E-mail to leedevicelab@gmail.com

2. Deadline: Oct. 10, 2019

■ Answer the questions (problems) of the Chapters 1 and 2 with explanations and/or calculations:

Chapter 1: Overview (usual / general knowledge on overall CMOS process)

Problem 1-1: Calculate the approximated number of 10-10-mm dice on the 16-inch wafer, assuming the dice on the border of the wafer are also squares.

Problem 1-2: Explain the Moore's law in three different rules (i.e. DRAM, Transistor, and Feature size) and provide respective mathematical equations in exponential formula with basis of two.

Problem 1-3: Draw a basic NMOS process flowchart along with key cross-sections and masks.

Problem 1-4: There are 7 elementary processes of CMOS (excluding the wafer preparation process).

But Mr. Park remembers only 4 names among those 7 processes:

1. Photo-Lithography

2. ??

3. ion-implantation

4. diffusion

5. metallization (i.e. interconnections and contact))

6. ??

7. ??

What is the rest (2, 6, and 7)?

Chapter 2: Photo-Lithography (1st elementary process)

Problem 2-1: Explain briefly the definition of the clean room class.

Problem 2-2: Explain why do we prefer <100> or <111> wafer rather than <110> from the physical point of view in terms of the crystal orientation and atomic density.

Problem 2-3: Explain briefly why do we need a soft-bake and hard-bake processes of the PR, respectively.

Problem 2-4: Explain the differences between a negative and positive PRs, providing an advantage of usage of combinations of negative and positive PRs.

Problem 2-5: Explain the difference between anisotropic and isotropic etching. For the case of isotropic etching, e.g. wet-chemical etching, provide a dependence on Crystal orientation of Silicon. And provide details of anisotropic etching techniques, e.g. 3 dry-etching methods. In any case, explain the role of elements (F, Cl, N) in either wet-solutions or ions in plasma.

Problem 2-6: Provide 3 different photo-lithographical printing techniques with explaining pros and cons for each case.

Problem 2-7: Explain the wave-length ranges of typical UV, DUV, and EUV, providing the relationship between the feature size and wave-length of the UV light (explain it with the concept of optics in depth of field for the aperture size of unity).