McLeanゼミ

Sec7.7 exercise 2&8

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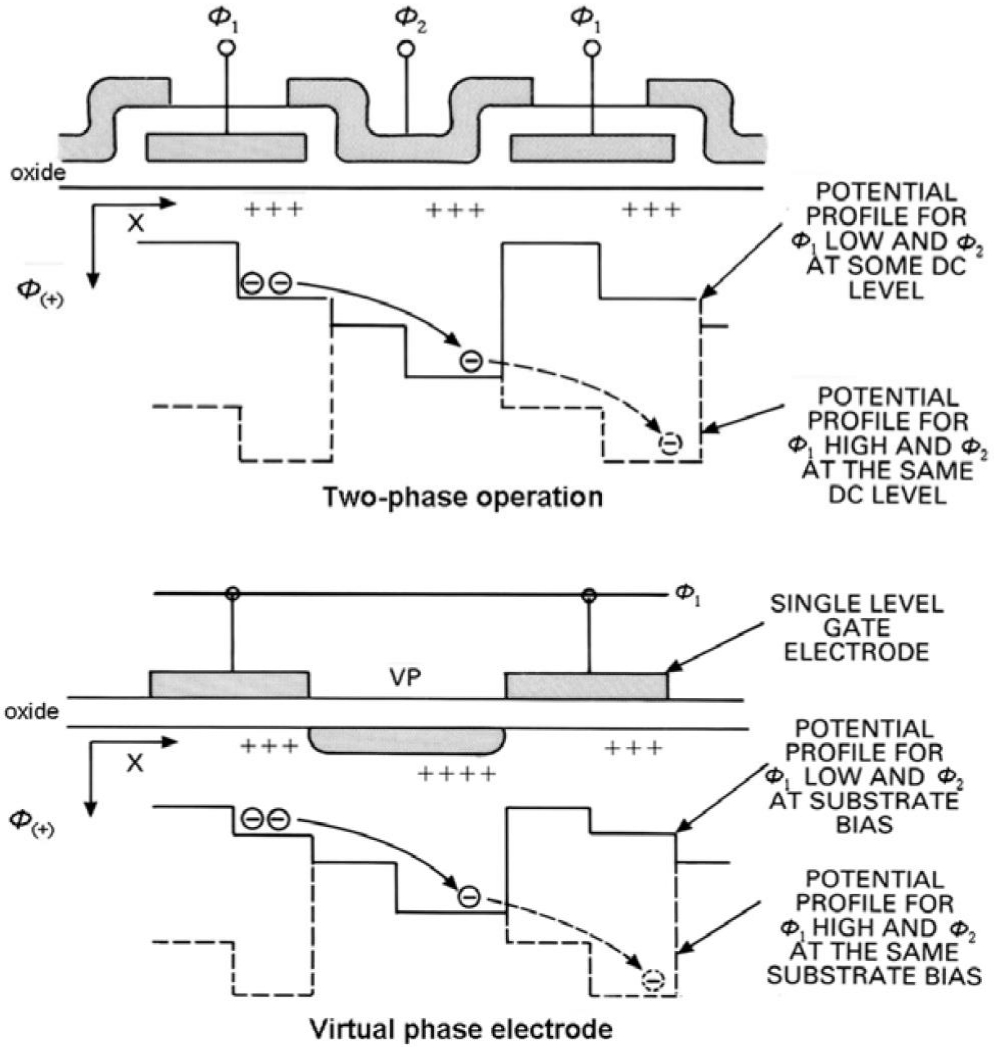
2. Describe with the aid of a diagram what is meant by a “virtual-phase” CCD.

- The single-clock CCD developed by Texas Instruments Corp.
- Its principle is very similar to a two-phase CCD.
- In a two-phase CCD, one electrode at a constant voltage produces an intermediate depletion region.
- This electrode is not necessary if there is a semi-opaque overlying metal gate, because the same effect can be achieved by diffusion directly into the substrate.
- Only one electrode is physically needed and the other half of the pixel is uncovered except for its implant.
- This is the “virtual” electrode or virtual phase.



8. What is an electron-multiplied (EM) CCD? Give an example of the gain achieved.

- A type of CCD with a large gain achieved by means of the repetitive avalanche multiplication, a phenomenon in which an electron transferred into an electrode will create a second electron with a few percent probability (~1-2%) .
- This type of CCD can increase the readout rate because a large gain factor (G) reduces the equivalent readout noise (R/G, R:readout noise) .
- For example, for a 1% probability of an extra electron released and 600 elements the gain is $1.01^{600} = 392$.