Tutorial III: MOSFETs

B. G. Streetman (6th Edition): End-of-Chapter 6 Problems

6.10) An n^+-polysilicon-gate p-channel MOS transistor is made on a n-type Si substrate with $N_d = 5\times10^{16}$ cm^{-3}. The SiO_2 thickness is 100Å in the gate region, and the effective interface charge Q_i is 2×10^{11} qC/cm^2. **Sketch the *C-V*** curve for this device and give important numbers for the scale.

6.12) Calculate the $\boldsymbol{V_T}$ of a Si MOS transistor for an n^+-polysilicon gate with silicon oxide thickness = 50 Å, $N_d = 1\times10^{18}$ cm^{-3}, and a fixed charge of 2×10^{10} qC/cm^2. Is it an enchancement-or depletion-mode device? What **B dose** is required to change the V_T to 0 V? Assume a shallow B implant.

6.19-6.20) Calculate the $\boldsymbol{V_T}$ of a Si n-channel MOSFET for an n^+-polysilicon gate with gate oxide thickness = 100 Å, $N_a = 10^{18}$ cm^{-3}, and a fixed oxide charge of 5×10^{10} qC/cm^2. If the MOSFET has Z = 50 µm, L = 2 µm, calculate the **drain current** at V_G = 5 V, V_D = 0.1 V. Repeat for V_G = 3 V, V_D = 5 V. Assume an electron channel mobility μ_n = 200 cm^2/V-s, and the substrate is connected to the source.

6.22) For the MOSFET characteristics shown in the Fig. P6-22, calculate:

1. Linear V_T and k_N
2. Saturation V_T and k_N

Assume channel mobility, μ_n = 500 cm^2/V-s, and V_{FB} = 0 V

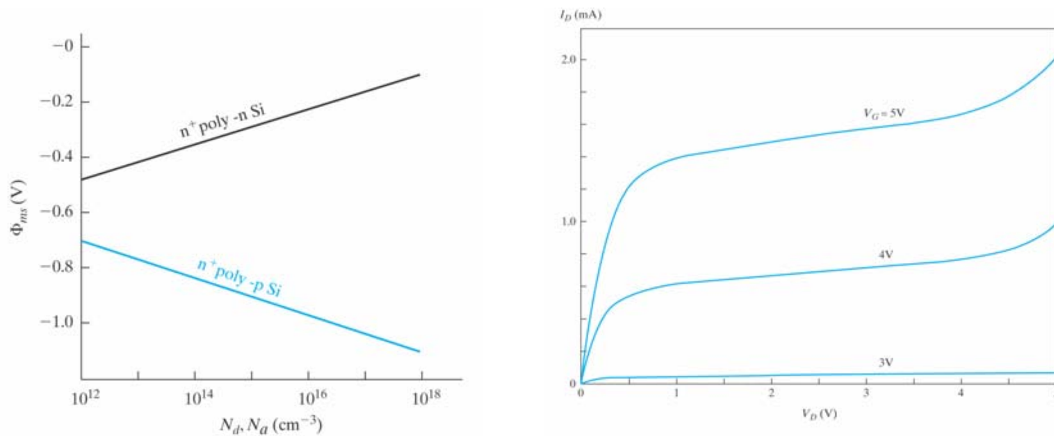

Figure 6.48.2 P6-22

Self-study Book: อุปกรณ์สารกึ่งตัวนำ Examples 7.1-7.3