Chapter 6 Physics of MOS Transistors

6.2. Operation of MOSFET

$$I_D = \frac{1}{2}\mu_n C_{ox}\frac{W}{L}[2(V_{GS}-V_{TH})V_{DS}-V_{DS}^2].$$ (9)

$$I_{D,max} = \frac{1}{2}\mu_n C_{ox}\frac{W}{L}(V_{GS}-V_{TH})^2$$ (10)

$$R_{on} = \frac{1}{\mu_n C_{ox}\dfrac{W}{L}(V_{GS}-V_{TH})}.$$

$$I_{D1} = \frac{1}{2}\mu_n C_{ox}\frac{W}{L}(V_{GS}-V_{TH})^2(1+\lambda V_{DS1})$$ (35)

$$g_m = \frac{\partial I_D}{\partial V_{GS}}.$$ (44)

$$g_m = \mu_n C_{ox}\frac{W}{L}(V_{GS}-V_{TH}),$$ (45)

$$g_m = \sqrt{2\mu_n C_{ox}\frac{W}{L}I_D}.$$ (46)

$$g_m = \frac{2I_D}{V_{GS}-V_{TH}},$$ (47)

6.3. MOS Device Models

$$r_O = \frac{1}{\lambda I_D}$$ (65)

6.4. PMOS Transistor

$$|I_{D,sat}| = \frac{1}{2}\mu_p C_{ox}\frac{W}{L}(|V_{GS}|-|V_{TH}|)^2(1+\lambda|V_{DS}|)$$ (69)

$$|I_{D,tri}| = \frac{1}{2}\mu_p C_{ox}\frac{W}{L}[2(|V_{GS}|-|V_{TH}|)|V_{DS}|-V_{DS}^2].$$

(70)