University of New Mexico

Department of Electrical and Computer Engineering

ECE 321 - Electronics I (Fall 2012)

Homework Solution # 7

3.33
$$I_{lock}^{3V}$$
 $V_{0} = 1.2 \rightarrow |Ids| = \frac{V_{0} - 3}{100K} \rightarrow |Ids| = 18\mu A$
 $V_{0} = 0.8 \rightarrow R = \frac{0.8}{18\mu A} \rightarrow R = 44.4 k.\Omega$

Assuming Linear

$$|Idsl = |kp| \left(\frac{W}{L}\right) \left[\left(|Vgsl - Wtpl \right) |Vdsl - \frac{Vds^2}{2} \right]$$

$$|8\mu A = 50\mu A |V^2 \times 3 \times \left[\left(|Vgsl - 0.4| \right) \left(|0.8 - 1.2| \right) - \frac{0.4^2}{2} \right] \Rightarrow$$

$$|Vgsl = 1.1 \longrightarrow Vg = 0.1$$

3.36

$$V_{5B=0-(0.3)=0.3V}$$
 $V_{t=V_{t0}+8}$
 $V_{t=0.5V+0.1V_{t0}}$
 $V_{t=0.5163V}$
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$$V_{T} = V_{TO} + \delta \cdot (\sqrt{12}Q_{F} + V_{SB}) - \sqrt{12}Q_{F})$$

$$\sqrt{12}Q_{F} + V_{SB} = \sqrt{12}Q_{F}) + \frac{V_{T} - V_{TO}}{\delta} \rightarrow V_{SB} = (\sqrt{12}Q_{F}) + \frac{V_{T} - V_{TO}}{\delta})^{2} - |2Q_{F}|$$

$$V_{SB} = 86.17 \text{ mV} \rightarrow V_{BS} = -26.17 \text{ mV}$$

$$3.38 \stackrel{0}{\underset{2}{\checkmark}} V_{O}$$

$$V_{T} = V_{TO} + \delta \cdot (\sqrt{2}Q_{F} + V_{SB} - \sqrt{2}Q_{F})$$

$$V_{T} = 0.6 \text{ V} + 0.25 \cdot (\sqrt{0.7} + V_{O} - \sqrt{0.7})$$

$$(Maximum V_{O}) = V_{OM} - V_{T} \rightarrow V_{T} = 2 - V_{O}$$

$$V_{T} = 0.74 \text{ V}$$