$\mu_p C_{ox} = 70\,\mu A/V^2$

$$\left(\frac{W}{L}\right)_{PMOS} = \frac{1}{70\times10^{-6}(70\times10^{-3})(1.3)} = \frac{10^9}{70\times70\times1.3}$$

$\approx 1.6\times10^5 = W/L$

$L = 180\,nm$

$W = 0.288\times10^5\,\mu m$

$= 28.8\,mm$

Gate area $= W\times L = 28.8\,m \times 0.18\,\mu$

$\approx 5000\,\mu m^2$

gate capacitance $\approx 5\,fF/\mu m^2$

Total gate cap. $C_{gate\_p} = 25\,pF$

For NMOS, $\mu C_{ox} = 350\ \mu A/V^2$

W/L for $R_{ds\text{-}on} = 70\ m\Omega$

$= \frac{1}{5} \times W/L$ of PMOS

$\approx 6\ mm$

Gate cap, $C_{gate\text{-}N} = 5\ pF$

Total gate cap $= 30\ pF$

$P_{gate\_sw} = C_{gate} V_{dd}^2 F_{sw}$

Assume $F_{sw} = 1\ MHz$

$P_{gate\_sw} = 30 \times 10^{-12} \times (1.8)^2 \times 10^6$

$= 30 \times (1.8)^2 \times 10^{-6}$

$\approx 100\ \mu W$

$F_{sw} = 10\ MHz$

$P_{gate\_sw} \approx 1\ mW$

$< 1\%$ of total loss.

Dead time loss.

$t_{dead} = 2\ ns$

$F_{sw} = 1\ MHz$

$$P_{dead\_sw} = 2 \times \frac{t_{dead}}{T_{sw}} \times 0.7 \times 1A$$

$$= 2 \times \frac{2\ ns}{1\ \mu s} \times 0.7 = 2.8\ mW$$

P_{dead_sw} at $10\ MHz$

$\approx 28\ mW$

which is much higher $\approx 25\%$ of total loss.

Efficiency at 1 MHz & 1 A load current

$\eta_{at\ 1MHz} \simeq 90\%$

η at 10 MHz

$\eta_{at\ 10MHz} \simeq 88\%$

at $I_{load} = 100\ mA$

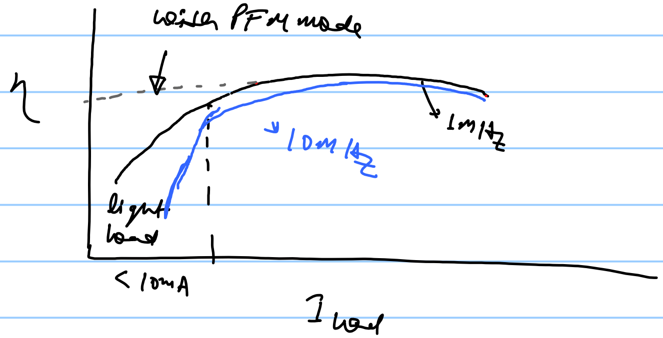
$P_{out} = 120\ mW$

for 90% efficiency

$P_{loss} = \left(\frac{1}{\eta} - 1\right) P_{out} \simeq 13\ mW$

I^2R loss $= (0.1)^2 \times 120\ mW$

$= 1.2\ mW$



$F_{sw} = 10\ MHz$

$$\Delta V_o = \frac{V_{dd} \cdot D \cdot (1-D)}{8\,L\,C\,F_{sw}^2}$$

$$= \frac{1.8V\,(0.5)(0.5)}{8\,L\,C\,F_{sw}^2}$$

Assume $\Delta V_o = 10mV$ (max)

$$LC = \frac{1.8(0.25)}{8 \times (10\times10^6)^2 \times 10mV} = \frac{0.45}{8 \times 10\!\!\!/ \times 10^{12} \times 10^{-2}}$$

$$= \frac{0.45}{8 \times 10^{12}} = 5.6 \times 10^{-14} \left(\frac{sec}{rad}\right)^2$$

For Li-ion battery, V_{dd} (typ) = 3.6V

$L = 3.3 \mu H$ for 1MHz

For $V_{dd} = 1.8V$

$L = 1.65 \mu H$ for 1MHz

at $F_{sw} = 10 MHz$

$L = 165 nH$

$$C = \frac{5.6 \times 10^{-14}}{165 \times 10^{-9}} = \frac{560}{165} \times 10^{-7}$$

$$= 0.34 \mu F$$