

### EE6320 RF Integrated Circuits Homework 5

1. A class-A power amplifier is shown in figure 1 below. The device bias current is chosen to be exactly equal to the peak signal current so that the transistor just touches cut-off at the negative end of the input signal cycle and just touches linear region at the positive end of the input signal cycle. Neglect the saturation voltage  $V_{D,SAT}$  of the transistor in relation to  $V_{DD}$  (so that the drain output voltage  $V_X$  swings between 0 and  $V_{DD}$ ). Assume that  $L_1$  is very large and that the matching network is ideal.
  - (a) Prove that the drain efficiency of the class-A PA is exactly 50%
  - (b) Prove that other ("wasted") 50% of the supply power is dissipated in  $M_1$ .
2. A cascoded class-A power amplifier is shown in figure 2 below. Assume that  $M_1$  and  $M_2$  are biased such that  $M_1$  is biased at the edge of triode region. Determine the maximum possible drain efficiency. In this problem, do not ignore the saturation voltage  $V_{D,SAT}$  of the transistors. Assume that  $L_1$  is very large and that the matching network is ideal.

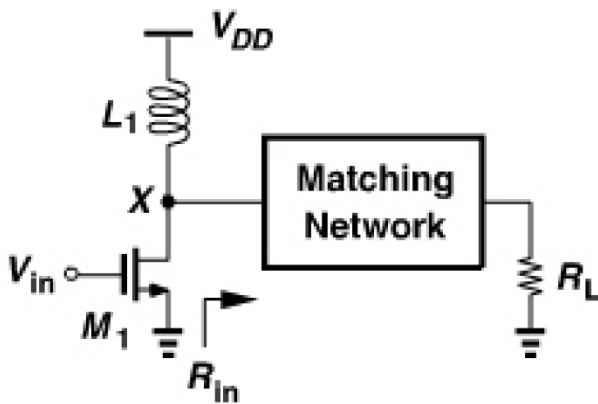


Figure 1

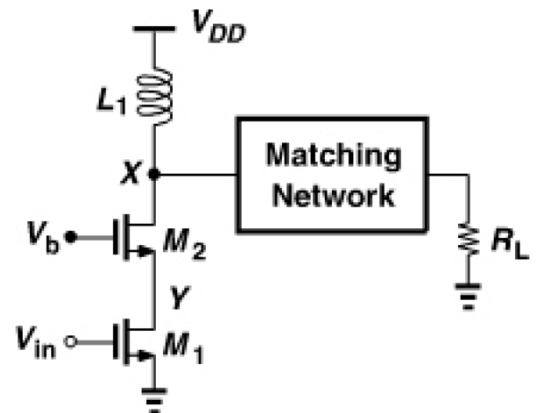


Figure 2