

EE-241. Introductory Electronics Laboratory

Lab 9 Handout*

Principles of amplification

Fall 2009

Mandatory Reading

A *MOSFET-resistor inverter* section in Experiment 12 of Y. Tsividis *pg. 90 - 91.*

Prelab Problems

1. Draw the schematic diagram of a sample-and-hold circuit. What will be its output if the input signal is a sinusoidal wave and $v_{control}$ is a square wave of ten times ($\times 10$) higher frequency
2. In your previous lab you used CD4066 IC instead of CD4007 IC for making a chopper and track-and-hold circuit. Can you give a reason for doing so? See the datasheet of CD4066 and tell why this IC is better than the other for using MOSFET as a switch.
Hint: the triangle with a small circle at the tip is a symbol for an inverter! Logic table of an inverter is given on page 104. Where logic 0 indicates low voltage (usually 0V) and logic 1 represents high voltage (usually 5V)
3. Draw the v_{GS} vs. v_{DS} plot for the circuit given in Fig. 1 of experiment 12.
 - (a) How would you select a bias point based on this plot?
 - (b) What is the slope of this graph on the bias point? Is it positive or negative? Why? Can you reason why this behavior is called inverting?
 - (c) If v_{GS} is a sinusoid with amplitude equal to bias voltage, what would v_{DS} look like?
4. *Diode-Connected MOS Transistors.* Recall that an ideal diode conducts a current when the voltage across it is positive (i.e., when it is forward biased), but it conducts no current when the voltage across it is negative (i.e., when it is reverse biased). It is common to use an MOS transistor as a "diode" by connecting its drain and gate together. Explain why it behaves like a diode when connected in this manner. Draw a diode symbol and show how you would replace it with a diode-connected nMOS transistor and with a diode-connected pMOS transistor. When "forward biased," does a diode-connected MOS transistor operate in the ohmic region or the saturation region? Does the answer to this question depend on the level of inversion? *Hint: the channel is also called the inversion layer*

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