

43 – Analog to Digital (A/D) Conversion

1. Assuming ideal op-amps and MOSFET in the circuit of Figure 43-1, sketch the expected output waveform on the supplied graph. Assume the charging time constant for the capacitor is about 1/10 of the square wave period time. Determine also the individual "hold" voltage levels.

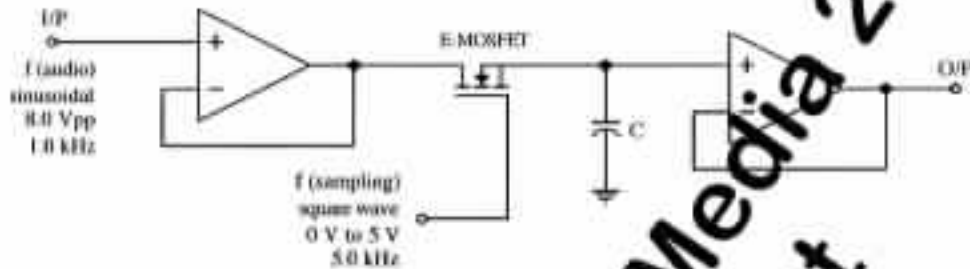
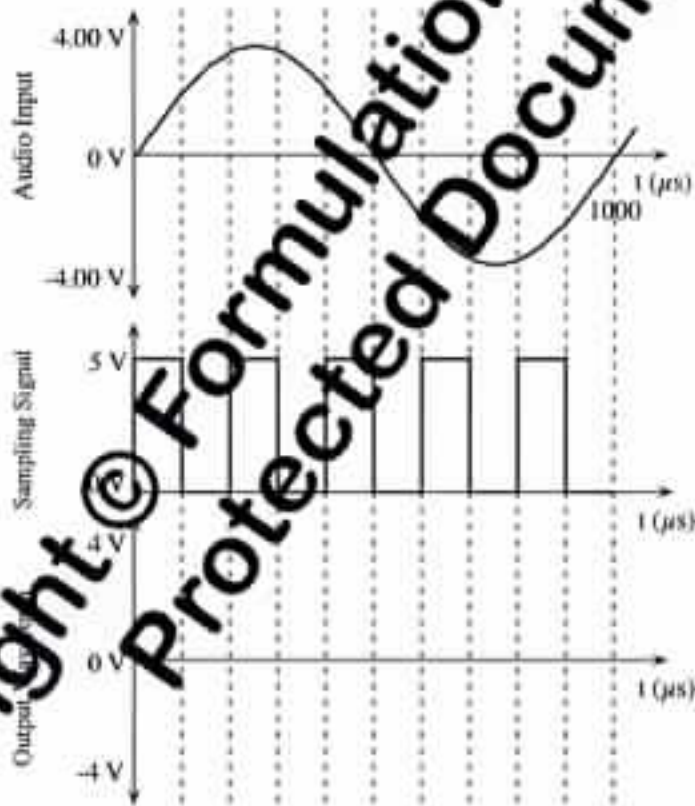


Figure 43-1. Sample & Hold Circuit for Problem 1



2. Assuming ideal op amps and MOSFET in the circuit of Figure 43-2, sketch the expected output waveform on the supplied graph. Assume the charging time constant for the capacitor is about 1/10 of the square wave period time. Determine also the individual "hold" voltage levels.

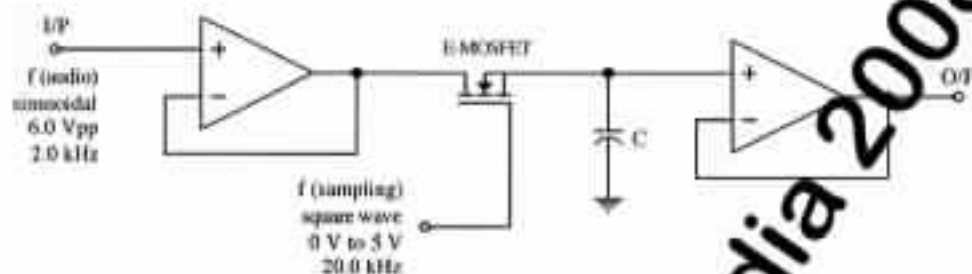
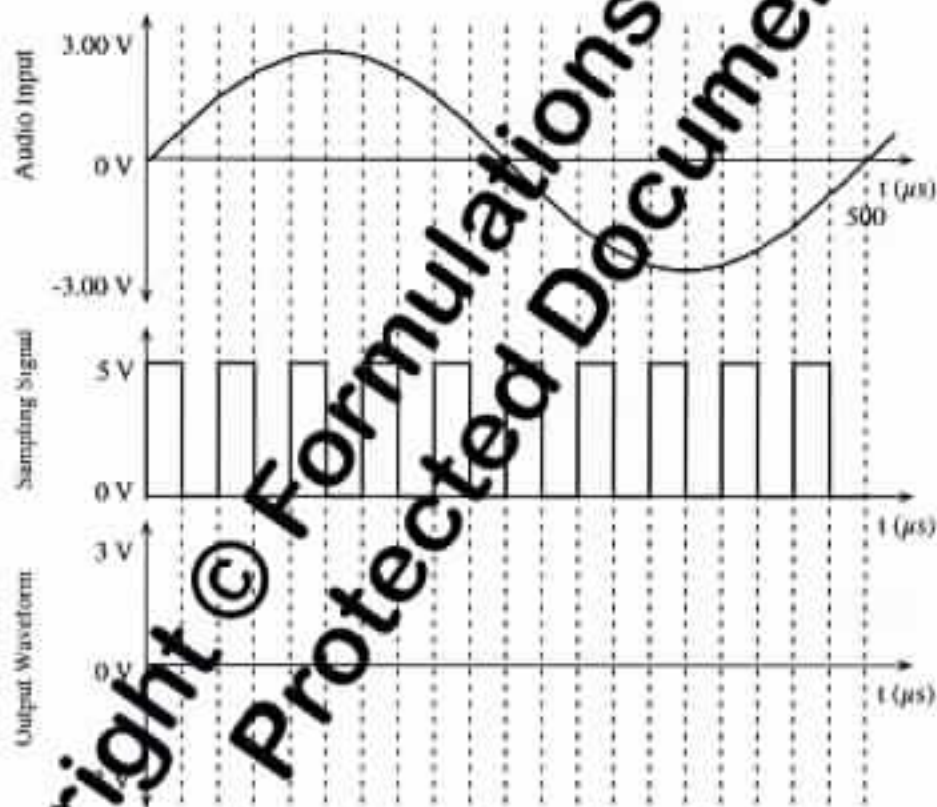


Figure 43-2. Sample & Hold Circuit for Problem 2



3. A second-order high pass filter has been designed to provide a critical -3.0 dB frequency of 2.50 kHz. What frequency would describe the limit of the maximally flat (-0.3 dB) response?
4. A second-order high pass filter has been designed to provide a critical -3.0 dB frequency of 850 Hz. What frequency would describe the limit of the maximally flat (-0.3 dB) response?
5. A second-order low pass filter has been designed to provide a critical -3.0 dB frequency of 360 Hz. What frequency would describe the limit of the maximally flat (-0.3 dB) response?
6. A second-order low pass filter has been designed to provide a critical -3.0 dB frequency of 1.90 kHz. What frequency would describe the limit of the maximally flat (-0.3 dB) response?
7. How many levels will exist in an 8-bit A/D converter?
8. How many levels will exist in a 12-bit A/D converter?
9. How many steps will exist in a 10-bit A/D converter?
10. How many steps will exist in a 6-bit A/D converter?
11. A low pass anti-aliasing filter is used in a 10-bit A/D converter. What gain or attenuation in decibels is required in the stop band to assure aliasing does not occur?
12. A low pass anti-aliasing filter is used in a 16-bit A/D converter. What gain or attenuation in decibels is required in the stop band to assure aliasing does not occur?
13. An 8-bit A/D uses a 15.0 kHz sampling frequency. What is the maximum acceptable audio input frequency?
14. A 16-bit A/D uses a 44.1 kHz sampling frequency. What is the maximum acceptable audio input frequency?
15. A 12.0 kHz audio signal is being digitized. What is the minimum sampling frequency which may be used?
16. A 185 kHz oscillating signal is being digitized. What is the minimum sampling frequency which may be used?

17. A 10-bit A/D converter uses an input span of 0 V to 4 V. Determine
- the number of input levels,
 - the number of input steps,
 - the step size,
 - the quantization error voltage,
 - the normalized step size, normalized to a span of 0 V to 1 V, and
 - the normalized error voltage.
18. A 6-bit A/D converter uses an input span of 0 V to 5 V. Determine
- the number of input levels,
 - the number of input steps,
 - the step size,
 - the quantization error voltage,
 - the normalized step size, normalized to a span of 0 V to 1 V, and
 - the normalized error voltage.
19. An 8-bit A/D converter with an input span of 0 V to 2 V has a DC input level of 75 mV. Determine the output in decimal, binary and hex.
20. A 6-bit A/D converter with an input span of 0 V to 1 V has a DC input level of 953.124 mV. Determine the output in decimal, binary and hex.
21. An 8-bit A/D converter with an input span of 0 V to 4 V has an output of F2 hex. What is the input voltage?
22. A 6-bit A/D converter with an input span of 0 V to 2 V has an output of 3B hex. What is the input voltage?

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