

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Department of Electrical Engineering

6.331 Advanced Circuit Techniques

Design Problem 1
Sample and Hold

Issued : February 22, 2002
Due : Friday, March 8, 2002

Design a sample-and-hold circuit for either (not both) of the sets of specifications listed below. Common requirements include operation from +15 and -15 volt supplies over a temperature range of 0°C to +50°C. Assume that you are supplied the sampling pulse from TTL levels.

High-Accuracy Circuit :

- Input Range from -10 to +10 volts.
- Total Sampling Time < 80 μ s.
- Output must be available immediately following sampling interval.
- Hold Time > 0.5 s.
- Total Error < 20 mV. (Include sampling error and droop)
- Tracking Error < 10 mV for a 10 V/ms ramp.
- Low impedance source.
- Maximum Current drawn from source at any time < 1 mA.
- Minimum Output Load = 1 k Ω

High-Speed Circuit :

- Input Range from -5 to +5 volts.
- Total Sampling Time < 150 ns from 'begin' signal until switch open.
- Output must be settled within 2 μ s after sampling is completed.
- Hold Time > 2 ms.
- Total Error < 30 mV. (Include sampling error and droop)
- Tracking Error < 20 mV for a 1 V/ μ s ramp.
- Source Resistance = 1 k Ω
- Maximum Current drawn from source at any time < 1 mA.
- Minimum Output Load = 2 k Ω

Note: You should include calculations to show that you meet all specifications. (You may find our discussion on error coefficients of some help for the determination of ramp error.)