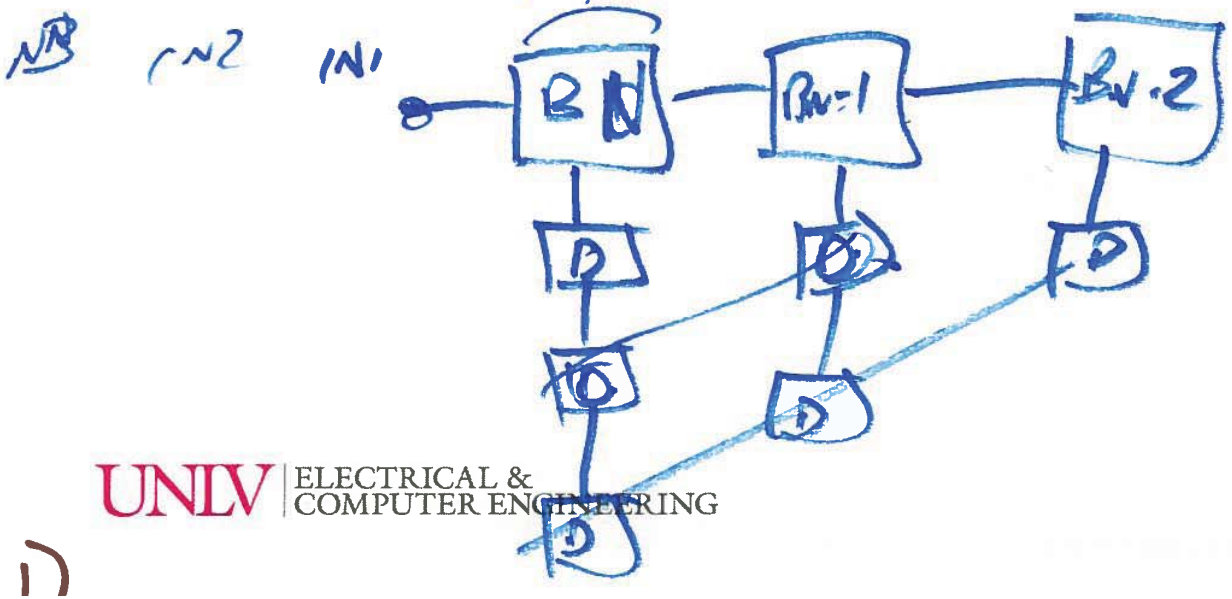
EEG 720
Advanced Analog IC Design

April 19, 2016

Lecture 24

Pipeline ADC



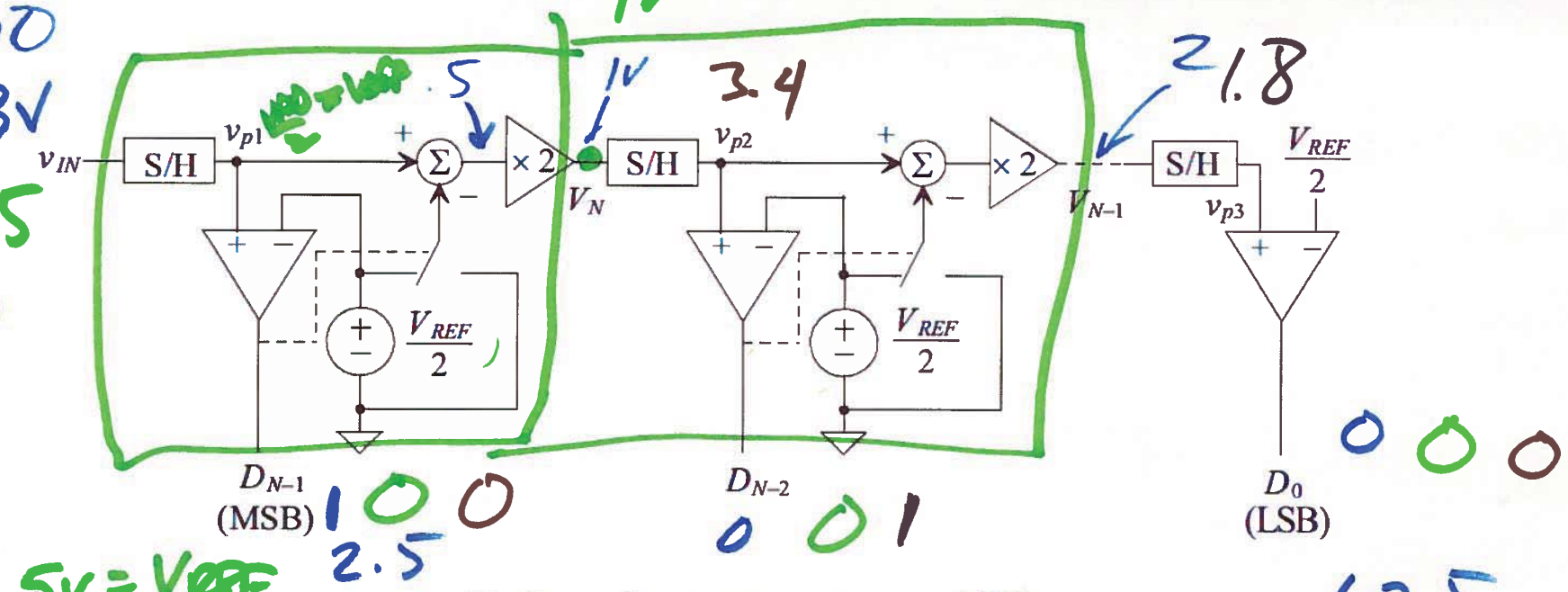


Figure 29.30 Block diagram of a pipeline ADC.

$$LSB = \frac{5}{8} = 0.625$$

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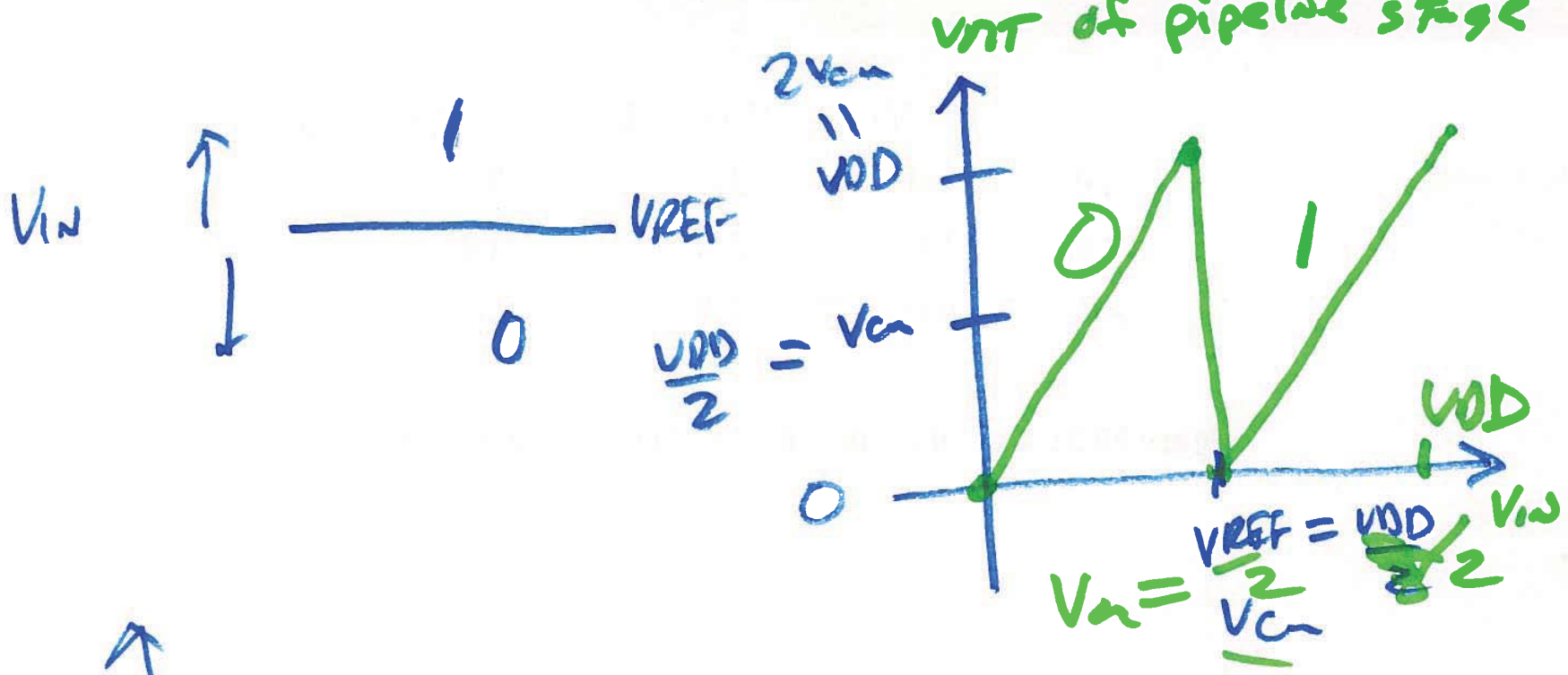
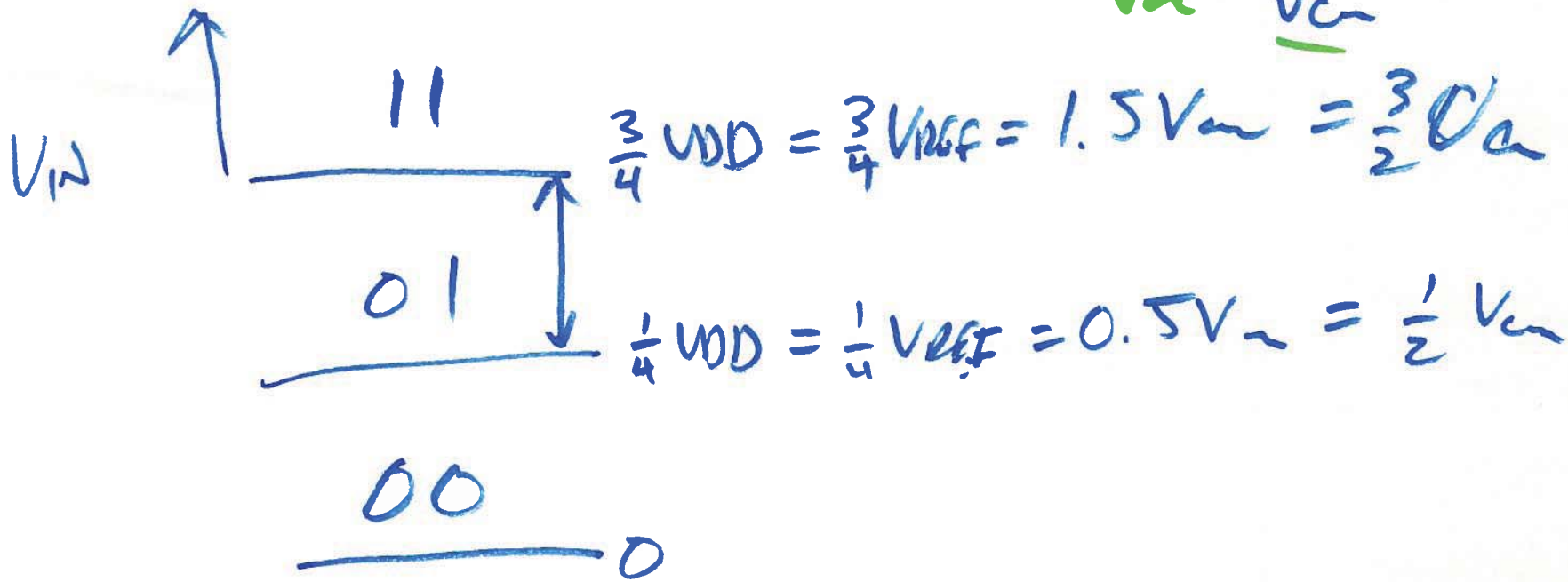

VTT of pipeline stage
2Vcm
=
VDD
VDD/2 = Vcm
0
1
VIN
VREF
0
1
VDD
0
VIN
VREF = VDD/2
Vcm = VREF/2
Vcm


11
VIN
3/4 VDD = 3/4 VREF = 1.5Vcm = 3/2 Vcm
01
1/4 VDD = 1/4 VREF = 0.5Vcm = 1/2 Vcm
00
0

3)

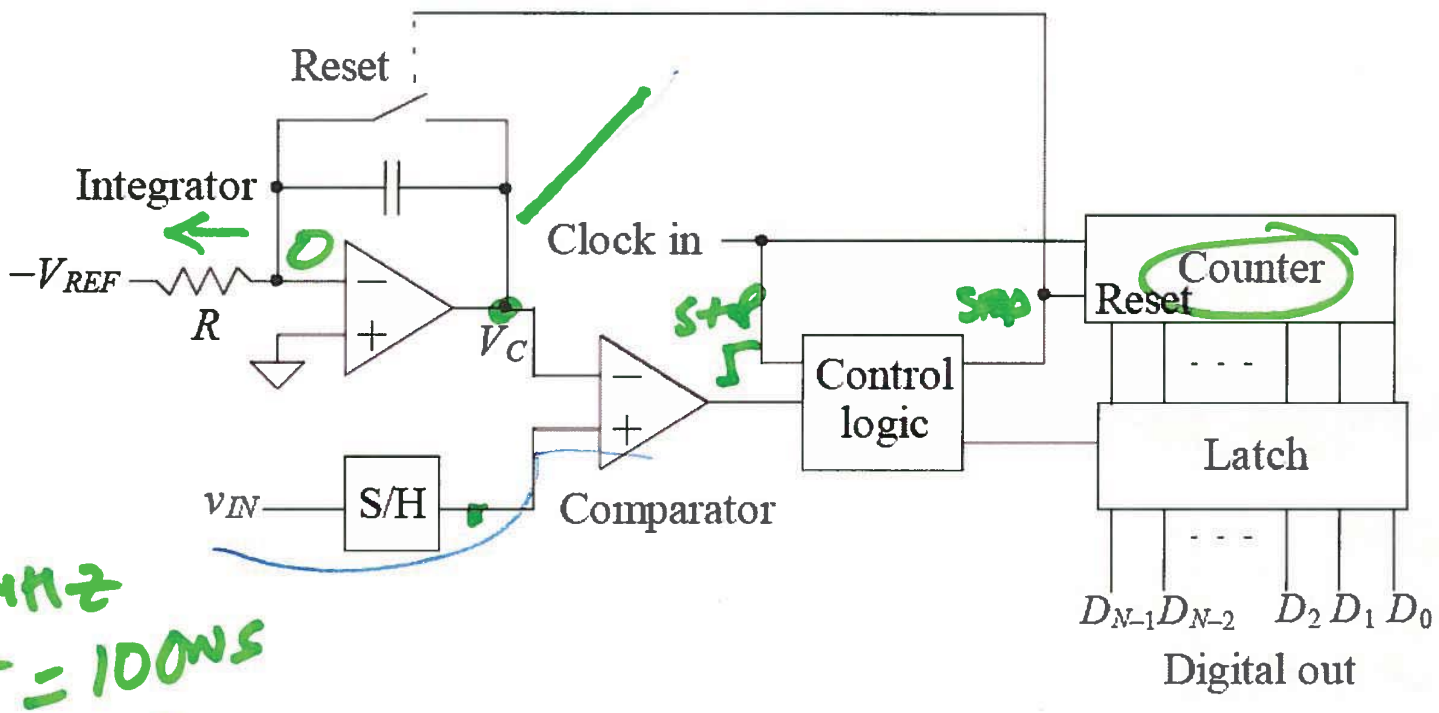
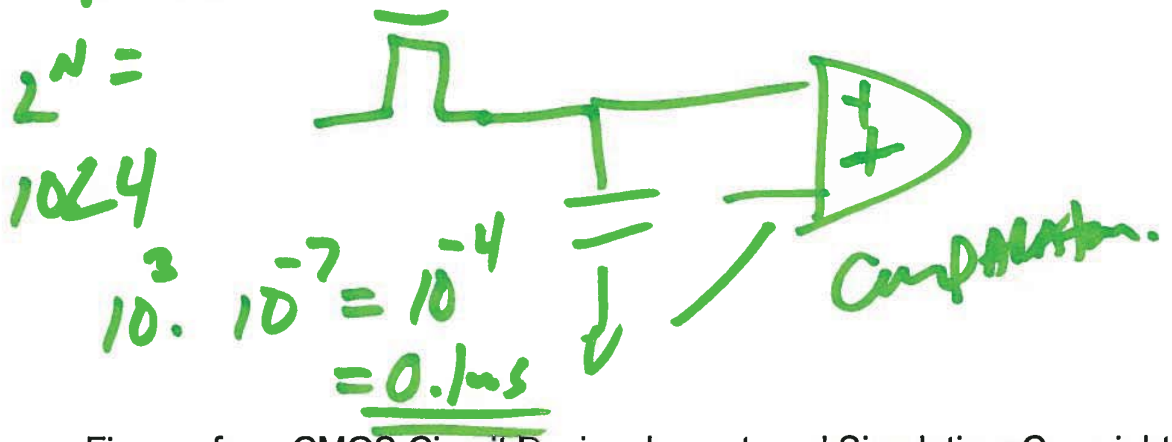


Figure 29.32 Block diagram of a single-slope ADC.



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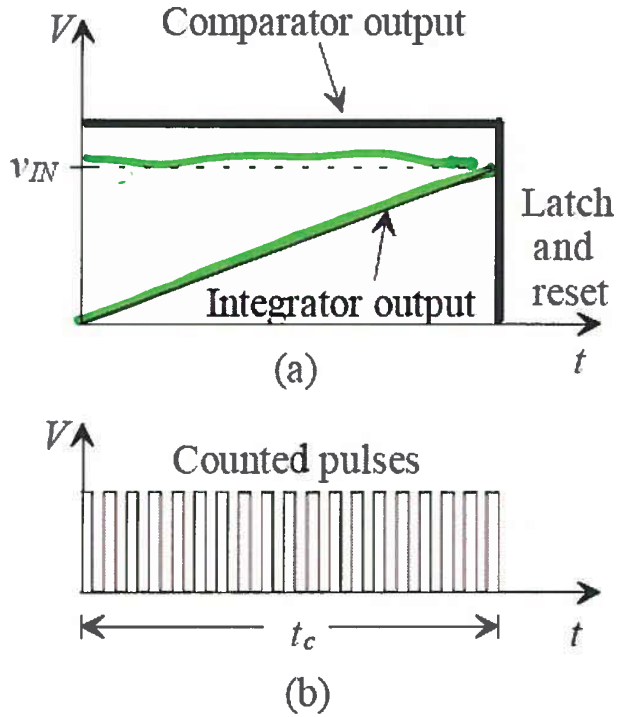

Figure 29.33 Single-slope ADC timing diagrams for (a) the comparator inputs and outputs and (b) the resulting counted pulses.

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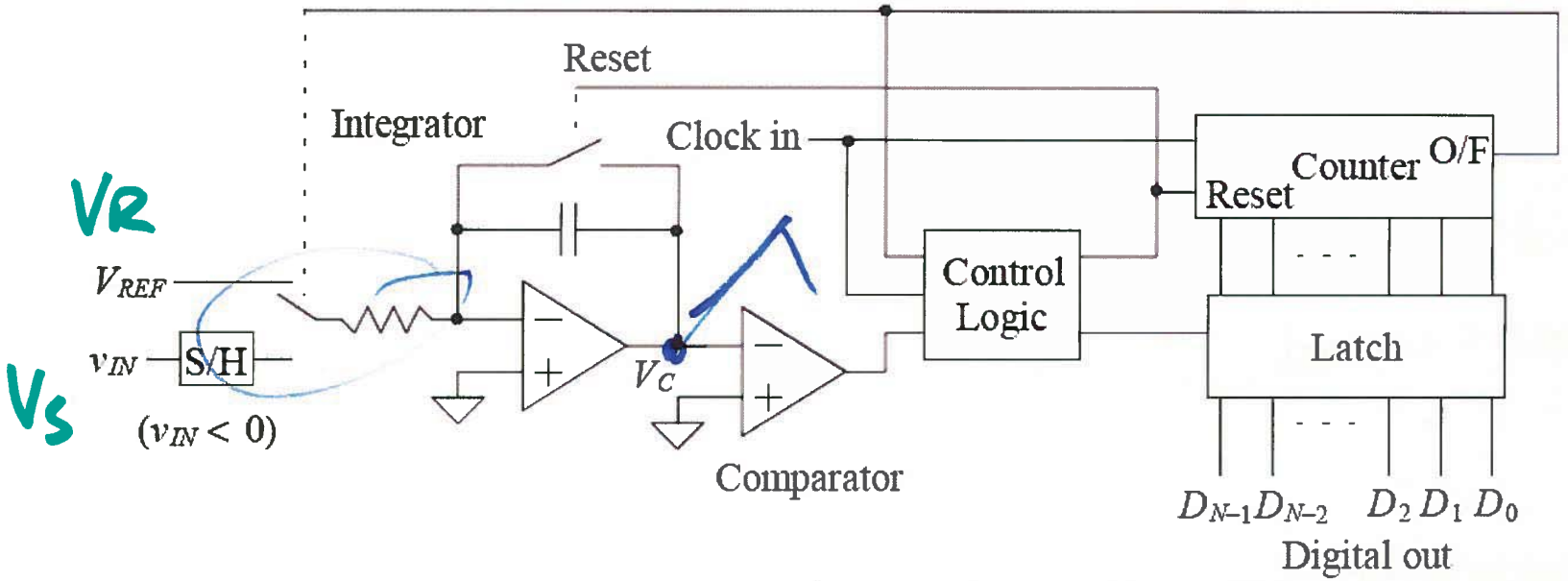
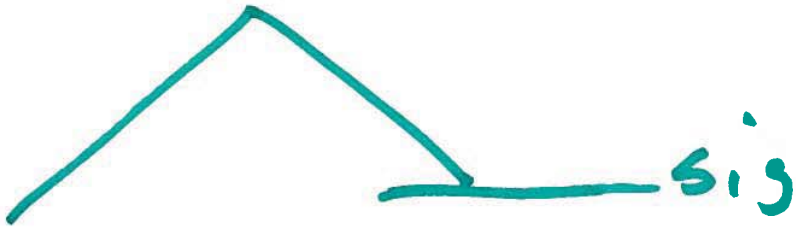


Figure 29.34 Block diagram of a dual-slope ADC.



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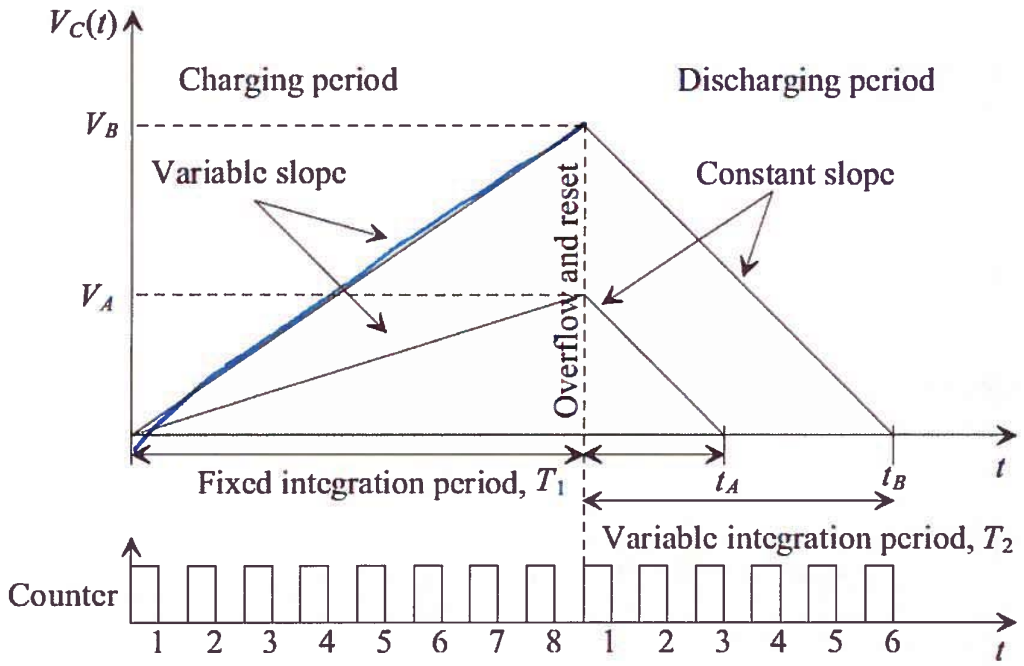

Figure 29.35 Integration periods and counter output for two separate samples of a 3-bit dual-slope ADC.

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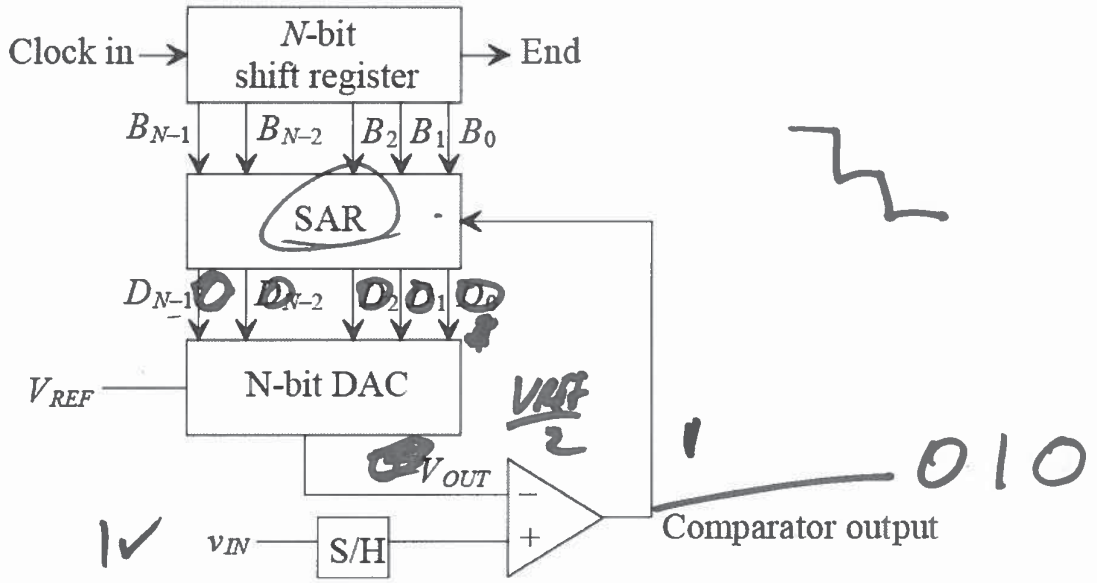

Figure 29.36 Block diagram of the successive approximation ADC.

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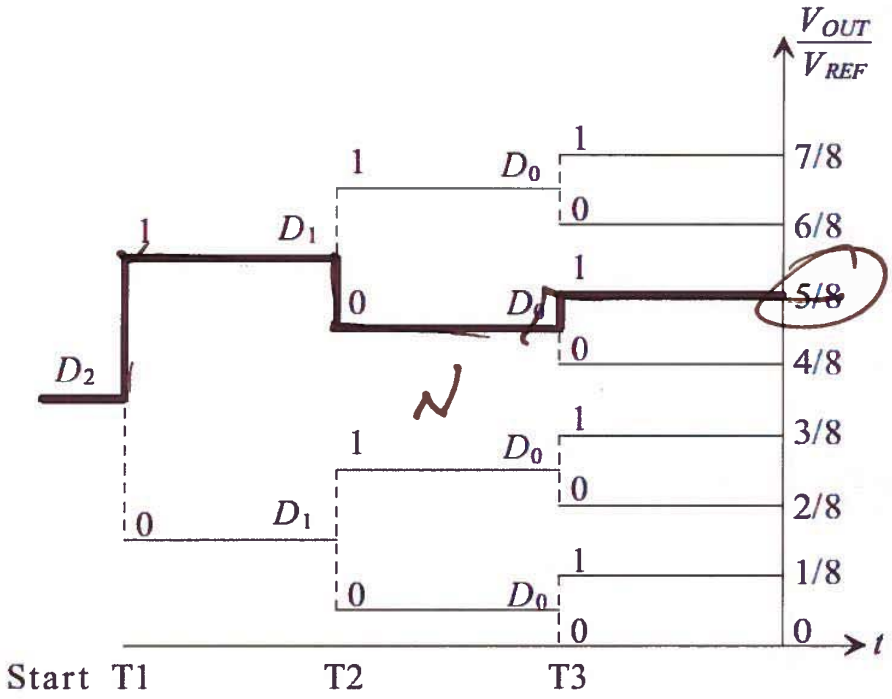

Figure 29.37 Binary search performed by a 3-bit successive approximation ADC for D=101.

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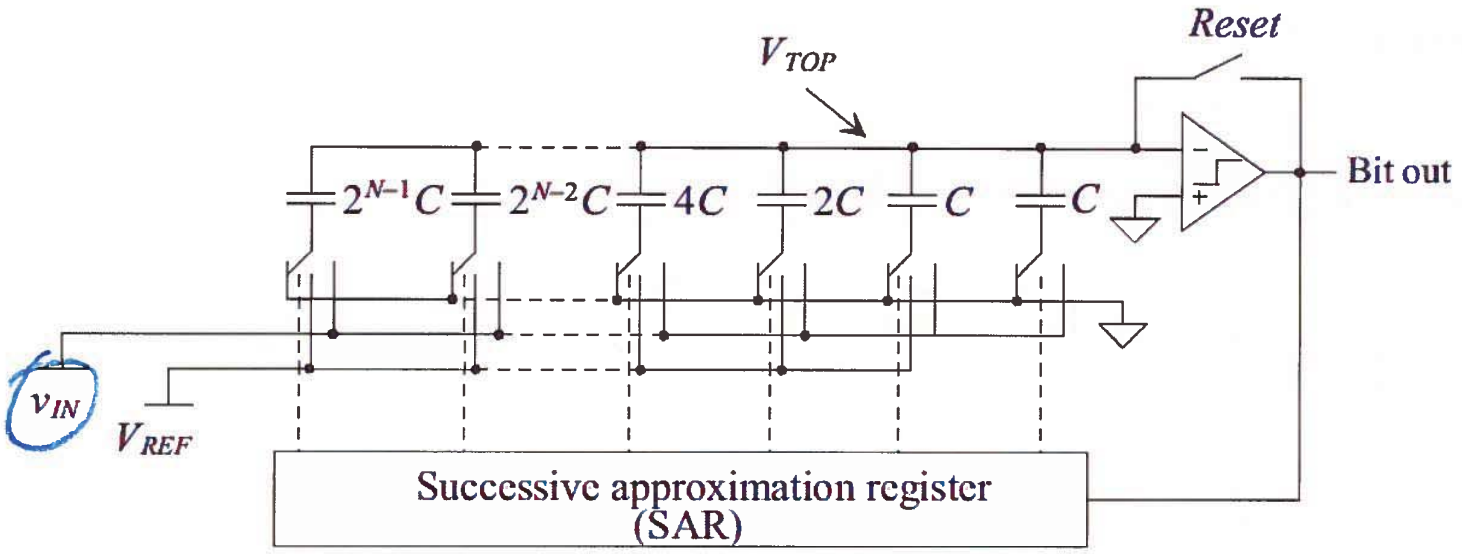

Figure 29.39 A charge redistribution ADC using a binary-weighted capacitor array DAC.

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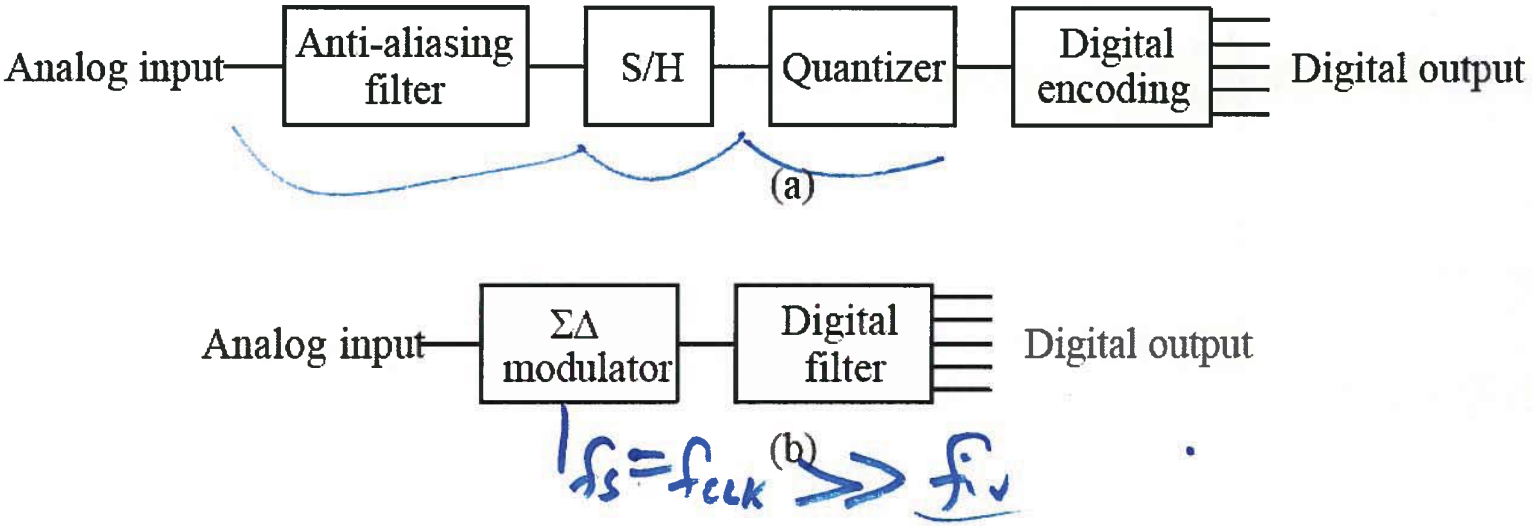

Figure 29.41 Typical block diagram for (a) Nyquist rate converters and (b) oversampling ADCs.

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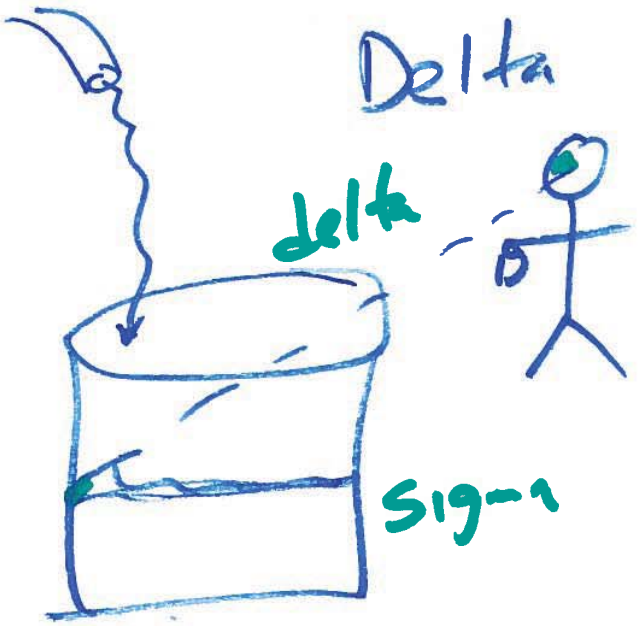

t(s)	RMV
0	0
10	1
20	1
30	0
40	1
50	1
60	0

$\frac{2\text{cups}}{30\text{sec}}$ = flow

$$\frac{\frac{X_1 + X_2 + X_3}{3}}{1}$$

digital filter

$$\frac{\frac{X_2 + X_3 + X_4}{3}}{2}$$

moving average filter

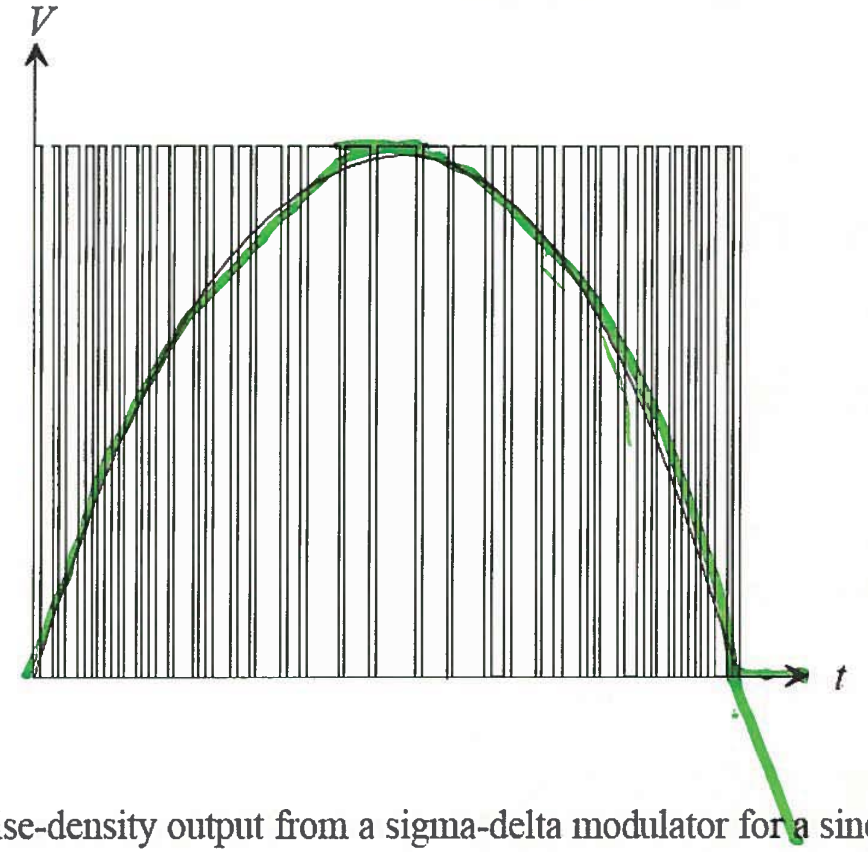

Figure 29.43 Pulse-density output from a sigma-delta modulator for a sine wave input.

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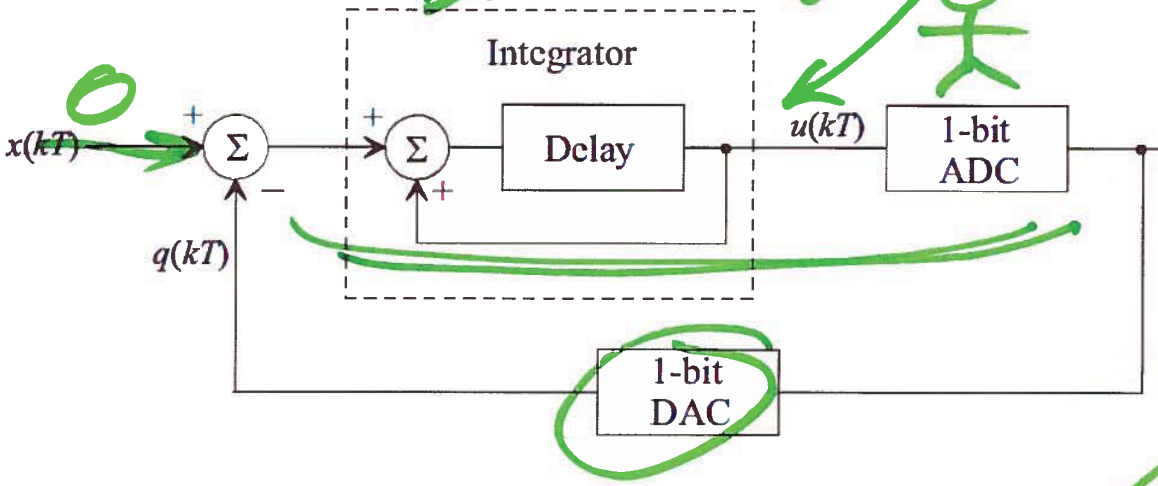

Figure 29.44 A first-order sigma-delta modulator.

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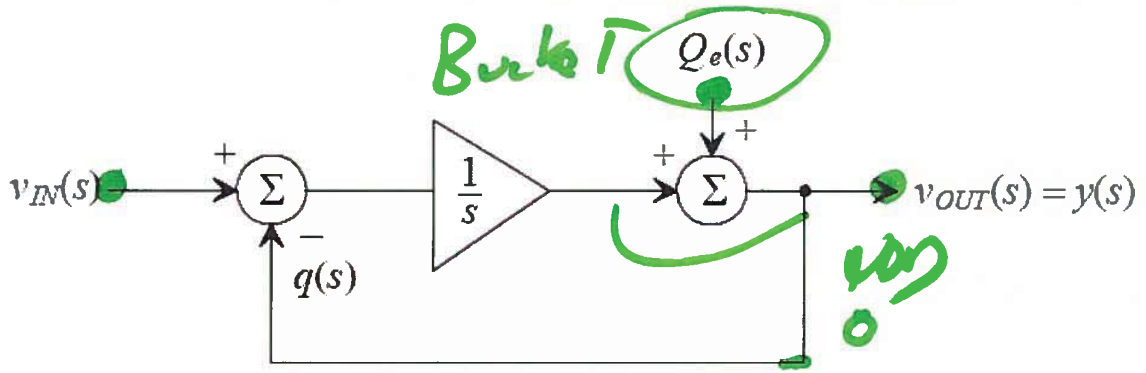
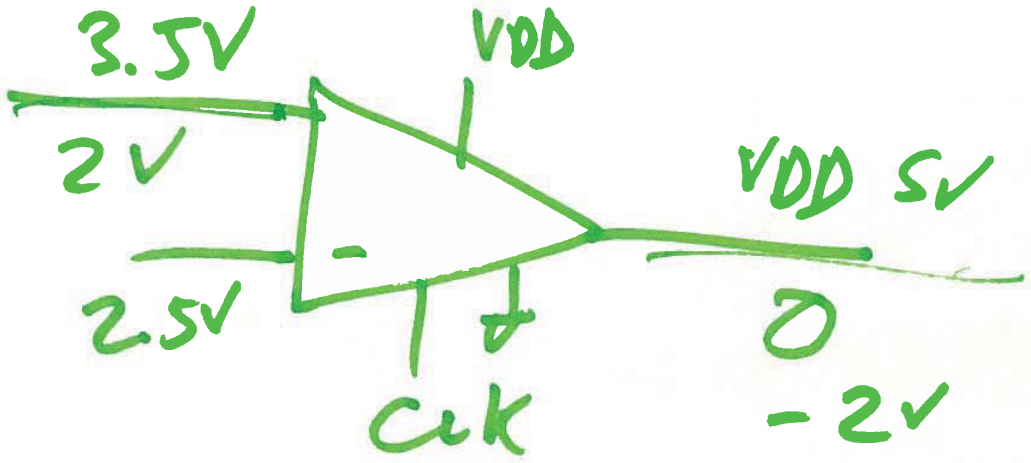


Figure 29.45 A frequency domain model for the first-order sigma-delta modulator.



$$STF = \frac{V_{OUT}}{V_{IN}} \qquad NTF = \frac{V_{OUT}}{Q_e}$$

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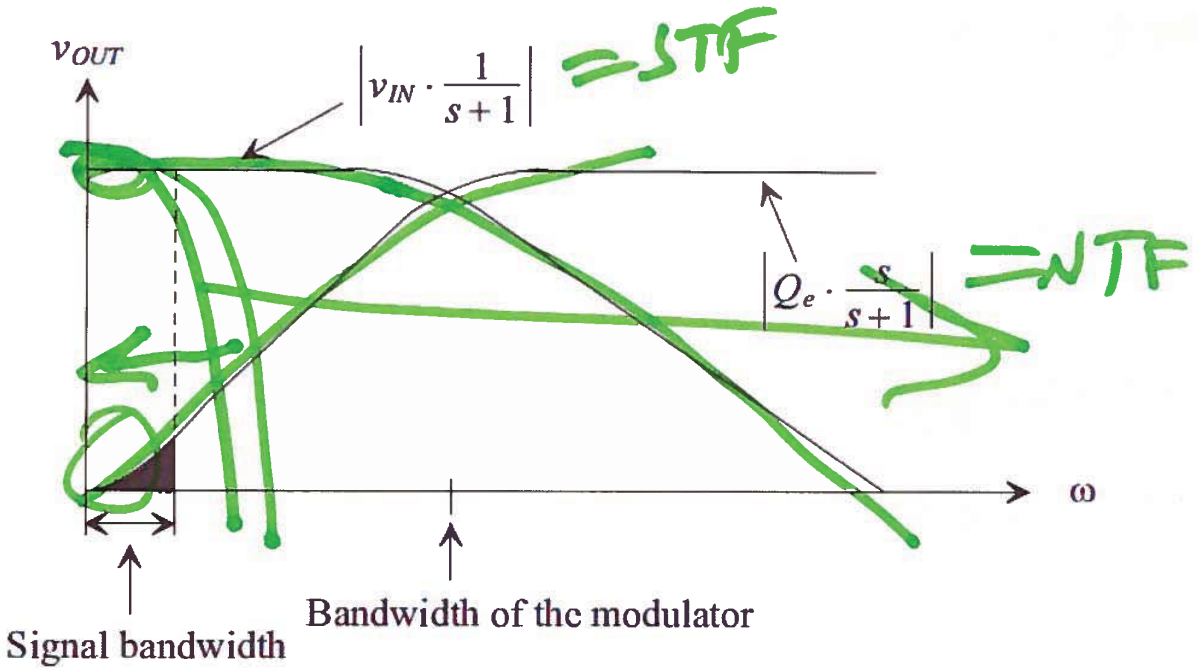

Figure 29.46 Frequency response of the first-order sigma-delta modulator.

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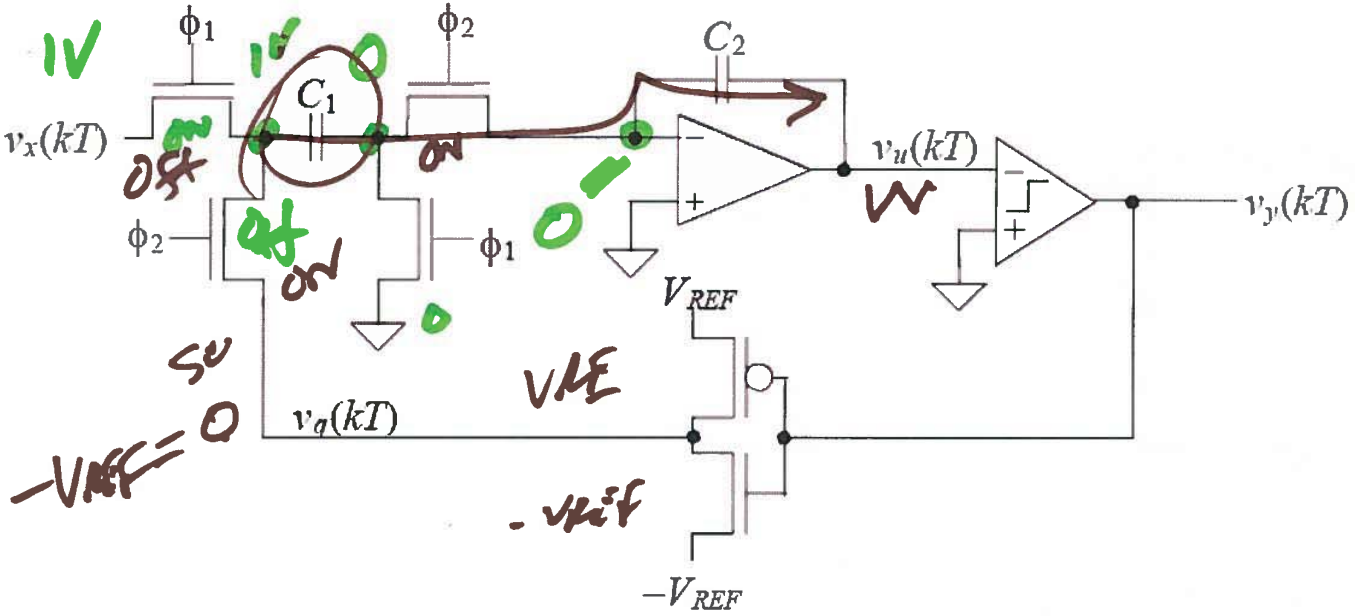

Figure 29.47 Implementation of a first-order sigma-delta modulator using a switched capacitor integrator.

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