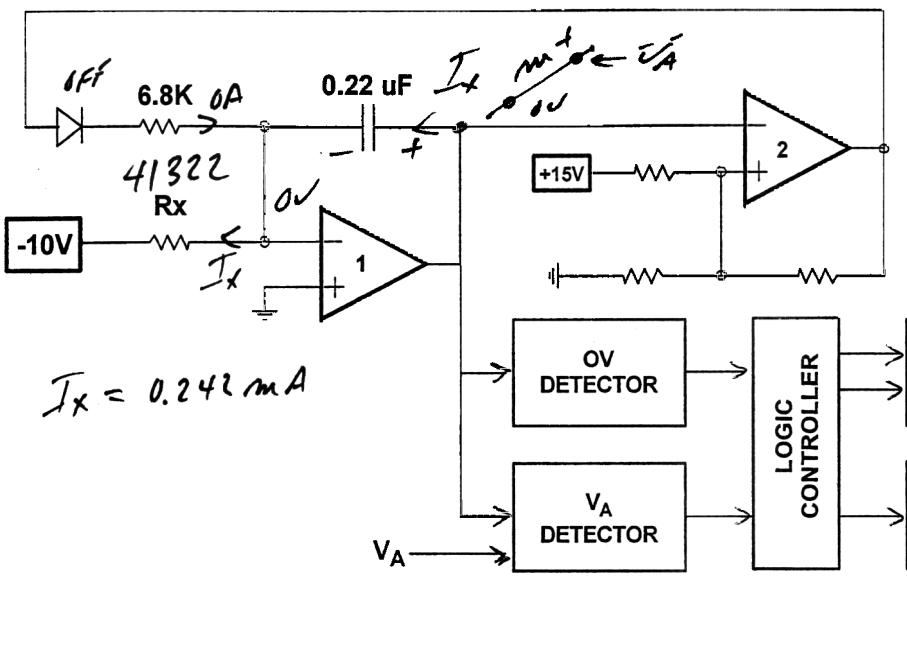
ELECTRONICS 3 QUIZ ADC-1 FEB 03W

NAME: SOLUTIONS (25)



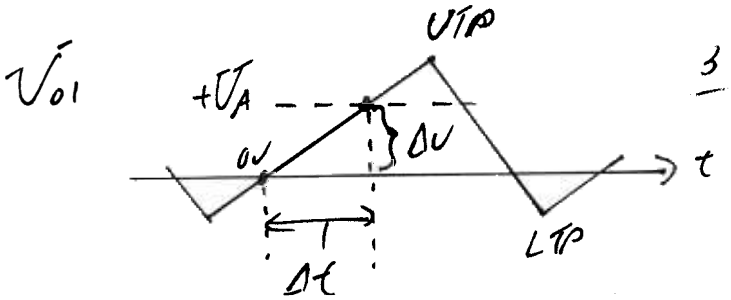
$I_x = 0.242\,mA$

QUIZ #2
$V_A = 0 \rightarrow 8.6955\,V$
$\Delta V_A = 8.5\,mV$
$I^+ = 0.374\,mA$
$m^+ = 1700\,V/s$

QUIZ #3
$I^+ = 0.506\,mA$
$m^+ = 2300\,V/s$
$V_A = 0 \rightarrow +11.4765\,V$
$\Delta V_A = 11.5\,mV$

Assume Rx = 41322 and V_{sat} = ±14V for op amps and F_{CLK} = 200 kHz for counter.

(9) A) Draw the waveform V_{o1} of op amp 1 and explain how this A to D converter works and derive the basic conversion equation $BIN = \frac{V_A \times F_{clk}}{m^+}$



3

0V Crossing counter starts. V_A Crossing counter stops and count is binary Conversion desired. 3

$\frac{\Delta V}{\Delta t} = \frac{V_A - 0}{BIN \times \frac{1}{F_{CLK}}} = m^+$ 3

$BIN = \frac{V_A}{m^+} \times F_{CLK}$

(7) B) What is the analog conversion range of the ADC and its resolution in mV?

$V_A = \frac{BIN \times m^+}{F_{CLK}} = \frac{BIN}{F_{CLK}} \times \frac{I_x}{C_F} = \frac{0 \rightarrow 2^{10}-1}{200k} \times \frac{0.242m}{0.22\mu} = 1100\,V/s \times \frac{BIN}{200k}$

(4) C) Explain why this ADC is less accurate than the dual slope ADC.

$V_A = 0V \rightarrow +5.6265\,V$ 6
$\Delta V_A = 5.5\,mV$ = Res. 1

$BIN = \frac{V_A}{m^+} \times F_{CLK} = \frac{V_A}{\frac{|V_{REF}|}{R_x C_F}} \times F_{CLK}$

BIN depends on accuracy of V_{REF}, F_{CLK}, R_x, C_F 3

in DUAL SLOPE BIN Conversion is independent of F_{CLK}, R_x and C_F