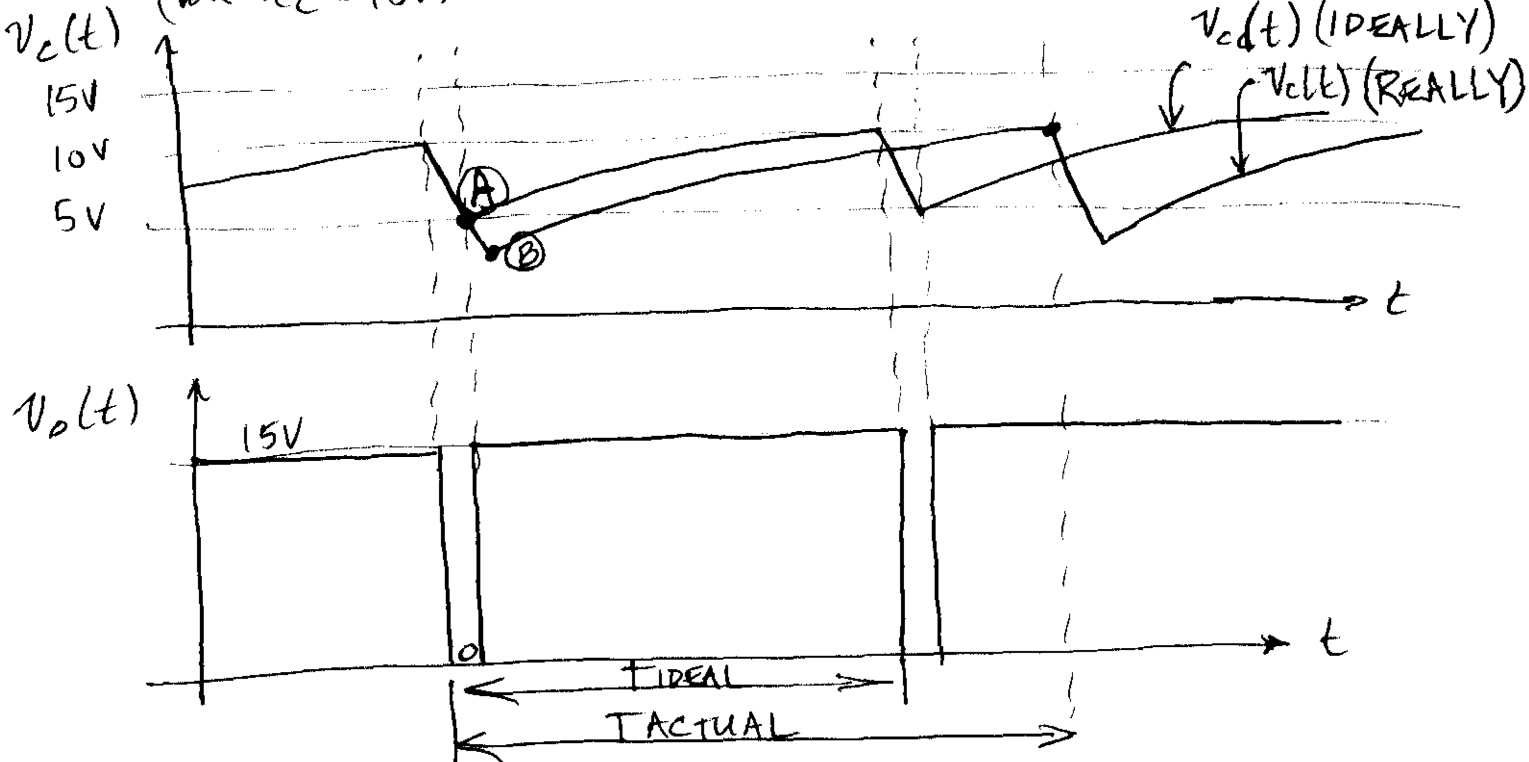
9/11/98

LAB 1, PART 3.2, QUESTION ABOUT WHY f_p IS TOO LOW...

(FOR $V_{CC} = 15V$)



AT POINT Ⓐ, THE INTERNAL COMPARATOR GOES HIGH, THE INTERNAL FLIP-FLOP IS SET, $\overline{Q}$ GOES LOW, Q_{14} (BJT INSIDE 555) IS TURNED OFF, AND THEN THE CAPACITOR IS CHARGING UP THRU RA AND RB. THE PROPAGATION DELAY ASSOCIATED WITH THESE STEPS CAUSES THE CAPACITOR VOLTAGE TO CONTINUE TO FALL UNTIL POINT Ⓑ, WHEN THE BJT Q_{14} ACTUALLY TURNS OFF. THE SUBSEQUENT CAPACITOR CHARGE WAVEFORM STARTS FROM AN INITIAL CONDITION LESS THAN THE <u>IDEAL</u> INITIAL CONDITION OF Ⓐ, RESULTING IN A LONGER RISE TIME AND LOWER FREQUENCY f_p.

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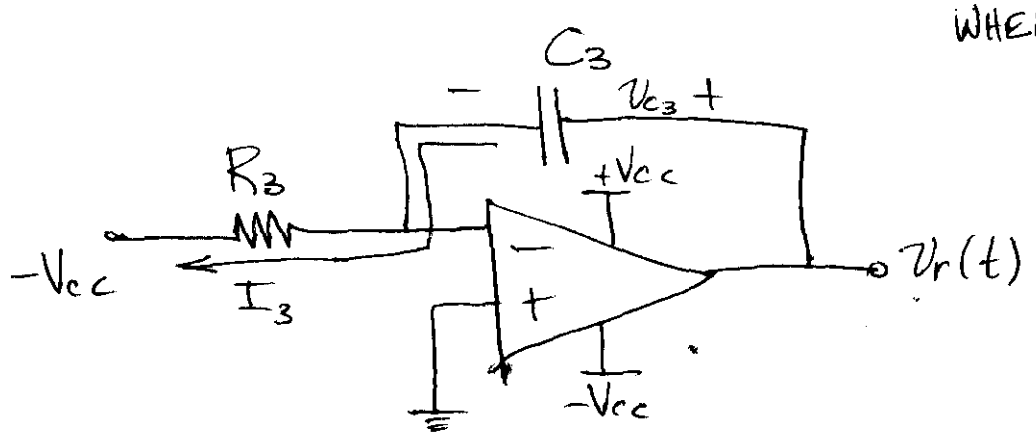
RAMP WAVEFORM GENERATOR

WHEN MOSFET IS <u>OFF</u>



$v_{c3}(0) \cong 0$ (INITIAL CONDITION)

$$v_r(t) = v_- + v_{c3}(t)$$

$$v_r(t) = v_{c3}(t)$$

$$I_3 = \frac{V_{cc}}{R_3} = \text{CONSTANT}$$

$$C_3 \frac{dv_{c3}(t)}{dt} = I_3$$

$$\frac{dv_{c3}(t)}{dt} = \frac{V_{cc}}{R_3 C_3}$$

$$v_{c3}(t) = \frac{V_{cc}}{R_3 C_3} t = v_r(t)$$

(EQUATION FOR RAMP FUNCTION)

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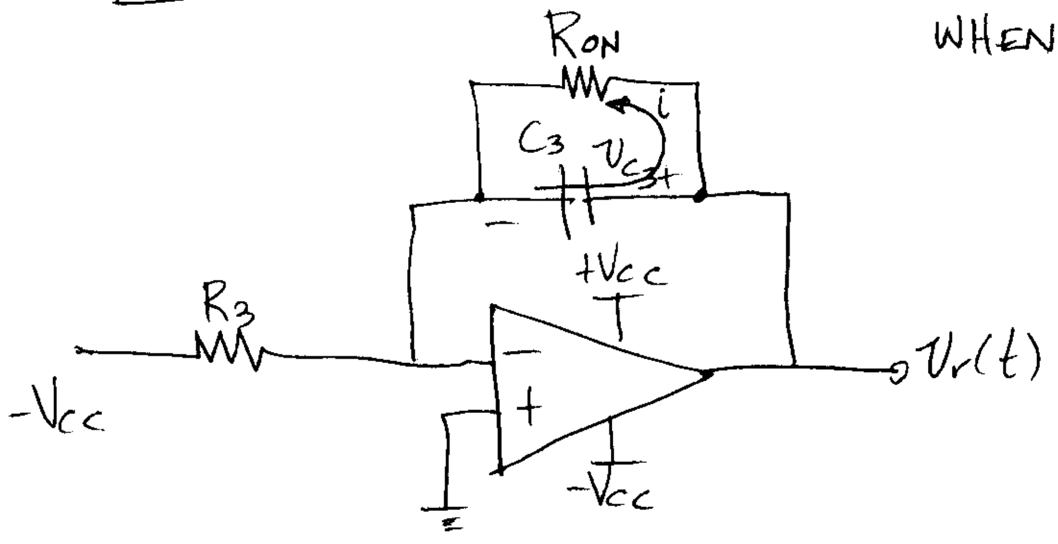
(SAWTOOTH) RAMP WAVEFORM GENERATOR

WHEN MOSFET IS ON



THERE IS A SMALL "ON-RESISTANCE" ASSOCIATED WITH ANY REAL MOSFET. THE CAPACITOR C_3 DISCHARGES THROUGH R_{ON}.

$R_{ON} \approx$ SEVERAL OHMS

$$\tau = R_{ON} C_3$$

$$v_{C_3}(t) = v_r(t)_{[MAX]}\, e^{-t/\tau}, \quad v_{C_3}(0) = v_r(t)_{\{MAX\}} (\doteq 4V)$$

MAKE $v_{C_3}(t_1) = 0$

FOR t_1 AS SMALL AS POSSIBLE