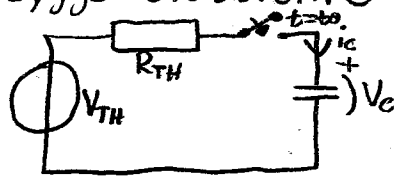
Inbyggd elektronik 2018-04-24 #10



$i_C = C\frac{dV_C}{dt}$

V_C is continous

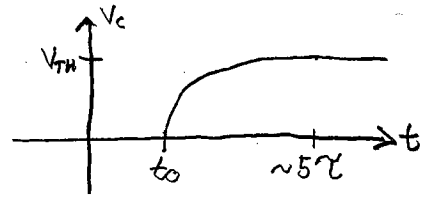
Solution: $V_C(t) = V_C(\infty) + [V_C(t=t_0) - V_C(\infty)]e^{\frac{-(t-t_0)}{\tau}}$
where $\tau = R_{TH} \cdot C$

For $t < t_0$ $V_C(t<t_0) = 0$ since capacitor is not charged ($Q = CV$)

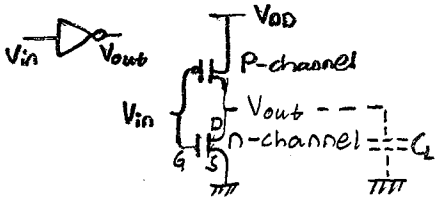
At $t = \infty$ C is fully charged and $V_C(\infty) = V_{TH}$

$V_C(t \geq t_0) = V_{TH} + (0 - V_{TH})\, e^{\frac{-(t-t_0)}{R_{TH} \cdot C}}$

$R_{TH} = 1k\Omega$, $C = 1\mu F$ $\Rightarrow \tau = 1ms$



Time delay in digital circuits



Complementary metal-oxide semiconductor (CMOS)

if $V_{IN} = V_{DD}$ n-channel is ON and low R to GND $\Rightarrow V_{OUT} = 0V$
p-channel is OFF and high R to V_{DD}

$V_{IN} = 0$ n-channel is OFF, high R to GND
p-channel is ON, low R to V_{DD}

MOSFET is basically a capacitor when looking into the G terminal.

① Assume $V_{IN} = V_{DD} \Rightarrow V_{OUT} = 0V \Rightarrow C_L$ is discharged

② $V_{IN} \downarrow$ GND $\Rightarrow V_{OUT} \uparrow V_{DD} \Rightarrow$ p-channel on and Vout goes to V_{DD} with time constant $\tau = R_{CH}^{PFET} \cdot C_L$

This decides max frequency

$P = \frac{1}{2} C_L V_{DD}^2 \cdot f$ $\Rightarrow$ Fast circuit $\Rightarrow$ high power