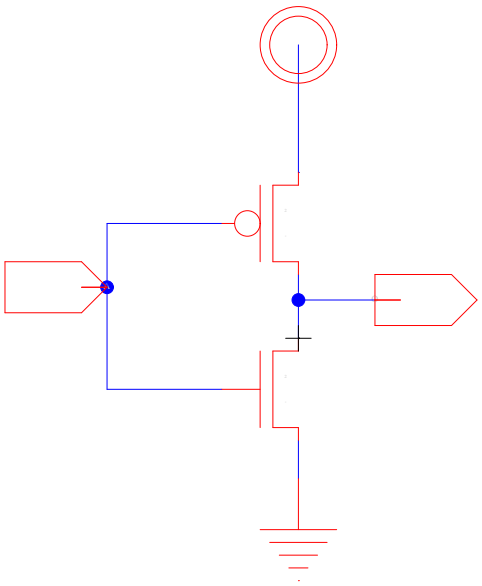
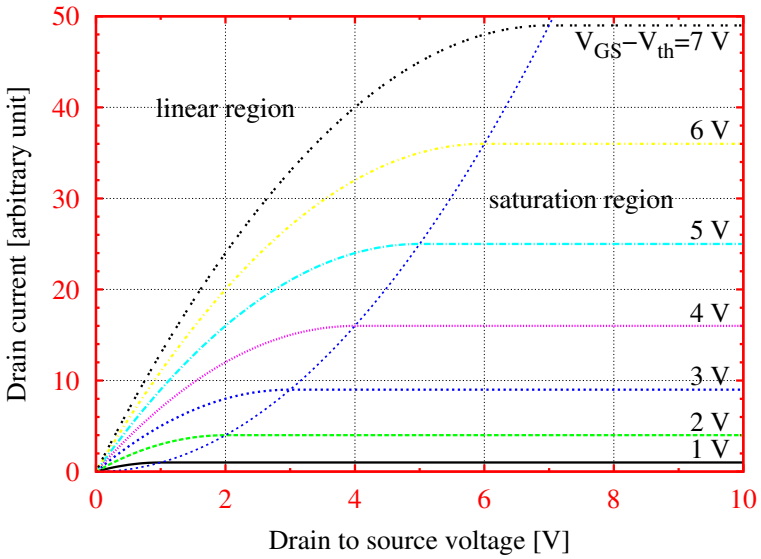


1. What current flows in the inverter in steady state? Think about the region of operation of the devices for each input case.



V_{GS}	V_{DS}	Mode	I_{DS}
$> V_{th}$	$< V_{GS} - V_{th}$	Resistive	$\mu_n C_{OX} \left(\frac{W}{L}\right) \left((V_{GS} - V_{th}) V_{DS} - \frac{(V_{DS})^2}{2} \right)$
	$> V_{GS} - V_{th}$ & $< V_{DSAT}$	Saturation	$\frac{\mu_n C_{OX}}{2} \left(\frac{W}{L}\right) (V_{GS} - V_{th})^2$
	$> V_{DSAT}$	Velocity Saturation	$\nu_{sat} C_{OX} W \left(V_{GS} - V_{th} - \frac{V_{DSAT}}{2} \right)$
$< V_{th}$		Subthreshold	$I_S \left(\frac{W}{L}\right) e^{\frac{V_{GS} - V_{th}}{nkT/q}}$

2. For a transistor in subthreshold, If V_{th} =300mV, $S = n\left(\frac{kT}{q}\right)\ln(10) = 100\text{mV}$, what is $I_{ds}(V_{gs} = 300\text{mV})/I_{ds}(V_{gs} = 0\text{V})$? [ ]

3. Consider an NMOS transistor with L_{eff}=25nm and V_{ds}=1V

   (a) What is the electrical field (F) in V/μm in the channel between source and drain? [ ]

   ($F = V/L$)

   (b) With an electron mobility of μ_n=500 $\text{cm}^2/\left(\text{V}\cdot\text{s}\right)$, what is the velocity of the electron in this field? (in m/s)? [ ]

   (velocity $v = \mu \times F$)

   (c) At what V_{ds} voltage does the velocity reach 10^5 m/s ? [ ]