Some useful formula

Parameters	NMOS	PMOS
V_{TO} (zero-bias threshold)	0.4V	-0.4V
γ (body-bias factor)	$0.2V^{1/2}$	$0.2V^{1/2}$
R_{eq}	12.5KΩ/□	30KΩ/□
$2|\Phi_F|$	0.88V	0.88V
u_n, u_p (mobility)	270 cm^2/V-s	70cm^2/V-s
E_c (critical field)	6V/um	24V/um
C_{ox} (oxide capacitance)	$1.6x10^{-6}$ F/cm^2	$1.6x10^{-6}$ F/cm^2
C_{eff} (total self capacitance)	1fF/um	1fF/um
Cg (total gate capacitance)	2fF/um	2fF/um
υ_{sat} (velocity saturation)	8 x 10^6 cm/s	8 x 10^6 cm/s
λ	0	0

$$V_T = V_{T0} + \gamma\left(\sqrt{V_{SB} + |2\phi_F|} - \sqrt{|2\phi_F|}\right)$$

$$I_{DS} = \frac{W}{L} \frac{\mu_e C_{ox}}{\left(1 + \frac{V_{DS}}{E_c L}\right)} \left(V_{GS} - V_T - \frac{V_{DS}}{2}\right) V_{DS}$$

Linear current

$$I_{DS} = W\upsilon_{sat} C_{ox} \frac{(V_{GS} - V_T)^2}{(V_{GS} - V_T) + E_c L}$$

Sat current short channel device

$$C_J = \frac{C_{j0} A}{\left(1 - \frac{V_J}{\phi_B}\right)^m}$$

Junction capacitance V_J is **forward** bias voltage junction

$$V_S = \frac{V_{DD} - |V_{TP}| + \chi V_{TN}}{1 + \chi}$$

Switching voltage of CMOS inverter where

$$\chi = \sqrt{\dfrac{\dfrac{W_N}{E_{CN}L_N}}{\dfrac{W_P}{E_{CP}L_P}}} = \sqrt{\dfrac{\mu_n W_N}{\mu_p W_P}}$$