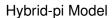
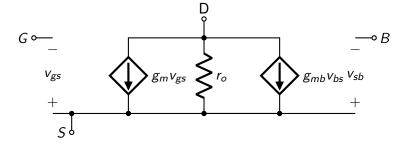
MOSFET Device Equation Sheet Dr. Roshan Weerasekera

Large Signal Models:

	NMOS	PMOS
	G V_{CSS} $V_{DS(sat)} = V_{CS} - V_{THN}$ $V_{DS(sat)} = V_{CS} - V_{THN}$ Saturation Region V_{CS2} V_{CS2} V_{CS2} V_{CS3} V_{CS2} V_{CS3} V_{CS2} V_{CS3} V_{CS2} V_{CS3} V_{CS3} V_{CS2} V_{CS3}	$G = V_{SG1}$ V_{DS} V_{DS} V_{SG2} V_{SG3} Saturation Region $V_{SD(set)} = V_{SG} - V_{THP} $ V_{SG5} V_{SG5} $k_p = k_p' \frac{W}{L}; \ k_p' = \mu_p C_{OX}; \ V_{THP} < 0$
Cut-off	$V_{GS} < V_{THN}$	$V_{SG} < V_{THP} $
	$I_{DS}=0$	$I_{SD}=0$
Triode	$V_{GS} \geq V_{THN}$ and $V_{DS} < V_{GS} - V_{THN}$	$V_{SG} \ge V_{THP} $ and $V_{SD} < V_{SG} - V_{THP} $
	$I_{DS} = \frac{k_n}{2} \{ 2(V_{GS} - V_{THN})V_{DS} - V_{DS}^2 \}$	$I_{SD} = \frac{k_p}{2} \{ 2(V_{SG} - V_{THP})V_{SD} - V_{SD}^2 \}$
Saturation	$V_{GS} > V_{THN}$ and $V_{DS} \geq V_{GS} - V_{THN}$	$V_{SG} > V_{THP} $ and $V_{SD} \ge V_{SG} - V_{THP} $
(Active)	$I_{DS} = rac{k_n}{2}(V_{GS} - V_{THN})^2(1 + \lambda_n V_{DS})$	$I_{SD} = rac{k_p}{2}(V_{SG} - V_{THP})^2(1 + \lambda_p V_{SD})$

Small Signal Model:





$$g_{m} = \mu_{n} C_{ox} \frac{W}{L} (V_{GS} - V_{TH}) = \sqrt{2\mu_{n} C_{ox} \frac{W}{L} I_{D}} = \frac{2I_{D}}{(V_{GS} - V_{TH})}$$
 $g_{mb} = \eta g_{m} \; ; \; r_{o} = \frac{1}{\lambda I_{D}} = \frac{V_{A}}{I_{D}}$

