

# MOSFET Design Calculations II

Jose Valdez and Stella Quinones\*

Electrical and Computer Engineering  
The University of Texas at El Paso



\*[stellaq@utep.edu](mailto:stellaq@utep.edu)



Create an Excel spreadsheet that calculates  $V_{DSAT}$  and  $I_{DSAT}$  for a channel width ( $W$ ) of  $10\ \mu\text{m}$  and for channel length values ( $L$ ) of  $1\ \mu\text{m}$  and  $2\ \mu\text{m}$  using the values of  $T_{OX}$ ,  $C_{OX}$ , and  $V_T$  determined for the NFET with an n+poly gate modeled in the first assignment for  $N_A$  values of  $10^{15}$ ,  $5 \times 10^{15}$ ,  $10^{16}$ ,  $5 \times 10^{16}$ ,  $10^{17}$ , and  $5 \times 10^{17}/\text{cm}^3$  and  $T_{OX}$  values of 5, 10 and 15 nm. Use the format shown below for the second spreadsheet, and place this spreadsheet directly below the first. Assume that  $V_{GS} = 2\ \text{V}$  and  $\mu_{n\text{channel}} = \mu_{n\text{bulk}}/3$ .

					$V_{GS} = 2\ \text{V}$	$V_{GS} = 2\ \text{V}$	$V_{GS} = 2\ \text{V}$	$V_{GS} = 2\ \text{V}$ $L = 1\ \mu\text{m}$	$V_{GS} = 2\ \text{V}$ $L = 1\ \mu\text{m}$	$V_{GS} = 2\ \text{V}$ $L = 1\ \mu\text{m}$	$V_{GS} = 2\ \text{V}$ $L = 2\ \mu\text{m}$	$V_{GS} = 2\ \text{V}$ $L = 2\ \mu\text{m}$	$V_{GS} = 2\ \text{V}$ $L = 2\ \mu\text{m}$
					5 nm	10 nm	15 nm	5 nm	10 nm	15 nm	5 nm	10 nm	15 nm
$N_A$	$W$	$\mu_n$	$L$	$L$	$V_{GS} - V_T$	$V_{GS} - V_T$	$V_{GS} - V_T$	$I_{DSAT}$	$I_{DSAT}$	$I_{DSAT}$	$I_{DSAT}$	$I_{DSAT}$	$I_{DSAT}$
$\text{cm}^{-3}$	$\mu\text{m}$	$\text{cm}^2/\text{Vs}$	$\mu\text{m}$	$\mu\text{m}$	V	V	V	mA	mA	mA	mA	mA	mA
$10^{15}$													
$5 \times 10^{15}$													
$10^{16}$													
$5 \times 10^{16}$													
$10^{17}$													
$5 \times 10^{17}$													