

~ AMPLIFIERS ~

For calculations of:

Intrinsic voltage gain ("open-circuit," "unloaded"):  $A_{vo} = v_{out}/v_{in}$ , set  $R_L = \infty$ ,  $R_S = 0$

Intrinsic current gain ("short-circuit"):  $A_{io} = i_{out}/i_{in}$ , set  $R_L = 0$ ,  $R_S = \infty$

Intrinsic transconductance:  $G_{mo} = i_{out}/v_{in}$ , set  $R_L = 0$ ,  $R_S = 0$

Intrinsic transresistance:  $R_{mo} = v_{out}/i_{in}$ , set  $R_L = \infty$ ,  $R_S = \infty$

To calculate  $R_{in}$ :  $R_{in} = v_{test}/i_{test}$  (@ input), and connect  $R_L$ .

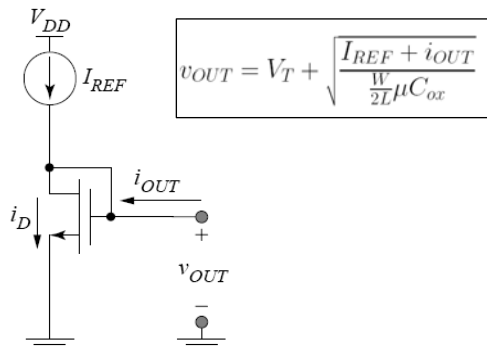
To calculate  $R_{out}$ :  $R_{out} = v_{test}/i_{test}$  (@ output), and connect  $R_S$ .

\* For CE and CS configurations,  $R_{in}$  is independent of  $R_L$ , and  $R_{out}$  independent of  $R_S$ .

Summary of Single-Stage Amplifier Characteristics:

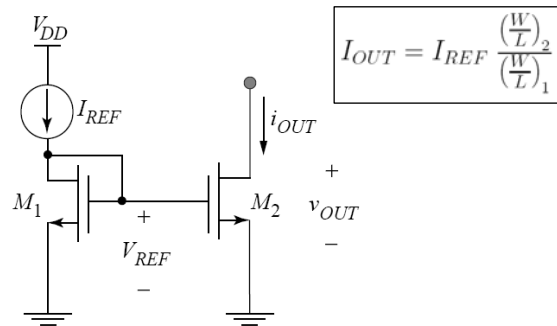
stage	$A_{vo}$ , $G_{mo}$ , $A_{io}$	$R_{in}$	$R_{out}$	key function
CS	$G_{mo} = g_m$	$\infty$	$r_o // r_{oc}$	transcond. amp.
CD	$A_{vo} \simeq \frac{g_m}{g_m + g_{mb}}$	$\infty$	$\frac{1}{g_m + g_{mb}}$	voltage buffer
CG	$A_{io} \simeq -1$	$\frac{1}{g_m + g_{mb}}$	$r_{oc} // [r_o(1 + g_m R_S)]$	current buffer
CE	$G_{mo} \simeq g_m$	$r_\pi$	$r_o // r_{oc}$	transcond. amp.
CC	$A_{vo} \simeq 1$	$r_\pi + \beta(r_o // r_{oc} // R_L)$	$\frac{1}{g_m} + \frac{R_S}{\beta}$	voltage buffer
CB	$A_{io} \simeq -1$	$\frac{1}{g_m}$	$r_{oc} // \{r_o[1 + g_m(r_\pi // R_S)]\}$	current buffer

MOSFET Voltage Source



(NMOS)

MOSFET Current Source



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