

$g_{mb}$  is the body transconductance defined as:

$$g_{mb} = \left. \frac{\partial I_D}{\partial V_{BS}} \right|_{\substack{V_{GS}=\text{const} \\ V_{DS}=\text{const}}}$$

Reminder: The dependence of  $I_D$  on  $V_{BS}$  is through the dependence of  $V_T$  on  $V_{BS}$ .

$$V_T = V_{T0} + \gamma \left[ \sqrt{2\phi_f + V_{SB}} - \sqrt{2\phi_f} \right]$$

Try developing it and show that:

$$g_{mb} = g_m \frac{\gamma}{2\sqrt{2\phi_f + V_{SB}}}$$