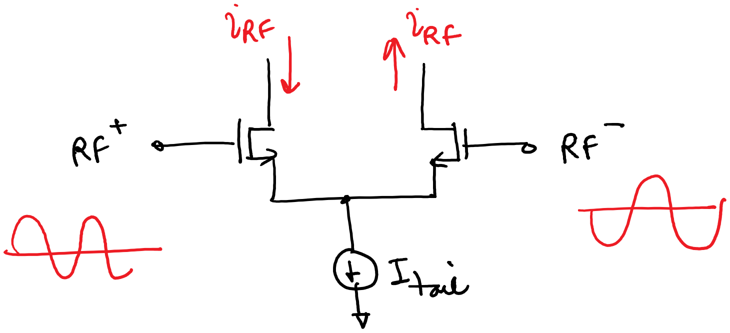
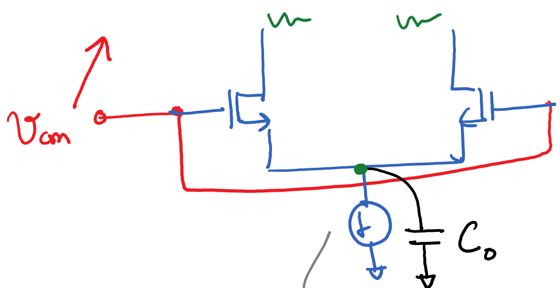
ECE 513- Lecture 26

Tuesday, November 27, 2018 9:33 AM

Common-mode rejection

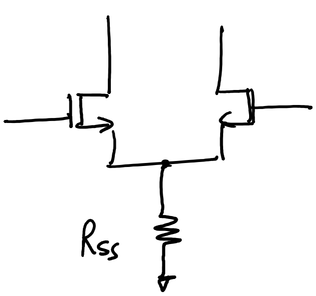


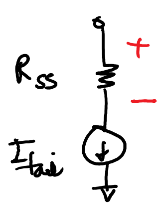


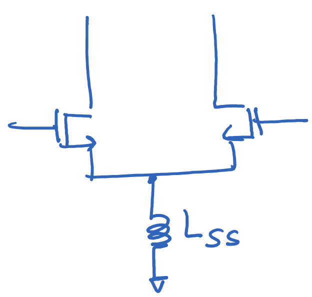
$$v_{icm} = \frac{v_{RF^+} + v_{RF^-}}{2}$$

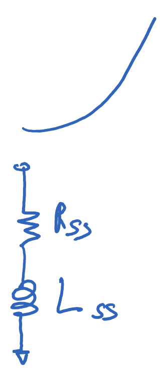
We need ideal (output resistance is ∞) for CM rejection

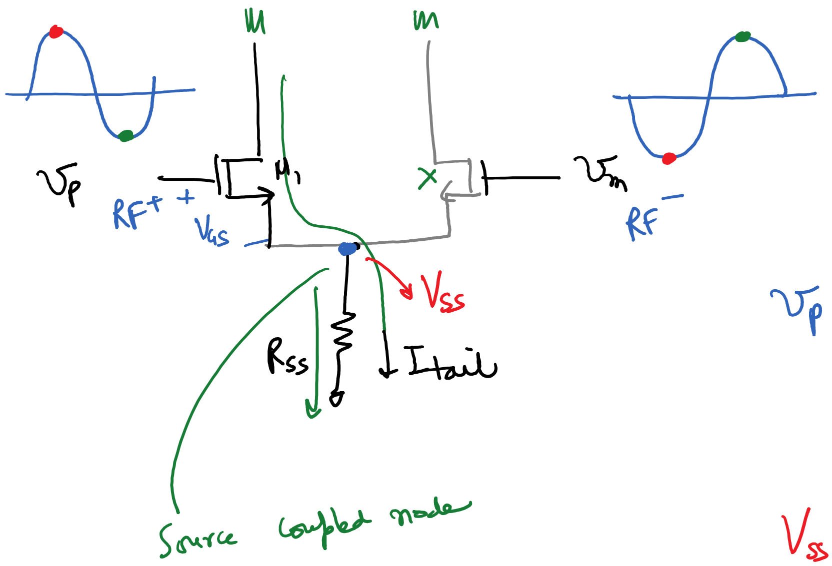
At higher frequencies, output resistance starts to look capacitive $X_c = \frac{1}{|j\omega c|}$

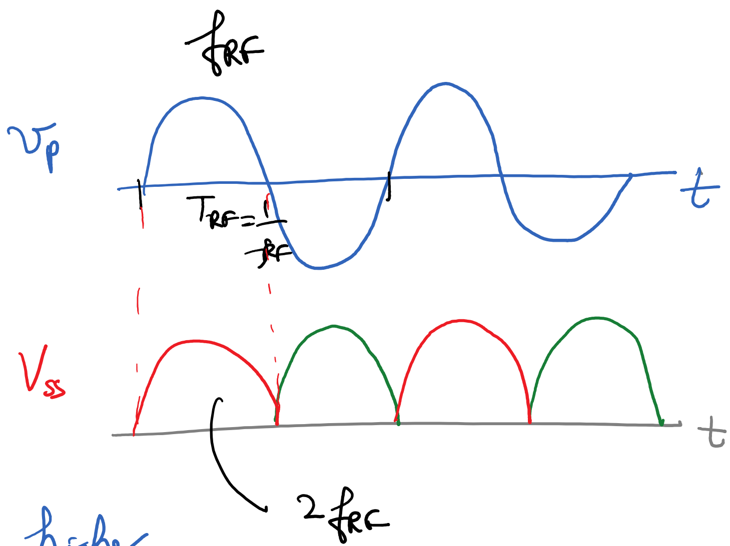




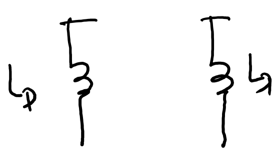


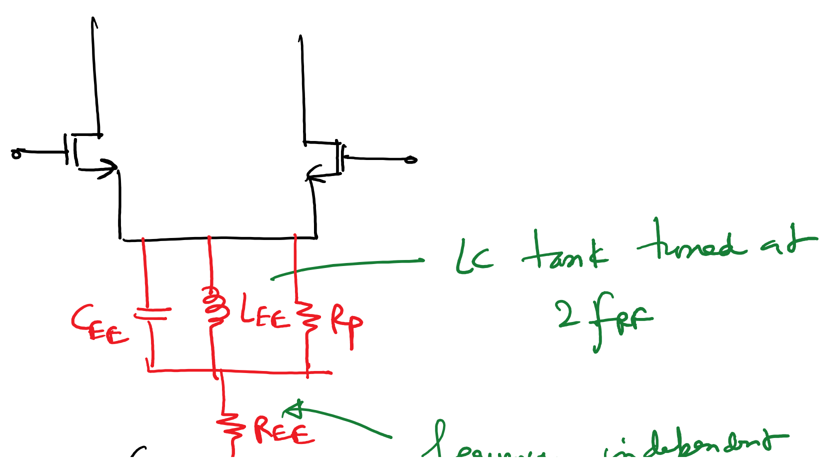


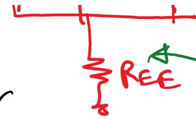




* V_{SS} is not AC ground at higher frequencies → 2^{nd} harmonic
"Even-order distortion"
→ IIP_2



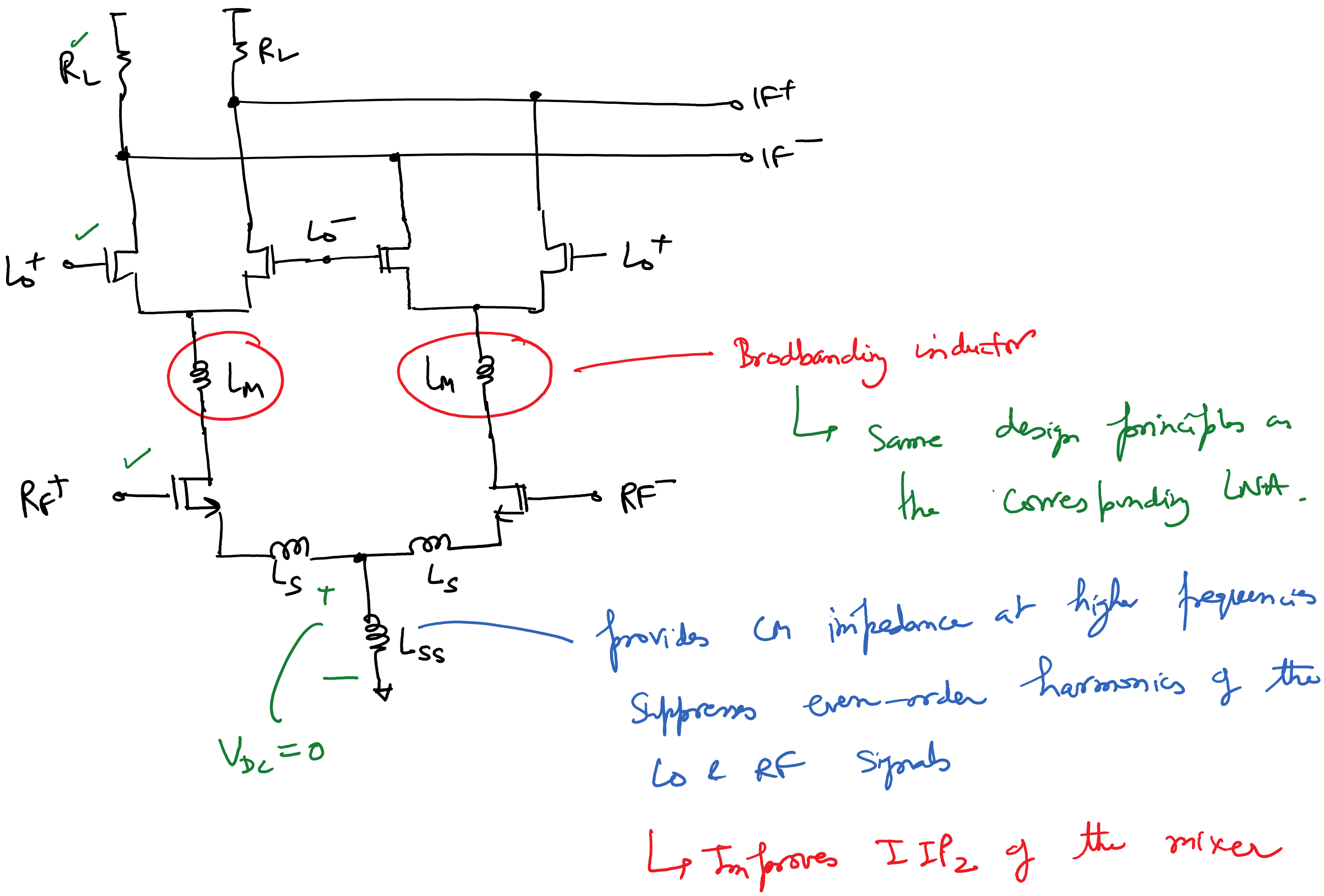




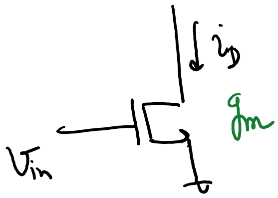
frequency independent

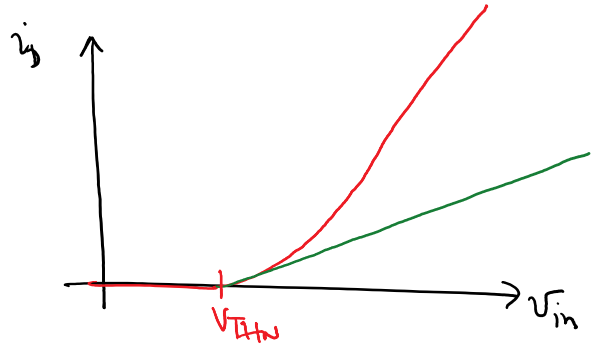
Build in CM rejection at $2f_{RF}$

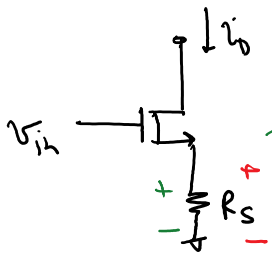
mmWave Broadbanding for Gilbert Mixers



* $L_M \Rightarrow$ improve the gain & NF of the mixer







$$G_m = \frac{g_m}{1+g_m R_s}$$

Source degeneration to improve linearity

↳ trade-off gain for linearity

* for higher linearity →

$$G_m = \frac{g_m}{1+g_m R_s} = \frac{1}{\frac{1}{g_m} + R_s} \approx \frac{1}{R_s}$$

g_m → non linearity

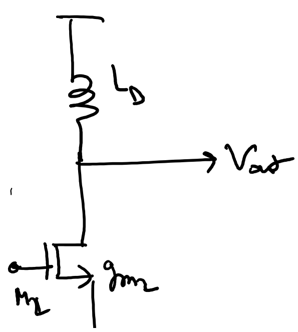
$\frac{1}{R_s}$ ↳ linear

for $g_m R_s >> 1$

$\Rightarrow \frac{1}{g_m} << R_s$

* Higher linearization as $g_m R_s \uparrow$

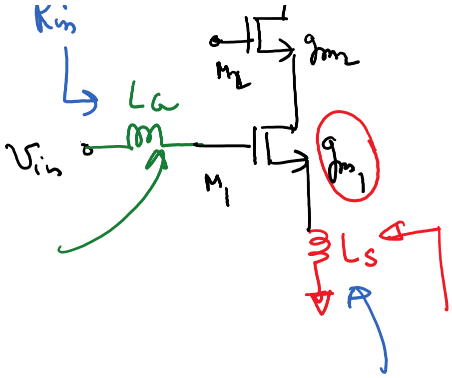
for fixed J_D → $W \uparrow$ → $g_m \uparrow$



R_{in}

$N_f = 5$ → plot P_{1dB} || P_3

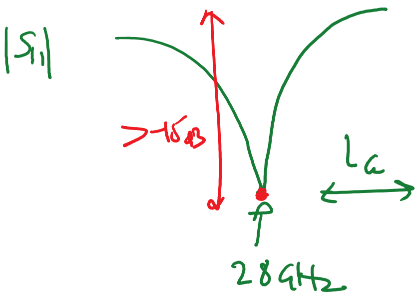
IIP_3

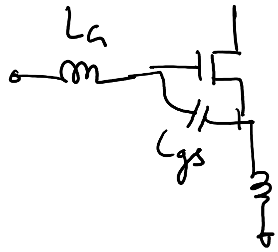


$N_f = 80 \Rightarrow \quad IIP_3 > 3\ dBm$

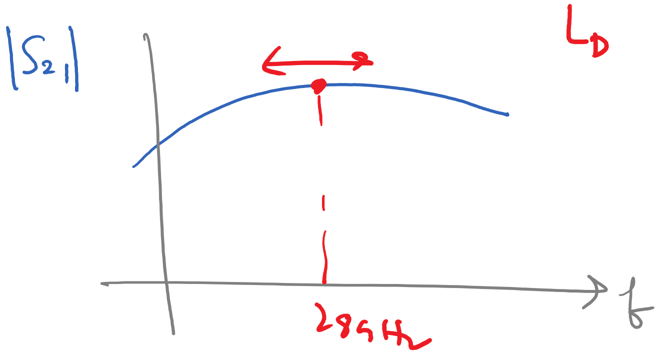
$Re\{Z_{in}\} \simeq 50\Omega$

$$R_{in} = \omega_T L_s = Z_0 = 50\Omega$$



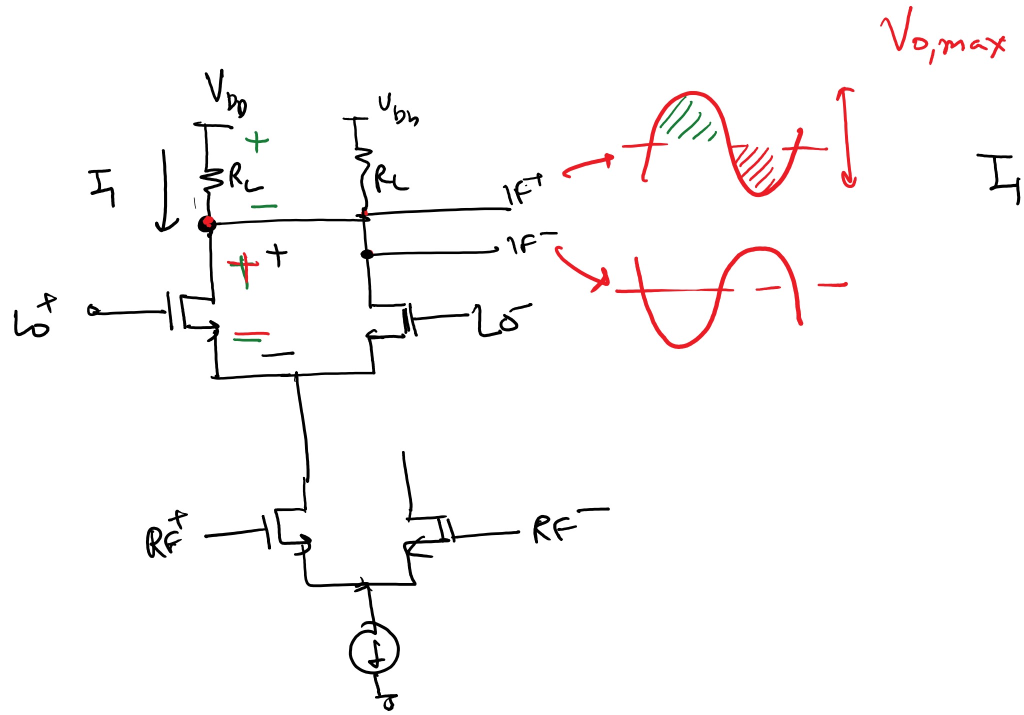


Q



L_D

$\{L_S, L_G, L_D\}$



$I_1 R_L = V_{DS} - V_{DS,sat}$