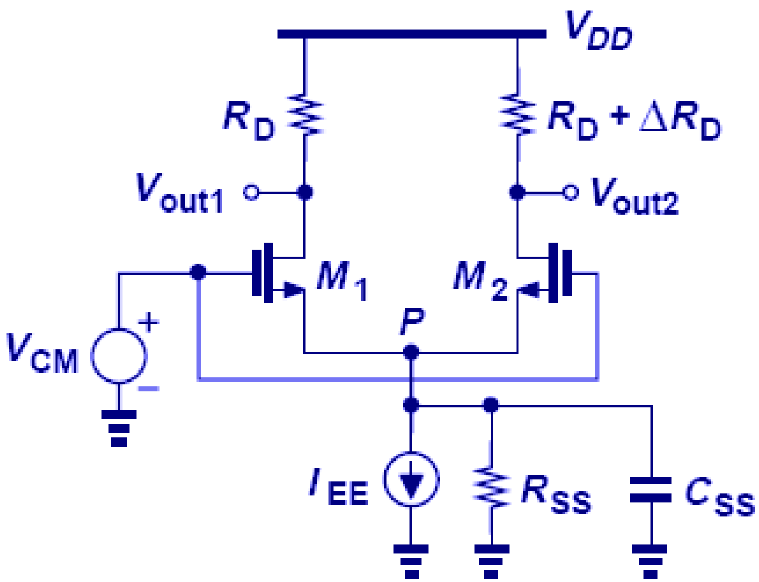
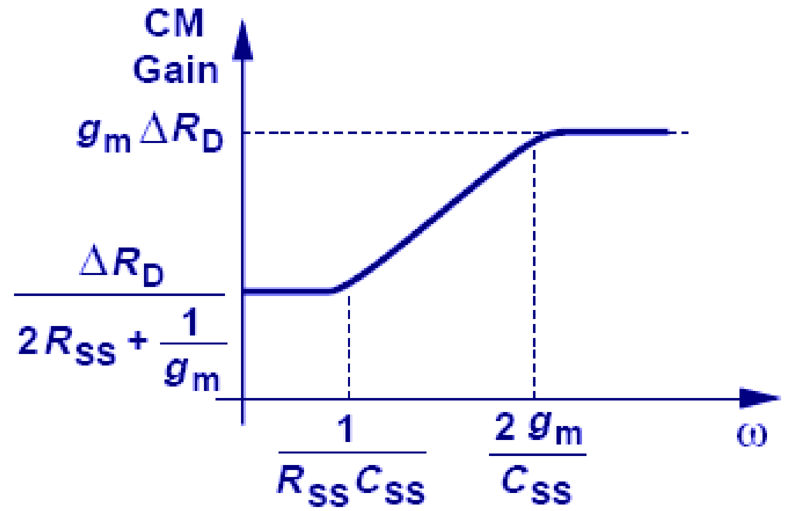
Common Mode Frequency Response





$$\left|\frac{\Delta V_{out}}{\Delta V_{CM}}\right| = \frac{\Delta R_D}{\frac{1}{g_m} + 2\left(R_{SS} \,\middle\|\, \frac{1}{C_{SS}s}\right)}$$

≈ 0 **at high frequency**

$$\approx g_m \Delta R_D$$

$\approx \infty$ **at low frequency**

$$\left|\frac{\Delta V_{out}}{\Delta V_{CM}}\right| = \frac{\Delta R_D}{\frac{1}{g_m} + 2\left(R_{SS} \,\middle\|\, \frac{1}{C_{SS}s}\right)} \approx \frac{\Delta R_D}{\frac{1}{g_m} + 2R_{SS}}$$

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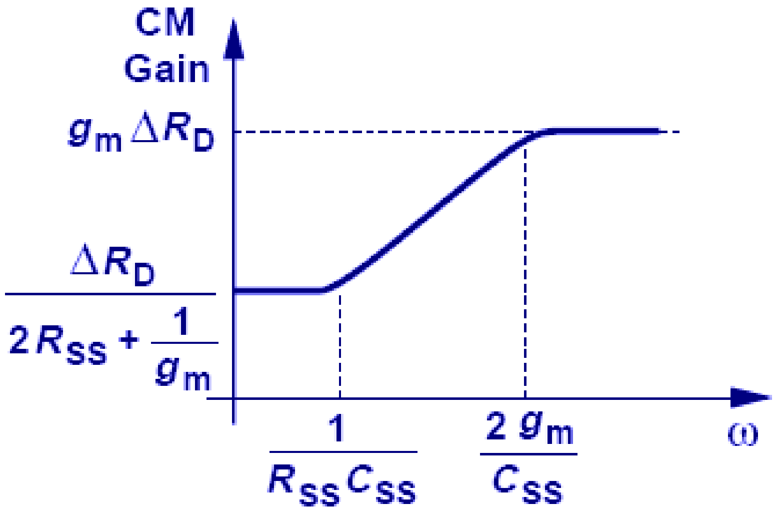
In page 590 of textbook:

The CM gain indeed rises dramatically at high frequency – by a factor of $2g_mR_{ss}$ (why?)



gain at high frequency

$$\left|\frac{A_{CM,high\_f}}{A_{CM,low\_f}}\right| = \frac{g_m \Delta R_D}{\frac{\Delta R_D}{\frac{1}{g_m} + 2R_{SS}}} \approx 2g_m R_{SS} \text{ if } 2R_{SS} >> \frac{1}{g_m}$$

gain at low frequency

Usage: If an amount increases by a factor of two, for example, then it becomes two times bigger.