Power Management Integrated Circuits
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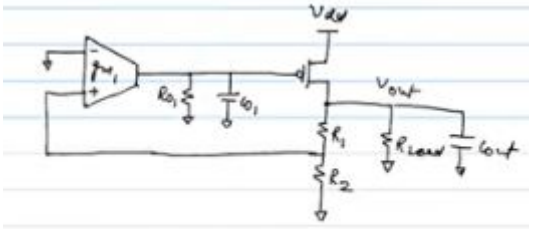
Lecture – 24
Line Regulation and PSRR of PMOS LDO

- Line Regulation is the ratio of small-signal changes in V_{out} to small-signal changes in V_{dd} at DC.

$$\text{Line Regulation (dc)} = \frac{\partial V_{out}}{\partial V_{dd}}$$



$$R_{out} = r_{o2} \| (R_1 + R_2) \| R_{Load}$$

- The line regulation of the PMOS LDO is $1/(\beta g_{m1} R_{o1})$, i.e. the line regulation depends on the feedback factor β and on the gain of the error amplifier $g_{m1}R_{o1}$. It is independent of the gain of the output stage.

- Assuming that the error amplifier pole $\omega_{p1} = 1/(R_{o1}C_{o1})$ is dominant, the capacitor C_{our} can be neglected while finding the PSRR at frequencies $\omega < \omega_{ugb}$ since $\omega_{p2} = 1/(R_{out}C_{out})$ lies beyond ω_{ugb}.
- Approximate expression of the PSRR at frequencies $\omega < \omega_{ugb}$:

$$\omega_{p_1} = \frac{1}{R_{o_1} C_{o_1}}$$

$$\& \; A_0 = g_{m_1} R_{o_1} g_{m_2} R_{o_2}$$

$$LG(dc) = \beta A_0$$

$$\frac{V_{out}(s)}{V_{dd}(s)} = \frac{1}{\beta g_{m_1} R_{o_1}} \cdot \frac{1 + s/\omega_{p_1}}{1 + s/\beta A_0 \omega_{p_1}}$$