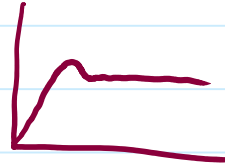


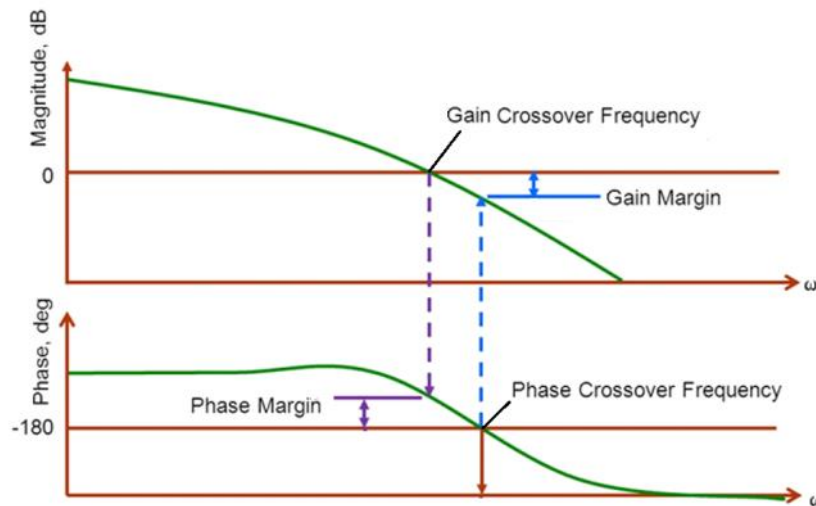
Gain and Phase Margin

Phase Margin $\rightarrow 180 - |\phi|$

Phase margin ≥ 60 degrees



Gain Margin \rightarrow gain at $|\phi| = 180^\circ$

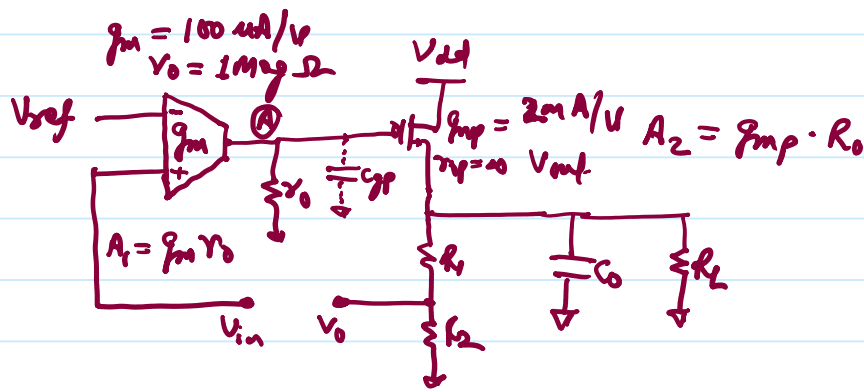




EE5325 - Power Management Integrated Circuits

Integrated Circuits and Systems Group, Department of EE, IIT Madras

Frequency Response of LDO



$$H(s) \text{ or } L_G(s) = \frac{A_1 \cdot A_2}{(1 + r_o C_{cp} s)(1 + R_o C_o)} \times \beta$$

$$R_1 + R_2 = 100 K\Omega$$

$$R_L = 1 K\Omega$$

$$R_o = (R_1 + R_2) \parallel R_L$$

$$A_1 \cdot A_2 \approx 100 \times 2$$

$$\beta = \frac{R_2}{R_1 + R_2}$$

4 marks

$$V_{ref} = 0.6V \quad V_{out} = 1.2V$$

$$\beta = 1/2$$

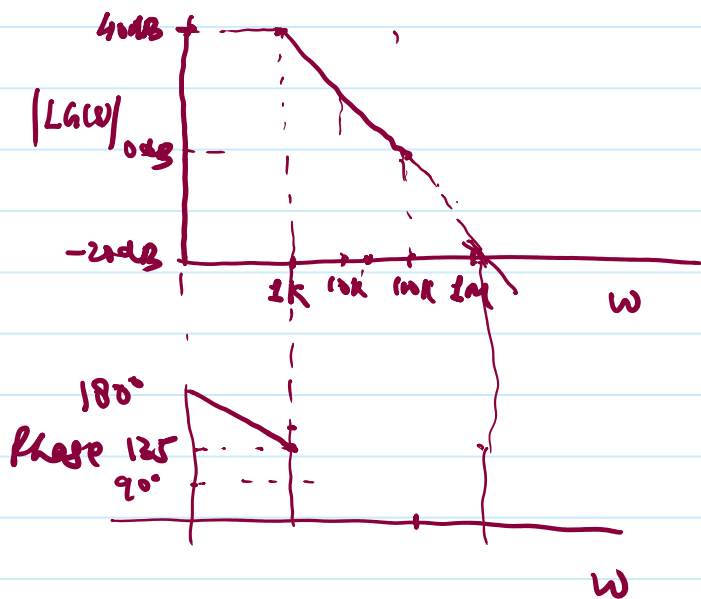
$$C_{cp} = 1 pF$$

$$\omega_{p1} = \frac{1}{r_o C_{cp}} = \frac{1}{1 M\Omega \times 1 pF} = 1 M rad/s$$

$$\omega_{p2} \approx \frac{1}{R_L C_o} = \frac{1}{1 K\Omega \times 1 \mu F} = 1 K rad/s$$

$$L_G(s) = \frac{100}{(1 + s/\omega_{p1})(1 + s/\omega_{p2})}$$

Frequency Response of LDO



assume, $C_0 = 10nF$, $R_1 + R_2 \gg R_L$

$$\omega_{p2} = \frac{1}{C_0 R_0} = \frac{1}{10n \times 1K} = 100K \text{ rad/s}$$

