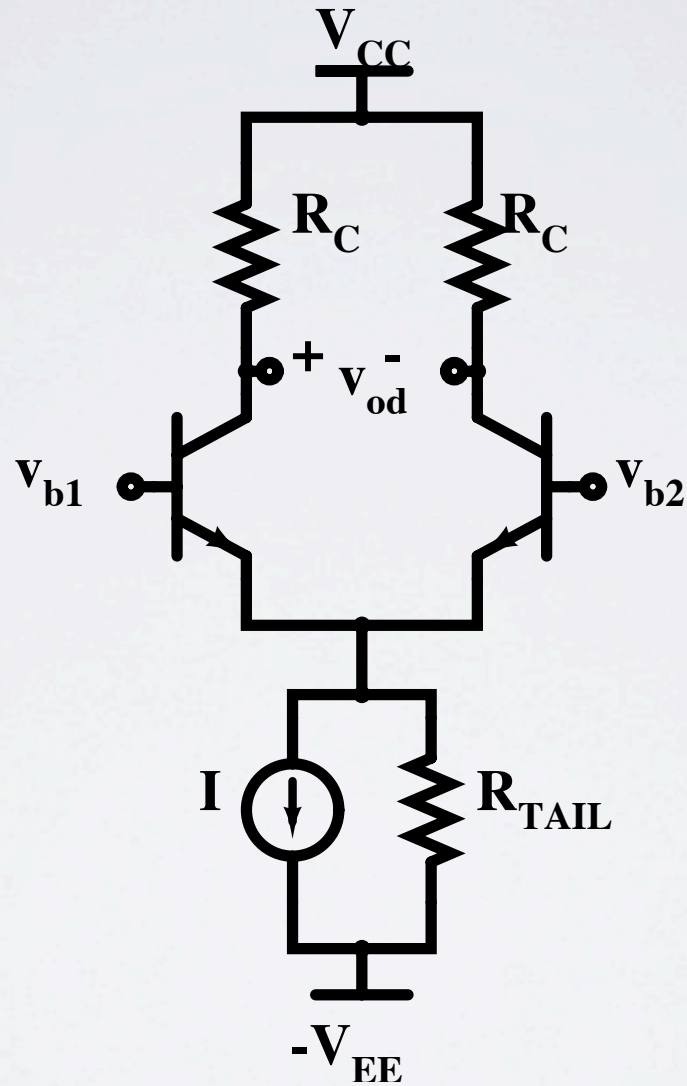


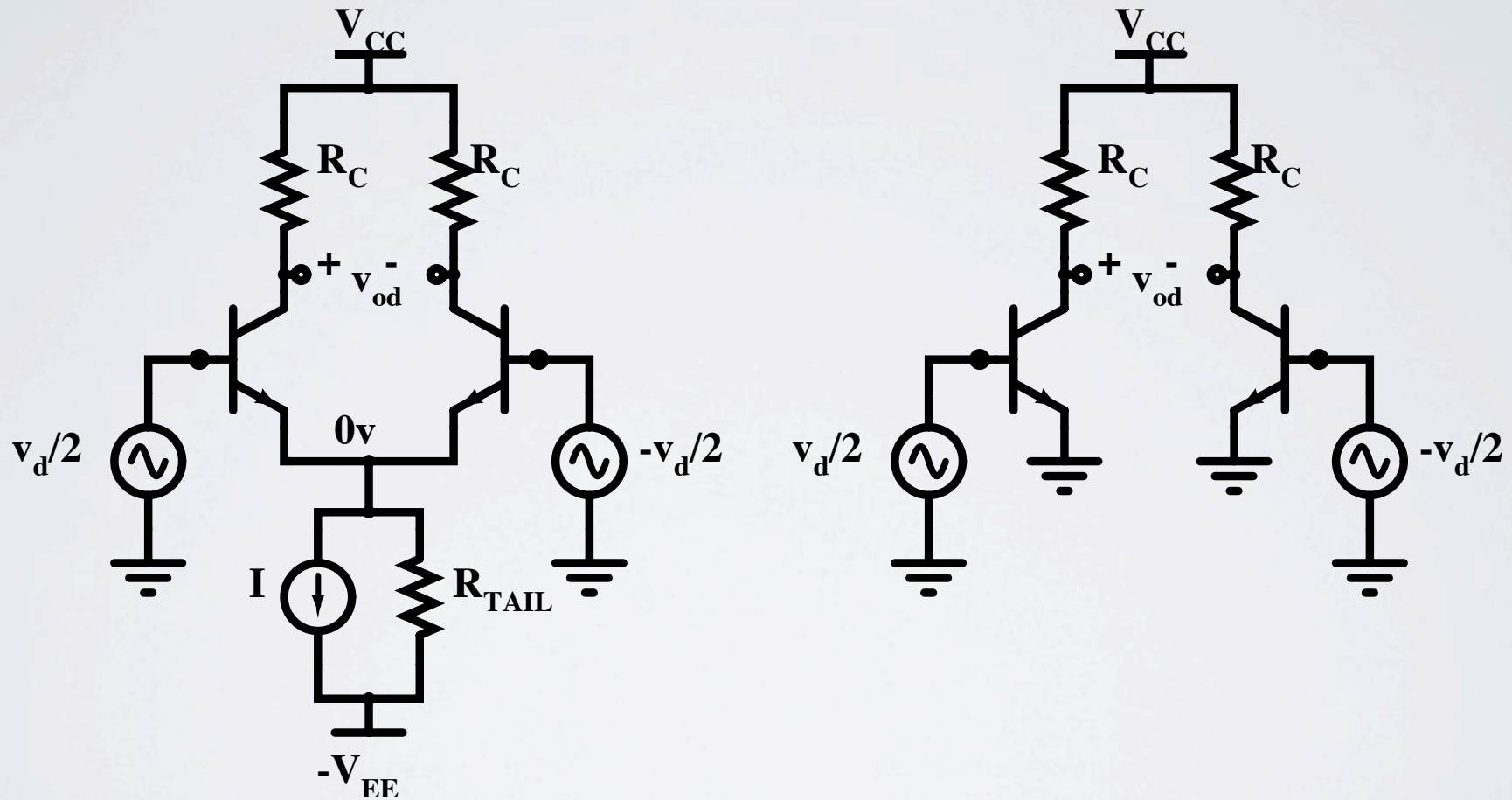
DIFFERENTIAL AMPLIFIERS

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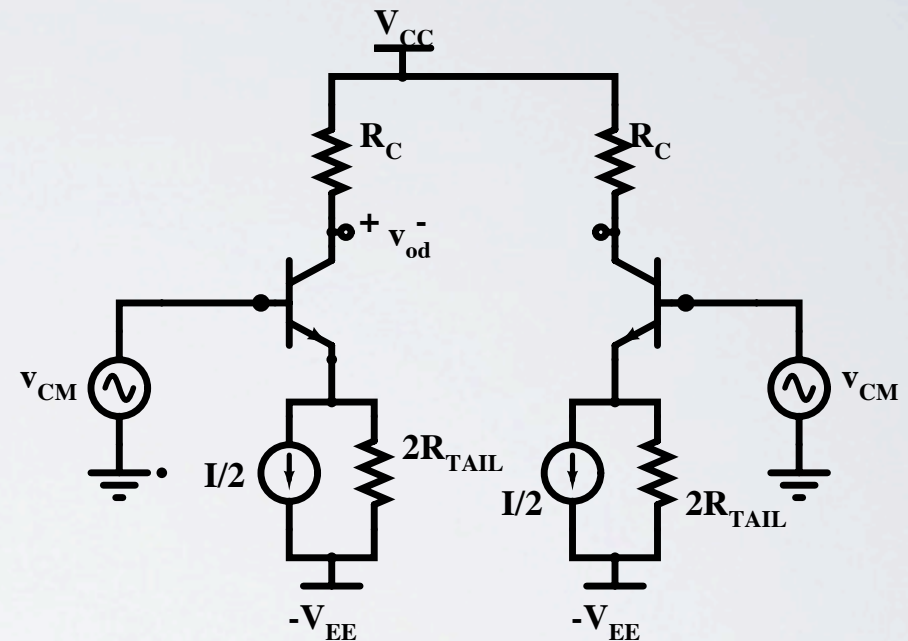
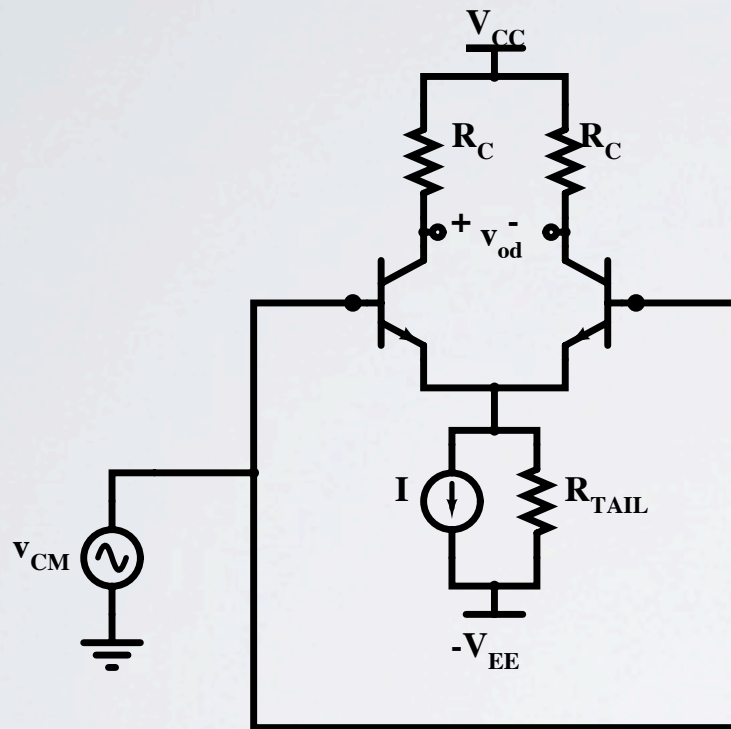
Basic Configuration



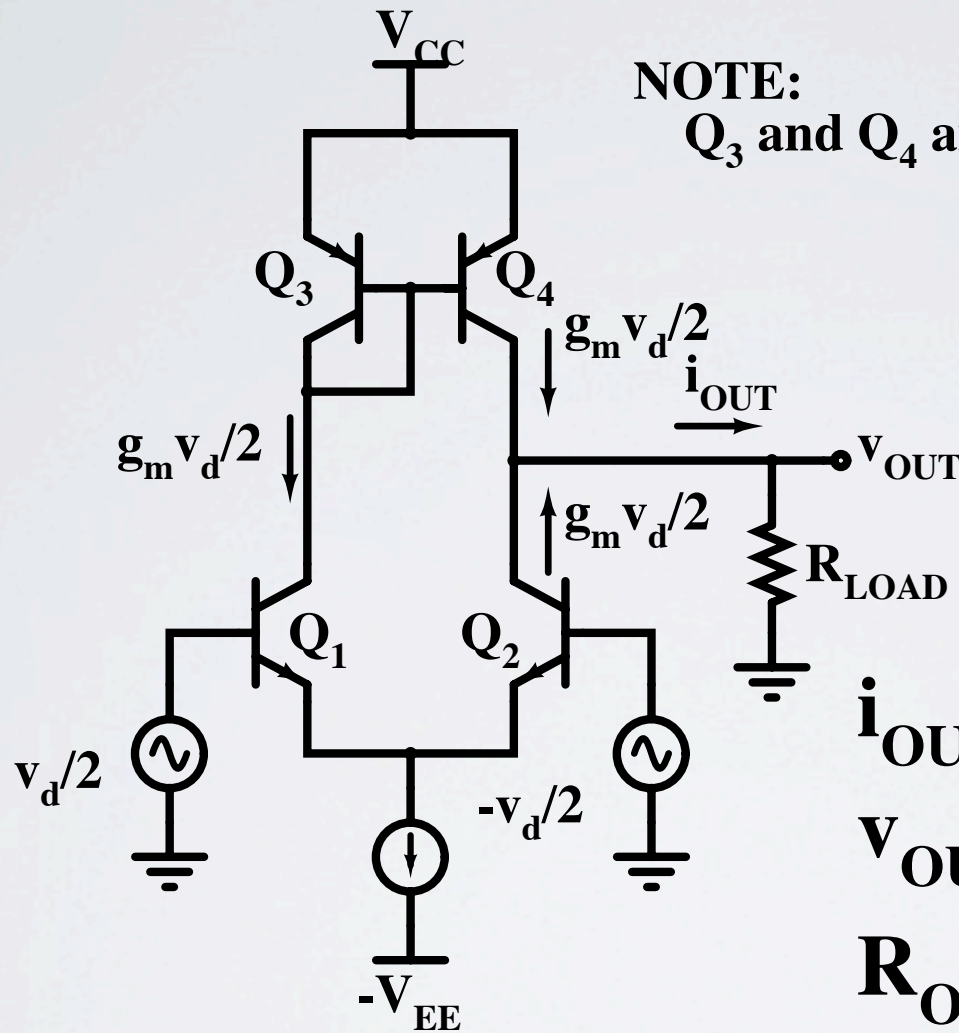
Differential-mode gain and input resistance.



Common-mode gain and input resistance.



Active Loads

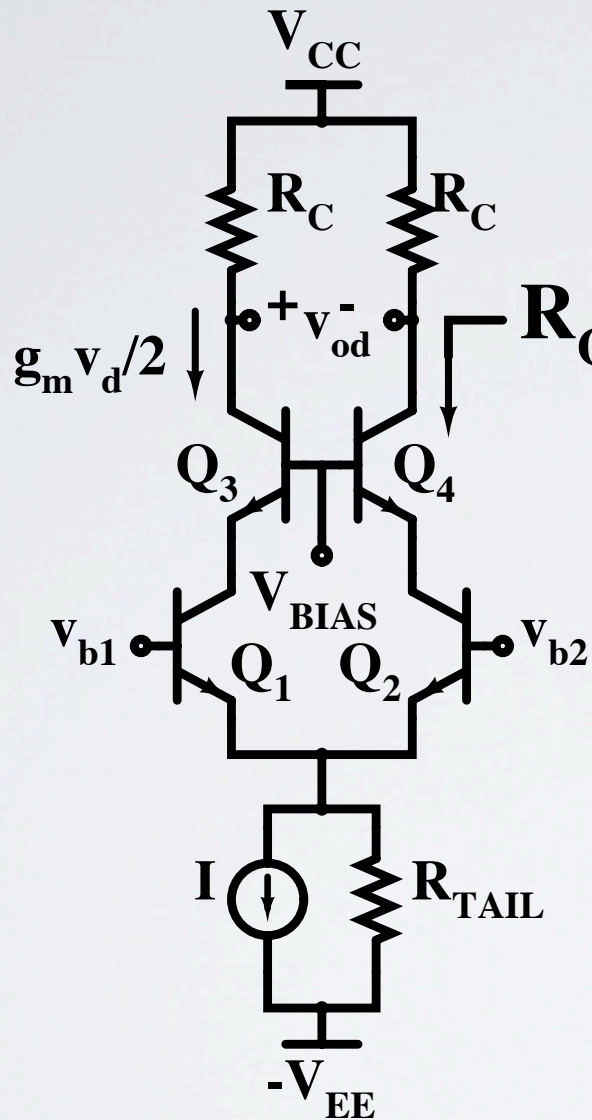


NOTE:
 Q_3 and Q_4 are PNP BJTs

$$i_{OUT} = g_m v_d$$

$$V_{OUT} = i_{OUT} R_O$$

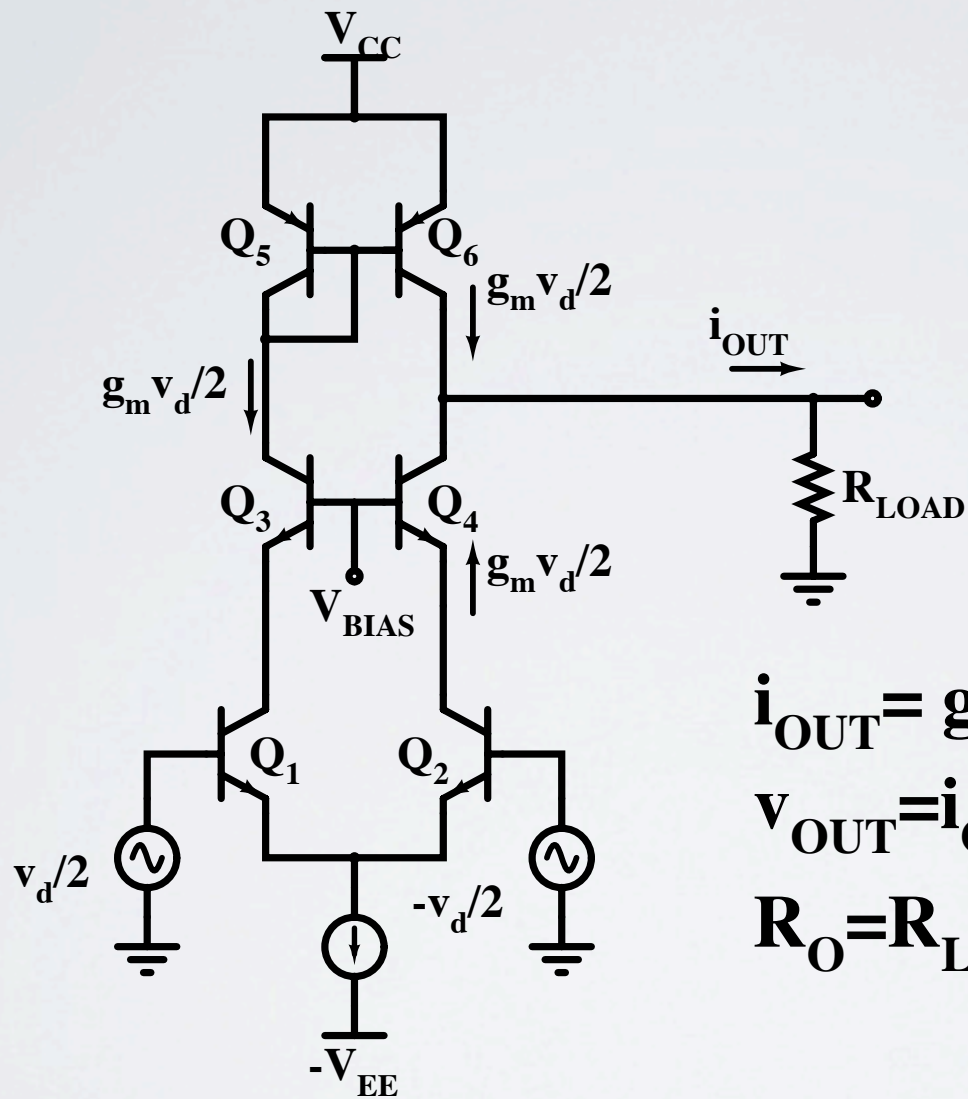
$$R_O = R_{LOAD} \parallel r_{O2} \parallel r_{O4}$$



$$R_O = (1 + g_{m4} R_P) r_{O4}$$

$$R_P = r_{O2} \parallel r_{\pi 4}$$

$$R_O = (1 + \beta) r_{O4}$$



$$i_{OUT} = g_m v_d$$

$$v_{OUT} = i_{OUT} R_O$$

$$R_O = R_{LOAD} \parallel r_{O6} \parallel (1 + \beta) r_O$$

