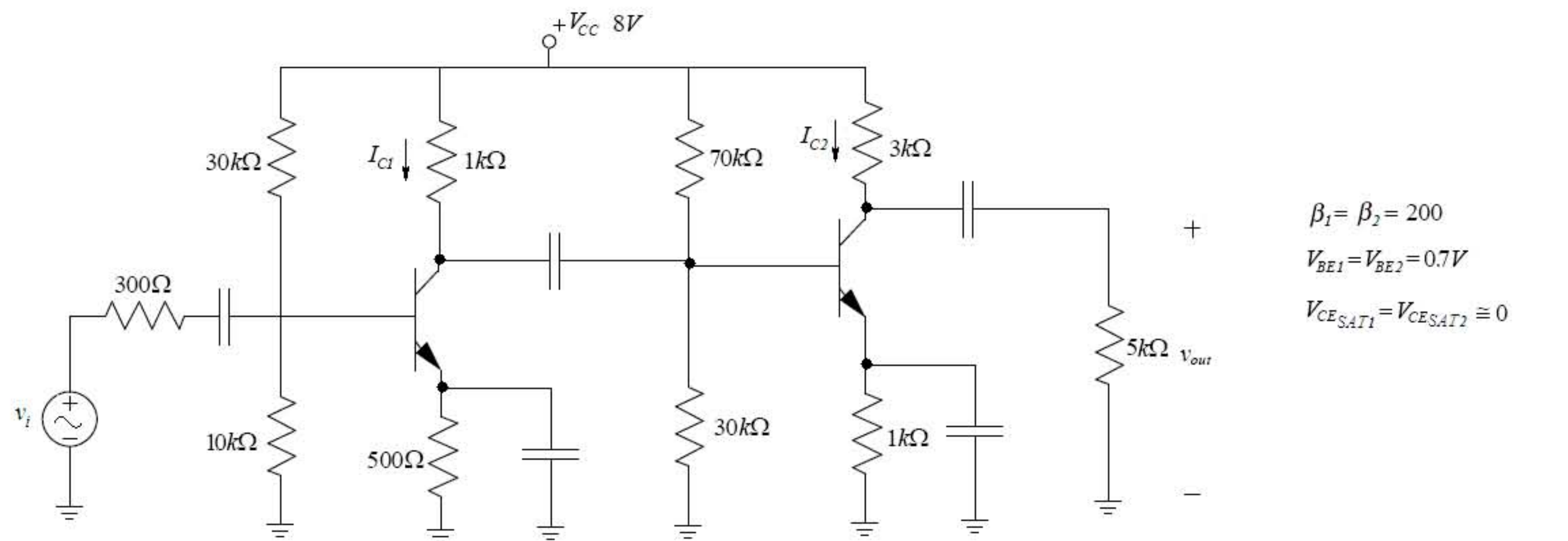
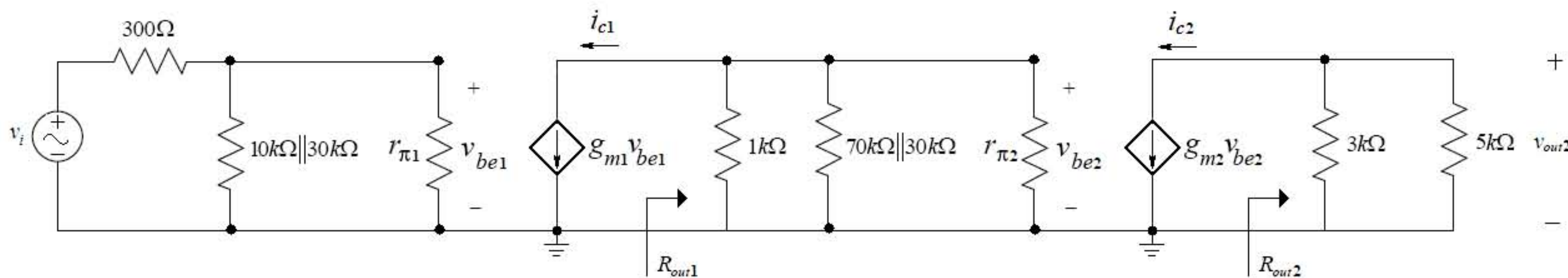


Calculate the peak-to-peak maximum (unclipped) voltage swing at the output.

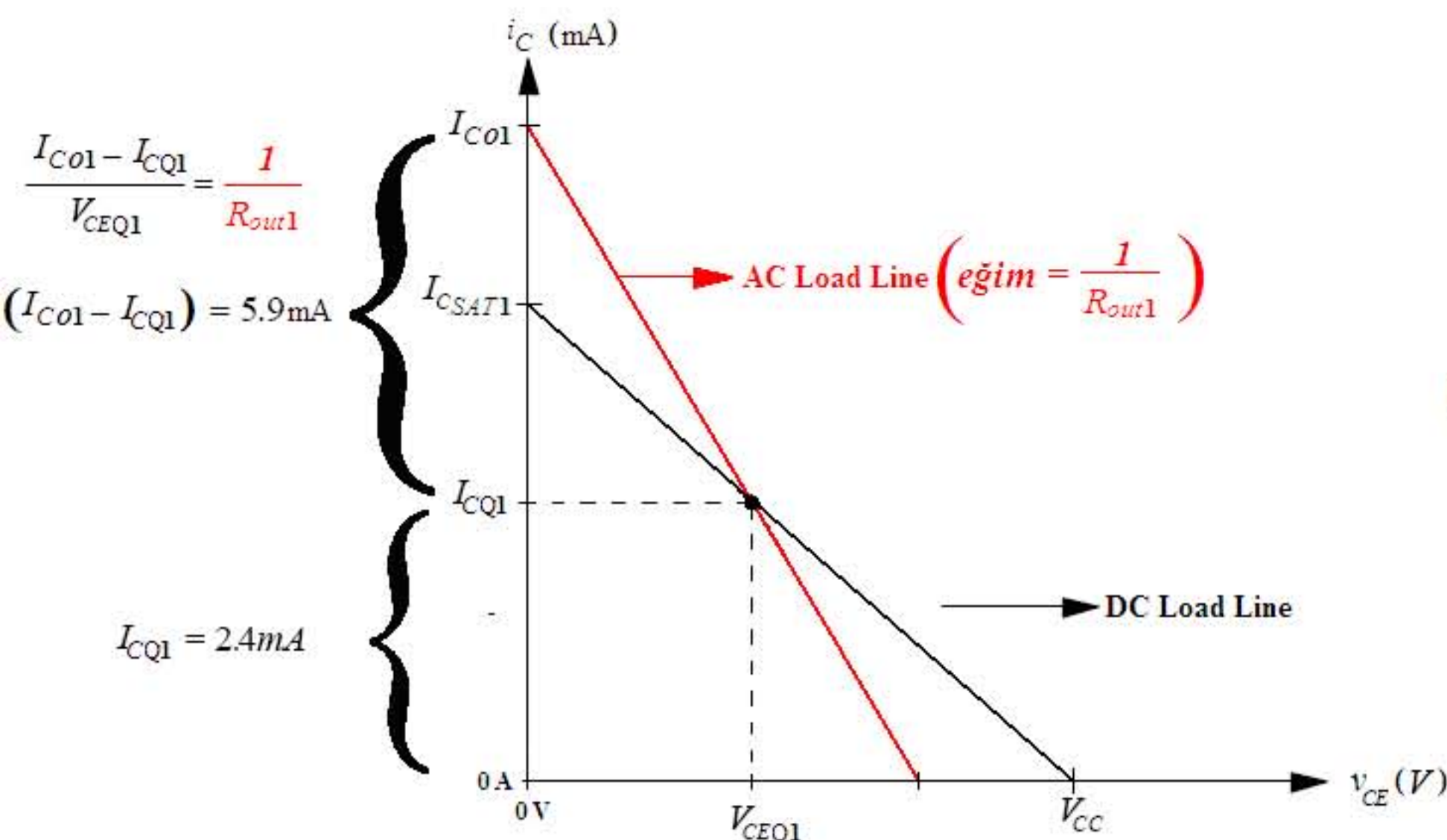


$$I_{CQ1} = 2.4mA \quad I_{CSAT1} = \frac{V_{CC}}{1k\Omega + 500\Omega} = 5.33mA \quad I_{CQ2} = 1.54mA \quad I_{CSAT2} = \frac{V_{CC}}{1k\Omega + 3k\Omega} = 2mA$$
$$V_{CEQ1} = V_{CC} - 1k\Omega \cdot I_{CQ1} - 500\Omega \cdot I_{CQ1} = 4.4V \quad V_{CEQ2} = V_{CC} - 3k\Omega \cdot I_{CQ1} - 1k\Omega \cdot I_{CQ2} = 1.84V$$
$$r_{\pi1} = \beta_1 \frac{26mV}{I_{CQ1}} = 2.16k\Omega \quad r_{\pi2} = \beta_2 \frac{26mV}{I_{CQ2}} = 3.38k\Omega$$

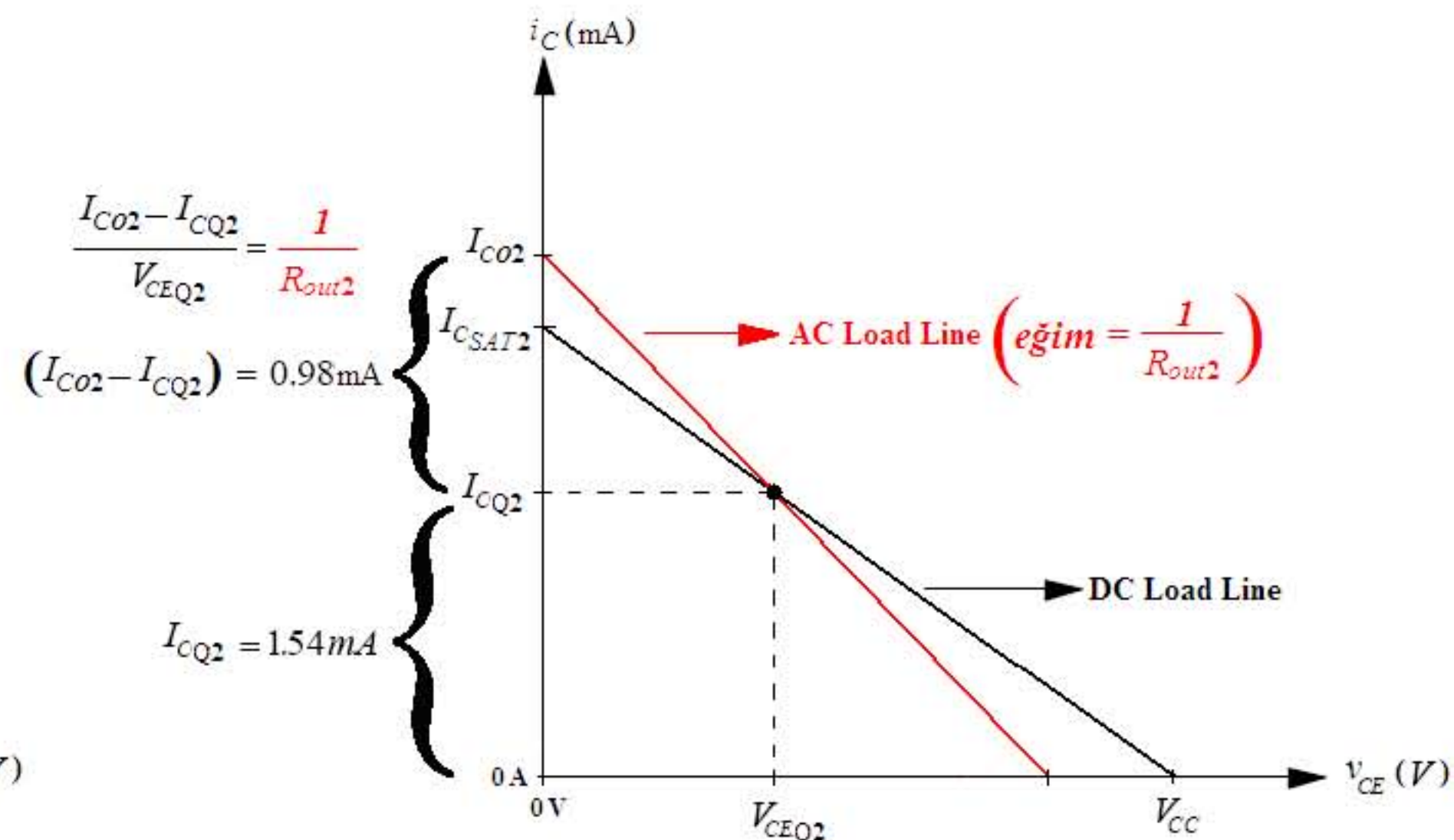


$$R_{out1} = 1k\Omega \parallel 70k\Omega \parallel 30k\Omega \parallel r_{\pi2} = 0.743k\Omega$$

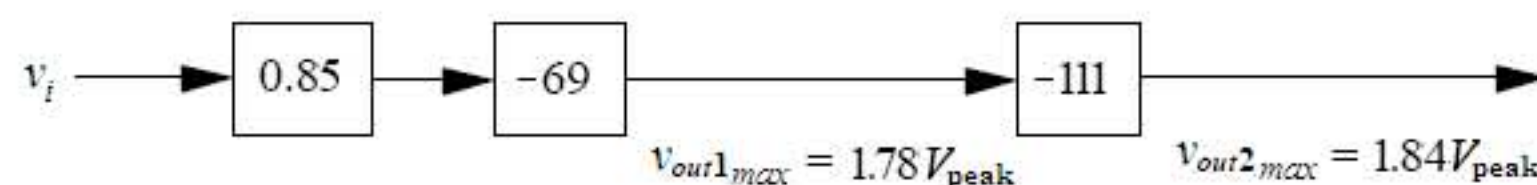
$$R_{out2} = 5k\Omega \parallel 3k\Omega = 1.875k\Omega$$



$$i_{c1max} = 2.4mA_{peak}$$
$$v_{out1max} = i_{c1max} \cdot R_{out1} = 1.78V_{peak}$$



$$i_{c2max} = 0.98mA_{peak}$$
$$v_{out2max} = i_{c2max} \cdot R_{out2} = 1.84V_{peak}$$



$1.84 < 1.78 \cdot 111$ so voltage swing at the output gets $1.84V_{peak}$ before clipping occurs. Unclipped maximum voltage swing at the output is $2 \cdot 1.84V_{peak-peak}$