

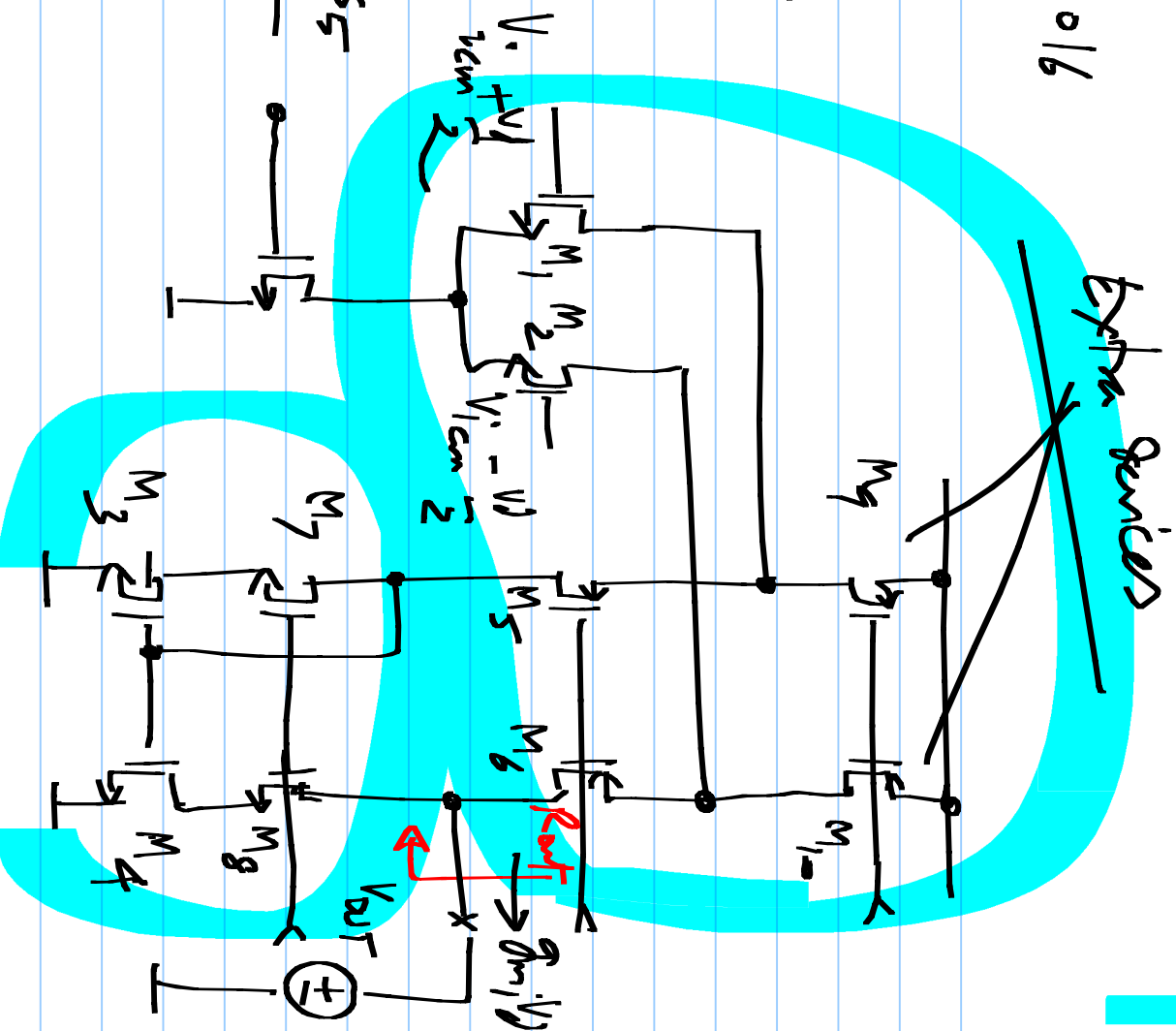
Lecture 25

9/3/2016

Folded cascode opamp:

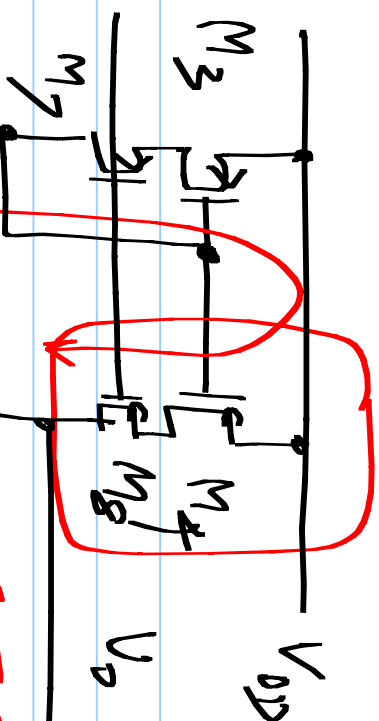
$$G_{out} \approx \frac{g_{ds3} \cdot g_{ds7}}{g_{m7}}$$

$$+ \frac{(g_{ds1} + g_{ds5}) \cdot g_{ds5}}{g_{m5}}$$



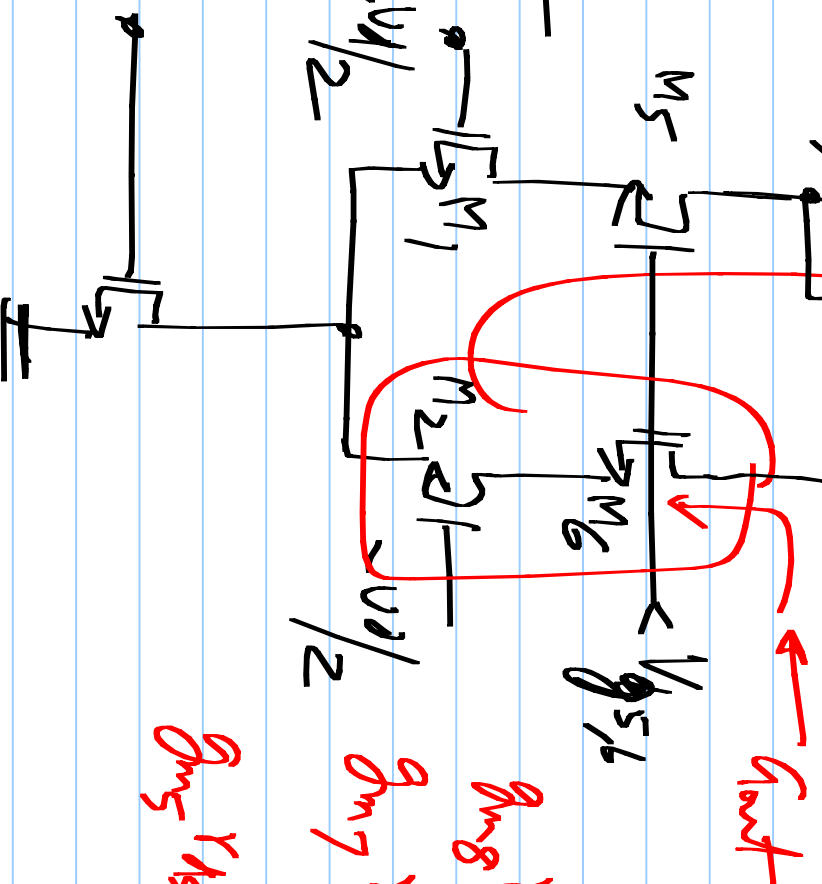
Simple diff. pair opamp.

$$G_{out} \approx g_{ds1} + g_{ds3}$$



Telescopic concode:

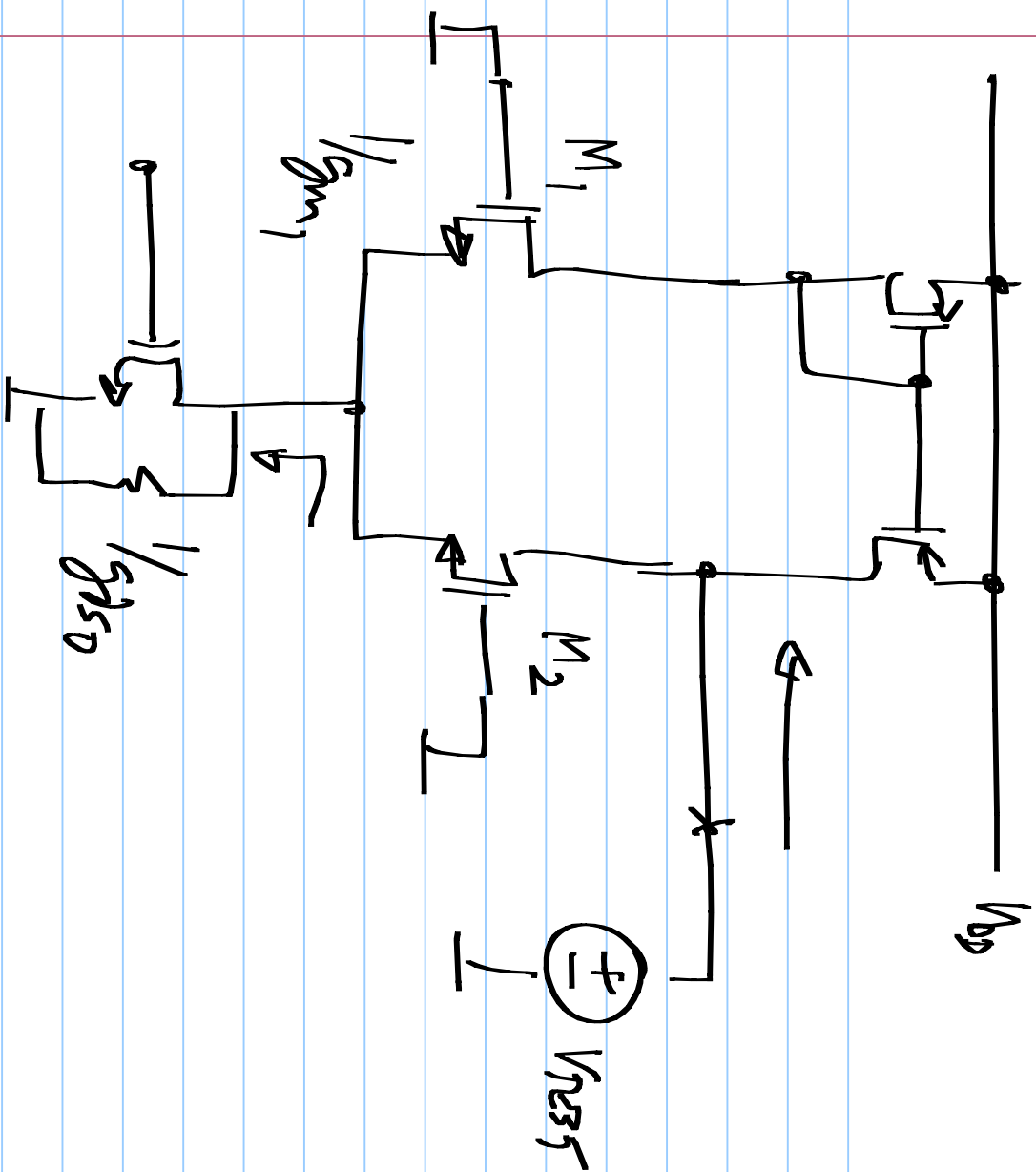
$$G_{out} \approx \frac{g_{ds1} g_{ds5}}{g_{m5}} + \frac{g_{ds3} g_{ds4} V_{d1}}{2}$$



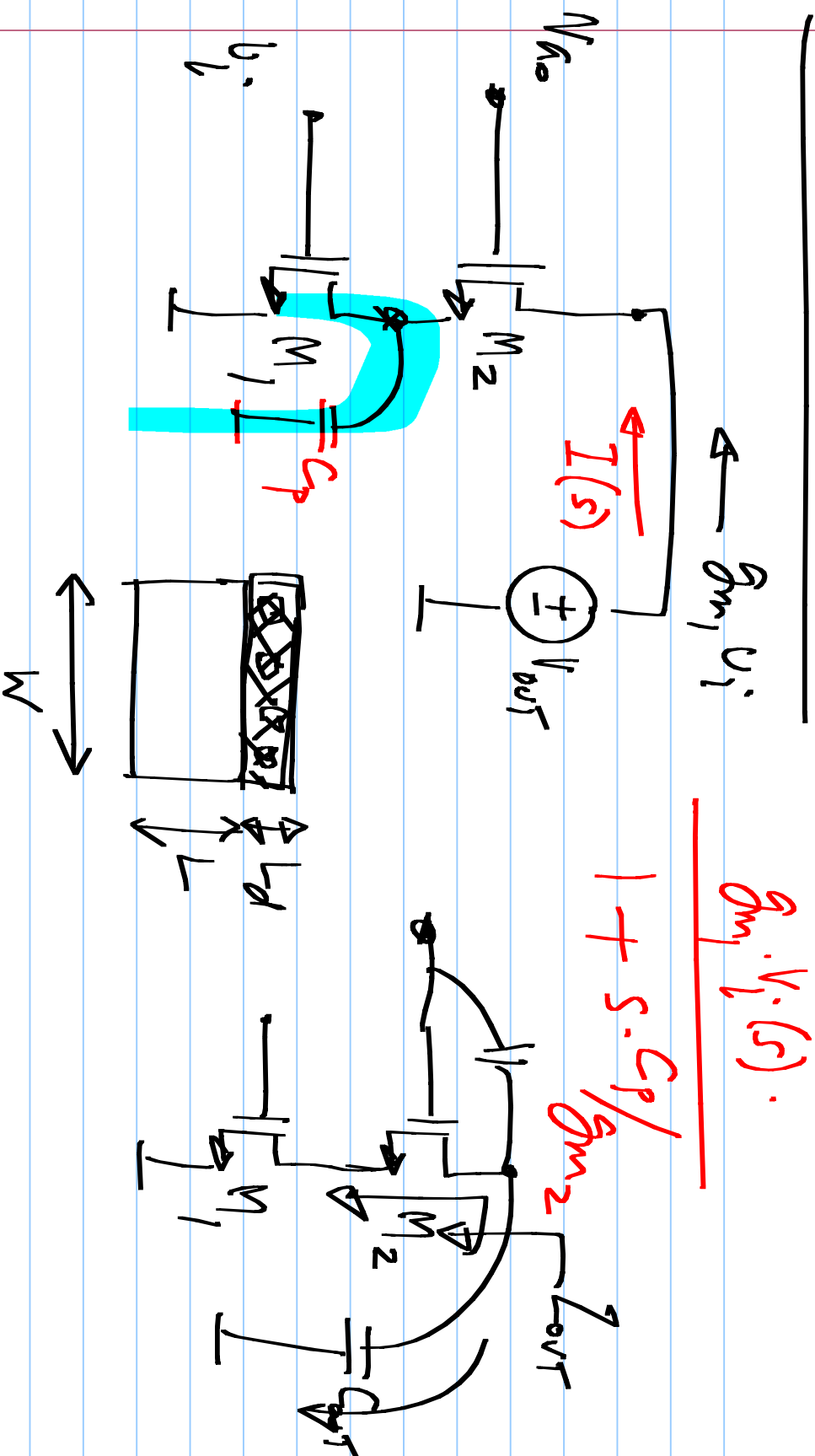
$$g_{m8} r_{ds8} \cdot r_{ds4}$$

$$g_{m7} r_{ds7} r_{ds3}$$

$$g_{m5} r_{ds5} r_{ds2}$$

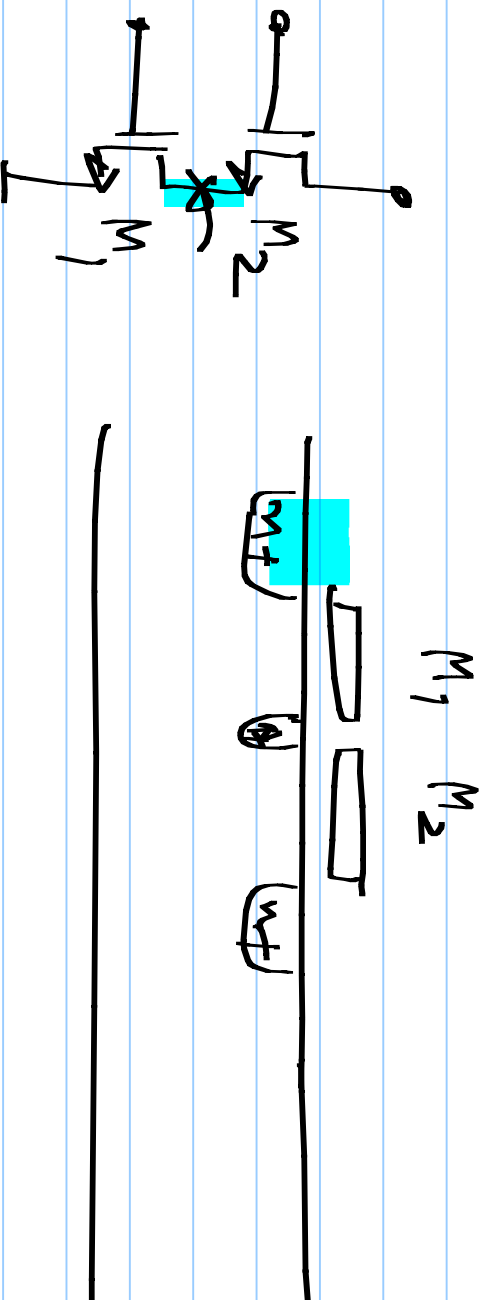


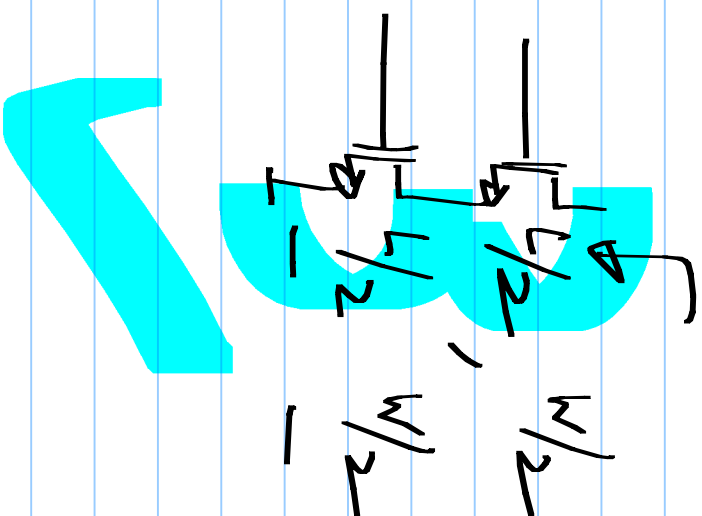
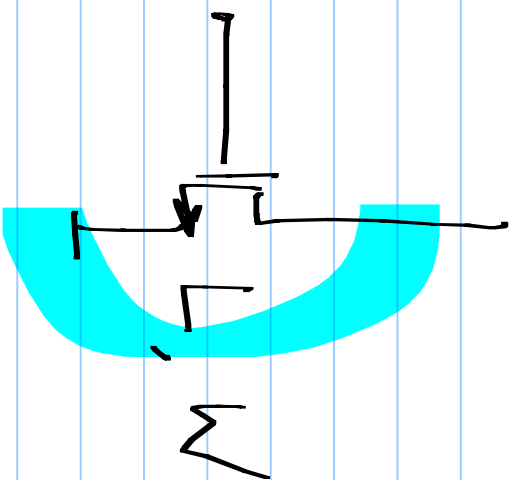
Cascode device size:

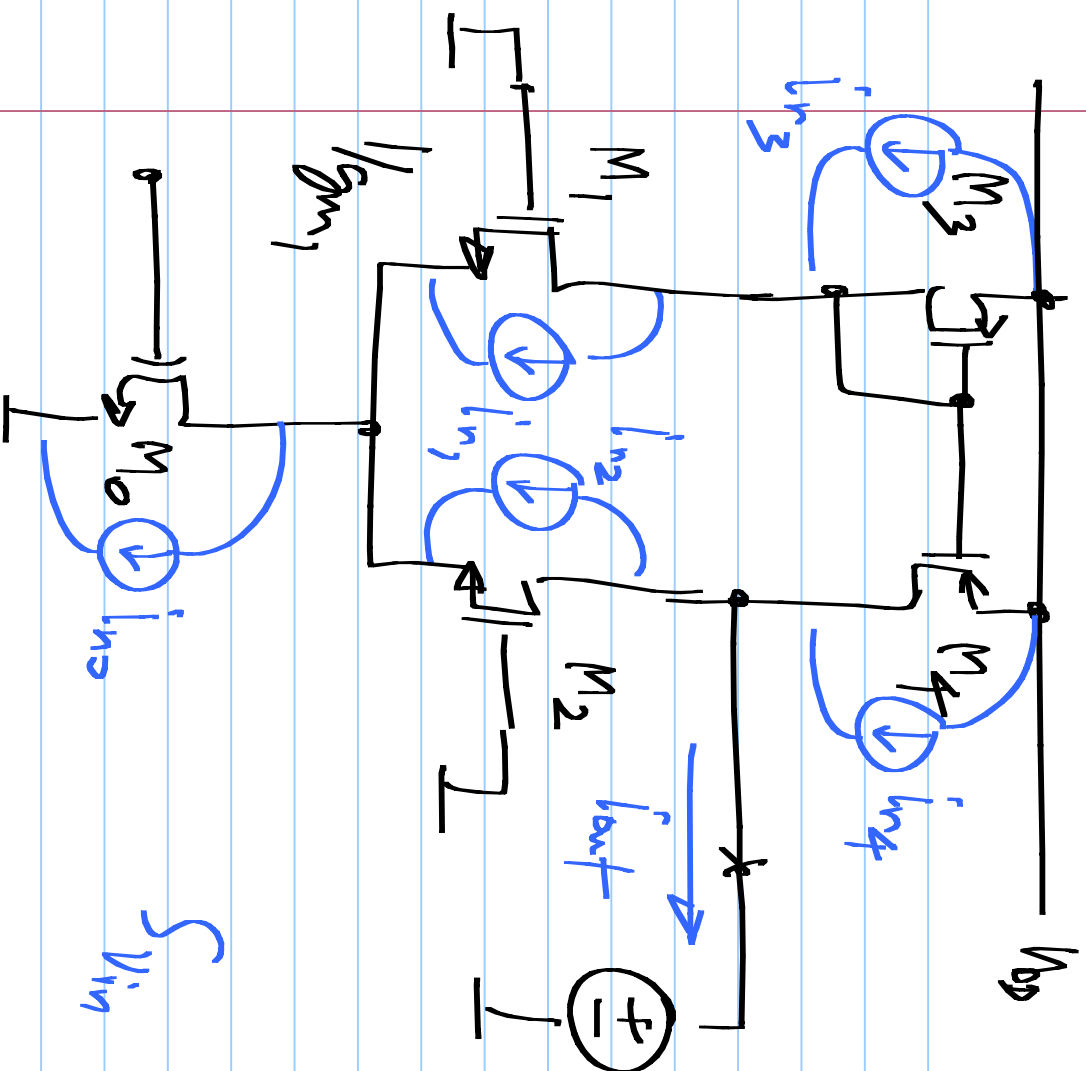


Cascode sizing: (W)

* Upper device small when C_{int} is desired



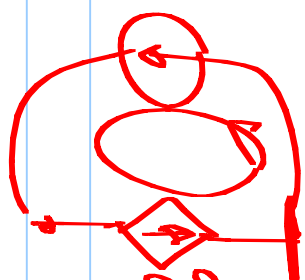
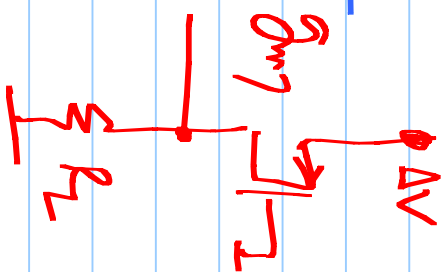
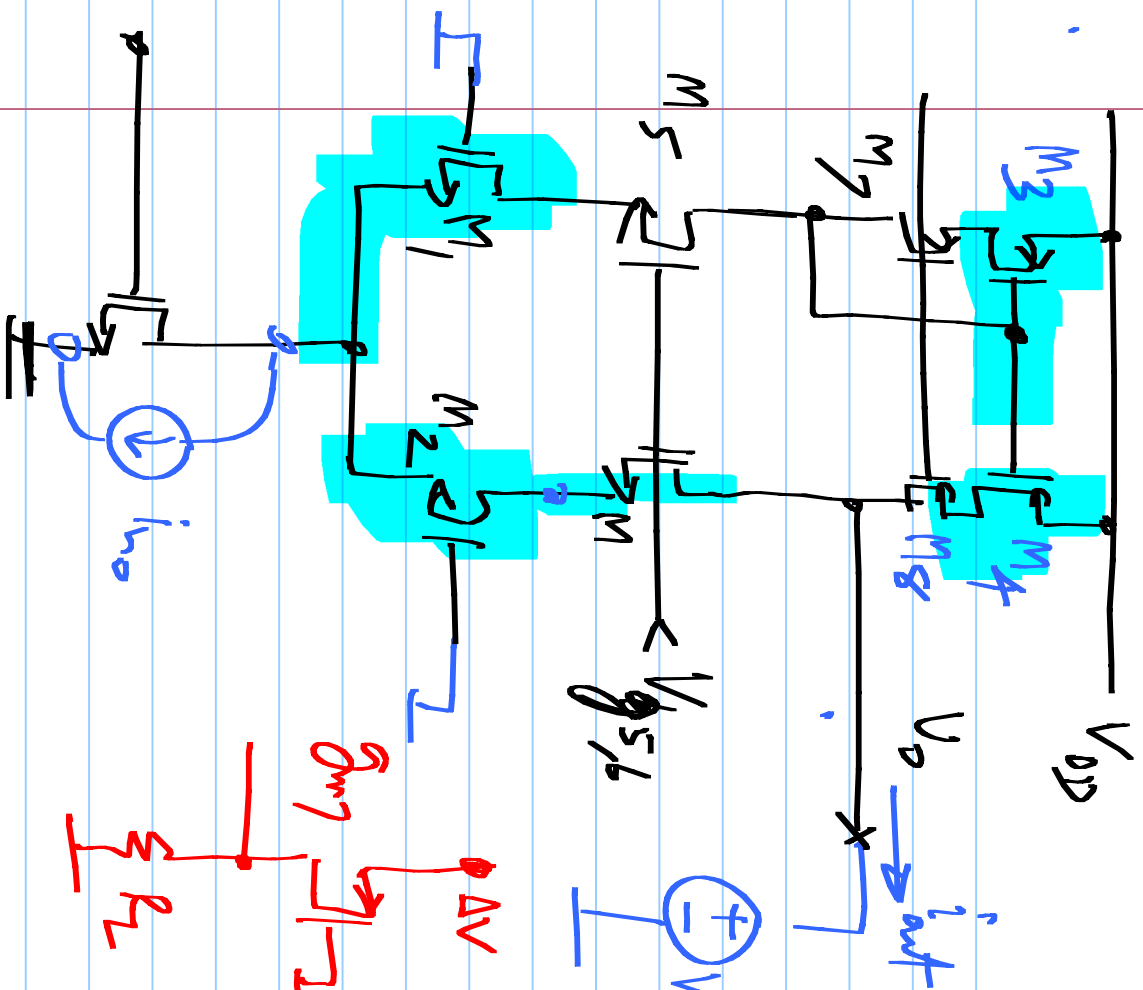




$$i_{out} = i_{n1} - i_{n2} - i_{n3} + i_{n4}$$

$$i_{out} = \frac{16kT}{3} (g_{m1} + g_{m3})$$

$$S_{vin} = \frac{16kT}{3g_{m1}} \left(1 + \frac{g_{m3}}{g_{m1}} \right)$$



$$= \frac{i_{in}}{g_{m3}}$$

