

# E151 Lecture 12 – Current Mirrors

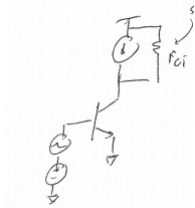
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## Disclaimer

These are notes for Prof. Spencer to give the lecture, they were not intended as a reference for students. Students asked for them anyway, so I'm putting them up as a courtesy. Remember that they are not intended as a substitute for attending lecture.

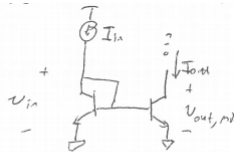
# What's a Current Mirror and Why?

- Active loads are pretty cool, but tough to bias
- Amount to biasing w/ a current source ... ideal load (inf. Z, inf. Vsw)
- Fix biasing by using current mirrors



$A_v = g_m (r_o \parallel r_{o1})$   $\rightarrow$  unrelated to DC value of  $V_{out}$  (both in FBR)  
Cool!

- ISSUE 1: How to make
- ISSUE 2: What's large signal  $V_o$



"simple mirror"

$$i_c = T(v_{be}) \text{ on left}$$

$$i_c = T^{-1}(v_{be}) \text{ on right}$$

$$= T(T^{-1}(i_c))$$

# What do we care about w/ mirrors?

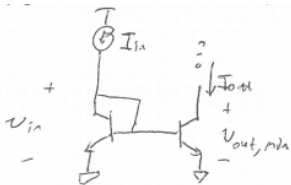
- Mirror design specifications – functions of  $I_c$ , compare @ same  $I_c$

- $V_{IN}$
- $V_{MIN}$
- Error =  $\epsilon = I_{OUT}/I_{IN}$
- rout

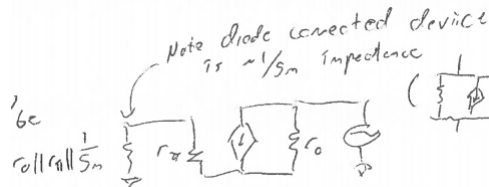
- $V_{BEON}$
- $V_{CESAT}$
- beta/(beta+2)
- ro

$$I_{in} = I_{b1} + I_{c1} \stackrel{I_{b2}}{\approx} (\beta+1) I_{b1}$$

$$I_{out} = \beta I_{b1}$$



"simple mirror"



## Use Mirrors to Make Active Loads

- $a_v = g_m \cdot (r_{o1} \parallel r_{o2})$  – very high! ( $\sim 1/2$  of what we saw w/ isrc load)
- Need to pick  $V_B$  st we're in FAR, do w/ load line or another mirror

