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#10

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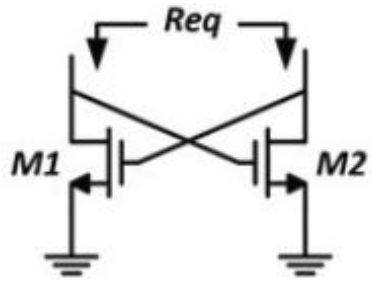
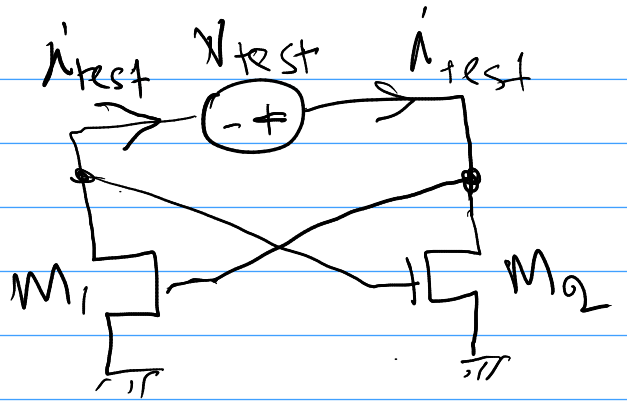
Thursday Analog Quiz



Assume gm*ro >> 1. Derive an expression for Req. Can you mention two different types of circuits that use this cross-coupled structure?

We apply a test voltage:



$$i_{test} = g_m V_{GS_2} + \frac{V_{GS_1}}{r_o} \quad \text{--- (1)}$$

$$i_{test} = -\left(g_m V_{GS_1} + \frac{V_{GS_2}}{r_o}\right) \quad \text{--- (2)}$$

(1) + (2):

$$2 i_{test} = (V_{GS_2} - V_{GS_1})\, g_m + \left(\frac{V_{GS_1} - V_{GS_2}}{r_o}\right) \quad \text{as } V_{test} = V_{GS_1} - V_{GS_2}$$

$$2 i_{test} = -V_{test} g_m + \frac{V_{test}}{r_o}$$

$$2 i_{test} = V_{test}\left(\frac{1 - g_m r_o}{r_o}\right)$$

$$\frac{V_{test}}{i_{test}} = -\frac{2}{g_m}$$

this circuit has a characteristic of positive feedback.
and it's used in latched comparators.