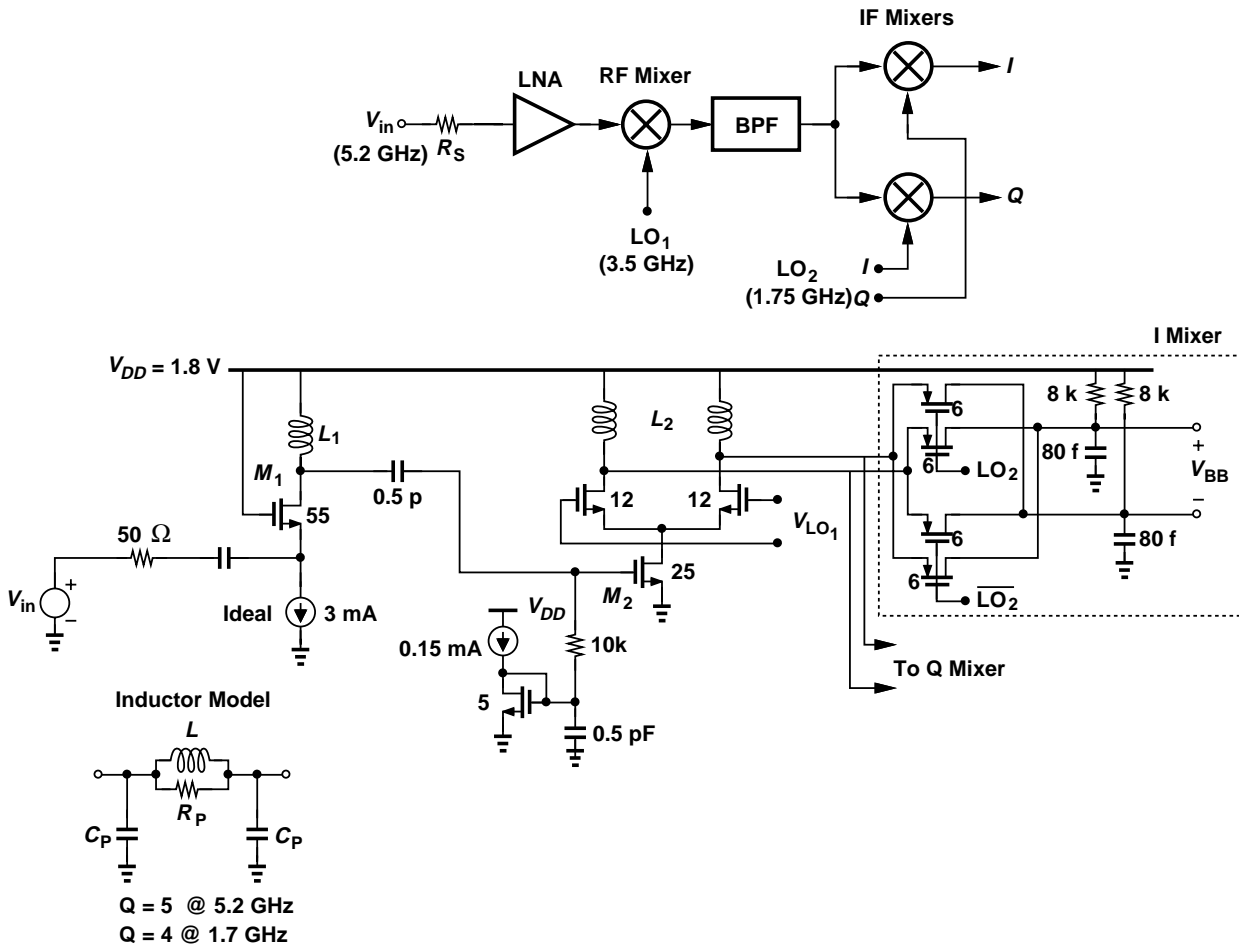


Homework #4

Due Thur., Feb. 14, 2013

In this homework, we use Cadence to study a single-VCO heterodyne receiver. The architecture and circuit implementation are shown below. The IF mixers are realized as passive switches. For simplicity, the divide-by-two stage that would generate LO_2 from LO_1 is omitted from this homework. All transistors have a channel length of $0.18\ \mu\text{m}$. For LO_1 , assume a frequency of 3.5 GHz, a common-mode level of 1.5 V, and a peak-to-peak differential amplitude of 0.8 V. For LO_2 , these numbers will be 1.75 GHz, 0.9 V, and 3.6 V, respectively. The inductors must be modeled as shown, where $C_P = 5\ \text{fF}$ for every nanohenry of inductance.



- Determine the values of L_1 and L_2 to obtain resonance at 5.2 GHz and 1.7 GHz at the LNA output and RF mixer output, respectively.
- Compute the total voltage gain of the receiver, with the input level defined as $V_{in}/2$.
- Determine the image-reject ratio of the receiver.
- Identify two mechanisms through which the receiver translates an interferer at 8.7 GHz to baseband. Assume no mismatches or even-order harmonics. Determine the gain experienced by such a component and normalize the result to the gain found in (a).