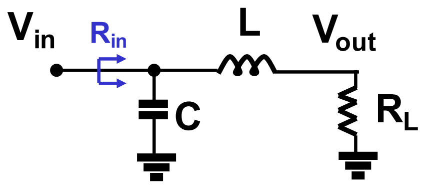
Tutorial T6

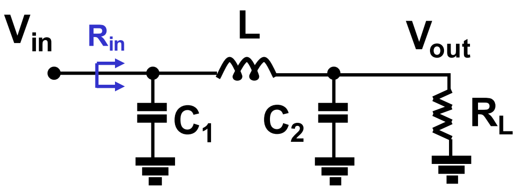
T6.1 Let us consider the L-match network in figure, where R_L=50Ω.



a) Size L and C in order to obtain R_{in}=100Ω at 5 GHz. What is the Q of the network?
b) Driving the input port of the network with a current source, evaluate the complex transimpedance V_{out}/I_{in} at 5GHz.

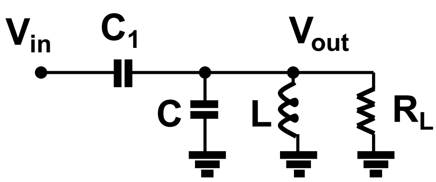
[Solution: a. C = 318fF, L = 1.59nH; b. V_{out}/|I_{in} = 50Ω - j50Ω]

T6.2 Let us consider the π-match network in figure, where R_L=50Ω. Size L, C_1 and C_2 in order to obtain R_{in}=100Ω at 5GHz, and a quality factor of the resulting network equal to Q=5.



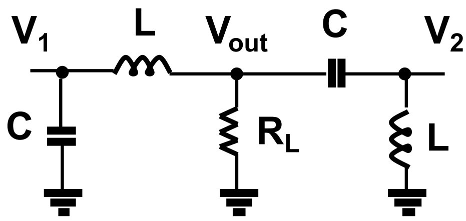
[Solution: a. C_1 = 955fF, C_2 = 1.274fF, L = 1.59nH]

T6.3 Let us consider the impedance transformation network in figure. Assuming R_L=50Ω and C=2pF, size L and C_1 to obtain an equivalent input impedance of 5Ω at 5GHz. What is the quality factor of the network?



[Solution: L = 258pH, C_1 = 2.12pH, Q = 3]

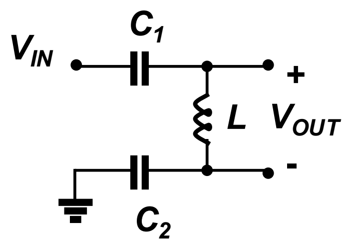
T6.4 We want to design a differential to single-ended signal converter Let us consider the circuit in figure, where R_L=50Ω.



a) Find the values of L and C to have a gain $|V_{out}|/|V_1-V_2|$ = 1 at 5GHz.
b) Evaluate the differential impedance between V_1 and V_2 at 5GHz.

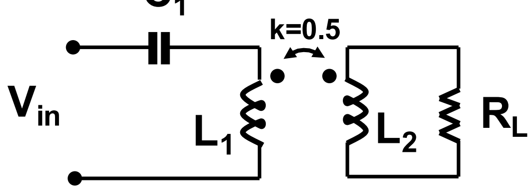
[Solution: a. L=1.59nH, C=637fF; b. R_{diff}=50Ω]

T6.5 We want to design a single-ended-to-differential converter of a sinusoidal signal from V_{IN} to V_{OUT}, using the circuit in figure. Assuming a 50Ω source resistance for V_{IN}, set C_1, C_2, and L to achieve differential output and V_{OUT}/V_{IN} = 3 at 5GHz.



[Solution: C_1 = C_2 = 424fF, L = 4.78nH]

T6.6 Let us consider the impedance-matching network in figure, based on a real transformer. Given a coupling factor k=0.5 between primary and secondary windings, L_2 = 1.59nH and R_L=50Ω, size L_1 and C_1 to obtain an equivalent input impedance of 5Ω at 5GHz. What is the Q of the resulting network?



[Solution: L_1 = 1.237nH, C_1= 909.5fF, Q=7]