
Topic 1. 50 ohm environment and Smith Chart. On the chart below, indicate a perfect match, open circuit, and short circuit. Draw a circle that indicates 20 dB return loss. Indicate a load with a complex reflection coefficient of $0.5 \, e^{j30}$.

Multiple Choice: The Smith Chart is used to:

1. Display Impedance and transmission line information at a glance
2. Suggest changes to improve performance
3. Quickly sort RF and non RF engineers
4. All of the above

Topic 2. Sketch an approximate scale layout of a two stage amplifier on the rectangular die below. Include bond pads, several spiral inductors, rectangles for transistors, some rectangles for capacitors, and some long skinny traces for resistors. The circuit doesn’t have to work, but the components should be of an appropriate size and arranged in a way that makes sense. Label everything.
Topic 3. Frequency Mixers, modulators, upconverters, downconverters. Draw the schematic of a JFET mixer used to down convert an RF signal to a lower frequency IF. Include enough detail that you could enter the circuit into a schematic capture program such as LTspice and run the simulation.

Topic 4. Discuss the effects of bond wire parasitics. Use a numerical example to illustrate how a typical bond wire behaves in a 50 ohm system at 1 GHz and 10 GHz. Show how to add series capacitance to remove the effect of bond wire inductance, and describe the bandwidth of the technique.

Topic 5. Sketch the design of a lumped-element two-way Wilkenson splitter for 900 MHz, with component values. Are these components practical for an RFIC?

Topic 6. Describe in words how the length of transmission line between a narrow RF filter and the RF port of a mixer can impact circuit behavior.