Lumped LC Balun Design

Neil (Bing) Hao

29-Nov-2019

http://uniteng.com

Part I: Introduction

The RF SOCs have either Single Ended or Differential Ended RF Input/Output. For example, TI CC2538 is Differential Ended. NXP JN5169 is Single Ended. For the Differential Ended SOC, the Balun may be required to turn the Differential Ended signal into the Single Ended signal due to the requirements of PA, Antenna, etc. On the other hand, The Balun can also perform impedance matching.

We will focus on the theoretical part of LC Balun design. Thus, to simplify analysis, lumped parameter models, rather than distributed parameter models are used in this paper. Therefore, all theoretical calculations in this paper can not be used in the real-world design directly.

Part II: Understanding the Differential Signal

According to the CC2538 datasheet, the differential impedance on the RF pins is 66 + j64 Ohm. This value is adopted to illustrate the concept of the differential signal.

The Impedance is Defined as

$$Z = R + jX$$

Where the real part of impedance is the resistance R and the imaginary part is the reactance X.

$$X > 0 \rightarrow Inductance$$

$$X = 0 \rightarrow Resistance$$

$$X < 0 \rightarrow Capacitance$$

The CC2538 differential impedance is 66 + j64 Ohm which means the imaginary part is positive. Therefore, the reactance is inductance.