

LNA

May 6, 2021

1 Low-noise RF amplifier

A low-noise RF amplifier converts the voltage of 300Ω balanced floating source into a current for a mixer.

1.1 Signal and signal source

The signal source is isolated from the ground. It has a differential impedance of 300Ω and a common-mode impedance of 0.5pF . The frequency range of interest ranges from $1 \cdots 250\text{MHz}$.

1.2 Load and load signal

The load consists of a balanced mixer with a differential impedance of 100Ω and a common-mode impedance of 1pF . It should be driven with a current and the maximum peak differential input current should be $500\mu\text{A}$. The common-mode input voltage range of the load ranges from $0.8 \cdots 1\text{V}$.

1.3 The LNA

The low-noise amplifier should have the following properties:

1. Input impedance: $300\Omega \pm 5\%$
2. Frequency range (-3dB): $1 \cdots 250\text{MHz}$
3. Differential output impedance: $> 10\text{k}\Omega$
4. Noise figure @ 300Ω source impedance: $< 2.5\text{dB}$ over the frequency range of interest.
5. Gain from input voltage to load current $40\text{mS} \pm 10\%$
6. IM3 distortion at 100MHz (5mV_p at 200MHz and 5mV_p at 500MHz) $< -66\text{dB}$
7. Peak differential output current $> 500\mu\text{A}$
8. Supply current @ 1.8V supply voltage $< 20\text{mA}$

1.4 Environmental conditions

The audio amplifier should operate from 0 to 70 degrees Celsius.

1.5 Design task

Design the LNA according to the specifications above. You can use CMOS18 devices. The circuit should operate from at $1.8V \pm 5\%$.