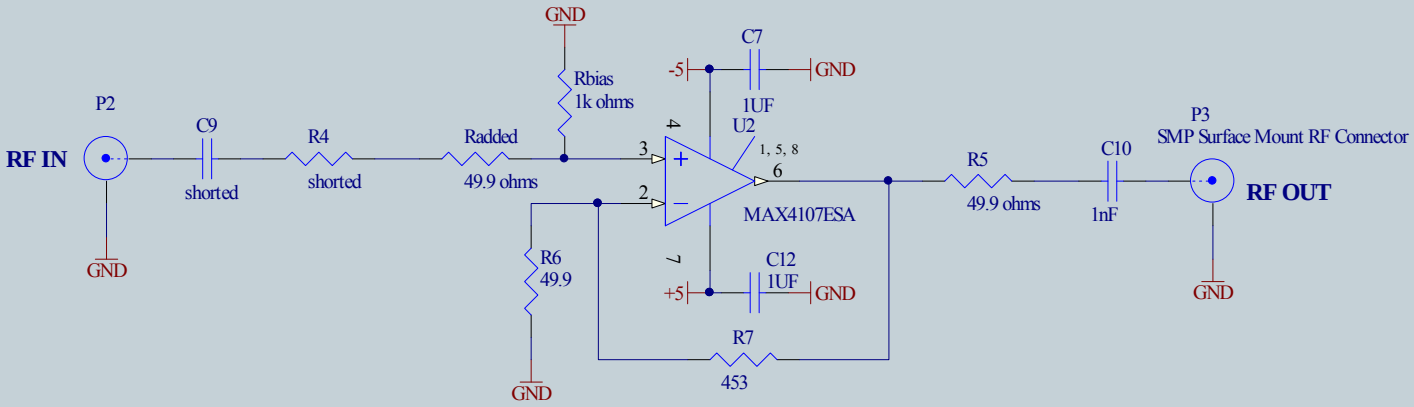
LSC RFPD Analysis

OBSERVED INSTABILITIES IN RF OPAMPS

R. ABBOTT, 30 JULY 2010

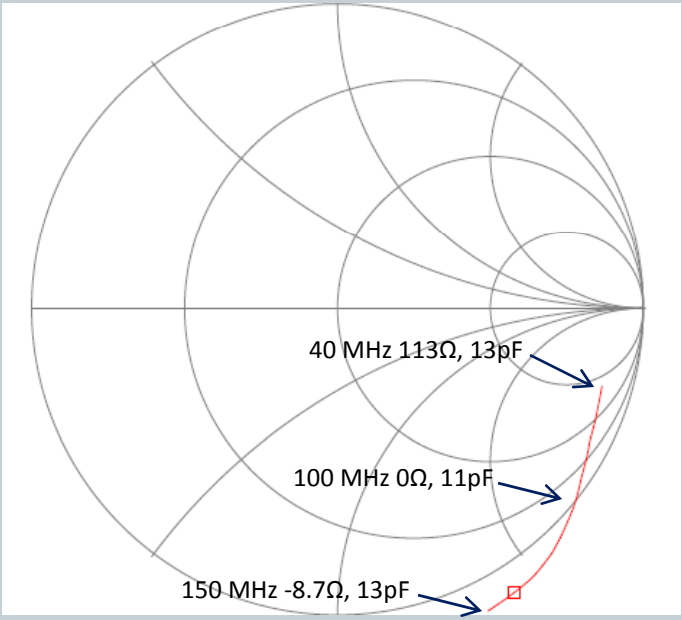
Test Setup

•Network Analyzer input on P2 with path shorted to U2. P3 terminated in 50 ohms. Measurement taken of input impedance (S11) vs. frequency

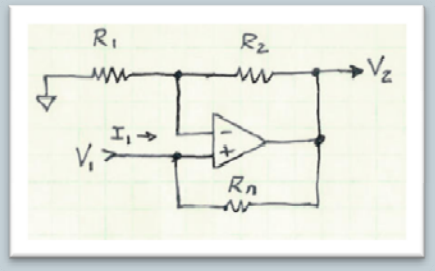


Observations of Input Impedance

- Frequencies above 100 MHz are potentially unstable (negative resistance)



Making A Negative Resistance



Opamp Circuit

Input Impedance

$$V_2 = \left(1 + \frac{R_2}{R_1}\right) V_1$$

$$I_1 = \frac{(V_1 - V_2)}{R_n} = -V_1 \frac{R_2}{R_n R_1}$$

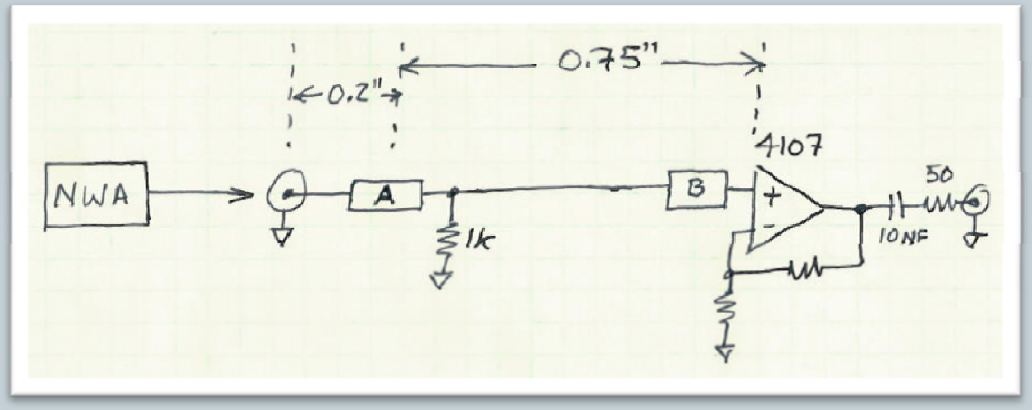
$$R_{in} = \frac{V_1}{I_1} = -R_n \left(\frac{R_1}{R_2}\right)$$

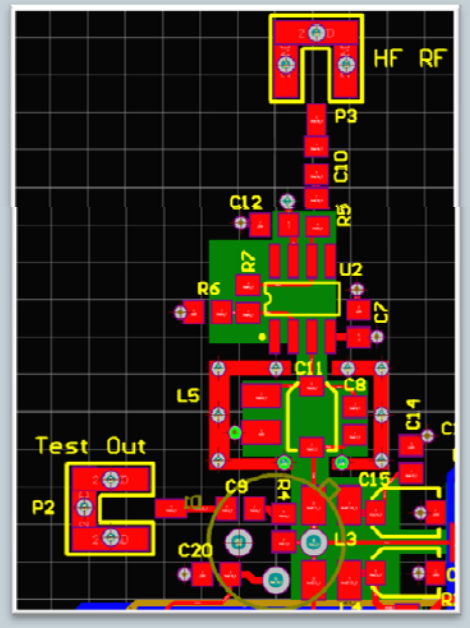
THE PRESENCE OF R_n MAKES R_{in} NEGATIVE

A negative resistance implies gain. Gain in conjunction with a frequency selective network can, and does, create an oscillator.

Who Is To Blame?

- Positive feedback could be internal to the RF opamp, bleeding back out the + pin.
- Positive feedback could be related to circuit layout.





Measured Data

- Real and imaginary data in ohms
- A substantial change in input impedance is only seen when 50 Ω is added to the RF input, not the input of the opamp.
- Conclusion is that the phenomenon is related to layout.

Frequency	S11 Bare Board	S11 50Ω on RF input	S11 50Ω touching 4107
50 MHz	69.7Ω, -258Ω	103Ω, -257Ω	71Ω, -257Ω
100 MHz	0.4Ω, -141Ω	34Ω, -132Ω	1Ω, -137Ω
150 MHz	-8.2Ω, -79Ω	27Ω, -80Ω	-3Ω, -73Ω