

APPLICATION NOTE 4264

# Increasing the IP3 of the MAX2659 Low-Noise Amplifier (LNA)

*Abstract: This application note explains how adding a degeneration inductor can improve the IP3 performance of the MAX2659 low-noise amplifier (LNA).*

The [MAX2659](#) is a high-gain, low-noise amplifier (LNA) designed for use in GPS, Galileo, and GLONASS systems. The part is ideal for adding GPS functionality to both stand-alone personal navigation devices and mobile handsets, such as cell phones, smartphones, and PDAs.

While the linearity of the MAX2659 is more than sufficient for most applications, it is possible to improve the device's IP3. This can be accomplished by adding a degeneration inductor between pin 2 (the amplifier's emitter) and ground, as shown in **Figure 1**. While this addition increases IP3 significantly, there is a trade off: the gain will reduce and the noise figure will degrade slightly.

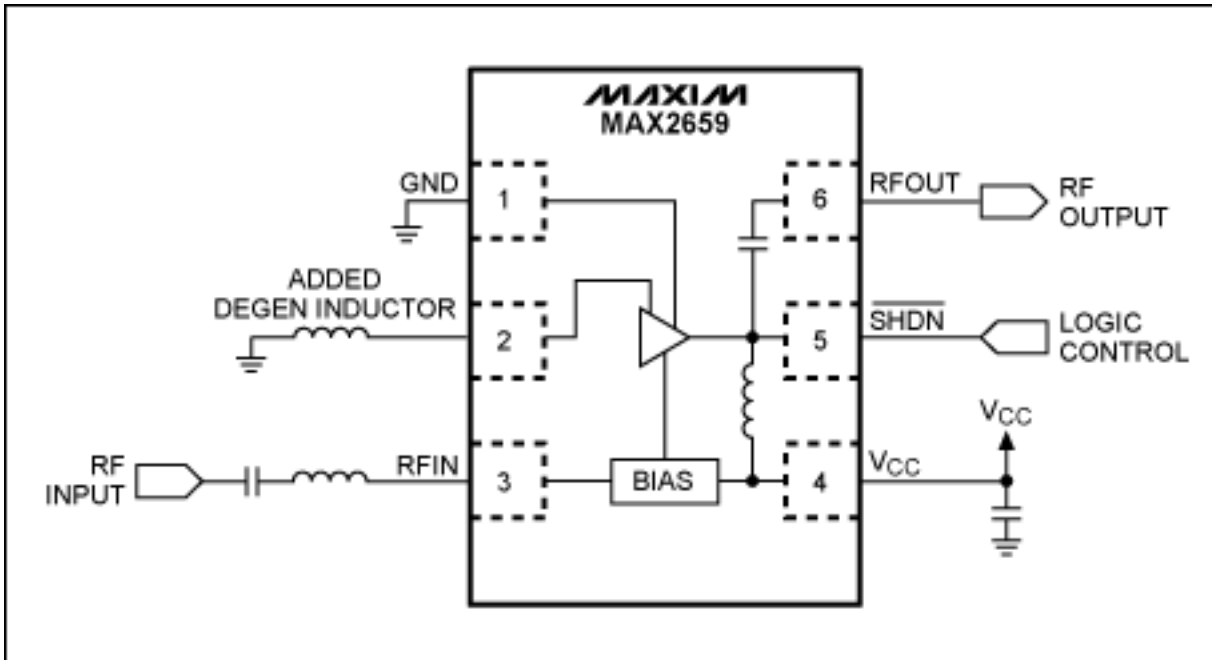


Figure 1. Typical application circuit for increased linearity.

Using a 0.9nH inductor provides a good balance among linearity, gain, and noise figure. Measured results are shown in **Table 1**. Of course, a different value inductor can be used if more or less linearity is required, although gain and noise figure will change accordingly.

**Table 1. Performance of the MAX2659 With and Without a Degeneration Inductor**

Degeneration Inductor	I <sub>CC</sub> (mA)	Gain (dB)	NF (dB)	IP1dB (dBm)	IIP3 (dBm) *
0.9nH	4.0	18.4	1.0	-7.0	6.2
None	4.1	20.5	0.8	-12	-0.5

\*Tone 1 was at 1713.42MHz and -17dBm; Tone 2 was at 1851.42MHz and -59dBm.

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