CEL California Eastern Laboratories

RF Applications Engineering   *Technical Note*

µPC8236T6N

Three Circuit Configurations
For GPS Application

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Introduction

NEC's uPC8236T6N is a silicon germanium carbon (SiGe:C) MMIC designed as low noise amplifier for GPS applications. It features low supply voltage, low noise figure and high gain. It also includes an integrated output matching circuit, a robust bandgap regulator, and ESD protection circuits. More detailed technical specifications can be found in uPG8236T6N's datasheet, available on CEL's website: www.cel.com.

In the early days of GPS applications, most GPS receivers were stand-alone devices.

In that case, the in-band RF performance specs are usually the critical parameters for a low noise amplifier front end design. The recent trend, however, is the integration of GPS receivers into more and more wireless products, such as cell phones and various short range wireless devices.

In these applications, there are often strong out-of-band (OOB) signals in the proximity of GPS receiver, which can severely degrade the GPS receiving sensitivity. Consequently the OOB specifications of a front-end amplifier are equally important as in-band specifications for achieving an optimized GPS system performance in many applications. Generally there are two approaches in dealing with the OOB signal interference:

i.   Use a filter to reduce the OOB signal strength at the amplifier.

ii.   Increase the linearity, which is usually characterized by IIP3 or P1dB points, of the amplifier to make it less susceptible to the interference.

This application note describes three circuit configurations for a GPS low noise amplifier using uPC8236T6N. Each configuration is designed for a specific application requirement as follows:

- Normal Configuration: optimized for in-band performance.

- High-pass Matching Configuration: high rejection to low frequency signals.

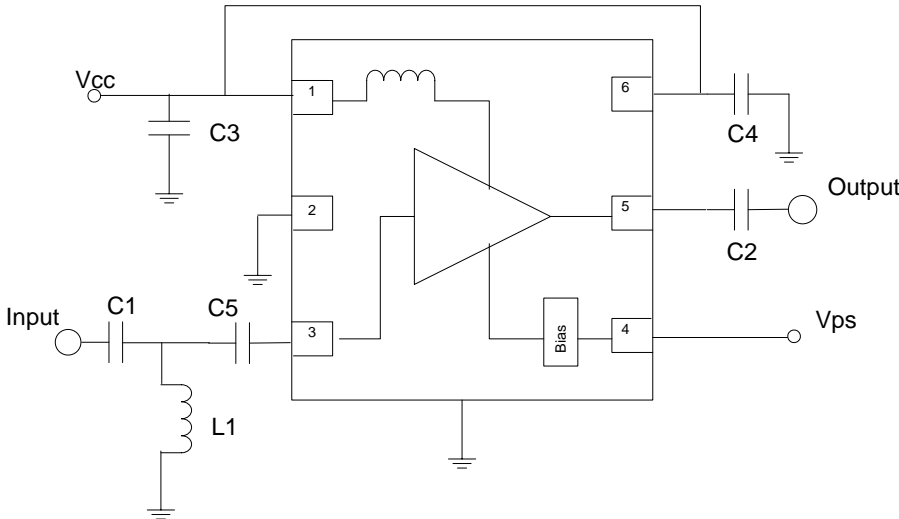- High IIP3 Configuration: Improved linearity.

Circuits Description

The three circuit configurations and their component values are shown in the following.
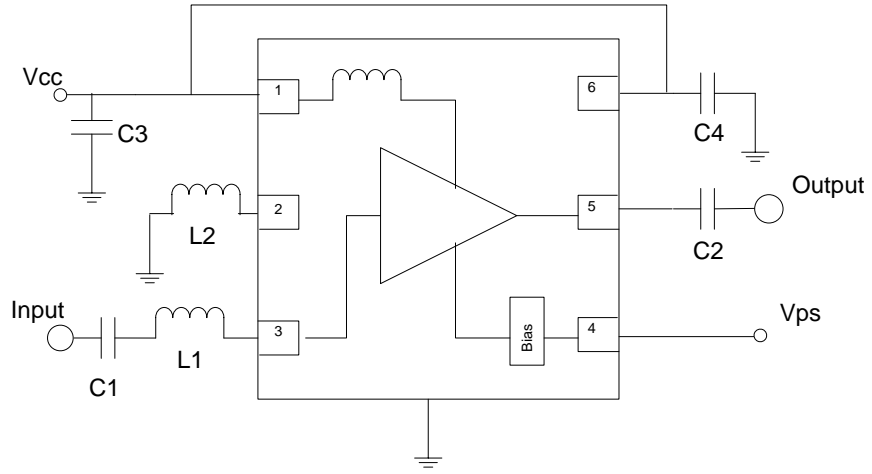
Normal Configuration
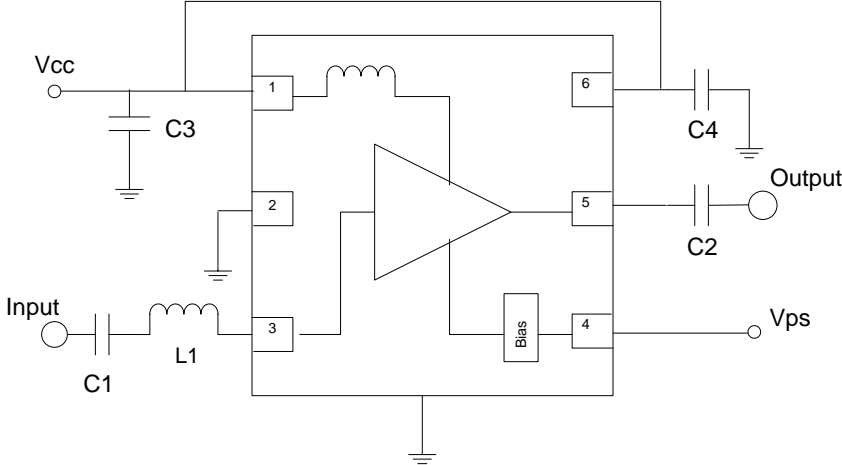
High-pass Configuration

High IIP3 Configuration

Component value list

Component	Configuration		
	Normal	High-pass	High IIP3
C1, pF	1000	5	1000
C2, pF	1	1	1
C3, pF	1000	1000	1000
C4, pF	1000	1000	1000
C5, pF		10000	
L1, nH	5.6	5.6	5.6
L2, nH			0.6

Performance Data

The following table lists measured data on a set of circuit boards.

Test Conditions: Vcc=Vps=2.7V, f=1575MHz

Parameters	Configuration		
	Normal	High-pass	High IIP3
Power Gain, dB	19.3	18.3	14.9
Noise Figure, dB	0.9	1.0	1.0
Input Return Loss, dB	14.3	7.7	8.7
Output Return Loss, dB	20.3	22.2	12.6
Isolation, dB	40.9	40.8	34.9
Input P1dB point, dBm	-18.5	-17.2	-12.6
Input IP3 point, dBm	-3.5	-1.5	+3.2