2.4 - 2.5 GHz LNA With Bypass

Description

The LX5563 is a low noise amplifier (LNA) for WLAN applications in the 2.412 to 2.472 GHz frequency range. It operates with a single voltage supply of 3.3V, and features both high gain and bypass modes.

The LNA is fully matched on both the input and output ports; no external inductors or matching is required. It includes all bias circuitry and operates with a digital control signal. Only one external bypass capacitor on the supply line is required.

The LNA is packaged in a 1.5x1.5x0.5 mm dual-flat no-leads (DFN) package.

Features

- 2.412GHz to 2.472GHz Frequency Range
- Single 3.3V Operation
- 14dB Gain in High Gain Mode; 7dB Loss in Bypass Mode
- 1.3dB Noise Figure
- Input IP3 = +7.5 dBm (high gain)
- Input P1dB = -3 dBm (high gain) or +18dBm (bypass)
- Single Control Enables LNA in High Gain Mode, or Places LNA into Bypass Mode.

Applications

- 2.4GHz Wi-Fi RF Front Ends
- 802.11 b/g/n/ac Radios
- Laptops, Tablets
- Smartphones
- Wireless Access Points
- Routers

Block Diagram

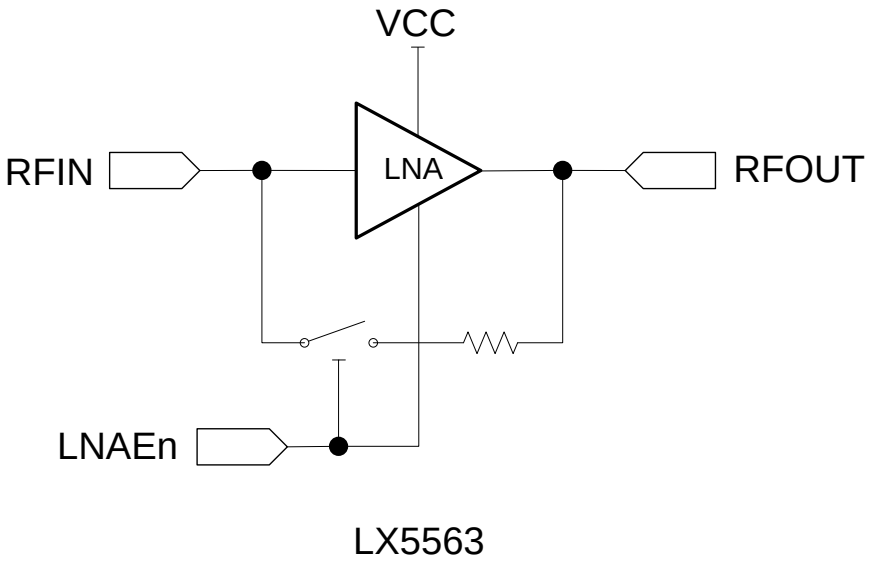


Figure 1 · Functional Block Diagram

Pin Configuration

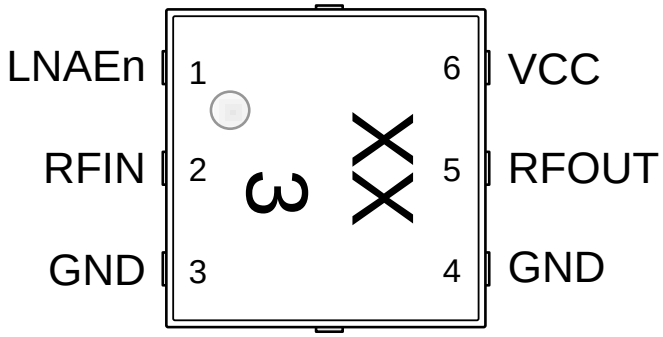


Figure 2 · Pinout

- Top view XX = Encoded date code
  3 = Encoded Part Number
- 1.5 x 1.5 x 0.5mm DFN package

Ordering Information

Ambient Temperature	Type	Package	Part Number	Packaging Type
-40°C to 85°C	RoHS2 compliant, Pb-free	DFN 1.5x1.5 - 6L	LX5563LL	Bulk / Tube
			LX5563LL -TR	Tape and Reel

Pin Description

Pin Number	Pin Designator	Description
1	LNAEn	LNA Enable/Bypass mode select
2	RFIN	RF input. This pin is AC coupled to the transistor; no DC blocking is required.
3	GND	Ground
4	GND	Ground
5	RFOUT	RF output. This pin is AC coupled to the transistor; no DC blocking is required.
6	VCC	3.3V Supply voltage

Absolute Maximum Ratings

Parameter	Value	Units
DC Supply Voltage, RF off	4	V
RF input power	+10	dBm
Operational ground slug temperature	-40 to +85	°C
Storage temperature range	-65 to +150	°C

Note: Stresses in excess of these absolute ratings may cause permanent damage. The device is not implied to be functional under these conditions.

General Electrical Characteristics

Symbol	Parameter	Test Condition	Min	Typ	Max	Units
VCC	Operating voltage		3	3.3	3.6	V
VIH	Logic high	LNAEn	VCC-1.1		3.6	V
VIL	Logic low	LNAEn	0		0.8	V
	ESD	All pins, HBM	1500			V

Note: The device may be operated safely over these conditions. However, performance is guaranteed only over the conditions defined in the electrical specifications.

Operating Overview

Referring to the functional block diagram (Figure 1 ·), the LX5563 is an LNA with two modes. When the LNAEn pin is high, the LNA is enabled, and the device is in High gain mode. When LNAEn is low, the LNA is disabled, and the device is placed in Bypass mode. Bypass mode can be used to extend the overall dynamic range of a receiver, or to allow the receiver to operate in the presence of strong blocker signals by reducing the gain and offering higher linearity than in high gain mode.

Electrical Specifications

Symbol	Parameter		Test Condition	Min	Typ	Max	Units
F	Frequency range			2.412		2.472	GHz
S21	Small signal gain	HG	High gain mode	13.5	15	16.5	dB
		Bypass	Bypass mode	-8	-7	-6	
ΔS21	Gain variation	HG	HG mode, over single 20 MHz channel	-0.25		0.25	
			HG mode, over single 80 MHz channel	-0.3		0.3	
			HG mode over entire frequency range	-0.3		0.3	
EVM	EVM	HG	OFDM Input signal at -20 dBm. For information only.		-40		dB
F	Noise figure	HG	At 25°C ambient, High gain.		1.25	1.55	dB
		Bypass	At 25°C ambient, bypass mode.		7		
IIP3	Input IP3	HG	5MHz tone spacing, -8 dBm<Pin<0 dBm	7	9		dBm
		Bypass	5MHz tone spacing, 2 dBm<Pin<17 dBm		26		
IP1dB	Input P1dB	HG	High mode		0		dBm
		Bypass	Bypass mode		17		
S11	Input return loss	HG	High mode	10	18		dB
		Bypass	Bypass	10	18		
S22	Output return loss	HG	High mode	10	12		dB
		Bypass	Bypass mode	9.5	11		
I_{CC}	Quiescent current	HG	No RF input signal applied		9	12	mA
		Bypass	Leakage currently only		4	6.5	µA
2f/3f	Harmonic generation	Bypass	LNAEn low, +8 dBm, 2.437 GHz OFDM signal applied on RFin pin			-48	dBm/MHz
Jammer performance	Leakage at 5180MHz	HG	Input signal at 2.462GHz and -30dBm; jammer at 5180 and -10 dBm		-3		dBm
	Leakage at 2718MHz				-40		
Trise	Turn on time		From bypass to high gain mode, 10-90%		100		ns
Tfall	Turn off time		From high gain to bypass mode, 10-90%		100		ns

Note: Nominal test conditions: VCC=3.3 V, Ambient temperature = 25°C. 20 MHz BW, 64 QAM OFDM test signals applied at 2.437 GHz unless otherwise noted. Min and Max are over the entire 3.0V to 3.6V supply range and -40°C to 85°C temperature range.

Characteristic Curves

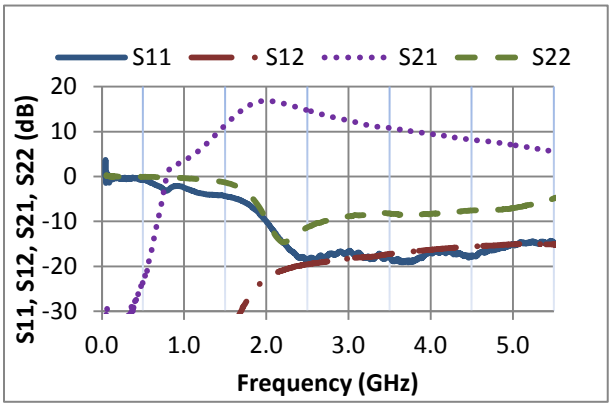


Figure 3 · S-Parameters (V_{CC}= 3.3V, I_{DD} =8.6mA 25°C)

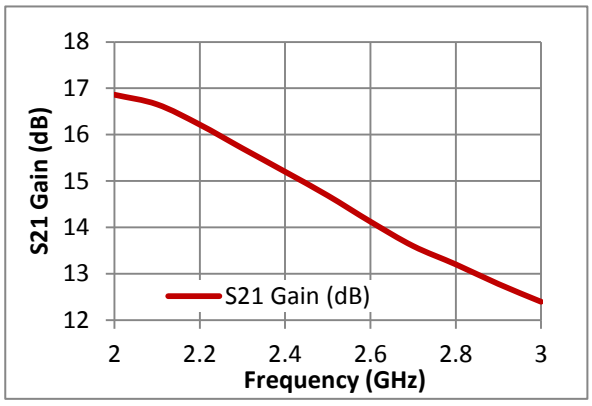


Figure 4 · S21 Gain V_{CC} =3.3V, 25°C

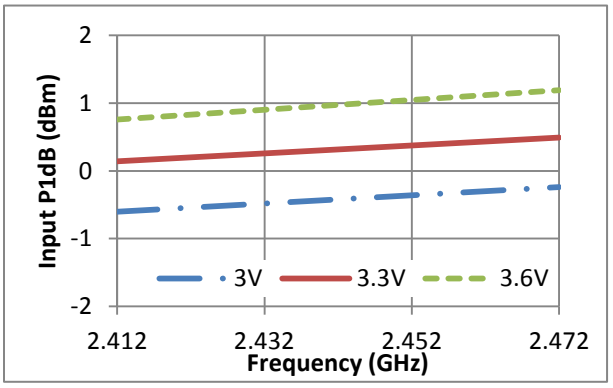


Figure 5 · HG Input P1dB (dBm, 25°C)

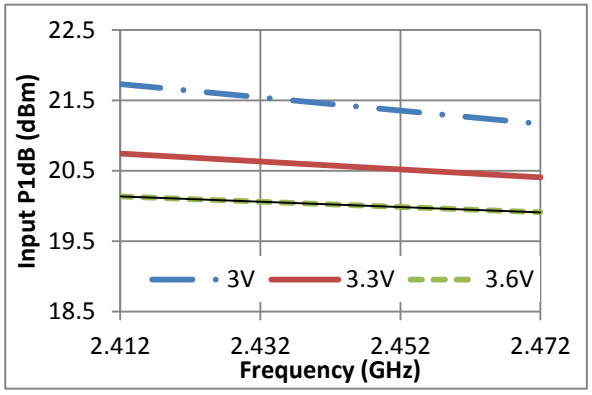


Figure 6 · Bypass Input P1dB (dBm, 25°C)

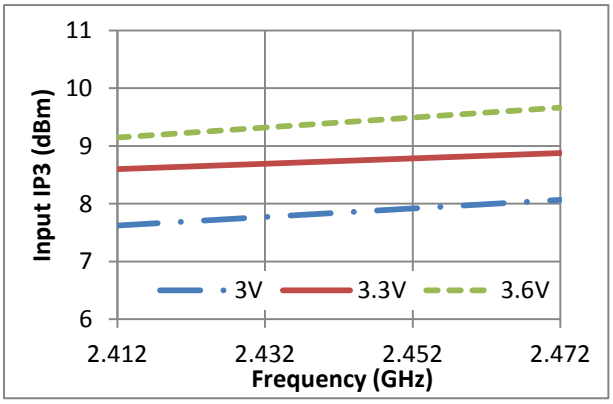


Figure 7 · HG Input IP3 (dBm, 25°C)

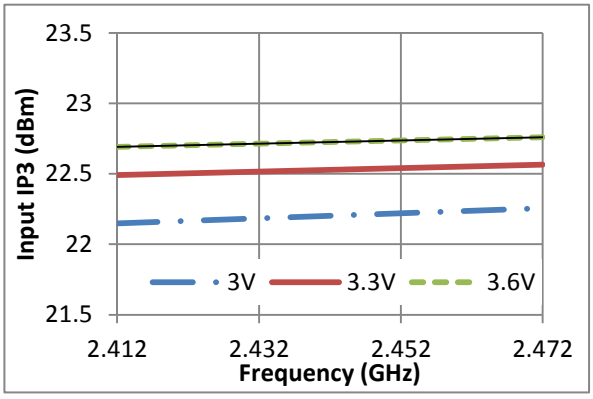


Figure 8 · Bypass Input IP3 (dBm, 25°C)

Characteristic Curves

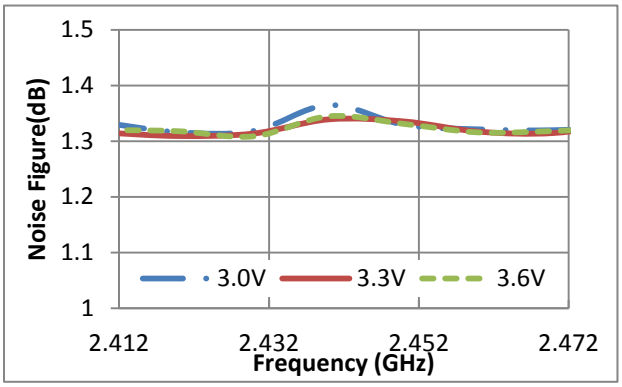


Figure 9 · HG Noise Figure (dB, 25°C)

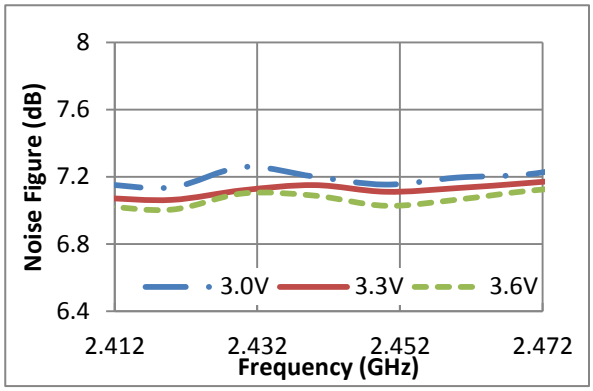


Figure 10 · Bypass Noise Figure (dB, 25°C)

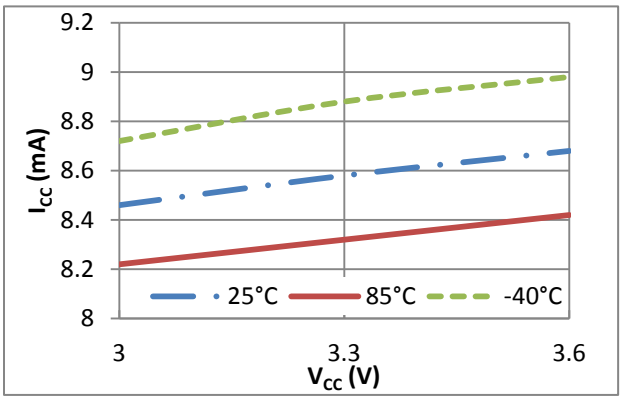


Figure 11 · Input Current vs. Temperature and Voltage

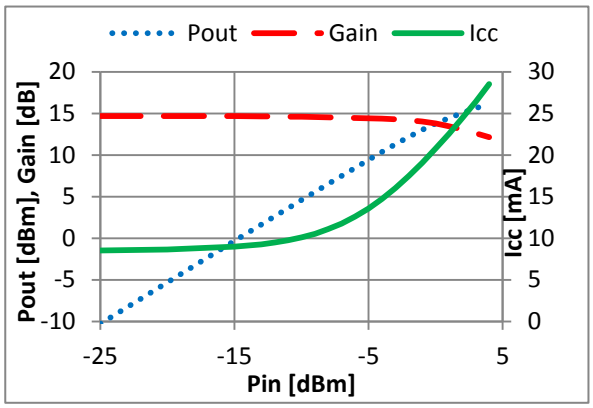


Figure 12 · Power Sweep (V_{CC}=3.3V, Icq = 8.6mA, 25°C)

Application Information

The LX5563 is fully matched on both RF ports. No external matching is required. An external decoupling capacitor is recommended on the supply line, as shown in Figure 13 · .

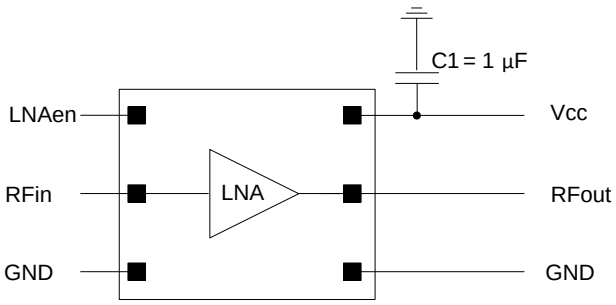
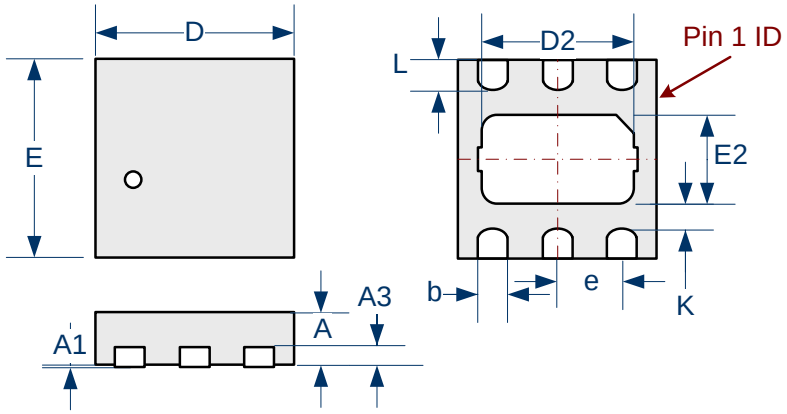


Figure 13 · Application Schematic

Package Outline Dimensions

The package is halogen free and meets RoHS2 and REACH standards.



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.41	0.50	0.016	0.020
A1	0.0	0.05	0.0	0.002
A3	0.15 REF		0.006 REF	
b	0.18	0.30	0.07	0.012
D	1.50 BSC		0.059 BSC	
D2	1.05	1.30	0.041	0.051
E	1.50 BSC		0.059 BSC	
E2	0.55	0.80	0.022	0.031
e	0.50 BSC		0.20 BSC	
K	0.15	-	0.006	-
L	0.125	0.225	0.005	0.009

Figure 14 · 6 Pin DFN Package Dimensions

Recommended PCB Footprint

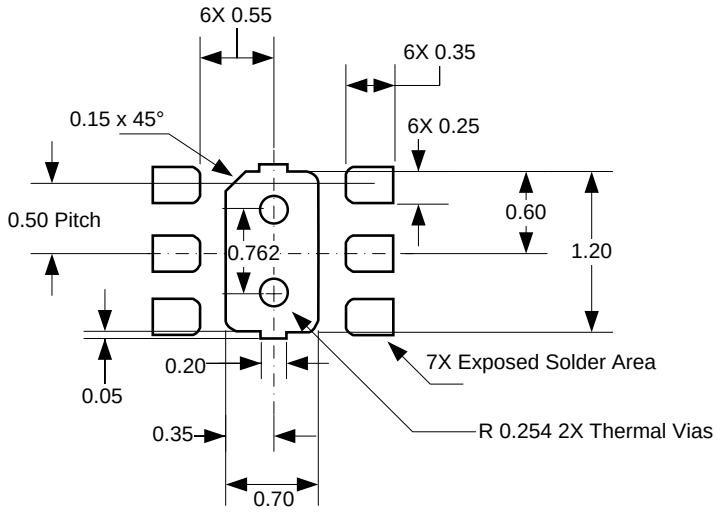


Figure 15 · PCB Layout Footprint (Top View)

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