50 MHz to 6 GHz RF/IF Gain Blocks

Preliminary Technical Data

ADL5541/ADL5542

FEATURES

Fixed gain of 15 dB ADL5541
Fixed gain of 20 dB ADL5542
Operation up to 6 GHz
40.9 dBm Output Third-Order Intercept at 900 MHz ADL5541
40 dBm Output Third-Order Intercept at 900 MHz ADL5542
3.5 dB noise figure at 900 MHz ADL5541
3.0 dB noise figure at 900 MHz ADL5542
Input/output internally matched to 50 Ω
Stable vs. temperature and power supply
5 V power supply
92 mA power supply current
1000 V ESD (Class 1C)

FUNCTIONAL BLOCK DIAGRAM

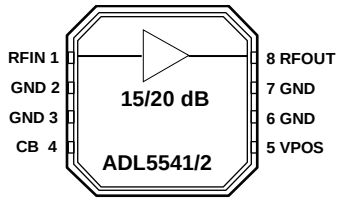

Figure 1.

GENERAL DESCRIPTION

The ADL5541 and ADL5542 are broadband 15 dB and 20 dB linear amplifiers respectively that operate at frequencies up to 6 GHz. The devices can be used in a wide variety of wired and wireless devices including cellular, GSM and WCDMA, and broadband applications.

The ADL5541 provides a gain of 15 dB, which is stable over frequency, temperature, power supply, and from device to device. It achieves an OIP3 of 40.9 dBm with an output compression point of 18.2 dBm and a noise figure of 3.5 dB at 900 MHz.

The ADL5542 provides a gain of 20 dB. It achieves an OIP3 of 40 dBm with an output compression point of 20.6 dBm and a noise figure of 3.0 dB at 900 MHz.

Both amplifiers are internally matched to 50 Ω with an input return loss of 10 dB or better up to 6 GHz. Only input/output ac-coupling capacitors, power supply decoupling capacitors, and an external inductor are required for operation.

The devices operate with a supply voltage of 5 V with a supply current of 92 mA.

The ADL5541 and ADL5542 are fabricated on an InGaP HBT process and have an ESD rating of 1000 V (Class 1C). The devices are packaged in a 3 mm × 3 mm LFCSP that uses an exposed paddle for excellent thermal impedance. They operate from −40°C to +85°C. A fully populated evaluation board is available.

Rev. PrD 5/07

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REVISION HISTORY

5/07—Rev. PrD: Preliminary Version

SPECIFICATIONS

ADL5541 VPOS = 5 V and T_A = 25°C, unless otherwise noted.

Table 1.

Parameter	Conditions	Min	Typ	Max	Unit
OVERALL FUNCTION					
Frequency Range		50		6000	MHz
Gain Vs. Frequency	over any 100 MHz Frequency Range from 50 MHz to 4.2 GHz		±0.05		dB
Input Return Loss (S11)	Frequency 500 MHz to 5 GHz			10	dB
Output Return Loss (S22)	Frequency 500 MHz to 5 GHz		10	8	dB
FREQUENCY = 500 MHz					
Gain			15.1		dB
vs. Temperature	−40°C ≤ T_A ≤ +85°C		±0.3		dB
Output 1 dB Compression Point			19.9		dBm
Output Third-Order Intercept	Δf = 1 MHz , Output Power (P_{OUT}) = 0 dBm per tone		42		dBm
Noise Figure			3.5		dB
FREQUENCY = 900 MHz					
Gain			15.2		dB
vs. Frequency	850 MHz to 950 MHz		±0.05		dB
vs. Temperature	−40°C ≤ T_A ≤ +85°C		±0.3		dB
Output 1 dB Compression Point			18.2		dBm
Output Third-Order Intercept	Δf = 1 MHz , Output Power (P_{OUT}) = 0 dBm per tone		40.9		dBm
Noise Figure			3.5		dB
FREQUENCY = 2000 MHz					
Gain			14.7		dB
vs. Frequency	1950 MHz to 2050 MHz		±0.05		dB
vs. Temperature	−40°C ≤ T_A ≤ +85°C		±0.3		dB
Output 1 dB Compression Point			16.3		dBm
Output Third-Order Intercept	Δf = 1 MHz , Output Power (P_{OUT}) = 0 dBm per tone		39.2		dBm
Noise Figure			3.8		dB
FREQUENCY = 2400 MHz					
Gain			14.5		dB
vs. Frequency	2350 MHz to 2450 MHz		±0.05		dB
vs. Temperature	−40°C ≤ T_A ≤ +85°C		±0.4		dB
Output 1 dB Compression Point			14.9		dBm
Output Third-Order Intercept	Δf = 1 MHz , Output Power (P_{OUT}) = 0 dBm per tone		38.7		dBm
Noise Figure			3.9		dB
FREQUENCY = 3500 MHz					
Gain			14.3		dB
vs. Frequency	2350 MHz to 2450 MHz		±0.05		dB
vs. Temperature	−40°C ≤ T_A ≤ +85°C		±0.4		dB
Output 1 dB Compression Point			12.1		dBm
Output Third-Order Intercept	Δf = 1 MHz , Output Power (P_{OUT}) = 0 dBm per tone		31		dBm
Noise Figure			4.1		dB
POWER INTERFACE	Pins RFOUT, VCC				
Supply Voltage		4.5	5	5.5	V
Supply Current			92		mA
vs. Temperature	−40°C ≤ T_A ≤ +85°C		103		mA
Power Dissipation	VPOS = 5 V		500		mW

ADL5542 VPOS = 5 V and T_A = 25°C, unless otherwise noted.

Table 2.

Parameter	Conditions	Min	Typ	Max	Unit
OVERALL FUNCTION					
Frequency Range		50		6000	MHz
Gain Vs. Frequency	over any 100 MHz Frequency Range from 50 MHz to 4.5 GHz		±0.15		dB
Input Return Loss (S11)	Frequency 50 MHz to 5 GHz			10	dB
Output Return Loss (S22)			10	8	dB
FREQUENCY = 500 MHz					
Gain			19.5		dB
vs. Temperature	−40°C ≤ T_A ≤ +85°C		±0.2		dB
Output 1 dB Compression Point			20.6		dBm
Output Third-Order Intercept	Δf = 1 MHz , Output Power (P_{OUT}) = 0 dBm per tone		43.6		dBm
Noise Figure			2.9		dB
FREQUENCY = 900 MHz					
Gain			19.7		dB
vs. Frequency	850 MHz to 950 MHz		±0.05		dB
vs. Temperature	−40°C ≤ T_A ≤ +85°C		±0.2		dB
Output 1 dB Compression Point			20.6		dBm
Output Third-Order Intercept	Δf = 1 MHz , Output Power (P_{OUT}) = 0 dBm per tone		40		dBm
Noise Figure			3.0		dB
FREQUENCY = 2000 MHz					
Gain			18.7		dB
vs. Frequency	1950 MHz to 2050 MHz		±0.05		dB
vs. Temperature	−40°C ≤ T_A ≤ +85°C		±0.3		dB
Output 1 dB Compression Point			18.0		dBm
Output Third-Order Intercept	Δf = 1 MHz , Output Power (P_{OUT}) = 0 dBm per tone		39		dBm
Noise Figure			3.2		dB
FREQUENCY = 2400 MHz					
Gain			18.3		dB
vs. Frequency	2350 MHz to 2450 MHz		±0.05		dB
vs. Temperature	−40°C ≤ T_A ≤ +85°C		±0.3		dB
Output 1 dB Compression Point			16.8		dBm
Output Third-Order Intercept	Δf = 1 MHz , Output Power (P_{OUT}) = 0 dBm per tone		38		dBm
Noise Figure			3.5		dB
FREQUENCY = 3500 MHz					
Gain			17.4		dB
vs. Frequency	3450 MHz to 3550 MHz		±0.05		dB
vs. Temperature	−40°C ≤ T_A ≤ +85°C		±0.4		dB
Output 1 dB Compression Point			13.7		dBm
Output Third-Order Intercept	Δf = 1 MHz , Output Power (P_{OUT}) = 0 dBm per tone		33.5		dBm
Noise Figure			3.7		dB
POWER INTERFACE	Pins RFOUT, VCC				
Supply Voltage		4.5	5	5.5	V
Supply Current			92		mA
vs. Temperature	−40°C ≤ T_A ≤ +85°C		103		mA
Power Dissipation	VPOS = 5 V		500		mW

ABSOLUTE MAXIMUM RATINGS

Table 3.

Parameter	Rating
Supply Voltage, VPOS	6.5V
Input Power (re: 50 Ω)	10 dBm
Internal Power Dissipation (Paddle Soldered)	650 mW
θ_{JC} (Junction to Paddle)	TBD °C/W
Maximum Junction Temperature	TBD °C
Operating Temperature Range	−40°C to +85°C
Storage Temperature Range	−65°C to +150°C

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

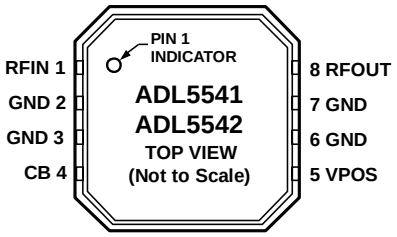

Figure 2. Pin Configuration

Table 4. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	RFIN	RF Input: Requires a dc blocking capacitor. For normal operation a 33pF capacitor is recommended
2,3,6,7	GND	Ground: Connect these pins to a low impedance ground plane.
4	CB	Low Frequency Bypass: A 1 µF capacitor should be connected between this pin and ground.
5	VPOS	Power Supply for Bias Controller: Connect directly to external power supply
7	RFOUT	RF Output and Supply Voltage: DC bias is provided to this pin through an inductor that is tied to the external power supply. A 47 nH inductor is recommended for normal operation. RF path requires a DC blocking capacitor. For normal operation a 33pF capacitor is recommended
	Exposed Paddle	Exposed Paddle: Internally connected to GND. Solder to a low impedance ground plane.

TYPICAL PERFORMANCE CHARACTERISTICS

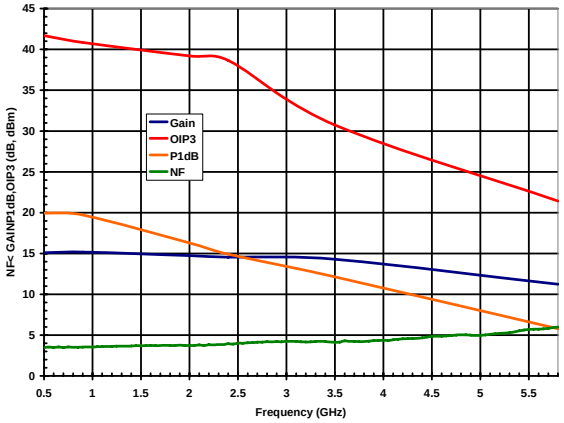

Figure 3. ADL5541 Gain, Noise Figure, OIP3 and P1dB vs. Frequency

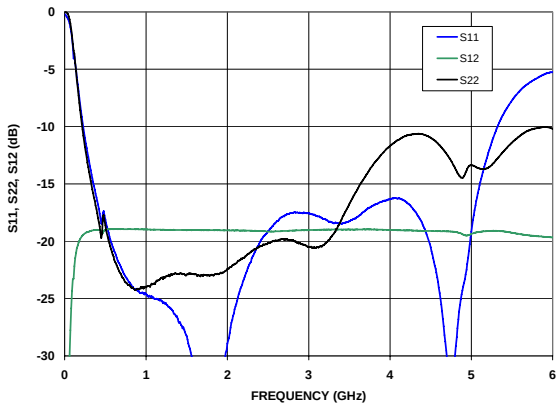

Figure 4. ADL5541 Input/ Output Return Loss and Reverse Isolation vs. Frequency

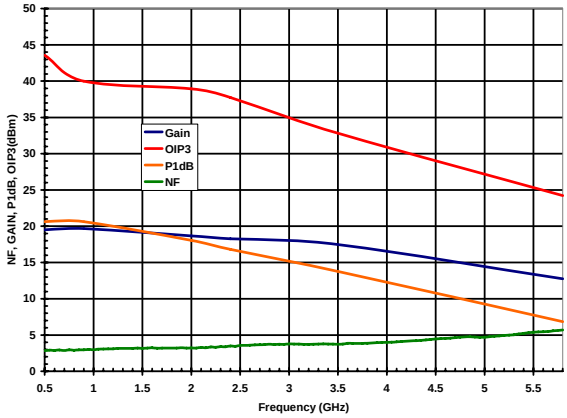

Figure 5. ADL5542 Gain, Noise Figure, OIP3 and P1dB vs. Frequency

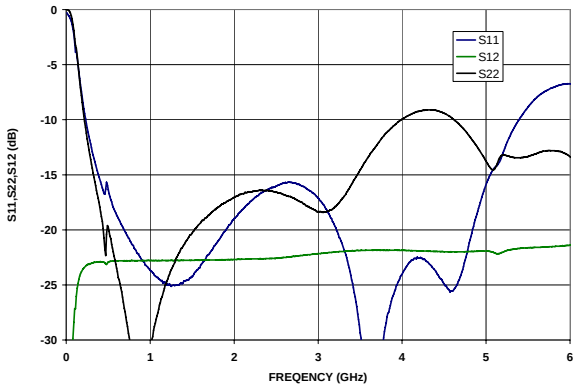

Figure 6. ADL5542 Input/Output Return Loss and Reverse Isolation vs. Frequency

EVALUATION BOARD

Figure 9 shows the schematic for the ADL5541 /ADL5542 evaluation board. The board is powered by a single 5 V supply.

The components used on the board are listed in. Power can be applied to the board through clip-on leads (Vcc, Gnd), or through Jumper W1.

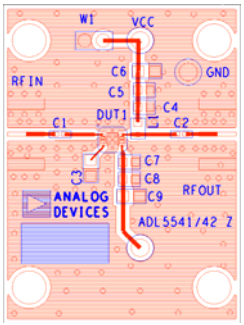

Figure 7. Evaluation Board Layout (Top)

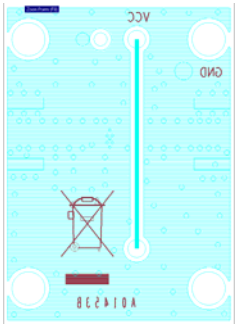

Figure 8. Evaluation Board Layout (Bottom)

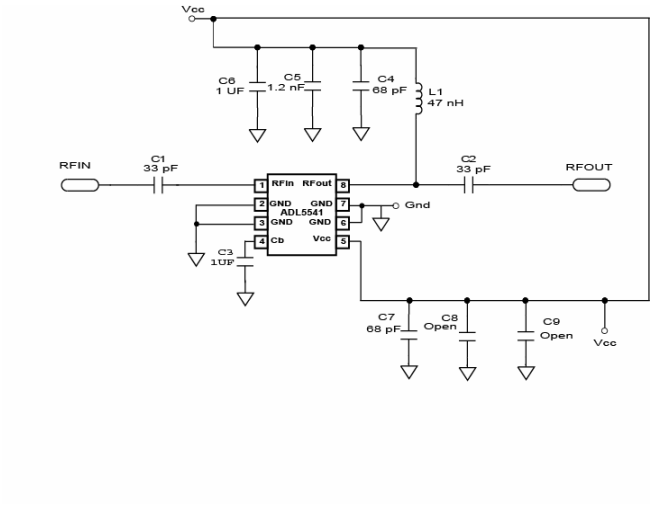

Figure 9. Evaluation Board Schematic

Evaluation Board Configuration Options

Component	Function	Default Value
C1, C2	AC-coupling capacitors.	33 pF 0402
C3	Low frequency bypass capacitor.	1 uF 0805
L1	DC bias inductor.	47 nH L0603
Vcc & Gnd	Clip-on terminals for power supply.	
W1	2-pin jumper for connection of ground and supply via cable.	
C4,C5,C6, C7,C8,C9	Power supply decoupling capacitors	C4, C7 68 pF 0603 C5 1.2 nF 0603 C6 1uF 0805 C8, C9 Open

OUTLINE DIMENSIONS

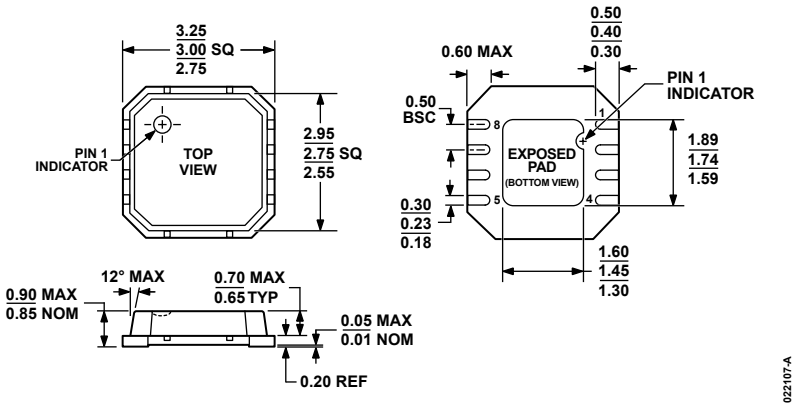

Figure 10. 8-Lead Lead Frame Chip Scale Package [LFCSP_VD]
3 mm × 3 mm Body, Very Thin, Dual Lead
(CP-8-2)
Dimensions shown in millimeters

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option	Branding	Ordering Quantity
ADL5541ACPZ-R7[1]	−40°C to +85°C	8-Lead LFCSP Tape and Reel	CP-8-2		
ADL5541ACPZ-WP[1]	−40°C to +85°C	8-Lead LFCSP Waffle Pack	CP-8-2		
ADL5542ACPZ-R7[1]	−40°C to +85°C	8-Lead LFCSP Tape and Reel	CP-8-2		
ADL5542ACPZ-WP[1]	−40°C to +85°C	8-Lead LFCSP Waffle Pack	CP-8-2		
ADL5541-EVALZ		Evaluation Board			
ADL5542-EVALZ		Evaluation Board			

[1] Z = RoHS Compliant Part.

PR06832-0-5/07(PrD)