50 MHz to 4.0 GHz RF/IF Gain Block

Preliminary Technical Data — ADL5601

FEATURES

- Fixed gain of 15 dB
- Operation from 50 MHz to 4.0 GHz
- Highest dynamic range gain block
- Input/output internally matched to 50 Ω
- Integrated bias control circuit
- OIP3 of 43.7 dBm at 900 MHz
- P1dB of 19.2 dBm at 900 MHz
- Noise figure of 3.7 dB at 900 MHz
- Single 5V power supply
- Low quiescent current of 85 mA
- Thermally efficient SOT-89 package
- ESD rating of ±1 kV (Class 1C)

FUNCTIONAL BLOCK DIAGRAM

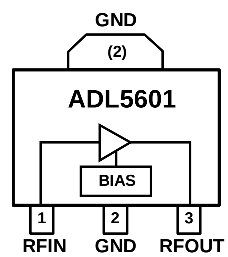

Figure 1. Block Diagram

GENERAL DESCRIPTION

The ADL5601 is a broadband 15 dB linear amplifier that operates at frequencies up to 4 GHz. The device can be used in a wide variety of cellular, CATV, military, and instrumentation equipment.

The ADL5601 provides the highest dynamic range available from an internally matched gain block. This is accomplished by providing extremely low noise figures and very high OIP3 specifications simultaneously, across the entire 4 GHz frequency range.

The ADL5601 provides a gain of 15 dB, which is stable over frequency, temperature, power supply, and from device to device. The device is internally matched to 50 Ω at the input and output, making the ADL5601 very easy to implement in a wide variety of applications. Only input/output ac coupling capacitors, power supply decoupling capacitors, and an external inductor are required for operation.

The ADL5601 is fabricated on an InGaP HBT process and has an ESD rating of ± 1 kV (Class 1C). The device is available in a thermally efficient SOT-89 package.

The ADL5601 consumes 85 mA on a single 5 V supply and is fully specified for operation from −40°C to +85°C.

A fully populated RoHS-compliant evaluation board is available.

Rev. PrB

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SPECIFICATIONS

V_{CC}=5.0 V, T=25°C, otherwise noted.

Table 1.

Parameter	Conditions	Min	Typ	Max	Unit
OVERALL FUNCTION					
Frequency Range		50		4000	MHz
FREQUENCY = 50 MHz					
Gain			TBD		dB
Output 1 dB Compression Point			TBD		dB
Output Third-Order Intercept	Δf = 1 MHz, output power (P_{OUT}) = TBD dBm per tone		TBD		dB
Noise Figure			TBD		dB
FREQUENCY = 140 MHz					dBm
Gain		TBD	15.4	TBD	dBm
vs. Frequency	±50 MHz		±0.05		dB
vs. Temperature	−40°C ≤ T_A ≤ +85°C		±0.2		dB
vs. Supply	4.75 V to 5.25 V		TBD		dB
Output 1 dB Compression Point			18.9		dBm
Output Third-Order Intercept	Δf = 1 MHz, output power (P_{OUT}) = 0 dBm per tone		34.8		dBm
Noise Figure			3.8	TBD	dB
FREQUENCY = 350 MHz					
Gain		TBD	15.2	TBD	dB
vs. Frequency	±50 MHz		±0.03		dB
vs. Temperature	−40°C ≤ T_A ≤ +85°C		±0.4		dB
vs. Supply	4.75 V to 5.25 V		TBD		dB
Output 1 dB Compression Point			19.2		dBm
Output Third-Order Intercept	Δf = 1 MHz, output power (P_{OUT}) = 0 dBm per tone		36		dBm
Noise Figure			3.8	TBD	dB
FREQUENCY = 700 MHz					
Gain		TBD	15.2	TBD	dB
vs. Frequency	±50 MHz		±0.02		dB
vs. Temperature	−40°C ≤ T_A ≤ +85°C		±0.4		dB
vs. Supply	4.75 V to 5.25 V		TBD		dB
Output 1 dB Compression Point			19.2		dBm
Output Third-Order Intercept	Δf = 1 MHz, output power (P_{OUT}) = 0 dBm per tone		36		dBm
Noise Figure			3.8	TBD	dB
FREQUENCY = 900 MHz					
Gain		TBD	15.3	TBD	dB
vs. Frequency	±50 MHz		±0.02		dB
vs. Temperature	−40°C ≤ T_A ≤ +85°C		±0.4		dB
vs. Supply	4.75 V to 5.25 V		TBD		dB
Output 1 dB Compression Point			19.2		dBm
Output Third-Order Intercept	Δf = 1 MHz, output power (P_{OUT}) = 0 dBm per tone		43.7		dBm
Noise Figure			3.7	TBD	dB

Parameter	Conditions	Min	Typ	Max	Unit
FREQUENCY = 2000 MHz					
Gain		TBD	14.2	TBD	dB
vs. Frequency	±50 MHz		±0.1		dB
vs. Temperature	−40°C ≤ T_A ≤ +85°C		±0.25		dB
vs. Supply	4.75 V to 5.25 V		TBD		dB
Output 1 dB Compression Point			17.5		dBm
Output Third-Order Intercept	Δf = 1 MHz, output power (P_{OUT}) = 0 dBm per tone		34.3		dBm
Noise Figure			4.5	TBD	dB
FREQUENCY = 2600 MHz					
Gain		TBD	13.2	TBD	dB
vs. Frequency	±50 MHz		±0.06		dB
vs. Temperature	−40°C ≤ T_A ≤ +85°C		±0.22		dB
vs. Supply	4.75 V to 5.25 V		TBD		dB
Output 1 dB Compression Point			15.9		dBm
Output Third-Order Intercept	Δf = 1 MHz, output power (P_{OUT}) = 0 dBm per tone		30.6		dBm
Noise Figure			4.8	TBD	dB
FREQUENCY = 3500 MHz					
Gain		TBD	12.7	TBD	dB
vs. Frequency	±50 MHz		±0.05		dB
vs. Temperature	−40°C ≤ T_A ≤ +85°C		±0.32		dB
vs. Supply	4.75 V to 5.25 V		TBD		dB
Output 1 dB Compression Point			14.1		dBm
Output Third-Order Intercept	Δf = 1 MHz, output power (P_{OUT}) = 0 dBm per tone		26.5		dBm
Noise Figure			5.5	TBD	dB
FREQUENCY = 4000 MHz					
Gain		TBD	12	TBD	dB
vs. Frequency	±50 MHz		±0.1		dB
vs. Temperature	−40°C ≤ T_A ≤ +85°C		±0.5		dB
vs. Supply	4.75 V to 5.25 V		TBD		dB
Output 1 dB Compression Point			12.6		dBm
Output Third-Order Intercept	Δf = 1 MHz, output power (P_{OUT}) = 0 dBm per tone		25.0		dBm
Noise Figure			6.0	TBD	dB
POWER INTERFACE	Pin VCC				
Supply Voltage (V_{CC})		4.75	5	5.25	V
Supply Current			85	TBD	mA
vs. Temperature	−40°C ≤ T_A ≤ +85°C		TBD		mA
Power Dissipation	VPOS = 5 V		425		mW

ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Rating
Supply Voltage, V_{CC}	6.5V
Input Power (re: 50 Ω)	TBD dBm
Internal Power Dissipation (Paddle Soldered)	552 mW
$θ_{JC}$ (Junction to Paddle)	TBD °C/W
Maximum Junction Temperature	TBD °C
Lead Temperature (Soldering 60 sec)	260°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

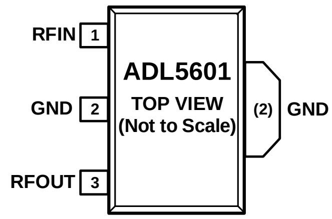

Figure 2.Pin Configuration

Table 3. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	RFIN	RF Input. This pin requires a dc blocking capacitor.
2	GND	Ground. Connect this pin to a low impedance ground plane.
3	RFOUT	RF Output and Supply Voltage. DC bias is provided to this pin through an inductor that is connected to the external power supply. RF path requires a dc blocking capacitor.
Exposed Paddle		Exposed Paddle. Internally connected to GND. Solder to a low impedance ground plane.

TYPICAL PERFORMANCE CHARACTERISTICS

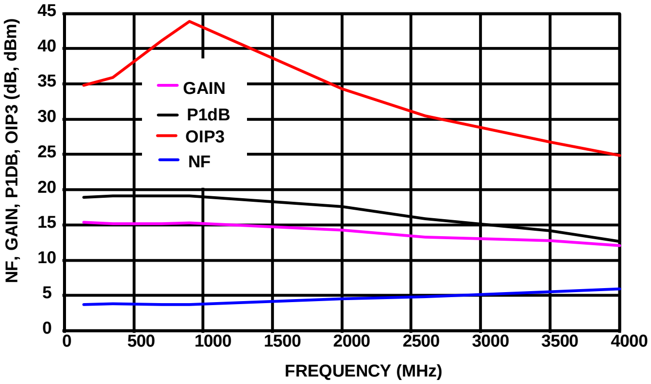

Figure 3 Gain, P1dB and OIP3 (0dBm per tone) and Noise Figure vs. Frequency

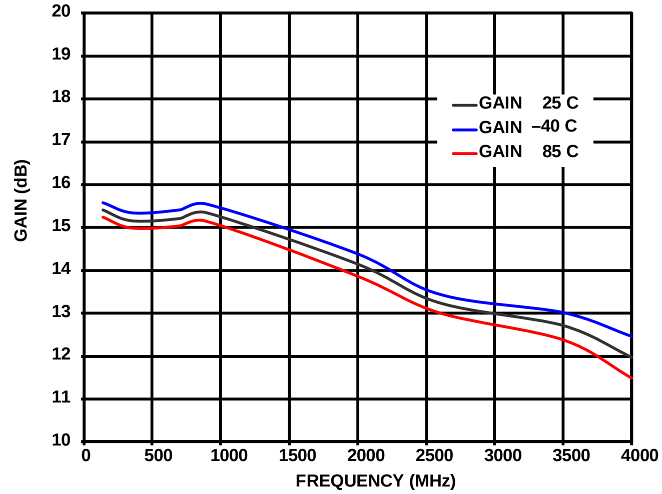

Figure 6 Gain vs. Frequency and Temperature

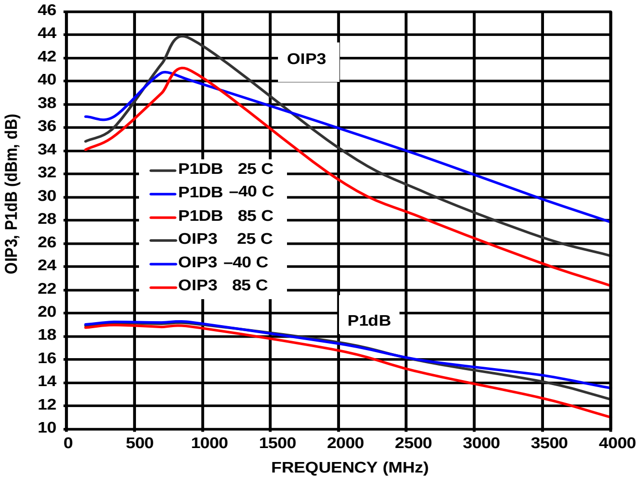

Figure 4 OIP3 vs. Output Power (POUT) and Frequency

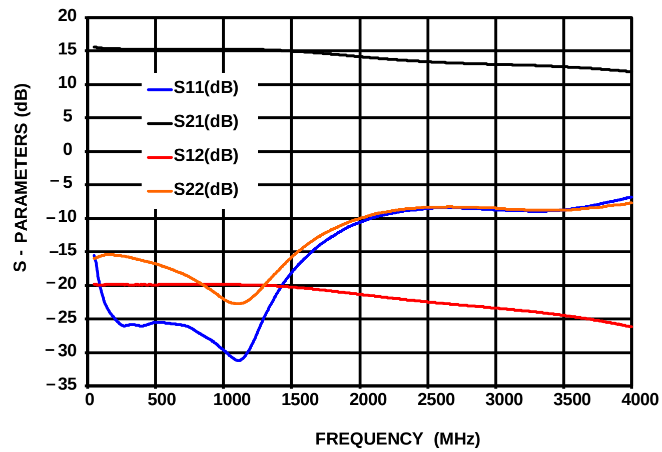

Figure 7. Small Signal S-Parameters

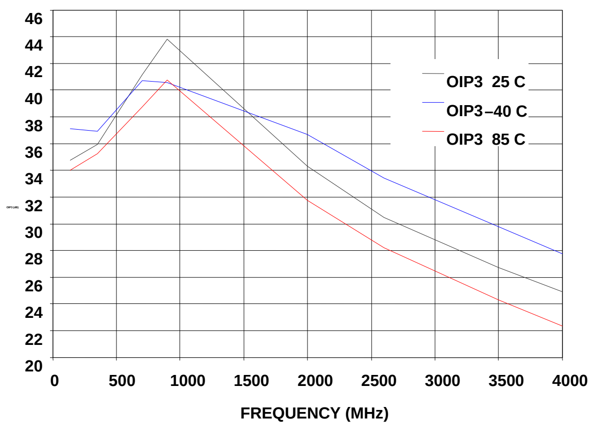

Figure 5. OIP3 (0dBm per tone) and P1dB vs. Frequency and Temperature

EVALUATION BOARD

Figure 8 shows the schematic for the ADL5601 evaluation board. The board is powered by a single 5 V supply. The components used on the board are listed in Table 4. Power can be applied to the board through clip-on leads (V_{CC}, GND).

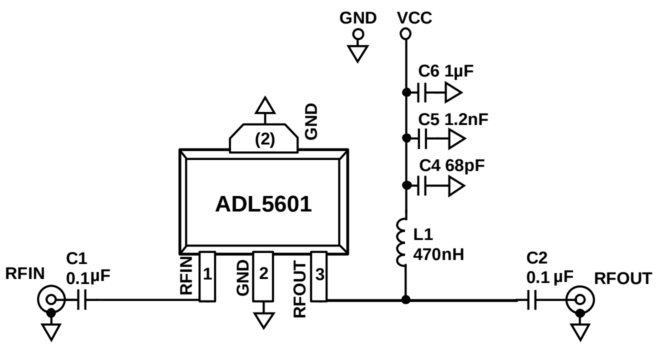

Figure 8. Evaluation Board Schematic

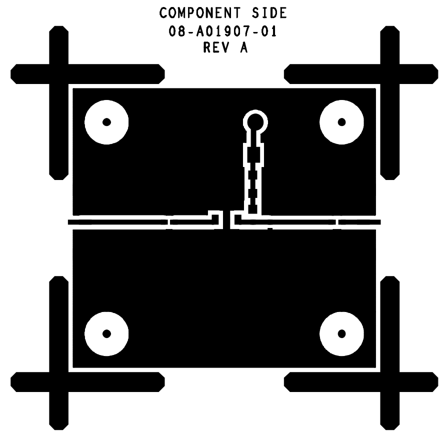

Figure 9.Evaluation Board Layout (Top)

Table 4. Evaluation Board Configuration Options

Component	Function	Default Value
C1, C2	AC-coupling capacitors.	0.1 µF 0402
L1	DC bias inductor.	470 nH 0603 (Coilcraft 0603LS-NX or equivalent)
VCC & GND	Clip-on terminals for power supply.	
C4,C5,C6	Power supply decoupling capacitors	C4, 68 pF 0603 C5 1.2 nF 0603 C6 1µF 1206

OUTLINE DIMENSIONS

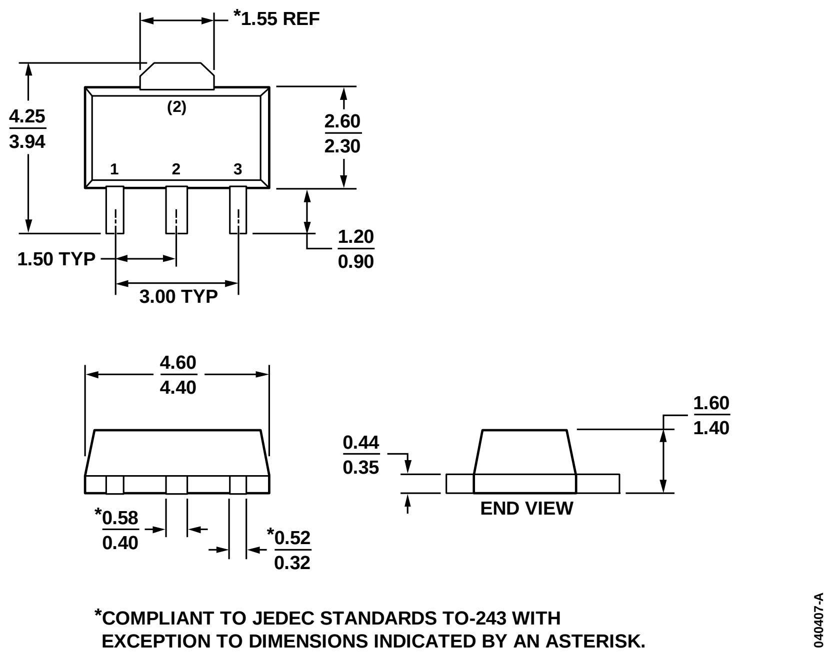

Figure 10.3 Lead Small Outline Transistor Package {SOT-89}
(RK-3)
Dimensions shown in Millimeters

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
ADL5601ARKZ-R7[1]	−40°C to +85°C	3-Lead SOT-89, 7" Tape and Reel	RK-3
ADL5601-EVALZ[1]	−40°C to +85°C	Evaluation Board	

[1] Z = RoHS Compliant Part.

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