

AH31

High Dynamic Range IF Amplifier

Product Information



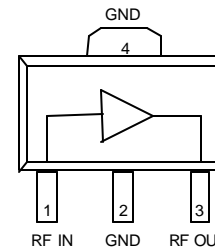
Product Features

- 50 – 1000 MHz
- ISO & EPC compliant
- 19 dB Gain
- +22 dBm P1dB
- +42 dBm OIP3
- 1.8 dB Noise Figure
- Single Voltage Supply (+5 V)
- MTTF > 100 years
- SOT-89 SMT Package

Product Description

The AH31 is a high dynamic range amplifier in a low-cost surface-mount package. Its robustness and ease of use make it an ideal candidate for the core of any RFID reader application. It is compliant with EPC and ISO standards. The combination of low noise figure, high gain, and high output IP3 is ideal as an IF amplifier for receiver and transmitter applications. The device combines dependable performance with consistent quality to maintain MTTF values exceeding 100 years at mounting temperatures of +85°C and is housed in a SOT-89 industry-standard SMT package.

Functional Diagram



Function	Pin No.
Input	1
Output/Bias	3
Ground	2, 4

Applications

- RFID: HF, UHF, microwave
- Readers
 - Industrial
 - Portable
 - Handheld

The broadband MMIC amplifier can be directly applied to various current and next generation RFID technologies such as EPC, ISO, ETSI, and ANSI. Their small size makes them ideal for PCMCIA applications.

Specifications

Parameter	Units	Min	Typ	Max
Frequency Range	MHz	50	240	1000
Gain	dB		19	
Input Return Loss	dB		15	
Output Return Loss	dB		17	
Output P1dB	dBm		+22	
Output IP3 (2)	dBm		+42	
Output IP3 (50 Ω _{test} fixture, 800, 810 MHz)	dBm	+37		
Noise Figure	dB		1.8	
Supply Voltage	V		+5	
Operating Current Range	mA	120	150	180
Thermal Resistance	°C / W			59
Junction Temperature (3)	°C			160

Test conditions unless otherwise noted.

1. T = 25°C, V_{dd} = +5 V, Frequency = 240 MHz in a tuned application circuit.
2. 3OIP measured with two tones at an output power of +10 dBm/tone separated by 1 MHz. The suppression on the largest IM3 product is used to calculate the 3OIP using a 2:1 rule.
3. The junction temperature ensures a minimum MTTF rating of 1 million hours of usage.

Typical Performance

Parameter	Units	Typical				
Frequency	MHz	75	170	240	500	900
S21	dB	19	19	19	18	16.8
S11	dB	-25	-13	-15	-15	-14
S22	dB	-25	-20	-17	-10	-11
Output P1dB	dBm	+22	+22	+22	+22	+21
Output IP3	dBm	+42	+42	+42	+42	+41
Noise Figure	dB	2.4	1.8	1.8	1.7	2.1

Typical parameters reflect performance in an application circuit.

Absolute Maximum Rating

Parameter	Rating
Operating Case Temperature	-40 to +85 °C
Storage Temperature	-55 to +125 °C
DC Voltage	+6 V
RF Input Power (continuous)	4 dB above Input P1dB
Junction Temperature	+220° C

Operation of this device above any of these parameters may cause permanent damage.

Ordering Information

Part No.	Description
AH31	High Dynamic Range IF Amplifier
AH31-PCB75	65 – 85 MHz Fully Assembled Evaluation Board
AH31-PCB170	155 – 185 MHz Fully Assembled Evaluation Board
AH31-PCB240	220 – 260 MHz Fully Assembled Evaluation Board
AH31-PCB500	450 – 550 MHz Fully Assembled Evaluation Board

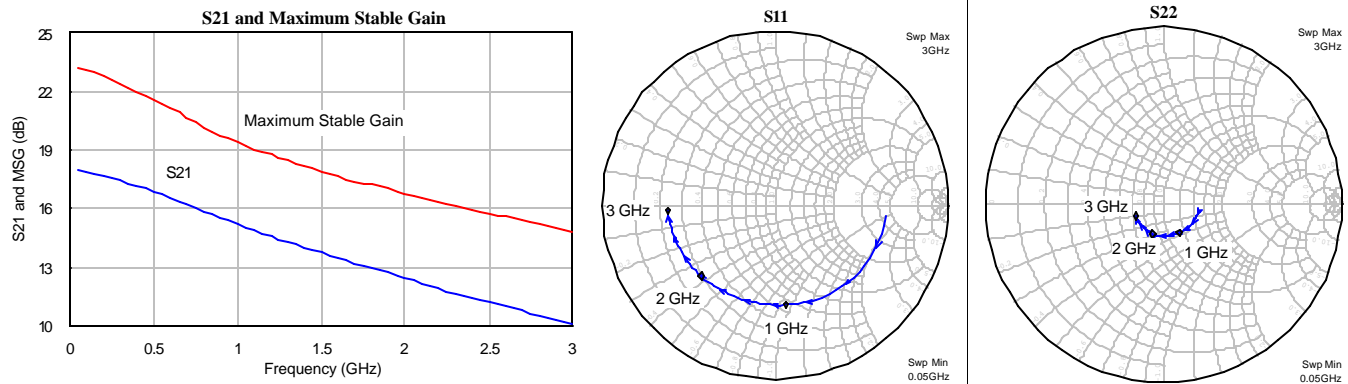
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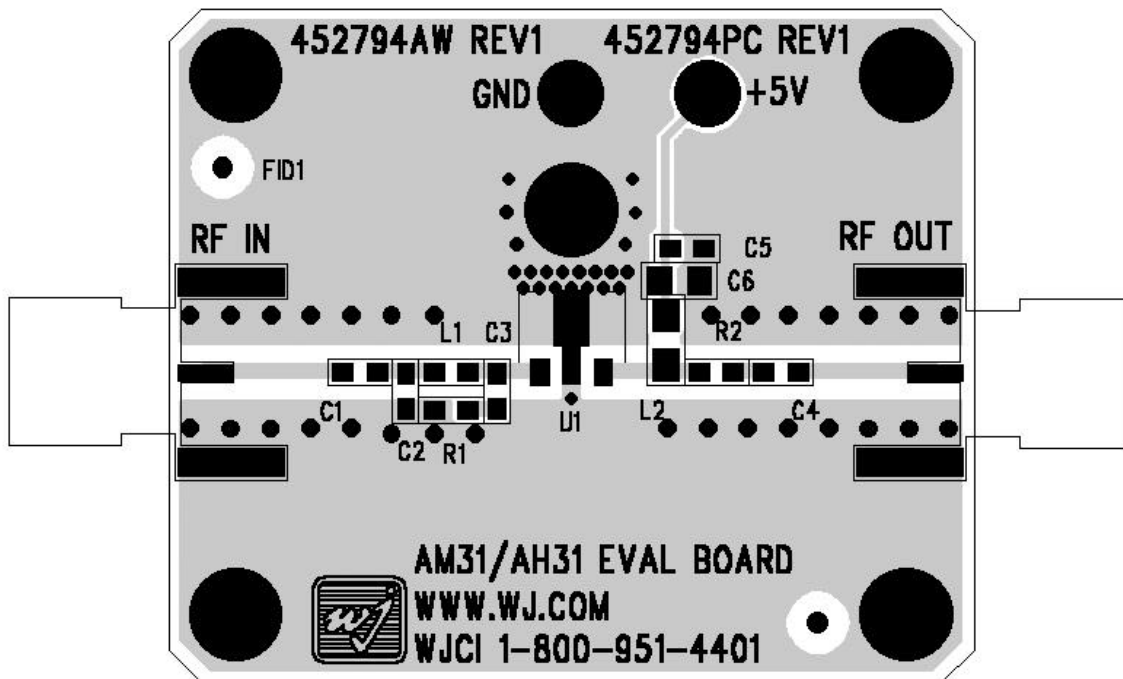
Typical Device Data

S-parameters ($V_d = +5\text{ V}$, $I_d = 150\text{ mA}$, unmatched $50\ \Omega$ system).

- Measurements are shown for an unmatched packaged device with the data being de-embedded to the device leads.
- The amplifier requires a matching network at the input for proper operation. The amplifier is intrinsically well matched at the output and ideally should “look” into $50\ \Omega$. Any deviation from this can affect the linearity IP3 performance for the device.



Application Circuit PC Board Layout



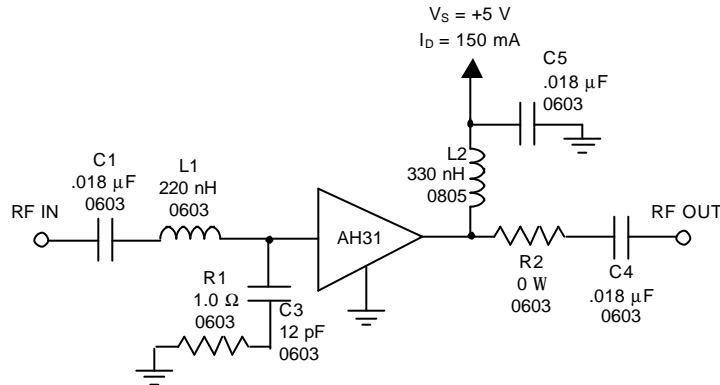
Circuit Board Material: .014" FR-4, 4 layers (other layers added for rigidity), .062" total thickness, 1 oz copper
Microstrip line details: width = .024", spacing = .036"



Application Circuit: 65 – 85 MHz (AH31-PCB75)

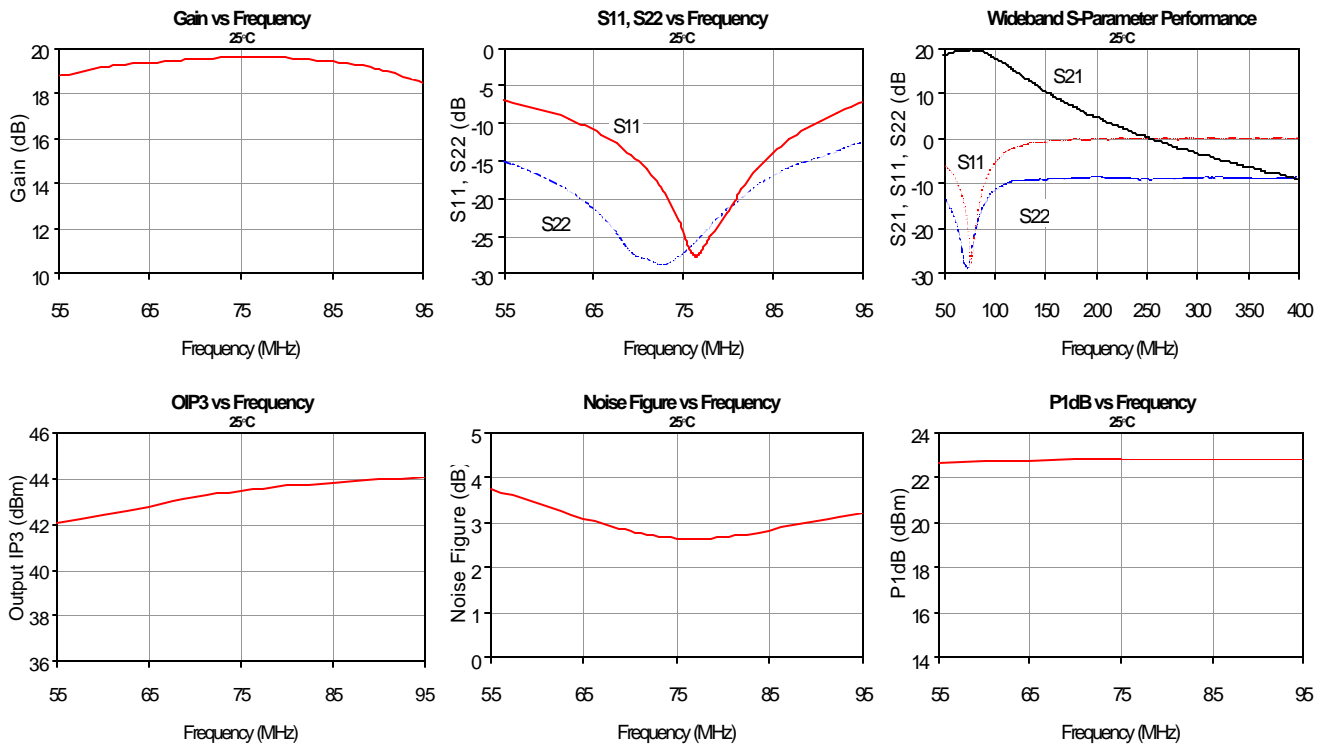
Typical Performance

Frequency	75 MHz
S21 - Gain	19 dB
S11	-25 dB
S22	-25 dB
Output P1dB	+22 dBm
Output IP3	+42 dBm
Noise Figure	2.4 dB
Bias	+5 V @ 150 mA



Notes:

1. The amplifier should be connected directly to a +5 V regulator; no dropping resistor is required.
2. If no DC signal is present at the input (pin 1), C1 can be removed. The gate is internally grounded in the amplifier.
3. R2 is used as a placeholder for a different application circuit. It can be removed from the circuit.
4. C2 (from the silkscreen) is not utilized in this application circuit.

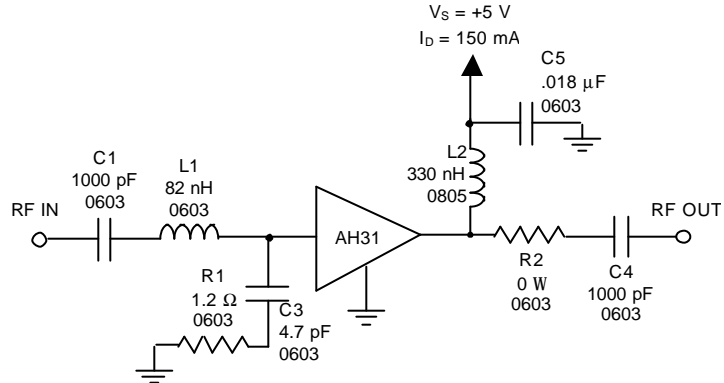




Application Circuit: 155 – 185 MHz (AH31-PCB170)

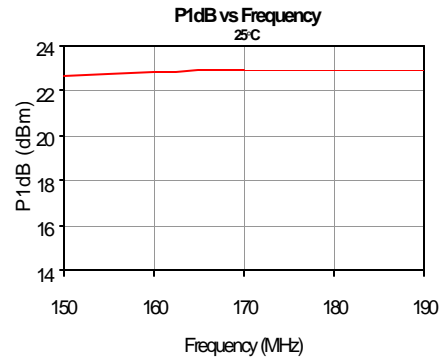
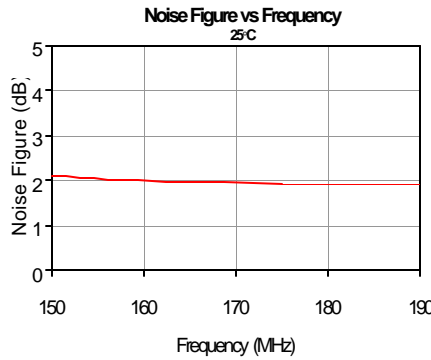
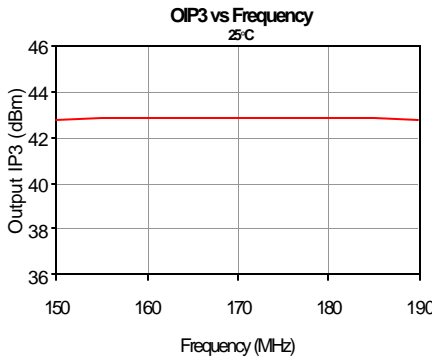
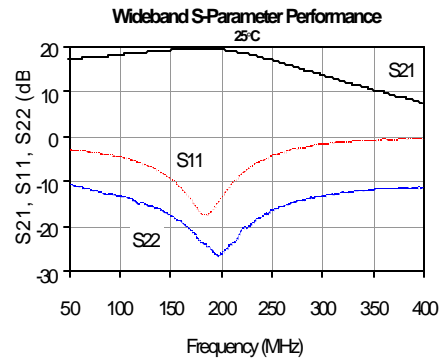
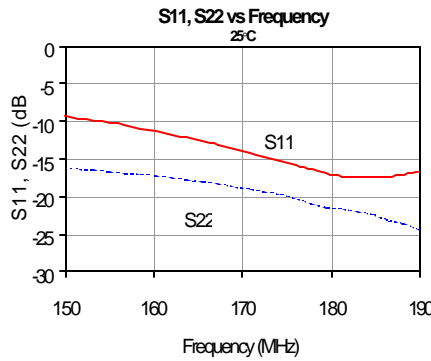
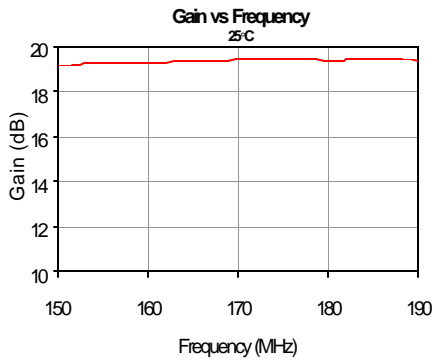
Typical Performance

Frequency	170 MHz
S21 - Gain	19 dB
S11	-18 dB
S22	-20 dB
Output P1dB	+21 dBm
Output IP3	+42 dBm
Noise Figure	1.8 dB
Bias	+5 V @ 150 mA



Notes:

1. The amplifier should be connected directly to a +5 V regulator; no dropping resistor is required.
2. If no DC signal is present at the input (pin 1), C1 can be removed. The gate is internally grounded in the amplifier.
3. R2 is used as a placeholder for a different application circuit. It can be removed from the circuit.
4. C2 (from the silkscreen) is not utilized in this application circuit.

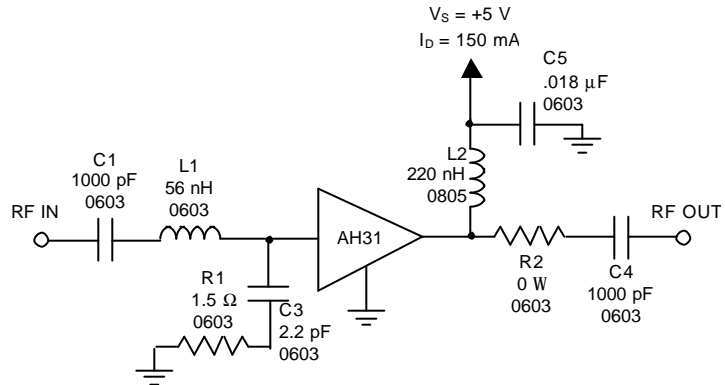




Application Circuit: 220 – 260 MHz (AH31-PCB240)

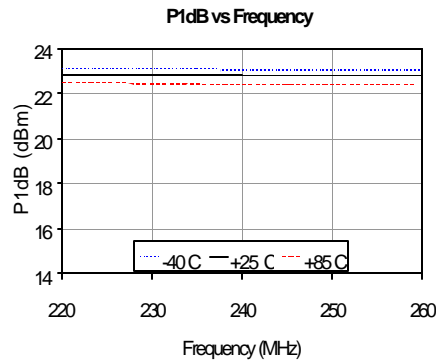
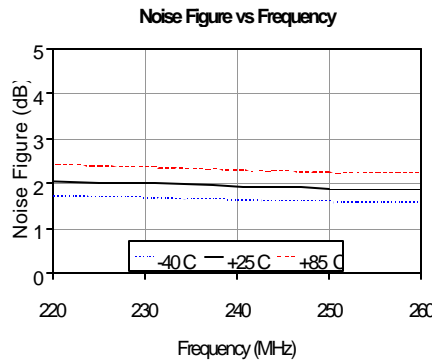
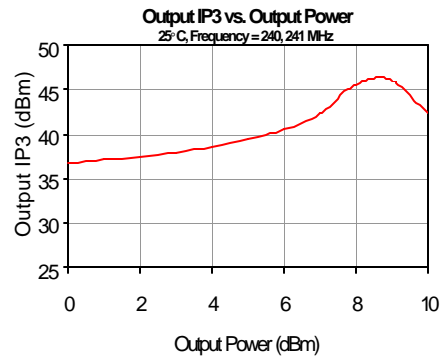
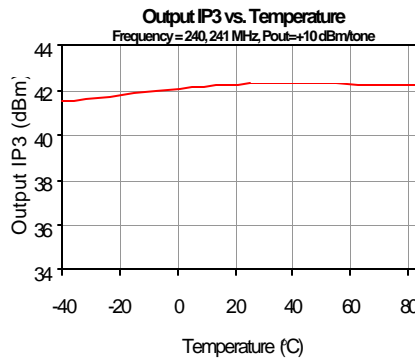
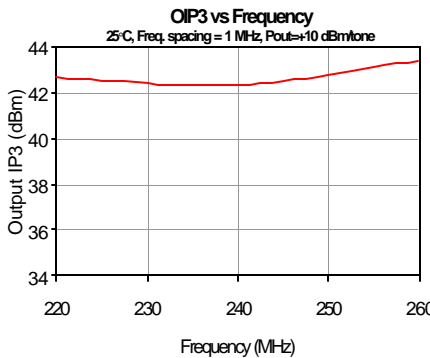
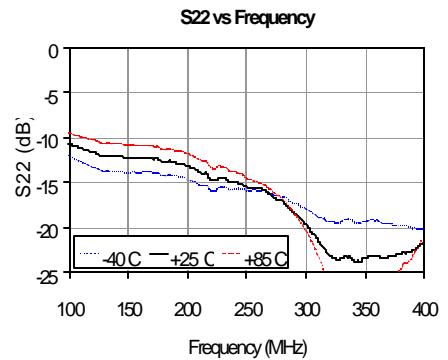
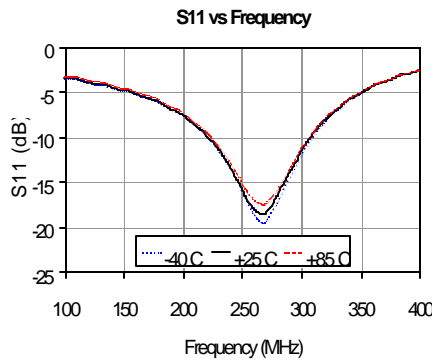
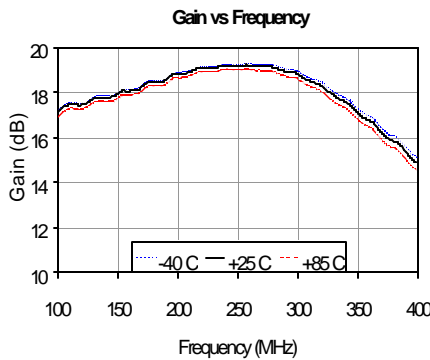
Typical Performance

Frequency	240 MHz
S21 - Gain	19 dB
S11	-15 dB
S22	-17 dB
Output P1dB	+22 dBm
Output IP3	+42 dBm
Noise Figure	1.8 dB
Bias	+5 V @ 150 mA



Notes:

1. The amplifier should be connected directly to a +5 V regulator; no dropping resistor is required.
2. If no DC signal is present at the input (pin 1), C1 can be removed. The gate is internally grounded in the amplifier.
3. R2 is used as a placeholder for a different application circuit. It can be removed from the circuit.
4. C2 (from the silkscreen) is not utilized in this application circuit.



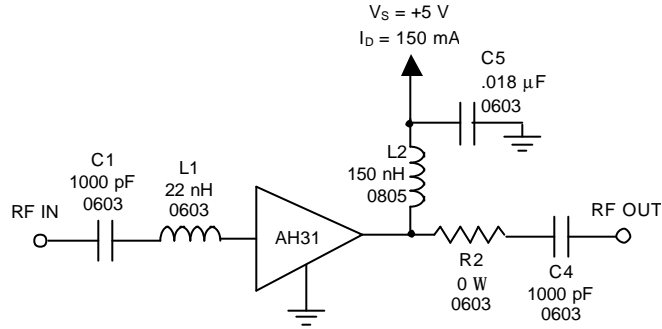
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Application Circuit: 450 – 550 MHz (AH31-PCB500)

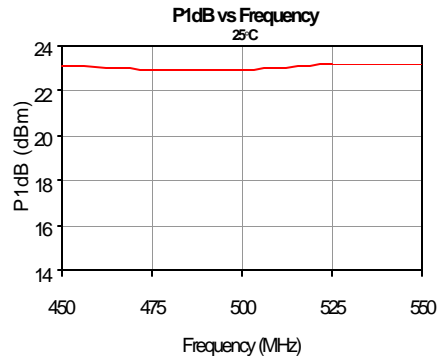
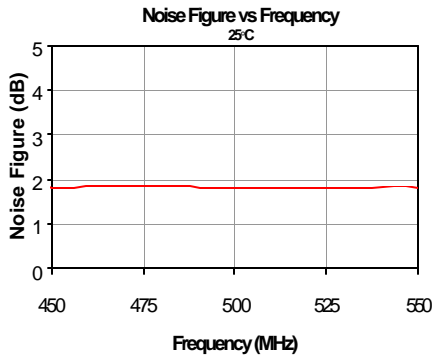
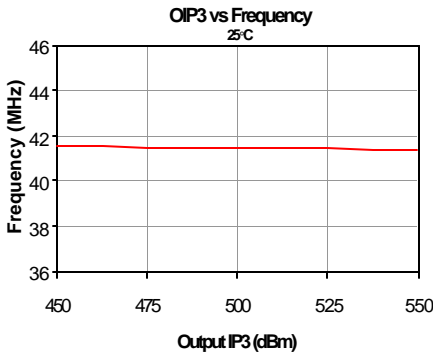
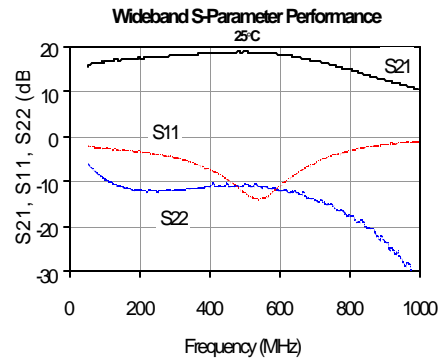
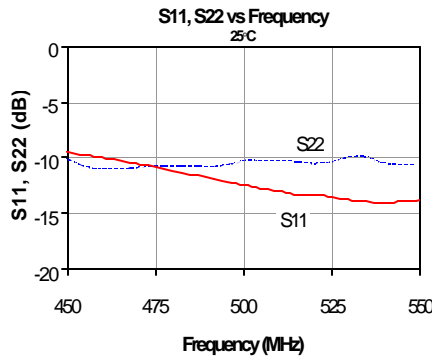
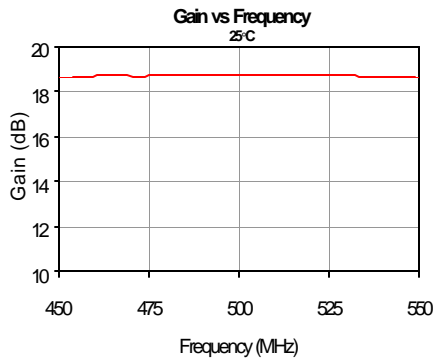
Typical Performance

Frequency	500 MHz
S21 - Gain	18 dB
S11	-15 dB
S22	-10 dB
Output P1dB	+22 dBm
Output IP3	+42 dBm
Noise Figure	1.7 dB
Bias	+5 V @ 150 mA



Notes:

1. The amplifier should be connected directly to a +5 V regulator; no dropping resistor is required.
2. If no DC signal is present at the input (pin 1), C1 can be removed. The gate is internally grounded in the amplifier.
3. R2 is used as a placeholder for a different application circuit. It can be removed from the circuit.
4. R1, C2, and C3 (from the silkscreen) are not utilized in this application circuit.

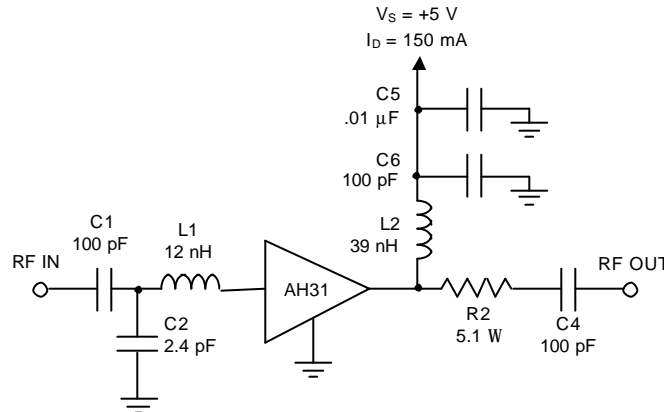




Reference Design: 870 – 960 MHz

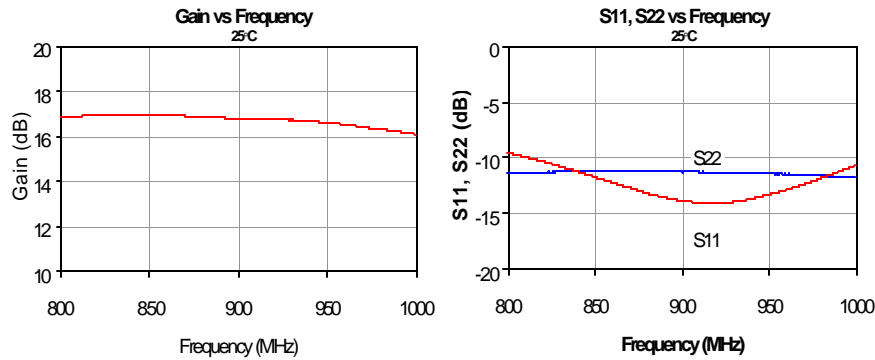
Typical Performance

Frequency	900 MHz
S21	16.8 dB
S11	-14 dB
S22	-11 dB
Output P1dB	+21 dBm
Output IP3	+41 dBm
Noise Figure	2.1 dB
Bias	5 V @ 150 mA



Notes:

1. The amplifier should be connected directly to a +5 V regulator; no dropping resistor is required.
2. If no DC signal is present at the input (pin 1), C1 can be removed. The gate is internally grounded in the amplifier.
3. All components are of size 0603.
4. **This is a reference design only. Sample evaluation boards are not readily available for this circuit. The actual implementation can be achieved by requesting an AH31 Evaluation board (any frequency) and replacing the passive components with the values given above.**



Typical Device Data

S-Parameters ($V_D = +5\text{ V}$, $I_D = 150\text{ mA}$, $T = 25^\circ\text{C}$, calibrated to device leads)

Freq (MHz)	S11 (dB)	S11 (ang)	S21 (dB)	S21 (ang)	S12 (dB)	S12 (ang)	S22 (dB)	S22 (ang)
50	-2.89	-5.15	16.14	175.42	-29.18	5.50	-11.16	-10.29
100	-2.89	-8.61	16.07	173.09	-29.05	8.21	-11.42	-11.71
200	-2.93	-16.91	15.99	167.64	-28.46	13.72	-11.47	-17.87
300	-2.96	-25.39	15.90	162.22	-27.82	17.52	-11.60	-25.22
400	-3.01	-33.42	15.78	156.27	-27.04	20.10	-11.73	-32.59
500	-3.10	-41.65	15.72	150.37	-26.35	22.46	-11.88	-40.41
600	-3.16	-49.82	15.54	144.69	-25.57	23.12	-12.01	-48.04
700	-3.23	-57.37	15.25	139.50	-24.79	22.98	-12.22	-55.71
800	-3.24	-65.10	15.14	134.31	-24.33	21.53	-12.37	-62.56
900	-3.30	-72.57	14.98	129.13	-23.74	19.94	-12.50	-69.95
1000	-3.38	-79.77	14.74	124.24	-23.15	18.03	-12.67	-77.38

