

## Product Features

- 50 – 2200 MHz
- +30 dBm P1dB
- +47 dBm Output IP3
- 17 dB Gain @ 900 MHz
- MTTF >100 Years
- Single Positive Supply
- Internally Matched
- Lead-free/RoHS-compliant 6x6mm QFN SMT package

## Applications

- Mobile Infrastructure
- CATV / DBS
- Optimal for VHF / UHF broadband applications
- Defense / Homeland Security

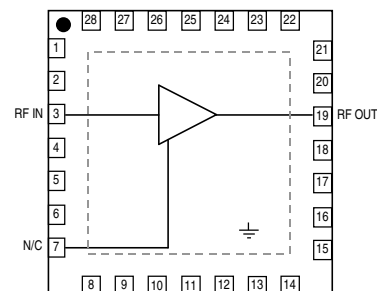
## Product Description

The AH202 is a 1-Watt driver amplifier that offers excellent dynamic range in a low-cost, lead-free/RoHS-compliant 6x6 mm 28-pin QFN surface-mount package. This device provides its optimum P1dB and OIP3 performance when biased at + 11 V; It can also be biased as low as +9 V for lower power applications.

The backside metalization provides excellent thermal dissipation while allowing visible evidence of solder reflow across the bottom of the package on a SMT board. Superior thermal design allows the product an MTTF of over 100 years at a mounting temperature of +85° C. All devices are 100% RF & DC tested.

The product is targeted for use as a driver amplifier for wireless infrastructure or CATV applications where high linearity and medium power is required.

## Functional Diagram



| Function             | Pin No.         |
|----------------------|-----------------|
| Input                | 3               |
| No Connect           | 7               |
| Output/Bias          | 19              |
| No Connect or Ground | All other pins  |
| Ground               | Backside Paddle |

## Specifications <sup>(1)</sup>

| Parameters                                          | Units | Min | Typ | Max  |
|-----------------------------------------------------|-------|-----|-----|------|
| Operational Bandwidth                               | MHz   | 50  |     | 2200 |
| Test Frequency                                      | MHz   |     | 800 |      |
| Gain                                                | dB    | 14  | 17  |      |
| Input Return Loss                                   | dB    |     | 20  |      |
| Output Return Loss                                  | dB    |     | 18  |      |
| Output P1dB                                         | dBm   | +29 | +30 |      |
| Output IP3 <sup>(2)</sup>                           | dBm   | +45 | +47 |      |
| Noise Figure                                        | dB    |     | 2.5 |      |
| IS-95 Channel Power <sup>(3)</sup><br>@ -45dBc ACPR | dBm   |     | +24 |      |
| Operating Current Range                             | mA    |     | 330 | 390  |
| Supply Voltage                                      | V     |     | +11 |      |

1. Test conditions unless otherwise noted: 25°C, Vdd = 11 V in a 50-Ω matched fixture.
2. 3OIP measured with two tones at an output power of +10 dBm/line separated by 10 MHz. The suppression on the largest IM3 product is used to calculate the 3OIP using a 2:1 rule.
3. IS-95, 9 Channels Forward, Pk/Avg Ratio = 11.5 dB at a .001% probability, ±885 kHz offset, 30 kHz bandwidth, Channel BW = 1.25 MHz.

## Typical Performance <sup>(4)</sup>

| Parameters                                          | Units | Typical         |
|-----------------------------------------------------|-------|-----------------|
| Frequency                                           | MHz   | 900 1900 2140   |
| Gain                                                | dB    | 17 15 15        |
| Input Return Loss                                   | dB    | 20 17 8         |
| Output Return Loss                                  | dB    | 18 10 13        |
| Output P1dB                                         | dBm   | +30 +29.7 +29.4 |
| Output IP3                                          | dBm   | +47 +46 +45.5   |
| Noise Figure                                        | dB    | 2.8 3.8 4.8     |
| IS-95 Channel Power <sup>(3)</sup><br>@ -45dBc ACPR | dBm   | +24 +23 -       |
| WCDMA Channel Power <sup>(5)</sup><br>@ -45dBc ACLR | dBm   | - - +20.5       |
| Supply Bias                                         |       | +11 V @ 330 mA  |

4. Data reflects performance of a typical AH202 in an application circuit including associated circuit board and passive component losses.
5. 3GPP W-CDMA, Test Model 1, +32 DPCH, Pk/Avg Ratio = 8.5 dB at a 0.01% probability, ±5 MHz offset, Integrated Channel BW = 3.84 MHz.

## Absolute Maximum Rating

| Parameter                    | Rating         |
|------------------------------|----------------|
| Operating Case Temperature   | -40 to +85 °C  |
| Storage Temperature          | -55 to +125 °C |
| DC Voltage                   | +13 V          |
| RF Input Power (continuous)  | +16 dBm        |
| Maximum Junction Temperature | +220 °C        |

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

## Ordering Information

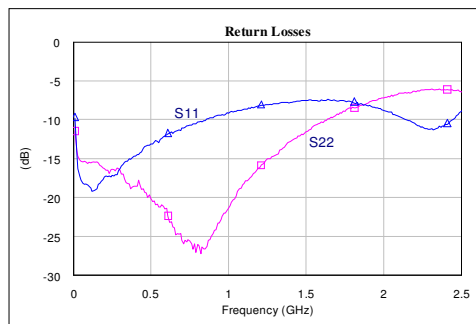
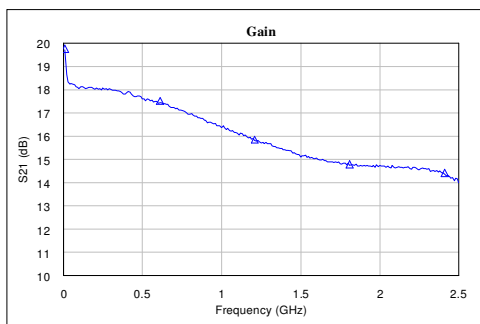
| Part No.      | Description                                                                 |
|---------------|-----------------------------------------------------------------------------|
| AH202-F       | 1W High Linearity Amplifier<br>(lead-free/RoHS-compliant 6x6mm QFN package) |
| AH202-PCB900  | 900 MHz Evaluation Board                                                    |
| AH202-PCB1900 | 1900 MHz Evaluation Board                                                   |
| AH202-PCB2140 | 2140 MHz Evaluation Board                                                   |

Specifications and information are subject to change without notice

## Typical Device Data

S-parameters ( $V_{DS} = +11\text{ V}$ ,  $I_{DS} = 330\text{mA}$ , unmatched device in a  $50\ \Omega$  system).

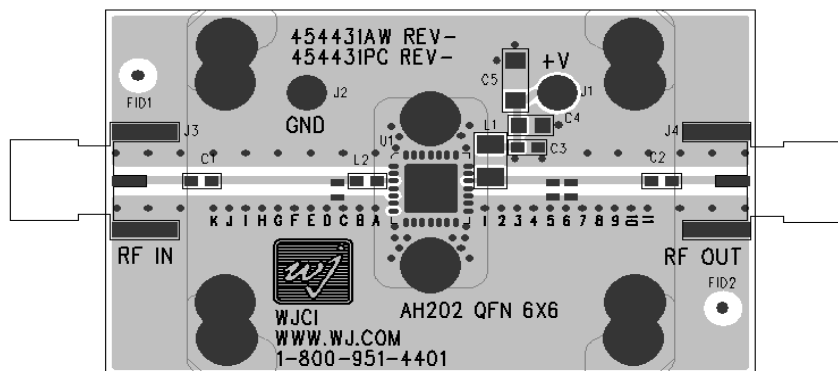
- Measurements are shown for an unmatched packaged device with the data being de-embedded to the device leads.



S-Parameters ( $V_{DS} = +11.0\text{V}$ ,  $I_{DS} = 330\text{mA}$ ,  $T = +25^\circ\text{C}$ , unmatched device in a  $50\ \Omega$  system)

| Freq (MHz) | S11 (dB) | S11 (ang) | S21 (dB) | S21 (ang) | S12 (dB) | S12 (ang) | S22 (dB) | S22 (ang) |
|------------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
| 50         | -17.78   | -137.86   | 18.26    | 169.32    | -21.43   | 1.41      | -15.33   | -170.64   |
| 100        | -18.60   | -153.83   | 18.06    | 166.20    | -21.34   | -4.54     | -15.51   | 177.37    |
| 200        | -17.34   | -150.80   | 18.03    | 156.86    | -21.46   | -12.16    | -16.27   | 161.24    |
| 400        | -14.70   | -149.17   | 17.87    | 135.75    | -21.84   | -25.03    | -18.57   | 135.96    |
| 600        | -11.92   | -159.61   | 17.43    | 115.76    | -22.34   | -37.49    | -21.38   | 93.89     |
| 800        | -10.29   | -171.08   | 16.93    | 96.20     | -22.96   | -48.84    | -26.07   | 25.81     |
| 1000       | -9.20    | 174.71    | 16.36    | 77.49     | -23.72   | -61.29    | -21.37   | -47.34    |
| 1200       | -8.23    | 160.52    | 15.90    | 58.22     | -24.54   | -73.36    | -16.16   | -78.06    |
| 1400       | -7.74    | 145.06    | 15.43    | 40.52     | -25.32   | -85.56    | -12.76   | -98.55    |
| 1600       | -7.43    | 127.89    | 15.04    | 23.04     | -26.07   | -99.09    | -10.27   | -114.42   |
| 1800       | -7.73    | 108.79    | 14.82    | 4.23      | -26.69   | -115.15   | -8.39    | -129.46   |
| 2000       | -8.76    | 84.28     | 14.72    | -15.48    | -26.94   | -132.95   | -7.17    | -144.14   |
| 2200       | -10.40   | 43.69     | 14.59    | -38.77    | -26.60   | -155.57   | -6.37    | -158.61   |
| 2400       | -10.57   | -24.74    | 14.42    | -65.43    | -25.80   | 176.52    | -6.14    | -172.06   |
| 2600       | -6.72    | -90.87    | 13.29    | -97.06    | -25.02   | 143.13    | -6.69    | 176.96    |
| 2800       | -3.60    | -136.82   | 10.89    | -128.44   | -24.82   | 111.82    | -7.11    | 173.14    |
| 3000       | -1.91    | -167.99   | 7.61     | -154.46   | -25.13   | 87.68     | -6.73    | 174.58    |

## Application Circuit PC Board Layout



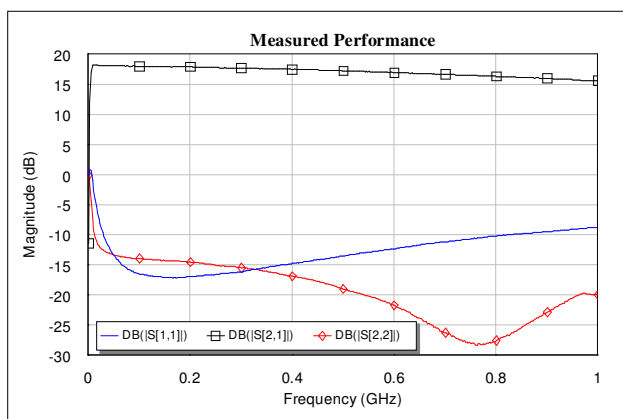
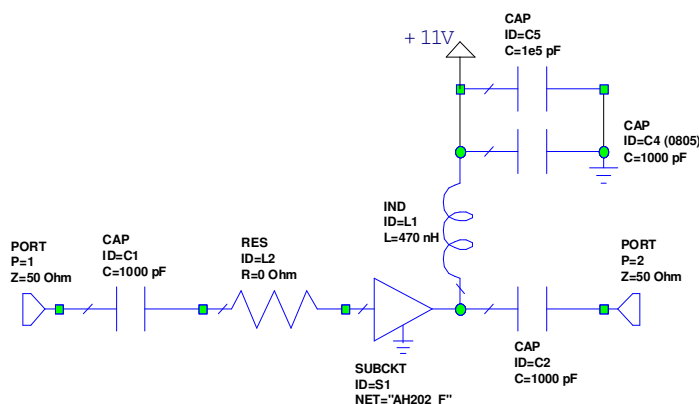
Circuit Board Material: .014" Getek ( $\epsilon_r=4.2$ ), four layer, 1 oz copper  
Microstrip line details: width = .026", spacing = .026"

Specifications and information are subject to change without notice

## Reference Design: 50-800 MHz

The AH202 is suitable for applications between 50 – 800 MHz without any requirements for input or output matching. Only bypass and blocking capacitors and an RF bias choke are needed for operation. A user can simply request an AH202-PCB900 Evaluation Board and replace components C1, C2, C3, C6, L1, and L2 to the values shown below to evaluate the device.

| Frequency                                      | MHz | 50             | 200  | 400  | 600   | 800   |
|------------------------------------------------|-----|----------------|------|------|-------|-------|
| S21 – Gain                                     | dB  | 18             | 17.9 | 17.5 | 17.0  | 16.3  |
| S11 – Input Return Loss                        | dB  | -13            | -17  | -15  | -12.4 | -10.3 |
| S22 – Output Return Loss                       | dB  | -13            | -15  | -17  | -22   | -28   |
| Output P1dB                                    | dBm | +30            |      |      |       |       |
| Output IP3<br>(+10 dBm / tone, 10 MHz spacing) | dBm | +47            |      |      |       |       |
| Supply Bias                                    | dB  | +11 V @ 330 mA |      |      |       |       |



### Notes:

- R=0  $\Omega$  (at designator L2) is used as a place holder for a different application circuit. It can be removed from the circuit without any effect to the performance.
- The microstrip line is weakly co-planar. Ground planes around it are not necessary for operation of the AH202.
- Adequate heat sinking is required for the device. Further mounting instructions are shown in the AH202 datasheet.
- The RF choke should be a wirewound ceramic type to insure sufficient current carrying capacity. Coilcraft's 1008 CS series is recommended (part #1008CS-471X\_B\_).



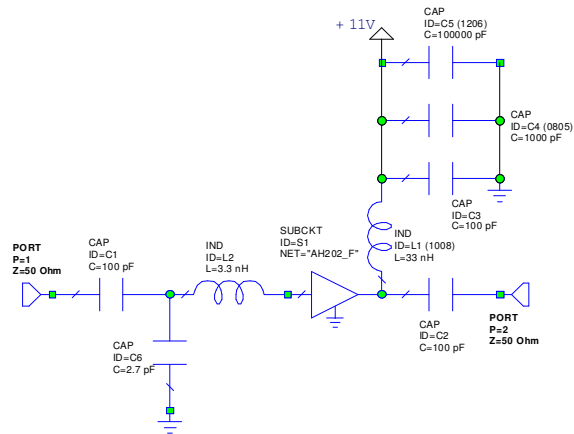
# AH202

## 1W High Linearity Amplifier

### Application Circuit: 900 MHz (AH202-PCB900)

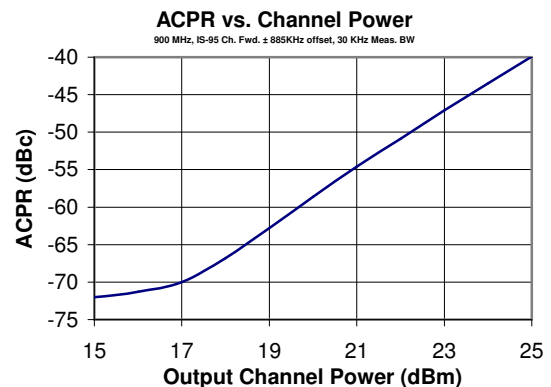
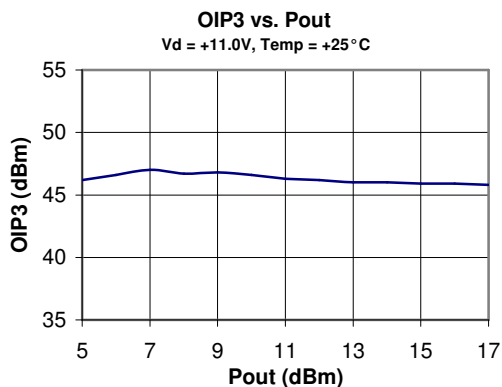
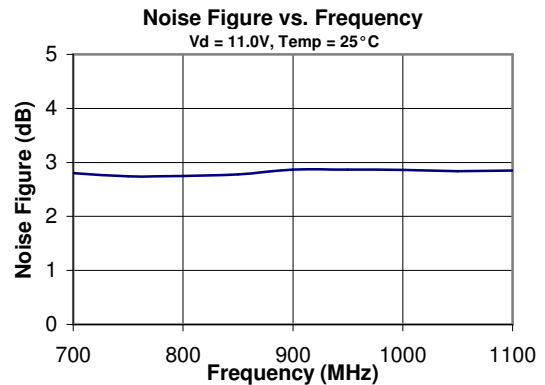
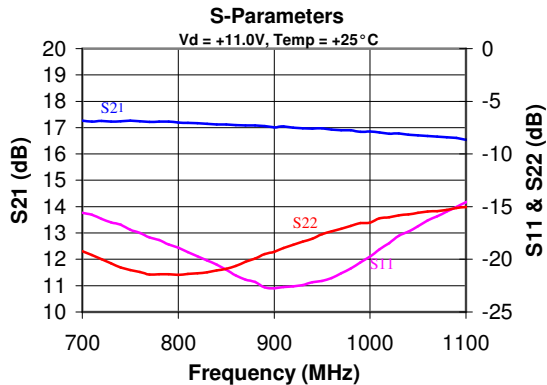
#### Typical RF Performance at 25°C

| Frequency                          | 900 MHz  |
|------------------------------------|----------|
| S21 - Gain                         | 17 dB    |
| S11                                | - 20 dB  |
| S22                                | - 18 dB  |
| Output P1dB                        | + 30 dBm |
| Output IP3                         | + 47 dBm |
| IS-95A Ch. Power<br>@ -45 dBc ACPR | + 24 dBm |
| Noise Figure                       | 2.8 dB   |
| Supply Voltage                     | +11 V    |
| Supply Current                     | 330 mA   |



#### Notes:

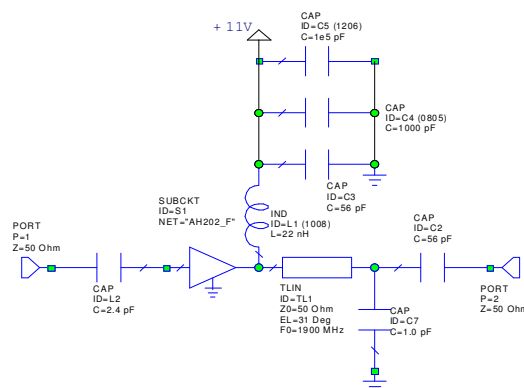
1. The amplifier should be connected directly to a +11 V regulator; no dropping resistor is required.
2. If no DC signal is present at the input (pin 1), C1 can be removed. The gate (input pin) is internally grounded in the amplifier.
3. Component sizes are 0603 unless otherwise noted. RF choke L1 should be wirewound ceramic type to insure sufficient current carrying capacity. Coilcraft's 1008 CS series (part # 1008CS-330X\_B) is recommended.
4. C6 is located at silk screen marker "C" on the WJ evaluation board.



## Application Circuit: 1900 MHz (AH202-PCB1900)

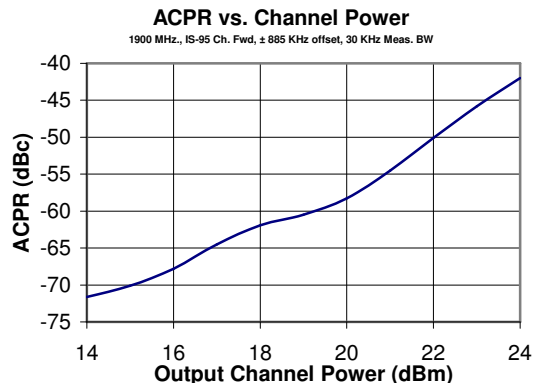
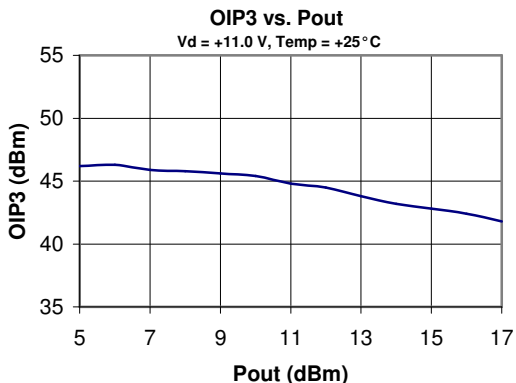
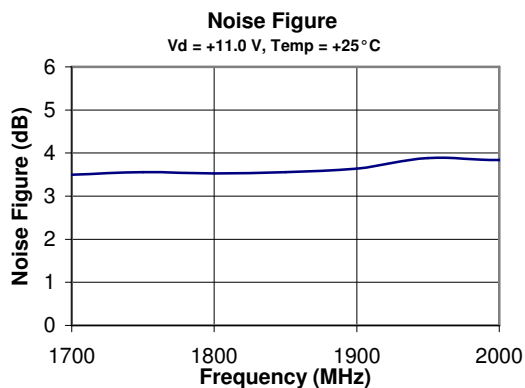
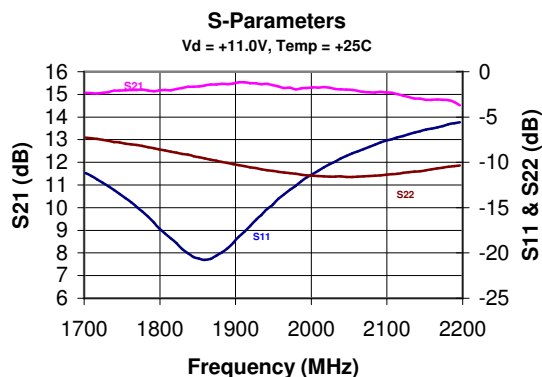
### Typical RF Performance at 25°C

| Frequency                          | 1900 MHz  |
|------------------------------------|-----------|
| S21 - Gain                         | 15 dB     |
| S11                                | -17 dB    |
| S22                                | -10 dB    |
| Output P1dB                        | +29.7 dBm |
| Output IP3                         | +46 dBm   |
| IS-95A Ch. Power<br>@ -45 dBc ACPR | +23 dBm   |
| Noise Figure                       | 3.8 dB    |
| Supply Voltage                     | +11 V     |
| Supply Current                     | 330 mA    |



#### Notes:

1. The amplifier should be connected directly to a +11 V regulator; no dropping resistor is required.
2. Component sizes are 0603 unless otherwise noted. RF choke L1 should be wirewound ceramic type to insure sufficient current carrying capacity. Coilcraft's 1008 CS series (part # 1008CS-220X\_B) is recommended.
3. C8 is located at silk screen marker "7" on the WJ evaluation board.

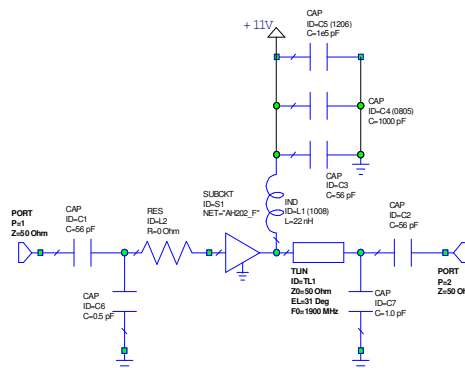


## Reference Design: 1900 MHz

using the AH202 in the previously recommended circuit configuration with the AH201 (AH201-PCB1900)

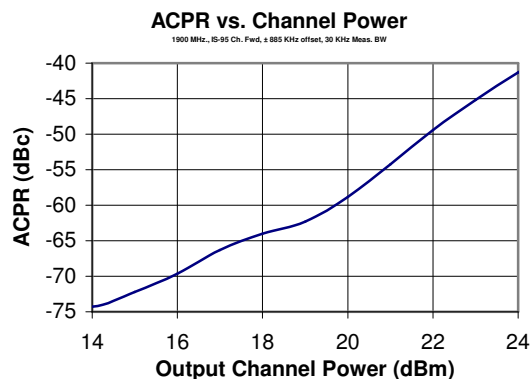
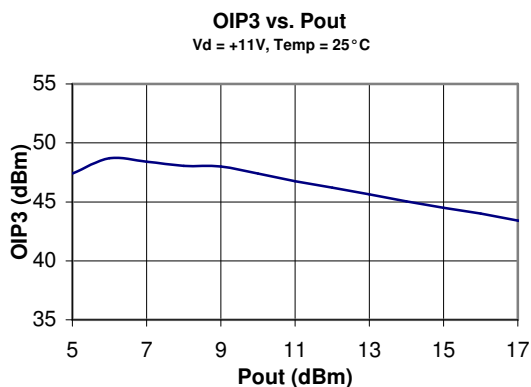
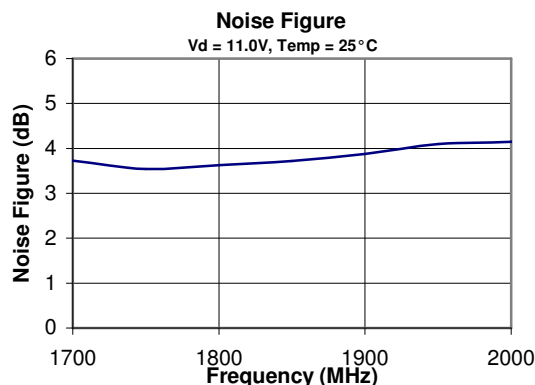
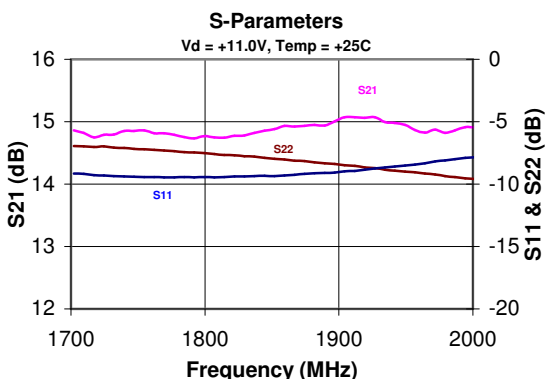
### Typical RF Performance at 25°C

| Frequency                          | 1900 MHz   |
|------------------------------------|------------|
| S21 - Gain                         | 15 dB      |
| S11                                | - 8 dB     |
| S22                                | - 8 dB     |
| Output P1dB                        | + 29.7 dBm |
| Output IP3                         | + 46 dBm   |
| IS-95A Ch. Power<br>@ -45 dBc ACPR | + 23 dBm   |
| Noise Figure                       | 3.8 dB     |
| Supply Voltage                     | +11 V      |
| Supply Current                     | 330 mA     |



#### Notes:

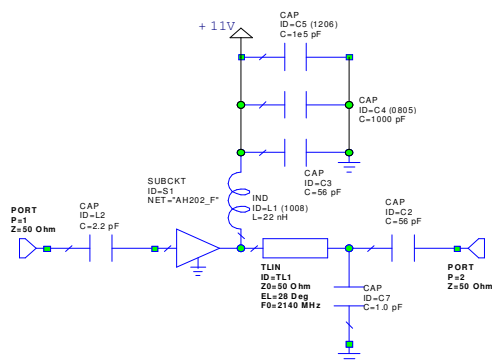
1. The amplifier should be connected directly to a +11 V regulator; no dropping resistor is required.
2. If no DC signal is present at the input (pin 1), C1 can be removed. The gate (input pin) is internally grounded in the amplifier.
3. Component sizes are 0603 unless otherwise noted. RF choke L1 should be wirewound ceramic type to insure sufficient current carrying capacity. Coilcraft's 1008 CS series (part # 1008CS-220X\_B) is recommended.
4. R = 0  $\Omega$  at designator L2 is used as a place holder for a different application circuit. It can be removed from the circuit without any effect to the performance.
5. C6 is located at silk screen marker "C" and C8 is located between silk screen markers "6" and "7" on the WJ evaluation board.



## Application Circuit: 2140 MHz (AH202-PCB2140)

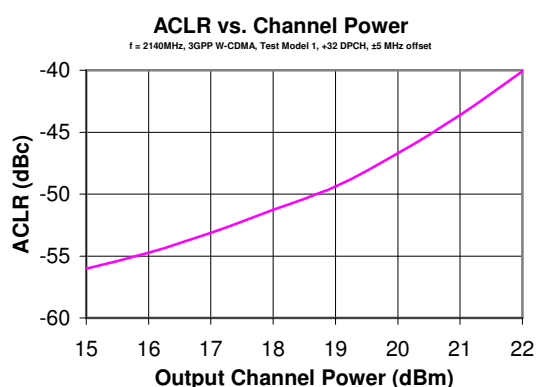
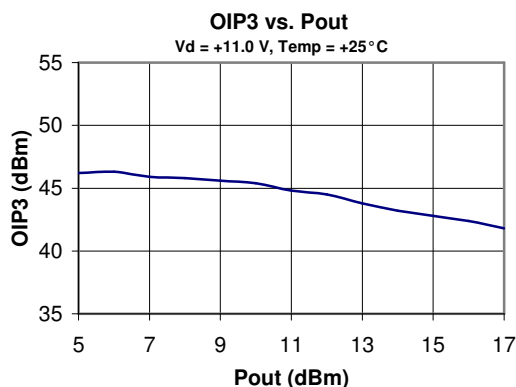
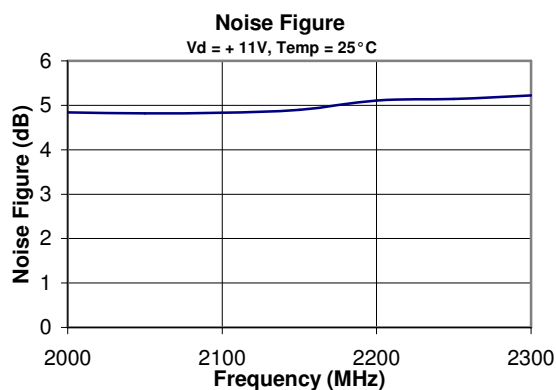
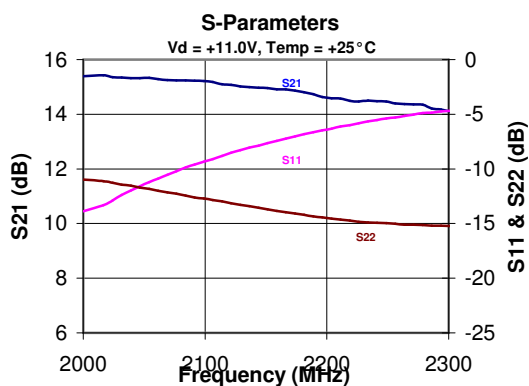
### Typical RF Performance at 25°C

| Frequency                          | 2140 MHz   |
|------------------------------------|------------|
| S21 - Gain                         | 15 dB      |
| S11                                | - 8 dB     |
| S22                                | - 13 dB    |
| Output P1dB                        | + 29.4 dBm |
| Output IP3                         | + 45.5 dBm |
| W-CDMA Ch. Power<br>@ -45 dBc ACLR | + 20.5 dBm |
| Noise Figure                       | 4.8 dB     |
| Supply Voltage                     | +11 V      |
| Supply Current                     | 330 mA     |



#### Notes:

1. The amplifier should be connected directly to a +11 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 (input pin) is internally grounded in the amplifier.
3. Component sizes are 0603 unless otherwise noted. RF choke L1 should be wirewound ceramic type to insure sufficient current carrying capacity. Coilcraft's 1008 CS series (part # 1008CS-220X\_B) is recommended.
4. C7 is located at silk screen marker "6" on the WJ evaluation board.

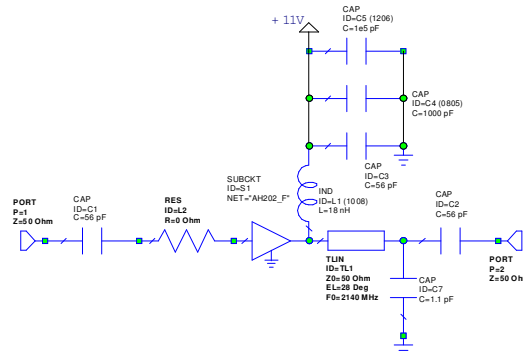


## Reference Design: 2140 MHz

using the AH202 in the previously recommended circuit configuration with the AH201 (AH201-PCB2140)

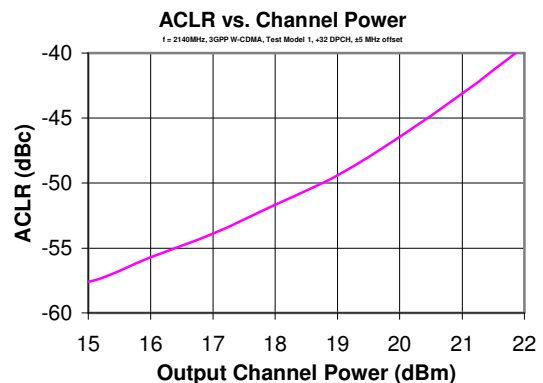
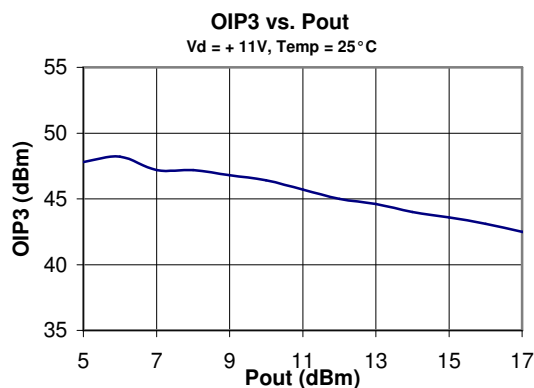
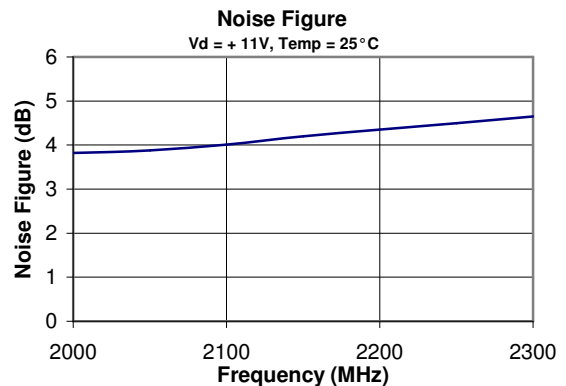
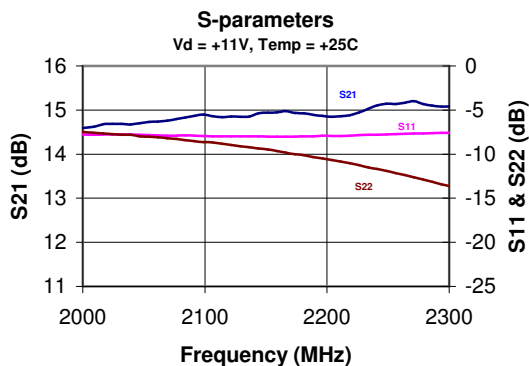
### Typical RF Performance at 25°C

| Frequency                          | 2140 MHz   |
|------------------------------------|------------|
| S21 - Gain                         | 14.6 dB    |
| S11                                | -7 dB      |
| S22                                | -7 dB      |
| Output P1dB                        | + 29.4 dBm |
| Output IP3                         | + 45.5 dBm |
| W-CDMA Ch. Power<br>@ -45 dBc ACLR | + 20.5 dBm |
| Noise Figure                       | 4.2 dB     |
| Supply Voltage                     | +11 V      |
| Supply Current                     | 330 mA     |



#### Notes:

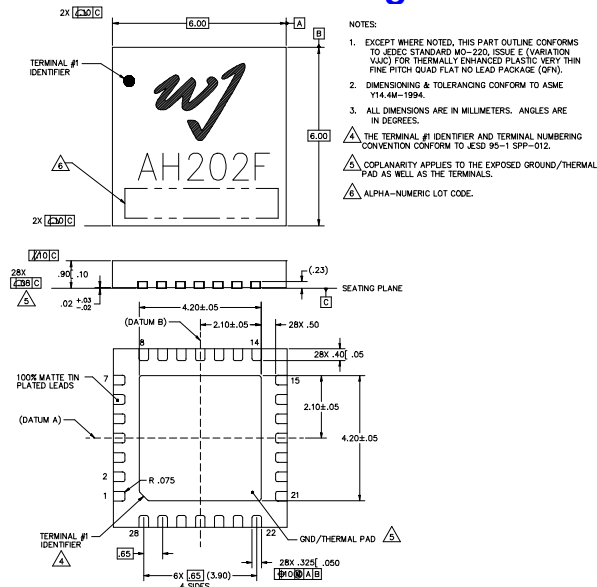
1. The amplifier should be connected directly to a +11 V regulator; no dropping resistor is required.
2. If no DC signal is present at the input (pin 1), C1 can be removed. The gate (input pin) is internally grounded in the amplifier.
3. Component sizes are 0603 unless otherwise noted. RF choke L1 should be wirewound ceramic type to insure sufficient current carrying capacity. Coilcraft's 1008 CS series (part # 1008CS-180X\_B) is recommended.
4. R = 0  $\Omega$  at designator L2 is used as a place holder for a different application circuit. It can be removed from the circuit without any effect to the performance.
5. C7 is located between silk screen markers "5" and "6" on the WJ evaluation board.



## Mechanical Information

This package is lead-free/RoHS-compliant. It is compatible with both lead-free (maximum 260°C reflow temperature) and leaded (maximum 245°C reflow temperature) soldering processes. The plating material on the pins is annealed matte tin over copper.

## Outline Drawing



## Product Marking

The component will be lasermarked with a "AH202F" product label with an alphanumeric lot code on the top surface of the package.

Tape and reel specifications for this part will be located on the website in the "Application Notes" section.

## ESD / MSL Information



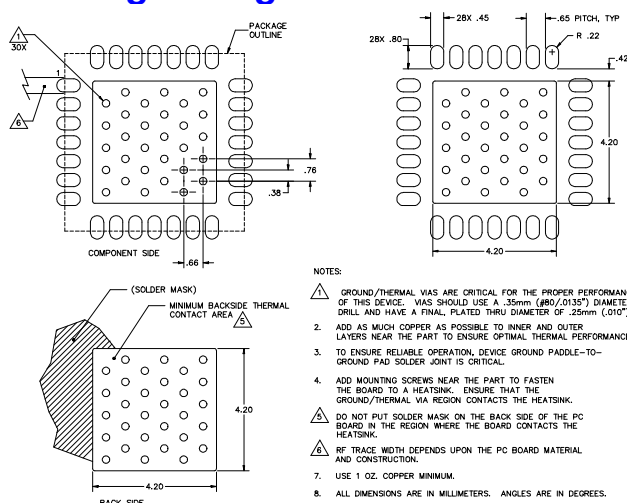
**Caution!** ESD sensitive device.

ESD Rating: Class 1B  
Value: Passes between 500 and 1000V  
Test: Human Body Model (HBM)  
Standard: JEDEC Standard JESD22-A114

ESD Rating: Class III  
Value: Passes between 500 and 1000V  
Test: Charged Device Model (CDM)  
Standard: JEDEC Standard JESD22-C101

MSL Rating: Level 2 at +260 °C convection reflow  
Standard: JEDEC Standard J-STD-020

## Mounting Configuration / Land Pattern



## Functional Pin Layout

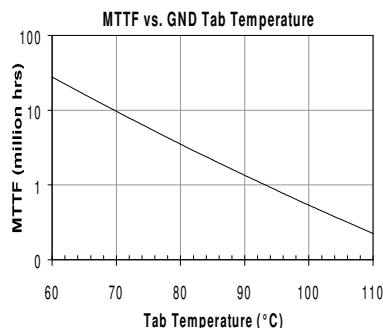
| Pin | FUNCTION   | Pin | FUNCTION   |
|-----|------------|-----|------------|
| 1   | GND or N/C | 15  | GND or N/C |
| 2   | GND or N/C | 16  | GND or N/C |
| 3   | RF Input   | 17  | GND or N/C |
| 4   | GND or N/C | 18  | GND or N/C |
| 5   | GND or N/C | 19  | RF Output  |
| 6   | GND or N/C | 20  | GND or N/C |
| 7   | No Connect | 21  | GND or N/C |
| 8   | GND or N/C | 22  | GND or N/C |
| 9   | GND or N/C | 23  | GND or N/C |
| 10  | GND or N/C | 24  | GND or N/C |
| 11  | GND or N/C | 25  | GND or N/C |
| 12  | GND or N/C | 26  | GND or N/C |
| 13  | GND or N/C | 27  | GND or N/C |
| 14  | GND or N/C | 28  | GND or N/C |

## Thermal Specifications

| Parameter                                           | Rating        |
|-----------------------------------------------------|---------------|
| Operating Case Temperature                          | -40 to +85 °C |
| Thermal Resistance, R <sub>th</sub> <sup>(1)</sup>  | 17.5 °C / W   |
| Junction Temperature, T <sub>j</sub> <sup>(2)</sup> | 152 °C        |

Notes:

- The amplifier can be operated at 105 °C case temperature for up to 1000 hours over its lifetime with minimal degradation in performance and will not degrade device operation at the recommended maximum 85 °C case temperature for the rest of its lifetime.
- The thermal resistance is referenced from the hottest part of the junction to the backside copper paddle.
- This corresponds to the typical biasing condition of +11V, 350 mA at an 85° C case temperature. A minimum MTTF of 1 million hours is achieved for junction temperatures below 160° C.



Backside paddle is RF and DC ground. Pin 7 is required to be not connected or grounded for the AH202 to be functional.