



### Product Features

- 250-3000 MHz
- +41 dBm Output IP3
- 2.7 dB Noise Figure
- 13.5 dB Gain
- +21 dBm P1dB
- MTBF >100 Years
- SOT-89 SMT Package
- Single +5 V Supply



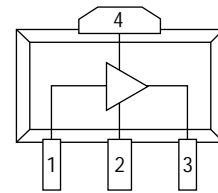
Actual Size

### Product Description

The AH1 is a high dynamic range amplifier packaged in a low cost SOT-89 surface mount package. The combination of low noise figure and high output IP3 at the same bias point makes it ideal for receiver and transmitter applications. The AH1 achieves +41 dBm OIP3 at a mounting temperature of 85°C with an associated MTBF of >100 years<sup>5</sup>. All devices are 100% RF and DC tested.

The product is targeted for applications where high linearity is required.

### Functional Diagram



| Function    | Pin No. |
|-------------|---------|
| Input       | 1       |
| Ground      | 2       |
| Output Bias | 3       |
| Ground      | 4       |

### Specifications

| Parameter                            | Units | Min. | Typical  | Max. |
|--------------------------------------|-------|------|----------|------|
| Frequency Range                      | MHz   |      | 250-3000 |      |
| S21 - Gain                           | dB    | 12.4 | 13.5     |      |
| S11 - Input Return Loss <sup>3</sup> | dB    |      | -8       |      |
| S22 - Output Return Loss             | dB    |      | -15      |      |
| Output IP3 <sup>2</sup>              | dBm   | +37  | +41      |      |
| Output P1dB                          | dBm   |      | +21      |      |
| Noise Figure                         | dB    |      | 2.7      |      |
| Operating Current Range              | mA    | 120  | 150      | 180  |
| Supply Voltage                       | V     |      | 5        |      |

Test conditions unless otherwise noted.

1. T = 25°C, Vdd = 5.0, Freq = 800 MHz, 50 ohm system.

2. OIP3 measured with two tones at an output power of 5 dBm/tone separated by 10 MHz. The suppression on the largest IM3 product is used to calculate the OIP3 using a 2:1 slope rule.

3. S21 and S11 can be improved in the band of interest using a single input shunt microstrip to ground.

4. Degradation of OIP3 occurs at low temperatures. Minimum typical OIP3 at -40°C is +35dBm.

5. MTBF calculated with channel temperature at 155°C.

### Absolute Maximum Ratings

| Parameter                   | Rating         |
|-----------------------------|----------------|
| Operating Case Temperature  | -40 to +85°C   |
| Storage Temperature         | -55 to +125 °C |
| Supply Voltage              | +6.0 V         |
| Input RF Power (continuous) | +10 dBm        |

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

### Typical Parameters

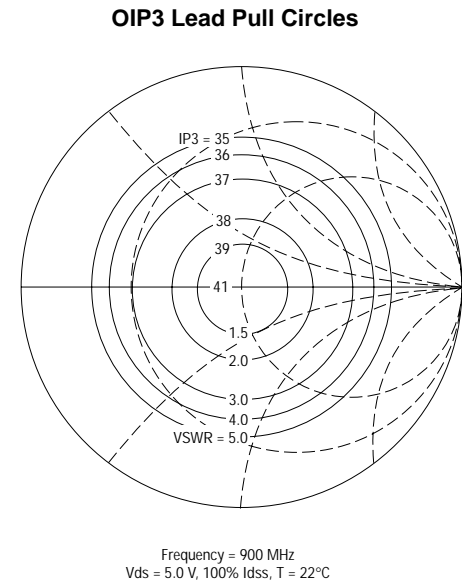
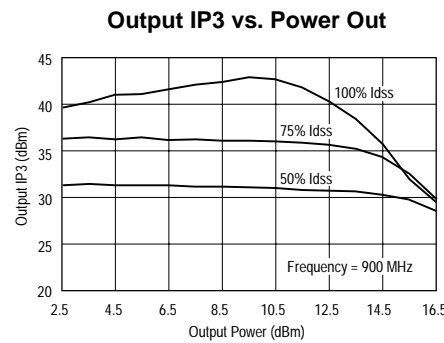
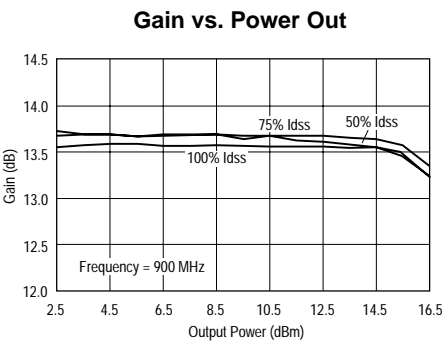
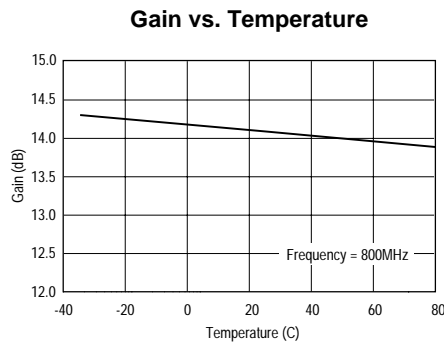
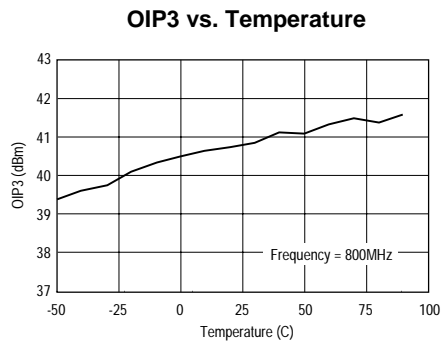
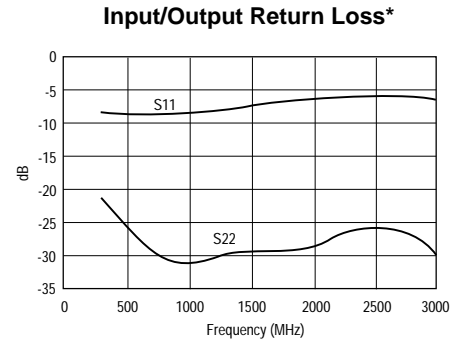
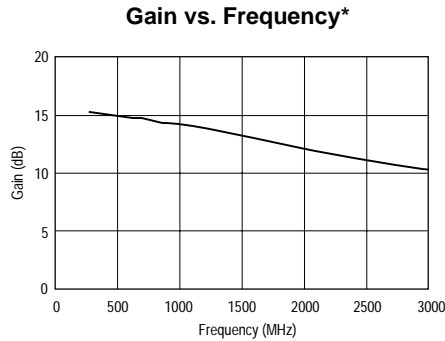
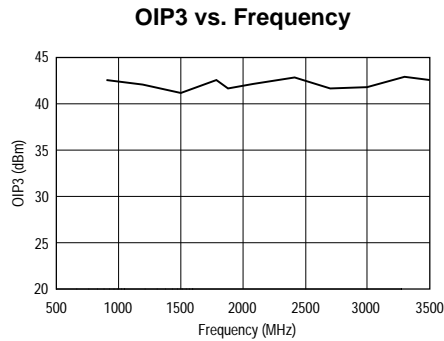
| Parameter    | Units | Typical |       |
|--------------|-------|---------|-------|
| Frequency    | MHz   | 900     | 1900  |
| S21          | dB    | 14.3    | 12.6  |
| S11          | dB    | -16.5   | -14.5 |
| S22          | dB    | -13.9   | -11.7 |
| Output IP3   | dBm   | +41.0   | +41.0 |
| Output P1dB  | dBm   | +21.2   | +21.0 |
| Noise Figure | dB    | 2.5     | 2.5   |

Typical parameters reflect performance in an application circuit.

### Ordering Information

| Part No. | Description  |
|----------|--|
| AH1      | High Dynamic Range Amplifier<br>(Available in tape and reel) |
| AH1-PCB  | Fully Assembled Application Circuit                          |

## Performance Charts (V<sub>ds</sub> = 5.0 V, I<sub>ds</sub> = 150 mA, T = 22°C, unmatched device in a 50 ohm system)

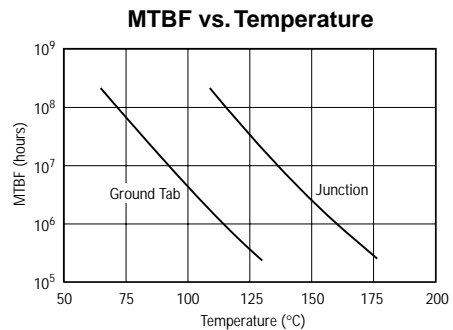


## Thermal Specifications

| Parameter                                  | Rating       |
|--|--------------|
| Operating Case Temperature                 | -40 to +85°C |
| Thermal Resistance (Maximum)               | 59°C/W       |
| Junction Temperature (Recommended Maximum) | +155°C       |

### Notes:

1. Thermal Resistance determined at Maximum Tab Temperature and Maximum Power Dissipation.
2. Recommended Maximum Junction Temperature insures a MTBF of 1 million hours.
3. Refer to WJ Application Note "AH1 Temperature Effects on Reliability" for more information.

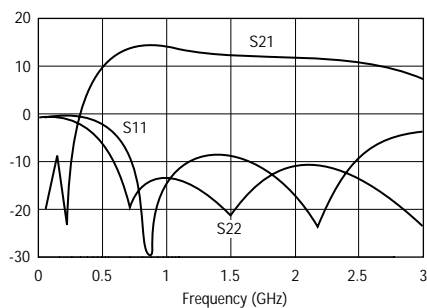


## Application Circuit: 0.9-2.5 GHz

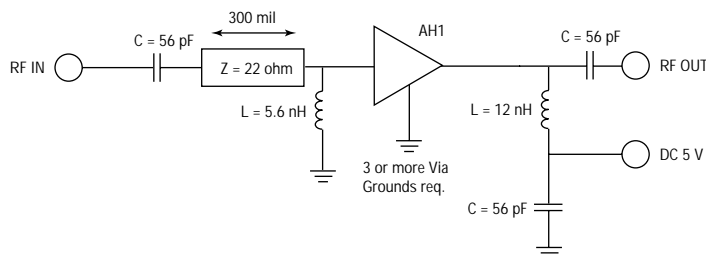
### Typical Performance

| Frequency     | 0.9 GHz               | 1.9 GHz  | 2.4 GHz  |
|---------------|-----------------------|----------|----------|
| Magnitude S21 | 14.2 dB               | 12.4 dB  | 11.7 dB  |
| Magnitude S11 | -18.5 dB              | -12.9 dB | -13.6 dB |
| Magnitude S22 | -14.7 dB              | -12.6 dB | -11.0 dB |
| OIP3          | 39.0 dBm              | 41.0 dBm | 40 dBm   |
| Noise Figure  | 2.7 dB                | 3.4 dB   | 3.7 dB   |
| Bias          | Vd = 5 V, Id = 170 mA |          |          |

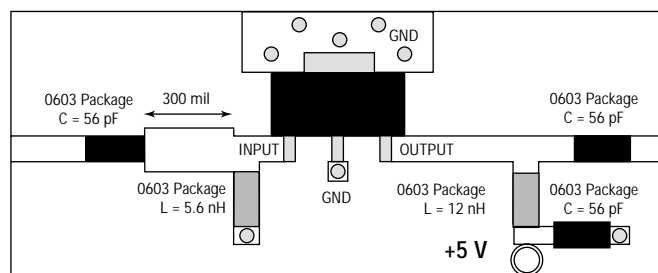
### S-Parameters



### Schematic



### FR4 Board Layout (T = 14 Mil)

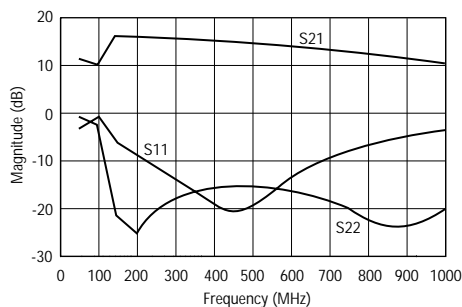


## Application Circuit: 250-650 MHz

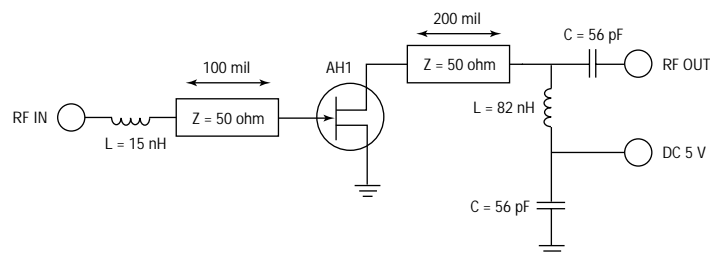
### Typical Specifications

| Frequency     | 250 MHz               | 650 MHz  |
|---------------|-----------------------|----------|
| Magnitude S21 | 15.4 dB               | 14.2 dB  |
| Magnitude S11 | -11.0 dB              | -11.5 dB |
| Magnitude S22 | -19.9 dB              | -14.0 dB |
| OIP3          | 40.0 dBm              | 40.0 dBm |
| Noise Figure  | 2.8 dB                | 2.8 dB   |
| Bias          | Vd = 5 V, Id = 160 mA |          |

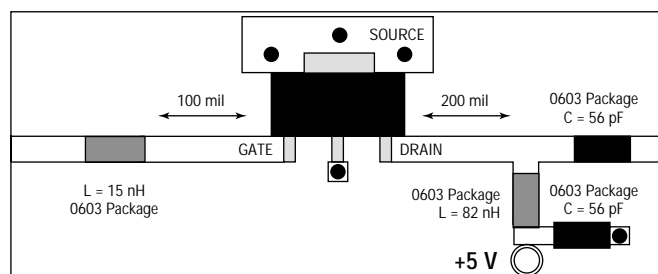
### S-Parameters



### Schematic



### FR4 Board Layout (T = 14 Mil)

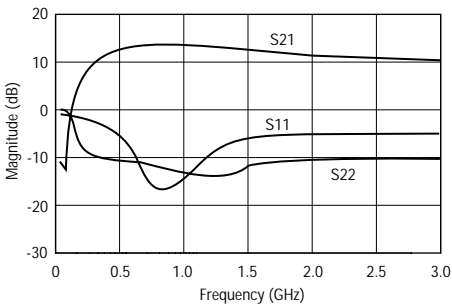


## Application Circuit: 900 MHz

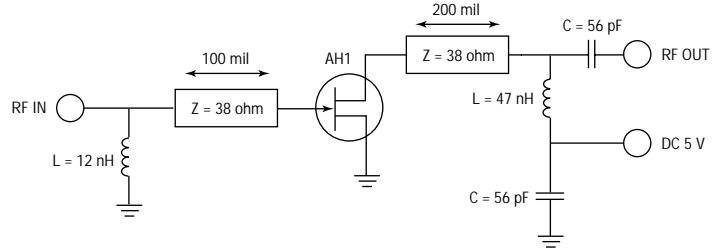
### Typical Specifications

|               |                       |
|---------------|-----------------------|
| Frequency     | 900 MHz               |
| Magnitude S21 | 14.3 dB               |
| Magnitude S11 | -16.5 dB              |
| Magnitude S22 | -13.9 dB              |
| OIP3          | 41.0 dBm              |
| Noise Figure  | 2.5 dB                |
| Bias          | Vd = 5 V, Id = 170 mA |

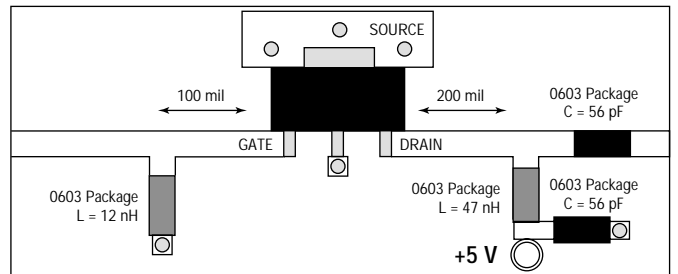
### S-Parameters



### Schematic



### FR4 Board Layout (T = 14 Mil)

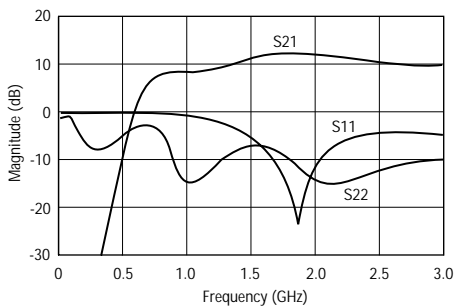


## Application Circuit: 1900 MHz

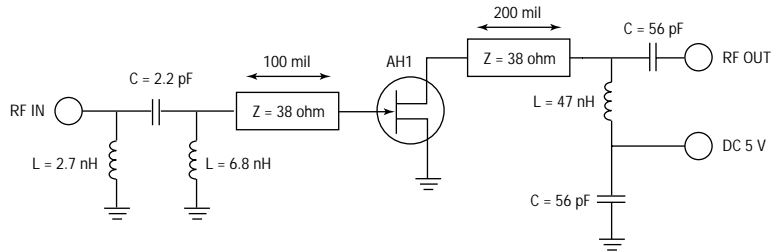
### Typical Specifications

|               |                        |
|---------------|------------------------|
| Frequency     | 1900 MHz               |
| Magnitude S21 | 12.6 dB                |
| Magnitude S11 | -14.5 dB               |
| Magnitude S22 | -11.7 dB               |
| OIP3          | 41.0 dBm               |
| Noise Figure  | 2.5 dB                 |
| Bias          | Vds = 5 V, Id = 170 mA |

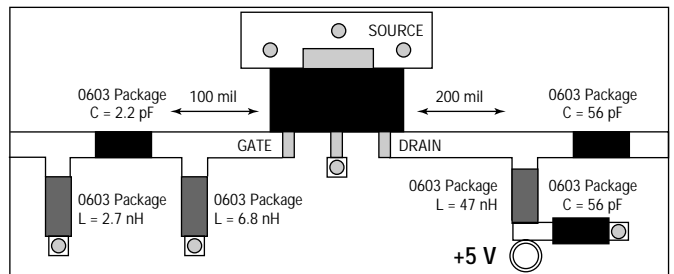
### S-Parameters



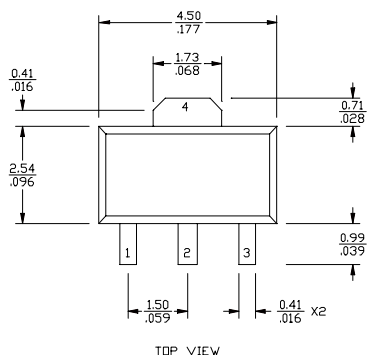
### Schematic



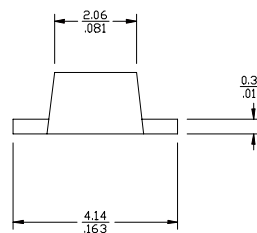
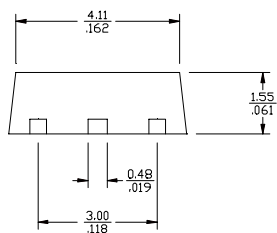
### FR4 Board Layout (T = 14 Mil)



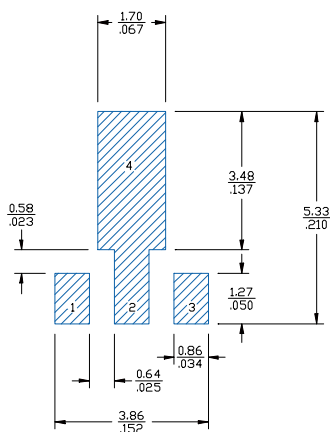
## Outline Drawing



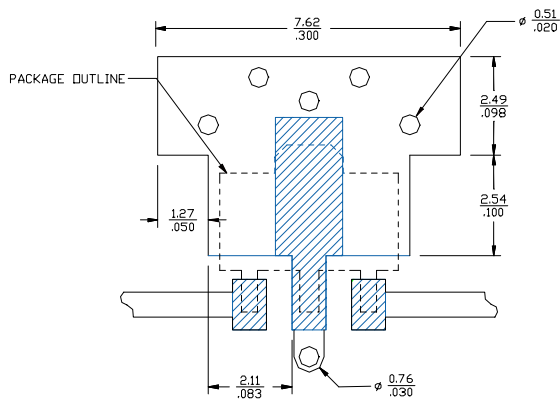
mm  
inch



## Land Pattern



## Mounting Configuration



| FUNCTION      | PIN NO. |
|---------------|---------|
| INPUT         | 1       |
| GROUND        | 2       |
| OUTPUT (BIAS) | 3       |
| GROUND        | 4       |

- Notes:
1. Ground vias are critical for thermal and RF grounding considerations.
  2. A minimum of 6 ground vias are required for 14 mil and 28 mil FR4 board.
  3. If your PCB design rules allow, ground vias should be placed under the land pattern for better RF and thermal performance. Otherwise ground vias should be placed as close to land pattern as possible.
  4. Trace width depends on PC board.

Specifications and information are subject to change without notice.



**Caution!** ESD sensitive device.

## Typical Test Data

S-Parameters (Vds = +5 V, Ids= 150 mA, T = 22°C, unmatched device in a 50 ohm system)

| Freq (MHz) | S11 (Mag) | S11 (Ang) | S21 (Mag) | S21 (Ang) | S12 (Mag) | S12 (Ang) | S22 (Mag) | S22 (Ang) | K Value |
|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|---------|
| 300        | 0.385     | -46.990   | 5.742     | 157.037   | 0.087     | 3.964     | 0.089     | -66.530   | 1.062   |
| 400        | 0.374     | -53.376   | 5.633     | 152.400   | 0.087     | -0.428    | 0.070     | -70.095   | 1.090   |
| 500        | 0.373     | -60.650   | 5.564     | 147.518   | 0.088     | -3.847    | 0.055     | -69.277   | 1.103   |
| 600        | 0.373     | -68.718   | 5.488     | 142.410   | 0.088     | -6.806    | 0.043     | -75.238   | 1.116   |
| 700        | 0.376     | -76.746   | 5.409     | 137.282   | 0.088     | -9.585    | 0.036     | -80.347   | 1.128   |
| 800        | 0.380     | -84.449   | 5.313     | 132.011   | 0.088     | -12.184   | 0.031     | -88.416   | 1.139   |
| 900        | 0.383     | -92.673   | 5.199     | 126.442   | 0.087     | -14.643   | 0.028     | -102.961  | 1.154   |
| 1000       | 0.388     | -101.021  | 5.141     | 121.353   | 0.087     | -17.006   | 0.029     | -115.173  | 1.159   |
| 1100       | 0.394     | -109.189  | 5.052     | 116.267   | 0.087     | -19.432   | 0.029     | -127.412  | 1.168   |
| 1200       | 0.403     | -116.975  | 4.952     | 111.154   | 0.087     | -21.689   | 0.031     | -124.686  | 1.176   |
| 1300       | 0.413     | -124.433  | 4.841     | 106.042   | 0.086     | -24.093   | 0.033     | -90.875   | 1.185   |
| 1400       | 0.425     | -131.566  | 4.724     | 101.024   | 0.086     | -26.335   | 0.035     | -93.847   | 1.198   |
| 1500       | 0.438     | -138.169  | 4.609     | 96.109    | 0.085     | -28.545   | 0.034     | -94.192   | 1.210   |
| 1600       | 0.450     | -144.356  | 4.490     | 91.324    | 0.084     | -30.630   | 0.035     | -91.925   | 1.224   |
| 1700       | 0.463     | -149.987  | 4.371     | 86.560    | 0.084     | -32.708   | 0.035     | -138.791  | 1.241   |
| 1800       | 0.477     | -155.154  | 4.254     | 81.996    | 0.083     | -34.679   | 0.035     | -131.588  | 1.253   |
| 1900       | 0.489     | -160.003  | 4.139     | 77.549    | 0.082     | -36.681   | 0.036     | -120.952  | 1.272   |
| 2000       | 0.500     | -164.309  | 4.030     | 73.226    | 0.081     | -38.358   | 0.039     | -112.026  | 1.289   |
| 2100       | 0.509     | -168.120  | 3.929     | 69.032    | 0.081     | -40.127   | 0.042     | -104.837  | 1.306   |
| 2200       | 0.517     | -171.726  | 3.836     | 64.905    | 0.080     | -41.728   | 0.046     | -99.684   | 1.322   |
| 2300       | 0.523     | -175.359  | 3.749     | 60.845    | 0.079     | -43.332   | 0.049     | -94.737   | 1.344   |
| 2400       | 0.527     | -9.058    | 3.667     | 56.754    | 0.079     | -44.949   | 0.052     | -92.048   | 1.366   |
| 2500       | 0.528     | 176.218   | 3.600     | 52.689    | 0.078     | -46.419   | 0.053     | -90.189   | 1.389   |
| 2600       | 0.526     | 173.376   | 3.537     | 48.710    | 0.078     | -48.000   | 0.052     | -88.680   | 1.418   |
| 2700       | 0.523     | 169.003   | 3.477     | 44.647    | 0.078     | -49.738   | 0.050     | -87.931   | 1.450   |
| 2800       | 0.518     | 164.088   | 3.422     | 40.452    | 0.077     | -51.479   | 0.048     | -88.079   | 1.486   |
| 2900       | 0.513     | 158.780   | 3.366     | 36.157    | 0.077     | -53.246   | 0.042     | -87.362   | 1.526   |
| 3000       | 0.510     | 153.067   | 3.311     | 31.816    | 0.077     | -55.207   | 0.034     | -82.552   | 1.561   |