



AH3

High Dynamic Range Gain Block

Product Features

- 50-450 MHz
- +40 dBm Output IP3
- No Matching Elements Required
- 3.0 dB Noise Figure
- 13.5 dB Gain
- +20 dBm P1dB
- MTBF >100 Years
- SOT-89 SMT Package
- Single Bias Supply (+5 V)

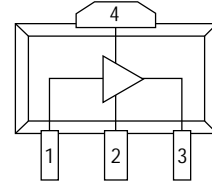


Actual Size

Product Description

The AH3 is a high dynamic range amplifier for IF requirements. The product achieves low noise figure and high output IP3 at the same bias point, making it ideal for receiver and transmitter applications. In addition, the device is internally matched for 50 ohms in a low cost SOT-89 package. The AH3 is manufactured using GaAs MESFET technology and boasts an MTBF of >100 years³ at a mounting temperature of 85°C. The package is a SOT-89. All devices are 100% RF and DC tested.

Functional Diagram



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

Specifications

| Parameter | Units | Minimum | Typical | Maximum | Condition |
|--------------------------------------|-------|---------|---------|---------|-------------|
| Frequency Range | MHz | | 50-450 | | |
| S21 - Gain | dB | 12 | 13.5 | 16 | |
| S11 - Input Return Loss ¹ | dB | | -10 | | |
| S22 - Output Return Loss | dB | | -20 | | |
| Output IP3 | dBm | +37 | +40 | | |
| Output P1dB | dBm | | +20 | | |
| Noise Figure ¹ | dB | | 4.5 | | 50 MHz |
| Noise Figure | dB | | 3.0 | | 450 MHz |
| Operating Current Range | mA | 120 | 150 | 180 | Vdd = 5.0 V |
| Supply Voltage | V | | 5 | | |

Test conditions unless otherwise noted, T = 25°C, Vdd = 5.0 V, 50 Ω system, 800 MHz.

1. S11 and Noise Figure can be improved using an optional input matching network.

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

3. MTBF calculated with ground lead temperature at 85°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.

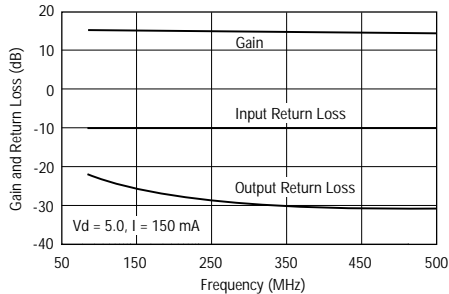
Ordering Information

| Part No. | Description |
|-----------|--|
| AH3 | High Dynamic Range Amplifier (Available in tape and reel) |
| AH3WB-PCB | Fully Assembled Application Circuit |

AH3

Performance Charts (Vds = 5 V, Ids = 150 mA, T = 22°C, unmatched device in a 50 ohm system)

Gain and Return Loss vs. Frequency

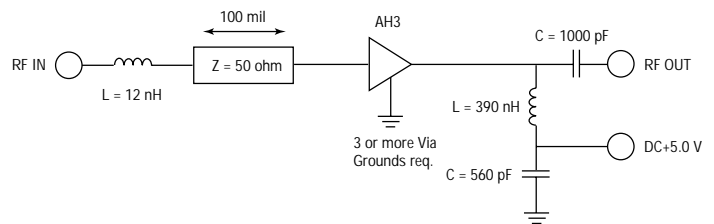


Application Circuit: 50 to 450 MHz

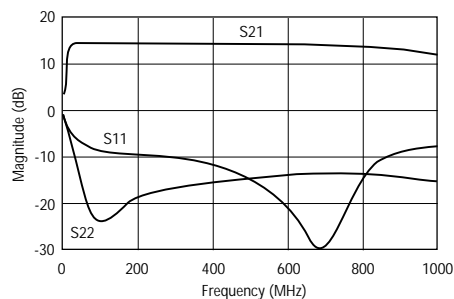
Typical Specifications

| Parameter | 50 MHz | 450 MHz |
|---------------|--------------------------|----------|
| Frequency | 50 MHz | 450 MHz |
| Magnitude S21 | 13.7 dB | 13.7 dB |
| Magnitude S11 | -8.3 dB | -13.3 dB |
| Magnitude S22 | -18.0 dB | -15.2 dB |
| OIP3 | 36 dBm | 40 dBm |
| Noise Figure | 3.6 dB | 2.7 dB |
| Bias | Vds = 5.0 V, Id = 150 mA | |

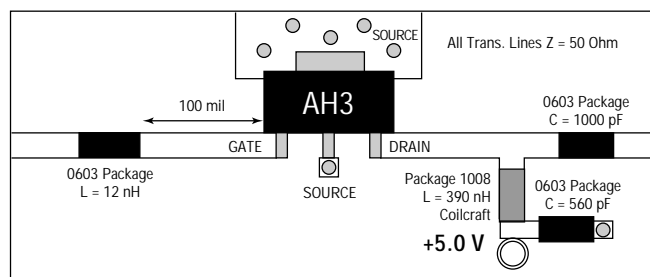
Schematic



S-Parameters



FR4 Board Layout (T = 14 Mils)



NOTE: The application circuit is designed for wide bandwidth. For narrow band applications, S11 and S21 can be improved with an input shunt microstrip element to ground.

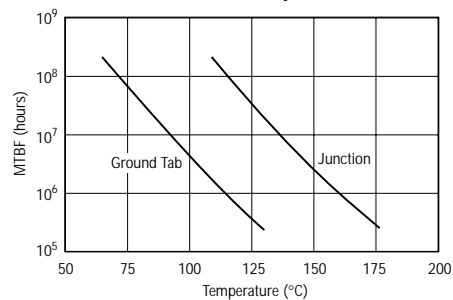
Thermal Specifications

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

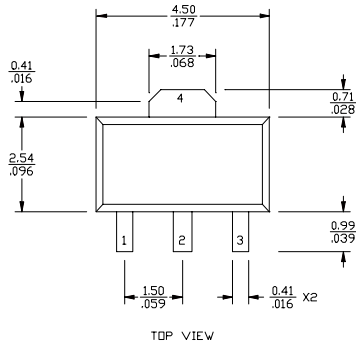
Notes:

- Thermal Resistance determined at Maximum Tab Temperature and Maximum Power Dissipation.
- Recommended Maximum Junction Temperature insures a MTBF of 1 million hours.
- Refer to WJ Application Note "AH3 Temperature Effects on Reliability" for more information.

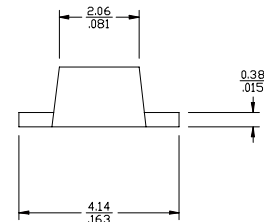
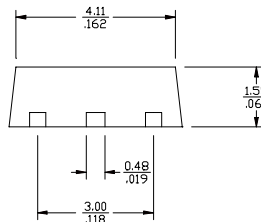
MTBF vs. Temperature



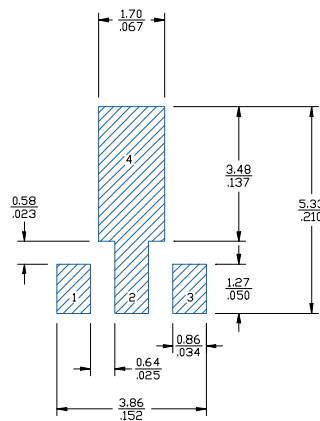
Outline Drawing



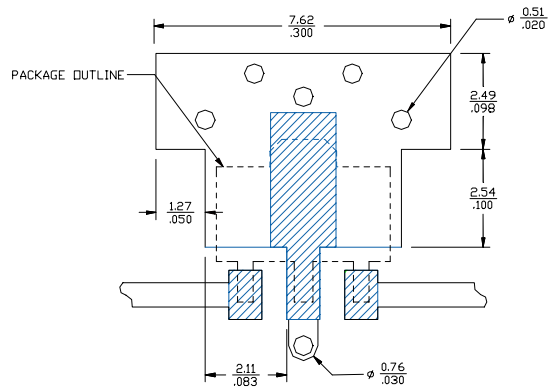
mm
inch



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 (V_{ds} = +5 V, I_{ds} = 150 mA, V_{gs} = +5 V, T = 22°C, unmatched device in a 50 ohm system)

| Freq (MHz) | S11 (dB) | S11 (Ang) | S21 (dB) | S21 (Ang) | S12 (dB) | S12 (Ang) | S22 (dB) | S22 (Ang) |
|------------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
| 10 | -2.530 | -27.743 | 18.006 | 165.650 | -24.219 | 47.465 | -7.854 | -41.178 |
| 20 | -5.360 | -34.617 | 16.548 | 164.710 | -21.904 | 28.449 | -11.561 | -57.965 |
| 30 | -7.146 | -33.940 | 15.878 | 166.540 | -21.304 | 19.597 | -14.429 | -64.686 |
| 40 | -8.272 | -31.787 | 15.564 | 167.950 | -21.056 | 14.734 | -16.616 | -67.287 |
| 50 | -8.913 | -29.549 | 15.389 | 168.780 | -20.936 | 11.417 | -18.343 | -69.016 |
| 60 | -9.323 | -28.201 | 15.282 | 169.330 | -20.881 | 9.429 | -19.736 | -69.098 |
| 70 | -9.627 | -27.238 | 15.207 | 169.600 | -20.852 | 7.568 | -20.943 | -69.025 |
| 80 | -9.813 | -26.483 | 15.173 | 169.600 | -20.843 | 6.415 | -21.935 | -68.672 |
| 90 | -9.961 | -26.149 | 15.137 | 169.540 | -20.802 | 5.182 | -22.729 | -68.056 |
| 100 | -10.046 | -26.190 | 15.118 | 169.360 | -20.793 | 4.339 | -23.484 | -67.324 |
| 110 | -10.128 | -26.224 | 15.102 | 169.040 | -20.786 | 3.538 | -24.103 | -66.366 |
| 120 | -10.184 | -26.163 | 15.074 | 168.700 | -20.764 | 2.903 | -24.634 | -66.106 |
| 130 | -10.242 | -26.641 | 15.070 | 168.310 | -20.768 | 2.329 | -25.055 | -64.929 |
| 140 | -10.226 | -27.245 | 15.059 | 167.860 | -20.752 | 1.733 | -25.426 | -65.650 |
| 150 | -10.294 | -28.086 | 15.036 | 167.360 | -20.735 | 1.163 | -25.889 | -65.519 |
| 160 | -10.269 | -28.741 | 15.019 | 166.910 | -20.751 | 0.987 | -26.221 | -65.007 |
| 170 | -10.257 | -29.077 | 15.007 | 166.490 | -20.763 | 0.413 | -26.613 | -64.748 |
| 180 | -10.310 | -29.991 | 14.995 | 166.070 | -20.752 | 0.005 | -26.830 | -64.337 |
| 190 | -10.301 | -30.544 | 14.981 | 165.590 | -20.760 | -0.451 | -27.101 | -64.336 |
| 200 | -10.272 | -31.453 | 14.965 | 165.070 | -20.766 | -0.838 | -27.295 | -65.225 |
| 210 | -10.290 | -32.422 | 14.954 | 164.590 | -20.776 | -1.054 | -27.595 | -64.672 |
| 220 | -10.289 | -33.275 | 14.953 | 163.990 | -20.786 | -1.431 | -27.783 | -65.233 |
| 230 | -10.340 | -34.491 | 14.915 | 163.590 | -20.752 | -1.523 | -28.024 | -67.769 |
| 240 | -10.265 | -35.226 | 14.930 | 162.990 | -20.763 | -2.062 | -28.402 | -66.306 |
| 250 | -10.301 | -36.310 | 14.928 | 162.510 | -20.761 | -2.114 | -28.556 | -65.739 |
| 260 | -10.289 | -37.198 | 14.920 | 161.780 | -20.766 | -2.567 | -28.724 | -66.872 |
| 270 | -10.280 | -38.284 | 14.910 | 161.380 | -20.746 | -2.924 | -28.899 | -66.403 |
| 280 | -10.267 | -39.078 | 14.912 | 160.760 | -20.742 | -3.082 | -29.125 | -67.517 |
| 290 | -10.269 | -40.329 | 14.896 | 160.110 | -20.731 | -3.442 | -29.270 | -67.635 |
| 300 | -10.247 | -41.322 | 14.893 | 159.560 | -20.751 | -3.708 | -29.315 | -66.567 |
| 310 | -10.244 | -42.477 | 14.877 | 159.060 | -20.739 | -3.997 | -29.553 | -67.442 |
| 320 | -10.234 | -43.257 | 14.869 | 158.480 | -20.739 | -4.204 | -29.668 | -67.745 |
| 330 | -10.211 | -44.361 | 14.848 | 157.900 | -20.750 | -4.549 | -29.642 | -68.462 |
| 340 | -10.209 | -45.284 | 14.830 | 157.400 | -20.740 | -4.737 | -29.770 | -68.852 |
| 350 | -10.190 | -46.406 | 14.835 | 156.850 | -20.756 | -5.043 | -29.860 | -69.355 |
| 360 | -10.190 | -47.389 | 14.818 | 156.300 | -20.730 | -5.115 | -29.972 | -70.060 |
| 370 | -10.096 | -48.510 | 14.813 | 155.630 | -20.736 | -5.669 | -30.217 | -70.769 |
| 380 | -10.125 | -49.505 | 14.809 | 155.070 | -20.731 | -5.639 | -30.176 | -71.251 |
| 390 | -10.069 | -50.448 | 14.804 | 154.520 | -20.706 | -5.940 | -30.147 | -71.839 |
| 400 | -10.037 | -51.503 | 14.799 | 153.880 | -20.726 | -6.180 | -30.320 | -72.002 |
| 410 | -10.009 | -52.645 | 14.772 | 153.220 | -20.731 | -6.471 | -30.463 | -72.484 |
| 420 | -10.042 | -53.633 | 14.769 | 152.630 | -20.703 | -6.842 | -30.488 | -73.831 |
| 430 | -10.003 | -54.608 | 14.755 | 151.990 | -20.727 | -7.052 | -30.490 | -74.433 |
| 440 | -9.981 | -55.914 | 14.749 | 151.430 | -20.723 | -7.190 | -30.626 | -75.605 |
| 450 | -9.999 | -56.888 | 14.724 | 150.780 | -20.749 | -7.483 | -30.629 | -76.007 |
| 460 | -9.945 | -57.864 | 14.712 | 150.230 | -20.736 | -7.717 | -30.691 | -77.373 |
| 470 | -9.897 | -58.974 | 14.701 | 149.610 | -20.733 | -7.927 | -30.690 | -78.350 |
| 480 | -9.902 | -59.988 | 14.667 | 149.060 | -20.743 | -8.242 | -30.789 | -80.021 |
| 490 | -9.856 | -61.009 | 14.664 | 148.480 | -20.725 | -8.424 | -30.891 | -80.993 |
| 500 | -9.812 | -62.011 | 14.652 | 147.990 | -20.754 | -8.530 | -30.973 | -81.750 |