

ALH497

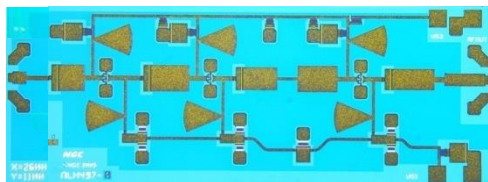
80 – 100 GHz

Low Noise Amplifier

NORTHROP GRUMMAN

Product Datasheet

Revision: April 2015



X=2900 mm Y=1100 mm

Product Features

- ◆ RF Frequency: 80 to 100 GHz
- ◆ Linear Gain:
 - 17 dB typ. (80 to 100 GHz)
 - 19 dB typ. (92 to 96 GHz)
- ◆ Noise Figure (Average over 80-100 GHz):
 - 4.2 dB typ. LNA Option (-LN)
 - 4.9 dB typ. Gain Block: Option (-GB)
- ◆ Single Vg & Vd ports for simplified bias and assembly
- ◆ Narrow Y dimension (1.1mm)
- ◆ Die Size: < 3.2 sq. mm.
- ◆ DC Power: 2 VDC @ 25 mA

Performance Characteristics (Ta = 25°C)

| Specification | Min | Typ | Max | Unit |
|--------------------------|-----|------|-----|------|
| Frequency | 80 | | 100 | GHz |
| Linear Gain [92-96 GHz] | | 19 | | dB |
| Linear Gain [80-100 GHz] | 14 | 17 | | dB |
| Noise Figure (Ave.) | | | | |
| (-LN) | | 4.2 | 4.3 | dB |
| (-GB) | | 4.9 | 5 | dB |
| Input Return Loss | | 5 | | dB |
| Output Return Loss | | | | |
| 80-90 GHz | | 3 | | dB |
| 90-100 GHz | | 14 | | dB |
| P1dB | | 0 | | dBm |
| Vd3 | | 2 | | V |
| Vg3 | | -0.4 | | V |
| Id3 | | 25 | | mA |

Applications

- ◆ Millimeter-wave Imaging
- ◆ Short Haul / High Capacity Links for FCC Allocated Communication Bands
 - 81-86 GHz E-Band Application
 - 92-95 GHz W-Band Application
- ◆ Sensors
- ◆ Radar

Description and Application

The ALH497 is a broadband, three-stage, low noise monolithic HEMT amplifier designed for use in Millimeter-Wave Imaging, commercial digital microwave radios and wireless LANs. The small die size allows for extremely compact packaging. To ensure rugged and reliable operation, HEMT devices are fully passivated. Both bond pad and backside metallization are Ti/Au, which is compatible with conventional die attach, thermocompression and thermosonic wire bonding assembly techniques.

Ordering Information

To Order LNA specify: ALH497 (-LN)
To Order Gain Block Specify: ALH497 (-GB)

Absolute Maximum Ratings (Ta = 25°C)

| Parameter | Min | Max | Unit |
|--------------------------------|------|-----|--------|
| Vd3 | | 3 | V |
| Id3 | | 31 | mA |
| Vg3 | -0.8 | 0.4 | V |
| Input drive level | | -10 | dBm |
| Assy. Temperature (60 seconds) | | 300 | deg. C |

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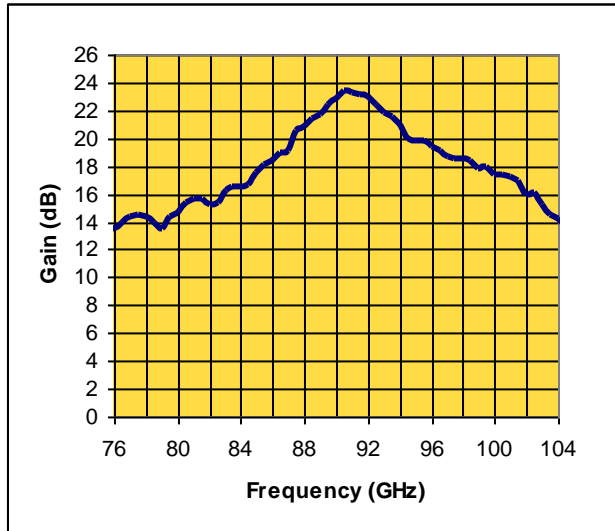
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Product Datasheet

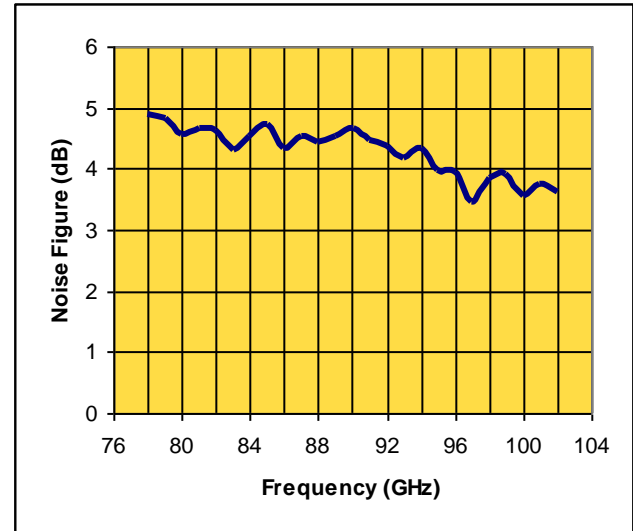
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Measured Performance Characteristics (Typical Performance at 25°C) Vd3 = 2V, Id3 = 25 mA

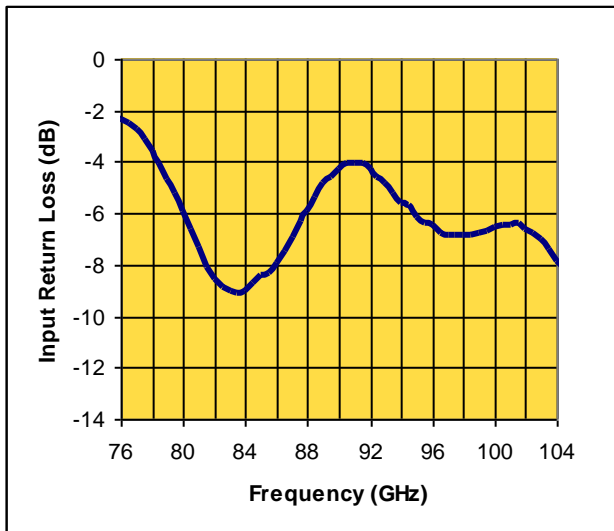
Linear Gain Versus Frequency



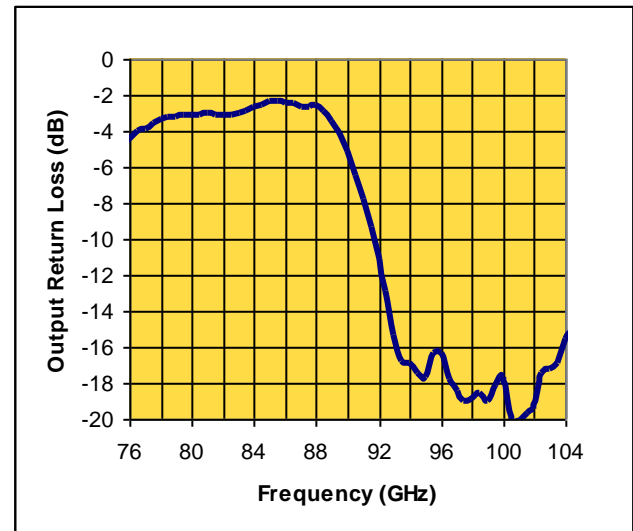
Noise Figure Versus Frequency



Input Return Loss Versus Frequency



Output Return Loss Versus Frequency



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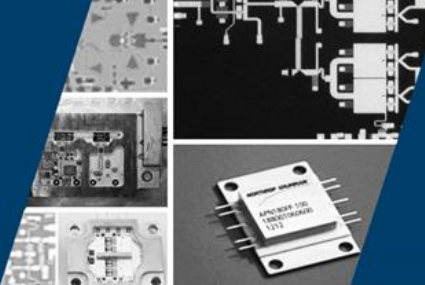
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Measured Performance Characteristics (Typical Performance at 25°C)

Vd3 = 2V, Id3 = 25 mA

| Freq (GHz) | S11 Mag | S11 Ang | S21 Mag | S21 Ang | S12 Mag | S12 Ang | S22 Mag | S22 Ang |
|------------|---------|---------|---------|----------|---------|----------|---------|---------|
| 80.0 | 0.524 | 53.594 | 5.427 | 87.080 | 0.013 | -53.423 | 0.853 | 87.737 |
| 80.5 | 0.479 | 51.826 | 5.825 | 75.727 | 0.012 | -66.040 | 0.750 | 86.051 |
| 81.0 | 0.437 | 51.722 | 6.041 | 62.967 | 0.011 | -66.231 | 0.718 | 86.293 |
| 81.5 | 0.398 | 52.110 | 6.024 | 52.005 | 0.011 | -65.118 | 0.711 | 85.124 |
| 82.0 | 0.371 | 54.615 | 5.715 | 45.768 | 0.011 | -71.425 | 0.711 | 83.246 |
| 82.5 | 0.352 | 57.930 | 5.743 | 38.431 | 0.011 | -74.779 | 0.709 | 80.651 |
| 83.0 | 0.343 | 61.575 | 6.362 | 31.969 | 0.011 | -76.731 | 0.719 | 77.728 |
| 83.5 | 0.333 | 65.180 | 6.547 | 19.688 | 0.011 | -80.412 | 0.731 | 74.294 |
| 84.0 | 0.334 | 67.638 | 6.488 | 13.198 | 0.011 | -83.586 | 0.744 | 71.018 |
| 84.5 | 0.349 | 70.033 | 6.661 | 7.672 | 0.011 | -88.263 | 0.758 | 67.471 |
| 85.0 | 0.358 | 72.208 | 7.242 | 1.383 | 0.010 | -90.760 | 0.776 | 63.436 |
| 85.5 | 0.365 | 72.983 | 7.818 | -9.496 | 0.011 | -92.581 | 0.781 | 57.786 |
| 86.0 | 0.381 | 74.599 | 7.985 | -19.643 | 0.010 | -101.685 | 0.769 | 53.667 |
| 86.5 | 0.405 | 75.131 | 8.532 | -26.423 | 0.010 | -107.302 | 0.768 | 48.657 |
| 87.0 | 0.433 | 74.806 | 8.641 | -37.127 | 0.010 | -113.501 | 0.760 | 43.909 |
| 87.5 | 0.466 | 73.447 | 10.220 | -43.647 | 0.008 | -116.262 | 0.763 | 38.411 |
| 88.0 | 0.492 | 70.546 | 10.667 | -57.445 | 0.008 | -112.394 | 0.771 | 31.874 |
| 88.5 | 0.525 | 67.609 | 11.431 | -68.863 | 0.008 | -114.905 | 0.759 | 25.022 |
| 89.0 | 0.562 | 64.135 | 11.968 | -80.925 | 0.007 | -109.383 | 0.722 | 15.436 |
| 89.5 | 0.591 | 59.251 | 13.138 | -92.596 | 0.006 | -99.040 | 0.681 | 5.329 |
| 90.0 | 0.618 | 53.655 | 13.829 | -106.047 | 0.006 | -83.499 | 0.614 | -1.336 |
| 90.5 | 0.643 | 47.197 | 14.840 | -117.574 | 0.005 | -76.517 | 0.539 | -7.229 |
| 91.0 | 0.652 | 40.513 | 14.851 | -133.008 | 0.004 | -30.745 | 0.475 | -14.609 |
| 91.5 | 0.657 | 32.955 | 14.734 | -137.682 | 0.004 | -21.225 | 0.409 | -20.535 |
| 92.0 | 0.641 | 25.459 | 14.700 | -93.121 | 0.004 | -14.399 | 0.342 | -25.282 |
| 92.5 | 0.617 | 19.142 | 13.937 | 13.906 | 0.005 | -20.745 | 0.279 | -24.528 |
| 93.0 | 0.600 | 13.293 | 13.199 | 99.812 | 0.006 | -27.671 | 0.213 | -25.086 |
| 93.5 | 0.571 | 8.136 | 12.661 | 143.157 | 0.007 | -39.635 | 0.172 | -23.529 |
| 94.0 | 0.544 | 2.176 | 11.933 | 138.967 | 0.008 | -44.857 | 0.156 | -13.550 |
| 94.5 | 0.535 | -2.418 | 10.565 | 128.786 | 0.009 | -49.460 | 0.142 | -1.497 |
| 95.0 | 0.505 | -6.872 | 10.332 | 121.991 | 0.009 | -58.971 | 0.135 | 4.389 |
| 95.5 | 0.493 | -11.782 | 10.348 | 113.389 | 0.009 | -65.376 | 0.158 | 5.845 |
| 96.0 | 0.485 | -16.174 | 9.768 | 100.972 | 0.010 | -69.190 | 0.161 | -0.405 |
| 96.5 | 0.468 | -20.899 | 9.414 | 93.110 | 0.011 | -74.466 | 0.141 | 3.893 |
| 97.0 | 0.462 | -26.087 | 8.959 | 83.291 | 0.011 | -82.450 | 0.132 | 7.652 |
| 97.5 | 0.461 | -30.891 | 8.764 | 74.300 | 0.011 | -87.635 | 0.127 | 6.163 |
| 98.0 | 0.460 | -35.695 | 8.752 | 64.835 | 0.011 | -89.025 | 0.131 | 0.584 |
| 98.5 | 0.463 | -41.504 | 8.616 | 53.929 | 0.011 | -93.421 | 0.139 | -2.643 |
| 99.0 | 0.466 | -47.513 | 8.039 | 42.886 | 0.011 | -98.597 | 0.136 | -8.923 |
| 99.5 | 0.471 | -54.344 | 8.207 | 32.829 | 0.012 | -98.873 | 0.147 | -26.450 |
| 100 | 0.478 | -61.004 | 7.640 | 20.991 | 0.012 | -110.093 | 0.154 | -41.541 |

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Die Size and Bond Pad Locations (Not to Scale)

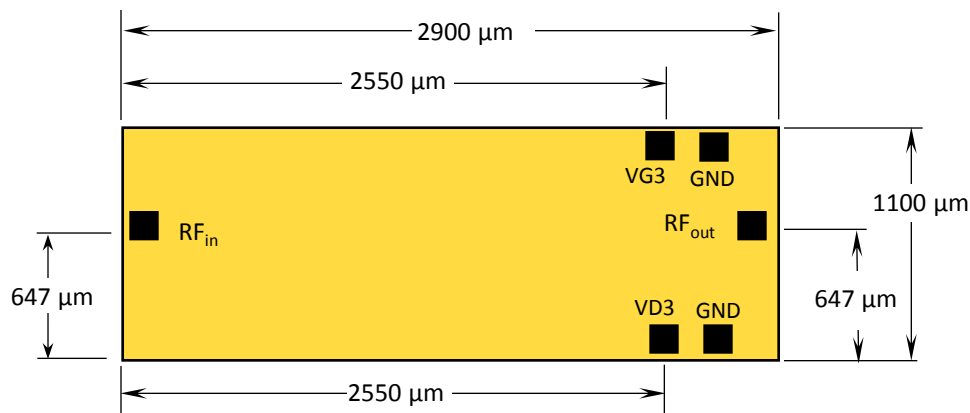
X = 2900 μm \pm 25 μm

Y = 1100 \pm 25 μm

RF Bond Pad = 51 x 51 \pm 0.5 μm

DC Bond Pad = 101 x 101 \pm 0.5 μm

Chip Thickness = 101 \pm 5 μm



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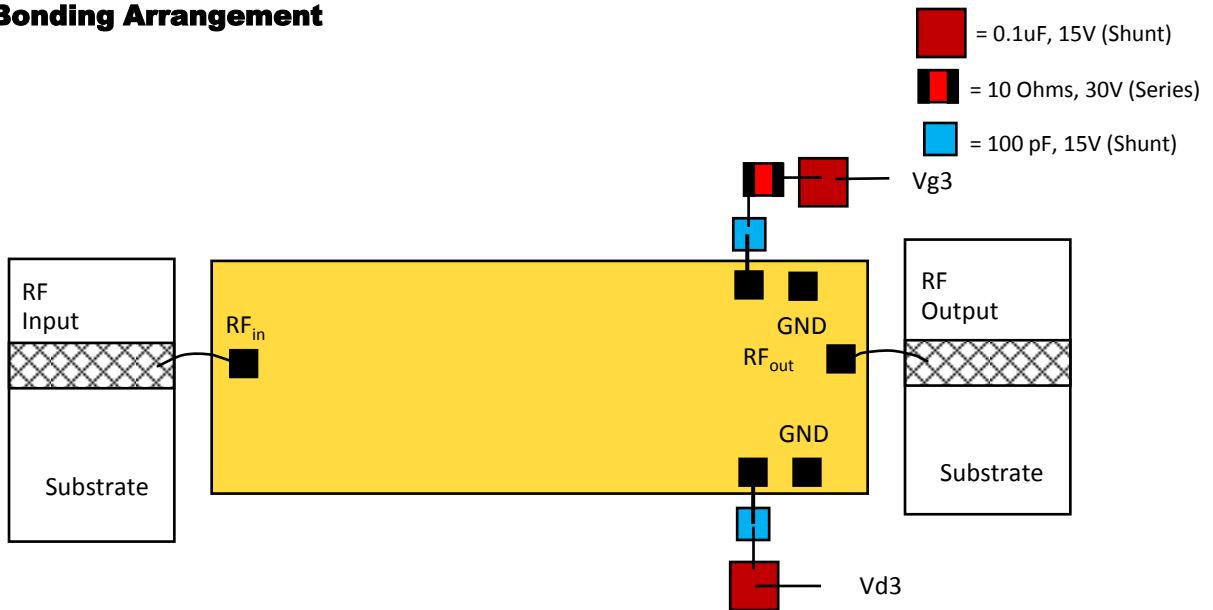
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Suggested Bonding Arrangement



Recommended Assembly Notes

1. Bypass caps should be 100 pF (approximately) ceramic (single-layer) placed no farther than 30 mils from the amplifier.
2. Best performance obtained from use of < 6 mil (long) by 1.5 by 0.5 mil ribbons on input and output.

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