NORTHROP GRUMMAN

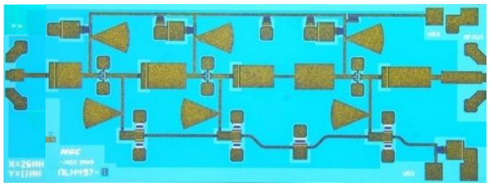
Microelectronic Products & Services

# ALH497

## 80 – 100 GHz Low Noise Amplifier

Product Datasheet

Revision: December 2011



**X=2900 µm Y=1100 µm**

### 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

### 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.

### 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 |

### Ordering Information

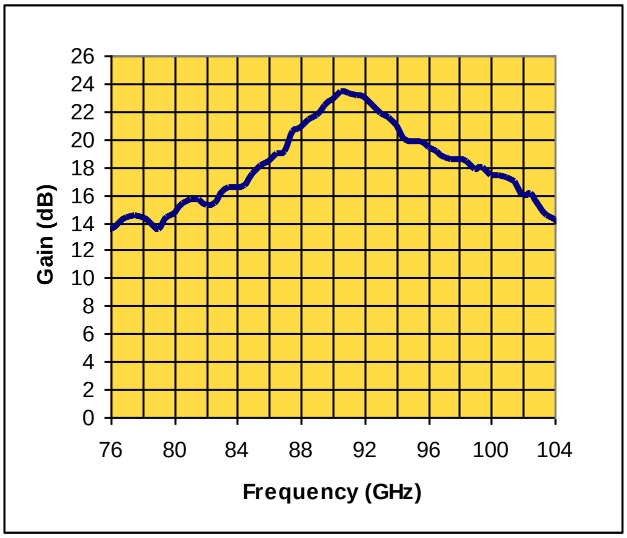
To Order LNA specify: ALH497 (-LN)
To Order Gain Block Specify: ALH497 (-GB)

### Absolute Maximum Ratings (Ta = 25 C)

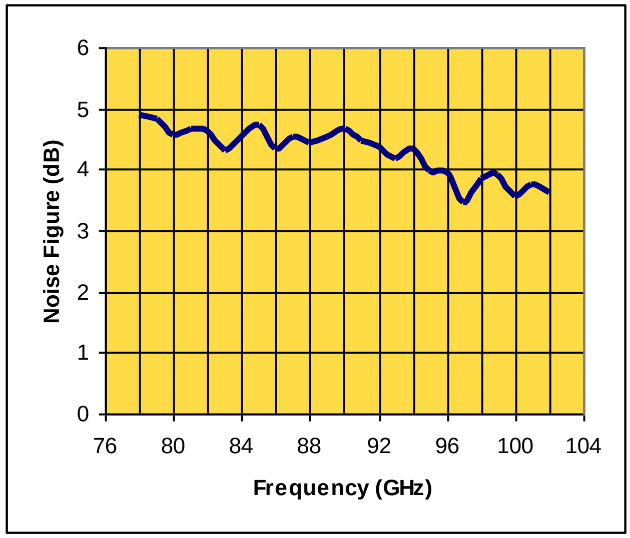
| Parameter | Min | Max | Unit |
|---|---|---|---|
| Vd3 | | 3 | V |
| Id3 | | 31 | mA |
| Vg3 | -0.8 | 0.4 | V |
| Input drive level | | -10 | dBm |
| Assy. Temperature (60 seconds) | | 300 | deg. C |

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

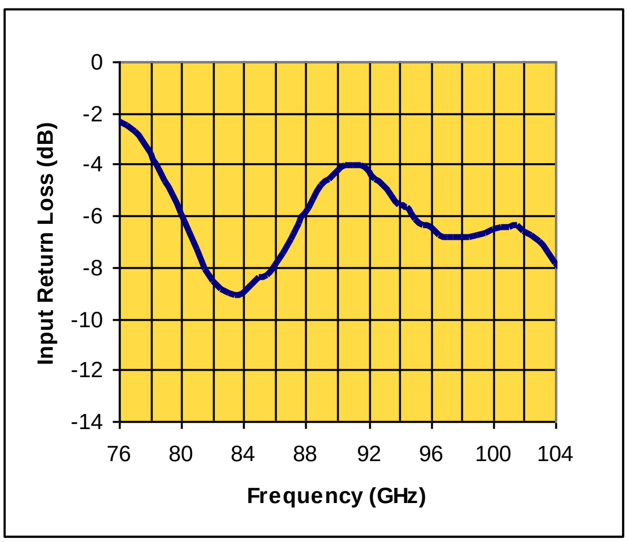
## Linear Gain Versus Frequency



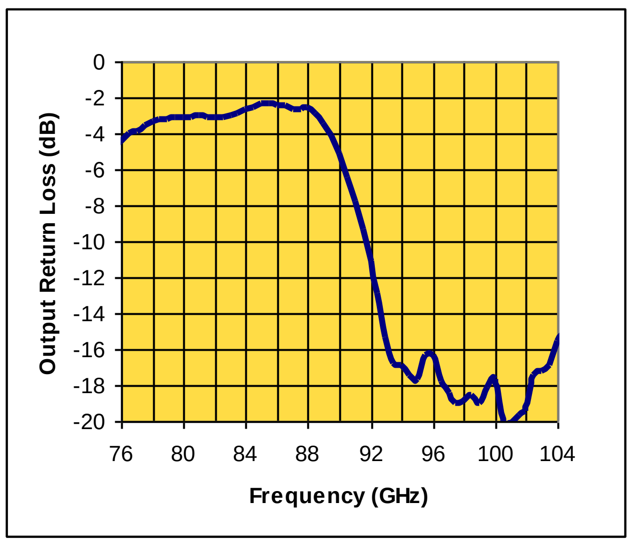

## Noise Figure Versus Frequency




## Input Return Loss Versus Frequency




## Output Return Loss Versus Frequency

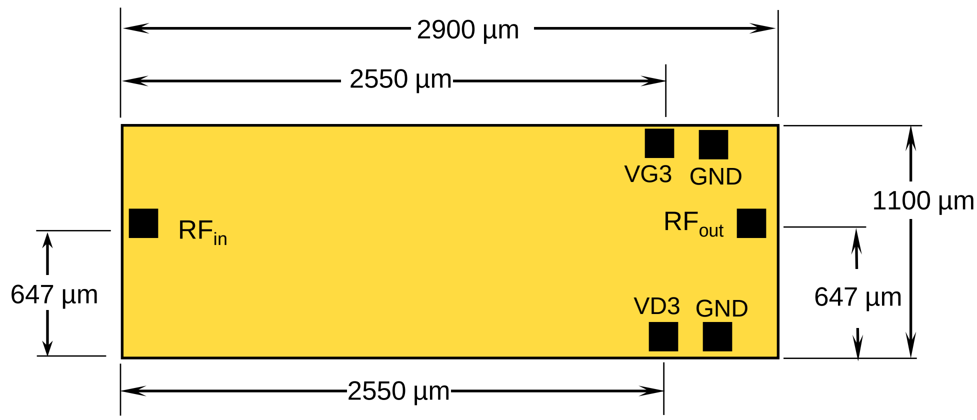


**Measured Performance Characteristics (Typical Performance at 25°C)**
**Vd3 = 2V, Id3 = 25 mA**

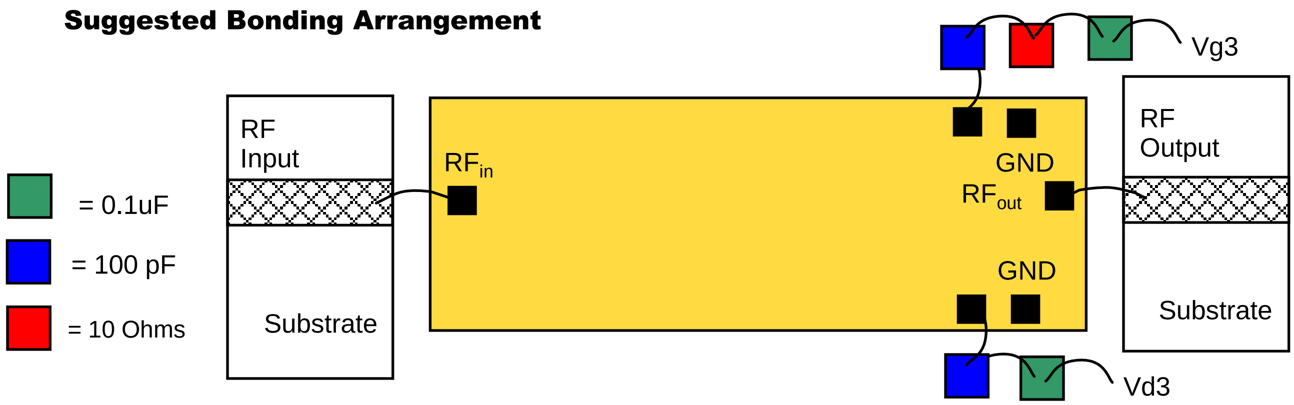
| Freq. (GHz) | S11 Mag | S11 Ang | S21 Mag | S21 Ang | S12 Mag | S12 Ang | S22 Mag | S22 Ang |
|---|---|---|---|---|---|---|---|---|
| 80.0 | 0.524 | 53.594 | 5.427 | 87.080 | 0.013 | -53.423 | 0.853 | 87.737 |
| 80.5 | 0.479 | 51.826 | 5.825 | 75.727 | 0.012 | -66.040 | 0.750 | 86.051 |
| 81.0 | 0.437 | 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 |

### Die Size and Bond Pad Locations

X = 2900 µm    25 µm
Y = 1100    25 µm
RF Bond Pad = 51 x 51    0.5 µm
DC Bond Pad = 101 x 101    0.5 µm
Chip Thickness = 101    5 µm




### 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.