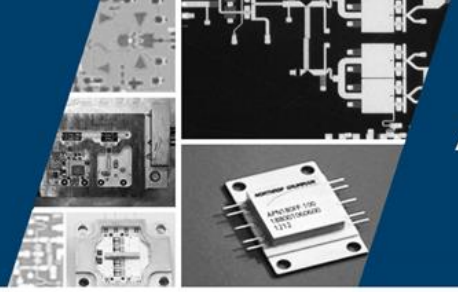
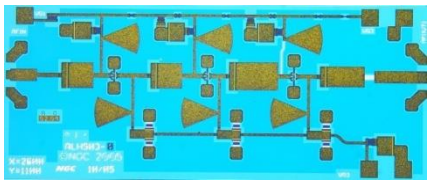
ALH503
80 – 100 GHz
Low Noise Amplifier



NORTHROP GRUMMAN

Product Datasheet

Revision: April 2015



X=2600 µm Y=1100 µm

Product Features

- RF Frequency: 80 to 100 GHz

  Effective Bandwidth:

- Linear Gain (average from 80 to 100 GHz) :
  - 16 dB, Typical
- Noise Figure (Average from 80 to 100 GHz):
  - 4.2 dB typ. LNA Option (-LN)
  - 4.9 dB typ Gain Block: Option (–GB)
- Die Size: < 2.9 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 ALH503 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 (Average)	14	16		dB
Noise Figure (Average)				
(-LN)		4.2	4.3	dB
(-GB)		4.9	5	dB
Input Return Loss		6		dB
Output Return Loss		8		dB
P1dB		0		dBm
Vd3		2		V
Vg3		-0.4		V
Id3		25		mA

Ordering Information

To Order LNA specify: ALH503 (-LN)

To Order Gain Block Specify: ALH503 (-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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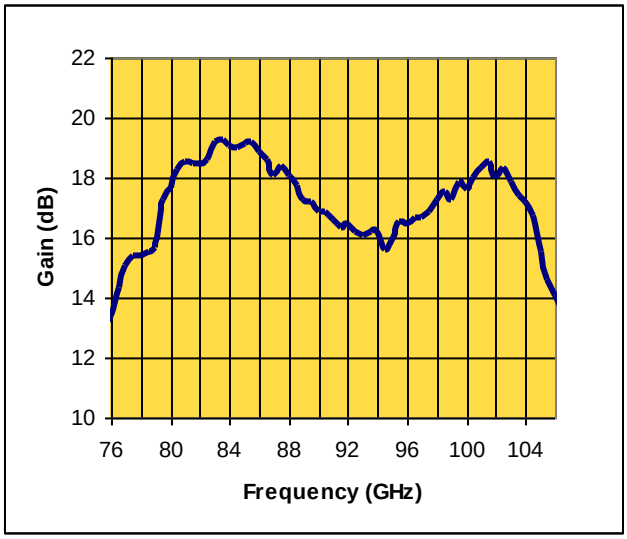
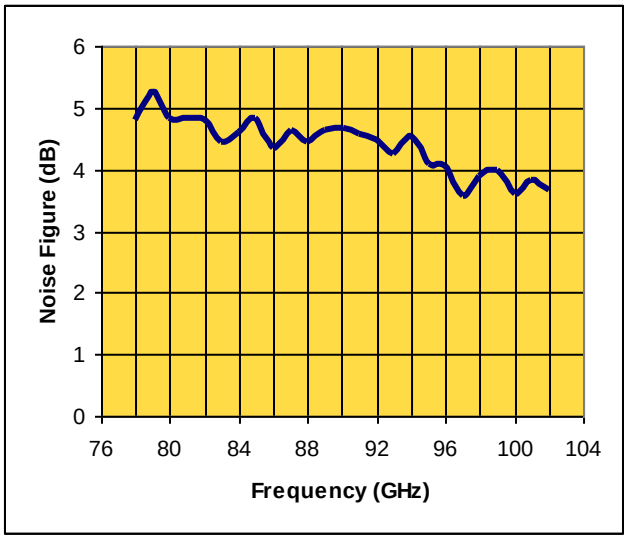
Measured Performance Characteristics (Typical Performance at 25°C)
Vd3 = 2V, Id3 = 25 mA

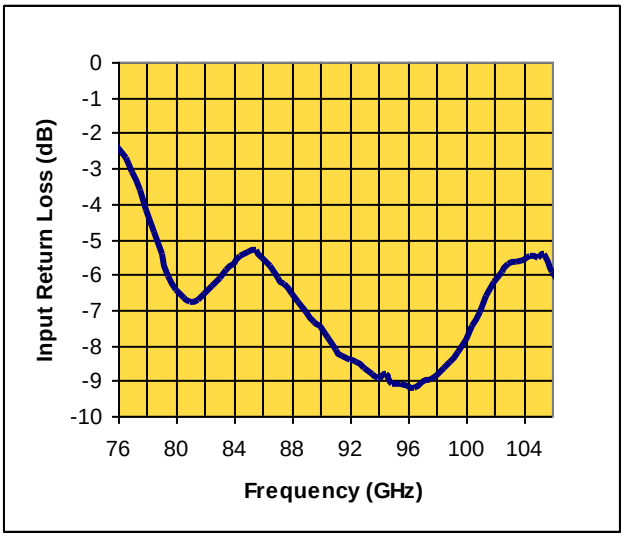
Linear Gain Versus Frequency



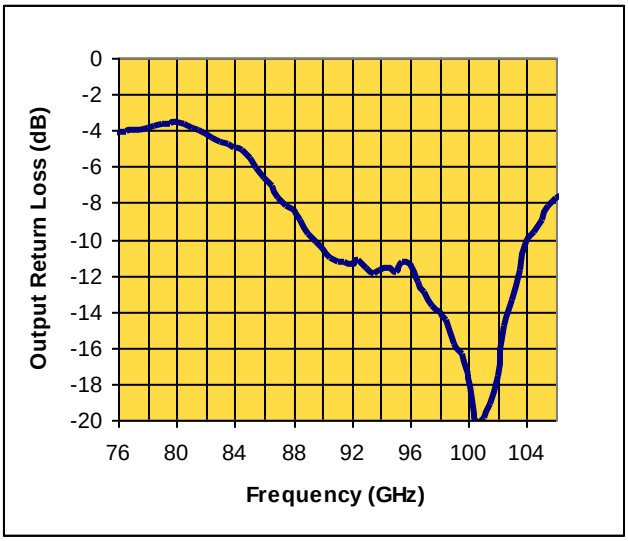
Noise Figure Versus Frequency

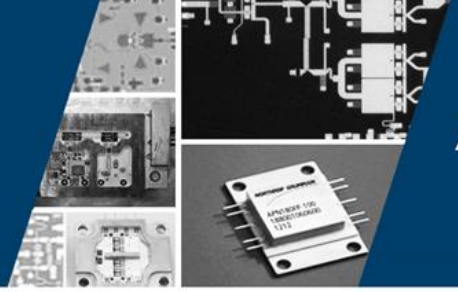


Input Return Loss Versus Frequency



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	0.528	45.911	7.448	-172.815	0.014	-18.824	0.816	54.226
80.5	0.522	48.065	7.914	173.841	0.010	-36.866	0.722	53.566
81.0	0.504	48.590	8.224	158.896	0.012	-5.316	0.650	53.533
81.5	0.513	49.958	8.252	146.602	0.011	-24.145	0.636	52.414
82.0	0.526	50.895	8.204	138.541	0.013	-29.968	0.621	50.046
82.5	0.541	50.575	8.327	127.934	0.014	-32.649	0.604	47.039
83.0	0.547	50.810	9.034	116.683	0.013	-30.405	0.584	44.540
83.5	0.564	49.793	9.005	102.944	0.017	-34.145	0.578	43.141
84.0	0.577	46.609	8.951	92.673	0.014	-34.605	0.557	39.074
84.5	0.592	43.838	8.820	82.972	0.013	-55.112	0.548	35.120
85.0	0.589	40.846	9.084	73.043	0.011	-51.222	0.515	32.236
85.5	0.593	37.023	9.061	60.313	0.015	-63.775	0.496	29.485
86.0	0.577	32.641	8.748	47.947	0.012	-86.153	0.445	26.847
86.5	0.569	30.341	8.498	38.757	0.014	-73.013	0.427	25.289
87.0	0.542	29.164	7.961	27.425	0.011	-69.339	0.396	25.259
87.5	0.524	27.034	8.156	20.575	0.010	-67.783	0.374	23.466
88.0	0.503	23.493	7.815	8.029	0.012	-86.853	0.361	21.861
88.5	0.482	22.649	7.461	-1.408	0.010	-80.825	0.342	23.505
89.0	0.464	22.313	7.075	-10.534	0.010	-63.806	0.308	21.048
89.5	0.443	20.652	6.905	-17.471	0.010	-85.184	0.288	18.077
90.0	0.436	19.033	6.684	-25.257	0.011	-69.641	0.283	22.118
90.5	0.417	17.310	6.620	-31.708	0.012	-93.152	0.254	25.731
91.0	0.405	18.320	6.398	-39.648	0.007	-81.984	0.253	28.178
91.5	0.395	16.827	6.134	-47.473	0.006	-76.351	0.252	29.244
92.0	0.390	16.020	6.285	-53.720	0.008	-100.171	0.252	32.167
92.5	0.385	14.229	6.044	-62.718	0.006	-105.646	0.256	32.381
93.0	0.386	13.422	5.995	-68.953	0.004	-81.593	0.242	35.832
93.5	0.372	13.043	6.043	-76.561	0.007	-128.070	0.229	33.801
94.0	0.370	8.522	6.067	-84.377	0.006	-115.863	0.236	31.634
94.5	0.382	5.910	5.661	-90.452	0.003	-88.449	0.249	32.396
95.0	0.371	3.401	5.915	-93.952	0.001	-162.239	0.229	32.352
95.5	0.370	-0.703	6.303	-102.948	0.004	-131.676	0.254	27.280
96.0	0.371	-4.757	6.260	-113.171	0.005	-140.814	0.256	18.499
96.5	0.364	-9.258	6.372	-118.987	0.003	124.210	0.225	20.501
97.0	0.361	-15.889	6.329	-126.880	0.004	68.569	0.205	18.639
97.5	0.363	-21.715	6.520	-134.266	0.004	-161.767	0.184	17.946
98.0	0.362	-27.628	6.834	-142.033	0.002	-148.758	0.175	10.047
98.5	0.364	-35.248	7.040	-151.680	0.002	32.392	0.173	3.977
99.0	0.363	-43.514	6.936	-161.077	0.002	114.572	0.143	-4.709
99.5	0.369	-52.899	7.354	-170.555	0.009	24.748	0.135	-29.620
100.0	0.377	-62.428	7.236	178.861	0.010	41.858	0.120	-50.153

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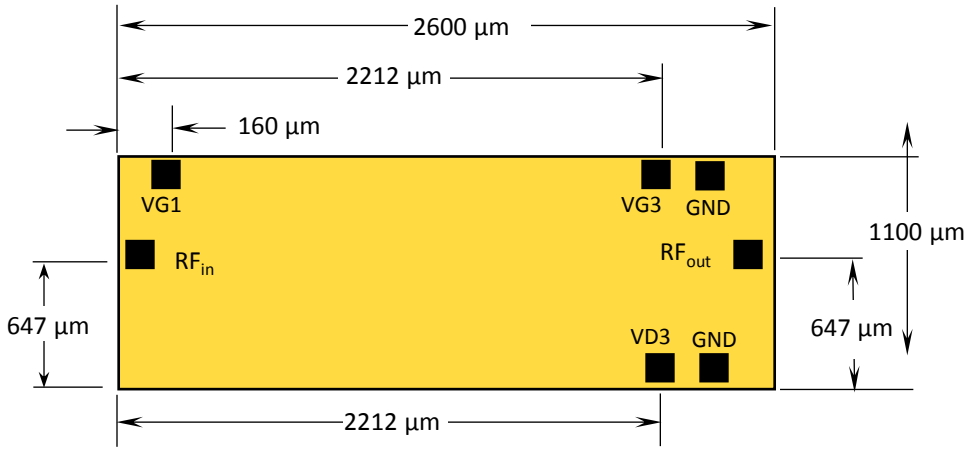
Die Size and Bond Pad Locations (Not to Scale)

X = 2600 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



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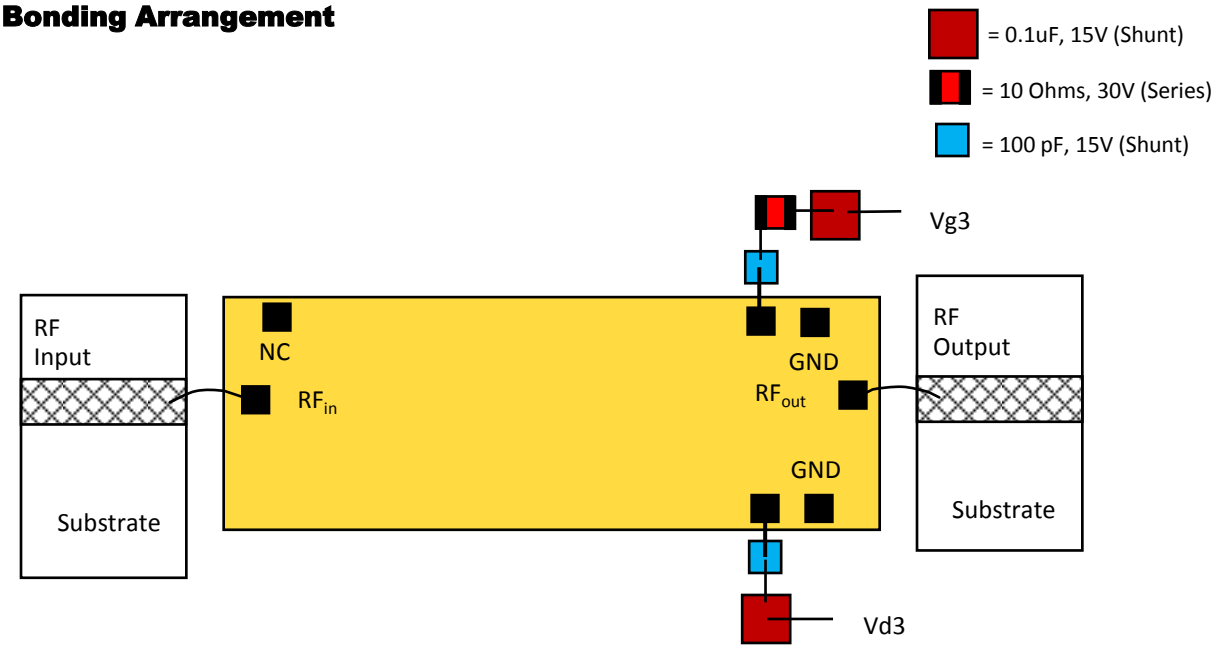
Suggested Bonding Arrangement



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.
3. Vg1 is an optional gate bias pad and can be used in place of Vg3. Typical use would be NC.

Approved for Public Release: Northrop Grumman Case 15-0868, 04/29/15