

ALH504

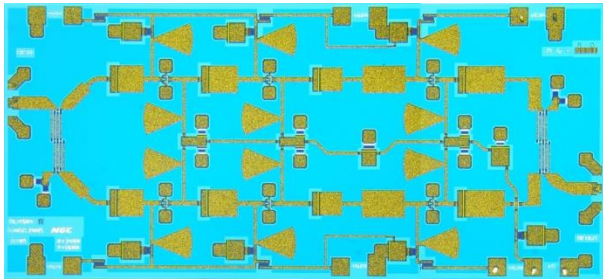
82 – 102 GHz

Balanced LNA

NORTHROP GRUMMAN

Product Datasheet

Revision: April 2015



X=3400 μm Y=1600 μm

Product Features

- ◆ RF Frequency: 82 to 102 GHz
effective bandwidth:
- ◆ Linear Gain (average from 82 to 102 GHz):
 - 18 dB typ.
- ◆ Noise Figure (average from 82 to 102 GHz):
 - 4.1 dB typ. LNA Option (-LN)
 - 4.8 dB typ. Gain Block: Option (-GB)
- ◆ Noise Figure (92-96 GHz) 3.7 dB Typ. (-LN)
- ◆ Balanced Input and Output
- ◆ Die Size: < 5.5 sq. mm.
- ◆ DC Power: 2 VDC @ 50 mA

Performance Characteristics (Ta = 25°C)

Specification	Min	Typ	Max	Unit
Frequency	82		102	GHz
Linear Gain (Average)	16	18		dB
Noise Figure (Average)				
(-LN)		4.1	4.4	dB
(-GB)		4.8	5.1	dB
Input Return Loss	13	20		dB
Output Return Loss	15	20		dB
P1dB		3		dBm
Vd		2		V
Vg3a, Vg3b		-0.4		V
Id		50		mA

Applications

- ◆ Wide Bandwidth Millimeter-wave Imaging RX Chains
- ◆ 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 ALH504 is a Balanced, three-stage, low noise monolithic HEMT amplifier designed for use in Millimeter-Wave Imaging, commercial digital microwave radios and wireless LANs where broad bandwidth and good return loss are important. 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: ALH504 (-LN)
To Order Gain Block Specify: ALH504 (-GB)

Absolute Maximum Ratings (Ta = 25°C)

Parameter	Min	Max	Unit
Vd		3	V
Id		62	mA
Vg3a, Vg3b	-0.8	0.4	V
Input drive level		-10	dBm
Assy. Temperature (60 seconds)		300	deg. C

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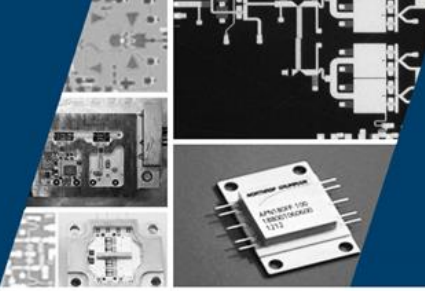
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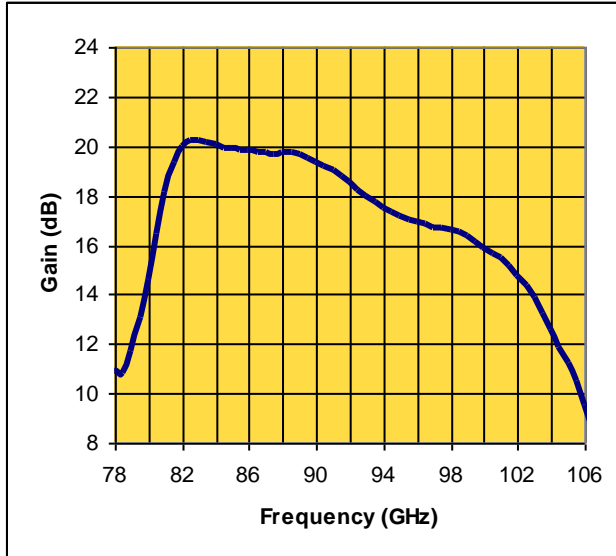
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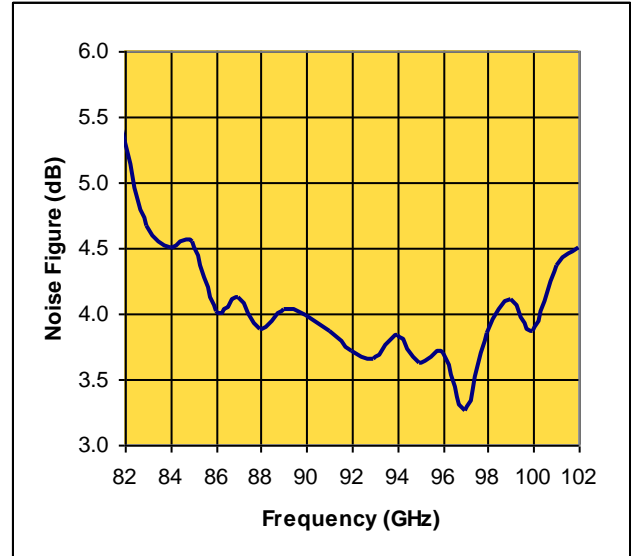
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Measured Performance Characteristics (Typical Performance at 25°C) Vd = 2V, Id = 50 mA

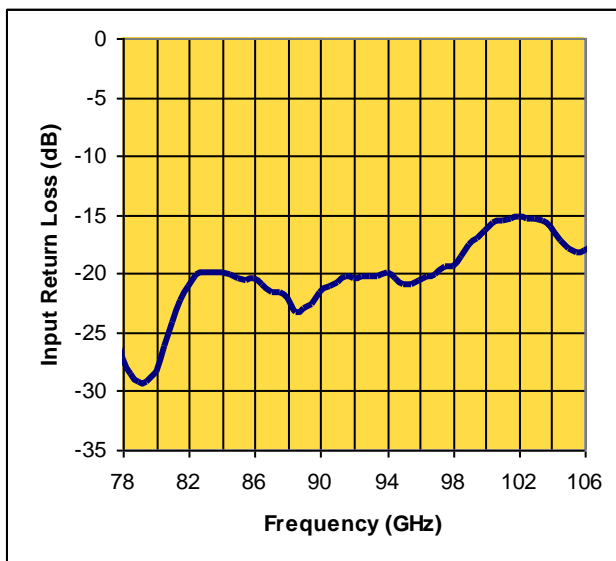
Linear Gain Versus Frequency



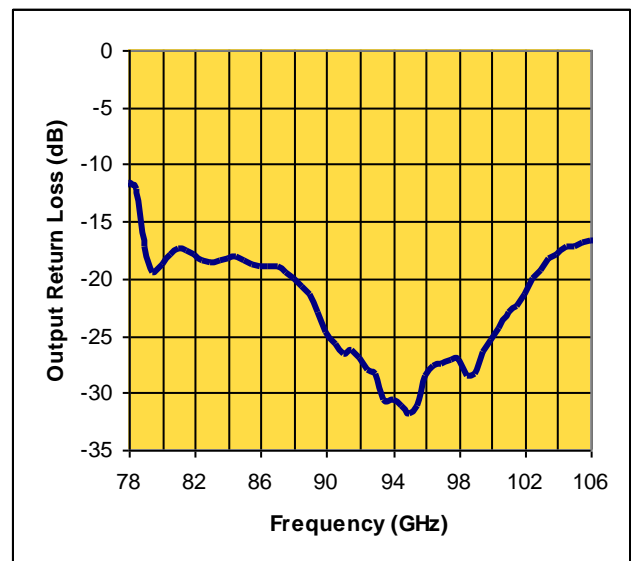
Noise Figure Versus Frequency



Input Return Loss Versus Frequency



Output Return Loss Versus Frequency



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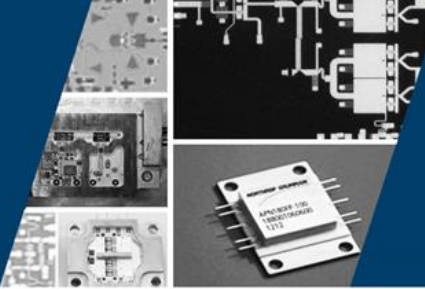
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Measured Performance Characteristics (Typical Performance at 25°C)

Vd = 5 V, Id = 50 mA

Freq. (GHz)	S11 Mag	S11 Ang	S21 Mag	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
82.0	0.053	1.516	9.104	125.461	0.003	-69.524	0.254	45.043
82.5	0.073	46.699	9.291	106.738	0.003	-74.527	0.250	45.725
83.0	0.117	51.402	9.758	90.252	0.004	-96.937	0.263	45.064
83.5	0.150	48.858	9.664	71.445	0.003	-98.062	0.266	42.963
84.0	0.179	45.258	9.258	57.992	0.004	-104.099	0.272	39.143
84.5	0.195	38.205	9.044	45.414	0.004	-122.945	0.271	35.567
85.0	0.205	35.558	9.172	33.005	0.004	-154.873	0.264	33.069
85.5	0.220	31.455	9.244	19.466	0.004	-133.621	0.263	30.582
86.0	0.225	26.331	9.066	5.161	0.005	-138.273	0.256	27.025
86.5	0.231	23.156	9.054	-6.478	0.004	-132.138	0.259	23.719
87.0	0.224	19.534	8.778	-21.156	0.005	-174.753	0.239	22.204
87.5	0.211	19.580	9.187	-31.336	0.008	167.954	0.231	20.991
88.0	0.213	18.705	9.100	-47.116	0.007	150.518	0.222	21.001
88.5	0.215	18.003	9.072	-60.531	0.005	150.258	0.219	20.163
89.0	0.224	18.678	8.852	-74.411	0.007	144.992	0.209	20.740
89.5	0.224	16.003	8.789	-86.854	0.008	125.255	0.214	20.532
90.0	0.233	14.375	8.549	-100.162	0.009	111.114	0.219	21.053
90.5	0.223	11.622	8.455	-111.632	0.007	108.791	0.215	19.983
91.0	0.223	10.737	8.133	-125.265	0.008	86.373	0.219	16.801
91.5	0.220	7.892	7.747	-138.529	0.009	69.422	0.213	14.364
92.0	0.221	7.127	7.741	-149.145	0.010	73.095	0.212	13.075
92.5	0.221	5.894	7.352	-162.508	0.008	59.014	0.215	12.082
93.0	0.216	3.195	7.136	-173.280	0.011	57.682	0.203	10.268
93.5	0.214	2.840	7.089	174.916	0.010	40.460	0.192	9.830
94.0	0.210	-0.077	7.000	163.019	0.012	31.176	0.188	7.848
94.5	0.204	-3.042	6.439	152.825	0.009	17.122	0.189	10.980
95.0	0.186	-4.248	6.607	144.651	0.011	5.344	0.180	10.817
95.5	0.180	-6.030	6.876	131.081	0.010	5.212	0.191	5.853
96.0	0.170	-7.466	6.673	116.697	0.009	-4.348	0.185	-4.534
96.5	0.148	-10.320	6.627	106.426	0.011	-5.521	0.144	-0.201
97.0	0.129	-9.766	6.433	94.290	0.009	-9.464	0.133	6.879
97.5	0.110	-12.161	6.445	82.779	0.009	-21.447	0.125	11.313
98.0	0.085	-2.815	6.570	71.287	0.008	-42.355	0.128	17.336
98.5	0.074	9.910	6.585	57.524	0.008	-56.711	0.134	22.008
99.0	0.061	31.002	6.265	43.626	0.009	-55.278	0.140	25.278
99.5	0.075	60.917	6.470	30.699	0.008	-53.393	0.139	26.211
100.0	0.097	68.260	6.135	15.612	0.010	-58.600	0.139	27.404
100.5	0.129	77.442	6.179	3.813	0.008	-73.537	0.131	40.910
101.0	0.167	76.631	6.196	-11.718	0.008	-75.940	0.152	42.035
101.5	0.198	76.279	6.077	-29.074	0.005	-94.569	0.171	43.373
102.0	0.240	74.186	5.430	-44.540	0.003	-144.360	0.192	45.871

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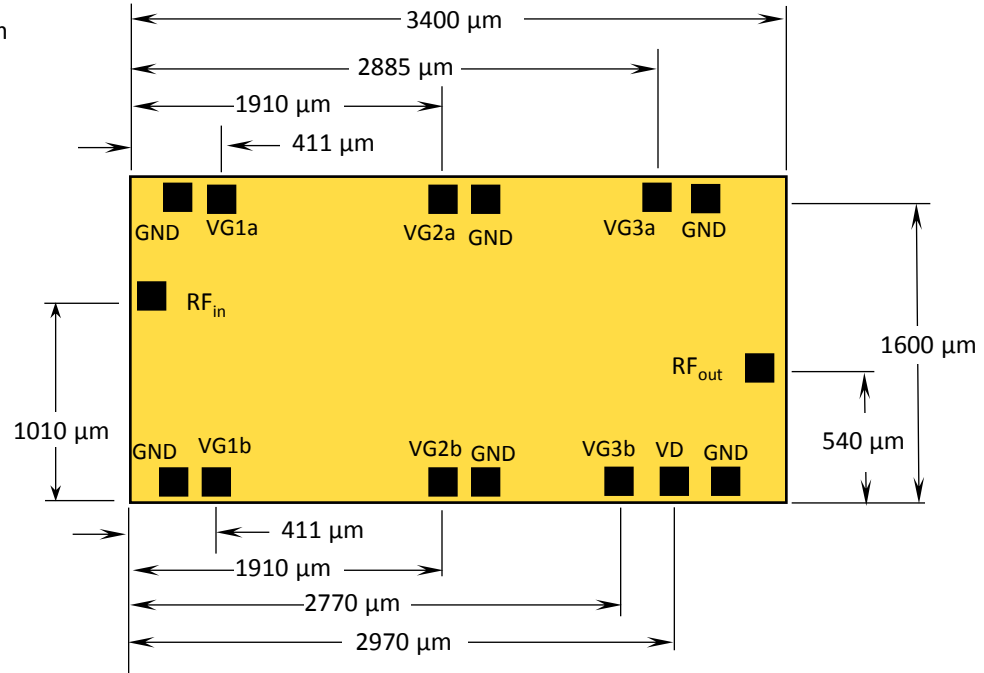
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Die Size and Bond Pad Locations (Not to Scale)

X = 3400 μm \pm 25 μm
 Y = 1600 μm \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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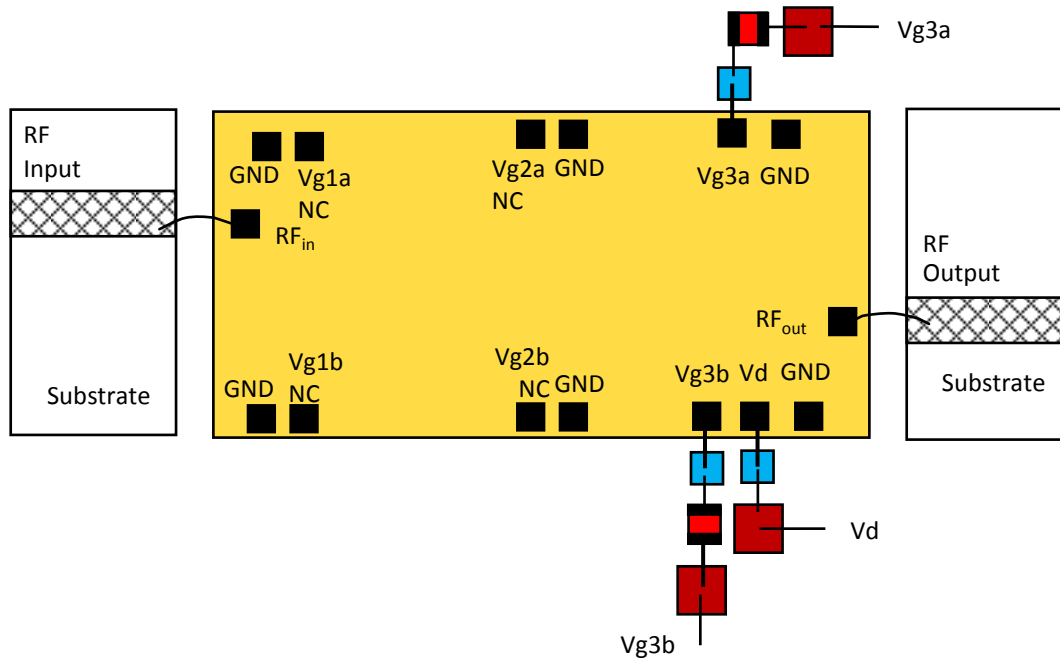
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Suggested Bonding Arrangement

- = 0.1 μ F, 15V (Shunt)
- = 10 Ohms, 30V (Series)
- = 100 pF, 15V (Shunt)



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. Vg1a/b and Vg2a/b are optional gate bias pads and can be used in place of Vg3a/b. Typical use would be NC.

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