NORTHROP GRUMMAN

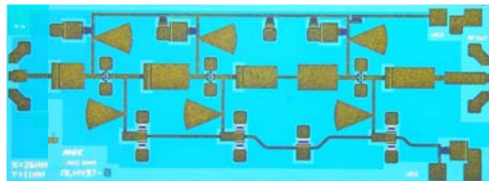
Velocium Products

ALH497

80 – 100 GHz Low Noise Amplifier

Preliminary Datasheet

Revision: May 2007



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

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

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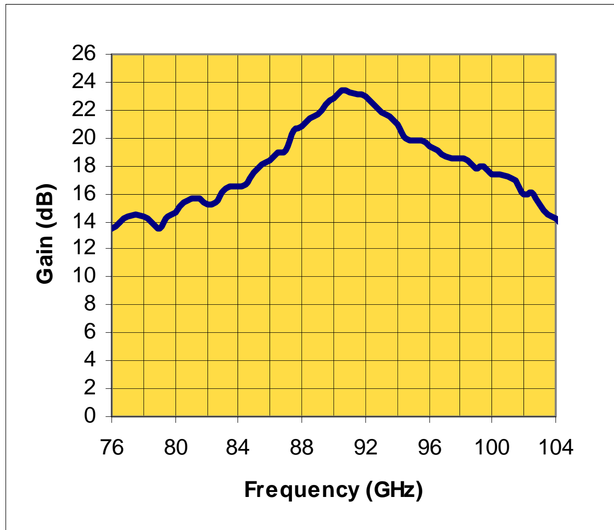
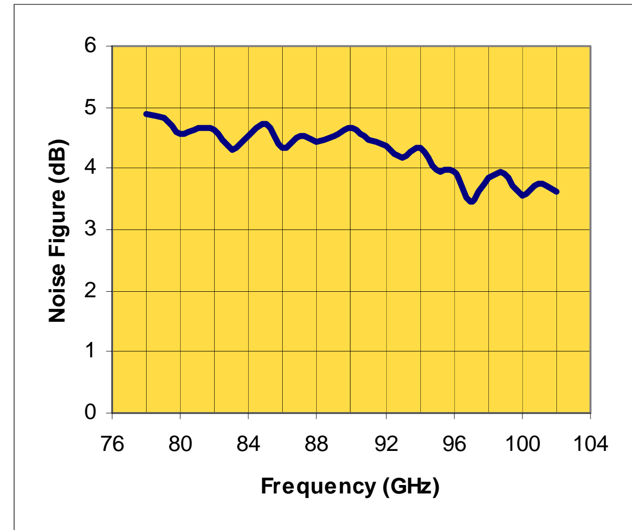
Measured Performance Characteristics (Typical Performance at 25°C)
Vd3 = 2V, Id3 = 25 mA

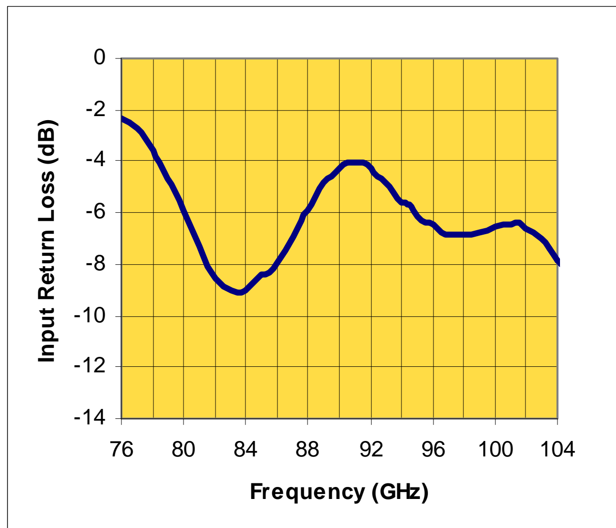
Linear Gain Versus Frequency



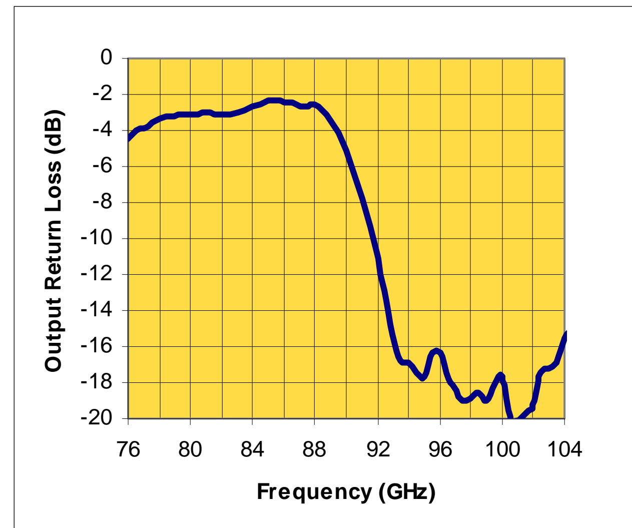
Noise Figure Versus Frequency



Input Return Loss Versus Frequency



Output Return Loss Versus Frequency



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ALH497

80 – 100 GHz Low Noise Amplifier

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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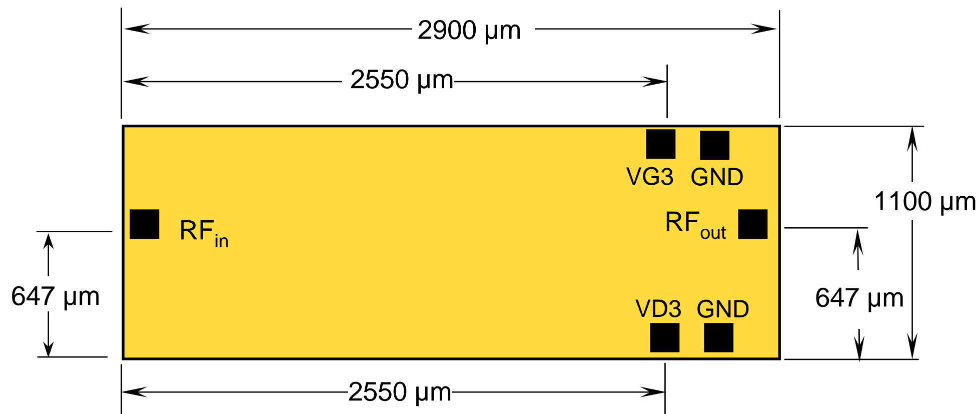
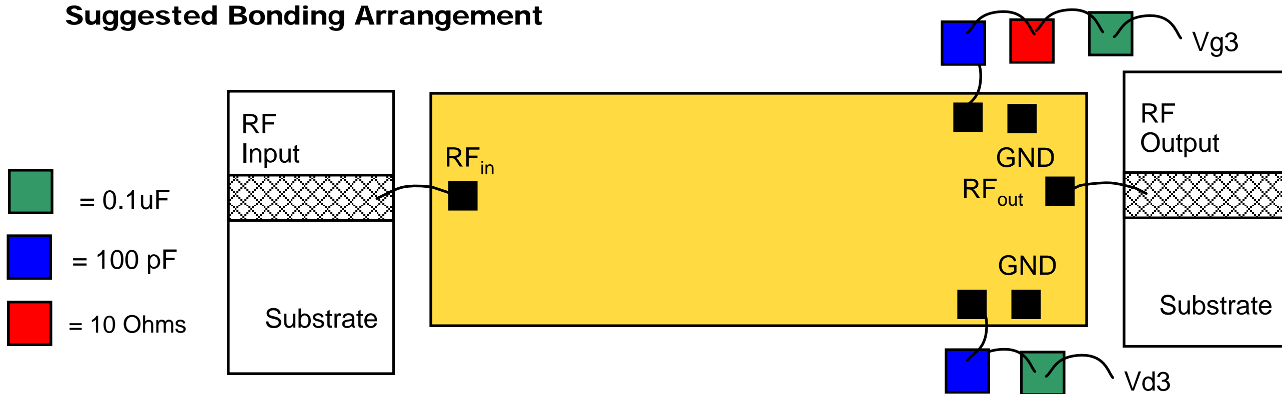
Die Size and Bond Pad Locations

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.

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