



1.7 – 2.2 GHz LOW NOISE AMPLIFIER WHM19-3032AE¹

WHM19-3032AE LNA is a low noise figure, wideband, and high linearity SMT packaged amplifier with unconditional stable design. The amplifier offers typical 0.90 dB noise figure, 30 dB gain, and output IP₃ of 27.0 dBm at the frequency range from 1.7 GHz to 2.2 GHz of DCS, PCS, and 3G bands. WHM19-3032AE is most suitable for cellular base stations, wireless data communications, tower top receiver amplifiers, last-mile wireless communication systems, and wireless measurement applications.



Key Features:

Impedance:	50 Ohm
MTBF ² :	>600,000 hrs (68 Years)
LGA (land grid array) Package:	6-pin
Low Noise:	0.90 dB
Output IP ₃ :	31.0 dBm
Gain:	30.0 dB
P _{1dB} :	16.0 dBm
Single Power Supply:	95 mA @ +5V
Frequency Range:	1.7 ~ 2.2 GHz
Operating Temperature:	-40 ~ +85 °C
VSWR:	1.3:1
Small Size:	0.30" x 0.30" x 0.060" (7.62 mm x 7.62 mm x 1.52 mm)
Built-In Functions:	DC blocks at input and output, temperature compensation circuits, and auto DC biases.

Absolute Maximum Ratings³:

Symbol	Parameters	Units	Absolute Maximum
V _{dd}	DC Power Supply Voltage	V	6.0
I _{dd}	Drain Current	mA	120
P _{diss}	Total Power Dissipation	mW	700
P _{In,Max}	RF Input Power	dBm	10
T _{ch}	Channel Temperature	°C	150
T _{STG}	Storage Temperature	°C	-55 ~ 125
T _{O,MAX}	Maximum Operating Temperature	°C	-40 ~ +85
T _{Re,MAX}	Maximum Reflow Temperature	°C	230 ⁴
R _{th,c}	Thermal Resistance	°C/W	220

¹ Specifications are subject to change without notice.

² MTBF: Mean Time Between Failure, Per TR-NWT-000332, ISSUE 3, SEPTEMBER, 1990, T=40°C

³ Operation of this device above any one of these parameters may cause permanent damage.

⁴ Refer to Wan7com's AN-109 for correct solder reflow temperature profile.



Specifications:

a) **Table 1** Summary of the electrical specifications WHM19-3032AE at room temperature

Index	Testing Item	Symbol	Test Constraints	Nom (RT)	Min	Max	Unit
1	Gain	S_{21}	1.7 – 2.2 GHz	30	28	32	dB
2	Gain Variation	ΔG	1.7 – 2.2 GHz	+/- 0.20		+/- 0.50	dB
3	Input Return Loss	S_{11}	1.7 – 2.2 GHz	20	16		
4	Output VSWR	VSWR ₂	1.7 – 2.2 GHz	20	16		
5	Reverse Isolation	S_{12}	1.7 – 2.2 GHz	45	40		dB
6	Noise figure	NF	1.7 – 2.2 GHz	0.90		1.0	dB
7	Output Power 1dB compression Point	P_{1dB}	1.7 – 2.2 GHz	16	15		dBm
8	Output-Third-Order Interception point	IP_3	Two-Tone, $P_{out} = +0$ dBm each, 1 MHz separation	31	30		dBm
10	Current Consumption	I_{dd}	$V_{dd} = +5$ V	95	85	100	mA
11	Power Supply Voltage	V_{dd}		+5	+4.7	+5.3	V
12	Thermal Resistance	$R_{th,c}$	Junction to case			220	°C/W
13	Operating Temperature	T_o			-40	+85	°C
14	Maximum Average RF Input Power	$P_{IN, MAX}$	1.7 – 2.2 GHz			10	dBm

b) Passband Frequency Response

As shown in **Figure 1**, the typical gain of the WHM19-3032AE is 30.0 dB across 1.7 to 2.2 GHz. The typical input and output return losses are 20 dB across the frequency of 1.7 to 2.2 GHz.

Figure 2 shows the measured P_{1dB} and IP_3 of the WHM19-3032AE. The typical P_{1dB} and IP_3 are 16.0 dBm and 31.0 dBm in the frequency range of 1.7 to 2.2 GHz, respectively.

Figure 3 illustrates the measured noise figure performance at full temperature. The measured results include the test fixture loss of approximately 0.05 ~ 0.10 dB. The noise figure is 0.90 dB across the frequency range of 1.7 to 2.2 GHz at room temperature. At 85 °C, WHM19-3032AE only has 0.30 dB noise increases. At -40 °C, WHM19-3032AE offers approximately 0.25 dB less noise figure than that at room temperature.

Figure 4 demonstrates the stability factor k of the amplifier. It is greater than 1.0 in full frequency band and the amplifier is unconditional stable.

Figure 5 is the frequency response of WHM19-3032AE in the extended frequencies. The amplifier works from 1.5 GHz to 2.5 GHz.

Figure 6 is the block diagram of internal circuit of WHM19-3032AE. It is a two-stage amplifier with the DC block capacitors at the input and output RF ports. All the RF matching networks, DC bias circuitries, and temperature compensation circuits are built in.

Figure 7 demonstrates the application schematic diagram of WHM19-3032AE. It may require one external decoupling capacitor of 0.01 uF to build a LNA with WHM19-3032AE. The +5V DC can be applied at Pin 2. No DC block capacitor is required for both input and output RF ports. The NC pins connecting to ground are recommended. For +5V line trace length being longer than 6 inch without a decoupling capacitor, an additional 0.01 ~ 0.1 uF decoupling capacitor with minimum rating voltage of 10V may be needed across the +5V line to ground. The capacitor must be rated in the temperature range of -40 °C to 85 °C to ensure the entire circuit working in the specified temperature range.

Figure 8 shows the mechanical outline and recommended motherboard layout of WHM19-3032AE. Plenty ground vias on the motherboard are essential for the RF grounding. The width of the 50-Ohm lines at the input and output RF ports may be different for different characteristics of the substrate.

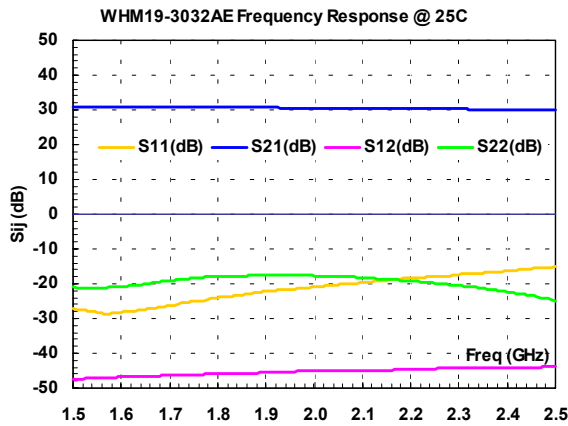


FIG. 1 Typical small signal performance.

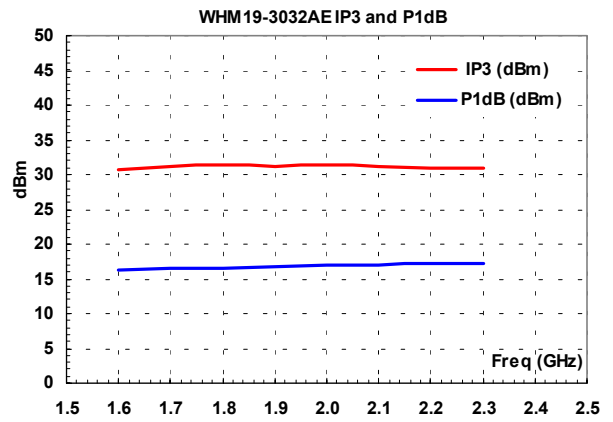


FIG. 2 Typical P_{1dB} and IP₃ at room temperature.

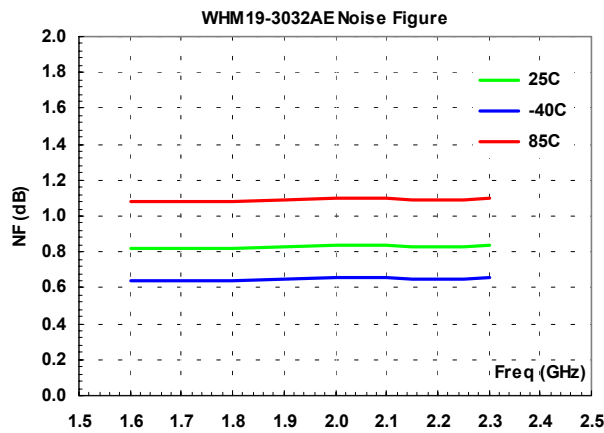


FIG. 3 Noise figure performance at full temperature

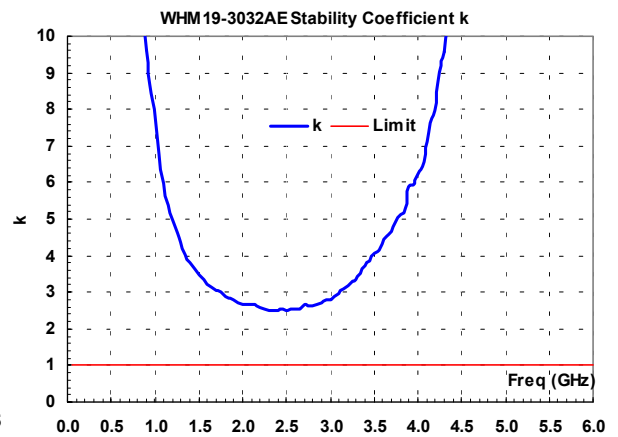


FIG. 4 Stability factor k

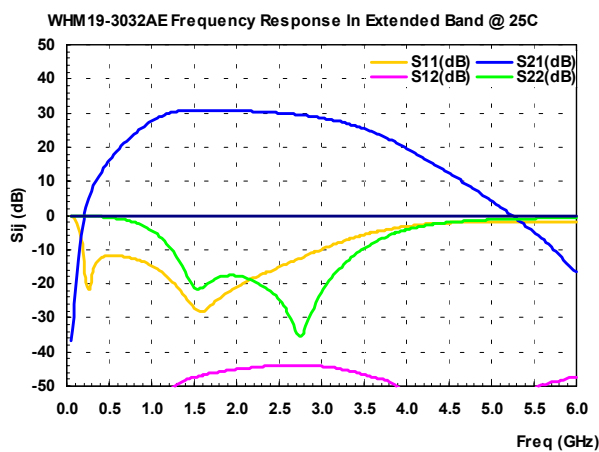


FIG. 5 Frequency response in the extended frequencies

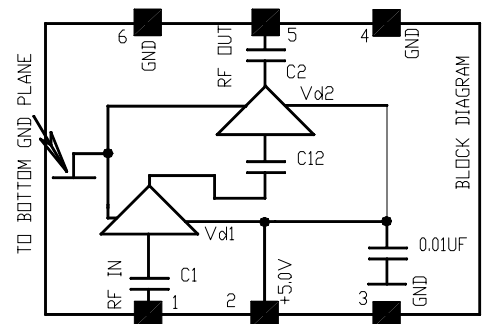


FIG. 6 Block diagram of internal circuit.

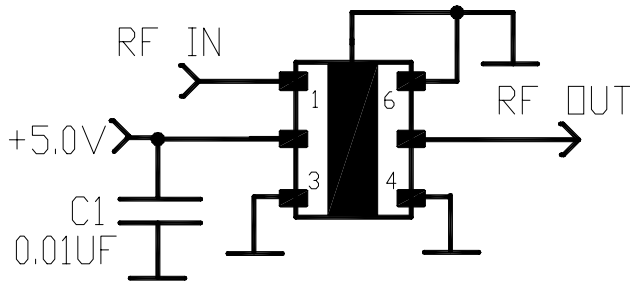


FIG. 7 Typical application schematic for WHM19-3032AE

WHM19-3032AE Mechanical Outline, WHM-2:

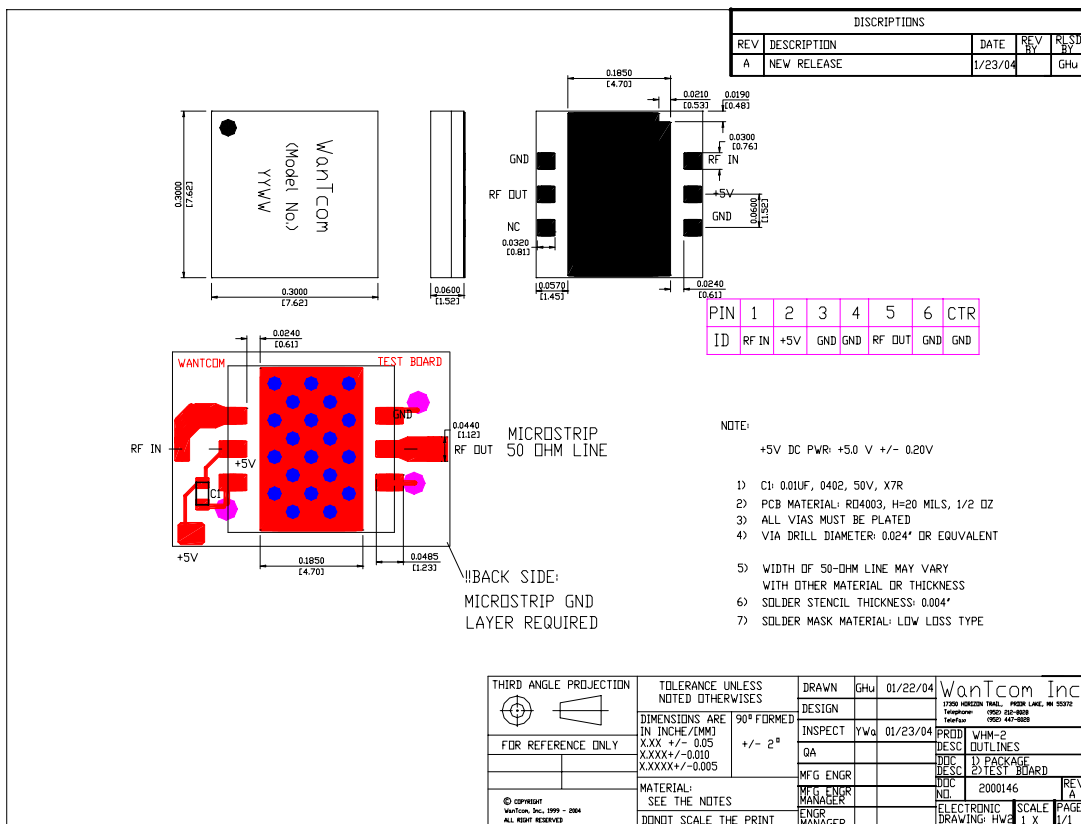


FIG. 8 WHM19-3032AE outline



Ordering Information

Model Number	WHM19-3032AE
---------------------	--------------

Waffle pack with the capacity of 64 pieces (8 x 8) is used for the packing. Contact factory for tape and reel packing option for higher volume requirements.

Small Signal S-Parameters:

! WLA19-3032AE
! Vdd = +5.0 V, Idd = 95 mA, Last Updat: 3/20/04
Ghz s ma r 50

0.05	0.972	-37.7	0.032	-19.6	0.000051	141.0	0.998	-8.6
0.1	0.836	-67.2	0.165	-68.0	0.000053	-110.8	0.996	-14.3
0.2	0.258	-138.0	0.946	-139.6	0.000026	-174.2	0.990	-29.0
0.3	0.137	-50.7	2.399	169.9	0.000119	57.1	0.976	-43.5
0.4	0.236	-74.4	4.185	133.3	0.000143	18.2	0.957	-58.5
0.5	0.260	-100.2	6.288	104.2	0.000199	-36.1	0.932	-73.9
0.6	0.255	-124.8	8.814	78.2	0.000303	-65.9	0.897	-90.2
0.7	0.246	-148.4	11.911	53.4	0.000595	-95.6	0.852	-106.9
0.8	0.230	-172.1	15.580	29.5	0.000864	-114.8	0.791	-125.1
0.9	0.210	163.3	19.556	5.4	0.001277	-138.6	0.710	-143.7
1	0.181	138.7	23.598	-19.6	0.001731	-159.5	0.606	-163.4
1.1	0.151	116.0	27.312	-45.1	0.002330	179.0	0.486	177.3
1.2	0.119	94.6	30.467	-70.4	0.002906	160.7	0.358	159.2
1.3	0.090	76.6	32.565	-94.6	0.003362	141.1	0.239	144.6
1.4	0.062	66.5	33.818	-118.1	0.003847	122.6	0.143	140.1
1.5	0.044	69.0	34.470	-140.3	0.004241	107.1	0.089	154.0
1.6	0.039	82.8	34.589	-161.3	0.004533	93.2	0.091	175.3
1.7	0.048	89.2	34.532	178.4	0.004773	80.7	0.110	175.6
1.8	0.062	88.0	34.328	158.9	0.005070	68.3	0.126	166.8
1.9	0.078	80.2	34.081	140.0	0.005266	56.6	0.132	152.7
2	0.089	72.3	33.748	121.4	0.005588	45.3	0.130	137.3
2.1	0.103	62.0	33.401	103.1	0.005686	35.8	0.122	120.5
2.2	0.121	53.8	32.952	84.9	0.005873	24.9	0.110	100.6
2.3	0.134	43.9	32.446	66.8	0.006173	14.4	0.094	81.2
2.4	0.152	33.4	31.890	48.7	0.006285	3.3	0.076	58.4
2.5	0.174	24.5	31.285	30.4	0.006405	-6.1	0.057	34.6
2.6	0.197	13.5	30.508	12.1	0.006435	-15.7	0.037	5.8
2.7	0.222	4.5	29.682	-6.0	0.006214	-27.1	0.020	-46.6
2.8	0.250	-6.5	28.650	-24.3	0.006459	-36.5	0.022	-146.3
2.9	0.284	-17.3	27.578	-42.9	0.006339	-47.1	0.043	167.3
3	0.318	-29.1	26.465	-61.4	0.006269	-57.5	0.074	134.6
3.1	0.355	-39.6	25.135	-79.9	0.005962	-68.7	0.115	108.5
3.2	0.394	-51.3	23.722	-98.5	0.005710	-78.7	0.158	86.2
3.3	0.436	-63.8	22.159	-117.1	0.005423	-87.5	0.209	64.1
3.4	0.479	-76.2	20.457	-135.9	0.004932	-99.6	0.267	43.9
3.5	0.518	-88.6	18.653	-154.9	0.004518	-110.0	0.327	24.4
3.6	0.559	-100.9	16.731	-173.3	0.004249	-121.2	0.389	4.9
3.7	0.594	-113.7	14.834	168.6	0.003984	-129.7	0.450	-13.2
3.8	0.629	-126.5	12.925	150.9	0.003608	-139.9	0.511	-30.8
3.9	0.666	-138.9	11.114	133.7	0.003087	-153.0	0.565	-47.3
4	0.698	-152.1	9.464	117.1	0.002915	-166.7	0.616	-63.1
4.1	0.718	-164.6	8.022	100.2	0.002542	177.7	0.662	-78.0
4.2	0.738	-177.1	6.824	84.2	0.002268	166.1	0.700	-92.2
4.3	0.754	170.9	5.768	68.9	0.001893	144.7	0.735	-106.2
4.4	0.767	158.6	4.805	53.8	0.001573	124.3	0.766	-119.1
4.5	0.778	146.7	3.989	38.4	0.001398	99.6	0.792	-131.7
5	0.803	88.6	1.584	-33.8	0.001339	-3.4	0.871	171.9
5.5	0.803	32.1	0.697	-96.5	0.002869	0.2	0.902	122.7
6	0.797	-21.1	0.318	-135.2	0.004094	-48.3	0.919	78.2