



0.50 – 2.50 GHz LOW NOISE AMPLIFIER WHM0526AE¹

WHM0526AE LNA is a low noise figure, wideband, and high linear amplifier with SMT package design. The amplifier offers typical 0.85 dB noise figure and 31 dBm minimum output IP₃ at the frequency range from 0.50 GHz to 2.50 GHz. WHM0526AE LNA is most suitable for cellular base stations, wireless data communications, tower top receiver amplifiers, cellular micro-cells, last-mile wireless communication systems, and wireless measurement applications.



WHM0526AE is designed to meet the rugged standards of MIL-STD-202, and MIL-STD-883. WHM0526AE is RoHS complied.

Key Features:

RoHS Compliance:	Yes
Impedance:	50 Ohm
MTBF ² :	>600,000 hrs (68 Years)
LGA (land grid array) package:	6-pin
Low Noise:	0.8 ~ 1.0 dB
Output IP ₃ :	31 dBm minimum
Gain:	14.5 ~ 20 dB
P _{1dB} :	16 dBm Min
Single power supply:	65 mA @ +3.0V
Frequency Range:	0.50 ~ 2.50 GHz
Operating Temperature:	-40 ~ +85 °C
Return Losses:	16 dB
Miniature size:	0.250" x 0.250" x 0.060" (6.35 mm x 6.35 mm x 1.52 mm)

Absolute Maximum Ratings³:

Symbol	Parameters	Units	Absolute Maximum
V _{dd}	DC Power Supply Voltage	V	5.0
I _{dd}	Drain Current	mA	85
P _{diss}	Total Power Dissipation	mW	400
P _{In,Max}	RF Input Power	dBm	10
T _{ch}	Channel Temperature	°C	150
T _{STG}	Storage Temperature	°C	-65 ~ 150
T _{O,MAX}	Maximum Operating Temperature	°C	-55 ~ 100
R _{th,c}	Thermal Resistance	°C/W	215

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.

**Specifications:****a) Table 1** Summary of the electrical specifications WHM0526AE at room temperature

Index	Testing Item	Symbol	Test Constraints	Nom (RT)	Min	Max	Unit
1	Gain	S_{21}	0.50 – 2.50 GHz		14	21	dB
2	Gain Variation	ΔG	0.50 – 2.50 GHz	+/- 3.5			dB
3	Input Return Loss	S_{11}	0.50 – 0.70 GHz		14		dB
			0.70 – 2.30 GHz	20	16		
			2.30 – 2.50 GHz		14		
4	Output Return Loss	S_{22}	0.50 – 0.70 GHz		14		dB
			0.70 – 2.30 GHz	20	16		
			2.30 – 2.50 GHz		14		
5	Reverse Isolation	S_{12}	0.50 – 2.50 GHz		15		dB
6	Noise figure	NF	0.50 – 2.50 GHz			1.2	dB
7	Output P_{1dB} compression	P_{1dB}	0.50 – 2.50 GHz		16		dBm
8	Output-Third-Order Interception point	$TOIP_3$	Two-Tone, $P_{out}=+0$ dBm each, 1 MHz separation		31		dBm
9	Current Consumption	I_{dd}	$V_{dd}=+3.0$ V	65			mA
10	Power Supply Voltage	V_{dd}		+3	+2.8	+3.2	V
11	Thermal Resistance	$R_{th,c}$	Junction to case			215	°C/W
12	Operating Temperature	T_o			-40	+85	°C

b) Passband Frequency Response

As shown in **Figure 1**, the typical gain of the WHM0526AE is from 14.0 dB to 21.0 dB across 0.50 to 2.50 GHz frequency range. The typical input and output return losses are 18 dB across the frequency of 0.50 to 2.50 GHz.

Figure 2 shows the P_{1dB} and IP_3 of the WHM0526AE. The typical P_{1dB} and IP_3 are 16.0 dBm and 32.0 to 34.0 dBm in the frequency range of 0.50 to 2.50 GHz, respectively.

Figure 3 illustrates the noise figure performance at full temperature. The data include the test fixture loss of approximately 0.05 dB. The noise figure is 0.90 ~ 1.0 dB across the frequency range of 0.50 to 2.50 GHz at room temperature. At 85 °C, WHM0526AE only has 0.30 dB noise increases. At -40 °C, WHM0526AE 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 less than 1.0 in some frequency band and the amplifier is conditional stable.

Figure 5 shows the frequency response in the extended frequency band.

Figure 6 is the block diagram of internal circuit of WHM0526AE. It is a one-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 WHM0526AE. It may require one external decoupling capacitor of 0.01 uF to build a LNA with WHM0526AE. The +3V DC is applied at Pin 3. No DC block capacitor is required for both input and output RF ports. The NC pins connected to ground are recommended. For +3V line trace length being longer than 6 inch without a decoupling capacitor, an additional 0.01 ~ 0.1 uF de-coupling capacitor with minimum rating voltage of 10V may be needed across the +3V line to the 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 WHM0526AE. Plenty of 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 property of the substrate.

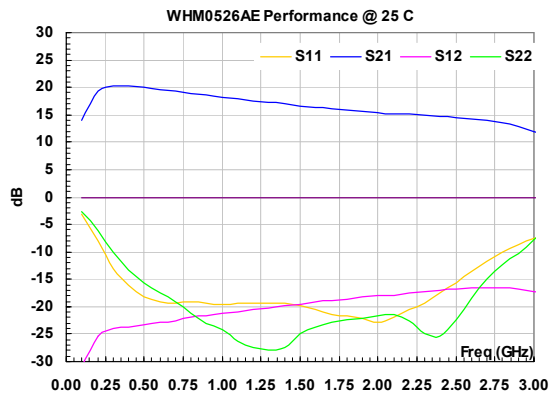


FIG. 1 Typical small signal performance.

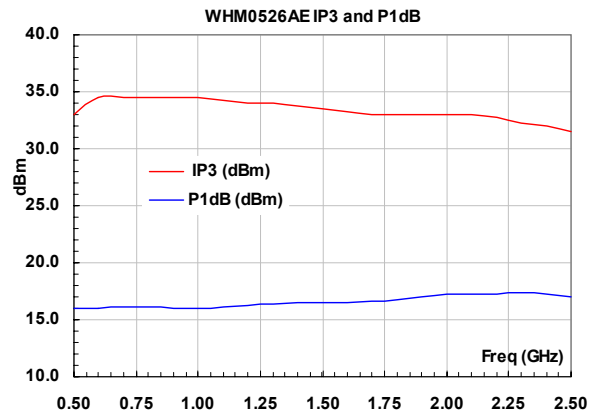


FIG. 2 Typical P_{1dB} and IP_3 at room temperature.

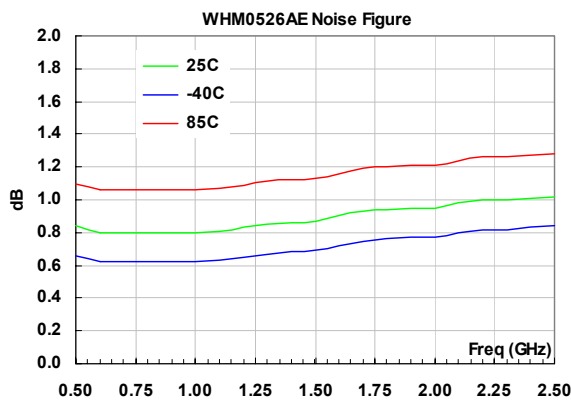


FIG. 3 Noise figure performance at full temperature

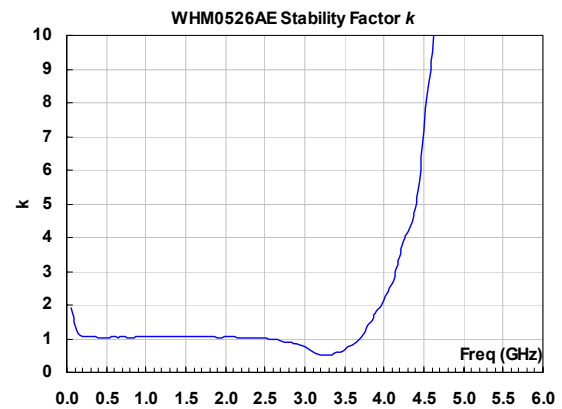


FIG. 4 Measured stability factor k

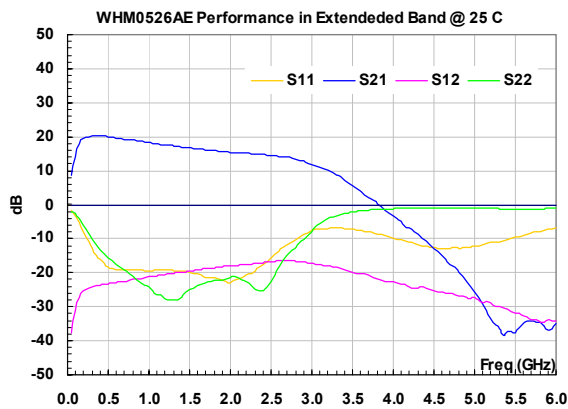


FIG. 5 Small signal performance at extended band

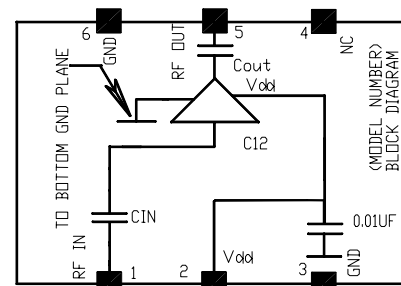


FIG. 6 Block diagram of internal circuit.

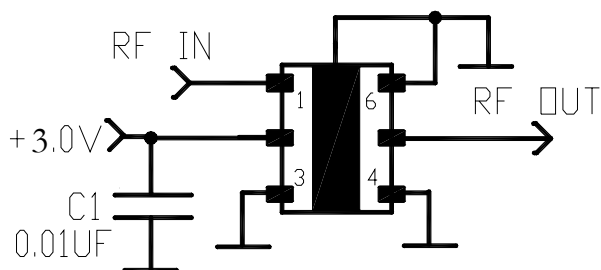


FIG. 7 Typical application schematic for WHM0526AE

WHM0526AE Mechanical Outline, WHM-1S:

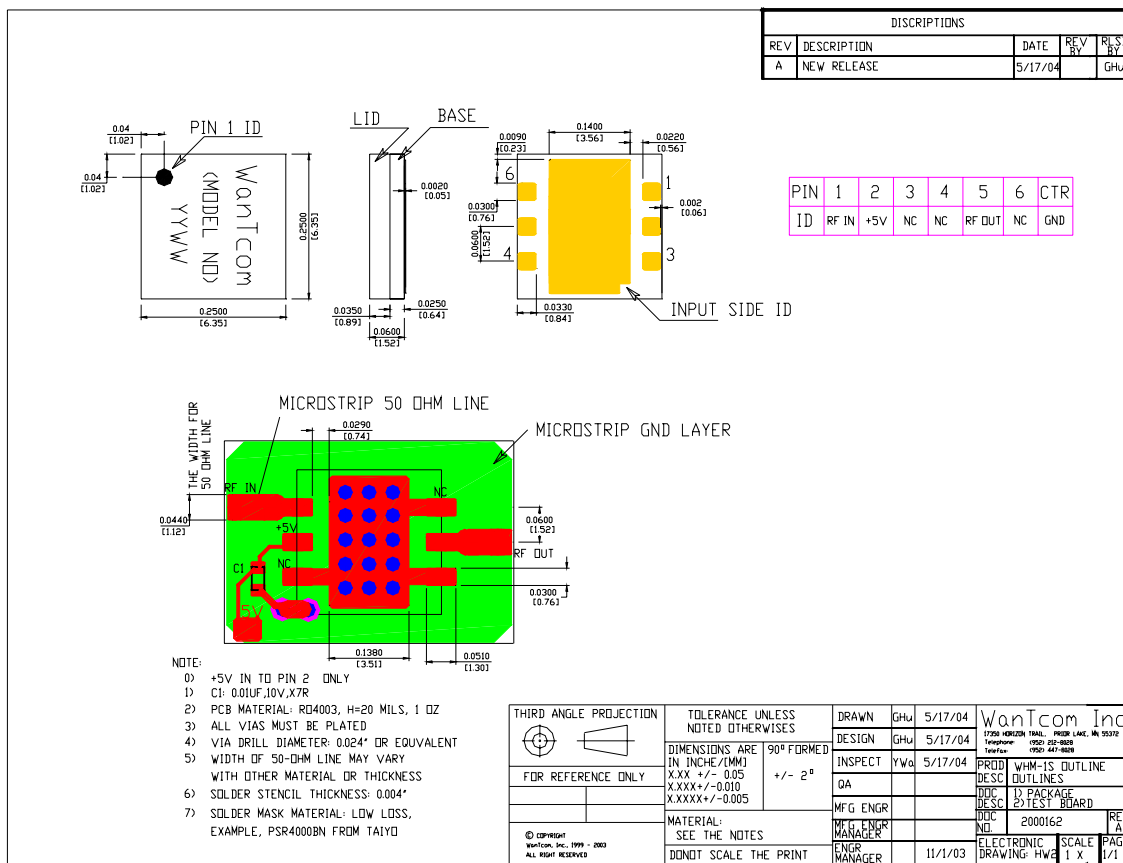


FIG. 8 WHM0526AE outline



Ordering Information

Model Number	WHM0526AE
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Waffle pack with the capacity of 100 pieces (10 x 10) is used for the packing. Contact factory for tape and reel packing option for higher volume requirements.

Small Signal S-Parameters

IWHM0526AE

Is-parameters at Vdd=3V, Id=65 mA, including the test board.

!Last updated 7/22/03.

GHz s MA R 50

IF(MHz)	MAG S11	ANG S11	MAG S21	ANG S21	MAG S12	ANG S12	MAG S22	ANG S22
0.05	0.823	-50.1	2.68	-9.2	0.0130	176.0	0.783	-44.3
0.1	0.7	-76.6	5.076	-71.4	0.0280	121.7	0.744	-69.4
0.2	0.398	-137.6	9.277	-138.4	0.0540	69.1	0.498	-129.2
0.3	0.224	-178.6	10.216	-175.8	0.0630	45.0	0.313	-171.4
0.4	0.157	149.4	10.265	158.7	0.0660	30.0	0.218	154.0
0.5	0.123	121.4	9.977	138.9	0.0690	22.1	0.167	123.1
0.6	0.112	97.2	9.564	120.7	0.0710	13.0	0.133	93.1
0.7	0.109	76.4	9.2	105.4	0.0750	8.7	0.109	65.2
0.8	0.109	61.7	8.863	91.3	0.0800	3.3	0.088	36.7
0.9	0.108	47.7	8.474	78.1	0.0820	-1.9	0.071	8.2
1	0.104	35.4	8.151	65.6	0.0870	-7.3	0.061	-22.0
1.1	0.109	26.3	7.828	53.2	0.0900	-11.5	0.048	-52.6
1.2	0.109	16.6	7.54	41.5	0.0940	-17.4	0.042	-89.1
1.3	0.108	8.2	7.246	30.0	0.0980	-21.8	0.04	-130.2
1.4	0.107	0.7	7.015	18.6	0.1020	-27.0	0.043	-168.4
1.5	0.102	-6.6	6.775	7.5	0.1050	-32.2	0.056	162.6
1.6	0.095	-11.9	6.557	-3.5	0.1100	-37.0	0.065	139.6
1.7	0.086	-15.6	6.374	-14.2	0.1130	-42.9	0.072	116.4
1.8	0.083	-18.1	6.218	-25.4	0.1180	-48.1	0.077	94.9
1.9	0.078	-20.0	6.075	-36.6	0.1220	-53.7	0.079	74.3
2	0.071	-12.8	5.894	-47.9	0.1260	-59.9	0.083	58.1
2.1	0.081	-3.3	5.753	-58.6	0.1280	-64.7	0.085	32.6
2.2	0.093	-2.8	5.69	-70.4	0.1330	-71.7	0.074	4.2
2.3	0.108	4.2	5.56	-82.3	0.1370	-78.1	0.057	-28.9
2.4	0.135	4.0	5.454	-94.7	0.1400	-86.0	0.054	-75.8
2.5	0.166	-1.3	5.308	-107.3	0.1450	-92.2	0.076	-125.6
2.6	0.211	-7.5	5.159	-121.0	0.1480	-100.4	0.121	-162.1
2.7	0.262	-18.5	4.997	-135.2	0.1490	-109.6	0.18	171.1
2.8	0.315	-28.7	4.729	-149.6	0.1470	-118.9	0.24	149.0
2.9	0.364	-41.2	4.355	-164.5	0.1440	-127.3	0.308	130.5
3	0.416	-56.6	3.899	-178.8	0.1380	-135.1	0.409	115.5
3.1	0.442	-72.8	3.613	167.9	0.1320	-141.7	0.536	94.5
3.2	0.448	-86.6	3.281	153.1	0.1280	-149.6	0.629	72.8
3.3	0.453	-100.2	2.764	136.6	0.1200	-158.1	0.694	53.3
3.4	0.444	-112.7	2.266	122.6	0.1110	-163.0	0.739	36.3
3.5	0.433	-124.9	1.914	109.9	0.1020	-170.5	0.778	20.5
3.6	0.417	-135.9	1.576	99.5	0.0980	-177.2	0.809	5.6
3.7	0.395	-146.7	1.279	89.1	0.0910	178.5	0.832	-7.9
3.8	0.373	-156.2	1.024	79.1	0.0810	175.2	0.849	-20.6
3.9	0.347	-164.6	0.819	69.7	0.0750	169.6	0.86	-33.0
4	0.327	-172.1	0.671	61.2	0.0730	165.4	0.873	-44.2
4.1	0.302	-179.4	0.563	53.4	0.0690	161.5	0.881	-55.1
4.2	0.287	175.5	0.457	46.4	0.0630	158.1	0.888	-65.4
4.3	0.258	170.4	0.367	39.7	0.0600	154.5	0.897	-75.4
4.4	0.248	166.8	0.291	30.8	0.0590	147.8	0.908	-84.8
4.5	0.235	163.4	0.23	22.2	0.0530	146.6	0.904	-94.1
5	0.243	154.6	0.052	-23.0	0.0430	120.5	0.908	-135.6
5.5	0.331	134.0	0.013	178.5	0.0260	101.2	0.861	-170.9
6	0.461	101.8	0.018	106.0	0.0200	99.0	0.884	158.3
