



3.0 - 4.2 GHz LOW NOISE AMPLIFIER WHM3043AE¹

WHM3043AE LNA is a low noise figure, wideband, and exceptional gain flatness amplifier. The amplifier offers 1.10 dB noise figure, 25.0 dB gain, and 11.0 dB P_{1dB} at the frequency range from 3.0 GHz to 4.2 GHz.

WHM3043AE is most suitable for handheld wireless data communication receiver amplifiers, last-mile wireless communication systems, and wireless measurement applications at S and C bands.

Preliminary

Key Features:

Impedance:	50 Ohm
Low Noise:	1.10 dB
Gain:	25.0
Gain Flatness:	+/- 0.30 dB
Input VSWR:	1.25:1
Output VSWR:	1.35:1
P _{1dB} :	11.0 dBm
Single Power Supply:	50 mA, @ +5.0 V (+3.3V for WHM3043BE Version)
Frequency Range:	3.0 ~ 4.2 GHz
Operating Temperature:	-40 ~ +85 °C

Absolute Maximum Ratings²:

Symbol	Parameters	Units	Absolute Maximum
V _{dd}	DC Power Supply Voltage	V	7.0 (+5.0 for BE Version)
I _{dd}	Drain Current	mA	70
P _{diss}	Total Power Dissipation	mW	500
P _{In,Max}	RF Input Power	dBm	5
T _{ch}	Channel Temperature	°C	150
T _{STG}	Storage Temperature	°C	-65 ~ 150
T _{O,MAX}	Maximum Operating Temperature	°C	-40 ~ 85
R _{th,c}	Thermal Resistance	°C/W	220

¹ Specifications are subject to change without notice.

² Operation of this device above any one of these parameters may cause permanent damage.

**Specifications:**

a) **Table 1** Summary of the electrical specifications of WHM3043AE at room temperature

Index	Testing Item	Symbol	Test Constraints	Nom (RT)	Min	Max	Unit
1	Gain	S_{21}	3.0 – 4.2 GHz	25	24.0	26.0	dB
2	Gain Variation	ΔG	3.0 – 4.2 GHz	+/- 0.30		+/- 0.7	dB
3	Input Return Loss	S_{11}	3.0 – 4.2 GHz	20	16		dB
4	Output Return Loss	S_{22}	3.0 – 4.2 GHz	17	15		dB
5	Reverse Isolation	S_{12}	3.0 – 4.2 GHz	45	40		dB
6	Noise figure	NF	3.0 – 4.2 GHz	1.10		1.30	dB
7	Output P_{1dB} compression	P_{1dB}	3.0 – 4.2 GHz	11.0	10		dBm
8	Output-Third-Order Interception point	IP_3	Two-Tone, P_{out} -10 dBm each, 1 MHz separation	--			dBm
9	Current Consumption	I_{dd}	$V_{dd} = +5$ V	50			mA
10	Power Supply Voltage	V_{dd}	WHM3043AE	5.0	4.80	5.20	V
			WHM3043BE	3.3	3.0	3.6	V
11	Operating Temperature	T_o			-40	+85	°C
12	Maximum Average RF Input Power	$P_{IN, MAX}$	3.0 – 4.2 GHz			5	dBm

As shown in **Figure 1**, the typical gain of the WHM3043AE is 25.0 dB across 3.0 GHz to 4.2 GHz. The typical input and output return losses are 20 dB and 16 dB, respectively. The LNA exhibits excellent gain flatness over wide frequency bandwidth.

The noise figure, as shown in **Figure 2**, of WHM3043AE is 1.10 dB³ at room temperature. The noise figure of 1.10 dB includes 0.05 dB loss of the SMA connector.

The output 1-dB compression point is shown in **Figure 3**. WHM3043AE offers typical 11.0 dBm P_{1dB} at room temperature.

Figure 4 demonstrates the stability factor k of the amplifier. k is greater than 1 in all frequency range and thus the amplifier is unconditional stable.

Figure 5 demonstrates the frequency response of WHM3043AE in the extended frequency range.

Figure 6 is the block diagram of internal circuit of WHM3043AE. It is a two-stage amplifier with the DC block capacitors at the input and output RF ports. All the RF matching networks, DC-DC converter, DC bias circuitries, and temperature compensation circuits are built in.

Figure 7 shows the mechanical outline and recommended motherboard layout of WHM3043AE. 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.

³ In order to measure such low noise figure, a low ENR noise source such as HP465A is required to reduce the non-linearity of the detector due to the high ENR. Please refers to AN-106 which is available at www.wantcominc.com

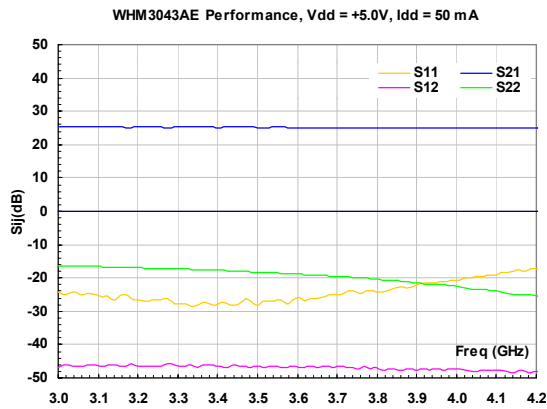


FIG. 1 Small signal performance of WHM3043AE

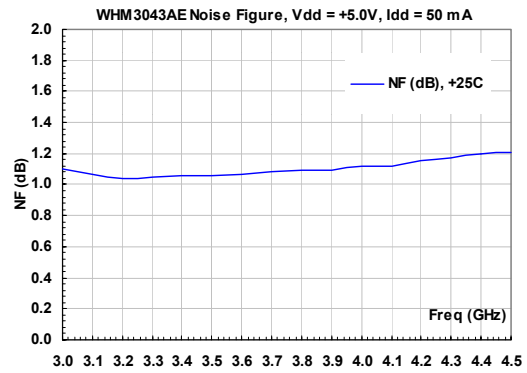


FIG. 2 Noise figure performance

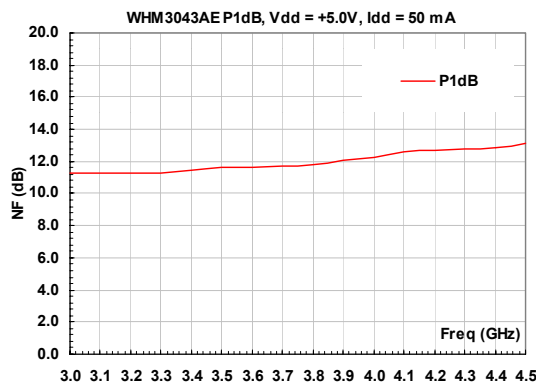


Fig. 3 Output 1-dB compression point

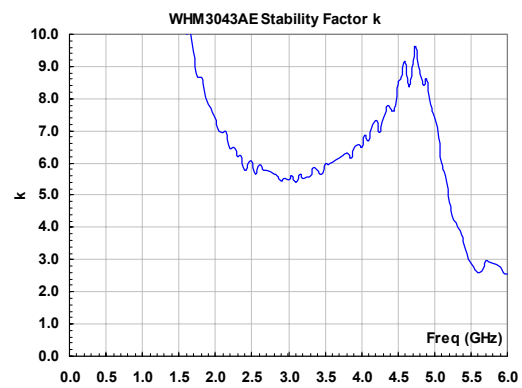


Fig. 4 Stability factor k

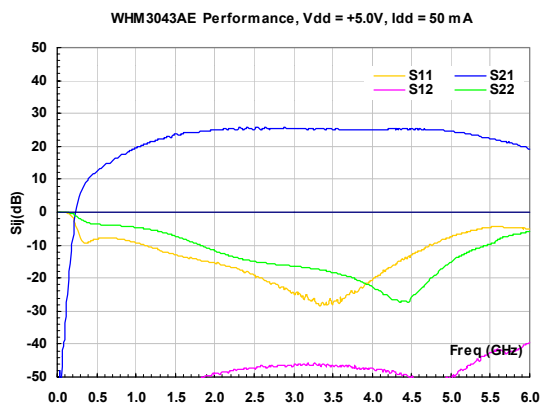


FIG. 5 Frequency response in the extended band.

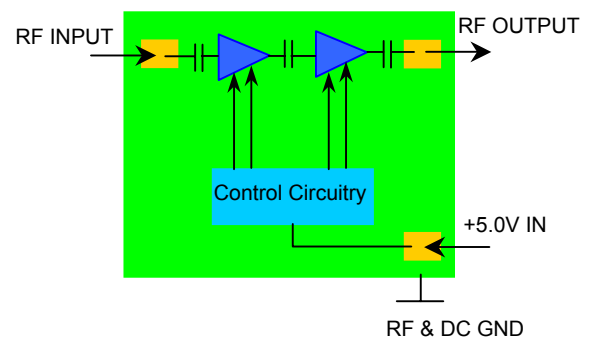


FIG. 6 Block diagram of WHM3043AE



WHM3043AE Mechanical Outline, WHM-2

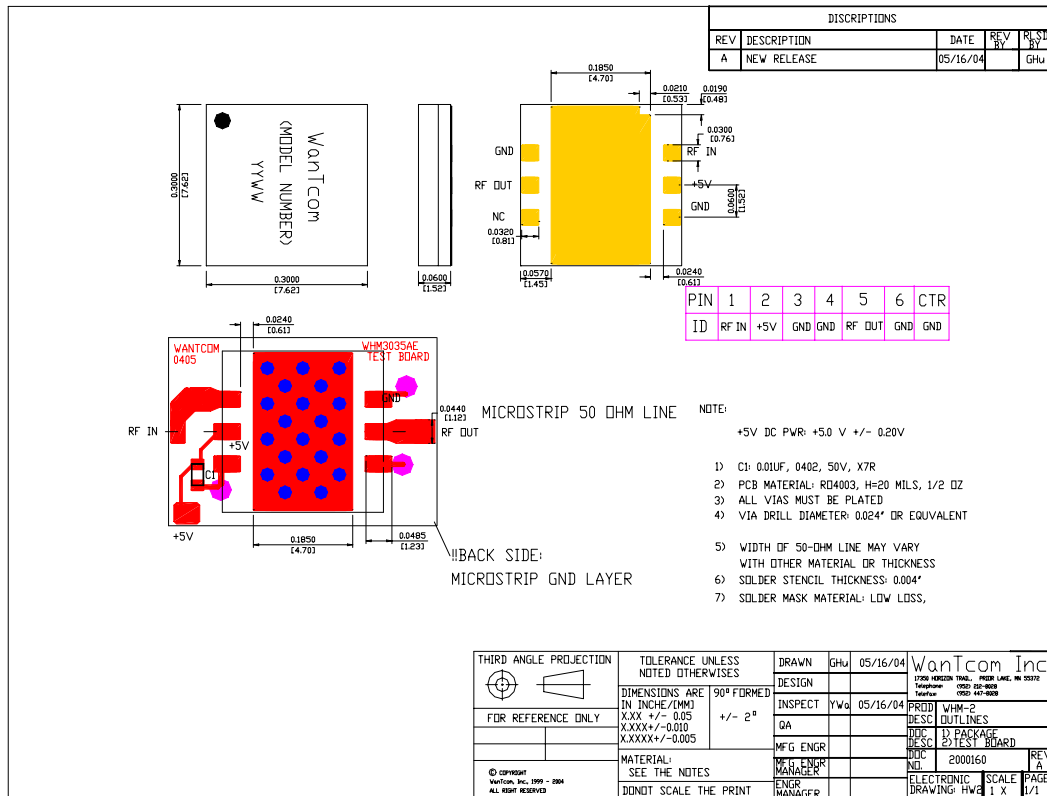


FIG. 7 WHM-2 Outline

Ordering Information

Vdd	+5.0V	+3.3V
Model Number	WHM3043AE	WHM3043BE



Small Signal S-parameters

IWHM3043AE

Is-parameters at Vdd=5V, Idd=50mA. Last updated 04/28/05.

GHZ s MA R 50

IFreq (GHz)	MAGS11	ANGS11	MAGS21	ANGS21	MAGS12	ANGS12	MAGS22	ANGS22
0.05	0.999	-13.7	0.002	-25.9	0.000073	-28.2	0.999	-9.3
0.1	0.991	-28.8	0.019	46.9	0.000053	72.4	0.995	-18.9
0.2	0.808	-65.2	0.487	-57.9	0.000071	178.7	0.930	-39.4
0.3	0.400	-80.8	2.010	-147.5	0.000112	157.2	0.786	-55.2
0.4	0.348	-64.3	3.253	153.0	0.000215	179.3	0.693	-64.3
0.5	0.394	-68.6	4.235	116.0	0.000252	150.8	0.660	-72.8
0.6	0.412	-80.0	5.158	88.8	0.000308	123.0	0.647	-82.8
0.7	0.407	-92.5	6.164	66.7	0.000446	118.4	0.637	-94.0
0.8	0.396	-105.0	7.191	46.3	0.000568	132.0	0.625	-105.8
0.9	0.373	-117.2	8.331	26.9	0.000570	127.0	0.611	-118.1
1	0.347	-128.5	9.481	8.6	0.000856	125.3	0.592	-130.5
1.1	0.319	-139.6	10.553	-9.5	0.000947	115.4	0.569	-142.9
1.2	0.293	-149.6	11.891	-26.3	0.001317	112.6	0.542	-155.3
1.3	0.267	-158.2	13.199	-43.6	0.001501	106.6	0.508	-167.5
1.4	0.246	-166.1	14.129	-60.0	0.001810	97.9	0.472	-179.4
1.5	0.226	-173.5	15.288	-76.1	0.002176	85.7	0.435	169.0
1.6	0.212	179.5	15.806	-92.5	0.002523	78.3	0.397	158.1
1.7	0.203	172.3	16.123	-108.8	0.002732	69.9	0.358	147.8
1.8	0.186	164.7	16.758	-124.0	0.002965	58.5	0.322	138.5
1.9	0.178	156.6	17.206	-139.8	0.003287	52.9	0.289	130.2
2	0.169	148.1	17.965	-155.6	0.003401	43.4	0.260	122.7
2.1	0.162	141.0	17.968	-169.3	0.003683	35.8	0.236	116.1
2.2	0.146	132.6	18.342	176.5	0.003952	27.2	0.216	110.1
2.3	0.136	124.7	18.643	163.8	0.004087	19.8	0.200	104.1
2.4	0.125	114.8	18.626	149.1	0.004441	11.1	0.188	98.3
2.5	0.110	108.1	18.187	135.4	0.004361	2.3	0.179	92.9
2.6	0.099	98.5	17.997	121.0	0.004535	-3.6	0.171	87.0
2.7	0.087	90.1	18.277	108.1	0.004598	-12.1	0.165	80.8
2.8	0.077	82.5	18.496	95.3	0.004654	-19.6	0.160	73.6
2.9	0.066	72.8	19.048	81.6	0.004711	-25.4	0.157	66.0
3	0.061	66.7	18.549	68.7	0.004810	-35.5	0.152	57.7
3.1	0.053	56.0	18.434	56.6	0.004944	-40.9	0.148	48.8
3.2	0.044	39.4	18.411	45.0	0.004841	-48.2	0.142	37.7
3.3	0.043	27.1	18.303	31.2	0.004806	-56.3	0.137	27.0
3.4	0.043	17.5	18.206	18.4	0.004685	-61.2	0.131	16.0
3.5	0.047	-1.5	17.802	5.3	0.004630	-67.9	0.123	3.5
3.6	0.048	-14.5	17.730	-6.8	0.004642	-75.0	0.115	-9.3
3.7	0.057	-38.3	17.943	-18.8	0.004501	-83.9	0.106	-22.6
3.8	0.062	-55.3	18.010	-30.7	0.004373	-92.7	0.097	-37.4
3.9	0.076	-64.3	17.789	-43.3	0.004330	-99.1	0.085	-53.1
4	0.094	-78.0	17.900	-55.3	0.004259	-111.8	0.076	-71.5
4.1	0.112	-87.0	18.031	-67.3	0.004099	-119.3	0.064	-91.5
4.2	0.140	-99.4	18.073	-80.2	0.003698	-126.5	0.054	-116.9
4.3	0.160	-109.6	18.111	-93.4	0.003633	-142.0	0.046	-153.2
4.4	0.192	-120.2	18.281	-106.4	0.003419	-154.2	0.044	169.8
4.5	0.223	-131.3	18.283	-120.4	0.003054	-169.4	0.049	124.1
5	0.422	173.0	17.038	167.8	0.003156	89.3	0.177	-0.4
5.5	0.587	112.2	13.161	95.5	0.007533	-1.5	0.330	-79.9
6	0.548	51.3	9.190	25.4	0.011000	-55.3	0.514	-143.0
