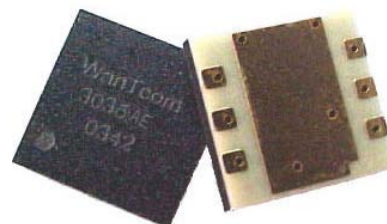




3.0 – 3.7 GHz LOW NOISE AMPLIFIER WHM3035AE¹

WHM3035AE LNA is a low noise figure, wideband, and high linearity SMT packaged amplifiers with unconditional stable design. The amplifier offers typical 1.20 dB noise figure and 27 dBm output IP₃ at the frequency range from 3.0 GHz to 3.7 GHz of S and C bands. WHM3035AE LNA 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
LGA (land grid array) package:	6-pin
Low Noise:	1.20 dB
Output IP ₃ :	27 dBm
Gain:	26.0 dB
P _{1dB} :	13.0 dBm
Single power supply:	50 mA @ +5V
Frequency Range:	3.0 ~ 3.7 GHz
Operating Temperature:	-40 ~ +85 °C
Return Losses:	16 dB or better
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 Ratings²:

Symbol	Parameters	Units	Absolute Maximum
V _{dd}	DC Power Supply Voltage	V	8.0
I _{dd}	Drain Current	mA	100
P _{diss}	Total Power Dissipation	mW	350
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
T _{Re,MAX}	Maximum Reflow Temperature	°C	230 ³
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.

³ Refer to Wan7com's AN-109 for correct solder reflow temperature profile.



Specifications:

a) **Table 1** Summary of the electrical specifications WHM3035AE at room temperature

Index	Testing Item	Symbol	Test Constraints	Nom (RT)	Min	Max	Unit
1	Gain	S_{21}	3.0 – 3.7 GHz	26	25		dB
2	Gain Variation	ΔG	3.0 – 3.7 GHz	+/- 0.3		+/- 0.5	dB
3	Input Return Loss	S_{11}	3.0 – 3.7 GHz	22	20		dB
4	Output Return Loss	S_{22}	3.0 – 3.7 GHz	18	16		dB
5	Reverse Isolation	S_{12}	3.0 – 3.7 GHz	45	40		dB
6	Noise figure	NF	3.0 – 3.7 GHz	1.20		1.4	dB
7	Output Power 1dB compression Point	P_{1dB}	3.0 – 3.7 GHz	13	12		dBm
8	Output-Third-Order Interception point	IP_3	Two-Tone, P_{out} +0 dBm each, 1 MHz separation	27	25		dBm
9	Current Consumption	I_{dd}	V_{dd} = +5 V	50	45	55	mA
10	Power Supply Voltage	V_{dd}		+5	+4.7	+5.3	V
11	Thermal Resistance	$R_{th,c}$	Junction to case			215	°C/W
12	Operating Temperature	T_o			-40	+85	°C
13	Maximum Average RF Input Power	$P_{IN, MAX}$	3.0 – 3.7 GHz			10	dBm

b) Passband Frequency Response

As shown in **Figure 1**, the typical gain of the WHM3035AE is 26.0 dB across 3.0 to 3.7 GHz. The typical input return loss is 22 dB across the frequency of 3.0 to 3.7 GHz. The typical output return loss is 18 dB across the frequency of 3.0 to 3.7 GHz.

Figure 2 shows the measured P_{1dB} and IP_3 of the WHM3035AE. The typical P_{1dB} and IP_3 are 13 dBm and 27 dBm in the frequency range of 3.0 to 3.7 GHz, respectively.

Figure 3 illustrates the measured noise figure performance at full temperature. The measured results include the test fixture loss of approximately 0.10 dB. The noise figure is 1.20 dB across the frequency range of 3.0 to 3.7 GHz at room temperature. At 85 °C, WHM3035AE only has 0.25 dB noise increases. At -40 °C, WHM3035AE 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 1.5 in full frequency band.

Figure 5 is the block diagram of internal circuit of WHM3035AE. 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 6 demonstrates the application schematic diagram of WHM3035AE. It requires only one external decoupling capacitor of 0.01 uF to build a LNA with WHM3035AE. The +5V DC can be 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 +5V line trace length 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 +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 7 shows the mechanical outline and recommended motherboard layout of WHM3035AE. Sufficient number of ground vias on the motherboard is 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.

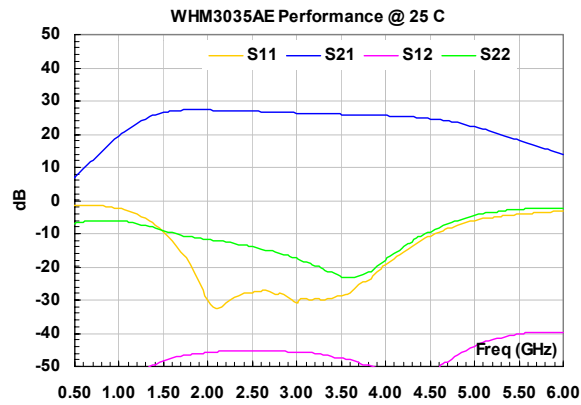


FIG. 1 Typical small signal performance.

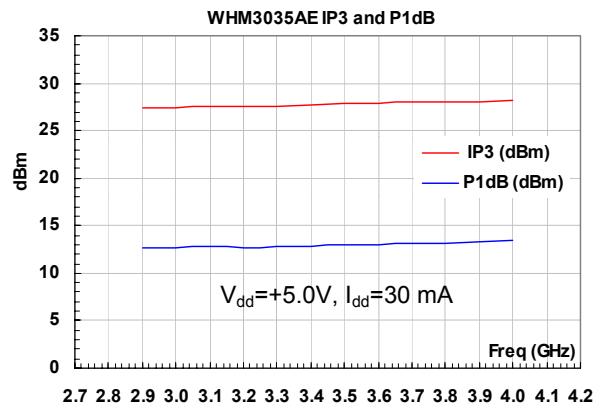


FIG. 2 Typical P_{1dB} and IP_3 at room temperature.

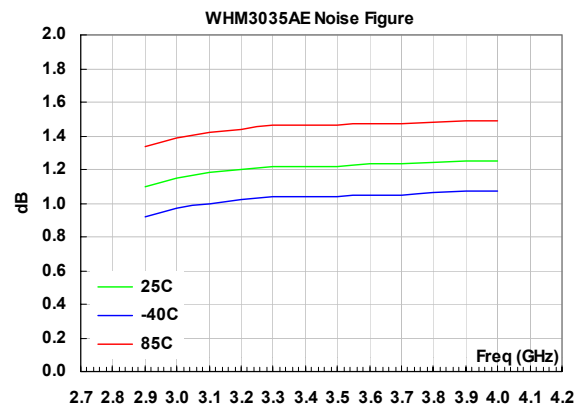


FIG. 3 Noise figure performance at full temperature

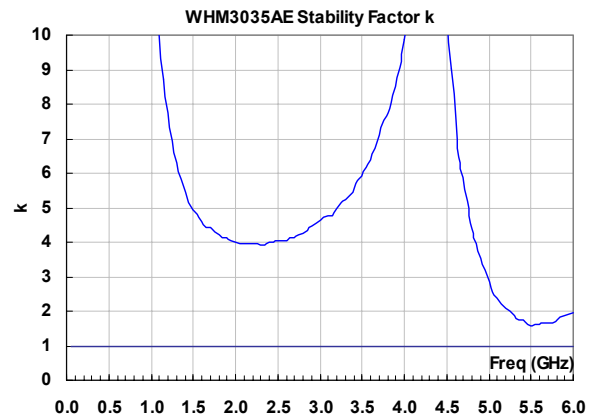


FIG. 4 Measured stability factor k

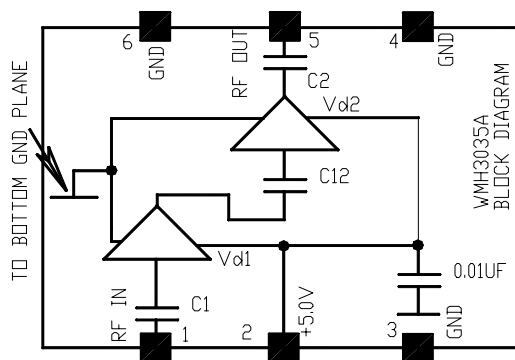


FIG. 5 Block diagram of internal circuit.

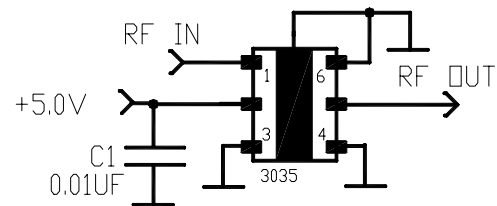


FIG. 6 Typical application schematic for WHM3035AE



WHM3035AE Mechanical Outline, WHM-2:

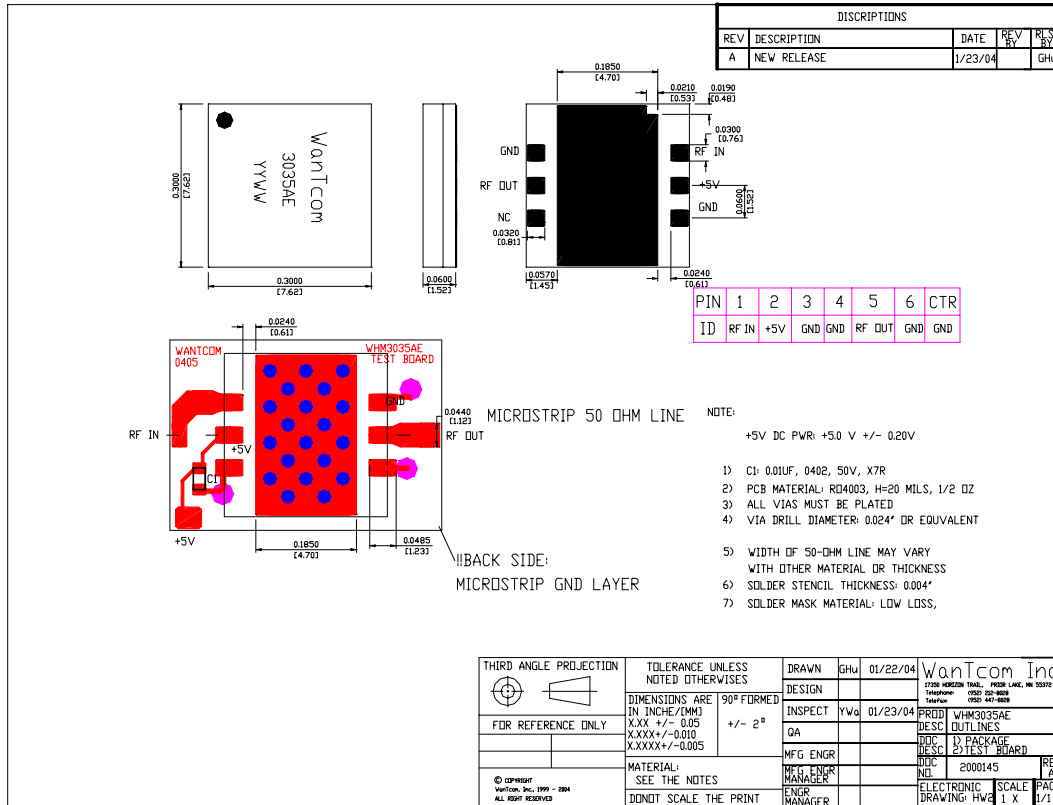


FIG. 7 WHM3035AE outline

Ordering Information

Model Number	WHM3035AE
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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:

IWHM3035AE

!s-parameters at Vdd=5V, Idd=50 mA, including the test board.

!Last updated 1/22/04.

GHZ s MA R 50

!F(GHz)	MAG S11	ANG S11	MAG S21	ANG S21	MAG S12	ANG S12	MAG S22	ANG S22
0.05	0.991	-17.3	0.001	-3.5	0.0001	133.6	0.993	-16.2
0.1	0.983	-30.3	0.013	45.0	0.0001	55.4	0.969	-28.1
0.2	0.855	-81.9	0.277	-31.4	0.0001	-88.7	0.784	-59.4
0.3	0.382	93.8	0.940	-117.2	0.0004	142.8	0.494	-72.4
0.4	0.792	-11.7	1.660	-175.8	0.0003	44.2	0.429	-68.1
0.5	0.852	-44.7	2.214	151.1	0.0003	18.1	0.455	-73.7
0.6	0.855	-67.7	3.006	127.3	0.0004	-19.9	0.477	-84.8
0.7	0.845	-87.6	4.089	106.5	0.0005	-48.7	0.493	-98.1
0.8	0.825	-106.7	5.526	86.6	0.0007	-63.3	0.498	-112.5
0.9	0.795	-126.1	7.304	66.6	0.0009	-83.2	0.496	-127.6
1	0.754	-146.1	9.439	45.8	0.0012	-100.9	0.487	-143.4
1.1	0.693	-166.3	11.881	23.8	0.0017	-120.4	0.471	-159.2
1.2	0.622	172.4	14.525	0.9	0.0022	-139.6	0.449	-175.3
1.3	0.530	150.7	17.028	-22.5	0.0028	-157.8	0.418	168.5
1.4	0.432	129.0	19.326	-46.1	0.0034	-177.0	0.386	153.7
1.5	0.334	108.3	21.172	-69.1	0.0038	164.5	0.354	139.5
1.6	0.243	89.6	22.359	-90.8	0.0042	147.5	0.324	126.1
1.7	0.169	71.9	22.919	-111.8	0.0045	131.8	0.302	113.2
1.8	0.107	58.7	23.078	-131.7	0.0048	117.9	0.286	101.1
1.9	0.060	49.7	23.167	-150.6	0.0049	104.9	0.271	88.9
2	0.031	58.7	23.109	-168.4	0.0051	92.9	0.260	75.7
2.1	0.023	90.5	22.942	174.8	0.0053	81.3	0.245	62.6
2.2	0.029	114.0	22.749	158.5	0.0053	70.1	0.238	49.4
2.3	0.035	110.2	22.545	142.6	0.0054	60.8	0.224	35.9
2.4	0.041	98.6	22.268	127.0	0.0054	51.5	0.213	22.5
2.5	0.041	87.6	22.030	111.5	0.0055	41.9	0.199	8.5
2.6	0.043	75.3	21.818	96.4	0.0055	32.0	0.187	-4.8
2.7	0.042	61.0	21.686	82.0	0.0055	23.3	0.175	-18.9
2.8	0.039	42.5	21.373	67.5	0.0054	14.6	0.158	-32.2
2.9	0.035	29.6	21.049	53.0	0.0053	6.5	0.149	-45.6
3	0.029	9.3	20.773	38.5	0.0052	-2.6	0.134	-60.0
3.1	0.033	-2.3	20.594	24.6	0.0051	-10.6	0.119	-74.1
3.2	0.034	-18.0	20.309	10.6	0.0049	-19.1	0.104	-90.3
3.3	0.032	-26.3	20.110	-3.7	0.0047	-26.9	0.095	-105.2
3.4	0.034	-37.2	19.982	-17.6	0.0045	-35.1	0.082	-125.6
3.5	0.036	-37.8	19.827	-31.4	0.0043	-44.8	0.070	-147.5
3.6	0.041	-50.2	19.684	-45.4	0.0040	-54.7	0.069	-174.2
3.7	0.054	-52.9	19.521	-59.6	0.0036	-63.7	0.073	157.2
3.8	0.063	-60.2	19.370	-73.9	0.0033	-72.5	0.083	129.4
3.9	0.085	-66.5	19.200	-88.4	0.0030	-84.7	0.101	102.5
4	0.109	-78.2	19.053	-102.9	0.0026	-101.4	0.124	84.1
4.1	0.133	-88.1	18.874	-117.6	0.0022	-118.6	0.160	65.7
4.2	0.168	-97.7	18.545	-132.6	0.0018	-141.3	0.199	48.0
4.3	0.207	-110.0	18.072	-148.0	0.0018	-176.2	0.239	32.9
4.4	0.245	-123.6	17.611	-163.4	0.0018	150.5	0.291	18.1
4.5	0.287	-136.0	17.106	-179.1	0.0022	123.2	0.340	3.5
5	0.497	152.5	12.877	101.0	0.0064	37.5	0.592	-68.4
5.5	0.626	78.9	8.084	23.4	0.0096	-15.8	0.740	-131.1
6	0.681	11.0	4.974	-46.4	0.0100	-59.3	0.776	173.1
