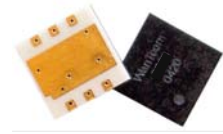




## 1700 – 2200 MHz LOW NOISE AMPLIFIER WHM19-1730AE<sup>1</sup>

WHM19-1730AE LNA is a low noise figure, wideband, and high linear SMT packaged amplifier with exceptional gain flatness. The amplifier offers typical 0.90 dB noise figure, 16.0 dB gain, and 28.5 dBm output IP<sub>3</sub> at the frequency range from 1700 MHz to 2200 MHz of DCS, PCS, and 3G bands. WHM19-1730AE LNA is most suitable for wireless base stations, wireless data communications, tower top receiver amplifiers, last-mile wireless communication systems, and wireless measurement applications.



### Key Features:

Impedance:	50 Ohm
MTBF <sup>2</sup> :	>1,500,000 hrs (171 Years)
LGA (land grid array) package:	6-pin
Low Noise:	0.90 dB
Output IP <sub>3</sub> :	28.5 dBm
Gain:	16.0 dB
P <sub>1dB</sub> :	16.0 dBm
Single power supply <sup>3</sup> :	33 mA @ +5.0V
Frequency Range:	1700 ~ 2200 MHz
Operating Temperature:	-40 ~ +85 °C
Return Losses:	18 dB Typical
Small size:	0.25" x 0.25" x 0.060" (6.35 mm x 6.35 mm x 1.52 mm)
Built-in Functions:	DC blocks at input and output, temperature compensation circuits, and auto DC biases.

### Absolute Maximum Ratings<sup>4</sup>:

Symbol	Parameters	Units	Absolute Maximum
V <sub>dd</sub>	DC Power Supply Voltage	V	7.0
I <sub>dd</sub>	Drain Current	mA	60
P <sub>diss</sub>	Total Power Dissipation	mW	350
P <sub>In,Max</sub>	RF Input Power	dBm	10
T <sub>ch</sub>	Channel Temperature	°C	150
T <sub>STG</sub>	Storage Temperature	°C	-65 ~ 150
T <sub>O,MAX</sub>	Maximum Operating Temperature	°C	-55 ~ 100
T <sub>Re,MAX</sub>	Maximum Reflow Temperature	°C	230 <sup>5</sup>
R <sub>th,c</sub>	Thermal Resistance	°C/W	220

<sup>1</sup> Specifications are subject to change without notice.

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

<sup>3</sup> can be configured to 20 mA for the 1<sup>st</sup> stage of a LNA.

<sup>4</sup> Operation of this device above any one of these parameters may cause permanent damage.

<sup>5</sup> Refer to Wan7com's AN-109 for correct solder reflow temperature profile.

**Specifications:**

- a)
- Table 1**
- Summary of the electrical specifications WHM19-1730AE at room temperature

Index	Testing Item	Symbol	Test Constraints	Nom (RT)	Min	Max	Unit
1	Gain	$S_{21}$	1700 – 2200 MHz	16	15	17	dB
2	Gain Variation	$\Delta G$	1700 – 2200 MHz	+/- 0.35		+/- 0.5	dB
3	Input Return Loss	$S_{11}$	1700 – 2200 MHz	20	16		dB
4	Output Return Loss	$S_{22}$	1700 – 2200 MHz	18	16		dB
5	Reverse Isolation	$S_{12}$	1700 – 2200 MHz	20	18		dB
6	Noise figure	NF	1700 – 2200 MHz	0.90		1.1	dB
7	Output Power 1dB compression Point	$P_{1dB}$	1700 – 2200 MHz	16	15		dBm
8	Output-Third-Order Interception point	$IP_3$	Two-Tone, $P_{out}$ +0 dBm each, 1 MHz separation	28.5	27		dBm
9	Current Consumption	$I_{dd}$	$V_{dd} = +5.0$ V	33	30	35	mA
10	Power Supply Voltage	$V_{dd}$		+5.0	+4.8	+5.2	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	$P_{IN, MAX}$	1700 – 2200 MHz			10	dBm

**b) Passband Frequency Response**

As shown in **Figure 1**, the typical gain of the WHM19-1730AE is 16.0 dB across 1700 to 2200 MHz. The typical input and output return losses are 20 dB and 18 dB across the frequency from 1700 to 2200 MHz. The gain variation is less than 0.70 dB (+/- 0.35 dB) from the frequency of 1700 to 2200 MHz.

**Figure 2** shows the measured  $P_{1dB}$  and  $IP_3$  of the WHM19-1730AE. The typical  $P_{1dB}$  and  $IP_3$  are 16.0 dBm and 28.5 dBm in the frequency range of 1700 to 2200 MHz, respectively.

**Figure 3** illustrates the measured noise figure performance at full temperature. The noise figure is 0.90 dB across the frequency range of 1700 to 2200 MHz at room temperature. At 85 °C, WHM19-1730AE has only 0.35 dB noise increases. At -40 °C, WHM19-1730AE offers approximately 0.25 dB less noise figure than that at room temperature.

**Figure 4** demonstrates the stability factor  $k$  of the amplifier. The amplifier is conditional stable since the stability factor  $k$  is less than 1 at the frequency from 2.5 GHz to 3.5 GHz. Careful design consideration may be required when cascading the amplifier to other device.

**Figure 5** is the block diagram of internal circuit of WHM19-1730AE. 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 6** demonstrates the application schematic diagram of WHM19-1730AE. It requires two (2) external de-coupling capacitors,  $C_1$  and  $C_2$  at Pin 2 and Pin 4 respectively. These two capacitors should be as close as to the Pins and have good high frequency performance. The 0603 size or 0402 size ceramic capacitor is recommended. The +5.0V DC power can be applied either to Pin 2 or Pin 4. It is recommended only apply +5V DC voltage to one Pin to avoid the unexpected coupling between the output and the input of the amplifier through the DC line. This parasitic coupling could cause amplifier oscillation. All these external components 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 for WHM19-1730AE. 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 property of the substrate.

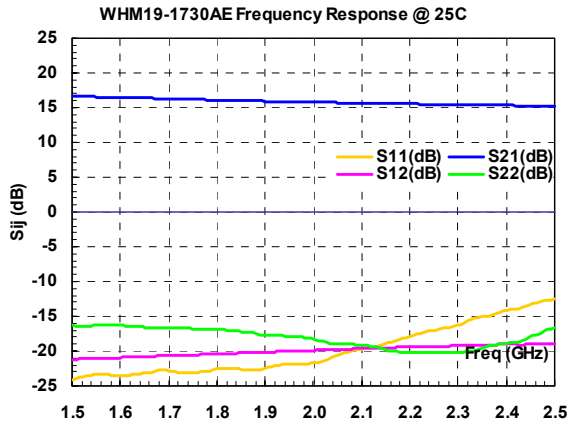


FIG. 1 Typical small signal performance.

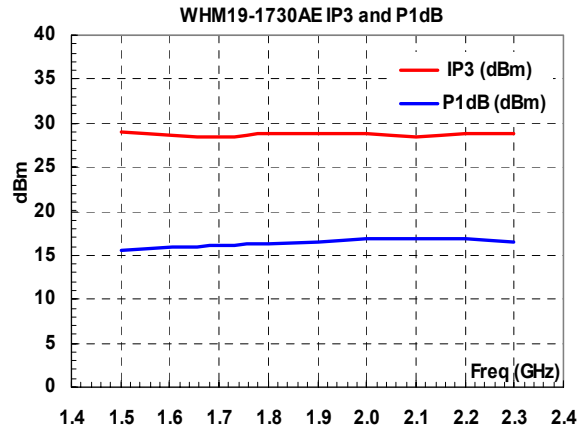


FIG. 2 Typical  $P_{1dB}$  and  $IP_3$  at room temperature.

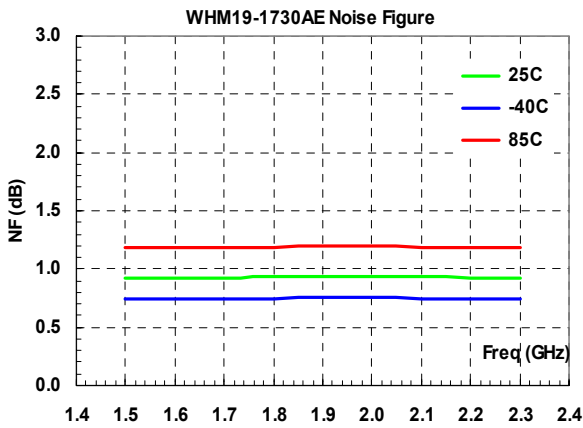


FIG. 3 Noise figure performance at full temperature

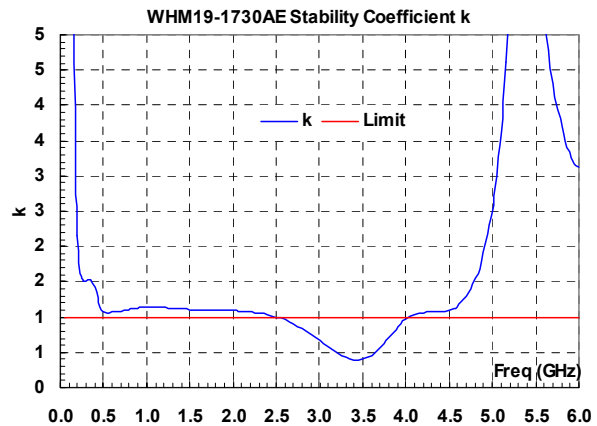


FIG. 4 Stability factor  $k$

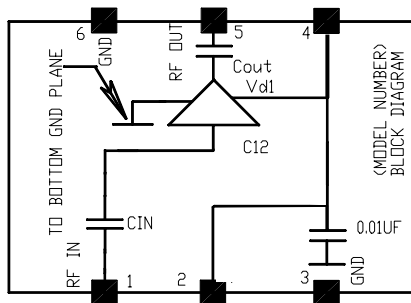


FIG. 5 Block diagram of internal circuit.

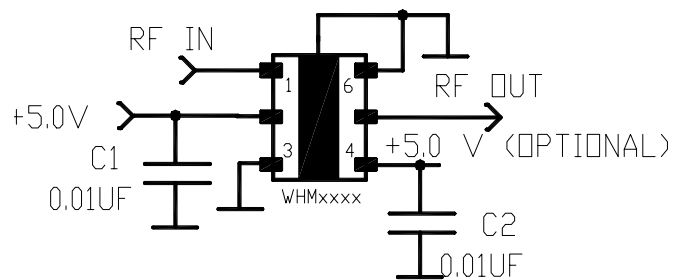


FIG. 6 Typical application schematic for WHM19-1730AE



WHM19-1730AE Mechanical Outline, WHM-1:

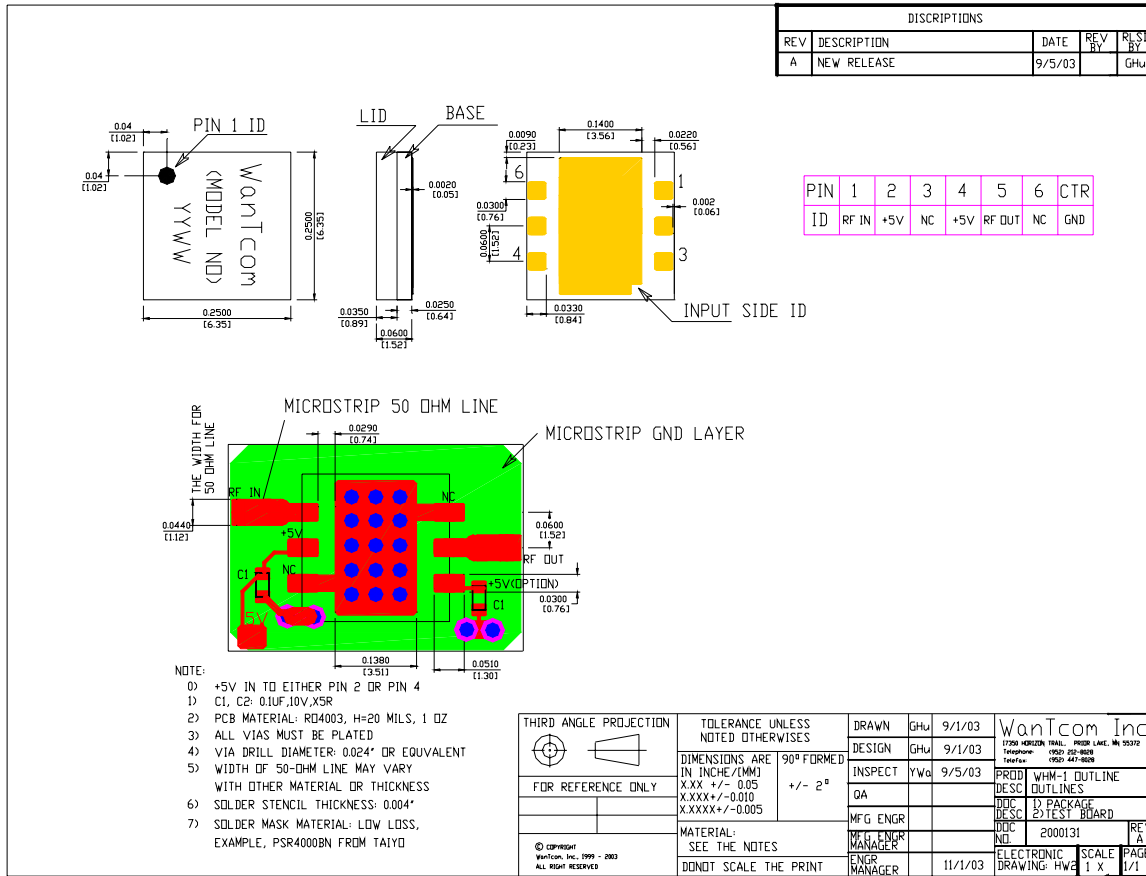


FIG. 7 WHM19-1730AE outline

Ordering Information

<b>Model Number</b>	WHM19-1730AE
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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:

! WLA19-1730AE

! Vdd = +5.0 V, Id = 33 mA, Last Updat: 4/07/04

# Ghz s ma r 50

0.05	0.997	-16.7	0.005	146.6	0.000035	-2.5	0.998	-8.5
0.1	0.989	-28.2	0.023	136.5	0.000090	-6.9	0.996	-14.2
0.2	0.967	-60.7	0.258	105.7	0.001533	-45.7	0.992	-29.2
0.3	0.769	-112.2	1.486	49.6	0.011000	-87.9	0.955	-45.8
0.4	0.076	76.8	3.467	-14.3	0.030000	-155.6	0.854	-59.7
0.5	0.412	-61.7	4.824	-65.9	0.039000	157.2	0.816	-72.2
0.6	0.462	-100.1	5.562	-101.2	0.046000	130.5	0.754	-88.0
0.7	0.406	-130.1	6.288	-129.6	0.054000	110.4	0.660	-103.8
0.8	0.318	-156.8	6.883	-154.4	0.061000	92.6	0.545	-118.4
0.9	0.220	179.4	7.223	-176.8	0.067000	76.8	0.431	-129.7
1	0.133	160.1	7.334	162.7	0.072000	63.0	0.328	-137.8
1.1	0.070	150.1	7.294	144.3	0.075000	51.1	0.252	-140.9
1.2	0.029	162.7	7.201	127.5	0.078000	40.6	0.199	-139.4
1.3	0.027	-133.9	7.069	112.2	0.082000	31.2	0.170	-135.6
1.4	0.050	-135.1	6.931	98.1	0.085000	22.4	0.157	-130.6
1.5	0.062	-146.1	6.804	84.7	0.087000	14.1	0.153	-128.2
1.6	0.066	-161.4	6.648	71.9	0.090000	6.3	0.153	-128.9
1.7	0.072	175.7	6.507	59.4	0.093000	-1.1	0.147	-130.3
1.8	0.075	148.7	6.380	47.4	0.095000	-8.0	0.142	-132.5
1.9	0.075	120.9	6.263	36.0	0.098000	-15.2	0.131	-135.6
2	0.082	95.7	6.148	24.6	0.101000	-22.2	0.121	-136.2
2.1	0.104	68.3	6.067	13.3	0.104000	-29.2	0.110	-133.2
2.2	0.128	43.9	5.993	2.1	0.107000	-36.3	0.097	-126.8
2.3	0.156	23.2	5.918	-9.0	0.109000	-43.6	0.098	-115.8
2.4	0.195	3.5	5.840	-20.0	0.112000	-51.0	0.113	-103.7
2.5	0.238	-12.8	5.747	-31.2	0.113000	-58.3	0.147	-98.7
2.6	0.283	-29.9	5.644	-42.9	0.114000	-65.5	0.186	-98.7
2.7	0.329	-45.2	5.581	-54.5	0.112000	-72.9	0.237	-101.7
2.8	0.380	-60.0	5.467	-66.1	0.111000	-81.4	0.294	-109.5
2.9	0.437	-75.0	5.328	-77.9	0.110000	-89.0	0.361	-117.5
3	0.491	-90.1	5.164	-89.7	0.107000	-95.8	0.425	-127.6
3.1	0.538	-104.1	4.965	-101.6	0.102000	-102.7	0.490	-138.9
3.2	0.584	-118.0	4.717	-113.4	0.097000	-109.2	0.558	-150.7
3.3	0.633	-132.7	4.472	-125.6	0.092000	-115.1	0.620	-162.8
3.4	0.671	-146.6	4.236	-137.5	0.086000	-119.7	0.681	-175.8
3.5	0.703	-160.2	3.994	-149.2	0.078000	-123.8	0.735	170.9
3.6	0.728	-174.0	3.699	-161.1	0.072000	-126.5	0.781	157.9
3.7	0.746	172.4	3.384	-173.2	0.067000	-127.9	0.818	144.6
3.8	0.752	159.8	3.081	174.6	0.063000	-126.1	0.848	130.9
3.9	0.757	147.2	2.781	162.8	0.061000	-123.4	0.871	117.4
4	0.765	134.3	2.495	151.3	0.060000	-120.8	0.887	104.3
4.1	0.747	122.7	2.193	141.4	0.064000	-120.4	0.894	90.8
4.2	0.740	110.9	1.888	131.1	0.070000	-119.6	0.898	77.7
4.3	0.725	99.4	1.616	120.9	0.077000	-119.9	0.892	64.7
4.4	0.703	88.2	1.375	110.9	0.082000	-122.2	0.888	52.3
4.5	0.685	78.2	1.165	101.8	0.088000	-125.8	0.880	39.7
5	0.591	30.0	0.356	62.7	0.126000	-148.0	0.816	-20.3
5.5	0.502	-14.3	0.132	171.4	0.159000	179.9	0.756	-75.6
6	0.422	-56.4	0.399	149.3	0.178000	148.7	0.703	-127.6

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