



0.7-1.5 GHz LOW NOISE AMPLIFIER WHM0815J¹

WHM0815J LNA is a low noise figure, wideband, and exceptional gain flatness amplifier. The amplifier offers 1.35 dB noise figure, 28.0 dB gain, 1.0 dB P_{1dB} and output IP₃ of 10.0 dBm at the frequency range from 700 MHz to 1500 MHz.

WHM0815J is most suitable for handheld wireless data communication receiver amplifiers, last-mile wireless communication systems, and wireless measurement applications of UHF, Cellular, GSM, and GPS bands.

Preliminary

Key Features:

Impedance:	50 Ohm
Low Noise:	1.35 dB
Output IP ₃ :	10.0 dBm
Gain:	28.0
Gain Flatness:	+/- 0.20 dB
Input VSWR:	1.35:1
Output VSWR:	1.35:1
P _{1dB} :	2.0 dBm
Single Power Supply:	20 mA, @ +5.0 V
Frequency Range:	700 ~ 1500 MHz
Operating Temperature:	-40 ~ +85 °C

Absolute Maximum Ratings²:

Symbol	Parameters	Units	Absolute Maximum
V _{dd}	DC Power Supply Voltage	V	7.0
I _{dd}	Drain Current	mA	30
P _{diss}	Total Power Dissipation	mW	220
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 WHM0815J at room temperature

Index	Testing Item	Symbol	Test Constraints	Nom (RT)	Min	Max	Unit
1	Gain	S_{21}	700 - 1500 MHz	28	27.0	29.0	dB
2	Gain Variation	ΔG	700 - 1500 MHz	+/- 0.20		+/- 0.3	dB
3	Input Return Loss	S_{11}	700 - 1500 MHz	18	16		dB
4	Output Return Loss	S_{22}	700 - 1500 MHz	18	16		dB
5	Reverse Isolation	S_{12}	700 - 1500 MHz	40	37		dB
6	Noise figure	NF	700 - 1500 MHz	1.35		1.50	dB
7	Output P_{1dB} compression	P_{1dB}	700 - 1500 MHz	1.0	0		dBm
8	Output-Third-Order Interception point	IP_3	Two-Tone, P_{out} -10 dBm each, 1 MHz separation	10.0	9		dBm
10	Current Consumption	I_{dd}	$V_{dd} = +5 V$	20			mA
11	Power Supply Voltage	V_{dd}		5.0	4.80	5.20	V
12	Operating Temperature	T_o			-40	+85	°C
14	Maximum Average RF Input Power	$P_{IN, MAX}$	700 - 1500 MHz			5	dBm

As shown in **Figure 1**, the typical gain of the WHM0815J is 28.0 dB across 700 MHz to 1500MHz. The typical input and output return losses are 18 dB, respectively. The LNA exhibits excellent consistent performance over the full temperature.

The noise figure, as shown in **Figure 2**, of WHM0815J is 1.35 dB³ at room temperature. The noise figure of 1.35 dB includes 0.03 dB loss of the SMA connector. The LNA noise figure is 1.50 dB at 85 C and 1.20 dB at -40 C.

The output 1-dB compression point and IP_3 are shown in **Figure 3**. WHM0815J offers typical 1.0 dBm of P_{1dB} and 10.0 dBm of IP_3 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 WHM0815J in the extended frequency range.

Figure 6 is the block diagram of internal circuit of WHM0815J. 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 WHM0815J. 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

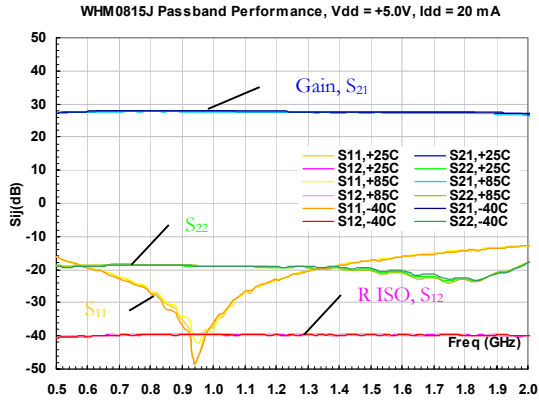


FIG. 1 Small signal performance of WHM0815J

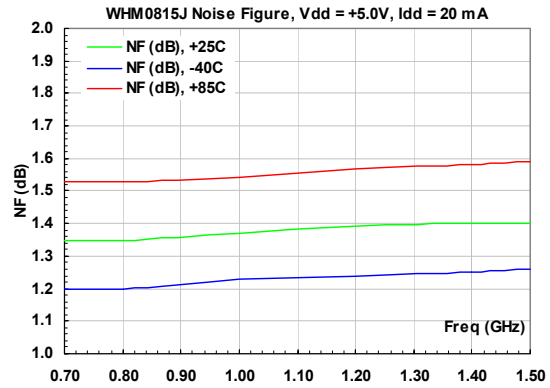


FIG. 2 Noise figure performance at full temperature

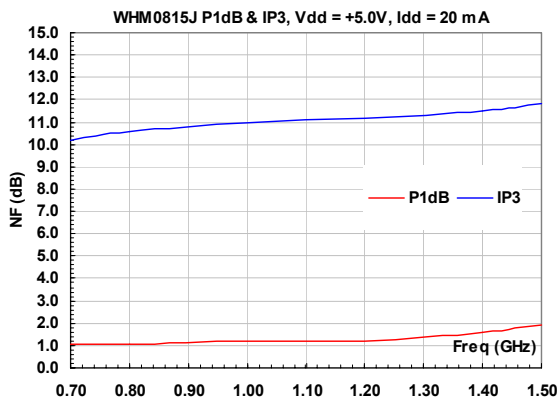


Fig. 3 Output 1-dB compression point and IP₃

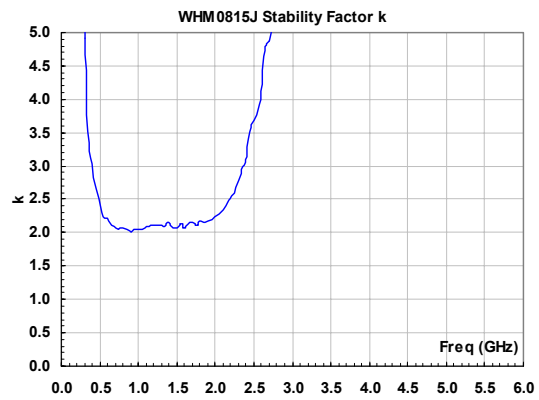


Fig. 4 Stability factor *k*

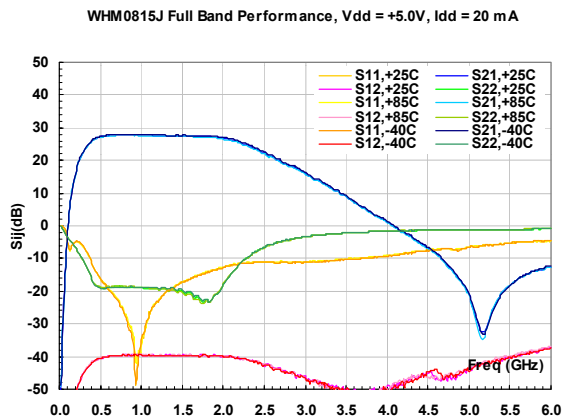


FIG. 5 Frequency response in the extended band.

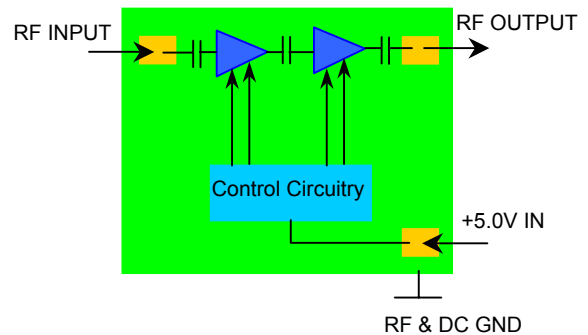


FIG. 6 Block diagram of WHM0815J



WHM0815J Mechanical Outline, WHM-2

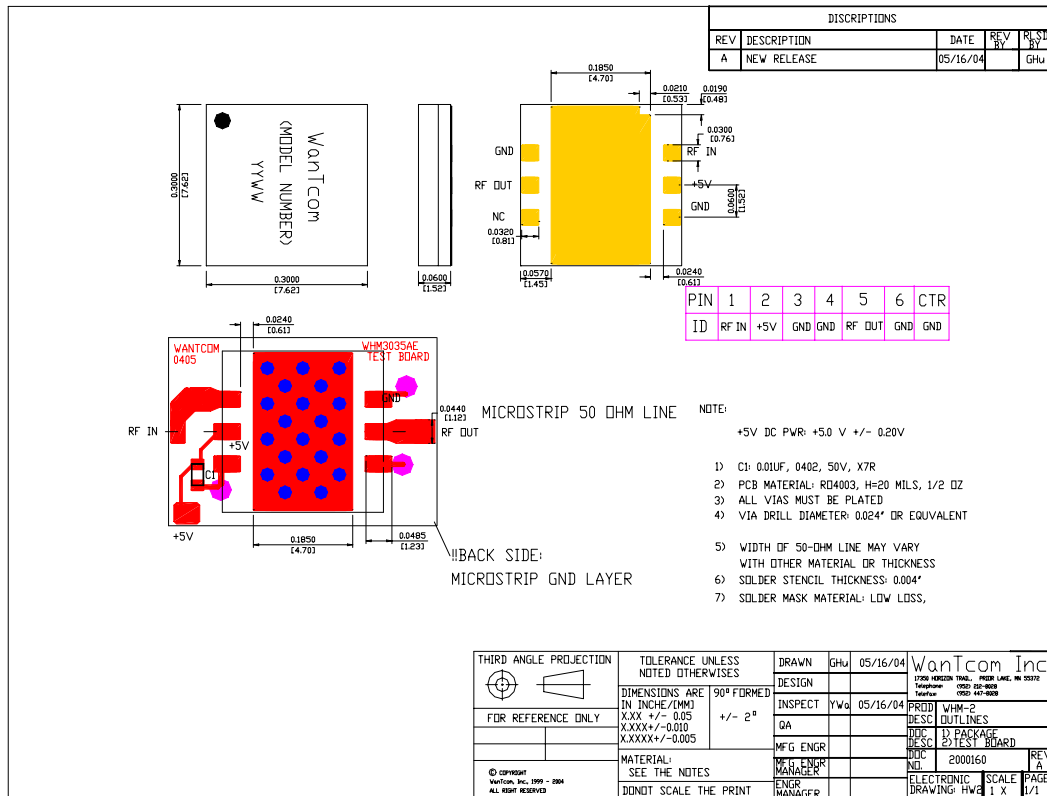


FIG. 7 WHM-2 Outline

Ordering Information

Model Number	WHM0815J
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Small Signal S-parameters



IWHM0815J

Is-parameters at Vdd=5V, Idd =20mA. Last updated 04/2/05.

GHZ s MA R 50

IFreq (GHz)	MAGS11	ANGS11	MAGS21	ANGS21	MAGS12	ANGS12	MAGS22	ANGS22
0.05	0.976	-49.3	0.330	-60.1	0.0001	132.9	0.867	-37.5
0.1	0.671	-145.6	1.355	-122.6	0.0002	-66.2	0.677	-64.4
0.2	0.576	-18.0	6.299	164.3	0.0027	-168.2	0.452	-103.9
0.3	0.470	-80.6	13.296	105.6	0.0056	138.3	0.280	-138.9
0.4	0.263	-115.8	19.100	57.5	0.0080	96.1	0.151	-154.2
0.5	0.155	-126.9	22.188	18.9	0.0094	67.6	0.114	-149.2
0.6	0.108	-134.6	23.559	-12.4	0.0099	45.4	0.114	-152.5
0.7	0.079	-144.9	24.205	-38.9	0.0100	28.9	0.117	-163.3
0.8	0.045	-155.2	24.501	-62.5	0.0100	14.3	0.115	-175.2
0.9	0.016	-157.3	24.465	-84.1	0.0110	3.3	0.116	173.0
1	0.016	-21.6	24.261	-104.1	0.0110	-7.2	0.112	161.4
1.1	0.045	-34.2	24.095	-122.9	0.0100	-16.8	0.110	150.5
1.2	0.068	-44.3	23.947	-141.1	0.0100	-26.4	0.108	139.4
1.3	0.094	-59.0	23.676	-158.9	0.0100	-35.9	0.109	127.1
1.4	0.116	-73.2	23.535	-176.0	0.0100	-42.4	0.106	112.1
1.5	0.138	-87.3	23.570	166.7	0.0110	-50.4	0.102	94.1
1.6	0.154	-103.5	23.477	148.9	0.0110	-58.7	0.093	71.4
1.7	0.176	-119.9	23.325	130.8	0.0100	-66.6	0.079	40.5
1.8	0.195	-136.3	23.092	112.2	0.0100	-76.5	0.072	-2.4
1.9	0.209	-154.6	22.551	92.8	0.0100	-84.3	0.087	-52.1
2	0.224	-170.6	21.596	73.2	0.0100	-95.9	0.126	-95.2
2.1	0.248	171.4	20.381	53.4	0.0100	-104.2	0.186	-127.4
2.2	0.262	153.2	18.884	33.3	0.0095	-113.1	0.257	-153.1
2.3	0.275	134.6	16.890	13.7	0.0089	-126.2	0.328	-175.8
2.4	0.275	117.5	14.965	-4.3	0.0085	-133.2	0.398	163.0
2.5	0.276	100.3	13.185	-21.1	0.0074	-143.0	0.463	143.5
2.6	0.282	84.4	11.632	-38.2	0.0070	-154.7	0.517	126.4
2.7	0.278	67.3	9.807	-54.2	0.0065	-163.2	0.564	110.8
2.8	0.272	53.5	8.362	-67.1	0.0057	-168.6	0.607	95.9
2.9	0.279	38.8	7.624	-81.6	0.0052	-177.3	0.647	81.9
3	0.276	23.8	6.480	-98.3	0.0050	173.0	0.680	68.5
3.1	0.283	11.0	5.486	-111.6	0.0042	164.9	0.703	55.7
3.2	0.289	-2.8	4.742	-123.2	0.0039	146.2	0.721	43.5
3.3	0.293	-13.5	4.124	-135.6	0.0039	144.1	0.740	32.5
3.4	0.300	-25.9	3.594	-146.9	0.0033	131.4	0.759	21.8
3.5	0.310	-37.7	3.024	-159.5	0.0032	116.3	0.774	11.7
3.6	0.313	-47.8	2.450	-168.6	0.0029	101.2	0.790	1.5
3.7	0.322	-60.3	2.052	-176.5	0.0026	84.9	0.804	-8.4
3.8	0.325	-71.2	1.745	175.0	0.0024	71.2	0.812	-17.9
3.9	0.342	-83.5	1.447	166.8	0.0029	60.9	0.817	-27.0
4	0.347	-95.6	1.221	158.8	0.0032	38.9	0.829	-36.7
4.1	0.358	-107.3	0.987	152.5	0.0035	28.1	0.837	-46.0
4.2	0.377	-119.3	0.829	147.0	0.0037	18.7	0.844	-55.0
4.3	0.386	-131.2	0.683	140.1	0.0044	0.6	0.845	-63.8
4.4	0.405	-141.5	0.521	134.7	0.0053	-12.5	0.855	-72.1
4.5	0.421	-154.5	0.412	131.5	0.0062	-31.3	0.855	-81.0
5	0.468	151.4	0.093	-144.0	0.0065	-57.7	0.864	-124.0
5.5	0.548	93.5	0.298	-144.4	0.0099	-97.6	0.861	-165.0
6	0.592	38.7	0.342	-176.1	0.0140	-141.1	0.897	155.6
