0.5- 1.0 GHz SUPER LOW NOISE AMPLIFIER WBA0510 SERIES [1]

WBA0510 series is a super low noise figure, wideband, and high linearity amplifier. The amplifier offers typical 0.40 dB noise figure, +/- 0.25 dB exceptional gain flatness, 20.0 dB output P_{1dB}, and 30.0 dBm output IP_3 at the frequency range from 0.50 GHz to 1.0 GHz of UHF, Cellular, and GPS bands. WBA0510 series LNA can be configured with built-in bias-T for remote 5 V DC power supply (WBA0510ABT or WBA0510ASBT series) through the RF output port.

WBA0510 series is most suitable for cellular base stations, wireless data communications, tower top receiver amplifiers, last-mile wireless communication systems, and wireless measurement applications.

WBA0510 series is designed to meet the rugged standards of MIL-STD-202, and MIL-STD-883.

Key Features:

Impedance:	50 Ohm
MTBF[2]:	>300,000 hrs (34 years)
Unconditional Stable:	k>1
Low Noise:	0.50 dB, WBA0510A 0.40 dB, WBA0510AS
Output IP_3:	30 dBm
Gain:	39.0 dB
P_{1dB}:	20.0 dBm
Single power supply:	100 mA @ +5V
Wide Bandwidth:	0.5 ~ 1.0 GHz
Operating Temperature:	-40 ~ +85 ºC
Input & Output Return Losses:	18.0 dB
Small size:	SMA Female, 0.90" x 0.70" x 0.4" (41.9 mm x 17.8 mm x 10.2 mm) gold plated housing.
Built-in Functions:	DC blocks at input and output, temperature compensation circuits, and auto DC biases.

Absolute Maximum Ratings[3]:

Symbol	Parameters	Units	Absolute Maximum
V_{dd}	DC Power Supply Voltage	V	5.5
I_{dd}	Drain Current	mA	120
P_{diss}	Total Power Dissipation	mW	650
$P_{In,Max}$	RF Input Power	dBm	10
T_{ch}	Channel Temperature	°C	150
T_{STG}	Storage Temperature	°C	-55 ~ 125
$T_{O,MAX}$	Maximum Operating Temperature	°C	-40 ~ 85
$R_{th,c}$	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℃
[3] Operation of this device above any one of these parameters may cause permanent damage.

Specifications:

a) Table 1 Summary of the electrical specifications WBA0510 series at room temperature

Index	Testing Item	Symbol	Test Constraints		Nom (RT)	Min	Max	Unit
1	Gain	S_{21}	0.5 – 1.0 GHz		39	37	41	dB
2	Gain Variation	ΔG	0.5 – 1.0 GHz		+/- 0.25		+/-0.50	dB
3	Input Return Loss	S_{11}	0.5 – 1.0 GHz		20	16		dB
4	Output Return Loss	S_{22}	0.5 – 1.0 GHz		18	16		dB
5	Reverse Isolation	S_{12}	0.5 – 1.0 GHz		50	45		dB
6	Noise figure	NF	0.5 – 1.0 GHz	WBA0510A	0.50		0.63	dB
				WBA0510AS	0.40		0.53	
7	Output Power 1dB compression Point	P_{1dB}	0.5 – 1.0 GHz		20	18		dBm
8	Output-Third-Order Interception point	IP_3	Two-Tone, P_{out} +0 dBm each, 1 MHz separation		30	28		dBm
9	Current Consumption	I_{dd}	V_{dd}= +5 V		100	90	110	mA
10	Power Supply Voltage	V_{dd}			+5	+4.7	+5.3	V
11	Thermal Resistance	$R_{th,c}$	Junction to case				215	^{o}C/W
12	Operating Temperature	T_o				-40	+85	^{o}C
13	Maximum Average RF Input Power	$P_{IN, MAX}$	0.5 – 1.0 GHz				10	dBm

b) Passband Frequency Response

As shown in **Figure 1**, the typical gain of the WBA0510 series is 39.0 dB across 0.50 to 1.0 GHz. The amplifier provides excellent gain flatness across the passband. The typical input and output return losses are 16 dB or better across the frequency of 0.50 to 1.0 GHz.

Figure 2 shows P_{1dB} and IP_3 of the WBA0510 series. The typical P_{1dB} and IP_3 are 20.0 dBm and 30.0 dBm in the frequency range of 0.50 to 1.0 GHz, respectively.

Figure 3 illustrates the noise figure performance of WBA0510AS. The noise figure is 0.40 dB across the frequency range of 0.50 to 1.0 GHz at room temperature. At 85 ^{0}C, WBA0510 series only has 0.10 dB noise increases. At –40 ^{0}C, WBA0510 series offers approximately 0.10 dB less noise figure than that at room temperature. WBA0510A has approximately 0.10 dB higher noise figure than that of WBA0510AS.

Figure 4 is the plot of the stability factor *k* of WBA0510 series. The amplifier is unconditional stable at all temperature since the stability factor *k* is great than 1 at all frequency ranges.

Figure 5 demonstrates the small signal performance of WBA0510 series at the extended frequency range at room temperature. The amplifier works well from 0.40 GHz to 1.40 GHz frequency range.

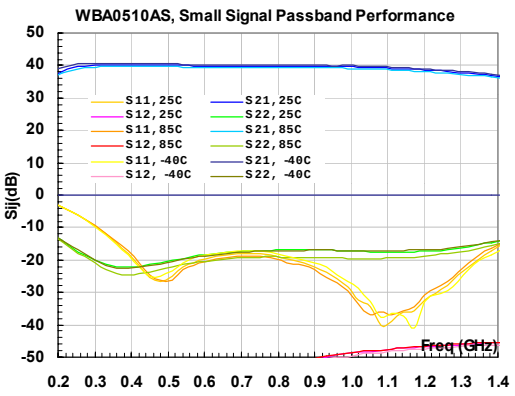

FIG. 1 Typical small signal performance.

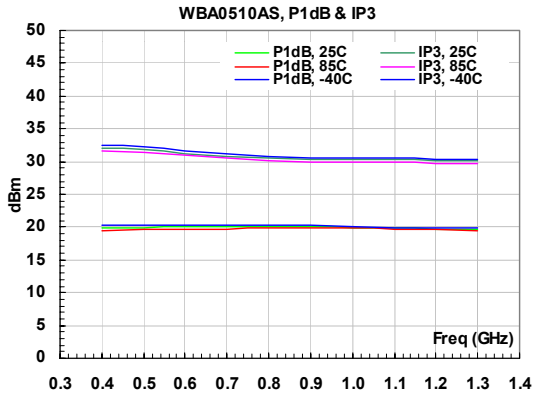

FIG. 2 Typical P_{1dB} and IP_3 at full temperature.

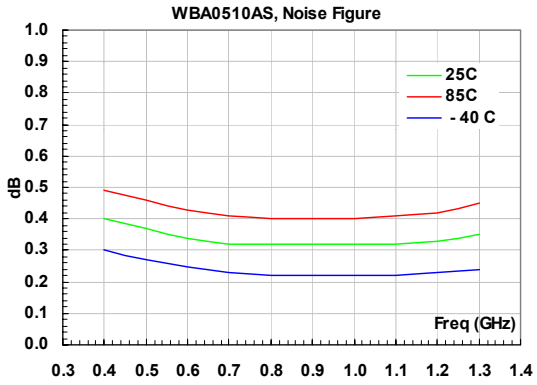

FIG. 3 Noise figure performance

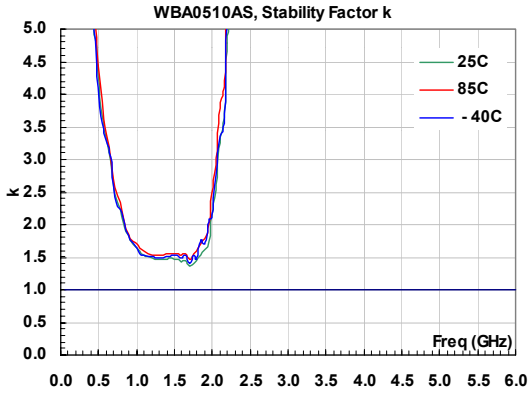

FIG. 4 Stability factor *k* of WBA0510 series

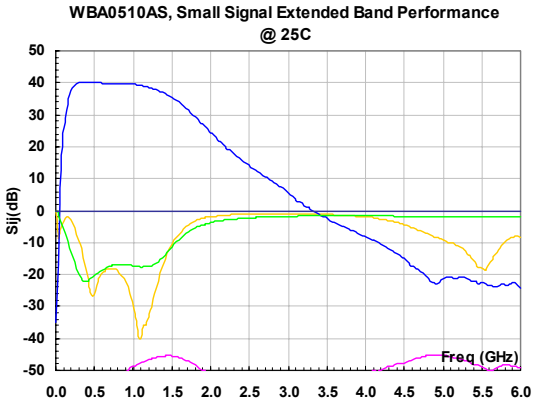

FIG. 5 Performance at the extended frequency band

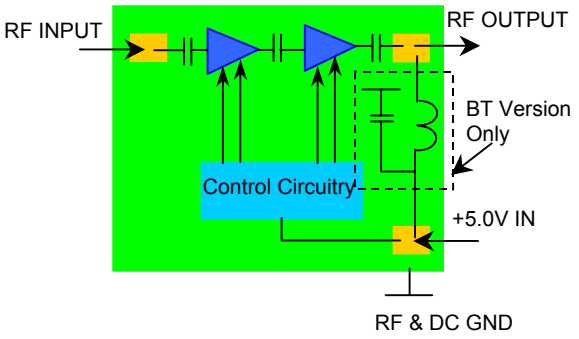

FIG. 6 Block diagram of WBA0510 series

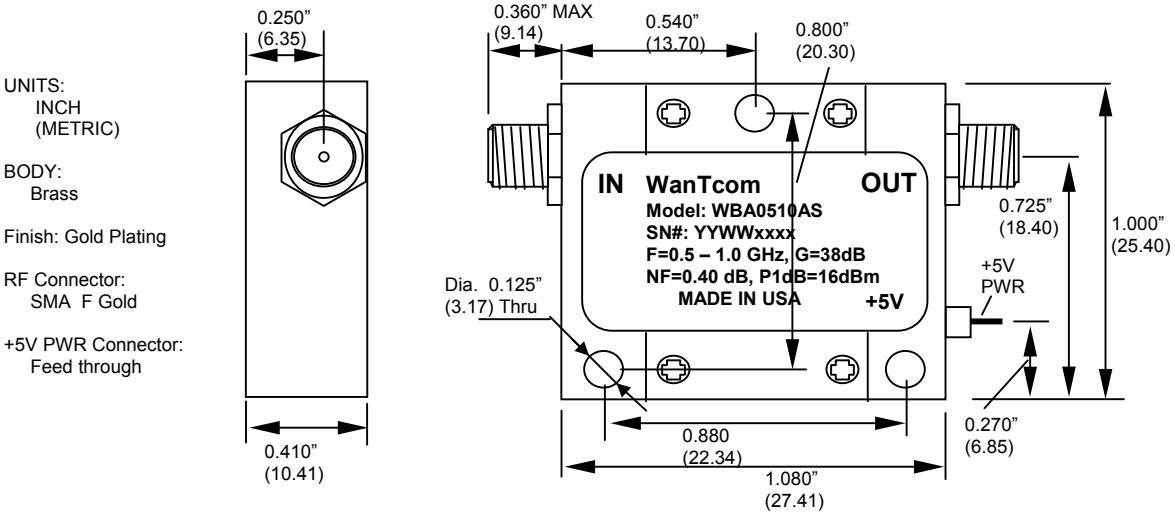

FIG. 7 WBA0510 series outline

WBA0510 Series LNA Mechanical Outline, WP-5:

Figure 7 shows the mechanical outline sample of WBA0510AS LNA. It is a WanTcom's standard WP-5 housing with gold plating finish. Both RF input and output ports are equipped with SMA female connectors and the DC port connector is an EMI filtered feed thru pin.

Ordering Information

NF (dB)	0.50	0.40	Built-In Bias-T
Model Number:	WBA0510A	WBA0510AS	No
	WBA0510ABT	WBA0510ASBT	Yes

Small Signal S-Parameters:

!WBA0510AS, +25C
!s-parameters at Vdd=5V, Idd=103mA. Last updated 11/5/05.

GHZ s MA R 50

!Freq(GHz)	MAGS11	ANGS11	MAGS21	ANGS21	MAGS12	ANGS12	MAGS22	ANGS22
0.05	0.438	3.7	9.144	149.1	0.000038	144.5	0.805	-70.4
0.1	0.667	-5.1	25.018	116.6	0.000035	124.7	0.527	-123.5
0.2	0.686	-64.8	68.164	55.4	0.000291	-170.3	0.219	174.1
0.3	0.331	-106.0	94.676	1.8	0.000500	143.0	0.100	154.5
0.4	0.113	-120.2	99.265	-37.7	0.000952	122.8	0.077	166.0
0.5	0.052	-49.2	98.610	-68.7	0.001186	109.4	0.095	164.4
0.6	0.105	-36.1	97.269	-95.9	0.001553	90.8	0.118	147.8
0.7	0.125	-50.2	96.709	-121.3	0.001990	79.8	0.134	124.6
0.8	0.113	-70.5	96.327	-146.3	0.002496	65.3	0.141	97.3
0.9	0.076	-95.1	95.309	-171.7	0.003045	48.2	0.143	67.4
1	0.033	-125.0	93.137	162.3	0.003545	35.0	0.137	34.7
1.1	0.012	135.9	89.037	135.8	0.004076	18.5	0.132	2.9
1.2	0.024	98.8	83.069	109.4	0.004567	1.2	0.135	-25.1
1.3	0.065	115.9	75.749	82.8	0.004956	-15.7	0.153	-47.2
1.4	0.157	108.3	67.419	56.2	0.005247	-34.6	0.197	-66.5
1.5	0.293	86.8	58.149	29.5	0.005266	-54.6	0.267	-87.6
1.6	0.443	64.7	48.170	3.2	0.005009	-74.5	0.359	-110.8
1.7	0.583	42.0	38.405	-21.8	0.004538	-95.2	0.450	-134.6
1.8	0.682	21.2	29.341	-44.2	0.003779	-111.2	0.530	-157.7
1.9	0.758	2.4	22.190	-64.5	0.003082	-129.1	0.594	-178.8
2	0.801	-13.9	16.750	-82.2	0.002383	-144.2	0.645	161.7
2.1	0.824	-28.0	12.585	-98.0	0.001757	-158.8	0.682	144.1
2.2	0.851	-40.8	9.878	-112.3	0.001282	-173.9	0.711	127.9
2.3	0.875	-52.6	7.927	-125.1	0.000928	175.6	0.736	112.8
2.4	0.887	-64.0	6.465	-137.9	0.000530	154.0	0.754	99.0
2.5	0.889	-75.3	5.332	-148.8	0.000287	132.8	0.771	85.6
2.6	0.898	-85.2	4.378	-159.2	0.000122	51.6	0.782	73.0
2.7	0.895	-95.3	3.621	-169.3	0.000310	31.1	0.793	61.0
2.8	0.896	-105.2	2.979	-179.9	0.000459	-6.8	0.801	49.4
2.9	0.893	-114.6	2.465	169.7	0.000625	-20.3	0.809	38.1
3	0.888	-123.8	1.922	157.9	0.000765	-32.0	0.813	27.0
3.1	0.883	-132.2	1.510	150.4	0.000978	-39.0	0.819	16.4
3.2	0.871	-140.8	1.249	144.1	0.000991	-42.7	0.823	5.7
3.3	0.871	-148.5	1.012	137.3	0.001228	-51.4	0.830	-4.8
3.4	0.881	-157.3	0.848	134.0	0.001254	-58.1	0.832	-14.9
3.5	0.869	-166.9	0.704	128.1	0.001657	-61.8	0.833	-25.0
3.6	0.855	-176.4	0.573	122.0	0.001724	-61.4	0.838	-35.3
3.7	0.855	174.9	0.450	116.0	0.001969	-73.0	0.839	-45.2
3.8	0.834	166.1	0.337	109.0	0.002140	-79.1	0.838	-55.2
3.9	0.808	156.7	0.246	97.8	0.002317	-85.5	0.840	-64.9
4	0.803	148.3	0.170	82.9	0.002630	-96.2	0.838	-74.8

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