0.20 - 3.3 GHz LOW NOISE AMPLIFIER WBA0235A[1]

WBA0235A LNA is a low noise figure, wideband, and high linearity low noise amplifier with exceptional gain flatness design. The amplifier offers typical 1.0 dB noise figure, 17.0 dB gain, +/- 0.35 dB gain variation, and 24.0 dBm output IP_3 at the frequency range from 0.20 GHz to 3.30 GHz.

WBA0235A is most suitable for cellular base stations, wireless data communications, tower top receiver amplifiers, cellular micro-cells, 3G, ISM, last-mile wireless communication systems, and wireless measurement applications.

WBA0235A is designed to meet the rugged standards of MIL-STD-202, and MIL-STD-883. WBA0235A is leaded product for highest quality application or RoHS complied product with WBA0235AG model. WBA0235A-5 or WBA0235AG-5 is for +5.0V DC power operation.

Key Features:

Impedance:	50 Ohm
MTBF[2]:	>300,000 hrs (34Years)
Low Noise:	1.0 dB typical
Output IP_3:	24.0 dBm
Gain:	17.0
Gain Flatness:	+/-1.0 dB maximum
Input VSWR:	1.40 maximum
Output VSWR:	1.40 maximum
P_{1dB}:	12.0 dBm minimum
Single Power Supply:	30 mA, @ V_{dd} = +7.0 – 35.0 V or +5.0 V
Frequency Range:	0.20 ~ 3.30 GHz
Operating Temperature:	-40 ~ +85 ºC
Small size:	SMA Female, 1.00" x 1.08" x 0.41" (25.4 mm x 27.4 mm x 10.4 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	45
P_{diss}	Total Power Dissipation	mW	220
$P_{In,Max}$	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
$R_{th,c}$	Thermal Resistance	°C/W	220

[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 of WBA0235A at room temperature

Index	Testing Item	Symbol	Test Constraints	Nom (RT)	Min	Max	Unit
1	Gain	S_{21}	0.20 – 3.30 GHz	17.0			dB
2	Gain Variation	ΔG	0.20 – 3.30 GHz	+/- 0.35		+/- 0.60	dB
3	Input Return Loss	S_{11}	0.20 – 3.30 GHz		16		dB
4	Output Return Loss	S_{22}	0.20 – 3.30 GHz		16		dB
5	Reverse Isolation	S_{12}	0.20 – 3.30 GHz		18		dB
6	Noise figure	NF	0.20 – 3.30 GHz	1.0		1.2	dB
7	Output P_{1dB} compression	P_{1dB}	0.20 – 3.30 GHz		12		dBm
8	Output-Third-Order Interception point	IP_3	Two-Tone, Pout 0 dBm each, 1 MHz separation		24		dBm
9	Current Consumption	I_{dd}	V_{dd}	30		35	mA
10	Power Supply Voltage	V_{dd}	WBA0235A		7.0	35.0	V
			WBA0235A-5	5.0	4.8	5.2	V
11	Operating Temperature	T_o			-40	+85	^oC
12	Maximum Average RF Input Power	$P_{IN, MAX}$	0.20 – 3.30 GHz			10	dBm

b) Passband Frequency Response

As shown in **Figure 1**, the typical gain of the WBA0235A is 17.0 dB across 0.2 GHz to 3.0 GHz frequency range. The typical input and output return losses are 16 dB across 0.2 GHz to 3.0 GHz frequency range.

Figure 2 shows P_{1dB} and IP_3 of the WBA0235A. The typical P_{1dB} and IP_3 are 12.0 dBm and 24.0 dBm in the frequency range of 0.2 GHz to 3.0 GHz, respectively.

Figure 3 illustrates the noise figure performance. The noise figure is 1.0 dB across the frequency range of 0.2 GHz to 3.0 GHz. At 85 ^{0}C, WBA0235A only has 0.23 dB noise increases. At –40 ^{0}C, WBA0235A offers approximately 0.18 dB less noise figure than that at room temperature.

Figure 4 is the plot of the stability factor *k* of WBA0235A. The amplifier may be conditional stable at room temperature due to *k* may below 1.0 at some frequency ranges.

Figure 5 demonstrates the small signal performance of WBA0235A at the extended frequency range.

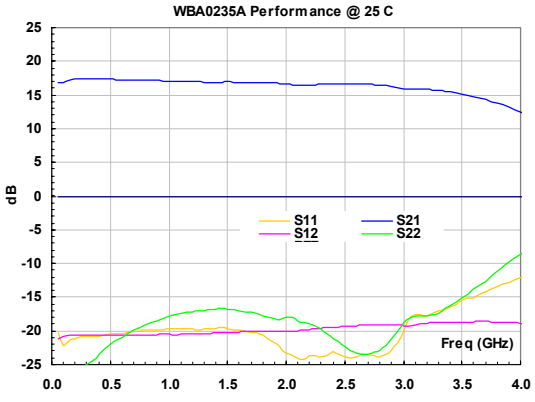

FIG. 1 Typical small signal performance.

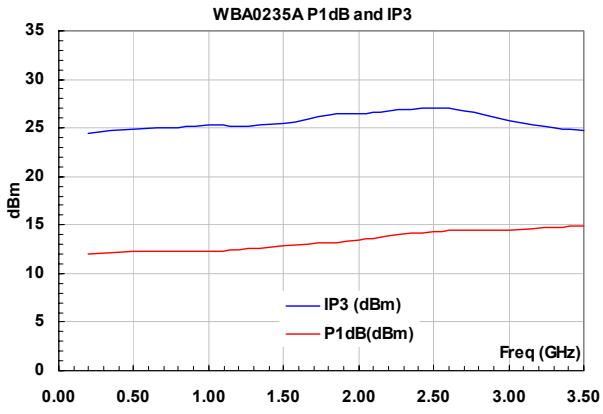

FIG. 2 Typical P_{1dB} and IP_3 at room temperature.

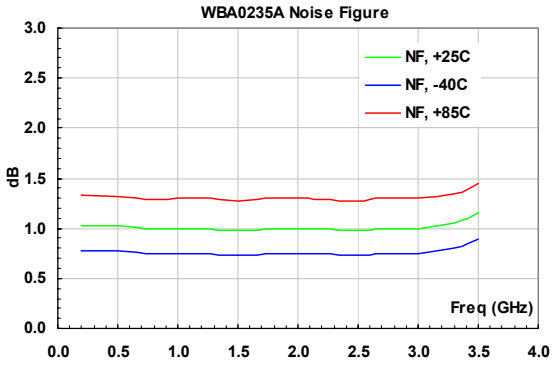

FIG. 3 Noise figure performance at room temperature

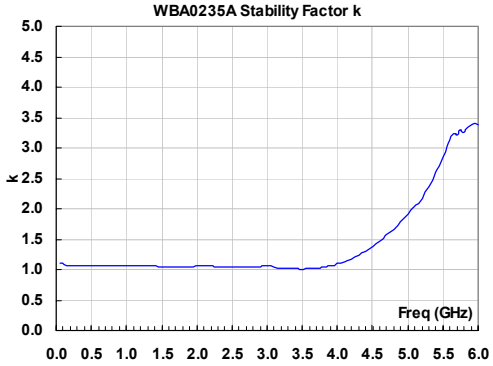

FIG. 4 Stability factor *k* of WBA0235A

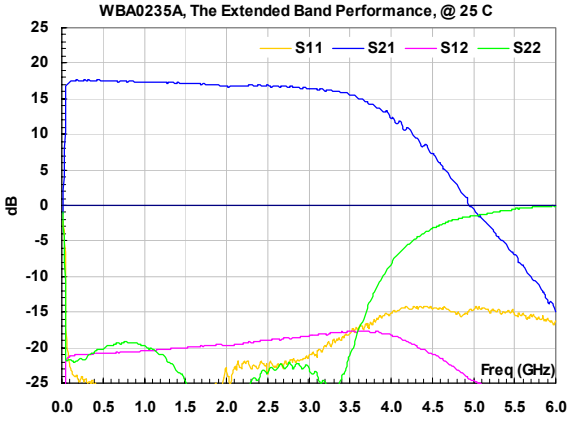

FIG. 5 Performance at the extended frequency band

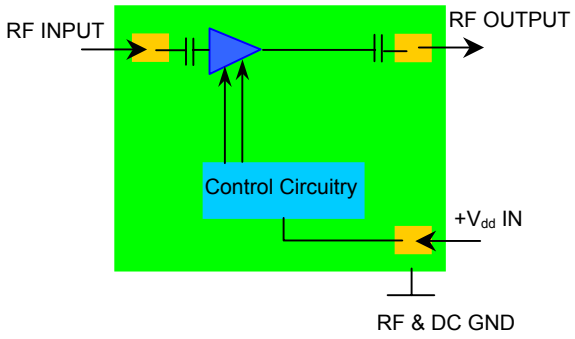

FIG. 6 Block diagram of WBA0235A

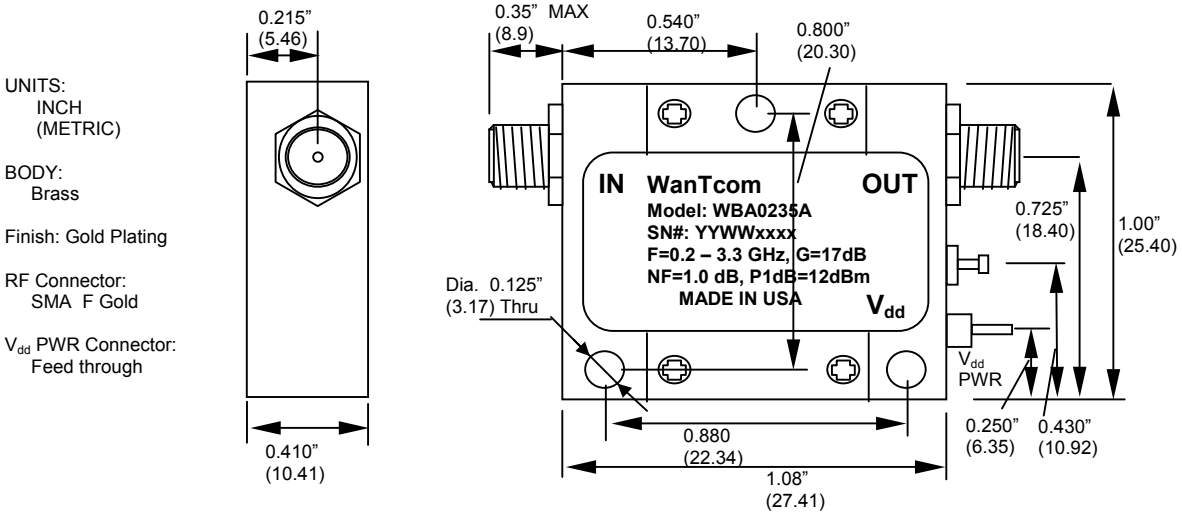

FIG. 7 WBA0235A outline

WBA0235A Mechanical Outline, WP-5:

Figure 7 shows the mechanical outline of WBA0235A. It is a WanTcom's standard WP-5 housing with gold plating. Both RF input and output ports are equipped with SMA female connectors and the DC port connector is an EMI filtered feed thru pin. Adding G after model number for RoHS complied product and –5 for +5.0V DC operation.

Ordering Information

Leaded	RoHS Complied	V_{dd}
WBA0235A	WBA0235AG	+7 ~ +35V
WBA0235A-5	WBA0235AG-5	+5.0V

Small Signal S-Parameters:

!WBA0235A, S-parameters at Vdd=5V, Idd=30mA. Last updated 11/20/03.

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	0.098	98.2	6.950	-142.7	0.0880	45.1	0.039	164.2
0.1	0.078	40.0	6.959	-159.2	0.0910	24.4	0.042	139.5
0.2	0.088	-10.2	7.370	173.0	0.0930	4.0	0.047	99.5
0.3	0.091	-29.8	7.381	158.2	0.0940	-5.0	0.056	72.7
0.4	0.091	-46.8	7.374	146.0	0.0940	-11.8	0.067	50.8
0.5	0.096	-62.0	7.344	134.7	0.0940	-17.5	0.079	32.7
0.6	0.095	-77.0	7.298	123.7	0.0940	-23.0	0.090	15.5
0.7	0.099	-90.0	7.267	113.3	0.0940	-28.0	0.101	-1.2
0.8	0.101	-102.3	7.224	102.8	0.0940	-33.0	0.111	-17.7
0.9	0.101	-114.1	7.171	92.7	0.0940	-38.0	0.119	-33.5
1	0.103	-126.9	7.119	82.6	0.0950	-42.7	0.128	-48.6
1.1	0.105	-138.0	7.074	72.4	0.0950	-47.3	0.134	-64.1
1.2	0.104	-150.6	7.029	62.3	0.0950	-51.9	0.139	-79.1
1.3	0.103	-162.6	7.002	52.4	0.0960	-56.5	0.142	-94.2
1.4	0.104	-173.5	6.996	42.5	0.0960	-61.2	0.145	-108.9
1.5	0.105	175.3	7.015	32.6	0.0970	-66.0	0.146	-123.8
1.6	0.101	162.2	6.997	22.5	0.0980	-70.9	0.142	-139.2
1.7	0.098	148.5	6.971	11.9	0.0990	-75.7	0.137	-155.0
1.8	0.094	137.3	6.933	1.4	0.1000	-80.5	0.131	-170.4
1.9	0.082	124.6	6.893	-9.3	0.1000	-85.7	0.124	174.9
2	0.068	112.2	6.754	-19.5	0.0990	-90.7	0.125	161.9
2.1	0.063	108.9	6.677	-28.8	0.1000	-94.5	0.119	142.7
2.2	0.066	104.8	6.684	-38.5	0.1020	-98.9	0.114	121.7
2.3	0.064	88.5	6.732	-48.8	0.1040	-103.7	0.103	98.5
2.4	0.070	70.2	6.764	-59.5	0.1060	-108.9	0.088	73.2
2.5	0.064	52.5	6.795	-70.5	0.1080	-114.2	0.077	47.0
2.6	0.064	32.4	6.782	-81.6	0.1090	-120.0	0.069	14.9
2.7	0.067	14.4	6.753	-92.8	0.1100	-125.8	0.067	-20.1
2.8	0.064	-5.4	6.673	-104.4	0.1120	-131.8	0.072	-52.1
2.9	0.072	-17.3	6.528	-116.2	0.1120	-138.0	0.087	-82.8
3	0.101	-30.1	6.270	-127.2	0.1090	-143.3	0.116	-117.0
3.1	0.131	-59.2	6.188	-137.1	0.1110	-146.7	0.129	-156.5
3.2	0.130	-81.6	6.184	-148.4	0.1140	-152.5	0.129	173.2
3.3	0.139	-94.6	6.081	-160.8	0.1160	-158.9	0.136	147.6
3.4	0.151	-108.0	5.928	-173.1	0.1170	-165.2	0.154	122.0
3.5	0.168	-118.7	5.737	174.5	0.1170	-171.5	0.177	96.0
3.6	0.177	-129.7	5.482	162.0	0.1170	-178.0	0.203	70.5
3.7	0.198	-139.2	5.206	149.5	0.1180	175.5	0.235	45.2
3.8	0.215	-150.2	4.882	137.0	0.1170	169.1	0.277	22.2
3.9	0.229	-159.3	4.542	124.4	0.1160	162.3	0.324	0.2
4	0.249	-169.2	4.192	112.0	0.1140	155.1	0.369	-20.9
4.1	0.268	179.6	3.854	99.7	0.1140	147.9	0.422	-40.3
4.2	0.282	169.7	3.536	87.9	0.1110	141.7	0.475	-57.9
4.3	0.294	159.7	3.211	76.4	0.1070	135.3	0.524	-75.5
4.4	0.307	149.6	2.883	65.3	0.1030	128.6	0.568	-91.5
4.5	0.314	139.1	2.583	54.2	0.1000	122.2	0.611	-106.7
5	0.314	89.5	1.448	4.4	0.0820	96.2	0.760	-171.4
5.5	0.261	43.8	0.828	-38.0	0.0710	73.4	0.816	137.9
6	0.233	4.1	0.549	-72.0	0.0670	52.9	0.864	95.7

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