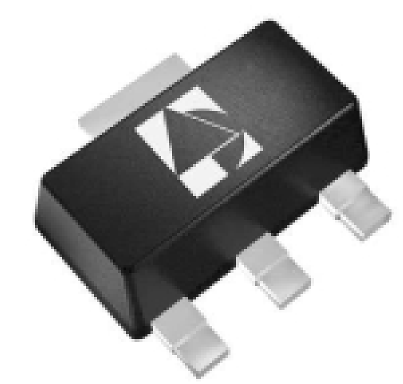
AGB3301

50Ω High IP3 Low Noise Wideband Gain Block

PRELIMINARY DATA SHEET - Rev 1.5

FEATURES
- 250-3000 MHz Frequency Range
- +45 dBm Output IP3
- Low Noise Figure: 2.4 dB at 900 MHz
- 13.5 dB Gain at 900 MHz
- +24 dBm P1dB
- SOT-89 Package
- Single +5V to +9V Supply
- Low Power: less than 1 Watt
- Case Temperature: -40 to +100 °C

APPLICATIONS
- Cellular Base Stations for W-CDMA, CDMA, TDMA, GSM, PCS and CDPD systems
- Fixed Wireless
- MMDS/WLL
- WLAN, HyperLAN
- CATV



S24 Package
SOT-89

PRODUCT DESCRIPTION
The AGB3301 is one of a series of GaAs MESFET amplifiers designed for use in applications requiring high linearity, low noise and low distortion. With a high output IP3, low noise figure and wide band operation, the AGB3301 is ideal for 50Ω wireless infrastructure applications such as Cellular Base Stations, MMDS, and WLL. Offered in a low cost SOT-89 surface mount package, the AGB3301 requires a single +5V to +9V supply, and typically consumes less than 1 Watt of power.

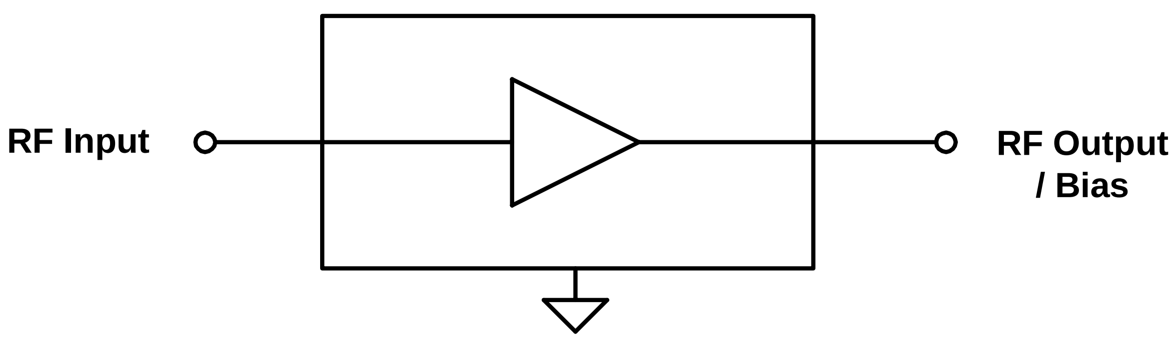


Figure 1: Block Diagram

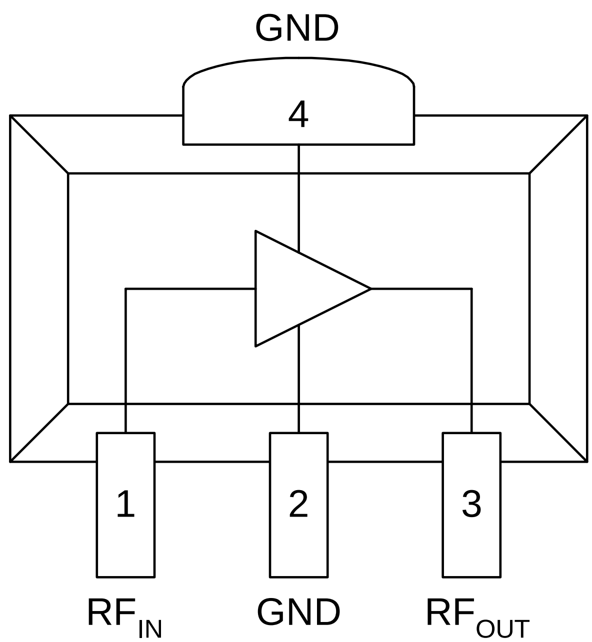


Figure 2: Pin Out

Table 1: Pin Description

PIN	NAME	DESCRIPTION
1	RF_{IN}	RF Input
2	GND	Ground
3	RF_{OUT}	RF Output / Bias
4	GND	Ground

ELECTRICAL CHARACTERISTICS

Table 2: Absolute Minimum and Maximum Ratings

PARAMETER	MIN	MAX	UNIT
Device Voltage	0	+12	VDC
RF Input Power	-	+15	dBm
Storage Temperature	-40	+150	°C
Soldering Temperature	-	TBD	°C
Soldering Time	-	TBD	sec

Stresses in excess of the absolute ratings may cause permanent damage. Functional operation is not implied under these conditions. Exposure to absolute ratings for extended periods of time may adversely affect reliability.

Table 3: Operating Ranges

PARAMETER	MIN	TYP	MAX	UNIT
Frequency Range: f	250	-	3000	MHz
Device Voltage: V_{DD}	-	+9	+10	VDC
Thermal Resistance: θ_{JC}	-	-	40	°C/W
Case Temperature: T_C	-40	-	+100	°C

The device may be operated safely over these conditions; however, parametric performance is guaranteed only over the conditions defined in the electrical specifications.

Table 4: Electrical Specifications - Unmatched 50Ω Test Circuit
(T_A = +25 °C, V_{DD} = +9 VDC, f = 900 MHz, see Figure 3)

PARAMETER	MIN	TYP	MAX	UNIT
Gain: S_{21}	12	13.5	15	dB
Input Return Loss: S_{11}	-	-15	-10	dB
Output Return Loss: S_{22}	-	-15	-10	dB
Output IP3 (1)	+42	+45	-	dBm
Noise Figure	-	2.4	3.5	dB
Output 1dB Compression: P1dB	-	+24	-	dBm
Supply Current	90	110	130	mA

Notes:
(1) OIP3 is measured with two tones: 900 MHz and 901 MHz, +5dBm output per tone.

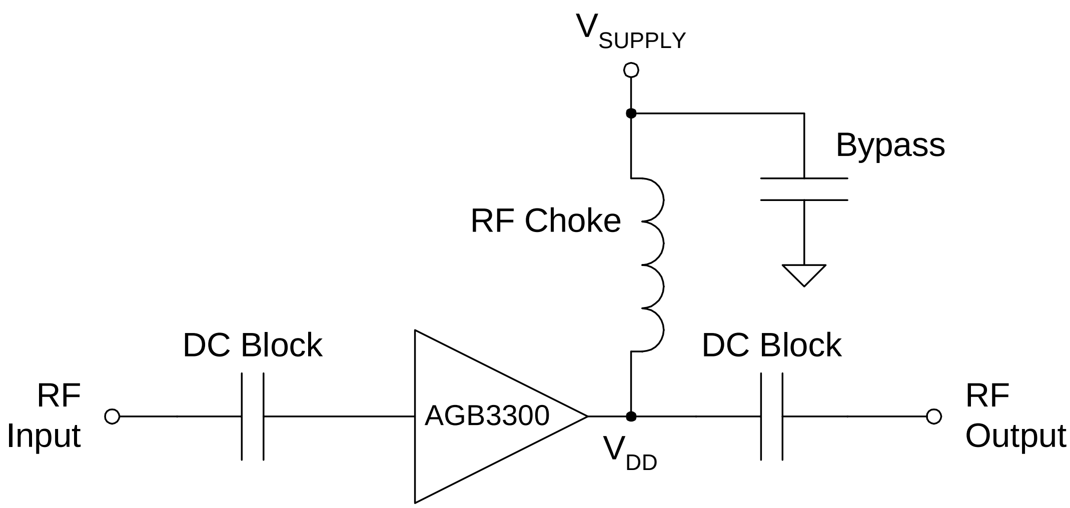


Figure 3: Unmatched 50Ω Test Circuit

PERFORMANCE DATA

Figures 4 through 8 contain data for the device as tested in the unmatched 50Ω test circuit shown in Figure 3. Unless otherwise indicated, V_{DD} = +9 VDC.

Figure 4: OIP3 vs. Frequency (in Unmatched 50Ω Test Circuit)

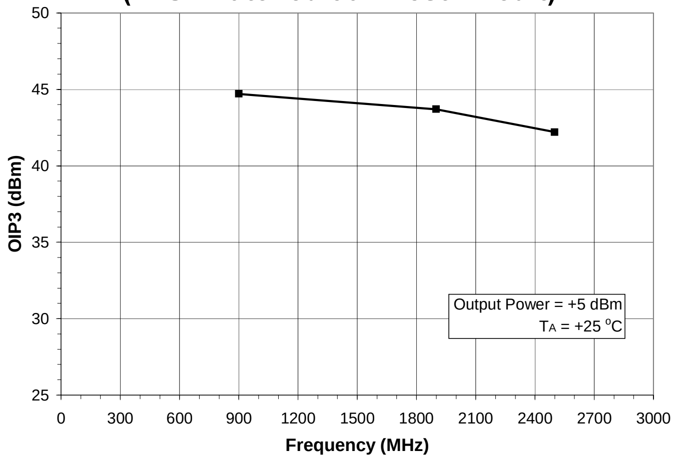


Figure 5: OIP3 vs. Case Temperature (in Unmatched 50Ω Test Circuit)

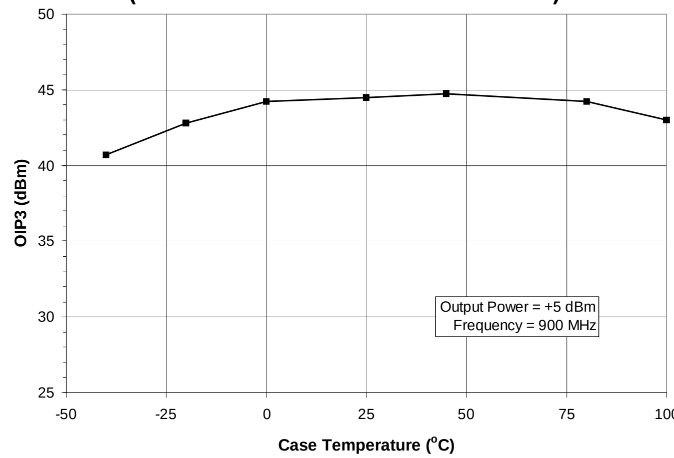


Figure 6: Gain vs. Frequency (in Unmatched 50Ω Test Circuit)

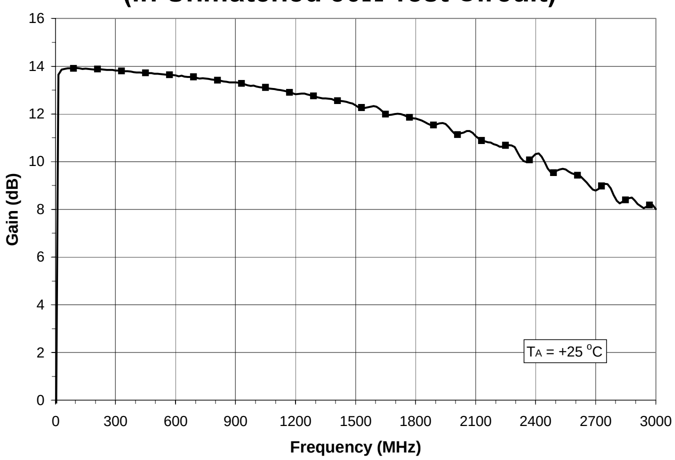


Figure 7: Gain vs. Case Temperature (in Unmatched 50Ω Test Circuit)

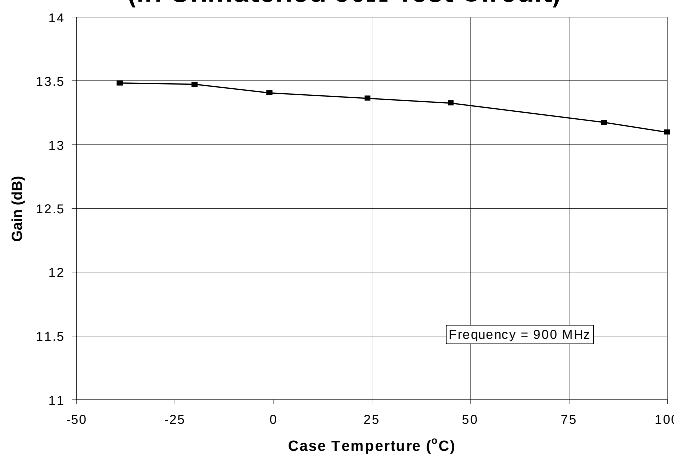
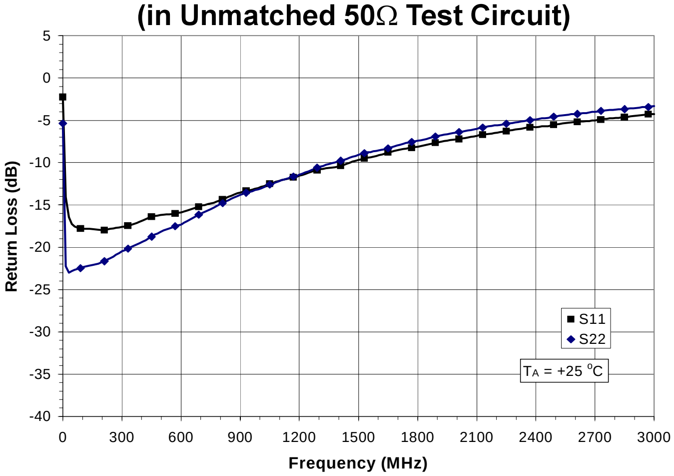


Figure 8: Return Loss vs. Frequency (in Unmatched 50Ω Test Circuit)



APPLICATION INFORMATION

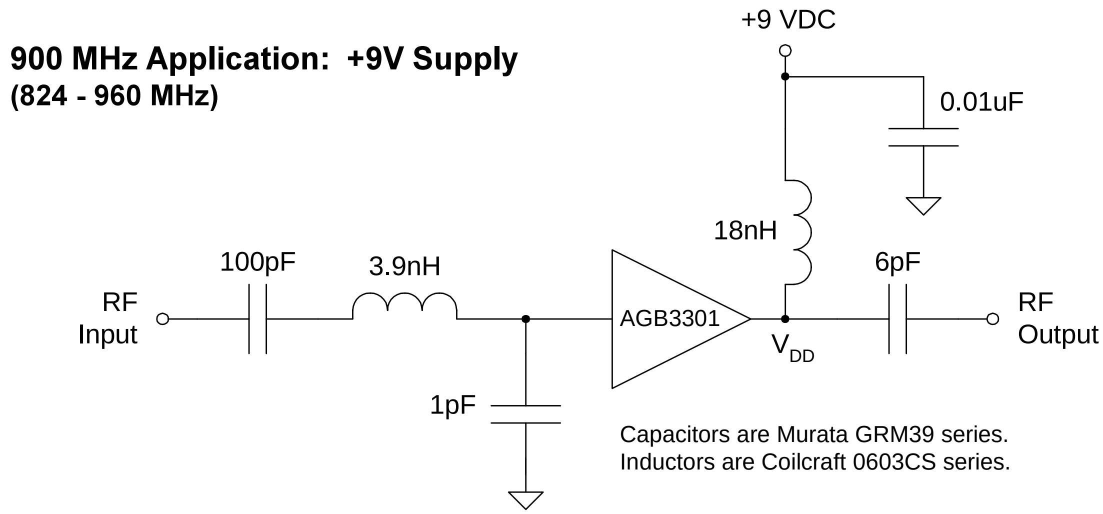


Figure 9: 900 MHz Application Circuit (50Ω Terminations)

Table 5: 900 MHz Application Performance (V_{SUPPLY} = +9 VDC)

PARAMETER	TYP	UNIT
Gain: S_{21}	13.8	dB
Input Return Loss: S_{11}	-20	dB
Output Return Loss: S_{22}	-18	dB
Output IP3 [(1)]	+47	dBm
Noise Figure	2.4	dB
Output 1dB Compression: P1dB	+24	dBm

Note:
(1) OIP3 is measured with two tones: 900 MHz and 901 MHz, +5dBm output per tone.

Figure 10: Output 3rd-Order Intercept vs. Power (Vsupply = +9 VDC, 900 MHz Application Circuit)

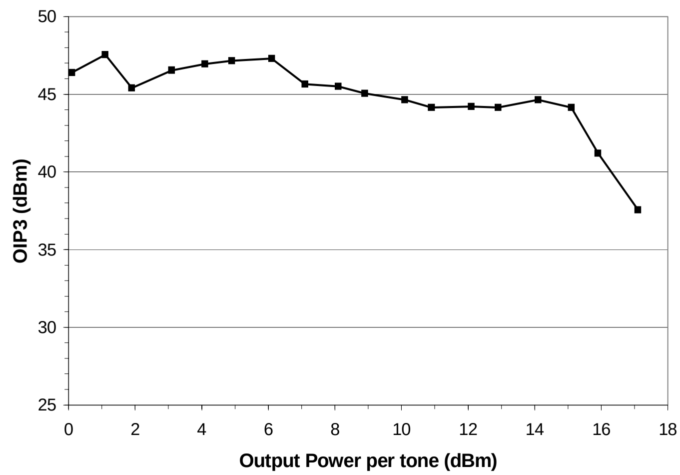


Figure 11: Gain vs. Frequency (V_{SUPPLY} = +9 VDC, 900 MHz Application Circuit)

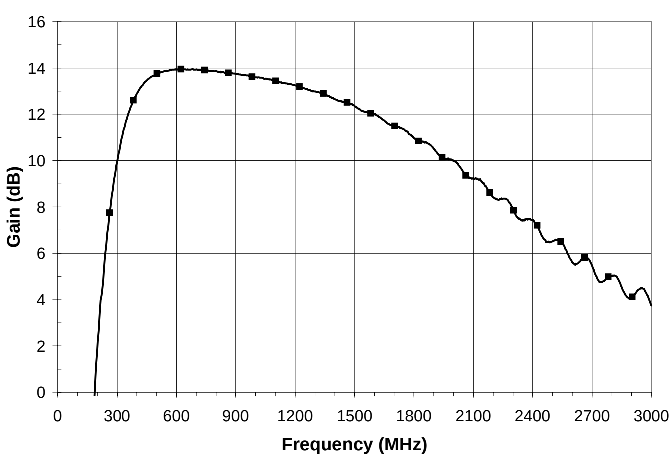
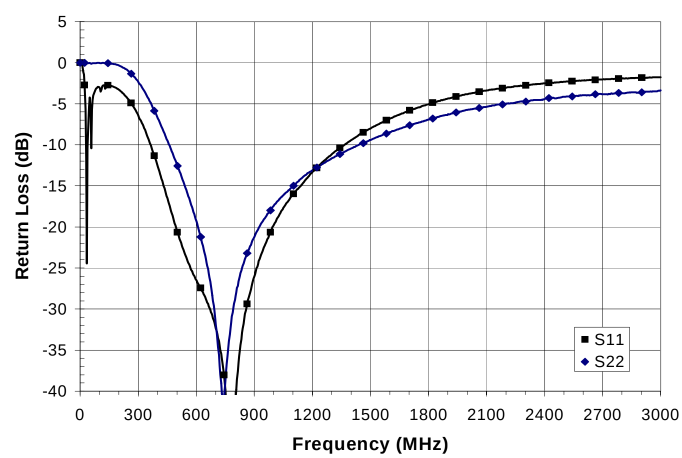


Figure 12: Return Loss vs. Frequency (V_{SUPPLY} = +9 VDC, 900 MHz Application Circuit)



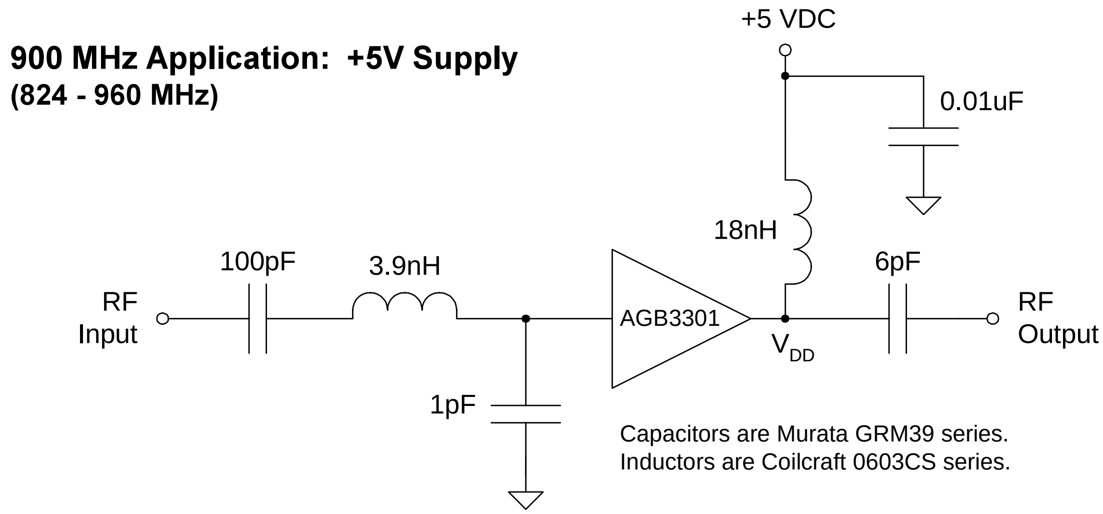


Figure 13: 900 MHz Application Circuit (50Ω Terminations)

Table 6: 900 MHz Application Performance (V_{SUPPLY} = +5 VDC)

PARAMETER	TYP	UNIT
Gain: S_{21}	13.5	dB
Input Return Loss: S_{11}	-20	dB
Output Return Loss: S_{22}	-20	dB
Output IP3 (1)	+42.5	dBm
Noise Figure	2.5	dB
Output 1dB Compression: P1dB	+18.5	dBm

Note:
(1) OIP3 is measured with two tones: 900 MHz and 901 MHz, +5dBm output per tone.

Figure 14: Output 3rd-Order Intercept vs. Power (Vsupply = +5 VDC, 900 MHz Application Circuit)

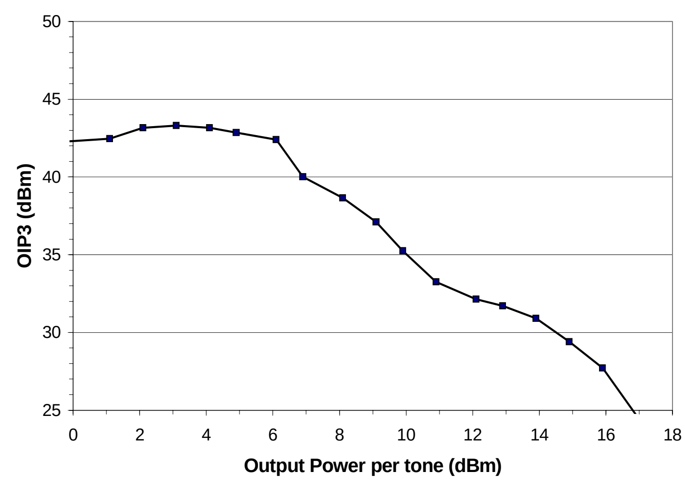


Figure 15: Gain vs. Frequency (V_{SUPPLY} = +5 VDC, 900 MHz Application Circuit)

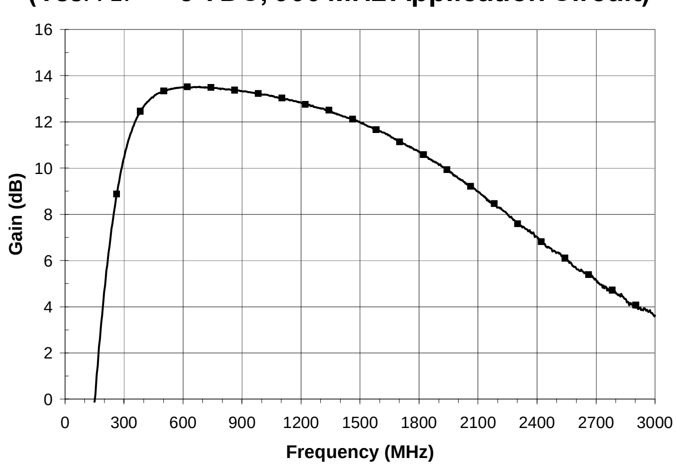
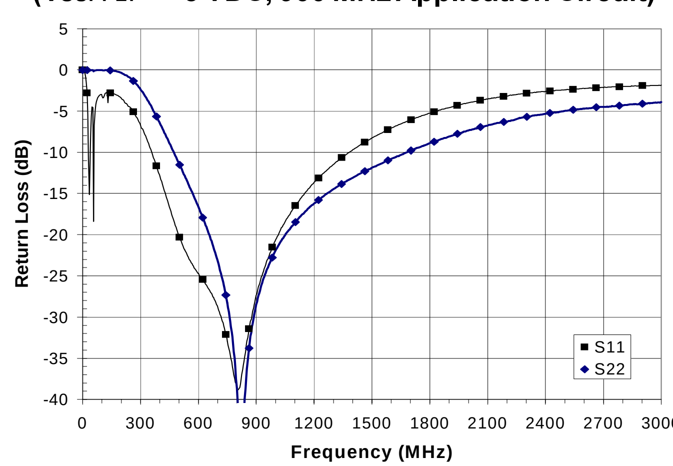


Figure 16: Return Loss vs. Frequency (V_{SUPPLY} = +5 VDC, 900 MHz Application Circuit)



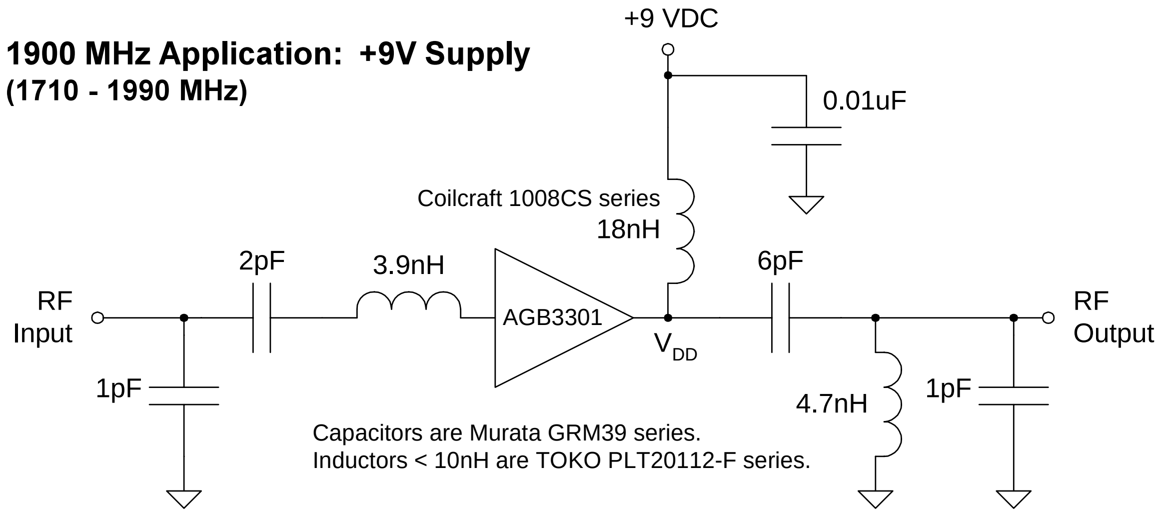


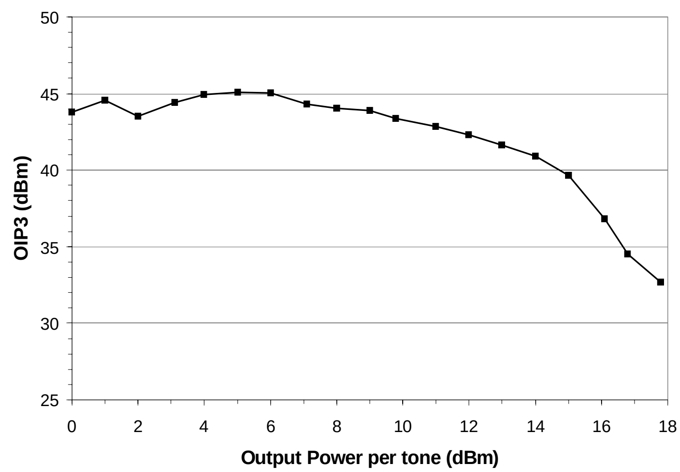
Figure 17: 1900 MHz Application Circuit (50Ω Terminations)

Table 7: 1900 MHz Application Performance (V_{SUPPLY} = +9 VDC)

PARAMETER	TYP	UNIT
Gain: S_{21}	12.1	dB
Input Return Loss: S_{11}	-10	dB
Output Return Loss: S_{22}	-12	dB
Output IP3 (1)	45	dBm
Noise Figure	2.9	dB
Output 1dB Compression: P1dB	+21	dBm

Note:
(1) OIP3 is measured with two tones: 1900 MHz and 1901 MHz, +5dBm output per tone.

Figure 18: Output 3rd-Order Intercept vs. Power (V_{SUPPLY} = +9 VDC, 1900 MHz Application Circuit)



19: Gain vs. Frequency (V_{SUPPLY} = +9 VDC, 1900 MHz Application Circuit)

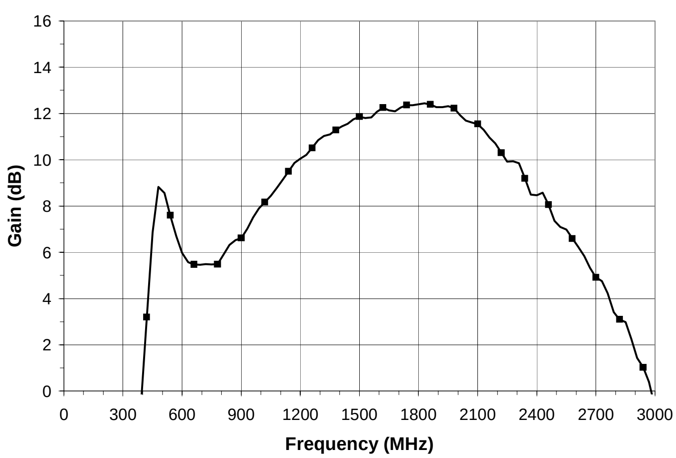
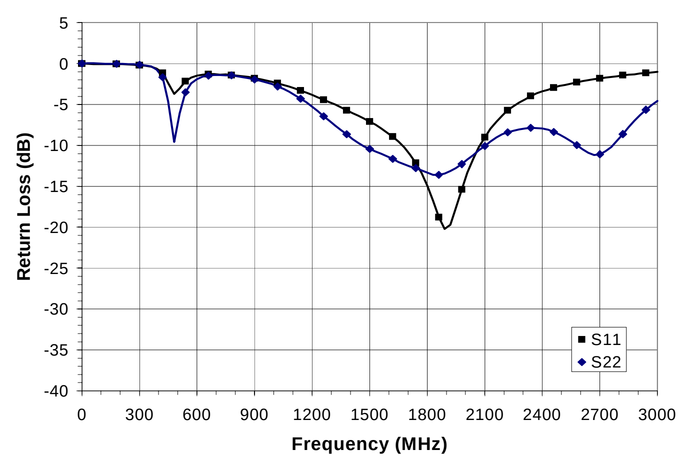


Figure 20: Return Loss vs. Frequency (V_{SUPPLY} = +9 VDC, 1900 MHz Application Circuit)



1900 MHz Application: +5V Supply
(1710 - 1990 MHz)

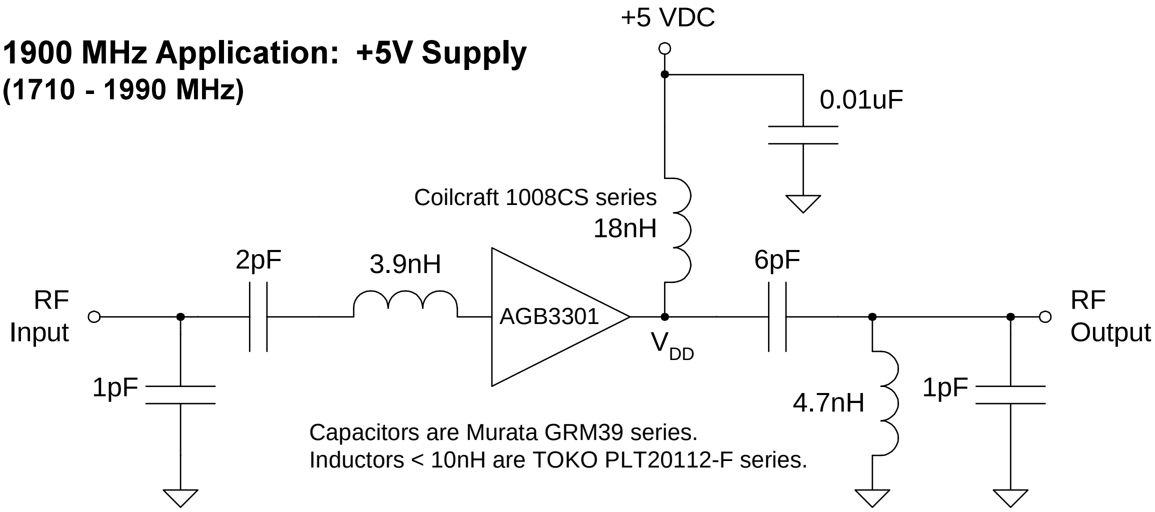


Figure 21: 1900 MHz Application Circuit (50Ω Terminations)

Table 8: 1900 MHz Application Performance (V_{SUPPLY} = +5 VDC)

PARAMETER	TYP	UNIT
Gain: S_{21}	12.0	dB
Input Return Loss: S_{11}	-10	dB
Output Return Loss: S_{22}	-15	dB
Output IP3 (1)	+37	dBm
Noise Figure	2.8	dB
Output 1dB Compression: P1dB	+18	dBm

Note:
(1) OIP3 is measured with two tones: 1900 MHz and 1901 MHz, +5dBm output per tone.

Figure 22: Output 3rd-Order Intercept vs. Power (V_{SUPPLY} = +5 VDC, 1900 MHz Application Circuit)

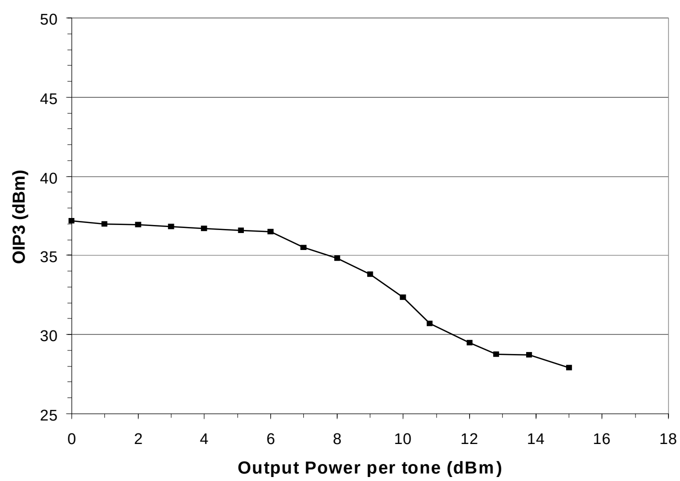


Figure 23: Gain vs. Frequency (V_{SUPPLY} = +5 VDC, 1900 MHz Application Circuit)

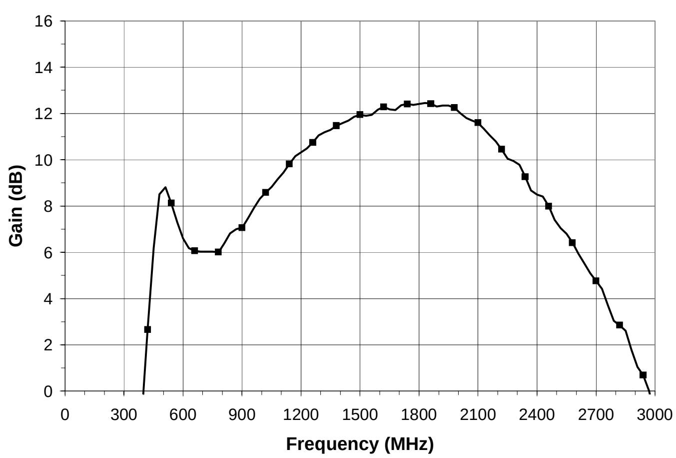
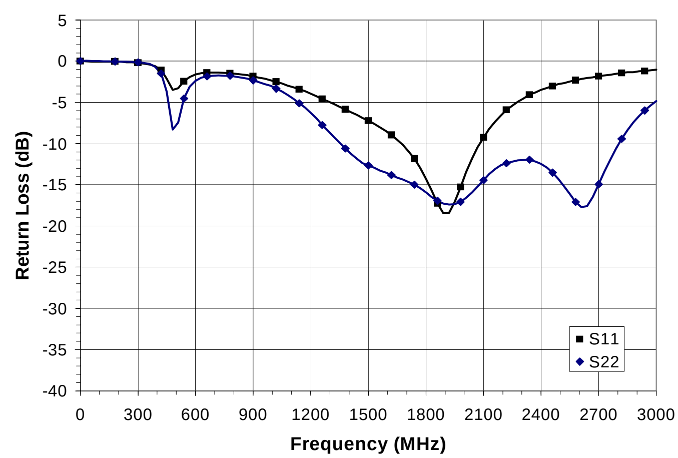


Figure 24: Return Loss vs. Frequency (V_{SUPPLY} = +5 VDC, 1900 MHz Application Circuit)



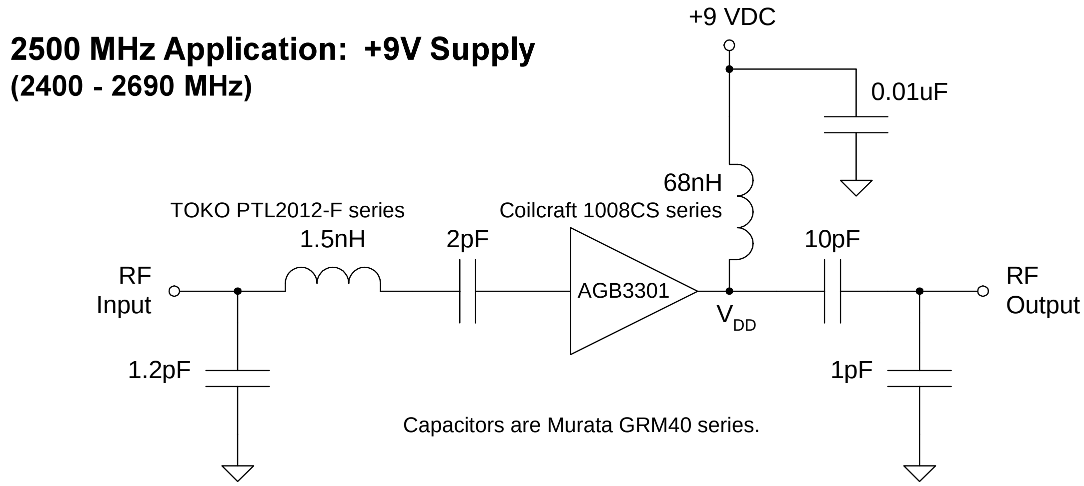


Figure 25: 2500 MHz Application Circuit (50Ω Terminations)

Table 9: 2500 MHz Application Performance (V_{SUPPLY} = +9 VDC)

PARAMETER	TYP	UNIT
Gain: S_{21}	11.5	dB
Input Return Loss: S_{11}	-15	dB
Output Return Loss: S_{22}	-11	dB
Output IP3 (1)	+45	dBm
Noise Figure	3.4	dB
Output 1dB Compression: P1dB	+19	dBm

Note:
(1) OIP3 is measured with two tones: 2500 MHz and 2501 MHz, +5dBm output per tone.

Figure 26: Output 3rd-Order Intercept vs. Power (V_{SUPPLY} = +9 VDC, 2500 MHz Application Circuit)

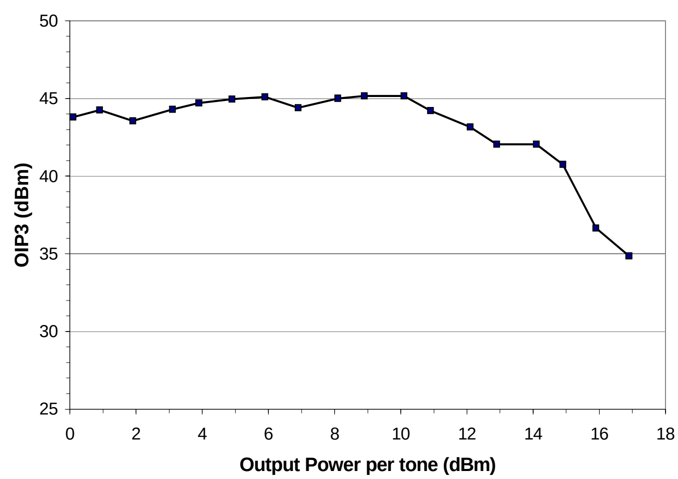


Figure 27: Gain vs. Frequency (V_{SUPPLY} = +9 VDC, 2500 MHz Application Circuit)

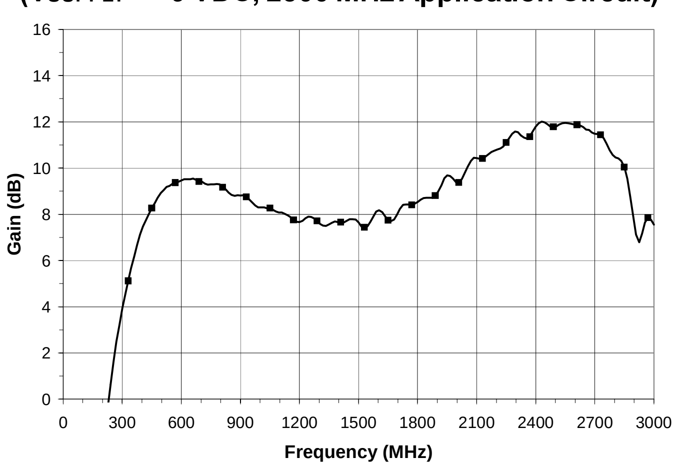
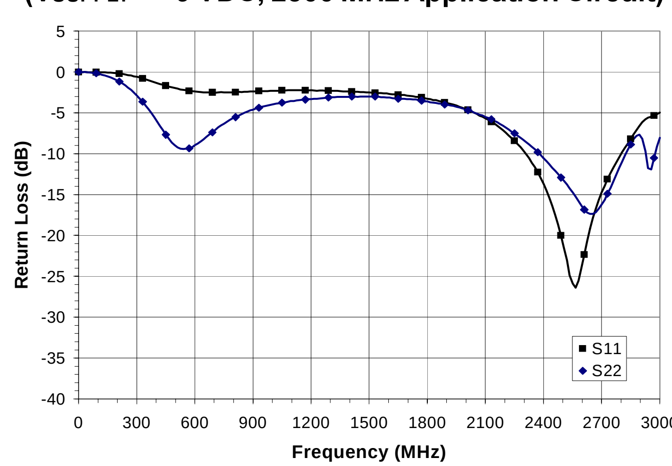


Figure 28: Return Loss vs. Frequency (V_{SUPPLY} = +9 VDC, 2500 MHz Application Circuit)



2500 MHz Application: +5V Supply
(2400 - 2690 MHz)

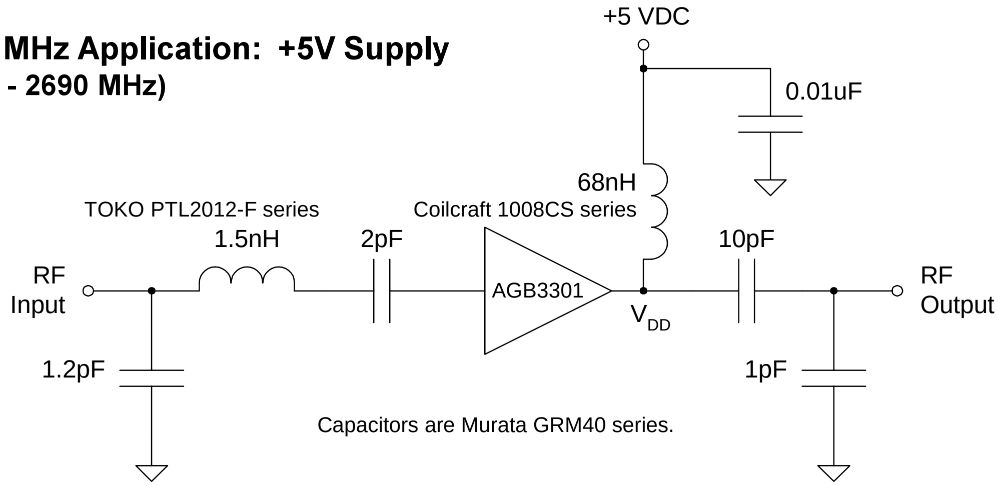


Figure 29: 2500 MHz Application Circuit (50Ω Terminations)

Table 10: 2500 MHz Application Performance (V_{SUPPLY} = +5 VDC)

PARAMETER	TYP	UNIT
Gain: S21	11.5	dB
Input Return Loss: S11	-15	dB
Output Return Loss: S22	-15	dB
Output IP3 (1)	+42	dBm
Noise Figure	3.3	dB
Output 1dB Compression: P1dB	+17	dBm

Note:
(1) OIP3 is measured with two tones: 2500 MHz and 2501 MHz, +5dBm output per tone.

Figure 30: Output 3rd-Order Intercept vs. Power (V_{SUPPLY} = +5 VDC, 2500 MHz Application Circuit)

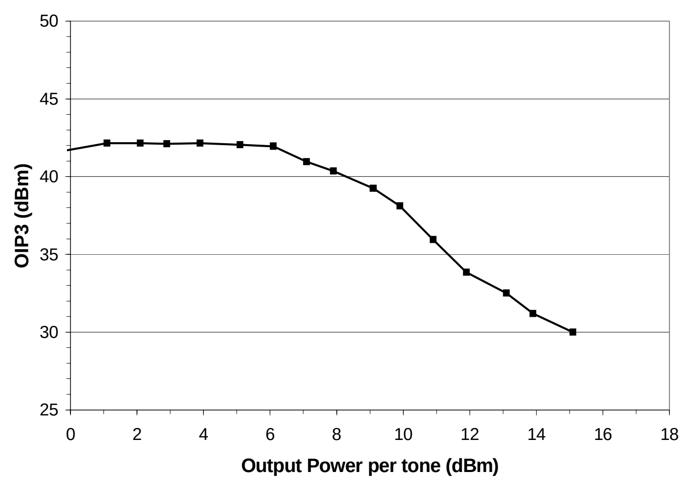


Figure 31: Gain vs. Frequency (V_{SUPPLY} = +5 VDC, 2500 MHz Application Circuit)

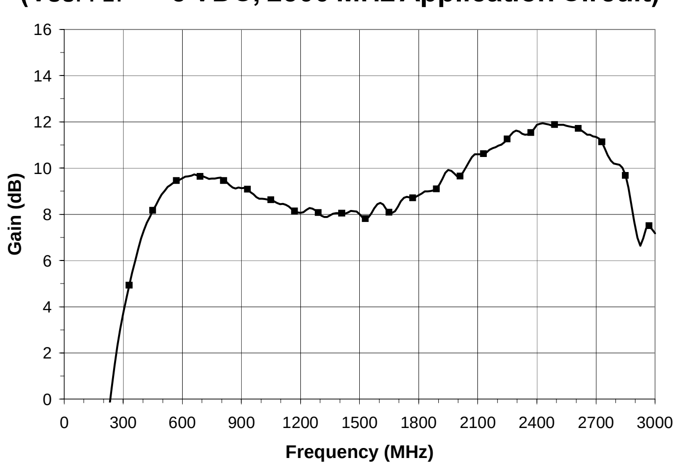
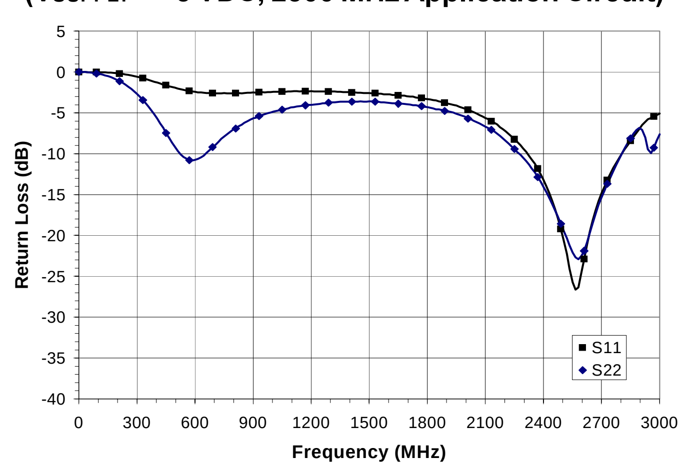


Figure 32: Return Loss vs. Frequency (V_{SUPPLY} = +5 VDC, 2500 MHz Application Circuit)



Bias Circuit

A schematic of the basic, unmatched bias circuit for the AGB Series Gain Blocks is shown in Figure 33. The RF input and output terminations are 50Ω. Inductor L1 provides DC power from V_{SUPPLY} and serves as an RF choke to maintain desired AC performance. The input capacitor C1 and output capacitor C2 are RF blocks that isolate DC current from adjacent circuits. Capacitor C3 is used as an RF bypass that minimizes noise from the supply.

In some applications, a feedback resistor R1 may be added in series with L1, as shown in Figure 34, for improved stability or to serve as a voltage drop for operation from higher supply voltages.

Matching for RF Performance

The AGB3301 Gain Block amplifier can be used in many fixed wireless frequency bands, such as the 824-894 MHz U.S. cellular bands, the 1850-1990 MHz PCS band, the 880-960 MHz GSM band, the 2400-2500 MHz ISM band, and the 2500-2686 MHz MMDS band. Reactive matching circuits may be designed for both the input and output, in order to optimize the RF performance for a particular application. For example, gain, linearity (OIP3) and return loss may be improved over a particular frequency band of interest.

Recommended matching circuits for various applications, as well as wideband S-parameters to use in the simulation of custom designs, are included in this data sheet. For a particular application not addressed in the data sheet, please consult with an ANADIGICS Sales Reperesentative or Application Engineer.

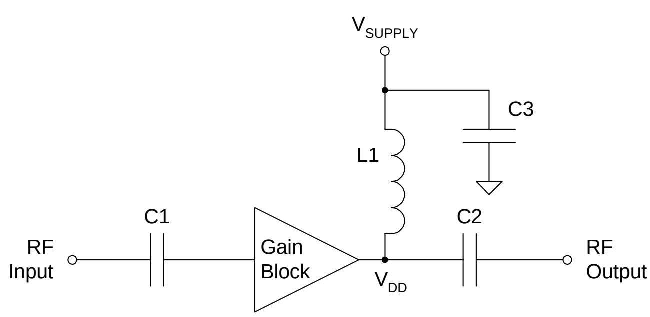


Figure 33: Unmatched Bias Circuit

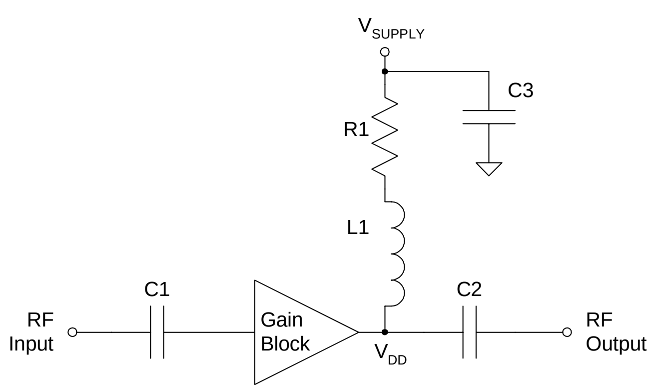


Figure 34: Bias Circuit with Optional Feedback / Voltage Drop Resistor

Evaluation Boards

A versatile evaluation board that enables users to measure actual device performance has been developed for the AGB Series Gain Blocks. The generic layout allows the user to implement a wide variety of matching circuits, in order to assess performance for a particular application.

The evaluation board is 1.0” square, and is fabricated on 0.031” thick FR-4 material. Figures 35 and 36 show the via hole locations and the layout pattern on both sides of the evaluation board. The vias have a 0.010” diameter and are plated through.

To request an evaluation board, please contact an ANADIGICS Sales Reperesentative or Application Engineer.

ESD Sensitivity

Electrostatic discharges can cause permanent damage to this device. Electrostatic discharges accumulate on test equipment and the human body, and can discharge without detection. Although the AGB3301 has some internal ESD protection, proper precautions and handling are strongly recommended. Refer to the ANADIGICS application note on ESD precautions.

S-Parameter Data

Table 11 depicts the raw Magnitude and Angle data for an unmatched AGB3301 over the 50 to 3000 MHz frequency range of operation. Data is shown in 100 MHz steps, with a characteristic impedance of 50 Ohms, V_{DD} =+9V, and at T_A = +25 °C.

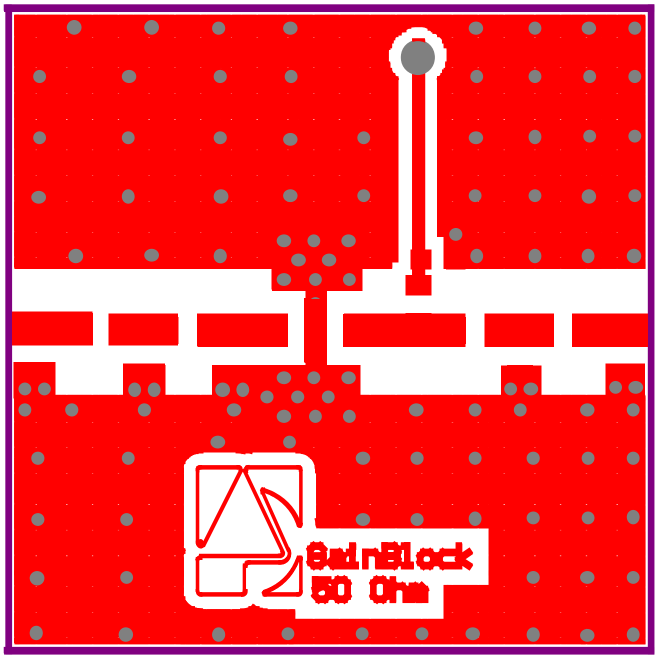


Figure 35: Evaluation Board - Front
(not to scale)

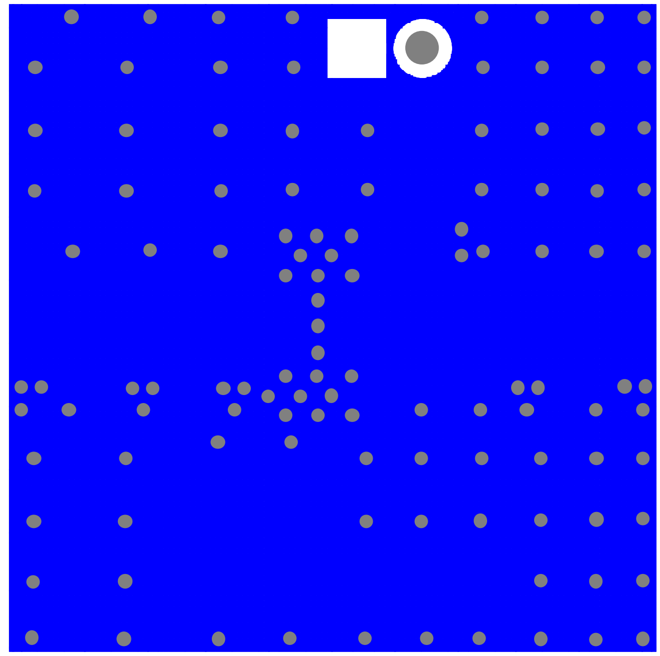
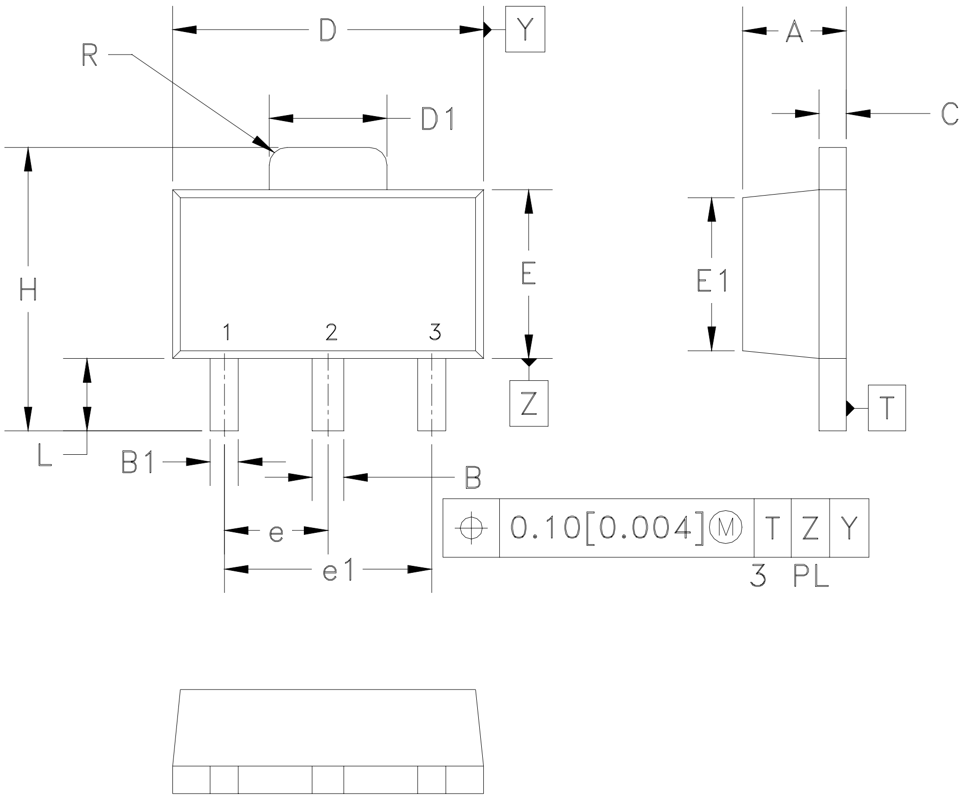


Figure 36: Evaluation Board - Back (X-ray)
(not to scale)

Table 11: AGB3301 S-Parameters in Unmatched 50 Ohm Test Fixture
(T_A = +25 °C, V_{DD} = +9 VDC)

FREQ (MHz)	S11 (dB MAG)	S11 (ANG)	S21 (dB MAG)	S21 (ANG)	S12 (dB MAG)	S12 (ANG)	S22 (dB MAG)	S22 (ANG)	K Factor
50	-17.240	-26.836	13.890	177.501	-17.739	-5.826	-22.828	-12.593	1.071
100	-17.818	-24.935	13.923	166.419	-17.740	-12.179	-22.325	-9.197	1.071
200	-17.974	-34.201	13.867	152.851	-17.761	-22.231	-21.803	-8.616	1.074
300	-17.597	-48.060	13.823	137.564	-17.829	-34.138	-20.469	-13.300	1.075
400	-16.818	-61.919	13.738	122.524	-17.880	-46.032	-19.340	-22.688	1.074
500	-16.203	-72.241	13.689	109.623	-17.981	-56.240	-18.198	-32.842	1.074
600	-15.872	-86.658	13.618	94.800	-18.068	-68.243	-17.305	-42.732	1.075
700	-15.078	-99.811	13.505	80.160	-18.252	-79.835	-15.953	-55.898	1.077
800	-14.502	-111.363	13.431	67.244	-18.380	-90.550	-14.951	-66.502	1.074
900	-13.558	-123.957	13.324	52.393	-18.552	-102.255	-13.797	-79.947	1.067
1000	-12.872	-136.927	13.155	37.799	-18.793	-114.050	-13.045	-94.039	1.073
1100	-12.164	-147.021	13.041	25.076	-18.992	-124.586	-12.202	-106.633	1.067
1200	-11.546	-159.463	12.828	10.497	-19.285	-136.011	-11.418	-120.336	1.074
1300	-10.784	-170.927	12.712	-4.332	-19.621	-148.937	-10.467	-134.472	1.063
1400	-10.459	178.426	12.567	-16.845	-19.828	-158.967	-9.884	-144.828	1.063
1500	-9.687	166.125	12.363	-31.761	-20.305	-171.081	-9.063	-158.869	1.060
1600	-9.113	154.614	12.297	-46.270	-20.620	175.644	-8.547	-172.334	1.045
1700	-8.542	144.746	11.990	-57.669	-20.966	166.403	-7.995	175.205	1.046
1800	-8.130	132.897	11.806	-72.889	-21.605	153.682	-7.426	162.038	1.066
1900	-7.614	121.269	11.563	-86.545	-22.073	141.197	-6.857	148.241	1.061
2000	-7.248	111.723	11.180	-100.060	-22.884	131.005	-6.447	136.894	1.131
2100	-6.829	99.551	11.067	-114.887	-23.345	116.441	-6.000	123.076	1.113
2200	-6.460	88.236	10.692	-128.636	-24.074	105.279	-5.583	110.380	1.164
2300	-6.101	78.176	10.611	-142.376	-24.869	93.413	-5.240	98.427	1.191
2400	-5.808	67.626	10.326	-153.887	-25.528	82.036	-4.884	85.867	1.228
2500	-5.462	56.234	9.626	-167.744	-27.027	68.885	-4.507	72.338	1.463
2600	-5.221	46.556	9.472	179.161	-27.961	56.842	-4.273	61.953	1.564
2700	-5.002	35.297	8.791	166.470	-29.593	45.457	-4.003	49.279	1.949
2800	-4.731	25.044	8.367	151.095	-31.373	26.771	-3.738	36.788	2.365
2900	-4.499	15.361	8.378	140.912	-32.317	14.056	-3.573	25.880	2.484
3000	-4.268	5.171	8.018	126.890	-34.888	-1.921	-3.327	13.676	3.298

PACKAGE OUTLINE



SYMBOL	MILLIMETERS		INCHES		NOTE
	MIN.	MAX.	MIN.	MAX.	
A	1.40	1.60	0.055	0.063	–
B	0.44	0.56	0.017	0.022	–
B_1	0.36	0.48	0.014	0.019	3
C	0.35	0.44	0.014	0.017	–
D	4.40	4.60	0.173	0.181	–
D_1	1.62	1.83	0.064	0.072	–
E	2.29	2.60	0.090	0.102	–
E_1	2.13	2.29	0.084	0.090	4
e	1.50 BSC		0.059 BSC		–
e_1	3.00 BSC		0.118 BSC		–
H	3.94	4.25	0.155	0.167	–
L	0.89	1.20	0.035	0.047	–
R	–	0.25	–	0.010	–

NOTES:

1. CONTROLLING DIMENSIONS: MILLIMETERS.
2. DIMENSIONS DO NOT INCLUDE END FLASH, MOLD FLASH OR MATERIAL PROTRUSIONS.
3. DIMENSION B1, 2 PLACES.
4. DIMENSION E1 – REFERENCE ONLY.
5. REFERENCE JEDEC TO–243 (AA).

Figure 37: S24 Package Outline - SOT-89

ORDERING INFORMATION

PART NUMBER	TEMPERATURE RANGE	PACKAGE DESCRIPTION	COMPONENT PACKAGING
AGB3301S24Q1	-40 to +85°C	SOT-89 Package	1,000 piece Tape and Reel

ANADIGICS, Inc.
141 Mount Bethel Road
Warren, New Jersey 07059, U.S.A.
Tel: +1 (908) 668-5000
Fax: +1 (908) 668-5132

URL: http://www.anadigics.com
E-mail: Mktg@anadigics.com