



AH1

High Dynamic Range Amplifier

The Communications Edge™

Product Features

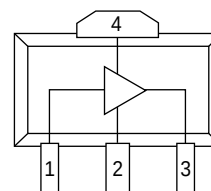
- 250-3000 MHz Bandwidth
- 41 dBm Output IP3
- 2.7 dB Noise Figure
- 13.5 dB Gain
- 21 dBm P1dB
- High Reliability
- SOT-89 Surface Mount Package
- Single +5 V Supply

Product Description

The AH1 is a high dynamic range amplifier packaged in a low cost surface mount package. The combination of low noise figure and high output IP3 at the same bias point makes it ideal for receiver and transmitter applications. The AH1 achieves +41 dBm IP3 at a mounting temperature of 85°C with an associated MTTF of >100 years. The package is a SOT-89. All devices are 100% RF & dc tested.

The product is targeted for applications where high linearity is required.

Functional Diagram



Function	Pin No.
Input	1
Ground	2
Output Bias	3
Ground	4

Specifications

Parameter	Units	Minimum	Typical	Maximum	Condition
Frequency Range	MHz		250-3000		
S21-Gain	dB	12.4	13.5		
S11-Input Return Loss	dB		-8		
S22-Output Return Loss	dB		-15		
Output IP3	dBm	37	41		
Noise Figure	dB		2.7		
Output P1dB	dBm		21		
Operating Current Range	mA	120	150	180	Vdd = 5.0 V
Supply Voltage	V		5		

Test conditions unless otherwise noted.

1. T = 25°C, Vdd = 5.0, Freq = 800 MHz, 50 ohm system.

2. 3OIP Measured with two tones at an output power of 5 dBm/tone separated by 10 MHz. The suppression on the largest IM3 product is used to calculate the 3OIP using a 2:1 slope rule.

3. S21 and S11 can be improved in the band of interest using a single input shunt microstrip to ground.

4. Degradation of 3OIP occurs at low temperatures. Minimum typical 3OIP at -40°C is 35dBm.

5. MTTF calculated with channel temperature at 155°C and ground lead temperature at 85°C.

Absolute Maximum Ratings

Parameter	Rating
Operating Case Temperature	-40 to +85°C
Storage Temperature	-40 to +125 °C
Junction Temperature	+155°C
Thermal Resistance (θ_{JC})	85°C/W
Supply Voltage	+6.0 V
Input RF Power (continuous)	+10 dBm

Operation of this device above any of these parameters may cause permanent damage.

Ordering Information

Part No.	Description
AH1	High Dynamic Range Amplifier (Available in tape and reel)
AH1-PCB	Fully Assembled Application Circuit

AH1

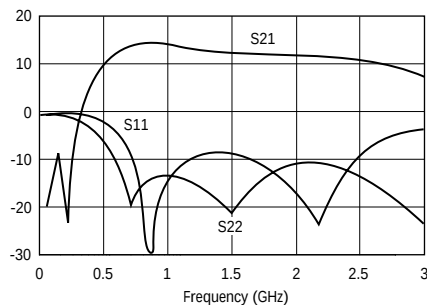
Advanced Product Information

Application Circuit: 0.9-2.5 GHz

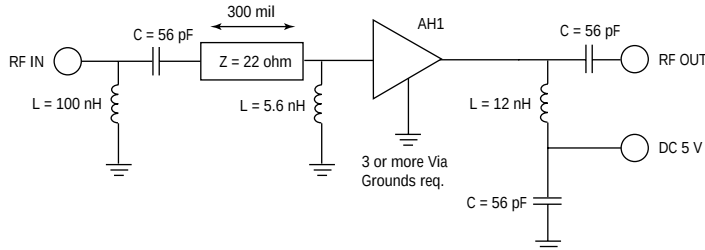
Typical Performance

Frequency	0.9 GHz	1.9 GHz	2.4 GHz
Magnitude S21	14.2 dB	12.4 dB	11.7 dB
Magnitude S11	-18.5 dB	-12.9 dB	-13.6 dB
Magnitude S22	-14.7 dB	-12.6 dB	-11.0 dB
IP3	39.0 dBm	41.0 dBm	40 dBm
Noise Figure	2.7 dB	3.4 dB	3.7 dB
Bias	Vd = 5 V, Id = 170 mA		

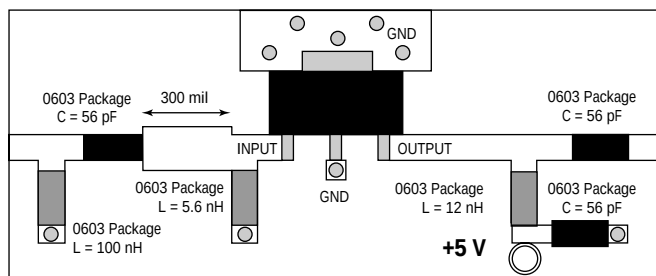
S-Parameters



Schematic



FR4 Board Layout (T = 14 Mil)

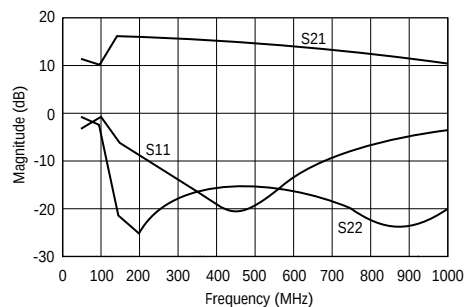


Application Circuit: 250-650 MHz

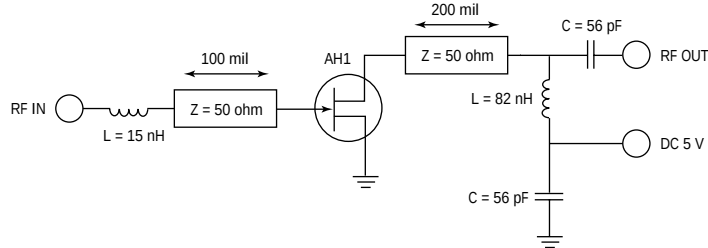
Typical Specifications

Frequency	250 MHz	650 MHz
Magnitude S21	15.4 dB	14.2 dB
Magnitude S11	-11.0 dB	-11.5 dB
Magnitude S22	-19.9 dB	-14.0 dB
IP3	40.0 dBm	40.0 dBm
Noise Figure	2.8 dB	2.8 dB
Bias	Vd = 5 V, Id = 160 mA	

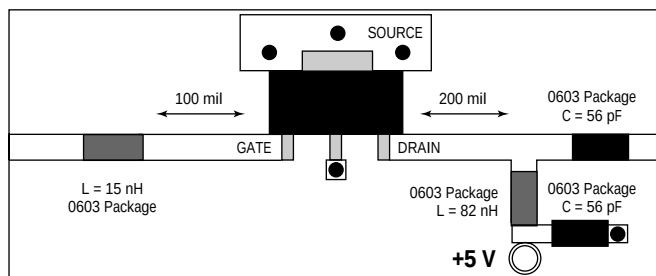
S-Parameters



Schematic



FR4 Board Layout (T = 14 Mil)

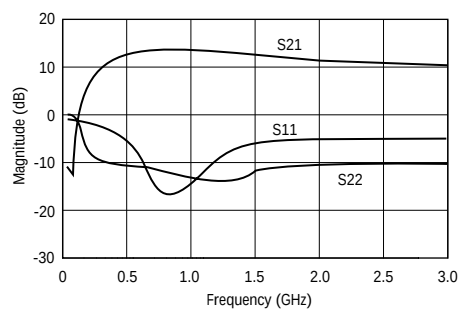


Application Circuit: 900 MHz

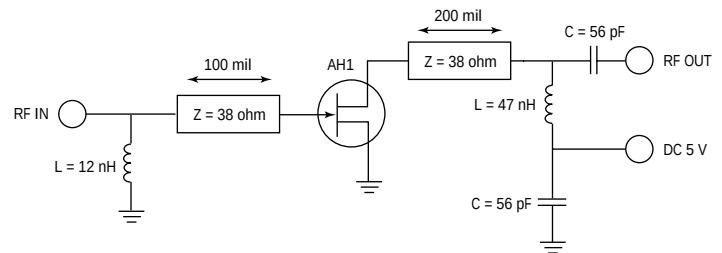
Typical Specifications

Frequency	900 MHz
Magnitude S21	14.3 dB
Magnitude S11	-16.5 dB
Magnitude S22	-13.9 dB
IP3	41.0 dBm
Noise Figure	2.5 dB
Bias	Vd = 5 V, Id = 170 mA

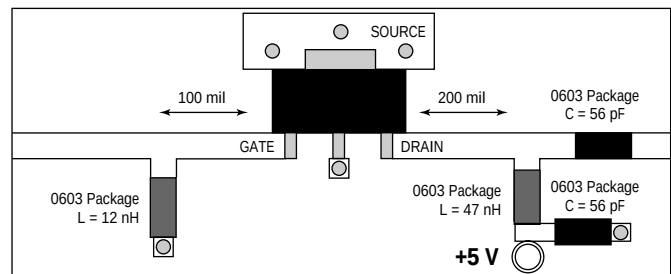
S-Parameters



Schematic



FR4 Board Layout (T = 14 Mil)

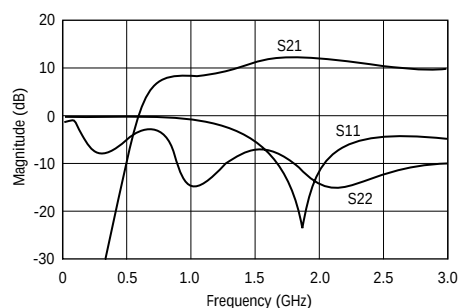


Application Circuit: 1900 MHz

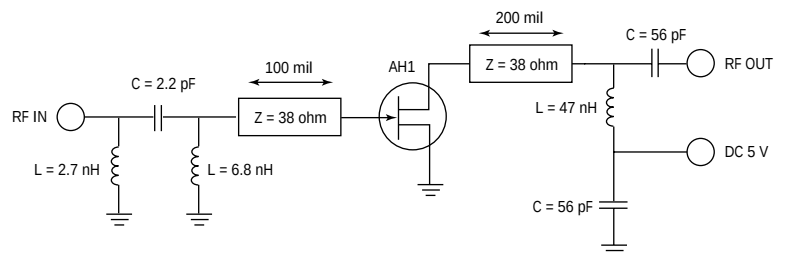
Typical Specifications

Frequency	1900 MHz
Magnitude S21	12.6 dB
Magnitude S11	-14.5 dB
Magnitude S22	-11.7 dB
IP3	41.0 dBm
Noise Figure	2.5 dB
Bias	Vds = 5 V, Id = 170 mA

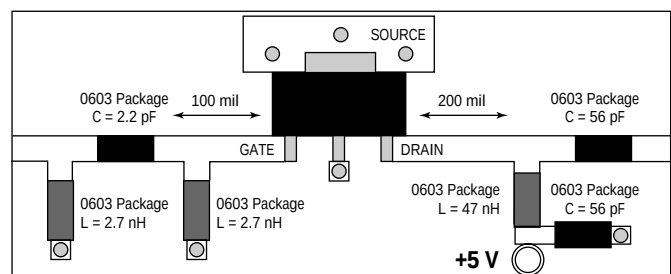
S-Parameters



Schematic

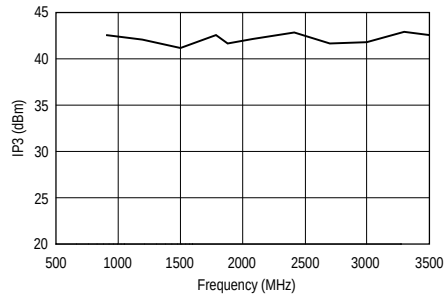


FR4 Board Layout (T = 14 Mil)

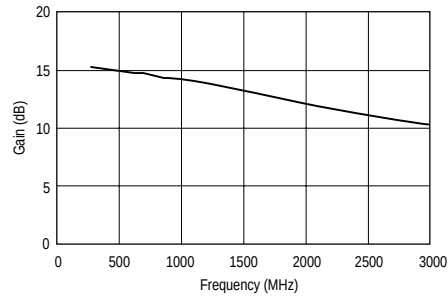


Performance Charts ($V_{DS} = 5.0\text{ V}$, $I_{DS} = 150\text{ mA}$, $T = 22^\circ\text{C}$, unmatched device in a 50 ohm system)

IP3 vs. Frequency

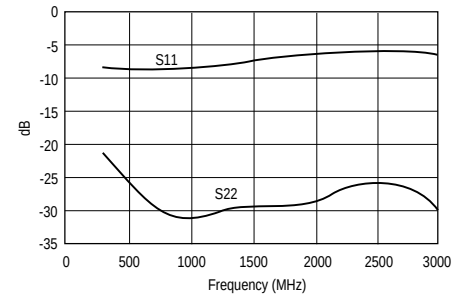


Gain vs. Frequency*



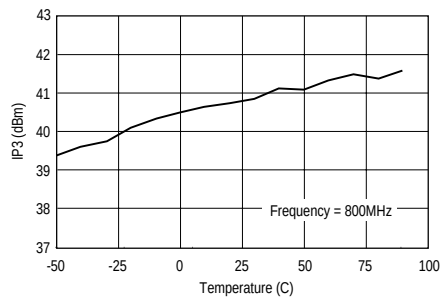
* without matching circuit

Input/Output Return Loss*

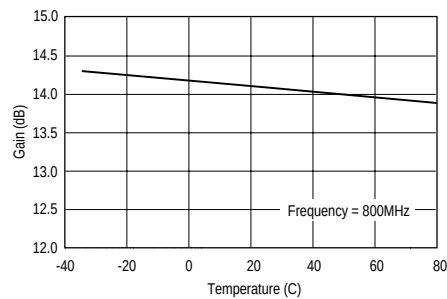


* without matching circuit

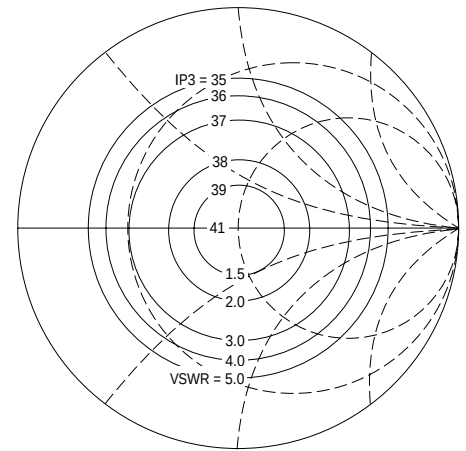
IP3 vs. Temperature



Gain vs. Temperature

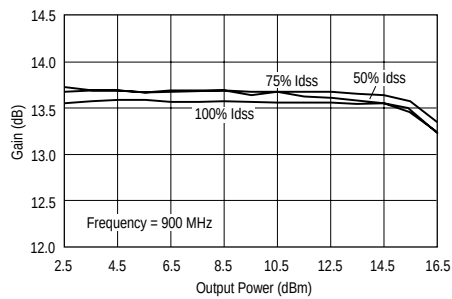


IP3 Pull Circles

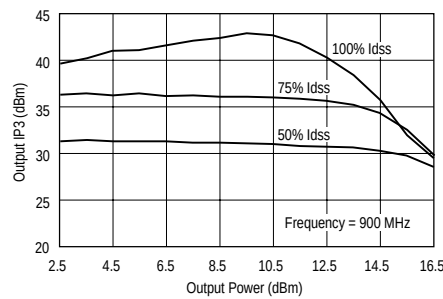


Frequency = 900 MHz
 $V_{ds} = 5.0\text{ V}$, 100% I_{dss} , $T = 22^\circ\text{C}$

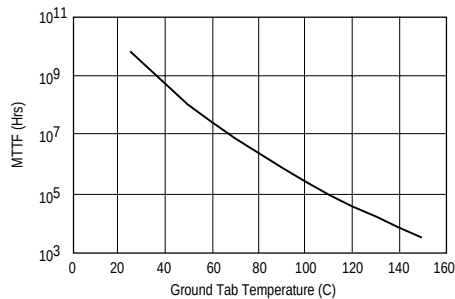
Gain vs. Power Out



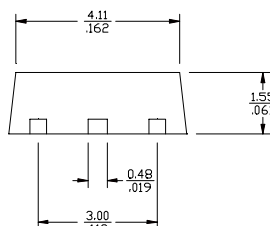
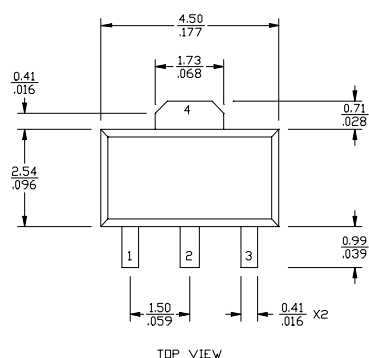
Output IP3 vs. Power Out



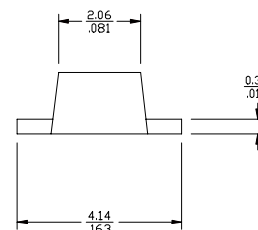
MTTF vs. Temperature



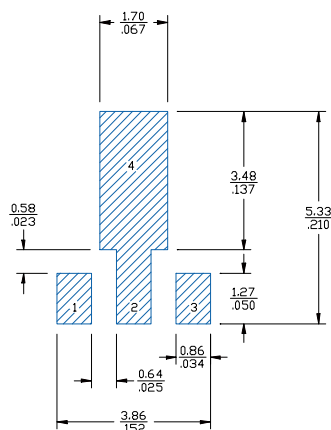
Outline Drawing



mm
inch

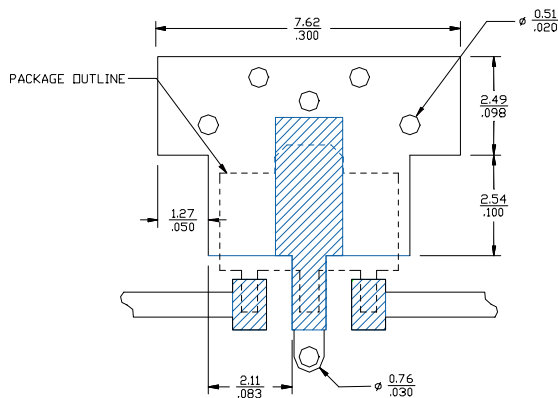


Land Pattern



FUNCTION	PIN NO.
INPUT	1
GROUND	2
OUTPUT (BIAS)	3
GROUND	4

Mounting Configuration



- Notes:
1. Ground vias are critical for thermal and RF grounding considerations.
 2. A minimum of 6 ground vias are required for 14 mil and 28 mil FR4 board.
 3. If your PCB design rules allow, ground vias should be placed under the land pattern for better RF and thermal performance. Otherwise ground vias should be placed as close to land pattern as possible.
 4. Trace width depends on PC board.

Typical Test Data

S-Parameters ($I_{DS} = 150 \text{ mA}$, $V_{DS} = +5 \text{ V}$, $T = 22^\circ\text{C}$, $Z = 50 \text{ ohms}$)

Freq (MHz)	S11 Mag	S11 Ang	S21 (dB)	S21 Mag	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang	K Value
300	0.385	-46.990	15.181	5.742	157.037	0.087	3.964	0.089	-66.530	1.062
400	0.374	-53.376	15.015	5.633	152.400	0.087	-0.428	0.070	-70.095	1.090
500	0.373	-60.650	14.908	5.564	147.518	0.088	-3.847	0.055	-69.277	1.103
600	0.373	-68.718	14.788	5.488	142.410	0.088	-6.806	0.043	-75.238	1.116
700	0.376	-76.746	14.663	5.409	137.282	0.088	-9.585	0.036	-80.347	1.128
800	0.380	-84.449	14.507	5.313	132.011	0.088	-12.184	0.031	-88.416	1.139
900	0.383	-92.673	14.318	5.199	126.442	0.087	-14.643	0.028	-102.961	1.154
1000	0.388	-101.021	14.220	5.141	121.353	0.087	-17.006	0.029	-115.173	1.159
1100	0.394	-109.189	14.069	5.052	116.267	0.087	-19.432	0.029	-127.412	1.168
1200	0.403	-116.975	13.896	4.952	111.154	0.087	-21.689	0.031	-124.686	1.176
1300	0.413	-124.433	13.698	4.841	106.042	0.086	-24.093	0.033	-90.875	1.185
1400	0.425	-131.566	13.487	4.724	101.024	0.086	-26.335	0.035	-93.847	1.198
1500	0.438	-138.169	13.273	4.609	96.109	0.085	-28.545	0.034	-94.192	1.210
1600	0.450	-144.356	13.045	4.490	91.324	0.084	-30.630	0.035	-91.925	1.224
1700	0.463	-149.987	12.811	4.371	86.560	0.084	-32.708	0.035	-138.791	1.241
1800	0.477	-155.154	12.577	4.254	81.996	0.083	-34.679	0.035	-131.588	1.253
1900	0.489	-160.003	12.337	4.139	77.549	0.082	-36.681	0.036	-120.952	1.272
2000	0.500	-164.309	12.106	4.030	73.226	0.081	-38.358	0.039	-112.026	1.289
2100	0.509	-168.120	11.885	3.929	69.032	0.081	-40.127	0.042	-104.837	1.306
2200	0.517	-171.726	11.677	3.836	64.905	0.080	-41.728	0.046	-99.684	1.322
2300	0.523	-175.359	11.478	3.749	60.845	0.079	-43.332	0.049	-94.737	1.344
2400	0.527	-9.058	11.287	3.667	56.754	0.079	-44.949	0.052	-92.048	1.366
2500	0.528	176.218	11.125	3.600	52.689	0.078	-46.419	0.053	-90.189	1.389
2600	0.526	173.376	10.972	3.537	48.710	0.078	-48.000	0.052	-88.680	1.418
2700	0.523	169.003	10.823	3.477	44.647	0.078	-49.738	0.050	-87.931	1.450
2800	0.518	164.088	10.684	3.422	40.452	0.077	-51.479	0.048	-88.079	1.486
2900	0.513	158.780	10.543	3.366	36.157	0.077	-53.246	0.042	-87.362	1.526
3000	0.510	153.067	10.400	3.311	31.816	0.077	-55.207	0.034	-82.552	1.561

Specifications and information are subject to change without notice.



Caution! ESD sensitive device.