AH22

High Dynamic Range CATV Amplifier

The Communications Edge™

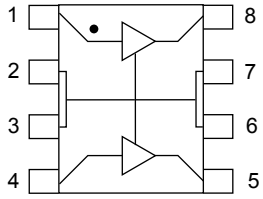
Product Features

- 50-1000 MHz
- Contains 2 matched high-linearity amplifiers in one package
- -69 dBc CTB
- -70 dBc CSO
- +23 dBm P1dB
- +41 dBm Output IP3
- +70 dBm Output IP2
- MTBF >100 Years
- +5 V Single Positive Supply

Product Description

The AH22 is a high dynamic range amplifier targeting cable TV markets. The combination of gain flatness, high linearity and bandwidth makes it ideal for CATV distribution, cable modem and laser diode driver applications. The device uses two matched AH2 devices and is ideal for operation in a push-pull configuration to achieve high second order linearity. A mature and reliable GaAs MESFET technology is employed to maximize linearity at low power dissipation. The package is thermally enhanced in a SOIC-8 and all devices are 100% RF and DC tested.

Functional Diagram



Function	Pin No.
Input 1	1
Ground	2,3,6,7
Input 2	4
Output/Bias2	5
Output/Bias1	8

Specifications

Parameter	Units	Min.	Typ.	Max.	Condition
Frequency Range	MHz		50-1000		
S21	dB	13	14.5		See Note 1
Output IP3	dBm	+37	+40		See Note 2
Output IP2	dBm		+47		See Note 1
P1dB	dBm		+20		See Note 1
Operating Current	mA	240	300	360	
Supply Voltage	V		+5		
Junction Temperature	°C			160	See Note 3
Thermal Resistance	°C/W			28	

Test conditions unless otherwise noted:

1. Parameters reflect single-ended amplifier performance in a packaged device in a 75 Ω system at 25°C, Vdd = 5.0 V, and 800 MHz (there are 2 matched amplifiers in the AH22 package).
2. OIP3 measured with 2 tones at an output power of +8 dBm/tone separated by 10 MHz. The suppression on the largest IM3 product is used to calculate the OIP3 using a 2:1 slope rule.
3. The maximum junction temperature ensures a minimum MTBF rating of 1 million hours of usage. Refer to WJ Application Note "AH22 Temperature Effects on Reliability" for more information.

Typical Specifications

Parameter	Units	Typical	Condition
Frequency	MHz	50-1000	
S21	dB	11.2	50 MHz
S21	dB	10.6	860 MHz
S11	dB	-14.5	
S22	dB	-15.1	
Output IP3	dBm	+41	See Note 2
Output IP2	dBm	+70	
P1dB	dBm	+23	
Noise Figure	dB	4.5	
CTB	dBc	-69	See Note 5
CSO	dBc	-70	See Note 5
Xmod	dBc	-66	See Note 5

Test conditions unless otherwise noted:

4. T=25°C, Vdd = 5.0V, and in a 75 Ω application circuit.
5. 77 Channels, 50 - 550 MHz output power = +39 dBmV/channel, flat loaded.

Absolute Maximum Ratings

Parameter	Rating
Operating Temperture	-40 to +85°C
Storage Temperature	-40 to +125°C
DC Voltage	+6.0 V
Input RF Power (continuous)	+13 dBm

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

Ordering Information

Part No.	Description
AH22	High Dynamic Range CATV Amplifier (Available in tape and reel)
AH22-PCB	Fully Assembled Application Circuit 50-860 MHz
AH22DUAL-PCB	Fully Assembled Application Circuit, Dual AH22

AH22

75 Ω Push-Pull Circuit 50-860 MHz

Typical Performance (75 Ohm System)

Frequency	MHz	50	450	750	860
Magnitude S21	dB	11.2	10.9	10.9	10.6
Magnitude S11	dB	-12.4	-12.2	-29.8	-14.6
Magnitude S22	dB	-17.4	-12.9	-18.1	-12.4
OIP2	dBm	+72	+70	+72	+70
OIP3	dBm	+42	+43	+41	+40
Noise Figure	dB	5.5	4.3	4.2	4.3
Bias	Vdd = 5 V, Id = 300 mA				

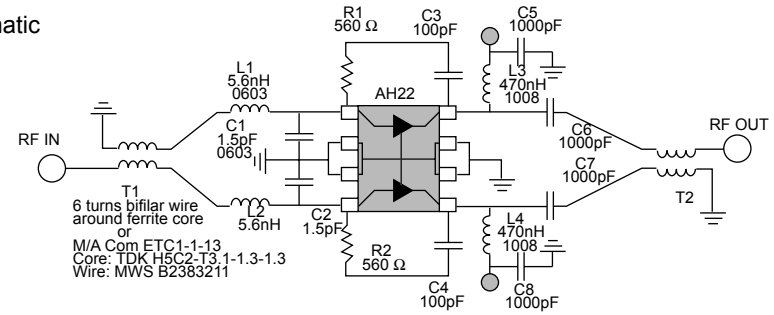
Note: Balun and board losses have not been extraced but typically account for 0.4 dB loss midband and 1.1 dB loss at 860 MHz.

Multi-channel Measurements

Frequency	50-550 MHz
CTB	-69 dBc
CSO	-70 dBc
XMOD	-66 dBc

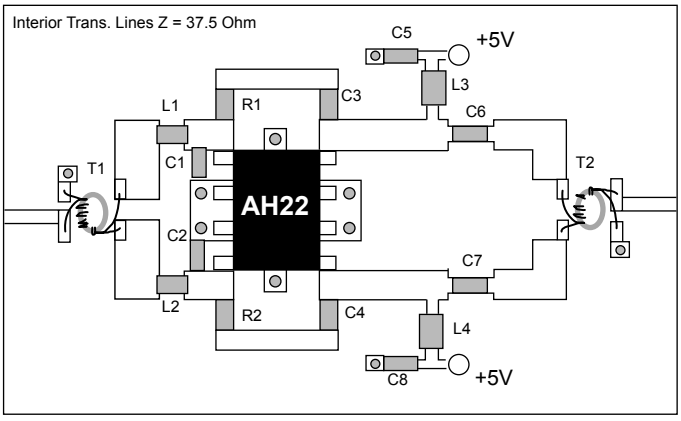
Note: 77 Channels, +39 dBmV/Ch. output power, flat-loaded.

Schematic



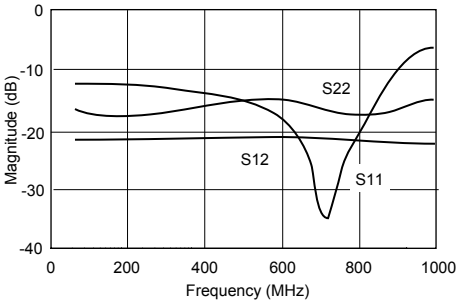
All components are of size 0603 unless otherwise noted.

FR4 Board Layout (T = 28 Mils to ground plane)

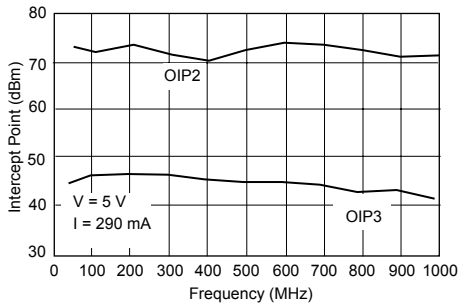


Performance Charts

Input / Output Retrun Loss and Isolation

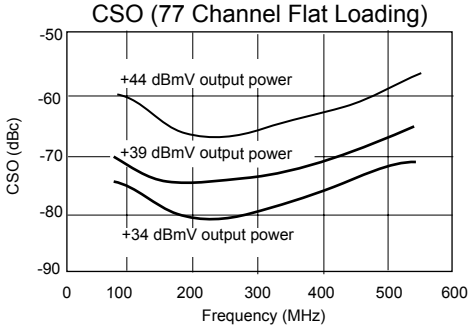


Linearity vs. Frequency

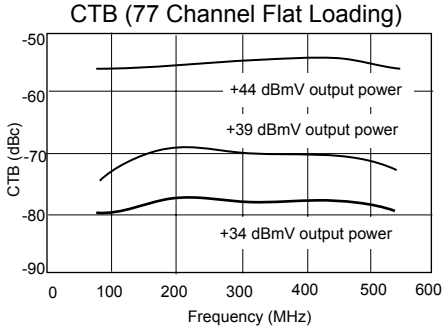


75 Ω Push-Pull Circuit: 50-860 MHz

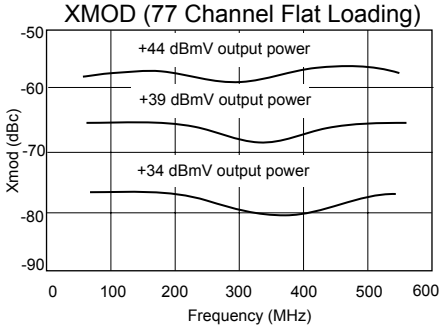
CSO (77 Channel Flat Loading)



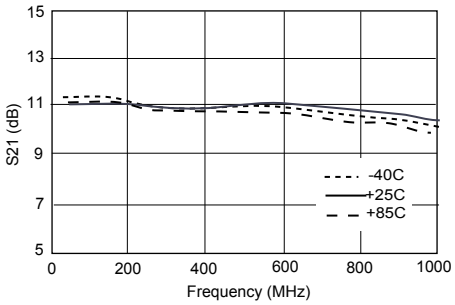
CTB (77 Channel Flat Loading)



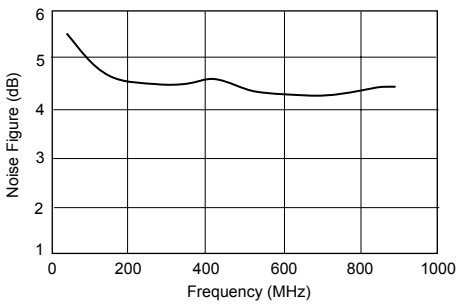
XMOD (77 Channel Flat Loading)



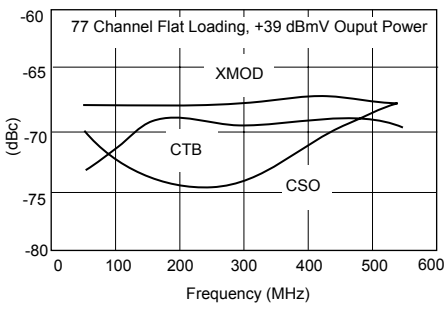
Gain



Noise Figure



CTB, CSO, and, XMOD



75 Ω Dual Push-Pull Circuit: 50-860 MHz

Typical Performance (75 Ohm System)

Frequency	MHz	50	450	750	860
Magnitude S21	dB	12.9	12.3	11.3	10.5
Magnitude S11	dB	-13.3	-15.6	-13.1	-10.2
Magnitude S22	dB	-12.5	-16.6	-17.2	-14.8
OIP2	dBm	+73	+72	+75	+76
OIP3	dBm	+45	+49	+46	+47
Noise Figure	dB	4.7	4.2	4.8	5.1
Bias	Vdd = 5 V, Id = 600 mA				

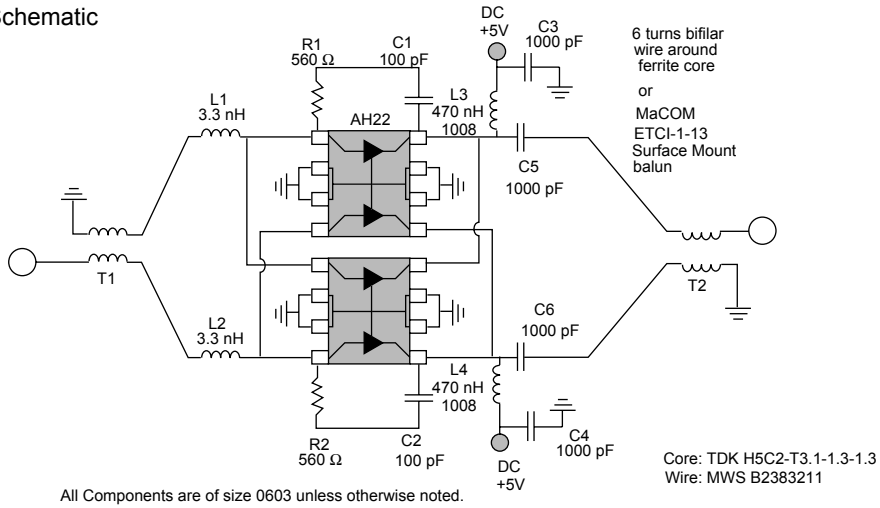
Note: Balun and board losses have not been extracted but typically account for 0.4 dB loss midband and 1.1 dB loss at 860 MHz.

Multi-channel Measurements

Frequency	50-550 MHz
CTB	-73 dBc
CSO	-74 dBc
XMOD	-68 dBc

Note: 77 Channels, +39 dBmV/Ch. Output power, flat-loaded

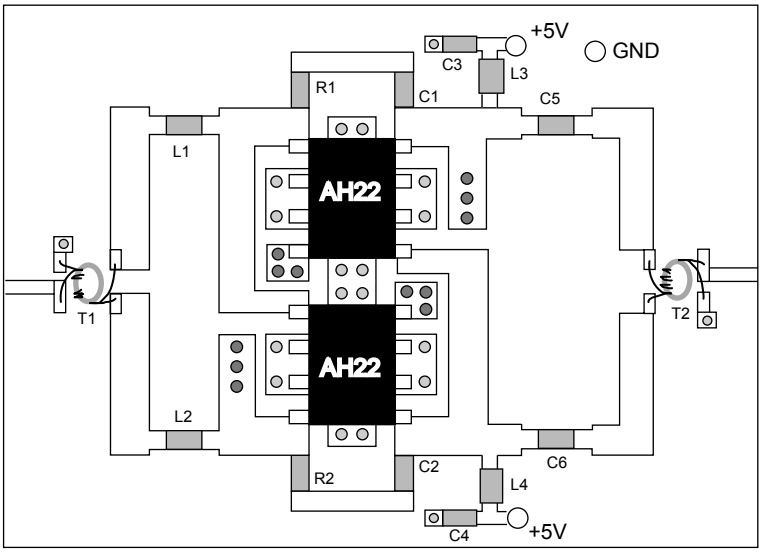
Schematic



Core: TDK H5C2-T3.1-1.3-1.3
Wire: MWS B2383211

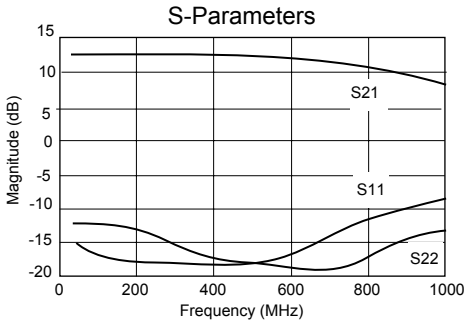
All Components are of size 0603 unless otherwise noted.

FR4 Board Layout (T = 28 Mils to ground plane)

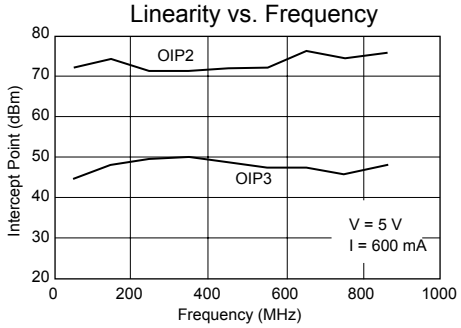


Performance

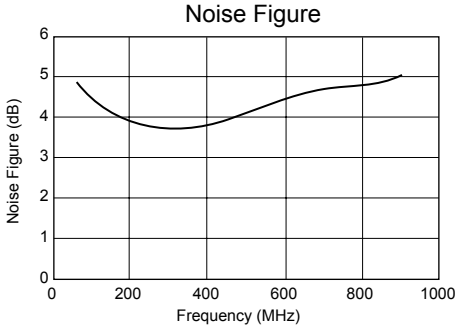
S-Parameters



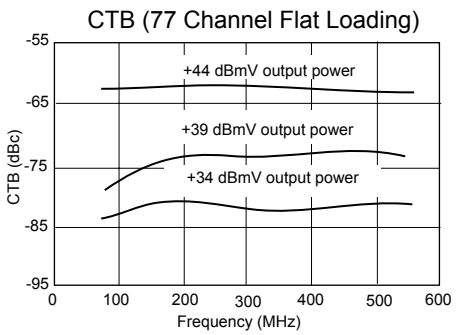
Linearity vs. Frequency

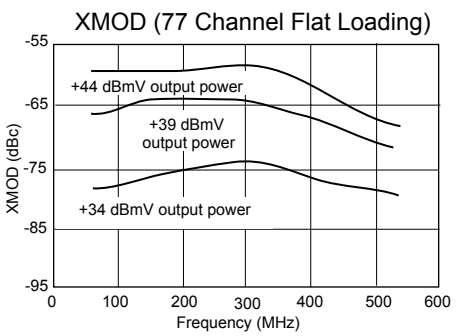


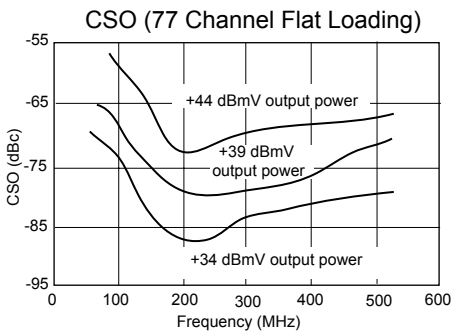
Noise Figure



75 Ω Dual Push-Pull Circuit: 50-860 MHz





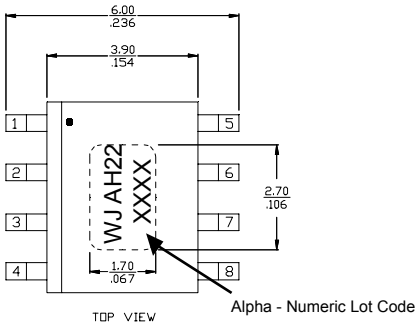


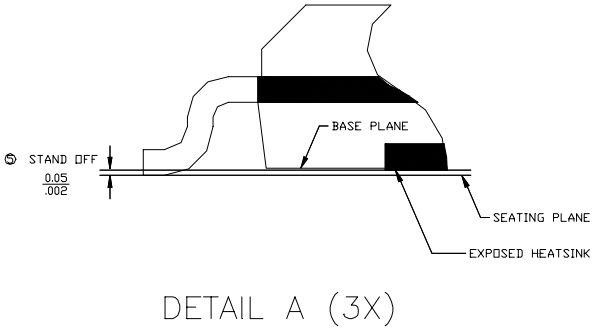
Typical Device Data

S-Parameters of a single-ended unmatched amplifier de-embedded to device leads. (Vdd = +5 V, Ids = 150 mA, T = 22°C, Z = 75 Ω) There are two matched amplifiers in an AH22 package.

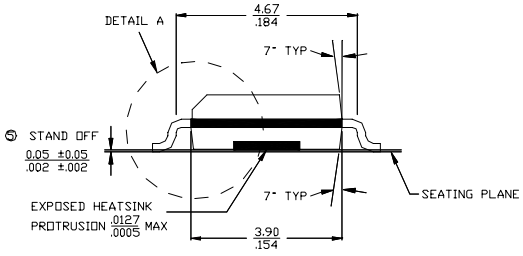
Freq. (MHz)	S11 (dB)	S11 (Ang)	S21 (dB)	S21 (Ang)	S12 (dB)	S12 (Ang)	S22 (dB)	S22 (Ang)
10	-6.56	-1.06	16.19	179.34	-26.86	-0.24	-11.34	-2.97
50	-6.57	-5.11	16.21	176.71	-26.79	0.98	-11.38	-3.37
100	-6.58	-10.53	16.20	173.44	-26.75	2.07	-11.37	-6.44
150	-6.59	-15.58	16.15	170.06	-26.68	2.99	-11.42	-9.98
200	-6.56	-20.57	16.11	166.96	-26.64	3.89	-11.47	-12.90
250	-6.60	-25.69	16.06	164.01	-26.51	5.01	-11.59	-15.76
300	-6.62	-30.46	16.03	160.82	-26.35	5.50	-11.61	-18.81
350	-6.56	-35.67	15.98	157.75	-26.17	6.15	-11.65	-21.96
400	-6.55	-40.48	15.94	154.71	-26.01	7.06	-11.70	-24.72
450	-6.53	-45.36	15.86	151.43	-25.87	6.72	-11.77	-27.85
500	-6.51	-50.19	15.78	148.50	-25.68	6.94	-11.89	-31.18
550	-6.46	-54.97	15.70	145.54	-25.45	7.07	-11.92	-34.36
600	-6.42	-59.85	15.63	142.41	-25.25	7.15	-12.08	-37.39
650	-6.39	-64.24	15.51	139.38	-25.09	6.43	-12.13	-40.47
700	-6.36	-69.05	15.39	136.57	-24.93	6.19	-12.26	-43.92
750	-6.29	-73.42	15.32	133.72	-24.76	6.22	-12.41	-47.02
800	-6.27	-77.91	15.20	130.69	-24.53	5.32	-12.51	-50.28
850	-6.16	-82.11	15.07	128.05	-24.47	4.72	-12.64	-53.77
900	-6.10	-86.56	14.98	125.45	-24.45	4.23	-12.78	-56.88
950	-6.07	-90.56	14.86	122.44	-24.10	3.18	-12.91	-60.02
1000	-5.98	-94.80	14.73	120.01	-23.97	2.44	-13.06	-63.45

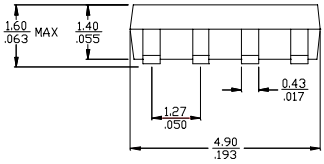
Outline Drawing



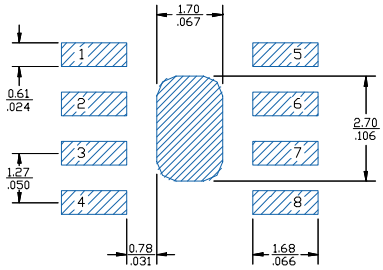


DETAIL A (3X)



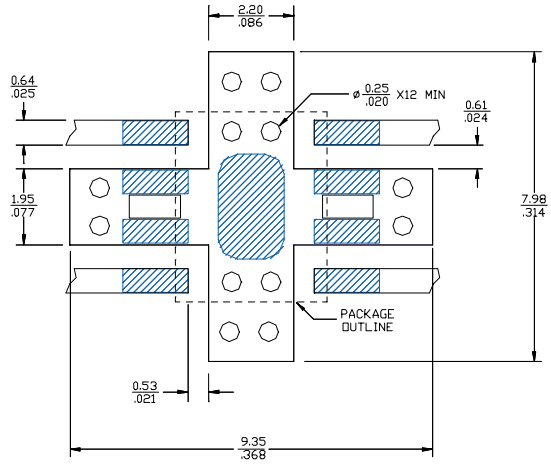


Land Pattern



FUNCTION	PIN NO.
RF INPUT 1	1
GROUND	2-3
RF INPUT 2	4
RF OUTPUT 2/ BIAS 2	5
GROUND	6-7
RF OUTPUT 1/ BIAS 1	8

Mounting Configuration



Notes:
1. Ground vias are critical for thermal and RF grounding considerations.
2. A minimum of 12 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.
5. 'Stand-off' is the distance between 'seating plane' and the 'exposed heatsink', or base plane of the package, which ever is lower.

DIMENSIONS IN $\frac{\text{mm}}{\text{inch}}$