



# AH116

1/2 Watt, High Linearity InGaP HBT Amplifier

The Communications Edge™

Product Information

## Product Features

- 800 – 1000 MHz
- +28 dBm P1dB
- +43 dBm Output IP3
- 17.5 dB Gain @ 900 MHz
- +5V Single Positive Supply
- MTTF > 100 Years
- Lead-free/green/RoHS-compliant SOIC-8 SMT Pkg.

## Applications

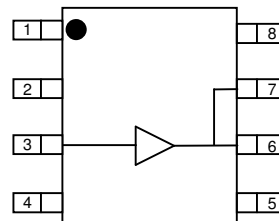
- Final stage amplifiers for Repeaters
- Mobile Infrastructure

## Product Description

The AH116 is a high dynamic range driver amplifier in a low-cost surface mount package. The InGaP/GaAs HBT is able to achieve high performance for various narrow-band tuned application circuits with up to +43 dBm OIP3 and +28 dBm of compressed 1-dB power and is housed in a lead-free/green/RoHS-compliant SOIC-8 package. All devices are 100% RF and DC tested.

The product is targeted for use as driver amplifiers for wireless infrastructure where high linearity and medium power is required. The internal active bias allows the AH116 to maintain high linearity over temperature and operate directly off a +5 V supply. This combination makes the device an excellent fit for transceiver line cards and power amplifiers in current and next generation multi-carrier 3G base stations.

## Functional Diagram



Function	Pin No.
Vref	1
Input	3
Output	6, 7
Vbias	8
GND	Backside Paddle
N/C or GND	2, 4, 5

## Specifications <sup>(1)</sup>

Parameters	Units	Min	Typ	Max
Frequency Range	MHz		900	
Gain	dB	15	17.5	
Input R.L.	dB		18	
Output R.L.	dB		7	
Output P1dB	dBm	+27	+28.7	
Output IP3 <sup>(2)</sup>	dBm	+42	+43	
IS-95A Channel Power @ -45 dBc ACPR	dBm		+23	
Noise Figure	dB		7	
Operating Current Range <sup>(3)</sup>	mA	200	250	300
Device Voltage	V		+5	

1. Test conditions unless otherwise noted: 25 °C, +5V Vsupply, 900 MHz, in tuned application circuit.
2. 3OIP measured with two tones at an output power of +13 dBm/tones separated by 1 MHz. The suppression on the largest IM3 product is used to calculate the 3OIP using a 2:1 rule.
3. This corresponds to the quiescent current or operating current under small-signal conditions. It is expected that the current can increase up to 300mA at P1dB.

## Typical Performance <sup>(1)</sup>

Parameters	Units	Typical
Frequency	MHz	900
Gain	dB	17.5
S11	dB	-18
S22	dB	-7
Output P1dB	dBm	+28.7
Output IP3 <sup>(2)</sup>	dBm	+43
IS-95A Channel Power @ -45 dBc ACPR	dBm	+23
Noise Figure	dB	7
Supply Bias		+5 V @ 250 mA

## Absolute Maximum Rating

Parameter	Rating
Operating Case Temperature	-40 to +85 °C
Storage Temperature	-65 to +150 °C
RF Input Power (continuous)	+22 dBm
Device Voltage	+8 V
Device Current	400 mA
Device Power	2 W
Junction Temperature	+250 °C

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

## Ordering Information

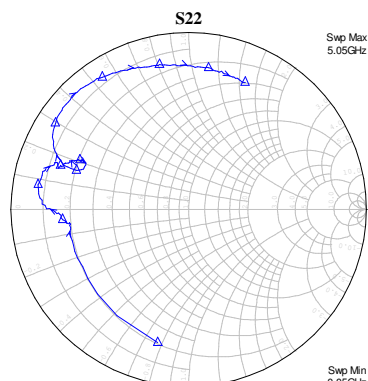
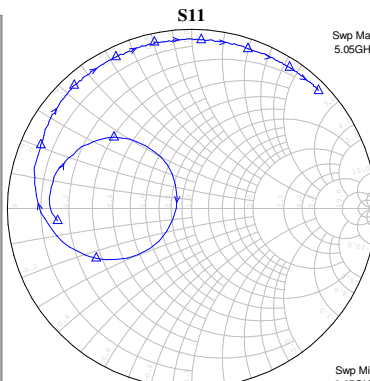
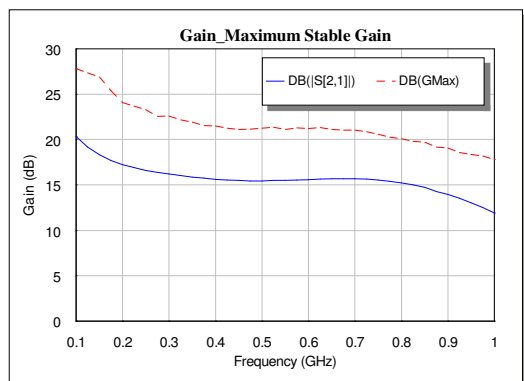
Part No.	Description
AH116-S8G	1/2 Watt, High Linearity InGaP HBT Amplifier (lead-free/green/RoHS-compliant SOIC-8 Pkg)
AH116-S8PCB900	900 MHz Evaluation Board

Specifications and information are subject to change without notice



## Typical Device Data

S-Parameters ( $V_{cc} = +5\text{ V}$ ,  $I_{cc} = 250\text{ mA}$ ,  $T = 25^\circ\text{C}$ , calibrated to device leads)



### Notes:

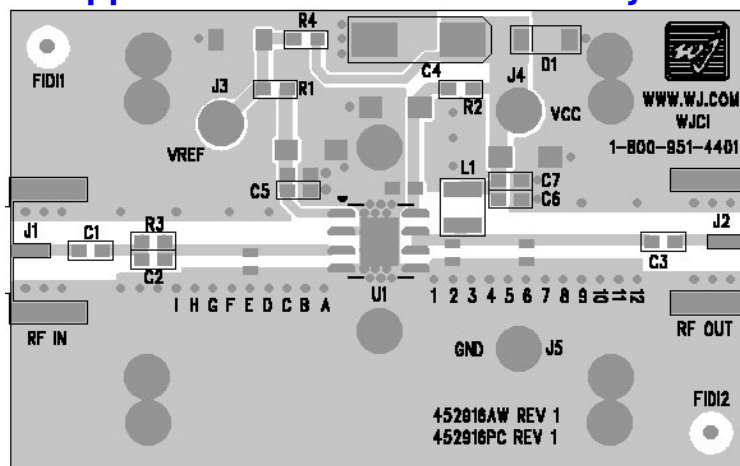
The gain for the unmatched device in 50 ohm system is shown as the trace in black color. For a tuned circuit for a particular frequency, it is expected that actual gain will be higher, up to the maximum stable gain. The maximum stable gain is shown in the dashed red line. The return loss plots are shown from 50 – 5050 MHz, with markers placed at 0.5 – 5.05 GHz in 0.5 GHz increments.

S-Parameters ( $V_{cc} = +5\text{ V}$ ,  $I_{cc} = 250\text{ mA}$ ,  $T = 25^\circ\text{C}$ , unmatched 50 ohm system, calibrated to device leads)

Freq (MHz)	S11 (dB)	S21 (dB)	S21 (ang)	S12 (dB)	S12 (ang)	S22 (dB)	S22 (ang)
50	-2.72	24.16	133.35	-36.72	29.75	-2.23	-102.97
100	-2.25	20.33	124.95	-35.31	13.96	-3.08	-137.03
200	-2.31	17.23	119.37	-34.90	2.32	-3.32	-159.63
400	-3.08	15.63	98.28	-33.62	-16.36	-3.48	-172.70
600	-5.79	15.58	69.70	-32.10	-37.73	-2.87	-176.25
800	-19.72	15.22	25.60	-31.19	-78.95	-2.27	-179.74
1000	-6.06	11.91	-22.67	-33.26	-129.67	-1.40	173.15

Device S-parameters are available for download off of the website at: <http://www.wj.com>

## Application Circuit PC Board Layout



Circuit Board Material: .014" Getek, 4 - layer, 1 oz copper, Microstrip line details: width = .026", spacing = .026"

The silk screen markers 'A', 'B', 'C', etc. and '1', '2', '3', etc. are used as placemarkers for the input and output tuning Shunt capacitors – C8 and C9. The markers and vias are spaced in .050" increments.



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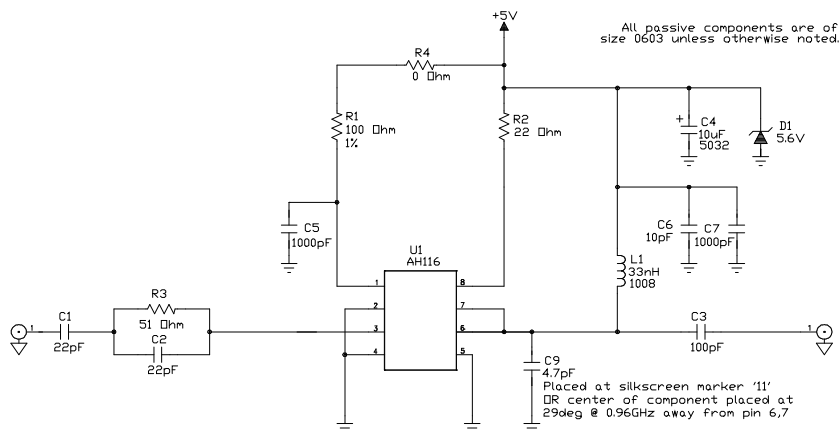
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Product Information

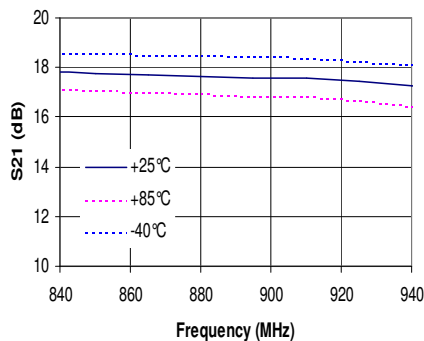
## 900 MHz Application Circuit (AH116-S8PCB900)

### Typical RF Performance at 25 °C

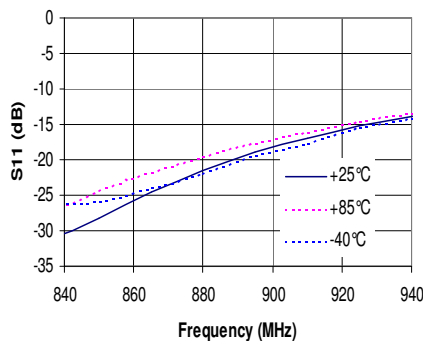
Frequency	900 MHz
S21 – Gain	17.5 dB
S11 – Input Return Loss	-18 dB
S22 – Output Return Loss	-7 dB
Output P1dB	+28.7 dBm
Output IP3 (+17 dBm / tone, 1 MHz spacing)	+43 dBm
Channel Power (@-45 dBc ACPR, IS-95 9 channels fwd)	+23 dBm
Noise Figure	7 dB
Device / Supply Voltage	+5 V
Quiescent Current	250 mA



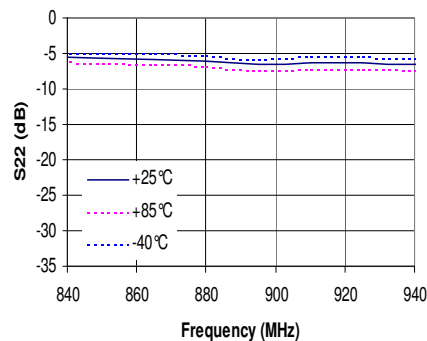
S21 vs Frequency



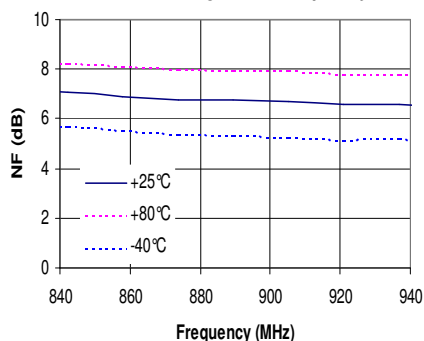
S11 vs. Frequency



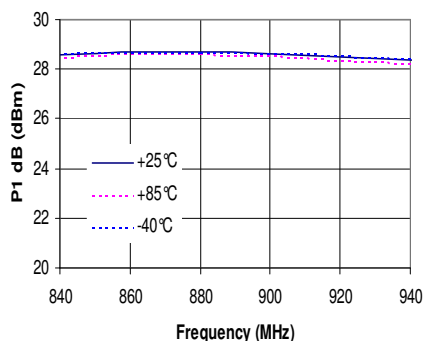
S22 vs. Frequency



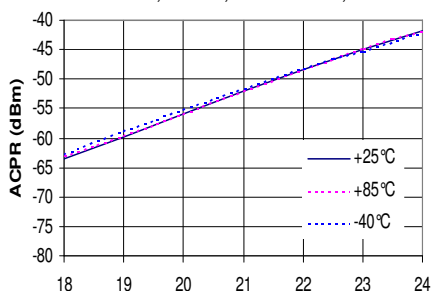
Noise Figure vs. Frequency



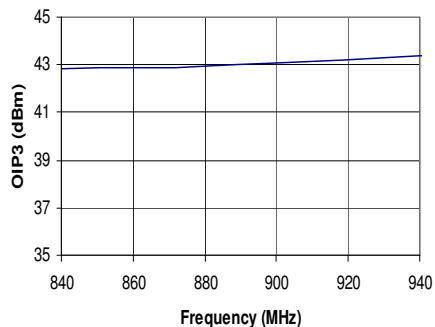
P1 dB vs. Frequency



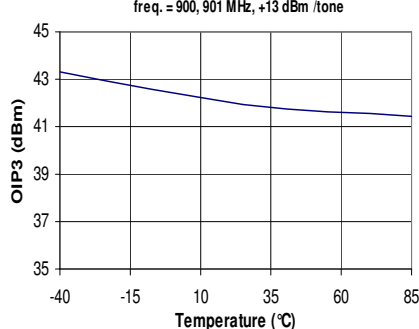
ACPR vs. Channel Power  
IS-95, 9 Ch. Fwd, ±885KHz Meas BW, 900 MHz



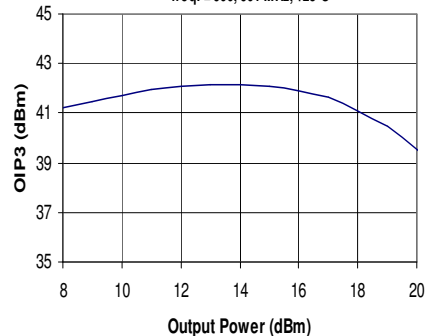
OIP3 vs. Frequency  
+25°, +13 dBm / tone



OIP3 vs. Temperature  
freq. = 900, 901 MHz, +13 dBm / tone



Output Channel Power  
OIP3 vs. Output Power  
freq. = 900, 901 MHz, +25 °C



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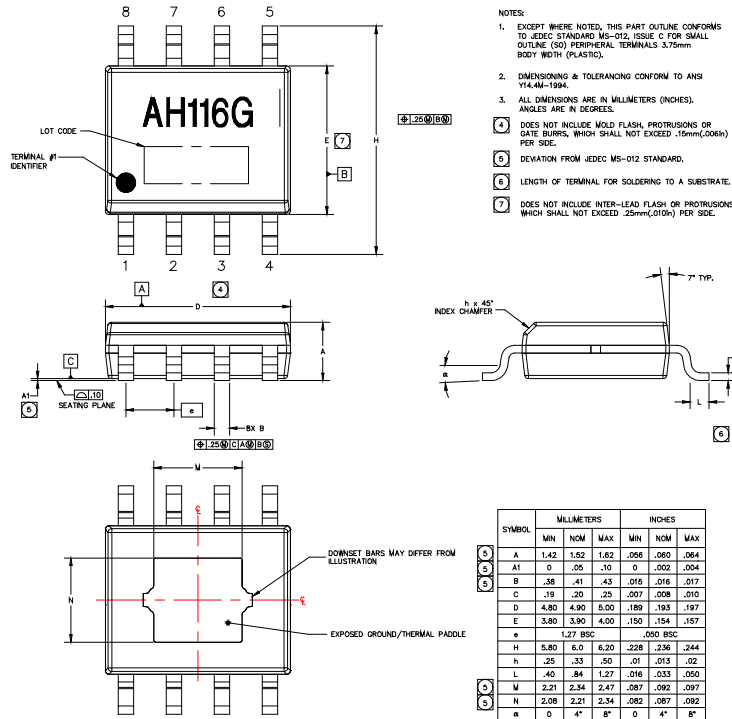
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Product Information

## AH116-S8G (Lead-Free Package) Mechanical Information

This package is lead-free/green/RoHS-compliant. The plating material on the leads is NiPdAu. It is compatible with both lead-free (maximum 260 °C reflow temperature) and lead (maximum 245 °C reflow temperature) soldering processes.

### Outline Drawing



### Product Marking

The component will be marked with an "AH116G" designator with an alphanumeric lot code on the top surface of the package. The obsolete tin-lead package is marked with an "AH116-S8" or "ECP052G" designator followed by an alphanumeric lot code.

Tape and reel specifications for this part are located on the website in the "Application Notes" section.

### ESD / MSL Information



Caution! ESD sensitive device.

ESD Rating: Class 1B

Value: Passes  $\geq 500V$  to  $<1000V$

Test: Human Body Model (HBM)

Standard: JEDEC Standard JESD22-A114

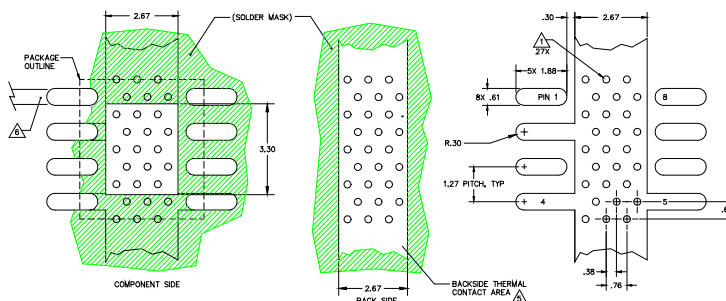
MSL Rating: Level 2 at +260 °C convection reflow

Standard: JEDEC Standard J-STD-020

### Mounting Config. Notes

- Ground / thermal vias are critical for the proper performance of this device. Vias should use a .35mm (#80 / .0135") diameter drill and have a final plated thru diameter of .25 mm (.010").
- Add as much copper as possible to inner and outer layers near the part to ensure optimal thermal performance.
- Mounting screws can be added near the part to fasten the board to a heatsink. Ensure that the ground / thermal via region contacts the heatsink.
- Do not put solder mask on the backside of the PC board in the region where the board contacts the heatsink.
- RF trace width depends upon the PC board material and construction.
- Use 1 oz. Copper minimum.
- All dimensions are in millimeters (inches). Angles are in degrees.

### Mounting Configuration / Land Pattern



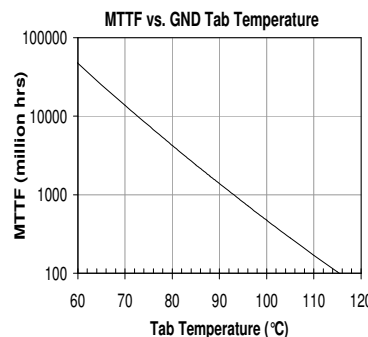
### Thermal Specifications

Parameter	Rating
Operating Case Temperature <sup>(1)</sup>	-40 to +85 °C
Thermal Resistance <sup>(2)</sup> , R <sub>th</sub>	62 °C / W
Junction Temperature <sup>(3)</sup> , T <sub>j</sub>	162 °C

Notes:

- The amplifier can be operated at 105 °C case temperature for up to 1000 hours over its lifetime without degradation in performance and will not degrade device operation at the recommended maximum 85 °C case temperature for the rest of its lifetime.
- The thermal resistance is referenced from the junction-to-case at a case temperature of 85 °C. T<sub>jc</sub> is a function of the voltage at pins 6 and 7 and the current applied to pins 6, 7, and 8 and can be calculated by:  

$$T_{jc} = T_{case} + R_{th} * V_{cc} * I_{cc}$$
- This corresponds to the typical condition of +5V, 250 mA at an 85 °C case temperature. A minimum MTTF of 1 million hours is achieved for junction temperatures below 247 °C.



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