

Ultra High Dynamic Range

# Monolithic Amplifier

PHA-101+

50Ω 0.05 to 1.5 GHz

## The Big Deal

- Ultra High IP3
- Broadband High Dynamic Range without external Matching Components
- May be used as a replacement to WJ AH101<sup>a,b</sup>



SOT-89 PACKAGE

## Product Overview

PHA-101+ (RoHS compliant) is an advanced wideband amplifier fabricated using E-PHEMT technology and offers extremely high dynamic range over a broad frequency range and with low noise figure. In addition, the PHA-101+ has good input and output return loss over a broad frequency range without the need for external matching components and has demonstrated excellent reliability. It has repeatable performance from lot to lot and is enclosed in a SOT-89 package for very good thermal performance.

## Key Features

Feature	Advantages
Broad Band: 0.05 to 1.5 GHz	Broadband covering primary wireless communications bands: Cellular, PCS, LTE
Extremely High IP3 Versus DC power Consumption 45 dBm typical at 0.9 GHz	The PHA-101+ matches industry leading IP3 performance relative to device size and power consumption. The combination of the design and E-PHEMT Structure provides enhanced linearity over a broad frequency range as evidence in the IP3 being typically 20 dB above the P 1dB point. This feature makes this amplifier ideal for use in: <ul style="list-style-type: none"><li>• Driver amplifiers for complex waveform up converter paths</li><li>• Drivers in linearized transmit systems</li><li>• Secondary amplifiers in ultra High Dynamic range receivers</li></ul>
No External Matching Components Required	Unlike competing products, Mini-Circuits PHA-101+ provides Input and Output Return Loss of 9.9-12.5 dB up to 1.5 GHz without the need for any external matching components

Notes:

a. Suitability for model replacement within a particular system must be determined by and is solely the responsibility of the customer based on, among other things, electrical performance criteria, stimulus conditions, application, compatibility with other components and environmental conditions and stresses.

b. The WJ AH101 part number is used for identification and comparison purposes only.



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0.05-1.5 GHz

## Product Features

- High IP3, 45 dBm typ. at 0.9 GHz
- Gain, 15.2 dB typ. at 0.9 GHz
- High Pout, P1dB 26 dBm typ. at 0.9 GHz
- Low noise figure, 4.0 dB at 0.9 GHz
- No external matching components required
- May be used as replacement for WJ AH101<sup>a,b</sup>



Generic photo used for illustration purposes only

CASE STYLE: DF782

## Typical Applications

- Base station infrastructure
- CATV
- LTE

## PHA-101+

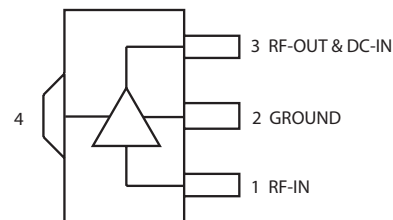
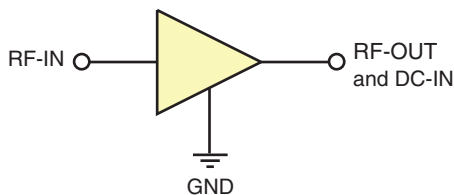
**+RoHS Compliant**

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

## General Description

PHA-101+ (RoHS compliant) is an advanced wideband amplifier fabricated using E-PHEMT technology and offers extremely high dynamic range over a broad frequency range and with low noise figure. In addition, the PHA-101+ has good input and output return loss over a broad frequency range without the need for external matching components. It has repeatable performance from lot to lot and is enclosed in a SOT-89 package for very good thermal performance.

## simplified schematic and pin description



Function	Pin Number	Description
RF IN	1	RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation.
RF-OUT and DC-IN	3	RF output and bias pin. DC voltage is present on this pin; therefore a DC blocking capacitor is necessary for proper operation. An RF choke is needed to feed DC bias without loss of RF signal due to the bias connection, as shown in "Recommended Application Circuit", Fig. 2
GND	2,4	Connections to ground. Use via holes as shown in "Suggested Layout for PCB Design" to reduce ground path inductance for best performance.

### Notes:

- a. Suitability for model replacement within a particular system must be determined by and is solely the responsibility of the customer based on, among other things, electrical performance criteria, stimulus conditions, application, compatibility with other components and environmental conditions and stresses.
- b. The WJ AH101 part number is used for identification and comparison purposes only.



Electrical Specifications at 25°C, 50 ohms, unless noted

Parameter	Condition (MHz)	Vd=9V <sup>1</sup>			Units
		Min.	Typ.	Max.	
Frequency range		0.05		1.5	GHz
Gain	50	—	15.3	—	dB
	450	—	15.5	—	
	900	13.8	15.2	16.9	
	1500	—	15.0	—	
Input return loss	50		10.7		dB
	450		11.4		
	900		10.7		
	1500		9.5		
Output return loss	50		13.2		dB
	450		10.7		
	900		10.2		
	1500		8.9		
Reverse isolation			20.5		dB
Output power @ 1dB compression	50		25.3		dBm
	450		26.2		
	900		25.8		
	1500		25.4		
Output IP3 <sup>2</sup>	50	—	47.0	—	dBm
	450	—	44.3	—	
	900	40.0	45.0	—	
	1500	—	43.8	—	
Noise figure	50		4.1		dB
	450		3.9		
	900		4.0		
	1500		4.2		
Device operating voltage			9.0		V
Device operating current		—	182	220	mA
Device current variation vs. temperature <sup>3</sup>			-4		μA/°C
Device current variation vs voltage			0.024		mA/mV
Thermal Resistance, junction-to-ground lead at 85°C stage temperature			20		°C/W

1. Measured on Mini-Circuits Characterization test board TB-869+. See Characterization Test Circuit (Fig. 1)

2. Tested at Pout=8dBm / tone.

3. (Current at 85°C — Current at -45°C)/130

Absolute Maximum Ratings<sup>4</sup>

Parameter	Ratings
Operating Temperature (ground lead)	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Operating Current at 9V	360 mA
Power Dissipation	3.25 W
Input Power (CW)	+24 dBm (5 minutes max.) +20 dBm (continuous)
DC Voltage on Pin 3	11 V

4. Permanent damage may occur if any of these limits are exceeded.  
Electrical maximum ratings are not intended for continuous normal operation.

Characterization Test Circuit

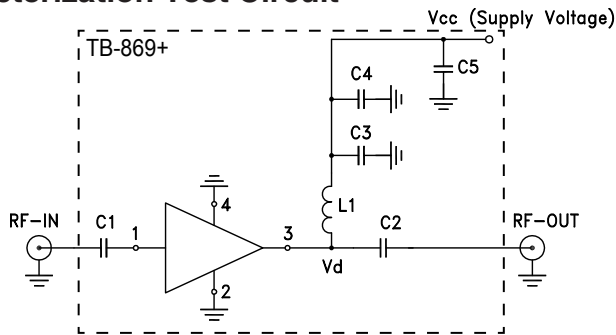


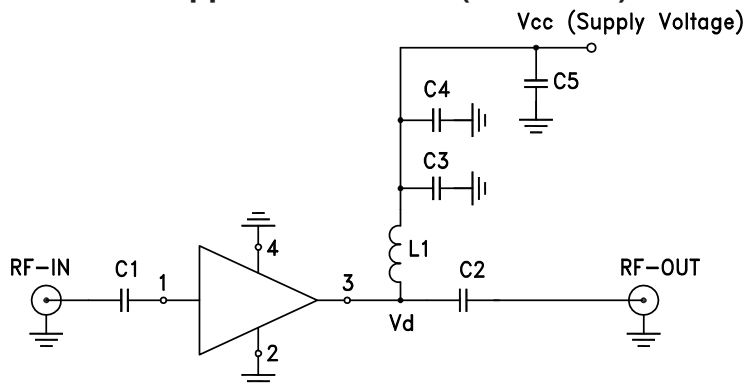
Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization test board TB-869+)

Gain, Return loss, Output power at 1dB compression (P1 dB) , output IP3 (OIP3) and noise figure measured using Agilent's N5242A PNA-X microwave network analyzer.

Conditions:

1. Gain and Return loss: Pin= -25dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 8 dBm/tone at output.

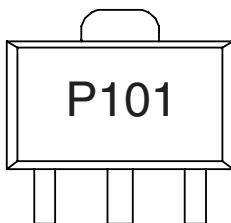
Recommended Application Circuit (TB-869A+)



Component	Value	Size	Part Number	Manufacturer
C1, C2, C3	150 pF	0603	GRM1885C1H151JA01D	Murata
C4	0.01 μF	0603	GRM188R71H103KA01D	Murata
C5	10 μF	1206	GRM31CR61H106KA12L	Murata
L1	390 nH	0505	0805CS-391XJEC	Coilcraft

Fig 2. Test board (TB-869A+) includes case, connectors, and components soldered to PCB

Product Marking



Marking may contain other features or characters for internal lot control

<b>Additional Detailed Technical Information</b> <i>additional information is available on our dash board. To access this information <a href="#">click here</a></i>	
<b>Performance Data</b>	Data Table
	Swept Graphs
	S-Parameter (S2P Files) Data Set (.zip file)
<b>Case Style</b>	DF782 (SOT 89) <i>Plastic package, exposed paddle lead finish: Matte-Tin</i>
<b>Tape &amp; Reel</b> Standard quantities available on reel	F55 <i>7" reels with 20, 50, 100, 200, 500 or 1K devices</i>
<b>Suggested Layout for PCB Design</b>	PL-486
<b>Evaluation Board</b>	TB-869A+
<b>Environmental Ratings</b>	ENV08T1

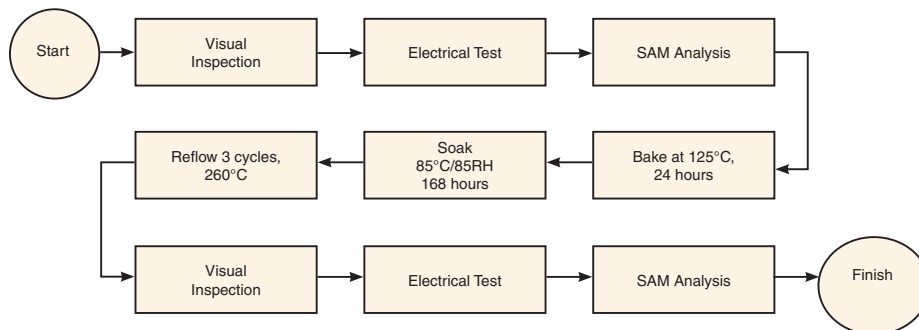
**ESD Rating**

Human Body Model (HBM): Class 1A (250 to <500V) in accordance with ANSI/ESD STM 5.1 - 2001  
Machine Model (MM): Class M1 (>25V) in accordance with ANSI/ESD STM5.2-1999

**MSL Rating**

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020D

**MSL Test Flow Chart**



**Additional Notes**

- A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at [www.minicircuits.com/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp)

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