



Mini-Circuits

ULTRA HIGH DYNAMIC RANGE

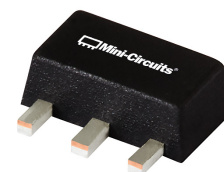
# Monolithic Amplifier

PHA-83W+

50Ω 50 MHz to 8 GHz

## THE BIG DEAL

- Ultra Wideband, 50 MHz to 8 GHz
- Excellent Gain Flatness 15.7±1.4 dB Typ.
- High Linearity, +23.3 dBm P1dB & +35.5 dBm OIP3
- Robust ESD performance (Class 1B)



Generic photo used for illustration purposes only

CASE STYLE: DF782

## +RoHS Compliant

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

## APPLICATIONS

- WiFi
- WLAN
- LTE
- WiMAX
- S-band Radar
- C-Band Satcom

## PRODUCT OVERVIEW

PHA-83W+ (RoHS compliant) is an advanced wideband amplifier fabricated using PHEMT technology and offers extremely high dynamic range over a broad frequency range and with excellent gain flatness. In addition, the PHA-83W+ has good input and output return loss over a broad frequency range. PHA-83W+ is enclosed in a SOT-89 package and has very good thermal performance.

## KEY FEATURES

Feature	Advantages
Ultra Wideband: 50 MHz to 8 GHz	Broadband covering primary wireless communications bands
Extremely High IP3 +36.6 dBm typ. at 50 MHz +37 dBm typ. at 6 GHz	The PHA-83W+ matches industry leading IP3 performance relative to device size and power consumption. The combination of the design and PHEMT Structure provides enhanced linearity over a broad frequency range as evidenced in the IP3 being approximately 12 dB above the P1dB 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>
Excellent Gain Flatness	Typical ±1.4 dB gain flatness across the entire frequency range minimizes the need for external equalizer networks making it a great fit for instrumentation and EW application.

REV. A  
ECO-010399  
PHA-83W+  
MCL NY  
240722





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## ELECTRICAL SPECIFICATIONS AT +25°C, 50Ω, UNLESS NOTED OTHERWISE

Parameter	Condition (MHz)	Vd=+9V <sup>1</sup>			Vd=+5V <sup>1</sup>	Vd=+9V <sup>2</sup>	Vd=+5V <sup>2</sup>	Units
		Min.	Typ.	Max.	Typ.	Typ.	Typ.	
Frequency range		50		8000	50-8000	50-8000	50-8000	MHz
Gain	50	14.2	16.7	19.2	15.1	16.3	14.9	dB
	2000	13.7	16.3	18.6	14.4	16	14.2	
	4000	13.2	15.7	17.8	13.2	15.3	12.8	
	6000	13.7	16	18.5	12.6	15.5	12.4	
	8000	—	14.2	—	10	12.4	8.2	
Gain Flatness	50 - 8000		1.4		2.8	—	—	dB
Input Return Loss	50		23		20	16	16	dB
	2000		21		14	21	17	
	4000		13		11	14	12	
	6000		13		14	14	16	
	8000		4		6	3	5	
Output Return Loss	50		17		26	13	17	dB
	2000		30		17	33	22	
	4000		18		13	17	12	
	6000		18		12	15	20	
	8000		5		6	6	6	
Output Power @1 dB Compression	50		+23.8		+16.5	+23.7	+15.6	dBm
	2000		+23.8		+16.3	+24.3	+16	
	4000		+23.3		+15.9	+22.6	+14.1	
	6000		+22.6		+16.4	+22.6	+15.8	
	8000		+18.5		+13.2	+16.7	+11	
Output IP3 (Pout= 0dBm/Tone)	50		+36.6		+24.1	+36.5	+25.9	dBm
	2000		+36		+23.4	+35.4	+24.6	
	4000		+35.5		+23.4	+34.5	+22.8	
	6000		+37		+23.6	+35.6	+25.1	
	8000		+31.9		+20.9	+29.9	+19.5	
Noise Figure	50		3.3		2.8	3.4	2.8	dB
	2000		2.9		2.7	2.9	2.7	
	4000		3.3		3.1	3.5	3.1	
	6000		3.9		3.6	3.9	3.5	
	8000		5.1		4.7	5.4	4.9	
Device Operating Voltage		+8.5	+9	+9.5	+5	+9	+5	V
Device Operating Current			110	127	40.8	115	42.7	mA
Device Current Variation vs. Temperature <sup>3</sup>			34.6		30.8	34.6	30.8	μA/°C
Device Current Variation vs. Voltage <sup>4</sup>			0.018		0.015	0.018	0.015	mA/mV
Thermal Resistance, junction-to-ground Lead at 85°C stage temperature			41		41	41	41	°C/W

1. Measured on Mini-Circuits Characterization Test Board TB-PHA-83W+. See Characterization Test Circuit (Figure 1).

2. Measured on Mini-Circuits Application Evaluation Board TB-PHA-83WE+. See Application Test Circuit (Figure 2).

3. Device Current Variation vs. Temperature= (Current at 85°C - Current at -45°C)/130

4. Device Current Variation vs. Voltage = (Current at 9.5V - Current at 8.5V) / ((9.5V-8.5V)\*1000 mV/V)





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## ABSOLUTE MAXIMUM RATINGS<sup>5</sup>

Parameter	Ratings
Operating Temperature (ground lead)	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Power Dissipation	1.58 W
Input Power (CW)	+18 dBm (continuous) +24 dBm (5 minutes max)
DC Voltage on Pin 3	+10.5 V

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

## SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION



Function	Pin Number	Description
RF IN	1	RF Input
RF-OUT and DC-IN	3	RF Output and DC Bias
GND	2,4	Connections to ground.

## CHARACTERIZATION TEST CIRCUIT

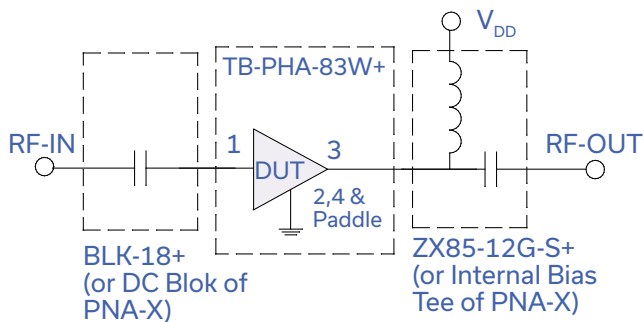


Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization test board TB-PHA-83W+)  
Gain, Return loss, Output power at 1dB compression (P1 dB), output IP3 (OIP3) and noise figure measured using Agilent's N5242A PNA-X microwave network analyzer.

Conditions:

1. Gain and Return loss:  $P_{IN} = -25\text{dBm}$
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 0 dBm/tone at output.

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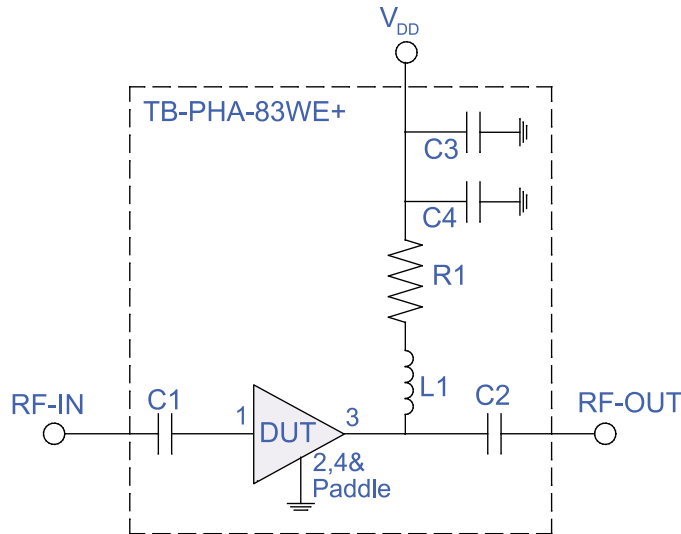
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## APPLICATION TEST CIRCUIT



Component	Size	Value	Part Number	Manufacturer
C1	0402	1000pF	GRM1555C1H102JA01D	Murata
C2	0402	180pF	GRM1555C1H181JA01D	Murata
C3	0402	0.1uF	GRM155R71C104KA88D	Murata
C4	0402	10000pF	GRM155R71E103KA01D	Murata
L1	0603	330nH	LQW18CNR33J00D	Murata
R1	0402	20hm	RK73H1ETTP2R00F	Koa

Fig 2. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Application test board TB-PHA-83WE+)

Gain, Return loss, Output power at 1dB compression (P1dB), output IP3 (OIP3) and noise figure measured using Agilent's N5242A PNA-X microwave network analyzer

Conditions:

1. Gain and Return loss:  $P_{IN} = -25\text{dBm}$
2. Output IP3 (OIP3): Two Tones spaced 1 MHz apart, 0 dBm/ tone at output.

## PRODUCT MARKING



Marking may contain other features or characters for internal lot control

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ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASHBOARD.

[CLICK HERE](#)

Performance Data	Data Table
	Swept Graphs
	S-Parameter (S2P Files) Data Set (.zip file)
Case Style	DF782 (SOT 89) Plastic package, exposed paddle lead finish: matte-tin
Tape & Reel Standard quantities available on reel	F55 7" reels with 20, 50, 100, 200, 500 or 1K devices
Suggested Layout for PCB Design	PL-653
Evaluation Board	TB-PHA-83WE+
Environmental Ratings	ENV08T1

## ESD RATING

Human Body Model (HBM): Class 1B (500V) in accordance with ANSI/ESD STM 5.1 - 2001

## NOTES

- 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.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- 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/terms/viewterm.html](http://www.minicircuits.com/terms/viewterm.html)

