



Mini-Circuits

ULTRA HIGH DYNAMIC RANGE

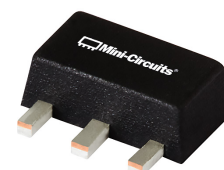
# Monolithic Amplifier

PHA-23LN+

50Ω 30 MHz to 2 GHz

## THE BIG DEAL

- Ultra-High IP3, +37.4 dBm typ. at 1 GHz
- Low supply voltage, +3 to +5V
- Excellent Noise Figure, 1.2 dB typ. at 1 GHz
- Gain, 21 dB at 1 GHz



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

- Base station infrastructure
- CATV
- Cellular

## PRODUCT OVERVIEW

PHA-23LN+ (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-23LN+ has good input and output return loss over a broad frequency range. PHA-23LN+ is enclosed in a SOT-89 package and has very good thermal performance.

## KEY FEATURES

Feature	Advantages
Broad Band: 30 MHz to 2 GHz	Broadband covering primary wireless communications bands: VHF, UHF, Cellular
Extremely High IP3 +40.9 dBm typical at 30 MHz +37.4 dBm typical at 1 GHz	The PHA-23LN+ 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 approximately 13-18 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>
Low Noise Figure 1.2 dB at 1 GHz	Enables lower system noise figure performance and along with High OIP3 provides high dynamic range
Low Supply Voltage	PHA-23LN+ supports low supply voltage operation which indicate low power consumption.

REV. B  
ECO-010399  
PHA-23LN+  
MCL NY  
240722





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ELECTRICAL SPECIFICATIONS<sup>1</sup> AT +25°C, 50Ω, UNLESS NOTED OTHERWISE

Parameter	Condition (MHz)	Vd=+5V <sup>1</sup>			Vd=+3V <sup>1</sup>	Units
		Min.	Typ.	Max.	Typ.	
Frequency Range		30		2000	30-2000	MHz
Gain	30	—	23.0	—	22.3	dB
	500	—	21.9	—	21.0	
	1000	18.9	21.0	23.1	19.7	
	1500	18.1	20.1	22.1	18.5	
	2000	—	18.9	—	17.0	
Input Return Loss	30		12.0		12.4	dB
	500		11.6		10.5	
	1000		9.4		7.5	
	1500		9.6		7.7	
	2000		8.9		6.9	
Output Return Loss	30		14.9		16.6	dB
	500		16.5		21.0	
	1000		18.8		18.0	
	1500		12.2		10.8	
	2000		9.4		8.5	
Reverse Isolation	1000		27.2		26.9	dB
Output Power @1 dB compression	30		+22.8		+17.4	dBm
	500		+24.1		+19.0	
	1000		+23.9		+18.8	
	1500		+23.4		+18.4	
	2000		+23.3		+18.0	
Output IP3 <sup>2</sup>	30		+40.9		+34.7	dBm
	500		+39.3		+33.3	
	1000		+37.4		+30.9	
	1500		+36.3		+30.5	
	2000		+35.6		+29.7	
Noise Figure	30		1.1		1.1	dB
	500		1.0		1.0	
	1000		1.2		1.2	
	1500		1.3		1.3	
	2000		1.6		1.6	
Device Operating Voltage			+5.0		+3.0	V
Device Operating Current			141.7	162	72.4	mA
Device Current Variation vs. Temperature <sup>3</sup>			14.2		33.1	μA/°C
Device Current Variation vs Voltage			0.0354		0.0354	mA/mV
Thermal Resistance, Junction-to-ground lead at 85°C stage temperature			23.3		23.3	°C/W

1. Measured on Mini-Circuits Characterization test board TB-951-23LN+. See Characterization Test Circuit (Fig. 1)

2. Tested at Pout= 0 dBm / tone.

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





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ABSOLUTE MAXIMUM RATINGS<sup>4</sup>

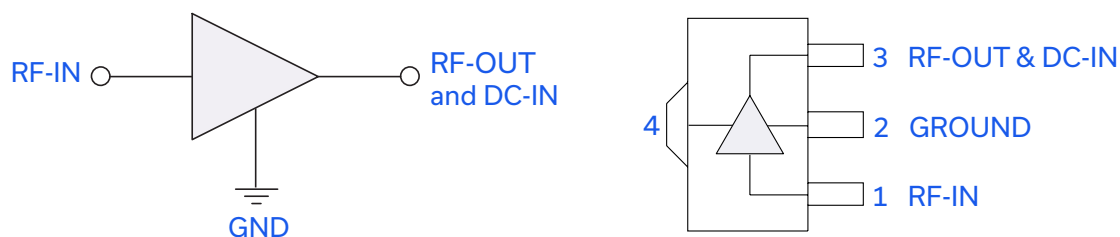
Parameter	Ratings
Operating Temperature (ground lead)	-40°C to +105°C
Storage Temperature	-65°C to +150°C
Power Dissipation <sup>5</sup>	3.3 W
Input Power (CW)	+22 dBm (5 minutes max) <sup>6</sup> +4 dBm (continuous) for 0.03-1GHz at +3V +8 dBm (continuous) for 0.03-1GHz at +5V +12 dBm (continuous) for 1-2GHz at +3V +15 dBm (continuous) for 1-2GHz at +5V
DC Voltage on Pin 3	+10 V

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

5. Up to 85°C, derate linearly to 2.5 W at 105°C.

6. Up to 85°C, derate linearly to +19 dBm at 105°C.

## SIMPLIFIED SCHEMATIC AND PIN 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.



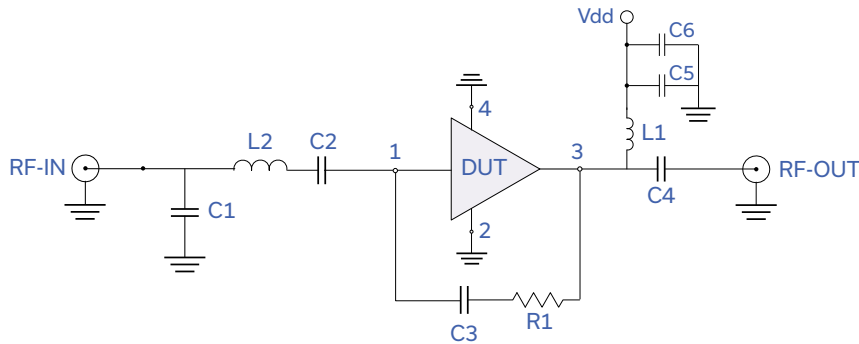
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## CHARACTERIZATION TEST / RECOMMENDED APPLICATION CIRCUIT



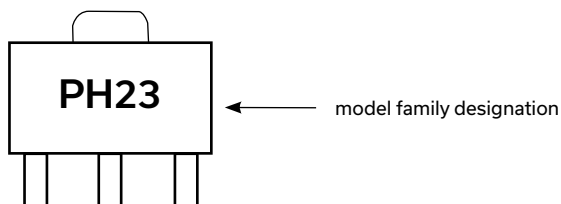
Component	Size	Value	Manufacturer	P/N
C1	0402	1.2pF	Murata	GRM1555C1H1R2WA01D
C2,C3,C6		0.1uF		GRM155R71C104KA88D
C4		0.001uF		GRM1555C1H102JA01D
C5		0.01uF		GRM155R71E103KA01D
R1		1.21KOhm	KOA	RK73H1ETTP1211F
L1	0805	0.68uH	Coilcraft	0805LS-681XJLB
L2	0402	1nH		0402CS-1N0XJLW

Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization test board TB-951-23LN+) 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.

## 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-512
Evaluation Board	TB-951-23LN+
Environmental Ratings	ENV08T9

## ESD RATING

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

## MSL RATING

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

## 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/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp)



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