



ULTRA HIGH DYNAMIC RANGE

Monolithic Amplifier

PHA-23HLN+

50Ω 30MHz to 2 GHz

THE BIG DEAL

- Ultra-High IP3, +44.4 dBm typ.
- Medium Power, +28.4 dBm typ.
- Excellent Noise Figure, 1.4 dB typ.



Generic photo used for illustration purposes only

CASE STYLE: DF782

APPLICATIONS

- Base station infrastructure
- CATV
- Cellular

+RoHS Compliant

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

PRODUCT OVERVIEW

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

KEY FEATURES

| Feature | Advantages |
|---|---|
| Broad Band: 30MHz to 2GHz | Broadband covering primary wireless communications bands: VHF, UHF, Cellular |
| Extremely High IP3 40.9 dBm typical at 30MHz 44.4 dBm typical at 1GHz | The PHA-23HLN+ 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 14-17 dB above the P1dB point. This feature makes this amplifier ideal for use in: <ul style="list-style-type: none"> • Driver amplifiers for complex waveform up converter paths • Drivers in linearized transmit systems • Secondary amplifiers in ultra-High Dynamic range receivers |
| Low Noise Figure 1.4 dB at 1 GHz | Enables lower system noise figure performance |
| High P1dB 28.4 dBm at 1 GHz | High P1dB, High OIP3, Low NF results in a very dynamic range preventing amplifier saturation under strong interfering signals. It can also be used to drive mixers requiring high drive |

REV. B
ECO-010399
PHA-23HLN+
MCL NY
221221





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Mini-Circuits

ELECTRICAL SPECIFICATIONS¹ AT 25°C, 50Ω, UNLESS NOTED OTHERWISE

| Parameter | Condition (MHz) | Vd=8V ¹ | | | Units |
|---|-----------------|--------------------|--------|------|-------|
| | | Min. | Typ. | Max. | |
| Frequency Range | | 30 | | 2000 | MHz |
| Gain | 30 | — | 23.2 | — | dB |
| | 500 | — | 22.1 | — | |
| | 1000 | 19.2 | 21.3 | 23.5 | |
| | 1500 | 18.5 | 20.6 | 22.6 | |
| | 2000 | — | 19.5 | — | |
| Input Return Loss | 30 | | 11.9 | | dB |
| | 500 | | 11.7 | | |
| | 1000 | | 9.9 | | |
| | 1500 | | 10.3 | | |
| | 2000 | | 9.5 | | |
| Output Return Loss | 30 | | 14.8 | | dB |
| | 500 | | 14.5 | | |
| | 1000 | | 14.2 | | |
| | 1500 | | 10.6 | | |
| | 2000 | | 8.2 | | |
| Reverse isolation | 1000 | | 27.5 | | dB |
| Output Power @1 dB compression | 30 | | 26.2 | | dBm |
| | 500 | | 28.1 | | |
| | 1000 | | 28.4 | | |
| | 1500 | | 28.0 | | |
| | 2000 | | 27.8 | | |
| Output IP3 ² | 30 | | 40.9 | | dBm |
| | 500 | | 43.6 | | |
| | 1000 | | 44.4 | | |
| | 1500 | | 45.8 | | |
| | 2000 | | 42.5 | | |
| Noise Figure | 30 | | 1.3 | | dB |
| | 500 | | 1.2 | | |
| | 1000 | | 1.4 | | |
| | 1500 | | 1.5 | | |
| | 2000 | | 1.9 | | |
| Device Operating Voltage | | | 8.0 | | V |
| Device Operating Current | | | 235 | 273 | mA |
| Device Current Variation vs. Temperature ³ | | | -209.8 | | μA/°C |
| Device Current Variation vs Voltage | | | 0.0254 | | mA/mV |
| Thermal Resistance, Junction-to-ground lead at 85°C stage temperature | | | 23.3 | | °C/W |

1. Measured on Mini-Circuits Characterization test board TB-951+. 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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MAXIMUM RATINGS⁴

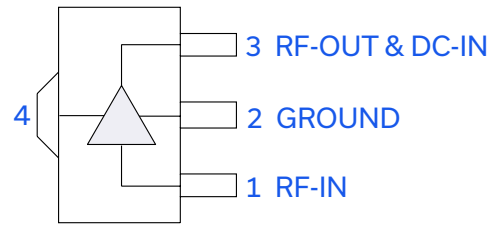
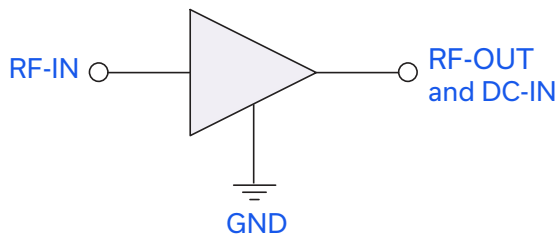
| Parameter | Ratings |
|-------------------------------------|--|
| Operating Temperature (ground lead) | -40°C to 95°C |
| Storage Temperature | -65°C to 150°C |
| Power Dissipation ⁵ | 3.3W |
| Input Power (CW) | +22 dBm (5 minutes max) ⁶ +11 dBm (continuous) for 0.03-1GHz +18 dBm (continuous) for 1-2 GHz |
| DC Voltage on Pin 3 | 10V |

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 3W at 95°C.

6. Up to 85°C, derate linearly to +19dBm at 95°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. |

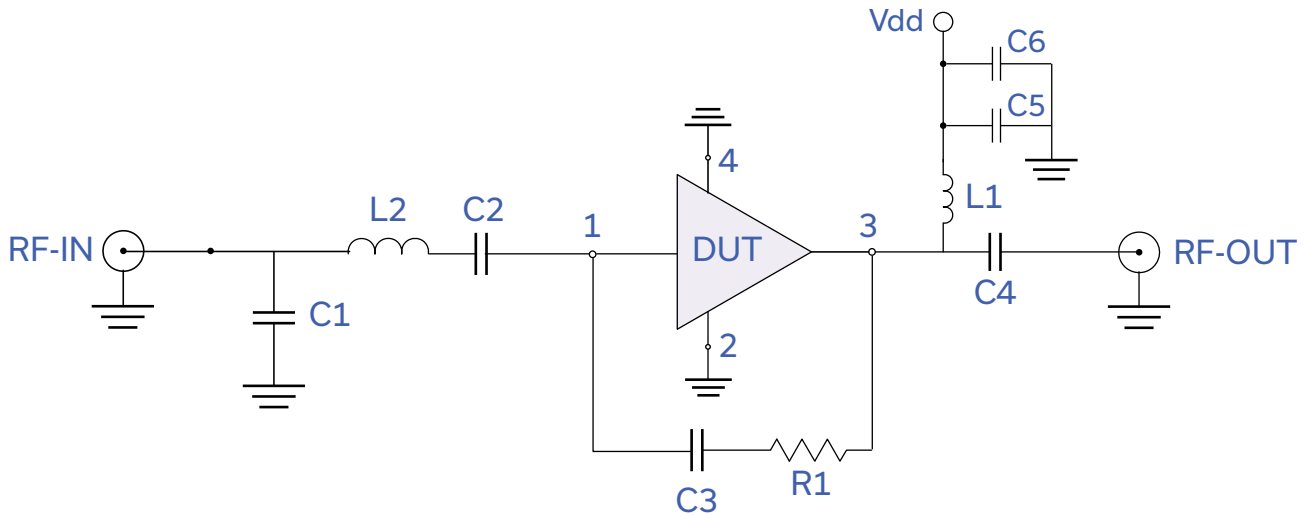


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CHARACTERIZATION TEST / RECOMMENDED APPLICATION CIRCUIT



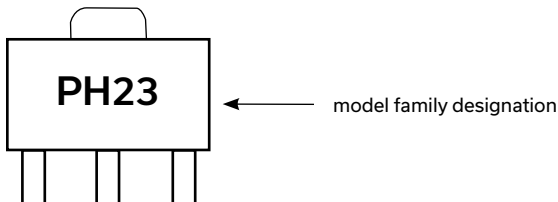
| Component | Size | Value | Manufacturer | P/N |
|-----------|------|----------|--------------|--------------------|
| C1 | 0402 | 1.2pF | Murata | GRM1555C1H1R2WA01D |
| C2,C3,C6 | | 0.1uF | | GRM155R71C104KA88D |
| C4 | | 0.001uF | | GRM1555C1H102JA01D |
| C5 | | 0.01uF | | GRM155R71E103KA01D |
| R1 | | 1.21KOhm | | KOA |
| 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+) 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:

- Gain and Return loss: Pin= -25dBm
- 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 DASH BOARD. TO ACCESS [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-523 |
| Evaluation Board | TB-969-13LN+ |
| Environmental Ratings | ENV08T9 |

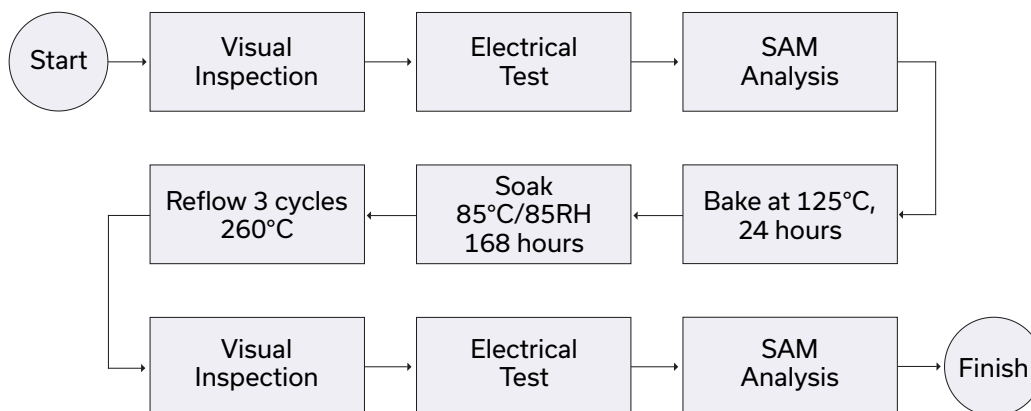
ESD RATING

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

MSL TEST FLOW CHART



- 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

