



ULTRA HIGH DYNAMIC RANGE

# Monolithic Amplifier

## LHA-23LN+

50Ω 30 MHz to 2 GHz

### THE BIG DEAL

- Ultra-High IP3, +36.9 dBm typ
- Gain, 21.2 dB typ. at 1 GHz
- Low noise figure, 1.2 dB at 1 GHz
- Low voltage, 5V and 3V.



Generic photo used for illustration purposes only

CASE STYLE: DQ1225

#### +RoHS Compliant

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

### APPLICATIONS

- Base station infrastructure
- CATV
- Cellular

### PRODUCT OVERVIEW

LHA-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 LHA-23LN+ has good input and output return loss over a broad frequency range. LHA-23LN+ is enclosed in a 3mm x 3mm, 12-lead MCLP 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<br>40.3 dBm typical at 0.5 GHz<br>36.9 dBm typical at 1GHz | The LHA-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 11-17 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<br>1.2 dB at 1 GHz   | Enables lower system noise figure performance and along with High OIP3 provides high dynamic range   |
| Low Supply Voltage  | LHA-23LN+ supports low supply voltage operation which indicate low power consumption.  |

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ECO-011665  
LHA-23LN+  
MCL NY  
220124





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# LHA-23LN+

Mini-Circuits

## 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   | —    | 21.1               |       |
|   | 1000            | 18.9               | 21.2   | 23.1 | 19.9               |       |
|   | 1500            | 18.1               | 20.4   | 22.1 | 18.8               |       |
|   | 2000            | —                  | 19.6   | —    | 17.6               |       |
| Input Return Loss                                     | 30              |                    | 12     |      | 12                 | dB    |
|   | 500             |                    | 11     |      | 11                 |       |
|   | 1000            |                    | 10     |      | 8                  |       |
|   | 1500            |                    | 10     |      | 7                  |       |
|   | 2000            |                    | 10     |      | 8                  |       |
| Output Return Loss                                    | 30              |                    | 14     |      | 16                 | dB    |
|   | 500             |                    | 15     |      | 18                 |       |
|   | 1000            |                    | 19     |      | 23                 |       |
|   | 1500            |                    | 15     |      | 13                 |       |
|   | 2000            |                    | 11     |      | 9                  |       |
| Reverse isolation                                     | 1000            |                    | 26.9   |      | 26.6               | dB    |
| Output Power @1 dB compression                        | 30              |                    | 22.8   |      | 17.1               | dBm   |
|   | 500             |                    | 24.2   |      | 19.2               |       |
|   | 1000            |                    | 23.8   |      | 18.8               |       |
|   | 1500            |                    | 23.2   |      | 18.4               |       |
|   | 2000            |                    | 23.0   |      | 18.0               |       |
| Output IP3 <sup>2</sup>                               | 30              |                    | 39.8   |      | 33.9               | dBm   |
|   | 500             |                    | 39.0   |      | 33.5               |       |
|   | 1000            |                    | 36.9   |      | 31.6               |       |
|   | 1500            |                    | 35.2   |      | 30.7               |       |
|   | 2000            |                    | 34.6   |      | 30.0               |       |
| Noise Figure  | 30              |                    | 1.0    |      | 1.0                | dB    |
|   | 500             |                    | 1.1    |      | 1.1                |       |
|   | 1000            |                    | 1.2    |      | 1.2                |       |
|   | 1500            |                    | 1.3    |      | 1.3                |       |
|   | 2000            |                    | 1.5    |      | 1.6                |       |
| Device Operating Voltage                              |                 |                    | 5.0    |      | 3.0                | V     |
| Device Operating Current                              |                 |                    | 146    | 162  | 75                 | mA    |
| Device Current Variation vs. Temperature <sup>3</sup> |                 |                    | -26.1  |      | 17.5               | μA/°C |
| Device Current Variation vs Voltage                   |                 |                    | 0.0359 |      | 0.0364             | mA/mV |
| Thermal Resistance, junction-to-ground lead           |                 |                    |        |      |                    |       |
| Junction-to-ground lead at 85°C stage temperature     |                 |                    | 23.3   |      | 23.3               | °C/W  |

1. Measured on Mini-Circuits Characterization test board TB-1061-23LN+. See Characterization Test Circuit (Fig. 1)

2. Tested at Pout= 0 dBm / tone.

3. (Current at 105°C – Current at -45°C)/150

## 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>      | 3.3W   |
| Input Power (CW)                    | +22 dBm (5 minutes max) <sup>6</sup><br>+4 dBm (continuous) for 0.03-1GHz at 3V<br>+8 dBm (continuous) for 0.03-1GHz at 5V<br>+12 dBm (continuous) for 1-2GHz at 3V<br>+15 dBm (continuous) for 1-2GHz at 5V |
| DC Voltage on Pin 7                 | 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 2.5W at 105°C.

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



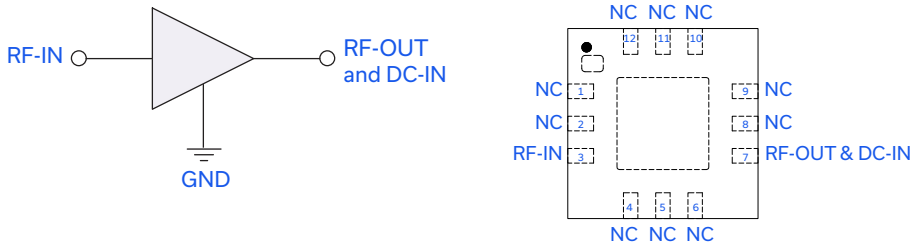


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## SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION



| Function         | Pad Number     | Description                        |
|------------------|----------------|------------------------------------|
| RF-IN            | 3              | RF Input                           |
| RF-OUT and DC-IN | 7              | RF Output and DC Bias              |
| GND              | Paddle         | Connections to ground.             |
| NC               | 1-2, 4-6, 8-12 | No connection, grounded externally |

## CHARACTERIZATION TEST / RECOMMENDED APPLICATION CIRCUIT

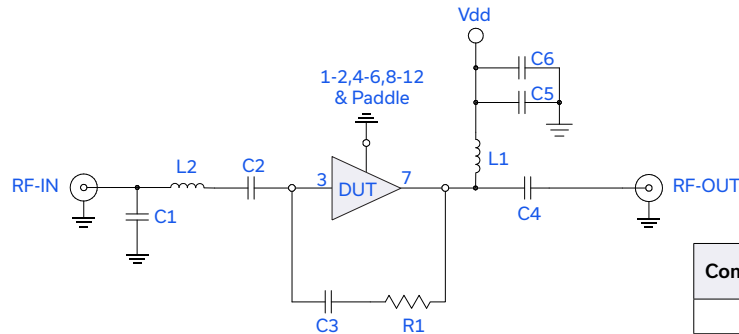


Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization test board TB-1061-23LN+)  
Gain, Return loss, Output power at 1dB compression (P1 dB), output IP3 (OIP3) and noise figure measured using Agilent's N5242A PNA-X microwave network analyzer.

- Conditions:
1. Gain and Return loss: Pin= -25dBm
  2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 0 dBm/ tone at output.

| Components | Size | Value    | Manu-<br>facturer | 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       |
| L2         | 0402 | 1nH      | 0402CS-1N0XJLW    |                    |                 |

## PRODUCT MARKING



Marking may contain other features or characters for internal lot control





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## LHA-23LN+

ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD. TO ACCESS [CLICK HERE](#)

|  |  |
|--|--|
| Performance Data                                     | Data Table<br>Swept Graphs                                       |
| Case Style   | DQ1225<br>Plastic package, exposed paddle lead finish: Matte-Tin |
| Tape & Reel<br>Standard quantities available on reel | F66<br>7" reels with 20, 50, 100, 200, 500, 1K, or 2K devices    |
| Suggested Layout for PCB Design                      | PL-587   |
| Evaluation Board                                     | TB-1061-23HLN+   |
| Environmental Ratings                                | ENV08T9  |

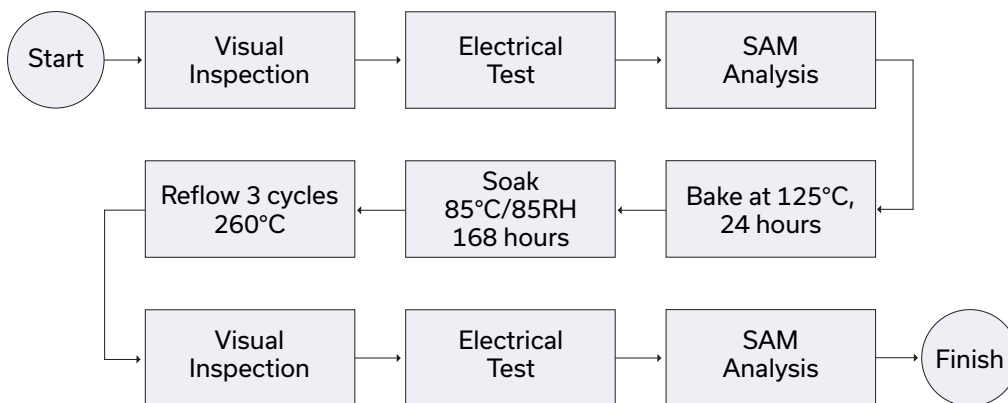
### ESD RATING

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

