



Mini-Circuits

ULTRA HIGH DYNAMIC RANGE

# Monolithic Amplifier

**LHA-13LN+**

50Ω 1 MHz to 1 GHz

## THE BIG DEAL

- Ultra-High IP3, +38.3 dBm typ.
- Gain, 22.4 dB typ. at 0.5 GHz
- Low supply voltage, +3 to +5V
- Excellent Noise Figure, 1.1 dB typ.



Generic photo used for illustration purposes only

CASE STYLE: DQ1225

### +RoHS Compliant

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

## APPLICATIONS

- Base station infrastructure
- CATV
- Cellular

## PRODUCT OVERVIEW

LHA-13LN+ (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-13LN+ has good input and output return loss over a broad frequency range. LHA-13LN+ is enclosed in a 3mm x 3mm, 12-lead MCLP package and has very good thermal performance.

## KEY FEATURES

Feature	Advantages
Broad Band: 1 MHz to 1 GHz	Broadband covering primary wireless communications bands: VHF, UHF, Cellular
Extremely High IP3 +36.1 dBm typical at 1 MHz +38.3 dBm typical at 0.5 GHz	The LHA-13LN+ 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 13-17 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, 0.9 dB at 0.5 GHz	Enables lower system noise figure performance and along with High OIP3 provides high dynamic range
Low Supply Voltage	LHA-13LN+ supports low supply voltage operations which indicate low power consumption

REV. A  
ECO-011665  
LHA-13LN+  
MCL NY  
240725





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

Parameter	Condition (MHz)	Min.	Vd=+5V <sup>1</sup> Typ.	Max.	Vd=+3V <sup>1</sup> Typ.	Units
Frequency Range		1		1000	1-1000	MHz
Gain	1	22.1	24.6	27.1	23.7	dB
	20	—	24.0	—	23.2	
	250	—	22.8	—	22.0	
	500	20.2	22.4	24.6	21.5	
	1000	—	20.1	—	18.7	
Input Return Loss	1		11		10	dB
	20		15		15	
	250		18		18	
	500		18		15	
	1000		11		9	
Output Return Loss	1		12		12	dB
	20		20		22	
	250		18		20	
	500		25		22	
	1000		11		9	
Reverse Isolation	500		26		25.6	dB
Output Power @ 1 dB compression	1		+20.8		+14.6	dBm
	20		+22.0		+15.8	
	250		+24.2		+19.3	
	500		+23.9		+18.9	
	1000		+23.3		+17.6	
Output IP3 <sup>2</sup>	1	—	+36.1		+29.6	dBm
	20	—	+38.9		+32.5	
	250	—	+40.0		+33.6	
	500	+36	+38.3		+32.3	
	1000	—	+36.4		+28.5	
Noise Figure	1		3.1		3.0	dB
	20		1.1		1.0	
	250		0.9		1.0	
	500		1.1		1.0	
	1000		1.2		1.2	
Device Operating Voltage			+5.0		+3.0	V
Device Operating Current			143	162	73	mA
Device Current Variation vs. Temperature <sup>3</sup>			98.2		-29.7	μA/°C
Device Current Variation vs Voltage			0.0355		0.0354	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-1063-13LN+. See Characterization Test Circuit (Fig. 1)

2. Tested at Pout= 0 dBm / tone.

3. (Current at 105°C — Current at -45°C)/140

## ABSOLUTE MAXIMUM RATINGS<sup>4</sup>

Parameter	Ratings
Operating Temperature (ground lead)	-40°C to +95°C
Storage Temperature	-65°C to +150°C
Power Dissipation	3.3 W <sup>5</sup>
Input Power (CW)	+21 dBm (5 minutes max) <sup>6</sup> +10 dBm (continuous) for 1-10 MHz +11 dBm (continuous) for 10-1000 MHz
DC Voltage on Pad <sup>7</sup>	+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 95°C.

6. up to 85°C, derate linearly to 18 dBm at 95°C.





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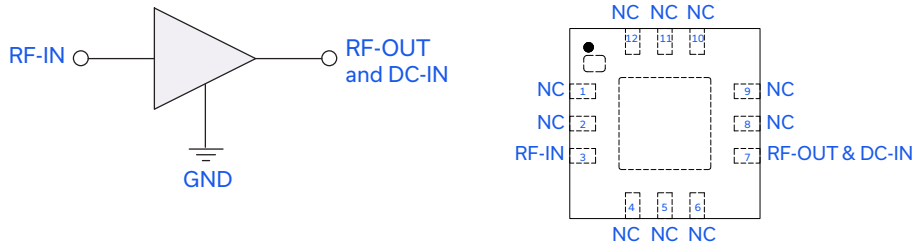
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LHA-13LN+

50Ω

1 MHz to 1 GHz

## 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

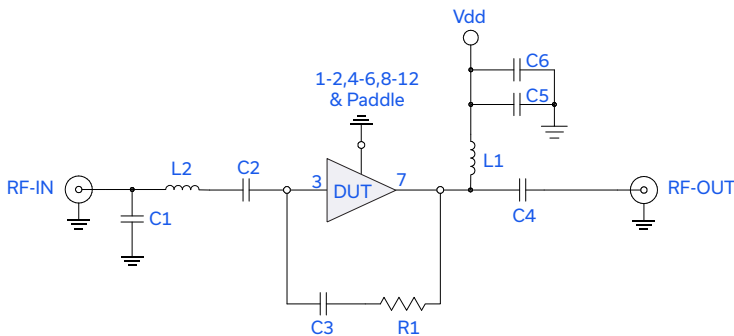


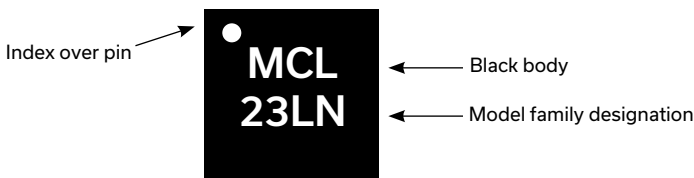
Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization test board TB-1063-13HLN+)  
Gain, Return loss, Output power at 1dB compression (P1 dB), output IP3 (OIP3) and noise figure measured using Agilent's N5242A PNA-X microwave network analyzer.

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.

Components	Size	Value	Manufacturer	P/N
C1	0402	1.5 pF	Murata	GRM1555C1H1R5CA01
C2	0603	2.2 uF		GRM188R61C225KE15
C3	0402	0.1 uF		GRM155R71C104KA88
C4	0603	2.2uF		GRM188R61C225KE15
C5	0402	1000 pF		GRM1555C1H102JA01
C6	0805	10 uF		GRM21BR61C106KE15
L1	1210	15 uH	Coilcraft	LQH32DN150K53L
L2	0603	5.1 nH		0603CS-5N1XJL
R1	0402	1500 Ohms	Koa	RK73H1ELTP1501F

## 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
Case Style	DQ1225 Plastic package, exposed paddle lead finish: Matte-Tin
Tape & Reel Standard quantities available on reel	F66 7" reels with 20, 50, 100, 200, 500, 1K, 2K or 3K devices
Suggested Layout for PCB Design	PL-594
Evaluation Board	TB-1063-13LN+
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

## 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)

