

Ultra High Dynamic Range

# Monolithic Amplifier

LHY-1H+

50Ω    0.05 to 6 GHz

## The Big Deal

- Ultra High IP3
- Broadband High Dynamic Range without external Matching Components
- Small size 2 x 2 mm



2mm x 2mm

## Product Overview

LHY-1H+ (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 LHY-1H+, unlike competitive models, is well matched (input and output) over a broad frequency range without the need for external matching components. Lead finish is tin-silver over nickel. It is enclosed in a 2x2 mm MCLP package for low parasitic interface.

## Key Features

Feature	Advantages
Broad Band: 0.05 to 6.0 GHz	Broadband covering primary wireless communications bands: Cellular, PCS, LTE, WiMAX
Extremely High IP3 versus DC power Consumption 41 dBm typical at 2 GHz	The LHY-1H+ 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 typically 17 dB above the P 1dB 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: 2.7 dB typ. up to 4 GHz 3.1 dB typ. up to 6 GHz	A unique feature of the LHY-1H+ which separates this design from all competitors is the low noise figure performance in combination with the high dynamic range.
Small size 2 x 2 mm	Saves PCB area



# Ultra High Dynamic Range Monolithic Amplifier

## LHY-1H+

50Ω 0.05 to 6 GHz

### Product Features

- High IP3, 41 dBm typ. at 2 GHz, 5V
- Gain, 14.0 dB typ. at 2 GHz, 5V
- High Pout, P1dB 22.5 dBm typ. at 2 GHz, 5V
- Low noise figure, 2.1 dB @2 GHz, 5V
- Usable to 4.0V
- No external matching components required



Generic photo used for illustration purposes only

CASE STYLE: MC1630-1

### +RoHS Compliant

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

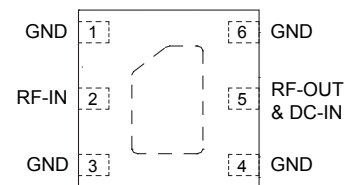
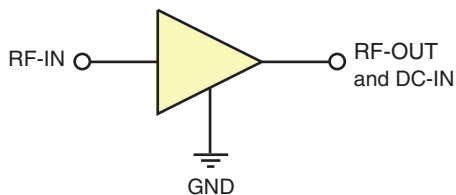
### Typical Applications

- Base station infrastructure
- Portable Wireless
- CATV & DBS
- MMDS & Wireless LAN
- LTE

### General Description

LHY-1H+ (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 LHY-1H+ has well matched input and output over a broad frequency range without the need for external matching components. Lead finish is tin-silver over nickel. It has repeatable performance from lot to lot and is enclosed in a 2 x 2 mm MCLP package for low parasitic interface.

### simplified schematic and pad description



Function	Pad Number	Description
RF-IN	2	RF input pad
RF-OUT and DC-IN	5	RF output and bias pad
GND	1,3,4,6 paddle	Connections to ground.

Electrical Specifications<sup>1</sup> at 25°C, unless noted

Parameter	Condition (GHz)	Vd=5.0V			Vd=4.5V	Vd=4.0V	Units
		Min.	Typ.	Max.	Typ.	Typ.	
Frequency Range		0.05		6	0.05-6	0.05-6	GHz
Gain	0.05	16.0	17.7	19.6	17.5	17.3	dB
	0.8	14.3	15.8	17.5	15.7	15.4	
	2.0	—	14.0	—	13.8	13.6	
	3.0	—	12.4	—	12.2	11.9	
	4.0	9.9	10.9	12.0	10.7	10.4	
	6.0	—	8.5	—	8.3	8.0	
Input Return Loss	0.05	—	11.1	—	11.0	10.6	dB
	0.8	12.5	15.5	—	15.3	14.9	
	2.0	—	10.9	—	10.8	10.6	
	3.0	—	9.2	—	9.1	8.9	
	4.0	—	7.8	—	7.7	7.6	
	6.0	—	6.7	—	6.7	6.7	
Output Return Loss	0.05	—	14.1	—	14.0	13.8	dB
	0.8	16.0	21.0	—	20.6	20.0	
	2.0	—	18.8	—	18.0	16.8	
	3.0	—	17.3	—	16.6	15.4	
	4.0	—	16.2	—	15.4	14.3	
	6.0	—	13.7	—	13.3	12.6	
Reverse Isolation	2.0	—	19.3	—	19.1	18.9	dB
Output Power @1 dB compression	0.05	20.0	22.7	—	21.4	19.9	dBm
	0.8	20.0	22.6	—	21.4	19.9	
	2.0	20.0	22.5	—	21.3	19.8	
	3.0	—	22.8	—	21.5	19.9	
	4.0	—	22.7	—	21.5	20.0	
	6.0	—	22.3	—	21.2	19.7	
Output IP3	0.05	—	40.1	—	37.9	34.6	dBm
	0.8	37.0	40.0	—	39.7	35.1	
	2.0	—	41.0	—	36.3	33.0	
	3.0	—	41.6	—	36.2	32.6	
	4.0	—	40.8	—	35.7	32.2	
	6.0	—	39.4	—	35.4	31.9	
Noise Figure	0.05	—	1.6	—	1.5	1.4	dB
	0.8	—	1.8	—	1.7	1.7	
	2.0	—	2.1	—	2.0	2.0	
	3.0	—	2.3	—	2.3	2.2	
	4.0	—	2.6	—	2.4	2.4	
	6.0	—	3.1	—	3.1	2.8	
Device Operating Voltage		4.8	5.0	5.2	4.5	4.0	V
Device Operating Current		—	144	165	116	88	mA
Device Current Variation vs. Temperature <sup>2</sup>			113		136	152	μA/°C
Device Current Variation vs Voltage			0.059		0.057	0.056	mA/mV
Thermal Resistance, junction-to-ground lead			55		55	55	°C/W

1. Measured on Mini-Circuits Characterization test board TB-621+. See Characterization Test Circuit (Fig. 1)

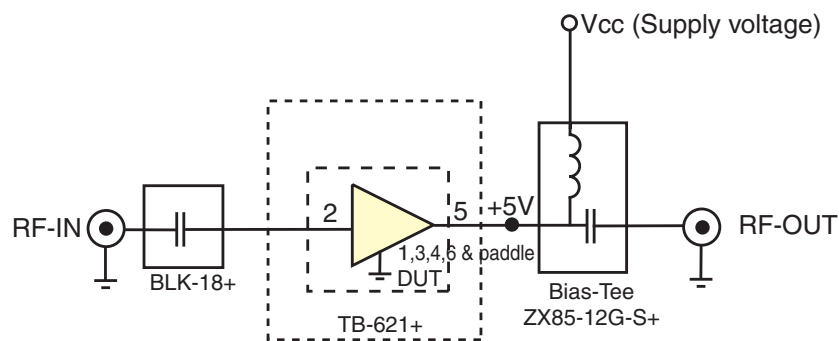
2. (Current at 85°C — Current at -45°C)/130

Absolute Maximum Ratings<sup>3</sup>

Parameter	Ratings
Operating Temperature (ground lead)	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Operating Current at 5V	210 mA
Power Dissipation	1 W
Input Power (CW)	24 dBm
DC Voltage on Pad 5	6 V

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

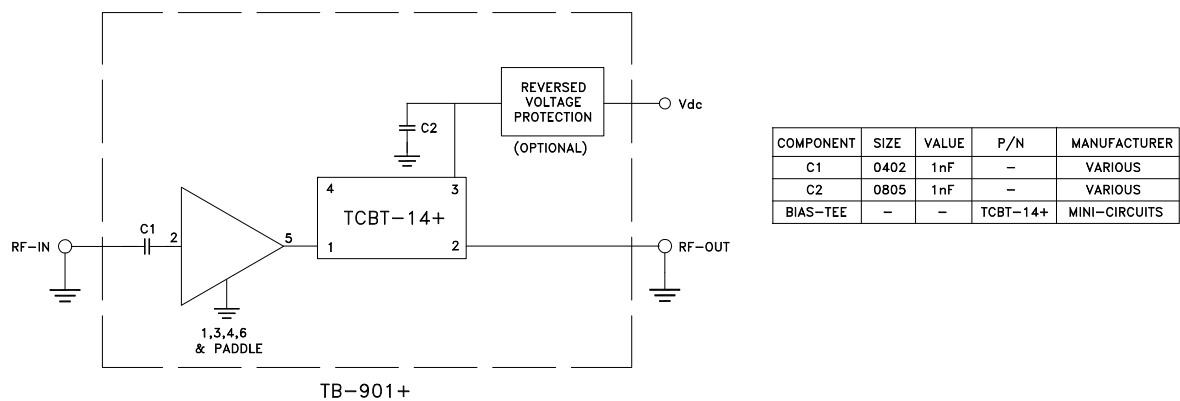
Characterization Test Circuit



**Fig 1. Block Diagram of Test Circuit used for characterization.** (DUT soldered on Mini-Circuits Characterization test board TB-621+) 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, 5 dBm/tone at output.

Recommended Application Circuit



**Fig 2. Test Board includes case, connectors, and components soldered to PCB.**

Product Marking



Marking may contain other features or characters for internal lot control

Additional Detailed Technical Information	
additional information is available on our dash board. To access this information <a href="#">click here</a>	
Performance Data	Data Table
	Swept Graphs
	S-Parameter (S2P Files) Data Set (.zip file)
Case Style	MC1630-1 (2x2 mm MCLP) Plastic package, exposed paddle lead finish: tin-silver over nickel
Tape & Reel	F66
Standard quantities available on reel	7" reels with 20, 50, 100, 200, 500 or 1K devices
Suggested Layout for PCB Design	PL-493
Evaluation Board	TB-901+
Environmental Ratings	ENV08T1

## ESD Rating

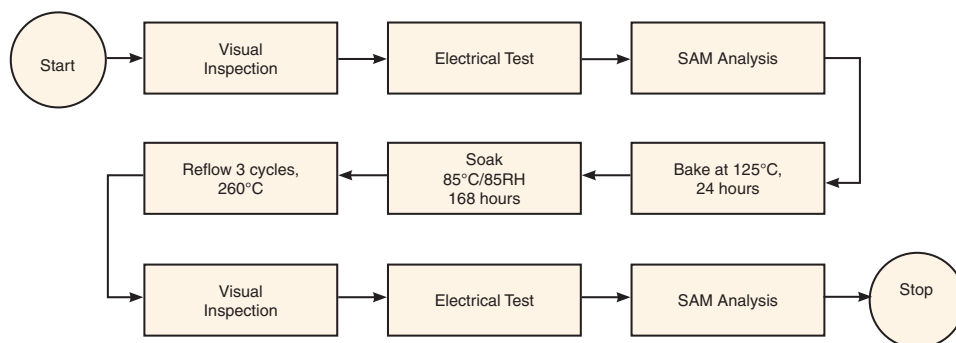
Human Body Model (HBM): Class 1B (500 to <1000V) in accordance with ANSI/ESD STM 5.1 - 2001

Machine Model (MM): Class M1 (>25V) in accordance with ANSI/ESD STM5.2-1999

## MSL Rating

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

## MSL Test Flow Chart



## Additional 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)