

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



CASE STYLE: MC1630-1

## 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:<br>Cellular, PCS, LTE, WiMAX   |
| Extremely High IP3<br>versus DC power Consumption<br>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:<br>2.7 dB typ. up to 4 GHz<br>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   |

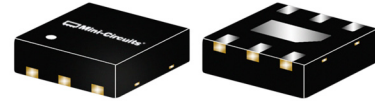
Ultra High Dynamic Range

# Monolithic Amplifier

0.05-6 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



**LHY-1H+**

CASE STYLE: MC1630-1

## Typical Applications

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

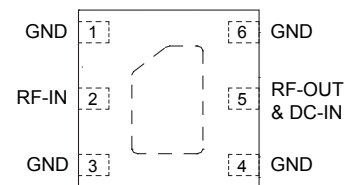
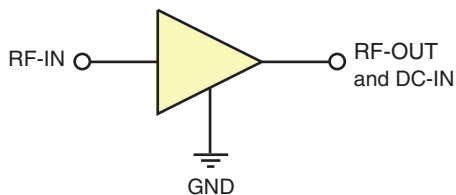
### +RoHS Compliant

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

## 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)

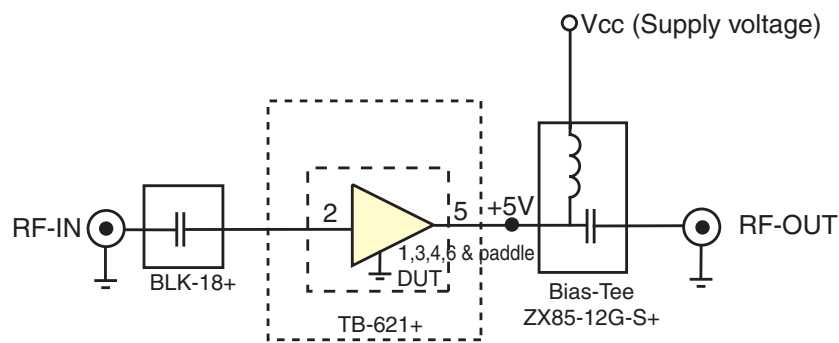
2. (Current at 85°C — Current at -45°C)/130

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.

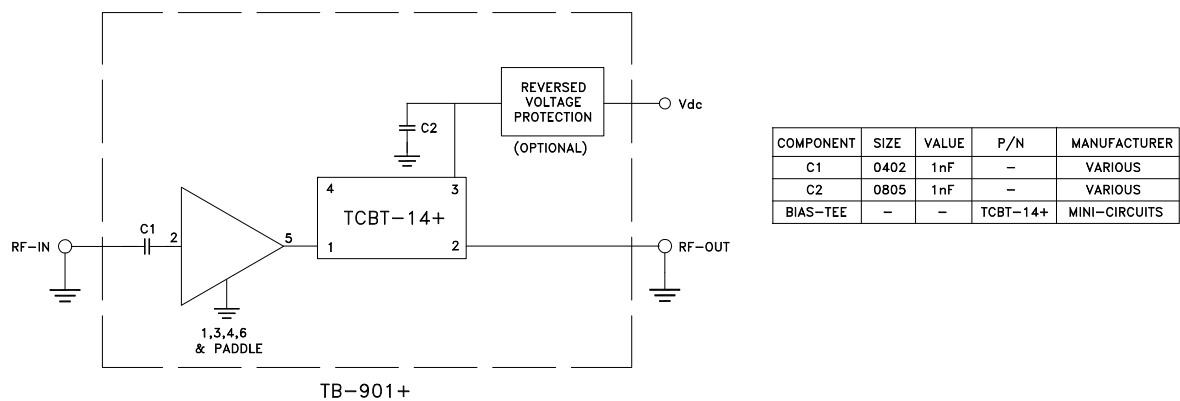
Characterization Test Circuit



**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

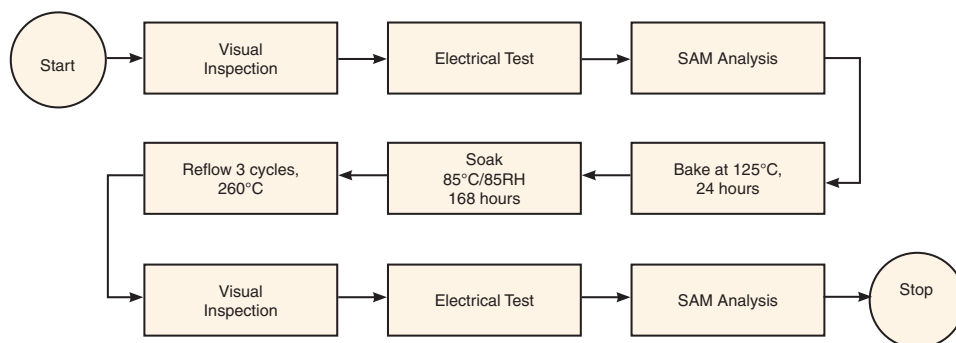
Human Body Model (HBM): Class 1B (500 to <1000V) in accordance with ANSI/ESD STM 5.1 - 2001

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)