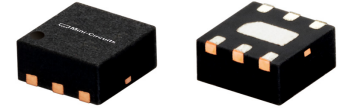


**THE BIG DEAL**

- High Gain, 24.4 dB typ. at 10 MHz
- High P1dB, 20.8 dB typ. at 10 MHz
- High IP3, +38.5 dBm typ. at 10 MHz
- Small size, 2 x 2mm
- Ruggedized design
- Fixed 5V operation
- Unconditionally stable
- Excellent ESD Protection
- Transient protected, US patent 6,943,629



Generic photo used for illustration purposes only

CASE STYLE: MC1630-1

**+RoHS Compliant**

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

**APPLICATIONS**

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

**PRODUCT OVERVIEW**

LHY-84+ (RoHS compliant) is a wideband amplifier offering high dynamic range. Lead finish is matte-tin. It has repeatable performance from lot to lot and is enclosed in a 2mm x 2mm MCLP package. It uses patented Transient Protected Darlington configuration and is fabricated using InGaP HBT technology.

**KEY FEATURES**

| Feature  | Advantages  |
|--|---|
| Broad Band: DC to 7 GHz  | Broadband covering primary wireless communications bands: CATV & DBS, MMDS & Wireless LAN, LTE  |
| Combination of high P1dB & OIP3:<br>P1dB, +20.8 dBm at 10 MHz<br>OIP3, +38.5 dBm at 10 MHz | The LHY-84+ matches industry leading IP3 performance relative to device size and power consumption. IP3 is typically 12-18 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> |
| High Gain, 24 dB typ. at 100 MHz   | Minimizes number of stages, PCB space and cost to achieve high gain.  |
| Small 2 x 2mm, 6-lead MCLP package   | Tiny footprint saves space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB.   |



5 VOLT-SURFACE MOUNT

# Monolithic Amplifier

## LHY-84+

Mini-Circuits

50Ω DC to 7 GHz

### ELECTRICAL SPECIFICATIONS AT 25°C, +5V & 50Ω, UNLESS NOTED OTHERWISE

| Parameter   | Condition (MHz) | Vd=5V <sup>1</sup> |       |       | Vd=5V <sup>2</sup> | Units |
|---|-----------------|--------------------|-------|-------|--------------------|-------|
|   |                 | Min.               | Typ.  | Max.  | Typ.               |       |
| Frequency Range <sup>6</sup>                                    |                 | DC                 |       | 7     | DC-7               | GHz   |
| Gain  | 10              | 22                 | 24.4  | 26.8  | 24.3               | dB    |
|   | 1000            | 20.5               | 22.8  | 25.1  | 22.7               |       |
|   | 2000            | 17.9               | 20.0  | 21.9  | 19.9               |       |
|   | 4000            | 13.4               | 15.7  | 16.4  | 14.5               |       |
|   | 6000            | —                  | 11.8  | —     | 9.9                |       |
|   | 7000            | —                  | 9.8   | —     | 7.9                |       |
| Input Return Loss   | 10              | 18                 | 24    | —     | 22                 | dB    |
|   | 1000            | 13                 | 17    | —     | 18                 |       |
|   | 2000            | 10                 | 15    | —     | 15                 |       |
|   | 4000            | —                  | 15    | —     | 11                 |       |
|   | 6000            | —                  | 14    | —     | 10                 |       |
|   | 7000            | —                  | 12    | —     | 9                  |       |
| Output Return Loss  | 10              | 16                 | 22    | —     | 20                 | dB    |
|   | 1000            | —                  | 9     | —     | 9                  |       |
|   | 2000            | —                  | 6     | —     | 6                  |       |
|   | 4000            | —                  | 6     | —     | 5                  |       |
|   | 6000            | —                  | 6     | —     | 5                  |       |
|   | 7000            | —                  | 5     | —     | 6                  |       |
| Reverse Isolation   | 2000            |                    | 28    |       | 28                 | dB    |
| Output Power @1dB Compression                                   | 10              |                    | 20.8  |       | 20.1               | dBm   |
|   | 1000            |                    | 21.0  |       | 20.7               |       |
|   | 2000            |                    | 21.1  |       | 20.6               |       |
|   | 4000            |                    | 19.6  |       | 19.0               |       |
|   | 6000            |                    | 16.8  |       | 15.5               |       |
|   | 7000            |                    | 15.5  |       | 14.0               |       |
| Output IP <sub>3</sub> <sup>3</sup>                             | 10              | 32.3               | 38.5  | —     | 36.7               | dBm   |
|   | 1000            | 30.6               | 34.4  | —     | 34.5               |       |
|   | 2000            | 28.7               | 33.1  | —     | 33.5               |       |
|   | 4000            | —                  | 31.1  | —     | 30.8               |       |
|   | 6000            | —                  | 29.7  | —     | 27.7               |       |
|   | 7000            | —                  | 27.9  | —     | 26.8               |       |
| Noise Figure  | 10              |                    | 5.1   |       | 5.1                | dB    |
|   | 1000            |                    | 5.2   |       | 5.1                |       |
|   | 2000            |                    | 5.4   |       | 5.5                |       |
|   | 4000            |                    | 5.6   |       | 5.9                |       |
|   | 6000            |                    | 6.1   |       | 6.4                |       |
|   | 7000            |                    | 6.5   |       | 6.9                |       |
| Device Operating Voltage  |                 | +4.75              | +5.0  | +5.25 | +5.0               | V     |
| Device Operating Current  |                 |                    | 111   | 130   | 106                | mA    |
| Device Current Variation vs. Temperature <sup>4</sup>           |                 |                    | 78    |       | 78                 | μA/°C |
| Device Current Variation vs Voltage <sup>5</sup>                |                 |                    | 0.057 |       | 0.055              | mA/mV |
| Thermal Resistance, Junction-to-Ground Lead at 85°C Stage Temp. |                 |                    | 64    |       | 64                 | °C/W  |

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

2. Measured on Mini-Circuits Application test board TB-1064+. See Characterization Test Circuit (Fig. 2)

3. Tested at P<sub>out</sub>=0dBm / tone.

4. (Current at 85°C – Current at -45°C)/130

5. (Current at +5.25V-current - Current at +4.75V)/1000

6. Guaranteed specifications DC-7 GHz. Low frequency cut-off determined by external coupling capacitors and external bias choke.





5 VOLT-SURFACE MOUNT

# Monolithic Amplifier

## LHY-84+

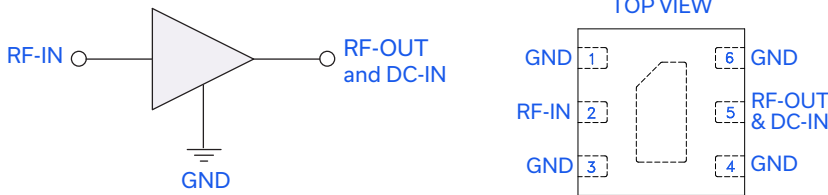
50Ω DC to 7 GHz

### MAXIMUM RATINGS<sup>7</sup>

| Parameter                           | Ratings        |
|-------------------------------------|----------------|
| Operating Temperature (ground lead) | -40°C to 85°C  |
| Storage Temperature                 | -65°C to 150°C |
| Power Dissipation                   | 1W             |
| Input Power (CW)                    | +13 dBm        |
| DC Voltage on Pad 5                 | +5.8V          |

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

### SIMPLIFIED SCHEMATIC AND PIN DESCRIPTION



| Function         | Pin Number       | Description   |
|------------------|------------------|---|
| RF-IN            | 2                | RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation  |
| RF-OUT and DC-IN | 5                | RF output and bias pin. DC voltage is present on this pin; therefore a DC blocking capacitor is necessary for proper operation. An RF choke is needed to feed DC bias without loss of RF signal due to the bias connection, as shown in "Recommended Application Circuit", Fig. 2 |
| GND              | 1,3,4,6 & paddle | Connections to ground. Use via holes as shown in "Suggested Layout for PCB Design" to reduce ground path inductance for best performance.   |



5 VOLT-SURFACE MOUNT

# Monolithic Amplifier

## LHY-84+

50Ω DC to 7 GHz

### CHARACTERIZATION TEST CIRCUIT

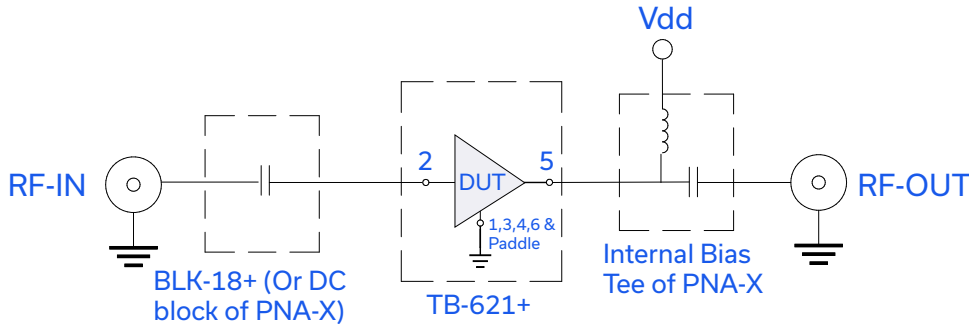


Fig 1. Characterization Circuit

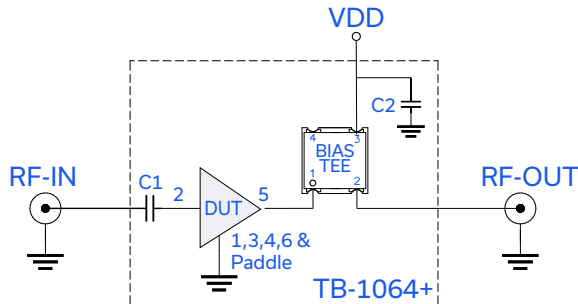
Note: This block diagram is used for characterization. (DUT soldered on Mini-Circuits Characterization test board TB-621+)

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, 0 dBm/tone at output.

### RECOMMENDED APPLICATION CIRCUIT



| Component | P/N                | Supplier | Value  | Size        |
|-----------|--------------------|----------|--------|-------------|
| DUT       | LHY-84+            | MCL      | --     | 2x2 mm      |
| C1        | LBB0402X104MGT1C8  | Presidio | 0.1uF  | 0402        |
| C2        | GRM188R71H103KA01D | Murate   | 0.01uF | 0603        |
| Bias-Tee  | TCBT-123+          | MCL      | --     | 0.15"x0.15" |

Fig 2. Application Circuit

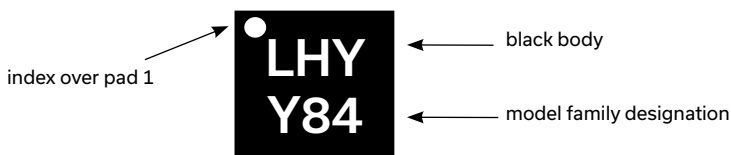
Note: (DUT soldered on Mini-Circuits Application test board TB-1064+). TB-1064+ uses a three layer PCB, see drawing.

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.

### PRODUCT MARKING



Marking may contain other features or characters for internal lot control





5 VOLT-SURFACE MOUNT

# Monolithic Amplifier

## LHY-84+

Mini-Circuits

50Ω DC to 7 GHz

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

|  |  |
|--|--|
| Performance Data                                     | Data Table<br>Swept Graphs<br>S-Parameter (S2P Files) Data Set (.zip file) |
| Case Style   | MC1630-1 Plastic package, exposed paddle<br>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-593   |
| Evaluation Board                                     | TB-1064+   |
| Environmental Ratings                                | ENV08T1  |

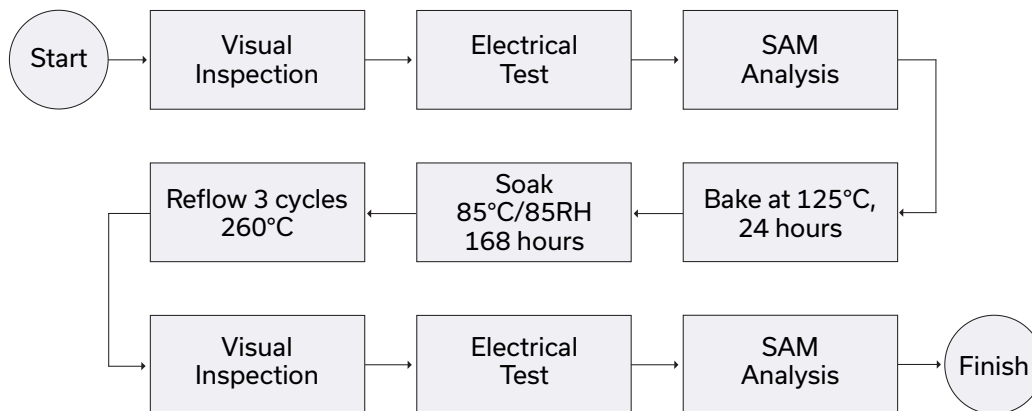
### ESD RATING

Human Body Model (HBM): Class 1C (Pass 1000V) 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/terms/viewterm.html](http://www.minicircuits.com/terms/viewterm.html)

