



LOW CURRENT, WIDEBAND, FLAT GAIN

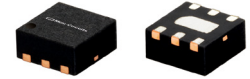
# Monolithic Amplifier

## EHA-163L+

50Ω DC to 16 GHz

### THE BIG DEAL

- Super Wideband, DC to 16 GHz
- Excellent Flat Gain,  $\pm 0.75$  dB Up to 12 GHz
- Low Current Consumption, 20 mA
- Good Input & Output Return Loss ( $>10$  dB)
- Repeatable Performance (HBT Process)
- Small Package (2 x 2 mm 6L MCLP)



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

- Instrumentation
- Cable Infrastructure
- 5G

### PRODUCT OVERVIEW

The EHA-163L+ is a low current, wideband gain block that operates up to 16 GHz fabricated using highly reliable HBT process. This low current consumption Darlington pair amplifier delivers excellent gain flatness and good return loss across a wide bandwidth, without the need of an external matching network. It has highly repeatable performance from lot to lot and it is enclosed in a 2 x 2 mm 6-lead package.

### KEY FEATURES

| Feature   | Advantages  |
|---|---|
| Super Wideband, DC to 16 GHz                        | General purpose wideband amplifier is suitable for wideband and multi-band applications.  |
| Low Current Consumption, 20 mA                      | Low current consumption is ideal for use in power sensitive applications such as portable test equipment and handheld radios.                                 |
| Excellent Gain Flatness, $\pm 0.75$ dB Up to 12 GHz | As a desirable characteristic of a wideband amplifier, excellent gain flatness allows amplification of a signal without changing the waveform in time domain. |
| No External Matching Component Required             | EHA-163L+ provides input & output return loss of 10 dB up to 16 GHz without the need for any external matching components.                                    |

REV. B  
ECO-025003  
EHA-163L+  
MCL NY  
250326





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### ELECTRICAL SPECIFICATIONS AT +25°C, V<sub>CC</sub>= +5 V, R=50Ω UNLESS NOTED OTHERWISE

| Parameter  | Condition (MHz) | V <sub>CC</sub> = +5 V <sup>1</sup> |        |       | V <sub>CC</sub> = +5 V <sup>2</sup> | Units |
|--|-----------------|-------------------------------------|--------|-------|-------------------------------------|-------|
|  |                 | Min.                                | Typ.   | Max.  | Typ.                                |       |
| Frequency Range <sup>3</sup>                                     |                 | 10                                  |        | 16000 | 10-16000                            | MHz   |
| Gain   | 10              |                                     | 15.7   |       | 15.3                                | dB    |
|  | 5000            |                                     | 15.6   |       | 14.8                                |       |
|  | 8000            | 13.1                                | 15.3   | 16.0  | 14.2                                |       |
|  | 10000           |                                     | 14.9   |       | 13.5                                |       |
|  | 12000           |                                     | 14.2   |       | 13.1                                |       |
|  | 16000           |                                     | 11.6   |       | 8.9                                 |       |
| Input Return Loss  | 10              |                                     | 18     |       | 17                                  | dB    |
|  | 5000            |                                     | 13     |       | 18                                  |       |
|  | 8000            |                                     | 12     |       | 15                                  |       |
|  | 10000           |                                     | 12     |       | 15                                  |       |
|  | 12000           |                                     | 11     |       | 15                                  |       |
|  | 16000           |                                     | 16     |       | 12                                  |       |
| Output Return Loss   | 10              |                                     | 14     |       | 14                                  | dB    |
|  | 5000            |                                     | 13     |       | 14                                  |       |
|  | 8000            |                                     | 13     |       | 16                                  |       |
|  | 10000           |                                     | 14     |       | 16                                  |       |
|  | 12000           |                                     | 13     |       | 11                                  |       |
|  | 16000           |                                     | 15     |       | 8                                   |       |
| Reverse Isolation  | 8000            |                                     | 19     |       | 20                                  | dB    |
| Output Power @ 1 dB Compression                                  | 10              |                                     | +7.7   |       | +6.2                                | dBm   |
|  | 5000            |                                     | +6.0   |       | +5.2                                |       |
|  | 8000            |                                     | +6.5   |       | +6.8                                |       |
|  | 10000           |                                     | +4.4   |       | +3.9                                |       |
|  | 12000           |                                     | +2.7   |       | +2.1                                |       |
|  | 16000           |                                     | +2.0   |       | +0.3                                |       |
| Output IP <sub>3</sub> <sup>4</sup>                              | 10              |                                     | +21.0  |       | +19                                 | dBm   |
|  | 5000            |                                     | +17.3  |       | +17.8                               |       |
|  | 8000            |                                     | +15.6  |       | +16.2                               |       |
|  | 10000           |                                     | +13.2  |       | +13.3                               |       |
|  | 12000           |                                     | +12.0  |       | +11.6                               |       |
|  | 16000           |                                     | +11.8  |       | +10.7                               |       |
| Noise Figure   | 10              |                                     | 5.2    |       | 5.2                                 | dB    |
|  | 5000            |                                     | 5.0    |       | 5.0                                 |       |
|  | 8000            |                                     | 5.2    |       | 5.2                                 |       |
|  | 10000           |                                     | 5.5    |       | 5.3                                 |       |
|  | 12000           |                                     | 5.4    |       | 5.3                                 |       |
|  | 16000           |                                     | 5.2    |       | 6.2                                 |       |
| DC Supply (V <sub>CC</sub> )                                     |                 | +4.75                               | +5     | +5.25 | +5                                  | V     |
| Device Operating Current   |                 |                                     | 20.9   | 24    | 19.3                                | mA    |
| Device Current Variation vs. Temperature <sup>5</sup>            |                 |                                     | 59     |       | 59                                  | μA/°C |
| Device Current Variation vs. Voltage <sup>6</sup>                |                 |                                     | 0.0178 |       | 0.0178                              | mA/mV |
| Thermal Resistance, Junction-to-Ground Lead at +85°C Stage Temp. |                 |                                     | 349    |       | 349                                 | °C/W  |

1. Measured on Mini-Circuits Characterization test circuit TB-883-163L+. See Characterization Test Circuit (Fig. 1).

2. Measured on Mini-Circuits Recommended Application Circuit TB-995+. See Application Test Circuit (Fig. 2).

3. Low frequency cut-off determined by external coupling capacitors & RF choke.

4. Tested at P<sub>OUT</sub>=5 dBm/1000.

5. (Current at +85°C - Current at -45°C)/130

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



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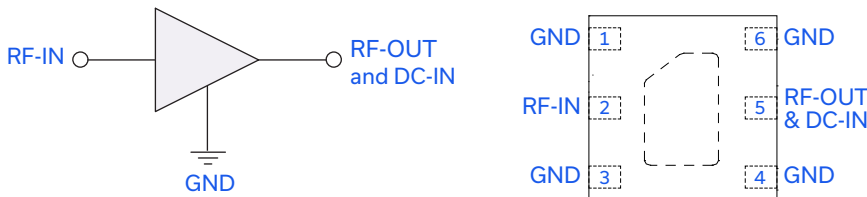
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### ABSOLUTE MAXIMUM RATINGS<sup>7</sup>

| Parameter                           | Ratings   |
|-------------------------------------|---|
| Operating Temperature (Ground Lead) | -40°C to +85°C                                  |
| Storage Temperature                 | -65°C to +150°C                                 |
| Junction Temperature                | +150°C  |
| Power Dissipation                   | 0.2 W   |
| Input Power (CW)                    | +22 dBm (5 minutes max.)<br>+8 dBm (continuous) |
| V <sub>CC</sub> (Supply Voltage)    | +6 V  |

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 PAD DESCRIPTION



| Function         | Pad Number | Description            |
|------------------|------------|------------------------|
| RF-IN            | 2          | RF input               |
| RF-OUT and DC-IN | 5          | RF output and DC input |
| GND              | Paddle     | Ground                 |
| NC               | 1,3,4,6    | No connections         |

### CHARACTERIZATION TEST CIRCUIT

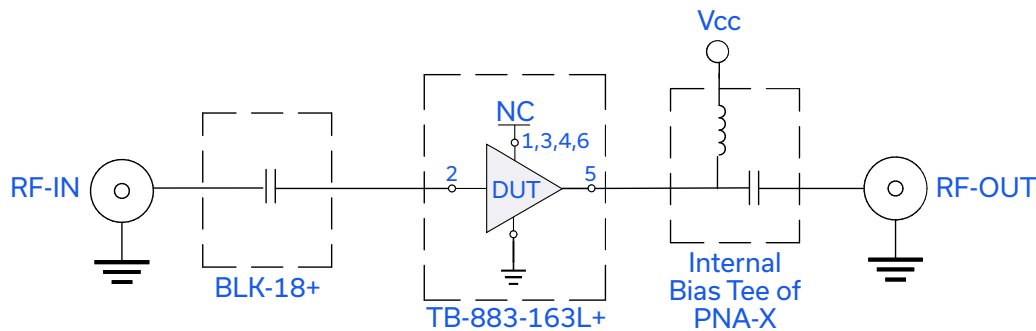


Fig 1. Characterization Circuit

Note: This block diagram is used for characterization. (DUT soldered on Mini-Circuits Characterization test board TB-883-163L+) Gain, Return Loss, Output Power at 1 dB Compression (P1dB), Output IP3 (OIP3) and Noise Figure measured using Agilent's N5242A PNA-X microwave network analyzer.

Conditions:

1. Gain and Return Loss: P<sub>IN</sub> = -25 dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, -5 dBm/tone at output.





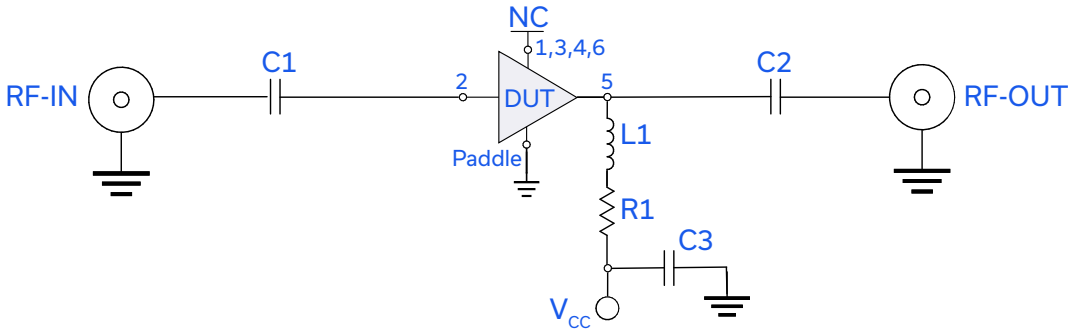
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### APPLICATION TEST CIRCUIT



| Component | P/N                | Supplier                | Value     | Size        |
|-----------|--------------------|-------------------------|-----------|-------------|
| DUT       | EHA-163L+          | MCL                     | NA        | 2 mm x 2 mm |
| C1,C2     | LBB0402X104MGT1C8  | Presidio Components Inc | 0.1 μF    | 0402        |
| C3        | GRM155R71E103KA01D | Murata                  | 0.01 μF   | 0402        |
| R1        | RK73H1JTDD4R99F    | KOA                     | 49.9 ohms | 0603        |
| L1        | BCR-652JLC         | Coilcraft               | 6.5 μH    | 4422        |

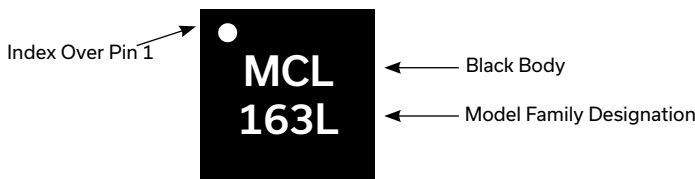
Fig 2. Application Test Circuit

Note: (DUT soldered on Mini-Circuits Application test board TB-995+) Gain, Return Loss, Output Power at 1 dB Compression (P1dB), Output IP3 (OIP3) and Noise Figure measured using Agilent's N5242A PNA-X microwave network analyzer.

Conditions:

1. Gain and Return Loss:  $P_{IN} = -25$  dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, -5 dBm/tone at output.

### PRODUCT MARKING



Marking may contain other features or characters for internal lot control.





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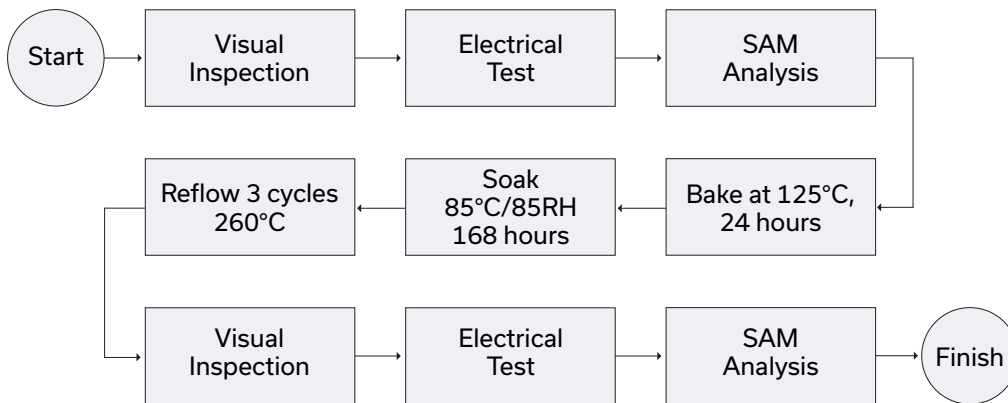
ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASHBOARD. TO ACCESS [CLICK HERE](#)

|  |  |
|--|--|
| Performance Data                                     | Data Table<br>Swept Graphs<br>S-Parameter (S2P Files) Data Set (.zip file) |
| Case Style   | MC1630-1 Plastic package, exposed paddle, lead finish: Matte-Tin           |
| Tape & Reel<br>Standard Quantities Available on Reel | F66<br>7" Reels with 20, 50, 100, 200, 500, 1000, 2000, or 3000 devices    |
| Suggested Layout for PCB Design                      | PL-544   |
| Evaluation Board                                     | TB-995+  |
| Environmental Ratings                                | ENV08T1  |

### ESD RATING

Human Body Model (HBM): Class 1A (Pass 250 V) in accordance with ANSI/ESD STM 5.1 - 2001

### 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.
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