COAXIAL

# Low Phase Noise Amplifier ZX60-123LPN+

50Ω 0.05 to 10 GHz SMA Female

## THE BIG DEAL

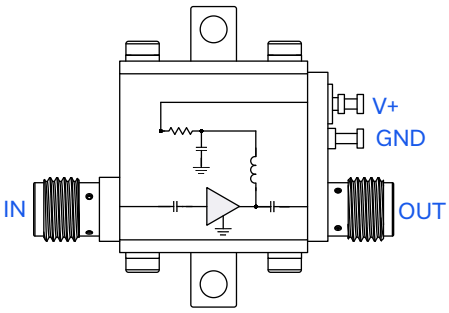
- Ultra Broadband Performance
- Gain, 16 dB Typ.
- Excellent Gain Flatness, ±0.9 dB, 0.05 to 6 GHz
- Excellent Return Loss, 20 dB Typ., 2 GHz
- Low Additive Phase Noise, Typically -168 dBc/Hz at 10 kHz
- Protected by US Patent 6,790,049

*Generic photo used for illustration purposes only*

## APPLICATIONS

- Low Phase Noise Applications
- Base Station Infrastructure
- Test Instruments
- MMDS & Wireless LAN
- Satellite Communication
- Avionics

## FUNCTIONAL DIAGRAM




## PRODUCT OVERVIEW

Mini-Circuits' ZX60-123LPN+ is an advanced ultra-wideband amplifier fabricated using GaAs HBT technology that provides extremely low additive phase noise and offers excellent gain flatness over a broad frequency range. In addition, the ZX60-123LPN+ has good input and output return loss over this frequency range without the need for external matching components. Housed in a rugged, cost effective unibody chassis, this amplifier supports a wide variety of applications requiring moderate power output, low distortion and 50Ω matched input/output ports.

## KEY FEATURES

| Feature | Advantages |
|---|---|
| Ultra Broadband, 0.05 to 10 GHz | Broadband covering primary wireless communications bands: Cellular, PCS, LTE, WiMAX in a single amplifier. |
| Ultra Flat Gain, ±0.9 dB Typ: 0.05 to 6 GHz | Ultra Flat Gain, eliminates need for compensation networks to achieve published results. |
| Low Additive Phase Noise | Extremely low additive phase noise of -168 dBc/Hz typ. at 10 kHz offset from 2 GHz carrier, with +1 dBm of input power. |
| Excellent Input and Output Return Loss | ZX60-123LPN+ provides good Input and Output Return Loss of 12 to 28 dB over 0.05 to 6 GHz without the need for any external matching components. |
| Unconditionally Stable | Capable to operate to a wide range of source and load impedances. |
| Very Small Size, 0.75x0.75" | The unique unibody size and construction enable the ZX60-123LPN+ to be used in extremely compact connectorized applications. |
| Rugged, Unibody Construction | Mini-Circuits unibody construction integrates the RF connector into the case body, providing high reliability and excellent survivability in critical applications. |

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## ELECTRICAL SPECIFICATIONS AT +25 °C

| Parameter | Frequency (GHz) | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Frequency Range | | 0.05 | | 10 | GHz |
| Gain | 0.05 | 15.2 | 16.2 | | dB |
| | 2.0 | | 16.5 | | |
| | 6.0 | | 15.5 | | |
| | 8.0 | | 14.5 | | |
| | 10.0 | | 11.5 | | |
| Input Return Loss | 0.05 | 15.0 | 13.0 | | dB |
| | 2.0 | | 20.2 | | |
| | 6.0 | | 18.4 | | |
| | 8.0 | | 10.5 | | |
| | 10.0 | | 7.2 | | |
| Output Return Loss | 0.05 | | 15.0 | | dB |
| | 2.0 | | 17.6 | | |
| | 6.0 | | 20.5 | | |
| | 8.0 | | 6.50 | | |
| | 10.0 | | 10.5 | | |
| Output Power at 1 dB Compression (P1dB) | 0.05 | | +16.9 | | dBm |
| | 2.0 | | +16.2 | | |
| | 6.0 | | +13.5 | | |
| | 8.0 | | +9.6 | | |
| | 10.0 | | +6.7 | | |
| Output Third Order Intercept Point (OIP3) | 0.05 | | +19.2 | | dBm |
| | 2.0 | | +29.9 | | |
| | 6.0 | | +23.3 | | |
| | 8.0 | | +21.0 | | |
| | 10.0 | | +16.8 | | |
| Directivity (Isolation - Gain) | 0.05 | | 4.7 | | dB |
| | 6.0 | | 6.2 | | |
| | 10.0 | | 11.9 | | |
| Noise Figure | 0.05 | | 5.8 | | dB |
| | 2.0 | | 3.9 | | |
| | 6.0 | | 4.3 | | |
| | 8.0 | | 4.5 | | |
| | 10.0 | | 5.4 | | |
| Additive Phase Noise[1] | 2.0 | | -168.0 | | dBc/Hz |
| DC Supply Voltage | | +4.8 | +5.0 | +5.2 | V |
| DC Current | | | 48 | 65 | mA |

1. Input power +1 dBm, 2 GHz, 10 kHz offset.

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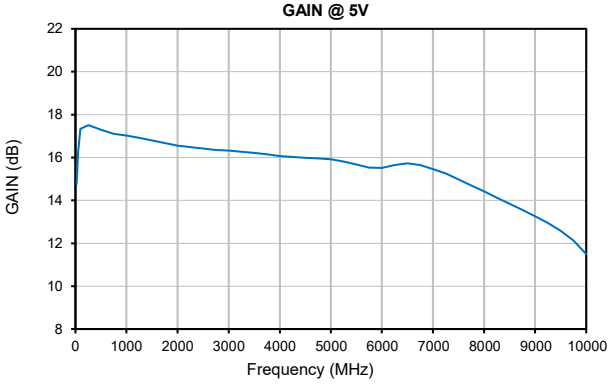
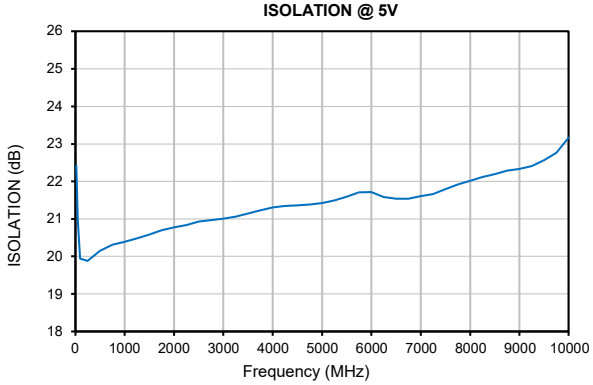
## TYPICAL PERFORMANCE GRAPHS

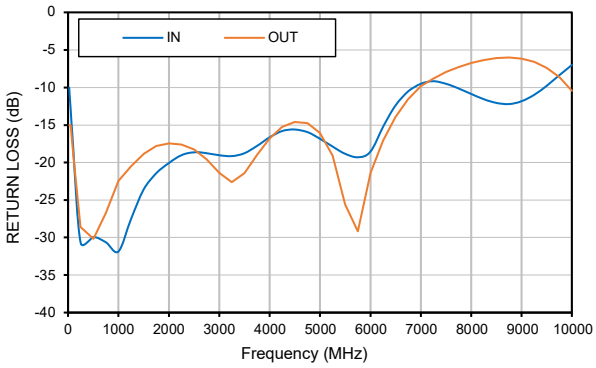
GAIN @ 5V



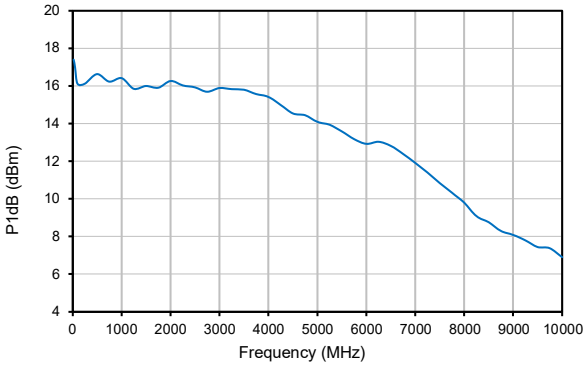

ISOLATION @ 5V



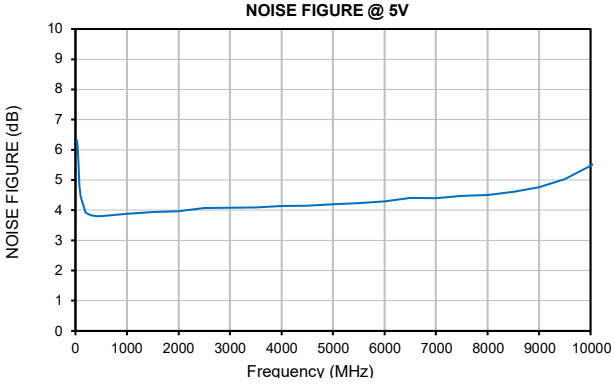

RETURN LOSS @ 5V



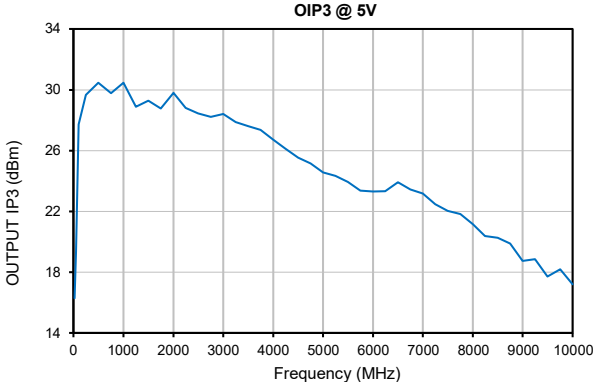

P1dB @ 5V




NOISE FIGURE @ 5V

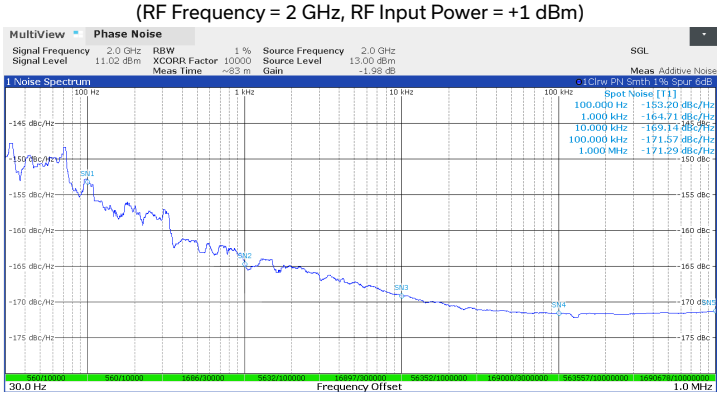



OIP3 @ 5V




## ADDITIVE PHASE NOISE vs. OFFSET FREQUENCY

(RF Frequency = 2 GHz, RF Input Power = +1 dBm)



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## ABSOLUTE MAXIMUM RATINGS

| Parameter | Ratings |
|---|---|
| Operating Temperature (Ground Lead) | -40 °C to +85 °C |
| Storage Temperature | -65 °C to +150 °C |
| Total Power Dissipation | 0.34 W |
| RF Input Power (CW) | +28 dBm (5 minutes max.)<br>+11 dBm (continuous) |
| DC Voltage | +6 V[2] |
| Operating Current at | +5.2 V (V+) 65 mA |

2. No protection against application of reverse voltage.
Permanent damage may occur if any of these limits are exceeded.

## DETERMINING MAXIMUM THERMAL RESISTANCE OF USERS' EXTERNAL HEATSINK

$$\textit{MAXIMUM THERMAL RESISTANCE} = \frac{\textit{MAXIMUM OPERATING CASE TEMP} - \textit{MAXIMUM USER AMBIENT TEMP}}{\textit{POWER DISSIPATION}}$$

| | |
|---|---|
| **Example:** | MAXIMUM OPERATING CASE TEMP = +50 °C (CHECK MAXIMUM RATINGS TABLE FOR THIS VALUE)<br>MAXIMUM USER AMBIENT TEMP = +30 °C (USER DEFINED)<br>POWER DISSIPATION = 10 WATTS (CHECK MAXIMUM RATINGS TABLE FOR THIS VALUE)<br>THEN MAXIMUM ALLOWABLE THERMAL RESISTANCE = 2 °C/W |

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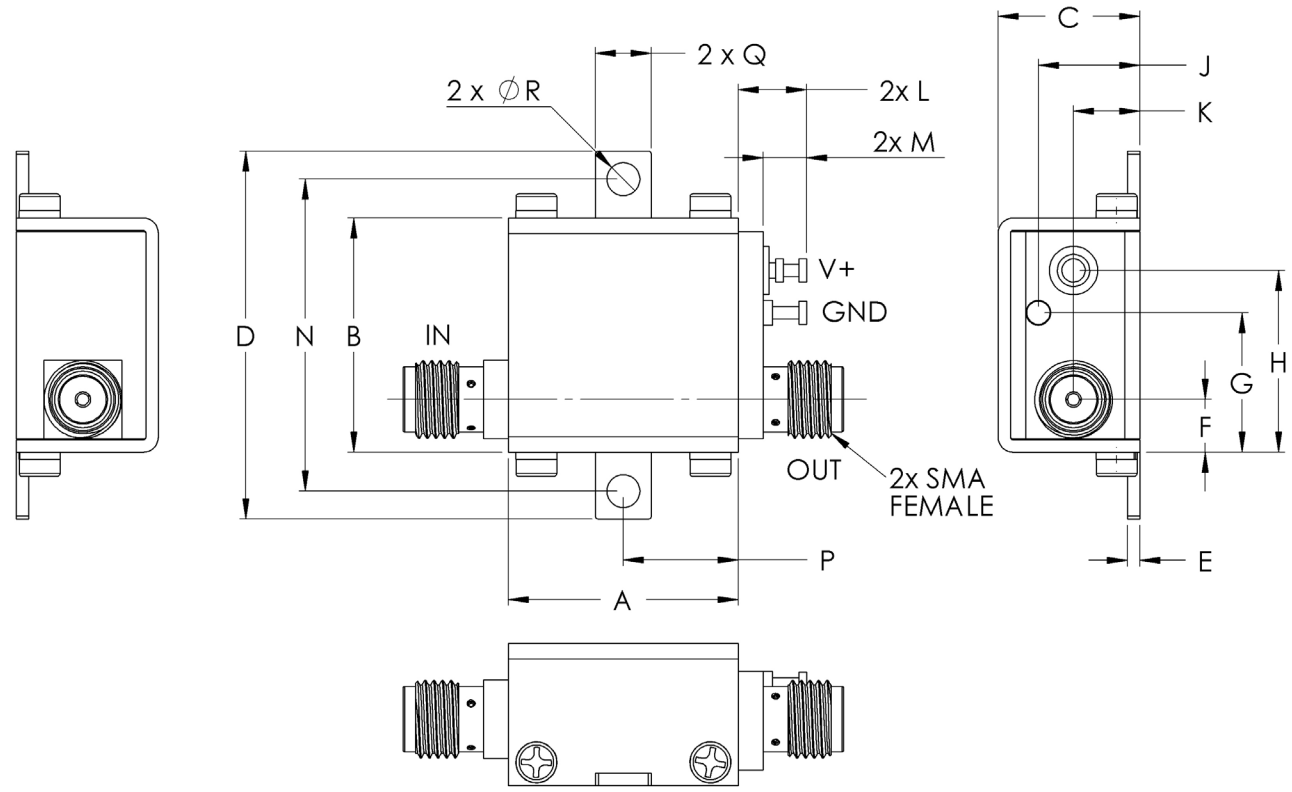
## OUTLINE DRAWING




⚠ NOTE: When soldering the DC connections, caution must be used to avoid overheating the DC terminal. See Application Note AN-40-010.

## OUTLINE DIMENSIONS (Inches / mm)

| A | B | C | D | E | F | G | H | J | K | L | M | N | P | Q | R | wt |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .74 | .75 | .46 | 1.18 | .04 | .17 | .45 | .59 | .33 | .21 | .22 | .14 | 1.00 | .37 | .18 | .106 | grams |
| 18.80 | 19.1 | 11.68 | 30.0 | 1.02 | 4.32 | 11.4 | 14.99 | 8.38 | 5.33 | 5.59 | 3.56 | 25.40 | 9.40 | 4.57 | 2.69 | 23.0 |

# Low Phase Noise Amplifier ZX60-123LPN+

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## ADDITIONAL INFORMATION IS AVAILABLE ON OUR DASHBOARD.

| | |
|---|---|
| **Performance Data & Graphs** | Data<br>Graphs<br>S-Parameter (S2P Files) Data Set (.zip file) |
| **RoHS Status** | Compliant |
| **Environmental Ratings** | ENV23T10 |

## ORDERING INFORMATION

| | |
|---|---|
| **Model No. Link** | ZX60-123LPN+ |
| **Case Style** | GC957 |
| **Connector** | IN SMA female / OUT SMA female |

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