WIDEBAND

# Low Noise Amplifier ZX60-14LN-S+

50Ω 0.05 to 10 GHz SMA Female

## THE BIG DEAL

- Low NF, <2dB Typ. to 7.5 GHz
- Very Flat Gain, 22 ± 0.7 dB Typ. to 8 GHz
- Wideband, 50 MHz to 10 GHz
- Single +6V Supply

*Generic photo used for illustration purposes only*

| | |
|---|---|
| **Model No.** | ZX60-14LN-S+ |
| **Case Style** | GC957 |
| **Connectors** | SMA Female |

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

## APPLICATIONS

- Broadband Telecom
- LTE & 5G MIMO Infrastructure
- WiFi6E, IoT, & UWB
- L, S, C-Band Radar and SATCOM
- Test & Measurement Equipment
- R&D Lab, Production, and OTA Test Systems
- Communications and Radar Defense Systems

## PRODUCT OVERVIEW

Mini-Circuits' ZX60-14LN-S+ is a low-noise amplifier offering industry-leading performance over its full frequency range from 50 MHz to 10 GHz. The internal MMIC amplifier utilizes E-pHEMT technology to achieve excellent noise figure performance in a unique configuration enabling the combination of very wide band performance and flat gain. This design operates on a single 6V supply.

## KEY FEATURES

| Feature | Advantages |
|---|---|
| Ultra-wideband: 50 MHz – 10 GHz | Ideal for a wide range of transmitter applications including military, commercial wireless, and instrumentation. |
| Very flat gain | Ideal for broadband or multi-band applications. Just one, cost-efficient model required for multiple frequency usage. |
| High OIP3, +32 dBm typ., up to 10 GHz | Provides enhanced linearity over a broad frequency range. |
| High gain, 22 dB typ. | Reduces the number of gain stages, lowering component count and overall system cost. |
| Rugged unibody construction | Mini-Circuits' unibody construction integrates the RF connectors into the case body, providing high reliability and excellent survivability in critical applications. |

REV. OR
ECO-016347
ZX60-14LN-S+
MM/CP/AM
230105

## ELECTRICAL SPECIFICATIONS AT 25°C, Zo =50Ω AND +6V, UNLESS NOTED OTHERWISE

| Parameter | Condition (GHz) | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Frequency Range | | 0.05 | | 10 | GHz |
| Gain | 0.05 | 21.0 | 22.0 | 23.9 | dB |
| | 0.8 | | 22.5 | | |
| | 2.0 | | 22.2 | | |
| | 3.2 | | 22.0 | | |
| | 4.0 | | 21.9 | | |
| | 5.2 | | 21.8 | | |
| | 8.0 | | 20.6 | | |
| | 10.0 | | 18.2 | | |
| Gain Flatness | 0.05-8.0 | | ±1.0 | | dB |
| | 0.05-10.0 | | ±2.2 | | |
| Input Return Loss | 0.05 | | 22.2 | | dB |
| | 0.8 | | 24.0 | | |
| | 2.0 | | 17.4 | | |
| | 3.2 | | 14.1 | | |
| | 4.0 | | 13.2 | | |
| | 5.2 | | 14.5 | | |
| | 8.0 | | 18.4 | | |
| | 10.0 | | 13.7 | | |
| Output Return Loss | 0.05 | | 16.2 | | dB |
| | 0.8 | | 20.4 | | |
| | 2.0 | | 24.5 | | |
| | 3.2 | | 20.5 | | |
| | 4.0 | | 19.1 | | |
| | 5.2 | | 21.2 | | |
| | 8.0 | | 16.4 | | |
| | 10.0 | | 24.6 | | |
| Output Power at 1dB Compression | 0.05 | | 21.7 | | dBm |
| | 0.8 | | 22.8 | | |
| | 2.0 | | 22.8 | | |
| | 3.2 | | 21.3 | | |
| | 4.0 | | 21.6 | | |
| | 5.2 | | 21.3 | | |
| | 8.0 | | 19.6 | | |
| | 10.0 | | 15.9 | | |
| Output IP3 | 0.5 | | 33.1 | | dBm |
| | 2.0 | | 32.3 | | |
| | 4.0 | | 30.8 | | |
| | 8.0 | | 32.8 | | |
| | 10.0 | | 33.5 | | |
| Noise Figure | 0.05 | | 1.81 | | dB |
| | 0.8 | | 1.07 | | |
| | 2.0 | | 1.22 | | |
| | 3.2 | | 1.32 | | |
| | 4.0 | | 1.40 | | |
| | 5.2 | | 1.59 | | |
| | 8.0 | | 2.20 | | |
| | 10.0 | | 3.62 | | |
| Device Operating Voltage ($V_{DD}$) | — | 5.75 | 6.0 | 6.25 | V |
| Device Operating Current ($I_{DD}$) | — | — | 72 | 96 | mA |

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# Low Noise Amplifier ZX60-14LN-S+

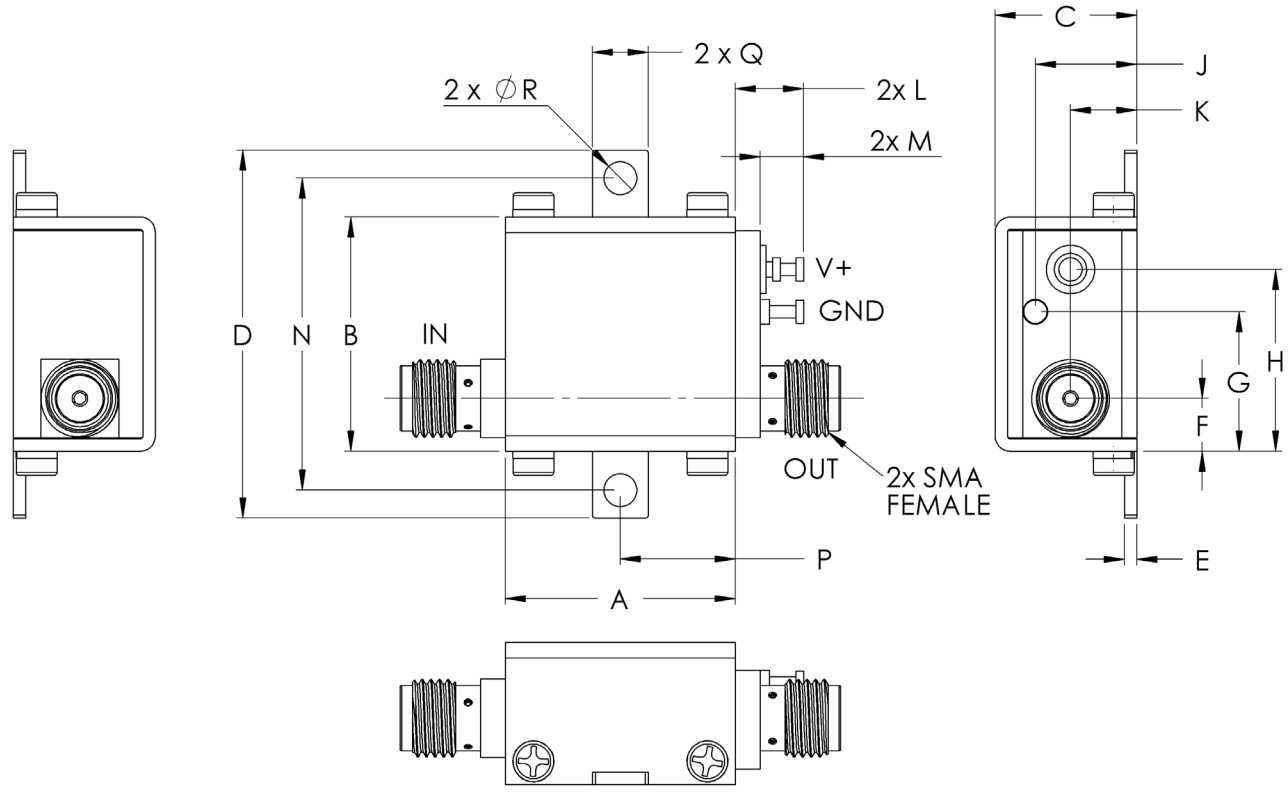
50Ω 0.05 to 10 GHz SMA Female

## ABSOLUTE MAXIMUM RATINGS[1]

| Parameter | Ratings |
|---|---|
| Operating Temperature (Baseplate) | -40°C to 85°C |
| Storage Temperature | -55°C to 100°C |
| Total Power Dissipation | 0.6 W |
| Input Power | +25 dBm (5 minutes max.)<br>+12 dBm (continuous) |
| DC Voltage Vdd | +7V |

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

## 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 Noise Amplifier ZX60-14LN-S+

50Ω 0.05 to 10 GHz SMA Female

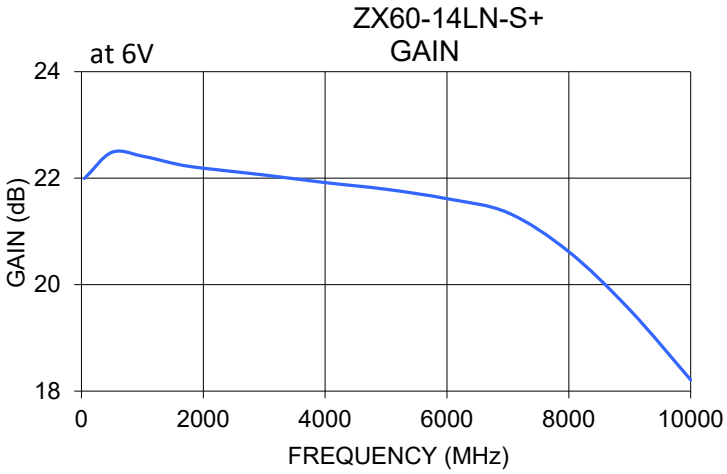
## TYPICAL PERFORMANCE DATA

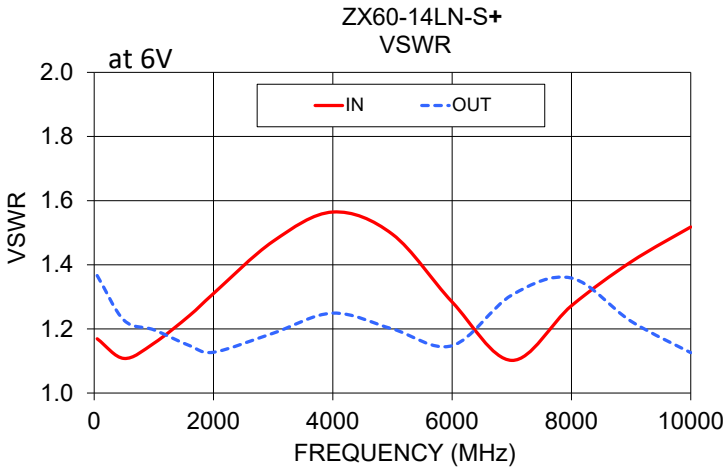
| Frequency (MHz) | Gain (dB) | VSWR (:1) IN | VSWR (:1) OUT | Power Out @1 dB COMPR. (dBm) | Noise Figure (dB) | Frequency (MHz) | Output IP3 (dBm) |
|---|---|---|---|---|---|---|---|
| 50 | 21.99 | 1.2 | 1.4 | 21.72 | 1.81 | 500 | 33.06 |
| 500 | 22.49 | 1.1 | 1.2 | 22.46 | 1.03 | 2000 | 32.30 |
| 1000 | 22.41 | 1.2 | 1.2 | 22.91 | 1.07 | 4000 | 30.75 |
| 1600 | 22.25 | 1.2 | 1.1 | 22.65 | 1.31 | 8000 | 32.75 |
| 2000 | 22.19 | 1.3 | 1.1 | 22.83 | 1.22 | 10000 | 33.51 |
| 3000 | 22.06 | 1.5 | 1.2 | 22.40 | 1.40 | | |
| 4000 | 21.92 | 1.6 | 1.2 | 21.57 | 1.40 | | |
| 5000 | 21.79 | 1.5 | 1.2 | 21.54 | 1.52 | | |
| 6000 | 21.61 | 1.3 | 1.1 | 21.10 | 1.71 | | |
| 7000 | 21.35 | 1.1 | 1.3 | 21.07 | 1.90 | | |
| 8000 | 20.62 | 1.3 | 1.4 | 19.63 | 2.20 | | |
| 9000 | 19.53 | 1.4 | 1.2 | 17.08 | 2.92 | | |
| 10000 | 18.21 | 1.5 | 1.1 | 15.94 | 3.62 | | |

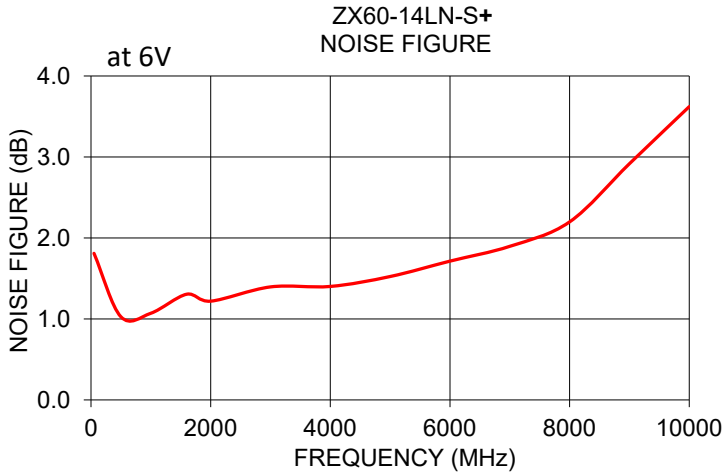
# Low Noise Amplifier ZX60-14LN-S+

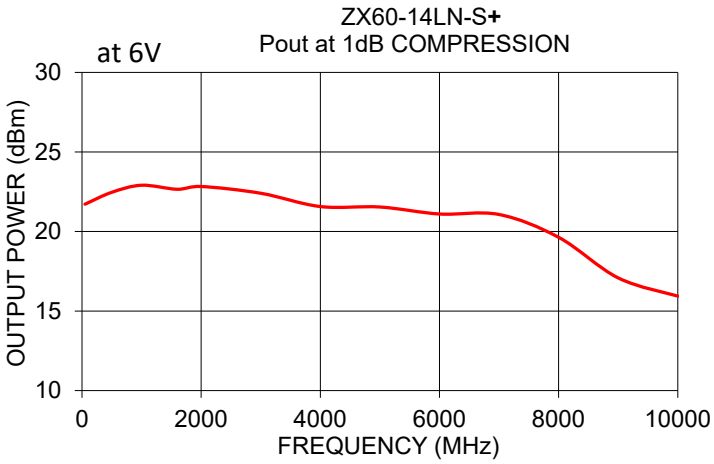
50Ω 0.05 to 10 GHz SMA Female

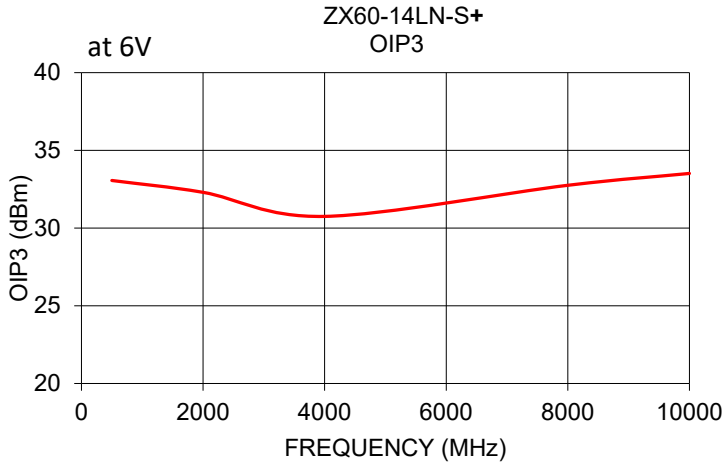
## TYPICAL PERFORMANCE GRAPHS




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

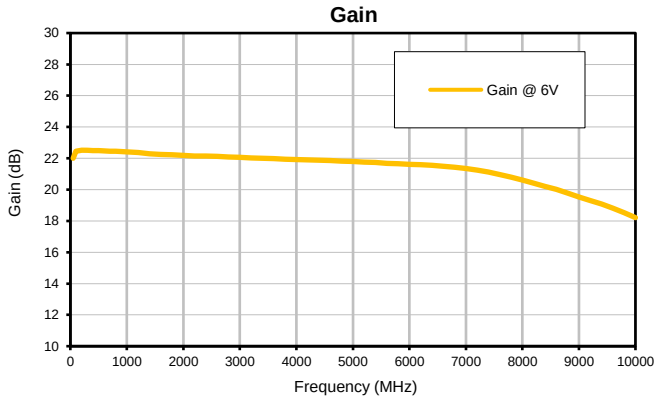
# Low Noise Amplifier ZX60-14LN-S+

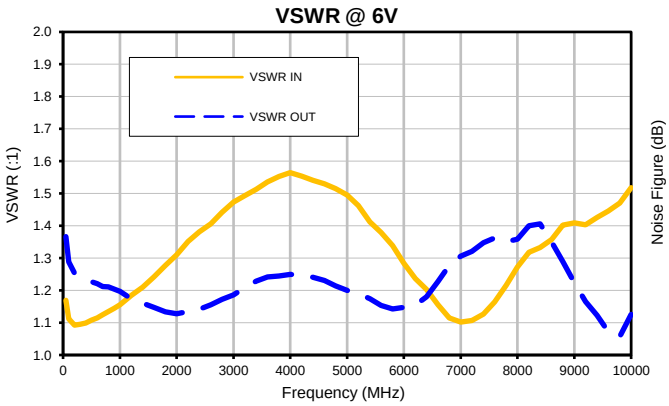
## *Typical Performance Data*

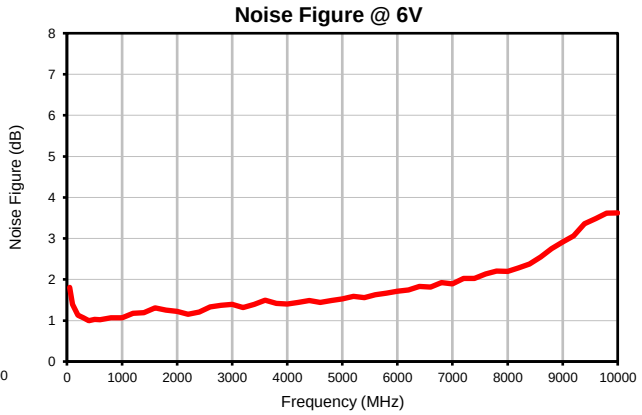
| FREQUENCY (MHz) | GAIN (dB) 6V | VSWR (:1) IN 6V | VSWR (:1) OUT 6V | NOISE FIGURE (dB) 6V | POUT @ 1 dB COMPRESSION (dBm) 6V |
|---|---|---|---|---|---|
| 50 | 21.99 | 1.17 | 1.37 | 1.81 | 21.72 |
| 100 | 22.45 | 1.11 | 1.29 | 1.40 | 22.61 |
| 200 | 22.52 | 1.09 | 1.25 | 1.13 | 22.88 |
| 300 | 22.51 | 1.09 | 1.24 | 1.07 | 23.28 |
| 400 | 22.50 | 1.10 | 1.23 | 1.00 | 22.39 |
| 500 | 22.49 | 1.11 | 1.23 | 1.03 | 22.46 |
| 600 | 22.47 | 1.12 | 1.22 | 1.02 | 22.80 |
| 700 | 22.46 | 1.13 | 1.21 | 1.04 | 22.88 |
| 800 | 22.45 | 1.13 | 1.21 | 1.07 | 22.81 |
| 900 | 22.43 | 1.14 | 1.20 | 1.07 | 22.84 |
| 1000 | 22.41 | 1.16 | 1.20 | 1.07 | 22.91 |
| 1200 | 22.37 | 1.18 | 1.17 | 1.18 | 23.02 |
| 1400 | 22.30 | 1.21 | 1.16 | 1.19 | 22.84 |
| 1600 | 22.25 | 1.24 | 1.15 | 1.31 | 22.65 |
| 1800 | 22.23 | 1.28 | 1.13 | 1.25 | 23.12 |
| 2000 | 22.19 | 1.31 | 1.13 | 1.22 | 22.83 |
| 2200 | 22.15 | 1.35 | 1.13 | 1.15 | 23.05 |
| 2400 | 22.14 | 1.38 | 1.14 | 1.21 | 22.58 |
| 2600 | 22.12 | 1.41 | 1.16 | 1.33 | 22.29 |
| 2800 | 22.09 | 1.44 | 1.17 | 1.37 | 22.70 |
| 3000 | 22.06 | 1.47 | 1.19 | 1.40 | 22.40 |
| 3200 | 22.03 | 1.49 | 1.21 | 1.32 | 21.32 |
| 3400 | 22.00 | 1.51 | 1.23 | 1.40 | 21.23 |
| 3600 | 21.97 | 1.54 | 1.24 | 1.50 | 21.64 |
| 3800 | 21.95 | 1.55 | 1.24 | 1.42 | 21.20 |
| 4000 | 21.92 | 1.56 | 1.25 | 1.40 | 21.57 |
| 4200 | 21.90 | 1.55 | 1.25 | 1.44 | 21.02 |
| 4400 | 21.89 | 1.54 | 1.24 | 1.49 | 21.40 |
| 4600 | 21.85 | 1.53 | 1.23 | 1.44 | 21.85 |
| 4800 | 21.82 | 1.51 | 1.21 | 1.49 | 21.59 |
| 5000 | 21.79 | 1.50 | 1.20 | 1.52 | 21.54 |
| 5200 | 21.76 | 1.46 | 1.19 | 1.59 | 21.33 |
| 5400 | 21.73 | 1.41 | 1.17 | 1.56 | 21.66 |
| 5600 | 21.68 | 1.38 | 1.15 | 1.63 | 21.49 |
| 5800 | 21.65 | 1.34 | 1.14 | 1.67 | 21.63 |
| 6000 | 21.61 | 1.28 | 1.15 | 1.71 | 21.10 |
| 6200 | 21.59 | 1.24 | 1.15 | 1.75 | 20.90 |
| 6400 | 21.55 | 1.20 | 1.18 | 1.83 | 21.33 |
| 6600 | 21.48 | 1.16 | 1.23 | 1.81 | 21.20 |
| 6800 | 21.42 | 1.11 | 1.28 | 1.92 | 20.89 |
| 7000 | 21.35 | 1.10 | 1.31 | 1.90 | 21.07 |
| 7200 | 21.25 | 1.11 | 1.32 | 2.02 | 20.64 |
| 7400 | 21.12 | 1.13 | 1.35 | 2.03 | 20.50 |
| 7600 | 20.96 | 1.16 | 1.36 | 2.14 | 19.99 |
| 7800 | 20.80 | 1.22 | 1.35 | 2.20 | 19.60 |
| 8000 | 20.62 | 1.27 | 1.36 | 2.20 | 19.63 |
| 8200 | 20.41 | 1.32 | 1.40 | 2.28 | 18.76 |
| 8400 | 20.21 | 1.33 | 1.41 | 2.38 | 18.39 |
| 8600 | 20.01 | 1.36 | 1.35 | 2.55 | 18.41 |
| 8800 | 19.77 | 1.40 | 1.29 | 2.75 | 17.53 |
| 9000 | 19.53 | 1.41 | 1.22 | 2.92 | 17.08 |
| 9200 | 19.31 | 1.40 | 1.16 | 3.07 | 16.87 |
| 9400 | 19.07 | 1.43 | 1.12 | 3.36 | 16.40 |
| 9600 | 18.81 | 1.45 | 1.07 | 3.48 | 15.59 |
| 9800 | 18.52 | 1.47 | 1.06 | 3.62 | 15.91 |
| 10000 | 18.21 | 1.52 | 1.13 | 3.62 | 15.94 |

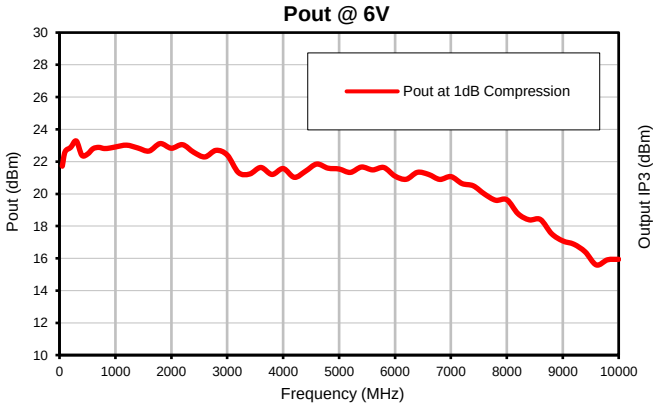
| FREQUENCY (MHz) | OUTPUT IP3 (dBm) 6V |
|---|---|
| 500 | 33.06 |
| 2000 | 32.30 |
| 4000 | 30.75 |
| 8000 | 32.75 |
| 10000 | 33.51 |

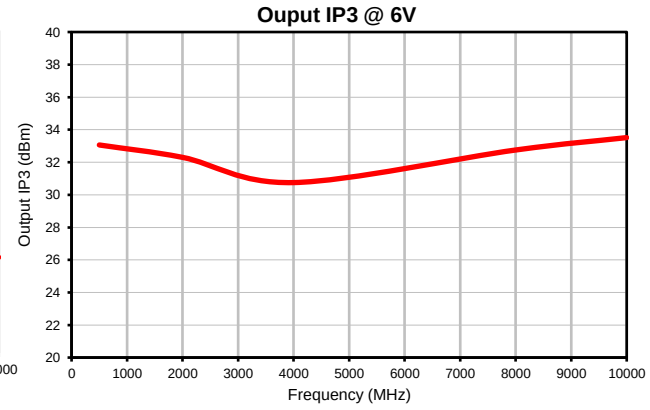
## *Typical Performance Curves*



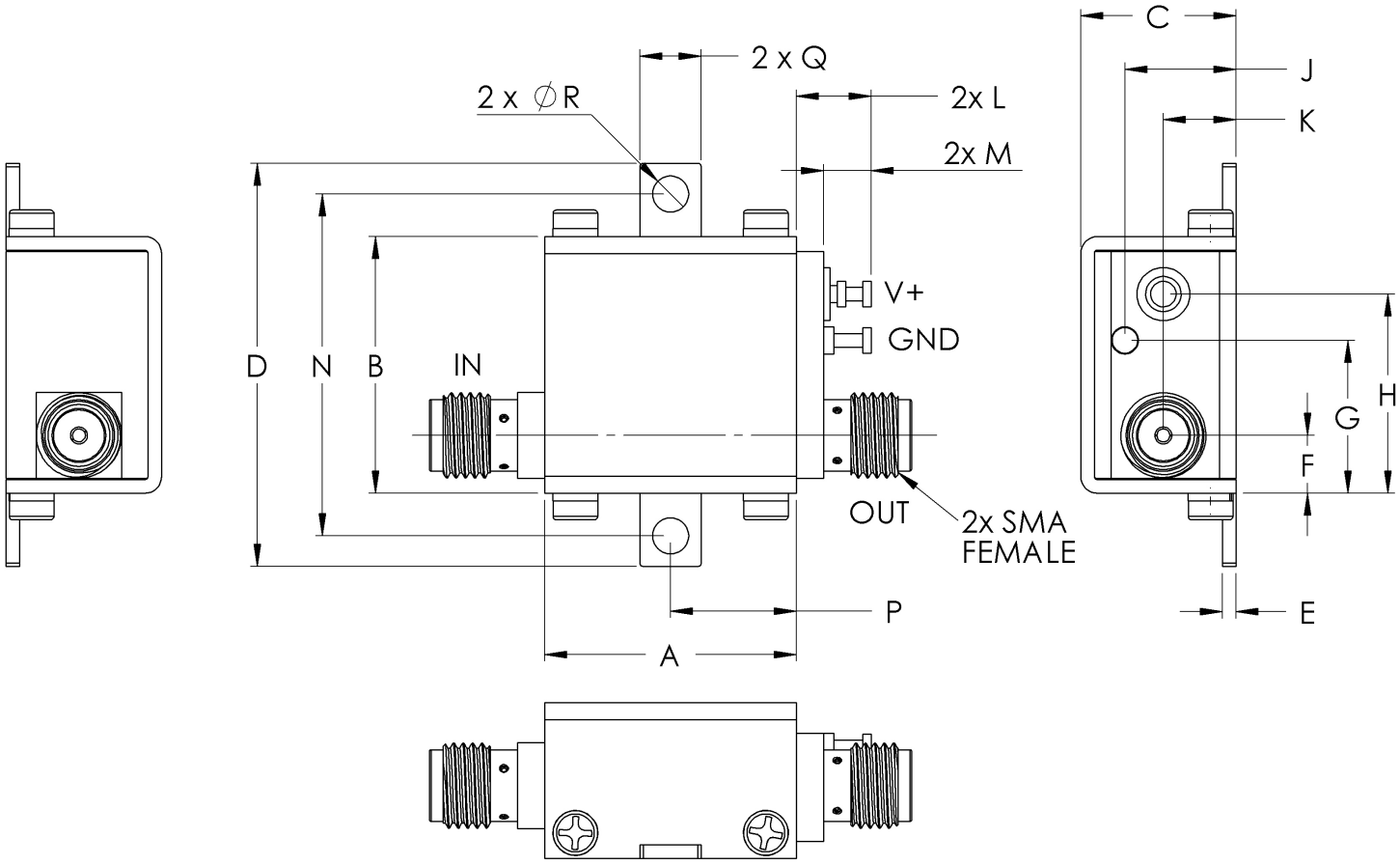



# Case Style GC

## Outline Dimensions

GC957




| CASE #. | A | B | C | D | E | F | G | H | J | K | L | M | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GC957 | .74 (18.80) | .75 (19.15) | .46 (11.61) | 1.18 (30.07) | .04 (1.02) | .17 (4.32) | .45 (11.40) | .59 (14.86) | .33 (8.31) | .21 (5.44) | .22 (5.59) | .14 (3.56) | 1.00 (25.4) |

| CASE #. | P | Q | R | WT GRAMS |
|---|---|---|---|---|
| GC957 | .37 (9.40) | .18 (4.57) | .106 (2.69) | 23.0 |

**Dimensions are in inches (mm). Tolerances: 2Pl. ± .03; 3Pl. ± .015**
**Tolerance on hole size and interaxes dimensions to be ± .005.**

**Note:**

1. Case material: Brass
2. Case finish: Nickel plate


Mini-Circuits®
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Mini-Circuits

# Environmental Specifications ENV23T10

All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

| Specification | Test/Inspection Condition | Reference/Spec |
|---|---|---|
| Operating Temperature | -40° to 85° C<br>Case Temperature | Individual Model Data Sheet |
| Storage Temperature | -55° to 100° C<br>Ambient Environment | Individual Model Data Sheet |
| Stabilization Bake | (non-operating)<br>125°C, 24 hours | - - - |
| Burn-in at Elevated Temp. | (DC on)<br>160 hours at 85° C | MIL-STD-202, Method 108 |
| Thermal Shock | -55° to 100°C, 5 cycles | MIL-STD-202, Method 107, Condition A, except 100°C |