MEDIUM POWER, HIGH GAIN

# Wideband Amplifier

# ZVA-543HP+ ZVA-543HPX+

50Ω 18 to 54 GHz 1.85 mm Female

## THE BIG DEAL

- High Gain, 31 dB Typ. Over the Entire Operating Band
- Good Gain Flatness, ±2.0 dB Typ.
- +29 dBm $P_{SAT}$ Typ.
- Adjustable DC Voltage, +10 to +15 V
- DC Protected Against Over-Voltage, Reverse Voltage Conditions



*Generic photo used for illustration purposes only*

| Model No. | ZVA-543HP+ | ZVA-543HPX+ |
|---|---|---|
| Option | With Heatsink & Fan | Without Heatsink & Fan |
| Case Style | VN3071-4 | |
| Connector | 1.85 mm female | |

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

## APPLICATIONS

- Wideband Test and Instrumentation
- 5G mmW
- SATCOM
- Wireless Infrastructure

## PRODUCT OVERVIEW

Mini-Circuits' ZVA-543HP(X)+ is a coaxial, medium power, wideband high gain amplifier, operating from 18 to 54 GHz. This model operates over a single positive supply range of +10 to +15 V, allowing users to choose their desired operating voltage. Internal DC-DC conversion circuitry maintains constant efficiency over the full input voltage range. The amplifier incorporates several DC-protection features, such as over-voltage, reverse voltage and in-rush current, that protect the amplifier from damage if mishandled during operation. The wideband operation combined with high output power makes this amplifier an ideal choice for testing and instrumentation applications.

## KEY FEATURES

| Features | Advantages |
|---|---|
| Wideband Amplifier, 18 to 54 GHz | A single amplifier serves the need for applications including 5G bands (24 to 54 GHz), SATCOM, Test & Instrumentation, etc. |
| Integrated Fan Assembly | Model ZVA-543HP+ utilizes two integrated fans, keeping the amplifier cool to the touch during normal operation at room temperature. |
| High Gain<br>Low VSWR<br>Medium RF Power | The amplifier provides 31 dB (typ.) of gain over the entire operating band, and is capable of delivering over 1 Watt of RF power. |
| Adjustable DC Supply Voltage | The device is capable of operating from +10 to +15 V with consistent DC power consumption. |
| DC Protection –<br>Over-Voltage<br>Reverse Voltage<br>In-Rush Current | The internal DC circuitry protects the amplifier from external mishandling that could lead to catastrophic failures in the field. |

REV. OR
ECO-014881
ZVA-543HP(X)+
MCL NY
260323

## ELECTRICAL SPECIFICATIONS AT +25 °C BASEPLATE

| Parameter | Condition (GHz) | ZVA-543HP+ ZVA-543HPX+ Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Frequency Range | | 18 | | 54 | GHz |
| Gain | 18-20 | | 29.0 | | dB |
| | 20-40 | 29.0 | 33.0 | | |
| | 40-54 | 28.0 | 31.0 | | |
| Output Power at 1 dB Compression | 18-20 | | +27.0 | | dBm |
| | 20-40 | +27.0 | +30.0 | | |
| | 40-54 | +24.5 | +27.5 | | |
| Saturated Output Power | 18-20 | | +28.0 | | dBm |
| | 20-40 | +28.0 | +31.0 | | |
| | 40-54 | +26.0 | +28.5 | | |
| Output IP3 (Output Power = +14 dBm/Tone) | 18-54 | | +37.0 | | dBm |
| Input VSWR | 18-54 | | 1.5 | 2.0 | :1 |
| Output VSWR | 18-54 | | 1.5 | 2.0 | :1 |
| Noise Figure | 18-50 | | 6.5 | | dB |
| Operating DC Voltage | | +10 | | +15 | V |
| Device Operating Current[1] at +10 V | | | 1500 / 1650 | 2400 / 2550 | mA |

1. Typical current measured under small signal conditions. Max. DC current measured at $P_{SAT}$. DC current increases as amplifier is driven into compression.

## ABSOLUTE MAXIMUM RATINGS[2,3]

| Parameter | Ratings |
|---|---|
| Operating Temperature | ZVA-543HP+ -40 °C to +50 °C Ambient<br>ZVA-543HPX+ -40 °C to +60 °C Baseplate |
| Storage Temperature | -40 °C to +85 °C |
| Total Power Dissipation | 22.5 W |
| RF Input Power (CW) | +5 dBm |
| DC Operating Voltage | +16 V |

2. Specified under matched load to 50Ω. Open or Short at amplifier output while it is connected to power may cause damage to the unit.
3. Continuous operation is not recommended at these extremes. Permanent damage may occur if any of these limits are exceeded.

## DETERMINING MAXIMUM THERMAL RESISTANCE OF USERS' EXTERNAL HEATSINK

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

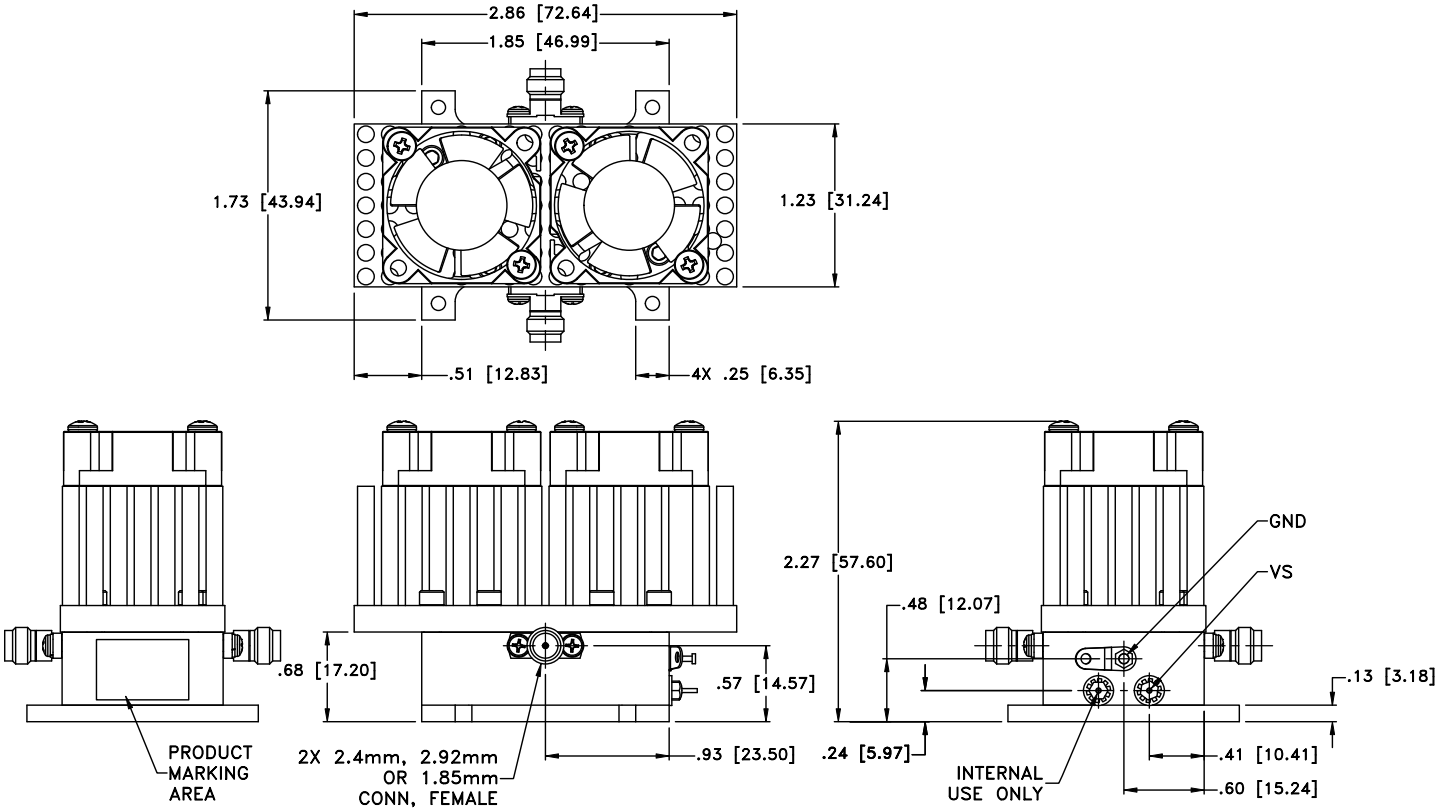
| | |
|---|---|
| **Example:** | MAXIMUM OPERATING CASE TEMP = +50 °C (CHECK MAXIMUM RATINGS TABLE FOR THIS VALUE)<br>MAXIMUM USER AMBIENT TEMP = +30 °C (USER DEFINED)<br>POWER DISSIPATION = 10 WATTS (CHECK MAXIMUM RATINGS TABLE FOR THIS VALUE)<br>THEN MAXIMUM ALLOWABLE THERMAL RESISTANCE = 2 °C/W |

# Wideband Amplifier

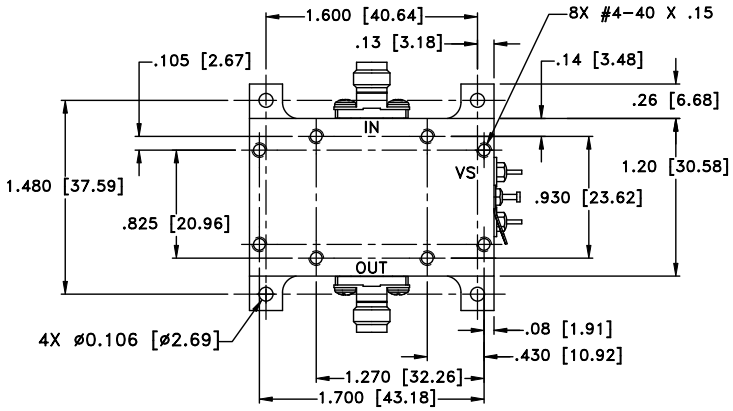
# ZVA-543HP+
# ZVA-543HPX+

50Ω 18 to 54 GHz 1.85 mm Female

## OUTLINE DRAWING FOR MODELS WITH HEATSINK (ZVA-543HP+)




## MOUNTING INFORMATION FOR MODELS WITHOUT HEATSINK (ZVA-543HPX+)




Weight: 160 grams; Without Heatsink: 60 grams
Dimensions are in inches [mm]. Tolerances: 2 Pl.±.03; 3 Pl. ±.015

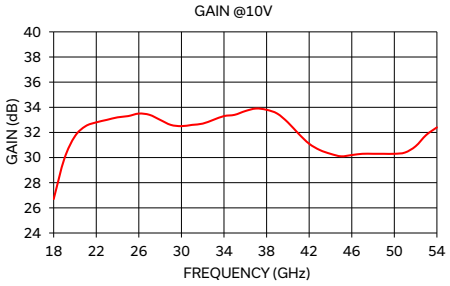
# Wideband Amplifier

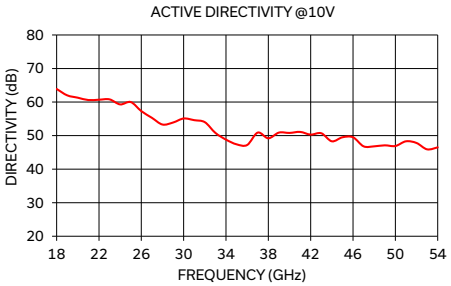
# ZVA-543HP+
# ZVA-543HPX+

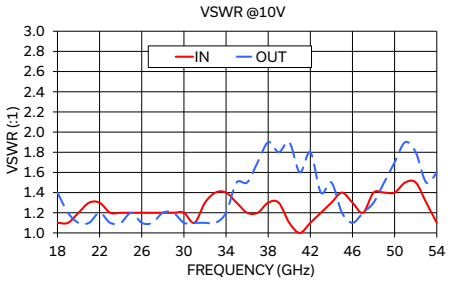
50Ω 18 to 54 GHz 1.85 mm Female

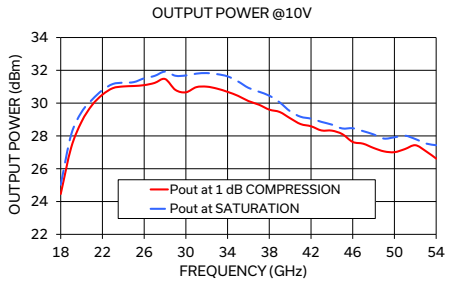
## TYPICAL PERFORMANCE DATA/GRAPHS

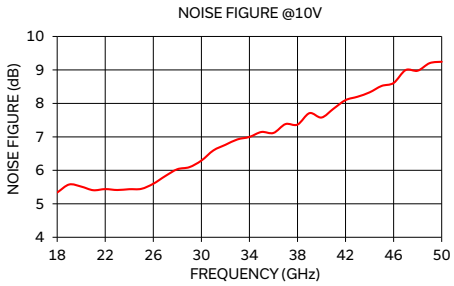
| Frequency (GHz) | Gain (dB) | Active Directivity (dB) | VSWR (:1) | | $P_{OUT}$ at 1 dB Compression (dBm) | $P_{OUT}$ at Saturation (dBm) | Output IP3 (dBm) | Noise Figure (dB) |
|---|---|---|---|---|---|---|---|---|
| | | | +10 V | | | | | |
| | +10 V | +10 V | IN | OUT | +10 V | +10 V | +10 V | +10 V |
| 18 | 26.7 | 63.9 | 1.1 | 1.4 | 24.5 | 25.0 | 27.4 | 5.3 |
| 20 | 31.7 | 61.3 | 1.2 | 1.1 | 28.9 | 29.5 | 32.2 | 5.5 |
| 22 | 32.8 | 60.7 | 1.3 | 1.2 | 30.5 | 30.8 | 34.6 | 5.4 |
| 24 | 33.2 | 59.3 | 1.2 | 1.1 | 31.0 | 31.2 | 35.6 | 5.4 |
| 26 | 33.5 | 57.3 | 1.2 | 1.1 | 31.1 | 31.5 | 36.0 | 5.6 |
| 28 | 33.0 | 53.3 | 1.2 | 1.2 | 31.5 | 31.9 | 37.2 | 6.0 |
| 30 | 32.5 | 55.1 | 1.2 | 1.1 | 30.7 | 31.7 | 36.0 | 6.3 |
| 32 | 32.7 | 54.0 | 1.3 | 1.1 | 31.0 | 31.8 | 37.0 | 6.8 |
| 34 | 33.3 | 48.8 | 1.4 | 1.2 | 30.7 | 31.6 | 36.9 | 7.0 |
| 36 | 33.7 | 47.2 | 1.2 | 1.5 | 30.1 | 30.9 | 35.7 | 7.1 |
| 38 | 33.8 | 49.2 | 1.3 | 1.9 | 29.6 | 30.5 | 35.9 | 7.4 |
| 40 | 32.8 | 50.8 | 1.1 | 1.9 | 29.1 | 29.5 | 38.2 | 7.6 |
| 42 | 31.1 | 50.3 | 1.1 | 1.8 | 28.6 | 29.1 | 36.4 | 8.1 |
| 44 | 30.3 | 48.3 | 1.3 | 1.5 | 28.3 | 28.7 | 37.7 | 8.3 |
| 46 | 30.2 | 49.5 | 1.3 | 1.1 | 27.6 | 28.5 | 37.1 | 8.6 |
| 48 | 30.3 | 46.8 | 1.4 | 1.3 | 27.3 | 28.1 | 35.2 | 9.0 |
| 50 | 30.3 | 46.9 | 1.4 | 1.7 | 27.0 | 27.9 | 34.1 | 9.2 |
| 52 | 30.9 | 47.8 | 1.5 | 1.8 | 27.4 | 27.8 | 33.8 | |
| 54 | 32.4 | 46.5 | 1.1 | 1.6 | 26.6 | 27.4 | 35.1 | |

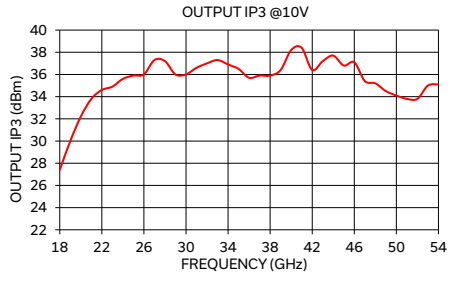



**NOTES**

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

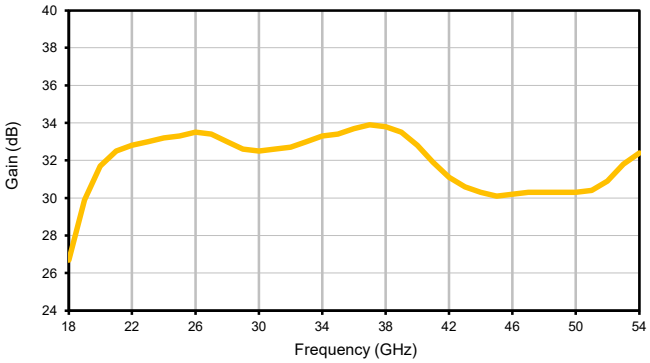
# Coaxial Amplifier ZVA-543HP(X)+

## *Typical Performance Data*

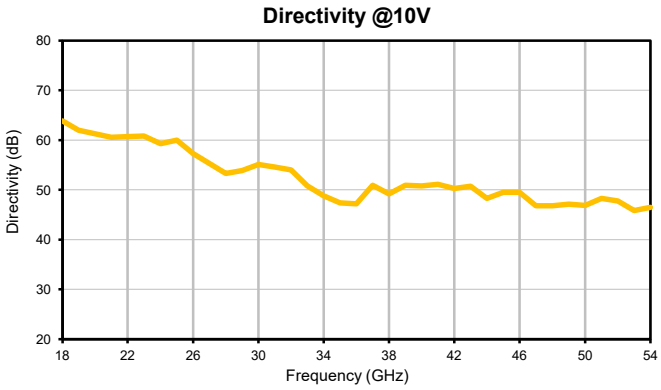
| FREQUENCY (GHz) | GAIN (dB) 10V | DIRECTIVITY (dB) 10V | VSWR (:1) IN 10V | VSWR (:1) OUT 10V | OIP3 (dBm) 10V | Pout @ 1 dB COMPRESSION (dBm) 10V | Pout at SATURATION (dBm) 10V | Noise Figure (dB) 10V |
|---|---|---|---|---|---|---|---|---|
| 18.0 | 26.7 | 63.9 | 1.1 | 1.4 | 27.4 | 24.5 | 25.0 | 5.3 |
| 19.0 | 29.9 | 62.0 | 1.1 | 1.2 | 30.0 | 27.3 | 28.1 | 5.6 |
| 20.0 | 31.7 | 61.3 | 1.2 | 1.1 | 32.2 | 28.9 | 29.5 | 5.5 |
| 21.0 | 32.5 | 60.6 | 1.3 | 1.1 | 33.8 | 29.9 | 30.2 | 5.4 |
| 22.0 | 32.8 | 60.7 | 1.3 | 1.2 | 34.6 | 30.5 | 30.8 | 5.4 |
| 23.0 | 33.0 | 60.8 | 1.2 | 1.1 | 34.9 | 30.9 | 31.2 | 5.4 |
| 24.0 | 33.2 | 59.3 | 1.2 | 1.1 | 35.6 | 31.0 | 31.2 | 5.4 |
| 25.0 | 33.3 | 60.0 | 1.2 | 1.2 | 35.9 | 31.0 | 31.3 | 5.4 |
| 26.0 | 33.5 | 57.3 | 1.2 | 1.1 | 36.0 | 31.1 | 31.5 | 5.6 |
| 27.0 | 33.4 | 55.3 | 1.2 | 1.1 | 37.3 | 31.2 | 31.7 | 5.8 |
| 28.0 | 33.0 | 53.3 | 1.2 | 1.2 | 37.2 | 31.5 | 31.9 | 6.0 |
| 29.0 | 32.6 | 53.9 | 1.2 | 1.2 | 36.0 | 30.8 | 31.7 | 6.1 |
| 30.0 | 32.5 | 55.1 | 1.2 | 1.1 | 36.0 | 30.7 | 31.7 | 6.3 |
| 31.0 | 32.6 | 54.6 | 1.1 | 1.1 | 36.6 | 31.0 | 31.8 | 6.6 |
| 32.0 | 32.7 | 54.0 | 1.3 | 1.1 | 37.0 | 31.0 | 31.8 | 6.8 |
| 33.0 | 33.0 | 50.8 | 1.4 | 1.1 | 37.3 | 30.9 | 31.8 | 6.9 |
| 34.0 | 33.3 | 48.8 | 1.4 | 1.2 | 36.9 | 30.7 | 31.6 | 7.0 |
| 35.0 | 33.4 | 47.4 | 1.3 | 1.5 | 36.5 | 30.4 | 31.3 | 7.1 |
| 36.0 | 33.7 | 47.2 | 1.2 | 1.5 | 35.7 | 30.1 | 30.9 | 7.1 |
| 37.0 | 33.9 | 50.9 | 1.2 | 1.7 | 35.9 | 29.9 | 30.7 | 7.4 |
| 38.0 | 33.8 | 49.2 | 1.3 | 1.9 | 35.9 | 29.6 | 30.5 | 7.4 |
| 39.0 | 33.5 | 50.9 | 1.3 | 1.8 | 36.4 | 29.5 | 30.0 | 7.7 |
| 40.0 | 32.8 | 50.8 | 1.1 | 1.9 | 38.2 | 29.1 | 29.5 | 7.6 |
| 41.0 | 31.9 | 51.1 | 1.0 | 1.6 | 38.4 | 28.7 | 29.2 | 7.8 |
| 42.0 | 31.1 | 50.3 | 1.1 | 1.8 | 36.4 | 28.6 | 29.1 | 8.1 |
| 43.0 | 30.6 | 50.7 | 1.2 | 1.4 | 37.2 | 28.3 | 28.9 | 8.2 |
| 44.0 | 30.3 | 48.3 | 1.3 | 1.5 | 37.7 | 28.3 | 28.7 | 8.3 |
| 45.0 | 30.1 | 49.5 | 1.4 | 1.2 | 36.8 | 28.1 | 28.5 | 8.5 |
| 46.0 | 30.2 | 49.5 | 1.3 | 1.1 | 37.1 | 27.6 | 28.5 | 8.6 |
| 47.0 | 30.3 | 46.8 | 1.2 | 1.2 | 35.4 | 27.5 | 28.3 | 9.0 |
| 48.0 | 30.3 | 46.8 | 1.4 | 1.3 | 35.2 | 27.3 | 28.1 | 9.0 |
| 49.0 | 30.3 | 47.1 | 1.4 | 1.5 | 34.5 | 27.1 | 27.8 | 9.2 |
| 50.0 | 30.3 | 46.9 | 1.4 | 1.7 | 34.1 | 27.0 | 27.9 | 9.2 |
| 51.0 | 30.4 | 48.3 | 1.5 | 1.9 | 33.8 | 27.2 | 28.0 | - |
| 52.0 | 30.9 | 47.8 | 1.5 | 1.8 | 33.8 | 27.4 | 27.8 | - |
| 53.0 | 31.8 | 45.9 | 1.3 | 1.5 | 35.0 | 27.1 | 27.5 | - |
| 54.0 | 32.4 | 46.5 | 1.1 | 1.6 | 35.1 | 26.6 | 27.4 | - |

## *Typical Performance Curves*

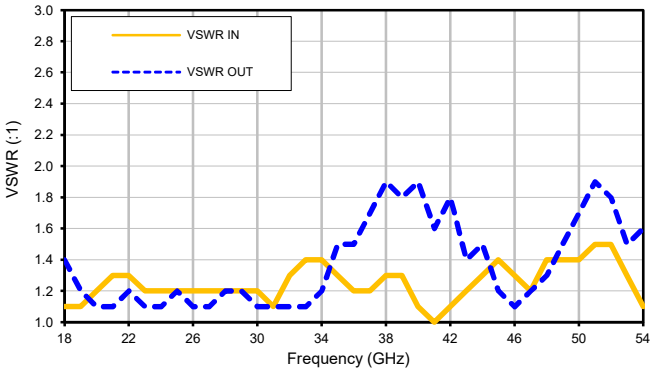
**GAIN @10V**



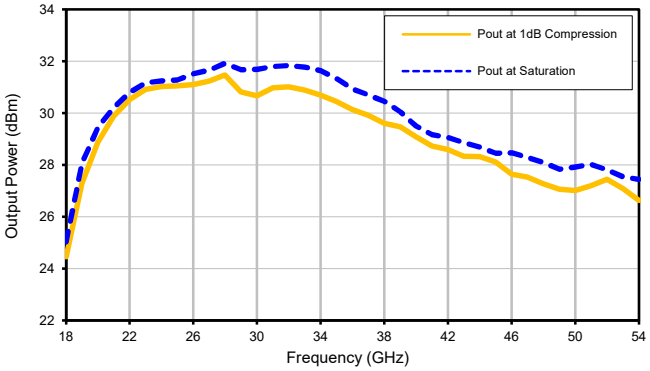

**Directivity @10V**



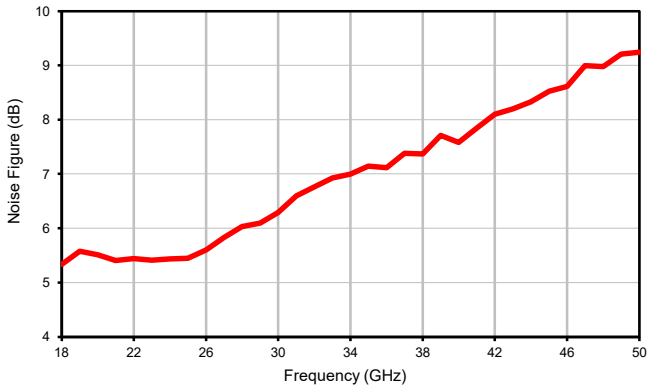

**VSWR @10V**



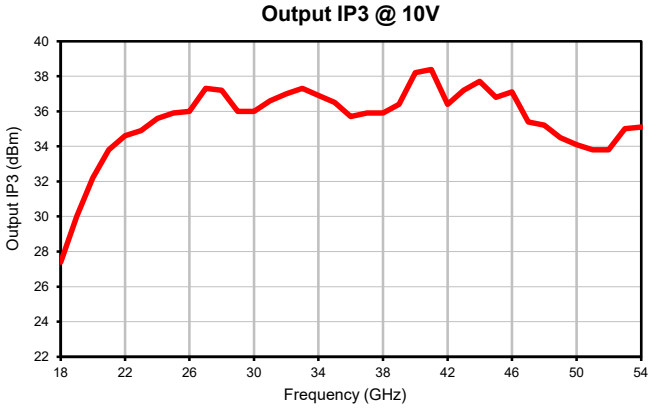

**Pout @10V**




**Noise Figure @ 10V**

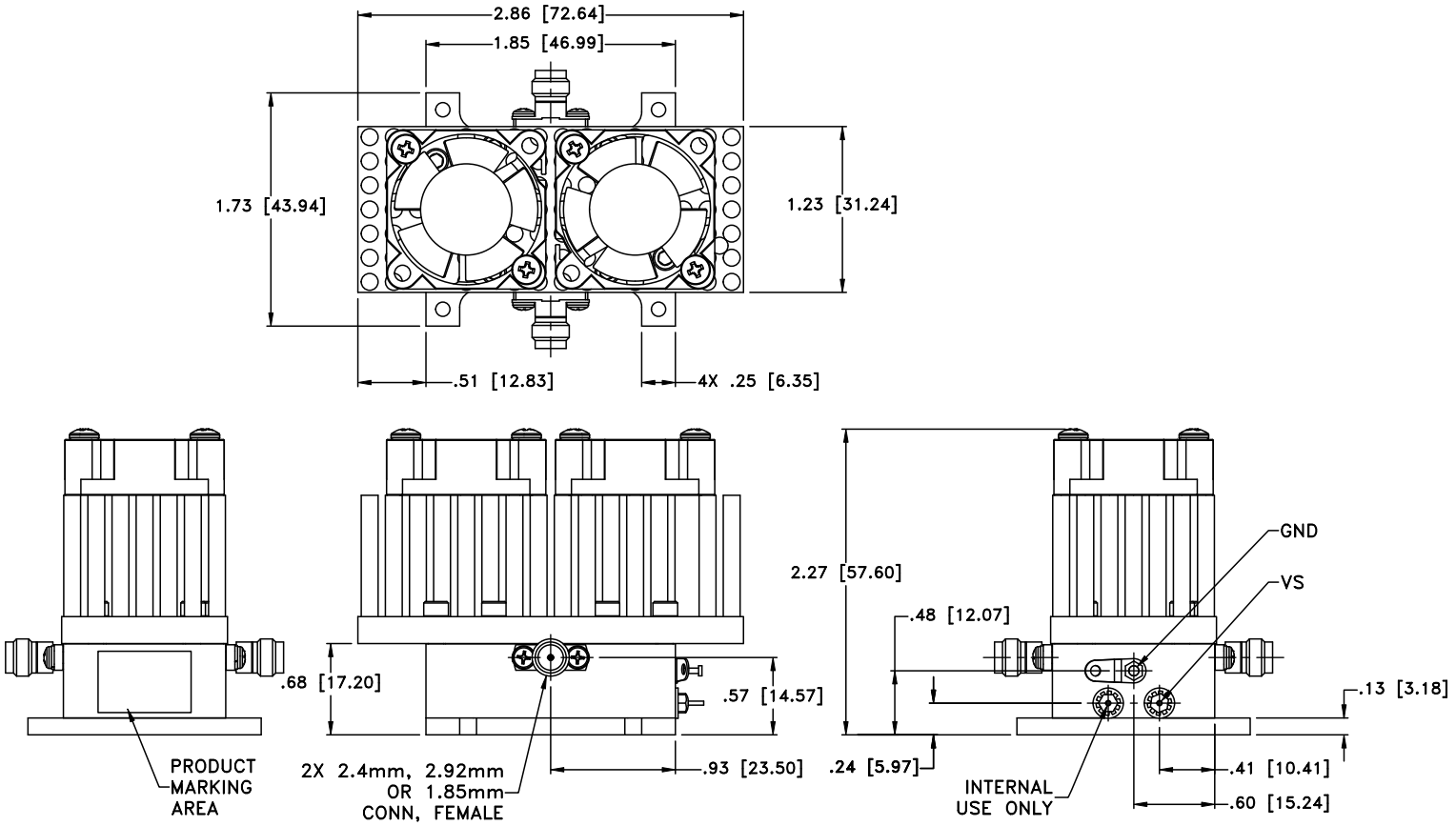



**Output IP3 @ 10V**

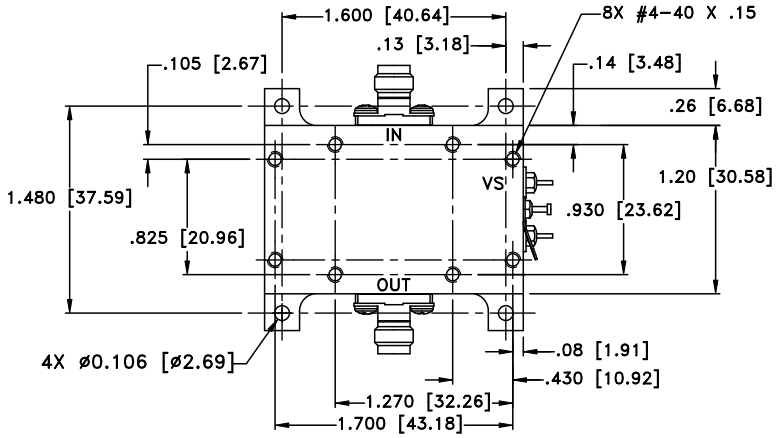


# Case Style VN

## Outline Dimensions VN3071-4




**MOUNTING INFORMATION OF MODEL WITHOUT HEATSINK**




WT. WT. GRAMS 160 grams; WITHOUT HEATSINK GRAMS 60 grams

Dimensions are in inches (mm). Tolerances: 2 Pl.Ñ03; 3 Pl. Ñ015

**Notes**:
1. Case material: Aluminum.
2. Case finish: Gold plating;
3. Heat sink finish: Black anodize.
4. Refer to the individual model data sheet for the type of connectors available.
5. Shape of connector flange may vary.

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# Environmental Specifications ENV130

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 +60° C<br>Baseplate Temp | Individual Model Data Sheet |
| Storage Temperature | -40° to +85° C<br>Ambient Environment | Individual Model Data Sheet |
| Burn-in | (DC on)<br>72 hours at 25°C | ---- |
| Thermal Shock | -40° C to +85°C, 100 cycles | Transition time = 5 mins, Dwell time = 30 mins |
| Vibration | Random Vibration<br>(non-operating) | MIL-STD-883K, Method 2025, Cond. 1A |


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