



Mini-Circuits®

MEDIUM POWER, HIGH GAIN

# Wideband Amplifier

**ZVE-433HP+  
ZVE-433HPX+**

50Ω 18 to 43.5 GHz 2.92 mm Female

## KEY FEATURES

- Wideband Coverage, 18 to 43.5 GHz
- Excellent Gain Flatness,  $\pm 2.5$  dB Typ.
- Wide Input DC Voltage Range, +10 to +15 V
- Reverse Voltage Protected
- Saturated Output Power, +31 dBm Typ.
- High Directivity, 40 dB Typ.

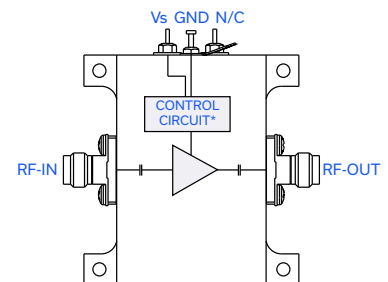


Generic photo used for illustration purposes only

## APPLICATIONS

- 5G FR2 Millimeter Wave Testing
- Aerospace and Defense
- Test and Measurement
- Broadband Telecom
- Ka-Band Satcom

## FUNCTIONAL DIAGRAM



\*Voltage regulation, over-voltage, reverse voltage, and in-rush current protection circuits.

## PRODUCT OVERVIEW

Mini-Circuits' ZVE-433HP+ is a coaxial, wideband, medium power amplifier, operating from 18 to 43.5 GHz. The model operates over a single supply range of +10 to +15 V, allowing users to choose their desired operating voltage. Internal DC-DC conversion circuitry maintains consistent efficiency over the full input voltage range. The amplifier incorporates several DC-protection features, such as over-voltage, reverse voltage and in-rush current limiting, 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.

## ELECTRICAL SPECIFICATIONS<sup>1</sup> AT +25 °C BASEPLATE AND $V_S = +10.0$ V

| Parameter                                | Condition (GHz) | Min.  | Typ.                                 | Max.                                  | Units |
|------------------------------------------|-----------------|-------|--------------------------------------|---------------------------------------|-------|
| Frequency Range                          | –               | 18    | –                                    | 43.5                                  | GHz   |
| Gain                                     | 18 – 30         | 33    | 37                                   | –                                     | dB    |
|                                          | 30 – 43.5       | 35    | 40                                   | –                                     |       |
| Noise Figure                             | 18 – 43.5       | –     | 6.0                                  | –                                     | dB    |
| Input Return Loss                        | 18 – 43.5       | –     | 13.9                                 | 10.0                                  | dB    |
| Output Return Loss                       | 18 – 43.5       | –     | 13.9                                 | 10.0                                  | dB    |
| Output Power at 1 dB Compression (P1dB)  | 18 – 26         | +25.0 | +29.0                                | –                                     | dBm   |
|                                          | 26 – 40         | +29.0 | +30.5                                | –                                     |       |
|                                          | 40 – 43.5       | +27.5 | +30.0                                | –                                     |       |
| Output Third Order Intercept Point       | 18 – 43.5       | –     | +41.0                                | –                                     | dBm   |
| DC Supply Voltage ( $V_S$ )              | –               | +10.0 | –                                    | +15.0                                 | V     |
| DC Current <sup>2</sup> at $V_S = +10$ V | –               | –     | 900 <sup>3</sup> / 1100 <sup>4</sup> | 1600 <sup>3</sup> / 1800 <sup>4</sup> | mA    |

1. Open and short-circuit loads are not recommended at the amplifier output. Ensure proper 50 Ohm load before turning the amplifier ON.

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

3. For units without heatsink, limit the maximum baseplate temperature to 60°C.

4. For units with heatsink, limit ambient temperature to 50°C.

5. Power supply should be capable of delivering 2.5 A at start-up.

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REV. OR  
ECO-025849  
ZVE-433HP(X)+  
MCL NY  
250611

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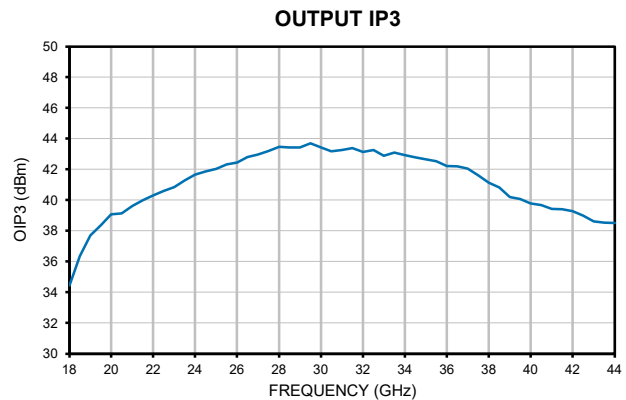
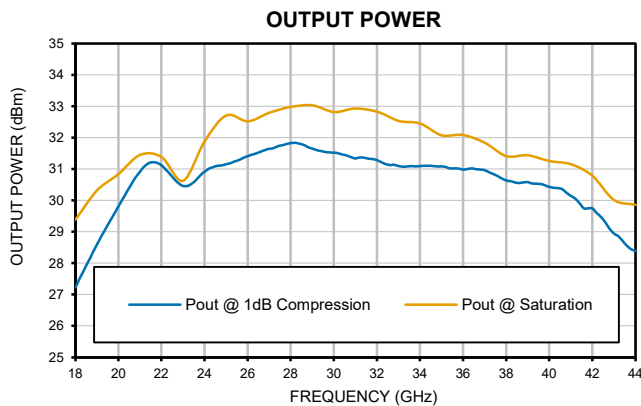
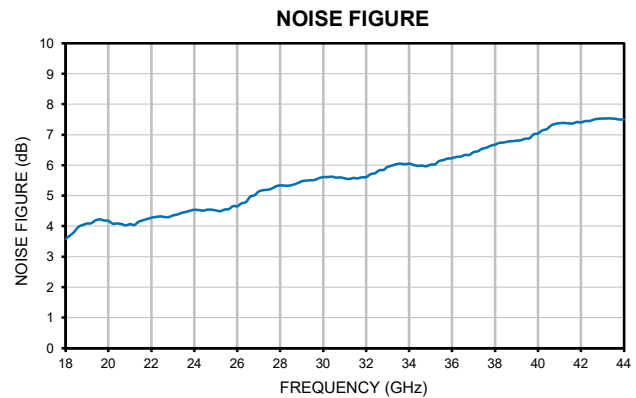
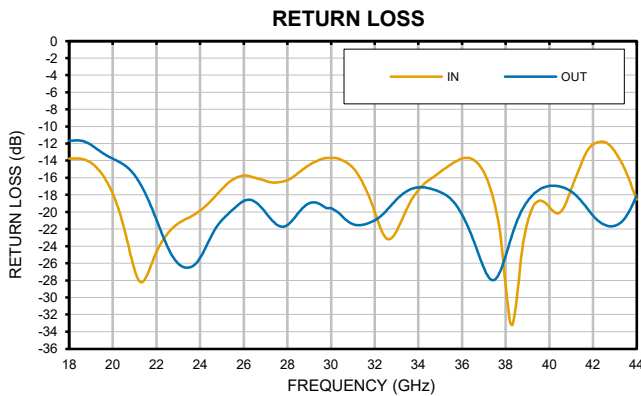
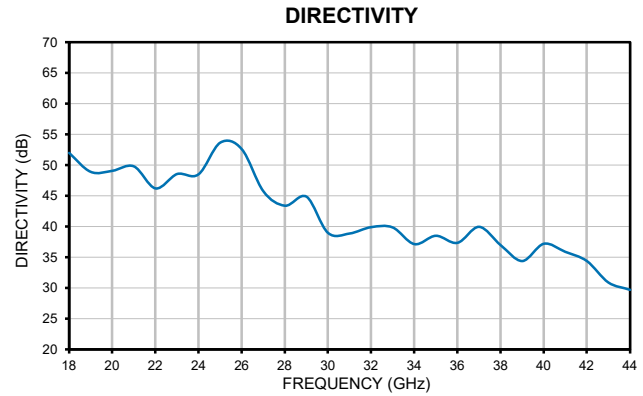
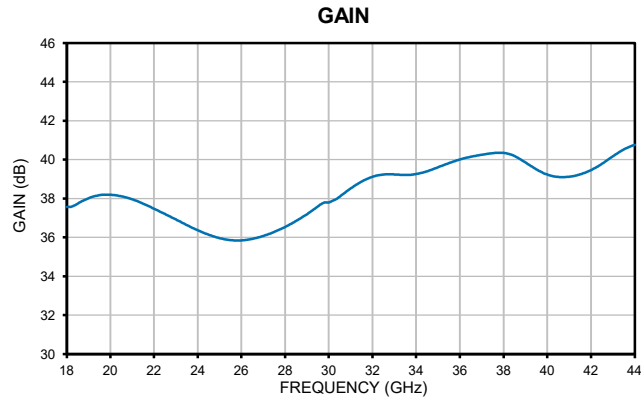
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## TYPICAL PERFORMANCE GRAPHS





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## ABSOLUTE MAXIMUM RATINGS<sup>6,7</sup>

| Parameter                         | Ratings                                                                       |
|-----------------------------------|-------------------------------------------------------------------------------|
| Operating Temperature (Baseplate) | ZVE-433HP+ -40 °C to +50 °C Ambient<br>ZVE-433HPX+ -40 °C to +60 °C Baseplate |
| Storage Temperature               | -40 °C to +85 °C                                                              |
| Total Power Dissipation           | 24 W                                                                          |
| RF Input Power (CW)               | +2 dBm                                                                        |
| DC Operating Voltage              | +16 V                                                                         |

6. Specified under matched load to 50 ohms.

7. 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 HEAT SINK

|                                                                                                                                                   |                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $\text{MAXIMUM THERMAL RESISTANCE} = \frac{\text{MAXIMUM OPERATING BASEPLATE TEMP} - \text{MAXIMUM USER AMBIENT TEMP}}{\text{POWER DISSIPATION}}$ |                                                                                                                                                                                                                                                                                |
| <b>Example:</b>                                                                                                                                   | MAXIMUM OPERATING BASEPLATE 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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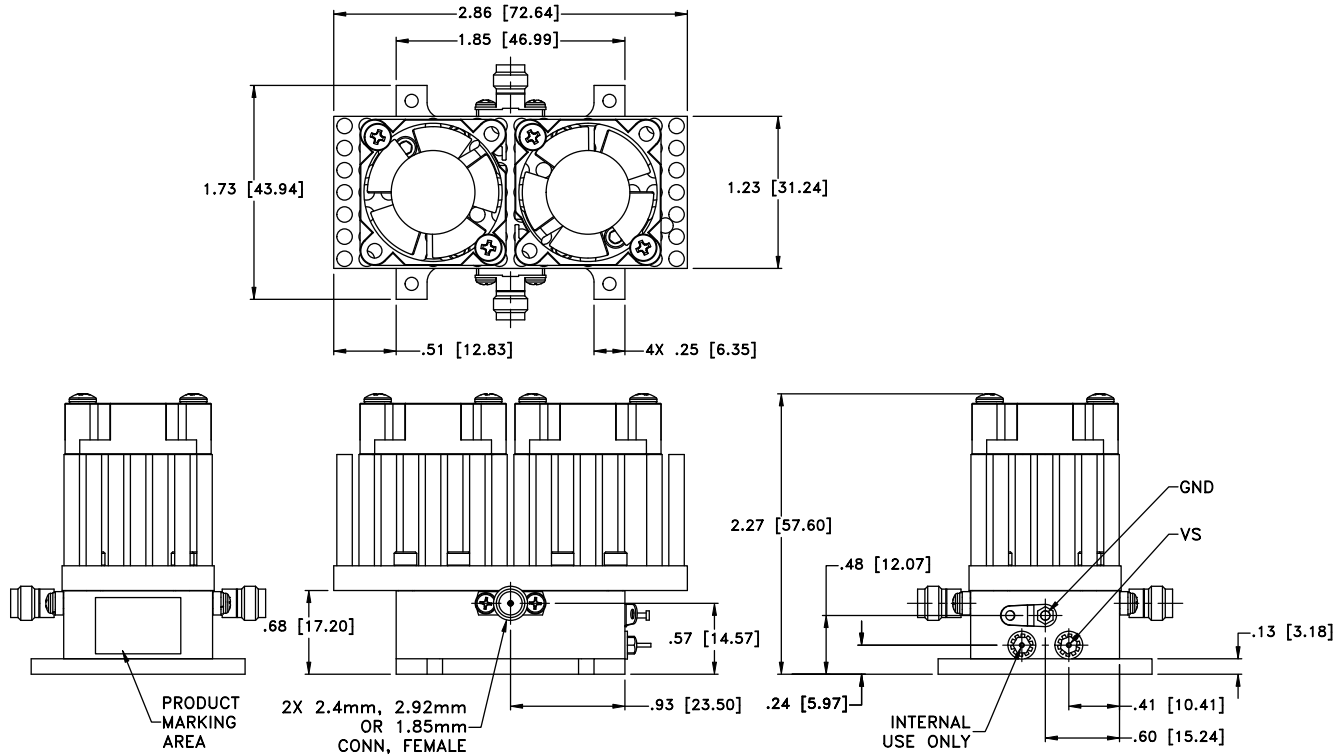
MEDIUM POWER, HIGH GAIN

# Wideband Amplifier

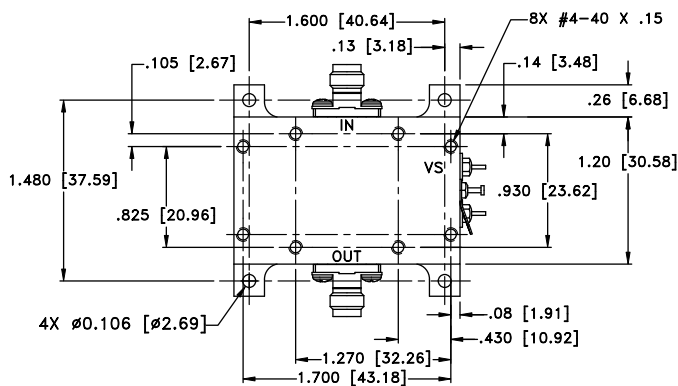
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## CASE STYLE DRAWING FOR MODELS WITH HEATSINK (ZVE-433HP+)



## CASE STYLE DRAWING FOR MODELS WITHOUT HEATSINK (ZVE-433HPX+)



Weight: 160 grams; Without Heatsink: 60 grams

Dimensions are in inches [mm]. Tolerances: 2 Pl.±.03; 3Pl.±.015





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**ZVE-433HPX+**

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## ADDITIONAL INFORMATION IS AVAILABLE ON OUR DASHBOARD.

|                           |                                              |
|---------------------------|----------------------------------------------|
| Performance Data & Graphs | Data                                         |
|                           | Graphs                                       |
|                           | S-Parameter (S2P Files) Data Set (.zip file) |
| RoHS Status               | Compliant                                    |
| Environmental Ratings     | ENV130                                       |
| Export Information        | ECCN# 3A001.B.4                              |

## ORDERING INFORMATION

|                 |                            |                             |
|-----------------|----------------------------|-----------------------------|
| Model No. Links | <a href="#">ZVE-433HP+</a> | <a href="#">ZVE-433HPX+</a> |
| Option          | With heatsink              | Without heatsink            |
| Product Marking | ZVE-433HP+                 | ZVE-433HPX+                 |
| Case Style      | VN3071-4                   |                             |
| Connector       | 2.92 mm 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](http://www.minicircuits.com/terms/viewterm.html)



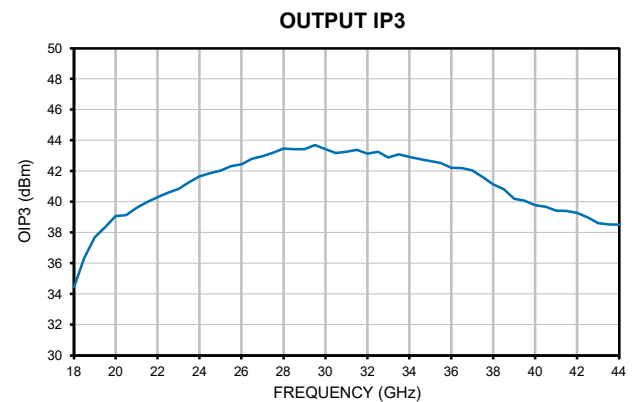
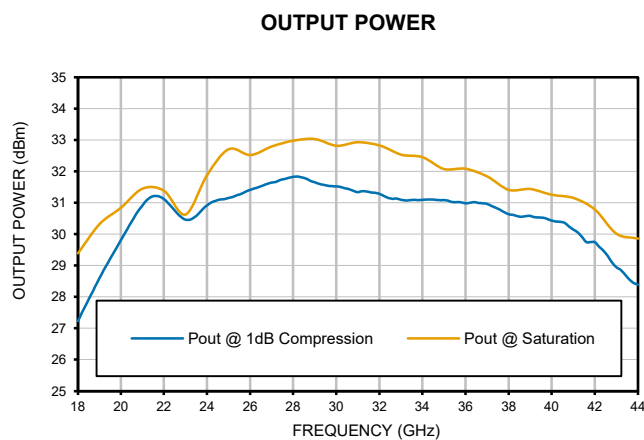
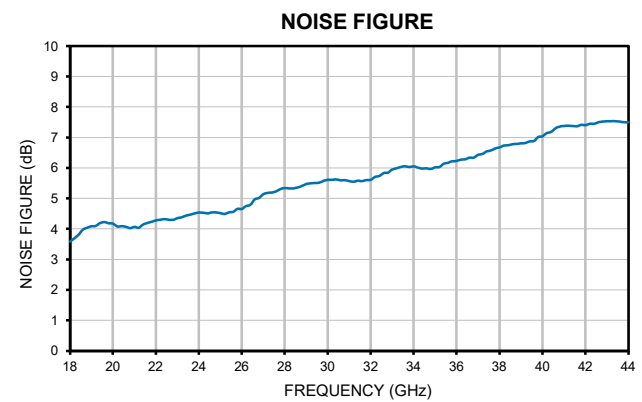
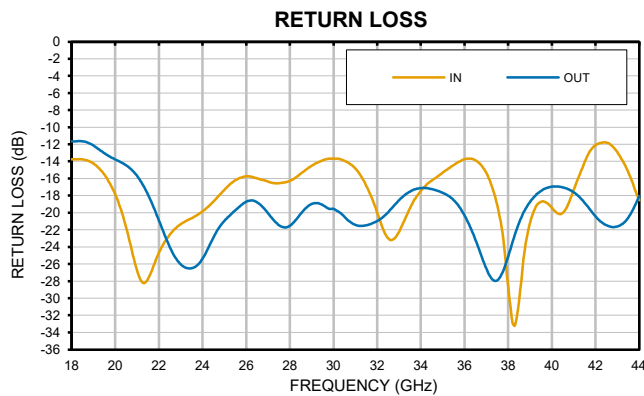
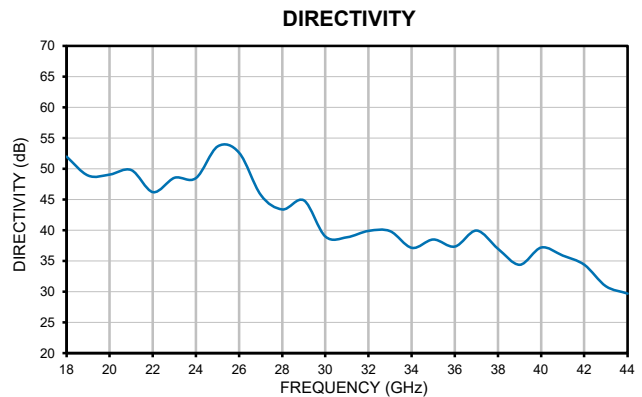
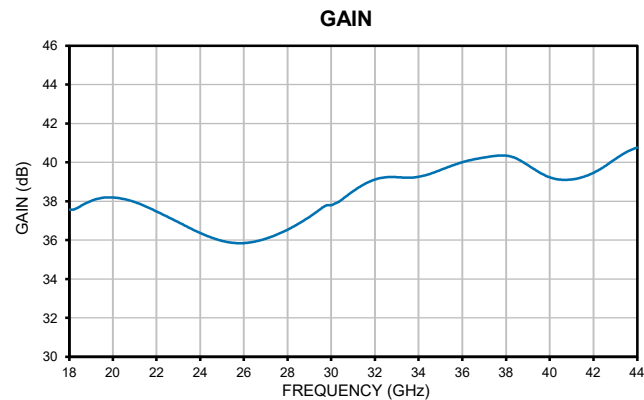
## Typical Performance Data

| FREQUENCY<br>(GHz) | GAIN<br>(dB) | DIRECTIVITY<br>(dB) | RETURN LOSS (dB) |       | Pout @ 1 dB<br>COMPRESSION<br>(dBm) | NOISE FIGURE<br>(dB) | OIP3<br>dBm |
|--------------------|--------------|---------------------|------------------|-------|-------------------------------------|----------------------|-------------|
|                    |              |                     | IN               | OUT   |                                     |                      |             |
| 18.0               | 37.58        | 52.00               | 13.75            | 11.64 | 27.2                                | 3.6                  | 34.45       |
| 19.0               | 38.02        | 48.90               | 14.24            | 12.12 | 28.6                                | 3.9                  | 37.69       |
| 20.0               | 38.20        | 49.07               | 17.88            | 13.77 | 29.8                                | 4.1                  | 38.98       |
| 21.0               | 37.96        | 49.79               | 26.81            | 15.66 | 30.9                                | 3.9                  | 39.67       |
| 22.0               | 37.48        | 46.20               | 24.64            | 20.91 | 31.1                                | 4.2                  | 40.39       |
| 23.0               | 36.93        | 48.54               | 21.31            | 26.09 | 30.5                                | 4.3                  | 41.59       |
| 24.0               | 36.37        | 48.49               | 19.81            | 25.41 | 30.9                                | 4.7                  | 39.90       |
| 25.0               | 35.97        | 53.64               | 17.29            | 20.89 | 31.2                                | 4.5                  | 41.21       |
| 26.0               | 35.85        | 52.64               | 15.74            | 18.66 | 31.4                                | 4.5                  | 42.16       |
| 27.0               | 36.08        | 45.74               | 16.36            | 20.06 | 31.6                                | 4.9                  | 45.70       |
| 28.0               | 36.55        | 43.41               | 16.26            | 21.57 | 31.8                                | 5.4                  | 43.17       |
| 29.0               | 37.20        | 44.86               | 14.48            | 18.91 | 31.7                                | 5.6                  | 44.08       |
| 30.0               | 37.80        | 38.96               | 13.66            | 19.67 | 31.5                                | 5.5                  | 45.18       |
| 31.0               | 38.53        | 38.85               | 14.84            | 21.56 | 31.3                                | 5.7                  | 43.60       |
| 32.0               | 39.13        | 39.91               | 20.01            | 20.64 | 31.3                                | 5.5                  | 41.31       |
| 33.0               | 39.24        | 39.85               | 22.18            | 18.01 | 31.1                                | 5.7                  | 45.94       |
| 34.0               | 39.27        | 37.13               | 17.41            | 17.08 | 31.1                                | 6.2                  | 41.22       |
| 35.0               | 39.62        | 38.53               | 15.29            | 17.90 | 31.1                                | 5.7                  | 44.17       |
| 36.0               | 40.02        | 37.33               | 13.73            | 21.32 | 31.0                                | 6.2                  | 44.93       |
| 37.0               | 40.26        | 39.97               | 15.37            | 27.72 | 31.0                                | 6.3                  | 44.62       |
| 38.0               | 40.35        | 37.00               | 28.78            | 23.33 | 30.6                                | 6.6                  | 42.60       |
| 39.0               | 39.86        | 34.40               | 21.13            | 18.06 | 30.6                                | 6.8                  | 40.67       |
| 40.0               | 39.23        | 37.19               | 19.43            | 16.89 | 30.4                                | 6.8                  | 42.00       |
| 41.0               | 39.13        | 35.91               | 17.28            | 17.98 | 30.2                                | 7.4                  | 38.56       |
| 42.0               | 39.47        | 34.40               | 12.08            | 21.00 | 29.7                                | 7.5                  | 36.91       |
| 43.0               | 40.18        | 30.90               | 12.94            | 21.39 | 28.9                                | 7.5                  | 38.71       |
| 44.0               | 40.77        | 29.72               | 18.52            | 16.87 | 28.4                                | 7.5                  | 40.05       |

# Coaxial Amplifier

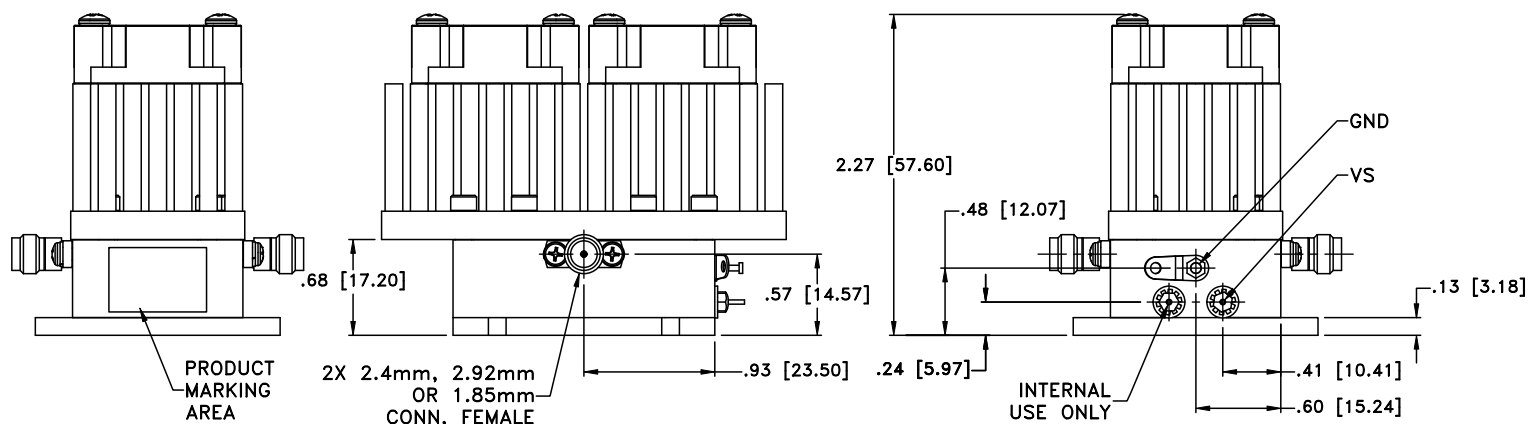
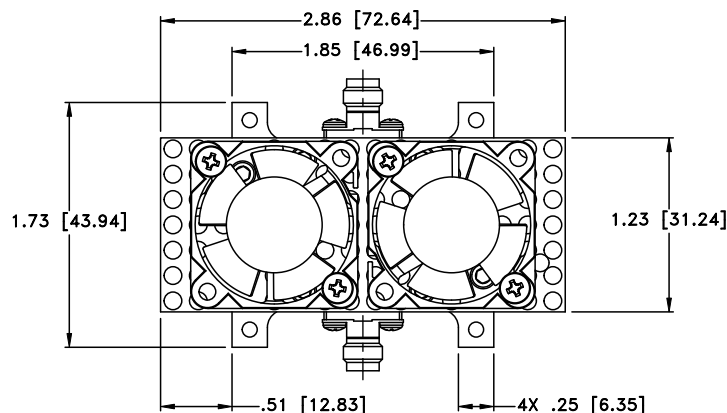
# ZVE-433HP(X)+

## Typical Performance Curves

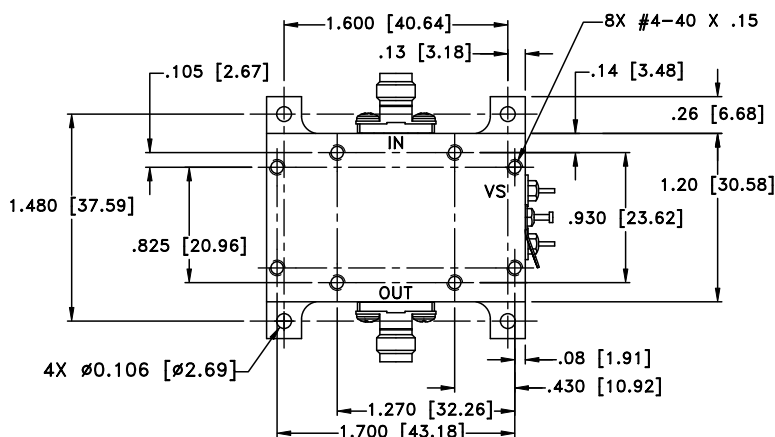


## Outline Dimensions

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.  $\pm 0.03$ ; 3 Pl.  $\pm 0.015$

### 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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RF/IF MICROWAVE COMPONENTS



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            |