



COAXIAL

# Wideband Amplifier

## ZVA-02653G+ ZVA-02653GX+

Mini-Circuits

50Ω 2 to 65 GHz Medium Power High Gain

### THE BIG DEAL

- High gain 21 dB typ. over the entire operating band
- Good gain flatness,  $\pm 3.0$  dB typ. up to 60 GHz
- +18 dBm Psat typ.
- Wide operating DC voltage, +10 to +15 V
- DC protected against over-voltage, reverse-voltage conditions

### APPLICATIONS

- 4G, 5G FR1, FR2 & FR2+
- Broadband Telecom
- Satellite Communications
- Test & Measurements
- WiFi6E (2.4, 5.8, 7.2 GHz)
- Aerospace & Defense



Generic photo used for illustration purposes only

|                   |               |                  |
|-------------------|---------------|------------------|
| <b>Model No.</b>  | ZVA-02653G+   | ZVA-02653GX+     |
| <b>Option</b>     | With heatsink | Without heatsink |
| <b>Case Style</b> | WC3071-6      |                  |
| <b>Connector</b>  | 1.85mm Female |                  |

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

### PRODUCT OVERVIEW

Mini-Circuits' ZVA-02653G(X)+ is a coaxial ultra-wideband amplifier, operating from 2 to 65 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 medium output power makes this amplifier an ideal choice for testing and instrumentation applications.

### KEY FEATURES

| Features  | Advantages   |
|---|--|
| Ultra-wideband amplifier, 2 to 65 GHz                                 | A single amplifier serves the need for applications including 5G bands, Broadband Telecom, SATCOM, Test & Instrumentation, etc.  |
| Heatsink option   | Model ZVA-02653G+ comes with a heatsink, 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 21 dB (typ.) of gain over the entire operating band, and can deliver over 60 mW of RF power making this amplifier an ideal choice for testing and instrumentation applications. |
| Wide Operating 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 allows the amplifier to be protected from external mishandling, that could lead to catastrophic failures in the field  |





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### ELECTRICAL SPECIFICATIONS AT 25 °C BASEPLATE

| Parameter                               | Condition (GHz) | ZVA-02653G+ <sup>3</sup><br>ZVA-02653GX+ <sup>4</sup> |                  |      | Units |
|---|-----------------|---|------------------|------|-------|
|   |                 | Min.  | Typ.             | Max. |       |
| Frequency Range                         |                 | 2   |                  | 65   | GHz   |
| Gain                                    | 2-60            | 18.0  | 21.0             | -    | dB    |
|   | 60-65           | -   | 19.0             | -    |       |
| Output Power at 1dB compression         | 2-20            | 16.0  | 19.0             | -    | dBm   |
|   | 20-40           | 13.5  | 16.5             | -    |       |
|   | 40-60           | 9.0   | 14.0             | -    |       |
|   | 60 - 65         | -   | 9.50             | -    |       |
| Saturated Output Power <sup>7</sup>     | 2-20            | 17.0  | 19.5             | -    | dBm   |
|   | 20-40           | 14.5  | 18.0             | -    |       |
|   | 40-60           | 12.0  | 16.0             | -    |       |
|   | 60 - 65         | -   | 12.5             | -    |       |
| Output IP3 (Output Power = +7 dBm/tone) | 2-65            | -   | 23.0             | -    | dBm   |
| Input VSWR                              | 2-65            | -   | 1.5              | 2.1  | :1    |
| Output VSWR <sup>1</sup>                | 2-65            | -   | 1.5              | 2.1  | :1    |
| Noise Figure                            | 2-54            | -   | 5.0              | -    | dB    |
| Operating DC Voltage                    |                 | +10   | -                | +15  | V     |
| Device Operating Current at +10 V       |                 | -   | 270              | 310  | mA    |
| Total Power Dissipation at +10 V        |                 | -   | 2.9 <sup>2</sup> | -    | W     |

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

2. Device operating power based on current when amplifier is in saturation.

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

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

### MAXIMUM RATINGS<sup>6</sup>

| Parameter                        | Ratings   |
|----------------------------------|---|
| Operating Temperature            | ZVA-02653G+ -40 °C to +50 °C Ambient<br>ZVA-02653GX+ -40 °C to +60 °C Baseplate |
| Storage Temperature              | -40 °C to +85 °C  |
| RF Input Power <sup>5</sup> (CW) | +8 dBm  |
| DC Operating Voltage             | +16 V   |

5. Specified under matched load to 50 ohms.

6. Continuous operation is not recommended at these extremes. Permanent damage may occur if any of these limits are exceeded.

7. At Psat, Pout changes less than 0.1 dB for a 1 dB change in Pin.

### DETERMINING MAXIMUM THERMAL RESISTANCE OF USERS' EXTERNAL HEAT SINK

|                                   |   |
|-----------------------------------|---|
| <b>MAXIMUM THERMAL RESISTANCE</b> | $= \frac{\text{MAXIMUM OPERATING CASE TEMP} - \text{MAXIMUM USER AMBIENT TEMP}}{\text{POWER DISSIPATION}}$  |
| <b>Example:</b>                   | <p>MAXIMUM OPERATING BASEPLATE TEMP = 60°C (CHECK MAXIMUM RATINGS TABLE FOR THIS VALUE)</p> <p>MAXIMUM USER AMBIENT TEMP = 50 °C (USER DEFINED)</p> <p>POWER DISSIPATION = 2.9 WATTS (CHECK MAXIMUM RATINGS TABLE FOR THIS VALUE)</p> <p>THEN MAXIMUM ALLOWABLE THERMAL RESISTANCE = 3.4 °C/W</p> |





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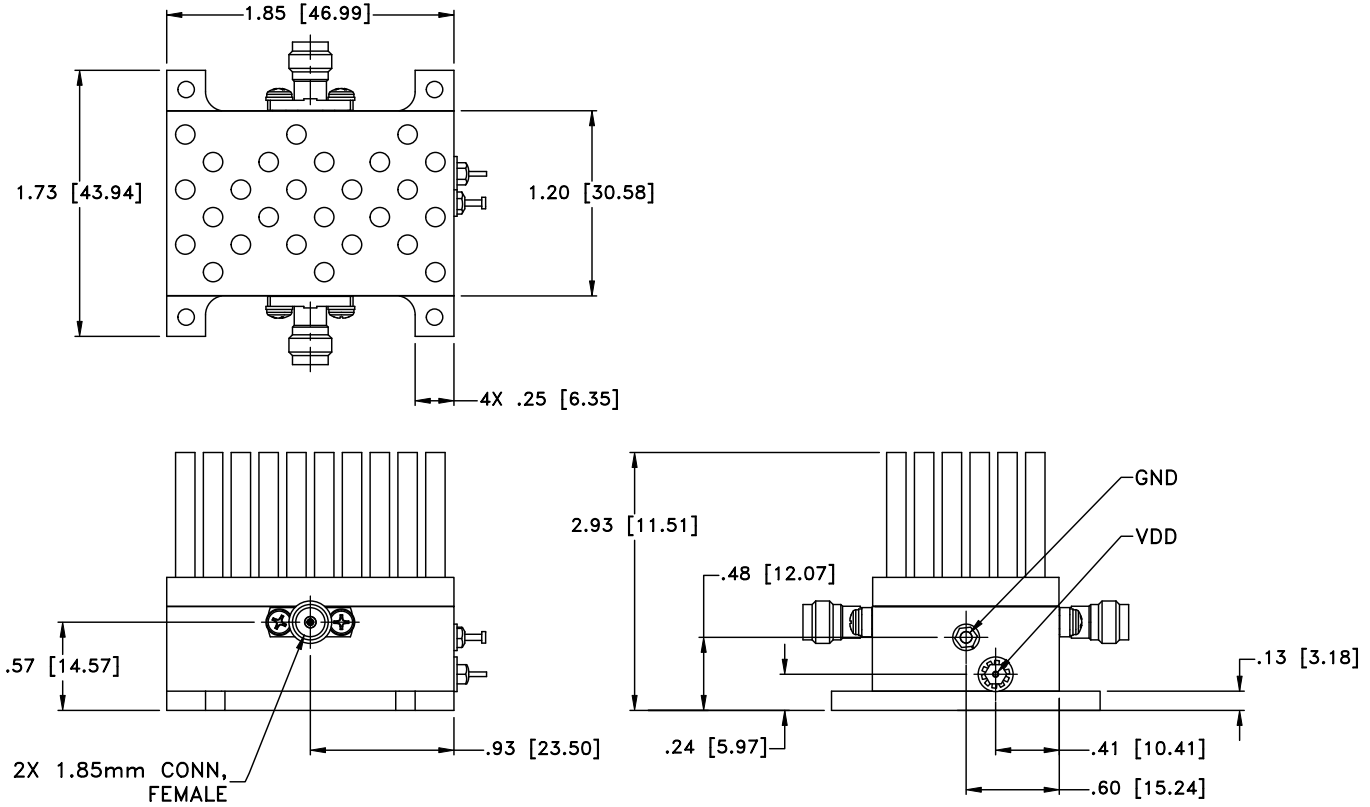
# Wideband Amplifier

## ZVA-02653G+ ZVA-02653GX+

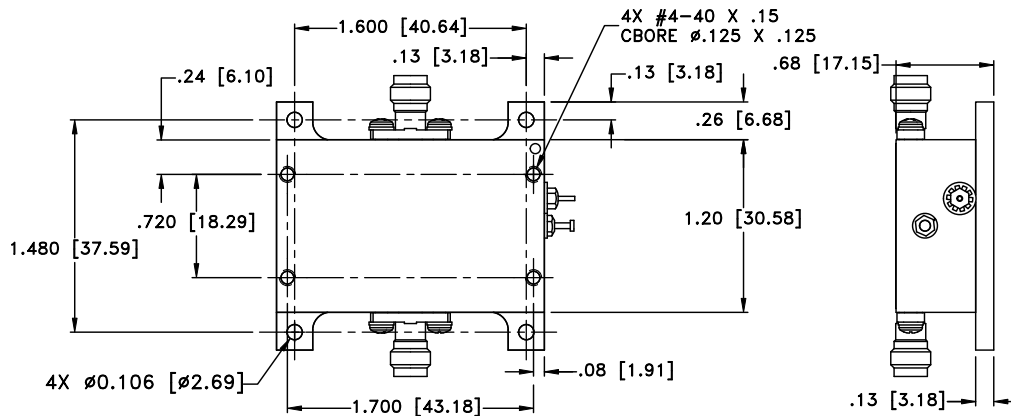
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50Ω 2 to 65 GHz Medium Power High Gain

### OUTLINE DRAWING FOR MODELS WITH HEATSINK (ZVA-02653G+)



### MOUNTING INFORMATION FOR MODELS WITHOUT HEATSINK (ZVA-02653GX+)



WT. GRAMS 90 grams; WITHOUT HEATSINK GRAMS 60 grams  
Dimensions are in inches [mm]. Tolerances: 2 Pl. ±.03; 3 Pl. ±.015





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# Wideband Amplifier

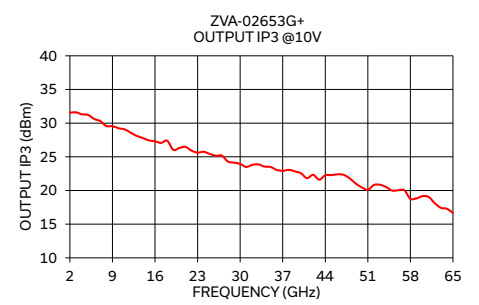
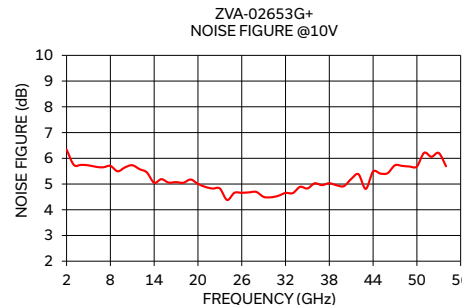
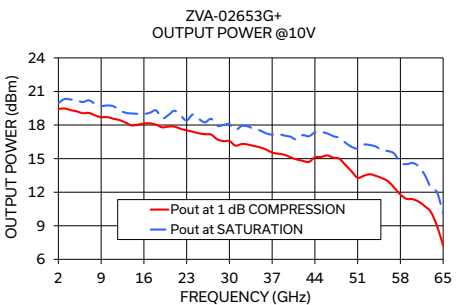
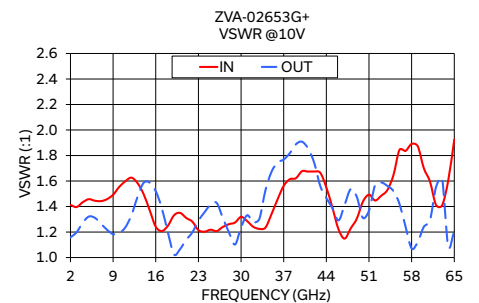
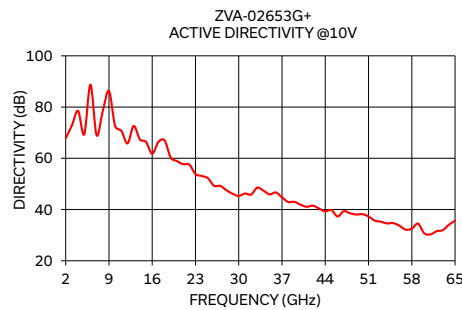
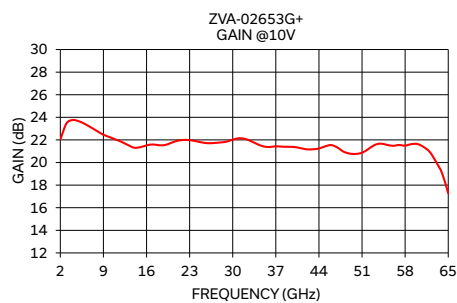
## ZVA-02653G+ ZVA-02653GX+

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50Ω 2 to 65 GHz Medium Power High Gain

### TYPICAL PERFORMANCE DATA / GRAPHS

| Frequency (GHz) | Gain (dB) 10V | Active Directivity (dB) 10V | VSWR (:1) 10V |     | Pout @ 1 dB Compression (dBm) 10V | Pout @ Saturation (dBm) 10V | Output IP3 (dBm) 10V | Noise Figure (dB) 10V |
|-----------------|---------------|-----------------------------|---------------|-----|-----------------------------------|-----------------------------|----------------------|-----------------------|
|                 |               |                             | IN            | OUT |                                   |                             |                      |                       |
| 2.0             | 22.0          | 67.8                        | 1.4           | 1.2 | 19.4                              | 20.0                        | 31.5                 | 6.3                   |
| 6.0             | 23.4          | 88.7                        | 1.4           | 1.3 | 19.1                              | 20.1                        | 30.6                 | 5.7                   |
| 10.0            | 22.3          | 72.5                        | 1.6           | 1.2 | 18.7                              | 19.7                        | 29.2                 | 5.6                   |
| 14.0            | 21.3          | 67.4                        | 1.5           | 1.6 | 18.0                              | 19.0                        | 27.8                 | 5.0                   |
| 18.0            | 21.5          | 67.0                        | 1.3           | 1.2 | 18.0                              | 19.3                        | 27.4                 | 5.0                   |
| 22.0            | 22.0          | 57.6                        | 1.3           | 1.2 | 17.7                              | 18.8                        | 25.9                 | 4.8                   |
| 26.0            | 21.7          | 49.2                        | 1.2           | 1.4 | 17.2                              | 18.2                        | 25.2                 | 4.7                   |
| 30.0            | 22.0          | 45.3                        | 1.3           | 1.2 | 16.6                              | 18.1                        | 24.0                 | 4.5                   |
| 34.0            | 21.6          | 47.4                        | 1.2           | 1.5 | 16.1                              | 17.6                        | 23.6                 | 4.9                   |
| 38.0            | 21.4          | 43.0                        | 1.6           | 1.8 | 15.4                              | 17.2                        | 23.1                 | 5.0                   |
| 42.0            | 21.2          | 41.5                        | 1.7           | 1.7 | 14.8                              | 17.1                        | 22.3                 | 5.4                   |
| 46.0            | 21.5          | 37.3                        | 1.2           | 1.3 | 15.3                              | 17.3                        | 22.4                 | 5.4                   |
| 50.0            | 20.8          | 38.2                        | 1.4           | 1.3 | 13.9                              | 16.1                        | 20.5                 | 5.7                   |
| 54.0            | 21.7          | 34.6                        | 1.5           | 1.6 | 13.5                              | 16.1                        | 20.5                 | 5.7                   |
| 58.0            | 21.5          | 32.5                        | 1.9           | 1.1 | 11.8                              | 14.6                        | 18.8                 | -                     |
| 62.0            | 20.9          | 31.5                        | 1.4           | 1.6 | 10.8                              | 13.5                        | 18.1                 | -                     |
| 65.0            | 17.3          | 35.7                        | 1.9           | 1.2 | 7.2                               | 10.1                        | 16.7                 | -                     |



#### 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)



# Coaxial Amplifier

# ZVA-02653GX+

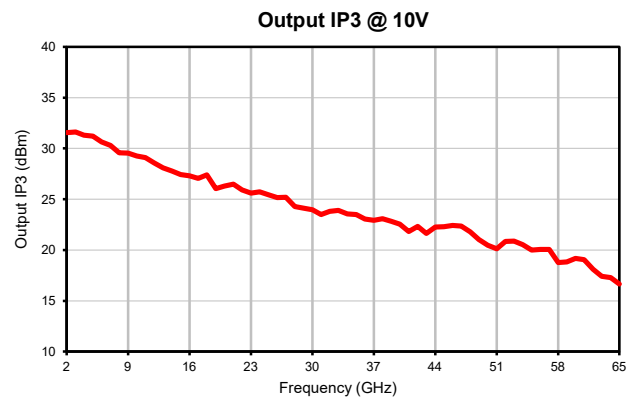
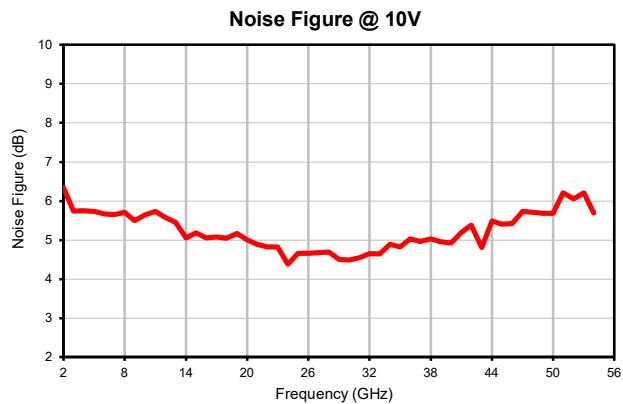
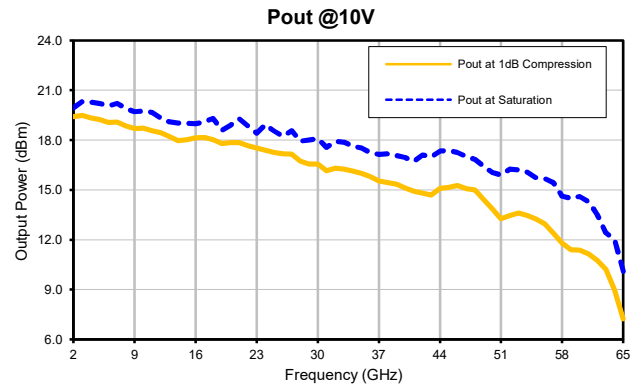
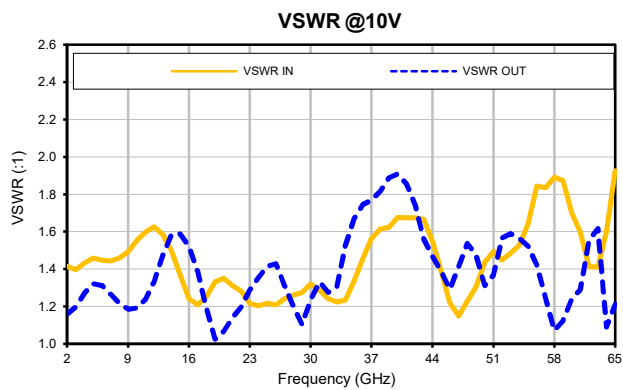
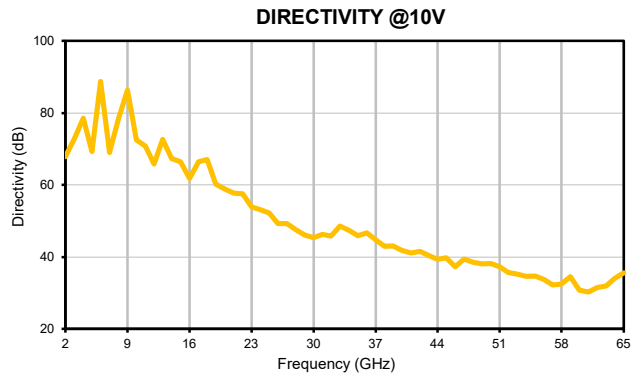
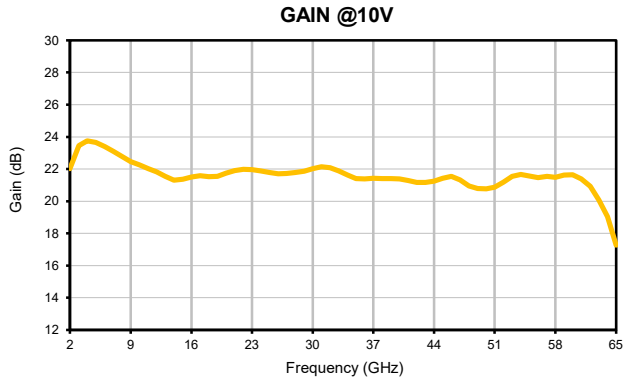
## Typical Performance Data

| FREQUENCY<br>(GHz) | GAIN<br>(dB)<br>10V | DIRECTIVITY<br>(dB)<br>10V | VSWR (:1) |            | Pout @ 1 dB<br>COMPRESSION<br>(dBm)<br>10V | OIP3<br>(dBm)<br>10V | Pout at<br>SATURATION<br>(dBm)<br>10V | FREQUENCY<br>(GHz) | Noise Figure<br>(dB)<br>10V |
|--------------------|---------------------|----------------------------|-----------|------------|--|----------------------|---------------------------------------|--------------------|-----------------------------|
|                    |                     |                            | IN<br>10V | OUT<br>10V |  |                      |                                       |                    |                             |
| 2.0                | 22.04               | 67.83                      | 1.41      | 1.16       | 19.42                                      | 31.54                | 20.0                                  | 2.0                | 6.34                        |
| 3.0                | 23.46               | 72.83                      | 1.40      | 1.20       | 19.48                                      | 31.61                | 20.3                                  | 3.0                | 5.74                        |
| 4.0                | 23.76               | 78.52                      | 1.43      | 1.27       | 19.33                                      | 31.31                | 20.3                                  | 4.0                | 5.74                        |
| 5.0                | 23.65               | 69.34                      | 1.46      | 1.32       | 19.22                                      | 31.22                | 20.2                                  | 5.0                | 5.73                        |
| 6.0                | 23.41               | 88.74                      | 1.45      | 1.31       | 19.06                                      | 30.62                | 20.1                                  | 6.0                | 5.67                        |
| 7.0                | 23.10               | 69.00                      | 1.44      | 1.27       | 19.08                                      | 30.31                | 20.2                                  | 7.0                | 5.65                        |
| 8.0                | 22.77               | 78.50                      | 1.46      | 1.22       | 18.86                                      | 29.57                | 19.9                                  | 8.0                | 5.70                        |
| 9.0                | 22.46               | 86.28                      | 1.49      | 1.18       | 18.70                                      | 29.56                | 19.7                                  | 9.0                | 5.49                        |
| 10.0               | 22.25               | 72.52                      | 1.55      | 1.19       | 18.71                                      | 29.24                | 19.7                                  | 10.0               | 5.64                        |
| 11.0               | 22.03               | 70.79                      | 1.60      | 1.24       | 18.56                                      | 29.08                | 19.7                                  | 11.0               | 5.73                        |
| 12.0               | 21.81               | 65.80                      | 1.63      | 1.33       | 18.45                                      | 28.58                | 19.3                                  | 12.0               | 5.58                        |
| 13.0               | 21.54               | 72.63                      | 1.58      | 1.47       | 18.22                                      | 28.10                | 19.1                                  | 13.0               | 5.45                        |
| 14.0               | 21.31               | 67.37                      | 1.50      | 1.59       | 17.97                                      | 27.80                | 19.0                                  | 14.0               | 5.05                        |
| 15.0               | 21.36               | 66.40                      | 1.37      | 1.59       | 18.03                                      | 27.44                | 19.0                                  | 15.0               | 5.19                        |
| 16.0               | 21.52               | 61.79                      | 1.24      | 1.52       | 18.14                                      | 27.31                | 19.0                                  | 16.0               | 5.05                        |
| 17.0               | 21.60               | 66.38                      | 1.21      | 1.39       | 18.15                                      | 27.07                | 19.1                                  | 17.0               | 5.07                        |
| 18.0               | 21.53               | 66.99                      | 1.25      | 1.20       | 18.03                                      | 27.40                | 19.3                                  | 18.0               | 5.05                        |
| 19.0               | 21.55               | 60.23                      | 1.33      | 1.02       | 17.79                                      | 26.04                | 18.6                                  | 19.0               | 5.17                        |
| 20.0               | 21.74               | 58.93                      | 1.35      | 1.07       | 17.86                                      | 26.32                | 18.9                                  | 20.0               | 5.01                        |
| 21.0               | 21.92               | 57.69                      | 1.31      | 1.14       | 17.86                                      | 26.48                | 19.3                                  | 21.0               | 4.89                        |
| 22.0               | 22.00               | 57.55                      | 1.28      | 1.20       | 17.66                                      | 25.92                | 18.8                                  | 22.0               | 4.82                        |
| 23.0               | 21.98               | 53.87                      | 1.22      | 1.29       | 17.53                                      | 25.63                | 18.4                                  | 23.0               | 4.83                        |
| 24.0               | 21.89               | 53.10                      | 1.20      | 1.35       | 17.41                                      | 25.75                | 18.9                                  | 24.0               | 4.38                        |
| 25.0               | 21.78               | 52.24                      | 1.22      | 1.42       | 17.26                                      | 25.43                | 18.5                                  | 25.0               | 4.66                        |
| 26.0               | 21.71               | 49.25                      | 1.21      | 1.43       | 17.18                                      | 25.16                | 18.2                                  | 26.0               | 4.66                        |
| 27.0               | 21.73               | 49.24                      | 1.24      | 1.31       | 17.15                                      | 25.18                | 18.6                                  | 27.0               | 4.67                        |
| 28.0               | 21.78               | 47.57                      | 1.26      | 1.20       | 16.73                                      | 24.30                | 17.9                                  | 28.0               | 4.69                        |
| 29.0               | 21.85               | 46.15                      | 1.27      | 1.10       | 16.56                                      | 24.13                | 18.0                                  | 29.0               | 4.50                        |
| 30.0               | 22.03               | 45.31                      | 1.32      | 1.24       | 16.57                                      | 23.95                | 18.1                                  | 30.0               | 4.48                        |
| 31.0               | 22.14               | 46.26                      | 1.29      | 1.33       | 16.16                                      | 23.50                | 17.6                                  | 31.0               | 4.54                        |
| 32.0               | 22.09               | 45.85                      | 1.24      | 1.28       | 16.30                                      | 23.81                | 17.9                                  | 32.0               | 4.65                        |
| 33.0               | 21.88               | 48.55                      | 1.22      | 1.30       | 16.26                                      | 23.88                | 17.9                                  | 33.0               | 4.65                        |
| 34.0               | 21.62               | 47.36                      | 1.23      | 1.53       | 16.13                                      | 23.55                | 17.6                                  | 34.0               | 4.89                        |
| 35.0               | 21.42               | 45.92                      | 1.34      | 1.67       | 16.01                                      | 23.50                | 17.5                                  | 35.0               | 4.83                        |
| 36.0               | 21.37               | 46.67                      | 1.46      | 1.75       | 15.81                                      | 23.06                | 17.26                                 | 36.0               | 5.03                        |
| 37.0               | 21.44               | 44.78                      | 1.56      | 1.77       | 15.54                                      | 22.92                | 17.14                                 | 37.0               | 4.96                        |
| 38.0               | 21.40               | 42.96                      | 1.61      | 1.82       | 15.44                                      | 23.07                | 17.18                                 | 38.0               | 5.03                        |
| 39.0               | 21.39               | 43.02                      | 1.62      | 1.89       | 15.35                                      | 22.85                | 17.06                                 | 39.0               | 4.95                        |
| 40.0               | 21.37               | 41.87                      | 1.68      | 1.91       | 15.12                                      | 22.56                | 16.95                                 | 40.0               | 4.92                        |
| 41.0               | 21.28               | 41.07                      | 1.67      | 1.85       | 14.93                                      | 21.84                | 16.71                                 | 41.0               | 5.19                        |
| 42.0               | 21.17               | 41.52                      | 1.67      | 1.74       | 14.80                                      | 22.33                | 17.10                                 | 42.0               | 5.38                        |
| 43.0               | 21.17               | 40.38                      | 1.66      | 1.56       | 14.70                                      | 21.61                | 16.99                                 | 43.0               | 4.81                        |
| 44.0               | 21.24               | 39.30                      | 1.55      | 1.47       | 15.11                                      | 22.25                | 17.34                                 | 44.0               | 5.48                        |
| 45.0               | 21.43               | 39.77                      | 1.39      | 1.39       | 15.15                                      | 22.28                | 17.38                                 | 45.0               | 5.41                        |
| 46.0               | 21.54               | 37.29                      | 1.22      | 1.29       | 15.28                                      | 22.40                | 17.26                                 | 46.0               | 5.42                        |
| 47.0               | 21.32               | 39.37                      | 1.15      | 1.41       | 15.09                                      | 22.33                | 17.01                                 | 47.0               | 5.73                        |
| 48.0               | 20.96               | 38.55                      | 1.23      | 1.54       | 14.99                                      | 21.82                | 16.84                                 | 48.0               | 5.70                        |
| 49.0               | 20.79               | 38.06                      | 1.30      | 1.48       | 14.43                                      | 21.05                | 16.42                                 | 49.0               | 5.68                        |
| 50.0               | 20.76               | 38.21                      | 1.44      | 1.31       | 13.87                                      | 20.47                | 16.06                                 | 50.0               | 5.68                        |
| 51.0               | 20.87               | 37.31                      | 1.49      | 1.37       | 13.28                                      | 20.10                | 15.90                                 | 51.0               | 6.21                        |
| 52.0               | 21.19               | 35.68                      | 1.45      | 1.57       | 13.46                                      | 20.82                | 16.25                                 | 52.0               | 6.06                        |
| 53.0               | 21.54               | 35.26                      | 1.48      | 1.59       | 13.60                                      | 20.85                | 16.22                                 | 53.0               | 6.21                        |
| 54.0               | 21.67               | 34.59                      | 1.53      | 1.56       | 13.45                                      | 20.52                | 16.07                                 | 54.0               | 5.69                        |
| 55.0               | 21.57               | 34.72                      | 1.64      | 1.52       | 13.25                                      | 19.99                | 15.73                                 |                    |                             |
| 56.0               | 21.48               | 33.69                      | 1.84      | 1.42       | 12.96                                      | 20.04                | 15.67                                 |                    |                             |
| 57.0               | 21.55               | 32.17                      | 1.84      | 1.24       | 12.40                                      | 20.04                | 15.44                                 |                    |                             |
| 58.0               | 21.49               | 32.50                      | 1.89      | 1.07       | 11.79                                      | 18.77                | 14.62                                 |                    |                             |
| 59.0               | 21.63               | 34.52                      | 1.87      | 1.12       | 11.40                                      | 18.83                | 14.50                                 |                    |                             |
| 60.0               | 21.64               | 30.77                      | 1.70      | 1.24       | 11.38                                      | 19.16                | 14.61                                 |                    |                             |
| 61.0               | 21.37               | 30.27                      | 1.60      | 1.29       | 11.15                                      | 19.04                | 14.30                                 |                    |                             |
| 62.0               | 20.94               | 31.54                      | 1.41      | 1.55       | 10.75                                      | 18.13                | 13.53                                 |                    |                             |
| 63.0               | 20.07               | 31.96                      | 1.41      | 1.62       | 10.22                                      | 17.43                | 12.42                                 |                    |                             |
| 64.0               | 19.05               | 34.05                      | 1.60      | 1.09       | 8.98                                       | 17.29                | 11.99                                 |                    |                             |
| 65.0               | 17.27               | 35.65                      | 1.93      | 1.21       | 7.23                                       | 16.67                | 10.10                                 |                    |                             |

# Coaxial Amplifier

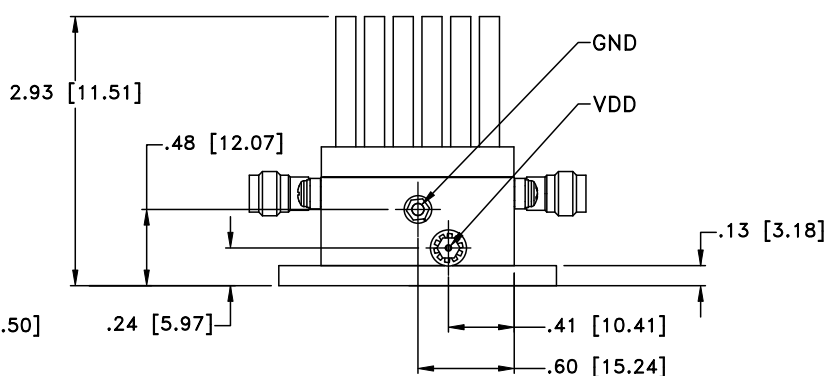
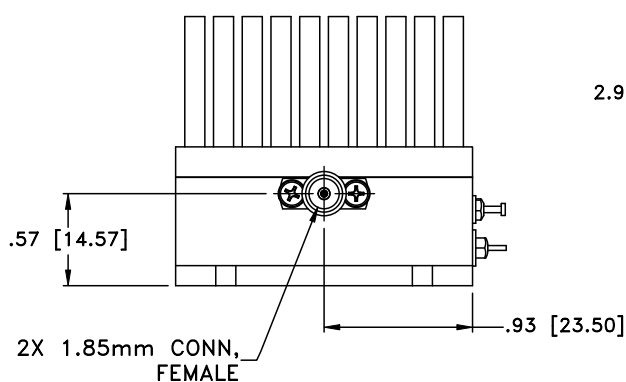
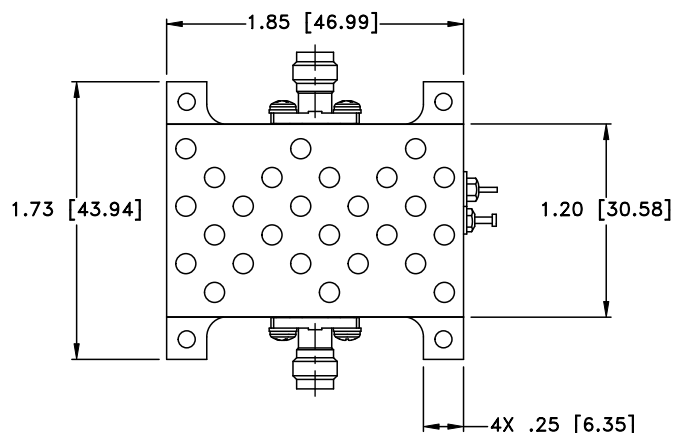
# ZVA-02653GX+

## Typical Performance Curves

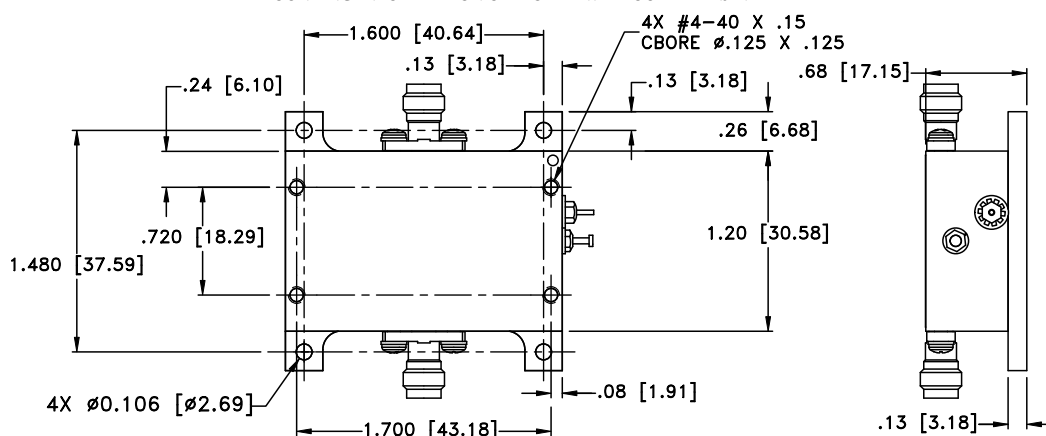


## Outline Dimensions

WC3071-6



### MOUNTING INFORMATION OF MODEL WITHOUT HEATSINK



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

Dimensions are in inches (mm). Tolerances: 2 Pl. ±.03; 3 Pl. ±.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.

| <b>Specification</b>  | <b>Test/Inspection Condition</b>      | <b>Reference/Spec</b>                          |
|-----------------------|---------------------------------------|--|
| 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            |