

# Suspended Substrate Stripline Filters and Multiplexers

50Ω      DC to 40 GHz

## The Big Deal

- Low insertion loss
- Ultra-wide passband width
- Fast roll-off with wide stopband
- Good power handling and temperature stability
- Passband up to 40 GHz
- Stopband up to 40 GHz



## Product Overview

Mini-Circuits' Suspended Substrate Stripline filters offer low insertion loss by implementing printed circuit board suspended between two parallel ground planes, providing high Q. Low insertion loss combined with wide stopband makes them an excellent choice for wideband instruments and systems like ECM, ECCM, ELINT and ultra-broadband receivers.

Low pass, high pass, band pass, band stop, diplexer and multiplexer designs can be realized with this technology. Advanced filter design and construction can achieve stopband width greater than 6x the center frequency, and temperature stability will be better than other printed circuit realizations because the fields are mainly in the air rather than in a dielectric. The inside walls of the housing hold the circuit and prevent movement that could be caused by vibration or mechanical shock, making these designs excellent candidates for harsh operating environments.

Suspended substrate stripline filters can be realized in small form factors with high-quality, precise machining for applications where size is critical. Excellent repeatability across units is achieved through precise tuning and process control.

## Key Features

| Feature                         | Advantages                                                                                                       |
|---------------------------------|------------------------------------------------------------------------------------------------------------------|
| Low insertion loss              | Low signal loss results in better SNR in receiver front end and better power delivery to antenna in transmitters |
| Fast roll-off                   | Higher selectivity results in better adjacent channel rejection and dynamic range                                |
| Wide stopband                   | Wide, spur-free stop band results in better receiver sensitivity                                                 |
| High power handling             | Well suited for transmitter applications                                                                         |
| Excellent temperature stability | Ensures minimal variation in electrical performance across temperature                                           |

**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/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp)

# Suspended substrate stripline Low Pass Filter

50Ω DC to 24000 MHz

## ZLSS-K24G+



Generic photo used for illustration purposes only

CASE STYLE: UZ3156

| Connectors | Model      |
|------------|------------|
| 2.92mm-F   | ZLSS-K24G+ |

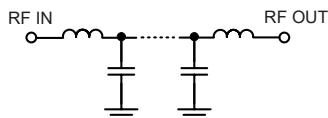
### Features

- Wider stopband up to 40000 MHz
- High rejection of 90 dB typical
- Low passband IL 1.5 dB typ.
- Low VSWR of 2:1 typ. in passband

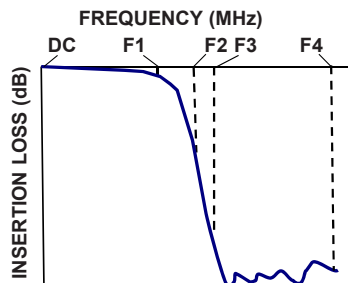
### Applications

- 5G
- Test and instrumentation
- Harmonic rejection
- Transmitter / Receiver

### Functional Schematic



### Typical Frequency Response



#### +RoHS Compliant

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

### Electrical Specifications at 25°C

| Parameter |                | F#    | Frequency (MHz) | Min. | Typ. | Max. | Unit |
|-----------|----------------|-------|-----------------|------|------|------|------|
| Pass Band | Insertion Loss | DC-F1 | DC - 24000      | -    | 1.5  | 2.5  | dB   |
|           | VSWR           | DC-F1 | DC - 24000      | -    | 2.0  | -    | :1   |
| Stop Band | Insertion Loss | F2-F3 | 29000 - 33000   | 20   | 40   | -    | dB   |
|           |                | F3-F4 | 33000 - 40000   | 50   | 70   | -    | dB   |

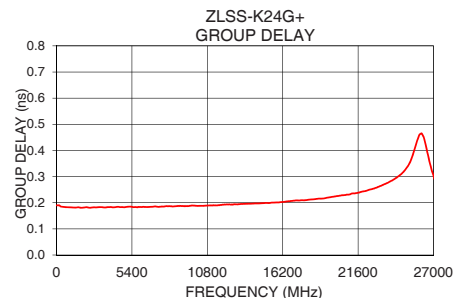
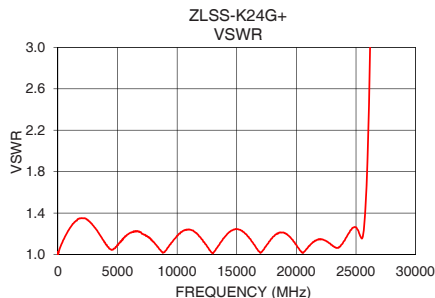
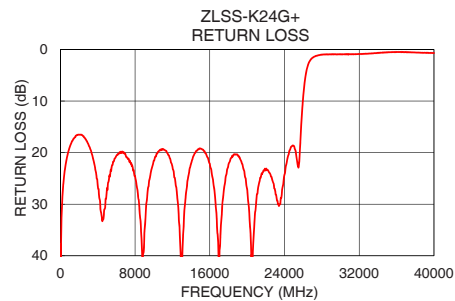
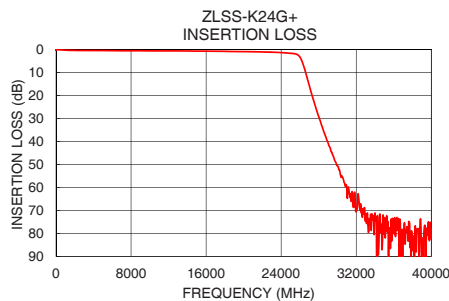
#### Maximum Ratings

|                       |                |
|-----------------------|----------------|
| Operating Temperature | -40°C to 85°C  |
| Storage Temperature   | -55°C to 100°C |
| RF Power Input        | 2W @ 25°C      |

Permanent damage may occur if any of these limits are exceeded.

### Typical Performance Data at 25°C

| Frequency (MHz) | Insertion Loss (dB) | VSWR (:1) | Frequency (MHz) | Group Delay (ns) |
|-----------------|---------------------|-----------|-----------------|------------------|
| 10              | 0.03                | 1.00      | 10              | 0.19             |
| 100             | 0.01                | 1.04      | 500             | 0.18             |
| 1000            | 0.28                | 1.25      | 1000            | 0.18             |
| 2000            | 0.39                | 1.35      | 1500            | 0.18             |
| 5000            | 0.46                | 1.13      | 2000            | 0.18             |
| 10000           | 0.59                | 1.18      | 3000            | 0.18             |
| 20000           | 0.92                | 1.06      | 4000            | 0.18             |
| 21000           | 0.97                | 1.06      | 5000            | 0.18             |
| 24000           | 1.33                | 1.12      | 6000            | 0.18             |
| 26000           | 3.28                | 1.96      | 7000            | 0.19             |
| 27000           | 15.74               | 11.03     | 8000            | 0.19             |
| 27300           | 20.01               | 13.65     | 9000            | 0.19             |
| 28500           | 35.10               | 20.58     | 10000           | 0.19             |
| 29000           | 40.57               | 21.82     | 11000           | 0.19             |
| 29500           | 45.97               | 21.49     | 12000           | 0.19             |
| 30000           | 50.42               | 20.48     | 13000           | 0.19             |
| 33000           | 74.35               | 18.59     | 14000           | 0.20             |
| 35000           | 73.18               | 20.72     | 15000           | 0.20             |
| 38000           | 80.86               | 22.43     | 20000           | 0.22             |
| 40000           | 78.01               | 23.06     | 24000           | 0.28             |



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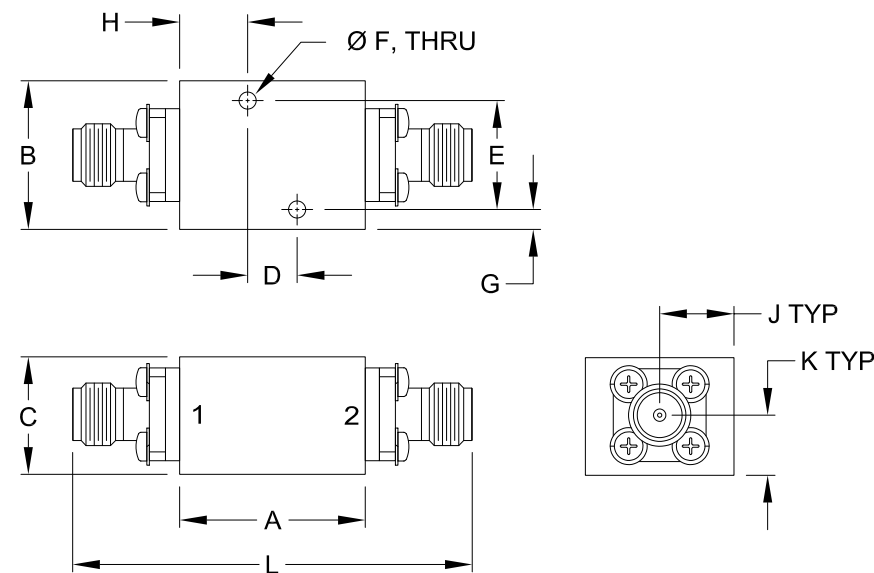
[www.minicircuits.com](http://www.minicircuits.com) P.O. Box 350166, Brooklyn, NY 11235-0003 (718) 934-4500 [sales@minicircuits.com](mailto:sales@minicircuits.com)

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Coaxial Connections

|          |               |
|----------|---------------|
| PORT - 1 | 2.92mm-Female |
| PORT - 2 | 2.92mm-Female |

Outline Drawing



Outline Dimensions (  $\frac{\text{inch}}{\text{mm}}$  )

|      |      |      |      |       |      |       |
|------|------|------|------|-------|------|-------|
| A    | B    | C    | D    | E     | F    | G     |
| .75  | .60  | .48  | .200 | .440  | .070 | .08   |
| 19.1 | 15.2 | 12.1 | 5.08 | 11.18 | 1.78 | 2.0   |
| H    | J    | K    | L    |       |      | Wt.   |
| .28  | .30  | .24  | 1.61 |       |      | grams |
| 7.0  | 7.6  | 6.2  | 41.0 |       |      | 35    |

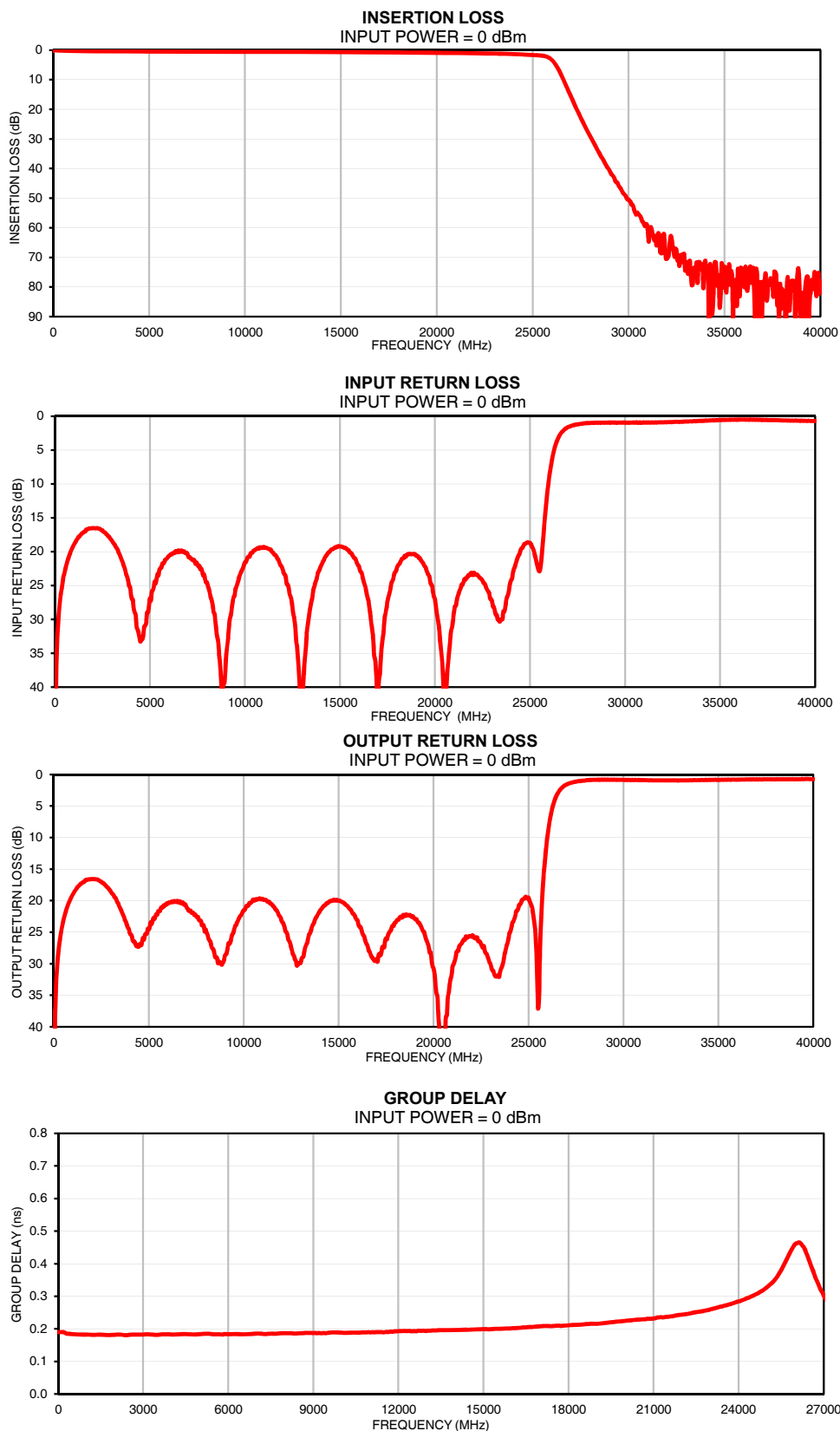
Note: Please refer to case style drawing for details

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## Typical Performance Data

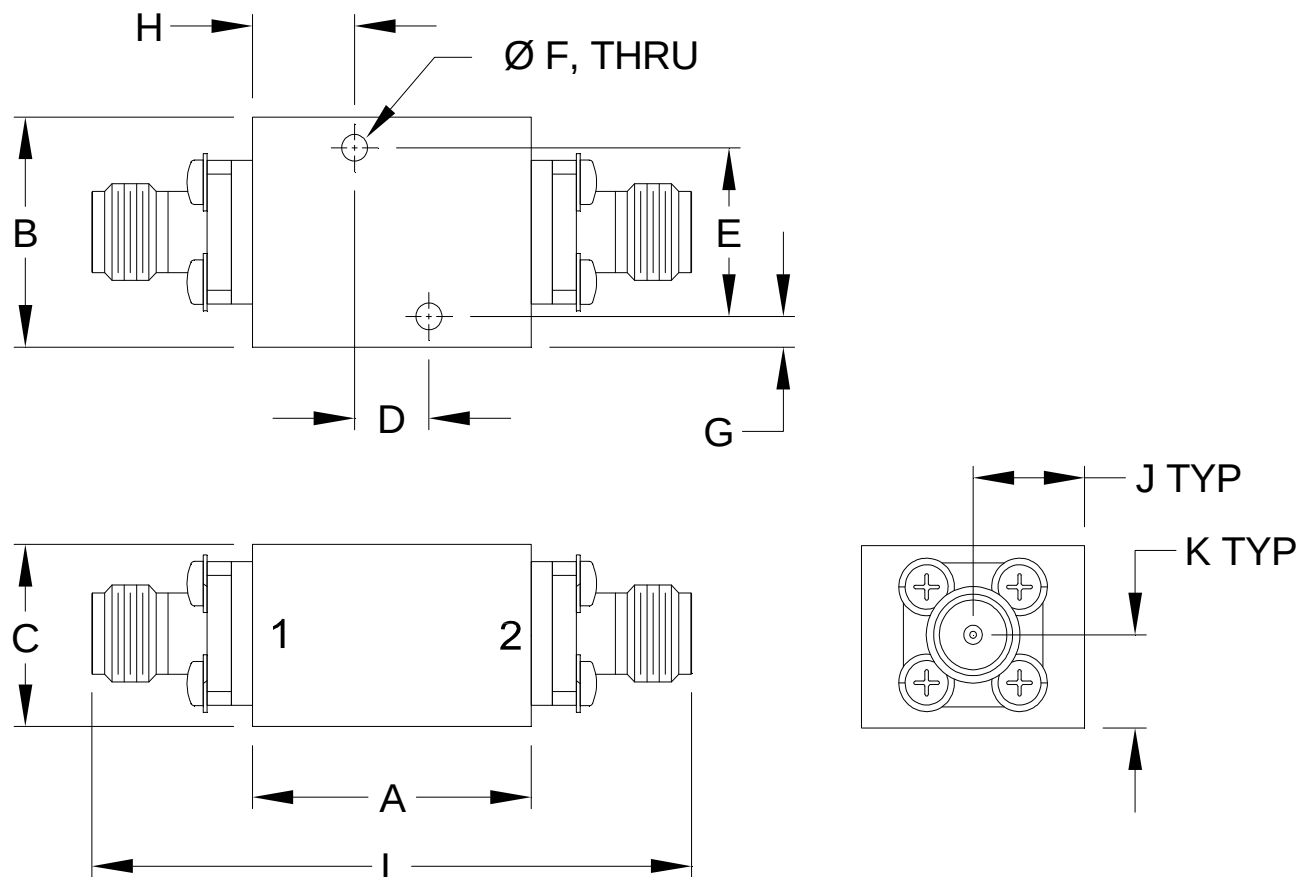
| FREQ. | Insertion Loss | Input Return Loss | Output Return Loss | FREQ. | Group Delay |
|-------|----------------|-------------------|--------------------|-------|-------------|
| (MHz) | (dB)           | (dB)              | (dB)               | (MHz) | (ns)        |
| 10    | 0.03           | 51.44             | 52.25              | 10    | 0.19        |
| 50    | 0.06           | 42.17             | 41.68              | 50    | 0.19        |
| 100   | 0.01           | 34.69             | 34.73              | 100   | 0.19        |
| 500   | 0.18           | 23.23             | 23.28              | 300   | 0.19        |
| 1000  | 0.28           | 18.95             | 19.02              | 500   | 0.18        |
| 2000  | 0.39           | 16.52             | 16.61              | 700   | 0.18        |
| 2500  | 0.42           | 16.85             | 17.01              | 900   | 0.18        |
| 3000  | 0.42           | 18.37             | 18.54              | 1100  | 0.18        |
| 4000  | 0.45           | 26.24             | 25.12              | 1300  | 0.18        |
| 5000  | 0.46           | 26.91             | 24.59              | 1500  | 0.18        |
| 6000  | 0.52           | 20.62             | 20.51              | 1700  | 0.18        |
| 6500  | 0.53           | 19.82             | 20.02              | 1900  | 0.18        |
| 7000  | 0.55           | 20.54             | 21.09              | 2100  | 0.18        |
| 7500  | 0.54           | 21.92             | 22.45              | 2300  | 0.18        |
| 8000  | 0.55           | 24.54             | 24.56              | 2500  | 0.18        |
| 9000  | 0.55           | 35.61             | 28.84              | 2700  | 0.18        |
| 10000 | 0.59           | 21.58             | 21.53              | 2900  | 0.18        |
| 10500 | 0.61           | 19.80             | 19.83              | 3100  | 0.18        |
| 11000 | 0.62           | 19.30             | 19.72              | 3300  | 0.18        |
| 11500 | 0.62           | 20.21             | 20.63              | 3500  | 0.18        |
| 11700 | 0.62           | 21.01             | 21.42              | 3700  | 0.18        |
| 12000 | 0.61           | 22.74             | 23.26              | 3900  | 0.18        |
| 12400 | 0.59           | 26.61             | 26.40              | 4100  | 0.18        |
| 12500 | 0.60           | 28.24             | 27.43              | 4300  | 0.18        |
| 13000 | 0.61           | 46.14             | 29.87              | 4500  | 0.18        |
| 13600 | 0.62           | 25.61             | 24.08              | 4700  | 0.18        |
| 15000 | 0.70           | 19.21             | 20.02              | 4900  | 0.18        |
| 16000 | 0.73           | 22.14             | 23.17              | 5100  | 0.18        |
| 20000 | 0.92           | 27.04             | 30.75              | 5300  | 0.18        |
| 24000 | 1.33           | 24.27             | 25.15              | 5500  | 0.18        |
| 26000 | 3.28           | 9.23              | 9.75               | 5700  | 0.18        |
| 26500 | 8.49           | 3.12              | 3.17               | 5900  | 0.18        |
| 27000 | 15.74          | 1.61              | 1.58               | 6100  | 0.18        |
| 27300 | 20.01          | 1.33              | 1.27               | 6300  | 0.18        |
| 27500 | 22.75          | 1.19              | 1.14               | 6500  | 0.18        |
| 27700 | 25.35          | 1.09              | 1.02               | 6700  | 0.18        |
| 27900 | 27.97          | 1.05              | 0.98               | 6900  | 0.18        |
| 28000 | 29.05          | 0.99              | 0.95               | 7000  | 0.19        |
| 28300 | 32.78          | 0.98              | 0.87               | 7500  | 0.19        |
| 28500 | 35.10          | 0.93              | 0.84               | 8000  | 0.19        |
| 28700 | 37.34          | 0.98              | 0.81               | 8500  | 0.19        |
| 28900 | 39.67          | 0.97              | 0.83               | 9000  | 0.19        |
| 29000 | 40.57          | 0.93              | 0.80               | 9500  | 0.19        |
| 29300 | 44.04          | 0.91              | 0.84               | 10000 | 0.19        |
| 29500 | 45.97          | 0.93              | 0.81               | 10500 | 0.19        |
| 29700 | 48.13          | 0.96              | 0.86               | 11000 | 0.19        |
| 29900 | 49.96          | 0.95              | 0.86               | 11500 | 0.19        |
| 30000 | 50.42          | 0.96              | 0.85               | 12000 | 0.19        |
| 30300 | 54.10          | 0.94              | 0.85               | 12500 | 0.19        |
| 32000 | 70.48          | 0.91              | 0.93               | 13000 | 0.19        |
| 32500 | 67.55          | 0.87              | 0.93               | 13500 | 0.20        |
| 33000 | 74.35          | 0.81              | 0.94               | 14000 | 0.20        |
| 33500 | 74.67          | 0.77              | 0.91               | 14500 | 0.20        |
| 34000 | 71.10          | 0.69              | 0.88               | 15000 | 0.20        |
| 34500 | 71.62          | 0.64              | 0.84               | 16000 | 0.20        |
| 35000 | 73.18          | 0.57              | 0.84               | 17000 | 0.21        |
| 35500 | 77.94          | 0.51              | 0.81               | 20000 | 0.22        |
| 36000 | 77.80          | 0.52              | 0.81               | 21000 | 0.23        |
| 39000 | 91.25          | 0.63              | 0.74               | 22000 | 0.24        |
| 40000 | 78.01          | 0.70              | 0.75               | 24000 | 0.28        |

## Typical Performance Curves



## Outline Dimensions

UZ3156



| CASE#  | A             | B             | C             | D              | E               | F              | G            |
|--------|---------------|---------------|---------------|----------------|-----------------|----------------|--------------|
| UZ3156 | .75<br>(19.1) | .60<br>(15.2) | .48<br>(12.1) | .200<br>(5.08) | .440<br>(11.18) | .070<br>(1.78) | .08<br>(2.0) |

| CASE#  | H            | J            | K            | L              | WT. GRAMS |
|--------|--------------|--------------|--------------|----------------|-----------|
| UZ3156 | .28<br>(7.0) | .30<br>(7.6) | .24<br>(6.2) | 1.61<br>(41.0) | 35        |

Dimensions are in inches (mm). Tolerances: 2 Pl.  $\pm .100$ ; 3 Pl.  $\pm .015$

### Notes:

1. Case material: Brass.
2. Case Finish: Powder coated over silver plating.
3. Refer to the individual model data sheet for the type of connectors available.



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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 85° C<br>Ambient Temperature  | Individual Model Data Sheet |
| Storage Temperature   | -55° to 100° C<br>Ambient Environment | Individual Model Data Sheet |