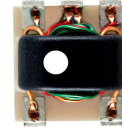


# Surface Mount RF Transformer

50Ω

2 to 200 MHz

TC9-1+



CASE STYLE: AT224-1

## Maximum Ratings

|                                                                 |                |
|-----------------------------------------------------------------|----------------|
| Operating Temperature                                           | -20°C to 85°C  |
| Storage Temperature                                             | -55°C to 100°C |
| RF Power                                                        | 0.25W          |
| DC Current                                                      | 30mA           |
| Permanent damage may occur if any of these limits are exceeded. |                |

## Pin Connections

|               |   |
|---------------|---|
| PRIMARY DOT   | 6 |
| PRIMARY       | 4 |
| SECONDARY DOT | 1 |
| SECONDARY     | 3 |
| SECONDARY CT  | 2 |

## Features

- good return loss
- excellent amplitude unbalance, 0.1dB typ. and phase unbalance, 1 deg typ. in 1dB band width
- plastic base with leads
- aqueous washable

## Applications

- impedance matching

### \*Addition of Top hat™ feature

#### Benefits

- Allows faster pick-and-place
- Enables visual identification marking

### +RoHS Compliant

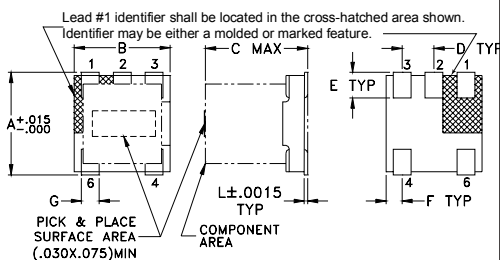
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

## Transformer Electrical Specifications

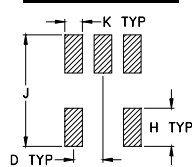
| Ω<br>RATIO<br>(Secondary/Primary) | FREQUENCY<br>(MHz) | INSERTION LOSS* |             |             |
|-----------------------------------|--------------------|-----------------|-------------|-------------|
|                                   |                    | 3 dB<br>MHz     | 2 dB<br>MHz | 1 dB<br>MHz |
| 9                                 | 2-200              | 2-200           | 3-100       | 5-40        |

\* Insertion Loss is referenced to mid-band loss, 0.7 dB typ.

## Outline Drawing AT224-1



### PCB Land Pattern

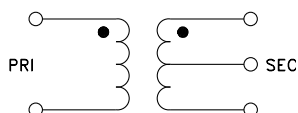


Suggested Layout,  
Tolerance to be within ±002

## Outline Dimensions (inch/mm)

| A    | B    | C    | D    | E    | F     |
|------|------|------|------|------|-------|
| .150 | .150 | .160 | .050 | .040 | .025  |
| 3.81 | 3.81 | 4.06 | 1.27 | 1.02 | 0.64  |
| G    | H    | J    | K    | L    | wt    |
| .028 | .065 | .190 | .030 | .007 | grams |
| 0.71 | 1.65 | 4.83 | 0.76 | 0.18 | 0.15  |

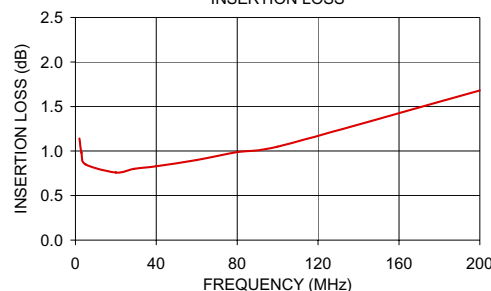
## Config. A



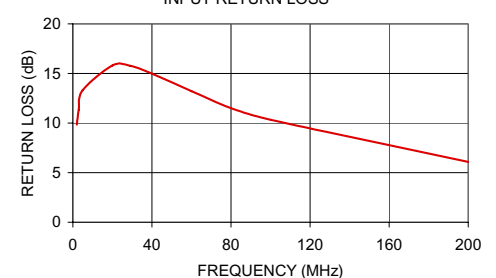
## Typical Performance Data

| FREQUENCY<br>(MHz) | INSERTION<br>LOSS<br>(dB) | INPUT<br>R. LOSS<br>(dB) |
|--------------------|---------------------------|--------------------------|
| 2.00               | 1.14                      | 9.85                     |
| 3.00               | 0.98                      | 11.35                    |
| 5.00               | 0.85                      | 13.33                    |
| 20.00              | 0.76                      | 15.80                    |
| 29.00              | 0.80                      | 15.77                    |
| 40.00              | 0.83                      | 14.99                    |
| 60.00              | 0.90                      | 13.22                    |
| 80.00              | 0.99                      | 11.50                    |
| 100.00             | 1.05                      | 10.34                    |
| 200.00             | 1.68                      | 6.08                     |

TC9-1+  
INSERTION LOSS



TC9-1+  
INPUT RETURN LOSS



## Notes

- 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.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- 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)



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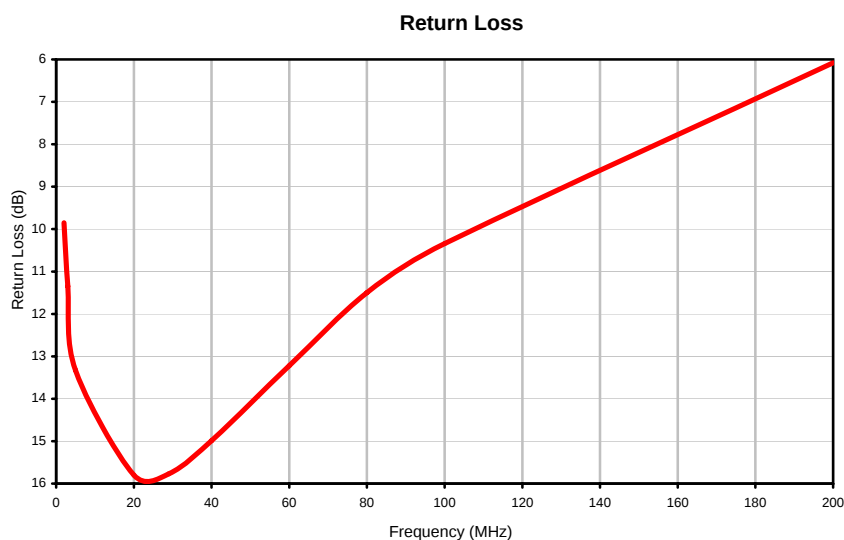
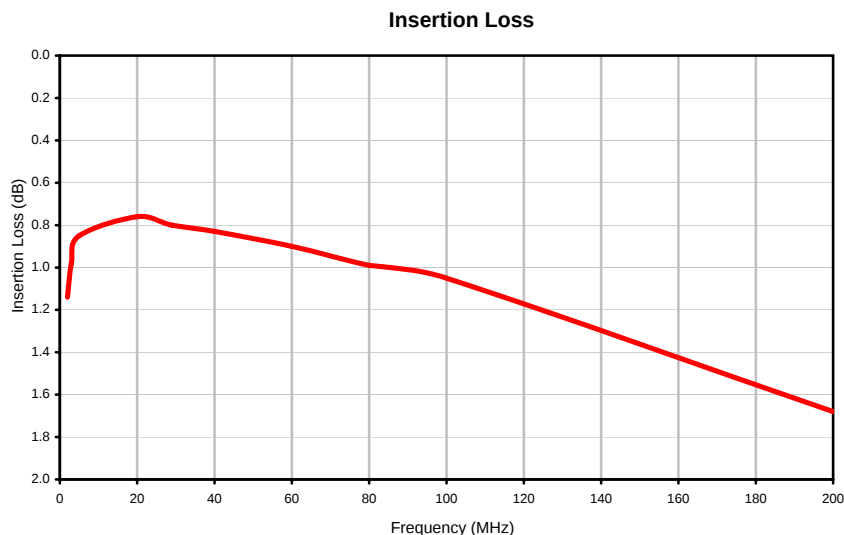
REV. D  
M151107  
TC9-1+  
ED-4155/2  
HY/TD/CP/AM  
151019  
Page 1 of 1

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*Typical Performance Data*

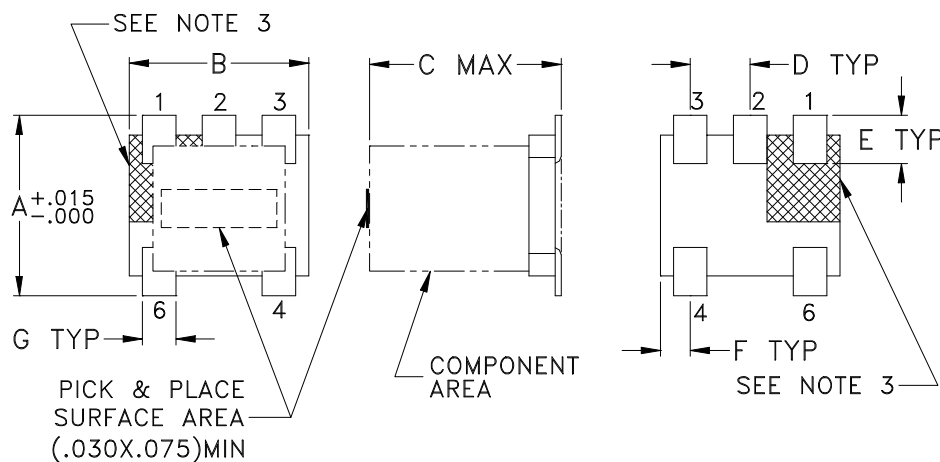
| FREQUENCY<br>(MHz) | INSERTION<br>LOSS<br>(dB) | RETURN<br>LOSS<br>(dB) |
|--------------------|---------------------------|------------------------|
| 2.00               | 1.14                      | 9.85                   |
| 3.00               | 0.98                      | 11.35                  |
| 5.00               | 0.85                      | 13.33                  |
| 20.00              | 0.76                      | 15.80                  |
| 29.00              | 0.80                      | 15.77                  |
| 40.00              | 0.83                      | 14.99                  |
| 60.00              | 0.90                      | 13.22                  |
| 80.00              | 0.99                      | 11.50                  |
| 100.00             | 1.05                      | 10.34                  |
| 200.00             | 1.68                      | 6.08                   |

## Typical Performance Curves

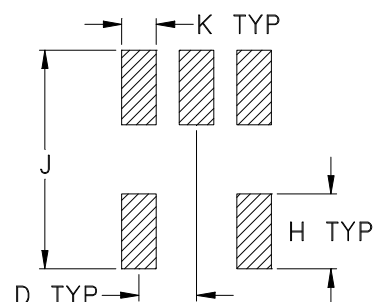


## Outline Dimensions

AT224-1A



## PCB Land Pattern



Suggested Layout,  
Tolerance to be within  $\pm.002$

| CASE #   | A              | B              | C              | D              | E              | F              | G              | H              | J              | K              | WT. GRAMS |
|----------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------|
| AT224-1A | .150<br>(3.81) | .150<br>(3.81) | .160<br>(4.06) | .050<br>(1.27) | .040<br>(1.02) | .025<br>(0.64) | .028<br>(0.71) | .065<br>(1.65) | .190<br>(4.83) | .030<br>(0.76) | .15       |

Dimensions are in inches (mm). Tolerances: 2 Pl.  $\pm .01$ ; 3 Pl.  $\pm .005$

### Notes:

- Case material: Plastic.
- Termination finish:  
For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.
- Lead #1 identifier shall be located in the cross-hatched area shown.  
Identifier may be either a molded or marked feature.



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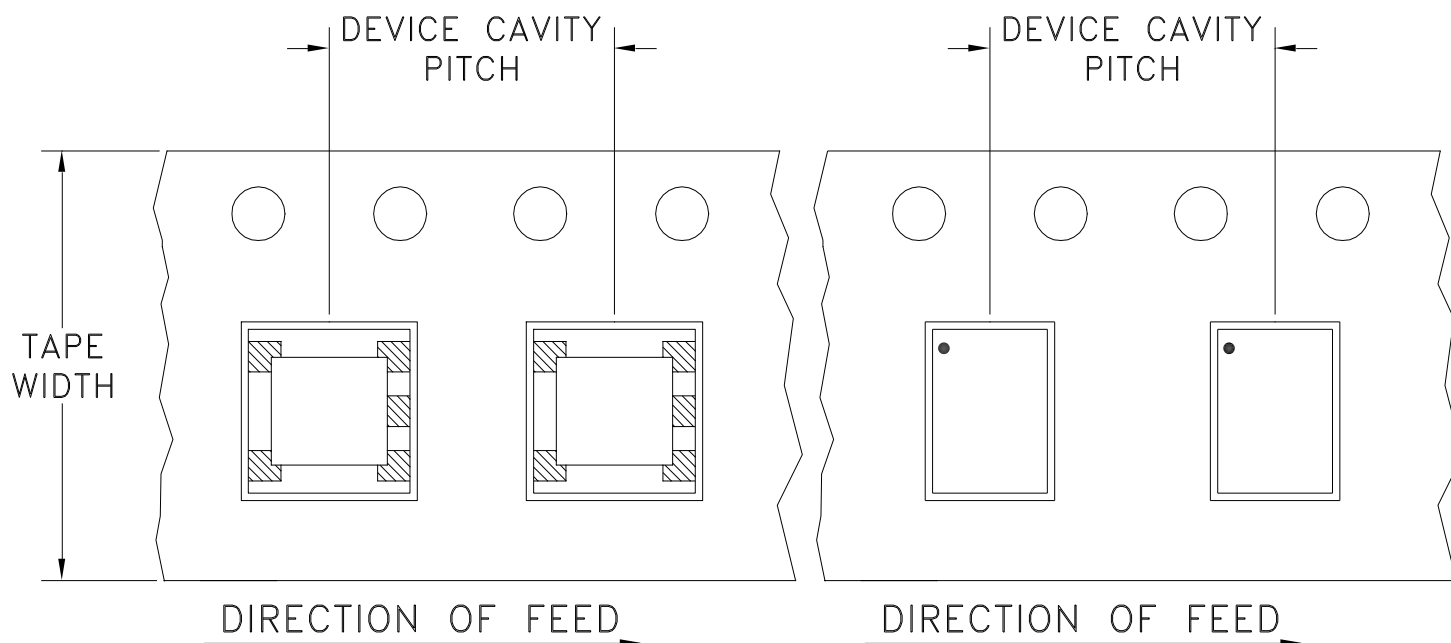


The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: [www.minicircuits.com](http://www.minicircuits.com)

RF/IF MICROWAVE COMPONENTS

# Tape & Reel Packaging TR-F17

## DEVICE ORIENTATION IN T&R



| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel                    |      |
|----------------|-------------------------|-------------------|-------------------------------------|------|
| 12             | 8                       | 7                 | Small quantity standards (see note) | 20   |
|                |                         |                   |                                     | 50   |
|                |                         |                   |                                     | 100  |
|                |                         |                   |                                     | 200  |
|                |                         |                   |                                     | 500  |
|                |                         | 13                | Standard                            | 1000 |
|                |                         |                   |                                     | 2000 |

Note: Please Consult individual model data sheet to determine device per reel availability.

Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: [www.minicircuits.com/pages/pdfs/tape.pdf](http://www.minicircuits.com/pages/pdfs/tape.pdf)



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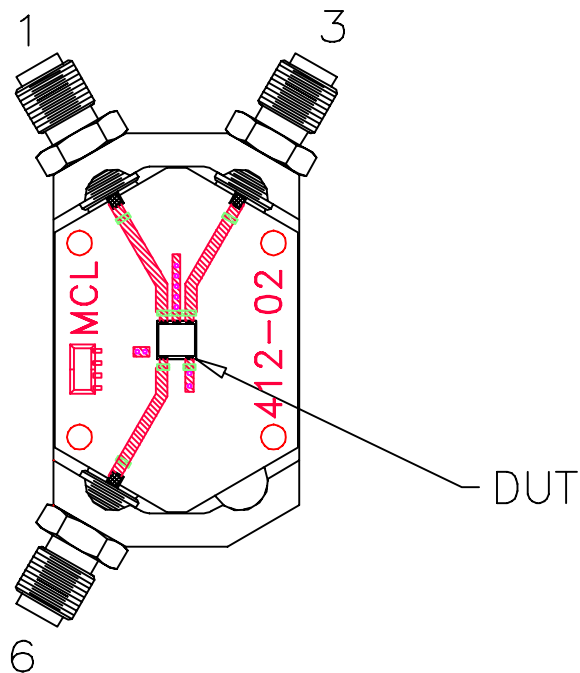


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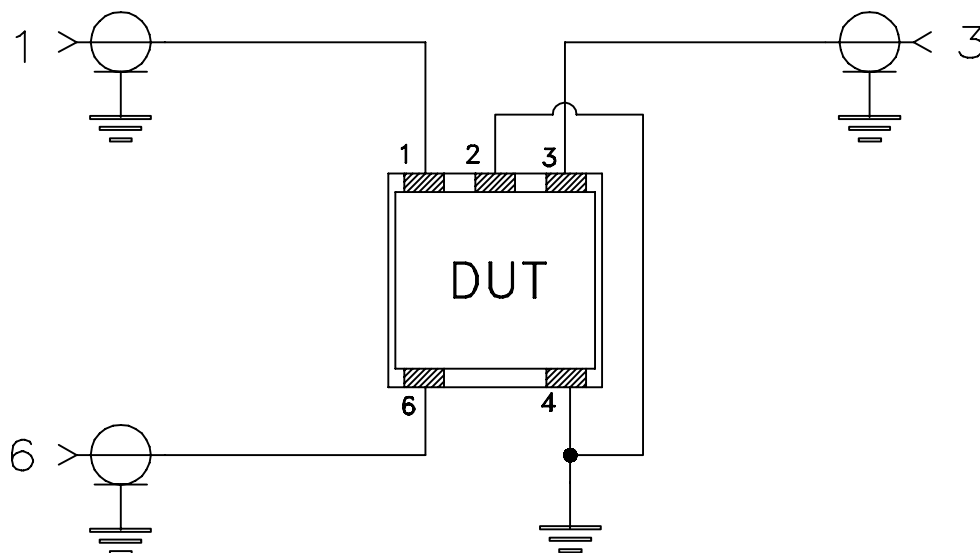
RF/IF MICROWAVE COMPONENTS

# Evaluation Board and Circuit

For Pin Connections refer to Data Sheet of the DUT



TB-145



Schematic Diagram

## Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: Rogers R04350B or its equivalent, Dielectric Constant=3.5, Thickness=.020"

 **Mini-Circuits®**



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          | -20° to 85°C<br>Ambient Environment                                                                                                                             | Individual Model Data Sheet                                                                          |
| Storage Temperature            | -55° to 100° C<br>Ambient Environment                                                                                                                           | Individual Model Data Sheet                                                                          |
| Humidity                       | 90 to 95% RH, 240 hours, 50°C                                                                                                                                   | MIL-STD-202, Method 103, Condition A, Except 50°C and end-point electrical test done within 12 hours |
| Thermal Shock                  | -55° to 100°C, 100 cycles                                                                                                                                       | MIL-STD-202, Method 107, Condition A-3, except +100°C                                                |
| Solder Reflow Heat             | Sn-Pb Eutetic Process: 225°C peak<br>Pb-Free Process 245° - 250°C peak                                                                                          | J-STD-020, Table 4-1, 4-2 and 5-2, Figure 5-1                                                        |
| Solderability                  | 10X Magnification                                                                                                                                               | J-STD-002, 95% Coverage                                                                              |
| Vibration (High Frequency)     | 20g peak, 10-2000 Hz, 12 times in each of three perpendicular directions (total 36)                                                                             | MIL-STD-202, Method 204, Condition D                                                                 |
| Mechanical Shock               | 50g, 11 ms, 1/2-sine, 18 shocks: 3 each direction, each of 3 axes                                                                                               | MIL-STD-202, Method 213, Condition A                                                                 |
| Marking Resistance to Solvents | Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C;<br>distilled water + proylene glycol monomethyl ether + monoethanolamine at 63°C to 70°C | MIL-STD-202, Method 215                                                                              |