THIN FILM SURFACE MOUNT

# Bandpass Filter

# ABF-9R3G+

50Ω 9.2 to 9.4GHz

## KEY FEATURES

- Low Passband Insertion Loss of 1.2 dB Typ.
- High Rejection of 53 dB Typ.
- Good Return Loss of 15 dB Typ.
- Small Size, 5.59 x 8.13 x 2.03 mm

*Generic photo used for illustration purposes only*

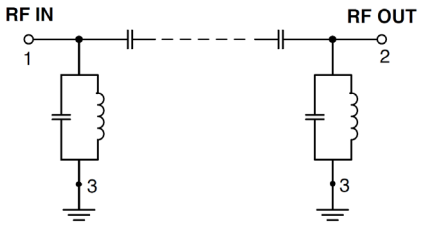
## APPLICATIONS

- Phased Array SATCOM Antenna
- Ground Antenna for weather satellites both commercial & military
- Test and Measurement Equipment

## PRODUCT OVERVIEW

Mini-Circuits' Surface Mount Thin-Film filters offer low insertion loss and high rejection realized via Thin-Film on Alumina substrate, using a sputtering process that can guarantee an enhanced Q and repeatable performance. Low pass, high pass, and bandpass surface mount thin-film designs can be realized with this technology up to 40 GHz in a small form factor helping customers achieve their SWaP objectives. Using our high quality thin-film manufacturing process we can guarantee repeatability on large batches of filters.

## FUNCTIONAL DIAGRAM




## ELECTRICAL SPECIFICATIONS[1,2,3] AT +25°C

| Parameter | | F# | Frequency (GHz) | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| Pass Band | Center Frequency[4] | — | — | — | 9.3 | — | GHz |
| | Insertion Loss | F1-F2 | 9.2 - 9.4 | | 1.2 | 2.4 | dB |
| | Return Loss | F1-F2 | 9.2 - 9.4 | — | 15 | — | dB |
| Stopband, Lower | Rejection | DC-F3 | DC - 6.5 | 43 | 53 | — | dB |
| | | F3-F4 | 6.5 - 7.8 | 20 | 35 | — | |
| Stopband, Upper | Rejection | F5-F6 | 10.7 - 12 | 20 | 32 | — | dB |
| | | F6-F7 | 12 - 17 | 33 | 42 | — | |
| | | F7-F8 | 17 - 19 | — | 30 | — | |

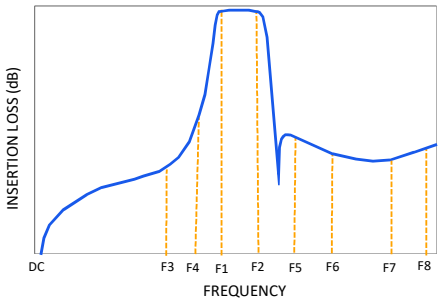
1. Tested in Evaluation Board P/N TB-ABF-9R3G+ with feedline losses removed by normalization of S12 and S21 traces to mesurement of TB thru-line.
2. This filter is bi-directional RF1 and RF2 ports may be interchanged, see S-Parameters for actual performance.
3. This component is not intended for use as a DC-blocking circuit element. In applications where DC voltage and/or current is present at either the input or output ports, external DC blocking capacitors are required.
4. Typical variation ±3%.

## ABSOLUTE MAXIMUM RATINGS[5]

| Parameter | Ratings |
|---|---|
| Operating Temperature | -55 °C to +125 °C |
| Storage Temperature | -55 °C to +125 °C |
| Input Power[6] | 1W Max. at 25°C |

5. Permanent damage may occur if any of these limits are exceeded.
6. Power rating applies only to signals within the passband.

## TYPICAL FREQUENCY RESPONSE AT +25°C




REV. A
ECO-024318
ABF-9R3G+
EDU4429
URJ
250127

# Bandpass Filter

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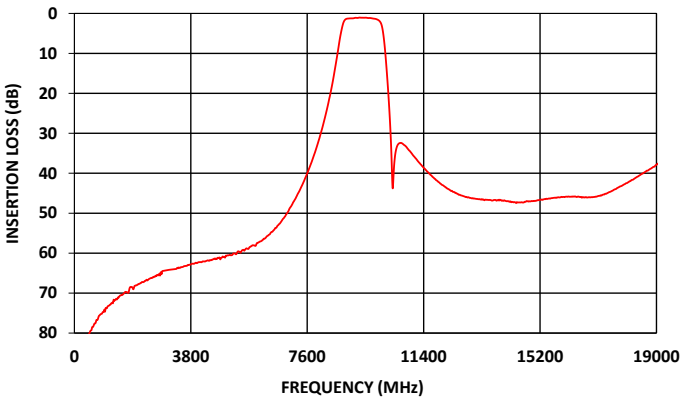
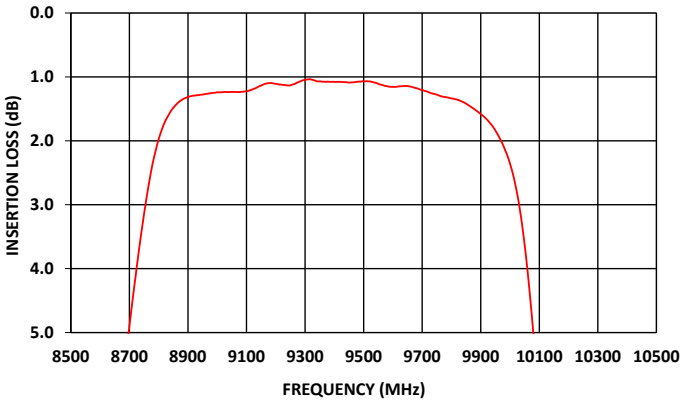
50Ω 9.2 to 9.4GHz

## TYPICAL PERFORMANCE GRAPHS AT +25°C

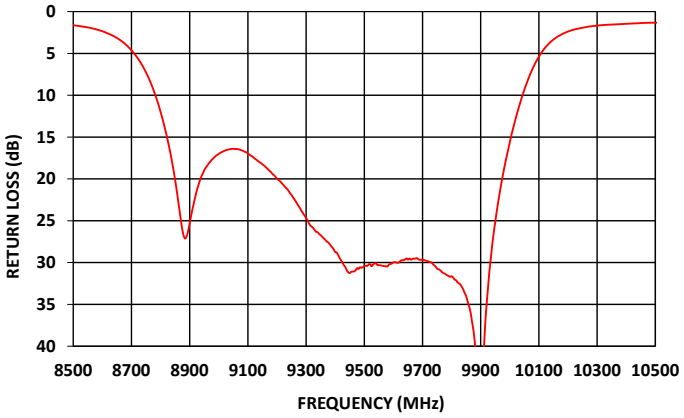
ABF-9R3G+
INSERTION LOSS



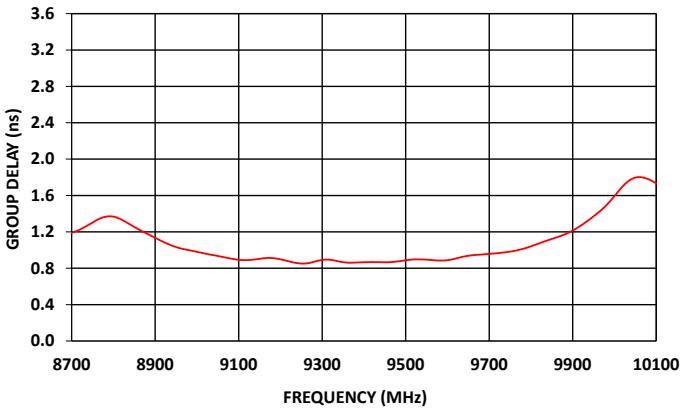

ABF-9R3G+
INSERTION LOSS (Zoomed)




ABF-9R3G+
RETURN LOSS




ABF-9R3G+
GROUP DELAY



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## FUNCTIONAL DIAGRAM

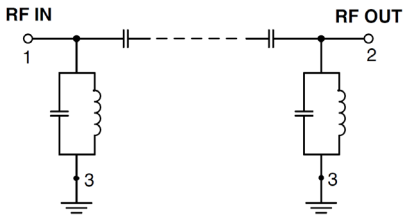
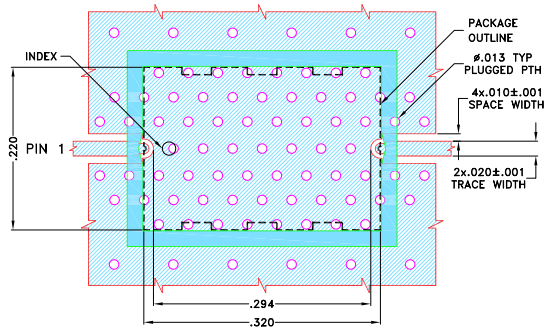



Figure 1. ABF-9R3G+ Functional Diagram

## PAD DESCRIPTION

| Function | Pad Number | Description |
|---|---|---|
| RF1[2] | 1 | Connects to RF Input Port |
| RF2[2] | 2 | Connects to RF Output Port |
| GROUND | 3 | Connects to Ground on PCB, (See drawing PL-652) |
| NC | — | No connection, not used internally. See drawing PL-652 for connection to PCB |

## SUGGESTED PCB LAYOUT (PL-652)

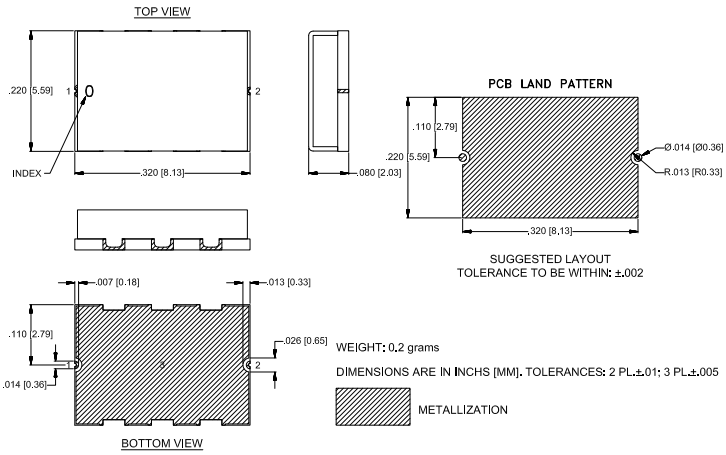



NOTES:
1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS (RO4350B) WITH DIELECTRIC THICKNESS .010±.0010. COPPER: 1/2 Oz. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

DENOTES PCB COPPER PATTERN WITH SMOBC (SOLDER MASK OVER BARE COPPER)
DENOTES PCB COPPER PATTERN FREE OF SOLDERMASK

Figure 2. Suggested PCB Layout PL-652

## CASE STYLE DRAWING




## PRODUCT MARKING*: ABF-9R3G

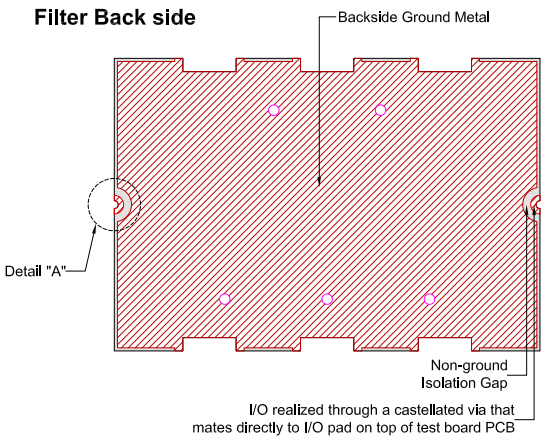
*Marking may contain other features or characters for internal lot control.

# Bandpass Filter

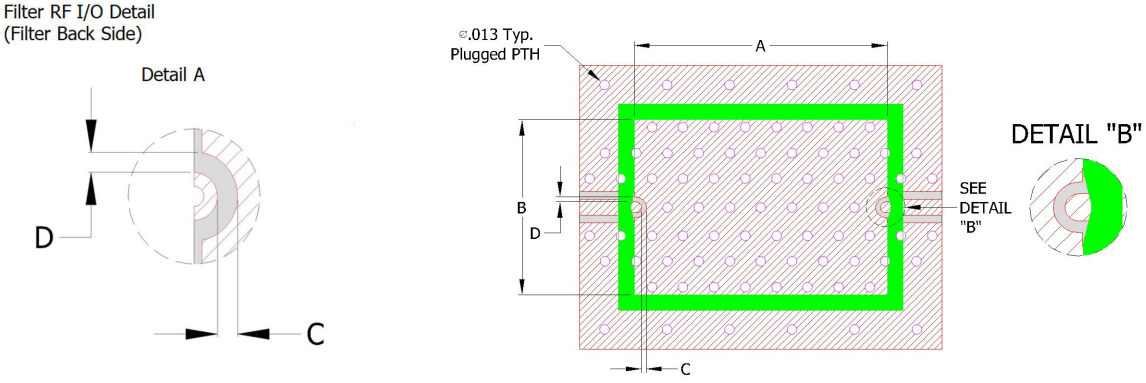
# ABF-9R3G+

50Ω 9.2 to 9.4GHz

## RECOMMENDED PCB LAYOUT PATTERN FOR FILTER




PCB Pattern Recommendations

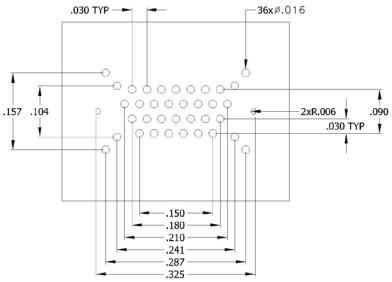



1) Customer PCB's ground pattern length (dimension A) can be similar to filter length.
2) Customer PCB's ground pattern width (dimension B) can be similar to filter width.
3) Dimensions C and D on Filter RF I/O detail and Customer PCB pattern can be closely match. The dimensions of C and D on the Customer PCB pattern can be slightly larger to account for component alignment tolerance (ground metal can be pulled back from RF I/O trace).
4) Recommend to use Solder mask at Customer PCB at outer area of filter pattern/ footprint with a clearance of about 1.25mil at each side. (Tighter registration tolerance required for solder mask)
5) Recommended to use Solder mask at I/O of Customer PCB as per above diagram (refer detail B).

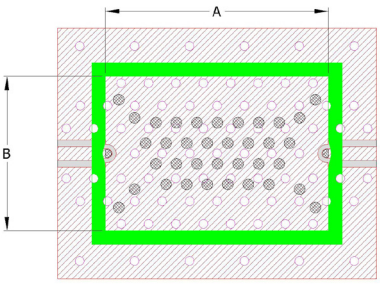
## COMMENTS ON COMPONENT HANDLING AND SOLDER ATTACH

1) Avoid using soldering iron directly to the ceramic filter. This would lead to development of crack in the component due to thermal shock.
2) Vacuum pick-up tool or plastic tweezers are recommended for handling the components. Extra care should be taken not to scratch the filter or metal area.
3) Use 2-3 mil thickness stencil plate and screen print the solder. Refer below picture for recommended stencil pattern to get the best solder attachment.

Stencil opening drawing




Solder location after screen print




4) Plugged ground vias in the PWB will improve attachment consistency.
5) Recommended to have a similar or closer test board material and thickness (refer Mini-Circuits evaluation board for details) to minimize the CTE over the temperature range.

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**ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASHBOARD.** CLICK HERE

| | |
|---|---|
| **Performance Data and Graphs** | Data<br>Graphs<br>S-Parameter (S2P Files) Data Set (.zip file) De-embedded to device pads |
| **Case Style** | UC2731 Lead Finish: Gold over Nickel plate |
| **RoHS Status** | Compliant |
| **Tape and Reel** | TR-F003 |
| **Suggested Layout for PCB Design** | PL-652 |
| **Evaluation Board** | TB-ABF-9R3G+ |
| | Gerber File |
| **Environmental Rating** | ENV120 |

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-Circuits' 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

# Thin-Film Bandpass Filter ABF-9R3G+

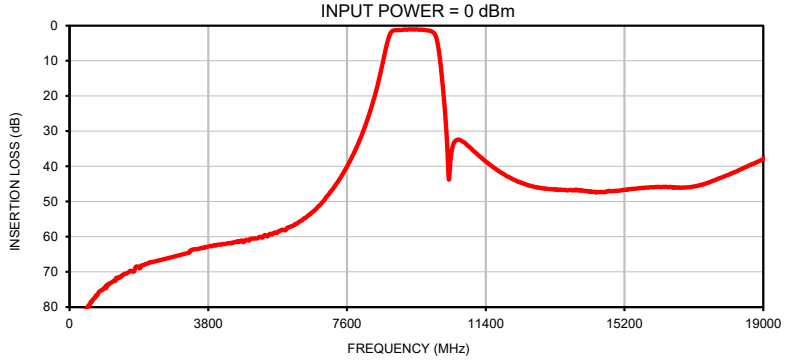
*Typical Performance Data*

| FREQ. | Insertion Loss | Input Return Loss | Output Return Loss |
|---|---|---|---|
| (MHz) | (dB) | (dB) | (dB) |
| 10 | 102.81 | 0.07 | 0.09 |
| 20 | 108.63 | 0.08 | 0.10 |
| 40 | 108.38 | 0.11 | 0.11 |
| 100 | 93.36 | 0.05 | 0.07 |
| 160 | 89.14 | 0.15 | 0.15 |
| 200 | 87.54 | 0.16 | 0.17 |
| 260 | 85.33 | 0.20 | 0.21 |
| 400 | 82.10 | 0.25 | 0.25 |
| 600 | 78.51 | 0.29 | 0.29 |
| 800 | 75.72 | 0.35 | 0.35 |
| 900 | 75.13 | 0.34 | 0.33 |
| 1000 | 74.64 | 0.33 | 0.34 |
| 1500 | 70.57 | 0.34 | 0.35 |
| 2000 | 68.07 | 0.34 | 0.34 |
| 2100 | 67.69 | 0.34 | 0.34 |
| 3300 | 63.97 | 0.30 | 0.30 |
| 3500 | 63.49 | 0.30 | 0.31 |
| 4000 | 62.53 | 0.38 | 0.39 |
| 4500 | 61.69 | 0.48 | 0.50 |
| 5000 | 60.54 | 0.61 | 0.63 |
| 5500 | 59.19 | 0.69 | 0.69 |
| 6000 | 57.33 | 0.75 | 0.72 |
| 6500 | 54.29 | 0.81 | 0.81 |
| 6700 | 52.63 | 0.84 | 0.83 |
| 6900 | 50.47 | 0.86 | 0.87 |
| 7000 | 49.23 | 0.90 | 0.91 |
| 7200 | 46.55 | 0.86 | 0.93 |
| 7300 | 45.05 | 0.89 | 0.96 |
| 7800 | 35.93 | 1.00 | 1.04 |
| 8000 | 31.18 | 1.01 | 1.05 |
| 8320 | 21.31 | 1.22 | 1.24 |
| 9200 | 1.11 | 19.97 | 20.00 |
| 9300 | 1.05 | 24.66 | 24.67 |
| 9400 | 1.08 | 28.75 | 28.65 |
| 9600 | 1.15 | 29.99 | 33.53 |
| 10050 | 3.63 | 9.33 | 9.12 |
| 10250 | 20.39 | 1.93 | 2.01 |
| 10700 | 32.53 | 1.26 | 1.24 |
| 11500 | 39.44 | 1.11 | 1.07 |
| 12000 | 42.92 | 1.04 | 1.04 |
| 12500 | 45.16 | 0.97 | 1.02 |
| 13000 | 46.22 | 0.94 | 0.94 |
| 13500 | 46.68 | 0.97 | 1.02 |
| 14000 | 46.93 | 1.05 | 1.15 |
| 14500 | 47.31 | 1.17 | 1.27 |
| 15000 | 46.97 | 1.26 | 1.35 |
| 15200 | 46.67 | 1.28 | 1.36 |
| 15300 | 46.57 | 1.29 | 1.35 |
| 15800 | 46.01 | 1.28 | 1.31 |
| 16500 | 45.94 | 1.18 | 1.19 |
| 17000 | 45.91 | 1.13 | 1.13 |
| 17500 | 44.62 | 1.14 | 1.14 |
| 17600 | 44.19 | 1.12 | 1.13 |
| 17800 | 43.33 | 1.15 | 1.17 |
| 18000 | 42.53 | 1.19 | 1.21 |
| 18500 | 40.26 | 1.30 | 1.37 |
| 18600 | 39.81 | 1.30 | 1.38 |
| 18700 | 39.37 | 1.34 | 1.44 |
| 18800 | 38.90 | 1.37 | 1.46 |
| 19000 | 37.87 | 1.43 | 1.53 |

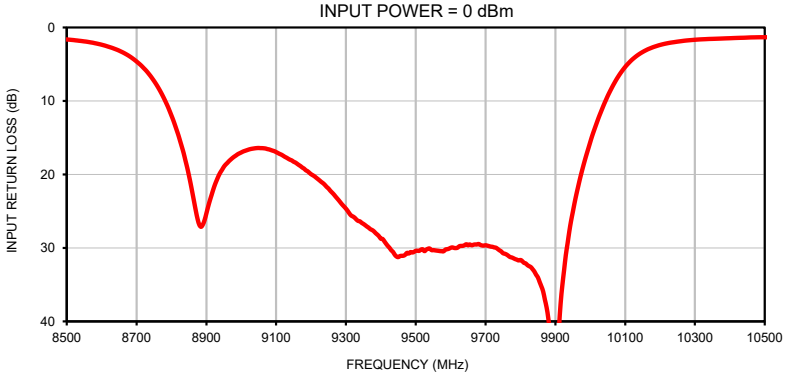
| FREQ. | Group Delay |
|---|---|
| (MHz) | (ns) |
| 9200 | 0.90 |
| 9205 | 0.89 |
| 9210 | 0.89 |
| 9215 | 0.88 |
| 9220 | 0.88 |
| 9225 | 0.87 |
| 9230 | 0.86 |
| 9235 | 0.86 |
| 9240 | 0.86 |
| 9245 | 0.85 |
| 9250 | 0.85 |
| 9255 | 0.85 |
| 9260 | 0.85 |
| 9270 | 0.86 |
| 9275 | 0.86 |
| 9280 | 0.87 |
| 9285 | 0.88 |
| 9290 | 0.88 |
| 9295 | 0.89 |
| 9300 | 0.89 |
| 9305 | 0.89 |
| 9310 | 0.89 |
| 9315 | 0.89 |
| 9320 | 0.89 |
| 9325 | 0.89 |
| 9330 | 0.88 |
| 9335 | 0.88 |
| 9340 | 0.87 |
| 9345 | 0.87 |
| 9350 | 0.87 |
| 9355 | 0.86 |
| 9360 | 0.86 |
| 9365 | 0.86 |
| 9370 | 0.86 |
| 9375 | 0.86 |
| 9380 | 0.86 |
| 9385 | 0.86 |
| 9390 | 0.86 |
| 9395 | 0.87 |
| 9400 | 0.87 |

*Typical Performance Curves*

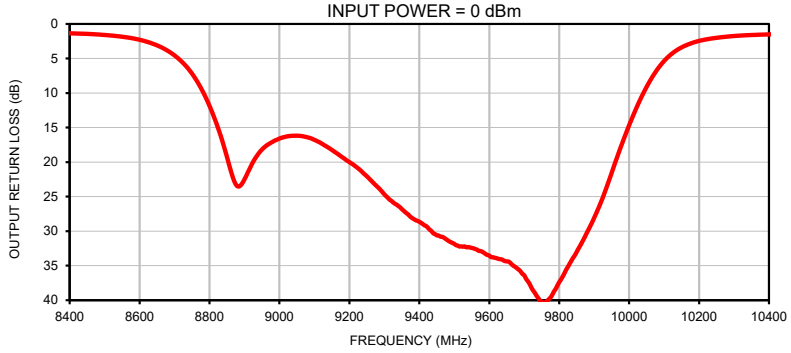
**INSERTION LOSS**
INPUT POWER = 0 dBm



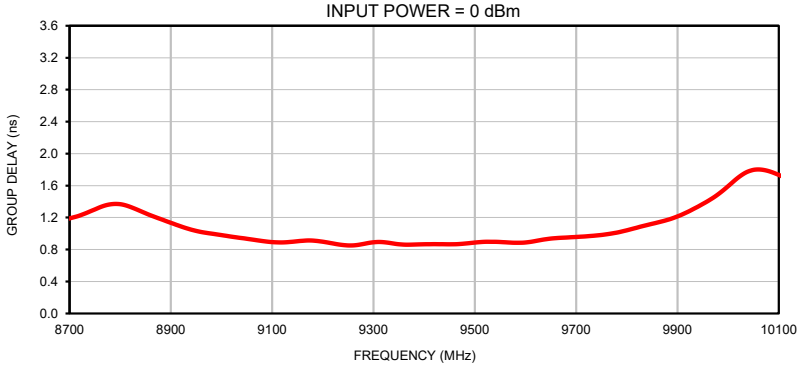

**INPUT RETURN LOSS**
INPUT POWER = 0 dBm




**OUTPUT RETURN LOSS**
INPUT POWER = 0 dBm

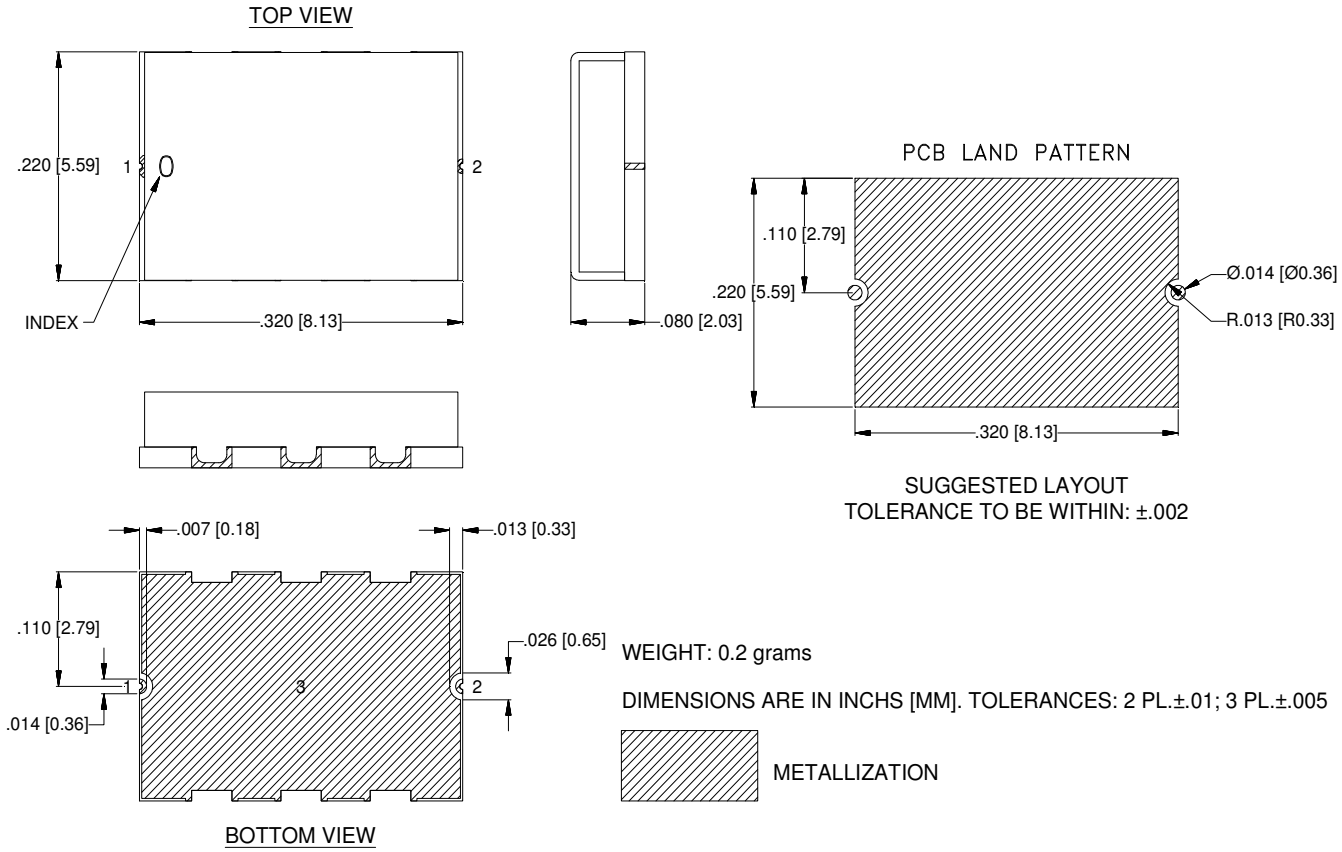



**GROUP DELAY**
INPUT POWER = 0 dBm



# Case Style UC

## Outline Dimensions UC2731




**Notes:**

1. Case material: Gold over Nickel over Annealed Stainless Steel.
2. Base: Ceramic
3. Termination finish: **as shown below or indicated on Data Sheet.**
   For RoHS Case Styles: Gold over Nickel plate. All models, (+) suffix.



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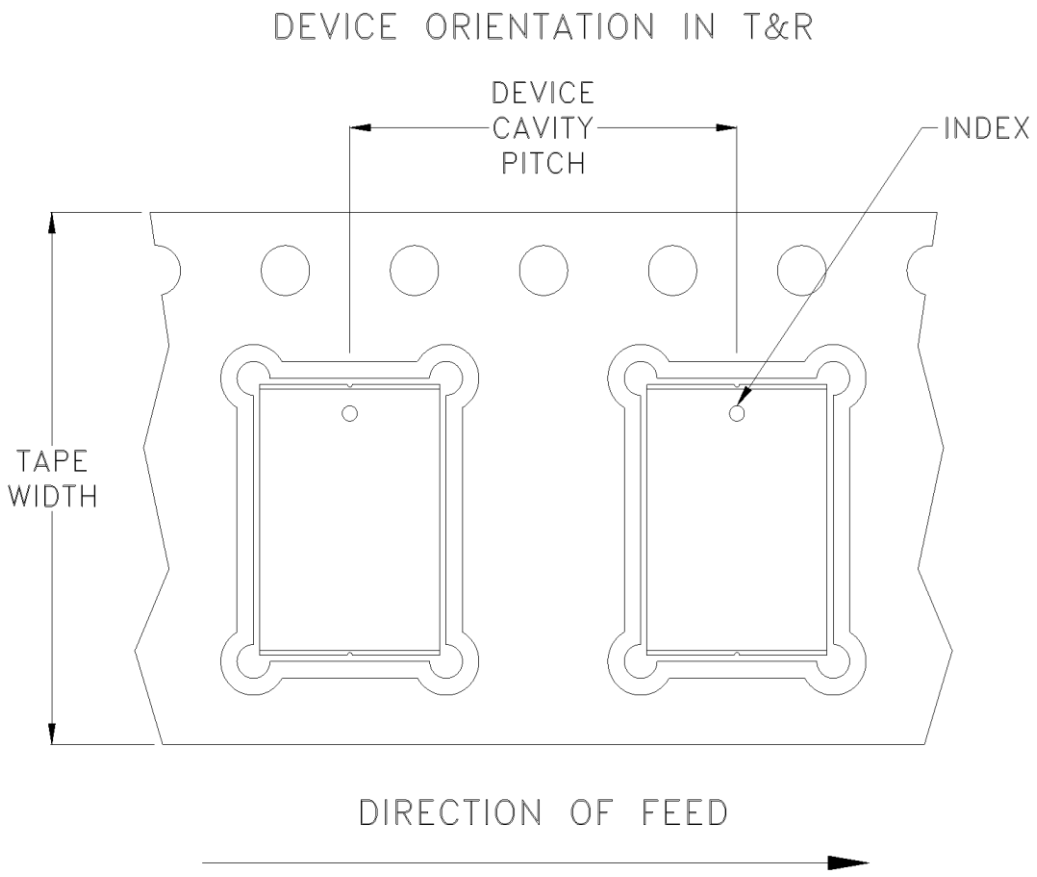
# Tape & Reel Packaging TR-F003




| Tape Width, mm | Device Cavity Pitch, mm | Real Size, inches | Devices per Reel See note |
|---|---|---|---|
| 16 | 12 | 7 | 10 |
| | | | 20 |
| | | | 50 |
| | | | 100 |
| | | | 200 |
| | | 13 | 500 |

Note: Please consult individual model data sheet/dashboard 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

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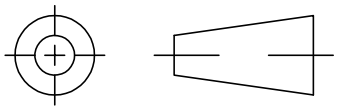
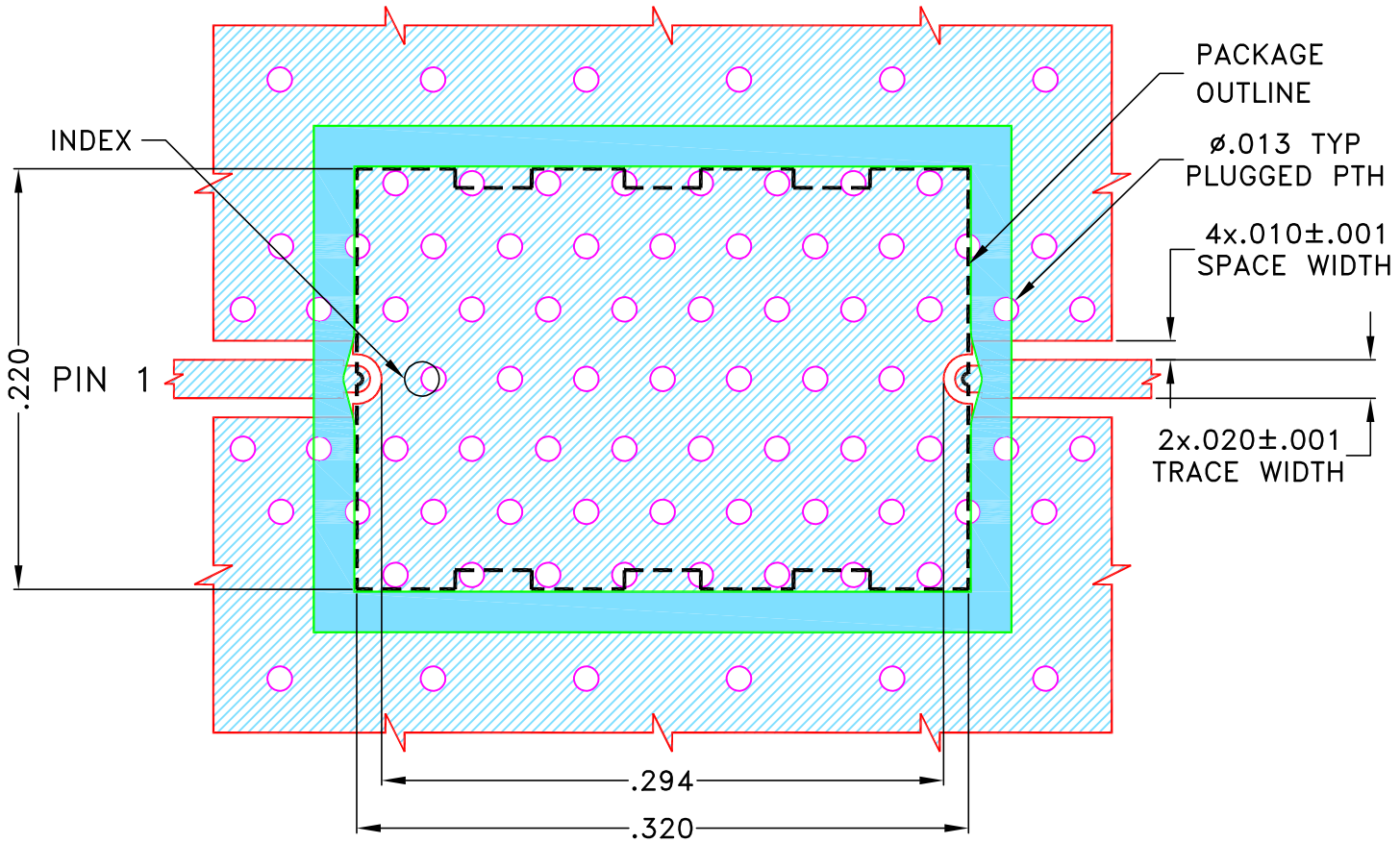
THIRD ANGLE PROJECTION



| REVISIONS | | | | | |
|---|---|---|---|---|---|
| REV | ECN No. | DESCRIPTION | DATE | DR | AUTH |
| OR | ECO-007104 | NEW RELEASE | MAR 21 | DDR | VC |
| A | ECO-010633 | UPDATED AS PER CURRENT TEST BOARD | NOV 21 | DDR | VC |
| B | ECO-019739 | UPDATED TRACE AND SPACE WIDTH | OCT 23 | LK | VC |
| | | TOLERANCE ONLY NO OTHER CHANGES | | | |

# SUGGESTED MOUNTING CONFIGURATION FOR UC2731 CASE STYLE

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2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

DENOTES PCB COPPER PATTERN WITH SMOBC (SOLDER MASK OVER BARE COPPER)

DENOTES PCB COPPER PATTERN FREE OF SOLDERMASK

| UNLESS OTHERWISE SPECIFIED | | INITIALS | DATE |
|---|---|---|---|
| DIMENSIONS ARE IN INCHES | DRAWN | DDR | 29 MAR 21 |
| TOLERANCES ON: | CHECKED | RR | 29 MAR 21 |
| 2 PL DECIMALS ± .005 | APPROVED | NN | 29 MAR 21 |
| 3 PL DECIMALS ± | | | |
| ANGLES ± | | | |
| FRACTIONS ± | | | |

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ASHEETA1.DWG REV:A DATE:01/12/95

Mini-Circuits®
13 Neptune Avenue
Brooklyn NY 11235

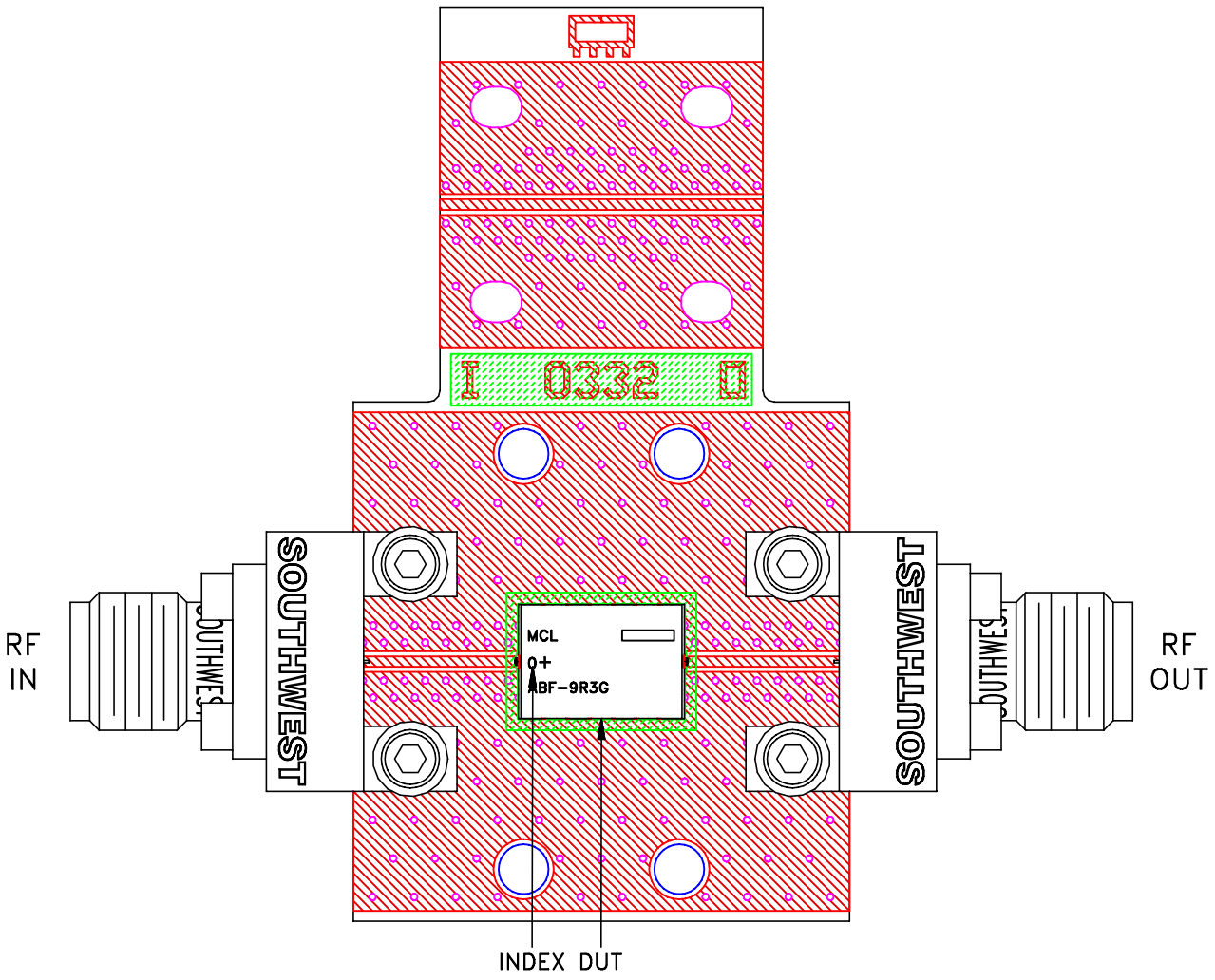
PL DWG, UC2731 C.S, 50 OHM, ABF

| SIZE | CODE IDENT | DRAWING NO: | REV: |
|---|---|---|---|
| A | 15542 | 98-PL-652 | B |

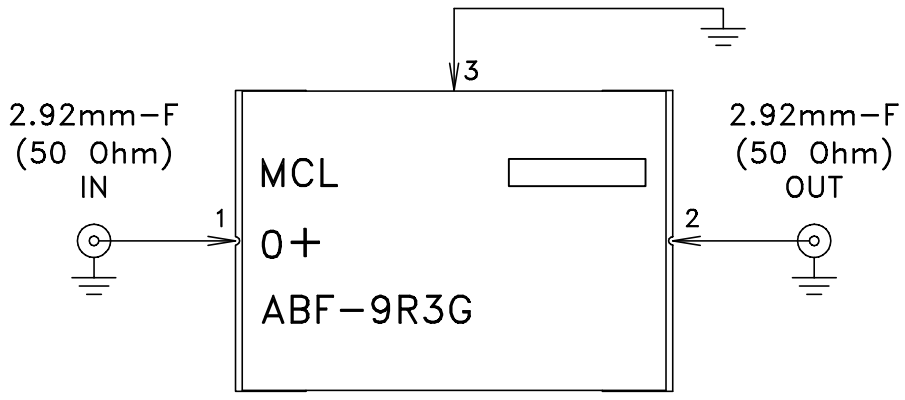
| FILE: | SCALE: | SHEET: |
|---|---|---|
| 98-PL-652 | 10:1 | 1 OF 1 |

# Evaluation Board and Circuit

TB-ABF-9R3G+




Schematic diagram




Notes:

1. PCB Material: ROGERS (RO4350B) OR Equivalent, Dielectric Constant=3.48±.05
Dielectric Thickness: .010±.001 inch
2. 50 Ohm 2.92mm Female Connectors.

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# Environmental Specifications ENV120

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 | -55° to 125° C<br>Ambient Environment | Individual Model Data Sheet |
| Storage Temperature | -55° to 125° C<br>Ambient Environment | Individual Model Data Sheet |
| Solderability | 10X Magnification | J-STD-002, Para 4.2.5, Test S, 95% Coverage |
| Thermal Shock | -55° to 125°C, 100 cycles | MIL-STD-202, Method 107, Condition A-3, Except +125°C |


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