



Mini-Circuits®

CERAMIC

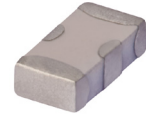
## High Pass Filter

HFCN-650D+

50Ω 710 to 2490 MHz

## THE BIG DEAL

- Low cost
- Small size
- 7 sections
- Temperature stable
- LTCC construction
- Excellent power handling, 7W
- Hermetically sealed



Generic photo used for illustration purposes only

CASE STYLE: FV1206

**+RoHS Compliant**

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

## APPLICATIONS

- Sub-harmonic rejection
- Transmitters/receivers
- Lab use

ELECTRICAL SPECIFICATIONS <sup>1,2</sup> AT 25°C

| Parameter | Frequency (MHz) | Min.     | Typ. | Max. | Units |
|-----------|-----------------|----------|------|------|-------|
| Stop Band | Rejection Loss  | 390      | 40   | —    | dB    |
|           |                 | 480      | 20   | —    |       |
|           | Freq. Cut-Off   | 650      | —    | 3.0  | dB    |
|           | VSWR            | 390-480  | —    | 20   | :1    |
| Pass Band | Insertion Loss  | 710-2490 | —    | 2.0  | dB    |
|           |                 | 850-2000 | —    | 1.3  | dB    |
|           | VSWR            | 760-1700 | —    | 1.5  | :1    |

1. DC Resistance to ground is 100 Mohms min..

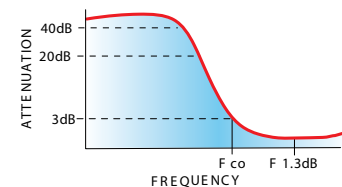
2. Measured on Mini-Circuits Characterization Test Board TB-270.

## MAXIMUM RATINGS

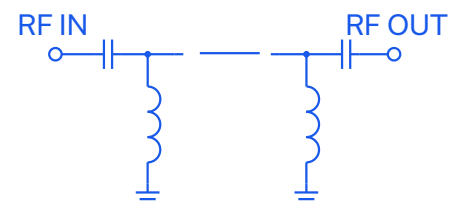
| Parameter                   | Ratings         |
|-----------------------------|-----------------|
| Operating temperature       | -55°C to +100°C |
| Storage temperature         | -55°C to +100°C |
| RF Power Input <sup>3</sup> | 7W max.at 25°C  |
| Max. DC Voltage at pins 1&3 | 25 VDC          |

3. Passband rating, derate linearly to 3W at 100°C ambient. Permanent damage may occur if any of these limits are exceeded.

## TYPICAL FREQUENCY RESPONSE



## FUNCTIONAL SCHEMATIC



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REV. C  
ECO-012120  
HFCN-650D+  
AD/CP/AM  
220224

PAGE 1 OF 3



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# High Pass Filter

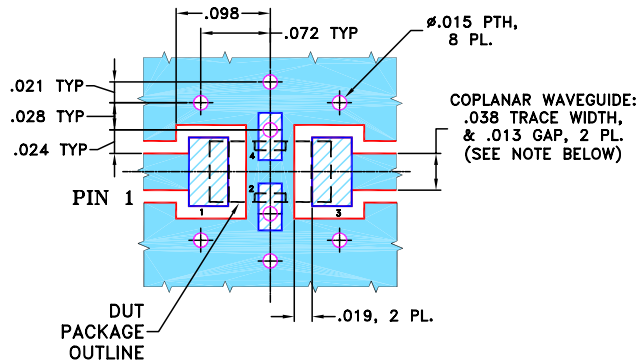
HFCN-650D+

## PIN CONNECTIONS

|        |     |
|--------|-----|
| RF IN  | 1   |
| RF OUT | 3   |
| GROUND | 2,4 |

PRODUCT MARKING: N/A

DEMO BOARD MCL P/N: TB-270  
SUGGESTED PCB LAYOUT (PL-137)

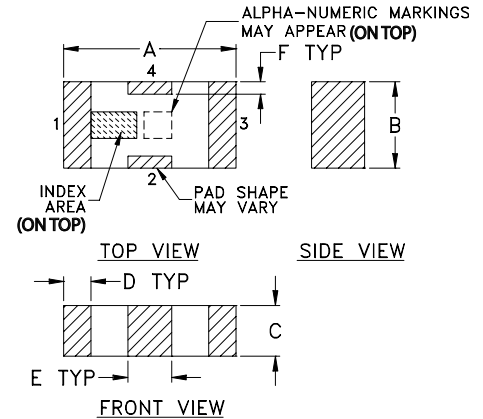


**NOTES:** 1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH THICKNESS .020" ± .0015". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.

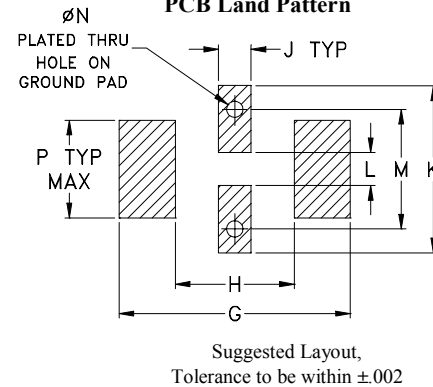
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

- DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
- DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

## OUTLINE DRAWING



## PCB Land Pattern



## OUTLINE DIMENSIONS (Inches mm)

| A    | B    | C    | D    | E    | F    | G    | H    | J    | K    | L    | M    | N    | P    | wt    |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| .126 | .063 | .037 | .020 | .032 | .009 | .169 | .087 | .024 | .122 | .024 | .087 | .012 | .071 | grams |
| 3.20 | 1.60 | 0.94 | 0.51 | 0.81 | 0.23 | 4.29 | 2.21 | 0.61 | 3.10 | 0.61 | 2.21 | 0.30 | 1.80 | .020  |

TAPE & REEL INFORMATION: F71



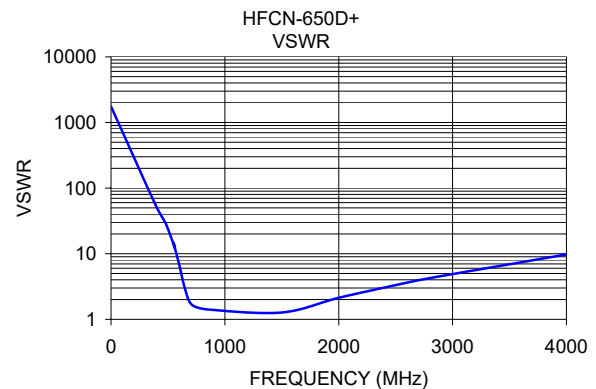
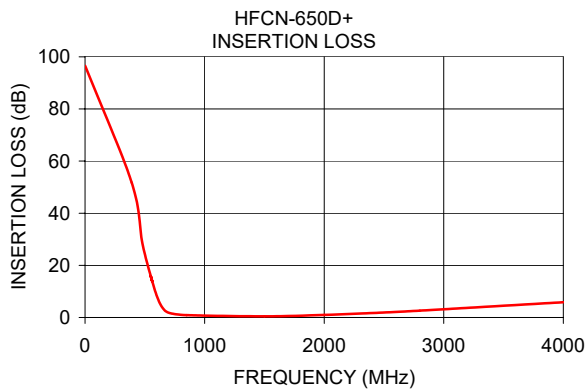
CERAMIC

# High Pass Filter

HFCN-650D+

## TYPICAL PERFORMANCE DATA AT 25°C

| Frequency (MHz) | Insertion Loss (dB) | VSWR :1 |
|-----------------|---------------------|---------|
| 1.00            | 96.55               | 1737.18 |
| 390.00          | 51.73               | 56.04   |
| 480.00          | 28.47               | 28.96   |
| 560.00          | 14.13               | 12.44   |
| 550.00          | 15.77               | 14.26   |
| 600.00          | 8.26                | 6.63    |
| 650.00          | 3.61                | 2.89    |
| 710.00          | 1.66                | 1.66    |
| 850.00          | 0.90                | 1.42    |
| 1500.00         | 0.44                | 1.27    |
| 2000.00         | 0.99                | 2.13    |
| 2490.00         | 1.89                | 3.29    |
| 2800.00         | 2.61                | 4.25    |
| 4000.00         | 5.86                | 9.74    |



### 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)



# Ceramic High Pass Filter

**HFCN-650D+**

## Typical Performance Data

| FREQ.<br>(MHz) | INSERTION LOSS<br>(dB) |          |           | INPUT RETURN LOSS<br>(dB) |          |           | OUTPUT RETURNLOSS<br>(dB) |          |           |
|----------------|------------------------|----------|-----------|---------------------------|----------|-----------|---------------------------|----------|-----------|
|                | @ -55° C               | @ +25° C | @ +100° C | @ -55° C                  | @ +25° C | @ +100° C | @ -55° C                  | @ +25° C | @ +100° C |
| 1              | 101.80                 | 96.55    | 96.41     | 0.00                      | 0.01     | 0.00      | 0.01                      | 0.01     | 0.01      |
| 50             | 72.57                  | 67.30    | 67.17     | 0.01                      | 0.01     | 0.01      | 0.01                      | 0.00     | 0.01      |
| 100            | 59.90                  | 64.74    | 64.68     | 0.02                      | 0.03     | 0.04      | 0.01                      | 0.02     | 0.02      |
| 265            | 54.58                  | 55.31    | 55.17     | 0.05                      | 0.10     | 0.12      | 0.11                      | 0.12     | 0.16      |
| 340            | 58.99                  | 59.83    | 60.26     | 0.16                      | 0.22     | 0.25      | 0.16                      | 0.20     | 0.26      |
| 390            | 53.02                  | 51.73    | 50.79     | 0.23                      | 0.31     | 0.35      | 0.23                      | 0.29     | 0.36      |
| 420            | 42.79                  | 42.01    | 41.42     | 0.30                      | 0.38     | 0.43      | 0.29                      | 0.37     | 0.42      |
| 470            | 31.08                  | 30.50    | 30.02     | 0.43                      | 0.54     | 0.61      | 0.43                      | 0.53     | 0.63      |
| 480            | 29.11                  | 28.47    | 28.02     | 0.48                      | 0.60     | 0.69      | 0.48                      | 0.57     | 0.68      |
| 495            | 26.13                  | 25.58    | 25.13     | 0.53                      | 0.69     | 0.80      | 0.52                      | 0.67     | 0.78      |
| 520            | 21.54                  | 20.99    | 20.54     | 0.73                      | 0.91     | 1.03      | 0.66                      | 0.85     | 0.98      |
| 550            | 16.25                  | 15.77    | 15.33     | 0.98                      | 1.22     | 1.44      | 0.98                      | 1.21     | 1.43      |
| 585            | 10.69                  | 10.32    | 9.96      | 1.68                      | 2.07     | 2.41      | 1.69                      | 2.05     | 2.42      |
| 630            | 5.19                   | 5.06     | 4.89      | 3.90                      | 4.53     | 5.20      | 3.91                      | 4.53     | 5.22      |
| 650            | 3.60                   | 3.61     | 3.55      | 5.56                      | 6.27     | 7.13      | 5.57                      | 6.30     | 7.12      |
| 660            | 3.02                   | 3.06     | 3.03      | 6.50                      | 7.28     | 8.17      | 6.52                      | 7.29     | 8.19      |
| 710            | 1.50                   | 1.66     | 1.75      | 11.29                     | 12.08    | 12.93     | 11.28                     | 12.09    | 12.92     |
| 750            | 1.10                   | 1.26     | 1.36      | 13.80                     | 14.47    | 14.87     | 13.86                     | 14.52    | 14.89     |
| 760            | 1.04                   | 1.19     | 1.31      | 14.18                     | 14.77    | 15.06     | 14.22                     | 14.81    | 15.09     |
| 810            | 0.86                   | 1.00     | 1.12      | 14.87                     | 15.31    | 15.12     | 15.03                     | 15.41    | 15.25     |
| 850            | 0.77                   | 0.90     | 1.02      | 14.92                     | 15.28    | 14.96     | 15.07                     | 15.37    | 15.07     |
| 1000           | 0.55                   | 0.68     | 0.76      | 16.12                     | 16.35    | 16.30     | 15.99                     | 16.22    | 16.23     |
| 1200           | 0.35                   | 0.47     | 0.55      | 25.04                     | 24.71    | 26.33     | 24.42                     | 24.08    | 25.23     |
| 1400           | 0.30                   | 0.42     | 0.49      | 24.61                     | 24.32    | 22.74     | 24.21                     | 23.70    | 21.87     |
| 1500           | 0.33                   | 0.44     | 0.52      | 18.72                     | 18.51    | 17.84     | 18.60                     | 18.31    | 17.50     |
| 1700           | 0.46                   | 0.59     | 0.68      | 12.98                     | 12.94    | 12.76     | 12.97                     | 12.91    | 12.73     |
| 1900           | 0.71                   | 0.85     | 0.92      | 10.05                     | 9.92     | 9.87      | 10.00                     | 9.84     | 9.81      |
| 2000           | 0.86                   | 0.99     | 1.08      | 9.02                      | 8.84     | 8.78      | 8.93                      | 8.77     | 8.79      |
| 2300           | 1.36                   | 1.52     | 1.62      | 6.52                      | 6.44     | 6.35      | 6.48                      | 6.42     | 6.35      |
| 2490           | 1.76                   | 1.89     | 2.03      | 5.46                      | 5.45     | 5.36      | 5.41                      | 5.40     | 5.34      |
| 2500           | 1.76                   | 1.90     | 2.04      | 5.40                      | 5.37     | 5.27      | 5.35                      | 5.34     | 5.25      |
| 3000           | 2.92                   | 3.07     | 3.22      | 3.52                      | 3.53     | 3.61      | 3.51                      | 3.50     | 3.52      |
| 3500           | 4.28                   | 4.42     | 4.65      | 2.41                      | 2.41     | 2.56      | 2.45                      | 2.40     | 2.50      |
| 4000           | 5.49                   | 5.86     | 6.06      | 1.69                      | 1.79     | 1.84      | 1.69                      | 1.75     | 1.79      |
| 4500           | 7.19                   | 7.44     | 7.93      | 1.27                      | 1.33     | 1.46      | 1.24                      | 1.32     | 1.41      |
| 5000           | 8.85                   | 9.22     | 9.89      | 0.80                      | 1.05     | 1.10      | 0.80                      | 1.03     | 1.08      |
| 5500           | 11.36                  | 11.78    | 12.19     | 0.70                      | 0.89     | 0.99      | 0.68                      | 0.86     | 0.98      |
| 6190           | 23.99                  | 28.44    | 27.49     | 0.65                      | 0.88     | 1.24      | 0.70                      | 1.01     | 1.44      |
| 6300           | 26.92                  | 19.92    | 14.58     | 0.78                      | 1.39     | 2.11      | 0.90                      | 1.59     | 2.63      |
| 6540           | 5.49                   | 5.81     | 6.83      | 6.82                      | 5.41     | 4.07      | 9.97                      | 7.37     | 5.09      |
| 7000           | 11.92                  | 13.15    | 15.13     | 0.96                      | 1.05     | 1.12      | 0.93                      | 1.05     | 1.16      |

REV. X1

HFCN-650D+

070930

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IF/RF MICROWAVE COMPONENTS • ISO 9001 ISO 14001 AS9100 CERTIFIED RoHS compliant

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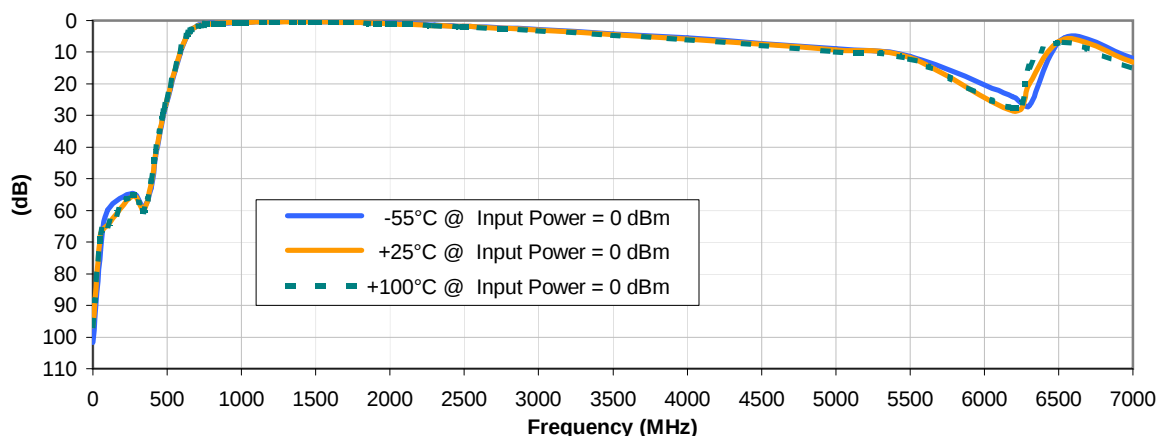


The Design Engineers Search Engine finds the model you need, Instantly • For detailed performance specs & shopping online see

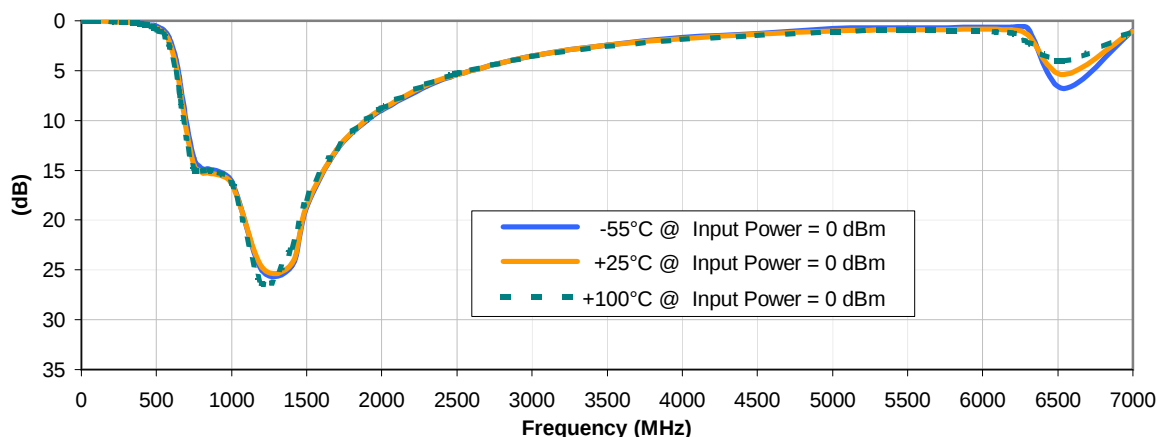


## Typical Performance Curves

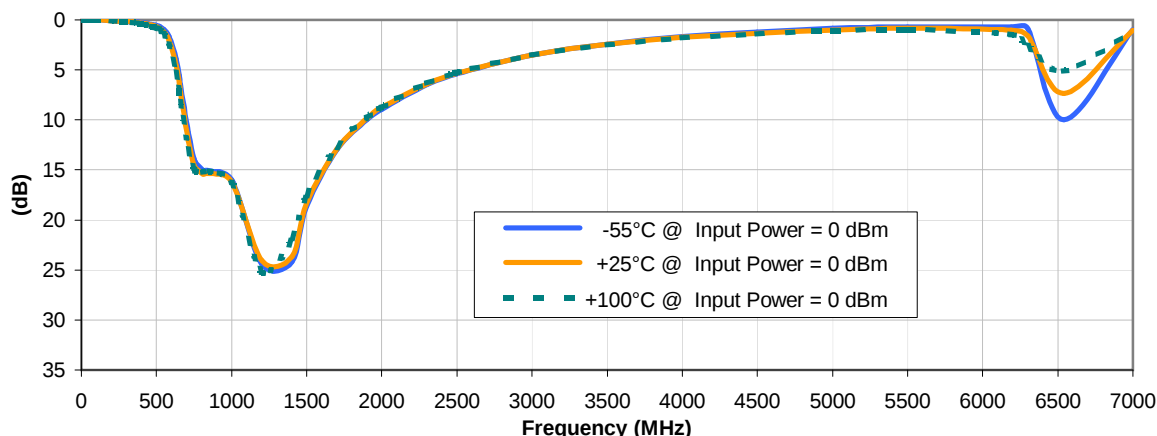
INSERTION LOSS vs. TEMPERATURE



INPUT RETURN LOSS vs. TEMPERATURE



OUTPUT RETURN LOSS vs. TEMPERATURE



### Outline Dimensions



### PCB Land Pattern



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

| CASE # | A              | B              | C              | D              | E              | F              | G              | H              | J              | K              | L              | M              | N              | P              | WT. GRAM |
|--------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------|
| FV1206 | .126<br>(3.20) | .063<br>(1.60) | .037<br>(0.94) | .020<br>(0.51) | .032<br>(0.81) | .009<br>(0.23) | .169<br>(4.29) | .087<br>(2.21) | .024<br>(0.61) | .122<br>(3.10) | .024<br>(0.61) | .087<br>(2.21) | .012<br>(0.30) | .071<br>(1.80) | .020     |

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

#### Notes:

- Open style, ceramic base.
- Termination finish: **as shown below or indicated on Data Sheet.**  
 For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.  
 For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.



P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site



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RF/IF MICROWAVE COMPONENTS

# Tape & Reel Packaging TR-F71



ILLUSTRATION 1

| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel                    |      |
|----------------|-------------------------|-------------------|-------------------------------------|------|
| 8              | 4                       | 7                 | Small quantity standards (see note) | 20   |
|                |                         |                   |                                     | 50   |
|                |                         |                   |                                     | 100  |
|                |                         |                   |                                     | 200  |
|                |                         |                   |                                     | 500  |
|                |                         |                   |                                     | 1000 |
|                |                         |                   | Standard                            | 3000 |

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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RF/IF MICROWAVE COMPONENTS

## THIRD ANGLE PROJECTION



## REVISIONS

| REV | ECN No. | DESCRIPTION           | DATE     | DR  | AUTH |
|-----|---------|-----------------------|----------|-----|------|
| OR  | M88634  | NEW RELEASE           | 08/28/03 | GF  | ABD  |
| A   | M102713 | ADDED "...WITH SMOBC" | 01/17/06 | MMG | IL   |
|     |         |                       |          |     |      |
|     |         |                       |          |     |      |

SUGGESTED MOUNTING CONFIGURATION  
FOR FV1206 CASE STYLE, "nx" PIN CONNECTION



NOTES: 1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS R04350B WITH THICKNESS .020"  $\pm$  .0015".  
 COPPER: 1/2 OZ. EACH SIDE.  
 FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.

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



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



DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

UNLESS OTHERWISE SPECIFIED

INITIALS

DATE

DIMENSIONS ARE IN INCHES

TOLERANCES ON:

2 PL DECIMALS  $\pm$ 3 PL DECIMALS  $\pm$  .005ANGLES  $\pm$ FRACTIONS  $\pm$ 

DRAWN

GF

08/27/03

CHECKED

AV

08/28/03

APPROVED

ABD

08/28/03



**Mini-Circuits®**

13 Neptune Avenue  
 Brooklyn NY 11235

PL, nx, FV1206, LFCN/HFCN, TB-270

SIZE

A

CODE IDENT

15542

DRAWING NO:

98-PL-137

REV:

A

FILE:

98PL137

SCALE:

10:1

SHEET:

1 OF 1

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

# Evaluation Board and Circuit



Schematic Diagram

## Notes:

1. SMA Female connectors.
2. PCB Material: ROGERS RO4350 or equivalent,  
Dielectric Constant=3.5, Thickness=.020 inch.

 **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      | -55° to 100°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 |
| 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, Para 4.2.5, Test S, 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                                                                 |