*Surface Mount*

# Bandpass Filter

## BPF-AS1600-75+

75Ω 950 to 2250 MHz

*Generic photo used for illustration purposes only*

CASE STYLE: TK2678

## The Big Deal

- Wide bandwidth
- Low insertion loss
- Miniature shielded package

## Product Overview

The BPF-AS1600-75+ is a 75Ω band pass filter fabricated using SMT technology centered at 1600 MHz. The band-pass filter is designed in a very small (0.433" x 0.276" x 0.197") shielded package that covers 1600 MHz ± 650 MHz bandwidth. They use high Q capacitors and inductors for low insertion loss and has consistent performance across temperature & repeatable performance across lots.

## Key Features

| Feature | Advantages |
|---|---|
| Low insertion loss | Can be used in high performance applications like L-band satellite communication systems. |
| Small form factor | This filter can be used in dense layout applications. |
| Shielded case | Reduced interference with and from the surrounding components. |

*Surface Mount*

# Bandpass Filter

## BPF-AS1600-75+

75Ω 950 to 2250 MHz

*Generic photo used for illustration purposes only*

CASE STYLE:TK2678

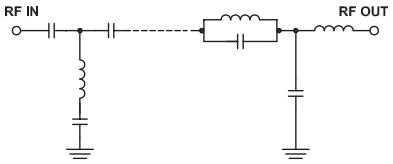
### Features

- Wide bandwidth
- Low passband IL
- Miniature shielded package

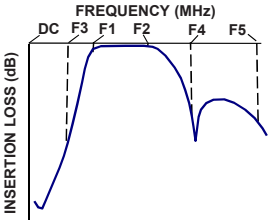
### Applications

- L-Band satellite applications
- Telecommunication & broadband wireless system
- Base station controllers
- Weather instruments / Radar networks

### 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

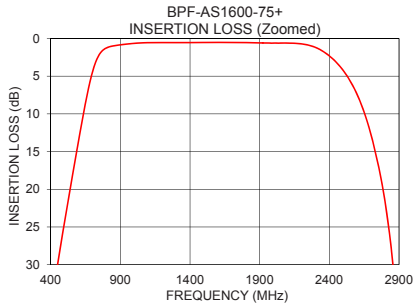
| Parameter | | F# | Frequency (MHz) | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| **Pass Band** | Center Frequency | — | — | — | 1600 | — | MHz |
| | Insertion Loss | F1-F2 | 950-2250 | — | 1.0 | 1.6 | dB |
| | VSWR | F1-F2 | 950-2250 | — | 1.6 | 2.0 | :1 |
| **Stop Band, Lower** | Insertion Loss | DC-F3 | DC-480 | 20 | 30 | — | dB |
| | VSWR | DC-F3 | DC-480 | — | 30 | — | :1 |
| **Stop Band, Upper** | Insertion Loss | F4-F5 | 3000-3500 | 16 | 20 | — | dB |
| | VSWR | F4-F5 | 3000-3500 | — | 10 | — | :1 |

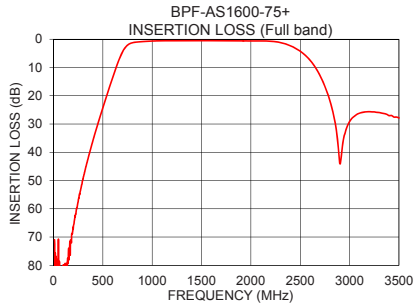
| Maximum Ratings | |
|---|---|
| Operating Temperature | -40°C to 85°C |
| Storage Temperature | -55°C to 100°C |
| RF Power Input | 1 W |

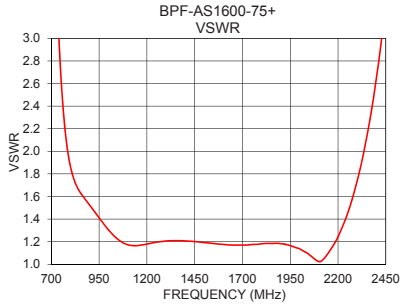
Permanent damage may occur if any of these limits are exceeded.

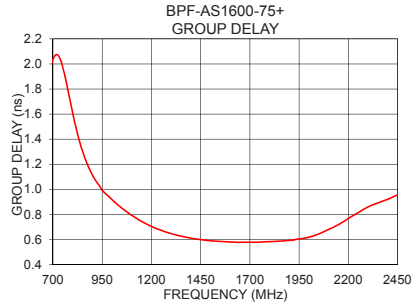
### Typical Performance Data at 25°C

| Frequency (MHz) | Insertion Loss (dB) | VSWR (:1) | Frequency (MHz) | Group Delay (nsec) |
|---|---|---|---|---|
| 10 | 70.96 | 354.40 | 950 | 0.99 |
| 250 | 57.52 | 356.60 | 1000 | 0.92 |
| 448 | 30.12 | 83.21 | 1050 | 0.85 |
| 480 | 26.49 | 66.98 | 1100 | 0.79 |
| 538 | 20.14 | 44.08 | 1150 | 0.74 |
| 650 | 8.53 | 12.06 | 1200 | 0.70 |
| 724 | 3.07 | 3.69 | 1250 | 0.67 |
| 950 | 0.74 | 1.41 | 1300 | 0.65 |
| 1600 | 0.53 | 1.18 | 1350 | 0.63 |
| 2250 | 0.89 | 1.45 | 1450 | 0.60 |
| 2445 | 3.07 | 3.25 | 1450 | 0.60 |
| 2650 | 9.81 | 8.71 | 1500 | 0.59 |
| 2700 | 12.85 | 9.80 | 1550 | 0.58 |
| 2790 | 20.57 | 10.75 | 1600 | 0.58 |
| 2840 | 27.14 | 10.94 | 1700 | 0.58 |
| 2860 | 30.80 | 11.14 | 1800 | 0.58 |
| 3000 | 29.14 | 14.13 | 1900 | 0.59 |
| 3200 | 25.64 | 23.45 | 2000 | 0.62 |
| 3400 | 27.04 | 27.90 | 2100 | 0.68 |
| 3500 | 27.85 | 26.90 | 2250 | 0.81 |




Notes

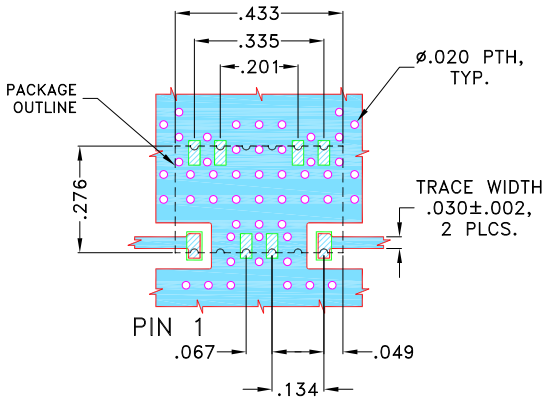
A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's 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

## Pad Connections

| | |
|---|---|
| RF IN | 1 |
| RF OUT | 6 |
| GROUND | 3,4,7,8,11,12 |
| NOT CONNECTED | 2,5,9,10 |

***Demo Board MCL P/N: TB-1072+***
***Suggested PCB Layout (PL-599)***

SUGGESTED MOUNTING CONFIGURATION FOR
TK2678 CASE STYLE "12FL04" PIN CODE



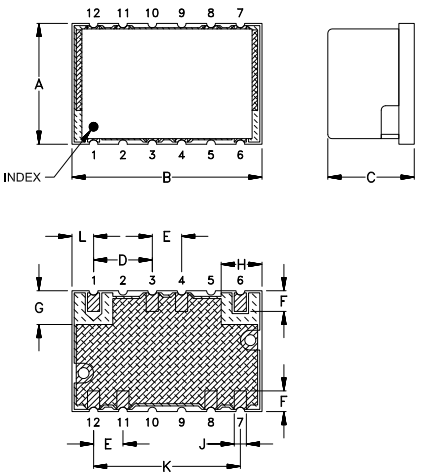

NOTES:

1. TRACE WIDTH IS SHOWN FOR ROGERS(RO4350B) WITH DIELECTRIC THICKNESS .030"±.002". COPPER: 1/2 Oz EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

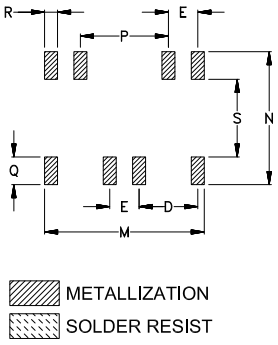
DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)

DENOTES COPPER LAND PATTERN FREE OF SOLDERMASK

## Outline Drawing




PCB LAND PATTERN




## Outline Dimensions ( inch / mm )

| A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|
| **.276** | **.433** | **.197** | **.134** | **.067** | **.047** | **.077** | **.093** | **.028** | **.335** |
| 7.01 | 11.00 | 5.00 | 3.40 | 1.70 | 1.19 | 1.96 | 2.36 | 0.71 | 8.51 |

| L | M | N | P | Q | R | S | | | Wt. |
|---|---|---|---|---|---|---|---|---|---|
| **.049** | **.364** | **.303** | **.201** | **.063** | **.030** | **.177** | | | grams |
| 1.24 | 9.25 | 7.67 | 5.11 | 1.60 | 0.76 | 4.50 | | | 0.6 |

*Note: Please refer to case style drawing for details*

# Band Pass Filter BPF-AS1600-75+

*Typical Performance Data*

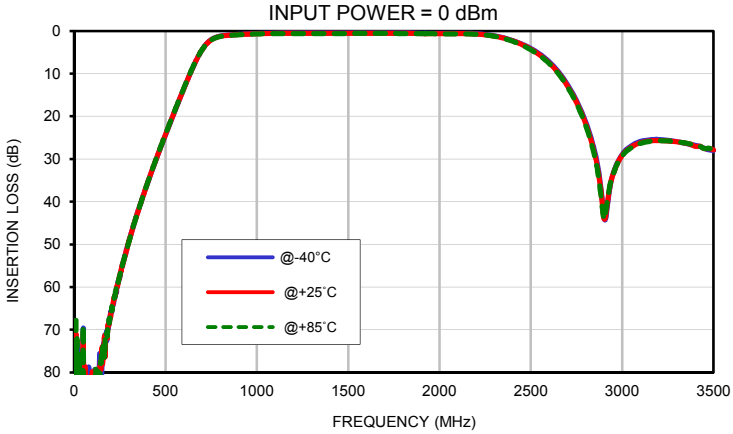
| FREQ. (MHz) | INSERTION LOSS (dB) | | | INPUT RETURN LOSS (dB) | | | OUTPUT RETURN LOSS (dB) | | |
|---|---|---|---|---|---|---|---|---|---|
| | @-40°C | @+25°C | @+85°C | @-40°C | @+25°C | @+85°C | @-40°C | @+25°C | @+85°C |
| 10 | 73.81 | 70.96 | 67.79 | 0.05 | 0.05 | 0.06 | 0.05 | 0.05 | 0.05 |
| 50 | 69.99 | 70.92 | 69.41 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 |
| 100 | 80.27 | 80.30 | 92.98 | 0.03 | 0.03 | 0.04 | 0.03 | 0.04 | 0.04 |
| 150 | 83.26 | 77.86 | 75.51 | 0.02 | 0.03 | 0.03 | 0.03 | 0.04 | 0.04 |
| 200 | 65.75 | 67.03 | 66.58 | 0.02 | 0.04 | 0.04 | 0.06 | 0.06 | 0.07 |
| 250 | 57.78 | 57.52 | 57.25 | 0.03 | 0.05 | 0.05 | 0.12 | 0.11 | 0.12 |
| 300 | 49.06 | 49.46 | 49.27 | 0.05 | 0.07 | 0.07 | 0.18 | 0.18 | 0.18 |
| 350 | 42.06 | 42.30 | 42.31 | 0.08 | 0.11 | 0.10 | 0.26 | 0.26 | 0.25 |
| 400 | 35.85 | 35.83 | 35.84 | 0.13 | 0.15 | 0.14 | 0.34 | 0.35 | 0.35 |
| 450 | 29.98 | 29.91 | 29.84 | 0.19 | 0.21 | 0.20 | 0.43 | 0.45 | 0.46 |
| 480 | 26.58 | 26.49 | 26.42 | 0.23 | 0.26 | 0.26 | 0.48 | 0.52 | 0.54 |
| 500 | 24.37 | 24.27 | 24.19 | 0.27 | 0.30 | 0.29 | 0.53 | 0.56 | 0.59 |
| 540 | 19.99 | 19.92 | 19.82 | 0.38 | 0.40 | 0.40 | 0.63 | 0.69 | 0.72 |
| 550 | 18.91 | 18.85 | 18.75 | 0.41 | 0.44 | 0.44 | 0.67 | 0.72 | 0.76 |
| 600 | 13.58 | 13.55 | 13.45 | 0.69 | 0.72 | 0.74 | 0.93 | 1.01 | 1.07 |
| 720 | 3.24 | 3.27 | 3.27 | 4.44 | 4.55 | 4.68 | 4.84 | 5.08 | 5.25 |
| 800 | 1.19 | 1.25 | 1.29 | 10.25 | 10.40 | 10.53 | 11.71 | 11.98 | 12.14 |
| 850 | 0.92 | 0.98 | 1.02 | 12.16 | 12.32 | 12.51 | 13.58 | 13.87 | 14.09 |
| 900 | 0.78 | 0.85 | 0.88 | 13.56 | 13.65 | 13.84 | 14.46 | 14.62 | 14.82 |
| 950 | 0.67 | 0.74 | 0.77 | 15.35 | 15.36 | 15.45 | 15.82 | 15.80 | 15.87 |
| 1000 | 0.58 | 0.65 | 0.69 | 17.60 | 17.64 | 17.51 | 17.76 | 17.61 | 17.48 |
| 1050 | 0.52 | 0.59 | 0.63 | 19.96 | 20.15 | 19.79 | 19.89 | 19.70 | 19.35 |
| 1100 | 0.49 | 0.56 | 0.60 | 21.84 | 22.01 | 21.61 | 21.37 | 21.11 | 20.74 |
| 1200 | 0.48 | 0.55 | 0.58 | 22.23 | 21.74 | 21.89 | 20.03 | 19.89 | 19.97 |
| 1300 | 0.48 | 0.55 | 0.59 | 21.07 | 20.61 | 20.71 | 17.97 | 18.00 | 18.10 |
| 1400 | 0.48 | 0.55 | 0.59 | 20.74 | 20.58 | 20.37 | 17.49 | 17.63 | 17.55 |
| 1500 | 0.47 | 0.54 | 0.58 | 20.92 | 21.16 | 20.68 | 18.40 | 18.66 | 18.33 |
| 1600 | 0.46 | 0.53 | 0.57 | 21.19 | 21.86 | 21.30 | 20.63 | 20.85 | 20.46 |
| 1700 | 0.46 | 0.53 | 0.57 | 21.30 | 22.14 | 22.24 | 22.44 | 22.67 | 22.98 |
| 1800 | 0.48 | 0.55 | 0.59 | 20.80 | 21.64 | 22.84 | 21.07 | 21.64 | 22.78 |
| 1900 | 0.51 | 0.59 | 0.63 | 20.69 | 21.58 | 23.13 | 19.68 | 20.59 | 21.51 |
| 2000 | 0.53 | 0.61 | 0.66 | 23.21 | 23.96 | 25.04 | 21.56 | 22.46 | 22.93 |
| 2100 | 0.52 | 0.61 | 0.66 | 34.69 | 38.85 | 35.78 | 36.04 | 37.95 | 37.10 |
| 2200 | 0.62 | 0.72 | 0.76 | 19.15 | 19.30 | 20.44 | 17.80 | 18.02 | 18.84 |
| 2250 | 0.79 | 0.89 | 0.93 | 14.38 | 14.73 | 15.38 | 13.04 | 13.38 | 13.79 |
| 2400 | 2.23 | 2.32 | 2.41 | 6.63 | 6.93 | 6.95 | 5.71 | 5.91 | 5.92 |
| 2450 | 3.06 | 3.17 | 3.29 | 5.12 | 5.39 | 5.37 | 4.40 | 4.49 | 4.48 |
| 2500 | 4.10 | 4.26 | 4.41 | 3.93 | 4.16 | 4.16 | 3.35 | 3.40 | 3.40 |
| 2550 | 5.43 | 5.66 | 5.81 | 2.99 | 3.18 | 3.25 | 2.52 | 2.54 | 2.55 |
| 2600 | 7.18 | 7.46 | 7.61 | 2.28 | 2.47 | 2.59 | 1.84 | 1.88 | 1.90 |
| 2700 | 12.52 | 12.85 | 13.05 | 1.60 | 1.78 | 1.97 | 0.98 | 1.03 | 1.06 |
| 2800 | 21.27 | 21.72 | 22.14 | 1.43 | 1.61 | 1.75 | 0.62 | 0.68 | 0.72 |
| 2850 | 28.30 | 28.93 | 29.54 | 1.37 | 1.58 | 1.67 | 0.53 | 0.60 | 0.63 |
| 2860 | 30.15 | 30.80 | 31.52 | 1.35 | 1.56 | 1.65 | 0.52 | 0.58 | 0.62 |
| 2890 | 39.16 | 40.19 | 41.12 | 1.30 | 1.51 | 1.57 | 0.48 | 0.54 | 0.59 |
| 2900 | 43.23 | 43.90 | 44.12 | 1.27 | 1.49 | 1.55 | 0.47 | 0.53 | 0.57 |
| 2950 | 33.40 | 33.67 | 33.52 | 1.16 | 1.38 | 1.42 | 0.42 | 0.49 | 0.54 |
| 3000 | 28.93 | 29.14 | 29.28 | 1.02 | 1.23 | 1.27 | 0.37 | 0.44 | 0.48 |
| 3050 | 26.94 | 27.23 | 27.37 | 0.89 | 1.10 | 1.14 | 0.33 | 0.41 | 0.46 |
| 3100 | 25.89 | 26.19 | 26.34 | 0.77 | 0.96 | 1.01 | 0.30 | 0.38 | 0.43 |
| 3150 | 25.52 | 25.76 | 25.86 | 0.67 | 0.84 | 0.89 | 0.27 | 0.35 | 0.40 |
| 3200 | 25.40 | 25.64 | 25.69 | 0.59 | 0.74 | 0.81 | 0.25 | 0.34 | 0.39 |
| 3250 | 25.62 | 25.73 | 25.76 | 0.55 | 0.68 | 0.76 | 0.25 | 0.34 | 0.39 |
| 3300 | 25.86 | 25.94 | 25.92 | 0.51 | 0.63 | 0.72 | 0.24 | 0.33 | 0.38 |
| 3350 | 26.34 | 26.31 | 26.26 | 0.50 | 0.62 | 0.73 | 0.25 | 0.35 | 0.41 |
| 3400 | 26.81 | 27.04 | 26.96 | 0.52 | 0.62 | 0.73 | 0.26 | 0.36 | 0.42 |
| 3425 | 27.03 | 27.01 | 27.02 | 0.51 | 0.61 | 0.71 | 0.26 | 0.37 | 0.43 |
| 3450 | 27.51 | 27.55 | 27.56 | 0.51 | 0.61 | 0.71 | 0.27 | 0.38 | 0.43 |
| 3475 | 27.82 | 27.54 | 27.48 | 0.53 | 0.63 | 0.73 | 0.29 | 0.39 | 0.45 |
| 3500 | 28.04 | 27.85 | 27.86 | 0.53 | 0.65 | 0.76 | 0.29 | 0.39 | 0.46 |

## *Typical Performance Data*

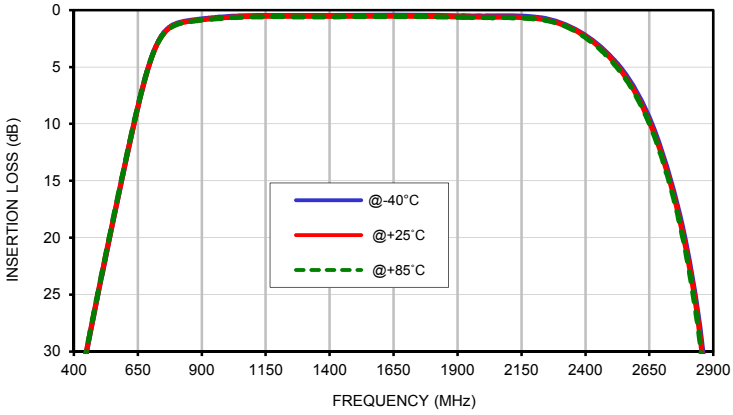
| FREQ. (MHz) | GROUP DELAY (nsec) | | |
|---|---|---|---|
| | @-40°C | @+25°C | @+85°C |
| 950 | 1.01 | 0.99 | 0.98 |
| 975 | 0.97 | 0.95 | 0.95 |
| 1000 | 0.93 | 0.92 | 0.91 |
| 1025 | 0.89 | 0.88 | 0.87 |
| 1050 | 0.86 | 0.85 | 0.84 |
| 1075 | 0.83 | 0.82 | 0.81 |
| 1100 | 0.80 | 0.79 | 0.79 |
| 1125 | 0.78 | 0.77 | 0.76 |
| 1150 | 0.76 | 0.74 | 0.74 |
| 1175 | 0.73 | 0.72 | 0.72 |
| 1200 | 0.72 | 0.70 | 0.70 |
| 1225 | 0.70 | 0.69 | 0.68 |
| 1250 | 0.68 | 0.67 | 0.67 |
| 1275 | 0.67 | 0.66 | 0.65 |
| 1300 | 0.66 | 0.65 | 0.64 |
| 1325 | 0.65 | 0.64 | 0.63 |
| 1350 | 0.64 | 0.63 | 0.62 |
| 1375 | 0.63 | 0.62 | 0.61 |
| 1400 | 0.62 | 0.61 | 0.61 |
| 1425 | 0.61 | 0.60 | 0.60 |
| 1450 | 0.61 | 0.60 | 0.59 |
| 1475 | 0.60 | 0.59 | 0.59 |
| 1500 | 0.60 | 0.59 | 0.58 |
| 1525 | 0.60 | 0.59 | 0.58 |
| 1550 | 0.59 | 0.58 | 0.58 |
| 1575 | 0.59 | 0.58 | 0.58 |
| 1600 | 0.59 | 0.58 | 0.57 |
| 1650 | 0.59 | 0.58 | 0.57 |
| 1700 | 0.59 | 0.58 | 0.57 |
| 1750 | 0.59 | 0.58 | 0.58 |
| 1800 | 0.59 | 0.58 | 0.58 |
| 1850 | 0.60 | 0.59 | 0.58 |
| 1900 | 0.60 | 0.59 | 0.59 |
| 1950 | 0.61 | 0.60 | 0.60 |
| 2000 | 0.63 | 0.62 | 0.61 |
| 2050 | 0.65 | 0.64 | 0.64 |
| 2100 | 0.69 | 0.68 | 0.68 |
| 2150 | 0.73 | 0.72 | 0.71 |
| 2200 | 0.78 | 0.77 | 0.77 |
| 2225 | 0.80 | 0.79 | 0.79 |
| 2250 | 0.82 | 0.81 | 0.82 |

## *Typical Performance Curves*

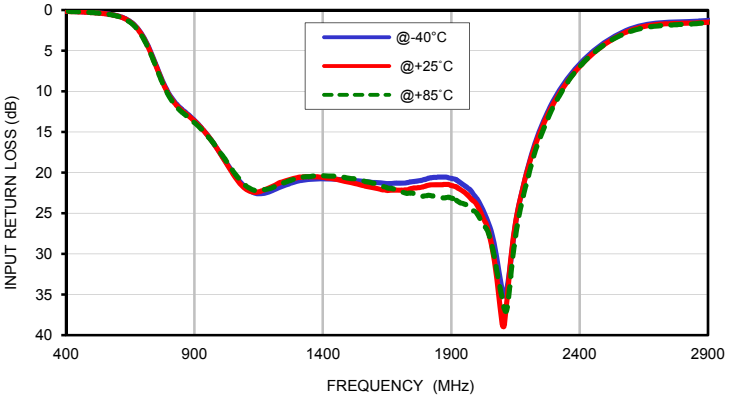
**INSERTION LOSS vs. TEMPERATURE**
INPUT POWER = 0 dBm



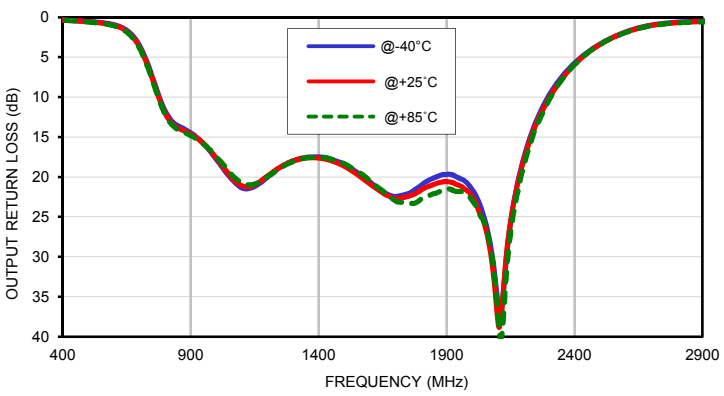

**INSERTION LOSS vs. TEMPERATURE (Zoomed)**
INPUT POWER = 0 dBm



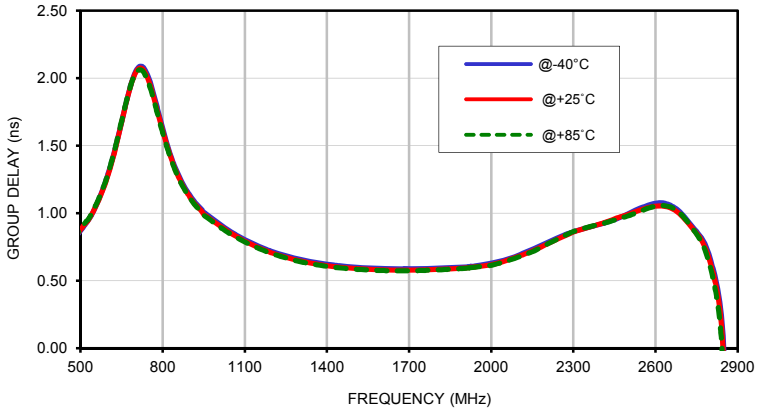

**INPUT RETURN LOSS vs. TEMPERATURE**
INPUT POWER = 0 dBm




**OUTPUT RETURN LOSS vs. TEMPERATURE**
INPUT POWER = 0 dBm



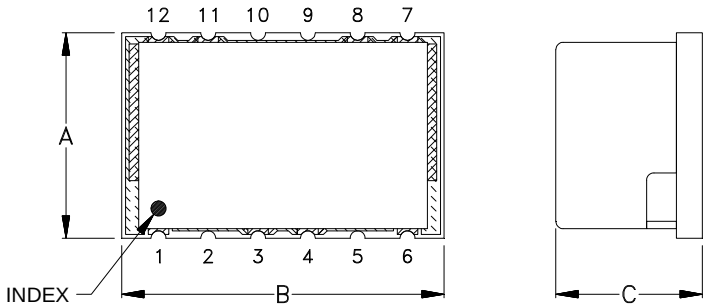

**GROUP DELAY vs. TEMPERATURE**
**INPUT POWER = 0 dBm**

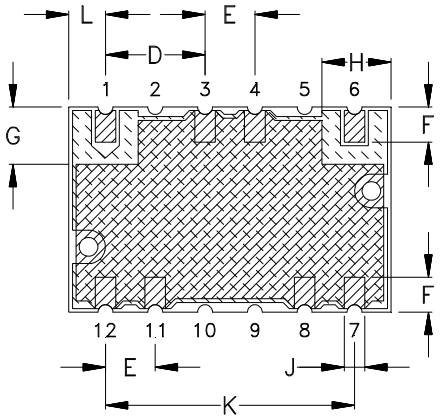


# Case Style TK

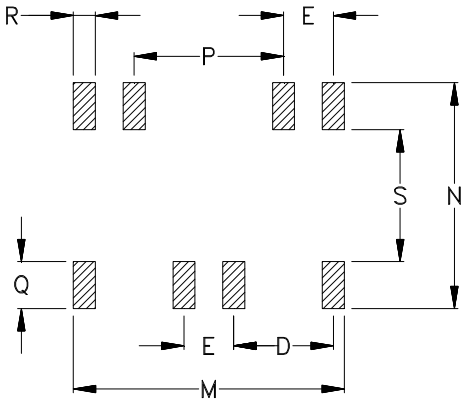
## Outline Dimensions

**TK2678**




PCB LAND PATTERN




METALLIZATION

SOLDER RESIST

| CASE# | A | B | C | D | E | F | G | H | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TK2678 | .276 (7.01) | .433 (11.00) | .197 (5.00) | .134 (3.40) | .067 (1.70) | .047 (1.19) | .077 (1.96) | .093 (2.36) | .028 (0.71) | .335 (8.51) | .049 (1.24) | .364 (9.25) |

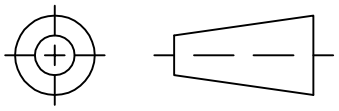
| CASE# | N | P | Q | R | S | WT.GRAMS |
|---|---|---|---|---|---|---|
| TK2678 | .303 (7.67) | .201 (5.11) | .063 (1.60) | .030 (0.76) | .177 (4.50) | 0.6 |

**Dimensions are in inches (mm). Tolerances: 2PL. ± .03; 3PL. ± .015**

### Notes:

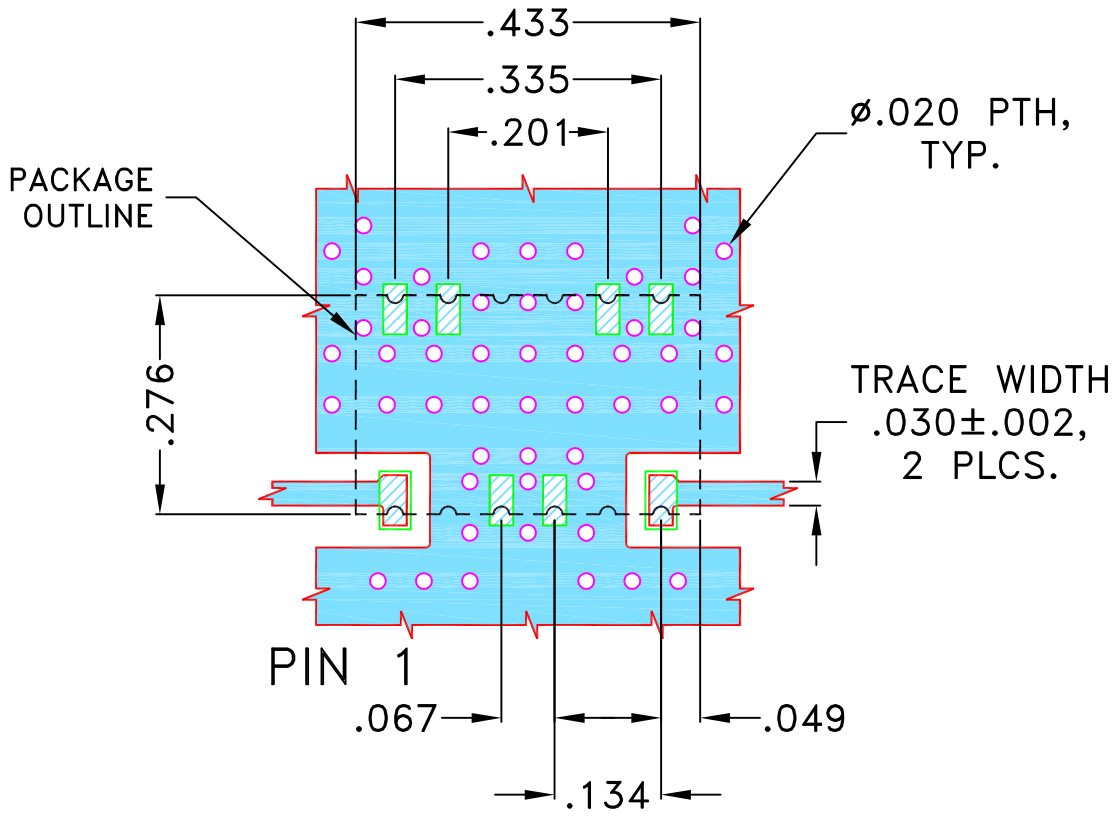
1. Case material: Nickel-Silver alloy.
2. Base: Printed wiring laminate.
3. Termination finish:
   For RoHS Case Styles: 2-5 µ inch (.05-.13 microns) Gold over 120-240 µ inch (3.05-6.10 microns) Nickel plate.
   All models, (+) suffix.

THIRD ANGLE PROJECTION



| REVISIONS | | | | | |
|---|---|---|---|---|---|
| REV | ECN No. | DESCRIPTION | DATE | DR | AUTH |
| OR | M168517 | NEW RELEASE | JUL 18 | TM | VC |
| | | | | | |
| | | | | | |
| | | | | | |

# SUGGESTED MOUNTING CONFIGURATION FOR TK2678 CASE STYLE "12FL04" PIN CODE




NOTES:

1. TRACE WIDTH IS SHOWN FOR ROGERS(RO4350B) WITH DIELECTRIC THICKNESS .030"±.002". COPPER: 1/2 Oz EACH SIDE.
   FOR OTHER MATERIALS TRACE WIDTH 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 SOLDERMASK

| UNLESS OTHERWISE SPECIFIED | | INITIALS | DATE |
|---|---|---|---|
| DIMENSIONS ARE IN INCHES | DRAWN | TM | 17 JUL 18 |
| TOLERANCES ON: | CHECKED | MD | 17 JUL 18 |
| 2 PL DECIMALS ± .005" | APPROVED | VC | 17 JUL 18 |
| 3 PL DECIMALS ± | | | |
| ANGLES ± | | | |
| FRACTIONS ± | | | |



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

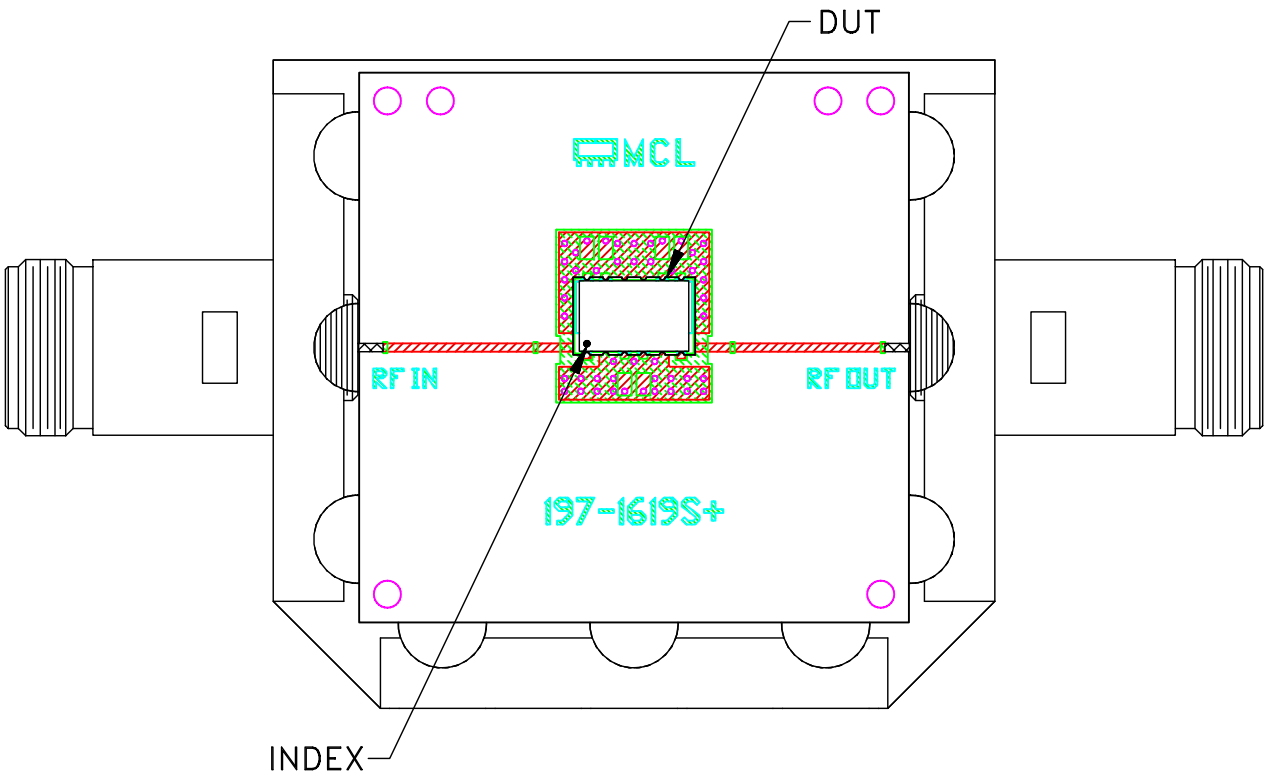
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

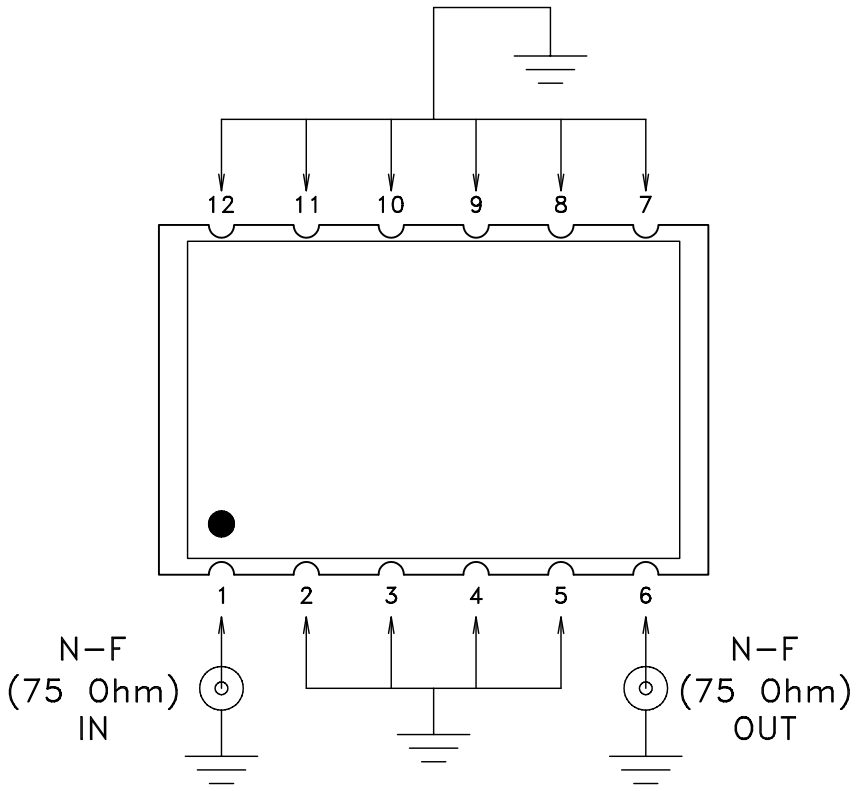
# PL, 12FL04, TK2678, BPF, TB-1072+, 75 Ohm

| SIZE | CODE IDENT | DRAWING NO: | REV: |
|---|---|---|---|
| A | 15542 | 98-PL-599 | OR |
| FILE: 98PL599 | | SCALE: 3:1 | SHEET: 1 OF 1 |

# Evaluation Board and Circuit

## TB-1072+




Notes:

1. 75 Ohm N Female connectors.
2. PCB Material: Rogers (RO4350) OR Equivalent
   Dielectric Constant=3.48±.05, Thickness=.030 inch.

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# Environmental Specifications ENV02T1

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 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 |