LUMPED LC SURFACE MOUNT

# Triplexer

# TPLX-E870+

50Ω DC to 870 MHz (DC-174, 378-522, 763-870 MHz)

## KEY FEATURES

- Low Passband Insertion Loss, 0.4 dB Typ. at Lowpass and 0.6 dB Typ. at Bandpass and 0.5 dB Typ. at Highpass Channel
- Good Rejection, 40 dB Typ.
- Power Handling: 3 Watts
- Compact Size, 30.48 x 30.48 mm

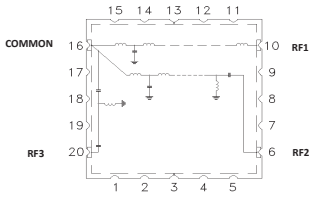


*Generic photo used for illustration purposes only*

## APPLICATIONS

- Fixed Wireless Access
- Police Mobile Radio

## FUNCTIONAL DIAGRAM




## PRODUCT OVERVIEW

Mini-Circuits' TPLX-E870+ is a high performance 50Ω triplexer with the lowpass channel-1 at DC-174 MHz, bandpass channel-2 at 378-522 MHz and highpass channel-3 at 763-870 MHz. The channels are well isolated to minimize inter-channel interference and have minimal insertion loss through their respective bands. The triplexer is built in a shielded package.

## ELECTRICAL SPECIFICATIONS[1] AT +25°C

| Parameter | | Function (Port) | Frequency (MHz) | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Pass Band | Insertion Loss | Low Pass (RF COM-RF1) | DC - 174 | — | 0.4 | 0.6 | dB |
| | | Band Pass (RF COM-RF2) | 378 - 522 | — | 0.6 | 1.0 | |
| | | High Pass (RF COM-RF3) | 763 - 870 | — | 0.5 | 0.7 | |
| | Return Loss | Low Pass (RF1) | DC - 174 | 15 | 20 | — | dB |
| | | Band Pass (RF2) | 378 - 522 | 12 | 15 | — | |
| | | High Pass (RF3) | 763 - 870 | 12 | 15 | — | |
| | | Common (COM) | DC - 174 | 15 | 20 | — | |
| | | | 378 - 522 | 12 | 15 | — | |
| | | | 763 - 870 | 12 | 15 | — | |
| Stop Band Rejection | | Low Pass (RF COM-RF1) | 378 - 522 | 25 | 30 | — | dB |
| | | | 522 - 870 | 35 | 40 | — | |
| | | Band Pass (RF COM-RF2) | DC - 174 | 30 | 35 | — | |
| | | | 763 - 870 | 20 | 25 | — | |
| | | High Pass (RFCOM-RF3) | DC - 174 | 35 | 40 | — | |
| | | | 174 - 522 | 25 | 30 | — | |

1. Tested in Evaluation Board P/N TB-TPLX-E870+.

## ABSOLUTE MAXIMUM RATINGS[2]

| | |
|---|---|
| **Operating Temperature** | -40°C to +85°C |
| **Storage Temperature** | -55°C to +100°C |
| **Input Power (RF COM)[3]** | 3 W |
| **Input Power (RF1)[3]** | 3 W |
| **Input Power (RF2)[3]** | 3 W |
| **Input Power (RF3)[3]** | 3 W |

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

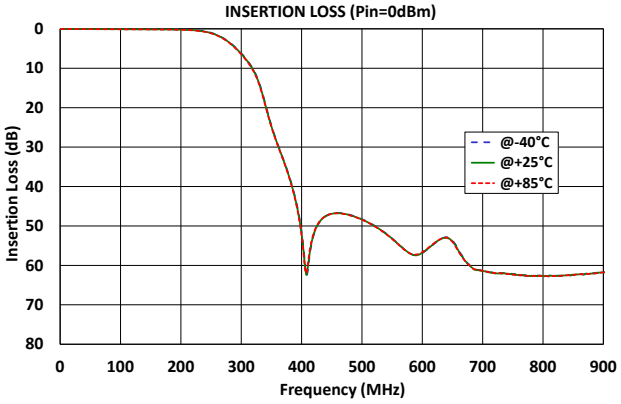
# Triplexer

# TPLX-E870+

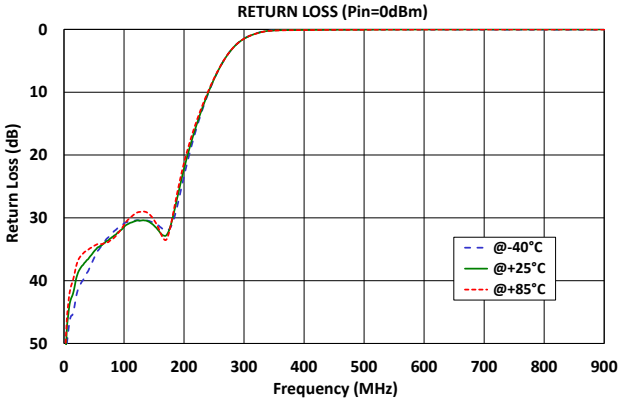
50Ω DC to 870 MHz (DC-174, 378-522, 763-870 MHz)

## TYPICAL PERFORMANCE GRAPHS

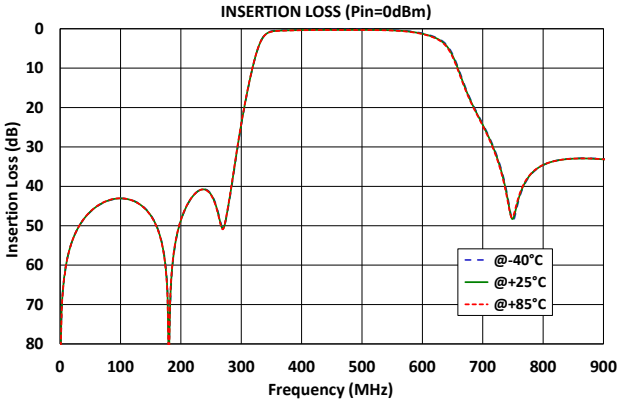
TPLX-E870+ LOW PASS PORT
INSERTION LOSS (Pin=0dBm)



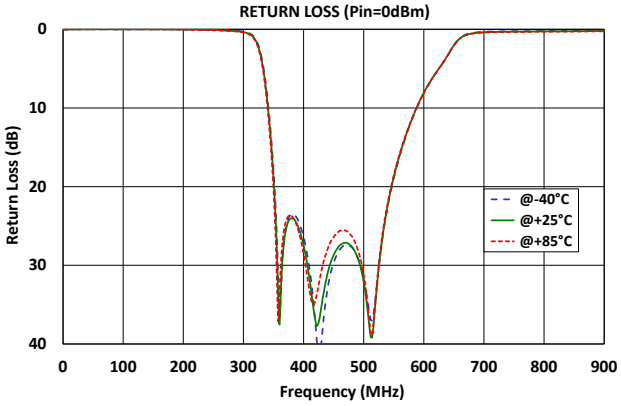

TPLX-E870+ LOW PASS PORT
RETURN LOSS (Pin=0dBm)



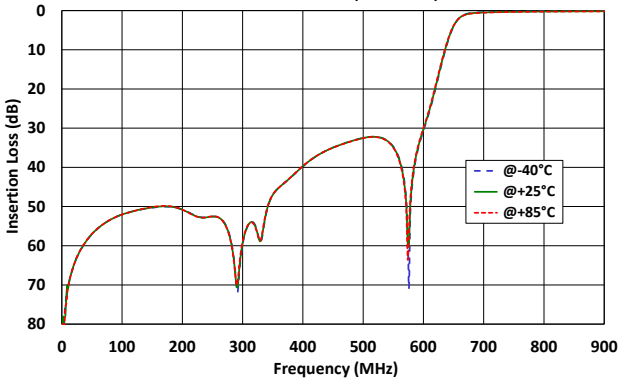

TPLX-E870+ BAND PASS PORT
INSERTION LOSS (Pin=0dBm)



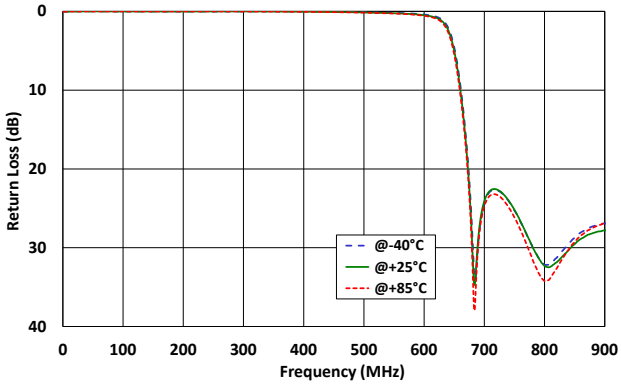

TPLX-E870+ BAND PASS PORT
RETURN LOSS (Pin=0dBm)




TPLX-E870+ HIGH PASS PORT
INSERTION LOSS (Pin=0dBm)




TPLX-E870+ HIGH PASS PORT
RETURN LOSS (Pin=0dBm)



LUMPED LC SURFACE MOUNT

# Triplexer

# TPLX-E870+

50Ω DC to 870 MHz (DC-174, 378-522, 763-870 MHz)

## FUNCTIONAL DIAGRAM

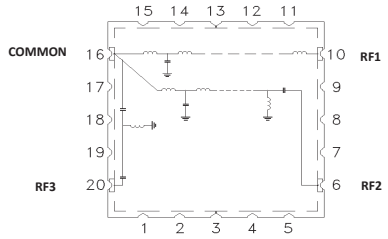
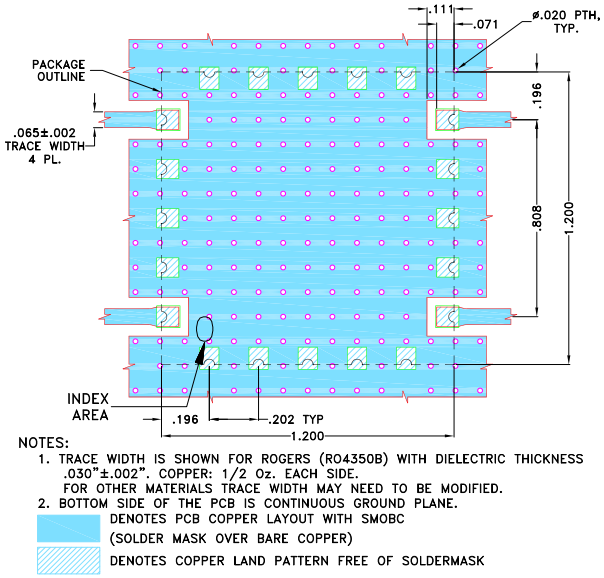



Figure 1. TPLX-E870+ Functional Diagram

## PAD DESCRIPTION

| Port | Pad Number | Description |
|---|---|---|
| COMMON | 16 | Connects to Common Port |
| RF1 | 10 | Connects to Low Pass Port |
| RF2 | 6 | Connects to Band Pass Port |
| RF3 | 20 | Connects to High Pass Port |
| GROUND | 1,2,3,4,5,7,8,9,11,12, 13,14,15,17,18,19 | Connects to Ground on PCB, (See drawing PL-409) |

## SUGGESTED PCB LAYOUT



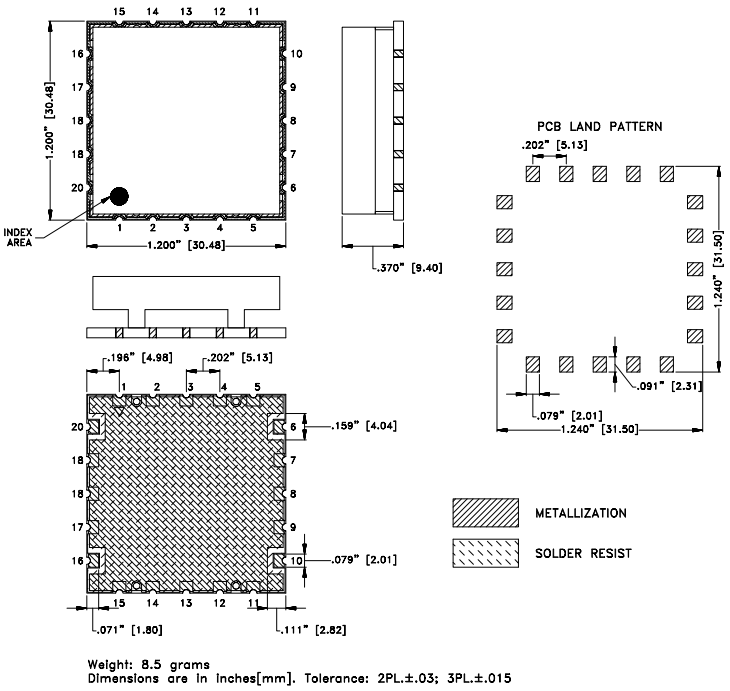

NOTES:
1. TRACE WIDTH IS SHOWN FOR ROGERS (RO4350B) WITH DIELECTRIC THICKNESS .030"±.002". COPPER: 1/2 Oz. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

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

DENOTES COPPER LAND PATTERN FREE OF SOLDERMASK

Figure 2. Suggested PCB Layout PL-409

## CASE STYLE DRAWING




Weight: 8.5 grams
Dimensions are in Inches[mm]. Tolerance: 2PL.±.03; 3PL.±.015

## PRODUCT MARKING*: TPLX-E870

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

# Triplexer

# TPLX-E870+

50Ω DC to 870 MHz (DC-174, 378-522, 763-870 MHz)

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

| | |
|---|---|
| **Performance Data & Graphs** | Data<br>Graphs<br>S-Parameter (S4P Files) Data Set (.zip file) De-embedded to device pads |
| **Case Style** | HR1843 Lead Finish: Gold over Nickel Place |
| **RoHS Status** | Compliant |
| **Tape and Reel** | F80 |
| **Suggested Layout for PCB Design** | PL-409 |
| **Evaluation Board** | TB-TPLX-E870+<br>Gerber File |
| **Environmental Rating** | ENV02T1 |

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

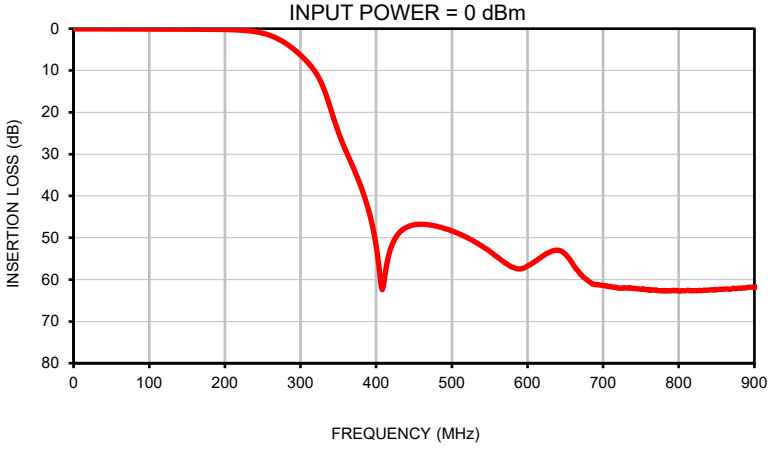
# Triplexer TPLX-E870+

*Typical Performance Data*

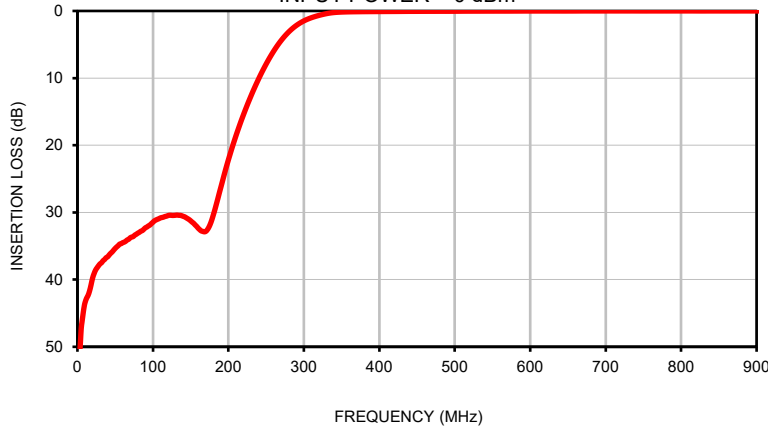
| FREQUENCY (MHz) | INSERTIONLOSS (dB) | | | ISOLATION (dB) | | | RETURNLOSS (dB) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Lowpass port | Bandpass port | Highpass port | (between LPF and HPF) | (between BPF and HPF) | (between LPF and BPF) | Common port | Lowpass port | Bandpass port | Highpass port |
| 1 | 0.05 | 81.92 | 82.03 | 85.92 | 95.10 | 79.13 | 55.67 | 57.37 | 0.04 | 0.03 |
| 10 | 0.06 | 59.84 | 71.09 | 71.09 | 120.80 | 59.83 | 43.07 | 43.45 | 0.02 | 0.02 |
| 20 | 0.06 | 53.88 | 64.87 | 65.02 | 110.77 | 53.92 | 38.60 | 39.80 | 0.01 | 0.01 |
| 30 | 0.07 | 50.50 | 61.34 | 61.61 | 121.36 | 50.56 | 35.75 | 37.65 | 0.01 | 0.01 |
| 40 | 0.07 | 48.14 | 58.95 | 59.14 | 98.64 | 48.28 | 33.75 | 36.60 | 0.00 | 0.00 |
| 50 | 0.07 | 46.44 | 57.03 | 57.34 | 100.12 | 46.61 | 32.18 | 35.36 | 0.00 | 0.00 |
| 60 | 0.08 | 45.18 | 55.55 | 55.82 | 98.85 | 45.39 | 30.93 | 34.50 | 0.00 | 0.00 |
| 80 | 0.09 | 43.59 | 53.42 | 53.61 | 95.73 | 43.85 | 29.41 | 33.08 | 0.00 | 0.01 |
| 90 | 0.09 | 43.19 | 52.65 | 52.80 | 94.66 | 43.46 | 28.95 | 32.29 | 0.01 | 0.01 |
| 100 | 0.10 | 43.06 | 52.03 | 52.08 | 97.88 | 43.31 | 28.65 | 31.46 | 0.00 | 0.01 |
| 110 | 0.11 | 43.20 | 51.54 | 51.51 | 94.08 | 43.42 | 28.51 | 30.81 | 0.00 | 0.01 |
| 120 | 0.11 | 43.62 | 51.11 | 51.02 | 95.30 | 43.81 | 28.80 | 30.46 | 0.00 | 0.01 |
| 136 | 0.12 | 45.03 | 50.57 | 50.44 | 96.47 | 45.15 | 29.66 | 30.43 | 0.00 | 0.01 |
| 140 | 0.13 | 45.57 | 50.49 | 50.34 | 99.06 | 45.66 | 30.00 | 30.57 | 0.00 | 0.01 |
| 150 | 0.13 | 47.36 | 50.21 | 50.12 | 103.62 | 47.44 | 31.08 | 31.24 | 0.01 | 0.01 |
| 160 | 0.14 | 50.23 | 50.04 | 49.97 | 98.68 | 50.27 | 32.64 | 32.34 | 0.01 | 0.01 |
| 174 | 0.15 | 59.55 | 49.95 | 49.93 | 102.43 | 59.35 | 33.07 | 32.23 | 0.01 | 0.02 |
| 180 | 0.16 | 83.20 | 50.01 | 49.95 | 96.30 | 69.29 | 31.08 | 30.39 | 0.02 | 0.02 |
| 190 | 0.18 | 55.19 | 50.31 | 50.12 | 97.20 | 55.33 | 26.79 | 26.27 | 0.03 | 0.01 |
| 200 | 0.21 | 48.64 | 50.82 | 50.39 | 90.95 | 49.17 | 22.69 | 22.18 | 0.03 | 0.01 |
| 210 | 0.25 | 44.88 | 51.50 | 50.80 | 88.96 | 45.70 | 19.09 | 18.60 | 0.04 | 0.01 |
| 220 | 0.34 | 42.46 | 52.29 | 51.40 | 88.81 | 43.54 | 15.90 | 15.45 | 0.06 | 0.01 |
| 230 | 0.48 | 41.08 | 52.75 | 52.23 | 88.42 | 42.38 | 13.04 | 12.65 | 0.07 | 0.01 |
| 240 | 0.71 | 40.82 | 52.75 | 53.39 | 87.41 | 42.28 | 10.49 | 10.14 | 0.08 | 0.01 |
| 250 | 1.08 | 42.10 | 52.56 | 55.08 | 87.30 | 43.76 | 8.23 | 7.92 | 0.10 | 0.01 |
| 260 | 1.63 | 45.90 | 52.79 | 57.39 | 90.15 | 48.43 | 6.28 | 5.99 | 0.13 | 0.01 |
| 270 | 2.41 | 50.74 | 54.33 | 60.86 | 90.65 | 48.18 | 4.66 | 4.39 | 0.16 | 0.00 |
| 280 | 3.45 | 43.64 | 58.50 | 66.72 | 89.87 | 38.87 | 3.39 | 3.12 | 0.20 | 0.00 |
| 290 | 4.76 | 33.85 | 70.59 | 80.12 | 93.18 | 33.03 | 2.46 | 2.17 | 0.26 | 0.00 |
| 300 | 6.32 | 24.26 | 59.35 | 71.79 | 86.63 | 28.79 | 1.85 | 1.48 | 0.36 | 0.00 |
| 308 | 7.76 | 17.56 | 55.05 | 66.86 | 76.13 | 26.05 | 1.61 | 1.09 | 0.53 | 0.01 |
| 320 | 10.47 | 9.09 | 54.70 | 64.18 | 63.28 | 22.88 | 2.03 | 0.66 | 1.37 | 0.01 |
| 330 | 14.02 | 4.02 | 58.83 | 64.50 | 55.29 | 21.82 | 4.20 | 0.40 | 3.79 | 0.01 |
| 340 | 19.25 | 1.49 | 51.03 | 67.11 | 50.37 | 23.13 | 9.47 | 0.24 | 9.29 | 0.01 |
| 350 | 24.70 | 0.70 | 47.03 | 69.64 | 47.53 | 26.14 | 18.39 | 0.17 | 18.77 | 0.02 |
| 360 | 29.22 | 0.50 | 45.20 | 72.20 | 45.55 | 29.82 | 31.45 | 0.13 | 37.54 | 0.02 |
| 378 | 36.87 | 0.40 | 42.81 | 75.70 | 42.68 | 37.52 | 24.35 | 0.10 | 24.09 | 0.03 |
| 380 | 37.83 | 0.40 | 42.53 | 76.41 | 42.40 | 38.51 | 24.30 | 0.10 | 24.02 | 0.03 |
| 390 | 43.44 | 0.36 | 41.12 | 77.98 | 41.06 | 44.27 | 25.16 | 0.09 | 24.91 | 0.04 |
| 400 | 51.91 | 0.33 | 39.72 | 81.07 | 39.84 | 53.31 | 27.61 | 0.09 | 27.43 | 0.04 |
| 410 | 60.97 | 0.31 | 38.46 | 82.18 | 38.73 | 63.28 | 31.96 | 0.08 | 31.77 | 0.05 |
| 420 | 52.17 | 0.30 | 37.37 | 82.48 | 37.71 | 52.33 | 39.09 | 0.08 | 37.16 | 0.05 |
| 430 | 48.93 | 0.29 | 36.44 | 82.08 | 36.78 | 48.93 | 38.34 | 0.07 | 35.09 | 0.06 |
| 440 | 47.52 | 0.29 | 35.65 | 80.77 | 35.92 | 47.42 | 32.78 | 0.06 | 30.98 | 0.07 |
| 450 | 46.91 | 0.28 | 34.96 | 81.52 | 35.15 | 46.72 | 29.98 | 0.06 | 28.72 | 0.08 |
| 460 | 46.77 | 0.28 | 34.36 | 79.60 | 34.44 | 46.53 | 28.57 | 0.05 | 27.47 | 0.09 |
| 470 | 46.92 | 0.29 | 33.82 | 79.63 | 33.82 | 46.62 | 28.15 | 0.05 | 27.12 | 0.10 |
| 480 | 47.24 | 0.29 | 33.32 | 77.83 | 33.29 | 46.99 | 28.48 | 0.05 | 27.60 | 0.11 |
| 490 | 47.77 | 0.29 | 32.88 | 78.72 | 32.87 | 47.56 | 29.72 | 0.05 | 29.10 | 0.12 |
| 500 | 48.36 | 0.29 | 32.51 | 78.34 | 32.56 | 48.30 | 32.12 | 0.04 | 32.13 | 0.14 |
| 510 | 49.11 | 0.29 | 32.26 | 78.15 | 32.41 | 49.17 | 34.80 | 0.03 | 38.13 | 0.15 |
| 522 | 50.11 | 0.31 | 32.24 | 78.27 | 32.50 | 50.39 | 30.75 | 0.03 | 32.72 | 0.18 |
| 530 | 50.89 | 0.32 | 32.48 | 77.73 | 32.79 | 51.32 | 26.65 | 0.03 | 27.14 | 0.20 |
| 600 | 56.80 | 1.27 | 30.30 | 76.24 | 27.41 | 55.67 | 8.47 | 0.01 | 8.08 | 0.49 |
| 630 | 53.40 | 2.99 | 13.43 | 66.36 | 16.56 | 54.35 | 5.41 | 0.01 | 4.46 | 1.25 |
| 700 | 61.37 | 24.39 | 0.48 | 61.59 | 24.86 | 48.04 | 24.51 | 0.00 | 0.38 | 24.08 |
| 763 | 62.53 | 41.45 | 0.28 | 63.53 | 42.57 | 44.26 | 25.33 | 0.00 | 0.29 | 27.10 |
| 800 | 62.70 | 34.60 | 0.23 | 63.87 | 35.01 | 42.75 | 28.96 | 0.00 | 0.27 | 32.31 |
| 850 | 62.45 | 32.98 | 0.19 | 63.80 | 33.27 | 41.06 | 28.47 | 0.00 | 0.25 | 29.54 |
| 870 | 62.21 | 32.93 | 0.18 | 63.59 | 33.22 | 40.44 | 27.71 | 0.00 | 0.23 | 28.45 |

*Typical Performance Curves*

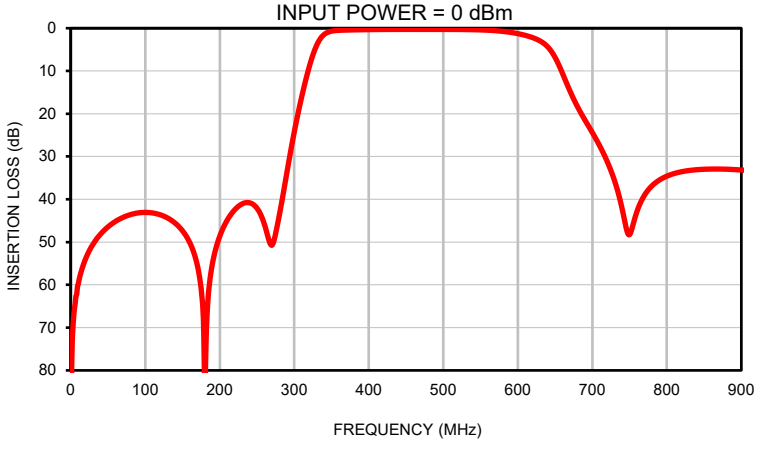
**LOWPASS INSERTION LOSS**
INPUT POWER = 0 dBm



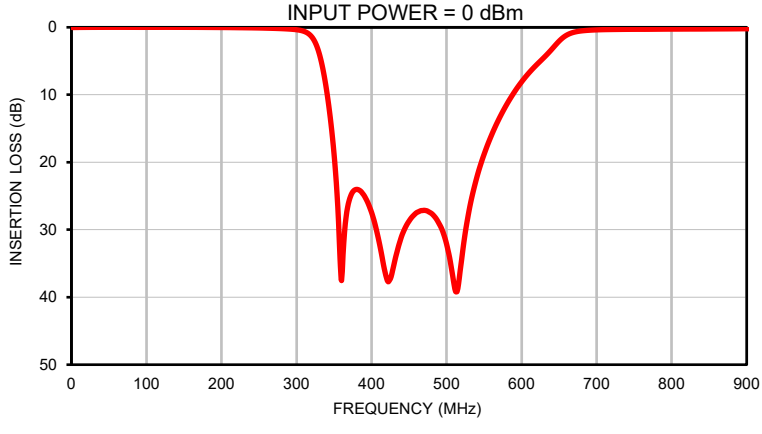

**LOWPASS RETURN LOSS**
INPUT POWER = 0 dBm



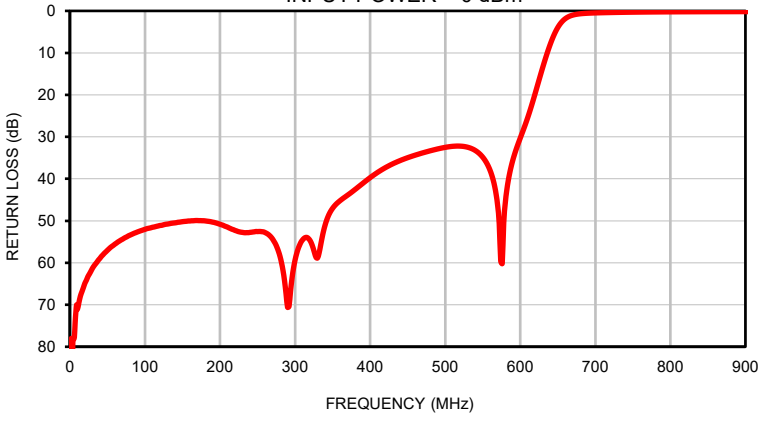

**BANDPASS INSERTION LOSS**
INPUT POWER = 0 dBm



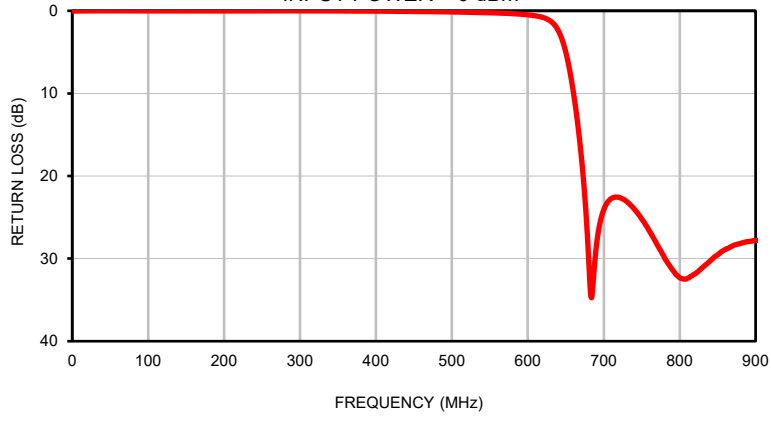

**BANDPASS RETURN LOSS**
INPUT POWER = 0 dBm




**HIGHPASS INSERTION LOSS**
INPUT POWER = 0 dBm

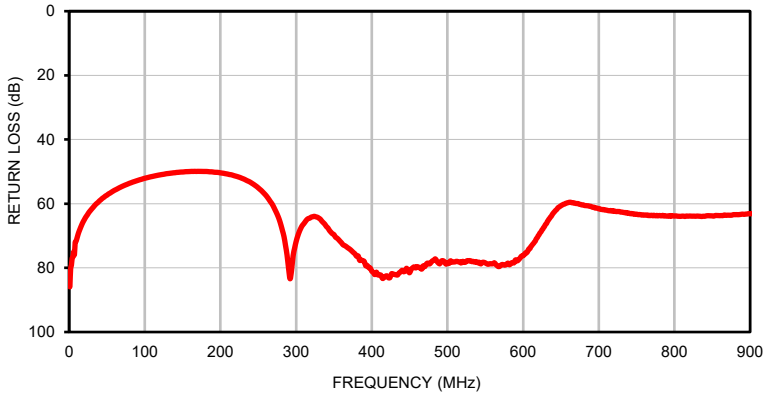



**HIGHPASS RETURN LOSS**
INPUT POWER = 0 dBm

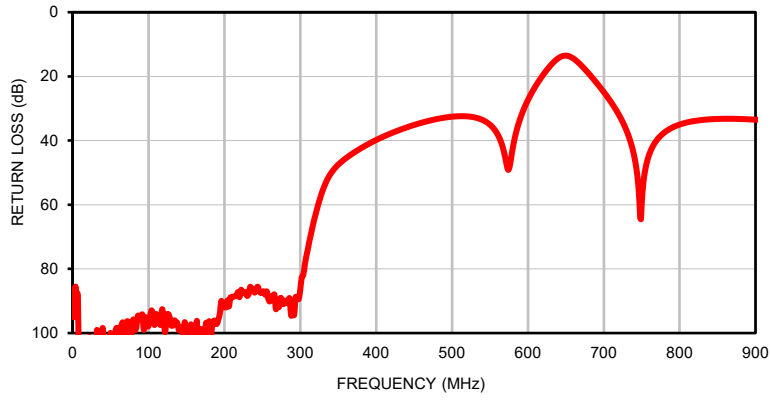


*Typical Performance Curves*

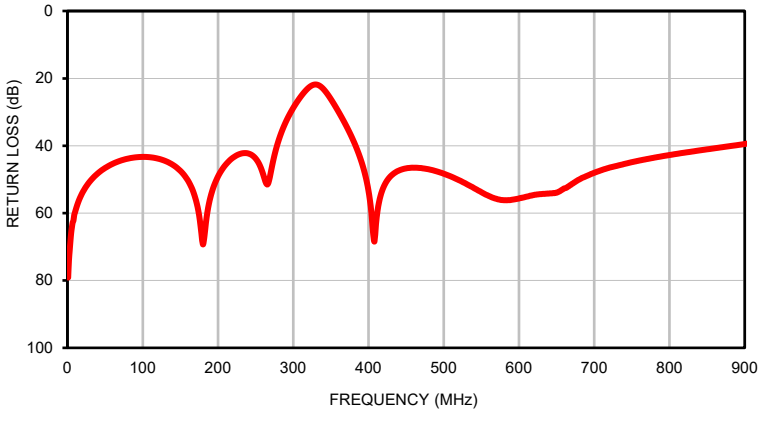
**CROSSOVER ISOLATION LPF-HPF**
INPUT POWER = 0 dBm



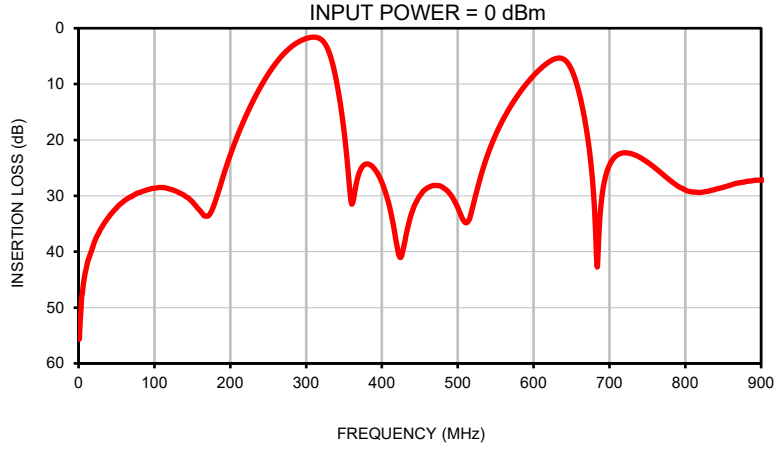

**CROSSOVER ISOLATION BPF-HPF**
INPUT POWER = 0 dBm




**CROSSOVER ISOLATION LPF-BPF**
INPUT POWER = 0 dBm



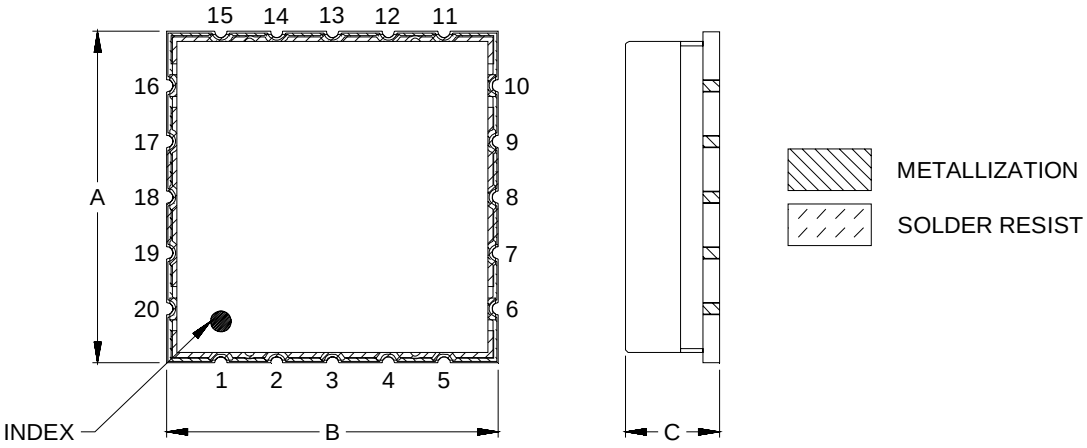

**COMMON PORT RETURN LOSS**
INPUT POWER = 0 dBm



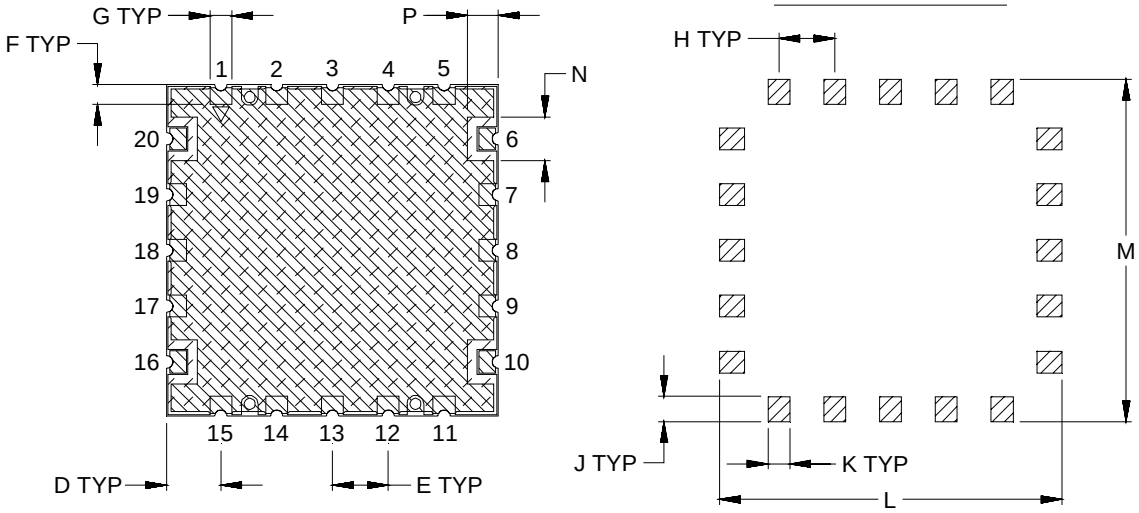
# Case Style HR

## Outline Dimensions

**HR1843**




PCB Land Pattern




Suggested Layout,
Tolerance to be within ±.002

| CASE# | A | B | C | D | E | F | G | H | J | K | L | M | N | P | WT.GRAMS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HR1843 | 1.200 (30.48) | 1.200 (30.48) | .370 (9.40) | .196 (4.98) | .202 (5.13) | .071 (1.80) | .079 (2.01) | .202 (5.13) | .091 (2.31) | .079 (2.01) | 1.240 (31.50) | 1.240 (31.50) | .159 (4.04) | .111 (2.82) | 8 |

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

### Notes:

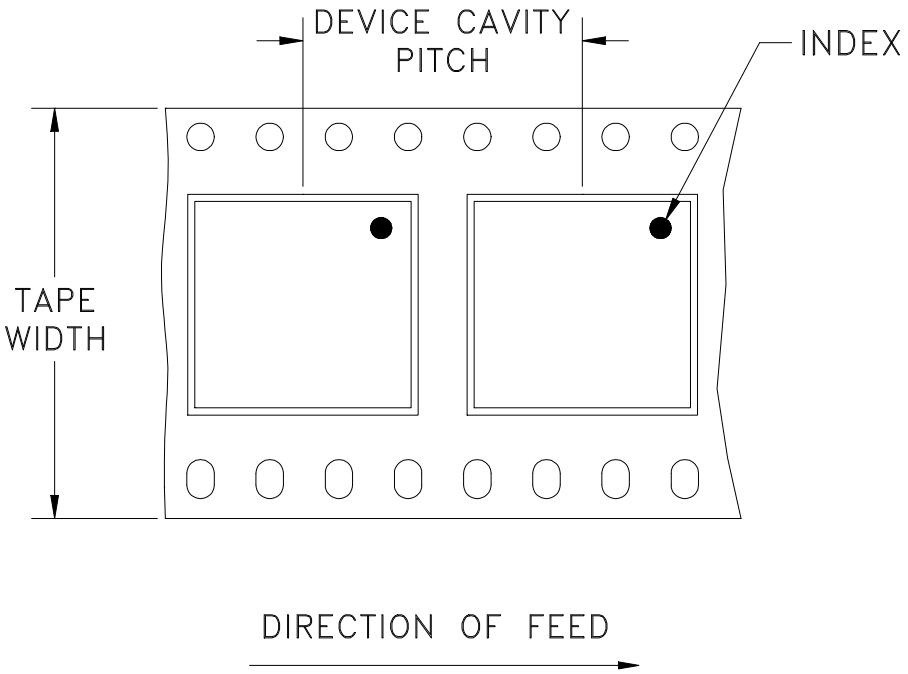
1. Case material: Nickel-Silver alloy.
2. Base: Printed wiring laminate.
3. Termination finish:
   For RoHS Case Styles: 3-5 µ inch Gold over 120-240 µ inch Nickel plate.
   For RoHS-5 Case Styles: Tin-Lead plate.

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# Tape & Reel Packaging TR-F80

DEVICE ORIENTATION IN T&R




| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel |
|---|---|---|---|
| 44 | 40 | 13 | 100 |

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

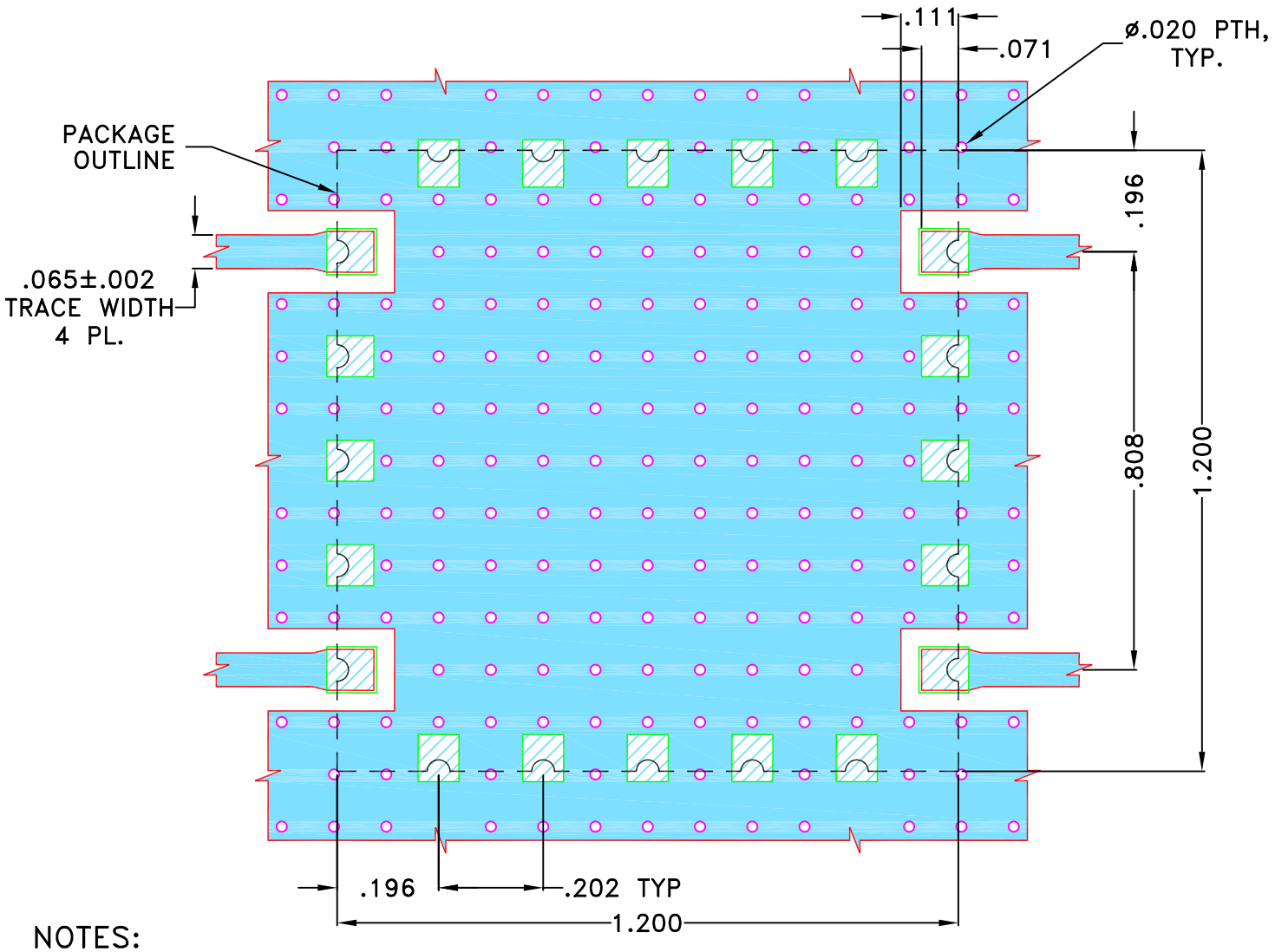
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THIRD ANGLE PROJECTION

| REVISIONS | | | | | |
|---|---|---|---|---|---|
| REV | ECN No. | DESCRIPTION | DATE | DR | AUTH |
| OR | M144572 | NEW RELEASE | DEC 13 | DDR | KG |
| | | | | | |
| | | | | | |
| | | | | | |

# SUGGESTED MOUNTING CONFIGURATION FOR HR1843 CASE STYLE "20FS01" 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 | DDR | 26 DEC 13 |
| TOLERANCES ON: | CHECKED | MD | 26 DEC 13 |
| 2 PL DECIMALS ± | APPROVED | KR | 26 DEC 13 |
| 3 PL DECIMALS ± .005" | | | |
| ANGLES ± | | | |
| FRACTIONS ± | | | |

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

Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

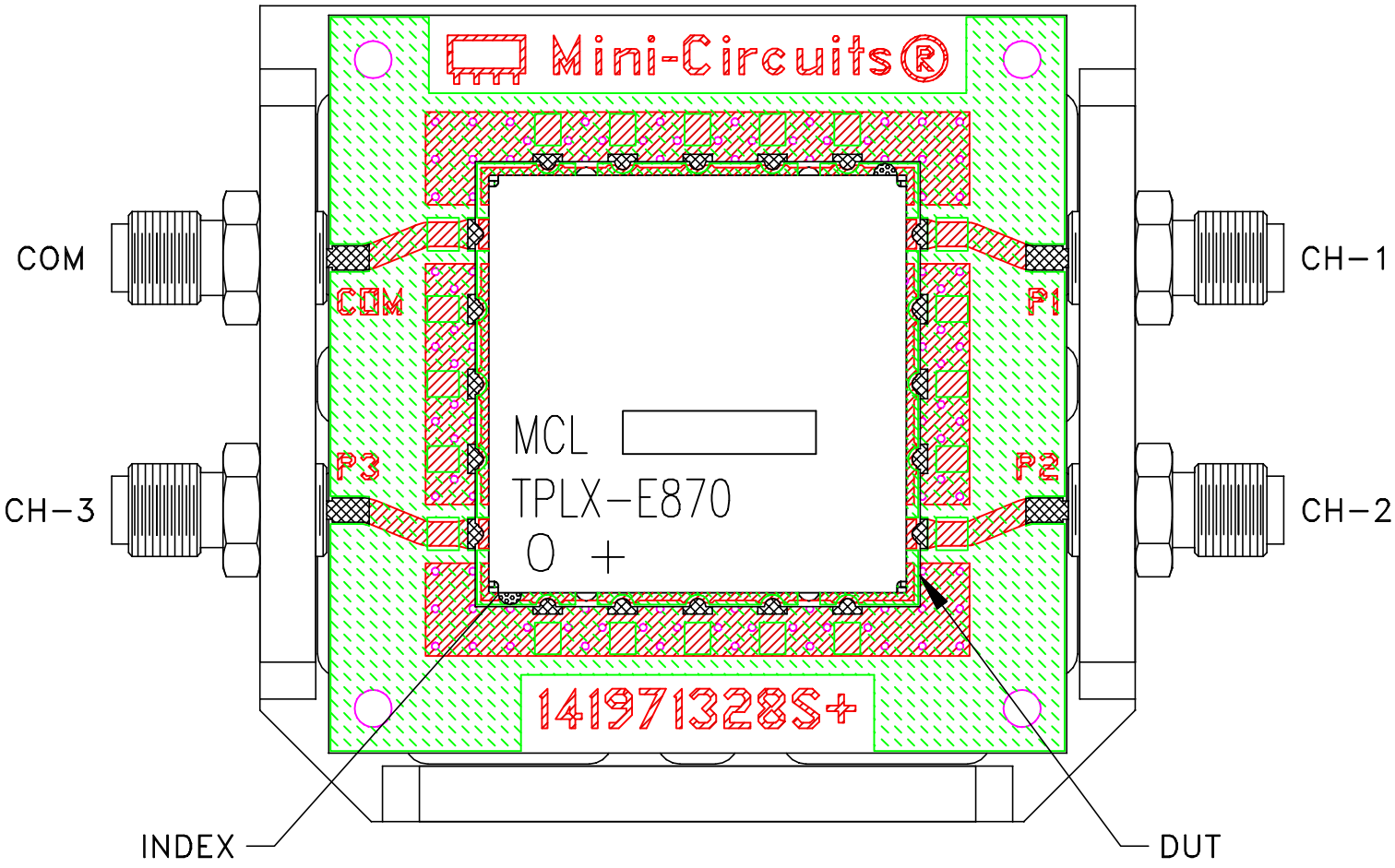
# PL, 20FS01, HR1843, TTP TB-767+, 50 Ohm

| SIZE | CODE IDENT | DRAWING NO: | REV: |
|---|---|---|---|
| A | 15542 | 98-PL-409 | OR |

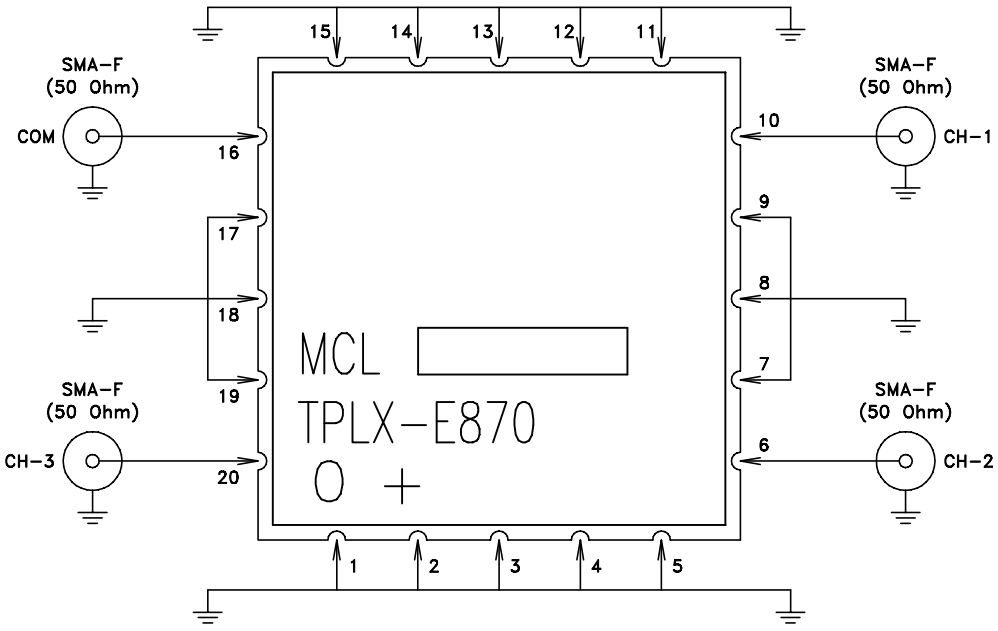
| FILE: | SCALE: | SHEET: |
|---|---|---|
| 98PL409 | 3:1 | 1 OF 1 |

# Evaluation Board and Circuit

TB-TPLX-E870+




Schematic diagram




Notes:

1. PCB Material: ROGERS (RO4350B) OR Equivalent, Dielectric Constant=3.48±.05
Dielectric Thickness: .030±.002
2. 50 Ohm SMA Female Connectors.

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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 |


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