Surface Mount

Bandpass Filter

BPF-C495+

50Ω 470 to 520 MHz

CASE STYLE: HU1186

The Big Deal

- High rejection (70 dB typical)
- Linear phase (± 9deg typical over Fc ± 30 MHz)
- Miniature shielded case

Product Overview

The BPF-C495+ is a narrow band pass filter in a metal shielded package (size of 0.87" x 0.80" x .25") fabricated using SMT technology. The BPF-C495+ offers a typical pass band insertion loss of 1.7 dB with sharp roll-off and stopband rejection down to 90 dB typ. In addition, it has repeatable performance across production lots and consistent performance across temperature.

Key Features

Feature	Advantages
Minimal Phase deviation over attenuation range: ± 9 deg typical over Fc ±30MHz.	Can provide low signal distortion for high data rate communication systems.
High rejection, 70dB typical	Achieving 90dB rejection at 1200MHz; the BPF-C495+ provides a versatile anti aliasing solution for high data rate receivers.
Good VSWR, 1.3:1 typical over passband	The BPF-C495+ has very good return loss over the operating bandwidth which enables low ripple interface when cascaded with other devices.
Sharp roll off	Provides good rejection of signals close to the passband, for improved system performance.
Metal SMT shielded case	Reduced interference to, and from surrounding components.

Surface Mount

Bandpass Filter

BPF-C495+

50Ω 470 to 520 MHz

CASE STYLE: HU1186

Features

- High rejection, 70 dB typical
- Linear phase, up to ±9 deg typical over Fc ±30MHz
- Good VSWR, 1.3:1 typical in passband
- Sharp insertion loss roll off
- Shielded case
- Aqueous washable

Applications

- Harmonic rejection
- Transmitters / receivers
- TV broadcasting

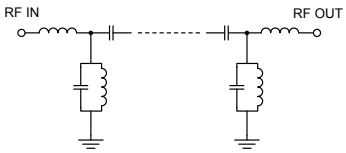
Electrical Specifications at 25°C

Parameter		F#	Frequency (MHz)	Min.	Typ.	Max.	Unit
Pass Band	Center Frequency	Fc			495		MHz
	Insertion Loss	F1-F2	470-520		2.0	3.0	dB
	VSWR	F1-F2	470-520		1.3	1.8	:1
Stop Band, Lower	Insertion Loss	DC-F3	DC-410	20	27		dB
	VSWR	DC-F3	DC-410		29		:1
Stop Band, Upper	Insertion Loss	F4-F5	625-2600	20	30		dB
	VSWR	F4-F5	625-2600		27		:1
Maximum Deviation from Linear Phase		Fc ±30MHz	465-525		±9	±18	deg

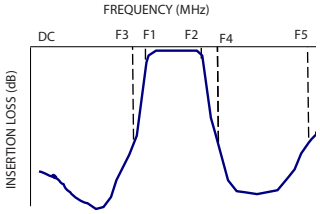
Maximum Ratings	
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power Input	1W max.

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

Functional Schematic



Typical Frequency Response

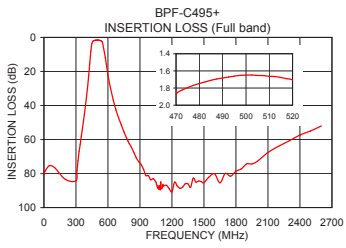


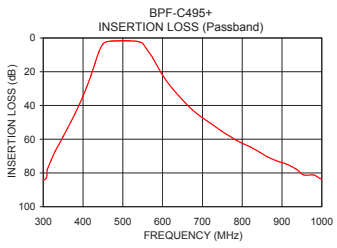
Typical Performance Data at 25°C

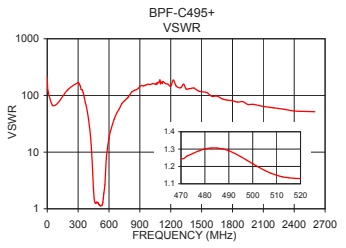
Frequency (MHz)	Insertion Loss (dB)	VSWR (:1)	Frequency (MHz)	Group Delay (nsec)
0.5	87.14	211.87	465.0	8.60
370.0	48.91	74.88	466.0	7.39
410.0	28.18	28.64	470.0	3.46
430.0	14.83	11.27	472.0	1.95
440.0	8.14	4.95	474.0	0.70
450.0	3.85	2.08	476.0	-0.34
460.0	2.45	1.34	478.0	-1.18
470.0	2.06	1.25	480.0	-1.85
480.0	1.90	1.30	484.0	-2.75
495.0	1.79	1.26	490.0	-3.21
510.0	1.76	1.15	495.0	-2.93
520.0	1.78	1.13	500.0	-2.22
550.0	3.17	1.90	503.0	-1.63
560.0	6.57	2.63	504.0	-1.41
575.0	11.67	8.09	506.0	-0.94
600.0	21.88	17.81	510.0	0.10
625.0	29.80	27.07	515.0	1.47
700.0	46.47	57.93	518.0	2.28
1200.0	90.71	145.46	520.0	2.81
2600.0	52.36	51.57	525.0	3.99

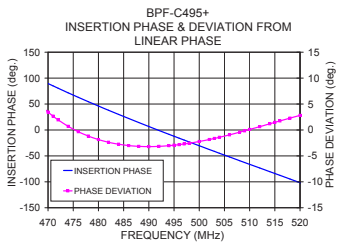
+RoHS Compliant

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









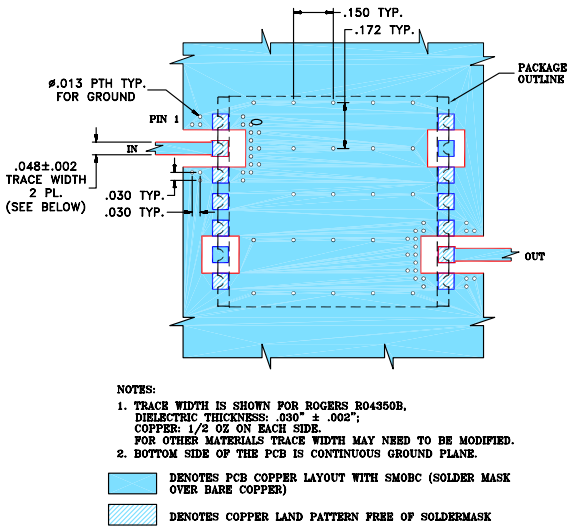
Notes

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

INPUT	2
OUTPUT	9
NOT CONNECTED	6,13
GROUND	1,3,4,5,7,8,10,11,12,14

Demo Board MCL P/N: TB-500+
Suggested PCB Layout (PL-294)

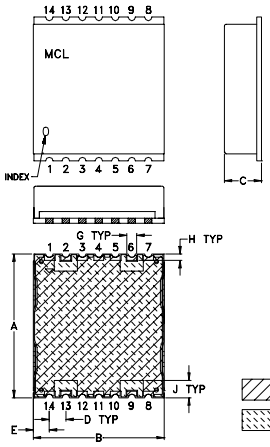


NOTES:
1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B, DIELECTRIC THICKNESS: .030" ± .002"; COPPER: 1/2 OZ ON EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

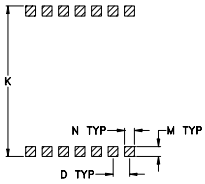
DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)

DENOTES COPPER LAND PATTERN FREE OF SOLDERMASK

Outline Drawing



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

Outline Dimensions (inch / mm)

A	B	C	D	E	F	G	H
.870	.800	.25	.100	.097	--	.060	.040
22.10	20.32	6.35	2.54	2.46	--	1.52	1.02

J	K	L	M	N	P	wt
.105	.910	--	.060	.060	--	grams
2.67	23.11	--	1.52	1.52	--	2.85

Typical Performance Data

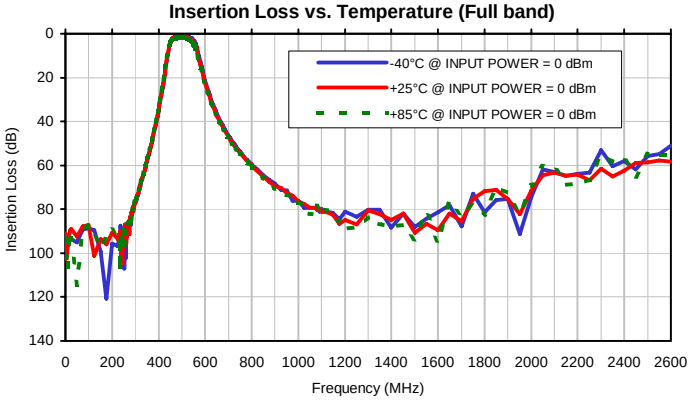
FREQ.	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
(MHz)	(dB)			(dB)			(dB)		
	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C
0.5	95.47	91.08	94.38	0.06	0.09	0.11	0.05	0.08	0.11
1.0	94.06	102.59	93.19	0.06	0.08	0.10	0.06	0.08	0.11
5.0	101.18	101.95	102.43	0.09	0.11	0.13	0.08	0.11	0.14
10.0	91.83	95.36	107.04	0.11	0.14	0.15	0.10	0.14	0.17
50.0	94.94	92.55	114.36	0.21	0.24	0.26	0.20	0.23	0.25
75.0	89.20	87.91	88.64	0.21	0.25	0.26	0.17	0.22	0.26
125.0	89.50	101.17	91.55	0.17	0.20	0.22	0.12	0.17	0.20
150.0	99.05	93.57	97.89	0.15	0.18	0.20	0.09	0.15	0.18
175.0	120.83	95.91	93.46	0.12	0.16	0.17	0.07	0.13	0.17
200.0	95.55	90.80	89.60	0.11	0.14	0.16	0.06	0.12	0.15
240.0	94.66	101.00	93.43	0.09	0.12	0.14	0.04	0.11	0.15
250.0	91.41	97.46	89.33	0.08	0.12	0.14	0.03	0.11	0.15
260.0	88.69	95.78	90.77	0.08	0.12	0.14	0.04	0.12	0.16
270.0	88.57	89.98	84.61	0.08	0.12	0.14	0.04	0.12	0.16
280.0	87.30	83.78	84.08	0.08	0.12	0.14	0.04	0.13	0.17
290.0	78.68	81.11	80.93	0.08	0.12	0.14	0.05	0.13	0.17
300.0	76.20	77.20	77.55	0.09	0.13	0.15	0.05	0.14	0.18
310.0	73.73	73.73	72.97	0.09	0.13	0.16	0.06	0.16	0.20
320.0	70.00	69.08	68.70	0.10	0.14	0.17	0.07	0.17	0.22
330.0	66.46	65.52	65.30	0.10	0.15	0.18	0.08	0.19	0.24
340.0	62.12	62.12	61.79	0.11	0.16	0.19	0.10	0.21	0.27
350.0	58.58	58.18	57.68	0.13	0.18	0.21	0.13	0.25	0.31
360.0	54.34	53.91	53.43	0.14	0.20	0.24	0.16	0.29	0.36
370.0	49.92	49.46	48.97	0.17	0.24	0.28	0.21	0.35	0.42
380.0	45.30	44.79	44.27	0.20	0.28	0.32	0.27	0.43	0.51
400.0	35.08	34.47	33.85	0.31	0.42	0.49	0.48	0.69	0.82
410.0	29.38	28.67	27.97	0.42	0.56	0.65	0.66	0.92	1.09
420.0	23.19	22.40	21.61	0.59	0.80	0.93	0.93	1.27	1.52
440.0	9.70	8.94	8.25	2.06	2.85	3.52	2.55	3.54	4.38
460.0	2.04	2.35	2.52	14.27	17.43	20.12	14.10	17.60	21.47
470.0	1.52	1.93	2.15	25.31	27.26	27.97	27.62	32.64	32.97
470.5	1.51	1.92	2.15	25.69	27.44	28.04	28.49	33.21	32.62
471.0	1.50	1.91	2.14	25.99	27.55	28.05	29.31	33.59	32.25
471.5	1.49	1.90	2.13	26.27	27.63	28.03	30.11	33.74	31.84
472.0	1.48	1.89	2.12	26.50	27.67	27.99	30.80	33.69	31.41
472.5	1.47	1.88	2.11	26.66	27.65	27.90	31.39	33.45	30.99
473.0	1.46	1.87	2.11	26.79	27.60	27.80	31.82	33.08	30.55
473.5	1.45	1.86	2.09	26.88	27.54	27.67	32.08	32.65	30.16
474.0	1.45	1.86	2.09	26.90	27.42	27.50	32.15	32.12	29.76
474.5	1.44	1.85	2.08	26.88	27.29	27.32	32.00	31.58	29.37
475.0	1.43	1.84	2.08	26.80	27.10	27.11	31.71	31.03	29.00
475.5	1.43	1.84	2.07	26.69	26.90	26.87	31.26	30.47	28.62
480.0	1.39	1.79	2.03	24.70	24.53	24.39	26.72	26.40	25.84
485.0	1.36	1.76	2.00	21.91	21.79	21.81	23.06	23.27	23.46
490.0	1.35	1.75	1.98	19.63	19.75	20.06	20.58	21.13	21.76
495.0	1.35	1.74	1.97	18.11	18.54	19.18	19.01	19.85	20.86
500.0	1.35	1.74	1.96	17.39	18.19	19.23	18.27	19.47	20.91
505.0	1.34	1.73	1.96	17.59	18.86	20.44	18.45	20.16	22.25
510.0	1.32	1.73	1.97	18.97	20.89	23.21	19.93	22.59	26.06
515.0	1.32	1.74	2.01	22.16	24.56	26.13	23.76	29.07	34.30
520.0	1.33	1.79	2.09	27.00	24.57	22.12	36.28	30.69	24.41
530.0	1.54	2.09	2.48	16.65	14.93	13.83	17.16	15.28	13.81
540.0	2.06	2.74	3.25	10.69	10.33	10.01	10.28	9.53	8.79
550.0	3.03	3.93	4.70	7.82	7.96	7.82	6.52	6.03	5.50
600.0	21.15	22.50	23.53	0.95	1.11	1.19	0.47	0.66	0.75
605.0	23.02	24.31	25.30	0.82	0.97	1.05	0.41	0.60	0.69
610.0	24.81	26.03	26.97	0.72	0.87	0.94	0.37	0.55	0.65
615.0	26.50	27.67	28.57	0.65	0.79	0.86	0.33	0.51	0.61
620.0	28.10	29.23	30.10	0.58	0.71	0.78	0.30	0.48	0.57
625.0	29.61	30.70	31.54	0.53	0.66	0.72	0.28	0.46	0.55
630.0	31.07	32.11	32.92	0.49	0.61	0.67	0.26	0.43	0.52
635.0	32.45	33.47	34.25	0.45	0.56	0.63	0.24	0.41	0.50
640.0	33.77	34.76	35.53	0.41	0.53	0.59	0.22	0.39	0.48
645.0	35.04	35.99	36.75	0.39	0.50	0.55	0.21	0.38	0.46
650.0	36.25	37.19	37.91	0.36	0.46	0.52	0.19	0.36	0.44
700.0	46.36	47.07	47.61	0.22	0.31	0.35	0.11	0.27	0.35
800.0	59.71	60.24	60.60	0.14	0.21	0.25	0.05	0.21	0.29
1000.0	76.04	76.42	76.65	0.13	0.21	0.25	0.02	0.20	0.28
2000.0	74.46	71.48	69.16	0.22	0.34	0.41	0.07	0.35	0.52
2600.0	50.95	58.37	55.17	0.23	0.37	0.45	0.05	0.37	0.55

Typical Performance Data

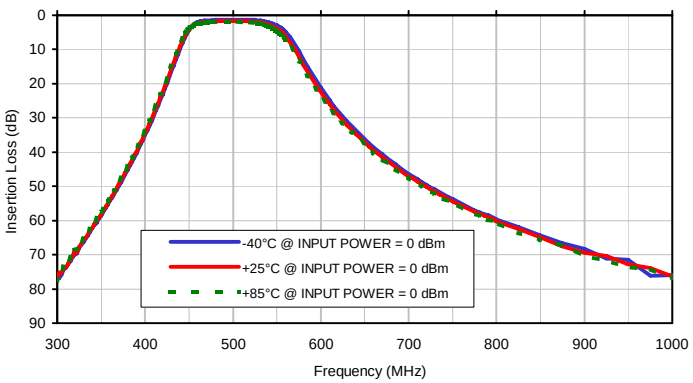
FREQ.	Deviation from Linear Phase			Insertion Phase		
(MHz)	(Deg.)			(Deg.)		
	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C
465.0	4.89	4.19	3.66	-90.67	-96.87	-101.18
465.5	4.34	3.71	3.25	-93.16	-99.28	-103.51
466.0	3.81	3.26	2.84	-95.64	-101.65	-105.83
466.5	3.29	2.79	2.45	-98.10	-104.05	-108.13
467.0	2.79	2.38	2.07	-100.54	-106.38	-110.43
467.5	2.27	1.95	1.70	-103.00	-108.74	-112.71
468.0	1.85	1.57	1.35	-105.37	-111.04	-114.97
468.5	1.42	1.21	1.04	-107.74	-113.33	-117.20
469.0	1.01	0.85	0.74	-110.09	-115.61	-119.41
469.5	0.61	0.52	0.44	-112.43	-117.87	-121.62
470.0	0.25	0.20	0.16	-114.74	-120.11	-123.82
470.5	-0.11	-0.11	-0.12	-117.04	-122.35	-126.01
471.0	-0.45	-0.42	-0.40	-119.32	-124.58	-128.20
471.5	-0.76	-0.68	-0.61	-121.57	-126.77	-130.33
472.0	-1.08	-0.93	-0.84	-123.83	-128.94	-132.47
472.5	-1.36	-1.18	-1.06	-126.06	-131.12	-134.60
473.0	-1.65	-1.44	-1.26	-128.29	-133.30	-136.72
473.5	-1.92	-1.66	-1.46	-130.50	-135.45	-138.83
474.0	-2.15	-1.86	-1.65	-132.67	-137.57	-140.93
474.5	-2.39	-2.07	-1.84	-134.86	-139.71	-143.04
475.0	-2.59	-2.23	-1.97	-137.00	-141.79	-145.08
475.5	-2.82	-2.45	-2.15	-139.17	-143.94	-147.17
480.0	-4.15	-3.57	-3.13	-157.98	-162.39	-165.37
485.0	-4.68	-4.01	-3.47	-177.94	-182.08	-184.85
490.0	-4.48	-3.78	-3.21	-197.16	-201.10	-203.72
495.0	-3.67	-3.00	-2.47	-215.77	-219.57	-222.11
500.0	-2.41	-1.87	-1.47	-233.94	-237.69	-240.24
505.0	-0.88	-0.55	-0.32	-251.83	-255.62	-258.23
510.0	0.73	0.77	0.79	-269.65	-273.55	-276.25
515.0	2.24	1.95	1.73	-287.56	-291.62	-294.44
520.0	3.54	2.90	2.42	-305.68	-309.92	-312.89
525.0	4.50	3.55	2.80	-324.15	-328.52	-331.64

Typical Performance Curves

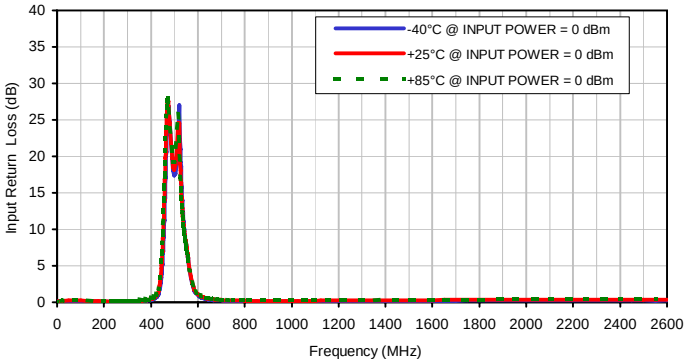
Insertion Loss vs. Temperature (Full band)



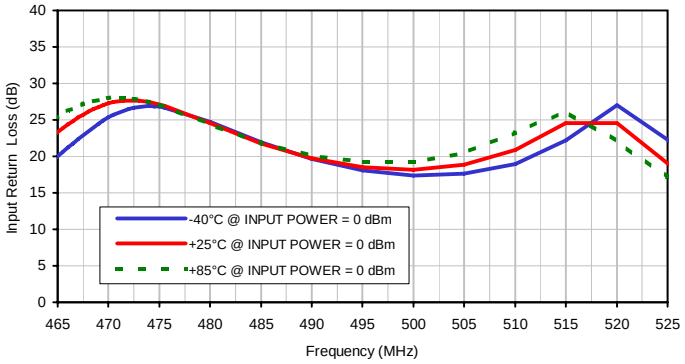
Insertion Loss vs. Temperature (Pass band)



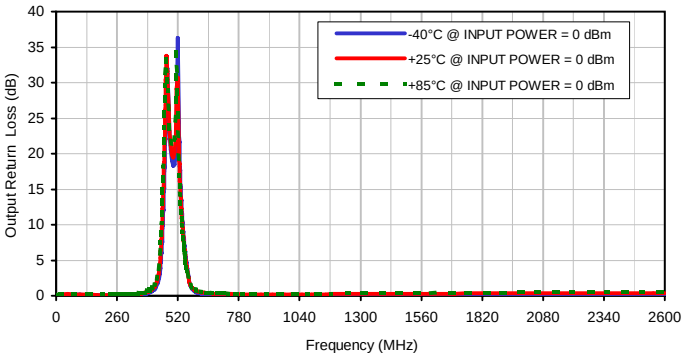
Input Return Loss vs. Temperature



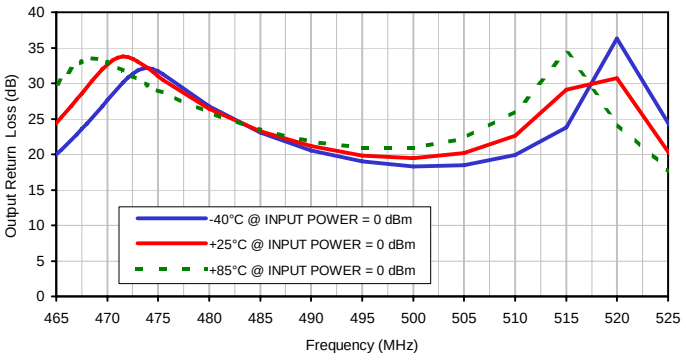
Input Return Loss vs. Temperature



Output Return Loss vs. Temperature



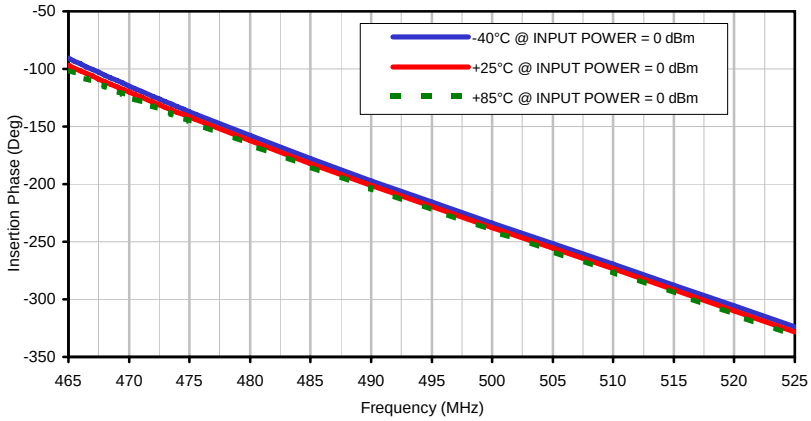
Output Return Loss vs. Temperature



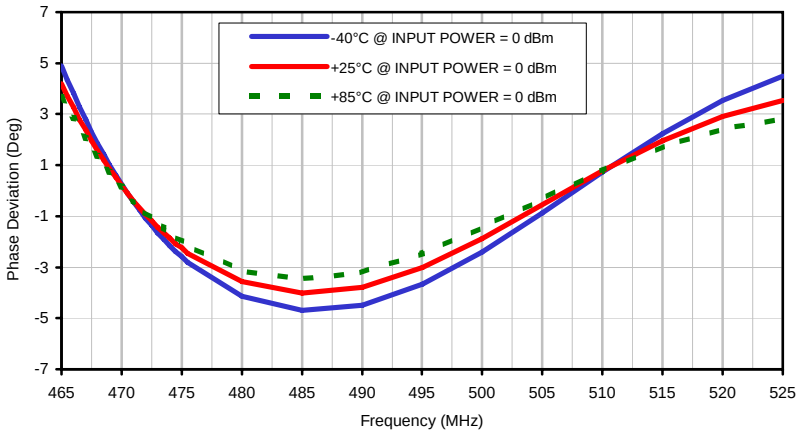
Surface Mount Band Pass Filter BPF-C495+

Typical Performance Curves

Insertion Phase vs. Temperature



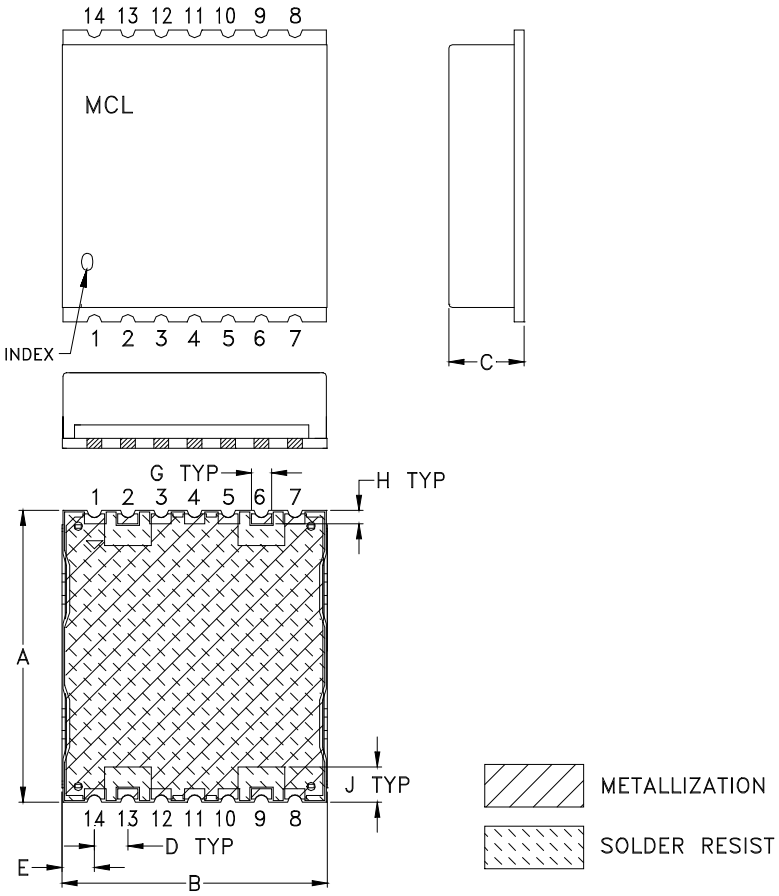
Deviation from Linear Phase vs. Temperature



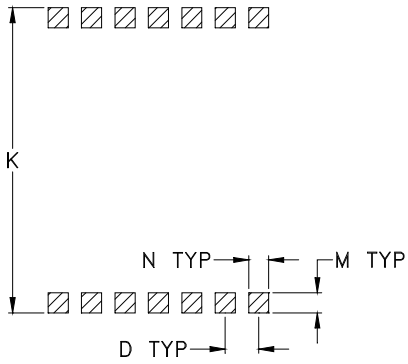
Case Style HU

Outline Dimensions

HU1186



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, GRAM
HU1186	.870 (22.10)	.800 (20.32)	.25 (6.35)	.100 (2.54)	.097 (2.46)	- -	.060 (1.52)	.040 (1.02)	.105 (2.67)	.910 (23.11)	- -	.060 (1.52)	.060 (1.52)	- -	2.85

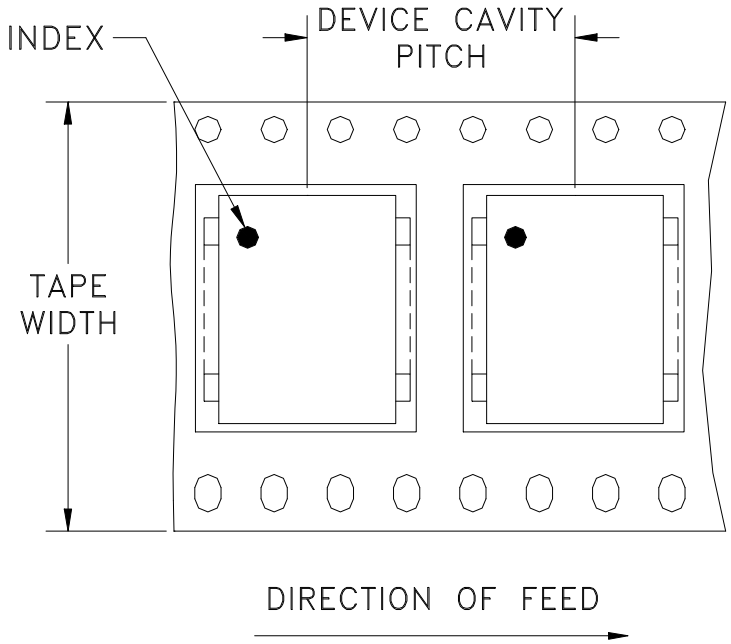
Dimensions are in inches (mm). Tolerances: 2PL. +/- .03; 3PL. +/- .015

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.
   For RoHS-5 Case Styles: Tin-Lead plate.

Tape & Reel Packaging TR-F21

DEVICE ORIENTATION IN T&R



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel
32	32	13	200

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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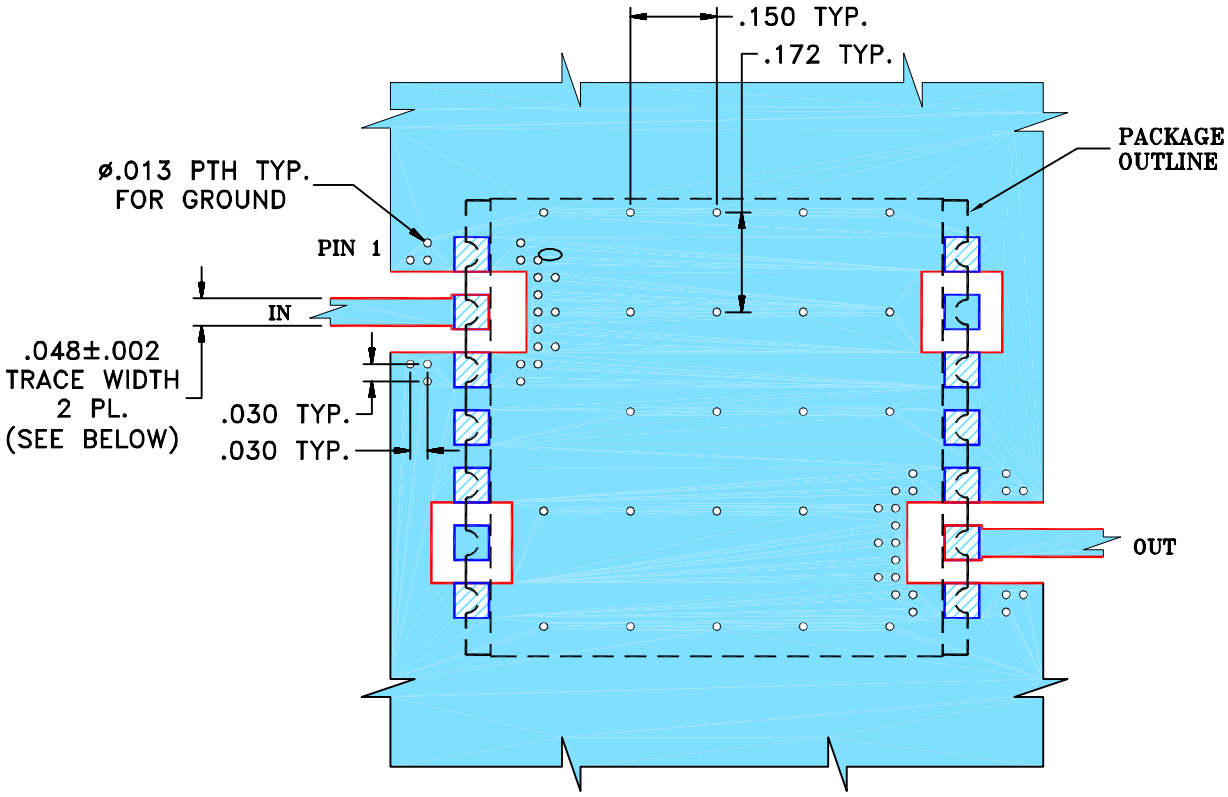
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M119979	NEW RELEASE (FROM RAVON)	11/08	DK	HH
OR	R74463	NEW RELEASE (FROM RAVON)	11/08	DK	HH

SUGGESTED MOUNTING CONFIGURATION FOR HU1186 CASE STYLE, "14FL03" PIN CODE



NOTES:

1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B, DIELECTRIC THICKNESS: .030" ± .002"; COPPER: 1/2 OZ ON 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	DK (RAVON)	02 NOV 08
TOLERANCES ON:	CHECKED	DH (RAVON)	02 NOV 08
2 PL DECIMALS ±	APPROVED	HH (RAVON)	02 NOV 08
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

Mini-Circuits®

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

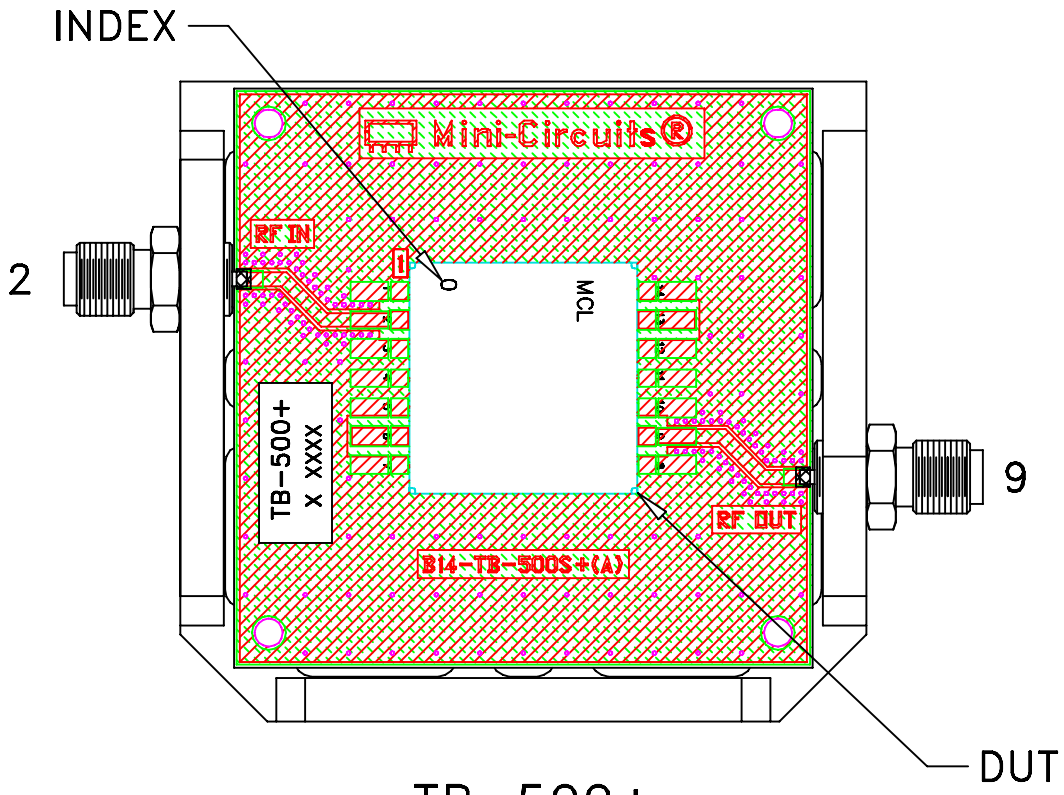
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, 14FL03, HU1186, BPF-C
TB-500+ (50 OHM)

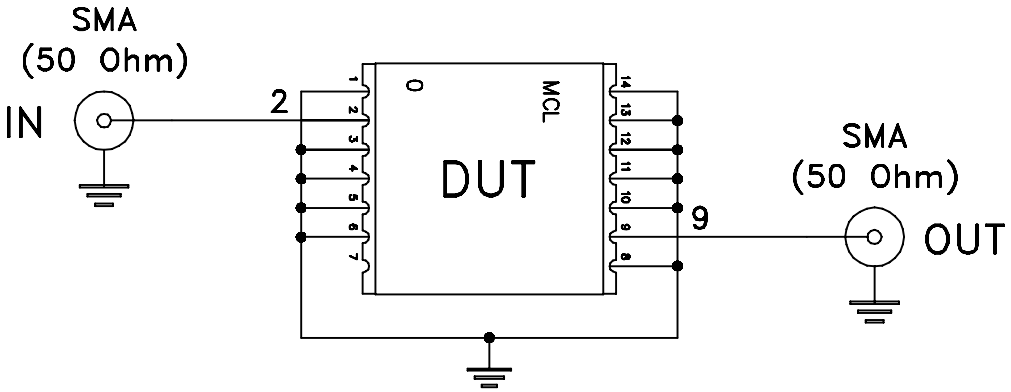
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-294	OR

FILE:	SCALE:	SHEET:
98PL294	3:1	1 OF 1

Evaluation Board and Circuit



TB-500+



Schematic Diagram

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: RO4350 or equivalent.
   Dielectric Constant=3.5, Thickness=.030 inch.

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Environmental Specifications ENV12

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 Ambient Environment	Individual Model Data Sheet
Storage Temperature	-65° to 150° C Ambient Environment	Individual Model Data Sheet
Autoclave	15 psig, 100% RH, 121°C, 96 hours	JESD22-A102-C, Condition C
Temperature Cycling	-65° to 150°C, 100 cycles	JESD22-A104
Temperature Humidity	85°C/ 85% RH, 168 hours	JESD22-113
Solder Reflow Heat	Sn-Pb Eutetic Process: 240°C peak Pb-Free Process: 260°C peak	J-STD-020, Table 4-1, 4-2 and 5-2; Figure 5-1
Moisture Sensitivity: Level 1	Bake at 125°C for 24 hours Soak at 85°C/85% RH for 168 hours, Reflow 3 cycles at 240°C peak (Non-RoHS) or 260°C (RoHS)	J-STD-020
Solderability	10X magnification, 95% coverage	JESD22-B102, Method 1: Dip and Look Test
Mechanical Shock	50g, 11 ms, 1/2-sine, 18 shocks: 3 each direction, each of 3 axes	MIL-STD-202, Method 213, Condition A
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