Surface Mount

Bandpass Filter

BPF-C4R5+

50Ω 2 to 7 MHz

Generic photo used for illustration purposes only
CASE STYLE: HU1186

The Big Deal

- Low insertion loss
- Good VSWR
- Miniature shielded package

Product Overview

BPF-C4R5+ is a bandpass filter fabricated using SMT technology. This filter offers good rejection and low insertion loss for use in aviation and communication systems. This unit uses a miniature high Q capacitors and wire welded inductors for high reliability.

Key Features

Feature	Advantages
Low insertion loss	Suitable for high performance applications.
Good VSWR, 1.1:1 typical in passband	The BPF-C4R5+ has very good VSWR which provides good matching when used with other devices.
Shielded package	Reduced interference with the surrounding components.

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CASE STYLE: HU1186

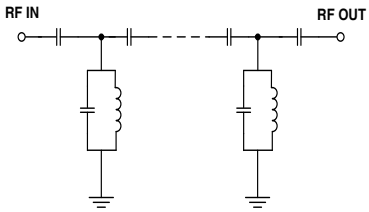
Features

- Low insertion loss
- Good VSWR
- Miniature shielded package

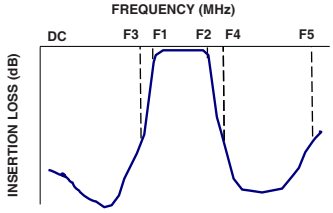
Applications

- Aviation
- Communication systems

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

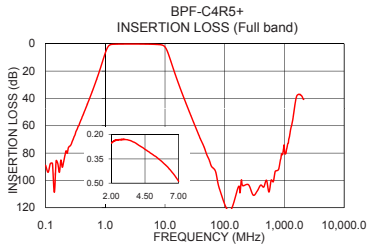
Parameter		F#	Frequency (MHz)	Min.	Typ.	Max.	Unit
Pass Band	Center Frequency	—	—	-	4.5	-	MHz
	Insertion Loss	F1-F2	2-7	-	0.5	1.5	dB
	VSWR	F1-F2	2-7	-	1.1	1.5	:1
Stop Band, Lower	Insertion Loss	DC-F3	DC-0.6	20	35.9	-	dB
	VSWR	DC-F3	DC-0.6	-	20	-	:1
Stop Band, Upper	Insertion Loss	F4-F5	17-2100	20	28.9	-	dB
	VSWR	F4-F5	17-2100	-	20	-	:1

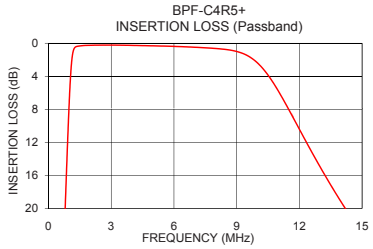
Maximum Ratings	
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power Input	1 W max.

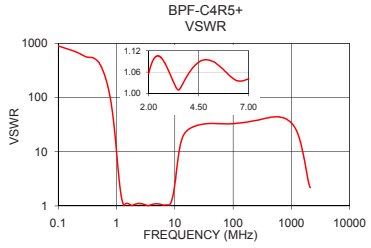
Permanent damage may occur if any of these limits are exceeded.

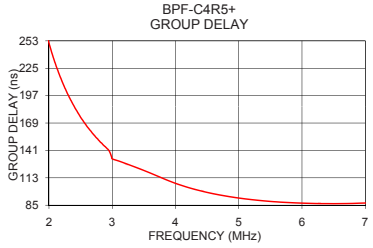
Typical Performance Data at 25°C

Frequency (MHz)	Insertion Loss (dB)	VSWR (:1)	Frequency (MHz)	Group Delay (nsec)
0.10	88.93	898.07	2.0	250.52
0.60	35.20	293.81	2.2	212.56
0.66	30.30	215.92	2.6	165.56
0.79	20.51	92.29	2.8	150.39
1.08	3.05	4.05	3.0	132.37
1.10	2.43	3.31	3.2	127.88
2.00	0.25	1.06	3.4	123.03
4.50	0.29	1.09	3.6	117.89
7.00	0.49	1.04	3.8	112.44
9.00	1.00	1.34	4.0	107.33
9.90	2.17	2.34	4.2	103.11
10.30	3.21	3.22	4.4	99.60
14.20	20.03	20.48	4.8	94.30
17.00	29.73	25.63	5.0	92.33
17.10	30.03	25.75	5.4	89.40
500.00	99.85	43.88	5.8	87.64
950.00	78.75	35.82	6.2	86.75
1500.00	44.47	12.10	6.6	86.61
1960.00	38.39	2.77	6.8	86.83
2100.00	40.73	2.18	7.0	87.26







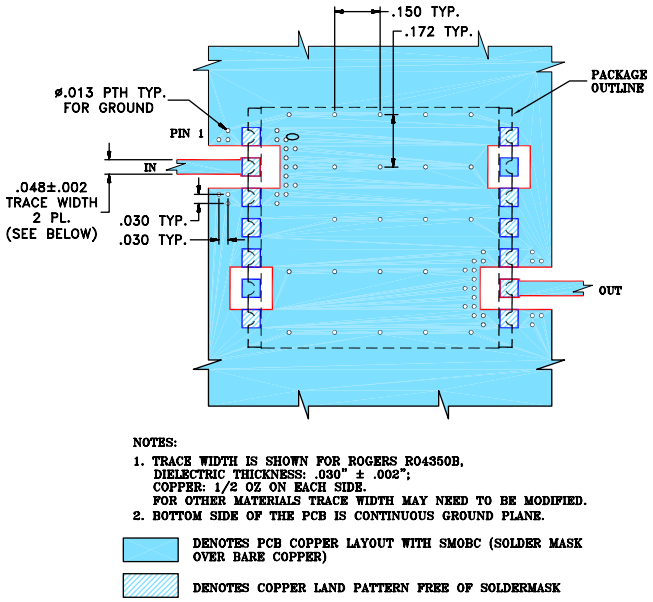


Notes
A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's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

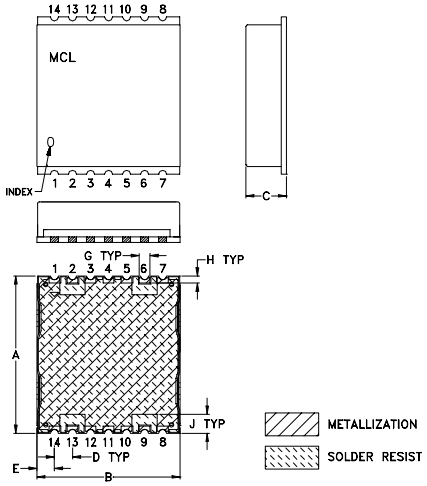
Pad Connections

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

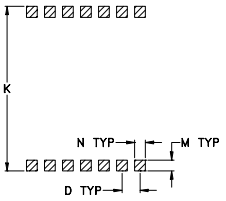
Demo Board MCL P/N: TB-500+
Suggested PCB Layout (PL-294)



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

Note: Please refer to case style drawing for details

Band Pass Filter BPF-C4R5+

Typical Performance Data

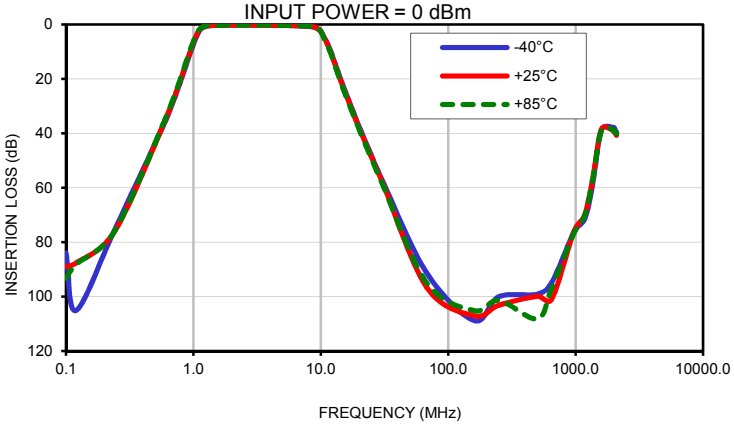
FREQ. (MHz)	INSERTION LOSS (dB)			INPUT RETURN LOSS (dB)			OUTPUT RETURN LOSS (dB)		
	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C
0.10	83.97	88.93	93.28	0.02	0.02	0.02	0.02	0.02	0.02
0.12	105.07	87.62	88.11	0.02	0.02	0.02	0.02	0.02	0.02
0.24	75.61	76.19	76.05	0.02	0.02	0.03	0.03	0.03	0.03
0.60	35.70	35.20	34.79	0.05	0.05	0.06	0.05	0.06	0.07
0.81	19.70	19.07	18.56	0.20	0.22	0.24	0.20	0.22	0.25
0.82	19.01	18.36	17.84	0.21	0.24	0.26	0.22	0.24	0.27
0.95	10.29	9.58	9.01	0.81	0.93	1.05	0.82	0.94	1.06
1.07	3.92	3.40	3.02	3.38	3.93	4.45	3.38	3.92	4.43
1.16	1.45	1.21	1.07	8.44	9.59	10.63	8.40	9.53	10.55
1.28	0.53	0.48	0.45	21.58	24.32	26.99	21.32	23.87	26.27
1.32	0.45	0.42	0.40	30.67	36.72	44.58	29.67	34.03	37.78
1.43	0.38	0.35	0.35	26.37	26.48	26.78	26.47	26.68	27.05
1.62	0.32	0.30	0.29	24.99	27.13	29.35	25.04	27.27	29.66
1.74	0.29	0.27	0.27	28.58	32.75	37.17	28.77	33.38	39.28
1.90	0.28	0.26	0.25	35.81	35.50	31.86	37.96	36.64	31.98
2.00	0.27	0.25	0.25	35.29	31.12	28.30	36.38	31.25	28.25
2.12	0.26	0.24	0.24	31.58	28.15	26.09	31.95	28.28	26.15
3.20	0.25	0.23	0.22	35.35	34.62	34.37	35.61	34.82	34.60
3.40	0.26	0.24	0.23	44.16	44.80	46.00	43.40	43.24	43.69
3.50	0.26	0.24	0.23	60.45	58.40	52.48	48.05	46.26	44.71
3.70	0.27	0.25	0.24	40.73	38.36	36.55	39.66	37.54	35.86
3.90	0.28	0.26	0.25	35.00	33.16	31.81	34.42	32.72	31.40
4.00	0.28	0.26	0.26	33.32	31.61	30.32	32.86	31.23	29.98
4.50	0.31	0.29	0.29	29.35	27.77	26.66	28.99	27.52	26.44
4.70	0.33	0.30	0.30	28.87	27.28	26.17	28.49	27.01	25.93
5.70	0.40	0.36	0.36	33.04	30.58	29.02	31.21	29.50	28.23
6.00	0.42	0.39	0.38	37.69	34.19	32.01	33.33	31.85	30.45
6.40	0.46	0.42	0.41	47.04	44.51	39.43	34.77	34.98	34.15
6.50	0.47	0.43	0.42	44.12	49.86	42.92	34.44	35.26	34.85
6.70	0.50	0.45	0.44	38.99	46.01	55.25	33.54	35.16	35.75
6.90	0.52	0.48	0.46	35.98	40.16	45.97	32.47	34.31	35.51
7.00	0.54	0.49	0.48	34.90	38.41	42.85	32.06	33.93	35.28
7.20	0.57	0.51	0.50	33.82	36.71	40.22	31.47	33.30	34.81
7.60	0.63	0.57	0.56	34.29	37.61	41.60	31.88	33.88	35.34
8.10	0.73	0.66	0.65	36.90	35.47	32.98	33.22	32.71	31.19
8.60	0.87	0.80	0.80	24.45	22.99	21.77	24.05	22.66	21.49
9.00	1.06	1.00	1.02	17.90	16.81	15.94	17.76	16.68	15.81
9.80	1.96	1.97	2.08	9.49	8.72	8.17	9.44	8.67	8.11
10.00	2.35	2.40	2.55	8.02	7.32	6.83	7.99	7.28	6.79
11.70	8.62	9.00	9.43	2.15	1.87	1.75	2.15	1.87	1.74
13.70	17.50	18.01	18.51	1.07	0.92	0.89	1.07	0.92	0.88
14.30	19.90	20.42	20.93	0.97	0.84	0.81	0.97	0.84	0.80
14.40	20.29	20.81	21.32	0.96	0.83	0.80	0.96	0.83	0.79
15.00	22.52	23.06	23.57	0.90	0.78	0.75	0.90	0.77	0.74
17.00	29.16	29.73	30.25	0.79	0.68	0.66	0.79	0.68	0.66
17.30	30.07	30.63	31.16	0.78	0.67	0.66	0.78	0.67	0.65
20.60	38.82	39.42	39.97	0.71	0.61	0.60	0.71	0.60	0.59
31.00	58.09	58.92	59.46	0.62	0.54	0.54	0.62	0.54	0.53
68.00	91.33	96.60	95.01	0.56	0.54	0.57	0.56	0.53	0.55
160.00	108.79	107.01	105.11	0.50	0.52	0.55	0.49	0.50	0.53
250.00	100.00	103.15	101.36	0.46	0.48	0.51	0.44	0.46	0.49
500.00	99.07	99.85	108.15	0.39	0.42	0.44	0.37	0.40	0.42
650.00	94.81	100.93	96.83	0.38	0.43	0.45	0.36	0.40	0.42
970.00	76.30	76.13	76.78	0.45	0.52	0.55	0.42	0.50	0.52
1180.00	71.43	70.03	70.20	0.61	0.69	0.73	0.56	0.66	0.69
1360.00	58.76	56.89	57.25	0.93	1.05	1.09	0.82	0.96	1.00
1600.00	38.62	38.44	38.76	1.92	2.10	2.10	1.72	1.98	2.01
2000.00	37.83	39.07	38.83	6.41	6.70	6.46	6.88	7.24	6.94
2020.00	38.29	39.57	39.32	6.75	6.98	6.74	7.25	7.56	7.24
2100.00	39.67	40.73	40.21	7.63	7.51	7.42	8.59	8.61	8.25

Typical Performance Data

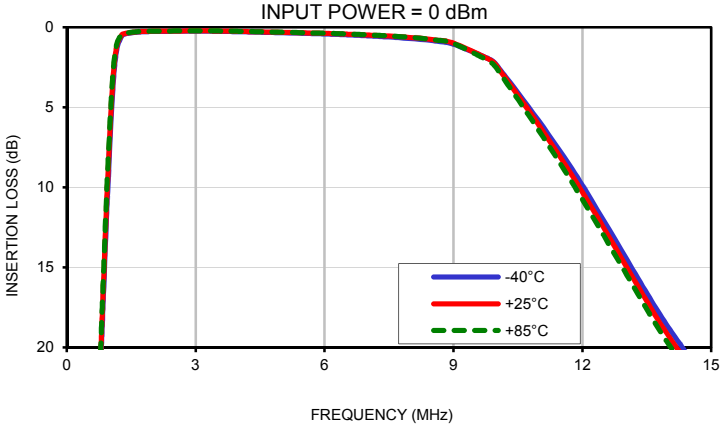
FREQ.	GROUP DELAY		
	(nsec)		
(MHz)	@-40°C	@+25°C	@+85°C
2.00	252.72	250.52	248.63
2.05	241.67	239.61	238.00
2.10	231.80	229.86	228.34
2.15	222.47	220.71	219.35
2.20	214.08	212.56	211.13
2.25	206.33	204.88	203.62
2.30	199.42	198.05	196.96
2.35	192.96	191.77	190.94
2.40	186.87	185.74	184.92
2.45	181.25	180.22	179.46
2.50	175.82	174.78	174.05
2.55	170.94	170.11	169.48
2.60	166.34	165.56	165.04
2.65	162.16	161.53	161.07
2.70	158.08	157.60	157.20
2.75	154.39	153.91	153.55
2.80	150.88	150.39	150.16
2.85	147.60	147.08	146.85
2.90	144.34	144.07	143.85
2.95	140.75	140.56	140.38
3.00	132.42	132.37	132.35
3.10	130.28	130.23	130.32
3.20	127.93	127.88	127.89
3.40	123.08	123.03	123.23
3.50	120.48	120.53	120.68
3.60	117.81	117.89	118.12
3.70	115.05	115.18	115.38
3.80	112.26	112.44	112.60
3.90	109.58	109.78	109.98
4.00	107.11	107.33	107.58
4.10	104.86	105.14	105.40
4.20	102.84	103.11	103.40
4.30	100.95	101.27	101.56
4.40	99.26	99.60	99.92
4.50	97.69	98.07	98.41
4.60	96.29	96.69	97.05
4.70	95.01	95.45	95.82
4.80	93.86	94.30	94.68
4.90	92.78	93.25	93.67
5.00	91.82	92.33	92.75
5.10	90.94	91.46	91.91
5.20	90.18	90.71	91.20
5.30	89.46	90.03	90.52
5.40	88.80	89.40	89.93
5.50	88.23	88.86	89.40
5.60	87.76	88.41	88.97
5.70	87.29	87.99	88.57
5.80	86.93	87.64	88.28
5.90	86.60	87.35	88.00
6.00	86.32	87.10	87.78
6.10	86.08	86.90	87.60
6.20	85.90	86.75	87.49
6.30	85.74	86.62	87.40
6.40	85.67	86.59	87.38
6.50	85.63	86.58	87.42
6.60	85.61	86.61	87.48
6.70	85.66	86.70	87.59
6.80	85.77	86.83	87.77
6.90	85.90	87.02	87.98
7.00	86.09	87.26	88.27

Typical Performance Curves

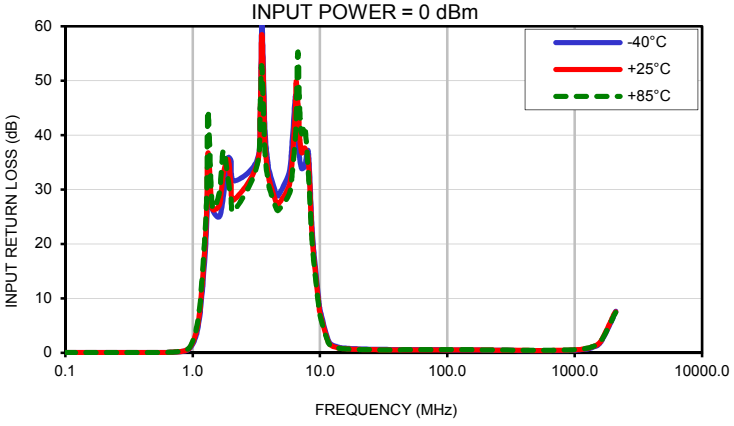
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



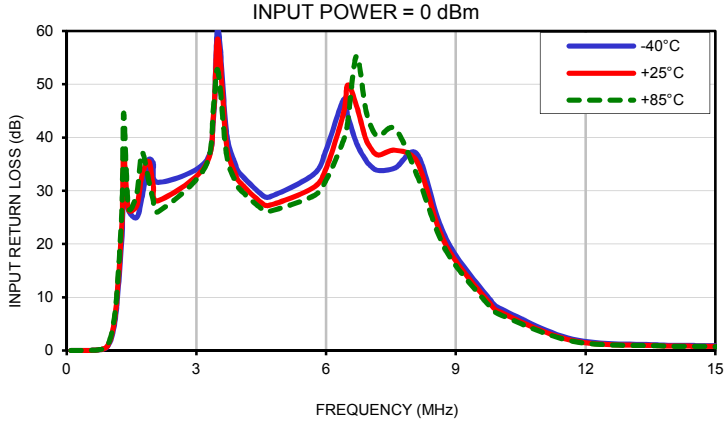
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



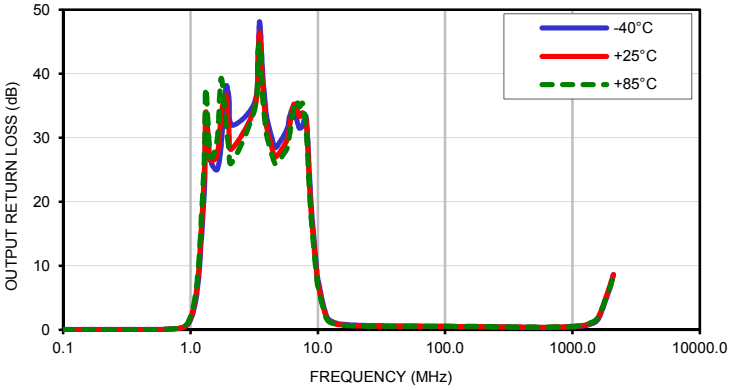
INPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



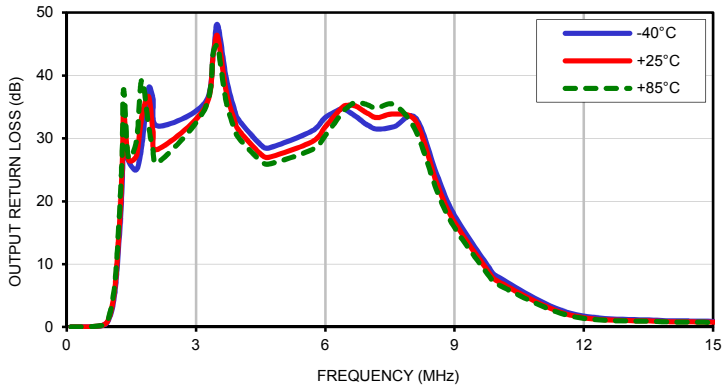
INPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



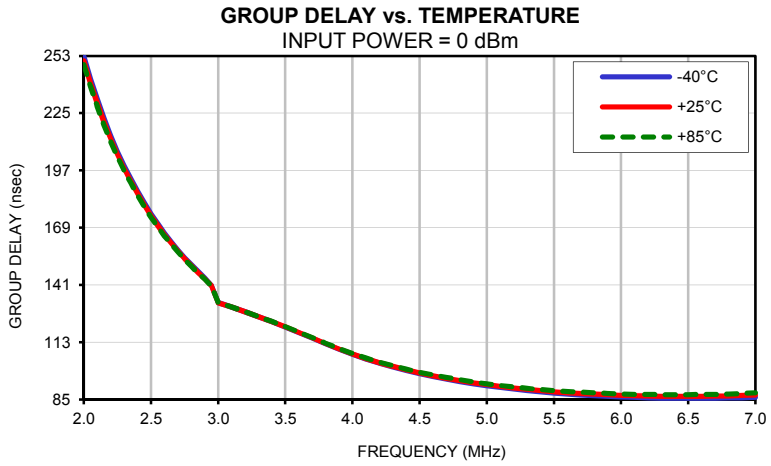
OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



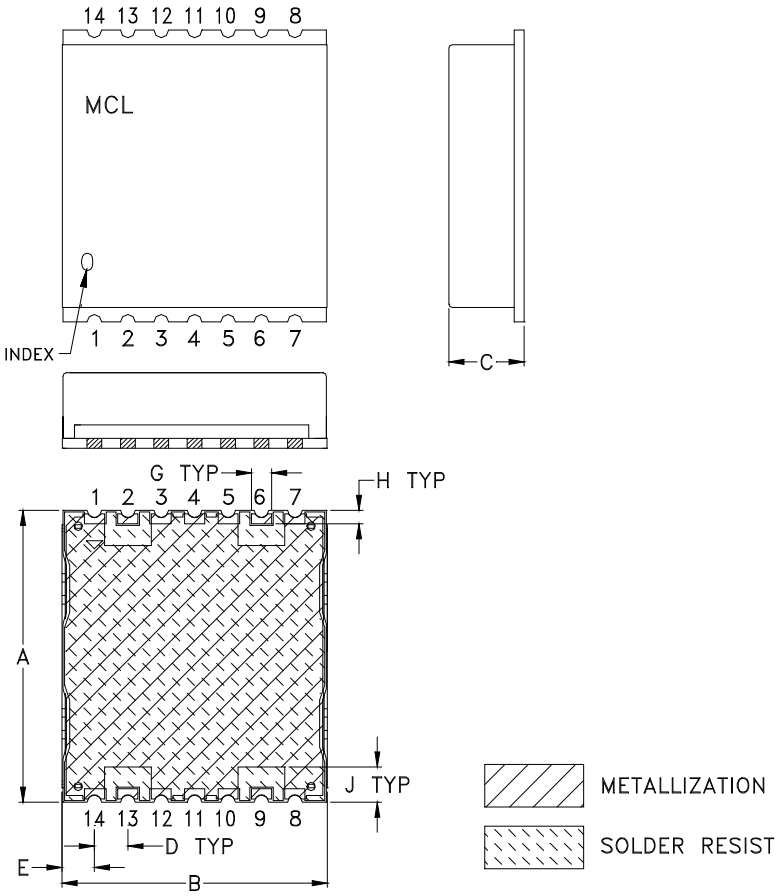
Typical Performance Curves



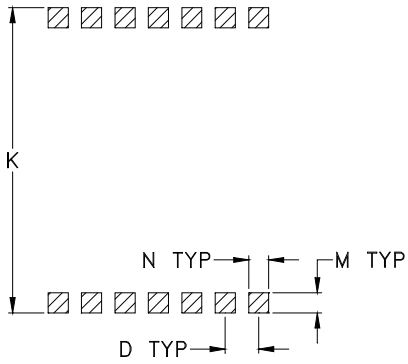
Case Style HU

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

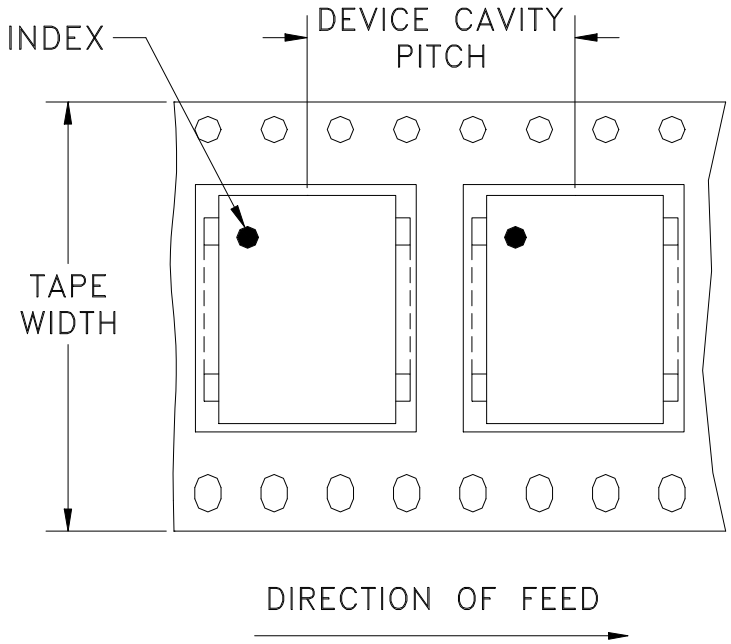
Dimensions are in inches (mm). Tolerances: 2PL. +/- .03; 3PL. +/- .015

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.

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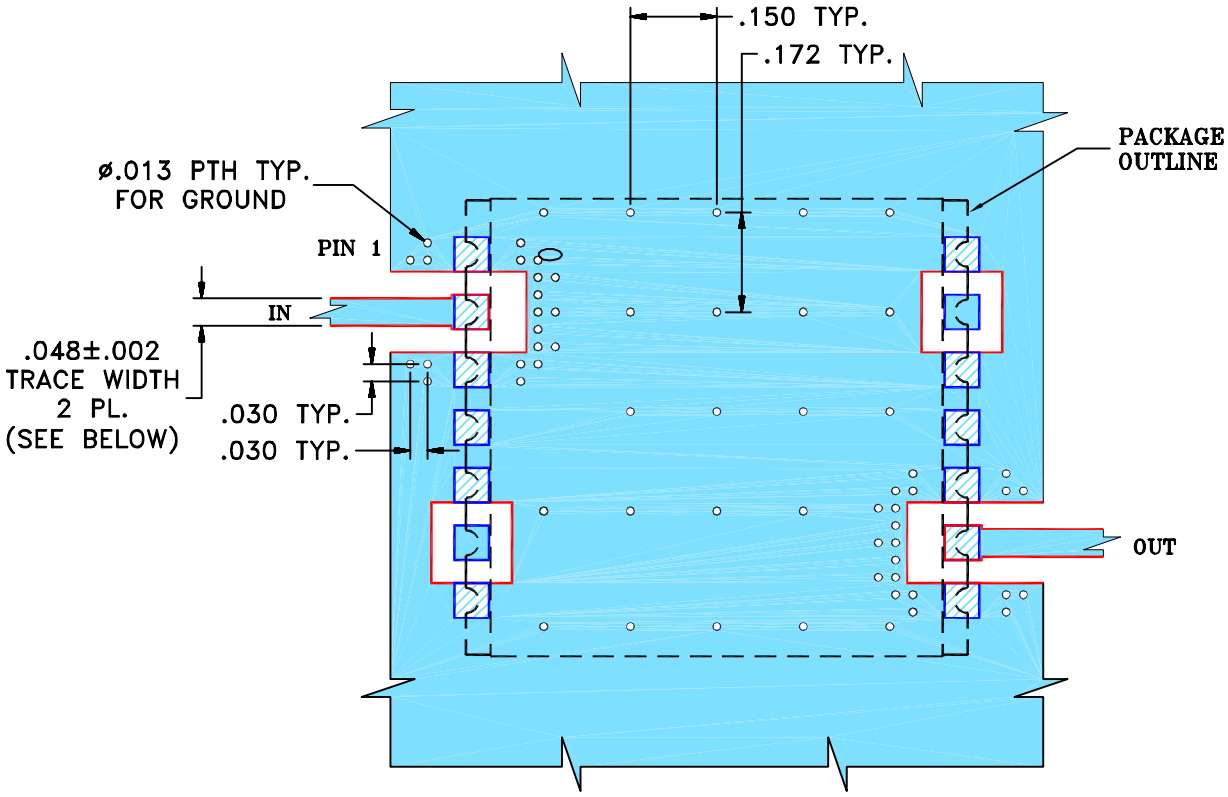
THIRD ANGLE PROJECTION

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 ±			

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

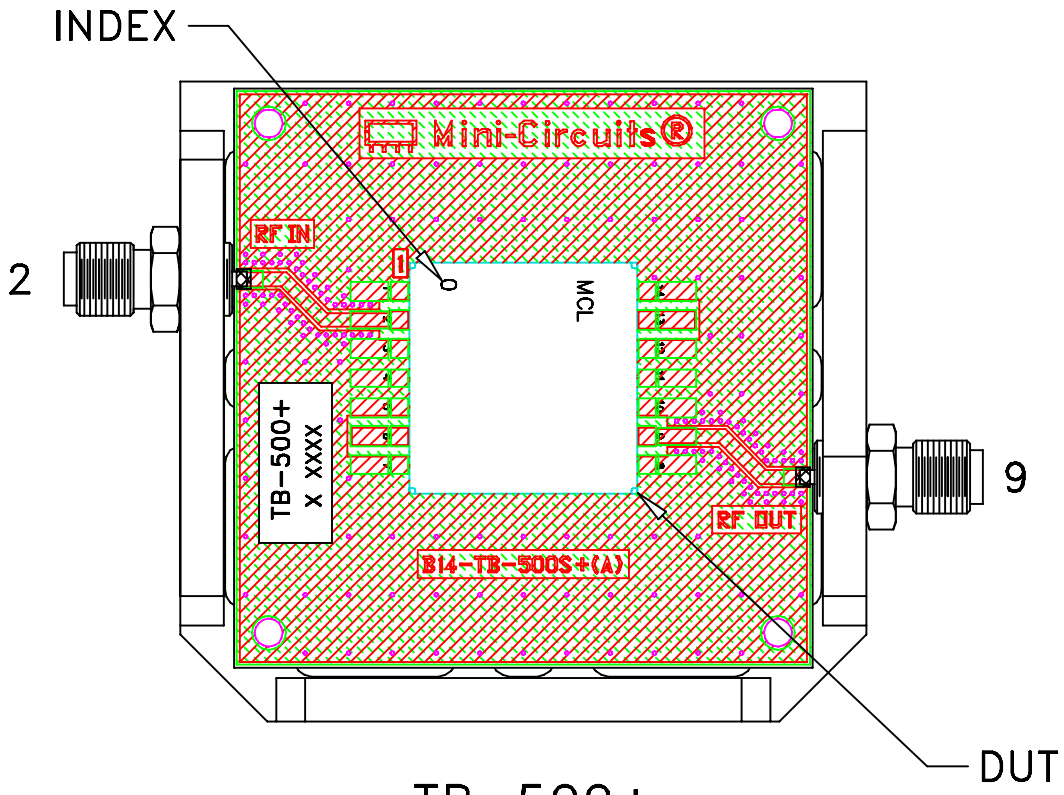
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

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

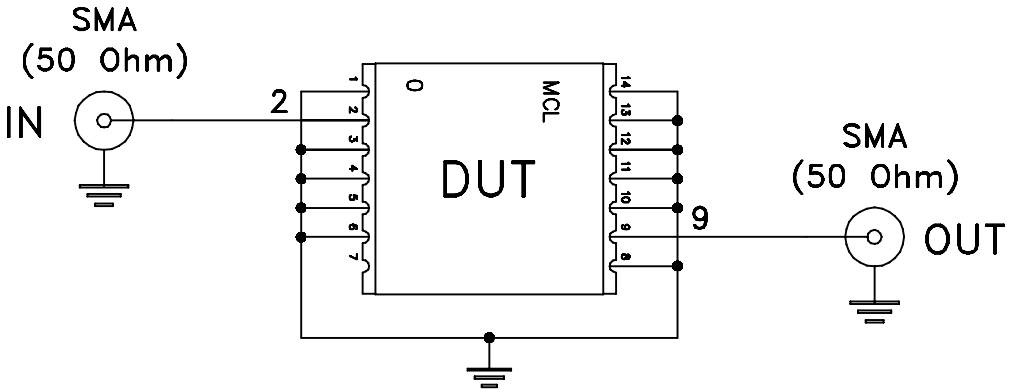
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-294	OR

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