LUMPED LC SURFACE MOUNT

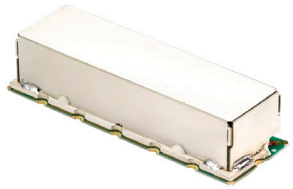
Low Pass Filter

LPHI-90+

50Ω DC to 90 MHz

KEY FEATURES

- Excellent Rejection of 80 dB Typ.
- Fast Roll-off Transition at Stopband
- Good Insertion Loss of 2 dB Typ.



Generic photo used for illustration purposes only

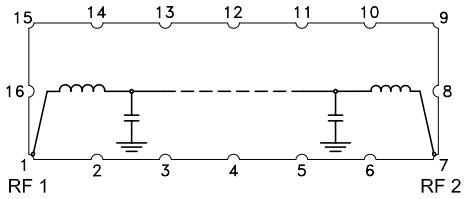
APPLICATIONS

- Test and Measurements
- Harmonic Rejection
- Receivers/Transmitters

PRODUCT OVERVIEW

Mini-Circuits' LPHI-90+ is a Lumped LC filter in a metal shielded package, that offers a good insertion loss and high rejection. This low pass filter covers from DC to 90 MHz and the stopband up to 1.8 GHz. This filter has high Q capacitors and inductors to achieve a low insertion loss. It has repeatable performance across production lots.

FUNCTIONAL DIAGRAM



ELECTRICAL SPECIFICATIONS[1,2] AT +25°C

Parameter		F#	Frequency (MHz)	Min.	Typ.	Max.	Units
Passband	Insertion Loss	DC-F1	DC - 90	—	2	2.7	dB
	Return Loss	DC-F1	DC - 90	12	20	—	dB
Stopband	Rejection	F2-F3	100 - 110	20	28	—	dB
		F3-F4	110 - 600	70	80	—	
		F4-F5	600 - 1800	58	72	—	

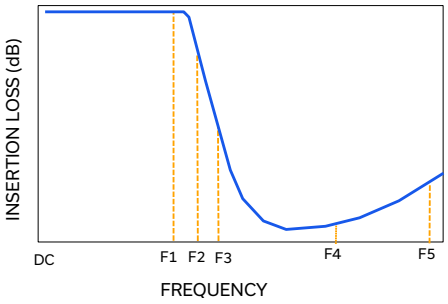
1. Tested in Evaluation Board P/N TB-LPHI-90+
2. In applications where DC voltage and/or current is present at either the input or output ports, external DC blocking capacitors are required.

ABSOLUTE MAXIMUM RATINGS[3]

Parameter	Ratings
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +100°C
Input Power[4]	2 W at +25°C

3. Permanent damage may occur if any of these limits are exceeded.
4. Power rating applies only to signals within the passband. Power rating above +25°C, de-rate linearly to 0.5 W at +85°C.

TYPICAL FREQUENCY RESPONSE



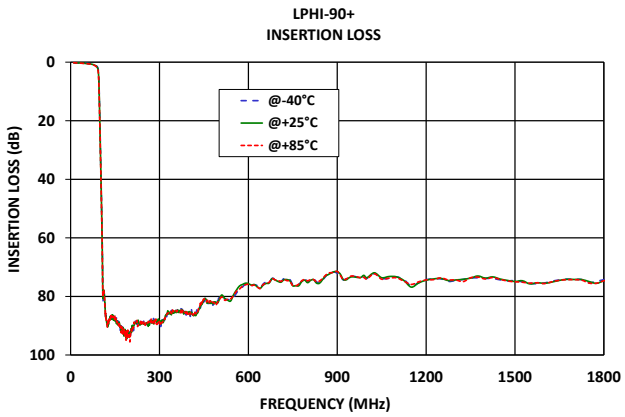
REV. OR
ECO-024893
LPHI-90+
EDU5069
URJ
250318

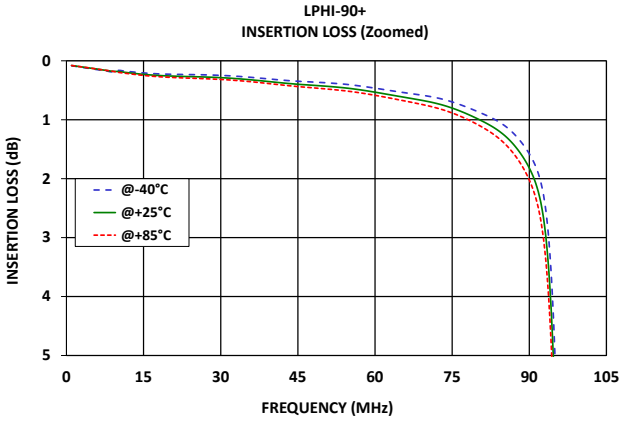
Low Pass Filter

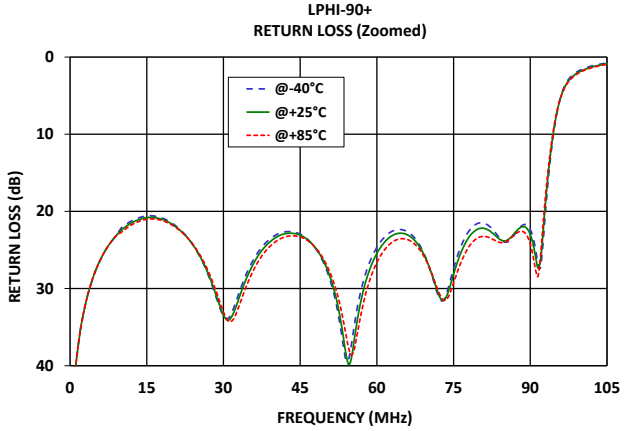
LPHI-90+

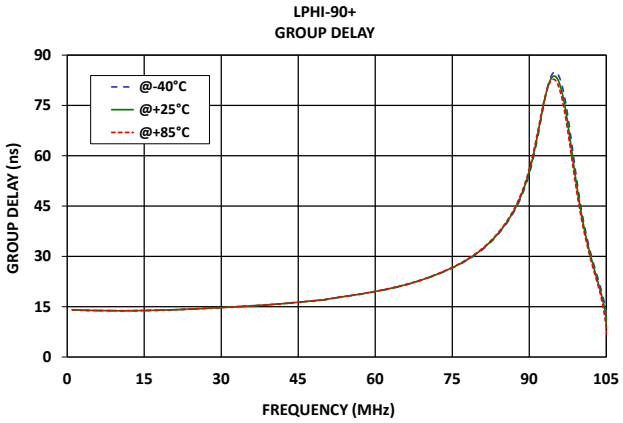
50Ω DC to 90 MHz

TYPICAL PERFORMANCE GRAPHS









LUMPED LC SURFACE MOUNT

Low Pass Filter

LPHI-90+

50Ω DC to 90 MHz

FUNCTIONAL DIAGRAM

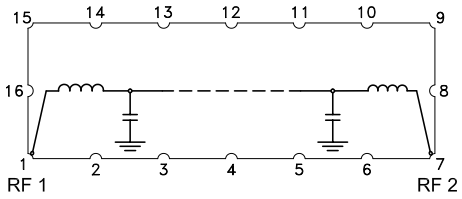


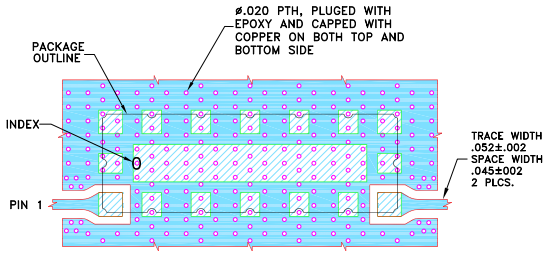
Figure 1. LPHI-90+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description
RF1[2]	1	Connects to RF Input Port
RF2[2]	7	Connects to RF Output Port
GROUND	2-6 & 8-16	Connects to Ground on PCB, (See drawing PL-814)
NC	—	No connection, not used internally. See drawing PL-814 for connection to PCB

SUGGESTED PCB LAYOUT (PL-814)

SUGGESTED MOUNTING CONFIGURATION
FOR CASE STYLE BAN2915-1



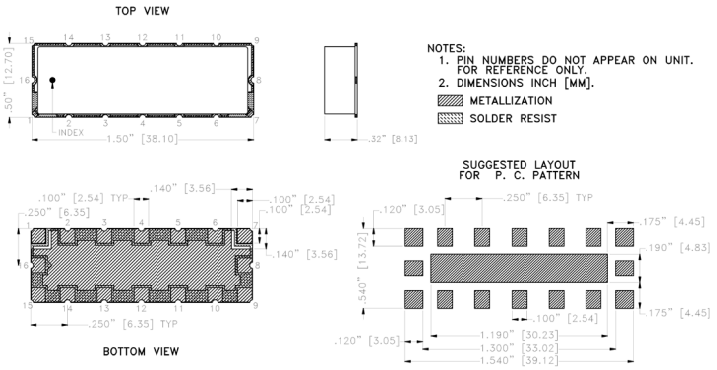
NOTES:
1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS (RO4350B) WITH DIELECTRIC THICKNESS .023±.002; COPPER: 1/2 Oz. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

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

DENOTES PCB COPPER PATTERN FREE OF SOLDERMASK

Figure 2. Suggested PCB Layout PL-814

CASE STYLE DRAWING



Weight: 6.5 gram
Dimensions are in inches (mm). Tolerances: 2Pl. ± .03; 3Pl. ± .015

PRODUCT MARKING*: LPHI-90

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

Low Pass Filter

LPHI-90+

50 Ω DC to 90 MHz

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASHBOARD. CLICK HERE

Performance Data and Graphs	Data Graphs S-Parameter (S2P Files) Data Set (.zip file) De-embedded to device pads
Case Style	BAN2915-1 Lead Finish: Gold over Nickel
RoHS Status	Compliant
Tape and Reel	TR-F019
Suggested Layout for PCB Design	PL-814
Evaluation Board	TB-LPHI-90+
	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

Surface mount Band Pass Filter LPHI-90+

Typical Performance Data

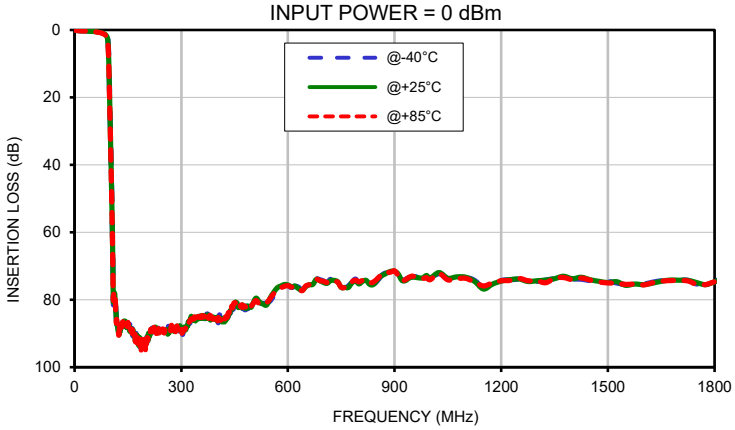
FREQ. (MHz)	INSERTION LOSS (dB)			INPUT RETURN LOSS (dB)			OUTPUT RETURN LOSS (dB)		
	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C
1	0.08	0.08	0.08	40.45	40.55	40.56	43.14	43.29	43.37
5	0.14	0.13	0.13	27.64	27.66	27.65	27.50	27.52	27.52
10	0.16	0.18	0.20	22.16	22.44	22.73	21.90	22.15	22.40
15	0.21	0.23	0.25	20.59	20.81	21.03	20.29	20.46	20.64
20	0.23	0.26	0.28	21.55	21.69	21.79	20.88	20.97	21.02
25	0.24	0.27	0.30	25.40	25.35	25.21	23.87	23.79	23.63
30	0.25	0.29	0.32	33.58	33.48	33.06	29.17	29.02	28.82
35	0.27	0.32	0.35	27.36	27.93	28.86	26.72	27.24	28.13
40	0.31	0.36	0.39	23.16	23.48	24.02	23.09	23.48	24.06
45	0.35	0.40	0.44	22.95	23.08	23.31	22.79	22.98	23.20
50	0.37	0.43	0.47	27.33	27.06	26.71	26.09	25.91	25.58
55	0.41	0.47	0.52	37.34	39.08	38.63	29.57	29.66	29.47
60	0.46	0.53	0.59	24.65	25.44	26.61	23.88	24.52	25.48
65	0.53	0.61	0.67	22.39	22.85	23.55	22.45	22.98	23.79
70	0.60	0.69	0.76	26.77	26.80	26.87	28.49	28.76	29.08
75	0.70	0.80	0.88	27.36	28.13	29.25	28.85	29.86	31.70
80	0.86	0.99	1.08	21.50	22.23	23.35	21.90	22.76	24.09
85	1.09	1.25	1.39	23.98	23.83	23.99	29.26	29.80	30.29
90	1.58	1.82	2.02	22.36	23.01	24.23	23.42	24.14	25.26
95	5.03	5.80	6.52	8.00	7.86	7.68	6.84	6.54	6.23
100	26.53	27.37	28.22	1.62	1.78	1.89	0.91	1.02	1.11
105	51.86	52.65	53.52	0.78	0.88	0.95	0.45	0.52	0.58
110	79.86	79.33	78.42	0.47	0.54	0.59	0.28	0.34	0.38
115	81.33	81.54	81.13	0.32	0.37	0.41	0.20	0.24	0.28
120	87.29	87.42	87.97	0.24	0.28	0.31	0.15	0.18	0.22
125	89.91	90.43	90.06	0.18	0.22	0.25	0.11	0.15	0.18
130	88.34	88.26	87.48	0.15	0.18	0.21	0.10	0.13	0.15
135	86.64	87.44	87.03	0.13	0.16	0.18	0.08	0.12	0.14
140	87.05	86.28	87.16	0.12	0.15	0.17	0.08	0.11	0.13
145	86.38	86.68	87.37	0.11	0.13	0.15	0.07	0.09	0.12
150	87.22	88.28	86.71	0.10	0.12	0.14	0.06	0.08	0.11
200	92.87	92.35	95.54	0.08	0.09	0.10	0.05	0.07	0.08
250	88.93	89.52	89.35	0.09	0.10	0.11	0.06	0.08	0.09
300	88.92	88.59	88.57	0.09	0.11	0.12	0.07	0.09	0.11
350	84.55	85.11	85.24	0.09	0.11	0.12	0.07	0.10	0.11
400	85.36	85.17	85.62	0.10	0.12	0.13	0.08	0.11	0.13
450	81.75	81.22	80.89	0.10	0.13	0.14	0.09	0.12	0.14
500	80.60	81.49	81.47	0.09	0.12	0.13	0.09	0.12	0.14
550	80.33	79.45	79.68	0.10	0.13	0.15	0.10	0.14	0.16
600	75.83	75.62	75.82	0.11	0.13	0.15	0.11	0.15	0.17
650	75.78	76.15	75.94	0.09	0.13	0.14	0.10	0.14	0.16
700	74.44	74.88	74.52	0.10	0.14	0.16	0.11	0.16	0.18
750	75.98	76.36	76.30	0.11	0.14	0.17	0.13	0.17	0.20
780	74.85	74.97	74.67	0.10	0.14	0.16	0.12	0.16	0.19
800	75.12	75.30	74.66	0.09	0.13	0.16	0.11	0.16	0.19
850	74.53	74.31	73.90	0.10	0.14	0.17	0.13	0.17	0.20
900	72.08	71.53	71.43	0.09	0.13	0.16	0.13	0.18	0.21
950	73.19	73.29	72.99	0.09	0.14	0.17	0.13	0.18	0.21
1000	73.86	73.61	74.06	0.10	0.14	0.17	0.13	0.19	0.22
1050	73.83	73.62	74.11	0.15	0.20	0.22	0.13	0.18	0.22
1100	73.35	73.32	73.65	0.09	0.14	0.18	0.13	0.19	0.23
1150	76.40	76.83	75.90	0.09	0.15	0.18	0.14	0.20	0.24
1200	74.28	74.47	74.35	0.08	0.14	0.17	0.13	0.20	0.24
1250	73.99	73.85	73.67	0.09	0.15	0.19	0.14	0.21	0.26
1300	74.56	74.37	74.38	0.10	0.16	0.20	0.15	0.23	0.27
1400	73.85	73.76	74.04	0.11	0.18	0.23	0.16	0.24	0.28
1500	74.57	74.90	75.00	0.32	0.44	0.52	0.16	0.25	0.30
1600	75.41	75.52	75.61	0.15	0.23	0.27	0.19	0.28	0.32
1700	74.21	74.22	74.29	0.15	0.23	0.18	0.20	0.29	0.34
1800	74.28	74.67	74.65	0.16	0.24	0.28	0.22	0.31	0.35

Typical Performance Data

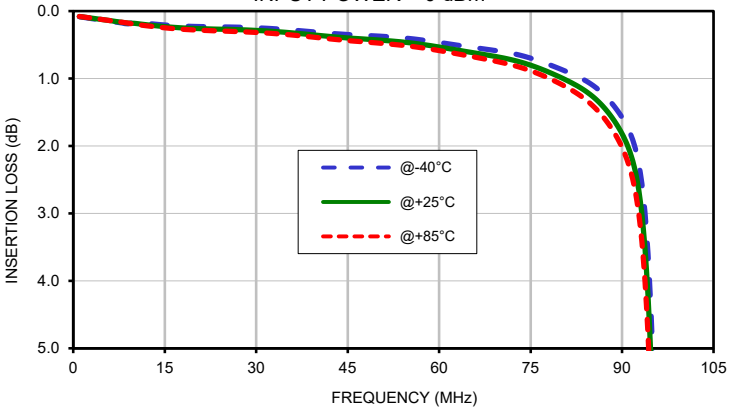
FREQ. (MHz)	GROUP DELAY (nsec)		
	@-40°C	@+25°C	@+85°C
1	14.09	14.08	14.08
5	13.88	13.88	13.88
10	13.77	13.79	13.81
15	13.84	13.87	13.88
20	14.04	14.05	14.07
25	14.35	14.36	14.37
27	14.49	14.50	14.51
29	14.65	14.66	14.67
30	14.72	14.74	14.75
33	14.97	14.99	15.00
35	15.15	15.17	15.18
37	15.33	15.36	15.38
40	15.65	15.67	15.69
43	16.01	16.04	16.06
45	16.30	16.32	16.35
47	16.60	16.62	16.64
50	17.03	17.06	17.07
53	17.79	17.82	17.84
55	18.24	18.27	18.29
57	18.71	18.74	18.78
60	19.49	19.54	19.58
63	20.41	20.46	20.52
64	20.75	20.81	20.87
65	21.13	21.19	21.25
68	22.42	22.48	22.54
70	23.43	23.50	23.56
72	24.57	24.64	24.71
74	25.84	25.93	26.01
76	27.28	27.39	27.50
78	28.96	29.10	29.24
80	9.50	31.16	31.33
81	32.18	32.37	32.56
82	33.52	33.73	33.93
83	35.02	35.24	35.46
84	36.71	36.95	37.19
85	38.61	38.87	39.14
86	40.77	41.07	41.38
87	43.26	43.62	44.00
88	46.24	46.68	47.16
89	49.91	50.47	51.06
90	54.61	55.31	56.05

Typical Performance Curves

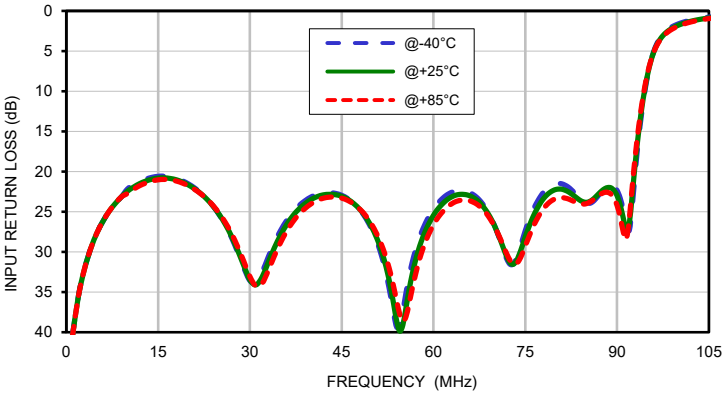
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



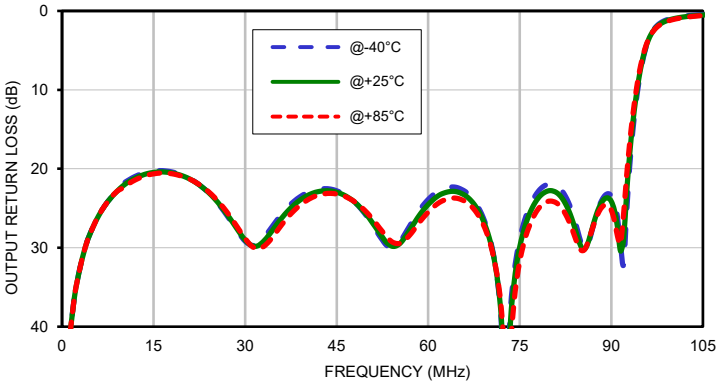
INSERTION LOSS vs. TEMPERATURE (Zoomed)
INPUT POWER = 0 dBm



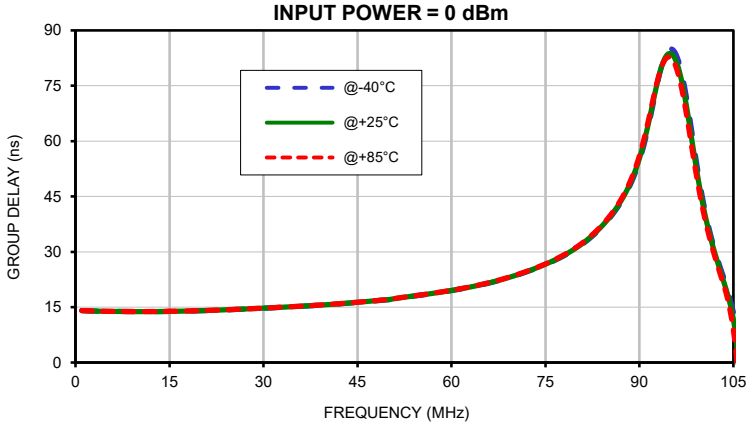
INPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



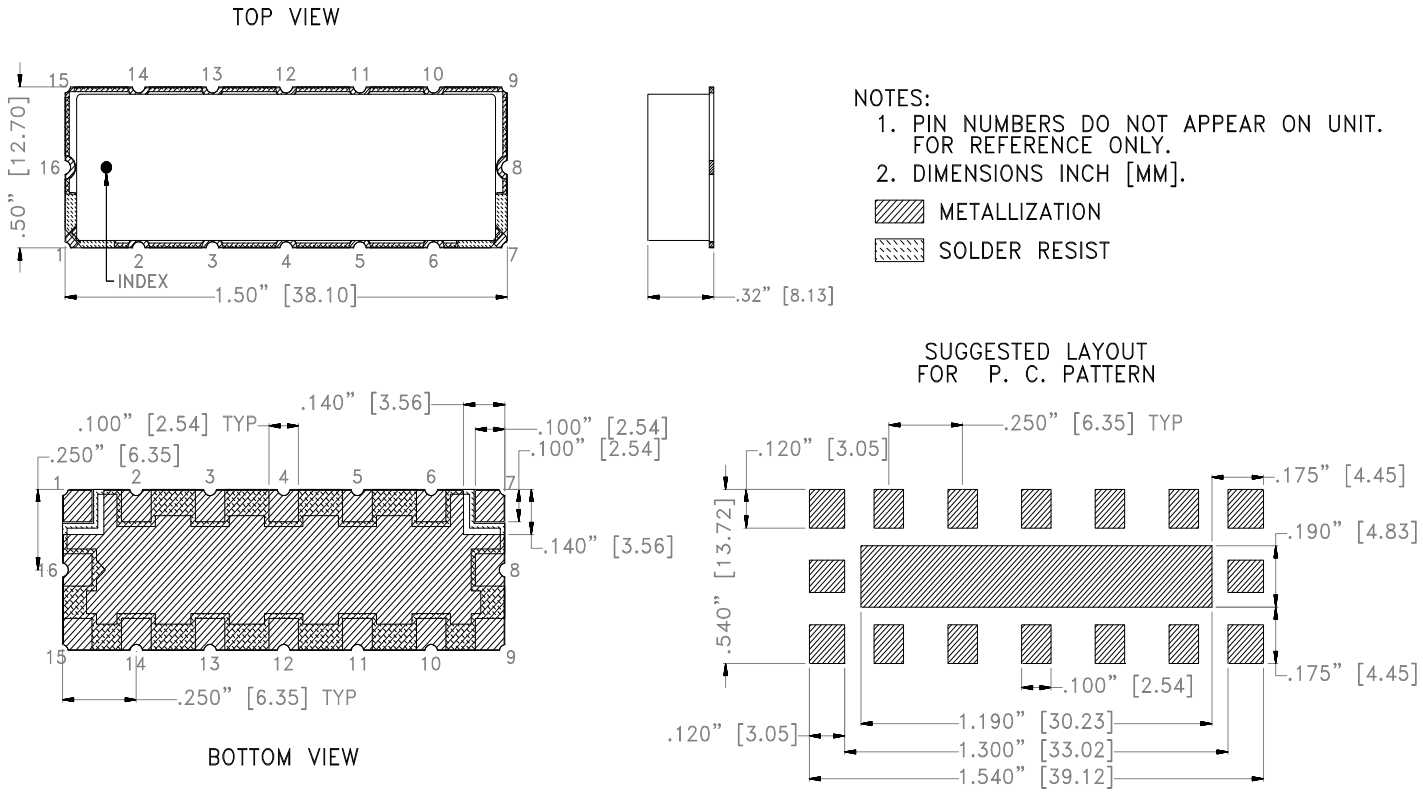
GROUP DELAY vs. TEMPERATURE
INPUT POWER = 0 dBm



Case Style BAN

Outline Dimension

BAN2915-1



Dimensions are in inches [mm]. Tolerances: 2 Pl ± .03; 3 Pl ± .015

Notes:

1. Case material: Nickel-Silver alloy.
2. Base: Printed wiring laminate.
3. Unit Weight: 6.5g
4. 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.

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RF/IF MICROWAVE COMPONENTS

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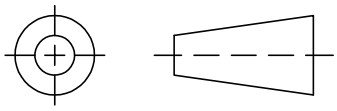
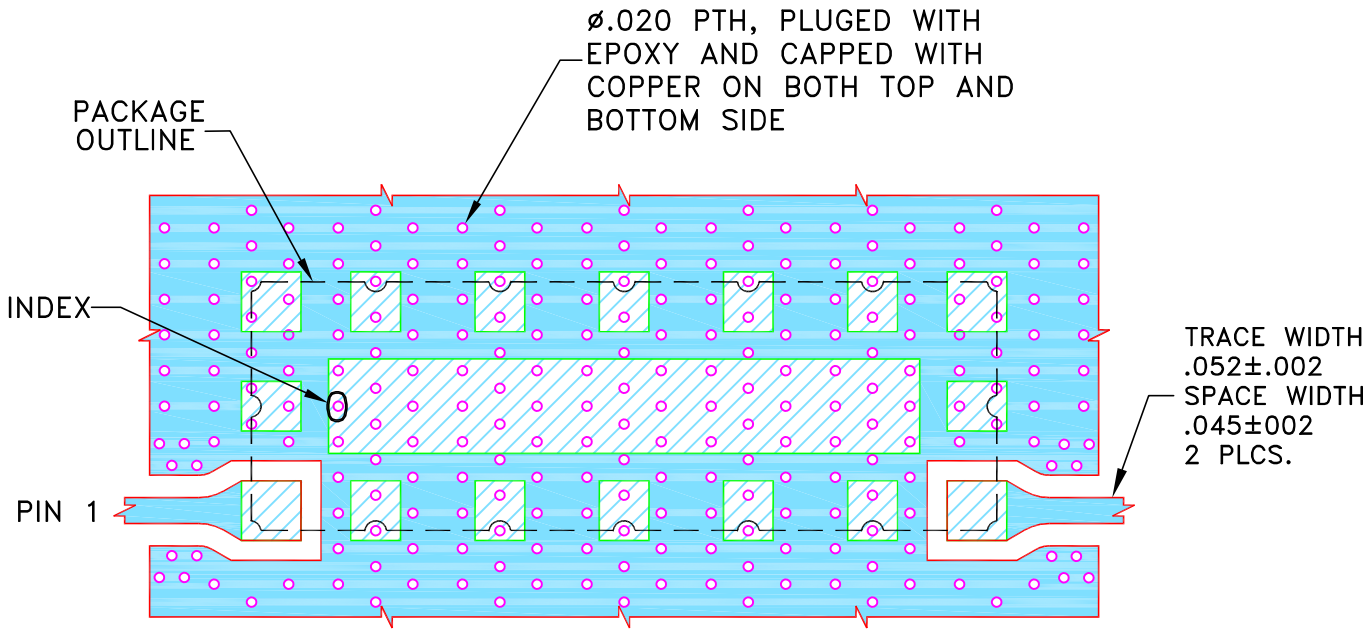
THIRD ANGLE PROJECTION



REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	NPO-005031	NEW RELEASE	FEB 25	LK	VR

SUGGESTED MOUNTING CONFIGURATION FOR CASE STYLE BAN2915-1



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   FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

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

DENOTES PCB COPPER PATTERN FREE OF SOLDERMASK

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	LK	03 FEB 25
TOLERANCES ON:	CHECKED	LK	03 FEB 25
2 PL DECIMALS ±	APPROVED	KSK	13 FEB 25
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

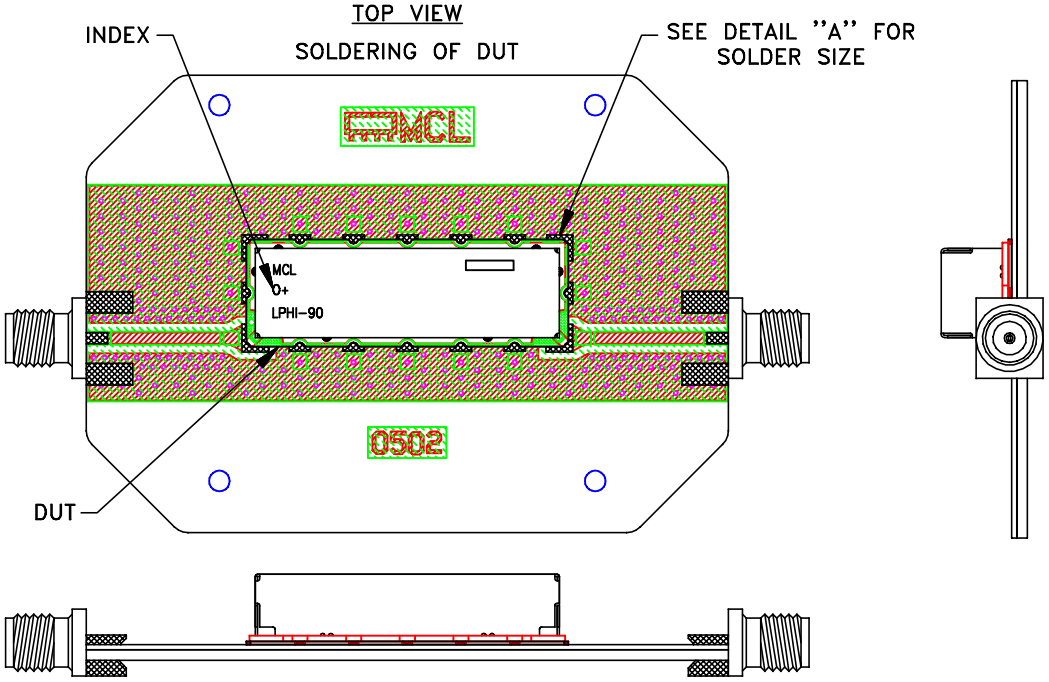
PL DWG, BAN2915-1, TB-1215

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-814	OR

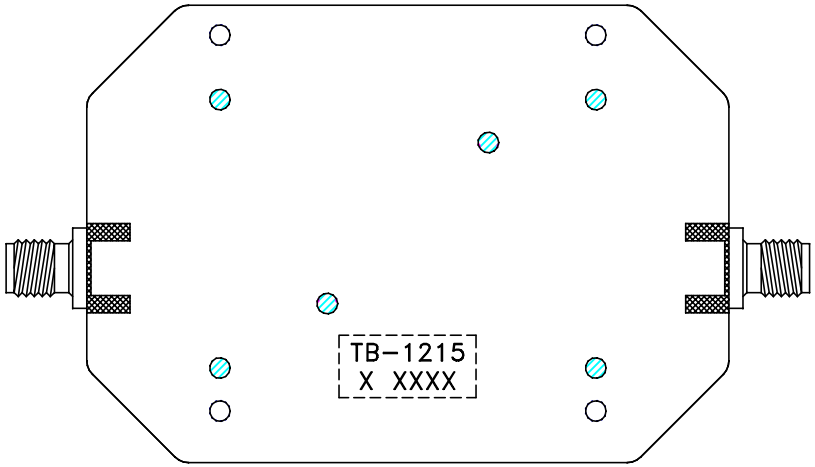
FILE:	SCALE:	SHEET:
98-PL-814	2.5:1	1 OF 1

TOP VIEW

SOLDERING OF DUT

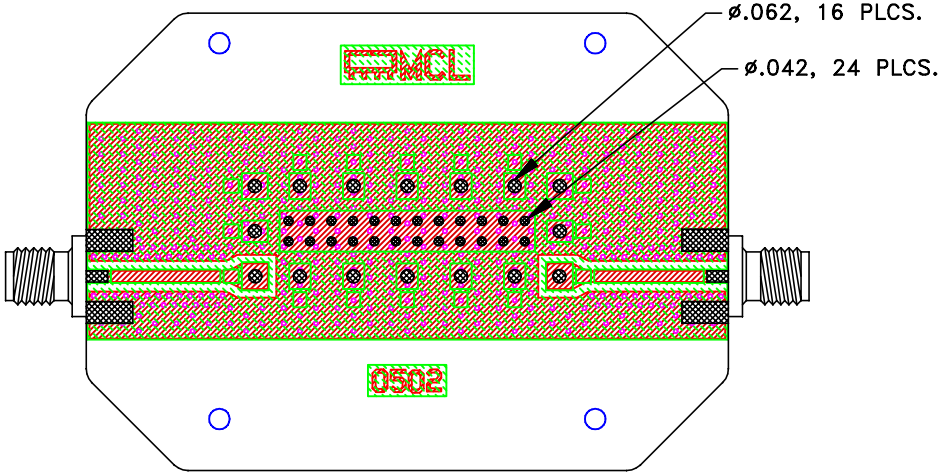


BOTTOM VIEW



DETAIL "A"

SOLDER PASTE LOCATION FOR DUT



NOTES:

1. DENOTES SOLDER.
2. DENOTES METALLIZATION.
3. DENOTES SOLDER MASK.

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES TOLERANCES ON: 2 PL DECIMALS ± 3 PL DECIMALS ± ANGLES ± FRACTIONS ±	DRAWN	SPM	11 FEB 25
	CHECKED	DDR	12 FEB 25
	APPROVED	KSK	

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BSHEETA1.DWG REV:A DATE:01/12/94

Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

EVAL BOARD, FOR LPHI-90+

SIZE	CODE IDENT	DRAWING NO:	REV:
B	15542	TB-LPHI-90-20+	OR

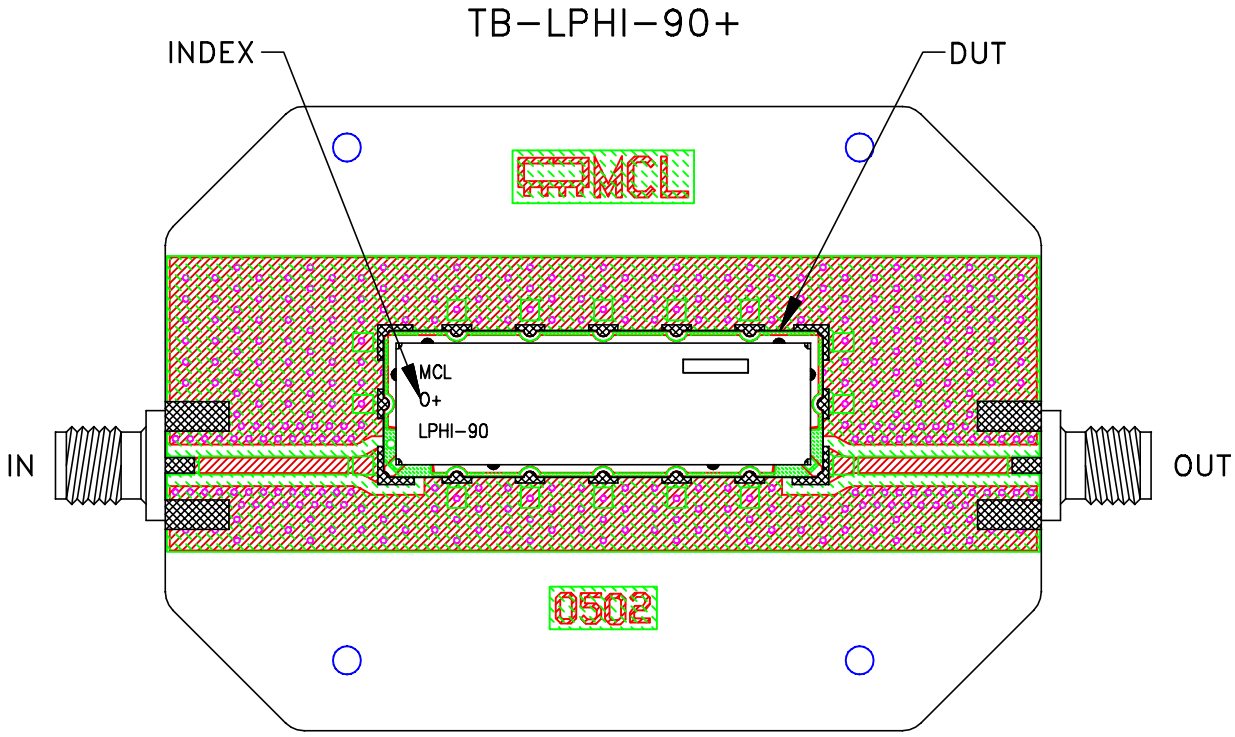
FILE: WTB-LPHI-90+ SCALE: 1.5:1 SHEET: 1 OF 2

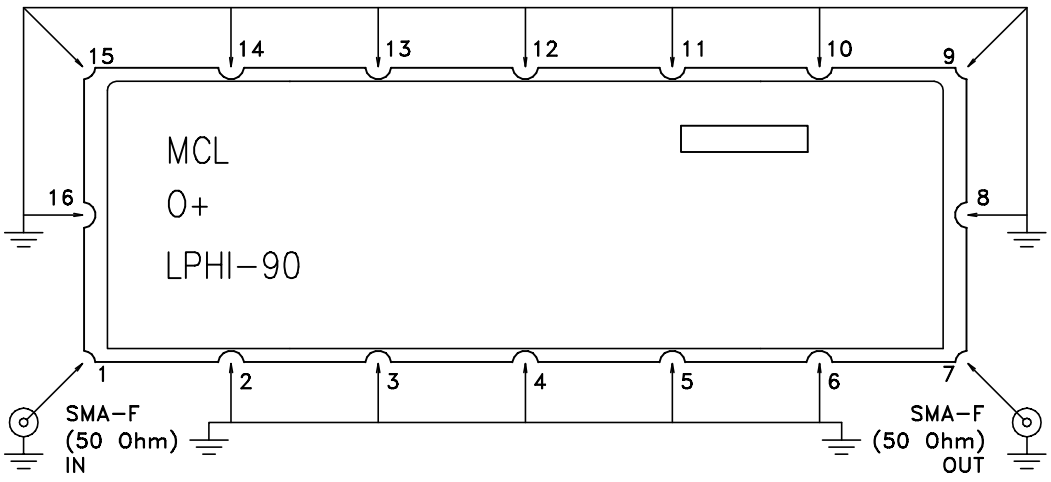
THIRD ANGLE PROJECTION

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	NPO-005037	NEW RELEASE	FEB 25	SPM	VC

REVISIONS

Evaluation Board and Circuit





Schematic diagram

Notes:
1. 50 Ohm SMA female connectors.
2. PCB Material: ROGERS (RO4350B) OR Equivalent
Dielectric Constant=3.48, Thickness=.023 ± .002 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 Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° C 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 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; distilled water + proylene glycol monomethyl ether + monoethanolamine at 63°C to 70°C	MIL-STD-202, Method 215

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