LTCC SURFACE MOUNT

Low Pass Filter

LFHK-320+

50Ω DC to 320 MHz

THE BIG DEAL

- Low Insertion Loss, 1.6 dB Typ.
- Passband Return Loss, 13 dB Typ.
- Stopband Rejection, 80 dB Typ.
- 1008 Surface Mount Footprint
- Power Handling: 9 W
- Shielded Construction: Prevents De-Tuning & EMI
- Protected by US Patents 11,638,370 and 11,744,057

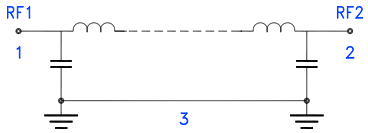


Generic photo used for illustration purposes only

APPLICATIONS

- Test and Measurement Equipment
- Broadband Access Infrastructure
- Harmonic Rejection
- SDR and Wideband Radio Receivers

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

The LFHK-320+ is a passive RF component designed for signal conditioning in low-frequency circuits. It utilizes ceramic-based construction to achieve stable electrical behavior across a broad operating range. The device supports bidirectional signal flow and is optimized for integration into compact layouts, making it suitable for dense PCB designs. It's surface-mount format aligns with standard automated assembly processes, and the internal structure is engineered to minimize parasitic effects that could impact performance at microwave frequencies. The component is built to maintain consistent characteristics under varying environmental conditions, contributing to overall system reliability.

ELECTRICAL SPECIFICATIONS[1,2,3] AT +25°C

Parameter		F#	Frequency (MHz)	Min.	Typ.	Max.	Units
Passband	Insertion Loss	DC-F1	DC - 320	—	1.6	2.2	dB
	Freq. Cut-Off[4]	Fc	460	—	3	—	
	Return Loss	DC-F1	DC - 320	8	13	—	
Stopband	Rejection	F2-F3	620 - 990	20	34	—	dB
		F3-F4	990 - 3000	66	80	—	
		F4-F5	3000 - 7000	—	79	—	
		F5-F6	7000 - 15000	—	32	—	
		F6-F7	15000 - 40000	—	33	—	

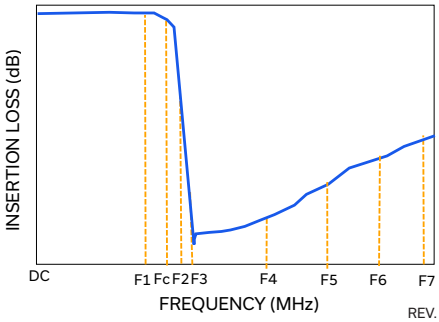
1. Tested in Evaluation Board P/N TB-LFHK-320+.
2. This filter is bi-directional RF1 and RF2 ports may be interchanged, see S-Parameters for actual performance.
3. This component should not be used as a DC-block. In applications where DC voltage and/or current is present at either the input or output ports, external DC blocking capacitors are required.
4. Typical variation ± 5%.

ABSOLUTE MAXIMUM RATINGS[5]

Operating Temperature	-55°C to +125°C
Storage Temperature	-55°C to +125°C
Input Power[6]	9 W @ +25°C

5. Permanent damage may occur if any of these limits are exceeded.
6. Power rating applies only to signals within the passband. Power rating above +25°C operating temperature decreases linearly to 1.3 W at +125°C.

TYPICAL FREQUENCY RESPONSE



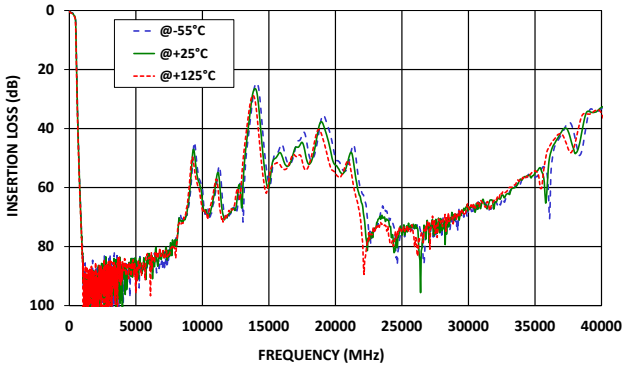
Low Pass Filter

LFHK-320+

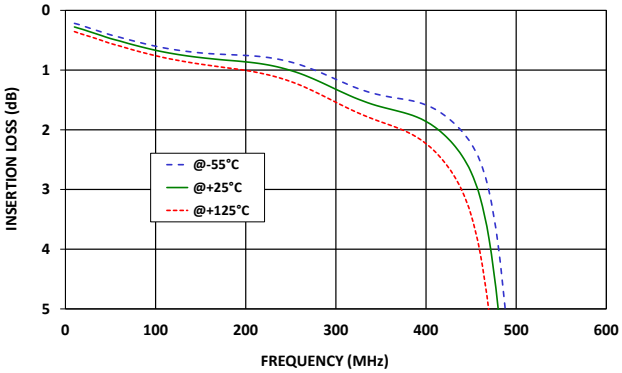
50Ω DC to 320 MHz

TYPICAL PERFORMANCE GRAPHS

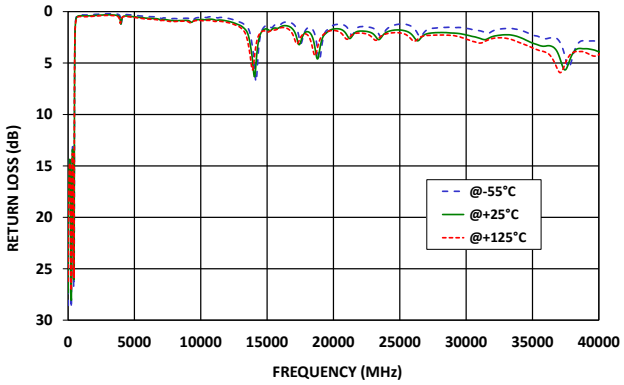
LFHK-320+
INSERTION LOSS



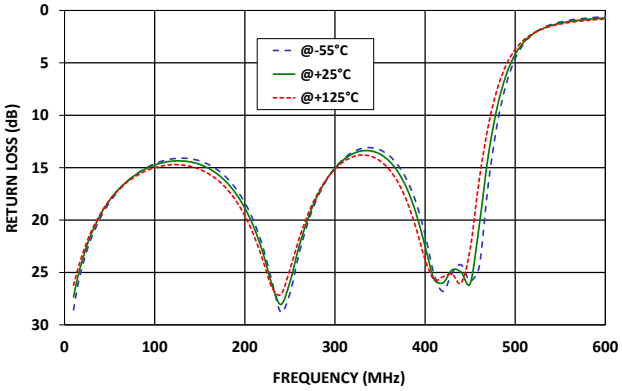
LFHK-320+
INSERTION LOSS (Zoomed)



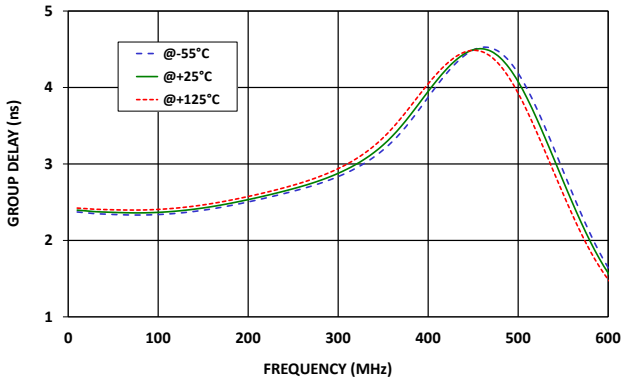
LFHK-320+
RETURN LOSS



LFHK-320+
RETURN LOSS (Zoomed)



LFHK-320+
GROUP DELAY



Low Pass Filter

LFHK-320+

50Ω DC to 320 MHz

FUNCTIONAL DIAGRAM

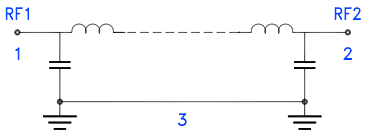
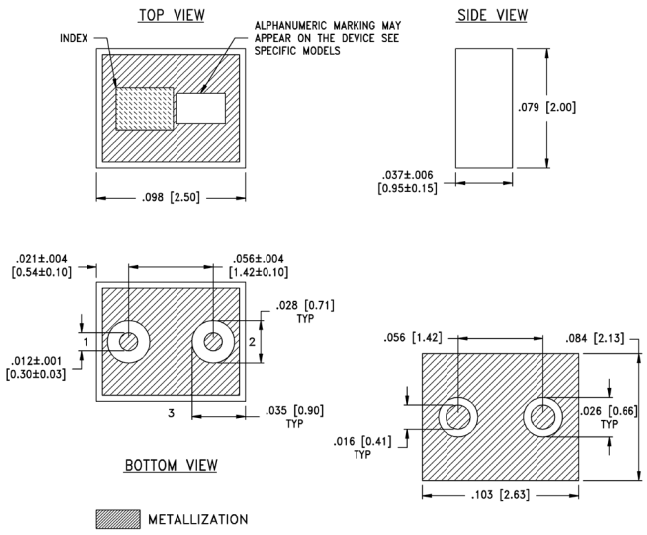


Figure 1. LFHK-320+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description
RF1[2]	1	Connects to RF Input Port
RF2[2]	2	Connects to RF Output Port
GROUND	3	Connects to Ground on PCB, (See drawing PL-798)

CASE STYLE DRAWING



Weight: .019grms.
Dimensions are in inches (mm). Tolerances: 2Pl. ± .01; 3Pl. ± .005

PRODUCT MARKING*: X9

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

Low Pass Filter

LFHK-320+

50Ω DC to 320 MHz

SUGGESTED PCB LAYOUT

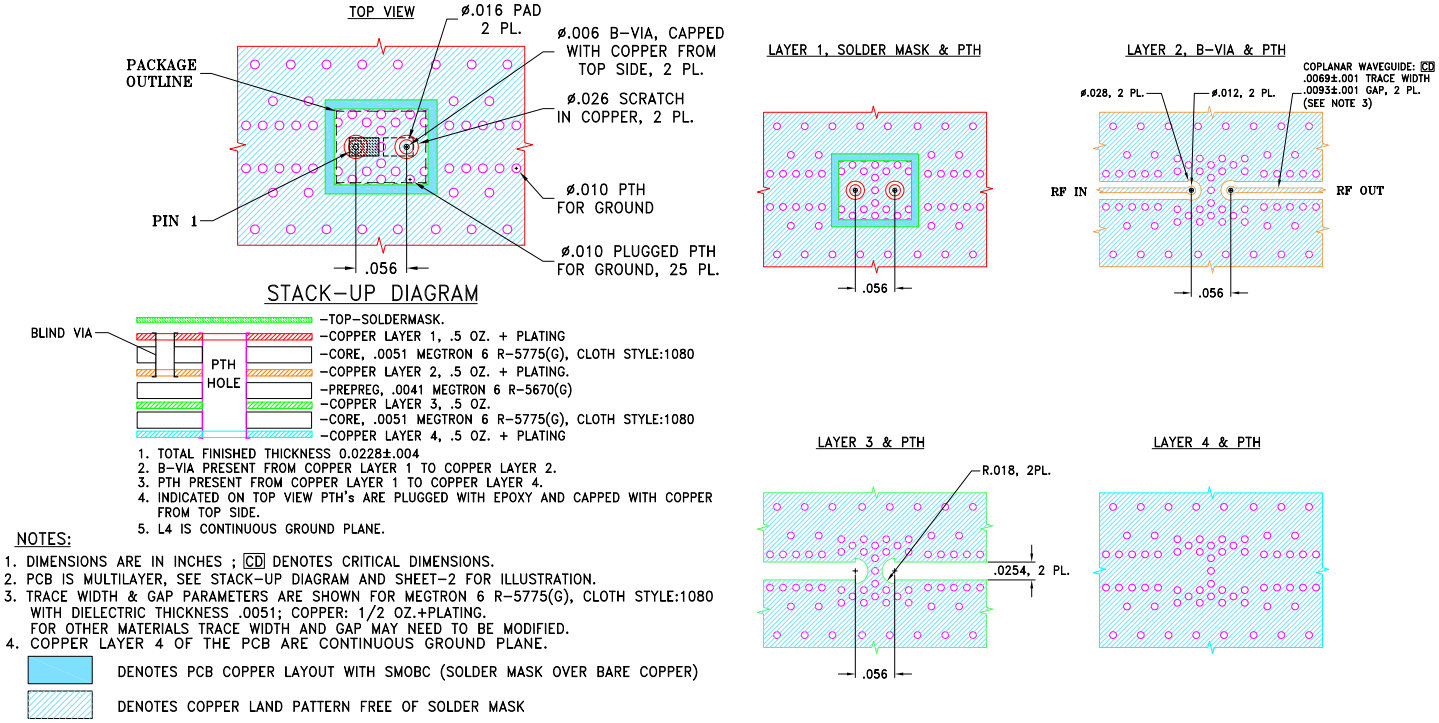


Figure 2. Suggested PCB Layout

LTCC SURFACE MOUNT

Low Pass Filter

LFHK-320+

50Ω DC to 320 MHz

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASHBOARD CLICK HERE

Performance Data & Graphs	Data Graphs S-Parameter (S2P Files) Data Set (.zip file) De-embedded to device pads
Case Style	NL1008C-12 Lead Finish: Gold over Electroless Nickel
RoHS/REACH Status	Compliant
Tape and Reel	F75
Suggested Layout for PCB Design	PL-798
Evaluation Board	TB-LFHK-320+ Gerber File
Environmental Rating	ENV06T10

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

Ceramic Low Pass Filter LFHK-320+

Typical Performance Data

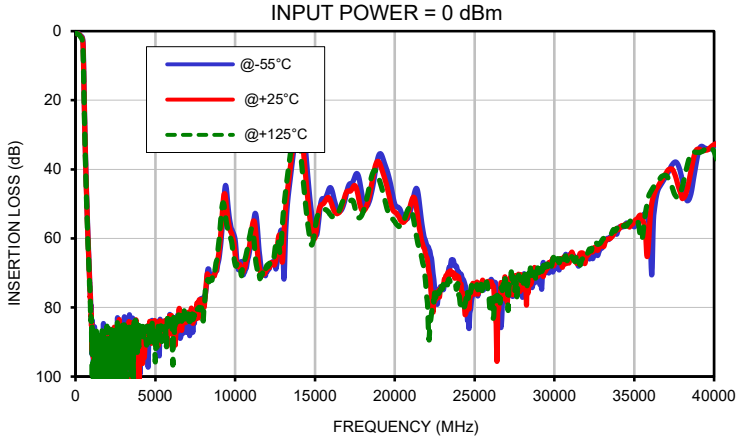
FREQ.	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
(MHz)	(dB)			(dB)			(dB)		
	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C
10	0.22	0.28	0.36	28.57	27.34	26.23	28.51	27.27	26.11
50	0.41	0.47	0.55	18.31	18.11	18.08	18.32	18.13	18.09
100	0.60	0.67	0.76	14.63	14.76	15.01	14.67	14.81	15.06
150	0.71	0.79	0.90	14.35	14.69	15.16	14.41	14.75	15.24
180	0.74	0.84	0.96	15.98	16.41	17.03	16.06	16.49	17.14
190	0.75	0.85	0.98	17.00	17.46	18.13	17.08	17.53	18.26
200	0.75	0.86	1.01	18.35	18.85	19.58	18.44	18.93	19.73
220	0.78	0.90	1.06	22.55	23.10	23.84	22.79	23.32	24.22
250	0.87	1.01	1.19	27.01	25.93	24.73	27.77	26.59	25.27
280	1.02	1.18	1.39	17.97	17.78	17.59	18.10	17.94	17.74
300	1.15	1.32	1.54	15.03	15.05	15.13	15.13	15.16	15.24
320	1.28	1.46	1.69	13.50	13.67	13.96	13.58	13.75	14.05
350	1.42	1.62	1.87	13.31	13.71	14.35	13.35	13.75	14.41
370	1.48	1.69	1.98	14.77	15.43	16.42	14.84	15.46	16.49
380	1.50	1.73	2.04	16.21	17.04	18.26	16.32	17.08	18.35
400	1.58	1.86	2.23	21.39	22.51	23.78	21.68	22.70	24.13
410	1.65	1.96	2.37	25.21	25.66	25.70	25.83	26.22	26.34
460	2.53	3.13	4.06	24.48	20.58	16.17	24.45	20.57	16.17
490	5.37	6.69	8.55	7.01	6.14	5.19	7.05	6.16	5.23
500	7.36	8.84	10.86	4.59	4.18	3.71	4.62	4.21	3.76
520	12.28	13.83	15.85	2.23	2.23	2.18	2.28	2.26	2.23
550	19.86	21.25	23.09	1.10	1.22	1.30	1.16	1.25	1.36
600	30.79	31.97	33.56	0.60	0.72	0.81	0.65	0.74	0.86
620	34.64	35.76	37.28	0.51	0.63	0.72	0.57	0.65	0.77
700	47.91	48.87	50.28	0.36	0.47	0.55	0.41	0.48	0.60
780	58.98	59.91	61.50	0.32	0.42	0.50	0.37	0.43	0.54
990	82.52	82.11	83.31	0.31	0.40	0.48	0.36	0.41	0.52
1000	83.69	85.32	83.25	0.31	0.40	0.48	0.36	0.41	0.52
1150	96.17	99.31	91.56	0.32	0.41	0.49	0.36	0.42	0.52
2000	90.82	90.82	93.78	0.27	0.38	0.44	0.32	0.39	0.48
3000	83.95	88.27	91.33	0.20	0.31	0.37	0.22	0.31	0.39
3500	88.03	89.60	88.58	0.22	0.33	0.40	0.23	0.33	0.42
5500	86.74	87.89	87.37	0.43	0.58	0.66	0.48	0.59	0.70
6000	84.70	82.36	83.65	0.47	0.64	0.72	0.53	0.64	0.76
7000	87.27	82.27	82.50	0.66	0.82	0.87	0.71	0.83	0.90
8500	70.81	71.13	72.05	0.66	0.86	0.93	0.65	0.79	0.91
10000	60.36	64.65	67.50	0.56	0.77	0.86	0.58	0.76	0.89
12000	69.63	68.86	67.72	0.65	0.92	1.06	0.72	0.96	1.15
15000	58.84	59.85	57.32	1.33	1.70	1.96	1.40	1.71	1.96
16000	45.41	49.50	53.32	1.26	1.48	1.58	1.21	1.44	1.57
17000	46.40	46.39	49.35	1.25	1.82	2.42	1.18	1.63	2.11
18000	48.72	52.09	52.52	1.64	1.95	2.22	1.92	2.04	2.19
19000	35.89	37.87	42.58	4.47	3.41	2.65	3.64	4.46	3.55
20000	50.02	52.35	55.14	1.32	1.69	1.84	1.69	1.86	2.00
21000	51.60	49.98	51.16	1.50	2.25	2.68	1.50	2.15	2.67
22000	61.90	65.49	77.01	1.47	1.89	2.08	1.52	1.89	2.14
23000	74.81	73.61	74.44	1.62	2.18	2.62	1.61	2.09	2.59
24000	69.59	71.17	76.31	1.73	2.01	2.16	1.55	1.84	2.06
25000	74.34	76.16	75.14	1.21	1.79	2.06	1.15	1.71	2.01
26000	72.33	73.23	78.29	1.56	2.38	2.85	1.56	2.31	2.93
30000	68.91	66.48	66.68	1.62	2.27	2.67	1.44	2.02	2.52
31000	64.47	65.23	64.85	1.85	2.58	3.06	1.65	2.34	2.82
32000	65.04	64.93	64.73	1.89	2.42	2.61	1.99	2.49	2.75
33000	62.70	62.05	60.39	1.64	2.25	2.59	1.89	2.46	2.97
34000	57.31	57.51	57.21	1.77	2.48	3.00	1.90	2.64	3.21
35000	56.66	55.08	54.28	2.27	3.06	3.52	2.32	3.00	3.52
36000	60.15	53.54	46.77	2.64	3.35	3.96	2.53	3.23	3.92
37000	41.99	41.09	41.84	2.84	4.31	5.86	2.59	3.96	5.31
38000	42.97	48.41	45.20	4.51	4.15	4.00	4.36	4.04	3.89
40000	33.29	32.85	34.87	2.95	3.89	4.18	3.13	4.09	4.50

Typical Performance Data

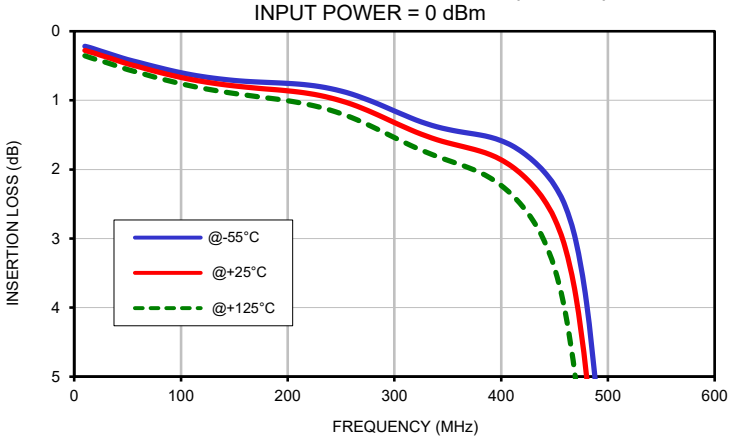
FREQ. (MHz)	GROUP DELAY (nsec)		
	@-55°C	@+25°C	@+125°C
10	2.37	2.40	2.42
15	2.37	2.39	2.42
20	2.36	2.39	2.42
25	2.36	2.38	2.41
30	2.35	2.38	2.41
40	2.34	2.37	2.40
50	2.34	2.37	2.40
60	2.33	2.36	2.40
70	2.33	2.36	2.40
80	2.33	2.36	2.40
90	2.33	2.36	2.40
100	2.34	2.37	2.41
110	2.34	2.37	2.41
120	2.35	2.38	2.42
130	2.37	2.39	2.43
140	2.38	2.41	2.45
150	2.39	2.42	2.46
160	2.41	2.44	2.48
170	2.43	2.46	2.50
180	2.45	2.48	2.53
190	2.48	2.51	2.55
200	2.50	2.53	2.57
210	2.53	2.56	2.60
220	2.56	2.59	2.63
230	2.58	2.61	2.66
240	2.61	2.64	2.69
250	2.64	2.68	2.72
260	2.68	2.71	2.76
270	2.71	2.75	2.80
280	2.75	2.78	2.84
290	2.79	2.83	2.89
300	2.83	2.88	2.94
310	2.89	2.93	3.00
320	2.95	3.00	3.07

Typical Performance Curves

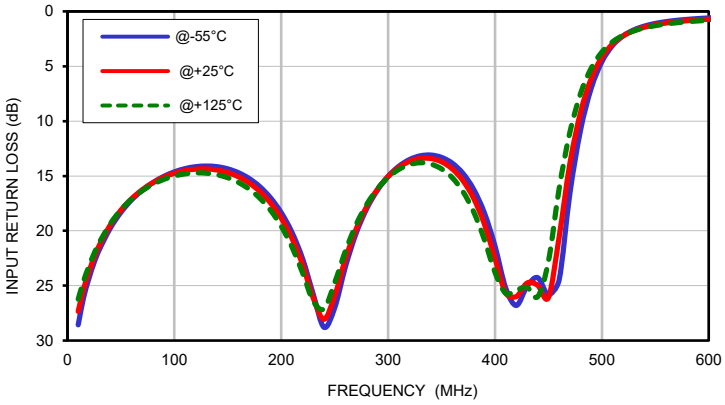
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



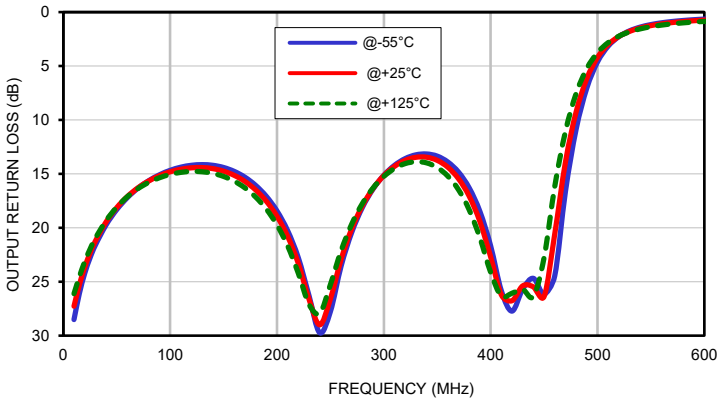
INSERTION LOSS vs. TEMPERATURE (Zoomed)
INPUT POWER = 0 dBm



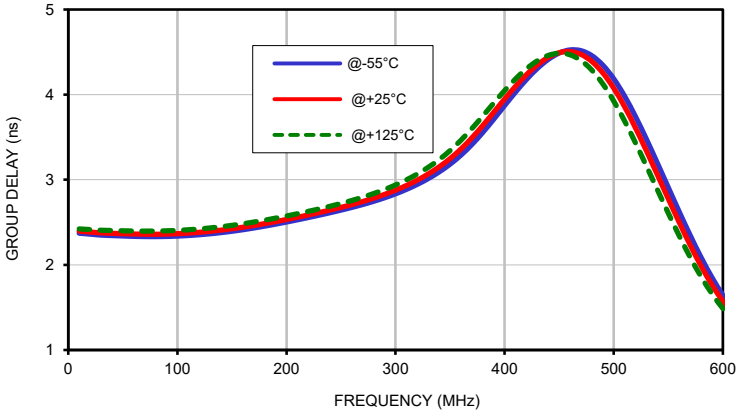
INPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm

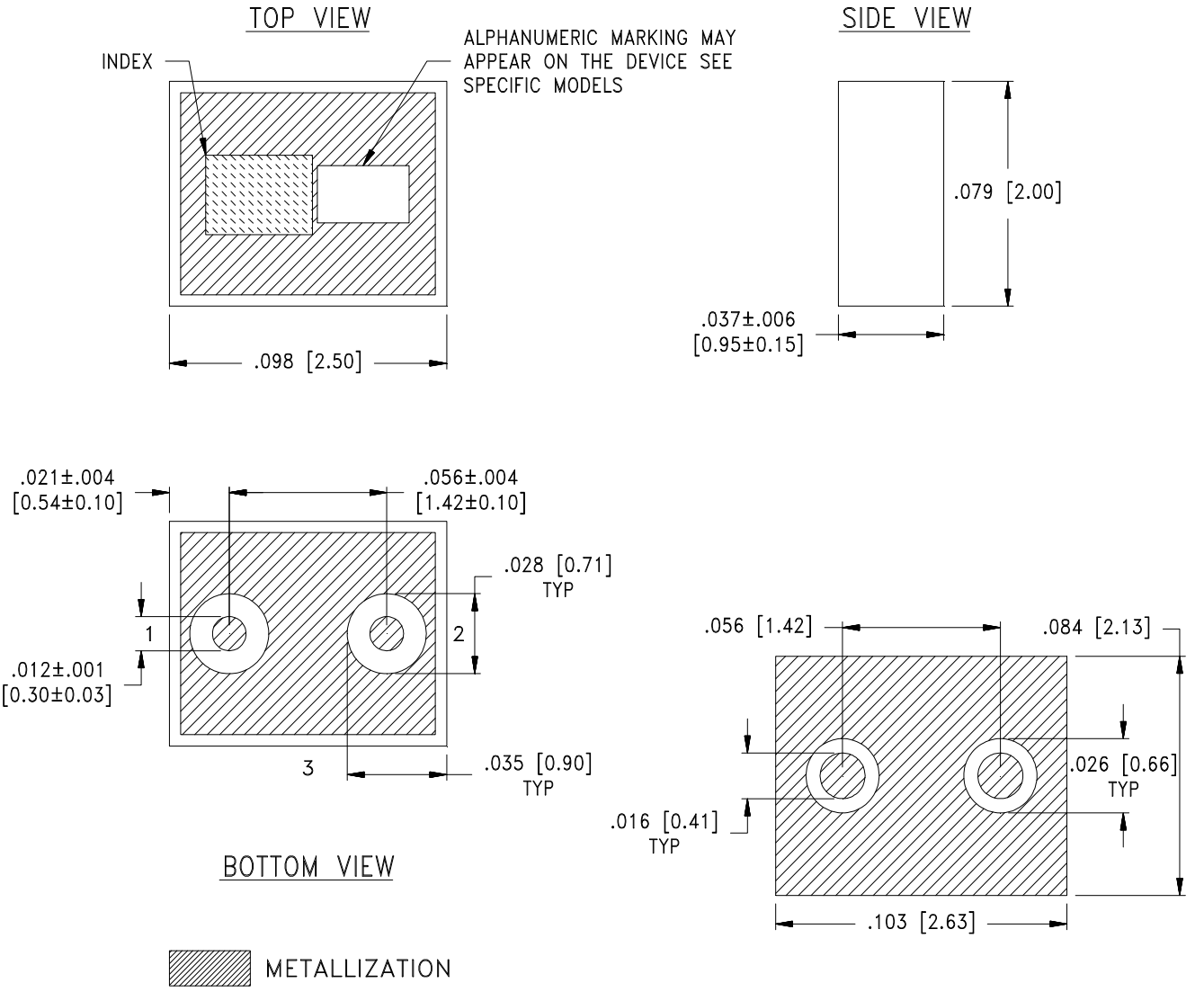


GROUP DELAY vs. TEMPERATURE
INPUT POWER = 0 dBm



Case Style NL

Outline Dimensions NL1008C-12



Dimensions are in inches (mm). Tolerances: 2Pl. ± .01; 3Pl. ± .005

SUGGESTED LAYOUT FOR PCB LAND PATTERN

PATTERN TO BE WITHIN ±.002

Notes:

1. Open style, Ceramic base.
2. Termination finish: **as shown below or indicated on Data sheet.**
   For RoHS Case Styles: Gold plate over nickel plate. All models, (+) suffix.
3. Weight: .019 grams.
4. Pad tolerance is non-cumulative.

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Tape & Reel Packaging TR-F75

DEVICE ORIENTATION IN T&R

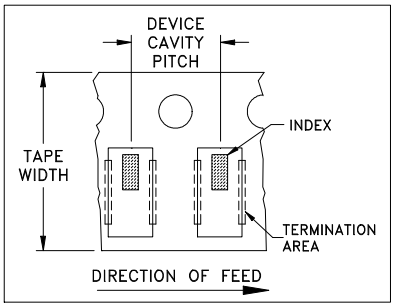


ILLUSTRATION 1

Applicable Case Styles
FV1206-1
FV1206-3

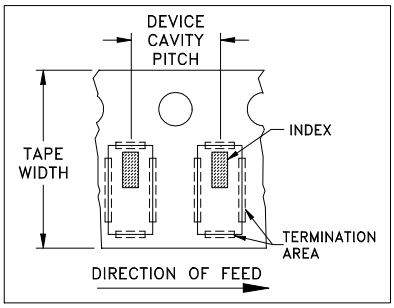


ILLUSTRATION 2

Applicable Case Styles
FV1206-4
FV1206-5
FV1206-6
FV1206-7
FV1206-9

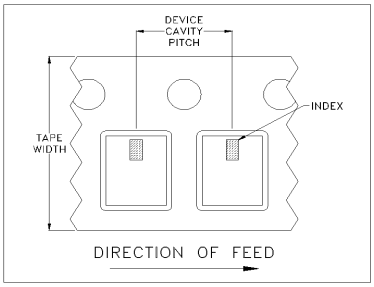


ILLUSTRATION 3

Applicable Case Styles
FV1206-11
FV1206-12
GE0805C-18
NL1008C-6
NL1008C-7
NL1008C-9
NL1008C-10
NL1008C-12

Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel	
8	4	7	Small quantity standards (see note)	20
				50
				100
				200
				500
				1000
			Standard	3000

Note: Please consult individual model data sheet to determine device per reel availability.

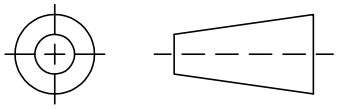
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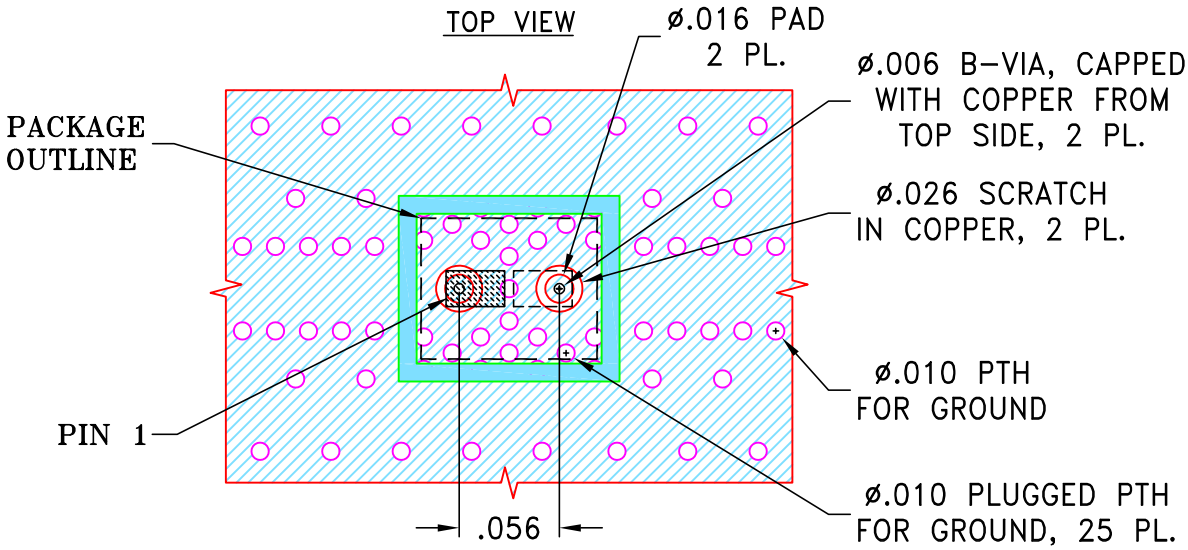
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THIRD ANGLE PROJECTION

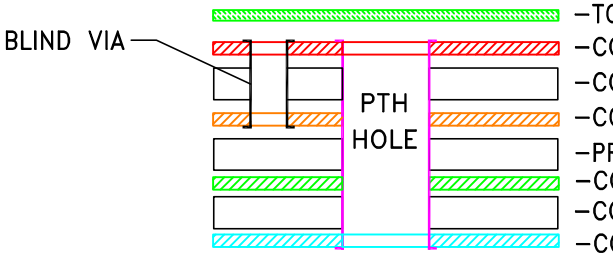


REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-023057	NEW RELEASE	SEP 24	AGS	GT
OR1	NPO-004738	ADDED NL1008C-10 CASE STYLE	OCT 24	AGS	GT
OR2	ECO-023820	NOTES & TOLERANCES UPDATED	NOV 24	AGS	GT

SUGGESTED MOUNTING CONFIGURATION FOR NL1008C-9,NL1008C-10 CASE STYLE



STACK-UP DIAGRAM



-TOP-SOLDERMASK.
-COPPER LAYER 1, .5 OZ. + PLATING
-CORE, .0051 MEGTRON 6 R-5775(G), CLOTH STYLE:1080
-COPPER LAYER 2, .5 OZ. + PLATING.
-PREPREG, .0041 MEGTRON 6 R-5670(G)
-COPPER LAYER 3, .5 OZ.
-CORE, .0051 MEGTRON 6 R-5775(G), CLOTH STYLE:1080
-COPPER LAYER 4, .5 OZ. + PLATING

1. TOTAL FINISHED THICKNESS 0.0228±.004
2. B-VIA PRESENT FROM COPPER LAYER 1 TO COPPER LAYER 2.
3. PTH PRESENT FROM COPPER LAYER 1 TO COPPER LAYER 4.
4. INDICATED ON TOP VIEW PTH's ARE PLUGGED WITH EPOXY AND CAPPED WITH COPPER FROM TOP SIDE.
5. L4 IS CONTINUOUS GROUND PLANE.

NOTES:

1. DIMENSIONS ARE IN INCHES ; [CD] DENOTES CRITICAL DIMENSIONS.
2. PCB IS MULTILAYER, SEE STACK-UP DIAGRAM AND SHEET-2 FOR ILLUSTRATION.
3. TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR MEGTRON 6 R-5775(G), CLOTH STYLE:1080 WITH DIELECTRIC THICKNESS .0051; COPPER: 1/2 OZ.+PLATING.
   FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
4. COPPER LAYER 4 OF THE PCB ARE CONTINUOUS GROUND PLANE.

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

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	AGS	14 SEP 24
TOLERANCES ON:	CHECKED	MD	16 SEP 24
2 PL DECIMALS ±	APPROVED	GTP	17 SEP 24
3 PL DECIMALS ± .002			
ANGLES ±			
FRACTIONS ±			

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

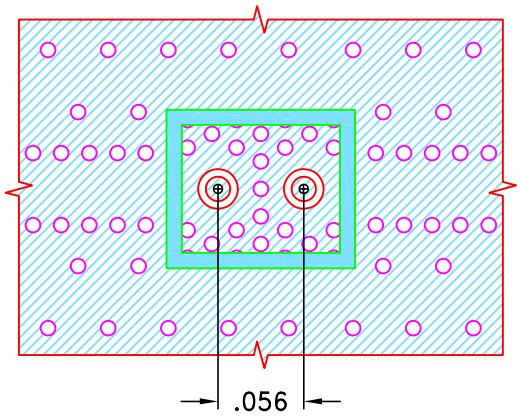
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Brooklyn NY 11235

PL, NL1008C-9/10, TB-LFHK-XXXX+

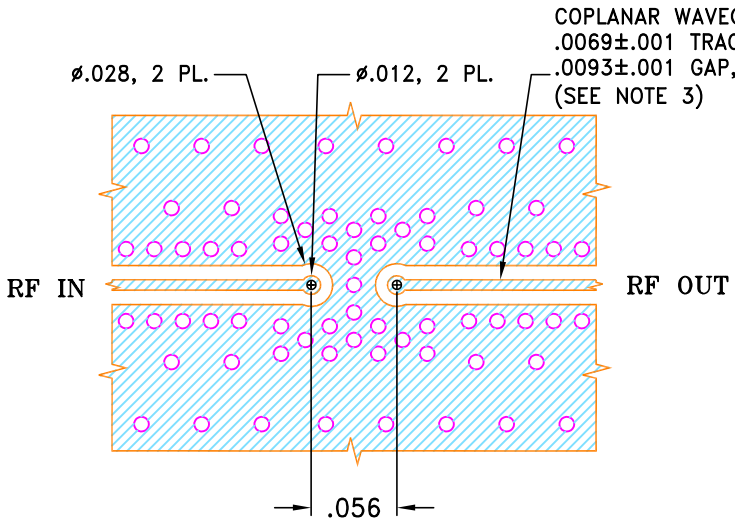
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A	15542	98-PL-798	OR2

FILE:	SCALE:	SHEET:
98-PL-798	9:1	1 OF 2

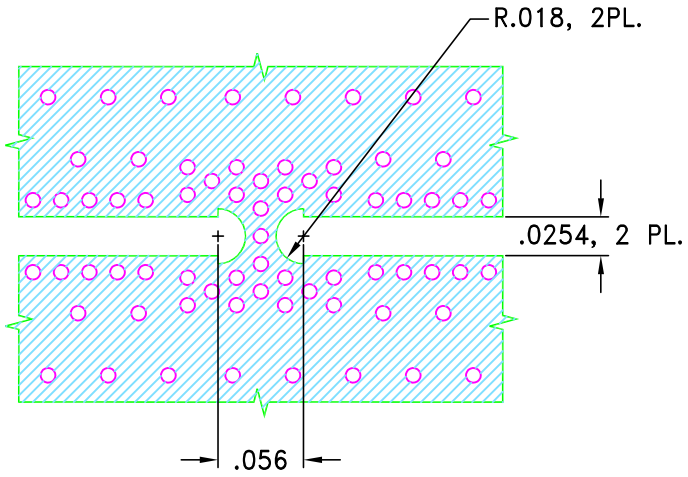
LAYER 1, SOLDER MASK & PTH



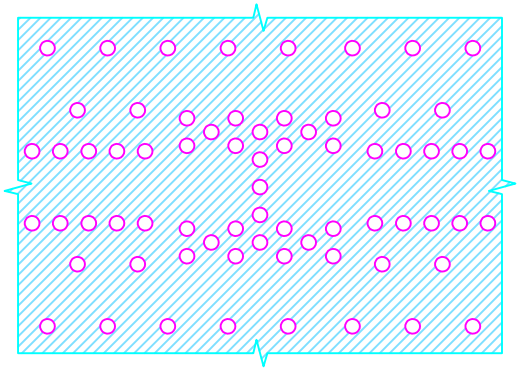
LAYER 2, B-VIA & PTH



LAYER 3 & PTH



LAYER 4 & PTH



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ASHEETA2.DWG REV:A DATE: 01/12/94

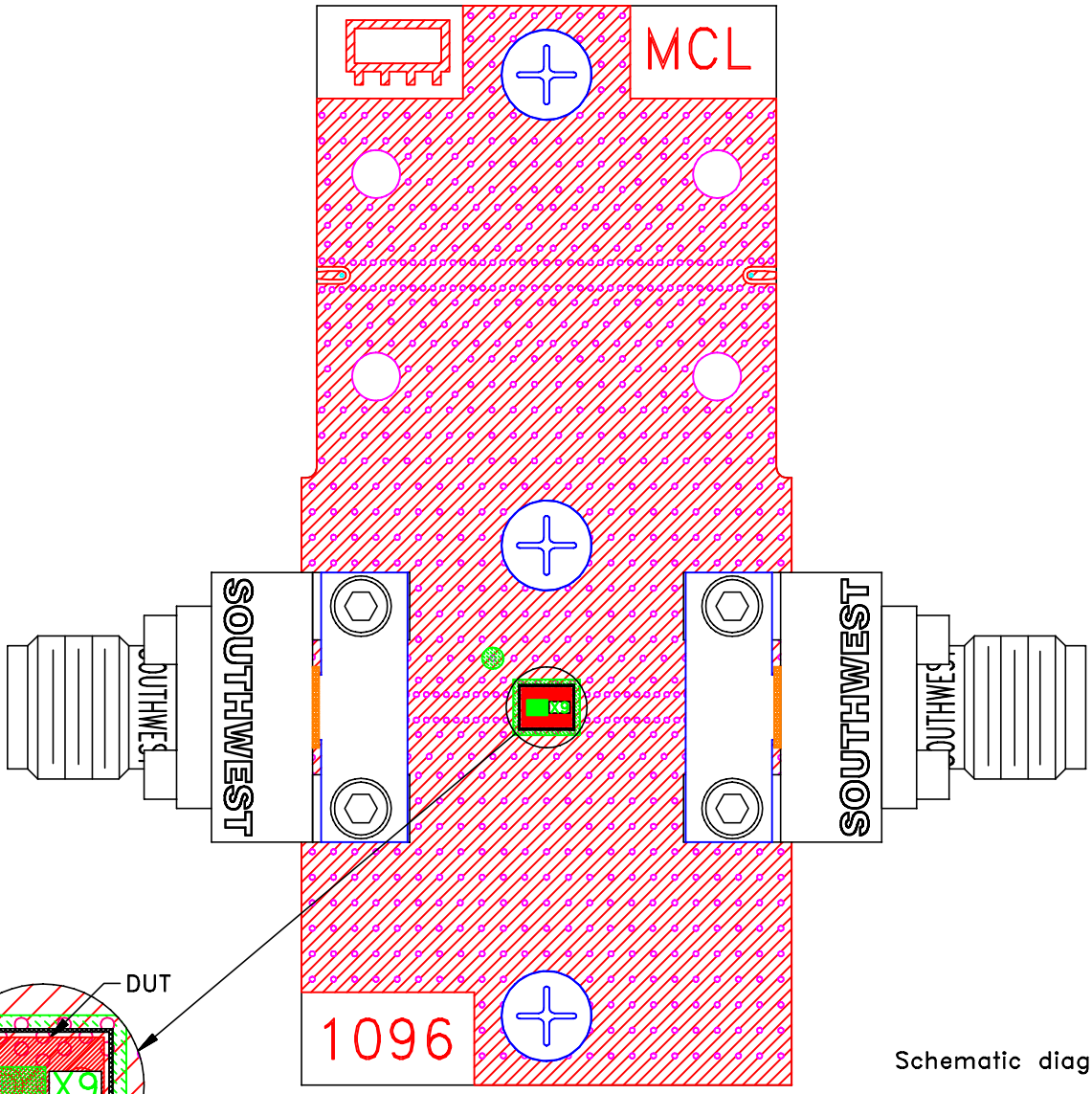
ALL DIMENSIONS ARE IN INCHES EXCEPT OTHERWISE SPECIFIED

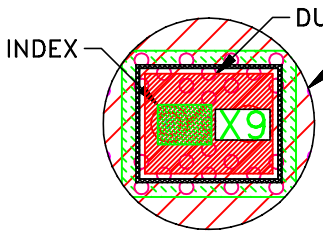
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FILE:	SCALE:	SHEET:
98-PL-798	7.7:1	2 OF 2

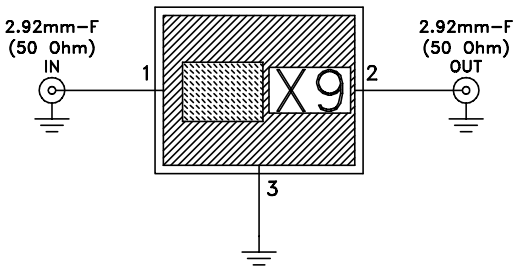
Evaluation Board and Circuit

TB-LFHK-320+

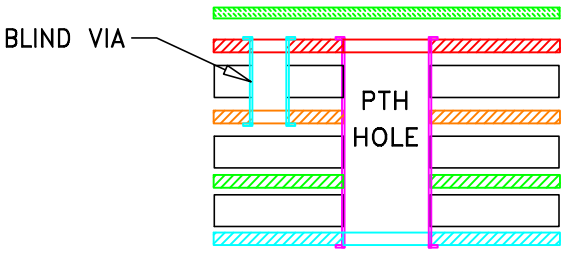




Schematic diagram



STACK-UP DIAGRAM



-TOP-SOLDERMASK.
-COPPER LAYER 1, .5 OZ. + PLATING
-CORE, .0051 MEGTRON 6 R-5775(G), CLOTH STYLE:1080
-COPPER LAYER 2, .5 OZ. + PLATING.
-PREPREG, .0041 MEGTRON 6 R-5670(G)
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-CORE, .0051 MEGTRON 6 R-5775(G), CLOTH STYLE:1080
-COPPER LAYER 4, .5 OZ. + PLATING

Notes:

1. PCB Material: MEGTRON-6 R5775(G) OR Equivalent, Dielectric Constant=3.6
2. Total finished thickness: .023 inch
3. 50 Ohm 2.92mm Female End Launch Connector.

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Environmental Specifications ENV06T10

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	-55° to 125° C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 125° 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
Solder Reflow Heat	Sn-Pb Eutectic Process 225°C peak Pb-Free Process 245° - 250°C peak	J-STD-020C, Table 4-1, 4-2 and 5-2, Figure 5-1
Solderability	10X Magnification	J-STD-002, Test B,B1, 95% Coverage
Thermal Shock	-55° to +125°C, 15 min dwell,250 cycles	MIL-STD-202, Method 107
Bend Test	1mm, deflection for 5 seconds Span of bending: 2.75"	--
High Temp Storage	125°C to 1000 Hrs	---

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