LTCC SURFACE MOUNT

High Pass Filter

HFHK-8400+

50Ω 9000 to 18500 MHz

THE BIG DEAL

- Insertion Loss, Typ. 1.4 dB
- Stopband Rejection, Typ. 72 dB
- Passband Return Loss, Typ. 14 dB
- 1008 Surface Mount Footprint
- Power Handling: 7.5 W
- Shielded Construction: Prevents De-Tuning & EMI
- Protected by US Patents 11,638,370 and 11,744,057

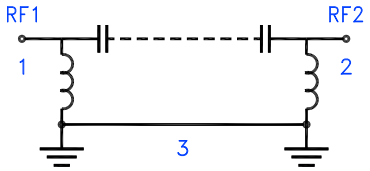
APPLICATIONS

- Radar, EW, ECM Defense Systems
- Test and Measurement Equipment
- Telecommunications and Broadband Wireless Systems



Generic photo used for illustration purposes only

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

The HFHK-8400+ is a passive RF component designed for signal conditioning in high-frequency circuits. It utilizes ceramic-based construction to achieve stable electrical behaviour 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	F4-F5	9000 - 11000	—	2	—	dB
		F5-F6	11000 - 16500	—	1.4	2.1	
		F6-F7	16500 - 18500	—	2.5	—	
	Freq. Cut-Off[4]	Fc	8250	—	3	—	
	Return Loss	F4-F5	9000 - 11000	—	9	—	
		F5-F6	11000 - 16500	—	14	—	
		F6-F7	16500 - 18500	—	13	—	
Stopband	Rejection	DC-F1	DC - 2200	63	72	—	dB
		F1-F2	2200 - 4000	40	48	—	
		F2-F3	4000 - 6400	20	29	—	

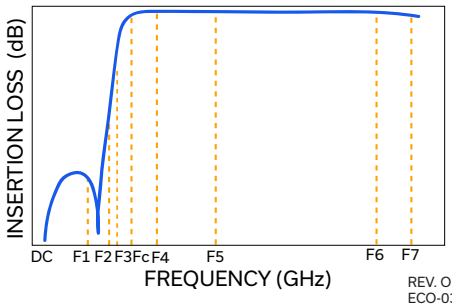
1. Tested in Evaluation Board P/N TB-HFHK-8400+.
2. This filter is bi-directional RF1 and RF2 ports may be interchanged, see S-Parameters for actual performance.
3. This component should not be used as a DC-block. In applications where DC voltage and/or current is present at either the input or output 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]	7.5 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 0.5 W at +125°C.

TYPICAL FREQUENCY RESPONSE



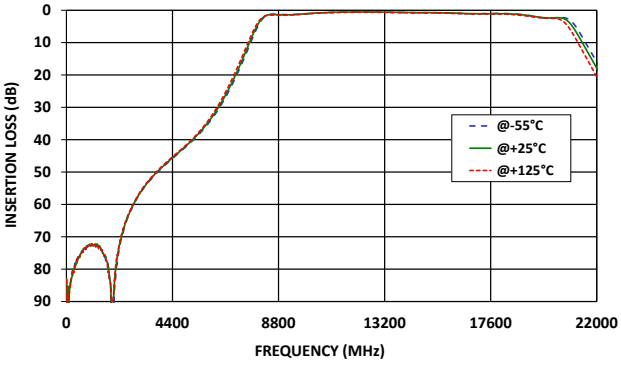
High Pass Filter

HFHK-8400+

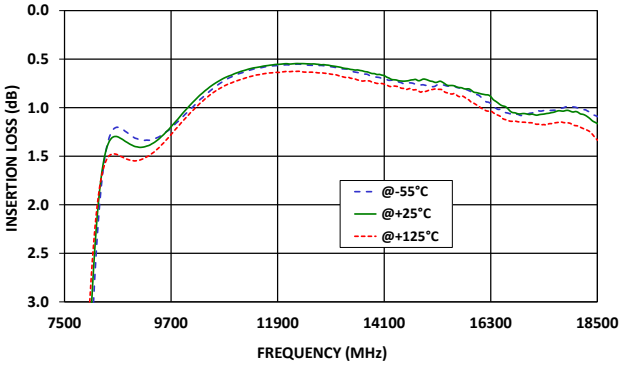
50Ω 9000 to 18500 MHz

TYPICAL PERFORMANCE GRAPHS

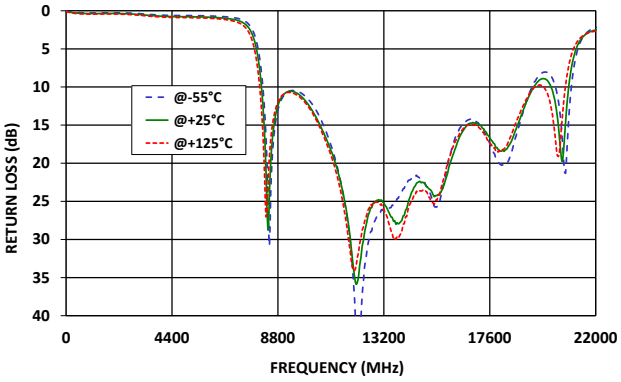
HFHK-8400+
INSERTION LOSS



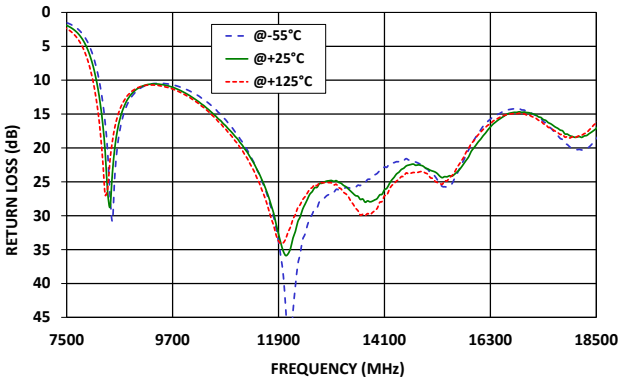
HFHK-8400+
INSERTION LOSS (Zoomed)



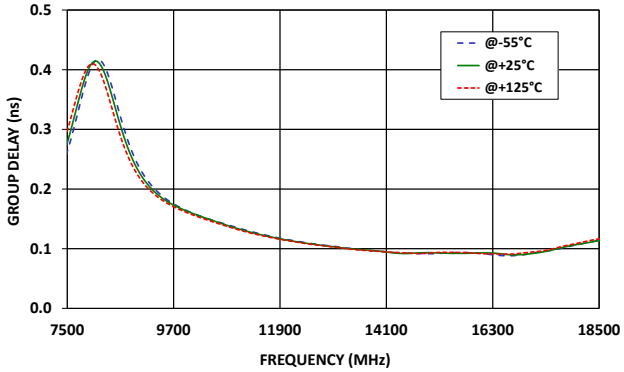
HFHK-8400+
RETURN LOSS



HFHK-8400+
RETURN LOSS (Zoomed)



HFHK-8400+
GROUP DELAY



High Pass Filter

HFHK-8400+

50Ω 9000 to 18500 MHz

FUNCTIONAL DIAGRAM

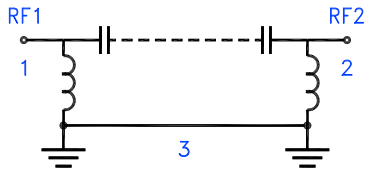
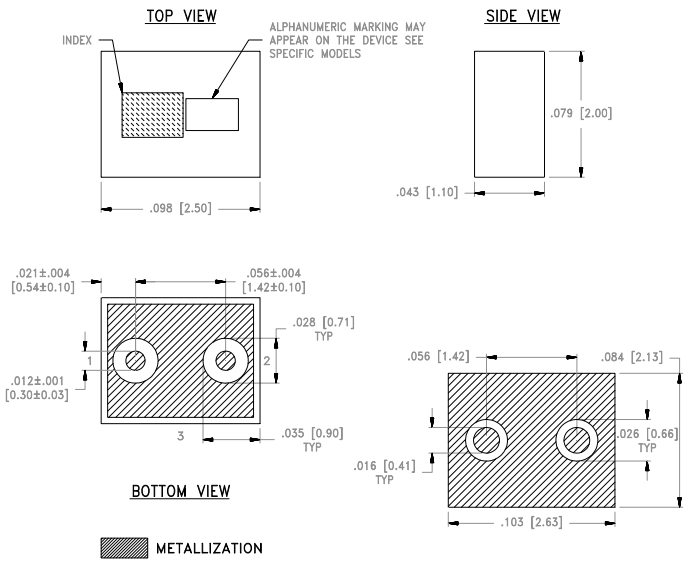


Figure 1. HFHK-8400+ Functional Diagram

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

PRODUCT MARKING*: X1

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

High Pass Filter

HFHK-8400+

50Ω 9000 to 18500 MHz

SUGGESTED PCB LAYOUT

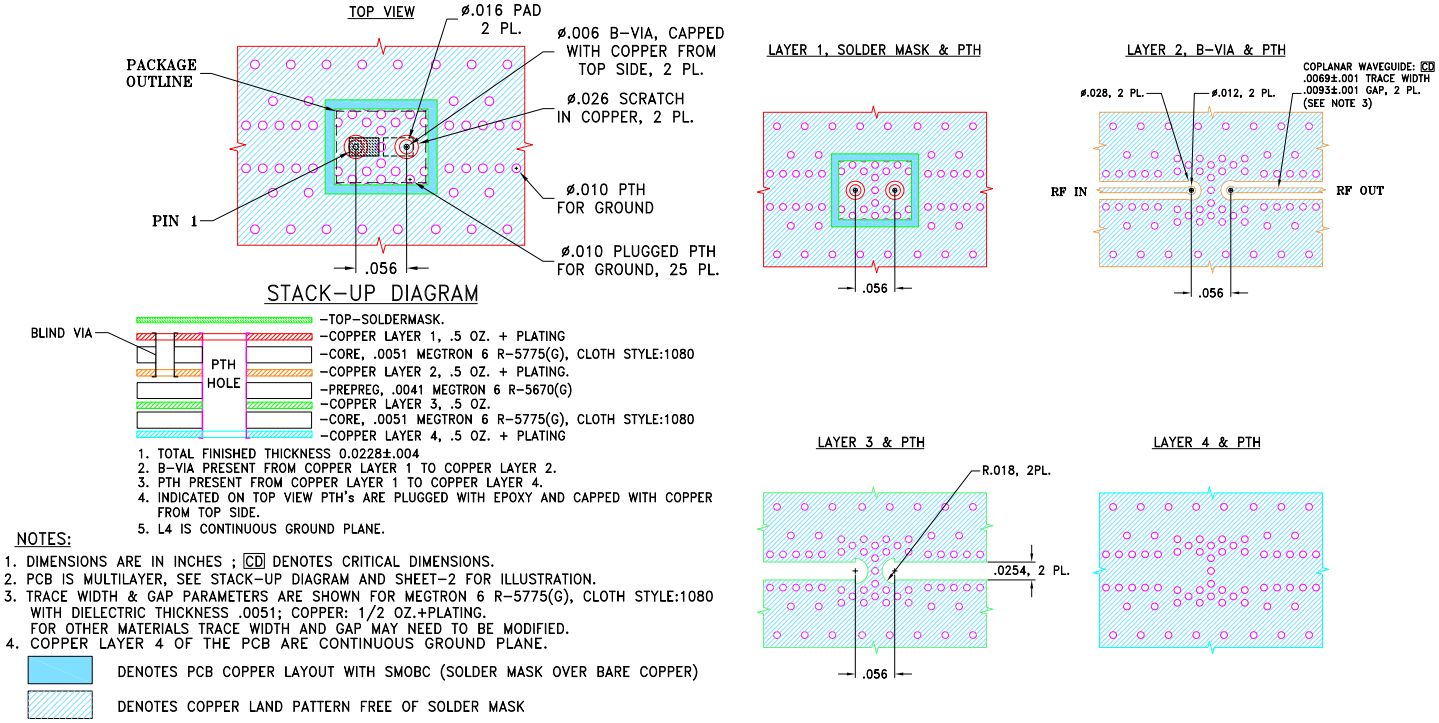


Figure 2. Suggested PCB Layout

High Pass Filter

HFHK-8400+

50Ω 9000 to 18500 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-10 Lead Finish: Tin Over Nickel Plating
RoHS/REACH Status	Compliant
Tape and Reel	F75
Suggested Layout for PCB Design	PL-798
Evaluation Board	TB-HFHK-8400+ 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 High Pass Filter HFHK-8400+

Typical Performance Data

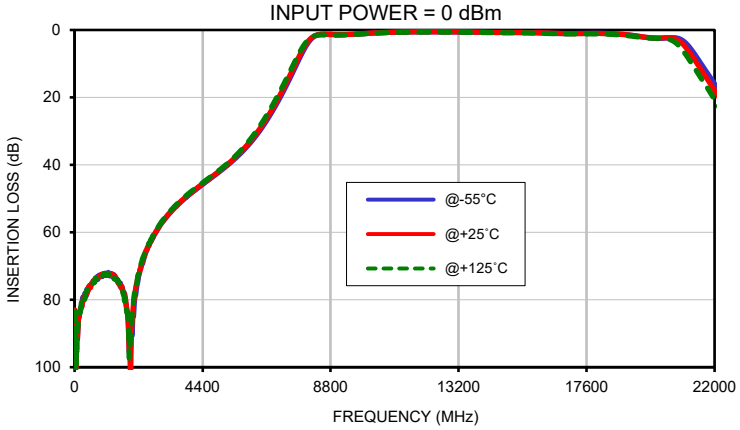
FREQ.	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
(MHz)	(dB)			(dB)			(dB)		
	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C
10	85.52	83.01	83.37	0.04	0.07	0.09	0.07	0.09	0.12
20	99.78	86.19	89.31	0.05	0.08	0.10	0.05	0.08	0.11
30	99.90	92.75	102.75	0.06	0.09	0.12	0.06	0.09	0.12
40	91.66	100.24	90.52	0.07	0.11	0.13	0.07	0.10	0.13
50	96.08	99.45	95.41	0.08	0.12	0.14	0.08	0.11	0.14
60	94.28	94.52	99.01	0.09	0.12	0.15	0.08	0.11	0.15
70	94.89	91.52	95.57	0.09	0.13	0.16	0.09	0.12	0.16
100	90.94	91.73	88.93	0.11	0.15	0.18	0.11	0.14	0.18
150	85.27	85.30	85.92	0.14	0.19	0.23	0.15	0.18	0.23
300	79.15	80.41	81.11	0.21	0.26	0.32	0.21	0.25	0.32
400	78.79	78.11	77.66	0.23	0.29	0.36	0.24	0.29	0.36
550	75.63	76.43	75.97	0.25	0.32	0.39	0.27	0.32	0.40
650	74.55	74.31	74.42	0.26	0.34	0.41	0.28	0.34	0.41
800	73.97	73.33	72.93	0.28	0.35	0.42	0.29	0.35	0.43
950	73.14	72.42	73.04	0.29	0.36	0.44	0.30	0.36	0.44
1000	72.65	72.88	72.55	0.28	0.36	0.43	0.30	0.37	0.45
1100	72.76	72.78	72.25	0.28	0.36	0.43	0.29	0.36	0.44
1350	72.58	72.88	73.73	0.28	0.36	0.43	0.29	0.36	0.44
1400	73.18	73.27	74.03	0.27	0.35	0.42	0.28	0.36	0.44
1650	76.87	77.41	77.14	0.26	0.35	0.42	0.26	0.35	0.43
1700	77.94	78.12	78.66	0.26	0.35	0.42	0.26	0.35	0.43
1900	96.48	95.12	96.16	0.25	0.35	0.42	0.25	0.35	0.44
1950	88.60	89.74	89.21	0.25	0.35	0.42	0.25	0.35	0.44
2000	85.09	83.65	82.82	0.26	0.35	0.43	0.26	0.35	0.44
2100	78.59	76.46	75.57	0.26	0.36	0.43	0.25	0.35	0.44
2200	73.00	72.41	72.33	0.27	0.36	0.44	0.25	0.36	0.45
2400	67.26	67.15	66.42	0.28	0.38	0.46	0.27	0.38	0.47
2500	64.99	64.51	64.36	0.29	0.39	0.48	0.28	0.39	0.48
2700	61.57	61.17	60.82	0.31	0.42	0.51	0.31	0.42	0.52
2950	57.75	57.71	57.50	0.35	0.47	0.56	0.35	0.46	0.56
3000	57.21	57.03	56.86	0.37	0.48	0.57	0.36	0.47	0.58
3250	54.53	54.38	54.05	0.42	0.55	0.64	0.42	0.53	0.64
3500	52.35	52.02	51.77	0.49	0.62	0.72	0.48	0.58	0.70
3700	50.66	50.44	50.13	0.53	0.66	0.77	0.53	0.62	0.75
4000	48.44	48.29	47.97	0.57	0.71	0.82	0.59	0.68	0.81
4325	46.29	46.06	45.80	0.61	0.75	0.87	0.64	0.72	0.85
4600	44.50	44.30	44.03	0.62	0.77	0.89	0.66	0.74	0.88
4900	42.54	42.32	42.05	0.62	0.78	0.90	0.67	0.76	0.90
5000	41.88	41.65	41.40	0.62	0.78	0.89	0.67	0.76	0.90
5200	40.51	40.24	39.98	0.63	0.79	0.91	0.67	0.77	0.92
5500	38.28	37.95	37.61	0.64	0.80	0.93	0.67	0.79	0.94
5600	37.48	37.12	36.76	0.65	0.81	0.94	0.67	0.79	0.95
5750	36.22	35.82	35.39	0.67	0.83	0.96	0.68	0.81	0.97
6000	33.87	33.40	32.85	0.68	0.85	0.99	0.71	0.85	1.02
6400	29.46	28.85	28.06	0.75	0.92	1.08	0.80	0.95	1.14
7000	21.03	20.27	19.21	0.93	1.17	1.40	0.96	1.20	1.46
7300	16.09	15.25	14.15	1.17	1.48	1.80	1.22	1.50	1.85
7900	5.58	4.94	4.29	3.93	4.91	6.31	3.98	4.75	6.10
8250	1.86	1.75	1.75	13.32	16.52	22.01	12.85	15.14	18.68
9000	1.32	1.40	1.54	11.34	11.13	11.05	11.37	10.85	10.81
10000	1.06	1.02	1.11	11.41	12.05	12.33	11.48	12.24	12.58
11000	0.67	0.65	0.73	17.65	18.31	18.98	17.76	18.89	19.72
12000	0.56	0.55	0.63	38.86	35.26	33.99	29.59	26.64	26.85
13000	0.58	0.57	0.65	26.55	24.80	25.16	34.02	28.10	27.67
14000	0.69	0.66	0.75	23.37	26.93	28.04	23.11	26.98	28.46
15000	0.77	0.72	0.82	23.17	23.09	23.86	21.25	25.35	26.66
16500	1.02	0.97	1.09	14.89	15.70	15.46	14.95	16.02	15.79
17000	1.07	1.06	1.15	14.41	14.70	14.96	14.36	14.88	15.16
18000	0.99	1.04	1.18	20.05	18.30	18.36	20.96	18.17	18.40
18500	1.09	1.16	1.33	18.67	17.12	16.30	19.40	17.61	16.60

Typical Performance Data

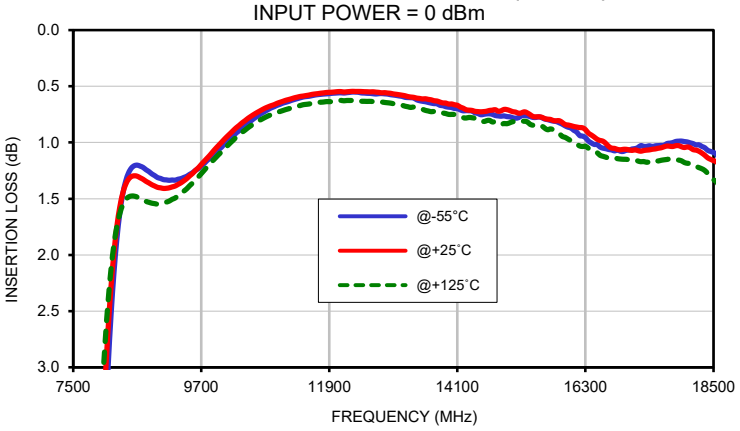
FREQ. (MHz)	GROUP DELAY (nsec)		
	@-55°C	@+25°C	@+125°C
9000	0.23	0.23	0.22
9500	0.19	0.18	0.18
9800	0.17	0.17	0.17
10000	0.16	0.16	0.16
10200	0.16	0.16	0.15
10300	0.15	0.15	0.15
10500	0.15	0.15	0.15
10600	0.15	0.14	0.14
10800	0.14	0.14	0.14
10900	0.14	0.14	0.14
11000	0.14	0.13	0.13
11200	0.13	0.13	0.13
11400	0.13	0.13	0.12
11500	0.12	0.12	0.12
11600	0.12	0.12	0.12
11700	0.12	0.12	0.12
11800	0.12	0.12	0.12
11900	0.12	0.12	0.12
12000	0.12	0.12	0.11
12200	0.11	0.11	0.11
12400	0.11	0.11	0.11
12600	0.11	0.11	0.11
12800	0.11	0.11	0.10
12900	0.10	0.10	0.10
13000	0.10	0.10	0.10
13200	0.10	0.10	0.10
13400	0.10	0.10	0.10
13600	0.10	0.10	0.10
13800	0.10	0.10	0.10
14000	0.10	0.10	0.10
14200	0.09	0.09	0.09
14400	0.09	0.09	0.09
14600	0.09	0.09	0.09
14800	0.09	0.09	0.09
15000	0.09	0.09	0.09
15500	0.09	0.09	0.09
16000	0.09	0.09	0.09
17000	0.09	0.09	0.09
18000	0.11	0.11	0.11
18500	0.11	0.11	0.12

Typical Performance Curves

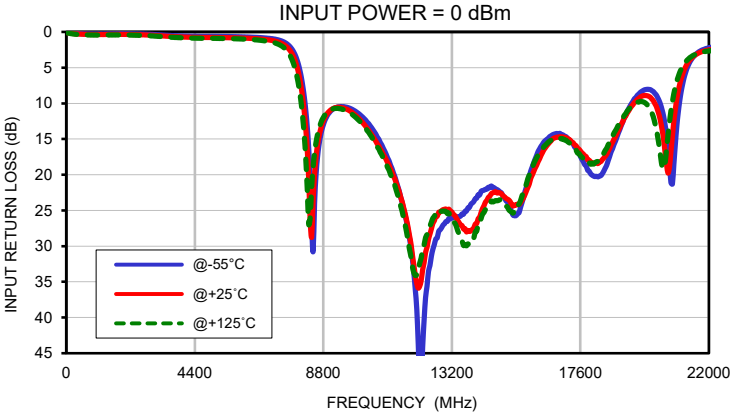
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



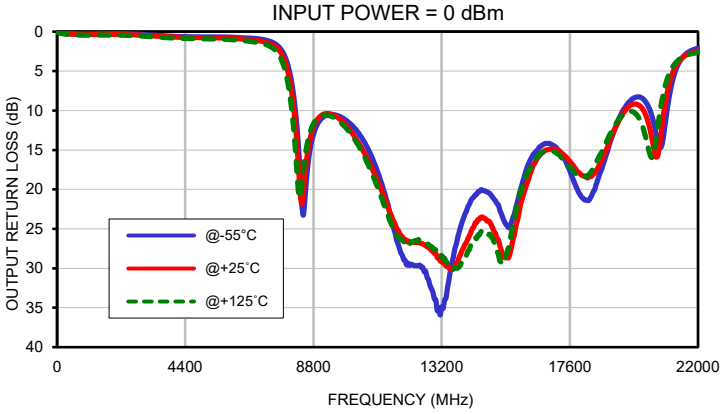
INSERTION LOSS vs. TEMPERATURE (Zoomed)
INPUT POWER = 0 dBm



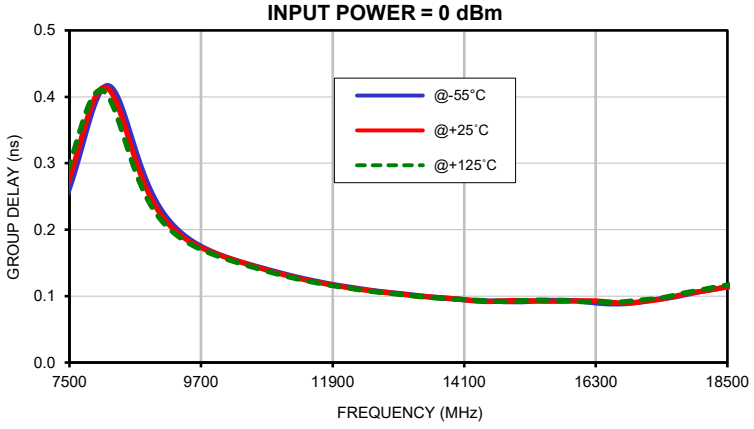
INPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm

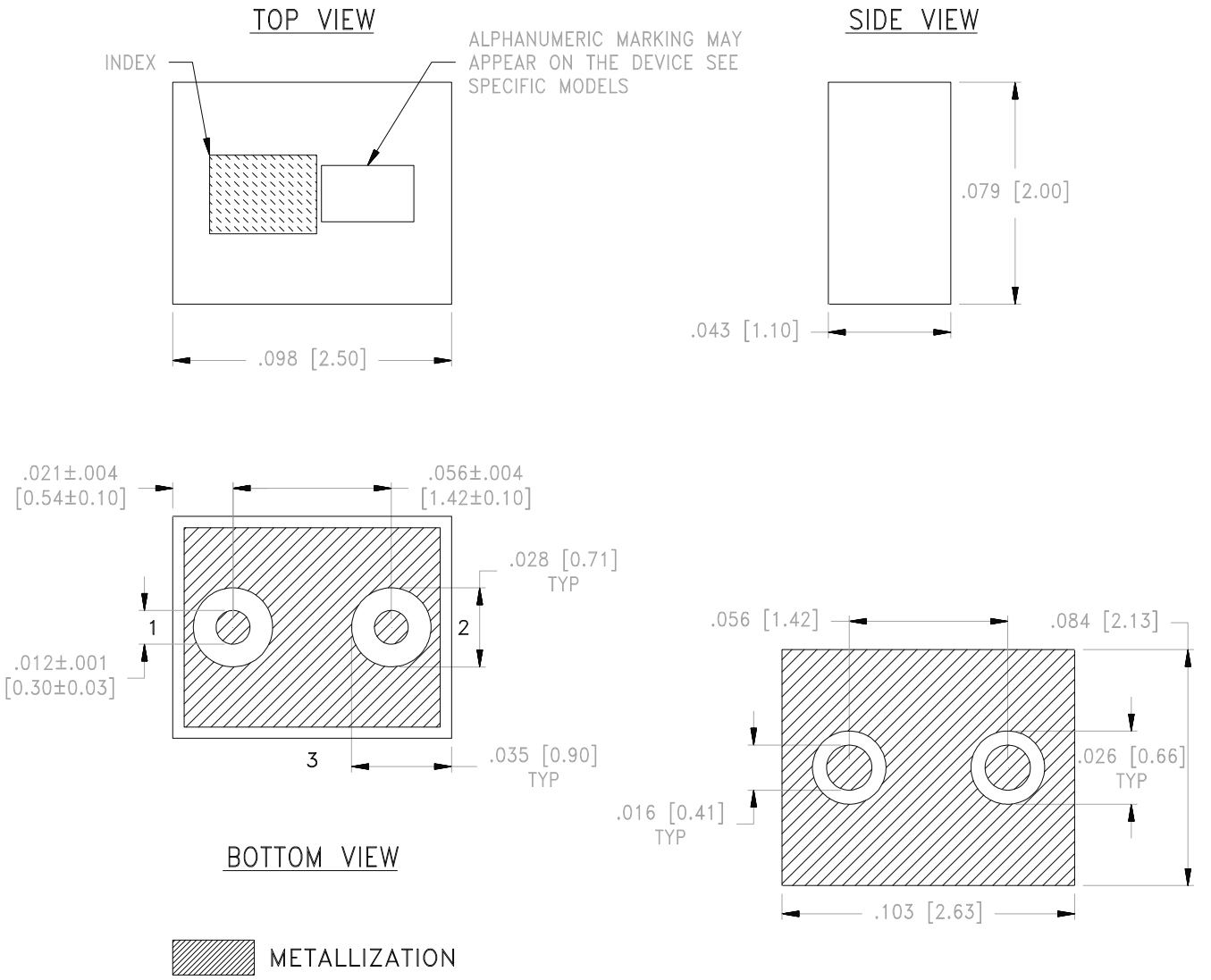


GROUP DELAY vs. TEMPERATURE
INPUT POWER = 0 dBm



Case Style NL

Outline Dimensions NL1008C-10



SUGGESTED LAYOUT FOR PCB LAND PATTERN

PATTERN TO BE WITHIN ±.002

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

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

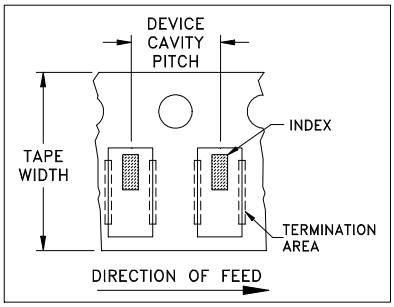


ILLUSTRATION 1

Applicable Case Styles
FV1206-1
FV1206-3

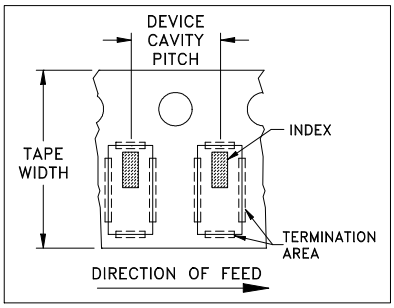


ILLUSTRATION 2

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

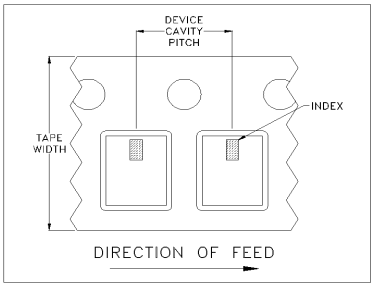


ILLUSTRATION 3

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.

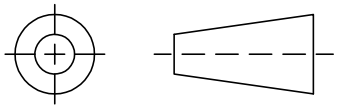
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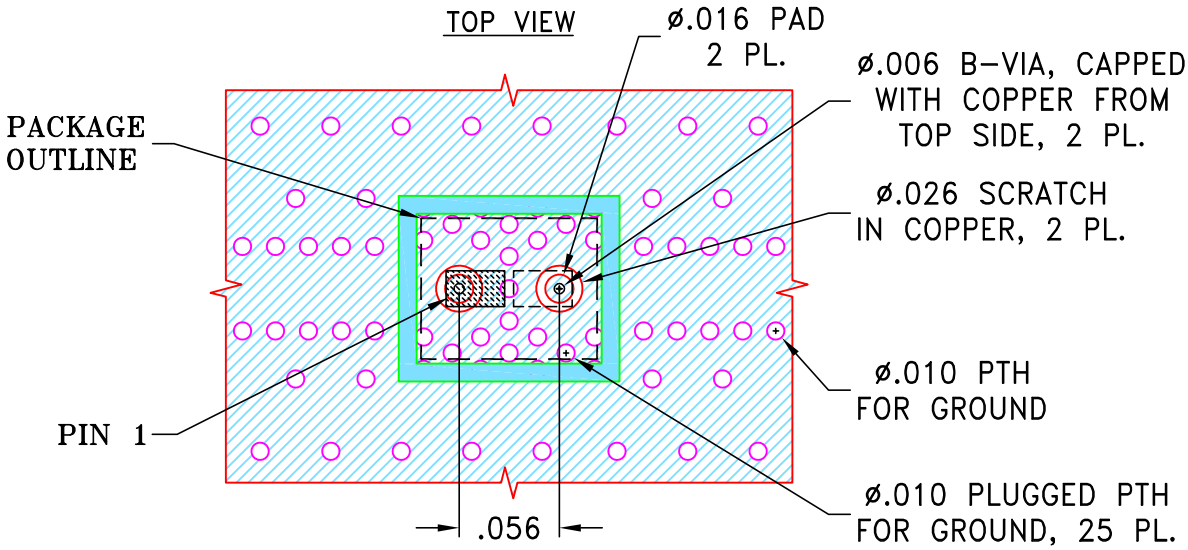
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THIRD ANGLE PROJECTION

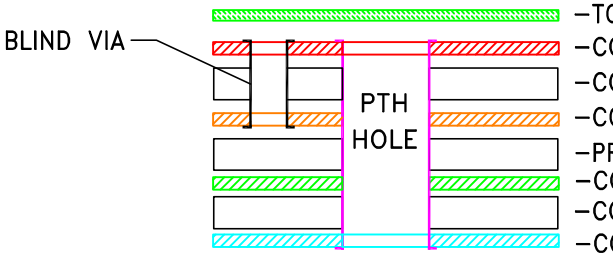


REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-023057	NEW RELEASE	SEP 24	AGS	GT
OR1	NPO-004738	ADDED NL1008C-10 CASE STYLE	OCT 24	AGS	GT
OR2	ECO-023820	NOTES & TOLERANCES UPDATED	NOV 24	AGS	GT

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

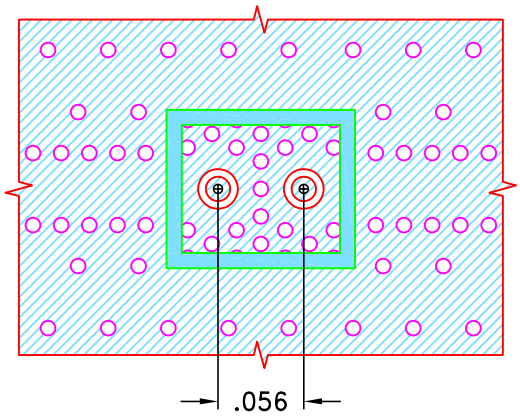
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PL, NL1008C-9/10, TB-LFHK-XXXX+

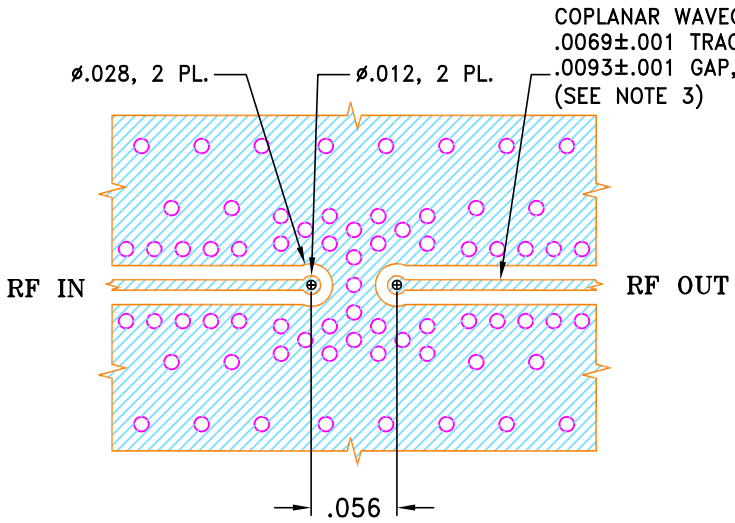
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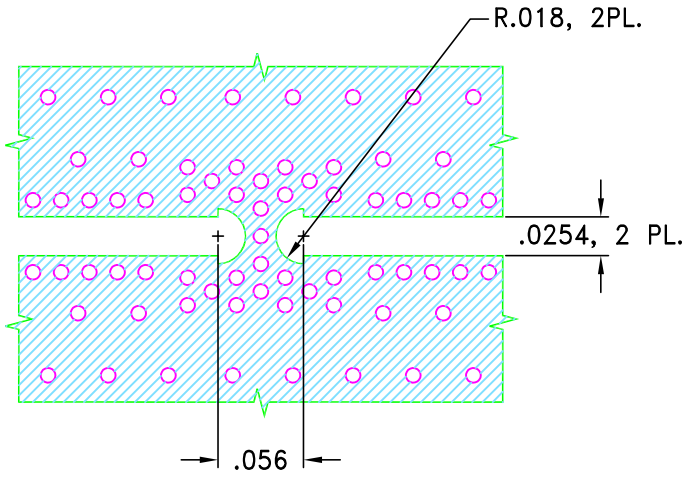
LAYER 1, SOLDER MASK & PTH



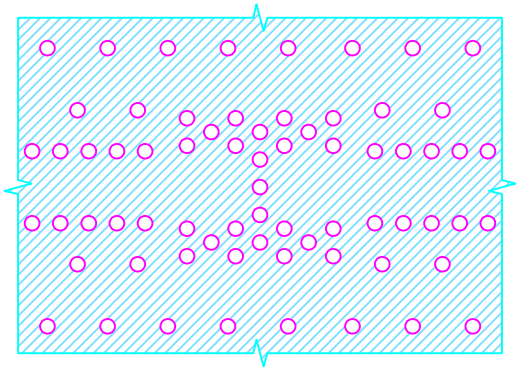
LAYER 2, B-VIA & PTH



LAYER 3 & PTH



LAYER 4 & PTH



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

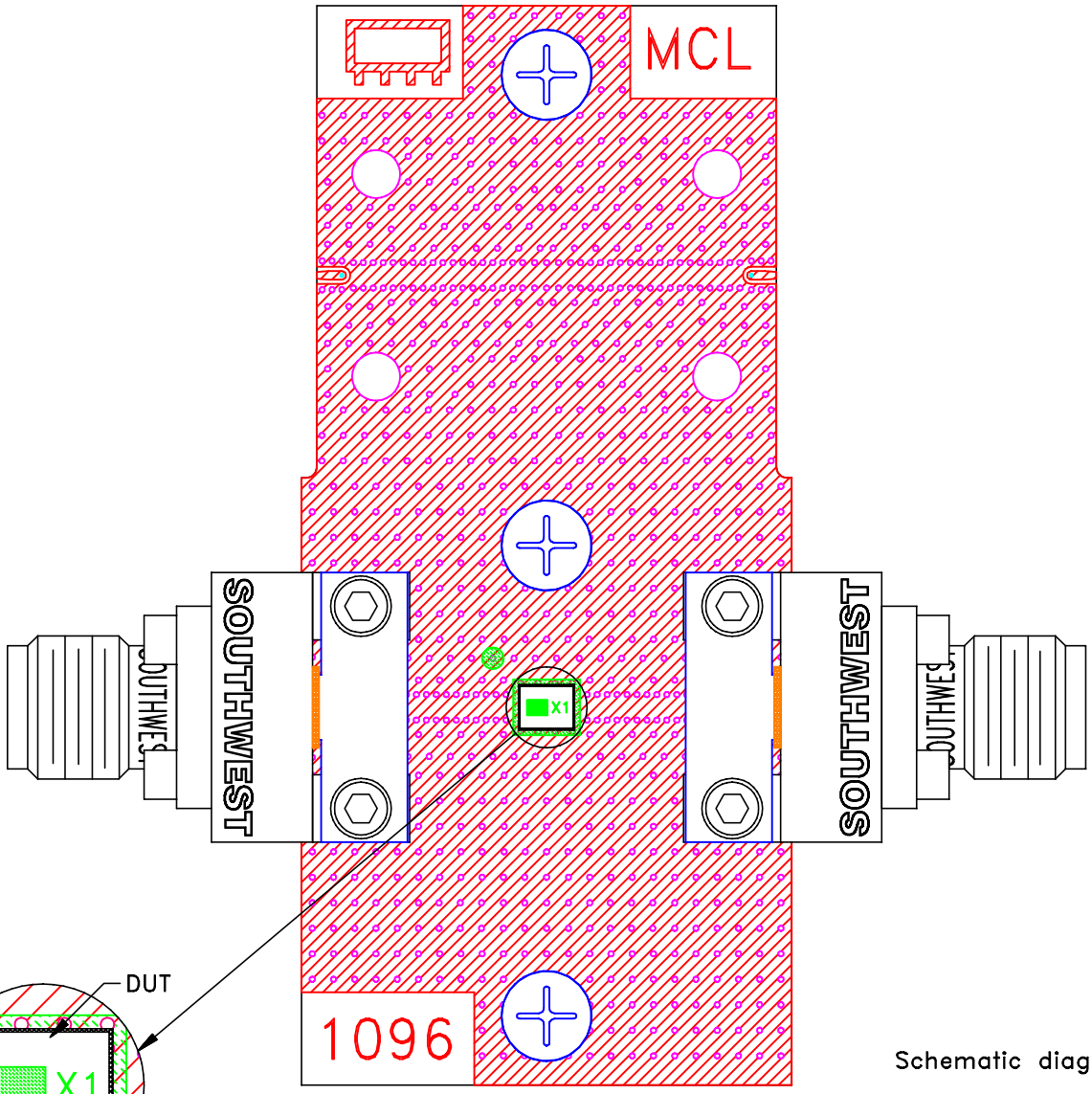
ALL DIMENSIONS ARE IN INCHES EXCEPT OTHERWISE SPECIFIED

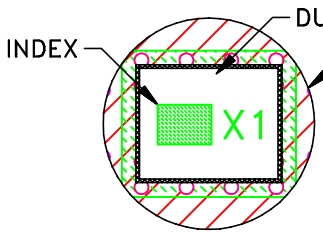
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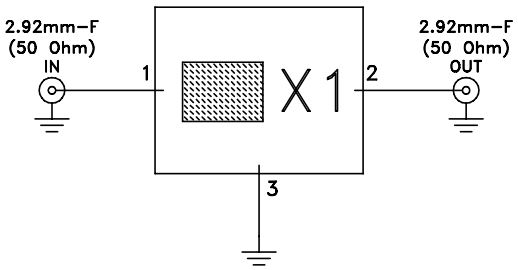
Evaluation Board and Circuit

TB-HFHK-8400+

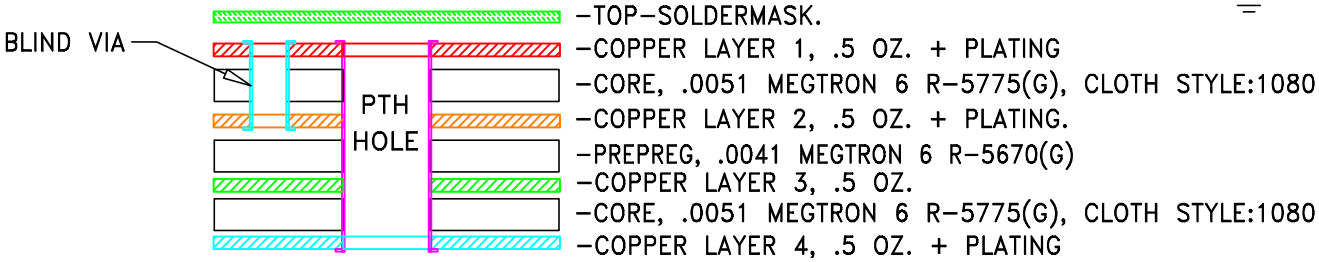




Schematic diagram



STACK-UP DIAGRAM



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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