LTCC SURFACE MOUNT

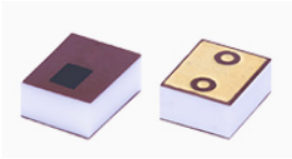
Thru-Line

TPHK-33+

50Ω DC to 30 GHz

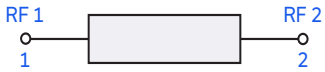
THE BIG DEAL

- Ultra-Wideband DC to 30 GHz Performance
- Compact 1008 Package
- Low Insertion Loss, Typ. <1.5 dB Through 30 GHz
- Ideal LTCC Thru-Line Solution for Placeholder and Signal Routing Applications



Generic photo used for illustration purposes only

FUNCTIONAL DIAGRAM



APPLICATIONS

- RF Signal Routing and Interconnection
- Placeholder Element for NL1008C-10 Footprint Components
- Broadband Signal Transmission Paths from DC to 30 GHz
- Prototyping and Evaluation of RF Signal Chains

PRODUCT OVERVIEW

The TPHK-33+ is a 50Ω LTCC surface-mount thru-line design to provide low-loss signal transmission from DC to 30 GHz. It serves as an ideal placeholder or routing element in RF signal chains, particularly in designs anticipating filter insertion or frequency-selective components. Fabricated using advanced LTCC technology, the device offers consistent electrical performance, excellent impedance matching and repeatability in high-frequency applications. Its compact 1008 footprint enables dense PCB layouts while minimizing parasitic effects, making it well-suited for modern high-frequency and high-density system designs.

KEY FEATURES

Features	Advantages
Wideband DC to 30 GHz Operation	Supports multi-band and broadband system architectures.
Low Insertion Loss	Minimizes signal degradation across the full frequency range.
Surface Mountable	Suitable for very high-volume automated assembly process.

Thru-Line

TPHK-33+

50Ω DC to 30 GHz

ELECTRICAL SPECIFICATIONS[1,2] AT +25 °C, Z_0 = 50Ω

Parameter		F#	Frequency (GHz)	Min.	Typ.	Max.	Units
Passband	Insertion Loss	DC–F1	DC–10	–	0.3	0.6	dB
		F1–F2	10–20	–	1.2	1.45	
		F2–F3	20–30	–	1.5	2.1	
	Return Loss	DC–F1	DC–10	10	20	–	dB
		F1–F2	10–20	10	15	–	
		F2–F3	20–30	–	11	–	

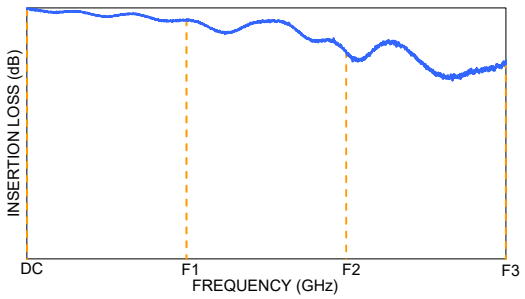
1. Tested in Evaluation Board P/N TB-TPHK-33C+ with the connector and feedline effects de-embedded using the 2X Thru IEEE P370 method.
2. Bi-directional, RF1 and RF2 ports can be interchanged, see S-Parameters for performance.

ABSOLUTE MAXIMUM RATINGS[3]

Parameter	Ratings
Operating Temperature	-55 °C to +125 °C
Storage Temperature	-55 °C to +125 °C
Input Power[4]	10 W

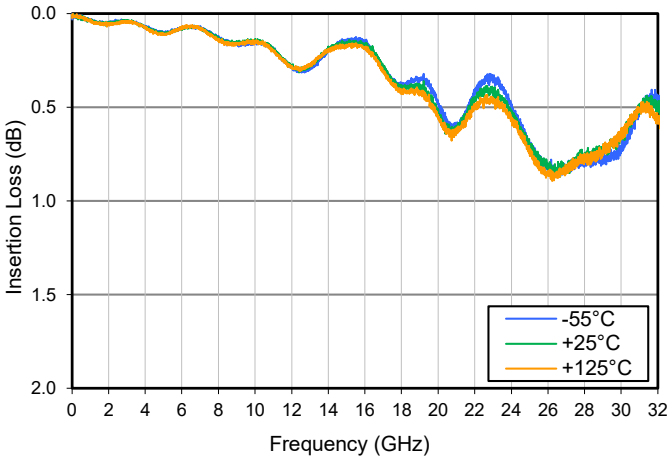
3. Permanent damage may occur if any of these limits are exceeded.
4. Power rating applies only to signals within the passband. Power rating above +25 °C operating temperature decreases linearly to 6.9 W at +125 °C.

TYPICAL FREQUENCY RESPONSE

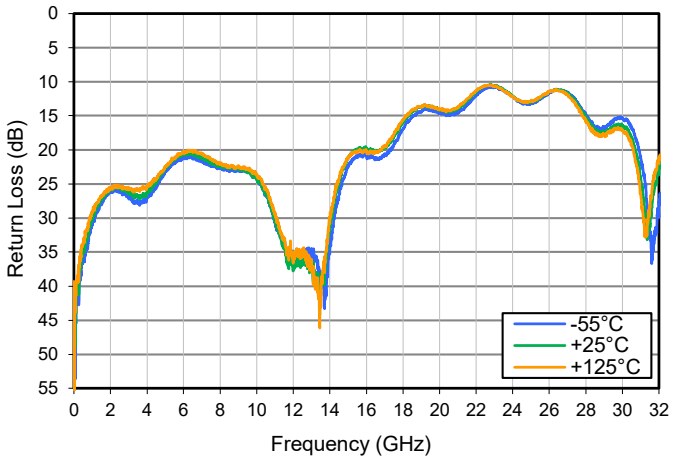


TYPICAL PERFORMANCE GRAPHS

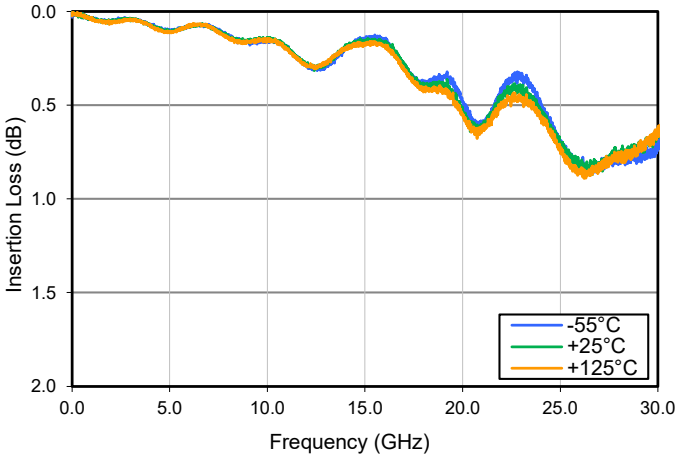
INSERTION LOSS



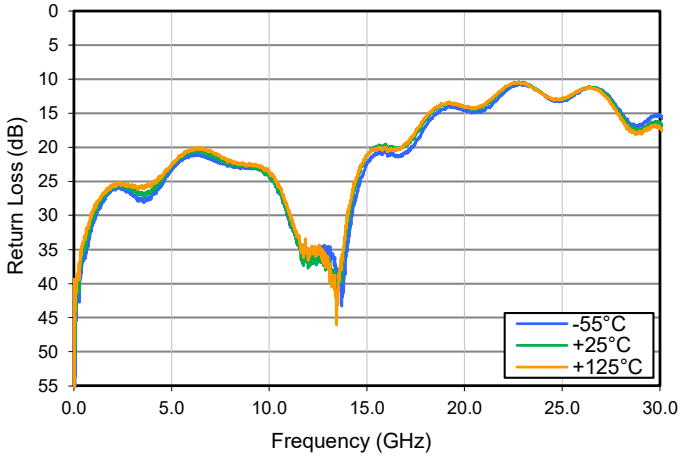
RETURN LOSS



INSERTION LOSS (PASSBAND)



RETURN LOSS (PASSBAND)



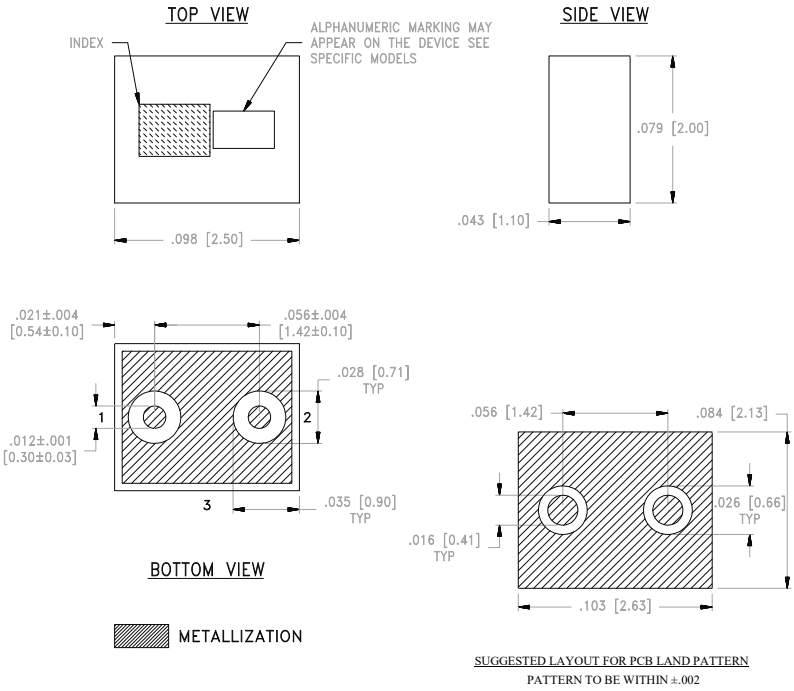
FUNCTIONAL DIAGRAM

Figure 1. TPHK-33+ 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



Dimensions are in inches [mm]. Tolerances: 2 Pl.±.01; 3 Pl.±.005

PRODUCT MARKING*: V1

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

SUGGESTED PCB LAYOUT (PL-798)

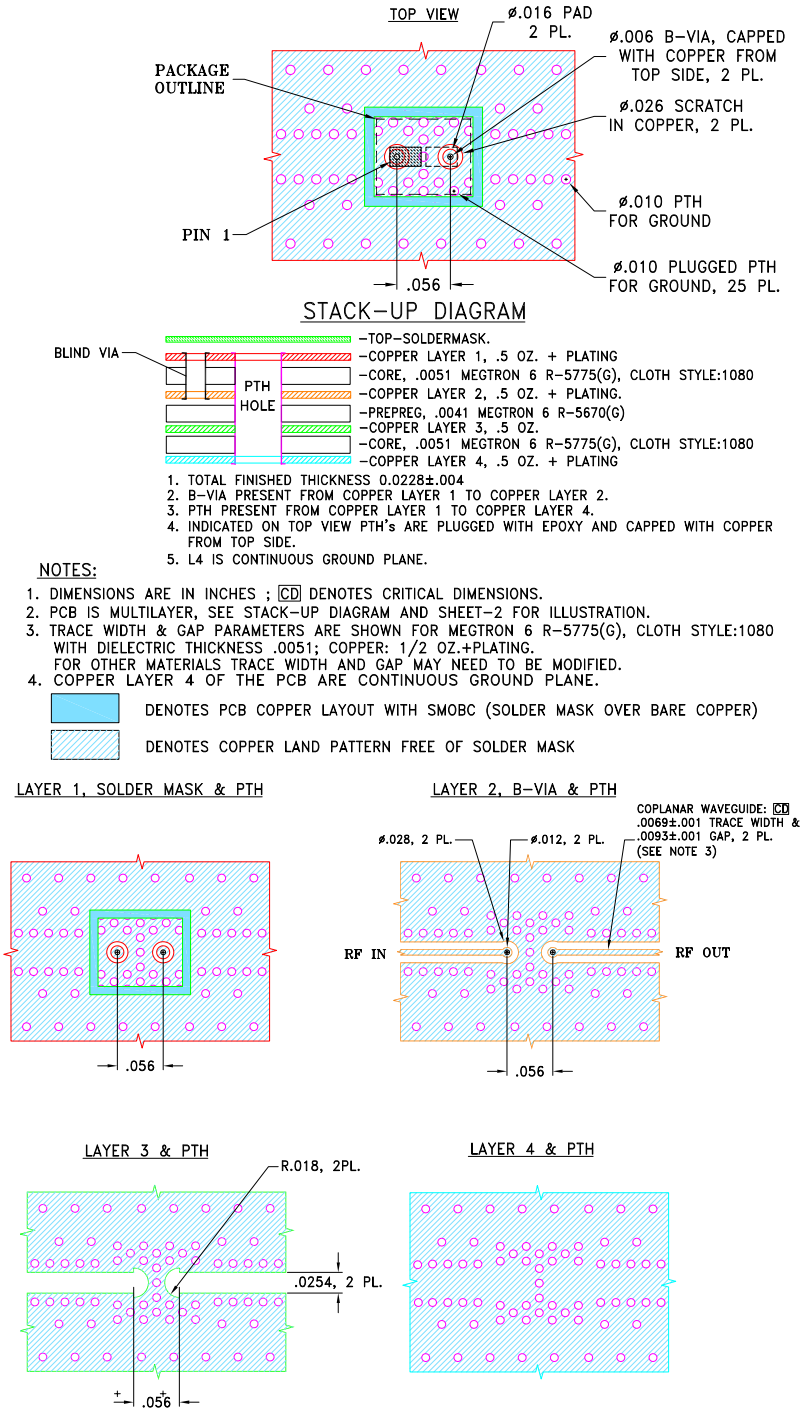


Figure 2. Suggested PCB Layout PL-798

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: Gold over Electroless Nickel
RoHS Status	Compliant
Tape and Reel	F75
Suggested Layout for PCB Design	PL-798
Evaluation Board	TB-TPHK-33C+ 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

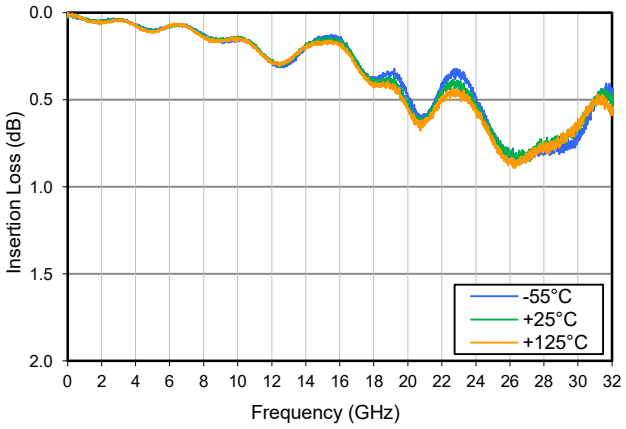
Ceramic Thru-Line TPHK-33+

Typical Performance Data

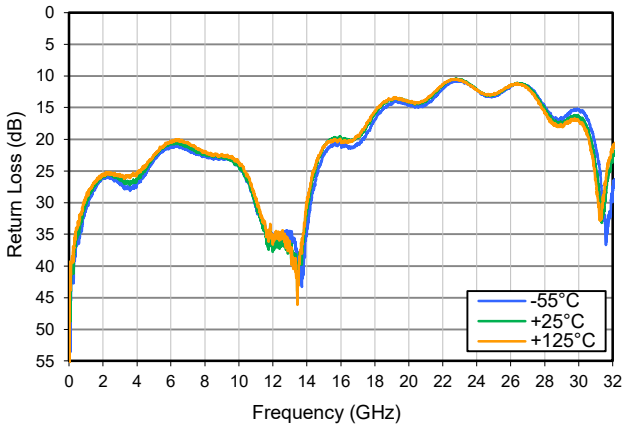
FREQUENCY (GHz)	INSERTION LOSS (dB)			RETURN LOSS (dB)		
	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C
0.01	0.03	0.02	0.02	39.90	39.37	39.29
0.05	0.01	0.01	0.01	55.68	50.67	45.66
0.10	0.02	0.01	0.02	44.01	42.29	39.88
0.50	0.02	0.02	0.02	36.34	35.14	33.91
1.00	0.03	0.03	0.03	30.73	29.93	29.01
2.00	0.05	0.06	0.06	26.07	25.74	25.63
3.00	0.04	0.04	0.05	26.97	26.21	25.72
4.00	0.07	0.07	0.07	27.00	26.36	25.44
5.00	0.10	0.11	0.11	23.31	22.72	22.52
6.00	0.08	0.08	0.07	21.12	20.58	20.29
7.00	0.08	0.08	0.08	21.75	21.24	20.62
8.00	0.13	0.14	0.14	22.56	22.30	21.97
9.00	0.15	0.15	0.16	22.96	22.70	22.52
10.00	0.15	0.14	0.15	24.14	24.16	23.64
11.00	0.19	0.19	0.20	30.69	30.49	29.53
12.00	0.29	0.29	0.29	35.61	36.82	35.95
13.00	0.29	0.28	0.28	34.50	36.15	36.07
14.00	0.19	0.18	0.19	34.96	31.59	30.48
15.00	0.16	0.16	0.17	22.50	21.24	21.27
16.00	0.14	0.16	0.18	20.84	19.81	20.28
17.00	0.29	0.28	0.31	20.79	19.67	19.50
18.00	0.38	0.39	0.42	16.85	15.92	15.54
19.00	0.35	0.38	0.42	14.42	13.82	13.76
20.00	0.48	0.52	0.55	14.72	14.19	14.12
21.00	0.61	0.63	0.61	14.54	13.97	13.71
22.00	0.40	0.45	0.51	11.99	11.43	11.28
23.00	0.37	0.44	0.48	10.77	10.53	10.59
24.00	0.49	0.53	0.55	12.21	12.12	12.20
25.00	0.69	0.73	0.72	13.18	12.96	12.85
26.00	0.81	0.81	0.84	11.61	11.48	11.44
27.00	0.84	0.82	0.84	11.62	11.73	11.95
28.00	0.79	0.74	0.77	14.84	15.18	15.67
29.00	0.77	0.71	0.73	16.69	17.36	17.78
30.00	0.71	0.64	0.62	15.42	16.52	17.16
31.00	0.53	0.49	0.52	21.18	24.18	26.64
32.00	0.47	0.51	0.59	27.52	22.45	21.10

Typical Performance Data

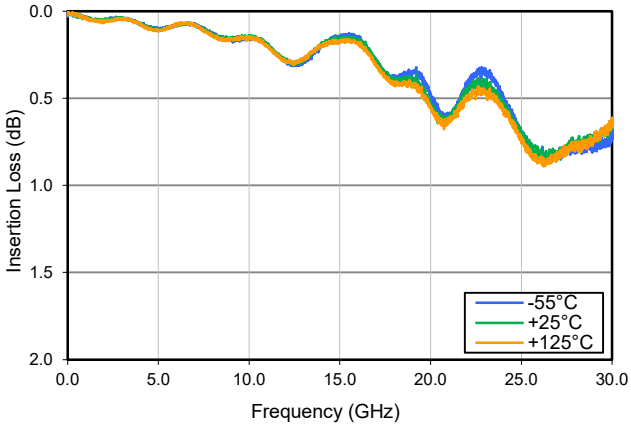
INSERTION LOSS



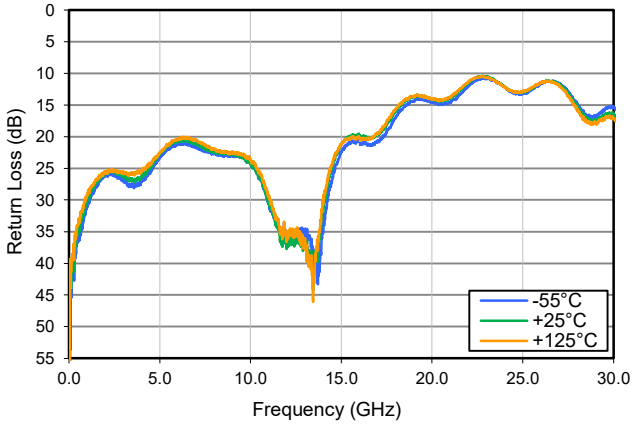
RETURN LOSS



INSERTION LOSS (PASSBAND)

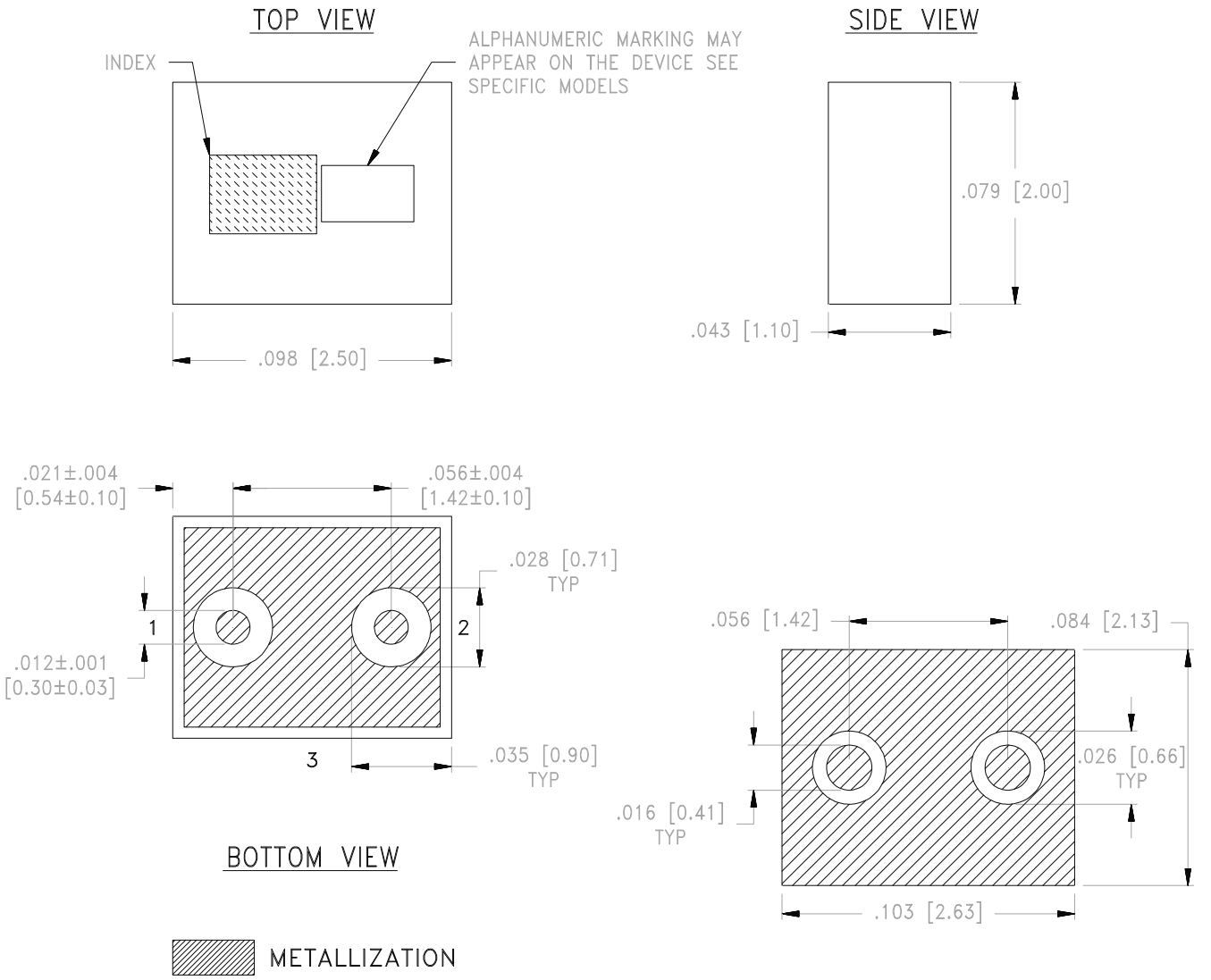


RETURN LOSS (PASSBAND)



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.

Tape & Reel Packaging TR-F75

DEVICE ORIENTATION IN T&R

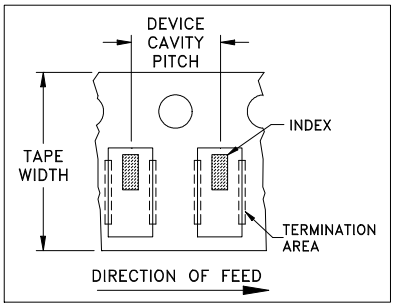


ILLUSTRATION 1

Applicable Case Styles
FV1206-1
FV1206-3

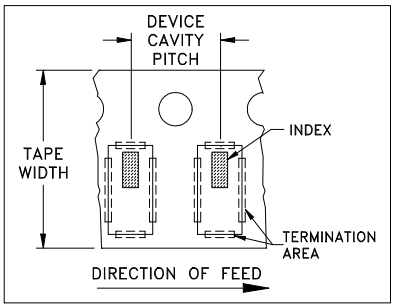


ILLUSTRATION 2

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

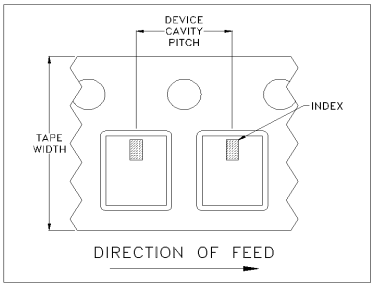


ILLUSTRATION 3

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.

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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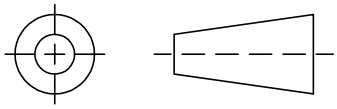
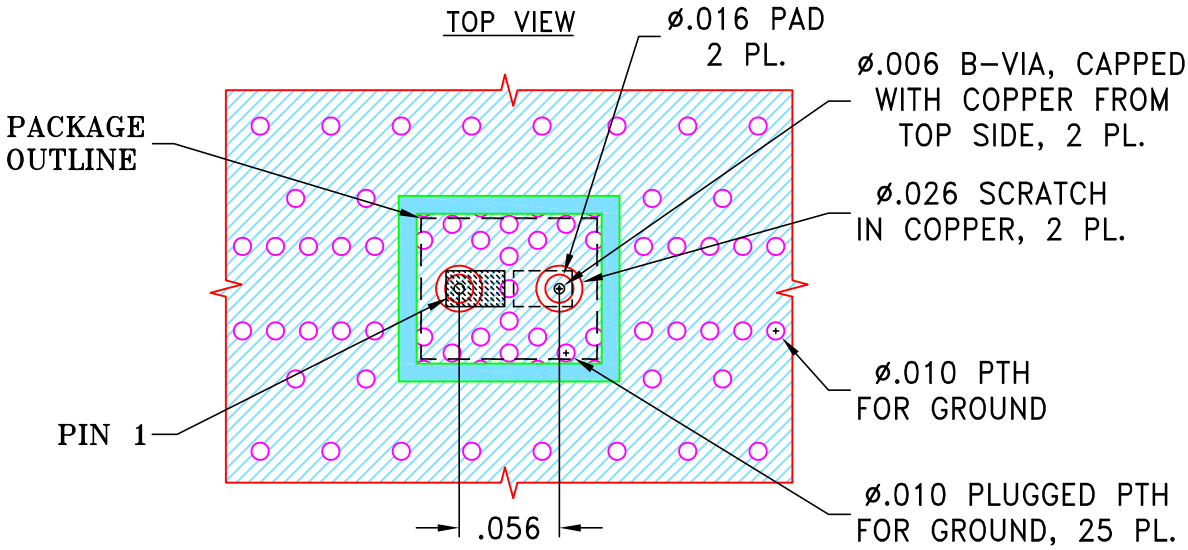
THIRD ANGLE PROJECTION

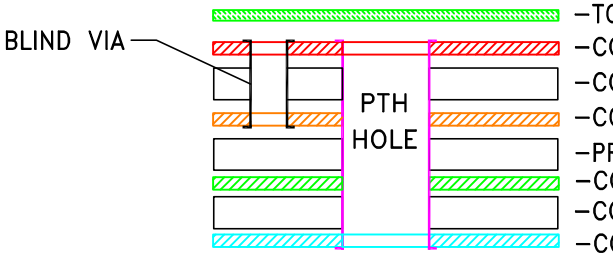


REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-023057	NEW RELEASE	SEP 24	AGS	GT
OR1	NPO-004738	ADDED NL1008C-10 CASE STYLE	OCT 24	AGS	GT
OR2	ECO-023820	NOTES & TOLERANCES UPDATED	NOV 24	AGS	GT

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 ±			

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

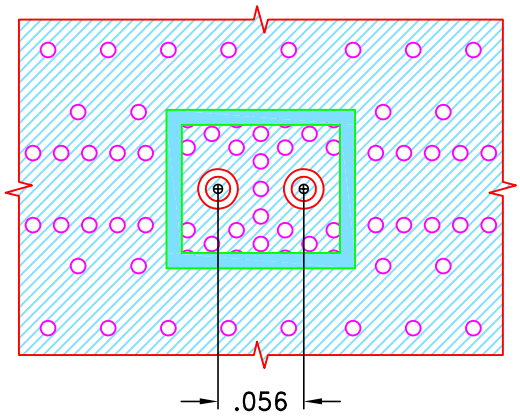
Mini-Circuits®
13 Neptune Avenue
Brooklyn NY 11235

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

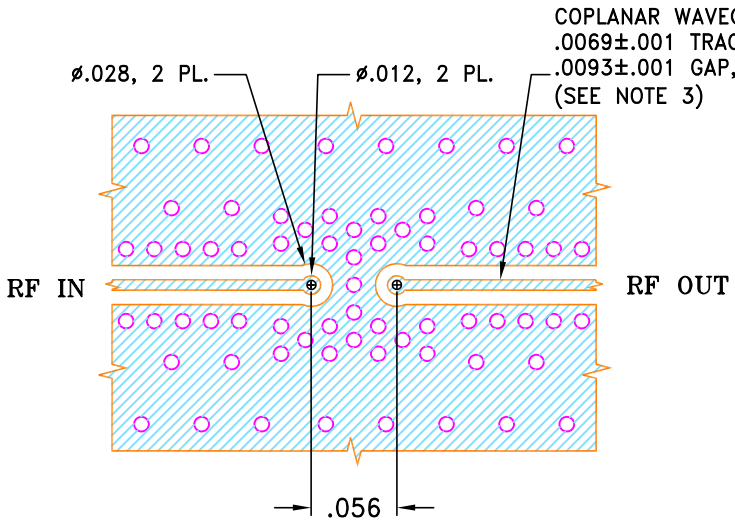
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-798	OR2

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

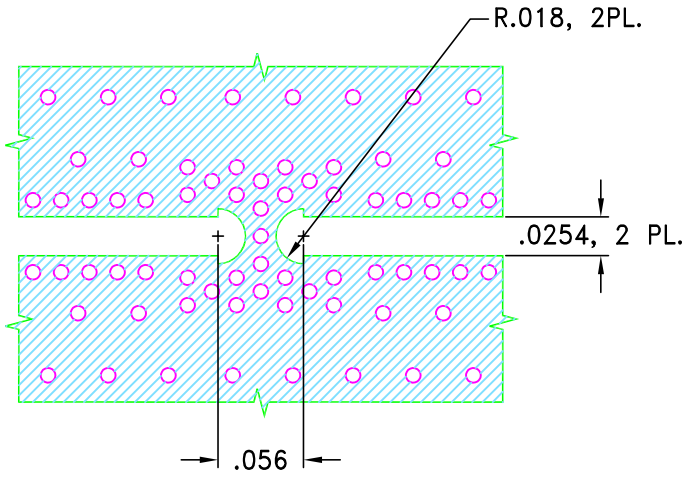
LAYER 1, SOLDER MASK & PTH



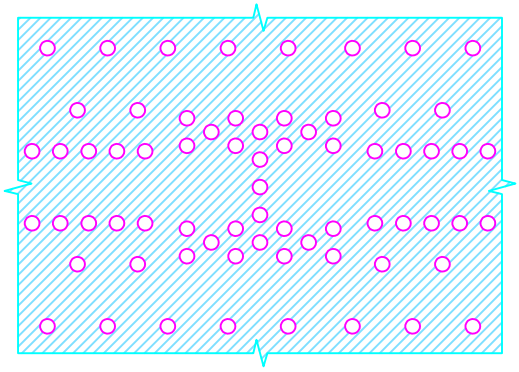
LAYER 2, B-VIA & PTH



LAYER 3 & PTH



LAYER 4 & PTH



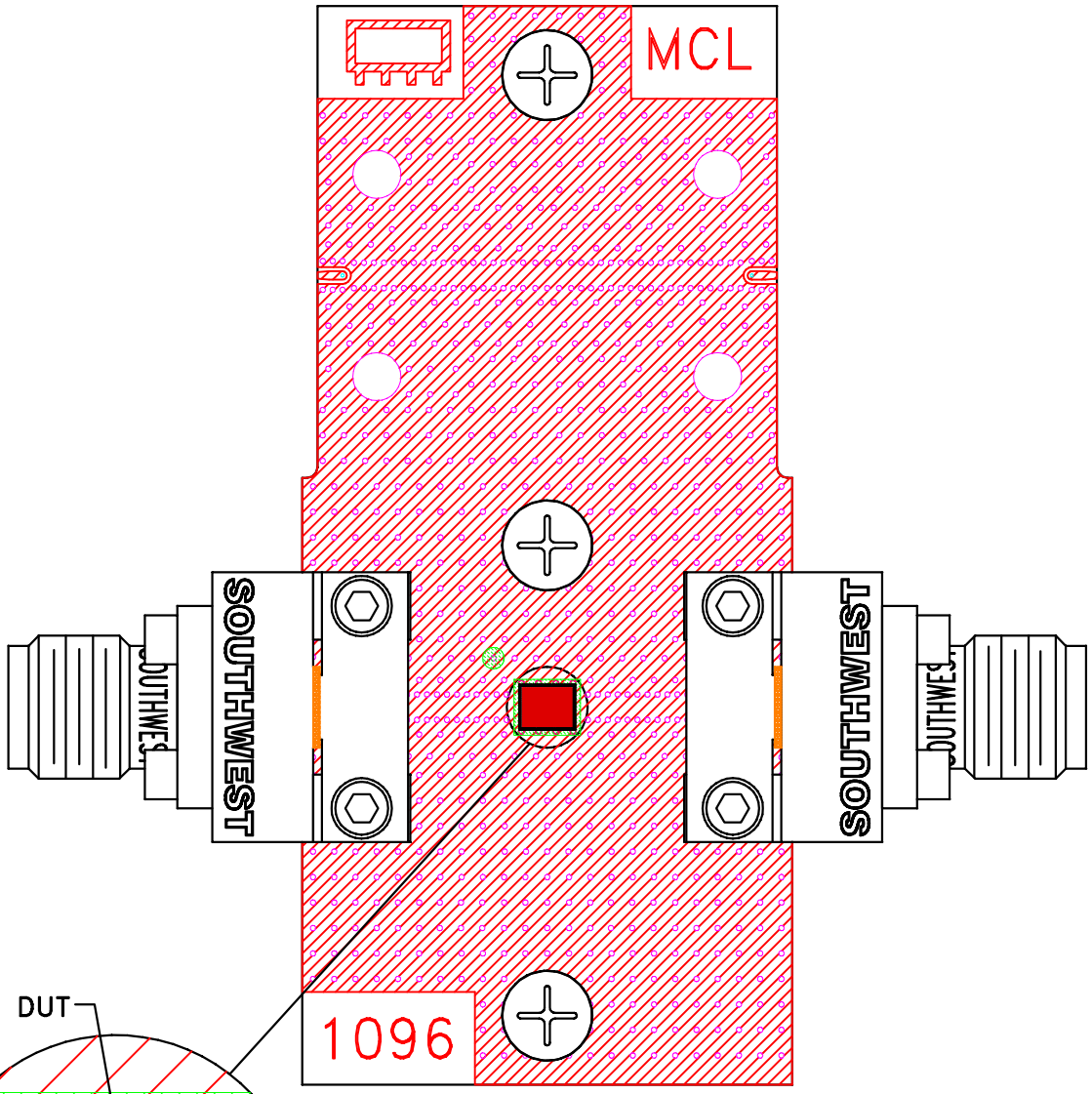
ASHEETA2.DWG REV:A DATE: 01/12/94

ALL DIMENSIONS ARE IN INCHES EXCEPT OTHERWISE SPECIFIED

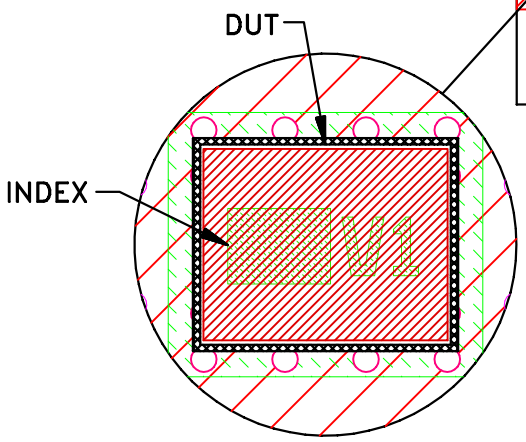
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-798	0R2

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

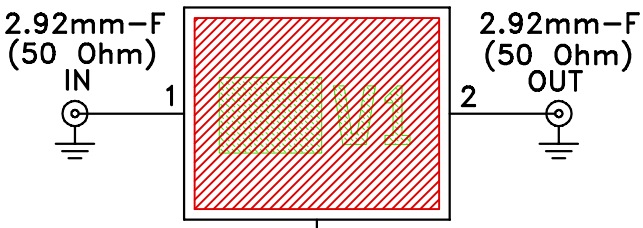
Evaluation Board and Circuit



TB-TPHK-33C+

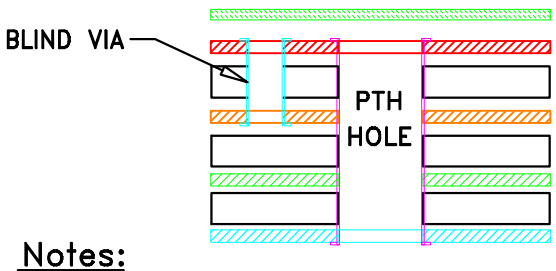


(SCALE 16:1)



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).
-COPPER LAYER 3, .5 OZ.
-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	---