Ceramic

Diplexer

LDPO-33-53+

50Ω DC to 3000 MHz (5000 to 5750 MHz)

The Big Deal

- Low insertion loss
- High stopband isolation
- Very small size, 0402

CASE STYLE: NK0402C

Product Overview

Mini-Circuits' LDPO-33-53+ is a tiny, surface-mount diplexer with a low pass channel from DC to 3000 MHz and a high pass channel from 5000 to 5750 MHz. This model provides low passband insertion loss, high stopband rejection, and RF input power handling up to 3W. Fabricated using LTCC technology, the unit comes housed in a tiny, 0402 ceramic package with excellent thermal stability from -55 to +125°C.

Key Features

Feature	Advantages
Low passband insertion loss	Ensures low signal loss through both channels
Tiny size	Saves space in dense circuit board layouts and minimizes the effects of parasitics.
Wrap-around terminations	Provides excellent solderability and easy visual inspection.
Wide operating temperature range, -55 to +125°C	Enables reliable performance in extreme environments.

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50Ω DC to 3000 MHz (5000 to 5750 MHz)

Generic photo used for illustration purposes only

CASE STYLE: NK0402C

+RoHS Compliant

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Available Tape and Reel at no extra cost

Reel Size	Devices/Reel
7"	20, 50, 100, 200, 500,1000, 4000

Maximum Ratings

Operating Temperature	-55°C to 125°C
Storage Temperature*	-55°C to 125°C
RF Power Input**	3W

*Refer to product storage temperature after installation.
Suggestion for T&R unused product storage condition: +5~+35°C, Humidity 45~75%RH, 12 Month max.
Permanent damage may occur if any of these limits are exceeded.
**Derate linearly to 1W at 125°C

Pad Connections

Low Pass Port	4
Band Pass Port	3
Common Port	1
Ground	2

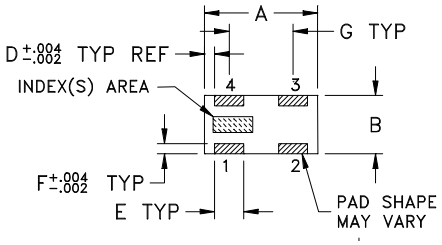
Features

- low insertion loss
- miniature size 0402
- low cost
- aqueous washable

Applications

- ISM Band
- WIFI
- Bluetooth
- Cellular

Outline Drawing



Outline Dimensions (inch / mm)

A	B	C	D	E	F	G	wt
.039	.020	.015	.004	.010	.004	.022	grams
1.0	0.51	0.38	0.10	0.25	0.10	0.56	.0007

Electrical Specifications[1] at 25°C

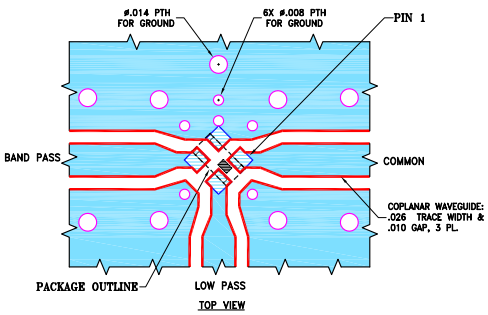
Parameter		Port	Frequency (MHz)	Min.	Typ.	Max.	Unit
Pass Band	Insertion Loss	Low Pass	DC - 3000	—	0.8	1.2	dB
		Band Pass	5000 - 5750	—	2.5	3.0	
	Return Loss	Low Pass	DC - 3000	—	15	—	dB
		Band Pass	5000 - 5750	—	11	—	
		Common	DC - 3000	—	18	—	
			5000 - 5750	—	15	—	
Stop Band Rejection		Low Pass	5000 - 12000	—	17	—	dB
		Band Pass	DC - 3000	19	25	—	dB
			7800 - 12000	15	23	—	

1. Tested on Evaluation Board TB-LDPO-33-53+

Typical Performance Data at 25°C

Frequency (MHz)	Insertion Loss (dB)		Return Loss (dB)		
	Low Pass Port	Band Pass Port	Common Port	Low Pass Port	Band Pass Port
10	0.04	70.45	56.56	58.15	0.16
50	0.08	55.54	45.75	46.53	0.14
100	0.06	49.20	41.19	42.00	0.08
500	0.11	35.41	26.09	26.14	0.03
1000	0.18	30.43	21.17	21.42	0.01
1500	0.26	28.83	19.97	20.73	0.08
2000	0.31	29.52	21.54	22.84	0.07
2500	0.37	35.58	27.11	30.07	0.16
3000	0.49	31.63	29.21	28.99	0.37
3500	0.89	17.49	19.25	17.35	0.79
4000	2.99	7.53	13.12	7.74	2.83
4500	11.93	2.39	12.19	2.11	9.27
5000	27.40	1.33	17.31	1.11	14.02
6000	19.61	1.29	41.28	1.17	22.94
7000	15.63	7.70	3.57	1.27	2.90
8000	23.80	26.88	0.55	1.26	0.60
9000	30.25	20.83	0.12	1.32	0.18
10000	25.09	22.08	0.13	0.84	0.26
11000	28.56	25.29	0.22	0.25	0.46
12000	40.40	31.81	0.03	0.07	0.47

Evaluation Board MCL P/N: TB-LDPO-33-53+
Suggested PCB Layout (PL-571)

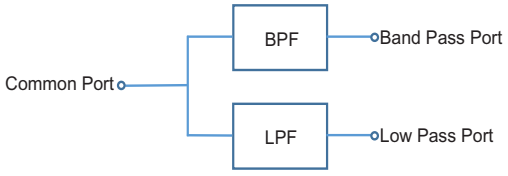


NOTES:
1. PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
2. TRACE WIDTH AND GAP ARE SHOWN FOR FR4, GRADE IT-180TC (ITEQ CORP.) WITH DIELECTRIC THICKNESS .003±.0005. COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.
3. LAYERS 3 & 4 OF THE PCB ARE CONTINUOUS GROUND PLANES.

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

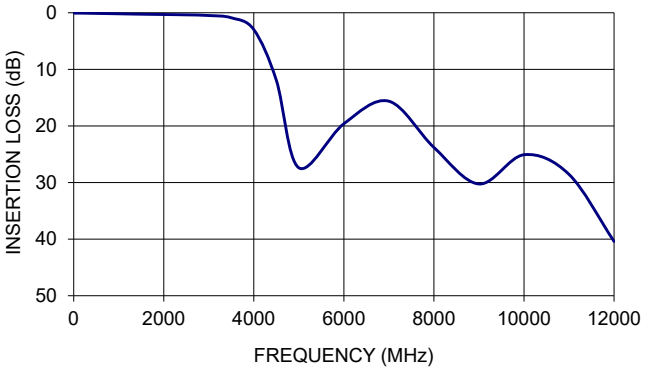
DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

Block Diagram

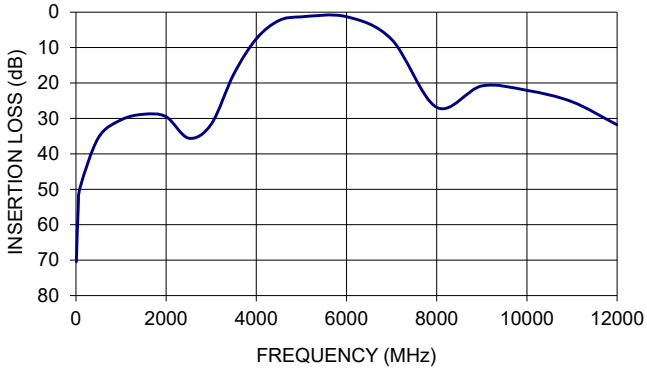


Notes
A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's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

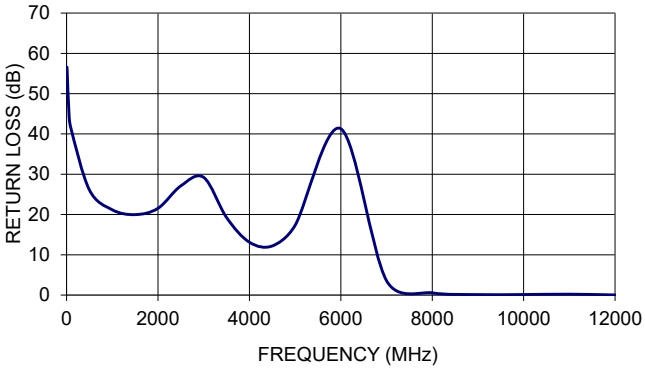
LDPO-33-53+
LOW PASS PORT INSERTION LOSS



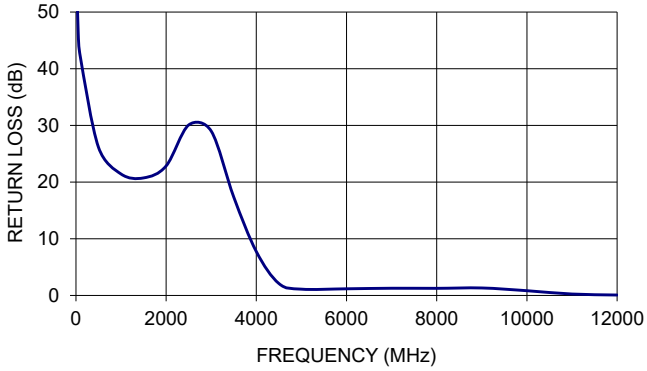
LDPO-33-53+
BAND PASS PORT INSERTION LOSS



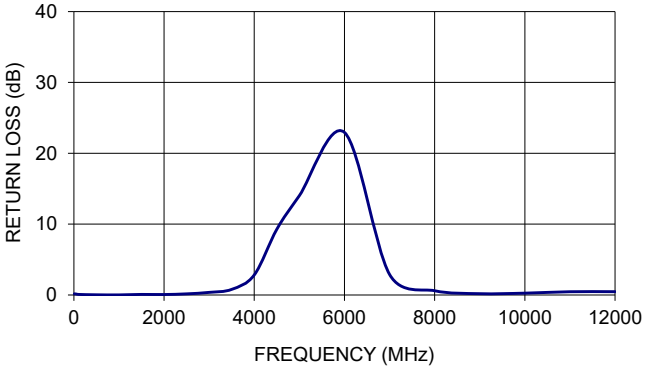
LDPO-33-53+
COMMON PORT RETURN LOSS



LDPO-33-53+
LOW PASS PORT RETURN LOSS



LDPO-33-53+
BAND PASS PORT RETURN LOSS



Ceramic Diplexer LDPO-33-53+

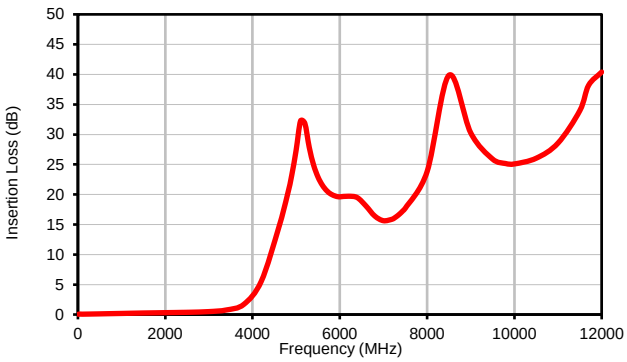
Typical Performance Data

FREQUENCY (MHz)	INSERTION LOSS (dB)		RETURN LOSS (dB)		
	Low Pass port	Band Pass port	Common port	Low Pass port	Band Pass port
10	0.04	70.45	56.56	58.15	0.16
50	0.08	55.54	45.75	46.53	0.14
100	0.06	49.20	41.19	42.00	0.08
500	0.11	35.41	26.09	26.14	0.03
800	0.16	31.82	22.49	22.71	0.07
1000	0.18	30.43	21.17	21.42	0.01
1500	0.26	28.83	19.97	20.73	0.08
2000	0.31	29.52	21.54	22.84	0.07
2200	0.33	30.83	23.20	24.81	0.11
2400	0.36	33.34	25.53	27.92	0.13
2410	0.36	33.52	25.70	28.09	0.14
2420	0.36	33.73	25.84	28.30	0.16
2430	0.36	33.94	26.01	28.48	0.16
2440	0.36	34.15	26.15	28.68	0.17
2450	0.36	34.36	26.33	28.90	0.17
2460	0.36	34.59	26.48	29.09	0.16
2470	0.37	34.81	26.59	29.35	0.16
2480	0.37	35.02	26.78	29.55	0.16
2490	0.37	35.32	26.94	29.83	0.16
2500	0.37	35.58	27.11	30.07	0.16
2600	0.39	39.36	29.03	33.08	0.19
3000	0.49	31.63	29.21	28.99	0.37
3400	0.76	19.77	20.83	19.32	0.68
3800	1.69	11.25	15.23	11.53	1.59
4200	5.52	4.64	11.88	4.62	5.11
4600	14.45	2.03	12.83	1.72	10.26
4800	19.92	1.58	14.70	1.29	11.98
4900	23.24	1.44	15.85	1.18	12.89
5000	27.40	1.33	17.31	1.11	14.02
5100	32.23	1.25	19.08	1.07	15.28
5200	31.83	1.18	21.32	1.05	16.82
5300	27.85	1.13	24.08	1.05	18.58
5400	24.91	1.11	27.31	1.06	20.56
5500	22.91	1.11	31.25	1.08	22.76
5600	21.56	1.12	35.46	1.10	24.42
5700	20.63	1.14	36.04	1.12	25.36
5800	20.05	1.17	34.64	1.14	25.25
5900	19.73	1.22	35.57	1.16	24.33
5950	19.65	1.25	37.45	1.16	23.71
6000	19.61	1.29	41.28	1.17	22.94
6200	19.71	1.50	27.82	1.19	18.68
6400	19.48	1.97	16.82	1.21	13.37
6600	18.08	2.93	10.35	1.23	8.57
6800	16.42	4.76	6.13	1.25	5.06
7000	15.63	7.70	3.57	1.27	2.90
7200	15.88	11.70	2.16	1.27	1.75
7250	16.08	12.85	1.92	1.26	1.56
7300	16.33	14.07	1.72	1.25	1.40
7350	16.62	15.36	1.54	1.25	1.27
7400	16.94	16.73	1.40	1.24	1.17
7450	17.31	18.18	1.27	1.24	1.08
7500	17.70	19.74	1.15	1.24	1.02
8000	23.80	26.88	0.55	1.26	0.60
8500	39.86	21.85	0.29	1.32	0.38
9000	30.25	20.83	0.12	1.32	0.18
9500	25.90	21.12	0.03	1.15	0.05
9800	25.16	21.63	0.10	0.97	0.19
10000	25.09	22.08	0.13	0.84	0.26
10500	26.04	23.47	0.20	0.50	0.39
11000	28.56	25.29	0.22	0.25	0.46
11500	33.98	27.83	0.16	0.11	0.49
11700	38.18	29.16	0.12	0.09	0.50
12000	40.40	31.81	0.03	0.07	0.47

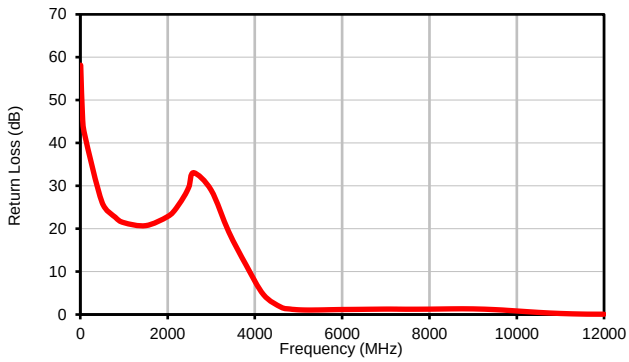
Ceramic Diplexer LDPO-33-53+

Typical Performance Curves

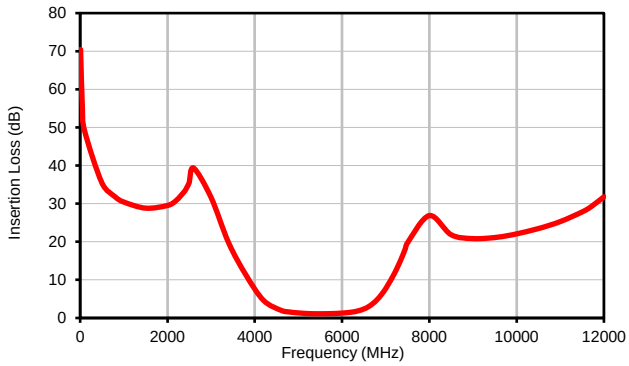
Low Pass Port Insertion Loss



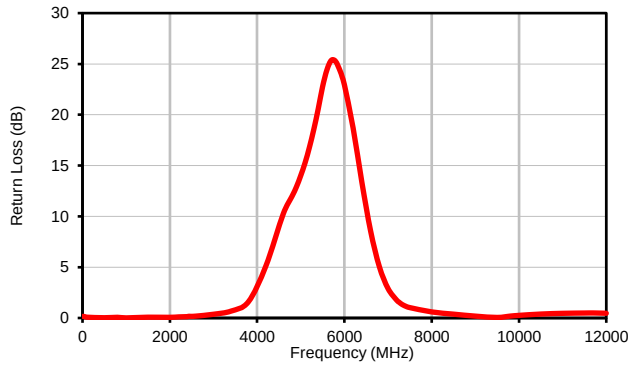
Low Pass Port Return Loss



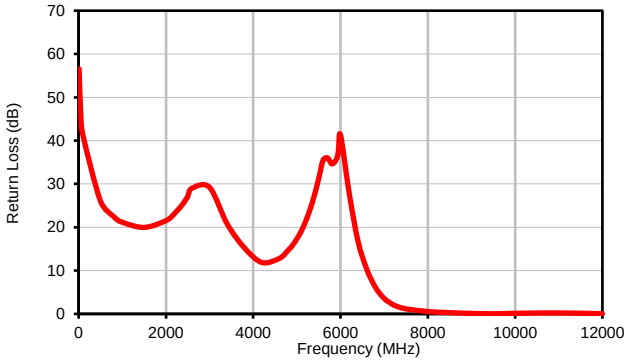
Band Pass Port Insertion Loss



Band Pass Port Return Loss



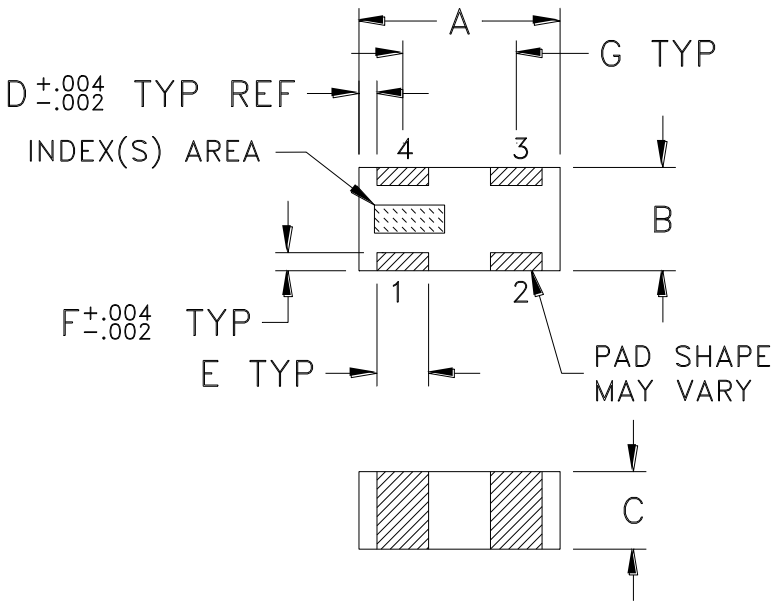
Common Port Return Loss



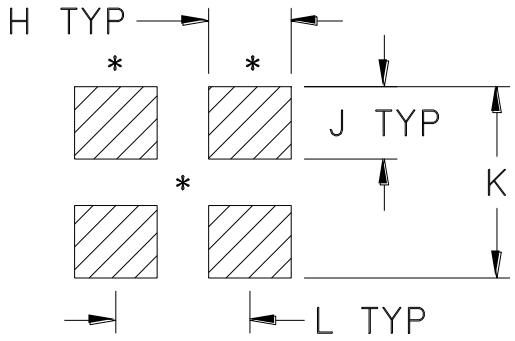
Case Style NK

NK0402C

Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

CASE#	A	B	C	D	E	F	G	H	J	K	L	WT.GRAMS
NK0402C	.039 (1.00)	.020 (.50)	.015 (0.37)	.004 (0.10)	.010 (0.25)	.004 (0.10)	.022 (0.55)	.016 (0.41)	.014 (0.36)	.037 (0.94)	.026 (0.65)	.0007

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

Notes:

1. Open style, ceramic base.
2. Termination finish:
   For RoHS Case Styles: Matte Tin over Nickel plating. Models with (+) suffix.
3. *Line width should be designed to match 50Ω characteristic impedance, depending on PCB material and thickness.

Tape & Reel Packaging TR-F114-1

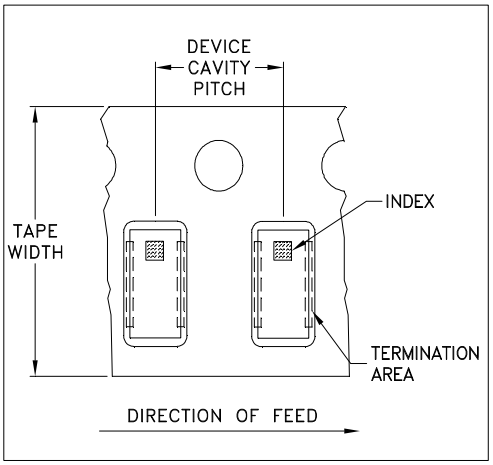


ILLUSTRATION 1

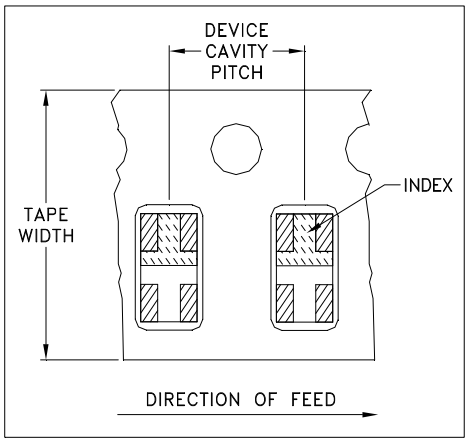


ILLUSTRATION 3

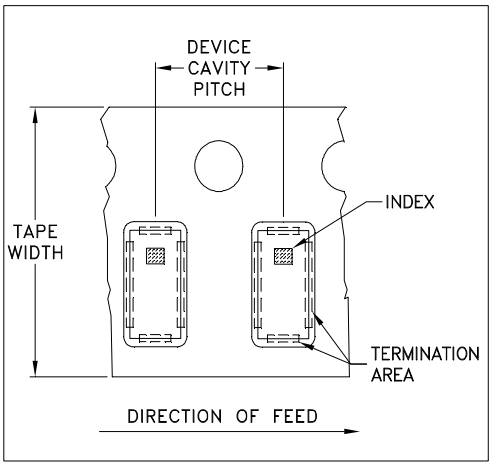


ILLUSTRATION 2

Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel	
8	2	7	Small quantity standards (see note)	20
				50
				100
				200
				500
				1000
			Standard	4000

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

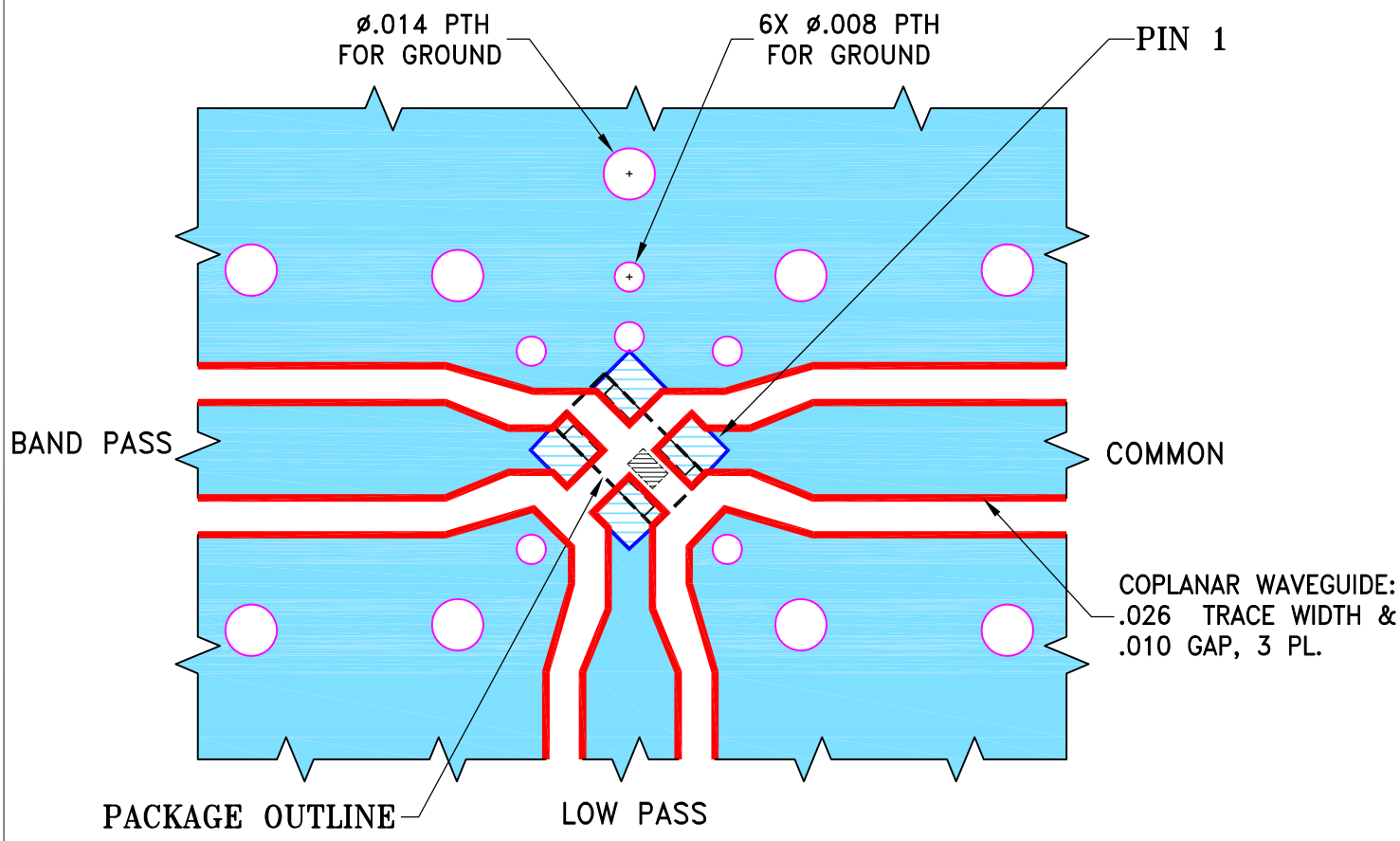
Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: www.minicircuits.com/pages/pdfs/tape.pdf

THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M168200	NEW RELEASE	05/31/18	NP	SL
A	M174015	UPDATED DESCRIPTION OF THE PORTS	04/25/19	ITG	SL

SUGGESTED MOUNTING CONFIGURATION
FOR NK0402C CASE STYLE, "04DP02" PIN CODE



TOP VIEW

NOTES:
1. PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
2. TRACE WIDTH AND GAP ARE SHOWN FOR FR4, GRADE IT-180TC (ITEQ CORP.) WITH DIELECTRIC THICKNESS .003±.0005. COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.
3. LAYERS 3 & 4 OF THE PCB ARE CONTINUOUS GROUND PLANES.

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	NP	05/30/18
TOLERANCES ON:	CHECKED	GF	05/30/18
2 PL DECIMALS ± .005	APPROVED	SL	05/31/18
3 PL DECIMALS ±			
ANGLES ±			
FRACTIONS ±			

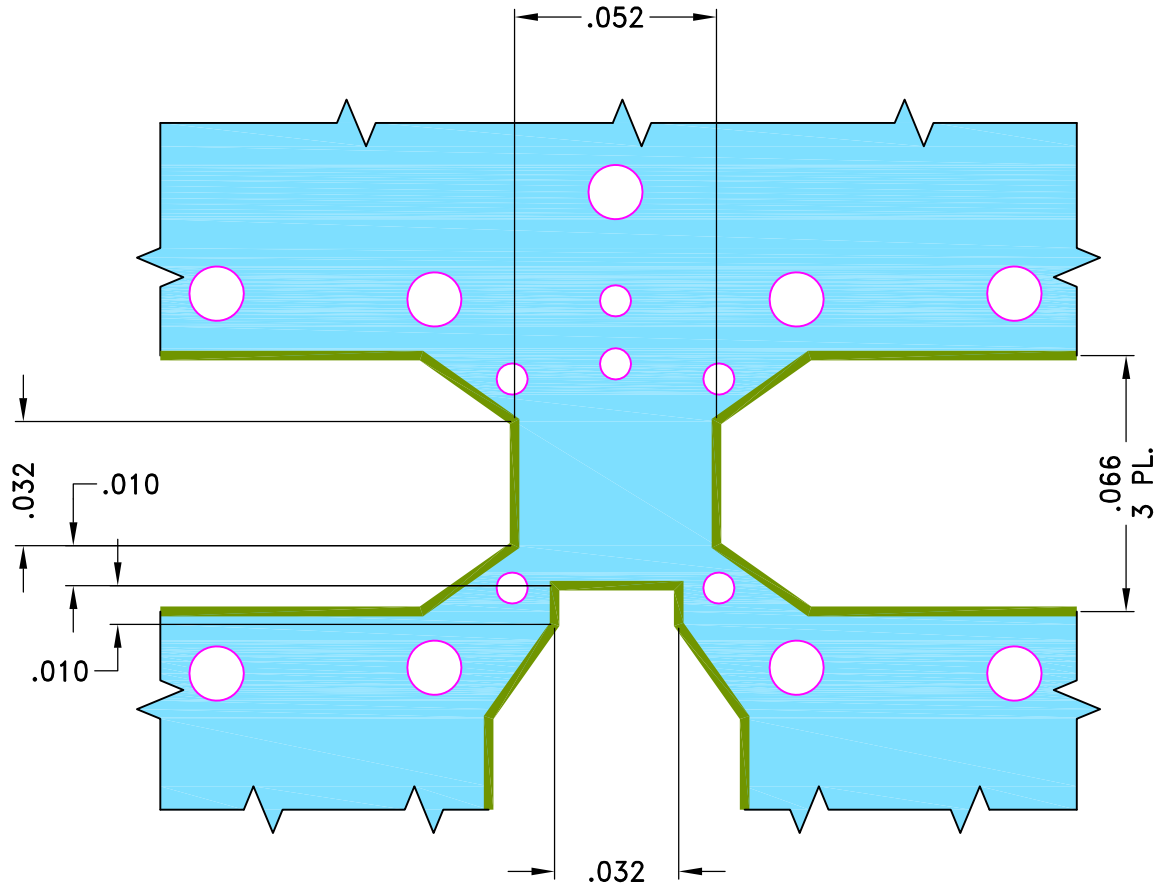
ASHEETA1.DWG REV:A DATE:01/12/95

Mini-Circuits®
13 Neptune Avenue
Brooklyn NY 11235

PL, 04DP02, NK0402C, TB-1040+

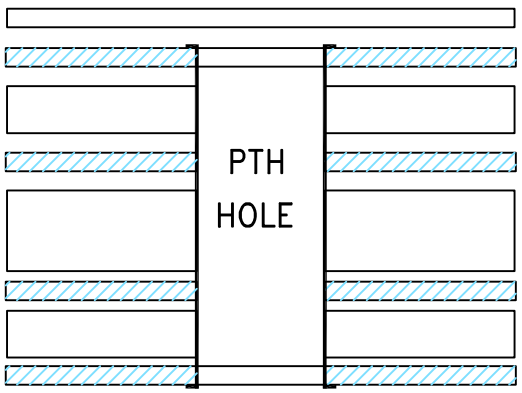
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-571	A

FILE:	SCALE:	SHEET:
98PL571	20:1	1 OF 2



LAYER 2

STACK-UP DIAGRAM



-TOP SOLDER MASK
-COPPER LAYER 1, 0.5 OZ.
-CORE, 0.003", FR4
-COPPER LAYER 2, 0.5 OZ.
-PREPREG, FR4
(THICKNESS AS REQUIRED)
-COPPER LAYER 3, 0.5 OZ.
-CORE, 0.003", FR4
-COPPER LAYER 4, 0.5 OZ.

1. TOTAL FINISHED THICKNESS 0.020" ± 10%.
2. PTH HOLES PRESENT FROM COPPER LAYER 1 TO 4.

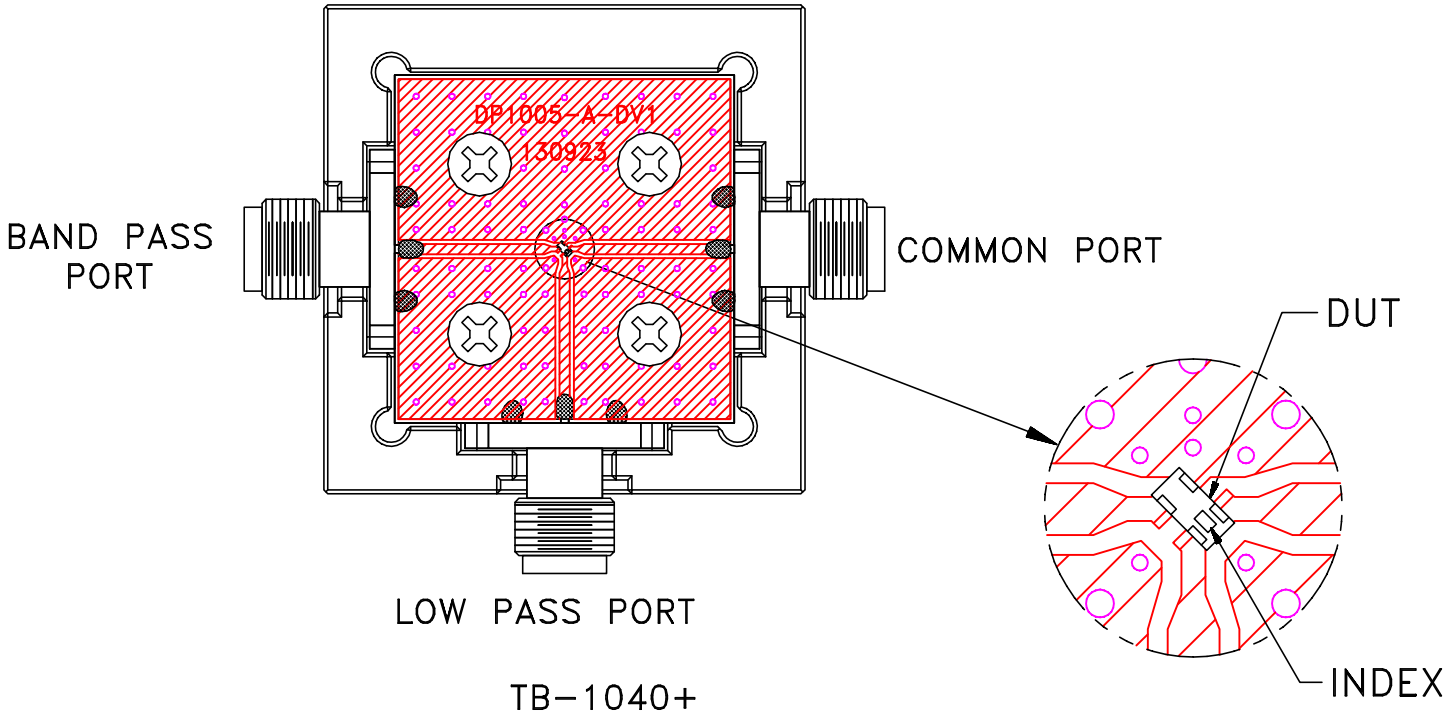
ASHEETA2.DWG REV:A DATE: 01/12/94

ALL DIMENSIONS ARE IN INCHES EXCEPT OTHERWISE SPECIFIED

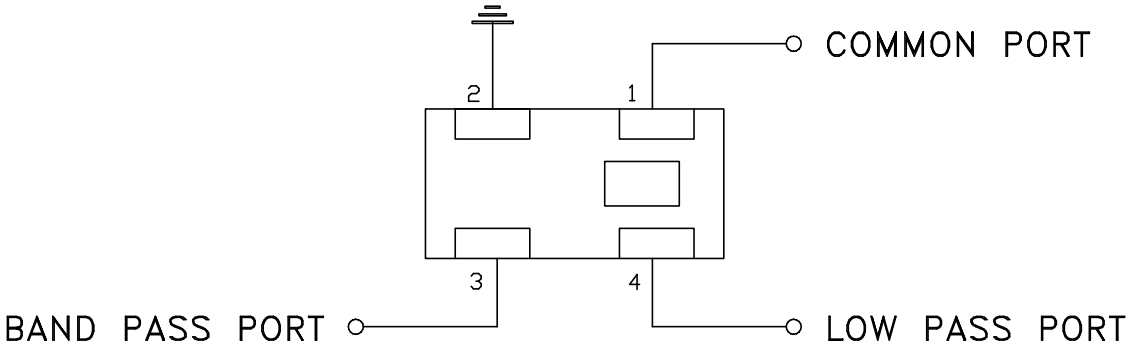
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-571	A

FILE:	SCALE:	SHEET:
98PL571	20:1	2 OF 2

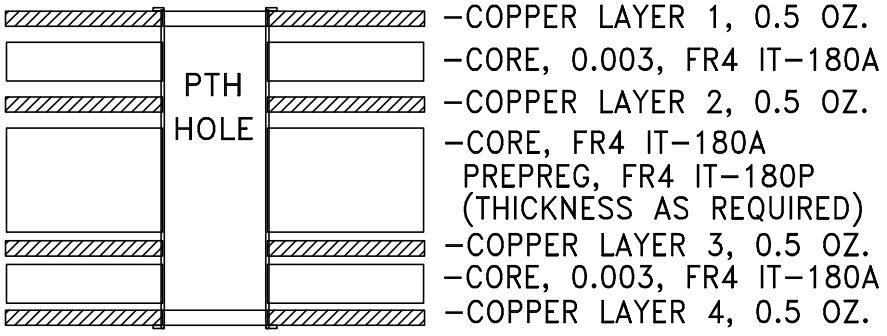
Evaluation Board and Circuit



TB-1040+



Schematic Diagram



Stack-up Diagram

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: FR4 or equivalent,
   Dielectric Constant=4.5,
   Total finished Thickness = .025 inch.

Mini-Circuits®

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: 250°C peak	J-STD-020C, Table 4-1, 4-2 and 5-2; Figure 5-1
Solderability	10X Magnification	J-STD-002, Para 4.2.5, Test S, 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