Surface Mount

Low Pass Filter

RLP-1094+

50Ω DC to 1094 MHz

Generic photo used for illustration purposes only

CASE STYLE: GP731

The Big Deal

- Passband (DC to 1094 MHz)
- Low Insertion Loss (0.7 dB typical)
- Good VSWR (1.4:1 typical)
- High Rejection
- Very small size (0.35" x 0.35" x 0.10")
- High power handling (3.5W)

Product Overview

The RLP-1094+ is a Lowpass filter fabricated using SMT technology. Covering up to 1094 MHz, this model offers very low passband insertion loss of 0.7 dB typical, good matching within the passband and high rejection. In addition it has repeatable performance across production lots and consistent performance across temperature.

Key Features

Feature	Advantages
Good VSWR, 1.4:1 typical in passband	This provides well matched input and output ports.
Flat group delay characteristics	The model has a group delay flatness of 0.5 nsec which helps in reducing the signal distortion.
More than 40 dB rejection up to 3400 MHz	This enables the filter to attenuate spurious signals and reject harmonics over a broad frequency band.
Small size, 0.35" x 0.35" x 0.10"	The surface mount package enables the RLP-1094+ to be used in compact designs.
Shielded case	Reduced interference with and from the surrounding components.

Surface Mount

Low Pass Filter

RLP-1094+

50Ω DC to 1094 MHz

Generic photo used for illustration purposes only

CASE STYLE: GP731

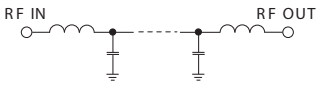
Features

- High rejection
- Good VSWR, 1.4:1 typical in passband
- Aqueous washable

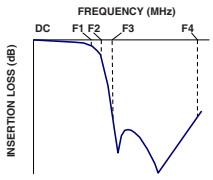
Applications

- TV Broad casting
- Wireless communications
- VHF/UHF receivers / transmitters
- Military

Functional Schematic



Typical Frequency Response



+RoHS Compliant

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

Electrical Specifications at 25°C

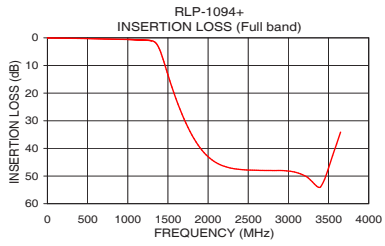
Parameter		F#	Frequency (MHz)	Min.	Typ.	Max.	Unit
Pass Band	Insertion Loss	DC-F1	DC-1094	—	0.7	1.0	dB
	Freq. Cut-Off	F2	1380	—	3.0	—	dB
	VSWR	DC-F1	DC-1094	—	1.4	1.9	:1
Stop Band	Rejection Loss	F3-F4	1700-3650	20	28	—	dB
	VSWR	F3-F4	1700-3650	—	37	—	:1

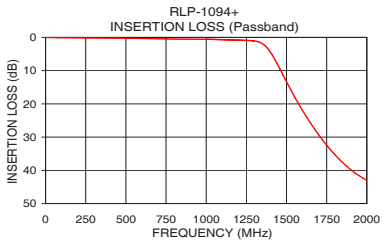
Maximum Ratings	
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power Input	3.5W max.

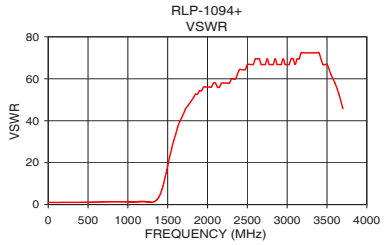
Permanent damage may occur if any of these limits are exceeded.

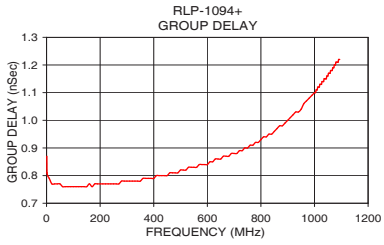
Typical Performance Data at 25°C

Frequency (MHz)	Insertion Loss (dB)	VSWR (:1)	Frequency (MHz)	Group Delay (nsec)
1.0	0.02	1.00	1.0	0.87
20.0	0.04	1.01	2.0	0.81
80.0	0.09	1.03	10.0	0.79
300.0	0.18	1.04	20.0	0.77
640.0	0.37	1.24	70.0	0.76
1000.0	0.61	1.34	100.0	0.76
1050.0	0.66	1.35	150.0	0.76
1094.0	0.72	1.39	200.0	0.77
1130.0	0.79	1.43	300.0	0.78
1250.0	0.95	1.34	400.0	0.79
1350.0	1.85	1.84	450.0	0.80
1380.0	3.18	3.05	500.0	0.82
1430.0	6.98	7.47	600.0	0.84
1500.0	13.50	18.50	650.0	0.86
1650.0	25.90	39.49	700.0	0.88
1700.0	29.36	43.44	800.0	0.93
1900.0	39.84	54.29	900.0	1.00
2300.0	47.40	59.91	1000.0	1.10
3400.0	53.85	72.39	1050.0	1.16
3650.0	35.73	52.65	1094.0	1.22









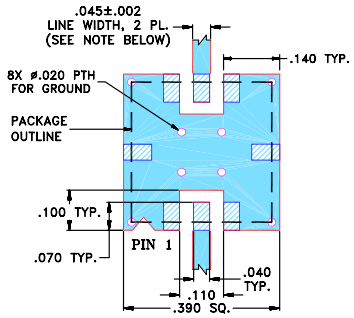
Notes

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

Pad Connections

INPUT	2
OUTPUT	6
GROUND	1,3,4,5,7,8

Demo Board MCL P/N: TB-332
Suggested PCB Layout (PL-176)

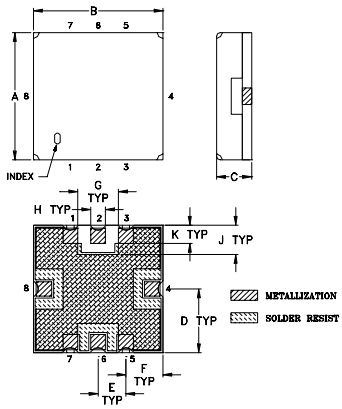


NOTES: 1. TRACE WIDTH IS SHOWN FOR FR4 WITH DIELECTRIC THICKNESS .025" ± .002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

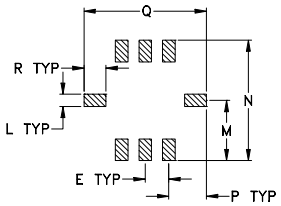
DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Outline Drawing



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

Outline Dimensions (inch / mm)

A	B	C	D	E	F	G	H	J
.350	.350	.100	.175	.075	.100	.110	.040	.080
8.89	8.89	2.54	4.45	1.91	2.54	2.79	1.02	2.03

K	L	M	N	P	Q	R	wt
.050	.040	.195	.390	.120	.390	.070	grams
1.27	1.02	4.95	9.91	3.05	9.91	1.78	0.25

Note: Please refer to case style drawing for details

Surface Mount Low Pass Filter RLP-1094+

Typical Performance Data

FREQ.	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
(MHz)	(dB)			(dB)			(dB)		
	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C
1.0	0.02	0.02	0.03	63.88	58.22	54.44	59.93	55.05	52.14
10.0	0.03	0.03	0.04	65.04	50.31	44.66	55.11	50.07	45.31
50.0	0.06	0.08	0.09	42.21	39.32	34.76	37.84	39.23	37.26
100.0	0.09	0.11	0.13	32.08	35.66	39.35	32.28	36.05	46.84
150.0	0.11	0.14	0.16	30.27	34.03	41.61	31.98	35.57	37.57
200.0	0.13	0.17	0.19	28.06	33.07	38.95	28.35	33.97	43.54
250.0	0.15	0.19	0.22	27.05	33.13	39.30	27.49	34.53	47.15
300.0	0.16	0.22	0.25	29.35	33.93	38.23	29.98	36.11	53.58
350.0	0.18	0.24	0.28	32.34	34.68	33.40	33.69	38.83	37.93
400.0	0.19	0.26	0.31	33.50	33.35	31.15	36.20	36.51	33.68
450.0	0.21	0.29	0.34	29.67	30.17	29.63	30.65	31.44	31.22
500.0	0.23	0.32	0.38	25.70	26.70	27.19	25.93	27.08	27.83
550.0	0.26	0.35	0.41	22.80	23.77	24.98	22.89	23.94	25.32
600.0	0.29	0.39	0.45	20.52	21.45	23.13	20.46	21.49	23.32
650.0	0.33	0.44	0.49	18.60	19.55	21.28	18.52	19.59	21.46
700.0	0.37	0.48	0.54	17.36	18.11	19.77	17.28	18.13	19.93
750.0	0.41	0.53	0.59	16.22	17.06	18.54	16.09	17.09	18.73
800.0	0.45	0.57	0.64	15.51	16.39	17.62	15.40	16.49	17.90
850.0	0.47	0.61	0.69	15.43	16.14	17.05	15.40	16.35	17.45
900.0	0.49	0.64	0.74	15.67	16.31	16.81	15.73	16.71	17.38
950.0	0.49	0.67	0.78	16.62	16.87	16.95	16.97	17.61	17.80
1000.0	0.50	0.69	0.82	17.82	17.60	17.35	18.77	18.85	18.54
1002.0	0.50	0.70	0.82	17.86	17.62	17.36	18.83	18.90	18.57
1020.0	0.51	0.71	0.84	18.12	17.78	17.50	19.38	19.24	18.83
1040.0	0.52	0.73	0.86	18.19	17.81	17.62	19.72	19.41	19.06
1080.0	0.57	0.78	0.91	17.26	17.20	17.44	18.76	18.62	18.79
1094.0	0.59	0.80	0.94	16.66	16.82	17.24	17.98	18.06	18.44
1120.0	0.65	0.86	0.99	15.49	15.99	16.71	16.46	16.88	17.59
1140.0	0.70	0.90	1.03	14.64	15.35	16.25	15.39	15.99	16.87
1180.0	0.80	1.00	1.12	13.42	14.45	15.58	13.80	14.68	15.73
1200.0	0.84	1.04	1.17	13.14	14.32	15.55	13.38	14.37	15.49
1240.0	0.89	1.11	1.26	13.77	15.33	16.92	13.69	14.88	16.13
1280.0	0.89	1.15	1.35	17.81	20.83	24.30	16.58	17.96	19.29
1300.0	0.91	1.23	1.46	24.93	35.18	35.20	19.60	20.02	20.08
1320.0	1.02	1.39	1.67	26.62	21.40	18.72	19.23	17.39	16.30
1330.0	1.14	1.54	1.85	19.18	16.68	15.08	16.46	14.86	13.91
1340.0	1.31	1.75	2.09	14.87	13.38	12.32	13.59	12.44	11.72
1380.0	2.90	3.47	3.93	6.07	5.86	5.63	5.90	5.75	5.62
1440.0	7.94	8.57	9.07	1.78	1.93	1.99	1.75	1.95	2.07
1450.0	8.93	9.56	10.06	1.49	1.66	1.74	1.47	1.69	1.82
1480.0	11.95	12.56	13.03	0.96	1.16	1.26	0.94	1.19	1.35
1500.0	13.93	14.52	14.98	0.76	0.97	1.07	0.74	1.00	1.16
1600.0	23.06	23.62	23.89	0.42	0.63	0.75	0.38	0.66	0.83
1625.0	25.13	25.68	25.87	0.39	0.60	0.72	0.36	0.64	0.80
1650.0	27.13	27.66	27.78	0.37	0.59	0.70	0.34	0.62	0.79
1675.0	29.08	29.57	29.58	0.35	0.57	0.69	0.33	0.61	0.78
1700.0	30.96	31.44	31.32	0.34	0.57	0.69	0.32	0.61	0.77
1800.0	37.70	37.93	37.20	0.32	0.55	0.67	0.29	0.60	0.78
2000.0	47.57	47.03	44.94	0.31	0.56	0.69	0.29	0.63	0.84
2400.0	52.90	51.85	49.47	0.33	0.59	0.76	0.31	0.69	0.99
2500.0	52.93	52.30	50.04	0.34	0.60	0.78	0.32	0.71	1.01
2800.0	51.48	51.57	50.67	0.35	0.62	0.82	0.36	0.72	1.00
3000.0	49.43	50.29	50.38	0.36	0.63	0.83	0.39	0.73	0.95
3400.0	60.73	61.79	62.11	0.36	0.64	0.83	0.33	0.70	0.85
3500.0	46.56	46.48	45.15	0.39	0.66	0.87	0.32	0.70	0.86
3600.0	38.54	38.52	37.92	0.37	0.67	0.88	0.27	0.71	0.87
3650.0	34.10	34.04	34.19	0.41	0.69	0.91	0.28	0.72	0.88

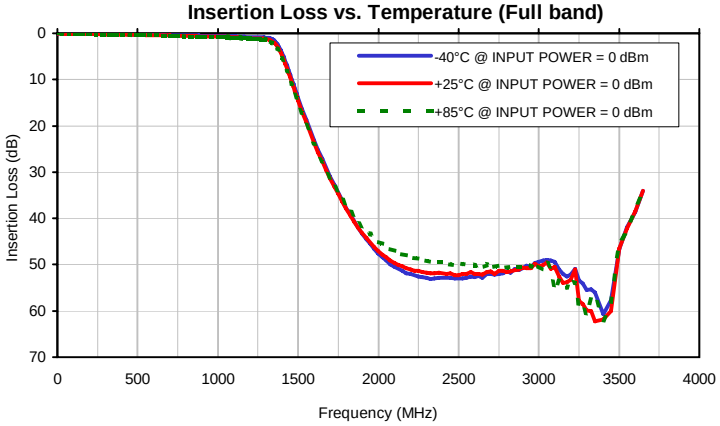
Typical Performance Data

FREQ. (MHz)	GROUP DELAY (nsec)		
	@-40°C	@+25°C	@+85°C
1.0	0.90	0.98	0.95
2.0	0.89	0.91	0.89
4.0	0.87	0.88	0.87
10.0	0.84	0.84	0.83
20.0	0.80	0.80	0.79
30.0	0.80	0.79	0.78
40.0	0.79	0.79	0.78
50.0	0.79	0.78	0.77
60.0	0.79	0.78	0.77
70.0	0.79	0.78	0.77
80.0	0.79	0.78	0.77
90.0	0.79	0.78	0.77
100.0	0.79	0.78	0.77
150.0	0.79	0.78	0.77
200.0	0.79	0.78	0.77
250.0	0.79	0.79	0.77
300.0	0.80	0.79	0.78
350.0	0.81	0.80	0.79
400.0	0.82	0.81	0.79
410.0	0.82	0.81	0.80
420.0	0.83	0.82	0.80
430.0	0.83	0.82	0.81
440.0	0.83	0.82	0.81
450.0	0.83	0.82	0.81
500.0	0.84	0.83	0.82
550.0	0.86	0.85	0.83
600.0	0.87	0.86	0.85
650.0	0.89	0.88	0.87
700.0	0.91	0.90	0.89
750.0	0.93	0.92	0.91
800.0	0.96	0.95	0.94
850.0	0.99	0.98	0.97
900.0	1.03	1.02	1.01
950.0	1.08	1.07	1.06
1000.0	1.14	1.12	1.11
1010.0	1.15	1.14	1.12
1020.0	1.17	1.16	1.14
1030.0	1.18	1.17	1.16
1040.0	1.19	1.18	1.17
1050.0	1.20	1.19	1.18
1052.0	1.21	1.19	1.18
1054.0	1.21	1.20	1.19
1056.0	1.21	1.20	1.19
1058.0	1.22	1.20	1.19
1060.0	1.22	1.21	1.20
1062.0	1.22	1.21	1.20
1064.0	1.23	1.22	1.21
1066.0	1.23	1.22	1.21
1068.0	1.24	1.22	1.21
1070.0	1.24	1.23	1.22
1072.0	1.24	1.23	1.22
1074.0	1.25	1.23	1.22
1076.0	1.25	1.24	1.23
1078.0	1.25	1.24	1.23
1080.0	1.25	1.24	1.23
1082.0	1.26	1.25	1.24
1084.0	1.26	1.25	1.24
1086.0	1.26	1.25	1.24
1088.0	1.26	1.25	1.24
1090.0	1.26	1.25	1.24
1092.0	1.27	1.25	1.25
1094.0	1.27	1.26	1.25

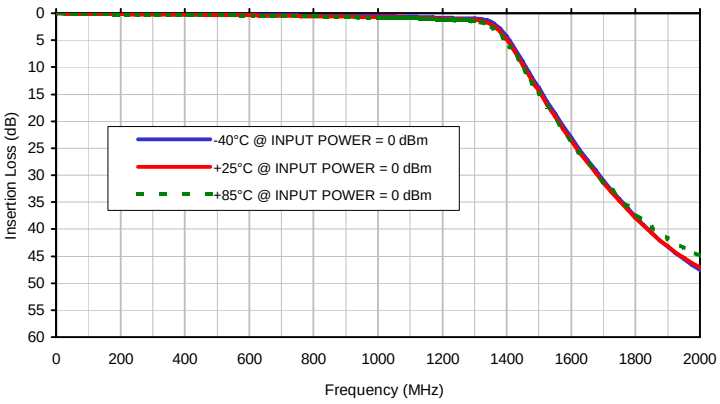
Surface Mount Low Pass Filter RLP-1094+

Typical Performance Curves

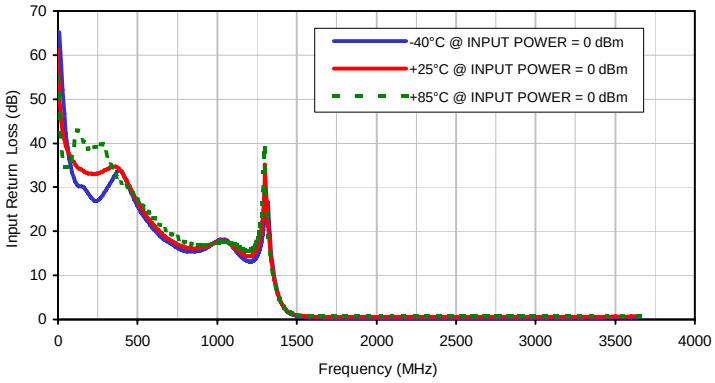
Insertion Loss vs. Temperature (Full band)



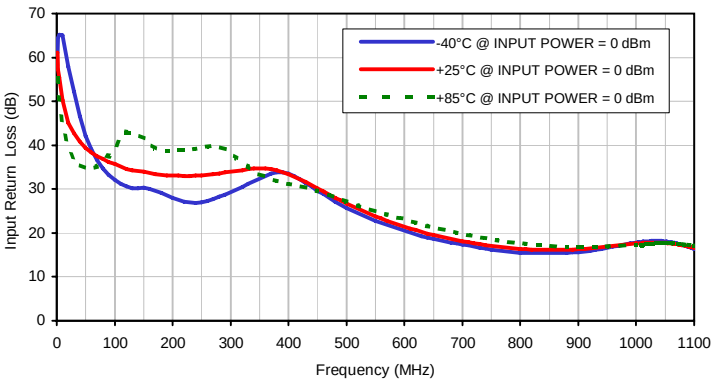
Insertion Loss vs. Temperature (Pass band)



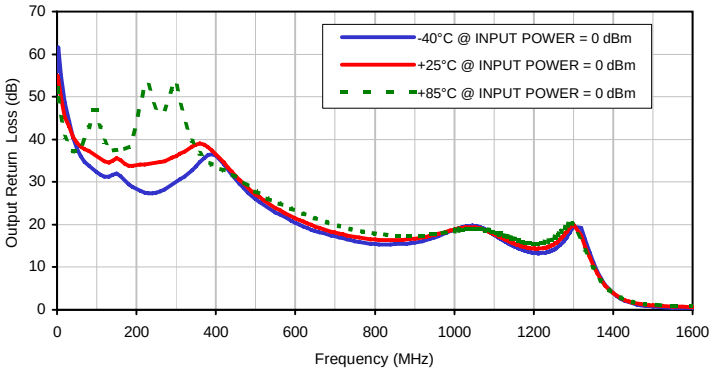
Input Return Loss vs. Temperature



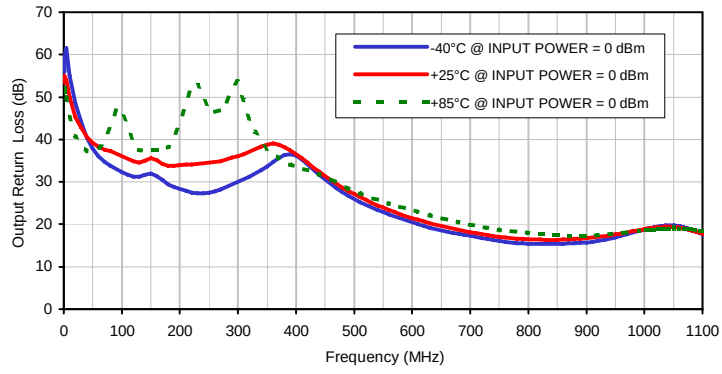
Input Return Loss vs. Temperature



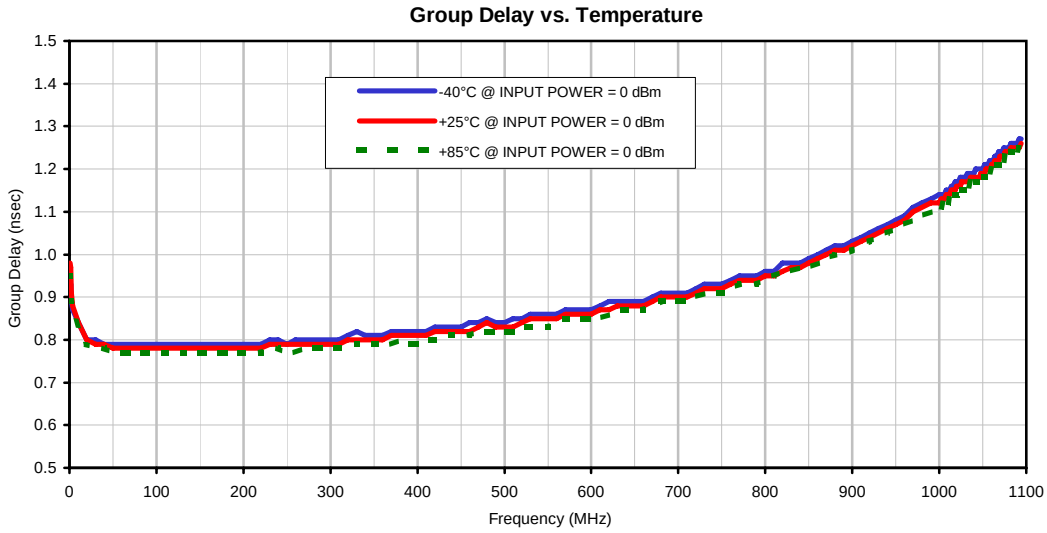
Output Return Loss vs. Temperature



Output Return Loss vs. Temperature

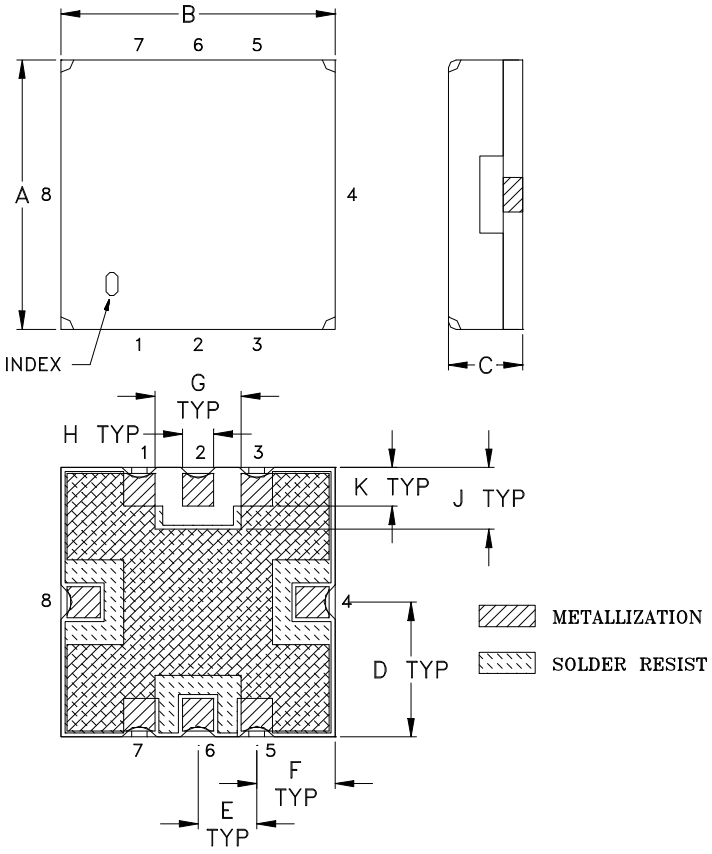


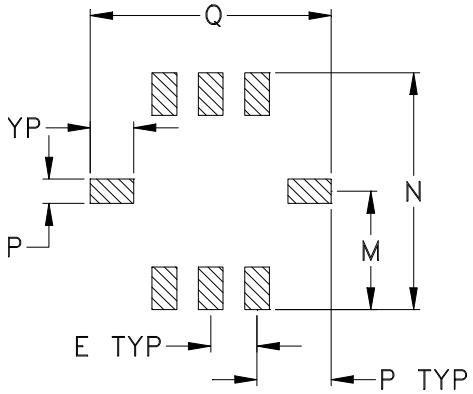
Typical Performance Curves



Case Style GP

Outline Dimensions GP731





CASE #	A	B	C	D	E	F	G	H	J	K	L	M
GP731	.350 (8.89)	.350 (8.89)	.100 (2.54)	.175 (4.45)	.075 (1.91)	.100 (2.54)	.110 (2.79)	.040 (1.02)	.080 (2.03)	.050 (1.27)	.040 (1.02)	.195 (4.95)

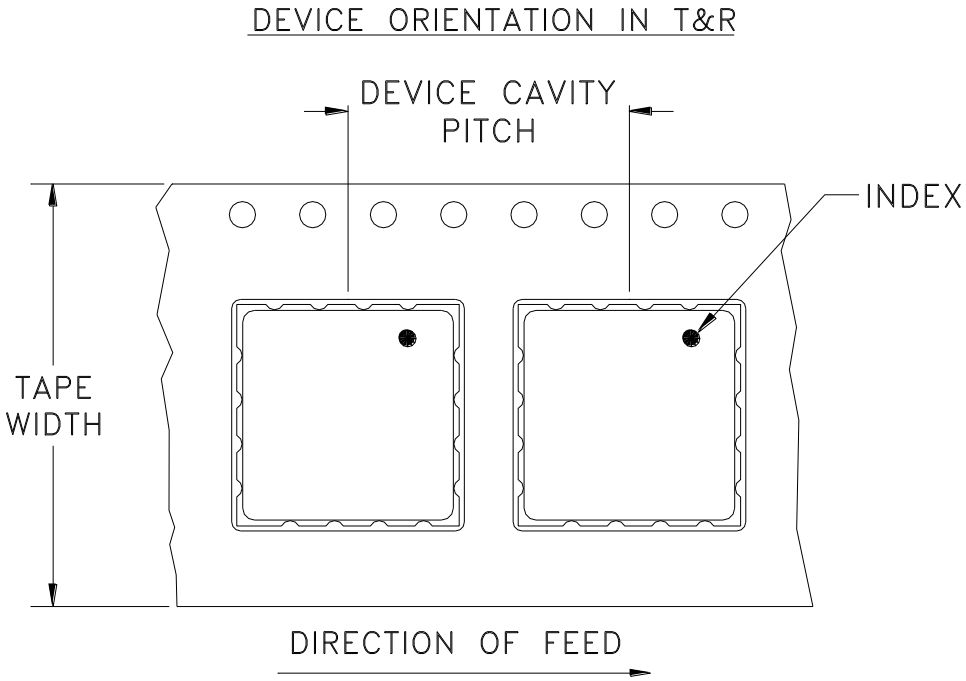
CASE #	N	P	Q	R	WT. GRAM	
GP731	.390 (9.91)	.120 (3.05)	.390 (9.91)	.070 (1.78)	.4	+0.3
						-0.0

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

Notes:

1. Case material: Nickel-Silver alloy.
2. Base: Printed wiring laminate.
3. Termination finish:
   For RoHS Case Styles: 3-5 µ inch (.08-.13 microns) Gold over 120-240 µ inch (3.05-6.10 microns) Nickel plate.
   For RoHS-5 Case Styles: Tin-Lead plate.

Tape & Reel Packaging TR-F78



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note
16	12	7	10
			20
			50
			100
			200
		13	500, 1000

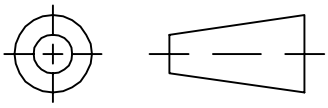
Note: Please consult individual model data sheet to determine device per reel availability.

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

Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010
Mini-Circuits ISO 9001 & ISO 14001 Certified

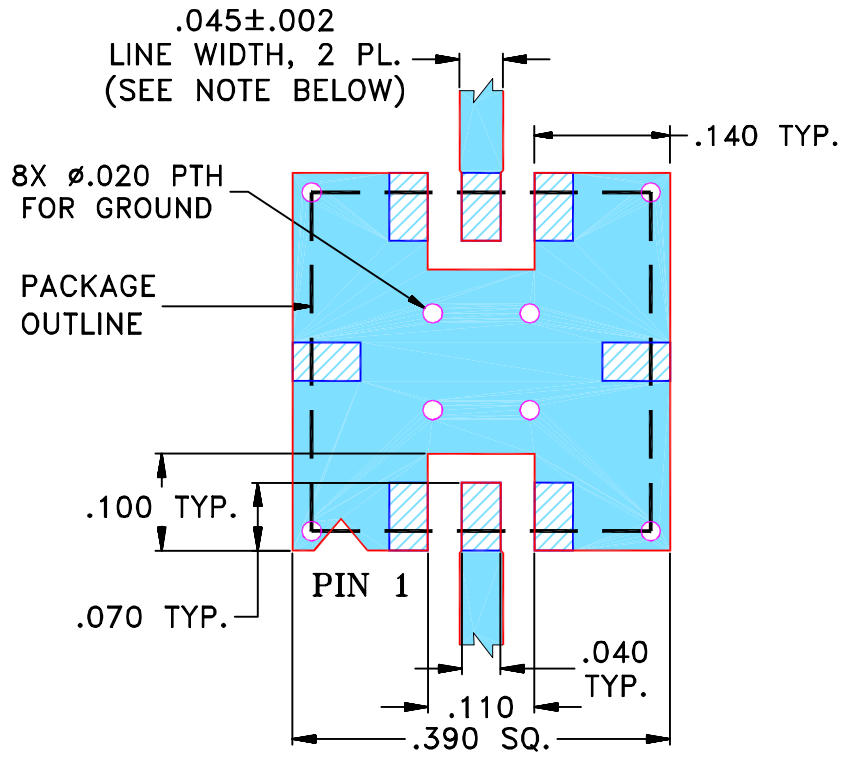
THIRD ANGLE PROJECTION



REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	R59289	NEW RELEASE (FROM RAVON)	02/05	DK	HH
A	M101151	ADDED "RBP" & CORRECTED PIN	10/10/05	MMG	DJ
		CONNECTION TO DESCRIPTION OF PL-DWG.			
B	M102713	UPDATED NOTES, ADDED "...WITH SMOBC"	01/20/06	GT	IL

SUGGESTED MOUNTING CONFIGURATION FOR GP731 CASE STYLE, "qf" PIN CONNECTION.



NOTES:
1. TRACE WIDTH IS SHOWN FOR FR4 WITH DIELECTRIC THICKNESS .025" ± .002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS 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	DK (RAVON)	10 FEB 05
TOLERANCES ON:	CHECKED	RZ (RAVON)	10 FEB 05
2 PL DECIMALS ±	APPROVED	HH (RAVON)	10 FEB 05
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

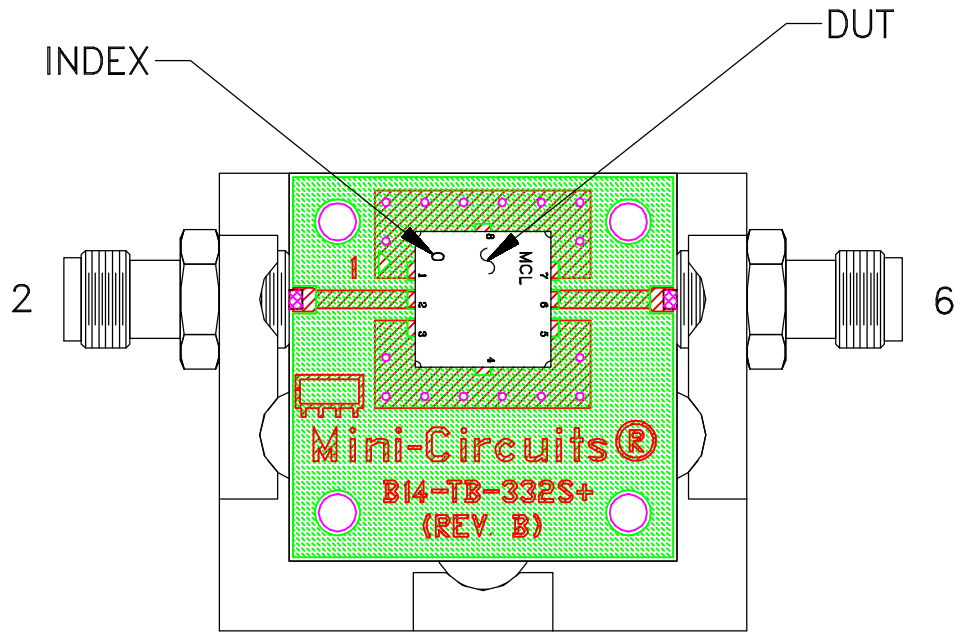
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, qf, GP731, RBP, TB-332

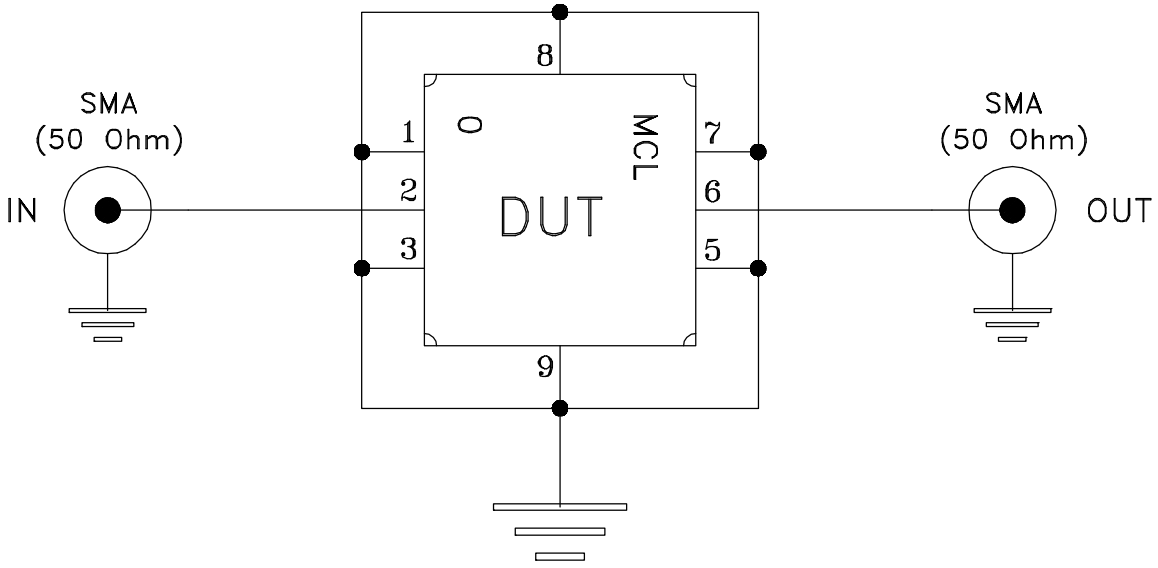
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-176	B

FILE:	SCALE:	SHEET:
98PL176	5:1	1 OF 1

Evaluation Board and Circuit



TB-332



Schematic Diagram

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: RO4350 or equivalent, Dielectric Constant=3.5, Thickness=.020 inch.

Mini-Circuits®

Mini-Circuits

Environmental Specifications ENV03T2

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
HAST	130°C, 85% RH, 96 hours	JESD22-A110
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 Eutectic Process: 225°C peak Pb-Free Process, 245°C peak	J-STD-020, 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, 20-2000 Hz, 4 times in each of three axes (total 12)	MIL-STD-883, Method 2007.3, Condition A
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