

Low Pass Filter

50Ω DC to 176 MHz

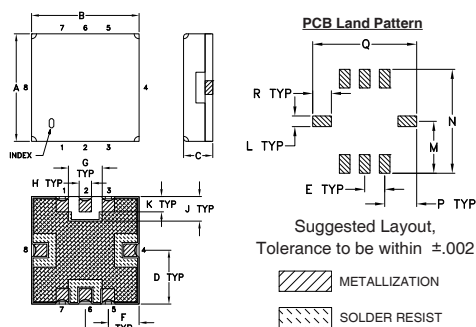
Maximum Ratings

Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power Input	0.5W Max
Permanent damage may occur if any of these limits are exceeded.	

Pin Connections

RF IN	2
RF OUT	6
GROUND	1, 3, 4, 5, 7, 8

Outline Drawing

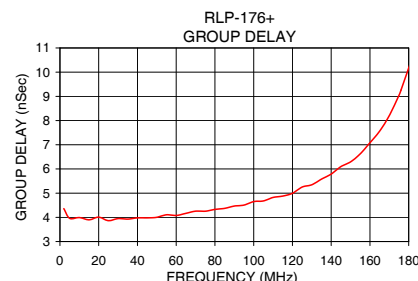
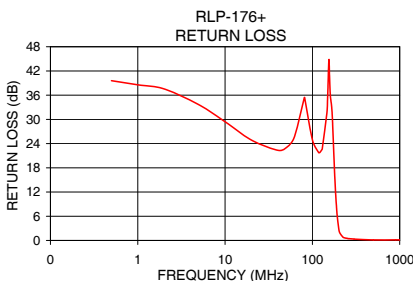
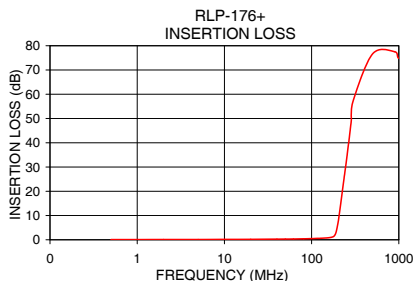
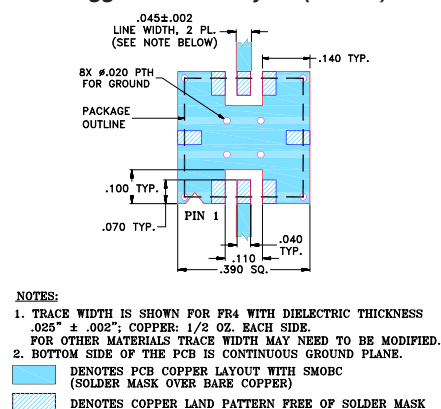


Outline Dimensions (inch/mm)

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

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



Notes

- 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.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuits' applicable established test performance criteria and measurement instructions.
- 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



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RLP-176+



Generic photo used for illustration purposes only
CASE STYLE: GP731

+RoHS Compliant

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

Reel Size	Devices/Reel
7"	10, 20, 50, 100, 200
13"	500, 1000

Features

- high rejection
- sharp insertion loss roll off
- excellent VSWR, 1.1:1 typ. @ passband
- aqueous washable

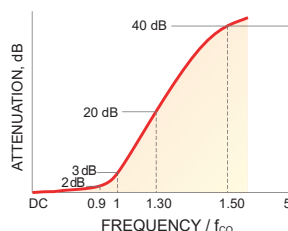
Applications

- wireless communications
- receivers / transmitters

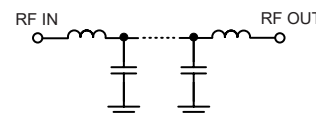
Low Pass Filter Electrical Specifications (T_{AMB} = 25°C)

PASSBAND (MHz)	f _{co} , MHz Nom.	STOPBAND (MHz)		VSWR (:1)	
(Loss < 2dB)	(Loss 3dB)	(Loss > 20dB)	(Loss > 40dB)	Passband Typ.	Stopband Typ.
DC - 176	191	245 - 285	285 - 1000	1.1	20

Typical Frequency Response



Functional Schematic



Typical Performance Data at 25°C

Frequency (MHz)	Insertion Loss (dB)	Return Loss (dB)	Frequency (MHz)	Group Delay (nSec)
$\bar{x}$	σ			
0.5	0.08	0.01	2.0	4.36
50.0	0.30	0.01	5.0	3.96
100.0	0.48	0.01	10.0	3.99
150.0	0.78	0.01	20.0	4.01
176.0	1.23	0.02	30.0	3.95
185.0	1.97	0.06	40.0	3.98
188.0	2.47	0.09	60.0	4.08
191.0	3.19	0.12	70.0	4.26
200.0	6.60	0.19	80.0	4.33
206.0	9.64	0.21	90.0	4.47
225.0	19.92	0.19	100.0	4.65
245.0	29.97	0.18	110.0	4.82
255.0	34.74	0.17	130.0	5.35
285.0	49.18	0.26	140.0	5.79
300.0	57.36	0.55	150.0	6.29
500.0	76.65	8.71	160.0	7.08
900.0	77.53	6.17	176.0	9.25
1000.0	74.82	4.14	180.0	10.17

Metal Shield Low Pass Filter

RLP-176+

Typical Performance Data

FREQ. (MHz)	INSERTION LOSS (dB)			INPUT RETURN LOSS (dB)			OUTPUT RETURN LOSS (dB)		
	@ -40° C	@ +25° C	@ +85° C	@ -40° C	@ +25° C	@ +85° C	@ -40° C	@ +25° C	@ +85° C
0.5	0.08	0.10	0.12	38.67	37.40	36.32	41.68	39.16	37.45
50	0.25	0.30	0.32	23.27	23.43	23.57	22.97	23.17	23.40
100	0.39	0.47	0.52	25.42	25.53	25.73	25.47	25.55	25.66
120	0.49	0.57	0.64	21.77	22.09	22.47	21.70	22.06	22.49
150	0.63	0.75	0.84	37.36	39.75	42.98	38.56	41.25	46.17
176	1.00	1.19	1.34	26.18	25.42	24.44	24.63	23.90	23.06
185	1.63	1.90	2.13	12.84	12.48	12.07	12.59	12.26	11.85
188	2.09	2.40	2.67	9.95	9.67	9.36	9.77	9.54	9.23
191	2.69	3.05	3.36	7.54	7.35	7.13	7.41	7.26	7.04
200	5.98	6.43	6.85	3.26	3.27	3.23	3.18	3.22	3.19
245	29.48	29.79	30.10	0.46	0.53	0.58	0.41	0.51	0.58
285	48.01	48.16	48.61	0.31	0.37	0.41	0.26	0.35	0.42
300	55.25	55.28	55.79	0.27	0.33	0.37	0.23	0.32	0.38
400	79.23	80.81	82.33	0.17	0.22	0.27	0.12	0.22	0.28
500	93.04	94.84	91.67	0.13	0.19	0.25	0.07	0.18	0.26
700	96.82	84.43	93.59	0.10	0.18	0.25	0.03	0.17	0.27
900	82.92	71.53	80.90	0.10	0.20	0.29	0.03	0.19	0.31
1000	78.32	65.18	79.37	0.11	0.21	0.31	0.02	0.20	0.33
1200	81.38	73.73	79.59	0.12	0.24	0.35	0.03	0.24	0.39
1400	66.47	71.48	66.09	0.15	0.28	0.40	0.04	0.27	0.44
1500	49.81	49.78	49.19	0.19	0.33	0.45	0.04	0.29	0.46
1800	48.85	49.29	49.50	0.18	0.33	0.46	0.06	0.32	0.51
2000	40.28	40.79	40.37	0.21	0.36	0.50	0.10	0.36	0.56
2200	48.65	48.74	50.19	0.21	0.37	0.50	0.08	0.36	0.57
2400	61.89	62.48	59.98	0.22	0.38	0.51	0.09	0.37	0.58
2500	51.11	50.33	52.74	0.23	0.39	0.52	0.09	0.38	0.59
2800	57.76	59.33	59.71	0.23	0.39	0.51	0.08	0.37	0.59
3000	51.71	53.20	53.33	0.22	0.38	0.51	0.07	0.38	0.60
3200	56.02	55.29	55.51	0.21	0.37	0.50	0.05	0.37	0.60
3400	49.85	51.23	48.83	0.22	0.39	0.53	0.05	0.38	0.62
3500	41.25	38.14	39.46	0.27	0.45	0.58	0.11	0.48	0.70
3800	41.64	42.65	44.27	0.27	0.45	0.61	0.02	0.40	0.66
4000	39.56	39.08	39.72	0.26	0.44	0.58	0.05	0.43	0.72
4200	38.21	39.47	38.68	0.28	0.48	0.64	0.02	0.45	0.75
4400	36.72	37.08	35.98	0.31	0.52	0.69	0.03	0.49	0.82
4500	36.22	35.40	36.69	0.28	0.50	0.68	0.06	0.51	0.82
4800	33.09	31.74	32.38	0.44	0.72	0.94	0.07	0.56	0.93
5000	27.58	26.23	25.13	0.49	0.95	1.55	0.19	0.68	1.10
5200	20.42	21.70	25.88	2.16	3.04	2.27	0.54	1.04	1.26
5400	26.22	29.42	32.35	1.17	1.18	1.25	0.36	0.80	1.18
5500	29.88	31.14	34.39	0.82	1.03	1.24	0.25	0.76	1.12
5800	37.17	35.00	38.88	0.90	1.25	1.54	0.44	0.90	1.31
6000	27.24	30.82	32.48	1.51	1.53	1.59	0.59	1.06	1.48
6200	25.76	29.57	30.94	0.77	1.06	1.29	0.63	1.22	1.80
6400	34.49	33.45	35.34	0.74	1.01	1.34	0.91	1.94	2.78
6500	31.14	31.61	32.46	0.75	1.10	1.45	1.80	3.94	4.57
6800	28.27	28.29	29.33	0.85	1.21	1.48	1.07	1.55	2.06
7000	27.64	26.61	26.92	0.70	1.14	1.52	0.67	1.35	1.91
7200	24.00	23.50	23.92	0.83	1.29	1.61	0.63	1.42	2.14
7400	20.33	19.82	19.54	0.78	1.28	1.68	0.69	1.72	2.55
7500	19.11	18.14	18.25	0.83	1.39	1.90	0.69	1.87	3.14
7800	13.57	13.53	12.62	1.32	1.90	2.79	2.56	3.97	6.17
8000	9.82	8.74	9.62	2.03	3.62	3.99	5.08	11.50	12.18
8500	8.90	10.54	12.16	1.84	2.18	2.47	2.29	2.96	3.53

REV. X2

RLP-176+

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Typical Performance Data

FREQ. (MHz)	GROUP DELAY (nsec)		
	@ -40° C	@ +25° C	@ +85° C
0.5	4.16	4.19	4.20
2	4.17	4.19	4.21
5	4.17	4.20	4.21
10	4.17	4.19	4.21
20	4.17	4.19	4.20
30	4.20	4.22	4.23
40	4.26	4.27	4.29
50	4.35	4.36	4.37
60	4.46	4.47	4.49
70	4.58	4.59	4.61
80	4.72	4.73	4.75
90	4.89	4.90	4.93
100	5.12	5.13	5.16
110	5.43	5.45	5.47
120	5.87	5.89	5.92
130	6.45	6.47	6.50
140	6.98	6.97	6.98
150	7.26	7.24	7.24
160	7.35	7.32	7.31
170	7.31	7.28	7.26
171	7.30	7.27	7.25
172	7.29	7.26	7.24
173	7.28	7.24	7.22
174	7.27	7.23	7.21
175	7.25	7.22	7.20
176	7.24	7.21	7.19
177	7.23	7.20	7.17
178	7.21	7.18	7.16
179	7.20	7.17	7.14
180	7.18	7.15	7.13
181	7.17	7.14	7.11
182	7.15	7.12	7.10
183	7.13	7.10	7.08
184	7.12	7.08	7.06
185	7.10	7.07	7.04
186	7.08	7.05	7.02
187	7.06	7.03	7.00
188	7.04	7.01	6.98
189	7.02	6.99	6.96
190	7.00	6.97	6.94
192	6.96	6.92	6.90
193	6.93	6.90	6.87
194	6.91	6.87	6.85
195	6.89	6.85	6.83
200	6.76	6.72	6.70
210	6.47	6.43	6.40
220	6.12	6.08	6.04
230	5.69	5.65	5.61
240	5.18	5.14	5.11
245	4.88	4.84	4.79
250	4.54	4.53	4.42
260	3.70	3.61	3.65
270	2.46	2.49	2.52
280	0.49	0.46	0.31

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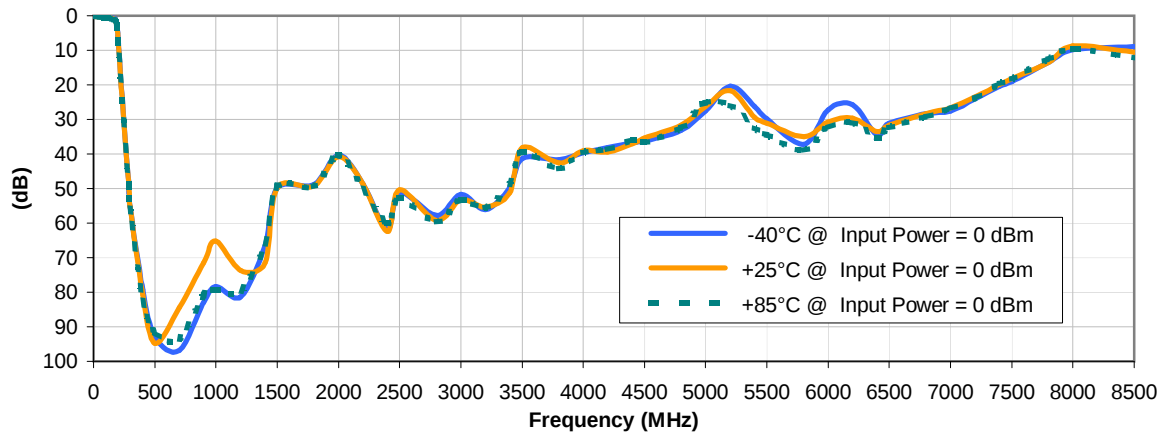


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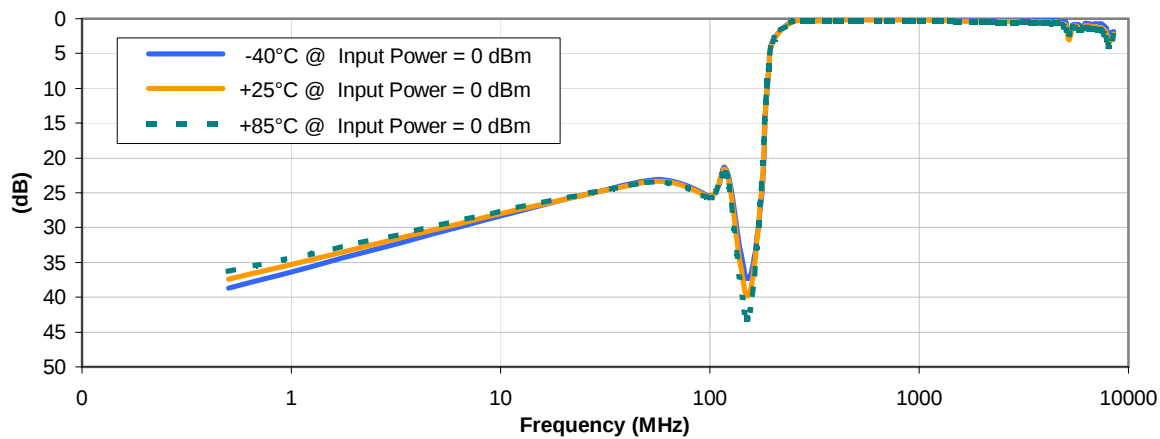


Typical Performance Curves

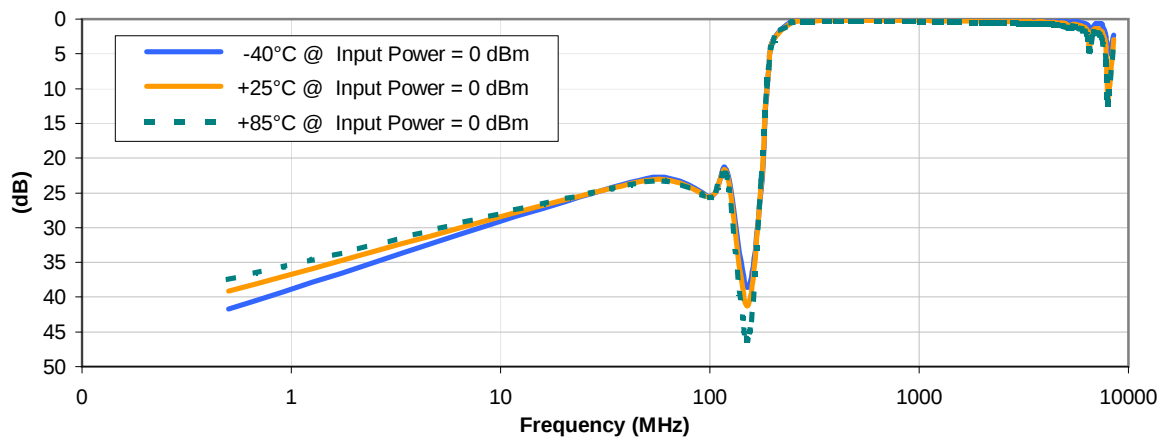
INSERTION LOSS vs. TEMPERATURE



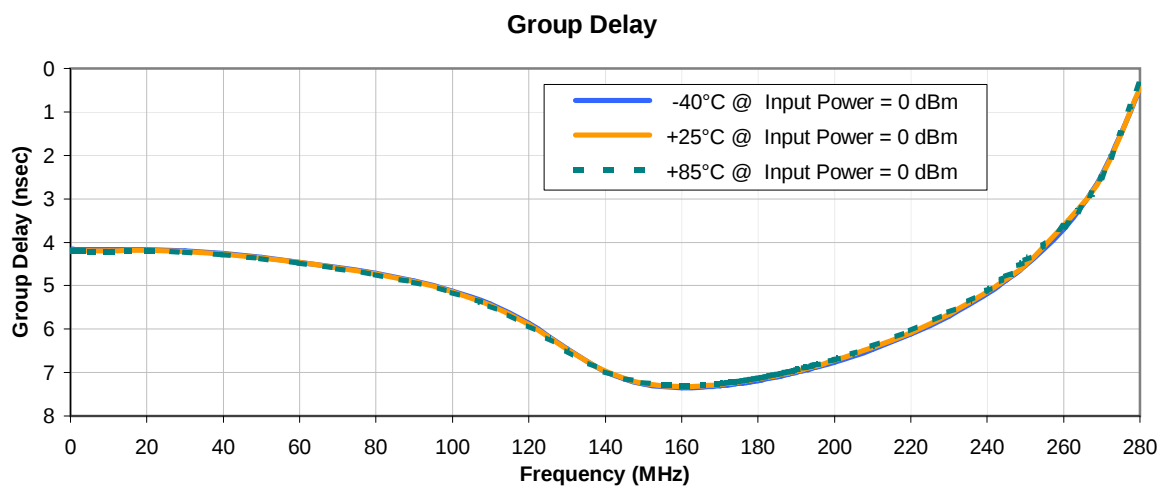
INPUT RETURN LOSS vs. TEMPERATURE



OUTPUT RETURN LOSS vs. TEMPERATURE



Typical Performance Curves



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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. $\pm .03$; 3Pl. $\pm .015$

Notes:

- Case material: Nickel-Silver alloy.
- Base: Printed wiring laminate.
- 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.

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RF/IF MICROWAVE COMPONENTS

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.

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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 TOLERANCES ON: 2 PL DECIMALS ± 3 PL DECIMALS ± .005 ANGLES ± FRACTIONS ±	DRAWN	DK (RAVON)	10 FEB 05
	CHECKED	RZ (RAVON)	10 FEB 05
	APPROVED	HH (RAVON)	10 FEB 05



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PL, qf, GP731, RBP, TB-332

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

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-176	B
FILE:	98PL176	SCALE: 5:1	SHEET: 1 OF 1

Evaluation Board and Circuit



TB-332



Schematic Diagram

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: R04350 or equivalent,
Dielectric Constant=3.5, Thickness=.020 inch.

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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