

Surface Mount Low Pass Filter

ULP-900+

50Ω DC to 900 MHz

The Big Deal

- Low Insertion loss, 1.5dB Typ.
- High rejection, > 30dB
- Sharp insertion loss roll-off
- Ultra miniature surface mount package



CASE STYLE: QA2224

Product Overview

The ULP-900+ is a lowpass filter in a top hat package (size of 0.25" x 0.25") fabricated using SMT technology. Covering DC to 900 MHz band width, these units offer good matching within the passband and high rejection. This model uses a miniature high Q capacitors and chip inductors for high reliability. In addition it has repeatable performance across production lots and consistent performance across temperature.

Key Features

Feature	Advantages
Low passband insertion loss	Passband insertion loss 1.5dB typical ensures low signal loss throughout the passband
Excellent stopband rejection	Rejection of 30 dB ensures unwanted spurious are eliminated
Small size, 0.25" x 0.25"	The Ultra miniature surface mount package enables the ULP-900+ to be used in compact designs.

Notes

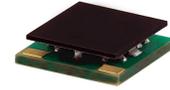
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B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
C. The parts covered by this specification document 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



Surface Mount ^{top hat®} Low Pass Filter

ULP-900+

50Ω DC to 900 MHz



CASE STYLE: QA2224

Features

- High rejection
- Sharp insertion loss roll-off
- Ultra miniature surface mount package

Applications

- Wireless communications
- Receivers / Transformers
- Lab use

Electrical Specifications at 25°C

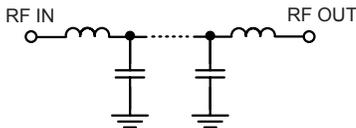
Parameter	F#	Frequency (MHz)	Min.	Typ.	Max.	Unit	
Pass Band	Insertion Loss	DC-F1	DC-900	—	1.5	2.0	dB
	Freq. Cut-Off	F2	1000	—	3.0	—	dB
	VSWR	DC-F1	DC-900	—	1.7	—	:1
Stop Band	Rejection Loss	F3-F4	1300-1750	20	27	—	dB
		F4-F5	1750-2900	30	35	—	dB
	VSWR	F3-F5	1300-2900	—	20	—	:1

Maximum Ratings

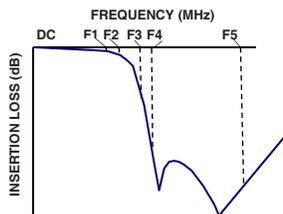
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power Input	1.5 W max.

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

Functional Schematic



Typical Frequency Response

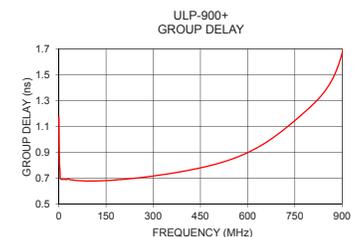
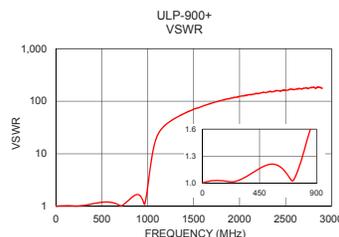
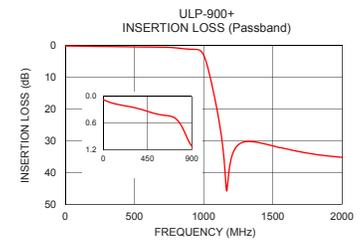
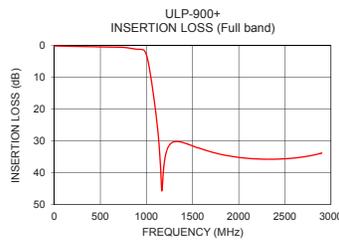


Typical Performance Data at 25°C

Frequency (MHz)	Insertion Loss (dB)	VSWR (:1)	Frequency (MHz)	Group Delay (nsec)
1	0.07	1.01	1	1.04
10	0.08	1.01	10	0.69
100	0.15	1.03	50	0.68
350	0.27	1.08	100	0.68
500	0.37	1.20	150	0.68
750	0.53	1.13	200	0.69
900	1.12	1.67	250	0.70
1000	2.96	2.38	300	0.72
1050	10.49	9.85	350	0.73
1100	20.97	21.15	400	0.76
1180	40.66	33.82	450	0.78
1200	35.44	36.31	500	0.81
1300	30.29	47.76	520	0.82
1500	31.61	69.83	600	0.90
1600	32.56	81.29	650	0.96
1750	33.89	98.13	700	1.05
2000	35.22	124.15	750	1.15
2150	35.65	135.51	800	1.25
2500	35.64	160.53	850	1.39
2900	33.88	175.24	900	1.67

+RoHS Compliant

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



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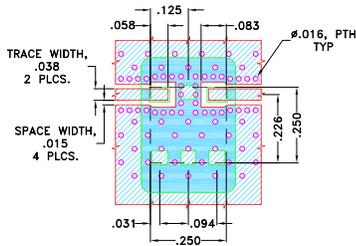
REV.A
M161927
ULP-900+
EDU2398
URJ
170513
Page 2 of 3

Pad Connections

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

Demo Board MCL P/N: TB-894+
Suggested PCB Layout (PL-484)

SUGGESTED MOUNTING CONFIGURATION FOR
 QA2224 CASE STYLE "06FL09" PIN CODE

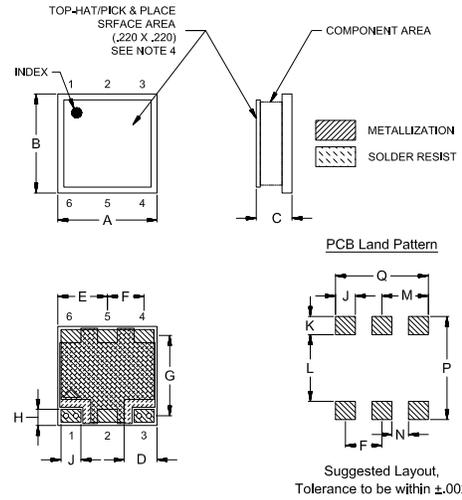


NOTES:

- TRACE WIDTH IS SHOWN FOR ROGERS (R04350B) WITH DIELECTRIC THICKNESS .020 \pm .0015". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
- 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 SOLDERMASK

Outline Drawing



Outline Dimensions (Inch / mm)

A	B	C	D	E	F	G	H	J	K
-	-	Min	Max	-	-	-	-	-	-
.250	.250	.075	.100	.075	.125	.092	.201	.041	.050
6.35	6.35	1.91	2.54	1.91	3.18	2.34	5.11	1.04	1.27
L	M	N	P	Q					
-	-	-	-	-					Wt.
.168	.117	.042	.260	.234					grams
4.27	2.97	1.07	6.60	5.94					0.25

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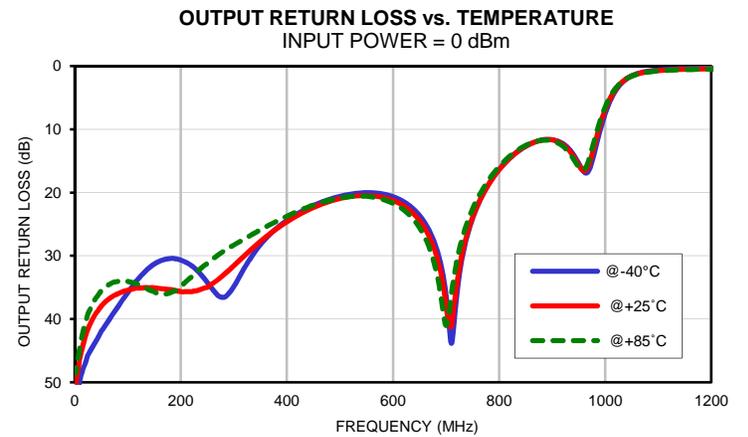
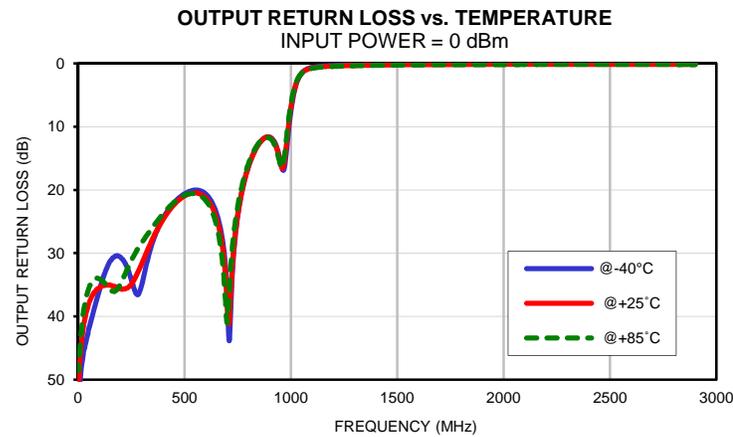
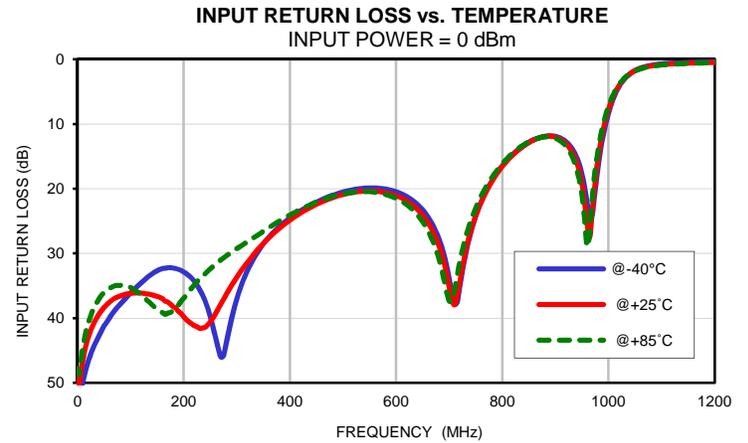
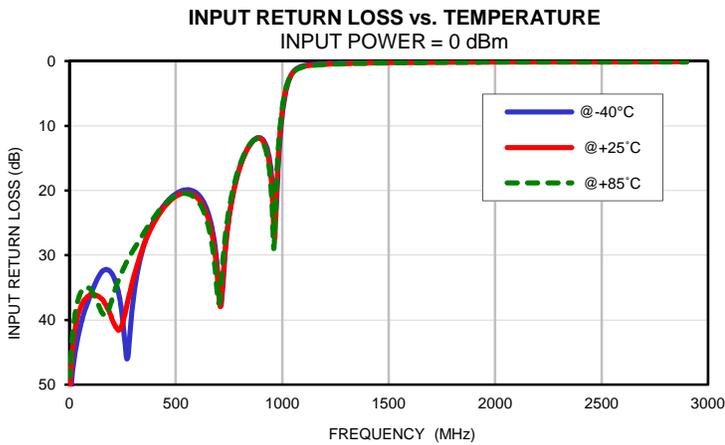
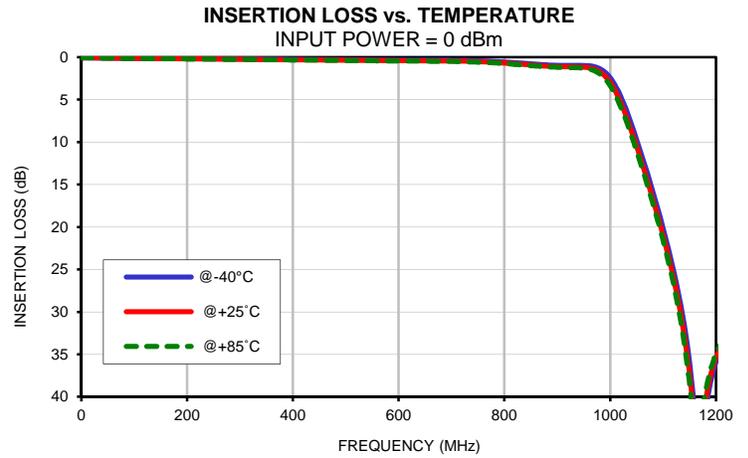
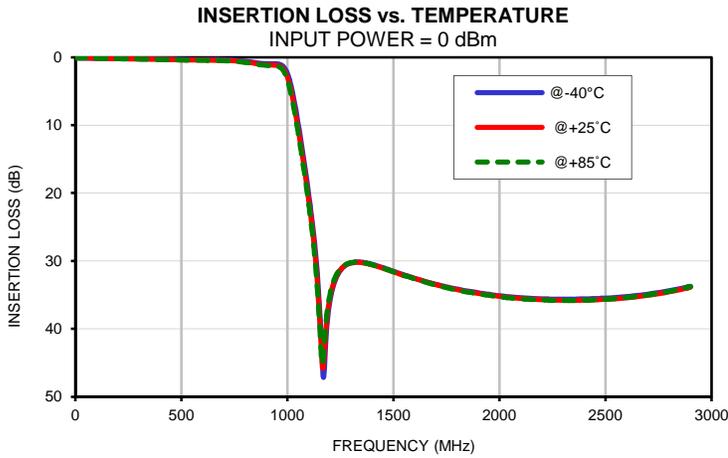
Typical Performance Data

FREQ. (MHz)	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
	(dB)			(dB)			(dB)		
	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C
1	0.07	0.07	0.08	52.79	50.14	48.62	51.86	49.46	47.99
2	0.07	0.08	0.08	53.30	50.41	48.71	52.98	50.19	48.54
5	0.07	0.08	0.08	52.38	49.18	47.43	51.84	48.75	47.06
10	0.08	0.08	0.09	49.78	46.40	44.55	49.70	46.17	44.32
15	0.08	0.09	0.09	48.14	44.50	42.41	48.08	44.32	42.27
20	0.08	0.09	0.10	46.66	43.01	40.83	47.00	42.94	40.74
25	0.09	0.10	0.10	45.58	41.90	39.62	45.67	41.48	39.22
50	0.11	0.12	0.12	41.21	38.30	36.03	41.97	37.94	35.54
100	0.14	0.15	0.16	36.07	36.13	35.26	35.82	35.43	34.05
150	0.16	0.18	0.18	32.66	36.65	38.68	31.28	35.04	35.70
200	0.18	0.20	0.21	32.84	39.77	36.92	30.68	35.66	34.83
250	0.19	0.22	0.24	39.70	40.55	32.38	34.25	34.97	31.19
300	0.20	0.25	0.26	36.96	33.64	29.24	34.88	31.57	28.29
350	0.22	0.27	0.29	28.51	28.44	26.57	28.24	27.72	25.89
400	0.25	0.30	0.33	24.53	24.86	24.07	24.39	24.62	23.74
500	0.31	0.37	0.40	20.51	20.90	20.79	20.59	20.94	20.85
600	0.35	0.42	0.45	20.45	21.06	21.47	20.65	21.25	21.69
700	0.36	0.46	0.50	33.80	35.08	37.31	36.29	37.81	41.02
900	0.96	1.12	1.19	11.89	12.01	12.19	11.63	11.68	11.80
925	0.97	1.14	1.22	13.10	13.47	13.96	12.55	12.72	13.03
950	0.97	1.18	1.30	17.64	19.13	20.93	15.39	15.64	15.97
1000	2.41	2.96	3.36	8.39	7.77	7.30	7.47	6.85	6.40
1010	3.37	4.02	4.47	5.95	5.57	5.29	5.35	4.96	4.68
1050	9.66	10.49	11.03	1.72	1.77	1.79	1.52	1.55	1.56
1100	20.12	20.97	21.55	0.70	0.82	0.87	0.61	0.70	0.75
1120	25.13	26.08	26.75	0.58	0.70	0.74	0.50	0.59	0.64
1130	28.06	29.10	29.87	0.53	0.65	0.69	0.46	0.56	0.61
1135	29.70	30.81	31.64	0.52	0.63	0.67	0.45	0.54	0.59
1140	31.50	32.70	33.59	0.50	0.62	0.65	0.44	0.52	0.58
1150	35.81	37.27	38.38	0.47	0.58	0.62	0.41	0.50	0.55
1200	35.95	35.44	34.99	0.37	0.48	0.51	0.32	0.41	0.45
1250	31.35	31.27	31.15	0.30	0.41	0.44	0.27	0.36	0.40
1300	30.28	30.29	30.26	0.26	0.36	0.38	0.22	0.31	0.35
1350	30.19	30.25	30.23	0.22	0.33	0.34	0.19	0.28	0.32
1400	30.51	30.58	30.57	0.18	0.30	0.31	0.16	0.25	0.29
1500	31.53	31.61	31.60	0.13	0.25	0.25	0.12	0.21	0.25
1600	32.56	32.56	32.65	0.09	0.21	0.22	0.08	0.18	0.21
1650	33.03	33.06	33.11	0.08	0.20	0.20	0.07	0.17	0.20
1700	33.44	33.50	33.55	0.06	0.19	0.19	0.06	0.16	0.19
1750	33.82	33.89	33.94	0.05	0.18	0.18	0.05	0.15	0.18
1800	34.12	34.22	34.28	0.04	0.17	0.17	0.04	0.14	0.18
1825	34.31	34.39	34.44	0.04	0.16	0.16	0.04	0.14	0.17
1850	34.44	34.54	34.60	0.03	0.16	0.16	0.03	0.14	0.17
1875	34.57	34.66	34.71	0.03	0.16	0.16	0.03	0.13	0.17
1900	34.69	34.78	34.84	0.02	0.15	0.15	0.02	0.13	0.17
1925	34.81	34.91	34.96	0.01	0.15	0.15	0.03	0.13	0.17
1950	34.92	35.02	35.07	0.01	0.15	0.14	0.02	0.13	0.16
1975	35.04	35.12	35.18	0.01	0.15	0.14	0.02	0.13	0.16
2000	35.13	35.22	35.29	0.01	0.14	0.14	0.02	0.13	0.16
2025	35.21	35.32	35.37	0.00	0.14	0.14	0.01	0.12	0.16
2050	35.30	35.40	35.44	0.00	0.14	0.14	0.01	0.12	0.16
2075	35.35	35.46	35.52	0.00	0.14	0.13	0.01	0.12	0.16
2100	35.41	35.52	35.59	0.01	0.13	0.13	0.01	0.12	0.16
2200	35.59	35.71	35.74	0.01	0.12	0.13	0.01	0.12	0.15
2250	35.63	35.77	35.81	0.02	0.12	0.12	0.00	0.11	0.15
2500	35.47	35.64	35.62	0.03	0.11	0.12	0.00	0.11	0.15
2750	34.66	34.83	34.76	0.03	0.10	0.12	0.00	0.12	0.16
2800	34.39	34.56	34.48	0.03	0.09	0.11	0.00	0.12	0.15
2850	34.09	34.23	34.15	0.03	0.10	0.12	0.00	0.12	0.15
2900	33.75	33.88	33.75	0.02	0.10	0.12	0.01	0.12	0.16

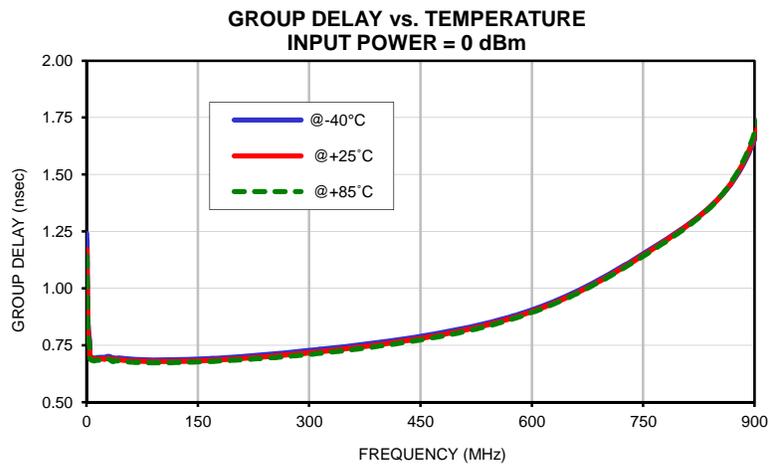
Typical Performance Data

FREQ. (MHz)	GROUP DELAY		
	(nsec)		
	@-40°C	@+25°C	@+85°C
1	1.11	1.04	1.03
2	0.85	0.83	0.81
3	0.80	0.79	0.78
4	0.78	0.76	0.75
5	0.70	0.70	0.69
10	0.69	0.69	0.68
15	0.70	0.69	0.69
20	0.70	0.69	0.68
25	0.70	0.69	0.68
50	0.69	0.68	0.68
75	0.69	0.68	0.67
100	0.69	0.68	0.67
120	0.69	0.68	0.67
140	0.69	0.68	0.68
160	0.69	0.68	0.68
180	0.69	0.69	0.68
200	0.70	0.69	0.68
220	0.70	0.69	0.69
240	0.71	0.70	0.69
260	0.71	0.71	0.70
280	0.72	0.71	0.70
300	0.73	0.72	0.71
320	0.73	0.72	0.72
340	0.74	0.73	0.72
360	0.75	0.74	0.73
380	0.76	0.75	0.74
400	0.77	0.76	0.75
420	0.77	0.77	0.76
440	0.78	0.78	0.77
460	0.79	0.79	0.78
480	0.81	0.80	0.79
500	0.82	0.81	0.80
520	0.83	0.82	0.82
540	0.85	0.84	0.83
560	0.86	0.86	0.85
580	0.88	0.88	0.87
600	0.91	0.90	0.89
620	0.93	0.92	0.92
640	0.96	0.95	0.95
660	0.99	0.98	0.98
680	1.02	1.01	1.01
700	1.05	1.05	1.04
720	1.09	1.09	1.08
740	1.13	1.13	1.12
760	1.17	1.17	1.16
780	1.21	1.21	1.20
800	1.26	1.25	1.25
805	1.27	1.26	1.26
810	1.28	1.28	1.27
815	1.29	1.29	1.28
820	1.30	1.30	1.30
830	1.33	1.33	1.32
840	1.36	1.36	1.35
850	1.39	1.39	1.39
855	1.41	1.41	1.41
860	1.42	1.43	1.43
870	1.47	1.47	1.47
880	1.52	1.52	1.53
890	1.58	1.59	1.60
900	1.65	1.67	1.68

Typical Performance Curves

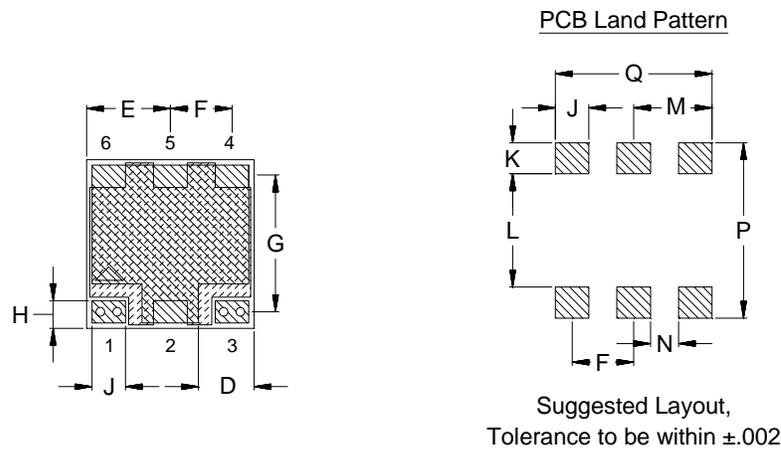
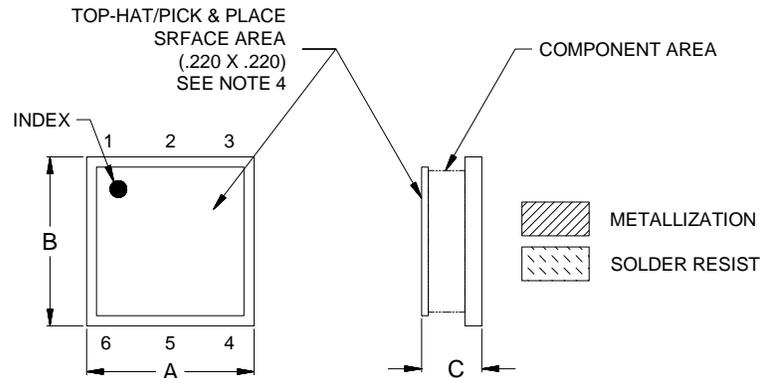


Typical Performance Curves



Outline Dimensions

QA2224



CASE#	A	B	C	D	E	F	G	H	J	K	L	M
QA2224	.250 (6.35)	.250 (6.35)	.070 (1.78)	.075 (1.91)	.125 (3.18)	.092 (2.34)	.201 (5.11)	.041 (1.04)	.050 (1.27)	.046 (1.17)	.168 (4.27)	.117 (2.97)

CASE#	N	P	Q	WT. GRAM
QA2224	.042 (1.07)	.260 (6.60)	.234 (5.94)	0.25

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

Notes:

- Case material: Ceramic base.
- Base: Printed wiring laminate.
- Termination finish:
For RoHS Case Styles: 3-5 μ inch Gold over 120-240 μ inch Nickel plate.
For RoHS-5 Case Styles: Tin-Lead plate.
- Top-Hat total thickness: .013 inches MAX



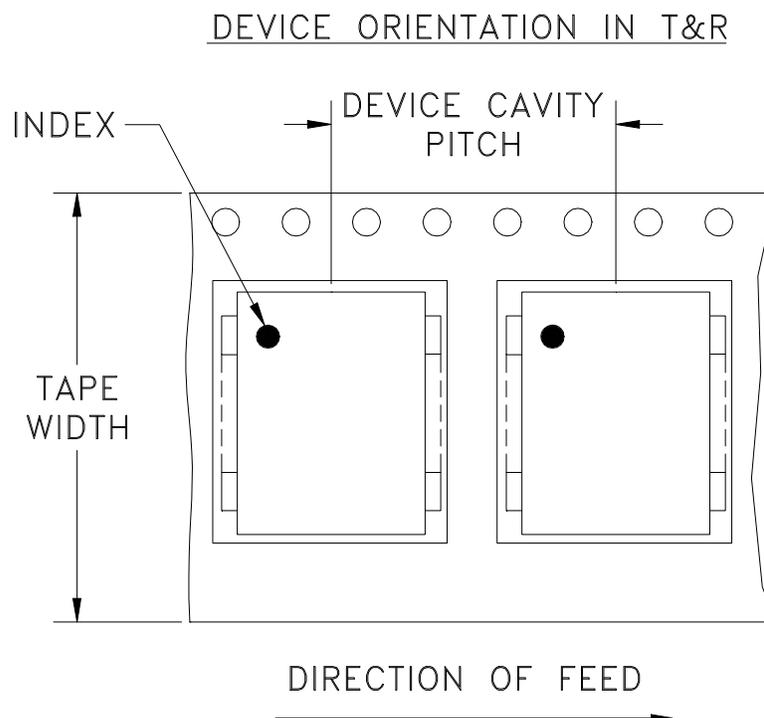
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The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com

RF/IF MICROWAVE COMPONENTS

Tape & Reel Packaging TR-F34



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note	
16	12	7	Small quantity standard (see note)	20
				50
				100
				200
		13	Standard	500
				1000

Note: Availability of small reel quantity varies by model.
Refer to pricing and availability on individual model dashboard.

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



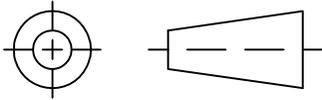
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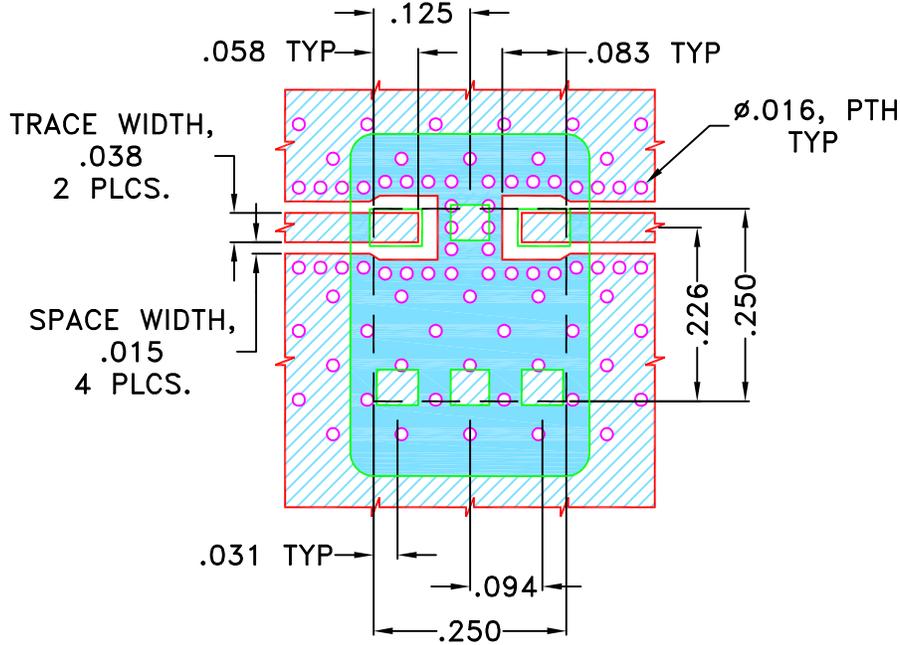
THIRD ANGLE PROJECTION



REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M156213	NEW RELEASE	MAY 16	TM	MD
A	M161508	COPPER LAND PATTERN UPDATED	APR 17	EJ	MD

SUGGESTED MOUNTING CONFIGURATION FOR QA2224 CASE STYLE "06FL09" PIN CODE



NOTES:

1. TRACE WIDTH IS SHOWN FOR ROGERS (R04350B) WITH DIELECTRIC THICKNESS .020"±.0015". 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 SOLDERMASK

UNLESS OTHERWISE SPECIFIED	INITIALS		DATE
DIMENSIONS ARE IN INCHES TOLERANCES ON: 2 PL DECIMALS ± 3 PL DECIMALS ± .005" ANGLES ± FRACTIONS ±	DRAWN	TM	02 MAY 16
	CHECKED	MD	02 MAY 16
	APPROVED	MD	02 MAY 16



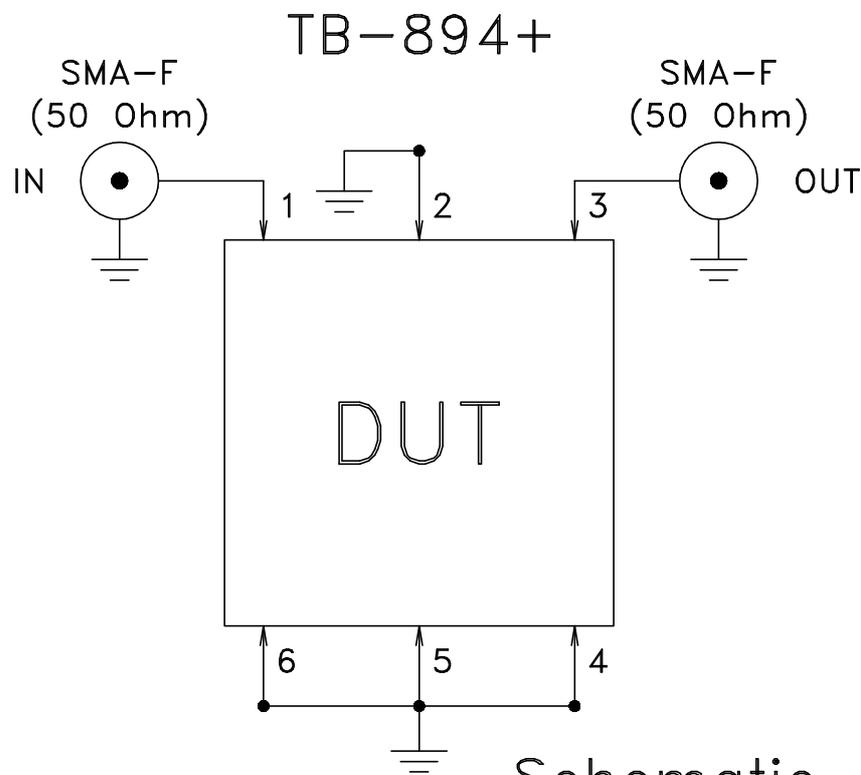
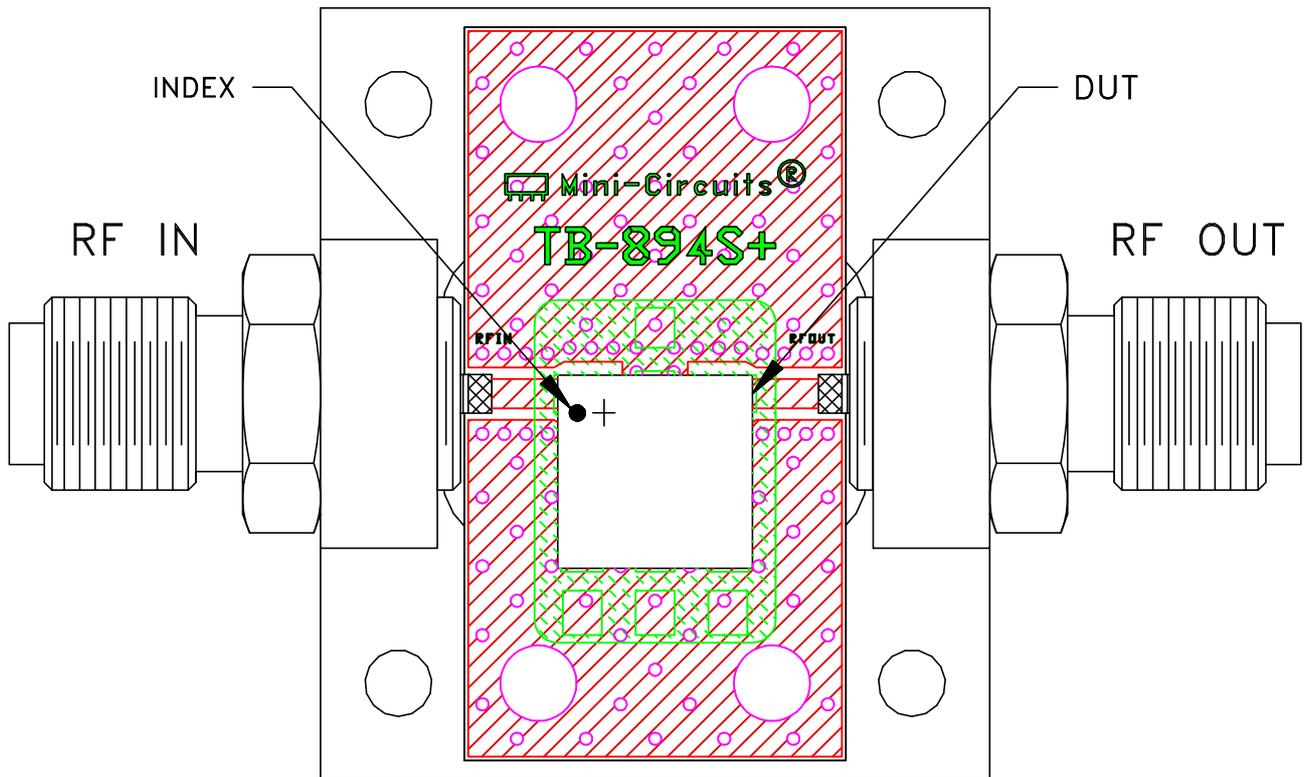
Mini-Circuits® 13 Neptune Avenue
Brooklyn NY 11235

PL, 06FL09, QA2224, ULP,
TB-894+, 50 Ohm

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SIZE A	CODE IDENT 15542	DRAWING NO: 98-PL-484	REV: A
FILE: 98PL484	SCALE: 4:1	SHEET: 1 OF 1	

Evaluation Board and Circuit



NOTES:

1. 50 Ohm SMA Female connectors.
2. PCB Material: ROGERS (RO4350B) OR Equivalent
Dielectric Constant=3.48±.05, Thickness=.020 inch.

Schematic Diagram

 **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	-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