

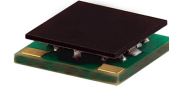
# Surface Mount <sup>top hat®</sup> Low Pass Filter

## ULP-83+

50Ω DC to 83 MHz

### The Big Deal

- Low Insertion loss, 1.5dB Typ.
- High rejection, > 40dB
- Sharp insertion loss roll-off
- Good VSWR
- Ultra miniature surface mount package



CASE STYLE: QA2224

### Product Overview

The ULP-83+ is a lowpass filter in a top hat package (size of 0.25" x 0.25") fabricated using SMT technology. Covering DC to 83 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 40 dB ensures unwanted spurious are eliminated
Excellent return loss at DC-83 MHz	This makes signal transmission with very less reflections and well-matched with the adjacent component used in the system
Small size, 0.25" x 0.25"	The Ultra miniature surface mount package enables the ULP-83+ to be used in compact designs.

#### Notes

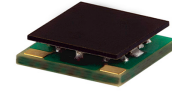
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# Surface Mount <sup>top hat®</sup> Low Pass Filter

50Ω DC to 83 MHz

## ULP-83+



CASE STYLE: QA2224

### Features

- High rejection
- Sharp insertion loss roll-off
- Good VSWR, 1.1:1 typ. at passband
- Ultra miniature surface mount package

### Applications

- Wireless communications
- Receivers / Transformers
- Lab use

### Electrical Specifications at 25°C

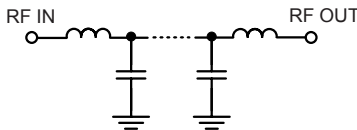
Parameter	F#	Frequency (MHz)	Min.	Typ.	Max.	Unit	
Pass Band	Insertion Loss	DC-F1	DC-83	—	1.5	2.0	dB
	Freq. Cut-Off	F2	93	—	3.0	—	dB
	VSWR	DC-F1	DC-83	—	1.1	—	:1
Stop Band	Rejection Loss	F3-F4	118-135	20	27	—	dB
		F4-F5	135-850	40	47	—	dB
	VSWR	F3-F5	135-850	—	20	—	:1

### Maximum Ratings

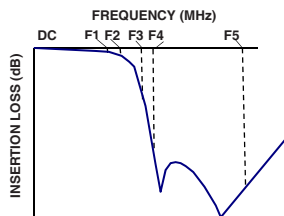
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power Input	0.15W max.

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

### Functional Schematic



### Typical Frequency Response

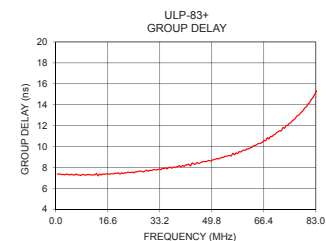
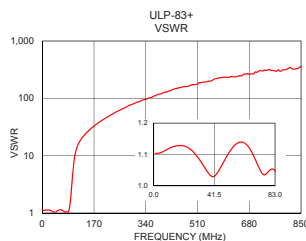
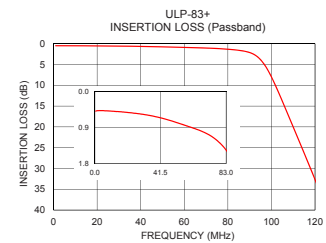
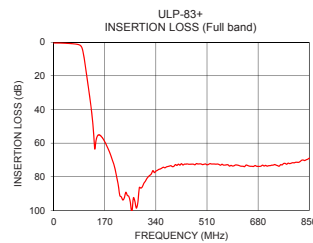


### Typical Performance Data at 25°C

Frequency (MHz)	Insertion Loss (dB)	VSWR (:1)	Frequency (MHz)	Group Delay (nsec)
1	0.49	1.10	1	7.38
10	0.49	1.12	2	7.32
40	0.65	1.03	5	7.36
80	1.33	1.05	10	7.32
83	1.46	1.05	15	7.38
90	2.12	1.29	20	7.49
93	2.91	1.75	25	7.49
94	3.32	1.99	35	7.97
100	7.99	4.88	40	8.07
105	13.83	8.64	45	8.46
110	20.05	11.98	50	8.72
118	30.11	15.84	55	9.12
130	47.92	20.24	60	9.67
135	60.20	21.89	65	10.32
200	72.50	42.77	68	10.72
400	73.75	126.88	70	11.17
500	72.57	173.05	75	12.27
600	73.45	234.35	78	13.18
700	73.60	289.59	80	13.82
850	69.00	355.59	83	15.20

### +RoHS Compliant

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



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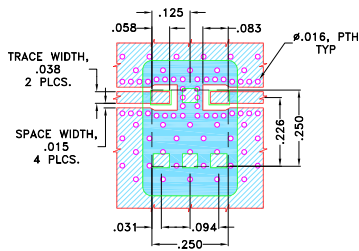
REV. OR  
M156166  
ULP-83+  
EDU2384  
URJ  
170511  
Page 2 of 3

## Pad Connections

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

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

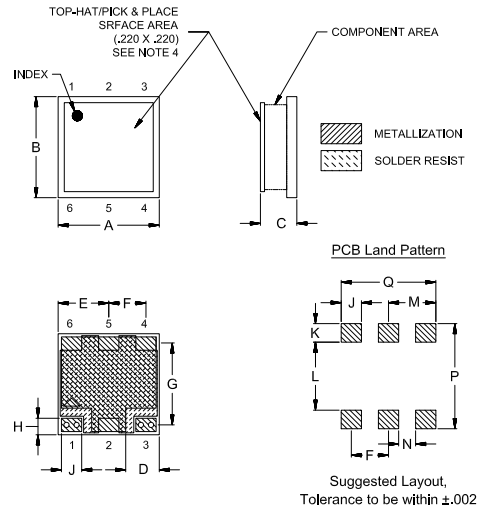
**SUGGESTED MOUNTING CONFIGURATION FOR  
 QA2224 CASE STYLE "06FL09" PIN CODE**



**NOTES:**

- TRACE WIDTH IS SHOWN FOR ROGERS (R04350B) WITH DIELECTRIC THICKNESS .020 ± .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)

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					
-	-	-	-	-					
.168	.117	.042	.260	.234					
4.27	2.97	1.07	6.60	5.94					
									Wt.
									grams
									0.25

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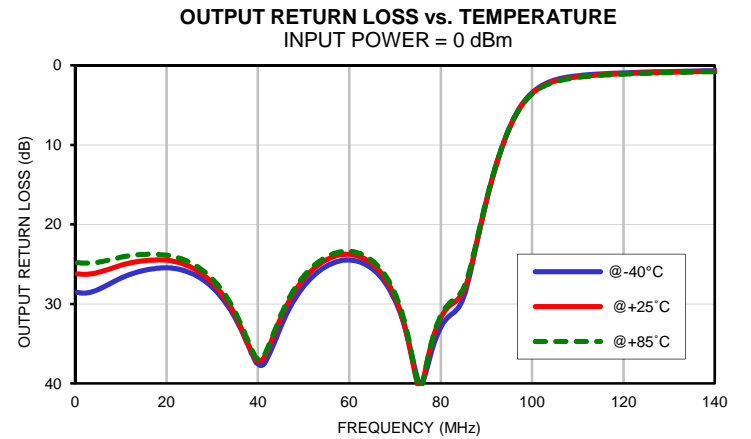
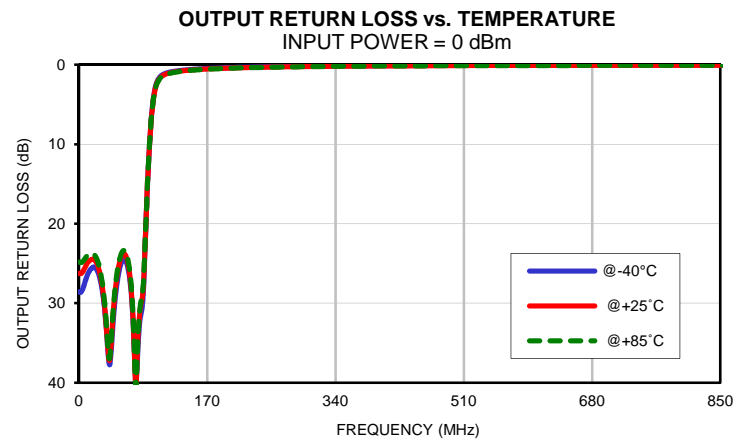
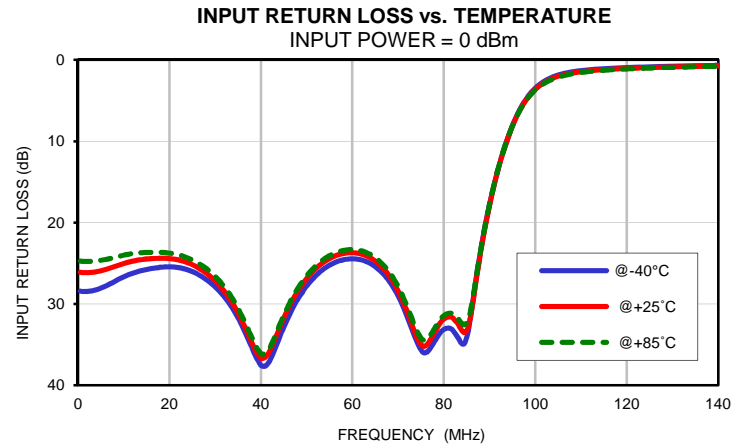
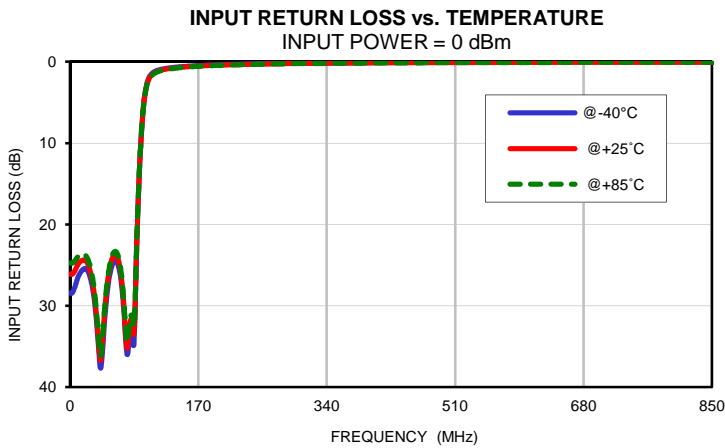
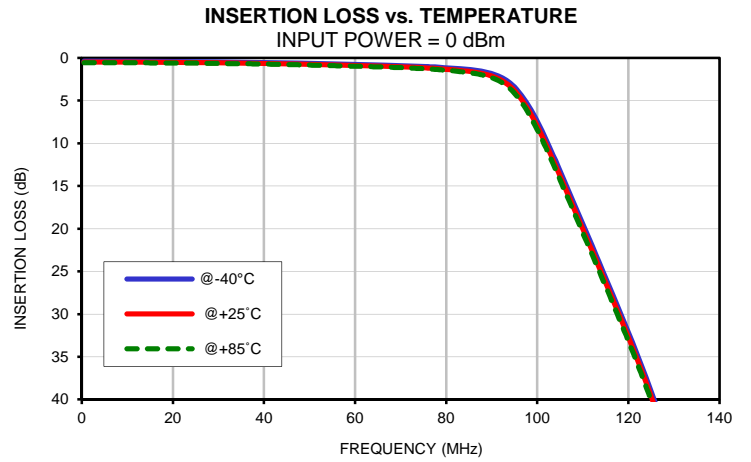
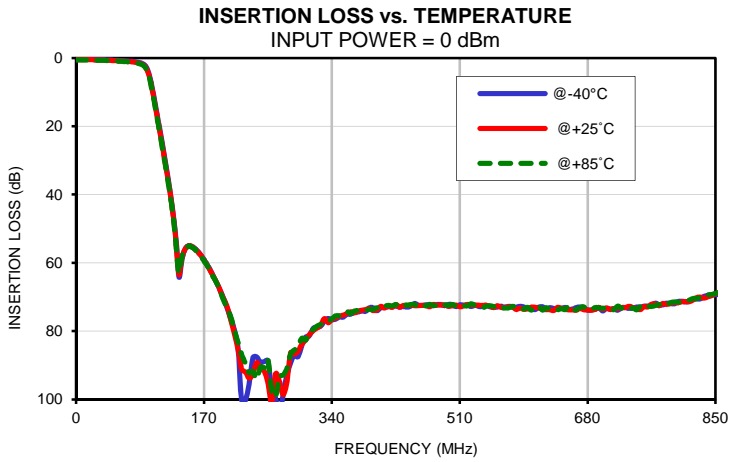
Typical Performance Data

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	0.38	0.49	0.57	28.46	26.13	24.75	28.60	26.23	24.83
2.0	0.38	0.48	0.56	28.47	26.15	24.78	28.63	26.27	24.87
5.0	0.37	0.48	0.56	28.04	25.91	24.63	28.23	26.07	24.77
10.0	0.39	0.49	0.57	26.66	25.02	24.01	26.75	25.13	24.12
15.0	0.40	0.51	0.59	25.75	24.47	23.66	25.80	24.57	23.77
20.0	0.42	0.52	0.60	25.43	24.41	23.74	25.45	24.50	23.87
25.0	0.45	0.55	0.62	26.02	25.17	24.58	26.04	25.28	24.74
30.0	0.47	0.57	0.65	27.90	27.18	26.61	27.89	27.30	26.83
35.0	0.51	0.61	0.68	31.68	31.09	30.51	31.73	31.40	30.96
40.0	0.54	0.65	0.72	37.54	36.67	36.10	37.55	37.15	36.92
45.0	0.59	0.70	0.78	32.89	31.75	31.44	32.84	31.74	31.43
50.0	0.64	0.76	0.84	27.80	26.88	26.55	27.83	26.90	26.55
55.0	0.70	0.82	0.91	25.25	24.44	24.08	25.26	24.46	24.09
60.0	0.76	0.89	0.98	24.45	23.70	23.32	24.49	23.77	23.39
65.0	0.82	0.96	1.05	25.41	24.73	24.31	25.57	24.95	24.56
70.0	0.90	1.04	1.14	28.98	28.38	27.85	29.51	29.10	28.68
75.0	1.00	1.16	1.27	35.63	34.94	34.15	39.57	40.25	40.13
80.0	1.15	1.33	1.45	33.13	31.88	31.45	32.96	31.77	31.52
83.0	1.27	1.46	1.60	34.01	32.36	31.69	31.04	29.81	29.43
85.0	1.37	1.58	1.73	34.16	33.31	32.34	29.19	28.41	28.01
90.0	1.84	2.12	2.32	17.78	17.89	17.74	17.08	17.05	16.90
93.0	2.56	2.91	3.16	11.27	11.32	11.25	10.99	10.98	10.90
95.0	3.42	3.84	4.14	8.09	8.15	8.13	7.92	7.94	7.91
98.0	5.52	6.03	6.41	4.82	4.93	4.98	4.73	4.82	4.85
100.0	7.43	7.99	8.40	3.48	3.61	3.69	3.41	3.53	3.60
105.0	13.24	13.83	14.27	1.87	2.02	2.12	1.84	1.98	2.06
110.0	19.47	20.05	20.49	1.32	1.45	1.54	1.30	1.43	1.51
115.0	25.73	26.30	26.74	1.08	1.20	1.27	1.07	1.18	1.25
118.0	29.54	30.11	30.56	0.99	1.10	1.17	0.98	1.08	1.15
119.0	30.83	31.40	31.86	0.96	1.07	1.14	0.95	1.06	1.12
120.0	32.14	32.70	33.16	0.94	1.04	1.11	0.93	1.03	1.09
125.0	39.05	39.62	40.11	0.85	0.94	1.00	0.84	0.93	0.98
130.0	47.30	47.92	48.50	0.77	0.86	0.91	0.77	0.85	0.90
135.0	59.73	60.20	60.43	0.71	0.79	0.84	0.71	0.79	0.83
140.0	59.99	59.57	59.04	0.66	0.74	0.78	0.66	0.74	0.77
145.0	55.91	55.87	55.88	0.62	0.69	0.74	0.62	0.69	0.73
150.0	55.02	55.06	55.20	0.58	0.65	0.69	0.58	0.65	0.68
175.0	60.78	61.03	61.03	0.44	0.50	0.53	0.44	0.50	0.53
200.0	72.82	72.50	72.96	0.35	0.41	0.43	0.35	0.41	0.43
250.0	88.96	91.71	90.65	0.24	0.29	0.31	0.24	0.29	0.31
300.0	84.20	83.89	82.11	0.17	0.22	0.23	0.18	0.22	0.24
500.0	72.25	72.57	72.18	0.07	0.10	0.11	0.06	0.10	0.12
700.0	74.09	73.60	73.35	0.02	0.06	0.07	0.02	0.07	0.08
750.0	73.01	73.72	72.82	0.01	0.06	0.07	0.01	0.05	0.07
800.0	71.36	71.72	71.50	0.01	0.05	0.06	0.01	0.06	0.07
850.0	69.36	69.00	68.96	0.00	0.05	0.06	0.00	0.05	0.07
900.0	65.68	65.89	65.49	0.01	0.05	0.06	0.00	0.05	0.06
600.0	73.38	73.45	73.02	0.04	0.07	0.08	0.04	0.08	0.09
625.0	73.49	73.74	73.18	0.03	0.07	0.08	0.03	0.08	0.09
650.0	73.08	73.64	73.70	0.03	0.07	0.08	0.03	0.08	0.09
675.0	73.10	73.75	72.90	0.02	0.06	0.07	0.02	0.07	0.08
700.0	74.09	73.60	73.35	0.02	0.06	0.07	0.02	0.07	0.08
750.0	73.01	73.72	72.82	0.01	0.06	0.07	0.01	0.05	0.07
775.0	72.34	72.55	72.22	0.01	0.06	0.06	0.01	0.06	0.07
800.0	71.36	71.72	71.50	0.01	0.05	0.06	0.01	0.06	0.07
810.0	71.47	71.37	71.11	0.01	0.05	0.06	0.01	0.06	0.07
820.0	70.69	70.92	70.46	0.01	0.05	0.06	0.01	0.06	0.07
830.0	70.52	70.05	70.07	0.01	0.05	0.06	0.01	0.06	0.07
840.0	69.51	69.90	69.39	0.01	0.05	0.06	0.01	0.06	0.07
850.0	69.36	69.00	68.96	0.00	0.05	0.06	0.00	0.05	0.07

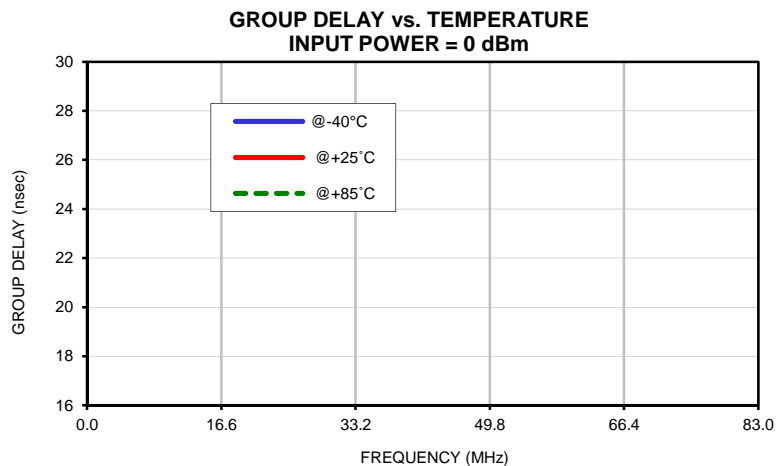
*Typical Performance Data*

FREQ.  (MHz)	GROUP DELAY		
	(nsec)		
	@-40°C	@+25°C	@+85°C
1.0	7.36	7.38	7.41
5.0	7.32	7.36	7.32
10.0	7.31	7.32	7.31
12.0	7.32	7.31	7.32
14.0	7.34	7.37	7.35
15.0	7.35	7.38	7.36
16.0	7.37	7.39	7.37
18.0	7.40	7.40	7.42
20.0	7.44	7.49	7.46
22.0	7.48	7.50	7.50
24.0	7.53	7.52	7.55
26.0	7.58	7.59	7.61
28.0	7.64	7.59	7.68
30.0	7.71	7.74	7.74
32.0	7.78	7.77	7.82
34.0	7.86	7.93	7.90
36.0	7.94	7.99	7.98
38.0	8.03	8.02	8.07
40.0	8.12	8.07	8.16
42.0	8.22	8.26	8.26
43.0	8.27	8.16	8.32
44.0	8.33	8.35	8.37
45.0	8.39	8.46	8.43
46.0	8.45	8.43	8.49
47.0	8.51	8.56	8.55
48.0	8.57	8.56	8.62
49.0	8.64	8.68	8.67
50.0	8.71	8.72	8.75
51.0	8.78	8.81	8.82
52.0	8.86	8.82	8.90
53.0	8.94	8.97	8.97
54.0	9.02	9.08	9.06
55.0	9.11	9.12	9.15
56.0	9.20	9.12	9.24
57.0	9.29	9.23	9.34
58.0	9.39	9.33	9.44
59.0	9.50	9.49	9.56
60.0	9.62	9.67	9.68
61.0	9.74	9.77	9.80
62.0	9.86	9.88	9.93
63.0	10.00	10.05	10.07
64.0	10.14	10.17	10.22
65.0	10.29	10.32	10.37
66.0	10.44	10.44	10.53
67.0	10.61	10.57	10.70
68.0	10.78	10.72	10.88
69.0	10.96	10.96	11.07
70.0	11.16	11.17	11.27
71.0	11.36	11.43	11.48
72.0	11.57	11.52	11.70
73.0	11.79	11.76	11.93
74.0	12.03	12.04	12.17
75.0	12.28	12.27	12.43
76.0	12.55	12.56	12.70
77.0	12.83	12.93	13.00
78.0	13.13	13.18	13.30
79.0	13.48	13.49	13.65
80.0	13.84	13.82	14.03
81.0	14.24	14.19	14.43
83.0	15.16	15.20	15.39

## Typical Performance Curves

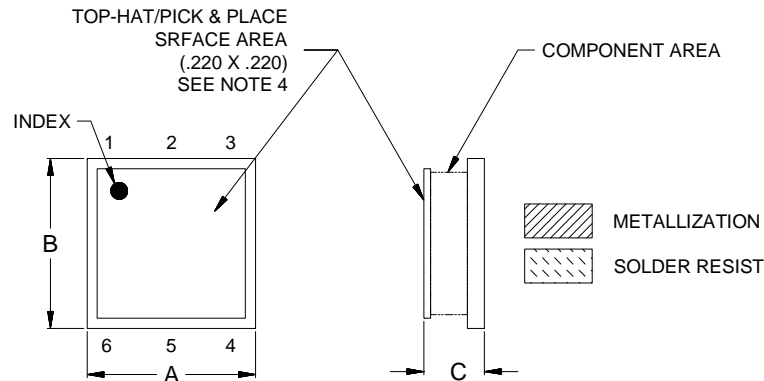


## Typical Performance Curves

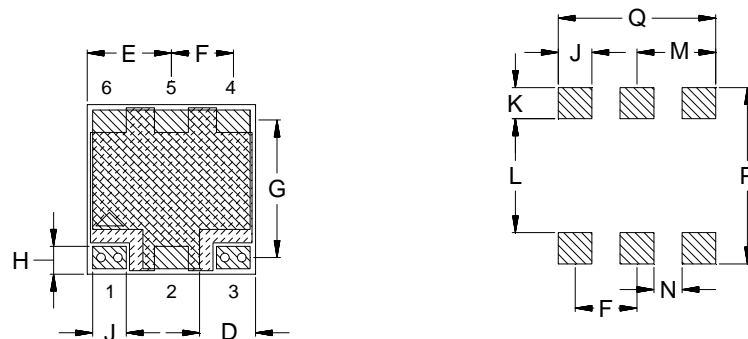


## Outline Dimensions

QA2224



PCB Land Pattern



Suggested Layout,  
Tolerance to be within  $\pm .002$

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

### Notes:

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



P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site

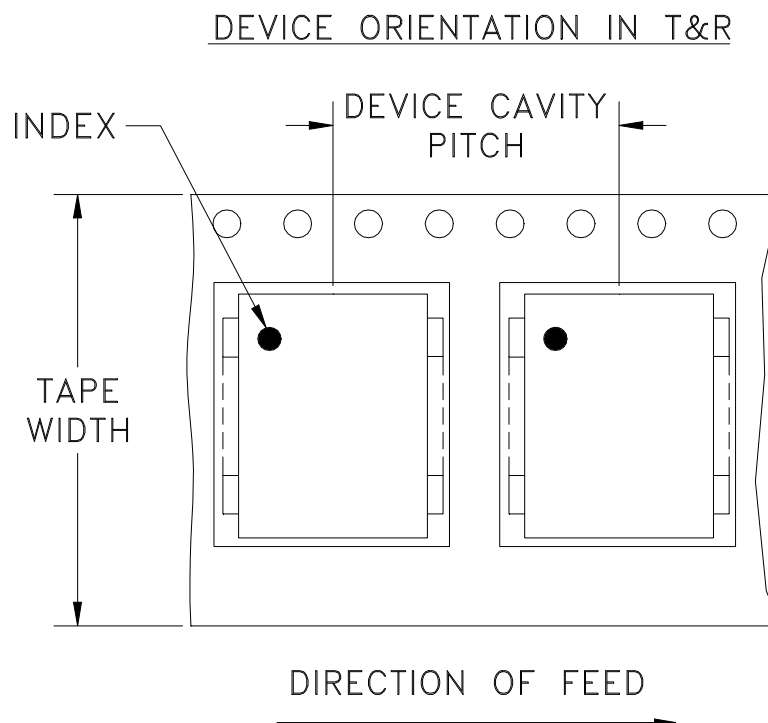


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RF/IF MICROWAVE COMPONENTS



# 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](http://www.minicircuits.com/pages/pdfs/tape.pdf)



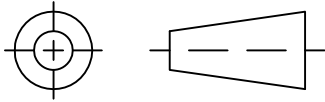
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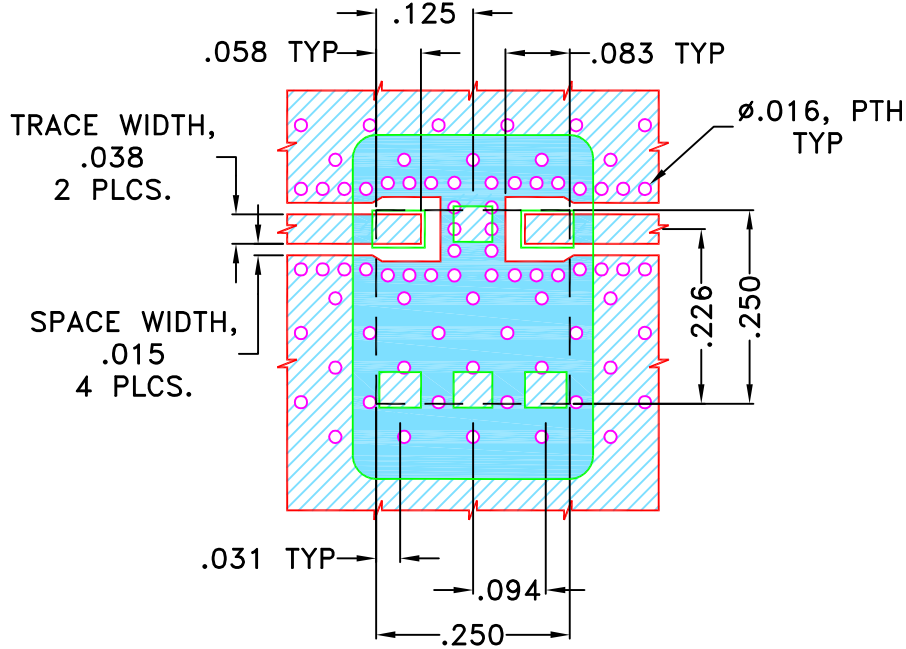
THIRD ANGLE PROJECTION



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



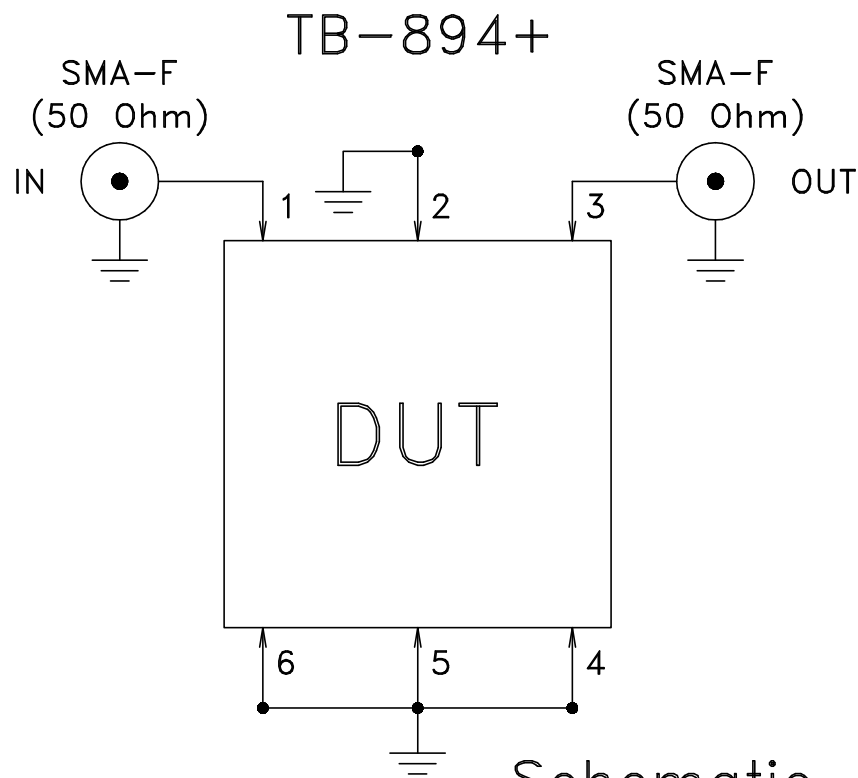
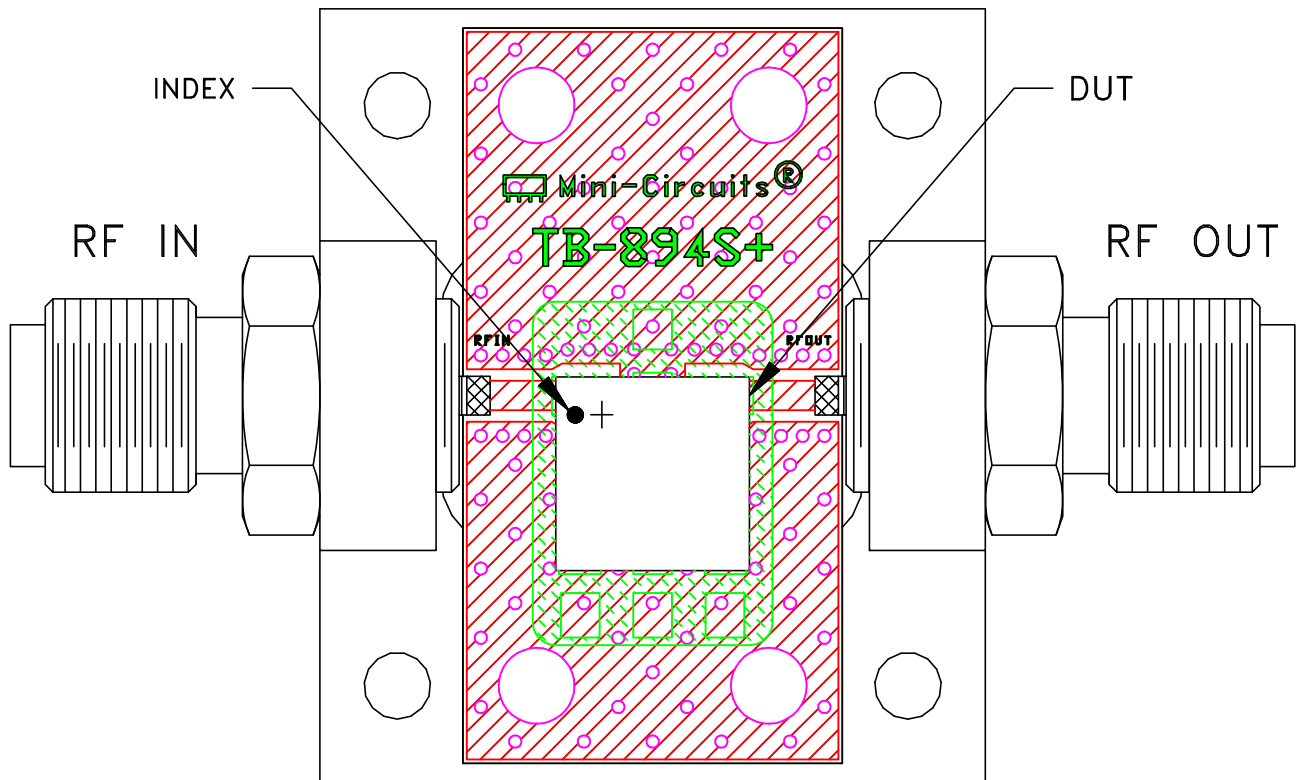
**Mini-Circuits®** 13 Neptune Avenue  
Brooklyn NY 11235

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

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SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-484	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