

Surface Mount ®

Low Pass Filter

ULP-264+

50Ω DC to 264 MHz



CASE STYLE: QA2224

The Big Deal

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

Product Overview

The ULP-264+ is a lowpass filter in a top hat package (size of 0.25" x 0.25") fabricated using SMT technology. Covering DC to 264 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
Small size, 0.25" x 0.25"	The Ultra miniature surface mount package enables the ULP-264+ to be used in compact designs.

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-Circuits' 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



Low Pass Filter

50Ω

DC to 264 MHz

ULP-264+

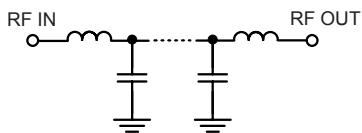
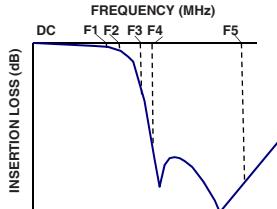
CASE STYLE: QA2224

Features

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

Applications

- Wireless communications
- Receivers / Transformers
- Lab use

Functional Schematic**Typical Frequency Response****Electrical Specifications at 25°C**

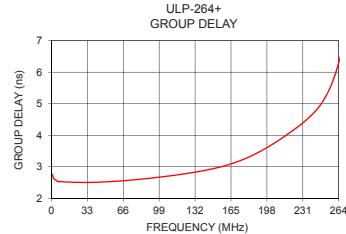
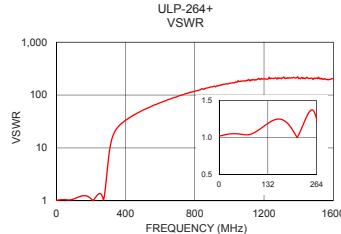
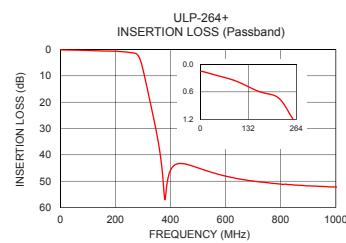
	Parameter	F#	Frequency (MHz)	Min.	Typ.	Max.	Unit
Pass Band	Insertion Loss	DC-F1	DC-264	—	1.5	2.0	dB
	Freq. Cut-Off	F2	288	—	3.0	—	dB
	VSWR	DC-F1	DC-264	—	1.55	—	:1
Stop Band	Rejection Loss	F3-F4	365-600	20	27	—	dB
		F4-F5	600-1600	40	47	—	dB
	VSWR	F3-F5	365-1600	—	20	—	:1

Maximum Ratings	
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power Input	1 W 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	0.15	1.02	1	2.76
10	0.16	1.03	3	2.60
50	0.25	1.05	5	2.55
100	0.37	1.08	10	2.53
150	0.55	1.24	50	2.52
264	1.30	1.25	80	2.60
288	3.34	2.41	100	2.67
289	3.59	2.59	120	2.77
337	25.14	20.22	140	2.88
365	41.61	26.65	160	3.04
380	57.06	29.61	170	3.15
395	47.26	32.42	180	3.29
450	43.43	42.24	190	3.45
500	44.96	51.51	200	3.65
600	48.09	71.80	210	3.87
750	50.60	106.25	220	4.11
1000	52.22	166.50	230	4.37
1250	52.28	206.22	250	5.11
1500	49.31	209.06	260	5.86
1600	46.56	203.58	264	6.30

**+RoHS Compliant**

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

Notes

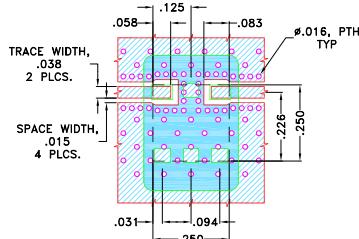
- A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's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

www.minicircuits.com P.O. Box 350166, Brooklyn, NY 11235-0003 (718) 934-4500 sales@minicircuits.com

Pad Connections

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

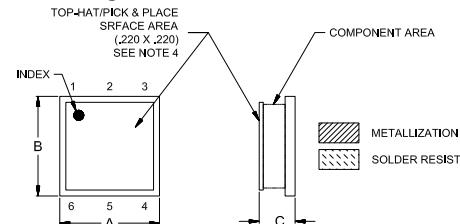
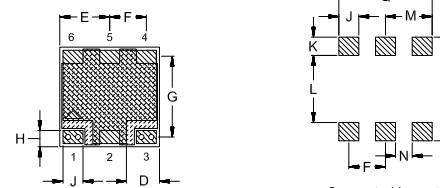
**Demo Board MCL P/N: TB-894+
Suggested PCB Layout (PL-484)**

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

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 SODERMASK

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	K
-	-	Min Max	-	-	-	-	-	-	-
.250	.250	.075 .100	.075	.125	.092	.201	.041	.050	.046
6.35	6.35	1.91 2.54	1.91	3.18	2.34	5.11	1.04	1.27	1.17

L	M	N	P	Q
.168	.117	.042	.260	.234

Wt.
grams
0.25

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-Circuits' 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



Low Pass Filter

ULP-264+

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
	0.13	0.15	0.17	40.87	38.35	36.83	40.39	37.98	36.53
5	0.13	0.15	0.17	39.76	37.49	36.11	39.69	37.41	36.06
10	0.14	0.16	0.18	37.98	35.96	34.76	37.72	35.74	34.57
50	0.22	0.25	0.27	33.13	31.84	31.04	33.28	31.77	31.07
100	0.32	0.37	0.40	30.75	28.11	26.87	30.51	28.05	26.88
250	0.98	1.14	1.25	16.31	16.04	15.52	16.19	15.87	15.32
264	1.13	1.30	1.42	18.35	19.04	19.02	17.77	18.14	17.94
265	1.13	1.31	1.44	18.93	19.75	19.80	18.21	18.63	18.44
270	1.20	1.41	1.54	24.44	26.75	27.28	21.50	21.70	21.25
275	1.34	1.59	1.76	29.82	25.21	23.21	22.03	20.07	18.89
280	1.65	1.97	2.20	16.57	15.17	14.32	15.29	13.98	13.17
285	2.28	2.69	3.00	10.53	9.86	9.38	10.05	9.36	8.86
286	2.46	2.89	3.21	9.64	9.07	8.63	9.23	8.63	8.18
287	2.65	3.10	3.44	8.83	8.34	7.95	8.47	7.95	7.54
288	2.87	3.34	3.69	8.09	7.67	7.32	7.77	7.32	6.96
290	3.37	3.87	4.25	6.79	6.50	6.23	6.54	6.22	5.93
300	6.96	7.52	7.99	2.98	3.02	2.98	2.87	2.89	2.84
310	11.61	12.12	12.57	1.60	1.72	1.75	1.52	1.63	1.66
320	16.46	16.91	17.33	1.08	1.20	1.26	1.02	1.14	1.19
325	18.89	19.31	19.71	0.94	1.06	1.12	0.89	1.01	1.06
326	19.37	19.79	20.19	0.92	1.04	1.10	0.87	0.98	1.04
327	19.86	20.27	20.67	0.90	1.02	1.08	0.85	0.96	1.02
330	21.31	21.72	22.11	0.84	0.96	1.02	0.80	0.91	0.96
340	26.23	26.64	27.00	0.72	0.83	0.88	0.68	0.79	0.84
345	28.79	29.19	29.56	0.68	0.78	0.83	0.64	0.74	0.79
346	29.30	29.71	30.09	0.67	0.77	0.83	0.63	0.73	0.78
347	29.84	30.24	30.62	0.66	0.76	0.82	0.62	0.72	0.77
350	31.45	31.87	32.25	0.64	0.74	0.79	0.60	0.70	0.75
355	34.30	34.75	35.15	0.61	0.71	0.76	0.57	0.67	0.72
340	26.23	26.64	27.00	0.72	0.83	0.88	0.68	0.79	0.84
350	31.45	31.87	32.25	0.64	0.74	0.79	0.60	0.70	0.75
360	37.42	37.92	38.36	0.58	0.68	0.73	0.55	0.64	0.69
365	41.02	41.61	42.09	0.56	0.65	0.70	0.53	0.62	0.67
375	51.38	52.24	52.84	0.52	0.61	0.65	0.49	0.58	0.62
400	46.07	45.88	45.66	0.44	0.52	0.56	0.42	0.50	0.54
450	43.35	43.43	43.39	0.34	0.41	0.44	0.33	0.39	0.42
500	44.87	44.96	44.95	0.27	0.34	0.37	0.26	0.32	0.35
550	46.62	46.70	46.71	0.22	0.28	0.31	0.21	0.27	0.29
600	48.03	48.09	48.11	0.18	0.24	0.27	0.18	0.23	0.25
650	49.07	49.20	49.16	0.15	0.21	0.23	0.14	0.20	0.22
700	49.87	49.95	49.97	0.12	0.19	0.21	0.12	0.17	0.20
750	50.48	50.60	50.59	0.10	0.16	0.19	0.10	0.16	0.18
800	50.99	51.15	51.08	0.09	0.15	0.17	0.09	0.14	0.16
850	51.36	51.47	51.42	0.07	0.14	0.16	0.07	0.13	0.15
900	51.67	51.78	51.79	0.06	0.12	0.14	0.06	0.12	0.14
950	52.00	52.03	52.05	0.05	0.11	0.14	0.05	0.11	0.13
1000	52.19	52.22	52.27	0.04	0.10	0.13	0.04	0.10	0.12
1050	52.35	52.34	52.34	0.03	0.09	0.12	0.03	0.09	0.11
1100	52.46	52.48	52.50	0.02	0.09	0.12	0.02	0.09	0.11
1150	52.46	52.47	52.46	0.02	0.09	0.12	0.02	0.08	0.11
1200	52.34	52.44	52.43	0.01	0.09	0.11	0.01	0.08	0.10
1250	52.22	52.28	52.26	0.01	0.08	0.11	0.00	0.08	0.10
1300	51.94	51.93	51.95	0.00	0.09	0.11	0.01	0.07	0.10
1350	51.58	51.54	51.65	0.00	0.08	0.11	0.00	0.07	0.10
1400	50.93	50.99	50.99	0.00	0.08	0.12	0.00	0.07	0.10
1450	50.22	50.26	50.24	0.00	0.08	0.12	0.00	0.07	0.10
1500	49.26	49.31	49.27	0.00	0.08	0.12	0.00	0.07	0.10
1550	48.07	48.07	48.05	0.00	0.09	0.12	0.01	0.07	0.10
1575	47.34	47.37	47.33	0.00	0.09	0.12	0.01	0.07	0.10
1600	46.52	46.56	46.52	0.00	0.09	0.12	0.01	0.07	0.10



ISO 9001 ISO 14001 AS 9100 CERTIFIED

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



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



IF/RF MICROWAVE COMPONENTS

REV. OR

ULP-264+

170214

Page 1 of 2

Typical Performance Data

FREQ. (MHz)	GROUP DELAY		
	(nsec)		
	@-40°C	@+25°C	@+85°C
1	2.78	2.76	2.77
2	2.64	2.64	2.63
3	2.60	2.60	2.59
4	2.59	2.58	2.58
5	2.55	2.55	2.55
10	2.53	2.53	2.53
15	2.51	2.52	2.52
20	2.51	2.51	2.51
25	2.50	2.50	2.50
30	2.50	2.50	2.50
35	2.50	2.50	2.50
40	2.51	2.51	2.51
45	2.51	2.51	2.51
50	2.52	2.52	2.52
55	2.53	2.53	2.53
60	2.54	2.54	2.54
65	2.55	2.55	2.55
70	2.57	2.57	2.57
75	2.58	2.58	2.58
80	2.60	2.60	2.60
85	2.61	2.62	2.62
90	2.63	2.63	2.64
95	2.65	2.65	2.66
100	2.67	2.67	2.68
105	2.70	2.70	2.70
110	2.72	2.71	2.72
115	2.74	2.74	2.74
120	2.77	2.77	2.77
125	2.80	2.79	2.79
130	2.83	2.82	2.82
135	2.85	2.84	2.84
140	2.89	2.88	2.87
145	2.92	2.91	2.91
150	2.96	2.95	2.94
155	3.00	2.99	2.99
160	3.04	3.04	3.03
165	3.09	3.09	3.09
170	3.15	3.15	3.15
175	3.21	3.22	3.22
180	3.27	3.29	3.29
185	3.35	3.36	3.37
190	3.44	3.45	3.46
195	3.53	3.55	3.56
200	3.63	3.65	3.67
205	3.74	3.75	3.77
210	3.85	3.87	3.89
215	3.97	3.98	4.00
220	4.10	4.11	4.12
225	4.23	4.23	4.24
230	4.36	4.37	4.37
235	4.51	4.51	4.51
240	4.67	4.67	4.67
245	4.85	4.86	4.87
250	5.08	5.11	5.13
252	5.19	5.22	5.25
255	5.38	5.43	5.46
258	5.61	5.67	5.72
260	5.79	5.86	5.91
262	5.99	6.06	6.13
264	6.21	6.30	6.38

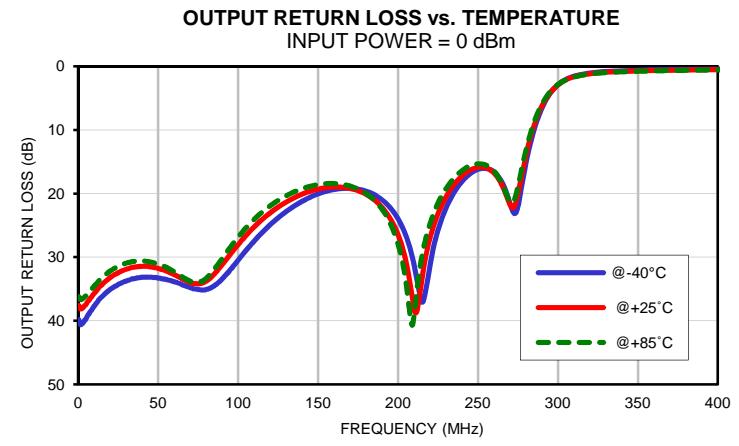
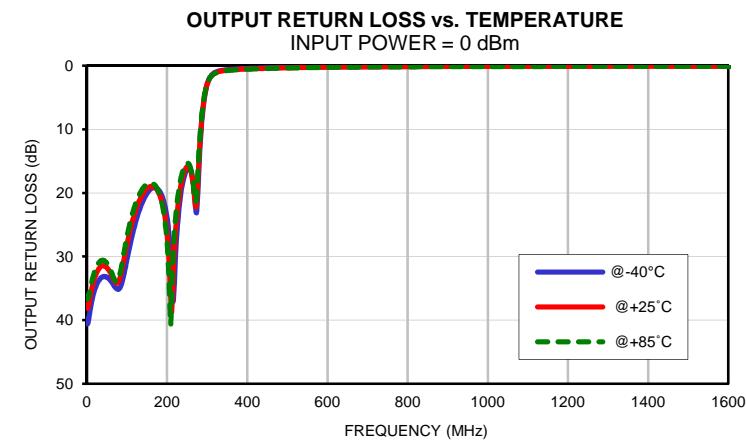
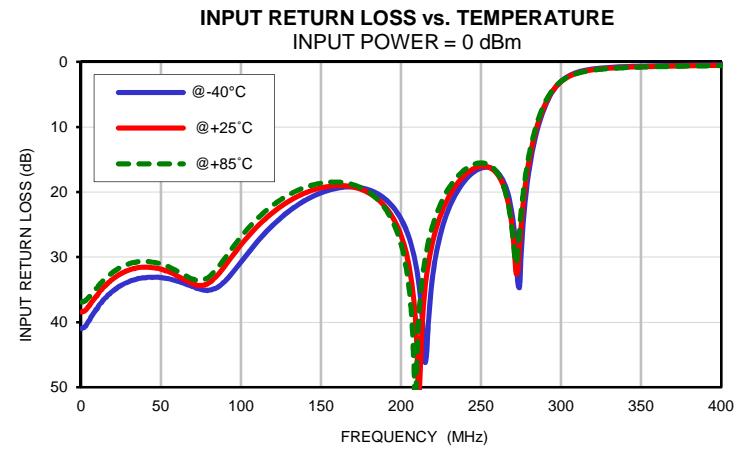
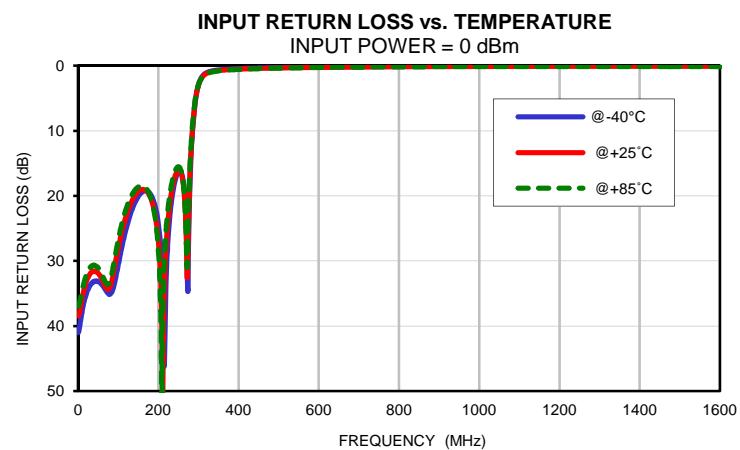
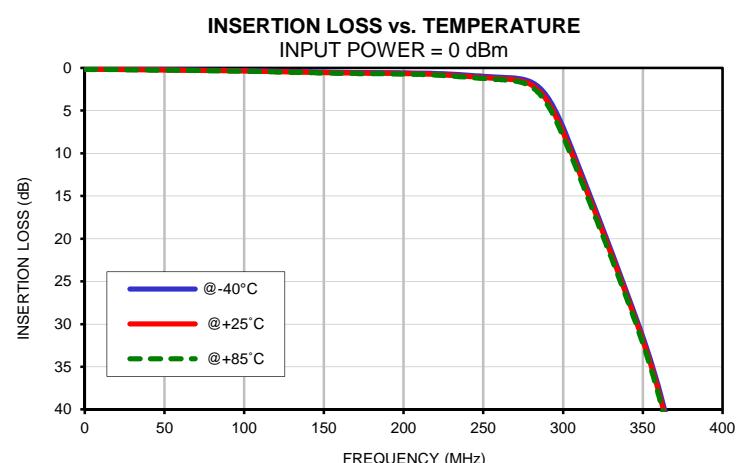
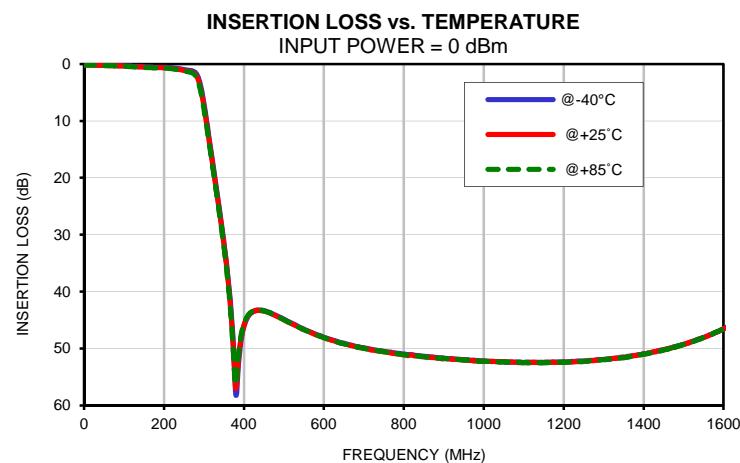


P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 • Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site
 The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com

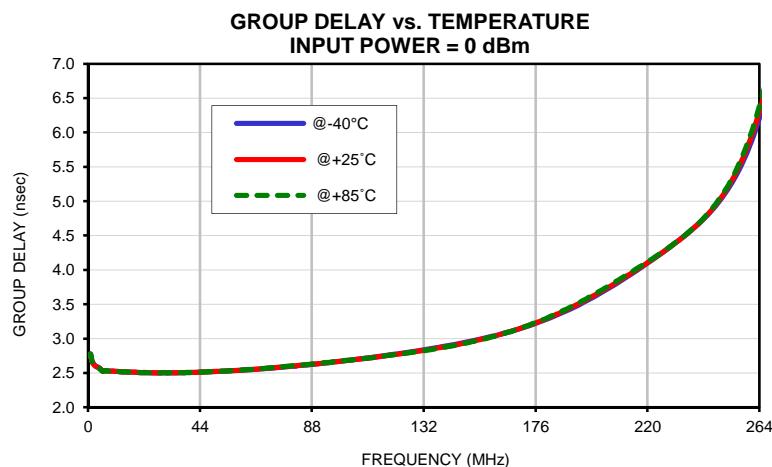
IF/RF MICROWAVE COMPONENTS



Typical Performance Curves



Typical Performance Curves

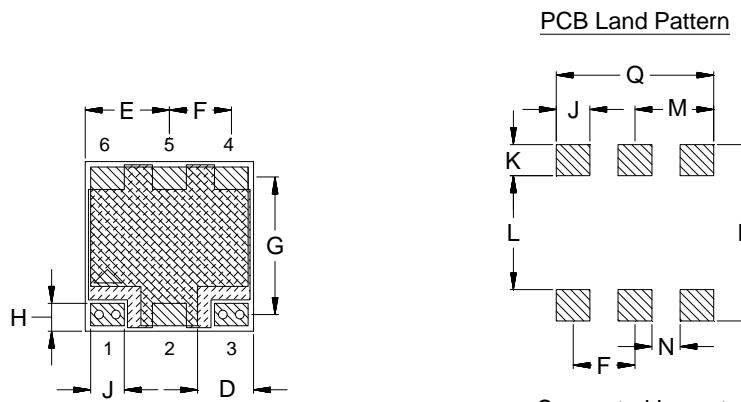
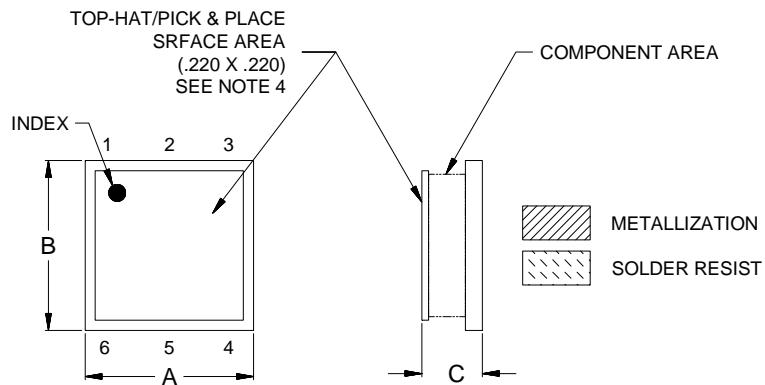


Case Style

QA

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

Notes:

1. Case material: Ceramic base.
2. Base: Printed wiring laminate.
3. 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.
4. Top-Hat total thickness: .013 inches MAX

 **Mini-Circuits®**
ISO 9001 ISO 14001 CERTIFIED

ALL NEW
minicircuits.com

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

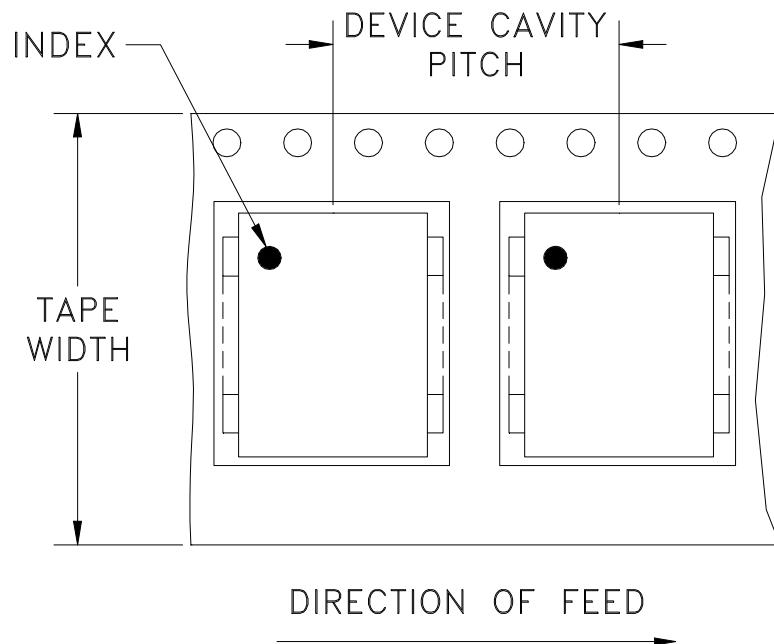


The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com

RF/F MICROWAVE COMPONENTS

Tape & Reel Packaging TR-F34

DEVICE ORIENTATION IN T&R



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



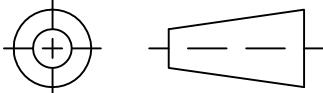
Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010

INTERNET <http://www.minicircuits.com>

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

Mini-Circuits ISO 9001 & ISO 14001 Certified

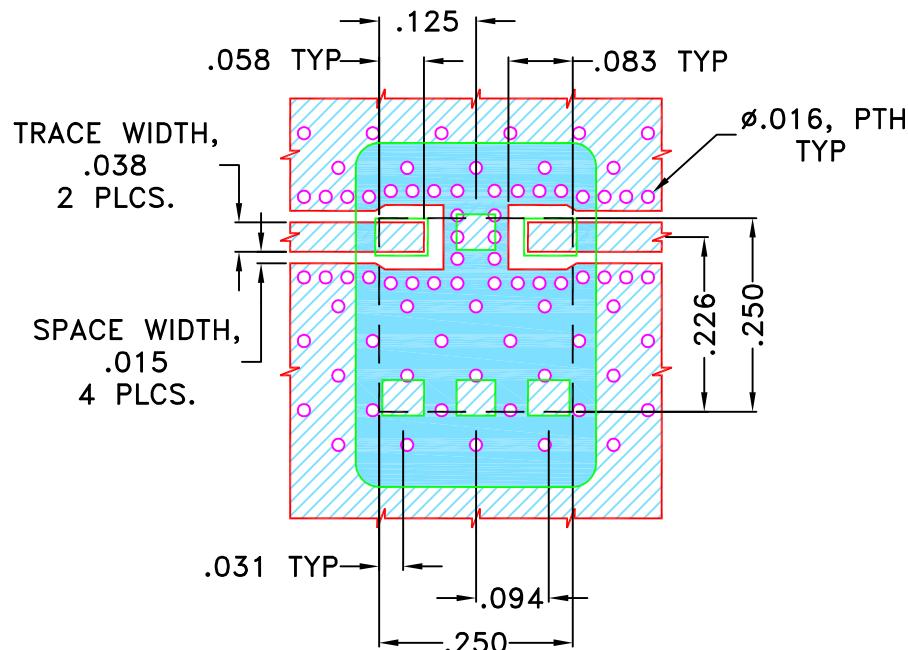
THIRD ANGLE PROJECTION



REVISONS

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 $.020 \pm .0015$ ". 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

DIMENSIONS ARE IN INCHES

TOLERANCES ON:

2 PL DECIMALS \pm 3 PL DECIMALS $\pm .005$ "ANGLES \pm FRACTIONS \pm 

Mini-Circuits®

THIS DOCUMENT AND ITS CONTENTS ARE THE PROPERTY OF MINI-CIRCUITS.
EXCEPT FOR USE EXPRESSLY GRANTED, IN WRITING, TO ITS VENDORS, VENDEE
AND THE UNITED STATES GOVERNMENT, MINI-CIRCUITS RESERVES ALL PROPRIETARY
DESIGN, USE, MANUFACTURING AND REPRODUCTION RIGHTS THERETO.
THESE CONTENTS SHALL NOT BE USED, DUPLICATED OR DISCLOSED TO ANY OUTSIDE
PARTY, IN WHOLE OR IN PART, WITHOUT WRITTEN PERMISSION OF MINI-CIRCUITS.

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



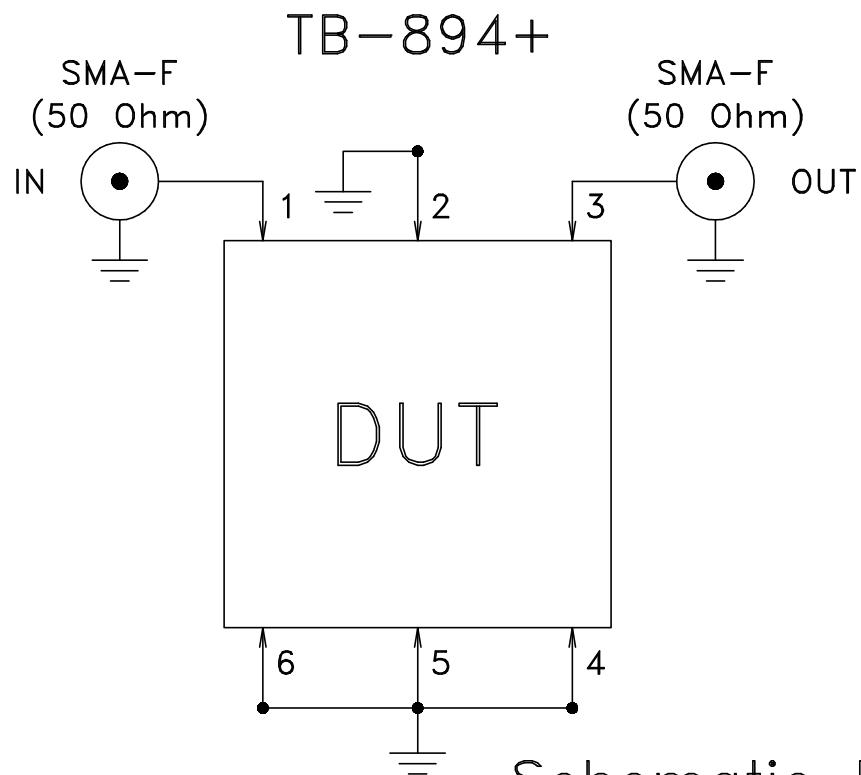
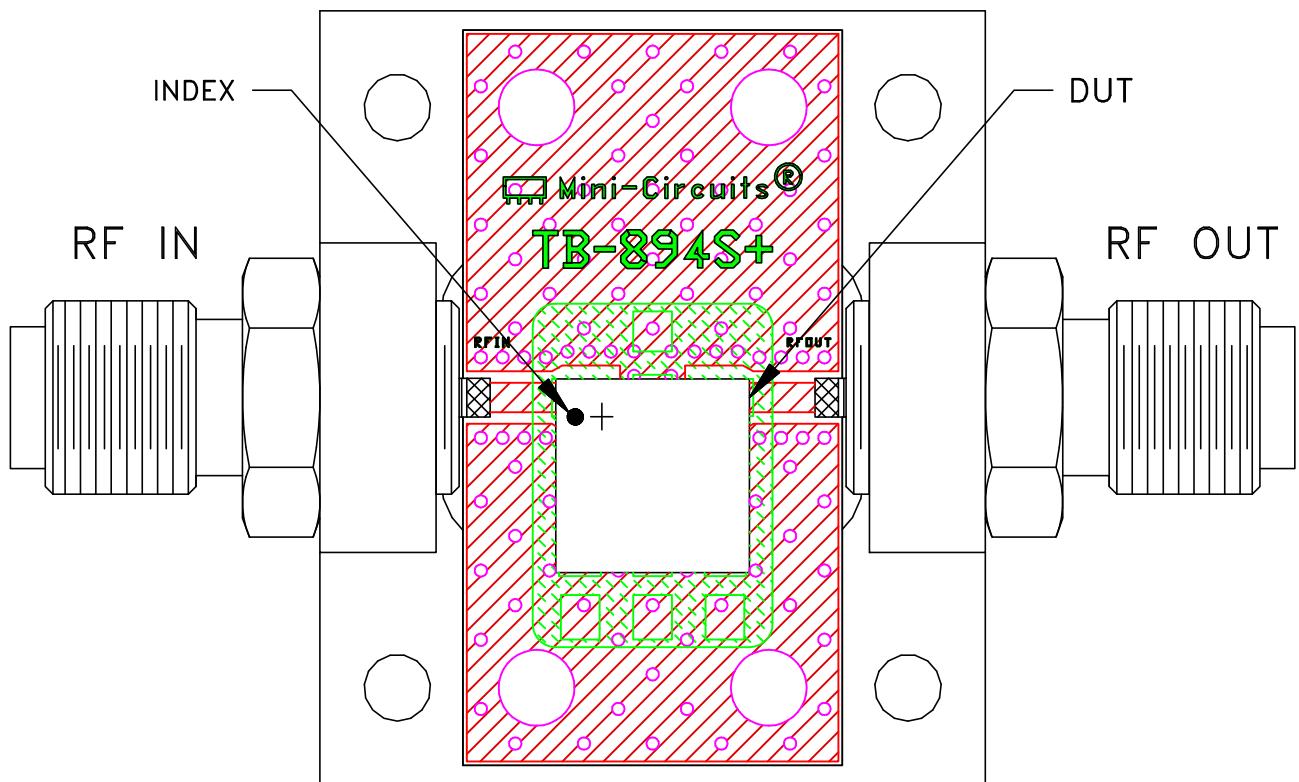
Mini-Circuits®

13 Neptune Avenue
Brooklyn NY 11235

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

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 (R04350B) OR Equivalent
Dielectric Constant=3.48±.05, Thickness=.020 inch.

Schematic Diagram

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 + propylene glycol monomethyl ether + monoethanolamine at 63°C to 70°C	MIL-STD-202, Method 215