Surface Mount

Coaxial-Ceramic Resonator Filters and Multiplexers

50Ω DC to 6 GHz

The Big Deal

- Low insertion loss with excellent power handling
- Passbands up to 6 GHz
- Fractional bandwidth from <1 to 25%
- Low profile designs with min. height of 0.120”
- Excellent temperature stability
- Rugged construction to handle demanding environmental conditions

Product Overview

Mini-Circuits’ *Coaxial-Ceramic Resonator filters* offer low insertion loss in very small form factors, using ceramic material with high dielectric constant and superior Q factor. Bandpass and bandstop filters,diplexer and multiplexer designs can be constructed using this technology. Low insertion loss combined with excellent power handling makes these filters well suited for transmitter and receiver signal chains. Advanced filter design and construction can achieve stopband width greater than 3x the center frequency as high as 20 GHz.

All our coaxial-ceramic resonator filters are built with rugged construction, qualified to withstand multiple demanding reflow cycles. Excellent repeatability across units is achieved through precise tuning and process control.

Key Features

Feature	Advantages
Low insertion loss	Low signal loss results in better SNR in signal chain
Fast roll-off	Higher selectivity results in better adjacent channel rejection and dynamic range
Wide stop band	Wide spur-free stopband results in better receiver sensitivity
Excellent power handling	Well suited for transmitter applications
Rugged Construction	These filter assemblies have been qualified over a wide range of thermal, mechanical and environmental conditions including withstanding the stress of extensive solder reflow cycles
Small Size	Very well suited for high performance applications where size is a constraint.
Temperature stability	Very minimal change in electrical performance across temperature makes these filters suitable for a wide range of operating conditions.

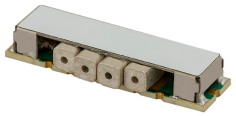
Notes
A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit’s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

Surface Mount

Bandpass Filter

50Ω 1600 to 1700 MHz

CBP4-1650Q+



Generic photo used for illustration purposes only

CASE STYLE: HQ2218

Features

- Broad stopband performance upto 5 GHz
- High selectivity
- Excellent rejection, 60dB typ.

Applications

- Mobile Satellite Service
- Defense / Military

Electrical Specifications[1] at 25°C

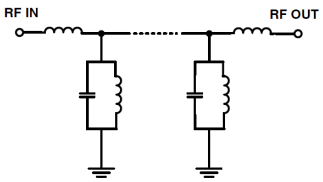
Parameter		F#	Frequency (MHz)	Min.	Typ.	Max.	Unit
Pass Band	Center Frequency	-	-	-	1650	-	MHz
	Insertion Loss	F1-F2	1600 - 1700	-	2.5	3	dB
	VSWR	F1-F2	1600 - 1700	-	1.35	1.92	:1
Stop Band, Lower	Insertion Loss	DC-F3	DC - 1200	55	65	-	dB
		F3-F4	1200 - 1470	20	27	-	dB
Stop Band, Upper	Insertion Loss	F5-F6	1875 - 2200	20	30	-	dB
		F6-F7	2200 - 3000	48	60	-	dB
		F7-F8	3000 - 5000	-	30	-	dB

1. Measured on Mini-Circuits Characterization Test Board TB-CBP4-1650Q+

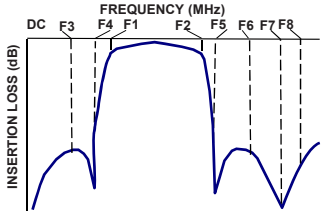
Maximum Ratings	
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power Input *	5W at 25°C

* Pass band rating
Permanent damage may occur if any of these limits are exceeded.

Functional Schematic



Typical Frequency Response

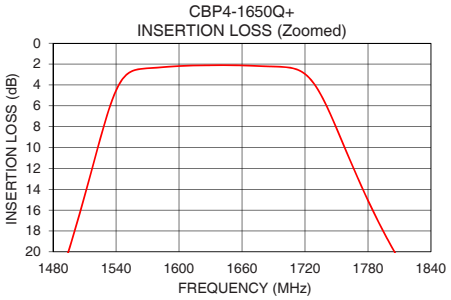


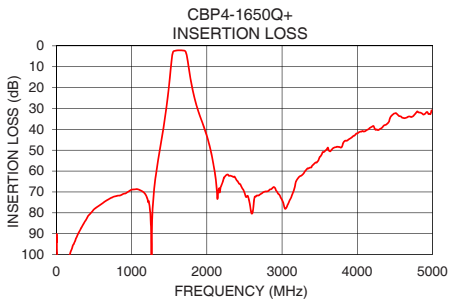
+RoHS Compliant

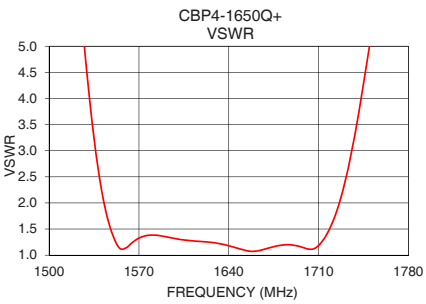
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

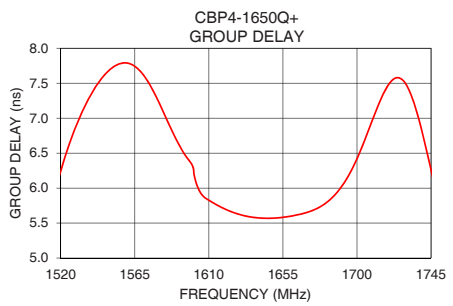
Typical Performance Data at 25°C

Frequency (MHz)	Insertion Loss (dB)	VSWR (:1)	Frequency (MHz)	Group Delay (ns)
1	94.18	382.05	1600	6.32
10	100.20	503.24	1605	5.93
1200	72.33	17.45	1610	5.83
1460	30.20	15.63	1615	5.76
1470	27.46	15.11	1620	5.70
1495	19.86	12.55	1625	5.65
1520	10.98	7.04	1630	5.61
1550	3.01	1.36	1635	5.59
1600	2.19	1.31	1640	5.57
1620	2.13	1.26	1645	5.57
1650	2.11	1.11	1650	5.57
1670	2.16	1.13	1655	5.58
1700	2.28	1.13	1660	5.60
1721	3.03	1.64	1665	5.62
1758	10.06	6.33	1670	5.66
1806	20.13	10.68	1675	5.70
1875	29.98	9.29	1680	5.77
2200	66.30	11.21	1685	5.87
3000	73.87	23.06	1690	6.00
5000	27.18	46.89	1700	6.42









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.

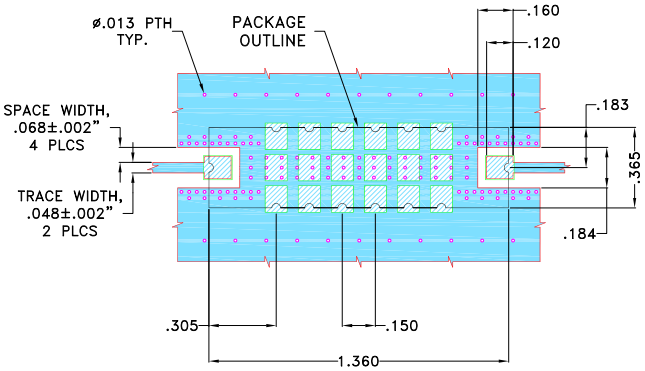
C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/MCLStore/terms.jsp

Pad Connections

INPUT	1
OUTPUT	8
GROUND	2,3,4,5,6,7,9,10,11,12,13,14

Demo Board MCL P/N: TB-CBP4-1650Q+
Suggested PCB Layout (PL-543)

SUGGESTED MOUNTING CONFIGURATION FOR
HQ2218 & HQ2299 CASE STYLE "14FL01" PIN CODE



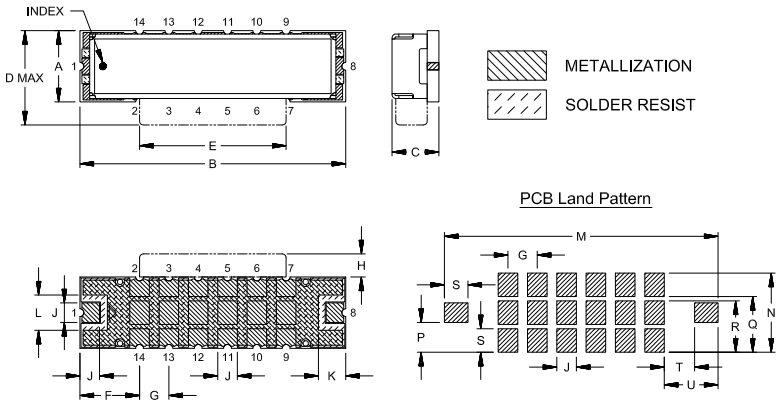
NOTES:

1. TRACE WIDTH IS SHOWN FOR FR4, IT180A 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 SOLDERMASK

Outline Drawing



Outline Dimensions (inch / mm)

A	B	C Min	C Max	D	E	F	G	H	J	K
.365	**1.360**	**.240**	**.270**	**.483**	**.750**	**.305**	**.150**	**.118**	**.100**	**.140**
9.27	34.54	6.10	6.86	12.27	19.05	7.75	3.81	3.00	2.54	3.56

L	M	N	P	Q	R	S	T	U	Wt.
.180	**1.400**	**.405**	**.153**	**.285**	**.263**	**.120**	**.155**	**.275**	grams
4.57	35.56	10.29	3.87	7.24	6.67	3.05	3.94	6.99	4.2

Note: Please refer to case style drawing for details

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

Surface mount Band Pass Filter CBP4-1650Q+

Typical Performance Data

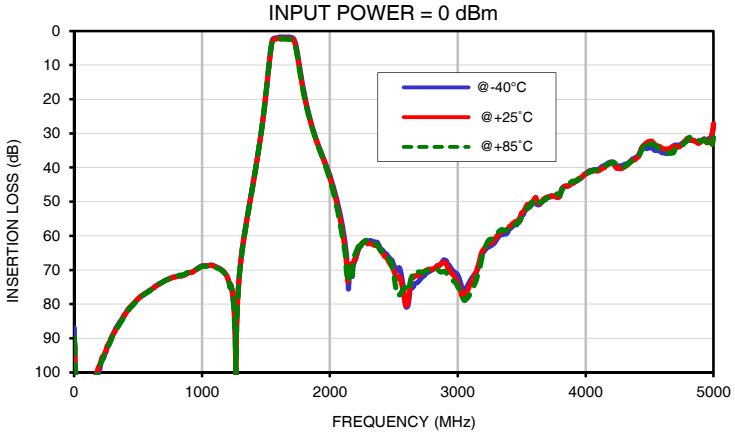
FREQ.	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
(MHz)	(dB)			(dB)			(dB)		
	@-40°C	@+25˚C	@+85˚C	@-40°C	@+25˚C	@+85˚C	@-40°C	@+25˚C	@+85˚C
1	87.00	94.18	92.92	0.05	0.05	0.05	0.05	0.04	0.05
10	100.19	100.20	100.69	0.03	0.03	0.04	0.04	0.04	0.04
100	106.11	104.93	108.02	0.00	0.01	0.02	0.00	0.01	0.02
200	99.18	97.81	98.63	0.02	0.05	0.06	0.03	0.05	0.06
300	89.09	89.30	89.34	0.08	0.12	0.14	0.10	0.13	0.14
400	82.82	83.00	83.27	0.13	0.17	0.20	0.16	0.19	0.21
500	78.52	78.35	78.70	0.18	0.23	0.26	0.21	0.26	0.29
600	75.80	75.77	75.90	0.23	0.29	0.33	0.27	0.33	0.37
700	73.34	73.40	73.38	0.27	0.35	0.40	0.31	0.38	0.43
800	71.93	71.96	71.86	0.33	0.43	0.49	0.35	0.45	0.52
900	70.74	70.85	70.63	0.40	0.53	0.63	0.41	0.53	0.63
1000	68.83	68.93	68.98	0.51	0.67	0.80	0.48	0.64	0.77
1100	68.87	68.93	69.12	0.61	0.82	0.98	0.56	0.76	0.92
1150	69.88	69.89	70.06	0.68	0.92	1.09	0.62	0.84	1.01
1200	72.33	72.33	72.51	0.75	1.00	1.17	0.69	0.92	1.09
1250	81.25	80.41	81.70	0.80	1.04	1.20	0.75	0.98	1.14
1300	68.19	68.62	68.82	0.84	1.07	1.21	0.81	1.04	1.19
1350	55.06	55.34	55.62	0.88	1.09	1.22	0.88	1.08	1.22
1400	44.28	44.46	44.65	0.88	1.07	1.19	0.93	1.12	1.24
1460	30.11	30.20	30.30	0.94	1.11	1.22	1.04	1.22	1.33
1470	27.40	27.46	27.54	0.98	1.15	1.26	1.08	1.26	1.38
1495	19.89	19.86	19.88	1.19	1.39	1.52	1.31	1.52	1.66
1520	11.09	10.98	10.97	2.13	2.48	2.72	2.23	2.61	2.85
1550	2.74	3.01	3.23	14.30	16.38	17.32	13.87	15.75	16.48
1600	1.88	2.19	2.40	16.85	17.47	17.73	19.72	22.78	24.81
1610	1.82	2.15	2.37	18.12	18.30	18.29	22.27	24.96	25.64
1620	1.80	2.13	2.35	19.03	18.83	18.76	23.16	23.68	23.34
1630	1.78	2.12	2.34	19.83	19.64	19.82	22.61	22.24	21.90
1640	1.77	2.11	2.34	21.31	21.63	22.32	22.35	21.90	21.61
1650	1.77	2.11	2.34	24.14	25.66	27.23	22.66	22.05	21.50
1660	1.77	2.13	2.37	27.48	28.99	28.30	22.71	21.50	20.54
1670	1.80	2.16	2.41	26.04	24.34	22.78	21.91	20.16	19.06
1680	1.82	2.20	2.46	23.45	21.30	20.01	21.34	19.35	18.27
1690	1.85	2.24	2.49	23.35	21.10	19.85	22.48	20.28	19.15
1700	1.89	2.28	2.53	26.49	24.34	22.89	27.72	25.54	24.11
1721	2.54	3.03	3.33	12.29	12.33	12.43	12.54	12.77	13.06
1758	9.24	10.06	10.41	2.59	2.77	2.91	2.70	2.87	3.04
1806	19.50	20.13	20.36	1.40	1.63	1.80	1.51	1.73	1.90
1875	29.61	29.98	30.08	1.53	1.88	2.17	1.50	1.82	2.08
2000	42.32	43.12	43.73	3.40	4.14	4.67	3.09	3.93	4.65
2100	57.44	59.21	60.89	2.50	2.71	2.84	4.79	5.20	5.48
2200	66.88	66.30	65.09	1.39	1.55	1.68	2.53	2.84	3.09
2300	61.72	62.25	61.50	0.93	1.12	1.27	1.43	1.72	1.97
2400	63.93	64.60	64.48	0.79	1.02	1.20	0.97	1.24	1.45
2500	68.63	70.32	71.54	0.77	1.06	1.29	0.71	0.94	1.12
2600	80.91	80.40	74.52	0.73	1.02	1.25	0.54	0.75	0.90
2700	73.06	71.41	70.62	0.70	0.98	1.20	0.40	0.60	0.73
2800	69.97	69.76	69.94	0.66	0.94	1.15	0.30	0.48	0.60
2900	67.15	67.86	70.51	0.58	0.84	1.02	0.22	0.39	0.51
3000	71.49	73.87	75.02	0.51	0.75	0.93	0.14	0.31	0.42
3100	72.99	74.05	76.59	0.41	0.65	0.81	0.09	0.25	0.35
3200	64.82	64.03	64.62	0.35	0.57	0.72	0.04	0.20	0.31
3400	58.23	57.45	58.21	0.19	0.40	0.54	0.02	0.13	0.24
3500	54.09	53.28	54.57	0.14	0.35	0.50	0.05	0.11	0.22
3600	49.64	49.18	49.55	0.09	0.30	0.43	0.07	0.08	0.22
3812	46.26	46.57	46.91	0.01	0.22	0.36	0.08	0.09	0.22
4001	41.76	41.95	41.84	0.00	0.22	0.36	0.05	0.12	0.26
4352	38.10	38.21	38.27	0.04	0.26	0.37	0.02	0.18	0.42
4730	33.36	33.93	33.95	0.09	0.31	0.46	0.21	0.49	0.38
5000	28.22	27.18	31.21	0.10	0.37	0.45	0.43	0.58	0.56

Typical Performance Data

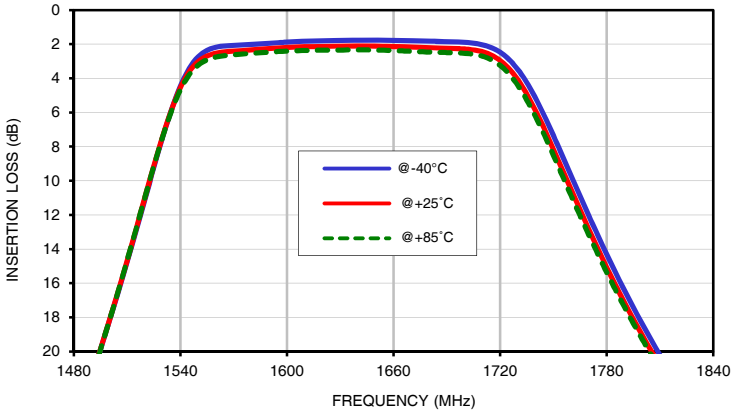
FREQ. (MHz)	GROUP DELAY (nsec)		
	@-40°C	@+25°C	@+85°C
1600	6.35	6.32	6.31
1602	6.11	6.10	6.09
1604	5.98	5.97	5.97
1606	5.90	5.90	5.89
1608	5.86	5.86	5.85
1610	5.83	5.83	5.82
1612	5.81	5.80	5.79
1614	5.78	5.77	5.76
1616	5.75	5.74	5.74
1618	5.73	5.72	5.71
1620	5.71	5.70	5.69
1622	5.69	5.68	5.67
1624	5.67	5.66	5.65
1626	5.65	5.64	5.64
1628	5.63	5.63	5.62
1630	5.62	5.61	5.61
1632	5.60	5.60	5.60
1634	5.59	5.59	5.59
1636	5.58	5.59	5.59
1638	5.57	5.58	5.58
1640	5.56	5.57	5.58
1642	5.56	5.57	5.57
1644	5.56	5.57	5.57
1646	5.56	5.57	5.57
1648	5.55	5.57	5.57
1650	5.56	5.57	5.57
1652	5.56	5.57	5.58
1654	5.56	5.58	5.58
1656	5.57	5.59	5.58
1658	5.58	5.59	5.59
1660	5.58	5.60	5.60
1662	5.59	5.61	5.60
1664	5.60	5.62	5.61
1666	5.62	5.63	5.62
1668	5.63	5.64	5.63
1670	5.64	5.66	5.65
1672	5.66	5.67	5.66
1674	5.68	5.69	5.68
1676	5.70	5.71	5.70
1678	5.73	5.74	5.73
1680	5.76	5.77	5.76
1682	5.79	5.80	5.79
1684	5.83	5.84	5.84
1686	5.87	5.89	5.88
1688	5.92	5.94	5.94
1690	5.97	6.00	6.00
1692	6.03	6.07	6.07
1694	6.10	6.14	6.15
1696	6.18	6.23	6.23
1698	6.26	6.32	6.33
1700	6.35	6.42	6.43

Typical Performance Curves

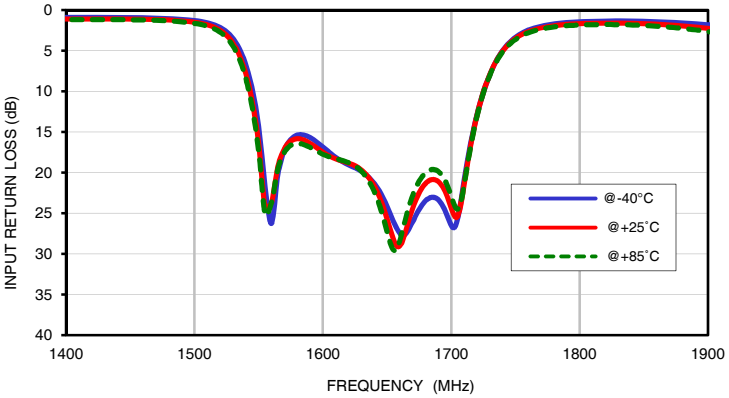
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



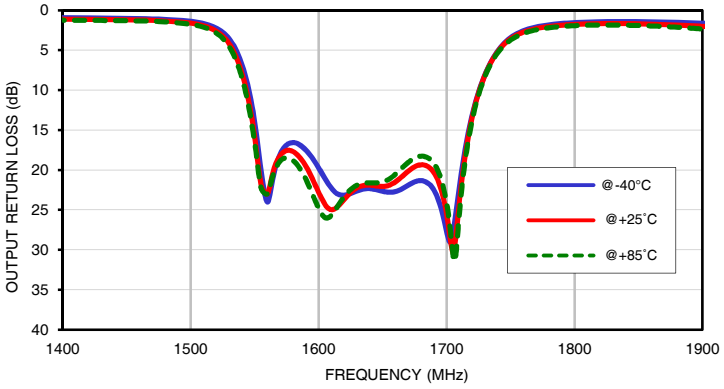
INSERTION LOSS vs. TEMPERATURE (Zoomed)
INPUT POWER = 0 dBm



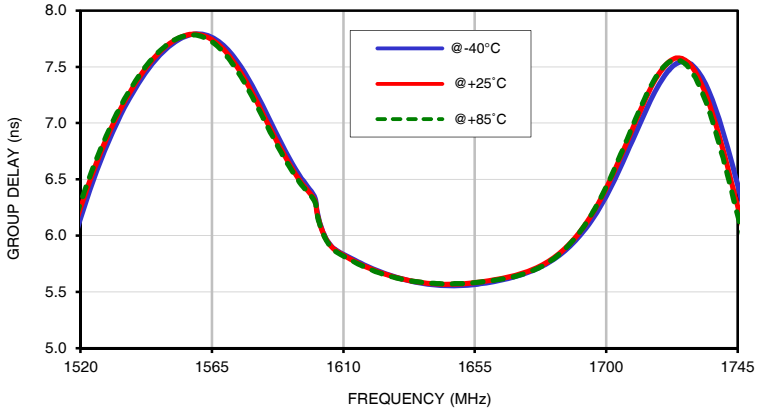
INPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



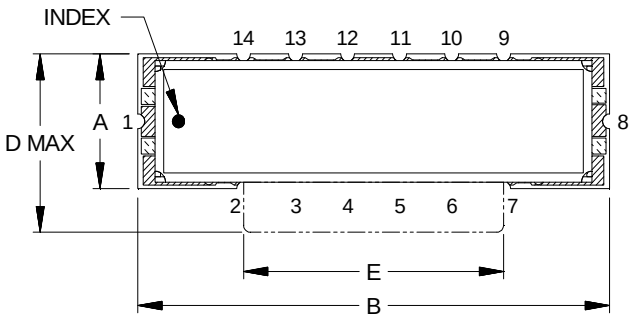
GROUP DELAY vs. TEMPERATURE
INPUT POWER = 0 dBm

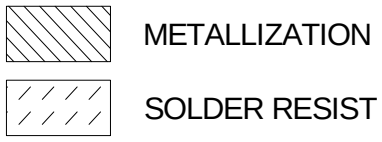


Case Style HQ

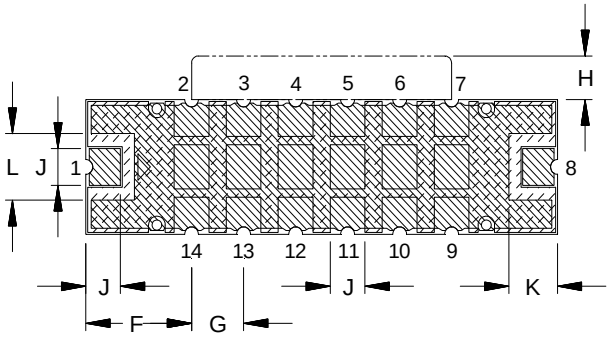
Outline Dimensions

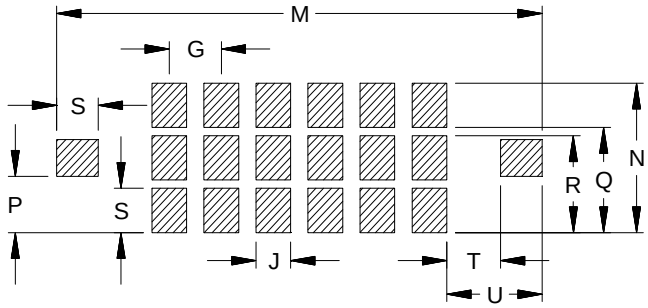
HQ2218





PCB Land Pattern





CASE#	A	B	C		D	E	F	G	H	J	K	L
			MIN	MAX								
HQ2218	.365 (9.27)	1.360 (34.54)	.240 (6.10)	.270 (6.86)	.483 (12.27)	.750 (19.05)	.305 (7.75)	.150 (3.81)	.118 (3.00)	.100 (2.54)	.140 (3.56)	.180 (4.57)

CASE#	M	N	P	Q	R	S	T	U	WT.GRAMS
HQ2218	1.400 (35.56)	.405 (10.29)	.153 (3.87)	.285 (7.24)	.263 (6.67)	.120 (3.05)	.155 (3.94)	.275 (6.99)	4.2

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

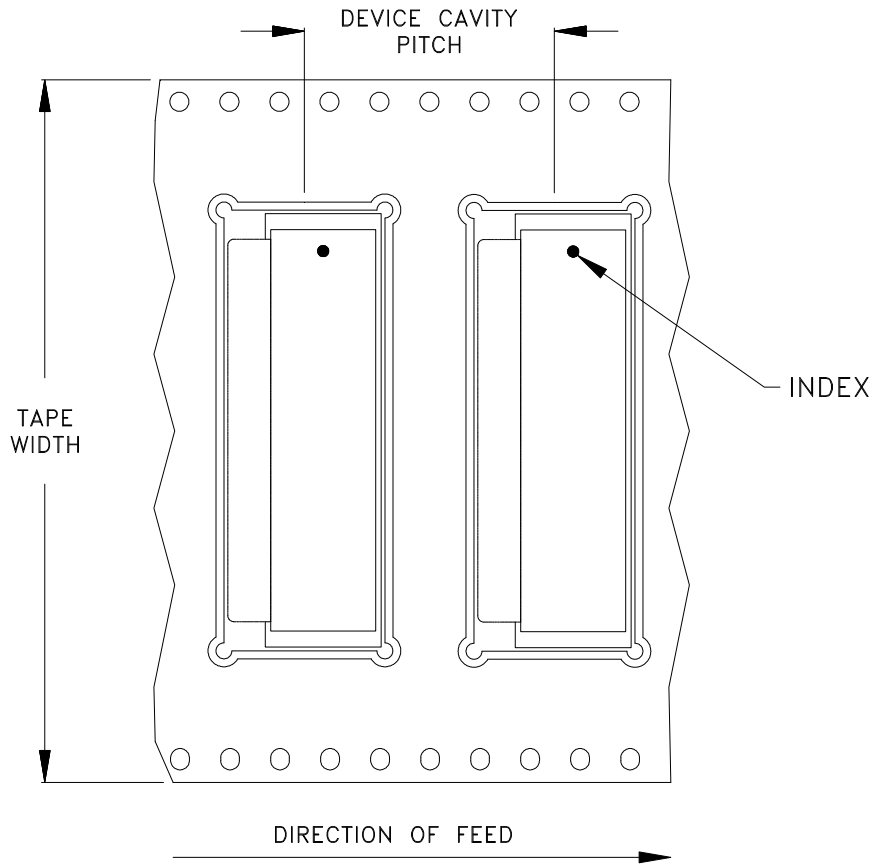
Notes:

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

This document and its contents are the property of Mini-Circuits.

Tape & Reel Packaging TR-F121

DEVICE ORIENTATION IN T&R



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel
56	20	13	100

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

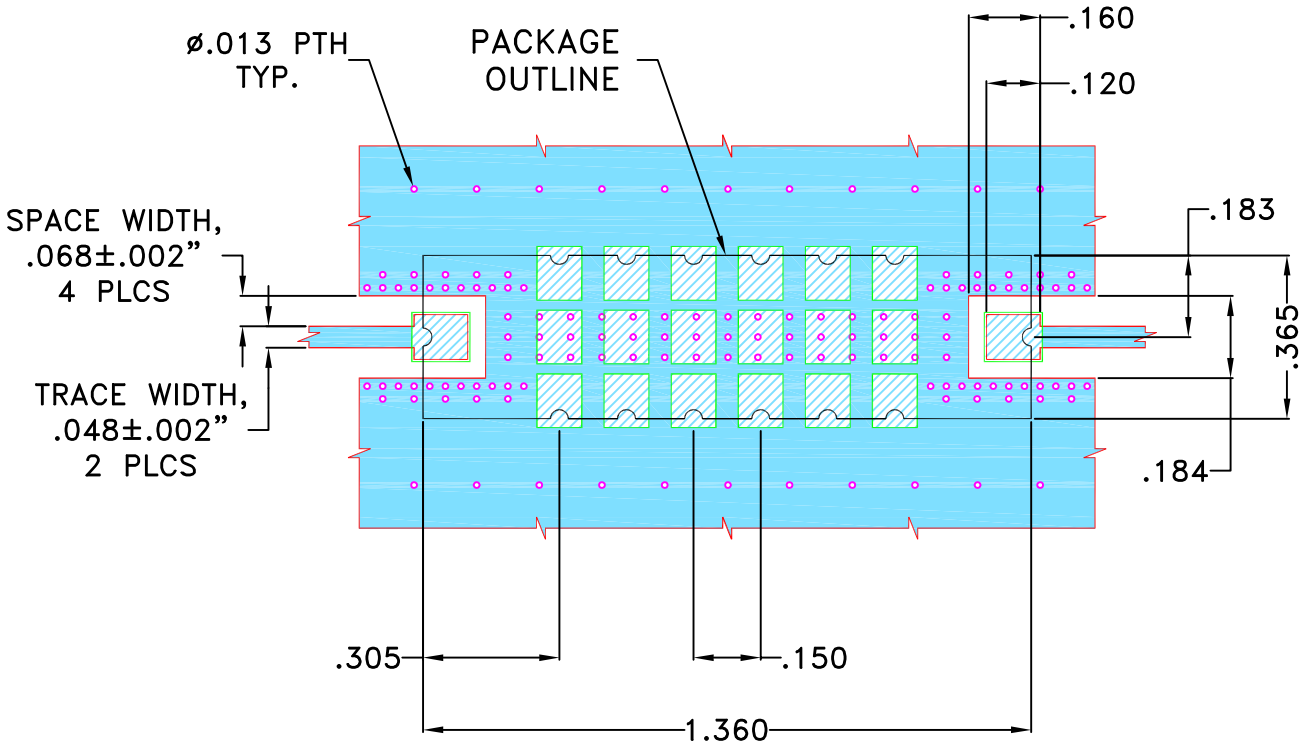
Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010
Mini-Circuits ISO 9001 & ISO 14001 Certified

This document and its contents are the property of Mini-Circuits.

THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M165612	NEW RELEASE	MAR 18	TM	MD

SUGGESTED MOUNTING CONFIGURATION FOR HQ2218 & HQ2299 CASE STYLE "14FL01" PIN CODE



NOTES:

1. TRACE WIDTH IS SHOWN FOR FR4, IT180A 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 SOLDERMASK

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	TM	12 MAR 18
TOLERANCES ON:	CHECKED	MD	12 MAR 18
2 PL DECIMALS ±	APPROVED	PTB	12 MAR 18
3 PL DECIMALS ± .005"			
ANGLES ±			
FRACTIONS ±			

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

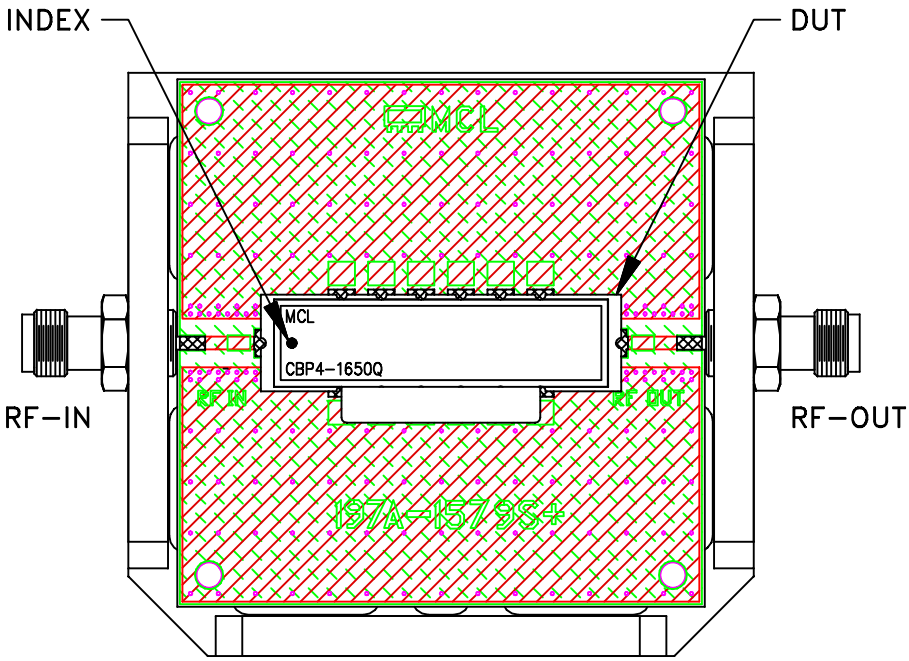
PL,14FL01,HQ2218, HQ2299,CBP TB-1006+, 50 Ohm

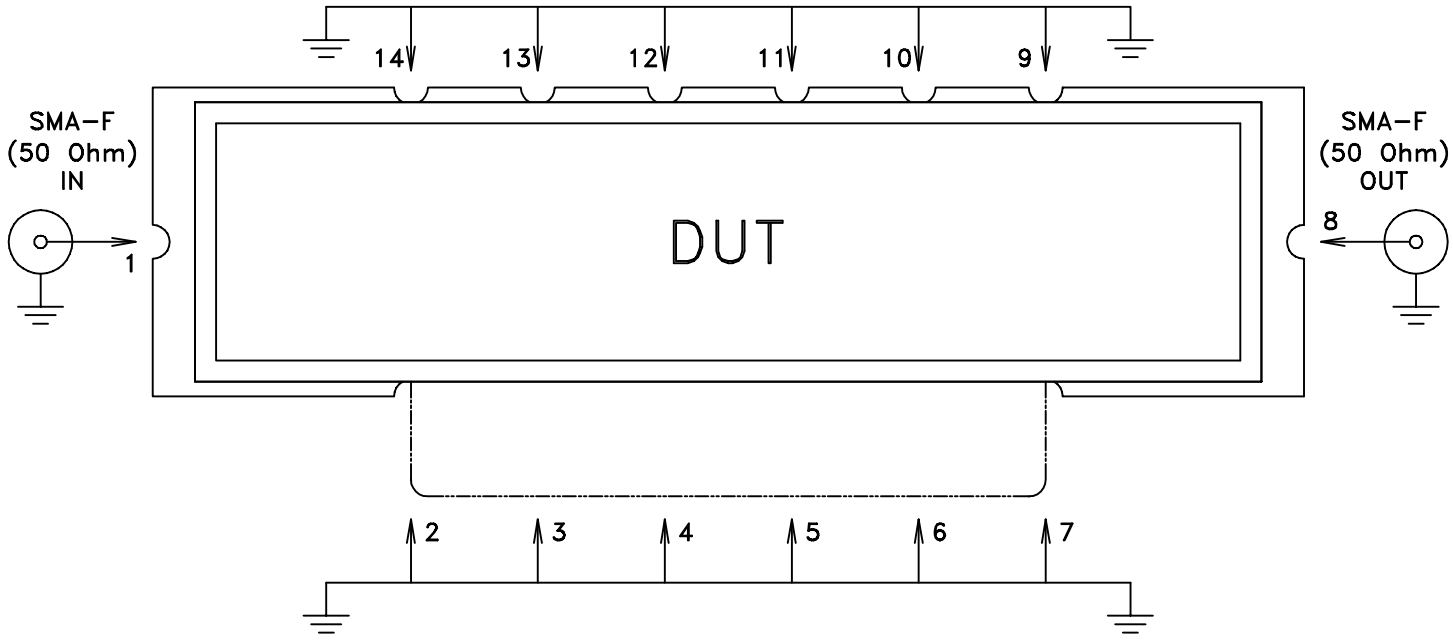
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-543	OR

FILE:	SCALE:	SHEET:
98PL543	2.25:1	1 OF 1

Evaluation Board and Circuit

TB-CBP4-1650Q+





Schematic Diagram

Notes:

1. PCB Material: FR4, GADE IT-180A OR Equivalent
   Dielectric Constant=4.7, Thickness=.025 inch.

Mini-Circuits®

THIS DOCUMENT AND ITS CONTENTS ARE THE PROPERTY OF MINI-CIRCUITS.

Mini-Circuits

Environmental Specifications ENV54

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
Humidity	90 to 95% RH, 96 hours, 40°C	MIL-STD-202, Method 103B, Condition B, Except 50°C
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, 10-2000 Hz, 4 times in each of three axes (total 12)	MIL-STD-202, Method 204, Condition D
Mechanical Shock	50g, 11 ms, 1/2-sine, 18 shocks: 3 each direction, each of 3 axes	MIL-STD-202, Method 213, Condition A

This document and its contents are the property of Mini-Circuits.