Ceramic

High Pass Filter

HFCW-9500+

50Ω 10500 to 20000 MHz

Generic photo used for illustration purposes only
CASE STYLE: JC0603C

The Big Deal

- Very good rejection, 36 dB typical
- Small size 0603 (0.063" X 0.032" X 0.024")
- Good Power handling, 2.5W
- Ceramic construction

Product Overview

HFCW-9500+ is a high pass filter with passband from 10500 MHz to 20000 MHz supporting a variety of applications. This model provides good insertion loss over a wide band due to strategically constructed layout. Housed in a tiny 0603 ceramic form factor with wraparound terminations, the filter is ideal for dense PCB layouts with minimal performance variation due to parasitics.

Key Features

Feature	Advantages
Small size, 0603 (0.063" X 0.032" X 0.024")	Accommodates tight space requirements for dense PCB layouts.
Wrap around termination	Provides excellent solderability and easy visual inspection capability.
LTCC construction	Provides a rugged package that is well suited for tough environments including high humidity and high temperature extremes.
Ultra-wide pass band	This filter has a very wide passband from 10.5 GHz to 20 GHz.

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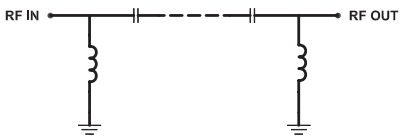
+RoHS Compliant
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Features
- Very good rejection, 36 dB typ.
- Small size 0603 (0.063" X 0.032" X 0.024")
- Temperature stable
- LTCC construction

Applications
- Test and measurements
- Military applications
- Telecommunications and broadband wireless systems

Functional Schematic



Electrical Specifications[1,2] at 25°C

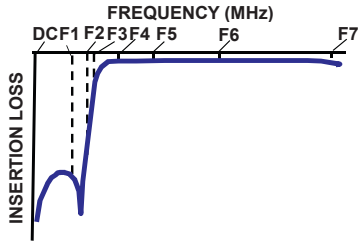
Parameter		F#	Frequency (MHz)	Min.	Typ.	Max.	Unit
Stop Band	Rejection Loss	DC-F1	DC - 6000	30	36	-	dB
		F1-F2	6000 - 7800	23	36	-	dB
	Freq. Cut-Off	F3*	9650	-	3.0	-	dB
Pass Band	Insertion Loss	F4-F5	10500 - 12000	-	1.9	-	dB
		F5-F6	12000 - 17500	-	0.9	1.6	dB
		F6-F7	17500 - 20000	-	1.2	-	dB
	Return Loss	F4-F5	10500 - 12000	-	14	-	dB
		F5-F6	12000 - 17500	-	12	-	dB
		F6-F7	17500 - 20000	-	8	-	dB

1 This component is not intended to act as a DC block. Please consult with Mini-Circuits for further details
2 Measured on Mini-Circuits Characterization Test Board TB-HFCW-9500+
* Typically, a ±5% frequency deviation from the stated value may occur on a unit-to-unit basis.

Maximum Ratings	
Operating Temperature	-55°C to 125°C
Storage Temperature	-55°C to 125°C
RF Power Input*	2.5W @ 25°C

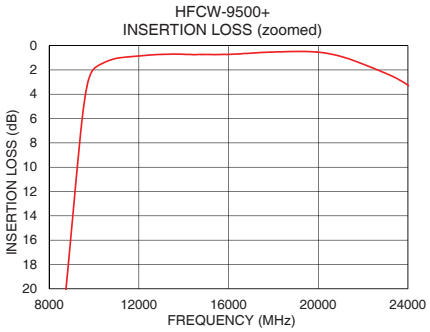
* Passband rating, derate linearly to 0.6W at 125°C ambient
Permanent damage may occur if any of these limits are exceeded.

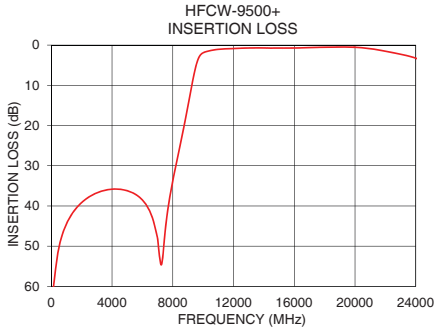
Typical Frequency Response

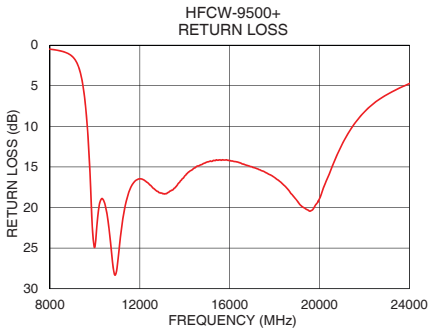


Typical Performance Data at 25°C

Frequency (MHz)	Insertion Loss (dB)	Return Loss (dB)
10	69.78	0.10
100	61.80	0.12
500	50.38	0.16
2000	39.16	0.16
3000	36.75	0.12
6000	38.51	0.17
7800	37.90	0.45
8200	30.03	0.58
8750	20.01	0.97
9500	5.59	5.58
9650	3.69	9.60
9725	3.04	12.74
10500	1.36	20.25
12000	0.86	16.46
14000	0.72	16.12
16000	0.73	14.22
17500	0.57	15.54
18000	0.53	16.31
19000	0.49	19.17
20000	0.54	18.90







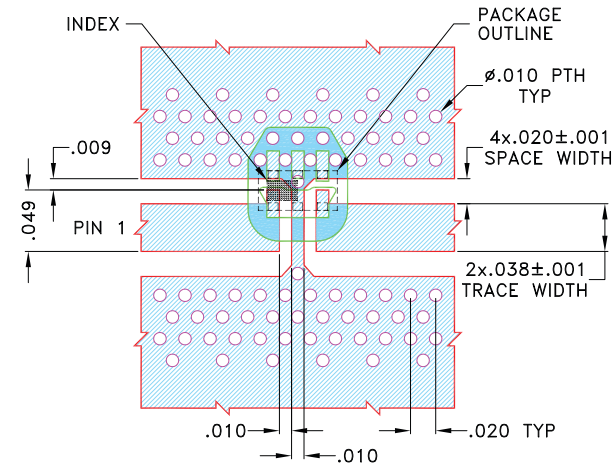
Notes
A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's 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	3
GROUND	2,4,5,6

Product Marking: V

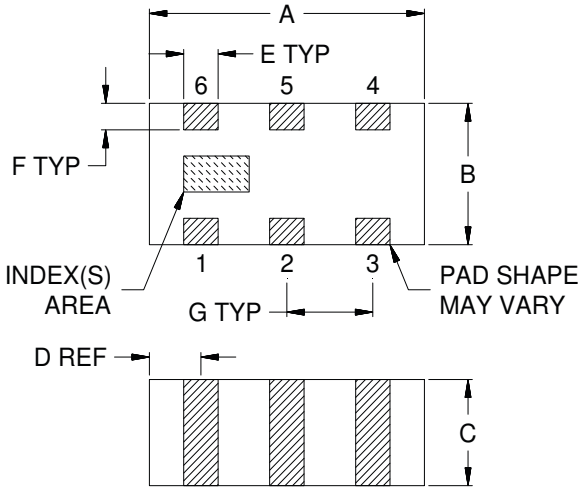
Demo Board MCL P/N: TB-HFCW-9500+
Suggested PCB Layout (PL-704)



NOTES:
1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS (RO3003) WITH DIELECTRIC THICKNESS .020±.001 COPPER: 1/2 Oz. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

DENOTES PCB COPPER PATTERN WITH SMOBC (SOLDER MASK OVER BARE COPPER)
DENOTES PCB COPPER PATTERN FREE OF SOLDERMASK

Outline Drawing



Outline Dimensions (inch / mm)

A	B	C	D	E	F	G	Wt.
.063	**.032**	**.024**	**.012**	**.008**	**.006**	**.020**	grams
1.60	0.80	0.60	0.30	0.20	0.15	0.50	.005

Note: Please refer to case style drawing for details.

Typical Performance Data

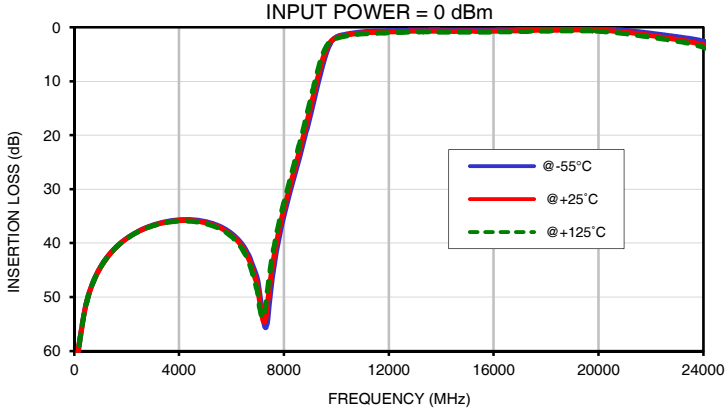
FREQ.	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
(MHz)	(dB)			(dB)			(dB)		
	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C
10	72.11	69.78	70.19	0.07	0.10	0.12	0.03	0.05	0.06
30	70.85	70.22	70.06	0.07	0.10	0.12	0.02	0.05	0.06
50	69.24	70.06	69.40	0.08	0.10	0.13	0.01	0.04	0.06
100	61.78	61.80	61.88	0.09	0.12	0.15	0.01	0.05	0.08
150	60.20	59.99	60.25	0.10	0.13	0.16	0.01	0.05	0.08
350	53.74	53.77	53.74	0.12	0.15	0.19	0.02	0.06	0.10
450	51.35	51.32	51.37	0.12	0.16	0.20	0.02	0.06	0.10
550	49.48	49.54	49.55	0.12	0.17	0.21	0.02	0.06	0.11
750	46.81	46.86	46.88	0.12	0.17	0.22	0.02	0.07	0.12
950	44.83	44.87	44.90	0.13	0.18	0.23	0.02	0.07	0.12
1200	42.95	42.98	43.00	0.12	0.18	0.23	0.01	0.07	0.12
1500	41.22	41.24	41.26	0.12	0.18	0.22	0.01	0.06	0.11
2000	39.13	39.16	39.18	0.10	0.16	0.21	0.01	0.05	0.10
2250	38.35	38.38	38.40	0.09	0.15	0.21	0.02	0.04	0.09
2500	37.68	37.72	37.75	0.08	0.14	0.20	0.03	0.03	0.09
2750	37.13	37.18	37.22	0.06	0.13	0.19	0.04	0.02	0.08
3000	36.68	36.75	36.79	0.05	0.12	0.18	0.06	0.02	0.07
3500	36.03	36.13	36.19	0.02	0.11	0.18	0.07	0.01	0.07
4000	35.69	35.82	35.92	0.00	0.10	0.17	0.08	0.00	0.07
4500	35.67	35.84	35.97	0.01	0.10	0.18	0.09	0.01	0.08
5000	36.02	36.22	36.38	0.00	0.11	0.20	0.08	0.02	0.11
5500	36.78	37.01	37.22	0.02	0.14	0.23	0.06	0.05	0.14
5750	37.38	37.65	37.88	0.03	0.15	0.25	0.05	0.07	0.16
6000	38.21	38.51	38.77	0.05	0.17	0.28	0.03	0.09	0.19
6250	39.33	39.71	40.04	0.07	0.20	0.31	0.01	0.11	0.21
6500	40.91	41.41	41.86	0.09	0.22	0.34	0.01	0.14	0.24
6750	43.33	44.08	44.79	0.12	0.26	0.38	0.04	0.17	0.28
7000	46.83	48.04	49.19	0.14	0.29	0.42	0.07	0.20	0.32
7250	55.14	54.63	53.09	0.18	0.33	0.47	0.10	0.24	0.37
7500	48.79	46.28	44.18	0.22	0.38	0.53	0.14	0.29	0.43
7800	39.26	37.90	36.50	0.27	0.45	0.62	0.20	0.36	0.51
8000	34.93	33.76	32.49	0.32	0.51	0.69	0.25	0.42	0.59
8200	31.13	30.03	28.78	0.37	0.58	0.78	0.31	0.50	0.68
8750	21.22	20.01	18.63	0.65	0.97	1.28	0.61	0.88	1.18
9500	6.63	5.59	4.76	3.66	5.58	7.67	3.64	5.25	7.33
9650	4.30	3.69	3.29	6.45	9.60	13.17	6.37	8.98	12.14
9725	3.43	3.04	2.83	8.54	12.74	17.13	8.45	11.68	15.24
10500	1.19	1.36	1.50	17.56	20.25	22.19	16.74	18.56	20.04
10800	0.97	1.15	1.29	22.01	27.11	32.27	19.55	22.03	23.60
11000	0.86	1.05	1.21	26.80	27.09	24.67	21.95	22.79	22.41
11300	0.76	0.97	1.14	22.83	20.49	18.74	21.48	20.20	19.02
11600	0.71	0.92	1.09	18.46	17.50	16.46	18.89	18.29	17.42
12000	0.66	0.86	1.02	16.51	16.46	15.94	17.65	17.94	17.55
12300	0.62	0.81	0.96	16.63	16.87	16.59	18.17	18.94	18.82
12600	0.58	0.75	0.92	17.25	17.64	17.31	19.58	20.58	20.70
13000	0.53	0.73	0.87	18.41	18.25	17.76	21.65	22.31	22.05
13500	0.51	0.70	0.86	18.40	17.73	16.98	21.22	20.15	19.38
14000	0.51	0.72	0.88	16.93	16.12	15.32	18.33	17.58	16.70
14500	0.53	0.74	0.90	15.48	15.01	14.29	16.58	16.01	15.28
15000	0.54	0.74	0.90	15.02	14.39	13.99	15.71	15.14	14.74
15500	0.52	0.74	0.90	14.68	14.17	13.91	15.46	14.90	14.61
16000	0.51	0.73	0.87	14.50	14.22	14.10	15.54	15.00	14.89
16500	0.47	0.69	0.82	14.76	14.54	14.45	15.79	15.34	15.20
17000	0.41	0.62	0.77	14.92	15.00	14.83	16.00	15.75	15.58
17500	0.36	0.57	0.73	15.00	15.54	15.25	15.84	16.13	15.74
18000	0.32	0.53	0.70	15.44	16.31	16.26	16.24	16.89	16.60
19000	0.25	0.49	0.64	17.90	19.17	21.01	18.90	20.13	20.74
19500	0.24	0.49	0.65	19.56	20.34	22.61	20.96	21.32	21.32
20000	0.27	0.54	0.74	19.27	18.90	18.57	19.61	18.78	17.32
24000	2.59	3.26	3.69	4.94	4.74	4.68	4.65	4.39	4.20

Typical Performance Data

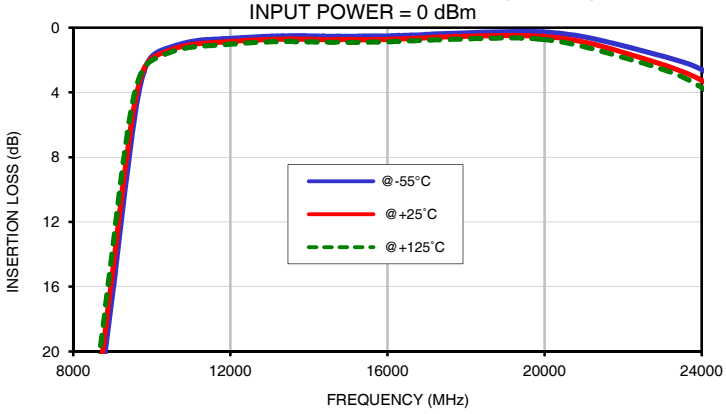
FREQ. (MHz)	GROUP DELAY (nsec)		
	@-55°C	@+25°C	@+125°C
10500	0.24	0.23	0.22
10750	0.21	0.20	0.20
11000	0.19	0.18	0.17
11250	0.17	0.16	0.16
11500	0.15	0.14	0.14
11750	0.13	0.13	0.13
12000	0.12	0.12	0.12
12250	0.11	0.11	0.11
12500	0.10	0.10	0.10
12750	0.10	0.09	0.09
13000	0.09	0.09	0.09
13250	0.09	0.08	0.08
13500	0.08	0.08	0.08
13750	0.08	0.07	0.07
14000	0.07	0.07	0.07
14250	0.07	0.06	0.06
14500	0.06	0.06	0.06
14750	0.06	0.06	0.06
15000	0.06	0.06	0.06
15250	0.06	0.05	0.05
15500	0.05	0.05	0.05
15750	0.05	0.05	0.05
16000	0.05	0.05	0.05
16250	0.05	0.05	0.05
16500	0.05	0.05	0.05
16750	0.05	0.05	0.05
17000	0.05	0.05	0.05
17250	0.05	0.05	0.05
17500	0.05	0.05	0.05
17750	0.05	0.05	0.05
18000	0.05	0.04	0.05
18250	0.05	0.04	0.05
18500	0.04	0.04	0.05
18750	0.05	0.04	0.05
18900	0.05	0.05	0.05
19000	0.05	0.05	0.05
19250	0.05	0.05	0.05
19500	0.05	0.05	0.05
19750	0.05	0.05	0.05
20000	0.05	0.05	0.05

Typical Performance Curves

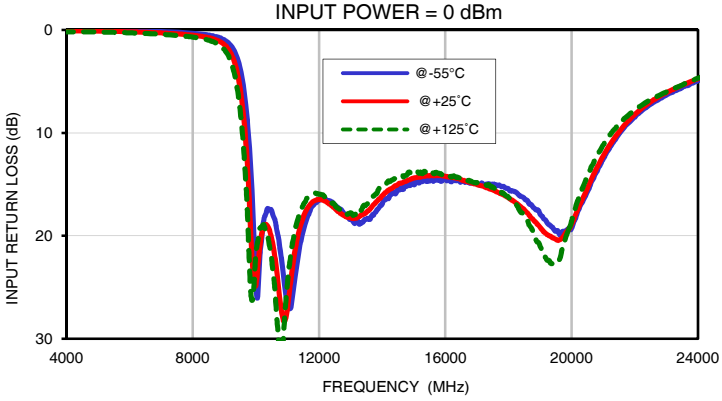
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



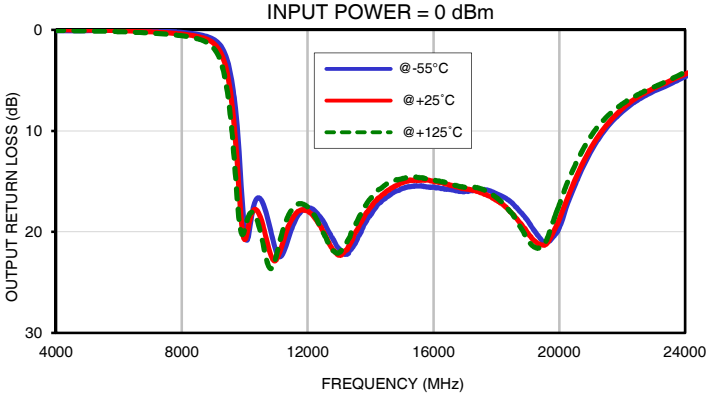
INSERTION LOSS vs. TEMPERATURE (Zoomed)
INPUT POWER = 0 dBm



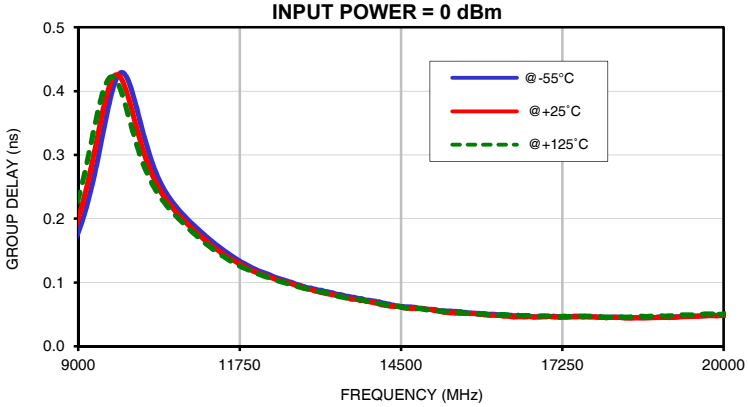
INPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm

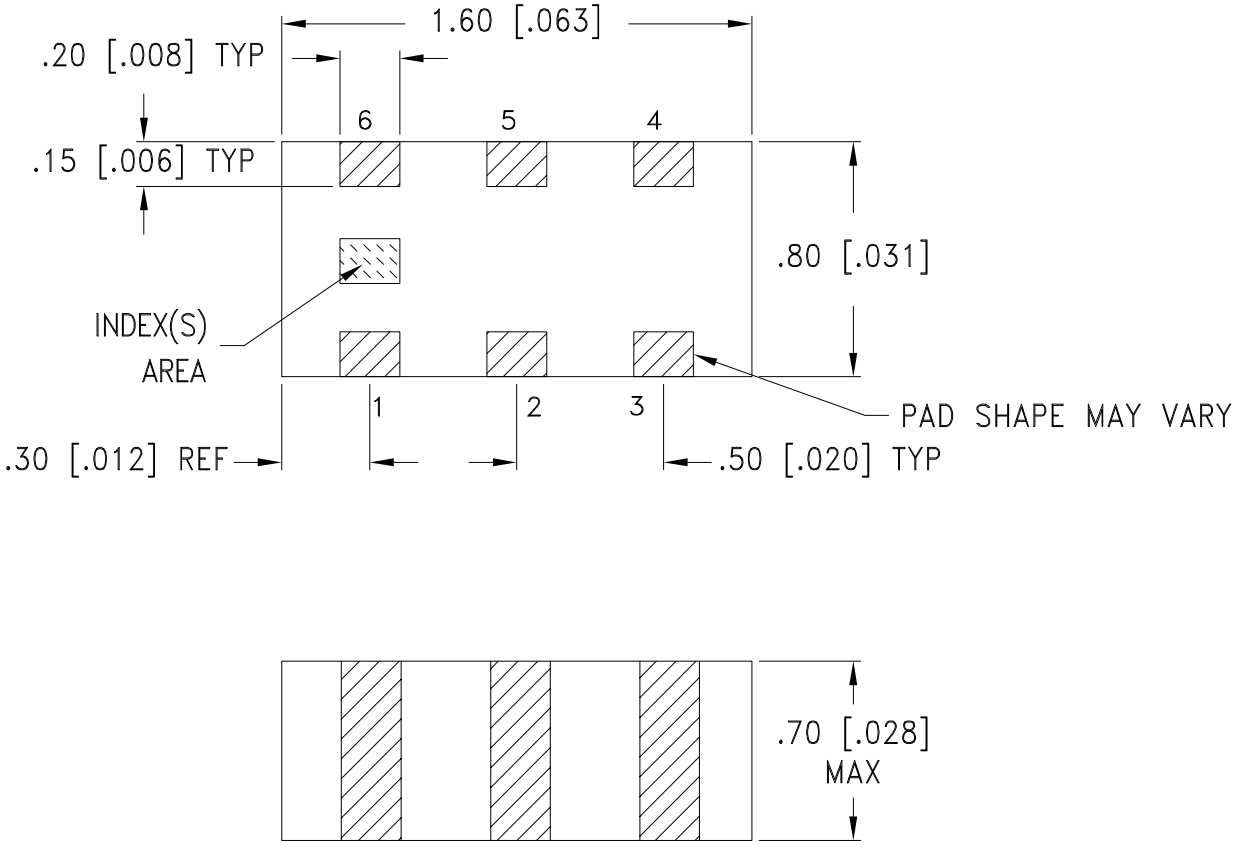


GROUP DELAY vs. TEMPERATURE
INPUT POWER = 0 dBm



Case Style JC

Outline Dimensions JC0603C



METALLIZATION

Weight: .005 grams

Dimensions are in mm [inch]. Tolerances: ±0.13 mm

Notes:

1. Open style, ceramic base.
2. Termination finish:
   For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.

Tape & Reel Packaging TR-F114

DEVICE ORIENTATION IN T&R

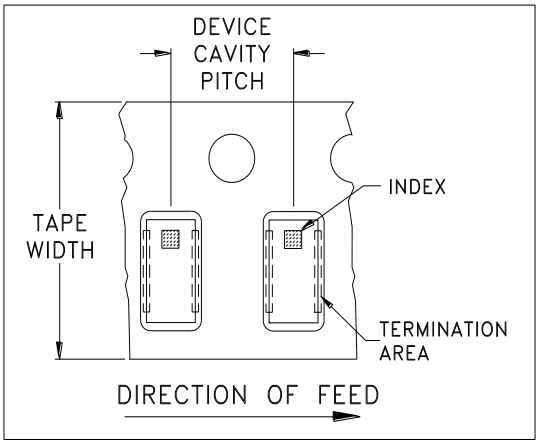


ILLUSTRATION 1

Applicable Case Styles	
GE0805C	JC0603C
GE0805C-1	JC0603C-4
GE0805C-1AP	JC0603C-6
GE0805C-7	
GE0805C-9	
GE0805C-10	
GE0805C-11	
GE0805C-12	

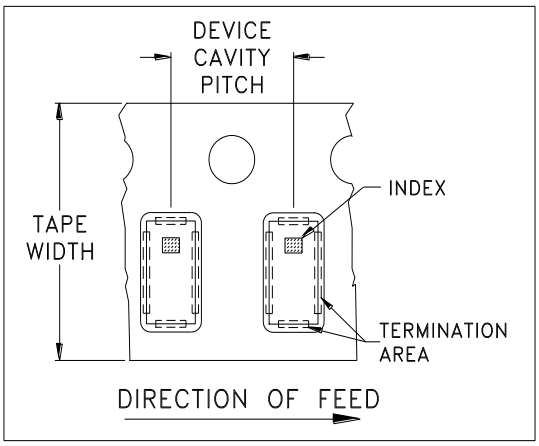


ILLUSTRATION 2

Applicable Case Styles	
GE0805C-2	JC0603C-1
GE0805C-3	JC0603C-2
GE0805C-4	JC0603C-3
GE0805C-5	JC0603C-5
GE0805C-6	JC0603C-7
GE0805C-8	
GE0805C-15	

Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel	
8	4	7	Small quantity standards (see note)	20
				50
				100
				200
				500
				1000
			Standard	4000

Note: Please Consult individual model data sheet to determine device per reel availability.

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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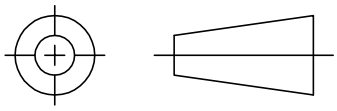
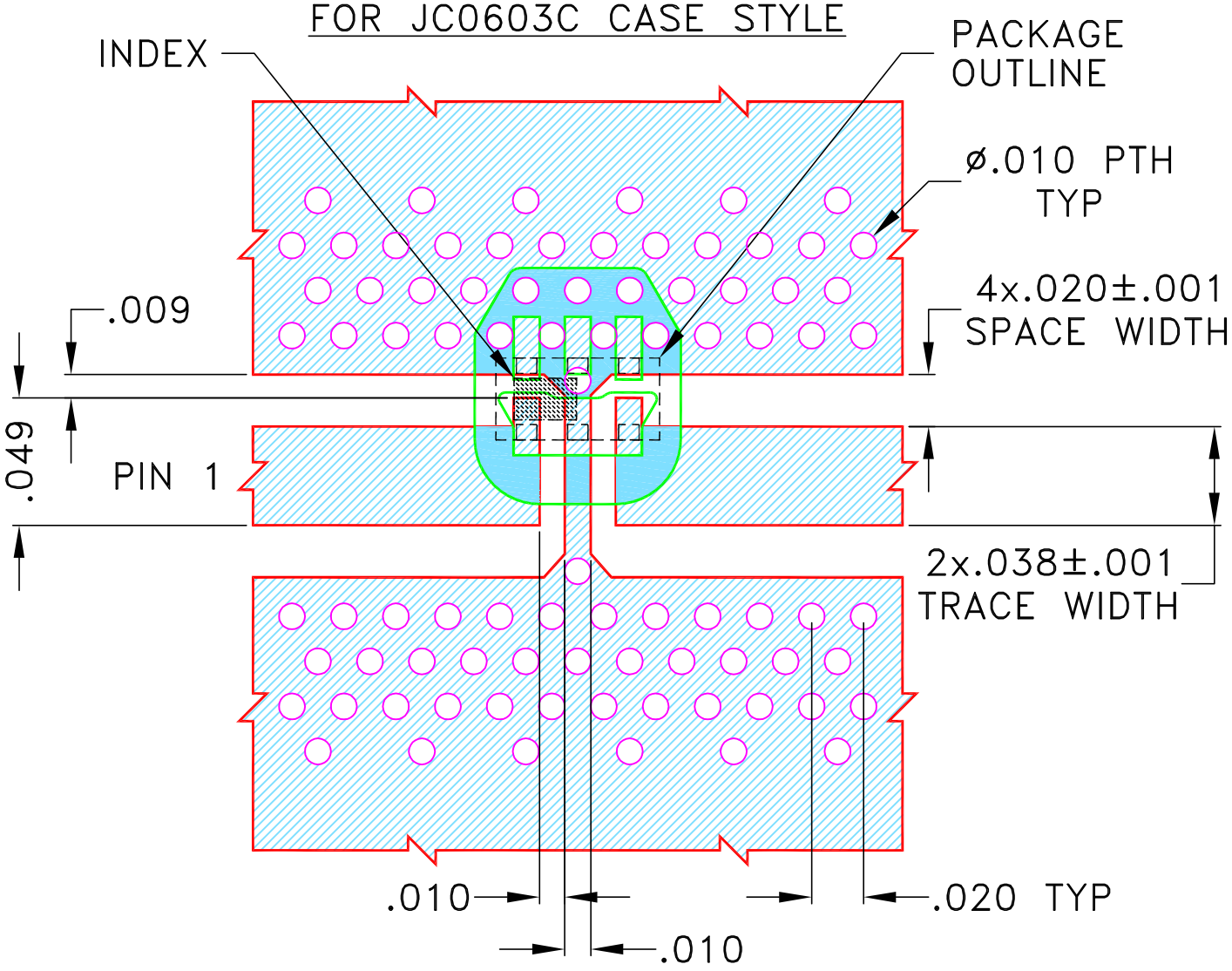
THIRD ANGLE PROJECTION



REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-006344	NEW RELEASE	FEB 21	KKR	VC

SUGGESTED MOUNTING CONFIGURATION FOR JC0603C CASE STYLE



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2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

DENOTES PCB COPPER PATTERN WITH SMOBC (SOLDER MASK OVER BARE COPPER)

DENOTES PCB COPPER PATTERN FREE OF SOLDERMASK

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	KKR	17 FEB 21
TOLERANCES ON:	CHECKED	DDR	17 FEB 21
2 PL DECIMALS ±	APPROVED	RV	17 FEB 21
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

Mini-Circuits®
13 Neptune Avenue
Brooklyn NY 11235

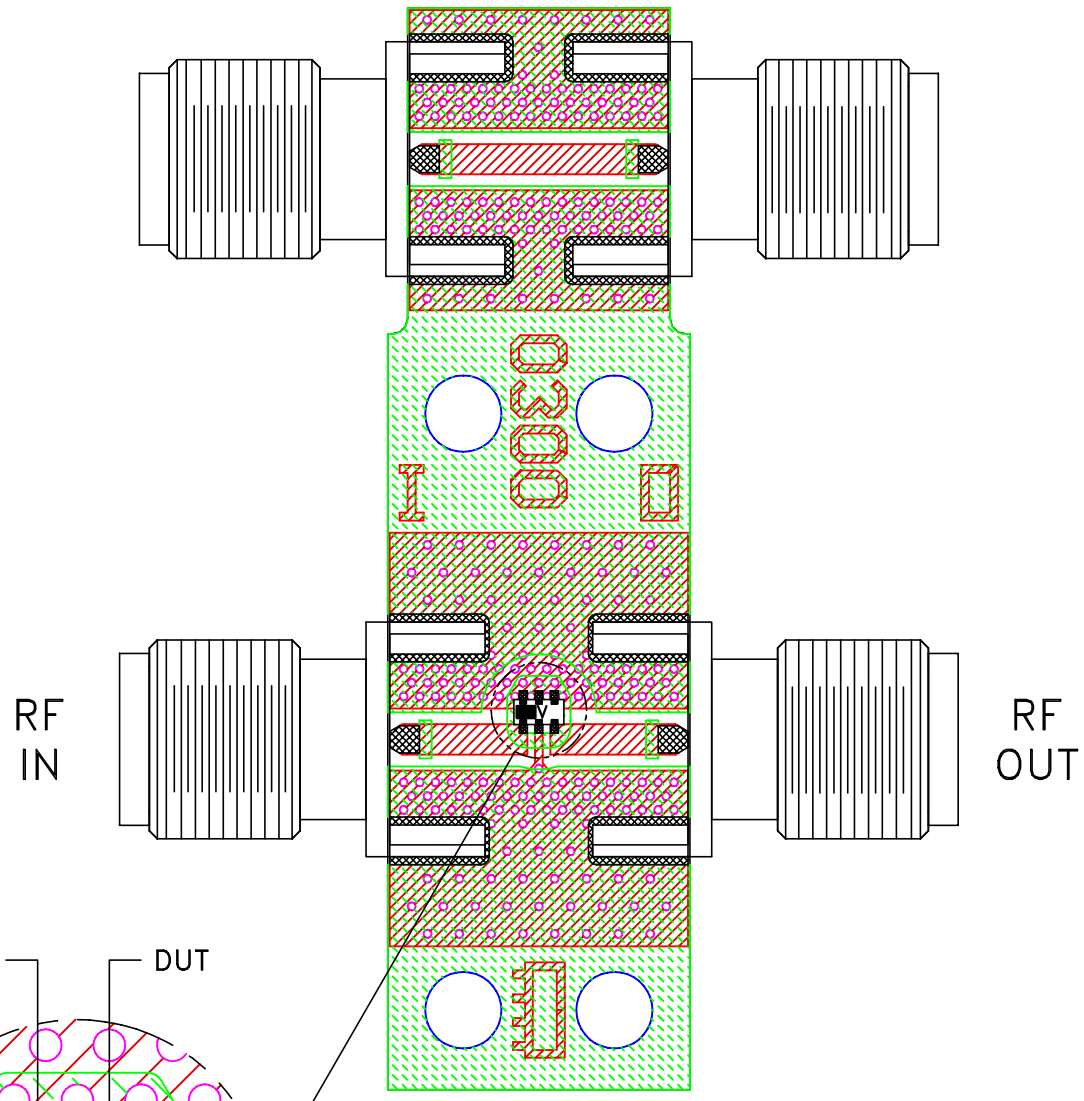
PL DWG, JC0603C C.S, 50 OHM, HFCW

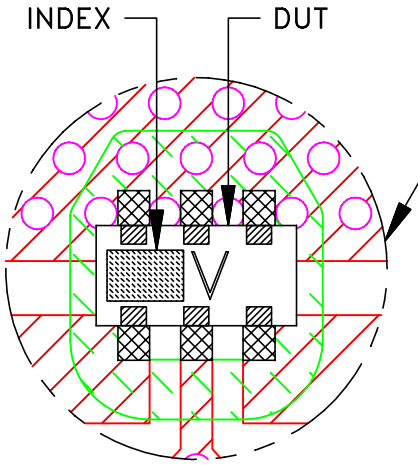
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-704	OR

FILE:	SCALE:	SHEET:
98PL704	15:1	1 OF 1

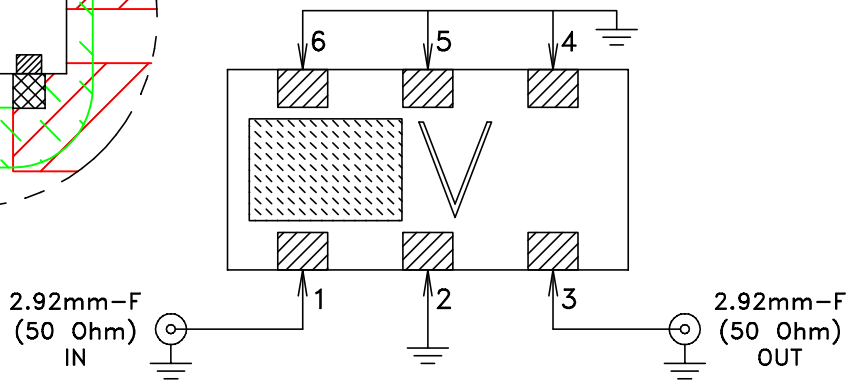
Evaluation Board and Circuit

TB-HFCW-9500+





Schematic diagram



Notes:

1. PCB Material: ROGERS (RO3003) OR Equivalent, Dielectric Constant=3.48±.05
Dielectric Thickness: .020±.001
2. 50 Ohm 2.92mm Female Connectors.
3. Connectors on the test board shall not be subjected to temperature greater than 200°C to avoid permanent damage to the connectors.

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Environmental Specifications ENV06

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	-55° to 100°C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° C Ambient Environment	Individual Model Data Sheet
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
Solder Reflow Heat	Sn-Pb Eutetic Process: 225°C peak Pb-Free Process 245° - 250°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, 12 times in each of three perpendicular directions (total 36)	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