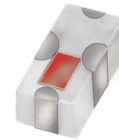


Ceramic Low Pass Filter

LFCW-123+

50Ω DC to 12 GHz



Generic photo used for illustration purposes only
CASE STYLE: JC0603C-1

The Big Deal

- Good rejection, 38 dB typical
- Rugged, ceramic construction
- Tiny size, 0.063 x 0.032 x 0.024" (0603)
- Good power handling, 2.5W

Product Overview

Mini-Circuits' LFCW-123+ is an LTCC low pass filter with a passband from DC to 12 GHz, supporting a variety of applications. This model provides 1.2 dB typical passband insertion loss and provides a very good stopband rejection due to strategically constructed layout with minimal interaction between components. It handles up to 2.5W RF input power and provides a wide operating temperature range from -55 to +125°C. Housed in a tiny 0603 ceramic form factor with wraparound terminations, the filter is ideal for dense PCB layouts and with minimal performance variation due to parasitics.

Key Features

Feature	Advantages
Ultra-wide stopband	The LTCC lowpass filter provides a very good stopband rejection until 26.5 GHz suitable for high end applications.
LTCC Construction	Provides repeatable performance in a rugged, ceramic package well suited for tough environments such as high humidity and temperature extremes.
Tiny size (0.063 x 0.032 x 0.024")	Saves space in dense circuit board layouts and minimizes the effects of parasitics.
Good power handling, 2.5W	Supports a wide range of system power requirements.
Wrap-around terminations	Provides excellent solderability and easy visual inspection

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



Low Pass Filter

LFCW-123+

50Ω DC to 12 GHz



Generic photo used for illustration purposes only
CASE STYLE: JC0603C-1

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

Features

- Low loss, 1.2 dB typical
- Good rejection 38 dB typical
- Extremely small size 0603 (0.063 X 0.032 X 0.024")
- Temperature stable
- LTCC construction

Applications

- Test and measurements
- Telecommunications and broadband wireless system
- Military applications
- Satcom modems

Electrical Specifications^{1,2} at 25°C

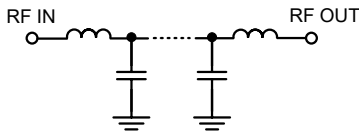
Parameter	F#	Frequency (MHz)	Min.	Typ.	Max.	Unit	
Pass Band	Insertion Loss	DC-F1	DC - 12000	—	1.2	2.1	dB
	Freq. Cut-Off	F2*	13800	—	3.0	—	dB
	Return Loss	DC-F1	DC - 12000	—	10	—	dB
Stop Band	Rejection Loss	F3-F4	16300 - 18500	20	38	—	dB
		F4-F5	18500 - 22000	28	38	—	dB
		F5-F6	22000 - 25000	25	35	—	dB
		F6-F7	25000 - 26500	—	20	—	dB

1 DC de-coupling capacitors are required in Applications where DC voltage and/or current is present at either input or output ports. Please contact Mini-Circuits for alternatives if DC pass from IN-OUT is required.

2 Measured on Mini-Circuits Characterization Test Board TB-LFCW-123+

* Typically, a ±5% frequency deviation from the stated value may occur on a unit-to-unit basis.

Functional Schematic



Maximum Ratings

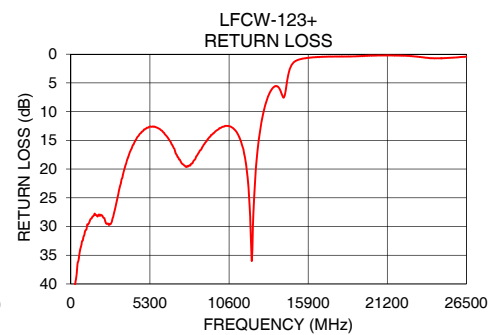
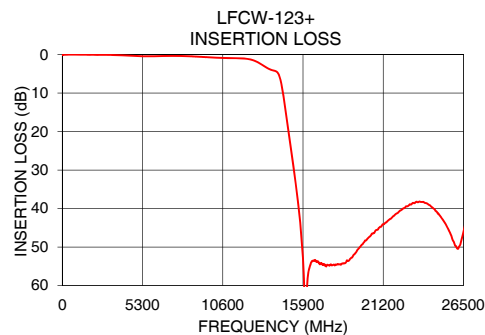
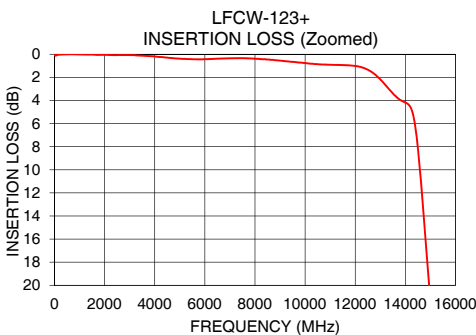
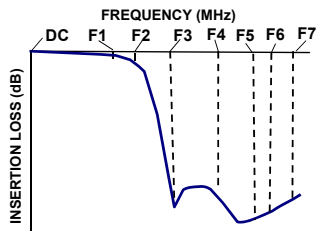
Operating Temperature	-55°C to 125°C
Storage Temperature	-55°C to 125°C
RF Power Input*	2.5 W @25°C

*Passband rating, derate linearly to 0.7 W at 125°C ambient
Permanent damage may occur if any of these limits are exceeded.

Typical Performance Data at 25°C

Frequency (MHz)	Insertion Loss (dB)	Return Loss (dB)
10	0.07	64.50
100	0.06	50.16
1000	0.01	30.62
2000	0.05	27.96
10000	0.76	12.86
12000	1.01	27.51
13360	3.06	6.54
13800	3.96	5.58
14000	4.19	6.14
15000	21.57	1.28
15300	30.04	0.92
15500	35.97	0.79
15800	47.47	0.67
16300	55.75	0.55
18000	54.76	0.39
18500	54.24	0.41
20000	48.30	0.30
22000	41.51	0.26
25000	42.12	0.70
26500	46.10	0.46

Typical Frequency Response



Notes

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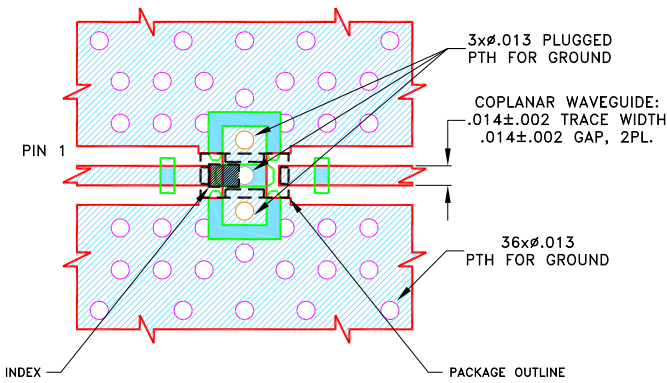


Pad Connections

INPUT	1
OUTPUT	3
GROUND	2, 4

Product Marking: J

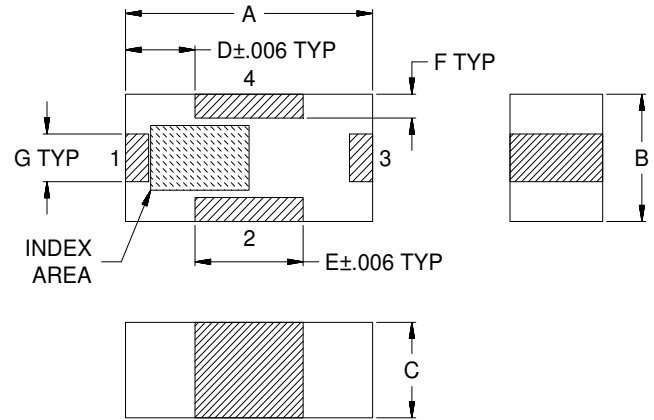
Demo Board MCL P/N: TB-LFCW-123+
Suggested PCB Layout (PL-661)



NOTES:

- COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS (R04350B) WITH DIELECTRIC THICKNESS $.0066 \pm .0007$. COPPER: 1/2 Oz. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
 - 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	.018	.028	.006	.012	grams
1.60	0.80	0.60	0.45	0.70	0.15	0.30	.005

Note: Please refer to case style drawing for details

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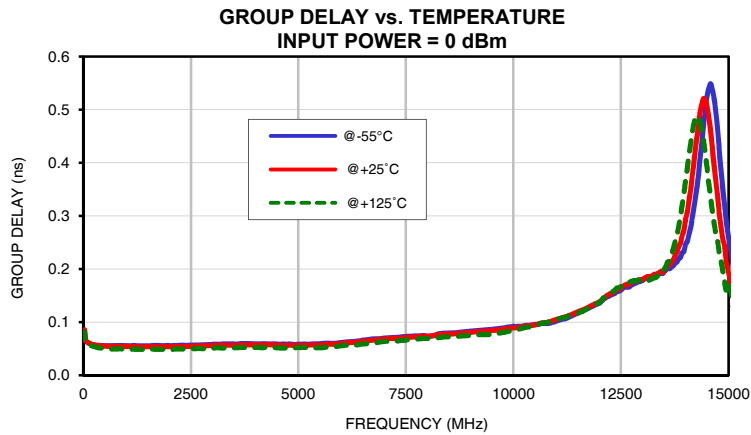
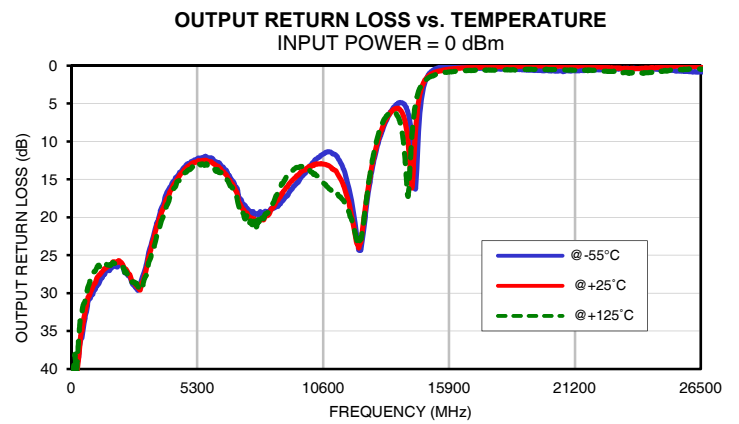
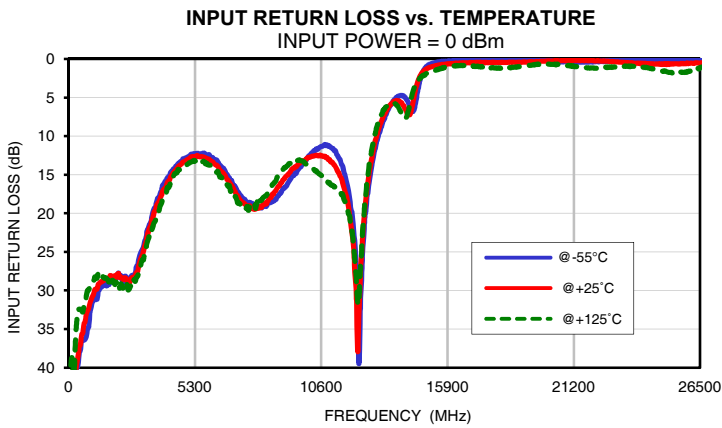
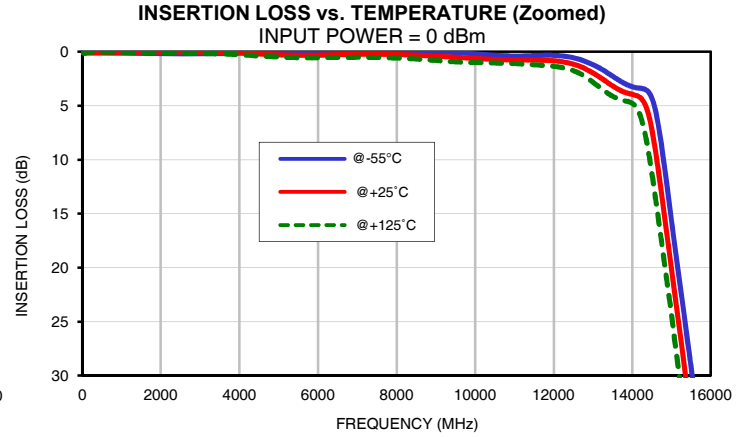
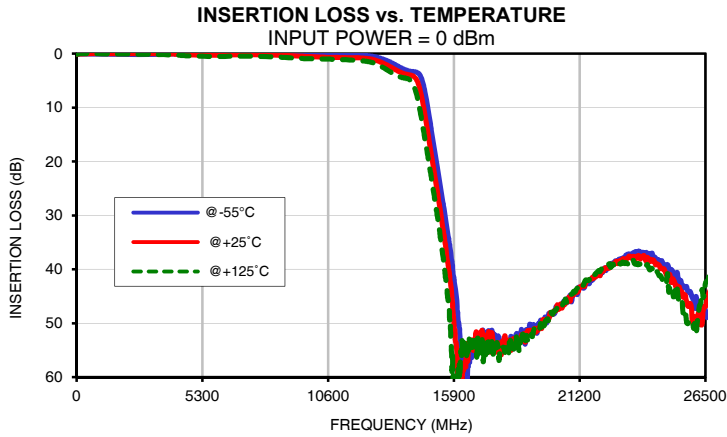
Typical Performance Data

FREQ. (MHz)	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
	(dB)			(dB)			(dB)		
	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C
10	0.08	0.06	0.05	54.27	61.23	55.60	52.67	59.06	55.19
100	0.10	0.08	0.06	54.25	49.02	39.63	59.85	50.17	39.59
200	0.09	0.06	0.03	43.37	43.14	41.64	43.02	42.90	40.46
250	0.09	0.05	0.02	40.56	41.05	39.95	39.39	40.16	39.03
300	0.10	0.05	0.01	40.17	40.25	36.17	38.57	38.82	36.39
400	0.10	0.04	0.00	39.65	38.56	32.74	36.08	35.47	32.90
500	0.11	0.04	0.01	37.72	37.01	32.49	34.58	33.74	31.54
600	0.11	0.04	0.02	36.37	35.47	32.77	32.85	32.17	30.61
700	0.12	0.04	0.02	36.31	33.98	31.59	31.13	30.57	29.21
800	0.13	0.04	0.03	35.03	32.63	29.97	30.64	29.93	28.18
1000	0.13	0.03	0.05	31.40	30.79	28.98	29.51	28.68	27.09
2000	0.16	0.02	0.10	28.11	28.00	28.92	26.01	25.69	26.10
3000	0.19	0.01	0.14	25.40	26.24	27.15	27.80	28.56	29.07
4000	0.11	0.09	0.26	16.20	16.87	17.76	16.93	17.62	18.58
6000	0.05	0.31	0.54	12.83	13.33	14.12	12.50	12.94	13.46
7000	0.07	0.22	0.50	16.55	17.22	17.80	16.37	17.07	17.94
8000	0.07	0.26	0.58	19.11	19.33	18.88	19.47	20.32	20.04
10000	0.19	0.61	0.99	12.87	12.90	13.54	13.36	13.30	13.64
10500	0.32	0.70	1.03	11.51	12.56	14.82	11.84	12.92	15.03
11000	0.40	0.75	1.10	11.40	13.32	16.29	11.61	13.64	16.72
11100	0.40	0.76	1.11	11.60	13.49	16.37	11.71	13.78	16.63
11200	0.39	0.75	1.13	11.88	13.93	16.52	12.02	14.18	16.86
11300	0.37	0.75	1.15	12.57	14.60	17.01	12.54	14.76	17.25
11500	0.35	0.77	1.21	13.85	16.01	17.51	13.91	16.09	17.98
12000	0.33	0.83	1.34	23.24	26.62	25.59	22.15	23.25	22.83
12100	0.34	0.86	1.39	29.19	33.55	29.72	24.30	24.02	23.61
12200	0.37	0.91	1.44	39.02	31.77	30.56	24.13	23.08	22.87
12500	0.55	1.14	1.74	18.88	17.44	16.70	16.78	16.04	15.91
12600	0.63	1.25	1.89	16.27	15.01	14.10	14.83	14.18	13.88
12700	0.74	1.40	2.07	14.28	13.20	12.20	13.13	12.56	12.05
12900	1.03	1.75	2.55	11.10	10.29	9.23	10.43	9.95	9.33
13000	1.19	1.96	2.82	9.92	9.21	8.16	9.36	8.94	8.27
13700	2.74	3.59	4.44	5.19	5.47	5.78	5.12	5.65	6.46
13800	2.92	3.73	4.51	4.94	5.44	6.06	4.91	5.69	7.04
14000	3.24	3.95	4.78	4.75	5.82	7.26	5.01	6.75	10.54
15000	15.64	20.15	24.43	1.00	1.29	1.91	1.37	1.47	1.68
15500	29.28	34.22	39.81	0.36	0.79	1.31	0.26	0.71	1.06
16000	44.86	54.03	67.97	0.22	0.59	0.94	0.07	0.42	0.80
16300	75.72	58.77	56.05	0.16	0.54	0.85	0.18	0.33	0.71
16500	58.00	53.85	54.40	0.09	0.50	0.83	0.21	0.29	0.64
17000	53.15	53.08	55.46	0.03	0.48	0.93	0.33	0.19	0.58
17500	51.31	51.75	53.25	0.06	0.47	1.13	0.38	0.15	0.57
18000	53.23	53.51	54.53	0.01	0.42	1.13	0.42	0.13	0.58
18500	52.48	53.08	54.27	0.06	0.42	1.10	0.46	0.09	0.56
19000	52.19	51.39	53.07	0.05	0.42	0.94	0.54	0.04	0.48
19500	50.30	50.63	51.24	0.01	0.35	0.74	0.63	0.02	0.51
20000	48.45	48.18	47.95	0.10	0.28	0.66	0.64	0.04	0.45
20500	46.06	46.27	46.23	0.29	0.17	0.65	0.66	0.02	0.55
21000	44.13	44.36	44.22	0.35	0.17	0.81	0.66	0.02	0.53
21500	42.43	42.16	42.02	0.39	0.18	1.07	0.63	0.00	0.59
22000	40.98	40.75	40.24	0.39	0.15	1.13	0.54	0.08	0.59
22500	39.13	39.35	39.64	0.22	0.26	1.15	0.48	0.20	0.72
23000	37.93	38.12	38.67	0.11	0.35	1.02	0.36	0.34	0.87
23500	37.41	37.69	38.89	0.06	0.49	0.91	0.38	0.35	0.89
24000	36.86	38.50	39.22	0.02	0.51	1.03	0.40	0.32	0.96
24500	38.20	39.08	40.79	0.06	0.59	1.28	0.44	0.26	0.79
25000	40.42	41.01	43.30	0.05	0.68	1.54	0.54	0.16	0.60
25500	42.97	44.14	45.32	0.21	0.63	1.71	0.67	0.01	0.53
26000	45.83	48.75	50.96	0.00	0.59	1.64	0.75	0.09	0.42
26500	48.72	46.85	42.44	0.03	0.50	1.11	0.80	0.10	0.48

Typical Performance Data

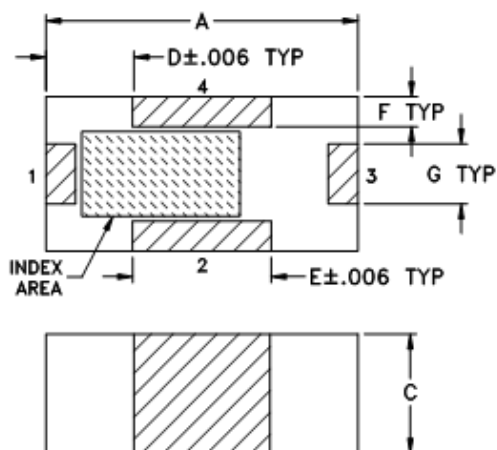
FREQ. (MHz)	GROUP DELAY		
	(nsec)		
	@-55°C	@+25°C	@+125°C
10	0.07	0.08	0.08
100	0.06	0.06	0.06
200	0.06	0.06	0.06
400	0.06	0.06	0.05
600	0.06	0.05	0.05
800	0.06	0.05	0.05
1000	0.06	0.05	0.05
1200	0.06	0.05	0.05
1400	0.06	0.05	0.05
1600	0.06	0.05	0.05
1800	0.06	0.05	0.05
2000	0.06	0.05	0.05
2200	0.06	0.05	0.05
2400	0.06	0.05	0.05
2600	0.06	0.05	0.05
2800	0.06	0.06	0.05
3000	0.06	0.06	0.05
3200	0.06	0.06	0.05
3400	0.06	0.06	0.05
3600	0.06	0.06	0.05
3800	0.06	0.06	0.05
4000	0.06	0.06	0.05
4200	0.06	0.06	0.05
4400	0.06	0.06	0.05
4600	0.06	0.06	0.05
4800	0.06	0.06	0.05
5000	0.06	0.06	0.05
5200	0.06	0.06	0.05
5400	0.06	0.06	0.05
5600	0.06	0.06	0.05
5800	0.06	0.06	0.05
6000	0.06	0.06	0.06
6200	0.06	0.06	0.06
7000	0.07	0.07	0.06
7200	0.07	0.07	0.06
7500	0.07	0.07	0.07
10000	0.09	0.09	0.08
10500	0.10	0.09	0.09
11000	0.10	0.11	0.11
11500	0.12	0.12	0.12
12000	0.14	0.14	0.14

Typical Performance Curves

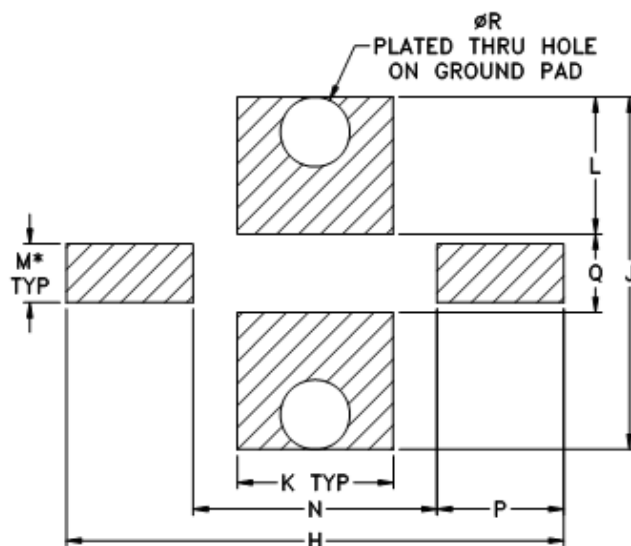


Outline Dimensions

JC0603C-1



PCB Land Pattern



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

CASE #	A	B	C	D	E	F	G	H	J	K	L
JC0603C-1	.063 (1.60)	.031 (0.80)	.024 (0.60)	.018 (0.45)	.028 (0.70)	.006 (0.15)	.012 (0.30)	.100 (2.54)	.071 (1.80)	.032 (0.80)	.028 (0.70)

CASE #	M*	N	P	Q	R	WT. GRAMS
JC0603C-1	.012 (0.30)	.049 (1.24)	.026 (0.65)	.016 (0.40)	.014 (0.35)	.005

Dimensions are in inches (mm). Tolerances: 3 Pl. $\pm .004$

Notes:

1. Open style, ceramic base.
2. Termination finish:
For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.
- 3.* - Line width should be designed to match 50 OHMS characteristic impedance, depending on PCB material & thickness.



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/MICROWAVE COMPONENTS

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
			Standard	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



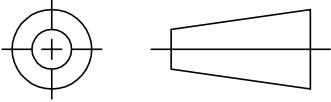
INTERNET <http://www.minicircuits.com>

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

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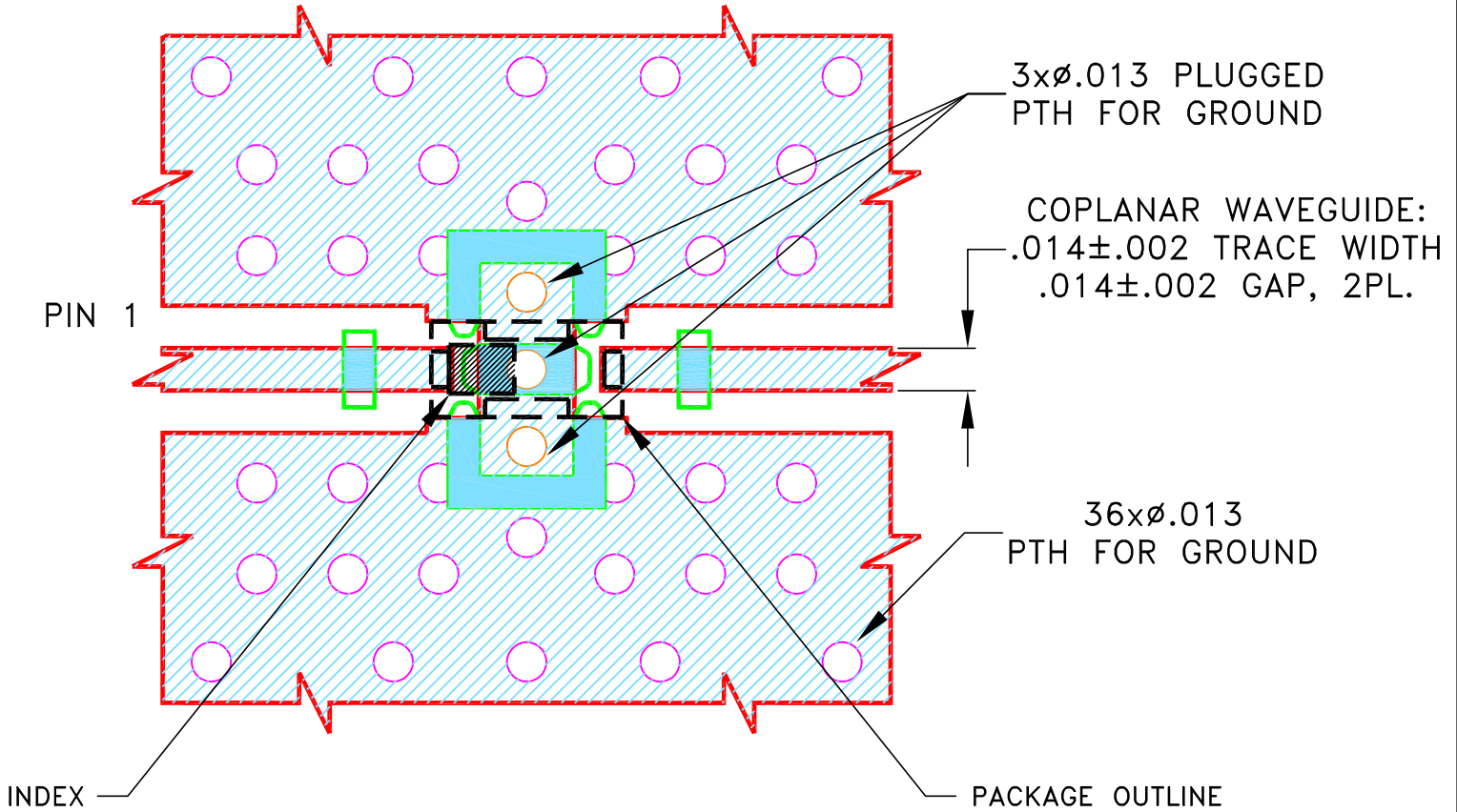
THIRD ANGLE PROJECTION



REVISIONS

REV OR	ECN No.	DESCRIPTION	DATE	DR	AUTH
	M176778	NEW RELEASE	DEC 19	DDR	VC

SUGGESTED MOUNTING CONFIGURATION
FOR JC0603C-1 CASE STYLE



NOTES:

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- 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: DDR	14 DEC 19
TOLERANCES ON:	CHECKED: RV	14 DEC 19
2 PL DECIMALS ±	APPROVED: RKS	14 DEC 19
3 PL DECIMALS ± .005		
ANGLES ±		
FRACTIONS ±		

Mini-Circuits[®] 13 Neptune Avenue
Brooklyn NY 11235

PL, JC0603C-1, TB-1124+

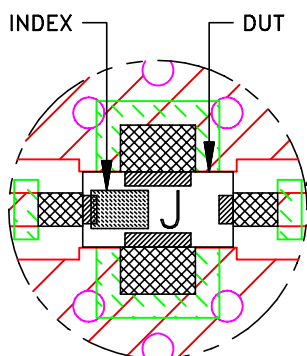
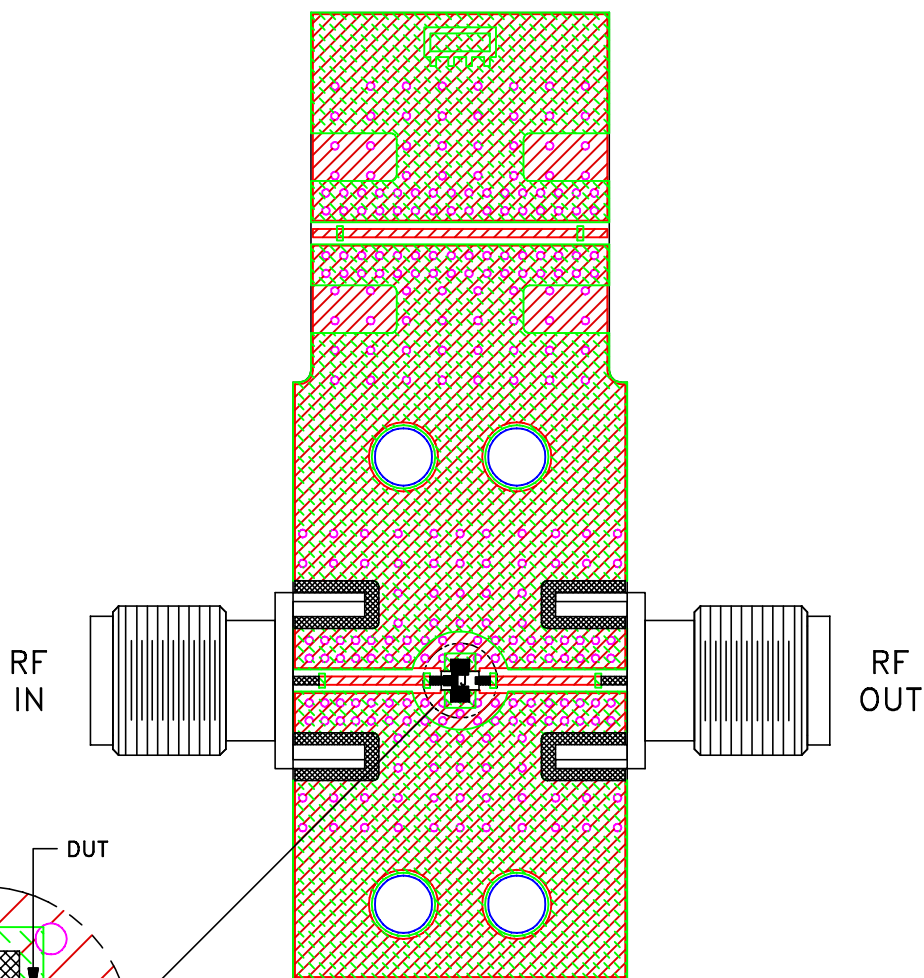
Mini-Circuits[®]
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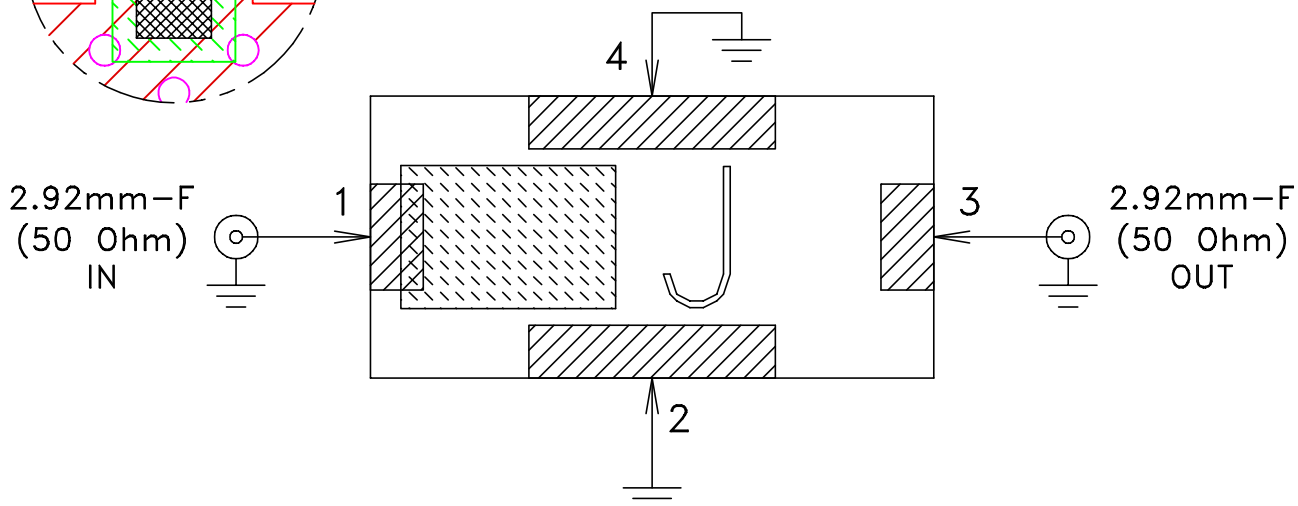
SIZE A	CODE IDENT 15542	DRAWING NO: 98-PL-661	REV: OR
FILE: 98PL661	SCALE: 16:1	SHEET: 1 OF 1	

Evaluation Board and Circuit

TB-LFCW-123+



Schematic diagram




Notes:

1. PCB Material: ROGERS (RO4350B) OR Equivalent, Dielectric Constant= 3.48 ± 0.05

Dielectric Thickness: $.0066 \pm .0007$

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.

 **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	-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