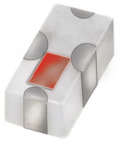
Ceramic

Low Pass Filter

LFCW-6000+

50Ω DC to 6 GHz



Generic photo used for illustration purposes only

CASE STYLE: JC0603C-1

The Big Deal

- Very good rejection, 43 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-6000+ is an LTCC low pass filter with a passband from DC to 6 GHz, supporting a variety of applications. This model provides 1.6 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

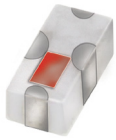
Notes
A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit’s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

Ceramic

Low Pass Filter

LFCW-6000+

50Ω DC to 6 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

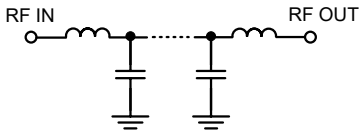
Features

- Low loss, 1.6 dB typical
- Good rejection 43 dB typical
- Extremely small size 0603 (0.063 X 0.032 X 0.024")
- Temperature stable
- LTCC construction

Applications

- Harmonic Rejection
- VHF/UHF transmitters / receivers
- Test and measurements
- Telecommunications and broadband wireless system
- Military applications
- Satcom modems

Functional Schematic



Electrical Specifications[1,2] at 25°C

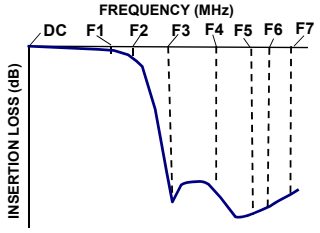
Parameter		F#	Frequency (MHz)	Min.	Typ.	Max.	Unit
Pass Band	Insertion Loss	DC-F1	DC - 6000	—	1.6	2.1	dB
	Freq. Cut-Off	F2*	6800	—	3.0	—	dB
	Return Loss	DC-F1	DC - 6000	—	14	—	dB
Stop Band	Rejection Loss	F3-F4	8200 - 9000	20	43	—	dB
		F4-F5	9000 - 14000	30	42	—	dB
		F5-F6	14000 - 18000	25	35	—	dB
		F6-F7	18000 - 26500	—	15	—	dB

1 In Applications where DC voltage and/or current is present at either input or output ports, DC de-coupling capacitors are required. If DC pass from IN-OUT is required, please contact Mini-Circuits for alternatives.
2 Measured on Mini-Circuits Characterization Test Board TB-LFCW-6000+
* 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*	2.5 W @25°C

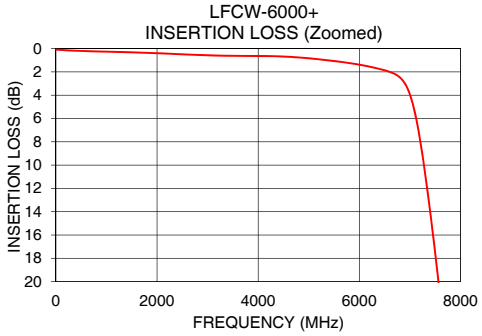
*Passband rating, derate linearly to 0.8W at 125°C ambient
Permanent damage may occur if any of these limits are exceeded.

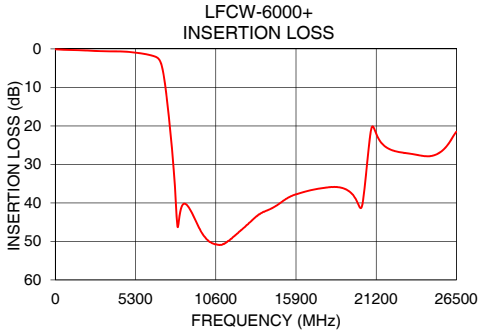
Typical Frequency Response

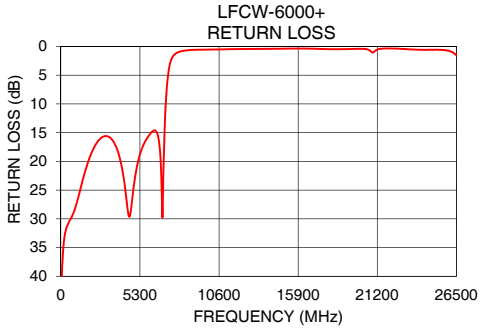


Typical Performance Data at 25°C

Frequency (MHz)	Insertion Loss (dB)	Return Loss (dB)
10	0.09	46.05
100	0.11	37.78
500	0.20	30.78
1000	0.26	27.86
2000	0.40	18.87
3000	0.58	15.59
4000	0.63	19.97
6000	1.38	15.15
6800	2.47	29.67
6910	3.07	17.71
7000	3.95	11.41
7570	20.25	1.51
7800	30.25	1.07
8200	43.60	0.76
9000	42.40	0.58
10000	49.45	0.53
14000	41.96	0.41
18000	35.98	0.47
25000	27.66	0.56
26500	21.49	1.53







Notes

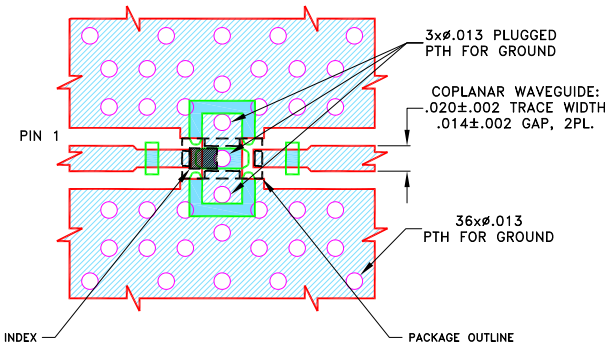
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Pad Connections

INPUT	1
OUTPUT	3
GROUND	2, 4

Product Marking: E

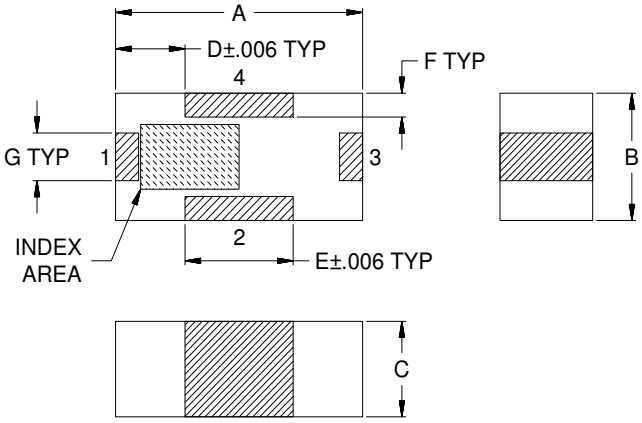
Demo Board MCL P/N: TB-LFCW-6000+
Suggested PCB Layout (PL-650)



NOTES:
1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS (RO4835 Lo Pro) WITH DIELECTRIC THICKNESS .0107±.0010. 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 LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
DENOTES COPPER LAND 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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Ceramic Low Pass Filter LFCW-6000+

Typical Performance Data

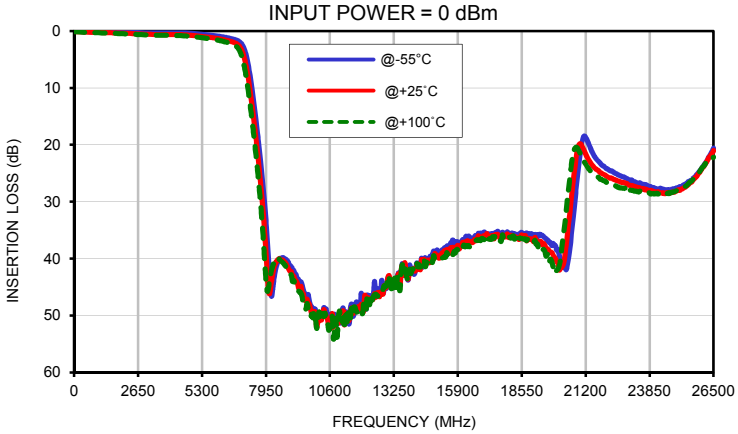
FREQ. (MHz)	INSERTION LOSS (dB)			INPUT RETURN LOSS (dB)			OUTPUT RETURN LOSS (dB)		
	@-55°C	@+25°C	@+100°C	@-55°C	@+25°C	@+100°C	@-55°C	@+25°C	@+100°C
10	0.07	0.09	0.10	44.89	41.09	41.32	47.80	46.94	44.30
100	0.07	0.11	0.12	40.78	37.35	35.27	40.72	37.84	35.31
200	0.08	0.14	0.16	33.87	33.90	33.63	33.47	33.55	32.68
250	0.09	0.15	0.17	31.75	32.54	33.28	31.77	32.33	32.13
300	0.09	0.16	0.19	30.61	31.80	33.11	30.83	31.46	31.70
350	0.10	0.17	0.20	30.69	31.61	33.18	30.26	30.54	30.95
400	0.10	0.18	0.22	30.60	31.05	32.15	29.97	30.00	30.48
500	0.11	0.20	0.24	30.02	30.07	30.45	28.78	28.91	29.50
550	0.11	0.20	0.25	29.42	29.73	30.05	27.99	28.39	29.08
600	0.11	0.21	0.26	28.89	29.41	29.99	27.51	28.00	28.68
650	0.11	0.22	0.26	28.34	29.13	29.93	27.05	27.60	28.26
700	0.11	0.22	0.27	27.94	28.91	29.95	26.75	27.25	27.81
750	0.11	0.23	0.28	27.89	28.99	30.13	26.49	26.94	27.39
800	0.12	0.23	0.29	27.67	28.61	29.68	26.24	26.57	26.98
850	0.12	0.24	0.29	27.85	28.66	29.61	25.97	26.21	26.57
1000	0.12	0.25	0.31	27.52	28.22	28.63	25.40	25.67	25.83
1200	0.13	0.27	0.34	25.35	26.20	26.73	23.53	23.88	23.94
1500	0.15	0.31	0.39	22.52	23.18	23.51	21.64	22.01	22.14
2000	0.19	0.38	0.48	18.85	19.24	19.28	18.92	19.23	19.20
2500	0.26	0.48	0.58	16.15	16.59	16.87	16.41	16.79	17.08
3000	0.34	0.57	0.69	14.78	15.30	15.76	14.83	15.34	15.84
3500	0.37	0.62	0.74	15.09	15.87	16.61	14.84	15.56	16.28
4000	0.34	0.62	0.77	18.33	19.15	20.13	17.64	18.35	19.20
5000	0.47	0.81	1.02	20.80	21.04	21.02	22.14	22.36	22.49
5100	0.51	0.86	1.07	19.54	19.87	19.94	20.27	20.53	20.68
5200	0.54	0.90	1.12	18.32	18.71	18.82	19.12	19.46	19.68
6000	0.92	1.36	1.65	14.77	14.94	14.87	15.12	15.21	15.05
6100	0.99	1.45	1.75	14.25	14.53	14.51	14.76	14.95	14.80
6200	1.06	1.53	1.85	14.11	14.44	14.49	14.78	15.01	14.89
6300	1.14	1.63	1.96	13.91	14.29	14.56	14.91	15.21	15.30
6400	1.23	1.73	2.07	13.86	14.50	15.10	15.28	15.75	16.13
6500	1.32	1.84	2.20	14.19	15.15	16.30	15.74	16.48	17.23
6600	1.43	1.98	2.38	14.86	16.47	18.69	16.55	17.64	18.71
6800	1.73	2.44	3.08	21.49	28.27	23.10	20.86	20.02	17.25
6910	2.10	3.05	3.99	24.27	17.49	13.17	19.00	15.10	12.26
7000	2.66	3.94	5.25	14.84	11.13	8.69	13.99	10.94	8.98
7500	14.37	17.51	20.38	1.53	1.72	1.79	2.52	2.82	2.98
7560	16.49	19.76	22.78	1.24	1.48	1.60	2.21	2.58	2.76
7590	17.58	20.92	24.03	1.15	1.41	1.53	2.12	2.52	2.72
7600	17.94	21.30	24.45	1.13	1.40	1.52	2.09	2.49	2.70
7700	21.78	25.46	28.97	0.88	1.20	1.34	1.78	2.23	2.47
8000	36.29	42.29	45.71	0.48	0.84	1.00	1.30	1.76	2.00
8200	46.42	43.51	41.75	0.35	0.71	0.87	1.13	1.57	1.81
8500	40.11	40.00	40.08	0.21	0.58	0.73	0.93	1.35	1.59
8700	39.91	40.50	40.99	0.15	0.52	0.66	0.79	1.21	1.46
8800	40.28	41.07	41.80	0.15	0.53	0.67	0.71	1.14	1.40
9000	41.43	42.30	42.93	0.13	0.53	0.68	0.59	1.02	1.28
9600	46.26	47.44	48.90	0.09	0.51	0.68	0.33	0.80	1.07
9800	48.24	48.91	50.14	0.06	0.49	0.68	0.29	0.77	1.03
10000	48.94	49.46	50.37	0.08	0.51	0.70	0.24	0.73	0.99
13000	43.42	43.33	43.07	0.21	0.37	0.67	0.02	0.54	0.85
14000	42.09	41.91	42.01	0.14	0.35	0.62	0.07	0.47	0.76
15000	39.03	39.60	40.21	0.12	0.32	0.49	0.17	0.47	0.79
15400	38.60	38.93	39.74	0.15	0.32	0.48	0.21	0.43	0.77
15700	36.74	38.02	39.30	0.23	0.29	0.46	0.20	0.46	0.84
16000	37.46	38.01	38.47	0.24	0.37	0.57	0.22	0.49	0.91
17000	35.34	36.03	36.66	0.22	0.43	0.75	0.20	0.47	0.87
18000	35.59	36.26	36.15	0.08	0.52	0.91	0.20	0.42	0.78
20000	38.53	40.56	42.08	0.44	0.32	0.67	0.32	0.47	0.98
26500	20.58	21.01	22.19	0.37	1.43	1.78	0.38	0.19	0.51

Typical Performance Data

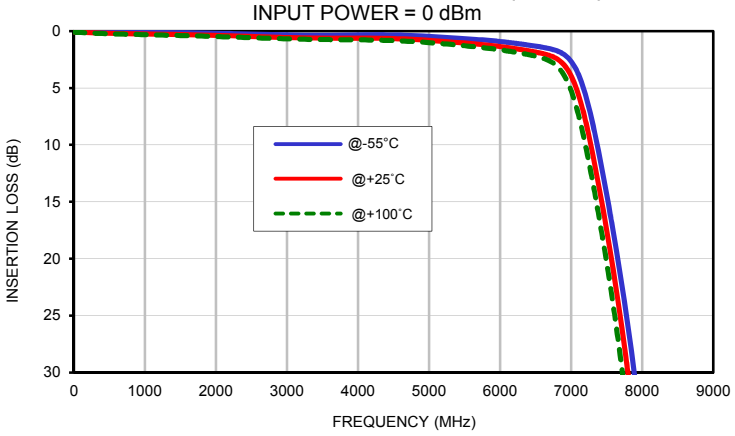
FREQ. (MHz)	GROUP DELAY (nsec)		
	@-55°C	@+25°C	@+100°C
10	0.09	0.11	0.11
50	0.10	0.11	0.11
100	0.10	0.11	0.11
150	0.10	0.11	0.10
200	0.10	0.11	0.10
250	0.10	0.10	0.10
300	0.10	0.10	0.10
350	0.10	0.10	0.10
400	0.10	0.10	0.10
450	0.10	0.10	0.10
500	0.10	0.10	0.10
550	0.10	0.10	0.10
1000	0.10	0.10	0.10
1150	0.10	0.10	0.10
1300	0.10	0.10	0.10
1450	0.10	0.10	0.10
1600	0.10	0.10	0.10
1750	0.11	0.10	0.10
1900	0.11	0.10	0.10
2050	0.11	0.11	0.10
2200	0.11	0.11	0.10
2350	0.11	0.11	0.11
2500	0.11	0.11	0.11
2650	0.11	0.11	0.11
2800	0.11	0.11	0.11
2950	0.12	0.11	0.11
3100	0.12	0.12	0.11
3250	0.12	0.12	0.12
3400	0.12	0.12	0.12
3550	0.13	0.12	0.12
3600	0.13	0.13	0.12
3700	0.13	0.13	0.13
3800	0.13	0.13	0.13
4000	0.14	0.14	0.14
4500	0.16	0.15	0.15
4800	0.17	0.17	0.17
5000	0.17	0.17	0.17
5100	0.18	0.18	0.18
5200	0.18	0.18	0.18
5500	0.20	0.20	0.20
6000	0.24	0.24	0.24

Typical Performance Curves

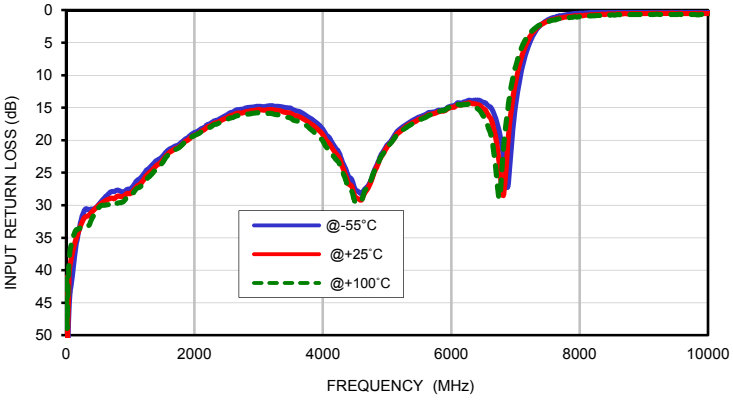
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



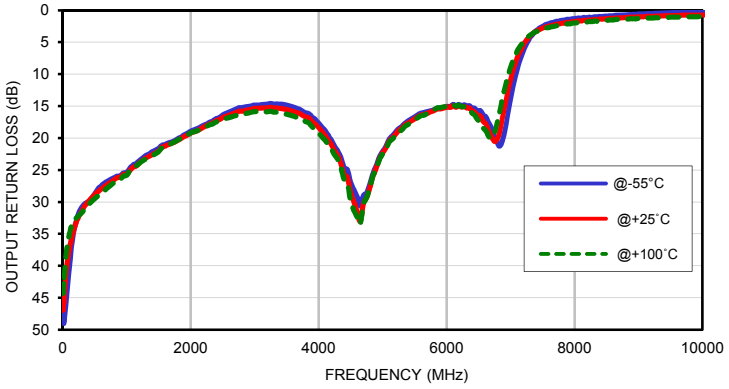
INSERTION LOSS vs. TEMPERATURE (Zoomed)
INPUT POWER = 0 dBm



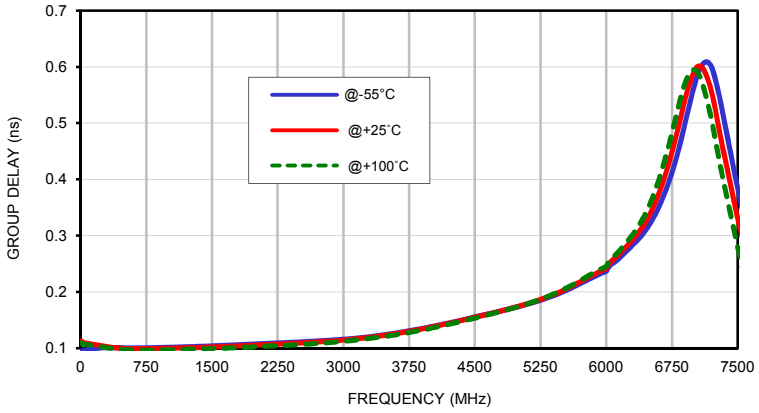
INPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



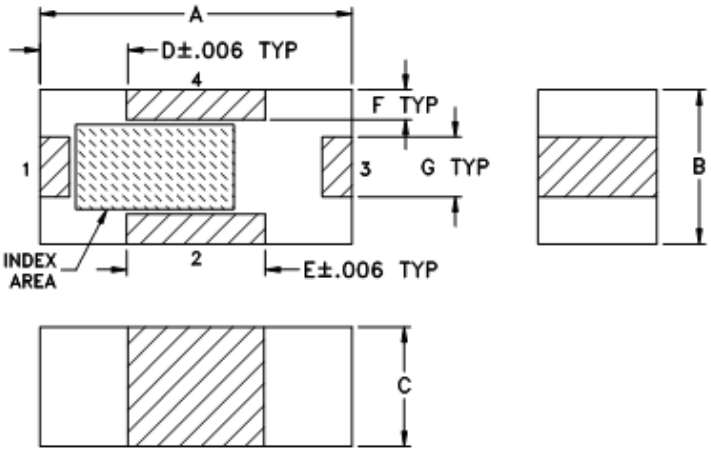
GROUP DELAY vs. TEMPERATURE
INPUT POWER = 0 dBm



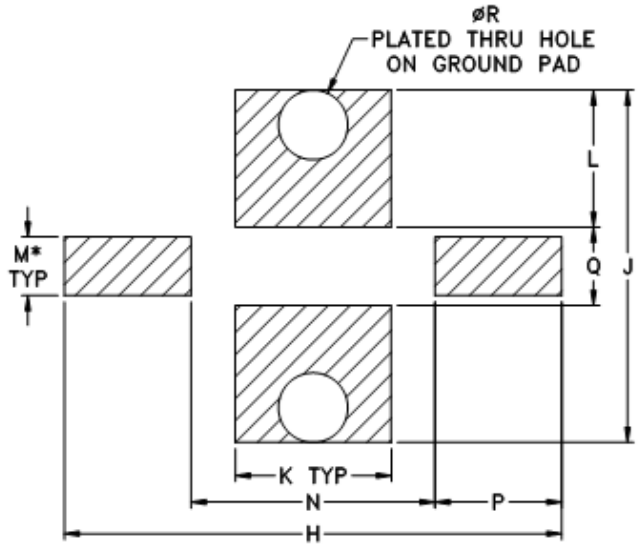
Case Style JC

Outline Dimensions

JC0603C-1



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.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. ± .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.

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Tape & Reel Packaging TR-F114

DEVICE ORIENTATION IN T&R

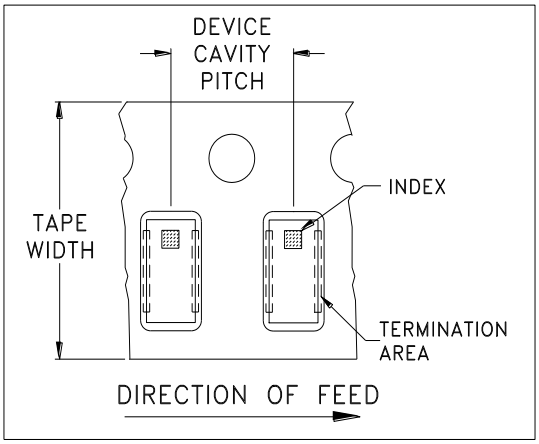


ILLUSTRATION 1

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

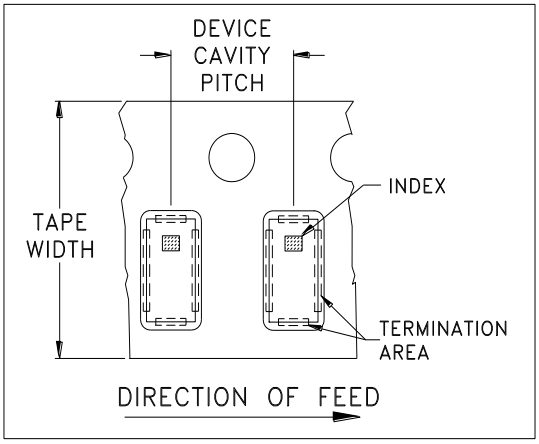


ILLUSTRATION 2

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.

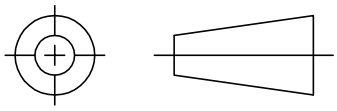
Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: www.minicircuits.com/pages/pdfs/tape.pdf

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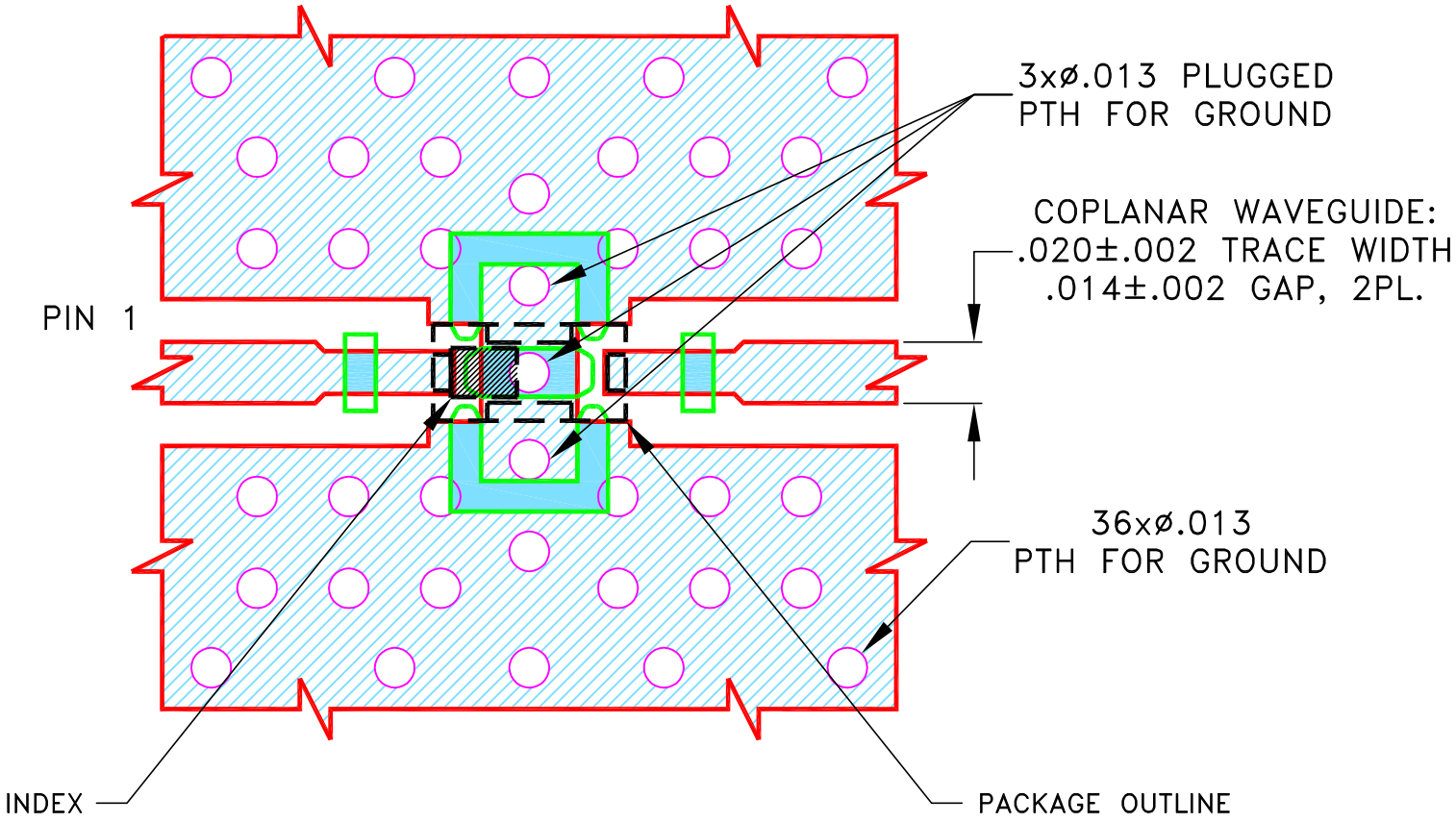
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THIRD ANGLE PROJECTION



REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M175765	NEW RELEASE	AUG 19	DDR	VC
A	M175661	DESIGN CHANGED	NOV 19	DDR	VC

SUGGESTED MOUNTING CONFIGURATION FOR JC0603C-1 CASE STYLE



NOTES:

1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS (RO4835 Lo Pro) WITH DIELECTRIC THICKNESS .0107±.0010. 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 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	DDR	05 AUG 19
TOLERANCES ON:	CHECKED	RV	05 AUG 19
2 PL DECIMALS ±	APPROVED	RKS	05 AUG 19
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

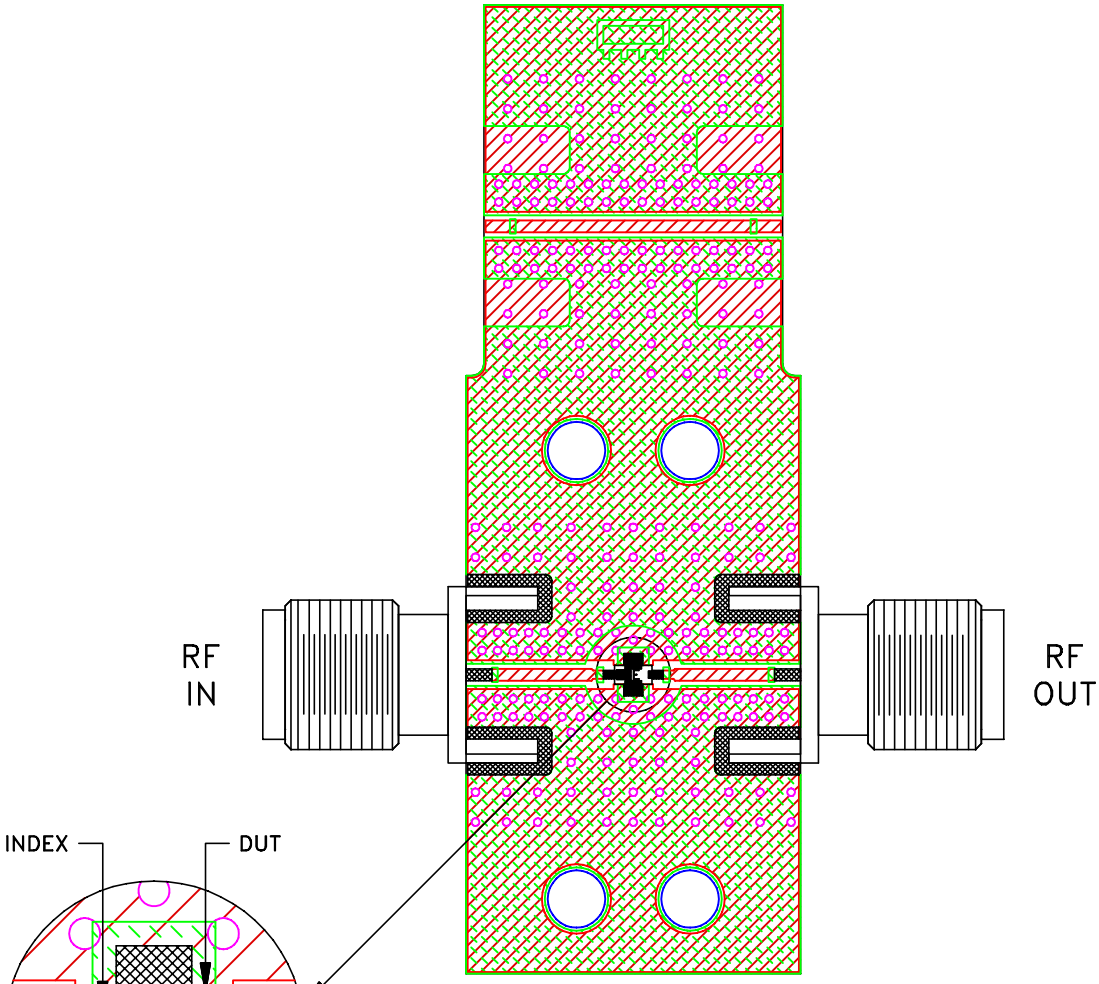
PL, JC0603C-1, TB-1114+

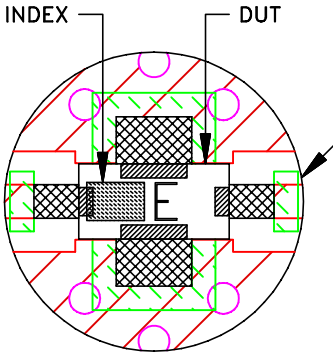
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-650	A

FILE:	SCALE:	SHEET:
98PL650	16:1	1 OF 1

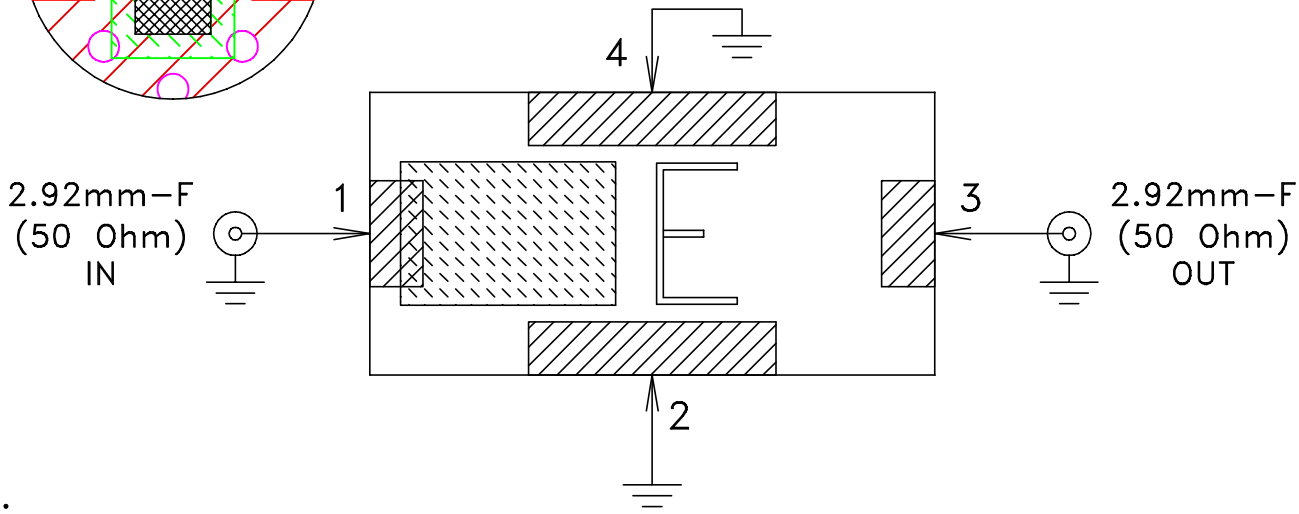
Evaluation Board and Circuit

TB-LFCW-6000+





Schematic diagram



Notes:

1. PCB Material: ROGERS (RO4835 Lo Pro) OR Equivalent, Dielectric Constant=3.48±.05 Dielectric Thickness: .0107±.0010
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 ENV126

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 125° C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 125° 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 Eutectic Process 225°C peak Pb-Free Process 245° - 250°C peak	J-STD-020C, 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

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