LTCC SURFACE MOUNT

Low Pass Filter

LFCG-160+

50Ω DC to 160 MHz

THE BIG DEAL

- Insertion Loss, Typ. 0.9 dB
- Stopband Rejection, Typ. 55 dB
- Passband Return Loss, Typ. 18 dB
- 0805 Surface Mount Footprint
- Power Handling: 3.5 W

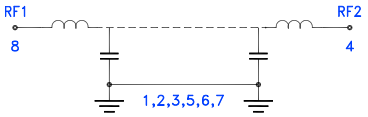


Generic photo used for illustration purposes only

APPLICATIONS

- Harmonic Rejection
- VHF/UHF Transmitters / Receivers
- Test and Measurement
- Telecommunications & Broadband Wireless Applications
- Satcom Modems

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

Mini-Circuits' LFCG-160+ is a miniature low temperature co-fired ceramic (LTCC) low pass filter with a DC to 160 MHz passband that supports a variety of applications. This model provides 0.9 dB typical insertion loss over a wide band, due to its rugged monolithic construction. Housed in an 0805 ceramic form factor, this filter is ideal for dense signal chain PCB layouts, where it complements MMIC size and performance. The LTCC fabrication process assures minimal RF performance variation while delivering a product that is well suited for environmental extremes of high humidity and temperature.

KEY FEATURES

Features	Advantages
Ultra-wide Stopband	Provides very good stopband rejection up to 8.5 GHz, suitable for wide band applications.
LTCC Construction	The use of LTCC technology allows for repeatable performance in a rugged ceramic package, well suited for tough environments such as high humidity and temperature extremes. See Mini-Circuits Environmental Rating ENV06T11 for more information.
Small Size, 0805	Saves space in dense circuit board layouts and minimizes the effects of parasitics.
Rugged Power Handling, 3.5 W	Handles up to 3.5 Watts in a small 0805 package.

Low Pass Filter

LFCG-160+

50Ω DC to 160 MHz

ELECTRICAL SPECIFICATIONS[1,2,3] AT +25°C

Parameter		F#	Frequency (MHz)	Min.	Typ.	Max.	Units
Passband	Insertion Loss	DC-F1	DC - 160	—	0.9	1.6	dB
	Freq. Cut-Off[4]	Fc	240	—	3	—	dB
	Return Loss	DC-F1	DC - 160	10	18	—	dB
Stopband	Rejection	F2-F3	350 - 750	20	31	—	dB
		F3-F4	750 - 1500	35	41	—	
		F4-F5	1500 - 3000	38	55	—	
		F5-F6	3000 - 6100	20	37	—	
		F6-F7	6100-8500	—	19	—	

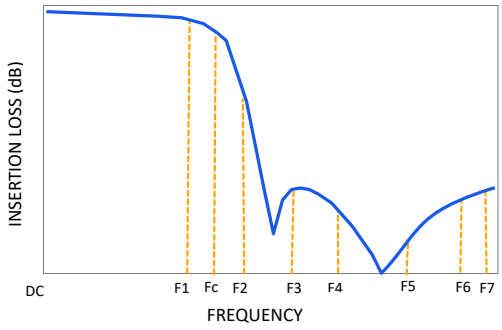
1. Tested on Evaluation Board P/N TB-LFCG-160+ with port extension on option in network analyzer.
2. This filter is bi-directional, RF1 and RF2 ports may be interchanged.
3. This component should not be used as a DC-block. In applications where DC voltage and/or current is present at either the input or output ports, external DC blocking capacitors are required.
4. Typical variation ±5%.

ABSOLUTE MAXIMUM RATINGS[5]

Parameter	Ratings
Operating Temperature	-55°C to +125°C
Storage Temperature	-55°C to +125°C
Input Power[6]	3.5 W @ +25°C

5. Permanent damage may occur if any of these limits are exceeded.
6. Power rating applies only to signals within the passband. Power rating above +25°C operating temperature decreases linearly to 0.8 W at +125°C.

TYPICAL FREQUENCY RESPONSE AT +25°C



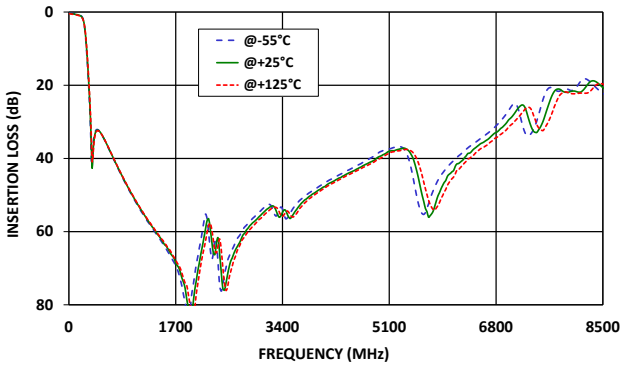
Low Pass Filter

LFCG-160+

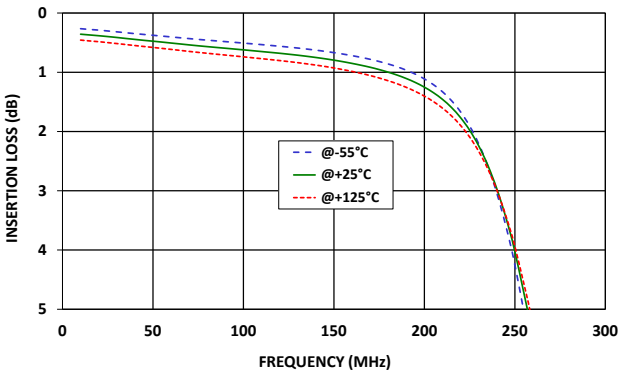
50Ω DC to 160 MHz

TYPICAL PERFORMANCE GRAPHS

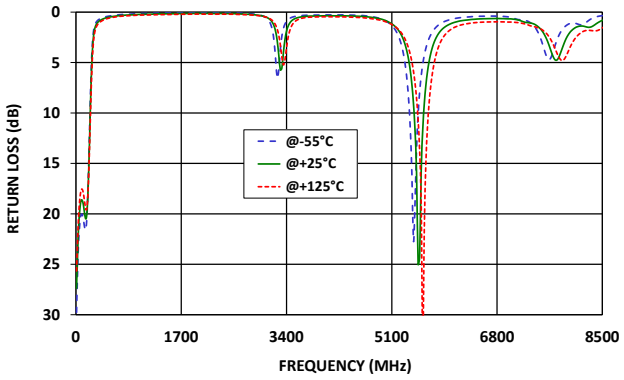
LFCG-160+
INSERTION LOSS



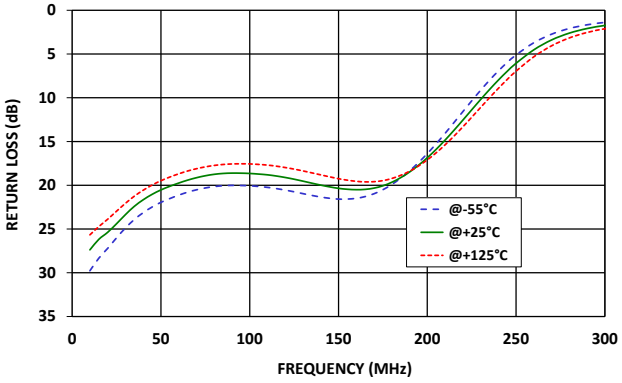
LFCG-160+
INSERTION LOSS (Zoomed)



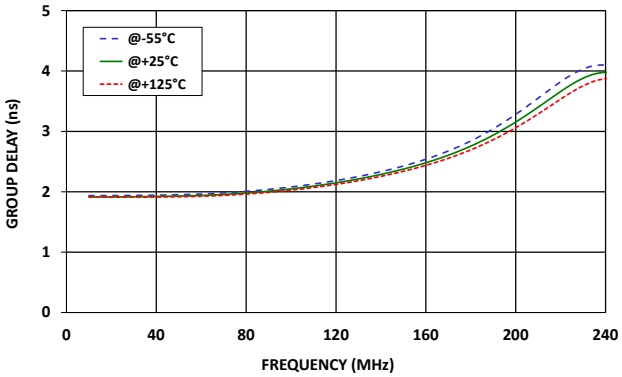
LFCG-160+
RETURN LOSS



LFCG-160+
RETURN LOSS (Zoomed)



LFCG-160+
GROUP DELAY



Low Pass Filter

LFCG-160+

50Ω DC to 160 MHz

FUNCTIONAL DIAGRAM

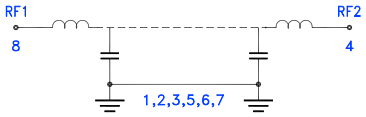
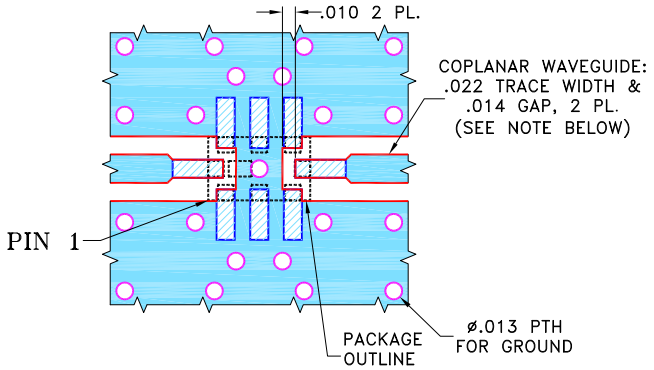


Figure 1. LFCG-160+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description
RF1[2]	8	Connects to RF Input Port
RF2[2]	4	Connects to RF Output Port
GROUND	1,2,3,5,6,7	Connects to Ground on PCB, (See drawing PL-429)
NC	-	No connection, not used internally. See drawing PL-429 for connection to PCB

SUGGESTED PCB LAYOUT (PL-429)



NOTES:

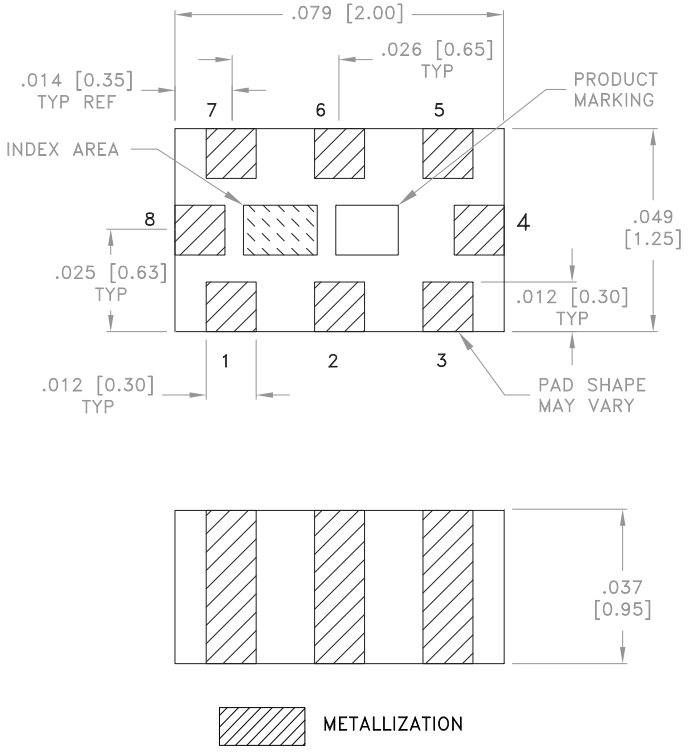
1. COPLANAR WAVEGUIDE IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010" ± .001". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

Figure 2. Suggested PCB Layout PL-429

CASE STYLE DRAWING



Weight: .008 grams.

Dimensions are in inches (mm). Tolerances: 2Pl. ± .01; 3 Pl. ± .005

PRODUCT MARKING*: E4

*Marking may contain other features or characters for internal lot control.

Low Pass Filter

LFCG-160+

50Ω DC to 160 MHz

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASHBOARD. CLICK HERE

Performance Data and Graphs	Data Graphs S-Parameter (S2P Files) Data Set (.zip file) De-embedded to device pads
Case Style	GE0805C-2 Lead Finish: Tin over Nickel Plating
RoHS Status	Compliant
Tape and Reel	TR-F114
Suggested Layout for PCB Design	PL-429
Evaluation Board	TB-LFCG-160+
	Gerber File
Environmental Rating	ENV06T11

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/terms/viewterm.html

Ceramic Low Pass Filter LFCG-160+

Typical Performance Data

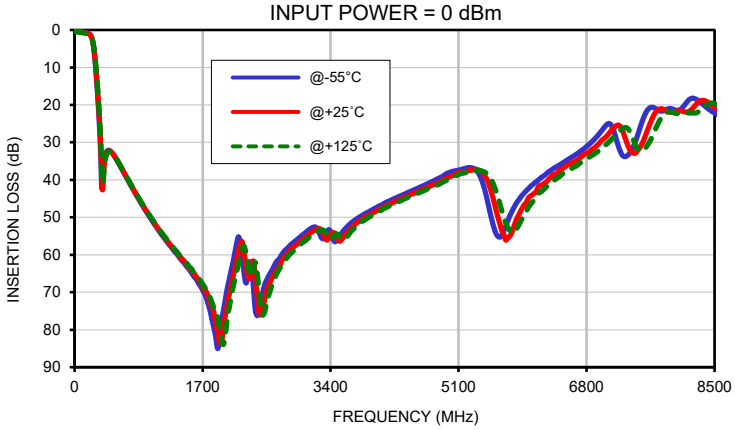
FREQ.	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
(MHz)	(dB)			(dB)			(dB)		
	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C
10	0.26	0.36	0.46	29.77	27.38	25.67	29.74	27.28	25.62
20	0.29	0.38	0.48	27.21	25.38	23.88	27.01	25.18	23.74
30	0.32	0.41	0.52	24.88	23.36	22.07	24.66	23.16	21.88
40	0.35	0.45	0.55	23.14	21.66	20.57	22.81	21.39	20.30
50	0.38	0.48	0.58	21.95	20.53	19.48	21.54	20.17	19.15
60	0.40	0.51	0.61	21.13	19.75	18.69	20.63	19.32	18.32
80	0.46	0.57	0.68	20.15	18.75	17.74	19.53	18.26	17.29
100	0.51	0.62	0.74	20.06	18.65	17.56	19.15	17.91	16.95
120	0.56	0.68	0.80	20.55	19.11	17.97	19.27	18.10	17.15
140	0.63	0.75	0.88	21.34	19.98	18.81	19.55	18.56	17.69
160	0.72	0.85	0.99	21.49	20.50	19.55	19.41	18.79	18.14
180	0.86	1.00	1.14	19.91	19.66	19.22	18.10	17.97	17.75
200	1.11	1.25	1.40	16.38	16.85	17.10	15.13	15.53	15.79
220	1.67	1.77	1.90	11.59	12.56	13.33	10.80	11.61	12.27
240	3.04	2.96	2.99	6.94	7.98	8.93	6.44	7.35	8.16
260	5.89	5.49	5.26	3.71	4.52	5.31	3.39	4.10	4.78
280	10.28	9.53	9.01	2.08	2.61	3.16	1.86	2.32	2.79
300	15.69	14.66	13.91	1.38	1.74	2.11	1.23	1.53	1.85
320	21.98	20.62	19.62	1.06	1.33	1.61	0.94	1.17	1.41
350	35.41	32.55	30.62	0.83	1.03	1.24	0.74	0.92	1.10
360	42.30	38.41	35.68	0.78	0.96	1.15	0.70	0.87	1.04
400	34.11	34.92	35.63	0.63	0.79	0.94	0.58	0.71	0.86
450	32.10	32.29	32.48	0.51	0.64	0.77	0.46	0.59	0.70
500	32.85	32.87	32.93	0.43	0.55	0.65	0.38	0.49	0.59
550	34.36	34.30	34.30	0.38	0.48	0.57	0.33	0.43	0.53
600	36.11	36.01	35.97	0.33	0.43	0.51	0.28	0.38	0.46
650	37.94	37.81	37.74	0.29	0.39	0.47	0.25	0.34	0.42
700	39.77	39.62	39.53	0.26	0.35	0.43	0.21	0.30	0.38
750	41.59	41.42	41.32	0.23	0.32	0.39	0.18	0.27	0.35
800	43.38	43.18	43.06	0.21	0.30	0.37	0.16	0.25	0.32
850	45.11	44.90	44.80	0.20	0.28	0.36	0.15	0.23	0.31
900	46.80	46.56	46.44	0.18	0.27	0.34	0.14	0.22	0.29
950	48.42	48.19	48.03	0.17	0.25	0.32	0.12	0.20	0.28
1000	50.03	49.73	49.56	0.15	0.23	0.30	0.11	0.18	0.26
1100	53.00	52.70	52.52	0.13	0.21	0.29	0.09	0.17	0.25
1200	55.83	55.42	55.28	0.12	0.20	0.28	0.08	0.16	0.24
1300	58.37	58.00	57.77	0.10	0.18	0.26	0.06	0.14	0.22
1400	60.91	60.53	60.26	0.09	0.17	0.25	0.06	0.14	0.22
1500	63.39	62.93	62.47	0.09	0.17	0.24	0.05	0.13	0.21
1600	66.18	65.36	64.87	0.07	0.15	0.22	0.04	0.12	0.20
1700	69.40	68.61	67.78	0.06	0.14	0.21	0.04	0.12	0.20
1800	74.96	72.72	71.43	0.06	0.14	0.21	0.04	0.12	0.20
1900	85.04	80.78	77.00	0.05	0.13	0.20	0.04	0.12	0.19
2000	72.18	76.33	81.67	0.05	0.13	0.19	0.04	0.12	0.19
2200	56.54	56.99	60.20	0.07	0.14	0.20	0.05	0.13	0.20
2400	74.89	66.10	62.00	0.07	0.14	0.20	0.07	0.16	0.24
2600	64.87	67.21	69.45	0.10	0.17	0.23	0.10	0.18	0.25
2800	58.70	60.43	61.34	0.15	0.22	0.27	0.16	0.23	0.30
3000	55.18	56.46	57.24	0.35	0.37	0.40	0.32	0.37	0.41
3200	52.60	53.29	54.04	2.94	1.40	1.03	1.71	1.04	0.88
3400	53.79	54.78	55.87	0.92	1.90	3.54	1.74	4.32	6.40
3600	52.93	54.51	55.53	0.37	0.52	0.70	0.45	0.68	0.98
3800	49.74	50.77	51.43	0.30	0.39	0.49	0.32	0.44	0.57
4000	47.46	48.43	48.91	0.28	0.37	0.46	0.30	0.40	0.50
5000	37.86	39.00	39.60	0.87	0.84	0.95	0.98	0.92	1.00
6000	42.88	46.02	48.45	0.82	1.31	1.98	0.83	1.27	1.86
6100	41.00	43.62	45.52	0.65	1.04	1.55	0.68	1.04	1.48
7000	26.91	29.48	31.41	0.49	0.67	0.99	0.88	0.89	1.13
8000	21.45	21.65	22.30	1.09	1.85	3.22	3.03	4.36	4.53
8500	22.15	20.65	19.70	0.35	0.82	1.56	0.78	1.33	2.21

Typical Performance Data

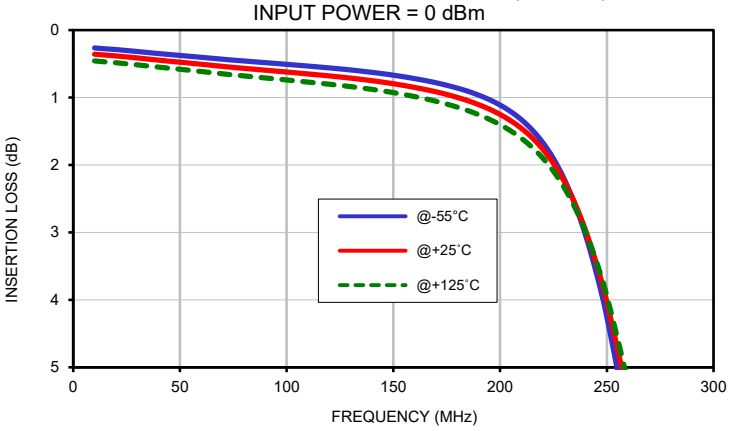
FREQ. (MHz)	GROUP DELAY (nsec)		
	@-55°C	@+25°C	@+125°C
10	1.94	1.91	1.91
15	1.94	1.91	1.91
20	1.94	1.91	1.91
25	1.94	1.92	1.91
30	1.94	1.92	1.91
35	1.94	1.92	1.91
40	1.94	1.92	1.91
45	1.95	1.93	1.91
50	1.95	1.93	1.92
55	1.96	1.93	1.92
60	1.96	1.94	1.93
65	1.97	1.95	1.93
70	1.98	1.96	1.94
75	1.99	1.97	1.95
80	2.01	1.98	1.96
85	2.02	1.99	1.98
90	2.04	2.01	1.99
95	2.06	2.03	2.01
100	2.08	2.05	2.03
105	2.10	2.07	2.05
110	2.13	2.09	2.07
115	2.16	2.12	2.10
120	2.19	2.15	2.12
125	2.22	2.18	2.15
130	2.25	2.21	2.18
135	2.29	2.25	2.22
140	2.33	2.29	2.26
145	2.38	2.33	2.30
150	2.43	2.38	2.34
155	2.48	2.43	2.39
160	2.54	2.48	2.44

Typical Performance Curves

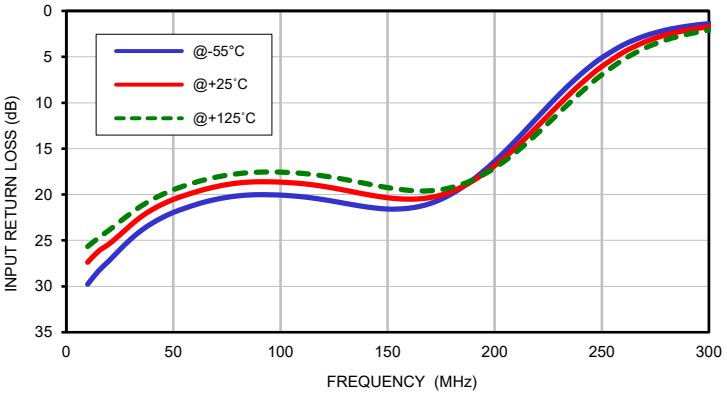
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



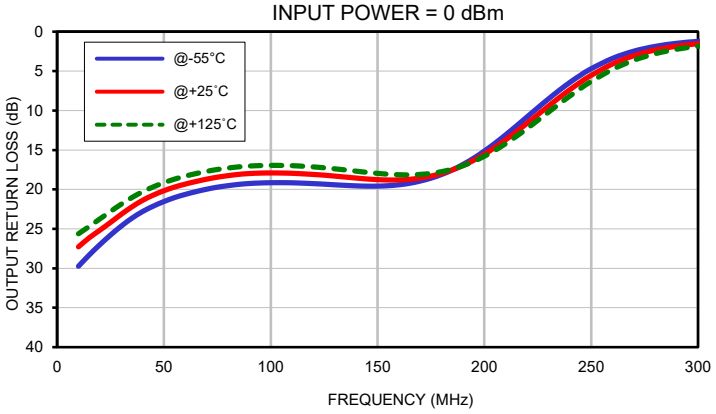
INSERTION LOSS vs. TEMPERATURE (Zoomed)
INPUT POWER = 0 dBm



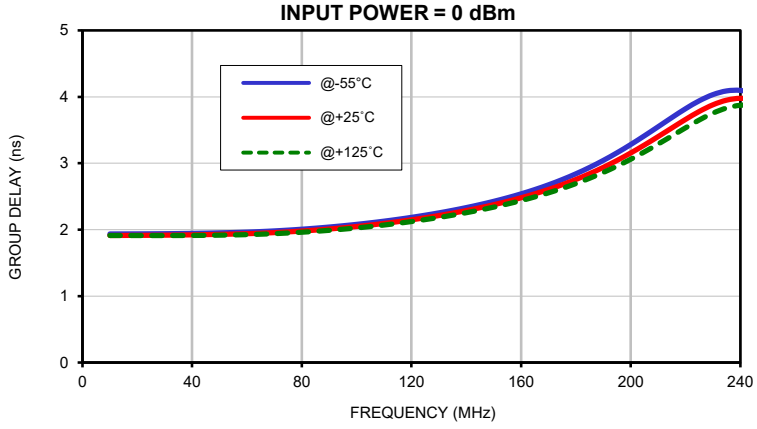
INPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



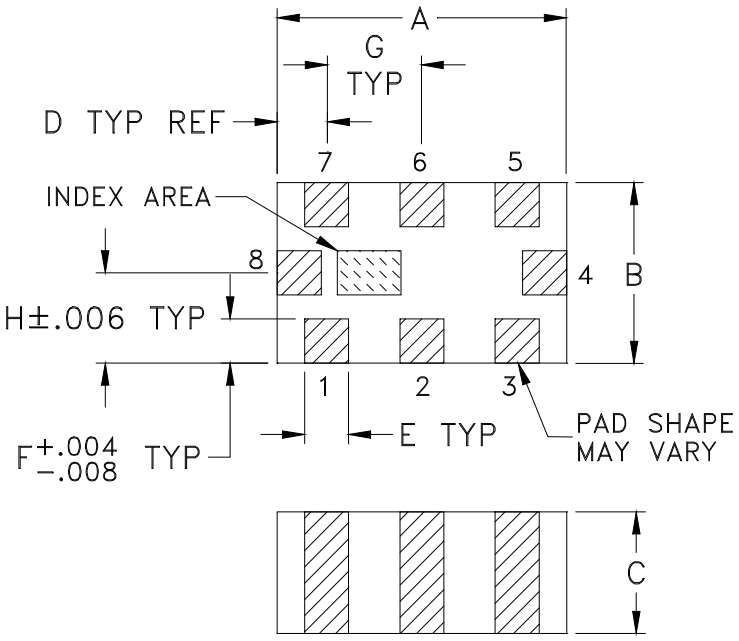
GROUP DELAY vs. TEMPERATURE
INPUT POWER = 0 dBm



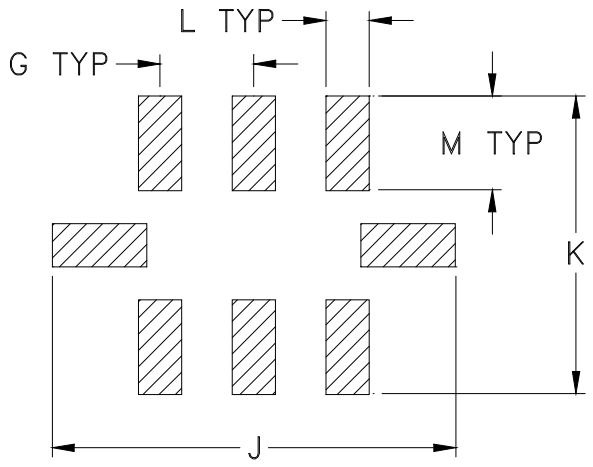
Case Style GE

GE0805C-2

Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

CASE #	A	B	C	D	E	F	G	H	J	K	L
GE0805C-2	.079 (2.00)	.049 (1.25)	.037 (0.95)	.014 (0.35)	.012 (0.30)	.012 (0.30)	.026 (0.65)	.025 (0.63)	.134 (3.40)	.110 (2.80)	.014 (0.35)

CASE #	M	WT. GRAM
GE0805C-2	.039 (1.00)	.008

Dimensions are in inches (mm). Tolerances: 2Pl. ± .01; 3 Pl. ± .005

Notes:

1. Open style, ceramic base.
2. Termination finish: For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.
   For RoHS-5 Case Styles: Tin-Lead plate over Nickel plate. All models, no (+) suffix.
3. Pad tolerance to be non-cumulative. Minimum spacing between each pad is .004 (0.1).

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

Tape & Reel Packaging TR-F114

DEVICE ORIENTATION IN T&R

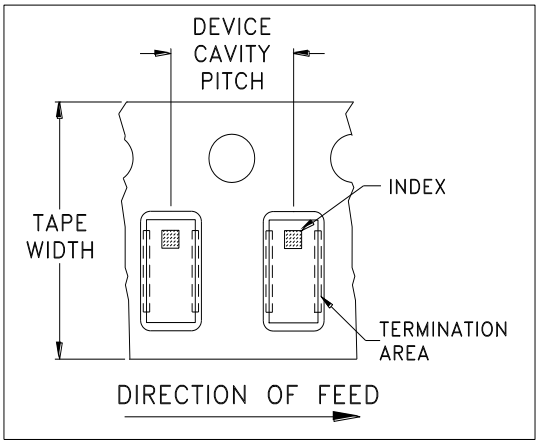


ILLUSTRATION 1

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

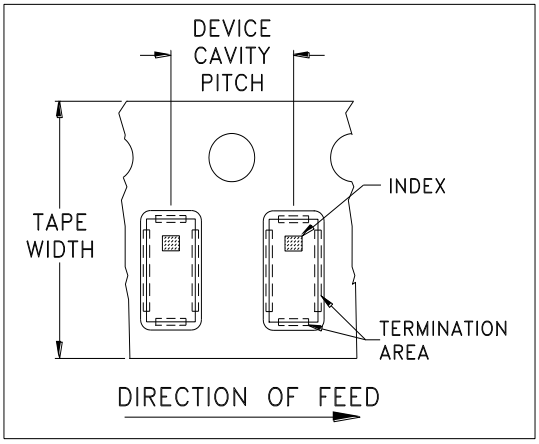


ILLUSTRATION 2

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

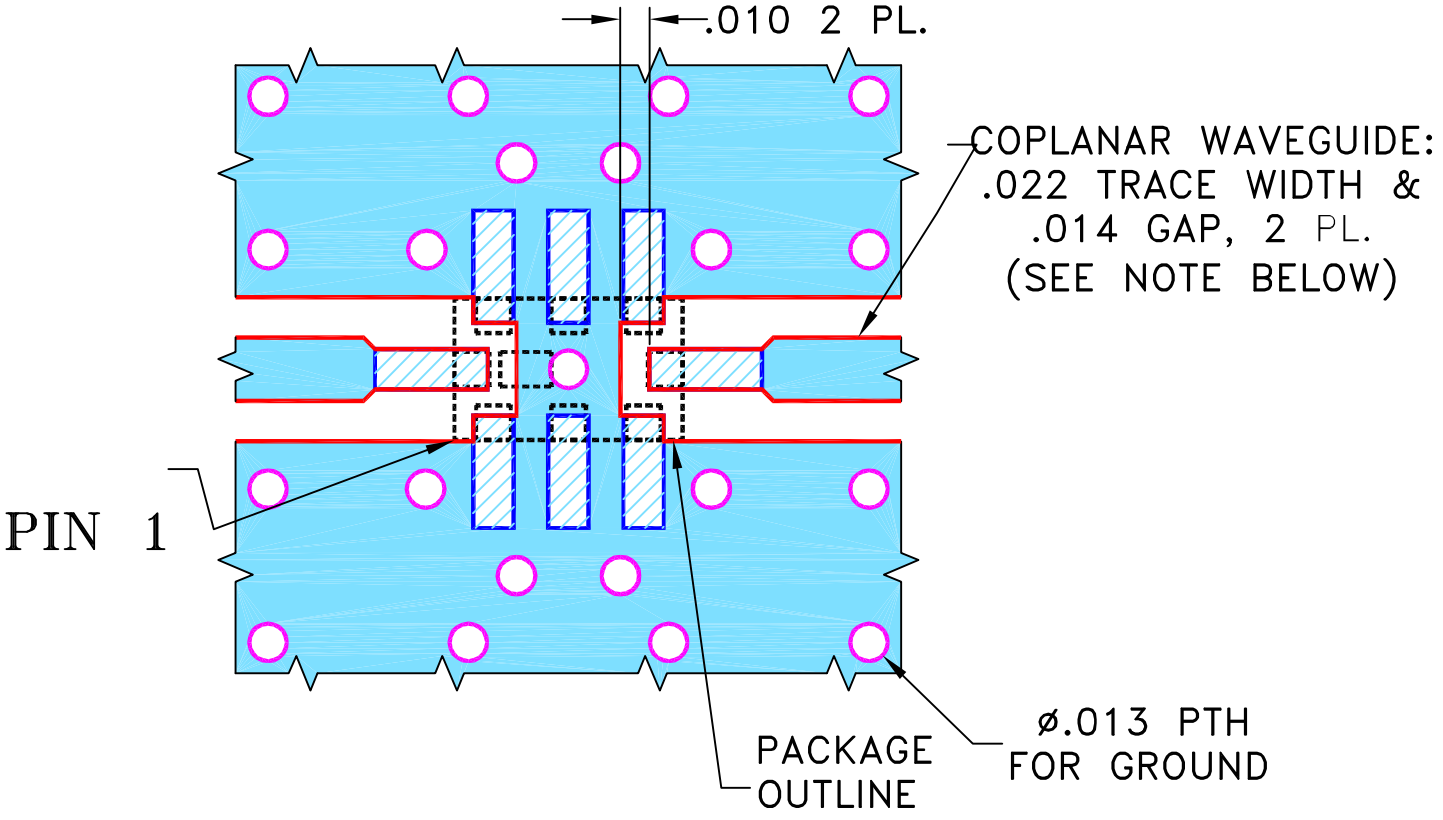
Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010
Mini-Circuits ISO 9001 & ISO 14001 Certified

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

THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M148457	NEW RELEASE	10/14/14	GF	MY

SUGGESTED MOUNTING CONFIGURATION FOR GE0805C-4 CASE STYLE, "08FL07" PIN CODE



NOTES:

1. COPLANAR WAVEGUIDE IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010" ± .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 LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	GF	10/01/14
TOLERANCES ON:	CHECKED	IL	10/14/14
2 PL DECIMALS ±	APPROVED	MY	10/14/14
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

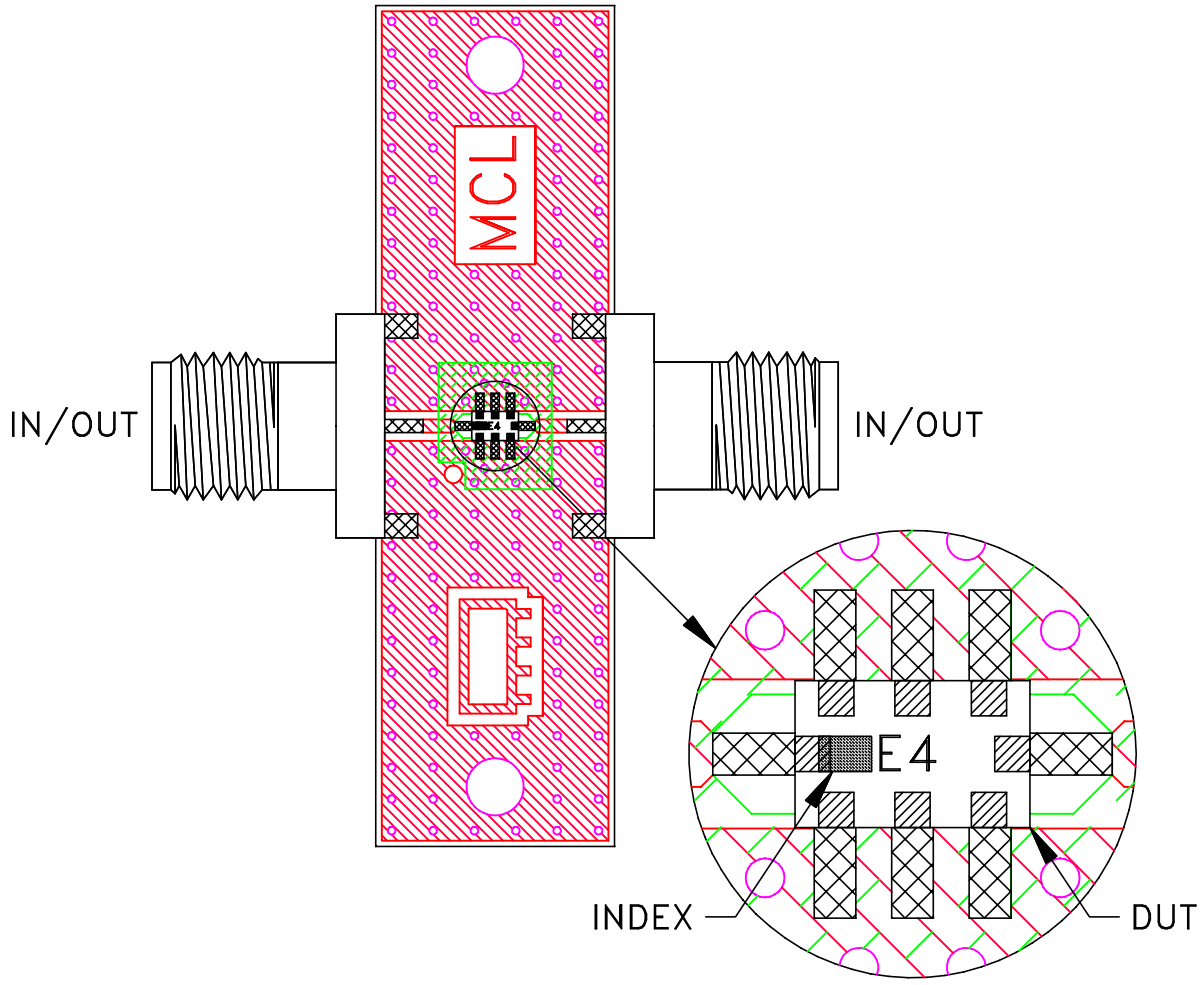
PL, 08FL07, GE0805C-4, TB-799+

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-429	OR

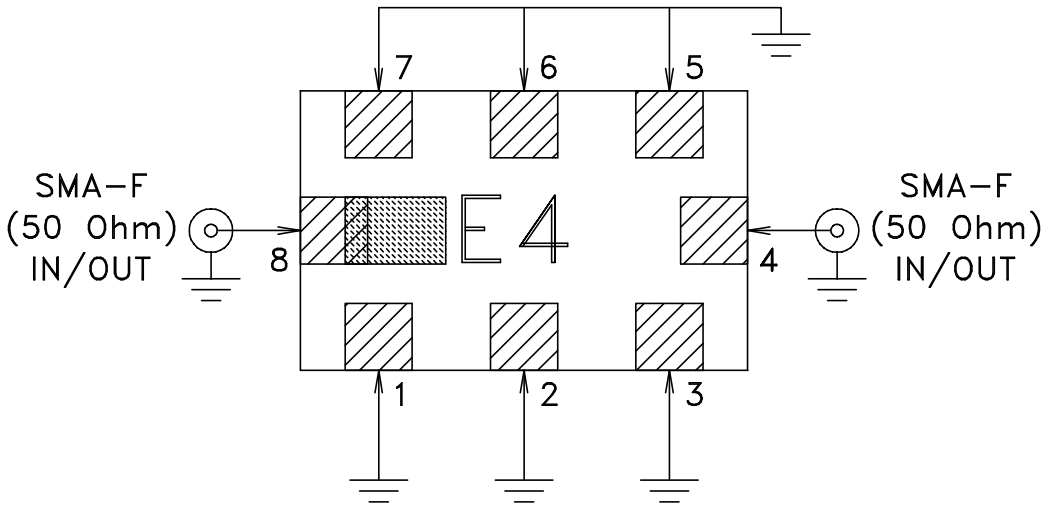
FILE:	SCALE:	SHEET:
98PL429	15:1	1 OF 1

Evaluation Board and Circuit

TB-LFCG-160+



Schematic diagram



Notes:

1. PCB Material: ROGERS (RO4350B) OR Equivalent, Dielectric Constant=3.48±.05
Dielectric Thickness: .010±.001 inch
2. 50 Ohm SMA Female Connectors.

Mini-Circuits®

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

Mini-Circuits

Environmental Specifications **ENV06T11**

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 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, Test B,B1, 95% Coverage
Thermal Shock	-40° to +125°C, 15 min dwell, 100 cycles	MIL-STD-202, Method 107
Bend Test	1mm, deflection for 5 seconds Span of bending: 2.75"	--
High Temp Storage	125°C to 1000 Hrs	---

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