LTCC SURFACE MOUNT

Bandpass Filter & Balun

BBFCG2-472+

50Ω 4200 to 5200 MHz 1:2 Ratio

THE BIG DEAL

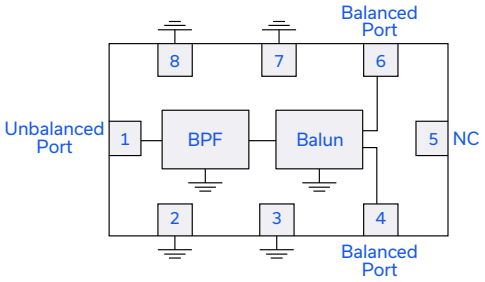
- Compact Design includes Balun and Filter in One Package
- Low Passband Insertion Loss, Typ. 2 dB avg.
- Excellent CMRR, Typ. 21.5 dB
- Small 0805 Surface Mount Footprint

Generic photo used for illustration purposes only

APPLICATIONS

- 5G Sub-6 GHz, MIMO Wireless Infrastructure Systems
- Satellite Communications
- Telecommunications
- RF Front-End Modules

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

Mini-Circuits' BBFCG2-472+ is a tiny ceramic RF balun filter with an impedance ratio of 1:2, covering a variety of wireless communications applications from 4200 to 5200 MHz. This model provides low insertion loss, low phase unbalance (relative to 180°), and low amplitude unbalance. Fabricated using LTCC technology, the unit comes housed in a tiny, rugged ceramic package (0.079" x 0.049" x 0.037") suitable for harsh operating environments.

KEY FEATURES

Features	Advantages
Compact Design	Integrates filter and balun in one small package.
Tiny Size, 0805	Accommodates tight space requirements for dense PCB layouts.
LTCC Construction	LTCC process enables tiny size and low cost, suitable for high-volume production. Rugged ceramic package provides excellent reliability in harsh operating environments.

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

Parameter		F#	Frequency (MHz)	Min.	Typ.	Max.	Units
Impedance Ratio		-	-	-	1:2		-
Passband	Center Frequency[3]	-	-	-	4700	-	MHz
	Average Insertion Loss[4]	F3-F4	4200 - 5200	-	2	2.5	dB
	Return Loss - Unbalanced Port	F3-F4	4200 - 5200	10	13.5	-	dB
	Return Loss - Balanced Port[4]	F3-F4	4200 - 5200	10	13.5	-	dB
Stopband, Lower	Rejection[4]	DC-F1	10 - 3100	27	32	-	dB
		F1-F2	3100 - 3580	-	25	-	
Stopband, Upper	Rejection[4]	F5-F6	6740 - 7650	28	32	-	dB
		F6-F7	7650 - 11000	30	39	-	
Amplitude Unbalance (±)		F3-F4	4200 - 5200	-1.4	±1.2	+1.4	dB
Phase Unbalance (Relative to 180°)		F3-F4	4200 - 5200	-11	-	+11	Deg.
CMRR		F3-F4	4200 - 5200	18	21.5	-	dB

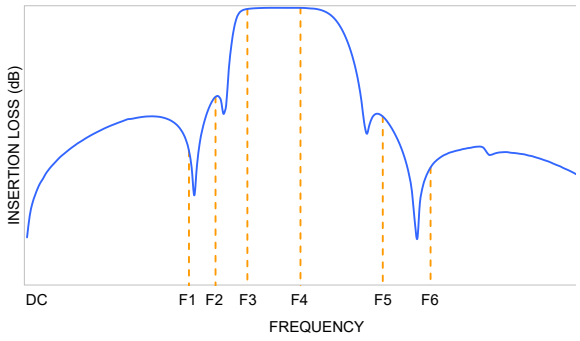
1. Tested on Evaluation Board P/N TB-BBFCG2-472C+ with connectors and feedline loss compensated.
2. This component should not be used as a DC Block. In applications where DC voltage and/or current is present at either the input or output ports, external DC blocking capacitors are required.
3. Typical variation ±3%.
4. Measured in mixed mode.

ABSOLUTE MAXIMUM RATINGS[5]

Parameter	Ratings
Operating Temperature	-55°C to +125°C
Storage Temperature	-55°C to +125°C
Input Power[6]	2 W

5. Permanent damage may occur if any of these limits are exceeded.
6. Power rating applies only to signals within the passband at +25°C. Power rating above +25°C operating temperature decreases linearly to 0.5 W at +125°C.

TYPICAL FREQUENCY RESPONSE AT +25°C



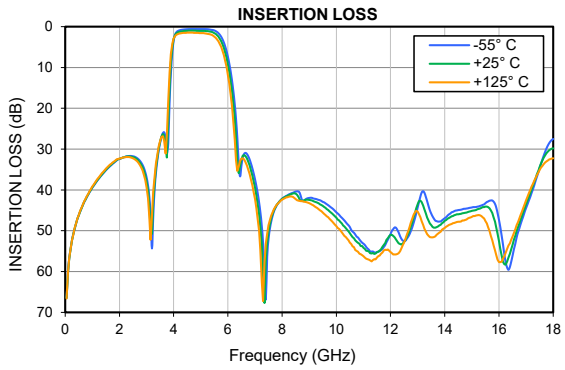
DC RESISTANCE PORT-PORT

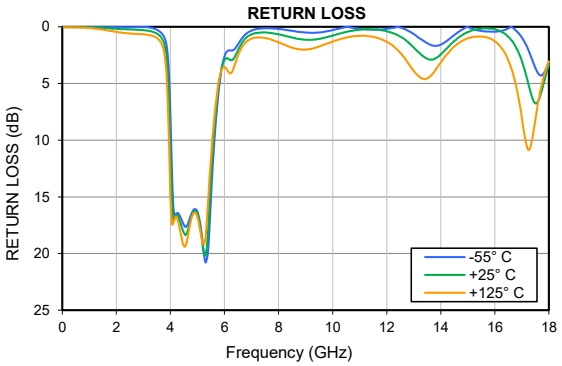
Function	Pad Number
Unbalanced Port to Ground	DC Short
Unbalanced Port to Balanced Port	DC Open
Balanced Port to Ground	DC Open
Balanced Port to Balanced Port	DC Short

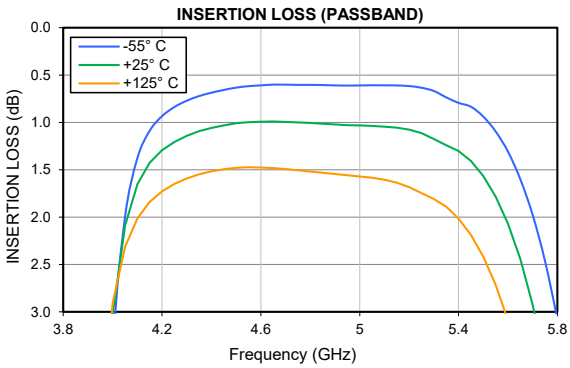
Bandpass Filter & Balun BBFCG2-472+

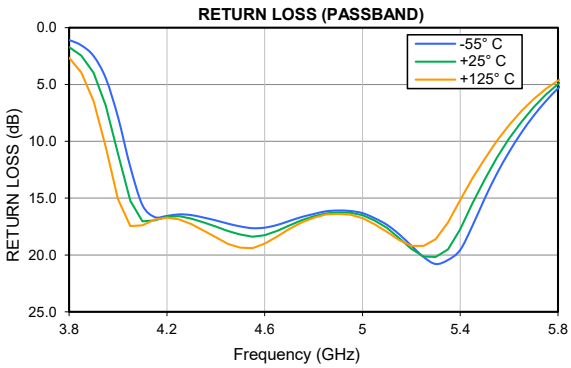
50Ω 4200 to 5200 MHz 1:2 Ratio

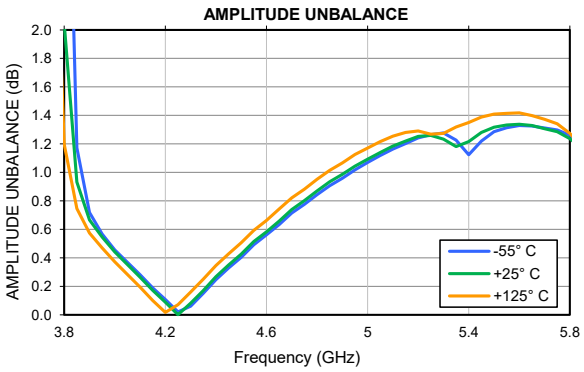
TYPICAL PERFORMANCE GRAPHS

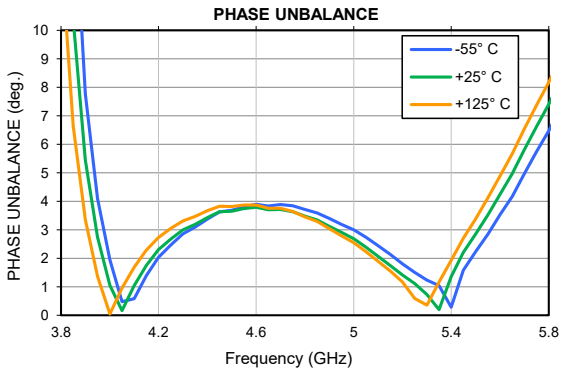


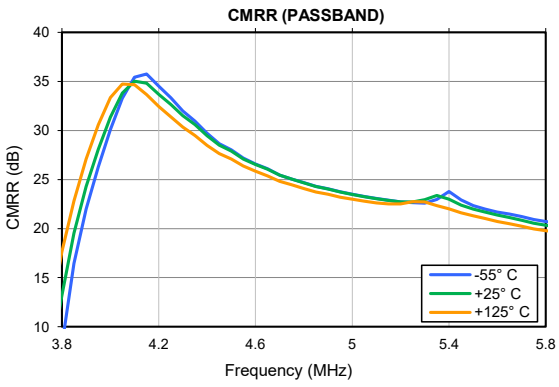












LTCC SURFACE MOUNT

Bandpass Filter & Balun BBFCG2-472+

50Ω 4200 to 5200 MHz 1:2 Ratio

FUNCTIONAL DIAGRAM

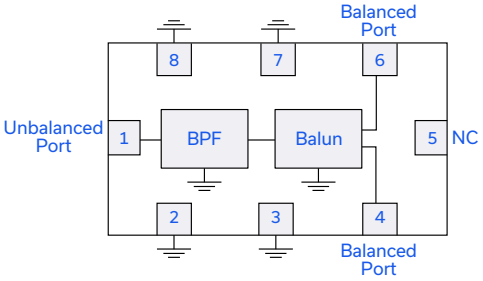
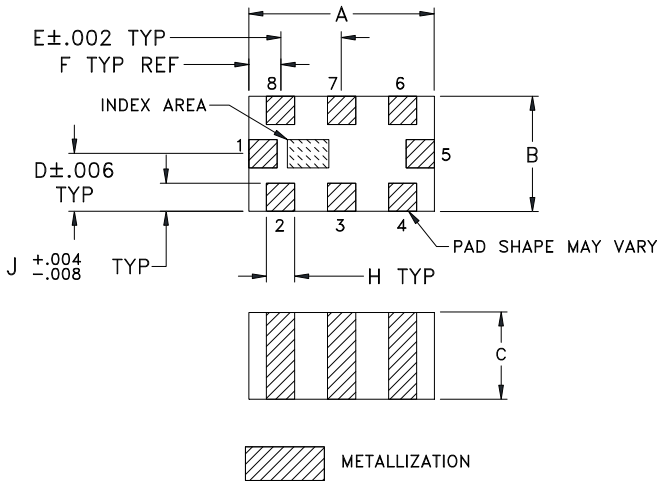


Figure 1. BBFCG2-472+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description
Unbalanced Port	1	Unbalanced Input Port
Balanced Ports	4, 6	Balanced Output Ports
Ground	2, 3, 7, 8	Connects to Ground on PCB. (See drawing PL-724)
NC	5	No connection, not used internally. See drawing PL-724 for connection to PCB.

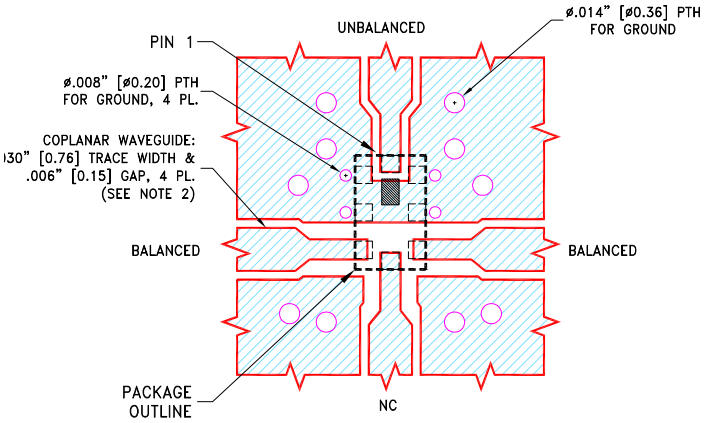
CASE STYLE DRAWING

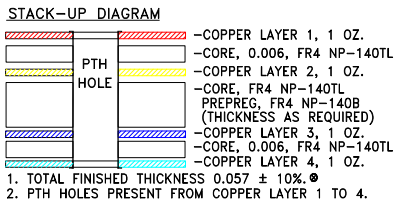


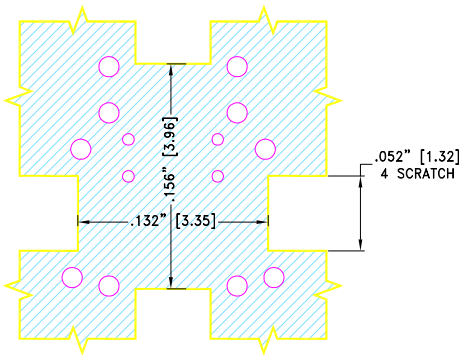
OUTLINE DIMENSIONS (inch / mm)

A	B	C	D	E	F	G	H	J	wt
.079	.049	.037	.025	.026	.014	.110	.012	.010	grams
2.00	1.25	0.95	0.63	0.65	0.35	2.80	0.30	0.25	.008

SUGGESTED PCB LAYOUT (PL-724)







TOP VIEW TO LAYER 2

NOTES:
1. PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
2. TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR FR4 NP-140TL WITH DIELECTRIC THICKNESS .006"±.0005"; COPPER: 1 OZ. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
3. COPPER LAYERS 3,4 OF THE PCB IS CONTINUOUS GROUND PLANES.

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

Figure 2. Suggested PCB Layout PL-724

PRODUCT MARKING*: NO MARKING

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

Bandpass Filter & Balun BBFCG2-472+

50Ω 4200 to 5200 MHz 1:2 Ratio

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASHBOARD. CLICK HERE

Performance Data & Graphs	Data Graphs S-Parameter (S3P Files) Data Set (.zip file) with connectors and feedline loss compensated.
Case Style	GE0805C-15 Lead Finish: Tin over Nickel Plating
RoHS Status	Compliant
Tape and Reel	F114
Suggested Layout for PCB Design	PL-724
Evaluation Board	TB-BBFCG2-472C+ Gerber File
Environmental Rating	ENV06T10

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.

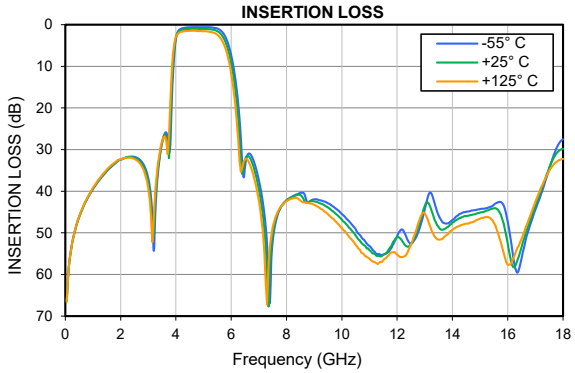
B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuits' applicable established test performance criteria and measurement instructions.

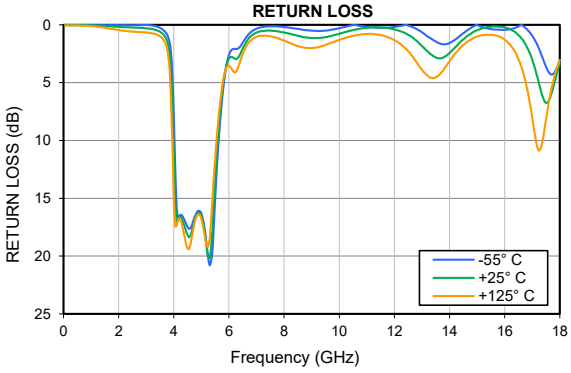
C. The parts covered by this specification document are subject to Mini-Circuits' standard limited warranty and terms and conditions (collectively, "Standard Terms"; Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the standard terms and the exclusive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

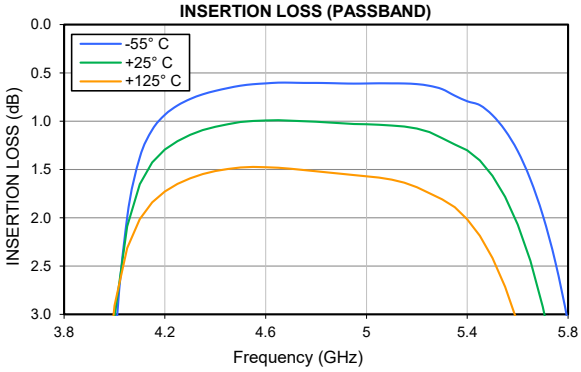
Typical Performance Data

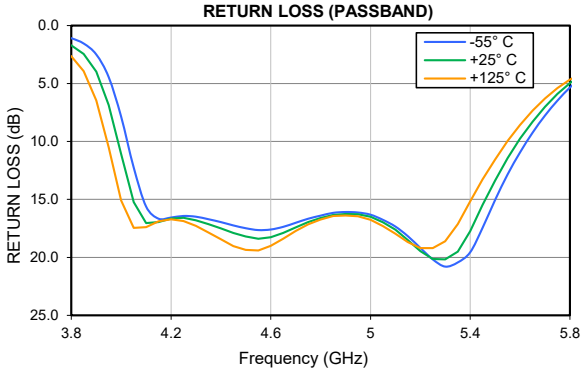
FREQUENCY (GHz)	AVERAGE INSERTION LOSS (dB)	RETURN LOSS (UNBALANCED PORT) (dB)	AMPLITUDE UNBALANCE (dB)	PHASE UNBALANCE (deg.)	CMRR (dB)
3.500	28.14	0.60	0.77	0.92	26.93
3.550	26.95	0.68	1.01	4.58	23.03
3.600	26.32	0.78	1.26	8.40	19.74
3.650	26.61	0.91	1.68	13.53	16.32
3.700	28.70	1.07	3.09	22.25	11.58
3.750	32.06	1.32	9.63	6.01	5.91
3.800	22.74	1.72	2.05	21.15	13.13
3.850	14.58	2.46	0.93	10.38	19.54
3.900	8.82	3.98	0.67	5.44	24.28
3.950	5.06	6.85	0.55	2.75	28.07
4.000	3.03	11.07	0.44	1.05	31.35
4.050	2.09	15.24	0.35	0.16	33.81
4.100	1.65	17.04	0.26	1.04	35.03
4.150	1.43	16.96	0.17	1.75	34.81
4.200	1.29	16.65	0.09	2.30	33.68
4.250	1.21	16.59	0.00	2.67	32.63
4.300	1.14	16.79	0.08	3.00	31.50
4.350	1.09	17.13	0.17	3.19	30.59
4.400	1.06	17.50	0.27	3.42	29.47
4.450	1.03	17.89	0.35	3.63	28.51
4.500	1.01	18.21	0.43	3.66	27.91
4.550	1.00	18.38	0.52	3.75	27.10
4.600	0.99	18.26	0.58	3.79	26.53
4.650	0.99	17.90	0.66	3.70	26.06
4.700	1.00	17.41	0.74	3.71	25.44
4.750	1.00	16.96	0.80	3.64	25.04
4.800	1.01	16.61	0.87	3.48	24.65
4.850	1.01	16.34	0.93	3.34	24.28
4.900	1.02	16.25	0.99	3.12	24.02
4.950	1.03	16.28	1.04	2.91	23.72
5.000	1.03	16.50	1.09	2.69	23.48
5.050	1.04	16.97	1.14	2.39	23.25
5.100	1.04	17.61	1.18	2.07	23.04
5.150	1.06	18.49	1.22	1.75	22.88
5.200	1.08	19.46	1.25	1.41	22.73
5.250	1.11	20.15	1.26	1.11	22.72
5.300	1.18	20.17	1.23	0.72	22.95
5.350	1.24	19.50	1.18	0.19	23.36
5.400	1.30	17.73	1.22	1.35	22.99
5.450	1.41	15.48	1.28	2.21	22.38
5.500	1.57	13.35	1.32	2.84	21.98
5.550	1.78	11.43	1.33	3.52	21.67
5.600	2.07	9.77	1.34	4.25	21.37
5.650	2.45	8.29	1.33	4.96	21.13
5.700	2.92	7.00	1.31	5.81	20.85
5.750	3.53	5.89	1.29	6.62	20.55
5.800	4.28	4.95	1.24	7.41	20.34
5.850	5.21	4.19	1.16	8.26	20.14
5.900	6.34	3.60	1.07	9.05	19.97
5.950	7.68	3.18	0.94	9.83	19.87
6.000	9.26	2.92	0.74	10.57	19.84
6.050	11.12	2.79	0.47	11.30	19.78
6.100	13.28	2.77	0.06	11.98	19.58
6.150	15.82	2.83	0.57	12.76	18.67
6.200	18.85	2.91	1.59	14.090	16.27
6.250	22.52	2.95	3.34	17.569	12.23
6.300	27.07	2.91	6.49	31.441	6.89
6.350	32.54	2.78	7.52	82.680	0.79
6.400	35.90	2.57	0.59	109.023	2.93
6.450	34.26	2.32	4.38	100.299	1.39
6.500	32.51	2.06	6.59	85.82	0.49

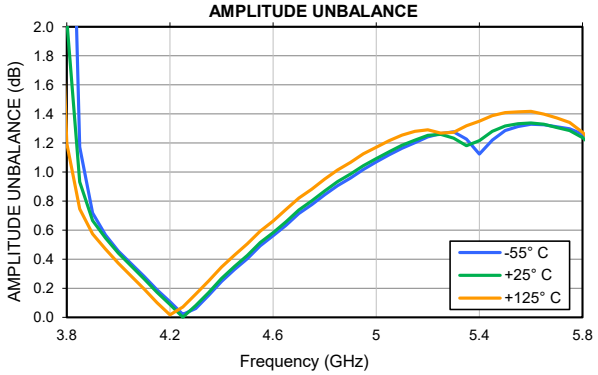
Typical Performance Curves

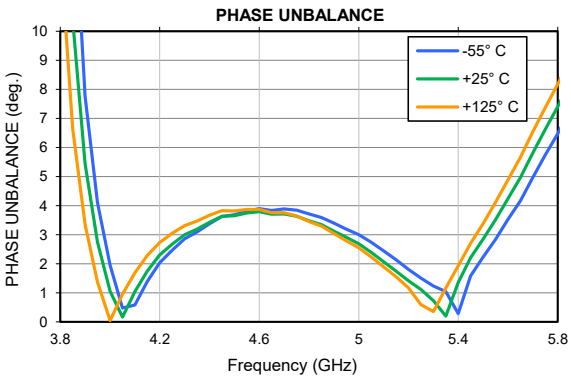


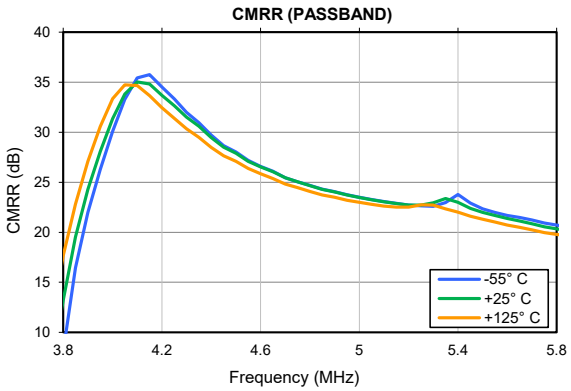










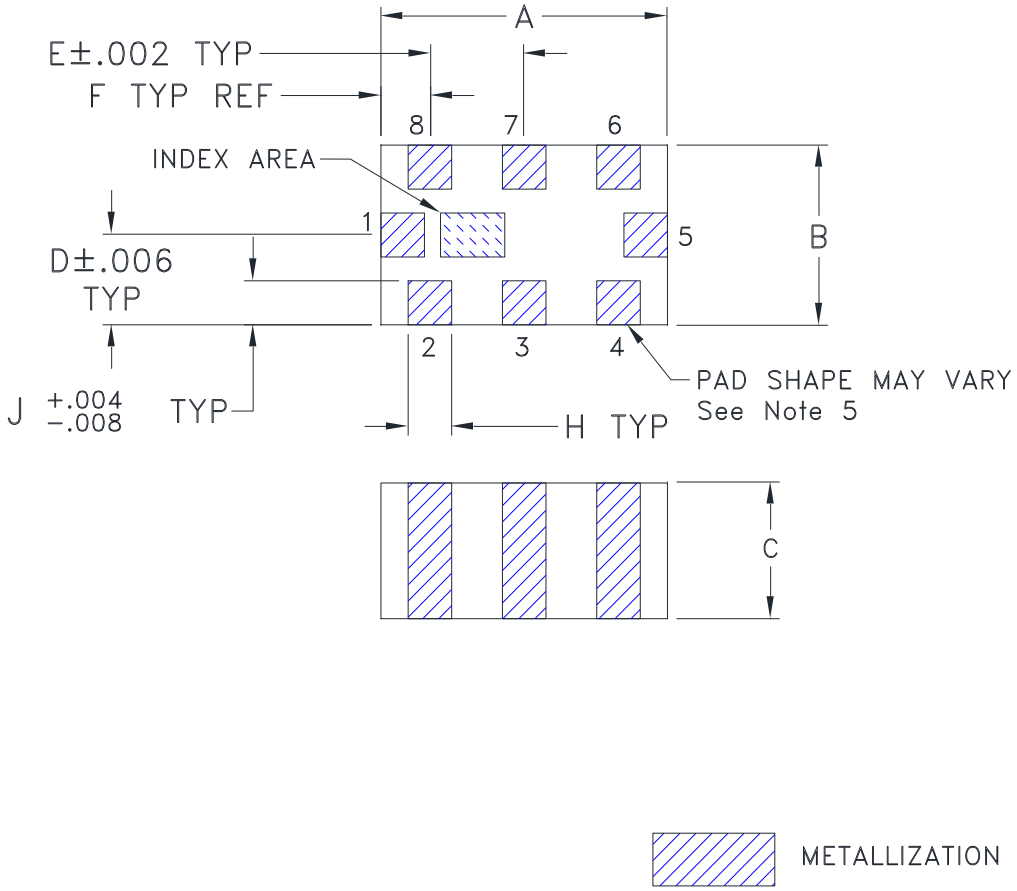


Case Style GE

GE0805C-15

Outline Dimensions

Top View



CASE#	A	B	C	D	E	F	G	H	J	WT, GRAM
GE0805C-15	.079 (2.00)	.049 (1.25)	.037 (0.95)	.025 (0.63)	.026 (0.65)	.014 (0.35)	.110 (2.80)	.012 (0.30)	.010 (0.25)	.008

Dimensions are in inches (mm). Tolerances: 2 Pl. ± .01(.25); 3 Pl. ± .005(.100)

Notes:

1. Open style, ceramic base
2. Termination finish: For RoHS Case Styles: Tin plate over Nickel plate. All model , (+) suffix.
   For RoHS-5 Case Styles: Tin-lead plate over Nickel plate. All model ,no (+) suffix.
3. Pad tolerance to be non-cumulative. Minimum spacing between each pad is .004(0.1).
4. Pin numbers do not appear on unit. For reference only.
5. During the manufacturing process, the pad shape may not be rectangular and may take on a more semi-circle shape. However, the pad dimensions reflect this, with the pad shape being within the specified lengths. The metallization compensates accordingly and so performance will not be affected. In addition, solderability will not be influenced by the pad shape

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Tape & Reel Packaging TR-F114

DEVICE ORIENTATION IN T&R

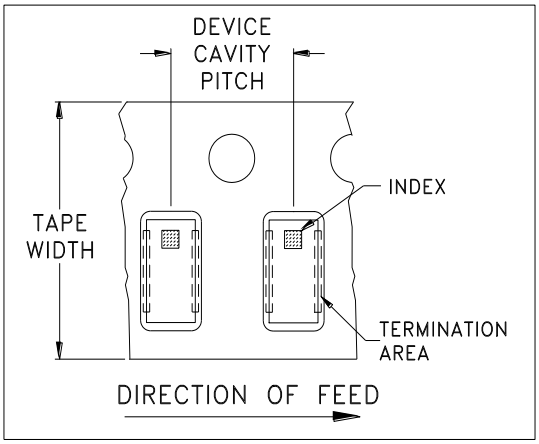

ILLUSTRATION 1

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

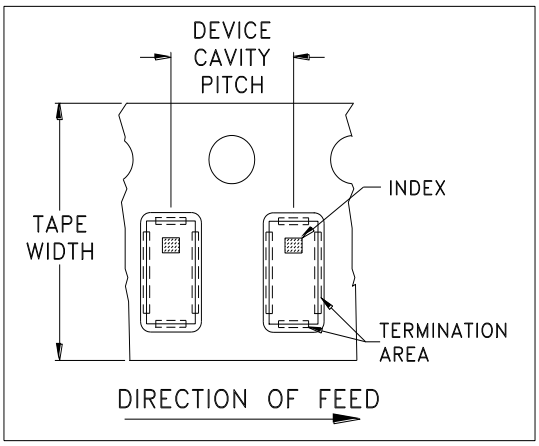

ILLUSTRATION 2

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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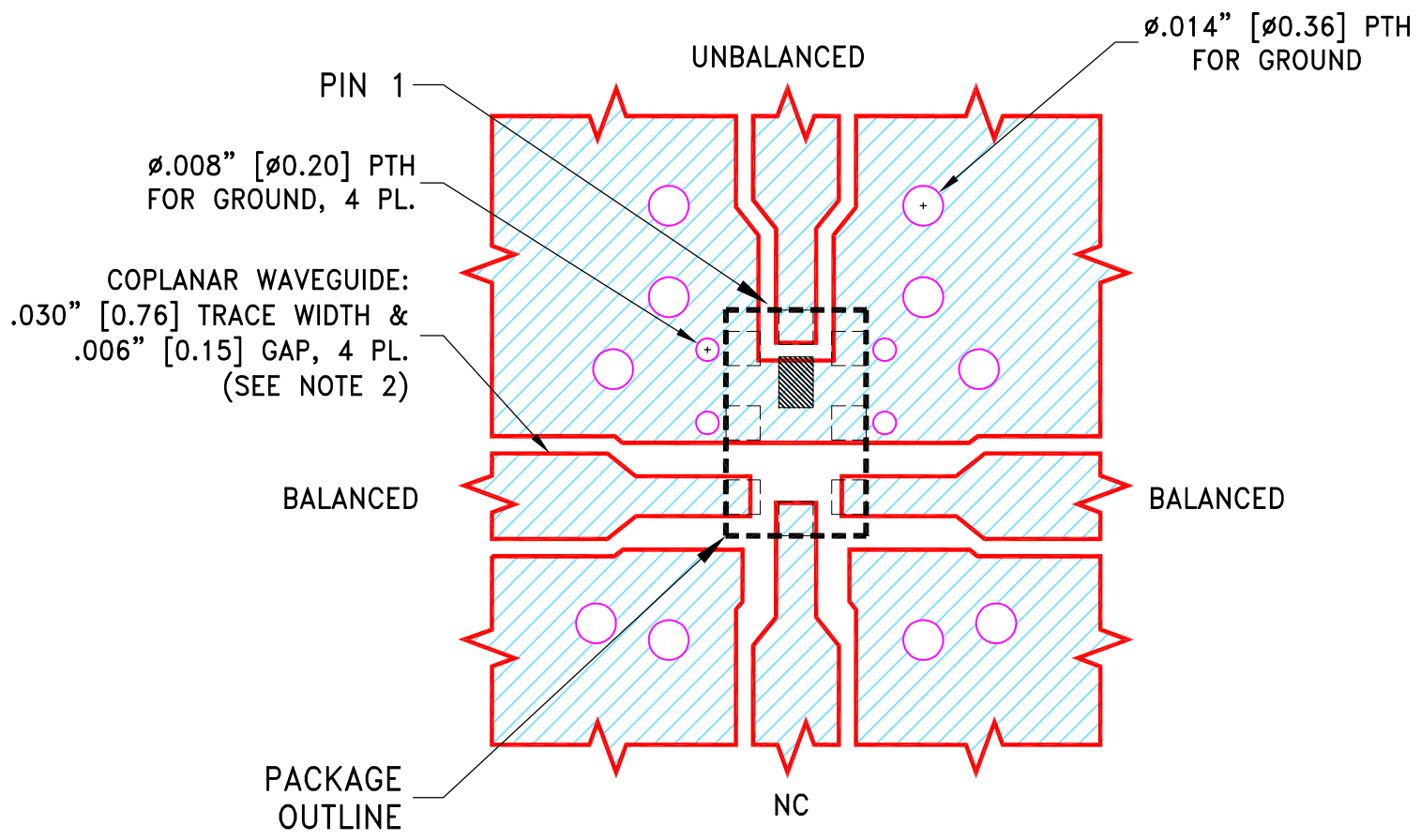
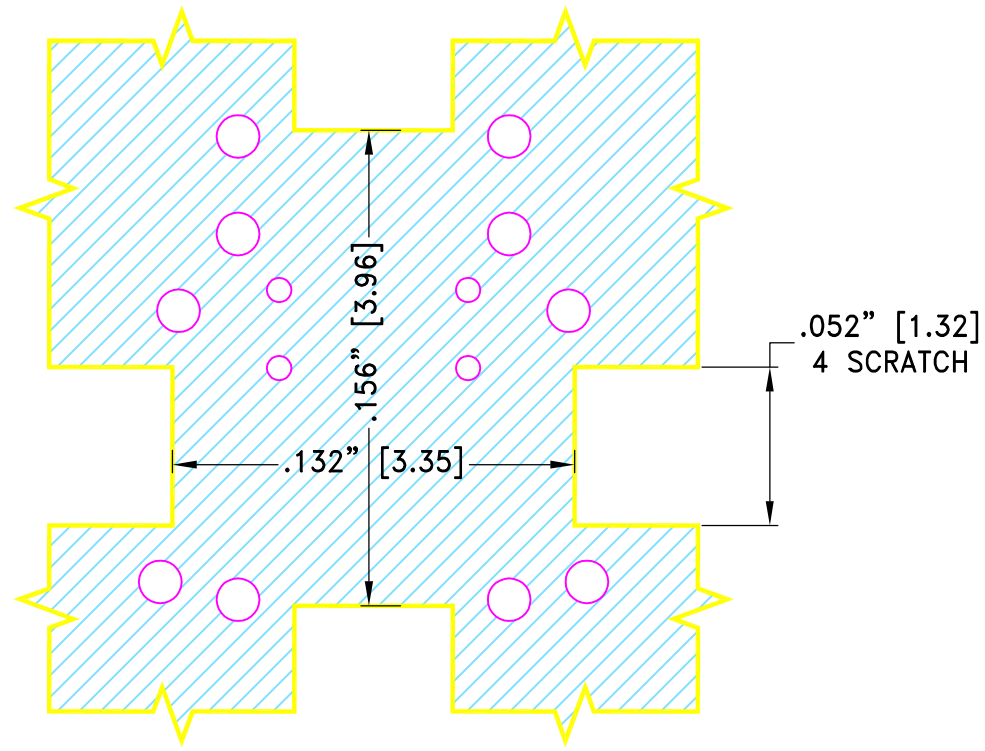
Mini-Circuits ISO 9001 & ISO 14001 Certified

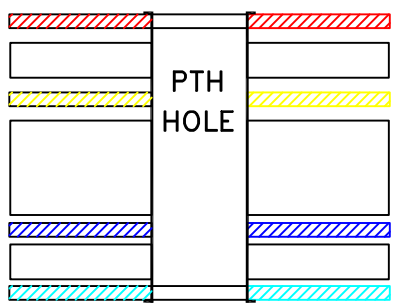
SUGGESTED MOUNTING CONFIGURATION
FOR GE0805C-15 CASE STYLE





TOP VIEW TO LAYER 2

STACK-UP DIAGRAM



-COPPER LAYER 1, 1 OZ.
-CORE, 0.006, FR4 NP-140TL
-COPPER LAYER 2, 1 OZ.
-CORE, FR4 NP-140TL
PREPREG, FR4 NP-140B
(THICKNESS AS REQUIRED)
-COPPER LAYER 3, 1 OZ.
-CORE, 0.006, FR4 NP-140TL
-COPPER LAYER 4, 1 OZ.

1. TOTAL FINISHED THICKNESS 0.057 ± 10%.⊗
2. PTH HOLES PRESENT FROM COPPER LAYER 1 TO 4.

NOTES:

1. PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
2. TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR FR4 NP-140TL WITH DIELECTRIC THICKNESS .006"±.0005"; COPPER: 1 OZ. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
3. COPPER LAYERS 3,4 OF THE PCB IS CONTINUOUS GROUND PLANES.

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
0R	ECO-010908	NEW RELEASE	12/02/21	ITG	IL

REVISIONS

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES TOLERANCES ON: 2 PL DECIMALS ± 3 PL DECIMALS ± .005 ANGLES ± 1° FRACTIONS ±	DRAWN	ITG	12/02/21
	CHECKED	GF	12/02/21
	APPROVED	IL	12/02/21

BSHEETA1.DWG REV:A DATE:01/12/94

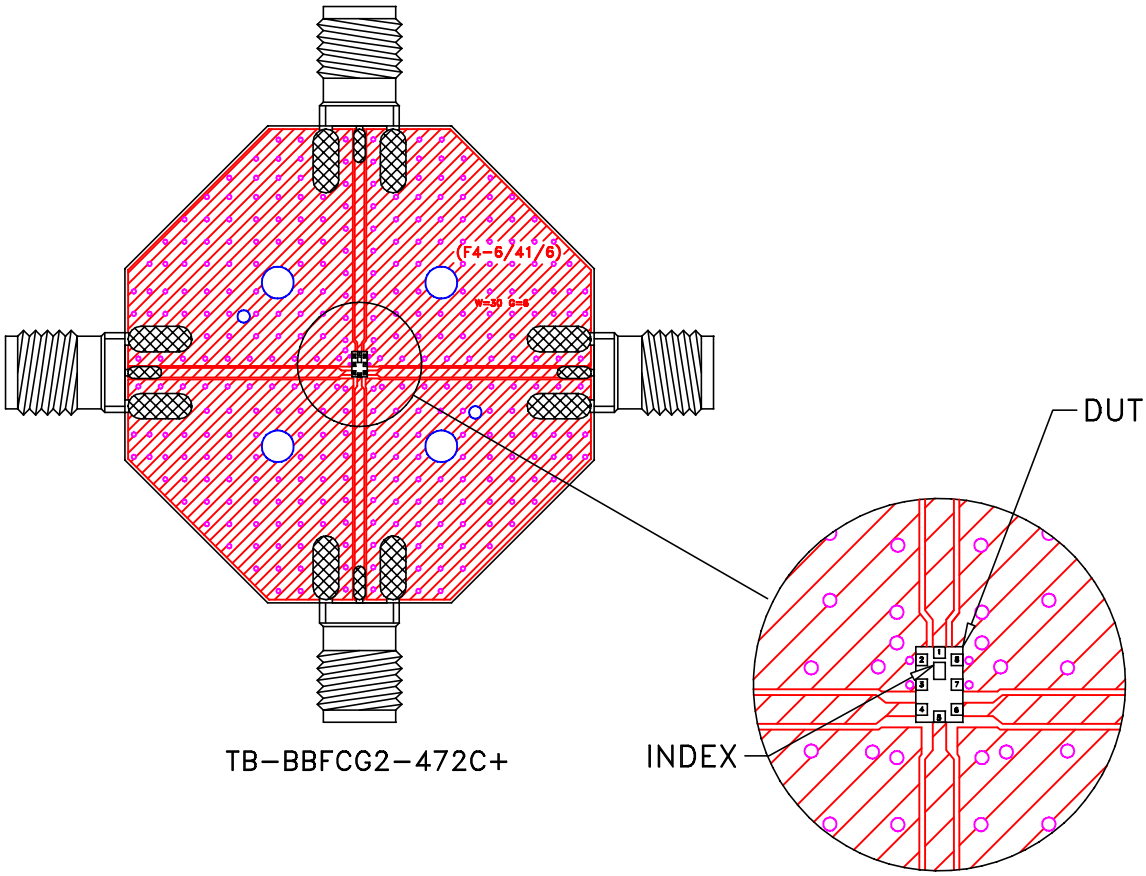
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, GE0805C-15, TB-1233+

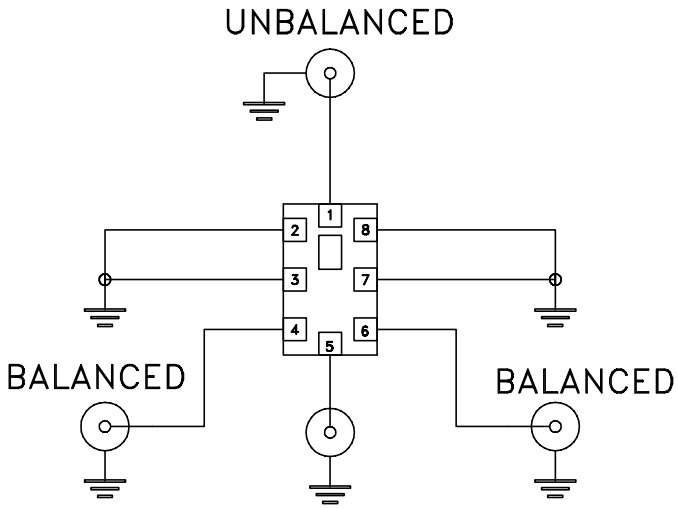
SIZE	CODE IDENT	DRAWING NO:	REV:
B	15542	98-PL-724	0R
FILE: 98PL724		SCALE: 15:1	SHEET: 1 OF 1

THIRD ANGLE PROJECTION

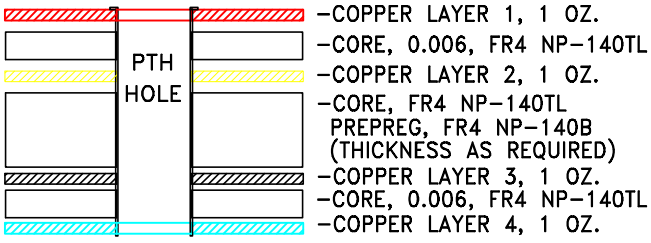
Evaluation Board and Circuit



TB-BBFCG2-472C+



Schematic Diagram



Stack-up Diagram

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: FR4 or equivalent,
   Dielectric Constant=4.5,
   Total finished Thickness = .057 inch.

Mini-Circuits®

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Environmental Specifications ENV06T10

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, Test B,B1, 95% Coverage
Thermal Shock	-55° to +125°C, 15 min dwell,250 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	---