



Mini-Circuits

SURFACE MOUNT

RF Transformer

NCS2-2702+

50Ω 9000 to 27000 MHz Ratio 1:2

KEY FEATURES

- 9000 to 27000 MHz coverage in a single 1:2 transformer
- Patent-pending technology
- Low insertion loss of 1.4 dB typical
- Compact 0805 footprint
- Low phase unbalance of 10 deg. typical
- Low amplitude unbalance of 1.3 dB

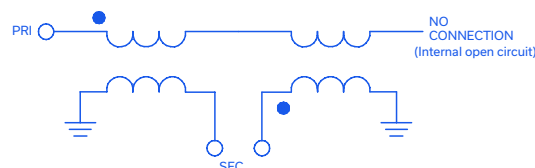


Generic photo used for illustration purposes only

APPLICATIONS

- X-Band, Ku-Band and K-Band RF Sampling ADCs/DACs
- Ku/Ka SATCOM Ground Terminals
- X-Band Radar
- Test & Measurement Equipment
- Emerging 6G cmWave Infrastructure

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

The Mini-Circuits NCS2-2702+ 1:2 transformer covers frequencies from 9000 to 27000 MHz in a compact 0805 package. Patent-pending technology enables ultra-wideband coverage to support applications in the X-band, Ku-Band and K-Band. Manufactured with LTCC technology, this component provides high reliability, performance and repeatability across the full operating frequency band. The low insertion loss, amplitude and phase unbalance make this component ideal for wideband applications that require balanced to unbalanced conversion.

ELECTRICAL SPECIFICATIONS^{1,2} AT +25 °C, $Z_0=50\Omega$

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Units
Impedance Ratio		2			
Frequency Range		9000		27000	MHz
Average Insertion Loss (above 3 dB)	9000-10000	-	1.4	1.5	dB
	10000-12000	-	0.9	1	
	12000-20000	-	0.8	1	
	20000-25000	-	1.5	1.7	
	25000-27000	-	2	2.5	
Return Loss - Unbalanced Port	9000-10000	-	7.8	-	dB
	10000-12000	-	11	-	
	12000-20000	13	16	-	
	20000-25000	-	9.3	-	
	25000-27000	-	9.3	-	
Amplitude Unbalance ($\pm$)	9000-10000	-	1.1	1.7	dB
	10000-12000	-	1	1.5	
	12000-20000	-	1.3	1.5	
	20000-25000	-	1.4	1.5	
	25000-27000	-	0.9	1.5	

Mini-Circuits

www.minicircuits.com P.O. Box 350166, Brooklyn, NY 11235-0003 (718) 934-4500 sales@minicircuits.com

 REV. OR
 ECO-031174
 NCS2-2702+
 MCL NY
 260914
 PAGE 1 OF 5

ELECTRICAL SPECIFICATIONS¹ AT +25 °C, $Z_0=50\Omega$

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Units
Phase Unbalance (Relative to 180°)	9000–10000	-	8	13	Deg.
	10000–12000	-	8	13	
	12000–20000	-	10	13	
	20000–25000	-	10	13	
	25000–27000	-	8.5	15	
CMRR	9000–27000	18	20	-	dB

1. Tested in Evaluation Board P/N TB-NCS2-2702C+ with the connector and feedline effects de-embedded using the TRL method.

2. Typical variation: $\pm 3\%$

ABSOLUTE MAXIMUM RATINGS³

Operating Temperature	-55 °C to +125 °C
Storage Temperature	-55 °C to +125 °C
Input Power ⁴	10 W

3. Permanent damage may occur if any of these limits are exceeded.

4. Power rating applies only to signals within the passband. Power rating above +25 °C operating temperature decreases linearly to 1.97 W at +125 °C.



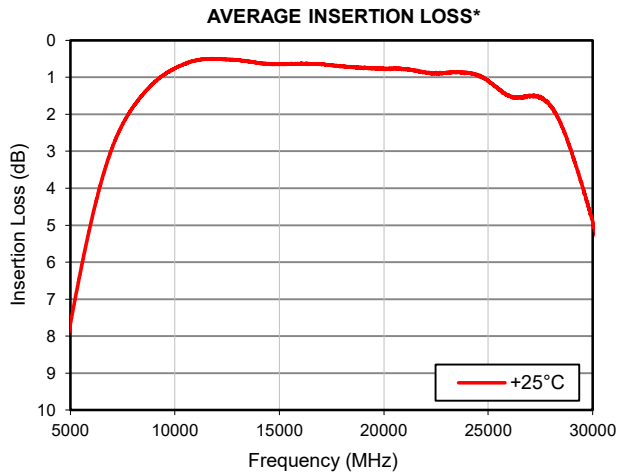
SURFACE MOUNT

RF Transformer

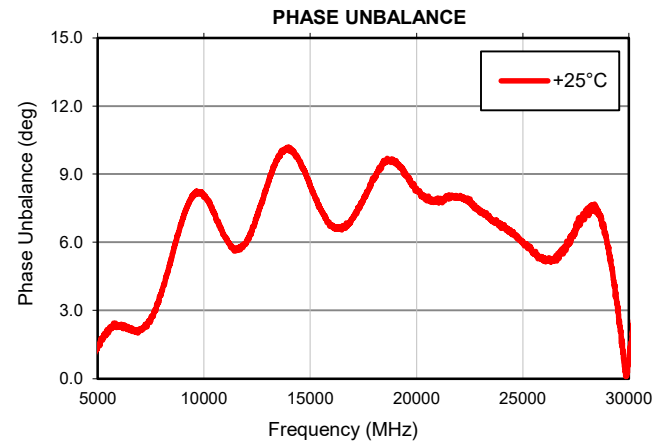
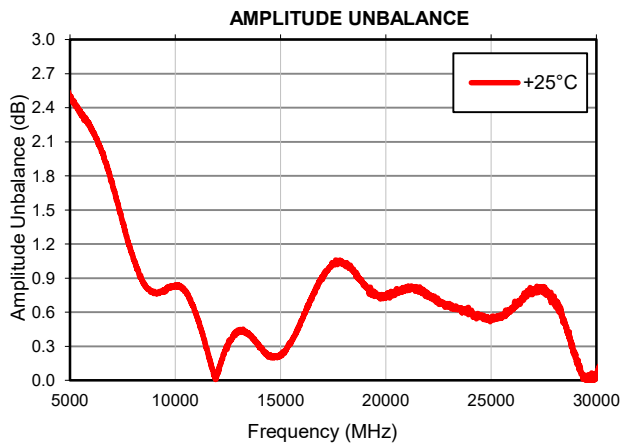
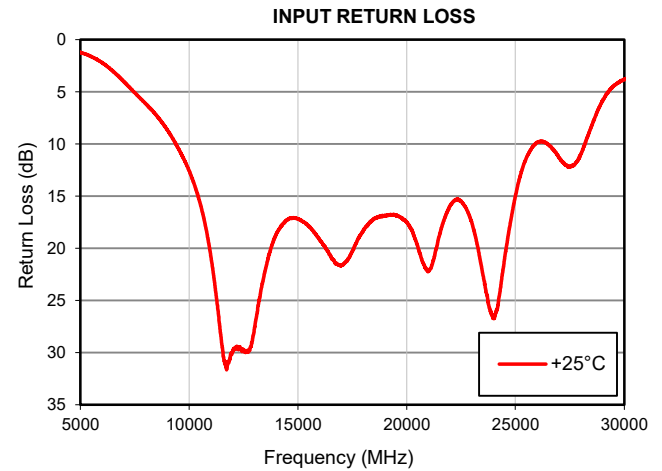
NCS2-2702+

50 Ω 9000 to 27000 MHz Ratio 1:2

TYPICAL PERFORMANCE GRAPHS



*Average Insertion loss above 3dB





SURFACE MOUNT

RF Transformer

NCS2-2702+

50Ω 9000 to 27000 MHz Ratio 1:2

FUNCTIONAL DIAGRAM

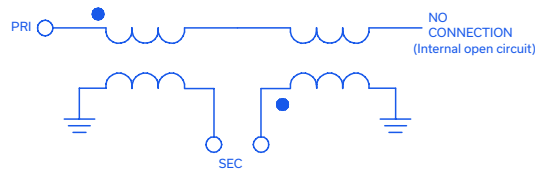
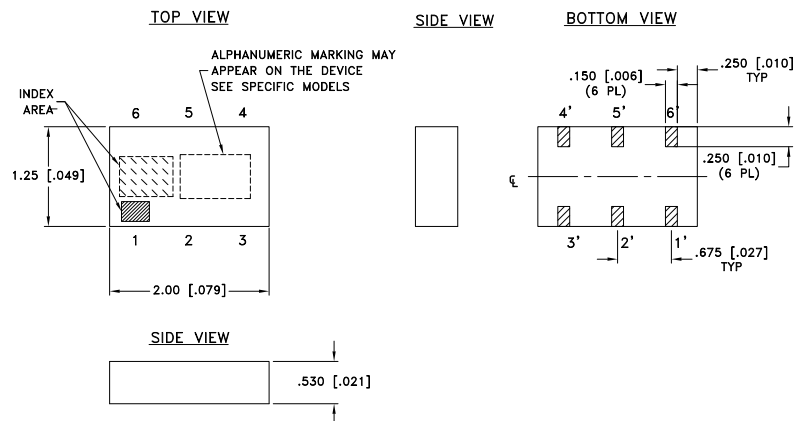


Figure 1. NCS2-2702+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description
Unbalanced Port	1	Unbalanced Input Port
Balanced Ports	3,4	Balanced Output Ports
Ground	2,5	Connects to Ground on PCB, (See drawing PL-860)
NC	6	No connection, not used internally. See drawing PL-860 for connection to PCB

CASE STYLE DRAWING



Weight: 0.005 grams
Dimensions are in inches [mm]. Tolerances: 2 Pl. ± 0.30 ; 3 Pl. ± 0.200

SUGGESTED PCB LAYOUT (PL-860)

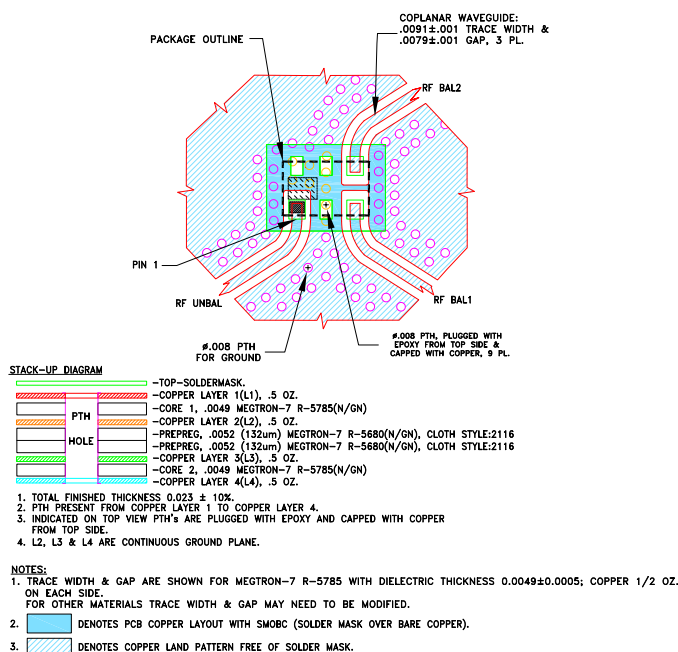
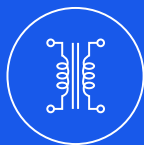


Figure 2. Suggested PCB Layout PL-860

PRODUCT MARKING*: T5

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



Mini-Circuits

SURFACE MOUNT

RF Transformer

NCS2-2702+

50Ω 9000 to 27000 MHz 1:2 Ratio

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASH BOARD.

[CLICK HERE](#)

Performance Data & Graphs	Data Graphs S-Parameter (S3P Files) Data Set (.zip file) De-embedded to device pads
Case Style	GE0805C-21 Lead Finish: Tin plate over Nickel
RoHS Status	Compliant
Tape and Reel	TR-F114
Suggested Layout for PCB Design	PL-860
Evaluation Board	TB-NCS2-2702C+ Gerber File
Environmental Rating	ENV163

NOTES

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



RF Transformer

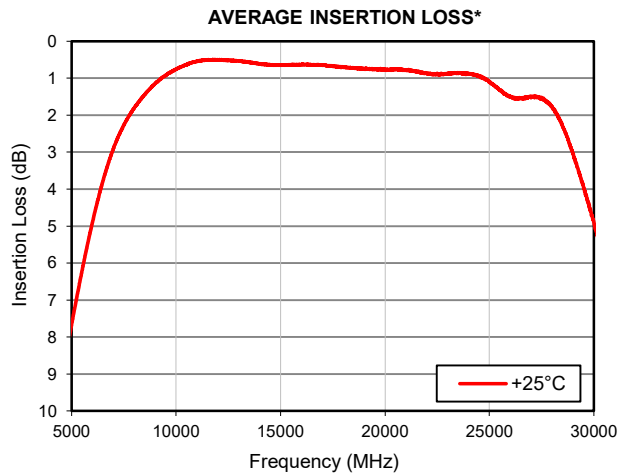
Typical Performance Data

NCS2-2702+

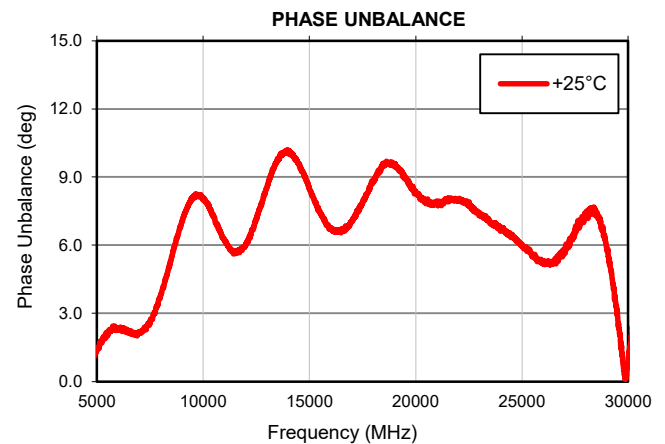
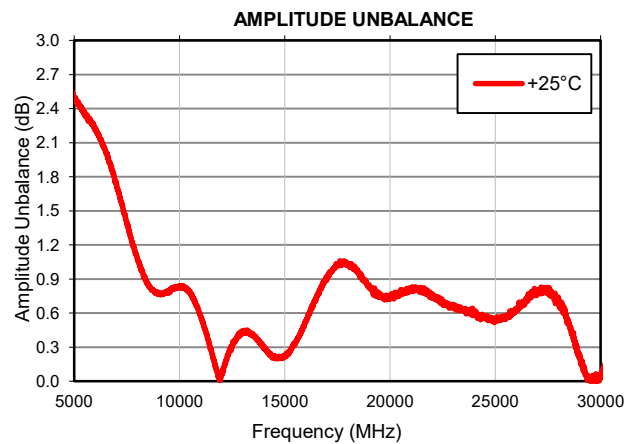
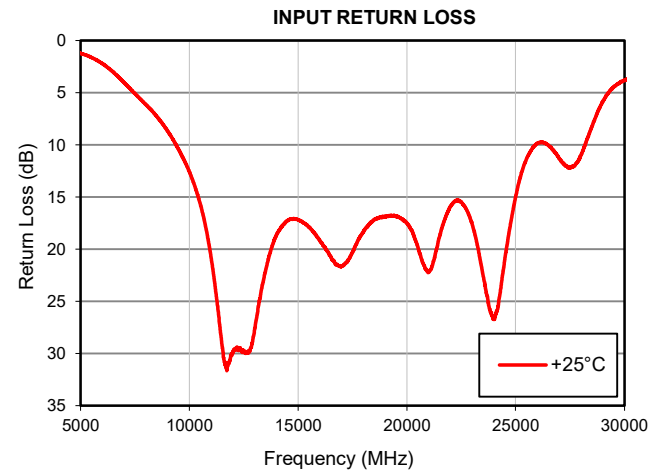
FREQUENCY (MHz)	INSERTION LOSS* (dB)	RETURN LOSS (dB)	AMPLITUDE UNBALANCE (dB)	PHASE UNBALANCE** (dB)
5000	7.69	1.22	2.49	1.43
5500	6.22	1.63	2.37	2.06
6000	4.91	2.21	2.23	2.38
6500	3.80	3.03	2.01	2.17
7000	2.91	4.03	1.74	2.17
7500	2.27	5.09	1.39	2.66
8000	1.81	6.14	1.08	3.81
8500	1.44	7.28	0.86	5.39
9000	1.15	8.67	0.77	7.05
9500	0.92	10.42	0.79	8.06
10000	0.76	12.58	0.83	7.98
10500	0.64	15.66	0.78	7.24
11000	0.55	20.86	0.57	6.22
11500	0.50	29.25	0.28	5.73
12000	0.51	29.98	0.05	6.06
12500	0.52	29.74	0.31	7.12
13000	0.53	27.64	0.43	8.52
13500	0.57	22.07	0.41	9.78
14000	0.61	18.65	0.29	10.18
14500	0.64	17.26	0.22	9.57
15000	0.65	17.19	0.22	8.47
15500	0.64	17.89	0.33	7.41
16000	0.63	19.18	0.53	6.76
16500	0.64	20.75	0.73	6.65
17000	0.65	21.60	0.89	7.08
17500	0.67	20.29	1.02	7.82
18000	0.70	18.32	1.04	8.78
18500	0.73	17.17	0.95	9.48
19000	0.75	16.90	0.85	9.50
19500	0.77	16.84	0.76	8.92
20000	0.77	17.51	0.75	8.26
20500	0.75	19.77	0.79	7.83
21000	0.78	22.18	0.80	7.96
21500	0.83	18.78	0.82	8.03
22000	0.88	15.95	0.74	7.96
22500	0.87	15.46	0.68	7.72
23000	0.88	17.60	0.65	7.37
23500	0.88	22.52	0.63	6.97
24000	0.88	26.64	0.58	6.77
24500	0.95	21.02	0.56	6.38
25000	1.09	14.97	0.55	5.99
25500	1.32	11.33	0.55	5.50
26000	1.49	9.82	0.63	5.17
26500	1.54	10.03	0.74	5.19
27000	1.52	11.32	0.79	5.79
28000	1.77	10.98	0.74	7.30
28500	2.29	8.26	0.50	7.40
29000	3.05	5.87	0.20	5.83
29500	3.94	4.45	0.02	2.87
30000	4.90	3.81	0.06	0.72

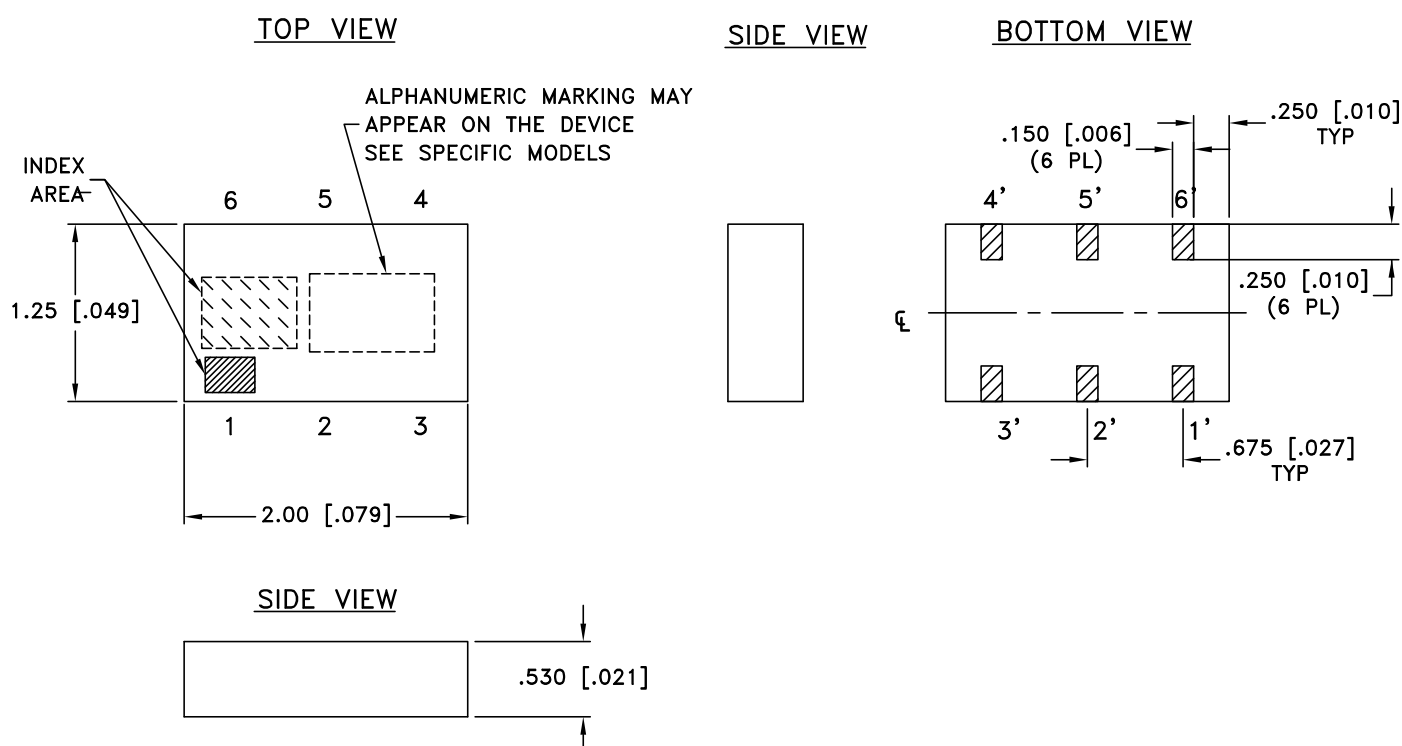
* Insertion Loss is Average Insertion loss above 3dB
 **Phase Unbalance is relative to 180°

Typical Performance Data



*Average Insertion loss above 3dB





Weight: .005 grams

Dimensions are in mm[inches]. Tolerances: 2 Pl.±.30 ; 3 Pl.±.200

Notes:

1. Open style, ceramic base.
2. Termination finish: Tin plate over Nickel plate.
3. Pad tolerance is non-cumulative. Minimum spacing between each pad is 0.1mm.

Mini-Circuits®

ISO 9001 ISO 14001 CERTIFIED

ALL NEW
minicircuits.com

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/IF MICROWAVE COMPONENTS

Tape & Reel Packaging TR-F114

DEVICE ORIENTATION IN T&R

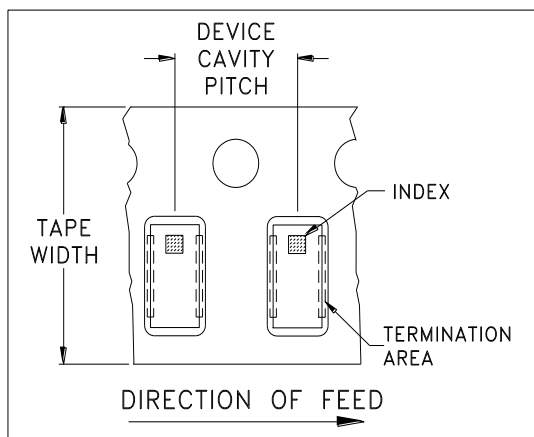


ILLUSTRATION 1

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

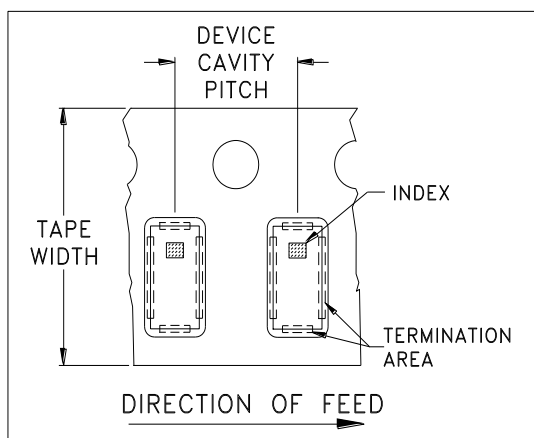


ILLUSTRATION 2

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
				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



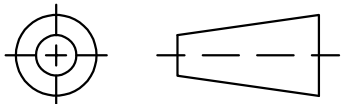
INTERNET <http://www.minicircuits.com>

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

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

THIRD ANGLE PROJECTION



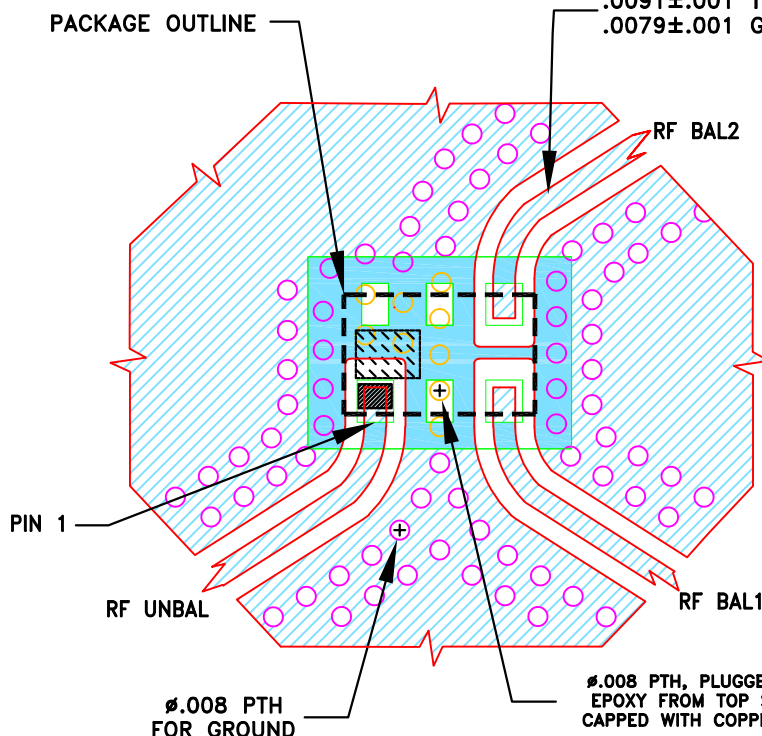
REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-029133	NEW RELEASE	04.08.26	TP	TD

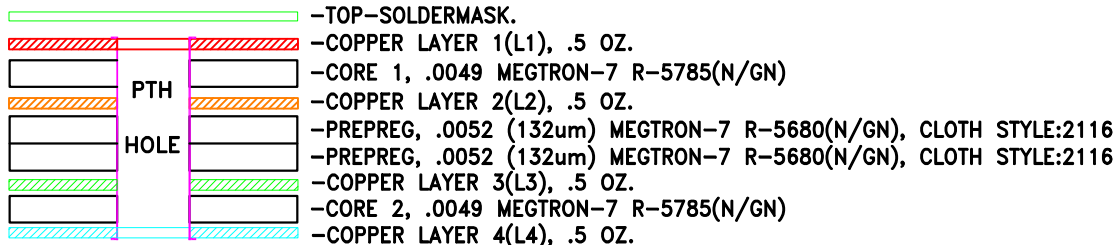
SUGGESTED MOUNTING CONFIGURATION

FOR GE0805C-21 CASE STYLE

COPLANAR WAVEGUIDE:
.0091±.001 TRACE WIDTH &
.0079±.001 GAP, 3 PL.



STACK-UP DIAGRAM



1. TOTAL FINISHED THICKNESS $0.023 \pm 10\%$.
2. PTH PRESENT FROM COPPER LAYER 1 TO COPPER LAYER 4.
3. INDICATED ON TOP VIEW PTH's ARE PLUGGED WITH EPOXY AND CAPPED WITH COPPER FROM TOP SIDE.
4. L2, L3 & L4 ARE CONTINUOUS GROUND PLANE.

NOTES:

1. TRACE WIDTH & GAP ARE SHOWN FOR MEGTRON-7 R-5785 WITH DIELECTRIC THICKNESS 0.0049 ± 0.0005 ; COPPER 1/2 OZ. ON EACH SIDE.
FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.
2.  DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).
3.  DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

UNLESS OTHERWISE SPECIFIED	INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN TP	04.08.26
TOLERANCES ON:	CHECKED IL	04.08.26
2 PL DECIMALS $\pm$	APPROVED TD	04.08.26
3 PL DECIMALS $\pm$.005		
ANGLES $\pm$		
FRACTIONS $\pm$		

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.



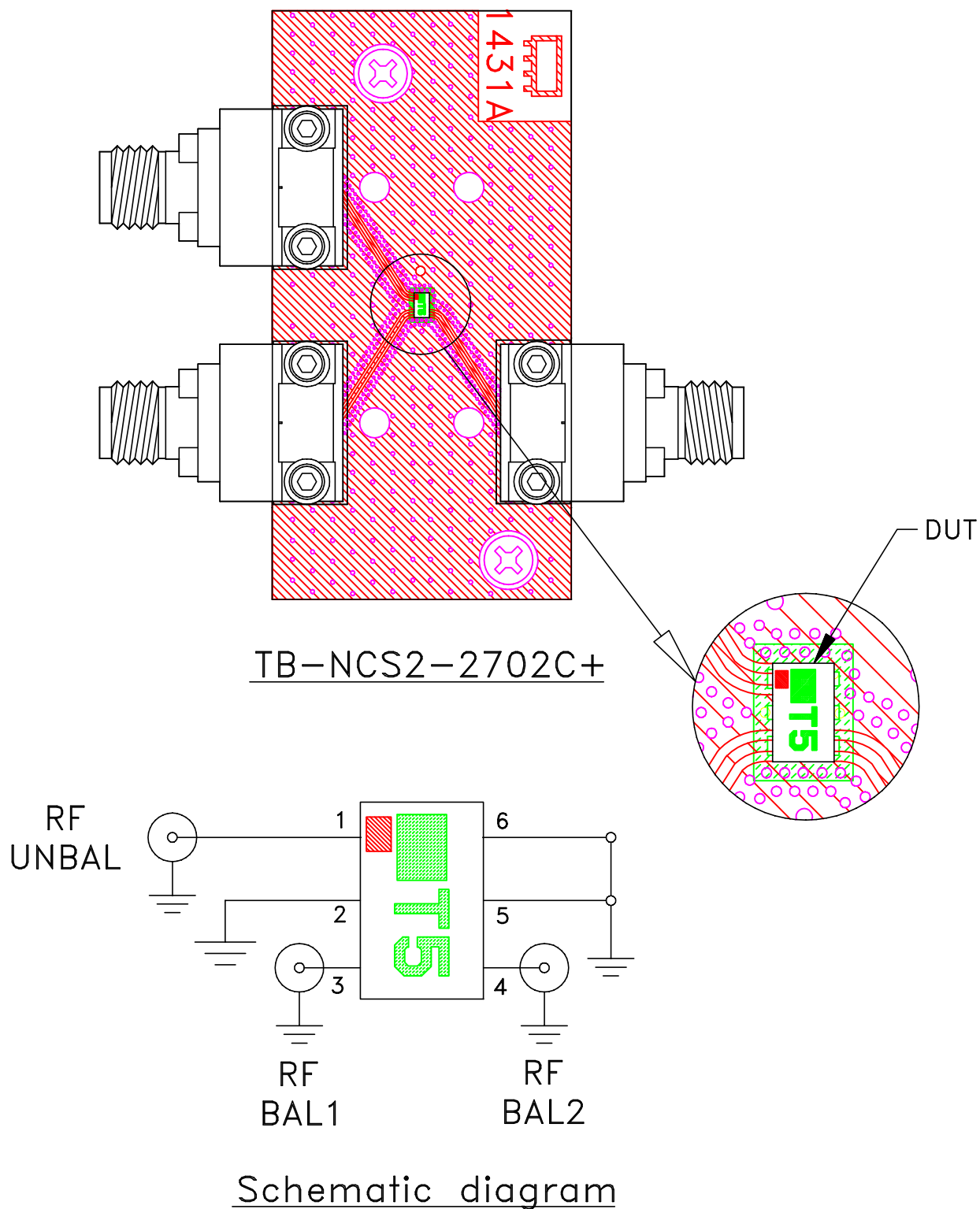
Mini-Circuits®

13 Neptune Avenue
Brooklyn NY 11235

PL, GE0805C-21, TB-NCS2-2702C+

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-860	OR
FILE:	98PL860	SCALE: 12:1	SHEET: 1 OF 1

Evaluation Board and Circuit



Notes:

1. 50 Ohm 2.92mm Female 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 125° C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 125° C Ambient Environment	Individual Model Data Sheet
Thermal Cycling	-55 to 125°C, 500 cycles, Dwell Time 15 minutes.	MIL-STD-202, Method 107, Condition A-3
Solderability	10X / 30X Magnification	J-STD-002 Method B, B1
Bend Test	1mm, deflection for 5 seconds	
Solder Reflow Heat	Pb-Free Process 245° - 250°C peak, 3X Reflow	J-STD-020