CERAMIC BALUN

RF Transformer

TCW2-133+

50Ω 7 to 13 GHz Ratio 1:2

THE BIG DEAL

- Insertion Loss (Above 3 dB): 1.0 dB Typ.
- Amplitude Unbalance: 1.7 dB Typ.
- Phase Unbalance: 13 Degrees Typ.
- RF Input Power: 2 W Max at +25°C
- 0603 Surface Mount Footprint



Generic photo used for illustration purposes only

CASE STYLE: JC0603C

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

APPLICATIONS

- Satellite Communication
- Clock Distribution
- Radar
- High Speed ADC/DAC Interface

PRODUCT OVERVIEW

Mini-Circuits' TCW2-133+ is a tiny ceramic RF balun transformer with an impedance ratio of 1:2, covering a variety of wireless communications applications from 7 to 13 GHz. This model provides low insertion loss, low phase unbalance (relative to 180°), low amplitude unbalance, and RF input power handling up to 2 W. It provides DC isolation from input to output. Fabricated using LTCC technology, the unit comes housed in a tiny, rugged ceramic package (0.06x0.03x0.02") suitable for harsh operating environments.

KEY FEATURES

Feature	Advantages
Extremely Wide Operating Temperature, -55 to +125°C	Able to be used in demanding commercial, industrial and military applications.
2 W Power Handling	Supports a wide range of power requirements
Tiny Size, 0603	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.

REV. A
ECO-016193
TCW2-133+
MCL NY
250709

ELECTRICAL SPECIFICATIONS AT +25°C[1]

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Units
Impedance Ratio			50:100		
Frequency Range		7000		13000	MHz
Average Insertion Loss (Above 3 dB)	7000-13000		1.0	1.5	dB
Amplitude Unbalance	7000-13000		1.7		dB
Phase Unbalance[2]	7000-13000		13		Degree
Return Loss Unbalanced Port	7000-13000		10		dB

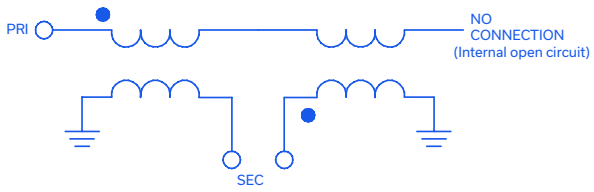
1. Tested on TB-TCW2-133+; Evaluation Board losses have been de-embedded.
2. Relative to 180°.

ABSOLUTE MAXIMUM RATINGS

Parameter	Ratings
Operating Temperature	-55°C to +125°C
Storage Temperature	-55°C to +125°C
RF Power Input[3]	2 W at +25°C

3. Passband rating. Derates linearly to 0.5 W at +125°C.
Permanent damage may occur if any of these limits are exceeded.

CONFIGURATION J



CERAMIC BALUN

RF Transformer

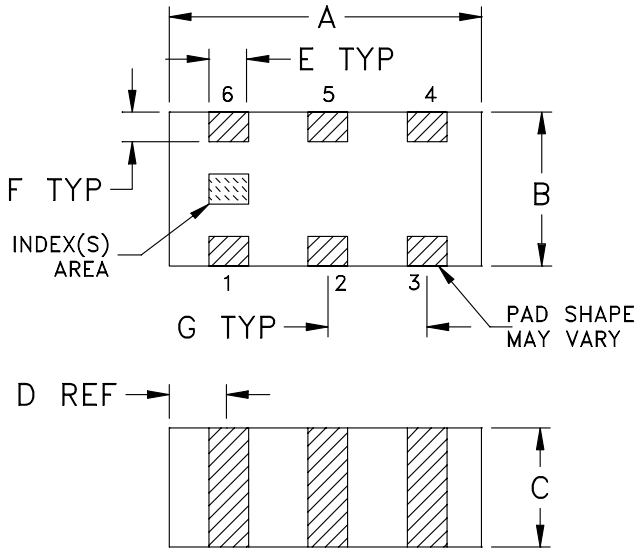
TCW2-133+

50Ω 7 to 13 GHz Ratio 1:2

PAD CONNECTIONS

UNBALANCED PORT (PRI)	1
BALANCED PORT (SEC)	3,4
GROUND	2,5
NO CONNECT	6

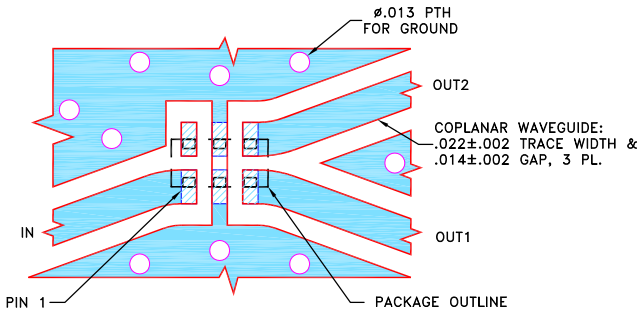
OUTLINE DRAWING



PRODUCT MARKING: TX

DEMO BOARD MCL P/N: TB-TCW2-133+

SUGGESTED PCB LAYOUT (PL-513)



1. TRACE WIDTH AND GAP PARAMETERS ARE 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.

OUTLINE DIMENSIONS (Inches / mm)

A	B	C	D	E	F	G	wt
.063	.031	.024	.012	.008	.006	.020	grams
1.60	0.79	0.61	0.30	0.20	0.15	0.51	0.005

TAPE & REEL INFORMATION: F114

CERAMIC BALUN

RF Transformer

TCW2-133+

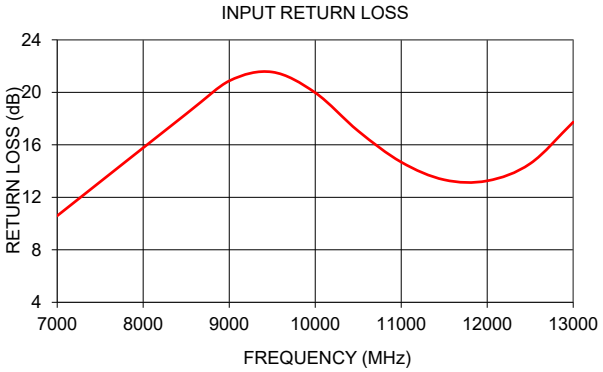
50Ω 7 to 13 GHz Ratio 1:2

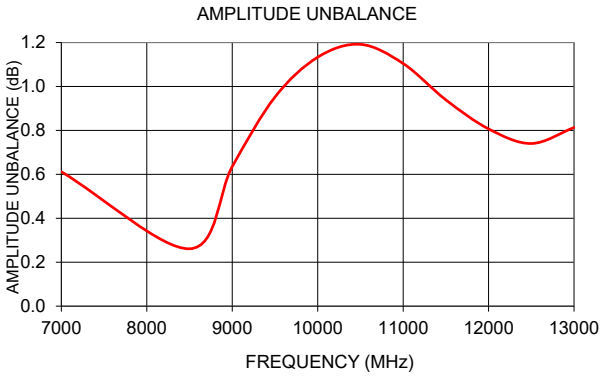
TYPICAL PERFORMANCE DATA

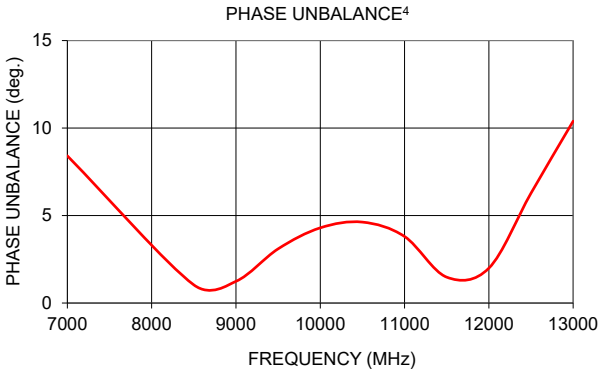
Frequency (MHz)	Insertion Loss (dB)	Return Loss (dB)	Amplitude Unbalance (dB)	Phase Unbalance[4] (deg)
7000	4.05	10.59	0.61	8.41
8500	3.72	18.36	0.26	1.04
9000	3.70	20.87	0.64	1.24
9500	3.73	21.55	0.95	3.10
10000	3.76	19.97	1.13	4.30
10500	3.82	17.05	1.19	4.63
11000	3.89	14.68	1.10	3.80
11500	3.92	13.34	0.94	1.48
12000	3.91	13.26	0.81	1.99
12500	3.84	14.57	0.74	6.28
13000	3.75	17.73	0.81	10.39

4. Relative to 180°.









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/terms/viewterm.html

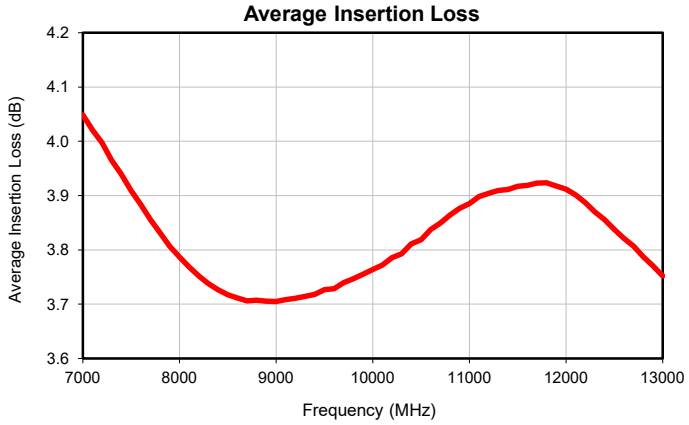
RF Transformer TCW2-133+

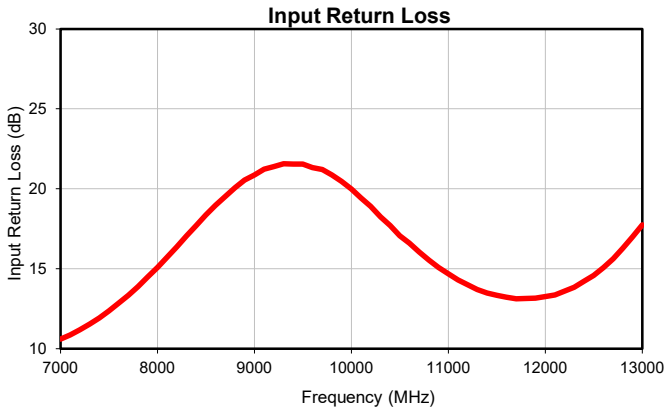
Typical Performance Data

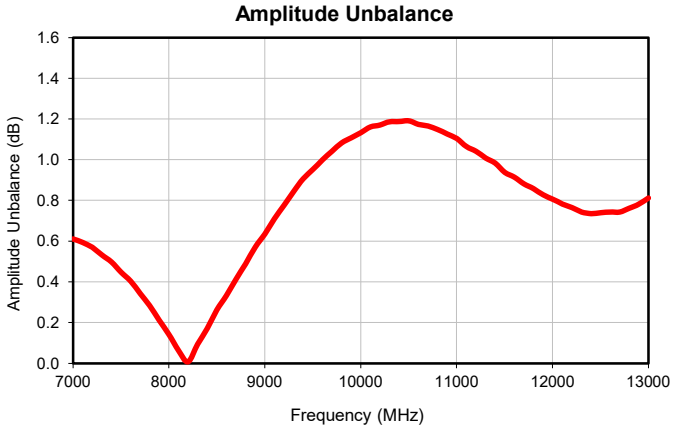
FREQUENCY MHz	AVERAGE INSERTION LOSS (dB)	INPUT RETURN LOSS (dB)	AMPLITUDE UNBALANCE (dB)	PHASE UNBALANCE (deg.)
7000	4.05	10.59	0.61	8.41
7100	4.02	10.85	0.59	7.91
7200	4.00	11.18	0.57	7.43
7300	3.97	11.54	0.53	6.92
7400	3.94	11.92	0.50	6.36
7500	3.91	12.35	0.45	5.87
7600	3.88	12.84	0.40	5.36
7700	3.86	13.34	0.34	4.88
7800	3.83	13.88	0.28	4.36
7900	3.81	14.48	0.21	3.90
8000	3.79	15.08	0.14	3.41
8100	3.77	15.73	0.06	2.97
8200	3.75	16.35	0.01	2.47
8300	3.74	17.06	0.09	1.97
8400	3.73	17.70	0.17	1.51
8500	3.72	18.36	0.26	1.04
8600	3.71	18.96	0.33	0.53
8700	3.71	19.52	0.41	0.11
8800	3.71	20.06	0.49	0.38
8900	3.71	20.54	0.57	0.78
9000	3.70	20.87	0.64	1.24
9100	3.71	21.22	0.71	1.56
9200	3.71	21.38	0.78	2.01
9300	3.71	21.57	0.84	2.37
9400	3.72	21.53	0.91	2.77
9500	3.73	21.55	0.95	3.10
9600	3.73	21.32	1.00	3.39
9700	3.74	21.21	1.04	3.69
9800	3.75	20.86	1.08	3.95
9900	3.75	20.46	1.11	4.17
10000	3.76	19.97	1.13	4.30
10100	3.77	19.42	1.16	4.45
10200	3.79	18.91	1.17	4.56
10300	3.79	18.25	1.19	4.63
10400	3.81	17.70	1.19	4.67
10500	3.82	17.05	1.19	4.63
10600	3.84	16.59	1.17	4.60
10700	3.85	16.03	1.17	4.43
10800	3.86	15.55	1.15	4.30
10900	3.88	15.08	1.13	4.00
11000	3.89	14.68	1.10	3.80
11100	3.90	14.30	1.07	3.37
11200	3.90	13.99	1.04	3.03
11300	3.91	13.70	1.01	2.51
11400	3.91	13.48	0.98	2.03
11500	3.92	13.34	0.94	1.48
11600	3.92	13.21	0.91	0.82
11700	3.92	13.11	0.88	0.15
11800	3.92	13.14	0.86	0.52
11900	3.92	13.15	0.83	1.25
12000	3.91	13.26	0.81	1.99
12100	3.90	13.35	0.78	2.80
12200	3.89	13.59	0.76	3.62
12300	3.87	13.84	0.74	4.52
12400	3.86	14.21	0.74	5.36
12500	3.84	14.57	0.74	6.28
12600	3.82	15.06	0.74	7.11
12700	3.81	15.62	0.74	7.99
12800	3.79	16.29	0.76	8.80
12900	3.77	16.97	0.78	9.64
13000	3.75	17.73	0.81	10.39

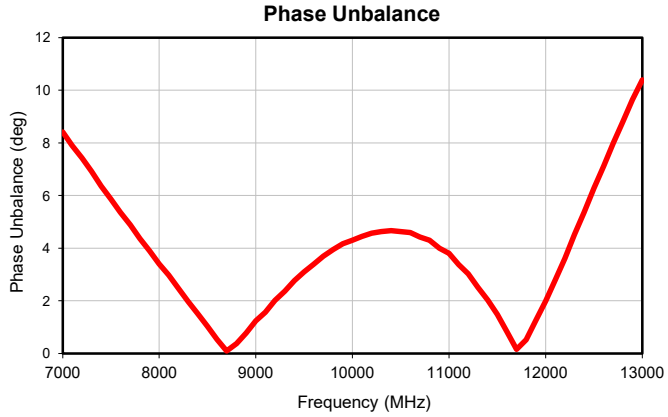
RF Transformer TCW2-133+

Typical Performance Data



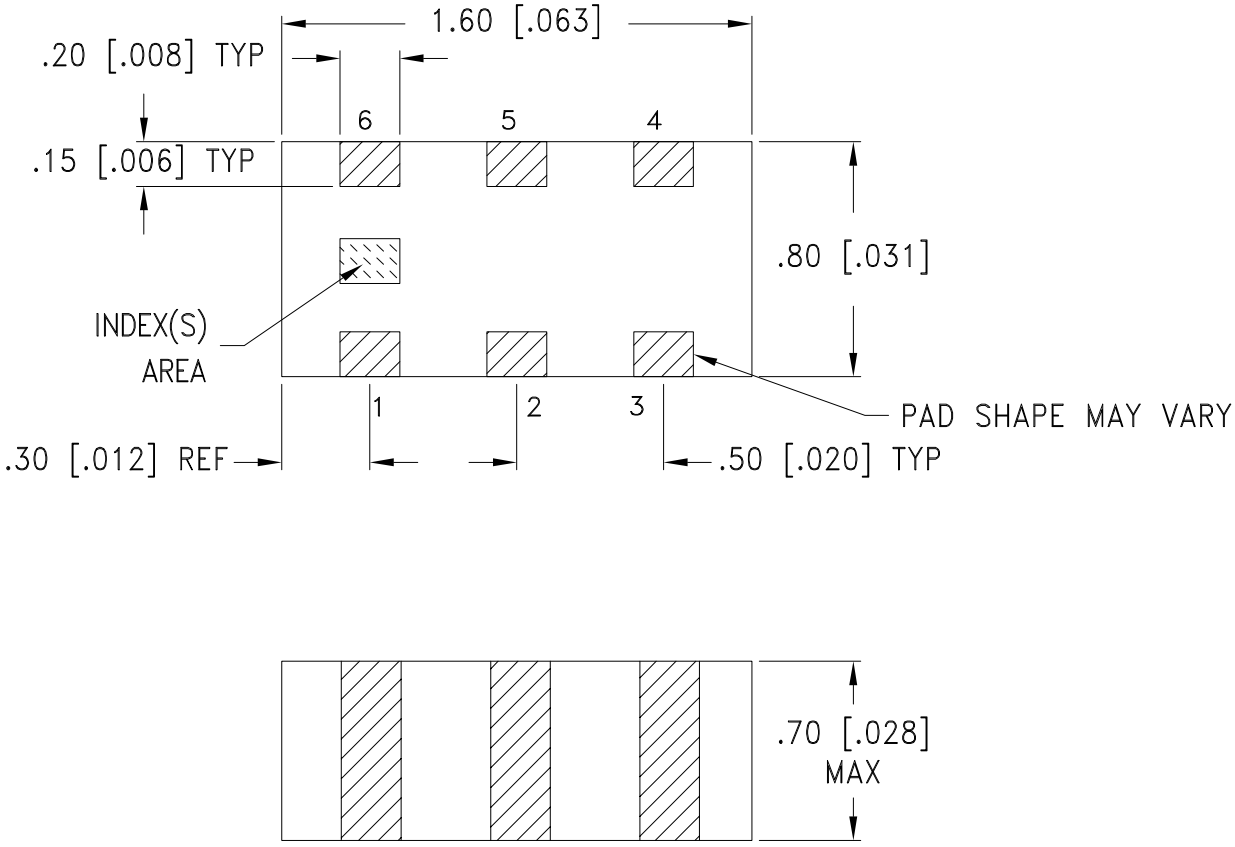






Case Style JC

Outline Dimensions JC0603C



METALLIZATION

Weight: .005 grams

Dimensions are in mm [inch]. Tolerances: ±0.13 mm

Notes:

1. Open style, ceramic base.
2. Termination finish:
   For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.

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RF/IF MICROWAVE COMPONENTS

Tape & Reel Packaging TR-F114

DEVICE ORIENTATION IN T&R

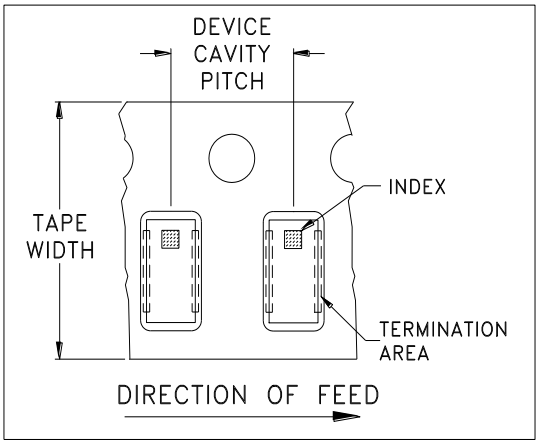


ILLUSTRATION 1

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

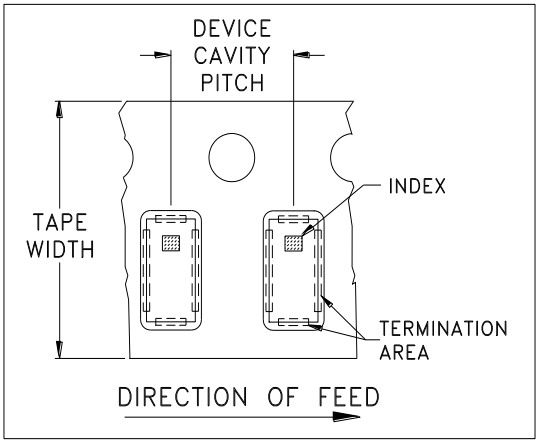


ILLUSTRATION 2

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

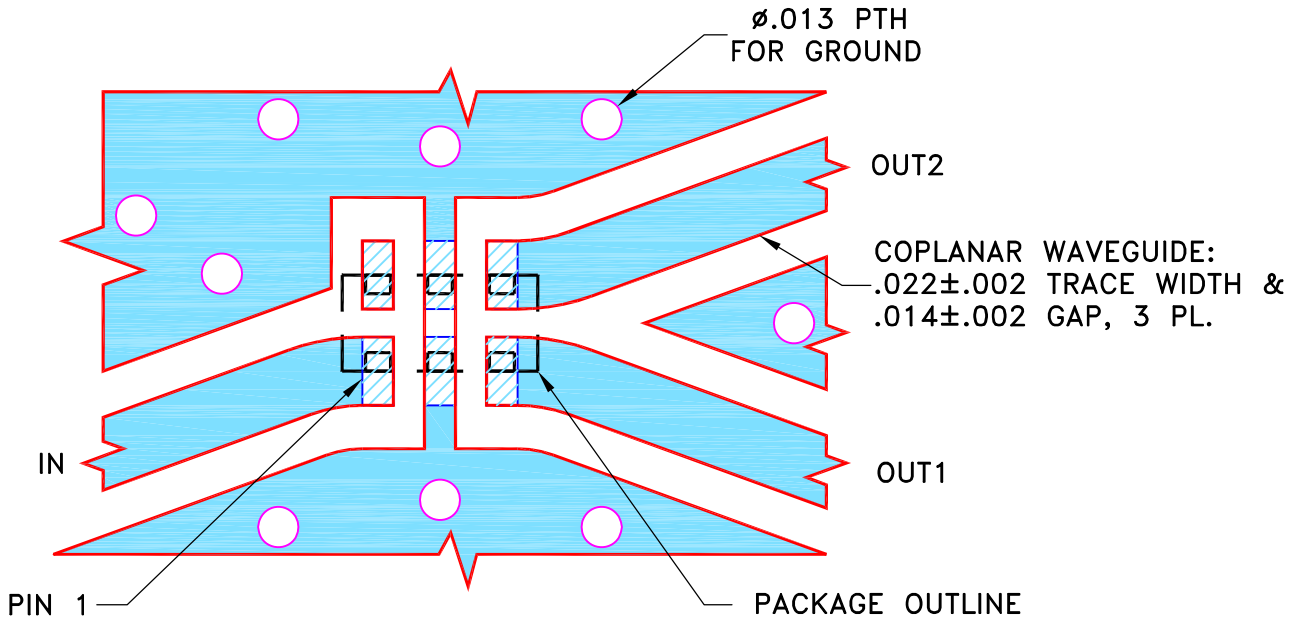
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THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M162337	NEW RELEASE	06/15/17	ITG	AVB

SUGGESTED MOUNTING CONFIGURATION
FOR JC0603C CASE STYLE, "06TR01" PIN CODE



1. TRACE WIDTH AND GAP PARAMETERS ARE 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	ITG	06/14/17
TOLERANCES ON:	CHECKED	GF	06/15/17
2 PL DECIMALS ±	APPROVED	AVB	06/15/17
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

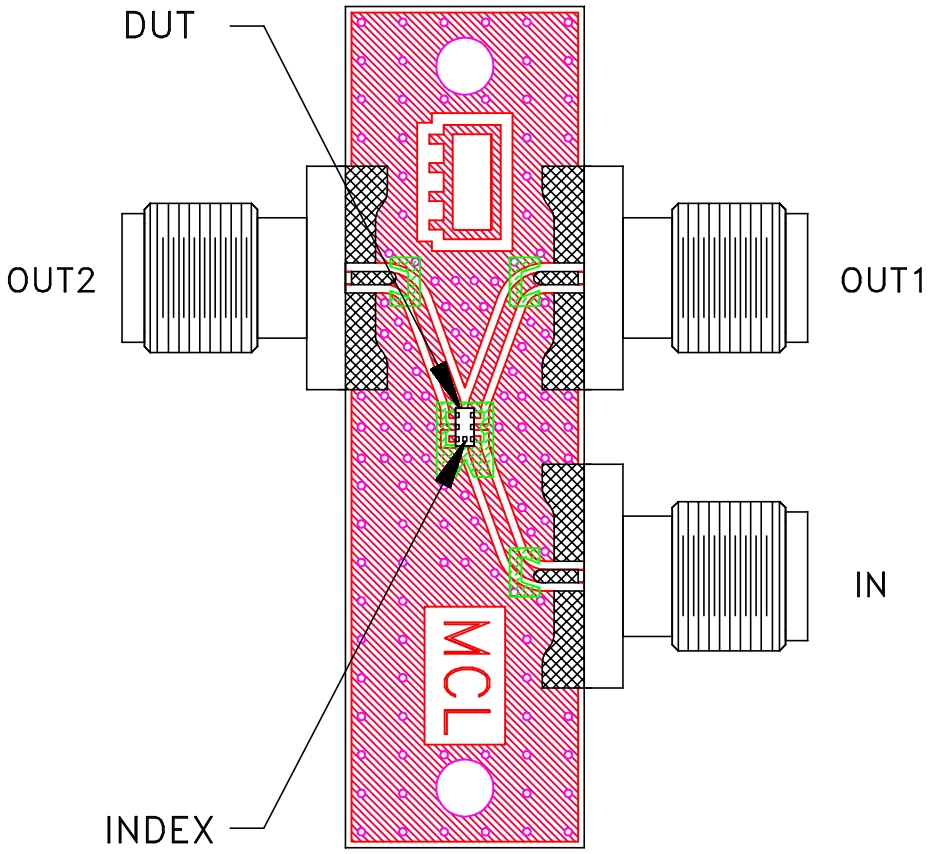
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PL, 06TR01, JC0603C, TB-828+

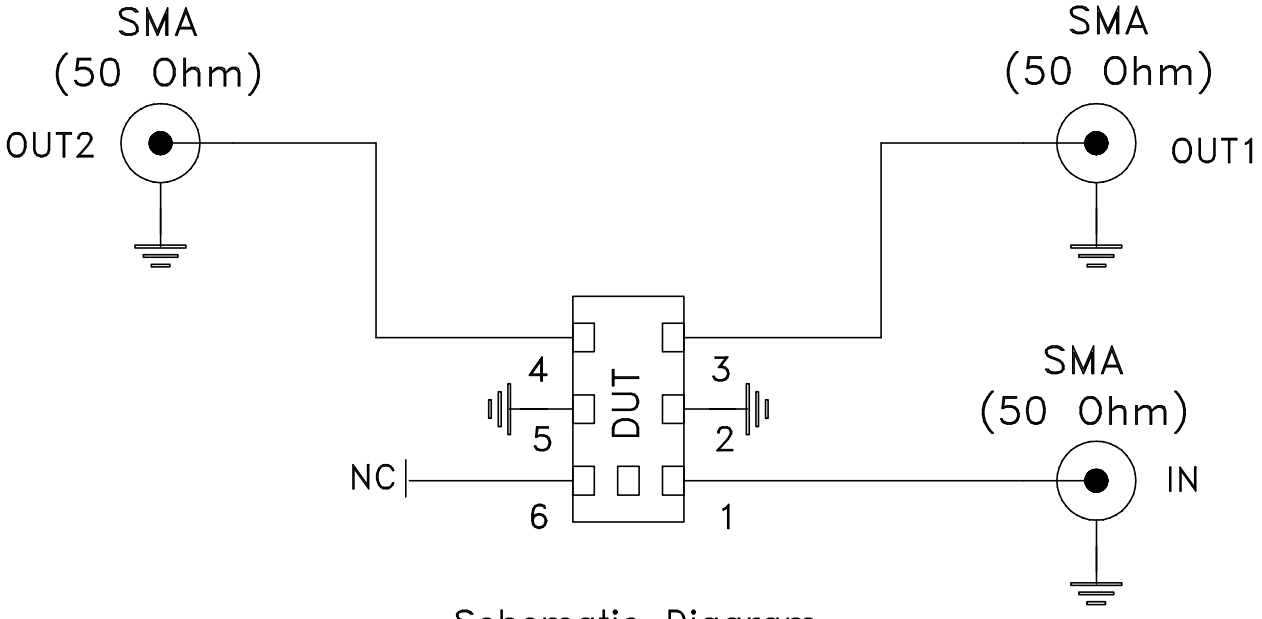
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-513	OR

FILE:	SCALE:	SHEET:
98PL513	16:1	1 OF 1

Evaluation Board and Circuit



TB-828+



Schematic Diagram

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: RO4350 or equivalent,
   Dielectric Constant=3.5, Thickness=.010 inch.

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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: 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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