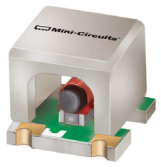
Surface Mount

Bias Tee

TCBT-14+

50Ω Wideband 10 MHz to 10 GHz



CASE STYLE: GU1414

The Big Deal

- Extremely Wideband
- Very high DC current up to 200mA
- Very low insertion loss,<1dB
- Well matched, VSWR1.1:1

Product Overview

TCBT-14+ is the world's smallest footprint wideband Bias-Tee measuring 3.8 mm x 3.8 mm which utilizes a unique design to cover a frequency range of 10 MHz to 10 GHz without resonances that are typically observed over such broad bands. It is designed to handle 1W of RF power and 200 mA current and is suitable for automated pick and place operation.

Key Features

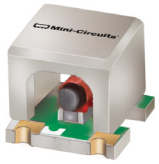
Feature	Advantages
Extremely wideband: 10 MHz to 10 GHz	Broad bandwidth enables biasing of wideband MMIC amplifiers or other active circuits starting at extremely low frequencies through microwave bands.
DC Current, 200 mA	Able to support most Class-A MMIC amplifiers with a P1dB of up to 22 dBm need less than 200 mA.
Low Insertion Loss: 0.2 dB typ. To 3 GHz 0.5 dB typ. to 5 GHz 1.0 dB typ. at 10 GHz	When used at the output of the amplifiers in a typical bias application; the low loss of the TCBT-14+ exhibits minimal impact on gain and over temperature improving reliability.
Excellent matching: 1:1.1 over 0.1- 4 GHz 1.2:1 over entire band	Excellent VSWR of TCBT minimizes interaction effects and resulting gain ripple. Use of TCBT-14+ with Mini-Circuits MMIC amplifiers has shown performance improvements over traditional L-C networks over the entire band.

Surface Mount

Bias-Tee

50Ω Wideband 10 MHz to 10 GHz

TCBT-14+



CASE STYLE: GU1414

+RoHS Compliant

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Available Tape and Reel at no extra cost

Reel Size	Devices/Reel
7"	10, 20, 50,100, 200, 500
13"	1000

Maximum Ratings

Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power	30dBm max.
Voltage at DC port	25V max.
Input Current	200mA

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

Pad Terminations

RF	2
RF&DC	1
DC	3
NOT USED	4

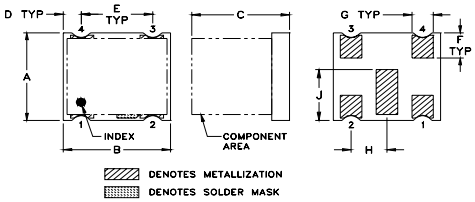
Features

- wideband, 10 to 10000 MHz
- low insertion loss, 0.5 dB typ.
- excellent VSWR, 1.25:1 typ.
- miniature surface mount 0.15"x0.15"
- aqueous washable
- protected by US Patent 8,644,029

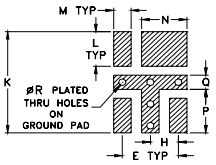
Applications

- biasing amplifiers
- biasing of laser diodes
- biasing of active antennas

Outline Drawing



PCB Land Pattern



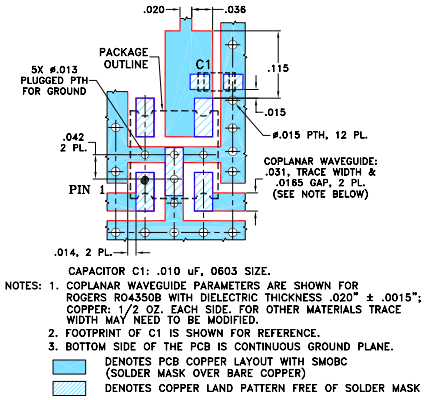
Suggested Layout, Tolerance to be within ±.002

Outline Dimensions (inch / mm)

A	B	C	D	E	F	G	H	J
.150	.150	.14	.025	.100	.043	.030	.050	.087
3.81	3.81	3.56	0.64	2.54	1.09	0.76	1.27	2.21

K	L	M	N	P	Q	R	wt
.193	.066	0.031	.081	.083	.027	0.013	grams
4.90	1.68	0.79	2.06	2.11	0.69	0.33	0.06

Demo Board MCL P/N: TB-510+
Suggested PCB Layout (PL-321)



Bias-Tee Electrical Specifications

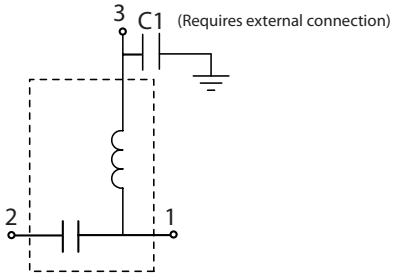
FREQUENCY (MHz)		INSERTION LOSS (dB)						ISOLATION (dB) (RF port to DC port) (RF&DC port to DC port)						VSWR (:1)					
		L		M		U		L		M		U		L		M		U	
f_L	f_U	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Max.	Typ.	Max.	Typ.	Max.
10	10000	0.1	0.5	0.35	0.8	0.8	1.6	55	30	33	18	22	15	1.05	1.3	1.2	1.5	1.3	1.5

L= 10-100 MHz M=100-5000 MHz U=5000-10000 MHz
External C1(0.01µF) is required. See functional schematic and PCB layout.

Typical Performance Data

FREQUENCY (MHz)	INSERTION LOSS (dB) with current		VSWR (:1) with current		ISOLATION (dB) 0mA	
	0mA	200mA	0mA	200mA	RF-DC	RF & DC - DC
10.00	0.11	0.11	1.21	1.21	35.29	34.85
100.00	0.04	0.04	1.02	1.02	67.27	76.84
500.00	0.07	0.07	1.03	1.03	58.28	56.42
1000.00	0.12	0.12	1.05	1.05	51.44	48.45
1450.00	0.13	0.13	1.04	1.04	44.41	42.96
2050.00	0.16	0.16	1.02	1.02	39.31	37.44
2500.00	0.18	0.18	1.03	1.03	35.19	34.15
3100.00	0.21	0.21	1.03	1.03	30.85	29.35
4000.00	0.30	0.30	1.16	1.16	27.39	25.43
5050.00	0.47	0.48	1.08	1.08	25.68	23.02
6100.00	0.66	0.66	1.20	1.20	22.61	19.71
7000.00	0.86	0.85	1.25	1.25	22.68	18.80
8050.00	0.78	0.77	1.11	1.11	20.55	18.49
9100.00	0.70	0.69	1.22	1.21	21.37	18.82
10000.00	0.99	0.97	1.09	1.09	20.70	17.68

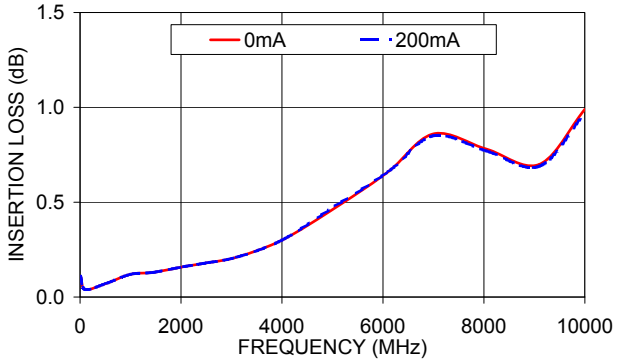
Functional Schematic



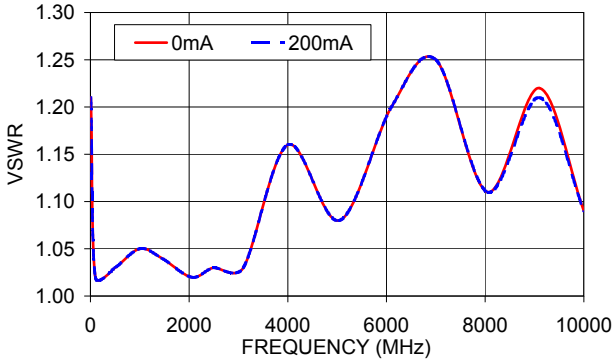
Notes

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

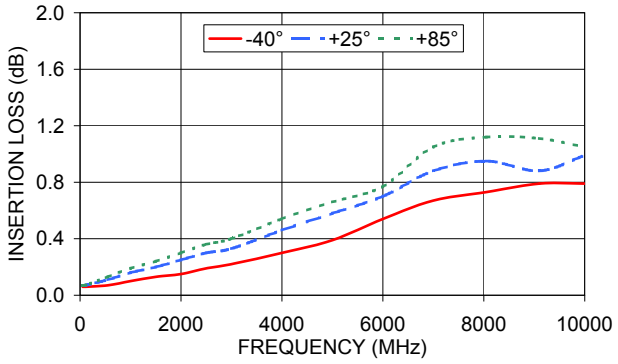
TCBT-14+
INSERTION LOSS vs. CURRENT



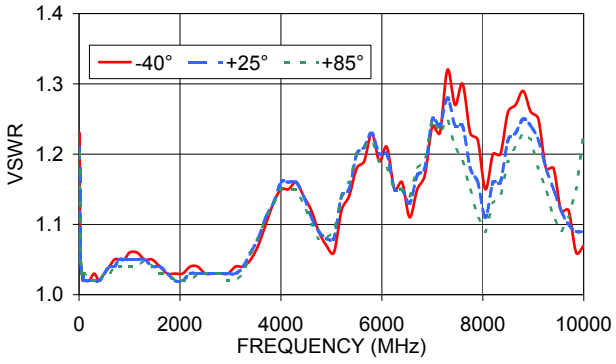
TCBT-14+
VSWR vs. CURRENT



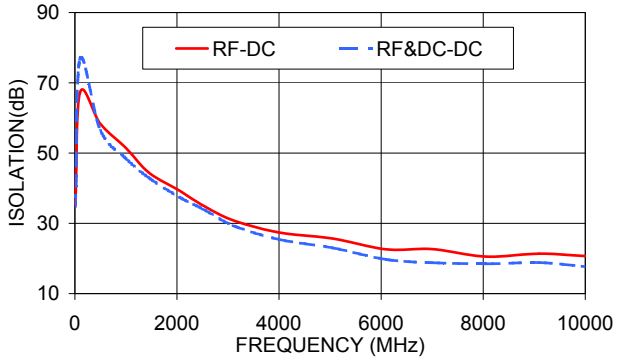
TCBT-14+
INSERTION LOSS vs. TEMPERATURE



TCBT-14+
VSWR vs. TEMPERATURE



TCBT-14+
ISOLATION @ 25°C & 0mA



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Surface Mount

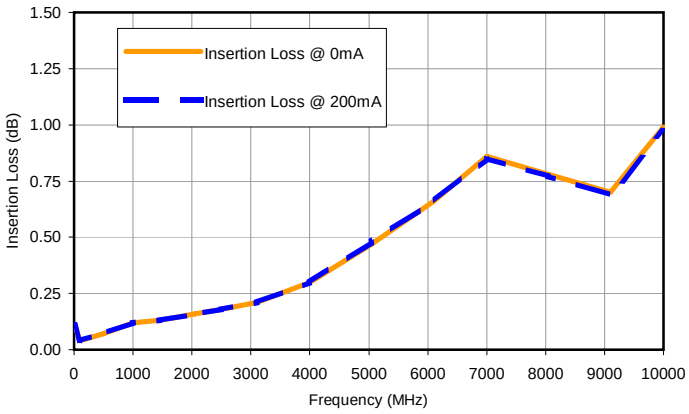
Bias-Tee TCBT-14+

Typical Performance Data

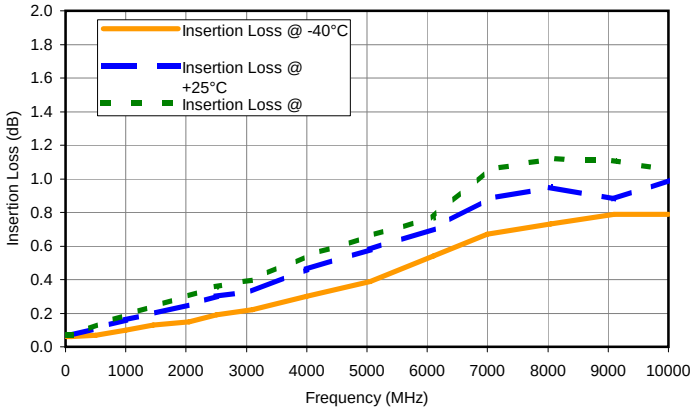
FREQUENCY	INSERTION LOSS (RF port to RF&DC port) (dB)					VSWR (:1)					ISOLATION (RF port to DC port) (RF&DC port to DC port) (dB)	
	+25°C		0mA			+25°C		0mA			+25°C & 0mA	
(MHz)	0mA	200mA	-40°C	+25°C	+85°C	0mA	200mA	-40°C	+25°C	+85°C	RF-DC	RF&DC-DC
10.0	0.11	0.11	0.06	0.07	0.07	1.21	1.21	1.23	1.21	1.20	35.29	34.85
100.0	0.04	0.04	0.06	0.07	0.07	1.02	1.02	1.02	1.02	1.03	67.27	76.84
500.0	0.07	0.07	0.07	0.11	0.13	1.03	1.03	1.03	1.03	1.03	58.28	56.42
1000.0	0.12	0.12	0.10	0.16	0.19	1.05	1.05	1.06	1.05	1.04	51.44	48.45
1450.0	0.13	0.13	0.13	0.20	0.24	1.04	1.04	1.05	1.04	1.04	44.41	42.96
2050.0	0.16	0.16	0.15	0.25	0.30	1.02	1.02	1.03	1.02	1.02	39.31	37.44
2500.0	0.18	0.18	0.19	0.30	0.36	1.03	1.03	1.03	1.03	1.03	35.19	34.15
3100.0	0.21	0.21	0.22	0.33	0.40	1.03	1.03	1.04	1.03	1.02	30.85	29.35
4000.0	0.30	0.30	0.30	0.46	0.54	1.16	1.16	1.15	1.16	1.15	27.39	25.43
5050.0	0.47	0.48	0.39	0.58	0.66	1.08	1.08	1.06	1.08	1.09	25.68	23.02
6100.0	0.66	0.66	0.54	0.70	0.77	1.20	1.20	1.21	1.20	1.18	22.61	19.71
7000.0	0.86	0.85	0.67	0.88	1.05	1.25	1.25	1.24	1.25	1.25	22.68	18.80
8050.0	0.78	0.77	0.73	0.95	1.12	1.11	1.11	1.15	1.11	1.09	20.55	18.49
9100.0	0.70	0.69	0.79	0.88	1.11	1.22	1.21	1.25	1.22	1.18	21.37	18.82
10000.0	0.99	0.97	0.79	0.99	1.05	1.09	1.09	1.07	1.09	1.23	20.70	17.68

Typical Performance Curves

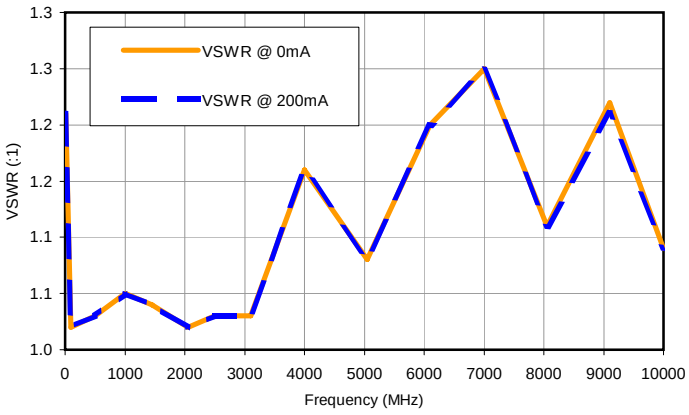
Insertion Loss @ +25°C



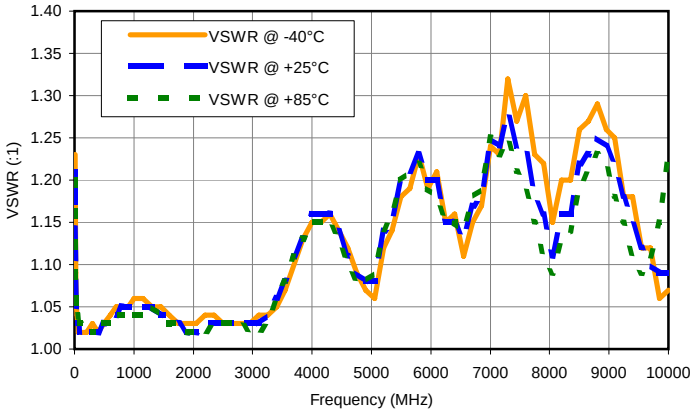
Insertion Loss @ 0mA



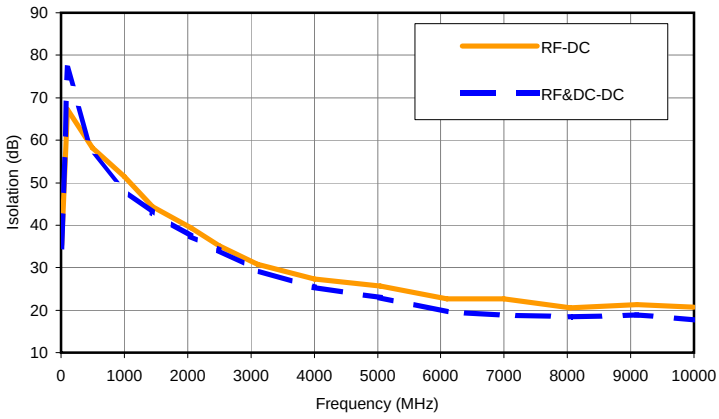
VSWR @ +25°C



VSWR @ 0mA



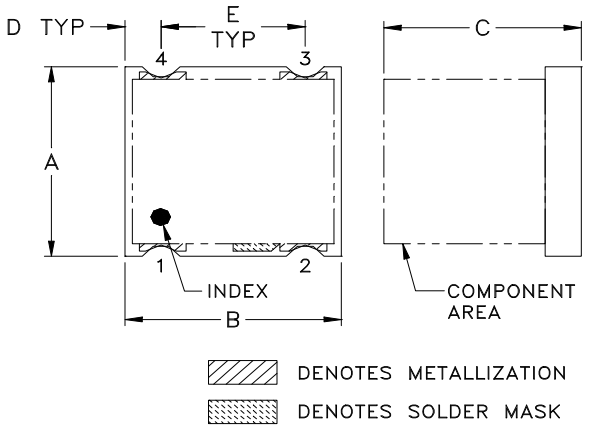
Isolation @ +25°C & 0mA



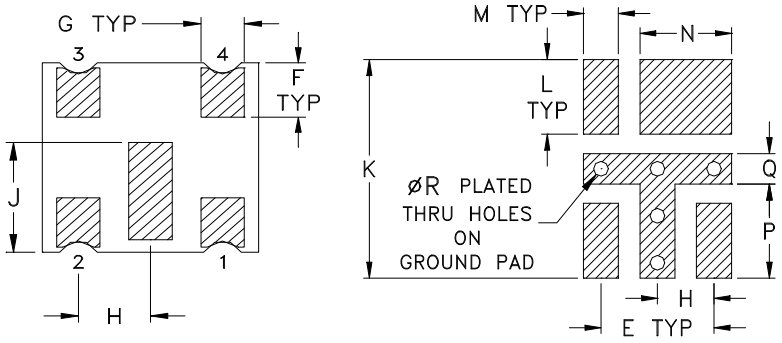
Case Style GU

Outline Dimensions

GU1414



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

CASE #	A	B	C	D	E	F	G	H	J	K	L	M	N
GU1414	.150 (3.81)	.150 (3.81)	.14 (3.56)	.025 (.64)	.100 (2.54)	.043 (1.09)	.030 (.76)	.050 (1.27)	.087 (2.21)	.193 (4.90)	.066 (1.68)	.031 (.79)	.081 (2.06)

CASE #	P	Q	R	WT. GRAMS
GU1414	.083 (2.11)	.027 (.69)	.013 (.33)	.06

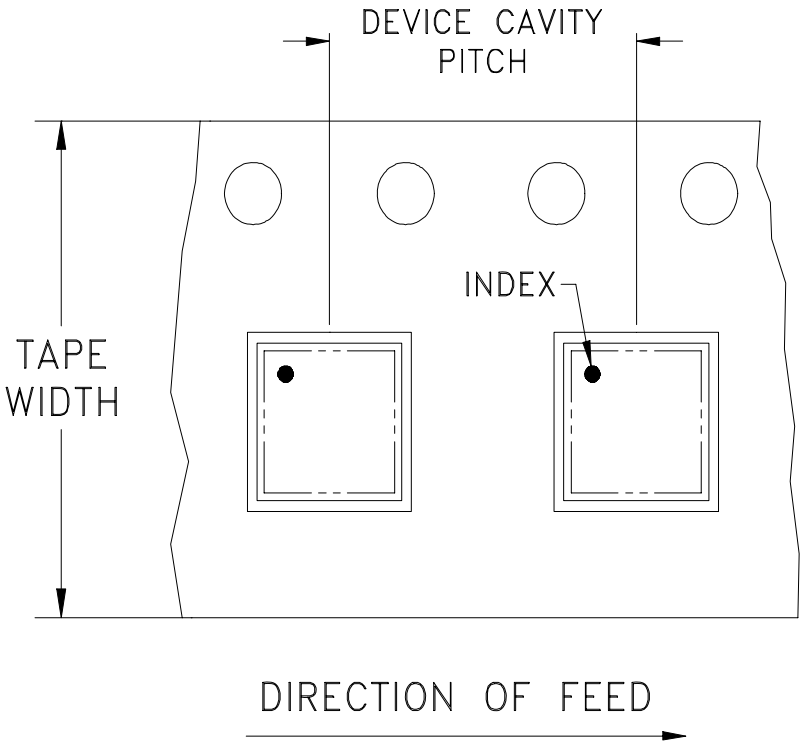
Dimensions are in inches (mm). Tolerances: 2 Pl. ± .01; 3 Pl. ± .005

Notes:

1. Case material: Plastic.
2. Termination finish: 3-5µinch Gold over 120-240 µinch Nickel Plate. All models (+) suffix.

Tape & Reel Packaging TR-F102

DEVICE ORIENTATION IN T&R



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel	
12	8	7	Small quantity standards (see note)	20
				50
				100
				200
				500
		13	Standard	1000

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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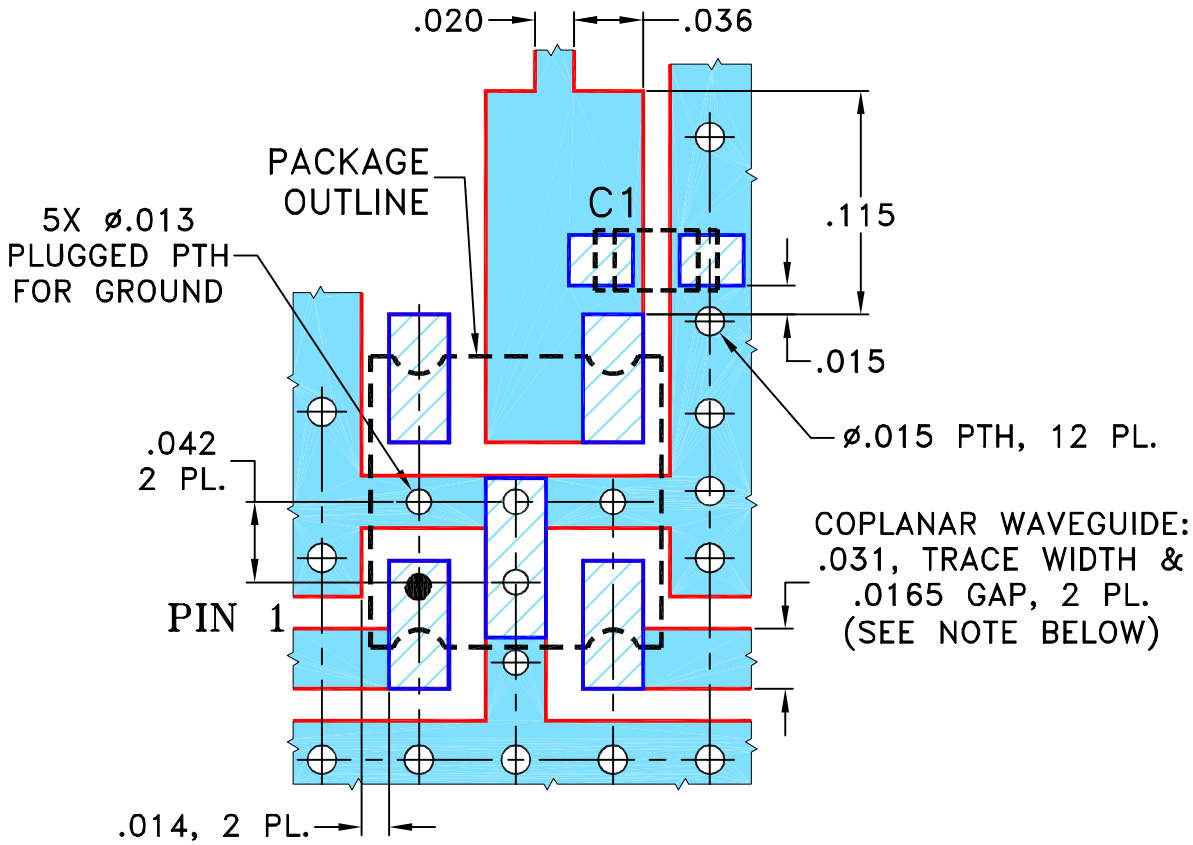
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M125202	NEW RELEASE	01/18/10	MMG	DJ
A	M130676	MODIFIED PATTERN	03/14/11	AV	DJ

SUGGESTED MOUNTING CONFIGURATION FOR GU1414 CASE STYLE, "04BT02" PIN CONNECTION



CAPACITOR C1: .010 uF, 0603 SIZE.

NOTES:
1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .020" ± .0015"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. FOOTPRINT OF C1 IS SHOWN FOR REFERENCE.
3. 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	MMG	12/30/09
TOLERANCES ON:	CHECKED	AV	01/18/10
2 PL DECIMALS ±	APPROVED	DJ	01/18/10
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

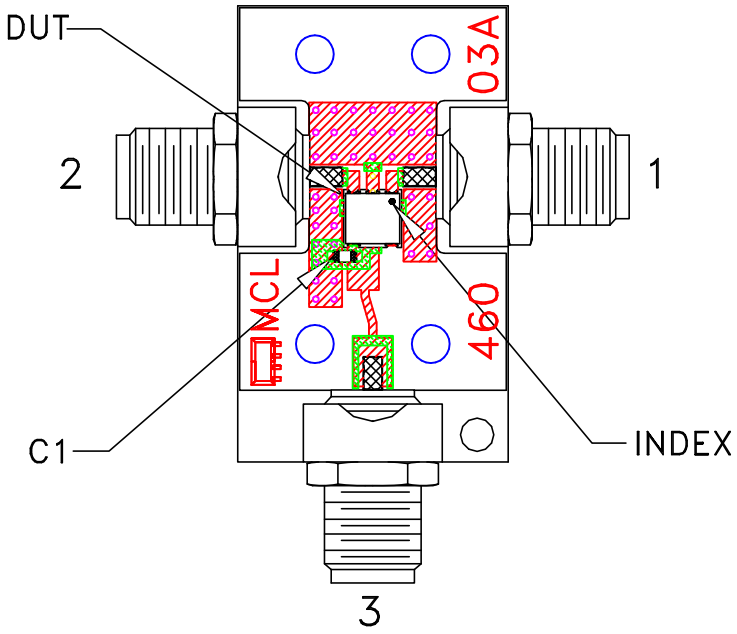
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, 04BT02, GU1414, TB-510+

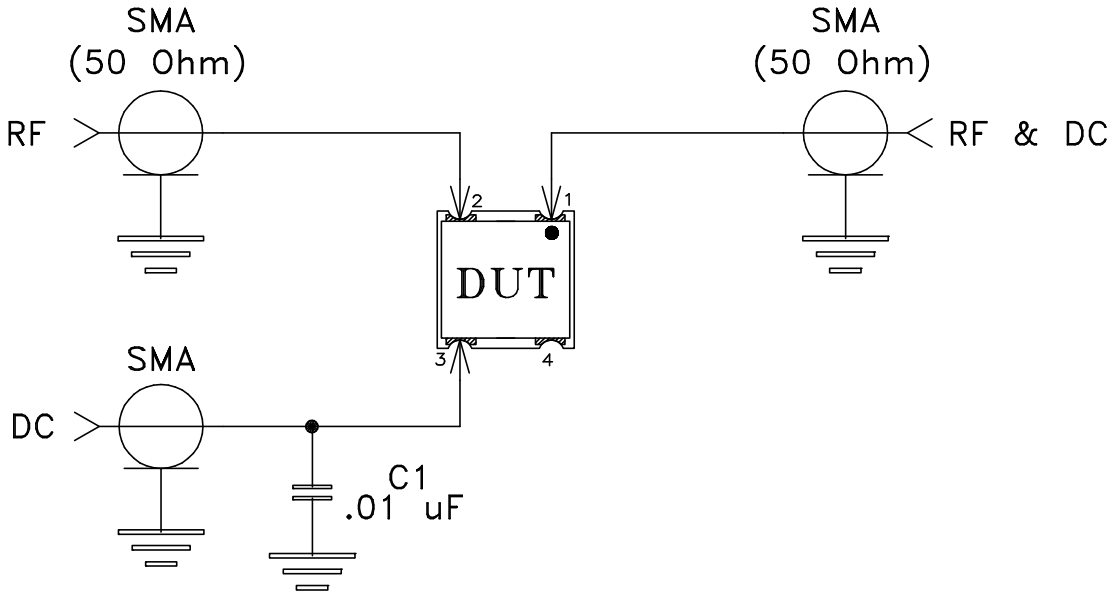
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-321	A

FILE:	SCALE:	SHEET:
98PL321	10:1	1 OF 1

Evaluation Board and Circuit



TB-510+



Schematic Diagram

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: RO4350 or equivalent, Dielectric Constant=3.5, Thickness=.020 inch.

Mini-Circuits®

Mini-Circuits

Environmental Specifications ENV02T1

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	-40° to 85°C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° 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
Thermal Shock	-55° to 100°C, 100 cycles	MIL-STD-202, Method 107, Condition A-3, except +100°C
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, 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
Marking Resistance to Solvents	Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C; distilled water + proylene glycol monomethyl ether + monoethanolamine at 63°C to 70°C	MIL-STD-202, Method 215