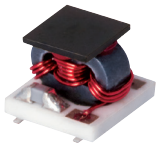
top hat®

Surface Mount Bias-Tee

TCBT-2R5GL+

50Ω Wideband 20 to 2500 MHz



CASE STYLE: GU1840

The Big Deal

- Wideband, 20 to 2500 MHz
- Very low insertion loss, 0.4 dB
- Excellent VSWR, 1.05:1
- Tiny size, 0.15 x 0.15 x 0.14”

Product Overview

Mini-Circuits’ TCBT-2R5GL+ is an ultra-wideband surface-mount bias tee covering applications from 20 to 2500 MHz with low insertion loss, excellent VSWR, and high DC-RF isolation over its entire frequency range. This model is capable of handling up to +30 dBm (1W) RF input power and DC input current up to 200mA. The unit features core and wire construction mounted on a ceramic base (0.15 x 0.15 x 0.14”) with Mini-Circuits Top-Hat feature for faster, more accurate pick and place assembly.

Key Features

Feature	Advantages
Wideband, 20 to 2500 MHz	Supports a wide range of applications with a single device, including biasing broadband amplifiers, laser diodes, active antennas and more.
Low insertion loss, 0.4 dB	Preserves signal strength from input to output and minimizes overall system loss
Excellent VSWR, 1.05:1	Provides excellent matching for 50Ω systems with minimal signal reflection.
RF power handling up to 1W	This model supports applications with a variety of power requirements.
Excellent DC-RF isolation	High DC-RF isolation (44 dB typ. at midband) minimizes RF leakage and interference with other elements in the system.
Miniature size, 0.15 x 0.15 x 0.14”	Small footprint makes the TCBT-2R5GL+ a space-saver in dense PCB-layouts.
Top-Hat feature	Improves speed and accuracy of pick and place assembly.
Leads for excellent solderability.	This model features leads to facilitate soldering on PCB assemblies.

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Surface Mount

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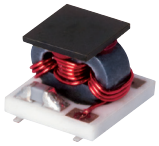


Generic photo used for illustration purposes only

CASE STYLE: GU1840

+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"	20, 50, 100, 200, 500, 1000
13"	2000

Features

- wideband, 20 to 2500 MHz
- low insertion loss, 0.4 dB typ.
- miniature surface mount 0.15"x0.15"
- aqueous washable
- protected by US Patent 7,012,486

Applications

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

Electrical Specifications

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Unit
Frequency Range		20		2500	MHz
Insertion Loss	20-200 200-1250 1250-2500	— — —	0.2 0.35 0.7	0.8 0.8 1.2	dB
Isolation	20-200 200-1250 1250-2500	40 25 20	65 44 40	— — —	dB
VSWR	20-200 200-1250 1250-2500	— — —	1.05 1.05 1.1	1.5 1.2 1.25	:1
DC Resistance, DC to RF and DC port		—	0.2	—	ohms

Maximum Ratings

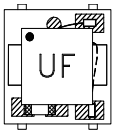
Parameter	Ratings
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power	30 dBm max.
Voltage at DC port	25 V max.
DC Current	200mA

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

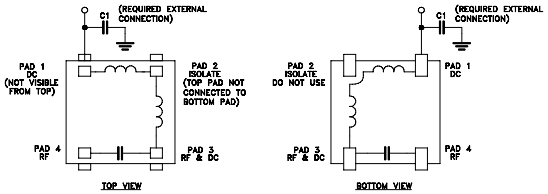
Pad Terminations

Function	Pad Number
RF	4
RF&DC	3
DC	1
ISOLATE (see PCB Layout)	2

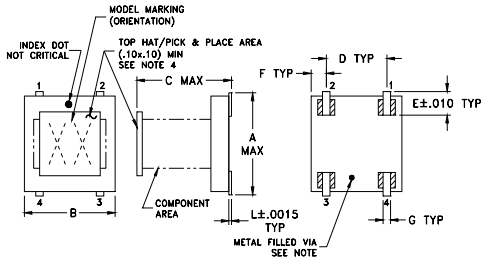
Product Marking



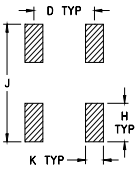
Functional Schematic



Outline Drawing



PCB Land Pattern



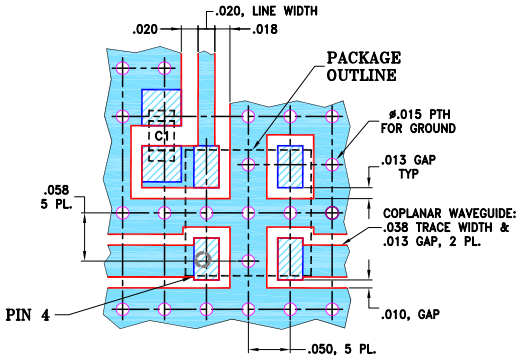
Suggested Layout,
Tolerance to be within ±.002

Outline Dimensions (inch / mm)

A	B	C	D	E	F
.166	.150	.155	.100	.037	.025
4.22	3.81	3.94	2.54	0.94	0.64

G	H	J	K	L	wt
.012	.060	.184	.030	0.004	grams
0.30	1.52	4.67	0.76	0.10	0.10

Demo Board MCL P/N: TB-268
Suggested PCB Layout (PL-146)



CAPACITOR C1: .010 uF, 0603 SIZE

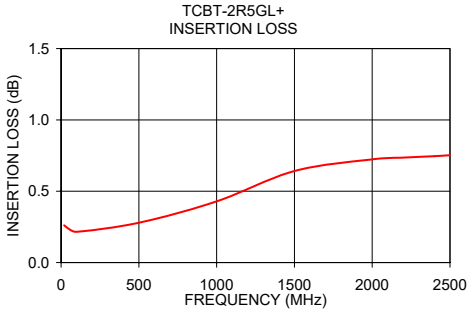
NOTES:
1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.020±0.0015; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

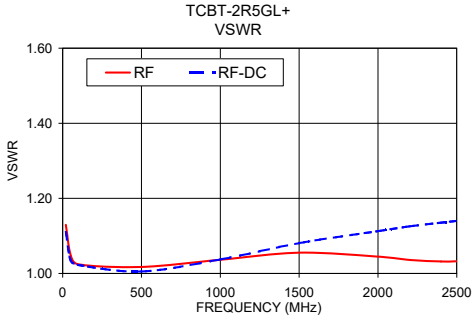
DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).

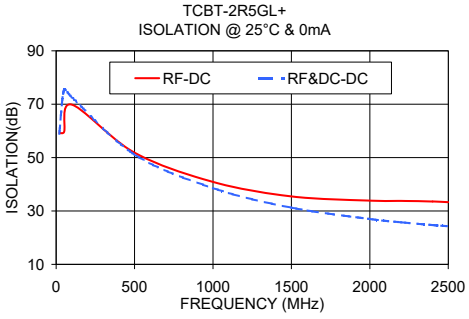
DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

Typical Performance Data

Frequency (MHz)	INSERTION LOSS (dB)	VSWR (:1)		Isolation 0 mA	
		RF	RF&DC	RF-DC	RF&DC-DC
20.00	0.26	1.13	1.11	59.24	58.93
50.00	0.24	1.05	1.04	59.60	75.37
100.00	0.22	1.02	1.02	69.83	72.61
500.00	0.28	1.02	1.01	51.83	51.15
1000.00	0.43	1.04	1.04	40.89	38.59
1500.00	0.64	1.06	1.08	35.46	31.24
2000.00	0.72	1.04	1.11	33.88	26.97
2200.00	0.74	1.04	1.13	33.78	25.75
2400.00	0.75	1.03	1.14	33.55	24.74
2500.00	0.75	1.03	1.14	33.30	24.28







Surface Mount

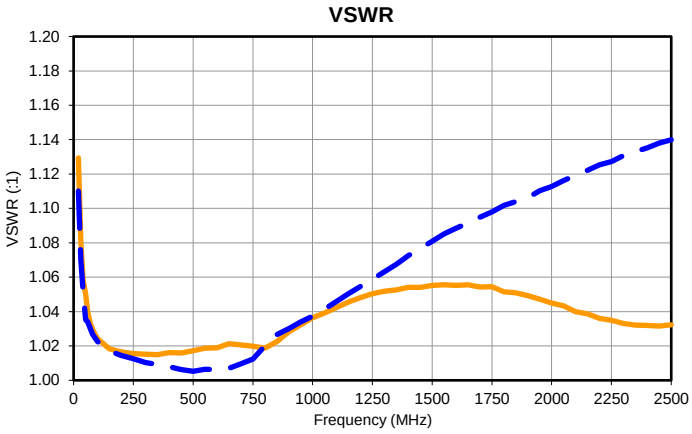
Bias-Tee TCBT-2R5GL+

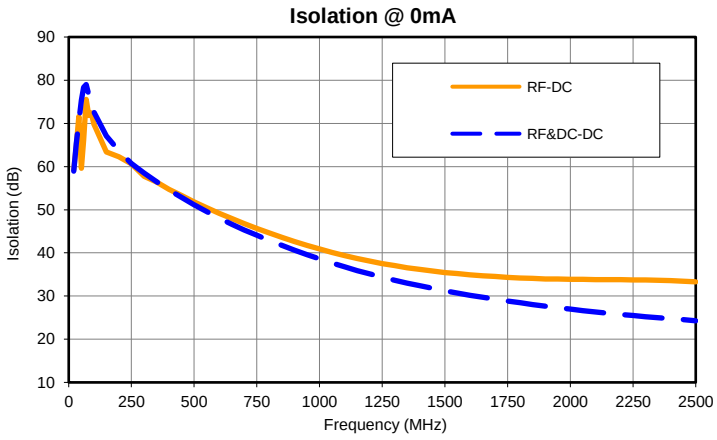
Typical Performance Data

FREQUENCY (MHz)	INSERTION LOSS (dB)	VSWR (:1)		ISOLATION 0mA (dB)	
		RF	RF& DC	RF-DC	RF& DC-DC
20	0.26	1.13	1.11	59.24	58.93
30	0.24	1.08	1.07	64.71	65.30
40	0.23	1.06	1.05	71.63	70.39
50	0.24	1.05	1.04	59.60	75.37
60	0.22	1.04	1.03	66.16	78.33
70	0.22	1.03	1.03	75.55	78.99
80	0.22	1.03	1.03	71.86	76.64
90	0.22	1.03	1.02	72.41	74.82
100	0.22	1.02	1.02	69.83	72.61
150	0.22	1.02	1.02	63.37	67.07
200	0.23	1.02	1.01	62.23	63.67
250	0.24	1.02	1.01	60.64	60.71
300	0.25	1.02	1.01	57.72	58.48
350	0.25	1.01	1.01	56.39	56.47
400	0.26	1.02	1.01	54.74	54.58
450	0.27	1.02	1.01	53.29	52.83
500	0.28	1.02	1.01	51.83	51.15
550	0.29	1.02	1.01	50.47	49.58
600	0.30	1.02	1.01	49.15	48.07
650	0.31	1.02	1.01	47.94	46.66
700	0.33	1.02	1.01	46.79	45.32
750	0.36	1.02	1.01	45.66	44.07
800	0.39	1.02	1.02	44.63	42.85
850	0.39	1.02	1.03	43.62	41.71
900	0.40	1.03	1.03	42.65	40.63
950	0.41	1.03	1.03	41.74	39.58
1000	0.43	1.04	1.04	40.89	38.59
1050	0.45	1.04	1.04	40.10	37.65
1100	0.47	1.04	1.05	39.38	36.76
1150	0.50	1.05	1.05	38.71	35.91
1200	0.52	1.05	1.05	38.10	35.13
1250	0.55	1.05	1.06	37.54	34.37
1300	0.57	1.05	1.06	37.04	33.68
1350	0.59	1.05	1.07	36.57	33.01
1400	0.61	1.05	1.07	36.16	32.39
1450	0.63	1.05	1.08	35.80	31.80
1500	0.64	1.06	1.08	35.46	31.24
1550	0.65	1.06	1.09	35.19	30.71
1600	0.67	1.06	1.09	34.94	30.21
1650	0.68	1.06	1.09	34.70	29.74
1700	0.69	1.05	1.09	34.51	29.29
1750	0.70	1.05	1.10	34.36	28.85
1800	0.70	1.05	1.10	34.21	28.44
1850	0.71	1.05	1.10	34.11	28.05
1900	0.72	1.05	1.11	33.99	27.68
1950	0.72	1.05	1.11	33.93	27.32
2000	0.72	1.04	1.11	33.88	26.97
2050	0.73	1.04	1.12	33.86	26.64
2100	0.73	1.04	1.12	33.84	26.33
2150	0.73	1.04	1.12	33.82	26.04
2200	0.74	1.04	1.13	33.78	25.75
2250	0.74	1.03	1.13	33.75	25.48
2300	0.74	1.03	1.13	33.71	25.23
2350	0.74	1.03	1.13	33.64	24.98
2400	0.75	1.03	1.14	33.55	24.74
2450	0.75	1.03	1.14	33.44	24.51
2500	0.75	1.03	1.14	33.30	24.28

Bias-Tee TCBT-2R5GL+

Typical Performance Curves

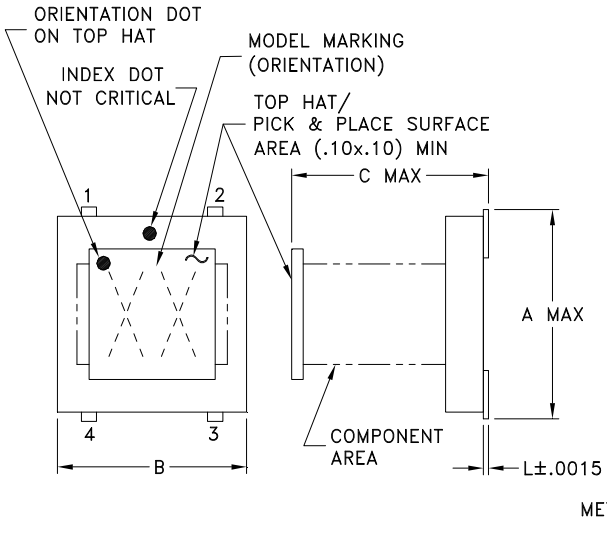


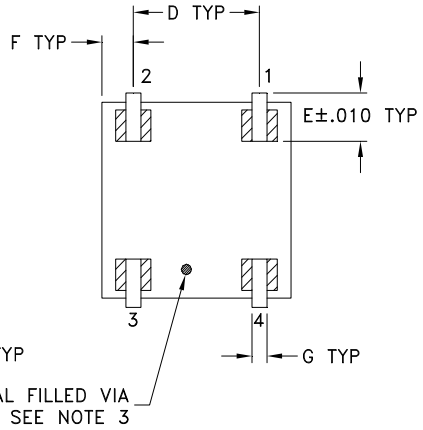


Case Style GU

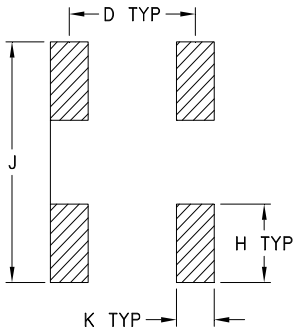
Outline Dimensions

GU1840





PCB Land Pattern



SUGGESTED LAYOUT
TOLERANCE TO BE WITHIN ±.002

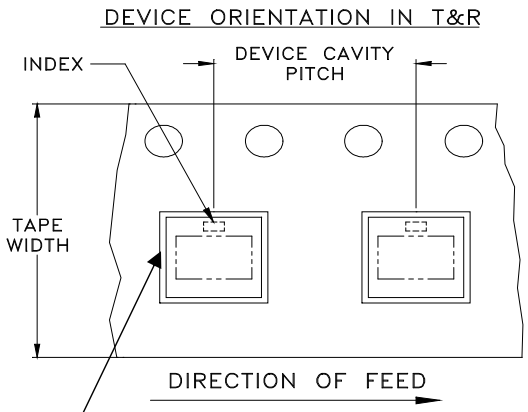
CASE #	A	B	C	D	E	F	G	H	J	K	L	WT.GRAMS
GU1840	.166 (4.22)	.150 (3.81)	.155 (3.94)	.100 (2.54)	.037 (.94)	.025 (.64)	.012 (.30)	.060 (1.52)	.184 (4.67)	.030 (.76)	.004 (0.10)	.10

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

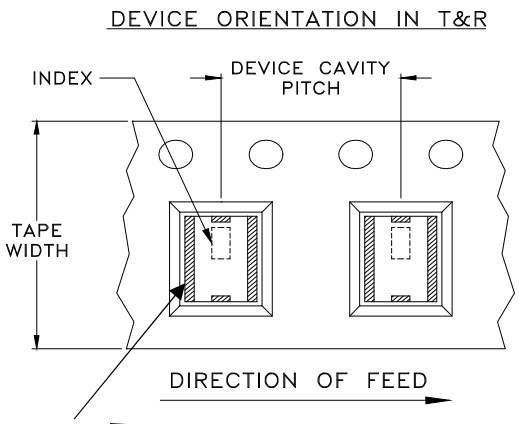
Notes:

1. Open style, Ceramic Base.
2. Termination finish: Palladium Silver.
3. Must be isolated from external conductors on mounting surface. Suggested solder mask area is .025 x .025. At Mini-Circuits option via may be removed.
4. Top-Hat total thickness: .013 inches MAX.
5. Orientation Dot on Top Hat corresponds to Pin #1.

Tape & Reel Packaging TR-F77



Note: The shape of the pocket may differ



Note: The location and shape of the metallization may differ

Applicable Case Styles
GU1604, GU1804, GU2644, TT1618-2

Applicable Case Styles
MZ4532C, NM1812C, NM1812C-1, NM1812C-2, NM1812C-3, NM1812C-5, NM1812C-6, NM3237

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
				1000
		13	Standard	2000

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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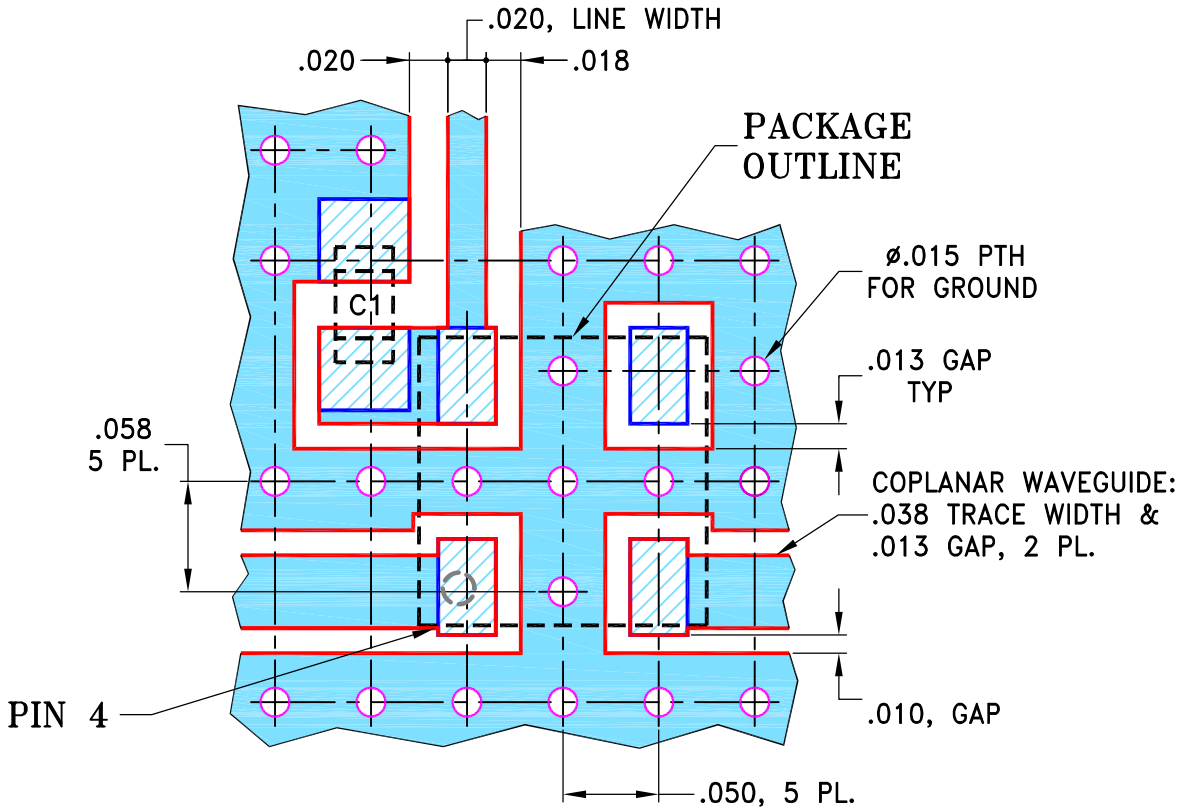
Mini-Circuits ISO 9001 & ISO 14001 Certified

THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
B	M102713	ADDED "...WITH SMOBC"	01/12/06	GF	IL
C	M103775	.010 uF WAS .010 mF	03/01/06	MMG	DJ
D	M154947	CHANGED PIN1 & PIN CONNECTION	02/03/16	ITG	DJ
E	M167305	CHANGED CASE STYLE & PIN CONNECT.	04/18/18	ITG	IG

SUGGESTED MOUNTING CONFIGURATION FOR GU1604 CASE STYLE, "04BT01" PIN CONNECTION



CAPACITOR C1: .010 uF, 0603 SIZE

NOTES:

1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.020±0.0015; 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	AV	10/13/03
TOLERANCES ON:	CHECKED	IL	10/23/03
2 PL DECIMALS ±	APPROVED	DJ	10/23/03
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

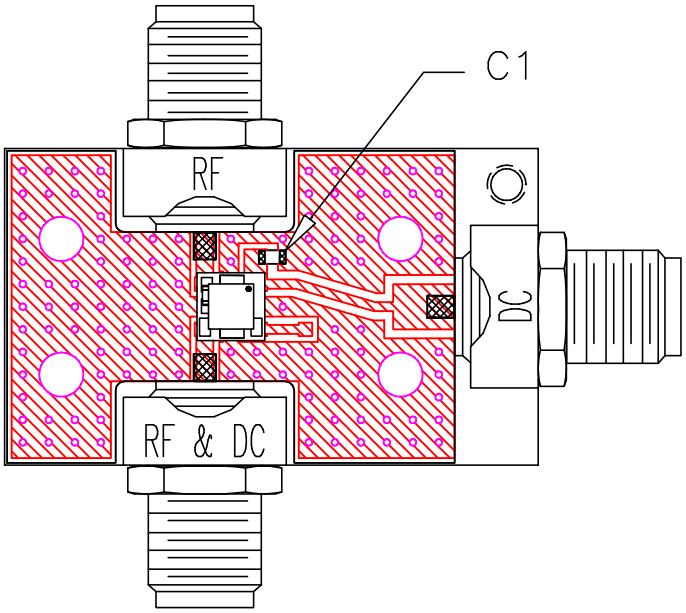
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, 04BT01, GU1604, TCBT, TB-268

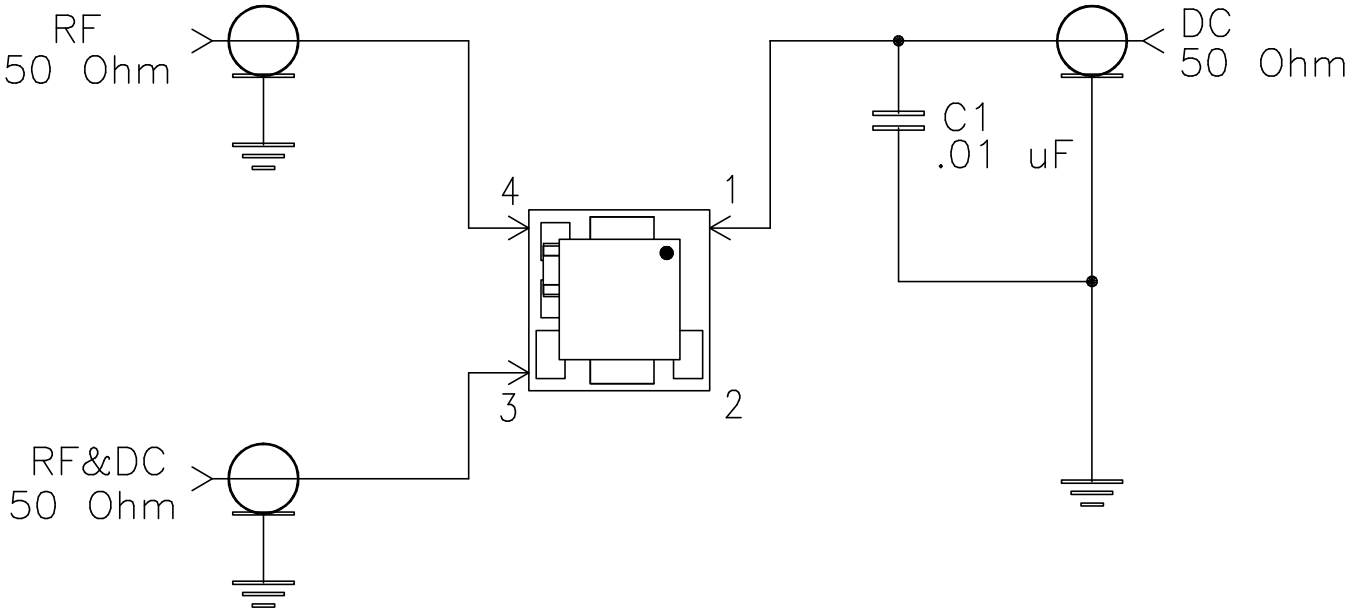
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-146	E

FILE:	SCALE:	SHEET:
98PL146	10:1	1 OF 1

Evaluation Board and Circuit



TB-268



Schematic Diagram

Notes:

1. SMA Female connectors.
2. PCB Material: Rogers 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