SURFACE MOUNT top hat®

RF Transformer

TC1-1T-75X+

75Ω 5 to 120 MHz

THE BIG DEAL

- Supports DOCSIS® 3.1 upstream bandwidth
- Low insertion loss, 0.2 dB
- Good return loss, 28 dB
- Low amplitude / phase unbalance, 0.2 dB / 2°
- Small size, 0.15 x 0.15 x 0.16"

Generic photo used for illustration purposes only

CASE STYLE: AT1521

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

APPLICATIONS

- Impedance matching
- Unbalance to balance transformation
- Cable/CATV and broadband fiber networks

PRODUCT OVERVIEW

TC1-1T-75X+ is a 75Ω surface-mount, DC-isolated transformer with a secondary center tap, covering the 5 to 120 MHz band, supporting upstream bandwidth requirements for DOCSIS® 3.1 systems and equipment. This model provides a 1:1 secondary/primary impedance ratio and is capable of handling up to 0.25W RF input power. It provides 0.2 dB insertion loss, 28 dB return loss, 0.2 dB amplitude unbalance and 2° phase unbalance. Featuring core and wire construction mounted on a 5-lead plastic base with tin over nickel termination finish, the unit measures 0.15 x 0.15 x 0.16" to accommodate dense circuit board layouts. It also incorporates Mini-Circuits' Top Hat® feature for faster, more accurate pick-and-place assembly.

KEY FEATURES

Feature	Advantages
Supports DOCSIS® 3.1 upstream bandwidth requirements	This model is optimized for use over the upstream bandwidth for CATV and broadband fiber networks including DOCSIS® 3.1 systems.
Low insertion loss, 0.2 dB	Provides excellent transmission of signal power from input to output.
Good return loss, 28 dB	Provides excellent matching for 75Ω systems.
Low unbalance: • 0.2dB amplitude unbalance • 2° phase unbalance	Low unbalance improves a system's electromagnetic compatibility by rejecting unwanted common-mode noise.
DC isolation	Provides DC isolation between circuits and efficient AC transmission, eliminating the need for external DC biasing components.
Secondary center tap	Allows DC feed up to 30 mA and DC bias without adding bias tees into the signal chain.
Small footprint (0.15 x 0.15 x 0.16")	Accommodates tight space requirements for dense PCB layouts.
Top Hat® feature	Improves speed and accuracy of pick and place assembly and provides clear device marking for visual inspection.

REV. A
ECO-021735
TC1-1T-75X+
MCL NY
240503

ELECTRICAL SPECIFICATIONS AT +25°C

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Unit
Impedance Ratio			1		Ohm
Frequency Range		5	—	120	MHz
Insertion Loss*	5 - 75	—	0.1	0.4	dB
	75 - 120	—	0.3	0.6	
Amplitude Unbalance	5 - 75	—	0.1	0.2	dB
	75 - 120	—	0.2	0.3	
Phase Unbalance	5 - 75	—	1	4	Degree
	75 - 120	—	3	6	
Return Loss	5 - 20	25	30	—	dB
	20-75	23	28	—	
	75-120	20	25	—	

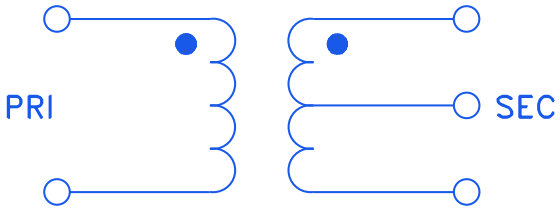
*Insertion Loss is referenced to mid-band loss, 0.25 dB typ.

MAXIMUM RATINGS

Parameter	Ratings
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power	0.25W
DC Current	30mA

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

CONFIGURATION A



SURFACE MOUNT top hat

RF Transformer

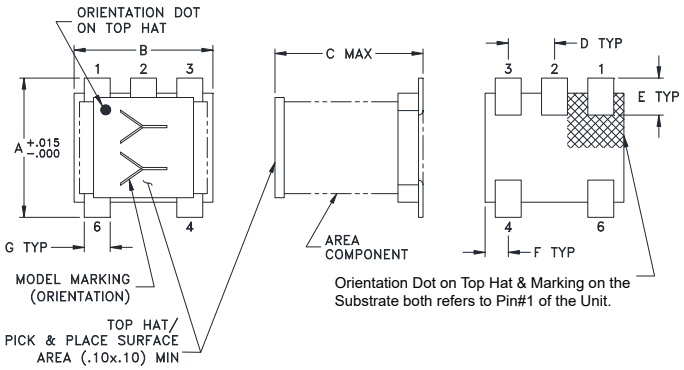
TC1-1T-75X+

75Ω 5 to 120 MHz

PIN CONNECTIONS

PRIMARY DOT	6
PRIMARY	4
SECONDARY DOT	1
SECONDARY	3
SECONDARY CT	2

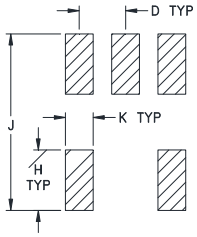
OUTLINE DRAWING



Top-hat total thickness: .013 inches MAX.

PRODUCT MARKING: JD

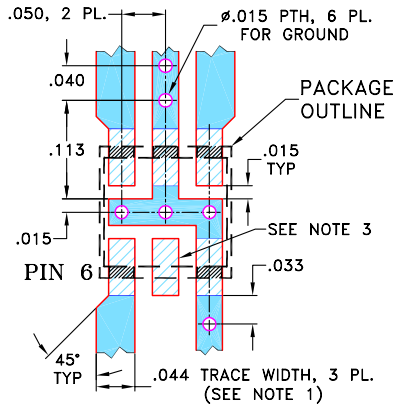
PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

DEMO BOARD MCL P/N: TB-145

SUGGESTED PCB LAYOUT: PL-244



1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .020" ± .0015"; COPPER: 1/2 OZ. ON EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
3. THIS PAD IS NOT REQUIRED FOR AT224 CASE STYLE.

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

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

OUTLINE DIMENSIONS (Inch / mm)

A	B	C	D	E	F	G	H	J	K
.150	.150	.160	.050	.040	.025	.028	.065	.190	.030
3.81	3.81	4.06	1.27	1.02	0.64	0.71	1.65	4.83	0.76

Weight: 0.15 grams

TAPE & REEL INFORMATION: F17

SURFACE MOUNT top hat®

RF Transformer

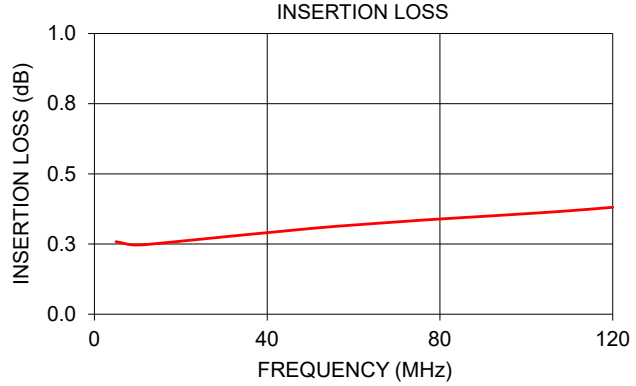
TC1-1T-75X+

75Ω 5 to 120 MHz

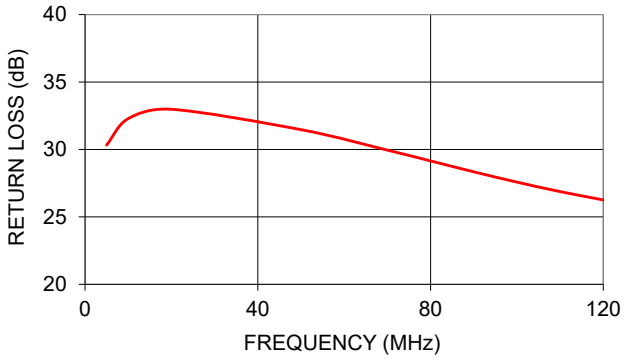
TYPICAL PERFORMANCE DATA AT +25°C

FREQUENCY (MHz)	INSERTION LOSS (dB)	INPUT R. LOSS (dB)	AMPLITUDE UNBALANCE (dB)	PHASE UNBALANCE (Deg.)
5.00	0.26	30.33	0.01	0.20
10.00	0.25	32.29	0.00	0.32
20.00	0.26	32.98	0.00	0.55
50.00	0.31	31.47	0.01	1.18
70.00	0.33	29.95	0.00	1.59
80.00	0.34	29.15	0.00	1.81
90.00	0.35	28.34	0.01	2.03
100.00	0.36	27.58	0.02	2.25
110.00	0.37	26.88	0.02	2.46
120.00	0.38	26.26	0.03	2.68

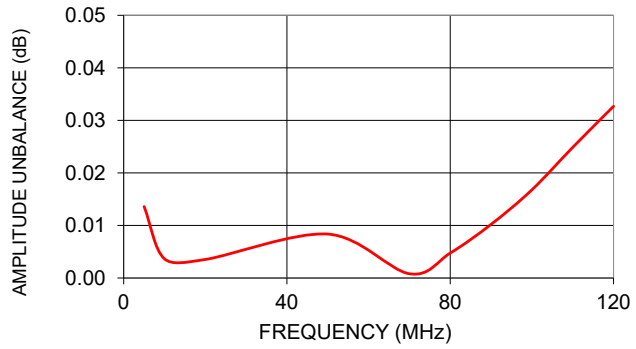
TC1-1T-75X+
INSERTION LOSS



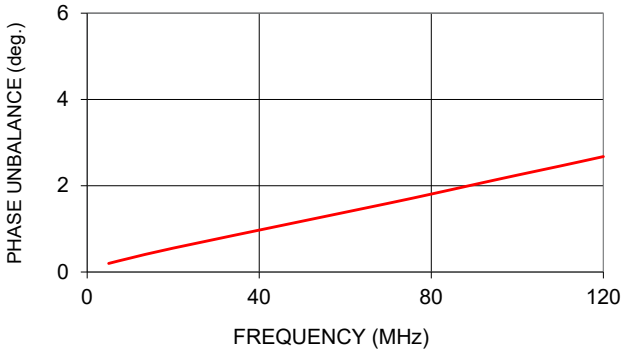
TC1-1T-75X+
INPUT RETURN LOSS



TC1-1T-75X+
AMPLITUDE UNBALANCE



TC1-1T-75X+
PHASE UNBALANCE



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 TC1-1T-75X+

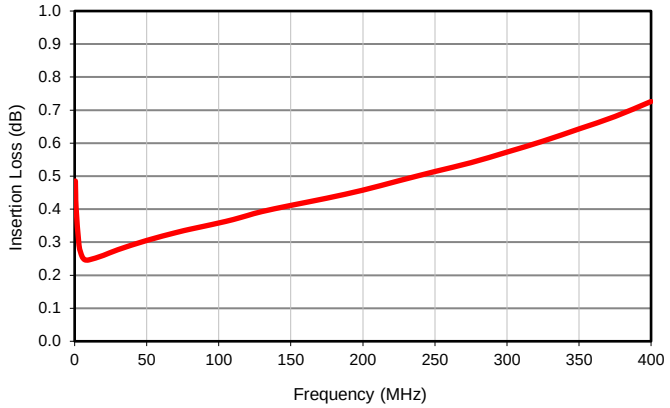
Typical Performance Data

FREQUENCY (MHz)	AVERAGE INSERTION LOSS (dB)	INPUT RETURN LOSS (dB)	AMPLITUDE UNBALANCE (dB)	PHASE UNBALANCE (deg.)
0.5	0.49	20.27	0.03	0.13
0.7	0.44	22.09	0.03	0.13
1.0	0.40	23.78	0.02	0.12
3.0	0.29	28.36	0.02	0.14
5.0	0.26	30.33	0.01	0.20
7.0	0.25	31.41	0.01	0.26
10	0.25	32.29	0.00	0.32
20	0.26	32.98	0.00	0.55
30	0.28	32.70	0.01	0.77
50	0.31	31.47	0.01	1.18
70	0.33	29.95	0.00	1.59
80	0.34	29.15	0.00	1.81
90	0.35	28.34	0.01	2.03
100	0.36	27.58	0.02	2.25
110	0.37	26.88	0.02	2.46
120	0.38	26.26	0.03	2.68
130	0.39	25.71	0.04	2.89
150	0.41	24.77	0.06	3.31
175	0.43	23.67	0.10	3.85
200	0.46	22.60	0.14	4.38
225	0.49	21.70	0.18	4.92
250	0.51	20.90	0.23	5.46
275	0.54	20.09	0.29	6.02
300	0.57	19.32	0.35	6.60
325	0.61	18.68	0.42	7.17
350	0.64	18.09	0.49	7.76
375	0.68	17.45	0.57	8.36
400	0.73	16.86	0.65	8.96

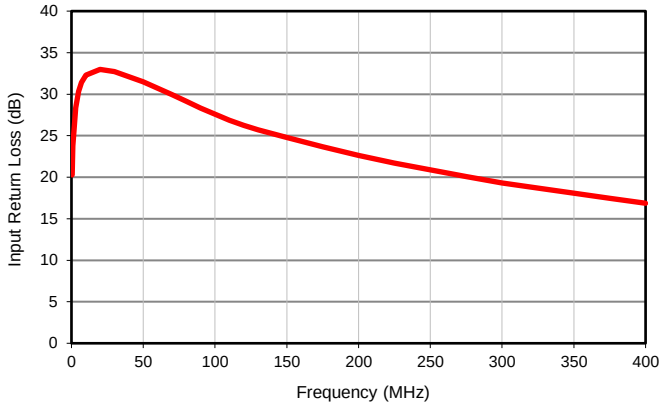
RF Transformer TC1-1T-75X+

Typical Performance Data

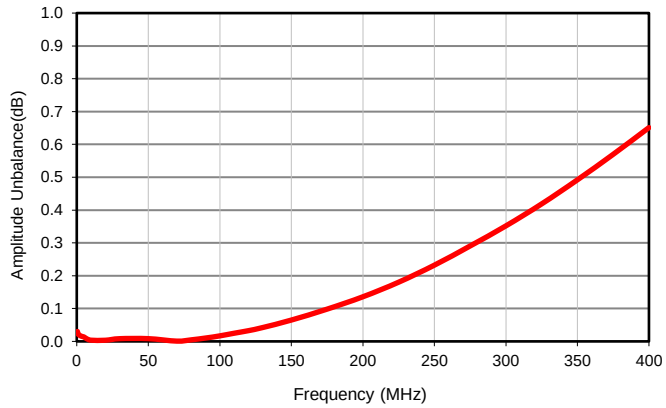
Average Insertion Loss



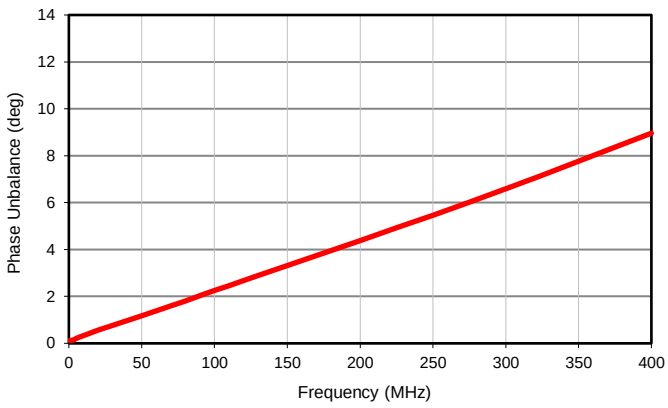
Input Return Loss



Amplitude Unbalance



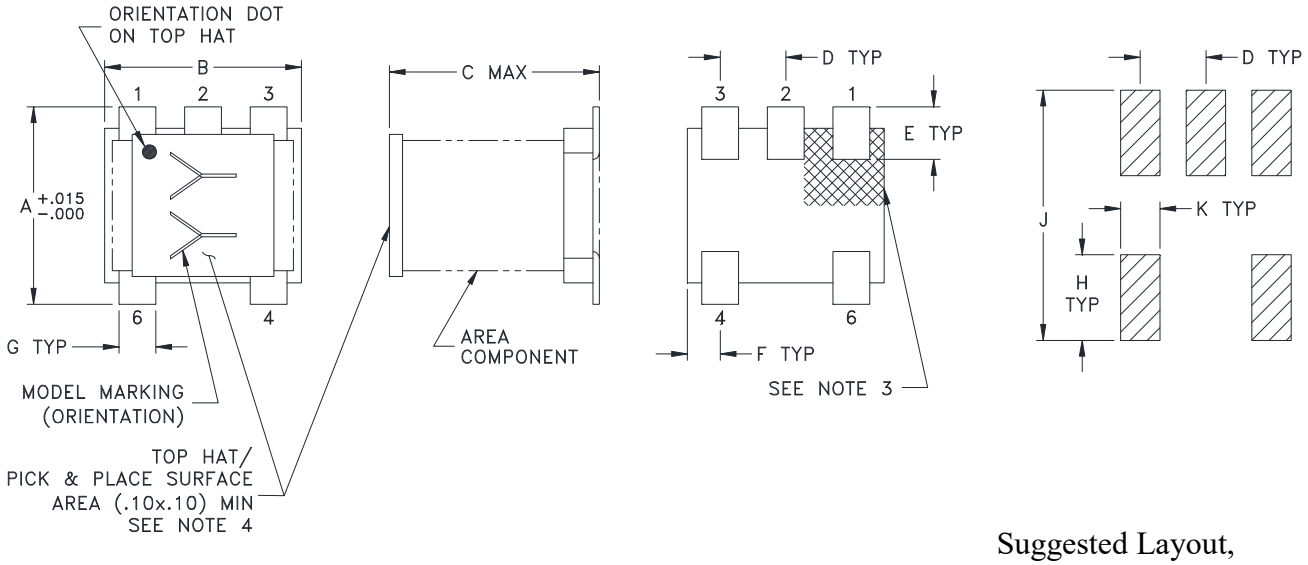
Phase Unbalance



Case Style AT

Outline Dimensions

AT1521



PCB Land Pattern

Suggested Layout,
Tolerance to be within ±.002

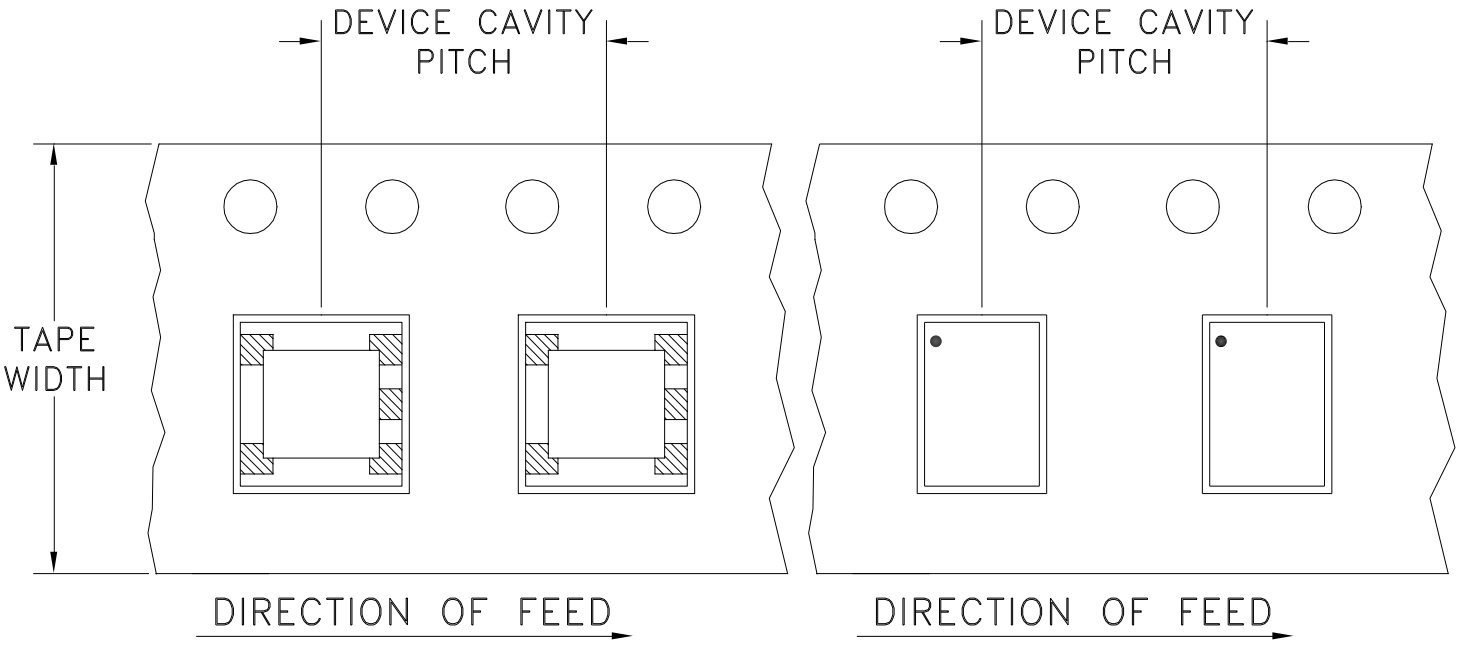
CASE #	A	B	C	D	E	F	G	H	J	K	WT. GRAMS
AT1521	.150 (3.81)	.150 (3.81)	.160 (4.06)	.050 (1.27)	.040 (1.02)	.025 (.64)	.028 (.71)	.065 (1.65)	.190 (4.83)	.030 (.76)	.15

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

Notes:
1. Case material: Plastic.
2. Termination finish:
   For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.
3. Orientation Dot on Top Hat & Marking on the Substrate both refers to Pin #1 of the Unit.
4. Top-Hat total thickness: .013 inches MAX.

Tape & Reel Packaging TR-F17

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
				2000

Note: Please Consult individual model data sheet to determine device per reel availability.

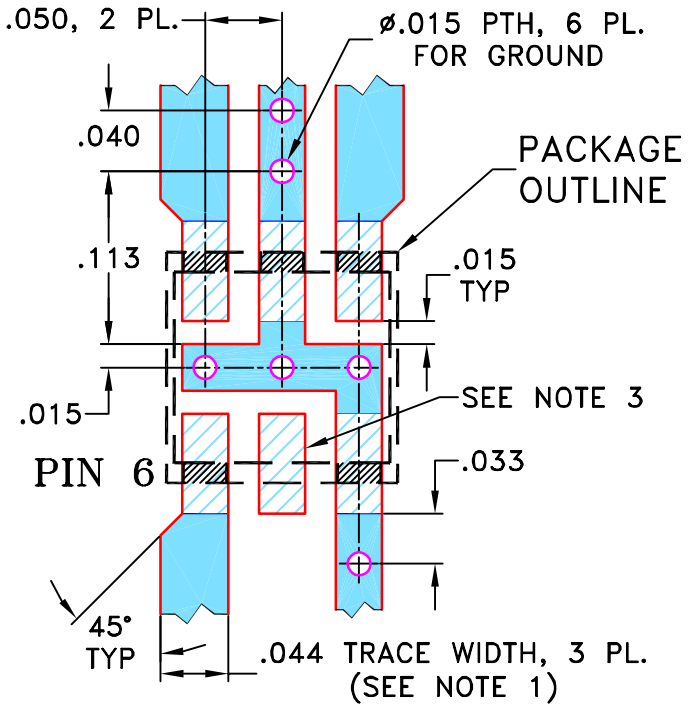
Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: www.minicircuits.com/pages/pdfs/tape.pdf

THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M106563	NEW RELEASE	08/23/06	AV	IG

SUGGESTED MOUNTING CONFIGURATION FOR AT224/DB714 CASE STYLE, "gs/ha/hd" PIN CONNECTIONS (FOR SINGLE ENDED TO BALANCED APPLICATION)



NOTES:
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2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
3. THIS PAD IS NOT REQUIRED FOR AT224 CASE STYLE.

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	07/28/06
TOLERANCES ON:	CHECKED	IL	08/23/06
2 PL DECIMALS ±	APPROVED	IG	08/23/06
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

Mini-Circuits®
13 Neptune Avenue
Brooklyn NY 11235

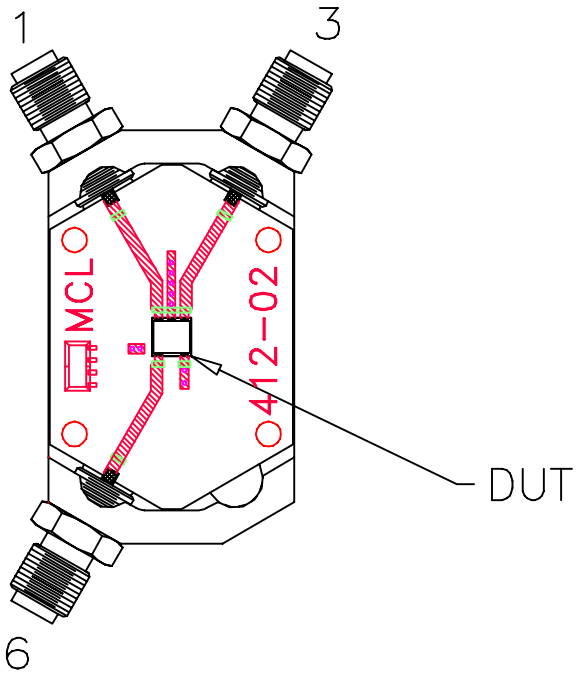
PL, gs/ha/hd, AT224/DB714, TC/TCM, TB-145

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-244	OR

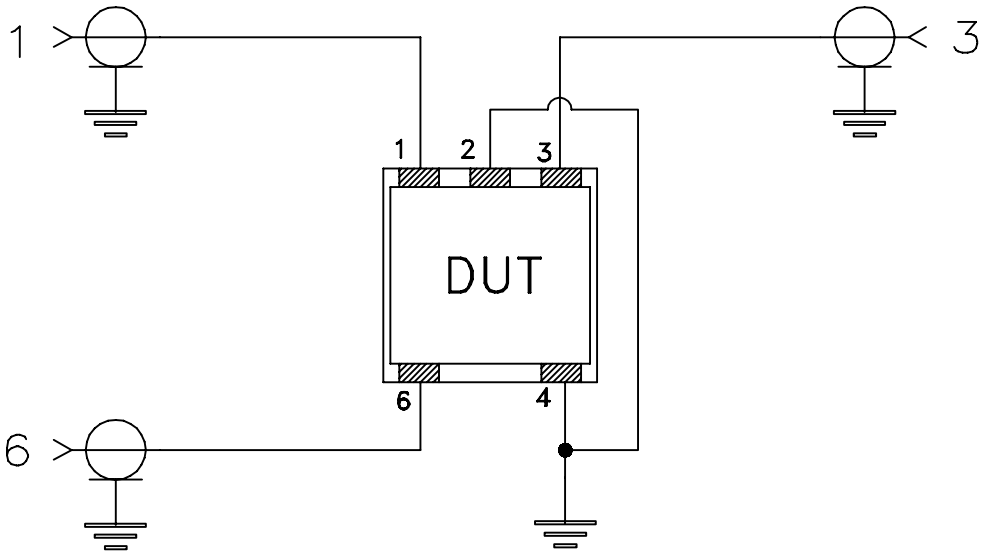
FILE:	SCALE:	SHEET:
98PL244	8:1	1 OF 1

Evaluation Board and Circuit

For Pin Connections refer to Data Sheet of the DUT



TB-145



Schematic Diagram

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: Rogers RO4350B or its equivalent, Dielectric Constant=3.5, Thickness=.020"

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