Limiter

RLM-33+

50Ω Broadband 30 to 3000 MHz

The Big Deal

- Wide Frequency range 30 to 3000 MHz
- Excellent limiting beyond +12 dBm input power
- Very quick recovery time, 10 nsec
- Low insertion loss, 0.23 dB

CASE STYLE: TT1224

Product Overview

The RLM-33+ is packaged in a miniature size (0.25 X 0.3 in.) and protects against ESD and input power surges over a frequency range 30 to 3000 MHz. Construction is on a micro strip low loss dielectric material and cased into Mini-Circuits high volume, low cost “R” package for cost efficiencies.

The RLM-33+ limiter provides excellent protection of low noise amplifiers in hostile environments where unwanted signals prevail such as in manufacturing sites, train tunnels, etc.

Key Features

Feature	Advantages
Limiting abilities from +12 to +30 dBm	Protects against strong undesired signals and prevents burn out of amplifiers
Frequency coverage 30 to 3000 MHz	Protects against many different types of unwanted signals including ESD
Surface mount package, miniature size	Allows convenient placement in amplifiers incorporating this protective device
Low insertion loss and VSWR	Provides minimal degradation to amplifier performance, especially for low noise amplifiers where input loss is critical
Low Cost	A practical solution to incorporate into amplifier design with a minimal affect on cost

+12 to +30 dBm

Limiter

RLM-33+

50Ω Broadband 30 to 3000 MHz

Generic photo used for illustration purposes only

CASE STYLE: TT1224

+RoHS Compliant

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

Maximum Ratings

Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Input Power	2W

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

Pin Connections

INPUT	1
OUTPUT	4
GROUND	2,3,5,6

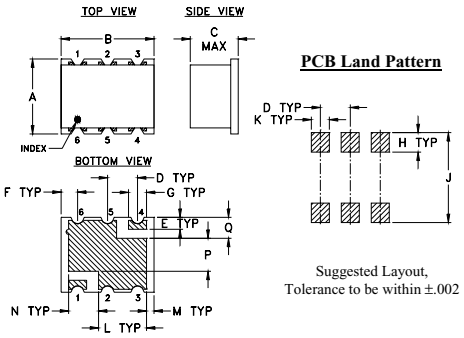
Features

- wideband, 30 to 3000 MHz
- low insertion loss 0.23 dB typ.
- fast recovery time, 10nsec typ.
- excellent VSWR 1.05:1 typ.
- low output power, 11.5 dBm typ.

Applications

- military, hi-rel applications
- stabilizing generator outputs
- reducing amplitude variations
- protects low noise amplifiers and other devices from ESD or input power damage

Outline Drawing



Outline Dimensions (inch / mm)

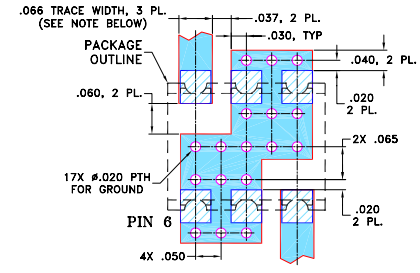
A	B	C	D	E	F	G	H
.25	.31	.16	.100	.040	.055	.060	.065
6.35	7.87	4.06	2.54	1.02	1.40	1.52	1.65

J	K	L	M	N	P	Q	wt.
.300	.060	.160	.025	.100	.110	.070	grams
7.62	1.52	4.06	0.64	2.54	2.79	1.78	0.16

Electrical Specifications

Parameter	Condition	Min.	Typ.	Max.	Units
Frequency Range		30		3000	MHz
Linear Range					
Max Input Power	less than 0.1 dB compression	—	—	5	dBm
Insertion Loss	less than +5 dBm input power	—	0.23	0.7	dB
VSWR	less than +5 dBm input power	—	1.05	1.5	:1
Limiting Range					
Input Power	>1dB compression filtered signal frequency	+12	—	+30	dBm
Output Power		—	+11.5	—	dBm
Δ Output/ Δ 1dB Input	Input Power Range (dBm)				
	12 to 20	—	0.2	—	dB/dB
	20 to 25	—	0.2	—	
	25 to 30	—	0.2	—	
Recovery Time	1 watt pulse 50 µsec pw 1kHz duty cycle recovery to within 90% of final value.	—	10	—	nsec
Response Time	-30 to +30 dBm input 50 µsec PW 1 kHz duty cycle	—	2	—	nsec

Demo Board MCL P/N: TB-393
Suggested PCB Layout (PL-258)



NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030" ± .002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH 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

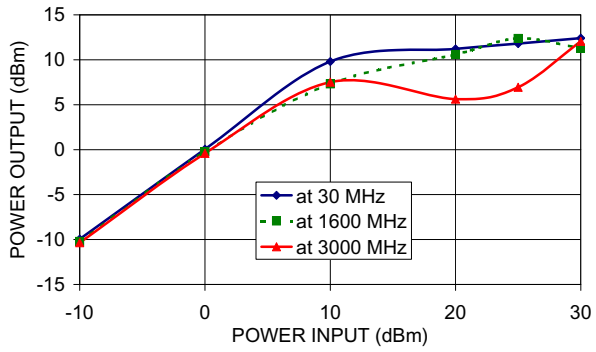
Typical Performance Data

Freq. (MHz)	I. Loss (dB) in Linear Range at -10 dBm	VSWR (:1) in Linear Range at -10 dBm	Power Output (dBm) +12 dBm Input	Power Output (dBm) +20 dBm Input	Power Output (dBm) +25 dBm Input	Power Output (dBm) +30 dBm Input	Δ Output / Δ 1dB Input +12 to +20 dBm Input	Δ Output / Δ 1dB Input +20 to +25 dBm Input	Δ Output / Δ 1dB Input +25 to +30 dBm Input
30.00	0.08	1.23	9.81	11.21	11.80	12.41	0.18	0.12	0.12
50.00	0.06	1.13	9.72	10.92	11.45	11.53	0.15	0.11	0.02
70.00	0.06	1.09	9.66	10.82	11.28	11.54	0.15	0.09	0.05
90.00	0.06	1.07	9.75	10.90	11.29	11.98	0.14	0.08	0.14
100.00	0.06	1.06	9.78	10.86	11.26	12.01	0.14	0.08	0.15
1000.00	0.22	1.05	8.36	9.48	12.01	13.78	0.14	0.51	0.35
1200.00	0.23	1.06	8.00	9.52	12.66	13.22	0.19	0.63	0.11
1600.00	0.29	1.07	7.31	10.59	12.37	11.29	0.41	0.36	-0.22
2000.00	0.32	1.07	6.62	11.44	9.71	10.77	0.60	-0.35	0.21
2200.00	0.34	1.08	6.48	10.73	8.92	11.37	0.53	-0.36	0.49
2400.00	0.39	1.11	6.66	9.78	8.08	11.49	0.39	-0.34	0.68
2600.00	0.40	1.12	7.16	8.65	7.30	11.64	0.19	-0.27	0.87
2800.00	0.41	1.13	7.57	7.25	6.87	11.76	-0.04	-0.08	0.98
3000.00	0.43	1.13	7.51	5.62	6.94	12.05	-0.24	0.26	1.02

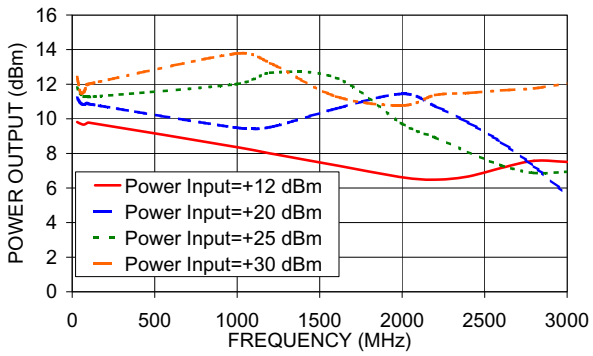
Notes

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

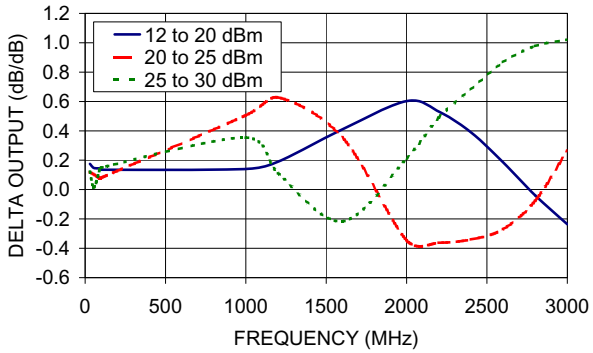
RLM-33+
POWER OUTPUT vs. POWER INPUT



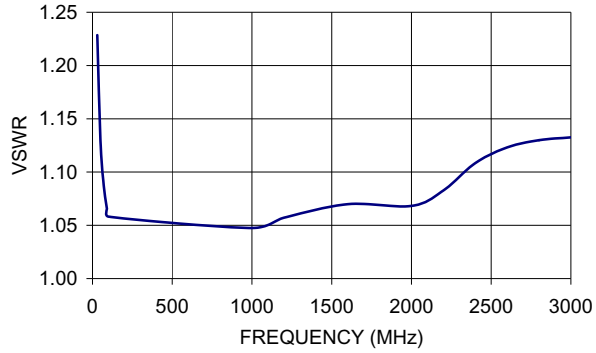
RLM-33+
POWER OUTPUT vs. FREQUENCY



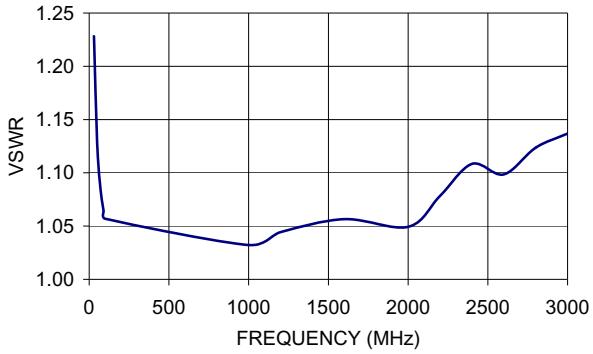
RLM-33+
DELTA OUTPUT/DELTA 1dB INPUT



RLM-33+
INPUT VSWR IN LINEAR RANGE



RLM-33+
OUTPUT VSWR IN LINEAR RANGE



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

Surface Mount Limiter RLM-33+

Typical Performance Data

FREQUENCY	LOW INPUT POWER			POWER OUTPUT (dBm)				DELTA OUTPUT/1dB DELTA INPUT (dB/dB)		
	INSERTION LOSS	VSWR								
(MHz)	(dB)	Input (:1)	Output (:1)	+12 dBm INPUT	+20 dBm INPUT	+25 dBm INPUT	+30 dBm INPUT	+12 to +20 dBm INPUT	+20 to +25 dBm INPUT	+25 to +30 dBm INPUT
30.0	0.08	1.23	1.23	9.81	11.21	11.80	12.41	0.18	0.12	0.12
50.0	0.06	1.13	1.13	9.72	10.92	11.45	11.53	0.15	0.11	0.02
70.0	0.06	1.09	1.09	9.66	10.82	11.28	11.54	0.15	0.09	0.05
90.0	0.06	1.07	1.06	9.75	10.90	11.29	11.98	0.14	0.08	0.14
100.0	0.06	1.06	1.06	9.78	10.86	11.26	12.01	0.14	0.08	0.15
1000.0	0.22	1.05	1.03	8.36	9.48	12.01	13.78	0.14	0.51	0.35
1200.0	0.23	1.06	1.04	8.00	9.52	12.66	13.22	0.19	0.63	0.11
1600.0	0.29	1.07	1.06	7.31	10.59	12.37	11.29	0.41	0.36	-0.22
2000.0	0.32	1.07	1.05	6.62	11.44	9.71	10.77	0.60	-0.35	0.21
2200.0	0.34	1.08	1.08	6.48	10.73	8.92	11.37	0.53	-0.36	0.49
2400.0	0.39	1.11	1.11	6.66	9.78	8.08	11.49	0.39	-0.34	0.68
2600.0	0.40	1.12	1.10	7.16	8.65	7.30	11.64	0.19	-0.27	0.87
2800.0	0.41	1.13	1.12	7.57	7.25	6.87	11.76	-0.04	-0.08	0.98
3000.0	0.43	1.13	1.14	7.51	5.62	6.94	12.05	-0.24	0.26	1.02

Typical Performance Data

POWER INPUT	POWER OUTPUT
@ 30 MHz	
(dBM)	
-10	-9.95
0	0.05
5	5.05
10	9.81
15	10.61
20	11.21
25	11.8
30	12.41

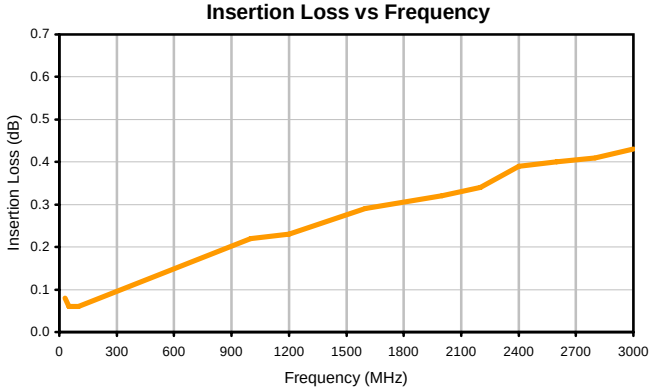
POWER INPUT	POWER OUTPUT
@ 1600 MHz	
(dBM)	
-10	-10.21
0	-0.22
5	4.69
10	7.31
15	7.86
20	10.59
25	12.37
30	11.29

POWER INPUT	POWER OUTPUT
@ 3000 MHz	
(dBM)	
-10	-10.35
0	-0.41
5	4.39
10	7.51
15	8.04
20	5.62
25	6.94
30	12.05

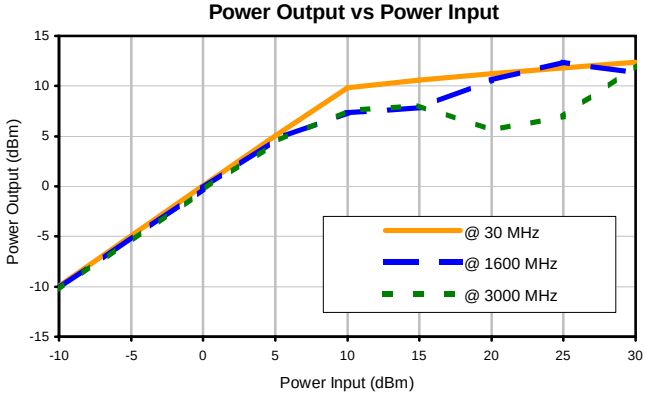
Surface Mount Limiter RLM-33+

Typical Performance Curves

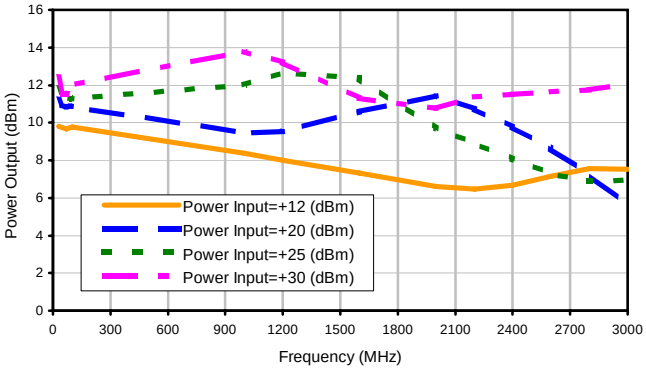
Insertion Loss vs Frequency



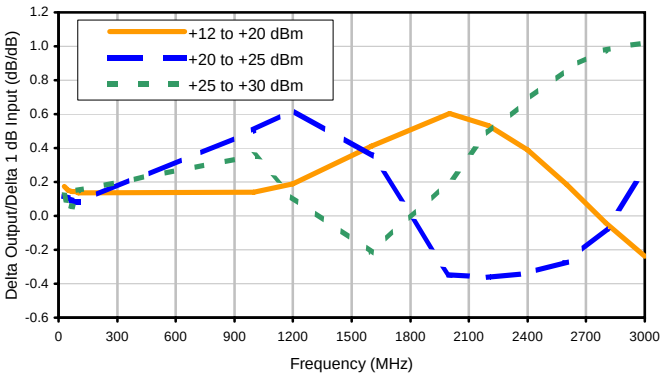
Power Output vs Power Input



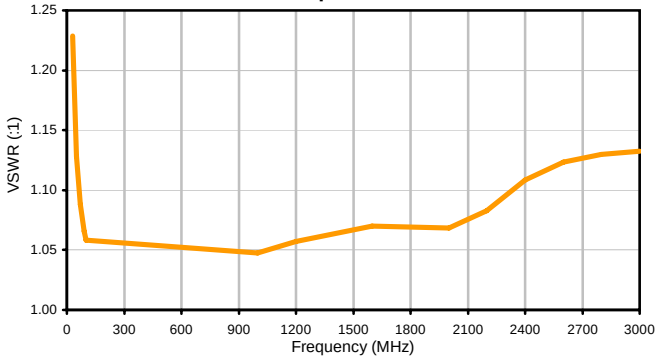
Power Output vs Frequency



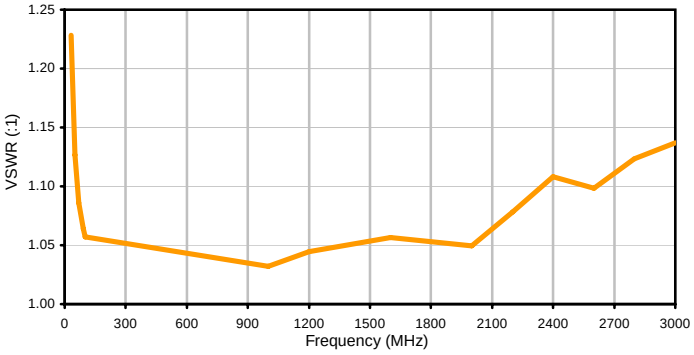
Delta Output / Delta 1dB Input



Input VSWR



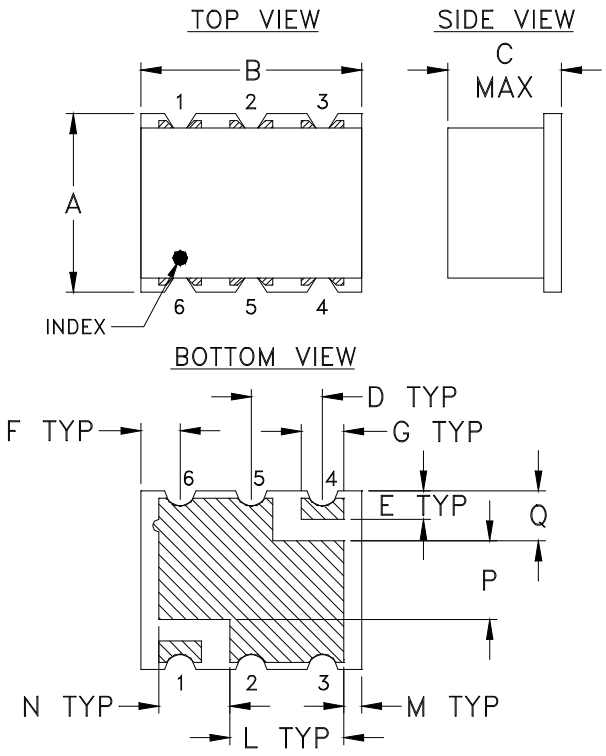
Output VSWR



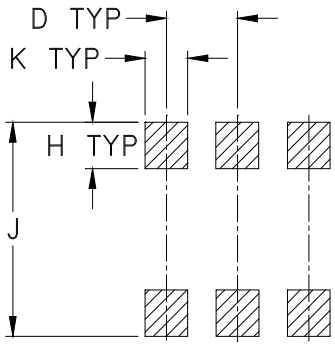
Case Style TT

TT1224

Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

CASE #	A	B	C	D	E	F	G	H	J	K	L
TT1224	.25 (6.35)	.31 (7.87)	.16 (4.06)	.100 (2.54)	.040 (1.02)	.055 (1.40)	.060 (1.52)	.065 (1.65)	.300 (7.62)	.060 (1.52)	.160 (4.06)

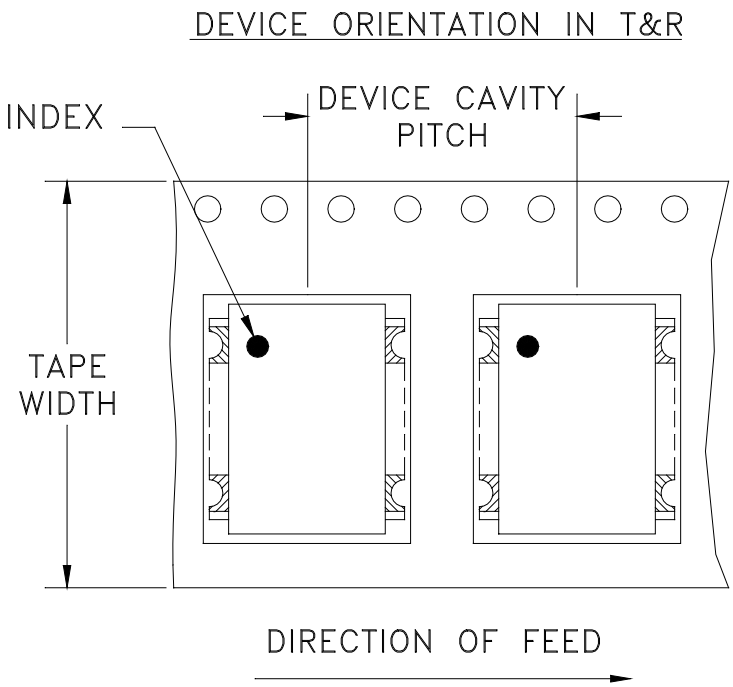
CASE #	M	N	P	Q	WT. GRAM
TT1224	.025 (.64)	.100 (2.54)	.110 (2.79)	.070 (1.78)	.16

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

Notes:

1. Case material: Plastic.
2. Termination: 2-10 µ inch (.05-.25 microns) Gold over 100-300 µ inch (2.54-7.62 microns) Nickel plate

Tape & Reel Packaging TR-F2



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel See note
16	12	7	10
			20
			50
			100
			200
		13	500
			1000

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.

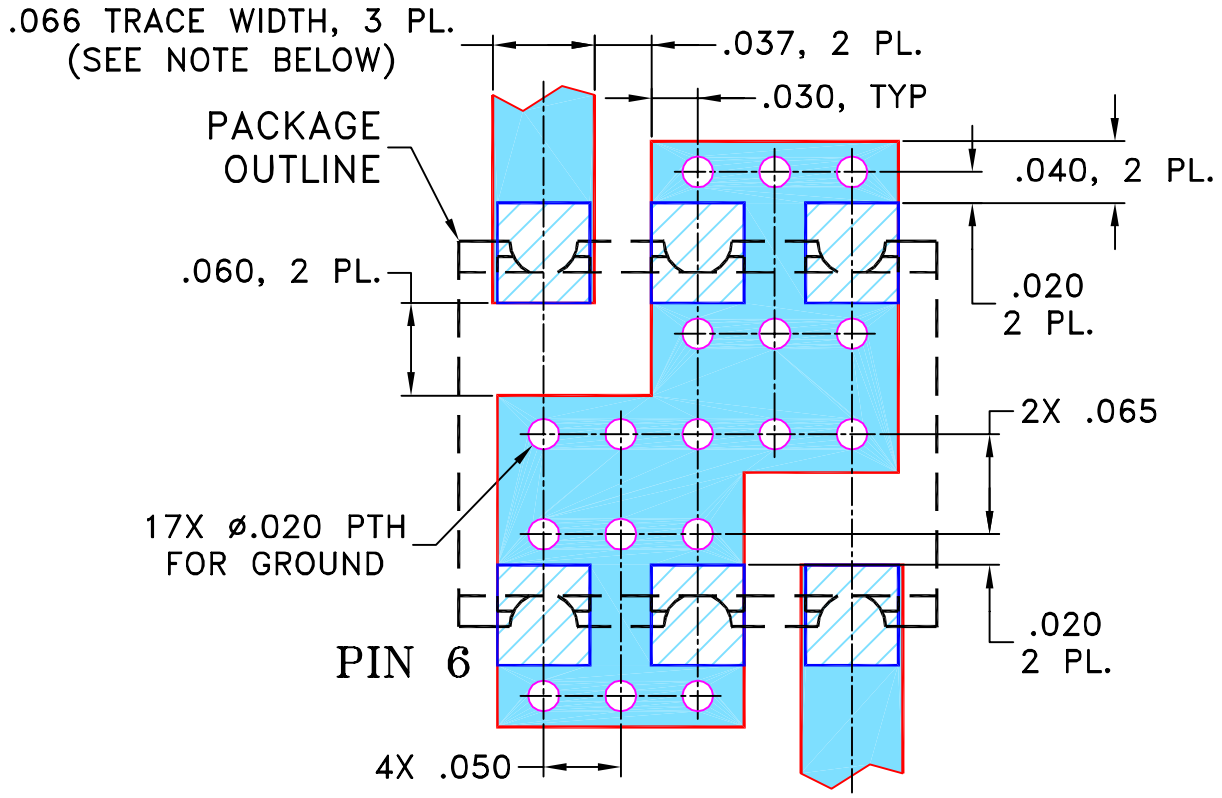
Go to: www.minicircuits.com/pages/pdfs/tape.pdf

Mini-Circuits®
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	M108897	NEW RELEASE	01/04/07	AV	DJ

SUGGESTED MOUNTING CONFIGURATION FOR TT1224 CASE STYLE "rv" PIN CONNECTION



NOTES:
1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030" ± .002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH 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	12/14/06
TOLERANCES ON:	CHECKED	IL	01/04/07
2 PL DECIMALS ±	APPROVED	DJ	01/04/07
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

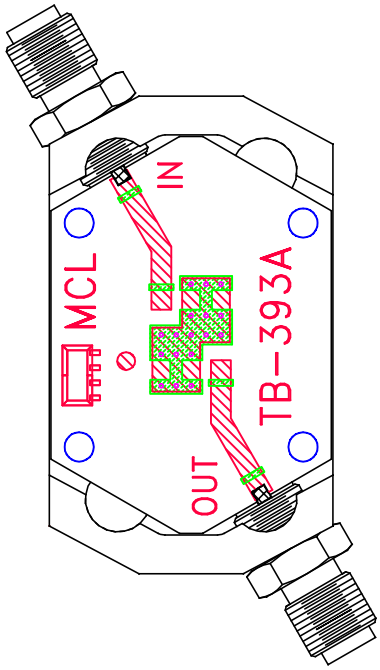
Mini-Circuits®
13 Neptune Avenue
Brooklyn NY 11235

PL, rv, TT1224, RMK-3-662+, TB-393

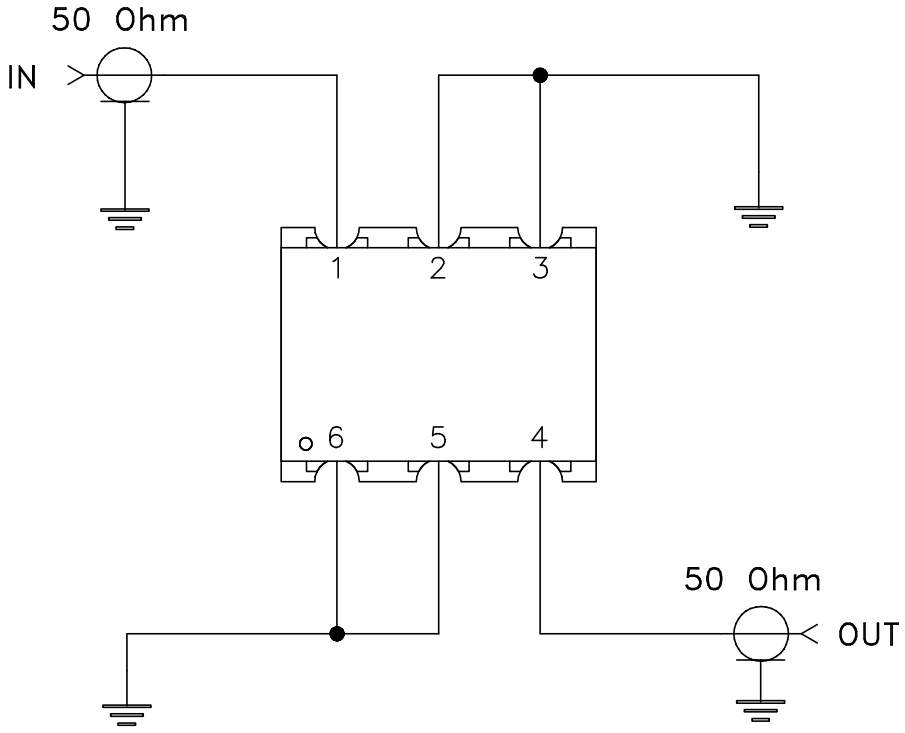
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-258	OR

FILE:	SCALE:	SHEET:
98PL258	8:1	1 OF 1

Evaluation Board and Circuit



TB-393



Schematic Diagram

Notes:

1. SMA Female connectors.
2. PCB Material: Rogers RO4350 or equivalent, Dielectric Constant=3.5, Thickness=.030 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