+10 to +37 dBm

Limiter

RLM-43-5W+

50Ω Broadband 20 to 4000 MHz



CASE STYLE: TT1224

The Big Deal

- Broadband, 20 MHz to 4 GHz
- Low output power leakage, +12 dBm
- Excellent limiting range,+10 to +37 dBm
- 0.3 dB Δ output / 1 dB Δ input

Product Overview

Mini-Circuits' RLM-43-5W+ is a passive PIN diode RF limiter ideal for protecting sensitive receiver circuitry from high-power signals, while allowing low-powered signals to be received.
Providing limiting range from +10 to +37 dBm and +12 dBm typical output power, the RLM-43-5W+ is ideal for many situations where unwanted signals prevail such as manufacturing sites, train tunnels, radar transceivers and more. The limiter is housed in a durable, surface mount plastic enclosure measuring 0.25 x 0.31 x 0.16", accommodating tight PCB layouts.

Key Features

Feature	Advantages
Wideband operation, from 20 to 4000 MHz	Ideal for a variety of applications where there is a need to protect sensitive receiver circuitry from unwanted signals as well as control ESD and power surges on the network.
Excellent limiting range from +10 to +37dBm	Prevents undesired signals from passing through the network and damaging sensitive electronic components.
0.3 dB Δ output / 1 dB Δ input	Low delta output per 1 dB delta input maintains signal stability in the presence of volatile input signal conditions.
Rapid recovery, 33ns	Minimal downtime after unwanted signals are removed with very quick restoration of standard operating levels.
Low loss insertion, 0.36 dB	Preserves the strength of low-power signals in the receive path.
low-output power loss, +12 dBm	Low output power prevents saturation of receiver circuitry and provides extra protection for sensitive components.

Notes
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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

+10 to +37 dBm

Limiter

RLM-43-5W+

50Ω Broadband 20 to 4000 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	5W

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

Pin Connections

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

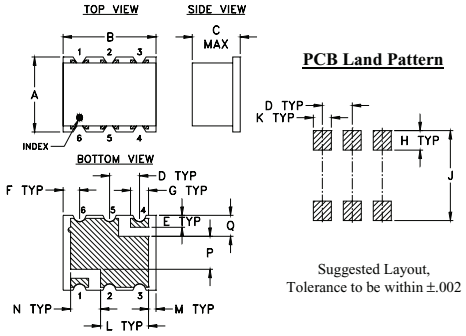
Features

- wideband, 20 to 4000 MHz
- low insertion loss 0.36 dB typ.
- fast recovery time, 33nsec typ.
- excellent VSWR 1.2:1 typ.
- low output power, 12 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)

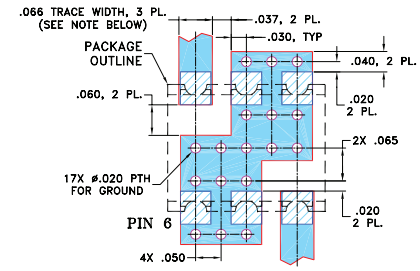
A	B	C	D	E	F	G	H
.25	.31	.16	.100	.040	.055	.060	.065
6.35	7.87	4.06	2.54	1.02	1.40	1.52	1.65

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		20		4000	MHz
Linear Range					
Max Input Power	less than 1 dB compression	—	5	—	dBm
Insertion Loss	less than +5 dBm input power	—	0.36	0.85	dB
VSWR	less than +5 dBm input power	—	1.2	1.58	:1
Limiting Range					
Input Power	>1dB compression filtered signal frequency	+10	—	+37	dBm
Output Power		—	+12	—	dBm
Δ Output/ Δ 1dB Input	Input Power Range (dBm)				
	10 to 20	—	0.3	—	dB/dB
	20 to 30	—	0.1	—	
	30 to 37	—	0.1	—	
Recovery Time	2 watt pulse 50 µsec pw 1kHz duty cycle recovery to within 90% of final value @ -5 dBm	—	33	—	nsec
Response Time	-30 to +33 dBm input 50 µsec PW 1 kHz duty cycle	—	21	—	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)

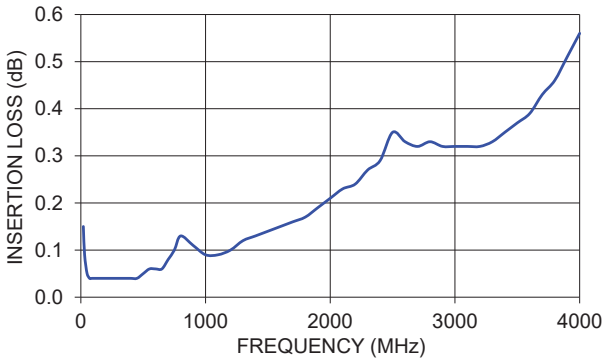
DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Typical Performance Data

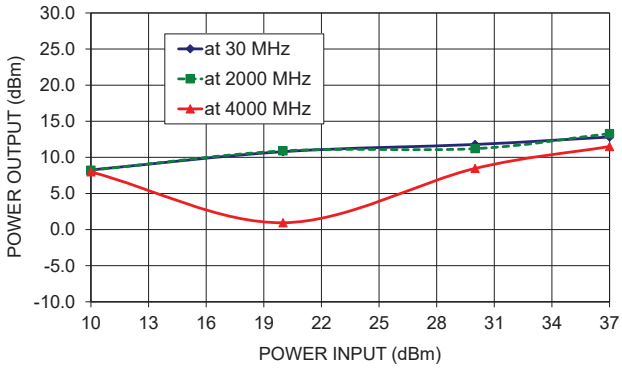
Freq. (MHz)	I. Loss (dB) in Linear Range at -10 dBm	VSWR (:1) in Linear Range at -10 dBm	Power Output (dBm) +10 dBm Input	Power Output (dBm) +20 dBm Input	Power Output (dBm) +30 dBm Input	Power Output (dBm) +37 dBm Input	Δ Output / Δ 1dB Input +10 to +20 dBm Input	Δ Output / Δ 1dB Input +20 to +30 dBm Input	Δ Output / Δ 1dB Input +30 to +37 dBm Input
20.00	0.15	1.36	8.22	10.72	11.78	12.86	0.25	0.11	0.15
50.00	0.05	1.13	8.27	10.81	11.75	12.76	0.25	0.09	0.14
90.00	0.04	1.06	8.12	10.61	11.44	12.55	0.25	0.08	0.16
200.00	0.04	1.03	8.13	10.57	11.52	13.21	0.24	0.09	0.24
500.00	0.05	1.02	8.44	10.44	12.86	12.94	0.20	0.24	0.01
1000.00	0.09	1.02	8.94	12.06	12.60	13.38	0.31	0.05	0.11
1200.00	0.10	1.04	8.25	11.59	12.68	13.19	0.33	0.11	0.07
1400.00	0.13	1.06	8.14	11.77	12.51	13.13	0.36	0.07	0.09
1600.00	0.15	1.10	8.02	11.89	12.45	13.01	0.39	0.06	0.08
2000.00	0.21	1.24	8.22	10.90	11.21	13.29	0.27	0.03	0.30
2500.00	0.35	1.39	8.42	6.91	10.75	12.12	-0.15	0.38	0.20
3000.00	0.32	1.33	8.35	4.20	9.54	11.41	-0.42	0.53	0.27
3500.00	0.37	1.17	8.08	2.96	9.03	11.87	-0.51	0.61	0.41
3800.00	0.46	1.26	7.85	1.89	8.66	11.89	-0.60	0.68	0.46
4000.00	0.56	1.36	7.99	0.95	8.47	11.51	-0.70	0.75	0.43

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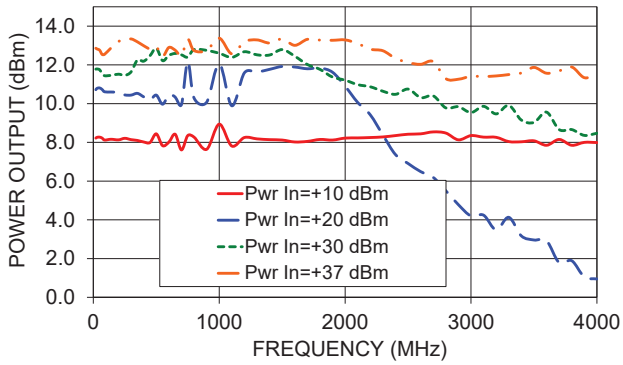
RLM-43-5W+
LOW INPUT POWER INSERTION LOSS



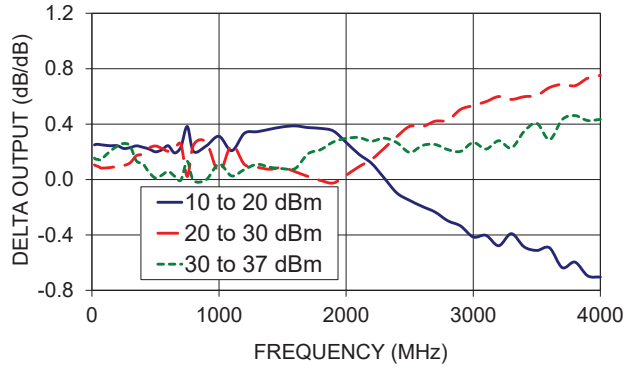
RLM-43-5W+
POWER OUTPUT vs. POWER INPUT



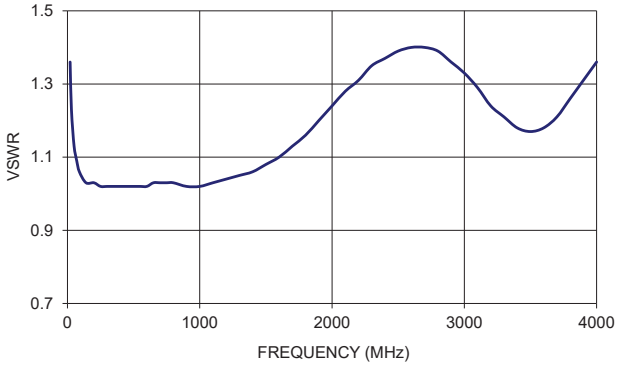
RLM-43-5W+
POWER OUTPUT vs. FREQUENCY



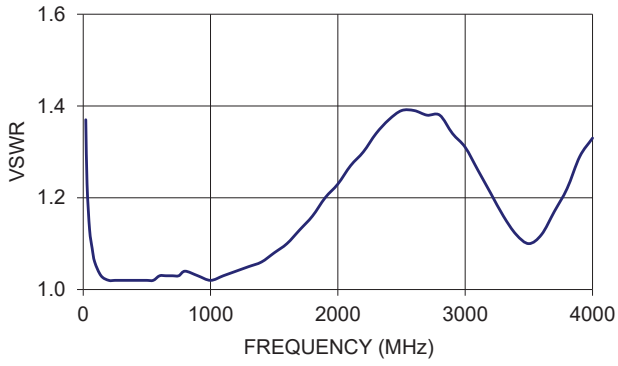
RLM-43-5W+
DELTA OUTPUT/DELTA 1dB INPUT



RLM-43-5W+
INPUT VSWR IN LINEAR RANGE



RLM-43-5W+
OUTPUT VSWR IN LINEAR RANGE



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Surface Mount Limiter RLM-43-5W+

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)	+10 dBm INPUT	+20 dBm INPUT	+30 dBm INPUT	+37 dBm INPUT	+10 to +20 dBm INPUT	+20 to +30 dBm INPUT	+30 to +37 dBm INPUT
20.0	0.15	1.36	1.37	8.22	10.72	11.78	12.86	0.25	0.11	0.15
30.0	0.09	1.23	1.23	8.26	10.79	11.79	12.82	0.25	0.10	0.15
50.0	0.05	1.13	1.13	8.27	10.81	11.75	12.76	0.25	0.09	0.14
70.0	0.04	1.09	1.09	8.22	10.73	11.56	12.54	0.25	0.08	0.14
90.0	0.04	1.06	1.06	8.12	10.61	11.44	12.55	0.25	0.08	0.16
140.0	0.04	1.03	1.03	8.16	10.60	11.46	12.87	0.24	0.09	0.20
200.0	0.04	1.03	1.02	8.13	10.57	11.52	13.21	0.24	0.09	0.24
250.0	0.04	1.02	1.02	8.21	10.45	11.46	13.28	0.22	0.10	0.26
300.0	0.04	1.02	1.02	8.14	10.44	11.64	13.34	0.23	0.12	0.24
350.0	0.04	1.02	1.02	8.10	10.53	12.25	13.19	0.24	0.17	0.13
400.0	0.04	1.02	1.02	8.02	10.35	12.19	12.99	0.23	0.18	0.11
450.0	0.04	1.02	1.02	7.99	10.19	12.47	12.83	0.22	0.23	0.05
500.0	0.05	1.02	1.02	8.44	10.44	12.86	12.94	0.20	0.24	0.01
550.0	0.06	1.02	1.02	7.83	9.97	12.22	12.44	0.21	0.23	0.03
600.0	0.06	1.02	1.03	8.01	10.45	12.49	12.90	0.24	0.20	0.06
650.0	0.06	1.03	1.03	8.42	10.34	12.59	12.76	0.19	0.23	0.02
700.0	0.08	1.03	1.03	7.61	9.95	12.52	12.49	0.23	0.26	0.00
750.0	0.10	1.03	1.03	8.35	12.18	12.40	13.32	0.38	0.02	0.13
800.0	0.13	1.03	1.04	8.27	10.29	12.79	12.74	0.20	0.25	-0.01
900.0	0.11	1.02	1.03	7.64	10.07	12.75	12.75	0.24	0.27	0.00
1000.0	0.09	1.02	1.02	8.94	12.06	12.60	13.38	0.31	0.05	0.11
1100.0	0.09	1.03	1.03	7.81	9.89	12.39	12.57	0.21	0.25	0.03
1200.0	0.10	1.04	1.04	8.25	11.59	12.68	13.19	0.33	0.11	0.07
1300.0	0.12	1.05	1.05	8.18	11.63	12.52	13.29	0.35	0.09	0.11
1400.0	0.13	1.06	1.06	8.14	11.77	12.51	13.13	0.36	0.07	0.09
1500.0	0.14	1.08	1.08	8.12	11.92	12.79	13.34	0.38	0.09	0.08
1600.0	0.15	1.10	1.10	8.02	11.89	12.45	13.01	0.39	0.06	0.08
1700.0	0.16	1.13	1.13	8.05	11.80	12.02	13.32	0.38	0.02	0.19
1800.0	0.17	1.16	1.16	8.15	11.84	11.77	13.28	0.37	-0.01	0.22
1900.0	0.19	1.20	1.20	8.12	11.62	11.37	13.27	0.35	-0.03	0.27
2000.0	0.21	1.24	1.23	8.22	10.90	11.21	13.29	0.27	0.03	0.30
2100.0	0.23	1.28	1.27	8.23	10.06	10.98	13.10	0.18	0.09	0.30
2200.0	0.24	1.31	1.30	8.25	9.42	10.87	12.81	0.12	0.15	0.28
2300.0	0.27	1.35	1.34	8.28	8.38	10.64	12.73	0.01	0.23	0.30
2400.0	0.29	1.37	1.37	8.35	7.37	10.48	12.34	-0.10	0.31	0.27
2500.0	0.35	1.39	1.39	8.42	6.91	10.75	12.12	-0.15	0.38	0.20
2600.0	0.33	1.40	1.39	8.44	6.49	10.31	12.03	-0.20	0.38	0.25
2700.0	0.32	1.40	1.38	8.54	6.19	10.40	12.17	-0.24	0.42	0.25
2800.0	0.33	1.39	1.38	8.48	5.50	9.78	11.29	-0.30	0.43	0.22
2900.0	0.32	1.36	1.34	8.13	4.78	9.84	11.26	-0.34	0.51	0.20
3000.0	0.32	1.33	1.31	8.35	4.20	9.54	11.41	-0.42	0.53	0.27
3100.0	0.32	1.29	1.26	8.27	4.24	9.86	11.40	-0.40	0.56	0.22
3200.0	0.32	1.24	1.21	8.26	3.48	9.47	11.43	-0.48	0.60	0.28
3300.0	0.33	1.21	1.16	8.04	4.13	9.91	11.50	-0.39	0.58	0.23
3400.0	0.35	1.18	1.12	8.03	3.17	9.15	11.58	-0.49	0.60	0.35
3500.0	0.37	1.17	1.10	8.08	2.96	9.03	11.87	-0.51	0.61	0.41
3600.0	0.39	1.18	1.12	7.85	2.92	9.56	11.57	-0.49	0.66	0.29
3700.0	0.43	1.21	1.17	8.15	1.79	8.66	11.69	-0.64	0.69	0.43
3800.0	0.46	1.26	1.22	7.85	1.89	8.66	11.89	-0.60	0.68	0.46
3900.0	0.51	1.31	1.29	8.00	1.05	8.36	11.34	-0.70	0.73	0.43
4000.0	0.56	1.36	1.33	7.99	0.95	8.47	11.51	-0.70	0.75	0.43

Typical Performance Data

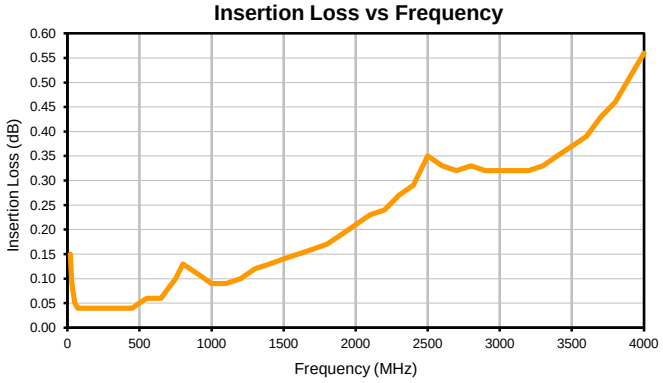
POWER INPUT	POWER OUTPUT
@ 30 MHz	
(dBM)	
-10	-10.09
10	8.27
20	10.81
30	11.75
37	12.76

POWER INPUT	POWER OUTPUT
@ 2000 MHz	
(dBM)	
-10	-10.21
10	8.28
20	8.38
30	10.64
37	12.73

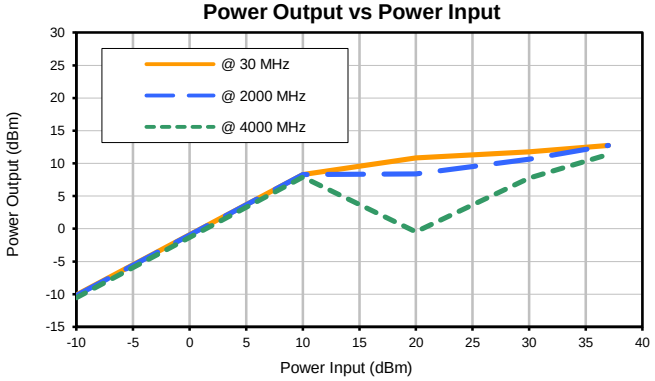
POWER INPUT	POWER OUTPUT
@ 4000 MHz	
(dBM)	
-10	-10.56
10	7.90
20	-0.48
30	7.76
37	11.35

Typical Performance Curves

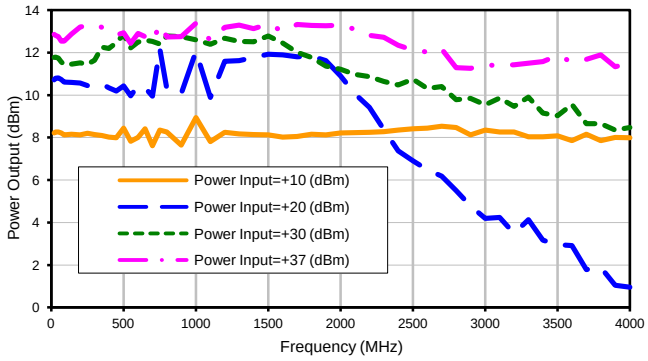
Insertion Loss vs Frequency



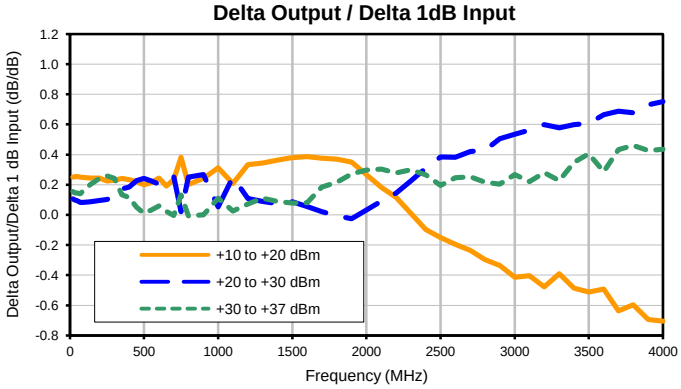
Power Output vs Power Input



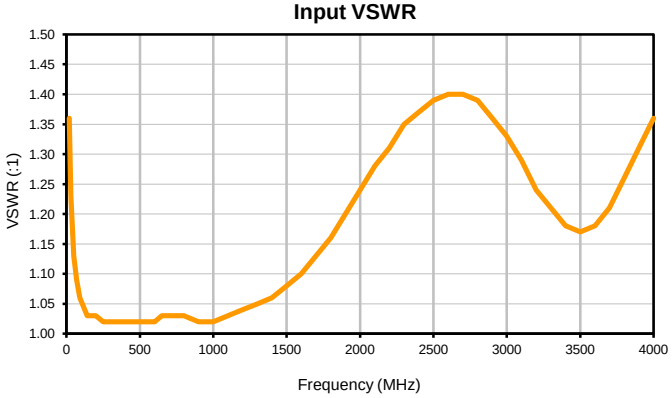
Power Output vs Frequency



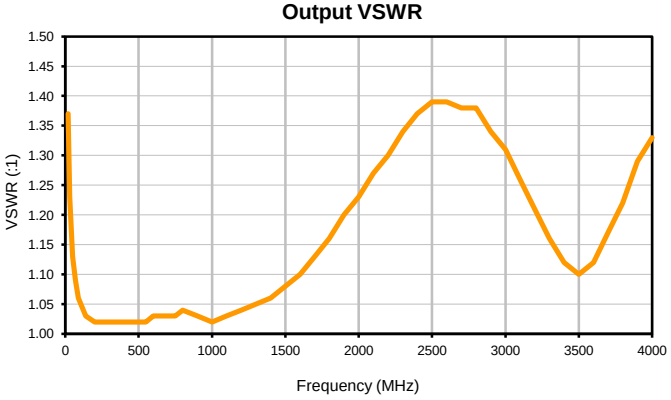
Delta Output / Delta 1dB Input



Input VSWR



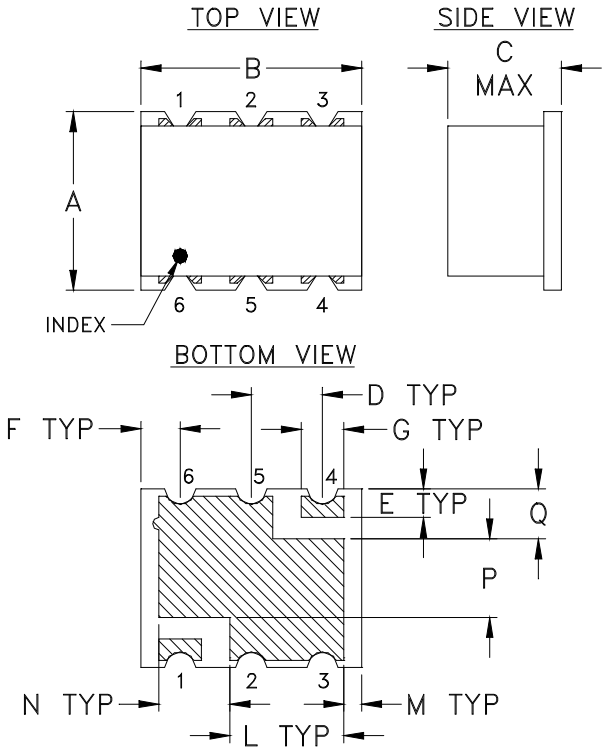
Output VSWR



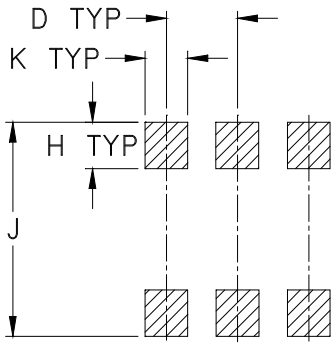
Case Style TT

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

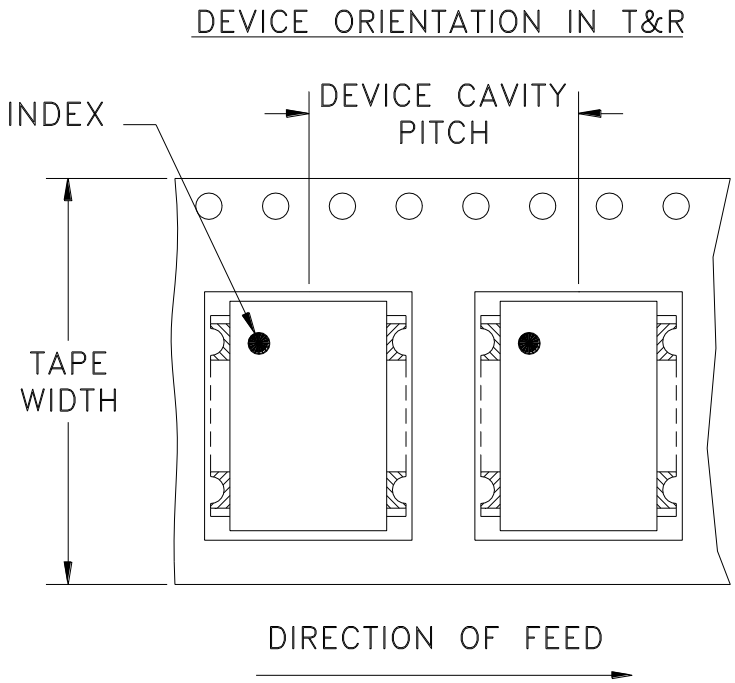
Dimensions are in inches (mm). Tolerances: 2Pl. ± .01; 3 Pl. ± .005

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

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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

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

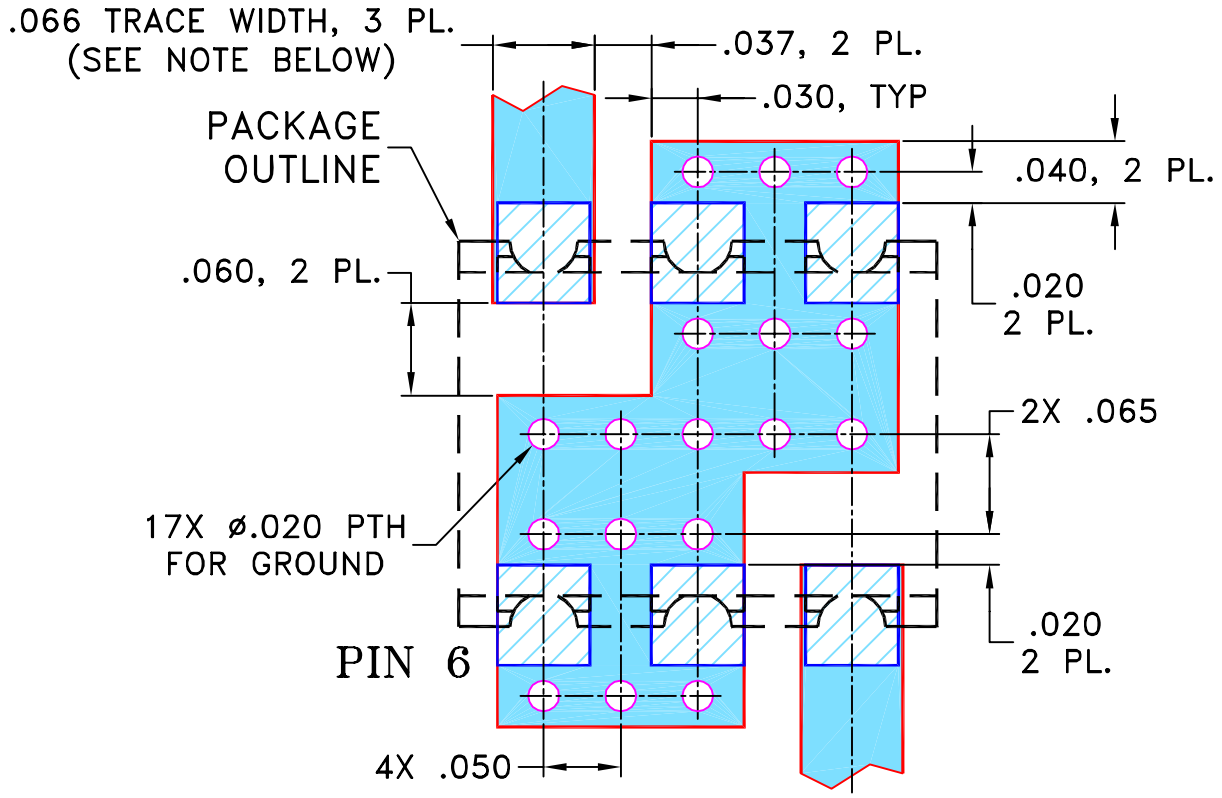
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THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	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 ±			

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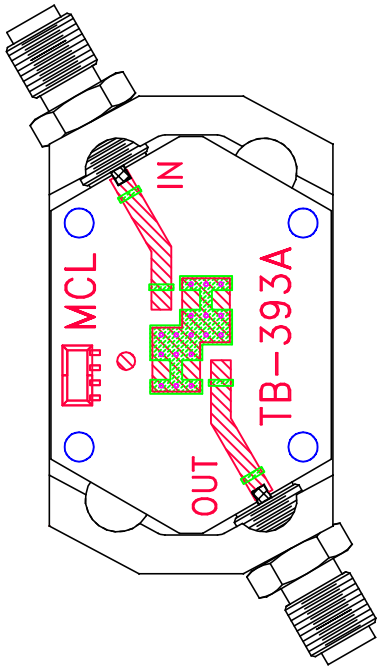
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PL, rv, TT1224, RMK-3-662+, TB-393

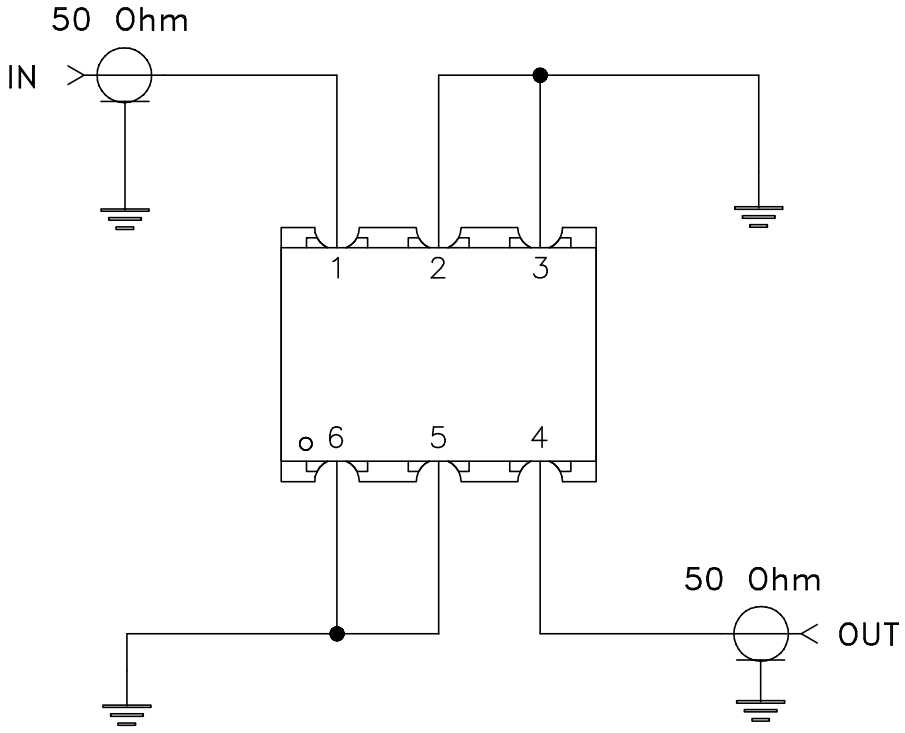
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-258	OR

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.

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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

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