

Surface Mount

Phase Shifter

SPHSA-251+

50Ω 180° Voltage Variable 150 to 250 MHz

The Big Deal

- Low insertion loss, 1.5 dB typ.
- Wide phase shift, 180°
- Low frequency and small size



CASE STYLE: JW1441

Product Overview

Mini-Circuits' SPHSA-251+ is a voltage variable phase shifter providing 180° phase control from 150 to 250 MHz in a miniature surface mount package. This model has a control bandwidth of DC to 30 kHz and a control voltage range from 0 to +15V. Housed in a shielded, 12-lead package with wrap-around terminations, the unit measures only 0.44 x 0.74 x 0.19", offering a space efficient, low-cost alternative to larger, expensive connectorized phase shifters typical for low frequency operation.

Feature	Advantages
Low insertion loss, 1.5 dB typ.	Enables good transmission of signal power from input to output and minimizes effect on system noise figure.
Wide phase shift, 180°	In test environments, 180° phase control allows the user to experiment with various incident phases. This can be used to test residual phase noise of amplifiers and to determine the influence of phase between two mismatched components in a system.

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



Phase Shifter

50Ω 180° Voltage Variable 150 to 250 MHz

SPHSA-251+



Generic photo used for illustration purposes only
CASE STYLE: JW1441

Maximum Ratings

Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Input Power	20 dBm max.
Control Voltage	20V

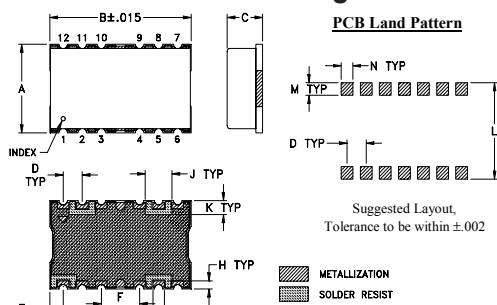
Permanent damage may occur if any of these limits are exceeded.

Pin Connections

IN	2
OUT	5
BIAS	8, 12 [^]
GROUND	1, 3, 4, 6, 7, 9, 10, 11

[^] proper operation is achieved with pins 8 or 12 or both connected to BIAS.

Outline Drawing



PCB Land Pattern

Suggested Layout,
Tolerance to be within ±.002

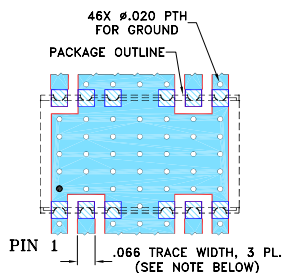
METALLIZATION
SOLDER RESIST

Outline Dimensions (inch mm)

A	B	C	D	E	F	G	H
.440	.740	.19	.100	.070	.200	.060	.040
11.18	18.80	4.83	2.54	1.78	5.08	1.52	1.02

J	K	L	M	N	P	wt
.140	.070	.480	.063	.061	--	grams
3.56	1.78	12.19	1.60	1.55	--	2.5

Demo Board MCL P/N: TB-524+ Suggested PCB Layout (PL-408)



- NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350 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.
3. DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
4. DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Features

- low insertion loss, 1.5 dB typ.
- wide phase shift, 180°
- aqueous washable

Applications

- cellular
- communication

Electrical Specifications at 25°C

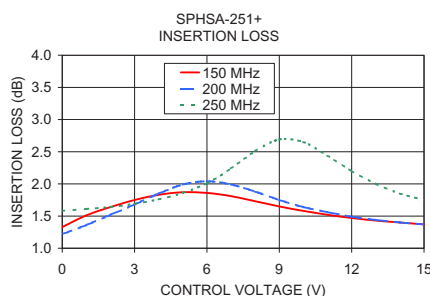
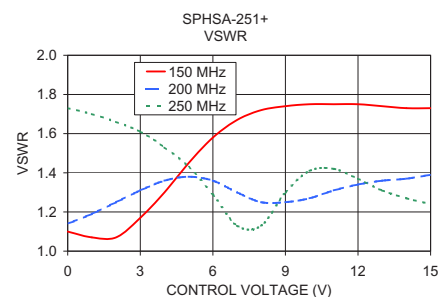
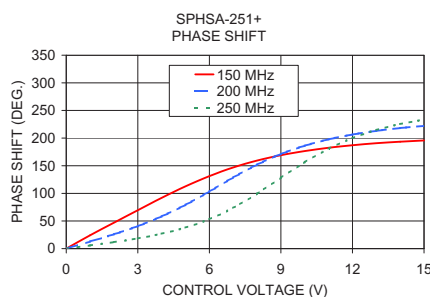
Parameter	Condition (MHz)	Min.	Typ.	Max.	Unit
Frequency Range		150		250	MHz
Phase Range	150 - 250	180	—	—	Degrees
Insertion Loss	150 - 250	—	1.5	3.5	dB
Control Voltage	150 - 250	—	0-15	—	V
Control Bandwidth	150 - 250	—	DC-30	—	kHz
VSWR	150 - 250	—	1.6	2.5	:1

DC input resistance at Control port: 2000 ohms typ.

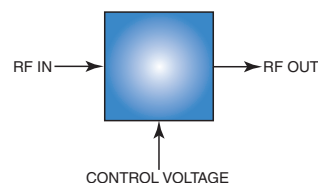
Typical Performance Data

Control Voltage (V)	Phase Shift* (Degrees)			VSWR (:1)			Insertion Loss (dB)		
	150 MHz	200 MHz	250 MHz	150 MHz	200 MHz	250 MHz	150 MHz	200 MHz	250 MHz
0.0	0.01	0.01	0.01	1.10	1.14	1.70	1.33	1.22	1.58
1.0	24.23	12.87	5.88	1.07	1.19	1.73	1.51	1.36	1.61
2.0	46.91	25.98	11.76	1.07	1.25	1.66	1.64	1.52	1.64
3.0	69.53	40.70	18.54	1.17	1.31	1.61	1.75	1.68	1.69
4.0	91.78	58.22	27.01	1.30	1.36	1.53	1.83	1.85	1.76
5.0	112.67	79.19	38.16	1.45	1.38	1.43	1.87	1.99	1.86
6.0	131.26	103.36	53.33	1.58	1.36	1.29	1.86	2.04	2.01
7.0	146.85	128.64	73.76	1.67	1.30	1.13	1.81	1.99	2.24
8.0	159.33	151.94	99.51	1.72	1.25	1.13	1.73	1.88	2.51
9.0	169.05	171.21	128.38	1.74	1.25	1.30	1.65	1.75	2.69
10.0	176.58	186.24	156.49	1.74	1.27	1.41	1.58	1.64	2.65
11.0	182.48	197.74	180.79	1.75	1.31	1.42	1.52	1.56	2.44
12.0	187.09	206.48	200.05	1.75	1.34	1.37	1.47	1.49	2.20
13.0	190.71	213.11	214.63	1.74	1.36	1.31	1.43	1.44	2.00
14.0	193.55	218.17	225.44	1.73	1.37	1.27	1.40	1.40	1.85
15.0	195.79	222.07	233.49	1.73	1.39	1.24	1.37	1.37	1.75

* Normalized at control voltage = 0V



electrical schematic



Notes

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REV. A
M151107
SPHSA-251+
ED-16256
WZ/CP/AM
200924

PHASE SHIFTER

SPHSA-251+

Typical Performance Data

CONTROL VOLTAGE (V)	PHASE SHIFT*			VSWR			INSERTION LOSS		
	(Deg.)			(:1)			(dB)		
	150 MHz	200 MHz	250 MHz	150 MHz	200 MHz	250 MHz	150 MHz	200 MHz	250 MHz
0.0	0.01	0.01	0.01	1.10	1.14	1.73	1.33	1.22	1.58
1.0	24.23	12.97	5.88	1.07	1.19	1.70	1.51	1.36	1.61
2.0	46.91	25.98	11.76	1.07	1.25	1.66	1.64	1.52	1.64
3.0	69.53	40.70	18.54	1.17	1.31	1.61	1.75	1.68	1.69
4.0	91.78	58.22	27.01	1.30	1.36	1.53	1.83	1.85	1.76
5.0	112.67	79.19	38.16	1.45	1.38	1.43	1.87	1.99	1.86
6.0	131.26	103.36	53.33	1.58	1.36	1.29	1.86	2.04	2.01
7.0	146.85	128.64	73.76	1.67	1.30	1.13	1.81	1.99	2.24
8.0	159.33	151.94	99.51	1.72	1.25	1.13	1.73	1.88	2.51
9.0	169.05	171.21	128.38	1.74	1.25	1.30	1.65	1.75	2.69
10.0	176.58	186.24	156.49	1.75	1.27	1.41	1.58	1.64	2.65
11.0	182.48	197.74	180.79	1.75	1.31	1.42	1.52	1.56	2.44
12.0	187.09	206.48	200.05	1.75	1.34	1.37	1.47	1.49	2.20
13.0	190.71	213.11	214.63	1.74	1.36	1.31	1.43	1.44	2.00
14.0	193.55	218.17	225.44	1.73	1.37	1.27	1.40	1.40	1.85
15.0	195.79	222.07	233.49	1.73	1.39	1.24	1.37	1.37	1.75

*Normalized at control voltage = 0V



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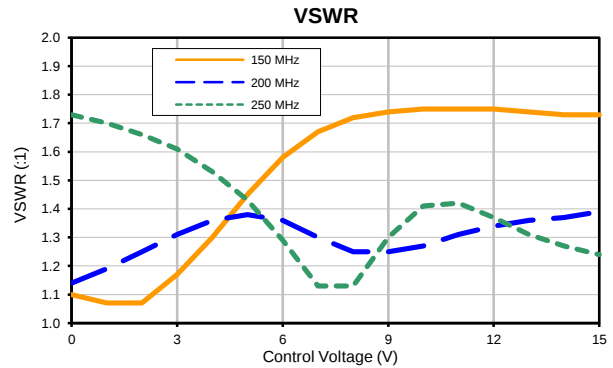
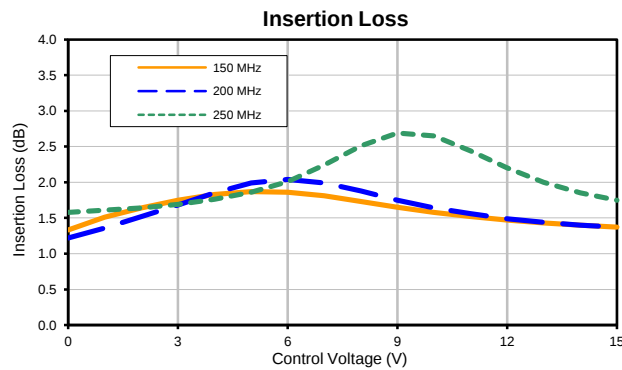
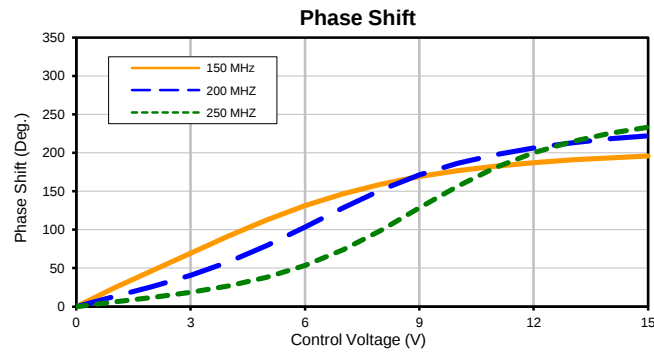
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IF/RF MICROWAVE COMPONENTS



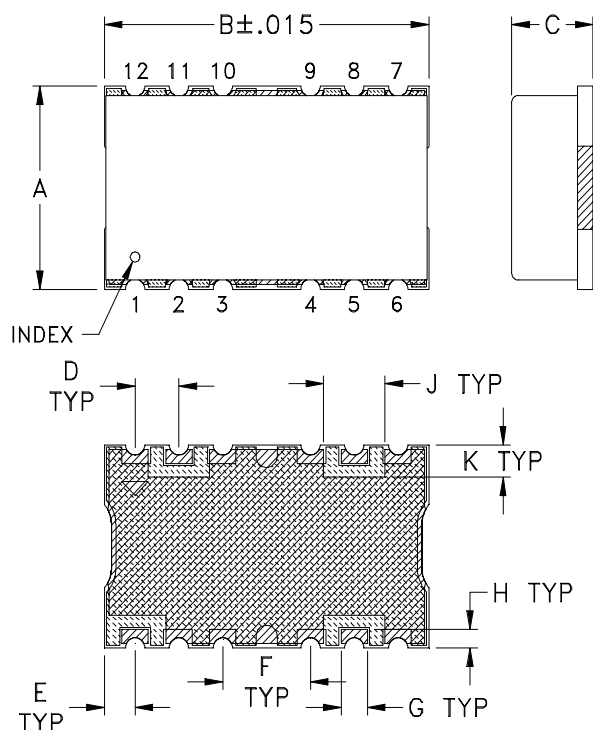
REV. OR
SPHSA-251+
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Page 1 of 1

Typical Performance Curves

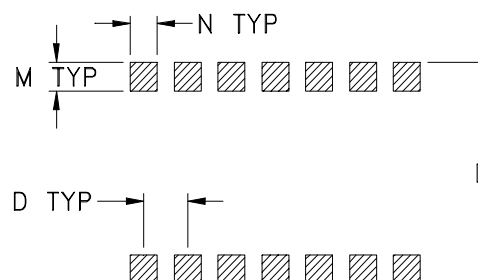


Outline Dimensions

JW1441



PCB Land Pattern



Suggested Layout,
Tolerance to be within $\pm .002$

CASE #	A	B	C	D	E	F	G	H	J	K	L	M	N
JW1441	.440 (11.18)	.740 (18.80)	.19 (4.83)	.100 (2.54)	.070 (1.78)	.200 (5.08)	.060 (1.52)	.040 (1.02)	.140 (3.56)	.070 (1.78)	.480 (12.19)	.063 (1.60)	.061 (1.55)

CASE #	P	WT. GRAM
JW1441	--	2.5

Dimensions are in inches (mm). Tolerances: 2 Pl. $\pm .03$; 3Pl. $\pm .015$

Notes:

- Case material: Nickel-Silver alloy.
- Base: Printed wiring laminate.
- Termination finish:
For RoHS Case Styles: Gold over Nickel plate.
For RoHS-5 Case Styles: Tin-Lead plate.



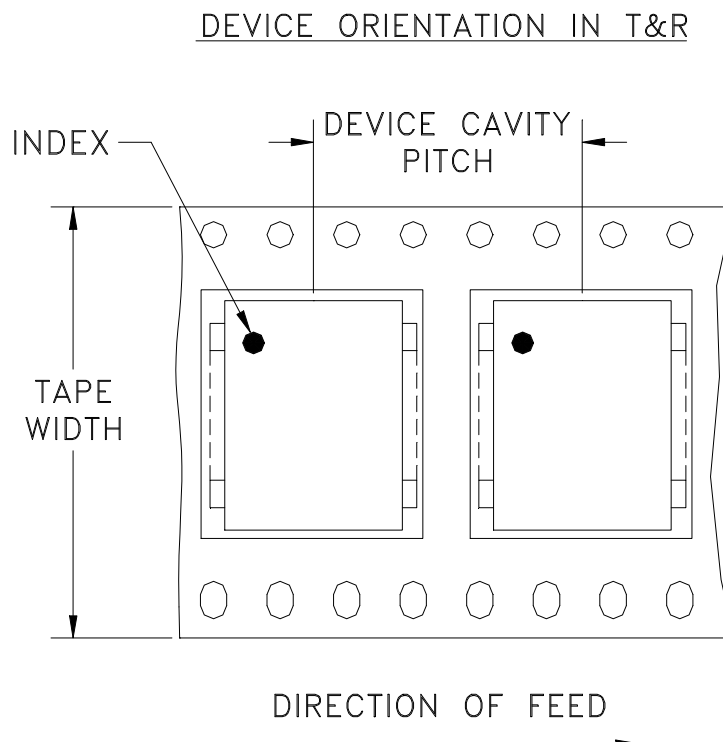
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Tape & Reel Packaging TR-F5



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel
32	16	13	500

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

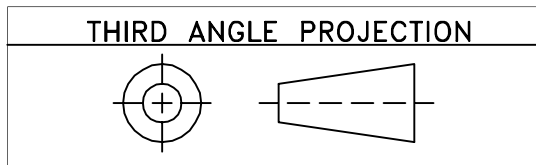


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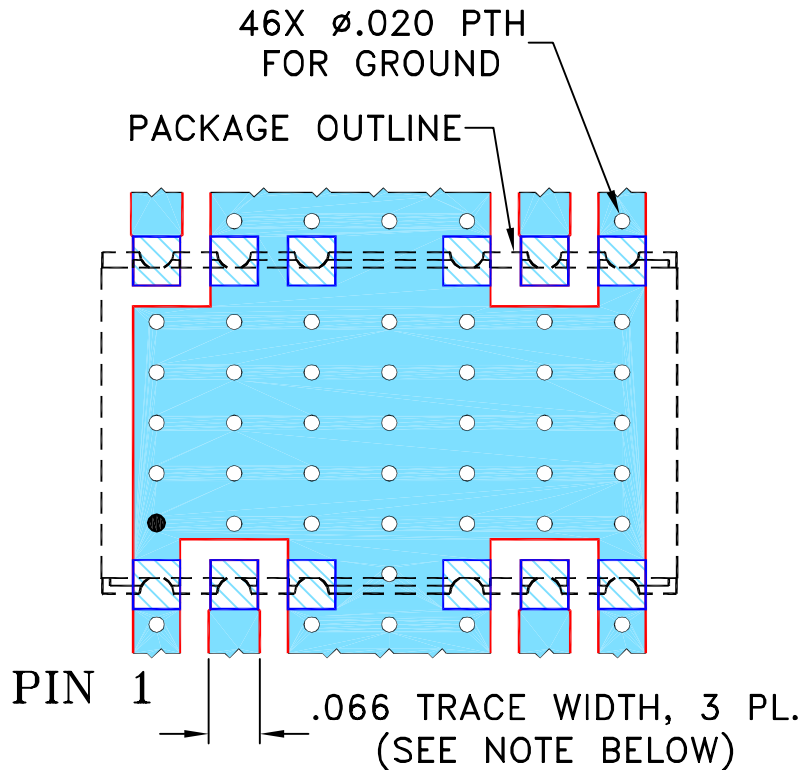
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REVISIONS					
REV OR	ECN No.	DESCRIPTION	DATE	DR	AUTH
	M144558	NEW RELEASE	01/22/14	AV	PW

SUGGESTED MOUNTING CONFIGURATION FOR
JW1441 CASE STYLE, "12PS01" PIN CODE



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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 TOLERANCES ON: 2 PL DECIMALS $\pm$ 3 PL DECIMALS $\pm$.005 ANGLES $\pm$ FRACTIONS $\pm$	DRAWN	AV	01/14/14
	CHECKED	IL	01/22/14
	APPROVED	PW	01/22/14



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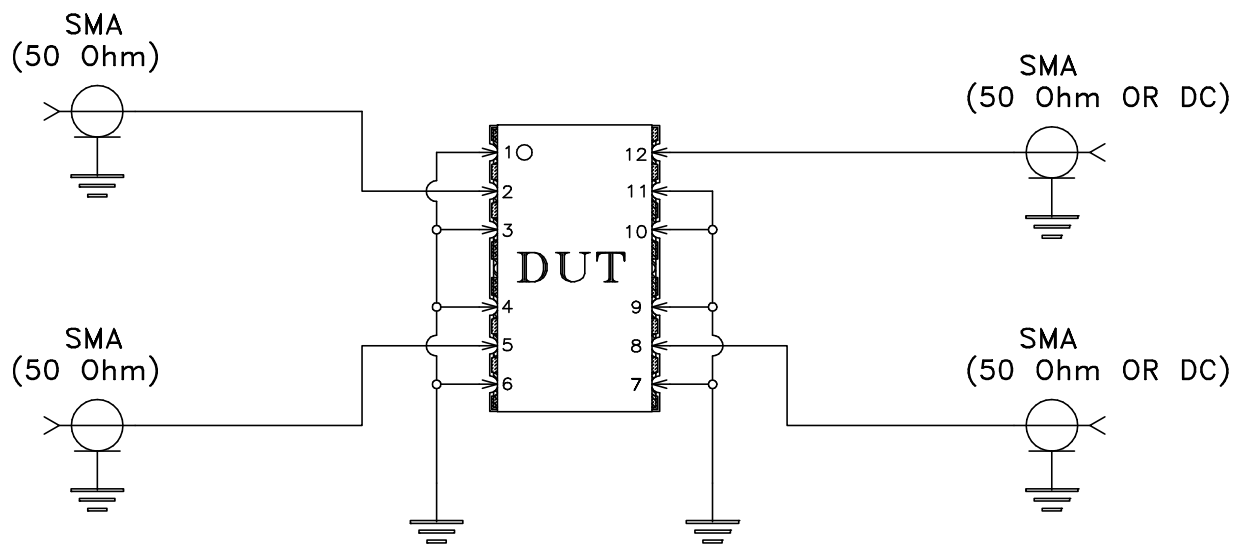
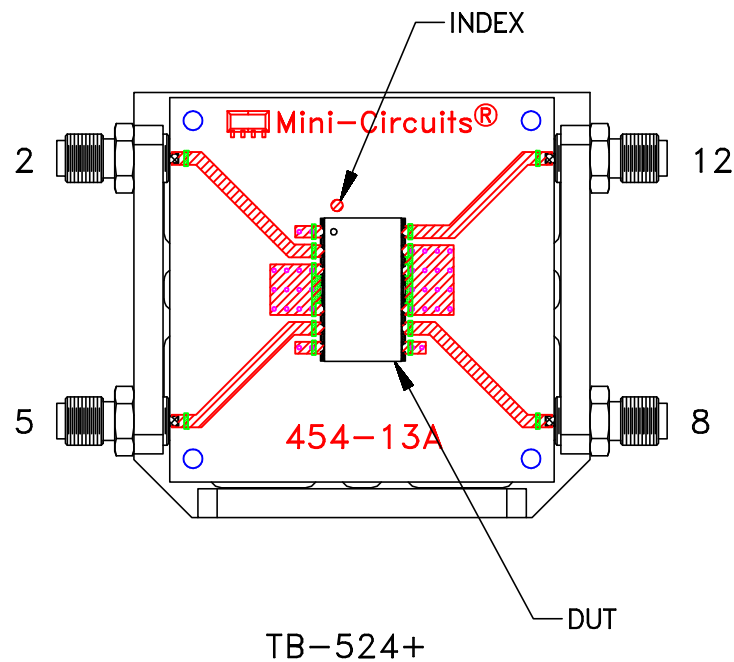
PL, 12PS01, JW1441, TB-524+

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SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-408	OR
FILE:	98PL408	SCALE:	4:1
SHEET:	1	OF	1

Evaluation Board and Circuit

For Pin Connection Refer to Data Sheet of the DUT



Schematic Diagram

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: Rogers R04350 or equivalent, Dielectric Constant=3.5, Thickness=.030 inch.

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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