Surface Mount

Voltage Variable Attenuator

SVA-2000+

50Ω 50 to 2000 MHz

Maximum Ratings

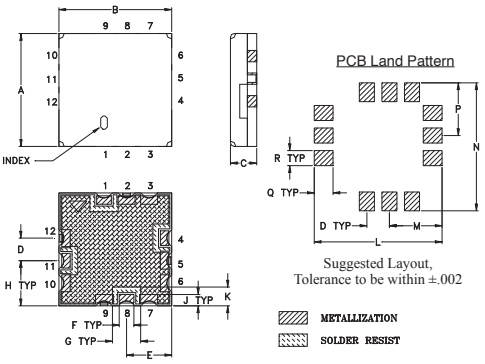
Operating Temperature	-45°C to 85°C
Storage Temperature	-55°C to 100°C
Absolute Max. Supply Voltage(V+)	7V
Absolute Max. Control Voltage(Vctrl)	15V
Absolute Max. RF Input Level	+17dBm

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

Pin Connections

RF IN	8
RF OUT	1
V CONTROL	4
V+	11
GROUND	2,3,5,6,7,9,10,12

Outline Drawing

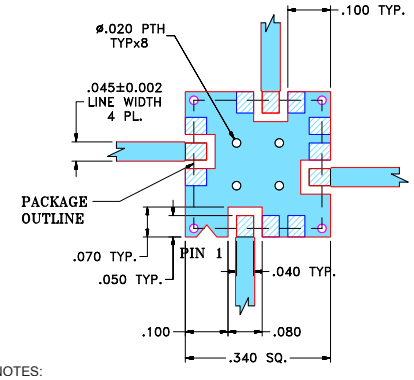


Outline Dimensions (inch / mm)

A	B	C	D	E	F	G	H	J
.300	.300	.100	.060	.120	.039	.075	.120	.030
7.62	7.62	2.54	1.52	3.05	0.99	1.91	3.05	0.76

K	L	M	N	P	Q	R	wt.
.050	.340	.140	.340	.140	.050	.040	grams
1.27	8.64	3.56	8.64	3.56	1.27	1.02	.25

Demo Board MCL P/N: TB-457+
Suggested PCB Layout (PL-277)



NOTES:

1. TRACE WIDTH IS SHOWN FOR RF4 WITH DIELECTRIC THICKNESS .025" ± .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

Features

- Frequency range, 50-2000 MHz
- Low insertion loss, 1.6dB typ.
- Maximum attenuation at minimum current
- No external bias and RF matching network required
- Small size, 0.3" x 0.3" x 0.1"
- Shielded case
- Aqueous washable

CASE STYLE: FZ990

Applications

- CATV
- Power level control
- Feed forward amplifiers

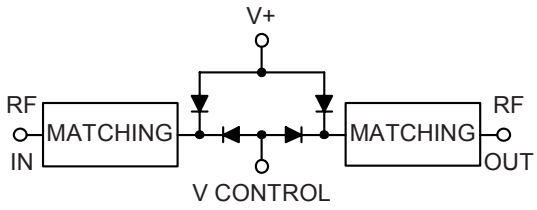
+RoHS Compliant
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Electrical Specifications (T_{AMB}= 25°C)

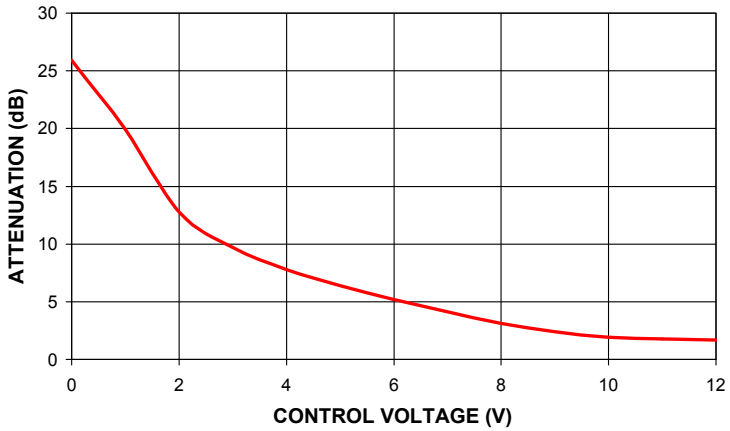
FREQ. (MHz)		MIN. INSERTION LOSS, dB (+12V)		MAX. ATTENUATION dB (0V)		INPUT POWER (dBm)	CONTROL Voltage (V)	CONTROL Current (mA)	IP3 (dBm)	RETURN LOSS (dB)	POWER SUPPLY Voltage (V)	POWER SUPPLY Current (mA)
Min.	Max.	Typ.	Max.	Typ.	Min.	Max.		Max.	Typ.	Typ.		Max.
50 -	500	1.5	2.0	35	26	+17	0 - 12	5	38	23	+5	2
500 -	1000	1.6	2.2	29	21	+17	0 - 12	5	44	21	+5	2
1000 -	2000	1.9	2.6	23	15	+17	0 - 12	5	47	20	+5	2

Notes:
Rise/Fall time: 15μSec/19μSec Typ.
Switching Time, turn on/off: 20μSec. Typ.

Equivalent Schematic



SVA-2000+
TYPICAL ATTENUATION AT 1000 MHz



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.
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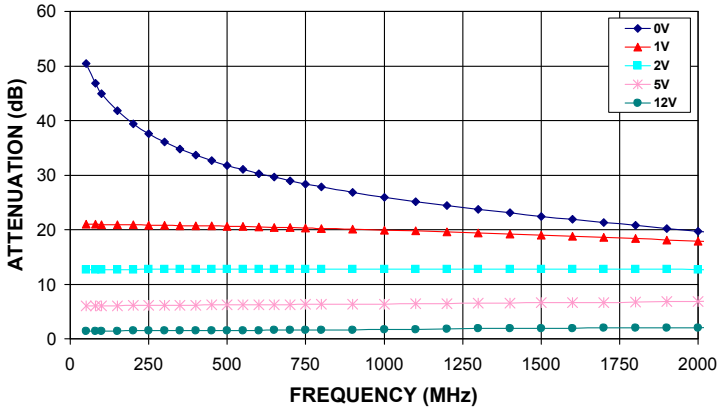
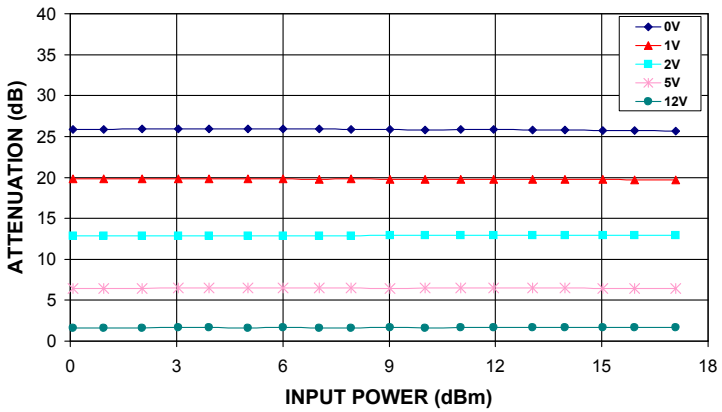
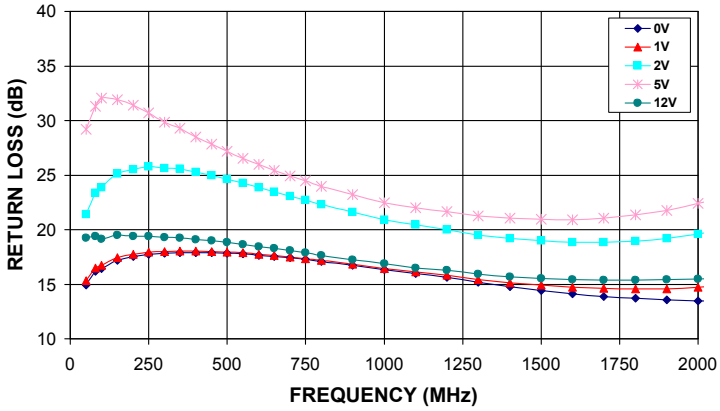
SVA-2000+
ATTENUATION Vs. FREQUENCY
OVER CONTROL VOLTAGES



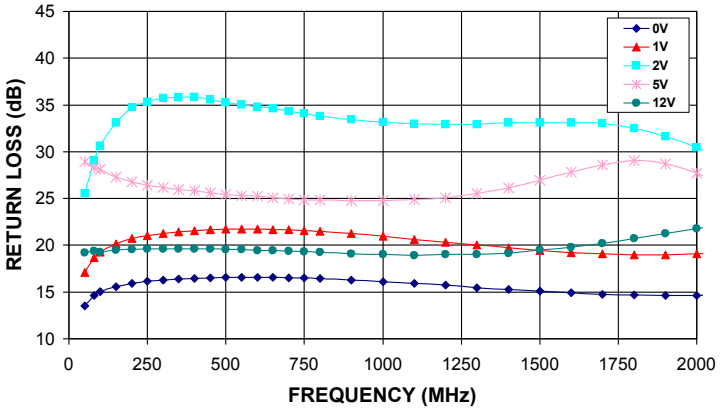
SVA-2000+
ATTENUATION Vs. INPUT POWER
OVER CONTROL VOLTAGES AT 1000MHz



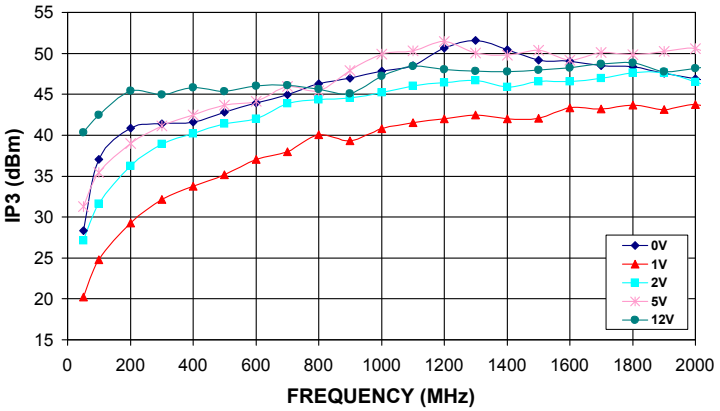
SVA-2000+
INPUT RETURN LOSS Vs. FREQUENCY
OVER CONTROL VOLTAGES



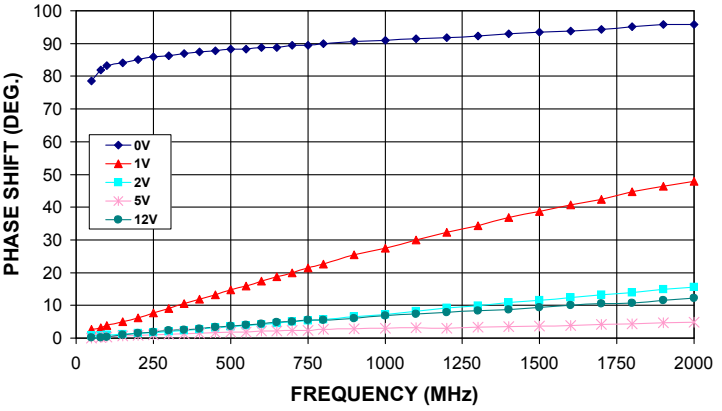
SVA-2000+
OUTPUT RETURN LOSS Vs. FREQUENCY
OVER CONTROL VOLTAGES



SVA-2000+
IP3 Vs. FREQUENCY
OVER CONTROL VOLTAGES



SVA-2000+
PHASE SHIFT Vs. FREQUENCY
OVER CONTROL VOLTAGES



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Voltage Variable Attenuator SVA-2000+

Typical Performance Data

V CONTROL (V)	ATTENUATION @ 1000 MHz (dB) @V+=5V
0.0	25.90
1.0	19.90
2.0	12.80
3.0	9.71
4.0	7.80
5.0	6.38
6.0	5.19
7.0	4.11
8.0	3.12
9.0	2.39
10.0	1.91
11.0	1.76
12.0	1.68

FREQ. (MHz)	ATTENUATION Vs. V CONTROL @ V+=5V (dB)				
	@V Control=0V	@V Control=1V	@V Control=2V	@V Control=5V	@V Control=12V
10	60.66	20.89	13.09	5.86	1.53
20	56.84	20.90	12.77	5.91	1.48
50	50.48	20.97	12.71	6.00	1.44
80	46.84	20.96	12.70	6.04	1.44
100	44.91	20.89	12.66	6.02	1.41
150	41.76	20.91	12.70	6.08	1.45
200	39.42	20.86	12.69	6.09	1.46
250	37.58	20.83	12.72	6.11	1.46
300	36.09	20.81	12.72	6.13	1.49
350	34.78	20.75	12.73	6.15	1.48
400	33.69	20.73	12.72	6.15	1.50
450	32.69	20.69	12.75	6.19	1.52
500	31.80	20.62	12.74	6.20	1.51
550	31.02	20.57	12.75	6.22	1.55
600	30.23	20.48	12.75	6.24	1.54
650	29.61	20.45	12.77	6.25	1.59
700	28.95	20.36	12.77	6.27	1.57
750	28.37	20.33	12.78	6.31	1.62
800	27.84	20.25	12.78	6.30	1.62
900	26.81	20.10	12.78	6.34	1.64
1000	25.91	19.90	12.78	6.38	1.68
1100	25.10	19.75	12.80	6.43	1.73
1200	24.44	19.61	12.80	6.46	1.82
1300	23.74	19.44	12.81	6.50	1.87
1400	23.08	19.21	12.80	6.53	1.87
1500	22.43	18.99	12.78	6.60	1.89
1600	21.86	18.77	12.78	6.64	1.93
1700	21.34	18.56	12.77	6.68	1.96
1800	20.83	18.35	12.76	6.73	1.99
1900	20.25	18.08	12.73	6.79	2.00
2000	19.71	17.84	12.70	6.87	2.02

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Typical Performance Data

FREQ. (MHz)	INPUT RETURN LOSS Vs. V CONTROL @ V+=5V (dB)				
	@V Control=0V	@V Control=1V	@V Control=2V	@V Control=5V	@V Control=12V
10	8.50	9.50	12.69	19.28	18.03
20	11.08	11.94	16.40	23.38	18.71
50	14.94	15.32	21.40	29.20	19.24
80	16.18	16.47	23.39	31.30	19.39
100	16.43	16.71	23.85	32.07	19.17
150	17.21	17.45	25.14	31.92	19.48
200	17.52	17.73	25.51	31.43	19.39
250	17.75	17.96	25.79	30.68	19.42
300	17.82	18.00	25.63	29.86	19.30
350	17.90	18.06	25.57	29.28	19.25
400	17.89	18.06	25.27	28.48	19.11
450	17.89	18.01	24.97	27.85	18.97
500	17.83	17.95	24.64	27.21	18.82
550	17.77	17.88	24.25	26.55	18.65
600	17.62	17.74	23.85	25.99	18.44
650	17.55	17.63	23.49	25.45	18.28
700	17.42	17.49	23.07	24.91	18.08
750	17.28	17.34	22.69	24.45	17.87
800	17.10	17.17	22.30	23.98	17.65
900	16.74	16.81	21.60	23.23	17.24
1000	16.35	16.45	20.92	22.46	16.86
1100	15.97	16.11	20.43	22.02	16.50
1200	15.65	15.85	20.02	21.67	16.28
1300	15.18	15.44	19.52	21.26	15.92
1400	14.77	15.15	19.20	21.04	15.68
1500	14.43	14.91	18.97	20.97	15.55
1600	14.12	14.71	18.83	20.92	15.44
1700	13.87	14.60	18.83	21.07	15.39
1800	13.70	14.57	18.96	21.36	15.40
1900	13.55	14.59	19.19	21.77	15.41
2000	13.49	14.73	19.61	22.39	15.49

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Typical Performance Data

FREQ. (MHz)	OUTPUT RETURN LOSS Vs. V CONTROL @ V+=5V (dB)				
	@V Control=0V	@V Control=1V	@V Control=2V	@V Control=5V	@V Control=12V
10	7.76	9.69	13.25	20.75	18.04
20	10.11	12.71	18.13	25.79	18.71
50	13.52	17.11	25.52	28.92	19.23
80	14.61	18.67	29.03	28.31	19.37
100	15.06	19.28	30.64	28.09	19.26
150	15.56	20.12	33.10	27.27	19.51
200	15.93	20.71	34.76	26.78	19.54
250	16.14	21.04	35.30	26.39	19.61
300	16.28	21.27	35.71	26.18	19.62
350	16.38	21.44	35.82	25.95	19.64
400	16.46	21.55	35.87	25.80	19.60
450	16.53	21.69	35.56	25.57	19.63
500	16.55	21.70	35.25	25.44	19.55
550	16.57	21.73	35.04	25.32	19.54
600	16.54	21.70	34.78	25.22	19.46
650	16.54	21.66	34.61	25.09	19.42
700	16.51	21.64	34.32	24.97	19.37
750	16.49	21.56	34.09	24.86	19.34
800	16.43	21.48	33.83	24.81	19.24
900	16.28	21.24	33.45	24.75	19.11
1000	16.10	20.96	33.17	24.75	19.01
1100	15.91	20.60	33.00	24.88	18.94
1200	15.73	20.34	32.93	25.08	19.01
1300	15.48	20.02	32.91	25.54	19.05
1400	15.29	19.73	33.07	26.14	19.16
1500	15.08	19.43	33.11	26.94	19.47
1600	14.90	19.22	33.12	27.81	19.81
1700	14.77	19.08	33.06	28.58	20.22
1800	14.68	18.97	32.49	29.06	20.75
1900	14.65	18.98	31.64	28.71	21.28
2000	14.66	19.06	30.44	27.71	21.79

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Typical Performance Data

FREQ. (MHz)	INPUT IP3 Vs. V CONTROL @ V+=5V (dBm)				
	@V Control=0V	@V Control=1V	@V Control=2V	@V Control=5V	@V Control=12V
10	16.45	12.29	15.68	19.00	31.69
20	25.98	14.91	19.84	24.07	35.73
50	28.35	20.21	27.14	31.27	40.30
100	37.06	24.76	31.59	35.44	42.46
200	40.83	29.27	36.27	38.97	45.44
300	41.40	32.16	38.92	41.11	44.96
400	41.59	33.78	40.21	42.49	45.84
500	42.83	35.16	41.38	43.71	45.36
600	43.97	37.07	41.99	44.17	46.01
700	44.98	38.01	43.86	45.97	46.08
800	46.29	40.09	44.38	45.44	45.61
900	46.98	39.30	44.54	47.92	45.10
1000	47.84	40.77	45.23	49.90	47.24
1100	48.48	41.53	45.99	50.30	48.46
1200	50.65	41.99	46.43	51.44	48.03
1300	51.60	42.48	46.71	50.05	47.81
1400	50.42	42.02	45.87	49.80	47.76
1500	49.17	42.07	46.58	50.41	47.95
1600	49.05	43.33	46.57	49.14	48.26
1700	48.49	43.21	46.93	50.14	48.70
1800	48.36	43.66	47.62	49.86	48.85
1900	47.57	43.14	47.63	50.27	47.77
2000	46.87	43.72	46.46	50.55	48.18

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Typical Performance Data

FREQ. (MHz)	PHASE SHIFT Vs. V CONTROL @ V+=5V (deg)				
	@V Control=0V	@V Control=1V	@V Control=2V	@V Control=5V	@V Control=12V
50	78.54	2.68	0.86	0.06	0.25
80	81.99	3.23	0.78	0.23	0.25
100	83.19	3.79	0.97	0.30	0.39
150	84.14	4.98	1.13	0.63	0.93
200	85.03	6.23	1.44	0.84	1.47
250	85.92	7.70	1.72	1.05	1.86
300	86.22	8.97	1.96	1.25	2.28
350	86.88	10.51	2.37	1.39	2.59
400	87.44	11.91	2.69	1.49	2.91
450	87.80	13.16	3.11	1.63	3.37
500	88.27	14.75	3.47	1.90	3.61
550	88.24	15.99	3.88	1.90	4.09
600	88.70	17.49	4.11	2.19	4.40
650	88.85	18.69	4.55	2.17	4.81
700	89.38	20.00	5.01	2.35	5.02
750	89.40	21.38	5.42	2.36	5.50
800	89.95	22.65	5.76	2.60	5.56
900	90.61	25.43	6.50	2.83	6.09
1000	90.96	27.51	7.22	3.03	6.79
1100	91.40	29.91	8.15	3.20	7.41
1200	91.82	32.31	9.14	3.07	7.81
1300	92.29	34.42	9.94	3.27	8.36
1400	93.04	36.85	10.81	3.55	8.75
1500	93.40	38.69	11.52	3.72	9.42
1600	93.81	40.77	12.36	3.88	9.99
1700	94.38	42.42	13.19	4.19	10.47
1800	95.19	44.75	13.96	4.43	10.80
1900	95.80	46.32	14.84	4.65	11.53
2000	95.86	47.91	15.55	4.79	12.30

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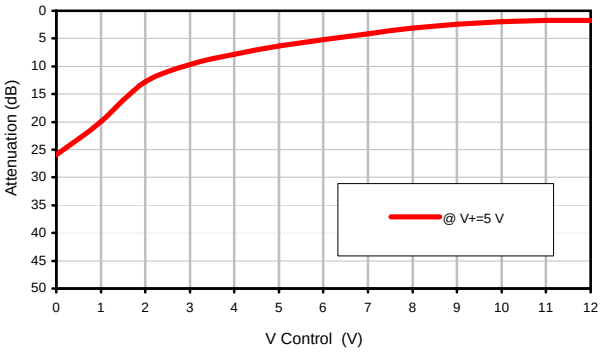
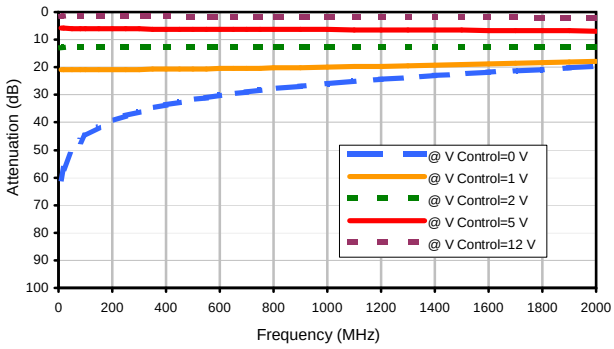
Voltage Variable Attenuator SVA-2000+

Typical Performance Curves

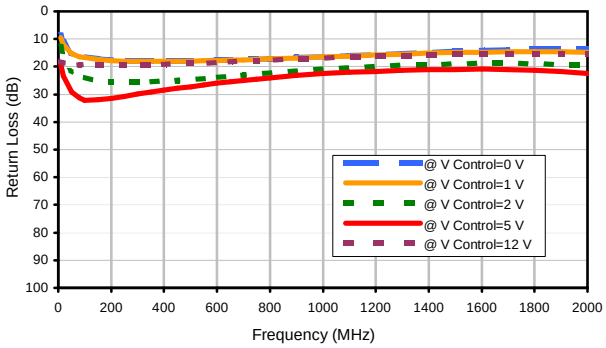
Attenuation @ 1000 MHz



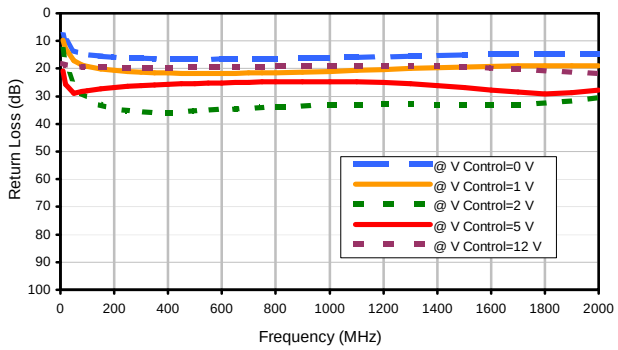
Attenuation @ V+=5 V



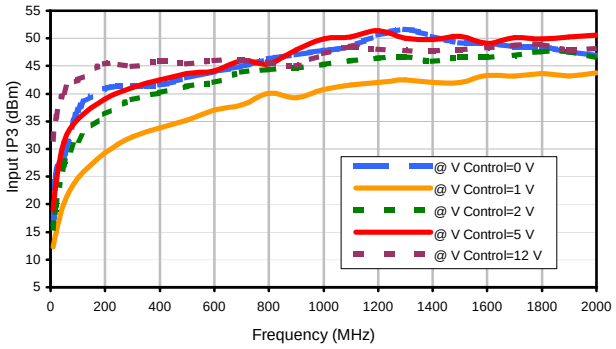
Input Return Loss @ V+=5 V



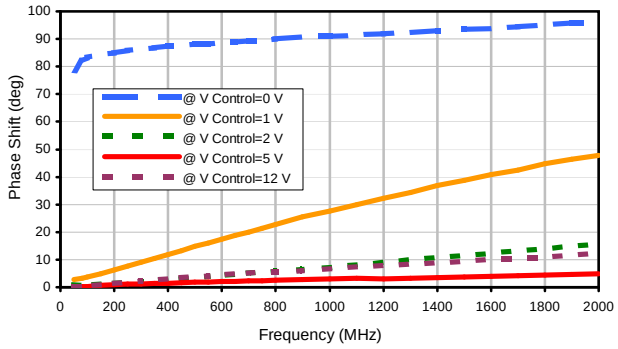
Output Return Loss @ V+=5 V



Input IP3 @ V+=5 V



Phase Shift @ V+=5 V



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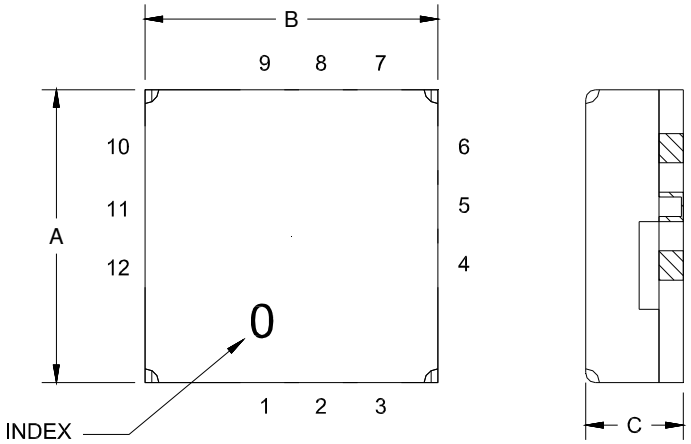
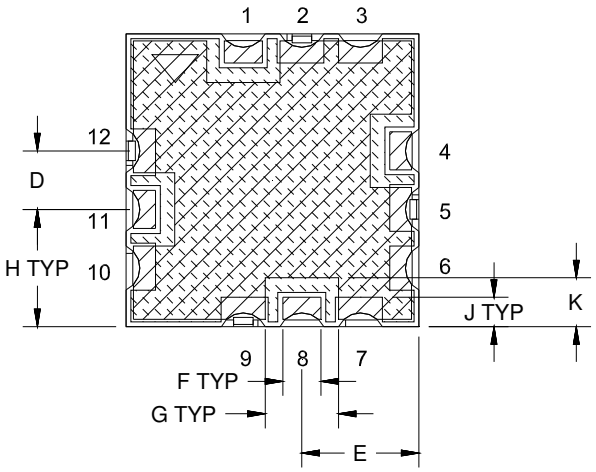
Case Style FZ

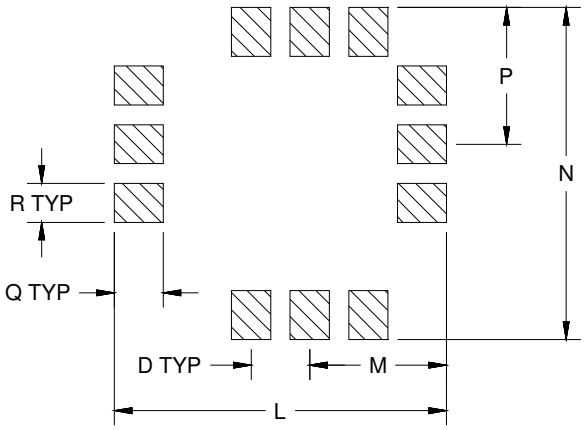
FZ990

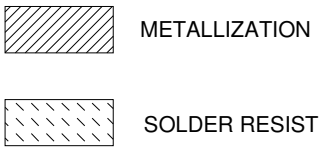
Outline Dimensions





PCB Land Pattern





CASE #	A	B	C	D	E	F	G	H	J	K
FZ990	.300 (7.62)	.300 (7.62)	.100 (2.54)	.060 (1.52)	.120 (3.05)	.039 (0.99)	.075 (1.91)	.120 (3.05)	.030 (0.76)	.050 (1.27)

CASE #	L	M	N	P	Q	R	WT. GRAM
FZ990	.340 (8.64)	.140 (3.56)	.340 (8.64)	.140 (3.56)	.050 (1.27)	.040 (1.02)	.25

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

Notes:

1. Case material: Nickel-Silver alloy.
2. Base: Printed wiring laminate.
3. Termination finish:
   For RoHS Case Styles: 3-5 µ inch (.08-.13 microns) Gold over 120-240 µ inch (3.05-6.10 microns) Nickel plate.

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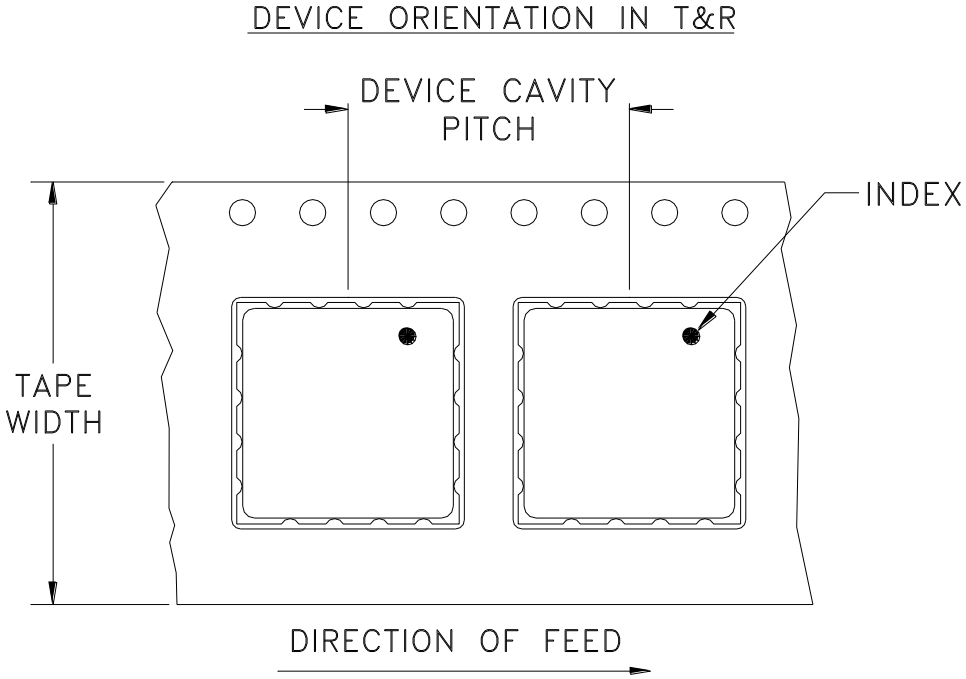
Tape & Reel Packaging TR-F78



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

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.

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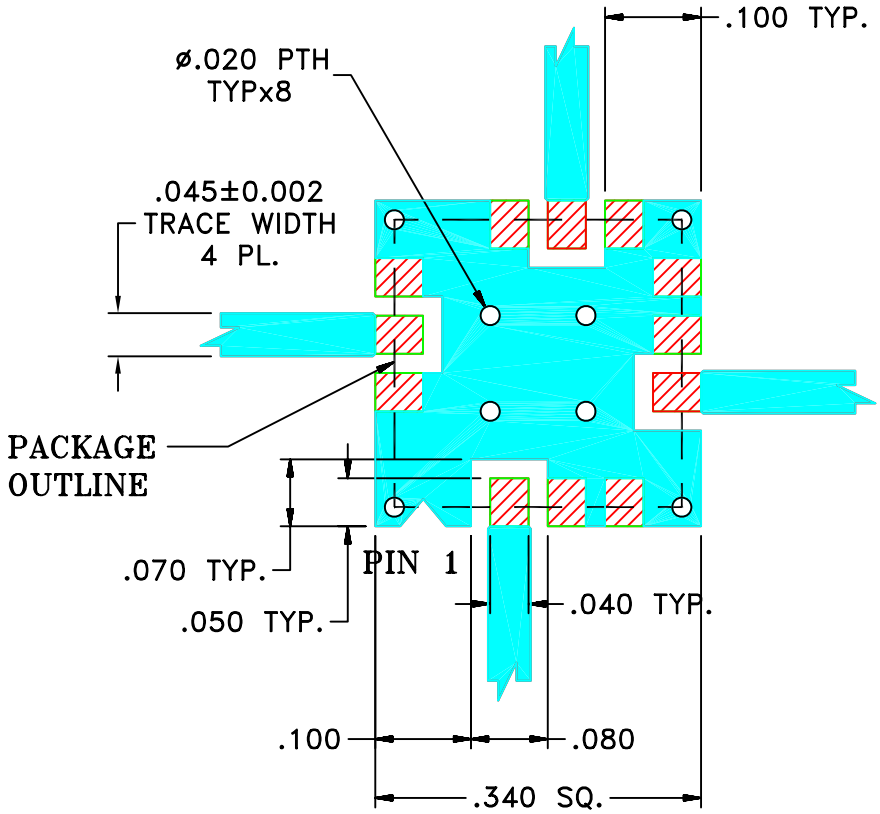
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M111698	NEW RELEASE (FROM RAVON)	06/07	DK	HH
OR	R68999	NEW RELEASE (FROM RAVON)	06/07	DK	HH

SUGGESTED MOUNTING CONFIGURATION
FOR FZ990 CASE STYLE, sk PIN CONNECTION.



NOTE:

1. TRACE WIDTH IS SHOWN FOR FR4 WITH DIELECTRIC THICKNESS. .025"±.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	DK (RAV)	14/06/07
TOLERANCES ON:	CHECKED	RZ (RAV)	14/06/07
2 PL DECIMALS ±	APPROVED	HH (RAV)	14/06/07
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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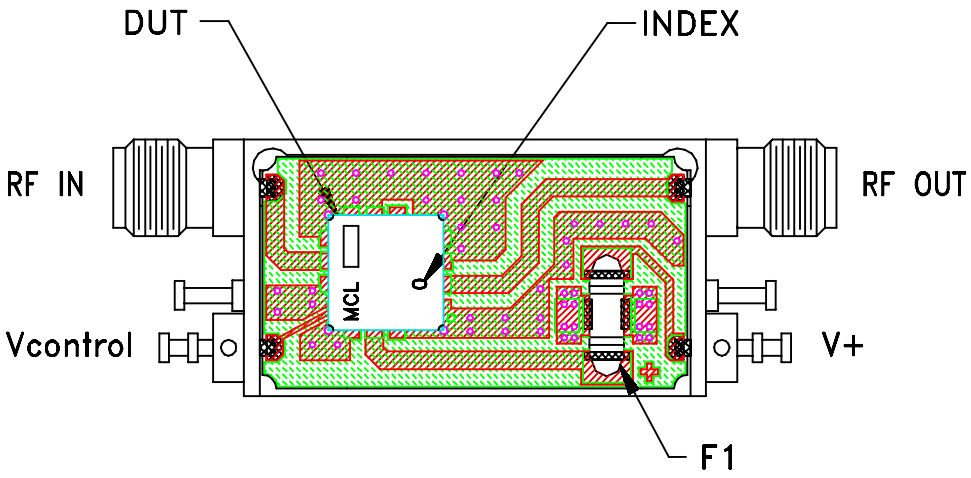
ASHEETA1.DWG REV:A DATE:01/12/95

Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

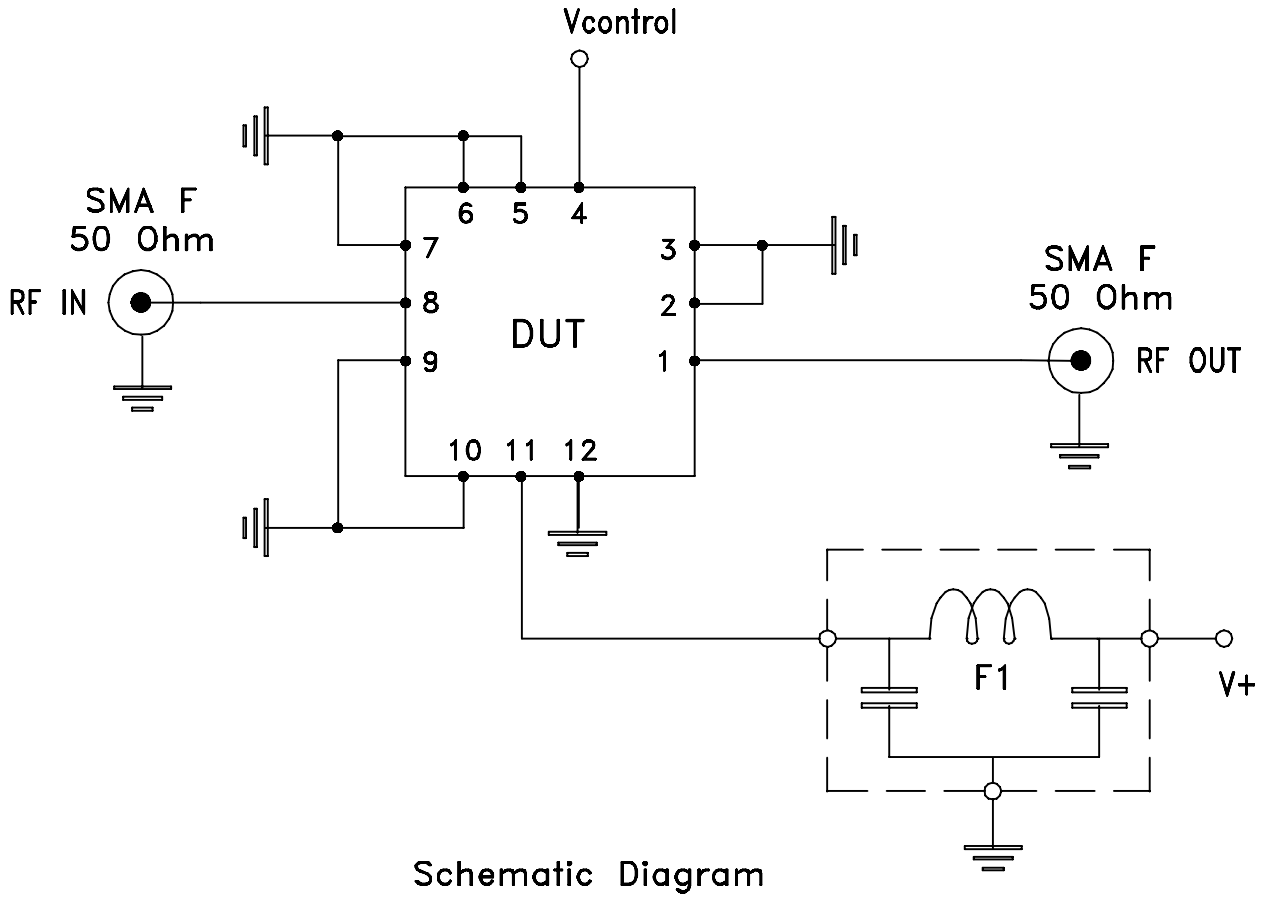
PL, sk, FZ990, SVA, TB-457+

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-277	OR
FILE: 98PL277	SCALE: 5:1	SHEET: 1 OF 1	

Evaluation Board and Circuit



TB-457+



Schematic Diagram

Notes:
1. SMA Female connectors.
2. PCB Material: FR4 GRADE IT-180TC (ITEQ CORPORATION)
   Dielectric Constant=4.5, Thickness=.025 inch.

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Environmental Specifications ENV03

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	-55° to 85°C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° C Ambient Environment	Individual Model Data Sheet
HAST	130°C, 85% RH, 96 hours	JESD22-A110
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 Eutectic Process: 225°C peak Pb-Free Process, 245°C peak	J-STD-020, Table 4-1, 4-2 and 5-2, Figure 5-1
Solderability	10X Magnification	J-STD-002, Para 4.2.5, Test S, 95% Coverage
Vibration (High Frequency)	20g peak, 20-2000 Hz, 4 times in each of three axes (total 12)	MIL-STD-883, Method 2007.3, Condition A
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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