Surface Mount

Voltage Variable Equalizer

VAEQ-1220-75+

75Ω **50 to 1220 MHz**

The Big Deal

- Adjustable attenuation slope
- IP3 +50 dBm typical
- Minimal deviation from linear loss, ± 0.5 dB

CASE STYLE: HE1354

Product Overview

The VAEQ-1220-75+ is a 75Ω Voltage Variable Equalizer built into a shielded case (size of 394”x.394”x.150”, 10 x 10 x 3.8 mm). This model offers excellent performance over a wide frequency range of 50 to 1220 MHz with the variable slope providing great flexibility in a small 10 mm package.
The VAEQ-1220-75+ is often used to compensate RF chain gain flatness or cable loss versus frequency.

Key Features

Feature	Advantages
Low power consumption: • Supply voltage +5V_{DC} at max 16mA • Control voltage 0-7V at max 20mA	Allows for use in applications with power constraints.
Adjustable attenuation slope (Control voltage of 0V to 7V)	Allows adjusting the slope to compensate for the precise losses encountered.
High linearity (IP3 +50 dBm typ.)	Low distortion enabling improved system performance.
Minimal deviation from linear loss over frequency range: ±0.5 dB	Provides low signal distortion over the passband.

Surface Mount

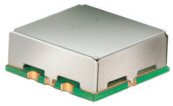
Voltage Variable Equalizer

VAEQ-1220-75+

75Ω 50 to 1220 MHz

Features

- Wide bandwidth
- Low insertion loss
- Low deviation from linear loss, ± 0.5 dB typ.
- High IP3 +50 dBm typ.
- Shielded case
- Aqueous washable



CASE STYLE: HE1354

Applications

- Cable loss compensation
- Instrumentation
- DOCSIS 3.1

+RoHS Compliant

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

Electrical Specifications at 25°C, V+=5V$_{DC}$ unless otherwise noted

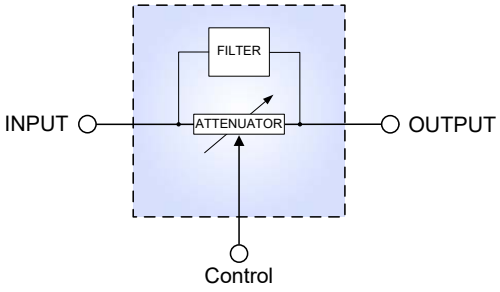
Parameter	Condition	Min.	Typ.	Max.	Units
Frequency Range		50		1220	MHz
Insertion Loss	50 MHz, Control Voltage, 0 - 7V 1220 MHz, Control Voltage, 0 - 7V		15 - 1.7 4.7 - 3.3		dB
Deviation from Linear Loss	Control Voltage 0 - 7V		± 0.5		dB
IP3	Control Voltage, 2.5 - 7V	+42	+50		dBm
1 dB Compression	Control Voltage, 0 - 7V		+30		dBm
Input Return Loss	Control Voltage, 0 - 7V		13		dB
Output Return Loss	Control Voltage, 0 - 7V		11.5		dB
Supply Voltage (V+)	Control Voltage, 0 - 7V	3.5	5	5.5	V
Supply Current	Control Voltage 7V, Control Voltage 0V,		0 10	 16	mA
Control Current	Control Voltage 7V Control Voltage 2.5V		12 0	20	mA

Maximum Ratings

Parameter	Ratings
Operating Temperature	0°C to 85°C
Storage Temperature	-55°C to 100°C
Input Power	+23 dBm
Control voltage	11 V
Supply Voltage (V+)	7 V

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

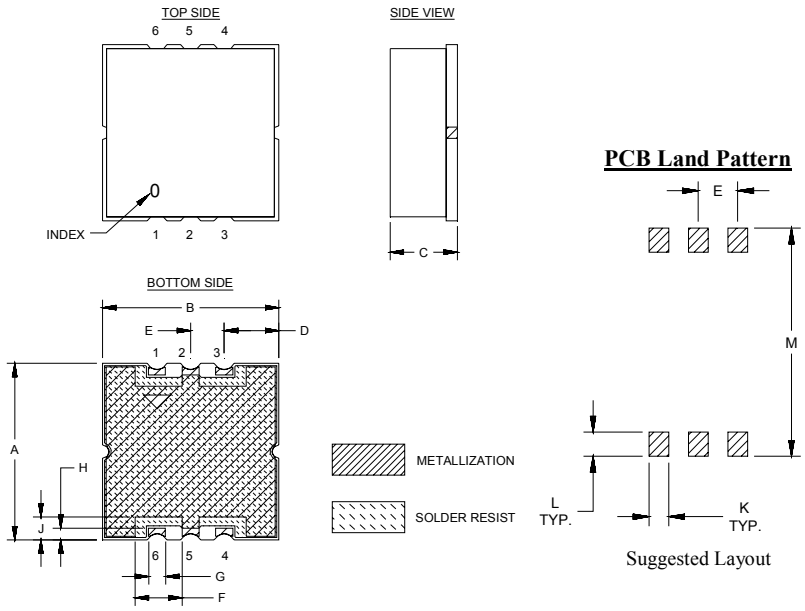
Simplified Functional Diagram



Pad Connections

Function	Pin Number
RF IN	1
RF OUT	6
V CONTROL	3
V+	4
GROUND	2,5

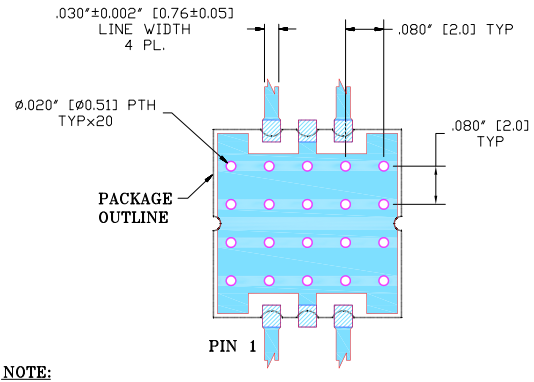
Outline Drawing



Outline Dimensions (inch / mm)

A	B	C	D	E	F	G	H	J	K	L	M	wt.
.394	.394	.150	.122	.075	.098	.038	.026	.051	.038	.046	.434	grams
10.01	10.01	3.81	3.10	1.90	2.49	0.97	0.66	1.29	0.97	1.17	11.02	0.7

Demo Board MCL P/N: TB-1052+
Suggested PCB Layout (PL-315)



NOTE:

1. TRACE WIDTH IS SHOWN FOR 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.

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

DENOTES COPPER LAND PATTERN FREE OF SOLDERMASK

Pad Connections

Function	Pin Number
RF IN	1
RF OUT	6
V CONTROL	3
V+	4
GROUND	2,5

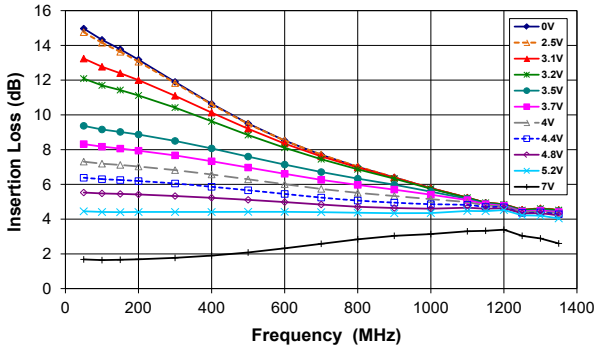
@ $V_{Control}$=0V & $V_{Control}$=2.5V

Frequency (MHz)	Insertion Loss (dB)		Input Return Loss (dB)		Output Return Loss (dB)		Deviation from Linear Loss (dB)		Insertion Phase (deg)		Input IP3 (dBm)	
	Vcontrol		Vcontrol		Vcontrol		Vcontrol		Vcontrol		Vcontrol	
	0V	2.5V	0V	2.5V	0V	2.5V	0V	2.5V	0V	2.5V	0V	2.5V
50	14.97	14.76	24.08	24.10	21.91	24.23	0.93	0.84	18.62	17.84	47.40	48.28
100	14.32	14.15	24.53	24.53	21.25	23.03	0.73	0.66	10.22	9.50	60.34	53.63
150	13.78	13.63	24.08	24.06	20.66	21.64	0.62	0.58	6.52	5.74	55.68	54.01
200	13.18	13.06	23.10	23.06	19.65	20.03	0.47	0.44	3.31	2.51	57.62	54.88
300	11.90	11.83	20.92	20.87	17.22	16.97	0.08	0.09	4.28	5.04	58.28	55.49
400	10.64	10.61	18.50	18.45	14.91	14.46	0.29	0.26	14.06	14.72	58.50	56.06
450	10.06	10.04	17.22	17.19	13.78	13.33	0.43	0.39	19.72	20.32	50.58	49.73
500	9.50	9.49	16.21	16.18	12.80	12.35	0.54	0.50	25.76	26.27	60.53	57.72
550	8.99	8.99	15.06	15.04	11.90	11.48	0.61	0.57	32.19	32.63	48.79	48.49
600	8.52	8.53	14.09	14.07	11.03	10.65	0.64	0.59	38.84	39.21	57.13	56.17
700	7.70	7.72	12.15	12.14	9.46	9.16	0.57	0.53	52.82	53.01	55.44	54.88
800	7.01	7.03	10.39	10.38	8.11	7.92	0.37	0.35	67.27	67.31	58.24	57.12
900	6.40	6.41	8.87	8.86	6.95	6.84	0.10	0.10	81.98	81.95	57.49	55.26
950	6.10	6.11	8.24	8.23	6.45	6.36	0.05	0.04	89.89	89.85	50.51	49.85
1000	5.78	5.78	7.57	7.56	6.09	6.03	0.17	0.15	97.44	97.36	55.94	53.49
1100	5.23	5.24	6.69	6.68	5.48	5.46	0.51	0.48	114.11	114.00	58.18	55.65
1150	4.94	4.94	6.30	6.30	5.31	5.30	0.66	0.62	122.37	122.27	50.19	48.90
1200	4.85	4.85	6.12	6.12	5.30	5.30	1.01	0.97	132.09	132.01	54.10	53.63
1220	4.73	4.74	6.02	6.01	5.28	5.29	1.07	1.02	135.30	135.22	49.70	48.51

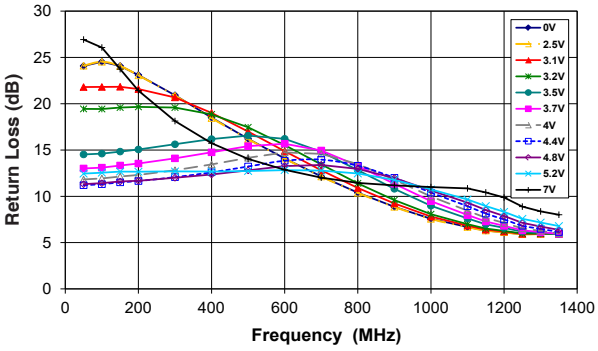
@ $V_{Control}$=5V & $V_{Control}$=7V

Frequency (MHz)	Insertion Loss (dB)		Input Return Loss (dB)		Output Return Loss (dB)		Deviation from Linear Loss (dB)		Insertion Phase (deg)		Input IP3 (dBm)	
	Vcontrol		Vcontrol		Vcontrol		Vcontrol		Vcontrol		Vcontrol	
	5.2V	7V	5.2V	7V	5.2V	7V	5.2V	7V	5.2V	7V	5V	7V
50	4.45	1.68	12.45	26.93	14.38	25.98	0.04	0.28	4.15	4.48	48.97	47.63
100	4.41	1.64	12.55	26.07	14.47	25.32	0.00	0.16	10.59	11.69	51.66	51.67
150	4.40	1.66	12.67	23.74	14.64	23.01	0.00	0.08	16.54	18.35	53.40	58.60
200	4.41	1.69	12.66	21.42	14.55	20.73	0.00	0.02	22.37	24.83	52.99	55.18
300	4.41	1.77	12.69	18.13	14.23	17.09	0.00	0.07	33.85	37.59	53.80	54.06
400	4.41	1.90	12.67	15.73	13.76	14.66	0.01	0.12	45.25	50.18	53.53	53.09
450	4.43	1.99	12.64	14.68	13.44	13.60	0.02	0.12	50.93	56.46	50.97	48.66
500	4.42	2.08	12.73	14.04	13.23	12.84	0.02	0.13	56.61	62.63	54.41	51.91
550	4.42	2.19	12.66	13.28	12.95	12.15	0.02	0.11	62.31	68.79	49.35	48.31
600	4.42	2.32	12.83	12.86	12.61	11.52	0.02	0.07	67.93	74.76	54.25	51.00
700	4.40	2.58	12.78	12.02	11.95	10.55	0.01	0.01	79.31	86.37	53.65	51.32
800	4.37	2.84	12.46	11.45	11.08	9.85	0.04	0.09	90.83	97.36	54.11	53.17
900	4.34	3.04	11.78	11.18	9.98	9.26	0.06	0.11	102.62	107.82	54.10	56.38
950	4.35	3.10	11.42	11.20	9.34	8.94	0.06	0.09	108.88	113.31	49.23	51.89
1000	4.35	3.14	10.74	11.00	8.78	8.69	0.06	0.03	114.71	118.35	53.04	55.90
1100	4.47	3.30	9.66	10.86	7.49	7.82	0.06	0.01	126.52	128.84	56.51	54.28
1150	4.46	3.33	8.95	10.42	6.90	7.34	0.06	0.04	131.47	133.03	48.45	53.41
1200	4.52	3.39	8.32	9.87	6.50	6.99	0.11	0.08	137.12	137.71	53.79	51.76
1220	4.43	3.30	8.00	9.49	6.36	6.86	0.02	0.20	138.75	138.82	48.81	50.74

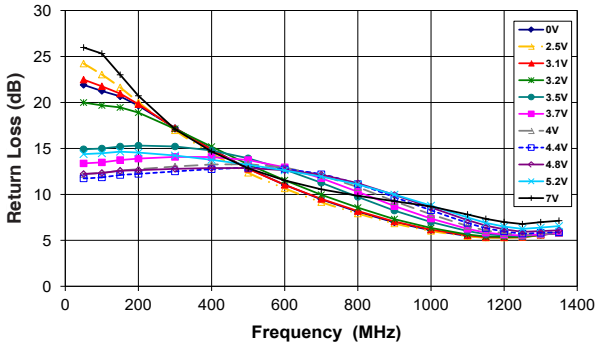
VAEQ-1220-75+
INSERTION LOSS Vs. FREQUENCY
OVER CONTROL VOLTAGES



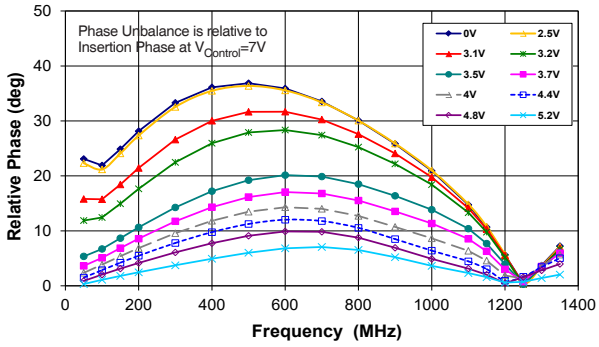
VAEQ-1220-75+
INPUT RETURN LOSS Vs. FREQUENCY
OVER CONTROL VOLTAGES



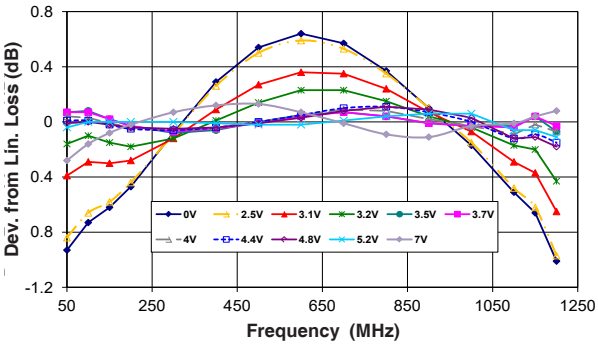
VAEQ-1220-75+
OUTPUT RETURN LOSS Vs. FREQUENCY
OVER CONTROL VOLTAGES



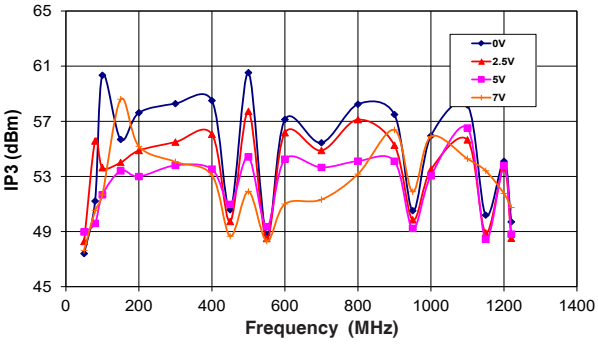
VAEQ-1220-75+
PHASE UNBALANCE Vs. FREQUENCY
OVER CONTROL VOLTAGES



VAEQ-1220-75+
DEVIATION FROM LINEAR LOSS Vs. FREQUENCY
OVER CONTROL VOLTAGES



VAEQ-1220-75+
IP3 Vs. FREQUENCY
OVER CONTROL VOLTAGES



Additional 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

Voltage Variable Equalizer, 75Ω

VAEQ-1220-75+

Typical Performance Data @ V+=5V

Frequency (MHz)	Insertion Loss (dB) Vcontrol		Input Return Loss (dB) Vcontrol		Output Return Loss (dB) Vcontrol		Deviation from Linear Loss (dB) Vcontrol		Insertion Phase (deg) Vcontrol	
	0V	2.5V	0V	2.5V	0V	2.5V	0V	2.5V	0V	2.5V
10	20.09	19.72	20.26	20.33	32.73	29.77	-	-	60.06	58.54
30	15.68	15.45	23.04	23.06	22.83	24.96	-	-	28.74	27.79
50	14.97	14.76	24.08	24.10	21.91	24.23	-0.93	-0.84	18.62	17.84
70	14.66	14.47	24.48	24.49	21.61	23.80	-0.80	-0.72	13.96	13.23
90	14.43	14.25	24.57	24.58	21.36	23.30	-0.75	-0.68	11.23	10.52
110	14.22	14.05	24.46	24.46	21.14	22.75	-0.71	-0.65	9.35	8.61
130	14.00	13.84	24.29	24.28	20.92	22.19	-0.67	-0.62	7.85	7.09
150	13.78	13.63	24.08	24.06	20.66	21.64	-0.62	-0.58	6.52	5.74
170	13.54	13.41	23.76	23.73	20.32	21.03	-0.57	-0.53	5.24	4.46
200	13.18	13.06	23.10	23.06	19.65	20.03	-0.47	-0.44	3.31	2.51
220	12.93	12.82	22.64	22.59	19.18	19.37	-0.40	-0.38	1.95	1.16
240	12.68	12.58	22.23	22.17	18.72	18.75	-0.32	-0.31	0.52	-0.28
260	12.42	12.33	21.87	21.81	18.24	18.15	-0.24	-0.24	-0.98	-1.77
300	11.90	11.83	20.92	20.87	17.22	16.97	-0.08	-0.09	-4.28	-5.04
320	11.64	11.58	20.35	20.30	16.71	16.41	0.00	-0.01	-6.07	-6.81
340	11.39	11.34	19.83	19.78	16.25	15.89	0.08	0.06	-7.95	-8.68
360	11.14	11.09	19.38	19.33	15.81	15.40	0.15	0.13	-9.90	-10.60
380	10.89	10.85	18.96	18.91	15.37	14.94	0.22	0.19	-11.92	-12.60
400	10.64	10.61	18.50	18.45	14.91	14.46	0.29	0.26	-14.06	-14.72
420	10.40	10.38	17.98	17.94	14.44	13.99	0.35	0.32	-16.29	-16.92
450	10.06	10.04	17.22	17.19	13.78	13.33	0.43	0.39	-19.72	-20.32
500	9.50	9.49	16.21	16.18	12.80	12.35	0.54	0.50	-25.76	-26.27
550	8.99	8.99	15.06	15.04	11.90	11.48	0.61	0.57	-32.19	-32.63
600	8.52	8.53	14.09	14.07	11.03	10.65	0.64	0.59	-38.84	-39.21
650	8.08	8.09	13.11	13.10	10.16	9.82	0.64	0.60	-45.83	-46.11
700	7.70	7.72	12.15	12.14	9.46	9.16	0.57	0.53	-52.82	-53.01
750	7.32	7.33	11.34	11.33	8.76	8.52	0.51	0.48	-60.19	-60.32
770	7.20	7.22	10.92	10.92	8.50	8.28	0.45	0.42	-63.09	-63.21
800	7.01	7.03	10.39	10.38	8.11	7.92	0.37	0.35	-67.27	-67.31
820	6.87	6.88	10.11	10.10	7.86	7.68	0.34	0.32	-70.19	-70.22
840	6.73	6.74	9.84	9.84	7.62	7.45	0.30	0.29	-73.33	-73.37
860	6.63	6.65	9.53	9.53	7.40	7.25	0.22	0.21	-76.43	-76.41
880	6.53	6.54	9.19	9.18	7.18	7.05	0.14	0.14	-79.22	-79.23
900	6.40	6.41	8.87	8.86	6.95	6.84	0.10	0.10	-81.98	-81.95
920	6.25	6.26	8.59	8.57	6.73	6.63	0.07	0.07	-85.01	-84.98
950	6.10	6.11	8.24	8.23	6.45	6.36	-0.05	-0.04	-89.89	-89.85
970	5.99	6.00	7.99	7.98	6.31	6.24	-0.12	-0.11	-92.84	-92.76
990	5.85	5.85	7.71	7.70	6.17	6.10	-0.15	-0.14	-95.82	-95.75
1000	5.78	5.78	7.57	7.56	6.09	6.03	-0.17	-0.15	-97.44	-97.36
1020	5.67	5.68	7.32	7.31	5.93	5.87	-0.24	-0.22	-100.68	-100.58
1040	5.58	5.58	7.13	7.11	5.77	5.72	-0.33	-0.30	-103.86	-103.78
1060	5.46	5.47	6.98	6.97	5.64	5.61	-0.39	-0.36	-107.01	-106.90
1100	5.23	5.24	6.69	6.68	5.48	5.46	-0.51	-0.48	-114.11	-114.00
1120	5.15	5.16	6.50	6.48	5.42	5.40	-0.61	-0.57	-117.25	-117.17
1140	5.01	5.02	6.35	6.34	5.34	5.33	-0.64	-0.61	-120.52	-120.41
1150	4.94	4.94	6.30	6.30	5.31	5.30	-0.66	-0.62	-122.37	-122.27
1180	4.83	4.84	6.20	6.19	5.29	5.29	-0.82	-0.78	-128.57	-128.46
1200	4.85	4.85	6.12	6.12	5.30	5.30	-1.01	-0.97	-132.09	-132.01
1220	4.73	4.74	6.02	6.01	5.28	5.29	-1.07	-1.02	-135.30	-135.22
1250	4.53	4.54	5.90	5.90	5.33	5.34	-	-	-141.55	-141.44
1300	4.60	4.62	5.94	5.94	5.58	5.60	-	-	-151.43	-151.30
1400	4.71	4.74	6.16	6.16	6.26	6.31	-	-	-172.24	-172.04

Frequency (MHz)	Input IP3 (dBm) Vcontrol	
	0V	2.5V
10	43.10	40.29
30	50.16	52.30
50	47.40	48.28
80	51.21	55.57
100	60.34	53.63
150	55.68	54.01
200	57.62	54.88
300	58.28	55.49
400	58.50	56.06
450	50.58	49.73
500	60.53	57.72
550	48.79	48.49
600	57.13	56.17
700	55.44	54.88
800	58.24	57.12
900	57.49	55.26
950	50.51	49.85
1000	55.94	53.49
1100	58.18	55.65
1150	50.19	48.90
1200	54.10	53.63
1220	49.70	48.51
1300	53.06	50.98
1400	54.02	50.37

Mini-Circuits®
www.minicircuits.com P.O. Box 350166, Brooklyn, NY 11235-0003 (718) 934-4500 sales@minicircuits.com

Voltage Variable Equalizer, 75Ω

VAEQ-1220-75+

Typical Performance Data @ V+=5V

Frequency (MHz)	Insertion Loss (dB) Vcontrol		Input Return Loss (dB) Vcontrol		Output Return Loss (dB) Vcontrol		Deviation from Linear Loss (dB) Vcontrol		Insertion Phase (deg) Vcontrol	
	5.2V	7V	5.2V	7V	5.2V	7V	5.2V	7V	5.2V	7V
10	4.80	2.10	11.94	20.73	13.41	18.61	-	-	3.73	4.91
30	4.51	1.74	12.32	25.48	14.20	24.11	-	-	-1.09	-1.00
50	4.45	1.68	12.45	26.93	14.38	25.98	-0.04	0.00	-4.15	-4.48
70	4.42	1.65	12.51	27.12	14.45	26.35	-0.02	0.00	-6.83	-7.48
90	4.41	1.64	12.53	26.51	14.46	25.78	0.00	0.00	-9.36	-10.32
110	4.41	1.64	12.56	25.58	14.49	24.82	0.00	0.00	-11.81	-13.04
130	4.41	1.65	12.62	24.62	14.56	23.87	0.00	0.00	-14.19	-15.72
150	4.40	1.66	12.67	23.74	14.64	23.01	0.00	0.00	-16.54	-18.35
170	4.40	1.67	12.68	22.84	14.65	22.15	0.00	0.00	-18.88	-20.95
200	4.41	1.69	12.66	21.42	14.55	20.73	0.00	0.00	-22.37	-24.83
220	4.41	1.70	12.67	20.56	14.47	19.81	0.00	0.00	-24.69	-27.40
240	4.41	1.72	12.71	19.87	14.41	19.01	0.00	0.00	-26.97	-29.96
260	4.41	1.74	12.75	19.32	14.37	18.32	0.00	0.00	-29.25	-32.50
300	4.41	1.77	12.69	18.13	14.23	17.09	0.00	0.00	-33.85	-37.59
320	4.41	1.80	12.64	17.48	14.13	16.51	-0.01	0.00	-36.15	-40.13
340	4.42	1.82	12.65	16.93	14.04	15.98	-0.01	0.00	-38.43	-42.66
360	4.42	1.85	12.68	16.51	13.97	15.52	-0.01	0.00	-40.67	-45.16
380	4.41	1.87	12.70	16.13	13.88	15.09	-0.01	0.00	-42.95	-47.66
400	4.41	1.90	12.67	15.73	13.76	14.66	-0.01	0.00	-45.25	-50.18
420	4.42	1.93	12.62	15.27	13.62	14.21	-0.01	0.00	-47.55	-52.72
450	4.43	1.99	12.64	14.68	13.44	13.60	-0.02	0.00	-50.93	-56.46
500	4.42	2.08	12.73	14.04	13.23	12.84	-0.02	0.00	-56.61	-62.63
550	4.42	2.19	12.66	13.28	12.95	12.15	-0.02	0.00	-62.31	-68.79
600	4.42	2.32	12.83	12.86	12.61	11.52	-0.02	0.00	-67.93	-74.76
650	4.41	2.43	12.72	12.36	12.22	10.91	0.00	0.00	-73.71	-80.74
700	4.40	2.58	12.78	12.02	11.95	10.55	0.01	0.00	-79.31	-86.37
750	4.38	2.70	12.66	11.77	11.55	10.18	0.03	0.00	-85.20	-92.12
770	4.38	2.77	12.53	11.58	11.38	10.05	0.02	0.00	-87.49	-94.30
800	4.37	2.84	12.46	11.45	11.08	9.85	0.04	0.00	-90.83	-97.36
820	4.35	2.87	12.45	11.46	10.87	9.72	0.06	0.00	-93.20	-99.51
840	4.34	2.90	12.37	11.45	10.66	9.60	0.07	0.00	-95.71	-101.79
860	4.35	2.97	12.19	11.37	10.46	9.49	0.05	0.00	-98.15	-103.98
880	4.36	3.02	11.97	11.26	10.23	9.39	0.05	0.00	-100.38	-105.92
900	4.34	3.04	11.78	11.18	9.98	9.26	0.06	0.00	-102.62	-107.82
920	4.32	3.04	11.64	11.16	9.71	9.12	0.09	0.00	-105.05	-109.94
950	4.35	3.10	11.42	11.20	9.34	8.94	0.06	0.00	-108.88	-113.31
970	4.37	3.14	11.20	11.16	9.15	8.86	0.04	0.00	-111.15	-115.26
990	4.35	3.14	10.89	11.05	8.91	8.76	0.05	0.00	-113.50	-117.27
1000	4.35	3.14	10.74	11.00	8.78	8.69	0.06	0.00	-114.71	-118.35
1020	4.38	3.17	10.49	10.91	8.51	8.52	0.03	0.00	-117.18	-120.53
1040	4.41	3.22	10.29	10.90	8.22	8.34	0.00	0.00	-119.47	-122.55
1060	4.43	3.24	10.12	10.93	7.95	8.15	-0.02	0.00	-121.70	-124.53
1100	4.47	3.30	9.66	10.86	7.49	7.82	-0.06	0.00	-126.52	-128.84
1120	4.50	3.35	9.33	10.67	7.26	7.65	-0.10	0.00	-128.46	-130.54
1140	4.48	3.35	9.06	10.49	7.01	7.44	-0.07	0.00	-130.37	-132.12
1150	4.46	3.33	8.95	10.42	6.90	7.34	-0.06	0.00	-131.47	-133.03
1180	4.46	3.34	8.60	10.15	6.64	7.10	-0.06	0.00	-135.20	-136.17
1200	4.52	3.39	8.32	9.87	6.50	6.99	-0.11	0.00	-137.12	-137.71
1220	4.43	3.30	8.00	9.49	6.36	6.86	-0.02	0.00	-138.75	-138.82
1250	4.22	3.04	7.57	8.89	6.25	6.77	-	-	-142.62	-141.87
1300	4.20	2.89	7.17	8.37	6.39	6.98	-	-	-149.14	-147.72
1400	4.19	2.63	6.70	7.98	6.91	7.42	-	-	-163.98	-161.71

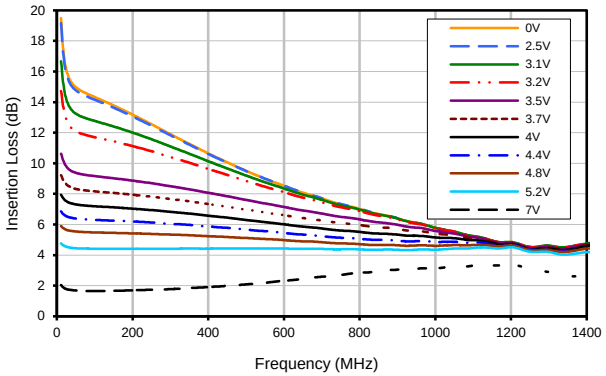
Frequency (MHz)	Input IP3 (dBm) Vcontrol	
	5V	7V
10	38.24	41.46
30	44.50	48.58
50	48.97	47.63
80	49.59	50.52
100	51.66	51.67
150	53.40	58.60
200	52.99	55.18
300	53.80	54.06
400	53.53	53.09
450	50.97	48.66
500	54.41	51.91
550	49.35	48.31
600	54.25	51.00
700	53.65	51.32
800	54.11	53.17
900	54.10	56.38
950	49.23	51.89
1000	53.04	55.90
1100	56.51	54.28
1150	48.45	53.41
1200	53.79	51.76
1220	48.81	50.74
1300	50.84	50.02
1400	50.81	49.59

Mini-Circuits®
www.minicircuits.com P.O. Box 350166, Brooklyn, NY 11235-0003 (718) 934-4500 sales@minicircuits.com

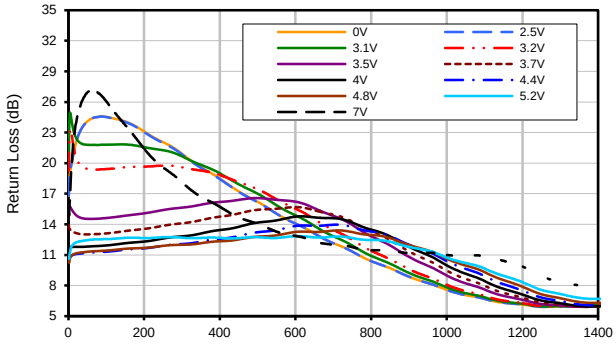
Voltage Variable Equalizer, 75Ω VAEQ-1220-75+

Typical Performance Curves @ V+=5V

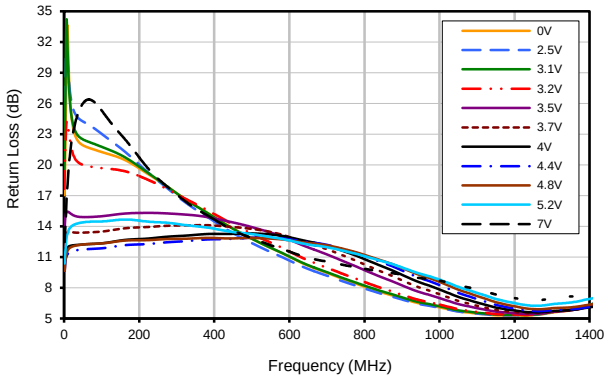
INSERTION LOSS
Vs.FREQUENCY OVER CONTROL VOLTAGES



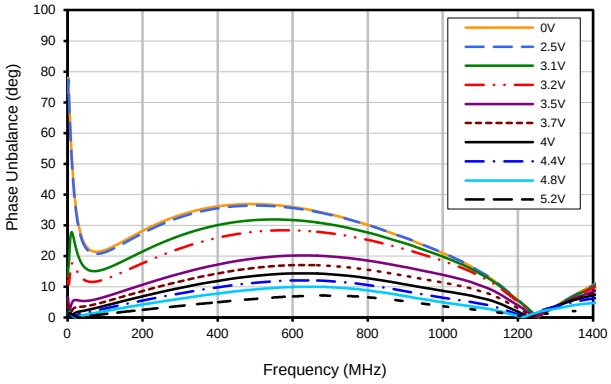
INPUT RETURN LOSS
Vs.FREQUENCY OVER CONTROL VOLTAGES



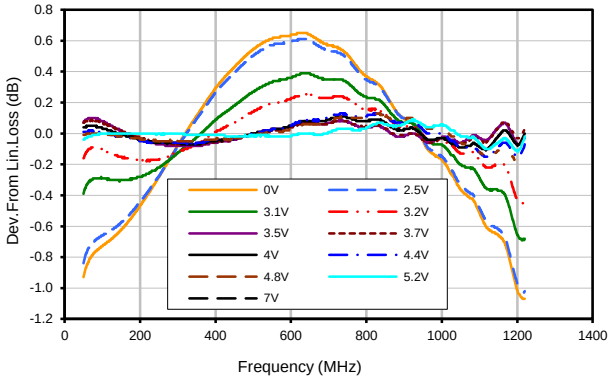
OUTPUT RETURN LOSS
Vs.FREQUENCY OVER CONTROL VOLTAGES



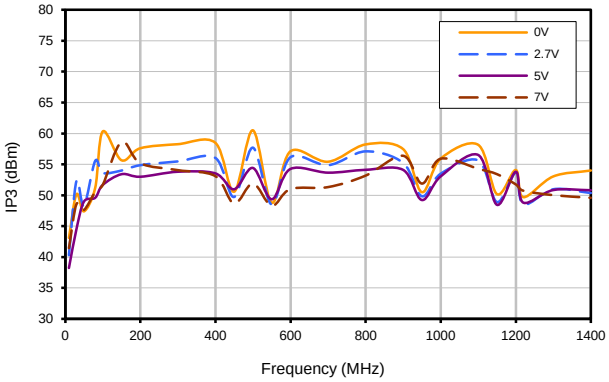
PHASE UNBALANCE
Vs.FREQUENCY OVER CONTROL VOLTAGES



DEVIATION FROM LINEAR LOSS
Vs.FREQUENCY OVER CONTROL VOLTAGES



IP3
Vs.FREQUENCY OVER CONTROL VOLTAGES

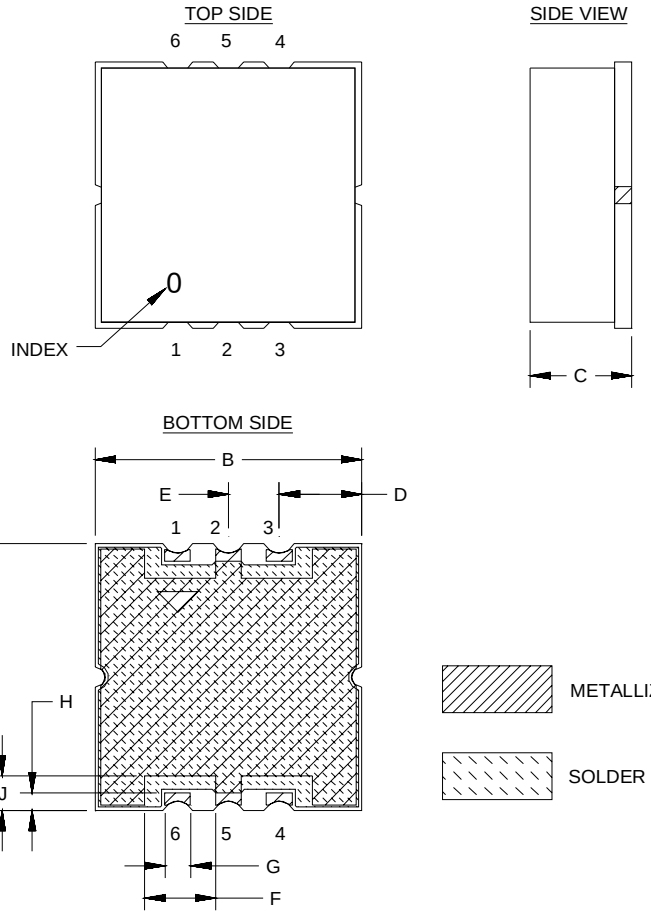


Mini-Circuits®
www.minicircuits.com P.O. Box 350166, Brooklyn, NY 11235-0003 (718) 934-4500 sales@minicircuits.com

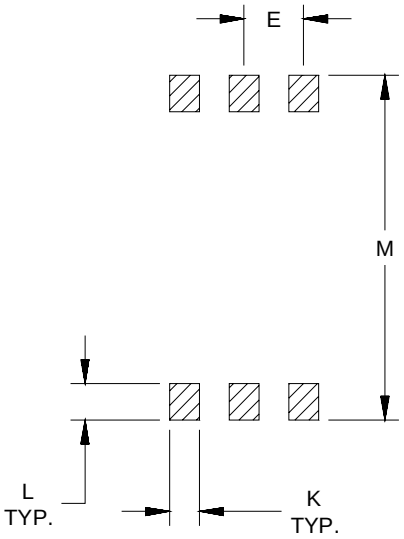
Case Style HE

HE1354

Outline Dimensions



PCB Land Pattern



Suggested Layout

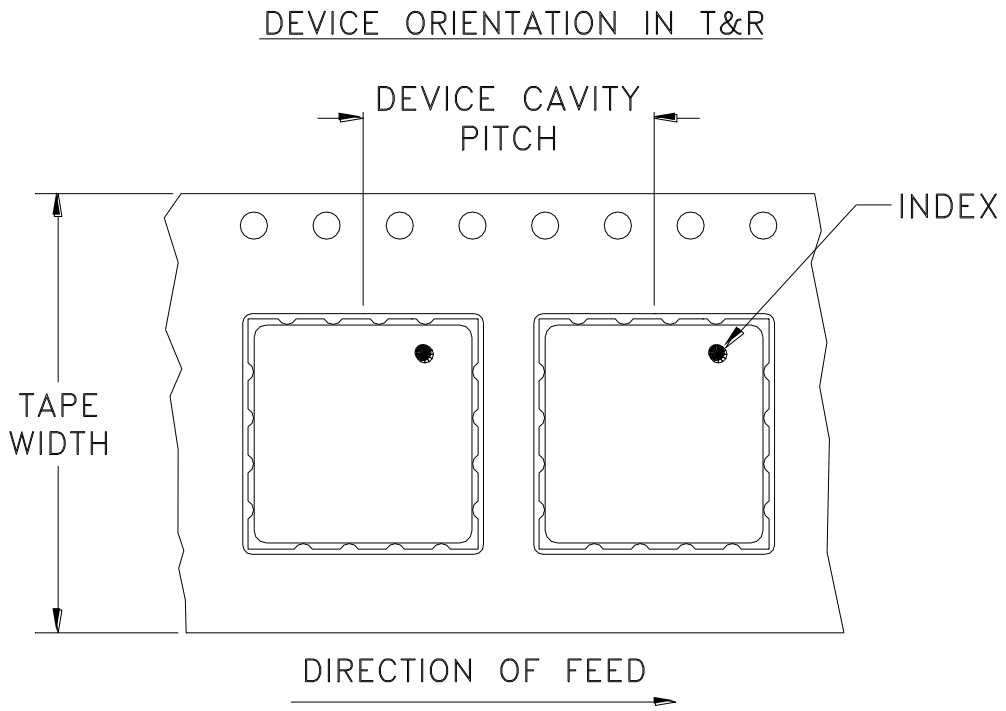
CASE #	A	B	C	D	E	F	G	H	J	K	L	M	WT. GRAMS
HE1354	.394 (10.01)	.394 (10.01)	.150 (3.81)	.122 (3.10)	.075 (1.90)	.098 (2.49)	.038 (0.97)	.026 (0.66)	.051 (1.29)	.038 (0.97)	.046 (1.17)	.434 (11.02)	0.7

Dimensions are in inches (mm). Tolerances: 2 Pl. ± .03; 3 Pl. ± .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.
   For RoHS-5 Case Styles: Tin-Lead plate.

Tape & Reel Packaging TR-F37



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel	
24	16	7	Small quantity standards (see note)	10
				20
				50
				100
		13	Standard	200
				500

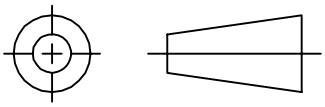
Note: Please consult individual model data sheet to determine device per reel availability.

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

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

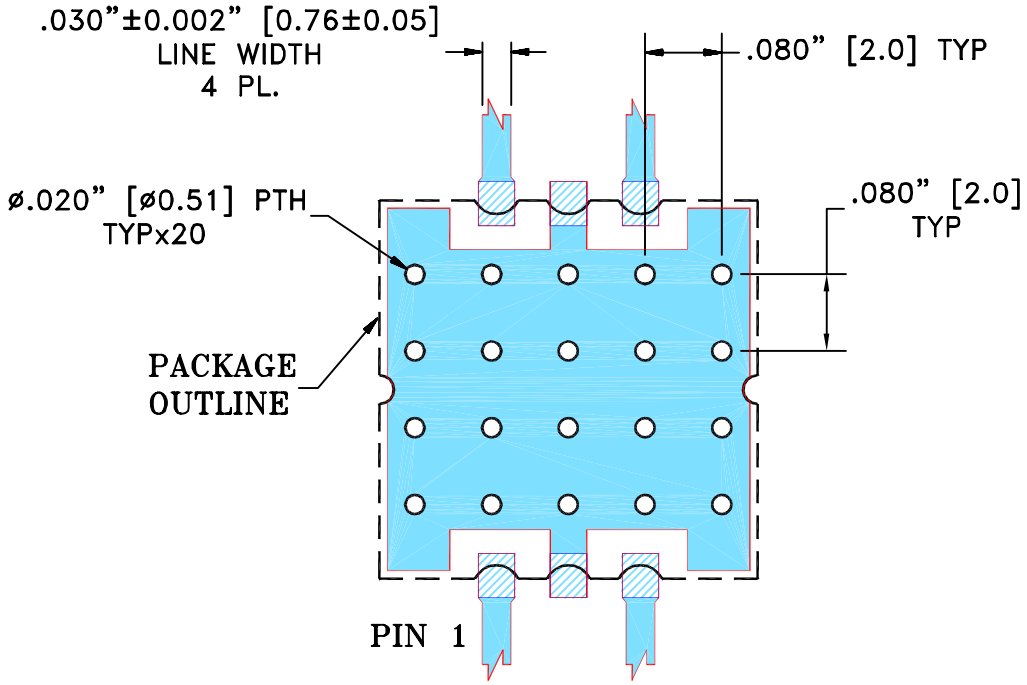
THIRD ANGLE PROJECTION



REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M124493	NEW RELEASE (FROM RAVON)	09/09	EM	YB
OR	R77678	NEW RELEASE (FROM RAVON)	09/09	EM	YB

SUGGESTED MOUNTING CONFIGURATION
FOR HE1354 CASE STYLE, qg PIN CONNECTION, 75 OHM



NOTE:

1. TRACE WIDTH IS SHOWN FOR 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 SOLDERMASK

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	EM (RAVON)	16 SEP 09
TOLERANCES ON:	CHECKED	HH (RAVON)	21 SEP 09
2 PL DECIMALS ±	APPROVED	YB (RAVON)	21 SEP 09
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

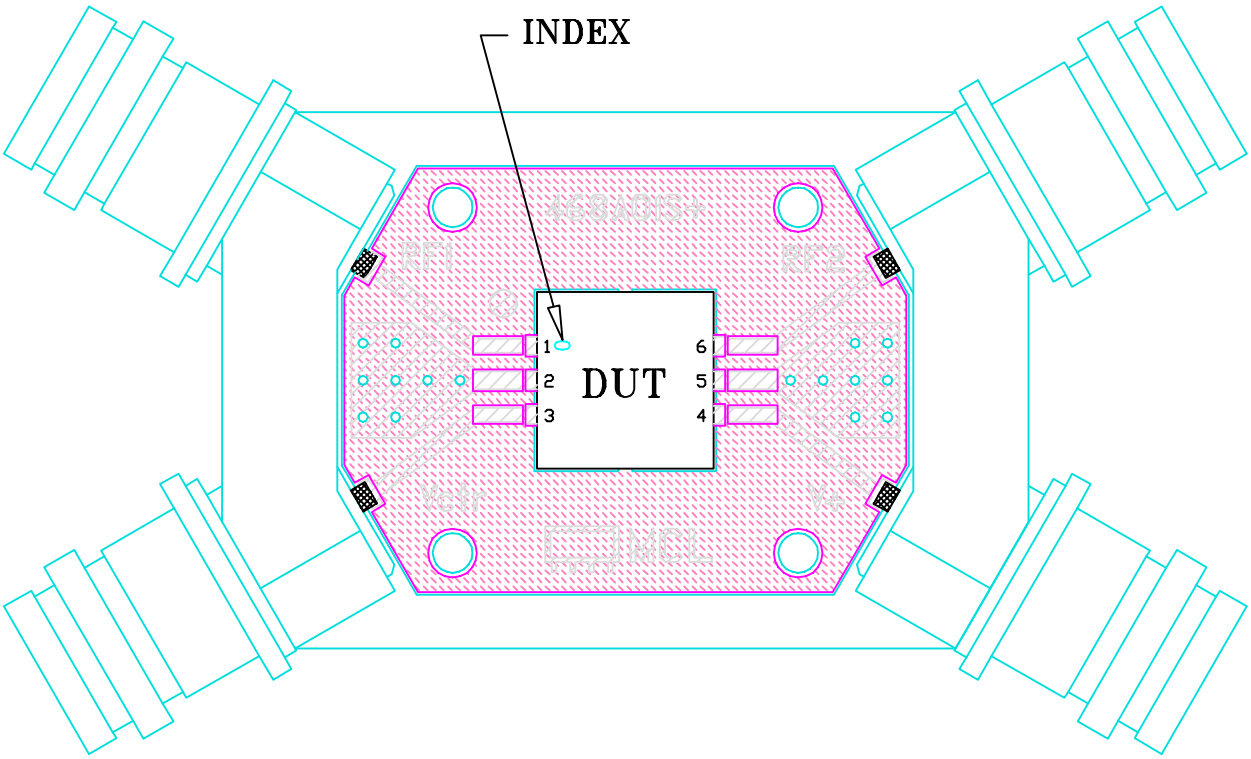
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, qg, HE1354, TB-549+, 75 OHM

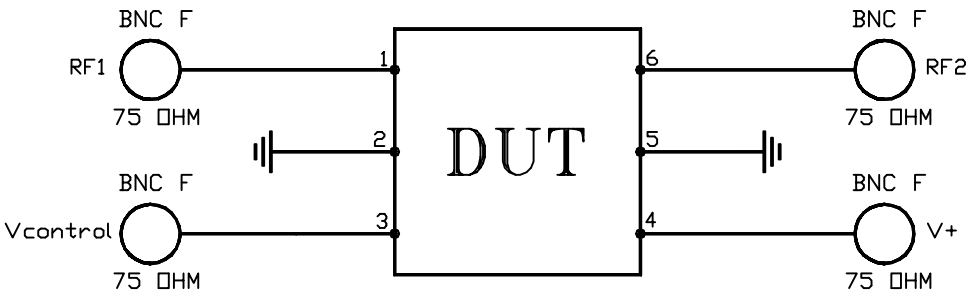
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-315	OR

FILE:	SCALE:	SHEET:
98PL315	5:1	1 OF 1

Evaluation Board and Circuit



TB-549+



Schematic Diagram

Notes:

1. BNC Female connectors.
2. PCB Material: Rogers RO4350B or equivalent, Dielectric constant=3.48, Thickness=.030 inch.

Mini-Circuits®

Mini-Circuits

Environmental Specifications ENV03T6

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	0° 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