

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,  $\pm 0.5$  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: <ul style="list-style-type: none"><li>• Supply voltage +5V<sub>DC</sub> at max 16mA</li><li>• Control voltage 0-7V at max 20mA</li></ul>	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: $\pm 0.5$ 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

### Applications

- Cable loss compensation
- Instrumentation
- DOCSIS 3.1



CASE STYLE: HE1354

### +RoHS Compliant

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

### Electrical Specifications at 25°C, V+=5V<sub>DC</sub> unless otherwise noted

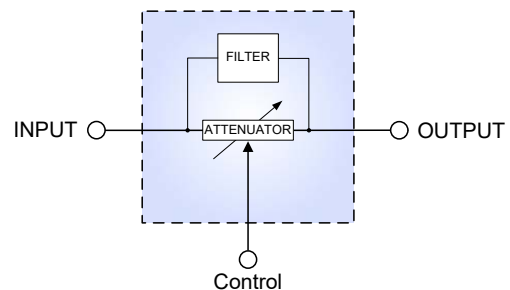
Parameter	Condition	Min.	Typ.	Max.	Units
Frequency Range		50		1220	MHz
Insertion Loss	50 MHz, Control Voltage, 0 - 7V 1220 MHz, Control Voltage, 0 - 7V		15 - 1.7 4.7 - 3.3		dB
Deviation from Linear Loss	Control Voltage 0 - 7V		± 0.5		dB
IP3	Control Voltage, 2.5 - 7V	+42	+50		dBm
1 dB Compression	Control 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.

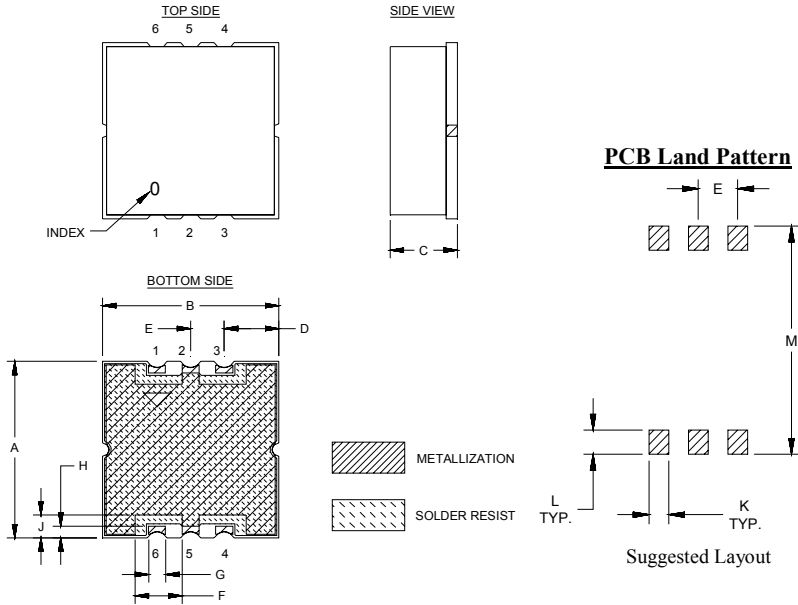
### Simplified Functional Diagram



### Pad Connections

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

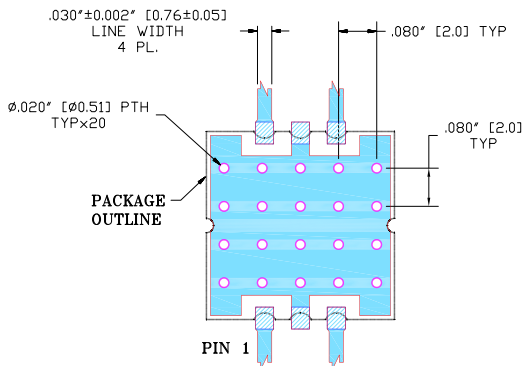
## Outline Drawing





## 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:

- TRACE WIDTH IS SHOWN FOR R04350 WITH DIELECTRIC THICKNESS.  $.030 \pm 0.002$ ". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
  - 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

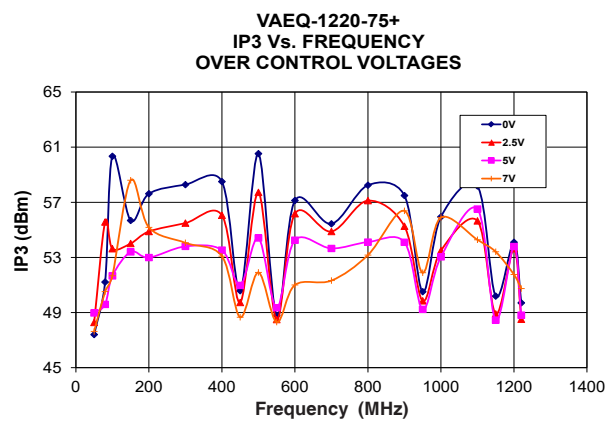
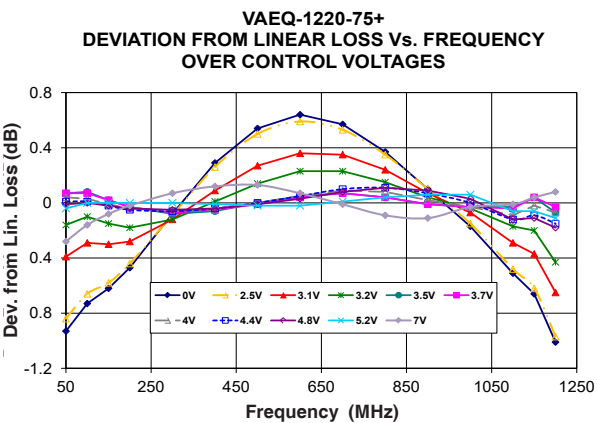
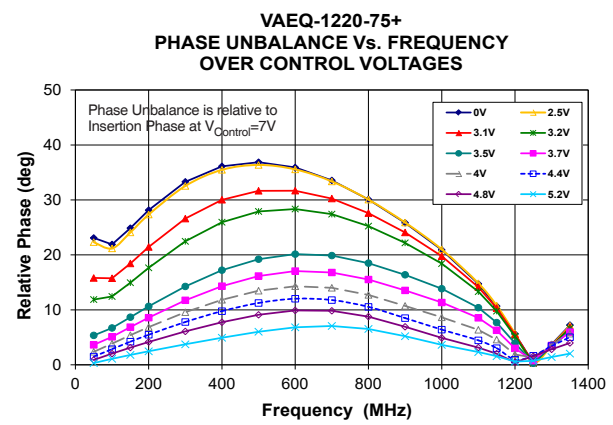
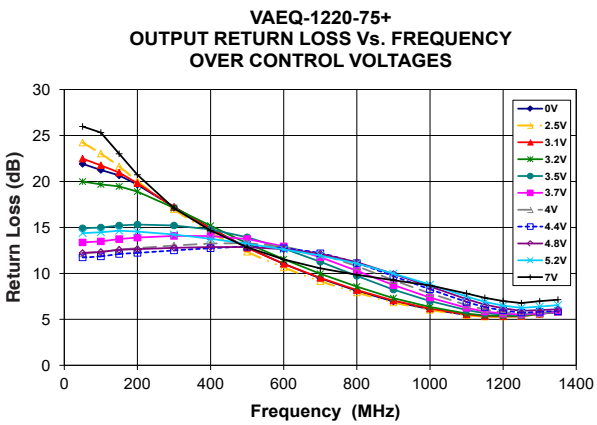
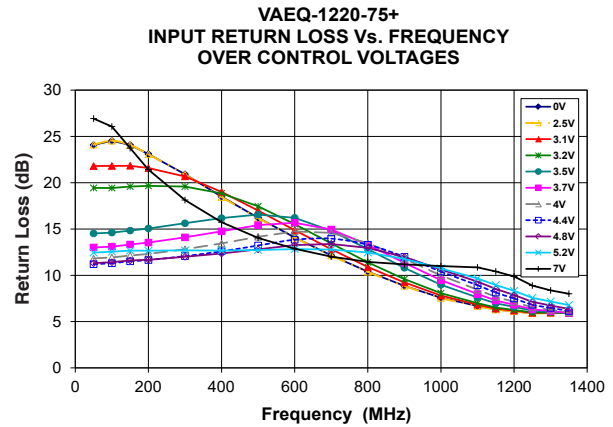
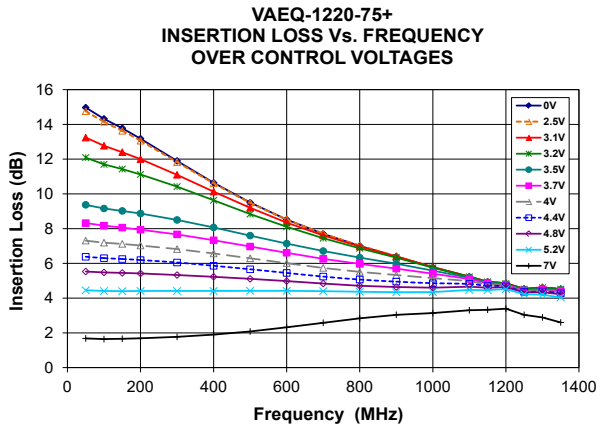
Function	Pin Number
RF IN	1
RF OUT	6
V CONTROL	3
V+	4
GROUND	2,5

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

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



## Additional Notes

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