

# Digital Step Attenuator

# ZX76-31R5A-SP+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, TEMPERATURE=-40°C

FREQUENCY (MHz)	STEP ATTENUATION* AT TTL CONTROL STATE (dB)							
	000000	000001	000010	000100	001000	010000	100000	111111
	THRU LOSS	0.5 dB	1.0 dB	2.0 dB	4.0 dB	8.0 dB	16 dB	31.5 dB
0.1	1.03	0.55	1.05	2.07	4.10	8.12	16.06	31.62
0.3	1.03	0.55	1.06	2.07	4.10	8.11	16.06	31.62
0.5	1.05	0.54	1.05	2.06	4.09	8.10	16.03	31.60
1	1.07	0.54	1.05	2.06	4.08	8.08	16.02	31.59
5	1.06	0.54	1.05	2.06	4.08	8.08	16.01	31.58
10	1.06	0.54	1.05	2.06	4.08	8.08	16.01	31.58
50	1.06	0.54	1.04	2.06	4.08	8.07	16.00	31.57
100	1.07	0.54	1.04	2.06	4.08	8.07	16.00	31.57
200	1.11	0.54	1.05	2.06	4.08	8.08	16.01	31.58
300	1.10	0.54	1.04	2.05	4.07	8.07	15.99	31.55
400	1.12	0.54	1.04	2.06	4.08	8.07	16.00	31.56
500	1.13	0.54	1.05	2.06	4.08	8.08	16.01	31.56
600	1.12	0.54	1.04	2.06	4.08	8.07	16.00	31.55
700	1.14	0.54	1.05	2.06	4.08	8.09	16.02	31.57
800	1.13	0.54	1.05	2.06	4.08	8.08	16.01	31.56
900	1.14	0.54	1.05	2.06	4.08	8.08	16.02	31.56
1000	1.16	0.54	1.05	2.06	4.08	8.09	16.02	31.57
1100	1.15	0.54	1.04	2.06	4.08	8.08	16.01	31.54
1200	1.19	0.54	1.05	2.06	4.08	8.09	16.03	31.56
1300	1.24	0.54	1.04	2.05	4.07	8.09	16.02	31.54
1400	1.31	0.53	1.04	2.04	4.06	8.08	16.01	31.51
1500	1.36	0.53	1.03	2.04	4.06	8.08	16.02	31.49
1600	1.43	0.53	1.03	2.04	4.05	8.09	16.02	31.45
1700	1.49	0.53	1.03	2.03	4.05	8.09	16.03	31.41
1800	1.56	0.53	1.02	2.03	4.04	8.10	16.04	31.36
1900	1.64	0.53	1.02	2.02	4.04	8.11	16.05	31.34
2000	1.70	0.53	1.02	2.02	4.04	8.13	16.08	31.36
2100	1.76	0.53	1.02	2.02	4.04	8.15	16.12	31.37
2200	1.82	0.53	1.02	2.03	4.05	8.17	16.16	31.38
2300	1.90	0.53	1.02	2.03	4.05	8.20	16.19	31.36
2400	1.97	0.53	1.02	2.03	4.06	8.23	16.23	31.35
2500	2.00	0.53	1.03	2.04	4.06	8.25	16.25	31.33
2600	2.03	0.53	1.03	2.04	4.07	8.27	16.27	31.31
2700	2.06	0.54	1.03	2.04	4.08	8.29	16.29	31.29
2800	2.09	0.54	1.04	2.05	4.08	8.31	16.32	31.28
2900	2.13	0.54	1.04	2.06	4.10	8.34	16.37	31.28
3000	2.16	0.54	1.04	2.06	4.11	8.38	16.41	31.25
3200	2.25	0.55	1.05	2.08	4.13	8.43	16.40	30.55
3400	2.31	0.56	1.06	2.09	4.15	8.48	16.43	30.57
3600	2.42	0.56	1.07	2.12	4.19	8.59	16.62	31.13
3800	2.62	0.56	1.07	2.14	4.25	8.74	16.93	32.26
4000	2.84	0.57	1.09	2.19	4.32	8.92	17.32	32.93
4200	2.76	0.59	1.12	2.24	4.39	9.08	17.46	31.31
4400	2.61	0.60	1.14	2.27	4.44	9.22	17.60	30.83
4600	2.61	0.60	1.14	2.27	4.46	9.34	17.79	31.16
4800	2.71	0.60	1.14	2.25	4.45	9.41	17.90	31.58
5000	2.93	0.59	1.12	2.24	4.44	9.48	18.01	31.89

\* Step Attenuation above Thru Loss (TTL Logic 00000).

**Notes**

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- C. The parts covered by this specification document are subject to Mini-Circuit's 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-Circuit's website at [www.minicircuits.com/MC\\_Store/terms.jsp](http://www.minicircuits.com/MC_Store/terms.jsp)



# Digital Step Attenuator

# ZX76-31R5A-SP+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, TEMPERATURE=-40°C

FREQUENCY (MHz)	INPUT RETURN LOSS AT TTL CONTROL STATE (dB)							
	000000 0 dB	000001 0.5 dB	000010 1.0 dB	000100 2.0 dB	001000 4.0 dB	010000 8.0 dB	100000 16 dB	111111 31.5 dB
0.1	19.72	22.01	24.49	22.83	25.72	36.93	26.19	23.61
0.3	19.72	22.00	24.47	22.83	25.72	36.79	26.26	23.62
0.5	19.71	21.99	24.46	22.74	25.53	35.85	26.45	23.63
1	19.57	21.86	24.30	22.57	25.30	35.29	26.53	23.63
5	19.45	21.72	24.13	22.44	25.17	35.00	26.60	23.69
10	19.44	21.70	24.11	22.42	25.14	34.90	26.63	23.71
50	19.47	21.71	24.09	22.39	25.07	34.57	26.74	23.80
100	19.49	21.71	24.08	22.32	24.95	34.04	26.95	23.95
200	19.51	21.68	23.98	22.14	24.63	32.91	27.45	24.35
300	19.37	21.49	23.72	21.90	24.30	32.08	28.07	24.78
400	19.12	21.20	23.36	21.71	24.11	31.84	28.30	24.93
500	18.97	21.02	23.16	21.66	24.07	31.83	28.36	24.95
600	18.85	20.91	23.04	21.70	24.17	32.25	28.09	24.75
700	18.95	21.08	23.30	21.98	24.57	33.40	27.41	24.29
800	19.11	21.30	23.60	22.21	24.88	34.22	27.03	24.04
900	19.41	21.67	24.07	22.57	25.33	35.37	26.54	23.73
1000	19.70	22.02	24.51	22.87	25.67	35.61	26.13	23.51
1100	19.66	21.97	24.43	22.77	25.51	34.55	26.12	23.59
1200	19.59	21.88	24.31	22.72	25.41	33.76	25.94	23.53
1300	19.23	21.34	23.51	21.63	23.86	29.50	26.63	24.63
1400	19.04	20.98	22.94	21.32	23.16	27.87	27.66	26.12
1500	18.83	20.72	22.58	20.90	22.65	27.36	28.76	27.41
1600	18.83	20.67	22.48	21.05	22.71	27.50	29.41	28.11
1700	19.13	21.00	22.83	21.17	22.75	27.26	28.63	28.25
1800	18.95	20.71	22.41	20.59	21.94	26.00	29.48	30.60
1900	19.09	20.77	22.35	20.17	21.36	25.41	31.68	33.44
2000	18.87	20.36	21.75	19.60	20.75	24.90	35.73	34.16
2100	18.68	19.99	21.18	19.55	20.68	25.06	40.58	31.55
2200	18.54	19.69	20.68	19.11	20.24	24.68	52.46	29.48
2300	18.21	19.10	19.83	18.46	19.59	23.98	39.88	26.61
2400	17.28	17.94	18.47	17.70	18.91	23.20	30.99	23.53
2500	16.79	17.37	17.84	17.45	18.73	23.01	28.61	22.38
2600	16.46	16.98	17.39	17.27	18.59	22.80	26.80	21.42
2700	16.18	16.63	16.98	17.03	18.38	22.39	25.02	20.41
2800	15.86	16.27	16.58	16.75	18.12	21.86	23.43	19.47
2900	15.59	15.97	16.22	16.56	17.93	21.35	22.07	18.63
3000	15.38	15.71	15.92	16.35	17.70	20.78	20.99	17.94
3200	14.95	15.16	15.28	15.84	17.07	19.29	18.82	16.47
3400	14.48	14.56	14.53	15.40	16.32	17.41	16.39	14.72
3600	14.48	14.38	14.19	14.77	15.25	15.41	14.25	13.09
3800	14.98	14.63	14.26	14.64	14.60	13.93	12.60	11.83
4000	15.01	14.63	14.20	14.50	14.28	13.36	11.93	11.26
4200	15.87	15.52	14.96	15.04	14.72	13.49	11.75	11.02
4400	18.22	17.60	16.59	16.65	15.78	13.68	11.50	10.78
4600	22.13	20.17	18.22	18.59	16.52	13.37	10.96	10.38
4800	26.23	21.32	18.72	19.33	16.30	12.64	10.26	9.89
5000	23.65	20.01	18.03	18.93	15.89	12.16	9.85	9.68

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# Digital Step Attenuator

# ZX76-31R5A-SP+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, TEMPERATURE=-40°C

FREQUENCY (MHz)	OUTPUT RETURN LOSS AT TTL CONTROL STATE (dB)							
	000000 0 dB	000001 0.5 dB	000010 1.0 dB	000100 2.0 dB	001000 4.0 dB	010000 8.0 dB	100000 16 dB	111111 31.5 dB
0.1	19.55	20.70	21.33	30.07	57.68	32.48	34.36	23.26
0.3	19.56	20.70	21.34	30.04	56.79	32.56	34.44	23.26
0.5	19.45	20.58	21.22	29.77	51.90	33.09	35.32	23.28
1	19.39	20.54	21.15	29.70	50.99	33.25	35.69	23.28
5	19.23	20.37	20.98	29.38	48.27	33.46	35.81	23.32
10	19.21	20.34	20.95	29.33	47.86	33.51	35.87	23.34
50	19.17	20.29	20.89	29.26	46.51	33.66	36.07	23.41
100	19.17	20.27	20.85	29.28	45.33	33.93	36.49	23.55
200	19.00	20.06	20.61	28.90	43.00	35.02	38.10	23.93
300	19.13	20.16	20.69	29.10	43.62	35.50	39.05	24.10
400	19.25	20.29	20.83	29.24	44.08	35.12	38.53	23.99
500	19.55	20.62	21.17	29.69	45.00	34.45	37.64	23.82
600	19.74	20.85	21.44	29.90	46.18	33.83	36.50	23.61
700	19.84	20.99	21.60	29.93	49.44	33.52	35.65	23.50
800	19.69	20.85	21.47	29.46	47.29	33.86	35.60	23.61
900	19.52	20.66	21.28	29.10	45.01	34.06	35.39	23.69
1000	19.31	20.43	21.04	28.60	41.89	34.49	35.42	23.90
1100	19.13	20.24	20.84	28.19	40.42	35.12	35.87	24.09
1200	19.19	20.30	20.90	28.31	40.75	34.89	35.58	24.05
1300	19.08	20.13	20.67	28.12	36.64	33.59	32.89	24.52
1400	19.10	20.04	20.48	27.10	34.38	38.26	34.30	26.73
1500	19.70	20.59	20.96	28.37	36.69	40.82	35.15	26.61
1600	19.91	20.74	21.03	27.58	34.19	41.96	33.63	27.81
1700	19.94	20.71	20.95	27.15	32.78	42.66	33.34	28.53
1800	20.08	20.71	20.86	26.85	31.03	40.33	33.26	29.37
1900	19.82	20.32	20.40	26.00	28.97	36.34	32.89	29.40
2000	19.95	20.33	20.35	25.72	27.96	35.27	34.93	27.73
2100	19.67	19.92	19.93	24.31	26.00	31.91	34.03	26.81
2200	19.14	19.30	19.33	22.94	24.25	29.40	34.34	25.06
2300	18.07	18.17	18.22	21.17	22.21	26.52	32.45	22.96
2400	17.12	17.19	17.29	19.64	20.52	24.28	29.91	20.90
2500	16.65	16.72	16.86	19.05	19.91	23.51	28.72	20.18
2600	16.24	16.33	16.50	18.46	19.31	22.76	27.43	19.53
2700	15.89	15.98	16.16	17.78	18.59	21.79	25.80	18.75
2800	15.54	15.64	15.83	17.15	17.93	20.87	24.21	17.97
2900	15.31	15.43	15.63	16.79	17.50	20.23	22.98	17.35
3000	15.01	15.15	15.37	16.44	17.09	19.60	21.88	16.78
3200	14.54	14.71	14.95	15.82	16.31	18.24	19.55	15.55
3400	14.49	14.66	14.88	15.65	15.94	17.35	17.93	14.74
3600	15.48	15.62	15.79	15.86	15.75	16.37	16.23	13.86
3800	17.74	17.78	17.86	16.84	16.06	15.67	14.90	13.30
4000	19.53	19.27	19.18	16.92	15.67	14.67	13.65	12.75
4200	19.97	19.47	19.17	16.09	14.75	13.49	12.37	11.94
4400	21.81	20.97	20.37	16.27	14.62	12.95	11.66	11.44
4600	25.72	23.70	22.45	16.71	14.67	12.53	11.10	11.09
4800	29.10	25.77	24.07	16.88	14.69	12.20	10.67	10.90
5000	23.64	22.55	21.82	16.12	14.14	11.54	10.02	10.50

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# Digital Step Attenuator

# ZX76-31R5A-SP+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, TEMPERATURE=+25°C

FREQUENCY (MHz)	STEP ATTENUATION* AT TTL CONTROL STATE (dB)							
	000000 THRU LOSS	000001 0.5 dB	000010 1.0 dB	000100 2.0 dB	001000 4.0 dB	010000 8.0 dB	100000 16 dB	111111 31.5 dB
0.1	1.21	0.52	1.01	2.01	4.00	7.97	15.85	31.32
0.3	1.22	0.52	1.01	2.01	4.00	7.97	15.85	31.31
0.5	1.22	0.51	1.01	2.01	4.00	7.97	15.85	31.32
1	1.23	0.51	1.01	2.01	4.00	7.97	15.85	31.31
5	1.23	0.52	1.01	2.01	4.00	7.97	15.85	31.32
10	1.24	0.52	1.01	2.01	4.00	7.97	15.85	31.33
50	1.25	0.52	1.01	2.01	4.00	7.97	15.85	31.33
100	1.27	0.52	1.01	2.01	4.00	7.97	15.85	31.33
200	1.31	0.52	1.01	2.01	4.00	7.97	15.85	31.32
300	1.34	0.51	1.01	2.01	4.00	7.97	15.85	31.31
400	1.38	0.51	1.01	2.00	3.99	7.97	15.85	31.31
500	1.42	0.51	1.01	2.00	3.99	7.97	15.85	31.31
600	1.46	0.51	1.00	2.00	3.99	7.97	15.85	31.30
700	1.49	0.51	1.00	2.00	3.99	7.97	15.85	31.30
800	1.54	0.51	1.00	2.00	3.99	7.97	15.86	31.31
900	1.57	0.51	1.00	1.99	3.98	7.97	15.86	31.31
1000	1.61	0.51	1.00	1.99	3.98	7.98	15.87	31.32
1100	1.65	0.51	1.00	1.99	3.98	7.98	15.88	31.32
1200	1.69	0.51	1.00	1.99	3.98	7.99	15.88	31.32
1300	1.73	0.51	1.00	1.99	3.98	7.99	15.89	31.33
1400	1.77	0.51	1.00	1.99	3.98	8.00	15.90	31.34
1500	1.81	0.51	1.00	1.99	3.98	8.00	15.91	31.36
1600	1.85	0.51	1.00	1.99	3.98	8.01	15.92	31.38
1700	1.89	0.51	1.00	1.99	3.98	8.01	15.93	31.40
1800	1.93	0.51	1.00	1.99	3.98	8.02	15.94	31.42
1900	1.98	0.51	1.00	1.99	3.98	8.02	15.95	31.43
2000	2.02	0.51	1.00	1.99	3.98	8.02	15.95	31.45
2100	2.07	0.51	1.00	1.99	3.98	8.02	15.96	31.46
2200	2.11	0.51	1.00	1.99	3.97	8.03	15.97	31.48
2300	2.15	0.51	1.00	1.99	3.97	8.03	15.98	31.51
2400	2.19	0.51	1.00	2.00	3.97	8.04	16.00	31.55
2500	2.23	0.51	1.00	2.00	3.97	8.05	16.03	31.59
2600	2.26	0.52	1.01	2.00	3.98	8.06	16.05	31.64
2700	2.29	0.52	1.01	2.00	3.98	8.08	16.08	31.70
2800	2.32	0.52	1.01	2.01	3.98	8.10	16.12	31.76
2900	2.35	0.52	1.02	2.01	3.99	8.12	16.17	31.83
3000	2.37	0.53	1.02	2.02	4.00	8.15	16.22	31.89
3200	2.41	0.53	1.03	2.04	4.03	8.23	16.35	31.99
3400	2.43	0.54	1.05	2.07	4.07	8.34	16.51	32.07
3600	2.44	0.55	1.07	2.10	4.13	8.46	16.68	31.93
3800	2.46	0.56	1.08	2.13	4.17	8.57	16.76	31.51
4000	2.52	0.56	1.08	2.15	4.20	8.69	16.95	31.81
4200	2.67	0.56	1.08	2.16	4.23	8.81	17.17	32.37
4400	2.93	0.56	1.07	2.16	4.25	8.93	17.46	33.47
4600	3.14	0.56	1.08	2.18	4.28	9.07	17.78	33.66
4800	3.12	0.57	1.09	2.18	4.29	9.17	17.95	32.29
5000	3.11	0.56	1.07	2.14	4.24	9.22	18.09	31.86

\* Step Attenuation above Thru Loss (TTL Logic 00000).

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# Digital Step Attenuator

# ZX76-31R5A-SP+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, TEMPERATURE=+25°C

FREQUENCY (MHz)	INPUT RETURN LOSS AT TTL CONTROL STATE (dB)							
	000000 0 dB	000001 0.5 dB	000010 1.0 dB	000100 2.0 dB	001000 4.0 dB	010000 8.0 dB	100000 16 dB	111111 31.5 dB
0.1	18.79	20.34	21.87	19.97	21.00	24.11	43.54	39.26
0.3	18.77	20.32	21.84	19.96	20.99	24.08	43.26	39.23
0.5	18.76	20.31	21.83	19.90	20.88	23.85	42.07	39.31
1	18.66	20.23	21.75	19.81	20.79	23.77	41.88	39.24
5	18.56	20.12	21.64	19.74	20.75	23.75	41.62	39.31
10	18.54	20.10	21.62	19.72	20.73	23.73	41.56	39.38
50	18.55	20.11	21.62	19.73	20.73	23.72	41.22	39.48
100	18.57	20.12	21.63	19.74	20.74	23.72	40.92	39.47
200	18.59	20.15	21.66	19.77	20.78	23.77	40.26	38.91
300	18.64	20.19	21.69	19.79	20.76	23.70	38.56	38.74
400	18.58	20.12	21.61	19.73	20.70	23.60	37.38	38.75
500	18.59	20.12	21.60	19.72	20.68	23.53	36.24	38.34
600	18.53	20.05	21.51	19.65	20.59	23.39	35.17	38.05
700	18.54	20.05	21.51	19.64	20.58	23.35	34.55	37.77
800	18.53	20.03	21.49	19.63	20.56	23.28	33.81	37.22
900	18.59	20.09	21.54	19.66	20.56	23.23	33.01	36.50
1000	18.60	20.08	21.51	19.63	20.49	23.06	31.95	35.67
1100	18.45	19.92	21.32	19.48	20.32	22.83	31.20	35.37
1200	18.44	19.89	21.29	19.44	20.26	22.73	30.74	35.06
1300	18.21	19.58	20.87	19.05	19.74	21.82	27.94	32.70
1400	18.09	19.40	20.60	18.75	19.30	21.07	26.22	31.08
1500	18.15	19.41	20.56	18.61	19.03	20.58	25.07	29.87
1600	18.11	19.31	20.38	18.36	18.64	20.01	24.08	28.71
1700	18.16	19.28	20.28	18.17	18.34	19.58	23.42	27.78
1800	17.98	19.01	19.90	17.82	17.94	19.18	23.07	26.90
1900	18.03	18.96	19.75	17.70	17.77	19.05	23.03	26.34
2000	17.60	18.38	19.05	17.24	17.36	18.73	22.78	25.25
2100	16.90	17.54	18.08	16.65	16.86	18.38	22.51	23.93
2200	16.33	16.85	17.27	16.23	16.59	18.37	22.81	23.02
2300	15.93	16.36	16.71	16.03	16.57	18.71	23.65	22.58
2400	15.47	15.84	16.12	15.79	16.55	19.11	24.59	22.02
2500	14.99	15.31	15.56	15.43	16.28	19.00	24.38	21.17
2600	14.73	15.02	15.24	15.28	16.22	19.14	24.49	20.66
2700	14.46	14.72	14.91	15.11	16.15	19.22	24.32	20.06
2800	14.41	14.63	14.78	15.16	16.30	19.58	24.24	19.59
2900	14.20	14.40	14.52	15.04	16.25	19.57	23.44	18.92
3000	14.15	14.32	14.40	15.05	16.33	19.67	22.72	18.41
3200	14.14	14.26	14.27	15.15	16.50	19.59	20.95	17.40
3400	13.84	13.87	13.79	14.80	15.96	18.09	18.19	15.70
3600	13.76	13.70	13.54	14.57	15.47	16.70	16.21	14.43
3800	13.84	13.66	13.41	14.37	14.90	15.22	14.34	13.14
4000	13.77	13.60	13.30	14.15	14.51	14.49	13.43	12.37
4200	14.90	14.63	14.12	15.01	15.08	14.38	12.78	11.82
4400	17.09	16.42	15.50	16.56	16.02	14.28	12.22	11.40
4600	21.93	19.84	17.97	19.40	17.50	14.24	11.79	11.25
4800	24.89	20.88	18.59	19.88	17.09	13.37	11.02	10.74
5000	22.12	19.52	17.97	18.84	16.24	12.62	10.42	10.39

**Notes**

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# Digital Step Attenuator

# ZX76-31R5A-SP+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, TEMPERATURE=+25°C

FREQUENCY (MHz)	OUTPUT RETURN LOSS AT TTL CONTROL STATE (dB)							
	000000 0 dB	000001 0.5 dB	000010 1.0 dB	000100 2.0 dB	001000 4.0 dB	010000 8.0 dB	100000 16 dB	111111 31.5 dB
0.1	18.63	19.24	19.43	24.48	28.24	32.18	28.59	36.22
0.3	18.62	19.23	19.42	24.47	28.22	32.16	28.58	36.17
0.5	18.52	19.13	19.32	24.32	27.99	31.69	28.19	36.20
1	18.51	19.13	19.30	24.34	27.99	31.68	28.14	36.21
5	18.41	19.03	19.22	24.21	27.88	31.63	28.17	36.18
10	18.39	19.02	19.21	24.20	27.86	31.61	28.16	36.19
50	18.42	19.06	19.24	24.24	27.90	31.66	28.19	36.13
100	18.52	19.15	19.33	24.35	28.02	31.76	28.24	36.06
200	18.49	19.12	19.30	24.30	27.94	31.64	28.17	36.14
300	18.54	19.16	19.34	24.31	27.88	31.38	27.97	36.53
400	18.42	19.03	19.22	24.10	27.58	30.96	27.69	37.19
500	18.53	19.14	19.32	24.22	27.69	30.98	27.66	37.29
600	18.55	19.16	19.33	24.22	27.66	30.82	27.55	37.19
700	18.51	19.11	19.28	24.10	27.46	30.44	27.27	37.66
800	18.50	19.10	19.27	24.06	27.37	30.24	27.11	37.93
900	18.49	19.09	19.25	24.00	27.23	29.92	26.86	38.14
1000	18.49	19.07	19.23	23.92	27.04	29.56	26.56	38.81
1100	18.47	19.06	19.21	23.87	26.96	29.35	26.39	38.97
1200	18.46	19.04	19.17	23.77	26.75	28.93	26.04	39.34
1300	18.43	18.96	19.05	23.40	25.97	27.52	24.83	41.98
1400	18.39	18.85	18.89	22.97	25.11	26.12	23.59	40.09
1500	18.34	18.74	18.72	22.59	24.36	25.04	22.65	35.86
1600	18.40	18.71	18.61	22.30	23.71	24.18	21.93	32.13
1700	18.46	18.67	18.51	22.00	23.04	23.42	21.38	29.15
1800	18.58	18.67	18.45	21.69	22.41	22.87	21.08	26.76
1900	18.33	18.34	18.09	21.00	21.52	22.19	20.81	24.79
2000	18.20	18.12	17.86	20.45	20.84	21.81	20.87	23.30
2100	17.83	17.70	17.49	19.67	20.05	21.47	21.17	21.95
2200	17.11	16.99	16.87	18.66	19.11	21.03	21.57	20.69
2300	16.41	16.32	16.28	17.75	18.29	20.67	22.22	19.64
2400	15.72	15.67	15.72	16.89	17.52	20.32	23.12	18.67
2500	15.20	15.20	15.30	16.34	17.04	20.03	23.40	18.19
2600	14.80	14.83	14.97	15.91	16.67	19.79	23.69	17.77
2700	14.49	14.54	14.72	15.57	16.35	19.60	23.93	17.40
2800	14.20	14.29	14.49	15.28	16.08	19.41	24.03	17.03
2900	14.01	14.12	14.34	15.05	15.85	19.21	23.89	16.66
3000	13.84	13.97	14.21	14.84	15.64	18.99	23.47	16.30
3200	13.83	13.99	14.25	14.70	15.43	18.63	22.22	15.67
3400	14.11	14.30	14.57	14.82	15.45	18.35	20.66	15.19
3600	15.04	15.21	15.47	15.34	15.71	17.97	18.91	14.72
3800	16.46	16.58	16.82	16.02	16.03	17.36	17.14	14.32
4000	17.39	17.45	17.64	16.09	15.76	16.18	15.31	13.73
4200	18.27	18.22	18.28	16.04	15.41	15.13	13.89	13.06
4400	20.26	20.04	19.89	16.55	15.52	14.51	12.95	12.59
4600	25.03	23.82	22.99	17.41	15.83	13.96	12.16	12.26
4800	27.89	25.53	24.21	17.70	15.80	13.28	11.37	11.94
5000	22.61	21.91	21.47	17.10	15.42	12.68	10.79	11.71

**Notes**

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# Digital Step Attenuator

# ZX76-31R5A-SP+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, TEMPERATURE=+85°C

FREQUENCY (MHz)	STEP ATTENUATION* AT TTL CONTROL STATE							
	(dB)							
	000000 THRU LOSS	000001 0.5 dB	000010 1.0 dB	000100 2.0 dB	001000 4.0 dB	010000 8.0 dB	100000 16 dB	111111 31.5 dB
0.1	1.22	0.52	1.02	2.01	4.00	7.92	15.89	31.25
0.3	1.23	0.52	1.02	2.01	4.00	7.92	15.89	31.24
0.5	1.25	0.52	1.02	2.01	3.99	7.90	15.87	31.22
1	1.27	0.52	1.02	2.01	3.99	7.89	15.86	31.21
5	1.26	0.52	1.02	2.01	3.99	7.90	15.86	31.22
10	1.26	0.52	1.02	2.01	3.99	7.90	15.86	31.22
50	1.26	0.52	1.02	2.01	3.99	7.90	15.86	31.22
100	1.26	0.52	1.02	2.01	3.99	7.90	15.86	31.22
200	1.30	0.52	1.02	2.01	3.99	7.90	15.87	31.23
300	1.29	0.52	1.02	2.01	3.99	7.90	15.86	31.22
400	1.31	0.52	1.02	2.01	4.00	7.90	15.87	31.23
500	1.34	0.52	1.02	2.01	3.99	7.90	15.87	31.23
600	1.34	0.52	1.02	2.01	3.99	7.90	15.86	31.21
700	1.38	0.52	1.02	2.01	3.99	7.90	15.87	31.22
800	1.38	0.52	1.02	2.01	3.99	7.90	15.86	31.20
900	1.41	0.52	1.02	2.01	3.99	7.90	15.86	31.20
1000	1.43	0.52	1.02	2.01	3.99	7.90	15.87	31.21
1100	1.43	0.52	1.02	2.01	3.99	7.90	15.86	31.19
1200	1.47	0.52	1.02	2.01	3.99	7.90	15.87	31.21
1300	1.56	0.52	1.02	2.01	3.99	7.91	15.88	31.21
1400	1.65	0.51	1.02	2.01	3.99	7.92	15.90	31.22
1500	1.74	0.51	1.02	2.01	3.99	7.93	15.92	31.23
1600	1.83	0.51	1.02	2.01	4.00	7.95	15.94	31.24
1700	1.92	0.51	1.02	2.01	4.00	7.96	15.96	31.25
1800	2.01	0.51	1.02	2.02	4.01	7.98	15.99	31.26
1900	2.10	0.51	1.02	2.02	4.01	8.00	16.02	31.29
2000	2.20	0.52	1.02	2.02	4.01	8.02	16.05	31.35
2100	2.29	0.52	1.02	2.03	4.02	8.04	16.09	31.42
2200	2.38	0.52	1.03	2.03	4.02	8.06	16.13	31.51
2300	2.47	0.52	1.03	2.04	4.02	8.09	16.17	31.60
2400	2.55	0.52	1.03	2.04	4.02	8.11	16.22	31.67
2500	2.59	0.53	1.03	2.04	4.02	8.12	16.24	31.68
2600	2.64	0.53	1.03	2.04	4.03	8.14	16.27	31.69
2700	2.68	0.53	1.04	2.05	4.03	8.15	16.29	31.70
2800	2.72	0.53	1.04	2.05	4.03	8.17	16.32	31.69
2900	2.77	0.53	1.04	2.05	4.03	8.19	16.35	31.65
3000	2.82	0.53	1.04	2.06	4.03	8.21	16.36	31.46
3200	2.89	0.54	1.04	2.07	4.04	8.24	16.36	31.13
3400	3.00	0.54	1.04	2.09	4.05	8.30	16.45	31.49
3600	3.17	0.54	1.05	2.09	4.07	8.39	16.64	32.21
3800	3.38	0.54	1.06	2.12	4.13	8.53	16.96	33.25
4000	3.47	0.55	1.08	2.16	4.18	8.68	17.21	32.47
4200	3.36	0.56	1.11	2.20	4.24	8.83	17.40	31.51
4400	3.28	0.58	1.13	2.23	4.30	9.01	17.71	31.69
4600	3.32	0.58	1.13	2.25	4.34	9.18	18.01	32.29
4800	3.49	0.58	1.12	2.25	4.34	9.30	18.24	32.82
5000	3.74	0.57	1.10	2.23	4.33	9.40	18.41	32.97

\* Step Attenuation above Thru Loss (TTL Logic 00000).

**Notes**

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# Digital Step Attenuator

# ZX76-31R5A-SP+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, TEMPERATURE=+85°C

FREQUENCY (MHz)	INPUT RETURN LOSS AT TTL CONTROL STATE (dB)							
	000000 0 dB	000001 0.5 dB	000010 1.0 dB	000100 2.0 dB	001000 4.0 dB	010000 8.0 dB	100000 16 dB	111111 31.5 dB
0.1	18.17	19.34	20.32	18.20	18.45	19.87	25.76	29.49
0.3	18.16	19.34	20.31	18.19	18.44	19.85	25.71	29.47
0.5	18.15	19.32	20.30	18.14	18.37	19.75	25.61	29.50
1	18.06	19.26	20.24	18.09	18.32	19.73	25.60	29.53
5	17.96	19.15	20.14	18.04	18.30	19.74	25.64	29.60
10	17.94	19.14	20.12	18.03	18.29	19.73	25.64	29.60
50	17.94	19.14	20.12	18.04	18.32	19.77	25.72	29.72
100	17.94	19.14	20.13	18.06	18.35	19.84	25.86	29.97
200	17.92	19.14	20.15	18.12	18.45	19.98	26.21	30.55
300	17.92	19.15	20.18	18.17	18.54	20.14	26.51	31.06
400	17.91	19.15	20.21	18.23	18.62	20.26	26.69	31.39
500	17.96	19.19	20.25	18.27	18.63	20.20	26.35	30.77
600	17.96	19.18	20.21	18.22	18.54	20.05	25.86	29.96
700	17.97	19.16	20.18	18.18	18.46	19.90	25.36	29.13
800	17.87	19.03	20.01	18.02	18.27	19.61	24.69	28.16
900	17.85	18.98	19.93	17.93	18.15	19.42	24.28	27.61
1000	17.82	18.93	19.85	17.83	18.01	19.23	23.81	26.97
1100	17.67	18.74	19.62	17.63	17.81	18.98	23.38	26.41
1200	17.62	18.68	19.54	17.56	17.72	18.87	23.19	26.20
1300	17.58	18.60	19.35	17.32	17.37	18.31	22.00	24.76
1400	17.46	18.42	19.12	17.04	16.96	17.70	20.84	23.35
1500	17.47	18.37	19.02	16.84	16.64	17.23	20.04	22.37
1600	17.53	18.37	18.95	16.71	16.41	16.89	19.48	21.64
1700	17.65	18.43	18.93	16.65	16.27	16.68	19.13	21.12
1800	17.63	18.33	18.77	16.53	16.15	16.58	18.98	20.81
1900	17.47	18.07	18.43	16.34	15.96	16.45	18.82	20.40
2000	17.09	17.59	17.86	16.07	15.79	16.40	18.82	20.12
2100	16.65	17.05	17.26	15.81	15.66	16.44	18.99	19.95
2200	16.08	16.41	16.58	15.50	15.52	16.55	19.25	19.77
2300	15.42	15.68	15.81	15.12	15.33	16.66	19.56	19.48
2400	14.86	15.07	15.15	14.84	15.26	16.92	20.14	19.26
2500	14.65	14.84	14.90	14.77	15.31	17.19	20.62	19.24
2600	14.49	14.67	14.71	14.74	15.40	17.52	21.20	19.26
2700	14.37	14.53	14.55	14.74	15.52	17.91	21.85	19.27
2800	14.17	14.33	14.33	14.66	15.56	18.18	22.28	19.12
2900	13.95	14.09	14.07	14.56	15.57	18.42	22.55	18.84
3000	13.78	13.89	13.87	14.50	15.60	18.66	22.69	18.54
3200	13.65	13.69	13.62	14.56	15.81	19.05	22.09	17.73
3400	13.64	13.60	13.46	14.61	15.85	18.64	20.07	16.60
3600	13.68	13.56	13.32	14.53	15.62	17.54	17.84	15.40
3800	13.42	13.23	12.92	14.08	14.93	16.05	15.79	14.08
4000	13.27	13.08	12.72	13.81	14.45	15.07	14.39	12.99
4200	14.36	14.07	13.53	14.67	15.02	14.87	13.55	12.34
4400	16.94	16.24	15.27	16.71	16.38	14.84	12.85	11.97
4600	20.89	18.96	17.28	19.05	17.44	14.43	12.13	11.64
4800	23.44	20.20	18.32	19.65	17.21	13.62	11.37	11.29
5000	20.80	18.90	17.80	18.42	16.32	12.92	10.83	11.08

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# Digital Step Attenuator

# ZX76-31R5A-SP+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, TEMPERATURE=+85°C

FREQUENCY (MHz)	OUTPUT RETURN LOSS AT TTL CONTROL STATE (dB)							
	000000 0 dB	000001 0.5 dB	000010 1.0 dB	000100 2.0 dB	001000 4.0 dB	010000 8.0 dB	100000 16 dB	111111 31.5 dB
0.1	18.03	18.36	18.23	21.73	23.27	23.97	21.63	31.20
0.3	18.03	18.35	18.22	21.72	23.25	23.94	21.62	31.19
0.5	17.93	18.26	18.14	21.63	23.14	23.81	21.48	31.19
1	17.92	18.27	18.14	21.65	23.16	23.82	21.48	31.22
5	17.84	18.20	18.08	21.58	23.13	23.86	21.55	31.35
10	17.83	18.18	18.07	21.57	23.12	23.86	21.55	31.36
50	17.88	18.25	18.14	21.66	23.24	24.00	21.67	31.66
100	18.03	18.40	18.28	21.87	23.47	24.25	21.86	32.21
200	18.13	18.52	18.42	22.12	23.81	24.69	22.22	33.46
300	18.29	18.69	18.59	22.37	24.14	25.06	22.51	34.65
400	18.19	18.59	18.51	22.25	24.05	25.01	22.50	34.62
500	18.10	18.48	18.39	22.01	23.71	24.55	22.14	33.10
600	17.89	18.26	18.16	21.64	23.24	24.01	21.74	31.74
700	17.76	18.12	18.01	21.36	22.88	23.57	21.37	30.67
800	17.69	18.04	17.91	21.18	22.61	23.21	21.07	29.90
900	17.75	18.10	17.95	21.22	22.60	23.13	20.98	29.71
1000	17.80	18.14	17.99	21.23	22.56	23.02	20.86	29.43
1100	17.83	18.16	18.00	21.24	22.53	22.93	20.77	29.24
1200	17.94	18.26	18.09	21.34	22.60	22.92	20.72	29.18
1300	17.77	18.02	17.84	20.82	21.78	21.79	19.71	26.91
1400	17.76	17.95	17.69	20.50	21.18	20.93	18.93	25.23
1500	17.75	17.87	17.55	20.18	20.59	20.17	18.24	23.73
1600	17.86	17.88	17.49	19.96	20.13	19.63	17.80	22.53
1700	17.89	17.83	17.38	19.64	19.62	19.15	17.48	21.41
1800	17.82	17.67	17.19	19.23	19.10	18.78	17.32	20.47
1900	17.67	17.45	16.97	18.78	18.59	18.50	17.29	19.67
2000	17.42	17.17	16.72	18.27	18.12	18.35	17.46	19.03
2100	17.02	16.76	16.37	17.67	17.61	18.21	17.72	18.40
2200	16.54	16.29	15.98	17.05	17.11	18.16	18.19	17.85
2300	15.95	15.76	15.58	16.44	16.66	18.21	18.91	17.40
2400	15.33	15.21	15.15	15.85	16.23	18.32	19.88	17.02
2500	15.00	14.92	14.91	15.53	15.98	18.32	20.39	16.79
2600	14.67	14.63	14.66	15.21	15.73	18.32	20.95	16.56
2700	14.40	14.39	14.46	14.94	15.52	18.33	21.56	16.35
2800	14.12	14.14	14.25	14.68	15.31	18.34	22.20	16.14
2900	13.88	13.93	14.09	14.45	15.13	18.37	22.84	15.96
3000	13.67	13.76	13.95	14.25	14.98	18.40	23.41	15.77
3200	13.66	13.78	14.00	14.16	14.87	18.47	23.82	15.38
3400	13.96	14.11	14.34	14.25	14.93	18.58	23.13	15.11
3600	14.64	14.78	15.03	14.64	15.23	18.70	21.38	14.92
3800	15.86	16.01	16.28	15.29	15.64	18.30	18.93	14.63
4000	16.60	16.72	16.96	15.36	15.50	17.18	16.62	14.15
4200	17.42	17.51	17.69	15.53	15.42	16.20	14.93	13.61
4400	19.82	19.78	19.84	16.44	15.90	15.59	13.77	13.26
4600	25.13	24.29	23.81	17.81	16.62	15.00	12.82	13.08
4800	27.99	26.00	24.89	18.42	16.81	14.20	11.91	12.87
5000	22.45	21.95	21.71	18.06	16.62	13.56	11.28	12.75

**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-Circuits' 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/MC\\_Store/terms.jsp](http://www.minicircuits.com/MC_Store/terms.jsp)

