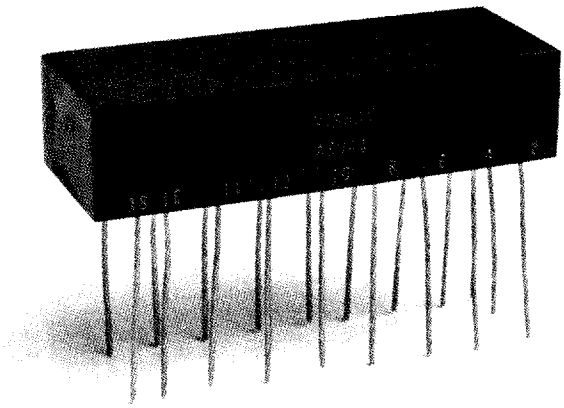
T-62-05



Standard Vishay binary ladder network performance is expressed in terms of Full Scale Accuracy (FSA). This is defined as

$$\frac{E \text{ actual} - E \text{ specified}}{E \text{ full scale}} \times 100 = \% \text{ FSA}$$

when the input voltage is applied to any combination of bit inputs.

For the worst possible case, the standard FSA of Vishay Networks is better than ±0.005% over an ambient temperature range of 0° to +60°C. Stated in terms of ppm deviation (1ppm = 0.0001%), this means that—for the worst case—the deviation of the actual signal output from expected output, for any combination of bits, will not exceed a total of 50ppm over this temperature span. Over the full −55°C to +125°C range, standard FSA of Vishay Networks will not exceed 100ppm (0.01%). On special order, FSA to ±0.001% @ 25°C can be supplied.

Because of the inherent stability of Vishay resistor elements, these networks will maintain this accuracy over a period of at least 5 (five) years, when operated with a maximum of 0.1 watt applied to any resistor.

Standard Vishay R-2R binary resistance ladder networks are available in 4-bit to 15-bit voltage-fed configurations with values of R between 100 ohms and 50K ohms.

Shunt legs can be furnished to compensate for switching impedances when values are specified.

Where a loading resistor is required, Vishay can supply a resistor with characteristics identical to those used in the network, either for external connection by the customer, or in a package meeting specific customer requirements.

Vishay offers two standard styles in nominal height and width:

Series 500—0.750″ (19.05mm) wide x 0.500 (12.70mm) high

Series 375—1.230″ (31.23mm) wide x 0.365 (9.27mm) high

Length of the network package is dependent on the number of bits in the package. For the Series 500, the nominal length ranges from 0.700″ (17.78mm) for the 4-bit unit to 1.900″ (48.26mm) for the 15-bit ladder. For the Series 375, nominal length ranges from 0.730″ (18.54mm) for the 4-bit unit to 2.590″ (65.79mm) for the 15-bit ladder. Other configurations are available on special order.

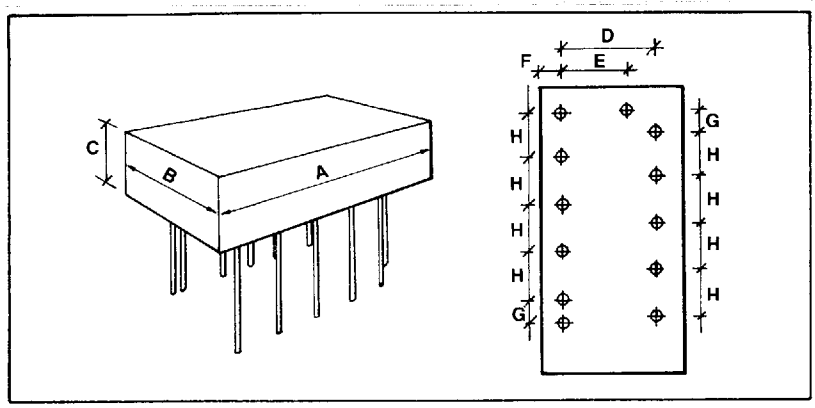


Figure 9: Vishay series 500

NUMBER OF BITS	Series 500 Dimensions—inches (metric-mm)							
	A	B	C	D	E	F	G	H
4 5	0.700 (17.78)	0.750 (19.05)	0.500 (12.70)	0.470 (11.94)	0.320 (8.13)	0.14 (3.56)	0.120 (3.05)	0.240 (6.10)
6 7 8	1.080 (27.43)	0.750 (19.05)	0.500 (12.70)	0.470 (11.94)	0.320 (8.13)	0.14 (3.56)	0.120 (3.05)	0.240 (6.10)
9 10	1.300 (33.02)	0.750 (19.05)	0.500 (12.70)	0.470 (11.94)	0.320 (8.13)	0.14 (3.56)	0.120 (3.05)	0.240 (6.10)
11	1.500 (38.10)	0.750 (19.05)	0.500 (12.70)	0.470 (11.94)	0.320 (8.13)	0.14 (3.56)	0.120 (3.05)	0.240 (6.10)
12 13	1.660 (42.16)	0.750 (19.05)	0.500 (12.70)	0.470 (11.94)	0.320 (8.13)	0.14 (3.56)	0.120 (3.05)	0.240 (6.10)
14 15	1.900 (48.26)	0.750 (19.05)	0.500 (12.70)	0.470 (11.94)	0.320 (8.13)	0.14 (3.56)	0.120 (3.05)	0.240 (6.10)

Figure 10:

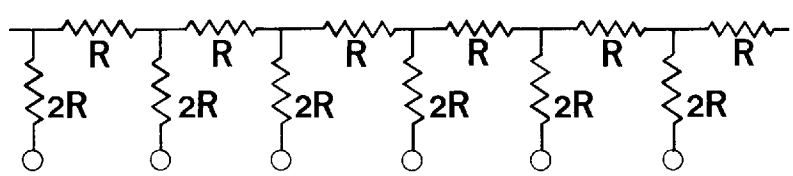
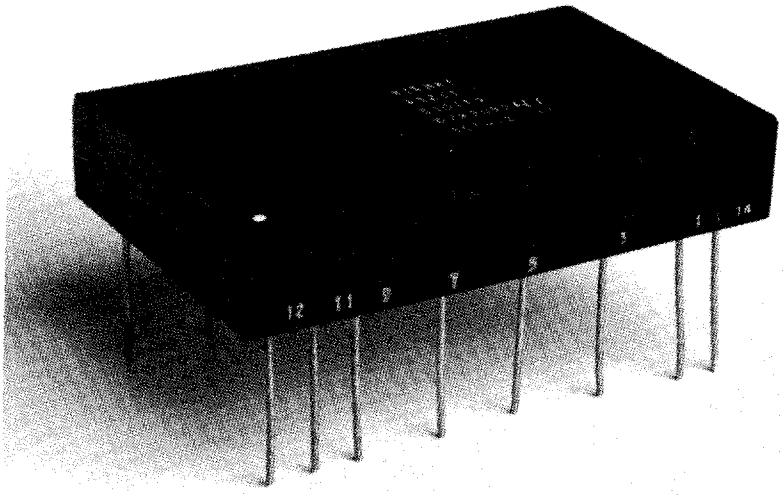


Figure 11:



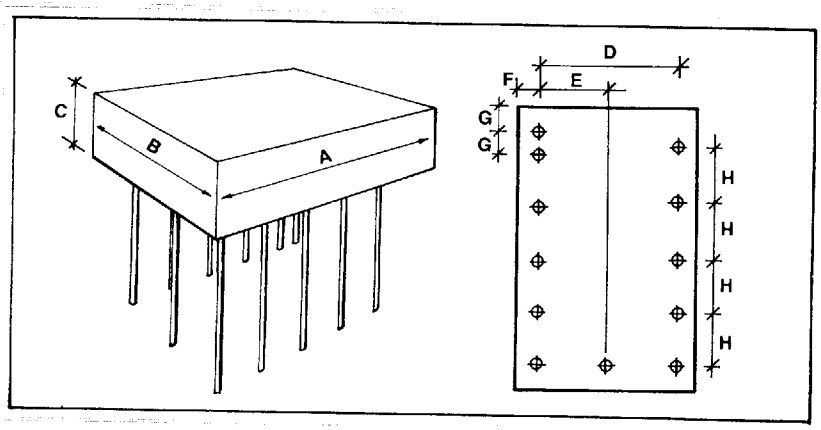


Figure 12: Vishay series 375

NUMBER OF BITS	Series 375 Dimensions—inches (metric-mm)							
	A	B	C	D	E	F	G	H
4	0.730 (18.54)	1.230 (31.24)	0.365 (9.27)	1.000 (25.4)	0.560 (14.22)	0.11 (2.79)	0.150 (3.81)	0.310 (7.87)
5 6	1.080 (27.43)	1.230 (31.24)	0.365 (9.27)	1.000 (25.4)	0.560 (14.22)	0.11 (2.79)	0.150 (3.81)	0.310 (7.87)
7 8	1.380 (35.05)	1.230 (31.24)	0.365 (9.27)	1.000 (25.4)	0.560 (14.22)	0.11 (2.79)	0.150 (3.81)	0.310 (7.87)
9 10	1.680 (42.67)	1.230 (31.24)	0.365 (9.27)	1.000 (25.4)	0.560 (14.22)	0.11 (2.79)	0.150 (3.81)	0.310 (7.87)
11 12	1.980 (50.29)	1.230 (31.24)	0.365 (9.27)	1.000 (25.4)	0.560 (14.2)	0.11 (2.79)	0.150 (3.81)	0.310 (7.87)
13 14	2.280 (57.91)	1.230 (31.24)	0.365 (9.27)	1.000 (25.4)	0.560 (14.22)	0.11 (2.79)	0.150 (3.81)	0.310 (7.87)
15	2.590 (65.79)	1.230 (31.24)	0.365 (9.27)	1.000 (25.4)	0.560 (14.22)	0.11 (2.79)	0.150 (3.81)	0.310 (7.87)

Figure 13:

Leads: Standard leads are #22 AWG (.025") tinned copper (round). Weldable nickel/gold-plated leads are available with standard case styles on special order.

Ladder Network Performance

Acceptance data for ladder networks is furnished in as much detail as requested. Typical test data is shown below.

ENGINEERING DATA SHEET — 11 BIT LADDER NETWORK 10K/20K S.N. 800478

BIT NO.	1 NOMINAL	2 25°C INITIAL	2 minus 1 ERROR	3 25°C Post BURN-IN	3 minus 2 CHANGE	4 −20°C LOW TEMP.	4 minus 3 CHANGE	5 +100°C HIGH TEMP.	5 minus 3 CHANGE
1	0.500000	0.499986	−0.000014	0.499985	−0.000001	0.499982	−0.000003	0.499988	+0.000003
2	0.250000	0.250002	+0.000002	0.250002	0.000000	0.249993	−0.000009	0.250006	+0.000004
3	0.125000	0.125007	+0.000007	0.125006	−0.000001	0.125012	+0.000006	0.125003	−0.000003
4	0.062500	0.062503	+0.000003	0.062503	0.000000	0.062506	+0.000003	0.062500	−0.000003
5	0.031250	0.031252	+0.000002	0.031252	0.000000	0.031253	+0.000001	0.031250	−0.000002
6	0.015625	0.015626	+0.000001	0.015625	−0.000001	0.015626	+0.000001	0.015625	0.000000
7	0.007812	0.007813	+0.000001	0.007812	−0.000001	0.007813	+0.000001	0.007812	0.000000
8	0.003906	0.003907	+0.000001	0.003906	−0.000001	0.003906	0.000000	0.003906	0.000000
9	0.001953	0.001954	+0.000001	0.001953	−0.000001	0.001953	0.000000	0.001953	0.000000
10	0.000977	0.000977	0.000000	0.000976	−0.000001	0.000976	0.000000	0.000976	0.000000
11	0.000488	0.000488	0.000000	0.000488	0.000000	0.000488	0.000000	0.000488	0.000000
		Maximum (+)	+0.000018	Maximum (+)	0.000000	Maximum (+)	+0.000012	Maximum (+)	+0.000007
		Maximum (−)	−0.000014	Maximum (−)	−0.000007	Maximum (−)	−0.000012	Maximum (−)	−0.000008
		Max. Error	+0.000018	Max. Error	−0.000007	Max. Error	±0.000012	Max. Error	−0.000008
		Max. Er. (%)	+0.0018%	Max. Er. (%)	−0.0007%				
		Max. Lim. (%)	0.0100%	Max. Lim. (%)	0.0150%				

Max ΔR due to burn in: 1 ppm

$$TCR = \frac{12ppm}{-45^{\circ}C} = -0.3ppm/^{\circ}C \qquad TCR = \frac{-8ppm}{+75^{\circ}C} = -0.1ppm/^{\circ}C$$

Figure 14:

ENGINEERING DATA SHEET — 11 BIT LADDER NETWORK 10K/20K S.N. 800479

BIT NO.	1 NOMINAL	2 25°C INITIAL	2 minus 1 ERROR	3 25°C Post BURN-IN	3 minus 2 CHANGE	4 −20°C LOW TEMP.	4 minus 3 CHANGE	5 +100°C HIGH TEMP.	5 minus 3 CHANGE
1	0.500000	0.500002	+0.000002	0.500000	−0.000002	0.500007	+0.000007	0.500000	0.000000
2	0.250000	0.249988	−0.000012	0.249990	+0.000002	0.249978	−0.000012	0.249989	−0.000001
3	0.125000	0.125006	+0.000006	0.125005	−0.000001	0.125008	+0.000003	0.1250007	+0.000002
4	0.062500	0.062503	+0.000003	0.062503	0.000000	0.062503	0.000000	0.062503	0.000000
5	0.031250	0.031252	+0.000002	0.031251	−0.000001	0.031251	0.000000	0.031250	−0.000001
6	0.015625	0.015625	0.000000	0.015624	−0.000001	0.015624	0.000000	0.015625	+0.000001
7	0.007812	0.007813	+0.000001	0.007812	−0.000001	0.007812	0.000000	0.007812	0.000000
8	0.003906	0.003907	+0.000001	0.003906	−0.000001	0.003906	0.000000	0.003906	0.000000
9	0.001953	0.001954	+0.000001	0.001953	−0.000001	0.001953	0.000000	0.001953	0.000000
10	0.000977	0.000977	0.000000	0.000976	−0.000001	0.000976	0.000000	0.000976	0.000000
11	0.000488	0.000489	+0.000001	0.000488	0.000000	0.000488	0.000000	0.000488	0.000000
		Maximum (+)	+0.000017	Maximum (+)	+0.000002	Maximum (+)	+0.000010	Maximum (+)	+0.000003
		Maximum (−)	−0.000012	Maximum (−)	−0.000009	Maximum (−)	−0.000012	Maximum (−)	−0.000002
		Max. Error	+0.000017	Max. Error	−0.000009	Max.Error	−0.000012	Max. Error	−0.000003
		Max. Er. (%)	+0.0017%	Max. Er. (%)	−0.0009%				
		Max. Lim. (%)	0.0100%	Max. Lim. (%)	0.0150%				

Max ΔR due to burn in: 2ppm

$$TCR = \frac{-12ppm}{-45^{\circ}C} = +0.3ppm/^{\circ}C \qquad TCR = \frac{+3ppm}{+75^{\circ}C} = 0.0ppm/^{\circ}C$$

Figure 15: