

■ FEATURES

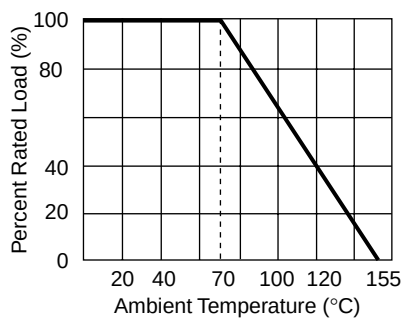
- $\pm 5\%$ tolerance
- High quality performance at economical prices
- Compatible with automatic insertion equipment
- Flame retardant type available
- Weldable type with copper plated lead wire available
- Values below 1Ω or above $10M\Omega$ are available by special request, please ask for details



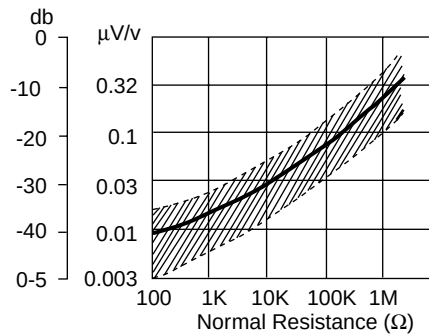
■ CHARACTERISTICS

Item	Characteristics
Operating Temperature Range	$-55^{\circ}\text{C} \sim +155^{\circ}\text{C}$
Temperature Coefficient	$1\Omega \sim 91K\Omega$ is $0 \sim -450\text{ppm}/^{\circ}\text{C}$; $100K\Omega \sim 1M\Omega$ is $0 \sim -700\text{ppm}/^{\circ}\text{C}$; $1.1M\Omega \sim 10M\Omega$ is $-800 \sim -700\text{ppm}/^{\circ}\text{C}$ Test methods: natural resistance change per temp. $^{\circ}\text{C}$; $[R_2 - R_1 / R_1(t_2 - t_1)] \times 10^6 (\text{ppm}/^{\circ}\text{C})$; R_1 is resis. value at room temp. (t_1); R_2 is resis. value at room temp. $+100^{\circ}\text{C}$ (t_2); Test pattern is room temp., room temp. $+100^{\circ}\text{C}$.
Dielectric Withstanding Voltage	No evidence of flashover mechanical damage, arcing or insulation breakdown. Test method is resistors are clamped in the trough of a 90° metallic V-block and tested at the maximum overload voltage for $60 +10/-0$ seconds.
Temperature Cycling	$\pm 1\% +0.05\Omega$ max. with no evidence of mechanical damage. Test method is five cycles for duty cycle as follows: step 1 at $-55^{\circ}\text{C} \pm 3^{\circ}\text{C}$ for 30 min.; step 2 at room temp. for 10~15 min.; step 3 at $+155^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 30 min.; step 4 at room temp. for 10~15 min.
Short-Time Overload (permanent resistance change)	$\pm 1\% +0.05\Omega$ max. with no evidence of mechanical damage. Test method is the application of a potential of 2.5 times RCWV for 5 seconds.
Load Life in Humidity	For normal type: $<100K\Omega$ is $\pm 3\%$, $\geq 100K\Omega$ is $\pm 5\%$. For flame retardant type: $<100K\Omega$ is $\pm 5\%$, $\geq 100K\Omega$ is $\pm 10\%$. Test method is 1,000 hours operating at RCWV with duty cycle of 1.5 hours "on", 0.5 hour "off" in a humidity test chamber controlled at $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and 90~95% relative humidity.
Load Life (permanent resistance change)	For normal type: $<56K\Omega$ is $\pm 2\%$, $\geq 56K\Omega$ is $\pm 3\%$. For flame retardant type: $<100K\Omega$ is $\pm 5\%$, $\geq 100K\Omega$ is $\pm 10\%$. Test method is 1,000 hours operating at RCWV with duty cycle of 1.5 hours "on", 0.5 hour "off" at $+70^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ambient.
Insulation Resistance	$10,000M\Omega$ min. Test method is resistors are clamped in the trough of a 90° metallic V-block and tested at the maximum overload voltage for $60 +10/-0$ seconds.
Resistance to Soldering Heat (permanent resistance change)	$\pm 1\% +0.05\Omega$ max. with no evidence of mechanical damage. Test method is leads are immersed $3.2\sim 4.8\text{mm}$ from the body in $350^{\circ}\text{C} \pm 10^{\circ}\text{C}$ solder for 3 ± 0.5 seconds

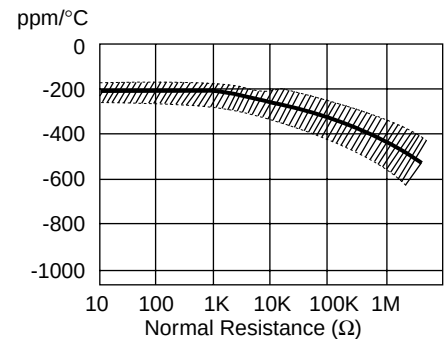
■ DERATING CURVE



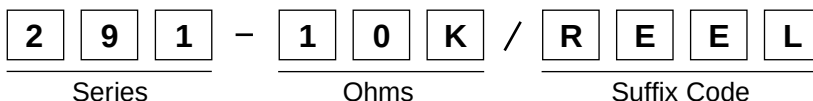
■ CURRENT NOISE



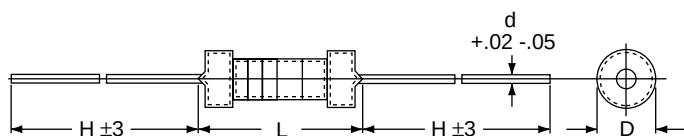
■ TEMPERATURE COEFFICIENT



■ PART NUMBERING SYSTEM



■ SERIES, WATTAGE, SIZE, VOLTAGE, DIMENSIONS, AND AVAILABLE PACKAGING



Suffix Code:	Package:
1000	Bulk
REEL	Tape and Reel
AP	Ammo Pack

Series	Watts	Size	Voltage (max.)		Dimensions (mm)						Standard Quantities Available		
			W.V.	O.V.	L max.	L min.	D max.	D min.	H	d	Bulk	Tape and Reel	Ammo Pack
291S	1/4W	Small	250	500	4.2	3.2	2.0	1.7	28	0.5	1,000	5,000	2,000
293S	1/2W	Small	350	700	9	5.6	3.0	2.1	28	0.6	1,000	5,000	1,000
294	1W	Small	500	1,000	12	10.5	5.0	4.0	28	0.7	1,000	3,000	1,000
297S	2W	Small	500	1,000	12	10.5	5.0	4.0	28	0.7	1,000	1,000	1,000
299	1/8W	Standard	200	400	4.2	3.2	2.0	1.7	28	0.5	1,000	5,000	2,000
291	1/4W	Standard	250	500	6.8	5.6	2.5	2.1	28	0.6	1,000	5,000	1,000
293	1/2W	Standard	350	700	10	8.5	3.5	3.0	28	0.6	1,000	3,000	1,000
294L	1W	Standard	500	1,000	16	14.5	5.5	4.5	28	0.8	1,000	1,000	1,000
297	2W	Standard	500	1,000	16	14.5	5.5	4.5	28	0.8	1,000	500	500

■ STANDARD VALUES (Ω)

0.5	2.0	4.3	9.1	20	43	91	200	430	910	2K	3.9K	8.2K	18K	39K	82K	180K	390K	820K	1.8M	3.9M	8.2M
1.0	2.2	4.7	10	22	47	100	220	470	1K	2.2K	4.3K	9.1K	20K	43K	91K	200K	430K	910K	2M	4.3M	9.1M
1.1	2.4	5.1	11	24	51	110	240	510	1.1K	2.4K	4.7K	10K	22K	47K	100K	220K	470K	1M	2.2M	4.7M	10M
1.2	2.7	5.6	12	27	56	120	270	560	1.2K	2.7K	5.1K	11K	24 K	51K	110K	240K	510K	1.1M	2.4M	5.1M	15M
1.3	3.0	6.2	13	30	62	130	300	620	1.3K	3K	5.6K	12K	27K	56K	120K	270K	560K	1.2M	2.7M	5.6M	22M
1.5	3.3	6.8	15	33	68	150	330	680	1.5K	3.2K	6.2K	13K	30K	62K	130K	300K	620K	1.3M	3M	6.2M	
1.6	3.6	7.5	16	36	75	160	360	750	1.6K	3.3K	6.8K	15K	33K	68K	150K	330K	680K	1.5M	3.3M	6.8M	
1.8	3.9	8.2	18	39	82	180	390	820	1.8K	3.6K	7.5K	16K	36K	75K	160K	360K	750K	1.6M	3.6M	7.5M	