



VISHAY INTERTECHNOLOGY, INC.

INTERACTIVE

data book

LEADED FIXED WIREWOUND RESISTORS

VISHAY

VSE-DB0008-0806

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VISHAY INTERTECHNOLOGY, INC.



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BASIC CONSTRUCTION

Wirewound resistors usually consist of a substrate of high grade special ceramic material of high mechanical stability onto which is wound, at constant pitch, a single layer wire or ribbon resistance element.

For less demanding applications a glass fibre cord is used as a substrate instead of the ceramic material (Types SKA ... KKA).

The ends of the winding are attached to the external terminations via caps or lugs by welding or hard soldering, thus providing reliable electrical and mechanical internal connections. The resistance elements are protected by a coating of cement or glaze against adverse mechanical and environmental conditions.

RESISTOR MATERIALS

Special alloys with different specific resistance are used as wire material for the resistance elements. Most commonly used are:

WM 50 (Class 1)

Copper nickel alloy with small additions of manganese (without iron and zinc) is preferred for cemented types.

The medium temperature coefficient is:

- 10 ... - 80 x 10⁻⁶/K between + 20 °C ... + 150 °C,
DIN designation CUNi 44.

WM 110 (Class 3)

Nickel chromium alloy with additions of iron is preferred for vitreous types, it is oxidation proof and antimagnetic.

The medium temperature coefficient is:

+ 100 ... + 180 x 10⁻⁶/K between + 20 °C ... + 150 °C,
DIN designation NiCr 6015.

If special characteristics are requested, we can also use other resistance wires upon request.

In addition to round wires, elements based upon ribbon shaped materials are available. In these the ribbon is corrugated and wound edgewise onto the substrate to maximise the amount of material that can be applied in a single winding (Types GBS ... ZBS ...).

For low resistance values the alloy WM 10 (copper nickel) with a temperature coefficient of + 650 ... + 750 x 10⁻⁶/K, DIN designation CUNi 6 is offered.

SURFACE PROTECTION

The coating applied on wirewound resistors (glazing, cement, lacquering) fixes the winding mechanically and prevents short-circuits. It protects the resistance elements against mechanical damage and detrimental contamination by the environment. The protective coating also provides electrical insulation.

GLAZING

For types in the ranges G ..., GWS, GW, GWK, RW only high quality special glazes are used. The temperature changes occurring frequently during operation should not cause any cracks in the glaze and the resistance element must remain encapsulated.

Moreover at high temperatures and d.c. current load no electrolytic effects should occur. Our glaze provides a high dielectric strength and a high insulation resistance and it is also resistant to all the usual washing and cleaning chemicals.

CEMENT

The principal material is a phosphate cement which is resistant to mold and termites and has been well proved over many years. Owing to the fine grain structure of the cement, cemented wirewound resistors generally cannot be designated as absolutely suited for tropical i.e. high humidity environments.

RESISTANCE VALUE

Rated Resistance

Rated resistance is the value marked on the components.

Critical Resistance Value

Critical resistance is that resistance value at which the rated voltage has the same value as the maximum permissible continuous voltage.

Tolerance

Tolerance is the permissible deviation from the rated value.

Resistance Ranges

Preferred resistance values are those of the ranges E 12, E 24 and E 48 as per IEC 63.

Rated Load

The rated load is defined in the catalog at an ambient temperature of 70 °C (40 °C, 25 °C) at which it is ensured that the fixed stability limits of the specification are not exceeded.

Temperature Coefficient of Resistance Value

The temperature dependence of the resistance value is usually defined as temperature coefficient. Temperature coefficient is the quotient of the relative resistance change $\Delta R/R$ and the temperature difference thus.

$$\text{TCR [ppm]} = \frac{\Delta R}{R} \times \frac{1}{\Delta T} \times 10^{-6}$$

The temperature coefficient is stated in ppm (parts per million) and refers to a temperature difference of 1 Kelvin.

Temperature Characteristic

The temperature dependence of the resistance value can also be defined as temperature characteristic. The temperature characteristic is the reversible change of resistance value appearing in a defined temperature range and is expressed in %.

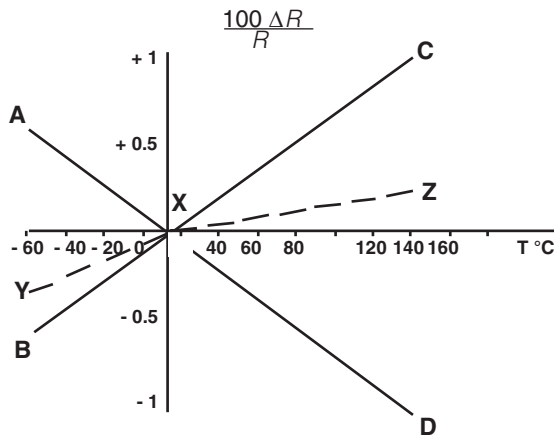
$$\text{Characteristics [\%]} = 100 \times \frac{\Delta R}{R}$$

Diagram

A, B, C, D represent the limits of the resistance change at the lower and upper category temperature.

AX, BX, XC, XD are the limit curves over the total temperature range.

YX/XZ is an example of the course of resistance change of a resistor with non-linear temperature coefficient.



DERATING CURVE

This curve shows the maximum permissible loss as a function of the ambient temperature.

LIMITING VOLTAGE IN CONTINUOUS OPERATION

This voltage is the maximum permissible operating voltage which may be applied continuously to the resistor without exceeding the maximum temperature in the middle of the resistor. This means that starting on the “critical” resistance value the load decreases with increasing resistance values.

D.C. STABILITY

Resistors of the type ranges GWS, GW and GWK were formerly produced in a.c. and d.c. versions. With a.c. resistors a d.c. operation caused an electrolytic reaction, the consequence of which could be a breakdown of the winding. To avoid this effect we now only produce resistors suited both to a.c. and d.c. operation. It is therefore no longer necessary to specify a.c. or d.c. operation when ordering.

STABILITY IN TROPICAL SURROUNDINGS

Vishay vitreous wirewound resistors have a fully sealed coating, i.e. all parts of the resistance element are entirely protected against atmospheric oxygen and influence of humidity.

ADJUSTABLE RESISTORS

The tap position may only be changed by completely loosening the sliding lug, and this should only be done when the resistor is not in operation.

CHARACTERISTICS - PARAMETERS							
MODEL	ENDURANCE		SHELF LIFE	DAMP HEAT, STEADY STATE			
	1000 h $\frac{\Delta R}{R}$ [%]	5000 h $\frac{\Delta R}{R}$ [%]	5000 h at °C $\frac{\Delta R}{R}$ [%]	40 °C 95 % $\frac{\Delta R}{R}$ [%]	112D	56D	21D
G 20	≤ 4	≤ 6	≤ 0.1	≤ 0.2		*	
GWS... GWK... RW.....		≤ 3	≤ 0.1	≤ 0.2	*	*	
Z30. Cl. 1		≤ 3	≤ 0.2	≤ 1		*	*
Cl. 3		≤ 3	≤ 0.2				*
ZWS... Cl. 1		≤ 2	≤ 0.1				*
Cl. 3		≤ 3	≤ 0.2				*
ZWK... Cl. 1		≤ 2	≤ 0.1				*
Cl. 3		≤ 3	≤ 0.2				*
KKA...	≤ 3 ⁽¹⁾ ≤ 5 ⁽²⁾		≤ 1	≤ 2			*
KKE...	≤ 3 ⁽¹⁾ ≤ 5 ⁽²⁾		≤ 1				*
KKE.. Si	≤ 2		≤ 1				*

Notes

- (1) at t = 70 °C
- (2) for WM 10



Resistors are listed by power rating. Locate the wattage you require, then match it with the model closest to your needs for temperature coefficient, value, tolerance, etc. Also, many non-standard versions of these resistors are available or can be engineered to your specifications. For more information and assistance, contact factory.

RESISTOR SELECTION GUIDE									
POWER WATTS	at °C	MODEL	TYPE	TEMPERATURE COEFFICIENT ppm/°C	RESISTANCE RANGE Ω	STD. TOL. %	MAX. WORKING VOLTAGE	LENGTH in millimeters [inches]	DIA./WIDTH in millimeters [inches]
0.4 W	25	RS1/4	Axial Leaded	20/50/90	0R1 - 3K4	1	$\sqrt{P \times R}$	6.35 [0.250]	2.16 [0.085]
0.5 W	25	CW1/2	Axial Leaded	30/50/90	0R1 - 1K77	5	$\sqrt{P \times R}$	6.35 [0.250]	2.16 [0.085]
0.75 W	25	RS1/2	Axial Leaded	20/50/90	0R1 - 4K9	1	$\sqrt{P \times R}$	7.92 [0.312]	1.98 [0.078]
1.0 W	25	CA0001	Axial Leaded	300/600	0R1 - 1K0	10	$\sqrt{P \times R}$	10.16 [0.400]	4.32 [0.170]
	25	CW001	Axial Leaded	30/50/90	0R1 - 6K37	5	$\sqrt{P \times R}$	10.31 [0.406]	2.39 [0.094]
	25	CW01M	Axial Leaded	30/50/90	0R1 - 3K3	5	$\sqrt{P \times R}$	7.24 [0.285]	2.79 [0.110]
	25	EGS01...80 (RWR81)	Axial Leaded	20/50/90	0R1 - 1K0	1	$\sqrt{P \times R}$	6.35 [0.250]	2.16 [0.085]
	25	G001...80 (RW81)	Axial Leaded	20/50/90	0R1 - 3K4 0R1 - 1K0	1	$\sqrt{P \times R}$	6.35 [0.250]	2.16 [0.085]
	25	LVR01	Axial Leaded	50 ... 400	R01 - R10	1	$\sqrt{P \times R}$	10.85 [0.427]	2.92 [0.115]
	25	RS01A (RW70)	Axial Leaded	20/50/90	0R1 - 10K4 0R1 - 2K74	1	$\sqrt{P \times R}$	10.31 [0.406]	2.39 [0.094]
	25	RS01M	Axial Leaded	20/50/90	0R1 - 6K85	1	$\sqrt{P \times R}$	7.24 [0.285]	2.79 [0.110]
	70	SR1	Radial Leaded	100/175	0R005 - 0R03	1/5	$\sqrt{P \times R}$	11.43 [0.450]	-
	40	Z301	Axial Leaded	- 10 ... - 80/100 ... 180	R30 - 2K0	5/10	$\sqrt{P \times R}$	8.50 [0.335]	3.00 [0.118]
1.5 W	25	EGS02 (RWR82)	Axial Leaded	20/50/90	0R1 - 1K3	1	$\sqrt{P \times R}$	7.92 [0.312]	1.98 [0.078]
	25	G002	Axial Leaded	20/50/90	0R1 - 4K9	1	$\sqrt{P \times R}$	7.92 [0.312]	1.98 [0.078]
2.0 W	25	CA0002	Axial Leaded	300/600	0R1 - 2K4	10	$\sqrt{P \times R}$	14.48 [0.570]	4.32 [0.170]
	40	CP0002 CP0002...3	Axial Leaded	300/600	0R1 - 12K0	10	$\sqrt{P \times R}$	17.46 [0.688]	6.35 [0.250]
	70	CPCC02	Vertical Mount	300/600	0R1 - 500	10	$\sqrt{P \times R}$	20.50 [0.807]	11.00 [0.433]
	70	CPCF02	Vertical Mount Film	50	501 - 150K0	5	$\sqrt{P \times R}$	20.50 [0.807]	11.00 [0.433]
	70	CPCL02	Vertical Mount	100/400	0R01 - 0R1	5	$\sqrt{P \times R}$	20.50 [0.807]	11.00 [0.433]
	70	CPCP02	Vertical Mount	20/50/90	0R1 - 4K0	1	$\sqrt{P \times R}$	20.50 [0.807]	11.00 [0.433]
	40	CPW02 CPW02...3	Axial Leaded	30/50/90	0R1 - 7K0	1	$\sqrt{P \times R}$	17.46 [0.688]	6.35 [0.250]
	25	EGS03...80 (RWR80)	Axial Leaded	20/50/90	0R1 - 3K16	1	$\sqrt{P \times R}$	10.31 [0.406]	2.39 [0.094]
	25	ESS2A (RWR71)	Axial Leaded	20/50/90	0R1 - 12K1	1	$\sqrt{P \times R}$	20.62 [0.812]	4.75 [0.187]
	25	G003...80 (RW80)	Axial Leaded	20/50/90	0R1 - 10K4 0R1 - 2K74	1	$\sqrt{P \times R}$	10.31 [0.406]	2.39 [0.094]
	70	SKF2	Pins	1300/- 80 ... 400	R10 - 7K5	5/10	$\sqrt{P \times R}$	19 ± 1 [0.748 ± 0.039]	5 ± 1 [0.197 ± 0.039]
	40	ZDA0411	Axial Leaded	- 10 ... - 80/100 ... 180	R62 - 4K3	5/10	$\sqrt{P \times R}$	11.00 [0.433]	4.00 [0.157]
2.5 W	25	CA5050	Axial Leaded	300/600	0R1 - 2K7	10	$\sqrt{P \times R}$	12.70 [0.500]	4.32 [0.170]

Resistor Selection Guide



Vishay

RESISTOR SELECTION GUIDE									
POWER WATTS	at °C	MODEL	TYPE	TEMPERATURE COEFFICIENT ppm/°C	RESISTANCE RANGE Ω	STD. TOL. %	MAX. WORKING VOLTAGE	LENGTH in millimeters [inches]	DIA./WIDTH in millimeters [inches]
3.0 W	25	CA5060	Axial Leaded	300/600	0R1 - 3K5	10	$\sqrt{P \times R}$	15.24 [0.600]	4.32 [0.170]
	40	CP0003 CP0003...3	Axial Leaded	300/600	0R1 - 22K0	10	$\sqrt{P \times R}$	22.22 [0.875]	7.94 [0.313]
	70	CPCC03	Vertical Mount	300/600	0R1 - 800	10	$\sqrt{P \times R}$	24.99 [0.984]	11.99 [0.472]
	70	CPCF03	Vertical Mount Film	50	801 - 150K	5	$\sqrt{P \times R}$	24.99 [0.984]	11.99 [0.472]
	70	CPCL03	Vertical Mount	100/400	0R01 - 0R1	5	$\sqrt{P \times R}$	24.99 [0.984]	11.99 [0.472]
	70	CPCP03	Vertical Mount	20/50/90	0R1 - 5K0	1	$\sqrt{P \times R}$	24.99 [0.984]	11.99 [0.472]
	40	CPL03 CPL03...3	Axial Leaded	300	0R01 - 0R10	5	$\sqrt{P \times R}$	22.22 [0.875]	7.94 [0.313]
	40	CPR03	Radial Terminal	300/600	0R1 - 1K0	5	$\sqrt{P \times R}$	23.01 [0.906]	9.53 [0.375]
	40	CPSL03...5	Four Terminal	100	0R01 - 0R10	5	$\sqrt{P \times R}$	22.22 [0.875]	7.94 [0.313]
	40	CPW03 CPW03...3	Axial Leaded	30/50/90	0R1 - 7K5	1	$\sqrt{P \times R}$	22.22 [0.875]	7.94 [0.313]
	25	ESS2B (RWR89)	Axial Leaded	20/50/90	0R1 - 4K12	1	$\sqrt{P \times R}$	14.22 [0.560]	4.75 [0.187]
	25	HLW03	Axial Leaded	30/50/90	0R1 - 6K0	5	$\sqrt{P \times R}$	11.13 [0.438]	5.16 [0.203]
	25	LVR03 (RLV30)	Axial Leaded	50...400	0R005 - 0R2 0R01 - 0R2	1	$\sqrt{P \times R}$	14.22 [0.205]	5.21 [0.560]
	25	RS02B (RW79)	Axial Leaded	20/50/90	0R1 - 24K5 0R1 - 6K49	1	$\sqrt{P \times R}$	14.22 [0.560]	4.75 [0.187]
	25	RS02C	Axial Leaded	20/50/90	0R1 - 32K3	1	$\sqrt{P \times R}$	12.7 [0.500]	5.54 [0.218]
	25	RS02C...23 (RW69)	Axial Leaded	20/50/90	0R1 - 32K3 0R1 - 2K0	5	$\sqrt{P \times R}$	12.7 [0.500]	5.54 [0.218]
	25	RS02M	Axial Leaded	20/50/90	0R1 - 18K74	1	$\sqrt{P \times R}$	12.7 [0.500]	4.7 [0.185]
	70	SR3	Radial Leaded	100/175/200	0R005 - 0R05	1/5	$\sqrt{P \times R}$	15.24 [0.600]	-
40	Z302	Axial Leaded	- 10 ... - 80/100 ... 180	0R10 - 3K3	1/2/5/10	$\sqrt{P \times R}$	13 [0.512]	4.8 [0.189]	
3.25 W	25	CW02C	Axial Leaded	30/50/90	0R1 - 19K9	5	$\sqrt{P \times R}$	12.70 [0.500]	5.54 [0.218]
3.75 W	25	CW02B	Axial Leaded	30/50/90	0R1 - 15K	5	$\sqrt{P \times R}$	14.27 [0.562]	4.78 [0.188]
4.0 W	70	CPS4	Radial Leaded	300/600	0R10 - 1K0	5	$\sqrt{P \times R}$	24 [0.945]	7.37 [0.29]
	25	CW02M	Axial Leaded	30/50/90	0R1 - 12K	5	$\sqrt{P \times R}$	12.7 [0.500]	4.7 [0.185]
	40	G 202	Leaded	100 ... 180	R10 - 10K	2/5/10	200	13 [0.512]	5.7 [0.224]
	25	G005	Axial Leaded	20/50/90	0R1 - 24K5	10	$\sqrt{P \times R}$	14.27 [0.562]	4.78 [0.188]
	40	KKA 4	Ceramic Case	650 ... 750/- 10 ... - 80/100 ... 180	R012 - 3K9	5/10/20	125	19.5 [0.768]	6 x 6 [0.236 x 0.236]
	40	KKE 4	Ceramic Case	650 ... 750/- 10 ... - 80/100 ... 180	R012 - 3K9	5/10/20	125	19.5 [0.768]	7 x 7.8 [0.276 x 0.307]
	40	KKE 7 SiCase	Ceramic Case	-	1R1 - 6K8	5/10	165	25 [0.984]	9 x 10.5 [0.354 x 0.413]
	25	RS002	Axial Leaded	20/50/90	0R10 - 47K1	1	$\sqrt{P \times R}$	15.88 [0.625]	6.35 [0.250]
	70	SKF 4	Pins	1300/- 80 ... 400	R10 - 11K	5/10	$\sqrt{P \times R}$	24 ± 1 [0.945 ± 0.039]	5 ± 1 [0.197 ± 0.039]



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POWER WATTS	at °C	MODEL	TYPE	TEMPERATURE COEFFICIENT ppm/°C	RESISTANCE RANGE Ω	STD. TOL. %	MAX. WORKING VOLTAGE	LENGTH in millimeters [inches]	DIA./WIDTH in millimeters [inches]
4.0 W	40	Z 303	Leaded	- 10 ... - 80/100 ... 180	R10 - 3K9	1/2/5/10	$\sqrt{P \times R}$	15.8 [0.622]	5.5 [0.217]
5.0 W	25	CA5100	Axial Leaded	300/600	0R15 - 6K7	10	$\sqrt{P \times R}$	25.40 [1.00]	4.32 [0.170]
	40	CP0005 CP0005...3	Axial Leaded	300/600	0R1 - 27K0	10	$\sqrt{P \times R}$	22.22 [0.875]	8.73 [0.344]
	70	CPCC05	Vertical Mount	300/600	0R1 - 800	10	$\sqrt{P \times R}$	25.48 [1.003]	13.00 [0.512]
	70	CPCF05	Vertical Mount Film	50	801 - 150K	5	$\sqrt{P \times R}$	25.48 [1.003]	13.00 [0.512]
	70	CPCL05	Vertical Mount	100/400	0R01 - 0R1	5	$\sqrt{P \times R}$	25.48 [1.003]	13.00 [0.512]
	70	CPCP05	Vertical Mount	20/50/90	0R1 - 5K0	1	$\sqrt{P \times R}$	25.48 [1.003]	13.00 [0.512]
	40	CPL05 CPL05...3	Axial Leaded	300	0R01 - 0R1	5	$\sqrt{P \times R}$	22.22 [0.875]	8.73 [0.344]
	40	CPR05	Radial Terminal	300/600	0R1 - 1K0	5	$\sqrt{P \times R}$	26.92 [1.060]	9.14 [0.360]
	70	CPS5	Radial Leaded	300/600	0R10 - 2K0	5	$\sqrt{P \times R}$	34.3 [1.350]	7.37 [0.29]
	40	CPSL05...5	Four Terminal	100	0R01 - 0R1	5	$\sqrt{P \times R}$	22.22 [0.875]	8.73 [0.344]
	40	CPW05 CPW05...3	Axial Leaded	30/50/90	0R1 - 8K5	1	$\sqrt{P \times R}$	22.22 [0.875]	8.73 [0.344]
	25	CW005...2	Axial Leaded	20/50/90	0R1 - 40K3	5	$\sqrt{P \times R}$	22.22 [0.875]	6.35 [0.250]
	25	ERH05 (RER60)	Chassis Mount	20/50/100	0R1 - 3K32	1	$\sqrt{P \times R}$	15.24 [0.600]	16.41 [0.646]
	25	ESS05 (RWR74)	Axial Leaded	20/50/90	0R1 - 12K1	1	$\sqrt{P \times R}$	22.23 [0.875]	7.92 [0.312]
	25	G05C	Axial Leaded	20/50/90	0R1 - 32K3	1	$\sqrt{P \times R}$	12.70 [0.500]	5.54 [0.218]
	40	KKA5	Ceramic Case	650 ... 750/- 10 ... - 80/100 ... 180	R02 - 6k8	5/10/20	$\sqrt{P \times R}$	25 [0.984]	6 x 6 [0.236 x 0.236]
	25	LVR05 (RLV31)	Axial Leaded	50...400	0R005 - 0R3 0R01 - 0R3	1	$\sqrt{P \times R}$	23.50 [0.925]	8.38 [0.330]
	25	RH005 (RE60)	Chassis Mount	20/50/100	0R02 - 24K5 0R1 - 3K32	1	$\sqrt{P \times R}$	15.24 [0.600]	16.41 [0.646]
	25	RS005 (RW74)	Axial Leaded	20/50/90	0R1 - 95K2 0R1 - 24K3	1	$\sqrt{P \times R}$	22.23 [0.875]	7.92 [0.312]
	70	SKF5	Pins	1300/- 80 ... 400	R22 - 20K	5/10	$\sqrt{P \times R}$	34 ± 1 [1.339 ± 0.039]	5 ± 1 [0.197 ± 0.039]
25	SR5	Radial Leaded	100/175/200	0R004 - 0R05	1/5	$\sqrt{P \times R}$	20.32 [0.800]	-	
5.25 W	25	HLW05	Axial Leaded	30/50/90	0R1 - 15K	5	$\sqrt{P \times R}$	15.88 [0.625]	6.35 [0.250]
5.5 W	25	CW002	Axial Leaded	30/50/90	0R1 - 28K7	5	$\sqrt{P \times R}$	15.87 [0.625]	6.35 [0.250]
	40	KKE 9 Si	Ceramic Case	-	2R2 - 13K0	5/10	$\sqrt{P \times R}$	38 [1.496]	9 x 10.5 [0.354 x 0.413]
6.0 W	40	Z 305	Leaded	- 10 ... - 80/100 ... 180	R10 - 10K	1/2/5/10	$\sqrt{P \times R}$	22.3 [0.878]	8.7 [0.343]
	40	ZWS 6	SL	- 10 ... - 80/100 ... 180	R82 - 13K	2/5/10	$\sqrt{P \times R}$	45 ± 1.5 [1.772 ± 0.059]	7.5 ± 0.5 [0.295 ± 0.02]
	40	ZWS 6 E	SL	- 10 ... - 80/100 ... 180	R82 - 4K7	5/10	$\sqrt{P \times R}$	45 ± 1.5 [1.772 ± 0.059]	7.5 ± 0.5 [0.295 ± 0.02]
	40	ZWS 6 ni	SL	- 10 ... - 80/100 ... 180	R15 - 2K4	5/10	$\sqrt{P \times R}$	45 ± 1.5 [1.772 ± 0.059]	7.5 ± 0.5 [0.295 ± 0.02]
6.5 W	70	CPS7	Radial Leaded	300/600	0R1 - 2K7	5	$\sqrt{P \times R}$	44.5 [1.752]	7.37 [0.29]

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6.5 W	25	CW005	Axial Leaded	30/50/90	0R1 - 58K5	5	$\sqrt{P \times R}$	22.22 [0.875]	7.92 [0.312]
	25	RS005...70 (RW67)	Axial Leaded	20/50/90	0R1 - 95K2 0R1 - 8K2	5	$\sqrt{P \times R}$	22.23 [0.875]	7.92 [0.312]
	70	SKF 6.5	Pins	1300/- 80 ... 400	0R47 - 27K0	5/10	$\sqrt{P \times R}$	44 ± 1 [1.732 ± 0.039]	5 ± 1 [0.197 ± 0.039]
7.0 W	40	CP0007 CP0007...3	Axial Leaded	300/600	0R1 - 35K	10	$\sqrt{P \times R}$	35.32 [1.391]	8.73 [0.344]
	40	CPL07 CPL07...3	Axial Leaded	300	0R01 - 0R1	5	$\sqrt{P \times R}$	35.32 [1.391]	8.73 [0.344]
	40	CPR07	Axial Leaded	300/600	0R1 - 1K429	5	$\sqrt{P \times R}$	35.51 [1.398]	9.14 [0.360]
	40	CPSL07...5	Four Terminal	100	0R01 - 0R1	5	$\sqrt{P \times R}$	35.32 [1.391]	8.73 [0.344]
	40	CPW07 CPW07...3	Axial Leaded	30/50/90	0R1 - 18K0	1	$\sqrt{P \times R}$	35.32 [1.391]	8.73 [0.344]
	25	EGS10...80 (RWR84)	Axial Leaded	20/50/90	0R1 - 12K4	1	$\sqrt{P \times R}$	22.23 [0.875]	7.92 [0.312]
	40	G 204	Leaded	100 ... 180	R10 - 39K	1/2/5/10	350	19.3 [0.76]	8.5 [0.335]
	25	G010	Axial Leaded	20/50/90	0R1 - 95K2	1	$\sqrt{P \times R}$	22.23 [0.875]	7.92 [0.312]
	40	GWK 10 ni	Ferrules	100 ... 180	2R4 - 1K0	5/10	280	46 ± 1 [1.811 ± 0.039]	7.5 ± 0.5 [0.295 ± 0.02]
	40	KKA 7	Ceramic Case	650 ... 750/- 10 ... - 80/100 ... 180	R036 - 13K	5/10/20	250	38 [1.496]	6 x 6 [0.236 x 0.236]
	40	KKE 11 Si	Ceramic Case	-	3R6 - 20K	5/10	350	50 [1.969]	9 x 10.5 [0.354 x 0.413]
	40	KKE 7	Ceramic Case	650 ... 750/- 10 ... - 80/100 ... 180	R02 - 6K8	5/10/20	250	25 [0.984]	9 x 10.5 [0.354 x 0.413]
	25	RS007	Axial Leaded	20/50/90	0R1 - 154K	1	$\sqrt{P \times R}$	30.99 [1.22]	7.92 [0.312]
7.5 W	25	RH005	Chassis Mount	20/50/100	0R1 - 24K5	1	$\sqrt{P \times R}$	15.24 [0.600]	8.48 [0.334]
8 W	25	HLW06	Axial Leaded	30/50/90	0R1 - 20K5	5	$\sqrt{P \times R}$	25.4 [1.000]	7.94 [0.313]
	70	SKF8	Pins	1300/- 80 ... 400	R47 - 36K	5/10	$\sqrt{P \times R}$	54 ± 1 [2.126 ± 0.039]	5 ± 1 [0.197 ± 0.039]
		Z306	Leaded	- 10 ... - 80/100 ... 180	R10 - 16K	1/2/5/10	$\sqrt{P \times R}$	32.3 [1.272]	8.7 [0.343]
	40	ZWS 8 E	SLSS	- 10 ... 80/100 ... 180	R62 - 6K8	5/10	$\sqrt{P \times R}$	50 ± 1.5 [1.969 ± 0.059]	9.5 ± 0.5 [0.374 ± 0.02]
	40	ZWS 8 ni	SLSS	- 10 ... - 80/100 ... 180	R24 - 3K6	5/10	$\sqrt{P \times R}$	50 ± 1.5 [1.969 ± 0.059]	9.5 ± 0.5 [0.374 ± 0.02]
		ZWS8	SLSS	- 10 ... - 80/100 ... 180	R68 - 20K	2/5/10	$\sqrt{P \times R}$	50 ± 1.5 [1.969 ± 0.059]	9.5 ± 0.5 [0.374 ± 0.02]
9 W	25	CW007	Axial Leaded	20/50/90	0R1 - 95K2	5	$\sqrt{P \times R}$	30.94 [1.22]	7.92 [0.312]
	40	KKA9	Ceramic Case	650 ... 750/- 10 ... - 80/100 ... 180	R036 - 13K	5/10	250	38 [1.496]	9 x 9 [0.354 x 0.354]
	40	KKE	Ceramic Case	650 ... 750/- 10 ... - 80/100 ... 180	R036 - 13K	5/10	250	38 [1.496]	9 x 10.5 [0.354 x 0.413]
10 W	25	CA5200	Axial Leaded	300/600	0R2 - 7K0	10	$\sqrt{P \times R}$	50.80 [2.00]	4.32 [0.170]
	40	CP0010 CP0010...3	Axial Leaded	300/600	0R1 - 40K	10	$\sqrt{P \times R}$	47.62 [1.875]	8.73 [0.344]
	70	CPCC10	Vertical Mount	300/600	0R1 - 1K5	10	$\sqrt{P \times R}$	34.85 [1.372]	16.08 [0.633]
	70	CPCL10	Vertical Mount	100/400	0R01 - 0R1	5	$\sqrt{P \times R}$	34.85 [1.372]	16.08 [0.633]



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10 W	70	CPCP10	Vertical Mount	20/50/90	0R1 - 8K0	1	$\sqrt{P \times R}$	34.85 [1.372]	16.08 [0.633]
	40	CPL10 CPL10...3	Axial Leaded	300	0R01 - 0R1	5	$\sqrt{P \times R}$	47.62 [1.875]	8.73 [0.344]
	40	CPR10	Radial Terminal	300/600	0R01 - 2K0	5	$\sqrt{P \times R}$	47.96 [1.888]	9.14 [0.360]
	40	CPSL10...5	Four Terminal	100	0R01 - 0R1	5	$\sqrt{P \times R}$	47.62 [1.875]	8.73 [0.344]
	40	CPW10 CPW10...3	Axial Leaded	30/50/90	0R12 - 30K0	1	$\sqrt{P \times R}$	47.62 [1.875]	8.73 [0.344]
	25	ERH10 (RER65)	Chassis Mount	20/50/100	0R1 - 5K62	1	$\sqrt{P \times R}$	19.05 [0.750]	20.32 [0.800]
	25	ESS10 (RWR78)	Axial Leaded	20/50/90	0R1 - 39K2	1	$\sqrt{P \times R}$	45.21 [1.78]	9.53 [0.375]
	40	GWK 10	Caps	100 ... 180	1R8 - 16K	2/5/10	280	46 ± 1 [1.881 ± 0.039]	7.5 ± 0.5 [0.295 ± 0.02]
	40	GWS 15 E	SL	100 ... 180	4R3 - 620R	5/10	250	45 ± 1.5 [1.772 ± 0.059]	7.5 ± 0.5 [0.295 ± 0.02]
	40	GWS 15 ni	SL	100 ... 180	5R1 - 910R	5/10	250	45 ± 1.5 [1.772 ± 0.059]	7.5 ± 0.5 [0.295 ± 0.02]
	25	HLM010	Tubular	30/50/90	0R1 - 15K0	5	$\sqrt{P \times R}$	33.32 [1.312]	9.52 [0.375]
	25	HLW10	Axial Leaded	30/50/90	0R10 - 29K	5	$\sqrt{P \times R}$	25.40 [1.000]	11.11 [0.438]
	40	KKE 17 Si	Ceramic Case	-	5R6 - 33K	5/10	500	75 [2.953]	9 x 10.5 [0.354 x 0.413]
	25	LVR10	Axial Leaded	50 ... 400	0R01 - 0R8	1	$\sqrt{P \times R}$	46.43 [1.828]	9.96 [0.392]
	25	RH010 (RE65)	Chassis Mount	20/50/100	0R01 - 47K1 0R1 - 5K62	1	$\sqrt{P \times R}$	19.05 [0.750]	20.32 [0.800]
	25	RS010 (RW78)	Axial Leaded	20/50/90	0R1 - 273K0 0R1 - 71K5	1	$\sqrt{P \times R}$	45.21 [1.78]	9.53 [0.375]
	40	Z 307	Leaded	- 10 ... - 80/100 ... 180	R20 - 30K	1/2/5/10	$\sqrt{P \times R}$	49.8 [1.961]	9 [0.354]
	40	ZWK 10	Caps	- 10 ... - 80/100 ... 180	R47 - 22K	2/5/10	$\sqrt{P \times R}$	51 ± 1.3 [2.008 ± 0.051]	12 ± 0.8 [0.472 ± 0.031]
11 W	25	HL011	Tubular	30/50/90	0R1 - 70K	5	$\sqrt{P \times R}$	44.45 [1.750]	9.53 [0.375]
	25	RS010...39 (13W) (RW68)	Axial Leaded	20/50/90	0R1 - 273K 0R1 - 20K	5	$\sqrt{P \times R}$	45.21 [1.78]	9.53 [0.375]
12 W	25	HL012	Tubular	30/50/90	0R1 - 58K	5	$\sqrt{P \times R}$	44.45 [1.750]	7.94 [0.313]
	25	HLA012	Tubular	30/50/90	1R0 - 10K	5/10	$\sqrt{P \times R}$	44.45 [1.750]	10.32 [0.406]
	25	HLW12	Axial Leaded	30/50/90	0R1 - 58K	5	$\sqrt{P \times R}$	44.45 [1.750]	7.94 [0.313]
13 W	25	CW010	Axial Leaded	30/50/90	0R1 - 167K	5	$\sqrt{P \times R}$	45.24 [1.781]	9.52 [0.375]
15 W	40	CP0015 CP0015...3	Axial Leaded	300/600	0R1 - 40K	10	$\sqrt{P \times R}$	47.62 [1.875]	12.70 [0.500]
	40	CPL15 CPL15...3	Axial Leaded	300	0R01 - 0R10	5	$\sqrt{P \times R}$	47.62 [1.875]	12.70 [0.500]
	40	CPR15	Radial Leaded	300/600	0R1 - 2K0	5	$\sqrt{P \times R}$	47.96 [1.888]	12.70 [0.500]
	40	CPSL15...5	Four Terminal	100	0R01 - 0R1	5	$\sqrt{P \times R}$	47.62 [1.875]	12.70 [0.500]
	40	CPW15 CPW15...3	Axial Leaded	30/50/90	0R12 - 30K	1	$\sqrt{P \times R}$	47.62 [1.875]	12.70 [0.500]
	25	HL015	Tubular	30/50/90	0R1 - 60K	5	$\sqrt{P \times R}$	38.10 [1.500]	11.11 [0.438]

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15 W	25	HLT015	Tubular	30/50/90	0R1 - 18K	10	$\sqrt{P \times R}$	38.10 [1.500]	14.29 [0.563]
	25	HLM015	Tubular	30/50/90	0R1 - 26K	5	$\sqrt{P \times R}$	39.67 [1.562]	9.52 [0.375]
	25	HLW15	Axial Leaded	30/50/90	0R1 - 58K	5	$\sqrt{P \times R}$	38.10 [1.500]	11.11 [0.438]
18 W	40	GWS 25 ni	SL SS	100 ... 180	6R8 - 1K8	5/10	300	55 ± 1.5 [2.165 ± 0.059]	11.8 ± 0.8 [0.465 ± 0.031]
	40	GWS 25E	SL SS	100 ... 180	5R1 - 1K3	5/10	300	55 ± 1.5 [2.165 ± 0.059]	11.8 ± 0.8 [0.465 ± 0.031]
	40	RW 10/44	Lugs FST	100 ... 180	1R0 - 36K	5/10	400	44.4 [1.748]	12.7 [0.500]
20 W	40	CP0020 CP0020...3	Axial Leaded	300/600	0R1 - 45K	10	$\sqrt{P \times R}$	63.5 [2.500]	12.7 [0.500]
	40	CPR20	Radial Leaded	300/600	0R15 - 2K855	5	$\sqrt{P \times R}$	63.45 [2.498]	12.7 [0.500]
	40	CPW20 CPW20...3	Axial Leaded	30/50/90	0R18 - 45K	1	$\sqrt{P \times R}$	63.5 [2.500]	12.7 [0.500]
	25	ERH25 (RER70)	Chassis Mounted	20/50/100	0R1 - 12K1	1	$\sqrt{P \times R}$	26.97 [1.062]	27.43 [1.080]
	40	GWK 20	Caps	100 ... 180	2R2 - 27K	2/5/10	400	51 ± 1.3 [2.008 ± 0.051]	12.3 ± 0.8 [0.484 ± 0.031]
	40	GWK 40 ni	Caps	100 ... 180	6R8 - 2K7	5/10	580	61 ± 1.5 [2.402 ± 0.059]	15.3 ± 0.8 [0.602 ± 0.031]
	40	GWS 20	SL SS	100 ... 180	3R6 - 30K	2/5/10	300	50 ± 1.5 [1.969 ± 0.059]	9.5 ± 0.5 [0.374 ± 0.020]
	25	HL020	Tubular	30/50/90	0R1 - 95K	5	$\sqrt{P \times R}$	50.8 [2.000]	11.11 [0.438]
	25	HLA020	Tubular	30/50/90	1R0 - 18K	5/10	$\sqrt{P \times R}$	50.80 [2.000]	14.29 [0.563]
	25	HLM020	Tubular	30/50/90	0R1 - 71K	5	$\sqrt{P \times R}$	66.68 [2.625]	9.52 [0.375]
	25	HLT020	Tubular	30/50/90	0R1 - 31K	10	$\sqrt{P \times R}$	50.80 [2.000]	14.29 [0.563]
	25	HLW20	Axial Leaded	30/50/90	0R1 - 95K	5	$\sqrt{P \times R}$	50.8 [2.000]	11.11 [0.438]
	25	RE70 (RH025 type)	Chassis Mounted	20/50/100	0R1 - 12K1	1	$\sqrt{P \times R}$	26.97 [1.062]	27.43 [1.080]
	40	ZW 13/64 FST	FST	- 10 ... - 80/100 ... 180	R91 - 47K	2/5/10	$\sqrt{P \times R}$	64 [2.52]	14 [0.551]
	40	ZWK 20	Caps	- 10 ... - 80/100 ... 180	R75 - 20K	2/5/10	$\sqrt{P \times R}$	81 ± 2 [3.189 ± 0.079]	15 ± 0.8 [0.591 ± 0.031]
	40	ZWK 20 ni	Caps	- 10 ... - 80/100 ... 180	R56 - 9K1	5/10	$\sqrt{P \times R}$	81 ± 2 [3.189 ± 0.079]	15 ± 0.8 [0.591 ± 0.031]
	40	ZWS 20	SL SS SB FST	- 10 ... - 80/100 ... 180	R62 - 43K	2/5/10	$\sqrt{P \times R}$	62 ± 2 [2.441 ± 0.079]	14.8 ± 0.8 [0.583 ± 0.031]
	40	ZWS 20 E	SL SS SB FST	- 10 ... - 80/100 ... 180	R62 - 15K	5/10	$\sqrt{P \times R}$	62 ± 2 [2.441 ± 0.079]	14.8 ± 0.8 [0.583 ± 0.031]
	40	ZWS 20 ni	SL SS SB FST	- 10 ... - 80/100 ... 180	R47 - 8K2	5/10	$\sqrt{P \times R}$	62 ± 2 [2.441 ± 0.079]	14.8 ± 0.8 [0.583 ± 0.031]
	22 W	40	CP0022 CP0022...3	Axial Leaded	300/600	0R1 - 10K	10	$\sqrt{P \times R}$	63.5 [2.500]
40		GWS 35 E	SL SS	100 ... 180	6R8 - 1K6	5/10	400	62 ± 2 [2.441 ± 0.079]	11.8 ± 0.8 [0.465 ± 0.031]
40		GWS 35 ni	SL SS	100 ... 180	8R2 - 2K4	5/10	400	62 ± 2 [2.441 ± 0.079]	11.8 ± 0.8 [0.465 ± 0.031]
25 W	40	CP0025	Axial Leaded	300/600	0R1 - 10K	10	$\sqrt{P \times R}$	63.5 [2.500]	15.87 [0.625]
	40	GWK 60 ni	Caps	100 ... 180	13R - 5K1	5/10	850	81 ± 2 [3.189 ± 0.079]	15.3 ± 0.8 [0.602 ± 0.031]



RESISTOR SELECTION GUIDE									
POWER WATTS	at °C	MODEL	TYPE	TEMPERATURE COEFFICIENT ppm/°C	RESISTANCE RANGE Ω	STD. TOL. %	MAX. WORKING VOLTAGE	LENGTH in millimeters [inches]	DIA./WIDTH in millimeters [inches]
25 W	40	GWS 25	SL SS	100 ... 180	3R6 - 39K	2/3/5/10	300	55 ± 1.5 [2.165 ± 0.059]	11.8 ± 0.8 [0.465 ± 0.031]
	25	HL025	Tubular	30/50/90	0R1 - 115K	5	$\sqrt{P \times R}$	50.8 [2.000]	14.29 [0.563]
	25	HLA025	Tubular	30/50/90	1R0 - 23K	5/10	$\sqrt{P \times R}$	50.8 [2.000]	17.46 [0.688]
	25	HLT025	Tubular	30/50/90	0R1 - 34K	10	$\sqrt{P \times R}$	50.8 [2.000]	17.46 [0.688]
	25	RH025	Chassis Mounted	20/50/100	0R01 - 95K2	1	$\sqrt{P \times R}$	26.97 [1.062]	27.43 [1.080]
	40	RW 12/51	Lugs FST	100 ... 180	1R0 - 56K	5/10	600	50.8 [2.000]	15.1 [0.594]
	40	ZW 13/80 FST	FST	- 10 ... - 80/100 ... 180	1R2 - 62K	2/5/10	$\sqrt{P \times R}$	80 [3.150]	14 [0.551]
26 W	25	HL026	Tubular	30/50/90	0R1 - 170K	5	$\sqrt{P \times R}$	76.2 [3.000]	11.11 [0.438]
	25	HLA026	Tubular	30/50/90	1R0 - 31K	5/10	$\sqrt{P \times R}$	76.2 [3.000]	14.29 [0.563]
	25	HLT026	Tubular	30/50/90	0R1 - 59K	10	$\sqrt{P \times R}$	76.2 [3.000]	14.29 [0.563]
	40	RW 33 (MIL-R-26)	Lugs FST	100 ... 180	8R2 - 8K2	5	1000	76.2 [3.000]	15.1 [0.594]
27 W	40	RW 12/76 E	Lugs FST	100 ... 180	2R0 - 4K3	5/10	1000	76.2 [3.000]	15.1 [0.594]
	40	RW 12/76 ni	Lugs FST	100 ... 180	16R - 6K2	5/10	1000	76.2 [3.000]	15.1 [0.594]
30 W	25	ERH50 (RER75)	Chassis Mount	20/50/100	R10 - 39K2	1	$\sqrt{P \times R}$	49.99 [1.968]	28.96 [1.140]
	40	GWK 40	Caps	100 ... 180	3R3 - 43K	2/5/10	580	61 ± 1.5 [2.402 ± 0.059]	15.3 ± 0.8 [0.602 ± 0.031]
	40	GWS 35	SL SS	100 ... 180	5R1 - 47K	2/3/5/10	400	62 ± 2 [2.441 ± 0.079]	11.8 ± 0.8 [0.465 ± 0.031]
	40	GWS 50 E	SL SS SB FST	100 ... 180	8R2 - 2K0	5/10	400	62 ± 2 [2.441 ± 0.079]	14.8 ± 0.8 [0.583 ± 0.031]
	40	GWS 50 ni	SL SS SB FST	100 ... 180	10R - 3K0	5/10	400	62 ± 2 [2.441 ± 0.079]	14.8 ± 0.8 [0.583 ± 0.031]
	25	HL024	Tubular	30/50/90	R10 - 11K	5	$\sqrt{P \times R}$	63.5 [2.500]	30.16 [1.188]
35 W	25	HLZ033	Tubular	30/50/90	R05 - 1R9	10	$\sqrt{P \times R}$	50.8 [2.000]	14.29 [0.563]
	40	ZW 13/100 FST	FST	- 10 ... - 80/100 ... 180	1R6 - 82K	2/5/10	$\sqrt{P \times R}$	100 [3.937]	14 [0.551]
	40	ZWS 35	SL SS SB FST	- 10 ... - 80/100 ... 180	1R1 - 83K	2/5/10	$\sqrt{P \times R}$	100 ± 2 [3.937 ± 0.079]	14.8 ± 0.8 [0.583 ± 0.031]
	40	ZWS 35 E	SL SS SB FST	- 10 ... - 80/100 ... 180	1R1 - 27K	5/10	$\sqrt{P \times R}$	100 ± 2 [3.937 ± 0.079]	14.8 ± 0.8 [0.583 ± 0.031]
	40	ZWS 35 ni	SL SS SB FST	- 10 ... - 80/100 ... 180	R91 - 15K	5/10	$\sqrt{P \times R}$	100 ± 2 [3.937 ± 0.079]	14.8 ± 0.8 [0.583 ± 0.031]
40 W	40	GWK 60	Caps	100 ... 180	6R2 - 82K	2/5/10	850	81 ± 2 [3.189 ± 0.079]	15.3 ± 0.8 [0.602 ± 0.031]
	40	GWS 50	SL SS SB FST	100 ... 180	3R3 - 62K	2/3/5/10	400	62 ± 2 [2.441 ± 0.079]	14.8 ± 0.8 [0.583 ± 0.031]
	25	HL035	Tubular	30/50/90	R10 - 26K	5	$\sqrt{P \times R}$	82.55 [3.250]	30.16 [1.188]
	40	ZW 20/80 FST	FST	- 10 ... - 80/100 ... 180	1R8 - 91K	2/5/10	$\sqrt{P \times R}$	80 [3.150]	21 [0.827]
	40	ZWK 40	Caps	- 10 ... - 80/100 ... 180	1R5 - 36K	2/5/10	$\sqrt{P \times R}$	101 ± 2.5 [3.976 ± 0.098]	22 ± 1 [0.866 ± 0.039]
	40	ZWK 40 ni	Caps	- 10 ... - 80/100 ... 180	1R1 - 18K	5/10	$\sqrt{P \times R}$	101 ± 2.5 [3.976 ± 0.098]	22 ± 1 [0.866 ± 0.039]

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POWER WATTS	at °C	MODEL	TYPE	TEMPERATURE COEFFICIENT ppm/°C	RESISTANCE RANGE Ω	STD. TOL. %	MAX. WORKING VOLTAGE	LENGTH in millimeters [inches]	DIA./WIDTH in millimeters [inches]
42 W	40	RW 20/76 E	Lugs FST	100 ... 180	1R0 - 75K	5/10	1000	26.2 [1.031]	23 [0.906]
	40	RW 20/76 ni	Lugs FST	100 ... 180	24R - 10K	5/10	1000	26.2 [1.031]	23 [0.906]
45 W	40	GWS 75 E	SL SS SB FST	100 ... 180	18R - 3K9	5/10	800	100 ± 2 [3.937 ± 0.079]	14.8 ± 0.8 [0.583 ± 0.031]
	40	GWS 75 ni	SL SS SB FST	100 ... 180	22R - 6K2	5/10	800	100 ± 2 [3.937 ± 0.079]	14.8 ± 0.8 [0.583 ± 0.031]
	40	RW 12/76	Lugs FST	100 ... 180	2R0 - 91K	5/10	1000	76.2 [3.000]	15.1 [0.594]
50 W	40	CP050B	Ceramic Case	300/600	R16 - 740R	10	$\sqrt{P \times R}$	91.69 [3.610]	19.05 [0.750]
	40	GBS 20/100 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R13 - 6R2	5/10	$\sqrt{P \times R}$	100 ± 2.5 [3.937 ± 0.098]	24 [0.945]
	40	GBS 20/100 WM10	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R13 - R51	5/10	$\sqrt{P \times R}$	100 ± 2.5 [3.937 ± 0.098]	24 [0.945]
	40	GWK 100 ni	Caps	100 ... 180	27R - 10K	5/10	1200	101 ± 2.5 [3.976 ± 0.098]	22 ± 1 [0.866 ± 0.039]
	25	HL050	Tubular	30/50/90	R10 - 112K	5	$\sqrt{P \times R}$	101.6 [4.000]	14.29 [0.563]
	25	HLA050	Tubular	30/50/90	1R0 - 57K	5/10	$\sqrt{P \times R}$	101.6 [4.000]	17.46 [0.688]
	25	HLT050	Tubular	30/50/90	0R1 - 104K	10	$\sqrt{P \times R}$	101.6 [4.000]	17.46 [0.688]
	25	RH050	Chassis Mount	20/50/100	R01 - 273K	1	$\sqrt{P \times R}$	49.99 [1.968]	28.96 [1.140]
	40	ZBS 20/100	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R13 - 6R2	5/10	$\sqrt{P \times R}$	100 ± 2.5 [3.937 ± 0.098]	24 [0.945]
	40	ZBS 20/100 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R13 - 6R2	5/10	$\sqrt{P \times R}$	100 ± 2.5 [3.937 ± 0.098]	24 [0.945]
	40	ZW 20/100 FST	FST	- 10 ... - 80/100 ... 180	2R4 - 130K	2/5/10	$\sqrt{P \times R}$	100 [3.937]	21 [0.827]
	40	ZWS 50	SS SSB SB FST	- 10 ... - 80/100 ... 180	1R3 - 91K	2/5/10	$\sqrt{P \times R}$	100 ± 2 [3.937 ± 0.079]	22.3 ± 1.3 [0.878 ± 0.051]
	40	ZWS 50 E	SS SSB SB FST	- 10 ... - 80/100 ... 180	1R3 - 33K	5/10	$\sqrt{P \times R}$	100 ± 2 [3.937 ± 0.079]	22.3 ± 1.3 [0.878 ± 0.051]
	40	ZWS 50 ni	SS SSB SB FST	- 10 ... - 80/100 ... 180	1R1 - 16K	5/10	$\sqrt{P \times R}$	100 ± 2 [3.937 ± 0.079]	22.3 ± 1.3 [0.878 ± 0.051]
	51 W	25	HL051	Tubular	30/50/90	R10 - 124K	5	$\sqrt{P \times R}$	88.9 [3.500]
25		HLA051	Tubular	30/50/90	1R0 - 95K	5/10	$\sqrt{P \times R}$	88.9 [3.500]	23.02 [0.906]
25		HLT051	Tubular	30/50/90	0R1 - 112K	10	$\sqrt{P \times R}$	88.9 [3.500]	23.02 [0.906]
55 W	25	HL055	Tubular	30/50/90	R10 - 54K	5	$\sqrt{P \times R}$	120.65 [4.750]	30.16 [1.188]
	25	HLT055	Tubular	30/50/90	0R1 - 49K	10	$\sqrt{P \times R}$	88.9 [3.500]	-
	40	RW 20/102 E	Lugs FST	100 ... 180	3R0 - 10K	5/10	1400	101.6 ± 1.6 [4.000 ± 0.063]	23 (26) [0.906 (1.024)]
	40	RW 20/102 ni	Lugs FST	100 ... 180	36R - 15K	5/10	1400	101.6 ± 1.6 [4.000 ± 0.063]	23 (26) [0.906 (1.024)]
	40	RW 35 (MIL-R-26)	Lugs FST	100 ... 180	8R - 20K	5	1400	101.6 ± 1.6 [4.000 ± 0.063]	23 (26) [0.906 (1.024)]
60 W	40	GWK 150 ni	Caps	100 ... 180	36R - 15K	5/10	1600	121 ± 3 [4.764 ± 0.118]	22 ± 1 [0.866 ± 0.039]
	40	GWS 100 E	SS SSB SB FST	100 ... 180	13R - 5.1K	5/10	600	100 ± 2 [3.937 ± 0.079]	22.3 ± 1.3 [0.878 ± 0.051]
	40	GWS 100 ni	SS SSB SB FST	100 ... 180	24R - 6.8K	5/10	600	100 ± 2 [3.937 ± 0.079]	22.3 ± 1.3 [0.878 ± 0.051]



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POWER WATTS	at °C	MODEL	TYPE	TEMPERATURE COEFFICIENT ppm/°C	RESISTANCE RANGE Ω	STD. TOL. %	MAX. WORKING VOLTAGE	LENGTH in millimeters [inches]	DIA./WIDTH in millimeters [inches]
60 W	25	HL060	Tubular	30/50/90	R10 - 145K	5	$\sqrt{P \times R}$	101.6 [4.000]	19.05 [0.750]
	25	HLA060	Tubular	30/50/90	1R0 - 74K	5/10	$\sqrt{P \times R}$	101.6 [4.000]	23.02 [0.906]
	25	HLT060	Tubular	30/50/90	0R1 - 136K	10	$\sqrt{P \times R}$	101.6 [4.000]	23.02 [0.906]
	40	ZWK 60	Caps	- 10 ... - 80/100 ... 180	1R8 - 47K	2/5/10	$\sqrt{P \times R}$	121 ± 3 [4.764 ± 0.118]	22 ± 1 [0.866 ± 0.039]
	40	ZWK 60 ni	Caps	- 10 ... - 80/100 ... 180	1R5 - 24K	5/10	$\sqrt{P \times R}$	121 ± 3 [4.764 ± 0.118]	22 ± 1 [0.866 ± 0.039]
65 W	40	GWS 75	SL SS SB FST	100 ... 180	7R5 - 130K	2/3/5/10	800	100 ± 2 [3.937 ± 0.079]	14.8 ± 0.8 [0.583 ± 0.031]
	25	HL065	Tubular	30/50/90	R10 - 170K	5	$\sqrt{P \times R}$	114.3 [4.500]	19.05 [0.750]
	25	HLA065	Tubular	30/50/90	1R0 - 130K	5/10	$\sqrt{P \times R}$	114.3 [4.500]	23.02 [0.906]
	25	HLT065	Tubular	30/50/90	0R1 - 159K	10	$\sqrt{P \times R}$	114.3 [4.500]	23.02 [0.906]
70 W	25	HL070	Tubular	30/50/90	R10 - 77K	5	$\sqrt{P \times R}$	152.4 [6.000]	30.16 [1.188]
	25	HLT070	Tubular	30/50/90	0R1 - 72K	10	$\sqrt{P \times R}$	120.65 [4.750]	-
	40	RW 20/76	Lugs FST	100 ... 180	1R0 - 75K	5/10	1000	76.2 ± 1.6 [3.000 ± 0.063]	23 (26) [0.906 (1.024)]
	25	SPR2213	Ceramic Case	30/50	1R0 - 24K	5	$\sqrt{P \times R}$	85.73 [3.375]	21.01 [0.827]
75 W	40	ZBS 30/100	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R10 - 8R2	5/10	$\sqrt{P \times R}$	100 ± 2.5 [3.937 ± 0.098]	37 ± 1 [1.457 ± 0.039]
	40	ZBS 30/100 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R10 - 8R2	5/10	$\sqrt{P \times R}$	100 ± 2.5 [3.937 ± 0.098]	37 ± 1 [1.457 ± 0.039]
	40	ZWS 30/100	SS SSB SB FST	- 10 ... - 80/100 ... 180	2R4 - 180K	2/5/10	$\sqrt{P \times R}$	100 ± 2.5 [3.937 ± 0.098]	32.5 ± 1.5 [1.28 ± 0.059]
	40	ZWS 30/100 E	SS SSB SB FST	- 10 ... - 80/100 ... 180	2R4 - 56K	5/10	$\sqrt{P \times R}$	100 ± 2.5 [3.937 ± 0.098]	32.5 ± 1.5 [1.28 ± 0.059]
	40	ZWS 30/100 ni	SS SSB SB FST	- 10 ... - 80/100 ... 180	2R0 - 30K	5/10	$\sqrt{P \times R}$	100 ± 2.5 [3.937 ± 0.098]	32.5 ± 1.5 [1.28 ± 0.059]
78 W	40	RW 36 (MIL-R-26)	Lugs FST	100 ... 180	24R - 30K	5	1600	101.6 [4.000]	33.3 (36.3) [1.311 (1.429)]
80 W	40	GBS 20/100	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R13 - 6R2	5/10	$\sqrt{P \times R}$	100 ± 2.5 [3.937 ± 0.098]	24 [0.945]
	40	GWK 100	Caps	100 ... 180	8R2 - 82K	2/5/10	1200	101 ± 2.5 [3.976 ± 0.098]	22 ± 1 [0.866 ± 0.039]
	40	GWS 100	SS SSB SB FST	100 ... 180	6R8 - 110K	2/3/5/10	600	100 ± 2 [3.937 ± 0.079]	22.3 ± 1.3 [0.878 ± 0.051]
	25	HL080	Tubular	30/50/90	R10 - 190K	5	$\sqrt{P \times R}$	101.6 [4.000]	28.58 [1.125]
	25	HLA080	Tubular	30/50/90	1R0 - 111K	5/10	$\sqrt{P \times R}$	101.6 [4.000]	33.34 [1.313]
	25	HLT080	Tubular	30/50/90	0R1 - 164K	10	$\sqrt{P \times R}$	101.6 [4.000]	33.34 [1.313]
	40	RW 30/102 E	Lugs FST	100 ... 180	2R7 - 15K	5/10	1600	101.6 ± 1.6 [4.000 ± 0.063]	33.3 (36.3) [1.311 (1.429)]
90 W	40	GBS 30/100 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R10 - 8R2	5/10	$\sqrt{P \times R}$	100 ± 2.5 [3.937 ± 0.098]	37 ± 1 [1.457 ± 0.039]
	40	GBS 30/100 WM 10	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R10 - R43	5/10	$\sqrt{P \times R}$	100 ± 2.5 [3.937 ± 0.098]	37 ± 1 [1.457 ± 0.039]
	25	HLZ090	Tubular	30/50/90	R10 - 5R7	10	$\sqrt{P \times R}$	101.6 [4.000]	14.3 [0.563]
	40	RW 20/102	Lugs FST	100 ... 180	3R - 110K	5/10	1400	101.6 ± 1.6 [4.000 ± 0.063]	23 (26) [0.906 (1.024)]

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POWER WATTS	at °C	MODEL	TYPE	TEMPERATURE COEFFICIENT ppm/°C	RESISTANCE RANGE Ω	STD. TOL. %	MAX. WORKING VOLTAGE	LENGTH in millimeters [inches]	DIA./WIDTH in millimeters [inches]
90 W	40	ZWK 90	Caps	- 10 ... - 80/100 ... 180	2R7 - 200K	2/5/10	$\sqrt{P \times R}$	166.5 ± 4.2 [6.555 ± 0.165]	22 ± 1 [0.866 ± 0.039]
		ZWK 90 ni	Caps	- 10 ... - 80/100 ... 180	2R2 - 36K	5/10	$\sqrt{P \times R}$	166.5 ± 4.2 [6.555 ± 0.165]	22 ± 1 [0.866 ± 0.039]
95 W	25	HL095	Tubular	30/50/90	R10 - 99K9	5	$\sqrt{P \times R}$	184.15 [7.250]	30.16 [1.188]
	25	HLT095	Tubular	30/50/90	0R1 - 96K	10	$\sqrt{P \times R}$	152.4 [6.000]	-
100 W	70	BWD 250	Aluminum Case	20 ... 100	33R - 830K	5	350	110 ± 1.5 [4.331 ± 0.059]	80 ± 1 x 15 ± 0.5 [3.150 ± 0.039] x [0.591 ± 0.0209]
	40	GBS 20/165 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R27 - 12R	5/10	$\sqrt{P \times R}$	165 ± 4 [6.496 ± 0.157]	24 [0.945]
	40	GBS 20/165 WM10	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R27 - 1R0	5/10	$\sqrt{P \times R}$	165 ± 4 [6.496 ± 0.157]	24 [0.945]
	40	GWK 150	Caps	100 ... 180	12R - 110K	2/5/10	1600	121 ± 3 [4.764 ± 0.118]	22 ± 1 [0.866 ± 0.039]
	40	GWK 200 ni	Caps	100 ... 180	56R - 22K	5/10	2300	166.5 ± 4.2 [6.555 ± 0.165]	22 ± 1 [0.866 ± 0.039]
	25	HL100	Tubular	30/50/90	R10 - 260K	5	$\sqrt{P \times R}$	165.1 [6.500]	19.05 [0.750]
	25	HLA100	Tubular	30/50/90	1R0 - 132K	5/10	$\sqrt{P \times R}$	165.1 [6.500]	23.02 [0.906]
	25	HLT100	Tubular	30/50/90	0R1 - 253K	10	$\sqrt{P \times R}$	165.1 [6.500]	23.02 [0.906]
	25	HLZ099	Tubular	30/50/90	R15 - 6R1	10	$\sqrt{P \times R}$	88.9 [3.500]	19.05 [0.750]
	25	RH100 (RE77)	Chassis Mount	20/50/100	R05 - 90K	1	$\sqrt{P \times R}$	88.9 [3.500]	71.42 [2.812]
	25	SPR2214	Ceramic Case	30/50	1R0 - 44K	5	$\sqrt{P \times R}$	115.90 [4.563]	21.01 [0.827]
	40	ZBS 20/165	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R27 - 12R	5/10	$\sqrt{P \times R}$	165 ± 4 [6.496 ± 0.157]	24 [0.945]
	40	ZBS 20/165 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R27 - 12R	5/10	$\sqrt{P \times R}$	165 ± 4 [6.496 ± 0.157]	24 [0.945]
	40	ZWS 100	SS SSB SB FST	- 10 ... - 80/100 ... 180	2R7 - 200K	2/5/10	$\sqrt{P \times R}$	165 ± 2 [6.496 ± 0.079]	23.3 ± 1.3 [0.878 ± 0.051]
	40	ZWS 100 E	SS SSB SB FST	- 10 ... - 80/100 ... 180	2R7 - 68K	5/10	$\sqrt{P \times R}$	165 ± 2 [6.496 ± 0.079]	23.3 ± 1.3 [0.878 ± 0.051]
	40	ZWS 100 ni	SS SSB SB FST	- 10 ... - 80/100 ... 180	2R2 - 33K	5/10	$\sqrt{P \times R}$	165 ± 2 [6.496 ± 0.079]	23.3 ± 1.3 [0.878 ± 0.051]
105 W	25	HLZ105	Tubular	30/50/90	R20 - 7R4	10	$\sqrt{P \times R}$	101.6 [4.000]	19.05 [0.750]
110 W	40	GWS 30/100 E	SS SSB SB FST	100 ... 180	22R - 8R2	5/10	1600	100 ± 2.5 [3.937 ± 0.098]	32.5 ± 1.5 [1.280 ± 0.059]
	25	HLZ110	Tubular	30/50/90	R20 - 8R6	10	$\sqrt{P \times R}$	114.3 [4.500]	19.05 [0.750]
	40	ZBS 30/133	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R15 - 12R	5/10	$\sqrt{P \times R}$	133 ± 3.3 [5.236 ± 0.130]	37 ± 1 [1.457 ± 0.039]
	40	ZBS 30/133 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R15 - 12R	5/10	$\sqrt{P \times R}$	133 ± 3.3 [5.236 ± 0.130]	37 ± 1 [1.457 ± 0.039]
	40	ZWS 30/133	SS SSB SB FST	- 10 ... - 80/100 ... 180	3R3 - 240K	2/5/10	$\sqrt{P \times R}$	133 ± 3 [5.236 ± 0.118]	32.5 ± 1.5 [1.280 ± 0.059]
	40	ZWS 30/133 E	SS SSB SB FST	- 10 ... - 80/100 ... 180	3R3 - 82K	5/10	$\sqrt{P \times R}$	133 ± 3 [5.236 ± 0.118]	32.5 ± 1.5 [1.280 ± 0.059]
	40	ZWS 30/133 ni	SS SSB SB FST	- 10 ... - 80/100 ... 180	2R7 - 43K	5/10	$\sqrt{P \times R}$	133 ± 3 [5.236 ± 0.118]	32.5 ± 1.5 [1.280 ± 0.059]
113 W	40	RW 37 (MIL-R-26)	Lugs FST	100 ... 180	33R - 47K	5	2500	152.4 ± 1.6 [6.000 ± 0.063]	33.3 (36.3) [1.311 (1.429)]



RESISTOR SELECTION GUIDE									
POWER WATTS	at °C	MODEL	TYPE	TEMPERATURE COEFFICIENT ppm/°C	RESISTANCE RANGE Ω	STD. TOL. %	MAX. WORKING VOLTAGE	LENGTH in millimeters [inches]	DIA./WIDTH in millimeters [inches]
120 W	40	GBS 30/133 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R15 - 12R	5/10	$\sqrt{P \times R}$	133 ± 3.3 [5.236 ± 0.130]	37 ± 1 [1.457 ± 0.039]
	40	GBS 30/133 WM 10	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R15 - R62	5/10	$\sqrt{P \times R}$	133 ± 3.3 [5.236 ± 0.130]	37 ± 1 [1.457 ± 0.039]
	40	GWS 220 E	SS SSB SB FST	100 ... 180	30R - 10K	5/10	1250	165 ± 2 [6.496 ± 0.079]	22.3 ± 1.3 [0.878 ± 0.051]
	40	GWS 220 ni	SS SSB SB FST	100 ... 180	51R - 16K	5/10	1250	165 ± 2 [6.496 ± 0.079]	22.3 ± 1.3 [0.878 ± 0.051]
	25	HL120	Tubular	30/50/90	R10 - 330K	5	$\sqrt{P \times R}$	152.4 [6.000]	28.58 [1.125]
	25	HLA120	Tubular	30/50/90	1R0 - 180K	5/10	$\sqrt{P \times R}$	152.4 [6.000]	33.34 [1.313]
	25	HLT120	Tubular	30/50/90	0R1 - 305K	10	$\sqrt{P \times R}$	152.4 [6.000]	33.34 [1.313]
130 W	40	GWS 30/133 E	SS SSB SB FST	100 ... 180	36R - 13K	5/10	2300	133 ± 3 [5.236 ± 0.118]	32.5 ± 1.5 [1.28 ± 0.059]
	25	HL130	Tubular	30/50/90	R10 - 380K	5	$\sqrt{P \times R}$	165.1 [6.500]	28.58 [1.125]
	25	HLA130	Tubular	30/50/90	1R0 - 192K	5/10	$\sqrt{P \times R}$	165.1 [6.500]	33.34 [1.313]
	25	HLT120	Tubular	30/50/90	0R1 - 358K	10	$\sqrt{P \times R}$	165.1 [6.500]	33.34 [1.313]
	40	RW 30/102	Lugs FST	100 ... 180	2R7 - 160K	5/10	1600	101.6 ± 1.6 [4.000 ± 0.063]	33.3 (36.3) [1.311 (1.429)]
	40	RW 30/152 E	Lugs FST	100 ... 180	4R7 - 24K	5/10	2500	152.4 ± 1.6 [6.000 ± 0.063]	33.3 (36.3) [1.311 (1.429)]
140 W	25	HLZ140	Tubular	30/50/90	R08 - 9R	10	$\sqrt{P \times R}$	101.6 [4.00]	28.58 [1.125]
150 W	40	GBS 30/100	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R10 - 8R2	5/10	$\sqrt{P \times R}$	100 ± 2.5 [3.937 ± 0.098]	37 ± 1 [1.457 ± 0.039]
	40	GBS 30/165 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R20 - 16R	5/10	$\sqrt{P \times R}$	165 ± 4 [6.496 ± 0.157]	37 ± 1 [1.457 ± 0.039]
	40	GBS 30/165 WM 10	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R20 - R91	5/10	$\sqrt{P \times R}$	165 ± 4 [6.496 ± 0.157]	37 ± 1 [1.457 ± 0.039]
	40	GWS 30/100	SS SSB SB FST	100 ... 180	9R1 - 100K	2/5/10	1600	100 ± 2.5 [3.937 ± 0.098]	32.5 ± 1.5 [1.28 ± 0.059]
	40	ZBS 20/265	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R47 - 22R	5/10	$\sqrt{P \times R}$	265 ± 6.6 [10.433 ± 0.260]	24 [0.945]
	40	ZBS 20/265 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R47 - 22R	5/10	$\sqrt{P \times R}$	265 ± 6.6 [10.433 ± 0.260]	24 [0.945]
	40	ZBS 30/165	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R20 - 16R	5/10	$\sqrt{P \times R}$	165 ± 4 [6.496 ± 0.157]	37 ± 1 [1.457 ± 0.039]
	40	ZBS 30/165 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R20 - 16R	5/10	$\sqrt{P \times R}$	165 ± 4 [6.496 ± 0.157]	37 ± 1 [1.457 ± 0.039]
	40	ZWK 150	Caps	- 10 ... - 80/100 ... 180	4R7 - 360K	2/5/10	$\sqrt{P \times R}$	266.5 ± 6.7 [10.492 ± 0.264]	22 ± 1 [0.866 ± 0.039]
	40	ZWK 150 ni	Caps	- 10 ... - 80/100 ... 180	3R9 - 62K	5/10	$\sqrt{P \times R}$	266.5 ± 6.7 [10.492 ± 0.264]	22 ± 1 [0.866 ± 0.039]
	40	ZWS 150	SS SSB SB FST	- 10 ... - 80/100 ... 180	4R7 - 360K	2/5/10	$\sqrt{P \times R}$	265 ± 4 [10.433 ± 0.157]	22.3 ± 1.3 [0.878 ± 0.051]
	40	ZWS 150 E	SS SSB SB FST	- 10 ... - 80/100 ... 180	4R7 - 120K	5/10	$\sqrt{P \times R}$	265 ± 4 [10.433 ± 0.157]	22.3 ± 1.3 [0.878 ± 0.051]
	40	ZWS 150 ni	SS SSB SB FST	- 10 ... - 80/100 ... 180	3R9 - 62K	5/10	$\sqrt{P \times R}$	265 ± 4 [10.433 ± 0.157]	22.3 ± 1.3 [0.878 ± 0.051]
159 W	40	RW 38	Lugs FST	100 ... 180	47R - 68K	5	3600	203.2 ± 1.6 [8.000 ± 0.063]	33.3 (36.3) [1.311 (1.429)]
160 W	40	GBS 20/165	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R27 - 12R	5/10	$\sqrt{P \times R}$	165 ± 4 [6.496 ± 0.157]	24 [0.945]
	40	GWK 200	Caps	100 ... 180	20R - 180K	2/5/10	2300	166.5 ± 4.2 [6.555 ± 0.165]	22 ± 1 [0.866 ± 0.039]

Resistor Selection Guide



Vishay

RESISTOR SELECTION GUIDE									
POWER WATTS	at °C	MODEL	TYPE	TEMPERATURE COEFFICIENT ppm/°C	RESISTANCE RANGE Ω	STD. TOL. %	MAX. WORKING VOLTAGE	LENGTH in millimeters [inches]	DIA./WIDTH in millimeters [inches]
160 W	40	GWS 220	SS SSB SB FST	100 ... 180	13R - 160K	2/3/5/10	1250	165 ± 2 [6.496 ± 0.079]	22.3 ± 1.3 [0.878 ± 0.051]
	25	HL160	Tubular	30/50/90	R10 - 470K	5	$\sqrt{P \times R}$	203.2 [8.000]	28.58 [1.125]
	25	HLA160	Tubular	30/50/90	1R0 - 249K	5/10	$\sqrt{P \times R}$	203.2 [8.000]	33.34 [1.313]
	25	HLT160	Tubular	30/50/90	0R1 - 446K	10	$\sqrt{P \times R}$	203.2 [8.000]	33.34 [1.313]
165 W	25	HLZ165	Tubular	30/50/90	R35 - 13R	10	$\sqrt{P \times R}$	165.1 [6.500]	19.05 [0.750]
175 W	25	HL175	Tubular	30/50/90	R10 - 500K	5	$\sqrt{P \times R}$	215.9 [8.500]	28.58 [1.125]
	25	HLA175	Tubular	30/50/90	1R0 - 398K	5/10	$\sqrt{P \times R}$	215.9 [8.500]	33.34 [1.313]
	25	HLT175	Tubular	30/50/90	0R1 - 481K	10	$\sqrt{P \times R}$	215.9 [8.500]	33.34 [1.313]
180 W	40	GBS 20/265 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R47 - 22R	5/10	$\sqrt{P \times R}$	265 ± 6.6 [10.433 ± 0.260]	24 [0.945]
	40	GBS 20/265 WM 10	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R47 - 1R8	5/10	$\sqrt{P \times R}$	265 ± 6.6 [10.433 ± 0.260]	24 [0.945]
	40	GWK 300 ni	Caps	100 ... 180	100R - 43K	5/10	4000	266.5 ± 6.7 [10.492 ± 0.264]	22 ± 1 [0.866 ± 0.039]
	40	RW 30/203 E	Lugs FST	100 ... 180	6R8 - 36K	5/10	3600	203.2 ± 1.6 [8.000 ± 0.063]	33.3 (36.3) [1.311 (1.429)]
200 W	70	BWD 500	Aluminum Case	20 ... 100	10R - 620R	5	350	216 ± 1.5 [8.504 ± 0.059]	80 ± 1 x 15 ± 0.5 [3.150 ± 0.039] x [0.591 ± 0.0209]
	40	GBS 30/133	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R15 - 12R	5/10	$\sqrt{P \times R}$	133 ± 3.3 [5.236 ± 0.130]	37 ± 1 [1.457 ± 0.039]
	40	GBS 30/215 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R27 - 24R	5/10	$\sqrt{P \times R}$	215 ± 5.4 [8.465 ± 0.213]	37 ± 1 [1.457 ± 0.039]
	40	GBS 30/215 WM 10	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R27 - 1R1	5/10	$\sqrt{P \times R}$	215 ± 5.4 [8.465 ± 0.213]	37 ± 1 [1.457 ± 0.039]
	40	GWS 30/133	SS SSB SB FST	100 ... 180	13R - 160K	2/5/10	2300	133 ± 3 [5.236 ± 0.118]	32.5 ± 1.5 [1.280 ± 0.059]
	40	GWS 300 E	SS SSB SB FST	100 ... 180	56R - 20K	5/10	2500	265 ± 4 [10.433 ± 0.157]	22.3 ± 1.3 [0.878 ± 0.051]
	40	GWS 300 ni	SS SSB SB FST	100 ... 180	100R - 30K	5/10	2500	265 ± 4 [10.433 ± 0.157]	22.3 ± 1.3 [0.878 ± 0.051]
	40	ZBS 30/215	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R27 - 24R	5/10	$\sqrt{P \times R}$	215 ± 5.4 [8.465 ± 0.213]	37 ± 1 [1.457 ± 0.039]
	40	ZBS 30/215 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R27 - 24R	5/10	$\sqrt{P \times R}$	215 ± 5.4 [8.465 ± 0.213]	37 ± 1 [1.457 ± 0.039]
210 W	40	RW 47	Lugs FST	100 ... 180	75R - 91K	5	5000	266.7 ± 1.6 [10.50 ± 0.063]	33.3 (36.3) [1.311 (1.429)]
220 W	25	HLZ220	Tubular	30/50/90	R10 - 16R	10	$\sqrt{P \times R}$	152.4 [6.000]	28.58 [1.125]
	40	RW 30/152	Lugs FST	100 ... 180	4R7 - 200K	5/10	2500	152.4 ± 1.6 [6.000 ± 0.063]	33.3 (36.3) [1.311 (1.429)]
225 W	25	HL225	Tubular	30/50/90	R10 - 645K	5	$\sqrt{P \times R}$	266.7 [10.50]	28.58 [1.125]
	25	HLA225	Tubular	30/50/90	1R0 - 337K	5/10	$\sqrt{P \times R}$	266.7 [10.50]	33.34 [1.313]
	25	HLT225	Tubular	30/50/90	0R1 - 622K	10	$\sqrt{P \times R}$	266.7 [10.50]	33.34 [1.313]
240 W	25	HLZ240	Tubular	30/50/90	R10 - 18R	10	$\sqrt{P \times R}$	165.1 [6.500]	28.58 [1.125]
	40	RW 30/267 E	Lugs FST	100 ... 180	8R2 - 47K	5/10	5000	266.7 ± 1.6 [10.50 ± 0.063]	33.3 (36.3) [1.311 (1.429)]



RESISTOR SELECTION GUIDE									
POWER WATTS	at °C	MODEL	TYPE	TEMPERATURE COEFFICIENT ppm/°C	RESISTANCE RANGE Ω	STD. TOL. %	MAX. WORKING VOLTAGE	LENGTH in millimeters [inches]	DIA./WIDTH in millimeters [inches]
250 W	40	GBS 30/165	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R20 - 16R	5/10	$\sqrt{P \times R}$	165 ± 4 [6.496 ± 0.157]	37 ± 1 [1.457 ± 0.039]
	40	GBS 30/265 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R30 - 27R	5/10	$\sqrt{P \times R}$	265 ± 6.6 [10.433 ± 0.260]	37 ± 1 [1.457 ± 0.039]
	40	GBS 30/265 WM 10	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R30 - 1R3	5/10	$\sqrt{P \times R}$	265 ± 6.6 [10.433 ± 0.260]	37 ± 1 [1.457 ± 0.039]
	25	RH250 (RE80)	Chassis Mount	20/30/100	R05 - 116K	1	$\sqrt{P \times R}$	114.3 [4.500]	76.2 [3.000]
	40	ZBS 30/265	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R30 - 27R	5/10	$\sqrt{P \times R}$	265 ± 6.6 [10.433 ± 0.260]	37 ± 1 [1.457 ± 0.039]
	40	ZBS 30/265 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R30 - 27R	5/10	$\sqrt{P \times R}$	265 ± 6.6 [10.433 ± 0.260]	37 ± 1 [1.457 ± 0.039]
	40	ZWS 250	SS SSB SB FST	- 10 ... - 80/100 ... 180	8R2 - 620K	2/5/10	$\sqrt{P \times R}$	330 ± 5 [12.992 ± 0.197]	32.5 ± 1.5 [1.280 ± 0.059]
	40	ZWS 250 E	SS SSB SB FST	- 10 ... - 80/100 ... 180	8R2 - 220R	5/10	$\sqrt{P \times R}$	330 ± 5 [12.992 ± 0.197]	32.5 ± 1.5 [1.280 ± 0.059]
40	ZWS 250 ni	SS SSB SB FST	- 10 ... - 80/100 ... 180	6R8 - 110K	5/10	$\sqrt{P \times R}$	330 ± 5 [12.992 ± 0.197]	32.5 ± 1.5 [1.280 ± 0.059]	
260 W	40	GWK 300	Caps	100 ... 180	20R - 180K	2/5/10	4000	266.5 ± 6.7 [10.492 ± 0.264]	22 ± 1 [0.866 ± 0.039]
275 W	25	HLZ275	Tubular	30/50/90	R15 - 23R	10	$\sqrt{P \times R}$	203.2 [8.000]	28.58 [1.125]
290 W	40	RW 30/305 E	Lugs FST	100 ... 180	10R - 56K	5/10	6000	304.8 ± 1.6 [12 ± 0.063]	33.3 (36.3) [1.311 (1.429)]
300 W	40	GBS 20/265	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R47 - 22R	5/10	$\sqrt{P \times R}$	265 ± 6.6 [10.433 ± 0.260]	24 [0.945]
	40	GBS 30/215	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R27 - 22R	5/10	$\sqrt{P \times R}$	215 ± 5.4 [8.465 ± 0.213]	37 ± 1 [1.457 ± 0.039]
	40	GWS 300	SS SSB SB FST	100 ... 180	24R - 300K	2/3/5/10	2500	265 ± 4 [10.433 ± 0.157]	22.3 ± 1.3 [0.878 ± 0.051]
	40	GWS 500 E	SS SSB SB FST	100 ... 180	100R - 36K	5/10	3000	330 ± 5 [12.992 ± 0.197]	32.2 ± 1.5 [1.268 ± 0.059]
	25	HLZ300	Tubular	30/50/90	R15 - 25R	10	$\sqrt{P \times R}$	215.9 [8.500]	28.58 [1.125]
	40	RW 30/203	Lugs FST	100 ... 180	6R8 - 270K	5/10	3600	203.2 ± 1.6 [8.000 ± 0.063]	33.3 (36.3) [1.311 (1.429)]
	40	ZBS 30/330	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R39 - 36R	5/10	$\sqrt{P \times R}$	330 ± 8 [12.992 ± 0.315]	37 ± 1 [1.457 ± 0.039]
40	ZBS 30/330 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R39 - 36R	5/10	$\sqrt{P \times R}$	330 ± 8 [12.992 ± 0.315]	37 ± 1 [1.457 ± 0.039]	
350 W	40	GBS 30/330 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R39 - 36R	5/10	$\sqrt{P \times R}$	330 ± 8 [12.992 ± 0.315]	37 ± 1 [1.457 ± 0.039]
	40	GBS 30/330 WM 10	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R39 - 1R8	5/10	$\sqrt{P \times R}$	330 ± 8 [12.992 ± 0.315]	37 ± 1 [1.457 ± 0.039]
375 W	40	GBS 30/265	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R30 - 27R	5/10	$\sqrt{P \times R}$	265 ± 6.6 [10.433 ± 0.260]	37 ± 1 [1.457 ± 0.039]
	25	HLZ375	Tubular	30/50/90	R20 - 32R	10	$\sqrt{P \times R}$	266.7 [10.500]	28.58 [1.125]
	40	ZBS 45/370	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R75 - 56R	5/10	$\sqrt{P \times R}$	370 ± 9 [14.567 ± 0.354]	52 ± 1 [2.047 ± 0.039]
	40	ZBS 45/370 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R75 - 56R	5/10	$\sqrt{P \times R}$	370 ± 9 [14.567 ± 0.354]	52 ± 1 [2.047 ± 0.039]
400 W	40	RW 30/267	Lugs FST	100 ... 180	8R2 - 390K	5/10	5000	266.7 ± 1.6 [10.5 ± 0.063]	33.3 (36.3) [1.311 (1.429)]
450 W	40	GBS 30/330	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R39 - 36R	5/10	$\sqrt{P \times R}$	330 ± 8 [12.992 ± 0.315]	37 ± 1 [1.457 ± 0.039]
480 W	40	RW 30/305	Lugs FST	100 ... 180	10R - 300K	5/10	6000	304 ± 1.6 [11.969 ± 0.063]	33.3 (36.3) [1.311 (1.429)]

Resistor Selection Guide

Vishay



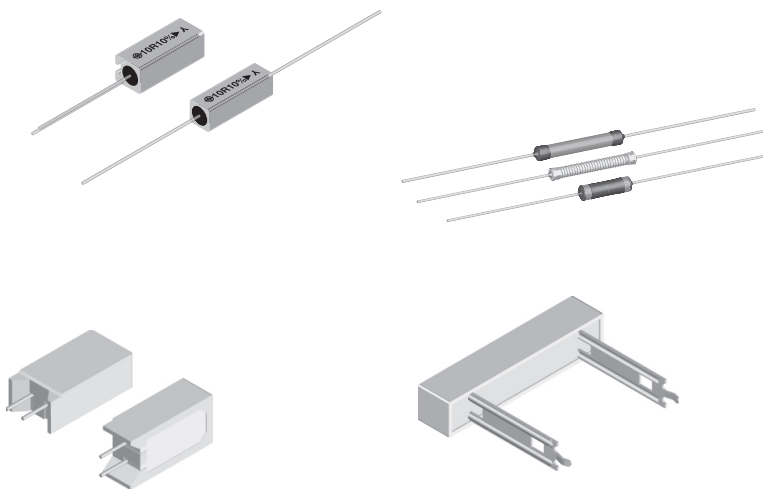
RESISTOR SELECTION GUIDE									
POWER WATTS	at °C	MODEL	TYPE	TEMPERATURE COEFFICIENT ppm/°C	RESISTANCE RANGE Ω	STD. TOL. %	MAX. WORKING VOLTAGE	LENGTH in millimeters [inches]	DIA./WIDTH in millimeters [inches]
500 W	40	GWS 500	SS SSB SB FST	100 ... 180	39R - 270K	5/10	3000	330 ± 5 [12.992 ± 0.197]	32.5 ± 1.5 [1.28 ± 0.059]
	40	ZBS 60/370	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R91 - 75R	5/10	$\sqrt{P \times R}$	370 ± 9 [14.567 ± 0.354]	67 ± 1 [2.638 ± 0.039]
	40	ZBS 60/370 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	R91 - 75R	5/10	$\sqrt{P \times R}$	370 ± 9 [14.567 ± 0.354]	67 ± 1 [2.638 ± 0.039]
550 W	40	GBS 45/370 WM 10	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	0R75 - 3R	5/10	$\sqrt{P \times R}$	370 ± 9 [14.567 ± 0.354]	52 ± 1 [2.047 ± 0.039]
700 W	40	GBS 45/370 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	0R75 - 56R	5/10	$\sqrt{P \times R}$	370 ± 9 [14.567 ± 0.354]	52 ± 1 [2.047 ± 0.039]
	40	GBS 60/370 WM 10	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	0R91 - 3R9	5/10		370 ± 9 [14.567 ± 0.354]	67 ± 1 [2.638 ± 0.039]
750 W	40	GBS 60/370 E	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	0R91 - 75R	5/10	$\sqrt{P \times R}$	370 ± 9 [14.567 ± 0.354]	67 ± 1 [2.638 ± 0.039]
1000 W	40	GBS 45/370	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	0R75 - 56R	5/10	$\sqrt{P \times R}$	370 ± 9 [14.567 ± 0.354]	52 ± 1 [2.047 ± 0.039]
	40	GBS 60/370	Lugs	650 ... 750/- 10 ... - 80/100 ... 180	0R91 - 75R	5/10	$\sqrt{P \times R}$	370 ± 9 [14.567 ± 0.354]	67 ± 1 [2.638 ± 0.039]

Note

- Check with factory for availability of specific value, tolerance and temperature coefficient combinations



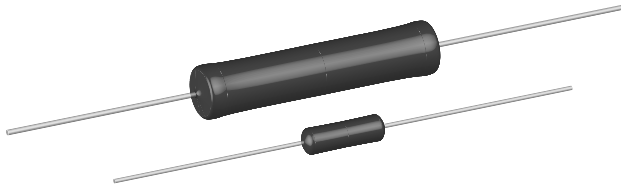
Commercial Power Wirewound Resistors



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Wirewound Resistors, Commercial Coated, Axial Lead



FEATURES

- High performance for low cost
- High temperature silicone coating
- Complete welded construction
- Excellent stability in operation
- High power to size ratio



RoHS*
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS					
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING ⁽¹⁾ P _{25 °C} W		RESISTANCE RANGE Ω ± 5 %, ± 10 % ⁽²⁾	WEIGHT (max.) g
		Characteristic U + 250 °C	Characteristic V + 350 °C		
CW1/2	CW-1/2	0.5	-	0.1 - 1.77K	0.21
CW001	CW-1	1.0	-	0.1 - 6.37K	0.34
CW01M	CW-1M	1.0	-	0.1 - 3.3K	0.3
CW002	CW-2	4.0	5.5	0.1 - 28.7K	2.1
CW02M	CW-2M	3.0	3.75	0.1 - 12K	0.65
CW02B	CW-2B	3.0	3.75	0.1 - 15K	0.7
CW02B...13	CW-2B-13	4.0	6.0	0.1 - 10.89K ⁽³⁾	0.9
CW02C	CW-2C	2.5	3.25	0.1 - 19.9K	1.8
CW02C...14	CW-2C-14	2.5	3.25	0.1 - 19.9K	1.2
CW005	CW-5	5.0	6.5	0.1 - 58.5K	4.2
CW005...2	CW-5-2	4.0	5.0	0.1 - 40.3K	4.2
CW005...3	CW-5-3	5.0	6.5	0.1 - 58.5K	4.2
CW007	CW-7	7.0	9.0	0.1 - 95.2K	4.7
CW010	CW-10	10.0	13.0	0.1 - 167K	9.0
CW010...3	CW-10-3	10.0	13.0	0.1 - 167K	9.0

Notes

⁽¹⁾ Vishay Dale CW models have two power ratings, depending on operating temperature and stability requirements

⁽²⁾ 3 % tolerance available

⁽³⁾ Higher values available on request

TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	CW RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/°C	± 90 for below 1.0 Ω, ± 50 for 1.0 Ω to 9.9 Ω, ± 30 for 10 Ω and above
Dielectric Withstanding Voltage	V _{AC}	1000
Short Time Overload	-	5 × rated power for 5 s for 3.75 W size and smaller, 10 × rated power for 5 s for 4 W size and greater
Terminal Strength	lb	10 minimum
Maximum Working Voltage	V	(P × R) ^{1/2}
Operating Temperature Range	°C	Characteristic U = - 65 to + 250, characteristic V = - 65 to + 350
Power Rating	-	Characteristic U = + 250 °C max. hot spot temperature, ± 0.5 % max. ΔR in 2000 h load life Characteristic V = + 350 °C max. hot spot temperature, ± 3.0 % max. ΔR in 2000 h load life

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: CW02C10K00JB1214 (preferred part number format)

C	W	0	2	C	1	0	K	0	0	J	B	1	2	1	4	
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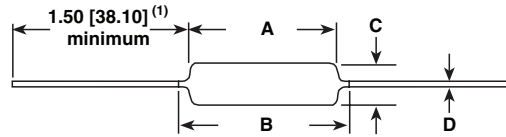
GLOBAL MODEL (See Standard Electrical Specifications Global Model column for options)	RES. VALUE R = Decimal K = Thousand 1R500 = 1.5 Ω 1K500 = 1.5 kΩ	TOL. CODE H = ± 3.0 % J = ± 5.0 % K = ± 10.0 %	PACKAGING E70 = Lead (Pb)-free, tape/reel 1K pieces E73 = Lead (Pb)-free, tape/reel 500 pieces E12 = Lead (Pb)-free, bulk D18 = Lead (Pb)-free, R1R80 tape/reel CW02B...13 pack code for Europe use only S70 = Tin/lead, tape/reel 1K pieces S73 = Tin/lead, tape/reel 500 pieces B12 = Tin/lead, bulk	SPECIAL (Dash Number) (up to 3 digits) From 1 - 999 as applicable
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Historical Part Number Example: CW-2C-14 10 kΩ 5 % B12 (will continue to be accepted for tin/lead product only)

CW-2C-14	10 kΩ	5 %	B12
HISTORICAL MODEL	RESISTANCE VALUE	TOLERANCE CODE	PACKAGING

* Pb containing terminations are not RoHS compliant, exemptions may apply

DIMENSIONS in inches [millimeters]



MODEL	DIMENSIONS in inches [millimeters]			
	A	B (maximum) ⁽²⁾	C	D
CW1/2	0.250 ± 0.031 [6.35 ± 0.787]	0.281 [7.14]	0.085 ± 0.020 [2.16 ± 0.508]	0.020 ± 0.002 [0.508 ± 0.051]
CW001	0.406 ± 0.031 [10.31 ± 0.787]	0.437 [11.10]	0.094 ± 0.031 [2.39 ± 0.787]	0.020 ± 0.002 [0.508 ± 0.051]
CW01M	0.285 ± 0.025 [7.24 ± 0.635]	0.311 [7.90]	0.110 ± 0.015 [2.79 ± 0.381]	0.020 ± 0.002 [0.508 ± 0.051]
CW002	0.625 ± 0.062 [15.87 ± 1.57]	0.765 [19.43]	0.250 ± 0.032 [6.35 ± 0.813]	0.040 ± 0.002 [1.02 ± 0.051]
CW02M	0.500 ± 0.062 [12.70 ± 1.57]	0.562 [14.27]	0.185 ± 0.015 [4.70 ± 0.381]	0.032 ± 0.002 [0.813 ± 0.051]
CW02B	0.562 ± 0.062 [14.27 ± 1.57]	0.622 [15.80]	0.188 ± 0.032 [4.78 ± 0.813]	0.032 ± 0.002 [0.813 ± 0.051]
CW02B...13	0.500 ± 0.062 [12.70 ± 1.57]	0.563 [14.30]	0.188 ± 0.032 [4.78 ± 0.813]	0.032 ± 0.002 [0.813 ± 0.051]
CW02C	0.500 ± 0.062 [12.70 ± 1.57]	0.593 [15.06]	0.218 ± 0.032 [5.54 ± 0.813]	0.040 ± 0.002 [1.02 ± 0.051]
CW02C...14	0.500 ± 0.062 [12.70 ± 1.57]	0.593 [15.06]	0.218 ± 0.032 [5.54 ± 0.813]	0.032 ± 0.002 [0.813 ± 0.051]
CW005	0.875 ± 0.062 [22.22 ± 1.57]	1.0 [25.40]	0.312 ± 0.032 [7.92 ± 0.813]	0.040 ± 0.002 [1.02 ± 0.051]
CW005...2	0.875 ± 0.062 [22.22 ± 1.57]	1.0 [25.40]	0.250 ± 0.032 [6.35 ± 0.813]	0.032 ± 0.002 [0.813 ± 0.051]
CW005...3	0.875 ± 0.062 [22.22 ± 1.57]	1.0 [25.40]	0.312 ± 0.032 [7.92 ± 0.813]	0.032 ± 0.002 [0.813 ± 0.051]
CW007	1.218 ± 0.062 [30.94 ± 1.57]	1.281 [32.54]	0.312 ± 0.032 [7.92 ± 0.813]	0.040 ± 0.002 [1.02 ± 0.051]
CW010	1.781 ± 0.062 [45.24 ± 1.57]	1.875 [47.62]	0.375 ± 0.032 [9.52 ± 0.813]	0.040 ± 0.002 [1.02 ± 0.051]
CW010...3	1.781 ± 0.062 [45.24 ± 1.57]	1.875 [47.62]	0.375 ± 0.032 [9.52 ± 0.813]	0.032 ± 0.002 [0.813 ± 0.051]

Notes

- ⁽¹⁾ On some standard reel pack methods, the leads may be trimmed to a shorter length than shown
- ⁽²⁾ B (maximum) dimension is clean lead to clean lead

MATERIAL SPECIFICATIONS

Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value

Core: Ceramic: Steatite or alumina, depending on physical size

Coating: Special high temperature silicone

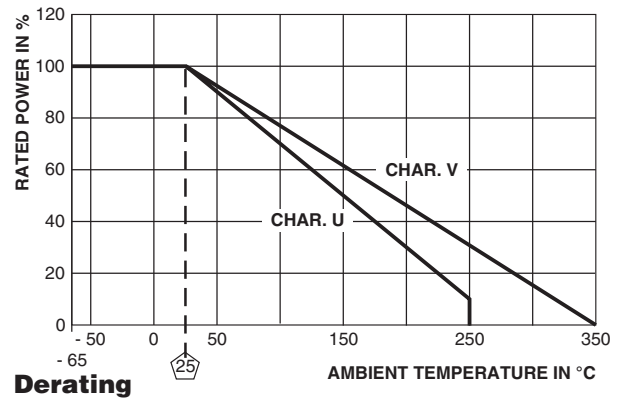
Standard Terminals: Tinned Copperweld[®]

End Caps: Stainless steel

Part Marking: DALE, model, wattage ⁽³⁾, value, tolerance, date code

Note

- ⁽³⁾ Wattage marked on resistor will be "V" characteristic, CW1/2 will not be marked with wattage



PERFORMANCE ⁽⁴⁾		
TEST	CONDITIONS OF TEST	TEST LIMITS (CHARACTERISTIC V)
Thermal Shock	Rated power applied until thermally stable, then a minimum of 15 min at - 55 °C	± (2.0 % + 0.05 Ω) ΔR
Short Time Overload	5 x rated power (3.75 W and smaller), 10 x rated power (4 W and larger) for 5 s	± (2.0 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	1000 V _{rms} , 1 min	± (0.1 % + 0.05 Ω) ΔR
Low Temperature Storage	- 65 °C for 24 h	± (2.0 % + 0.05 Ω) ΔR
High Temperature Exposure	250 h at + 350 °C	± (4.0 % + 0.05 Ω) ΔR
Moisture Resistance	MIL-STD-202 Method 106, 7b not applicable	± (2.0 % + 0.05 Ω) ΔR
Shock, Specified Pulse	MIL-STD-202 Method 213, 100 g's for 6 ms, 10 shocks	± (0.2 % + 0.05 Ω) ΔR
Vibration, High Frequency	Frequency varied 10 to 2000 Hz, 20 g peak, 2 directions 6 h each	± (0.2 % + 0.05 Ω) ΔR
Load Life	2000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"	± (3.0 % + 0.05 Ω) ΔR
Terminal Strength	5 to 10 s 10 pound pull test; torsion test - 3 alternating directions, 360 °C each	± (1.0 % + 0.05 Ω) ΔR

Note

- ⁽⁴⁾ All ΔR figures shown are maximum, based upon testing requirements per MIL-PRF-26 at a maximum operating temperature of + 350 °C. ΔR maximum figures are considerably lower when tested at a maximum operating temperature of + 250 °C.

Cemented Wirewound Resistors



FEATURES

- All welded construction
- Ceramic core
- Non-flammable cement coating
- Tinned copper-clad iron leads (see note 3 in the 12NC Ordering Code table)
- High power dissipation in small volume
- Ideal for pulse application
- Lead (Pb)-free
- Compatible with "Restriction of the use of Hazardous Substances" (RoHS) directive 2002/95/EC (issue 2004)



STANDARD ELECTRICAL SPECIFICATIONS								
GLOBAL MODEL	HISTORICAL MODEL	P _{40 °C} W	P _{70 °C} W	TOLERANCE E24 SERIES ± %	LIMITING VOLTAGE V	RESISTANCE RANGE Ω		
						TCR = - 10...- 80 ppm/K	TCR = 100...180 ppm/K	TCR = ± 100 ppm/K
AC01000	AC01	1	0.9	5	$\sqrt{P \times R}$	R10 - 33R	36R - 2K4	-
AC03000	AC03 ⁽¹⁾	3	2.5	5	$\sqrt{P \times R}$	R10 - 390R	430R - 3K3	3K6 - 5K1
AC04000	AC04	4	3.5	5	$\sqrt{P \times R}$	R10 - 620R	680R - 6K8	-
AC05000	AC05	5	4.7	5	$\sqrt{P \times R}$	R10 - 910R	1K0 - 10K	-
AC07000	AC07	7	5.8	5	$\sqrt{P \times R}$	R10 - 1K5	1K6 - 15K	-
AC10000	AC10	10	8.4	5	$\sqrt{P \times R}$	R22 - 560R	620R - 27K	-

Note:

⁽¹⁾ AC03 WSZ: P_{40 °C} = 1.8 W; P_{70 °C} = 1.5 W

GLOBAL PART NUMBER INFORMATION						
New Global Part Numbering: AC03000001509JAC00 (preferred part number format)						
<div style="display: flex; justify-content: space-around; text-align: center;"> AC03000001509JAC00 </div>						
MODEL	SPECIAL CHARACTER	TCR/MATERIAL	VALUE	TOLERANCE	PACKAGING	SPECIAL
(See Standard Electrical Specifications table)	0 = Neutral 1 = RT 2 = SWI = Special winding ⁽²⁾ 3 = DK SP 20 mm ⁽³⁾ 4 = DK LP 33 mm ⁽³⁾ 5 = DK LP 17.8 mm ⁽³⁾ 6 = NI = Non inductive 7 = DK LP 25.4 mm ⁽³⁾ 9 = WSZ 6720 8 = DK SP 25.4 mm Z = value overflow (Special) A = E/K 22.5 mm ⁽³⁾	0 = Standard	3 digit value 1 digit multiplier 7 = *10 ⁻³ 8 = *10 ⁻² 9 = *10 ⁻¹ 0 = *10 ⁰ 1 = *10 ¹ 2 = *10 ² 5 = 10 ⁻⁴	J = ± 5.0 %	(See Packaging table)	The 5 digit BV number will be encoded using a 36 character code. This code contains numbers 0...9 and letters A...Z (36 characters total) and allows to encode at least 46 655 five digit BV numbers. 00 = Standard E0 = CECC E0 E6 = CECC E6
Historical Part Number Example: AC03 15R 5 % AC (will continue to be accepted)						
AC03		15R		5 %		AC
HISTORICAL MODEL		VALUE		TOLERANCE		PACKAGING

Notes:

⁽²⁾ Special winding on request

⁽³⁾ Other dimensions and special character on request



PACKAGING TABLE		
SAP	DESCRIPTION	TYPE
AE	Bandolier in ammo pack, 2500 pieces radial taped	AC01RT
A1	Bandolier in ammopack straight leads, 1000 pieces	AC01
AB	Bandolier in ammopack straight leads, 250 pieces	AC10
AC	Bandolier in ammopack straight leads, 500 pieces	AC03, AC04, AC05, AC07
LC	Loose 500 pieces double kinked/kink type S	AC01 DK/EK, AC03 DK/EK, AC04 DK/EK, AC05 DK/EK
LB	Loose 250 pieces double kinked/kink type S	AC07 DK/EK
BM	Blister 1250 pieces WSZ	AC03 WSZ

12NC (HISTORICAL CODING REFERENCE) INDICATING RESISTOR TYPE AND PACKAGING				
TYPE	ORDERING CODE 23..			
	BANDOLIER IN AMMOPACK			
	RADIAL	STRAIGHT LEADS		
	2500 units	250 units	500 units	1000 units
AC01	06 328 90... (2) (3)	-	-	06 328 33...
AC03 (1)	-	-	22 329 03...	-
AC04 (1)	-	-	22 329 04...	-
AC05 (1)	-	-	22 329 05...	-
AC07 (1)	-	-	22 329 07...	-
AC10	-	Global part numbering	-	-

Notes:

- (1) Products with bent leads and bulk packaging (100 pieces) are available on request
- (2) Last 3 digits available on request
- (3) Radial parts with tin plated copper leads

12NC INFORMATION

- The resistors have a 12-digit ordering code starting with 23.
- The subsequent 7 digits indicate the resistor type, specification and packaging; see the 12NC Ordering Code table.
- The remaining 3 digits indicate the resistance value:
 - The first 2 digits indicate the resistance value.
 - The last digit indicates the resistance decade in accordance with the 12NC Indicating Resistance Decade table.

Last Digit of 12NC Indicating Resistance Decade

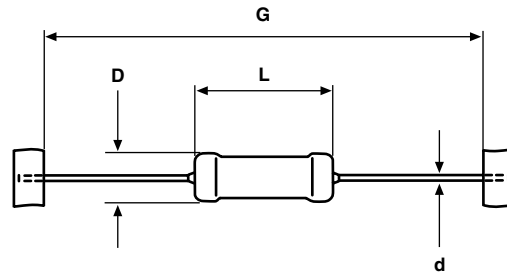
RESISTANCE DECADE	LAST DIGIT
0.1 Ω to 0.91 Ω	7
1 Ω to 9.1 Ω	8
10 Ω to 91 Ω	9
100 Ω to 910 Ω	1
1 k Ω to 9.1 k Ω	2
10 k Ω to 56 k Ω	3

Ordering Example

The ordering code of an AC01 resistor, value 47 k Ω supplied in ammopack of 1000 units is: 2306 328 33473.

Product specifications deviating from the standard values are available on request.

DIMENSIONS



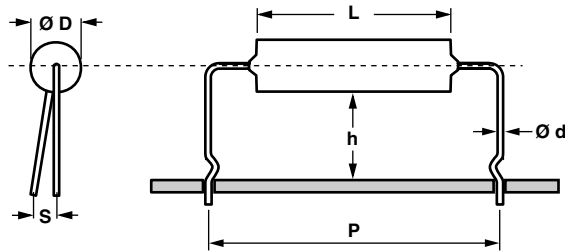
For packaging dimensions see separate packaging dimensions page.

DIMENSIONS - resistor types, mass and relevant physical dimensions					
MODEL	DIMENSIONS in millimeters [inches]				
	D _{max.}	L _{max.}	d	G	WEIGHT g PER 100 UNITS
AC01	4.3 [0.169]	11 [0.433]	0.8 ± 0.03 [0.031 ± 0.001]	63 ± 1 [2.480 ± 0.039]	52
AC03	4.8 [0.189]	13 [0.512]		63 ± 1 [2.480 ± 0.039]	75
AC04	5.5 [0.217]	16.5 [0.650]		63 ± 1 [2.480 ± 0.039]	110
AC05	7.5 [0.295]	18 [0.709]		63 ± 1 [2.480 ± 0.039]	190
AC07	7.5 [0.295]	26 [1.024]		73 ± 1 [2.874 ± 0.039]	260
AC10	8.0 [0.315]	44 [1.732]		88 ± 1 [3.465 ± 0.039]	450

PERFORMANCE	
TEST	TEST RESULTS
Climatic Category	40/200/56
Damp Heat, Steady State 56d	$\Delta R: \pm (5 \% R + 0.1 \Omega)$
Storage 1000 h, 200 °C, No Load	$\Delta R: \pm (5 \% R + 0.1 \Omega)$
Climatic Sequence	$\Delta R: \pm (1 \% R + 0.05 \Omega)$
Load Life 1000 h	$\Delta R: \pm (5 \% R + 0.1 \Omega)$
Resistance to Soldering Heat	$\Delta R: \pm (0.5 \% R + 0.05 \Omega)$
Robustness of Termination, 10N	$\Delta R: \pm (0.5 \% R + 0.05 \Omega)$
Short Time Overload, 10 x Rated Power for 5 s	$\Delta R: \pm (2 \% R + 0.1 \Omega)$

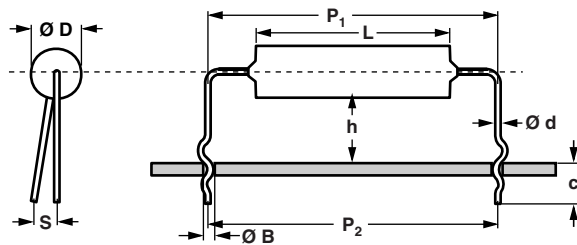
BENDING FORMS

KINK TYPE S = EK



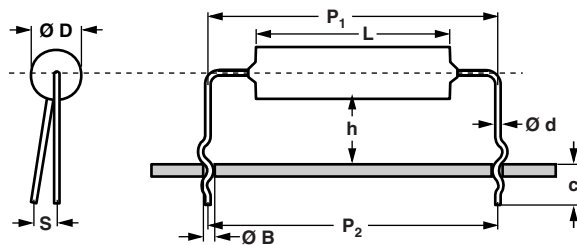
TYPE	Ø d	Ø D _{max.}	L	h ± 1	P ± 1	S _{max.}
AC01	0.8	(1)	(1)	8	17.8	2
AC03 - AC05					25.4	
AC07					33.0	

DOUBLE KINK SP = DK SP



TYPE	Ø d	Ø D _{max.}	L	h ± 1	P ₁ ± 1	P ₂ ± 3	S _{max.}	Ø B	c
AC01	0.8	(1)	(1)	8	19.8	17.8	2	1.0 ± 0.1	4.5 ± 1
AC03 - AC05					22.0	20.0			
					27.4	25.4			
AC07					35.0	33.0			

DOUBLE KINK LP = DK LP

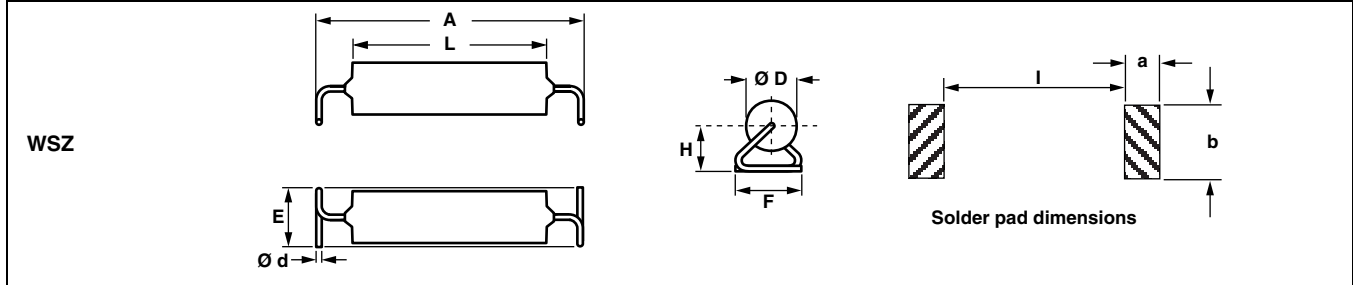


TYPE	Ø d	Ø D _{max.}	L	h ± 1	P ₁ ± 1	P ₂ ± 3	S _{max.}	Ø B	c
AC01 - AC03	0.8	(1)	(1)	8	17.8	17.8	2	1.0 ± 0.1	4.5 ± 1
AC03 - AC05					25.4	25.4			
AC07					33.0	33.0			

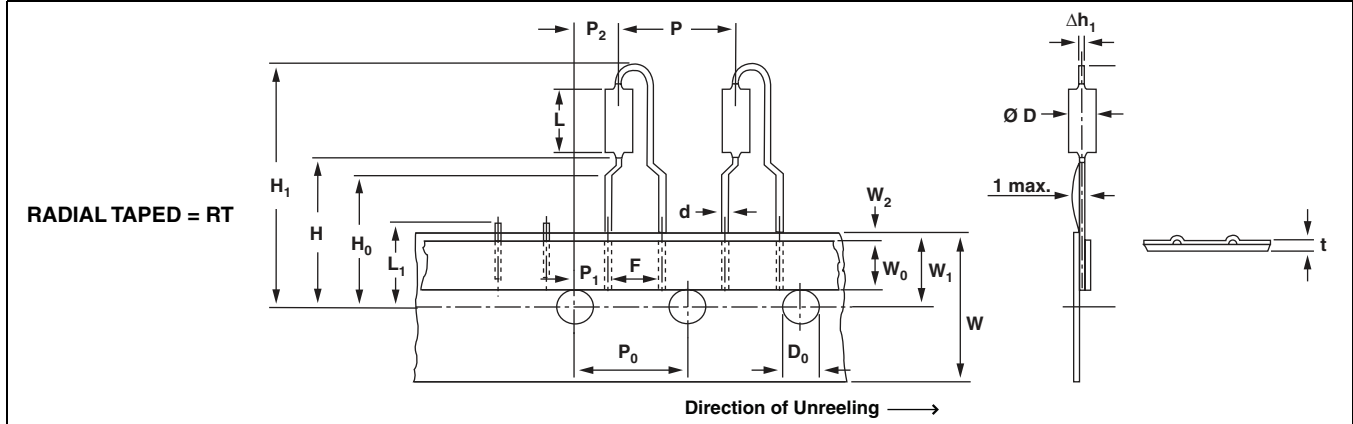
Note:

(1) See table DIMENSIONS

BENDING FORMS



TYPE	Ø d	Ø D _{max.}	A	L	F	H	E	a	b	l
AC03 WSZ	0.8	(1)	17 ± 0.5	11 - 12	4.8 ± 0.5	3.6 ± 0.5	5.0 ± 0.5	2.5	5.5	14.5



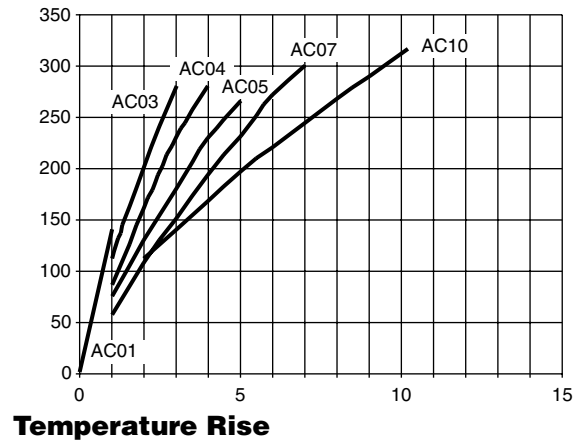
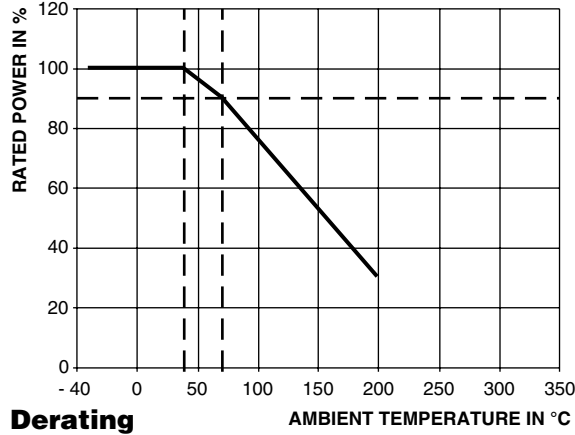
TYPE AC01		
Lead Ø	Ø d	0.8
Diameter	Ø D	(1)
Length	L	(1)
Pitch of components	P	12.7 ± 1.0
Pitch of spocket holes (2)	P ₀	12.7 ± 0.3
Distance between hole center and resistor center	P ₁	3.85 ± 0.7
Distance between hole center and lead center	P ₂	6.35 ± 1.0
Lead spacing	F	5.0 + 0.6, - 0.1
Angle of insertion	Δh ₁	2 max.
Width of carrier tape	W	18.0 ± 0.5
Width of adhesive tape	W ₀	12.0 ± 0.5
Position of holes	W ₁	9.0 ± 0.5
Position of adhesive tape	W ₂	0.5 max.
Body to hole center	H	19.5 ± 1.0
Lead crimp to hole center (3)	H ₀	16.0 ± 0.5
Hole Ø	D ₀	4.0 ± 0.2
Thickness of tape (4)	t	0.9 max.
Height for cutting	L ₁	11 max.
Height for insertion	H ₁	32 max.

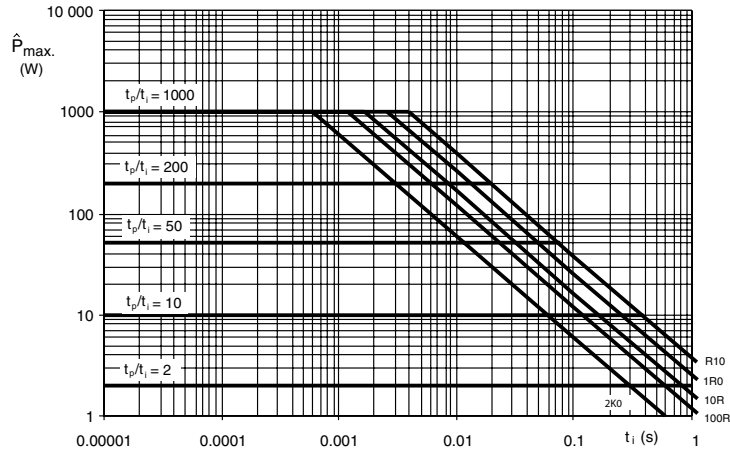
Notes:

- (1) See table DIMENSIONS
- (2) Test over 10 holes - 9 intervals P₀ 12.7 x 9 = 114.3 ± 0.5
- (3) Parallelism, < 0.5 mm
- (4) Thickness of carrier tape: 0.55 mm ± 0.1

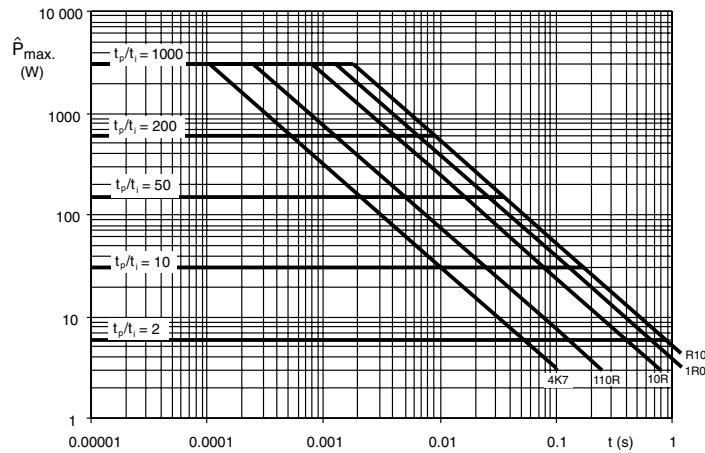


FUNCTIONAL PERFORMANCE

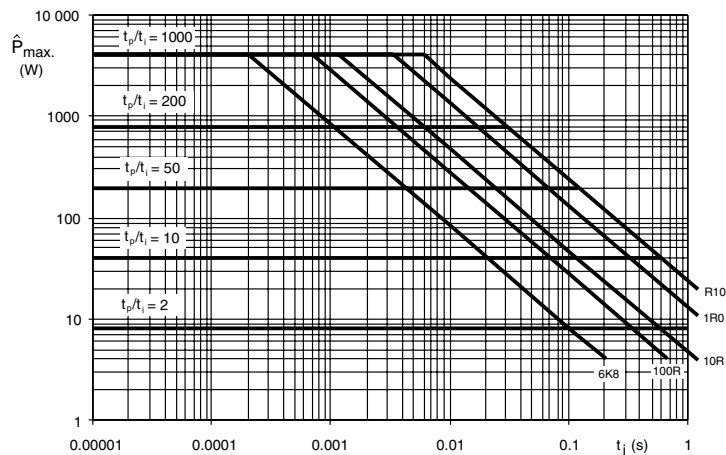




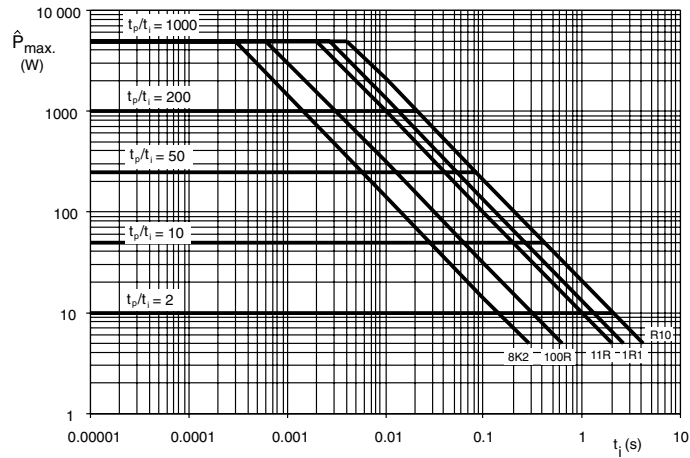
AC01 Pulse on a regular basis; maximum permissible peak pulse power (\hat{P}_{max}) as a function of pulse duration (t_i)



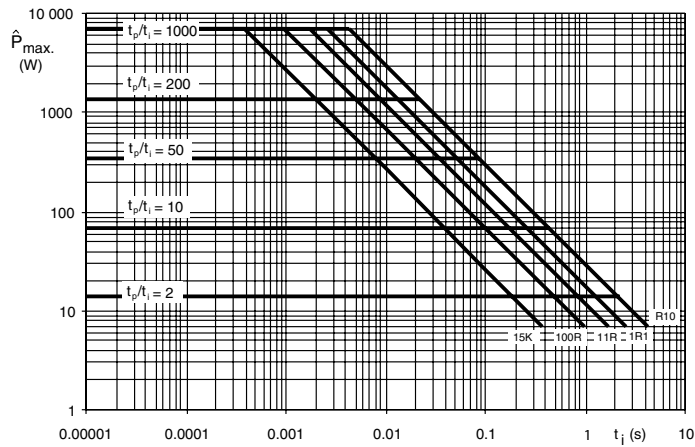
AC03 Pulse on a regular basis; maximum permissible peak pulse power (\hat{P}_{max}) as a function of pulse duration (t_i)



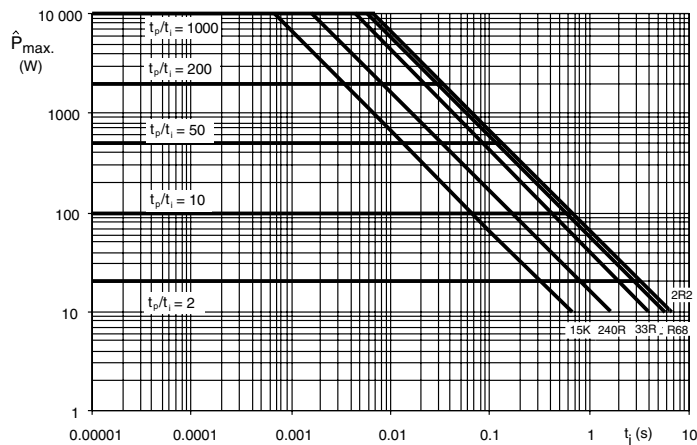
AC04 Pulse on a regular basis; maximum permissible peak pulse power (\hat{P}_{max}) as a function of pulse duration (t_i)



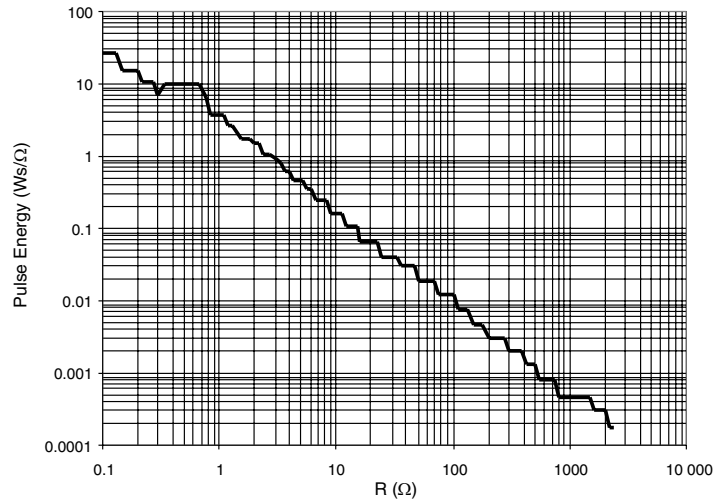
AC05 Pulse on a regular basis; maximum permissible peak pulse power (\hat{P}_{max}) as a function of pulse duration (t_i)



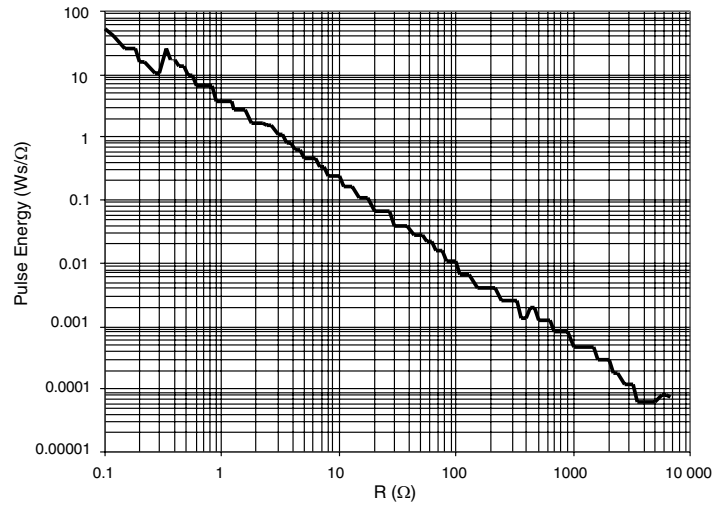
AC07 Pulse on a regular basis; maximum permissible peak pulse power (\hat{P}_{max}) as a function of pulse duration (t_i)



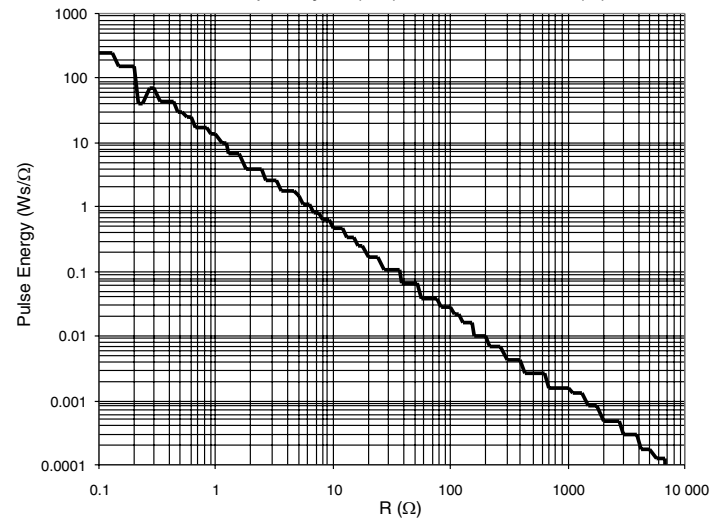
AC10 Pulse on a regular basis; maximum permissible peak pulse power (\hat{P}_{max}) as a function of pulse duration (t_i)



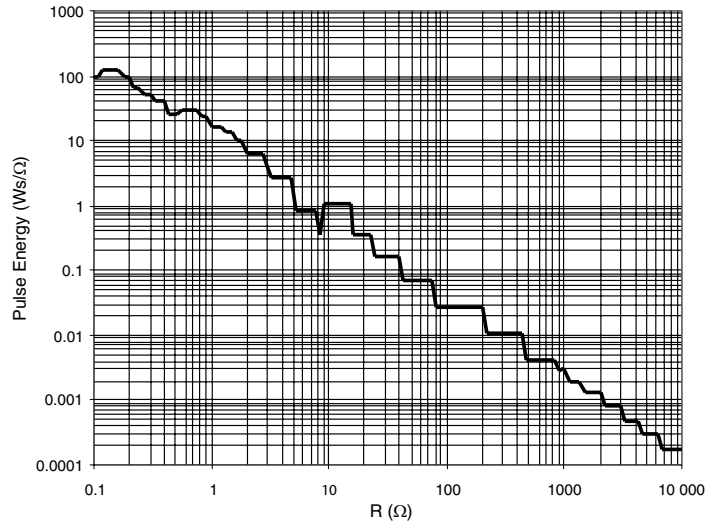
AC01 Pulse capability; E (Ws) as a function of R (Ω)



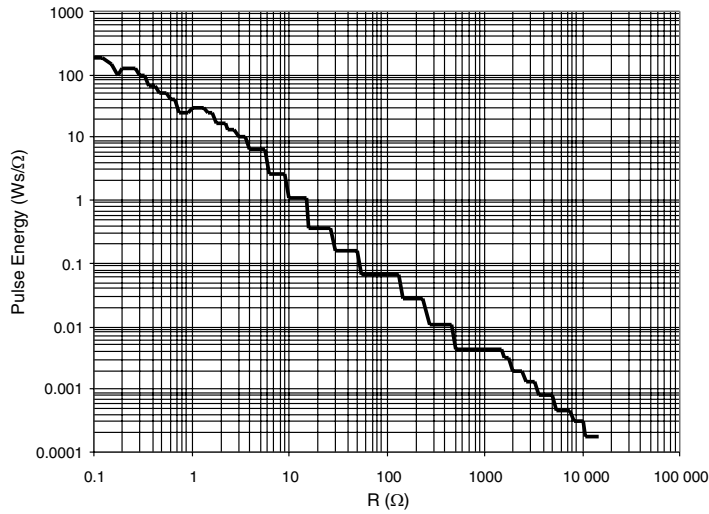
AC03 Pulse capability; E (Ws) as a function of R (Ω)



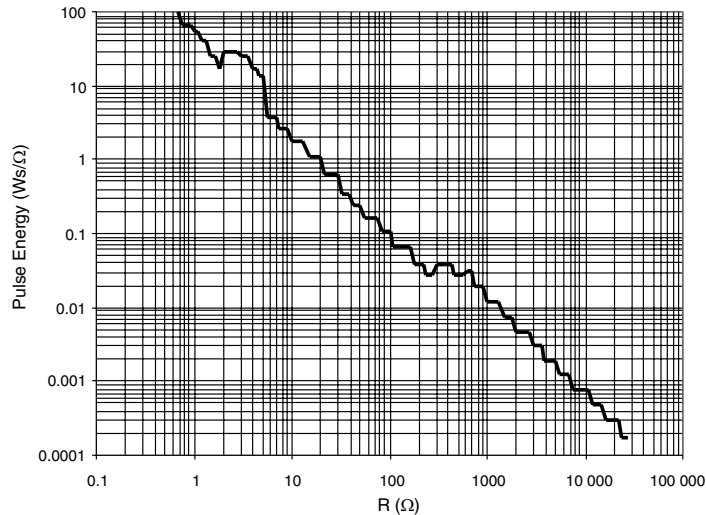
AC04 Pulse capability; E (Ws) as a function of R (Ω)



AC05 Pulse capability; E (Ws) as a function of R (Ω)

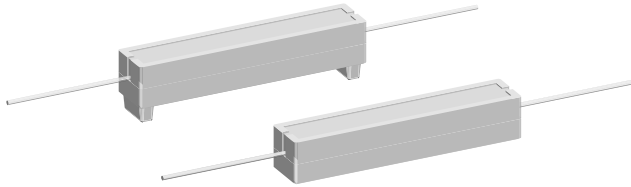


AC07 Pulse capability; E (Ws) as a function of R (Ω)



AC10 Pulse capability; E (Ws) as a function of R (Ω)

Wirewound Resistors, Commercial Power, Axial Lead



FEATURES

- High power to size ratio
- Ceramic cases are available with circuit board stand-offs (designated with a -3 model ending)
- Superior surge capability
- Complete welded construction
- Available in non-inductive styles with Aryton-Perry winding (CPWN in lieu of CPW, maximum resistance is one-half CPW range)
- Special inorganic potting compound and ceramic case provide high thermal conductivity in a fireproof package



RoHS* COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS				
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{40^\circ\text{C}}$ W	RESISTANCE RANGE Ω $\pm 1\%, \pm 2\%, \pm 3\%, \pm 5\%$	WEIGHT (typical) g
CPW02	CPW-2	2	0.1 - 7K	2.0
CPW02...3	CPW-2-3	2	0.1 - 7K	2.2
CPW03	CPW-3	3	0.1 - 7.5K	3.4
CPW03...3	CPW-3-3	3	0.1 - 7.5K	3.6
CPW05	CPW-5	5	0.1 - 8.5K	4.8
CPW05...3	CPW-5-3	5	0.1 - 8.5K	5.0
CPW07	CPW-7	7	0.1 - 18K	6.8
CPW07...3	CPW-7-3	7	0.1 - 18K	7.0
CPW10	CPW-10	10	0.12 - 30K	9.5
CPW10...3	CPW-10-3	10	0.12 - 30K	9.9
CPW15	CPW-15	15	0.12 - 30K	16.8
CPW15...3	CPW-15-3	15	0.12 - 30K	17.4
CPW20	CPW-20	20	0.18 - 45K	22.8
CPW20...3	CPW-20-3	20	0.18 - 45K	23.6

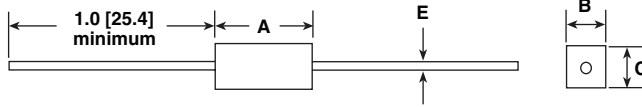
TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	CPW RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/°C	± 90 below 1.0 Ω , ± 50 for 1.0 Ω to 9.9 Ω , ± 30 for 10 Ω and above
Short Time Overload	-	5 x rated power for 5 s
Maximum Working Voltage	V	$(P \times R)^{1/2}$
Operating Temperature Range	°C	- 65 to + 275
Terminal Strength	lb	10 minimum
Dielectric Withstanding Voltage	V _{AC}	1000

GLOBAL PART NUMBER INFORMATION				
New Global Part Numbering: CPW0515R00JB313 (preferred part number format)				
C	P	W	0 5 1 5 R 0 0 J	B 3 1 3
GLOBAL MODEL (See Standard Electrical Specifications Global Model column for options)	VALUE R = Decimal K = Thousand R1500 = 0.15 Ω 1K500 = 1500 Ω	TOLERANCE D = $\pm 0.5\%$ F = $\pm 1.0\%$ G = $\pm 2.0\%$ H = $\pm 3.0\%$ J = $\pm 5.0\%$ K = $\pm 10.0\%$	PACKAGING E14 = Lead (Pb)-free bulk E31 = Lead (Pb)-free four layer bulk E01 = Lead (Pb)-free skin pack B14 = Tin/lead bulk B31 = Tin/lead four layer bulk J01 = Tin/lead skin pack	SPECIAL (Dash Number) (up to 3 digits) From 1 - 999 as applicable
Historical Part Number Example: CPW-5-3 15 Ω 5% B31 (will continue to be accepted)				
CPW-5-3	15 Ω	5%	B31	
HISTORICAL MODEL	RESISTANCE VALUE	TOLERANCE CODE	PACKAGING	

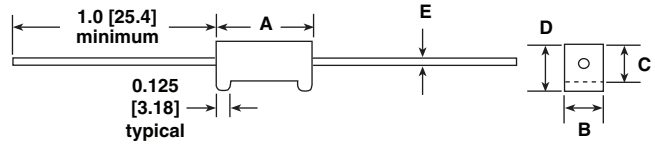
* Pb containing terminations are not RoHS compliant, exemptions may apply

DIMENSIONS in inches [millimeters]

CPWxx



CPWxx...3



GLOBAL MODEL	DIMENSIONS in inches [millimeters]				
	A ⁽¹⁾ ± 0.031 [0.794]	B ± 0.031 [0.794]	C ± 0.031 [0.794]	D ± 0.031 [0.794]	E ± 0.001 [0.025]
CPW02	0.688 [17.46]	0.250 [6.35]	0.250 [6.35]	-	0.032 [0.813]
CPW02...3	0.688 [17.46]	0.250 [6.35]	0.250 [6.35]	0.313 [7.94]	0.032 [0.813]
CPW03	0.875 [22.22]	0.313 [7.94]	0.313 [7.94]	-	0.032 [0.813]
CPW03...3	0.875 [22.22]	0.313 [7.94]	0.313 [7.94]	0.375 [9.52]	0.032 [0.813]
CPW05	0.875 [22.22]	0.375 [9.52]	0.344 [8.73]	-	0.032 [0.813]
CPW05...3	0.875 [22.22]	0.375 [9.52]	0.344 [8.73]	0.406 [10.32]	0.032 [0.813]
CPW07	1.391 [35.32]	0.375 [9.52]	0.344 [8.73]	-	0.032 [0.813]
CPW07...3	1.391 [35.32]	0.375 [9.52]	0.344 [8.73]	0.469 [11.91]	0.032 [0.813]
CPW10	1.875 [47.62]	0.375 [9.52]	0.344 [8.73]	-	0.032 [0.813]
CPW10...3	1.875 [47.62]	0.375 [9.52]	0.344 [8.73]	0.469 [11.91]	0.032 [0.813]
CPW15	1.875 [47.62]	0.500 [12.70]	0.500 [12.70]	-	0.032 [0.813]
CPW15...3	1.875 [47.62]	0.500 [12.70]	0.500 [12.70]	0.625 [15.87]	0.032 [0.813]
CPW20	2.500 [63.50]	0.500 [12.70]	0.500 [12.70]	-	0.032 [0.813]
CPW20...3	2.500 [63.50]	0.500 [12.70]	0.500 [12.70]	0.625 [15.87]	0.032 [0.813]

Note

⁽¹⁾ Potting compound may extend outside of ceramic case up to 0.060 [1.52] maximum per side.

MATERIAL SPECIFICATIONS

Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value

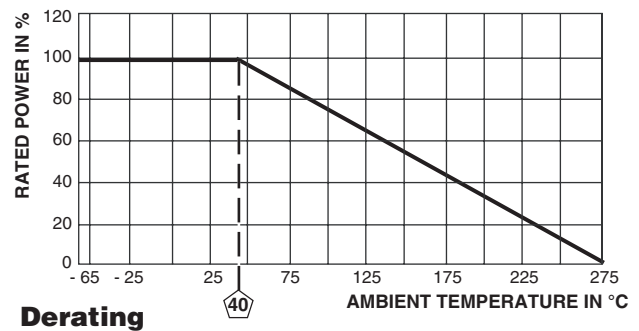
Core: Ceramic

End Caps: Tin plated steel

Body: Steatite ceramic case with inorganic potting compound

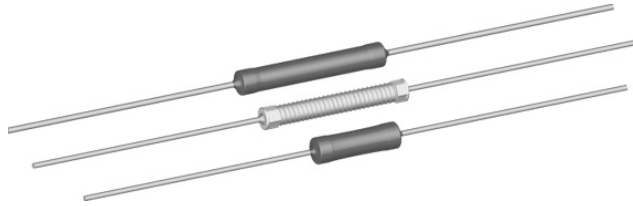
Terminals: Tinned Copperweld®

Part Marking: DALE, model, wattage, value, tolerance, date code



PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS (EIA RS-344)
Thermal Shock	- 55 °C to + 275 °C, 5 cycles, 30 min dwell time	± (2.0 % + 0.05 Ω) ΔR
Short Time Overload	5 x rated power for 5 s	± (2.0 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	1000 V _{rms} for 1 min	± (0.1 % + 0.05 Ω) ΔR
Low Temperature Storage	- 65 °C, full rated working voltage for 45 min	± (2.0 % + 0.05 Ω) ΔR
Bias Humidity	75 °C, 90 % - 100 % RH, 240 h	± (2.0 % + 0.05 Ω) ΔR
Load Life	1000 h at rated power, + 40 °C, 1.5 h "ON", 0.5 h "OFF"	± (3.0 % + 0.05 Ω) ΔR
Terminal Strength	5 to 10 s 10 pound pull test, torsion test - 3 alternating directions, 360° each	± (1.0 % + 0.05 Ω) ΔR
Resistance to Solder Heat	Terminal immersed 3.5 s in molten solder at 1/8" to 3/16" from body	± (1.0 % + 0.05 Ω) ΔR

Wirewound Resistors, Commercial Power, Axial Lead



FEATURES

- High performance for low cost
- Auto insertable
- CA0001, CA0002 and CA5000 models are supplied with a high temperature silicone coating for additional environmental protection
- Lead forming available



APPLICATIONS

Kitchen appliances: Percolators, blenders, mixers, ranges, toasters, deep fryers. Automotive devices: Horns, ignitions, windshield wipers, voltage regulators, instrument gauges. Entertainment devices: Radios, televisions, computers and power supplies.

RoHS* COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS				
GLOBAL ⁽¹⁾ MODEL	HISTORICAL ⁽¹⁾ MODEL	POWER RATING <i>P</i> _{25 °C} W	RESISTANCE RANGE Ω ± 10 % Standard, ± 5 % Available	WEIGHT (typical) g
CA0001	CA-1	1.0	0.1 - 1K	0.65
CA0002	CA-2	2.0	0.1 - 2.4K	0.80
CA4050/CA5050	CA-4050/CA-5050	2.0/2.5	0.1 - 170/0.1 - 2.7K	0.64/0.78
CA4055/CA5055	CA-4055/CA-5055	2.2/2.75	0.1 - 195/0.1 - 3.1K	0.65/0.80
CA4060/CA5060	CA-4060/CA-5060	2.4/3.0	0.1 - 220/0.1 - 3.5K	0.66/0.82
CA4070/CA5070	CA-4070/CA-5070	2.8/3.5	0.1 - 270/0.1 - 4.3K	0.68/0.86
CA4080/CA5080	CA-4080/CA-5080	3.2/4.0	0.1 - 320/0.1 - 5.1K	0.70/0.90
CA4090/CA5090	CA-4090/CA-5090	3.6/4.5	0.1 - 370/0.1 - 5.9K	0.72/0.94
CA4100/CA5100	CA-4100/CA-5100	4.0/5.0	0.15 - 420/0.15 - 6.7K	0.74/0.98
CA4150/CA5150	CA-4150/CA-5150	6.0/7.5	0.2 - 630/0.2 - 7K	0.84/1.19
CA4200/CA5200	CA-4200/CA-5200	8.0/10.0	0.2 - 920/0.2 - 7K	0.94/1.40
CA4220/CA5220	CA-4220/CA-5220	8.8/11.0	0.2 - 1.02K/0.2 - 7K	0.98/1.48

Note

⁽¹⁾ CA4000 and CA5000 model numbers are calculated from the CA4000 power rating of 4 W per inch and CA5000 power rating of 5 W per inch. The last three digits of the model number are the body length of the resistor in inches (decimal is between the first and second digit). Example: CA5150 = 1.50 inches x 5 W per inch = 7.5 W.

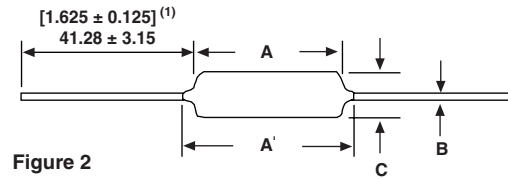
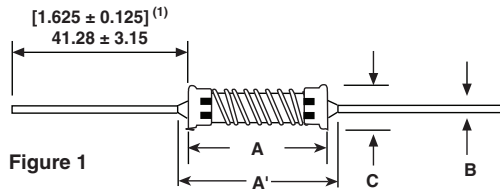
TECHNICAL SPECIFICATIONS					
PARAMETER	UNIT	CA0001	CA0002	CA4000	CA5000
Temperature Coefficient	ppm/°C	± 600 below 1 Ω, ± 300 1 Ω and above			
Power Rating	W	1	2	4 per inch	5 per inch
Short Time Overload	-	5 x rated power for 5 s			
Maximum Working Voltage	V	$(P \times R)^{1/2}$			
Dielectric Withstanding Voltage	V _{AC}	1000	1000	1000	1000
Operating Temperature Range	°C	- 65 to + 275	- 65 to + 275	- 65 to + 275	- 65 to + 275
Terminal Strength (minimum)	lb	10	10	10	10

Note

- Wirewound CA resistors can reliably function as a fuse and as a resistor. Such components involve compromise between fusing and resistive functions; therefore, each design should be tailored to the application to ensure optimum performance. Contact factory by using the e-mail address at the bottom of this page for design assistance.

GLOBAL PART NUMBER INFORMATION																	
New Global Part Numbering: CA000150R00JR05 (preferred part number format)																	
C	A	0	0	0	1	5	0	R	0	0	J	R	0	5			
GLOBAL MODEL (See Standard Electrical Specifications Global Model column for options)		VALUE R = Decimal K = Thousand R1500 = 0.15 Ω 1K500 = 1500 Ω		TOLERANCE H = ± 3.0 % J = ± 5.0 % K = ± 10.0 %		PACKAGING E14 = Lead (Pb)-free bulk E05 = Lead (Pb)-free tape and reel B14 = Tin/lead bulk R05 = Tin/lead tape and reel			SPECIAL (Dash Number) (up to 3 digits) From 1 - 999 as applicable								
Historical Part Number Example: CA-1 50 Ω 5 % R05 (will continue to be accepted for tin/lead product only)																	
CA-1 HISTORICAL MODEL		50 Ω RESISTANCE VALUE		5 % TOLERANCE CODE		R05 PACKAGING											

* Pb containing terminations are not RoHS compliant, exemptions may apply

DIMENSIONS in inches [millimeters]

Note

(1) On some standard reel pack methods, the leads may be trimmed to a shorter length than shown.

GLOBAL MODEL	DIMENSIONS in inches [millimeters]				FIGURE
	A ± 0.031 [0.794]	A' (maximum)	B ± 0.001 [0.025]	C	
CA0001	0.400 [10.16]	0.460 [11.68]	0.032 [0.813]	0.170 maximum [4.32 maximum]	2
CA0002	0.570 [14.48]	0.630 [16.00]	0.032 [0.813]	0.170 maximum [4.32 maximum]	2
CA4050	0.500 [12.70]	0.594 [15.09]	0.032 [0.813]	0.140 ± 0.031 [3.56 ± 0.794]	1
CA4055	0.550 [13.97]	0.644 [16.36]	0.032 [0.813]	0.140 ± 0.031 [3.56 ± 0.794]	1
CA4060	0.600 [15.24]	0.694 [17.63]	0.032 [0.813]	0.140 ± 0.031 [3.56 ± 0.794]	1
CA4070	0.700 [17.78]	0.794 [20.17]	0.032 [0.813]	0.140 ± 0.031 [3.56 ± 0.794]	1
CA4080	0.800 [20.32]	0.894 [22.71]	0.032 [0.813]	0.140 ± 0.031 [3.56 ± 0.794]	1
CA4090	0.900 [22.86]	0.994 [25.25]	0.032 [0.813]	0.140 ± 0.031 [3.56 ± 0.794]	1
CA4100	1.00 [25.40]	1.094 [27.79]	0.032 [0.813]	0.140 ± 0.031 [3.56 ± 0.794]	1
CA4150	1.50 [38.10]	1.594 [40.49]	0.032 [0.813]	0.140 ± 0.031 [3.56 ± 0.794]	1
CA4200	2.00 [50.80]	2.094 [53.19]	0.032 [0.813]	0.140 ± 0.031 [3.56 ± 0.794]	1
CA4220	2.20 [55.88]	2.294 [58.27]	0.032 [0.813]	0.140 ± 0.031 [3.56 ± 0.794]	1
CA5050	0.500 [12.70]	0.625 [15.88]	0.036 [0.914]	0.170 ± 0.031 [4.32 ± 0.794]	2
CA5055	0.550 [13.97]	0.675 [17.15]	0.036 [0.914]	0.170 ± 0.031 [4.32 ± 0.794]	2
CA5060	0.600 [15.24]	0.725 [18.42]	0.036 [0.914]	0.170 ± 0.031 [4.32 ± 0.794]	2
CA5070	0.700 [17.78]	0.825 [20.96]	0.036 [0.914]	0.170 ± 0.031 [4.32 ± 0.794]	2
CA5080	0.800 [20.32]	0.925 [23.50]	0.036 [0.914]	0.170 ± 0.031 [4.32 ± 0.794]	2
CA5090	0.900 [22.86]	1.025 [26.04]	0.036 [0.914]	0.170 ± 0.031 [4.32 ± 0.794]	2
CA5100	1.00 [25.40]	1.125 [28.58]	0.036 [0.914]	0.170 ± 0.031 [4.32 ± 0.794]	2
CA5150	1.50 [38.10]	1.625 [41.28]	0.036 [0.914]	0.170 ± 0.031 [4.32 ± 0.794]	2
CA5200	2.00 [50.80]	2.125 [53.98]	0.036 [0.914]	0.170 ± 0.031 [4.32 ± 0.794]	2
CA5220	2.20 [55.88]	2.325 [59.06]	0.036 [0.914]	0.170 ± 0.031 [4.32 ± 0.794]	2

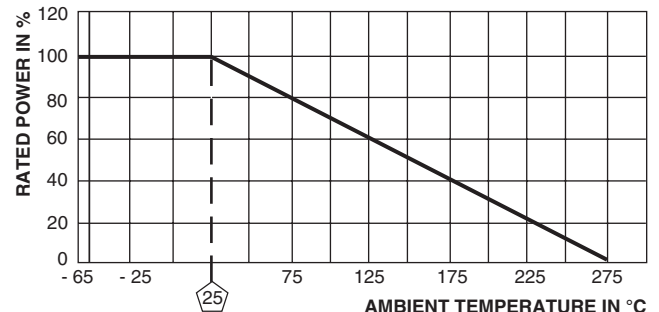
MATERIAL SPECIFICATIONS
Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value

Core: Woven fiberglass

Coating: Special high temperature silicone (CA4000 series is not coated)

Terminals: Tin/lead electroplated copper (Lead (Pb)-free will be 100 % tin)

End Caps: Tin plated steel

Part Marking: DALE, model, wattage, value, tolerance, date code

Derating

PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS (EIA RS-344)
Thermal Shock	- 55 °C to + 275 °C, 5 cycles, 30 min dwell time	± (5.0 % + 0.05 Ω) ΔR
Short Time Overload	5 x rated power for 5 s	± (4.0 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	600 V _{AC} , (CA0001, CA0002) for 1 min	± (2.0 % + 0.05 Ω) ΔR
Low Temperature Storage	- 65 °C, full rated working voltage for 45 min	± (3.0 % + 0.05 Ω) ΔR
Humidity	75 °C, 90 % - 100 % RH, 240 h	± (5.0 % + 0.05 Ω) ΔR
Load Life	1000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"	± (10.0 % + 0.05 Ω) ΔR
Terminal Strength	10 pounds for 30 s; body twisted about axis, 3 360° rotations	± (2.0 % + 0.05 Ω) ΔR
Resistance to Solder Heat	Terminal immersed 3.5 s in molten solder at 1/8" to 3/16" from body	± (4.0 % + 0.05 Ω) ΔR

Wirewound Resistors, Commercial Power, Axial Lead



FEATURES

- High performance for low cost
- Auto insertable
- High temperature coating for environmental protection



APPLICATIONS

Kitchen appliances:

- Percolators, blenders, mixers, ranges, toasters, deep fryers

Automotive devices:

- Horns, ignitions, windshield wipers, voltage regulators, instrument gauges

Entertainment and consumer devices:

- Radios, televisions
- Computers and power supplies

STANDARD ELECTRICAL SPECIFICATIONS

GLOBAL MODEL	POWER RATING $P_{25^{\circ}\text{C}}$ W	RESISTANCE RANGE Ω $\pm 5\%, \pm 10\%$	WEIGHT (typical) g
CA0001	1.0	0.1 - 1K	0.65
CA0002	2.0	0.1 - 1K	0.80

TECHNICAL SPECIFICATIONS

PARAMETER	UNIT	CA HIGH VOLUME RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/ $^{\circ}\text{C}$	± 350
Short Time Overload	-	5 x rated power for 5 s
Maximum Working Voltage	V	$(P \times R)^{1/2}$
Dielectric Withstanding Voltage	V_{AC}	350
Operating Temperature Range	$^{\circ}\text{C}$	- 65 to + 275
Terminal Strength (minimum)	lb	10

GLOBAL PART NUMBER INFORMATION

Global Part Numbering Example: CA000150R00JE66



GLOBAL MODEL
(See Standard Electrical Specifications Global Model column for options)

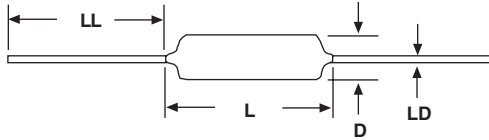
VALUE
R = Decimal
K = Thousand
R1500 = 0.15 Ω
1K000 = 1000 Ω

TOLERANCE
J = $\pm 5.0\%$
K = $\pm 10.0\%$

PACKAGING
E66 = Lead (Pb)-free, tape/reel

SPECIAL
(Dash Number)
(up to 3 digits)
From 1 - 999 as applicable

DIMENSIONS



GLOBAL MODEL	DIMENSIONS in inches [millimeters]			
	L ± 0.040 [1.0]	D ± 0.020 [0.5]	LD ± 0.002 [0.05]	LL ± 0.120 [3.0]
CA0001	0.354 [9]	0.138 [3.5]	0.024 [0.6]	1.102 [28]
CA0002	0.591 [15]	0.197 [5.0]	0.031 [0.8]	1.378 [35]

MATERIAL SPECIFICATIONS

Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value

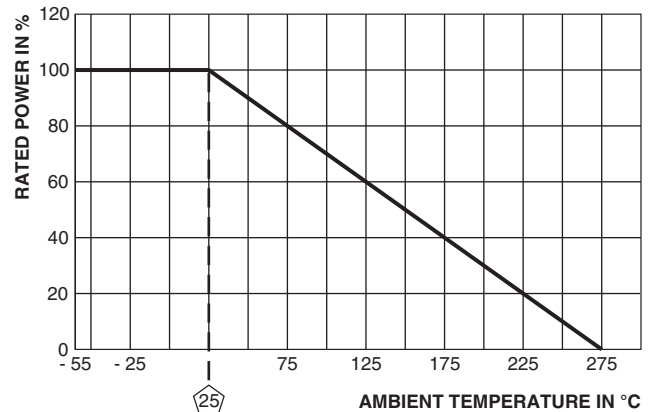
Core: Ceramic

Coating: Special high temperature material

Terminals: Tin plated copper

End Caps: Tin plated steel

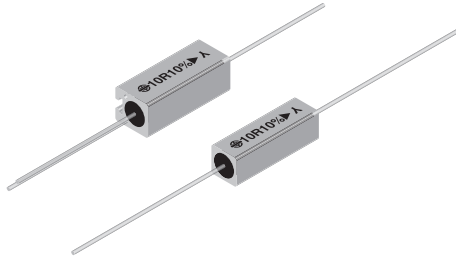
Part Marking: E24 color bands



Derating

PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS
Thermal Shock	- 55 °C to + 275 °C, 5 cycles, 30 min dwell time	± (5.0 % + 0.05 Ω) ΔR
Short Time Overload	5 x rated power for 5 s	± (1.0 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	350 V _{AC} for 1 min	± (2.0 % + 0.05 Ω) ΔR
Low Temperature Operation	- 65 °C, full rated working voltage for 45 min	± (3.0 % + 0.05 Ω) ΔR
Humidity	75 °C, 90 % - 100 % RH, 240 h	± (5.0 % + 0.05 Ω) ΔR
Load Life	1000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"	± (5.0 % + 0.05 Ω) ΔR
Terminal Strength	10 pounds for 30 s; body twisted about axis, 3 x 360° rotations	± (2.0 % + 0.05 Ω) ΔR
Resistance to Solder Heat	Terminal immersed 3.5 s in molten solder at 1/8" to 3/16" from body	± (1.0 % + 0.05 Ω) ΔR

Wirewound Resistors in Ceramic Case



FEATURES

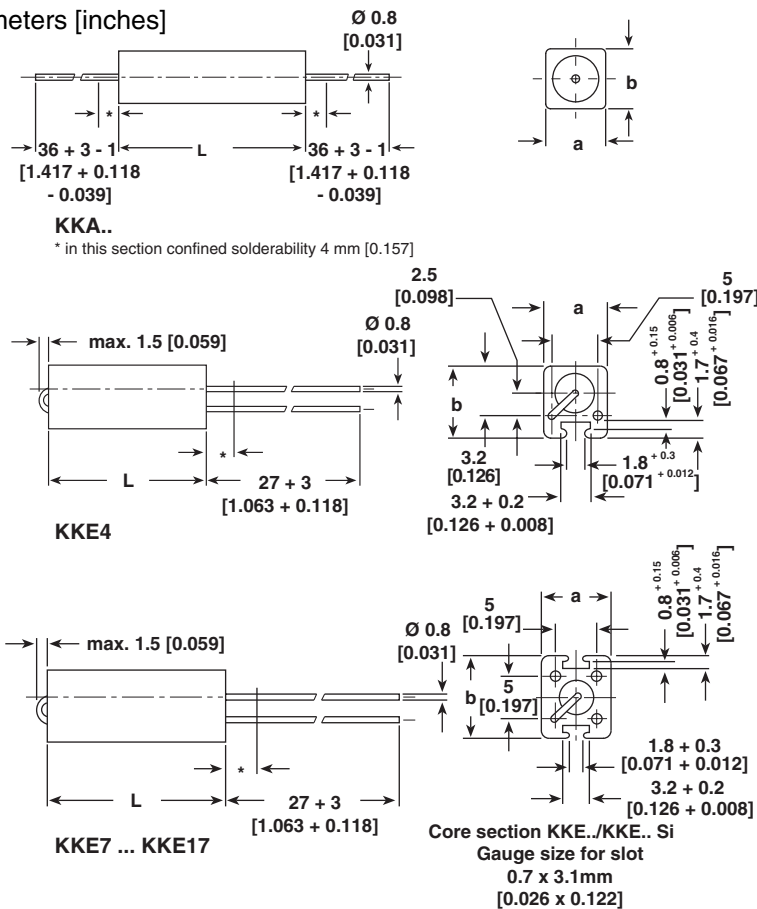
- Fiberglass core, ceramic case
- Fireproof inorganic construction
- Axial or radial leaded
- Fusing styles available as style KKE.. Si
- Pure tin plating provides compatibility with lead (Pb)-free and lead containing soldering processes
- Compatible with "Restriction of the use of Hazardous Substances" (RoHS) directive 2002/95/EC (issue 2004)



STANDARD ELECTRICAL SPECIFICATIONS							
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{40^\circ C}$ W	LIMITING VOLTAGE V	RESISTANCE RANGE E12/E24			
				TOLERANCE $\pm 10\%$		TOLERANCE $\pm 10\%$, $\pm 5\%$	
				TCR $+ 400 \pm 50$ ppm/K	TCR $+ 400 \pm 50$ ppm/K	TCR $+ 0 \pm 40$ ppm/K	TCR $+ 0 \pm 10$ ppm/K
KKA040	KKA4	4	125	R056 - R091	R10 - R20	R22 - 300R	330R - 9K1
KKA050	KKA5	5	185	R075 - R12	R15 - R30	R33 - 470R	510R - 15K
KKA070	KKA7	7	250	R11 - R30	R33 - R68	R75 - 910R	1K0 - 33K
KKA090	KKA9	9	250	R11 - R30	R33 - R68	R75 - 910R	1K0 - 33K
KKA110	KKA11	11	350	R15 - R47	R51 - 1R0	1R1 - 1K3	1K5 - 47K
KKA170	KKA17	17	500	R27 - R82	R91 - 1R6	1R8 - 2K4	2K7 - 82K
KKE040	KKE4	4	125	R056 - R091	R10 - R20	R22 - 300R	330R - 9K1
KKE070	KKE7	7	250	R075 - R12	R15 - R30	R33 - 470R	510R - 15K
KKE090	KKE9	9	250	R11 - R30	R33 - R68	R75 - 910R	1K0 - 33K
KKE110	KKE11	11	350	R15 - R47	R51 - 1R0	1R1 - 1K3	1K5 - 47K
KKE170	KKE17	17	500	R27 - R82	R91 - 1R6	1R8 - 2K4	2K7 - 82K
KKE07L	KKE7 Si	4	165	R075 - R13		R15 - 12K	Only $\pm 5\%$
KKE09L	KKE9 Si	5.5	250	R11 - R30		R33 - 33K	Only $\pm 5\%$
KKE11L	KKE11 Si	7	350	R28 - R47		R51 - 47K	Only $\pm 5\%$
KKE17L	KKE17 Si	10	500	R27 - R82		R91 - 82K	Only $\pm 5\%$

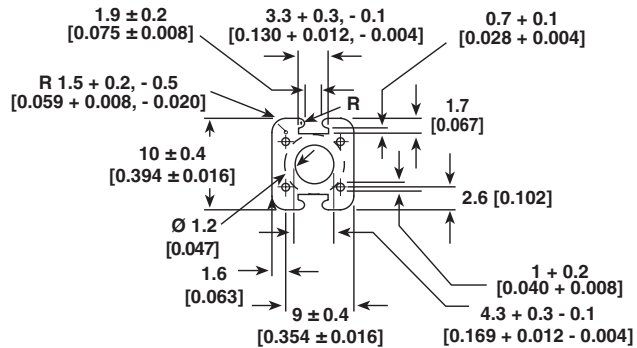
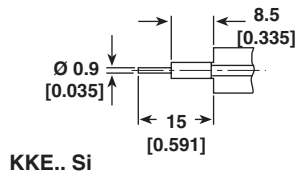
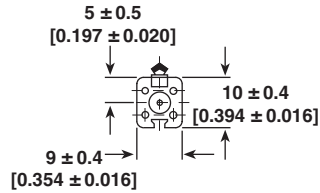
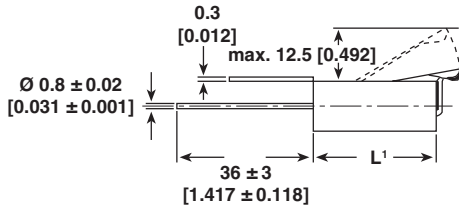
GLOBAL PART NUMBER INFORMATION															
New Global Part Numbering: KKA040B1009K G1000 (preferred part number format)															
<div style="display: flex; justify-content: space-around; font-weight: bold; font-size: 1.2em;"> KKA040B1009KG1000 </div>															
MODEL	SIZE	SPECIAL CHARACTER	TCR/MATERIAL	VALUE	TOLERANCE	PACKAGING	SPECIAL								
KKA KKE	04 = 4 05 = 5 07 = 7 09 = 9 11 = 11 17 = 17	0 = Neutral L = Si	0 = SWI per BV A = 400 ± 50 ppm/K B = $0 + 40 - 80$ pm/K C = 0 ± 10 ppm/K D = $+200... + 1200$ ppm/K	3 digit value 1 digit multiplier MULTIPLIER F = $*10^{-4}$ 7 = $*10^{-3}$ 8 = $*10^{-2}$ 9 = $*10^{-1}$ 0 = $*10^0$ 1 = $*10^1$ 2 = $*10^2$	J = $\pm 5.0\%$ K = $\pm 10.0\%$	(See Packaging table)	The 5 digit BV number will be encoded using a 36 character code. This code contains numbers 0...9 and letters A...Z (36 characters total) and allows to encode at least 46 655 five digit BV numbers. 000 = Standard								
Historical Part Number Example: KKA4 10R 10% 0 + 40 - 80 R1 (will continue to be accepted)															
KKA4		10R			10%		0 + 40 - 80			R1					
HISTORICAL MODEL		VALUE			TOLERANCE		TCR/MATERIAL			PACKAGING					

PACKAGING TABLE			
SAP	DALE LEGACY	DESCRIPTION	TYPE
G1	R1	reel pack tape 80 mm, 1000 pieces	KKA4, KKA5
LA	B12	loose pack, 100 pieces	KKA9, KKA11, KKE17
LJ	B12	loose pack, 200 pieces	KKA4, KKA5, KKA7, KKE4, KKE7, KKE9, KKE11
LJ	B12	loose pack, 200 pieces	KKE7 SI, KKE9 SI
LX	B14	loose pack, without quantity	all
ZX	S51	special pack (BV #), without quantity	all
51	A1	Ammo pack tape 80 mm, 1000 pieces	KKA4, KKA5

DIMENSIONS in millimeters [inches]


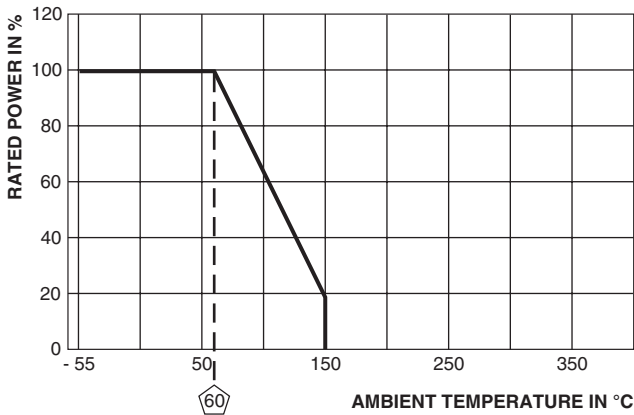
MODEL	DIMENSIONS in millimeters [inches]			WEIGHT (g)
	a	b	L	
KKA4	6.4 [0.256]	6.4 [0.256]	20 [0.787]	1.8
KKA5	6.4 [0.256]	6.4 [0.256]	25 [0.984]	5.5
KKA7	6.4 [0.256]	6.4 [0.256]	38 [1.496]	3.2
KKA9	9 [0.354]	9 [0.354]	38 [1.496]	7
KKA11	9 [0.354]	9 [0.354]	50 [1.969]	9
KKA17	9 [0.354]	9 [0.354]	75 [2.953]	13
KKE4	7 [0.276]	7.8 [0.307]	19.5 [0.768]	2
KKE7	9 [0.354]	10.5 [0.413]	25 [0.984]	4
KKE9	9 [0.354]	10.5 [0.413]	38 [1.496]	7.5
KKE11	9 [0.354]	10.5 [0.413]	50 [1.969]	9.5
KKE17	9 [0.354]	10.5 [0.413]	75 [2.953]	13.5

DIMENSIONS in millimeters [inches] (continued)

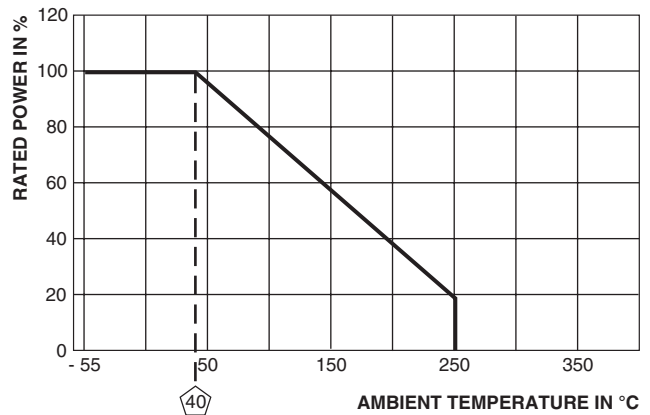


Profile dimensions

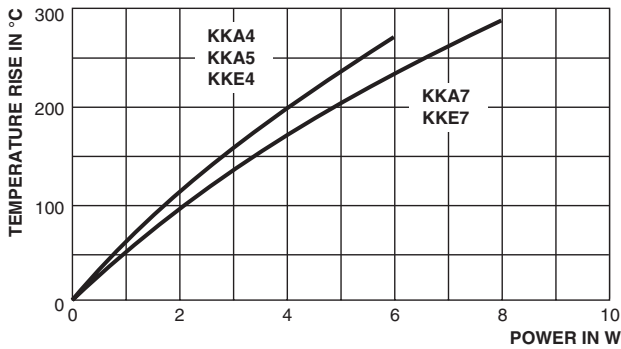
MODEL	DIMENSIONS in millimeters [inches]			
	a	b	L	WEIGHT (g)
KKE7 Si	9 [0.354]	10.5 [0.413]	25 [0.984]	5.5
KKE9 Si	9 [0.354]	10.5 [0.413]	38 [1.496]	8
KKE11 Si	9 [0.354]	10.5 [0.413]	50 [1.969]	9.8
KKE17 Si	9 [0.354]	10.5 [0.413]	75 [2.953]	13.7



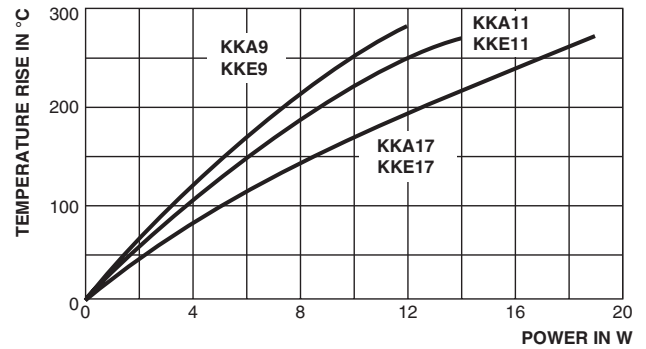
Derating KKA, KKE



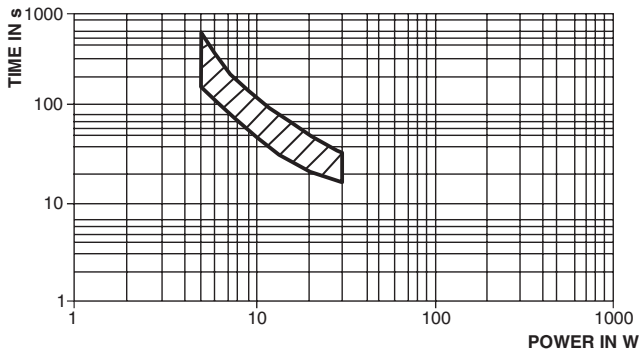
Derating KKE.. Si



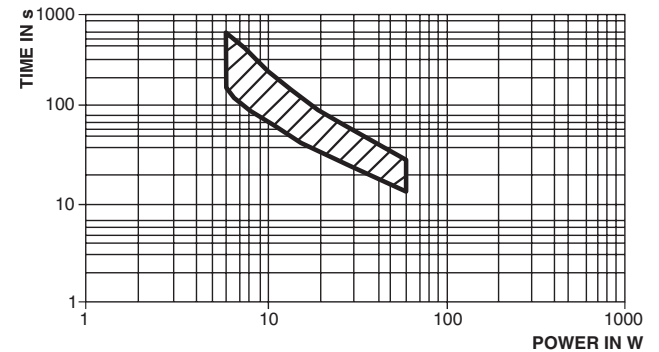
Temperature Rise



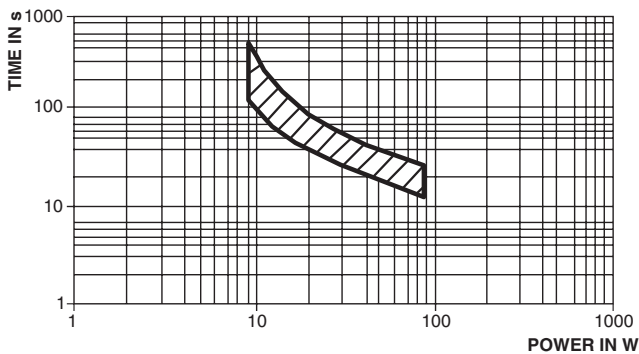
Temperature Rise



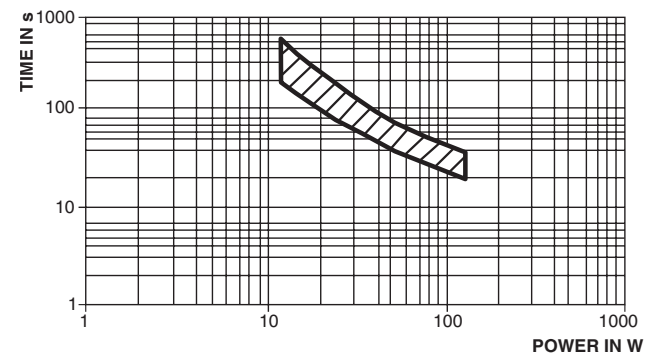
Fusing Characteristics KKE7 Si



Fusing Characteristics KKE9 Si



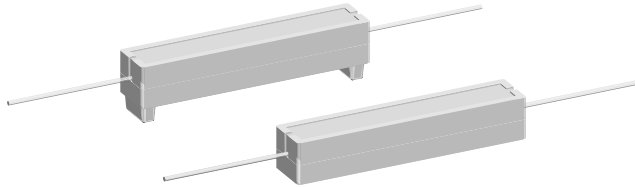
Fusing Characteristics KKE11 Si



Fusing Characteristics KKE17 Si

PERFORMANCE	
TEST	TEST RESULTS
Load Life (P_{70} , 70 °C, 1000 h)	$\leq \pm 3.0\% \Delta R$ average
Climatic Sequence	$\leq \pm 2.0\% \Delta R$
Damp Heat, Steady State (40 °C, 93 % r.h., 56 days)	$\leq \pm 2.0\% \Delta R$
Resistance to Solder Heat (260 °C, 10 s)	$\leq \pm 0.2\% \Delta R$ typical

Wirewound/Metal Oxide Resistors, Commercial Power, Axial Lead



FEATURES

- High performance for low cost
- Meets or exceeds requirements of EIA Standard RS-344
- High power to size ratio
- Ceramic cases are available with circuit board stand-offs (designated with a -3 model ending)
- Special inorganic potting compound and ceramic case provide high thermal conductivity in a fireproof package



RoHS*
COMPLIANT

STANDARD ELECTRICAL				
GLOBAL MODEL	POWER RATING $P_{40^\circ C}$ W	RESISTANCE RANGE (Ω) $\pm 10\%$ standard, $\pm 5\%$ available		WEIGHT (typical) g
		WIREWOUND (1)	METAL OXIDE (1)	
CP0002	2	0.1 - 1K	100 - 12K	2.0
CP0002...3	2	0.1 - 1K	100 - 12K	2.2
CP0003	3	0.1 - 2K	150 - 22K	3.4
CP0003...3	3	0.1 - 2K	150 - 22K	3.6
CP0005	5	0.1 - 2.4K	150 - 27K	4.8
CP0005...3	5	0.1 - 2.4K	150 - 27K	5.0
CP0007	7	0.1 - 5K	1K - 35K	6.8
CP0007...3	7	0.1 - 5K	1K - 35K	7.0
CP0010	10	0.1 - 7K	1K - 40K	9.5
CP0010...3	10	0.1 - 7K	1K - 40K	9.9
CP0015	15	0.1 - 8K	1K - 40K	16.8
CP0015...3	15	0.1 - 8K	1K - 40K	17.4
CP0020	20	0.1 - 10K	1K - 45K	22.8
CP0020...3	20	0.1 - 10K	-	23.6
CP0022	22	0.1 - 10K	-	24.5
CP0022...3	22	0.1 - 10K	-	25.3
CP0025	25	0.1 - 10K	-	37.0

Note

(1) To specifically order a Wirewound sub-assembly for resistance values that overlap between the Wirewound and Metal Oxide technologies, the model will be a CPxxx...85 for standard body and CPxxx...91 for body with stand-offs. To specifically order a Metal Oxide sub-assembly for resistance values that overlap between the Wirewound and Metal Oxide technologies, the model will be a CPxxx...100 for a standard body and CPxxx...101 for body with stand-offs. If no dash type is specified, either technology may be supplied.

TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	WIREWOUND CHARACTERISTICS
Temperature Coefficient	ppm/ $^\circ C$	± 600 below 1 Ω , ± 300 1 Ω and above
Short Time Overload	-	5 x rated power for 5 s
Terminal Strength	lb	10 minimum
Operating Temperature Range	$^\circ C$	- 65 to + 275
Dielectric Withstanding Voltage	V_{AC}	1000
Maximum Working Voltage	V	$(P \times R)^{1/2}$
PARAMETER	UNIT	METAL OXIDE CHARACTERISTICS
Temperature Coefficient	ppm/ $^\circ C$	± 300 for CP0002 to CP0005; ± 400 for CP0007 to CP0020
Short Time Overload	-	5 x rated power for 5 s
Terminal Strength	lb	10 minimum
Operating Temperature Range	$^\circ C$	- 65 to + 225
Dielectric Withstanding Voltage	V_{AC}	1000
Maximum Working Voltage	V	$(P \times R)^{1/2}$

Note

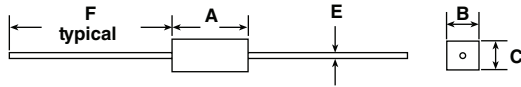
- Wirewound CP resistors can reliably function as a fuse and as a resistor. Such components involve compromise between fusing and resistive functions; therefore, each design should be tailored to the application to ensure optimum performance. Contact factory by using the e-mail address at the bottom of this page for design assistance.

GLOBAL PART NUMBER INFORMATION																	
New Global Part Numbering: CP000515R00JB143 (preferred part number format)																	
C	P	0	0	0	5	1	5	R	0	0	J	B	1	4	3		
GLOBAL MODEL (See Standard Electrical Specifications Global Model column for options)		VALUE R = Decimal K = Thousand R1500 = 0.15 Ω 1K500 = 1500 Ω		TOLERANCE H = $\pm 3.0\%$ J = $\pm 5.0\%$ K = $\pm 10.0\%$		PACKAGING E14 = Lead (Pb)-free bulk pack E31 = Lead (Pb)-free four layer bulk pack B14 = Bulk pack B31 = Four layer bulk pack			SPECIAL (Dash Number) (up to 3 digits) From 1 - 999 as applicable								
Historical Part Number Example: CP-5-3 15 Ω 5% B14 (will continue to be accepted)																	
CP-5-3		15 Ω		5%			B14										
HISTORICAL MODEL		RESISTANCE VALUE		TOLERANCE CODE			PACKAGING										

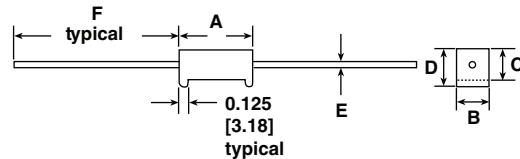
* Pb containing terminations are not RoHS compliant, exemptions may apply

DIMENSIONS in inches [millimeters]

CPxxxx



CPxxxx...3



GLOBAL MODEL	DIMENSIONS in inches [millimeters]							
	A ⁽¹⁾ ± 0.031 [0.794]	B ± 0.031 [0.794]	C ± 0.031 [0.794]	D ± 0.031 [0.794]	E ± 0.001 [0.025]		F	
					WIREWOUND	METAL OXIDE	± 0.125 [3.175]	METAL OXIDE MINIMUM
CP0002	0.688 [17.46]	0.250 [6.35]	0.250 [6.35]	-	0.032 [0.813]	0.0236 [0.600]	1.500 [38.10]	0.750 [19.05]
CP0002...3	0.688 [17.46]	0.250 [6.35]	0.250 [6.35]	0.313 [7.94]	0.032 [0.813]	0.0236 [0.600]	1.500 [38.10]	0.750 [19.05]
CP0003	0.875 [22.22]	0.313 [7.94]	0.313 [7.94]	-	0.036 [0.914]	0.032 [0.813]	1.500 [38.10]	1.000 [25.40]
CP0003...3	0.875 [22.22]	0.313 [7.94]	0.313 [7.94]	0.375 [9.52]	0.036 [0.914]	0.032 [0.813]	1.500 [38.10]	1.000 [25.40]
CP0005	0.875 [22.22]	0.375 [9.52]	0.344 [8.73]	-	0.036 [0.914]	0.032 [0.813]	1.500 [38.10]	1.000 [25.40]
CP0005...3	0.875 [22.22]	0.375 [9.52]	0.344 [8.73]	10.32 [0.406]	0.036 [0.914]	0.032 [0.813]	1.500 [38.10]	1.000 [25.40]
CP0007	1.391 [35.32]	0.375 [9.52]	0.344 [8.73]	-	0.036 [0.914]	0.032 [0.813]	1.500 [38.10]	1.000 [25.40]
CP0007...3	1.391 [35.32]	0.375 [9.52]	0.344 [8.73]	0.469 [11.91]	0.036 [0.914]	0.032 [0.813]	1.500 [38.10]	1.000 [25.40]
CP0010	1.875 [47.62]	0.375 [9.52]	0.344 [8.73]	-	0.036 [0.914]	0.032 [0.813]	1.500 [38.10]	1.000 [25.40]
CP0010...3	1.875 [47.62]	0.375 [9.52]	0.344 [8.73]	0.469 [11.91]	0.036 [0.914]	0.032 [0.813]	1.500 [38.10]	1.000 [25.40]
CP0015	1.875 [47.62]	0.500 [12.70]	0.500 [12.70]	-	0.036 [0.914]	0.032 [0.813]	1.500 [38.10]	1.000 [25.40]
CP0015...3	1.875 [47.62]	0.500 [12.70]	0.500 [12.70]	15.87 [0.625]	0.036 [0.914]	0.032 [0.813]	1.500 [38.10]	1.000 [25.40]
CP0020 ⁽²⁾	2.500 [63.50]	0.500 [12.70]	0.500 [12.70]	-	0.036 [0.914]	0.032 [0.813]	1.500 [38.10]	1.000 [25.40]
CP0020...3	2.500 [63.50]	0.500 [12.70]	0.500 [12.70]	0.625 [15.87]	0.036 [0.914]	-	1.500 [38.10]	-
CP0022	2.500 [63.50]	0.500 [12.70]	0.500 [12.70]	-	0.036 [0.914]	-	1.500 [38.10]	-
CP0022...3	2.500 [63.50]	0.500 [12.70]	0.500 [12.70]	0.625 [15.87]	0.036 [0.914]	-	1.500 [38.10]	-
CP0025	2.500 [63.50]	0.625 [15.87]	0.625 [15.87]	-	0.040 [1.016]	-	1.500 [38.10]	-

Notes

(1) Potting compound may extend outside of ceramic case up to 1.52 [0.060] maximum per side.

(2) Dimensions for the metal oxide are: A = 2.360 [59.94], B = 0.570 [14.48], C = 0.530 [13.46], E = 0.032 [0.813], F = 1.000 [25.40]

MATERIAL SPECIFICATIONS
Element: Wirewound = Copper-nickel alloy or nickel-chrome alloy, depending on resistance value

Metal Oxide = High temperature fired metal oxide film

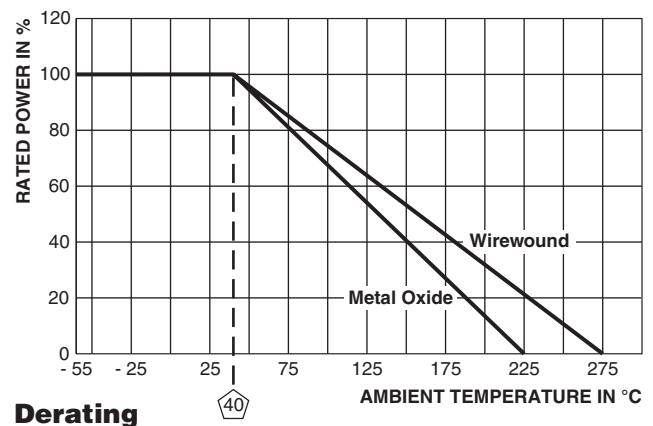
Core: Wirewound = Woven fiberglass

Metal Oxide = Alumina ceramic

Body: Steatite ceramic case with inorganic potting compound

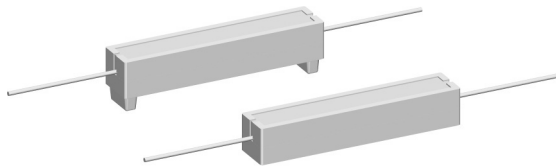
End Caps: Tin plated steel

Terminals: Tinned copper

Part Marking: DALE, model, wattage, value, tolerance, date code


PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS (EIA-344)
Thermal Shock	- 55 °C to + 275 °C (+ 225 °C for Metal Oxide), 5 cycles, 30 min dwell time	± (5.0 % + 0.05 Ω) ΔR
Short Time Overload	5 x rated power for 5 s	± (4.0 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	1000 V _{rms} , for 1 min	± (2.0 % + 0.05 Ω) ΔR
Low Temperature Storage	- 65 °C, full rated working voltage for 45 min	± (3.0 % + 0.05 Ω) ΔR
Humidity	75 °C, 90 % - 100 % RH, 240 h	± (5.0 % + 0.05 Ω) ΔR
Load Life	1000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"	± (10.0 % + 0.05 Ω) ΔR
Terminal Strength	5 pounds for 30 s; body twisted about axis, 3 x 360° rotations	± (2.0 % + 0.05 Ω) ΔR
Resistance to Solder Heat	Terminal immersed 3.5 s in molten solder at 1/8" to 3/16" from body	± (4.0 % + 0.05 Ω) ΔR

Wirewound/Metal Oxide Resistors, Commercial Power, Axial Lead



FEATURES

- High performance for low cost
- High power to size ratio
- Ceramic cases are available with circuit board stand-offs (designated with a ...3 model ending)
- Special cement potting compound and ceramic case provide high thermal conductivity in a fireproof package



RoHS
COMPLIANT

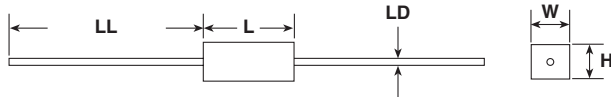
STANDARD ELECTRICAL SPECIFICATIONS				
GLOBAL MODEL	POWER RATING $P_{40^{\circ}\text{C}}$ W	RESISTANCE RANGE (Ω) $\pm 5\%$, $\pm 10\%$		WEIGHT (typical) g
		WIREWOUND	METAL OXIDE	
CP0002	2	0.1 - 82	83 - 30K	2.0
CP0003	3	0.1 - 180	181 - 33K	3.4
CP0005	5	0.1 - 180	181 - 50K	3.6
CP0005...3	5	0.1 - 180	181 - 50K	4.8
CP0007	7	0.1 - 430	431 - 50K	5.0
CP0007...3	7	0.1 - 430	431 - 50K	6.8
CP0010	10	0.1 - 470	471 - 50K	9.5
CP0010...3	10	0.1 - 470	471 - 50K	9.9
CP0015	15	0.5 - 600	601 - 50K	16.8
CP0020	20	0.5 - 1K	1.1K - 30K	22.8

TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	WIREWOUND CHARACTERISTICS
Temperature Coefficient	ppm/ $^{\circ}\text{C}$	± 400
Short Time Overload	-	5 x rated power for 5 s
Terminal Strength	lb	10 minimum
Operating Temperature Range	$^{\circ}\text{C}$	- 65/+ 275
Dielectric Withstanding Voltage	V_{AC}	1000
Maximum Working Voltage	V	$(P \times R)^{1/2}$
METAL OXIDE CHARACTERISTICS		
Temperature Coefficient	ppm/ $^{\circ}\text{C}$	± 400
Short Time Overload	-	5 x rated power for 5 s
Terminal Strength	lb	10 minimum
Operating Temperature Range	$^{\circ}\text{C}$	- 65 to + 275
Dielectric Withstanding Voltage	V_{AC}	1000
Maximum Working Voltage	V	$(P \times R)^{1/2}$

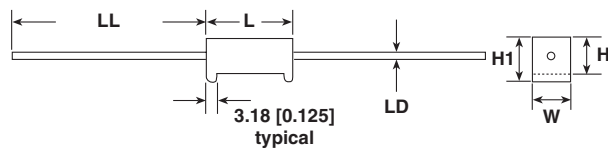
GLOBAL PART NUMBER INFORMATION																	
Global Part Numbering Example: CP000515R00JE663																	
C	P	0	0	0	5	1	5	R	0	0	J	E	6	6	3		
GLOBAL MODEL		VALUE		TOLERANCE		PACKAGING				SPECIAL							
(See Standard Electrical Specifications Global Model column for options)		R = Decimal K = Thousand R1500 = 0.15 Ω 1K500 = 1500 Ω		J = $\pm 5.0\%$ K = $\pm 10.0\%$		E66 = Lead (Pb)-free, bulk				(Dash Number) (up to 3 digits) From 1 - 999 as applicable							

DIMENSIONS in inches [millimeters]

CPxxxx



CPxxxx...3



GLOBAL MODEL	DIMENSIONS in inches [millimeters]					
	L ⁽¹⁾ ± 0.060 [1.5]	W ± 0.040 [1.0]	H ± 0.040 [1.0]	H1 ± 0.060 [1.5]	LD ± 0.002 [0.05]	LL ± 0.120 [3.0]
CP0002	0.71 [18]	0.276 [7]	0.276 [7]	-	0.0256 [0.65]	1.378 [35]
CP0003	0.87 [22]	0.315 [8]	0.315 [8]	-	0.031 [0.8]	1.378 [35]
CP0005	0.87 [22]	0.394 [10]	0.354 [9]	-	0.031 [0.8]	1.378 [35]
CP0005...3	0.87 [22]	0.394 [10]	0.354 [9]	0.413 [10.5]	0.031 [0.8]	1.378 [35]
CP0007	1.38 [35]	0.394 [10]	0.354 [9]	-	0.031 [0.8]	1.378 [35]
CP0007...3	1.38 [35]	0.394 [10]	0.354 [9]	0.472 [12]	0.031 [0.8]	1.378 [35]
CP0010	1.89 [48]	0.394 [10]	0.354 [9]	-	0.031 [0.8]	1.378 [35]
CP0010...3	1.89 [48]	0.394 [10]	0.354 [9]	0.472 [12]	0.031 [0.8]	1.378 [35]
CP0015	1.89 [48]	0.492 [12.5]	0.453 [11.5]	-	0.031 [0.8]	1.378 [35]
CP0020	2.36 [60]	0.551 [14]	0.531 [13.5]	-	0.031 [0.8]	1.378 [35]

Note

(1) Potting compound may extend outside of ceramic case up to 0.060 [1.52] maximum per side.

MATERIAL SPECIFICATIONS

Element: Wirewound = Copper-nickel alloy or nickel-chrome alloy, depending on resistance value
Metal Oxide = High temperature fired Metal Oxide film

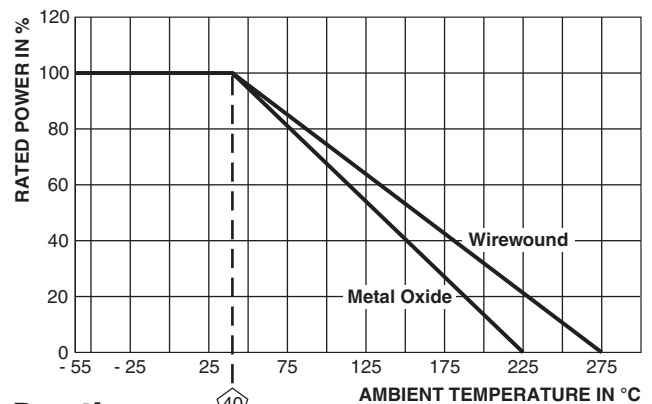
Core: Wirewound = Woven fiberglass
Metal Oxide = Ceramic

Body: Steatite ceramic case with cement potting compound

End Caps: Tin plated steel

Terminals: Tinned copper

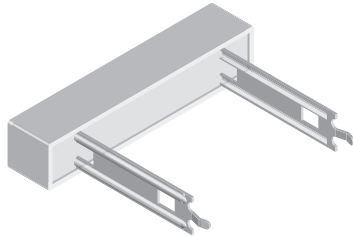
Part Marking: DALE, model, wattage, value, tolerance, date code



Derating

PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS
Thermal Shock	- 55 °C to + 275 °C (+ 225 °C for Metal Oxide), 5 cycles, 30 min dwell time	± (5.0 % + 0.05 Ω) ΔR
Short Time Overload	5 x rated power for 5 s	± (4.0 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	1000 V _{rms} for 1 min	± (2.0 % + 0.05 Ω) ΔR
Low Temperature Operation	- 65 °C, full rated working voltage for 45 min	± (3.0 % + 0.05 Ω) ΔR
Humidity	75 °C, 90 % - 100 % RH, 240 h	± (5.0 % + 0.05 Ω) ΔR
Load Life	1000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"	± (10.0 % + 0.05 Ω) ΔR
Terminal Strength	5 pounds for 30 s; body twisted about axis, 3 x 360° rotations	± (2.0 % + 0.05 Ω) ΔR
Resistance to Solder Heat	Terminal immersed 3.5 s in molten solder at 1/8" to 3/16" from body	± (4.0 % + 0.05 Ω) ΔR

Wirewound Resistors, Commercial Power, Radial Terminals



FEATURES

- Direct mounting on printed circuit board
- Circuit board lock-in mounting tabs
- High performance for low cost
- Meets or exceeds requirements of EIA Standard RS-344
- Special inorganic potting compound and ceramic case provide high thermal conductivity in a fireproof package



RoHS* COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS

GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{40^\circ\text{C}}$ W	RESISTANCE RANGE Ω $\pm 5\%, \pm 10\%$	WEIGHT (typical) g
CPR03	CPR-3	3	0.1 - 1K	5.6
CPR05	CPR-5	5	0.1 - 1K	6.6
CPR07	CPR-7	7	0.1 - 1.429K	9.4
CPR10	CPR-10	10	0.1 - 2K	10.0
CPR15	CPR-15	15	0.1 - 2K	20.3
CPR20	CPR-20	20	0.15 - 2.855K	25.6

TECHNICAL SPECIFICATIONS

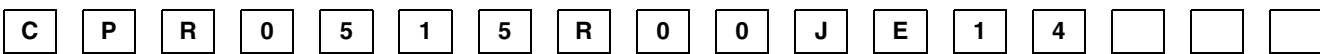
PARAMETER	UNIT	CPR RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/ $^\circ\text{C}$	± 600 below 1.0 Ω , ± 300 1.0 Ω and above
Short Time Overload	-	5 x rated power for 5 s
Terminal Strength	lb	10 minimum
Dielectric Withstanding Voltage	V_{AC}	1000
Maximum Working Voltage	V	$(P \times R)^{1/2}$
Operating Temperature Range	$^\circ\text{C}$	- 65 to + 275

Note

- Wirewound CPR resistors can reliably function as a fuse and as a resistor. Such components involve compromise between fusing and resistive functions; therefore, each design should be tailored to the application to ensure optimum performance. Contact factory by using the e-mail address at the bottom of this page for design assistance.

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: CPR0515R00JE14 (preferred part number format)

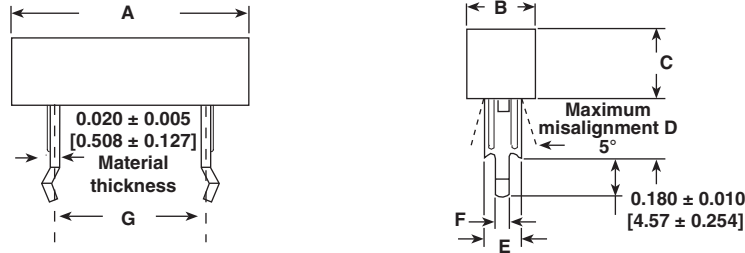


GLOBAL MODEL	VALUE	TOLERANCE	PACKAGING	SPECIAL
CPR03 CPR05 CPR07 CPR10 CPR15 CPR20	R = Decimal K = Thousand R1500 = 0.15 Ω 1K500 = 1500 Ω	H = $\pm 3.0\%$ J = $\pm 5.0\%$ K = $\pm 10.0\%$	E14 = Lead (Pb)-free bulk E31 = Lead (Pb)-free four layer bulk E10 = Lead (Pb)-free foam pack B14 = Tin/lead bulk B31 = Tin/lead four layer bulk F10 = Tin/lead foam pack	(Dash Number) (up to 3 digits) From 1 - 999 as applicable

Historical Part Number Example: CPR-5 15 Ω 5% B14 (will continue to be accepted)



* Pb containing terminations are not RoHS compliant, exemptions may apply

DIMENSIONS in inches [millimeters]


GLOBAL MODEL	DIMENSIONS in inches [millimeters]						
	A ± 0.040 [1.02]	B ± 0.031 [0.787]	C ± 0.031 [0.787]	D + 0.080 [2.03] - 0.040 [1.02]	E ± 0.012 [0.305]	F ± 0.008 [0.203]	G ± 0.060 [1.52]
CPR03	0.906 [23.01]	0.375 [9.53]	0.375 [9.53]	0.394 [10.01]	0.287 [7.29]	0.055 [1.40]	0.500 [12.70]
CPR05	1.060 [26.92]	0.375 [9.53]	0.360 [9.14]	0.394 [10.01]	0.287 [7.29]	0.055 [1.40]	0.590 [14.99]
CPR07	1.398 [35.51]	0.375 [9.53]	0.360 [9.14]	0.984 [24.99]	0.287 [7.29]	0.055 [1.40]	0.886 [22.50]
CPR10	1.888 [47.96]	0.375 [9.53]	0.360 [9.14]	0.984 [24.99]	0.287 [7.29]	0.055 [1.40]	1.380 [35.05]
CPR15	1.888 [47.96]	0.500 [12.70]	0.500 [12.70]	1.180 [29.97]	0.394 [10.01]	0.106 [2.69]	1.280 [32.51]
CPR20	2.498 [63.45]	0.500 [12.70]	0.500 [12.70]	1.180 [29.97]	0.394 [10.01]	0.106 [2.69]	1.870 [47.50]

MATERIAL SPECIFICATIONS

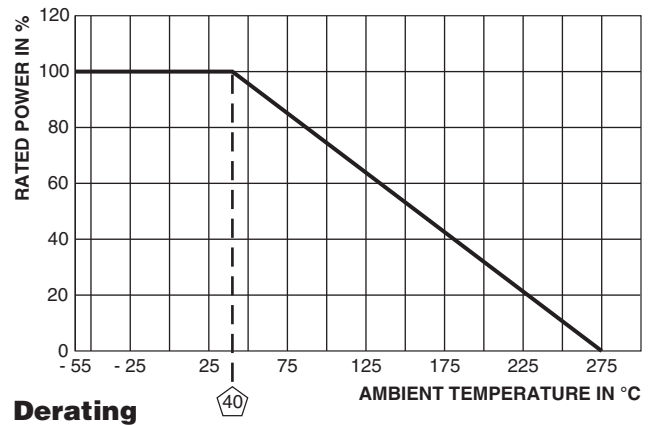
Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value

Core: Woven fiberglass

Body: Steatite ceramic case with inorganic potting compound

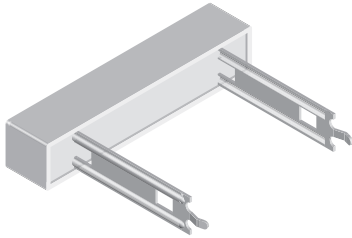
Terminals: Tin/lead plated CRS (Lead (Pb)-free will be 100 % tin)

Part Marking: DALE, model, wattage, value, tolerance, date code



PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS (EIA RS-344)
Thermal Shock	- 55 °C to + 275 °C, 5 cycles, 30 min dwell time	± (5.0 % + 0.05 Ω) ΔR
Short Time Overload	5 x rated power for 5 s	± (4.0 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	1000 V _{rms} for 1 min	± (2.0 % + 0.05 Ω) ΔR
Low Temperature Operation	- 65 °C, full rated working voltage for 45 min	± (3.0 % + 0.05 Ω) ΔR
Humidity	75 °C, 90 % - 100 % RH, 240 h	± (5.0 % + 0.05 Ω) ΔR
Load Life	1000 h at rated power, + 40 °C, 1.5 h "ON", 0.5 h "OFF"	± (10.0 % + 0.05 Ω) ΔR
Terminal Strength	10 pounds in axial direction for 30 s	± (2.0 % + 0.05 Ω) ΔR
Resistance to Solder Heat	Terminal immersed 3.5 s in molten solder at 1/8" to 3/16" from body	± (4.0 % + 0.05 Ω) ΔR

Wirewound/Metal Oxide Resistors, Commercial Power, Radial Terminals



FEATURES

- Direct mounting on printed circuit board
- Circuit board lock-in mounting tabs
- High performance for low cost
- Special inorganic potting compound and ceramic case provide high thermal conductivity in a fireproof package



RoHS
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS				
GLOBAL MODEL (1)	POWER RATING $P_{40^{\circ}\text{C}}$ W	RESISTANCE RANGE Ω $\pm 5\%, \pm 10\%$		WEIGHT (typical) g
		WIREWOUND	METAL OXIDE	
CPR03...xx	3	0.1 - 100	110 - 33K	5.5
CPR05...xx	5	0.1 - 100	110 - 33K	6.5
CPR07...xx	7	0.5 - 220	240 - 10K	9.5
CPR10...xx	10	0.5 - 220	240 - 10K	10.0
CPR15...xx	15	1.0 - 270	300 - 10K	20.3
CPR20...xx	20	1.0 - 270	300 - 10K	25.5

Notes

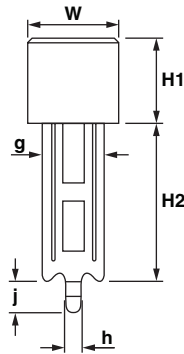
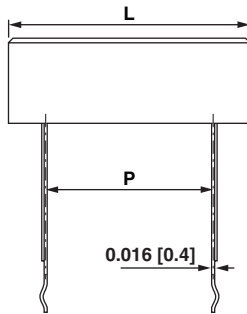
(1) The xx is for the two digit "special" number as specified in Global Part Number Information section. Standard part number without the two digit "special" is 10 mm, 1 pin.

TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	CPR HIGH VOLUME CHARACTERISTICS
Temperature Coefficient	ppm/ $^{\circ}\text{C}$	± 400
Short Time Overload	-	5 x rated power for 5 s
Maximum Working Voltage	V	$(P \times R)^{1/2}$
Terminal Strength	lb	10 minimum
Operating Temperature Range	$^{\circ}\text{C}$	- 65 to + 275 for Wirewound, - 65 to + 225 for Metal Oxide

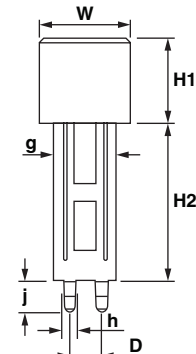
GLOBAL PART NUMBER INFORMATION																
Global Part Numbering Example: CPR05100R0JE6630																
C	P	R	0	5	1	0	0	R	0	J	E	6	6	3	0	
GLOBAL MODEL			VALUE			TOLERANCE		PACKAGING			SPECIAL					
CPR03 CPR05 CPR07 CPR10 CPR15 CPR20			R = Decimal K = Thousand R1500 = 0.15 Ω 1K500 = 1500 Ω			J = $\pm 5.0\%$ K = $\pm 10.0\%$		E66 = Lead (Pb)-free, bulk			Blank = 10 mm, 1 pin CPRxx...30 = 25 mm, 1 pin CPRxx...31 = 12 mm, 2 pin CPRxx...32 = 25 mm, 2 pin					



DIMENSIONS in inches [millimeters]



Terminal style 1 (Single Pin)



Terminal style 2 (Double Pin)

GLOBAL MODEL	TERMINAL STYLE	DIMENSIONS in inches [millimeters]								
		L ± 0.059 [1.5]	W ± 0.039 [1.0]	H1 ± 0.039 [1.0]	H2 ± 0.039 [1.0]	D ± 0.005 [0.13]	P ± 0.059 [1.5]	g ± 0.008 [0.2]	h ± 0.008 [0.2]	j ± 0.039 [1.0]
CPR03	1	0.944 [24]	0.354 [9.0]	0.354 [9.0]	0.413 [10.5]	-	0.492 [12.5]	0.197 [5.0]	0.059 [1.5]	0.193 [4.9]
CPR03...30	1	0.944 [24]	0.354 [9.0]	0.354 [9.0]	0.984 [25.0]	-	0.492 [12.5]	0.197 [5.0]	0.059 [1.5]	0.193 [4.9]
CPR03...31	2	0.944 [24]	0.354 [9.0]	0.354 [9.0]	0.472 [12.0]	0.197 [5.0]	0.492 [12.5]	0.287 [7.3]	0.059 [1.5]	0.193 [4.9]
CPR03...32	2	0.944 [24]	0.354 [9.0]	0.354 [9.0]	0.984 [25.0]	0.197 [5.0]	0.492 [12.5]	0.287 [7.3]	0.059 [1.5]	0.193 [4.9]
CPR05	1	1.10 [28]	0.394 [10.0]	0.394 [10.0]	0.413 [10.5]	-	0.590 [15.0]	0.197 [5.0]	0.059 [1.5]	0.193 [4.9]
CPR05...30	1	1.10 [28]	0.394 [10.0]	0.394 [10.0]	0.984 [25.0]	-	0.590 [15.0]	0.287 [7.3]	0.059 [1.5]	0.193 [4.9]
CPR05...31	2	1.10 [28]	0.394 [10.0]	0.394 [10.0]	0.472 [12.0]	0.197 [5.0]	0.590 [15.0]	0.287 [7.3]	0.059 [1.5]	0.193 [4.9]
CPR05...32	2	1.10 [28]	0.394 [10.0]	0.394 [10.0]	0.984 [25.0]	0.197 [5.0]	0.590 [15.0]	0.287 [7.3]	0.059 [1.5]	0.193 [4.9]
CPR07	1	1.42 [36]	0.394 [10.0]	0.394 [10.0]	0.413 [10.5]	-	0.787 [20.0]	0.197 [5.0]	0.059 [1.5]	0.193 [4.9]
CPR07...30	1	1.42 [36]	0.394 [10.0]	0.394 [10.0]	0.984 [25.0]	-	0.787 [20.0]	0.287 [7.3]	0.059 [1.5]	0.193 [4.9]
CPR07...31	2	1.42 [36]	0.394 [10.0]	0.394 [10.0]	0.472 [12.0]	0.197 [5.0]	0.787 [20.0]	0.287 [7.3]	0.059 [1.5]	0.193 [4.9]
CPR07...32	2	1.42 [36]	0.394 [10.0]	0.394 [10.0]	0.984 [25.0]	0.197 [5.0]	0.787 [20.0]	0.287 [7.3]	0.059 [1.5]	0.193 [4.9]
CPR10	1	1.89 [48]	0.394 [10.0]	0.394 [10.0]	0.413 [10.5]	-	1.26 [32.0]	0.197 [5.0]	0.059 [1.5]	0.193 [4.9]
CPR10...30	1	1.89 [48]	0.394 [10.0]	0.394 [10.0]	0.984 [25.0]	-	1.26 [32.0]	0.287 [7.3]	0.059 [1.5]	0.193 [4.9]
CPR10...31	2	1.89 [48]	0.394 [10.0]	0.394 [10.0]	0.472 [12.0]	0.197 [5.0]	1.26 [32.0]	0.287 [7.3]	0.059 [1.5]	0.193 [4.9]
CPR10...32	2	1.89 [48]	0.394 [10.0]	0.394 [10.0]	0.984 [25.0]	0.197 [5.0]	1.26 [32.0]	0.287 [7.3]	0.059 [1.5]	0.193 [4.9]
CPR15	1	1.89 [48]	0.492 [12.5]	0.472 [12.0]	0.413 [10.5]	-	1.26 [32.0]	0.197 [5.0]	0.059 [1.5]	0.193 [4.9]
CPR15...30	1	1.89 [48]	0.492 [12.5]	0.472 [12.0]	0.984 [25.0]	-	1.26 [32.0]	0.287 [7.3]	0.059 [1.5]	0.199 [5.1]
CPR15...31	2	1.89 [48]	0.492 [12.5]	0.472 [12.0]	1.18 [30.0]	0.197 [5.0]	1.26 [32.0]	0.394 [10.0]	0.069 [1.75]	0.199 [5.1]
CPR15...32	2	1.89 [48]	0.492 [12.5]	0.472 [12.0]	1.18 [30.0]	0.197 [5.0]	1.26 [32.0]	0.394 [10.0]	0.069 [1.75]	0.199 [5.1]
CPR20	1	2.36 [60]	0.591 [15.0]	0.512 [13.0]	0.591 [15.0]	-	1.65 [42.0]	0.394 [10.0]	0.106 [2.7]	0.193 [4.9]
CPR20...30	1	2.36 [60]	0.591 [15.0]	0.512 [13.0]	0.984 [25.0]	-	1.65 [42.0]	0.394 [10.0]	0.106 [2.7]	0.193 [4.9]
CPR20...31	2	2.36 [60]	0.591 [15.0]	0.512 [13.0]	1.18 [30.0]	0.197 [5.0]	1.65 [42.0]	0.394 [10.0]	0.069 [1.75]	0.199 [5.1]
CPR20...32	2	2.36 [60]	0.591 [15.0]	0.512 [13.0]	1.18 [30.0]	0.197 [5.0]	1.65 [42.0]	0.394 [10.0]	0.069 [1.75]	0.199 [5.1]

MATERIAL SPECIFICATIONS

Element:

Wirewound = Copper-nickel alloy or nickel-chrome alloy, depending on resistance value

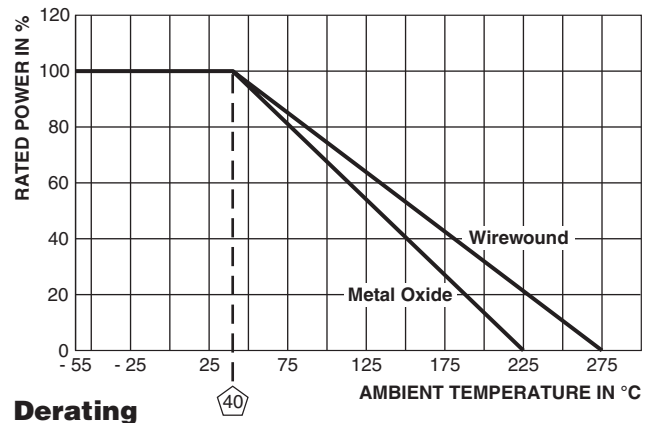
Metal Oxide = High temperature fired Metal Oxide film

Core: Ceramic

Body: Steatite ceramic case with cement potting compound

Terminals: Tin plated steel

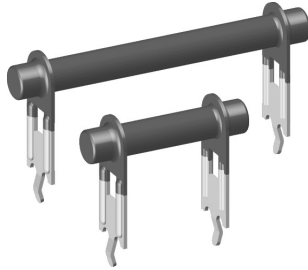
Part Marking: DALE, model, wattage, value, tolerance, date code



PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS
Thermal Shock	- 55 °C to + 275 °C (+ 225 °C for Metal Oxide), 5 cycles, 30 min dwell time	± (5.0 % + 0.05 Ω) ΔR
Short Time Overload	5 x rated power for 5 s	± (4.0 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	1000 V _{rms} for 1 min	± (2.0 % + 0.05 Ω) ΔR
Low Temperature Operation	- 65 °C, full rated working voltage for 45 min	± (3.0 % + 0.05 Ω) ΔR
Humidity	75 °C, 90 % - 100 % RH, 240 h	± (5.0 % + 0.05 Ω) ΔR
Load Life	1000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"	± (10.0 % + 0.05 Ω) ΔR
Terminal Strength	5 pounds for 30 s; body twisted about axis, 3 x 360° rotations	± (2.0 % + 0.05 Ω) ΔR
Resistance to Solder Heat	Terminal immersed 3.5 s in molten solder at 1/8" to 3/16" from body	± (4.0 % + 0.05 Ω) ΔR



Wirewound Resistors, Commercial Power, Radial Terminals



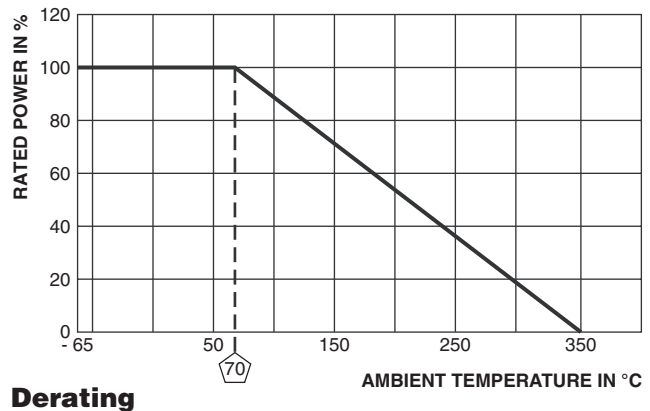
FEATURES

- Direct mounting on printed circuit board
- Circuit board lock-in mounting tabs
- High performance for low cost



RoHS*
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS			
GLOBAL MODEL	POWER RATING $P_{70^\circ\text{C}}$ W	RESISTANCE RANGE Ω	
		$\pm 5\%, \pm 10\%$	
		TCR $\pm 600 \text{ ppm}/^\circ\text{C}$	TCR $\pm 300 \text{ ppm}/^\circ\text{C}$
CPS04	4	R10 - R99	1R0 - 1K0
CPS05	5	R10 - R99	1R0 - 2K0
CPS07	6.5	R10 - R99	1R0 - 2K7



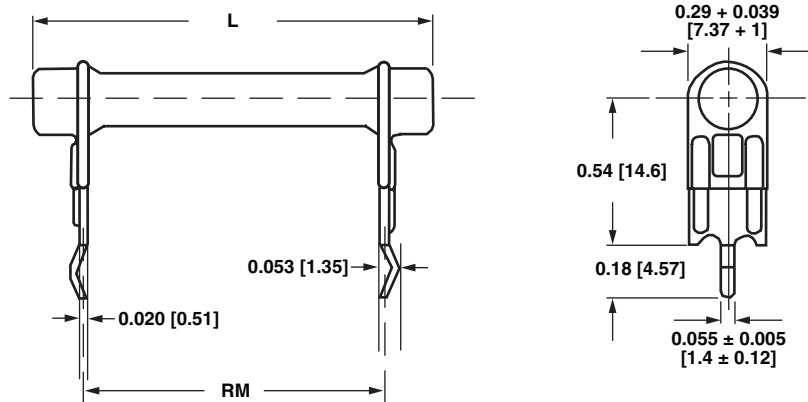
TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	CPS CHARACTERISTICS
Operating Temperature Range	$^\circ\text{C}$	- 65 to + 350
Short Time Overload	-	5 x rated power for 5 s
Terminal Strength	lb	10 minimum
Maximum Working Voltage	V	$(P \times R)^{1/2}$

PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS
Load Life	1000 h at rated power, 1.5 h "ON", 0.5 h "OFF"	$\pm 3.0\% \Delta R$ average
Climatic Sequence	1000 cycles, - 55 $^\circ\text{C}$ to + 125 $^\circ\text{C}$	$\pm 2.0\% \Delta R$
Damp Heat, Steady State	+ 40 $^\circ\text{C}$, 93 % RH, 56 days	$\pm 2.0\% \Delta R$
Resistance to Solder Heat	+ 260 $^\circ\text{C}$, 10 s	$\pm 0.2\% \Delta R$ typical
Low Temperature Operation	- 65 $^\circ\text{C}$, full rated working voltage for 45 min	$\pm 3.0\% \Delta R$

GLOBAL PART NUMBER INFORMATION																	
Global Part Numbering Example: CPS05P100R0KE14																	
C	P	S	0	5	P	1	0	0	R	0	K	E	1	4			
GLOBAL MODEL	TERMINAL	VALUE	TOLERANCE	PACKAGING	SPECIAL												
CPS04 CPS05 CPS07	P = /2	R = Decimal K = Thousand R1500 = 0.15 Ω 1K000 = 1000 Ω	J = $\pm 5.0\%$ K = $\pm 10.0\%$	E14 = Lead (Pb)-free bulk E31 = Lead (Pb)-free four layer bulk B14 = Tin/lead bulk B31 = Tin/lead four layer bulk	(Dash Number) (up to 3 digits) From 1 - 999 as applicable												

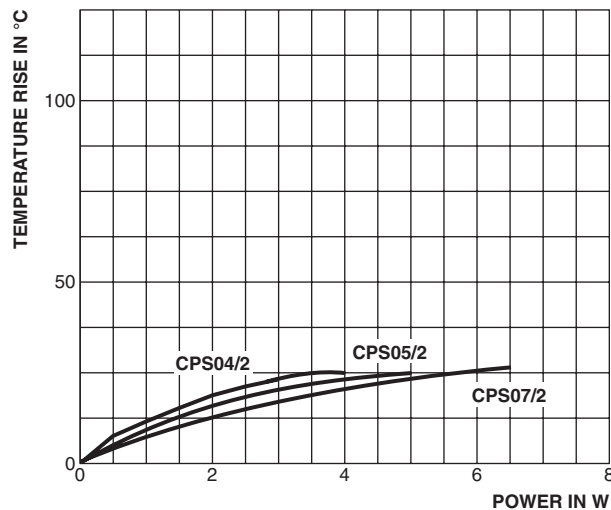
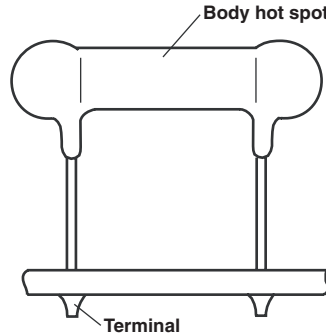
* Pb containing terminations are not RoHS compliant, exemptions may apply

DIMENSIONS in inches [millimeters]

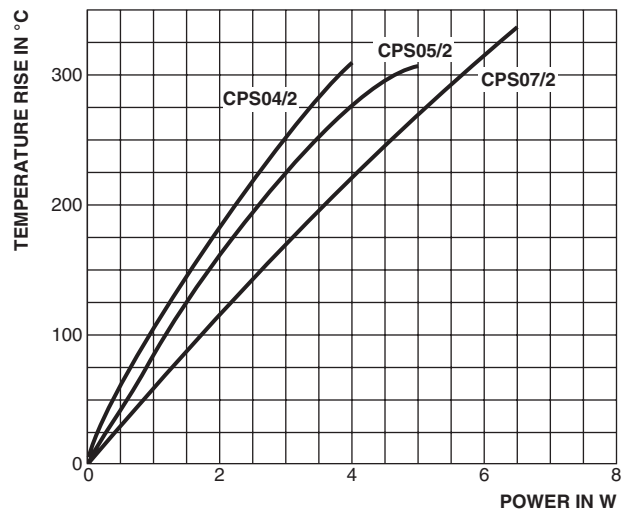


MODEL	DIMENSIONS in inches [millimeters]	
	L	RM
CPS04	0.945 ± 0.055 [24 ± 1.4]	0.598 [15.2]
CPS05	1.350 ± 0.055 [34.3 ± 1.4]	1.000 [25.4]
CPS07	1.752 ± 0.055 [44.5 ± 1.4]	1.398 [35.5]

SURFACE TEMPERATURE

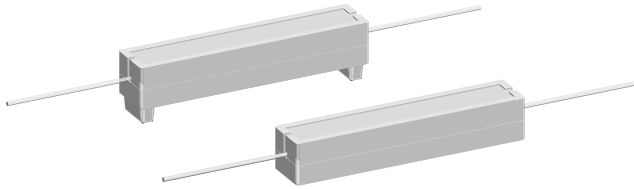


CPS Terminal Temperature



CPS Body Hot Spot Temperature Rise

Wirewound Resistors, Commercial Power, Axial Lead, Low Value



FEATURES

- High power to size ratio
- Low inductance
- Ceramic cases are available with circuit board stand-offs (designated with a -3 model ending)
- Superior surge capability
- Extremely low resistance values
- Complete welded construction
- Special inorganic potting compound and ceramic case provide high thermal conductivity in a fireproof package



RoHS*
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS				
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{40^{\circ}\text{C}}$ W	RESISTANCE RANGE ⁽¹⁾ Ω $\pm 5\%$ standard ⁽²⁾	WEIGHT (typical) g
CPL03	CPL-3	3	0.01 - 0.10	3.4
CPL03...3	CPL-3-3	3	0.01 - 0.10	3.6
CPL05	CPL-5	5	0.01 - 0.10	4.8
CPL05...3	CPL-5-3	5	0.01 - 0.10	5.0
CPL07	CPL-7	7	0.01 - 0.10	6.8
CPL07...3	CPL-7-3	7	0.01 - 0.10	7.0
CPL10	CPL-10	10	0.01 - 0.10	9.5
CPL10...3	CPL-10-3	10	0.01 - 0.10	9.9
CPL15	CPL-15	15	0.01 - 0.10	16.8
CPL15...3	CPL-15-3	15	0.01 - 0.10	17.4

Notes

- ⁽¹⁾ Resistance is measured 3/8" [9.52 mm] from resistor body.
⁽²⁾ $\pm 1\%$ and $\pm 3\%$ available

TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	CPL RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/ $^{\circ}\text{C}$	± 300
Short Time Overload	-	5 x rated power for 5 s
Maximum Working Voltage	V	$(P \times R)^{1/2}$
Operating Temperature Range	$^{\circ}\text{C}$	- 65 to + 275
Terminal Strength	lb	10 minimum
Dielectric Withstanding Voltage	V_{AC}	1000

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: CPL05R0500J B14 3

C	P	L	0	5	R	0	5	0	0	J	B	1	4	3		
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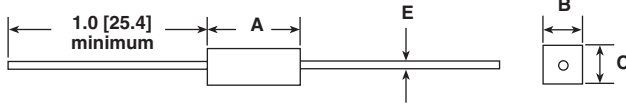
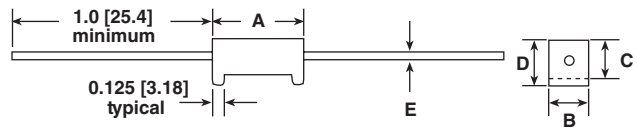
GLOBAL MODEL CPL03 CPL05 CPL07 CPL10 CPL05	VALUE R = Decimal R1000 = 0.10 Ω	TOLERANCE F = $\pm 1.0\%$ G = $\pm 2.0\%$ H = $\pm 3.0\%$ J = $\pm 5.0\%$ K = $\pm 10.0\%$	PACKAGING E14 = Lead (Pb)-free bulk E31 = Lead (Pb)-free four layer bulk E01 = Lead (Pb)-free skin pack B14 = Tin/lead bulk B31 = Tin/lead four layer bulk J01 = Tin/lead skin pack	SPECIAL (Dash Number) (up to 3 digits) From 1 - 999 as applicable
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Historical Part Number Example: CPL-5-3 0.05 Ω 5% B14 (will continue to be accepted)

CPL-5-3	0.05 Ω	5%	B14
HISTORICAL MODEL	RESISTANCE VALUE	TOLERANCE CODE	PACKAGING

* Pb containing terminations are not RoHS compliant, exemptions may apply

DIMENSIONS in inches [millimeters]

CPLxx

CPLxx...3


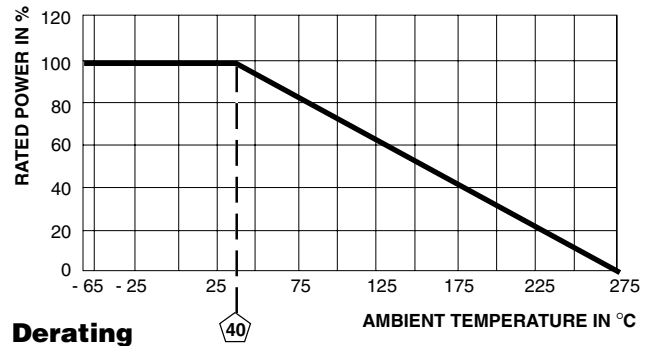
GLOBAL MODEL	DIMENSIONS in inches [millimeters]				
	A ⁽¹⁾ ± 0.031 [0.794]	B ± 0.031 [0.794]	C ± 0.031 [0.794]	C ± 0.031 [0.794]	E ± 0.001 [0.025]
CPL03	0.875 [22.22]	0.313 [7.94]	0.313 [7.94]	-	0.032 [0.813]
CPL03...3	0.875 [22.22]	0.313 [7.94]	0.313 [7.94]	0.375 [9.52]	0.032 [0.813]
CPL05	0.875 [22.22]	0.375 [9.52]	0.344 [8.73]	-	0.032 [0.813]
CPL05...3	0.875 [22.22]	0.375 [9.52]	0.344 [8.73]	0.406 [10.32]	0.032 [0.813]
CPL07	1.391 [35.32]	0.375 [9.52]	0.344 [8.73]	-	0.032 [0.813]
CPL07...3	1.391 [35.32]	0.375 [9.52]	0.344 [8.73]	0.469 [11.91]	0.032 [0.813]
CPL10	1.875 [47.62]	0.375 [9.52]	0.344 [8.73]	-	0.032 [0.813]
CPL10...3	1.875 [47.62]	0.375 [9.52]	0.344 [8.73]	0.469 [11.91]	0.032 [0.813]
CPL15	1.875 [47.62]	0.500 [12.70]	0.500 [12.70]	-	0.032 [0.813]
CPL15...3	1.875 [47.62]	0.500 [12.70]	0.500 [12.70]	0.625 [15.87]	0.032 [0.813]

Note
⁽¹⁾ Potting compound may extend outside of ceramic case up to 0.060 [1.52] maximum per side.

MATERIAL SPECIFICATIONS
Element: Self-supporting copper-nickel alloy or nickel-chrome alloy, depending on resistance range

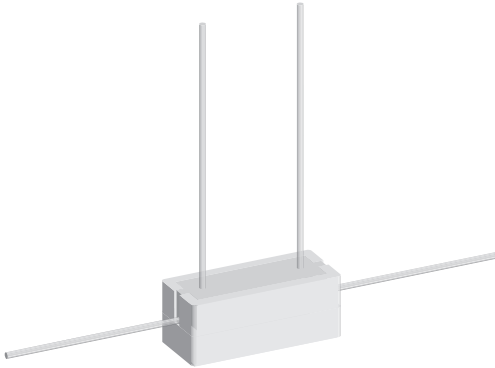
Body: Steatite ceramic case with inorganic potting compound

Terminals: Tinned copper

Part Marking: DALE, model, wattage, value, tolerance, date code


PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS (EIA RS-344)
Thermal Shock	- 55 °C to + 275 °C, 5 cycles, 30 min dwell time	± (5.0 % + 0.05 Ω) ΔR
Short Time Overload	5 x rated power for 5 s	± (4.0 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	1000 V _{rms} for 1 min	± (2.0 % + 0.05 Ω) ΔR
Low Temperature Operation	- 65 °C, full rated working voltage for 45 min	± (3.0 % + 0.05 Ω) ΔR
Bias Humidity	75 °C, 90 % - 100 % RH, 240 h	± (5.0 % + 0.05 Ω) ΔR
Load Life	1000 h at rated power, + 40 °C, 1.5 h "ON", 0.5 h "OFF"	± (5.0 % + 0.05 Ω) ΔR
Terminal Strength	5 to 10 s 10 pound pull test, torsion test - 3 alternating directions, 360° each	± (1.0 % + 0.05 Ω) ΔR
Resistance to Solder Heat	Terminal immersed 3.5 s in molten solder at 1/8" to 3/16" from body	± (1.0 % + 0.05 Ω) ΔR

Wirewound Resistors, Commercial Power, Four Terminal, Low Value



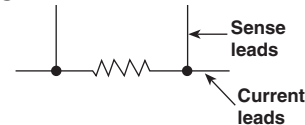
FEATURES

- Low inductance
- Extremely low resistance values
- Current sensing
- Low temperature coefficients
- High power to size ratio
- Ceramic cases are available with circuit board stand-offs (designated with a -3 model ending)
- Superior surge capability
- Complete welded construction
- Special inorganic potting compound and ceramic case provide high thermal conductivity in a fireproof package



RoHS*
COMPLIANT

SCHEMATIC



STANDARD ELECTRICAL SPECIFICATIONS

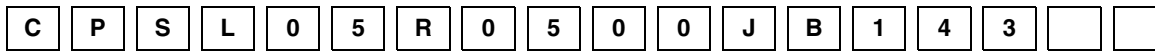
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{40\text{ }^\circ\text{C}}$ W	RESISTANCE RANGE Ω $\pm 5\%$ standard, $\pm 3\%$ available	WEIGHT (typical) g
CPSL03...5	CPSL-3-5	3	0.01 to 0.10	4.0
CPSL03...3	CPSL-3-3	3	0.01 to 0.10	4.2
CPSL05...5	CPSL-5-5	5	0.01 to 0.10	5.2
CPSL05...3	CPSL-5-3	5	0.01 to 0.10	5.4
CPSL07...5	CPSL-7-5	7	0.01 to 0.10	7.6
CPSL10...5	CPSL-10-5	10	0.01 to 0.10	10.2
CPSL15...5	CPSL-15-5	15	0.01 to 0.10	18.9

TECHNICAL SPECIFICATIONS

PARAMETER	UNIT	CPSL RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/ $^\circ\text{C}$	± 100 maximum
Short Time Overload	-	5 x rated power for 5 s
Maximum Working Voltage	V	$(P \times R)^{1/2}$
Operating Temperature Range	$^\circ\text{C}$	- 65 to + 275
Terminal Strength	lb	10 minimum
Dielectric Withstanding Voltage	V_{AC}	1000

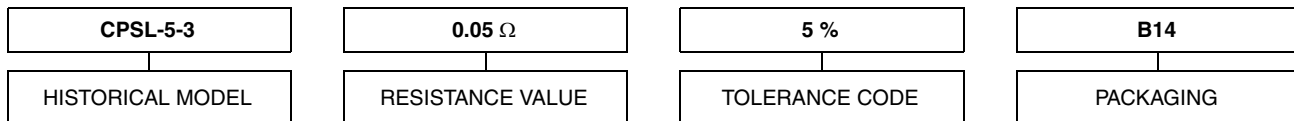
GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: CPSL05R05000J B143 (preferred part number format)

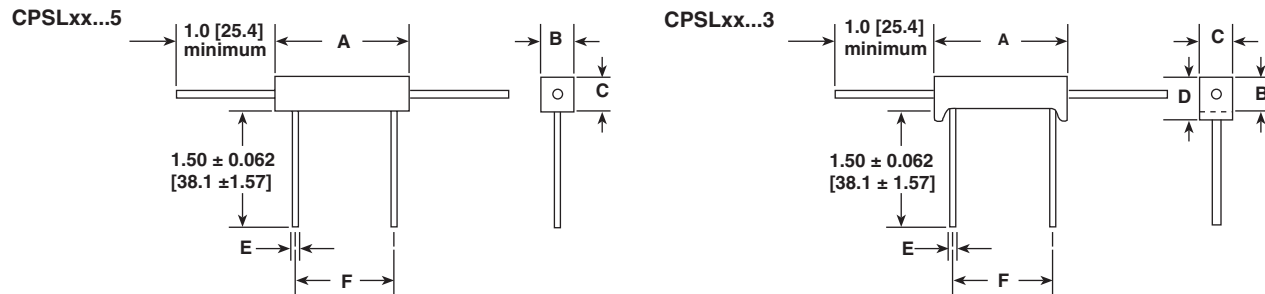


GLOBAL MODEL	VALUE	TOLERANCE	PACKAGING	SPECIAL
CPSL03 CPSL05 CPSL07 CPSL10 CPSL15	R = Decimal R1000 = 0.10 Ω	F = $\pm 1.0\%$ G = $\pm 2.0\%$ H = $\pm 3.0\%$ J = $\pm 5.0\%$ K = $\pm 10.0\%$	E14 = Lead (Pb)-free bulk E31 = Lead (Pb)-free four layer bulk B14 = Tin/lead bulk B31 = Tin/lead four layer bulk	(Dash Number) (up to 3 digits) From 1 - 999 as applicable

Historical Part Number Example: CPSL-5-3 0.05 Ω 5% B14 (will continue to be accepted)



* Pb containing terminations are RoHS compliant, exemptions may apply

DIMENSIONS in inches [millimeters]


GLOBAL MODEL	DIMENSIONS in inches [millimeters]					
	A ⁽¹⁾ ± 0.031 [0.794]	B ± 0.031 [0.794]	C ± 0.031 [0.794]	D ± 0.031 [0.794]	E ± 0.001 [0.025]	F ± 0.063 [1.59]
CPSL03...5	0.875 [22.22]	0.313 [7.94]	0.313 [7.94]	-	0.036 [0.914]	0.563 [14.30]
CPSL03...3	0.875 [22.22]	0.313 [7.94]	0.313 [7.94]	0.375 [9.52]	0.036 [0.914]	0.563 [14.30]
CPSL05...5	0.875 [22.22]	0.375 [9.52]	0.344 [8.73]	-	0.036 [0.914]	0.563 [14.30]
CPSL05...3	0.875 [22.22]	0.375 [9.52]	0.344 [8.73]	0.438 [11.11]	0.036 [0.914]	0.563 [14.30]
CPSL07...5	1.391 [35.32]	0.375 [9.52]	0.344 [8.73]	-	0.036 [0.914]	1.000 [25.40]
CPSL10...5	1.875 [47.62]	0.375 [9.52]	0.344 [8.73]	-	0.036 [0.914]	1.375 [34.93]
CPSL15...5	1.875 [47.62]	0.500 [12.70]	0.500 [12.70]	-	0.036 [0.914]	1.375 [34.93]

Note

⁽¹⁾ Potting compound may extend outside of ceramic case up to 0.060 [1.52] maximum per side.

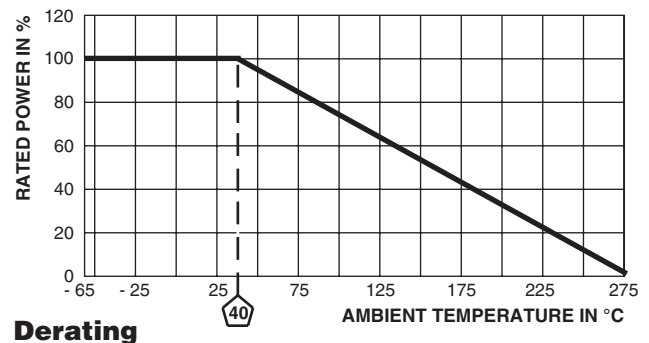
MATERIAL SPECIFICATIONS

Element: Self-supporting copper-nickel alloy or nickel-chrome alloy, depending on resistance value

Body: Steatite ceramic case with inorganic potting compound

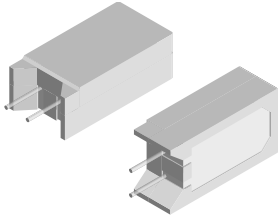
Terminals: Tinned copper

Part Marking: Dale, model, wattage, value, tolerance, date code



PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS
Thermal Shock	- 55 °C to + 275 °C, 5 cycles, 30 min dwell time	± (5.0 % + 0.05 Ω) ΔR
Short Time Overload	5 x rated power for 5 s	± (4.0 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	1000 V _{rms} for 1 min	± (2.0 % + 0.05 Ω) ΔR
Low Temperature Operation	- 65 °C, full rated working voltage for 45 min	± (3.0 % + 0.05 Ω) ΔR
Bias Humidity	75 °C, 90 % - 100 % RH, 240 h	± (5.0 % + 0.05 Ω) ΔR
Load Life	1000 h at rated power, + 40 °C, 1.5 h "ON", 0.5 h "OFF"	± (5.0 % + 0.05 Ω) ΔR
Terminal Strength	5 to 10 s 10 pound pull test, torsion test - 3 alternating directions, 360° each	± (1.0 % + 0.05 Ω) ΔR
Resistance to Solder Heat	Terminal immersed 3.5 s in molten solder at 1/8" to 3/16" from body	± (1.0 % + 0.05 Ω) ΔR

Wirewound/Metal Film Resistors, Commercial Power, Vertical Mount



FEATURES

- Space saving
- Direct mounting on printed circuit board
- Meets or exceeds requirements of EIA-Standard RS-344
- High power to size ratio
- Special inorganic potting compound and ceramic case provide high thermal conductivity in a fireproof package



RoHS*
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS					
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{70^{\circ}\text{C}}$ W	TOLERANCE ± %	RESISTANCE RANGE Ω	WEIGHT (typical) g
CPCL02	CPCL-2	2	5, 10	0.01 - 0.10	3.5
CPCC02	CPCC-2	2	5, 10	0.1 - 500	3.5
CPCP02	CPCP-2	2	1, 5	0.1 - 4K	3.5
CPCF02	CPCF-2	2	1, 5, 10	501 - 150K	3.5
CPCL03	CPCL-3	3	5, 10	0.01 - 0.10	5.5
CPCC03	CPCC-3	3	5, 10	0.1 - 800	5.5
CPCP03	CPCP-3	3	1, 5	0.1 - 5K	5.5
CPCF03	CPCF-3	3	1, 5, 10	801 - 150K	5.5
CPCL05	CPCL-5	5	5, 10	0.01 - 0.10	6.9
CPCC05	CPCC-5	5	5, 10	0.1 - 800	6.9
CPCP05	CPCP-5	5	1, 5	0.1 - 5K	6.9
CPCF05	CPCF-5	5	1, 5, 10	801 - 150K	6.9
CPCP07	CPCP-7	7	3, 5, 10	0.1 - 430	9.2
CPCL10	CPCL-10	10	5, 10	0.01 - 0.10	14.3
CPCC10	CPCC-10	10	5, 10	0.1 - 1.5K	14.3
CPCP10	CPCP-10	10	1, 5	0.1 - 8K	14.3

TECHNICAL SPECIFICATIONS					
PARAMETER	UNIT	CPCLxx	CPCCxx	CPCPxx	CPCFxx
Temperature Coefficient	ppm/°C	0.01 Ω - 0.049 Ω = ± 400 0.05 Ω - 0.1 Ω = ± 100	0.1 Ω - 0.99 Ω = ± 600 1.0 Ω and above = ± 300	0.1 Ω - 0.99 Ω = ± 90 1.0 Ω - 9.9 Ω = ± 50 10 Ω and above = ± 20	± 50 all values
Short Time Overload	-	5 x rated power for 5 s			
Maximum Working Voltage	V	$(P \times R)^{1/2}$			
Operating Temperature Range	°C	- 65 to + 275			- 65 to + 225
Terminal Strength	lb	10 minimum			
Dielectric Withstanding Voltage	V _{AC}	1000			

GLOBAL PART NUMBER INFORMATION					
New Global Part Numbering: CPCC0515R00JB32 (preferred part number format)					
C	P	C	C	0	5
1	5	R	0	0	J
B	3	2			
GLOBAL MODEL (See Standard Electrical Specifications Global Model column for options)	VALUE R = Decimal K = Thousand R1500 = 0.15 Ω 1K500 = 1500 Ω	TOLERANCE F = ± 1.0 % H = ± 3.0 % J = ± 5.0 % K = ± 10.0 %	PACKAGING E32 = Lead (Pb)-free two layer bulk E01 = Lead (Pb)-free skin pack B32 = Tin/lead two layer bulk J01 = Tin/lead skin pack		SPECIAL (Dash Number) (up to 3 digits) From 1 - 999 as applicable
Historical Part Number Example: CPCC-5 15 Ω 5 % B32 (will continue to be accepted for tin/lead product only)					
CPCC-5	15 Ω	5 %	B32		
HISTORICAL MODEL	RESISTANCE VALUE	TOLERANCE CODE	PACKAGING		

* Pb containing terminations are not RoHS compliant, exemptions may apply



DIMENSIONS in inches [millimeters]



GLOBAL MODEL	DIMENSIONS in inches [millimeters]				
	A ± 0.031 [0.794]	B ± 0.031 [0.794]	C + 0.043 [1.09] - 0.012 [0.305]	D ± 0.005 [0.127]	E ± 0.040 [1.02]
CPCL02 CPCC02 CPCP02 CPCF02	0.807 [20.50]	0.433 [11.00]	0.276 [7.01]	0.032 [0.813]	0.197 [5.00]
CPCL03 CPCC03 CPCP03 CPCF03	0.984 [24.99]	0.472 [11.99]	0.315 [8.00]	0.032 [0.813]	0.197 [5.00]
CPCL05 CPCC05 CPCP05 CPCF05	1.003 [25.48]	0.512 [13.00]	0.354 [8.99]	0.032 [0.813]	0.197 [5.00]
CPCP07	1.535 ± 0.059 [39.00 ± 1.50]	0.512 ± 0.043 [13.00 ± 1.10]	0.354 ± 0.043 [9.00 ± 1.10]	0.032 ± 0.005 [0.813 ± 0.127]	0.197 + 0.079/-0.039 [5.00 + 2.0/- 1.0]
CPCL10 CPCP10	1.372 [34.85]	0.633 [16.08]	0.485 [12.32]	0.040 [1.02]	0.290 [7.37]
CPCC10				0.036 [0.914]	

MATERIAL SPECIFICATIONS

Part Marking: DALE, model, wattage, value, tolerance, date code

CPCL: Element: Self-supporting copper-nickel alloy or nickel-chrome alloy, depending on resistance value

Body: Steatite ceramic case with inorganic potting compound

Terminals: Tinned copper

CPCC: Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value

Core: Woven fiberglass

Body: Steatite ceramic case with inorganic potting compound

End Caps: Tin plated steel

Terminals: Tinned copper

CPCP: Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value

Core: Ceramic

Body: Steatite ceramic case with inorganic potting compound

End Caps: Stainless steel (CPCP07 is tin plated CRS)

Terminals: Tinned Copperweld® (CPCP07 is tin plated copper)

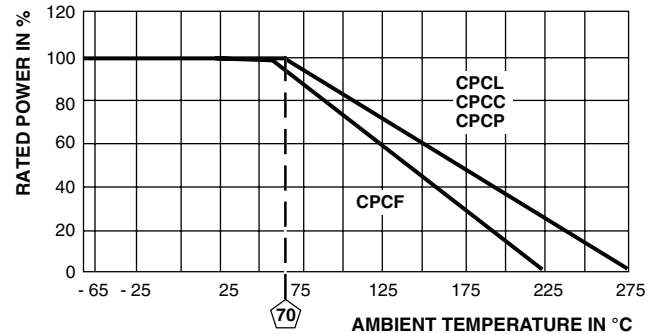
CPCF: Element: Metal film - nickel-chrome alloy

Core: Alumina ceramic

Body: Steatite ceramic case with inorganic potting compound

End Caps: Brass alloy

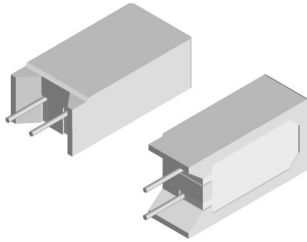
Terminals: Solder-coated copper



Derating

PERFORMANCE			
TEST	CONDITIONS OF TEST	CPCP TEST LIMITS	CPCC, CPCL, CPCF TEST LIMITS
Thermal Shock	- 55 °C to + 275 °C, 5 cycles, 30 min dwell time	± (2.0 % + 0.05 Ω) ΔR	± (5.0 % + 0.05 Ω) ΔR
Short Time Overload	5 x rated power for 5 s	± (2.0 % + 0.05 Ω) ΔR	± (4.0 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	1000 V _{rms} for 1 min	± (0.1 % + 0.05 Ω) ΔR	± (2.0 % + 0.05 Ω) ΔR
Low Temperature Storage	- 65 °C, full rated working voltage for 45 min	± (2.0 % + 0.05 Ω) ΔR	± (3.0 % + 0.05 Ω) ΔR
Bias Humidity	75 °C, 90 % - 100 % RH, 240 h	± (2.0 % + 0.05 Ω) ΔR	± (5.0 % + 0.05 Ω) ΔR
Load Life	1000 h at rated power, + 40 °C, 1.5 h "ON", 0.5 h "OFF"	± (5.0 % + 0.05 Ω) ΔR	± (5.0 % + 0.05 Ω) ΔR
Terminal Strength	5 to 10 s 10 pound pull test	± (1.0 % + 0.05 Ω) ΔR	± (1.0 % + 0.05 Ω) ΔR
Resistance to Solder Heat	Terminal immersed 3.5 s in molten solder up to body	± (1.0 % + 0.05 Ω) ΔR	± (4.0 % + 0.05 Ω) ΔR

Wirewound/Metal Oxide Resistors, Commercial Power, Vertical Mount



FEATURES

- Space saving
- Direct mounting on printed circuit board
- High power to size ratio
- Special cement potting compound and ceramic case provide high thermal conductivity in a fireproof package



RoHS
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS

GLOBAL MODEL	POWER RATING $P_{40^\circ\text{C}}$ W	RESISTANCE RANGE Ω $\pm 5\%, \pm 10\%$	TECHNOLOGY	WEIGHT (typical) g
CPCC02	2	0.1 - 100	Wirewound	4.7
CPCF02	2	101 - 10K	Metal Oxide	4.7
CPCC03	3	0.1 - 180	Wirewound	5.5
CPCF03	3	181 - 50K	Metal Oxide	5.5
CPCC05	5	0.1 - 180	Wirewound	6.9
CPCF05	5	181 - 50K	Metal Oxide	6.9
CPCC07	7	0.1 - 430	Wirewound	9.2
CPCF07	7	431 - 47K	Metal Oxide	9.2
CPCC10	10	0.1 - 470	Wirewound	14.3

TECHNICAL SPECIFICATIONS

PARAMETER	UNIT	CPCC AND CPCF HIGH VOLUME RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/°C	± 400
Short Time Overload	-	5 x rated power for 5 s
Maximum Working Voltage	V	$(P \times R)^{1/2}$
Operating Temperature Range	°C	- 65 to + 275 for wirewound, - 65 to + 225 for metal oxide
Terminal Strength	lb	10 minimum
Dielectric Withstanding Voltage	V_{AC}	1000

GLOBAL PART NUMBER INFORMATION

Global Part Numbering Example: CPCC0515R00JE66

C P C C 0 5 1 5 R 0 0 J E 6 6

GLOBAL MODEL (See Standard Electrical Specifications Global Model column for options)	VALUE R = Decimal K = Thousand R1500 = 0.15 W 1K500 = 1500 W	TOLERANCE J = $\pm 5.0\%$ K = $\pm 10\%$	PACKAGING E66 = Lead (Pb)-free, bulk	SPECIAL (Dash Number) (up to 3 digits) From 1 - 999 as applicable
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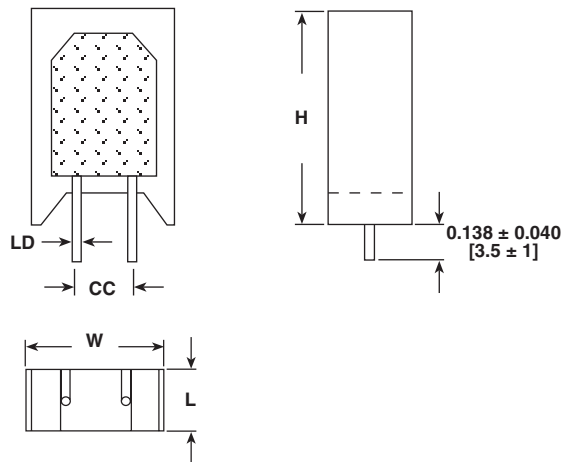


CPCC, CPCF High Volume

Wirewound/Metal Oxide Resistors, Commercial Power, Vertical Mount

Vishay Dale

DIMENSIONS in inches [millimeters]



GLOBAL MODEL	DIMENSIONS in inches [millimeters]				
	H ± 0.060 [1.5]	W ± 0.040 [1.0]	L ± 0.040 [1.0]	LD ± 0.002 [0.05]	CC + 0.08 - 0.04 [+ 2 - 1]
CPCC02	0.787 [20]	0.433 [11]	0.138 [3.5]	0.031 [0.8]	0.197 [5]
CPCF02	0.787 [20]	0.433 [11]	0.138 [3.5]	0.031 [0.8]	0.197 [5]
CPCC03	0.984 [25]	0.472 [12]	0.315 [8]	0.031 [0.8]	0.197 [5]
CPCF03	0.984 [25]	0.472 [12]	0.315 [8]	0.031 [0.8]	0.197 [5]
CPCC05	0.984 [25]	0.512 [13]	0.354 [9]	0.031 [0.8]	0.197 [5]
CPCF05	0.984 [25]	0.512 [13]	0.354 [9]	0.031 [0.8]	0.197 [5]
CPCC07	1.535 [39]	0.512 [13]	0.354 [9]	0.031 [0.8]	0.197 [5]
CPCF07	1.535 [39]	0.512 [13]	0.354 [9]	0.031 [0.8]	0.197 [5]
CPCC10	1.378 [35]	0.630 [16]	0.472 [12]	0.031 [0.8]	0.295 [7.5]

MATERIAL SPECIFICATIONS

Part Marking: DALE, model, wattage, value, tolerance, date code

CPCC: Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value

Core: Woven fiberglass

Body: Steatite ceramic case with cement potting compound

End Caps: Tin plated steel

Terminals: Tinned copper

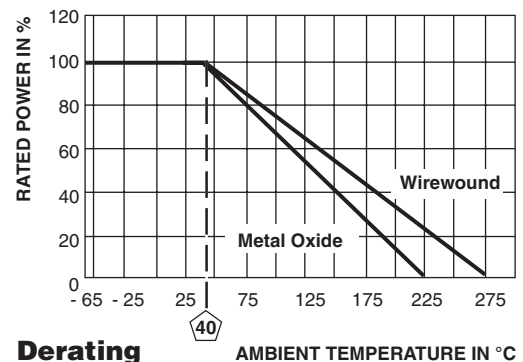
CPCF: Element: Nickel oxide

Core: Alumina ceramic

Body: Steatite ceramic case with inorganic potting compound

End Caps: Brass alloy

Terminals: Tinned copper



PERFORMANCE		
TEST	CONDITIONS OF TEST	CPCC, CPCF TEST LIMITS
Thermal Shock	- 55 °C to + 275 °C (+ 225 °C for Metal Oxide), 5 cycles, 30 min dwell time	± (5.0 % + 0.05 Ω) ΔR
Short Time Overload	5 x rated power for 5 s	± (4.0 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	1000 V _{rms} for 1 min	± (2.0 % + 0.05 Ω) ΔR
Low Temperature Operation	- 65 °C, full rated working voltage for 45 min	± (3.0 % + 0.05 Ω) ΔR
Bias Humidity	75 °C, 90 % - 100 % RH, 240 h	± (5.0 % + 0.05 Ω) ΔR
Load Life	1000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"	± (10.0 % + 0.05 Ω) ΔR
Terminal Strength	5 to 10 s 10 pound pull test	± (2.0 % + 0.05 Ω) ΔR
Resistance to Solder Heat	Terminal immersed 3.5 s in molten solder up to body	± (4.0 % + 0.05 Ω) ΔR

Wirewound Resistors, Commercial Power, Printed Circuit Board, Tab Type Terminals



FEATURES

- Variety of core lengths
- Terminals designed for direct mounting into a circuit board to be securely clamped
- Available potted in a ceramic case to increase power dissipation, contact factory by using the e-mail address at the bottom of this page



RoHS COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS				
GLOBAL MODEL (1)	HISTORICAL MODEL (1)	POWER RATING $P_{25^\circ\text{C}}$ W	RESISTANCE RANGE Ω $\pm 10\%$ standard, $\pm 5\%$ available	WEIGHT (typical) g
PCT4050	PCT-4050	2.0	0.10 - 390	0.57
PCT4065	PCT-4065	2.6	0.14 - 560	0.59
PCT4085	PCT-4085	3.4	0.20 - 785	0.62
PCT4105	PCT-4105	4.2	0.25 - 1.01K	0.65
PCT4145	PCT-4145	5.8	0.36 - 1.46K	0.71
PCT4185	PCT-4185	7.4	0.47 - 1.91K	0.77
PCT4215	PCT-4215	8.6	0.56 - 2.25K	0.81

Note

(1) PCT4000 model numbers are calculated from the power rating of 4 W per inch. The last three digits of the model number represent the mounting center spacing of the resistors in inches (decimal is between the first and second digit, mounting center spacing is available between 0.50" [12.70 mm] and 2.15" [54.61 mm]). **Example: PCT4150 = 1.50 inches x 4 W per inch = 6 W.**

TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	PCT4000 RESISTOR CHARACTERISTICS
Power Rating	W	4 per inch
Temperature Coefficient	ppm/ $^\circ\text{C}$	± 600 below 1.0 Ω , ± 300 1.0 Ω and above
Short Time Overload	-	5 x rated power for 5 s
Maximum Working Voltage	V	$(P \times R)^{1/2}$
Operating Temperature Range	$^\circ\text{C}$	- 65 to + 375
Terminal Strength	lb	10 minimum

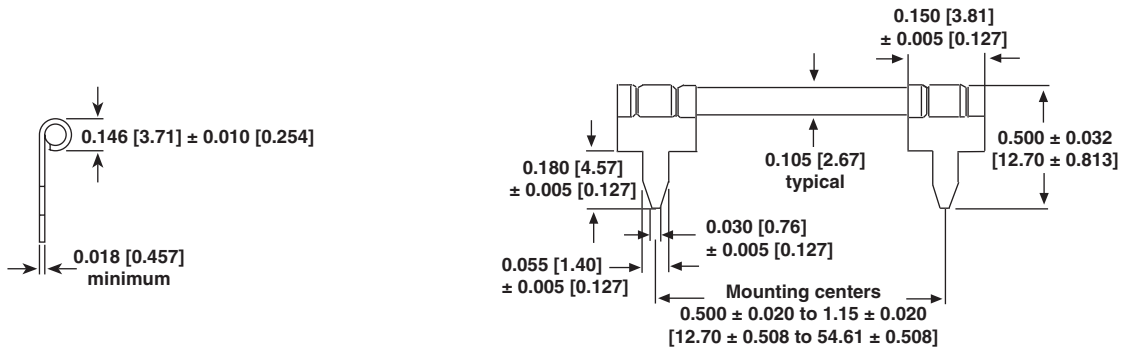
GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: PCT405015R00JB14 (preferred part numbering format)

P	C	T	4	0	5	0	1	5	R	0	0	J	B	1	4		
GLOBAL MODEL (See Standard Electrical Specifications Global Model column for options)			VALUE R = Decimal K = Thousand R1500 = 0.15 Ω 1K500 = 1500 Ω			TOLERANCE H = $\pm 3.0\%$ J = $\pm 5.0\%$ K = $\pm 10\%$			PACKAGING B14 = Lead (Pb)-free bulk B31 = Lead (Pb)-free four layer bulk			SPECIAL (Dash Number) (up to 2 digits) From 1 - 99 as applicable					

Historical Part Number Example: PCT-4050 15 Ω 5% B14 (will continue to be accepted)

PCT-4050	15 Ω	5%	B14
HISTORICAL MODEL	RESISTANCE VALUE	TOLERANCE CODE	PACKAGING

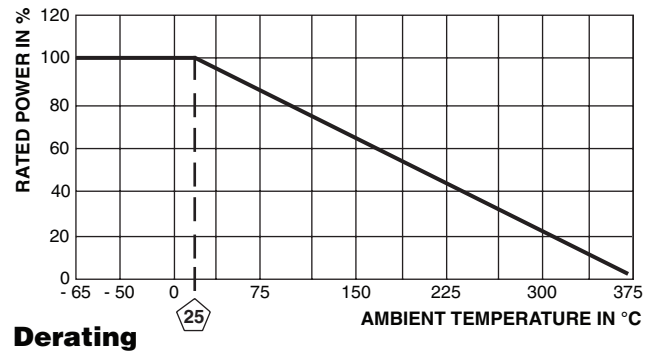
DIMENSIONS in inches [millimeters]
PCT4000

MATERIAL SPECIFICATIONS

Element: Nickel-chrome alloy or copper-nickel alloy, depending on resistance value

Core: Woven fiberglass

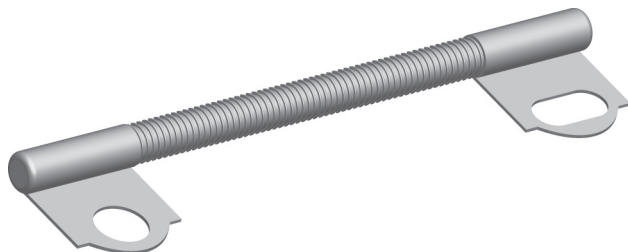
Terminals: Electro tin plated steel

Part Marking: None



PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS (EIA RS-344)
Thermal Shock	- 55 °C to + 275 °C, 5 cycles, 30 min dwell time	± (5.0 % + 0.05 Ω) ΔR
Short Time Overload	5 x rated power for 5 s	± (4.0 % + 0.05 Ω) ΔR
Low Temperature Operation	- 65 °C, full rated working voltage for 45 min	± (3.0 % + 0.05 Ω) ΔR
Humidity	75 °C, 90 % - 100 % RH, 240 h	± (5.0 % + 0.05 Ω) ΔR
Load Life	1000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"	± (10.0 % + 0.05 Ω) ΔR
Resistance to Solder Heat	Terminal immersed 3.5 s in molten solder at 1/8" to 3/16" from body	± (4.0 % + 0.05 Ω) ΔR

Wirewound Resistors, Commercial Power, Tab Type Terminals



FEATURES

- Variety of core diameters and length
- Numerous mounting hole sizes and shapes
- High performance for low cost



RoHS
COMPLIANT

APPLICATIONS

Appliance applications include food mixers, coffee makers, electric and electronic ranges, electric blankets, actuating heaters for bi-metal switches, toasters and deep fryers.

Other applications include toys, entertainment devices such as television, radio and amplifiers.

STANDARD ELECTRICAL SPECIFICATIONS				
GLOBAL MODEL ⁽¹⁾	HISTORICAL MODEL ⁽¹⁾	POWER RATING $P_{25\text{ }^\circ\text{C}}$ W	RESISTANCE RANGE Ω $\pm 10\%$ standard, $\pm 5\%$ available	WEIGHT (typical) g
CL4095	CL-4095	3.8	0.10 - 685	1.08
CL4100	CL-4100	4	0.11 - 740	1.09
CL4125	CL-4125	5	0.15 - 1.02K	1.16
CL4150	CL-4150	6	0.19 - 1.35K	1.23
CL4200	CL-4200	8	0.27 - 1.86K	1.37
CL4225	CL-4225	9	0.31 - 2.14K	1.44
CL4300	CL-4300	12	0.43 - 2.99K	1.65
CL6095	CL-6095	5.7	0.10 - 175	2.30
CL6100	CL-6100	6	0.10 - 190	2.35
CL6133	CL-6133	8	0.13 - 285	2.68
CL6167	CL-6167	10	0.18 - 380	2.97
CL6200	CL-6200	12	0.22 - 475	3.35
CL6233	CL-6233	14	0.27 - 570	3.68
CL6300	CL-6300	18	0.35 - 765	4.35

Note

⁽¹⁾ CL4000 and CL6000 model numbers are calculated from the CL4000 power rating of 4 W per inch and CL6000 power rating of 6 W per inch. The last three digits of the model number represent the mounting center spacing of the resistor in inches (decimal is between the first and second digit, mounting center spacing is available between 0.95" [24.13 mm] and 3.00" [76.20 mm]). Example: CL6133 = 1.33 inches x 6 W per inch = 8 W.

TECHNICAL SPECIFICATIONS			
PARAMETER	UNIT	CL 4000	CL 6000
Power Rating	W	4 per inch	6 per inch
Temperature Coefficient	ppm/ $^\circ\text{C}$	± 600 below 1.0 Ω , ± 300 for 1.0 Ω and above	
Short Time Overload	-	5 x rated power for 5 s	
Maximum Working Voltage	V	$(P \times R)^{1/2}$	
Operating Temperature Range	$^\circ\text{C}$	- 65 to + 375	
Terminal Strength	lb	10 minimum	

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: CL4100XX100RJB1410 (preferred part number format)

C	L	4	1	0	0	X	X	1	0	0	R	J	B	1	4	1	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

GLOBAL MODEL	LEFT TERMINAL	RIGHT TERMINAL	VALUE	TOLERANCE	PACKAGING	SPECIAL
(See Standard Electrical Specifications Global Model column for options)	A B C D F X	A B C D F X	R = Decimal K = Thousand R150 = 0.15 Ω 1K00 = 1000 Ω	H = $\pm 3.0\%$ J = $\pm 5.0\%$ K = $\pm 10.0\%$	B14 = Lead (Pb)-free bulk E31 = Lead (Pb)-free four layer bulk	(Dash Number) (up to 2 digits) From 1 - 99 as applicable

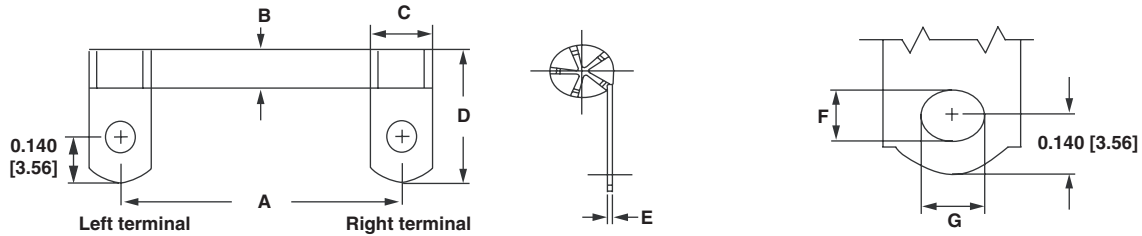
Historical Part Number Example: CL-4100XX-10 100 Ω 5% B14 (will continue to be accepted for tin/lead product only)

CL-4100XX-10	100 Ω	5 %	B14
HISTORICAL MODEL	RESISTANCE VALUE	TOLERANCE CODE	PACKAGING

Wirewound Resistors, Commercial Power, Tab Type Terminals

Vishay Dale

DIMENSIONS in inches [millimeters]



GLOBAL MODEL	DIMENSIONS in inches [millimeters]				
	± 0.020 [0.508]	B typical	± 0.010 [0.254]	± 0.010 [0.254]	± 0.005 [0.127]
CL4095	0.95 [24.13]	0.105 [2.67]	0.344 [8.73]	0.475 [12.07]	0.015 [0.38]
CL4100	1.00 [25.40]	0.105 [2.67]	0.344 [8.73]	0.475 [12.07]	0.015 [0.38]
CL4125	1.25 [31.75]	0.105 [2.67]	0.344 [8.73]	0.475 [12.07]	0.015 [0.38]
CL4150	1.50 [38.10]	0.105 [2.67]	0.344 [8.73]	0.475 [12.07]	0.015 [0.38]
CL4200	2.00 [50.80]	0.105 [2.67]	0.344 [8.73]	0.475 [12.07]	0.015 [0.38]
CL4225	2.25 [57.15]	0.105 [2.67]	0.344 [8.73]	0.475 [12.07]	0.015 [0.38]
CL4300	3.00 [76.20]	0.105 [2.67]	0.344 [8.73]	0.475 [12.07]	0.015 [0.38]
CL6095	0.95 [24.13]	0.170 [4.32]	0.344 [8.73]	0.575 [14.61]	0.018 [0.46]
CL6100	1.00 [25.40]	0.170 [4.32]	0.344 [8.73]	0.575 [14.61]	0.018 [0.46]
CL6133	1.33 [33.78]	0.170 [4.32]	0.344 [8.73]	0.575 [14.61]	0.018 [0.46]
CL6167	1.67 [42.42]	0.170 [4.32]	0.344 [8.73]	0.575 [14.61]	0.018 [0.46]
CL6200	2.00 [50.80]	0.170 [4.32]	0.344 [8.73]	0.575 [14.61]	0.018 [0.46]
CL6233	2.33 [59.18]	0.170 [4.32]	0.344 [8.73]	0.575 [14.61]	0.018 [0.46]
CL6300	3.00 [76.20]	0.170 [4.32]	0.344 [8.73]	0.575 [14.61]	0.018 [0.46]

GLOBAL MODEL	TERMINAL HOLE OPTIONS AND DIMENSIONS in inches [millimeters]					
	LEFT OPTION	± 0.010 [0.254]	± 0.010 [0.254]	RIGHT OPTION	± 0.010 [0.254]	± 0.010 [0.254]
CL4000	A	0.130 [3.30]	0.160 [4.06]	A	0.130 [3.30]	0.160 [4.06]
	B	0.172 [4.37]	0.210 [5.33]	B	0.172 [4.37]	0.210 [5.33]
	C	0.200 [5.08]	0.220 [5.59]	E	0.200 [5.08]	0.210 [5.33]
	D	0.128 [3.25]	0.128 [3.25]	D	0.128 [3.25]	0.128 [3.25]
CL6000	A	0.130 [3.30]	0.160 [4.06]	A	0.130 [3.30]	0.160 [4.06]
	B	0.172 [4.37]	0.210 [5.33]	B	0.172 [4.37]	0.210 [5.33]
	C	0.200 [5.08]	0.220 [5.59]	E	0.200 [5.08]	0.220 [5.59]
	F	0.180 [4.57]	0.180 [4.57]	F	0.180 [4.57]	0.180 [4.57]

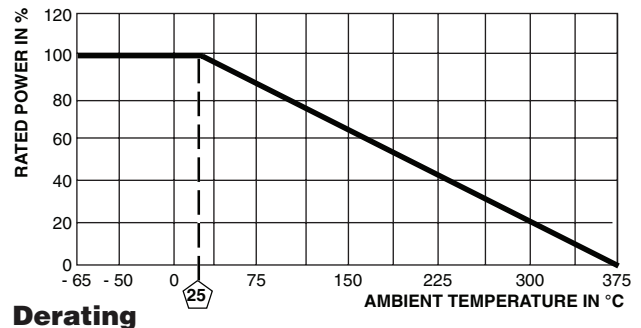
MATERIAL SPECIFICATIONS

Element: Nickel-chrome alloy or copper-nickel alloy, depending on resistance value

Core: Woven fiberglass

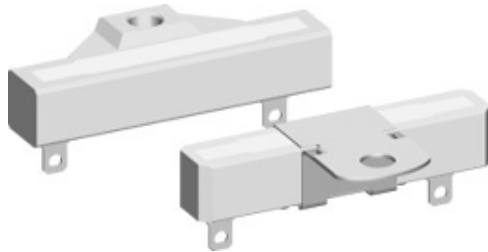
Terminals: Electro tin plated steel

Part Marking: Resistance is stamped on terminal in two places, maximum of three characters



PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS (EIA RS-344)
Thermal Shock	- 55 °C to + 275 °C, 5 cycles, 30 min dwell time	$\pm (5.0 \% + 0.05 \Omega) \Delta R$
Short Time Overload	5 x rated power for 5 s	$\pm (4.0 \% + 0.05 \Omega) \Delta R$
Low Temperature Operation	- 65 °C, full rated working voltage for 45 min	$\pm (3.0 \% + 0.05 \Omega) \Delta R$
Humidity	75 °C, 90 % - 100 % RH, 240 h	$\pm (5.0 \% + 0.05 \Omega) \Delta R$
Load Life	1000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"	$\pm (10.0 \% + 0.05 \Omega) \Delta R$
Resistance to Solder Heat	Terminal immersed 3.5 s in molten solder at 1/8" to 3/16" from body	$\pm (4.0 \% + 0.05 \Omega) \Delta R$

Wirewound Resistors, Commercial High Power, Quick Connect Terminals



FEATURES

- Can be purchased with or without brackets installed
- Quick connect terminals
- High power ratings
- Special inorganic potting compound and ceramic case provide high thermal conductivity in a fireproof package



RoHS
COMPLIANT

APPLICATIONS

The CP resistors are suited for use in high ambient temperatures and also where ease of mounting and electrical connections are to be made with quick connect terminals. Model CP0050 is particularly recommended for automotive electronic ignition ballast, appliance and motor ballasts and two-speed fans.

STANDARD ELECTRICAL SPECIFICATIONS				
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{40^\circ\text{C}}$ W	RESISTANCE RANGE Ω $\pm 10\%$ standard, $\pm 5\%$ available	WEIGHT (typical) g
CP015B	CP-15B	15	0.1 - 288	21.5
CP020B	CP-20B	20	0.1 - 460	27.5
CP026B ⁽¹⁾	CP-26B ⁽¹⁾	25	0.12 - 570	44.0
CP26SM	CP-26SM	25	0.12 - 570	56.9
CP30SM	CP-30SM	30	0.32 - 623	57.5
CP050B ⁽¹⁾	CP-50B ⁽¹⁾	50	0.16 - 740	90.0
CP050B...1 ⁽¹⁾	CP-50B-1 ⁽¹⁾	50	0.16 - 740	90.0

Note

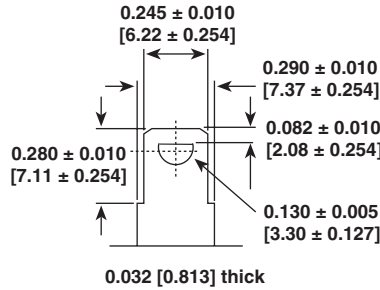
⁽¹⁾ To order the CP026B, CP050B and CP050B...1 without brackets, remove the B from model number (CP0026, CP0050 and CP0050...1).

TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	CP QUICK CONNECT CHARACTERISTICS
Temperature Coefficient	ppm/°C	± 600 below $1.0\ \Omega$, ± 300 $1.0\ \Omega$ and above
Short Time Overload	-	$10 \times$ rated power for 5 s
Operating Temperature Range	°C	- 65 to + 275
Dielectric Withstanding Voltage	V_{AC}	1000
Maximum Working Voltage	V	$(P \times R)^{1/2}$

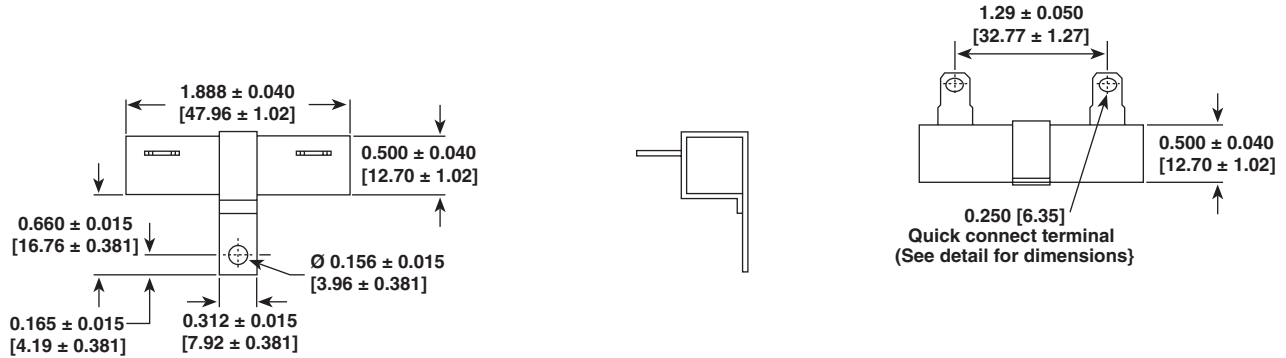
GLOBAL PART NUMBER INFORMATION																	
New Global Part Numbering: CP050B15R00JB141 (preferred part number format)																	
C	P	0	5	0	B	1	5	R	0	0	J	B	1	4	1		
GLOBAL MODEL (See Standard Electrical Specifications Global Model column for options)		VALUE R = Decimal K = Thousand R1500 = $0.15\ \Omega$ 1K500 = $1500\ \Omega$		TOLERANCE H = $\pm 3.0\%$ J = $\pm 5.0\%$ K = $\pm 10.0\%$		PACKAGING B14 = Lead (Pb)-free, bulk B31 = Lead (Pb)-free, four layer bulk				SPECIAL (Dash Number) (up to 3 digits) From 1 - 999 as applicable							
Historical Part Number Example: CP-50B-1 $15\ \Omega$ 5% B14 (will continue to be accepted)																	
CP-50B-1 HISTORICAL MODEL		15 Ω RESISTANCE VALUE		5 % TOLERANCE CODE		B14 PACKAGING											

DIMENSIONS in inches [millimeters]

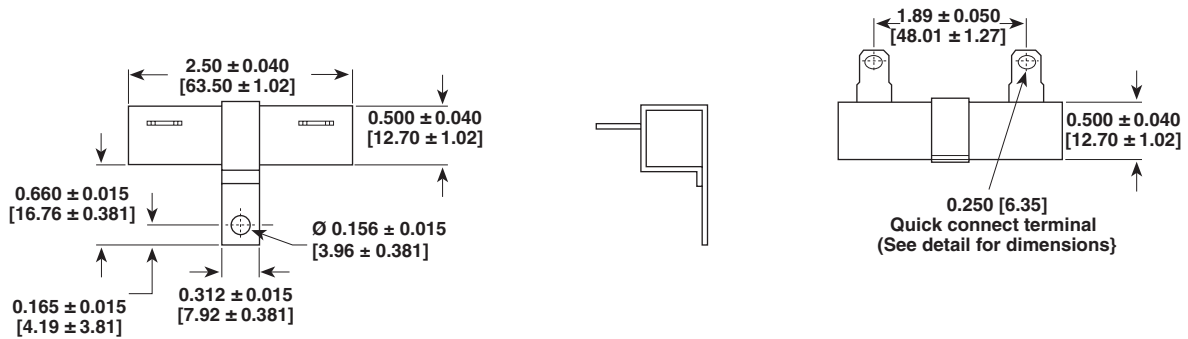
Quick Connect Terminal Connections 0.250 [6.35]



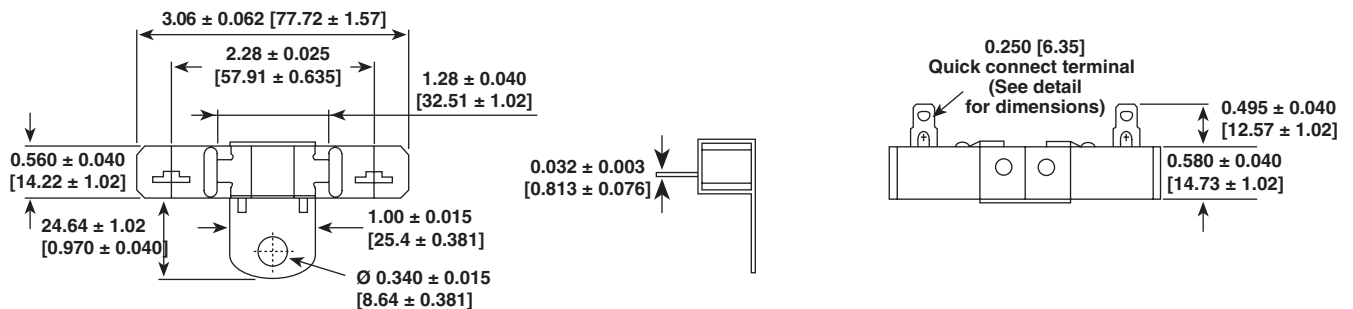
MODEL CP015B



MODEL CP020B



MODEL CP0026 AND CP026B



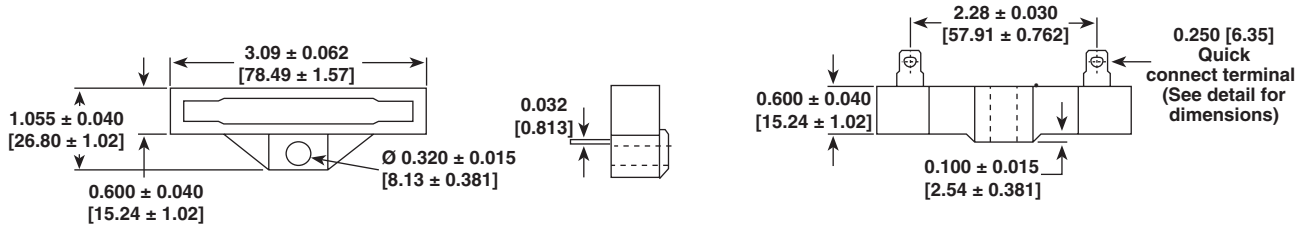
CP Quick Connect



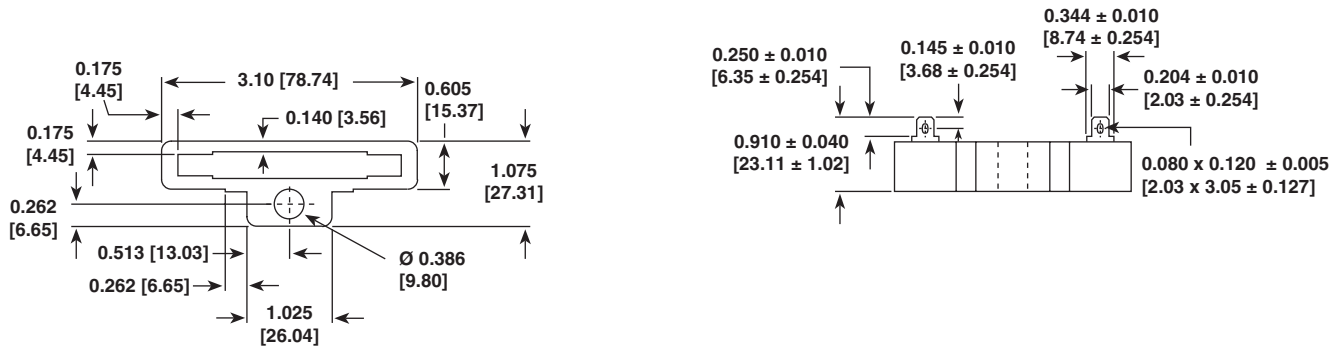
Vishay Dale

Wirewound Resistors, Commercial High Power,
Quick Connect Terminals

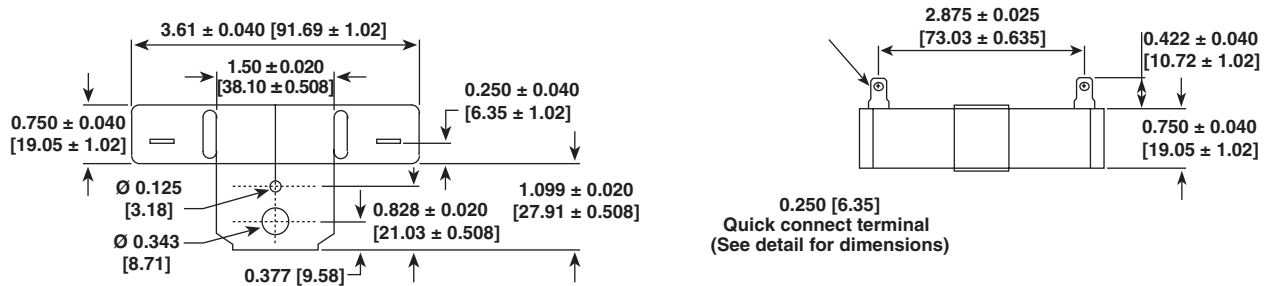
MODEL CP26SM



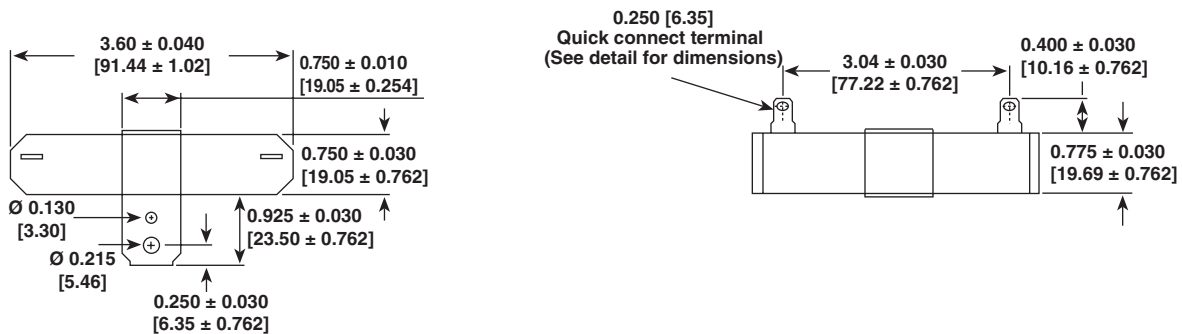
MODEL CP30SM

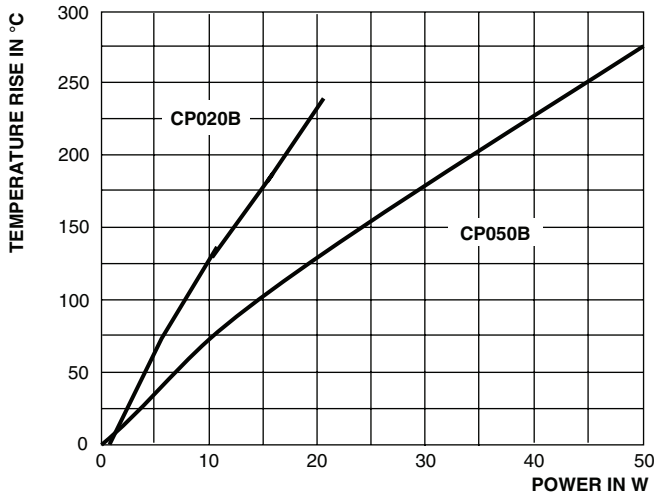


MODEL CP0050 AND CP050B

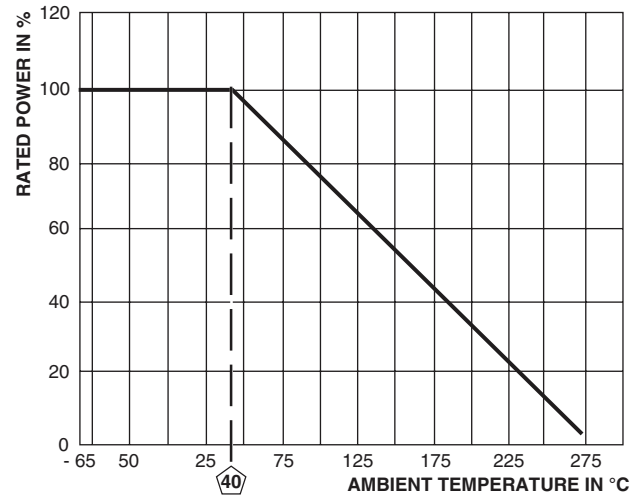


MODEL CP0050...1 AND CP050B...1





Temperature Rise



Derating

MATERIAL SPECIFICATIONS

Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value

Core: Woven fiberglass

Body: Steatite ceramic case with inorganic potting compound

Terminals: Bare brass (CP30SM is tin plated steel)

Bracket: Aluminum

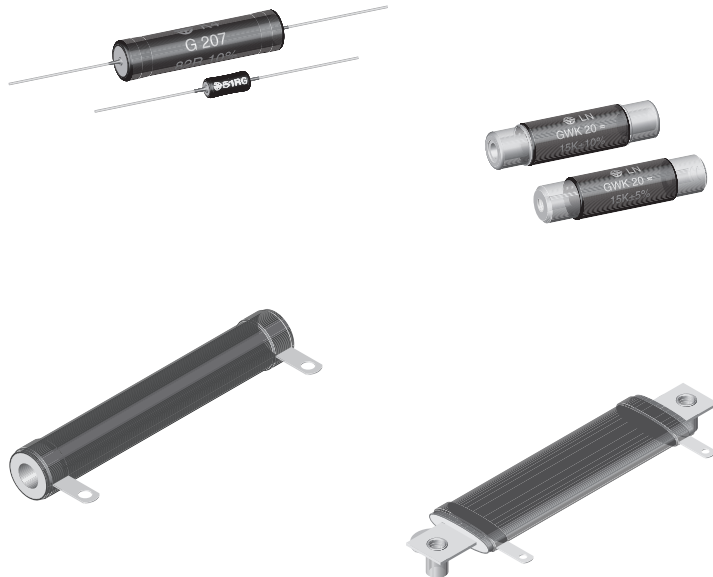
Part Marking: DALE, model, wattage, value, tolerance, date code

PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS (EIA RS-344)
Thermal Shock	- 55 °C to + 275 °C, 5 cycles, 30 min dwell time	± (5.0 % + 0.05 Ω) ΔR
Short Time Overload	10 x rated power for 5 s	± (4.0 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	1000 V _{rms} for 1 min	± (2.0 % + 0.05 Ω) ΔR
Low Temperature Operation	- 65 °C, full rated working voltage for 45 min	± (3.0 % + 0.05 Ω) ΔR
Humidity	75 °C, 90 % - 100 % RH, 240 h	± (5.0 % + 0.05 Ω) ΔR
Load Life	1000 h at rated power, + 40 °C, 1.5 h "ON", 0.5 h "OFF"	± (10.0 % + 0.05 Ω) ΔR
Terminal Strength	10 pounds for 30 s	± (2.0 % + 0.05 Ω) ΔR





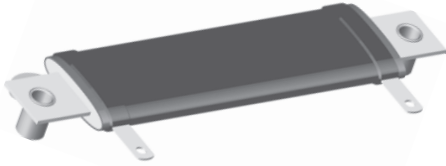
Industrial Power Wirewound Resistors



Contents

HL, NHL FLAT and HLM, NHLM	72
HL, NHL	76
HLA	80
HLT	82
HLW, NHLW	84
HLZ	86
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ZBS	128
ZWK	132
Mounting Accessoires for Resistors	136
Alternative Lead Configurations	140

Wirewound Resistors, Industrial Power, Flat (HL), Miniature Flat (HLM)



TYPE HL FLAT STYLE

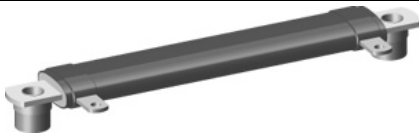
FEATURES

- High temperature silicon coating
- Mounting accommodations ideally suited to high density packaging
- Self-stacking hardware for horizontal or vertical placement
- Withstands high vibrations without loosening
- Mounting hardware functions as a heat sink allowing greater heat dissipation and less derating of stacked units
- Available in non-inductive styles (type NHL and NHLM) with Aryton-Perry winding



RoHS*
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS					
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{25\text{ }^\circ\text{C}}$ W	RESISTANCE RANGE Ω		WEIGHT (typical) g
			$\pm 5\%$	$\pm 10\%$	
HL024 NHL024	HL-24 NHL-24	30	1.0 - 11K 1.0 - 1.2K	0.10 - 11K 1.0 - 1.2K	20.14
HL035 NHL035	HL-35 NHL-35	40	1.0 - 26K 1.0 - 3K	0.10 - 26K 1.0 - 3K	30.07
HL055 NHL055	HL-55 NHL-55	55	1.0 - 54K 1.0 - 6.8K	0.10 - 54K 1.0 - 6.8K	51.25
HL070 NHL070	HL-70 NHL-70	70	1.0 - 77K 1.0 - 9.4K	0.10 - 77K 1.0 - 9.4K	60.48
HL095 NHL095	HL-95 NHL-95	95	1.0 - 99.9K 1.0 - 12.4K	0.10 - 99.9K 1.0 - 12.4K	76.51



TYPE HLM MINIATURE FLAT STYLE

STANDARD ELECTRICAL SPECIFICATIONS					
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{25\text{ }^\circ\text{C}}$ W	RESISTANCE RANGE Ω		WEIGHT (typical) g
			$\pm 5\%$	$\pm 10\%$	
HLM010 NHLM010	HLM-10 NHLM-10	10	1.0 - 15K 1.0 - 1.8K	0.10 - 15K 1.0 - 1.8K	0.41
HLM015 NHLM015	HLM-15 NHLM-15	15	1.0 - 26K 1.0 - 3.6K	0.10 - 26K 1.0 - 3.6K	0.47
HLM020 NHLM020	HLM-20 NHLM-20	20	1.0 - 71K 1.0 - 9.8K	0.10 - 71K 1.0 - 9.8K	0.74

GLOBAL PART NUMBER INFORMATION																		
New Global Part Numbering: NHLM01010Z10R00JJ (preferred part number format)																		
N	H	L	M	0	1	0	1	0	Z	1	0	R	0	0	J	J		
GLOBAL MODEL	TERMINAL DESIGNATION	TERMINAL FINISH	RESISTANCE VALUE	TOLERANCE	PACKAGING CODE		SPECIAL											
NHLM010 (See "Standard Electrical Specifications" table above for additional P/N's)	09 10 16	E = Lead (Pb)-free Z = Tin/lead N = Nickel	R = Decimal K = Thousand 10R00 = 10.0 Ω 1K000 = 1 k Ω	J = $\pm 5.0\%$ K = $\pm 10.0\%$	E = Lead (Pb)-free skin pack J* = Skin pack (J01)		(Dash Number) (up to 2 digits) From 1 - 99 as applicable											
Historical Part Number Example: NHLM-10-10Z 10 Ω 5% J01 (will continue to be accepted)																		
NHLM-10			10Z			10 Ω			5%			J01						
HISTORICAL MODEL			TERMINAL/FINISH			RESISTANCE VALUE			TOLERANCE			PACKAGING						

* Pb containing terminations are not RoHS compliant, exemptions may apply



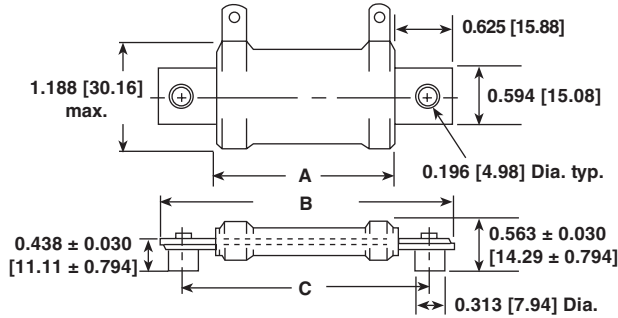
HL, NHL FLAT and HLM, NHLM

Wirewound Resistors,
Industrial Power, Flat (HL), Miniature Flat (HLM)

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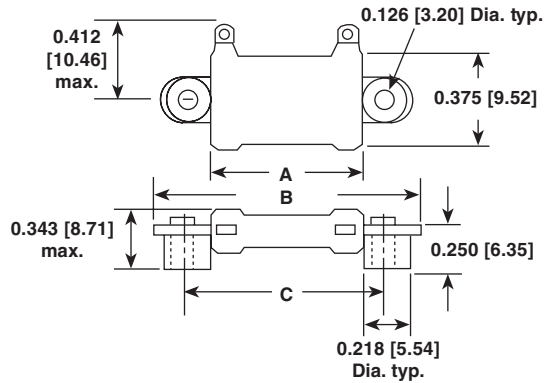
DIMENSIONS in inches [millimeters]

TYPE HL FLAT STYLE



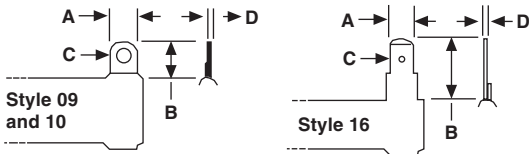
MODEL	DIMENSIONS in inches [millimeters]					TERMINAL DESIGNATION	
	A	B	C	DISTANCE BETWEEN TERMINALS (REF.)	STANDARD	OPTIONAL	
	± 0.063 [1.59]	± 0.063 [1.59]	± 0.031 [0.79]				
HL024	1.250	2.500	2.000	0.718	09Z	16N	
NHL024	[31.75]	[63.50]	[50.80]	[18.24]			
HL035	2.000	3.250	2.750	1.468	09Z	16N	
NHL035	[50.80]	[82.55]	[69.85]	[37.29]			
HL055	3.500	4.750	4.250	2.968	09Z	16N	
NHL055	[88.90]	[120.65]	[107.95]	[75.39]			
HL070	4.750	6.000	5.500	4.218	09Z	16N	
NHL070	[120.65]	[152.40]	[139.70]	[107.14]			
HL095	6.000	7.250	6.750	5.468	09Z	16N	
NHL095	[152.40]	[184.15]	[171.45]	[138.89]			

TYPE HLM MINIATURE FLAT STYLE



MODEL	DIMENSIONS in inches [millimeters]					STANDARD TERMINAL DESIGNATION
	A	B	C	DISTANCE BETWEEN TERMINALS (REF.)		
	± 0.063 [1.59]	± 0.063 [1.59]	± 0.031 [0.79]			
HLM010	0.750	1.312	1.000	0.406	10Z	
NHLM010	[19.05]	[33.32]	[25.40]	[10.31]		
HLM015	1.000	1.562	1.250	0.656	10Z	
NHLM015	[25.40]	[39.67]	[31.75]	[16.66]		
HLM020	2.062	2.625	2.313	1.718	10Z	
NHLM020	[52.37]	[66.68]	[58.75]	[43.64]		

TERMINAL DIMENSIONS



DIMENSION	DIMENSIONS in inches [millimeters]		
	TERMINAL TYPE		
	TERM 09	TERM 10	TERM 16
A	0.188 [4.76]	0.125 [3.18]	0.188 [4.76]
B	0.500 [12.70]	0.188 [4.76]	0.563 [14.29]
C	0.104 [2.64]	0.063 [1.60]	0.050 [1.27]
D	0.020 [0.51]	0.020 [0.51]	0.020 [0.51]

TERMINAL FINISH

"E" Finish - 100 % Sn coated steel. "Z" Finish - 60/40 Sn/Pb coated steel. "N" Finish - Nickel coated steel. Finish for terminal style 16 is limited to nickel plated steel (N).

HL, NHL FLAT and HLM, NHLM



Vishay Dale

Wirewound Resistors,
Industrial Power, Flat (HL), Miniature Flat (HLM)

TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	HL, HLM RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/°C	± 90 for 0.1 Ω to 0.99 Ω; ± 50 for 1 Ω to 9.9 Ω; ± 30 for 10 Ω and above
Dielectric Withstanding Voltage	V _{AC}	1000, from terminal to mounting hardware
Short Time Overload	-	10 x rated power for 5 s
Maximum Working Voltage	V	$(P \times R)^{1/2}$
Insulation Resistance	Ω	1000 MΩ minimum dry, 100 MΩ minimum after moisture test
Operating Temperature Range	°C	- 55 to + 350

POWER RATING

Vishay HL flat and HLM resistor wattage ratings are based on mounting horizontally to 10" x 10" x 0.04" [254.0 mm x 254.0 mm x 1.02 mm] steel plate in 25 °C ambient with no air flow.

EXCLUSIVE BRACKET DESIGN

Mounting strap fits snugly through resistor core and is bound against unit by two eccentric spacers. The bracket eliminates expensive cements and improves heat transfer and power handling capabilities.

MATERIAL SPECIFICATIONS

Element: Copper-nickel alloy of nickel-chrome alloy, depending on resistance value

Core: Ceramic, steatite

Coating: Special high temperature silicone

Standard Terminals: Model "Z" terminals are tinned steel

Terminal Bands: Steel

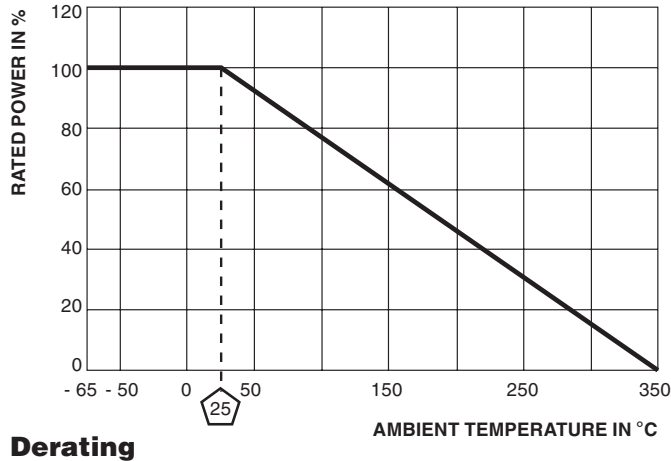
Part Marking: DALE, model, wattage, value, tolerance, date code

NHL, NHLM NON-INDUCTIVE

Models of equivalent physical and electrical specifications are available with non-inductive (Aryton-Perry) winding. They are identified by adding the letter N to the front of the HL and HLM type designation (NHLM020, for example). For NHL and NHLM models maximum resistance values are lower, see STANDARD ELECTRICAL SPECIFICATIONS table.

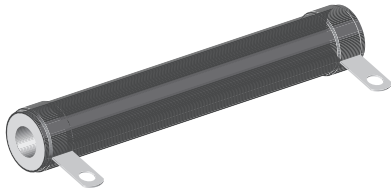


Derating is required for ambient temperatures above 25 °C per the following graph.



PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS
Thermal Shock	Rated power applied until thermally stable, then a minimum of 15 min at - 55 °C	± (2.0 % + 0.05 Ω) ΔR
Short Time Overload	10 x rated power for 5 s	± (2.0 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	1000 V _{rms} , 1 min	± (0.1 % + 0.05 Ω) ΔR
Low Temperature Storage	- 55 °C for 24 h	± (2.0 % + 0.05 Ω) ΔR
High Temperature Exposure	250 h at + 350 °C	± (2.0 % + 0.05 Ω) ΔR
Moisture Resistance	MIL-STD-202 Method 106, 7b not applicable	± (2.0 % + 0.05 Ω) ΔR
Shock, Specified Pulse	MIL-STD-202 Method 213, 100 g's for 6 ms, 10 shocks	± (0.2 % + 0.05 Ω) ΔR
Vibration, High Frequency	Frequency varied 10 to 2000 Hz, 20 g peak, 2 directions 6 h each	± (0.2 % + 0.05 Ω) ΔR
Load Life	1000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"	± (3.0 % + 0.05 Ω) ΔR

Wirewound Resistors, Industrial Power, Tubular (HL), Non-Inductive Tubular (NHL)



FEATURES

- High temperature silicon coating
- Complete welded construction
- Available in non-inductive styles (model NHL) with Aryton-Perry winding
- Tight tolerance of 5 % for values above 1 Ω
- Excellent stability in operation (< 3 % change in resistance)

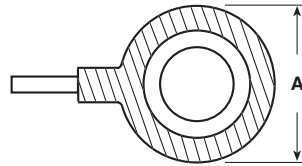


RoHS*
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS					
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{25^\circ\text{C}}$ W	RESISTANCE RANGE Ω		WEIGHT (typical) g
			$\pm 5\%$	$\pm 10\%$	
HL011 NHL011	HL-11 NHL-11	11	1.0 - 70K 1.0 - 4.7K	0.10 - 70K 1.0 - 4.7K	10.50
HL012 NHL012	HL-12 NHL-12	12	1.0 - 58K 1.0 - 3.9K	0.10 - 58K 1.0 - 3.9K	6.69
HL015 NHL015	HL-15 NHL-15	15	1.0 - 60K 1.0 - 4.3K	0.10 - 60K 1.0 - 4.3K	8.64
HL020 NHL020	HL-20 NHL-20	20	1.0 - 95K 1.0 - 6.8K	0.10 - 95K 1.0 - 6.8K	12.57
HL025 NHL025	HL-25 NHL-25	25	1.0 - 115K 1.0 - 8.8K	0.10 - 115K 1.0 - 8.8K	20.72
HL026 NHL026	HL-26 NHL-26	26	1.0 - 170K 1.0 - 11.8K	0.10 - 170K 1.0 - 11.8K	15.34
HL050 NHL050	HL-50 NHL-50	50	1.0 - 112K 1.0 - 21.5K	0.10 - 112K 1.0 - 21.5K	42.08
HL051 NHL051	HL-51 NHL-51	51	1.0 - 124K 1.0 - 22.9K	0.10 - 124K 1.0 - 22.9K	51.96
HL060 NHL060	HL-60 NHL-60	60	1.0 - 145K 1.0 - 27.2K	0.10 - 145K 1.0 - 27.2K	65.64
HL065 NHL065	HL-65 NHL-65	65	1.0 - 170K 1.0 - 31.4K	0.10 - 170K 1.0 - 31.4K	64.82
HL080 NHL080	HL-80 NHL-80	80	1.0 - 190K 1.0 - 38.3K	0.10 - 190K 1.0 - 38.3K	121.58
HL100 NHL100	HL-100 NHL-100	100	1.0 - 260K 1.0 - 48.5K	0.10 - 260K 1.0 - 48.5K	91.37
HL120 NHL120	HL-120 NHL-120	120	1.0 - 330K 1.0 - 64.1K	0.10 - 330K 1.0 - 64.1K	183.82
HL130 NHL130	HL-130 NHL-130	130	1.0 - 380K 1.0 - 70.2K	0.10 - 380K 1.0 - 70.2K	192.36
HL160 NHL160	HL-160 NHL-160	160	1.0 - 470K 1.0 - 105K	0.10 - 470K 1.0 - 105K	245.86
HL175 NHL175	HL-175 NHL-175	175	1.0 - 500K 1.0 - 112K	0.10 - 500K 1.0 - 112K	250.80
HL225 NHL225	HL-225 NHL-225	225	1.0 - 645K 1.0 - 121K	0.10 - 645K 1.0 - 121K	309.97

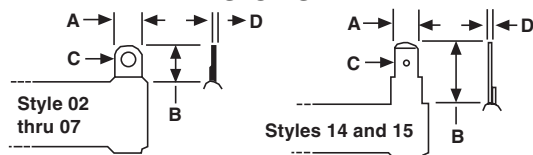
GLOBAL PART NUMBER INFORMATION																	
New Global Part Numbering: NHL10006Z10R00JJ (preferred part number format)																	
N	H	L	1	0	0	0	6	Z	1	0	R	0	0	J	J		
GLOBAL MODEL	TERMINAL DESIGNATION	TERMINAL FINISH	RESISTANCE VALUE				TOLERANCE	PACKAGING CODE		SPECIAL							
NHL100 <small>(See "Standard Electrical Specifications" table above for additional P/N's)</small>	02 05 06 07 14 15	E = Lead (Pb)-free Z = Tin/lead N = Nickel	R = Decimal K = Thousand 10R00 = 10.0 Ω 1K000 = 1 k Ω				J = $\pm 5.0\%$ K = $\pm 10.0\%$	E = Lead (Pb)-free skin pack J* = Skin pack (J01)		(Dash Number) (up to 2 digits) From 1 - 99 as applicable							
Historical Part Number Example: NHL-100-06Z 10 Ω 5 % J01 (will continue to be accepted)																	
NHL-100	06Z	10 Ω	5 %	J01													
HISTORICAL MODEL	TERMINAL/FINISH	RESISTANCE VALUE	TOLERANCE	PACKAGING													

* Pb containing terminations are not RoHS compliant, exemptions may apply

DIMENSIONS


(Includes Coating and Terminal Band)

GLOBAL MODEL	DIMENSIONS in inches [millimeters]								
	A (max.)	CORE DIMENSIONS			TERMINAL SETBACK ± 0.031 [± 0.79]	DISTANCE BETWEEN TERMINALS (REF.)	TERMINAL DESIGNATION		MOUNTING HARDWARE OPTIONS
		LENGTH ± 0.062 [± 1.59]	O.D.	I.D. ± 0.031 [± 0.79]			STANDARD	OPTIONAL	
HL011 NHL011	11.91 [0.469]	1.750 [44.45]	0.375 [9.53]	4.76 [0.188]	0.094 [2.38]	1.187	02	-	101, 204, 301
HL012 NHL012	10.32 [0.406]	1.750 [44.45]	0.313 [7.94]	4.76 [0.188]	0.094 [2.38]	1.187	05	14	101, 204, 301
HL015 NHL015	0.563 [14.29]	1.500 [38.10]	0.438 [11.11]	0.313 [7.94]	0.094 [2.38]	0.937	02	14	101, 203, 301
HL020 NHL020	0.563 [14.29]	2.000 [50.8]	0.438 [11.11]	0.313 [7.94]	0.094 [2.38]	1.437	02	14	101, 203, 301
HL025 NHL025	0.688 [17.46]	2.000 [50.8]	0.563 [14.29]	0.313 [7.94]	0.094 [2.38]	1.312	06	15	101, 203, 301
HL026 NHL026	0.563 [14.29]	3.000 [76.2]	0.438 [11.11]	0.313 [7.94]	0.094 [2.38]	2.437	02	14	101, 203, 301
HL050 NHL050	0.688 [17.46]	4.000 [101.6]	0.563 [14.29]	0.313 [7.94]	0.094 [2.38]	3.312	06	15	101, 203, 301
HL051 NHL051	0.906 [23.02]	3.500 [88.9]	0.750 [19.05]	0.500 [12.70]	0.125 [3.18]	2.75	06	15	102, 206, 303
HL060 NHL060	0.906 [23.02]	4.000 [101.6]	0.750 [19.05]	0.500 [12.70]	0.125 [3.18]	3.250	06	15	102, 206, 303
HL065 NHL065	0.906 [23.02]	114.3 [4.500]	0.750 [19.05]	0.500 [12.70]	0.125 [3.18]	3.750	06	15	102, 206, 303
HL080 NHL080	1.313 [33.34]	4.000 [101.6]	1.125 [28.58]	0.500 [12.70]	0.219 [5.56]	2.812	07	15	103, 205, 303
HL100 NHL100	0.906 [23.02]	6.500 [165.1]	0.750 [19.05]	0.500 [12.70]	0.125 [3.18]	5.750	06	15	102, 206, 303
HL120 NHL120	1.313 [33.34]	6.000 [152.4]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	4.812	07	15	103, 205, 303
HL130 NHL130	1.313 [33.34]	6.500 [165.1]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	5.312	07	15	103, 205, 303
HL160 NHL160	1.313 [33.34]	8.000 [203.2]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	6.812	07	15	103, 205, 303
HL175 NHL175	1.313 [33.34]	8.500 [215.9]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	7.312	07	15	103, 205, 303
HL225 NHL225	1.313 [33.34]	266.7 [10.500]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	9.312	07	15	103, 205, 303

TERMINAL DIMENSIONS

TERMINAL FINISH

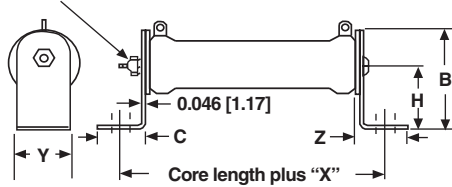
“E” Finish - 100 % Sn coated steel. “Z” Finish - 60/40 SnPb coated steel. “N” Finish - Nickel coated steel. Finish for terminal style 14 and 15 limited to nickel plated steel (N).

DIMENSION	TERMINAL TYPE					
	02	05	06	07	14	15
A	0.188 [4.76]	0.188 [4.76]	0.250 [6.35]	0.375 [9.53]	0.188 [4.76]	0.250 [6.35]
B	0.406 [10.32]	0.438 [11.11]	0.563 [14.29]	0.625 [15.88]	0.563 [14.29]	0.594 [15.08]
C	0.093 [2.36]	0.104 [2.64]	0.166 [4.22]	0.173 [4.39]	0.050 [1.27]	0.065 [1.65]
D	0.020 [0.51]	0.020 [0.51]	0.020 [0.51]	0.020 [0.51]	0.020 [0.51]	0.031 [0.79]

MOUNTING HARDWARE DIMENSIONS in inches [millimeters]

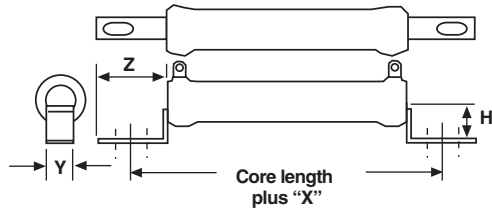
Horizontal Thru-Bolt

(Threaded rod supplied as standard on HL050 thru HL225 sizes.)



BRACKET TYPE	X	Y	Z	H	MOUNTING SLOT	C	B
101	1.063 [26.99]	0.500 [12.70]	0.859 [21.83]	1.000 [25.40]	0.219 x 0.438 [5.56 x 11.11]	0.750 [19.05]	1.375 [34.93]
102	1.063 [26.99]	0.750 [19.05]	0.859 [21.83]	1.250 [31.75]	0.219 x 0.438 [5.56 x 11.11]	0.750 [19.05]	1.750 [44.45]
103	1.063 [26.99]	1.250 [31.75]	1.000 [25.40]	1.500 [38.10]	0.281 x 0.563 [7.14 x 14.29]	0.875 [22.23]	2.125 [53.98]

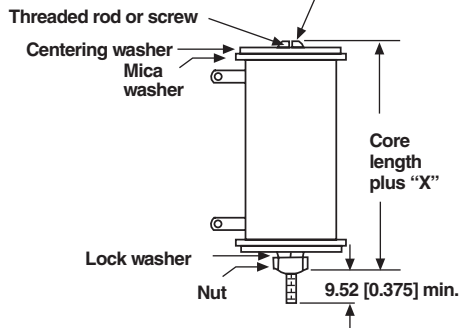
Push-In



BRACKET TYPE	X	H	Y	Z	HOLE (Dia.)
203	0.625 [15.88]	0.672 [17.07]	0.250 [6.35]	0.469 [11.91]	0.161 [4.09]
204	0.375 [9.53]	0.281 [7.14]	0.250 [6.35]	0.344 [8.73]	0.144 [3.66]
205	0.813 [20.64]	1.391 [35.32]	0.500 [12.70]	0.688 [17.46]	0.196 x 0.260 [4.98 x 6.60]
206	0.719 [18.26]	0.969 [24.61]	0.375 [9.53]	0.625 [15.88]	0.196 x 0.260 [4.98 x 6.60]

Vertical Thru-Bolt

(Threaded rod supplied as standard on HL050 thru HL225 sizes.)



BRACKET TYPE	X (Approximate)	THREAD
301	0.438 [11.11]	8-32
303	0.500 [12.70]	10-32

TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	HL, NHL RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/°C	± 90 for 0.1 Ω to 0.99 Ω; ± 50 for 1 Ω to 9.9 Ω; ± 30 for 10 Ω and above
Dielectric Withstanding Voltage	V _{AC}	1000, from terminal to mounting hardware
Short Time Overload	-	10 × rated power for 5 s
Maximum Working Voltage	V	(P × R) ^{1/2}
Insulation Resistance	Ω	1000 MΩ minimum dry, 100 MΩ minimum after moisture test
Operating Temperature Range	°C	- 55 to + 350



MATERIAL SPECIFICATIONS

Element: Copper-nickel alloy of nickel-chrome alloy, depending on resistance value

Core: Ceramic, steatite

Coating: Special high temperature silicone

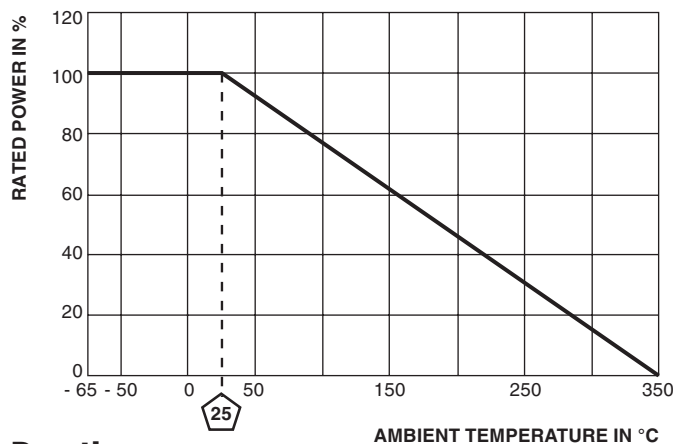
Standard Terminals: Model “Z” terminals are tinned steel

Terminal Bands: Steel

Part Marking: DALE, model, wattage, value, tolerance, date code

NHL NON-INDUCTIVE

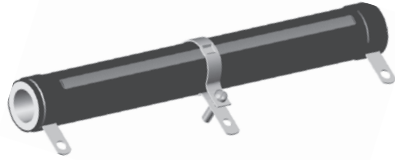
Models of equivalent physical and electrical specifications are available with non-inductive (Aryton-Perry) winding. They are identified by adding the letter N to the front of the HL type designation (NHL-225 for example). For NHL models maximum resistance values are lower, see STANDARD ELECTRICAL SPECIFICATIONS table.



Derating

PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS
Thermal Shock	Rated power applied until thermally stable, then a minimum of 15 min at - 55 °C	± (2.0 % + 0.05 Ω) ΔR
Short Time Overload	10 x rated power for 5 s	± (2.0 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	1000 V _{rms} , 1 min	± (0.1 % + 0.05 Ω) ΔR
Low Temperature Storage	- 55 °C for 24 h	± (2.0 % + 0.05 Ω) ΔR
High Temperature Exposure	250 h at + 350 °C	± (2.0 % + 0.05 Ω) ΔR
Moisture Resistance	MIL-STD-202 Method 106, 7b not applicable	± (2.0 % + 0.05 Ω) ΔR
Shock, Specified Pulse	MIL-STD-202 Method 213, 100 g's for 6 ms, 10 shocks	± (0.2 % + 0.05 Ω) ΔR
Vibration, High Frequency	Frequency varied 10 to 2000 Hz, 20 g peak, 2 directions 6 h each	± (0.2 % + 0.05 Ω) ΔR
Load Life	1000 h at rated power, + 25 °C, 1.5 h “ON”, 0.5 h “OFF”	± (3.0 % + 0.05 Ω) ΔR

Wirewound Resistors, Industrial Power, Adjustable Tapped Tubular



FEATURES

- Adjustable resistor or voltage divider
- High temperature silicon coating
- Can be used to quickly obtain odd resistance values
- One or more adjustable lugs can be provided for voltage divider applications
- Can be used as multi-tap resistor



RoHS*
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS				
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{25\text{ }^\circ\text{C}}$ W	RESISTANCE RANGE Ω	WEIGHT (typical) g
			$\pm 5\%$	
HLA012	HLA-12	12	1.0 - 10K	6.69
HLA020	HLA-20	20	1.0 - 18K	12.57
HLA025	HLA-25	25	1.0 - 23K	20.72
HLA026	HLA-26	26	1.0 - 31K	15.34
HLA050	HLA-50	50	1.0 - 57K	42.08
HLA051	HLA-51	51	1.0 - 95K	51.96
HLA060	HLA-60	60	1.0 - 74K	65.64
HLA065	HLA-65	65	1.0 - 130K	64.82
HLA080	HLA-80	80	1.0 - 111K	121.58
HLA100	HLA-100	100	1.0 - 132K	91.37
HLA120	HLA-120	120	1.0 - 180K	183.82
HLA130	HLA-130	130	1.0 - 192K	192.36
HLA160	HLA-160	160	1.0 - 249K	245.86
HLA175	HLA-175	175	1.0 - 398K	250.80
HLA225	HLA-225	225	1.0 - 337K	309.97

TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	HLA RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/ $^\circ\text{C}$	± 90 for 0.1 Ω to 0.99 Ω ; ± 50 for 1 Ω to 9.9 Ω ; ± 30 for 10 Ω and above
Short Time Overload ⁽¹⁾	-	10 x rated power for 5 s
Maximum Working Voltage	V	$(P \times R)^{1/2}$
Operating Temperature Range	$^\circ\text{C}$	- 55 to + 350

Note

⁽¹⁾ Short Time Overload is rated without adjustable lug attached.

MATERIAL SPECIFICATIONS

Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance range

Core: Ceramic, steatite

Coating: Special high temperature silicone

Standard Terminals: Model "Z" terminals are tinned steel

Terminal Bands: Steel

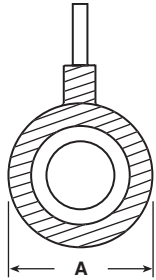
Part Marking: DALE, model, wattage, value, tolerance, date code

GLOBAL PART NUMBER INFORMATION																	
New Global Part Numbering: HLA22507Z200R0J (preferred part number format)																	
H	L	A	2	2	5	0	7	Z	2	0	0	R	0	J	J		
GLOBAL MODEL	TERMINAL DESIGNATION	TERMINAL FINISH	RESISTANCE VALUE	TOLERANCE	PACKAGING CODE	SPECIAL											
HLA225 (See "Standard Electrical Specifications" table above for additional P/N's)	02 05 06 07 14 15	E = Lead (Pb)-free Z = Tin/lead N = Nickel	R = Decimal K = Thousand 10R00 = 10.0 Ω 1K000 = 1 k Ω	J = 5.0 % K = 10.0 %	E = Lead (Pb)-free skin pack J* = Skin pack (J01)	(Dash Number) (up to 2 digits) From 1 - 99 as applicable											
Historical Part Number Example: HLA-225-07Z 200 Ω 5% J01 (will continue to be accepted)																	
HLA-225	07Z	200 Ω	5%	J01													
HISTORICAL MODEL	TERMINAL/FINISH	RESISTANCE VALUE	TOLERANCE	PACKAGING													

* Pb containing terminations are not RoHS compliant, exemptions may apply

DIMENSIONS

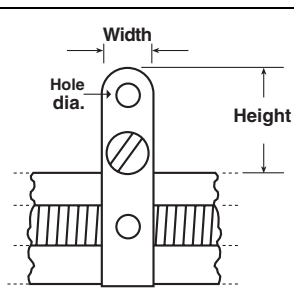
GLOBAL MODEL	DIMENSIONS in inches [millimeters]									
	A (max.)	CORE DIMENSIONS			TERMINAL SETBACK ± 0.031 [0.79]	DISTANCE BETWEEN TERMINALS (REF.)	TERMINAL DESIGNATION		ADJ. SLIDER	MOUNTING HARDWARE OPTIONS
		LENGTH ± 0.063 [1.59]	O.D.	I.D. ± 0.031 [0.79]			STANDARD	OPTIONAL		
HLA012	0.406 [10.32]	1.750 [44.45]	0.313 [7.94]	0.188 [4.76]	0.094 [2.38]	1.187	05Z	14 N	70	101, 204, 301
HLA020	0.563 [14.29]	2.000 [50.80]	0.438 [11.11]	0.313 [7.94]	0.094 [2.38]	1.437	02Z	14 N	71	101, 203, 301
HLA025	0.688 [17.46]	2.000 [50.80]	0.563 [14.29]	0.313 [7.94]	0.094 [2.38]	1.312	06Z	15 N	72	101, 203, 301
HLA026	0.563 [14.29]	3.000 [76.20]	0.438 [11.11]	0.313 [7.94]	0.094 [2.38]	2.437	02Z	14 N	71	101, 203, 301
HLA050	0.688 [17.46]	4.000 [101.60]	0.563 [14.29]	0.313 [7.94]	0.094 [2.38]	3.312	06Z	15 N	72	101, 203, 301
HLA051	0.906 [23.02]	3.500 [88.90]	0.750 [19.05]	0.500 [12.70]	0.125 [2.38]	2.75	06Z	15 N	73	102, 206, 303
HLA060	0.906 [23.02]	4.000 [101.60]	0.750 [19.05]	0.500 [12.70]	0.125 [2.38]	3.250	06Z	15 N	73	102, 206, 303
HLA065	0.906 [23.02]	4.500 [114.30]	0.750 [19.05]	0.500 [12.70]	0.125 [2.38]	3.750	06Z	15 N	73	102, 206, 303
HLA080	1.313 [33.34]	4.000 [101.60]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	2.812	07Z	15 N	74	103, 205, 303
HLA100	0.906 [23.02]	6.500 [165.10]	0.750 [19.05]	0.500 [12.70]	0.125 [2.38]	5.750	06Z	15 N	73	102, 206, 303
HLA120	1.313 [33.34]	6.000 [152.40]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	4.812	07Z	15 N	74	103, 205, 303
HLA130	1.313 [33.34]	6.500 [165.10]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	5.312	07Z	15 N	74	103, 205, 303
HLA160	1.313 [33.34]	8.000 [203.20]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	6.812	07Z	15 N	74	103, 205, 303
HLA175	1.313 [33.34]	215.90 [8.500]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	7.312	07Z	15 N	74	103, 205, 303
HLA225	1.313 [33.34]	10.500 [266.70]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	9.312	07Z	15 N	74	103, 205, 303



(Includes Coating and Terminal Band)

Moving Adjustable Lugs: The coating protects the resistance wire from shifting and shorting to other turns during adjustment. However, the following three steps should always be taken whenever adjustments are made:

- (1) Turn off power to avoid possible operator injury and damage to the unit.
- (2) Loosen adjustable lug until it will slide completely free, without touching the exposed wire.
- (3) When adjustment point has been selected, retighten lug only enough to assure a firm contact, do not tighten beyond this point. Failure to follow these three steps in order can result in damage to the resistor.



SLIDER MODEL NUMBER	WIDTH	HEIGHT	HOLE DIAMETER
70	0.188 [4.76]	0.516 [13.10]	0.125 [3.18]
71	0.250 [6.35]	0.594 [15.08]	0.156 [3.96]
72	0.250 [6.35]	0.719 [18.26]	0.141 [3.58]
73	0.250 [6.35]	0.781 [19.84]	0.141 [3.58]
74	0.313 [7.94]	0.781 [19.84]	0.170 [4.32]

TERMINAL DIMENSIONS

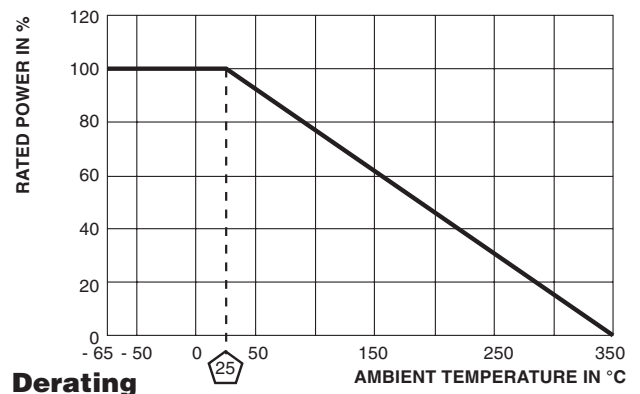

DIMENSION	TERMINAL TYPE					
	02	05	06	07	14	15
A	0.188 [4.76]	0.188 [4.76]	0.250 [6.35]	0.375 [9.53]	0.188 [4.76]	0.250 [6.35]
B	0.406 [10.32]	0.438 [11.118]	0.563 [14.29]	0.625 [15.88]	0.563 [14.29]	0.594 [15.08]
C	0.093 [2.36]	0.104 [2.64]	0.166 [4.22]	0.173 [4.39]	0.050 [1.27]	0.065 [1.65]
D	0.020 [0.51]	0.020 [0.51]	0.020 [0.51]	0.020 [0.51]	0.020 [0.51]	0.031 [0.79]

TERMINAL FINISH

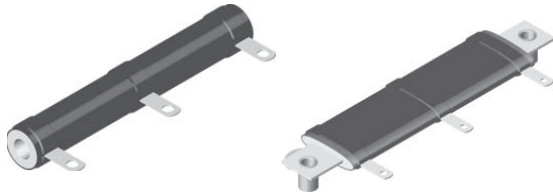
“E” Finish - 100 % Sn coated steel. “Z” Finish - 60/40 Sn/Pb coated steel. “N” Finish - Nickel coated steel. Finish for terminal style 14 and 15 is limited to nickel plated steel (N).

MOUNTING HARDWARE

HLA resistors use same mounting hardware as standard HL resistors, see HL data sheet for mounting hardware dimensions.



Wirewound Resistors, Industrial Power, Tapped Tubular



FEATURES

- Fixed taps for voltage dividers
- High temperature silicon coating
- Complete welded construction
- Excellent stability in operation (< 3 % change in resistance)
- Can be used as multi-tap resistor



RoHS*
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS				
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{25^\circ\text{C}}$ W	RESISTANCE RANGE TOTAL RESISTANCE WITH ONE TAP $\Omega \pm 10\%$	WEIGHT (typical) g
HLT015	HLT-15	15	0.1 - 18K	8.64
HLT020	HLT-20	20	0.1 - 31K	12.57
HLT025	HLT-25	25	0.1 - 34K	20.72
HLT026	HLT-26	26	0.1 - 59K	15.34
HLT050	HLT-50	50	0.1 - 104K	42.08
HLT051	HLT-51	51	0.1 - 112K	51.96
HLT055	HLT-55	55	0.1 - 49K	60.48
HLT060	HLT-60	60	0.1 - 136K	65.64
HLT065	HLT-65	65	0.1 - 159K	64.82
HLT070	HLT-70	70	0.1 - 72K	60.48
HLT080	HLT-80	80	0.1 - 164K	121.58
HLT095	HLT-95	95	0.1 - 96K	76.51
HLT100	HLT-100	100	0.1 - 253K	91.37
HLT120	HLT-120	120	0.1 - 305K	183.82
HLT130	HLT-130	130	0.1 - 358K	192.36
HLT160	HLT-160	160	0.1 - 446K	245.86
HLT175	HLT-175	175	0.1 - 481K	250.80
HLT225	HLT-225	225	0.1 - 622K	309.97

TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	HLT RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/°C	± 90 for 0.1 Ω to 0.99 Ω , ± 50 for 1.0 Ω to 9.9 Ω , ± 30 for 10 Ω and above
Dielectric Withstanding Voltage	V_{AC}	1000, from terminal to mounting hardware
Short Time Overload	-	10 x rated power for 5 s
Maximum Working Voltage	V	$(P \times R)^{1/2}$
Insulation Resistance	Ω	1000 M Ω minimum dry, 100 M Ω minimum after moisture test
Operating Temperature Range	°C	- 55 to + 350

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: HLT12007Z150R0KJ (preferred part numbering format)

H	L	T	1	2	0	0	7	Z	1	5	0	R	0	K	J		
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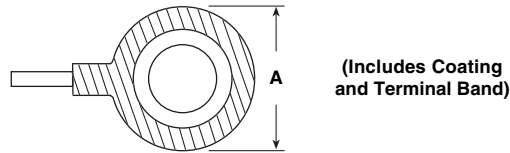
GLOBAL MODEL	TERMINAL DESIGNATION	TERMINAL FINISH	RESISTANCE VALUE	TOLERANCE	PACKAGING CODE	SPECIAL
HLT120 (See "Standard Electrical Specifications" table above for additional P/N's)	02 06 07 09 14 15 16	E = Lead (Pb)-free Z = Tin/lead N = Nickel	R = Decimal K = Thousand 10R00 = 10.0 Ω 1K000 = 1 k Ω	K = $\pm 10.0\%$	E = Lead (Pb)-free skin pack J* = Skin pack (J01)	(Dash Number) (up to 2 digits) From 1 - 99 as applicable

* Tin/lead for type "Z", lead (Pb)-free for type "N"

Historical Part Number Example: HLT-120-07Z 150 Ω 10% J01 (will continue to be accepted)

HLT-120	07Z	150 Ω	10 %	J01
HISTORICAL MODEL	TERMINAL/FINISH	RESISTANCE VALUE	TOLERANCE	PACKAGING

* Pb containing terminations are not RoHS compliant, exemptions may apply

DIMENSIONS


MODEL	DIMENSIONS in inches [millimeters]								
	A (max.)	CORE DIMENSIONS			TERMINAL SETBACK ± 0.031 [± 0.79]	DISTANCE BETWEEN TERMINALS (REF.)	TERMINAL DESIGNATION		MOUNTING HARDWARE OPTIONS
		LENGTH ± 0.062 [± 1.59]	O.D.	I.D. ± 0.031 [± 0.79]			STANDARD	OPTIONAL	
HLT015	0.563 [14.29]	1.500 [38.10]	0.438 [11.11]	0.313 [7.94]	0.094 [2.38]	0.937 [23.80]	02Z	14N	101, 203, 301
HLT020	0.563 [14.29]	2.000 [50.80]	0.438 [11.11]	0.313 [7.94]	0.094 [2.38]	1.437 [36.50]	02Z	14N	101, 203, 301
HLT025	0.688 [17.46]	2.000 [50.80]	0.563 [14.29]	0.313 [7.94]	0.094 [2.38]	1.312 [33.32]	06Z	15N	101, 203, 301
HLT026	0.563 [14.29]	3.000 [76.20]	0.438 [11.11]	0.313 [7.94]	0.094 [2.38]	2.437 [61.90]	02Z	14N	101, 203, 301
HLT050	0.688 [17.46]	4.000 [101.60]	0.563 [14.29]	0.313 [7.94]	0.094 [2.38]	3.312 [84.12]	06Z	15N	101, 203, 301
HLT051	0.906 [23.02]	3.500 [88.90]	0.750 [19.05]	0.500 [12.70]	0.125 [3.18]	2.75 [69.85]	06Z	15N	102, 206, 303
HLT055	(1)	3.500 [88.90]	(1)	(1)	(1)	2.968 [75.39]	09Z	16N	(1)
HLT060	0.906 [23.02]	4.000 [101.60]	0.750 [19.05]	0.500 [12.70]	0.125 [3.18]	3.250 [82.55]	06Z	15N	102, 206, 303
HLT065	0.906 [23.02]	4.500 [114.30]	0.750 [19.05]	0.500 [12.70]	0.125 [3.18]	3.750 [95.25]	06Z	15N	102, 206, 303
HLT070	(1)	4.750 [120.65]	(1)	(1)	(1)	4.218 [107.14]	09Z	16N	(1)
HLT080	1.313 [33.34]	4.000 [101.60]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	2.812 [71.42]	07Z	15N	103, 205, 303
HLT095	(1)	6.000 [152.40]	(1)	(1)	(1)	5.468 [138.89]	09Z	16N	(1)
HLT100	0.906 [23.02]	6.500 [165.10]	0.750 [19.05]	0.500 [12.70]	0.125 [3.18]	5.750 [146.05]	06Z	15N	102, 206, 303
HLT120	1.313 [33.34]	6.000 [152.40]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	4.812 [122.23]	07Z	15N	103, 205, 303
HLT130	1.313 [33.34]	6.500 [165.10]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	5.312 [134.93]	07Z	15N	103, 205, 303
HLT160	1.313 [33.34]	8.000 [203.20]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	6.812 [173.03]	07Z	15N	103, 205, 303
HLT175	1.313 [33.34]	8.500 [215.90]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	7.312 [185.73]	07Z	15N	103, 205, 303
HLT225	1.313 [33.34]	10.500 [266.70]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	9.312 [236.53]	07Z	15N	103, 205, 303

Note

(1) HLT-55, HLT-70 and HLT-95 are HL Flat style, see HL Flat data sheet for detail dimensions

TERMINAL DIMENSIONS


DIMENSION	TERMINAL TYPE						
	02	06	07	09	14	15	16
A	0.188 [4.76]	0.250 [6.35]	0.375 [9.53]	0.188 [4.76]	0.188 [4.76]	0.250 [6.35]	0.188 [4.76]
B	0.406 [10.32]	0.563 [14.29]	0.625 [15.88]	0.500 [12.70]	0.563 [14.29]	0.594 [15.08]	0.563 [14.29]
C	0.093 [2.36]	0.166 [4.22]	0.173 [4.39]	0.104 [2.64]	0.050 [1.27]	0.065 [1.65]	0.050 [1.27]
D	0.020 [0.51]	0.020 [0.51]	0.020 [0.51]	0.020 [0.51]	0.020 [0.51]	0.031 [0.79]	0.020 [0.51]

MOUNTING HARDWARE

HLT type resistors use same mounting hardware as standard HL type resistor, see HL data sheet for mounting hardware dimensions.

MATERIAL SPECIFICATIONS
Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value

Core: Ceramic, steatite

Coating: Special high temperature silicone

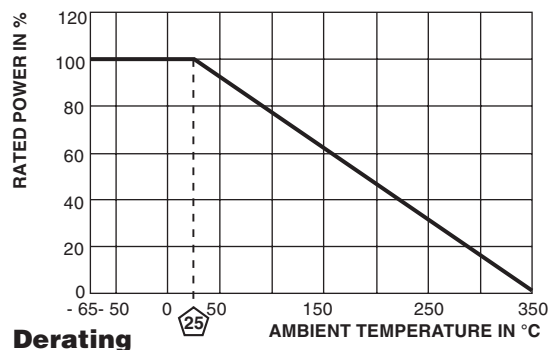
Standard Terminals: Model "Z" terminals are tinned steel

Terminal Bands: Steel

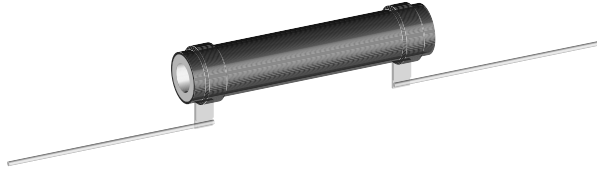
Part Marking: DALE, model, wattage, value, tolerance, date code

TERMINAL FINISH

"E" Finish - 100 % Sn coated steel. "Z" Finish - 60/40 Sn/Pb coated steel. "N" Finish - Nickel coated steel. Finish for terminal style 14 and 15 is limited to nickel plated steel (N).



Wirewound Resistors, Industrial Power, Tubular



FEATURES

- High temperature silicon coating
- Complete welded construction
- Excellent for intermittent power and pulsing applications
- Available in non-inductive styles (model NHLW) with Aryton-Perry winding
- Axial or radial terminals for through hole or lead weld applications
- Excellent stability in operation (< 3 % change in resistance)



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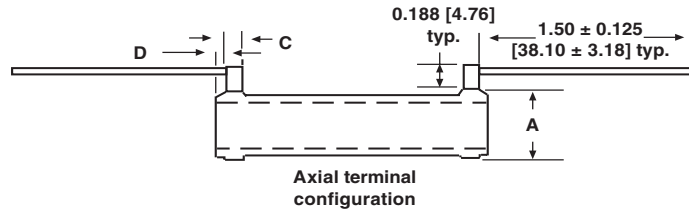
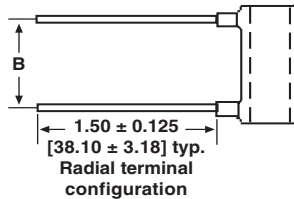
STANDARD ELECTRICAL SPECIFICATIONS					
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{25\text{ }^\circ\text{C}}$ W	RESISTANCE RANGE Ω		WEIGHT (typical) g
			$\pm 5\%$	$\pm 10\%$	
HLW03 NHLW03	HLW-3 NHLW-3	3	1.0 - 6K 1.0 - 700	0.10 - 6K 1.0 - 700	1.16
HLW05 NHLW05	HLW-5 NHLW-5	5.25	1.0 - 15K 1.0 - 1.9K	0.10 - 15K 1.0 - 1.9K	2.12
HLW06 NHLW06	HLW-6 NHLW-6	8	1.0 - 20.5K 1.0 - 2.7K	0.10 - 20.5K 1.0 - 2.7K	4.60
HLW10 NHLW10	HLW-10 NHLW-10	10	1.0 - 29K 1.0 - 3.7K	0.10 - 29K 1.0 - 3.7K	6.24
HLW12 NHLW12	HLW-12 NHLW-12	12	1.0 - 58K 1.0 - 3.9K	0.10 - 58K 1.0 - 3.9K	6.60
HLW15 NHLW15	HLW-15 NHLW-15	15	1.0 - 60K 1.0 - 4.3K	0.10 - 58K 1.0 - 4.3K	8.82
HLW20 NHLW20	HLW-20 NHLW-20	20	1.0 - 95K 1.0 - 6.8K	0.10 - 95K 1.0 - 6.8K	11.36

TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	HLW RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/°C	± 90 for 0.1 Ω to 0.99 Ω ; ± 50 for 1 Ω to 9.9 Ω ; ± 30 for 10 Ω and above
Dielectric Withstanding Voltage	V_{AC}	1000, from terminal to mounting hardware
Short Time Overload	-	10 x rated power for 5 s
Maximum Working Voltage	V	$(P \times R)^{1/2}$
Insulation Resistance	Ω	1000 M Ω minimum dry, 100 M Ω minimum after moisture test
Operating Temperature Range	°C	- 55 to + 350

GLOBAL PART NUMBER INFORMATION																	
New Global Part Numbering: NHLW12A1Z10R00JF (preferred part number format)																	
N	H	L	W	1	2	A	1	Z	1	0	R	0	0	J	F		
GLOBAL MODEL	TERMINAL DESIGNATION			TERMINAL FINISH		RESISTANCE VALUE		TOLERANCE		PACKAGING CODE			SPECIAL				
NHLW12 (See "Standard Electrical Specifications" table above for additional P/N's)	A1 A2 R1 R2			E = Lead (Pb) -free Z = Tin/lead		R = Decimal K = Thousand 10R00 = 10.0 Ω 1K000 = 1 k Ω		J = $\pm 5.0\%$ K = $\pm 10.0\%$		E = Lead (Pb)-free foam pack F = Tin/lead foam pack (F01)			(Dash Number) (up to 2 digits) From 1 - 99 as applicable				
Historical Part Number Example: NHLW-12-A1Z 10 Ω 5 % F01 (will continue to be accepted)																	
NHLW-12			A1Z			10 Ω			5 %			F01					
HISTORICAL MODEL			TERMINAL/FINISH			RESISTANCE VALUE			TOLERANCE			PACKAGING					

* Pb containing terminations are not RoHS compliant, exemptions may apply

DIMENSIONS in inches [millimeters]



GLOBAL MODEL	A (max.)	B typ.	C ± 0.031 [0.79]	D typ.	CORE DIMENSIONS			AXIAL TERMINAL DESIGNATION	RADIAL TERMINAL DESIGNATION	MOUNTING HARDWARE
					LENGTH ± 0.063 [1.59]	O.D.	I.D. ± 0.031 [0.79]			
HLW03	0.297 [7.54]	0.282 [7.16]	0.063 [1.59]	0.047 [1.19]	0.438 [11.11]	0.203 [5.16]	0.125 [3.18]	A2Z	R2Z	-
HLW05	0.344 [8.73]	0.469 [11.91]	0.063 [1.59]	0.047 [1.19]	0.625 [15.88]	0.250 [6.35]	0.125 [3.18]	A2Z	R2Z	-
HLW06	0.406 [10.32]	0.688 [17.48]	0.125 [3.18]	0.094 [2.38]	1.000 [25.40]	0.313 [7.94]	0.188 [4.76]	A1Z	R1Z	101, 204, 301
HLW10	0.563 [14.28]	0.688 [17.48]	0.125 [3.18]	0.094 [2.38]	1.000 [25.40]	0.438 [11.11]	7.94 [0.313]	A1Z	R1Z	101, 203, 301
HLW12	0.406 [10.32]	1.438 [36.53]	0.125 [3.18]	0.094 [2.38]	1.750 [44.45]	0.313 [7.94]	4.76 [0.188]	A1Z	R1Z	101, 204, 301
HLW15	0.563 [14.29]	1.188 [30.18]	0.125 [3.18]	0.094 [2.38]	1.500 [38.10]	0.438 [11.11]	7.94 [0.313]	A1Z	R1Z	101, 203, 301
HLW20	0.563 [14.29]	1.688 [42.88]	0.125 [3.18]	0.094 [2.38]	2.000 [50.80]	0.438 [11.11]	7.94 [0.313]	A1Z	R1Z	101, 203, 301

TERMINAL FINISH

Terminals are 20 AWG for HLW03 and HLW05 size and 18 AWG for all other sizes. "E" Finish - 100 % Sn, coated Copperweld®. "Z" Finish - 60/40 Sn/Pb coated Copperweld®.

MOUNTING HARDWARE DIMENSIONS in inches [millimeters]

HORIZONTAL THRU-BOLT	
DIMENSION	BRACKET TYPE
	101
X	1.063 [26.99]
Y	0.500 [12.70]
Z	0.859 [21.83]
H	1.000 [25.40]
B	1.375 [34.93]
C	0.750 [19.05]
MOUNTING SLOT	0.219 x 0.438 [5.56 x 11.11]

PUSH-IN		
DIMENSION	BRACKET TYPE	
	203	204
X	0.625 [15.88]	0.375 [9.53]
H	0.672 [17.07]	0.281 [7.14]
Y	0.250 [6.35]	0.250 [6.35]
Z	0.469 [11.91]	0.344 [8.73]
HOLE (Dia.)	0.161 [4.09]	0.144 [3.66]

VERTICAL THRU-BOLT	
DIMENSION	BRACKET TYPE
	301
X (Approximate)	0.438 [11.11]
THREAD	8-32

MATERIAL SPECIFICATIONS

Element: Copper-nickel alloy of nickel-chrome alloy, depending on resistance value

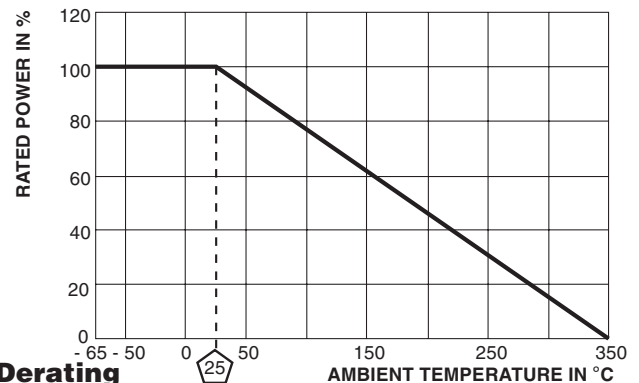
Core: Ceramic, steatite

Coating: Special high temperature silicone

Standard Terminals: Model "Z" terminals are tinned Copperweld®

Terminal Bands: Steel

Part Marking: DALE, model, wattage, value, tolerance, date code



Wirewound Resistors, Industrial Power, Edgewound



FEATURES

- High temperature silicon coating
- Complete welded construction
- Excellent for intermittent power and pulsing applications
- Designed to meet heavy-duty requirement where space is at a premium
- Excellent stability in operation (< 3 % change in resistance)



RoHS*
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS				
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{25\text{ }^\circ\text{C}}$ W	RESISTANCE RANGE Ω $\pm 10\%$ standard, $\pm 5\%$ available	WEIGHT (typical) g
HLZ033	HLZ-33	35	0.05 - 1.9	18
HLZ090	HLZ-90	90	0.10 - 5.7	36
HLZ099	HLZ-99	100	0.15 - 6.1	41
HLZ105	HLZ-105	105	0.20 - 7.4	49
HLZ110	HLZ-110	110	0.20 - 8.6	54
HLZ140	HLZ-140	140	0.08 - 9.0	109
HLZ165	HLZ-165	165	0.35 - 13.0	91
HLZ220	HLZ-220	220	0.10 - 16.0	163
HLZ240	HLZ-240	240	0.10 - 18.0	186
HLZ275	HLZ-275	275	0.15 - 23.0	224
HLZ300	HLZ-300	300	0.15 - 25.0	236
HLZ375	HLZ-375	375	0.20 - 32.0	286

TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	HLZ RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/ $^\circ\text{C}$	± 90 for 0.1 Ω to 0.99 Ω ; ± 50 for 1 Ω to 9.9 Ω ; ± 30 for 10 Ω and above
Dielectric Withstanding Voltage	V_{AC}	1000, from terminal to mounting hardware
Short Time Overload	-	10 x rated power for 5 s
Maximum Working Voltage	V	$(P \times R)^{1/2}$
Insulation Resistance	Ω	1000 M Ω minimum dry, 100 M Ω minimum after moisture test
Operating Temperature Range	$^\circ\text{C}$	- 55 to + 350

MATERIAL SPECIFICATIONS

Element: Copper-nickel alloy of nickel-chrome alloy, depending on resistance range

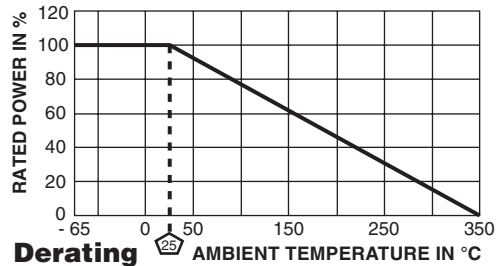
Core: Ceramic, steatite

Coating: Special high temperature silicone

Standard Terminals: Model "Z" terminals are tinned steel

Terminal Bands: Steel

Part Marking: DALE, model, wattage, value, tolerance, date code

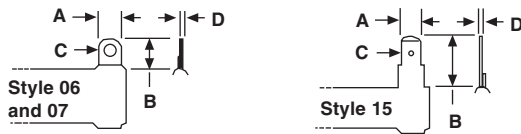


GLOBAL PART NUMBER INFORMATION																	
New Global Part Numbering: HLZ16506Z10R00KJ (preferred part number format)																	
H	L	Z	1	6	5	0	6	Z	1	0	R	0	0	K	J		
GLOBAL MODEL	TERMINAL DESIGNATION	TERMINAL FINISH	RESISTANCE VALUE	TOLERANCE	PACKAGING CODE	SPECIAL											
HLZ165 (See "Standard Electrical Specifications" table above for additional P/N's)	06 07 15	E = Lead (Pb)-free Z = Tin/lead N = Nickel	R = Decimal K = Thousand 10R00 = 10.0 Ω 1K000 = 1 k Ω	J = $\pm 5.0\%$ K = $\pm 10.0\%$	E = Lead (Pb)-free skin pack J* = Skin pack (J01)	(Dash Number) (up to 2 digits) From 1 - 99 as applicable											
Historical Part Number Example: HLZ-165-06Z 10 Ω 10 % J01 (will continue to be accepted)																	
HLZ-165	06Z	10 Ω	10 %	J01													
HISTORICAL MODEL	TERMINAL/FINISH	RESISTANCE VALUE	TOLERANCE	PACKAGING													

* Pb containing terminations are not RoHS compliant, exemptions may apply

DIMENSIONS in inches [millimeters]

MODEL	CORE DIMENSIONS			TERMINAL SETBACK ± 0.031 [± 0.79]	DISTANCE BETWEEN TERMINALS (REF.)	TERMINAL DESIGNATION		MOUNTING HARDWARE OPTIONS
	LENGTH ± 0.062 [± 1.59]	O.D.	I.D. ± 0.031 [± 0.79]			STANDARD	OPTIONAL	
HLZ033	2.000 [50.8]	0.563 [14.29]	0.313 [7.94]	0.094 [2.38]	1.437	06Z	15N	101, 203, 301
HLZ090	4.000 [101.6]	0.563 [14.29]	0.313 [7.94]	0.094 [2.38]	3.312	06Z	15N	101, 203, 301
HLZ099	3.500 [88.9]	0.750 [19.05]	0.500 [12.70]	0.125 [3.18]	2.750	06Z	15N	102, 206, 303
HLZ105	4.000 [101.6]	0.750 [19.05]	0.500 [12.70]	0.125 [3.18]	3.250	06Z	15N	102, 206, 303
HLZ110	4.500 [114.3]	0.750 [19.05]	0.500 [12.70]	0.125 [3.18]	3.750	06Z	15N	102, 206, 303
HLZ140	4.000 [101.6]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	2.812	07Z	15N	103, 205, 303
HLZ165	6.500 [165.1]	0.750 [19.05]	0.750 [19.05]	0.125 [3.18]	5.750	06Z	15N	102, 206, 303
HLZ220	6.000 [152.4]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	4.812	07Z	15N	103, 205, 303
HLZ240	6.500 [165.1]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	5.312	07Z	15N	103, 205, 303
HLZ275	8.000 [203.2]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	6.812	07Z	15N	103, 205, 303
HLZ300	8.500 [215.9]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	7.312	07Z	15N	103, 205, 303
HLZ375	10.500 [266.7]	1.125 [28.58]	0.750 [19.05]	0.219 [5.56]	9.312	07Z	15N	103, 205, 303

TERMINAL DIMENSIONS


DIMENSION	TERMINAL TYPE		
	06	07	15
A	0.250 [6.35]	0.375 [9.53]	0.250 [6.35]
B	0.563 [14.29]	0.625 [15.88]	0.594 [15.08]
C	0.166 [4.22]	0.173 [4.39]	0.065 [1.65]
D	0.020 [0.51]	0.020 [0.51]	0.031 [0.79]

TERMINAL FINISH

“E” finish - 100 % Sn coated steel. “Z” finish - 60/40 Sn/Pb coated steel. “N” finish - nickel coated steel. Finish for terminal style 14 and 15 are limited to nickel plated steel (N).

MOUNTING HARDWARE DIMENSIONS in inches [millimeters]

HORIZONTAL THRU-BOLT				PUSH-IN				VERTICAL THRU-BOLT			
<p>(Threaded rod supplied as standard on HLZ050 and HLZ225 sizes)</p>								<p>(Threaded rod supplied as standard on HLZ050 and HLZ225 sizes)</p>			
DIMENSION	BRACKET TYPE			DIMENSION	BRACKET TYPE			DIMENSION	BRACKET TYPE		
	101	102	103		203	205	206		301	303	
X	1.063 [26.99]	1.063 [26.99]	1.063 [26.99]	X	0.625 [15.88]	0.813 [20.64]	0.719 [18.26]	X (Approximate)	0.438 [11.11]	0.500 [12.70]	
Y	0.500 [12.70]	0.750 [19.05]	1.250 [31.75]	H	0.672 [17.07]	1.391 [35.32]	0.969 [24.61]	THREAD	8-32	10-32	
Z	0.859 [21.83]	0.859 [21.83]	1.000 [25.40]	Y	0.250 [6.35]	0.500 [12.70]	0.375 [9.53]				
H	1.000 [25.40]	1.250 [31.75]	1.500 [38.10]	Z	0.469 [11.91]	0.688 [17.46]	0.625 [15.88]				
MOUNTING SLOT	0.219 x 0.438 [5.56 x 11.11]	0.219 x 0.438 [5.56 x 11.11]	0.281 x 0.563 [7.14 x 14.29]	HOLE (Dia.)	0.161 [4.09]	0.196 x 0.260 [4.98 x 6.60]	0.196 x 0.260 [4.98 x 6.60]				
C	0.750 [19.05]	0.750 [19.05]	0.875 [22.23]								
B	1.375 [34.93]	1.750 [44.45]	2.125 [53.98]								

Axial Vitreous Wirewound Resistors



FEATURES

- Complete welded construction
- Vitreous coating
- Enhanced humidity protection
- TCR 100...180 ppm/K
- Pure tin plating provides compatibility with lead (Pb)-free and lead containing soldering processes
- Compatible with "Restriction of the use of Hazardous Substances" (RoHS) directive 2002/95/EC (issue 2004)



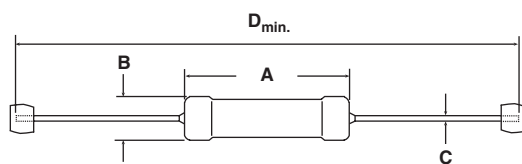
STANDARD ELECTRICAL SPECIFICATIONS						
GLOBAL MODEL	HISTORICAL MODEL	APPROVED	POWER RATING $P_{40^\circ\text{C}}$ W	RESISTANCE RANGE E12/E24		LIMITING VOLTAGE V
		CECC 40201-801		TOL. $\pm\%$	Ω	
G220414	G202	FDG	4	10 5 2 1	R10 - 10K R10 - 10K R36 - 10K ⁽¹⁾ on request	200
G240719	G204	FDK	7	10 5 2 1	R10 - 39K R10 - 39K R10 - 39K on request	350
G260933	G206	FDP	13	10 5 2 1	R15 - 68K R15 - 68K R15 - 68K on request	500
G270947	G207		17	10 5 2 1	R20 - 120K R20 - 120K R20 - 120K on request	650

Note

⁽¹⁾ R10 - R36 on request

GLOBAL PART NUMBER INFORMATION						
New Global Part Numbering: G24071933902J4B000 (preferred part number format)						
G	2	4	0	7	1	9
3	3	9	0	2	J	4
B	0	0	0			
MODEL (See Standard Electrical Specifications table)	TCR/MATERIAL 3 = Class 3 WM110 100...180 ppm/K	VALUE 3 digit value 1 digit multiplier 7 = *10 ⁻³ 8 = *10 ⁻² 9 = *10 ⁻¹ 0 = *10 ⁰ 1 = *10 ¹ 2 = *10 ² 3 = *10 ³	TOLERANCE F = $\pm 1.0\%$ G = $\pm 2.0\%$ J = $\pm 5.0\%$ K = $\pm 10.0\%$	PACKAGING (See Packaging table)	SPECIAL The 5 digit BV number will be encoded using a 36 character code. This code contains numbers 0...9 and letters A...Z (36 characters total) and allows to encode at least 46 655 five digit BV numbers. 000 = Standard	
Historical Part Number Example: G204 39K 5% AB G73 (will continue to be accepted)						
G204	39K	5%	AB G73			
HISTORICAL MODEL	VALUE	TOLERANCE	PACKAGING			

PACKAGING TABLE			
SAP	DRALORIC LEGACY	DESCRIPTION	TYPE
2C	AC G53	Ammo pack tape 53 mm, 500 pieces	G202
4B	AB G73	Ammo pack tape 73 mm, 250 pieces	G204
4C	AC G73	Ammo pack tape 73 mm, 500 pieces	G202
7B	AB G88	Ammo pack tape 88 mm, 250 pieces	G204
8B	AB G88 CL	Ammo pack tape 88 mm, CL, 250 pieces	G204
D1	R1 G53	Reel pack tape 53 mm, 1000 pieces	G202
F1	R1 G73	Reel pack tape 73 mm, 1000 pieces	G202
FC	RC G73	Reel pack tape 73 mm, 500 pieces	G204
IC	RC G88	Reel pack tape 88 mm, 500 pieces	G204
LA	LA	loose pack, 100 pcs	G206, G207
LD	-	loose pack, 50 pieces	G204
LJ	-	loose pack, 200 pieces	G204
LL	-	loose pack, 400 pieces	-

DIMENSIONS


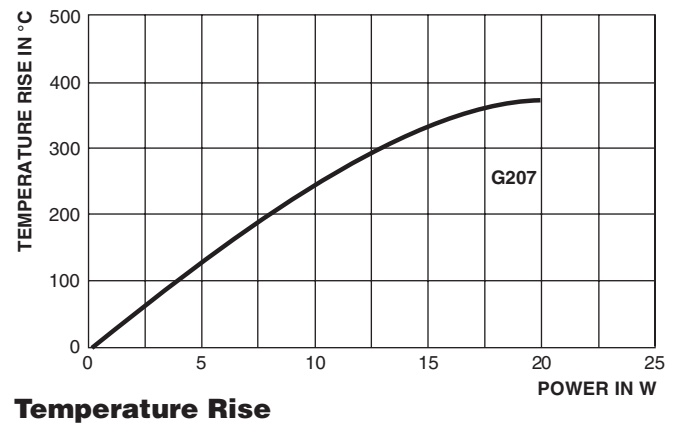
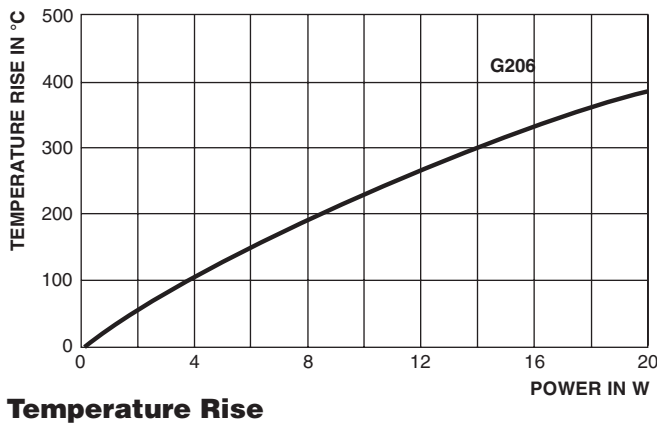
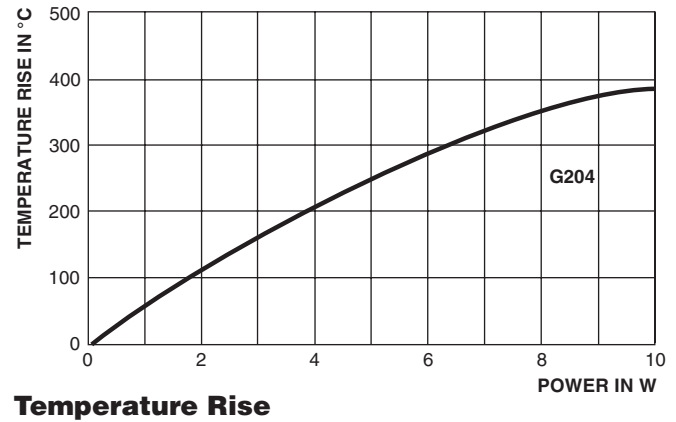
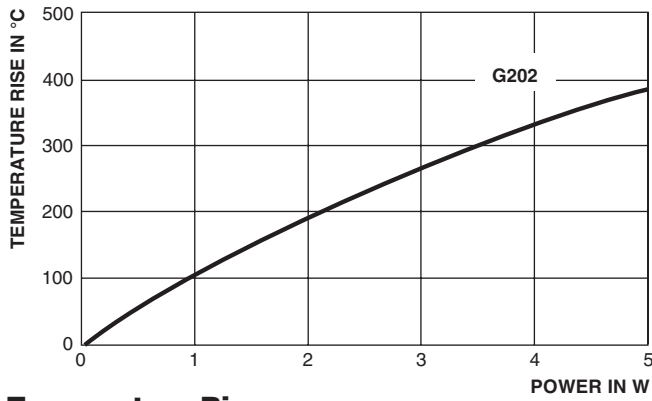
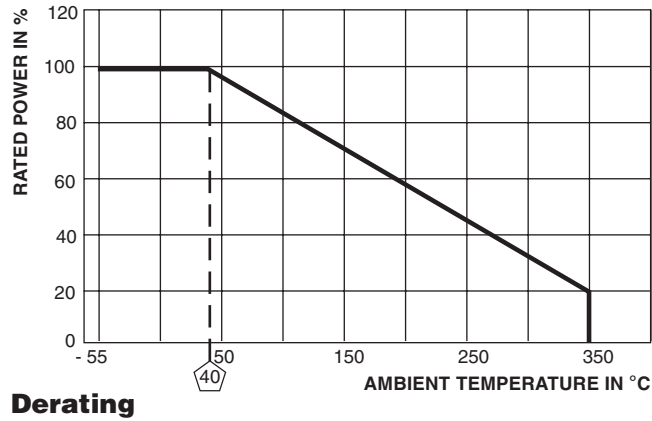
For packaging dimensions see separate packaging dimensions page.

MODEL	DIMENSIONS in millimeters [inches]				
	A _{max.}	B _{max.} ⁽¹⁾	C ⁽²⁾	D _{min.}	Weight (g)
G 202	13 [0.512]	5.7 [0.224]	0.8 [0.031]	53 ± 1 [2.087 ± 0.039]	1
G 204	19.3 [0.760]	8.5 [0.335]	0.8 [0.031]	73 ± 1 [2.874 ± 0.039]	2.2
G 206	32.3 [1.272]	9.8 [0.386]	0.8 [0.031]	107 ± 2 [4.213 ± 0.079]	6.5
G 207	49.3 [1.941]	10.5 [0.413]	0.8 [0.031]	120 ± 2 [4.724 ± 0.079]	10

Note

⁽¹⁾ The body diameter should be increased by 1 mm [0.039"] for ohmic values ≤ 10 Ω

⁽²⁾ C according to IEC60301





PERFORMANCE	
TEST	TEST RESULTS
Damp Heat, Steady State	$\pm 5\% \Delta R$
Climatic Sequence	$\pm 5\% \Delta R$
Load Life	$\pm 5\% \Delta R$
Short Time Overload	$\pm 1\% \Delta R$
Vibration	$\pm 1\% \Delta R$
Shock	$\pm 1\% \Delta R$
Resistance to Soldering Heat	$\pm 1\% \Delta R$

Vitreous Wirewound Resistors with Lugs



FEATURES

- Complete welded construction
- Ceramic core
- High quality vitreous coating
- Available in adjustable = “E” or non inductive design = “Ni”
- Lugs with various termination styles suitable for soldering or bolt connection
- TCR 100 . . .180 ppm/K



STANDARD ELECTRICAL SPECIFICATIONS								
GLOBAL MODEL	HISTORICAL MODEL	TERMINAL	SIZE DIN 41432	POWER RATING $P_{40^{\circ}\text{C}}$ W	LIMITING VOLTAGE V	RESISTANCE RANGE Ω	TOLERANCE $\pm \%$	E-SERIES
GWS0153	GWS 15	SL	9 x 45	15	250	4R3 - 20K	10	E 12, E 24, DIN 41432
						30R - 15K	5	
						220R - 20K	3	
GWS0158	GWS 15 E	SL	9 x 45	10	250	4R3 - 620R	10	E 12, E 24
							5	
							10	
GWS015D	GWS 15 Ni	SL	9 x 45	10	250	5R1 - 910R	10	
							5	
							5	
GWS0203	GWS 20	SL	-	20	300	3R6 - 30K	10	E 12, E 24
		SS				-	5	
GWS0204	GWS 20 E	SL	-	15	300	180R - 30K	3	
		SS				4R3 - 1K0	2	
GWS0208	GWS 20 Ni	SL	-	15	300	5R1 - 1K3	10	
		SS				5R1 - 1K3	5	
GWS0209	GWS 20 Ni	SL	-	15	300	5R1 - 1K3	10	E 12, E 24, DIN 41432
		SS				5R1 - 1K3	5	
GWS020D	GWS 20 Ni	SL	-	15	300	5R1 - 1K3	10	
		SS				5R1 - 1K3	5	
GWS020E	GWS 20 Ni	SL	-	15	300	5R1 - 1K3	10	
		SS				5R1 - 1K3	5	
GWS0253	GWS 25	SL	13 x 55	25	300	3R6 - 39K	10	E 12, E 24, DIN 41432
		SS				3R6 - 39K	5	
GWS0254	GWS 25 E	SL	13 x 55	18	300	30R - 20K	3	
		SS				30R - 20K	3	
GWS0258	GWS 25 Ni	SL	13 x 55	18	300	91R - 39K	2	
		SS				91R - 39K	2	
GWS0259	GWS 25 Ni	SL	13 x 55	18	300	5R1 - 1K3	10	E 12, E 24
		SS				5R1 - 1K3	5	
GWS025D	GWS 25 Ni	SL	13 x 55	18	300	6R8 - 1K8	10	
		SS				6R8 - 1K8	5	
GWS025E	GWS 25 Ni	SL	13 x 55	18	300	6R8 - 1K8	10	
		SS				6R8 - 1K8	5	
GWS0353	GWS 35	SL	-	30	400	5R1 - 47K	10	E 12, E 24
		SS				-	5	
GWS0354	GWS 35 E	SL	-	22	400	56R - 47K	3	
		SS				56R - 47K	2	
GWS0358	GWS 35 Ni	SL	-	22	400	6R8 - 1K6	10	
		SS				6R8 - 1K6	5	
GWS0359	GWS 35 Ni	SL	-	22	400	8R2 - 2K4	10	E 12, E 24, DIN 41432
		SS				8R2 - 2K4	5	
GWS035D	GWS 35 Ni	SL	-	22	400	8R2 - 2K4	10	
		SS				8R2 - 2K4	5	
GWS035E	GWS 35 Ni	SL	-	22	400	8R2 - 2K4	5	
		SS				8R2 - 2K4	5	
GWS0503	GWS 50	SL	16 x 63	40	400	3R3 - 62K	10	E 12, E 24, DIN 41432
		SS				3R3 - 62K	5	
		SB				33R - 24K	3	
		FST				33R - 24K	3	
		FST				100R - 62K	2	



STANDARD ELECTRICAL SPECIFICATIONS													
GLOBAL MODEL	HISTORICAL MODEL	TERMINAL	SIZE DIN 41432	POWER RATING $P_{40^{\circ}\text{C}}$ W	LIMITING VOLTAGE V	RESISTANCE RANGE Ω	TOLERANCE $\pm \%$	E-SERIES					
GWS0508	GWS 50 E	SL	16 x 63	30	400	8R2 - 2K0	10	E 12, E 24					
GWS0509		SS					5						
GWS050A		SB											
GWS050C		FST											
GWS050D	GWS 50 Ni	SL				10R - 3K0			10				
GWS050E		SS					5						
GWS050F		SB											
GWS050H		FST											
GWS0753	GWS 75	SL	16 x 100	65	800	7R5 - 130K		10	E 12, E 24, DIN 41432				
GWS0754		SS					5						
GWS0755		SB						15R - 39K		3			
GWS0757		FST								30R - 130K	2		
GWS0758	GWS 75 E	SL				18R - 3K9					10	E 12, E 24	
GWS0759		SS					5						
GWS075A		SB											
GWS075C		FST											
GWS075D	GWS 75 Ni	SL	45	800	22R - 6K2			10	E 12, E 24				
GWS075E		SS					5						
GWS075F		SB											
GWS075H		FST											
GWS1004	GWS 100	SS			24 x 100	80		600		6R8 - 110K	10	E 12, E 24, DIN 41432	
GWS1006		SSB					5						
GWS1005		SB									20R - 51K		3
GWS1007		FST											75R - 110K
GWS1009	GWS 100 E	SS	13R - 5K1	10					E 12, E 24				
GWS100B		SSB		5									
GWS100A		SB											
GWS100C		FST											
GWS100E	GWS 100 Ni	SS			60	600	24R - 6K8	10		E 12, E 24			
GWS100G		SSB		5									
GWS100F		SB											
GWS100H		FST											

STANDARD ELECTRICAL SPECIFICATIONS										
GLOBAL MODEL	HISTORICAL MODEL	TERMINAL	SIZE DIN 41432	POWER RATING $P_{40^{\circ}\text{C}}$ W	LIMITING VOLTAGE V	RESISTANCE RANGE Ω	TOLERANCE \pm %	E-SERIES		
GWS2204	GWS 220	SS	24 x 165	160	1250	13R - 160K	10	E 12, E 24, DIN 41432		
GWS2206		SSB					5			
GWS2205		SB					3			
GWS2207		FST					2			
GWS2209	GWS 220 E	SS		120		30R - 10K	10	E 12, E 24		
GWS220B		SSB					5			
GWS220A		SB								
GWS220C		FST								
GWS220E	GWS 220 Ni	SS				51R - 16K			10	
GWS220G		SSB					5			
GWS220F		SB								
GWS220H		FST								
GWS3004	GWS 300	SS		24 x 165		300		2500	24R - 300K	10
GWS3006		SSB					5			
GWS3005		SB					3			
GWS3007		FST					2			
GWS3009	GWS 300 E	SS	200		56R - 20K	10	E 12, E 24			
GWS300B		SSB				5				
GWS300A		SB								
GWS300C		FST								
GWS300E	GWS 300 Ni	SS			100R - 30K				10	
GWS300G		SSB				5				
GWS300F		SB								
GWS300H		FST								
GWS5004	GWS 500	SS	36 x 330		500		3000		39R - 270K	10
GWS5006		SSB				5				
GWS5005		SB				3				
GWS5007		FST				2				
GWS5009	GWS 500 E	SS		300	100R - 36K	10		E 12, E 24		
GWS500B		SSB				5				
GWS500A		SB								
GWS500C		FST								



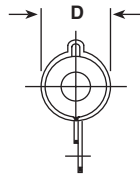
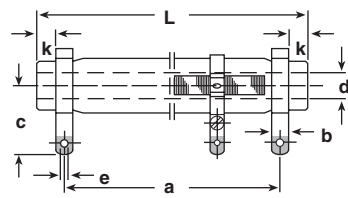
STANDARD ELECTRICAL SPECIFICATIONS									
GLOBAL MODEL	HISTORICAL MODEL	TERMINAL	SIZE DIN 41432	POWER RATING $P_{40^\circ C}$ W	LIMITING VOLTAGE V	RESISTANCE RANGE Ω	TOLERANCE $\pm \%$	E-SERIES	
GWSN844	GWS 30/100	SS		150	1600	9R1 - 100K	10	E 12, E 24, DIN 41432	
GWSN846		SSB				5			
GWSN845		SB				3			
GWSN847		FST				27R - 100K	2		
GWSN849	GWS 30/100 E	SS		110		2300	22R - 8K2	10	E 12, E 24
GWSN84B		SSB						5	
GWSN84A		SB							
GWSN84C		FST							
GWSN914	GWS 30/133	SS		200	2300		13R - 160K	10	E 12, E 24, DIN 41432
GWSN916		SSB					5		
GWSN915		SB					3		
GWSN917		FST					27R - 160K	2	
GWSN919	GWS 30/133 E	SS	130	2300		36R - 13K	10	E 12, E 24	
GWSN91B		SSB					5		
GWSN91A		SB							
GWSN91C		FST							

GLOBAL PART NUMBER INFORMATION																							
New Global Part Numbering: GWS01531009KLX000 (preferred part number format)																							
<table border="1" style="width:100%; text-align:center;"> <tr> <td>G</td><td>W</td><td>S</td><td>0</td><td>1</td><td>5</td><td>3</td><td>1</td><td>0</td><td>0</td><td>9</td><td>K</td><td>L</td><td>X</td><td>0</td><td>0</td><td>0</td> </tr> </table>							G	W	S	0	1	5	3	1	0	0	9	K	L	X	0	0	0
G	W	S	0	1	5	3	1	0	0	9	K	L	X	0	0	0							
MODEL	TCR/MATERIAL	SPECIAL CHARACTER	VALUE	TOLERANCE	PACKAGING	SPECIAL																	
GWS	015 = 15 020 = 20 025 = 25 035 = 35 050 = 50 075 = 75 100 = 100 220 = 220 300 = 300 500 = 500 N84 = 30/100 N91 = 30/133	3 = SL 4 = SS 5 = SB 6 = SSB 7 = FST 8 = E SL 9 = E SS A = E SB B = E SSB C = E FST D = NI SL E = NI SS F = NI SB G = NI SSB H = NI FST I = SWI SL J = SWI SS K = SWI SB L = SWI SSB M = SWI FST Z = Value overflow (BV)	3 digit value 1 digit multiplier MULTIPLIER 8 = $\times 10^{-2}$ 9 = $\times 10^{-1}$ 0 = $\times 10^0$ 1 = $\times 10^1$ 2 = $\times 10^2$ 3 = $\times 10^3$	G = $\pm 2.0\%$ H = $\pm 3.0\%$ J = $\pm 5.0\%$ K = $\pm 10.0\%$	(See Packing table)	The 5 digit BV number will be encoded using a 36 character code. This code contains numbers 0...9 and letters A...Z (36 characters total) and allows to encode at least 46 655 five digit BV numbers. 000 = Standard																	
Historical Part Number Example: GWS 15 SL 10R 10% (will continue to be accepted)																							
GWS 15		SL	10R	10%																			
HISTORICAL MODEL		SPECIAL CHARACTER	VALUE	TOLERANCE																			

PACKAGING TABLE		
SAP	DESCRIPTION	TYPE
LX	Loose pack, without quantity	all
ZX	Special pack (with BV #), without quantity Note: LX = B29 on Dale legacy ZX = S51 on Dale legacy	all

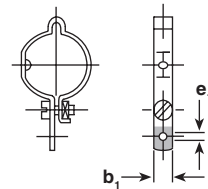
DIMENSIONS

SL TERMINALS

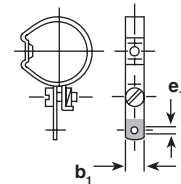


ADJUSTABLE LUGS

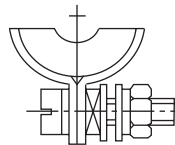
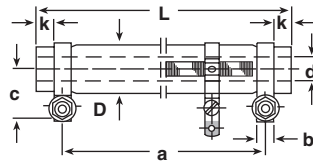
GWS 15 E
GWS 20 E



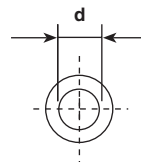
from GWS 25 E



SS TERMINALS



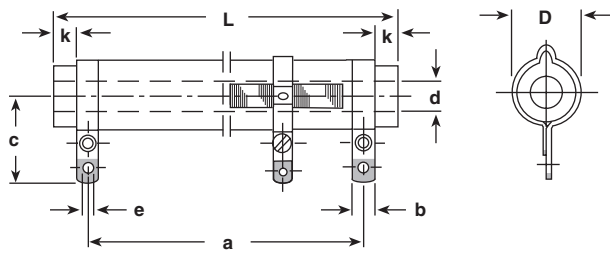
CORE SECTION



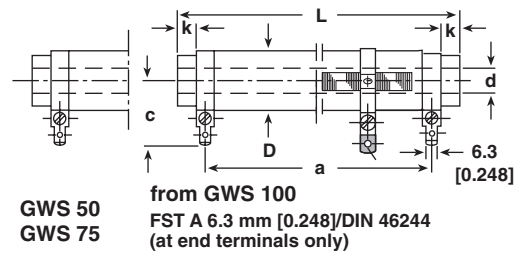
MODEL	DIMENSIONS in millimeters [inches]							
	GWS 15 GWS 15 E GWS 15 Ni		GWS 20 GWS 20 E GWS 20 Ni		GWS 25 GWS 25 E GWS 25 Ni		GWS 35 GWS 35 E GWS 35 Ni	
TERMINAL	SL		SL	SS	SL	SS	SL	SS
DIMENSION								
D	7.5 ± 0.5 [0.295 ± 0.020]		9.5 ± 0.5 [0.374 ± 0.020]		11.8 ± 0.8 [0.465 ± 0.031]		11.8 ± 0.8 [0.465 ± 0.031]	
L	45 ± 1.5 [1.772 ± 0.059]		50 ± 1.5 [1.969 ± 0.059]		55 ± 1.5 [2.165 ± 0.059]		62 ± 2 [2.441 ± 0.079]	
a ± 2 [a ± 0.079]	36 [1.417]		39 [1.535]	40 [1.575]	43 [1.693]	44 [1.732]	50 [1.969]	51 [2.008]
b	4 [0.157]		4 [0.157]	5 [0.197]	4 [0.157]	5 [0.197]	4 [0.157]	5 [0.197]
b ₁	4 [0.157]		4 [0.157]	4 [0.157]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]
c	15.5 [0.610]		18 [0.709]	10.5 [0.413]	19 [0.748]	11.5 [0.453]	19 [0.748]	11.5 [0.453]
d	2.6 [0.102]		3.5 [0.138]	3.5 [0.138]	5.5 [0.217]	5.5 [0.217]	5.5 [0.217]	5.5 [0.217]
e	1.5 [0.059]		2 [0.079]	M3 x 16	2 [0.079]	M3 x 16	2 [0.079]	M3 x 16
e ₁	2.8 [0.110]		2.8 [0.110]	2.8 [0.110]	2.8 [0.110]	2.8 [0.110]	2.8 [0.110]	2.8 [0.110]
k	2.5 [0.098]		3.5 [0.138]	2.5 [0.098]	4 [0.157]	3 [0.118]	4 [0.157]	3 [0.118]
WEIGHT (g)	6		8		13		15	

DIMENSIONS (continued)

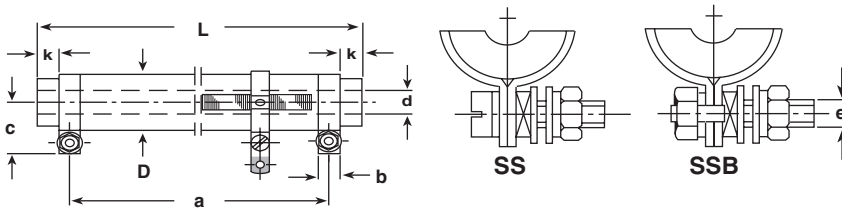
SL TERMINALS



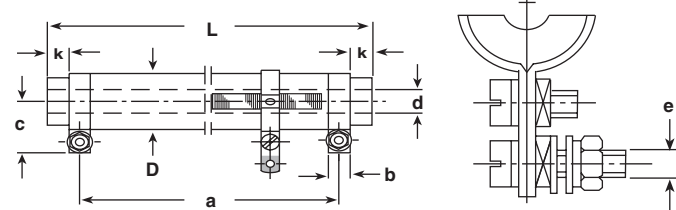
FST TERMINALS



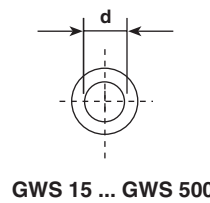
SS AND SSB TERMINALS



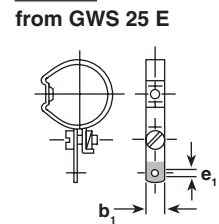
SB TERMINALS



CORE SECTION



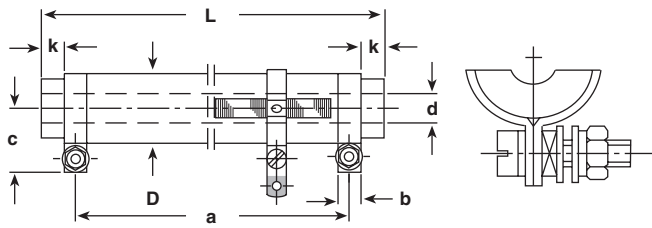
ADJUSTABLE LUGS



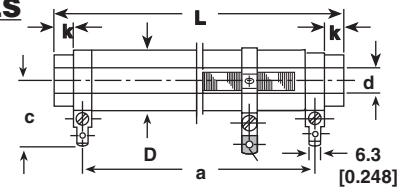
MODEL	DIMENSIONS in millimeters [inches]															
	GWS 50 GWS 50 E GWS 50 Ni				GWS 75 GWS 75 E GWS 75 Ni				GWS 100 GWS 100 E GWS 100 Ni				GWS 220 GWS 220 E GWS 220 Ni			
TERMINAL	SL	SS	SB	FST	SL	SS	SB	FST	SL	SSB	SB	FST	SS	SSB	SB	FST
DIMENSION																
D	14.8 ± 0.8 [0.583 ± 0.031]				14.8 ± 0.8 [0.583 ± 0.031]				22.3 ± 1.3				22.3 ± 1.3			
L	62 ± 2 [2.441 ± 0.079]				100 ± 2 [4.100 ± 0.080]				100 ± 2 [4.100 ± 0.080]				165 ± 2 [6.760 ± 0.080]			
a ± 2 [a ± 0.079]	50 [1.969]	51 [2.008]	51 [2.008]	48 [1.890]	86 [3.520]	87 [3.570]	87 [3.570]	84 [3.440]	72 [2.950]				136 [5.570]			
b	4 [0.157]	5 [0.197]	5 [0.197]	6.3 [0.248]	4 [0.157]	5 [0.197]	5 [0.197]	6.3 [0.248]	8 [0.330]	8 [0.330]	8 [0.330]	6.3 [0.620]	8 [0.330]	8 [0.330]	8 [0.330]	6.3 [0.620]
b ₁	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]
c	20.5 [0.807]	13 [0.512]	23 [0.906]	23.5 [0.925]	20.5 [0.807]	13 [0.512]	23 [0.906]	23.5 [0.925]	18.5 [0.760]	18.5 [0.760]	29.5 [1.210]	27 [1.110]	18.5 [0.760]	18.5 [0.760]	29.5 [1.210]	27 [1.110]
d	5.5 [0.217]	5.5 [0.217]	5.5 [0.217]	5.5 [0.217]	5.5 [0.217]	5.5 [0.217]	5.5 [0.217]	5.5 [0.217]	10 [0.410]	10 [0.410]	10 [0.410]	10 [0.410]	10 [0.410]	10 [0.410]	10 [0.410]	10 [0.410]
e	2 [0.079]	M3 x 16		-	2 [0.079]	M3 x 16		-	M4 x 20			-	M4 x 20			-
e ₁	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]
k	4 [0.157]	3 [0.118]	3 [0.118]	3 [0.118]	5 [0.197]	4 [0.157]	4 [0.157]	4 [0.157]	10 [0.410]	10 [0.410]	10 [0.410]	10 [0.410]	10.5 [0.430]	10.5 [0.430]	10.5 [0.430]	10.5 [0.430]
WEIGHT (g)	25				40				92				135			

DIMENSIONS (continued)

SS TERMINALS

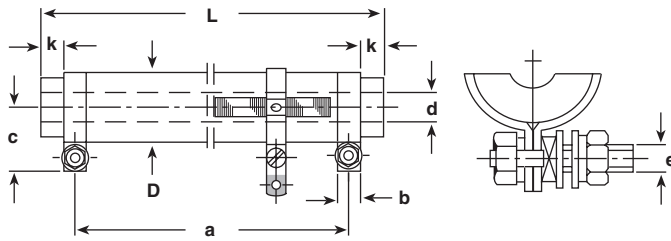


FST TERMINALS

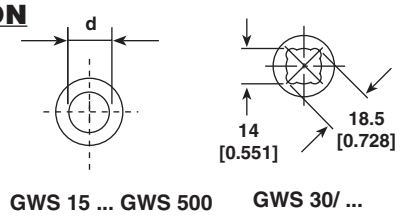


FST A 6.3 mm [0.248]/DIN 46244 (at end terminals only)

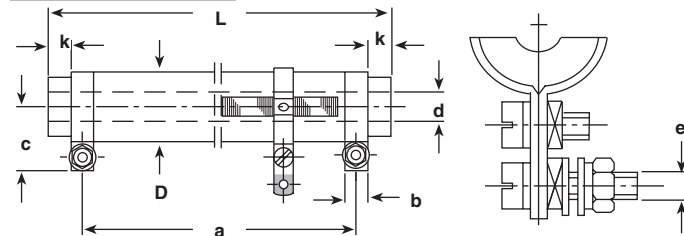
SSB TERMINALS



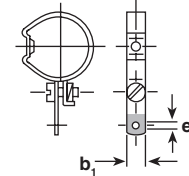
CORE SECTION



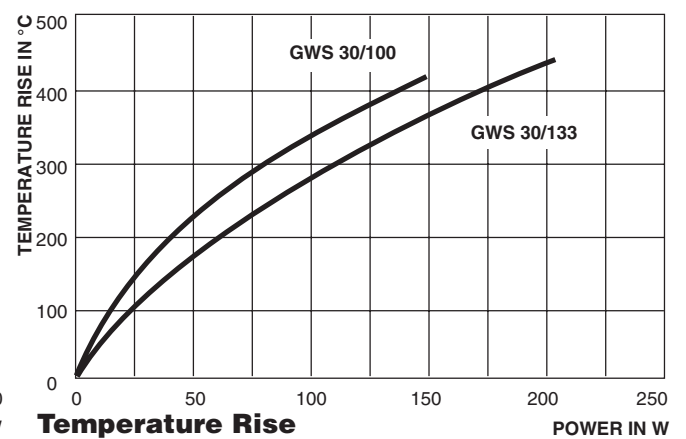
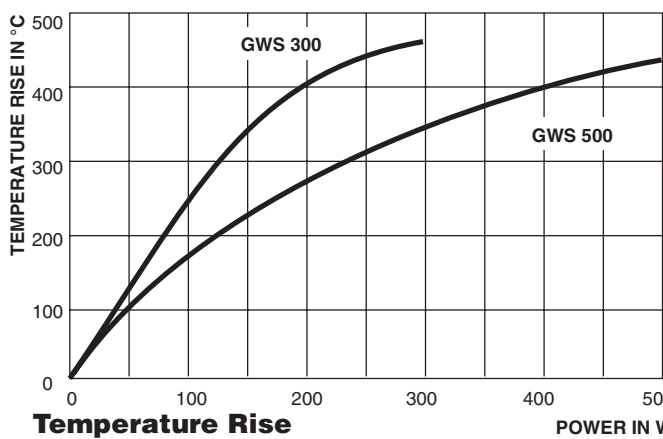
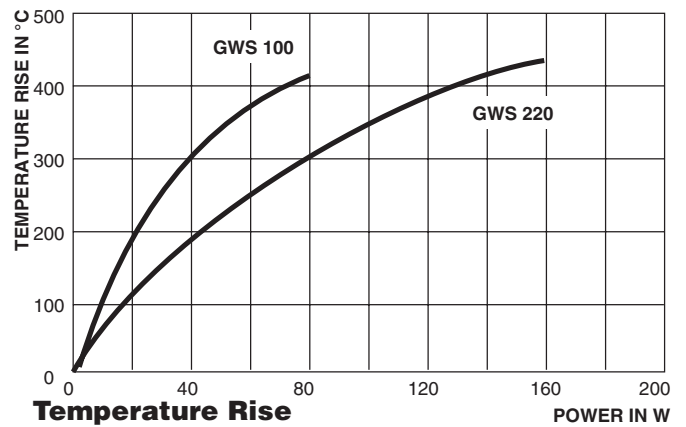
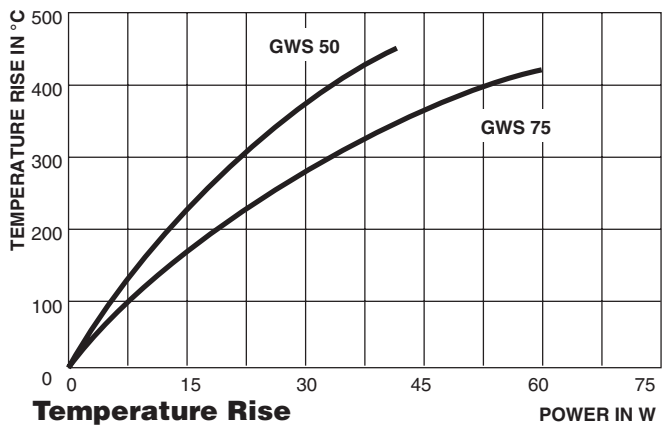
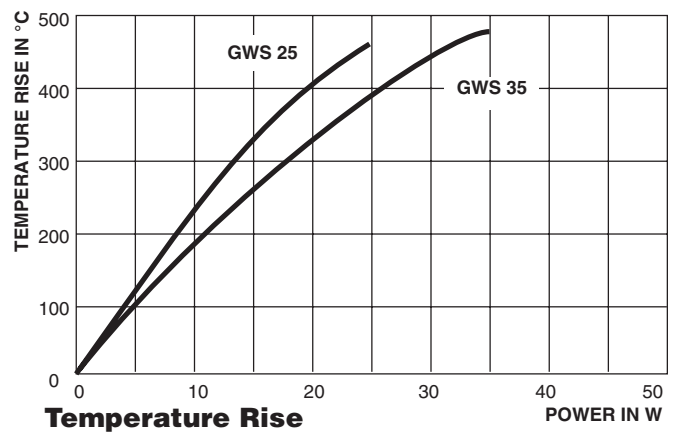
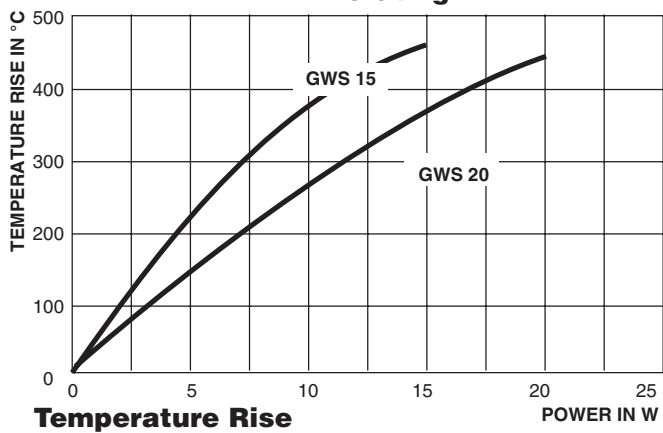
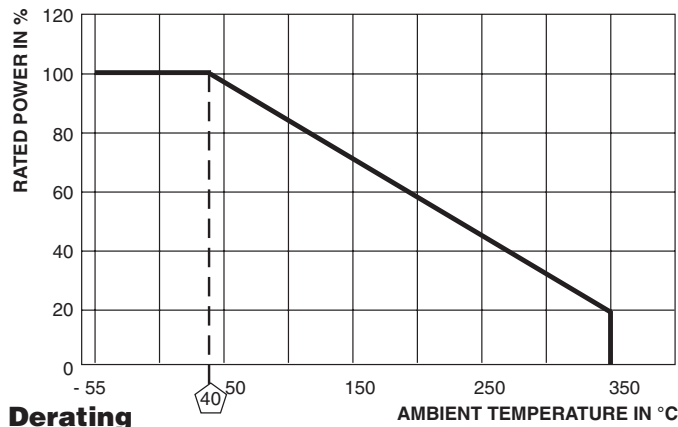
SB TERMINALS



ADJUSTABLE LUGS from GWS 25 E



MODEL	DIMENSIONS in millimeters [inches]															
	GWS 300 GWS 300 E GWS 300 Ni				GWS 500 GWS 500 E				GWS 30/100 GWS 30/100 E				GWS 30/133 GWS 30/133 E			
TERMINAL	SS	SSB	SB	FST	SS	SSB	SB	FST	SS	SSB	SB	FST	SS	SSB	SB	FST
DIMENSION																
D	22.3 ± 1.3 [0.878 ± 0.051]				32.5 ± 1.5 [1.330 ± 0.060]				32.5 ± 1.5 [1.330 ± 0.060]				32.5 ± 1.5 [1.330 ± 0.060]			
L	265 ± 4 [2.433 ± 0.157]				330 ± 5 [13.52 ± 0.200]				100 ± 2.5 [4.100 ± 0.100]				133 ± 3 [5.450 ± 0.120]			
a ± 2 [a ± 0.079]	235 [9.252]				280 [11.48]				85 [3.480]				118 [4.840]			
b	8 [0.315]	8 [0.315]	8 [0.315]	6.3 [0.248]	8 [0.315]	8 [0.315]	8 [0.315]	6.3 [0.248]	8 [0.315]	8 [0.315]	8 [0.315]	6.3 [0.248]	8 [0.315]	8 [0.315]	8 [0.315]	6.3 [0.248]
b ₁	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	8 [0.315]	8 [0.315]	8 [0.315]	8 [0.315]	8 [0.315]	8 [0.315]	8 [0.315]	8 [0.315]	8 [0.315]	8 [0.315]	8 [0.315]	8 [0.315]
c	18.5 [0.728]	18.5 [0.728]	29.5 [1.161]	27 [1.063]	23.5 [0.960]	23.5 [0.960]	35 [1.430]	31.5 [1.290]	23.5 [0.960]	23.5 [0.960]	35 [1.430]	31.5 [1.290]	23.5 [0.960]	23.5 [0.960]	35 [1.430]	31.5 [1.290]
d	10 [0.394]	10 [0.394]	10 [0.394]	10 [0.394]	18.5 [0.760]	18.5 [0.760]	18.5 [0.760]	18.5 [0.760]	14 [0.570]	14 [0.570]	14 [0.570]	14 [0.570]	14 [0.570]	14 [0.570]	14 [0.570]	14 [0.570]
e	M4 x 20				M4 x 20				M4 x 20				M4 x 20			
e ₁	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	4.2 [0.170]	4.2 [0.170]	4.2 [0.170]	4.2 [0.170]	4.2 [0.170]	4.2 [0.170]	4.2 [0.170]	4.2 [0.170]	4.2 [0.170]	4.2 [0.170]	4.2 [0.170]	4.2 [0.170]
k	11 [0.433]	11 [0.433]	11 [0.433]	11 [0.433]	21 [0.860]	21 [0.860]	21 [0.860]	21 [0.860]	3.5 [0.138]	3.5 [0.138]	3.5 [0.138]	3.5 [0.138]	3.5 [0.138]	3.5 [0.138]	3.5 [0.138]	3.5 [0.138]
WEIGHT (g)	238				425				183				265			



Vitreous Resistors with Corrugated Ribbon



FEATURES

- All welded construction
- High power rating up to 1000 W
- Corrugated ribbon construction aids rapid cooling
- Complete vitreous coating for perfect humidity protection
- Adjustable design available = "E"



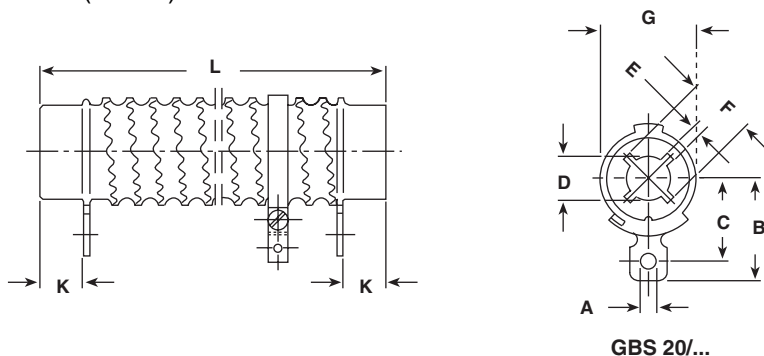
STANDARD ELECTRICAL SPECIFICATIONS							
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{40^\circ\text{C}}$ W		RESISTANCE RANGE $\pm 10\%$ / $\pm 5\%$ E-SERIES: E12 / E24			WEIGHT (g)
		WM50 WM110	WM10 (1)	TCR + 650... + 750 ppm/K WM 10	TCR - 10... - 80 ppm/K WM 50	TCR + 100 ... + 180 ppm/K WM 110	
GBS202S0 GBS202S1	GBS 20/100 GBS 20/100 E	80 50	50	R13 - R51	R56 - 2R2	1R3 - 6R2	100
GBS204L0 GBS204L1	GBS 20/165 GBS 20/165 E	160 100	100	R27 - 1R0	1R1 - 4R7	2R4 - 12R	150
GBS207D0 GBS207D1	GBS 20/265 GBS 20/265 E	300 180	180	R47 - 1R8	2R0 - 7R5	4R3 - 22R	250
GBS302S0 GBS302S1	GBS 30/100 GBS 30/100 E	150 90	90	R10 - R43	R47 - 3R3	1R0 - 8R2	200
GBS303P0 GBS303P1	GBS 30/133 GBS 30/133 E	200 120	120	R15 - R62	R68 - 5R1	1R5 - 12R	250
GBS304L0 GBS304L1	GBS 30/165 GBS 30/165 E	250 150	150	R20 - R91	1R0 - 6R8	2R0 - 16R	300
GBS305Z0 GBS305Z1	GBS 30/215 GBS 30/215 E	300 200	200	R27 - 1R1	1R2 - 9R1	2R7 - 24R	400
GBS307D0 GBS307D1	GBS 30/265 GBS 30/265 E	375 250	250	R30 - 1R3	1R5 - 11R	3R9 - 27R	500
GBS30960 GBS30961	GBS 30/330 GBS 30/330 E	450 350	350	R39 - 1R8	2R0 - 15R	5R1 - 36R	600
GBS45AA0 GBS45AA1	GBS 45/370 GBS 45/370 E	750 550	550	R75 - 3R0	3R3 - 24R	8R2 - 56R	1000
GBS60AA0 GBS60AA1	GBS 60/370 GBS 60/370 E	1000 700	700	R91 - 3R9	4R3 - 33R	10R - 75R	1200

Note

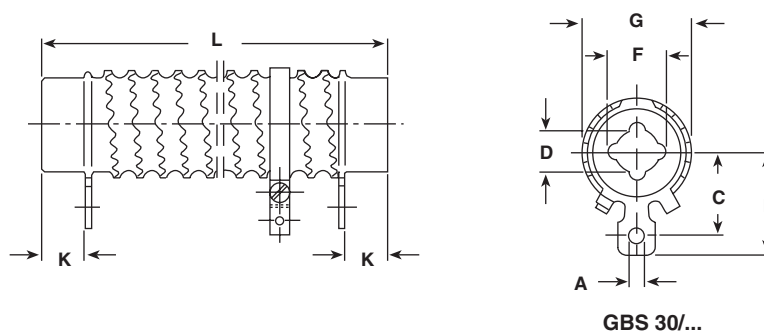
(1) WM10 power range reduced

GLOBAL PART NUMBER INFORMATION																									
New Global Part Numbering: GBS60AA03750K LX 000																									
<table border="1" style="width:100%; text-align:center;"> <tr> <td>G</td><td>B</td><td>S</td><td>6</td><td>0</td><td>A</td><td>A</td><td>0</td><td>3</td><td>7</td><td>5</td><td>0</td><td>K</td><td>L</td><td>X</td><td>0</td><td>0</td><td>0</td> </tr> </table>								G	B	S	6	0	A	A	0	3	7	5	0	K	L	X	0	0	0
G	B	S	6	0	A	A	0	3	7	5	0	K	L	X	0	0	0								
MODEL	SIZE	SPECIAL CHARACTER	TCR/MATERIAL	VALUE	TOLERANCE	PACKAGING	SPECIAL																		
GBS	202S = 20/100 204L = 20/165 207D = 20/265 302S = 30/100 303P = 30/133 304L = 30/165 305Z = 30/215 307D = 30/265 3096 = 30/330 45AA = 45/370 60AA = 60/370	0 = Neutral 1 = E Z = Value overflow (BV)	1 = - 10... - 80 ppm/K WM50 Class 1 3 = 100...180 ppm/K WM110 Class 3 4 = 650...750 ppm/K WM10 5 = SWI	2 digit value 1 digit multiplier MULTIPLIER 8 = $\times 10^{-2}$ 9 = $\times 10^{-1}$ 0 = $\times 10^0$	J = $\pm 5.0\%$ K = $\pm 10.0\%$	(see Packaging table)	The 5 digit BV number will be encoded using a 36 character code. This code contains numbers 0...9 and letters A...Z (36 characters total) and allows to encode at least 46 655 five digit BV numbers. 000 = Standard																		
Historical Part Number Example: GBS60/370 110 75R 10% (will continue to be accepted)																									
GBS60/370		110		75R		10%																			
HISTORICAL MODEL		TCR/MATERIAL		VALUE		TOLERANCE																			

PACKAGING TABLE		
SAP	DESCRIPTION	TYPE
LX	Loose pack, without quantity	all
XX	Sample, without quantity	all
ZX	Special pack (with BV #), without quantity Note: LX = B29 on Dale legacy XX = S27 on Dale legacy ZX = S51 on Dale legacy	all

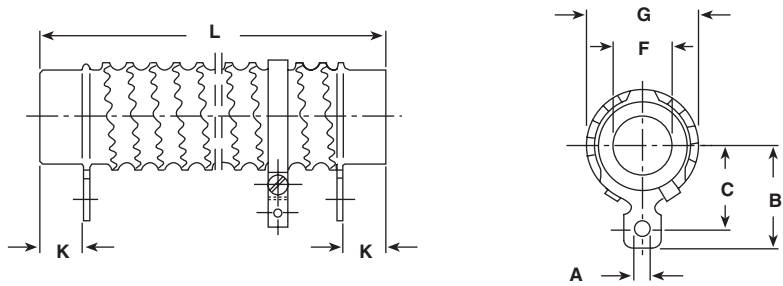
DIMENSIONS in millimeters (inches)


MODEL	DIMENSIONS in millimeters [inches]								
	L	K	A	B	C	D	E	F	G
GBS 20/100 GBS 20/100 E	100 ± 2.5 [3.937 ± 0.098]	15 [0.591]	4.2 [0.165]	26.5 [1.043]	22 [0.866]	10 [0.394]	1.5 [0.059]	14 [0.551]	24 [0.945]
GBS 20/165 GBS 20/165 E	165 ± 4 [6.496 ± 0.157]	15 [0.591]	4.2 [0.165]	26.5 [1.043]	22 [0.866]	10 [0.394]	1.5 [0.059]	14 [0.551]	24 [0.945]
GBS 20/265 GBS 20/265 E	265 ± 6.6 [10.433 ± 0.260]	15 [0.591]	4.2 [0.165]	26.5 [1.043]	22 [0.866]	10 [0.394]	1.5 [0.059]	14 [0.551]	24 [0.945]

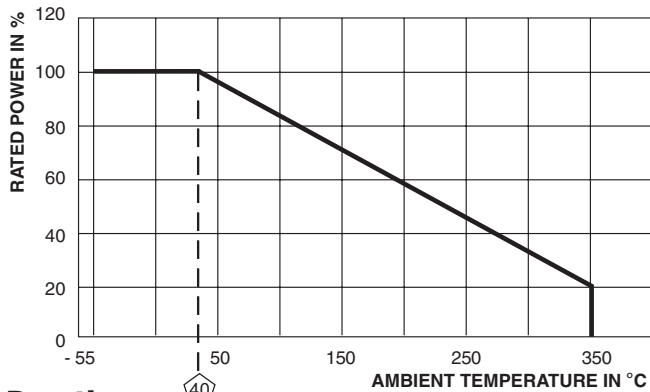


MODEL	DIMENSIONS in millimeters [inches]								
	L	K	A	B	C	D	F	G	
GBS 30/100 GBS 30/100 E	100 ± 2.5 [3.937 ± 0.098]	15 [0.591]	5.2 [0.205]	34 [1.339]	28 [1.102]	14 [0.551]	18.5 [0.728]	37 ± 1 [1.457 ± 0.039]	
GBS 30/133 GBS 30/133 E	133 ± 3.3 [5.236 ± 0.130]	15 [0.591]	5.2 [0.205]	34 [1.339]	28 [1.102]	14 [0.551]	18.5 [0.728]	37 ± 1 [1.457 ± 0.039]	
GBS 30/165 GBS 30/165 E	165 ± 4 [6.496 ± 0.157]	15 [0.591]	5.2 [0.205]	34 [1.339]	28 [1.102]	14 [0.551]	18.5 [0.728]	37 ± 1 [1.457 ± 0.039]	
GBS 30/215 GBS 30/215 E	215 ± 5.4 [8.465 ± 0.213]	15 [0.591]	5.2 [0.205]	34 [1.339]	28 [1.102]	14 [0.551]	18.5 [0.728]	37 ± 1 [1.457 ± 0.039]	
GBS 30/265 GBS 30/265 E	265 ± 6.6 [10.433 ± 0.260]	15 [0.591]	5.2 [0.205]	34 [1.339]	28 [1.102]	14 [0.551]	18.5 [0.728]	37 ± 1 [1.457 ± 0.039]	
GBS 30/330 GBS 30/330 E	330 ± 8 [12.992 ± 0.315]	15 [0.591]	5.2 [0.205]	34 [1.339]	28 [1.102]	14 [0.551]	18.5 [0.728]	37 ± 1 [1.457 ± 0.039]	

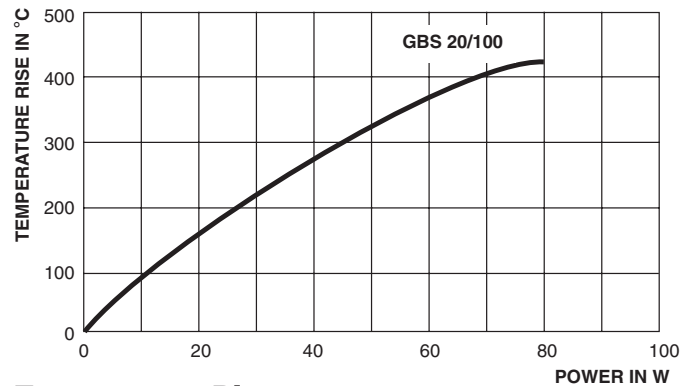
DIMENSIONS (continued)



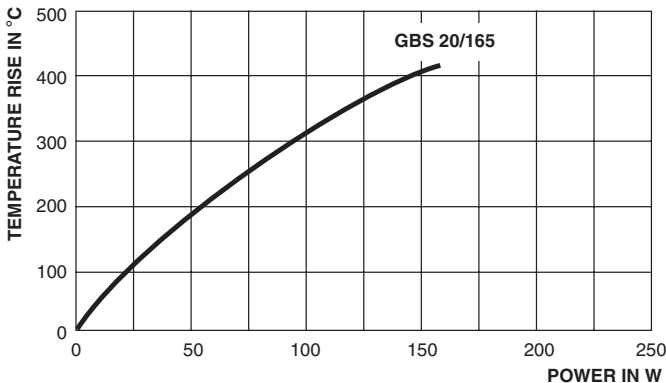
MODEL	DIMENSIONS in millimeters [inches]						
	L	K	A	B	C	F	G
GBS 45/370	370 ± 9	15	5.2	42.5	37	30	52 ± 1
GBS 45/370 E	[14.567 ± 0.354]	[0.591]	[0.205]	[1.673]	[1.457]	[1.181]	[2.047 ± 0.039]
GBS 60/370	370 ± 9	15	5.2	51.5	45.5	45	67 ± 1
GBS 60/370 E	[14.567 ± 0.354]	[0.591]	[0.205]	[2.028]	[1.791]	[1.772]	[2.638 ± 0.039]



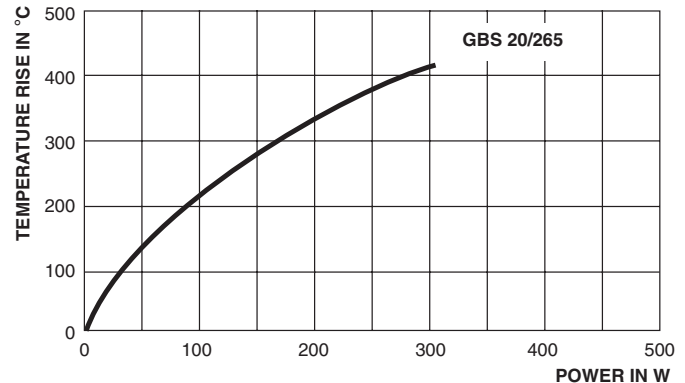
Derating



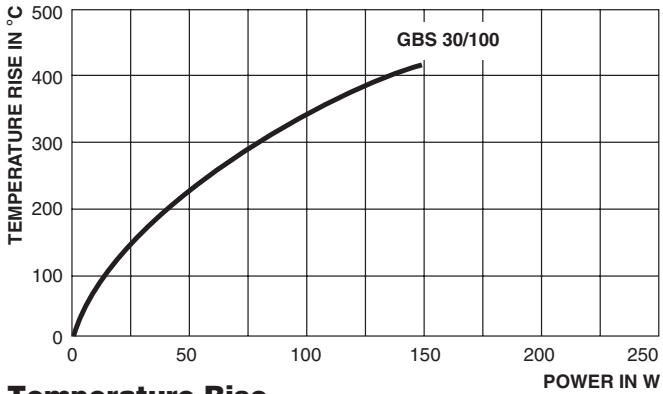
Temperature Rise



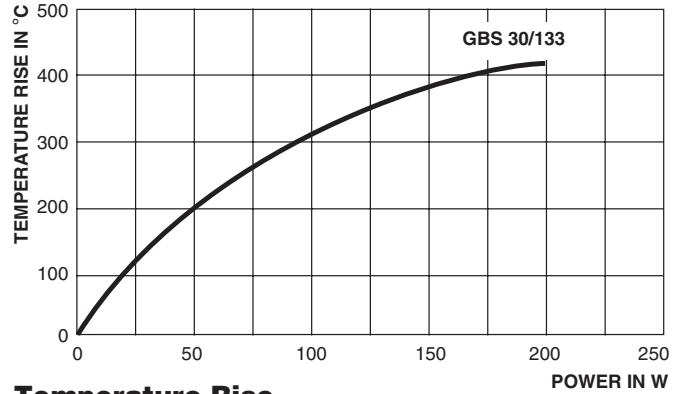
Temperature Rise



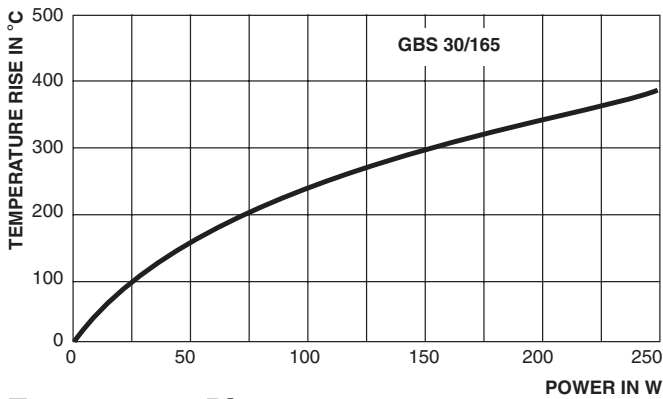
Temperature Rise



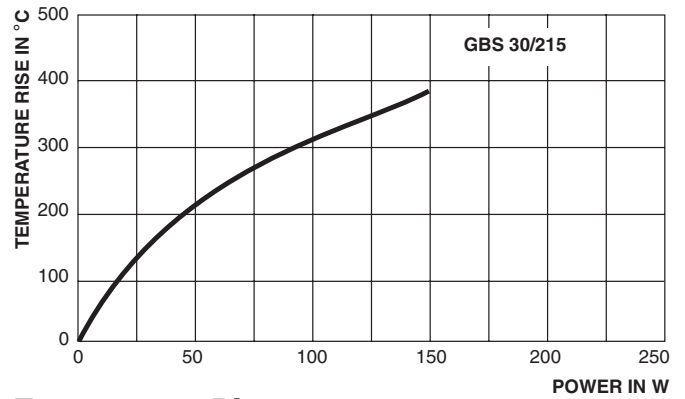
Temperature Rise



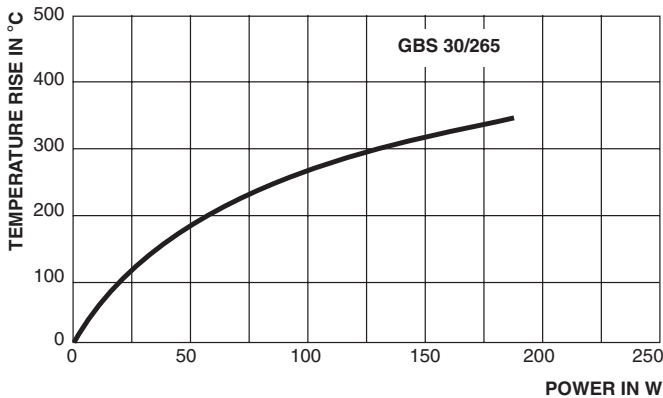
Temperature Rise



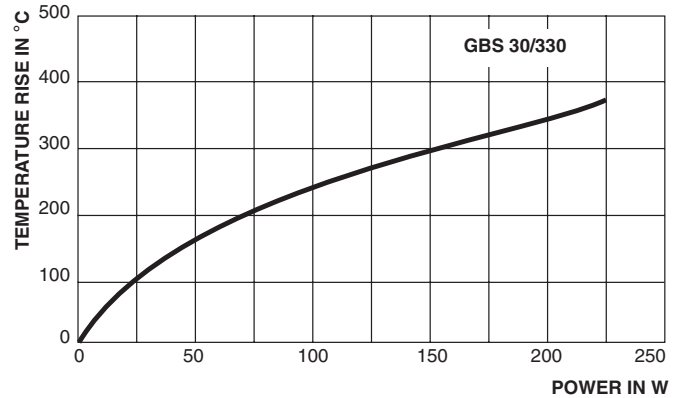
Temperature Rise



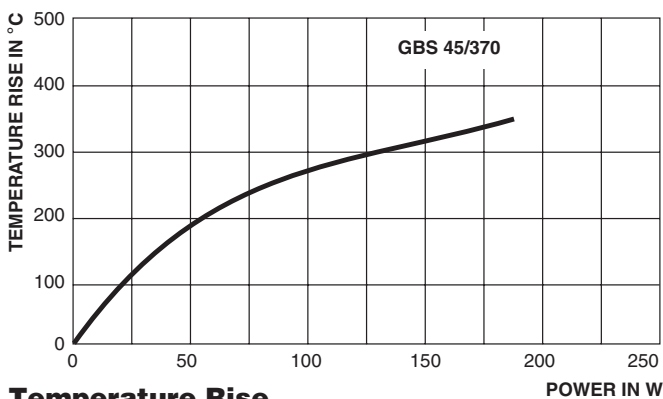
Temperature Rise



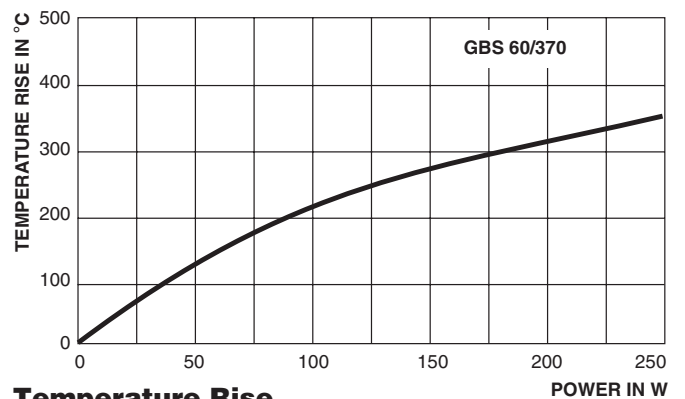
Temperature Rise



Temperature Rise

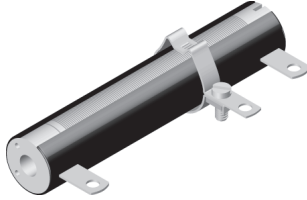


Temperature Rise



Temperature Rise

Vitreous Wirewound Resistors



FEATURES

- All welded construction
- Ceramic core
- Models acc. MIL-R-26 available
- Complete vitreous coating for perfect humidity protection
- Available in adjustable = "E" or non inductive design = "Ni"
- TCR 100...180 ppm/K - WM110 (Class 3)



STANDARD ELECTRICAL SPECIFICATIONS						
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{40^{\circ}\text{C}}$ W	LIMITING VOLTAGE V	RESISTANCE RANGE (1) Ω	TOLERANCE $\pm \%$	E-SERIES
RW010440	RW 10 x 44	18	400	1R0 - 3R9	10	E 12
				4R3 - 36K	10	E 12
				7R5 - 36K	5	E 24
RW010441	RW 10 x 44 E	11		1R0 - 6R2	10	E 12
				6R8 - 1K6	10	E 12
				6R8 - 1K6	5	E 24
RW010442	RW 10 x 44 Ni	11		6R2 - 2K4	10	E 12
				6R2 - 2K4	5	E 24
RW012250	RW 12 x 25	11		120	R39 - 3R3	10
			3R6 - 13K		10	E 12
			33R - 13K		5	E 24
RW012380	RW 12 x 38	15	1R0 - 3R6		10	E 12
			3R9 - 33K		10	E 12
			5R6 - 33K		5	E 24
RW012381	RW 12 x 38 E	14	-		-	-
			4R3 - 1K5		10	E 12
			5R6 - 1K5		5	E 24
RW012382	RW 12 x 38 Ni	14	5R6 - 2K2	10	E 12	
			5R6 - 2K2	5	E 24	
RW012510	RW 12 x 51	25	600	1R0 - 3R9	10	E 12
				4R3 - 56K	10	E 12
				5R6 - 56K	5	E 24
RW012511	RW 12 x 51 E	17		1R0 - 6R2	10	E 12
				6R8 - 2K4	10	E 12
				6R8 - 2K4	5	E 24
RW012512	RW 12 x 51 Ni	17		9R1 - 3K6	10	E 12
				9R1 - 3K6	5	E 24

Note

(1) Values in the first line of 10 % tolerance are produced with corrugated ribbon.



STANDARD ELECTRICAL SPECIFICATIONS							
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{40\text{ }^\circ\text{C}}$ W	LIMITING VOLTAGE V	RESISTANCE RANGE ⁽¹⁾ Ω	TOLERANCE \pm %	E-SERIES	
RW012760	RW 12 x 76	45	1000	2R0 - 7R5	10	E 12	
				8R2 - 91K	10	E 12	
				8R2 - 91K	5	E 24	
RW012761	RW 12 x 76 E	27		2R0 - 12R	10	E 12	
				13R - 4K3	10	E 12	
				13R - 4K3	5	E 24	
RW012762	RW 12 x 76 Ni	27		16R - 6K2	10	E 12	
				16R - 6K2	5	E 24	
RW020760	RW 20 x 76	70		1000	1R0 - 11R	10	E 12
			12R - 75K		10	E 12	
			12R - 75K		5	E 24	
RW020761	RW 20 x 76 E	42	1R0 - 18R		10	E 12	
			20R - 6K8		10	E 12	
			20R - 6K8		5	E 24	
RW020762	RW 20 x 76 Ni	42	24R - 10K		10	E 12	
			24R - 10K		5	E 24	
RW201020	RW 20 x 102	90	1400		3R - 16R	10	E 12
				18R - 110K	10	E 12	
				18R - 110K	5	E 24	
RW201021	RW 20 x 102 E	55		3R - 27R	10	E 12	
				30R - 10K	10	E 12	
				30R - 10K	5	E 24	
RW201022	RW 20 x 102 Ni	55		36R - 15K	10	E 12	
				36R - 15K	5	E 24	
RW301020	RW 30 x 102	130		1600	2R7 - 22R	10	E 12
			24R - 160K		10	E 12	
			24R - 160K		5	E 24	
RW301021	RW 30 x 102 E	80	2R7 - 22R		10	E 12	
			43R - 15K		10	E 12	
			43R - 15K		5	E 24	
RW301520	RW 30 x 152	220	2500		4R7 - 30R	10	E 12
					33R - 200K	10	E 12
					33R - 200K	5	E 24
RW301521	RW 30 x 152 E	130		4R7 - 30R	10	E 12	
				75R - 24K	10	E 12	
				75R - 24K	5	E 24	

Note

⁽¹⁾ Values in the first line of 10 % tolerance are produced with corrugated ribbon.

STANDARD ELECTRICAL SPECIFICATIONS						
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{40^{\circ}\text{C}}$ W	LIMITING VOLTAGE V	RESISTANCE RANGE ⁽¹⁾ Ω	TOLERANCE \pm %	E-SERIES
RW302030	RW 30 x 203	300	3600	6R8 - 43R	10	E 12
				47R - 270K	10	E 12
				47R - 270K	5	E 24
RW302031	RW 30 x 203 E	180	3600	6R8 - 43R	10	E 12
				100R - 36K	10	E 12
				100R - 36K	5	E 24
RW302670	RW 30 x 267	400	5000	8R2 - 68R	10	E 12
				75R - 390K	10	E 12
				75R - 390K	5	E 24
RW302671	RW 30 x 267 E	240	5000	8R2 - 68R	10	E 12
				150R - 47K	10	E 12
				150R - 47K	5	E 24
RW303050	RW 30 x 305	480	6000	10R - 68R	10	E 12
				75R - 300K	10	E 12
				75R - 300K	5	E 24
RW303051	RW 30 x 305 E	290	6000	10R - 68R	10	E 12
				160R - 56K	10	E 12
				160R - 56K	5	E 24
RW000290 ⁽²⁾	RW 29	11	400	7R5 - 3K3	5	E 24
RW000300 ⁽²⁾	RW 30	11	120	33R - 1K1	5	E 24
RW000310 ⁽²⁾	RW 31	14	350	5R6 - 3K	5	E 24
RW000320 ⁽²⁾	RW 32	17	600	5R6 - 4K7	5	E 24
RW000330 ⁽²⁾	RW 33	26	1000	8R2 - 8K2	5	E 24
RW000350 ⁽²⁾	RW 35	55	1400	18R - 20K	5	E 24
RW000360 ⁽²⁾	RW 36	78	1600	24R - 30K	5	E 24
RW000370 ⁽²⁾	RW 37	113	2500	33R - 47K	5	E 24
RW000380 ⁽²⁾	RW 38	159	3600	47R - 68K	5	E 24
RW000470 ⁽²⁾	RW 47	210	5000	75R - 91K	5	E 24

Notes

⁽¹⁾ Values in the first line of 10 % tolerance are produced with corrugated ribbon.

⁽²⁾ Model according to MIL-R-26.



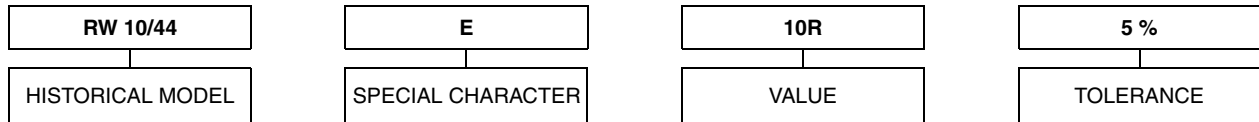
GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: RW0104411009JLX000 (preferred part number format)

R W 0 1 0 4 4 1 1 0 0 9 J L X 0 0 0

MODEL	SIZE	SPECIAL CHARACTER	VALUE	TOLERANCE	PACKAGING	SPECIAL
RW	01044 = 10/44 01225 = 12/25 01238 = 12/38 01251 = 12/51 01276 = 12/76 02076 = 20/76 20102 = 20/102 30102 = 30/102 30152 = 30/152 30203 = 30/203 30267 = 30/267 30305 = 30/305 00029 = 29 00030 = 30 00031 = 31 00032 = 32 00033 = 33 00035 = 35 00036 = 36 00037 = 37 00038 = 38 00047 = 47	0 = Neutral 1 = E 2 = NI 7 = FST C = E FST H = NI FST Z = Value overflow (BV) (Note: NI is also known as SWI)	3 digit value 1 digit multiplier MULTIPLIER 7 = $\times 10^{-3}$ 8 = $\times 10^{-2}$ 9 = $\times 10^{-1}$ 0 = $\times 10^0$ 1 = $\times 10^1$ 2 = $\times 10^2$ 3 = $\times 10^3$ 4 = $\times 10^4$	J = $\pm 5.0\%$ K = $\pm 10.0\%$	(see Packaging table)	The 5 digit BV number will be encoded using a 36 character code. This code contains numbers 0...9 and letters A...Z (36 characters total) and allows to encode at least 46 655 five digit BV numbers. 000 = Standard

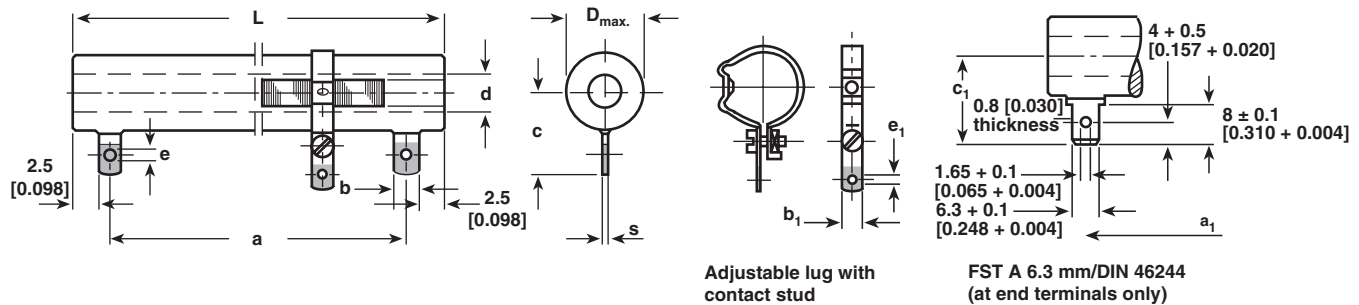
Historical Part Number Example: RW 10/44 E 10R 5% (will continue to be accepted)



PACKAGING TABLE

SAP	DESCRIPTION	TYPE
LX	Loose pack, without quantity	all
ZX	Special pack (with BV #), without quantity Note: LX = B29 on Dale legacy ZX = S51 on Dale legacy	all

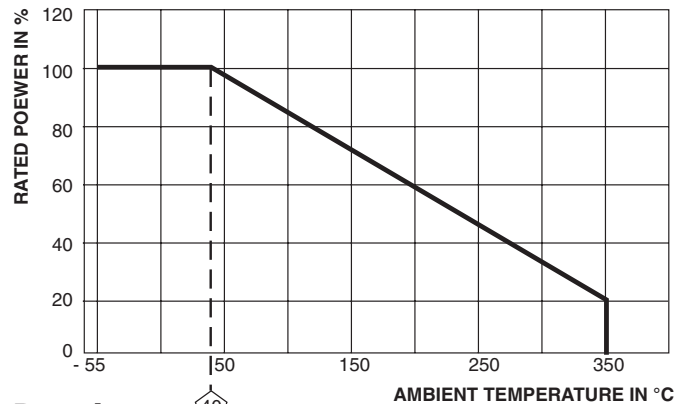
DIMENSIONS in millimeters [inches]



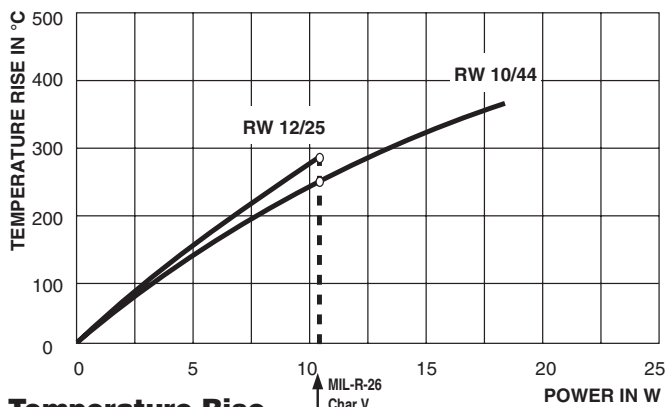
MODEL		DIMENSIONS in millimeters [inches]					
		RW 10/44 RW 10/44 E RW 10/44 Ni RW 29 ⁽²⁾	RW 12/25 RW 30 ⁽²⁾	RW 12/38 RW 12/38 E RW 12/38 Ni RW 31 ⁽²⁾	RW 12/51 RW 12/51 E RW 12/51 Ni RW 32 ⁽²⁾	RW 12/76 RW 12/76 E RW 12/76 Ni RW 33 ⁽²⁾	RW 20/76 RW 20/76 E RW 20/76 Ni
MM	D _{max.} ⁽¹⁾	12.7 (15.7) [0.5 (0.618)]	15.1 (18.1) [0.595 (0.713)]	15.1 (18.1) [0.595 (0.713)]	15.1 (18.1) [0.595 (0.713)]	15.1 (18.1) [0.595 (0.713)]	23 (26) [0.906 (1.024)]
	L ± 1.6 mm	44.4 [1.748]	25.4 [1.000]	38.1 [1.500]	50.8 [2.000]	76.2 [3.000]	76.2 [3.000]
	a	33.4 [1.315]	14.4 [0.570]	27.1 [1.070]	39.8 [1.570]	65.2 [2.570]	63.2 [2.490]
	a ₁	31.4 [1.236]	-	25.1 [0.990]	37.8 [1.490]	63.2 [2.490]	63.2 [2.490]
	b	6 [0.236]	6 [0.240]	6 [0.240]	6 [0.240]	6 [0.240]	8 [0.310]
	b ₁	5 [0.197]	-	5 [0.200]	5 [0.200]	5 [0.200]	5 [0.200]
	c	16.5 [0.650]	17.5 [0.690]	17.5 [0.690]	17.5 [0.690]	17.5 [0.690]	22 [0.870]
	c ₁	18.5 [0.728]	-	19 [0.750]	19 [0.750]	19 [0.750]	23 [0.910]
	d	4.5 [0.177]	5.5 [0.220]	5.5 [0.220]	5.5 [0.220]	5.5 [0.220]	12 [0.470]
	e	3.2 [0.126]	3.2 [0.130]	3.2 [0.130]	3.2 [0.130]	3.2 [0.130]	4.2 [0.170]
	e ₁	2.8 [0.110]	-	3.2 [0.130]	3.2 [0.130]	3.2 [0.130]	3.2 [0.130]
	s	0.6 [0.024]	0.6 [0.020]	0.6 [0.020]	0.6 [0.020]	0.6 [0.020]	0.8 [0.030]
	Weight (g)	10	10	10	15	15	30
MODEL		RW 20/102 RW 20/102 E RW 20/102 Ni RW 35 ⁽²⁾	RW 30/102 RW 30/102 E RW 36 ⁽²⁾	RW 30/152 RW 30/152 E RW 37 ⁽²⁾	RW 30/203 RW 30/203 RW 38 ⁽²⁾	RW 30/267 RW 30/267 E RW 47 ⁽²⁾	RW 30/305 RW 30/305 E
MM	D _{max.} ⁽¹⁾	23 (26) [0.906 (1.024)]	33.3 (36.3) [1.310 (1.430)]	33.3 (36.3) [1.310 (1.430)]	33.3 (36.3) [1.310 (1.430)]	33.3 (36.3) [1.310 (1.430)]	33.3 (36.3) [1.310 (1.430)]
	L ± 1.6 mm	101.6 [4.000]	101.6 [4.000]	152.4 [6.000]	203.2 [8.000]	266.7 [10.50]	304.8 [12.00]
	a	88.6 [3.490]	88.6 [3.490]	139.4 [5.490]	190.2 [7.490]	253.7 [9.990]	291.8 [11.49]
	a ₁	88.6 [3.490]	88.6 [3.490]	139.4 [5.490]	190.2 [7.490]	253.7 [9.990]	291.8 [11.49]
	b	8 [0.310]	8 [0.310]	8 [0.310]	8 [0.310]	8 [0.310]	8 [0.310]
	b ₁	5 [0.200]	8 [0.310]	8 [0.310]	8 [0.310]	8 [0.310]	8 [0.310]
	c	22 [0.870]	31 [1.220]	31 [1.220]	31 [1.220]	31 [1.220]	31 [1.220]
	c ₁	23 [0.910]	27 [1.060]	27 [1.060]	27 [1.060]	27 [1.060]	27 [1.060]
	d	12 [0.470]	18.5 [0.730]	18.5 [0.730]	18.5 [0.730]	18.5 [0.730]	18.5 [0.730]
	e	4.2 [0.170]	4.2 [0.170]	4.2 [0.170]	4.2 [0.170]	4.2 [0.170]	4.2 [0.170]
	e ₁	3.2 [0.130]	4.2 [0.170]	4.2 [0.170]	4.2 [0.170]	4.2 [0.170]	4.2 [0.170]
	s	0.8 [0.030]	0.8 [0.030]	0.8 [0.030]	0.8 [0.030]	0.8 [0.030]	0.8 [0.030]
	Weight (g)	62	136	200	260	330	430

Notes

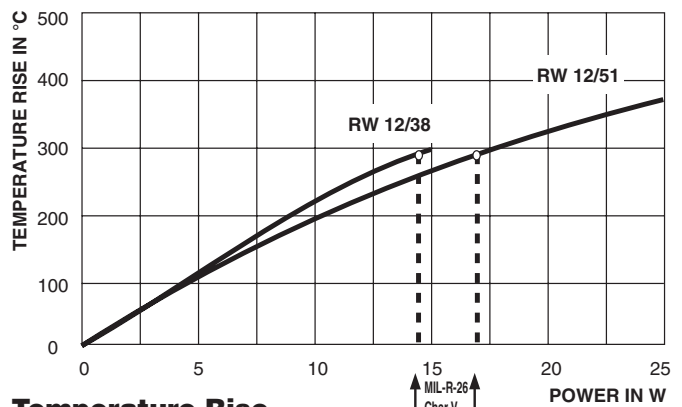
⁽¹⁾ Numbers in (parenthesis) represent the Dimension D_{max.} for resistor produced with corrugated ribbon.
⁽²⁾ Model according to MIL-R-26.



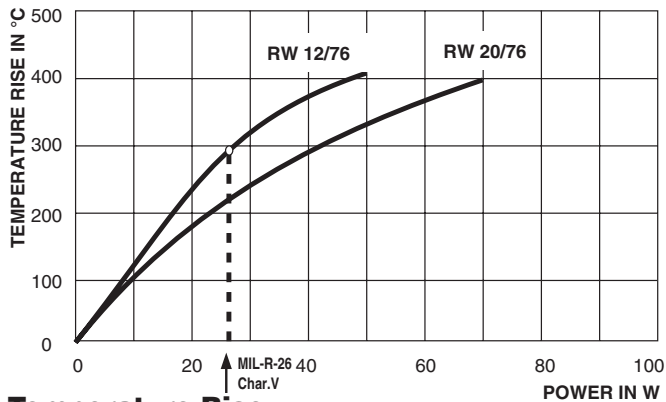
Derating



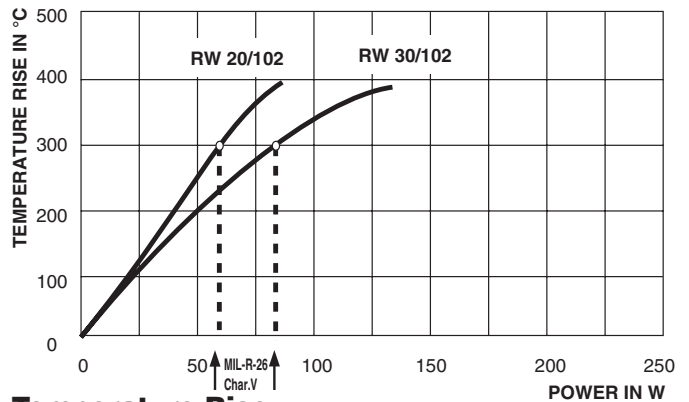
Temperature Rise



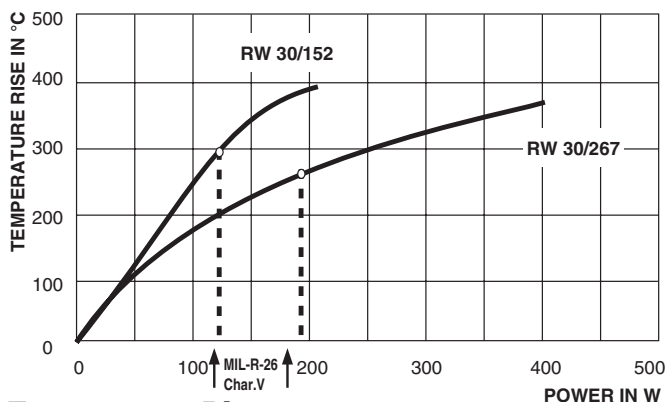
Temperature Rise



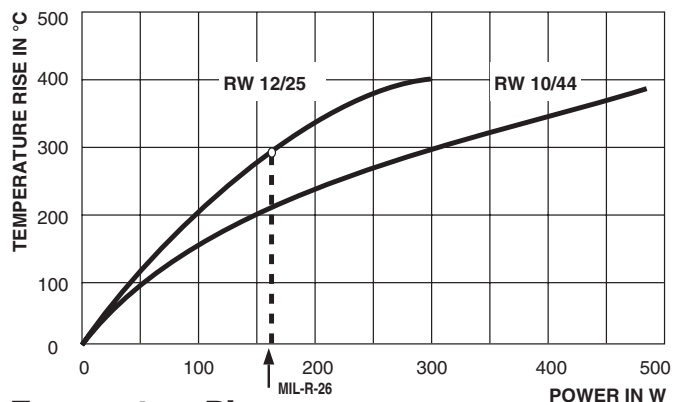
Temperature Rise



Temperature Rise



Temperature Rise



Temperature Rise

Vitreous Wirewound Resistors with Ferrules



FEATURES

- Caps made from drawn brass, nickel plated (GZK style)
- Machined caps with inner thread available (GDK style)
- Easy to change when mounted with spring clips
- Complete vitreous coating for perfect humidity protection
- TCR 100. . .180 ppm/K - WM110 (Class 3)
- Non inductive version = "Ni"
- Lead (Pb)-free



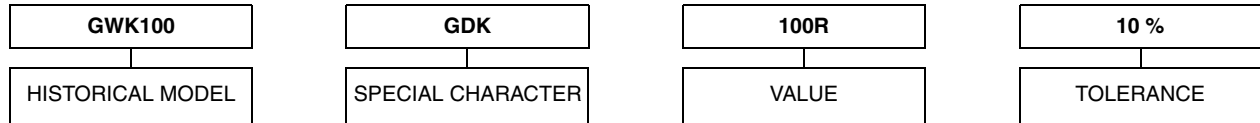
STANDARD ELECTRICAL SPECIFICATIONS						
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{40^{\circ}\text{C}}$ W	LIMITING VOLTAGE V	RESISTANCE RANGE	TOLERANCE \pm %	E-SERIES
GWK010	GWK 10	10	280	1R8 - 16K 6R8 - 16K 270R - 16K	10 5 2	E 12 E 24 E 24
	GWK 10 Ni	7		2R4 - 1K0 15R - 1K0	10 5	E 12 E 24
GWK020	GWK 20	20	400	2R2 - 27K 12R - 27K 360R - 27K8	10 5 2	E 12 E 24 E 24
	GWK 20 Ni	13		4R7 - 1K8 20R - 1K80	10 5	E 12 E 24
GWK040	GWK 40	30	580	3R3 - 43K 12R - 43K 470R - 43K	10 5 2	E 12 E 24 E 24
	GWK 40 Ni	20		6R8 - 2K7 20R - 2K7	10 5	E 12 E 24
GWK060	GWK 60	40	850	6R2 - 82K 6R2 - 82K 47R - 82K	10 5 2	E 12 E 24 E 24
	GWK 60 Ni	25		13R - 5K1 13R - 5K1	10 5	E 12 E 24
GWK100	GWK 100	80	1200	8R2 - 82K 8R2 - 82K 47R - 82K	10 5 2	E 12 E 24 E 24
	GWK 100 Ni	50		27R - 10K 27R - 10K	10 5	E 12 E 24
GWK150	GWK 150	100	1600	12R - 110K 12R - 110K 30R - 110K	10 5 2	E 12 E 24 E 24
	GWK 150 Ni	60		36R - 15K 36R - 15K	10 5	E 12 E 24
GWK200	GWK 200	160	2300	20R - 180K 20R - 180K 20R - 180K	10 5 2	E 12 E 24 E 24
	GWK 200 Ni	100		56R - 22K 56R - 22K	10 5	E 12 E 24
GWK300	GWK 300	260	4000	36R - 330K 36R - 330K 36R - 330K	10 5 2	E 12 E 24 E 24
	GWK 300 Ni	180		100R - 43K 100R - 43K	10 5	E 12 E 24

GLOBAL PART NUMBER INFORMATION

 New Global Part Numbering: **GWK100J1000KLX000** (preferred part number format)

G	W	K	1	0	0	J	1	0	0	0	K	L	X	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

MODEL	SIZE	SPECIAL CHARACTER	VALUE	TOLERANCE	PACKAGING	SPECIAL
GWK	010 = 10 020 = 20 040 = 40 060 = 60 100 = 100 150 = 150 200 = 200 220 = 220 300 = 300	I = GZK J = GDK (Also known as GDR and M4) O = GZK NI P = GDK NI Z = Value overflow (BV) (Note: NI is also known as SWI)	3 digit value 1 digit multiplier 8 = $\times 10^{-2}$ 9 = $\times 10^{-1}$ 0 = $\times 10^0$ 1 = $\times 10^1$ 2 = $\times 10^2$ 3 = $\times 10^3$	G = $\pm 2.0\%$ J = $\pm 5.0\%$ K = $\pm 10.0\%$	(See Packaging table)	The 5 digit BV number will be encoded using a 36 character code. This code contains numbers 0...9 and letters A...Z (36 characters total) and allows to encode at least 46 655 five digit BV numbers. 000 = Standard

 Historical Part Number Example: **GWK100 GDK 100R 10 %** (will continue to be accepted)

PACKAGING TABLE

SAP	DESCRIPTION	TYPE
LX	Loose pack, without quantity Note LX = B29 on Dale legacy ZX = S51 on Dale legacy	all

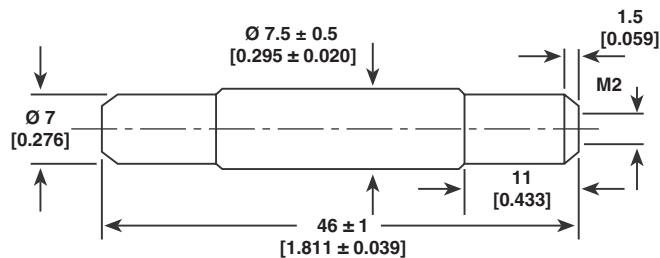
DIMENSIONS in millimeters [inches]


Figure 1: GWK 10

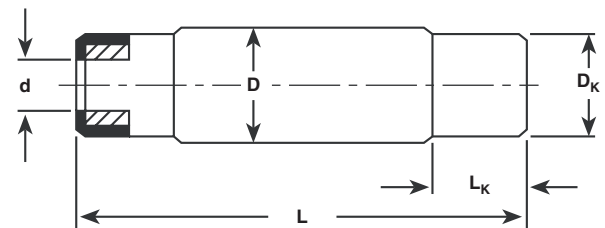
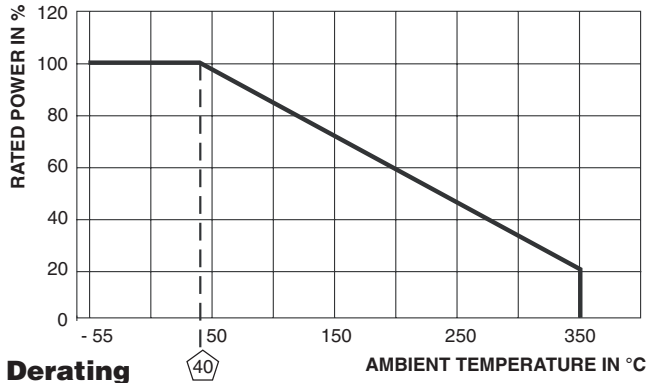


Figure 2: GWK 20...GWK 300

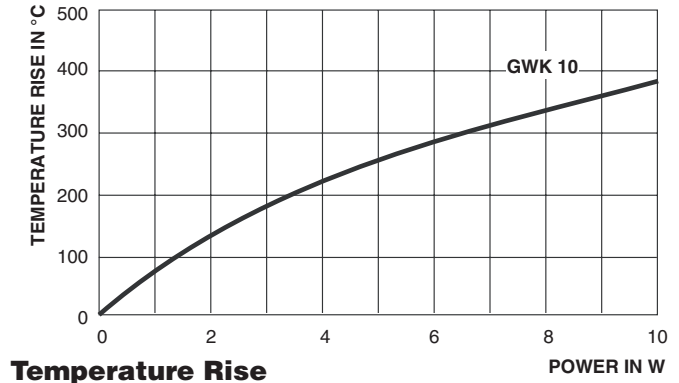
MODEL	DIMENSIONS in millimeters [inches]			
	GWK 10 GWK 10 Ni	GWK 20 GWK 20 Ni	GWK 40 GWK 40 Ni	GWK 60 GWK 60 Ni
D	See Drawing Figure 1	12.3 ± 0.8 [0.484 ± 0.031]	15.3 ± 0.8 [0.602 ± 0.031]	15.3 ± 0.8 [0.602 ± 0.031]
L		51 ± 1.3 [2.008 ± 0.051]	61 ± 1.5 [2.402 ± 0.059]	81 ± 2 [3.189 ± 0.079]
D _k		11 [0.433]	14 [0.551]	14 [0.551]
L _k		10 [0.394]	13 [0.512]	13 [0.512]
d		4.5 [0.177]	5.5 [0.217]	5.5 [0.217]

MODEL	DIMENSIONS in millimeters [inches]			
	GWK 100 GWK 100 Ni	GWK 150 GWK 150 Ni	GWK 200 GWK 200 Ni	GWK 300 GWK 300 Ni
D	22 ± 1 [0.866 ± 0.039]	22 ± 1 [0.866 ± 0.039]	22 ± 1 [0.866 ± 0.039]	22 ± 1 [0.866 ± 0.039]
L	101 ± 2.5 [3.976 ± 0.098]	121 ± 3 [4.764 ± 0.118]	166.5 ± 4.2 [6.555 ± 0.165]	266.5 ± 6.7 [10.492 ± 0.264]
D _k	21 [0.827]	21 [0.827]	21 [0.827]	21 [0.827]
L _k	16 [0.63]	16 [0.63]	16 [0.63]	16 [0.63]
d	10 [0.394]	10 [0.394]	10 [0.394]	10 [0.394]

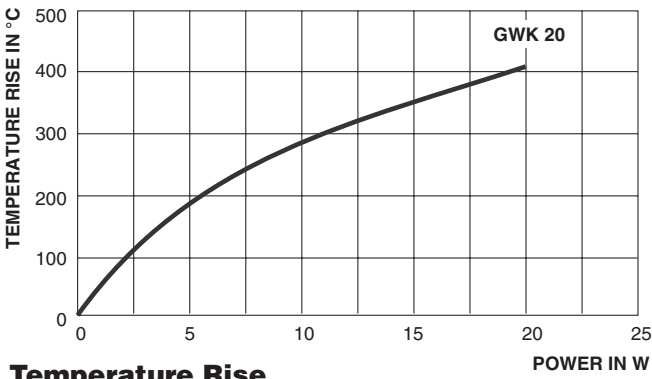


Derating

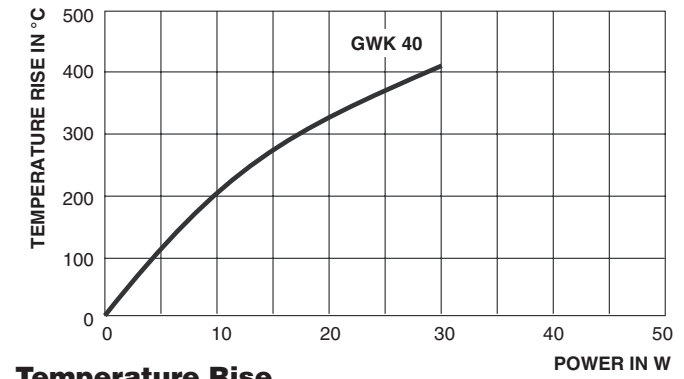
40



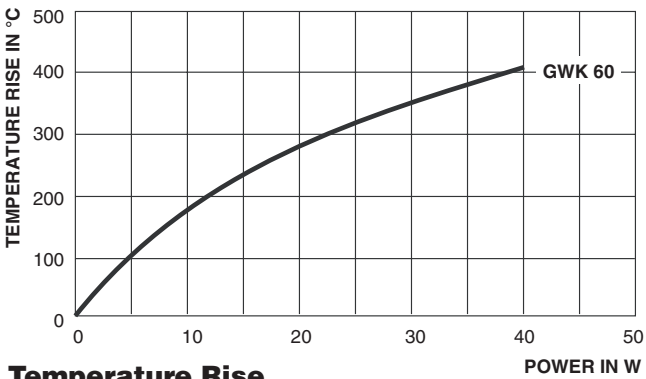
Temperature Rise



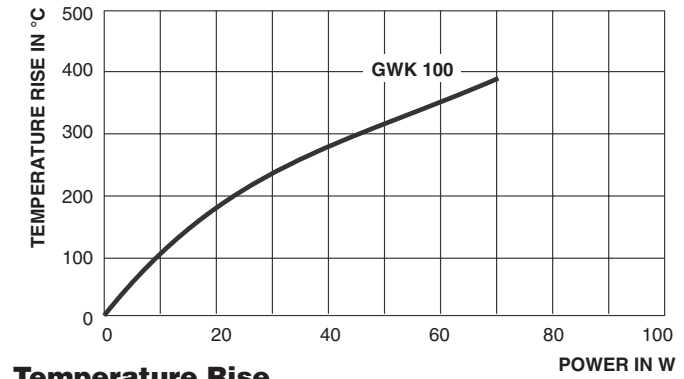
Temperature Rise



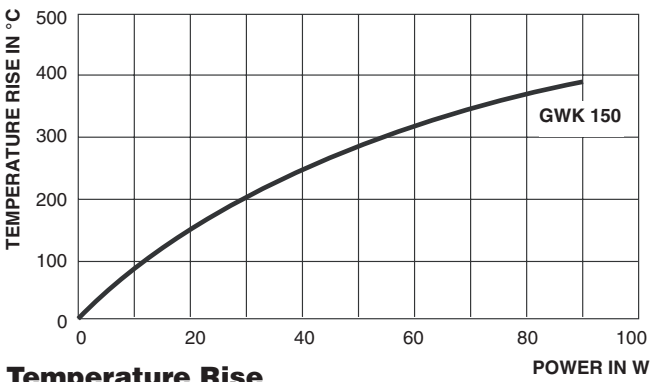
Temperature Rise



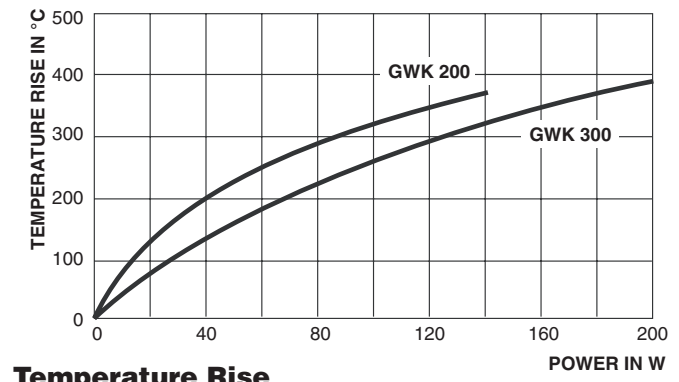
Temperature Rise



Temperature Rise



Temperature Rise



Temperature Rise



PULSE HANDLING FOR SHORT PULSES (less than 100 ms)

For single pulsed up to 100 ms duration time the following energy resistance chart can be used to calculate the energy a resistor can handle. Look to the resistance value or the next higher value of the model you need and follow this row to the energy per ohm column to the left. The energy per ohm value multiplied by the resistance value is the energy the resistor can handle for 100 ms. This energy divided by 0.1 ms is the power the resistor can handle for 100 ms For the power the resistor can handle for 10 ms needed divide the energy by 0.01. The maximum pulse power is limited at 625 x rated power.

Do not use this chart for GWK...Ni styles. For more information and assistance please contact factory.

ENERGY RESISTANCE CHART															
GWK10		GWK 20		GWK 40		GWK 60		GWK 100		GWK 150		GWK 200		GWK 300	
ENERGY/Ω [Ws/Ω]	R [Ω]	ENERGY/Ω [Ws/Ω]	R [Ω]	ENERGY/Ω [Ws/Ω]	R [Ω]	ENERGY/Ω [Ws/Ω]	R [Ω]	ENERGY/Ω [Ws/Ω]	R [Ω]	ENERGY/Ω [Ws/Ω]	R [Ω]	ENERGY/Ω [Ws/Ω]	R [Ω]	ENERGY/Ω [Ws/Ω]	R [Ω]
1.17E - 04	16.0K	1.15E - 04	27.0	1.15E - 04	43.0	1.15E - 04	82.0K	2.80E - 04	82.0K	2.80E - 04	110K	2.80E - 04	180K	2.79E - 04	330K
1.17E - 04	13.0K	1.16E - 04	2.40	1.15E - 04	36.0	1.15E - 04	68.0K	2.80E - 04	62.0K	2.80E - 04	82.0K	2.80E - 04	130K	2.80E - 04	240K
1.72E - 04	9.1K	1.70E - 04	16.0	1.69E - 04	24.0	1.68E - 04	43.0K	4.41E - 04	43.0K	4.40E - 04	56.0K	4.40E - 04	91.0K	4.40E - 04	160K
2.88E - 04	6.2K	2.83E - 04	11.0	2.82E - 04	18.0	2.81E - 04	33.0K	7.52E - 04	30.0K	7.51E - 04	39.0K	7.51E - 04	62.0K	7.50E - 04	120K
4.53E - 04	4.3K	4.47E - 04	7.5K	4.45E - 04	11.0	4.42E - 04	22.0K	1.20E - 03	22.0K	1.20E - 03	30.0K	1.20E - 03	47.0K	1.20E - 03	82.0
7.72E - 04	3.0K	7.65E - 04	5.1K	7.58E - 04	8.2K	7.54E - 04	15.0K	1.84E - 03	15.0K	1.83E - 03	20.0K	1.83E - 03	33.0K	1.83E - 03	62.0
1.24E - 03	2.2K	1.23E - 03	3.9K	1.22E - 03	5.6K	1.21E - 03	11.0K	2.93E - 03	10.0K	2.93E - 03	15.0K	2.93E - 03	22.0K	2.92E - 03	39.0
1.91E - 03	1.5K	1.87E - 03	2.7K	1.86E - 03	3.9K	1.84E - 03	7.5K	4.53E - 03	3.0K	4.51E - 03	4.3K	4.49E - 03	6.8K	4.48E - 03	12.0
3.06E - 03	1.1K	3.00E - 03	1.8K	2.98E - 03	2.7K	2.95E - 03	5.1K	7.12E - 03	2.2K	7.09E - 03	3.0K	7.05E - 03	4.7K	7.04E - 03	9.1K
5.05E - 03	330	4.79E - 03	560	4.70E - 03	820	4.58E - 03	1.6K	1.14E - 02	1.6K	1.14E - 02	2.0K	1.13E - 02	3.3K	1.13E - 02	6.2K
8.11E - 03	220	7.61E - 03	390	7.44E - 03	560	7.20E - 03	1.1K	1.85E - 02	1.1K	1.84E - 02	1.5K	1.83E - 02	2.4K	1.83E - 02	4.3K
1.31E - 02	160	1.23E - 02	300	1.19E - 02	430	1.17E - 02	750	2.98E - 02	750	2.97E - 02	1.0K	2.94E - 02	1.6K	2.94E - 02	3.0K
2.06E - 02	110	2.01E - 02	200	1.94E - 02	300	1.89E - 02	560	4.81E - 02	560	4.78E - 02	750	4.75E - 02	1.2K	4.73E - 02	2.2K
3.56E - 02	75	3.24E - 02	150	3.16E - 02	200	3.04E - 02	390	1.14E - 01	390	1.14E - 01	560	7.23E - 02	1.0K	7.20E - 02	1.8K
5.77E - 02	56	5.30E - 02	100	5.10E - 02	150	4.93E - 02	270	1.79E - 01	300	1.78E - 01	390	1.13E - 01	910	1.13E - 01	1.6K
1.34E - 01	43	1.24E - 01	75	1.21E - 01	110	7.49E - 02	220	2.81E - 01	200	2.79E - 01	270	1.77E - 01	620	1.76E - 01	1.1K
2.14E - 01	30	1.98E - 01	51	1.90E - 01	75	1.17E - 01	200	4.81E - 01	150	4.79E - 01	180	2.77E - 01	430	2.76E - 01	750
3.47E - 01	20	3.14E - 01	36	3.00E - 01	56	1.83E - 01	150	7.75E - 01	100	7.69E - 01	130	4.75E - 01	300	4.72E - 01	560
5.96E - 01	15	5.48E - 01	24	5.22E - 01	36	2.88E - 01	100	1.19E + 00	68	1.17E + 00	100	7.62E - 01	220	7.57E - 01	390
9.93E - 01	10	8.86E - 01	18	8.41E - 01	27	4.96E - 01	68	1.87E + 00	51	1.85E + 00	68	1.17E +	150	1.16E + 00	270
1.54E + 00	7.5	1.38E + 00	13	1.29E + 00	20	7.98E - 01	51	2.92E + 00	36	2.89E + 00	47	1.83E +	110	1.81E + 00	200
2.52E + 00	5.1	2.21E + 00	9.1	2.05E + 00	15	1.23E + 00	36	4.61E + 00	27	4.56E + 00	36	2.85E +	82	2.82E + 00	150
4.00E + 00	3.9	3.48E + 00	6.8	3.26E + 00	10	1.93E + 00	27	7.46E + 00	18	7.36E + 00	24	4.50E +	56	4.45E + 00	100
6.58E + 00	2.7	5.64E + 00	4.7	5.26E + 00	6.8	3.05E + 00	18	1.21E + 01	12	1.19E + 01	18	7.24E +	39	7.16E + 00	68
1.12E + 01	1.8	9.11E + 00	3.6	8.50E + 00	5.1	4.84E + 00	13	1.97E ± 01	8.2	1.93E + 01	12	1.17E +	27	1.15E + 01	51
		1.56E + 01	2.2	1.42E + 01	3.3	7.86E + 00	9.1					1.89E +	20	1.86E + 01	36
						1.29E + 01	6.2								

Axial Cemented Wirewound Resistors



FEATURES

- All welded construction
- Non flammable cement coating
- Ceramic core
- Various kinds of lead forming available
- Lead (Pb)-free
- Pure tin plating provides compatibility with lead (Pb)-free and lead containing soldering processes
- Compatible with "Restriction of the use of Hazardous Substances" (RoHS) directive 2002/95/EC (issue 2004)



STANDARD ELECTRICAL SPECIFICATIONS

GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{40\text{ }^{\circ}\text{C}}$ W	TOLERANCE \pm %	RESISTANCE RANGE E12/E24 ⁽¹⁾	
				Ω	
				WM 50 (Class 1) TCR -10...-80 ppm/K	WM 110 (Class 3) TCR 100...180 ppm/K
Z310309	Z301	1	10 5 2 1	R30 - 270R R30 - 270R - -	R68 - 2K0 R68 - 2K0 - -
ZDA0411	ZDA0411	2	10 5 2 1	R47 - 560R R47 - 560R on request on request	1R5 - 4K3 1R5 - 4K3 - -
ZDV0411	ZDV0411	2	10 5 2 1	R47 - 560R R47 - 560R on request on request	1R5 - 4K3 1R5 - 4K3 - -
Z320414	Z302	3	10 5 2 1	R10 - 510R R10 - 510R R22 - 510R 1R0 - 510R	1R8 - 3K3 24R - 3K3 - -
Z330617	Z303	4	10 5 2 1	R10 - 1K0 R10 - 1K0 R10 - 1K0 1R0 - 1K0	1R8 - 3K9 12R - 3K9 - -
Z350922	Z305	6	10 5 2 1	R10 - 2K4 R10 - 2K4 R62 - 2K4 R62 - 2K4	3R9 - 10K 10R - 10K - -
Z360933	Z306	8	10 5 2 1	R13 - 4K7 R13 - 4K7 1R0 - 4K7 2R2 - 4K7	6R8 - 16K 6R8 - 16K - -
Z370947	Z307	10	10 5 2 1	R20 - 8K2 R20 - 8K2 1R8 - 8K2 3R3 - 8K2	12R - 30K 12R - 30K - -

Note

⁽¹⁾ Lower TCR or other power range on request



GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: Z32041411509K2C000 (preferred part numbering format)

Z	3	2	0	4	1	4	1	1	5	0	9	K	2	C	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

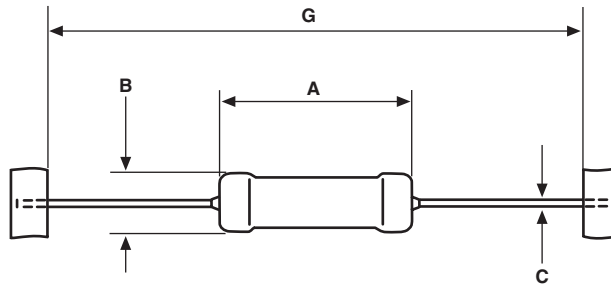
MODEL	TCR/MATERIAL	VALUE	TOLERANCE CODE	PACKAGING	SPECIAL
(See Standard Electrical Specifications table)	1 = - 10...- 80 ppm/K WM50 Class 1 3 = 100...180 ppm/K WM110 Class 3 4 = SWI (special winding)	3 digit value 1 digit multiplier MULTIPLIER F = *10 ⁻⁴ 7 = *10 ⁻³ 8 = *10 ⁻² 9 = *10 ⁻¹ 0 = *10 ⁰ 1 = *10 ¹ 2 = *10 ²	F = ± 1.0 % G = ± 2.0 % J = ± 5.0 % K = ± 10.0 %	(See Packaging table)	The 5 digit BV number will be encoded using a 36 character code. This code contains numbers 0...9 and letters A...Z (36 characters total and allows to encode at least 46.655 five digit BV numbers. 000 = Standard

Historical Part Number Example: Z302 1 15R 10 % AC G53 (will continue to be accepted)

Z302	1	15R	10 %	AC G53
HISTORICAL MODEL	TCR/MATERIAL	VALUE	TOLERANCE CODE	PACKAGING

PACKAGING TABLE			
SAP	DRALORIC LEGACY	PACKAGING 2 digits	
21	A1 G53	Ammo pack tape 53 mm, 1000 pieces	Z301
DS	RS G53	Reel pack tape 53 mm, 7500 pieces	Z301, Z302
D2	R2 G53	Reel pack tape 53 mm, 2000 pieces	Z301, Z302
6C	AC G83	Ammo pack tape 83 mm, 500 pieces	Z302, Z303
H1	R1 G83	Reel pack tape 83 mm, 1000 pieces	Z302, Z303
2C	AC G53	Ammo pack tape 53 mm, 500 pieces	Z302, Z303
JS	RS 108	Reel pack tape 108 mm, 7500 pieces	Z302
HS	RS G83	Reel pack tape 83 mm, 7500 pieces	Z302
4C	AC G73	Ammo pack tape 73 mm, 500 pieces	Z302
D1	R1 G53	Reel pack tape 53 mm, 1000 pieces	Z303
6B	AB G83	Ammo pack tape 83 mm, 250 pieces	Z305, Z306
41	A1 G73	Ammo pack tape 73 mm, 1000 pieces	ZDA0411
F2	R2 G73	Reel pack tape 73 mm, 2000 pieces	ZDA0411
40	A2 G73	Ammo pack tape 73 mm, 2000 pieces	ZDV0411
HC	RC G83	Reel pack tape 83 mm, 500 pieces	Z305, Z306
LC	LC	loose PKG, 500 pieces	Z302, Z303
LJ	LJ	loose PKG, 200 pieces	Z307
L1	L1	loose PKG, 1000 ppieces	ZL302
24	A4 G53	Ammo pack tape 53 mm, 4000 pieces	Z302
6A	A4 G83	Ammo pack tape 83 mm, 100 pieces	Z305
25	A4 G63	Ammo pack tape 63 mm, 4000 pieces	Z302

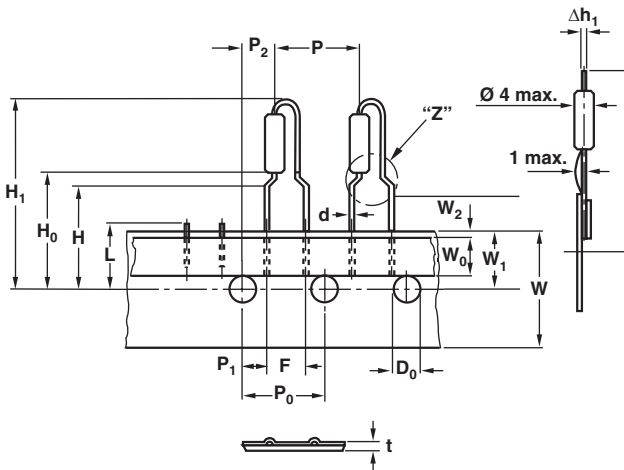
DIMENSIONS



For packaging dimensions see appropriate catalog or web page.

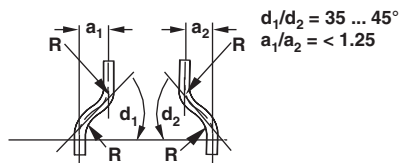
MODEL	DIMENSIONS in millimeters [inches]				
	A _{max.}	B _{max.}	C _{max.}	G	Weight (g)
Z301	8.5 [0.355]	3 [0.118]	0.7 [0.027]	53 ± 1 [2.087 ± 0.039]	0.5
ZDA0411	11 [0.433]	4 [0.157]	0.7 [0.027]	53 ± 1 [2.087 ± 0.039]	0.8
Z302	13 [0.512]	4.8 [0.189]	0.8 [0.031]	53 ± 1 [2.087 ± 0.039]	1.1
Z303	15.8 [0.622]	5.5 [0.217]	0.8 [0.031]	53 ± 1 [2.087 ± 0.039]	1.4
Z305	22.3 [0.878]	8.7 [0.343]	0.8 [0.031]	83 ± 1 [3.268 ± 0.039]	3.7
Z306	32.3 [1.272]	8.7 [0.343]	0.8 [0.031]	83 ± 1 [3.268 ± 0.039]	5
Z307	49.8 [1.961]	9 [0.354]	0.8 [0.031]	120 ± 2 [4.724 ± 0.079]	7

DIMENSIONS ZDV0411



For body dimensions, see dimensions table above, model ZDA0411.

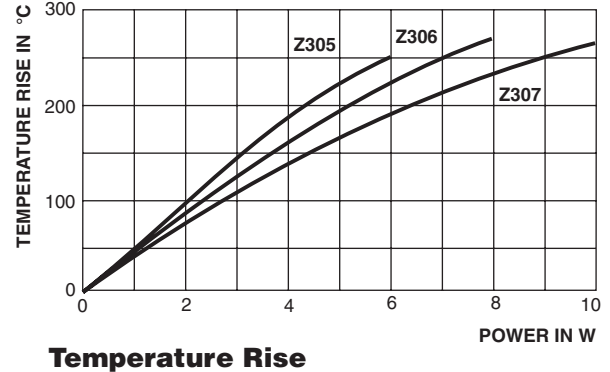
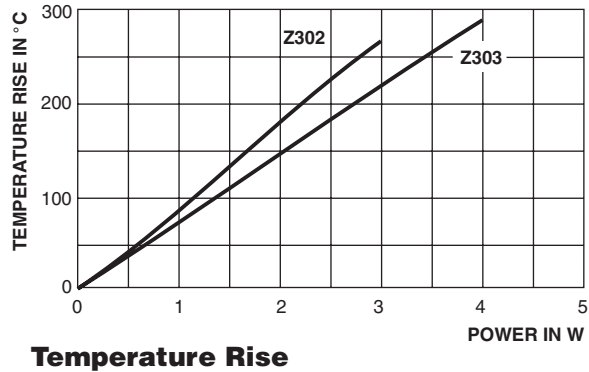
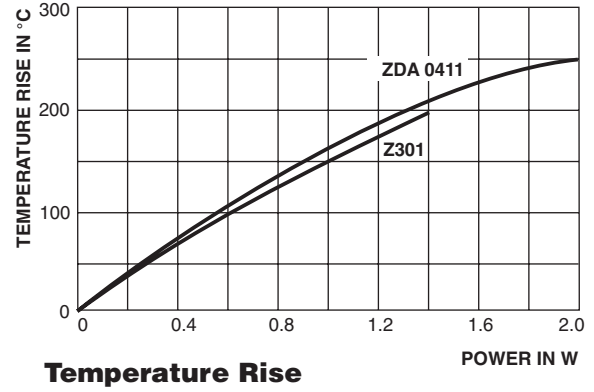
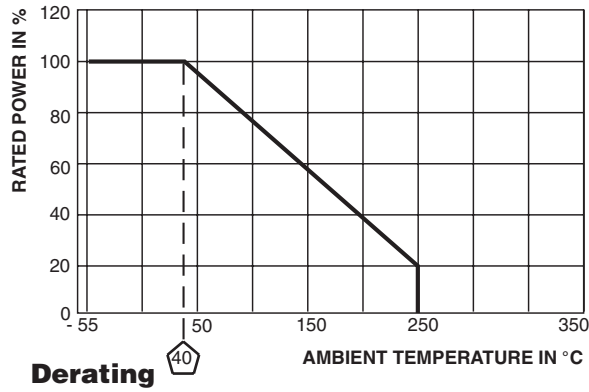
Area "Z"



Notes

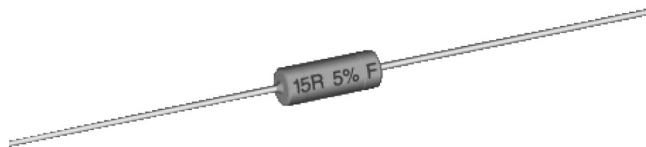
- (1) Test over 10 holes - 9 intervals P_0 $12 \times 9 = 114.3 \pm 0.5$
- (2) Parallelism, < 0.5 mm
- (3) Thickness of carrier tape: 0.55 mm ± 0.1

DIMENSIONS in millimeters			TOL.
Lead Ø	d	0.6	
Pitch of components	P	12.7	± 1.0
Pitch of sprocket holes ⁽¹⁾	P ₀	12.7	± 0.3
Distance between hole center and resistor center	P ₁	3.85	± 0.7
Distance between hole center and lead center	P ₂	6.35	± 0.7
Lead spacing	F	5	+ 0.6, - 0.1
Angle of Insertion	Δh ₁	2 max.	-
Width of carrier tape	W	18.0	+ 1, - 0.5
Width of adhesive tape	W ₀	12.0	± 0.5
Position of holes	W ₁	9	+ 0.75, - 0.5
Position of adhesive tape	W ₂	0.5	+ 0, - 0.5
Body to hole center	H	16.0	± 0.5
Lead crimp to hole center ⁽²⁾	H ₀	19.5	± 1.0
Hole Ø	D ₀	4.0	± 0.2
Thickness of tape ⁽³⁾	t	0.9 max.	-
Height of cutting	L	11 max.	-
Height of insertion	H ₁	32.3 max.	-



PERFORMANCE	
TEST	TEST RESULTS
Damp Heat, Steady State 56 Days	± 3 % ΔR
Climatic Sequence	± 3 % ΔR
Load Life 5000 h	± 3 % ΔR
Short Time Overload, 5 x Rated Power x 5 s	± 1 % ΔR
Vibration	± 1 % ΔR
Shock	± 1 % ΔR
Resistance to Soldering Heat	± 1 % ΔR

Axial Cemented, Fusible, Wirewound Resistors



FEATURES

- Can operate as both a normal resistor and as a fuse
- Fuses when overloaded by more than 100 times the rated power
- Ceramic core
- Non flammable cement coating
- Mainly designed to customer requirements
- Pure tin plating provides compatibility with lead (Pb)-free and lead containing soldering processes
- Compatible with "Restriction of the use of Hazardous Substances" (RoHS) directive 2002/95/EC (issue 2004)



STANDARD ELECTRICAL SPECIFICATIONS									
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{40\text{ }^\circ\text{C}}$ W (max.)	STANDARD TOL. (max.) $\pm\%$	NOMINAL RES. ⁽¹⁾ (typical) Ω	TEMP. COEF. (typical) ppm/ $^\circ\text{C}$	MAX. PEAK ENERGY ⁽¹⁾ Ws (max.)	MAX. PEAK POWER ⁽²⁾ W (max.)	PERMISSIBLE $I^2 \times t$ VALUE ⁽³⁾ AT 40 $^\circ\text{C}$ A ² s (min.)	FUSING $I^2 \times t$ VALUE ⁽³⁾ AT 40 $^\circ\text{C}$ A ² s (min.)
Z3020414	Z302 BV 20327	3	10 5	15	100 to 180	1.07	1875	0.07	0.27

Notes

- ⁽¹⁾ Ambient temperature = 23 $^\circ\text{C}$
- ⁽²⁾ Ambient temperature = 40 $^\circ\text{C}$
- ⁽³⁾ Ambient temperature = 100 $^\circ\text{C}$

CHARACTERISTICS OF FUSIBLE RESISTORS

Fusible resistors are capable of acting as both a regular resistor and as a fuse when abnormal current comes in. Since the two functions are performed by only one component the cost is lower.

The Z302 BV 20327 fuses when overloaded at more than 100 times the rated power. In line-powered devices, these fusible resistors can be used to act as a fuse when malfunction occurs and line voltage drops across the resistor.

To prevent flames or explosion when fusing, the device has an inflammable construction with high dielectric strength. After fusing the resistance value will be more than 100 k Ω to realize sufficient circuit break. The components are mainly designed specifically to customer requirements.

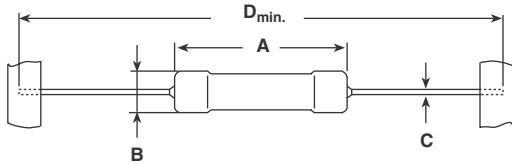
APPLICATIONS FOR FUSIBLE RESISTORS

- Power supplies
- Energy saving lamps
- Battery charges

GLOBAL PART NUMBER INFORMATION																	
New Global Part Numbering: Z302041441509JD2FON (preferred part numbering format)																	
Z	3	2	0	4	1	4	4	1	5	0	9	J	D	2	F	O	N
MODEL	TCR/MATERIAL	VALUE	TOLERANCE CODE	PACKAGING	SPECIAL												
Z302	4 = SWI (special winding)	3 digit value 1 digit multiplier 9 = $\times 10^{-1}$	J = $\pm 5.0\%$ K = $\pm 10.0\%$	(See Packaging table)	The 5 digit BV number will be encoded using a 36 character code. This code contains numbers 0...9 and letters A...Z (36 characters total and allows to encode at least 46.655 five digit BV numbers. 000 = Standard												
Historical Part Number Example: Z302 SWI 15R 10% R2 G53 (will continue to be accepted)																	
Z302	SWI	15R	10%	R2 G53													
HISTORICAL MODEL	TCR/MATERIAL	VALUE	TOLERANCE CODE	PACKAGING													

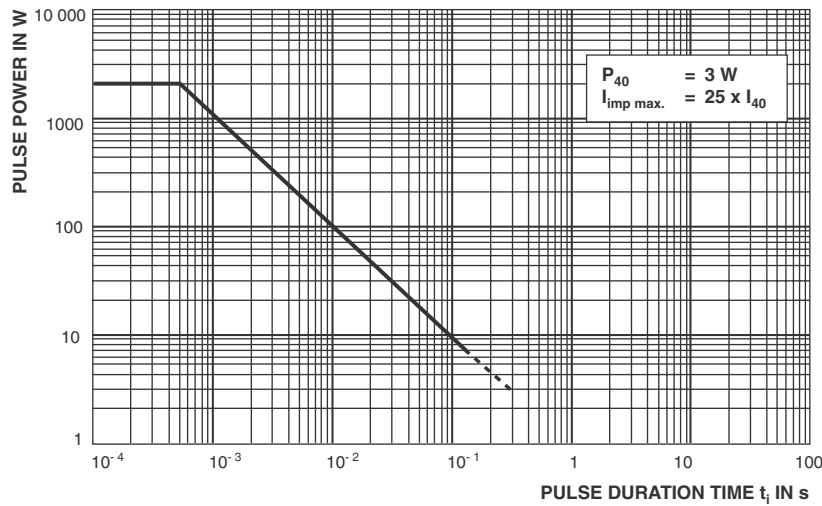
PACKAGING TABLE			
SAP	DRALORIC LEGACY	PACKAGING 2 digits	
D2	R2 G53	Reel pack tape 53 mm, 2000 pieces	Z302 BV 20327

DIMENSIONS

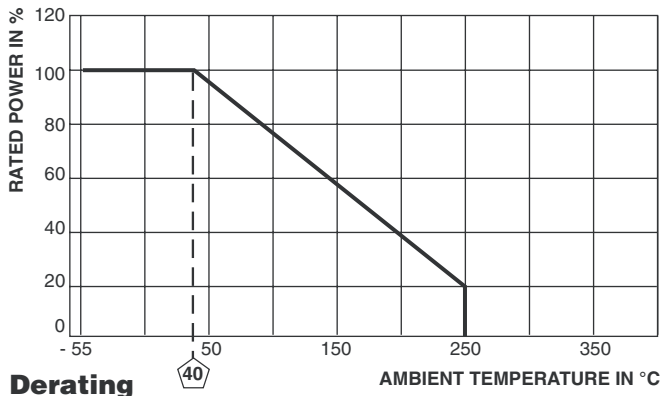


MODEL	DIMENSIONS in millimeters [inches]				WEIGHT (g)
	A	B	C	D _{min.}	
Z302 BV 20327	13 [0.512]	4.8 [0.189]	0.8 [0.31]	53 ± 1 2.087 ± 0.039	0.8 typical

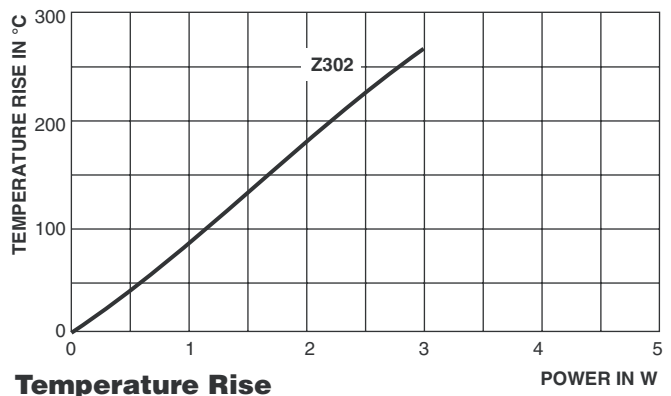
PERFORMANCE	
TEST	TEST RESULTS
Load Life, 12 000 h	± 3 % ΔR
Vibration	± 1 % ΔR
Shock	± 1 % ΔR
Resistance to Soldering Heat	± 1 % ΔR



Pulse performance for single square pulses at 40 °C

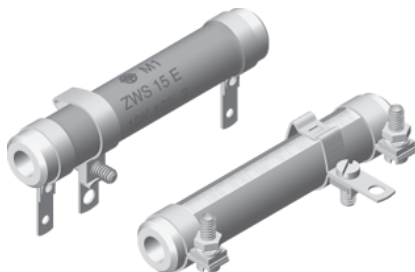


Derating



Temperature Rise

Cemented Wirewound Resistors with Lugs



FEATURES

- Complete welded construction
- Ceramic core
- Available in adjustable = “E” or non inductive design = “Ni”
- Lugs with various termination styles for soldering or bolt connection



RoHS
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS										
GLOBAL MODEL	HISTORICAL MODEL	TERMINAL	POWER RATING $P_{40\text{ }^\circ\text{C}}$ W	LIMITING VOLTAGE V	RESISTANCE RANGE Ω		TOLERANCE \pm %	E-SERIES		
					TCR - 10 ... - 80 ppm/K	TCR 100 ... 180 ppm/K				
ZWS0063	ZWS6	SL	6	$\sqrt{P \times R}$	R82 - 5K1	1R8 - 13K	10	E 12		
								5	E 24	
								2		
ZWS0068	ZWS6 E	SL	6	$\sqrt{P \times R}$	R82 - 130R	1R8 - 4K7	10	E 12		
								5	E 24	
ZWS006D	ZWS6 Ni	SL	6	$\sqrt{P \times R}$	R15 - 910R	R33 - 2K4	10	E 12		
								5	E 24	
ZWS0083	ZWS8	SL	8	$\sqrt{P \times R}$	R68 - 7K5	1R8 - 20K	10	E 12		
ZWS0084		SS					5	E 24		
ZWS0088	ZWS8 E	SL	8	$\sqrt{P \times R}$	3R3 - 7K5	-	2			
ZWS0089		SS						10	E 12	
ZWS008D	ZWS8 Ni	SL	8	$\sqrt{P \times R}$	R62 - 200R	1R8 - 6K8	5	E 24		
ZWS008E		SS			R24 - 1K3	R56 - 3K6	10	E 12		
ZWS0123	ZWS12	SL	12	$\sqrt{P \times R}$	1R0 - 1K3	2R0 - 3K6	5	E 24		
ZWS0124		SS								
ZWS0128	ZWS12 E	SL	12	$\sqrt{P \times R}$	R62 - 10K	1R8 - 27K	10	E 12		
ZWS0129		SS						5	E 24	
ZWS012D	ZWS12 Ni	SL	12	$\sqrt{P \times R}$	R56 - 270R	1R8 - 9K1	10	E 12		
ZWS012E		SS						5	E 24	
ZWS0153	ZWS15	SL	15	$\sqrt{P \times R}$	R68 - 12K	2R2 - 33K	10	E 12		
ZWS0154		SS						5	E 24	
ZWS0158	ZWS15 E	SL	15	$\sqrt{P \times R}$	2R2 - 12K	-	2			
ZWS0159		SS								
ZWS015D	ZWS15 Ni	SL	15	$\sqrt{P \times R}$	R68 - 330R	2R2 - 11K	10	E 12		
ZWS015E		SS						5	E 24	
ZWS0203	ZWS20	SL	20	$\sqrt{P \times R}$	R39 - 2K2	R82 - 6K2	10	E 12		
ZWS0204		SS						5	E 24	
ZWS0205		SB								
ZWS0207		FST			1R0 - 2K2	2R0 - 6K2	5	E 24		
ZWS0208	ZWS20 E	SL	20	$\sqrt{P \times R}$	R62 - 16K	1R3 - 43K	10	E 12		
ZWS0209		SS								
ZWS020A		SB								
ZWS020C		FST								
ZWS020D	ZWS20 Ni	SL	20	$\sqrt{P \times R}$	R62 - 430R	1R3 - 15K	10	E 12		
ZWS020E		SS								
ZWS020F		SB								
ZWS020H		FST								
					1R0 - 2K7	2R0 - 8K2	5	E 24		



STANDARD ELECTRICAL SPECIFICATIONS									
GLOBAL MODEL	HISTORICAL MODEL	TERMINAL	POWER RATING $P_{40^{\circ}\text{C}}$ W	LIMITING VOLTAGE V	RESISTANCE RANGE Ω		TOLERANCE \pm %	E-SERIES	
					TCR - 10 ... - 80 ppm/K	TCR 100 ... 180 ppm/K			
ZWS0353	ZWS35	SL	35	$\sqrt{P \times R}$	1R1 - 30K	2R7 - 82K	10	E 12	
ZWS0354		SS					5		
ZWS0355		SB							
ZWS0357		FST					2		E 24
ZWS0358	ZWS35 E	SL			1R1 - 750K	2R7 - 27K	10	E 12	
ZWS0359		SS					5		E 24
ZWS035A		SB							
ZWS035C		FST							
ZWS035D	ZWS35 Ni	SL			R91 - 5K1	2R - 15K	10	E 12	
ZWS035E		SS					5		E 24
ZWS035F		SB							
ZWS035H		FST							
ZWS0504	ZWS50	SS	50	$\sqrt{P \times R}$	1R3 - 33K	3R0 - 91K	10	E 12	
ZWS0506		SSB					5		E 24
ZWS0505		SB			2	E 24			
ZWS0507		FST							
ZWS0509	ZWS50 E	SS			1R3 - 910R	3R0 - 33K	10	E 12	
ZWS050B		SSB					5		E 24
ZWS050A		SB							
ZWS050C		FST							
ZWS050E	ZWS50 Ni	SS			1R1 - 6K2	2R4 - 16K	10	E 12	
ZWS050G		SSB					5		E 24
ZWS050F		SB							
ZWS050H		FST							
ZWS1004	ZWS100	SS	100	$\sqrt{P \times R}$	2R7 - 68K	6R2 - 68K	10	E 12	
ZWS1006		SSB					5		E 24
ZWS1005		SB			2	E 24			
ZWS1007		FST							
ZWS1009	ZWS100 E	SS			2R7 - 1K8	6R2 - 68K	10	E 12	
ZWS100B		SSB					5		E 24
ZWS100A		SB							
ZWS100C		FST							
ZWS100E	ZWS100 Ni	SS			2R2 - 13K	4R7 - 33K	10	E 12	
ZWS100G		SSB					5		E 24
ZWS100F		SB							
ZWS100H		FST							
ZWS1504	ZWS150	SS	150	$\sqrt{P \times R}$	4R7 - 130K	11R - 360K	10	E 12	
ZWS1506		SSB					5		E 24
ZWS1505		SB			2	E 24			
ZWS1507		FST							
ZWS1509	ZWS150 E	SS			4R7 - 3K3	11R - 120K	10	E 12	
ZWS150B		SSB					5		E 24
ZWS150A		SB							
ZWS150C		FST							
ZWS150E	ZWS150 Ni	SS			3R9 - 22K	9R1 - 62K	10	E 12	
ZWS150G		SSB					5		E 24
ZWS150F		SB							
ZWS150H		FST							

STANDARD ELECTRICAL SPECIFICATIONS										
GLOBAL MODEL	HISTORICAL MODEL	TERMINAL	POWER RATING $P_{40\text{ }^\circ\text{C}}$ W	LIMITING VOLTAGE V	RESISTANCE RANGE Ω		TOLERANCE \pm %	E-SERIES		
					TCR - 10 ... - 80 ppm/K	TCR 100 ... 180 ppm/K				
ZWS2504	ZWS250	SS	250	$\sqrt{P \times R}$	8R2 - 220K	20R - 620K	10	E 12		
ZWS2506		SSB					5			
ZWS2505		SB						2	E 24	
ZWS2507		FST					-			
ZWS2509	ZWS250 E	SS			8R2 - 6K2	20R - 220K	10	E 12		
ZWS250B		SSB					5	E 24		
ZWS250A		SB								
ZWS250C		FST								
ZWS250E	ZWS250 Ni	SS			6R8 - 39K	15R - 110K	10	E 12		
ZWS250G		SSB					5	E 24		
ZWS250F		SB								
ZWS250H		FST								
ZWSN844	ZWS30/100	SS			75	$\sqrt{P \times R}$	2R4 - 62K	5R1 - 180K	10	E 12
ZWSN846		SSB							5	
ZWSN845		SB					2	E 24		
ZWSN847		FST							3R0 - 62K	-
ZWSN849	ZWS30/100 E	SS	2R4 - 1K6	5R1 - 56K			10	E 12		
ZWSN84B		SSB					5	E 24		
ZWSN84A		SB								
ZWSN84C		FST								
ZWSN84E	ZWS30/100 Ni	SS	2R0 - 11K	4R3 - 30K			10	E 12		
ZWSN84G		SSB					5	E 24		
ZWSN84F		SB								
ZWSN84H		FST								
ZWSN914	ZWS30/133	SS	110	$\sqrt{P \times R}$			3R3 - 91K	7R5 - 240K	10	E 12
ZWSN916		SSB							5	
ZWSN915		SB					2	E 24		
ZWSN917		FST							-	
ZWSN919	ZWS30/133 E	SS			3R3 - 2K4	7R5 - 82K	10	E 12		
ZWSN91B		SSB					5	E 24		
ZWSN91A		SB								
ZWSN91C		FST								
ZWSN91E	ZWS30/133 Ni	SS			2R7 - 16K	6R2 - 43K	10	E 12		
ZWSN91G		SSB					5	E 24		
ZWSN91F		SB								
ZWSN91H		FST								

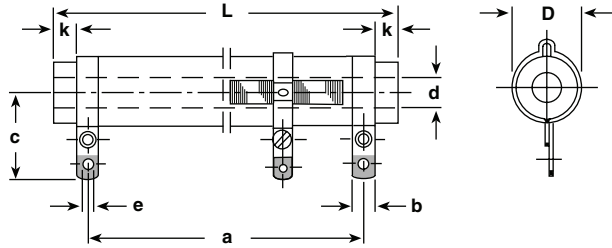


GLOBAL PART NUMBER INFORMATION																									
New Global Part Numbering: ZWS006331001KLX000 (preferred part number format)																									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px 10px;">Z</td> <td style="padding: 2px 10px;">W</td> <td style="padding: 2px 10px;">S</td> <td style="padding: 2px 10px;">0</td> <td style="padding: 2px 10px;">0</td> <td style="padding: 2px 10px;">6</td> <td style="padding: 2px 10px;">3</td> <td style="padding: 2px 10px;">3</td> <td style="padding: 2px 10px;">1</td> <td style="padding: 2px 10px;">0</td> <td style="padding: 2px 10px;">0</td> <td style="padding: 2px 10px;">1</td> <td style="padding: 2px 10px;">K</td> <td style="padding: 2px 10px;">L</td> <td style="padding: 2px 10px;">X</td> <td style="padding: 2px 10px;">0</td> <td style="padding: 2px 10px;">0</td> <td style="padding: 2px 10px;">0</td> </tr> </table>								Z	W	S	0	0	6	3	3	1	0	0	1	K	L	X	0	0	0
Z	W	S	0	0	6	3	3	1	0	0	1	K	L	X	0	0	0								
MODEL	SIZE	SPECIAL CHARACTER	TCR/MATERIAL	VALUE	TOLERANCE	PACKAGING	SPECIAL																		
ZWS	006 = 6 008 = 8 012 = 12 015 = 15 020 = 20 035 = 35 050 = 50 100 = 100 150 = 150 250 = 250 N68 = 6/30 N84 = 30/100 N91 = 30/133 N94 = 30/145 N97 = 30/235 N98 = 50/165 OSM = 10/30 (Note: NI is also known as SWI)	3 = SL 4 = SS 5 = SB 6 = SSB 7 = FST 8 = E SL 9 = E SS A = E SB B = E SSB C = E FST D = NI SL E = NI SS F = NI SB G = NI SSB H = NI FST I = GSCH Z = Value overflow (BV)	1 = - 10 ... - 80 ppm/K WM50 Class 1 3 = 100 ... 180 ppm/K WM110 Class 3 0 = SWI	3 digit value 1 digit multiplier MULTIPLIER 7 = *10 ⁻³ 8 = *10 ⁻² 9 = *10 ⁻¹ 0 = *10 ⁰ 1 = *10 ¹ 2 = *10 ² 3 = *10 ³	G = ± 2.0 % J = ± 5.0 % K = ± 10.0 % 0 = by BV	(See Packaging table)	The 5 digit BV number will be encoded using a 36 character code. This code contains numbers 0...9 and letters A...Z (36 characters total) and allows to encode at least 46 655 five digit BV numbers. 000 = Standard																		
Historical Part Number Example: ZWS6 SL 3 1K0 10 % (will continue to be accepted)																									
ZWS6	SL	3	1K0	10 %																					
HISTORICAL MODEL	SPECIAL CHARACTER	TCR/MATERIAL	VALUE	TOLERANCE																					

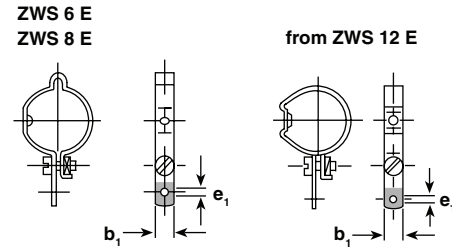
PACKAGING TABLE		
SAP	DESCRIPTION	TYPE
LX	Loose pack, without quantity	all
ZX	Special pack (with BV #), without quantity	all

DIMENSIONS

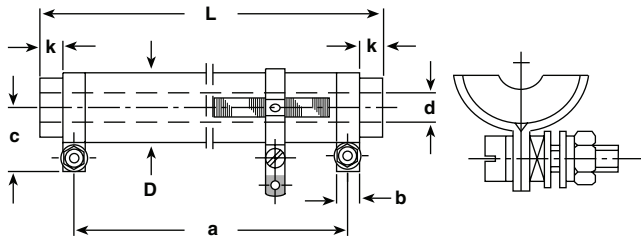
SL TERMINALS



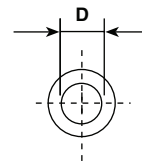
ADJUSTABLE LUGS



SS TERMINALS



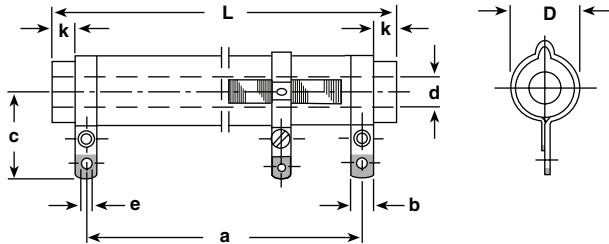
CORE SECTION



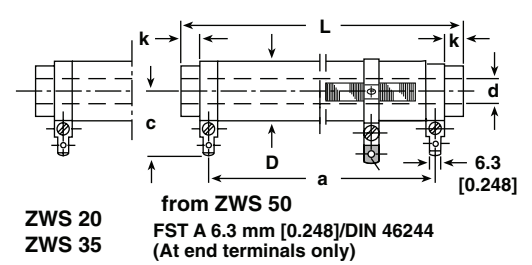
MODEL	DIMENSIONS in millimeters [inches]							
	ZWS 6 ZWS 6 E ZWS 6 Ni		ZWS 8 ZWS 8 E ZWS 8 Ni		ZWS 12 ZWS 12 E ZWS 12 Ni		ZWS 15 ZWS 15 E ZWS 15 Ni	
TERMINAL	SL		SL	SS	SL	SS	SL	SS
DIMENSION D	7.5 ± 0.5 [0.295 ± 0.020]		9.5 ± 0.5 [0.374 ± 0.020]		11.8 ± 0.8 [0.465 ± 0.031]		11.8 ± 0.8 [0.465 ± 0.031]	
L	45 ± 1.5 [1.772 ± 0.059]		50 ± 1.5 [1.969 ± 0.059]		55 ± 1.5 [2.165 ± 0.059]		62 ± 2 [2.441 ± 0.079]	
a	36 [1.417]	39 [1.535]	40 [1.575]	43 [1.693]	44 [1.732]	50 [1.969]	51 [2.008]	
b	4 [0.157]	4 [0.157]	5 [0.197]	4 [0.157]	5 [0.197]	4 [0.157]	5 [0.197]	
b ₁	4 [0.157]	4 [0.157]	4 [0.157]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	
c	15.5 [0.610]	18 [0.709]	10.5 [0.413]	19 [0.748]	11.5 [0.453]	19 [0.748]	11.5 [0.453]	
d	2.6 [0.102]	3.5 [0.138]	3.5 [0.138]	5.5 [0.217]	5.5 [0.217]	5.5 [0.217]	5.5 [0.217]	
e	1.5 [0.059]	2 [0.079]	M3 × 12	2 [0.079]	M3 × 12	2 [0.079]	M3 × 12	
e ₁	2.8 [0.110]	2.8 [0.110]	2.8 [0.110]	2.8 [0.110]	2.8 [0.110]	2.8 [0.110]	2.8 [0.110]	
k	2.5 [0.098]	3.5 [0.138]	2.5 [0.098]	4 [0.157]	3 [0.118]	4 [0.157]	3 [0.118]	
WEIGHT (g)	5		6.5		11.5		12.5	

DIMENSIONS (continued)

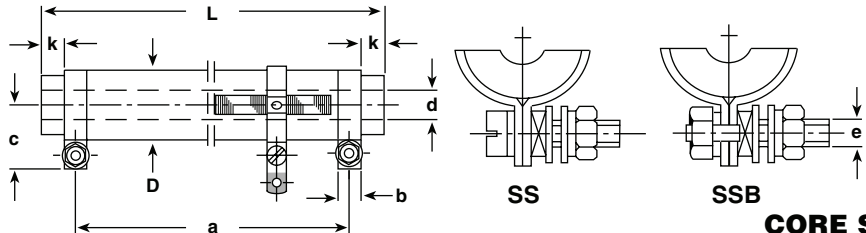
SL TERMINALS



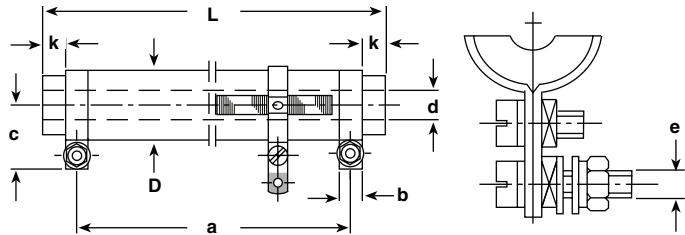
FST TERMINALS



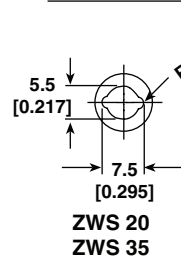
SS AND SSB TERMINALS



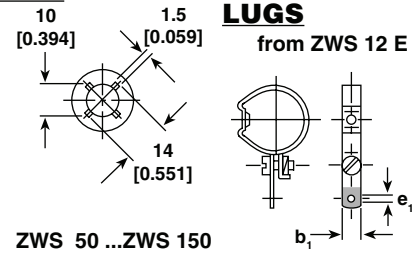
SB TERMINALS



CORE SECTION



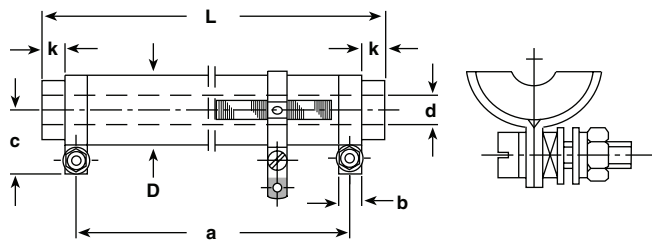
ADJUSTABLE LUGS



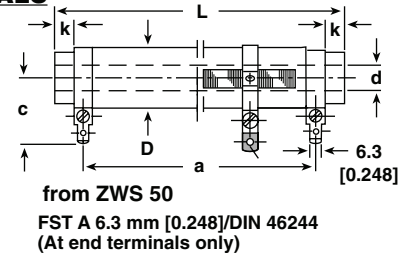
MODEL	DIMENSIONS in millimeters [inches]															
	ZWS 20 ZWS 20 E ZWS 20 Ni				ZWS 35 ZWS 35 E ZWS 35 Ni				ZWS 50 ZWS 50 E ZWS 50 Ni				ZWS 100 ZWS 100 E ZWS 100 Ni			
TERMINAL	SL	SS	SB	FST	SL	SS	SB	FST	SS	SSB	SB	FST	SS	SSB	SB	FST
DIMENSION D	14.8 ± 0.8 [0.583 ± 0.031]				14.8 ± 0.8 [0.583 ± 0.031]				22.3 ± 1.3 [0.878 ± 0.051]				22.3 ± 1.3 [0.878 ± 0.051]			
L	62 ± 2 [2.441 ± 0.079]				100 ± 2 [3.937 ± 0.079]				100 ± 2 [3.937 ± 0.079]				165 ± 2 [6.496 ± 0.079]			
a ± 2 [a ± 0.079]	50 [1.969]	51 [2.008]	51 [2.008]	48 [1.890]	86 [3.386]	87 [3.425]	87 [3.425]	84 [3.307]	71 [2.795]				136 [5.354]			
b	4 [0.157]	5 [0.197]	5 [0.197]	6.3 [0.248]	4 [0.157]	5 [0.197]	5 [0.197]	6.3 [0.248]	8 [0.315]	8 [0.315]	8 [0.315]	6.3 [0.248]	8 [0.315]	8 [0.315]	8 [0.315]	6.3 [0.248]
b₁	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]
c	20.5 [0.807]	13 [0.512]	23 [0.906]	23.5 [0.925]	20.5 [0.807]	13 [0.512]	23 [0.906]	23.5 [0.925]	18.5 [0.728]	18.5 [0.728]	29.5 [1.161]	27 [1.063]	18.5 [0.728]	18.5 [0.728]	29.5 [1.161]	27 [1.063]
d	5.5 [0.217]	5.5 [0.217]	5.5 [0.217]	5.5 [0.217]	5.5 [0.217]	5.5 [0.217]	5.5 [0.217]	5.5 [0.217]	10 [0.394]	10 [0.394]	10 [0.394]	10 [0.394]	10 [0.394]	10 [0.394]	10 [0.394]	10 [0.394]
e	2 [0.079]	M3 × 12	M3 × 12	-	2 [0.079]	M3 × 12	M3 × 12	-	M4 × 16	M4 × 18	M4 × 16	-	M4 × 16	M4 × 18	M4 × 16	-
e₁	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]
k	4 [0.157]	3 [0.118]	3 [0.118]	3 [0.118]	5 [0.197]	4 [0.157]	4 [0.157]	4 [0.157]	10.5 [0.413]	10.5 [0.413]	10.5 [0.413]	10.5 [0.413]	10.5 [0.413]	10.5 [0.413]	10.5 [0.413]	10.5 [0.413]
WEIGHT (g)	25				33				80				113			

DIMENSIONS (continued)

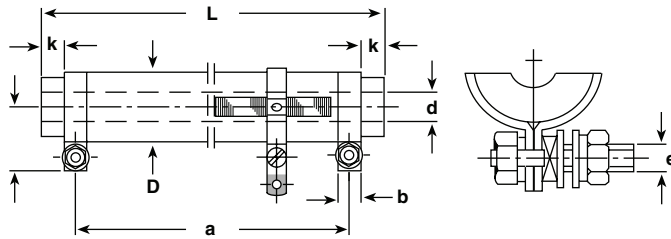
SS TERMINALS



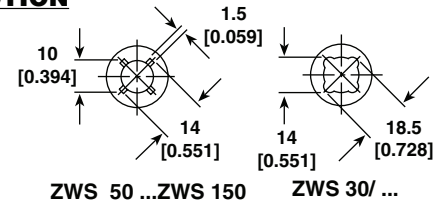
FST TERMINALS



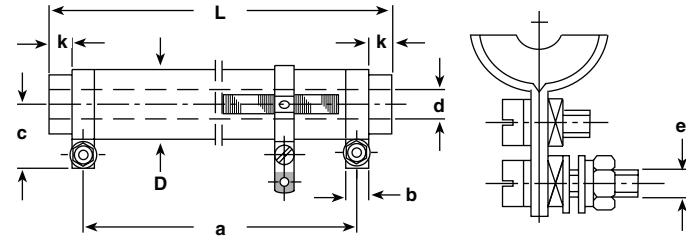
SSB TERMINALS



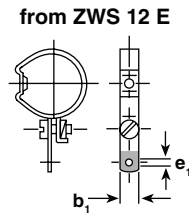
CORE SECTION



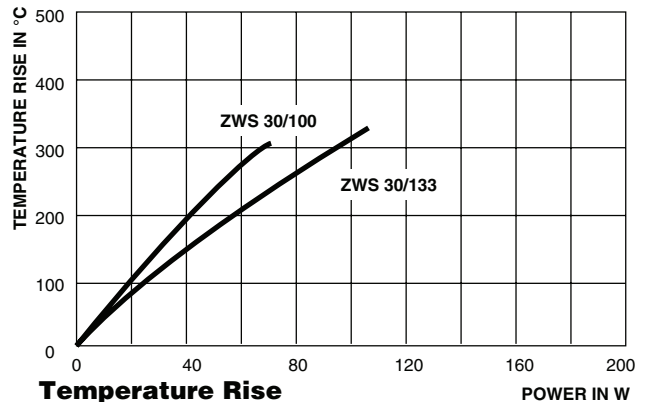
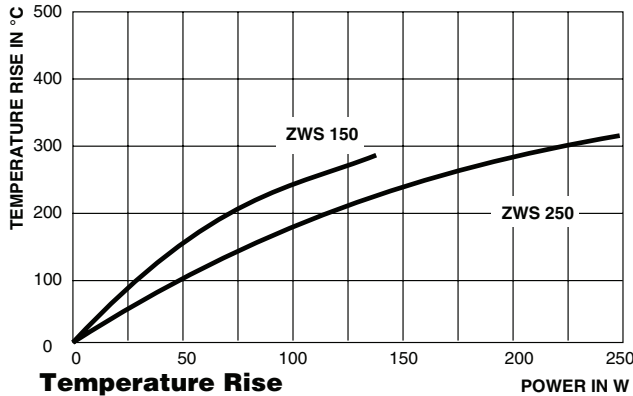
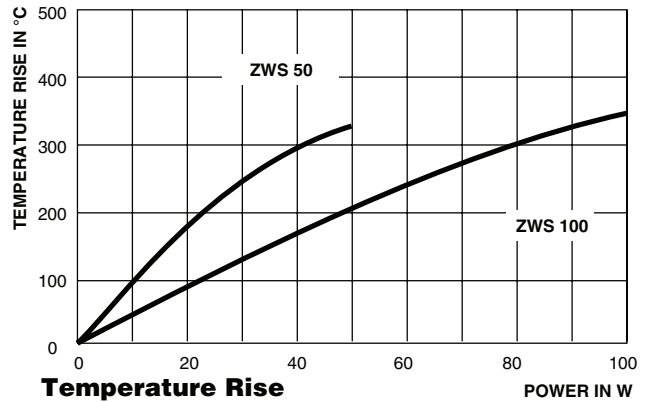
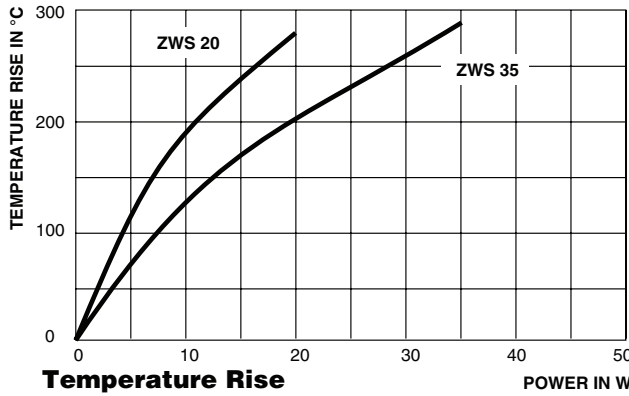
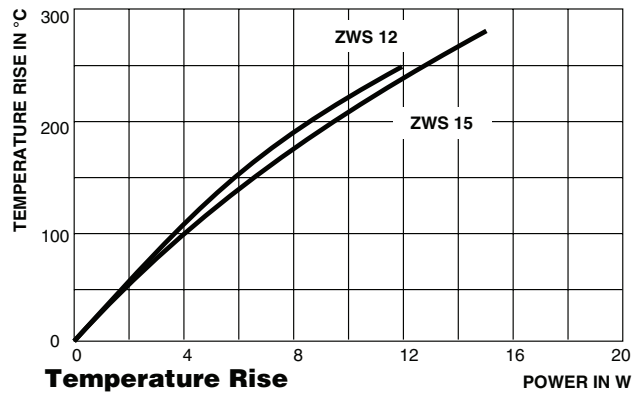
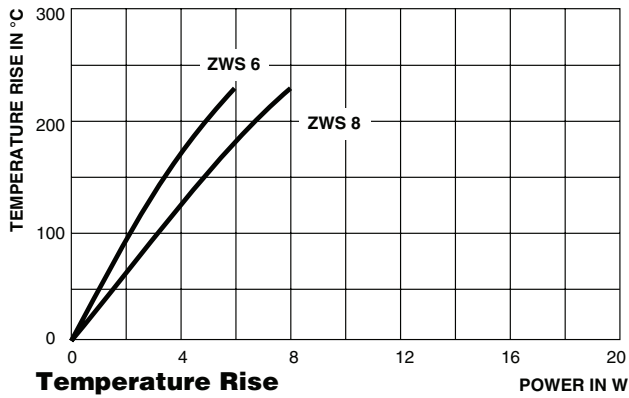
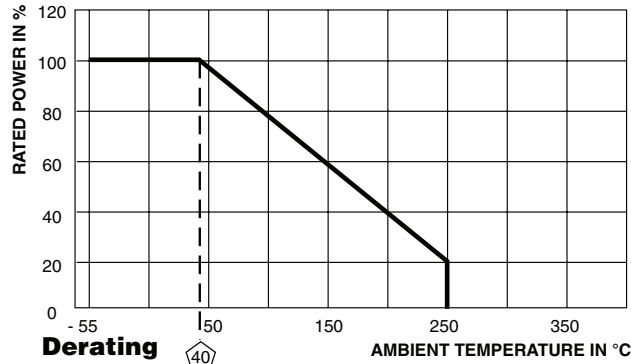
SB TERMINALS



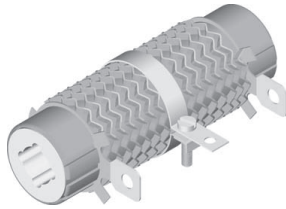
ADJUSTABLE LUGS



MODEL	DIMENSIONS in millimeters [inches]															
	ZWS 150 ZWS 150 E ZWS 150 Ni				ZWS 250 ZWS 250 E ZWS 250 Ni				ZWS 30/100 ZWS 30/100 E ZWS 30/100 Ni				ZWS 30/133 ZWS 30/133 E ZWS 30/133 Ni			
TERMINAL	SS	SSB	SB	FST	SS	SSB	SB	FST	SS	SSB	SB	FST	SS	SSB	SB	FST
DIMENSION D	22.3 ± 1.3 [0.878 ± 0.051]				32.3 ± 1.5 [1.28 ± 0.059]				32.3 ± 1.5 [1.28 ± 0.059]				32.3 ± 1.5 [1.28 ± 0.059]			
L	265 ± 4 [10.433 ± 0.079]				330 ± 5 [12.992 ± 0.197]				100 ± 2.5 [3.937 ± 0.098]				133 ± 3 [5.236 ± 0.118]			
a	236 [9.291]				280 [11.024]				85 [3.346]				118 [4.646]			
b	8 [0.315]	8 [0.315]	8 [0.315]	6.3 [0.248]	8 [0.315]	8 [0.315]	8 [0.315]	6.3 [0.248]	8 [0.315]	8 [0.315]	8 [0.315]	6.3 [0.248]	8 [0.315]	8 [0.315]	8 [0.315]	6.3 [0.248]
b ₁	5 [0.197]	5 [0.197]	5 [0.197]	5 [0.197]	8 [0.315]	8 [0.315]	8 [0.315]	8 [0.315]	8 [0.315]	8 [0.315]	8 [0.315]	8 [0.315]	8 [0.315]	8 [0.315]	8 [0.315]	8 [0.315]
c	18.5 [0.728]	18.6 [0.732]	29.5 [1.161]	27 [1.063]	23.5 [0.925]	23.5 [0.925]	35 [1.378]	31.5 [1.24]	23.5 [0.925]	23.5 [0.925]	35 [1.378]	31.5 [1.24]	23.5 [0.925]	23.5 [0.925]	35 [1.378]	31.5 [1.24]
d	10 [0.394]	10 [0.394]	10 [0.394]	10 [0.394]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]	14 [0.551]	14 [0.551]	14 [0.551]	14 [0.551]	14 [0.551]	14 [0.551]	14 [0.551]	14 [0.551]
e	M4 × 16	M4 × 18	M4 × 16	-	M4 × 16	M4 × 18	M4 × 16	-	M4 × 16	M4 × 18	M4 × 16	-	M4 × 16	M4 × 18	M4 × 16	-
e ₁	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	3.2 [0.126]	4.2 [0.165]	4.2 [1.654]	4.2 [1.654]	4.2 [0.165]	4.2 [0.165]	4.2 [0.165]	4.2 [0.165]	4.2 [0.165]	4.2 [0.165]	4.2 [0.165]	4.2 [0.165]	4.2 [0.165]
k	10.5 [0.413]	10.5 [0.413]	10.5 [0.413]	10.5 [0.413]	21 [0.827]	21 [0.827]	21 [0.827]	21 [0.827]	3.5 [0.138]	3.5 [0.138]	3.5 [0.138]	3.5 [0.138]	3.5 [0.138]	3.5 [0.138]	3.5 [0.138]	3.5 [0.138]
WEIGHT (g)	194				375				167				212			



Cemented Resistors with Corrugated Ribbon



FEATURES

- All welded construction
- Power rating up to 500 W
- Corrugated ribbon construction aids rapid cooling
- Available in adjustable design = "E"



RoHS
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS

GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{40^\circ\text{C}}$ W	RESISTANCE RANGE $\pm 10\%/\pm 5\%$			WEIGHT (g)
			TCR + 650 ... + 750 ppm/K WM10	TCR - 10 ... - 80 ppm/K WM50	TCR + 100 ... + 180 ppm/K WM110	
ZBS202S0 ZBS202S1	ZBS 20/100 ZBS 20/100 E	50	R13 - R51	R56 - 2R2	1R3 - 6R2	100
ZBS204L0 ZBS204L1	ZBS 20/165 ZBS 20/165 E	100	R27 - 1R0	1R1 - 4R7	2R4 - 12R	150
ZBS207D0 ZBS207D1	ZBS 20/265 ZBS 20/265 E	150	R47 - 1R8	2R0 - 7R5	4R3 - 22R	250
ZBS302S0 ZBS302S1	ZBS 30/100 ZBS 30/100 E	75	R10 - R43	R47 - 3R3	1R0 - 8R2	200
ZBS303P0 ZBS303P1	ZBS 30/133 ZBS 30/133 E	110	R15 - R62	R68 - 5R1	1R5 - 12R	250
ZBS304L0 ZBS304L1	ZBS 30/165 ZBS 30/165 E	150	R20 - R91	1R0 - 6R8	2R0 - 16R	300
ZBS305Z0 ZBS305Z1	ZBS 30/215 ZBS 30/215 E	200	R27 - 1R1	1R2 - 9R1	2R7 - 24R	400
ZBS307D0 ZBS307D1	ZBS 30/265 ZBS 30/265 E	250	R30 - 1R3	1R5 - 11R	3R9 - 27R	500
ZBS30960 ZBS30961	ZBS 30/330 ZBS 30/330 E	300	R39 - 1R8	2R0 - 15R	5R1 - 36R	600
ZBS45AA0 ZBS45AA1	ZBS 45/370 ZBS 45/370 E	375	R75 - 3R0	3R3 - 24R	8R2 - 56R	1000
ZBS60AA0 ZBS60AA1	ZBS 60/370 ZBS 60/370 E	500	R91 - 3R9	4R3 - 33R	10R - 75R	1200

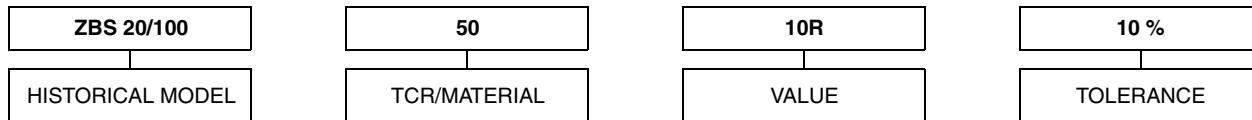
GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: ZBS202S01100K L X 0 0 0 (preferred part number format)

Z B S 2 0 2 S 0 1 1 0 0 K L X 0 0 0

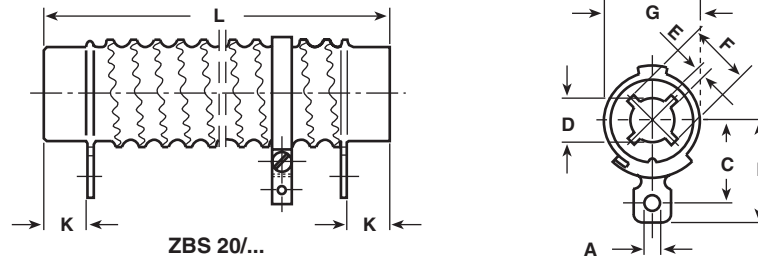
MODEL	SIZE	SPECIAL CHARACTER	TCR/MATERIAL	VALUE	TOLERANCE	PACKAGING	SPECIAL
ZBS	202S =20/100 204L =20/165 207D =20/265 302S =30/100 303P =30/133 304L =30/165 305Z =30/215 307D =30/265 308D =30/303 3096 =30/330 45AA =45/370 60AA =60/370	0 = Neutral 1 = E Z = Value overflow (BV)	1 = - 10 ... - 80 ppm/K WM50 Class 1 3 = 100 ... 180 ppm/K WM110 Class 3 4 = 650 ... 750 ppm/K WM10 Class 1 0 = SWI	2 digit value 1 digit multiplier MULTIPLIER 8 = $\times 10^{-2}$ 9 = $\times 10^{-1}$ 0 = $\times 10^0$	J = $\pm 5.0\%$ K = $\pm 10.0\%$	(See Packaging table)	The 5 digit BV number will be encoded using a 36 character code. This code contains numbers 0...9 and letters A...Z (36 characters total) and allows to encode at least 46 655 five digit BV numbers. 000 = Standard

Historical Part Number Example: ZBS 20/100 50 10R 10 % (will continue to be accepted)

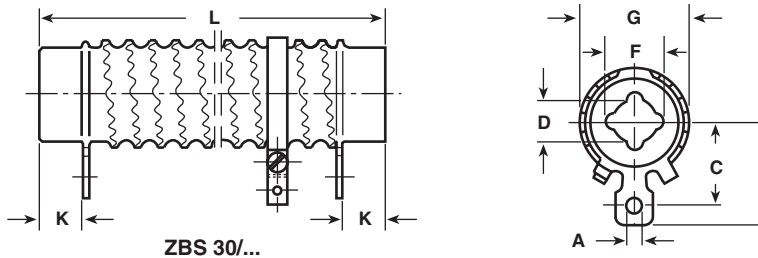


PACKAGING TABLE		
SAP	DESCRIPTION	TYPE
LX	Loose pack, without quantity	all
ZX	Special pack (with BV #), without quantity Note LX = B29 on Dale legacy ZX = S51 on Dale legacy	all

DIMENSIONS

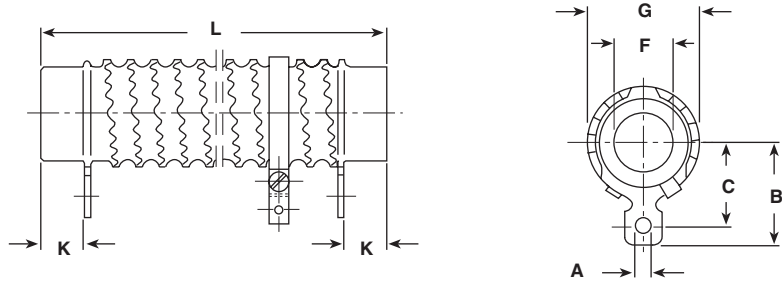


MODEL	DIMENSIONS in millimeters [inches]								
	L	K	A	B	C	D	E	F	G
ZBS 20/100 ZBS 20/100 E	100 ± 2.5 [3.937 ± 0.098]	15 [0.591]	4.2 [0.165]	26.5 [1.043]	22 [0.866]	10 [0.394]	1.5 [0.059]	14 [0.551]	24 [0.945]
ZBS 20/165 ZBS 20/165 E	165 ± 4 [6.496 ± 0.157]	15 [0.591]	4.2 [0.165]	26.5 [1.043]	22 [0.866]	10 [0.394]	1.5 [0.059]	14 [0.551]	24 [0.945]
ZBS 20/265 ZBS 20/265 E	265 ± 6.6 [10.433 ± 0.260]	15 [0.591]	4.2 [0.165]	26.5 [1.043]	22 [0.866]	10 [0.394]	1.5 [0.059]	14 [0.551]	24 [0.945]



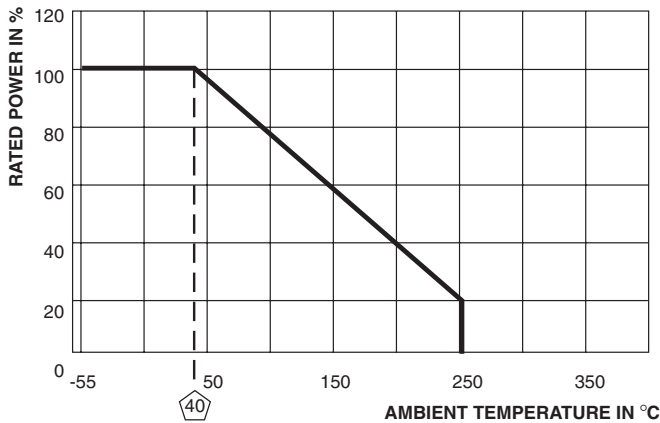
MODEL	DIMENSIONS in millimeters [inches]							
	L	K	A	B	C	D	F	G
ZBS 30/100 ZBS 30/100 E	100 ± 2.5 [3.937 ± 0.098]	15 [0.591]	5.2 [0.205]	34 [1.339]	28 [1.102]	14 [0.551]	18.5 [0.728]	37 ± 1 [1.457 ± 0.039]
ZBS 30/133 ZBS 30/133 E	133 ± 3.3 [5.236 ± 0.130]	15 [0.591]	5.2 [0.205]	34 [1.339]	28 [1.102]	14 [0.551]	18.5 [0.728]	37 ± 1 [1.457 ± 0.039]
ZBS 30/165 ZBS 30/165 E	165 ± 4 [6.496 ± 0.157]	15 [0.591]	5.2 [0.205]	34 [1.339]	28 [1.102]	14 [0.551]	18.5 [0.728]	37 ± 1 [1.457 ± 0.039]
ZBS 30/215 ZBS 30/215 E	215 ± 5.4 [8.465 ± 0.213]	15 [0.591]	5.2 [0.205]	34 [1.339]	28 [1.102]	14 [0.551]	18.5 [0.728]	37 ± 1 [1.457 ± 0.039]
ZBS 30/265 ZBS 30/265 E	265 ± 6.6 [10.433 ± 0.260]	15 [0.591]	5.2 [0.205]	34 [1.339]	28 [1.102]	14 [0.551]	18.5 [0.728]	37 ± 1 [1.457 ± 0.039]
ZBS 30/330 ZBS 30/330 E	330 ± 8 [12.992 ± 0.315]	15 [0.591]	5.2 [0.205]	34 [1.339]	28 [1.102]	14 [0.551]	18.5 [0.728]	37 ± 1 [1.457 ± 0.039]

DIMENSIONS (continued)

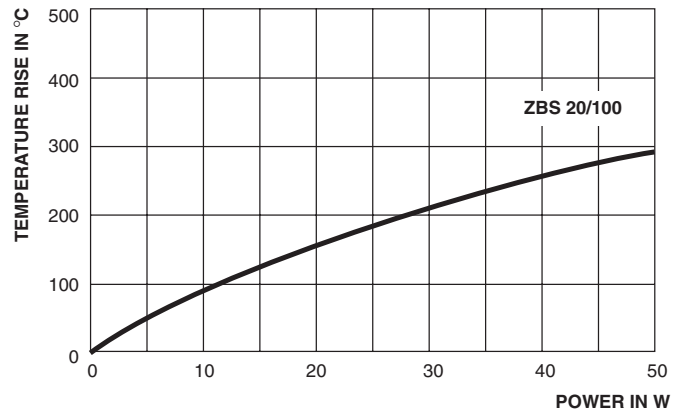


ZBS 45/370, ZBS 60/370

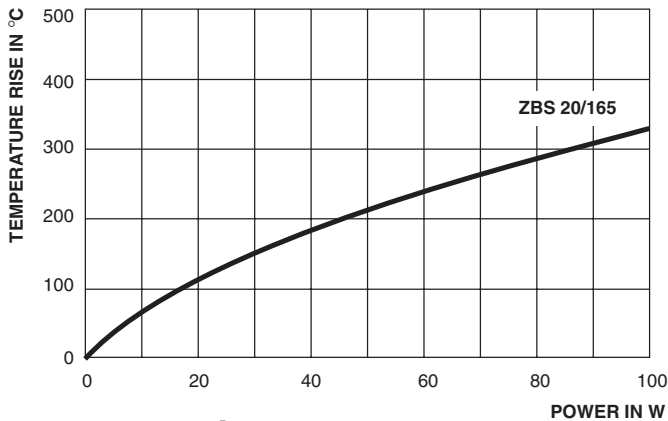
MODEL	DIMENSIONS in millimeters [inches]						
	L	K	A	B	C	F	G
ZBS 45/370 ZBS 45/370 E	370 ± 9 [14.567 ± 0.354]	15 [0.591]	5.2 [0.205]	42.5 [1.673]	37 [1.457]	30 [1.181]	52 ± 1 [2.047 ± 0.039]
ZBS 60/370 ZBS 60/370 E	370 ± 9 [14.567 ± 0.354]	15 [0.591]	5.2 [0.205]	51.5 [2.028]	45.5 [1.791]	45 [1.772]	67 ± 1 [2.638 ± 0.039]



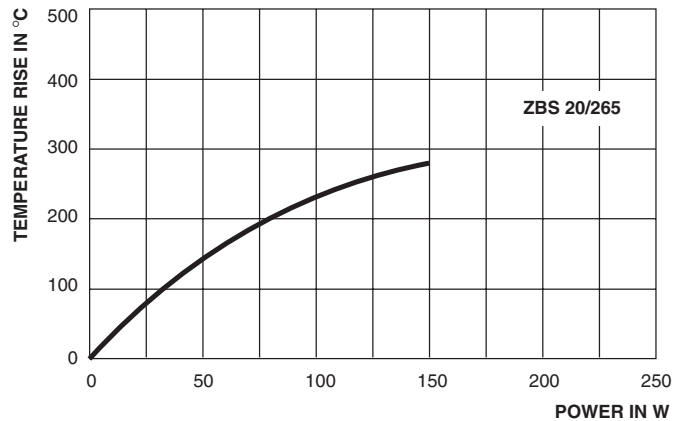
Derating



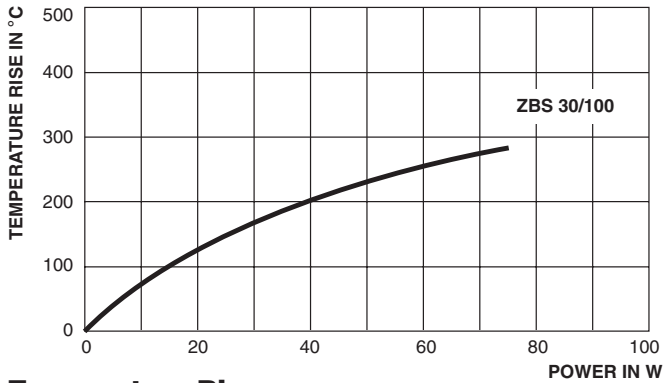
Temperature Rise



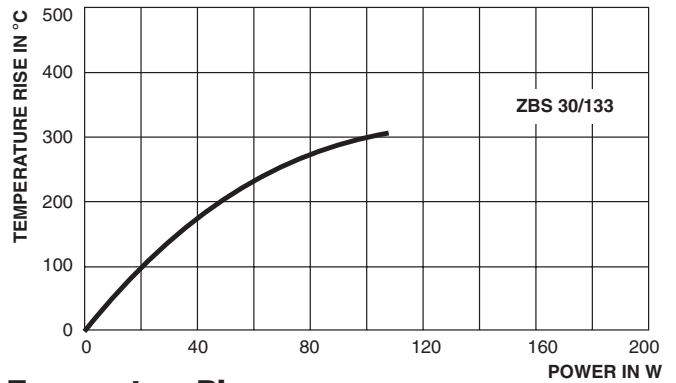
Temperature Rise



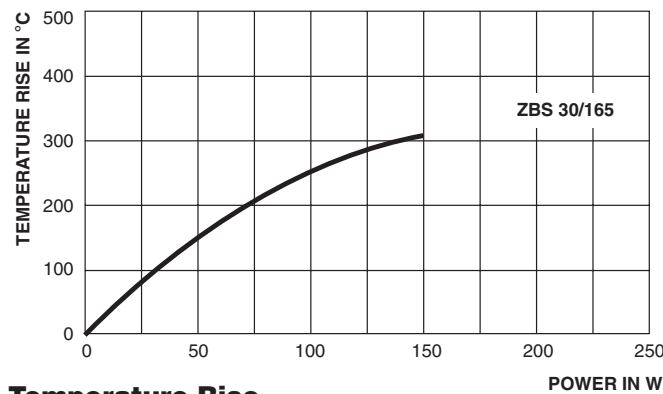
Temperature Rise



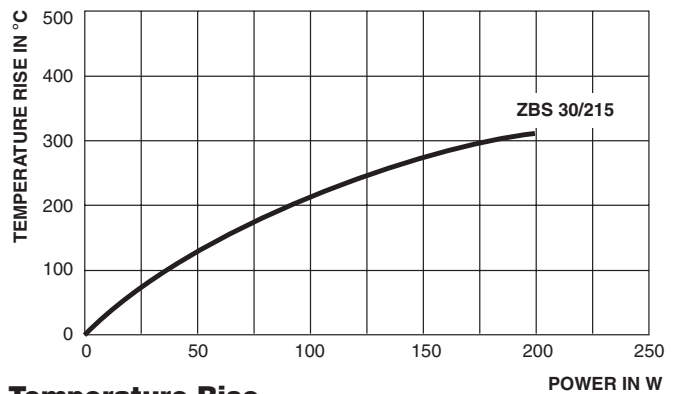
Temperature Rise



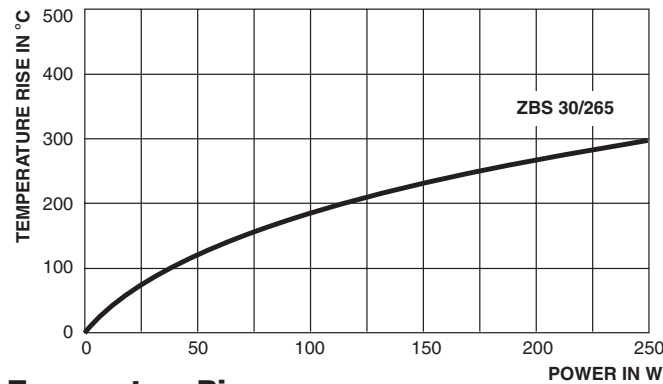
Temperature Rise



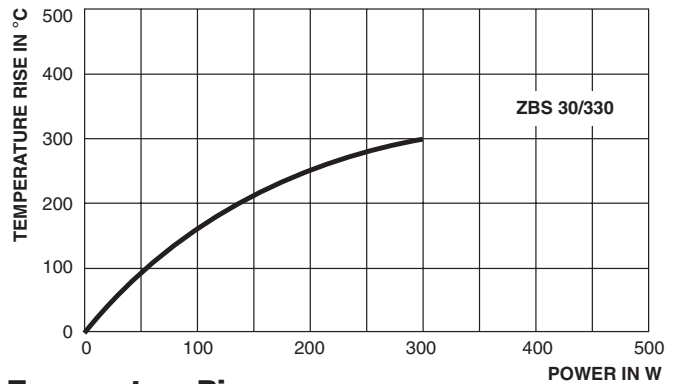
Temperature Rise



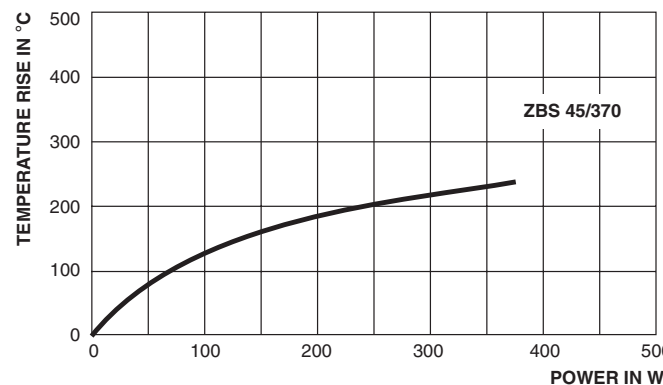
Temperature Rise



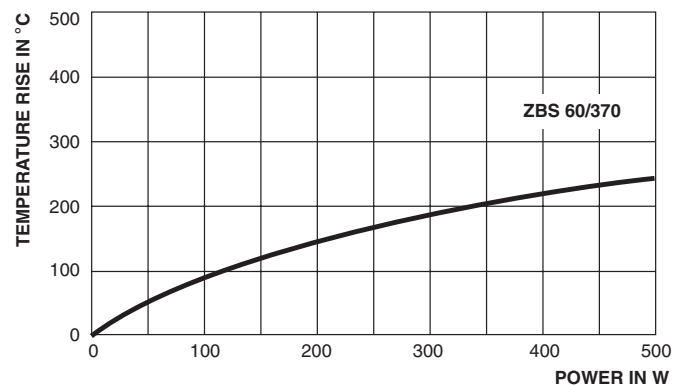
Temperature Rise



Temperature Rise

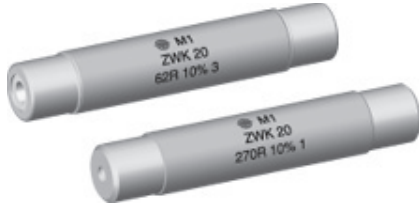


Temperature Rise



Temperature Rise

Cemented Resistors with Ferrules



FEATURES

- Machined caps with inner thread available
- Easy to change when mounted with spring clips (see Mounting Accessories)
- Corrugated ribbon construction aids rapid cooling
- Non inductive design = “Ni”
- Caps made from drawn brass, nickel plated (GZK style)
- Machined caps with inner thread available (GDK style)



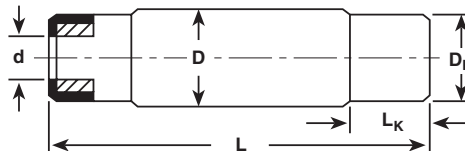
RoHS
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS							
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{40^\circ\text{C}}$ W	LIMITING VOLTAGE V	RESISTANCE RANGE (Ω)		TOLERANCE \pm %	E-SERIES
				TCR - 10 ... + 80 ppm/K	TCR 100 ... 180 ppm/K		
ZWK010	ZWK 10	10	$\sqrt{P \times R}$	R47 - 8K2	1R5 - 22K	10	E 12
	ZWK 10 Ni			R51 - 8K2	1R5 - 22K	5	E 24
ZWK015	ZWK 15	15	$\sqrt{P \times R}$	5R1 - 8K2	-	2	E 24
	ZWK 15 Ni			R24 - 1K5	R56 - 3K9	10	E 12
ZWK020	ZWK 20	20	$\sqrt{P \times R}$	1R0 - 1K5	1R0 - 3K9	5	E 24
	ZWK 20 Ni			R47 - 12K	1R1 - 33K	10	E 12
ZWK040	ZWK 40	40	$\sqrt{P \times R}$	R51 - 12K	1R2 - 33K	5	E 24
	ZWK 40 Ni			5R1 - 12K	-	2	E 24
ZWK060	ZWK 60	60	$\sqrt{P \times R}$	R36 - 2K2	R82 - 5K6	10	E 12
	ZWK 60 Ni			R75 - 2K2	1R0 - 5K6	5	E 24
ZWK090	ZWK 90	90	$\sqrt{P \times R}$	1R5 - 20K	1R6 - 51K	10	E 12
	ZWK 90 Ni			R75 - 20K	1R6 - 51K	5	E 24
ZWK150	ZWK 150	150	$\sqrt{P \times R}$	2R0 - 20K	-	2	E 24
	ZWK 150 Ni			R56 - 3K3	1R3 - 9K1	10	E 12
ZWK010	ZWK 10	10	$\sqrt{P \times R}$	R56 - 3K3	1R3 - 9K1	5	E 24
	ZWK 10 Ni			1R5 - 36K	3R3 - 100K	10	E 12
ZWK015	ZWK 15	15	$\sqrt{P \times R}$	1R5 - 36K	3R3 - 100K	5	E 24
	ZWK 15 Ni			2R2 - 20K	-	2	E 24
ZWK020	ZWK 20	20	$\sqrt{P \times R}$	1R1 - 6K8	2R7 - 18K	10	E 12
	ZWK 20 Ni			1R1 - 6K8	2R7 - 18K	5	E 24
ZWK040	ZWK 40	40	$\sqrt{P \times R}$	1R8 - 47K	4R3 - 130K	10	E 12
	ZWK 40 Ni			1R8 - 47K	4R3 - 130K	5	E 24
ZWK060	ZWK 60	60	$\sqrt{P \times R}$	2R - 47K	-	2	E 24
	ZWK 60 Ni			1R5 - 8K2	3R3 - 24K	10	E 12
ZWK090	ZWK 90	90	$\sqrt{P \times R}$	1R5 - 8K2	3R3 - 24K	5	E 24
	ZWK 90 Ni			2R7 - 75K	6R2 - 200K	10	E 12
ZWK150	ZWK 150	150	$\sqrt{P \times R}$	2R7 - 75K	6R2 - 200K	5	E 24
	ZWK 150 Ni			2R7 - 75K	-	2	E 24
ZWK010	ZWK 10	10	$\sqrt{P \times R}$	2R2 - 13K	5R1 - 36K	10	E 12
	ZWK 10 Ni			2R2 - 13K	5R1 - 36K	5	E 24
ZWK015	ZWK 15	15	$\sqrt{P \times R}$	4R7 - 130K	11R - 360K	10	E 12
	ZWK 15 Ni			4R7 - 130K	11R - 360K	5	E 24
ZWK020	ZWK 20	20	$\sqrt{P \times R}$	4R7 - 130K	-	2	E 24
	ZWK 20 Ni			3R9 - 24K	9R1 - 62K	10	E 12
ZWK040	ZWK 40	40	$\sqrt{P \times R}$	3R9 - 24K	9R1 - 62K	5	E 24
	ZWK 40 Ni						

GLOBAL PART NUMBER INFORMATION							
New Global Part Numbering: ZWK010J11000KLX000 (preferred part number format)							
<div style="display: flex; justify-content: space-around; font-weight: bold; font-size: 1.2em;"> ZWK010J11000KLX000 </div>							
MODEL	SIZE	SPECIAL CHARACTER	TCR/MATERIAL	VALUE	TOLERANCE	PACKAGING	SPECIAL
ZWK	010 = 10 015 = 15 020 = 20 040 = 40 060 = 60 090 = 90 150 = 150	I = GZK J = GDK (Also known as GDR and M4) O = GZK NI P = GDK NI Z = Value overflow (BV) Note: NI is also known as SWI	1 = - 10 ... - 80 ppm/K WM50 Class 1 3 = 100 ... 180 ppm/K WM110 Class 3	3 digit value 1 digit multiplier MULTIPLIER 7 = *10 ⁻³ 8 = *10 ⁻² 9 = *10 ⁻¹ 0 = *10 ⁰ 1 = *10 ¹ 2 = *10 ² 3 = *10 ³	G = ± 2.0 % J = ± 5.0 % K = ± 10.0 %	(see Packaging table)	The 5 digit BV number will be encoded using a 36 character code. This code contains numbers 0...9 and letters A...Z (36 characters total) and allows to encode at least 46 655 five digit BV numbers. 000 = Standard
Historical Part Number Example: ZWK 10 1 GDK 100R 10 % (will continue to be accepted)							
ZWK 10	1	GDK	100R	10 %			
HISTORICAL MODEL	TCR/MATERIAL	SPECIAL CHARACTER	VALUE	TOLERANCE			

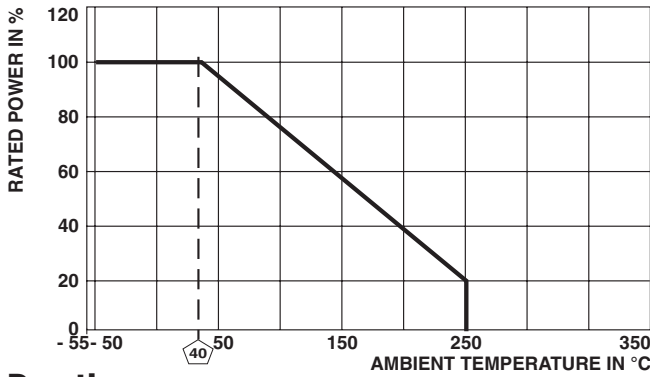
PACKAGING TABLE		
SAP	DESCRIPTION	TYPE
LX	Loose pack, without quantity	all
ZX	Special pack (with BV #), without quantity Note LX = B29 on Dale legacy ZX = S51 on Dale legacy	all

DIMENSIONS

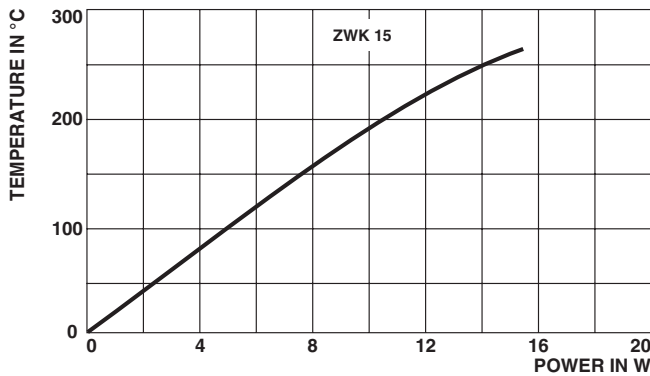


MODEL	DIMENSIONS in millimeters [inches]		
	ZWK 10 ZWK 10 Ni	ZWK 15 ZWK 15 Ni	ZWK 20 ZWK 20 Ni
D	12 ± 0.8 [0.484 ± 0.031]	15 ± 0.8 [0.602 ± 0.031]	15 ± 0.8 [0.602 ± 0.031]
L	51 ± 1.3 [2.008 ± 0.051]	61 ± 1.5 [2.402 ± 0.059]	81 ± 2 [3.189 ± 0.079]
D _K	11 [0.433]	14 [0.551]	14 [0.551]
L _K	10 [0.394]	13 [0.512]	13 [0.512]
d	4.5 [0.177]	5.5 [0.217]	5.5 [0.217]

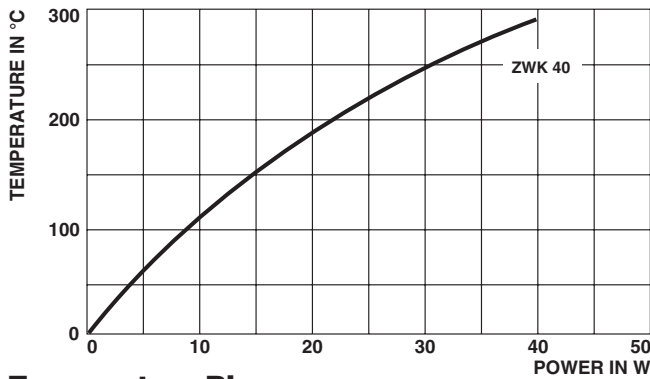
MODEL	DIMENSIONS in millimeters [inches]			
	ZWK 40 ZWK 40 Ni	ZWK 60 ZWK 60 Ni	ZWK 90 ZWK 90 Ni	ZWK 150 ZWK 150 Ni
D	22 ± 1 [0.866 ± 0.039]	22 ± 1 [0.866 ± 0.039]	22 ± 1 [0.866 ± 0.039]	22 ± 1 [0.866 ± 0.039]
L	101 ± 2.5 [3.976 ± 0.098]	121 ± 3 [4.764 ± 0.118]	166.5 ± 4.2 [6.555 ± 0.165]	266.5 ± 6.7 [10.492 ± 0.264]
D _K	21 [0.827]	21 [0.827]	21 [0.827]	21 [0.827]
L _K	16 [0.63]	16 [0.63]	16 [0.63]	16 [0.63]
d	10 [0.394]	10 [0.394]	10 [0.394]	10 [0.394]



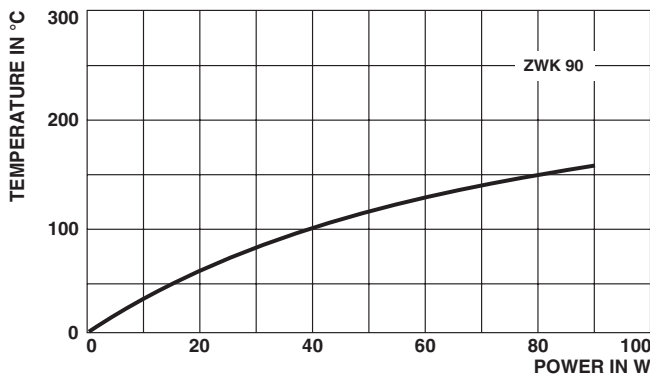
Derating



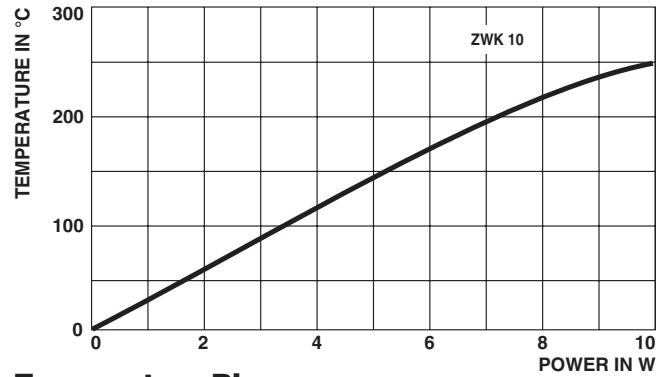
Temperature Rise



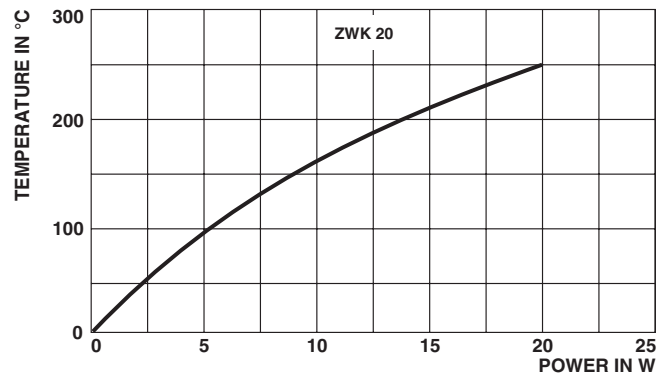
Temperature Rise



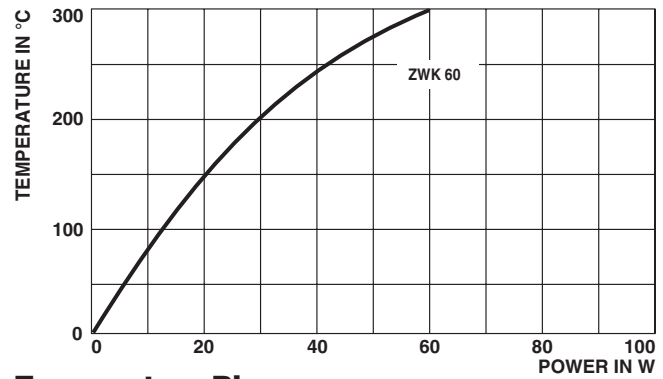
Temperature Rise



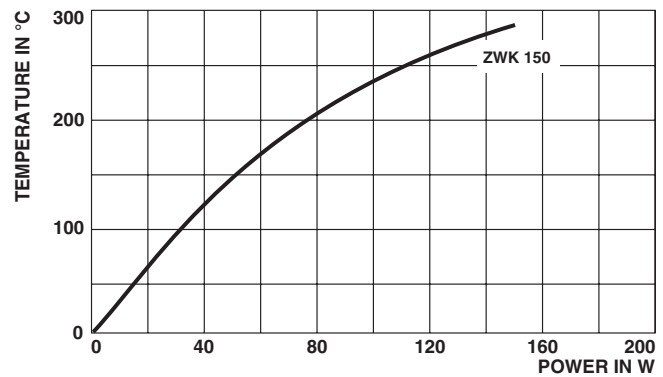
Temperature Rise



Temperature Rise



Temperature Rise



Temperature Rise



PULSE HANDLING FOR SHORT PULSES (less than 100 ms)

For single pulses up to 100 ms duration time the following energy resistance chart can be used to calculate the energy a resistor can handle. Look to the resistance value or the next higher value of the model you need and follow this row to the energy per ohm column to the left. The energy per ohm value multiplied by the resistance value is the energy the resistor can handle for 100 ms. This energy divided by 0.1 ms is the power the resistor can handle for 100 ms. For the power the resistor can handle for 10 ms needed divide the energy by 0.01. The maximum pulse power is limited at 625 x rated power.

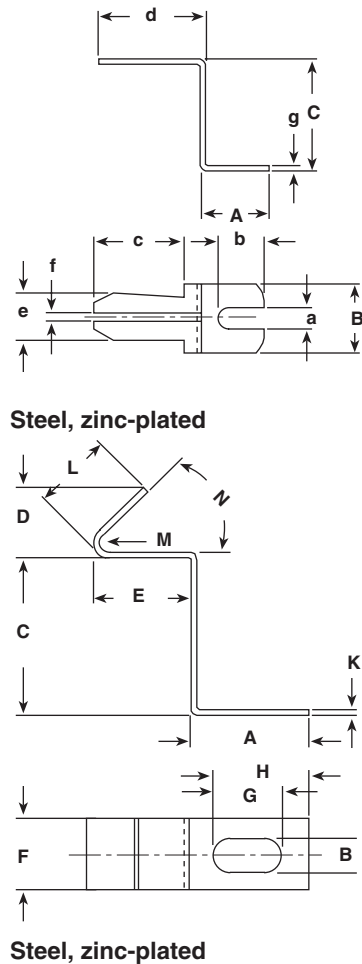
Do not use this chart for ZWK ... Ni styles. For more information and assistance please contact factory.

ENERGY RESISTANCE CHART													
ZWK 10		ZWK 15		ZWK 20		ZWK 40		ZWK 60		ZWK 90		ZWK 150	
ENERGY/Ω [Ws/Ω]	R [Ω]	ENERGY/Ω [Ws/Ω]	R [Ω]	ENERGY/Ω [Ws/Ω]	R [Ω]	ENERGY/Ω [Ws/Ω]	R [Ω]	ENERGY/Ω [Ws/Ω]	R [Ω]	ENERGY/Ω [Ws/Ω]	R [Ω]	ENERGY/Ω [Ws/Ω]	R [Ω]
4.70E - 04	22K	4.69E - 04	33K	4.69E - 04	51K	4.68E - 04	100K	4.68E - 04	130K	4.68E - 04	200K	4.68E - 04	360K
4.71E - 04	16K	4.70E - 04	24K	4.69E - 04	39K	4.68E - 04	75K	4.68E - 04	100K	4.68E - 04	150K	4.68E - 04	270K
8.03E - 04	12K	8.01E - 04	18K	8.00E - 04	27K	7.99E - 04	56K	7.99E - 04	68K	7.98E - 04	110K	7.98E - 04	180K
1.29E - 03	8.2K	1.28E - 03	12K	1.28E - 03	20K	1.28E - 03	39K	1.28E - 03	51K	1.28E - 03	75K	1.28E - 03	130K
1.35E - 03	5.6K	1.34E - 03	8.2K	1.34E - 03	13K	1.34E - 03	27K	1.34E - 03	33K	1.34E - 03	51K	1.34E - 03	91K
2.50E - 03	3.6K	2.49E - 03	5.6K	2.48E - 03	9.1K	2.48E - 03	18K	2.48E - 03	22K	2.48E - 03	33K	2.47E - 03	62K
4.26E - 03	2.7K	4.25E - 03	3.9K	4.24E - 03	6.2K	4.23E - 03	12K	4.23E - 03	15K	4.23E - 03	24K	4.23E - 03	43K
6.85E - 03	2.0K	6.83E - 03	3.0K	6.81E - 03	4.7K	6.80E - 03	9.1K	6.79E - 03	11K	6.79E - 03	18K	6.78E - 03	30K
1.04E - 02	1.5K	1.04E - 02	2.2K	1.03E - 02	3.3K	1.03E - 02	6.8K	1.03E - 02	8.2K	1.03E - 02	13K	1.03E - 02	22K
1.53E - 02	1.1K	1.52E - 02	1.6K	1.51E - 02	2.7K	1.51E - 02	5.1K	1.51E - 02	6.8K	1.51E - 02	10K	1.51E - 02	18K
2.17E - 02	910	2.16E - 02	1.3K	2.16E - 02	2.0K	1.94E - 02	4.7K	1.94E - 02	6.2K	2.14E - 02	9.1K	2.14E - 02	15K
2.98E - 02	680	2.96E - 02	1.0K	2.95E - 02	1.6K	2.15E - 02	3.9K	2.15E - 02	5.1K	2.94E - 02	6.2K	2.93E - 02	11K
4.05E - 02	470	4.02E - 02	680	4.00E - 02	1.1K	2.94E - 02	3.3K	2.94E - 02	4.3K	3.98E - 02	4.3K	3.98E - 02	7.5K
6.89E - 02	330	6.86E - 02	470	6.82E - 02	750	3.99E - 02	2.2K	3.98E - 02	2.7K	6.77E - 02	3.0K	6.77E - 02	5.1K
1.10E - 01	240	1.10E - 01	360	1.09E - 01	560	6.79E - 02	1.5K	6.78E - 02	2.0K	1.08E - 01	2.2K	1.08E - 01	3.9K
1.68E - 01	200	1.67E - 01	270	1.66E - 01	430	1.09E - 01	1.1K	1.08E - 01	1.5K	1.65E - 01	1.6K	1.65E - 01	3.0K
2.47E - 01	150	2.45E - 01	200	2.44E - 01	330	1.66E - 01	820	1.65E - 01	1.1K	2.42E - 01	1.3K	2.41E - 01	2.2K
3.03E - 01	130	3.50E - 01	160	3.47E - 01	270	2.43E - 01	620	2.42E - 01	820	2.92E - 01	1.2K	3.44E - 01	1.8K
3.52E - 01	110	4.80E - 01	130	4.76E - 01	200	3.45E - 01	510	3.45E - 01	680	3.44E - 01	1.0K	4.71E - 01	1.5K
4.84E - 01	91	6.46E - 01	110	6.41E - 01	180	4.73E - 01	390	4.73E - 01	510	4.72E - 01	820	6.35E - 01	1.1K
6.52E - 01	75	8.23E - 01	100	8.14E - 01	160	6.38E - 01	330	6.37E - 01	430	6.36E - 01	620	8.35E - 01	910
8.35E - 01	68	8.51E - 01	91	8.44E - 01	150	8.39E - 01	270	8.38E - 01	360	8.36E - 01	560	1.08E + 00	750
8.60E - 01	62	1.10E + 00	75	1.09E + 00	120	1.09E + 00	220	1.08E + 00	300	1.08E + 00	430	1.38E + 00	680
1.11E + 00	51	1.41E + 00	62	1.40E + 00	100	1.39E + 00	200	1.38E + 00	240	1.38E + 00	360	1.73E + 00	470
1.28E + 00	47	1.77E + 00	47	1.75E + 00	75	1.74E + 00	150	1.73E ± 00	180	1.73E + 00	270	2.65E + 00	360
1.42E + 00	43	2.73E + 00	33	2.69E + 00	56	2.67E + 00	110	2.66E ± 00	130	2.65E + 00	200	3.87E + 00	240
1.80E + 00	30	4.01E + 00	22	3.95E + 00	36	3.90E + 00	75	3.89E ± 00	91	3.88E + 00	150	6.46E + 00	180
2.77E + 00	22	6.72E + 00	16	6.61E + 00	27	6.53E + 00	51	6.50E ± 00	68	6.48E + 00	100	1.02E + 01	150
4.08E + 00	15	1.06E + 01	13	1.04E + 01	22	1.03E + 01	43	1.02E ± 01	56	1.02E + 01	82	1.34E + 01	120
6.85E + 00	11	1.39E + 01	11	1.26E + 01	20	1.23E + 01	39	1.23E ± 01	51	1.22E + 01	75	1.74E + 01	91
1.07E + 01	9.1	1.82E + 01	8.2	1.37E + 01	18	1.35E + 01	33	1.35E ± 01	43	1.34E + 01	68	2.49E + 01	68
1.42E + 01	7.5	2.60E + 01	6.8	1.79E + 01	13	1.76E + 01	27	1.75E ± 01	33	1.74E + 01	51	3.45E + 01	62
1.86E + 01	5.6	3.62E + 01	5.6	2.55E + 01	11	2.52E + 01	20	2.51E ± 01	27	2.50E + 01	39	4.25E + 01	43
2.68E + 01	4.3	4.52E + 01	3.9	3.55E + 01	9.1	3.50E + 01	18	3.49E ± 01	22	3.47E + 01	36	6.83E + 01	30
3.70E + 01	3.9	7.27E + 01	3.0	4.41E + 01	6.2	4.32E + 01	12	4.29E ± 01	16	4.27E + 01	24	1.04E + 02	24
4.65E + 01	2.7	1.11E + 02	2.2	7.09E + 01	4.7	6.94E + 01	9.1	6.90E ± 01	12	6.86E + 01	18	1.52E + 02	18
7.51E + 01	2.0	1.63E + 02	1.8	1.08E + 02	3.6	1.06E + 02	6.8	1.05E ± 02	9.1	1.04E + 02	13	2.16E + 02	15
1.13E + 02	1.8	2.31E + 02	1.5	1.59E + 02	2.7	1.55E + 02	5.1	1.54E ± 02	6.8	1.53E + 02	10	2.96E + 02	11
1.69E + 02	1.2	3.21E + 02	1.1	2.26E + 02	2.2	2.20E + 02	4.3	2.19E ± 02	5.6	2.17E + 02	8.2	4.01E + 02	9.1
2.43E + 02	0.91	4.36E + 02	0.91	3.10E + 02	1.8	3.02E + 02	3.3	3.00E ± 02	4.3	2.98E + 02	6.8	5.26E + 02	7.5
3.33E + 02	0.75	5.74E + 02	0.75	3.40E + 02	1.6	4.10E + 02	2.7	4.07E ± 02	3.6	3.18E + 02	6.2	6.85E + 02	4.7
4.72E + 02	0.47	7.74E + 02	0.47	4.21E + 02	1.5	5.39E + 02	2.2	5.34E ± 02	3.0	4.04E + 02	5.1		
				5.54E + 02	1.2	7.06E + 02	1.5	7.01E ± 02	1.8	5.30E + 02	4.3		
				7.37E + 02	0.75					6.93E + 02	2.7		

PUSH-IN BRACKET FORM A

For the assembly of resistors without pins. The retaining brackets are supplied loose.

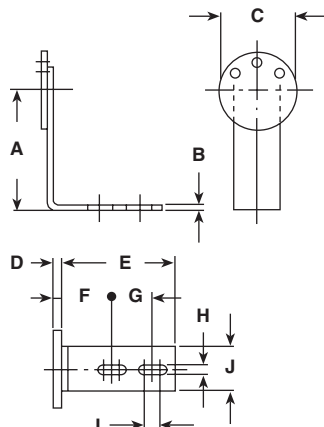
To prevent rotation the resistors are also available slotted at one end upon request. Depending on the type, this reduces the leakage path (creeping distance) to the clamp by 1.2...3.5 mm.



ORDER REF.	SUITABLE FOR	DIMENSIONS in millimeters [inches]									
		A	B	C	a	b	c	d	e	f	g
401 541 DN 104	GWS 25, 35, GWS 50, 75 RW 12/... ZWS 12, 15	15 [0.591]	10 [0.394]	20.5 [0.807]	4.3 [0.169]	11 [0.433]	16 [0.63]	20 [0.787]	5.9 [0.232]	1.5 [0.059]	1 [0.039]
401 543 DN 104	ZWS 20, 35 ZW 13/...	15 [0.591]	16 [0.63]	25.5 [1.004]	5.3 [0.209]	11 [0.433]	21 [0.827]	25 [0.984]	8 [0.315]	1.8 [0.071]	1 [0.039]
401 545 DN 104	GWS 100, GWS 220, 300	15 [0.591]	16 [0.63]	25.5 [1.004]	5.3 [0.209]	11 [0.433]	21 [0.827]	25 [0.984]	10.5 [0.413]	1.8 [0.071]	1 [0.039]
401 546 DN 104	GBS 20/... ZWS 50, 100, ZWS 150 ZW 20/... ZBS 20/...	15 [0.591]	16 [0.63]	25.5 [1.004]	5.3 [0.209]	11 [0.433]	21 [0.827]	25 [0.984]	14.5 [0.571]	1.8 [0.071]	1 [0.039]
401 547 DN 104	GWS 500 ... GWS 30/... RW 30/... GBS 30/... ZWS 30/... ZBS 30/...	20 [0.787]	30 [1.181]	30.5 [1.200]	5.3 [0.209]	16 [0.630]	21 [0.827]	25 [0.984]	19 [0.749]	2.5 [0.098]	1.5 [0.059]
401 548 DN 104	GBS 45/... ZBS 45/...	20 [0.787]	40 [1.575]	45.5 [1.791]	5.3 [0.209]	16 [0.63]	21 [0.827]	25 [0.984]	31 [1.22]	2.5 [0.098]	1.5 [0.059]

ORDER REF.	SUITABLE FOR	DIMENSIONS in millimeters [inches]											
		A	B	C	D	E	F	G	H	K	L	M	N
424 339	GWS 500 GWS 30/... RW 30/... GBS 30/... ZWS 30/... ZBS 30/...	17.5 [0.689]	5 [0.197]	28.2 [1.11]	16 [0.63]	17.5 [0.689]	12.7 [0.5]	6.5 [0.256]	8.5 [0.335]	0.64 [0.025]	-	-	-
402 996	RW 20/76 RW 20/102	15.8 [0.622]	4.4 [0.173]	20.6 [0.811]	9.5 [0.374]	12.7 [0.5]	9.5 [0.374]	9 [0.354]	12 [0.472]	0.64 [0.025]	11 [0.433]	1.6 [0.063]	45°

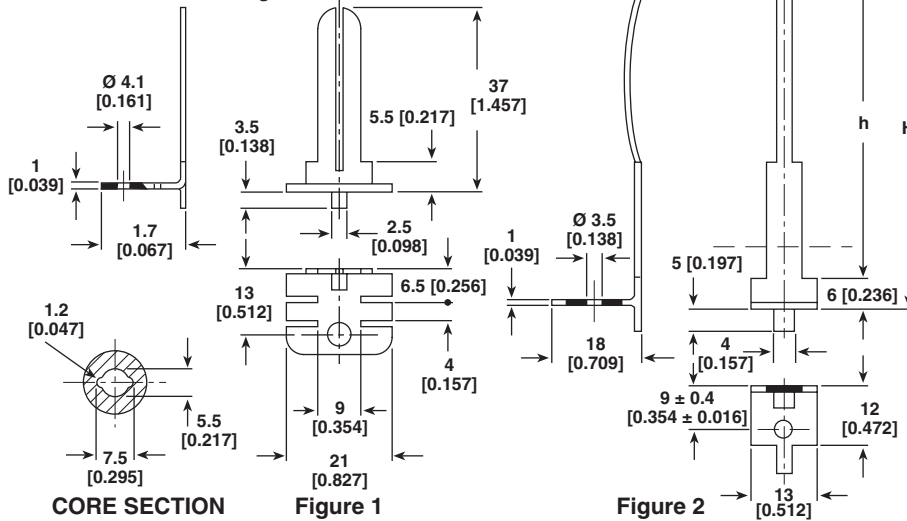
RETAINING BRACKET



ORDER REF.	SUITABLE FOR	DIMENSIONS in millimeters [inches]									
		A	B	C	D	E	F	G	H	I	J
406 330	GBS 60/370 GBS 60/370 E ZBS 60/370 ZBS 60/370 E	68 [2.677]	3 [0.118]	43.8 - 0.1 [1.724 - 0.004]	3.5 [0.138]	63 [2.48]	28 [1.102]	22 [0.866]	5.5 [0.217]	8 [0.315]	25 [0.984]

PUSH-IN BRACKET FORM C

For resistors with locking slot.



Steel, zinc-plated

FIG.	ORDER REF.	SUITABLE FOR	DIM. mm ⁽¹⁾	
			H	h
1	402 998	ZW 13/...FST ZWS 20, 35	-	-
2	402 999	ZW 13/64 FST	72 [2.835]	64.3 [2.531]
2	403 001	ZW 13/80 FST	88 [3.465]	80.3 [3.161]

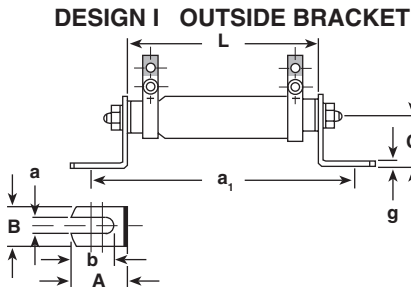
⁽¹⁾ In millimeters [inches]

PUSH-IN BRACKET FORM B

For the assembly of resistors with threaded bolt.

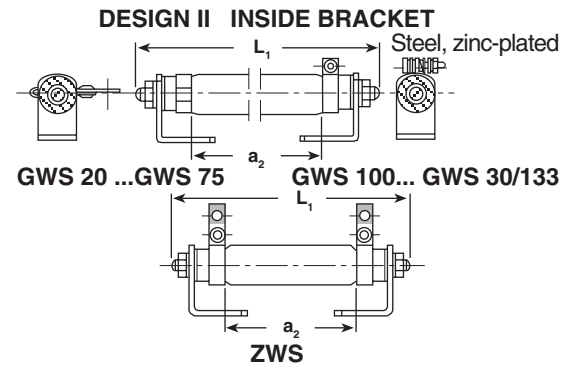
Delivery a) as loose accessories

b) fully assembled



Design I and II are a set of:

- 1 pcs Screw bolt
- 2 pcs Centering discs
- 2 pcs Brackets Form B
- 2 pcs Lock washers
- 2 pcs Hexagonal nuts



ORDER REF.	SUITABLE FOR	ORDER REF.	SUITABLE FOR	DIMENSIONS in millimeters [inches]									
				L	L ₁	a ₁	a ₂	A	B	a	b	g	
043 427	GWS 20	043 436	ZWS 8	50 [1.969]	61 [2.402]	69 [2.717]	34 [1.339]	15 [0.591]	10 [0.394]	13.5 [0.531]	4.3 [0.169]	11 [0.433]	1.5 [0.059]
043 428	GWS 25	043 437	ZWS 12	55 [2.165]	68 [2.677]	74 [2.913]	39 [1.535]	15 [0.591]	10 [0.394]	13.5 [0.531]	4.3 [0.169]	11 [0.433]	1.5 [0.059]
043 429	GWS 35	043 438	ZWS 15	62 [2.441]	74 [2.913]	81 [3.189]	46 [1.811]	15 [0.591]	10 [0.394]	13.5 [0.531]	4.3 [0.169]	11 [0.433]	1.5 [0.059]
043 430	GWS 50	043 439	ZWS 20	62 [2.441]	74 [2.913]	82 [3.228]	47 [1.85]	15 [0.591]	13 [0.512]	16.5 [0.65]	4.3 [0.169]	11 [0.433]	1.5 [0.059]
043 431	GWS 75	043 440	ZWS 35	100 [3.937]	114 [4.488]	120 [4.724]	85 [3.346]	15 [0.591]	13 [0.512]	16.5 [0.65]	4.3 [0.169]	11 [0.433]	1.5 [0.059]
043 432	GWS 100	043 441	ZWS 50	100 [3.937]	116 [4.567]	120 [4.724]	85 [3.346]	15 [0.591]	20 [0.787]	20 [0.787]	5.3 [0.209]	11 [0.433]	1.5 [0.059]
043 433	GWS 220	043 442	ZWS 100	165 [6.496]	182 [7.165]	185 [7.283]	150 [5.913]	15 [0.591]	20 [0.787]	20 [0.787]	5.3 [0.209]	11 [0.433]	1.5 [0.059]
043 434	GWS 300	043 443	ZWS 150	265 [10.433]	283 [11.142]	285 [11.22]	250 [9.843]	15 [0.591]	20 [0.787]	20 [0.787]	5.3 [0.209]	11 [0.433]	1.5 [0.059]
043 435	GWS 500	043 444	ZWS 250	330 [12.992]	353 [13.898]	356 [14.016]	310 [12.205]	20 [0.787]	30 [1.181]	30 [1.181]	5.3 [0.209]	15 [0.591]	2 [0.079]
047 163	GWS 30/100	047 174	ZWS 30/100	100 [3.937]	116 [4.567]	126 [4.961]	80 [3.15]	20 [0.787]	30 [1.181]	30 [1.181]	5.3 [0.209]	15 [0.591]	2 [0.079]
047 164	GWS 30/133	047 175	ZWS 30/133	133 [5.236]	161 [6.339]	159 [6.26]	113 [4.449]	20 [0.787]	30 [1.181]	30 [1.181]	5.3 [0.209]	15 [0.591]	2 [0.079]

Note

- The use of ceramic centering discs increases the dimensions L, L₁, a₁ and a₂ about 10 mm [0.394"] with types GWS 25...GWS 30/133 and ZWS 12...ZWS 30/133.

SPRING CLIPS

Suitable for GWK and ZWK

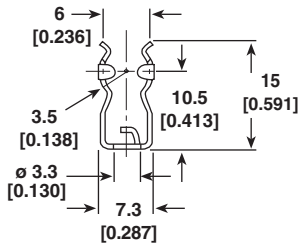
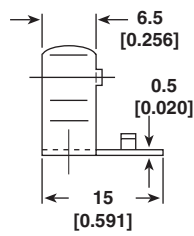


Figure 1: Spring clip



401 549 DN 105

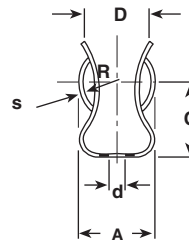
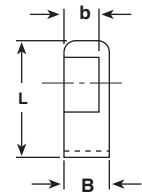


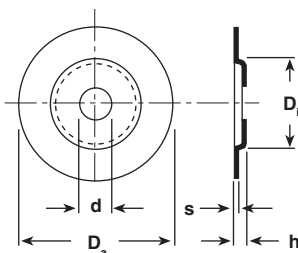
Figure 2: Spring clip



401 550 DN 105
401 551 DN 105
401 553 DN 105

MODEL	SPRING CLIP DIMENSIONS in millimeters [inches]						
	GWK 10 GWK 10 Ni	GWK 20 GWK 20 Ni	ZWK 10 ZWK 10 Ni	GWK 40.. GWK 40 Ni GWK 60 GWK 60 Ni	ZWK 15 ZWK 15 Ni ZWK 20 ZWK 20 Ni	GWK 100 GWK 100 Ni GWK 150 GWK 150 Ni GWK 200 GWK 200 Ni GWK 300 GWK 300 Ni	ZWK 40 ZWK 40 Ni ZWK 60 ZWK 60 Ni ZWK 90 ZWK 90 Ni ZWK 150 ZWK 150 Ni
ORDER REF.	401 549 DN 105	401 550 DN 105	401 551 DN 105	401 551 DN 105	401 551 DN 105	401 553 DN 105	401 553 DN 105
D	See Drawing Figure 1	9	[0.354]	11.5	[0.453]	18	[0.709]
R		5.5	[0.217]	7	[0.276]	10.5	[0.413]
A		11	[0.433]	15	[0.591]	20	[0.787]
B		10	[0.394]	10	[0.394]	15	[0.591]
C		13	[0.512]	16	[0.630]	20	[0.787]
d		3.5	[0.138]	4.5	[0.177]	4.5	[0.177]
L		20	[0.787]	24	[0.945]	31	[1.220]
s		0.6	[0.024]	0.6	[0.024]	0.8	[0.031]
b		8.5	[0.335]	8	[0.315]	12.5	[0.492]

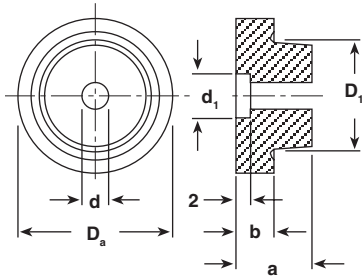
CENTERING DISCS (steel, zinc-plated) For resistors with through-pin



ORDER REF.	SUITABLE FOR	DIMENSIONS in millimeters [inches]				
		D _a	D _i	d	h	s
401 542 DN 102	GWS 25, 35, 50, 75 RW12/.. ZWS 12, 15, 20, 35 ZW 13/...	13 [0.512]	5.3 [0.209]	3.2 [0.126]	1.5 [0.059]	0.5 [0.020]
401 528 DN 102	GWS 100, 220, 300 GBS 20/.. ZWS 50, 100, 150	20 [0.787]	9.7 [0.382]	4.5 [0.177]	1.5 [0.059]	0.5 [0.020]
401 529 DN 102	RW 20/...	20 [0.787]	11.6 [0.457]	4.5 [0.177]	1.5 [0.059]	0.5 [0.020]
401 531 DN 102	GWS 500 RW 30/.. ZWS 250	30 [1.181]	17.6 [0.693]	5.3 [0.209]	1.5 [0.059]	0.5 [0.020]
414 295 DN 102	GWS 30/... GBS 30/.. ZWS 30/... ZBS 30/...	30 [1.181]	13.8 [0.543]	5.3 [0.209]	1.5 [0.059]	0.5 [0.020]

CERAMIC CENTERING DISCS (KER 221 DIN 40685)

To increase the leakage path (creeping distance) when assembling resistors with through-pin.

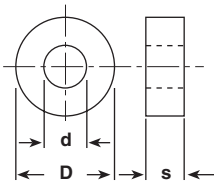


ORDER REF.	SUITABLE FOR	DIMENSIONS in millimeters [inches]					
		Da	D ₁	d	d ₁	a	b
405 499 BN 117	GWS 25, 35, 50, 75 RW12/.. ZWS 12, 15, 20, 35	10 [0.394]	5.2 [0.205]	3.2 [0.126]	-	6.5 [0.256]	5 [0.197]
401 182 BN 117	GWS 100, 220, 300 ZWS 50, 100, 150 ZW 20/..	20 [0.787]	9.5 [0.374]	5 [0.197]	10 [0.394]	10 [0.394]	5 [0.197]
401 183 BN 117	GWS 30/.. GBS 30/.. ZWS 30/.. ZBS 30/..	30 [1.181]	13.5 [0.531]	6 [0.236]	12 [0.472]	10 [0.394]	5 [0.197]
401 184 BN 117	GWS 500 RW 30/..	30 [1.181]	17.3 [0.681]	6 [0.236]	12 [0.472]	10 [0.394]	5 [0.197]
401 185 BN 117	ZWS 250	30 [1.181]	19.2 [0.756]	6 [0.236]	12 [0.472]	10 [0.394]	5 [0.197]

Ceramic centering discs can be supplied fully assembled with retaining brackets form B and resistors GWS 25 - GWS 30/133, ZWS 12 - ZWS 30/133 which can be delivered completely mounted.

CENTERING DISCS (KER 110 DIN 40685)

The manufacture of centering discs for resistors of small inside diameter is not feasible. To increase the leakage path (creeping distance) of these types, we supply ceramic discs, centered together with the resistors through the retaining pin.



ORDER REF.	SUITABLE FOR	DIMENSIONS in millimeters [inches]		
		D	d	s
400 840 BN 103	GWS 15	6 [0.236]	2.3 [0.091]	5 [0.197]
400 848 BN 103	GWS 20 ZWS 8	8 [0.315]	3.5 [0.138]	5 [0.197]
400 867 BN 103	GWS 25, 35 ZWS 12, 15	10 [0.394]	5.5 [0.217]	5 [0.197]
400 875 BN 103	GWS 50, 75 RW 12/.. ZWS 20, 35	13 [0.512]	5.5 [0.217]	5 [0.197]

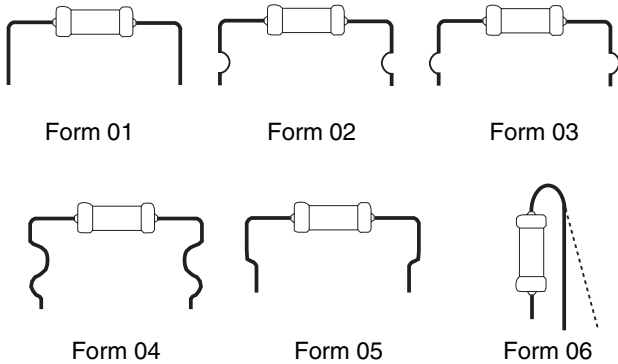
Alternative Lead Configurations

Vishay Draloric



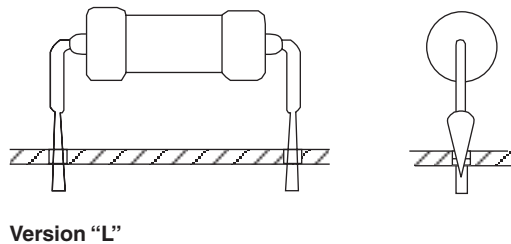
The lead configurations listed below are samples of the available alternative lead forms for axial leaded resistors of G 20... and Z 30... styles. For more information and assistance about dimensions please contact factory.

LEAD CONFIGURATIONS (available for G 20 ... and Z 30 ... Series)



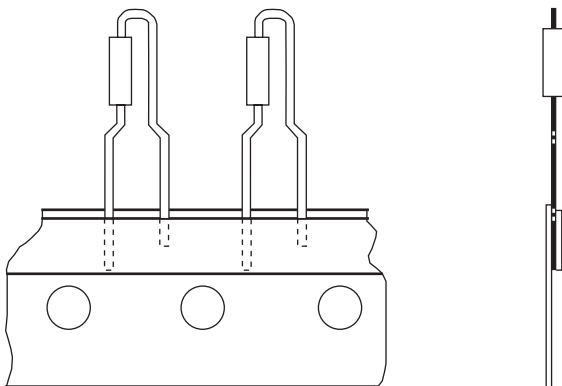
HOW TO ORDER		
AVAILABLE FOR MODEL	LEAD TERM	ORDERING TERM
G 202	01 ... 06	GS 202 BV ...
G 204	01 ... 06	GS 204 BV ...
G 206	01 ... 06	GS 206 BV ...
G 207	01 ... 06	GS 207 BV ...
Z 301	01 ... 06	ZS 301 BV ...
ZDA 0411	01 ... 06	ZDS 0411 BV ...
Z 302	01 ... 06	ZS 302 BV ...
Z 303	01 ... 06	ZS 303 BV ...
Z 305	01 ... 06	ZS 305 BV ...
Z 306	01 ... 06	ZS 306 BV ...
Z 307	01 ... 06	ZS 307 BV ...

LEAD CONFIGURATIONS (available for Z 30 ... Series)



HOW TO ORDER		
AVAILABLE FOR MODEL	LEAD TERM	ORDERING TERM
Z 301	Version "L"	ZL 301 BV ...
ZDA 0411		ZDL 0411 BV ...
Z 302		ZL 302 BV ...
Z 303		ZL 303 BV ...
Z 305		ZL 305 BV ...
Z 306		ZL 306 BV ...
Z 307		ZL 307 BV ...

RADIAL TAPING (only available for model ZDA 0411)

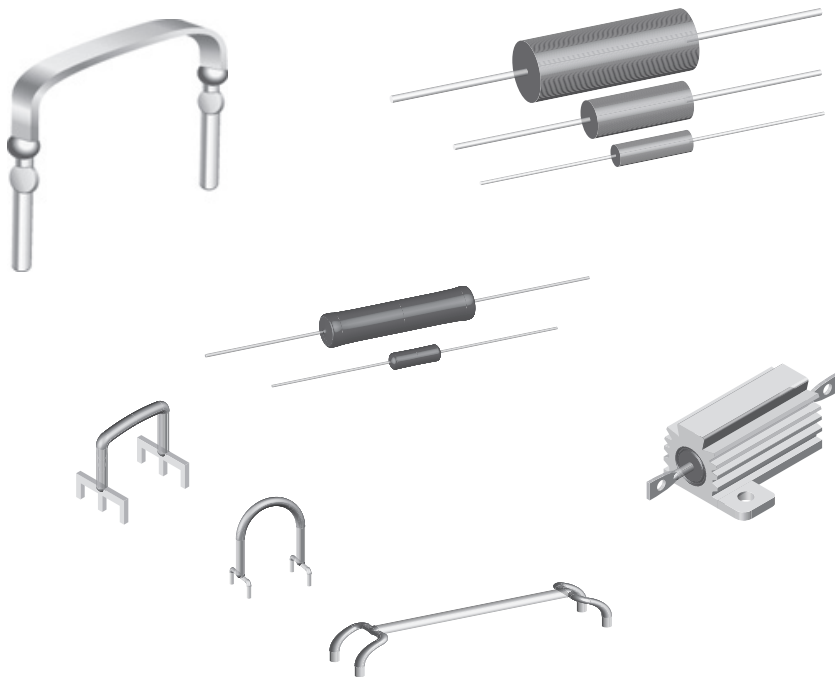


HOW TO ORDER		
AVAILABLE FOR MODEL	LEAD TERM	ORDERING TERM
ZDA 0411	Radial avisert	ZDL 0411 BV ...

Radial avisert according to IEC 60286-2



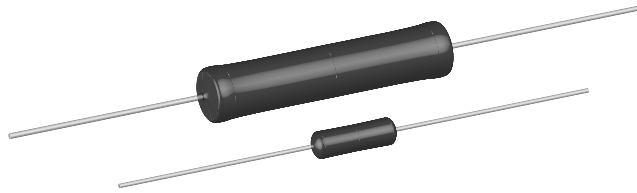
Precision and Military Power Wirewound Resistors



Contents

RS, NS	142
PAC.. Series	144
G, GN	150
LVR	152
RH, NH	154
ESS, ESN, EGS, EGN	158
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SPU Molded Style	166
SPU Open Style	168

Wirewound Resistors, Military, MIL-PRF-26 Qualified, Type RW, Precision Power, Silicone Coated



FEATURES

- High temperature coating (> 350 °C)
- Complete welded construction
- Meets applicable requirements of MIL-PRF-26
- Available in non-inductive styles (type NS) with Aryton-Perry winding for lowest reactive components
- Excellent stability in operation (typical resistance shift < 0.5 %)
- Lead (Pb)-free version is RoHS compliant



RoHS*
COMPLIANT

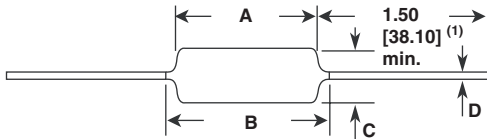
STANDARD ELECTRICAL SPECIFICATIONS											
GLOBAL MODEL	HIST. MODEL	MIL-PRF-26 TYPE	POWER RATING ⁽³⁾ P _{25 °C} W		RESISTANCE RANGE - MIL. RANGE SHOWN IN BOLD FACE W					WEIGHT (typical) g	
			U ± 0.05 % thru ± 5 %	V ± 3 % thru ± 10 %	± 0.05 %	± 0.1 %	± 0.25 %	± 0.5 % & ± 1 %	± 3 %, ± 5 %, ± 10 %		
RS1/8	RS-18	-	0.125	-	-	-	-	-	0.1 - 950	0.1 - 950	0.15
RS1/4	RS-1/4	-	0.4	-	1 - 1K	0.499 - 1K	0.499 - 3.4K	0.1 - 3.4K	0.1 - 3.4K	0.1 - 3.4K	0.21
RS1/2	RS-1/2	-	0.75	-	1 - 1.3K	0.499 - 1.3K	0.499 - 4.9K	0.1 - 4.9K	0.1 - 4.9K	0.1 - 4.9K	0.23
RS01A	RS-1A	-	1.0	-	1 - 2.74K	0.499 - 2.74K	0.499 - 10.4K	0.1 - 10.4K	0.1 - 10.4K	0.1 - 10.4K	0.34
RS01A...300	RS-1A-300	RW70 (2)	1.0 1.0	-	-	0.499 - 2.74K	0.499 - 10.4K	0.1 - 10.4K	0.1 - 2.74K	0.1 - 10.4K	0.34
RS01M	RS-1M	-	1.0	-	1 - 1.32K	0.499 - 1.67K	0.499 - 6.85K	0.1 - 6.85K	0.1 - 6.85K	0.1 - 6.85K	0.30
RS002	RS-2	-	4.0	5.5	0.499 - 12.7K	0.499 - 12.7K	0.1 - 47.1K	0.1 - 47.1K	0.1 - 47.1K	0.1 - 47.1K	2.10
RS02M	RS-2M	-	3.0	-	0.499 - 4.49K	0.499 - 4.49K	0.1 - 18.74K	0.1 - 18.74K	0.1 - 18.74K	0.1 - 18.74K	0.65
RS02B	RS-2B	-	3.0	3.75	0.499 - 6.5K	0.499 - 6.5K	0.1 - 24.5K	0.1 - 24.5K	0.1 - 24.5K	0.1 - 24.5K	0.70
RS02B...300	RS-2B-300	RW79 (2)	3.0 3.0	-	-	0.499 - 6.5K	0.1 - 24.5K	0.1 - 24.5K	0.1 - 6.49K	0.1 - 24.5K	0.70
RS02C	RS-2C	-	2.5	3.25	0.499 - 8.6K	0.499 - 8.6K	0.1 - 32.3K	0.1 - 32.3K	0.1 - 32.3K	0.1 - 32.3K	1.6
RS02C...17	RS-2C-17	-	2.5	3.25	0.499 - 6.8K	0.499 - 8.6K	0.1 - 32.3K	0.1 - 32.3K	0.1 - 32.3K	0.1 - 32.3K	1.6
RS02C...23	RS-2C-23	RW69 (1)	-	3.25 3.0	-	-	-	-	-	0.1 - 32.3K 0.1 - 2.0K	16
RS005	RS-5	-	5.0	6.5	0.499 - 25.7K	0.499 - 25.7K	0.1 - 95.2K	0.1 - 95.2K	0.1 - 95.2K	0.1 - 95.2K	4.2
RS005...69	RS-5-69	RW74 (2)	5.0 5.0	-	-	0.499 - 25.7K	0.1 - 95.2K	0.1 - 95.2K	0.1 - 95.2K	0.1 - 24.3K	4.2
RS005...70	RS-5-70	RW67 (1)	-	6.5 6.5	-	-	-	-	-	0.1 - 95.2K 0.1 - 8.2K	4.2
RS007	RS-7	-	7.0	9.0	0.499 - 41.4K	0.499 - 41.4K	0.1 - 154K	0.1 - 154K	0.1 - 154K	0.1 - 154K	4.7
RS010	RS-10	-	10.0	13.0	0.499 - 73.4K	0.499 - 73.4K	0.1 - 273K	0.1 - 273K	0.1 - 273K	0.1 - 273K	9.0
RS010...38	RS-10-38	RW78 (2)	10.0 10.0	-	-	0.499 - 73.4K	0.1 - 273K	0.1 - 273K	0.1 - 273K	0.1 - 71.5K	9.0
RS010...39	RS-10-39	RW68 (1)	-	13.0 11.0	-	-	-	-	-	0.1 - 273K 0.1 - 20K	9.0

Notes

- (1) Available tolerance for these MIL parts is ± 5 % for 1 Ω and above, ± 10 % below 1 Ω
- (2) Available tolerance for these MIL parts is ± 0.5 % and ± 1 % for resistance values 0.1 Ω and above, ± 0.1 % for resistance values 0.499 Ω and above
- (3) Vishay Dale RS models have two power ratings depending on operation temperature and stability requirements
- Shaded area indicates most popular models

GLOBAL PART NUMBER INFORMATION																
New Global Part Numbering: RS02C10K00FS7017 (preferred part number format)																
R	S	0	2	C	1	0	K	0	0	F	S	7	0	1	7	
GLOBAL MODEL (See Standard Electrical Specifications Global Model column for options)	RESISTANCE VALUE R = Decimal K = Thousand 15R00 = 15 Ω 10K00 = 10 kΩ			TOLERANCE CODE A = 0.05 % B = 0.1 % C = 0.25 % D = 0.5 % F = 1.0 % J = 5.0 % K = 10.0 %			PACKAGING E70 = Lead (Pb)-free, tape/reel (smaller than RS005) E73 = Lead (Pb)-free, tape/reel (RS005 and larger) E12 = Lead (Pb)-free, bulk Lead (Pb)-free is not available on RW military type S70 = Tin/lead, tape/reel (smaller than RS005) S73 = Tin/lead, tape/reel (RS005 and larger) B12 = Tin/lead, bulk					SPECIAL (Dash Number) (up to 3 digits) From 1 - 999 as applicable				
Historical Part Number Example: RS-2C-17 10 kΩ 1 % S70 (will continue to be accepted)																
RS-2C-17	10 kΩ			1 %			S70									
HISTORICAL MODEL	RESISTANCE VALUE			TOLERANCE CODE			PACKAGING									

* Pb containing terminations are not RoHS compliant, exemptions may apply

DIMENSIONS in inches [millimeters]

Notes

- (1) On some standard reel pack methods, the leads may be trimmed to a shorter length than shown
- RS-1/8 terminal length will be 1.0" [25.4 mm] minimum

MATERIAL SPECIFICATIONS

Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value

Core: Ceramic, steatite or alumina, depending on physical size

Coating: Special high temperature silicone

Standard Terminals: 100 % Sn, or 60/40 Sn/Pb coated Copperweld®

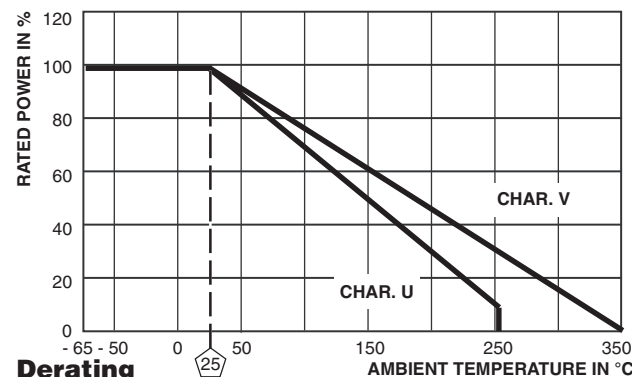
End Caps: Stainless steel

Deviations for RS-1/8: Thermoset silicone molded construction, endcaps will be nickel-silver alloy and terminals will be tinned copper

Part Marking: DALE, model, wattage (2), value, tolerance, date code

Note

- (2) Wattage marked on part will be "U" characteristic
- Military "RW" parts are only available with 60/40 Sn/Pb finish


Derating

GLOBAL MODEL	DIMENSIONS in inches [millimeters]			
	A	B ⁽³⁾ (max.)	C	D
RS1/8	0.155 ± 0.015 [3.94 ± 0.381]	-	0.065 ± 0.015 [1.65 ± 0.381]	0.020 ± 0.002 [0.508 ± 0.051]
RS1/4	0.250 ± 0.031 [6.35 ± 0.787]	0.281 [7.14]	0.085 ± 0.020 [2.16 ± 0.508]	0.020 ± 0.002 [0.508 ± 0.051]
RS1/2	0.312 ± 0.016 [7.92 ± 0.406]	0.328 [8.33]	0.078 + 0.016 - 0.031 [1.98 + 0.406 - 0.787]	0.020 ± 0.002 [0.508 ± 0.051]
RS01A	0.406 ± 0.031 [10.31 ± 0.787]	0.437 [11.10]	0.094 ± 0.031 [2.39 ± 0.787]	0.020 ± 0.002 [0.508 ± 0.051]
RS01M	0.285 ± 0.025 [7.24 ± 0.635]	0.311 [7.90]	0.110 ± 0.015 [2.79 ± 0.381]	0.020 ± 0.002 [0.508 ± 0.051]
RS002	0.625 ± 0.062 [15.88 ± 1.57]	0.765 [19.43]	0.250 ± 0.031 [6.35 ± 0.787]	0.040 ± 0.002 [1.02 ± 0.051]
RS02M	0.500 ± 0.062 [12.70 ± 1.57]	0.562 [14.27]	0.185 ± 0.015 [4.70 ± 0.381]	0.032 ± 0.002 [0.813 ± 0.051]
RS02B	0.560 ± 0.062 [14.22 ± 1.57]	0.622 [15.80]	0.187 ± 0.031 [4.75 ± 0.787]	0.032 ± 0.002 [0.813 ± 0.051]
RS02C	0.500 ± 0.062 [12.70 ± 1.57]	0.593 [15.06]	0.218 ± 0.031 [5.54 ± 0.787]	0.040 ± 0.002 [1.02 ± 0.051]
RS02C...17	0.500 ± 0.062 [12.70 ± 1.57]	0.593 [15.06]	0.218 ± 0.031 [5.54 ± 0.787]	0.032 ± 0.002 [0.813 ± 0.051]
RS005	0.875 ± 0.062 [22.23 ± 1.57]	1.0[25.4]	0.312 ± 0.031 [7.92 ± 0.787]	0.040 ± 0.002 [1.02 ± 0.051]
RS007	1.22 ± 0.062 [30.99 ± 1.57]	1.28 [32.51]	0.312 ± 0.031 [7.92 ± 0.787]	0.040 ± 0.002 [1.02 ± 0.051]
RS010	1.78 ± 0.062 [45.21 ± 1.57]	1.87 [47.50]	0.375 ± 0.031 [9.53 ± 0.787]	0.040 ± 0.002 [1.02 ± 0.051]
RS010...39	1.78 ± 0.062 [45.21 ± 1.57]	1.84 [46.74]	0.375 ± 0.031 [9.53 ± 0.787]	0.040 ± 0.002 [1.02 ± 0.051]
RS010...38	1.78 ± 0.062 [45.21 ± 1.57]	1.84 [46.74]	0.375 ± 0.031 [9.53 ± 0.787]	0.040 ± 0.002 [1.02 ± 0.051]

Note

- (3) B (max.) dimension is clean lead to clean lead

NS NON-INDUCTIVE

Models of equivalent physical and electrical specifications are available with non-inductive (Aryton-Perry) winding. They are identified by substituting the letter N for R in the model number (NS-5, for example).

Two conditions apply:

- For NS models, divide maximum resistance values by two
- Body O.D. on NS-2C may exceed that of the RS-2C by 010"

TECHNICAL SPECIFICATIONS

PARAMETER	UNIT	RS RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/°C	± 90 for below 1 Ω, ± 50 for 1 Ω to 9.9 Ω, ± 20 for 10 Ω and above
Dielectric Withstanding Voltage	V _{AC}	500 minimum for RS-1/8 thru RS-1A, 1000 minimum for all others
Maximum Working Voltage	V	(P x R) ^{1/2}
Insulation Resistance	Ω	1000 MΩ minimum dry, 100 MΩ minimum after moisture test
Terminal Strength	lb	5 minimum for RS-1/8 thru RS-1A, 10 minimum for all others
Solderability	-	MIL-PRF-26 type - meets requirements of ANSI J-STD-002
Operating Temperature Range	°C	Characteristic U = - 65 to + 250, characteristic V = - 65 to + 350

PERFORMANCE (1)

TEST	CONDITIONS OF TEST	TEST LIMITS	
		Characteristic U	Characteristic V
Thermal Shock	Rated power applied until thermally stable, then a minimum of 15 min at - 55 °C	± (0.2 % + 0.05 Ω) ΔR	± (2.0 % + 0.05 Ω) ΔR
Short Time Overload	5 x rated power (3.75 W and smaller), 10 x rated power (4 W and larger) for 5 s	± (0.2 % + 0.05 Ω) ΔR	± (2.0 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	500 minimum for RS-1/8 thru RS-1A, 1000 for all others, duration of 1 min	± (0.1 % + 0.05 Ω) ΔR	± (0.1 % + 0.05 Ω) ΔR
Low Temperature Storage	- 65 °C for 24 h	± (0.2 % + 0.05 Ω) ΔR	± (2.0 % + 0.05 Ω) ΔR
High Temperature Exposure	250 h at: U = + 250 °C, V = + 350 °C	± (0.5 % + 0.05 Ω) ΔR	± (2.0 % + 0.05 Ω) ΔR
Moisture Resistance	MIL-STD-202 Method 106, 7b not applicable	± (0.2 % + 0.05 Ω) ΔR	± (2.0 % + 0.05 Ω) ΔR
Shock, Specified Pulse	MIL-STD-202 Method 213, 100 g's for 6 ms, 10 shocks	± (0.1 % + 0.05 Ω) ΔR	± (0.2 % + 0.05 Ω) ΔR
Vibration, High Frequency	Frequency varied 10 to 2000 Hz, 20 g peak, 2 directions 6 h each	± (0.1 % + 0.05 Ω) ΔR	± (0.2 % + 0.05 Ω) ΔR
Load Life	2000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"	± (0.5 % + 0.05 Ω) ΔR	± (3.0 % + 0.05 Ω) ΔR
Terminal Strength	5 to 10 s, 5 or 10 lb pull test (depending on size), torsion test - 3 alternating directions, 360° each	± (0.1 % + 0.05 Ω) ΔR	± (1.0 % + 0.05 Ω) ΔR

Note

- All ΔR figures shown are maximum, based upon testing requirements per MIL-PRF-26

Cemented Wirewound Precision Resistors



FEATURES

- High power dissipation in small volume
- Ideal for pulse application
- TCR ± 100 ppm/K
- Maximum permissible hot spot temperature is 275 °C
- Lead (Pb)-free
- Tolerance 1 %
- Compatible with "Restriction of the use of Hazardous Substances" (RoHS) directive 2002/95/EC (issue 2004)



The resistor element is a resistive wire which is wound in a single layer on a ceramic rod. Metal caps are pressed over the ends of the rod. The ends of the resistance wire and the leads are connected to the caps by welding. Tinned copper-clad iron leads with poor heat conductivity are employed permitting the use of relatively short leads to obtain stable mounting without overheating the solder joint.

The resistor is coated with a green silicon cement which is not resistant to aggressive fluxes. The coating is non-inflammable, will not drip even at high overloads and is resistant to most commonly used cleaning solvents, in accordance with "MIL-STD-202E, method 215" and "IEC 60068-2-45".

STANDARD ELECTRICAL SPECIFICATIONS

GLOBAL MODEL	HISTORICAL MODEL	$P_{25\text{ }^\circ\text{C}}$ W	TOLERANCE E24/E96 series \pm %	LIMITING VOLTAGE V	RESISTANCE RANGE Ω TCR ± 100 ppm/K
PAC100	PAC01	1	1	$\sqrt{P \times R}$	R10 - 2K2
PAC200	PAC02 (1)	2	1	$\sqrt{P \times R}$	R10 - 3K6
PAC300	PAC03	3	1	$\sqrt{P \times R}$	R10 - 4K7
PAC400	PAC04	4	1	$\sqrt{P \times R}$	R10 - 8K2
PAC500	PAC05	5	1	$\sqrt{P \times R}$	R10 - 10K
PAC600	PAC06	6	1	$\sqrt{P \times R}$	R10 - 12K

Notes:

(1) PAC02 WSZ: $P_{25\text{ }^\circ\text{C}} = 1.8$ W

- For Pulse Diagrams see AC..series (<http://www.vishay.com/doc?28730>)

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: PAC300004641FAC000 (preferred part number format)

P A C 3 0 0 0 0 4 7 0 1 F A C 0 0 0

MODEL	SPECIAL CHARACTER	TCR/MATERIAL	VALUE	TOLERANCE	PACKAGING	SPECIAL
(See Standard Electrical Specifications table)	0 = Neutral 1 = RT 2 = SWI = Special winding (2) 3 = DK SP 20 mm 4 = DK LP 33 mm (3) 5 = DK LP 17.8 mm (3) 6 = NI = Non inductive 7 = DK LP 25.4 mm (3) 8 = DK SP 25.4 mm 9 = WSZ 6720 A = E/K 22.5 mm (3) Z = Value overflow (Special)	0 = Standard (100 ppm) K = 90 ppm (2) C = 50 ppm (2) L = 30 ppm (2)	3 digit value 1 digit multiplier MULTIPLIER 7 = 10^{-3} 8 = 10^{-2} 9 = 10^{-1} 0 = 10^0 1 = 10^1 2 = 10^2 3 = 10^3 4 = 10^4 5 = 10^5	F = ± 1.0 %	(See Packaging table)	The 3 digits are used for all special part styles. To encode the non standard specifications all special parts of one series are listed in a cross reference table. 000 = Standard 0E0 = CECC E0 0E6 = CECC E6

Historical Part Number Example: PAC03 4K7 1% AC (will continue to be accepted)



Notes:

(2) Special winding on request

(3) Other dimensions and special character on request



PACKAGING TABLE		
SAP	DESCRIPTION	TYPE
A1	Bandolier in ammopack straight leads, 1000 pieces	PAC01
AC	Bandolier in ammopack straight leads, 500 pieces	PAC02, PAC03, PAC04, PAC05, PAC06
AE	Bandolier in ammo pack, 2500 pieces radial taped	PAC01RT
LC	Loose 500 pieces double kinked/kink type S	PAC01 - PAC04 DK/EK
LB	Loose 250 pieces double kinked/kink type S	PAC05 - PAC06 DK/EK
BM	Blister 1250 pieces WSZ	PAC02 WSZ

12NC ORDERING CODE INDICATING RESISTOR TYPE AND PACKAGING

TYPE	ORDERING CODE 2306 327		
	BANDOLIER IN AMMOPACK		
	RADIAL	STRAIGHT LEADS	
	2500 units	500 units	1000 units
PAC01	RT ⁽¹⁾	-	2306 327 5....
PAC02	-	2306 327 0....	-
PAC03	-	2306 327 1....	-
PAC04	-	2306 327 2....	-
PAC05	-	2306 327 3....	-
PAC06	-	2306 327 4....	-

Note:

⁽¹⁾ Radial parts with tin plated copper leads

ORDERING INFORMATION

Ordering Code (12NC)

- The resistors have a 12-digit ordering code starting with 2306 327
- The subsequent first digit indicates the resistor type and packaging; see the 12NC Ordering Code table.
- The remaining 4 digits indicate the resistance value:
 - The first 3 digits indicate the resistance value.
 - The last digit indicates the resistance decade in accordance with the 12NC Indicating Resistance Decade table.

Last Digit of 12NC Indicating Resistance Decade

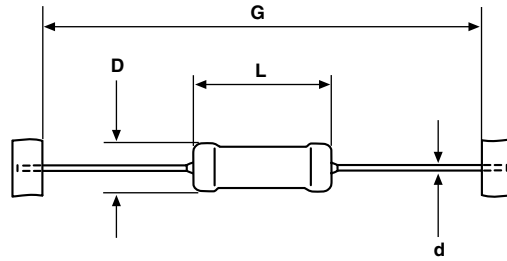
RESISTANCE DECADE	LAST DIGIT
0.10 to 0.976 Ω	7
1 to 9.76 Ω	8
10 to 97.6 Ω	9
100 to 976 Ω	1
1 to 9.76 kΩ	2
10 to 12 kΩ	3

Ordering Example

The ordering code for an PAC02, resistor value 47 Ω with ± 1 % tolerance, supplied in ammopack of 500 units is: 2306 327 04709.

Product specifications deviating from the standard values are available on request.

DIMENSIONS



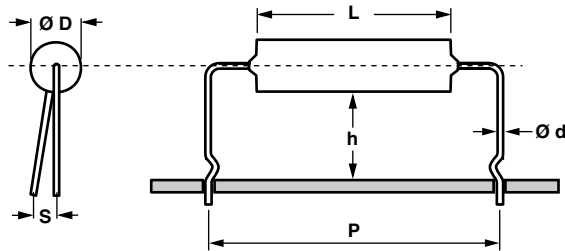
For packaging dimensions see separate packaging dimensions page.

MODEL	DIMENSIONS in millimeters [inches]				
	D _{max.}	L _{max.}	d	G	WEIGHT g per 100 units
PAC01	4.3 [0.169]	11 [0.433]	0.8 ± 0.03 [0.031 ± 0.001]	63 ± 1 [2.480 ± 0.039]	52
PAC02	4.8 [0.189]	13 [0.512]		63 ± 1 [2.480 ± 0.039]	75
PAC03	5.5 [0.217]	16.5 [0.650]		63 ± 1 [2.480 ± 0.039]	110
PAC04	7.5 [0.295]	18 [0.709]		73 ± 1 [2.874 ± 0.039]	190
PAC05	7.5 [0.295]	26 [1.024]		73 ± 1 [2.874 ± 0.039]	260
PAC06	7.5 [0.295]	26 [1.024]		73 ± 1 [2.874 ± 0.039]	260

PERFORMANCE	
TEST	TEST RESULTS
Climatic Category	55/200/56
Damp Heat, Steady State 56 Days	$\Delta R = \pm (1.0 \% R + 0.05 \Omega)$
Storage 1000 h, 200 °C, No Load	$\Delta R = \pm (1.0 \% R + 0.05 \Omega)$
Climatic Sequence	$\Delta R = \pm (0.5 \% R + 0.05 \Omega)$
Load Life 1000 h	$\Delta R = \pm (0.5 \% R + 0.05 \Omega)$
Resistance to Soldering Heat	$\Delta R = \pm (0.2 \% R + 0.05 \Omega)$
Robustness of Termination, 10 N	$\Delta R = \pm (0.1 \% R + 0.05 \Omega)$
Short Time Overload, 10 x Rated Power x 5 s	$\Delta R = \pm (0.2 \% R + 0.05 \Omega)$

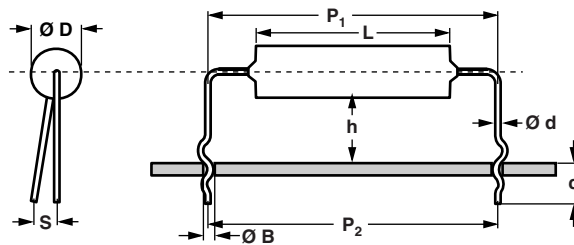
BENDING FORMS

KINK TYPE S = EK



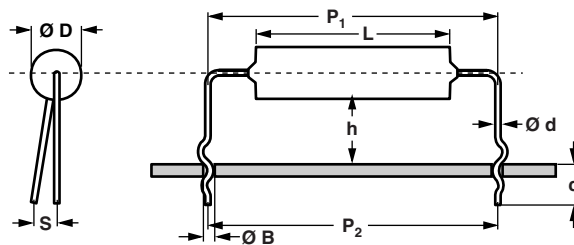
TYPE	Ø d	Ø D _{max.}	L	h ± 1	P ± 1	S _{max.}
PAC01	0.8	(1)	(1)	8	17.8	2
PAC02 - PAC04					25.4	
PAC05 - PAC06					33.0	

DOUBLE KINK SP = DK SP



TYPE	Ø d	Ø D _{max.}	L	h ± 1	P ₁ ± 1	P ₂ ± 3	S _{max.}	Ø B	c
PAC01	0.8	(1)	(1)	8	19.8	17.8	2	1.0 ± 0.1	4.5 ± 1
PAC02 - PAC04					22.0	20.0			
					27.4	25.4			
PAC05 - PAC06					35.0	33.0			

DOUBLE KINK LP = DK LP

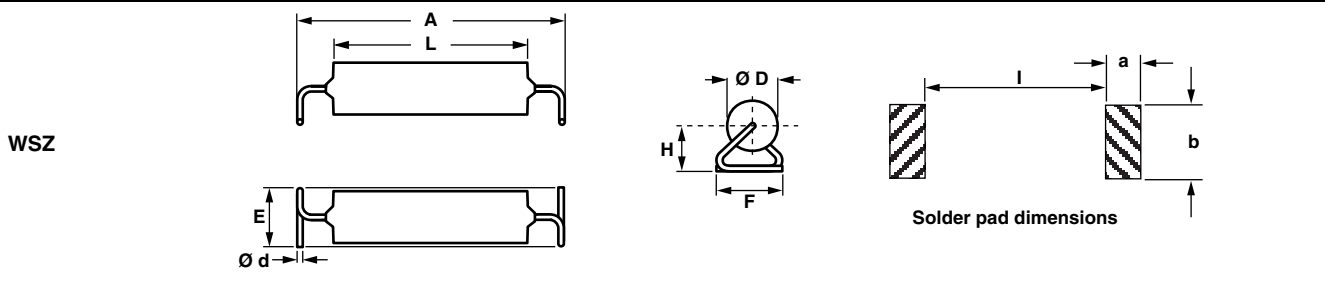


TYPE	Ø d	Ø D _{max.}	L	h ± 1	P ₁ ± 1	P ₂ ± 3	S _{max.}	Ø B	c
PAC01 - PAC02	0.8	(1)	(1)	8	17.8	17.8	2	1.0 ± 0.1	4.5 ± 1
PAC02 - PAC04					25.4	25.4			
PAC05 - PAC06					33.0	33.0			

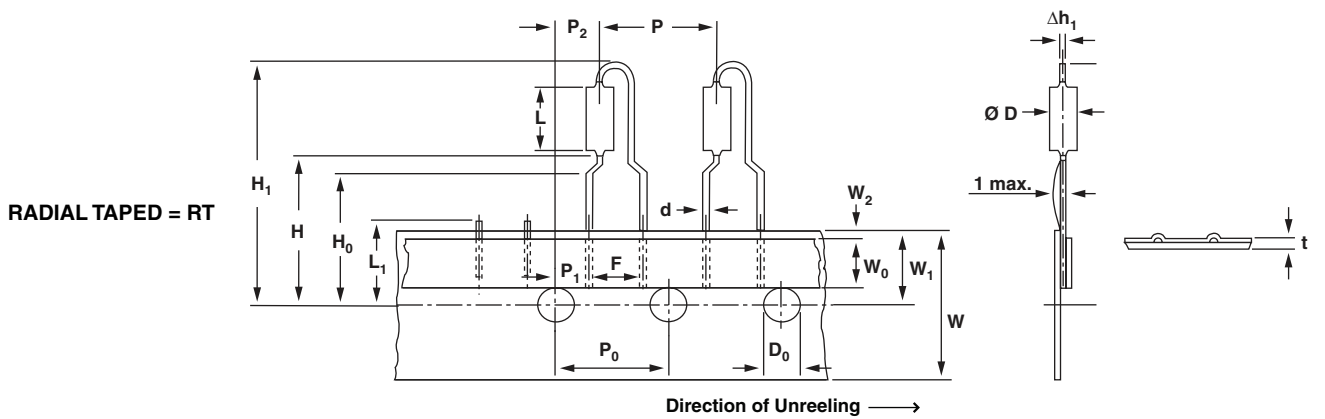
Note:

(1) See table DIMENSIONS

BENDING FORMS



TYPE	Ø d	Ø D _{max.}	A	L	F	H	E	a	b	l
PAC02 WSZ	0.8	(1)	17 ± 0.5	11 - 12	4.8 ± 0.5	3.6 ± 0.5	5.0 ± 0.5	2.5	5.5	14.5



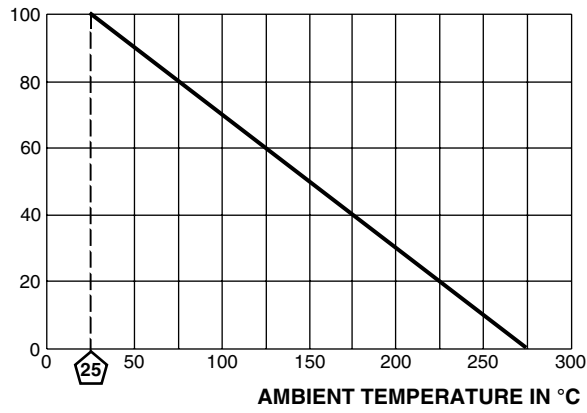
TYPE PAC01		
Lead Ø	Ø d	0.8
Diameter	Ø D	(1)
Length	L	(1)
Pitch of components	P	12.7 ± 1.0
Pitch of spocket holes (2)	P ₀	12.7 ± 0.3
Distance between hole center and resistor center	P ₁	3.85 ± 0.7
Distance between hole center and lead center	P ₂	6.35 ± 1.0
Lead spacing	F	5.0 + 0.6, - 0.1
Angle of insertion	Δh ₁	2 max.
Width of carrier tape	W	18.0 ± 0.5
Width of adhesive tape	W ₀	12.0 ± 0.5
Position of holes	W ₁	9.0 ± 0.5
Position of adhesive tape	W ₂	0.5 max.
Body to hole center	H	19.5 ± 1.0
Lead crimp to hole center (3)	H ₀	16.0 ± 0.5
Hole Ø	D ₀	4.0 ± 0.2
Thickness of tape (4)	t	0.9 max.
Height for cutting	L ₁	11 max.
Height for insertion	H ₁	32 max.

Notes:

- (1) See table DIMENSIONS
- (2) Test over 10 holes - 9 intervals P₀ 12.7 x 9 = 114.3 ± 0.5
- (3) Parallelism, < 0.5 mm
- (4) Thickness of carrier tape: 0.55 mm ± 0.1

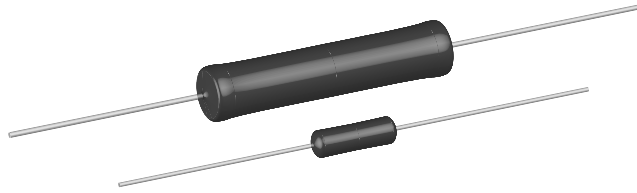


DERATING



Maximum dissipation (P_{max.}) as a function of the ambient temperature (T_{amb})

Wirewound Resistors, Military, MIL-PRF-26 Qualified, Type RW, Precision Power, Silicone Coated



FEATURES

- From 1.4 to 4 times higher power ratings than conventional resistors of equivalent size
- High temperature coating (> 350 °C)
- Complete welded construction
- Meets applicable requirements of MIL-PRF-26
- Available in non-inductive styles (type GN) with Aryton-Perry winding for lowest reactive components
- Excellent stability in operation (typical resistance shift < 0.5 %)
- Lead (Pb)-free version is RoHS compliant



RoHS*
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS									
GLOBAL MODEL	HIST. MODEL	MIL-PRF-26 TYPE	POWER RATING ⁽¹⁾ <i>P</i> _{25 °C} W		RESISTANCE RANGE MIL. RANGE SHOWN IN BOLD FACE Ω				WEIGHT (typical) g
			U ± 0.05 % thru ± 5 %	V ± 3 % thru ± 5 %	± 0.05 %	± 0.1 %	± 0.25 %	± 0.5 %, ± 1 %, ± 3 %, ± 5 %	
G001...80	G-1-80	-	1.0	-	1.0 - 1K	0.499 - 1K	0.499 - 3.4K	0.1 - 3.4K	0.20
G001...380	G-1-380	RW81	1.0	-	-	0.499 - 1K	0.499 - 1K	0.1 - 1K	0.20
G002	G-2	-	1.5	-	1.0 - 1.3K	0.499 - 1.3K	0.499 - 4.9K	0.1 - 4.9K	0.21
G003...80	G-3-80	-	2.0	-	1.0 - 2.74K	0.499 - 2.74K	0.499 - 10.4K	0.1 - 10.4K	0.34
G003...380	G-3-380	RW80	2.0	-	-	0.499 - 2.74K	0.499 - 2.74K	0.1 - 2.74K	0.34
G005	G-5	-	4.0	5.0	0.499 - 6.5K	0.499 - 6.5K	0.1 - 24.5K	0.1 - 24.5K	0.80
G05C	G-5C	-	5.0	7.0	0.499 - 8.6K	0.499 - 8.6K	0.1 - 32.3K	0.1 - 32.3K	1.20
G010	G-10	-	7.0	10.0	0.499 - 25.7K	0.499 - 25.7K	0.1 - 95.2K	0.1 - 95.2K	3.60

Notes

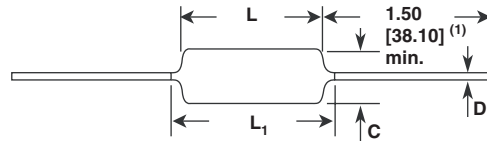
⁽¹⁾ Vishay Dale G models have two power ratings, depending on operation temperature and stability requirements

- Shaded area indicates most popular models

TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	G RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/°C	± 90 for below 1 Ω, ± 50 for 1 Ω to 9.9 Ω, ± 20 for 10 Ω and above
Dielectric Withstanding Voltage	V _{AC}	500 minimum for G-1-80 thru G-3-380, 1000 minimum for all others
Short Time Overload	-	5 x rated power for 5 s for G-1-80 thru G-5C (Characteristic U), 10 x rated power for 5 s for G-10
Maximum Working Voltage	V	(<i>P x R</i>) ^{1/2}
Insulation Resistance	W	1000 MΩ minimum dry, 100 MΩ minimum after moisture test
Terminal Strength	lb	5 minimum for G-1-80 thru G-3-380, 10 minimum for all others
Solderability	-	MIL-PRF-26 type - meets requirements of ANSI J-STD-002 Non Mil type - terminals are 60/40 electro tin plated to facilitate soldering
Operating Temperature Range	°C	Characteristic U = - 65 to + 250, characteristic V = - 65 to + 350
Power Rating	-	Characteristic U - + 250 °C max. hot spot temperature, ± 0.5 % max. Δ <i>R</i> in 2000 h load life Characteristic V - + 350 °C max. hot spot temperature, ± 3.0 % max. Δ <i>R</i> in 2000 h load life

GLOBAL PART NUMBER INFORMATION															
New Global Part Numbering: G00310R00FS7080 (preferred part number format)															
G	0	0	3	1	0	R	0	0	F	S	7	0	8	0	
GLOBAL MODEL (See Standard Electrical Specifications Global Model column for options)	RESISTANCE VALUE R = Decimal K = Thousand 15R00 = 15 Ω 10K00 = 10 kΩ			TOLERANCE CODE A = 0.05 % B = 0.1 % C = 0.25 % D = 0.5 % F = 1.0 % J = 5.0 % K = 10.0 %		PACKAGING E70 = Lead (Pb)-free, tape/reel (smaller than G010) E73 = Lead (Pb)-free, Tape/Reel (G010 and larger) E12 = Lead (Pb)-free, bulk Lead (Pb)-free is not available on RW military type S70 = Tin/lead, tape/reel (smaller than G010) S73 = Tin/lead, tape/reel (G010 and larger) B12 = Tin/lead, bulk					SPECIAL (Dash Number) (up to 3 digits) From 1 - 999 as applicable				
Historical Part Number Example: G-3-80 10 Ω 1 % S70 (will continue to be accepted)															
G-3-80			10 Ω			1 %			S70						
HISTORICAL MODEL			RESISTANCE VALUE			TOLERANCE CODE			PACKAGING						

* Pb containing terminations are not RoHS compliant, exemptions may apply

DIMENSIONS in inches [millimeters]


GLOBAL MODEL	DIMENSIONS in inches [millimeters]			
	L	L _{1 max.} (2)	C	D
G-1-80 G-1-380	0.250 ± 0.031 [6.35 ± 0.787]	0.281 [7.14]	0.085 ± 0.020 [2.16 ± 0.508]	0.020 ± 0.002 [0.508 ± 0.051]
G2	0.312 ± 0.016 [7.92 ± 0.406]	0.328 [8.33]	0.078 + 0.016 - 0.031 [1.98 + 0.406 - 0.787]	0.020 ± 0.002 [0.508 ± 0.051]
G-3-80 G-3-380	0.406 ± 0.031 [10.31 ± 0.787]	0.437 [11.10]	0.094 ± 0.031 [2.39 ± 0.787]	0.020 ± 0.002 [0.508 ± 0.051]
G-5	0.562 ± 0.062 [14.27 ± 1.57]	0.622 [15.80]	0.188 ± 0.032 [4.78 ± 0.813]	0.032 ± 0.002 [0.813 ± 0.051]
G-5C	0.500 ± 0.062 [12.70 ± 1.57]	0.593 [15.06]	0.218 ± 0.032 [5.54 ± 0.813]	0.040 ± 0.002 [1.02 ± 0.051]
G-10	0.875 ± 0.062 [22.23 ± 1.57]	1.0 [25.4]	0.312 ± 0.032 [7.92 ± 0.813]	0.040 ± 0.002 [1.02 ± 0.051]

Notes

(1) On some standard reel pack methods, the leads may be trimmed to a shorter length than shown

 (2) L_{1 max.} dimension is clean lead to clean lead

MATERIAL SPECIFICATIONS
Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value

Core: Ceramic, beryllium oxide or alumina, depending on resistor model

Coating: Special high temperature silicone

Standard Terminals: 100 % Sn, or 60/40 Sn/Pb coated Copperweld®

End Caps: Stainless steel

Part Marking: DALE, model, wattage (1), value, tolerance, date code

Notes

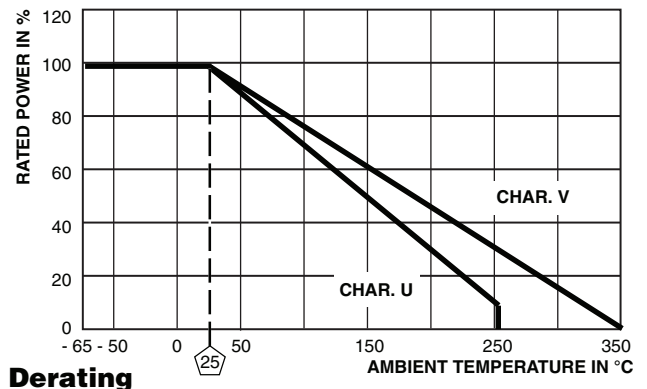
(1) Wattage marked on part will be "U" characteristic

- Military (RW) parts are only available with 60/40 Sn/Pb finish

GN NON-INDUCTIVE

Models of equivalent physical and electrical specifications are available with non-inductive (Aryton-Perry) winding. They are identified by inserting the letter N after G in the model number (GN-5, for example). Two conditions apply:

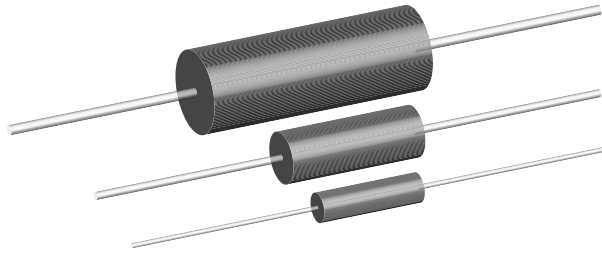
- For GN models, divide maximum resistance values by two
- Body O.D. on GN-5C may exceed that of the G-5C by 0.010"


Derating
TERMINATION

When G resistors will be operated at full rated power, resistance welding or high temperature solder are the recommended termination methods. Termination should be made within 1/2" from end of resistor body.

PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS (CHARACTERISTIC U)
Thermal Shock	Rated power applied until thermally stable, then a min. of 15 min at - 55 °C	± (0.2 % + 0.05 Ω) ΔR
Short Time Overload	5 x power (G-1-80 thru G-5C), 10 x power (G-10) for 5 s	± (0.2 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	1000 V _{rms} , 1 min	± (0.1 % + 0.05 Ω) ΔR
Low Temperature Storage	- 65 °C for 24 h	± (0.2 % + 0.05 Ω) ΔR
High Temperature Exposure	250 h at + 250 °C (Characteristic U)	± (0.5 % + 0.05 Ω) ΔR
Moisture Resistance	MIL-STD-202 Method 106, 7b not applicable	± (0.2 % + 0.05 Ω) ΔR
Shock, Specified Pulse	MIL-STD-202 Method 213, 100 g's for 6 ms, 10 shocks	± (0.1 % + 0.05 Ω) ΔR
Vibration, High Frequency	Frequency varied 10 to 2000 Hz, 20 g peak, 2 directions 6 h each	± (0.1 % + 0.05 Ω) ΔR
Load Life	2000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"	± (0.5 % + 0.05 Ω) ΔR
Terminal Strength	5 to 10 s, 5 or 10 lb pull test (depending on size), torsion test - 3 alternating directions, 360° each	± (0.1 % + 0.05 Ω) ΔR

Wirewound Resistors, Precision Power, Low Value, Commercial, Military, MIL-PRF-49465 Type RLV, Axial Lead



FEATURES

- Ideal for all types of current sensing applications including switching and linear power supplies, instruments and power amplifiers
- Proprietary processing technique produces extremely low resistance values
- Excellent load life stability
- Low temperature coefficient
- Low inductance
- Cooler operation for high power to size ratio



RoHS*
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS					
GLOBAL MODEL	HISTORICAL MODEL	MIL-PRF-49465 TYPE	POWER RATING $P_{25\text{ }^\circ\text{C}}$ W	RESISTANCE RANGE Ω ⁽¹⁾ $\pm 1\%, \pm 3\%, \pm 5\%, \pm 10\%$	TECHNOLOGY
LVR01	LVR-1	-	1	0.01 - 0.1 ⁽²⁾	Metal Strip
LVR03	LVR-3	-	3	0.005 - 0.2	Metal Strip
LVR03...26	LVR-3-26	RLV30 (M4946506)	3	0.01 - 0.2	Metal Strip
LVR05	LVR-5	-	5	0.005 - 0.3	Metal Strip
LVR05...26	LVR-5-26	RLV31 (M4946507)	5	0.01 - 0.3	Metal Strip
LVR10	LVR-10	-	10	0.01 - 0.8	Coil Spacewound

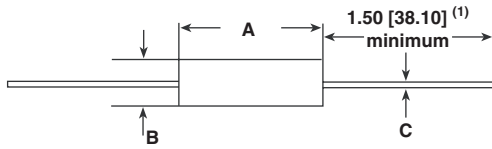
Notes

- ⁽¹⁾ Resistance is measured 3/8" [9.52 mm] from the body of the resistor, or at 1.183" [30.05 mm], 1.315" [33.40 mm], 1.675" [42.545 mm] or 2.575" [65.405 mm] spacing for the LVR01, LVR03, LVR05 and LVR10 respectively
- ⁽²⁾ Standard resistance values are 0.01 Ω , 0.015 Ω , 0.02 Ω , 0.025 Ω , 0.03 Ω , 0.033 Ω , 0.04 Ω , 0.05 Ω , 0.051 Ω , 0.06 Ω , 0.068 Ω , 0.07 Ω , 0.08 Ω , 0.09 Ω and 0.1 Ω with 1 % tolerance. Other resistance values may be available upon request

TECHNICAL SPECIFICATIONS						
PARAMETER	UNIT	LVR01	LVR03	LVR05	LVR10	
Rated Power at + 25 °C	W	1	3	5	10	
Operating Temperature Range	°C	- 65 to + 175		- 65 to + 275		
Dielectric Withstanding Voltage	V_{AC}	1000	1000	1000	1000	
Insulation Resistance	Ω	10 000 M Ω minimum dry				
Short Time Overload	-	5 x rated power for 5 s			10 x rated power for 5 s	
Terminal Strength (minimum)	lb	5	10	10	10	
Temperature Coefficient	ppm/°C	See TCR vs. Resistance Value chart				
Maximum Working Voltage	V	$(P \times R)^{1/2}$				
Weight (maximum)	g	2	2	5	11	

GLOBAL PART NUMBER INFORMATION																
New Global Part Numbering: LVR055L000FS73 (preferred part number format)																
L	V	R	0	5	5	L	0	0	0	F	S	7	3			
GLOBAL MODEL	VALUE		TOLERANCE		PACKAGING						SPECIAL					
LVR01 LVR03 LVR05 LVR10	R = Decimal L = m Ω (values < 0.010 Ω) R1500 = 0.15 Ω 7L000 = 0.007 Ω		D = $\pm 0.5\%$ F = $\pm 1.0\%$ G = $\pm 2.0\%$ H = $\pm 3.0\%$ J = $\pm 5.0\%$ K = $\pm 10.0\%$		E12 = Lead (Pb)-free bulk E03 = Lead (Pb)-free lacer pack (LVR10) E70 = Lead (Pb)-free, tape/reel 1000 pieces (LVR01, 03) E73 = Lead (Pb)-free, tape/reel 500 pieces B12 = Tin/lead bulk L03 = Tin/lead lacer pack (LVR10) S70 = Tin/lead, tape/reel 1000 pieces (LVR01, 03) S73 = Tin/lead, tape/reel 500 pieces						(Dash Number) (up to 3 digits) From 1 - 999 as applicable					
Historical Part Number Example: LVR-5 0.005 Ω 1% S73 (will continue to be accepted for tin/lead product only)																
LVR-5		0.005 Ω			1%			S73								
HISTORICAL MODEL		RESISTANCE VALUE			TOLERANCE CODE			PACKAGING								

* Pb containing terminations are not RoHS compliant, exemptions may apply

DIMENSIONS in inches [millimeters]


MODEL	DIMENSIONS in inches [millimeters]		
	A ± 0.010 [0.254]	B ± 0.010 [0.254]	C ± 0.002 [0.051]
LVR01	0.427 [10.85]	0.115 [2.92]	0.020 [0.508]
LVR03	0.560 [14.22]	0.205 [5.21]	0.032 [0.813]
LVR05	0.925 [23.50]	0.330 [8.38]	0.040 [1.02]
LVR10	1.828 [46.43]	0.392 [9.96]	0.040 [1.02]

Note

(1) On some standard reel pack methods, the leads may be trimmed to a shorter length than shown

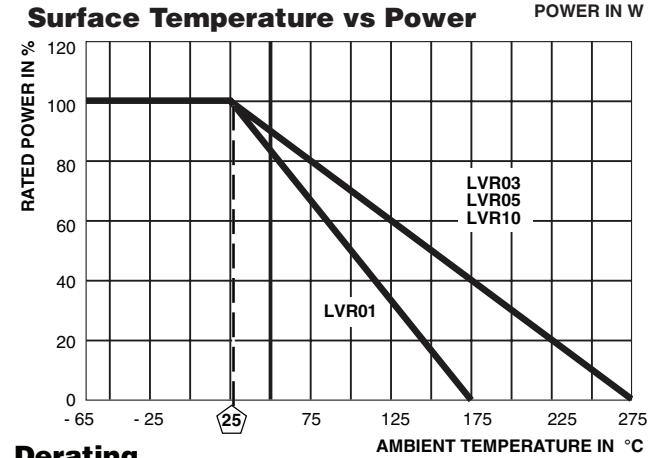
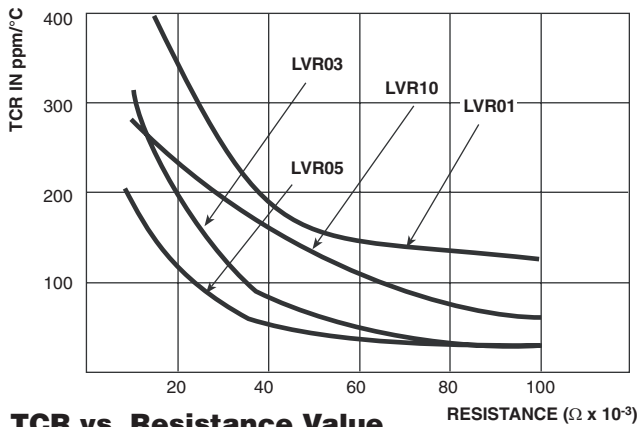
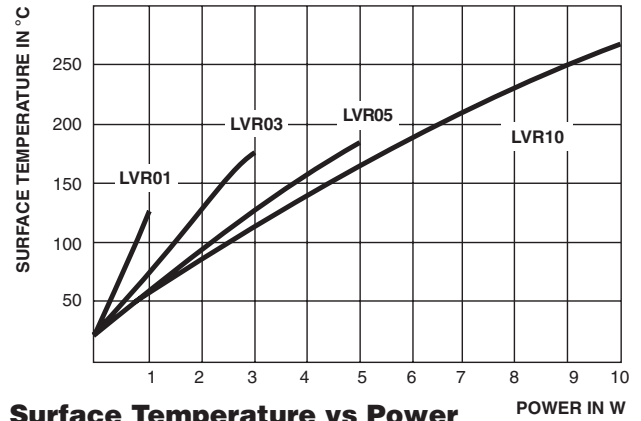
MATERIAL SPECIFICATIONS
Element: Self-supporting nickel-chrome alloy
 (LVR10 also utilizes manganin)

Encapsulation: High temperature mold compound

Terminals: Tinned copper

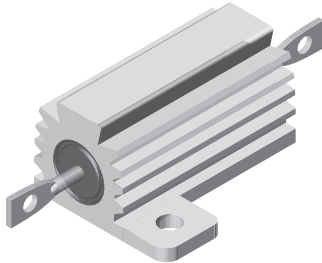
Part Marking: DALE, model, wattage, value, tolerance, date code

The improved TCR characteristics of these LVR models from -55 °C to +125 °C (reference to +25 °C) are as follows:


TCR vs. Resistance Value
Derating

PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS
Thermal Shock	-65 °C to +125 °C, 5 cycles, 15 min at each extrem	± (0.2 % + 0.0005 Ω) ΔR
Short Time Overload	5 x rated power (LVR01, 03, 05), 10 x rated power (LVR10) for 5 s	± (0.5 % + 0.0005 Ω) ΔR
Low Temperature Storage	-65 °C for 24 h	± (0.2 % + 0.0005 Ω) ΔR
High Temperature Exposure	250 h at +275 °C (+175 °C for LVR01)	± (2.0 % + 0.0005 Ω) ΔR
Dielectric Withstanding Voltage	1000 V _{rms} , 1 min	± (0.1 % + 0.0005 Ω) ΔR
Insulation Resistance	MIL-STD-202 Method 302, 100 V	1000 MΩ minimum
Moisture Resistance	MIL-STD-202 Method 106, 100 7b not applicable	± (0.2 % + 0.0005 Ω) ΔR
Shock, Specified Pulse	MIL-STD-202 Method 213, 100 g's for 6 ms, 10 shocks	± (0.1 % + 0.0005 Ω) ΔR
Vibration, High Frequency	Frequency varied 10 to 2000 Hz, 20 g peak, 2 directions 6 h each	± (0.1 % + 0.0005 Ω) ΔR
Load Life	2000 h at rated power, +25 °C, 1.5 h "ON", 0.5 h "OFF"	± (2.0 % + 0.0005 Ω) ΔR
Solderability	ANSI J-STD-002	95 % coverage
Bias Humidity	+85 °C, 85 % RH, 10 % bias, 1000 h	± (1.0 % + 0.0005 Ω) ΔR

Wirewound Resistors, Military, MIL-PRF-18546 Qualified, Type RE, Aluminum Housed, Chassis Mount



FEATURES

- Molded construction for total environmental protection
- Complete welded construction
- Meets applicable requirements of MIL-PRF-18546
- Available in non-inductive styles (type NH) with Aryton-Perry winding for lowest reactive components
- Mounts on chassis to utilize heat-sink effect
- Excellent stability in operation (< 1 % change in resistance)



RoHS*
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS									
GLOBAL MODEL	HISTORICAL MODEL	MIL-PRF-18546 TYPE	POWER RATING $P_{25^\circ\text{C}}$ W		RESISTANCE RANGE MIL. RANGE SHOWN IN BOLD FACE Ω				WEIGHT (typical) g
			DALE	MILITARY	$\pm 0.05\%$, $\pm 0.1\%$	$\pm 0.25\%$	$\pm 0.5\%$	$\pm 1\%$, $\pm 2\%$, $\pm 5\%$	
RH005	RH-5	RE60G	7.5 (5)	5	0.5 - 6.75K	0.1 - 8.6K	0.05 - 8.6K	0.02 - 24.5K 0.10 - 3.32K	3
NH005	NH-5	RE60N	7.5 (5)	5	0.5 - 2.32K	0.1 - 3.27K	0.05 - 3.27K	0.05 - 12.75K 1.0 - 1.65K	3.3
RH010	RH-10	RE65G	12.5 (10)	10	0.5 - 12.7K	0.1 - 16.69K	0.05 - 16.69K	0.01 - 47.1K 0.10 - 5.62K	6
NH010	NH-10	RE65N	12.5 (10)	10	0.5 - 4.45K	0.1 - 5.54K	0.05 - 5.54K	0.05 - 23.5K 1.0 - 2.8K	8.8
RH025	RH-25	RE70G	25	20	0.5 - 25.7K	0.1 - 32.99K	0.05 - 32.99K	0.01 - 95.2K 0.10 - 12.1K	13
NH025	NH-25	RE70N	25	20	0.5 - 9.09K	0.1 - 12.8K	0.05 - 12.8K	0.05 - 47.6K 1.0 - 6.04K	16.5
RH050	RH-50	RE75G	50	30	0.5 - 73.4K	0.1 - 96K	0.05 - 96K	0.01 - 273K 0.10 - 39.2K	28
NH050	NH-50	RE75N	50	30	0.5 - 26K	0.1 - 36.7K	0.05 - 36.7K	0.05 - 136K 1.0 - 19.6K	35
RH100	RH-100	RE77G	100	75	0.5 - 90K	0.1 - 90K	0.05 - 90K	0.05 - 90K 0.05 - 29.4K	350
NH100	NH-100	RE77N	100	75	0.5 - 37.5K	0.1 - 37.5K	0.05 - 37.5K	0.05 - 37.5K 1.0 - 14.7K	385
RH250	RH-250	RE80G	250	120	0.5 - 116K	0.1 - 116K	0.05 - 116K	0.05 - 116K 0.10 - 35.7K	630
NH250	NH-250	RE80N	250	120	0.5 - 48.5K	0.1 - 48.5K	0.05 - 48.5K	0.05 - 48.5K 1.0 - 17.4K	690

Note

- Figures in parentheses on RH-5 and RH-10 indicate wattage printed on parts, new construction allows these resistors to be rated at higher wattage but will only be printed with the higher wattage on customer request

GLOBAL PART NUMBER INFORMATION																
New Global Part Numbering: RH0054R125FC02 (preferred part number format)																
R	H	0	0	5	4	R	1	2	5	F	C	0	2			
GLOBAL MODEL	RESISTANCE VALUE	TOLERANCE CODE	PACKAGING				SPECIAL									
RH005 (See "Standard Electrical Specifications" table above for additional P/N's)	L = Milliohm R = Decimal K = Thousand 8L000 = 0.008 Ω 15R00 = 15 Ω	A = 0.05 % B = 0.1 % C = 0.25 % D = 0.5 % F = 1.0 %	E02 = Lead (Pb)-free, card pack (RH005 - RH050) E01 = Lead (Pb)-free, skin pack (RH100 and RH250) Lead (Pb)-free is not available on RE military type C02 = Tin/lead, card pack (RH005 - RH050) J01 = Tin/lead, skin pack (RH100 and RH250)				(Dash Number) (up to 3 digits) From 1 - 999 as applicable									
Historical Part Number Example: RH-5 4.125 Ω 1% C02 (will continue to be accepted)																
RH-5		4.125 Ω		1%		C02										
HISTORICAL MODEL		RESISTANCE VALUE		TOLERANCE CODE		PACKAGING										

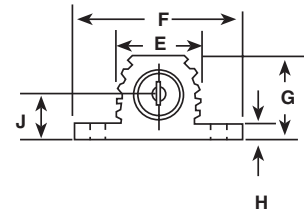
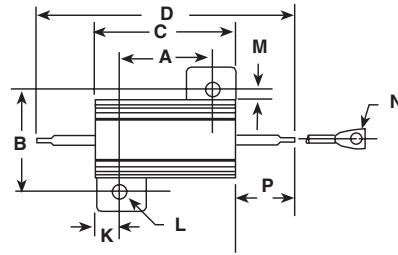
* Pb containing terminations are not RoHS compliant, exemptions may apply



Wirewound Resistors, Military, MIL-PRF-18546 Qualified,
Type RE, Aluminum Housed, Chassis Mount

DIMENSIONS in inches [millimeters]

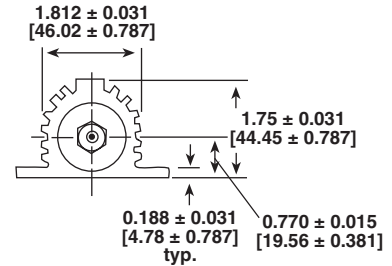
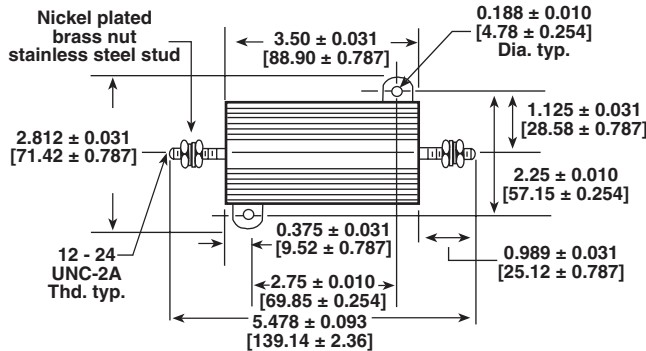
RH-5, -10, -25, -50
NH-5, -10, -25, -50



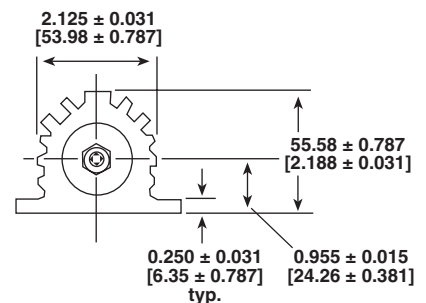
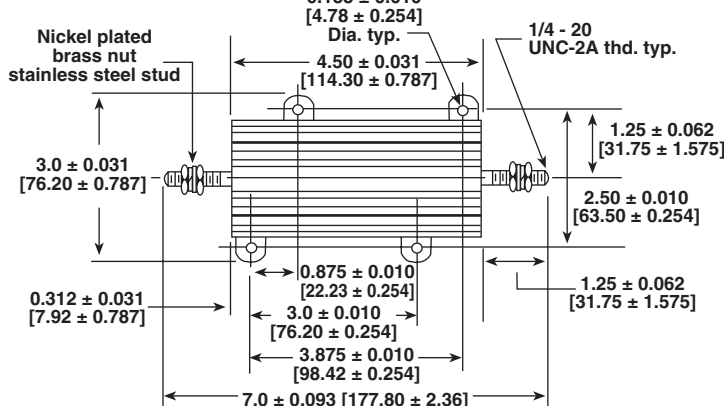
MODEL	DIMENSIONS in inches [millimeters]													
	A	B	C	D	E	F	G	H	J	K	L	M	N	P
RH-5 NH-5	0.444 ± 0.005 [11.28 ± 0.127]	0.490 ± 0.005 [12.45 ± 0.127]	0.600 ± 0.030 [15.24 ± 0.787]	1.125 ± 0.062 [28.58 ± 1.57]	0.334 ± 0.015 [8.48 ± 0.381]	0.646 ± 0.015 [16.41 ± 0.381]	0.320 ± 0.015 [8.13 ± 0.381]	0.065 ± 0.010 [1.65 ± 0.254]	0.133 ± 0.010 [3.38 ± 0.254]	0.078 ± 0.010 [1.98 ± 0.254]	0.093 ± 0.005 [2.36 ± 0.127]	0.078 ± 0.015 [1.98 ± 0.381]	0.050 ± 0.005 [1.27 ± 0.127]	0.266 ± 0.062 [6.76 ± 1.57]
RH-10 NH-10	0.562 ± 0.005 [14.27 ± 0.127]	0.625 ± 0.005 [15.88 ± 0.127]	0.750 ± 0.031 [19.05 ± 0.787]	1.375 ± 0.062 [34.93 ± 1.57]	0.420 ± 0.015 [10.67 ± 0.381]	0.800 ± 0.015 [20.32 ± 0.381]	0.390 ± 0.015 [9.91 ± 0.381]	0.075 ± 0.010 [1.91 ± 0.254]	0.165 ± 0.010 [4.19 ± 0.254]	0.093 ± 0.010 [2.36 ± 0.254]	0.094 ± 0.005 [2.39 ± 0.127]	0.102 ± 0.015 [2.59 ± 0.381]	0.085 ± 0.005 [2.16 ± 0.127]	0.312 ± 0.062 [7.92 ± 1.57]
RH-25 NH-25	0.719 ± 0.005 [18.26 ± 0.127]	0.781 ± 0.005 [19.84 ± 0.127]	1.062 ± 0.031 [26.97 ± 0.787]	1.938 ± 0.062 [49.23 ± 1.57]	0.550 ± 0.015 [13.97 ± 0.381]	1.080 ± 0.015 [27.43 ± 0.381]	0.546 ± 0.015 [13.87 ± 0.381]	0.075 ± 0.010 [1.91 ± 0.254]	0.231 ± 0.010 [5.87 ± 0.254]	0.172 ± 0.010 [4.37 ± 0.254]	0.125 ± 0.005 [3.18 ± 0.127]	0.115 ± 0.015 [2.92 ± 0.381]	0.085 ± 0.005 [2.16 ± 0.127]	0.438 ± 0.062 [11.13 ± 1.57]
RH-50 NH-50	1.562 ± 0.005 [39.67 ± 0.127]	0.844 ± 0.005 [21.44 ± 0.127]	1.968 ± 0.031 [49.99 ± 0.787]	2.781 ± 0.062 [70.64 ± 1.57]	0.630 ± 0.015 [16.00 ± 0.381]	1.140 ± 0.015 [28.96 ± 0.381]	0.610 ± 0.015 [15.49 ± 0.381]	0.088 ± 0.010 [2.24 ± 0.254]	0.260 ± 0.010 [6.60 ± 0.254]	0.196 ± 0.010 [4.98 ± 0.254]	0.125 ± 0.005 [3.18 ± 0.127]	0.107 ± 0.015 [2.72 ± 0.381]	0.085 ± 0.005 [2.16 ± 0.127]	0.438 ± 0.062 [11.13 ± 1.57]

DIMENSIONS in inches [millimeters]

RH-100, NH-100



RH-250, NH-250



TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	RH RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/°C	± 100 for 0.1 Ω to 0.99 Ω, ± 50 for 1 Ω to 9.9 Ω, ± 20 for 10 Ω and above
Dielectric Withstanding Voltage	V _{AC}	1000 for RH/5, RH-10 and RH/25, 2000 for RH/50, 4500 for RH/100 and RH/250
Short Time Overload	-	5 × rated power for 5 s
Maximum Working Voltage	V	$(P \times R)^{1/2}$
Insulation Resistance	Ω	10 000 MΩ minimum dry, 1000 MΩ minimum after moisture test
Terminal Strength	lb	5 minimum for RH-5 and RH-10, 10 minimum for all others
Solderability	-	MIL-PRF-18546 type - meets requirements of ANSI J-STD-002
Operating Temperature Range	°C	- 55 to + 250

POWER RATING

Vishay RH resistor wattage ratings are based on mounting to the following heat sink:

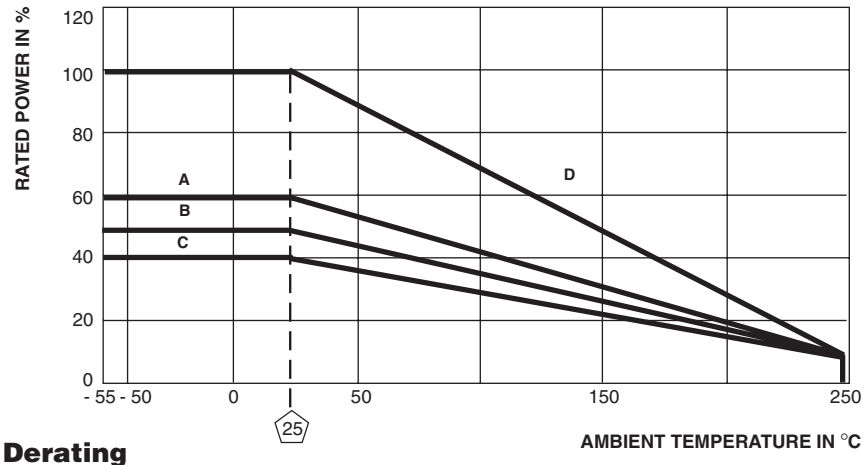
- RH-5 and RH-10: 4" x 6" x 2" x 0.040" thick aluminum chassis (129 sq. in. surface area)
- RH-25: 5" x 7" x 2" x 0.040" thick aluminum chassis (167 sq. in. surface area)
- RH-50: 12" x 12" x 0.059" thick aluminum panel (291 sq. in. surface area)
- RH-100 and RH-250: 12" x 12" x 0.125" thick aluminum panel (294 sq. in. surface area)

AMBIENT TEMPERATURE DERATING

Derating is required for ambient temperatures above 25 °C, see the following graph.

Curves **A**, **B**, **C** apply to operation of unmounted resistors. Curve **D** applies to all types when mounted to specified heat sink.

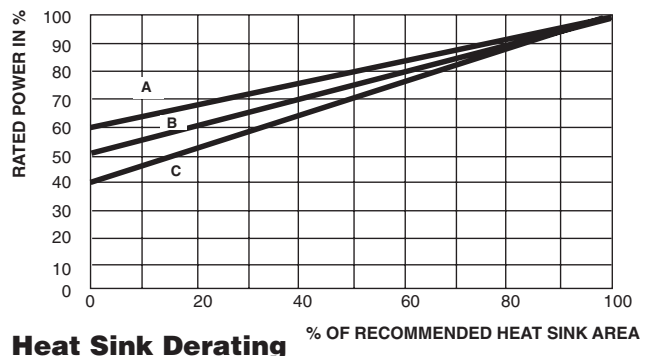
- A** = RH-5 and RH-10 size resistor, unmounted
- B** = RH-25 size resistor, unmounted
- C** = RH-50, RH-100 and RH-250 size resistor, unmounted
- D** = All types mounted to recommended aluminum heat sink



REDUCED HEAT SINK DERATING:

Derating is also required when recommended heat sink area is reduced.

- A** = RH-5 and RH-10 size resistor
- B** = RH-25 size resistor
- C** = RH-50, RH-100 and RH-250 size resistor





MATERIAL SPECIFICATIONS

Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value

Core: Ceramic, steatite or alumina, depending on physical size

Encapsulant: Silicone molded construction

Housing: Aluminum with hard anodic coating

End Caps: Stainless steel

Standard Terminals: For RH-5 through RH-50 size terminal finish - Tin/lead is 60/40 Sn/Pb w/Nickel underplate and Lead (Pb)-free is Ni/Pd/Au, finish is on copper clad steel core terminal. For RH-100 and RH-250 terminals are threaded stainless steel.

Note:

Military (RE) parts are only available with tin/lead finish

Part Marking: DALE, model, wattage, value, tolerance, date code

SPECIAL MODIFICATIONS

A number of special modifications to the aluminum housed resistor style are available upon request. Special modifications include:

- Terminal configurations and materials
- Resistance values and tolerances
- Low resistance temperature coefficient (RTC)
- Housing configuration
- Threaded mounting holes
- Preconditioning and other additional testing

APPLICABLE MIL SPECIFICATIONS

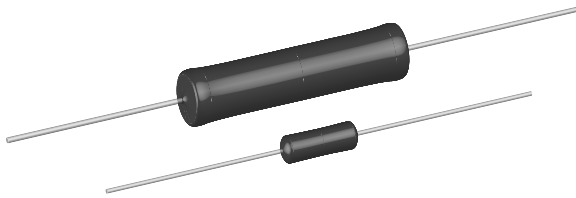
MIL-PRF-18546 is the military specification covering aluminum housed, chassis mount, power resistors. VISHAY RH and NH resistors are listed as qualified on the MIL-PRF-18546 QPL.

NH NON-INDUCTIVE

Models of equivalent physical and electrical specifications are available with non-inductive (Aryton-Perry) winding. They are identified by substituting the letter N for R in the model number (NH-5, for example).

PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS
Thermal Shock	Rated power applied until thermally stable, then a minimum of 15 min at - 55 °C	± (0.5 % + 0.05 Ω) ΔR
Short Time Overload	5 x rated power for 5 s	± (0.5 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	1000 V _{rms} for RH-5, RH-10 and RH-25; 2000 V _{rms} for RH-50 4500 V _{rms} for RH-100 and RH-250; duration 1 min	± (0.2 % + 0.05 Ω) ΔR
Temperature	250 °C for 2 h	± (0.5 % + 0.05 Ω) ΔR
Moisture Resistance	MIL-STD-202 Method 106, 7b not applicable	± (1.0 % + 0.05 Ω) ΔR
Shock, Specified Pulse	MIL-STD-202 Method 213, 100 g's for 6 ms, 10 shocks	± (0.2 % + 0.05 Ω) ΔR
Vibration, High Frequency	Frequency varied 10 to 2000 Hz, 20 g peak, 2 directions 6 h each	± (0.2 % + 0.05 Ω) ΔR
Load Life	1000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"	± (1.0 % + 0.05 Ω) ΔR
Terminal Strength	30 s, 5 pound pull test for RH-5 and RH-10, 10 pound pull test for other sizes, torque test - 24 pound inch for RH-100 and 32 pound inch for RH-250	± (0.2 % + 0.05 Ω) ΔR

Wirewound Resistors, Military/Established Reliability MIL-PRF-39007 Qualified, Type RWR, R Level



FEATURES

- High temperature silicone coated
- Complete welded construction
- Qualified to MIL-PRF-39007
- Available in non-inductive styles (types ESN and EGN) with Aryton-Perry winding for lowest reactive components
- “S” level failure rate available
- **Note:** “Terminal Wire and Winding” type “W” and “Z” are not listed below but are available upon request. Please reference MIL-PRF-39007 QPL for approved “failure rate” and “resistance tolerance/ranges”

STANDARD ELECTRICAL SPECIFICATIONS					
MODEL	MIL-PRF-39007 TYPE	POWER RATING $P_{25^{\circ}\text{C}}$ W	MILITARY RANGE Ω		WEIGHT (typical) g
			$\pm 0.1\%$	$\pm 0.5\%$ and $\pm 1\%$	
EGS-1-80	RWR81S	1	0.499 - 1K	0.1 - 1K	0.21
EGN-1-80	RWR81N	1	0.499 - 499	0.1 - 499	0.21
EGS-2	RWR82S	2	0.499 - 1.3K	0.1 - 1.3K	0.23
EGN-2	RWR82N	2	0.499 - 649	0.1 - 649	0.23
EGS-3-80	RWR80S	2	0.499 - 3.16K	0.1 - 3.16K	0.34
EGN-3-80	RWR80N	2	0.499 - 1.58K	0.1 - 1.58K	0.34
ESS-2A	RWR71S	2	0.499 - 12.1K	0.1 - 12.1K	0.90
ESN-2A	RWR71N	2	0.499 - 6.04K	0.1 - 6.04K	0.90
ESS-2B	RWR89S	3	0.499 - 4.12K	0.1 - 4.12K	0.70
ESN-2B	RWR89N	3	0.499 - 2.05K	0.1 - 2.05K	0.70
ESS-5	RWR74S	5	0.499 - 12.1K	0.1 - 12.1K	4.2
ESN-5	RWR74N	5	0.499 - 6.04K	0.1 - 6.04K	4.2
EGS-10-80	RWR84S	7	0.499 - 12.4K	0.1 - 12.4K	3.6
EGN-10-80	RWR84N	7	0.499 - 6.19K	0.1 - 6.19K	3.6
ESS-10	RWR78S	10	0.499 - 39.2K	0.1 - 39.2K	9.0
ESN-10	RWR78N	10	0.499 - 19.6K	0.1 - 19.6K	9.0

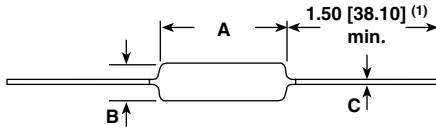
GLOBAL PART NUMBER INFORMATION						
Global/Military Part Numbering: RWR74S49R9FSB12						
<div style="display: flex; justify-content: space-around; font-weight: bold; font-size: 1.2em;"> RWR74S49R9FSB12 </div>						
MIL TYPE	TERMINAL WIRE AND WINDING	RESISTANCE VALUE	TOLERANCE CODE	FAILURE RATE	PACKAGING CODE	
RWR71 RWR74 RWR78 RWR80 RWR81 RWR82 RWR84 RWR89	S = Solderable, inductive N = Solderable, noninductive W = Weldable, inductive ⁽¹⁾ Z = Weldable, noninductive ⁽¹⁾	3 digit significant figure, followed by a multiplier 49R9 = 49.9 Ω 1000 = 100 Ω 1001 = 1000 Ω	B = $\pm 0.1\%$ D = $\pm 0.5\%$ F = $\pm 1.0\%$	M = 1.0%/1000 h P = 0.1%/1000 h R = 0.01%/1000 h S = 0.001%/1000 h	B12 = Bulk pack S70 = Tape/reel (smaller than 5 W) S73 = Tape/reel (5 W and higher) BSL = Bulk pack, single lot date code RSL = Tape/reel, single lot date code	

Note:

⁽¹⁾ Note that “W” and “Z” are not listed above but are available, see MIL-PRF-39007 QPL for available resistance values



DIMENSIONS in inches [millimeters]



MATERIAL SPECIFICATIONS

Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value

Core: Ceramic, beryllium oxide, steatite or alumina, depending on power requirement

Coating: Special high temperature silicone

Terminal and Winding: The terminal and the winding are identified by a letter symbol in the military type designation.

Military symbol:

- S = Solderable, inductively wound
- W = Weldable, inductively wound
- N = Solderable, non-inductively wound
- Z = Weldable, non-inductively wound

Terminals: Solderable - Tinned Copperweld®
Weldable - bare nickel per MIL-STD-1276, Type N-1

End Caps: Stainless steel

Part Marking: Source code, JAN, military PIN, date/lot code

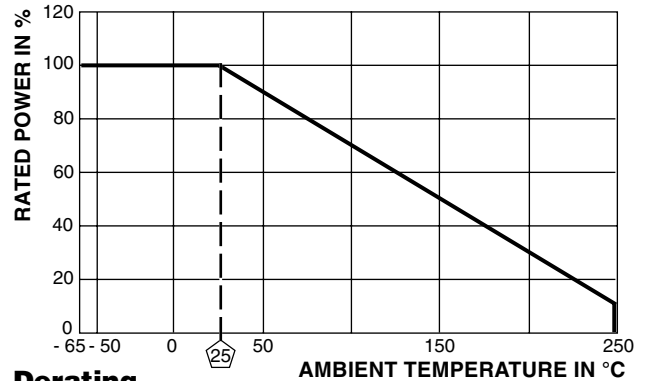
APPLICABLE MIL-SPECIFICATION

MIL-PRF-39007: This is the military specification covering axial lead established reliability power wirewound resistors. Vishay Dale ESS, ESW, EGS, EGW, ESN and EGN resistors meet or exceed the electrical, environmental and dimensional requirements of this specification.

MIL-PRF-39007 MODEL	DIMENSIONS in inches [millimeters]		
	A	B	C
RWR81	0.250 ± 0.031 [6.35 ± 0.787]	0.085 ± 0.020 [2.16 ± 0.508]	0.020 ± 0.0015 [0.508 ± 0.038]
RWR82	0.312 ± 0.016 [7.92 ± 0.406]	0.078 + 0.016 - 0.031 [1.98 + 0.406 - 0.787]	0.020 ± 0.0015 [0.508 ± 0.038]
RWR80	0.406 ± 0.031 [10.31 ± 0.787]	0.094 ± 0.031 [2.39 ± 0.787]	0.020 ± 0.0015 [0.508 ± 0.038]
RWR71	0.812 ± 0.062 [20.62 ± 1.58]	0.187 ± 0.031 [4.75 ± 0.787]	0.032 ± 0.002 [0.813 ± 0.051]
RWR89	0.560 ± 0.062 [14.22 ± 1.58]	0.187 ± 0.031 [4.75 ± 0.787]	0.032 ± 0.002 [0.813 ± 0.051]
RWR74	0.875 ± 0.062 [22.23 ± 1.58]	0.312 ± 0.031 [7.92 ± 0.787]	0.040 ± 0.002 [1.02 ± 0.051]
RWR84	0.875 ± 0.062 [22.23 ± 1.58]	0.312 ± 0.031 [7.92 ± 0.787]	0.040 ± 0.002 [1.02 ± 0.051]
RWR78	1.780 ± 0.062 [45.21 ± 1.58]	0.312 ± 0.031 [7.92 ± 0.787]	0.040 ± 0.002 [1.02 ± 0.051]

Note

(1) On some standard reel pack methods, the leads may be trimmed to a shorter length than shown



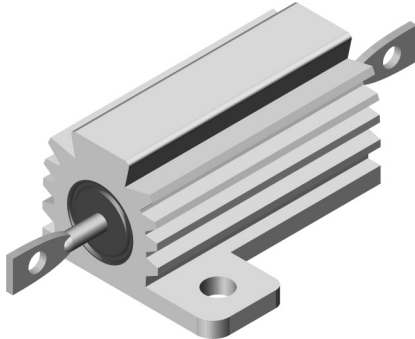
TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	RWR RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/°C	± 650 for 0.1 Ω to 0.499 Ω, ± 400 for 0.505 Ω to 1 Ω, ± 50 for 1.1 Ω to 10 Ω, ± 20 for 10 Ω and above
Dielectric Withstanding Voltage	V _{AC}	500 minimum for 2 W and smaller, 1000 minimum for 3 W and larger
Short Time Overload	-	5 x rated power for 5 s for 3 W size and smaller, 10 x rated power for 5 s for 5 W size and greater
Maximum Working Voltage	V	(P x R) ^{1/2}
Insulation Resistance	-	1000 MΩ minimum dry, 100 MΩ minimum after moisture test
Terminal Strength	lb	5 minimum for 2 W and smaller, 10 minimum for 3 W and larger
Solderability	-	Meets requirements of ANSI J-STD-002
Operating Temperature Range	°C	- 65 to + 250

PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS
Thermal Shock	MIL-STD-2.2, Method 303	± (0.2 % + 0.005 Ω) ΔR
Short Time Overload	5 x rated power (RWR71, 80, 81, 89, 82), 10 x rated power (RWR74, 78, 84) for 5 s	± (0.2 % + 0.005 Ω) ΔR
Dielectric Withstanding Voltage	500 V _{rms} (RWR80, 81, 82), 1000 V _{rms} (RWR71, 74, 78, 84, 89), 1 min duration	± (0.1 % + 0.005 Ω) ΔR
Low Temperature Storage	- 65 °C for 24 h	± (0.1 % + 0.005 Ω) ΔR
High Temperature Exposure	250 °C for 2000 h	± (1.0 % + 0.005 Ω) ΔR
Moisture Resistance	MIL-STD-202, Method 106	± (0.2 % + 0.005 Ω) ΔR
Shock, Specified Pulse	MIL-STD-202, Method 205, condition C	± (0.1 % + 0.005 Ω) ΔR
Vibration, High Frequency	MIL-STD-202, Method 204, condition D	± (0.1 % + 0.005 Ω) ΔR
Load Life	2000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"	± (0.5 % + 0.005 Ω) ΔR
Extended Life	10 000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"	± (1.0 % + 0.005 Ω) ΔR
Terminal Strength	MIL-STD-202, Method 211, condition A and C 5 pound (RWR80, 81, 82), 10 pound (RWR71, 74, 78, 84, 89)	± (0.1 % + 0.005 Ω) ΔR

Note

• For resistance values above 100 Ω, test limit is ± 1.0 %

Wirewound Resistors, Military/Established Reliability MIL-PRF-39009 Qualified, Type RER, R Level



FEATURES

- Aluminum heat sink housing
- Molded construction for total environmental protection
- Qualified to MIL-PRF-39009
- Complete welded construction
- Available in non-inductive styles (type ENH) with Aryton-Perry winding for lowest reactive components
- Mounts on chassis to utilize heat-sink effect

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	MIL-PRF-39009 TYPE	POWER RATING $P_{25\text{ }^\circ\text{C}}$ W		MILITARY RESISTANCE RANGE $\pm 1\%$ Ω	WEIGHT (typical) g
		MOUNTED	FREE AIR		
ENH-5	RER40	5	3	1 - 1.65K	3.3
ENH-10	RER45	10	6	1 - 2.8K	8.8
ENH-25	RER50	20	8	1 - 6.04K	16.5
ENH-50	RER55	30	10	1 - 4.99K	35
ERH-5	RER60	5	3	0.10 - 3.32K	3
ERH-10	RER65	10	6	0.10 - 5.62K	6
ERH-25	RER70	20	8	0.10 - 12.1K	13
ERH-50	RER75	30	10	0.10 - 39.2K	28

TECHNICAL SPECIFICATIONS

PARAMETER	UNIT	ERH, ENH RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/ $^\circ\text{C}$	± 100 for $0.1\ \Omega$ to $0.99\ \Omega$, ± 50 for $1\ \Omega$ to $19.9\ \Omega$, ± 20 for $20\ \Omega$ and above
Dielectric Withstanding Voltage	V_{AC}	1000 for ERH-5, ERH-10 and ERH-25, 2000 for ERH-50
Short Time Overload	-	5 x rated power for 5 s
Maximum Working Voltage	V	$(P \times R)^{1/2}$
Insulation Resistance	Ω	10 000 M Ω minimum dry, 1000 M Ω minimum after moisture test
Terminal Strength	lb	5 pull for ERH-5 and ERH-10, 10 pull for ERH-25 and ERH-50
Solderability	-	Meets requirements of ANSI J-STD-002
Operating Temperature Range	$^\circ\text{C}$	- 55 to + 250

GLOBAL PART NUMBER INFORMATION

Global/Military Part Numbering: RER65F1001RC02

R
E
R
6
5
F
1
0
0
1
R
C
0
2

MIL TYPE
RER40
RER45
RER50
RER55
RER60
RER65
RER70
RER75

TOLERANCE CODE
F = $\pm 1.0\%$

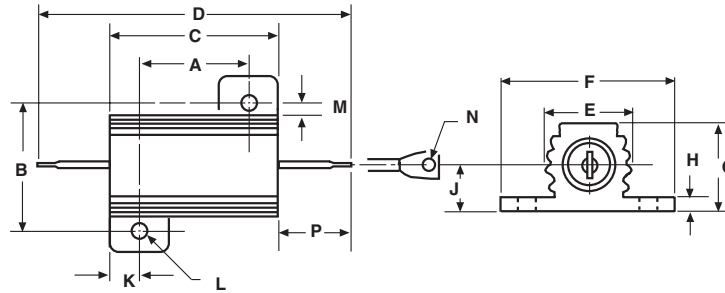
RESISTANCE VALUE
3 digit significant figure, followed by a multiplier
49R9 = 49.9 Ω
1000 = 100 Ω
1001 = 1000 Ω

FAILURE RATE
M = 1.0 %/1000 h
P = 0.1 %/1000 h
R = 0.01 %/1000 h

PACKAGING CODE
C02 = Tin/lead, card pack
CSL = Tin/lead, card pack, single lot date code



DIMENSIONS



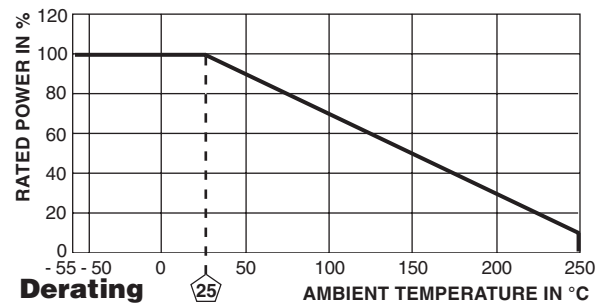
MODEL	DIMENSIONS in inches [millimeters]													
	A	B	C	D	E	F	G	H	J	K	L	M	N	P
ERH-5 ENH-5	0.444 ± 0.005 [11.280 ± 0.127]	0.490 ± 0.005 [12.450 ± 0.127]	0.600 ± 0.031 [15.240 ± 0.787]	1.125 ± 0.062 [28.580 ± 1.570]	0.334 ± 0.015 [8.480 ± 0.381]	0.646 ± 0.015 [16.410 ± 0.381]	0.320 ± 0.015 [8.130 ± 0.381]	0.065 ± 0.010 [1.650 ± 0.254]	0.133 ± 0.010 [3.380 ± 0.254]	0.078 ± 0.010 [1.980 ± 0.254]	0.093 ± 0.005 [2.360 ± 0.127]	0.078 ± 0.015 [1.980 ± 0.381]	0.050 ± 0.005 [1.270 ± 0.127]	0.266 ± 0.062 [6.760 ± 1.570]
ERH-10 ENH-10	0.562 ± 0.005 [14.270 ± 0.127]	0.625 ± 0.005 [15.880 ± 0.127]	0.750 ± 0.031 [19.050 ± 0.787]	1.375 ± 0.062 [34.930 ± 1.570]	0.420 ± 0.015 [10.670 ± 0.381]	0.800 ± 0.015 [20.320 ± 0.381]	0.390 ± 0.015 [9.910 ± 0.381]	0.075 ± 0.010 [1.900 ± 0.254]	0.165 ± 0.010 [4.190 ± 0.254]	0.093 ± 0.010 [2.360 ± 0.254]	0.094 ± 0.005 [2.390 ± 0.127]	0.102 ± 0.015 [2.590 ± 0.381]	0.085 ± 0.005 [2.160 ± 0.127]	0.312 ± 0.062 [7.920 ± 1.570]
ERH-25 ENH-25	0.719 ± 0.005 [18.260 ± 0.127]	0.781 ± 0.005 [19.840 ± 0.127]	1.062 ± 0.031 [26.970 ± 0.787]	1.938 ± 0.062 [49.230 ± 1.570]	0.550 ± 0.015 [13.970 ± 0.381]	1.080 ± 0.015 [27.430 ± 0.381]	0.546 ± 0.015 [13.870 ± 0.381]	0.075 ± 0.010 [1.900 ± 0.254]	0.231 ± 0.010 [5.870 ± 0.254]	0.172 ± 0.010 [4.370 ± 0.254]	0.125 ± 0.005 [3.180 ± 0.127]	0.115 ± 0.015 [2.920 ± 0.381]	0.085 ± 0.005 [2.160 ± 0.127]	0.438 ± 0.062 [11.130 ± 1.570]
ERH-50 ENH-50	1.562 ± 0.005 [39.670 ± 0.127]	0.844 ± 0.005 [21.440 ± 0.127]	1.968 ± 0.031 [49.990 ± 0.787]	2.781 ± 0.062 [70.640 ± 1.570]	0.630 ± 0.015 [16.000 ± 0.381]	1.140 ± 0.015 [28.960 ± 0.381]	0.610 ± 0.015 [15.490 ± 0.381]	0.088 ± 0.010 [2.240 ± 0.254]	0.260 ± 0.010 [6.600 ± 0.254]	0.196 ± 0.010 [4.980 ± 0.254]	0.125 ± 0.005 [3.180 ± 0.127]	0.107 ± 0.015 [2.720 ± 0.381]	0.085 ± 0.005 [2.160 ± 0.127]	0.438 ± 0.062 [11.130 ± 1.570]

MATERIAL SPECIFICATIONS

- Element:** Copper-nickel alloy or nickel-chrome alloy, depending on resistance value
- Core:** Ceramic, steatite or alumina, depending on physical size
- Encapsulant:** Silicone molded construction
- Housing:** Aluminum with hard anodic coating
- End Caps:** Stainless steel
- Standard Terminals:** Tinned Copperweld®
- Part Marking:** Source code, JAN, military PIN, date/lot code

POWER RATING

Vishay ERH and ENH resistor wattage ratings are based on mounting to the proper heat sink.
 ERH-5 and ERH-10: 4" x 6" x 2" x 0.040" thick aluminum chassis
 ERH-25 and ERH-50: 5" x 7" x 2" x 0.040" thick aluminum chassis



APPLICABLE MIL SPECIFICATION

MIL-PRF-39009: This is the military specification covering housed chassis mount established reliability power wirewound resistors. Vishay ERH and ENH resistors are listed as qualified on the MIL-PRF-39009 QPL.

PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS
Low Temperature Operation	Apply rated power until thermal stability, remove power subject to air temperature of - 55 °C for 15 to 30 min	± (0.5 % + 0.01 Ω) ΔR
Short Time Overload	5 x rated power for 5 s	± (0.3 % + 0.01 Ω) ΔR
Dielectric Withstanding Voltage	1000 V _{rms} (RER 40, 45, 50, 60, 65, 70), 2000 V _{rms} (RER55 and 75), 1 min duration	± (0.2 % + 0.01 Ω) ΔR
Low Temperature Storage	- 55 °C for 24 h	± (0.3 % + 0.01 Ω) ΔR
High Temperature Exposure	250 °C for 2000 h	± (1.0 % + 0.01 Ω) ΔR
Moisture Resistance	MIL-STD-202, Method 106	± (0.5 % + 0.01 Ω) ΔR
Shock, Specified Pulse	MIL-STD-202, Method 213, condition 1	± (0.2 % + 0.01 Ω) ΔR
Vibration, High Frequency	MIL-STD-202, Method 204, condition D	± (0.2 % + 0.01 Ω) ΔR
Load Life	2000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"	± (1.0 % + 0.01 Ω) ΔR
Extended Life	10 000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"	± (2.0 % + 0.01 Ω) ΔR
Terminal Strength	MIL-STD-202, Method 211, condition A 5 pound (RER40, 45, 60, 65), 10 pound (RER50, 55, 70, 75)	± (0.2 % + 0.01 Ω) ΔR

MILITARY PART ORDERING EXAMPLES

To help in ordering, the following are examples of military part numbers cross-referenced to Vishay Dale part numbers. For complete information on military part numbering, consult the specific military specification.

MIL-PRF-26 (Basic [RW]) (Established reliability alternate MIL-PRF-39007 [RWR])

Global/Military Part Numbering: **RW80U49RB12**
RW67V101S73

R **W** **8** **0** **U** **4** **9** **R** **9** **F** **B** **1** **2**

MIL TYPE	CHARACTERISTIC	RESISTANCE VALUE	TOLERANCE CODE	PACKAGING CODE
RW67 RW68 RW69 RW70 RW74 RW78 RW79 RW80 RW81	U = Max. hotspot 275 °C V = Max. hotspot 350 °C	U Characteristic 3 digit significant figure, followed by a multiplier 49R9 = 49.9 Ω 1000 = 100 Ω 1001 = 1000 Ω V Characteristic 2digit significant figure, followed by a multiplier 4R7 = 4.7 Ω 102 = 1000 Ω	Tolerance for "U" Characteristic only B = ± 0.1 % D = ± 0.5 % F = ± 1.0 % Tolerance for "V" characteristic is not listed and is as specified by MIL-PRF-26	B12 = Bulk pack S70 = Tape/reel (smaller than 5 W) S73 = Tape/reel (5 W and higher)

MIL-PRF-18546 (Basic [RE]) (Established reliability alternate MIL-PRF-39009 [RER])

Global/Military Part Numbering: **RE77N1302J01**

R **E** **7** **7** **N** **1** **3** **0** **2** **J** **0** **1**

MIL TYPE	CHARACTERISTIC	RESISTANCE VALUE	PACKAGING CODE
RE60 RE65 RE70 RE75 RE77 RE80	G = Inductive N = Noninductive • Only tolerance available for RE type is ± 1 %	3 digit significant figure, followed by a multiplier 49R9 = 49.9 Ω 1000 = 100 Ω 1001 = 1000 Ω 1302 = 13 000 Ω	C02 = Card pack J01 = Skin pack

MIL-PRF-39009 (Established Reliability [RER]) (Basic is MIL-PRF-18549 [RE])

Global/Military Part Numbering: **RER65F1001RC02**

R **E** **R** **6** **5** **F** **1** **0** **0** **1** **R** **C** **0** **2**

MIL TYPE	TOLERANCE CODE	RESISTANCE VALUE	FAILURE RATE	PACKAGING CODE
RER40 RER45 RER50 RER55 RER60 RER65 RER70 RER75	F = ± 1.0 %	3 digit significant figure, followed by a multiplier 49R9 = 49.9 Ω 1000 = 100 Ω 1001 = 1000 Ω	M = 1.0 %/1000 h P = 0.1 %/1000 h R = 0.01 %/1000 h	C02 = Tin/lead, card pack

MIL-PRF-39007 (Established Reliability [RWR]) (Basic is MIL-PRF-26 [RW])

Global/Military Part Numbering: **RWR74S49R9FSB12**

R **W** **R** **7** **4** **S** **4** **9** **R** **9** **F** **S** **B** **1** **2**

MIL TYPE	TERMINAL WIRE AND WINDING	RESISTANCE VALUE	TOLERANCE CODE	FAILURE RATE	PACKAGING CODE
RWR71 RWR74 RWR78 RWR80 RWR81 RWR82 RWR84 RWR89	S = Solderable, inductive N = Solderable, noninductive W = Weldable, inductive Z = Weldable, noninductive	3 digit significant figure, followed by a multiplier 49R9 = 49.9 Ω 1000 = 100 Ω 1001 = 1000 Ω	B = ± 0.1 % D = ± 0.5 % F = ± 1.0 %	M = 1.0 %/1000 h P = 0.1 %/1000 h R = 0.01 %/1000 h S = 0.001 %/1000 h	B12 = Bulk pack S70 = Tape/reel (smaller than 5 W) S73 = Tape/reel (5 W and higher)

MIL-PRF-49465 (Basic [RLV]) (Established reliability-none)

Global/Military Part Numbering: **M4946506TR0100FB12**

M **4** **9** **4** **6** **5** **0** **6** **T** **R** **0** **1** **0** **0** **F** **B** **1** **2**

MIL TYPE	SPEC. SHEET NUMBER	CHARACTERISTIC	RESISTANCE VALUE	TOLERANCE CODE	PACKAGING CODE
M49465	01 (RLV10) 06 (RLV30) 07 (RLV31)	T	R0100 = 0.01 Ω R1000 = 0.10 Ω	F = ± 1.0 % H = ± 3.0 % J = ± 5.0 %	B12 = Bulk pack S70 = Tape/reel (RLV30) S73 = Tape/reel (RLV31) J01 = Skin pack (RLV10)



STANDARD RESISTANCE VALUES FOR THE 10 TO 100 DECADE							
(B) 0.1 ⁽¹⁾ (D) 0.5	(F) 1.0	(B) 0.1 ⁽¹⁾ (D) 0.5	(F) 1.0	(B) 0.1 ⁽¹⁾ (D) 0.5	(F) 1.0	(B) 0.1 ⁽¹⁾ (D) 0.5	(F) 1.0
10.0	10.0	17.8	17.8	31.6	31.6	56.2	56.2
10.1		18.0	18.0	32.0		56.9	
10.2	10.2	18.2	18.2	32.4	32.4	57.6	57.6
10.4		18.4		32.8		58.3	
10.5	10.5	18.7	18.7	33.2	33.2	59.0	59.0
10.6		18.9		33.6		59.7	
10.7	10.7	19.1	19.1	34.0	34.0	60.4	60.4
10.9		19.3		34.4		61.2	
11.0	11.0	19.6	19.6	34.8	34.8	61.9	61.9
11.1		19.8		35.2		62.6	
11.3	11.3	20.0	20.0	35.7	35.7	63.4	63.4
11.4		20.3		36.1		64.2	
11.5	11.5	20.5	20.5	36.5	36.5	64.9	64.9
11.7		20.8		37.0		65.7	
11.8	11.8	21.0	21.0	37.4	37.4	66.5	66.5
12.0		21.3		37.9		67.3	
12.1	12.1	21.5	21.5	38.3	38.3	68.1	68.1
12.3		21.8		38.8		69.0	
12.4	12.4	22.1	22.1	39.2	39.2	69.8	69.8
12.6		22.3		39.7		70.6	
12.7	12.7	22.6	22.6	40.2	40.2	71.5	71.5
12.9		22.9		40.7		72.3	
13.0	13.0	23.2	23.2	41.2	41.2	73.2	73.2
13.2		23.4		41.7		74.1	
13.3	13.3	23.7	23.7	42.2	42.2	75.0	75.0
13.5		24.0		42.7		75.9	
13.7	13.7	24.3	24.3	43.2	43.2	76.8	76.8
13.8		24.6		43.7		77.7	
14.0	14.0	24.9	24.9	44.2	44.2	78.7	78.7
14.2		25.2		44.8		79.6	
14.3	14.3	25.5	25.5	45.3	45.3	80.6	80.6
14.5		25.8		45.9		81.6	
14.7	14.7	26.1	26.1	46.4	46.4	82.5	82.5
14.9		26.4		47.0		83.5	
15.0	15.0	26.7	26.7	47.5	47.5	84.5	84.5
15.2		27.1		48.1		85.6	
15.4	15.4	27.4	27.4	48.7	48.7	86.6	86.6
15.6		27.7		49.3		87.6	
15.8	15.8	28.0	28.0	49.9	49.9	88.7	88.7
16.0		28.4		50.5		89.8	
16.2	16.2	28.7	28.7	51.1	51.1	90.9	90.9
16.4		29.1		51.7		92.0	
16.5	16.5	29.4	29.4	52.3	52.3	93.1	93.1
16.7		29.8		53.0		94.2	
16.9	16.9	30.1	30.1	53.6	53.6	95.3	95.3
17.2		30.5		54.2		96.5	
17.4	17.4	30.9	30.9	54.9	54.9	97.6	97.6
17.6		31.2		55.6		98.8	

Note:

⁽¹⁾ Listing of resistance values for the B and D tolerance does not guarantee that all of these resistance values are available for all resistor models

Wirewound Resistors, Open Air, Current Sense, Low Value



FEATURES

- Open air design
- Low resistance values for all types of current sensing, voltage division and pulse applications including switching and linear supplies, instrumentation and power amplifiers
- All welded construction
- Solid metal nickel-chrome or copper-nickel alloy resistive element
- Solderable terminations
- Very low inductance
- Lead (Pb)-free version is RoHS compliant



RoHS*
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS			
MODEL	POWER RATING $P_{70\text{ }^\circ\text{C}}$ W	TOLERANCE $\pm \%$	RESISTANCE RANGE Ω
SR1	1.0	1, 5	0.005 - 0.03
SR3	3.0	1, 5	0.005 - 0.05
SR5	5.0	1, 5	0.004 - 0.05

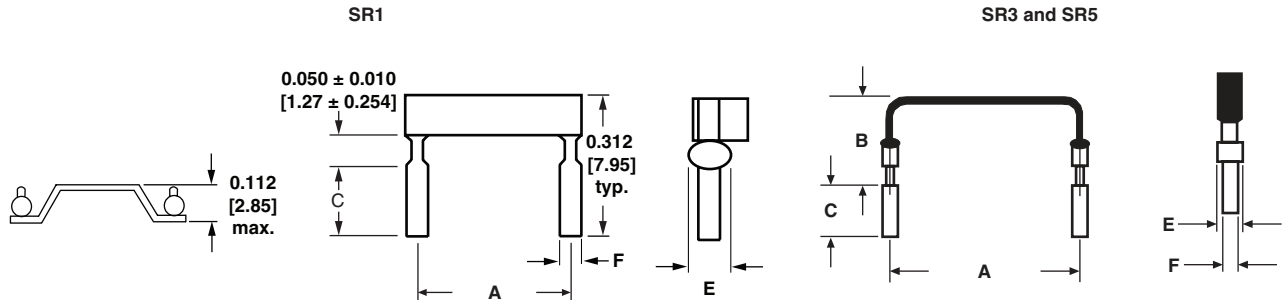
TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	SR Resistor Characteristics
Temperature Coefficient	ppm/ $^\circ\text{C}$	0.004 Ω - 0.005 Ω = \pm 300 0.0051 Ω - 0.0099 Ω = \pm 175 0.01 Ω - 0.05 Ω = \pm 100
Operating Temperature Range	$^\circ\text{C}$	- 65 to + 275
Maximum Continuous Current	A	$(P/R)^{1/2}$

SAP ORDERING INFORMATION (Part Number 18 digits)

Global Part Numbering Example: SR55L000JE14

S	R	5	5	L	0	0	0	J	E	1	4			
GLOBAL MODEL		VALUE			TOLERANCE			PACKAGING		SPECIAL				
SR1 SR3 SR5		L = m Ω (below 0.01 Ω) R = Decimal 5L000 = 0.005 Ω R0100 = 0.01 Ω			F = \pm 1.0 % J = \pm 5.0 % K = \pm 10 %			E14 = Lead (Pb)-free bulk B14 = Tin/lead bulk		(Dash Number) (up to 3 digits) From 1 - 999 as applicable				

* Pb containing terminations are not RoHS compliant, exemptions may apply

DIMENSIONS in inches [millimeters]


MODEL	DIMENSIONS in inches [millimeters]				
	A	B	C	E	F
SR1	0.450 + 0.020 [11.43 + 0.508]	-	0.125 ± 0.030 [3.18 ± 0.762]	0.070 [1.78]	0.040 ± 0.002 [1.02 ± 0.051]
SR3	0.600 + 0.040/- 0.020 [15.24 + 1.020/- 0.508]	1.0 maximum [25.4 maximum]		0.065 + 0.010/- 0.005 [1.65 + 0.254/- 0.127]	
SR5	0.800 + 0.040/- 0.020 [20.32 + 1.020/- 0.508]				

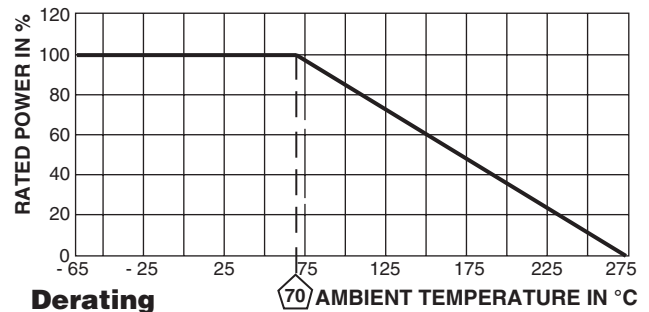
MATERIAL SPECIFICATIONS

Element: Nickel-chrome or copper-nickel alloy depending on resistance value

Terminals: Tinned copper

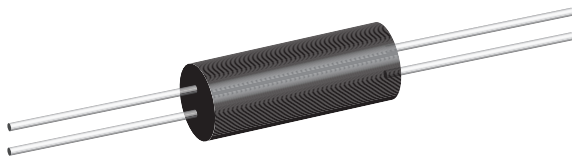
Encapsulation: None

Marking: None



PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS
Temperature Cycling	- 55 °C to + 125 °C, 1000 cycles, 15 min at each extreme	± (1.0 % + 0.0005 Ω) ΔR
Low Temperature Storage	- 65 °C for 24 h	± (0.5 % + 0.0005 Ω) ΔR
High Temperature Exposure	1000 h at + 275 °C	± (2.0 % + 0.0005 Ω) ΔR
Bias Humidity	+ 85 °C, 85 % RH, 10 % bias, 1000 h	± (1.0 % + 0.0005 Ω) ΔR
Mechanical Shock	100 g's for 11 ms, 5 pulses	± (0.2 % + 0.0005 Ω) ΔR
Vibration	Frequency varied 10 to 2000 Hz in 1 min, 3 directions, 12 h	± (0.2 % + 0.0005 Ω) ΔR
Load Life	1000 h at rated power, + 70 °C, 1.5 h "ON", 0.5 h "OFF"	± (2.0 % + 0.0005 Ω) ΔR
Resistance to Solder Heat	+ 260 °C solder, 10 - 12 s dwell, 25 mm/s emergence	± (0.5 % + 0.0005 Ω) ΔR
Moisture Resistance	MIL-STD-202 Method 106, 0 % power, 7a and 7b not required	± (0.5 % + 0.0005 Ω) ΔR

Wirewound Resistors, Molded Style, Current Shunts, Very Low Value, Four Terminal



FEATURES

- Molded four-terminal resistors for specialized applications
- Extremely low resistance values for current sensing applications
- Precision resistance tolerance
- Low temperature coefficients
- Complete welded construction

STANDARD ELECTRICAL SPECIFICATIONS				
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING ⁽¹⁾ $P_{25\text{ }^\circ\text{C}}$ W	RESISTANCE RANGE Ω $\pm 1\%$	WEIGHT (typical) g
SPU050	SPU-50	1	0.001 - 0.060	2.5
SPU051	SPU-51	2	0.001 - 0.060	3.7
SPU052	SPU-52	4	0.001 - 0.200	4.8
SPU053	SPU-53	5	0.010 - 0.500	10.8

Notes

⁽¹⁾ Wattage rating is limited to 25 A maximum

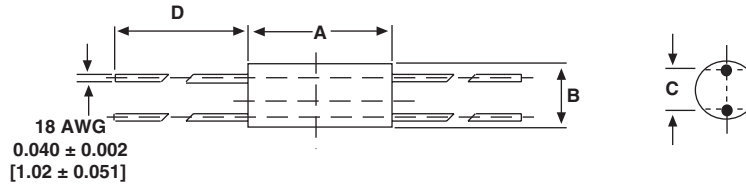
- Resistance tolerance available is 0.1 %, 0.25 %, 0.5 %, 1.0 %, 3.0 % and 5.0 % depending on resistor physical design and resistance value

TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	SPU MOLDED STYLE RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/°C	- 100 (- 10 °C to + 80 °C)
Dielectric Withstanding Voltage	V_{AC}	500 minimum
Short Time Overload	-	5 x power for 5 s, limited to 25 A maximum
Maximum Working Voltage	V	$(P \times R)^{1/2}$
Insulation Resistance	Ω	10 000 M Ω minimum dry
Operating Temperature Range	°C	SPU-50 and SPU-51 = - 55 to + 175, SPU-52 and SPU-53 = - 55 to + 275

GLOBAL PART NUMBER INFORMATION				
New Global Part Numbering: SPU052R10000FD (preferred part numbering format)				
S	P	U	0 5 2	R 1 0 0 0 0 F D
GLOBAL MODEL SPU052	RESISTANCE VALUE L = m Ω (below 0.01 Ω) R = Decimal 5L0000 = 0.005 Ω R10000 = 0.10 Ω	TOLERANCE CODE F = $\pm 1.0\%$ J = $\pm 5.0\%$	PACKAGING E* = Lead (Pb)-free, bulk D = Tin/lead, bulk	SPECIAL (Dash Number) (up to 2 digits) From 1 - 99 as applicable
* Lead (Pb)-free will not be available until Q1 2005				
Historical Part Number Example: SPU-52 0.1 Ω 1 % S51 (will continue to be accepted)				
SPU-52	0.100 Ω	1 %	S51	
HISTORICAL MODEL	RESISTANCE VALUE	TOLERANCE CODE	PACKAGING	



DIMENSIONS in inches [millimeters]



GLOBAL MODEL	DIMENSIONS in inches [millimeters]			
	A	B	C	D
SPU050	0.660 ± 0.010 [16.76 ± 0.25]	0.312 ± 0.010 [7.92 ± 0.25]	0.200 ± 0.015 [5.08 ± 0.38]	1.000 + 0.25 - 0.125 [25.40 + 6.35 - 3.17]
SPU051	0.790 ± 0.010 [20.06 ± 0.25]	0.375 ± 0.010 [9.52 ± 0.25]	0.200 ± 0.015 [5.08 ± 0.38]	1.000 + 0.25 - 0.125 [25.40 + 6.35 - 3.17]
SPU052	1.000 ± 0.010 [25.40 ± 0.25]	0.375 ± 0.010 [9.52 ± 0.25]	0.125 ± 0.015 [3.17 ± 0.38]	1.000 minimum [25.40 minimum]
SPU053	1.870 ± 0.010 [47.50 ± 0.25]	0.437 ± 0.010 [11.10 ± 0.25]	0.125 ± 0.015 [3.17 ± 0.38]	1.000 minimum [25.40 minimum]

Note

- Limited to 25 A maximum

MATERIAL SPECIFICATIONS

Element: Nickel-chromium alloy or copper-manganese alloy, depending on resistance value

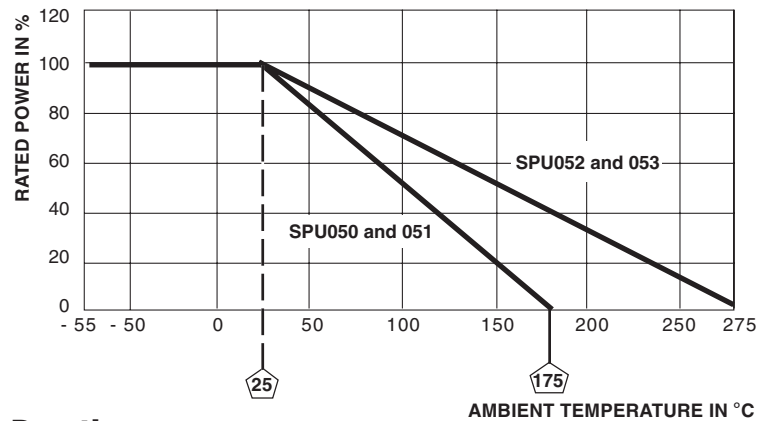
Molding Material: SPU050/051 thermo-set epoxy
SPU052/053 thermo-set silicone

Standard Terminals: SPU050/051: 100 % Sn or 60/40 Sn/Pb coated Copperweld®
SPU052/053: 100 % Sn or 60/40 Sn/Pb coated copper

Part Marking: DALE, model, wattage, value, tolerance, date code

AMBIENT TEMPERATURE DERATING

Derating is required for ambient temperature above 25 °C per the following graph



Derating

Wirewound Resistors, Open Style, Current Shunts, Custom Tailored, Very Low Value, High Precision



FEATURES

- Custom-made four-terminal resistors to meet your individual specifications
- Extremely low resistance values for current sensing applications
- Precision resistance tolerance
- Low temperature coefficients
- Complete welded construction

The mechanical configurations and electrical properties of our shunts are made to your specifications. The following are examples of "Typical Electrical Specifications" from several existing custom designs. Consult our engineering department for help in designing your own configuration and/or electrical properties, see email address at the bottom of this page.

STANDARD ELECTRICAL SPECIFICATIONS				
GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{25\text{ }^\circ\text{C}}$ W	CURRENT RATING (maximum) A	RESISTANCE RANGE Ω $\pm 1\%$
SPU104	SPU-104	1.875	25	0.0025 - 0.010
SPU111...1	SPU-111-1	1	10	0.005
SPU114	SPU-114	1	10	0.00167 - 0.020

Note

- Resistance tolerance available is 0.1 %, 0.25 %, 0.5 %, 1.0 %, 3.0 % and 5.0 % depending on resistor physical design and resistance value

TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	SPU OPEN STYLE RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/ $^\circ\text{C}$	Typical is ± 100 (- 10 $^\circ\text{C}$ to + 80 $^\circ\text{C}$) consult factory for tighter TCR availability
Resistance Range	Ω	Dependent upon configuration, consult factory
Maximum Current Rating	A	Dependent upon configuration, consult factory
Operating Temperature Range	$^\circ\text{C}$	- 55 to + 275

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: SPU1115L0000FD1 (preferred part numbering format)

S	P	U	1	1	1	5	L	0	0	0	0	F	D	1	
GLOBAL MODEL SPU111		RESISTANCE VALUE L = m Ω (below 0.01 Ω) R = Decimal 5L0000 = 0.005 Ω R10000 = 0.10 Ω				TOLERANCE CODE F = $\pm 1.0\%$ J = $\pm 5.0\%$		PACKAGING E* = Lead (Pb)-free, bulk D = Tin/lead, bulk			SPECIAL (Dash Number) (up to 2 digits) From 1 - 99 as applicable				

* Lead (Pb)-free will not be available until Q1 2005

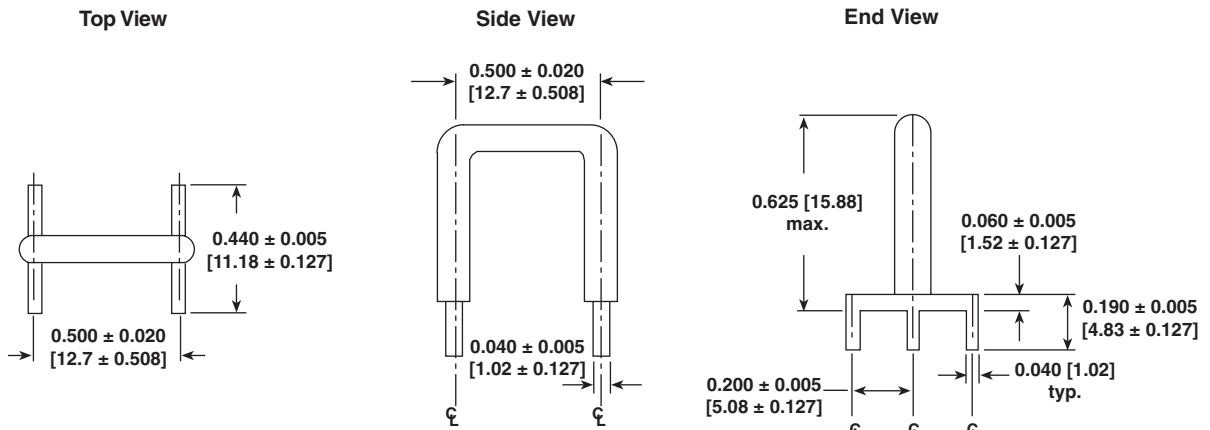
Historical Part Number Example: SPU-111-1 0.005 Ω 1% S51 (will continue to be accepted)

SPU-111-1	0.005 Ω	1%	S51
HISTORICAL MODEL	RESISTANCE VALUE	TOLERANCE CODE	PACKAGING



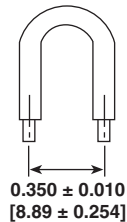
DIMENSIONS in inches [millimeters]

SPU104

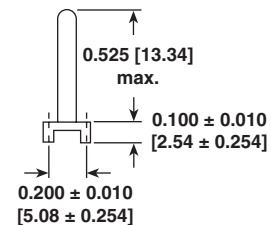


SPU111...1

Side View

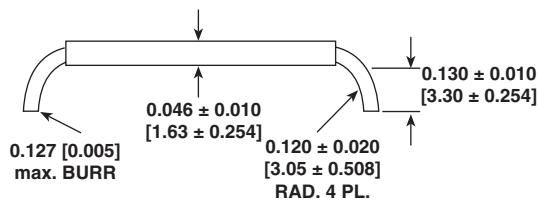


End View

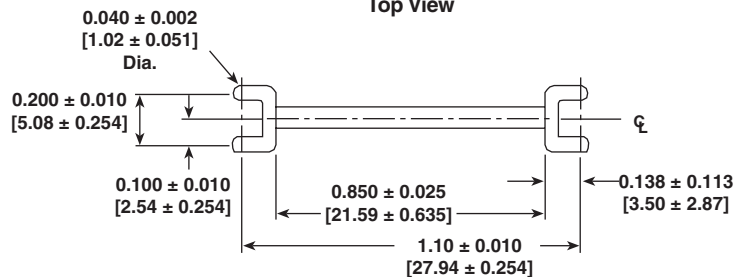


SPU114

Side View



Top View



MATERIAL SPECIFICATIONS

Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistor type and/or resistance value

Coating: None

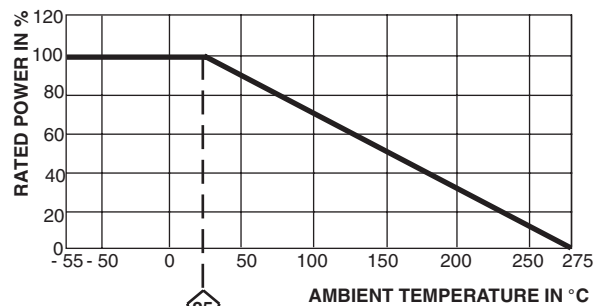
Standard Terminals: SPU104: 100 % Sn, w/Nickel underplate, or 60/40 Sn/Pb coated copper

Other Models: 100 % Sn, w/Nickel underplate, or 60/40 Sn/Pb coated Copperweld®

Part Marking: None

AMBIENT TEMPERATURE DERATING

Derating is required for ambient temperatures above 25 °C per the following graph

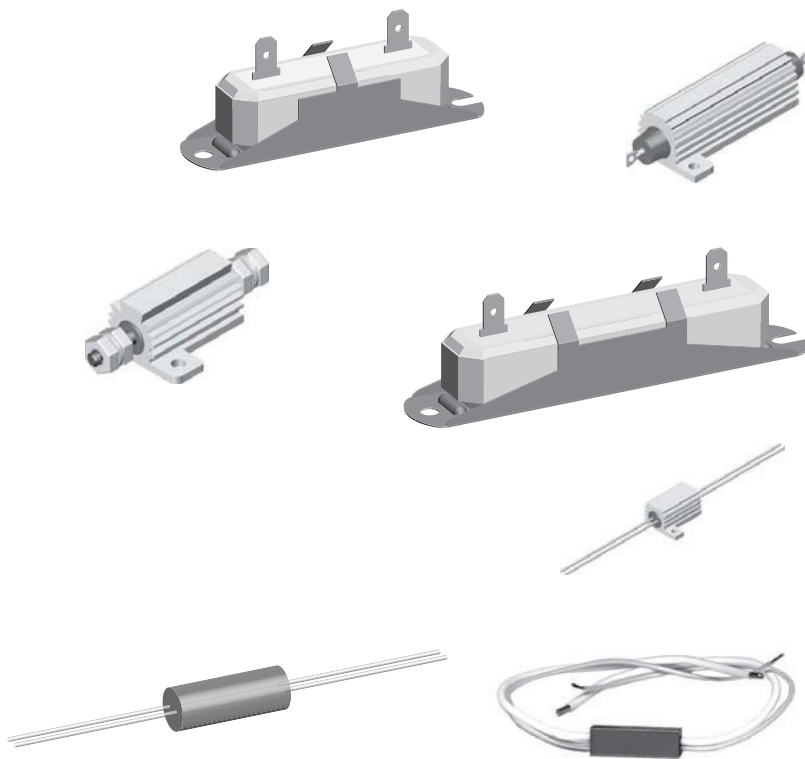


Derating





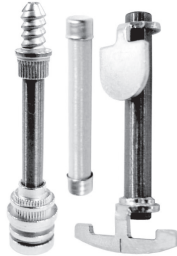
Special Purpose Wirewound Resistors



Contents

NSR	172
SPR2213 and SPR2214	176
RS Style Wirewound Fuse Resistor	178
Special Purpose	
• Housed	180
• Current Sensing	181
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Packaging	185

Wirewound Resistors, Noise Suppressor



FEATURES

- Ideal for reducing RFI during electrical discharges on gasoline engines
- Variety of resistance and inductance values available
- Special design of electrical contacts upon request
- Capability to withstand high voltage pulses at high frequency



RoHS
COMPLIANT

TECHNOLOGY

The resistor element is a resistive wire, which is wound in a single layer on a fiberglass core (ceramic core for type 3 shown below). Metallic caps or electrodes are fixed to the ends of the resistive core, following the specific ignition system characteristics. A coating protects the resistive element against moisture, mechanical shock and is able to withstand high temperatures. These products can be moulded with epoxy resin, thermoplastic or thermo set plastic materials.

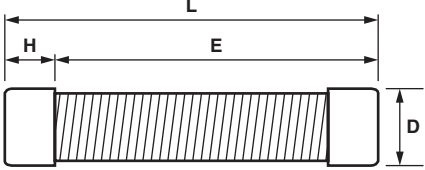
TYPE 1 (WITH CAPS)	TYPE 2 (WITH ELECTRODES)	TYPE 3 (AXIAL LEAD WIRE TERMINAL)

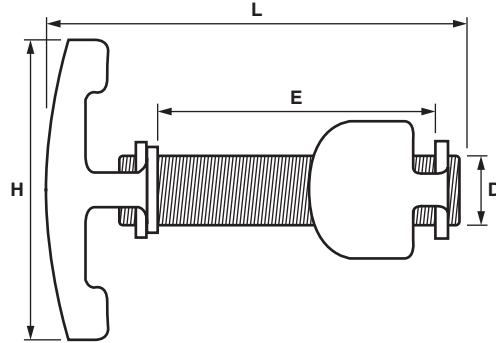
TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	NSR CHARACTERISTICS
Resistance Range ⁽¹⁾	Ω	1K - 15K
Tolerances ⁽²⁾	%	± 10 , ± 15 , ± 20
Inductance Range, 2 MHz ⁽³⁾	μH	5 to 72
Temperature Coefficient	ppm/ $^{\circ}\text{C}$	± 250
Operating Temperature Range	$^{\circ}\text{C}$	- 40 to + 200

Notes

- ⁽¹⁾ Special resistance values available upon request
- ⁽²⁾ Other tolerances available upon request
- ⁽³⁾ Special inductance values available upon request

TYPE 1 - NOISE SUPPRESSOR WITH CAPS

MECHANICAL DATA in inches [millimeters]							
							
ELECTRICAL DATA			MECHANICAL DATA				CODE NUMBER
VALUE	TOLERANCE	INDUCTANCE TYPICAL	L	D	H	E	
5 kΩ	± 20 %	20 μH	0.79 [20.0]	0.153 [3.88]	0.112 [2.85]	0.60 [15.1]	2306 309 90035
5.2 kΩ	± 15 %	15 μH	0.66 [16.8]	0.124 [3.15]	0.094 [2.40]	0.52 [13.0]	2306 309 90047
1 kΩ	+ 20 % - 10 %	16 μH	0.66 [16.8]	0.124 [3.15]	0.094 [2.40]	0.52 [13.0]	2306 309 90048
5 kΩ	± 20 %	18 μH	0.93 [23.7]	0.153 [3.88]	0.112 [2.85]	0.74 [18.8]	2306 309 90053
1 kΩ	± 20 %	10 μH	0.93 [23.7]	0.153 [3.88]	0.112 [2.85]	0.74 [18.8]	2306 309 90078
1 kΩ	± 20 %	9 μH	1.02 [26.0]	0.153 [3.88]	0.112 [2.85]	0.80 [20.3]	2306 309 90085
1 kΩ	± 20 %	5 μH	0.79 [20.0]	0.153 [3.88]	0.112 [2.85]	0.60 [15.1]	2306 309 90086
5 kΩ	± 20 %	16 μH	0.93 [23.7]	0.153 [3.88]	0.112 [2.85]	0.74 [18.8]	2306 309 90094
15 kΩ	± 20 %	72 μH	1.08 [27.3]	0.15 [3.82]	0.112 [2.85]	0.88 [22.4]	2306 309 90095
1.12 kΩ	± 20 %	13 μH	0.47 [11.9]	0.171 [4.35]	0.112 [2.85]	0.25 [6.4]	2306 309 90101
2 kΩ	± 20 %	14 μH	0.53 [13.5]	0.171 [4.35]	0.112 [2.85]	0.32 [8.0]	2306 309 90105
2 kΩ	± 20 %	21 μH	1.08 [27.3]	0.153 [3.88]	0.112 [2.85]	0.88 [22.4]	2306 309 90106
2 kΩ	± 20 %	8 μH	0.79 [20.0]	0.153 [3.88]	0.112 [2.85]	0.60 [15.1]	2306 309 90107
5 kΩ	± 20 %	10 μH	0.93 [23.7]	0.153 [3.88]	0.112 [2.85]	0.74 [18.8]	2306 309 90108
2 kΩ	± 20 %	9 μH	1.02 [26.0]	0.153 [3.88]	0.112 [2.85]	0.83 [21.1]	2306 309 90112

TYPE 2 - NOISE SUPPRESSOR WITH ELECTRODES**MECHANICAL DATA** in inches [millimeters]

ELECTRICAL DATA			MECHANICAL DATA				CODE NUMBER
VALUE	TOLERANCE	INDUCTANCE TYPICAL	L	D	H	E	
5 k Ω	+ 20 % - 10 %	50 μ H	1.35 [34.3]	0.16 [3.9]	0.43 [11.0]	0.93 [23.5]	2306 309 90008
4.5 k Ω	\pm 10 %	17 μ H	1.04 [26.3]	0.12 [3.0]	0.42 [10.5]	0.57 [14.4]	2306 309 90009
5 k Ω	\pm 10 %	19 μ H	1.19 [30.2]	0.12 [3.0]	0.42 [10.5]	0.58 [14.8]	2306 309 90014
5.3 k Ω	\pm 15 %	56 μ H	1.35 [34.3]	0.16 [3.9]	0.71 [18.0]	0.93 [23.5]	2306 309 90021
1.1 k Ω	\pm 15 %	9 μ H	1.17 [29.7]	0.154 [3.9]	0.71 [18.0]	0.42 [10.6]	2306 309 90027
1.1 k Ω	\pm 15 %	8.5 μ H	1.17 [29.7]	0.16 [3.9]	0.43 [11.0]	0.42 [10.6]	2306 309 90029
1 k Ω	\pm 10 %	5 μ H	1.19 [30.2]	0.12 [2.95]	0.42 [10.5]	0.58 [14.8]	2306 309 90038
5.2 k Ω	\pm 13 %	54 μ H	1.34 [34.1]	0.16 [3.9]	0.32 [8.15]	0.93 [23.5]	2306 309 90055
1 k Ω	\pm 10 %	5 μ H	1.19 [30.2]	0.12 [3.0]	0.71 [18.0]	0.58 [14.8]	2306 309 90057
5 k Ω	\pm 10 %	20 μ H	1.19 [30.2]	0.12 [3.0]	0.71 [18.0]	0.58 [14.8]	2306 309 90058
1 k Ω	\pm 10 %	4 μ H	1.39 [35.3]	0.12 [3.0]	0.71 [18.0]	0.81 [20.4]	2306 309 90069
5 k Ω	\pm 10 %	16 μ H	1.35 [34.25]	0.12 [3.0]	0.71 [18.0]	0.76 [19.2]	2306 309 90079

Note

- Other electrode designs available under request

TYPE 3 - NOISE SUPPRESSOR WITH AXIAL LEAD WIRE TERMINALS

MECHANICAL DATA in inches [millimeters]										
ELECTRICAL DATA			MECHANICAL DATA							CODE NUMBER
VALUE	TOLERANCE	INDUCTANCE TYPICAL	L	Ø D	Ø d	C	A	F1 - F2	S	
1 kΩ	± 20 %	18 μH	0.47 [11.8]	0.19 [4.7]	0.031 [0.80]	1.26 [32.0]	2.48 [63.0]	≤ 0.06 [≤ 1.4]	0.40 [10.0]	2306 326 90136

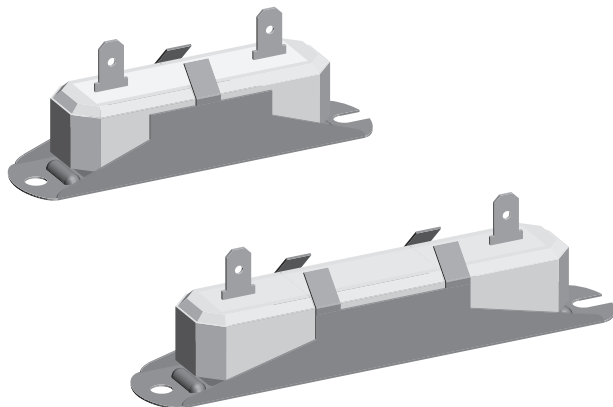
ORDERING INFORMATION

Composition of the catalogue Number:

2306 309 90xxx (fiberglass core) or 2306 326 90xxx (ceramic core)

The last three digits (xxx) in the above code number are defined in accordance with each new developed product. Contact factory for details.

Wirewound Resistors, Special Purpose Commercial, High Power



FEATURES

- High power/size ratio
- Quick connect terminals
- Complete welded construction
- High surge capability
- Non-inductive styles available
- Special inorganic potting compound and ceramic case provide high thermal conductivity in a fireproof package
- SPR2214 includes a center terminal option

STANDARD ELECTRICAL SPECIFICATIONS

GLOBAL MODEL	HISTORICAL MODEL	POWER RATING $P_{25^\circ\text{C}}$ W		RESISTANCE RANGE Ω $\pm 5\%, \pm 10\%$
		WITHOUT HEAT SINK	WITH HEAT SINK	
SPR2213	SPR-2213	40	70	0.5 - 24K
SPR2214	SPR-2214	50	100	1.0 - 44K

TECHNICAL SPECIFICATIONS

PARAMETER	UNIT	SPR2213 AND SPR2214 RESISTOR CHARACTERISTICS
Temperature Coefficient	ppm/ $^\circ\text{C}$	± 50 below $10\ \Omega$, ± 30 $10\ \Omega$ and above
Short Time Overload	-	10 x rated power for 5 s
Maximum Working Voltage	V	$(P \times R)^{1/2}$
Operating Temperature Range	$^\circ\text{C}$	- 65 to + 275
Dielectric Withstanding Voltage	V_{AC}	2500

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: SPR221375R000JD (preferred part numbering format)

S P R 2 2 1 3 7 5 R 0 0 0 J D

GLOBAL MODEL	VALUE	TOLERANCE	PACKAGING	SPECIAL
SPR2213 SPR2214	R = Decimal K = Thousand R15000 = $0.15\ \Omega$ 1K5000 = $1500\ \Omega$	J = $\pm 5.0\ \%$ K = $\pm 10\ \%$	D = Skin pack (S51)	(Dash Number) (up to 2 digits) From 1 - 99 as applicable

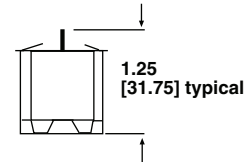
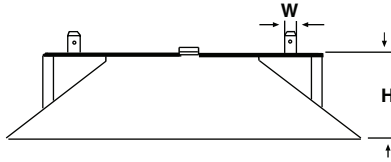
Historical Part Number Example: SPR-2213 75 Ω 5% S51 (will continue to be accepted)

SPR-2213	75 Ω	5%	S51
HISTORICAL MODEL	RESISTANCE VALUE	TOLERANCE CODE	PACKAGING

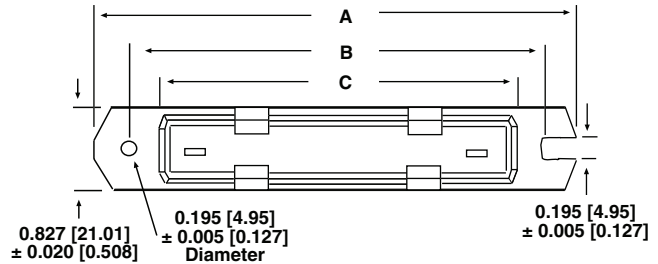
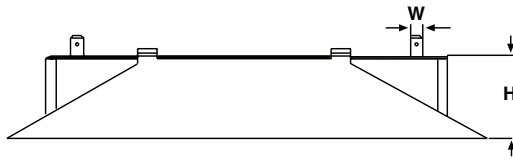


DIMENSIONS in inches [millimeters]

SPR2213



SPR2214



GLOBAL MODEL	DIMENSIONS in inches [millimeters]				
	A typical	± 0.031 [0.794] B	± 0.031 [0.794] C	± 0.005 [0.127] W	H typical
SPR2213	3.375 [85.73]	3.00 [76.20]	2.50 [63.50]	0.250 x 0.031 [6.35 x 0.794]	0.810 [20.57]
SPR2214	4.563 [115.90]	4.125 [104.78]	3.625 [92.08]	0.250 x 0.031 [6.35 x 0.794]	0.810 [20.57]

MATERIAL SPECIFICATIONS

Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value

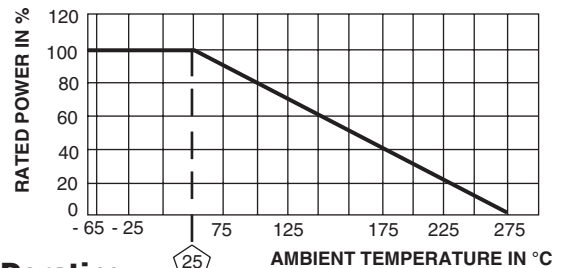
Core: Steatite ceramic

Body: Steatite ceramic case with inorganic potting compound

Terminals: Nickel plated steel

Bracket: Zinc plated steel

Part Marking: DALE, model, wattage, value, tolerance, date code



PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS
Thermal Shock	Rated power applied until thermally stable, then a minimum of 15 min at - 55 °C	± (2.0 % + 0.05 Ω) ΔR
Short Time Overload	10 x rated power for 5 s	± (2.0 % + 0.05 Ω) ΔR
Dielectric Withstanding Voltage	1000 V _{rms} , 1 min	± (0.1 % + 0.05 Ω) ΔR
Low Temperature Storage	- 65 °C for 24 h	± (2.0 % + 0.05 Ω) ΔR
High Temperature Exposure	250 h at + 275 °C	± (2.0 % + 0.05 Ω) ΔR
Moisture Resistance	MIL-STD-202 Method 106, 7b not applicable	± (2.0 % + 0.05 Ω) ΔR
Shock, Specified Pulse	MIL-STD-202 Method 213, 100 g's for 6 ms, 10 shocks	± (0.2 % + 0.05 Ω) ΔR
Vibration, High Frequency	Frequency varied 10 to 2000 Hz, 20 g peak, 2 directions 6 h each	± (0.2 % + 0.05 Ω) ΔR
Load Life	1000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"	± (3.0 % + 0.05 Ω) ΔR

Fast Acting, Molded Styles Custom Designed For Your Application



FEATURES

- Low temperature coefficient (down to 30 ppm/°C)
- High temperature silicone molded package (derated to 200 °C)
- Performs function of resistor and series fuse and provides predictable fusing times
- Complete welded construction
- No flaming or distortion of unit under fusing conditions
- Ideal for Squib circuit applications and protection of semi-conductor devices
- Negligible noise and voltage coefficient



TYPICAL ELECTRICAL SPECIFICATIONS

The following are offered as examples of reliable designs. Hundreds of possible combinations are available for meeting your requirements. Contact factory by using email address in the footer of this page, for assistance. Higher wattages available.

GLOBAL MODEL	HISTORICAL MODEL	FUSING PARAMETERS		RESISTANCE RANGE Ω $\pm 5\%$, $\pm 10\%$ available	1.0 W CONTINUOUS POWER ⁽¹⁾	
		FUSING CURRENT A	TYPICAL FUSING TIME ms		CONTINUOUS CURRENT A	CROSSOVER VALUE Ω
RS01A...209	RS-1A-209	0.5	4	49 - 500	0.10	100.0
RS01A...118	RS-1A-118	1.0	9	6.8 - 185	0.25	16.0
RS01A...212	RS-1A-212	1.25	8	4.7 - 107	0.30	11.11
RS01A...213	RS-1A-213	1.5	15	3.5 - 68	0.35	8.16
RS01A...143	RS-1A-143	2.0	15	2.2 - 35	0.40	6.25
RS01A...214	RS-1A-214	2.5	23	1.7 - 23	0.45	4.94
RS01A...162	RS-1A-162	3.0	48	1.1 - 12	0.55	3.31
RS01A...208	RS-1A-208	4.0	47	0.72 - 6.44	0.75	1.78
RS01A...207	RS-1A-207	6.0	70	0.35 - 2.17	1.0	1.0
RS01A...215	RS-1A-215	8.0	48	0.29 - 1.61	1.25	0.64
RS01A...173	RS-1A-173	10.0	50	0.23 - 1.16	1.50	0.44
RS01A...216	RS-1A-216	15.0	35	0.19 - 0.82	1.75	0.33
RS01A...217	RS-1A-217	20.0	46	0.12 - 0.42	2.0	0.25

Note

- ⁽¹⁾ The Continuous Current Rating applies only to values equal to or less than the Crossover Value. The Continuous Power Rating applies only to values equal to or higher than the Crossover Value.
- Be aware that the inherent compromise involved between resistive and fusing functions sometimes makes certain exact combinations unattainable. However, in nearly all cases, this does not prevent the production of a functional, reliable fuse resistor thoroughly capable of meeting application requirements.

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: RS01A402R0JS70209 (preferred part number format)

R S 0 1 A 4 0 2 R 0 J S 7 0 2 0 9

GLOBAL MODEL	VALUE	TOLERANCE	PACKAGING	SPECIAL
(See Typical Electrical Specifications Global Model column for options)	R = Decimal K = Thousand 15R00 = 15 Ω 10K00 = 10 k Ω	J = $\pm 5.0\%$ K = $\pm 10.0\%$	E70 = Lead (Pb)-free, tape/reel E12 = Lead (Pb)-free, bulk S70 = Tin/lead, tape/reel B12 = Tin/lead, bulk	(Dash Number) (up to 3 digits) From 1 - 999 as applicable

Historical Part Number Example: RS-1A-209 402 Ω 5% S70 (will continue to be accepted)

RS-1A-209	402 Ω	5%	S70
HISTORICAL MODEL	RESISTANCE VALUE	TOLERANCE CODE	PACKAGING

If a MODEL listed in TYPICAL ELECTRICAL SPECIFICATIONS table does not meet your requirements, then please include the following information. It will enable us to choose the best design for your application.

1. Operating wattage or current, ambient temperature and required resistance stability. (% $\Delta R/1000$ h)
2. Fusing wattage or current and maximum "blow" time. Also, minimum "blow" time, if applicable.
3. Nominal resistance and maximum allowable resistance tolerance, (5% to 10% preferred).
4. Maximum allowable physical size.
5. Voltage to be interrupted.
6. Frequency of power source, wave form and a brief description of your application.

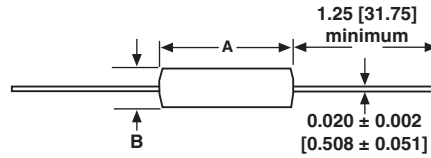


RS Style Wirewound Fuse Resistor

Fast Acting, Molded Styles
Custom Designed For Your Application

Vishay Dale

DIMENSIONS in inches [millimeters]



MODEL	A	B
1.0 W	0.422 ± 0.015 [10.72 ± 0.381]	0.110 ± 0.015 [2.79 ± 0.381]

TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	TYPICAL WIREWOUND FUSE RESISTOR CHARACTERISTICS
Resistance Tolerance	± %	3, 5, 10
Temperature Coefficient	ppm/°C	90 for 0.1 Ω thru 0.99 Ω; 50 for 1.0 Ω thru 9.9 Ω; 30 for 10 Ω and above
Power Rating	W	1.0 standard, higher power ratings available
Dielectric Strength	V _{AC}	500
Insulation Resistance	MΩ	1000 minimum dry
Fusing Times	s	0.001 to 1.0
Minimum Fusing Current	A	Approximately 4 times the continuous operating current obtainable on some designs. Larger ratios produce better designs.
Terminal Strength	lb	5 minimum
Solderability	-	Terminals are 60/40 electro tin plated to facilitate soldering

MATERIAL SPECIFICATIONS

Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value

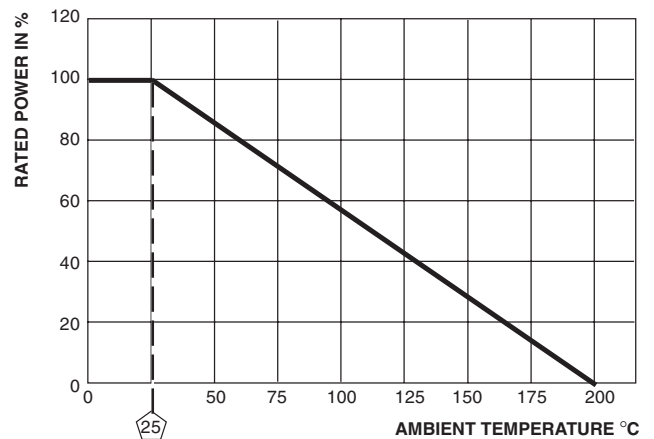
Core: Alumina ceramic

Encapsulant: Thermoset silicone mold compound

End Caps: Stainless steel

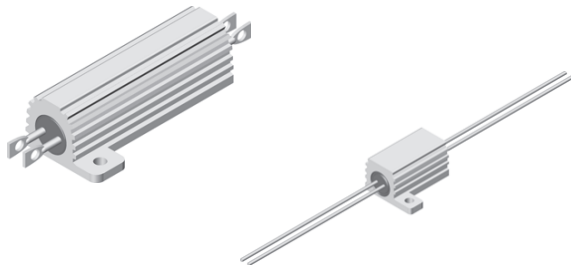
Terminals: Tinned copperweld

Part Marking: DALE, model, value, tolerance, date code



Derating

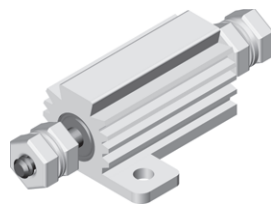
Wirewound Resistors Housed, Terminal Variations



MODELS RH-10, RH-25, RH-50

Four Terminals

Available in RH-10, RH-25 and RH-50 package size. Except for the terminals all physical and electrical characteristics are the same as standard RH type (see RH, NH data sheet). Consult our engineering department for specific part numbers and detailed data sheets, see email address at the bottom of this page.



MODELS RH-5, RH-10, RH-25, RH-50

Threaded Terminals

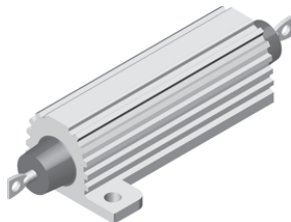
Available in RH-5, RH-10, RH-25 and RH-50 package size. Except for the terminals all physical and electrical characteristics are the same standard RH type (see RH, NH data sheet). Consult our engineering department for specific part numbers and detailed data sheets, see email address at the bottom of this page.



MODELS RH-10, RH-25, RH-50

Teflon Insulated, Flexible Terminals

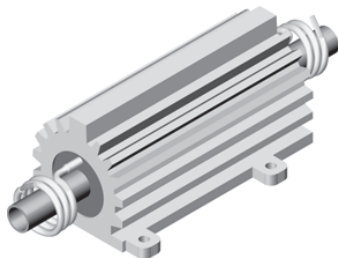
Available in RH-10, RH-25 and RH-50 package size. Except for the terminals all physical and electrical characteristics are the same as standard RH type (see RH, NH data sheet). Consult our engineering department for specific part numbers and detailed data sheets, see email address at the bottom of this page.



MODEL RH-25, RH-50

High Voltage Design

Available in RH-25 and RH-50 package size. The high voltage design incorporates extended molding compound at the terminals to give longer voltage creep distance. Consult our engineering department for specific part numbers and detailed data sheets, see email address at the bottom of this page.



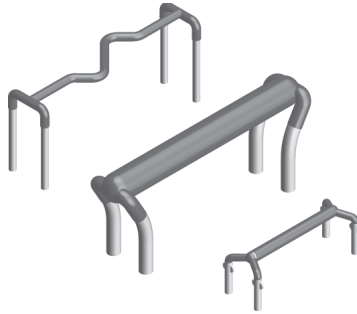
MODEL SPR-1002

High Wattage, Water Cooled

The SPR-1002 is a variation of the NH-250 (non-inductive) resistor that incorporates water cooling for increased power dissipation. The resistor is rated at 450 W when mounted on the standard NH-250 heat and cooled with 1.5 gallons of 25 °C water per minute. Physical dimensions are same as standard NH-250 except 12 AWG teflon insulated flexible wire terminals and 0.5" diameter copper water copper tube that extends 1.5" from each end. Consult our engineering department for specific part numbers and detailed data sheets, see email address at the bottom of this page.



Wirewound Resistors, Two and Four Terminal, Low Ohmic Value for Current Sensing



MODELS
SPR0676
SPR2039
SPR2093

Special Purpose
Open Style
Designed for
Printed Circuit Boards

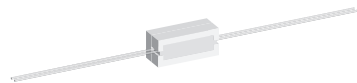
STANDARD ELECTRICAL SPECIFICATIONS				
GLOBAL MODEL	HISTORICAL MODEL	WATTAGE	RESISTANCE RANGE (Ω)	TYPICAL TOL.
SPR0676	SPR-676	1	0.0015 to 0.05	$\pm 0.5\%$
SPR2039	SPR-2039	3.5	0.0033 to 0.05	$\pm 1.0\%$
SPR2093	SPR-2093	(1)	0.0005 to 0.002	$\pm 1.5\%$

Note

(1) 13 W on 0.0005 Ω and 0.001 Ω , limited to 115 A
10 W on 0.001 Ω and 0.002 Ω

DIMENSIONS in inches [millimeters]			
GLOBAL MODEL	HISTORICAL MODEL	HOLE PATTERN	TERMINAL DIAMETER
SPR0676	SPR-676	0.20 [5.08] x 0.70 [17.78]	0.040 [1.02]
SPR2039	SPR-2039	0.25 [6.35] x 1.0 [25.4]	0.051 [1.30]
SPR2093	SPR-2093	0.25 [6.35] x 1.0 [25.4]	0.081 [2.06]

Consult our engineering department for specific part numbers and detailed data sheets, see email address at the bottom of this page.



MODELS
SPR2073
SPR2123
SPR2091

Special Purpose
Ceramic Potted
Designed for
Rugged Applications

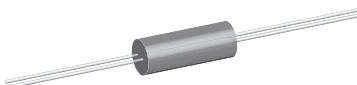
STANDARD ELECTRICAL SPECIFICATIONS				
GLOBAL MODEL	HISTORICAL MODEL	WATTAGE	RESISTANCE RANGE (Ω)	TYPICAL TOL.
SPR2073	SPR-2073	3 (2)	0.001 to 0.25	$\pm 1.0\%$
SPR2123	SPR-2123	5 (2)	0.001 to 0.25	$\pm 1.0\%$
SPR2091	SPR-2091	10 (2)	0.001 to 0.25	$\pm 1.0\%$

Note

(2) Limited to 25 A

DIMENSIONS in inches [millimeters]					
GLOBAL MODEL	HISTORICAL MODEL	LENGTH	WIDTH	HEIGHT	TERMINAL
SPR2073	SPR-2073	0.875 [22.22]	0.312 [7.94]	0.312 [7.94]	0.040 x 2.0 [1.02 x 50.80]
SPR2123	SPR-2123	0.875 [22.22]	0.375 [9.52]	0.344 [8.73]	
SPR2091	SPR-2091	1.875 [47.62]	0.375 [9.52]	0.344 [8.73]	

Consult our engineering department for specific part numbers and detailed data sheets, see email address at the bottom of this page.



MODEL
SPR1005

Special Purpose
Silicone Molded
SPR-1005-26 Qualified
To MIL-PRF-49465/1
Type RLV-10

STANDARD ELECTRICAL SPECIFICATIONS				
GLOBAL MODEL	HISTORICAL MODEL	WATTAGE	RESISTANCE RANGE (Ω)	TYPICAL TOL.
SPR1005	SPR-1005	5 (3)	0.0008 to 0.5	$\pm 1.0\%$

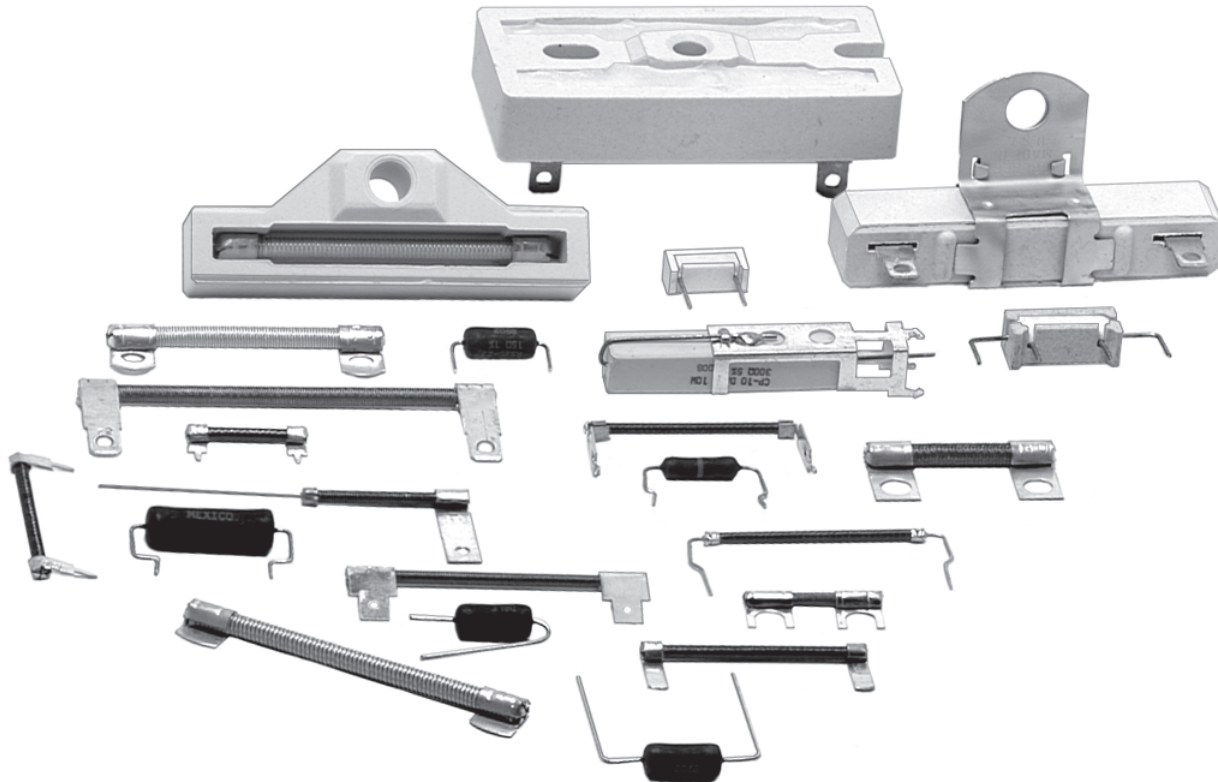
Note

(3) Limited to 25 A

DIMENSIONS in inches [millimeters]				
GLOBAL MODEL	HISTORICAL MODEL	LENGTH	DIAMETER	TERMINAL
SPR1005	SPR-1005	0.975 [24.77]	0.380 [9.65]	0.040 x 1.5 [1.02 x 38.10]

Consult our engineering department for specific part numbers and detailed data sheets, see email address at the bottom of this page.

Wirewound Resistors Lead Formed, High Powered, Tab Terminations



LEAD FORMED PRODUCTS

A variety of standard lead forms are available for use where auto-insertion is not available or practical. Forms vary from simple right angle lead bends, vertical hair pin bends, to lock in styles that lock into the circuit board. This provides for a positive stand-off while holding the part securely in place during further handling.

HIGH POWERED RESISTORS

High power, low cost, ceramic cased resistors are available in a range of wattage ratings and termination styles. From 25 W to 50 W (even more with proper heat sinks) these resistors can be supplied with wire leads or quick disconnects and several mounting techniques. Frequently used in power supplies, motor controllers, and automotive applications, these products can be custom tailored to individual needs.

TAB TYPE TERMINATIONS

These resistors, widely used in automotive applications, provide high wattage and easy mounting by directly mounting to binding posts, soldering or welding, or by use of quick disconnect terminals.

BRACKETS CHASSIS MOUNTS CIRCUIT BOARD MOUNTING

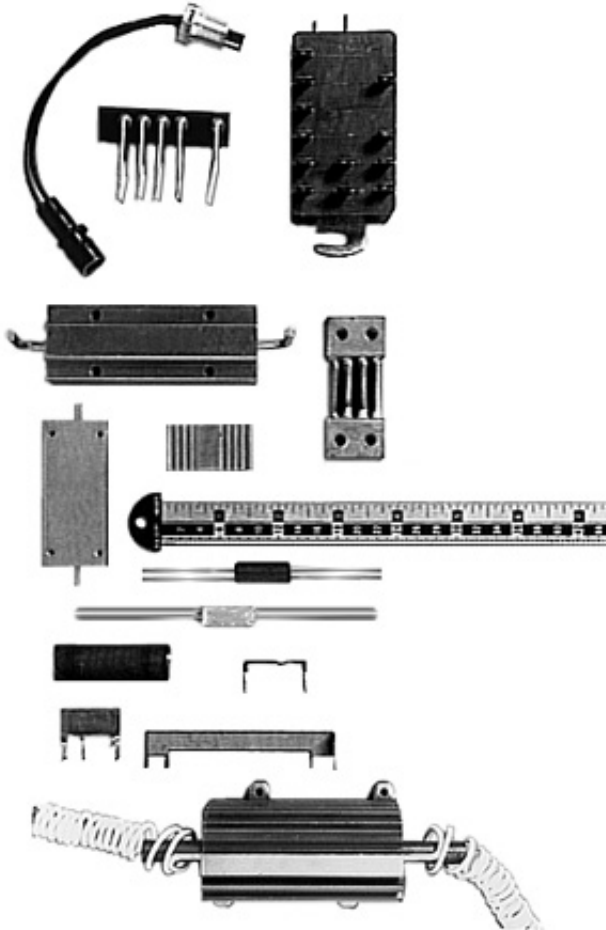
A variety of brackets are available for mounting ceramic cased resistors directly to a chassis or heat sink, or directly onto a circuit board. Benefits include higher heat dissipation and positive mounting where quick disconnect or hand solderable terminals are used, or a very minimal amount of board space is available making a vertical mount necessary. In addition, several styles can be supplied for mounting in circuit boards, with or without a ceramic case.

CONTACT VISHAY DALE ENGINEERING FOR ALL YOUR SPECIAL PURPOSE WIREWOUND RESISTOR REQUIREMENTS:

- Heaters
- High TCR
- Surface Mount
- Special Lead Forming
- Special Length, Flexible Resistors
- Fusible Types
- Current Sensing
- Special Mounting
- High Pulse Capabilities
- Lightning Surge/Power Cross Capabilities

Wirewound Resistors Lead Formed, High Powered, Tab Terminations

Vishay Dale



The photo on the left illustrates only a few of the many special purpose wirewound resistors built by the Vishay Dale Special Products Section of the Wirewound Division.

Full-time engineers assigned to this section draw on the industry's largest file of non-standard resistor design and production information. Often, in a matter of minutes, these engineers determine a fast, practical route to the production of your non-standard part.

The list below shows some of the options and combinations which can be achieved.

WIREWOUND OPTIONS

Construction:

Heat sink, silicone coated, epoxy or silicone molded (single or multi-element), clip mounted or fireproof inorganic construction.

Leads:

Radial and axial type, special materials and dimensions, spaded, threaded, insulated, quick-disconnect eyelet, printed circuit, ferrule.

Matching:

By pairs or sets for TCR, tolerance or ratio.

Special Types:

Extended low or high resistance range, adjustable, low reactance, special wire alloys, very low or high TCR, high stability, special tolerances, tapped, watercooled, temperature sensitive, inductive.

Pre-conditioning:

Power aging, temperature cycling, temperature and power, short-time overload, thermal shock, X-ray, temperature aging.

Shunts:

Low value, 4-terminal resistors built to customer specifications or designed by our engineers to meet your current sensing requirements.

Fuse Resistors:

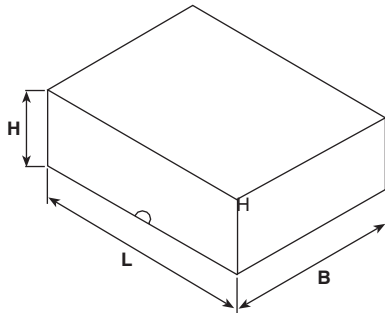
Our hybrid components designed to act as an ordinary resistor under normal circuit conditions, and as a fuse under fault conditions. Vishay Dale offers a variety of physical sizes and basic styles. Each application should be referred to Vishay Dale for an individual design to insure optimum performance in any particular circuit. See our special pages on fuse resistors.

For prompt attention to your special resistor requirements, contact Vishay per the e-mail address at the bottom of the page.



PREFERRED VALUES DIN 41 426									
E6 ± 20 %	E12 ± 10 %	E24 ± 5 %	E48 ± 2 %	E6 ± 20 %	E12 ± 10 %	E24 ± 5 %	E48 ± 2 %		
100	100	100	100	330	330	330	316		
			105				332		
		110	110			348			
			115			365			
	120	120	121		390	390	383		
			127				402		
		130	133			430	422		
			140				442		
	150	150	150		470	470	464		
			160				147	487	
							154	511	
			162				536		
180		180	169	560		560	562		
			178				590		
		200	187			620	619		
			196				649		
220		220	220	215		680	680	681	
				226				715	
			240	237				750	750
				249					787
	270	270	261	820	820		825		
			274				866		
		300	287		910		909		
			301				953		

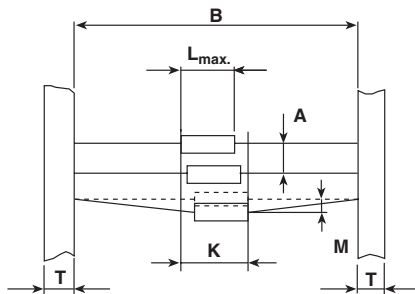
BULK PACK



MODEL	DIMENSIONS in millimeters [inches]			UNITS PER PACK
	L	B	H	
G 206	225 [8.858]	140 [5.512]	70 [2.756]	100
G 207	225 [8.858]	140 [5.512]	70 [2.756]	100
Z 307	225 [8.858]	140 [5.512]	70 [2.756]	200
KKA 4	262 [10.315]	100 [3.937]	35 [1.378]	200
KKA 5	260 [10.236]	115 [4.528]	35 [1.378]	200
KKA 7	235 [9.252]	130 [5.118]	44 [1.732]	200

MODEL	DIMENSIONS in millimeters [inches]			UNITS PER PACK
	L	B	H	
KKA 9	235 [9.252]	130 [5.118]	44 [1.732]	100
KKA 11				
KKE 4	181 [7.126]	126 [4.961]	33 [1.299]	200
KKE 7	235 [9.252]	130 [5.118]	44 [1.732]	200
KKE 9				
KKE 11	238 [9.370]	166 [6.535]	43 [1.693]	200
KKE 17	255 [10.039]	105 [4.134]	40 [1.575]	100
KKE 7 Si	235 [9.252]	129 [5.079]	60 [2.362]	200
KKE 9 Si				

TAPE DIMENSIONS

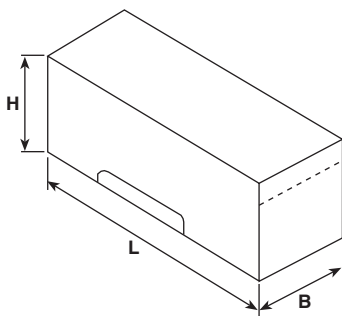


L_{max} see data sheets

Taping corresponds to IEC 60286

TAPE	DIMENSIONS in millimeters [inches]				
	B	A	K	M	T
G 53	53 ± 1 [2.087 ± 0.039]	5 ± 0.5 [0.197 ± 0.020]	L _{max} + 1.4 L _{max} + [0.055]	1.2 [0.047]	6 ± 0.5 [0.236 ± 0.020]
G 63	63 ± 1 [2.480 ± 0.039]	5 ± 0.5 [0.197 ± 0.020]	L _{max} + 1.4 L _{max} + [0.055]	1.2 [0.047]	6 ± 0.5 [0.236 ± 0.020]
G 73	73 ± 1 [2.874 ± 0.039]	5 ± 0.5 [0.197 ± 0.020]	L _{max} + 1.4 L _{max} + [0.055]	1.2 [0.047]	6 ± 0.5 [0.236 ± 0.020]
G 80	80 ± 1 [3.150 ± 0.039]	10 ± 0.5 [0.394 ± 0.020]	L _{max} + 1.4 L _{max} + [0.055]	1.2 [0.047]	6 ± 0.5 [0.236 ± 0.020]
G 83	83 ± 1 [3.268 ± 0.039]	10 ± 0.5 [0.394 ± 0.020]	L _{max} + 1.4 L _{max} + [0.055]	1.2 [0.047]	6 ± 0.5 [0.236 ± 0.020]
G 88	88 ± 1 [3.465 ± 0.039]	10 ± 0.5 [0.394 ± 0.020]	L _{max} + 1.4 L _{max} + [0.055]	1.2 [0.047]	6 ± 0.5 [0.236 ± 0.020]

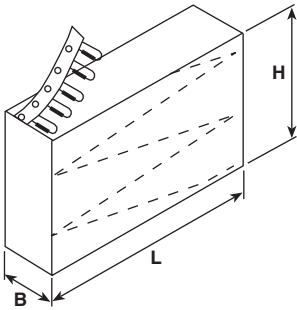
AMMOPACK



MODEL	TAPE	DIMENSIONS in millimeters [inches]			UNITS PER PACK
		L	B	H	
G 202	G 53	324 [12.756]	82 [3.228]	49 [1.929]	500
	G 73	324 [12.756]	101 [3.976]	49 [1.929]	500
G 204	G 88	324 [12.756]	111 [4.370]	75 [2.953]	250
Z 301	G 53	324 [12.756]	82 [3.228]	49 [1.929]	1000
ZDA 0411	G 73	324 [12.756]	101 [3.976]	64 [2.520]	1000
Z 302	G 53	324 [12.756]	82 [3.228]	49 [1.929]	500
	G 83	324 [12.756]	111 [4.370]	75 [2.953]	500

MODEL	TAPE	DIMENSIONS in millimeters [inches]			UNITS PER PACK
		L	B	H	
Z 303	G 83	324 [12.756]	111 [4.370]	90 [3.543]	500
Z 305	G 83	324 [12.756]	111 [4.370]	75 [2.953]	250
Z 306	G 80	324 [12.756]	111 [4.370]	75 [2.953]	250
CW-2B-13	G 80	324 [12.756]	111 [4.370]	75 [2.953]	500

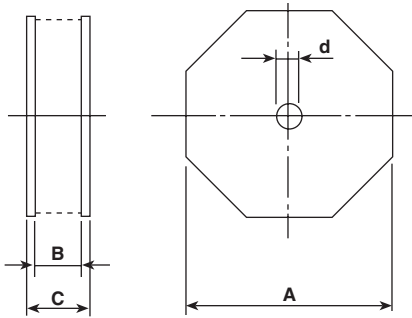
AMMOPACK (continued)



MODEL	DIMENSIONS in millimeters [inches]			UNITS PER PACK
	L	B	H	
ZDV 0411	324 [12.756]	53 [2.087]	147 [5.787]	2000

Ordering term of model ZDA0411 changes to ZDV 0411 when radial taped

REEL PACK



MODEL	TAPE	REEL DIMENSIONS in millimeters [inches]				PACKAGING UNIT (pieces)
		d	A	B	C	
G 202	R 53 ⁽¹⁾	20 [0.787]	250 [9.843]	75 [2.953]	87 [3.425]	1000
	R 73 ⁽¹⁾	20 [0.787]	250 [9.843]	95 [3.740]	107 [4.213]	1000
G 204	R 88	20 [0.787]	250 [9.843]	105 [4.134]	117 [4.213]	500
Z 301	R 53	20 [0.787]	250 [9.843]	75 [2.953]	87 [3.425]	2000
ZDA 0411	R 73	20 [0.787]	250 [9.843]	95 [3.740]	107 [4.213]	2000
Z 302	R 53 ⁽¹⁾	20 [0.787]	250 [9.843]	75 [2.953]	87 [3.425]	2000
	R 83	20 [0.787]	250 [9.843]	105 [4.134]	117 [4.213]	1000
Z 303	R 53 ⁽¹⁾	20 [0.787]	250 [9.843]	75 [2.953]	87 [3.425]	1000
	R 83	20 [0.787]	250 [9.843]	75 [2.953]	87 [3.425]	1000
Z 305	R 83	20 [0.787]	250 [9.843]	105 [4.134]	117 [4.213]	500
Z 306	R 83	20 [0.787]	250 [9.843]	105 [4.134]	117 [4.213]	500
KKA 4	R 80	26.5 [1.043]	330 [12.992]	95 [3.740]	101 [3.976]	1000
KKA 5	R 80	26.5 [1.043]	330 [12.992]	95 [3.740]	101 [3.976]	1000
CW-2B-13	R 53	14 [0.551]	280 [11.024]	73 [2.874]	87 [3.425]	1250
		14 [0.551]	280 [11.024]	73 [2.874]	87 [3.425]	1000
		14 [0.551]	190 [7.480]	73 [2.874]	81 [3.189]	500
	R 63	14 [0.551]	280 [11.024]	85 [3.346]	93 [3.661]	1250
		14 [0.551]	280 [11.024]	85 [3.346]	93 [3.661]	1000
		14 [0.551]	190 [7.480]	85 [3.346]	93 [3.661]	500
	R 80	14 [0.551]	280 [11.024]	101 [3.976]	115 [4.528]	1250
		14 [0.551]	280 [11.024]	101 [3.976]	115 [4.528]	1000
		14 [0.551]	190 [7.480]	101 [3.976]	108 [4.252]	500

Note:

⁽¹⁾ Dimension A in tape dimensions is 10 ± 0.5 mm [0.394 ± 0.020]



VISHAY DRALORIC PACKAGING CODE

Note: This packaging code is valid only for VISHAY DRALORIC resistors

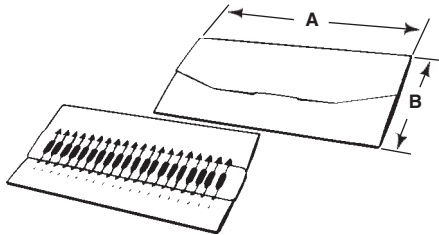
1st digit (Packaging Style)	A	Ammo Pack
	R	Reel
	L	Loose pack
	B	Embossed tape (Blister)
	P	Paper tape
	M	Bulk case (Murata)
	X	Sample

EXAMPLE:

A2 Ammopack 2000 pieces
 P0 Papertape 10 000 pieces

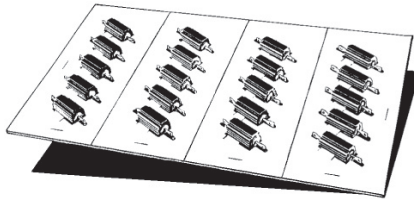
2nd digit (Quantity)	A	100
	B	250
	C	500
	D	50
	E	2500
	F	25
	G	40
	H	60
	I	
	J	200
	K	300
	L	400
	M	1250
	N	20 000
	O	
	P	1500
	Q	
	R	5000 (R26)
	S	7500
	T	30 000
	U	25 000
	V	
	W	
	X	Without quantity
	Y	
	Z	50 000
1	1000	
2	2000	
3	3000	
4	4000	
5	5000	
6		
7		
8		
9		
0	10 000	

LACER PACK



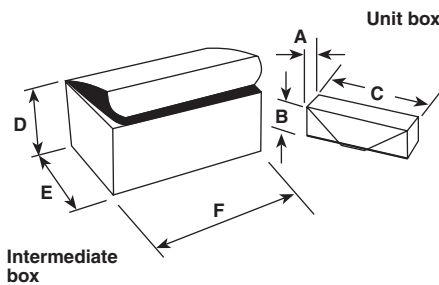
WIREWOUND LACER PACKAGING Dimensions in mm [inches]			
MODEL	A	B	
RS-1/4, RS-1/2, G-1, G-2, CW-1/2, EGS-1, EGS-2, RS-1A, RS-1B, G-3, CW-1, CW-1M, EGS-3, NS-1A, LVR-1	215.90 [8.500]	95.25 [3.750]	Resistor body is placed in slot, held in place with tongue insert. Terminals protected within folder. 20 units per folder.
RS-2B, RS-2M, CW-2B, CW-2M, G-5, ESS-2B, LVR-3, RS-2, RS-2C, CW-2C, G-5C	215.90 [8.500]	101.6 [4.000]	
RS-5, RS-7, CW-5, ESS-5, CW-7, G-10, EGS-10, LVR-5	279.40 [11.000]	127.00 [5.000]	
RS-10, CW-10, ESS-10, LVR-10	376.24 [14.813]	153.99 [6.063]	

CARD PACK



WIREWOUND CARD PACKAGING			
MODEL	QTY./PACK	TEAR OFF QTY.	
RH-5, NH-5, ERH-5, ENH-5	40	10	Resistor placed in slot and held in place with foldover protective paper. Each pack perforated to tear off into four smaller sub packs.
RH-10, NH-10, ERH-10, ENH-10	40	10	
RH-25, NH-25, ERH-25, ENH-25	20	5	
RH-50, NH-50, ERH-50, ENH-50	20	5	

BULK PACK



WIREWOUND BULK PACKAGING Dimensions in mm [inches]							
MODEL	A	B	C	D	E	F	
RS-1/8, RS-1/4, RS-1/2, RS-1M, CW-1/2, G-1, G-2, EGW-1, EGS-2, EGW-2	25.4 [1.000]	25.4 [1.000]	92.1 [3.625]	57.1 [2.250]	95.2 [3.750]	136.5 [5.375]	
RS-1A, RS-1B, CW-1, EGW-3	38.1 [1.500]	38.1 [1.500]	92.1 [3.625]	127 [5.000]	98.4 [3.875]	196.8 [7.750]	
RS-2, RS-2A, CW-2, G-5A, ESS-2A	76.2 [3.000]	57.1 [2.250]	104.7 [4.125]	152.4 [6.000]	184.2 [7.250]	304.8 [12.000]	
RS-2B, RS-2M, CW-2B, G-5, ESS-2B, LVR-3	50.8 [2.000]	50.8 [2.000]	98.4 [3.875]	152.4 [6.000]	184.2 [7.250]	304.8 [12.000]	
RS-2C, CW-2C, G-5C	66.8 [2.625]	63.5 [2.500]	101.6 [4.000]	152.4 [6.000]	184.2 [7.250]	304.8 [12.000]	
RS-5, CW-5, G-10, ESS-5, EGW-10, LVR-5	76.2 [3.000]	88.9 [3.500]	107.9 [4.125]	152.4 [6.000]	184.2 [7.250]	304.8 [12.000]	
RS-7, CW-7	98.4 [3.875]	63.5 [2.500]	117.4 [4.625]	190.5 [7.500]	190.5 [7.500]	393.7 [15.500]	
RS-10, CW-10, ESS-10	101.6 [4.000]	101.6 [4.000]	133.3 [5.250]	247.6 [9.750]	304.8 [12.000]	368.3 [14.500]	

Axial units are uniformly packaged 100 per box with 10 units per immediate container. Standard packaging for quantities of 300 and fewer.

AMMOPACK

Resistors are lead taped, the same as in Reel Pack (see page), then they are placed in a continuous "S" pattern (without paper inner leaf) in an appropriate box.

SKIN PACK

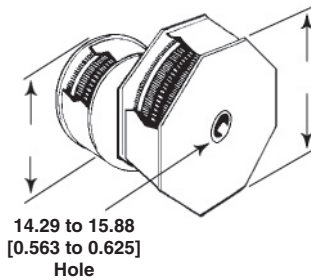
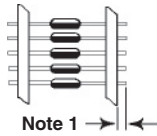
A versatile packaging method. Units are placed on double-faced corrugated board, then skin packed to board with polyfilm. Most resistor types are in multiples of five with insert strips.

MILITARY AND SPECIAL PACKAGING

Military packaging per MIL-P-116, Method 1A8. Blister pack, foam pack and vial pack also available for special requirements.

REEL PACK

VISHAY DALE STANDARD PACKAGING TECHNIQUE



WIREWOUND REEL PACKAGING Dimensions in mm [inches]				
MODEL	MAXIMUM UNITS PER REEL		PITCH ⁽¹⁾	TAPE SPACING ⁽²⁾
	SMALL FLANGE "B" 190.50 [7.500]	LARGE FLANGE "A" 281.78 [11.094]		
RS-1/4, RS-1/2, G-1, G-2, CW-1/2, EGS-1, EGS-2	2000	5000	5.08 [0.200]	52.37 [2.063]
RS-1A, RS-1B, G-3, CW-1, CW-1M, EGS-3	1500	4500	5.08 [0.200]	52.37 [2.063]
NS-1A, LVR-1	1000	4000	5.08 [0.200]	52.37 [2.063]
CA-1, CA-2 ⁽³⁾	1350	2500	5.08 [0.200]	73.02 [2.875]
RS-2B, RS-2M, CW-2B, CW-2M, G-5, ESS-2B	400	1200	10.16 [0.400]	63.5 [2.500]
LVR-3	400	1000	10.16 [0.400]	63.5 [2.500]
RS-2, RS-2C, CW-2C, G-5C	400	1000	10.16 [0.400]	63.5 [2.500]
RS-5, RS-7, CW-5, ESS-5, CW-7, G-10, EGS-10	-	700	10.16 [0.400]	73.02 [2.875]
LVR-5	-	600	10.16 [0.400]	73.02 [2.875]
RS-10, CW-10, ESS-10	-	600	10.16 [0.400]	85.72 [3.375]

Notes

- ⁽¹⁾ Leads will be trimmed to a maximum of 1.59 mm [0.063"] beyond tape edge
- ⁽²⁾ For non standard type and reel requirements, contact our engineering department, see email address at the bottom of the page
- ⁽³⁾ CA-1 and CA-2 will be taped at 0.200 pitch, 73.02 mm [2.875"] tape space without lead trim. CA-4000 and CA-5000 series will be taped at 0.200 pitch, tape space varies by body length



ONLINE INFORMATION

For product information and a current list of sales offices,
representatives and distributors, visit our website:

www.vishay.com

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One of the World's Largest Manufacturers of
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VSE-DB0008-0806