HIGH-OHMIC/HIGH-VOLTAGE RESISTORS

QUICK REFERENCE DATA

Type			VR37	VR68
Resistance range				
		E24 series	220 kΩ to 33 MΩ	100 kΩ to 68 MΩ
		E24/E96 series	220 kΩ to 33 MΩ	100 kΩ to 68 MΩ
Resistance tolerance				
		E24 series	± 5%	± 5%
		E24/E96 series	± 1%	± 1%
Max. permissible body temperature (hot spot)			155 °C	155 °C
Temperature coefficient			± 200.10^{-6}/K	± 200.10^{-6}/K
Rated dissipation at T_{amb} = 70 °C			0,5 W	1,0 W
Limiting voltage				
d.c.			3,5 kV	10 kV
r.m.s.			2,5 kV	7 kV
Dielectric withstanding voltage of the insulation for 1 minute		min.	700 V	700 V
Basic specification			IEC 115-1B	IEC 115-1B
Climatic category (IEC 68)			55/155/56	55/155/56
Stability after:				
1000 h max. load	ΔR/R	max. (req.: 1,5%)	typ. 0,5%	typ. 1%
6 days damp-heat test	ΔR/R	max. (req.: 1,5%)	typ. 0,5%	typ. 1%
56 days damp-heat test	ΔR/R	max. (req.: 0,5%)	typ. 0,5%	typ. 0,5%
Noise		max. (req.: 2,5 μV/V)	typ. 0,5 μV/V	typ. 0,5 μV/V

APPLICATION

Where high resistance, high stability and high reliability at high voltage are required. The resistors meet the safety requirements of IEC 65, 4th edition; NFC 92.130; BS415; VDE 0860.

DESCRIPTION

A metal-glazed film is deposited on a high grade ceramic body; tinned electrolytic copper wires are welded to the end caps. The resistors are coated with a light blue insulating lacquer which also provides protection against environmental effects.

MECHANICAL DATA

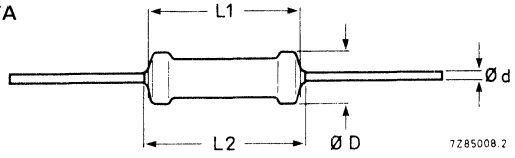

Fig. 1 Axial leads.

Table 1

type	D_{max}	$L_{1\ max}$	$L_{2\ max}$	d
VR37	3,7	9,0	10,0	0,7
VR68	6,8	16,5	19,0	0,8

The length of the body is measured by inserting the leads into holes of two identical gauge plates and moving those plates parallel to each other until the resistor body is clamped without deformation (IEC publication 294). For leads of 0,7 mm diameter, the diameter of the holes in the gauge plates is 1,0 mm; for leads of 0,8 mm diameter, the holes are 1,2 mm.

Mass (per 100) VR37: 42g; VR68: 148g

Mounting

The resistors are suitable for processing on automatic insertion equipment and cutting and bending machines.

Marking

The nominal resistance and the tolerance are marked on these resistors by four (E24 series) or five (E96 + E24) coloured bands according to IEC publication 62 "Colour code for fixed resistors". See General Section.
Yellow and grey are used instead of gold and silver, because metal particles in the lacquer could affect high-voltage properties.

ELECTRICAL DATA

Standard values of rated resistance and tolerance

Standard values of rated resistance (nominal resistance) are taken from the E24/E96 series (tolerance ± 1%) and E24 series (tolerance ± 5%) within the range 220 kΩ to 33 MΩ for type VR37 and 100 kΩ to 68 MΩ for type VR68. Values up to 220 MΩ are available on request. See the table "Standard series of values in a decade" at the back of the book.

→ The limiting voltage for resistor element is the maximum voltage that may be supplied continuously to the resistor element or the insulation, see IEC publications 115-1 and 115-2. This voltage is 3500 V (d.c.) or 2500 V (r.m.s.) for type VR37 and 10 kV (d.c.) or 7 kV (r.m.s.) for type VR68.

Table 2

type	packing	quantity	resistance range	tolerance ± %	series	catalogue number 2322 followed by:
VR37	ammopack	1000	220 kΩ to 33 MΩ	1	E24/E96	242 8 . . . .
				5	E24	242 13 . . .
	on reel	5000	220 kΩ to 33 MΩ	1	E24/E96	242 7 . . . .
		5000		5	E24	242 23 . . .
VR68	ammopack	500	100 kΩ to 68 MΩ	1	E24/E96	244 8 . . . .
				5	E24	244 13 . . .

COMPOSITION OF THE CATALOGUE NUMBER

The catalogue number in the above table is completed by inserting the resistance code: the first two figures (E24 series) resp. first three figures (E24/E96) of the resistance (in Ω) followed by:
4 for R = 100 kΩ to 976 kΩ
5 for R = 1 MΩ to 9,76 MΩ
6 for R = 10 MΩ to 68 MΩ

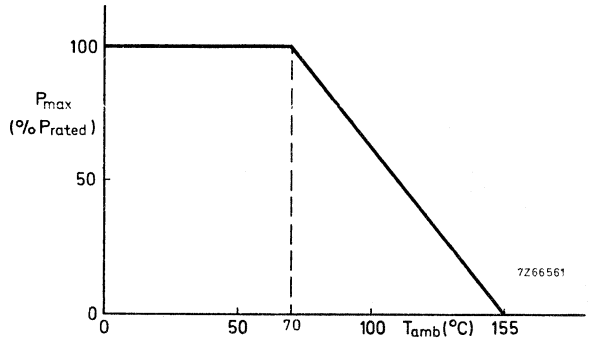

Fig. 2 Maximum dissipation (P_{max}) as a function of the ambient temperature (T_{amb}).

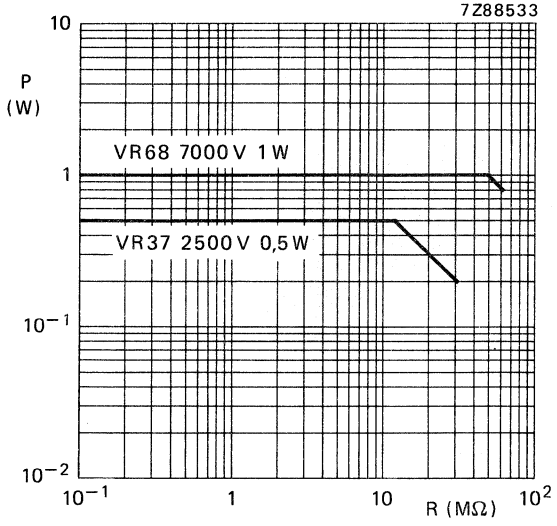

Fig. 3 Power versus resistance value of high-voltage resistors at T_{amb} = 70 °C.

TESTS AND REQUIREMENTS

Essentially all tests are carried out according to the schedule of IEC publication 115-1, category 55/155/56 (rated temperature range –55 to + 155 °C; damp heat, long term, 56 days) and along the lines of IEC publication 68, "Recommended basic climatic and mechanical robustness testing procedure for electronic components". In the following table the tests are listed with reference to the relevant clauses of IEC publications 115-1 and 68; a short description is also given of the test procedure and requirements. In some instances deviations from the IEC recommendation were necessary for our method of specifying.

Table 4

IEC 115-1 clause	IEC 68 test method	test	procedure	requirements
18		Robustness of terminations		
	Ua	Tensile all samples	load 10N; 10 s	number of failures: < 10 ppm
	Ub	Bending half number of samples	load 5N; 4 x 90°	number of failures: < 10 ppm
	Uc	Torsion other half number of samples	3 x 360° in opposite directions	no damage ΔR max. 0,5% + 0,05 Ω
19	T	Soldering	solderability: 2 s 230 °C, flux 600 thermal shock: 3 s 350 °C, 6 mm from body	good tinning, no damage ΔR max. 0,5% + 0,05 Ω
20	Na	Rapid change of temperature	½ h –55 °C/½ h + 155 °C, 5 cycles	ΔR max. 0,5% + 0,05 Ω
22	Fc	Vibration	frequency 10-500 Hz, displacement 1,5 mm or acceleration 10g, three directions; total 6 h (3 x 2 h)	no damage ΔR max. 0,5% + 0,05 Ω
21	Eb	Bump	3 x 1500 bumps in three directions, 40g	no damage ΔR max. 0,5% + 0,05 Ω

IEC 115-1 clause	IEC 68 test method	test	procedure	requirements
23		Climatic sequence		
23.2	Ba	Dry heat	16 h, 155 °C	
23.3	D	Damp heat (accel) 1st cycle	24 h; 55 °C; 95-100% R.H.	
23.4	Aa	Cold	2 h; −55 °C	
23.5	M	Low air pressure	2 h; 8,5 kPa; 15-35 °C	
23.6	D	Damp heat (accel) remaining cycles	5 days; 55 °C; 95-100% R.H.	R_{ins} min. 1000 MΩ ΔR max. 1,5%
24.2	Ca	Damp heat steady state	56 days; 40 °C; 90-95% R.H. dissipation $\leqslant 0{,}01\ P_n$ limiting voltage 16 V (d.c.)	R_{ins} min. 1000 MΩ ΔR max. 1,5%
26.2	–	Endurance	1000 hours; 70 °C nominal dissipation or V_{max}	ΔR max. 1,5%
11	–	Temperature coefficient	between −55 °C and + 155 °C	$\pm\ 200.10^{-6}$/K
10	–	Voltage proof on insulation	700 V (r.m.s.), 1 minute	no breakdown
14	–	Noise	IEC publication 195	max. 2,5 μV/V
9	–	Insulation resistance		min. 10^4 MΩ

STANDARD PACKAGING

The resistors are supplied on bandolier in ammopack or on reel.

type	quantity per box	
	bandolier ammopack	bandolier on reel
VR37	1000	5000
VR68	500	

Configuration of bandolier

Dimensions in mm

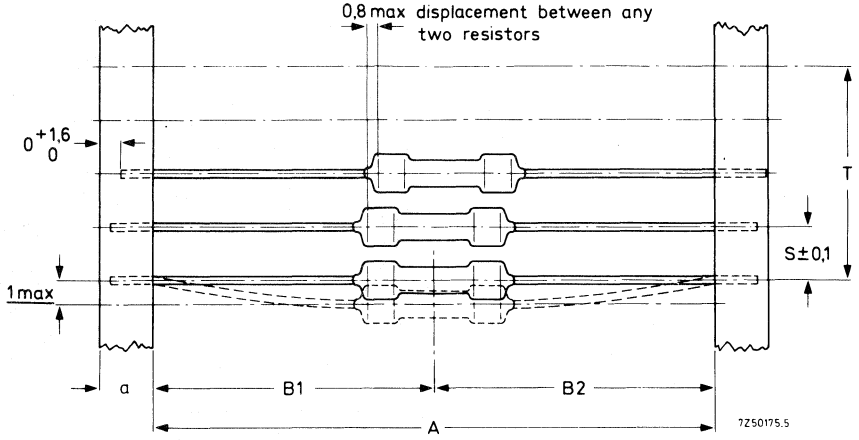

Fig. 4.

type	a ± 0,5	A ± 1,5	B1 - B2 ± max.	S (spacing)	T (max. deviation of spacing)
VR37	6	52,4	1,2	5	1 mm per 10 spacings
VR68	5	66,7	1,2	10	0,5 mm per 5 spacings