

# High Ohmic/High Voltage Metal Glaze Led Resistors



A metal glazed film is deposited on a high grade ceramic body. After a helical groove has been cut in the resistive layer, tinned electrolytic copper wires are welded to the end-caps. The resistors are coated with a light blue lacquer which provides electrical, mechanical, and climatic protection.

The encapsulation is resistant to all cleaning solvents in accordance with IEC 60068-2-45.

## FEATURES

- Technology: Metal glaze
- $R_{max.} = 33 \text{ M}\Omega$ ;  $U_{max.} = 3500 \text{ V}_{DC}$
- These resistors meet the safety requirements of:
  - UL1676 (510 k $\Omega$  to 11 M $\Omega$ ); File No: E171160
  - IEC 60065, clause 14.1.a)
  - DIN EN 60065, clause 14.1.a)
  - VDE 0860, clause 14.1.a)
  - CQC, China
- High pulse loading capability (10 kV)
- Small size (0309)
- Pure tin plating provides compatibility with lead (Pb)-free and lead containing soldering processes
- Compliant to RoHS Directive 2002/95/EC



**RoHS**  
COMPLIANT

## APPLICATIONS

- Where high resistance, high stability and high reliability at high voltage are required
- Safety component in combination with high voltage
- White goods
- High humidity environment
- Power supplies

TECHNICAL SPECIFICATIONS		
DESCRIPTION	UNIT	VR37
Resistance Range <sup>(1)</sup>	$\Omega$	100K to 33M
Resistance Tolerance	%	$\pm 1$ ; $\pm 5$
Resistance Series		$\pm 1$ %: E24/E96 series; $\pm 5$ %: E24 series
Rated Dissipation, $P_{70}$	W	0.5
Thermal Resistance ( $R_{th}$ )	K/W	120
Temperature Coefficient	ppm/K	$\leq \pm 200$
Maximum Permissible Voltage $U_{max.}$ :		
DC	V	3500
RMS		2500
Dielectric Withstanding Voltage of the Insulation for 1 Min	V	700
Basic Specifications		IEC 60115-1
Safety Requirements		UL1676 (510 k $\Omega$ to 11 M $\Omega$ ); DIN EN 60065, IEC 60065 clause 14.1.a); VDE 0860, clause 14.1.a), CQC
Climatic Category (IEC 60068-1)		55/155/56
Max. Resistance Change for Resistance Range, $\Delta R$ max., after:		
Load (1000 h, $P_{70}$ )		$\pm (1.5 \% R + 0.1 \Omega)$
Long Term Damp Heat Test (56 Days)		$\pm (1.5 \% R + 0.1 \Omega)$
Soldering (10 s, 260 °C)		$\pm (1.5 \% R + 0.1 \Omega)$
Noise	$\mu\text{V/V}$	max. 2.5

### Note

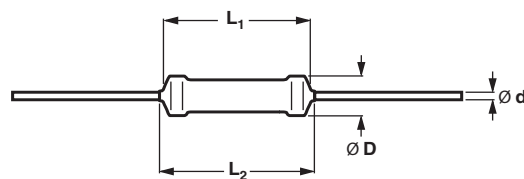
<sup>(1)</sup> Ohmic values (other than resistance range) are available on request

PART NUMBER						
PART NUMBER: VR37000001503JA100						
V	R	3	7	0	0	0
MODEL/SIZE	VARIANT	TCR/MATERIAL	VALUE	TOLERANCE	PACKAGING <sup>(1)</sup>	SPECIAL
VR37000	0 = Neutral Z = Value overflow (special)	0 = Standard	3 digit value 1 digit multiplier MULTIPLIER 3 = *10 <sup>3</sup> 4 = *10 <sup>4</sup> 5 = *10 <sup>5</sup>	F = ± 1 % J = ± 5 %	A1 R5	The 2 digits are used for all special parts. 00 = Standard
PRODUCT DESCRIPTION: VR37 5 % A1 150K						
VR37	5 %	A1	150K			
MODEL/SIZE	TOLERANCE	PACKAGING <sup>(1)</sup>	RESISTANCE VALUE			
VR37	± 1 % ± 5 %	A1 R5	150K = 150 kΩ 8M2 = 8.2 MΩ			

**Notes**

- The PART NUMBER is shown to facilitate the introduction of a unified part numbering system for ordering products
- <sup>(1)</sup> Please refer to table PACKAGING

PACKAGING					
MODEL	TAPING	AMMOPACK		REEL	
		PIECES	CODE	PIECES	CODE
VR37	Axial, 52 mm	1000	A1	5000	R5

**DIMENSIONS**


Outline

DIMENSIONS - Resistor type and relevant physical dimensions				
TYPE	Ø D <sub>max.</sub>	L <sub>1</sub> max.	L <sub>2</sub> max.	Ø d
VR37	4.0	9.0	10.0	0.7 ± 0.03

MASS PER UNIT	
TYPE	MASS (mg)
VR37	457

**MARKING**

The nominal resistance and tolerance are marked on the resistor using four or five colored bands in accordance with IEC 60062, marking codes for resistors and capacitors.

Yellow and grey are used instead of gold and silver because metal particles in the lacquer could affect high-voltage properties.



OUTLINES

The length of the body (L<sub>1</sub>) is measured by inserting the leads into holes of two identical gauge plates and moving

these plates parallel to each other until the resistor body is clamped without deformation (IEC 60294).

FUNCTIONAL PERFORMANCE
PRODUCT CHARACTERIZATION

Standard values of nominal resistance are taken from the E96/E24/E12 series for resistors with a tolerance of ± 1 %,

or 5 %. The values of the E96/E24 series are in accordance with IEC 60063.

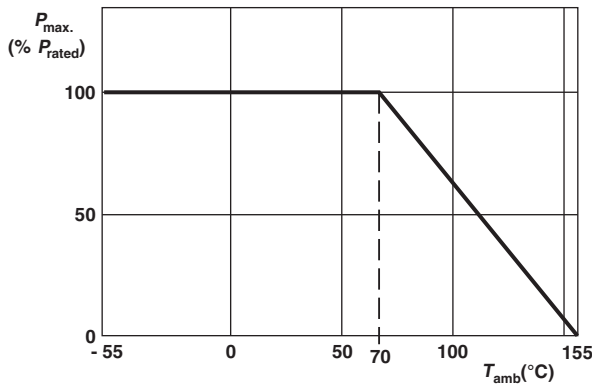
Table with 4 columns: TYPE, LIMITING VOLTAGE (1) Umax. (DC, RMS), and LIMITING POWER P70 (W). Row for VR37 shows DC: 3500, RMS: 2500, P70: 0.5.

Notes

- The maximum permissible hot-spot temperature is 155 °C
(1) The maximum voltage that may be continuously applied to the resistor element, see IEC 60115-1

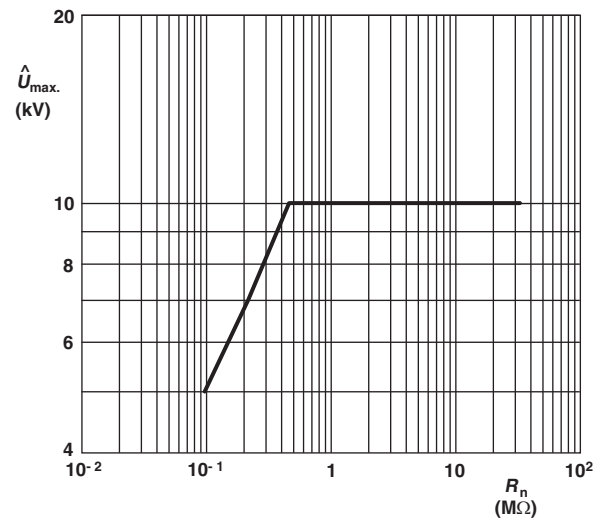
DERATING

The power that the resistor can dissipate depends on the operating temperature.

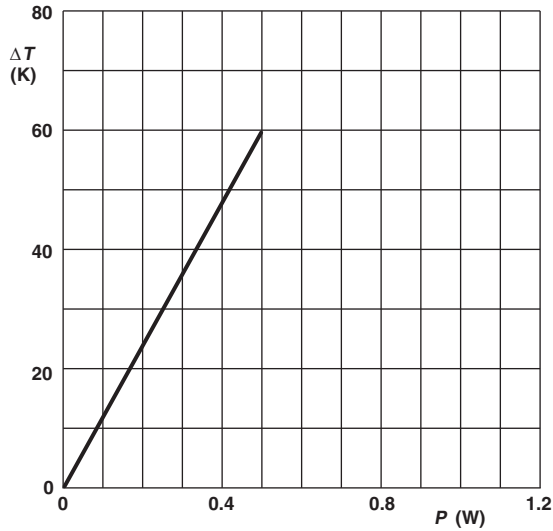
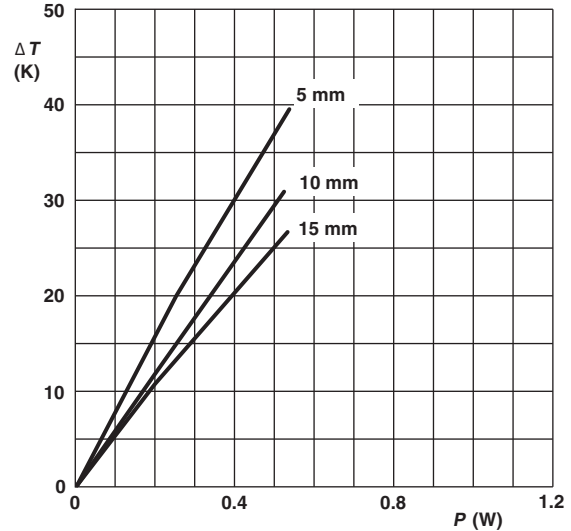


Maximum dissipation (Pmax) in percentage of rated power as a function of the ambient temperature (Tamb)

PULSE LOADING CAPABILITY



Maximum allowed peak pulse voltage in accordance with IEC 60065, 14.1.a); 50 discharges from a 1 nF capacitor charged to Umax.; 12 discharges/min (drift ΔR/R ≤ 2 %)

**APPLICATION INFORMATION**

 Hot-spot temperature rise ( $\Delta T$ ) as a function of dissipated power

 Temperature rise ( $\Delta T$ ) at the lead end (soldering point) as a function of dissipated power at various lead lengths after mounting

**TESTS AND REQUIREMENTS**

Essentially all tests are carried out in accordance with IEC 60115-1 specification, category LCT/UCT/56 (rated temperature range: Lower Category Temperature, Upper Category Temperature; damp heat, long term, 56 days).

The tests are carried out in accordance with IEC 60068-2-xx. Test method under standard atmospheric conditions according to IEC 60068-1, 5.3.

In the Test Procedures and Requirements table the tests and requirements are listed with reference to the relevant clauses of IEC 60115-1 and IEC 60068-2-xx test methods. A short description of the test procedure is also given. In some instances deviations from the IEC recommendations were necessary for our method of specifying.

All soldering tests are performed with mildly activated flux.

TEST PROCEDURES AND REQUIREMENTS				
IEC 60115-1 CLAUSE	IEC 60068-2-TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.16		Robustness of terminations:		
4.16.2	21 (Ua1)	Tensile all samples	Ø 0.7 mm; load 10 N; 10 s	Number of failures <math> < 10 \times 10^{-6}</math>
4.16.3	21 (Ub)	Bending half number of samples	Ø 0.7 mm; load 5 N; 4 x 90°	Number of failures <math> < 10 \times 10^{-6}</math>
4.16.4	21 (Uc)	Torsion other half of samples	3 x 360° in opposite directions	No damage $\Delta R \text{ max.: } \pm (0.5 \% R + 0.05 \Omega)$
4.17	20 (Ta)	Solderability	2 s; 235 °C: Solder bath method; SnPb40 3 s; 245 °C: Solder bath method; SnAg3Cu0.5	Good tinning ( $\geq 95 \%$ covered); no damage
		Solderability (after aging)	8 h steam or 16 h 155 °C; leads immersed 6 mm; for 2 s at 235 °C; solder bath (SnPb40) for 3 s at 245 °C; solder bath (SnAg3Cu0.5) method	Good tinning ( $\geq 95 \%$ covered); no damage
4.18	20 (Tb)	Resistance to soldering heat	Thermal shock: 10 s; 260 °C; 3 mm from body	$\Delta R \text{ max.: } \pm (0.5 \% R + 0.05 \Omega)$
4.19	14 (Na)	Rapid change of temperature	30 min at - 55 °C and 30 min at + 155 °C; 5 cycles	$\Delta R \text{ max.: } \pm (0.5 \% R + 0.05 \Omega)$
4.20	29 (Eb)	Bump	3 x 1500 bumps in 3 directions; 40 g	No damage $\Delta R \text{ max.: } \pm (0.5 \% R + 0.05 \Omega)$



TEST PROCEDURES AND REQUIREMENTS				
IEC 60115-1 CLAUSE	IEC 60068-2- TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.22	6 (Fc)	Vibration	Frequency 10 Hz to 500 Hz; displacement 1.5 mm or acceleration 10 g; 3 directions; total 6 h (3 x 2 h)	No damage $\Delta R$ max.: $\pm (0.5 \% R + 0.05 \Omega)$
4.23	2 (Ba) 30 (Db) 1 (Aa) 13 (M) 30 (Db)	Climatic sequence:		
4.23.2		Dry heat	16 h; 155 °C	
4.23.3		Damp heat (accelerated) 1 <sup>st</sup> cycle	24 h; 55 °C; 90 % to 100 % RH	
4.23.4		Cold	2 h; - 55 °C	
4.23.5		Low air pressure	2 h; 8.5 kPa; 15 °C to 35 °C	
4.23.6		Damp heat (accelerated) remaining cycles	5 days; 55 °C; 95 % to 100 % RH	$R_{ins}$ min.: $10^3 \text{ M}\Omega$ $\Delta R$ max.: $\pm (1.5 \% R + 0.1 \Omega)$
4.24	78 (Cab)	Damp heat (steady state)	56 days; 40 °C; 90 % to 95 % RH; dissipation $0.01 P_{70}$ ; limiting voltage $U = 100 V_{DC}$	$\Delta R$ max.: $\pm (1.5 \% R + 0.1 \Omega)$
4.25.1		Endurance	1000 h at 70 °C; $P_{70}$ or $U_{max}$ .	$\Delta R$ max.: $\pm (1.5 \% R + 0.1 \Omega)$
4.8		Temperature coefficient	Between - 55 °C and + 155 °C	$\leq \pm 200 \text{ ppm/K}$
4.7		Voltage proof on insulation	$U_{RMS} = 700 \text{ V}$ during 1 min; V-block method	No breakdown
4.12		Noise	IEC 60195	Max. 2.5 $\mu\text{V/V}$
4.6.1.1		Insulation resistance	$U = 500 V_{DC}$ during 1 min; V-block method	$R_{ins}$ min.: $10^4 \text{ M}\Omega$
4.13		Short time overload	Room temperature; dissipation $6.25 \times P_{70}$ (voltage not more than 2 x limiting voltage); 10 cycles; 5 s ON and 45 s OFF	$\Delta R$ max.: $\pm (2.0 \% R + 0.05 \Omega)$

**12NC INFORMATION FOR HISTORICAL CODING REFERENCE**

- The resistors have a 12-digit numeric code starting with 2322 242
- The subsequent:
  - First digit for 1 % tolerance products (E24 and E96 series) or 2 digits for 5 % (E24 series) indicate the resistor type and packing.
- The remaining digits indicate the resistance value:
  - The first 3 digits for 1 % or 2 digits for 5 % tolerance products indicate the resistance value.
  - The last digit indicates the resistance decade.

**Last Digit of 12NC Indicating Resistance Decade**

RESISTANCE DECADE	LAST DIGIT
100 k $\Omega$ to 976 k $\Omega$	4
1 M $\Omega$ to 9.76 M $\Omega$	5
$\geq 10 \text{ M}\Omega$	6

**12NC Example**

The 12NC for a VR37, resistor value 7.5 M $\Omega$ , 5 % tolerance, supplied on a bandolier of 1000 units in ammpack, is: 2322 242 13755.

12NC - Resistor type and packaging				
TYPE	TAPE WIDTH (mm)	TOL. (%)	2322 242 .....	
			BANDOLIER IN AMMOPACK	BANDOLIER ON REEL
			1000 UNITS	5000 UNITS
VR37	52	$\pm 1$	8....	6....
		$\pm 5$	13...	23...



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