

High Ohmic/High Voltage Metal Glaze Leaded 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

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

Note

⁽¹⁾ Ohmic values (other than resistance range) are available upon request

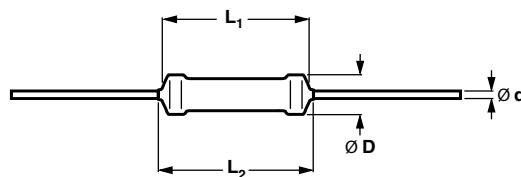
PART NUMBER						
PART NUMBER: VR37000001503JA100						
V	R	3	7	0	0	0
0	0	0	0	1	5	0
3	J	A	1	0	0	
MODEL/SIZE	VARIANT	TCR/MATERIAL	VALUE	TOLERANCE	PACKAGING (1)	SPECIAL
VR37000	0 = Neutral Z = Value overflow (Special)	0 = Standard	3 digit value 1 digit multiplier MULTIPLIER 3 = *10 ³ 4 = *10 ⁴ 5 = *10 ⁵	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 (1)	RESISTANCE VALUE			
VR37	± 1 % ± 5 %	A1 R5	150K = 150 kΩ 8M2 = 8.2 MΩ			

Notes

(1) Please refer to table PACKAGING

- The PART NUMBER is shown to facilitate the introduction of a unified part numbering system for ordering products

PACKAGING					
MODEL	TAPING	AMMO PACK		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 _{max.}	L ₁ max.	L ₂ 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_1) 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 $\pm 1\%$ or

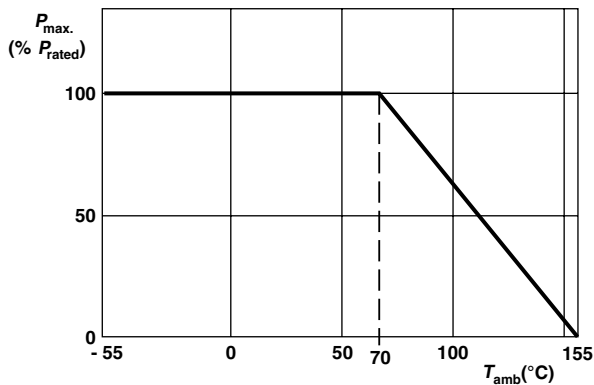
5%. The values of the E96/E24 series are in accordance with IEC 60063.

LIMITING VALUES			
TYPE	LIMITING VOLTAGE ⁽¹⁾ $U_{max.}$		LIMITING POWER, P_{70} (W)
	DC	RMS	
VR37	3500	2500	0.5

Notes

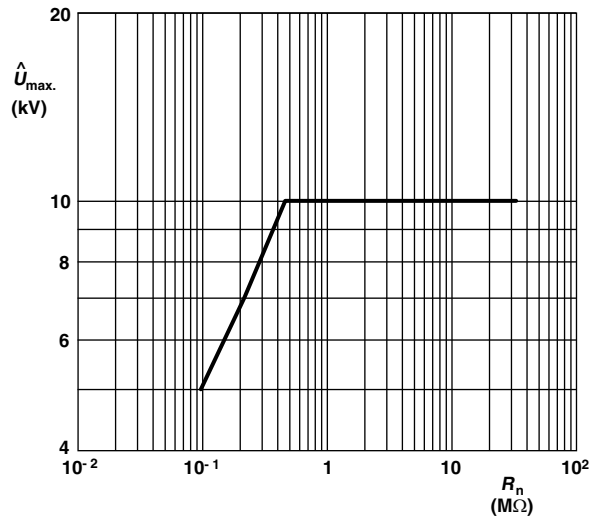
- ⁽¹⁾ The maximum voltage that may be continuously applied to the resistor element, see IEC 60115-1
- The maximum permissible hot-spot temperature is 155 °C

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



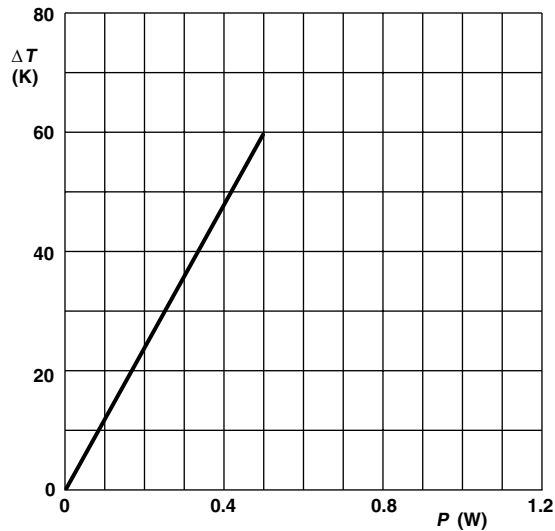
Maximum dissipation ($P_{max.}$) in percentage of rated power as a function of the ambient temperature (T_{amb})

Derating



Maximum allowed peak pulse voltage in accordance with IEC 60065, 14.1.a); 50 discharges from a 1 nF capacitor charged to $\hat{U}_{max.}$; 12 discharges/minute (drift $\Delta R/R \leq 2\%$)

Pulse Loading Capability


 Hot-spot temperature rise (ΔT) as a function of dissipated power

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

Application Information

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 < 10×10^{-6}
4.16.3	21 (Ub)	Bending half number of samples	Ø 0.7 mm; load 5 N; $4 \times 90^\circ$	Number of failures < 10×10^{-6}
4.16.4	21 (Uc)	Torsion other half of samples	$3 \times 360^\circ$ in opposite directions	No damage ΔR 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	ΔR 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	ΔR max.: $\pm (0.5 \% R + 0.05 \Omega)$



TEST PROCEDURES AND REQUIREMENTS				
IEC 60115-1 CLAUSE	IEC 60068-2- TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.20	29 (Eb)	Bump	3 x 1500 bumps in 3 directions; 40 g	No damage $\Delta R \text{ max.: } \pm (0.5 \% R + 0.05 \Omega)$
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 $\Delta R \text{ max.: } \pm (0.5 \% R + 0.05 \Omega)$
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 st 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	$R_{\text{ins min.:}} 10^3 \text{ M}\Omega$ $\Delta R \text{ max.: } \pm (1.5 \% R + 0.1 \Omega)$
4.24	78 (Cab)	Damp heat (steady state)	56 days; 40 °C; 90 % to 95 % RH; dissipation 0.01 P_{70} ; limiting voltage $U = 100 \text{ V}_{\text{DC}}$	$\Delta R \text{ max.: } \pm (1.5 \% R + 0.1 \Omega)$
4.25.1		Endurance	1000 h at 70 °C; P_{70} or U_{max}	$\Delta R \text{ max.: } \pm (1.5 \% R + 0.1 \Omega)$
4.8		Temperature coefficient	Between - 55 °C and + 155 °C	$\leq \pm 200 \text{ ppm/K}$
4.7		Voltage proof on insulation	$U_{\text{RMS}} = 700 \text{ V}$ 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	$U = 500 \text{ V}_{\text{DC}}$ during 1 min; V-block method	$R_{\text{ins min.:}} 10^4 \text{ M}\Omega$
4.13		Short time overload	Room temperature; dissipation 6.25 x P_{70} (voltage not more than 2 x limiting voltage); 10 cycles; 5 s ON and 45 s OFF	$\Delta R \text{ max.: } \pm (2.0 \% R + 0.05 \Omega)$

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 packaging
- 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 Ω to 976 k Ω	4
1 M Ω to 9.76 M Ω	5
$\geq 10 \text{ M}\Omega$	6

12NC Example

The 12NC for a VR37, resistor value 7.5 M Ω , 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	± 1	8....	6....
		± 5	13...	23...



Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk and agree to fully indemnify and hold Vishay and its distributors harmless from and against any and all claims, liabilities, expenses and damages arising or resulting in connection with such use or sale, including attorneys fees, even if such claim alleges that Vishay or its distributor was negligent regarding the design or manufacture of the part. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.