High Ohmic (up to 33 MΩ)/High Voltage (up to 3.5 kV) 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 "MIL-STD 202E, method 215" and "IEC 60068-2-45".

FEATURES

- Lead (Pb)-free solder contacts
- These resistors meet the safety requirements of:
  "UL1676" (510 kΩ to 11 MΩ); File No: E171160
  "IEC 60065"
  "EN60065"
  "VDE 0860" (Germany)
  "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
- Compatible with "Restriction of the use of Hazardous Substances" (RoHS) directive 2002/95/EC (issue 2004)

REG.-Nr. 40002857

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 kΩ to 33 MΩ
Resistance tolerance and series	± 1 %: E24/E96 series; ± 5 %: E24 series
Maximum dissipation at T_{amb} = 70 °C	0.5 W
Thermal resistance, R_{th}	120 K/W
Temperature coefficient	≤ ± 200 × 10^{-6}/K
Maximum permissible voltage: DC RMS	 3500 V 2500 V
Dielectric withstanding voltage of the insulation for 1 minute	700 V
Basic specifications	IEC 60115-1B
Safety requirements	UL1676 (510 kΩ to 11 MΩ); EN60065; VDE 0860; CQC
Climatic category (IEC 60068)	55/155/56
Stability after: load (1000 hours) accelerated damp heat test (6 days) long term damp heat test (56 days)	 ΔR max.: ± (1.5 % R + 0.1 Ω) ΔR max.: ± (1.5 % R + 0.1 Ω) ΔR max.: ± (1.5 % R + 0.1 Ω)
Noise	max. 2.5 µV/V

Note

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

For technical questions, contact: ff3dresistors@vishay.com
Document Number: 28733
Revision: 04-Aug-06

12NC INFORMATION

- 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 to 976 kΩ	4
1 to 9.76 MΩ	5
≥ 10 MΩ	6

12NC Example

The 12NC for a VR37, resistor value 7.5 MΩ, 5 % tolerance, supplied on a bandolier of 1000 units in ammopack, is: 2322 242 13755.

12NC - resistor type and packaging

TYPE	TAPE WIDTH (mm)	TOL. (%)	ORDERING CODE 2322 242	
			BANDOLIER IN AMMOPACK	BANDOLIER ON REEL
			1000 units	5000 units
VR37	52	± 1	8....	6....
		± 5	13...	23...

PART NUMBER

PART NUMBER: VR37000001503JA100

V	R	3	7	0	0	0	0	0	1	5	0	3	J	A	1	0	0

MODEL/SIZE	SPECIAL CHARACTER	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

[1)] Please refer to table PACKAGING.

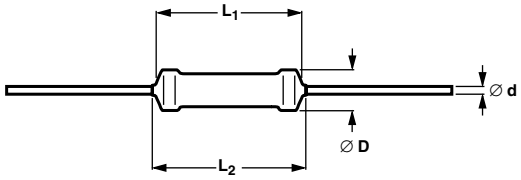
Note

Products can be ordered using either the 12NC or the PART NUMBER. The PART NUMBER is shown to facilitate the introduction of a unified part numbering system. Currently, this PART NUMBER is applicable in the Americas and Asia only.

PACKAGING

CODE	PIECES	DESCRIPTION	MODEL/SIZE
A1	1000	Bandolier in ammopack straight leads 52 mm	VR37
R5	5000	Bandolier on reel straight leads 52 mm	

DIMENSIONS



Outline

DIMENSIONS - resistor type and relevant physical dimensions				
TYPE	**∅ D MAX.**	**L_1 MAX.**	**L_2 MAX.**	**∅ d**
VR37	4.0	9.0	10.0	0.7 ± 0.03

MASS PER 100 UNITS	
TYPE	**MASS (g)**
VR37	45.7

MARKING

The nominal resistance and tolerance are marked on the resistor using four or five colored bands in accordance with IEC publication 60062 “Color codes for fixed resistors”.

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 publication 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 publication 60063”.

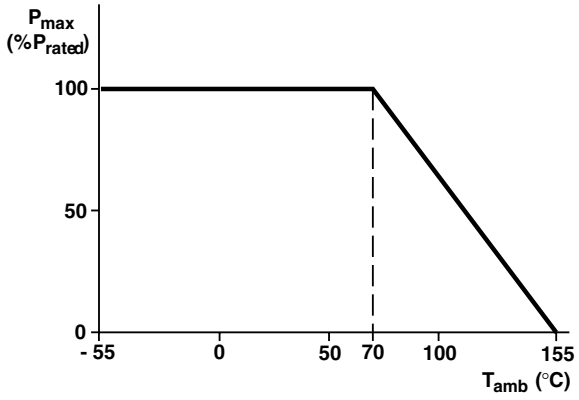
LIMITING VALUES			
TYPE	**LIMITING VOLTAGE[1] (V)**		**LIMITING POWER (W)**
	DC	**RMS**	
VR37	3500	2500	0.5

Note

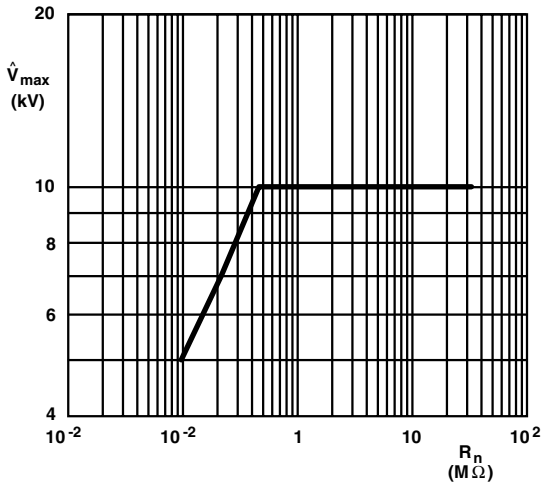
1. The maximum voltage that may be continuously applied to the resistor element, see “IEC publication 60115-1”.

The maximum permissible hot-spot temperature is 155 °C.

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

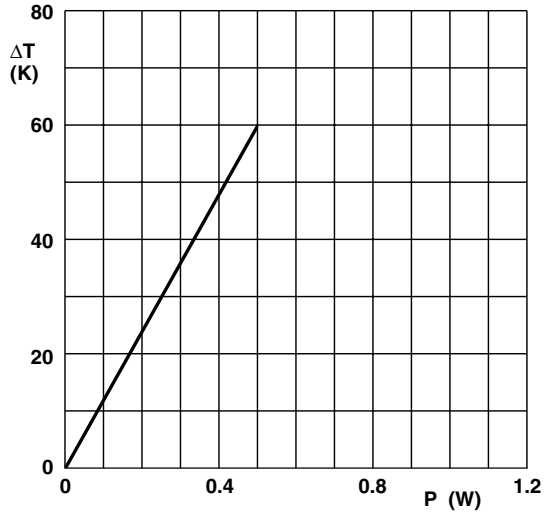


Maximum dissipation (P_{max}) in percentage of rated power as a function of the ambient temperature (T_{amb})



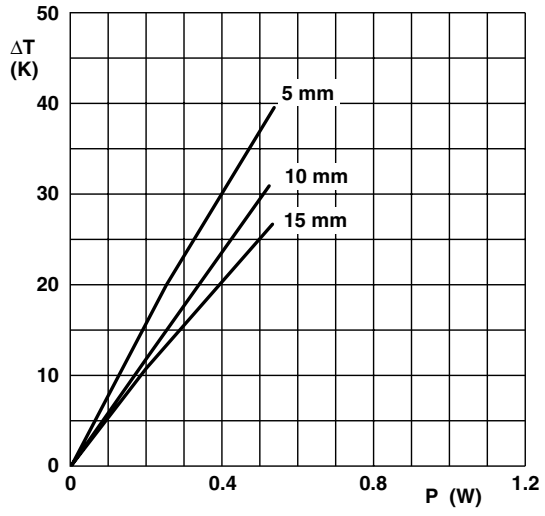
Maximum allowed peak pulse voltage in accordance with "IEC 60065 chapter 14.1"; 50 discharges from a 1 nF capacitor charged to $\hat{V}_{max}$; 12 discharges/minute (drift $\Delta R/R \leq 2$ %)

Derating



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

Pulse Loading Capability



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 the schedule of "IEC publication 60115-1", category LCT/UCT/56 (rated temperature range: Lower Category Temperature, Upper Category Temperature; damp heat, long term, 56 days). The testing also covers the requirements specified by EIA and EIAJ.

The tests are carried out in accordance with IEC publication 60068-2, "Recommended basic climatic and mechanical robustness testing procedure for electronic components" and under standard atmospheric conditions according to "IEC 60068-1", subclause 5.3.

In the Test Procedures and Requirements table the tests and requirements are listed with reference to the relevant clauses of "IEC publications 60115-1 and 60068-2"; 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	21 (U)	robustness of terminations:		
4.16.2	21 (Ua1)	tensile all samples	∅ 0.7 mm; load 10 N; 10 s	number of failures $< 10 \times 10^{-6}$
4.16.3	21 (Ub)	bending half number of samples	∅ 0.7 mm; load 5 N; 4 × 90°	number of failures $< 10 \times 10^{-6}$
4.16.4	21 (Uc)	torsion other half of samples	3 × 360° in opposite directions	no damage ΔR max.: ± (0.5 % R + 0.05 Ω)
4.17	20 (Ta)	solderability	2 s; 235 °C	good tinning; no damage
4.18	20 (Tb)	resistance to soldering heat	thermal shock: 3 s; 350 °C; 3 mm from body	ΔR max.: ± (0.5 % R + 0.05 Ω)
4.19	14 (Na)	rapid change of temperature	30 minutes at - 55 °C and 30 minutes at + 155 °C; 5 cycles	ΔR max.: ± (0.5 % R + 0.05 Ω)
4.20	29 (Eb)	bump	3 × 1500 bumps in 3 directions; 40 g	no damage ΔR max.: ± (0.5 % R + 0.05 Ω)
4.22	6 (Fc)	vibration	frequency 10 to 500 Hz; displacement 1.5 mm or acceleration 10 g; 3 directions; total 6 hours (3 × 2 hours)	no damage ΔR max.: ± (0.5 % R + 0.05 Ω)
4.23		climatic sequence:		
4.23.2	2 (Ba)	dry heat	16 hours; 155 °C	
4.23.3	30 (Db)	damp heat (accelerated) 1st cycle	24 hours; 55 °C; 90 to 100 % RH	
4.23.4	1 (Aa)	cold	2 hours; - 55 °C	
4.23.5	13 (M)	low air pressure	2 hours; 8.5 kPa; 15 to 35 °C	
4.23.6	30 (Db)	damp heat (accelerated) remaining cycles	5 days; 55 °C; 95 to 100 % RH	R_{ins} min.: 10^3 MΩ ΔR max.: ± (1.5 % R + 0.1 Ω)

TEST PROCEDURES AND REQUIREMENTS				
IEC 60115-1 CLAUSE	**IEC 60068-2 TEST METHOD**	**TEST**	**PROCEDURE**	**REQUIREMENTS**
4.24.2	3 (Ca)	damp heat (steady state)	56 days; 40 °C; 90 to 95 % RH; dissipation 0.01 P_n; limiting voltage 100 V (DC)	ΔR max.: ± (1.5 % R + 0.1 Ω)
4.25.1		endurance	1000 hours at 70 °C; P_n or V_{max}	ΔR max.: ± (1.5 % R + 0.1 Ω)
4.8.4		temperature coefficient	between - 55 °C and + 155 °C ($TC \times 10^{-6}$/K)	≤ ± 200
4.7		voltage proof on insulation	700 V (RMS) during 1 minute; V-block method	no breakdown
4.12		noise	"IEC publication 60195"	max. 2.5 µV/V
4.6.1.1		insulation resistance	500 V (DC) during 1 minute; V-block method	R_{ins} min.: 10^4 MΩ
4.13		short time overload	room temperature; dissipation 6.25 × P_n (voltage not more than 2 × limiting voltage); 10 cycles; 5 s on and 45 s off	ΔR max.: ± (2.0 % R + 0.05 Ω)

Notice

Specifications of the products displayed herein are subject to change without notice. Vishay Intertechnology, Inc., or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

Information contained herein is intended to provide a product description only. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document. Except as provided in Vishay's terms and conditions of sale for such products, Vishay assumes no liability whatsoever, and disclaims any express or implied warranty, relating to sale and/or use of Vishay products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Vishay for any damages resulting from such improper use or sale.