High Ohmic/High Voltage 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

- These resistors meet the safety requirements of:
  "UL1676" (range 510 kΩ to 11 MΩ)
  "IEC 60065"
  "EN60065"
  "BS60065" (U.K.)
  "VDE 0860" (Germany)
  "CQC" (China)
- High pulse loading capability
- Small size.

APPLICATIONS

- Where high resistance, high stability and high reliability at high voltage are required
- Safety component in combination with high voltage
- Picture tubes
- High voltage bleeders
- Cascade switches.

TECHNICAL SPECIFICATIONS

DESCRIPTION	VALUE
Resistance range(1)	100 kΩ to 68 MΩ
Resistance tolerance and series	± 1 %: E24/E96 series; ± 5 %: E24 series
Maximum dissipation at T_{amb} = 70 °C	1 W
Thermal resistance, R_{th}	70 K/W
Temperature coefficient	≤ ± 200 × 10^{-6}/K
Maximum permissible voltage: DC RMS	 10000 V 7000 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; BS60065; VDE 0860; NFC 92-130
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/R max.: ± 1.5 % + 0.1 Ω ΔR/R max.: ± 1.5 % + 0.1 Ω ΔR/R max.: ± 1.5 % + 0.1 Ω
Noise	max. 2.5 μV/V

Note

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

12NC ORDERING CODE INDICATING RESISTOR TYPE AND PACKAGING

TYPE	TAPE WIDTH (mm)	TOL. (%)	ORDERING CODE 2322 244	
			BANDOLIER IN AMMOPACK	BANDOLIER ON REEL
			500 units	750 units
VR68	66.7	± 1	8....	-
		± 5	13...	23...

ORDERING INFORMATION

Ordering Code (12NC)

- The resistors have a 12-digit ordering code starting with 2322 244.
- 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.

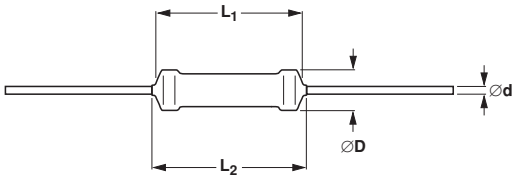
Last Digit of 12NC Indicating Resistance Decade

RESISTANCE DECADE	LAST DIGIT
100 to 976 kΩ	4
1 to 9.76 MΩ	5
≥10 MΩ	6

Ordering Example

The ordering code for a VR68, resistor value 7.5 MΩ, 5 % tolerance, supplied on a bandolier of 500 units in ammopack, is: 2322 244 13755.

DIMENSIONS



Outline.

DIMENSIONS - resistor type and relevant physical dimensions				
TYPE	**∅D MAX.**	**L_1 MAX.**	**L_2 MAX.**	**∅d**
VR68	6.8	18.0	19.0	0.78 ± 0.05

MASS PER 100 UNITS	
TYPE	**MASS (g)**
VR68	174

MARKING

The nominal resistance and tolerance are marked on the resistor using four or five coloured bands in accordance with IEC publication 60062 “Colour 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”.

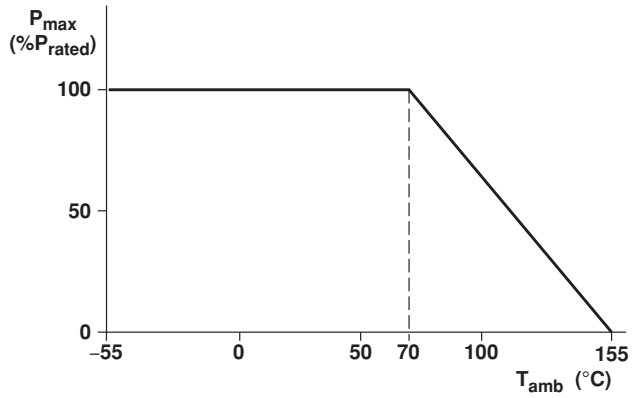
LIMITING VALUES			
TYPE	**LIMITING VOLTAGE(1) (V)**		**LIMITING POWER (W)**
	DC	**RMS**	
VR68	10000	7000	1.0

Note

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

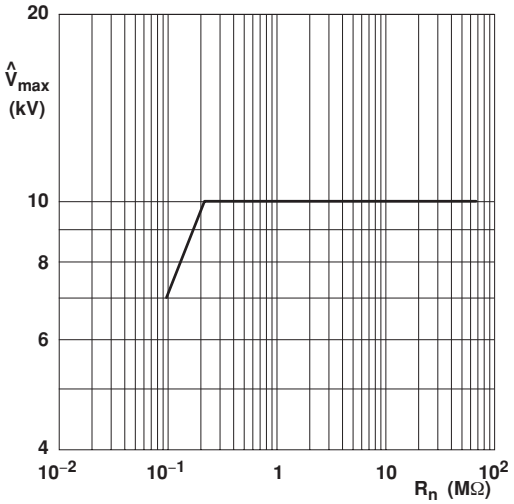
The maximum permissible hot-spot temperature is 155 °C.

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



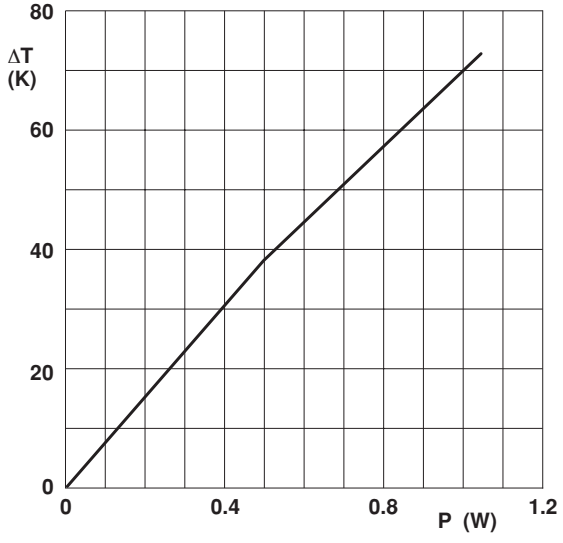
Maximum dissipation (P_{max}) in percentage of rated power as a function of the ambient temperature (T_{amb}).

Derating

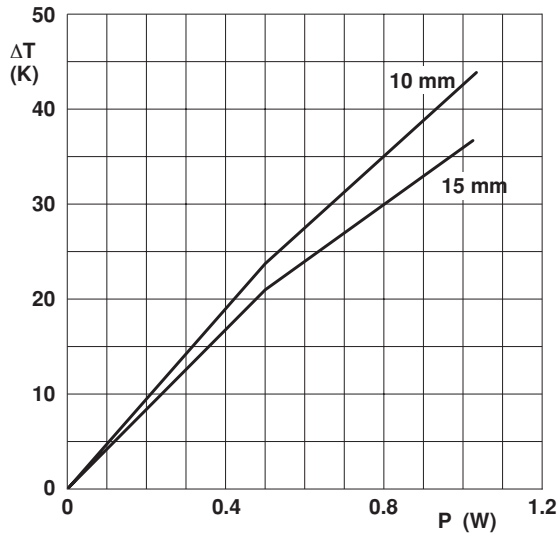


Maximum allowed peak pulse voltage in accordance with "IEC 60065 chapter 14.1"; 50 discharges from a 1 nF capacitor charged to $\hat{V}_{max}$; 12 discharges/minute (drift $\Delta R/R \leq 2$ %).

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 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 test 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	∅0.8 mm; load 10 N; 10 s	number of failures < 10×10^{-6}
4.16.3	21 (Ub)	bending half number of samples	∅0.8 mm; load 5 N; 4 × 90°	number of failures < 10×10^{-6}
4.16.4	21 (Uc)	torsion other half of samples	3 × 360° in opposite directions	no damage $\Delta R/R$ max.: ± 0.5 % + 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	$\Delta R/R$ max.: ± 0.5 % + 0.05 Ω
4.19	14 (Na)	rapid change of temperature	30 minutes at – 55 °C and 30 minutes at +155 °C; 5 cycles	$\Delta R/R$ max.: ± 0.5 % + 0.05 Ω

TEST PROCEDURES AND REQUIREMENTS				
IEC 60115-1 CLAUSE	**IEC 60068-2 TEST METHOD**	**TEST**	**PROCEDURE**	**REQUIREMENTS**
4.20	29 (Eb)	bump	3 × 1500 bumps in 3 directions; 40 g	no damage $\Delta R/R$ max.: ± 0.5 % + 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 $\Delta R/R$ max.: ± 0.5 % + 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 $\Delta R/R$ max.: ± 1.5 % + 0.1 Ω
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)	$\Delta R/R$ max.: ± 1.5 % + 0.1 Ω
4.25.1		endurance	1000 hours at 70 °C; P_n or V_{max}	$\Delta R/R$ max.: ± 1.5 % + 0.1 Ω

TEST PROCEDURES AND REQUIREMENTS				
IEC 60115-1 CLAUSE	**IEC 60068-2 TEST METHOD**	**TEST**	**PROCEDURE**	**REQUIREMENTS**
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; 10000 V max.); 10 cycles; 5 s on and 45 s off	ΔR/R max.: ± 2.0 % + 0.05 Ω