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

RoHS COMPLIANT

- Technology: Metal glaze
- $R_{max.}$ = 22 MΩ; $U_{max.}$ = 1600 V_{DC}
- High pulse loading capability (up to 7 kV)
- Small size (0207)
- Lead (Pb)-free solder contacts
- Pure tin plating provides compatibility with lead (Pb)-free and lead containing soldering processes
- Compliant to RoHS Directive 2002/95/EC
- AEC-Q200 qualified

APPLICATIONS

- Where high resistance, high stability and high reliability at high voltage are required
- High humidity environment
- White goods
- Power supplies

TECHNICAL SPECIFICATIONS

DESCRIPTION	UNIT	VR25
Resistance Range (1)	Ω	100K to 22M
Resistance Tolerance 100 kΩ to 15 MΩ 15 MΩ to 22 MΩ	%	 ± 1; ± 5; ± 5; ± 10
Resistance Series 100 kΩ to 15 MΩ 15 MΩ to 22 MΩ		 E24/E96 series; E24 series E24 series; E12 series
Rated Dissipation, P_{70}	W	0.25
Thermal Resistance (R_{th})	K/W	140
Temperature Coefficient	ppm/K	≤ ± 200
Maximum Permissible Voltage $U_{max.}$ DC RMS	V	 1600 1150
Dielectric Withstanding Voltage of the Insulation for 1 Min	V	700
Basic Specifications		IEC 60115-1
Climatic Category (IEC 60068-1)		55/155/56
Max. Resistance Change for Resistance Range, ΔR max., after: Load (1000 h, P_{70}) Long Term Damp Heat Test (56 Days) Soldering (10 s, 260 °C)		 ± (1.5 % R + 0.1 Ω) ± (1.5 % R + 0.1 Ω) ± (1.5 % R + 0.1 Ω)
Noise	μV/V	max. 5

Note

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

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PART NUMBER

PART NUMBER: VR25000001503JA100

V	R	2	5	0	0	0	0	0	1	5	0	3	J	A	1	0	0

MODEL/SIZE	VARIANT	TCR/MATERIAL	VALUE	TOLERANCE	PACKAGING (1)	SPECIAL
VR25000	**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 % **K** = ± 10 %	**A5** **A2** **A1** **R5** **N4**	The 2 digits are used for all special parts. **00** = Standard

PRODUCT DESCRIPTION: VR25 5 % A1 150K

VR25	5 %	A1	150K
MODEL/SIZE	TOLERANCE	PACKAGING (1)	RESISTANCE VALUE
VR25	**± 1** % **± 5** % **± 10** %	**A5** **A2** **A1** **R5** **N4**	**150K** = 150 kΩ **8M2** = 8.2 MΩ

Notes

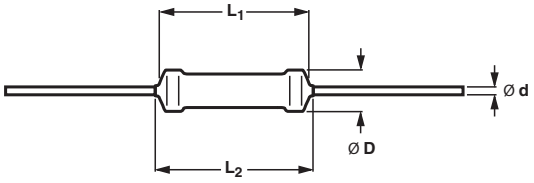
- The PART NUMBER is shown to facilitate the introduction of a unified part numbering system for ordering products

(1) Please refer to table PACKAGING

PACKAGING

MODEL	TAPING	AMMOPACK		REEL	
		PIECES	CODE	PIECES	CODE
VR25	Axial, 26 mm	2000	A2	-	-
	Axial, 52 mm	5000	A5	5000	R5
		1000	A1	-	-
	Radial	4000	N4	-	-

DIMENSIONS



Outline

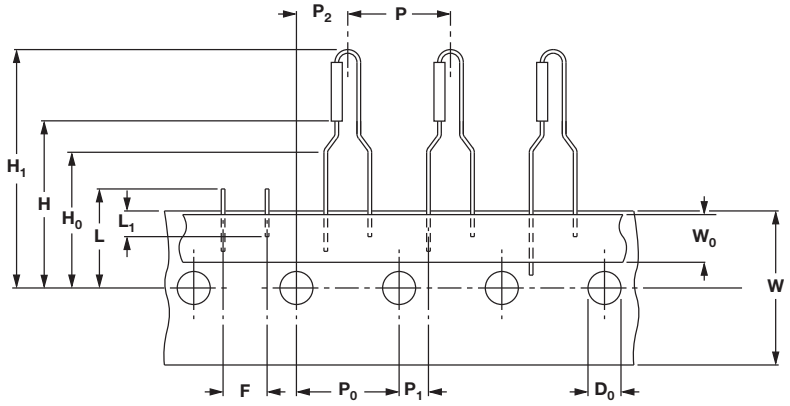
DIMENSIONS - Resistor type and relevant physical dimensions

TYPE	Ø $D_{max.}$	$L_{1\ max.}$	$L_{2\ max.}$	Ø d
VR25	2.5	6.5	7.5	0.58 ± 0.05

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PRODUCTS WITH RADIAL LEADS



DIMENSIONS - RADIAL TAPING				
SYMBOL	PARAMETER	VALUE	TOLERANCE	UNIT
P	Pitch of components	12.7	± 1.0	mm
P_0	Feed-hole pitch	12.7	± 0.2	mm
P_1	Feed-hole centre to lead at topside at the tape	3.85	± 0.5	mm
P_2	Feed-hole center to body center	6.35	± 1.0	mm
F	Lead-to-lead distance	4.8	+ 0.7/- 0	mm
W	Tape width	18.0	± 0.5	mm
W_0	Minimum hold down tape width	5.5	-	mm
H1	Component height	29	Max.	mm
H_0	Lead wire clinch height	16.5	± 0.5	mm
H	Height of component from tape center	19.5	± 1	mm
D_0	Feed-hole diameter	4.0	± 0.2	mm
L	Maximum length of snipped lead	11.0	-	mm
L_1	Minimum lead wire (tape portion) shortest lead	2.5	-	mm

Note
- Please refer document number 28721 “Packaging” for more detail

MASS PER UNIT	
TYPE	MASS (mg)
VR25, 52 mm	212
VR25, 26 mm	148

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 ± 1 %, 5 %, or 10 %. The values of the E96/E24/E12 series are in accordance with IEC 60063.

LIMITING VALUES			
TYPE	LIMITING VOLTAGE (1) $U_{max.}$		LIMITING POWER P_{70} (W)
	DC	RMS	
VR25	1600	1150	0.25

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

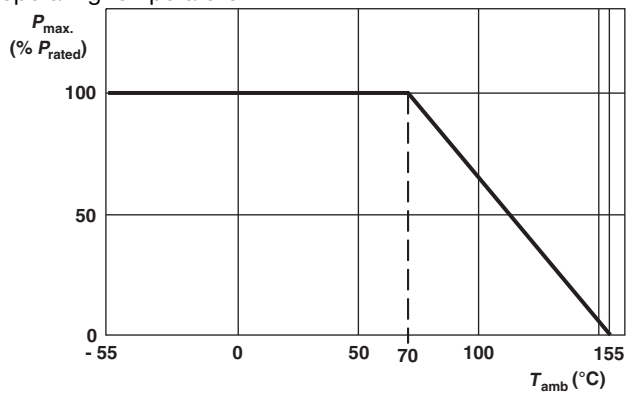
(1) The maximum voltage that may be continuously applied to the resistor element, see IEC 60115-1

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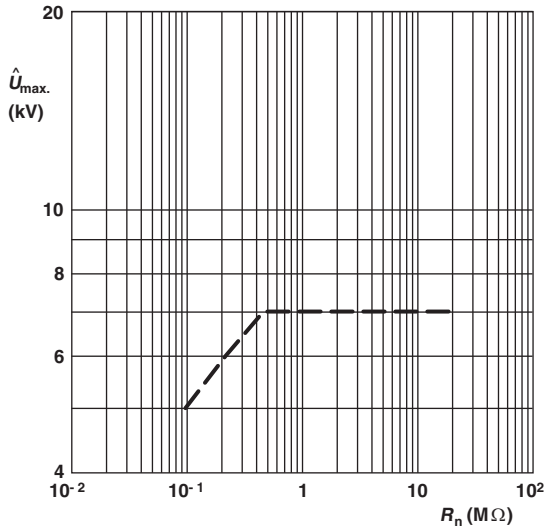
DERATING

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



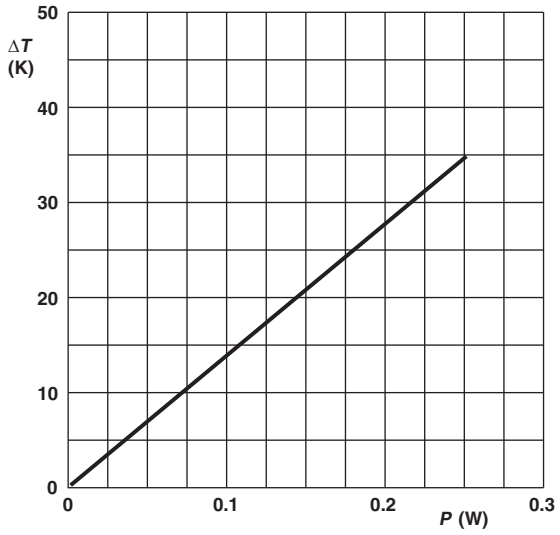
Maximum dissipation ($P_{max.}$) in percentage of rated power as a function of the ambient temperature (T_{amb})

PULSE LOADING CAPABILITY

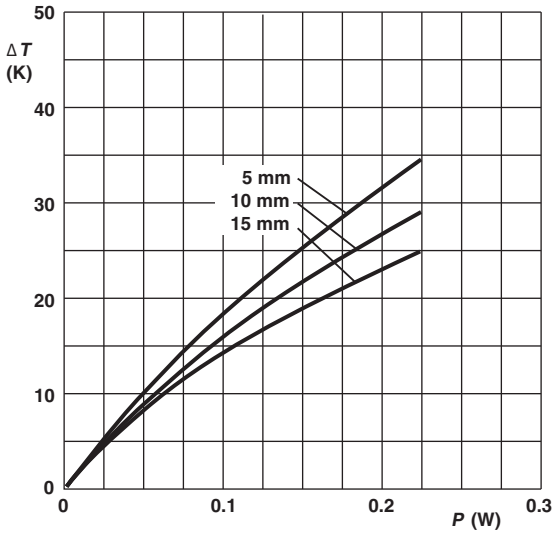


Maximum allowed peak pulse voltage in accordance with IEC 60065, 14.1.a; 50 discharges from a 1 nF capacitor charged to $\hat{U}_{max.}$; 12 discharges/min (drift $\Delta R/R \leq 2$ %)

APPLICATION INFORMATION



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

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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 0.6 mm; load 10 N; 10 s	Number of failures < 10×10^{-6}
4.16.3	21 (Ub)	Bending half number of samples	Ø 0.6 mm; load 5 N; 4 x 90°	Number of failures < 10×10^{-6}
4.16.4	21 (Uc)	Torsion other half of samples	3 x 360° in opposite directions	No damage ΔR max.: ± (0.5 % R + 0.05 Ω)
4.17	20 (Ta)	Solderability	2 s; 235 °C: Solder bath method; SnPb40 3 s; 245 °C: Solder bath method; SnAg3Cu0.5	Good tinning (≥ 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 (≥ 95 % covered); no damage
4.18	20 (Tb)	Resistance to soldering heat	Thermal shock: 10 s; 260 °C; 3 mm from body	ΔR max.: ± (0.5 % R + 0.05 Ω)
4.19	14 (Na)	Rapid change of temperature	30 min at - 55 °C and 30 min at + 155 °C; 5 cycles	ΔR max.: ± (0.5 % R + 0.05 Ω)
4.20	29 (Eb)	Bump	3 x 1500 bumps in 3 directions; 40 g	No damage ΔR max.: ± (0.5 % R + 0.05 Ω)
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 ΔR max.: ± (0.5 % R + 0.05 Ω)
4.23		Climatic sequence:		
4.23.2	2 (Ba)	Dry heat	16 h; 155 °C	
4.23.3	30 (Db)	Damp heat (accelerated) 1st cycle	24 h; 55 °C; 90 % to 100 % RH	
4.23.4	1 (Aa)	Cold	2 h; - 55 °C	
4.23.5	13 (M)	Low air pressure	2 h; 8.5 kPa; 15 °C 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)
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}	ΔR max.: ± (1.5 % R + 0.1 Ω)
4.25.1		Endurance	1000 h at 70 °C; P_{70} or $U_{max.}$	ΔR max.: ± (1.5 % R + 0.1 Ω)
4.8		Temperature coefficient	Between - 55 °C and + 155 °C	≤ ± 200 ppm/K
4.7		Voltage proof on insulation	U_{RMS} = 700 V during 1 min; V-block method	No breakdown
4.12		Noise	IEC 60195	Max. 5 µV/V
4.6.1.1		Insulation resistance	U = 500 V_{DC} during 1 min; V-block method	R_{ins} min.: 10^4 MΩ
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	ΔR max.: ± (2.0 % R + 0.05 Ω)

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TEST PROCEDURES AND REQUIREMENTS				
IEC 60115-1 CLAUSE	IEC 60068-2- TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.26		Active flammability "cheese-cloth test"	Steps of: 5/10/16/25/40 x P_{70} duration 5 min	No flaming of gauze cylinder
4.35		Passive flammability "needle-flame test"	Application of test flame for 20 s	No ignition of product; no ignition of under-layer; burning time less than 30 s

12NC INFORMATION FOR HISTORICAL CODING REFERENCE

- The resistors have a 12-digit numeric code starting with 2322 241
- The subsequent:
  first digit for 1 % tolerance products (E24 and E96 series) or 2 digits for 5 % (E24 series) and 10 % (E12 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 and 10 % 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 kΩ to 976 kΩ	4
1 MΩ to 9.76 MΩ	5
≥ 10 MΩ	6

12NC Example

The 12NC for a VR25, resistor value 7.5 MΩ, 5 % tolerance, supplied on a bandolier of 1000 units in ammopack, is: 2322 241 13755.

12NC - Resistor type and packaging

TYPE	TOL. (%)	2322 241				
		BANDOLIER IN AMMOPACK				BANDOLIER ON REEL
		RADIAL TAPED	STRAIGHT LEADS			
		4000 UNITS	52 mm	26 mm	52 mm	52 mm
			1000 UNITS	2000 UNITS	5000 UNITS	5000 UNITS
VR25	± 1	0....	8....	-	7....	6....
	± 5	36...	13...	43...	53...	23...
	± 10	38...	12...	42...	52...	22...

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