High ohmic/high voltage resistors VR25

FEATURES

- High pulse loading capability
- Small size.

APPLICATIONS

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

DESCRIPTION

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"*.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Resistance range	100 kΩ to 22 MΩ
Resistance tolerance and series:	
100 kΩ to 15 MΩ	±5%: E24 series
15 MΩ to 22 MΩ	±10%: E12 series
220 kΩ to 15 MΩ	±1%: E24/E96 series
Maximum dissipation at T_{amb} = 70 °C	0.25 W
Thermal resistance, R_{th}	200 K/W
Temperature coefficient	$\leq \pm 200 \times 10^{-6}$/K
Maximum permissible voltage:	
DC	1600 V
RMS	1150 V
Dielectric withstanding voltage of the insulation for 1 minute	700 V
Basic specifications	IEC 60115-1B
Climatic category (IEC 60068)	55/155/56
Stability after:	
load (1000 hours)	ΔR/R max.: ±1.5% + 0.1 Ω
accelerated damp heat test (6 days)	ΔR/R max.: ±1.5% + 0.1 Ω
long term damp heat test (56 days)	ΔR/R max.: ±1.5% + 0.1 Ω
Noise	max. 5 μV/V

ORDERING INFORMATION

Table 1 Ordering code indicating resistor type and packaging

TYPE	TAPE WIDTH (mm)	TOL. (%)	ORDERING CODE 2322 241			
			BANDOLIER IN AMMOPACK(1)			BANDOLIER ON REEL
			1000 units	2000 units	5000 units	5000 units
VR25	52	±1	8....	–	–	–
		±5	13...	–	53...	23...
		±10	12...	–	52...	22...
	26	±5	–	43...	–	–
		±10	–	42...	–	–

Note

1. Radial taped version available on request.

Ordering code (12NC)

- The resistors have a 12-digit ordering 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 packaging;
  see Table 1.
- 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 in accordance with Table 2.

Table 2 Last digit of 12NC

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

FUNCTIONAL DESCRIPTION

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 publication 60063"*.

Limiting values

TYPE	LIMITING VOLTAGE(1) (V)		LIMITING POWER (W)
	DC	RMS	
VR25	1600	1150	0.25

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.

DERATING

The power that the resistor can dissipate depends on the operating temperature; see Fig.1.

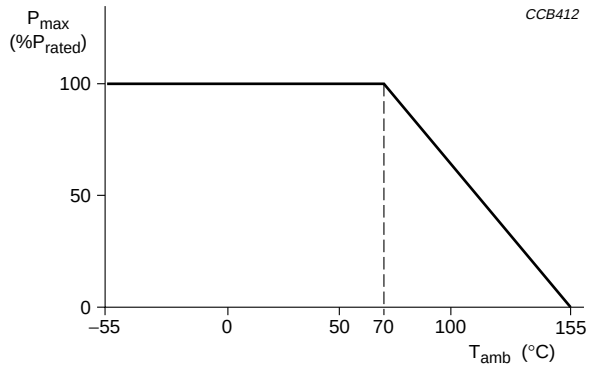


Fig.1 Maximum dissipation (P_{max}) in percentage of rated power as a function of the ambient temperature (T_{amb}).

PULSE LOADING CAPABILITY

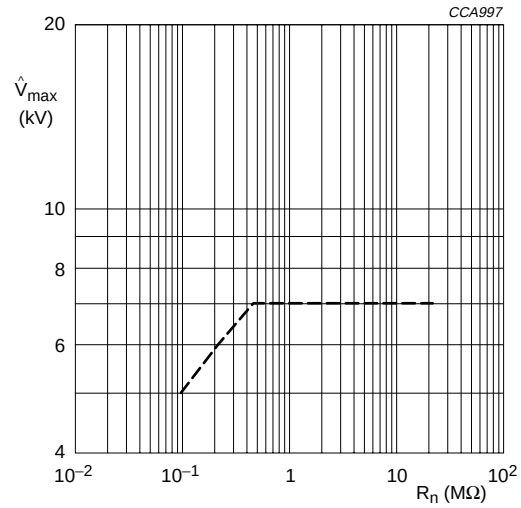
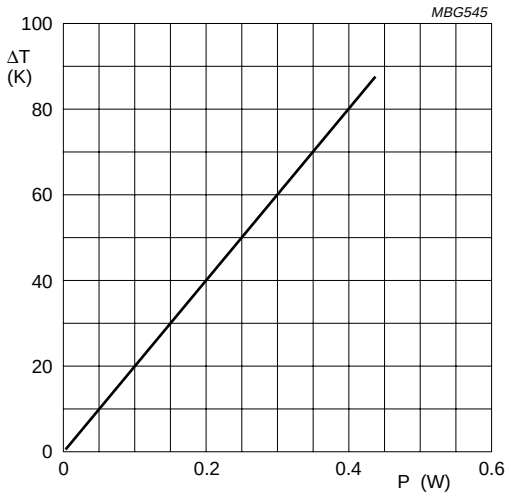


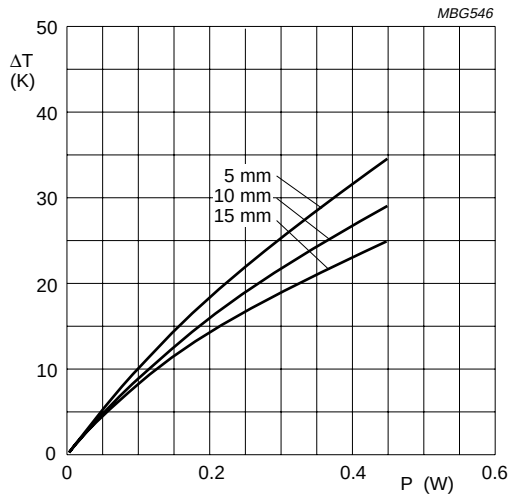
Fig.2 Maximum allowed peak pulse voltage in accordance with *"IEC 60065 chapter 14.1"*; 50 discharges from a 1 nF capacitor charged to $\hat{V}_{max}$; 12 discharges/minute (drift $\Delta R/R \leq 1\%$).

Application information



VR25

Fig.3 Hot spot temperature rise (ΔT) as a function of dissipated power.



VR25

Fig.4 Temperature rise (ΔT) at the lead end (soldering point) as a function of dissipated power at various lead lengths after mounting.

MECHANICAL DATA

Mass per 100 units

TYPE	MASS (g)
VR25	25

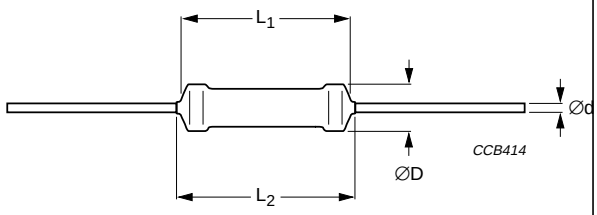
Marking

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")*.



For dimensions see Table 3.

Fig.5 Outline.

Table 3 Resistor type and relevant physical dimensions; see Fig.5

TYPE	∅D MAX. (mm)	L_1 MAX. (mm)	L_2 MAX. (mm)	∅d (mm)
VR25	2.5	6.5	7.5	0.58 ±0.05

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: **L**ower **C**ategory **T**emperature, **U**pper **C**ategory **T**emperature; 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, *"Recommended basic climatic and mechanical robustness testing procedure for electronic components"* and under standard atmospheric conditions according to *"IEC 60068-1"*, subclause 5.3.

Unless otherwise specified the following values apply:

Temperature: 15 °C to 35 °C

Relative humidity: 45% to 75%

Air pressure: 86 kPa to 106 kPa (860 mbar to 1060 mbar).

In Table 4 the tests and requirements are listed with reference to the relevant clauses of *"IEC publications 60115-1 and 60068"*; 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.

Table 4 Test procedures and requirements

IEC 60115-1 CLAUSE	IEC 60068 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.16	U	robustness of terminations:		
4.16.2	Ua	tensile all samples	∅0.6 mm; load 10 N; 10 s	number of failures $<10 \times 10^{-6}$
4.16.3	Ub	bending half number of samples	∅0.6 mm; load 5 N; $4 \times 90°$	number of failures $<10 \times 10^{-6}$
4.16.4	Uc	torsion other half of samples	$3 \times 360°$ in opposite directions	no damage $\Delta R/R$ max.: $\pm 0.5\% + 0.05\ \Omega$
4.17	Ta	solderability	2 s; 235 °C; flux 600	good tinning; no damage
4.18	Tb	resistance to soldering heat	thermal shock: 3 s; 350 °C; 6 mm from body	$\Delta R/R$ max.: $\pm 0.5\% + 0.05\ \Omega$
4.19	Na	rapid change of temperature	30 minutes at –55 °C and 30 minutes at +155 °C; 5 cycles	$\Delta R/R$ max.: $\pm 0.5\% + 0.05\ \Omega$
4.20	Eb	bump	3×1500 bumps in 3 directions; 40 g	no damage $\Delta R/R$ max.: $\pm 0.5\% + 0.05\ \Omega$
4.22	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.: $\pm 0.5\% + 0.05\ \Omega$
4.23		climatic sequence:		
4.23.2	Ba	dry heat	16 hours; 155 °C	
4.23.3	Db	damp heat (accelerated) 1st cycle	24 hours; 55 °C; 90 to 100% RH	
4.23.4	Aa	cold	2 hours; –55 °C	
4.23.5	M	low air pressure	2 hours; 8.5 kPa; 15 to 35 °C	
4.23.6	Db	damp heat (accelerated) remaining cycles	5 days; 55 °C; 95 to 100% RH	R_{ins} min.: $10^3\ M\Omega$ $\Delta R/R$ max.: $\pm 1.5\% + 0.1\ \Omega$

IEC 60115-1 CLAUSE	IEC 60068 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.24.2	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.: $\pm 1.5\% + 0.1\ \Omega$
4.25.1		endurance	1000 hours at 70 °C; P_n or V_{max}	$\Delta R/R$ max.: $\pm 1.5\% + 0.1\ \Omega$
4.8.4		temperature coefficient	between –55 °C and +155 °C ($TC \times 10^{-6}$/K)	$\leq \pm 200$
4.7		voltage proof on insulation	700 V (RMS) during 1 minute; V-block method	no breakdown
4.12		noise	*"IEC publication 60195"*	max. 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 $6.25 \times P_n$ (voltage not more than $2 \times$ limiting voltage); 10 cycles; 5 s on and 45 s off	$\Delta R/R$ max.: $\pm 0.5\% + 0.05\ \Omega$