DATA SHEET

UMA 0204
Ultra precision MELF resistor

Product specification
Supersedes data of 8th June 2001
File under BCcomponents, BC08

2002 Nov 22

BC COMPONENTS

Ultra precision MELF resistor UMA 0204

FEATURES

- Most advanced thin film technology
- Lowest T.C.: ±05 to ±15 ppm/K
- Ultra precision tolerance of value: ±0,02 to ±0,25%
- Superior overall stability
- Wide ultra precision range: 22 Ω to 221 kΩ
- Green product, supports lead-free soldering
- CECC approval under preparation.

Metric sizes

DIN:	0204
CECC:	RC 3715M

APPLICATIONS

- Measuring and calibration equipment
- Industrial process control systems
- Space and aircraft electronics

DESCRIPTION

UMA 0204 ultra precision thin film MINI-MELF resistors combine the proven reliability of professional MELF products with a most advanced level of precision and stability first achieved with axial thin film ultra precision resistors. This unique combination makes the product perfectly suited for all applications with outstanding requirements towards reliable precision and stability.

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A homogeneous film of metal alloy is deposited on a high grade ceramic body (85% Al_2O_3) and conditioned to achieve the desired temperature stability. Nickel plated steel terminations are firmly pressed on the metallised rods. A special laser is used to achieve the target value by smoothly cutting in the resistive layer without damaging the ceramics. A further conditioning is applied in order to stabilise the trimming result. The resistor elements are covered by a protective coating designed for electrical, mechanical and climatic protection. The terminations receive a final pure tin on nickel plating. Five colour rings designate the resistance value and tolerance in accordance with **IEC 60062**. Additional colour dots near the fourth ring are used to identify the temperature coefficient.

The result of the determined production is verified by an extensive testing procedure under strict temperature control, performed on 100% of the individual resistors. Only accepted products are laid directly into the antistatic blister tape in accordance with **IEC 60286-3**.

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using, reflow or vapour phase. Excellent solderability is proven, even after extended storage in excess of 10 years. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions.

The resistors are completely lead-free, the pure tin plating provides compatibility with lead-free soldering processes. The immunity of the plating against tin whisker growth has been proven under extensive testing. All products comply with the CEFIC-EECA-EICTA list of legal restrictions on hazardous substances.

The resistors are tested in accordance with **EN 140401-803 (superseding CECC 40401-803)** which refers to **EN 60115-1** and **EN140400.** Approval of conformity will be indicated by the CECC logo on the package label.

BCcomponents BEYSCHLAG has achieved **"Approval of Manufacturer"** in accordance with **EN 100114-1**. The release certificate for **"Technology Approval Schedule"** in accordance with **CECC 240001** based on **EN 100114-6** is granted for the BCcomponents BEYSCHLAG manufacturing process.

On request, resistors are available with established reliability in accordance with **EN 140101-803 Version E**. Please refer to the special data sheet for information on failure rate level, available resistance ranges and ordering codes.

Ultra precision MELF resistor UMA 0204

QUICK REFERENCE DATA

DESCRIPTION	UMA 0204	
Metric CECC size	RC 3715M	
Resistance range	22 Ω to 221 kΩ	
Resistance tolerance	±0,25%; ±0,1%; ±0,05%; ±0,02%	
Temperature coefficient	±15 ppm/K; ±10 ppm/K; ±05 ppm/K	
Operation mode	precision	standard
Climatic category (LCT/UCT/days)	10/85/56	55/125/56
Rated dissipation, P_{70}(1)	0,07 W	0,25 W
Operating voltage, U_{max} AC/DC	200 V	
Film temperature	85 °C	125 °C
Max. resistance change at P_{70} for resistance range, $\Delta R/R$ max., after:	100 Ω to 221 kΩ	
1000 h	≤ 0,02%	≤ 0,05%
8000 h	≤ 0,05%	≤ 0,1%
225000 h	≤ 0,15%	≤ 0,3%
Specified lifetime	225000 h	
Permissible voltage against ambient:		
1 minute; U_{ins}	300 V	
continuous	75 V	
Failure rate	≤ $0,7 \times 10^{-9}$/h	

Note

1. The power dissipation on the resistor generates a temperature rise against the local ambient, depending on the heatflow support of the printed-circuit board (thermal resistance). The rated dissipation applies only if the permitted film temperature is not exceeded.

Table 1 Temperature coefficient and resistance range

DESCRIPTION		RESISTANCE VALUE[1]
T.C.	**TOLERANCE**	**UMA 0204**
15 ppm/K	0,05%	47 Ω to 221 kΩ
10 ppm/K[2]	0,25%	22 Ω to 221 kΩ
	0,1%	43 Ω to 221 kΩ
	0,05%	100 Ω to 100 kΩ
05 ppm/K[2]	0,25%	100 Ω to 100 kΩ
	0,1%	100 Ω to 100 kΩ
	0,05%	100 Ω to 100 kΩ
	0,02%	100 Ω to 100 kΩ

Notes

1. Resistance values to be selected from E192 series, for other values please contact the factory.
2. TC10 and TC05 is specified over the temperature range from –10 °C to +85 °C.

ORDERING INFORMATION

Components may be ordered by using either a simple clear text ordering code, see "Type description and ordering code"or BCcomponents' unique 12NC.

Numeric Ordering code (12NC)

- The resistors have a 12-digit ordering code starting with 2312.
- The subsequent 4 digits indicate the resistor type, specification and packaging; see Table 2.
- The remaining 4 digits indicate the resistance value:
  - The first 3 digits indicate the resistance value.
  - The last digit indicates the resistance decade in accordance with Table 3.

Table 2 12NC ordering code indicating resistor type and packaging

DESCRIPTION			ORDERING CODE 2312			
			BULK	ANTISTATIC BLISTER TAPE ON REEL		
TYPE	T.C.	TOL.	AU 100 units	A1 1000 units	AL 3000 units	A0 10000 units
UMA 0204	±15 ppm/K	±0,05%	101 4....	106 4....	111 4....	116 4....
		note 1	101 91...	106 91...	111 91...	116 91...
	±10 ppm/K	±0,25%	102 2....	107 2....	112 2....	117 2....
		±0,1%	102 3....	107 3....	112 3....	117 3....
		±0,05%	102 4....	107 4....	112 4....	117 4....
		note 1	102 91...	107 91...	112 91...	117 91...
	±05 ppm/K	±0,25%	103 2....	108 2....	113 2....	118 2....
		±0,1%	103 3....	108 3....	113 3....	118 3....
		±0,05%	103 4....	108 4....	113 4....	118 4....
		±0,02%	103 6....	108 6....	113 6....	118 6....
		note 1	103 91...	108 91...	113 91...	118 91...

Note

1. Readable coding of resistance values is restricted to values with three significant digits. For resistance values with more than three significant digits, a non-readable sequential number will be issued by the factory for each requested combination of resistance value and tolerance.

Table 3 Last digit of 12NC indicating resistance decade

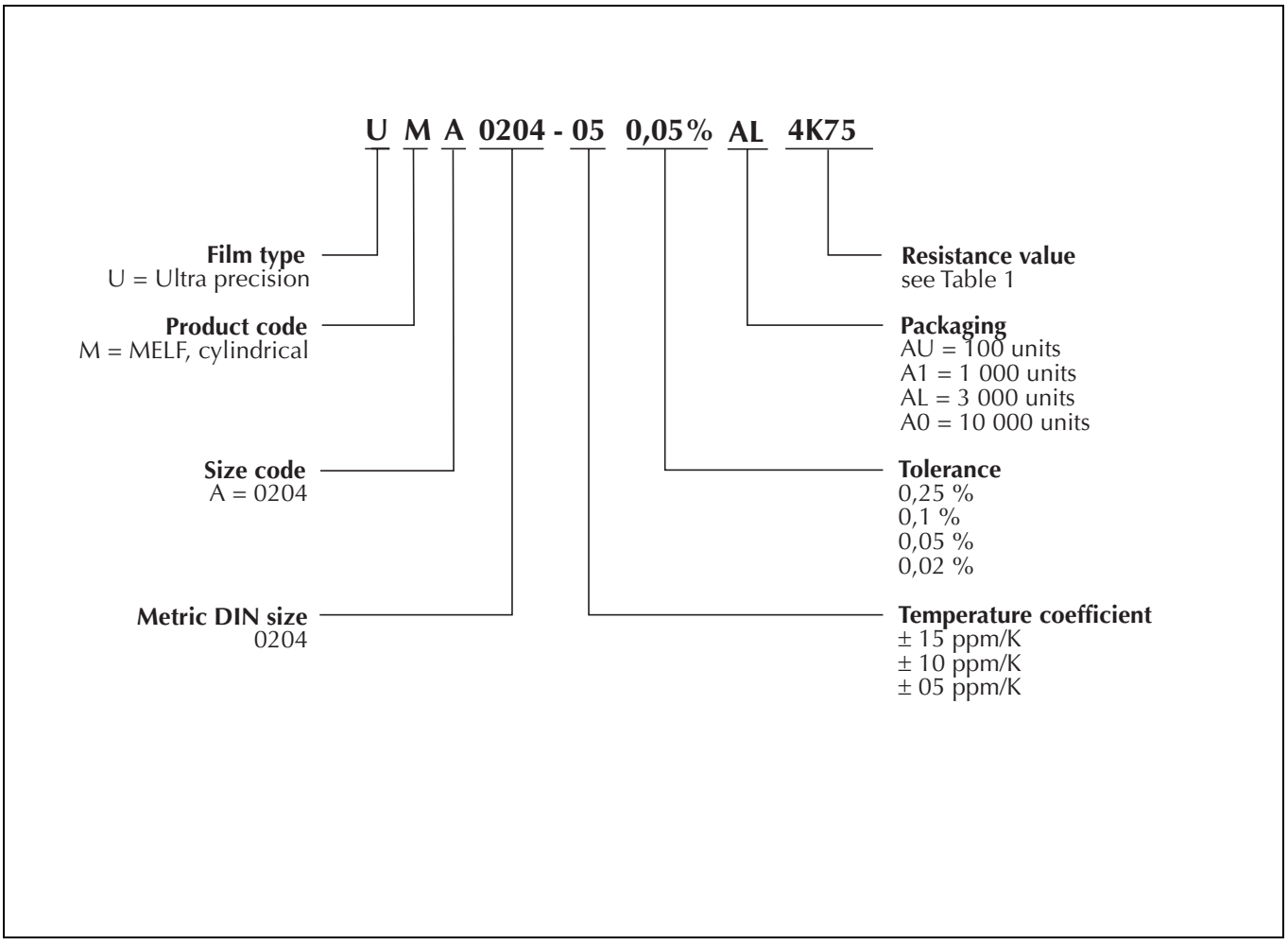
RESISTANCE DECADE	LAST DIGIT
10 to 99,9 Ω	9
100 to 999 Ω	1
1 to 9,99 kΩ	2
10 to 99,9 kΩ	3
100 to 999 kΩ	4

ORDERING EXAMPLE

The ordering code of an UMA 0204 resistor, value 4,75 kΩ and TC05 with ±0,05% tolerance, supplied in antistatic blister tape of 3000 units per reel is: 2312 113 44752.

Type description and ordering code

- We recommend that the clear text ordering code is used to minimize the possibility of errors in order handling.



FUNCTIONAL DESCRIPTION

Derating

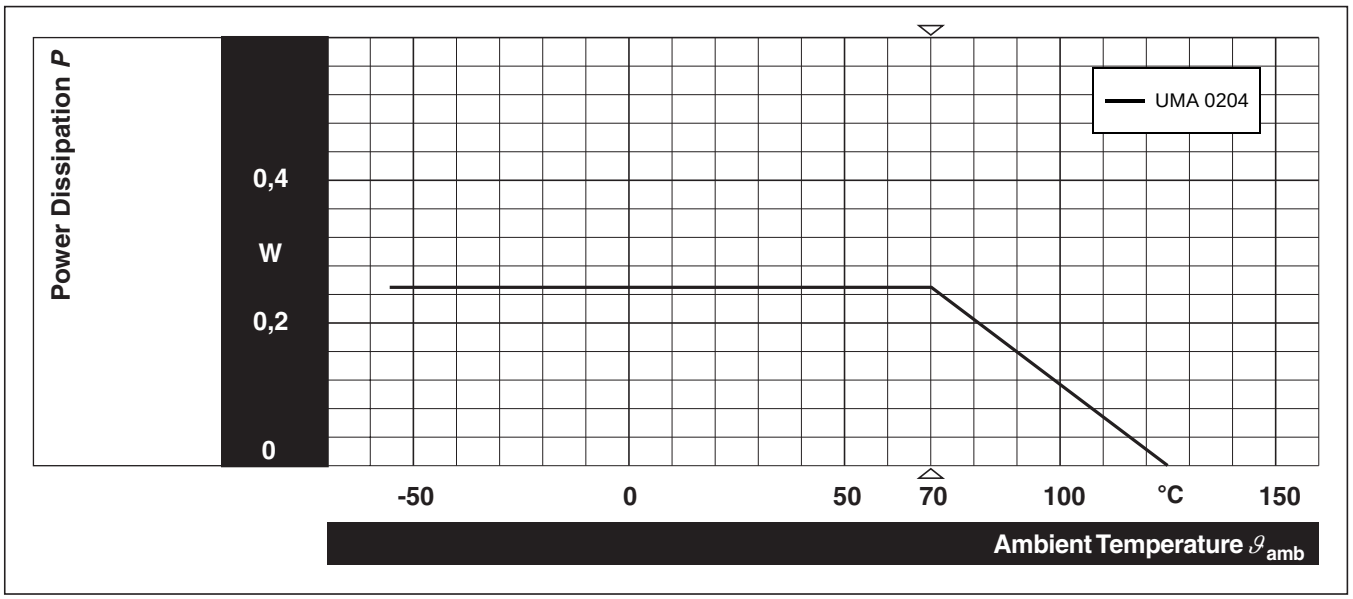


Fig.1 Derating, standard operation.

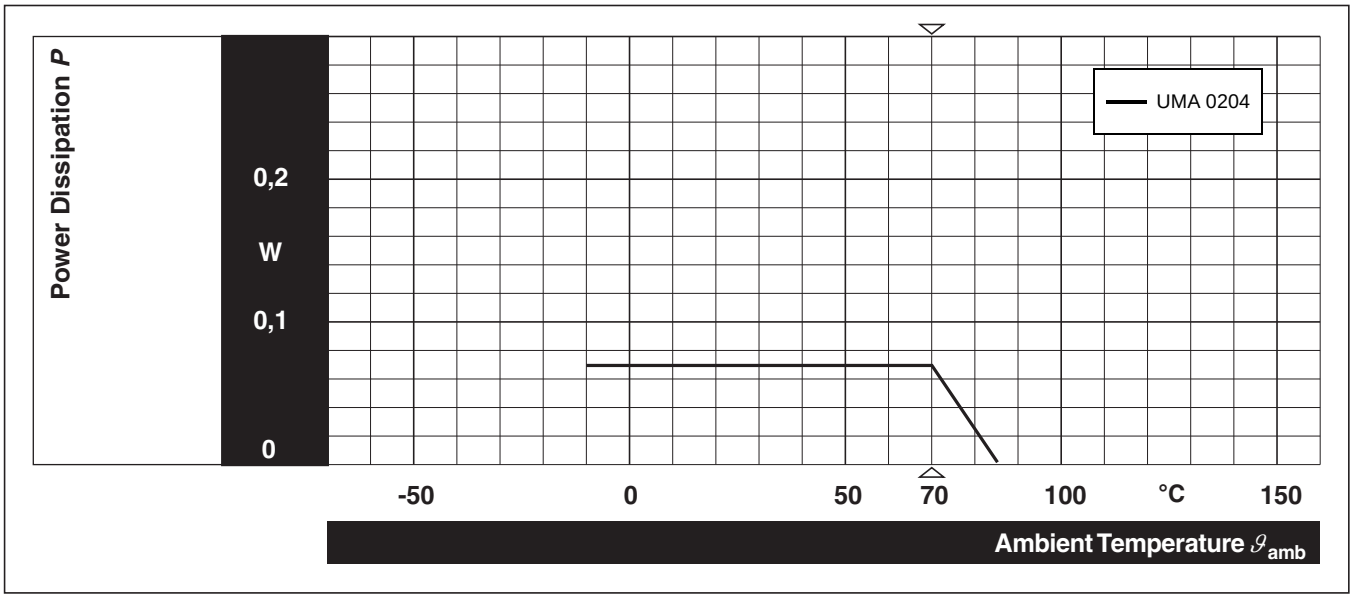


Fig.2 Derating, precision operation.

Current noise

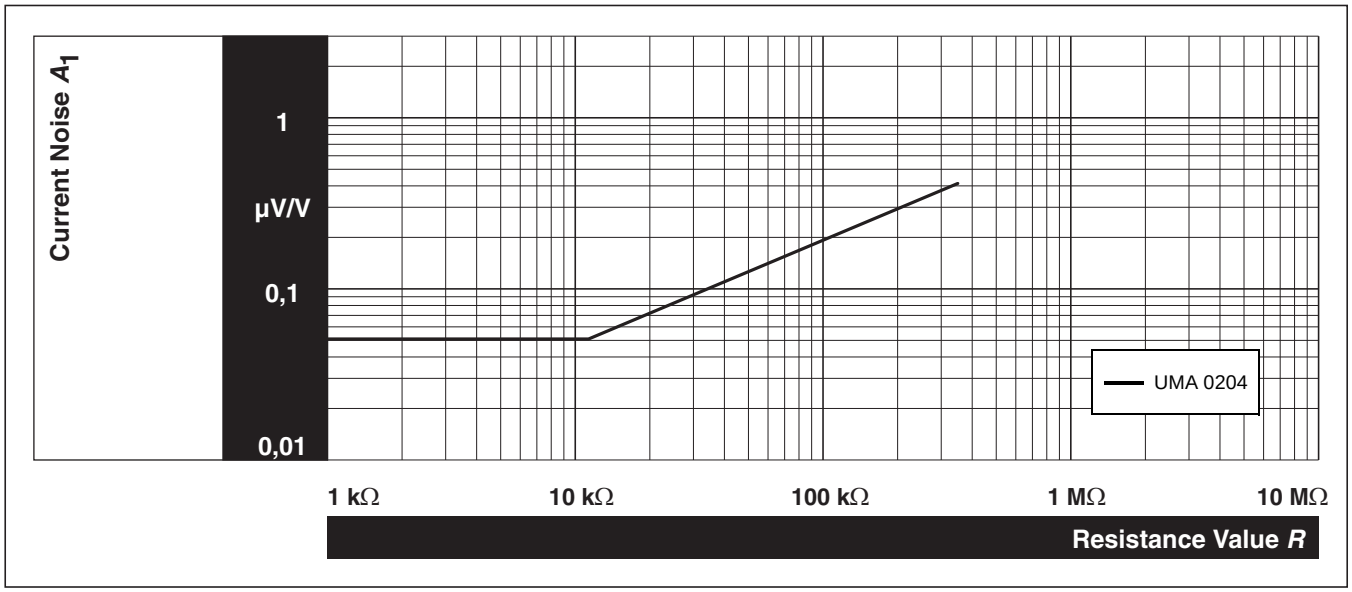
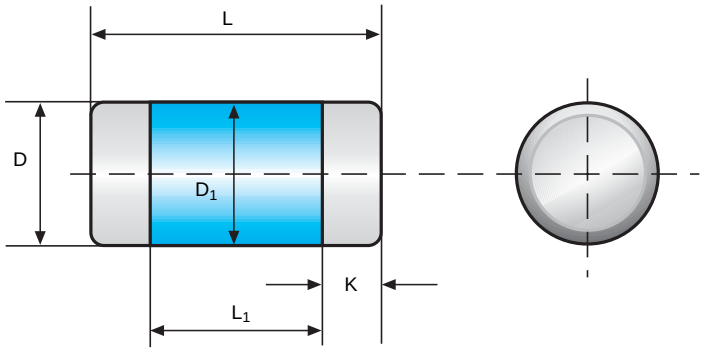


Fig.3 Current noise A_1 in accordance with IEC 60195.

MECHANICAL DATA

Outlines



For dimensions see Table 4.

Fig.4 Outlines.

Table 4 MELF resistor type, mass and relevant physical dimensions; see Fig.4

TYPE	L (mm)	D (mm)	$L_{1\ min}$ (mm)	D_1 (mm)	K (mm)	MASS (mg)
UMA 0204	3,6 +0/–0,2	1,4 +0/–0,1	1,8	D +0/–0,15	0,8 ±0,1	19

TESTS AND REQUIREMENTS

All tests are carried out in accordance with the following specifications:

EN 60115-1, generic specification

EN 140400, sectional specification

EN 140401-803, detail specification

Where applicable, approval of the components in accordance with the european CECC system is under preparation. For the full test schedule refer to the documents listed above. The testing also covers most of the requirements specified by EIA/IS-703 and JIS-C-5202.

The tests are carried out in accordance with IEC 60068 and under standard atmospheric conditions in accordance with IEC 60068-1, 5.3. Climatic category LCT/UCT/56 (rated temperature range: Lower Category Temperature, Upper Category Temperature; damp heat, long term, 56 days) is valid.

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 1 060 mbar).

The components are mounted for testing on printed-circuit boards in accordance with EN 140400, 2.3.3, unless otherwise specified.

The requirements stated in Table 5 are based on the required tests and permitted limits of EN 140401-803. However, some additional tests and a number of improvements against those minimum requirements have been included. The stated requirements for long-term tests are typically fulfilled with a statistical safety of at least $\bar{x}$ +5 s.

Table 5 Test procedures and requirements

EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)		
				STABILITY CLASS 0,05 OR BETTER	STABILITY CLASS 0,1 OR BETTER	STABILITY CLASS 0,25 OR BETTER
			stability for product types:			
			UMA 0204	100 Ω to 100 kΩ	43 Ω to 221 kΩ	22 Ω to 221 kΩ
4.5	–	resistance	–	±0,05%; ±0,02%; ±0,25%; ±0,1%		
4.8.4.2	–	temperature coefficient	at –20 / –10 / 20 °C and 20 / 85 / 20 °C	±10 ppm/K; ±05 ppm/K		
			at –20 / –55 / 20 °C and 20 / 125 / 20 °C	±15 ppm/K		
4.25.1	–	endurance at 70 °C: precision operation mode	$U = \sqrt{P_{70} \times R}$ ≤ U_{max}; 1,5 h on; 0,5 h off;			
			70 °C; 1000 h	±(0,02%R + 1 mΩ)		
			70 °C; 8000 h	±(0,05%R + 1 mΩ)		

EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)		
				STABILITY CLASS 0,05 OR BETTER	**STABILITY CLASS 0,1 OR BETTER**	**STABILITY CLASS 0,25 OR BETTER**
			stability for product types:			
			UMA 0204	100 Ω to 100 kΩ	43 Ω to 221 kΩ	22 Ω to 221 kΩ
4.25.1 (cont.)	–	endurance at 70 °C: standard operation mode	$U = \sqrt{P_{70} \times R}$ ≤ U_{max}; 1,5 h on; 0,5 h off;			
			70 °C; 1000 h	±(0,05%R + 1 mΩ)		
			70 °C; 8000 h	±(0,1%R + 1 mΩ)		
4.25.3	–	endurance at upper category temperature	85 °C; 1000 h	±(0,01%R + 1 mΩ)	±(0,05%R + 1 mΩ)	±(0,1%R + 1 mΩ)
			125 °C; 1000 h	±(0,05%R + 1 mΩ)	±(0,1%R + 1 mΩ)	±(0,15%R + 1 mΩ)
4.24	3 (Ca)	damp heat, steady state	40 ±2 °C; 56 days; 93 +2/–3% RH	±(0,03%R + 1 mΩ)	±(0,05%R + 1 mΩ)	±(0,1%R + 1 mΩ)
4.39	67 (Cy)	damp heat, steady state, accelerated	85 ±2 °C; 85 ±5% RH; $U = 0{,}1 \times \sqrt{P_{70} \times R}$ ≤ 100 V; 1000 h	±(0,1%R + 1 mΩ)	±(0,25%R + 1 mΩ)	
4.23		climatic sequence:				
4.23.2	2 (Ba)	dry heat	UCT; 16 h			
4.23.3	30 (Db)	damp heat, cyclic	55 °C; 24 h; ≥ 90% RH; 1 cycle			
4.23.4	1 (Aa)	cold	LCT °C; 2 h			
4.23.5	13 (M)	low air pressure	8,5 kPa; 2 h; 25 ± 10 °C			
4.23.6	30 (Db)	damp heat, cyclic	55 °C; 24 h; ≥ 90% RH; 5 cycles			
			LCT = –10 °C; UCT = 85 °C	±(0,03%R + 1 mΩ)	±(0,05%R + 1 mΩ)	–
			LCT = –55 °C; UCT = 125 °C	–	–	±(0,1%R + 1 mΩ)
–	1 (Aa)	cold	–55 °C; 2 h	±(0,02R + 1 mΩ)		

EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)		
				STABILITY CLASS 0,05 OR BETTER	**STABILITY CLASS 0,1 OR BETTER**	**STABILITY CLASS 0,25 OR BETTER**
			stability for product types: **UMA 0204**	100 Ω to 100 kΩ	43 Ω to 221 kΩ	22 Ω to 221 kΩ
4.19	14 (Na)	rapid change of temperature	30 minutes at LCT; 30 minutes at UCT; LCT = −10 °C; UCT = 85°C 5 cycles	±(0,01%R + 1 mΩ)	±(0,02%R + 1 mΩ)	–
			1000 cycles	±(0,05%R + 1 mΩ)	±(0,05%R + 1 mΩ)	–
			LCT = −55 °C; UCT = 125°C 5 cycles	–	–	±(0,025%R + 1 mΩ)
			1000 cycles	–	–	±(0,1%R + 1 mΩ)
4.13	–	short time overload; precision operation mode	$U = 2{,}5 \times \sqrt{P_{70} \times R}$ ≤ 2 × U_{max}; 5 s	±(0,005%R + 1 mΩ)	±(0,01%R + 1 mΩ)	
		short time overload; standard operation mode	$U = 2{,}5 \times \sqrt{P_{70} \times R}$ ≤ 2 × U_{max}; 5 s	±(0,01%R + 1 mΩ)		
4.27	–	single pulse high voltage overload; standard mode	severity no. 4: $U = 10 \times \sqrt{P_{70} \times R}$ ≤ 2 × U_{max}; 10 pulses 10 µs/700 µs	±(0,25%R + 5 mΩ)[1]		
4.37	–	periodic electric overload; standard mode	$U = \sqrt{15 \times P_{70} \times R}$ ≤ 2 × U_{max}; 0,1 s on; 2,5 s off; 1000 cycles	±(0,5%R + 5 mΩ)[1]		

EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)		
				STABILITY CLASS 0,05 OR BETTER	STABILITY CLASS 0,1 OR BETTER	STABILITY CLASS 0,25 OR BETTER
			stability for product types:			
			UMA 0204	100 Ω to 100 kΩ	43 Ω to 221 kΩ	22 Ω to 221 kΩ
4.22	6 (Fc)	vibration	endurance by sweeping; 10 to 2000 Hz; no resonance; amplitude ≤1,5 mm or ≤200 m/s^2; 6 h	±(0,01%R + 1 mΩ)		
4.17.2	58 (Td)	solderability	solder bath method; SnPb40; non-activated flux; 215 ±3 °C; 3 ±0,3 s	good tinning (≥ 95% covered); no visible damage		
			solder bath method; SnAg3Cu0,5 or SnAg3,5; non-activated flux; 235 ±3 °C; 2 ±0,2 s	good tinning (≥ 95% covered); no visible damage		
4.18.2	58 (Td)	resistance to soldering heat	solder bath method; 260 ±5 °C; 10 ±1 s	note 2		±(0,05%R + 10 mΩ)
			reflow method 2 (IR / forced gas convention) 260 ±5 °C; 10 ± 1 s	±(0,01%R + 1 mΩ)	±(0,02%R + 1 mΩ)	
4.29	45 (XA)	component solvent resistance	isopropyl alcohol; +50 °C; method 2	no visible damage		
4.30	45 (XA)	solvent resistance of marking	isopropyl alcohol; 50 °C; method 1, toothbrush	marking legible; no visible damage		
4.32	21 (Ue_3)	shear (adhesion)	45 N	no visible damage		

EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)		
				STABILITY CLASS 0,05 OR BETTER	STABILITY CLASS 0,1 OR BETTER	STABILITY CLASS 0,25 OR BETTER
			stability for product types: **UMA 0204**	100 Ω to 100 kΩ	43 Ω to 221 kΩ	22 Ω to 221 kΩ
4.33	21 (Ue_1)	substrate bending	depth 2 mm, 3 times	no visible damage, no open circuit in bent position		
				±(0,02%R + 10 mΩ)		±(0,05%R + 10 mΩ)
4.7	–	voltage proof	$U_{rms} = U_{ins}$; 60 s	no flashover or breakdown		
4.35	–	flammability	*IEC 60 695-2-2,* needle flame test; 10 s	no burning after 30 s		

Notes

1. The pulse load stability of professional MELF resistors applies also to precision resistors. However, severe pulse loads are likely to jeopardize stability requirements.
2. Wave soldering is not recommended.