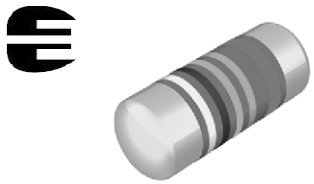
UMA 0204

Vishay Beyschlag

High Precision MINI-MELF Resistor



FEATURES

- Approved to EN 140401-803
- Most advanced thin film technology
- Superior overall stability
- TCR down to ± 5 ppm/K
- High precision tolerance down to 0.02 %
- Matte Sn termination on Ni barrier layer
- Compliant to RoHS Directive 2011/65/EU

Pb-free RoHS COMPLIANT

APPLICATIONS

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

UMA 0204 high 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 high precision resistors. This unique combination makes the product perfectly suited for all applications with outstanding requirements towards reliable precision and stability.

METRIC SIZE	
DIN	0204
CECC	RC 3715M

TECHNICAL SPECIFICATIONS		
DESCRIPTION	**UMA 0204**	
Metric CECC size	RC 3715M	
Resistance range	22 Ω to 332 kΩ	
Resistance tolerance	± 0.25 %; ± 0.1 %; ± 0.05 %; ± 0.02 %	
Temperature coefficient	± 15 ppm/K; ± 10 ppm/K; ± 5 ppm/K	
Operation mode	Precision	Standard
Rated dissipation, P_{70} (1)	0.07 W	0.25 W
Operating voltage, $U_{max.}$ AC/DC	200 V	
Permissible film temperature, ϑ_F max.	85 °C	125 °C
Operating temperature range	- 10 °C to 85 °C	- 55 °C to 125 °C
Max. resistance change at P_{70} for resistance range, $\Delta R/R$ max., after:	22 Ω to 332 kΩ	
1000 h	≤ 0.02 %	≤ 0.05 %
8000 h	≤ 0.05 %	≤ 0.1 %
225 000 h	≤ 0.15 %	≤ 0.3 %
Permissible voltage against ambient (insulation):		
1 min; U_{ins}	300 V	
Continuous	75 V	
Failure rate: $FIT_{observed}$	≤ 0.1 x 10^{-9}/h	

Notes

- These resistors do not feature a limited lifetime when operated within the permissible limits. However, resistance value drift increasing over operating time may result in exceeding a limit acceptable to the specific application, thereby establishing a functional lifetime.

(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.

For technical questions, contact: melf@vishay.com

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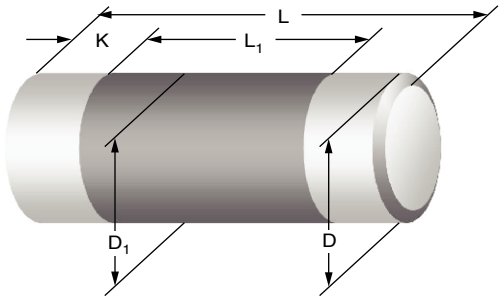
Revision: 20-Feb-12

DIMENSIONS

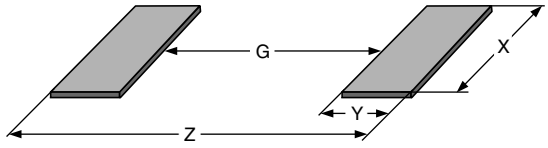


DIMENSIONS AND MASS						
TYPE	L (mm)	D (mm)	$L_{1\ min.}$ (mm)	D_1 (mm)	K (mm)	MASS (mg)
UMA 0204	3.6 + 0/- 0.2	1.4 + 0/- 0.1	1.8	D + 0/- 0.15	0.8 ± 0.1	22

Note

- Color code marking is applied according to IEC 60062 (3) in five bands. Each color band appears as a single solid line, voids are permissible if at least $^2/_3$ of the band is visible from each radial angle of view. The last color band for tolerance is approximately 50 % wider than the other bands. An interrupted band between the 4th and 5th full band indicates the temperature coefficient (orange = TC15, blue = TC10, violett = TC05).

PATTERN STYLES FOR MELF RESISTORS



RECOMMENDED SOLDER PAD DIMENSIONS								
TYPE	WAVE SOLDERING				REFLOW SOLDERING			
	G (mm)	Y (mm)	X (mm)	Z (mm)	G (mm)	Y (mm)	X (mm)	Z (mm)
UMA 0204	1.5	1.5	1.8	4.5	1.7	1.2	1.6	4.1

Note

- The given solder pad dimensions reflect the considerations for board design and assembly as outlined e.g. in standards IEC 61188-5-x, or in publication IPC-7351. They do not guarantee any supposed thermal properties, however, they will be found adequate for most general applications.

PART NUMBER AND PRODUCT DESCRIPTION

Part Number: UMA02040G4641AA300

U	M	A	0	2	0	4	0	G	4	6	4	1	A	A	3	0	0

TYPE/SIZE	VERSION	TCR	RESISTANCE	TOLERANCE	PACKAGING
UMA0204	**0** = Standard	**G** = ± 5 ppm/K **F** = ± 10 ppm/K **E** = ± 15 ppm/K	3 digit value 1 digit multiplier **Multiplier** **9** = $*10^{-1}$ **0** = $*10^{0}$ **1** = $*10^{1}$ **2** = $*10^{2}$ **3** = $*10^{3}$	**H** = ± 0.02 % **A** = ± 0.05 % **B** = ± 0.1 % **C** = ± 0.25 %	**AU** **A1** **A3** **A0**

Product Description: UMA 0204 - 05 0.05 % AL 4K64

UMA	0204	- 05	0.05 %	AL	4K64
TYPE	SIZE	TCR	TOLERANCE	PACKAGING	RESISTANCE
UMA	**0204**	± **05** ppm/K ± **10** ppm/K ± **15** ppm/K	± **0.02** % ± **0.05** % ± **0.1** % ± **0.25** %	**AU** **A1** **AL** **A0**	**4K64** = 4.64 kΩ

Notes
- Products can be ordered using either the PART NUMBER or the PRODUCT DESCRIPTION.
- The standard version includes approval to EN 140401-803, “Version A”, for selected ranges.

PACKAGING

TYPE	CODE	QUANTITY	CARRIER TAPE	WIDTH	PITCH	REEL DIAMETER
UMA 0204	AU	100	Antistatic blister tape acc. IEC 60286-3 type II	8 mm	4 mm	Box
	A1	1000				180 mm/7"
	A3 = AL	3000				
	A0	10 000				330 mm/13"

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE

DESCRIPTION		RESISTANCE
TCR	**TOLERANCE**	**UMA 0204**
15 ppm/K	0.05 %	47 Ω to 332 kΩ
10 ppm/K	0.25 %	22 Ω to 332 kΩ
	0.1 %	43 Ω to 332 kΩ
	0.05 %	75 Ω to 221 kΩ
05 ppm/K	0.25 %	33 Ω to 221 kΩ
	0.1 %	56 Ω to 221 kΩ
	0.05 %	75 Ω to 150 kΩ
	0.02 %	75 Ω to 100 kΩ

Notes
- Resistance values to be selected from E192 series, for other values please contact the factory.
- TCR 10 and TCR 05 is specified over the temperature range from - 10 °C to + 85 °C.
- Approval to EN 140401-803, “Version A” is achieved for TCR 10 with 0.25 % and 0.1 %

DESCRIPTION

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 (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** [3]. 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. This includes pulse load screening (for $R \geq 10\ \Omega$) and additional non-linearity screening (for $R \geq 30\ \Omega$) for the elimination of products with a potential risk of early life failures according to EN 140401-803, 2.1.2.2. Only accepted products are laid directly into the antistatic blister tape in accordance with **IEC 60286-3, Type II** [3].

ASSEMBLY

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow or vapour phase as shown in **IEC 61760-1** [3]. Solderability is specified for 2 years after production or requalification, however, excellent solderability is proven after extended storage in excess of 10 years. The permitted storage time is 20 years.

The resistors are completely lead (Pb)-free, the pure tin plating provides compatibility with lead (Pb)-free soldering processes. The immunity of the plating against tin whisker growth has been proven under extensive testing.

The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions. The suitability of conformal coatings, if applied, shall be qualified by appropriate means to ensure the long-term stability of the whole system.

All products comply with the **GADSL** [1] and the **CEFIC- EECA-EICTA** [2] list of legal restrictions on hazardous substances. This includes full compliance with the following directives:

- 2000/53/EC End of Vehicle life Directive (ELV) and Annex II (ELV II)
- 2011/65/EU Restriction of the use of Hazardous Substances Directive (RoHS)
- 2002/96/EC Waste Electrical and Electronic Equipment Directive (WEEE)

APPROVALS

Where applicable the resistors are approved within the IECQ-CECC Quality Assessment System for Electronic Components to the detail specification **EN 140401-803** which refers to **EN 60115-1**, **EN 140400** and the variety of environmental test procedures of the **IEC 60068** [3] series.

Conformity is attested by the use of the **CECC** logo ( ) as the mark of conformity on the package label.

Vishay BEYSCHLAG has achieved **"Approval of Manufacturer"** in accordance with **IEC QC 001002-3, clause 2**. The release certificate for **"Technology Approval Schedule"** in accordance with **CECC 240001** based on **IEC QC 001002-3, clause 6** is granted for the Vishay BEYSCHLAG manufacturing process.

RELATED PRODUCTS

For thin film products with a wider range or TCR, tolerance and resistance, see this datasheets:

- "Professional MELF Resistors" (www.vishay.com/doc?28713)
- "Precision MELF Resistors" (www.vishay.com/doc?28714)

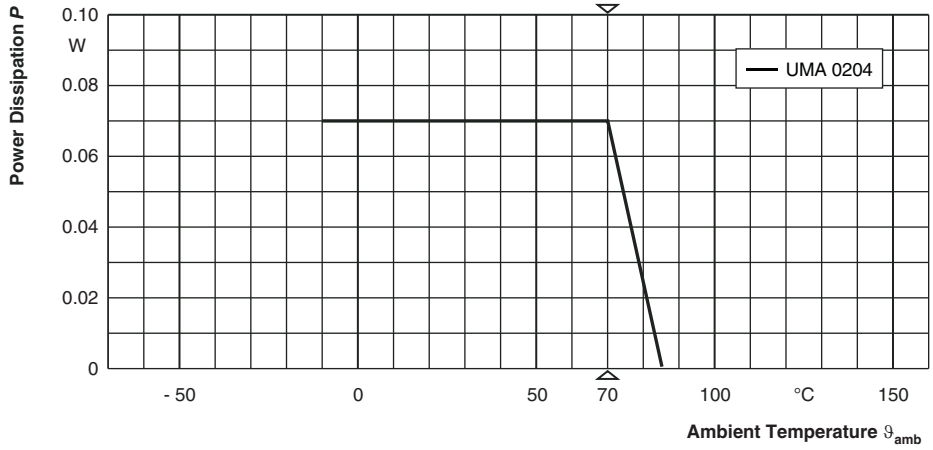
Notes

[1] Global Automotive Declarable Substance List, see www.gadsl.org.

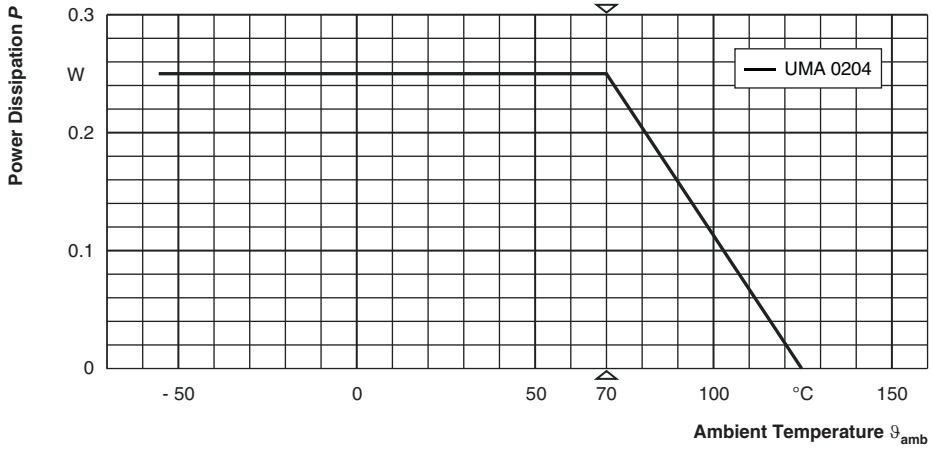
[2] CEFIC (European Chemical Industry Council), EECA (European Electronic Component Manufacturers Association), EICTA (European trade organisation representing the information and communications technology and consumer electronics), see www.eicta.org/index.php?id=995 → issues → environment policy → chemicals → chemicals for electronics.

[3] The quoted IEC standards are also released as EN standards with the same number and identical contents.

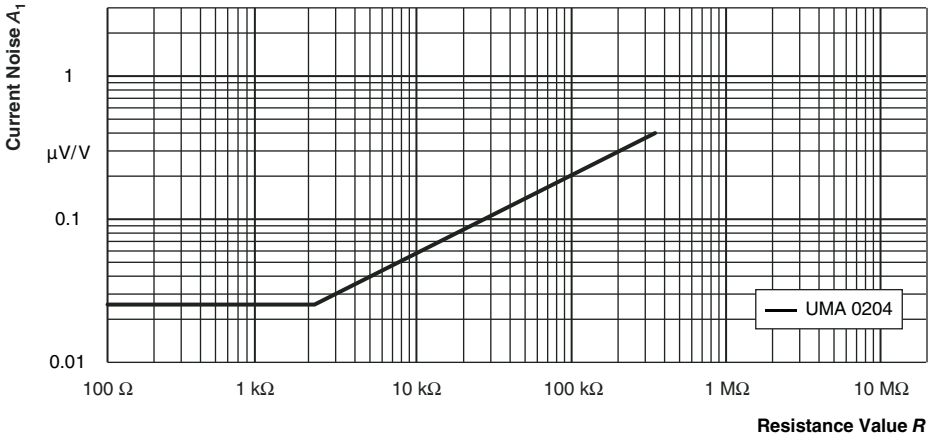
FUNCTIONAL PERFORMANCE



Derating - Precision Operation



Derating - Standard Operation



In accordance with IEC 60195

Current Noise - A_1

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

The components are approved in accordance with the IECQ-CECC-system, where applicable. 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 under standard atmospheric conditions in accordance with IEC 60068-1, 5.3 (3). Climatic category LCT/UCT/56 (rated temperature range: Lower category temperature, upper category temperature; damp heat, steady state, duration: 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 1060 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 below 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.

TEST PROCEDURES AND REQUIREMENTS

EN 60115-1 CLAUSE	IEC 60068-2 (3) TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\triangle R$)		
				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 332 kΩ
4.5	-	Resistance	-	± 0.25 % R; ± 0.1 % R; ± 0.05 % R; ± 0.02 % R		
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	$U = \sqrt{P_{70} \times R} \leq U_{max.}$; 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)		
		Endurance at 70 °C: Standard operating mode	$U = \sqrt{P_{70} \times R} \leq U_{max.}$; 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	78 (Cab)	Damp heat, steady state	(40 ± 2) °C; 56 days; (93 ± 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; $U = 0.3 \times \sqrt{P_{70} \times R} \leq 100$ V; 1000 h	± (0.1 % R + 1 mΩ)	± (0.25 % R + 1 mΩ)	

TEST PROCEDURES AND REQUIREMENTS

EN 60115-1 CLAUSE	IEC 60068-2 (3) TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR) 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 332 kΩ
4.23		Climatic sequence:				
4.23.2	2 (Bb)	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 (Ab)	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			
4.23.7	-	DC load	$U = \sqrt{P_{70} \times R} \leq U_{max.}$; 1 min.			
			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 (Ab)	Cold	- 55 °C; 2 h	± (0.02 % R + 1 mΩ)		
4.19	14 (Na)	Rapid change of temperature	30 min at LCT; 30 min 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	$U = 2.5 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max.}$; 5 s	± (0.005 % R + 1 mΩ)	± (0.01 % R + 1 mΩ)	
		Short time overload; standard operation mode	$U = 2.5 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max.}$; 5 s	± (0.01 % R + 1 mΩ)		
4.27	-	Single pulse high voltage overload; standard mode	severity no. 4: $U = 10 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max.}$; 10 pulses 10 µs/700 µs	± (0.25 % R + 5 mΩ) (1)		
4.37	-	Periodic electric overload; standard mode	$U = \sqrt{15 \times P_{70} \times R} \leq 2 \times U_{max.}$; 0.1 s on; 2.5 s off; 1000 cycles	± (0.5 % R + 5 mΩ) (1)		
4.22	6 (Fc)	Vibration	Endurance by sweeping; 10 Hz to 2000 Hz; no resonance; amplitude ≤ 1.5 mm or ≤ 200 m/s²; 7.5 h	± (0.01 % R + 1 mΩ)		
4.40	-	Electrostatic discharge (Human Body Model)	IEC 61340-3-1 (3); 3 pos. + 3 neg. discharges UMA 0204: 2 kV	± (0.5 % R + 50 mΩ) (1)		

TEST PROCEDURES AND REQUIREMENTS

EN 60115-1 CLAUSE	IEC 60068-2 [3] TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR)		
				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 332 kΩ
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		
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 60 695-11-5 [3], needle flame test; 10 s	No burning after 30 s		

Notes

[1] The pulse load stability of professional MELF resistors applies also to high precision resistors. However, severe pulse loads are likely to jeopardize high precision stability requirements.

[2] Wave soldering is not recommended.

[3] The quoted IEC standards are also released as EN standards with the same number and identical contents.

HISTORICAL 12NC INFORMATION

- The resistors had a 12-digit numeric code starting with 2312.
- The subsequent 4 digits indicated the resistor type, specification and packaging; see the 12NC table.
- The remaining 4 digits indicated the resistance value:
  - The first 3 digits indicated the resistance value.
  - The last digit indicated the resistance decade in accordance with the 12NC Indicating Resistance Decade table.

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

Historical 12NC Example

The 12NC of an UMA 0204 resistor, value 4.75 kΩ and TCR 05 with ± 0.05 % tolerance, supplied in antistatic blister tape of 3000 units per reel was: 2312 113 44752.

HISTORICAL 12NC - Resistor type and packaging

DESCRIPTION			2312			
			ANTISTATIC BLISTER TAPE	ANTISTATIC BLISTER TAPE ON REEL		
TYPE	TCR	TOL.	AU 100 units	A1 1000 units	AL 3000 units	A0 10 000 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...
	± 5 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...

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Material Category Policy

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.

Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.