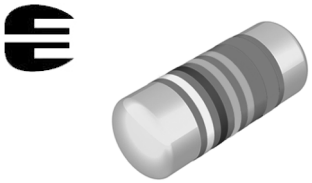
Ultra Precision MELF Resistor



FEATURES

- Most advanced thin film technology
- T.C.R. down to ± 5 ppm/K
- Ultra precision tolerance down to 0.02 %
- Superior overall stability
- Green product, supports lead-free soldering
- Approved according to EN 140401-803.

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.

APPLICATIONS

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

METRIC SIZE	
DIN:	0204
CECC:	RC 3715M

TECHNICAL SPECIFICATIONS

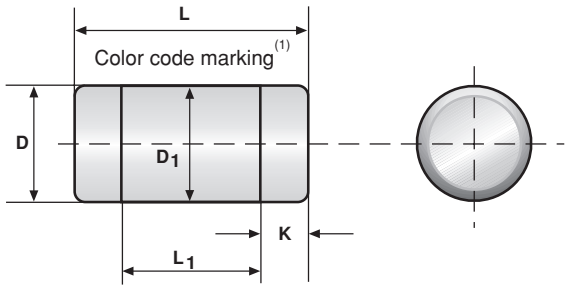
DESCRIPTION	UMA 0204	
Metric CECC size	RC 3715M	
Resistance range	22 Ω to 332 kΩ	
Resistance tolerance	± 0.25 %; ± 0.1 %; ± 0.05 %; ± 0.02 %	
Temperature coefficient	± 15 ppm/K; ± 10 ppm/K; ± 05 ppm/K	
Operation mode	precision	standard
Climatic category (LCT/UCT/days)	10/85/56	55/125/56
Rated dissipation, 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:	22 Ω to 332 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 (insulation):		
1 minute; U_{ins}	300 V	
continuous	75 V	
Failure rate	≤ 0.7×10^{-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.

ORDERING INFORMATION - type description and ordering code							
U	**M**	**A**	**0204**	**-05**	**0.05 %**	**AL**	**4 K 75**
FILM TYPE	PRODUCT CODE	SIZE CODE	METRIC DIN SIZE	TEMPERATURE COEFFICIENT	TOLERANCE	PACKAGING	RESISTANCE VALUE
U = Ultra precision	M = MELF, cylindrical	A = 0204	0204	± 15 ppm/K ± 10 ppm/K ± 05 ppm/K	0.25 % 0.1 % 0.05 % 0.02 %	AU = 100 units A1 = 1000 units AL = 3000 units A0 = 10000 units	See temperature Coefficient and Resistance Range Table

DIMENSIONS



DIMENSIONS - MELF resistor type, mass and relevant physical dimensions						
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

Note

1. Color code marking is applied according to IEC 60062 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 approx. 50 % wider than the other bands. An interrupted band between the 4th and 5th full band indicates the temperature coefficient.

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE		
DESCRIPTION		**RESISTANCE VALUE(1)**
T.C.	**TOLERANCE**	**UMA 0204**
15 ppm/K	0.05 %	47 Ω to 332 kΩ
10 ppm/K (2)	0.25 %	22 Ω to 332 kΩ
	0.1 %	43 Ω to 332 kΩ
	0.05 %	75 Ω to 221 kΩ
05 ppm/K (2)	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

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.

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 (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**.

ASSEMBLY

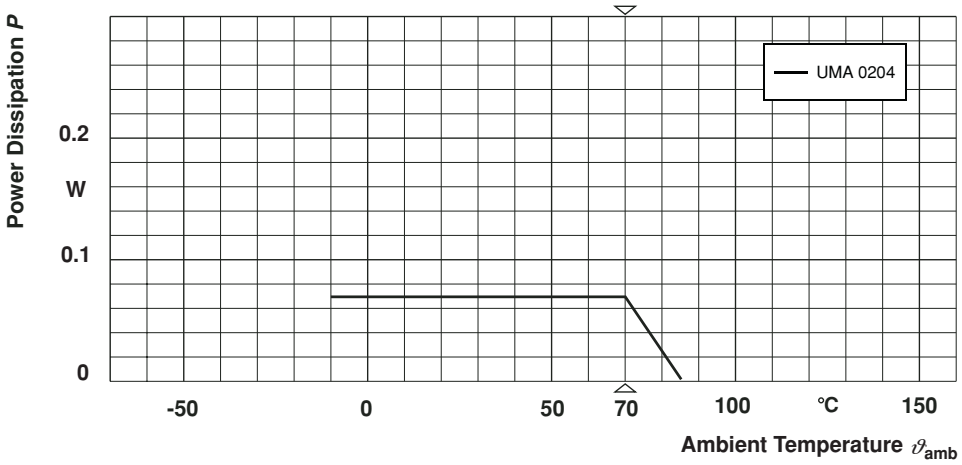
The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using reflow or vapour phase. Excellent solderability is proven, even after extended storage in excess of 10 years. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions.The resistors are completely lead (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. All products comply with the CEFIC-EECA-EICTA list of legal restrictions on hazardous substances. This includes full compatibility with the European RoHS directive.

APPROVALS

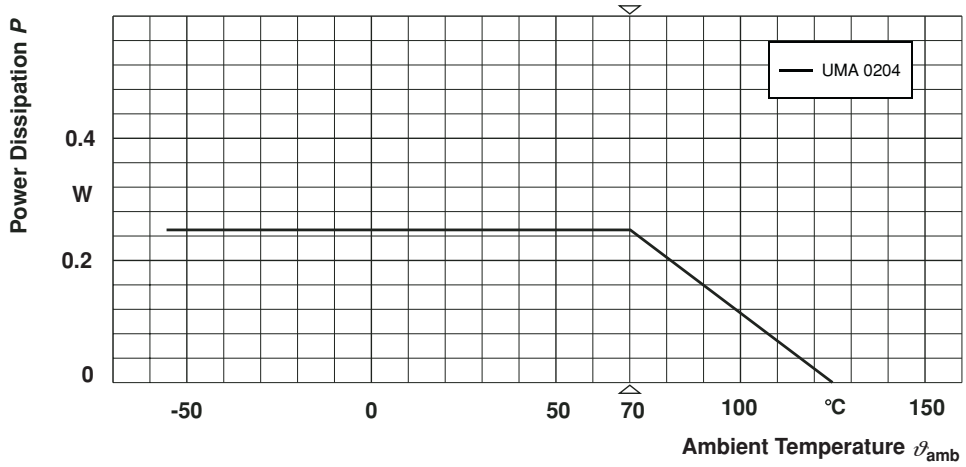
The resistors are tested in accordance with **EN 140401-803** which refers to **EN 60115-1, EN 140400** and the variety of enviromental test procedures of the **IEC 60068** series. Approval of conformity is indicated by the **CECC** logo on the package label.

Vishay 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 Vishay BEYSCHLAG manufacturing process.

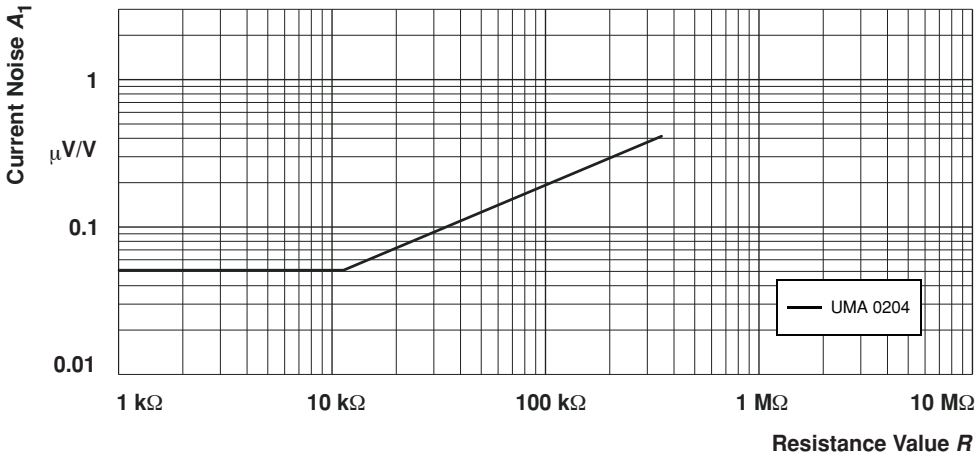
FUNCTIONAL PERFORMANCE



Derating - Precision Operation



Derating - Standard Operation



In accordance with IEC 60 195

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 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 to1 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 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 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 332 kΩ
4.5	–	resistance	–	± 0.25 %; ± 0.1 %; ± 0.05 %; ± 0.02 %;		
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	$U = \sqrt{P_{70} \times R} \le U_{max}$; 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	$U = \sqrt{P_{70} \times R} \le U_{max}$; 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)

TEST PROCEDURES AND REQUIREMENTS - continued

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 332 kΩ
4.39	67 (Cy)	damp heat, steady state, accelerated	(85 ± 2) °C; (85 ± 5) % RH; $U = 0.1 \times \sqrt{P_{70} \times R} \leq 100$ 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	± (0.02 %R + 1 mΩ)		
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	$U = 2.5 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max}$; 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)		

TEST PROCEDURES AND REQUIREMENTS - continued

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 332 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		
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		

Note

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

ORDERING INFORMATION

Components may be ordered by using either a simple clear text ordering code, see “Type description and ordering code”or Vishay 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 the 12NC Ordering Code table.
- 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 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

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.

12NC ORDERING CODE - resistor type and packaging

DESCRIPTION			ORDERING CODE 2312			
			ANTISTATIC BLISTER TAPE	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.