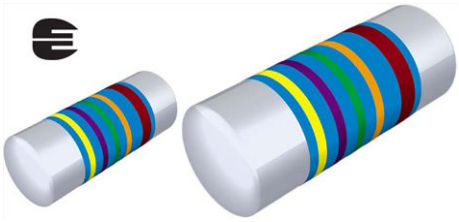
Ultra Precision Thin Film MELF Resistors



UMA 0204 and UMB 0207 ultra precision thin film MELF resistors combine the proven reliability of precision MELF products with the most advanced level of precision and stability first achieved with axial thin film precision resistors. This unique combination makes the product perfectly suited for all applications with outstanding requirements towards reliable precision and stability.

FEATURES

- Most advanced thin film technology
- Long term stability down to 0.02 %
- TCR down to ± 5 ppm/K
- High precision tolerance down to ± 0.02 %
- Operating voltage 350 V for UMB 0207
- Material categorization:
  For definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS COMPLIANT
HALOGEN FREE GREEN (5-2008)

APPLICATIONS

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

TECHNICAL SPECIFICATIONS

DESCRIPTION	UMA 0204	UMB 0207
DIN size	0204	0207
Metric CECC size	RC 3715M	RC 6123M
Resistance range	22 Ω to 332 kΩ	100 Ω to 390 kΩ
Resistance tolerance	± 0.25 %; ± 0.1 %; ± 0.05 %; ± 0.02 %	
Temperature coefficient	± 15 ppm/K; ± 10 ppm/K; ± 5 ppm/K	
Rated dissipation, P_{70} (1)	0.25 W	0.4 W
Operating voltage, $U_{max.}$ AC_{RMS} or DC	200 V	350 V
Permissible film temperature, $\vartheta_{max.}$ (1)	125 °C	
Operating temperature range	-55 °C to 125 °C	
Permissible voltage against ambient (insulation):		
1 min; U_{ins}	300 V	500 V
Continuous	75 V	75 V
Failure rate: $FIT_{observed}$	≤ 0.1 x 10^{-9}/h	

Note

(1) Please refer to APPLICATION INFORMATION below.

APPLICATION INFORMATION

The power dissipation on the resistor generates a temperature rise against the local ambient, depending on the heat flow support of the printed-circuit board (thermal resistance). The rated dissipation applies only if the permitted film temperature is not exceeded. Furthermore a high level of ambient temperature or of power dissipation may raise the temperature of the solder joint, hence special solder alloys or board materials may be required to maintain the reliability of the assembly.

These resistors do not feature a lifetime limitation when operated within the limits of rated dissipation, permissible operating voltage and permissible film temperature. However, the resistance typically increases due to the resistor's film temperature over operating time, generally known as drift. The drift may exceed the stability requirements of an individual application circuit and thereby limits the functional lifetime.

MAXIMUM RESISTANCE AT RATED DISSIPATION			
Operation mode		Precision	Standard
Rated dissipation, P_{70}	UMA 0204	0.07 W	0.25 W
	UMB 0207	0.11 W	0.4 W
Applied maximum film temperature, $\vartheta_{F\ max.}$		85 °C	125 °C
Max. resistance change at rated dissipation $\lvert\Delta R/R$ max.$\rvert$, after:			
	1000 h	≤ 0.02 %	≤ 0.05 %
	8000 h	≤ 0.05 %	≤ 0.1 %
	225 000 h	≤ 0.15 %	≤ 0.3 %

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE				
TYPE	TCR	TOLERANCE	RESISTANCE RANGE	E-SERIES
UMA 0204	± 15 ppm/K	± 0.05 %	47 Ω to 332 kΩ	E192
	± 10 ppm/K	± 0.25 %	22 Ω to 332 kΩ	
		± 0.1 %	43 Ω to 332 kΩ	
		± 0.05 %	75 Ω to 221 kΩ	
	± 5 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	
UMB 0207	± 15 ppm/K	± 0.05 %	100 Ω to 390 kΩ	
	± 10 ppm/K	± 0.25 %	100 Ω to 390 kΩ	
		± 0.1 %	100 Ω to 390 kΩ	
		± 0.05 %	100 Ω to 390 kΩ	
	± 5 ppm/K	± 0.25 %	270 Ω to 390 kΩ	
		± 0.1 %	270 Ω to 390 kΩ	
		± 0.05 %	270 Ω to 390 kΩ	
		± 0.02 %	270 Ω to 390 kΩ	

Notes

- TCR 10 ppm/K and TCR 05 ppm/K is specified over the temperature range from -10 °C to +85 °C.
- UMA 0204: Approval to EN 140401-803, "Version A" is achieved for TCR 10 ppm/K with 0.25 % and 0.1 %.

PACKAGING

TYPE	CODE	QUANTITY	CARRIER TAPE	WIDTH	PITCH	REEL DIAMETER
UMA 0204	AU	100	Antistatic blister tape acc. IEC 60286-3 type 2a	8 mm	4 mm	Box
	A1	1000				180 mm/7"
	A3 = AL	3000				
	A0	10 000				330 mm/13"
UMB 0207	BU	100	Antistatic blister tape acc. IEC 60286-3 type 2a	12 mm	4 mm	Box
	B1	1000				180 mm/7"
	B2	2000				
	B7	7000				330 mm/13"

PART NUMBER AND PRODUCT DESCRIPTION

Part Number: UMB02070F5620AB200

U	M	B	0	2	0	7	0	F	5	6	2	0	A	B	2	0	0

MODEL/SIZE	VERSION	TCR	RESISTANCE	TOLERANCE	PACKAGING
UMA 0204 **UMB 0207**	**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** **BU** **B1** **B2** **B7**

Product Description: UMB 0207-10 0.05 % B2 562R

UMB	0207	10	0.05 %	B2	562R
TYPE	SIZE	TCR	TOLERANCE	PACKAGING	RESISTANCE
UMA **UMB**	**0204** **0207**	± **5** ppm/K ± **10** ppm/K ± **15** ppm/K	± **0.02** % ± **0.05** % ± **0.1** % ± **0.25** %	**AU** **A1** **AL** **A0** **BU** **B1** **B2** **B7**	**562R** = 562 Ω

Note

- Products can be ordered using either the PART NUMBER or the PRODUCT DESCRIPTION.

DESCRIPTION

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A homogeneous film of special metal alloy is deposited on a high grade ceramic body (Al_2O_3) and conditioned to achieve the desired temperature coefficient. Nickel plated steel termination caps are firmly pressed on the metallized rods. A special laser is used to achieve the target value by smoothly cutting a helical groove in the resistive layer without damaging the ceramics. The resistor elements are covered by a unique protective coating designed for electrical, mechanical, and climatic protection. The terminations receive a final pure tin on nickel plating. Five color code rings designate the resistance value and tolerance in accordance with **IEC 60062** [3].

The result of the determined production is verified by an extensive testing procedure and optical inspection performed on 100 % of the individual resistors. This includes full screening for the elimination of products with a potential risk of early field failures. Only accepted products are laid directly into the blister tape in accordance with **IEC 60286-3, Type 2a** [3].

ASSEMBLY

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using 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 life Vehicle 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.

Vishay Beyschlag has achieved "**Approval of Manufacturer**" in accordance with **IECQ 03-1**. The release certificate for "**Technology Approval Schedule**" in accordance with **CECC 240001** based on **IECQ 03-3** is granted for the Vishay Beyschlag manufacturing process.

RELATED PRODUCTS

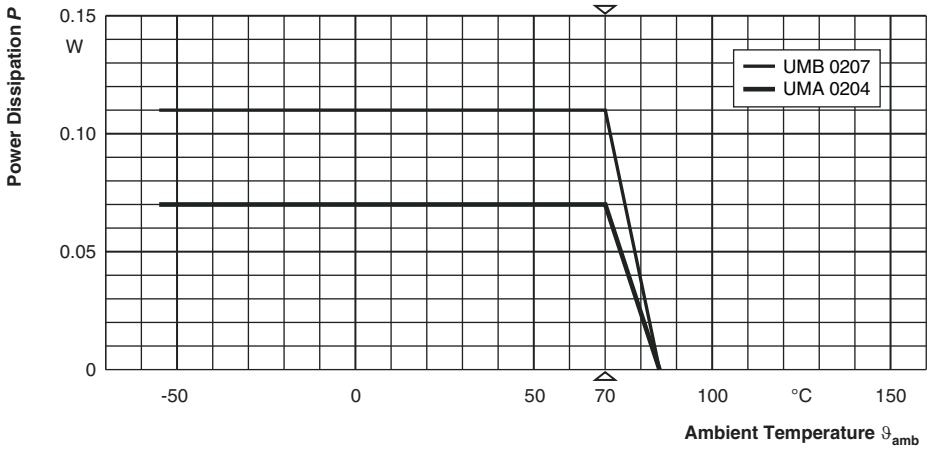
For products with a wider range of TCR, tolerance and resistance, see the datasheets:

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

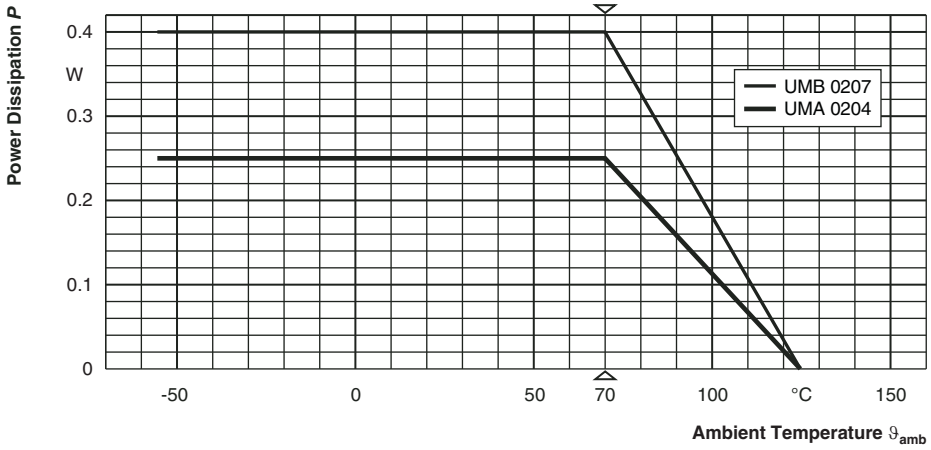
Notes

(1) Global Automotive Declarable Substance List, see www.gadsl.org.
(2) CEFIC (European Chemical Industry Council), EECA (European Electronic Component Manufacturers Association).
(3) The quoted IEC standards are also released as EN standards with the same number and identical contents.

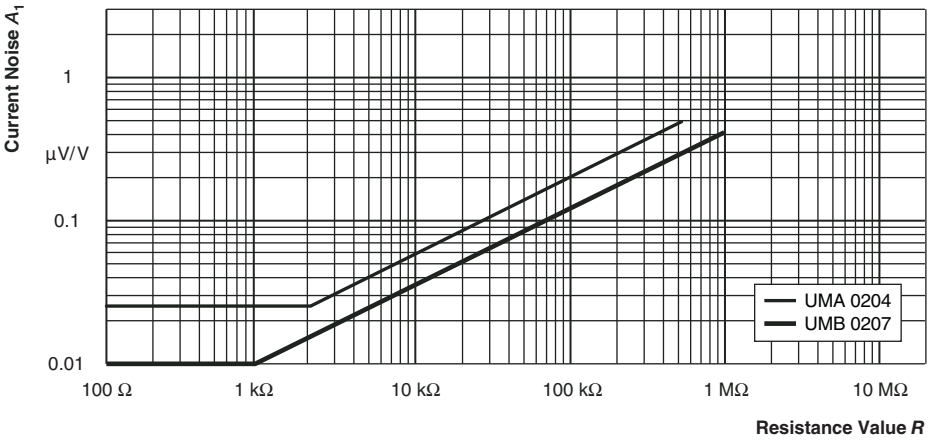
FUNCTIONAL PERFORMANCE



Derating - Precision Operation Mode



Derating - Standard Operation Mode



In accordance with IEC 60195

Current Noise - A_1

TESTS AND REQUIREMENTS

Essentially 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 under 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/ECA-703 and JIS-C-52001-1.

The tests are carried out in accordance with IEC 60068 and under standard atmospheric conditions in accordance with IEC 60068-1, 5.3. A climatic category is applied, defined by the lower category temperature (LCT), the upper category temperature (UCT), and the number of days of the damp heat, steady-state test (56).

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 in the Test Procedures and Requirements table 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.

TEST PROCEDURES AND REQUIREMENTS

EN 60115-1 CLAUSE	IEC 60068-2 (1) TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR)		
			Stability for product types:	STABILITY CLASS 0.05 OR BETTER	STABILITY CLASS 0.1 OR BETTER	STABILITY CLASS 0.25 OR BETTER
			UMA 0204	100 Ω to 100 kΩ	43 Ω to 221 kΩ	22 Ω to 332 kΩ
			UMB 0207	270 Ω to 100 kΩ	100 Ω to 390 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; ± 5 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 operation 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)
4.37	-	Damp heat, steady state, accelerated; Standard operation mode	(85 ± 2) °C; (85 ± 5) % RH; $U = 0.3 \times \sqrt{P_{70} \times R} \leq 0.3 \times U_{max.}$; 1000 h	± (0.1 % R + 1 mΩ)	± (0.25 % R + 1 mΩ)	

TEST PROCEDURES AND REQUIREMENTS

EN 60115-1 CLAUSE	IEC 60068-2 (1) TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR)		
			Stability for product types:	STABILITY CLASS 0.05 OR BETTER	STABILITY CLASS 0.1 OR BETTER	STABILITY CLASS 0.25 OR BETTER
			UMA 0204	100 Ω to 100 kΩ	43 Ω to 221 kΩ	22 Ω to 332 kΩ
			UMB 0207	270 Ω to 100 kΩ	100 Ω to 390 kΩ	-
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; 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 (Aa)	Cold	-55 °C; 2 h	± (0.02 % R + 0.1 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 operation 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)		
4.39	-	Periodic electric overload; Standard operation 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)		
4.22	6 (Fc)	Vibration	Endurance by sweeping; 10 Hz to 2000 Hz; no resonance; amplitude ≤ 1.5 mm or ≤ 200 m/s^2; 7.5 h	± (0.01 % R + 1 mΩ)		

TEST PROCEDURES AND REQUIREMENTS

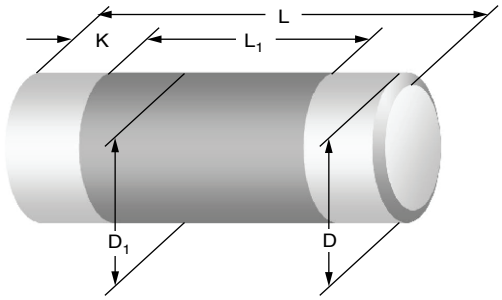
EN 60115-1 CLAUSE	IEC 60068-2 (1) TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR)		
			Stability for product types:	STABILITY CLASS 0.05 OR BETTER	STABILITY CLASS 0.1 OR BETTER	STABILITY CLASS 0.25 OR BETTER
			UMA 0204	100 Ω to 100 kΩ	43 Ω to 221 kΩ	22 Ω to 332 kΩ
			UMB 0207	270 Ω to 100 kΩ	100 Ω to 390 kΩ	-
4.38	-	Electrostatic discharge (Human Body Model)	IEC 61340-3-1 (1); 3 pos. + 3 neg. discharges UMA 0204: 2 kV UMB 0207: 4 kV	± (0.5 % R + 50 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; (2 ± 0.2) s	(2)		± (0.05 % R + 10 mΩ)
			Reflow method 2 (IR/forced gas convection); (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 60695-11-5 (1), needle flame test; 10 s	No burning after 30 s		

Notes

(1) The quoted IEC standards are also released as EN standards with the same number and identical contents.

(2) Wave soldering is not recommended.

DIMENSIONS

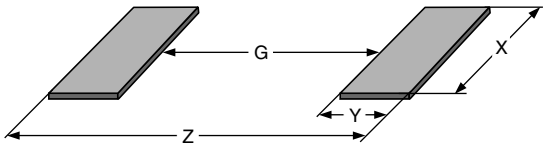


DIMENSIONS AND MASS						
TYPE	L (mm)	D (mm)	$L_{1\ min.}$ (mm)	D_1 (mm)	K (mm)	MASS (mg)
UMA 0204	3.6 + 0/- 0.2	1.4 + 0/- 0.1	1.8	D + 0/- 0.15	0.8 ± 0.1	22
UMB 0207	5.8 + 0/- 0.15	2.2 + 0/- 0.2	3.2	D + 0/- 0.2	1.15 ± 0.1	80

Note

- 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 approximately 50 % wider than the other bands. An interrupted band between the 4th and 5th full band indicates the temperature coefficient (orange = TCR 15 ppm/K, blue = TCR 10 ppm/K, violet = TCR 05 ppm/K).

PATTERN STYLES FOR MELF RESISTORS



RECOMMENDED SOLDER PAD DIMENSIONS								
TYPE	WAVE SOLDERING (1)				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
UMB 0207	2.8	2.1	2.6	7.0	3.2	1.7	2.4	6.6

Notes

- 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.

(1) Wave soldering is not recommended.

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