Professional High-Voltage Thin Film MELF Resistors

MMA 0204 HV and MMB 0207 HV professional thin film MELF resistors are the perfect choice for most fields of modern professional electronics where reliability and stability are of major concern. The devices' typical applications in the fields of lighting and medical equipment reflect the outstanding level of proven reliability.

FEATURES

- High operating voltage, $U_{max.}$ = 1000 V
- Advanced metal film technology
- Matte Sn termination on Ni barrier layer
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

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

APPLICATIONS

- Lighting
- Industrial
- Medical equipment

TECHNICAL SPECIFICATIONS		
DESCRIPTION	**MMA 0204 HV**	**MMB 0207 HV**
DIN size	0204	0207
Metric CECC size	RC 3715M	RC 6123M
Resistance range	340 kΩ to 10 MΩ	340 kΩ to 10 MΩ
Resistance tolerance	± 1 %	± 1 %
Temperature coefficient	± 50 ppm/K	± 50 ppm/K
Voltage coefficient	< 2 ppm/V	< 2 ppm/V
Rated dissipation, P_{70} (1)	0.4 W	1.0 W
Operating voltage, $U_{max.}$ AC/DC	500 V	1000 V
Operating temperature range	-55 °C to 155 °C	-55 °C to 155 °C
Permissible voltage against ambient (insulation):		
1 min, U_{ins}	300 V	500 V
Continuous	75 V	75 V

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. The applicable voltage is limited by maximum power.

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. At the maximum permissible film temperature of 155 °C the useful lifetime is specified for 8000 h. The designer may estimate the performance of the particular resistor application or set certain load and temperature limits in order to maintain a desired stability.

MAXIMUM RESISTANCE CHANGE AT RATED DISSIPATION

OPERATION MODE		STANDARD	POWER
Rated dissipation, P_{70}	MMA 0204 HV	0.25 W	0.4 W
	MMB 0207 HV	0.4 W	1.0 W (1)
Operating temperature range		-55 °C to 125 °C	-55 °C to 155 °C
Permissible film temperature, ϑ_F max.		125 °C	155 °C
Max. resistance change at P_{70} for resistance range, $\Delta R/R$ after:	MMA 0204 HV	340 kΩ to 10 MΩ	340 kΩ to 10 MΩ
	MMB 0207 HV	340 kΩ to 10 MΩ	340 kΩ to 10 MΩ
	1000 h	≤ 0.5 %	≤ 1 %
	8000 h	≤ 1 %	≤ 2 %

Note

(1) Specified power rating requires dedicated heat sink pads.

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE

TYPE/SIZE	TCR	TOLERANCE	RESISTANCE	E-SERIES
MMA 0204 HV	± 50 ppm/K	± 1 %	340 kΩ to 10 MΩ	E24; E96
MMB 0207 HV	± 50 ppm/K	± 1 %	340 kΩ to 10 MΩ	E24; E96

PACKAGING

TYPE/SIZE	CODE	QUANTITY	CARRIER TAPE	WIDTH	PITCH	REEL DIAMETER
MMA 0204 HV	B3 = BL	3000	Antistatic blister tape acc. IEC 60286-3 Type 2a	8 mm	4 mm	180 mm/7"
	B0	10 000				330 mm/13"
MMB 0207 HV	B2	2000	Antistatic blister tape acc. IEC 60286-3 Type 2a	12 mm	4 mm	180 mm/7"
	B7	7000				330 mm/13"

PART NUMBER AND PRODUCT DESCRIPTION

Part Number: MMB0207MC3324FB200

M	M	B	0	2	0	7	M	C	3	3	2	4	F	B	2	0	0

TYPE/SIZE	VERSION	TCR	RESISTANCE	TOLERANCE	PACKAGING
MMA0204 **MMB0207**	**M** = HV	**C** = ± 50 ppm/K	**3 digit value** **1 digit multiplier** MULTIPLIER **3** = *10^3 **4** = *10^4 **5** = *10^5	**F** = ± 1 %	**B3** **B0** **B2** **B7**

Product Description: MMB 0207 -50 1 % HV B2 3M32

MMB	0207	- 50	1 %	HV	B2	3M32
TYPE	SIZE	TCR	TOLERANCE	HIGH VOLTAGE	PACKAGING	RESISTANCE
MMA **MMB**	**0204** **0207**	± **50** ppm/K	± **1** %		**BL** **B0** **B2** **B7**	**3M32** = 3.32 MΩ

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 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 metallised 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 protective coating designed for electrical, mechanical and climatic protection. The terminations receive a final pure tin on nickel plating. Four or five color code rings designate the resistance value and tolerance in accordance with **IEC 60062** (1).

The result of the determined production is verified by an extensive testing procedure performed on 100 % of the individual resistors. This includes full screening for the elimination of products with a potential risk of early field failures according to EN 140401-803, 2.1.2.2. Only accepted products are laid directly into the blister tape in accordance with **IEC 60286-3, Type 2a** (1) or bulk case in accordance with **IEC 60286-6** (1).

ASSEMBLY

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow or vapor phase as shown in **IEC 61760-1** (1). 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.

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

All products comply with the **IEC 62474**, Material Declaration for Products of and for the Electrotechnical Industry.

The dedicated database (2), that list declarable substances, ensures 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)
- 2012/19/EU Waste Electrical and Electronic Equipment Directive (WEEE)

APPROVALS

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 03-3-1** is granted for the Vishay Beyschlag manufacturing process.

RELATED PRODUCTS

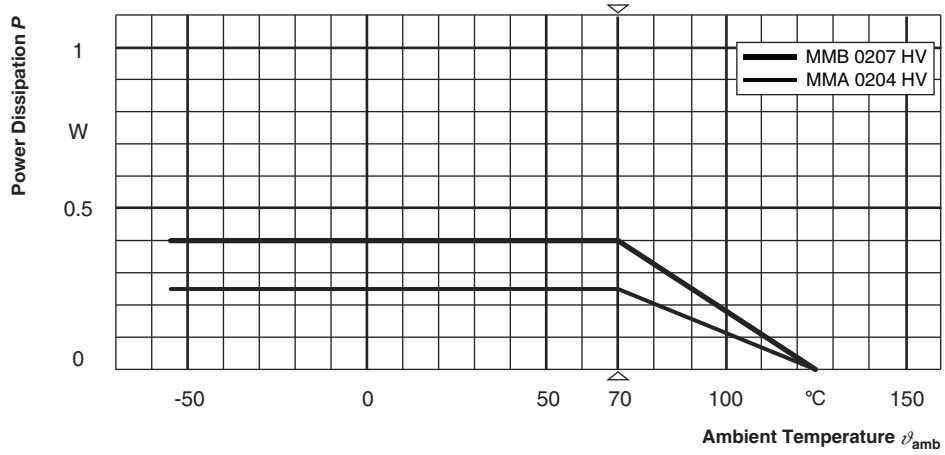
For products with professional specification see the datasheet:

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

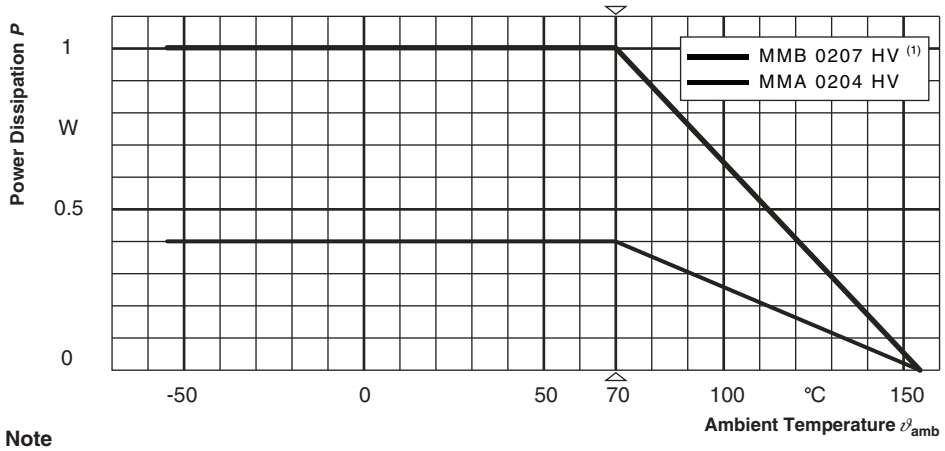
Notes

(1) The quoted IEC standards are also released as EN standards with the same number and identical contents.
(2) IEC 62474 database can be found at http://std.iec.ch/iec62474.

FUNCTIONAL PERFORMANCE

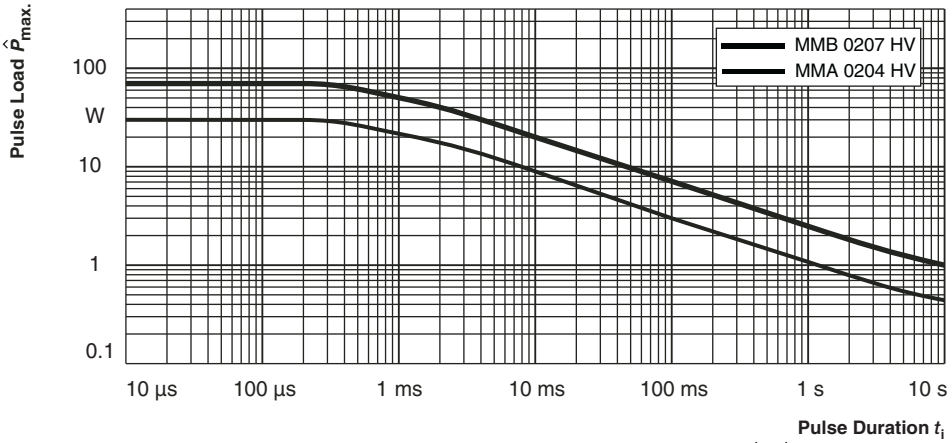


Derating - Standard Operation



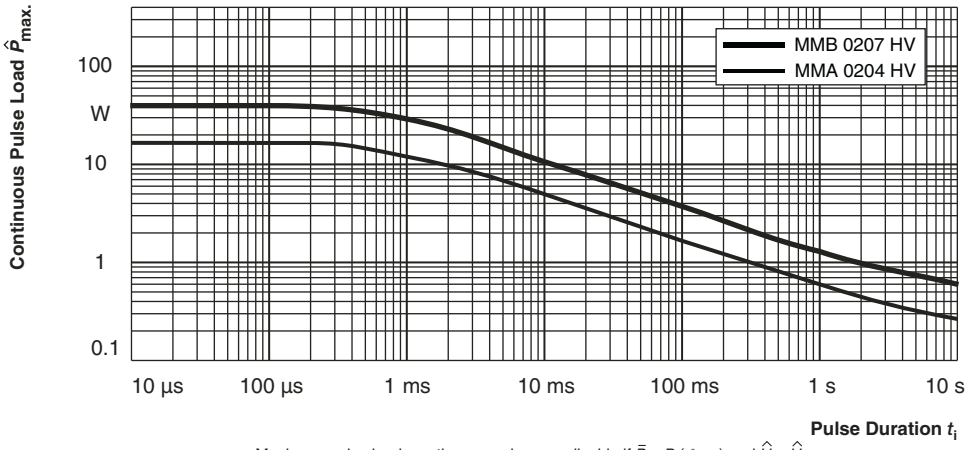
Note
(1) Specified power rating requires dedicated heat sink pads

Derating - Power Operation



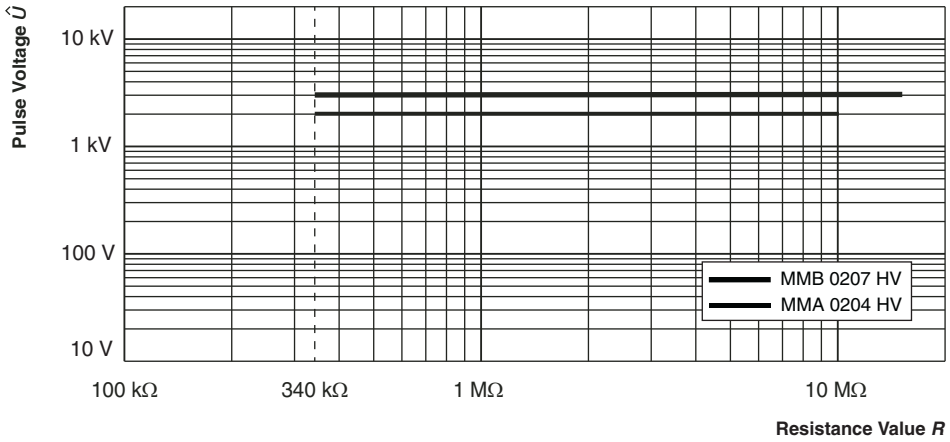
Single Pulse

Maximum pulse load, single pulse; applicable if $\bar{P} \rightarrow 0$ and $n \leq 1000$ and $\hat{U} \leq \hat{U}_{max.}$;
for permissible resistance change equivalent to 8000 h operation in power operation mode



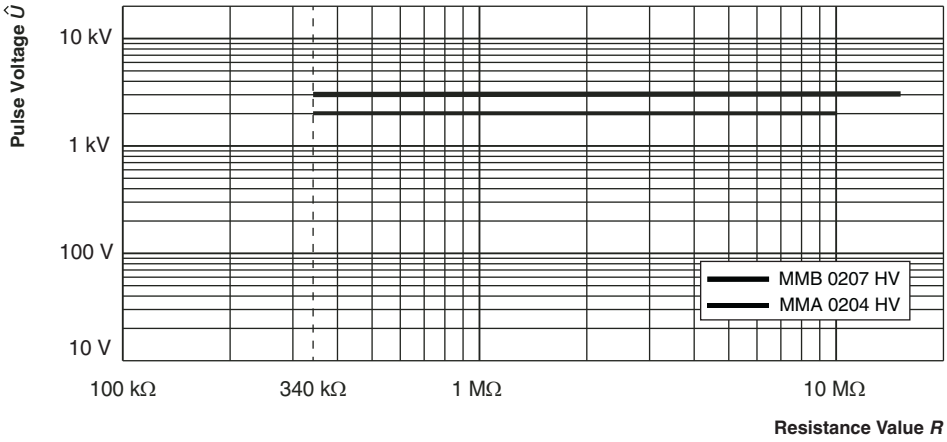
Maximum pulse load, continuous pulses; applicable if $\bar{P} \leq P(\vartheta_{amb})$ and $\hat{U} \leq \hat{U}_{max.}$;
for permissible resistance change equivalent to 8000 h operation in power operation mode

Continuous Pulse



Pulse load rating in accordance with IEC 60 115-1, 4.27; 1.2 µs/50 µs;
5 pulses at 12 s intervals; for permissible resistance change (0.5 % x R + 0.05 Ω)

1.2/50 Pulse



Pulse load rating in accordance with IEC 60115-1, 4.27; 10 µs/700 µs;
10 pulses at 1 minute intervals; for permissible resistance change (0.5 % x R + 0.05 Ω)

10/700 Pulse

TESTS AND REQUIREMENTS

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

EN 60115-1, generic specification

EN 60115-8 (successor of EN 140400), sectional specification

EN 140401-803, detail specification

IEC 60068-2-xx, test methods

The parameters stated in the Test Procedures and Requirements table are based on the required tests and permitted limits of EN 140401-803. The table presents only the most important tests, for the full test schedule refer to the documents listed above. However, some additional tests and a number of improvements against those minimum requirements have been included.

The testing also covers most of the requirements specified by EIA/ECA-703 and JIS-C-5201-1.

The tests are carried out under standard atmospheric conditions in accordance with IEC 60068-1, 4.3, whereupon the following values are applied:

Temperature: 15 °C to 35 °C

Relative humidity: 45 % to 75 %

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

A climatic category LCT/UCT/56 is applied, defined by the lower category temperature (LCT), the upper category temperature (UCT), and the duration of exposure in the damp heat, steady state test (56 days).

The components are mounted for testing on printed circuit boards in accordance with EN 60115-8, 2.4.2, unless otherwise specified.

TEST PROCEDURES AND REQUIREMENTS

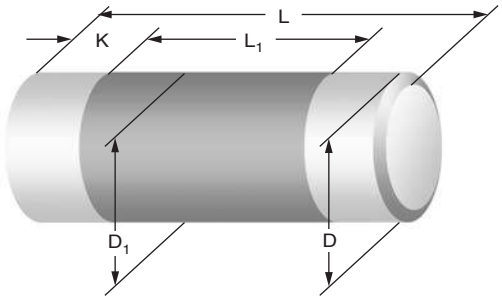
EN 60115-1 CLAUSE	IEC 60068-2 (1) TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR)	
			Stability for product types:	STABILITY CLASS 0.25 OR BETTER	STABILITY CLASS 2 OR BETTER
			MMA 0204 HV	-	> 340 kΩ
			MMB 0207 HV	340 kΩ to 1 MΩ	> 1 MΩ
4.5	-	Resistance	-	± 1 % R	± 1 % R
4.8.4.2	-	Temperature coefficient	At (20/-55/20) °C and (20/125/20) °C	± 50 ppm/K	
4.25.1	-	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 70 °C; 8000 h	± (0.15 % R + 10 mΩ) ± (0.3 % R + 10 mΩ)	± (0.5 % R + 10 mΩ) ± (1 % R + 10 mΩ)
	-	Endurance at 70 °C: Power operation mode	$U = \sqrt{P_{70} \times R} \leq U_{max.}$; 1.5 h on; 0.5 h off; 70 °C; 1000 h 70 °C; 8000 h	± (0.3 % R + 10 mΩ) ± (1 % R + 10 mΩ)	± (1 % R + 10 mΩ) ± (2 % R + 10 mΩ)
4.25.3	–	Endurance at upper category temperature	125 °C; 1000 h	± (0.15 % R + 5 mΩ)	± (1 % R + 5 mΩ)
			155 °C; 1000 h	± (0.3 % R + 5 mΩ)	± (2 % R + 5 mΩ)
4.24	78 (Cab)	Damp heat, steady state	(40 ± 2) °C; 56 days; (93 ± 3) % RH	± (0.15 % R + 10 mΩ)	± (1 % R + 10 mΩ)
-	1 (Ab)	Cold	-55 °C; 2 h	± (0.05 % R + 5 mΩ)	± (0.1 % R + 5 mΩ)
4.19	14 (Na)	Rapid change of temperature	30 min at LCT; 30 min at UCT; LCT = -55 °C; UCT = 155 °C 1000 cycles	± (0.25 % R + 10 mΩ)	± (0.5 % R + 10 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 0.25 OR BETTER**	**STABILITY CLASS 2 OR BETTER**
			MMA 0204 HV	-	> 340 kΩ
			MMB 0207 HV	340 kΩ to 1 MΩ	> 1 MΩ
4.13	-	Short time overload: Standard operation mode	$U = 2.5 \times \sqrt{P_{70} \times R}$ $\leq 2 \times U_{max.}$; 5 s	± (0.03 % R + 5 mΩ)	± (0.15 % R + 5 mΩ)
		Short time overload: Power operation mode		± (0.05 % R + 5 mΩ)	± (0.15 % 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	± (0.05 % R + 5 mΩ)	± (0.1 % R + 5 mΩ)
4.40	-	Electrostatic discharge (Human Body Model)	IEC 61340-3-1 [1]; 3 pos. + 3 neg. discharges MMA 0204 HV: 2 kV MMB 0207 HV: 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; (10 ± 1) s	± (0.05 % R + 10 mΩ)	± (0.25 % R + 10 mΩ)
			Reflow method 2 (IR/forced gas convection); (260 ± 5) °C; (10 ± 1) s	± (0.02 % R + 10 mΩ)	± (0.1 % R + 10 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 ± (0.05 % 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	

Note

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

DIMENSIONS

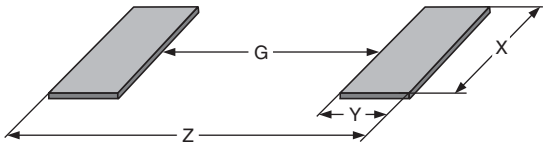


DIMENSIONS AND MASS						
TYPE	L (mm)	D (mm)	$L_{1\ min.}$ (mm)	D_1 (mm)	K (mm)	MASS (mg)
MMA 0204 HV	3.6 + 0/- 0.2	1.4 + 0/- 0.1	1.8	D + 0/- 0.15	0.8 ± 0.1	22
MMB 0207 HV	5.8 + 0/- 0.15	2.2 + 0/- 0.2	3.2	D + 0/- 0.2	1.15 ± 0.1	80

Note

- Color code marking is applied according to IEC 60062 (1) in four bands (E24 series) or five bands (E96 series). 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 violet band between the 3rd and 4th full band identifies the special high voltage type.

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)
MMA 0204 HV	1.5	1.5	1.8	4.5	1.7	1.2	1.6	4.1
MMB 0207 HV	2.8	2.1	2.6	7.0	3.2	1.7	2.4	6.6

Notes

- 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. Specified power rating above 125 °C requires dedicated heat-sink pads, which to a great extend depend on board materials and design. The given solder pad dimensions reflect the considerations for board design and assembly as outlined e.g. in standards IEC 61188-5-x (1), or in publication IPC-7351. They do not guarantee any supposed thermal properties, particularly as these are also strongly influenced by many other parameters.
  Still, the given solder pad dimensions will be found adequate for most general applications, e.g. those referring to “standard operation mode”. Please note however that applications for “power operation mode” require special considerations for the design of solder pads and adjacent conductor areas.

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

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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.

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.