

DATA SHEET

**MMU 0102 HF; MMA 0204 HF;
MMB 0207 HF
High frequency
MELF resistors**

Product specification
Supersedes data of 6th September 2000
File under BCcomponents, BC08

2002 Nov 19

High frequency MELF resistors

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FEATURES

- Speciality product for RF applications
- Low-inductance non-helical trimmed product
- Suitable for more than 10 GHz
- Resistance range: 1,5 Ω to 475 Ω
- Green product, supports lead-free soldering.

Metric sizes

DIN:	0102	0204	0207
CECC:	RC 2211M	RC 3715M	RC 6123M

APPLICATIONS

- Telecommunication equipment
- Industrial electronics.

DESCRIPTION

MMU 0102 HF, MMA 0204 HF and MMB 0207 HF speciality thin film MELF resistors for RF applications are the perfect choice in high frequency circuit designs where the impedance change due to the parasitic inductance of regular and professional resistors can not be accepted. Typical applications are in the fields of telecommunication equipment and industrial electronics. In special situations where MMU 0102 HF, MMA 0204 HF or MMB 0207 HF resistors were mounted to a solid ground plane or module case, the rated power dissipation could have been exceeded by far.

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 (85% Al₂O₃, for MICRO-MELF: 96% Al₂O₃) ceramic body 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 non helical groove with a resulting low inductivity 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 colour code rings designate the resistance value and tolerance in accordance with **IEC 60062**. Additional black dots near the 3rd colour ring identify the special HF product.

The result of the determined production is verified by an extensive testing procedure performed on 100% of the individual resistors. Only accepted products are laid directly into the blister tape in accordance with **IEC 60286-3** or bulk case in accordance with **IEC 60286-6**.

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, 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.

Where applicable the resistors are tested in accordance with **EN 140401-803 (superseding CECC 40401-803)** which refers to **EN 60115-1** and **EN140400**.

BCcomponents BEYSCHLAG has achieved "**Approval of Manufacturer**" in accordance with **EN 100 114-1**.

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QUICK REFERENCE DATA

DESCRIPTION	MMU 0102 HF		MMA 0204 HF		MMB 0207 HF	
Metric CECC size	RC 2211M		RC 3715M		RC 6123M	
Resistance range	6,8 Ω to 470 Ω		1,5 Ω to 475 Ω		6,8 Ω to 470 Ω	
Resistance tolerance	±2%		±1%		±2%	
Temperature coefficient	±50 ppm/K					
Operation mode	standard	power	standard	power	standard	power
Climatic category (LCT/UCT/days)	55/125/56	55/155/56	55/125/56	55/155/56	55/125/56	55/155/56
Rated dissipation, $P_{70}^{(1)}$	0,2 W	0,3 W	0,25 W	0,4 W	0,4 W	1,0 W ⁽²⁾
Operating voltage, U_{max} AC/DC	limited by P_{70}		limited by P_{70}		limited by P_{70}	
Film temperature	125 °C	155 °C	125 °C	155 °C	125 °C	155 °C
Max. resistance change at P_{70} for resistance range, $\Delta R/R$ max., after:	6,8 Ω to 470 Ω		1,5 Ω to 475 Ω		6,8 Ω to 470 Ω	
1000 h	≤ 0,25%	≤ 0,5%	≤ 0,25%	≤ 0,5%	≤ 0,25%	≤ 0,5%
8000 h	≤ 0,5%	≤ 1,0%	≤ 0,5%	≤ 1,0%	≤ 0,5%	≤ 1,0%
225000 h	≤ 1,5%	–	≤ 1,5%	–	≤ 1,5%	–
Specified lifetime	225000 h	8000 h	225000 h	8000 h	225000 h	8000 h
Permissible voltage against ambient :						
1 minute; U_{ins}	150 V		300 V		500 V	
continuous	75 V		75 V		75 V	
Failure rate	≤ 2,0 × 10 ⁻⁹ /h		≤ 0,7 × 10 ⁻⁹ /h		≤ 0,7 × 10 ⁻⁹ /h	

Notes

- 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. 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 requires dedicated heat-sink pads.

Table 1 Temperature coefficient and resistance range

DESCRIPTION		RESISTANCE VALUE ⁽¹⁾		
T.C.	TOLERANCE	MMU 0102 HF	MMA 0204 HF	MMB 0207 HF
±50 ppm/K	±2%	6,8 Ω to 470 Ω; 50 Ω	–	6,8 Ω to 470 Ω; 50 Ω
	±1%	–	1,5 Ω to 475 Ω; 50 Ω	–

Note

- Resistance value to be selected from E24 series for ±2% tolerance and from E96 series for ±1% tolerance.

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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						
			BLISTER TAPE ON REEL					BULK CASE	
TYPE	T.C.	TOL.	B1 1 000 units	B2 2 000 units	BL 3 000 units	B7 7 000 units	B0 10 000 units	M3 3 000 units	M8 8 000 units
MMU 0102 HF	±50 ppm/K	±2%	173 0....	–	168 0....	–	178 0....	–	063 0
MMA 0204 HF	±50 ppm/K	±1%	143 0....	–	158 0....	–	148 0....	043 0....	–
MMB 0207 HF	±50 ppm/K	±2%	183 0....	198 0....	–	188 0....	–	–	–

Resistance ranges printed in bold are preferred T.C. / tolerance combinations with optimized availability.

Table 3 Last digit of 12NC indicating resistance decade

RESISTANCE DECADE	LAST DIGIT
1 Ω to 9,99 Ω	8
10 Ω to 99,9 Ω	9
100 Ω to 999 Ω	1

ORDERING EXAMPLE

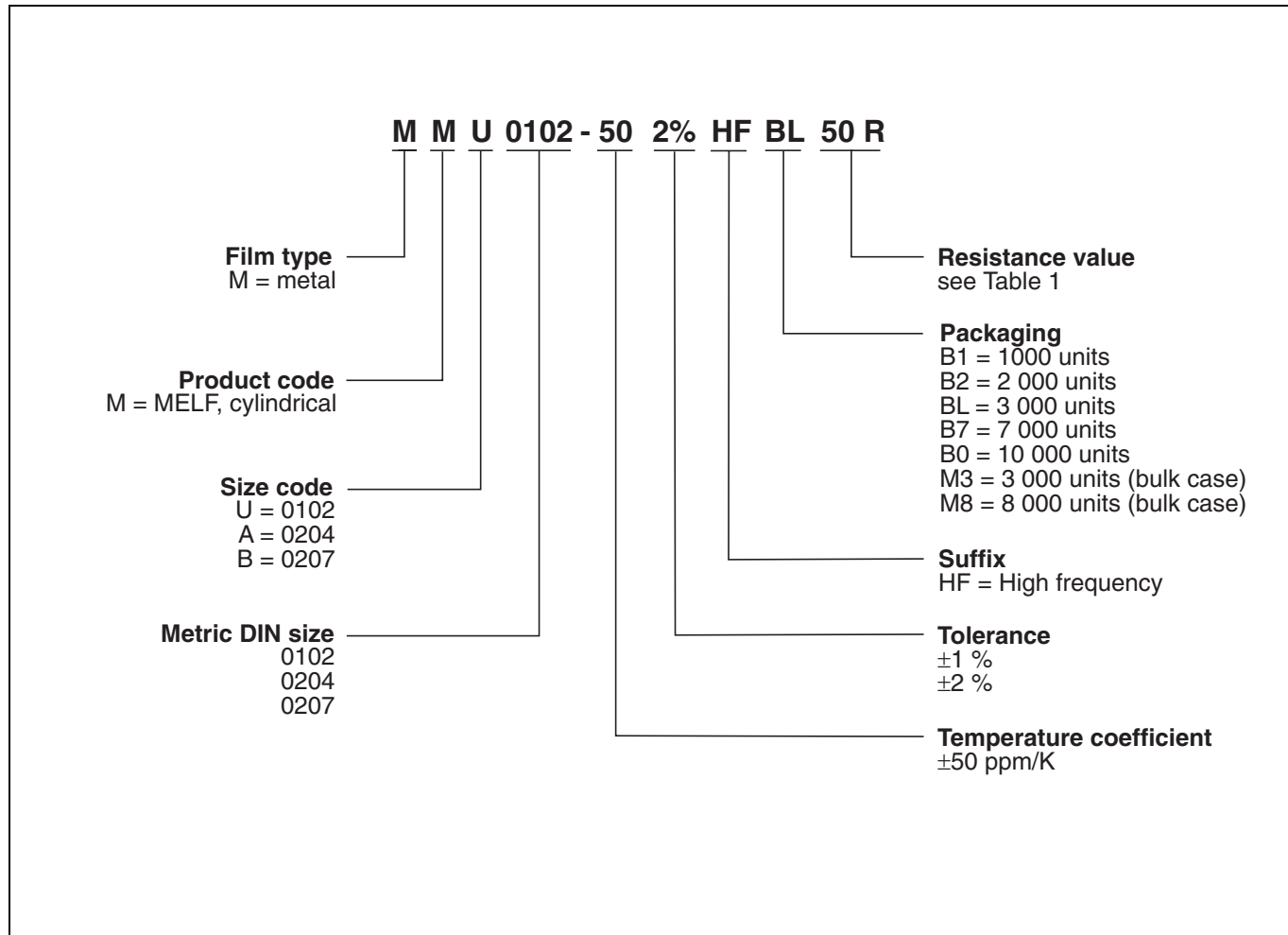
The ordering code of a MMU 0102 HF resistor, value 50 Ω and TC 50 with ±2% tolerance, supplied in blister tape of 3 000 units per reel is: 2312 168 0500 9.

High frequency MELF resistors

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Type description and ordering code

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



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FUNCTIONAL DESCRIPTION

Derating

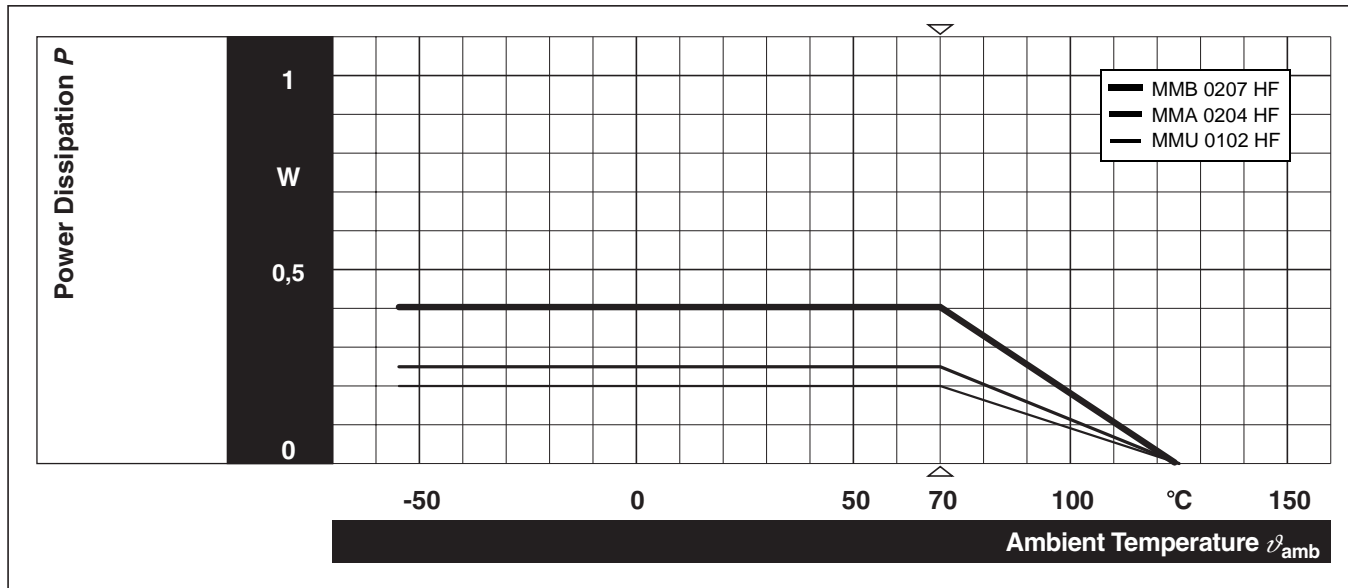


Fig.1 Derating, standard operation.

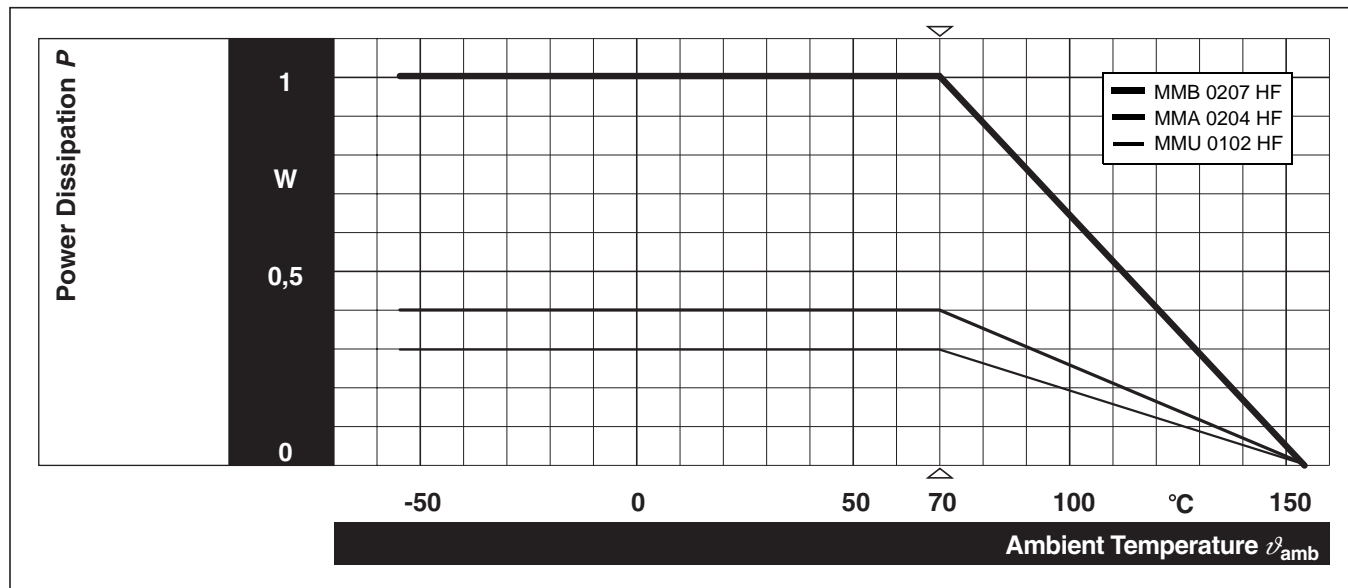


Fig.2 Derating, power operation.

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RF-behaviour

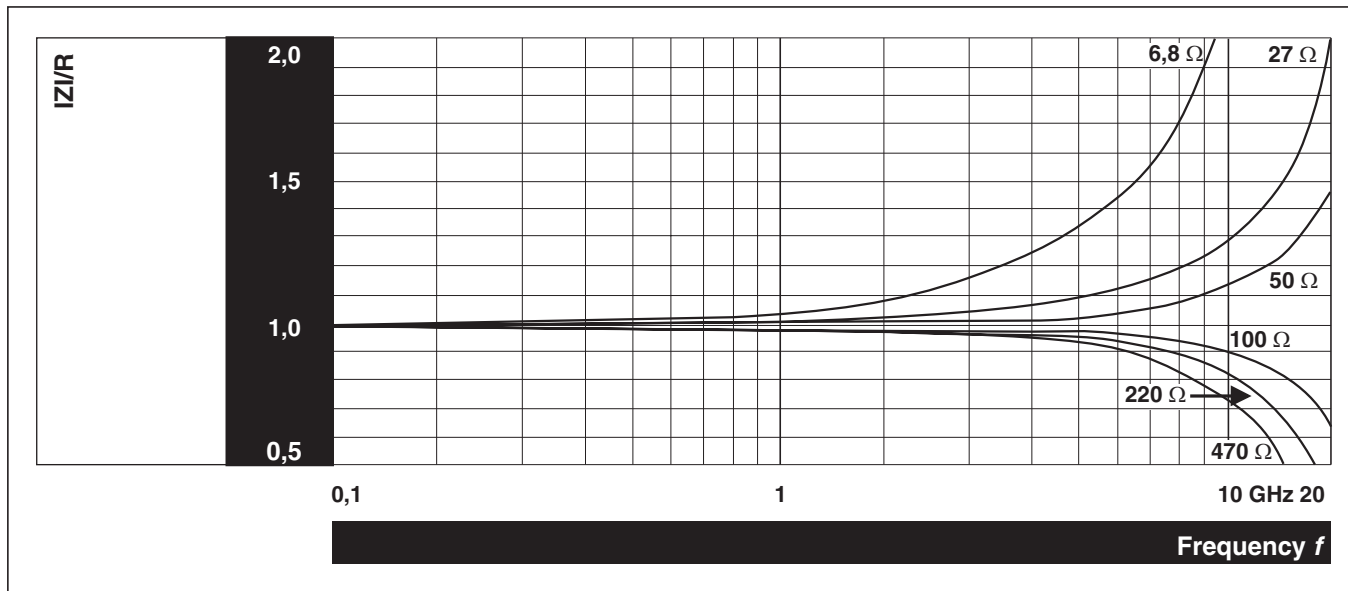


Fig.3 IZI/R for MMU 0102 HF.

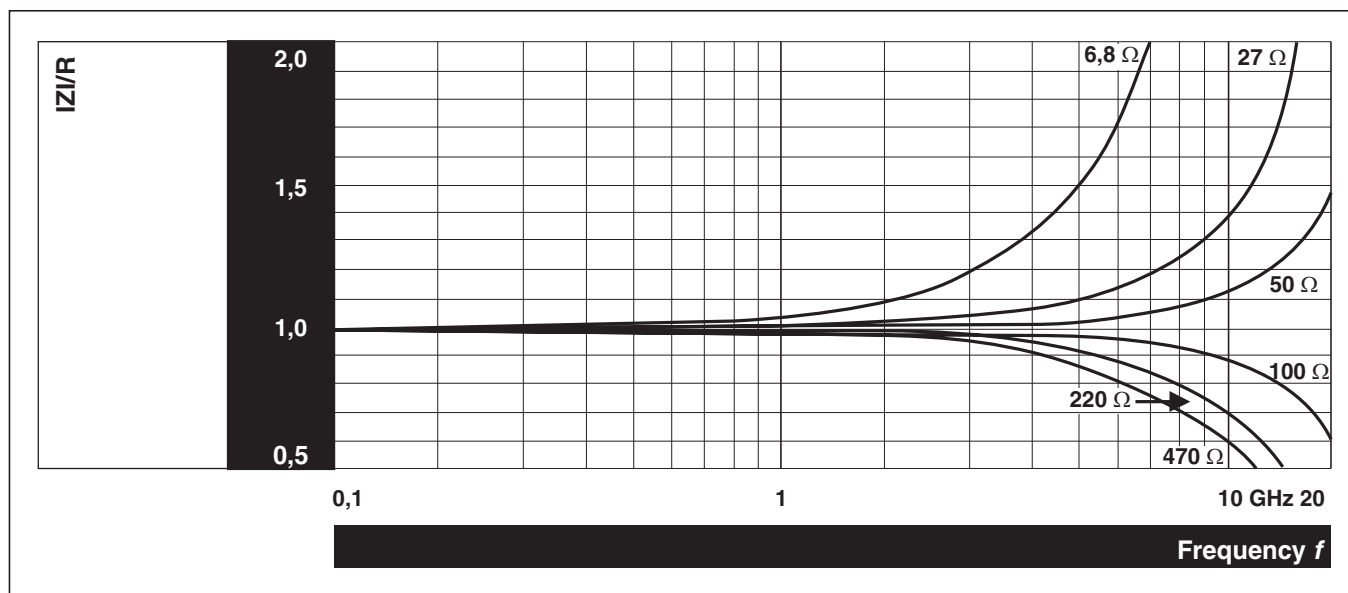


Fig.4 IZI/R for MMA 0204 HF.

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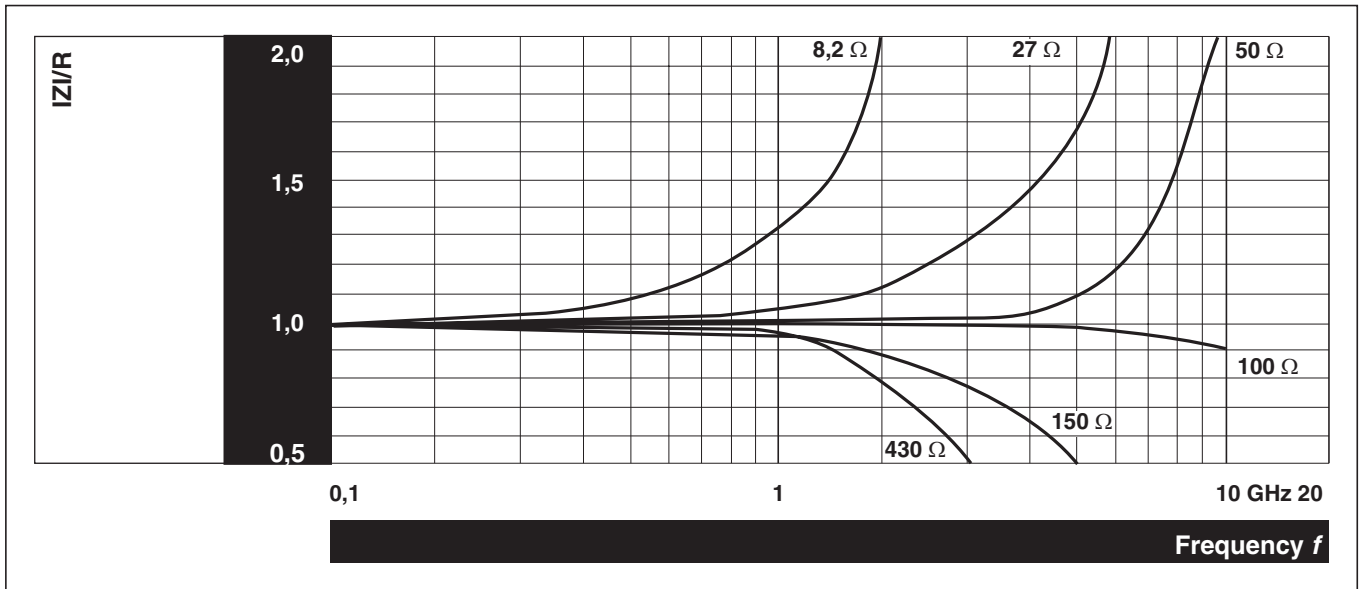


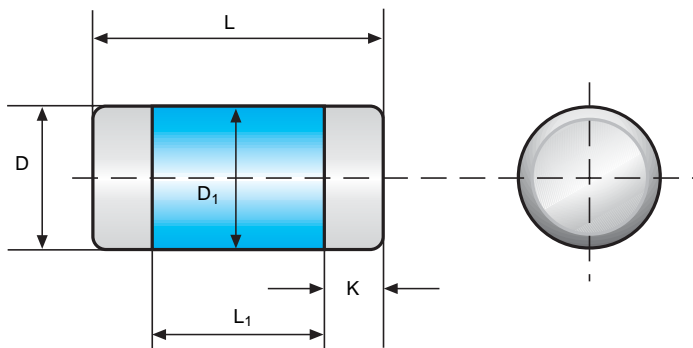
Fig.5 $I Z I / R$ for MMB 0207 HF.

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MECHANICAL DATA

Outlines



For dimensions see Table 4.

Fig.6 Outlines.

Table 4 MELF resistor types, mass and relevant physical dimensions; see Fig.6

TYPE	L (mm)	D (mm)	L ₁ min (mm)	D ₁ (mm)	K (mm)	MASS (mg)
MMU 0102 HF	2,2 +0/-0,1	1,1 +0/-0,1	1,2	D +0/-0,1	0,4 ±0,05	7
MMA 0204 HF	3,6 +0/-0,2	1,4 +0/-0,1	1,8	D +0/-0,15	0,8 ±0,1	19
MMB 0207 HF	5,8 +0/-0,2	2,2 +0/-0,2	2,8	D +0/-0,2	1,2 ±0,2	79

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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

Table 5 contains the applicable tests selected from the documents listed above.

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.

Table 5 Test procedures and requirements

EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)
			stability for product types:	
			MMU 0102 HF	6,8 Ω to 470 Ω
			MMA 0204 HF	1,5 Ω to 475 Ω
			MMB 0207 HF	6,8 Ω to 470 Ω
4.5	–	resistance	–	MMU 0102 HF, MMB 0207 HF: $\pm 2\%$ MMA 0204 HF: $\pm 1\%$
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	$\pm(0,25\% + 0,05 \Omega)$ $\pm(0,5\% + 0,05 \Omega)$
		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	$\pm(0,5\% + 0,05 \Omega)$ $\pm(1\% + 0,05 \Omega)$
4.25.3	–	endurance at upper category temperature	125 °C; 1000 h 155 °C; 1000 h	$\pm(0,5\% + 0,05 \Omega)$ $\pm(1\% + 0,05 \Omega)$

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			stability for product types:	
			MMU 0102 HF	6,8 Ω to 470 Ω
			MMA 0204 HF	1,5 Ω to 475 Ω
			MMB 0207 HF	6,8 Ω to 470 Ω
4.24	3 (Ca)	damp heat, steady state	40 \pm 2 $^{\circ}$ C; 56 days; 93 \pm 2/-3% RH	\pm (0,5% + 0,05 Ω)
4.23		climatic sequence:		
4.23.2	2 (Ba)	dry heat	UCT; 16 h	
4.23.3	30 (Db)	damp heat, cyclic	55 $^{\circ}$ C; 24 h; \geq 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 \pm 10 $^{\circ}$ C	
4.23.6	30 (Db)	damp heat, cyclic	55 $^{\circ}$ C; 24 h; \geq 90% RH; 5 cycles LCT = -55 $^{\circ}$ C; UCT = 155 $^{\circ}$ C	\pm (0,5% + 0,05 Ω) no visible damage
-	1 (Aa)	cold	-55 $^{\circ}$ C; 2 h	\pm (0,1% + 0,01 Ω)
4.13	-	short time overload; standard operation mode	room temperature; $U = 2,5 \times \sqrt{P_{70}} \times R$ or $U = 2 \times U_{maxi}$; 5 s	\pm (0,1% + 0,01 Ω) no visible damage
		short time overload; power operation mode	room temperature; $U = 2,5 \times \sqrt{P_{70}} \times R$ or $U = 2 \times U_{maxi}$; 5 s	\pm (0,1% + 0,01 Ω) no visible damage
4.19	14 (Na)	rapid change of temperature	30 minutes at -55 $^{\circ}$ C; 30 minutes at 155 $^{\circ}$ C; 5 cycles	\pm (0,25% + 0,05 Ω) no visible damage
4.29	45 (XA)	component solvent resistance	isopropyl alcohol; +23 $^{\circ}$ C; toothbrush method	marking legible; no visible damage

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			stability for product types:	
			MMU 0102 HF	6,8 Ω to 470 Ω
			MMA 0204 HF	1,5 Ω to 475 Ω
			MMB 0207 HF	6,8 Ω to 470 Ω
4.18.2	58 (Td)	resistance to soldering heat	solder bath method; 260 \pm 5 $^{\circ}$ C; 10 \pm 1 s	\pm (0,5% + 0,05 Ω) no visible damage
4.17.2	58 (Td)	solderability	solder bath method; 215 $^{\circ}$ C; 3 s	good tinning (\geq 95% covered); no visible damage
4.32	21 (Ue ₃)	shear (adhesion)	5 N; 10 s	no visible damage
4.7	–	voltage proof	$U_{rms} = U_{ins}$; 60 s	no flashover or breakdown