DATA SHEET

MMU 0102; MMA 0204;
MMB 0207

Professional MELF resistors

Product specification
File under BCcomponents, BC08

2001 Jun 08

BC COMPONENTS

FEATURES

- Advanced thin film technology
- Power dissipation rating up to 1 W
- Excellent overall stability: Class 0,25
- Wide professional range: 0,1 Ω to 10 MΩ
- Metric sizes:
  - DIN: 0102; 0204; 0207
  - CECC: RC 2211M; RC 3715M; RC 6123M

APPLICATIONS

- Automotive
- Telecommunication
- Industrial
- Medical equipment.

DESCRIPTION

MMU 0102, MMA 0204 and MMB 0207 professional thin film MELF resistors are the perfect choice for most fields of modern professional electronics where reliability and stability is of major concern. The typical applications in the fields of automotive, telecommunication and medical equipment reflect the outstanding level of proven reliability.

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, for MICRO-MELF: 96% 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 colour code rings designate the resistance value and tolerance in accordance with **IEC 60062**.

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. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions.

The resistors are tested in accordance with **CECC 40401-803** which refers to **EN 140000** (**IEC 60115-1)** and **EN 140400 (IEC 60115-8).**

BCcomponents 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 BCcomponents BEYSCHLAG manufacturing process.

This product family of thin film MELF resistors is completed by **Zero Ohm Jumpers**.

On request, resistors are available with established reliability in accordance with **CECC 40401-803 Version E**.

QUICK REFERENCE DATA

DESCRIPTION	MMU 0102		MMA 0204		MMB 0207	
CECC size	RC 2211M		RC 3715M		RC 6123M	
Resistance range	0,22 Ω to 2,21 MΩ		0,22 Ω to 10 MΩ		0,1 Ω to 8,2 MΩ	
Resistance tolerance	±5%; ±2%; ±1%; ±0,5%		±5%; ±1%; ±0,5%		±5%; ±2%; ±1%; ±0,5%	
Temperature coefficient	±50 ppm/K; ±25 ppm/K				±100 ppm/K; ±50 ppm/K; ±25 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}	0,2 W	0,3 W	0,25 W	0,4 W	0,4 W	1,0 W
Operating voltage, U_{max} AC/DC	150 V		200 V		300 V	
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:	0,22 Ω to 221 kΩ		0,22 Ω to 332 kΩ		0,22 Ω to 1 MΩ	
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	200 V		300 V		500 V	
continuous	75 V		75 V		75 V	
Failure rate	$\leq 2 \times 10^{-9}$/h		$\leq 0{,}7 \times 10^{-9}$/h		$\leq 0{,}7 \times 10^{-9}$/h	

Table 1 Temperature coefficient and resistance range

DESCRIPTION		RESISTANCE VALUE(1)		
T.C.	**TOLERANCE**	**MMU 0102**	**MMA 0204**	**MMB 0207**
±100 ppm/K	±5%	–	–	0,1 Ω to 0,2 Ω
±50 ppm/K	±5%	0,22 Ω to 0,91 Ω	0,22 Ω to 0,91 Ω	0,22 Ω to 0,91 Ω
	±2%	1 Ω to 9,1 Ω	–	0,22 Ω to 0,91 Ω(2)
	±1%	**10 Ω to 2,21 MΩ**	**1 Ω to 10 MΩ**	**1 Ω to 8,2 MΩ**
	±0,5%	47 Ω to 221 kΩ	10 Ω to 475 kΩ	–
±25 ppm/K	±1%	10 Ω to 221 kΩ	10 Ω to 475 kΩ	–
	±0,5%	**47 Ω to 221 kΩ**	**10 Ω to 475 kΩ**	**10 Ω to 1 MΩ**
Jumper	–	**≤ 10 mΩ; I_{max} = 2A**	**≤ 10 mΩ, I_{max} = 3A**	**≤ 10 mΩ; I_{max} = 5A**

Notes

1. Resistance values to be selected for ±5% and ±2% tolerance from E24, for ±1% tolerance from E24 and E96 and for ±0,5% tolerance from E24 and E192.
2. Available on request.

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

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 3.
- 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 4.

Table 2 12NC ordering code indicating resistor type and packaging

DESCRIPTION			ORDERING CODE 2312					
			BLISTER TAPE ON REEL				BULK CASE	
TYPE	T.C.	TOL.	B2 2000 units	BL 3000 units	B7 7000 units	B0 10000 units	M3 3000 units	M8 8000 units
MMU 0102	±50 ppm/K	±5%	–	165 3....	–	175 3....	–	060 3....
		±2%	–	165 2....	–	175 2....	–	060 2....
		±1%	–	**165 1**....	–	**175 1**....	–	**060 1....**
		±0,5%	–	165 5....	–	175 5....	–	060 5....
	±25 ppm/K	±1%	–	166 1....	–	176 1....	–	061 1....
		±0,5%	–	**166 5**....	–	**176 5**....	–	**061 5....**
	jumper	–	–	**165 90001**	–	**175 90001**	–	**060 90001**
MMA 0204	±50 ppm/K	±5%	–	155 3....	–	145 3....	040 3....	–
		±1%	–	**155 1....**	–	**145 1....**	**040 1....**	–
		±0,5%	–	155 5....	–	145 5....	040 5....	–
	±25 ppm/K	±1%	–	156 1....	–	146 1....	041 1....	–
		±0,5%	–	**156 5....**	–	**146 5....**	**041 5....**	–
	jumper	–	–	**155 90001**	–	**145 90001**	**040 90001**	–

DESCRIPTION			ORDERING CODE 2312					
			BLISTER TAPE ON REEL				BULK CASE	
TYPE	T.C.	TOL.	B2 2000 units	BL 3000 units	B7 7000 units	B0 10000 units	M3 3000 units	M8 8000 units
MMB 0207: ≤0,2 Ω	±100 ppm/K	±5%	195 3....	–	185 3....	–	–	–
MMB 0207: >0,2 Ω	±50 ppm/K	±5%	195 3....	–	185 3....	–	–	–
		±2%	195 2....	–	185 2....	–	–	–
		±1%	**195 1....**	–	**185 1....**	–	–	–
MMB 0207	±25 ppm/K	±0,5%	**196 5....**	–	**186 5....**	–	–	–
	jumper	–	**195 90001**	–	**185 90001**	–	–	–

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

Table 3 Last digit of 12NC indicating resistance decade

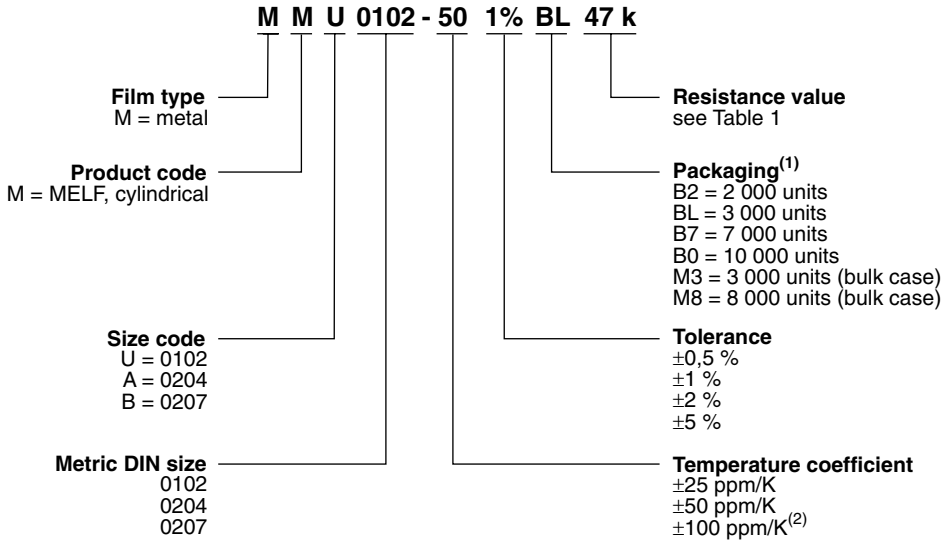
RESISTANCE DECADE	LAST DIGIT
0,1 Ω to 0,999 Ω	7
1 Ω to 9,99 Ω	8
10 Ω to 99,9 Ω	9
100 Ω to 999 Ω	1
1 kΩ to 9,99 kΩ	2
10 kΩ to 99,9 kΩ	3
100 kΩ to 999 kΩ	4
1 MΩ to 9,99 MΩ	5
10 MΩ to 99,9 MΩ	6

ORDERING EXAMPLE

The ordering code of a MMU 0102 resistor, value 47 kΩ and TC 50 with ±1% tolerance, supplied in blister tape of 3000 units per reel is: 2312 165 14703.

Type description and ordering code

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



Jumpers are ordered by the resistance value 0 Ω, e.g. MMA 0204 BL 0R0.

(1) Availability in accordance with Table 2.

(2) A temperature coefficient 100 is marked -00.

FUNCTIONAL DESCRIPTION

Derating

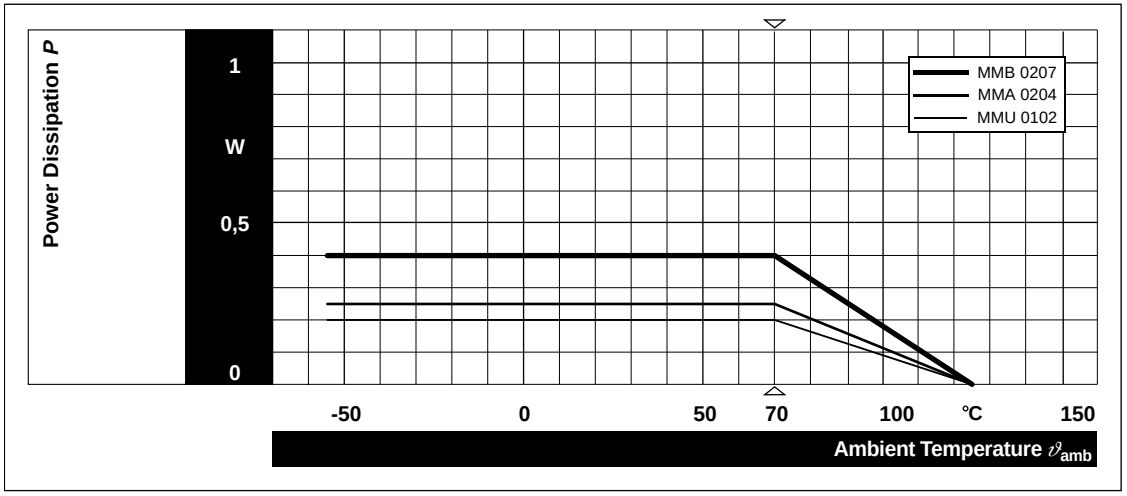


Fig.1 Derating, standard operation.

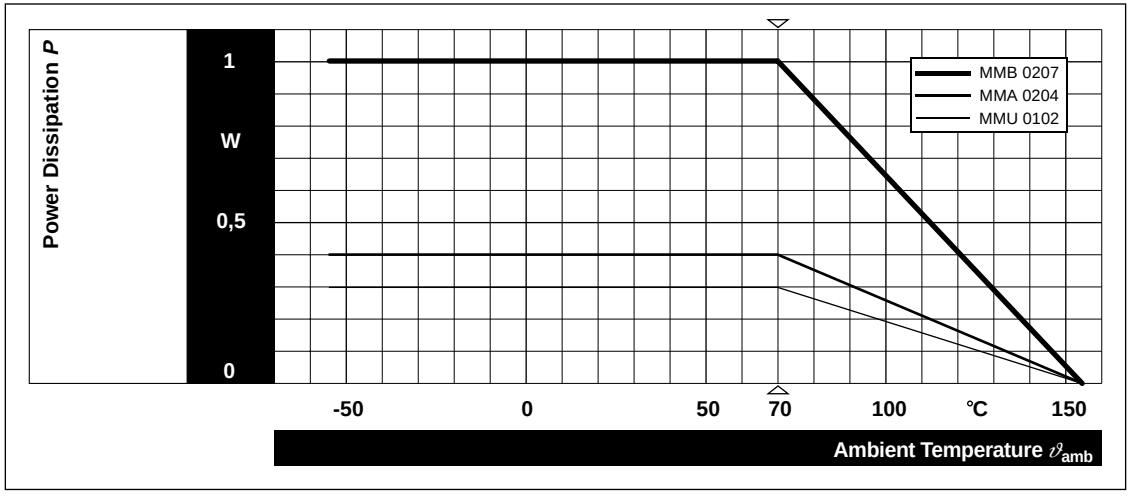


Fig.2 Derating, power operation.

Single pulse

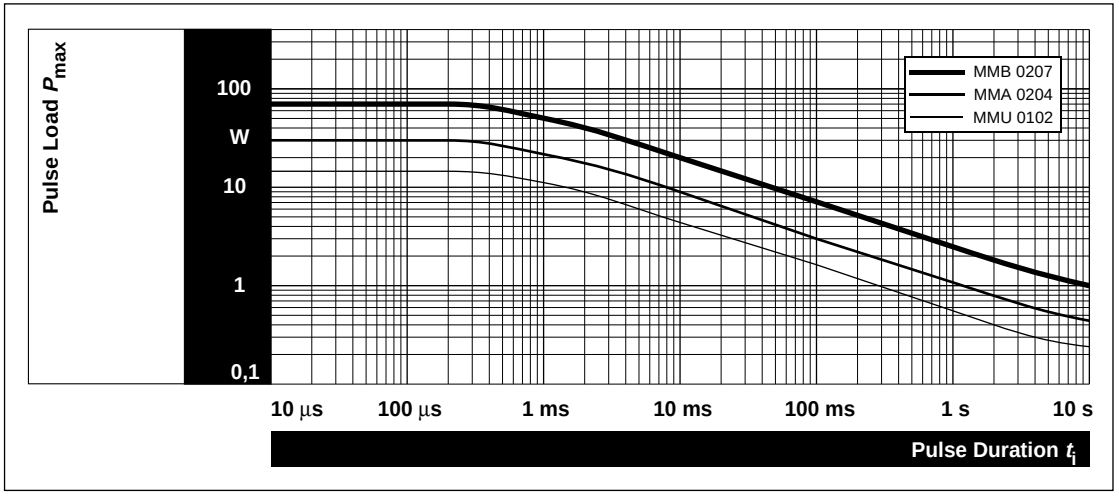


Fig.3 Maximum pulse load, single pulse; for permissible resistance change equivalent to 8000 h operation.

Continuous pulses

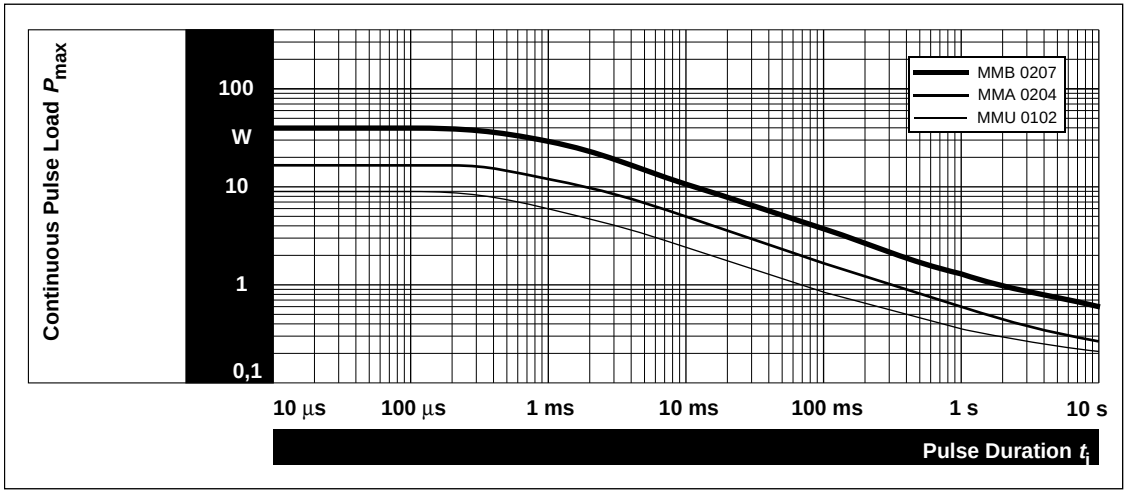


Fig.4 Maximum pulse load, continuous pulses; for permissible resistance change equivalent to 8000 h operation.

Pulse voltage

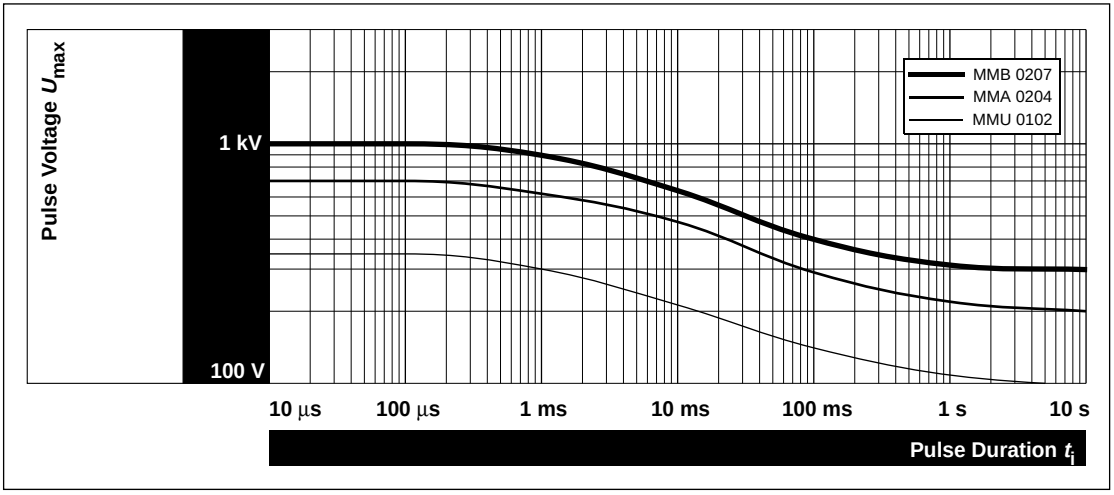


Fig.5 Maximum pulse voltage, single and continuous pulses; for permissible resistance change equivalent to 8000 h operation.

1,2/50 pulse

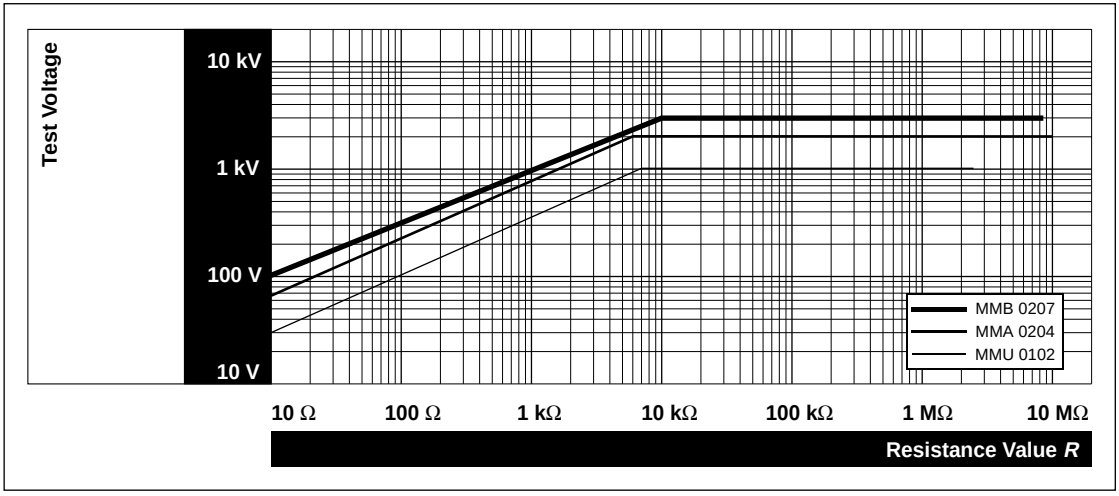


Fig.6 Pulse load rating in accordance with IEC 60115-1 clause 4.27; 1,2 µs / 50 µs; 5 pulses at 12 s intervals; for permissible resistance change 0,5%.

10/700 pulse

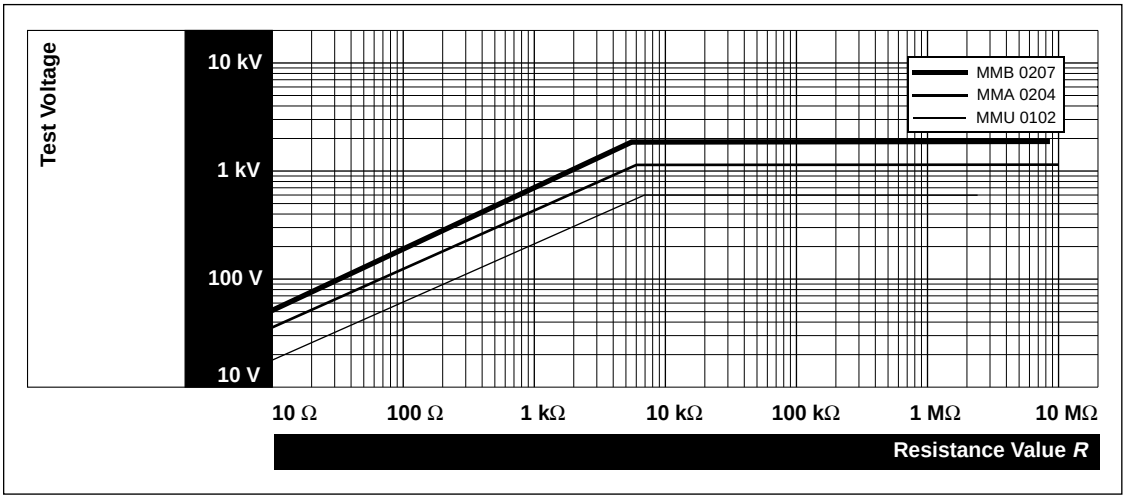


Fig.7 Pulse load rating in accordance with IEC 60115-1 clause 4.27; 10 µs / 700 µs; 10 pulses at 1 minute intervals; for permissible resistance change 0,5%.

Current noise

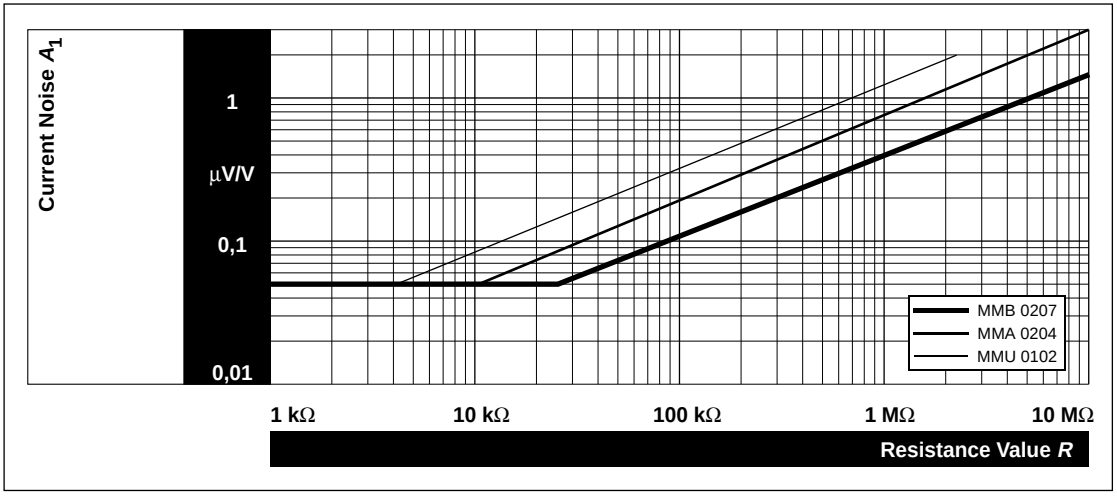


Fig.8 Current Noise A_1 in accordance with IEC 60195.

RF-behaviour

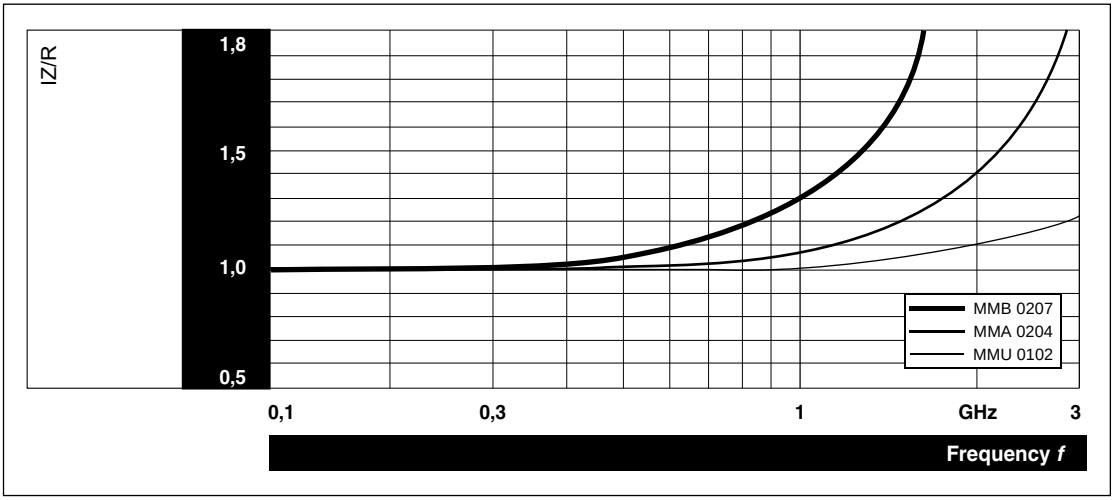
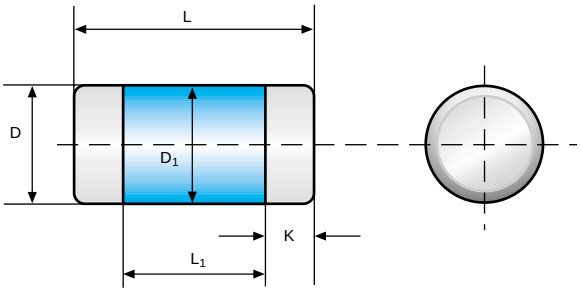


Fig.9 $|Z|/R$ for 49,9 Ω MELF resistor.

MECHANICAL DATA

Outlines



For dimensions see Table 4.

Fig.10 Outlines.

Table 4 MELF resistor types, mass and relevant physical dimensions; see Fig.10

TYPE	L (mm)	D (mm)	$L_{1\ min}$ (mm)	D_1 (mm)	K (mm)	MASS (mg)
MMU 0102	2,2 +0/–0,1	1,1 +0/–0,1	1,2	D +0/–0,04	0,4 ±0,05	7
MMA 0204	3,6 +0/–0,2	1,4 +0/–0,1	1,8	D +0/–0,15	0,8 ±0,1	19
MMB 0207	5,8 +0/–0,2	2,2 +0/–0,2	2,8	D +0/–0,2	1,2 ±0,2	79

TESTS AND REQUIREMENTS

Essentially all tests are carried out in accordance with the following specifications:

EN 140000 / IEC 60115-1, Generic specification (includes tests)

EN 140400 / IEC 60115-8, Sectional specification (includes schedule for qualification approval)

CECC 40401-803, Detail specification (includes schedule for conformance inspection)

Most of the components are approved in accordance with the European CECC-system, where applicable. Table 5 contains only the most important tests. 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 to 1 060 mbar).

For testing the components are mounted on a test board in accordance with IEC 60115-1, 4.31 unless otherwise specified.

In Table 5 only the tests and requirements are listed with reference to the relevant clauses of IEC 60115-1 and IEC 60 068-2; a short description of the test procedure is also given.

Table 5 Test procedures and requirements

IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)			
				STABILITY CLASS 0,25	STABILITY CLASS 0,5	STABILITY CLASS 1	STABILITY CLASS 2
			stability for product types:				
			MMU 0102	10 Ω to 221 kΩ	1Ω to < 10Ω	< 1 Ω	> 221 kΩ
			MMA 0204	10 Ω to 332 kΩ	1Ω to < 10Ω	< 1 Ω	> 332 kΩ
			MMB 0207	10 Ω to 1 MΩ	1Ω to < 10Ω	< 1 Ω	> 1 MΩ
4.5	–	resistance	–	±1%; ±0,5%	±2%; ±1%	±5%; ±2%	±1%
4.8.4.2	–	temperature coefficient	at 20 / –55 / 20 °C and 20 / 125 / 20 °C	±50 ppm/K; ±25 ppm/K			
4.25.1	–	endurance; standard operation mode	room temperature; $U = \sqrt{P_{70} \times R}$ ≤ U_{max}; 1,5 h on; 0,5 h off;				
			70 °C; 1000 h	±(0,25% + 0,05 Ω)	±(0,25% + 0,05 Ω)	±(0,25% + 0,05 Ω)	±(0,5% + 0,05 Ω)
			70 °C; 8000 h	±(0,5% + 0,05 Ω)	±(0,5% + 0,05 Ω)	±(0,5% + 0,05 Ω)	±(1% + 0,05 Ω)

IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)			
				STABILITY CLASS 0,25	STABILITY CLASS 0,5	STABILITY CLASS 1	STABILITY CLASS 2
			stability for product types:				
			MMU 0102	10 Ω to 221 kΩ	1 Ω to < 10 Ω	< 1 Ω	> 221 kΩ
			MMA 0204	10 Ω to 332 kΩ	1 Ω to < 10 Ω	< 1 Ω	> 332 kΩ
			MMB 0207	10 Ω to 1 MΩ	1 Ω to < 10 Ω	< 1 Ω	> 1 MΩ
4.25.1 (cont.)	–	endurance; power operation mode	room temperature; $U = \sqrt{P_{70} \times R}$ ≤ U_{max}; 1,5 h on; 0,5 h off;				
			70 °C; 1000 h	±(0,25% + 0,05 Ω)	±(0,5% + 0,05 Ω)	±(0,5% + 0,05 Ω)	±(1% + 0,05 Ω)
			70 °C; 8000 h	±(0,5% + 0,05 Ω)	±(1% + 0,05 Ω)	±(1% + 0,05 Ω)	±(2% + 0,05 Ω)
4.25.3	–	endurance at upper category temperature	125 °C; 1000 h	±(0,25% + 0,05 Ω)	±(0,5% + 0,05 Ω)	±(1% + 0,05 Ω)	+(2% 0,05 Ω); –(0,5% 0,05 Ω)
			155 °C; 1000 h	±(0,25% + 0,05 Ω)	±(1% + 0,05 Ω)	±(2% + 0,05 Ω)	+(2% +0,05 Ω); –(0,5% +0,05 Ω)
4.24	3 (Ca)	damp heat, steady state	40 ±2 °C; 56 days; 93 +2/–3% RH	±(0,25% + 0,05 Ω)	±(0,5% + 0,05 Ω)	±(1% + 0,05 Ω)	±(2% + 0,1 Ω)
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				
			LCT = –55 °C; UCT = 155 °C	±(0,25% + 0,05 Ω) no visible damage	±(0,5% + 0,05 Ω) no visible damage	±(1% + 0,05 Ω) no visible damage	±(2% + 0,1 Ω) no visible damage

IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)			
				STABILITY CLASS 0,25	STABILITY CLASS 0,5	STABILITY CLASS 1	STABILITY CLASS 2
			stability for product types:				
			MMU 0102	10 Ω to 221 kΩ	1 Ω to < 10 Ω	< 1 Ω	> 221 kΩ
			MMA 0204	10 Ω to 332 kΩ	1 Ω to < 10 Ω	< 1 Ω	> 332 kΩ
			MMB 0207	10 Ω to 1 MΩ	1 Ω to < 10 Ω	< 1 Ω	> 1 MΩ
–	1 (Aa)	cold	–55 °C; 2 h	±(0,05% + 0,01 Ω)	±(0,1% + 0,01 Ω)	±(0,25% + 0,05 Ω)	±(0,5% + 0,05 Ω)
4.13	–	short time overload; standard operation mode	room temperature; $U = 2{,}5 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max}$; 5 s	±(0,05% + 0,01 Ω) no visible damage	±(0,1% + 0,01 Ω) no visible damage	±(0,25% + 0,05 Ω) no visible damage	±(0,5% + 0,05 Ω) no visible damage
		short time overload; power operation mode	room temperature; $U = 2{,}5 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max}$; 5 s	±(0,05% + 0,01 Ω) no visible damage	±(0,1% + 0,01 Ω) no visible damage	±(0,25% + 0,05 Ω) no visible damage	±(0,5% + 0,05 Ω) no visible damage
4.19	14 (Na)	rapid change of temperature	30 minutes at –55 °C; 30 minutes at +155°C; 5 cycles	±(0,05% + 0,01 Ω) no visible damage	±(0,1% + 0,01 Ω) no visible damage	±(0,25% + 0,05 Ω) no visible damage	±(0,5% + 0,05 Ω) no visible damage
4.29	45 (XA)	component solvent resistance	isopropyl alcohol; +23 °C; toothbrush method	marking legible; no visible damage			
4.18.2	58 (Td)	resistance to soldering heat	solder bath method; 260 ±5 °C; 10 ±1 s	±(0,05% + 0,01 Ω) no visible damage	±(0,1% + 0,01 Ω) no visible damage	±(0,25% + 0,05 Ω) no visible damage	±(0,5% + 0,05 Ω) no visible damage
4.17.2	58 (Td)	solderability	solder bath method; 215 °C; 3 s	good tinning (≥ 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} = 100 V; 60 s	no flashover or breakdown			