TEST PROCEDURES AND REQUIREMENTS

EN 60115-1 CLAUSE	IEC 60068-2 (1) TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ('R)			
			Stability for product types:	STABILITY CLASS 0.25 OR BETTER	STABILITY CLASS 0.5 OR BETTER	STABILITY CLASS 1 OR BETTER	STABILITY CLASS 2 OR BETTER
			MMU 0102	10 : to 221 k :	1 : to < 10 :	< 1 :	> 221 k :
			MMA 0204	10 : to 332 k :	1 : to < 10 :	< 1 :	> 332 k :
			MMB 0207	10 : to 1 M :	1 : to < 10 :	< 1 :	> 1 M :
4.23		Climatic sequence:		± (0.15 % R + 10 m :)	± (0.5 % R + 10 m :)	± (1 % R + 10 m :)	± (1 % R + 10 m :)
4.23.2	2 (Bb)	Dry heat	UCT; 16 h				
4.23.3	30 (Db)	Damp heat, cyclic	55 °C; 24 h; t 90 % RH; 1 cycle				
4.23.4	1 (Ab)	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; t90 % RH; 5 cycles				
4.23.7	-	DC load	U = $\sqrt{P_{70} \times R}$ dU$_{max.}$; 1 min. LCT = - 55 °C; UCT = 155 °C				
-	1 (Ab)	Cold	- 55 °C; 2 h	± (0.05 % R + 5 m :)			± (0.1 % R + 5 m :)
4.19	14 (Na)	Rapid change of temperature	30 min at LCT; 30 min at UCT; LCT = - 55 °C; UCT = 125 °C				
			5 cycles	± (0.05 % R + 10 m :)			± (0.1 % R + 10 m :)
			1000 cycles	± (0.15 % R + 10 m :)			± (0.25 % R + 10 m :)
			LCT = - 55 °C; UCT = 155 °C				
			1000 cycles	± (0.25 % R + 10 m :)			± (0.5 % R + 10 m :)
4.13	-	Short time overload: Standard operation mode	U = 2.5 x $\sqrt{P_{70} \times R}$ d2 x U$_{max.}$; 5 s	± (0.03 % R + 5 m :)			± (0.15 % R + 5 m :)
		Short time overload: Power operation mode		± (0.05 % R + 5 m :)			± (0.15 % R + 5 m :)
4.27	-	Single pulse high voltage overload: Standard operation mode	Severity no. 4: U = 10 x $\sqrt{P_{70} \times R}$ d2 x U$_{max.}$; 10 pulses 10 µs/700 µs	± (0.25 % R + 5 m :)			
		Single pulse high voltage overload: Power operation mode		± (0.5 % R + 5 m :)			

For technical questions, contact: melf@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

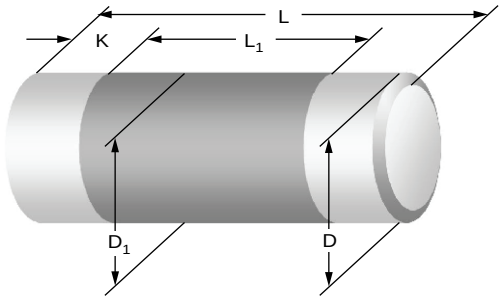
TEST PROCEDURES AND REQUIREMENTS

EN 60115-1 CLAUSE	IEC 60068-2 (1) TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ('R)			
			Stability for product types:	STABILITY CLASS 0.25 OR BETTER	STABILITY CLASS 0.5 OR BETTER	STABILITY CLASS 1 OR BETTER	STABILITY CLASS 2 OR BETTER
			MMU 0102	10 : to 221 k :	1 : to < 10 :	< 1 :	> 221 k :
			MMA 0204	10 : to 332 k :	1 : to < 10 :	< 1 :	> 332 k :
			MMB 0207	10 : to 1 M :	1 : to < 10 :	< 1 :	> 1 M :
4.37	-	Periodic electric overload: Standard operation mode	U = $\sqrt{15 \times P_{70} \times R}$ d2 x $U_{max.}$ 0.1 s on; 2.5 s off; 1000 cycles	± (0.5 % R + 5 m :)			
		Periodic electric overload: Power operation mode		± (1 % R + 5 m :)			
4.22	6 (Fc)	Vibration	Endurance by sweeping; 10 Hz to 2000 Hz; no resonance; amplitude d1.5 mm or d200 m/s^2; 7.5 h	± (0.05 % R + 5 m :)			± (0.1 % R + 5 m :)
4.40	-	Electrostatic discharge (Human Body Model)	IEC 61340-3-1 (1); 3 pos. + 3 neg. discharges MMU 0102: 1.5 kV MMA 0204: 2 kV MMB 0207: 4 kV	± (0.5 % R + 0.05 :)			
4.17.2	58 (Td)	Solderability	Solder bath method; SnPb40; non-activated flux; (215 ± 3) °C; (3 ± 0.3) s	Good tinning (t 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 (t 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 m :)	± (0.1 % R + 10 m :)	± (0.25 % R + 10 m :)	± (0.25 % R + 10 m :)
			Reflow method 2 (IR/forced gas convection); (260 ± 5) °C; (10 ± 1) s	± (0.02 % R + 10 m :)	± (0.05 % R + 10 m :)	± (0.05 % R + 10 m :)	± (0.1 % R + 10 m :)
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 + 5 m :) (2)			
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) Special requirements apply to MICRO-MELF, MMU 0102:
€ R < 100 : ± (0.25 % R + 10 m :)
€ 100 : dR d221 k : ± 0.1 % R
€ 221 k : < R: ± 0.25 % R

For technical questions, contact: melf@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

DIMENSIONS

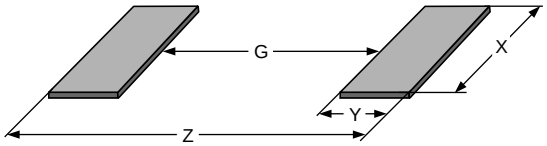


DIMENSIONS AND MASS						
TYPE/SIZE	L (mm)	D (mm)	$L_{1\ min.}$ (mm)	D_1 (mm)	K (mm)	MASS (mg)
MMU 0102	2.2 + 0/- 0.1	1.1 + 0/- 0.1	1.2	D + 0/- 0.1	0.4 ± 0.05	8
MMA 0204	3.6 + 0/- 0.2	1.4 + 0/- 0.1	1.8	D + 0/- 0.15	0.8 ± 0.1	22
MMB 0207	5.8 + 0/- 0.15	2.2 + 0/- 0.2	3.2	D + 0/- 0.2	1.25 ± 0.1	80

Note

€ Color code marking is applied according to IEC 60062 (1) in four bands (E24 series) or five bands (E96 or E192 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 yellow band between the 4 th and 5th full band indicates TC25.

PATTERN STYLES FOR MELF RESISTORS



RECOMMENDED SOLDER PAD DIMENSIONS								
TYPE/SIZE	WAVE SOLDERING				REFLOW SOLDERING			
	G (mm)	Y (mm)	X (mm)	Z (mm)	G (mm)	Y (mm)	X (mm)	Z (mm)
MMU 0102	0.7	1.2	1.5	3.1	1.1	0.8	1.3	2.7
MMA 0204	1.5	1.5	1.8	4.5	1.7	1.2	1.6	4.1
MMB 0207	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 onboard 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 modeŽ. Please note however that applications for •power operation modeŽ 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.

For technical questions, contact: melf@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

HISTORICAL 12NC INFORMATION

€ The resistors had a 12-digit numeric code starting with 2312.

€ The subsequent 4 digits indicated the resistor type, specification and packaging; see the 12NC table.

€ The remaining 4 digits indicated the resistance value:

- The first 3 digits indica ted the resistance value.
- The last digit indicated the resistance decade in accordance with the 12NC Indicating Resistance Decade table.

Last Digit of 12NC Indi cating Resistance Decade

RESISTANCE DECADE	LAST DIGIT
0.1 : to 0.999 :	7
1 : to 9.99 :	8
10 : to 99.9 :	9
100 : to 999.9 :	1
1 k : to 9.99 k :	2
10 k : to 99.9 k :	3
100 k : to 999 k :	4
1 M : to 9.99 M :	5
10 M : to 99.9 M :	6

Historical 12NC

The 12NC of a MMU 0102 resistor, value 47 k : . and TCR 50 with ± 1 % tolerance, supplied in blister tape of 3000 units per reel is: 2312 165 14703.

HISTORICAL 12NC - Resistor type and packaging

DESCRIPTION			2312		
			BLISTER TAPE ON REEL		BULK CASE
TYPE	TCR	TOL.	BL 3000 UNITS	B0 10 000 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
TYPE	TCR	TOL.	BL 3000 UNITS	B0 10 000 UNITS	M3 3000 UNITS
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
TYPE	TCR	TOL.	B2 2000 UNITS	B7 7000 UNITS	
MMB 0207	± 100 ppm/K	± 5 %	195 3....	185 3....	
	± 50 ppm/K	± 5 %	195 3....	185 3....	
		± 2 %	195 2....	185 2....	
		± 1 %	195 1....	185 1....	
	± 25 ppm/K	± 0.5 %	196 5....	186 5....	
	Jumper		195 90001	185 90001	

For technical questions, contact: melf@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay’s knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer’s responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer’s technical experts. Product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

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.