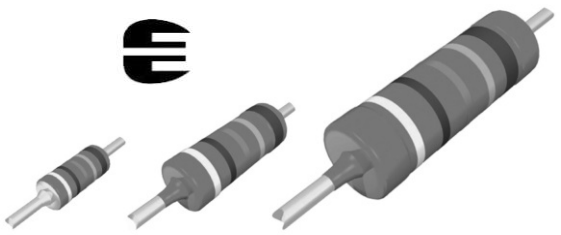
Precision Leaded Resistors



FEATURES

- Approved according to CECC 40101-806
- Advanced thin film technology
- Low TCR: ± 15 to ± 25 ppm/K
- Precision tolerance of value: ± 0.1 % and ± 0.25 %
- Lead (Pb)-free solder contacts
- Pure tin plating provides compatibility with lead (Pb)-free and lead containing soldering processes
- Compatible with "Restriction of the use of Hazardous Substances" (RoHS) directive 2002/95/EC (issue 2004)
- Superior overall stability: class 0.05
- Wide precision range: 10 Ω to 1.5 MΩ

DESCRIPTION

MBA/SMA 0204, MBB/SMA 0207 and MBE/SMA 0414 precision leaded thin film resistors combine the proven reliability of the professional products with an advanced level of precision and stability. Therefore they are perfectly suited for applications in the fields of test and measuring equipment along with industrial and medical electronics.

APPLICATIONS

- Test and measuring equipment
- Industrial electronics
- Medical electronics

METRIC SIZE			
DIN:	0204	0207	0414
CECC:	A	B	D

TECHNICAL SPECIFICATIONS

DESCRIPTION	MBA/SMA 0204		MBB/SMA 0207		MBE/SMA 0414	
CECC size	A		B		D	
Resistance range	22 Ω to 332 kΩ		10 Ω to 1 MΩ		22 Ω to 1.5 MΩ	
Resistance tolerance	± 0.25 %; ± 0.1 %					
Temperature coefficient	± 25 ppm/K; ± 15 ppm/K					
Operation mode	precision	standard	precision	standard	precision	standard
Climatic category (LCT/UCT/days)	10/85/56	55/125/56	10/85/56	55/125/56	10/85/56	55/125/56
Rated dissipation, P_{70}	0.07 W	0.25 W	0.11 W	0.40 W	0.17 W	0.65 W
Operating voltage, U_{max} AC/DC	200 V		350 V		500 V	
Film temperature	85 °C	125 °C	85 °C	125 °C	85 °C	125 °C
Max. resistance change at P_{70} for resistance range, $\Delta R/R$ max., after:	100 Ω to 100 kΩ		100 Ω to 270 kΩ		100 Ω to 470 kΩ	
1000 h	≤ 0.05 %	≤ 0.25 %	≤ 0.03 %	≤ 0.15 %	≤ 0.05 %	≤ 0.25 %
8000 h	≤ 0.1 %	≤ 0.5 %	≤ 0.1 %	≤ 0.5 %	≤ 0.1 %	≤ 0.5 %
225 000 h	≤ 0.3 %	≤ 1.5 %	≤ 0.3 %	≤ 1.5 %	≤ 0.3 %	≤ 1.5 %
Specified lifetime	225 000 h		225 000 h		225 000 h	
Permissible voltage against ambient:						
1 minute	300 V		500 V		800 V	
continuous	75 V		75 V		75 V	
Failure rate	≤ 0.7 x 10^{-9}/h		≤ 0.3 x 10^{-9}/h		≤ 0.1 x 10^{-9}/h	

Note:
MB_ series has been merged with the related SMA series to form one series "MB_/SMA__".

PART NUMBER AND PRODUCT DESCRIPTION

PART NUMBER: MBB02070D1001BCT00

M	B	B	0	2	0	7	0	D	1	0	0	1	B	C	T	0	0

MODEL/SIZE	SPECIAL	TCR/MATERIAL	VALUE	TOLERANCE	PACKAGING (1)	SPECIAL
MBA0204 = MBA/SMA 0204 **MBB0207** = MBB/SMA 0207 **MBE0414** = MBE/SMA 0414	**0** = neutral **N** = RB Radial 5 mm **S** = UB Radial 2.5 mm	**E** = ± 15 ppm/K **D** = ± 25 ppm/K	**3 digit value** **1 digit multiplier** MULTIPLIER **8** = $*10^{-2}$ **2** = $*10^{2}$ **9** = $*10^{-1}$ **3** = $*10^{3}$ **0** = $*10^{0}$ **4** = $*10^{4}$ **1** = $*10^{1}$ **5** = $*10^{5}$	**B** = ± 0.1 % **C** = ± 0.25 %	**CT** **C1** **RP** **R1** **R2** **R4** **N4**	**00** = standard

PRODUCT DESCRIPTION: MBB/SMA 0207-25 0.1 % CT 1K0

MBB/SMA 0207	-	25	0.1 %	CT	1K0
MODEL/SIZE		TCR	TOLERANCE	PACKAGING (1)	RESISTANCE
MBA/SMA 0204 **MBB/SMA 0207** **MBE/SMA 0414**		± **15** ppm/K ± **25** ppm/K	± **0.1** % ± **0.25** %	**CT** **C1** **RP** **R1** **R2** **R4** **N4**	**1K0** = 1 kΩ **51R1** = 51.1 Ω

Note:
(1) Please refer to table PACKAGING for complete information.
The PART NUMBER shown above is to facilitate the unified part numbering system for ordering products.

PACKAGING

MODEL	REEL		BOX	
	PIECES	CODE	PIECES	CODE
MBA/SMA 0204	1000 5000	R1 RP	1000 5000	C1 CT
MBB/SMA 0207	1000 4000 5000	R1 R4 (for RB, UB) RP	1000 4000 5000	C1 N4 (for RB, UB) CT
MBE/SMA 0414	2500	R2	1000	C1

12NC CODE FOR HISTORICAL CODING REFERENCE OF MBA 0204/MBB 0207/MBE 0414

DESCRIPTION			ORDERING CODE 2312 ... . (BANDOLIER)				
			AMMOPACK		REEL		
TYPE	TCR	TOL.	C1 1000 units	CT 5000 units	R1 1000 units	R2 2500 units	RP 5000 units
MBA 0204	± 25 ppm/K	± 0.25 %	901 6....	906 6....	701 6....	-	806 6....
		± 0.1 %	901 7....	906 7....	701 7....	-	806 7....
	± 15 ppm/K	± 0.25 %	902 6....	907 6....	702 6....	-	807 6....
		± 0.1 %	902 7....	907 7....	702 7....	-	807 7....
MBB 0207	± 25 ppm/K	± 0.25 %	911 6....	916 6....	711 6....	-	816 6....
		± 0.1 %	911 7....	916 7....	711 7....	-	816 7....
	± 15 ppm/K	± 0.25 %	912 6....	917 6....	712 6....	-	817 6....
		± 0.1 %	912 7....	917 7....	712 7....	-	817 7....
MBE 0414	± 25 ppm/K	± 0.25 %	921 6....	-	-	826 6....	-
		± 0.1 %	921 7....	-	-	826 7....	-
	± 15 ppm/K	± 0.25 %	922 6....	-	-	827 6....	-
		± 0.1 %	922 7....	-	-	827 7....	-

12NC INFORMATION

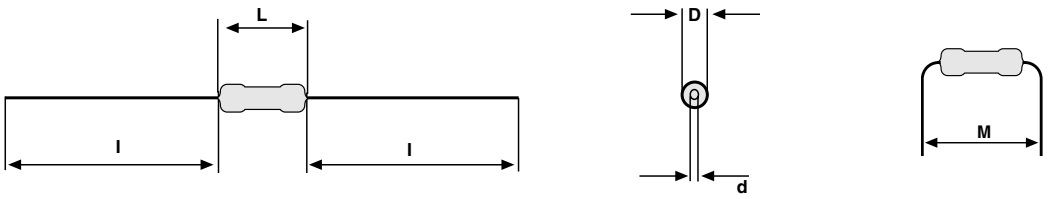
Last Digit of 12NC Indicating Resistance Decade

RESISTANCE DECADE	LAST DIGIT
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

12NC Example (For Historical coding reference of MBA 0204/MBB 0207/MBE 0414)

The 12NC code of a MBA 0204 resistor, value 47 kΩ and TCR 25 with ± 0.1 % tolerance, supplied on bandolier in a box of 5000 units is: 2312 906 74703.

DIMENSIONS



DIMENSIONS - leaded resistor types, mass and relevant physical dimensions						
TYPE	**D_{max} (mm)**	**L_{max} (mm)**	**d_{nom} (mm)**	**l_{min} (mm)**	**M_{min} (mm)**	**MASS (mg)**
MBA/SMA 0204	1.6	3.6	0.5	29.0	5.0	125
MBB/SMA 0207	2.5	6.3	0.6	28.0	10.0 (1)	220
MBE/SMA 0414	4.0	11.9	0.8	31.0	15.0	700

Note:
(1) For 7.5 ≤ M < 10.0 mm, use version MBB/SMA 0207 ... L0 without lacquer on the leads.

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE				
DESCRIPTION		**RESISTANCE VALUE (2)**		
TCR	**TOLERANCE**	**MBA/SMA 0204**	**MBB/SMA 0207**	**MBE/SMA 0414**
± 25 ppm/K	± 0.25 %	**22 Ω to 332 kΩ**	**10 Ω to 1 MΩ**	**22 Ω to 1.5 MΩ**
	± 0.1 %	**43 Ω to 332 kΩ**	**10 Ω to 1 MΩ**	**43 Ω to 1 MΩ**
± 15 ppm/K	± 0.25 %	22 Ω to 221 kΩ	10 Ω to 1 MΩ	22 Ω to 1 MΩ
	± 0.1 %	**43 Ω to 221 kΩ**	**10 Ω to 1 MΩ**	**43 Ω to 1 MΩ**

Note:
(2) Resistance values to be selected from E96 and E192 series, for other values please contact factory.

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

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 (85 % 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. A further conditioning is applied in order to stabilise the trimming result. Connecting wires of electrolytic copper plated with 100 pure tin are welded to the termination caps. The resistors are covered by 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 stuck directly on the adhesive tapes in accordance with **IEC 60286-1**.

ASSEMBLY

The resistors are suitable for processing on automatic insertion equipment and cutting and bending machines. Excellent solderability is proven, even after extended storage. They are suitable for automatic soldering using wave or dipping. 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. 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. This includes full compliance with the following directives:

- 2000/53/EC End of Vehicle Life Directive (ELV)
- 2000/53/EC Annex II to End of Vehicle Life Directive (ELV II)
- 2002/95/EC Restriction of the use of Hazardous Substances Directive (RoHS)
- 2002/96/EC Waste Electrical and Electrical Equipment Directive (WEEE)

APPROVALS

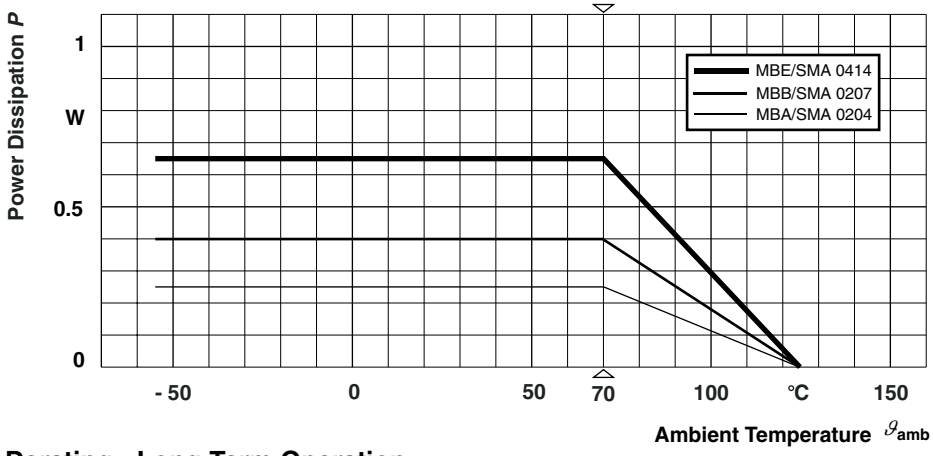
Where applicable, the resistors are tested in accordance with **CECC 40101-806** which refers to **EN 60115-1** and **EN 140100**. Approval of conformity is indicated by the CECC logo on the package label.

Vishay BEYSCHLAG has achieved **"Approval of Manufacturer"** in accordance with **EN 100114-1**.

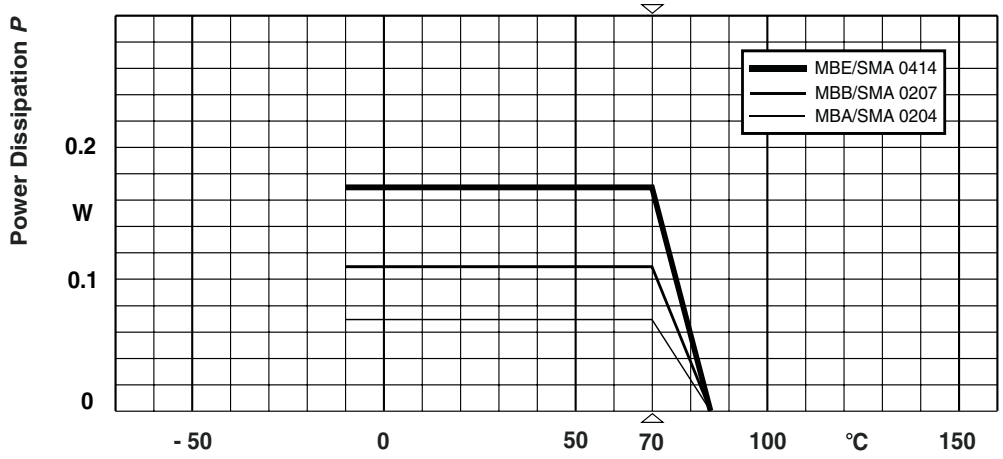
SPECIALS

On request, resistors are available with established reliability in accordance with **CECC 40101-806 Version E**. Please refer to the special data sheet for information on failure rate level, available resistance ranges and ordering codes.

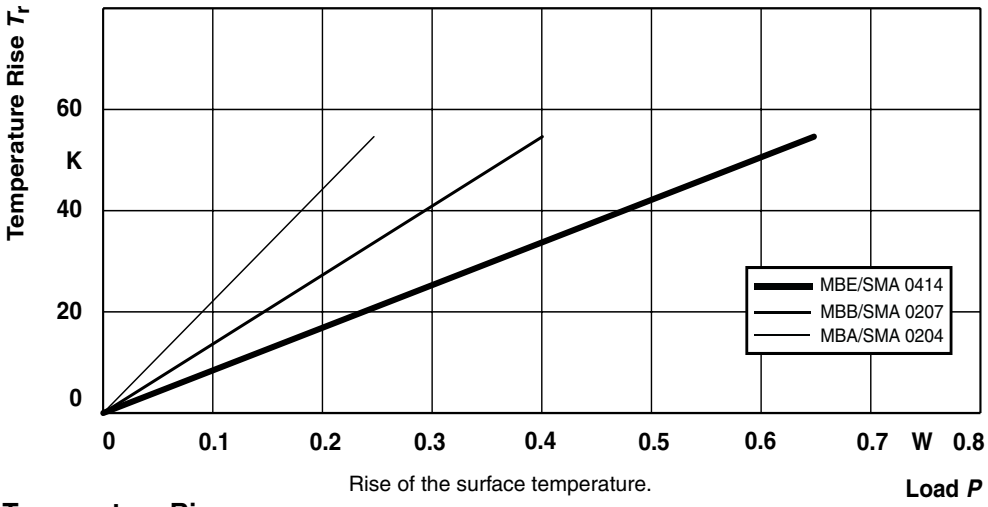
FUNCTIONAL PERFORMANCE



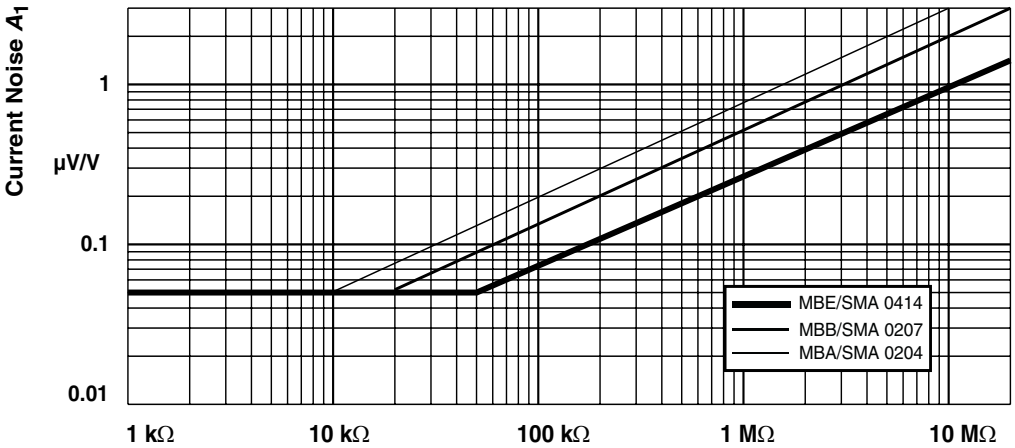
Derating - Long Term Operation



Derating - Precision Operation



Temperature Rise



Current Noise A_1 In Accordance With IEC 60195

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 140100/IEC 60115-2, Sectional specification (includes schedule for qualification approval)

CECC 40101-806, Detail specification (includes schedule for conformance inspection)

Most of the components are approved in accordance with the European CECC-system, where applicable. The Test Procedures and Requirements table 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 1060 mbar).

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

In the Test Procedures and Requirements table, 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.

TEST PROCEDURES AND REQUIREMENTS

IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR_{max})		
			stability for product types:	**STABILITY CLASS 0.05**	**STABILITY CLASS 0.1**	**STABILITY CLASS 0.25**
			MBA/SMA 0204	100 Ω to 100 kΩ	43 Ω to < 100 Ω; > 100 kΩ to 221 kΩ	22 Ω to < 43 Ω; > 221 kΩ to 332 kΩ
			MBB/SMA 0207	100 Ω to 270 kΩ	43 Ω to < 100 Ω; > 270 kΩ to 510 kΩ	10 Ω to < 43 Ω; > 510 kΩ to 1 MΩ
			MBE/SMA 0414	100 Ω to 470 kΩ	43 Ω to <100 Ω; > 470 kΩ to 1 MΩ	22 Ω to < 43 Ω; > 1 MΩ to 1.5 MΩ
4.5	–	resistance	–	± 0.25 %; ± 0.1 %		
4.8.4.2	–	temperature coefficient	at 20/LCT/20 °C and 20/UCT/20 °C	± 25 ppm/K; ±15 ppm/K		
4.25.1	–	endurance at 70 °C: precision operation mode	$U = \sqrt{P_{70} \times R}$ or $U = U_{max}$; 1.5 h on; 0.5 h off			
			70 °C; 1000 h	± (0.05 % R + 0.01 Ω) (1)	± (0.1 % R + 0.01 Ω)	± (0.25 % R + 0.05 Ω) (2)
			70 °C; 8000 h	± (0.1 % R + 0.01 Ω)	± (0.2 % R + 0.01 Ω)	± (0.5 % R + 0.05 Ω)
	–	endurance at 70 °C: standard operation mode	$U = \sqrt{P_{70} \times R}$ or $U = U_{max}$; 1.5 h on; 0.5 h off			

TEST PROCEDURES AND REQUIREMENTS

IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR_{max})		
			stability for product types:	**STABILITY CLASS 0.05**	**STABILITY CLASS 0.1**	**STABILITY CLASS 0.25**
			MBA/SMA 0204	100 Ω to 100 kΩ	43 Ω to < 100 Ω; > 100 kΩ to 221 kΩ	22 Ω to < 43 Ω; > 221 kΩ to 332 kΩ
			MBB/SMA 0207	100 Ω to 270 kΩ	43 Ω to < 100 Ω; > 270 kΩ to 510 kΩ	10 Ω to < 43 Ω; > 510 kΩ to 1 MΩ
			MBE/SMA 0414	100 Ω to 470 kΩ	43 Ω to <100 Ω; > 470 kΩ to 1 MΩ	22 Ω to < 43 Ω; > 1 MΩ to 1.5 MΩ
4.24	78 (Cab)	damp heat, steady state	(40 ± 2) °C; 56 days; (93 ± 3) % RH	± (0.05 % R +0.01 Ω)	± (0.1 % R + 0.01 Ω)	± (0.25 % R + 0.05 Ω)
4.23		climatic sequence:				
4.23.2	2 (Ba)	dry heat	125 °C; 16 h			
4.23.3	30 (Db)	damp heat, cyclic	55 °C; 24 h; 90 % to 100 % RH; 1 cycle			
4.23.4	1 (Aa)	cold	- 55 °C; 2 h			
4.23.5	13 (M)	low air pressure	8.5 kPa; 2 h; 15 °C to 35 °C			
4.23.6	30 (Db)	damp heat, cyclic	55 °C; 5 days; 95 % to 100 % RH; 5 cycles	± (0.05 % R + 0.01 Ω) no visible damage	± (0.1 % R + 0.01 Ω) no visible damage	± (0.25 % R + 0.05 Ω) no visible damage
4.13	–	short time overload	room temperature; $U = 2.5 \times \sqrt{P_{70} \times R}$ or $U = 2 \times U_{max}$; 5 s	± (0.01 % R + 0.01 Ω) no visible damage	± (0.02 % R + 0.01 Ω) no visible damage	± (0.05 % R + 0.01 Ω) no visible damage
4.19	14 (Na)	rapid change of temperature	30 minutes at LCT and 30 minutes at UCT; 5 cycles	± (0.01 % R + 0.01 Ω) no visible damage	± (0.02 % R + 0.01 Ω) no visible damage	± (0.05 % R + 0.01 Ω) no visible damage

TEST PROCEDURES AND REQUIREMENTS

IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR_{max})		
			stability for product types:	**STABILITY CLASS 0.05**	**STABILITY CLASS 0.1**	**STABILITY CLASS 0.25**
			MBA/SMA 0204	100 Ω to 100 kΩ	43 Ω to < 100 Ω; > 100 kΩ to 221 kΩ	22 Ω to < 43 Ω; > 221 kΩ to 332 kΩ
			MBB/SMA 0207	100 Ω to 270 kΩ	43 Ω to < 100 Ω; > 270 kΩ to 510 kΩ	10 Ω to < 43 Ω; > 510 kΩ to 1 MΩ
			MBE/SMA 0414	100 Ω to 470 kΩ	43 Ω to <100 Ω; > 470 kΩ to 1 MΩ	22 Ω to < 43 Ω; > 1 MΩ to 1.5 MΩ
4.29	45 (XA)	component solvent resistance	isopropyl alcohol + 23 °C; toothbrush method	marking legible; no visible damage		
4.18.2	20 (Tb)	resistance to soldering heat	unmounted components; (260 ± 5) °C; (10 ± 1) s	± (0.01 % R + 0.01 Ω) no visible damage	± (0.02 % R + 0.01 Ω) no visible damage	± (0.05 % R + 0.01 Ω) no visible damage
4.17	20 (Ta)	solderability	+ 235 °C; 2 s solder bath method	good tinning (≥ 95 % covered, no visible damage)		
4.22	6 (B4)	vibration	6 h; 10 Hz to 2000 Hz 1.5 mm or 196 m/s^2	± (0.01 % R + 0.01 Ω)	± (0.02 % R + 0.01 Ω)	± (0.05 % R + 0.01 Ω)
4.16	21 (Ua_1) 21 (Ub) 21 (Uc)	robustness of terminations	tensile, bending and torsion	± (0.01 % R + 0.01 Ω)	± (0.02 % R + 0.01 Ω)	± (0.05 % R + 0.01 Ω)
4.7	–	voltage proof	U_{RMS} = 100 V; 60 s	no flashover or breakdown		
	–		70 °C; 1000 h	± (0.25 % R + 0.05 Ω) (2)	-	-
			70 °C; 8000 h	± (0.5 % R + 0.05 Ω)	-	-
4.25.3	–	endurance at upper category temperature	85 °C; 1000 h 125 °C; 1000 h	- ± (0.05 % R + 0.01 Ω)	- ± (0.1 % R + 0.01 Ω)	- ± (0.25 % R + 0.05 Ω)

Notes:

(1) ± (0.03 % R + 0.01 Ω) for MBB/SMA 0207

(2) ± (0.15 % R + 0.05 Ω) for MBB/SMA 0207

Notice

Specifications of the products displayed herein are subject to change without notice. Vishay Intertechnology, Inc., or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

Information contained herein is intended to provide a product description only. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document. Except as provided in Vishay's terms and conditions of sale for such products, Vishay assumes no liability whatsoever, and disclaims any express or implied warranty, relating to sale and/or use of Vishay products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Vishay for any damages resulting from such improper use or sale.