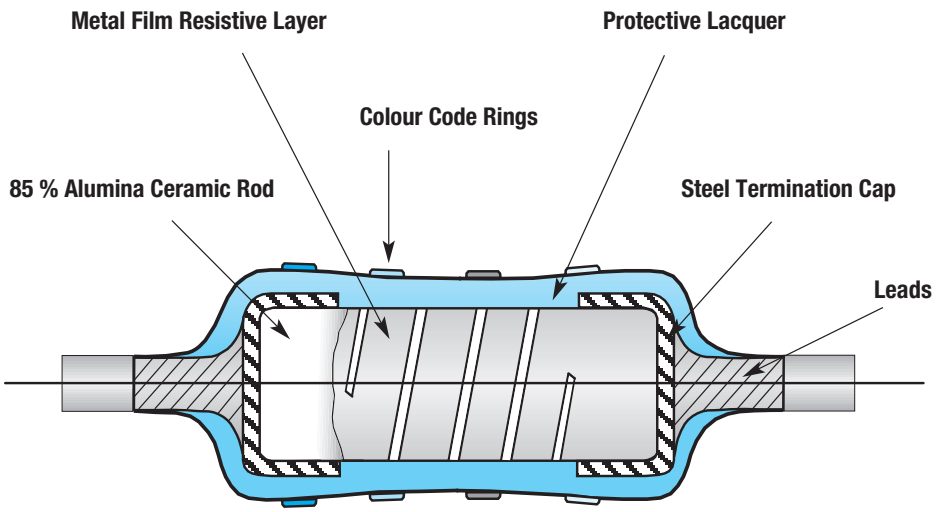

Metal Film Resistive Layer
Protective Lacquer
Colour Code Rings
85 % Alumina Ceramic Rod
Steel Termination Cap
Leads

MBA / MBB / MBE Precision

- **Advanced Thin Film Technology**
- **Low TC: 15 ... 50 ppm/K**
- **Precision Tolerance of Value: 0,1 and 0,25 %**
- **Superior Overall Stability: Class 0,05**
- **Wide Precision Range: 10 Ω ... 1,5 MΩ**
- **Sizes**

DIN:	**0204**	**0207**	**0414**
CECC:	**A**	**B**	**D**

MBA, MBB and MBE 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.

The production of the **MBA**, **MBB** and **MBE Precision Thin Film Resistors** strictly follows an extensive set of instructions established for reproducibility. A homogeneous film of metal alloy is deposited on a high grade (85 % Al_2O_3) 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 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 a base coating and a light blue outer lacquer. The encapsulation provides electrical, mechanical and climatic protection. Four or five colour code rings designate the resistance value and tolerance according to **IEC 60 062**.

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 according to **IEC 60 286-1**.

The resistors are suitable for processing on automatic insertion equipment and cutting and bending machines. 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 according to **IEC 60 115** and **IEC 60 068**. They meet all requirements of **CECC 40 101-806** and **EN 140 100**. On request, resistors with established reliability according to **CECC 40 101-806 Version E** are available.

BEYSCHLAG has achieved "**Approval of Manufacture**r" according to **EN 100 114-1**. The release certificate for "**Technology Approval Schedule**" according to **CECC 240 001** is granted for the BEYSCHLAG manufacturing process.

Temperature Coefficient and Resistance Range

	Tolerance	IEC Series	MBA 0204	MBB 0207	MBE 0414
TC 50	**0,25 %**	any resistance value	22 Ω - 332 kΩ	10 Ω - 1 MΩ	22 Ω - 1,5 MΩ
	0,1 %	any resistance value	43 Ω - 332 kΩ	40,2 Ω - 1 MΩ	43 Ω - 1 MΩ
TC 25	**0,25 %**	any resistance value	22 Ω - 332 kΩ	10 Ω - 1 MΩ	22 Ω - 1,5 MΩ
	0,1 %	any resistance value	43 Ω - 332 kΩ	40,2 Ω - 1 MΩ	43 Ω - 1 MΩ
TC 15	**0,25 %**	any resistance value	22 Ω - 221 kΩ	10 Ω - 562 kΩ	22 Ω - 1 MΩ
	0,1 %	any resistance value	43 Ω - 221 kΩ	40,2 Ω - 562 kΩ	43 Ω - 1 MΩ

Electrical Data

Style		MBA 0204		MBB 0207		MBE 0414	
Climatic Category		55 / 85 / 56	55 / 125 / 56	55 / 85 / 56	55 / 125 / 56	55 / 85 / 56	55 / 125 / 56
Operation Mode (see A4)		*P*recision	Long Term	*P*recision	Long Term	*P*recision	Long Term
Film Temperature	°C	85	125	85	125	85	125
Specified Lifetime	h	225 000		225 000		225 000	

Thermal Resistance R_{th}	K / W	200		140		85	
Rated Dissipation P_{70}	W	0,07	0,25	0,11	0,40	0,17	0,65

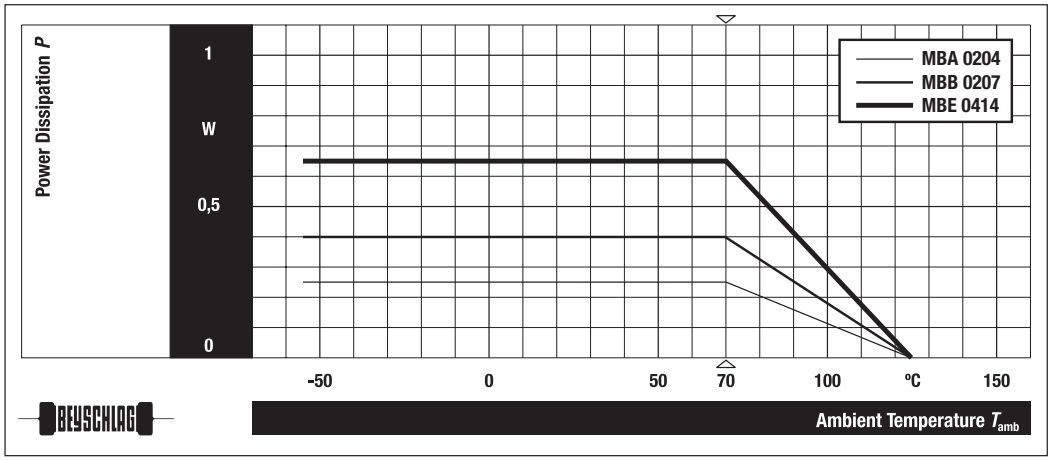
Current Noise, A_1	µV/V	down to 0,05		down to 0,05		down to 0,05	
Attenuation 3rd Harmonic, A_3	dB	up to 110		up to 115		up to 125	

Max. Resistance Change at P_{70} for Resistance Range		10 Ω - 100 kΩ		10 Ω - 270 kΩ		10 Ω - 470 kΩ	
Δ R/R after …							
… 1 000 h	%	≤ 0,05	≤ 0,25	≤ 0,05	≤ 0,25	≤ 0,05	≤ 0,25
… 8 000 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

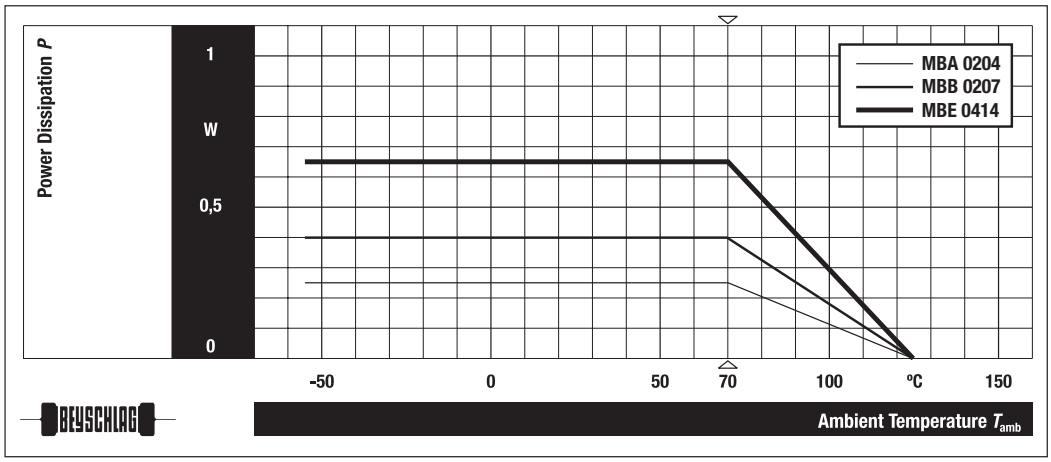
Operating Voltage, U_{max} AC / DC	V	200	300	500
Permissible Voltage against Ambient …				
… 1 minute	V	300	500	800
… continuous	V	75	75	75
Isolation Resistance	Ω	> 10^{10}	> 10^{10}	> 10^{10}

Failure Rate	10^{-9}/h	≤ 0,7	≤ 0,3	≤ 0,1

Derating • Long Term Operation

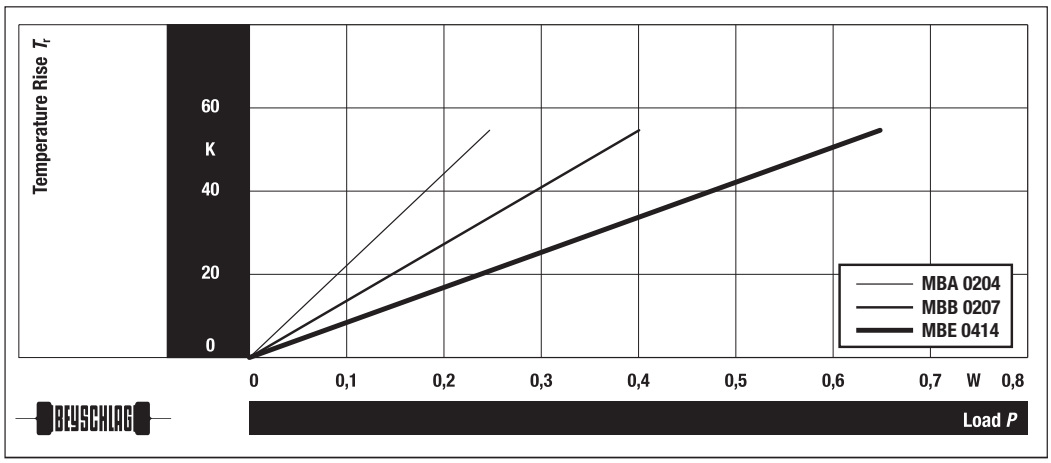


Derating • Precision Operation



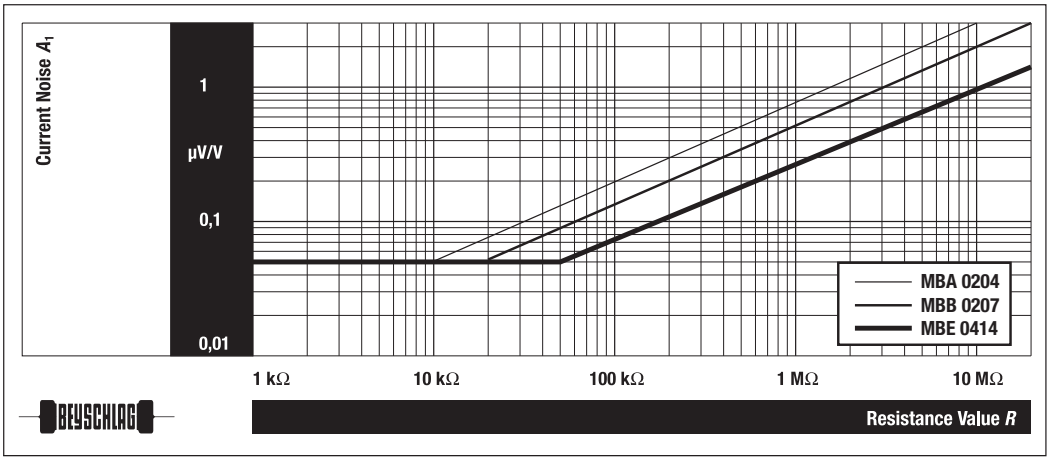
Temperature Rise

Rise of the Surface Temperature



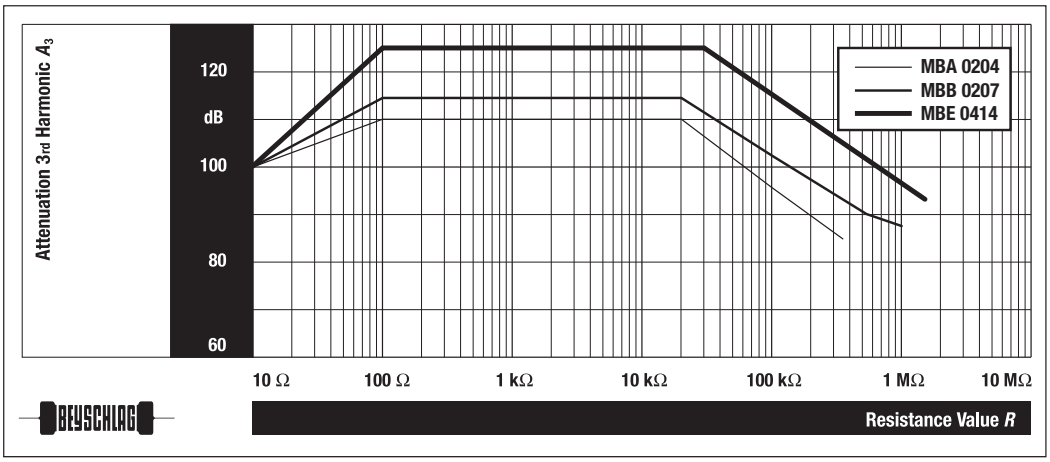
Current Noise

Current Noise A_1, IEC 60 195



Nonlinearity

Nonlinearity A_3, IEC 60 440



Performance Characteristics

BEYSCHLAG Metal Film Leaded Resistors fulfill the requirements of the following specifications:

EN 140 000	Generic Specification: Fixed Resistors
EN 140 100	Sectional Specification: Fixed low power non-wirewound Resistors
CECC 40 101-806	Detail Specification: Fixed low power non-wirewound Resistors

Tests

	IEC 60 115-1 Clause	IEC 60 068-2- (Method)	Test Condition	Permissible Change Δ R		
				Stability Class 0,05	**Stability Class 0,1**	**Stability Class 0,25**
			MBA 0204	100 Ω - 100 kΩ	43 Ω - 221 kΩ	10 Ω - 332 kΩ
			MBB 0207	100 Ω - 270 kΩ	43 Ω - 510 kΩ	10 Ω - 1 MΩ
			MBE 0414	100 Ω - 470 kΩ	43 Ω - 1 MΩ	10 Ω - 2,4 MΩ
Short-Time Overload	4.13		2,5 x rated voltage / 2 x U_{max} for 2 s	± (0,01%R+0,01Ω)	± (0,02%R+0,01Ω)	± (0,05%R+0,01Ω)
Robustness of Terminations	4.16	21 (U_{a1}) 21 (U_b) 21 (U_c)	Tensile, bending and torsion	± (0,01%R+0,01Ω)	± (0,02%R+0,01Ω)	± (0,05%R+0,01Ω)
Resistance to Soldering Heat	4.18.2	20 (Tb)	+ 260 °C ± 5 °C / 10 s	± (0,01%R+0,01Ω)	± (0,02%R+0,01Ω)	± (0,05%R+0,01Ω)
Rapid Change of Temperature	4.19	14 (Na)	5 cycles between - 65 °C / + 155 °C	± (0,01%R+0,01Ω)	± (0,02%R+0,01Ω)	± (0,05%R+0,01Ω)
Endurance at …	4.25.1		Rated voltage / U_{max} 1,5 h on / 0,5 h off			
… + 70 °C / 1 000 h				± (0,05%R+0,01Ω)	± (0,1%R+0,01Ω)	± (0,25%R+0,05Ω)
… + 70 °C / 8 000 h				± (0,1%R+0,01Ω)	± (0,2%R+0,01Ω)	± (0,5%R+0,05Ω)
Climatic Sequence	4.23	30 (D)	Dry heat – damp heat (1 cycle) – cold – low air pressure – damp heat (5 cycles)	± (0,05%R+0,01Ω)	± (0,1%R+0,01Ω)	± (0,25%R+0,05Ω)
Damp Heat, Steady State 56 Days	4.24	3 (Ca)	+ 40 °C / 93 % R.H.	± (0,05%R+0,01Ω)	± (0,1%R+0,01Ω)	± (0,25%R+0,05Ω)
Endurance at *U*CT / 1 000 h	4.25.3	27 (Ba)				
***U*CT = + 125 °C**				–	–	± (0,25%R+0,05Ω)
***U*CT = + 85 °C**				± (0,05%R+0,01Ω)	± (0,1%R+0,01Ω)	± (0,1%R+0,05Ω)
Vibration	4.22	6 (B4)	6 h / 10 - 2 000 Hz 1,5 mm or 196 m/s²	± (0,01%R+0,01Ω)	± (0,02%R+0,01Ω)	± (0,05%R+0,01Ω)

				Requirements
Voltage Proof (dielectric withstanding voltage)	4.7	V-block	60 s	No flashover or breakdown
Solderability	4.17.2	20 (Ta)	+ 230 °C / 2 s	Dipped area shall be covered with a smooth and bright solder coating of at least 95 %
Resistance against Solvents		45 (xA)	Alcohols, ester, hydrous solution, + 23 °C, tooth brush method	No mechanical damage Marking must be legible