

■ 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 M Ω**
- | | | | | |
|--------------|--------------|-------------|-------------|-------------|
| 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 % 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 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 Manufacturer**" 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) | | Precision | Long Term | Precision | Long Term | Precision | 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 |

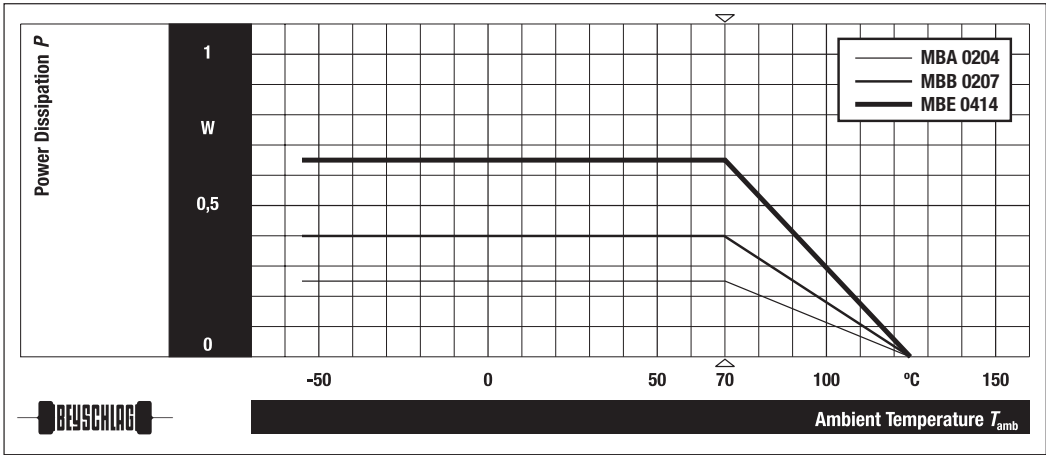
| | | | | |
|---------------------------------|-----------|--------------|--------------|--------------|
| Current Noise, A_1 | $\mu V/V$ | down to 0,05 | down to 0,05 | down to 0,05 |
| Attenuation 3rd Harmonic, A_3 | dB | up to 110 | up to 115 | up to 125 |

| Max. Resistance Change at P_{70} for Resistance Range | | 10 Ω - 100 k Ω | | 10 Ω - 270 k Ω | | 10 Ω - 470 k Ω | |
|---|---|------------------------------|-------------|------------------------------|-------------|------------------------------|-------------|
| $\Delta R/R$ after ... | | | | | | | |
| ... 1 000 h | % | $\leq 0,05$ | $\leq 0,25$ | $\leq 0,05$ | $\leq 0,25$ | $\leq 0,05$ | $\leq 0,25$ |
| ... 8 000 h | % | $\leq 0,1$ | $\leq 0,5$ | $\leq 0,1$ | $\leq 0,5$ | $\leq 0,1$ | $\leq 0,5$ |
| ... 225 000 h | % | $\leq 0,3$ | $\leq 1,5$ | $\leq 0,3$ | $\leq 1,5$ | $\leq 0,3$ | $\leq 1,5$ |

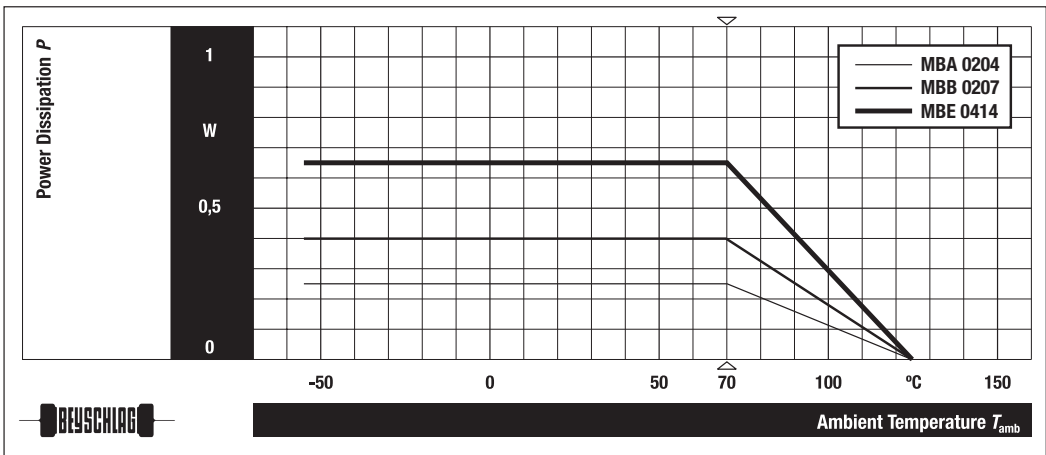
| | | | | |
|---|----------------|-------------|-------------|-------------|
| Operating Voltage, U_{max} AC / DC | V | 200 | 300 | 500 |
| Permissible Voltage against Ambient ... | | | | |
| | ... 1 minute | 300 | 500 | 800 |
| | ... continuous | 75 | 75 | 75 |
| Isolation Resistance | Ω | $> 10^{10}$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

| | | | | |
|--------------|-------|------------|------------|------------|
| Failure Rate | 10%/h | $\leq 0,7$ | $\leq 0,3$ | $\leq 0,1$ |
|--------------|-------|------------|------------|------------|

Derating • Long Term Operation

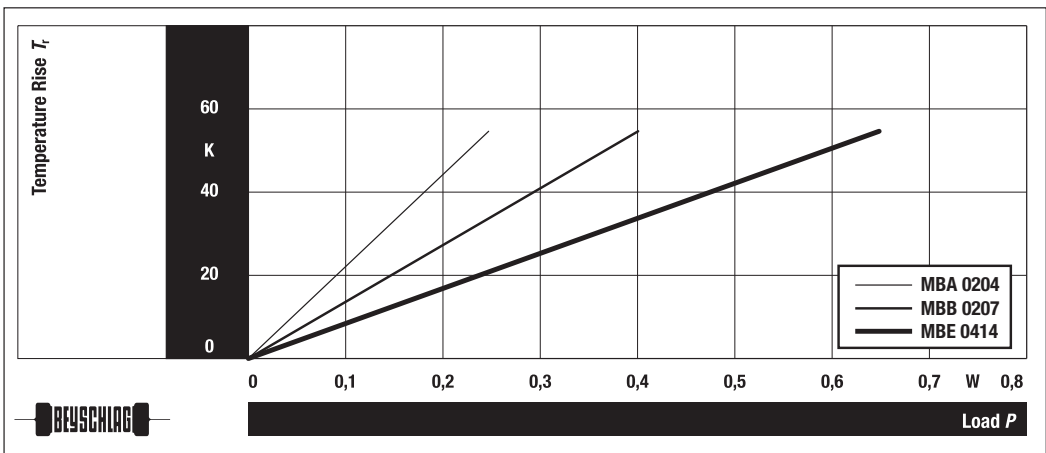


Derating • Precision Operation



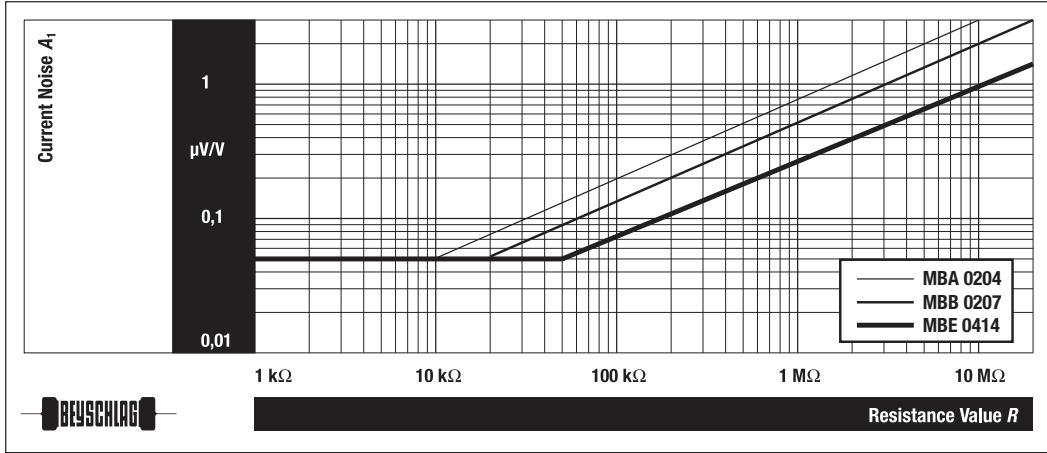
Temperature Rise

Rise of the Surface Temperature



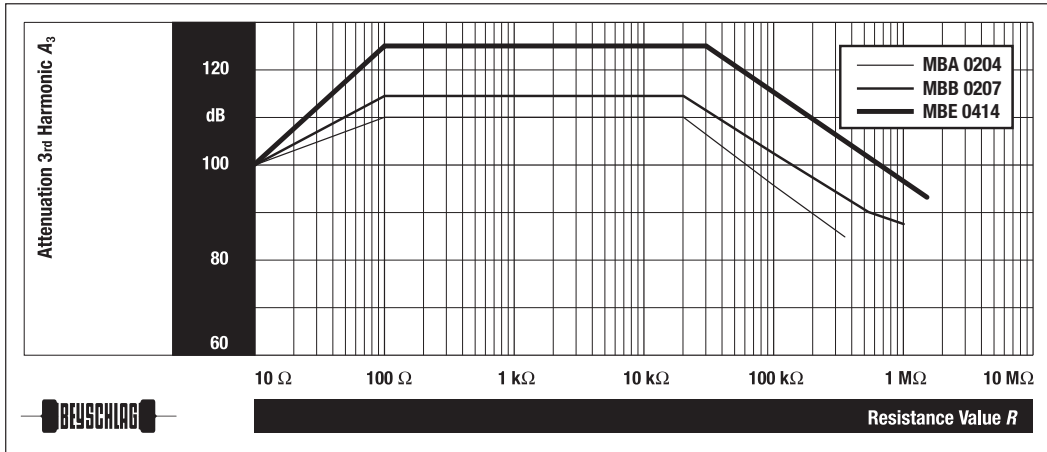
Current Noise

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 ΔR | | |
|------------------------|---------------------------|-----------------|-------------------------------|------------------------------|------------------------------|
| | | | Stability Class 0,05 | Stability Class 0,1 | Stability Class 0,25 |
| | | MBA 0204 | 100 Ω - 100 k Ω | 43 Ω - 221 k Ω | 10 Ω - 332 k Ω |
| | | MBB 0207 | 100 Ω - 270 k Ω | 43 Ω - 510 k Ω | 10 Ω - 1 M Ω |
| | | MBE 0414 | 100 Ω - 470 k Ω | 43 Ω - 1 M Ω | 10 Ω - 2,4 M Ω |

| | | | | | | |
|-------------------------------------|--------|-------------------------------|--|----------------------------|----------------------------|----------------------------|
| Short-Time Overload | 4.13 | | 2,5 x rated voltage / 2 x U_{max} for 2 s | $\pm (0,01\%R+0,01\Omega)$ | $\pm (0,02\%R+0,01\Omega)$ | $\pm (0,05\%R+0,01\Omega)$ |
| Robustness of Terminations | 4.16 | 21 (Jb) 21 (Jc) 21 (Jd) | Tensile, bending and torsion | $\pm (0,01\%R+0,01\Omega)$ | $\pm (0,02\%R+0,01\Omega)$ | $\pm (0,05\%R+0,01\Omega)$ |
| Resistance to Soldering Heat | 4.18.2 | 20 (Tb) | + 260 °C \pm 5 °C / 10 s | $\pm (0,01\%R+0,01\Omega)$ | $\pm (0,02\%R+0,01\Omega)$ | $\pm (0,05\%R+0,01\Omega)$ |
| Rapid Change of Temperature | 4.19 | 14 (Na) | 5 cycles between - 65 °C / + 155 °C | $\pm (0,01\%R+0,01\Omega)$ | $\pm (0,02\%R+0,01\Omega)$ | $\pm (0,05\%R+0,01\Omega)$ |

| | | | | | | |
|-------------------------|-----------------------|--|---|----------------------------|---------------------------|----------------------------|
| Endurance at ... | 4.25.1 | | Rated voltage / U_{max} 1,5 h on / 0,5 h off | | | |
| | ... + 70 °C / 1 000 h | | | $\pm (0,05\%R+0,01\Omega)$ | $\pm (0,1\%R+0,01\Omega)$ | $\pm (0,25\%R+0,05\Omega)$ |
| | ... + 70 °C / 8 000 h | | | $\pm (0,1\%R+0,01\Omega)$ | $\pm (0,2\%R+0,01\Omega)$ | $\pm (0,5\%R+0,05\Omega)$ |

| | | | | | | |
|--------------------------|------|--------|--|----------------------------|---------------------------|----------------------------|
| Climatic Sequence | 4.23 | 30 (D) | Dry heat – damp heat (1 cycle) – cold – low air pressure – damp heat (5 cycles) | $\pm (0,05\%R+0,01\Omega)$ | $\pm (0,1\%R+0,01\Omega)$ | $\pm (0,25\%R+0,05\Omega)$ |
|--------------------------|------|--------|--|----------------------------|---------------------------|----------------------------|

| | | | | | | |
|--|------|--------|---------------------|----------------------------|---------------------------|----------------------------|
| Damp Heat, Steady State 56 Days | 4.24 | 3 (Ca) | + 40 °C / 93 % R.H. | $\pm (0,05\%R+0,01\Omega)$ | $\pm (0,1\%R+0,01\Omega)$ | $\pm (0,25\%R+0,05\Omega)$ |
|--|------|--------|---------------------|----------------------------|---------------------------|----------------------------|

| | | | | | | |
|-----------------------------------|----------------|---------|--|----------------------------|---------------------------|----------------------------|
| Endurance at UCT / 1 000 h | 4.25.3 | 27 (Ba) | | | | |
| | UCT = + 125 °C | | | – | – | $\pm (0,25\%R+0,05\Omega)$ |
| | UCT = + 85 °C | | | $\pm (0,05\%R+0,01\Omega)$ | $\pm (0,1\%R+0,01\Omega)$ | $\pm (0,1\%R+0,05\Omega)$ |

| | | | | | | |
|------------------|------|--------|---|----------------------------|----------------------------|----------------------------|
| Vibration | 4.22 | 6 (B4) | 6 h / 10 - 2 000 Hz 1,5 mm or 196 m/s ² | $\pm (0,01\%R+0,01\Omega)$ | $\pm (0,02\%R+0,01\Omega)$ | $\pm (0,05\%R+0,01\Omega)$ |
|------------------|------|--------|---|----------------------------|----------------------------|----------------------------|

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 |
|------------------------------------|--|---------|---|---|