BEYSCHLAG

Metal Film Resistors

Harmonic Series

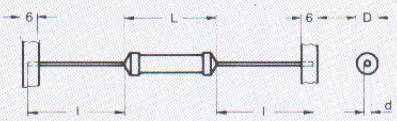
MHS 88. 09 E

Metal Film Resistors

PROFESSIONAL and PRECISION

Mechanical Data

1	2	3	4	5	6	7	8
Type - Style	Dmax mm	Lmax mm	d mm	l min mm	Minimum Module mm	Weight for 1000 Pieces g	
MBA 0204- · ·	1,6	3,6	0,5	29	5	130	
MBB 0207- · · *	2,5	6,3	0,6	28	7,5	220	
MBC 0309- · ·	2,9	8,3	0,7	27	10	320	
MBE 0414- · ·	4,0	11,9	0,8	31	15	750	



Electrical Data

	9	10	11	12	13			14		15	16
Type - Style	Rated Dissipation P70 W	Umax ac rms	Thermal Resistance Rth K/W	Surface Temperature ϑhs °C	Maximum Resistance Change at P70 Δ R/R in % after 1.000 h	8.000 h	225.000 h	Permissible Voltage against Ambient 1 min V-	constant V-	Insulation Resistance Ω	Failure Rate 10^{-9}/h
MBA 0204- · ·	0,4	200	200	155	0,5	1,0		300	75	$>10^{10}$	<0,7
MBB 0207- · ·	0,6	300	140	155	0,5	1,0		500	75	$>10^{10}$	<0,3
Ⓝ MBC 0309- · · *	0,66	300	125	155	0,4	0,8		600	75	$>10^{10}$	<0,1
MBE 0414- · ·	1,0	500	85	155	0,4	0,8		800	75	$>10^{10}$	<0,01
MBA 0204- · ·	0,25	200	200	125	0,25	0,5	1,5	300	75	$>10^{10}$	<0,7
MBB 0207- · ·	0,4	300	140	125	0,25	0,5	1,5	500	75	$>10^{10}$	<0,3
Ⓛ MBC 0309- · · *	0,4	300	125	125	0,2	0,4	1,2	600	75	$>10^{10}$	<0,1
MBE 0414- · ·	0,65	500	85	125	0,2	0,4	1,2	800	75	$>10^{10}$	<0,01

Ⓝ data for normal operation, Ⓛ data for long term operation, see explanation 12 — Climatic Category 65/155/56

BEYSCHLAG metal film resistors meet all requirements of the Standards DIN 44 061, DIN 44 062, DIN 45 921 Part 107, DIN 45 921 Part 1014 Draft, VG 95 295 (please mention when ordering), and the specifications CECC 40 101-017 and CECC 40 101-039.

Temperature Coefficients and Resistance Ranges

	17	18					
		Tolerance					
Type - Style	TC in 10^{-6}/K	PROFESSIONAL 5 %	2 %	1 %	0,5 %	PRECISION 0,25 %	0,1 %
MBA 0204-50 MBB 0207-50 MBC 0309-50 MBE 0414-50 *	± 50	0,22 Ω - 10 MΩ 0,22 Ω - 22 MΩ 0,22 Ω - 22 MΩ	1 Ω - 10 MΩ 1 Ω - 10 MΩ 1 Ω - 22 MΩ	1 Ω - 10 MΩ 1 Ω - 10 MΩ 1 Ω - 1,5 MΩ 1 Ω - 22 MΩ	10 Ω - 475 kΩ 10 Ω - 1MΩ 10 Ω - 1,5 MΩ 10 Ω - 2,4 MΩ	22 Ω - 330 kΩ 10 Ω - 1 MΩ 22 Ω - 1 MΩ 22 Ω - 1,5 MΩ	43 Ω - 330 kΩ 40,2 Ω - 1 MΩ 100 Ω - 680 kΩ 100 Ω - 1 MΩ
MBA 0204-25 MBB 0207-25 MBC 0309-25 MBE 0414-25 *	± 25			10 Ω - 475 kΩ 10 Ω - 1 MΩ 10 Ω - 1,5 MΩ 10 Ω - 2,4 MΩ	10 Ω - 475 kΩ 10 Ω - 1 MΩ 10 Ω - 1,5 MΩ 10 Ω - 2,4 MΩ	22 Ω - 330 kΩ 10 Ω - 1 MΩ 22 Ω - 1 MΩ 22 Ω - 1,5 MΩ	43 Ω - 330 kΩ 40,2 Ω - 1 MΩ 100 Ω - 680 kΩ 100 Ω - 1 MΩ
MBA 0204-15 MBB 0207-15 MBC 0309-15 MBE 0414-15 *	± 15				10 Ω - 221 kΩ 10 Ω - 560 kΩ 10 Ω - 360 kΩ 10 Ω - 470 kΩ	22 Ω - 221 kΩ 10 Ω - 560 kΩ 22 Ω - 360 kΩ 22 Ω - 470 kΩ	43 Ω - 221 kΩ 40,2 Ω - 560 kΩ 100 Ω - 360 kΩ 100 Ω - 470 kΩ
MBA 0204-50 HF	± 50	1,5 Ω - 475 Ω	1,5 Ω - 475 Ω				

Resistance values	E 24		E 24 and E 96	E 24 and E 192	All IEC Series and special values
Body colour	light blue				
Coding of resistance value	4 bands		5 bands		
Coding of temperature coefficient	Body colour light blue = TC 50		Colour dot yellow = TC 25		Colour dot orange = TC 15

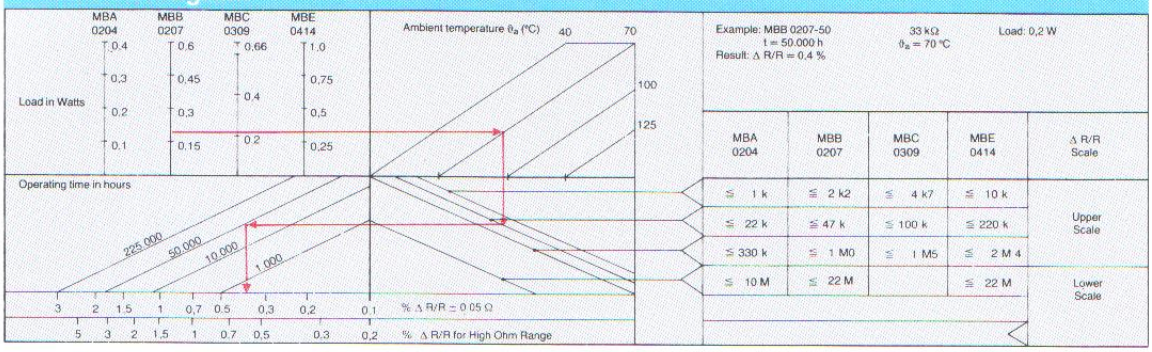
0 Ohm (Jumper)	MBA 0204 0R0	Rmax ≤ 20 mΩ	Imax = 2,0 A	Coding
	MBB 0207 0R0	Rmax ≤ 20 mΩ	Imax = 2,5 A	1 black band
∞ Resistors	MBA 0204 999 M	Rmin > 10^9 Ω		Coding
	MBB 0207 999 M	Rmin > 10^9 Ω		3 white bands

Recommended combinations

* Special production, not available from stock. Not recommended for new development as almost same data as MBB 0207.

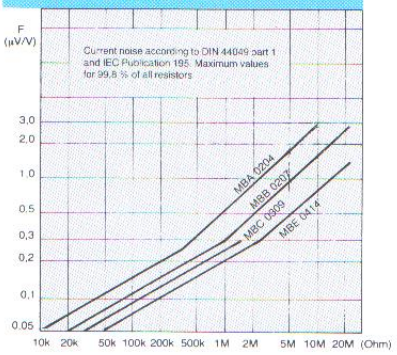
This data sheet gives no information on delivery possibilities. Changes within the scope of technical developments are reserved.

Drift Nomogram

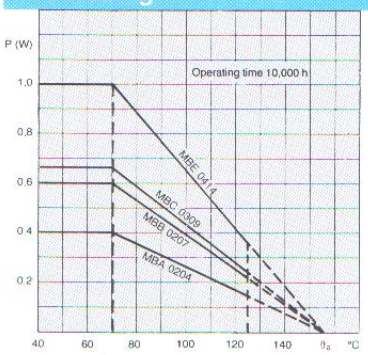


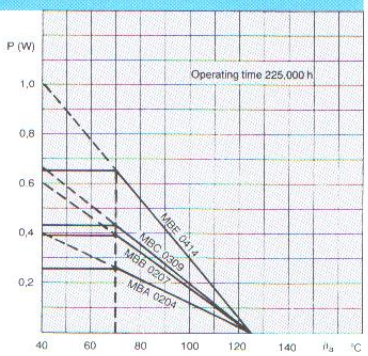
MBA 0204	MBB 0207	MBC 0309	MBE 0414	Δ R/R Scale
≦ 1 k	≦ 2 k2	≦ 4 k7	≦ 10 k	Upper Scale
≦ 22 k	≦ 47 k	≦ 100 k	≦ 220 k	
≦ 330 k	≦ 1 M0	≦ 1 M5	≦ 2 M 4	
≦ 10 M	≦ 22 M		≦ 22 M	Lower Scale

Current Noise

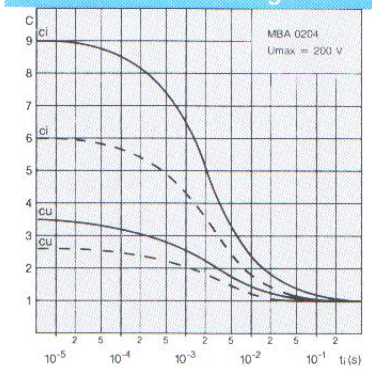


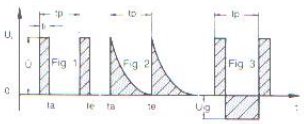
Derating





Pulse Load Rating



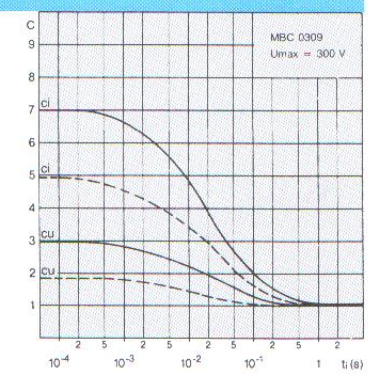


$$\frac{1}{t_p R}\int_{ta}^{te} U_i^2\,dt \leqq P_\vartheta \qquad (1)$$

$$|U_i| \leqq c_i \cdot \sqrt{P_\vartheta \cdot R} \qquad (2)$$

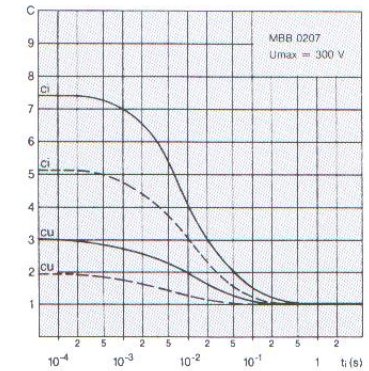
$$|U_i| \leqq c_u \cdot U_{max} \qquad (3)$$

P_ϑ: Permissible constant load at a given ambient temperature ϑ_a

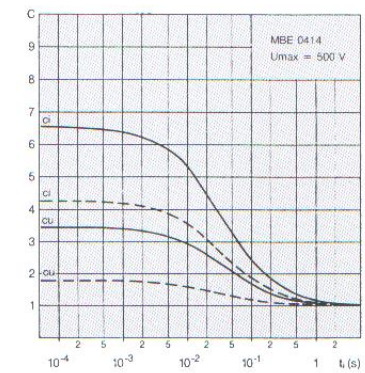


Operating Time 10,000 hours

Operating Time 225,000 hours



Example:	Pulse load rating for long term operation (ϑ_{hs} = 125 °C)
Given:	MBB 0207-50; R = 1 kΩ; ϑ_a = 70 °C; U_i = 85 V; t_i = 2 ms; t_p = 0,1 s (square wave pulse see fig. 1)
Limits:	P_{70} = 0,4 W; U_{max} = 300 V
From diagram:	c_i = 4,4; c_u = 1,6
Condition: (1)	For special case square wave pulse $\frac{\hat{U}_i^2}{R} \cdot \frac{t_i}{t_p}$ = 0,14 W ≦ 0,4 W = P_{70}
Condition (2):	$\lvert\hat{U}_i\rvert$ = 85 V ≦ $c_i \cdot \sqrt{P_{70} \cdot R}$ = 88 V
Condition (3):	$\lvert\hat{U}_i\rvert$ = 85 V ≦ $c_u \cdot U_{max}$ = 480 V
Result:	All three conditions are fulfilled, the load is permissible.



Explanations to page 2

No.	Explanation
1	Identification code: **M B B 0207 - 50 CT** M = Film type: Metal B = Lead form: axial B = BEYSCHLAG style 0207 = DIN style 50 = Temperature coefficient: 50 = 50 x 10^{-6}/K CT = Additional description for 5000 pieces packaging unit: Carton packaging RP = Reel packaging
	To simplify the description the suffix "BX" for BALOX ceramic, used since 1980, is no longer shown.
5	The lead length of the taped resistor is given. The length of the leads is 6 mm less when cut out of the taping.
6	Minimum module for resistors with leads bent at right angles.
9	P70 is the maximum rated dissipation for the given surface temperature at an ambient temperature of 70 °C. See explanation 12, too.
10	Umax: Maximum limiting element voltage in Volts, dc or ac rms. The maximum permissible peak value of an alternating voltage is higher by a factor of $\sqrt{2}$.
11	Rth: Thermal resistance in K/W measured on a printed circuit board in a chamber according to DIN 44050.
12	For the application of BEYSCHLAG resistors two derating curves are given. 1. Normal applications: Permissible surface temperature ϑ_{hs} = 155 °C for circa 10000 hours operation (corresponds to 6 years with 5 hours operation per day). 2. Long term applications: Permissible surface temperature ϑ_{hs} = 125 °C for an operation period of 225 000 hours (corresponds to 25 years continuous operation). Derating of resistance over a period of time is primarily dependent on the surface temperature of the resistor. At a surface temperature of ϑ_{hs} = 125 °C, resistance change is significantly lower than at a surface temperature of 155 °C. Under normal circumstances, the majority of the appliances in the entertainment and consumer electronics is switched on for a few hours a day only and such appliances rarely reach an operating life of 10 000 hours. Under such circumstances, a surface temperature for the resistor higher than 125 °C is acceptable without exceeding the permissible resistance change.
13	The maximum resistance change in % for 10 Ω to 100 kΩ for P70 at ϑ_{hs} = 125 °C and ϑ_{hs} = 155 °C at 75 % annual average relative humidity and maximum 95 % on 30 days per year is valid for 99,8 % of all resistors. For other application conditions the anticipated resistance value change for values > 10 Ohms can be taken from the drift nomogram.
14	The higher voltage in the left column is a test voltage which is measured in a V-block according to IEC 115-1 section 4.7. If a resistor is operated,with a voltage higher than 75 V against surroundings for a longer period a greater change of the resistance value must be expected.
15	The resistance of the lacquering layer measured between the leads and surroundings in a V-block according to IEC 115-1 section 4.6.
16	Failure rate for open-circuit valid from 10 Ω to 100 kΩ and for resistors mounted in equipment, when the equipment has left the test bay.
17	The temperature coefficient (TC) gives the reversible change of the resistance layer temperature of 1 Kelvin (previously given in ppm).

Tests

Test	Measurement and Test Procedure	Test regulation		Requirements					
Description	Short explanation	IEC Publication No.	Style	DIN 44 061 DIN 45 921 T. 107 CECC 40 101-017		Sept. 1983 Sept. 1983 Sept. 1983	BEYSCHLAG data according to CECC 40 101-039 May 1986		
				P70 W	max value Ω	Δ R/R* % max	P70 W	max value Ω	Δ R/R* % max
Endurance	1000 hours at P70, but at most Umax, 1,5 hours ON, 0,5 hours OFF	115-1 Section 4.25	0204 0207 0309 0414	0,21 0,34 0,40 0,57	100 k 1 M 1 M 1,5 M	+ 1,0 − 0,5	0,4 0,6 0,66 1,0	10 M 22 M 1,5 M 22 M	+ 0,5 − 0,5
Overload	2,5 times rated voltage, at most 2 times limiting element voltage (Umax) applied for duration given.	115-1 Section 4.13	all			± 0,25			± 0,25
Robustness of Terminations	Tensile, bending and torsion	115-1 Section 4.16	all			± 0,25			± 0,25
Vibration	6 hours in the 10-500 Hz frequency range, displacement 0,75 mm or acceleration of 98,1 m/sec^2	115-1 Section 4.22	all			± 0,25			± 0,25
Rapid Change of Temperature	5 temperature changes between −65 °C and + 155 °C; 30 minutes duration at each temperature level.	68-2-14	all			± 0,25			± 0,25
Climatic Sequence	16 hours dry heat at 155 °C, damp heat cycle, 2 hours coldness −65 °C, 1 hour low air pressure, 5 damp cycles (24 hours 95 % relative humidity at 55 °C)	115-1 Section 4.23	all			+ 1,0 − 0,5			+ 1,0 − 0,5
Damp Heat Steady State	56 days at 40 °C and 93 % relative humidity at a voltage of 0,1 times rated voltage, maximum 16 Volts	68-2-3	all			+ 1,0 − 0,5			+ 1,0 − 0,5
Resistance to Soldering Heat	The leads are dipped in a solder bath (260 ± 5 °C) to 2,5 mm distance from the resistance body; duration 10 seconds	68-2-20 Section 5.4 Test Tb method 1 A	all			± 0,25			± 0,25
Solderability	The leads are dipped in a solder bath (Sn 60/Pb 40) for 2 seconds at 230 °C.	68-2-20 Section 4.6 Test Ta method 1	all	Surface evenly soldered			Surface evenly soldered		
Current Noise	Measured at ϑ_A = 25 ± 5 °C	195	all	up to 1 MΩ ≤ 1 μV/V			up to 1 MΩ ≤ 0,7 μV/V		
Voltage Coefficient	Relative resistance change divided by the difference of the 2 measurement voltages	115-1 Section 4.11	all	<0,5 · 10^{-6}/V			<0,5 · 10^{-6}/V		
Voltage Proof	Measurement in V-block, duration 60 s	115-1 Section 4.7	all	No electrical breakdown			No electrical breakdown		
Resistance to Solvents	Washed with all typical printed circuit board cleaning agents such as 1-1-1 trichlorethylene, trichlorflourethylene with or without alcohol additives, alcohol in liquid or vapour form		all	No damage to lacquer or colour coding			No damage to lacquer or colour coding		

* The given changes of the resistance value Δ R/R are valid ± 0,05 Ω.