

**Metal Film Resistor**  
**.40 & .66 Watt**  
**.1% to 1%**

**C0309**  
**(MBC0309)**

## DESCRIPTION

A homogeneous film of metal alloy is deposited on a high grade BALOX ceramic body. After a helical groove has been cut in the resistive layer; tin plated, copper leads are welded onto the end caps. The resistors are coated with a blue lacquer which provides electrical, mechanical, and climatic protection. The encapsulation is resistant to all cleaning solvents in accordance with MIL-STD-202E, Method 215 and IEC 68-2-45.

MASS: 32 g per 100 units

## MOUNTING:

The resistors are suitable for processing on automatic insertion equipment in addition to cutting and bending machines. The minimum bending for this series is 10.2 mm (.400").

## MARKING

The nominal resistance and tolerance are marked on the resistors with a five band color code for .1% to 1% resistors as described in "General Introduction — Leaded Resistors". Additionally, resistors with a TCR of  $\pm 25$  ppm will have yellow dots and resistors with a TCR of  $\pm 15$  will have orange dots between the 4th and 5th bands.

## QUICK REFERENCE DATA

Resistance Range	1 $\Omega$ to 1.5 M $\Omega$ ; E24/E96/E192 Series See Table II
Resistance Tolerance	$\pm 1\%$ (E24/E96) $\pm .5\%$ (E24/E192) $\pm .25, .1\%$ (All Series & Specials)
Temperature Coefficient	$\leq \pm 50$ ppm/ $^{\circ}\text{C}$ $\leq \pm 25$ ppm/ $^{\circ}\text{C}$ $\leq \pm 15$ ppm/ $^{\circ}\text{C}$
Abs. Max. Dissipation at $T_{\text{amb}} = 70^{\circ}\text{C}$	See Table III
Normal Operation	0.66 W
Long Term Operation	0.40 W
Thermal Resistance, $R_{\text{th}}$	125 $^{\circ}\text{C}/\text{W}$
Max. Continuous Operating Voltage	300 V (DC or RMS)
Noise $R \leq 1 \text{ M}\Omega$	max. 1.0 $\mu\text{V}/\text{V}$
Operating Temperature Range	
Normal Operation	$-55^{\circ}\text{C}$ to $+155^{\circ}\text{C}$
Long Term Operation	$-55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$
Basic Specification	IEC 115-1, DIN 44 061, DIN 45 921 T.107
Stability ( $\Delta R/R$ max) after:	
Load	
Normal Operation	$\pm 0.50\% + 0.05 \Omega$
Long Term Operation	$\pm 0.25\% + 0.05 \Omega$
Climatic Tests	$\pm 1.00\% + 0.05 \Omega$
Resistance to Soldering Heat	$\pm 0.25\% + 0.05 \Omega$
Short Time Overload, 600 V max.	$\pm 0.25\% + 0.05 \Omega$

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**DISSIPATION**

Maximum power dissipation as a function of ambient temperature (Derating Curves) is shown in Fig 2 for Normal Operation and Fig 3 for Long Term Operation.

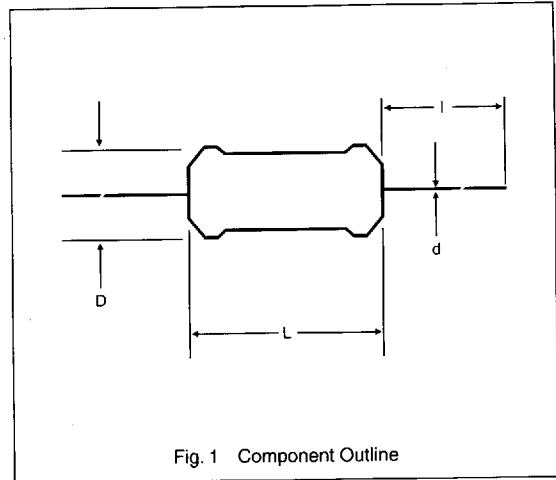
**CURRENT NOISE**

Fig 4 gives the Current Noise for the C0309 Series. The current noise is measured in accordance with DIN 44049 Part 1 and IEC 195. Maximum values are for 99.8% of all resistors.

**PERFORMANCE NOMOGRAM**

Figure 5 gives a performance nomogram showing the relationship between the load in watts, the ambient temperature, and the operating time in hours.

**MECHANICAL DATA**



**Table I** Component Dimensions  
 Values in inches (mm)

TYPE	D Max	L Max	d Nom	l min
C0309	.114 (2.9)	.327 (8.3)	.028 (0.7)	1.06 (27)

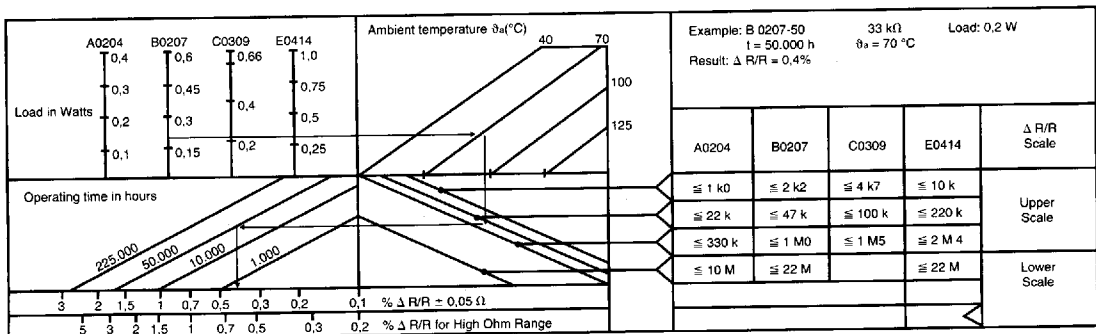
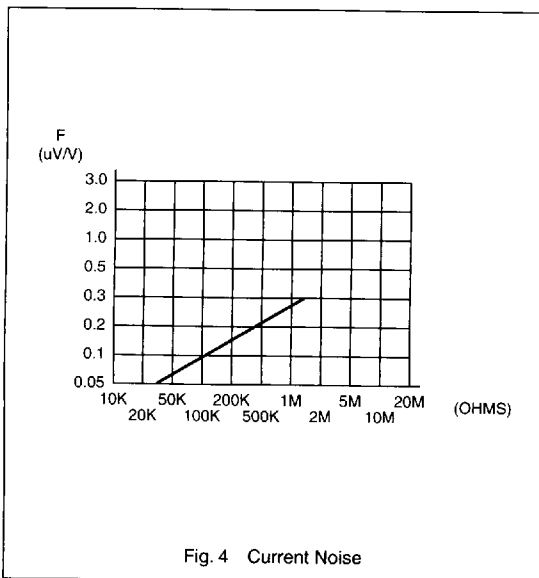
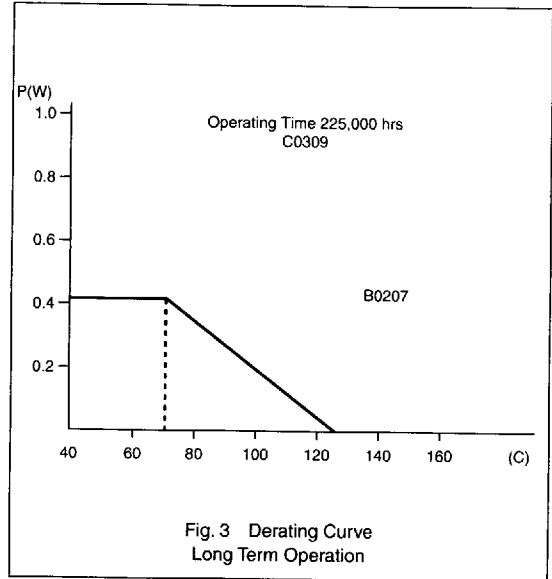
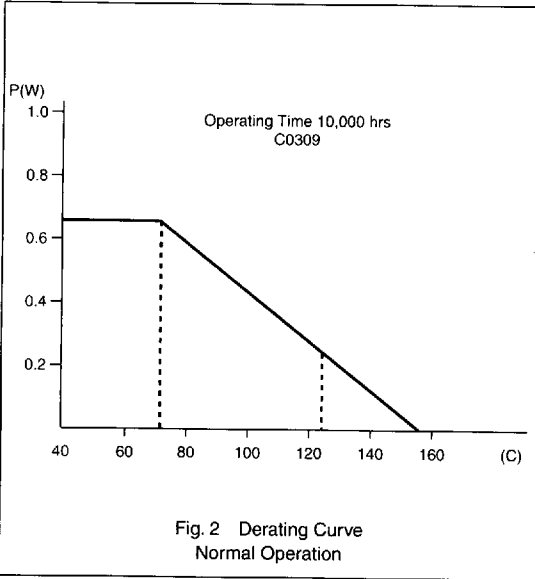


Fig. 5 Nomogram

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## ELECTRICAL DATA

**Table II** Resistance Ranges and TCR

Type	TCR ppm/°C	Precision			
		1%	.5%	.25%	.10%
		C0309-50	±50	1Ω-1.5 MΩ	10Ω-1.5 MΩ
C0309-25	±25	10Ω-1.5 MΩ	10Ω-1.5 MΩ	22Ω-1 MΩ	100Ω-680 MΩ
C0309-15	±15	—	10Ω-360 KΩ	22Ω-360 MΩ	100Ω-360 MΩ
Series		E24/E96	E24/E192	All Series and Special Values	

**Table III** Electrical Data for MBC0309

Type	Operation	Rated Power	Surface Temp °C	Max. Resistance Change at P70 ΔR/R in %			Permissible Voltage against Ambient V	
				1,000 hr	8,000 hr	225,000 hr	1 min	Constant
C0309	Normal	.66 W	155	0.40	0.80	—	600	75
	Long Term	.40W	125	0.20	0.40	1.2		

Note: The Failure Rate for the C0309 is  $< 0.1 \cdot 10^{-9}$  hr.

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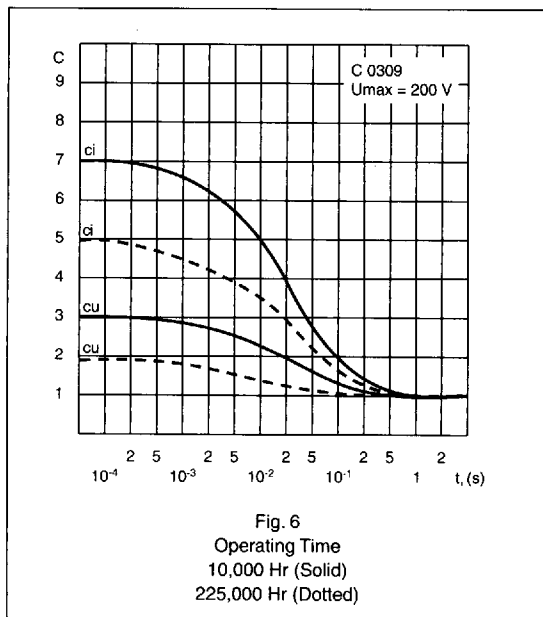
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**PULSE LOAD BEHAVIOR**

The Pulse Load Behavior must meet the requirements of Equations 1, 2, and 3 for the pulse load to be permissible for this series. The needed graph and wave form definitions are found in Figs 5 and 6.

**DEFINITIONS:**

- $P_U$ : Permissible constant load at a given ambient temp. a
- $t_p$ : Period Time
- $R$ : Resistance Value
- $U_i$ : Peak Voltage of the pulse
- $t_i$ : Pulse Duration
- $U_d$ : DC Voltage between pulses
- $t_a$ : Time at the beginning of the pulse period
- $t_e$ : Time at the end of the pulse period
- $U_{max}$ : Limiting voltage for continuous operation of the resistor
- $c$ : Factor independent on time for exceeding the rated dissipation.



(1)

$$\frac{1}{t_p R} \int_{t_a}^{t_e} U_i^2 dt \leq P_U$$

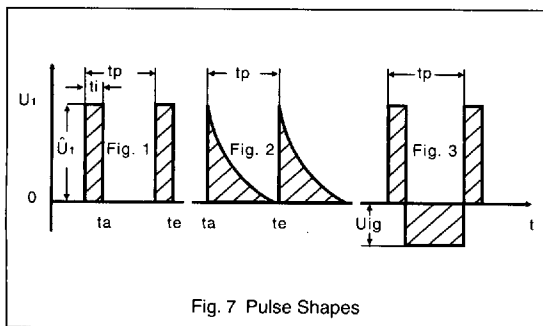
(2)

$$|U_i| \leq c_i \cdot \sqrt{P_U \cdot R}$$

(3)

$$|U_i| \leq C_U \cdot U_{max}$$

Example: See Pulse Loading under "B0207", page 209.



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**Table IV** North American Part Number

Type	Tol	TCR	Resistance Range	Part Number
C0309-50	1%	±50	1Ω-1.5 MΩ	C0309C.....F
	.5%		10Ω-1.5 MΩ	C0309C.....D
	.25%		22Ω-1 MΩ	C0309C.....C
	.1%		100Ω-680 MΩ	C0309C.....B
C0309-25	1%	±25	10Ω-1.5 MΩ	C0309E.....F
	.5%		10Ω-1.5 MΩ	C0309E.....D
	.25%		22Ω-1 MΩ	C0309E.....C
	.1%		100Ω-680 MΩ	C0309E.....B
C0309-15	.5%	±15	10Ω-360 KΩ	C0309F.....D
	.25%		22Ω-360 KΩ	C0309F.....C
	.1%		100Ω-360 KΩ	C0309F.....B

The "....." in the part number represents the value of the resistor. The format for the value is composed of five digits. Place the significant figures, separated by a "R", "K", or "M" as the decimal place, and finish out the remainder of the five digits with "0's" if required. For example: 100Ω is 100R0, 51.1KΩ is 51K10, etc.

**PACKAGING**

The C0309 Series is available in 5000 reels, 5000 ammo, and 1000 ammo. Contact the factory for Part Numbers not shown.