

## High Frequency Thin Film Leaded Resistors



### DESIGN SUPPORT TOOLS

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**3D**  
Models  
Available

MBA/SMA 0204 HF leaded thin film resistors for RF applications are the perfect choice in high frequency circuit designs; where the impedance change due to the parasitic inductance of regular and professional resistors can not be accepted. Typical applications are in the fields of telecommunication equipment and industrial electronics.

### FEATURES

- Speciality product for RF applications
- Low-inductance non-helical trimmed product
- Suitable for more than 3 GHz
- Resistance range: 1.5  $\Omega$  to 470  $\Omega$
- Lead (Pb)-free solder contacts
- Pure tin plating provides compatibility with lead (Pb)-free and lead containing soldering processes
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT

### APPLICATIONS

- Telecommunication equipment
- Industrial electronics

#### METRIC SIZE

DIN	0204
CECC	A

### TECHNICAL SPECIFICATIONS

DESCRIPTION	MBA/SMA 0204 HF		
CECC size	A		
Resistance range	1.5 $\Omega$ to 470 $\Omega$		
Resistance tolerance	$\pm 1\%$ ; $\pm 2\%$		
Temperature coefficient	$\pm 50$ ppm/K		
Operation mode	Long term	Standard	
Climatic category (LCT / UCT / days)	55 / 125 / 56	55 / 155 / 56	
Rated dissipation, $P_{70}$	0.25 W	0.4 W	
Operating voltage, $U_{max}$ . AC/DC	Limited by $P_{70}$		
Film temperature	125 $^{\circ}$ C	155 $^{\circ}$ C	
Max. resistance change at $P_{70}$ for resistance range, $\Delta R/R$ max., after:	1.5 $\Omega$ to 470 $\Omega$		
	1000 h	$\leq 0.25\%$	$\leq 0.5\%$
	8000 h	$\leq 0.5\%$	$\leq 1.0\%$
	225 000 h	$\leq 1.5\%$	-
Permissible voltage against ambient:	300 V		
	1 min; $U_{ins}$	75 V	
Continuous	75 V		
Failure rate	$\leq 0.7 \times 10^{-9}/h$		

#### Note

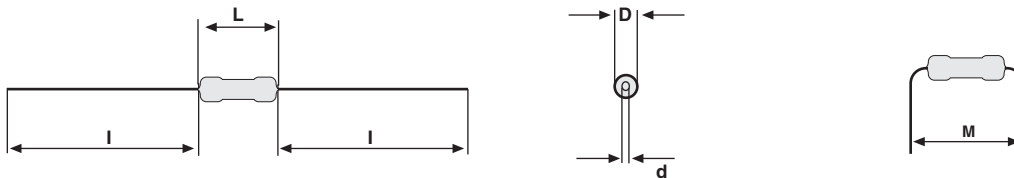
- These resistors do not feature a limited lifetime when operated within the permissible limits. However, resistance value drift increasing over operating time may result in exceeding a limit acceptable to the specific application, thereby establishing a functional lifetime

PART NUMBER AND PRODUCT DESCRIPTION																	
PART NUMBER: MBA0204AC5109GCT00																	
M	B	A	0	2	0	4	A	C	5	1	0	9	G	C	T	0	0
TYPE/SIZE		VARIANT		TCR		RESISTANCE		TOLERANCE		PACKAGING (1)		SPECIAL					
MBA0204 = MBA/SMA 0204		A = HF high frequency		C = 50 ppm		3 digit value 1 digit multiplier Multiplier 8 = *10 <sup>-2</sup> 9 = *10 <sup>-1</sup> 0 = *10 <sup>0</sup>		F = ± 1.0 % G = ± 2.0 %		CT C1		00 = standard					
PRODUCT DESCRIPTION: MBA/SMA 0204-50 2 % HF CT 51R0																	
MBA/SMA 0204	-	50	2 %	HF	CT	51R0											
TYPE/SIZE		TCR	TOLERANCE	VARIANT	PACKAGING (1)	RESISTANCE											
MBA/SMA 0204		50 ppm	± 1.0 % ± 2.0 %	HF	CT C1	51R0 = 51 Ω											

**Notes**

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

PACKAGING		
MODEL	BOX	
	PIECES	CODE
MBA/SMA 0204	1000	C1
	5000	CT

**DIMENSIONS**


DIMENSIONS - leaded resistor types, mass and relevant physical dimensions						
TYPE	D <sub>max.</sub> (mm)	L <sub>max.</sub> (mm)	d <sub>nom.</sub> (mm)	I <sub>min.</sub> (mm)	M <sub>min.</sub> (mm)	MASS (mg)
MBA/SMA 0204 HF	1.6	3.6	0.5	29.0	5.0	125

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE		
DESCRIPTION	RESISTANCE VALUE (1)	
TCR	TOLERANCE	MBA/SMA 0204 HF
± 50 ppm/K	± 1 %; ± 2 %	1.5 Ω to 470 Ω; 50 Ω

**Note**

- (1) Resistance values to be selected for ± 1 % from the E24/E96 series and for ± 2 % from E24 series



**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<sub>2</sub>O<sub>3</sub>) 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 low-inductivity non-helical groove in the resistive layer without damaging the ceramics. 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 colour code rings designate the resistance value and tolerance in accordance with **IEC 60062**. Additional black dots near the 3rd colour ring identify the special HF product.

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

**Notes**

(1) Global Automotive Declarable Substance List, see [www.gadsl.org](http://www.gadsl.org)

(2) CEFIC (European Chemical Industry Council), EECA (European Electronic Component Manufacturers Association), EICTA (European trade organisation representing the information and communications technology and consumer electronics), see [www.eicta.org/index.php?id=1053&id\\_article=340](http://www.eicta.org/index.php?id=1053&id_article=340)

wave or dipping. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions. 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 **GADSL** <sup>(1)</sup> and the **CEFIC-EECA-EICTA** <sup>(2)</sup> list of legal restrictions on hazardous substances. This includes full compatibility with the following directives:

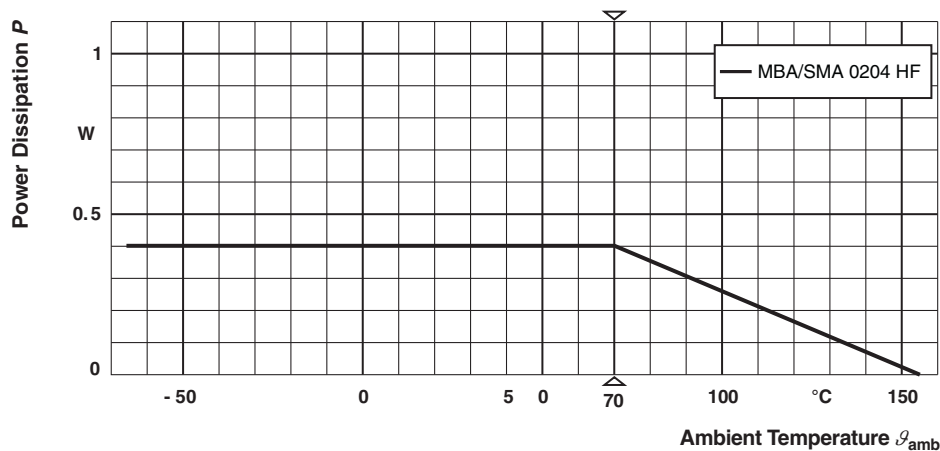
- 2000/53/EC End of Vehicle Life Directive (ELV) and Annex II (ELVII)
- 2002/95/EC Restriction of the use of Hazardous Substances Directive (RoHS)
- 2002/96/EC Waste Electrical and Electrical Equipment Directive (WEEE)

**APPROVALS**

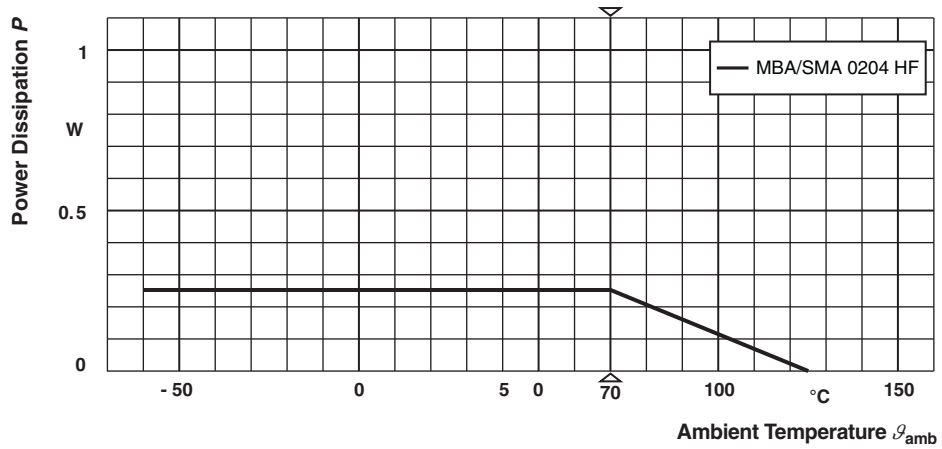
Where applicable, the resistors are tested in accordance with **CECC 40101-806** which refers to **EN 60115-1** and **EN 140100**.

Vishay Beyschlag has achieved “**Approval of Manufacturer**” in accordance with **IEC QC 001002-3, clause 2**. The release certificate for “**Technology Approval Schedule**” in accordance with **CECC 240001** based on **IEC QC 001002-3, clause 6** is granted for the Vishay Beyschlag manufacturing process.

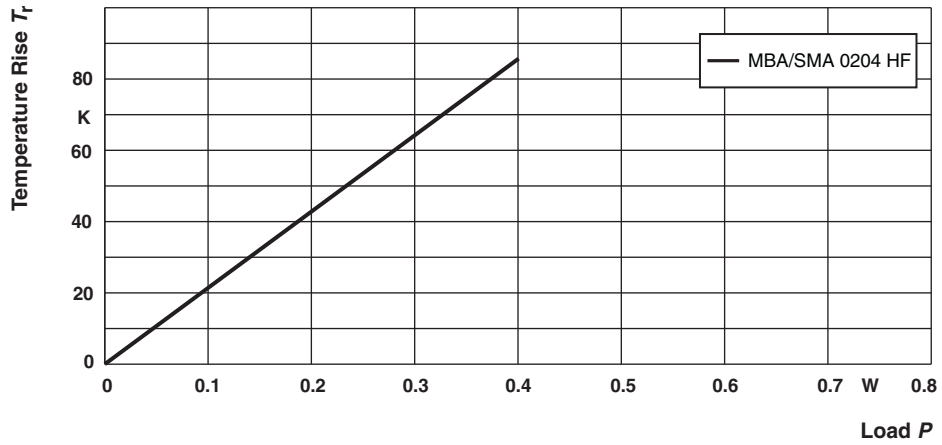
**FUNCTIONAL PERFORMANCE**



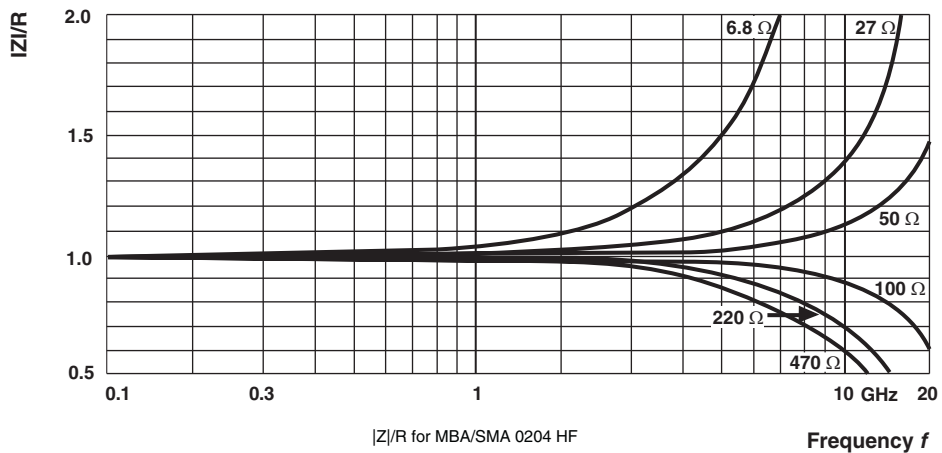
**Derating - Standard Operation**



### Rise of the Surface Temperature



### Temperature Rise



### RF - Behaviour



**TESTS AND REQUIREMENTS**

Essentially all tests are carried out in accordance with the following specifications:

EN 60115-1, generic specification (includes tests)

EN 140100, sectional specification (includes schedule for qualification approval)

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

The following table contains the applicable tests selected from the documents listed above.

The tests are carried out in accordance with IEC 60068-xx test method 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 60068-2 test methods. A short description of the test procedure is also given.

<b>TEST PROCEDURES AND REQUIREMENTS</b>				
<b>IEC 60115-1 CLAUSE</b>	<b>IEC 60068-2-xx TEST METHOD</b>	<b>TEST</b>	<b>PROCEDURE</b>	<b>REQUIREMENTS PERMISSIBLE CHANGE (ΔR MAX.)</b>
			Stability for product types: <b>MBA/SMA 0204 HF</b>	1.5 Ω to 470 Ω
4.5	-	Resistance		± 1 %; ± 2 %
4.8	-	Temperature coefficient	At (20 / LCT / 20) °C and (20 / UCT / 20) °C	± 50 ppm/K
4.25.1	-	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 70 °C; 1000 h 70 °C; 8000 h	± (0.5 % R + 0.05 Ω) ± (1 % R + 0.1 Ω)
	-	Endurance at 70°C: long term operation mode	$U = \sqrt{P_{70} \times R}$ or $U = U_{max.}$ ; 1.5 h ON; 0.5 h OFF 70 °C; 1000 h 70 °C; 8000 h	± (0.25 % R + 0.05 Ω) ± (0.5 % R + 0.05 Ω)
4.25.3	-	Endurance at upper category temperature	125 °C; 1000 h 155 °C; 1000 h	± (0.25 % R + 0.05 Ω) ± (0.5 % R + 0.05 Ω)
4.24	78 (Cab)	Damp heat, steady state	(40 ± 2) °C; 56 days; (93 ± 3) % RH	± (0.5 % R + 0.05 Ω)
4.23		Climatic sequence:		
4.23.2	2 (Ba)	Dry heat	155 °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	± (0.5 % R + 0.05 Ω) no visible damage
-	1 (Aa)	Cold	-55 °C; 2 h	± (0.1 % R + 0.01 Ω)
4.13	-	Short time overload	Room temperature; $U = 2.5 \times \sqrt{P_{70} \times R}$ or $U = 2 \times U_{max.}$ ; 5 s	± (0.1 % R + 0.01 Ω) no visible damage
4.19	14 (Na)	Rapid change of temperature	30 min at LCT and 30 min at UCT; 5 cycles	± (0.1 % R + 0.01 Ω) no visible damage



<b>TEST PROCEDURES AND REQUIREMENTS</b>				
IEC 60115-1 CLAUSE	IEC 60068-2-xx TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ( $\Delta R$ MAX.)
4.29	45 (XA)	Component solvent resistance	Stability for product types:	1.5 $\Omega$ to 470 $\Omega$
			<b>MBA/SMA 0204 HF</b>	
			Isopropyl alcohol +23 °C; toothbrush method	marking legible; no visible damage
4.18.2	20 (Tb)	Resistance to soldering heat	Unmounted components; (260 $\pm$ 3) °C; (10 $\pm$ 1) s	$\pm$ (0.1 % $R$ + 0.01 $\Omega$ ) no visible damage
4.17	20 (Ta)	Solderability	+235 °C; 2 s solder bath method; SnPb40	Good tinning ( $\geq$ 95 % $R$ covered); no visible damage
			+ 245 °C; 3 s solder bath method; SnAg3Cu0.5	
4.22	6 (B4)	Vibration	6 h; 10 Hz to 2000 Hz 1.5 mm or 196 m/s <sup>2</sup>	$\pm$ (0.1 % $R$ + 0.01 $\Omega$ )
4.16	21 (Ua <sub>1</sub> ) 21 (Ub) 21 (Uc)	Robustness of terminations	Tensile, bending and torsion	$\pm$ (0.1 % $R$ + 0.01 $\Omega$ ) no visible damage
4.7	-	Voltage proof	$U_{RMS} = U_{ins}$ ; 60 s	No flashover or breakdown

**12NC INFORMATION FOR HISTORICAL CODING REFERENCE**

**Last Digit of 12NC Indicating Resistance Decade**

RESISTANCE DECADE	LAST DIGIT
1 $\Omega$ to 9.99 $\Omega$	8
10 $\Omega$ to 99.9 $\Omega$	9
100 $\Omega$ to 999 $\Omega$	1

**Ordering Example (For historical coding reference of MBA 0204 HF)**

The ordering code of a MBA 0204 HF resistor, value 51  $\Omega$  and TCR 50 with  $\pm$  2 % tolerance, supplied on bandolier ammpack, in a box units is: 2312 908 05109.

<b>12NC CODE FOR HISTORICAL CODING REFERENCE OF MBA 0204 HF</b>				
DESCRIPTION			2312 ... ..	
			BANDOLIER IN BOX AMMOPACK	
TYPE	TCR	TOL.	C1 1000 UNITS	CT 5000 UNITS
MBA 0204 HF	$\pm$ 50 ppm/K	$\pm$ 2 %	903 0....	908 0....



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