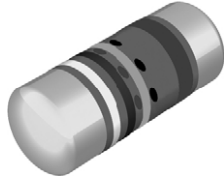




# Pulse Load Carbon Film MINI-MELF Resistors for High Frequency Applications



CMA 0204 HF specialty MELF resistors combine the advanced pulse load capability and the suitability for RF applications in a single component. They are the perfect choice in high frequency circuit designs where the parasitic inductance of regular, helical trimmed resistors cannot be accepted, but where also pulse energies apply. Typical applications are in the fields of telecommunication equipment and industrial electronics.

## FEATURES

- Specialty product for RF applications
- Low-inductance non-helical trimmed product
- Special carbon film technology
- ESD capability: 3 kV, human body model
- Suitable for more than 10 GHz
- Intrinsic sulfur resistance
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
**GREEN**  
(5-2008)

## APPLICATIONS

- Telecommunication
- Industrial

TECHNICAL SPECIFICATIONS	
DESCRIPTION	CMA 0204 HF
DIN size	0204
Metric size code	RC3715M
Resistance range	50 Ω; 47 Ω to 300 Ω
Resistance tolerance	± 2 %
Temperature coefficient	-250 ppm/K
Rated dissipation, $P_{70}$ <sup>(1)</sup>	0.4 W
Operating voltage, $U_{max}$ . AC <sub>RMS</sub> /DC	Limited by $P_{70}$
Permissible film temperature, $\vartheta_{F max}$ . <sup>(1)</sup>	155 °C
Operating temperature range <sup>(1)</sup>	-55 °C to 155 °C
Permissible voltage against ambient (insulation):  1 min; $U_{ins}$	300 V
Failure rate: FIT <sub>observed</sub>	≤ 0.1 x 10 <sup>-9</sup> /h

### Note

<sup>(1)</sup> Please refer to APPLICATION INFORMATION below.

## APPLICATION INFORMATION

When the resistor dissipates power, a temperature rise above the ambient temperature occurs, dependent on the thermal resistance of the assembled resistor together with the printed circuit board. The rated dissipation applies only if the permitted film temperature is not exceeded.

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.



MAXIMUM RESISTANCE CHANGE AT RATED DISSIPATION			
OPERATION MODE		STANDARD	POWER
Rated dissipation, $P_{70}$	CMA 0204 HF	0.25 W	0.4 W
Operating temperature range		-55 °C to 125 °C	-55 °C to 155 °C
Permissible film temperature, $\vartheta_F$ max.		125 °C	155 °C
Max. resistance change at $P_{70}$ for resistance range, $ \Delta R/R $ after:	CMA 0204 HF	50 $\Omega$ ; 47 $\Omega$ to 300 $\Omega$	50 $\Omega$ ; 47 $\Omega$ to 300 $\Omega$
	1000 h	$\leq 1\%$	$\leq 2\%$
	8000 h	$\leq 2\%$	$\leq 4\%$

**Note**

- The presented operation modes do not refer to different types of resistors, but actually show examples of different loads, that lead to different film temperatures and different achievable load-life stability (drift) of the resistance value. A suitable low thermal resistance of the circuit board assembly must be safeguarded in order to maintain the film temperature of the resistors within the specified limits. Please consider the application note "Thermal Management in Surface-Mounted Resistor Applications" ([www.vishay.com/doc?28844](http://www.vishay.com/doc?28844)) for information on the general nature of thermal resistance.

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE				
TYPE / SIZE	TCR	TOLERANCE	RESISTANCE	E-SERIES
CMA 0204 HF	-250 ppm/K	$\pm 2\%$	50 $\Omega$ ; 47 $\Omega$ to 300 $\Omega$	E24

PACKAGING						
TYPE / SIZE	CODE	QUANTITY	PACKAGING STYLE	WIDTH	PITCH	PACKAGING DIMENSIONS
CMA 0204 HF	B3 = BL	3000	Antistatic blister tape acc. IEC 60286-3, Type 2a	8 mm	4 mm	$\varnothing$ 180 mm / 7"

PART NUMBER AND PRODUCT DESCRIPTION																	
Part Number: CMA0204AX1000GB300																	
C	M	A	0	2	0	4	A	X	1	0	0	0	G	B	3	0	0
TYPE / SIZE		VERSION		TCR		RESISTANCE			TOLERANCE		PACKAGING						
CMA0204		A = HF high frequency		X = no indication		3 digit value 1 digit multiplier  Multiplier 9 = $\cdot 10^{-1}$ 0 = $\cdot 10^0$			G = $\pm 2\%$		B3						
Product Description: CMA 0204 2 % HF BL 100R																	
CMA	0204	2 %	HF	BL	100R	TYPE		SIZE		TOLERANCE		VERSION		PACKAGING		RESISTANCE	
CMA	0204	$\pm 2\%$	HF = high frequency	BL	100R = 100 $\Omega$												

**Note**

- Products can be ordered using either the PART NUMBER or PRODUCT DESCRIPTION.



## DESCRIPTION

Production of the CMA 0204 HF specialty MINI-MELF resistor is strictly controlled and follows an extensive set of instructions established for reproducibility. A homogeneous and dense carbon film is deposited on a high grade ceramic body (85 % Al<sub>2</sub>O<sub>3</sub>). Nickel plated steel termination caps are firmly pressed on the coated rods. A special laser is used to achieve the target value by smoothly cutting a non helical pattern with a resulting low inductivity in the resistive layer without damaging the ceramics. The resistor elements are covered by a protective coating designed for electrical, mechanical and climatic protection. The terminations receive a final pure matte tin on nickel plating. Four color code rings designate the resistance value and tolerance in accordance with **IEC 60062** <sup>(1)</sup>.

The result of the determined production is verified by an extensive testing procedure performed on 100 % of the individual resistors. Only accepted products are laid directly into the blister tape in accordance with **IEC 60286-3, Type 2a** <sup>(1)</sup>.

## ASSEMBLY

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow or vapor phase as shown in **IEC 61760-1** <sup>(1)</sup>. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions. The suitability of conformal coatings, potting compounds and their processes, if applied, shall be qualified by appropriate means to ensure the long term stability of the whole system.

The resistors are completely lead (Pb)-free, the pure matte tin plating provides compatibility with lead (Pb)-free and lead containing soldering processes. Solderability is specified for 2 years after production or requalification, however, excellent solderability is proven after extended storage in excess of 10 years. The permitted storage time is 20 years. The immunity of the plating against tin whisker growth has been proven under extensive testing.

## MATERIALS

Vishay acknowledges the following systems for the regulation of hazardous substances:

- IEC 62474, Material Declaration for Products of and for the Electrotechnical Industry, with the list of declarable substances given therein <sup>(2)</sup>
- The Global Automotive Declarable Substance List (GADSL) <sup>(3)</sup>
- The REACH regulation (1907/2006/EC) and the related list of substances with very high concern (SVHC) <sup>(4)</sup> for its supply chain

The products do not contain any of the banned substances as per IEC 62474, GADSL, or the SVHC list, see [www.vishay.com/how/leadfree](http://www.vishay.com/how/leadfree).

Hence the products fully comply with the following directives:

- 2000/53/EC End-of-Life Vehicle Directive (ELV) and Annex II (ELV II)
- 2011/65/EU Restriction of the Use of Hazardous Substances Directive (RoHS) with amendment 2015/863/EU
- 2012/19/EU Waste Electrical and Electronic Equipment Directive (WEEE)

Vishay pursues the elimination of conflict minerals from its supply chain, see the Conflict Minerals Policy at [www.vishay.com/doc?49037](http://www.vishay.com/doc?49037).

## APPROVALS

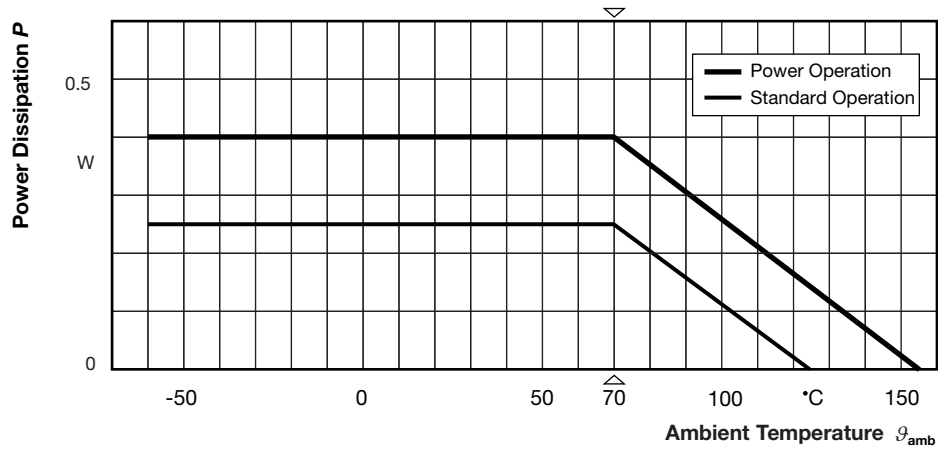
Where applicable the resistors are tested in accordance with **EN 140 401-803** which refers to **EN 60115-1, EN 60115-8** and the variety of environmental test procedures of the **IEC 60068** <sup>(1)</sup> series.

Vishay Beyschlag has achieved **“Approval of Manufacturer”** in accordance with **IECQ 03-1**. The release certificate for **“Technology Approval Schedule”** in accordance with **CECC 240001** based on **IECQ 03-3-1** is granted for the Vishay Beyschlag manufacturing process.

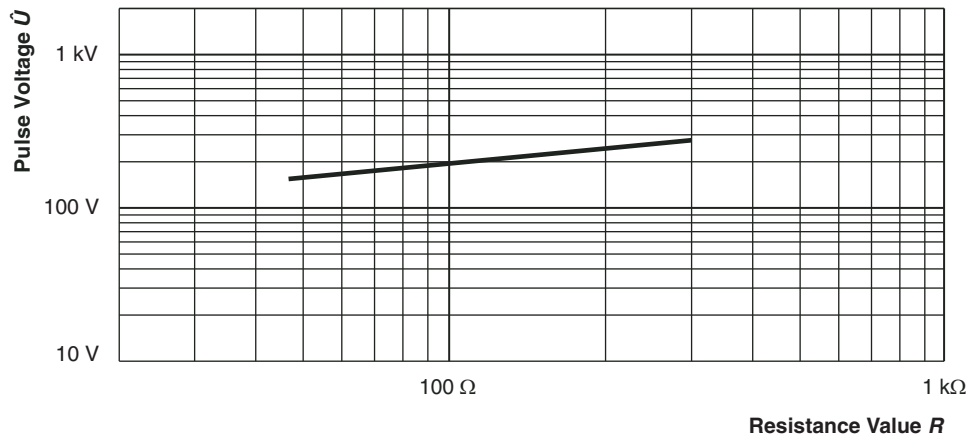
## Notes

- <sup>(1)</sup> The quoted IEC standards are also released as EN standards with the same number and identical contents.
- <sup>(2)</sup> The IEC 62474 list of declarable substances is maintained in a dedicated database, which is available at <http://std.iec.ch/iec62474>.
- <sup>(3)</sup> The Global Automotive Declarable Substance List (GADSL) is maintained by the American Chemistry Council and available at [www.gadsl.org](http://www.gadsl.org).
- <sup>(4)</sup> The SVHC list is maintained by the European Chemical Agency (ECHA) and available at <http://echa.europa.eu/candidate-list-table>.

**FUNCTIONAL PERFORMANCE**

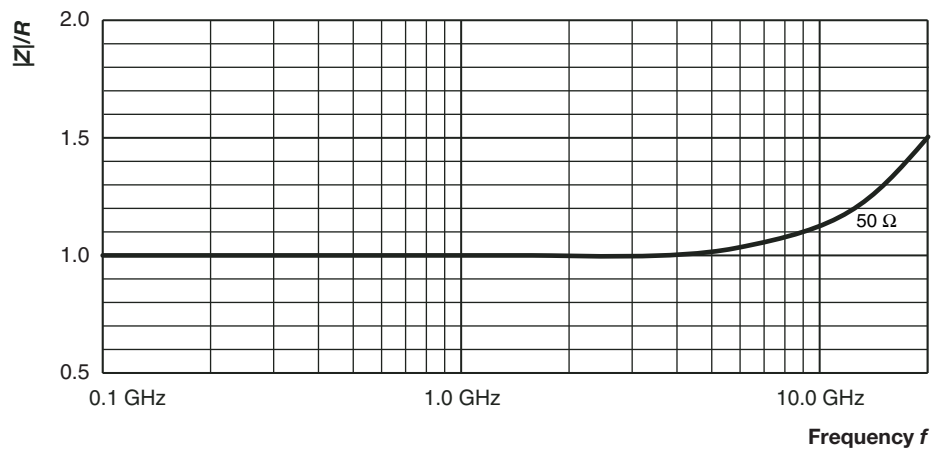


**Derating - Standard Operation**

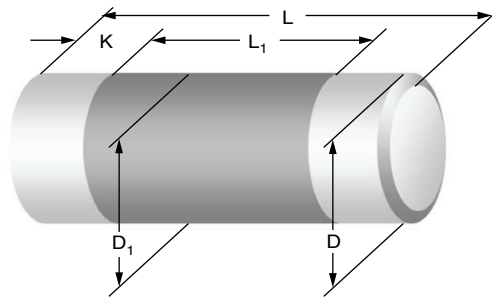


Pulse load rating in accordance with IEC 60115-1, 4.27; 1.2  $\mu$ s/50  $\mu$ s; 5 pulses at 12 s intervals; for permissible resistance change  $\pm (0.5 \% R + 0.05 \Omega)$

**1.2/50 Pulse**



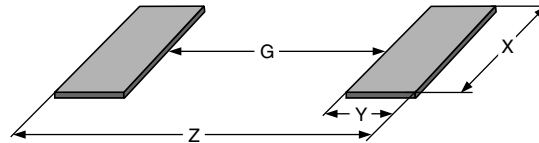
**RF - Behavior**

**DIMENSIONS**


DIMENSIONS AND MASS						
TYPE / SIZE	L (mm)	D (mm)	L <sub>1</sub> min. (mm)	D <sub>1</sub> (mm)	K (mm)	MASS (mg)
CMA 0204 HF	3.6 + 0 / - 0.2	1.4 + 0 / - 0.1	1.8	D + 0 / - 0.15	0.75 ± 0.1	19

**Note**

- Color code marking is applied according to IEC 60062<sup>(1)</sup> in four bands (E24 series). Each color band appears as a single solid line, voids are permissible if at least 2/3 of the band is visible from each radial angle of view. The last color band for tolerance is approximately 50 % wider than the other bands. Interrupted bands left and right of the 3<sup>rd</sup> full band indicate the special carbon film high frequency type.

**PATTERN STYLES FOR MELF RESISTORS**


RECOMMENDED SOLDER PAD DIMENSIONS								
TYPE / SIZE	WAVE SOLDERING				REFLOW SOLDERING			
	G (mm)	Y (mm)	X (mm)	Z (mm)	G (mm)	Y (mm)	X (mm)	Z (mm)
CMA 0204 HF	1.5	1.5	1.8	4.5	1.7	1.2	1.6	4.1

**Notes**

- The given solder pad dimensions reflect the considerations for board design and assembly as outlined e.g. in standards IEC 61188-5-x<sup>(1)</sup>, or in publication IPC-7351.

<sup>(1)</sup> The quoted IEC standards are also released as EN standards with the same number and identical contents.



**HISTORICAL 12NC INFORMATION**

- The resistors had a 12-digit numeric code starting with 2312.
- The subsequent 4 digits indicated the resistor type, specification and packaging; see the 12NC table.
- The remaining 4 digits indicated the resistance value:
  - The first 3 digits indicated the resistance value.
  - The last digit indicated the resistance decade in accordance with the 12NC Indicating Resistance Decade table.

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

RESISTANCE DECADE	LAST DIGIT
10 Ω to 99.9 Ω	9
100 Ω to 999 Ω	1

**Historical 12NC Example**

The 12NC of a CMA 0204 HF resistor, value 50 Ω with ± 2 % tolerance, supplied in blister tape of 3000 units per reel was: 2312 158 25009.

HISTORICAL 12NC - Resistor Type and Packaging		
DESCRIPTION		CODE 2312 ... ..
		BLISTER TAPE ON REEL
TYPE	TOL.	BL 3000 UNITS
CMA 0204 HF	± 2 %	158 2....



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