High Pulse Load Carbon Film MELF Resistors

VDE REG.-Nr. B583

CMB 0207 specialty MELF resistors with advanced pulse load capability are the perfect choice for the protection of circuitry with signal and mains input lines from surge pulses. The resistors are also suitable for circuits exposed to high levels of electromagnetic interference or electro-static discharge. The applications are in all fields of automotive, telecommunication, industrial and medical equipment.

FEATURES

- Approved to the safety requirements of IEC 60065, 14.1.a* (= VDE 0860, 14.1.a) VDE-REG.-Nr. B583
- AEC-Q200 qualified
- Special carbon film technology
- Up to 10 kV or 17 kW single pulse capability
- ESD capability: 16 kV, Human Body Model
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE GRADE

Pb-free

RoHS COMPLIANT

GREEN (5-2008)

APPLICATIONS

- Automotive
- Telecommunication
- Industrial
- Medical equipment

METRIC SIZE	
DIN	0207
CECC	RC 6123M

TECHNICAL SPECIFICATIONS		
DESCRIPTION	**CMB 0207**	
CECC size	RC 6123M	
Resistance range	2.2 Ω to 1.5 MΩ	
Resistance tolerance	± 5 %; ± 2 %; ± 1 %	
Temperature coefficient	See TCR graph	
Operation mode	Standard	Power
Climatic category (LCT/UCT/days)	55/125/56	55/155/56
Rated dissipation, P_{70} (1)	0.4 W	1.0 W (2)
Operating voltage, $U_{max.}$ AC/DC	500 V	
Film temperature	125 °C	155 °C
Max. resistance change at P_{70} for resistance range, $\Delta R/R$ after:	2.2 Ω to 10 kΩ	
1000 h	≤ 0.5 %	≤ 1 %
8000 h	≤ 1 %	≤ 2 %
225 000 h	t.b.f	-
Permissible voltage against ambient (insulation):		
1 min; U_{ins}	750 V	
Continuous	75 V	
Failure rate: $FIT_{observed}$	≤ 0.1 x 10^{-9}/h	

Notes

- 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.

(1) The power dissipation on the resistor generates a temperature rise against the local ambient, depending on the heatflow support of the printed-circuit board (thermal resistance). The rated dissipation applies only if the permitted film temperature is not exceeded. Furthermore, a high level of ambient temperature or of power dissipation may raise the temperature of the solder joint, hence special solder alloys or board materials may be required to maintain the reliability of the assembly.

(2) Specified power rating requires dedicated heat-sink pads.

For technical questions, contact: melf@vishay.com

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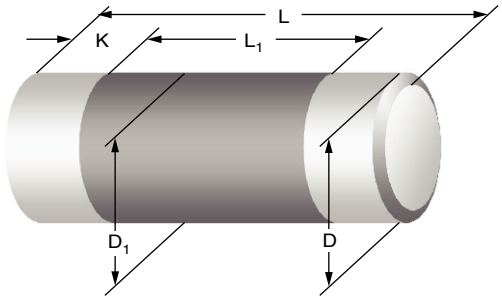
DIMENSIONS

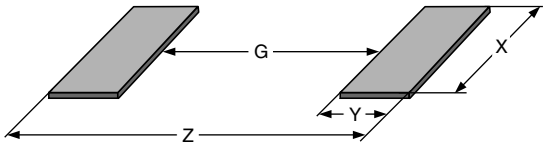


DIMENSIONS AND MASS						
TYPE	L (mm)	D (mm)	L_1 MIN. (mm)	D_1 (mm)	K (mm)	MASS (mg)
CMB 0207	5.8 + 0/- 0.15	2.2 + 0/- 0.2	3.2	D + 0/- 0.2	1.15 ± 0.1	79

Note

- Color code marking is applied according to IEC 60062 (3) in four bands. 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. An interrupted brown band between the 2nd and 3rd full band indicates the special carbon film type.

PATTERN STYLES FOR MELF RESISTORS



RECOMMENDED SOLDER PAD DIMENSIONS								
TYPE	WAVE SOLDERING				REFLOW SOLDERING			
	G (mm)	Y (mm)	X (mm)	Z (mm)	G (mm)	Y (mm)	X (mm)	Z (mm)
CMB 0207	2.8	2.1	2.6	7.0	3.2	1.7	2.4	6.6

Note

- The given solder pad dimensions reflect the considerations for board design and assembly as outlined e.g. in standards IEC 61188-5-x, or in publication IPC-7351. They do not guarantee any supposed thermal properties, however, they will be found adequate for most general applications.

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PART NUMBER AND PRODUCT DESCRIPTION

Part Number: CMB02070X4701GB200

C	M	B	0	2	0	7	0	X	4	7	0	1	G	B	2	0	0

MODEL/SIZE	VERSION	TCR	VALUE	TOLERANCE	PACKAGING	SPECIAL
CMB0207	**0** = Neutral	**X** = No indication	3 digit value 1 digit multiplier **Multiplier** **8** = $*10^{-2}$ **9** = $*10^{-1}$ **0** = $*10^{0}$ **1** = $*10^{1}$ **2** = $*10^{2}$ **3** = $*10^{3}$ **4** = $*10^{4}$	**J** = ± 5 % **G** = ± 2 % **F** = ± 1 %	**B2** **B7**	Up to 2 digits **00** = Standard

Product Description: CMB 0207 2 % B2 4K7

CMB	0207	2 %	B2	4K7
MODEL	SIZE	TOLERANCE	PACKAGING	RESISTANCE VALUE
CMB	**0207**	**± 5 %** **± 2 %** **± 1 %**	**B2** **B7**	**100R** = 100 Ω **4K7** = 4.7 kΩ

Note

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

PACKAGING

MODEL	BLISTER TAPE ON REEL ACC. IEC 60286-3, TYPE II		
	DIAMETER	QUANTITY	CODE
CMB 0207	180 mm/7"	2000	B2
	330 mm/13"	7000	B7

TOLERANCE AND RESISTANCE RANGE

DESCRIPTION	RESISTANCE VALUE (1)
TOLERANCE	**CMB 0207**
± 5 %	2.2 Ω to 15 Ω
± 2 %	16 Ω to 1.5 MΩ
± 1 %	16 Ω to 1 MΩ

Note

(1) Please select resistance values for ± 5 % and ± 2 % tolerance from the E24 series.

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DESCRIPTION

Production of the CMB 0207 specialty 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 (Al_2O_3). Nickel plated steel termination caps are firmly pressed on the coated rods. Products with a resistance of 15 Ω or lower are made without trimming, whereas a special laser is used to achieve a target value of 16 Ω or above by smoothly cutting a helical groove 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 tin on nickel plating. Four color code rings designate the resistance value and tolerance in accordance with **IEC 60062** [3].

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** [3].

ASSEMBLY

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow or vapour phase as shown in **IEC 61760-1** [3]. 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 resistors are completely lead (Pb)-free, the pure tin plating provides compatibility with lead (Pb)-free soldering processes. The immunity of the plating against tin whisker growth has been proven under extensive testing.

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, if applied, shall be qualified by appropriate means to ensure the long-term stability of the whole system.

All products comply with the **GADSL** [1] and the **CEFIC-EECA-EICTA** [2] list of legal restrictions on hazardous substances. This includes full compliance with the following directives:

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

Solderability is specified for 2 years after production or requalification. The permitted storage time is 20 years.

APPROVALS

Where applicable the resistors are tested in accordance with **EN 140401-803** which refers to **EN 60115-1, EN 140400** and the variety of environmental test procedures of the **IEC 60068** [3] series.

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.

RELATED PRODUCTS

- "Professional MELF Resistors" (www.vishay.com/doc?28713)
- "Precision MELF Resistors" (www.vishay.com/doc?28714)
- "High Pulse Load Carbon Film MELF Resistors" (www.vishay.com/doc?28717)

Notes

(1) Global Automotive Declarable Substance List, see 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=995 → issues → environment policy → chemicals → chemicals for electronics.

(3) The quoted IEC standards are also released as EN standards with the same number and identical contents.

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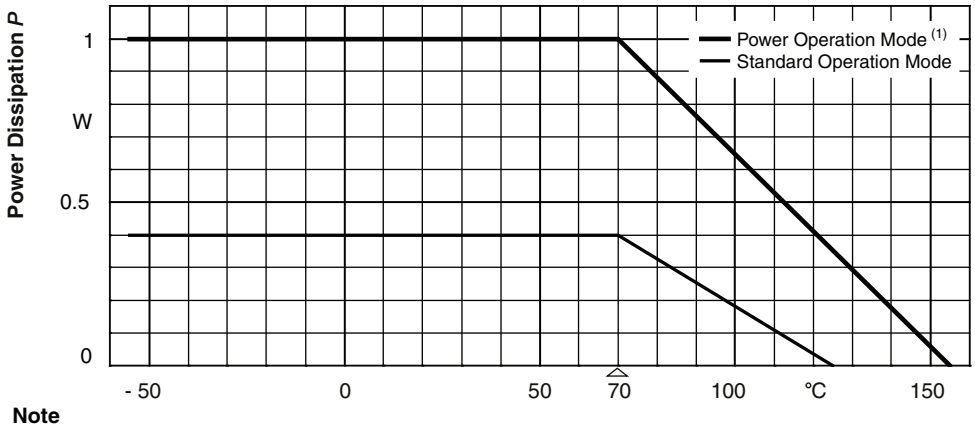
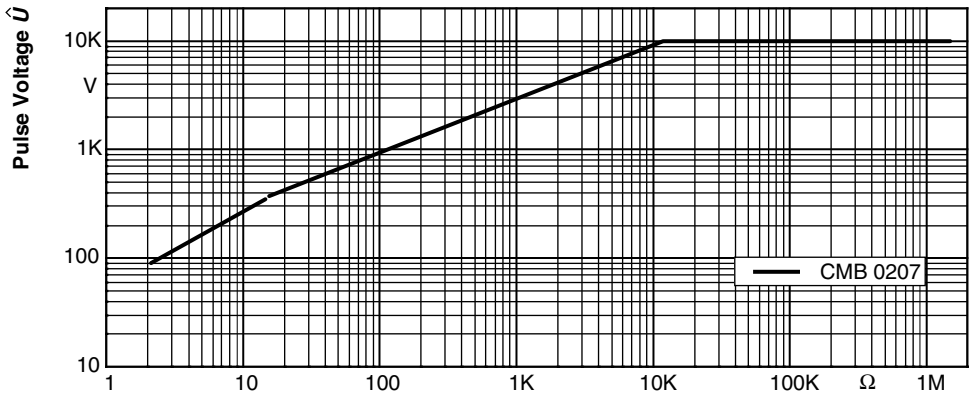
FUNCTIONAL PERFORMANCE



Note

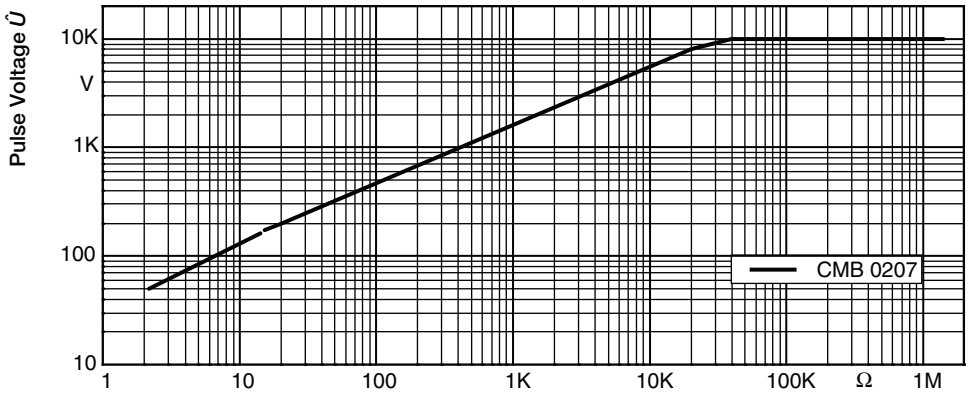
(1) Specified power rating requires dedicated heat sink pads

Derating



Pulse load rating in accordance with IEC 60115-1, 4.27; 1.2 µs/50 µs;
5 pulses at 12 s intervals; for permissible resistance change 0.5 %

1.2/50 Pulse



Pulse load rating in accordance with IEC 60115-1, 4.27; 10 µs/700 µs;
10 pulses at 1 minute intervals; for permissible resistance change 0.5 %

10/700 Pulse

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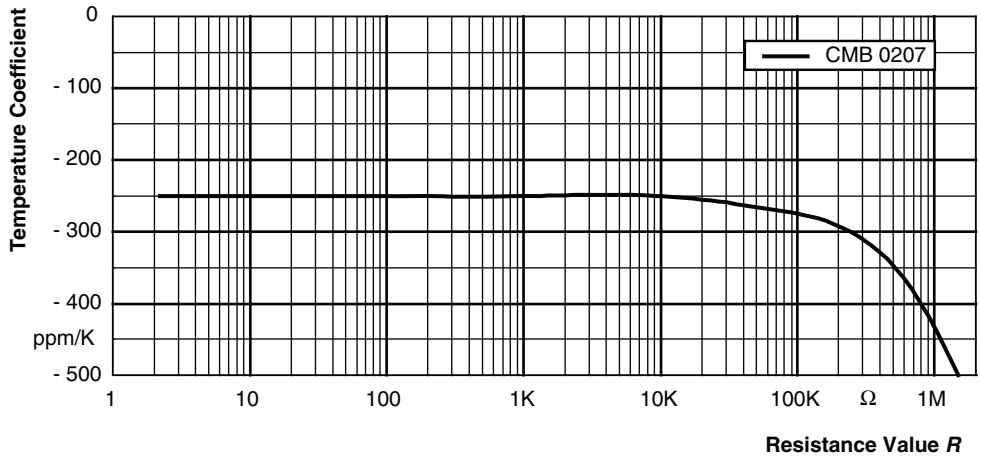
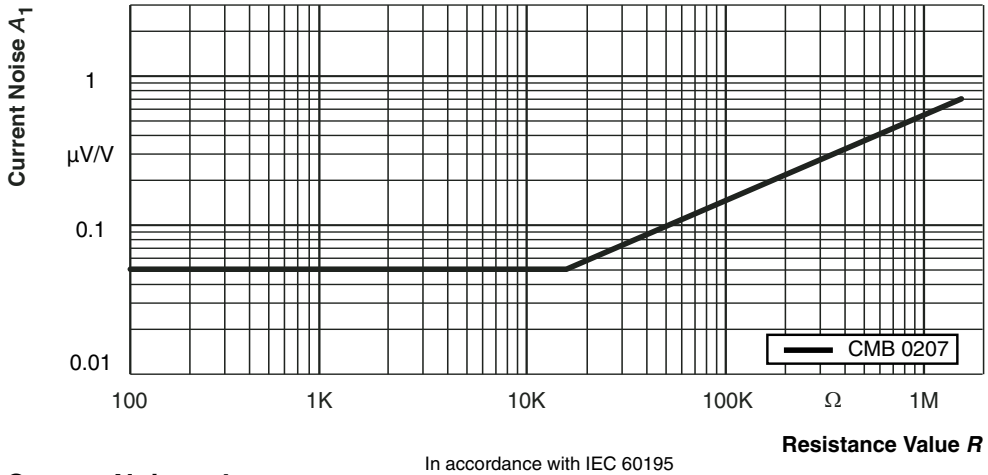


Temperature Coefficent (TCR) (typical curve)



In accordance with IEC 60195

Current Noise - A_1

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
1 Ω to 9.99 Ω	8
10 Ω to 99.9 Ω	9
100 Ω to 999 Ω	1
1 kΩ to 9.99 kΩ	2
10 kΩ to 99.9 kΩ	3
100 kΩ to 999 kΩ	4
1 MΩ to 9.99 MΩ	5

Historical 12NC Example

The 12NC of a CMB 0207 resistor, value 47 kΩ with ± 2 % tolerance, supplied in blister tape of 2000 units per reel was: 2312 199 24703.

HISTORICAL 12NC - Resistor Type and Packaging			
DESCRIPTION		**CODE 2312 ... .**	
		BLISTER TAPE ON REEL	
TYPE	**TOL.**	**B2 2000 UNITS**	**B7 7000 UNITS**
CMB 0207	± 5 %	199 3....	189 3....
	± 2 %	199 2....	189 2....
	± 1 %	199 1....	189 1....

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Material Category Policy

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.

Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.

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