THE DATASHEET OF

CBB0207004701GC100

High Pulse Load Carbon Film Leaded Resistors

CBB 0207 leaded resistors with advanced pulse load capability, are the perfect choice for circuitries exposed to high levels of electromagnetic interference or electrostatic discharge. The resistors can also be used to protect the circuitry of signal and mains input lines from surge pulses. Applications are in all fields of automotive, telecommunication and industrial equipment.

FEATURES

- Pulse load capability up to 6 kV or 140 W
- Specialty product for ESD and EMC sensitive applications
- Special carbon film technology for maximum heat stress capability
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS COMPLIANT
HALOGEN FREE
GREEN (5-2008)

APPLICATIONS

- Automotive
- Telecommunication
- Industrial equipment

TECHNICAL SPECIFICATIONS	
DESCRIPTION	**CBB 0207**
Resistance range	10 Ω to 1.5 MΩ
Res. Tolerance	± 2 %
Temperature coefficient	Refer to temperature coefficient graph
Rated dissipation, P_{70}	0.6 W
Operating voltage, $U_{max.}$ AC/DC	350 V
Maximum permissible film temperature	155 °C
Max. resistance change at P_{70} for resistance range, $\Delta R/R$ after:	10 Ω to 100 kΩ
1000 h	± 2 %
8000 h	+5 % / -4 %
Permissible voltage against ambient (insulation):	
1 min; U_{ins}	500 V
Continuous	75 V
Failure rate: $FIT_{observed}$	≤ 0.1 x 10^{-9}/h

APPLICATION INFORMATION

The power dissipation on the resistor generates a temperature rise against the local ambient, depending on the heat flow 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.

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. The designer may estimate the performance of the particular resistor application or set certain load and temperature limits in order to maintain a desired stability.

For technical questions, contact: filmresistorsleaded@vishay.com

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MAXIMUM RESISTANCE CHANGE AT RATED DISSIPATION

OPERATIONE MODE		STANDARD	POWER
Climatic category		-55 °C / +125 °C / 56 days	-55 °C / +155 °C / 56 days
Rated dissipation, P_{70}	CBB 0207	0.4 W	0.6 W
Applied maximum film temperature, $\vartheta_{F\ max.}$		125 °C	155 °C
Max. resistance change at rated dissipation $\lvert\Delta R/R_{max.}\rvert$, after:	CBB 0207	10 Ω to 100 kΩ	
	1000 h	≤ ± (1 % R + 0.05 Ω)	≤ ± (2 % R + 0.05 Ω)
	8000 h	≤ +(3 % R + 0.05 Ω) -(2 % R + 0.05 Ω)	≤ +(5 % R + 0.05 Ω) -(4 % R + 0.05 Ω)

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE

TYPE / SIZE	TCR	TOLERANCE	RESISTANCE	E-SERIES
CBB 0207	-250 ppm/K [1]	± 2 %	10 Ω to 1.5 MΩ	E24

Note

[1] This TCR figure is exhibited by most ohmic values up to 10 kΩ, for detailed information please see TCR curve on page 6.

PART NUMBER AND PRODUCT DESCRIPTION

Part Number: CBB0207001501GC100

C	B	B	0	2	0	7	0	0	1	5	0	1	G	C	1	0	0

TYPE / SIZE	SPECIAL CHARACTER	TCR	VALUE	TOLERANCE	PACKAGING	SPECIAL
CBB0207	**0** = neutral	**0** = standard **See TCR graph**	3 digit value 1 digit multiplier **Multiplier** **9** = $*10^{-1}$ **0** = $*10^{0}$ **1** = $*10^{1}$ **2** = $*10^{2}$ **3** = $*10^{3}$ **4** = $*10^{4}$	**G** = ± 2 %	**CT** **C1**	up to 2 digits **00** = standard

Product Description: CBB 0207 2 % C1 1K5

CBB	0207	2 %	C1	1K5
TYPE	SIZE	TOLERANCE	PACKAGING	RESISTANCE VALUE
CBB	**0207**	**± 2 %**	**CT** **C1**	**47K** = 47 kΩ **51R1** = 51.1 Ω

PACKAGING

TYPE / SIZE	CODE	QUANTITY	PACKAGING STYLE	WIDTH	PITCH	DIMENSIONS
CBB 0207	CT	5000	Taped acc. to IEC 60286-1 fan-folded in a box	52 mm	5 mm	77 mm x 82 mm x 324 mm
	C1	1000				74 mm x 42 mm x 184 mm

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DESCRIPTION

Production 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_2O_3) and conditioned to achieve the desired temperature coefficient. Nickel plated steel termination caps are firmly pressed on the rods. A special laser is used to achieve the target value by smoothly cutting a helical groove in the resistive layer without damaging the ceramics. Connecting wires of electrolytic copper plated with 100 % tin are welded to the termination caps. The resistors are covered by protective coating designed for electrical, mechanical and climatic protection. Five color code rings designate the resistance value and tolerance in accordance with **IEC 60062** [(1)].

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 wave or dipping. The encapsulation is resistant to all cleaning solvents [(3)] 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 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.

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
- The Global Automotive Declarable Substance List (GADSL) [(2)]
- The REACH regulation (1907/2006/EC) and the related list of substances with very high concern (SVHC) [(3)] 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.
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.

APPROVALS

Where applicable, the resistors are tested in accordance with **EN 140101-806 (successor of 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.

Notes

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

(2) Global Automotive Declarable Substance List, see www.gadsl.org. All products comply with the IEC 62474, Material Declaration for Products of and for the Electrotechnical Industry.
CEFIC (European Chemical Industry Council), EECA (European Electronic Component Manufacturers Association), EICTA (European trade organization representing the information and communications technology and consumer electronics), see www.digitaleurope.org/SearchResults.aspx?Search=eicta.

(3) Other cleaning solvents with aggressive chemicals should be evaluated in actual cleaning process for their suitability.

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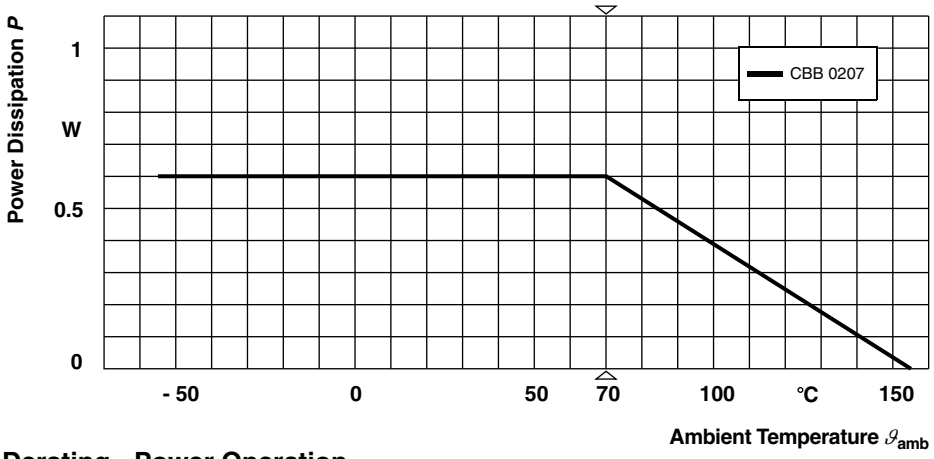
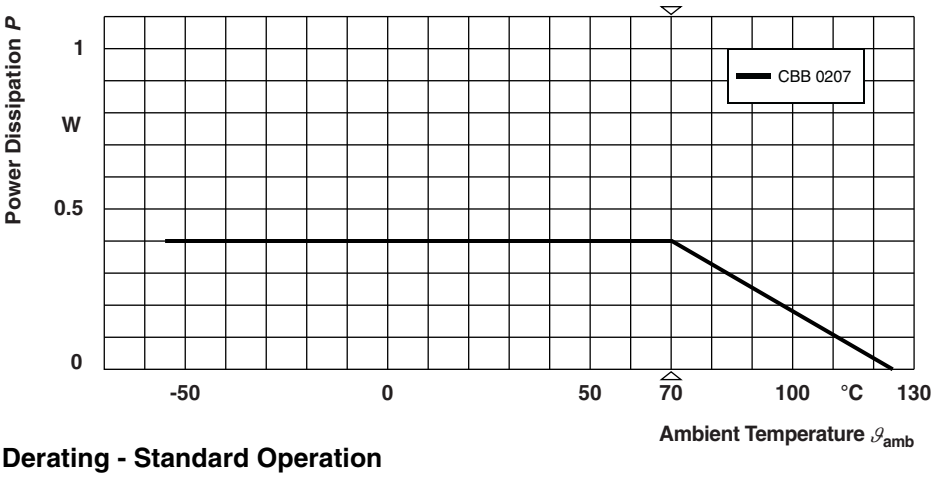
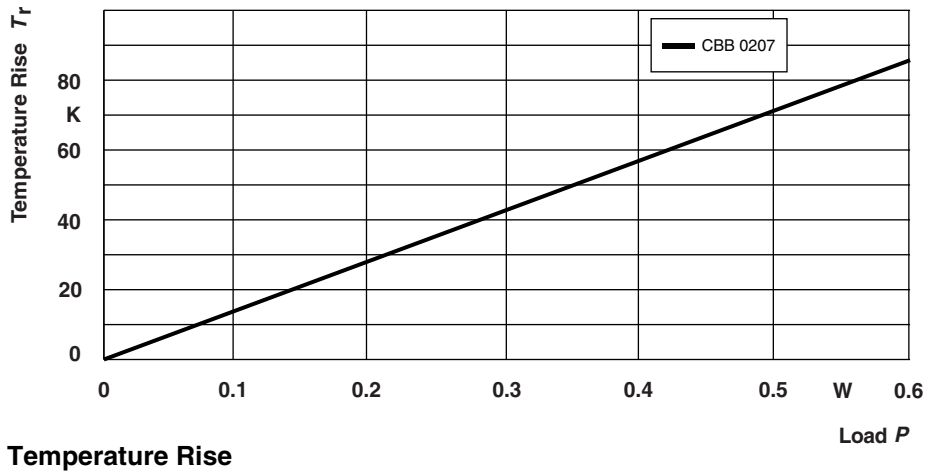
FUNCTIONAL DESCRIPTION



Derating - Power Operation



Derating - Standard Operation



Temperature Rise

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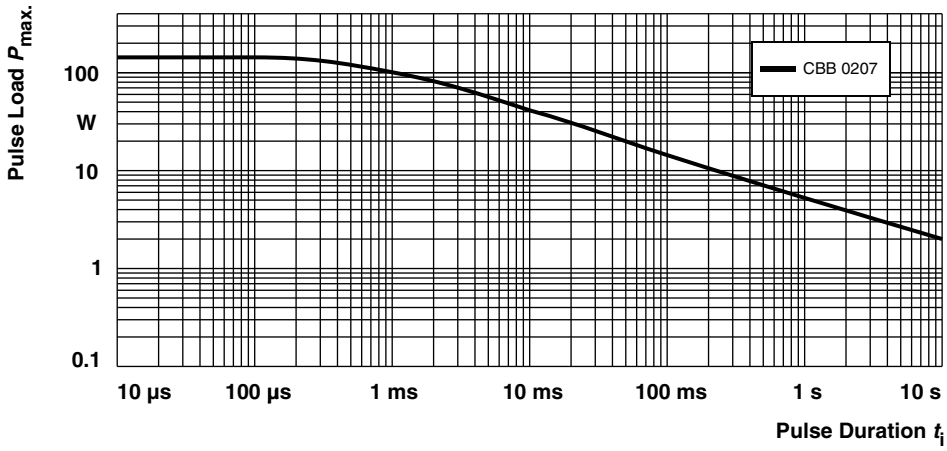
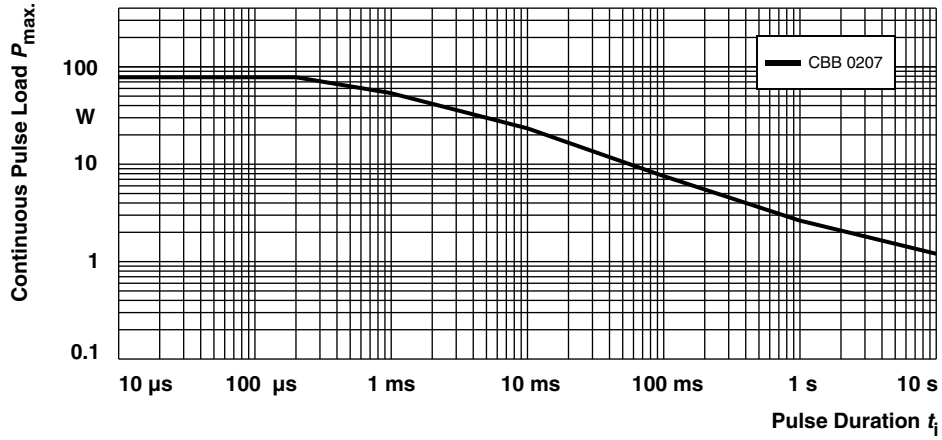


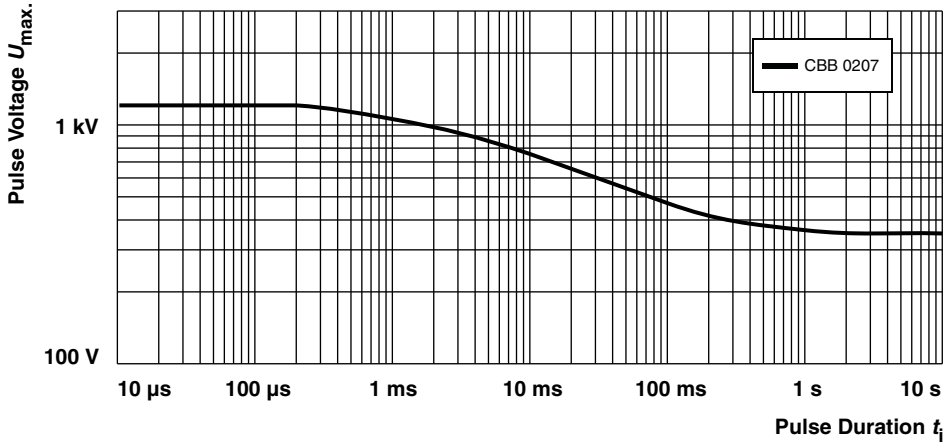
Maximum pulse load, single pulse; for permissible resistance change equivalent to 8000 h operation.

Single Pulse



Maximum pulse load, continuous pulses; for permissible resistance change equivalent to 8000 h operation.

Continuous Pulse



Maximum pulse voltage, single and continuous pulses; for permissible resistance change equivalent to 8000 h operation.

Pulse Voltage

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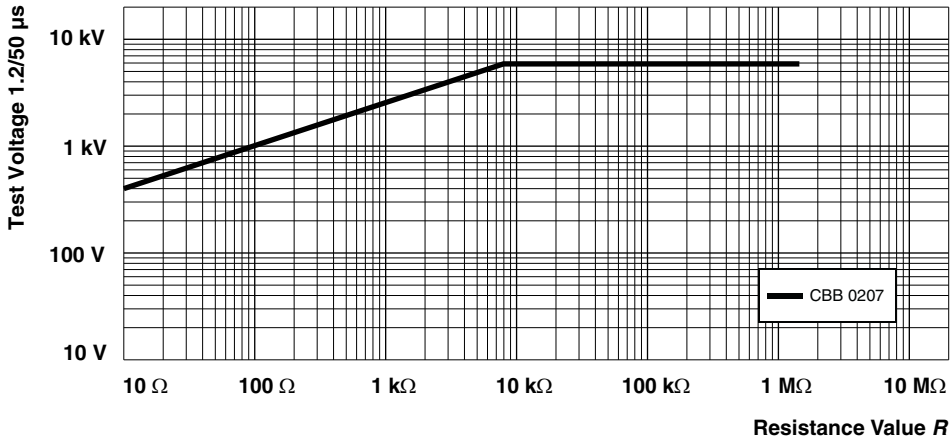
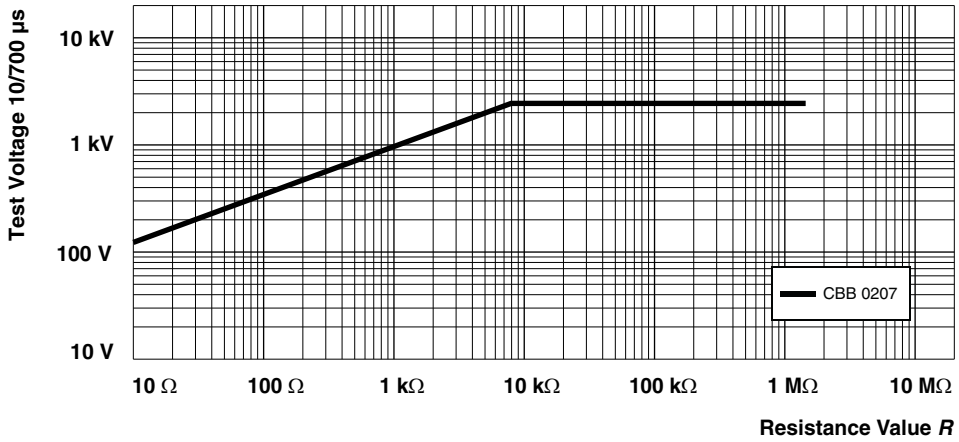


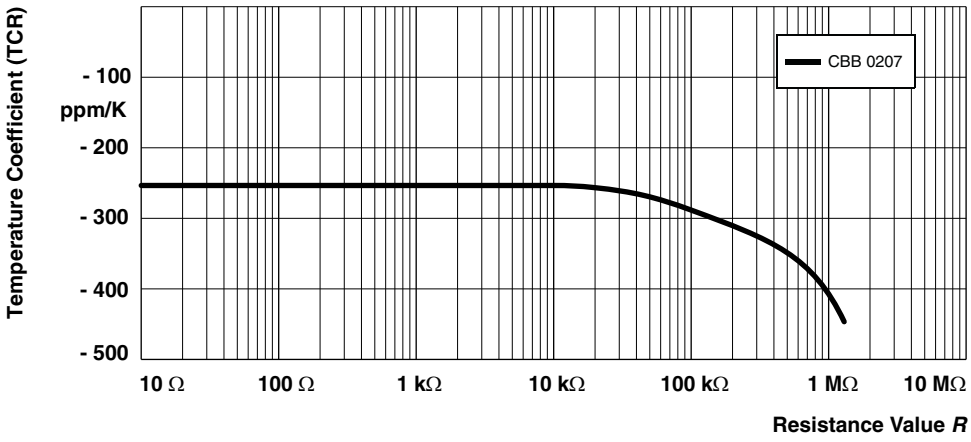
Pulse load rating in accordance with IEC 60115-1, 4.27; 1.2 µs/50 µs; 5 pulses at 12 s intervals; for permissible resistance change 0.5 %.

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



Temperature Coefficient (TCR)

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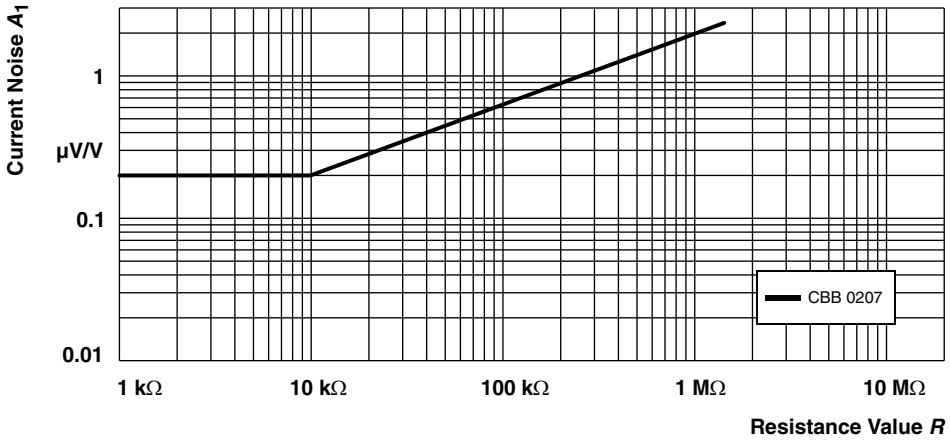

Current Noise - A_1 in accordance with IEC 60195

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)

EN 140101-806 (successor of 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 60068-2-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).

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-xx test methods. A short description of the test procedure is also given.

TEST PROCEDURES AND REQUIREMENTS

IEC 60115-1 CLAUSE	IEC 60068-2-xx TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R_{max.}$)
			Stability for product types:	
			CBB 0207	**10 Ω to 1.5 MΩ**
4.5	-	Resistance	-	± 2 %
4.7	-	Voltage proof	$U_{RMS} = U_{ins}$; 60 s	No flashover or breakdown
4.8	-	Temperature coefficient	At (20 / -55 / 20) °C and (20 / 155 / 20) °C	-
4.13	-	Short time overload	Room temperature; $U = 2.5 \times \sqrt{P_{70} \times R}$ or $U = 2 \times U_{max.}$; 5 s	± (0.5 % R + 0.1 Ω) no visible damage
4.16	21 (Ua_1) 21 (Ub) 21 (Uc)	Robustness of terminations	Tensile, bending and torsion	± (0.5 % R + 0.05 Ω)

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TEST PROCEDURES AND REQUIREMENTS				
IEC 60115-1 CLAUSE	**IEC 60068-2-xx TEST METHOD**	**TEST**	**PROCEDURE**	**REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R_{max.}$)**
			Stability for product types:	
			CBB 0207	**10 Ω to 1.5 MΩ**
4.17	20 (Ta)	Solderability	+235 °C; 2 s solder bath method SnPb40	Good tinning (≥ 95 % covered, no visible damage)
			+245 °C; 3 s solder bath method SnAG3Cu0.5	
4.18.2	20 (Tb)	Resistance to soldering heat	Unmounted components; (260 ± 3) °C; (10 ± 1) s	± (0.5 % R + 0.05 Ω) no visible damage
4.19	14 (Na)	Rapid change of temperature	30 min at LCT = -55 °C and 30 min at UCT = 155 °C; 200 cycles	± (0.5 % R + 0.05 Ω) no visible damage
4.22	6 (B4)	Vibration	6 h; 10 Hz to 2000 Hz 1.5 mm or 196 m/s^2	± (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; 90 % to 100 % RH; 5 cycles	± (1 % R + 0.1 Ω) no visible damage
4.23.7		DC load	apply rated power for 1 min	
4.24	78 (Cab)	Damp heat, steady state	(40 ± 2) °C; 56 days; (93 ± 3) % RH	± (1 % R + 0.1 Ω)
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	 ± (1 % R + 0.05 Ω) +(3 % R + 0.05 Ω) -(2 % R + 0.05 Ω)
	-	Endurance at 70 °C: power 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	 ± (2 % R + 0.05 Ω) +(5 % R + 0.05 Ω) -(4 % R + 0.05 Ω)
4.25.3	-	Endurance at upper category temperature	125 °C; 1000 h 155 °C; 1000 h	± (2 % R + 0.05 Ω) ± (4 % R + 0.1 Ω)
4.29	45 (XA)	Component solvent resistance	Isopropyl alcohol +23 °C; toothbrush method	Marking legible; no visible damage
4.40	-	Electrostatic discharge (human body model)	IEC 61340-3-1; 3 pos. + 3 neg. 16 kV	± (0.5 % R + 0.05 Ω)

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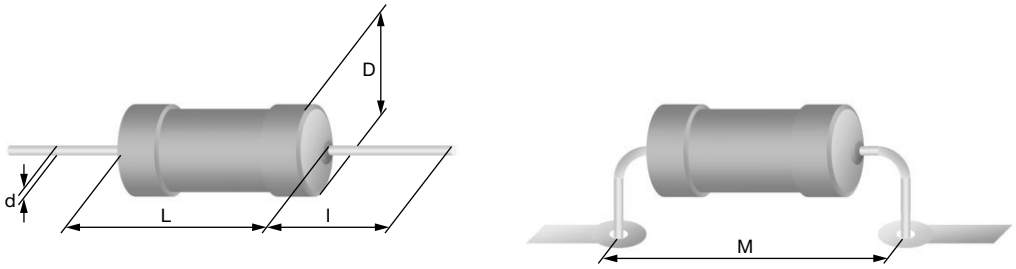
DIMENSIONS



DIMENSIONS AND MASS						
TYPE	$D_{max.}$ (mm)	$L_{max.}$ (mm)	$d_{nom.}$ (mm)	$l_{min.}$ (mm)	$M_{min.}$ (mm)	MASS (mg)
CBB 0207	2.5	6.3	0.6	28.0	10.0	220

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 Resistance Decade table.

Resistance Decade

RESISTANCE DECADE	LAST DIGIT
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

12NC Example

The 12NC of a CBB 0207 resistor, value 47 kΩ with ± 2 % tolerance, supplied on bandoleer in a box of 5000 units was: 2312 955 24703.

HISTORICAL 12NC - Resistor Type and Packaging			
DESCRIPTION		CODE 2312	
		BLISTER TAPE ON REEL	
TYPE	TOL.	C1 1000 UNITS	CT 5000 UNITS
CBB 0207	± 2 %	950 2....	955 2....

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