

## 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.

| METRIC SIZE |      |
|-------------|------|
| DIN         | 0207 |
| CECC        | B    |

### FEATURES

- Speciality product for EMC sensitive applications
- Special carbon film technology for maximum heat stress capability
- Up to 6 kV or 140 W pulse load capability
- Resistance range: 10 Ω to 1.5 MΩ
- Lead (Pb)-free solder contacts
- Pure tin plating provides compatibility with lead (Pb)-free and lead containing soldering processes
- Compliant to RoHS directive 2002/95/EC



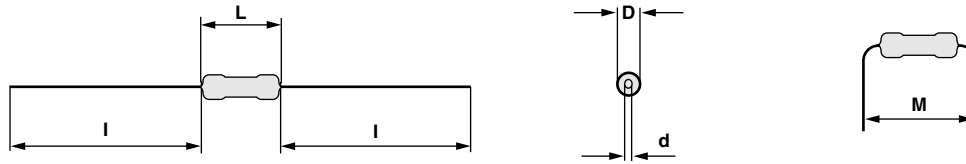
### APPLICATIONS

- Automotive
- Telecommunication
- Industrial equipment

| TECHNICAL SPECIFICATIONS                                                           |                                        |             |
|------------------------------------------------------------------------------------|----------------------------------------|-------------|
| DESCRIPTION                                                                        | CBB 0207                               |             |
| CECC Size                                                                          | B                                      |             |
| Resistance Range                                                                   | 10 Ω to 1.5 MΩ                         |             |
| Resistance Tolerance                                                               | ± 2 %                                  |             |
| Temperature Coefficient                                                            | Refer to Temperature Coefficient graph |             |
| Operation Mode                                                                     | Long term                              | Standard    |
| Climatic Category (LCT/UCT/Days)                                                   | 55/125/56                              | 55/155/56   |
| Rated Dissipation, $P_{70}$                                                        | 0.4 W                                  | 0.6 W       |
| Operating Voltage, $U_{max}$ , AC/DC                                               | 350 V                                  |             |
| Film Temperature                                                                   | 125 °C                                 | 155 °C      |
| Max. Resistance Change at $P_{70}$ for Resistance Range, $\Delta R/R$ max., After: | 10 Ω to 100 kΩ                         |             |
|                                                                                    | ± 1 %                                  | ± 2 %       |
|                                                                                    | + 3 %/- 1 %                            | + 5 %/- 2 % |
| Permissible Voltage Against Ambient:                                               | 500 V                                  |             |
|                                                                                    | 75 V                                   |             |
| Failure Rate: FIT <sub>observed</sub>                                              | ≤ 0.1 x 10 <sup>-9</sup> /h            |             |

#### Note

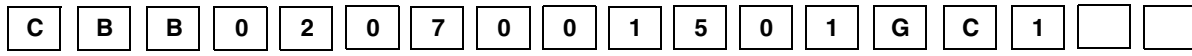
- These resistors do not feature a limited lifetime when operated within the permissible limits. However, resistance value drift increasing over operating time may result in exceeding a limit acceptable to the specific application, thereby establishing a functional lifetime.

**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) | l <sub>min.</sub> (mm) | M <sub>min.</sub> (mm) | MASS (mg) |
|----------|------------------------|------------------------|------------------------|------------------------|------------------------|-----------|
| CBB 0207 | 2.5                    | 6.3                    | 0.6                    | 28.0                   | 10.0                   | 220       |

**PART NUMBER AND PRODUCT DESCRIPTION**

PART NUMBER: CBB0207001501G C1



| MODEL/SIZE | VARIANT     | TCR                           | VALUE                                                                                                                                                                                                                                                                                                      | TOLERANCE | PACKAGING <sup>(1)</sup> | SPECIAL                         |
|------------|-------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------------------|---------------------------------|
| CBB0207    | 0 = Neutral | 0 = Standard<br>See TCR graph | <b>3 digit value</b><br><b>1 digit multiplier</b><br><b>MULTIPLIER</b><br>7 = *10 <sup>-3</sup> 2 = *10 <sup>2</sup><br>8 = *10 <sup>-2</sup> 3 = *10 <sup>3</sup><br>9 = *10 <sup>-1</sup> 4 = *10 <sup>4</sup><br>0 = *10 <sup>0</sup> 5 = *10 <sup>5</sup><br>1 = *10 <sup>1</sup> 6 = *10 <sup>6</sup> | G = ± 2 % | CT<br>C1                 | Up to 2 digits<br>00 = Standard |

PRODUCT DESCRIPTION: CBB 0207 2 % C1 1K5

|            |             |            |                          |                              |
|------------|-------------|------------|--------------------------|------------------------------|
| <b>CBB</b> | <b>0207</b> | <b>2 %</b> | <b>C1</b>                | <b>1K5</b>                   |
| MODEL      | SIZE        | TOLERANCE  | PACKAGING <sup>(1)</sup> | RESISTANCE VALUE             |
| CBB        | 0207        | ± 2 %      | CT<br>C1                 | 47K = 47 kΩ<br>51R1 = 51.1 Ω |

**Notes**
<sup>(1)</sup>Please refer to table PACKAGING

- The PART NUMBER is shown to facilitate the introduction of the unified part numbering system for ordering products

**PACKAGING**

| MODEL    | BOX          |          |
|----------|--------------|----------|
|          | PIECES/BOX   | CODE     |
| CBB 0207 | 1000<br>5000 | C1<br>CT |

**TOLERANCE AND RESISTANCE RANGE**

| TOLERANCE | RESISTANCE VALUE <sup>(1)</sup> |
|-----------|---------------------------------|
|           | CBB 0207                        |
| ± 2 %     | 10 Ω to 1.5 MΩ                  |

**Note**
<sup>(1)</sup>Resistance values to be selected from E24 series

## 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 %  $\text{Al}_2\text{O}_3$ ) 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% 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. Five colour code rings designate the resistance value and tolerance in accordance with **IEC 60062**.

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 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. 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 compliance 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**.

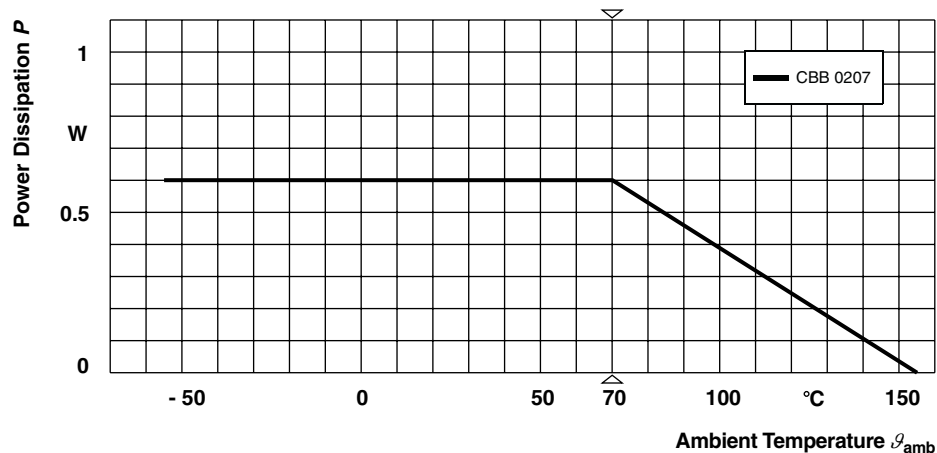
Vishay BEYSCHLAG has achieved “**Approval of Manufacturer**” in accordance with **IEC QC 001002-3, clause 2**. The release certificate for “**Technology Approval Schedule**” in accordance with **CECC 240001** based on **IEC QC 001002-3, clause 6** is granted for the Vishay BEYSCHLAG manufacturing process.

## Notes

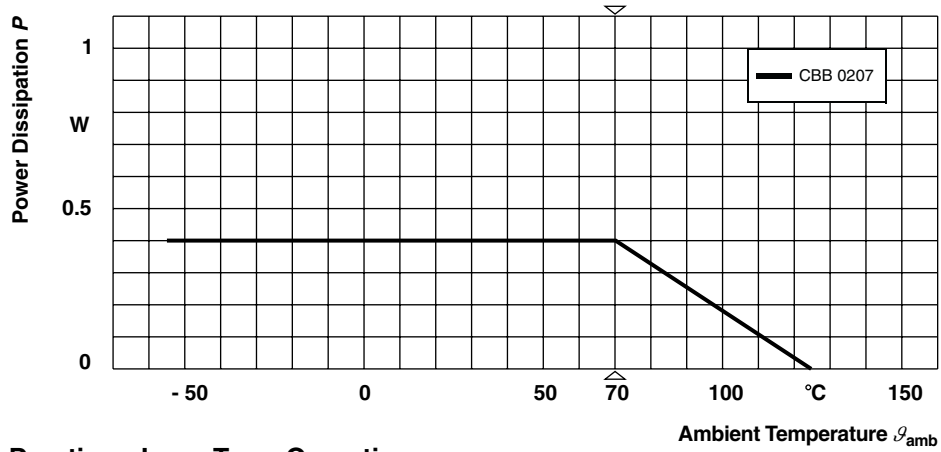
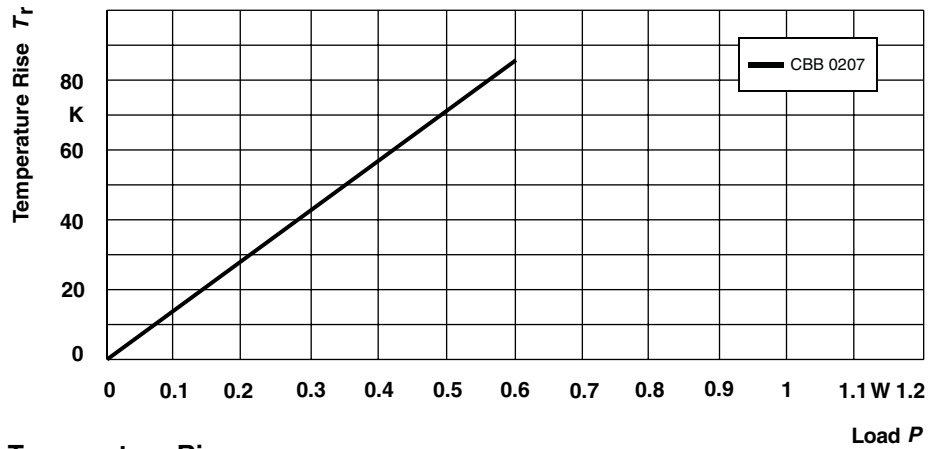
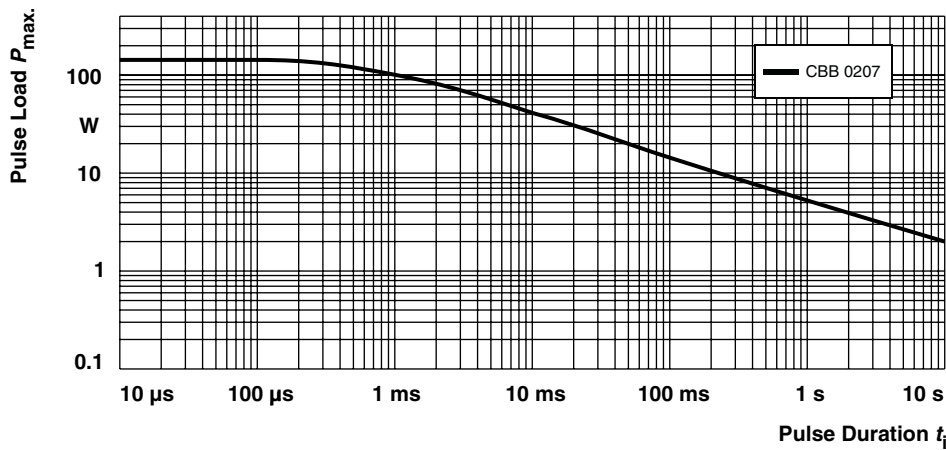
<sup>(1)</sup> Global Automotive Declarable Substance List, see [www.gadsl.org](http://www.gadsl.org)

<sup>(2)</sup> 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)

## FUNCTIONAL DESCRIPTION

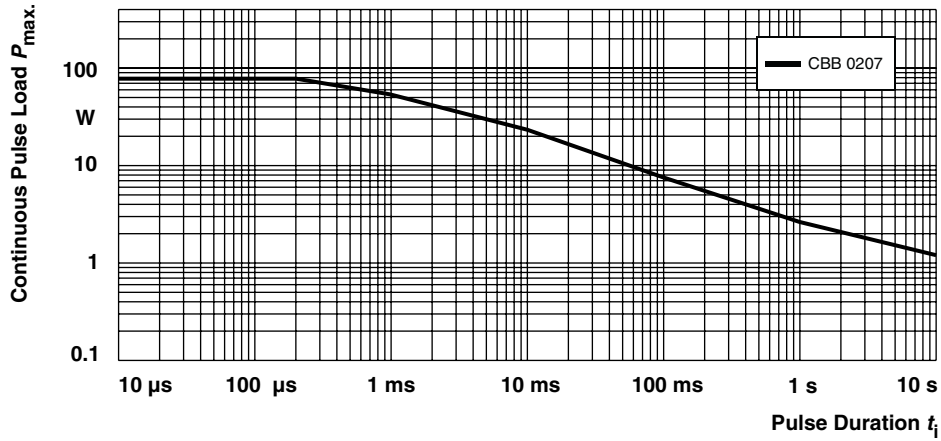


Derating - Standard Operation


**Derating - Long Term Operating**

**Temperature Rise**


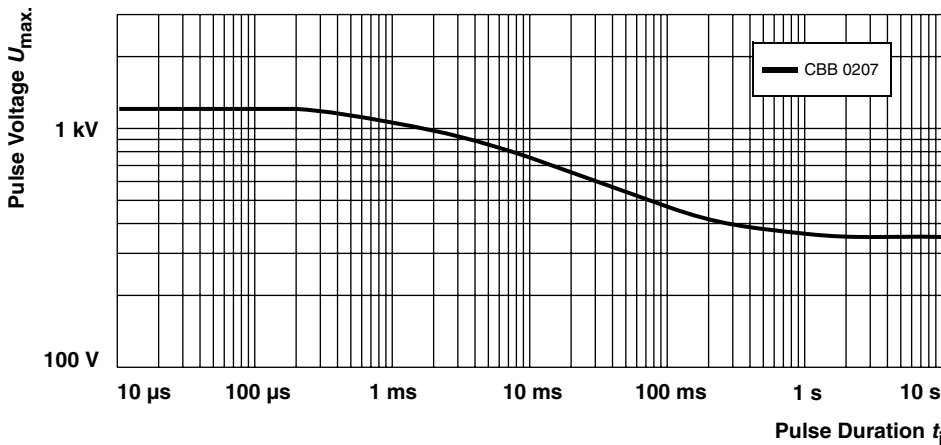
Maximum pulse load, single pulse; for permissible resistance change equivalent to 8000 h operation.

**Single Pulse**



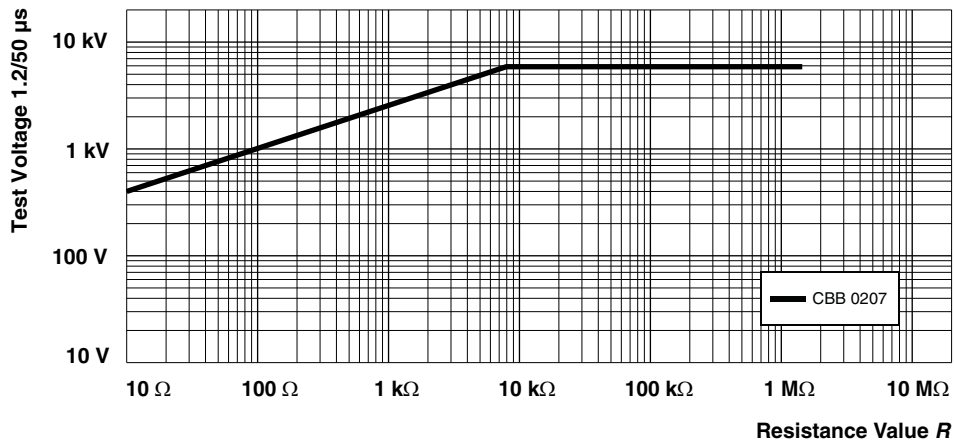
Maximum pulse load, continuous pulses; for permissible resistance change equivalent to 8000 h operation.

**Continuous Pulse**



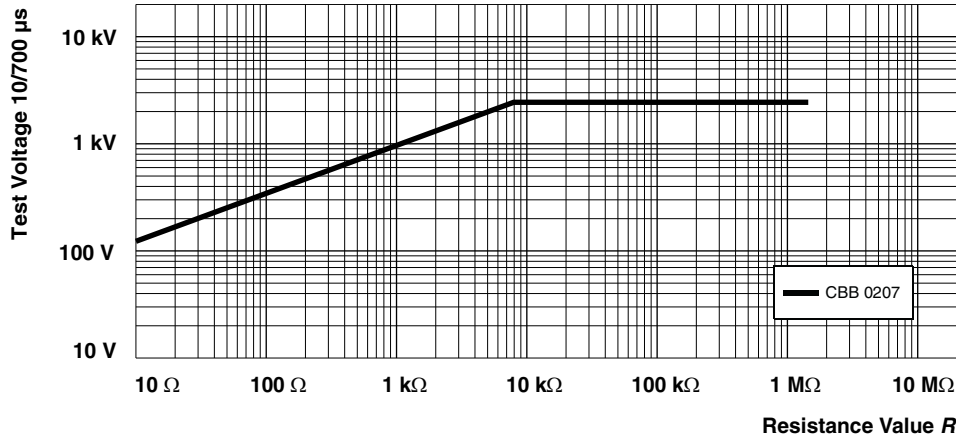
Maximum pulse voltage, single and continuous pulses; for permissible resistance change equivalent to 8000 h operation.

**Pulse Voltage**



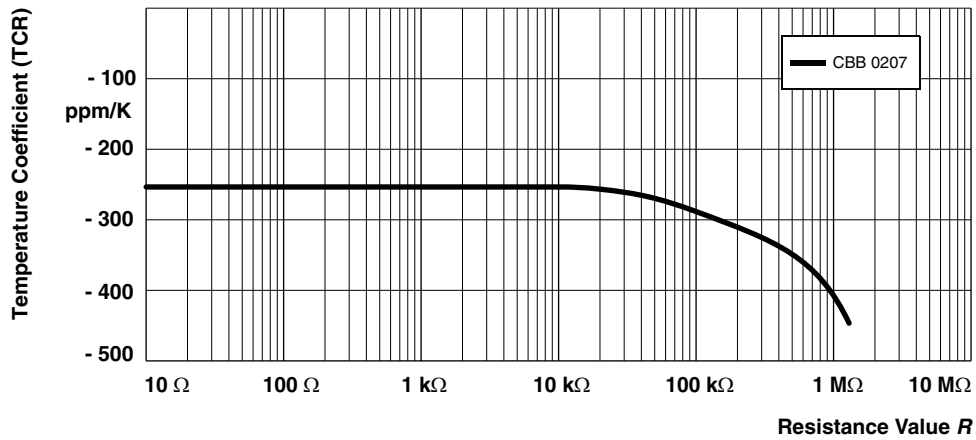
Pulse load rating in accordance with IEC 60115-1, 4.27; 1.2  $\mu$ s/50  $\mu$ s; 5 pulses at 12 s intervals; for permissible resistance change 0.5 %.

**1.2/50 Pulse**

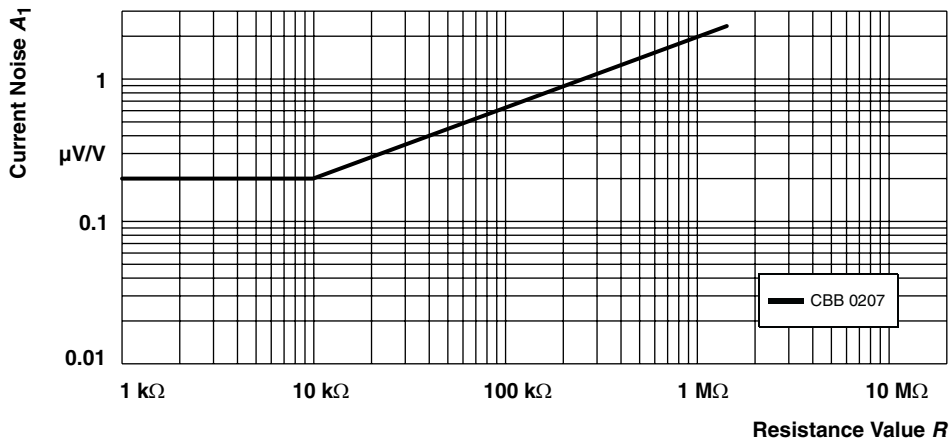


Pulse load rating in accordance with IEC 60115-1, 4.27; 10  $\mu$ s/ 700  $\mu$ s; 10 pulses at 1 minute intervals; for permissible resistance change 0.5 %.

### 10/700 Pulse



### Temperature Coefficient (TCR)



### 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)

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).

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-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 ( $\Delta R$ )             |
|                                  |                            |                                              | Stability for product types:                                                                            |                                                            |
|                                  |                            |                                              | <b>CBB 0207</b>                                                                                         | 10 $\Omega$ to 1.5 M $\Omega$                              |
| 4.5                              | -                          | Resistance                                   |                                                                                                         | $\pm 2\%$                                                  |
| 4.8                              | -                          | Temperature coefficient                      | At (20/LCT/20) °C and (20/UCT/20) °C                                                                    | -                                                          |
| 4.25.1                           | -                          | Endurance at 70 °C: standard operation mode  | $U = \sqrt{P_{70} \times R}$ or $U = U_{max.}$<br>1.5 h ON; 0.5 h OFF<br>70 °C; 1000 h<br>70 °C; 8000 h | $\pm (2\% R + 0.05 \Omega)$<br>$\pm (4\% R + 0.05 \Omega)$ |
| 4.25.1                           | -                          | Endurance at 70 °C: long term operation mode | $U = \sqrt{P_{70} \times R}$ or $U = U_{max.}$<br>1.5 h ON; 0.5 h OFF<br>70 °C; 1000 h<br>70 °C; 8000 h | $\pm (1\% R + 0.05 \Omega)$<br>$\pm (2\% R + 0.05 \Omega)$ |
| 4.25.3                           | -                          | Endurance at upper category temperature      | 125 °C; 1000 h<br>155 °C; 1000 h                                                                        | $\pm (2\% R + 0.05 \Omega)$<br>$\pm (4\% R + 0.1 \Omega)$  |
| 4.24                             | 78 (Cab)                   | Damp heat, steady state                      | (40 $\pm$ 2) °C; 56 days;<br>(93 $\pm$ 3) % RH                                                          | $\pm (1\% R + 0.1 \Omega)$                                 |
| 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;<br>90 % to 100 % RH;<br>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;<br>95 % to 100 % RH;<br>5 cycles                                                         | $\pm (1\% R + 0.1 \Omega)$<br>no visible damage            |
| -                                | 1 (Aa)                     | Cold                                         | - 55 °C; 2 h                                                                                            | $\pm (0.5\% R + 0.1 \Omega)$                               |



| <b>TEST PROCEDURES AND REQUIREMENTS</b> |                                             |                                            |                                                                                                 |                                                           |
|-----------------------------------------|---------------------------------------------|--------------------------------------------|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| IEC 60115-1 CLAUSE                      | IEC 60068-2-xx TEST METHOD                  | TEST                                       | PROCEDURE                                                                                       | REQUIREMENTS PERMISSIBLE CHANGE ( $\Delta R$ )            |
|                                         |                                             |                                            | Stability for product types:<br><b>CBB 0207</b>                                                 | 10 $\Omega$ to 1.5 M $\Omega$                             |
| 4.13                                    | -                                           | Short time overload                        | Room temperature;<br>$U = 2.5 \times \sqrt{P_{70}} \times R$ or<br>$U = 2 \times U_{max}$ ; 5 s | $\pm (0.5 \% R + 0.1 \Omega)$<br>no visible damage        |
| 4.19                                    | 14 (Na)                                     | Rapid change of temperature                | 30 min at LCT = - 55 °C and<br>30 min at UCT = 155 °C;<br>200 cycles                            | $\pm (0.5 \% R + 0.05 \Omega)$<br>no visible damage       |
| 4.29                                    | 45 (XA)                                     | Component solvent resistance               | Isopropyl alcohol + 23 °C;<br>toothbrush method                                                 | marking legible;<br>no visible damage                     |
| 4.18.2                                  | 20 (Tb)                                     | Resistance to soldering heat               | Unmounted components;<br>(260 $\pm$ 3) °C; (10 $\pm$ 1) s                                       | $\pm (0.5 \% R + 0.05 \Omega)$<br>no visible damage       |
| 4.17                                    | 20 (Ta)                                     | Solderability                              | + 235 °C; 2 s<br>solder bath method<br>SnPb40                                                   | Good tinning ( $\geq$ 95 % covered,<br>no visible damage) |
|                                         |                                             |                                            | + 245 °C; 3 s<br>solder bath method<br>SnAg3Cu0.5                                               |                                                           |
| 4.22                                    | 6 (B4)                                      | Vibration                                  | 6 h;<br>10 Hz to 2000 Hz<br>1.5 mm or 196 m/s <sup>2</sup>                                      | $\pm (0.5 \% R + 0.05 \Omega)$                            |
| 4.16                                    | 21 (Ua <sub>1</sub> )<br>21 (Ub)<br>21 (Uc) | Robustness of terminations                 | Tensile, bending and torsion                                                                    | $\pm (0.5 \% R + 0.05 \Omega)$                            |
| 4.7                                     | -                                           | Voltage proof                              | $U_{RMS} = U_{ins}$ ; 60 s                                                                      | No flashover or breakdown                                 |
| 4.40                                    | -                                           | Electrostatic discharge (human body model) | IEC 61340-3-1;<br>3 pos. + 3 neg.<br>16 kV                                                      | $\pm (0.5 \% R + 0.05 \Omega)$                            |

**12NC INFORMATION FOR HISTORICAL CODING REFERENCE**

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

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

| RESISTANCE DECADE                | LAST DIGIT |
|----------------------------------|------------|
| 10 $\Omega$ to 99.9 $\Omega$     | 9          |
| 100 $\Omega$ to 999 $\Omega$     | 1          |
| 1 k $\Omega$ to 9.99 k $\Omega$  | 2          |
| 10 k $\Omega$ to 99.9 k $\Omega$ | 3          |
| 100 k $\Omega$ to 999 k $\Omega$ | 4          |
| 1 M $\Omega$ to 9.99 M $\Omega$  | 5          |

**12NC Example**

The 12NC of a CBB 0207 resistor, value 47 k $\Omega$  with  $\pm 2 \%$  tolerance, supplied on bandolier in a box of 5000 units is: 2312 955 24703.

| <b>12NC - Resistor types and packaging</b> |            |                  |               |
|--------------------------------------------|------------|------------------|---------------|
| DESCRIPTION                                |            | 2312 ... ..      |               |
|                                            |            | BANDOLIER IN BOX |               |
| TYPE                                       | TOL.       | C1 1000 units    | CT 5000 units |
| CBB 0207                                   | $\pm 2 \%$ | 950 2....        | 955 2....     |

Resistance ranges printed in bold are preferred TCR/tolerance combinations with optimized availability.





## Disclaimer

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