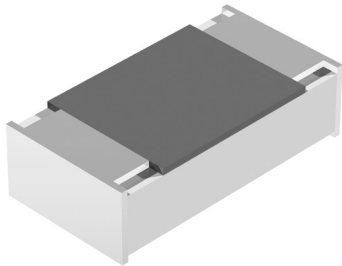


## Low Ohmic Flat Chip Resistors



NCT 0603 and NCU 0805 low ohmic flat chip resistors are best suited where low resistance paired with high stability and high reliability is required. Typical applications include current sensors and shunts in power supplies and battery chargers. Other demands for low ohmic resistors come from the computer industry.

### FEATURES

- Unique low ohmic chip resistor
- Standard TC:  $\pm 100$  ppm/K
- Excellent overall stability
- Wide low ohmic range:  $0.1 \Omega$  to  $< 1 \Omega$
- Green product, supports Lead (Pb)-free soldering.

### APPLICATIONS

- Power supplies
- Battery chargers
- Computer industry.

| METRIC SIZE |          |          |
|-------------|----------|----------|
| INCH:       | 0603     | 0805     |
| METRIC:     | RR 1608M | RR 2012M |

| TECHNICAL SPECIFICATIONS   |                                  |                              |                                  |                              |
|--|----------------------------------|------------------------------|----------------------------------|------------------------------|
| DESCRIPTION  | NCT 0603                         |                              | NCU 0805                         |                              |
| Metric size  | RR 1608M                         |                              | RR 2012M                         |                              |
| Resistance range   | $0.1 \Omega$ to $0.91 \Omega$    |                              | $0.1 \Omega$ to $0.91 \Omega$    |                              |
| Resistance tolerance   | $\pm 5 \%$                       |                              |                                  |                              |
| Temperature coefficient  | $\pm 100$ ppm/K                  |                              |                                  |                              |
| Operation mode   | standard                         | power                        | standard                         | power                        |
| Climatic category (LCT/UCT/days)   | 55/125/56                        | 55/155/56                    | 55/125/56                        | 55/155/56                    |
| Rated dissipation, $P_{70}^{(1)}$  | 0.1 W                            | 0.125 W                      | 0.125 W                          | 0.2 W                        |
| Operating voltage, $U_{max}$ AC/DC   | limited by $P_{70}$              |                              |                                  |                              |
| Film temperature   | $125 \text{ }^\circ\text{C}$     | $155 \text{ }^\circ\text{C}$ | $125 \text{ }^\circ\text{C}$     | $155 \text{ }^\circ\text{C}$ |
| Max. resistance change at $P_{70}$ for resistance range, $\Delta R/R$ max., after: | $0.22 \Omega$ to $0.91 \Omega$   |                              | $0.22 \Omega$ to $0.91 \Omega$   |                              |
| 1 000 h  | $\leq 1 \%$                      | $\leq 2 \%$                  | $\leq 1 \%$                      | $\leq 2 \%$                  |
| 8 000 h  | $\leq 2 \%$                      | $\leq 3 \%$                  | $\leq 2 \%$                      | $\leq 3 \%$                  |
| Specified lifetime   | 8 000 h                          |                              | 8 000 h                          |                              |
| Insulation voltage:  |                                  |                              |                                  |                              |
| 1 minute; $U_{ins}$  | 100 V                            |                              | 200 V                            |                              |
| continuous   | 75 V                             |                              | 75 V                             |                              |
| Failure rate   | $\leq 2 \times 10^{-9}/\text{h}$ |                              | $\leq 2 \times 10^{-9}/\text{h}$ |                              |

### Note

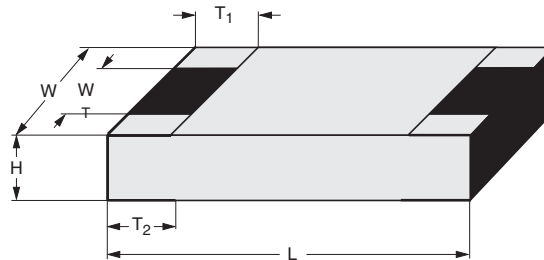
1. The power dissipation on the resistor generates a temperature rise against the local ambient, depending on the heat flow support of the printed-circuit board (thermal resistance). The rated dissipation applies only if the permitted film temperature is not exceeded.

| ORDERING INFORMATION - TYPE DESCRIPTION AND ORDERING CODE |               |                      |               |                            |            |                                       |  |
|---|---------------|----------------------|---------------|----------------------------|------------|---------------------------------------|--|
| <b>N</b>  | <b>C</b>      | <b>T</b>             | <b>0603</b>   | <b>-00</b>                 | <b>5 %</b> | <b>P5</b>                             | <b>0R22</b>  |
| FILM TYPE   | PRODUCT CODE  | SIZE CODE            | IMPERIAL SIZE | TEMPERATURE COEFFICIENT    | TOLERANCE  | PACKAGING                             | RESISTANCE VALUE                                       |
| N = Low ohmic   | C = Flat chip | T = 0603<br>U = 0805 | 0603<br>0805  | ± 100 ppm/K <sup>(1)</sup> | ± 5 %      | P5 = 5 000 units<br>PW = 20 000 units | See Temperature coefficient and resistance range table |

**Note:** We recommend that the clear text ordering code is used to minimize the possibility of errors in order handling.

1. A temperature coefficient 100 ppm/K is marked -00.

### DIMENSIONS



| DIMENSIONS - CHIP resistor types, mass and relevant physical dimensions |                  |             |             |                     |                     |                     |           |
|---|------------------|-------------|-------------|---------------------|---------------------|---------------------|-----------|
| TYPE  | H (mm)           | L (mm)      | W (mm)      | W <sub>T</sub> (mm) | T <sub>1</sub> (mm) | T <sub>2</sub> (mm) | MASS (mg) |
| NCT 0603  | 0.45 +0.1/-0.05  | 1.55 ± 0.05 | 0.85 ± 0.1  | > 75 % of W         | 0.3 + 0.15/-0.2     | 0.3 + 0.15/-0.2     | 1.9       |
| NCU 0805  | 0.45 + 0.1/-0.05 | 2.0 ± 0.1   | 1.25 ± 0.15 | > 75 % of W         | 0.4 + 0.1/-0.2      | 0.4 + 0.1/-0.2      | 4.6       |

| TEMPERATURE COEFFICIENT AND RESISTANCE RANGE |           |                                 |                        |
|--|-----------|---------------------------------|------------------------|
| DESCRIPTION                                  |           | RESISTANCE VALUE <sup>(1)</sup> |                        |
| T.C.   | TOLERANCE | NCT 0603                        | NCU 0805               |
| ± 100 ppm/K                                  | ± 5 %     | <b>0.1 Ω to 0.91 Ω</b>          | <b>0.1 Ω to 0.91 Ω</b> |

**Note**

1. Resistance values to be selected from E24 series.

**Resistance ranges printed in bold are preferred T.C. / tolerance combinations with optimized availability.**

**DESCRIPTION**

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A highly conductive film is built on a super high grade (96 % Al<sub>2</sub>O<sub>3</sub>) ceramic substrate and conditioned to achieve the desired temperature coefficient. Optimised inner contacts are built on both sides of the substrate. A special laser is used to achieve the target value by smoothly cutting 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.

The result of the determined production is verified by an extensive testing procedure and optical inspection performed on 100 % of the individual chip resistors. Only accepted products are laid directly into the paper tape in accordance with **EN 60 286-3**.

**ASSEMBLY**

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow or vapour phase. 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 the CEFIC-EECA-EICTA list of legal restrictions on hazardous substances.

This includes full compatibility with the following directives:

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

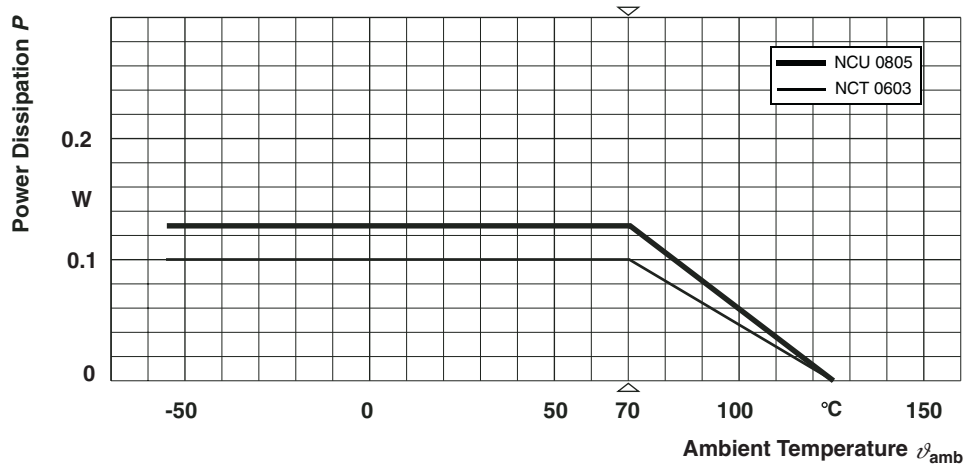
Solderability is specified for 2 years after production or re-qualification. The permitted storage time is 20 years.

**APPROVALS**

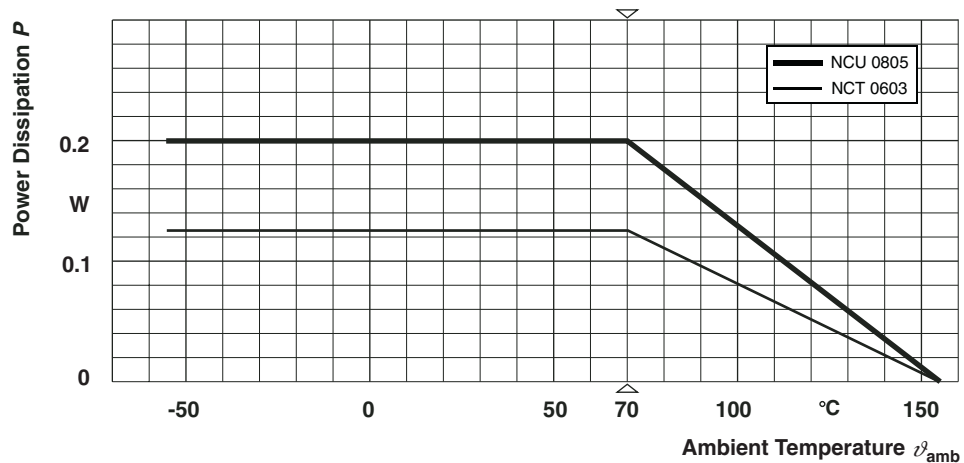
The resistors are tested in accordance with **EN 140 401-802** (superseding **CECC 40 401-802**) which refers to **EN 60115-1** and **EN 140 400**.

BCcomponents BEYSCHLAG has achieved "**Approval of Manufacturer**" in accordance with **EN 100 114-1**.

**FUNCTIONAL PERFORMANCE**



Derating - Standard Operation



Derating - Power Operation

**TESTS AND REQUIREMENTS**

All tests are carried out in accordance with the following specifications:

- EN 60115-1, Generic specification (includes tests)
- EN 140 400, Sectional specification (includes schedule for qualification approval)
- EN 140 401-802, Detail specification (includes schedule for conformance inspection)

The components are approved in accordance with the European CECC-system, where applicable. The following tables contain only the most important tests. For the full test schedule refer to the documents listed above. The testing also covers most of the requirements specified by EIA/IS-703 and JIS-C-5202.

The tests are carried out in accordance with IEC 60068 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 1 060 mbar).

The components are mounted for testing on boards in accordance with EN 60115-1, 4.31 unless otherwise specified.

The requirements stated in the Test Procedures and Requirements table are based on the required tests and permitted limits of EN 140 401-802. However, some additional tests and a number of improvements against those minimum requirements have been included.



| TEST PROCEDURES AND REQUIREMENTS |                         |  |   |  |
|----------------------------------|-------------------------|--|---|--|
| EN 60115-1 CLAUSE                | IEC 60068-2 TEST METHOD | TEST   | PROCEDURE   | REQUIREMENTS PERMISSIBLE CHANGE ( $\Delta R/R$ )   |
|                                  |                         |  | stability for product types:  |  |
|                                  |                         |  | <b>NCT 0603</b>   | 0.1 $\Omega$ to 0.91 $\Omega$  |
|                                  |                         |  | <b>NCU 0805</b>   | 0.1 $\Omega$ to 0.91 $\Omega$  |
| 4.5                              | –                       | resistance                                   |   | $\pm 5\%$  |
| 4.8.4.2                          | –                       | temperature coefficient                      | at 20 / –55 / 20 °C and 20 / 125 / 20 °C  | $\pm 100$ ppm/K  |
| 4.25.1                           | –                       | endurance at 70 °C: standard operation mode  | $U = \sqrt{P_{70} \times R}$ ;<br>1.5 h on; 0.5 h off<br>70 °C; 1000 h<br>70 °C; 8000 h   | $\pm (1\%R + 0.01 \Omega)$<br>$\pm (2\%R + 0.01 \Omega)$   |
|                                  | –                       | endurance at 70 °C: power operation mode     | $U = \sqrt{P_{70} \times R}$<br>1.5 h on; 0.5 h off<br>70 °C; 1000 h<br>70 °C; 8000 h   | $\pm (2\%R + 0.01 \Omega)$<br>$\pm (3\%R + 0.01 \Omega)$   |
| 4.25.3                           | –                       | endurance at upper category temperature      | 125 °C; 1000 h  | $\pm (2\%R + 0.01 \Omega)$   |
|                                  |                         |  | 155 °C; 1000 h  | $\pm (3\%R + 0.01 \Omega)$   |
| 4.24                             | 78 (Cab)                | damp heat, steady state                      | (40 $\pm$ 2) °C; 56 days; (93 $\pm$ 3) % RH   | $\pm (1\%R + 0.01 \Omega)$   |
| 4.23                             |                         | climatic sequence:                           |   |  |
| 4.23.2                           | 2 (Ba)                  | dry heat                                     | UCT; 16 h   |  |
| 4.23.3                           | 30 (Db)                 | damp heat, cyclic                            | 55 °C; 24 h; > 90 % RH;<br>1 cycle  |  |
| 4.23.4                           | 1 (Aa)                  | cold   | LCT; 2 h  |  |
| 4.23.5                           | 13 (M)                  | low air pressure                             | 8.5 kPa; 2 h; 25 $\pm$ 10 °C  |  |
| 4.23.6                           | 30 (Db)                 | damp heat, cyclic                            | 55 °C; 5 days; > 95 to 100 % RH;<br>5 cycles<br>LCT = – 55 °C; UCT = 125 °C   | $\pm (1\%R + 0.01 \Omega)$   |
| –                                | 1 (Aa)                  | cold   | –55 °C; 2 h   | $\pm (0.5\%R + 0.01 \Omega)$   |
| 4.19                             | 14 (Na)                 | rapid change of temperature                  | 30 minutes at LCT and 30 minutes at UCT;<br>LCT = – 55 °C; UCT = 125 °C;<br>5 cycles<br>LCT = – 55 °C; UCT = 125 °C;<br>1000 cycles | $\pm (0.5\%R + 0.01 \Omega)$<br>no visible damage<br>$\pm (1\%R + 0.01 \Omega)$<br>no visible damage |
| 4.13                             | –                       | short time overload; standard operation mode | $U = 2.5 \times \sqrt{P_{70} \times R}$ ; 5 s   | $\pm (0.5\%R + 0.01 \Omega)$   |
|                                  |                         | short time overload; power operation mode    |   | $\pm (1\%R + 0.01 \Omega)$   |
| 4.22                             | 6 (Fc)                  | vibration                                    | endurance by sweeping; 10 to 2000 Hz;<br>no resonance; amplitude $\leq$ 1.5 mm<br>or $\leq$ 200 m/s <sup>2</sup> ; 6 h              | $\pm (0.5\%R + 0.01 \Omega)$<br>no visible damage  |



| TEST PROCEDURES AND REQUIREMENTS - continued |                         |                              |  |  |
|--|-------------------------|------------------------------|--|--|
| EN 60115-1 CLAUSE                            | IEC 60068-2 TEST METHOD | TEST                         | PROCEDURE  | REQUIREMENTS PERMISSIBLE CHANGE ( $\Delta R/R$ )   |
|  |                         |                              | stability for product types:   |  |
|  |                         |                              | <b>NCT 0603</b>  | 0.1 $\Omega$ to 0.91 $\Omega$  |
|  |                         |                              | <b>NCU 0805</b>  | 0.1 $\Omega$ to 0.91 $\Omega$  |
| 4.17.2                                       | 58 (Td)                 | solderability                | solder bath method;<br>SnPb40; non-activated flux<br>(215 $\pm$ 3) $^{\circ}$ C; (3 $\pm$ 0.3) s                   | good tinning ( $\geq$ 95 % covered);<br>no visible damage                                    |
|  |                         |                              | solder bath method;<br>SnAg3Cu0,5 or SnAg3,5;<br>non-activated flux<br>(235 $\pm$ 3) $^{\circ}$ C; (2 $\pm$ 0.2) s |  |
| 4.18.2                                       | 58 (Td)                 | resistance to soldering heat | solder bath method; (260 $\pm$ 5) $^{\circ}$ C;<br>(10 $\pm$ 1) s  | $\pm$ (0.5 % $R$ + 0.05 $\Omega$ )<br>no visible damage                                      |
| 4.29   | 45 (XA)                 | component solvent resistance | isopropyl alcohol + 50 $^{\circ}$ C; method 2  | no visible damage  |
| 4.32   | 21 (Ue <sub>3</sub> )   | shear (adhesion)             | RR 1608M; 9N<br>RR 2012M; 45N  | no visible damage  |
| 4.33   | 21 (Ue <sub>1</sub> )   | substrate bending            | depth 2 mm, 3 times  | $\pm$ (0.5 % $R$ + 0.01 $\Omega$ )<br>no visible damage,<br>no open circuit in bent position |
| 4.7  | –                       | voltage proof                | $U_{rms} = U_{ins}$ ; 60 $\pm$ 5 s   | no flashover or breakdown  |
| 4.35   | –                       | flammability                 | IEC 60695-2-2,<br>needle flame test; 10 s  | no burning after 30 s  |

**ORDERING INFORMATION**

Components may be ordered by using either a simple clear text ordering code, see "Type description and ordering code" or Vishay BCcomponents' unique 12NC.

**Numeric Ordering Code (12NC)**

- The resistors have a 12-digit ordering code starting with 2312.
- The subsequent 4 digits indicate the resistor type, specification and packaging; see the 12NC Ordering Code 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 Last digit of 12NC Indicating Resistance Decade table.

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

| RESISTANCE DECADE             | LAST DIGIT |
|-------------------------------|------------|
| 0.1 $\Omega$ to 0.99 $\Omega$ | 7          |

**Ordering Example**

The ordering code of a NCT 0603 resistor, value 0.22  $\Omega$  and TC 100 with  $\pm$  5 % tolerance, supplied in cardboard tape of 5000 units per reel is: 2312 219 32207.

| 12NC ORDERING CODE - resistor type and packaging |                 |           |                           |                    |
|--|-----------------|-----------|---------------------------|--------------------|
| DESCRIPTION                                      |                 |           | ORDERING CODE 2312 ... .. |                    |
|  |                 |           | CARDBOARD TAPE ON REEL    |                    |
| TYPE   | T.C.            | TOL.      | P5<br>5 000 UNITS         | PW<br>20 000 UNITS |
| NCT 0603   | $\pm$ 100 ppm/K | $\pm$ 5 % | <b>219 3....</b>          | 209 3....          |
| NCU 0805   |                 |           | <b>259 3....</b>          | 249 3....          |

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



## Notice

Specifications of the products displayed herein are subject to change without notice. Vishay Intertechnology, Inc., or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

Information contained herein is intended to provide a product description only. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document. Except as provided in Vishay's terms and conditions of sale for such products, Vishay assumes no liability whatsoever, and disclaims any express or implied warranty, relating to sale and/or use of Vishay products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Vishay for any damages resulting from such improper use or sale.