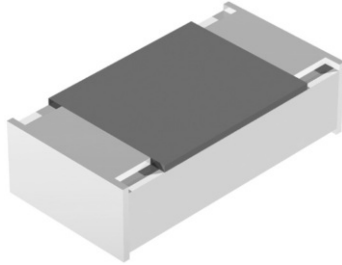


High Ohmic Flat Chip Resistors



OCT 0603 and OCU 0805 high ohmic flat chip resistors are best suited where high resistance, high stability and high reliability are required. Typical applications include any kind of battery driven electronics, particularly low consumption CMOS circuitry.

FEATURES

- Unique very high ohmic chip resistor product
- Standard TCR: ± 100 ppm/K
- Excellent overall stability
- Low voltage coefficient: 0.05 %/V
- Wide high ohmic range: > 10 M Ω to 130 M Ω
- Pure Sn termination on Ni barrier layer
- Compatible with lead (Pb)-free and lead containing soldering processes
- Lead (Pb)-free and RoHS compliant



APPLICATIONS

- Any kind of battery driven electronics
- Low consumption CMOS circuitry
- Small signal measurement

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

| TECHNICAL SPECIFICATIONS | | | | | |
|---|----------------------------------|------------|---------------------------------|------------|------------|
| DESCRIPTION | OCT 0603 | | OCU 0805 | | |
| Metric Size | RR 1608M | | RR 2012M | | |
| Resistance Range | 11 M Ω to 130 M Ω | | 11 M Ω to 130 M Ω | | |
| Resistance Tolerance | ± 5 % | | | | |
| Temperature Coefficient | ± 250 ppm/K; ± 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⁾ | Limited by U_{max} . | | | | |
| Operating Voltage, U_{max} . AC/DC | 75 V | 150 V | 150 V | 200 V | |
| Film Temperature | 125 °C | 155 °C | 125 °C | 155 °C | |
| Max. Resistance Change at P_{70} for Resistance Range, $\Delta R/R_{max.}$ after: | 11 M Ω to 47 M Ω | | 11 M Ω to 47 M Ω | | |
| | 1000 h | ≤ 1 % | ≤ 2 % | ≤ 1 % | ≤ 2 % |
| | 8000 h | ≤ 2 % | ≤ 4 % | ≤ 2 % | ≤ 4 % |
| Specified Lifetime | 8000 h | | | | |
| Insulation Voltage: 1 min; U_{ins} | 100 V | | 200 V | | |
| | continuous 75 V | | 75 V | | |
| Failure Rate | $\leq 2 \times 10^{-9}$ /h | | $\leq 2 \times 10^{-9}$ /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.



12NC INFORMATION FOR HISTORICAL CODING REFERENCE ONLY

- 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 MΩ to 99.9 MΩ | 6 |

Last Two Digits Indicating Sequential Code Number

| RESISTANCE VALUE | LAST DIGITS |
|------------------|-------------|
| 100 MΩ | 01 |
| 110 MΩ | 02 |
| 120 MΩ | 03 |
| 130 MΩ | 04 |

12NC Example

The 12 NC of a OCT 0603 resistor, value 51 MΩ and TC 250 with ± 5 % tolerance, supplied in cardboard tape of 20000 units per reel is: 2312 209 35106.

The 12 NC of a OCT 0603 resistor, value 130 MΩ and TC 250 with ± 5 % tolerance, supplied in cardboard tape of 5000 units per reel is: 2312 219 90104.

| 12NC - resistor type and packaging | | | | | |
|------------------------------------|-------------|-------|-------------------------|---------------------------|-----------------|
| DESCRIPTION | | | | ORDERING CODE 2312 | |
| | | | | CARDBOARD TAPE ON REEL | |
| TYPE | TCR | TOL. | RESISTANCE VALUE | P5 5000 UNITS | PW 20 000 UNITS |
| OCT 0603 | ± 250 ppm/K | ± 5 % | 51 MΩ to 91 MΩ | 219 3.... | 209 3.... |
| | | | ≥ 100 MΩ ⁽¹⁾ | 219 901.. | 209 901.. |
| OCU 0805 | ± 100 ppm/K | ± 5 % | 11 MΩ to 47 MΩ | 219 3.... | 209 3.... |
| | ± 250 ppm/K | ± 5 % | 51 MΩ to 91 MΩ | 259 3.... | 249 3.... |
| | | | ≥ 100 MΩ ⁽¹⁾ | 259 901.. | 249 901.. |
| | ± 100 ppm/K | ± 5 % | 11 MΩ to 47 MΩ | 259 3.... | 249 3.... |

Note

⁽¹⁾ Readable coding of resistance values is restricted to values below 100 MΩ. For resistance values from 100 MΩ onwards, refer to the pre-defined Table of non-readable sequential numbers above.

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

| PART NUMBER AND PRODUCT DESCRIPTION ⁽²⁾ | | | | | | |
|--|-------------------|------------------------------------|---|--------------------------|------------------------------|---------------------------------|
| PART NUMBER: OCT06030B5106JP500 | | | | | | |
| O | C | T | 0 | 6 | 0 | 3 |
| 0 | B | 5 | 1 | 0 | 6 | J |
| P | 5 | 0 | 0 | | | |
| MODEL/SIZE | SPECIAL CHARACTER | TCR | VALUE | TOLERANCE | PACKAGING ⁽³⁾ | SPECIAL |
| OCT0603 OCU0805 | 0 = neutral | B = ± 100 ppm/K W = ± 250 ppm/K | 3 digit value 1 digit multiplier 5 = *10 ⁵ 6 = *10 ⁶ | J = ± 5 % | P5 PW | up to 2 digits 00 = standard |
| PRODUCT DESCRIPTION: OCT 0603 -100 5% P5 51M | | | | | | |
| OCT | 0603 | -100 | 5 % | P5 | 51M | |
| MODEL | SIZE | TCR | TOLERANCE | PACKAGING ⁽³⁾ | RESISTANCE VALUE | |
| OCT OCU | 0603 0805 | ± 100 ppm/K ± 250 ppm/K | ± 5 % | P5 PW | 47M = 47 MΩ 220M = 220 MΩ | |

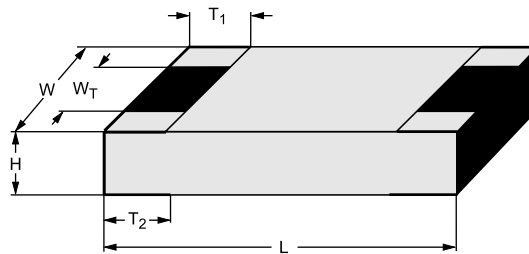
Notes

⁽²⁾ Products can be ordered using either the PRODUCT DESCRIPTION or the PART NUMBER.

⁽³⁾ Please refer to table PACKAGING, next page.

| PACKAGING | | |
|-----------|-------------------------------|------|
| MODEL | REEL | |
| | PIECES/ PAPER TAPE ON REEL | CODE |
| OCT0603 | 5000 | P5 |
| | 20 000 | PW |
| OCU0805 | 5000 | P5 |
| | 20 000 | PW |

DIMENSIONS



| DIMENSIONS - CHIP resistor types, mass and relevant physical dimensions | | | | | | | |
|---|-------------------|-------------|-------------|---------------------|---------------------|---------------------|-----------|
| TYPE | H (mm) | L (mm) | W (mm) | W _T (mm) | T ₁ (mm) | T ₂ (mm) | MASS (mg) |
| OCT 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 |
| OCU 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 ⁽¹⁾ | |
| TCR | TOLERANCE | OCT 0603 | OCU 0805 |
| ± 250 ppm/K | ± 5 % | 51 MΩ to 130 MΩ | 51 MΩ to 130 MΩ |
| ± 100 ppm/K | ± 5 % | 11 MΩ to 47 MΩ | 11 MΩ to 47 MΩ |

Note

⁽¹⁾ Resistance values to be selected from E24 series.

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

DESCRIPTION

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A newly developed cermet layer is deposited on a super high grade (Al_2O_3) ceramic substrate and conditioned to achieve the desired temperature coefficient. 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 60286-3**.

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***. 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 RoHS compliant; the pure tin plating provides compatibility with lead (Pb)-free and lead-containing soldering processes. Solderability is specified for 2 years after production or requalification. The permitted storage time is 20 years. The immunity of the plating against tin whisker growth has been proven under extensive testing.

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 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**.

Vishay BEYSCHLAG has achieved “**Approval of Manufacturer**” in accordance with **EN 100114-1**.

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 → issues → environment policy → chemicals → chemicals for electronics

- The quoted IEC standards marked with an asterisk (*) are also released as EN standards with the same number and identical contents

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 table contains 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 1060 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: | |
| | | | OCT 0603 | 11 M Ω to 130 M Ω |
| | | | OCU 0805 | 11 M Ω to 130 M Ω |
| 4.5 | - | Resistance | $U = 100 V$ | $\pm 5 \%$ |
| 4.8.4.2 | - | Temperature coefficient | At 20/- 55/20 °C and 20/125/20 °C | $\pm 250 \text{ ppm/K}$; $\pm 100 \text{ ppm/K}$ |
| 4.25.1 | - | Endurance at 70 °C: standard operation mode | $U = U_{\text{max}}$; 1.5 h ON; 0.5 h OFF 70 °C; 1000 h 70 °C; 8000 h | $\pm 1 \%$ $\pm 2 \%$ |
| 4.25.3 | - | Endurance at upper Category temperature | 125 °C; 1000 h 155 °C; 1000 h | $\pm 2 \%$ $\pm 3 \%$ |
| 4.24 | 78 (Cab) | Damp heat, steady state | (40 \pm 2) °C; 56 days; (93 \pm 3) % RH | $\pm 1 \%$ |
| 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; 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; 5 cycles LCT = - 55 °C; UCT = 125 °C | $\pm 1 \%$ no visible damage |
| - | 1 (Aa) | Cold | - 55 °C; 2 h | $\pm 0.5 \%$ |
| 4.19 | 14 (Na) | Rapid change of temperature | 30 min at LCT and 30 min at UCT; LCT = - 55 °C; UCT = 125 °C; 5 cycles LCT = - 55 °C; UCT = 125 °C; 1000 cycles | $\pm 0.5 \%$ no visible damage $\pm 1 \%$ no visible damage |



| TEST PROCEDURES AND REQUIREMENTS | | | | | |
|----------------------------------|-------------------------|---|--|--|---------------------------------|
| EN 60115-1 CLAUSE | IEC 60068-2 TEST METHOD | TEST | PROCEDURE | REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$) | |
| 4.13 | - | Short time overload | Stability for product types: | | |
| | | | | OCT 0603 | 11 M Ω to 130 M Ω |
| | | | | OCU 0805 | 11 M Ω to 130 M Ω |
| | | | $U = 2 \times U_{max.}; 5 \text{ s}$ | $\pm 0.5 \%$ | |
| 4.27 | - | Single pulse high voltage overload; standard operation mode | Severity no. 4, $U = 2 \times U_{max.}; 10 \text{ pulses}$ 10 $\mu\text{s}/700 \mu\text{s}$ | $\pm 1 \%$ no visible damage | |
| 4.22 | 6 (Fc) | Vibration | Endurance by sweeping; 10 to 2000 Hz; no resonance; amplitude $\leq 1.5 \text{ mm}$ or $\leq 200 \text{ m/s}^2$; 6 h | $\pm 0.5 \%$ no visible damage | |
| 4.17.2 | 58 (Td) | Solderability | Solder bath method; SnPb40; non-activated flux (215 \pm 3) $^{\circ}\text{C}$; (3 \pm 0.3) s | Good tinning (> 95 % covered); no visible damage | |
| | | | Solder bath method; SnAg3Cu0.5 or SnAg3.5; non-activated flux (235 \pm 3) $^{\circ}\text{C}$; (2 \pm 0.2) s | | |
| 4.18.2 | 58 (Td) | Resistance to soldering heat | Solder bath method; (260 \pm 5) $^{\circ}\text{C}$; (10 \pm 1) s | $\pm 0.5 \%$ No visible damage | |
| 4.29 | 45 (XA) | Component solvent resistance | Isopropyl alcohol + 50 $^{\circ}\text{C}$; method 2 | No visible damage | |
| 4.32 | 21 (Ue ₃) | Shear (adhesion) | RR 1608M; 9 N | No visible damage | |
| | | | RR 2012M; 45 N | | |
| 4.33 | 21 (Ue ₁) | Substrate bending | Depth 2 mm, 3 times | $\pm 0.5 \%$ no visible damage, no open circuit in bent position | |
| 4.7 | - | Voltage proof | $U_{rms} = U_{ins.}; 60 \pm 5 \text{ s}$ | No flashover or breakdown | |
| 4.35 | - | Flammability | IEC 60695-2-2, needle flame test; 10 s | No burning after 30 s | |





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