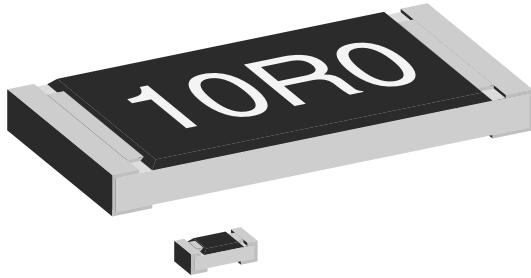


Lead (Pb)-free Thick Film, Rectangular Chip Resistors



FEATURES

- High volume product suitable for commercial and special applications
- Excellent stability ($\Delta R/R \leq 1\%$ for 1000 h at 70 °C)
- Compliant with “Restriction of the use of Hazardous Substances” (RoHS) directive 2002/95/EC (issue 2004)
- Lead (Pb)-free solder contacts on Ni barrier layer
- Pure tin plating provides compatibility with lead (Pb)-free and lead containing soldering processes
- Metal glaze on high quality ceramic
- Protective overglaze



| STANDARD ELECTRICAL SPECIFICATIONS | | | | | | | | |
|--|------|--------|---|--|----------------------------------|-------------------------------|------------------------------|---------------|
| MODEL | SIZE | | POWER RATING $P_{70^\circ\text{C}}$ W | LIMITING ELEMENT VOLTAGE MAX. V \cong | TEMPERATURE COEFFICIENT ppm/K | TOLERANCE % | RESISTANCE RANGE Ω | E-SERIES |
| | INCH | METRIC | | | | | | |
| CRCW0201 | 0201 | 0525 | 0.05 | 30 | ± 100 ± 200 | ± 1 ± 1 ± 5 | 47R - 1M0 10R - 1M0 | 24 + 96 |
| | | | | | | | | 24 + 96 24 |
| Zero-Ohm-Resistor: $R_{\text{max.}} = 50 \text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 1.0 A | | | | | | | | |
| D10/CRCW0402 | 0402 | 1005 | 0.063 | 50 | ± 100 ± 200 | ± 1 ± 5 | 1R0 - 10M | 24 + 96 |
| | | | | | | | | 24 |
| Zero-Ohm-Resistor: $R_{\text{max.}} = 20 \text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 1.5 A | | | | | | | | |
| D11/CRCW0603 | 0603 | 1608 | 0.10 | 75 | ± 100 ± 200 | ± 1 ± 5 | 1R0 - 10M | 24 + 96 |
| | | | | | | | | 24 |
| Zero-Ohm-Resistor: $R_{\text{max.}} = 20 \text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 2.0 A | | | | | | | | |
| D12/CRCW0805 | 0805 | 2012 | 0.125 | 150 | ± 100 ± 200 | ± 1 ± 5 | 1R0 - 10M | 24 + 96 |
| | | | | | | | | 24 |
| Zero-Ohm-Resistor: $R_{\text{max.}} = 20 \text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 2.5 A | | | | | | | | |
| D25/CRCW1206 | 1206 | 3216 | 0.25 | 200 | ± 100 ± 200 | ± 1 ± 5 | 1R0 - 10M | 24 + 96 |
| | | | | | | | | 24 |
| Zero-Ohm-Resistor: $R_{\text{max.}} = 20 \text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 3.5 A | | | | | | | | |
| CRCW1210 | 1210 | 3225 | 0.33 | 200 | ± 100 ± 200 | ± 1 ± 5 | 1R0 - 10M | 24 + 96 |
| | | | | | | | | 24 |
| Zero-Ohm-Resistor: $R_{\text{max.}} = 20 \text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 4.0 A | | | | | | | | |
| CRCW1218 | 1218 | 3246 | 1.0 | 200 | ± 100 ± 200 | ± 1 ± 5 | 1R0 - 2M2 | 24 + 96 |
| | | | | | | | | 24 |
| Zero-Ohm-Resistor: $R_{\text{max.}} = 20 \text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 7.0 A | | | | | | | | |
| CRCW2010 | 2010 | 5025 | 0.50 | 400 | ± 100 ± 200 | ± 1 ± 5 | 1R0 - 10M | 24 + 96 |
| | | | | | | | | 24 |
| Zero-Ohm-Resistor: $R_{\text{max.}} = 20 \text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 5.0 A | | | | | | | | |
| CRCW2512 | 2512 | 6332 | 1.0 | 500 | ± 100 ± 200 | ± 1 ± 5 | 1R0 - 10M | 24 + 96 |
| | | | | | | | | 24 |
| Zero-Ohm-Resistor: $R_{\text{max.}} = 20 \text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 7.0 A | | | | | | | | |

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.
- Marking and packaging: See appropriate catalog or web pages
- Power rating depends on the max. temperature at the solder point, the component placement density and the substrate material

| TECHNICAL SPECIFICATIONS | | | | | | | | | | |
|---|-------------------|--------------------|------------------------|------------------|------------------|------------------|----------|----------|----------|----------|
| PARAMETER | UNIT | CRCW0201 | D10/ CRCW0402 | D11/ CRCW0603 | D12/ CRCW0805 | D25/ CRCW1206 | CRCW1210 | CRCW1218 | CRCW2010 | CRCW2512 |
| Rated Dissipation at 70 °C ⁽³⁾ | W | 0.05 | 0.063 | 0.10 | 0.125 | 0.25 | 0.33 | 1.0 | 0.5 | 1.0 |
| Limiting Element Voltage ⁽²⁾ | V _≅ | 30 | 50 | 75 | 150 | 200 | 200 | 200 | 400 | 500 |
| Insulation Voltage (1 min) | V _{peak} | 50 | > 75 | > 100 | > 200 | > 300 | > 300 | > 300 | > 300 | > 300 |
| Thermal Resistance ⁽¹⁾ | K/W | | ≤ 870 | ≤ 550 | ≤ 440 | ≤ 220 | ≤ 140 | ≤ 65 | ≤ 88 | ≤ 65 |
| Insulation Resistance | Ω | > 10 ⁹ | | | | | | | | |
| Category Temperature Range | °C | - 55 to + 155 | | | | | | | | |
| Failure Rate | h ⁻¹ | 1.10 ⁻⁹ | 0.3 x 10 ⁻⁹ | | | | | | | |
| Weight/1000 pieces | g | 0.17 | 0.65 | 2 | 5.5 | 10 | 16 | 29.5 | 25.5 | 40.5 |

Notes

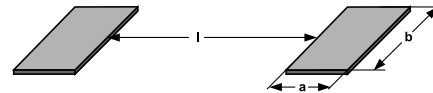
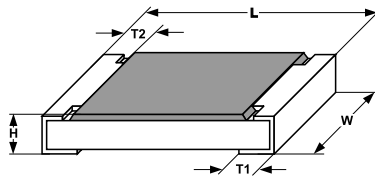
- (1) For sizes 0402 until 1206 the measuring conditions are in acc. to EN 140401-802. For all other sizes the result depends on the solder pad dimensions.
- (2) Rated voltage: $\sqrt{P \times R}$
- (3) The power dissipation on the resistor generates a temperature rise against the local ambient, depending on the heat flow support of the printed-circuit board (thermal resistance). The rated dissipation applies only if the permitted film temperature of 155 °C is not exceeded.

| PART NUMBER AND PRODUCT DESCRIPTION | | | | | | | | | | | | | | | | | |
|--|---|--|---|---|---|--|---|-------------------------------------|---|---|---|---|---|---|---|--|--|
| PART NUMBER: CRCW0603562RFKEC ⁽⁴⁾ | | | | | | | | | | | | | | | | | |
| C | R | C | W | 0 | 6 | 0 | 3 | 5 | 6 | 2 | R | F | K | E | C | | |
| MODEL | VALUE | TOLERANCE | | TCR | | PACKAGING ⁽⁵⁾ | | SPECIAL | | | | | | | | | |
| CRCW0201 CRCW0402 CRCW0603 CRCW0805 CRCW1206 CRCW1210 CRCW1218 CRCW2010 CRCW2512 | R = Decimal K = Thousand M = Million 0000 = Jumper | F = ± 1.0 % J = ± 5.0 % Z = Jumper | | K = ± 100 ppm/K N = ± 200 ppm/K 0 = Jumper S = Special | | EA, EB, EC, ED, EE, EF, EG, EH, EI, EK, EL, EY | | Up to 2 digits | | | | | | | | | |
| PRODUCT DESCRIPTION: D11/CRCW0603 100 562R 1% ET6 e3 | | | | | | | | | | | | | | | | | |
| D11/CRCW0603 | 100 | 562R | | 1% | | ET6 | | e3 | | | | | | | | | |
| MODEL | TCR | RESISTANCE VALUE | | TOLERANCE | | PACKAGING ⁽⁵⁾ | | LEAD (Pb)-FREE | | | | | | | | | |
| CRCW0201 D10/CRCW0402 D11/CRCW0603 D12/CRCW0805 D25/CRCW1206 CRCW1210 CRCW1218 CRCW2010 CRCW2512 | ± 200 ppm/K ± 100 ppm/K | 10R = 10 Ω 562R = 562 Ω 10K = 10.0 kΩ 1M = 1 MΩ 0R0 = Jumper | | ± 5 % ± 1 % | | ET1, ET5 ET6, ET7 EF4, E02 E67, E82 EG1, ET9 E20, E27 | | e3 = Pure tin Termination finish | | | | | | | | | |

Notes

- (4) Preferred way for ordering products is by use of the PART NUMBER
- (5) Please refer to table PACKAGING, see next page

| PACKAGING | | | | | | | | | | | |
|--------------|------------|---------------|-------|--------------|----------------|---------|---------------|---------|--------|----------------|---------------|
| MODEL | REEL | | | | | | | | BULK | | |
| | TAPE WIDTH | DIAMETER | PITCH | PIECES/ REEL | PACKAGING CODE | | | | PIECES | PACKAGING CODE | |
| | | | | | PART NUMBER | | PRODUCT DESC. | | | PART NUMBER | PRODUCT DESC. |
| | | | | | PAPER | BLISTER | PAPER | BLISTER | | | |
| CRCW0201 | 8 mm | 180 mm/7" | 2 mm | 10 000 | ED | | ET7 | | | | |
| | | 330 mm/13" | 2 mm | 50 000 | EE | | EF4 | | | | |
| D10/CRCW0402 | 8 mm | 180 mm/7" | 2 mm | 10 000 | ED | | ET7 | | 50 000 | EY | E27 |
| | | 330 mm/13" | 2 mm | 50 000 | EE | | EF4 | | | | |
| D11/CRCW0603 | 8 mm | 180 mm/7" | 4 mm | 5000 | EA | EI | ET1 | EG1 | 25 000 | EY | E27 |
| | | 285 mm/11.25" | 4 mm | 10 000 | EB | | ET5 | | | | |
| | | 330 mm/13" | 4 mm | 20 000 | EC | EL | ET6 | E20 | | | |
| D12/CRCW0805 | 8 mm | 180 mm/7" | 4 mm | 5000 | EA | EI | ET1 | EG1 | 10 000 | EY | E27 |
| | | 285 mm/11.25" | 4 mm | 10 000 | EB | | ET5 | | | | |
| | | 330 mm/13" | 4 mm | 20 000 | EC | EL | ET6 | E20 | | | |
| D25/CRCW1206 | 8 mm | 180 mm/7" | 4 mm | 5000 | EA | EI | ET1 | EG1 | | | |
| | | 285 mm/11.25" | 4 mm | 10 000 | EB | | ET5 | | | | |
| | | 330 mm/13" | 4 mm | 15 000 | | EL | | E20 | | | |
| | | 330 mm/13" | 4 mm | 20 000 | EC | | ET6 | | | | |
| CRCW1210 | 12 mm | 180 mm/7" | 4 mm | 5000 | EA | | ET1 | | | | |
| | | 285 mm/11.25" | 4 mm | 10 000 | EB | | ET5 | | | | |
| | | 330 mm/13" | 4 mm | 20 000 | EC | | ET6 | | | | |
| CRCW1218 | 12 mm | 180 mm/7" | 4 mm | 4000 | | EK | | ET9 | | | |
| CRCW2010 | 12 mm | 180 mm/7" | 4 mm | 4000 | | EF | | E02 | | | |
| CRCW2512 | 12 mm | 180 mm/7" | 8 mm | 2000 | | EG | | E67 | | | |
| | | | 4 mm | 4000 | | EH | | E82 | | | |

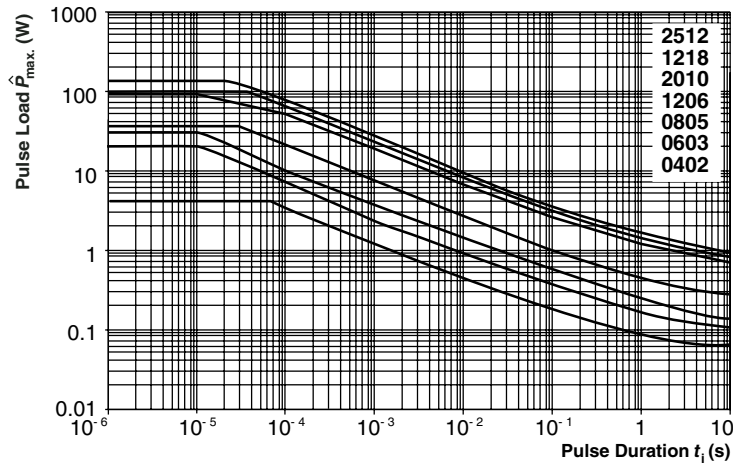
DIMENSIONS


| SIZE | | DIMENSIONS [in millimeters] | | | | | SOLDER PAD DIMENSIONS [in millimeters] | | | | | |
|------|--------|--|-------------|-------------|---|--|--|------|------|----------------|-----|-----|
| | | | | | | | REFLOW SOLDERING | | | WAVE SOLDERING | | |
| INCH | METRIC | L | W | H | T1 | T2 | a | b | l | a | b | l |
| 0201 | 0525 | 0.6 ± 0.05 | 0.3 ± 0.05 | 0.23 ± 0.05 | 0.15 ± 0.05 | 0.15 ^{+0.05} / _{-0.10} | 0.28 | 0.43 | 0.23 | | | |
| 0402 | 1005 | 1.0 ± 0.05 | 0.5 ± 0.05 | 0.35 ± 0.05 | 0.25 ± 0.05 | 0.2 ± 0.1 | 0.4 | 0.6 | 0.5 | | | |
| 0603 | 1608 | 1.55 ^{+0.10} / _{-0.05} | 0.85 ± 0.1 | 0.45 ± 0.05 | 0.3 ± 0.2 | 0.3 ± 0.2 | 0.5 | 0.9 | 1.0 | 0.9 | 0.9 | 1.0 |
| 0805 | 2012 | 2.0 ^{+0.20} / _{-0.10} | 1.25 ± 0.15 | 0.45 ± 0.05 | 0.3 ^{+0.20} / _{-0.10} | 0.3 ± 0.2 | 0.7 | 1.3 | 1.2 | 0.9 | 1.3 | 1.3 |
| 1206 | 3216 | 3.2 ^{+0.10} / _{-0.20} | 1.6 ± 0.15 | 0.55 ± 0.05 | 0.45 ± 0.2 | 0.4 ± 0.2 | 0.9 | 1.7 | 2.0 | 1.1 | 1.7 | 2.3 |
| 1210 | 3225 | 3.2 ± 0.2 | 2.5 ± 0.2 | 0.55 ± 0.05 | 0.45 ± 0.2 | 0.4 ± 0.2 | 0.9 | 2.5 | 2.0 | 1.1 | 2.5 | 2.2 |
| 1218 | 3246 | 3.2 ^{+0.10} / _{-0.20} | 4.6 ± 0.15 | 0.55 ± 0.05 | 0.45 ± 0.2 | 0.4 ± 0.2 | 1.05 | 4.9 | 1.9 | 1.25 | 4.8 | 1.9 |
| 2010 | 5025 | 5.0 ± 0.15 | 2.5 ± 0.15 | 0.6 ± 0.1 | 0.6 ± 0.2 | 0.6 ± 0.2 | 1.0 | 2.5 | 3.9 | 1.2 | 2.5 | 3.9 |
| 2512 | 6332 | 6.3 ± 0.2 | 3.15 ± 0.15 | 0.6 ± 0.1 | 0.6 ± 0.2 | 0.6 ± 0.2 | 1.0 | 3.2 | 5.2 | 1.2 | 3.2 | 5.2 |



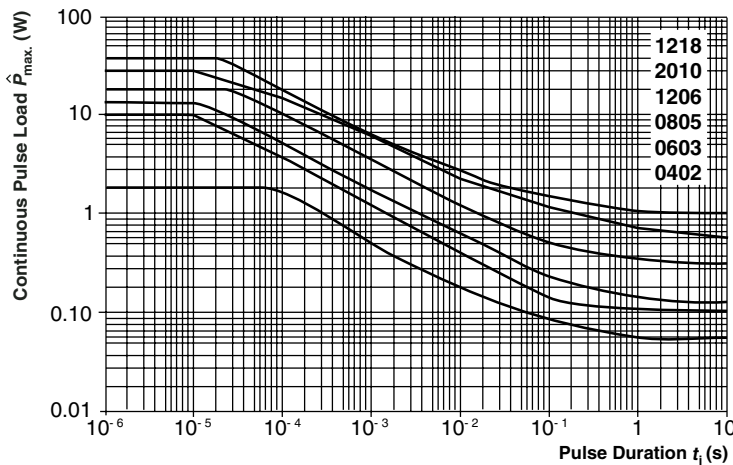
FUNCTIONAL PERFORMANCE

Single Pulse



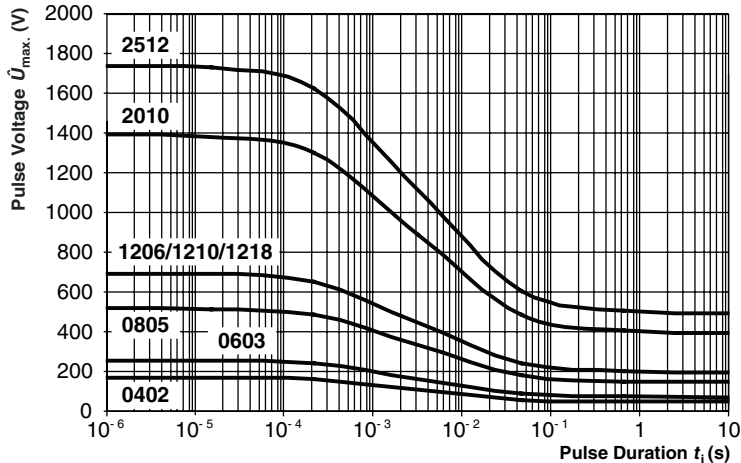
Maximum pulse load, single pulse; applicable if $\bar{P} \rightarrow 0$ and $n \leq 1000$ and $\hat{U} \leq \hat{U}_{max}$; for permissible resistance change equivalent to 8000 h operation

Continuous Pulse

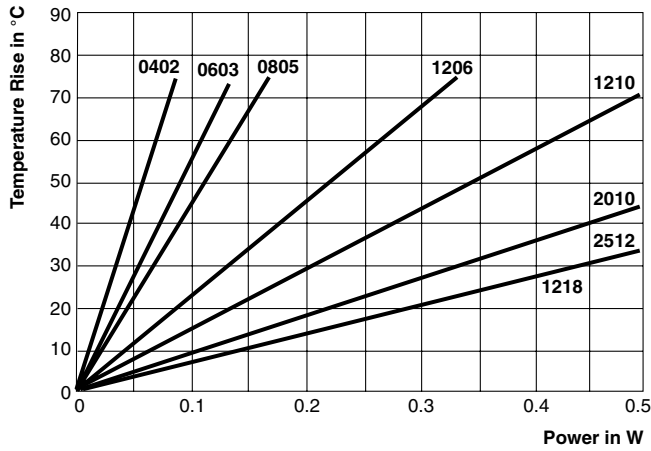


Maximum pulse load, continuous pulses; applicable if $\bar{P} \leq P(\vartheta_{amb})$ and $\hat{U} \leq \hat{U}_{max}$; for permissible resistance change equivalent to 8000 h operation

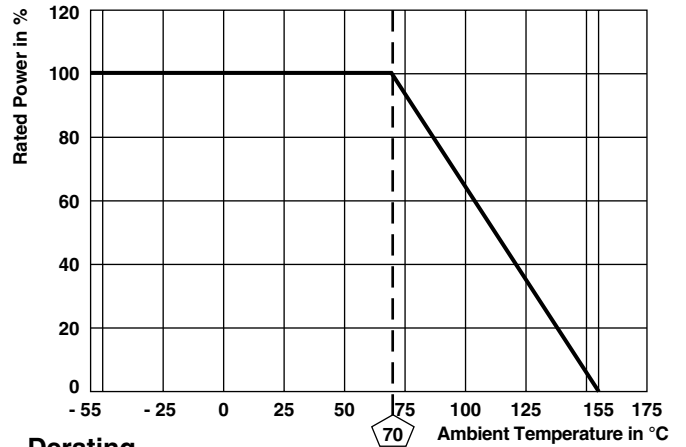
Pulse Voltage



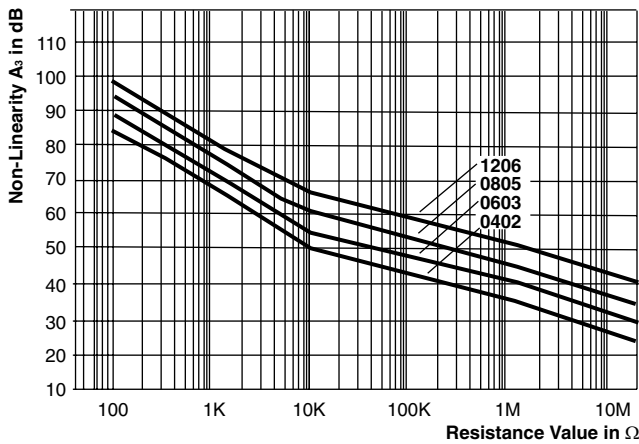
Maximum pulse voltage, single and continuous pulses; applicable if $\hat{P} \leq \hat{P}_{max}$; for permissible resistance change equivalent to 8000 h operation



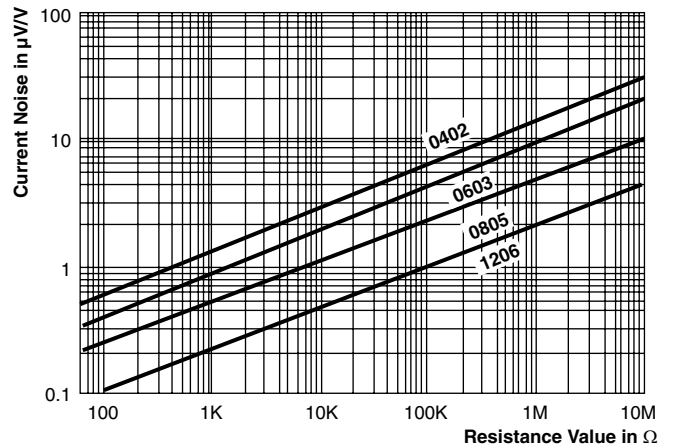
Temperature Rise



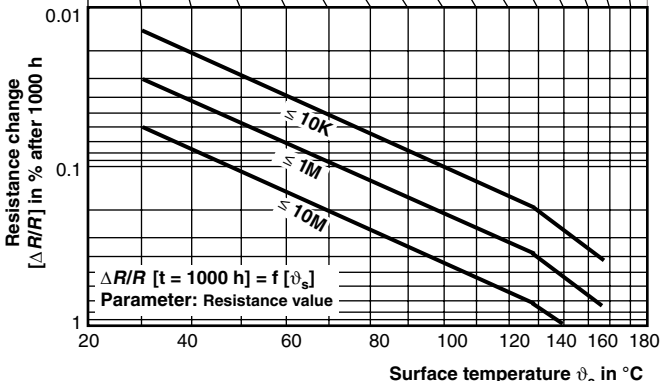
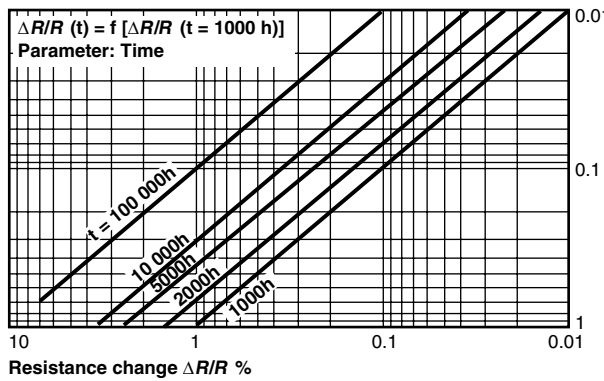
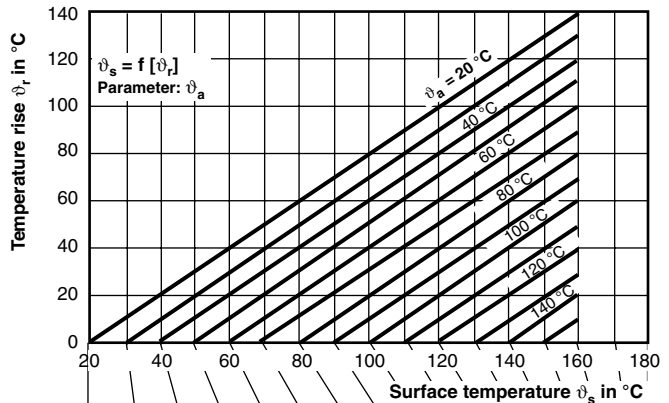
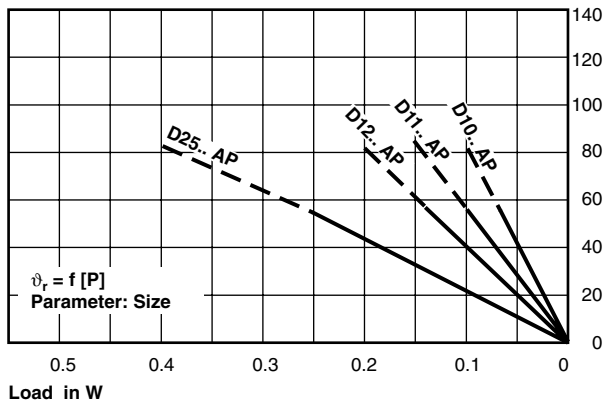
Derating



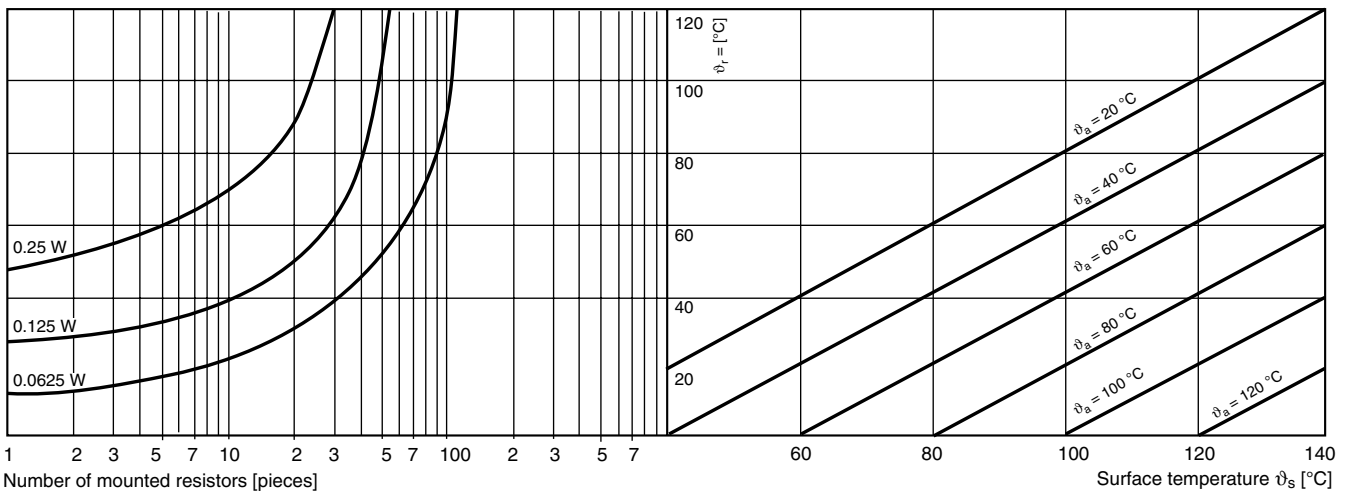
Non-Linearity



Current Noise



Stability nomogram typical values (for handling see general explanations)



Power rating as a function of packaging density (guideline)



| TEST PROCEDURES AND REQUIREMENTS | | | | |
|--|--|---|-------------------------------|--|
| EN 60115-1 | | | | SIZE 0201 ONLY |
| TEST (clause) | CONDITIONS OF TEST | REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$) | | REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$) |
| | | STABILITY CLASS 1 OR BETTER | STABILITY CLASS 2 OR BETTER | |
| | Stability for product types: | | | |
| | D../CRCW....e3 | 1 Ω to 10 M Ω | 1 Ω to 10 M Ω | 10 Ω to 1 M Ω |
| Resistance (4.5) | - | $\pm 1\%$ | $\pm 5\%$ | $\pm 1\%$; $\pm 5\%$ |
| Temperature coefficient (4.8.4.2) | 20/- 55/20 $^{\circ}\text{C}$ and 20/125/20 $^{\circ}\text{C}$ | ± 100 ppm/K | ± 200 ppm/K | ± 200 ppm/K |
| Overload (4.13) | $U = 2.5 \times (P_{70} \times R)^{1/2} \leq 2 \times U_{\text{max}}$; Duration: according the style | $\pm (0.25\% R + 0.05 \Omega)$ | $\pm (0.5\% R + 0.05 \Omega)$ | $\pm (1\% R + 0.05 \Omega)$ |
| Solderability (4.17.5) | Aging 4 h at 155 $^{\circ}\text{C}$, dryheat dolder bath method; 235 $^{\circ}\text{C}$; 2 s visual examination | Good tinning ($\geq 95\%$ covered) no visible damage | | |
| Resistance to soldering heat (4.18.2) | Solder bath method; (260 ± 5) $^{\circ}\text{C}$; (10 ± 1) s | $\pm (0.25\% R + 0.05 \Omega)$ | $\pm (0.5\% R + 0.05 \Omega)$ | $\pm (1\% R + 0.05 \Omega)$ |
| Rapid change of temperature (4.19) | 30 min at LCT = - 55 $^{\circ}\text{C}$; 30 min at UCT = 125 $^{\circ}\text{C}$; 5 cycles | $\pm (0.25\% R + 0.05 \Omega)$ | $\pm (0.5\% R + 0.05 \Omega)$ | $\pm (0.5\% R + 0.05 \Omega)$ |
| Damp heat, steady state (4.24) | (40 ± 2) $^{\circ}\text{C}$; 56 days; (93 ± 3) % RH | $\pm (1\% R + 0.05 \Omega)$ | $\pm (2\% R + 0.1 \Omega)$ | $\pm (2\% R + 0.1 \Omega)$ |
| Climatic sequence (4.23) | 16 h at UCT = 125 $^{\circ}\text{C}$; 1 cycle at 55 $^{\circ}\text{C}$; 2 h at LCT = - 55 $^{\circ}\text{C}$; 1 h/1 kPa at 15 $^{\circ}\text{C}$ to 35 $^{\circ}\text{C}$; 5 cycles at 55 $^{\circ}\text{C}$ $U = (P_{70} \times R)^{1/2}$ $U = U_{\text{max}}$; whichever is less severe | $\pm (1\% R + 0.05 \Omega)$ | $\pm (2\% R + 0.1 \Omega)$ | $\pm (2\% R + 0.1 \Omega)$ |
| Endurance at 70 $^{\circ}\text{C}$ (4.25.1) | $U = (P_{70} \times R)^{1/2}$ $U = U_{\text{max}}$; whichever is less severe 1.5 h on; 0.5 h off; 70 $^{\circ}\text{C}$; 1000 h | $\pm (1\% R + 0.05 \Omega)$ | $\pm (2\% R + 0.1 \Omega)$ | $\pm (3\% R + 0.1 \Omega)$ |
| Extended endurance (4.25.1.8) | Duration extended to 8000 h | $\pm (2\% R + 0.1 \Omega)$ | $\pm (4\% R + 0.1 \Omega)$ | $\pm (4\% R + 0.1 \Omega)$ |
| Endurance at upper category temperature (4.25.3) | UCT = 125 $^{\circ}\text{C}$; 1000 h | $\pm (1\% R + 0.05 \Omega)$ | $\pm (2\% R + 0.1 \Omega)$ | $\pm (2\% R + 0.1 \Omega)$ |

| APPLICABLE SPECIFICATIONS | |
|----------------------------------|--|
| • EN 60115-1 | Generic Specification |
| • EN 140400 | Sectional Specification |
| • EN 140401-802 | Detail Specification |
| • IEC 60068-2-X | Variety of environmental test procedures |
| • IEC 60286-3 | Packaging of SMD components |



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