

Standard Thick Film Chip Resistors



FEATURES

- Stability $\Delta R/R = 1\%$ for 1000 h at 70 °C
- 2 mm pitch packaging option for 0603 size
- Pure tin solder contacts on Ni barrier layer provides compatibility with lead (Pb)-free and lead containing soldering processes
- Metal glaze on high quality ceramic
- AEC-Q200 qualified
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

STANDARD ELECTRICAL SPECIFICATIONS

| MODEL | SIZE | | RATED DISSIPATION $P_{70^\circ\text{C}}$ W | LIMITING ELEMENT VOLTAGE $U_{\text{max. AC/DC}}$ | TEMPERATURE COEFFICIENT ppm/K | TOLERANCE % | RESISTANCE RANGE Ω | SERIES |
|--------------|------|----------|---|---|----------------------------------|--------------------|------------------------------|-----------------|
| | INCH | METRIC | | | | | | |
| D10/CRCW0402 | 0402 | RR 1005M | 0.063 | 50 | ± 100 ± 200 | ± 1 ± 5 | 1R0 to 10M | E24; E96 E24 |
| | | | Zero-Ohm-Resistor: $R_{\text{max.}} = 20\text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 1.5 A | | | | | |
| D11/CRCW0603 | 0603 | RR 1608M | 0.10 | 75 | ± 100 ± 200 | ± 1 ± 5 | 1R0 to 10M | E24; E96 E24 |
| | | | Zero-Ohm-Resistor: $R_{\text{max.}} = 20\text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 2.0 A | | | | | |
| D12/CRCW0805 | 0805 | RR 2012M | 0.125 | 150 | ± 100 ± 200 | ± 1 ± 5 | 1R0 to 10M | E24; E96 E24 |
| | | | Zero-Ohm-Resistor: $R_{\text{max.}} = 20\text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 2.5 A | | | | | |
| D25/CRCW1206 | 1206 | RR 3216M | 0.25 | 200 | ± 100 ± 200 | ± 1 ± 5 | 1R0 to 10M | E24; E96 E24 |
| | | | Zero-Ohm-Resistor: $R_{\text{max.}} = 20\text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 3.5 A | | | | | |
| CRCW1210 | 1210 | RR 3225M | 0.5 | 200 | ± 100 ± 200 | ± 1 ± 5 | 1R0 to 10M | E24; E96 E24 |
| | | | Zero-Ohm-Resistor: $R_{\text{max.}} = 20\text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 5.0 A | | | | | |
| CRCW1218 | 1218 | RR 3246M | 1.0 | 200 | ± 100 ± 200 | ± 1 ± 5 | 1R0 to 2M2 | E24; E96 E24 |
| | | | Zero-Ohm-Resistor: $R_{\text{max.}} = 20\text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 7.0 A | | | | | |
| CRCW2010 | 2010 | RR 5025M | 0.75 | 400 | ± 100 ± 200 | ± 1 ± 5 | 1R0 to 10M | E24; E96 E24 |
| | | | Zero-Ohm-Resistor: $R_{\text{max.}} = 20\text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 6.0 A | | | | | |
| CRCW2512 | 2512 | RR 6332M | 1.0 | 500 | ± 100 ± 200 | ± 1 ± 5 | 1R0 to 10M | E24; E96 E24 |
| | | | 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: See data sheet "Surface Mount Resistor Marking" (document number 20020).
- Power rating depends on the max. temperature at the solder point, the component placement density and the substrate material.

| TECHNICAL SPECIFICATIONS | | | | | | | | | |
|---|-------------|------------------------|------------------|------------------|------------------|----------|----------|----------|----------|
| PARAMETER | UNIT | D10/ CRCW0402 | D11/ CRCW0603 | D12/ CRCW0805 | D25/ CRCW1206 | CRCW1210 | CRCW1218 | CRCW2010 | CRCW2512 |
| Rated dissipation P_{70} ⁽¹⁾ | W | 0.063 | 0.1 | 0.125 | 0.25 | 0.5 | 1.0 | 0.75 | 1.0 |
| Limiting element voltage $U_{max. AC/DC}$ | V | 50 | 75 | 150 | 200 | 200 | 200 | 400 | 500 |
| Insulation voltage U_{ins} (1 min) | V | > 75 | > 100 | > 200 | > 300 | > 300 | > 300 | > 300 | > 300 |
| Insulation resistance | Ω | > 10^9 | | | | | | | |
| Category temperature range | $^{\circ}C$ | - 55 to + 155 | | | | | | | |
| Failure rate | h^{-1} | < 0.1×10^{-9} | | | | | | | |
| Weight | mg | 0.65 | 2 | 5.5 | 10 | 16 | 29.5 | 25.5 | 40.5 |

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 of 155 $^{\circ}C$ is not exceeded.

| PART NUMBER AND PRODUCT DESCRIPTION | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|--|---|---|---|-------------------------------------|---|---|---|---|---|--|--|
| Part Number: CRCW0603562RFKEC | | | | | | | | | | | | | | | | | |
| C | R | C | W | 0 | 6 | 0 | 3 | 5 | 6 | 2 | R | F | K | E | C | | |
| MODEL | | VALUE | | TOLERANCE | | TCR | | PACKAGING | | SPECIAL | | | | | | | |
| CRCW0402 CRCW0603 CRCW0805 CRCW1206 CRCW1210 CRCW1218 CRCW2010 CRCW2512 | | R = Decimal K = Thousand M = Million 0000 = Jumper | | F = $\pm 1.0\%$ J = $\pm 5.0\%$ Z = Jumper | | K = ± 100 ppm/K N = ± 200 ppm/K 0 = Jumper | | EA, EB, EC, ED, EE, EF, EG, EH, EI, EL, EK | | 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 | | LEAD (Pb)-FREE | | | | | | | |
| 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 k Ω 1M0 = 1 M Ω 0R0 = Jumper | | $\pm 5\%$ $\pm 1\%$ | | ET1, ET2, ET3, ET4, ET5, ET6, ET7, ET8, ET9, ET4, E02, E67, E82 | | e3 = Pure tin termination finish | | | | | | | |

| PACKAGING | | | | | | |
|-----------|----------|---------------|--|-------|---------------|---------------|
| MODEL | CODE | QUANTITY | CARRIER TAPE | WIDTH | PITCH | REEL DIAMETER |
| CRCW0402 | ED = ET7 | 10 000 | Paper tape acc. to IEC 60068-3 Type I | 8 mm | 2 mm | 180 mm/7" |
| | EE = EF4 | 50 000 | | | | 330 mm/13" |
| CRCW0603 | EI = ET2 | 5000 | | 8 mm | 2 mm | 180 mm/7" |
| | ED = ET3 | 10 000 | | | | 180 mm/7" |
| | EL = ET4 | 20 000 | | | | 285 mm/11.25" |
| | EE = ET8 | 50 000 | | | | 330 mm/13" |
| | EA = ET1 | 5000 | | | | 8 mm |
| EB = ET5 | 10 000 | 285 mm/11.25" | | | | |
| CRCW0805 | EC = ET6 | 20 000 | | 8 mm | 4 mm | 330 mm/13" |
| | EA = ET1 | 5000 | | | | 180 mm/7" |
| | EB = ET5 | 10 000 | | | | 285 mm/11.25" |
| CRCW1206 | EC = ET6 | 20 000 | | 8 mm | 4 mm | 330 mm/13" |
| | EA = ET1 | 5000 | | | | 180 mm/7" |
| | EB = ET5 | 10 000 | 285 mm/11.25" | | | |
| CRCW1210 | EC = ET6 | 20 000 | 8 mm | 4 mm | 330 mm/13" | |
| | EA = ET1 | 5000 | | | 180 mm/7" | |
| | EB = ET5 | 10 000 | | | 285 mm/11.25" | |
| CRCW1218 | EK = ET9 | 4000 | Blister tape acc. to IEC 60068-3 Type II | 12 mm | 4 mm | 180 mm/7" |
| CRCW2010 | EF = E02 | 4000 | | 12 mm | 4 mm | 180 mm/7" |
| CRCW2512 | EG = E67 | 2000 | | 12 mm | 8 mm | 4 mm |
| | EH = E82 | 4000 | | | | |

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 |
| 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 $n < 1000$ and $\dot{U} \leq \dot{U}_{max}$; for permissible resistance change equivalent to 8000 h operation

Continuous Pulse

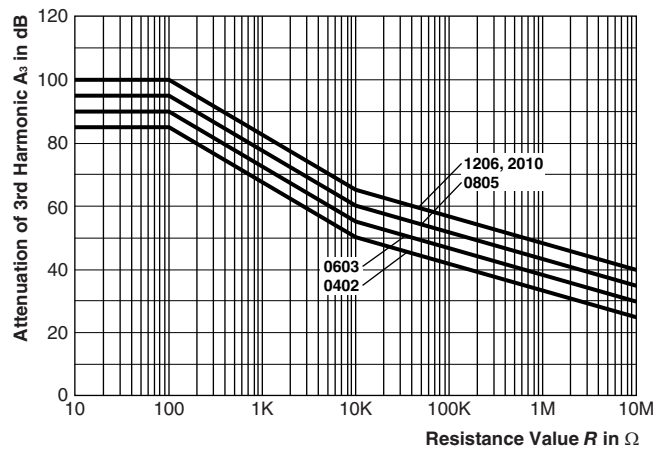


Maximum pulse load, continuous pulses; applicable if $\bar{P} \leq P(9_{amb})$ and $\dot{U} \leq \dot{U}_{max}$; for permissible resistance change equivalent to 8000 h operation



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

Derating



| TEST PROCEDURES AND REQUIREMENTS | | | | | |
|----------------------------------|----------------------------------|------------------------------|---|---|--|
| EN 60115-1 CLAUSE | IEC 60068-2 TEST METHOD | TEST | PROCEDURE | REQUIREMENTS PERMISSIBLE CHANGE (ΔR) | |
| | | | | SIZE 0402 to 2512 | |
| | | | | STABILITY CLASS 1 OR BETTER | STABILITY CLASS 2 OR BETTER |
| | | | Stability for product types: | | |
| | | | D/CRCW e3 | 1 Ω to 10 M Ω | |
| 4.5 | - | Resistance | - | $\pm 1\%$ | $\pm 5\%$ |
| 4.7 | - | Voltage proof | $U = 1.4 \times U_{ins}$; 60 s | No flashover or breakdown | |
| 4.13 | - | Short time overload | $U = 2.5 \times \sqrt{P_{70} \times R}$ $\leq 2 \times U_{max.}$; duration: Acc. to style | $\pm (0.25\% R + 0.05 \Omega)$ | $\pm (0.5\% R + 0.05 \Omega)$ |
| 4.17.2 | 58 (Td) | Solderability | Solder bath method; Sn60Pb40 non activated flux; (235 \pm 5) $^{\circ}$ C (2 \pm 0.2) s | Good tinning ($\geq 95\%$ covered) no visible damage | |
| | | | Solder bath method; Sn96.5Ag3Cu0.5 non-activated flux; (245 \pm 5) $^{\circ}$ C (3 \pm 0.3) s | Good tinning ($\geq 95\%$ covered) no visible damage | |
| 4.8.4.2 | - | Temperature coefficient | (20/- 55/20) $^{\circ}$ C and (20/125/20) $^{\circ}$ C | ± 100 ppm/K | ± 200 ppm/K |
| 4.32 | 21 (Uu ₃) | Shear (adhesion) | RR 1608 and smaller: 9 N RR 2012 and larger: 45 N | No visible damage | |
| 4.33 | 21 (Uu ₁) | Substrate bending | Depth 2 mm; 3 times | No visible damage, no open circuit in bent position $\pm (0.25\% R + 0.05 \Omega)$ | |
| 4.19 | 14 (Na) | Rapid change of temperature | 30 min. at - 55 $^{\circ}$ C; 30 min. at 125 $^{\circ}$ C | $\pm (0.25\% R + 0.05 \Omega)$ $\pm (1\% R + 0.05 \Omega)$ | $\pm (0.5\% R + 0.05 \Omega)$ $\pm (1\% R + 0.05 \Omega)$ |
| | | | 5 cycles 1000 cycles | | |
| 4.23 | - | Climatic sequence: | - | | |
| 4.23.2 | 2 (Ba) | Dry heat | 125 $^{\circ}$ C; 16 h | | |
| 4.23.3 | 30 (Db) | Damp heat, cyclic | 55 $^{\circ}$ C; $\geq 90\%$ RH; 24 h; 1 cycle | | |
| 4.23.4 | 1 (Aa) | Cold | - 55 $^{\circ}$ C; 2 h | $\pm (1\% R + 0.05 \Omega)$ | $\pm (2\% R + 0.1 \Omega)$ |
| 4.23.5 | 13 (M) | Low air pressure | 1 kPa; (25 \pm 10) $^{\circ}$ C; 1 h | | |
| 4.23.6 | 30 (Db) | Damp heat, cyclic | 55 $^{\circ}$ C; $\geq 90\%$ RH; 24 h; 5 cycles | | |
| 4.23.7 | - | DC load | $U = \sqrt{P_{70} \times R}$ | | |
| 4.25.1 | - | Endurance at 70 $^{\circ}$ C | $U = \sqrt{P_{70} \times R} \leq U_{max.}$; 1.5 h on; 0.5 h off; | | |
| | | | 70 $^{\circ}$ C; 1000 h | $\pm (1\% R + 0.05 \Omega)$ | $\pm (2\% R + 0.1 \Omega)$ |
| | | | 70 $^{\circ}$ C; 8000 h | $\pm (2\% R + 0.1 \Omega)$ | $\pm (4\% R + 0.1 \Omega)$ |



| TEST PROCEDURES AND REQUIREMENTS | | | | | |
|----------------------------------|----------------------------------|--|---|---|-----------------------------------|
| EN 60115-1 CLAUSE | IEC 60068-2 TEST METHOD | TEST | PROCEDURE | REQUIREMENTS PERMISSIBLE CHANGE (ΔR) | |
| | | | | SIZE 0402 to 2512 | |
| | | | | STABILITY CLASS 1 OR BETTER | STABILITY CLASS 2 OR BETTER |
| | | | Stability for product types: | | |
| | | | D/CRCW e3 | 1 Ω to 10 M Ω | |
| 4.18.2 | 58 (Td) | Resistance to soldering heat | Solder bath method (260 \pm 5) $^{\circ}$ C; (10 \pm 1) s | \pm (0.25 % R + 0.05 Ω) | \pm (0.5 % R + 0.05 Ω) |
| 4.35 | - | Flamability, needle flame test | IEC 60695-11-5; 10 s | No burning after 30 s | |
| 4.24 | 78 (Cab) | Damp heat, steady state | (40 \pm 2) $^{\circ}$ C; (93 \pm 3) % RH; 56 days | \pm (1 % R + 0.05 Ω) | |
| 4.25.3 | - | Endurance at upper category temperature | 155 $^{\circ}$ C, 1000 h | \pm (1 % R + 0.05 Ω) | \pm (2 % R + 0.1 Ω) |
| 4.40 | - | Electrostatic discharge (human body model) | IEC 61340-3-1; 3 pos. + 3 neg. discharges; ESD voltage acc. to size | \pm (1 % R + 0.05 Ω) | |
| 4.29 | 45 (XA) | Component solvent resistance | Isopropyl alcohol; 50 $^{\circ}$ C; method 2 | No visible damage | |
| 4.30 | 45 (XA) | Solvent resistance of marking | Isopropyl alcohol; 50 $^{\circ}$ C; method 1, toothbrush | Marking legible, no visible damage | |
| 4.22 | 6 (Fc) | Vibration, endurance by sweeping | f = 10 Hz to 2000 Hz; x, y, z \leq 1.5 mm; A \leq 200 m/s ² ; 10 sweeps per axis | \pm (0.25 % R + 0.05 Ω) | \pm (0.5 % R + 0.05 Ω) |
| 4.37 | - | Periodic electric overload | $U = \sqrt{15 \times P_{70} \times R}$ $\leq 2 \times U_{max.}$; 0.1 s on; 2.5 s off; 1000 cycles | \pm (1 % R + 0.05 Ω) | |
| 4.27 | - | Single pulse high voltage overload, 10 μ s/700 μ s | $\hat{U} = 10 \times \sqrt{P_{70} \times R}$ $\leq 2 \times U_{max.}$; 10 pulses | \pm (1 % R + 0.05 Ω) | |

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

- EN 60115-1, generic specification
- EN 140400, sectional specification
- EN 140401-802, detail specification
- IEC 60068-2-x, environmental test procedures

Packaging of components is done in paper or blister tapes according to IEC 60286-3.



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