

Lead (Pb)-Free Thick Film, Rectangular, Semi-Precision Chip Resistors



FEATURES

- Low temperature coefficient (50 ppm/K) and tight tolerances ($\pm 0.25\%$)
- Pure tin plating provides compatibility with lead (Pb)-free and lead containing soldering processing
- 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 | CASE SIZE INCH | CASE SIZE METRIC | POWER RATING P_{70} W | LIMITING ELEMENT VOLTAGE $U_{max. AC_{RMS}/DC}$ V | TEMPERATURE COEFFICIENT ppm/K | TOLERANCE % | RESISTANCE RANGE Ω | SERIES |
| D10/CRCW0402-P | 0402 | 1005 | 0.063 | 50 | ± 100 | ± 0.5 | 1R to 1M1 | E24; E96 |
| | | | | | ± 50 | $\pm 0.25, \pm 0.5, \pm 1$ | 100R to 1M | |
| D11/CRCW0603-P | 0603 | 1608 | 0.1 | 75 | ± 100 | $\pm 0.5, \pm 0.25$ | 1R to 10M | E24; E96 |
| | | | | | ± 50 | ± 0.25 | 100R to 1M | |
| D12/CRCW0805-P | 0805 | 2012 | 0.125 | 150 | ± 100 | ± 0.5 | 10R to 10M | E24; E96 |
| | | | | | ± 50 | ± 0.25 | 100R to 1M | |
| D25/CRCW1206-P | 1206 | 3216 | 0.25 | 200 | ± 100 | ± 0.5 | 10R to 10M | E24; E96 |
| | | | | | ± 50 | ± 0.25 | 100R to 1M | |
| CRCW1210-P | 1210 | 3225 | 0.5 | 200 | ± 100 | ± 0.5 | 100R to 1M | E24; E96 |
| | | | | | ± 50 | $\pm 0.5, \pm 1$ | 100R to 1M | |
| CRCW1218-P | 1218 | 3246 | 1.0 | 200 | ± 100 | ± 0.5 | 100R to 2M2 | E24; E96 |
| | | | | | ± 50 | $\pm 0.5, \pm 1$ | 100R to 2M2 | |
| CRCW2010-P | 2010 | 5025 | 0.75 | 400 | ± 100 | ± 0.5 | 10R to 10M | E24; E96 |
| | | | | | ± 50 | $\pm 0.5, \pm 1$ | 100R to 10M | |
| CRCW2512-P | 2512 | 6332 | 1.0 | 500 | ± 100 | ± 0.5 | 10R to 10M | E24; E96 |
| | | | | | ± 50 | $\pm 0.5, \pm 1$ | 100R to 10M | |

Notes

- These resistors do not feature a limited lifetime when operated within the limits of rated dissipation, permissible operating voltage and permissible film temperature. However, the resistance typically increase due to the resistor's film temperature over operating time generally known as drift. The drift may exceed the stability requirements of an individual application circuit and thereby limits the functional time.
- Marking and packaging: See datasheet "Surface Mount Resistor Marking" (www.vishay.com/doc?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-P | D11/ CRCW0603-P | D12/ CRCW0805-P | D25/ CRCW1206-P | CRCW1210-P | CRCW1218-P | CRCW2010-P | CRCW2512-P |
| Rated Dissipation at P_{70} ⁽¹⁾ | W | 0.063 | 0.1 | 0.125 | 0.25 | 0.5 | 1.0 | 0.75 | 1.0 |
| Operating Voltage U_{max} , AC _{RMS} /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 | | | | | | | |
| Operating Temperature Range | $^{\circ}\text{C}$ | - 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 $^{\circ}\text{C}$ is not exceeded.

| PART NUMBER AND PRODUCT DESCRIPTION | | | | | | | | | | | | | | | | |
|--|---|--|---|--|---|---|---|---|---|---|--|---|---|---|---|---|
| PART NUMBER: CRCW040275R0DKEDP | | | | | | | | | | | | | | | | |
| C | R | C | W | 0 | 4 | 0 | 2 | 7 | 5 | R | 0 | D | K | E | D | P |
| MODEL | | RESISTANCE | | TOLERANCE | | TCR | | PACKAGING | | | SPECIAL | | | | | |
| CRCW0402 CRCW0603 CRCW0805 CRCW1206 CRCW1210 CRCW1218 CRCW2010 CRCW2512 | | R = Decimal K = Thousand M = Million | | C = $\pm 0.25\%$ D = $\pm 0.5\%$ F = $\pm 1.0\%$ | | H = ± 50 ppm/K K = ± 100 ppm/K | | EA, EB, EC, ED, EE, EF, EG, EH, EI, EL EK | | | P = Semi-Precision | | | | | |
| PRODUCT DESCRIPTION: D10/CRCW0402-P 100 75R 0.5 % ET7 e3 | | | | | | | | | | | | | | | | |
| D10/CRCW0402-P | | 100 | | 75R | | 0.5 % | | ET7 | | | e3 | | | | | |
| MODEL | | TCR | | RESISTANCE | | TOLERANCE | | PACKAGING | | | LEAD (Pb)-FREE | | | | | |
| D10/CRCW0402-P D11/CRCW0603-P D12/CRCW0805-P D25/CRCW1206-P CRCW1210-P CRCW1218-P CRCW2010-P CRCW2512-P | | ± 50 ppm/K ± 100 ppm/K | | 49K9 = 49.9 k Ω 5R1 = 5.1 Ω | | $\pm 0.25\%$ $\pm 0.5\%$ $\pm 1\%$ | | ET1, ET2, ET3, ET4, ET5, ET6, ET7, ET8, ET9, EF4, E02, E67, E82 | | | e3 = Pure tin termination finish | | | | | |

| PACKAGING | | | | | | |
|----------------|----------|---------------|--|-------|---------------|---------------|
| MODEL | CODE | QUANTITY | CARRIER TAPE | WIDTH | PITCH | REEL DIAMETER |
| D10/CRCW0402-P | 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" |
| D11/CRCW0603-P | 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" | | | | |
| D12/CRCW0805-P | 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" | | | |
| D25/CRCW1206-P | 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-P | EC = ET6 | 20 000 | 12 mm | 4 mm | 330 mm/13" | |
| | EA = ET1 | 5000 | | | 180 mm/7" | |
| | EB = ET5 | 10 000 | | | 285 mm/11.25" | |
| CRCW1218-P | EK = ET9 | 4000 | Blister tape acc. to IEC 60068-3 Type II | 12 mm | 4 mm | 180 mm/7" |
| CRCW2010-P | EF = E02 | 4000 | | 12 mm | 4 mm | 180 mm/7" |
| CRCW2512-P | EG = E67 | 2000 | | 12 mm | 8 mm | 180 mm/7" |
| | EH = E82 | 4000 | 4 mm | | | 180 mm/7" |

| DIMENSIONS in millimeters | | | | | | | | | | | | |
|---------------------------|--------|--|-------------|-------------|---------------------------------------|-----------|-----------------------|-----|-----|----------------|-----|-----|
| | | | | | | | | | | | | |
| SIZE | | DIMENSIONS | | | | | SOLDER PAD DIMENSIONS | | | | | |
| INCH | METRIC | L | W | H | T1 | T2 | REFLOW SOLDERING | | | WAVE SOLDERING | | |
| | | | | | | | 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


| TEST PROCEDURES AND REQUIREMENTS | | | | |
|----------------------------------|-------------------------|-----------------------------|---|---|
| EN 60115-1 CLAUSE | IEC 60068-2 TEST METHOD | TEST | PROCEDURE | REQUIREMENTS PERMISSIBLE CHANGE (ΔR) |
| | | | Stability for product types: | STABILITY CLASS 1 OR BETTER |
| | | | D/CRCW-P e3 | 1 Ω to 10 M Ω |
| 4.5 | - | Resistance | - | $\pm 0.25\%$; $\pm 0.5\%$; $\pm 1\%$ |
| 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 | $\pm (0.25\% R + 0.05 \Omega)$ |
| 4.17.2 | 58 (Td) | Solderability | Solder bath method; Sn60Pb40 non-activated flux; (235 \pm 5) °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) °C (3 \pm 0.3) s | Good tinning ($\geq 95\%$ covered) no visible damage |
| 4.8.4.2 | - | Temperature coefficient | (20/- 55/20) °C and (20/125/20) °C | ± 50 ppm/K; ± 100 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 °C; 30 min at 125 °C | $\pm (0.25\% R + 0.05 \Omega)$ $\pm (1\% R + 0.05 \Omega)$ |
| | | | 5 cycles 1000 cycles | |

| TEST PROCEDURES AND REQUIREMENTS | | | | |
|----------------------------------|----------------------------------|--|---|---|
| EN 60115-1 CLAUSE | IEC 60068-2 TEST METHOD | TEST | PROCEDURE | REQUIREMENTS PERMISSIBLE CHANGE (ΔR) |
| | | | Stability for product types: | STABILITY CLASS 1 OR BETTER 1 Ω to 10 M Ω |
| | | | D/CRCW-P e3 | |
| 4.23 | - | Climatic sequence: | - | $\pm (1 \% R + 0.05 \Omega)$ |
| 4.23.2 | 2 (Ba) | Dry heat | 125 °C; 16 h | |
| 4.23.3 | 30 (Db) | Damp heat, cyclic | 55 °C; $\geq 90 \% RH$; 24 h; 1 cycle | |
| 4.23.4 | 1 (Aa) | Cold | - 55 °C; 2 h | |
| 4.23.5 | 13 (M) | Low air pressure | 1 kPa; (25 \pm 10) °C; 1 h | |
| 4.23.6 | 30 (Db) | Damp heat, cyclic | 55 °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 °C | $U = \sqrt{P_{70} \times R} \leq U_{max.}$; 1.5 h on; 0.5 h off; 70 °C; 1000 h 70 °C; 8000 h | $\pm (1 \% R + 0.05 \Omega)$ $\pm (2 \% R + 0.05 \Omega)$ |
| 4.18.2 | 58 (Td) | Resistance to soldering heat | Solder bath method (260 \pm 5) °C; (10 \pm 1) s | $\pm (0.25 \% R + 0.05 \Omega)$ |
| 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) °C; (93 \pm 3) % RH; 56 days | $\pm (1 \% R + 0.05 \Omega)$ |
| 4.25.3 | - | Endurance at upper category temperature | 155 °C, 1000 h | $\pm (1 \% R + 0.05 \Omega)$ |
| 4.40 | - | Electrostatic discharge (human body model) | IEC 61340-3-1; 3 pos. + 3 neg. discharges; ESD voltage acc. to size | $\pm (1 \% R + 0.05 \Omega)$ |
| 4.29 | 45 (XA) | Component solvent resistance | Isopropyl alcohol; 50 °C; method 2 | No visible damage |
| 4.30 | 45 (XA) | Solvent resistance of marking | Isopropyl alcohol; 50 °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 | $\pm (0.25 \% R + 0.05 \Omega)$ |
| 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 | $\pm (1 \% R + 0.05 \Omega)$ |
| 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 | $\pm (1 \% R + 0.05 \Omega)$ |

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, variety of environmental test procedures

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



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