

## Thick Film Surface Mount Chip Resistors, Wraparound, Extremely Low Value (0.01 Ω to 0.976 Ω)



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### FEATURES

- Extremely low resistance values (0.01 Ω to 0.976 Ω)
- Enhanced power rating due to long side terminal construction (0612, 1020 types)
- Suitable for current sensing and shunts
- Metal glaze on high quality ceramic
- Protective overglaze
- Lead (Pb)-free solder contacts on Ni barrier layer
- AEC-Q200 qualified
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### STANDARD ELECTRICAL SPECIFICATIONS

| GLOBAL MODEL | CASE SIZE | POWER RATING<br>$P_{70\text{ }^\circ\text{C}}$<br>W | TEMPERATURE COEFFICIENT<br>$\pm$ ppm/ $^\circ\text{C}$ | RESISTANCE RANGE<br>$\Omega$ | TOLERANCE<br>$\pm$ %          | E-SERIES <sup>(2)</sup> |
|--------------|-----------|-----------------------------------------------------|--------------------------------------------------------|------------------------------|-------------------------------|-------------------------|
| RCWE0402     | 0402      | 0.125                                               | 400                                                    | 0.033 to 0.05                | 5.0                           | 24                      |
|              |           |                                                     | 200                                                    | 0.051 to 0.18                | 1.0, 5.0                      | 24; 96                  |
|              |           |                                                     | 100                                                    | 0.2 to 0.976                 | 0.5 <sup>(1)</sup> , 1.0, 5.0 |                         |
| RCWE0603     | 0603      | 0.2                                                 | 700                                                    | 0.010 to 0.018               | 5.0                           | 24                      |
|              |           |                                                     | 400                                                    | 0.02 to 0.03                 | 1.0, 5.0                      | 24; 96                  |
|              |           |                                                     | 200                                                    | 0.033 to 0.105               | 1.0, 5.0                      |                         |
| RCWE0805     | 0805      | 0.25                                                | 100                                                    | 0.11 to 0.976                | 0.5 <sup>(1)</sup> , 1.0, 5.0 | 24; 96                  |
|              |           |                                                     | 400                                                    | 0.010 to 0.018               | 5.0                           |                         |
|              |           |                                                     | 300                                                    | 0.02 to 0.03                 | 1.0, 5.0                      |                         |
| RCWE0612     | 0612      | 1.0                                                 | 200                                                    | 0.033 to 0.05                | 1.0, 5.0                      | 24; 96                  |
|              |           |                                                     | 100                                                    | 0.051 to 0.976               | 0.5 <sup>(1)</sup> , 1.0, 5.0 |                         |
|              |           |                                                     | 300                                                    | 0.010 to 0.016               | 2.0, 5.0                      |                         |
| RCWE1206     | 1206      | 0.5                                                 | 200                                                    | 0.018 to 0.2                 | 2.0, 5.0                      | 24; 96                  |
|              |           |                                                     | 100                                                    | 0.205 to 0.976               | 1.0, 5.0                      |                         |
|              |           |                                                     | 600                                                    | 0.010 to 0.018               | 5.0                           |                         |
| RCWE1210     | 1210      | 1.0                                                 | 300                                                    | 0.02 to 0.03                 | 1.0, 5.0                      | 24; 96                  |
|              |           |                                                     | 200                                                    | 0.033 to 0.05                | 1.0, 5.0                      |                         |
|              |           |                                                     | 100                                                    | 0.051 to 0.976               | 0.5 <sup>(1)</sup> , 1.0, 5.0 |                         |
| RCWE1020     | 1020      | 2.0                                                 | 200                                                    | 0.010 to 0.016               | 2.0, 5.0                      | 24                      |
|              |           |                                                     | 100                                                    | 0.0162 to 0.976              | 1.0, 5.0                      | 24; 96                  |
| RCWE2010     | 2010      | 1.0                                                 | 600                                                    | 0.010 to 0.018               | 5.0                           | 24                      |
|              |           |                                                     | 300                                                    | 0.02 to 0.03                 | 1.0, 5.0                      | 24; 96                  |
|              |           |                                                     | 200                                                    | 0.033 to 0.05                | 1.0, 5.0                      |                         |
| RCWE2512     | 2512      | 2.0                                                 | 100                                                    | 0.051 to 0.976               | 0.5 <sup>(1)</sup> , 1.0, 5.0 | 24; 96                  |
|              |           |                                                     | 600                                                    | 0.010 to 0.018               | 5.0                           |                         |
|              |           |                                                     | 300                                                    | 0.02 to 0.03                 | 1.0, 5.0                      |                         |
|              |           |                                                     | 200                                                    | 0.033 to 0.05                | 1.0, 5.0                      |                         |
|              |           |                                                     | 100                                                    | 0.051 to 0.976               | 0.5 <sup>(1)</sup> , 1.0, 5.0 |                         |

#### Notes

- Power rating depends on the max. temperature at the solder point, the component placement density and the substrate material
- Part marking: Reference "Surface Mount Resistor Marking" ([www.vishay.com/doc?20020](http://www.vishay.com/doc?20020))
- <sup>(1)</sup> Tight tolerance of 0.5 % is available for resistance values above 0.300 Ω (0402 size) and above 0.200 Ω (0603 to 2512 sizes)
- <sup>(2)</sup> Use E24 decades only for 5.0 % tolerance. E24 or E96 decades are available for 0.5 % and 1.0 % tolerance. Refer to standard decade table ([www.vishay.com/doc?31001](http://www.vishay.com/doc?31001))

**GLOBAL PART NUMBER INFORMATION**

 Global Part Numbering example: RCWE060351L0FN EA (visit [www.vishay.net](http://www.vishay.net) Vishay Dale parts numbering manual for all options)

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R | C | W | E | 0 | 6 | 0 | 3 | 5 | 1 | L | 0 | F | N | E | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

|                                                                                                          |
|----------------------------------------------------------------------------------------------------------|
| GLOBAL MODEL<br>(8 digits)                                                                               |
| RCWE0402<br>RCWE0603<br>RCWE0805<br>RCWE0612<br>RCWE1206<br>RCWE1210<br>RCWE1020<br>RCWE2010<br>RCWE2512 |

|                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------|
| VALUE<br>(4 digits)                                                                                                     |
| L = mΩ *<br>R = decimal<br>10L0 = 0.01 Ω<br>R470 = 0.47 Ω<br><b>Note:</b><br>* Use "L" for resistance<br>values < 0.1 Ω |

|                                                          |
|----------------------------------------------------------|
| TOLERANCE<br>(1 digit)                                   |
| D = ± 0.5 %<br>F = ± 1.0 %<br>G = ± 2.0 %<br>J = ± 5.0 % |

|                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------|
| TCR<br>(1 digit)                                                                                                                         |
| K = ± 100 ppm/°C<br>N = ± 200 ppm/°C<br>M = ± 300 ppm/°C<br>Q = ± 400 ppm/°C<br>P = ± 500 ppm/°C<br>T = ± 600 ppm/°C<br>G = ± 700 ppm/°C |

|                                |
|--------------------------------|
| PACKAGING<br>(2 digits)        |
| EA = lead (Pb)-free, tape/reel |

**TECHNICAL SPECIFICATIONS**

| PARAMETER                            | UNIT | 0402                 | 0603  | 0805  | 0612  | 1206  | 1210  | 1020  | 2010  | 2512  |
|--------------------------------------|------|----------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Operating temperature range          | °C   | -55 to +155          |       |       |       |       |       |       |       |       |
| Maximum operating voltage            | V    | $(P \times R)^{1/2}$ |       |       |       |       |       |       |       |       |
| Insulation voltage $U_{ins}$ (1 min) | V    | > 75                 | > 100 | > 200 | > 100 | > 300 | > 300 | > 300 | > 300 | > 300 |
| Insulation resistance                | Ω    | > 10 <sup>9</sup>    |       |       |       |       |       |       |       |       |
| Weight/1000 pieces (typical)         | g    | 0.7                  | 3     | 5.5   | 11.5  | 10.5  | 17.5  | 27.5  | 26    | 40.5  |

**DIMENSIONS**

RCWE0402 to RCWE2512

RCWE0612, RCWE1020



| SIZE | RESISTANCE RANGE<br>Ω | DIMENSIONS in millimeters |             |            |             |             | SOLDER PAD DIMENSIONS in millimeters |     |     |     |     |     |
|------|-----------------------|---------------------------|-------------|------------|-------------|-------------|--------------------------------------|-----|-----|-----|-----|-----|
|      |                       | L                         | W           | H          | T1          | T2          | a                                    | b   | l   |     |     |     |
| 0402 | 0.033 to 0.976        | 1.05 ± 0.05               | 0.55 ± 0.05 | 0.35 ± 0.1 | 0.3 ± 0.15  | 0.25 ± 0.1  | 0.7                                  | 0.7 | 0.3 |     |     |     |
| 0603 | 0.01 to 0.03          | 1.6 ± 0.1                 | 0.85 ± 0.1  | 0.5 ± 0.1  | 0.5 ± 0.2   | 0.3 ± 0.2   | 0.9                                  | 1.0 | 0.4 |     |     |     |
|      | 0.033 to 0.976        |                           |             |            | 0.3 ± 0.2   |             |                                      |     |     | 0.7 | 1.0 | 0.8 |
| 0805 | 0.01 to 0.03          | 2.0 ± 0.15                | 1.3 ± 0.1   | 0.55 ± 0.1 | 0.6 ± 0.2   | 0.35 ± 0.2  | 1.0                                  | 1.4 | 0.6 |     |     |     |
|      | 0.033 to 0.976        |                           |             |            | 0.4 ± 0.2   |             |                                      |     |     | 0.8 | 1.4 | 1.0 |
| 0612 | 0.01 to 0.976         | 1.6 ± 0.2                 | 3.2 ± 0.2   | 0.6 ± 0.1  | 0.4 ± 0.15  | 0.25 ± 0.15 | 0.9                                  | 3.5 | 0.8 |     |     |     |
| 1206 | 0.01 to 0.03          | 3.1 ± 0.15                | 1.6 ± 0.15  | 0.6 ± 0.1  | 0.9 ± 0.2   | 0.45 ± 0.2  | 1.3                                  | 1.8 | 1.0 |     |     |     |
|      | 0.033 to 0.05         |                           |             |            | 0.8 ± 0.2   |             |                                      |     |     | 1.2 | 1.8 | 1.2 |
|      | 0.051 to 0.976        |                           |             |            | 0.45 ± 0.2  |             |                                      |     |     | 1.0 | 1.8 | 1.6 |
| 1210 | 0.01 to 0.03          | 3.1 ± 0.2                 | 2.5 ± 0.2   | 0.6 ± 0.1  | 0.8 ± 0.2   | 0.4 ± 0.2   | 1.3                                  | 2.6 | 1.1 |     |     |     |
|      | 0.033 to 0.976        |                           |             |            | 0.4 ± 0.2   |             |                                      |     |     | 0.9 | 2.6 | 2.0 |
| 1020 | 0.01 to 0.976         | 2.5 ± 0.2                 | 5.0 ± 0.2   | 0.6 ± 0.1  | 0.55 ± 0.15 | 0.30 ± 0.15 | 1.2                                  | 5.5 | 1.4 |     |     |     |
| 2010 | 0.01 to 0.03          | 5.0 ± 0.2                 | 2.5 ± 0.15  | 0.6 ± 0.1  | 1.6 ± 0.3   | 0.6 ± 0.2   | 2.3                                  | 3.0 | 1.4 |     |     |     |
|      | 0.033 to 0.05         |                           |             |            | 0.7 ± 0.3   |             |                                      |     |     | 1.4 | 3.0 | 3.2 |
|      | 0.051 to 0.976        |                           |             |            | 0.7 ± 0.3   |             |                                      |     |     | 1.4 | 3.0 | 3.2 |
| 2512 | 0.01 to 0.03          | 6.3 ± 0.2                 | 3.15 ± 0.15 | 0.6 ± 0.1  | 2.0 ± 0.3   | 0.6 ± 0.2   | 2.8                                  | 3.6 | 1.4 |     |     |     |
|      | 0.033 to 0.05         |                           |             |            | 0.8 ± 0.3   |             |                                      |     |     | 1.6 | 3.6 | 3.8 |
|      | 0.051 to 0.976        |                           |             |            | 0.8 ± 0.3   |             |                                      |     |     | 1.6 | 3.6 | 3.8 |

**DERATING**


| PERFORMANCE               |                                                                                   |                    |
|---------------------------|-----------------------------------------------------------------------------------|--------------------|
| TEST                      | CONDITIONS OF TEST                                                                | TEST LIMITS        |
| Thermal shock             | MIL-STD-202, method 107, -55 °C to +125 °C, 300 cycles at each extreme            | ± 1.0 % + 0.0005 Ω |
| Short time overload       | 2x rated power; duration according the model                                      | ± 0.5 % + 0.0005 Ω |
| High temperature exposure | MIL-STD-202, method 108, 1000 h at T = 125 °C, 0 % power                          | ± 2.0 % + 0.0005 Ω |
| Temperature cycling       | JESD 22, method JA-104, 1000 cycles (-55 °C to +125 °C)                           | ± 2.0 % + 0.0005 Ω |
| Biased humidity           | MIL-STD-202, method 103, 1000 h 85 °C/85 % RH, 10 % x (P x R) <sup>1/2</sup>      | ± 2.0 % + 0.0005 Ω |
| Mechanical shock          | MIL-STD-202, method 213, condition C, 10 g's, 6 ms (half sine), 3 directions      | ± 1.0 % + 0.0005 Ω |
| Vibration                 | MIL-STD-202, method 204, 5 g's, 20 min, 12 cycles, 3 directions, 10 Hz to 2000 Hz | ± 1.0 % + 0.0005 Ω |
| Operational life          | MIL-STD-202, method 108, 1000 h at T = 125 °C at rated power                      | ± 2.0 % + 0.0005 Ω |
| Resistance to solder heat | MIL-STD-202, method 210, +260 °C solder, 10 s to 12 s dwell, 25 mm/s emergence    | ± 1.0 % + 0.0005 Ω |
| Moisture resistance       | MIL-STD-202, method 106, 0 % power, 7a and 7b not required                        | ± 2.0 % + 0.0005 Ω |

| PACKAGING |                        |           |       |             |      |
|-----------|------------------------|-----------|-------|-------------|------|
| MODEL     | REEL                   |           |       |             |      |
|           | TAPE WIDTH             | DIAMETER  | PITCH | PIECES/REEL | CODE |
| RCWE0402  | 8 mm/punched paper     | 180 mm/7" | 2 mm  | 10 000      | EA   |
| RCWE0603  | 8 mm/punched paper     | 180 mm/7" | 4 mm  | 5000        | EA   |
| RCWE0805  | 8 mm/punched paper     | 180 mm/7" | 4 mm  | 5000        | EA   |
| RCWE0612  | 8 mm/punched paper     | 180 mm/7" | 4 mm  | 5000        | EA   |
| RCWE1206  | 8 mm/punched paper     | 180 mm/7" | 4 mm  | 5000        | EA   |
| RCWE1210  | 8 mm/punched paper     | 180 mm/7" | 4 mm  | 5000        | EA   |
| RCWE1020  | 12 mm/embossed plastic | 180 mm/7" | 4 mm  | 4000        | EA   |
| RCWE2010  | 12 mm/embossed plastic | 180 mm/7" | 4 mm  | 4000        | EA   |
| RCWE2512  | 12 mm/embossed plastic | 180 mm/7" | 8 mm  | 2000        | EA   |

**Note**

- Embossed carrier tape per EIA-481-1A



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