

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



### LINKS TO ADDITIONAL RESOURCES



### FEATURES

- Extremely low resistance values (0.01  $\Omega$  to 0.976  $\Omega$ )
- Sulfur resistant (per ASTM B809-95 humid vapor test)
- 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>$P_{70^{\circ}\text{C}}$<br>W | TEMPERATURE COEFFICIENT<br>+ ppm/ $^{\circ}\text{C}$ | RESISTANCE RANGE<br>$\Omega$ | TOLERANCE<br>$\pm$ %          | E-SERIES <sup>(2)</sup> |
|----------------------------|-----------|-----------------------------------------------|------------------------------------------------------|------------------------------|-------------------------------|-------------------------|
| RCWE0402 <sup>(3)(4)</sup> | 0402      | 0.125                                         | 400                                                  | 0.033 to 0.05                | 5.0                           | 24                      |
|                            |           |                                               | 200                                                  | 0.051 to 0.196               | 1.0, 5.0                      | 24; 96                  |
|                            |           |                                               | 100                                                  | 0.2 to 0.976                 | 0.5 <sup>(1)</sup> , 1.0, 5.0 |                         |
| RCWE0603 <sup>(4)</sup>    | 0603      | 0.2                                           | 700                                                  | 0.010 to 0.018               | 5.0                           | 24                      |
|                            |           |                                               | 400                                                  | 0.02 to 0.0324               | 1.0, 5.0                      | 24; 96                  |
|                            |           |                                               | 200                                                  | 0.033 to 0.105               | 1.0, 5.0                      |                         |
|                            |           |                                               | 100                                                  | 0.11 to 0.976                | 0.5 <sup>(1)</sup> , 1.0, 5.0 |                         |
| RCWE0805 <sup>(4)</sup>    | 0805      | 0.25                                          | 400                                                  | 0.010 to 0.018               | 5.0                           | 24                      |
|                            |           |                                               | 300                                                  | 0.02 to 0.0324               | 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 |                         |
| RCWE0612 <sup>(4)</sup>    | 0612      | 1.0                                           | 300                                                  | 0.010 to 0.016               | 2.0, 5.0                      | 24                      |
|                            |           |                                               | 200                                                  | 0.018 to 0.2                 | 2.0, 5.0                      | 24; 96                  |
|                            |           |                                               | 100                                                  | 0.205 to 0.976               | 1.0, 5.0                      |                         |
| RCWE1206 <sup>(4)</sup>    | 1206      | 0.5                                           | 600                                                  | 0.010 to 0.018               | 5.0                           | 24                      |
|                            |           |                                               | 300                                                  | 0.02 to 0.0324               | 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 |                         |
| RCWE1210 <sup>(4)</sup>    | 1210      | 1.0                                           | 500                                                  | 0.010 to 0.018               | 5.0                           | 24                      |
|                            |           |                                               | 300                                                  | 0.02 to 0.0324               | 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 <sup>(4)</sup>    | 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 <sup>(4)</sup>    | 2010      | 1.0                                           | 600                                                  | 0.010 to 0.018               | 5.0                           | 24                      |
|                            |           |                                               | 300                                                  | 0.02 to 0.0324               | 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 |                         |
| RCWE2512 <sup>(4)</sup>    | 2512      | 2.0                                           | 600                                                  | 0.010 to 0.018               | 5.0                           | 24                      |
|                            |           |                                               | 300                                                  | 0.02 to 0.0324               | 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 |                         |

### 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))
- Temperature range of TCR rating is 0  $^{\circ}\text{C}$  to 150  $^{\circ}\text{C}$ . TCR values are (+) range only with no (-) range values; 1/2 of previous tolerance range
- <sup>(1)</sup> Tight tolerance of 0.5 % is available for resistance values above 0.300  $\Omega$  (0402 size) and above 0.200  $\Omega$  (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))
- <sup>(3)</sup> Terminal strength tested per AEC-Q200-006 with the exception of 0.75 kg force is used
- <sup>(4)</sup> Qualified to AEC-Q200 rev. D

## GLOBAL PART NUMBER INFORMATION

Global Part Numbering Example: RCWE060351L0FNA (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  
(8 digits)

RCWE0402  
RCWE0603  
RCWE0805  
RCWE0612  
RCWE1206  
RCWE1210  
RCWE1020  
RCWE2010  
RCWE2512

VALUE  
(4 digits)

L = mΩ \*  
R = decimal  
10L0 = 0.01 Ω  
R470 = 0.47 Ω

Note:  
\* Use "L" for resistance  
values < 0.1 Ω

TOLERANCE  
(1 digit)

D = ± 0.5 %  
F = ± 1.0 %  
G = ± 2.0 %  
J = ± 5.0 %

TCR  
(1 digit)

K = +100 ppm/°C  
N = +200 ppm/°C  
M = +300 ppm/°C  
Q = +400 ppm/°C  
P = +500 ppm/°C  
T = +600 ppm/°C  
G = +700 ppm/°C

PACKAGING  
(2 digits)

EA = lead (Pb)-free,  
tape/reel

SPECIAL  
(up to 2 digits)

(dash number)  
from 1 to 99 as  
applicable

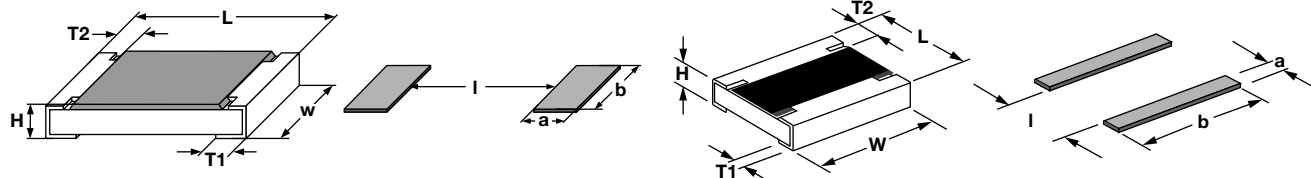
## TECHNICAL SPECIFICATIONS

| 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

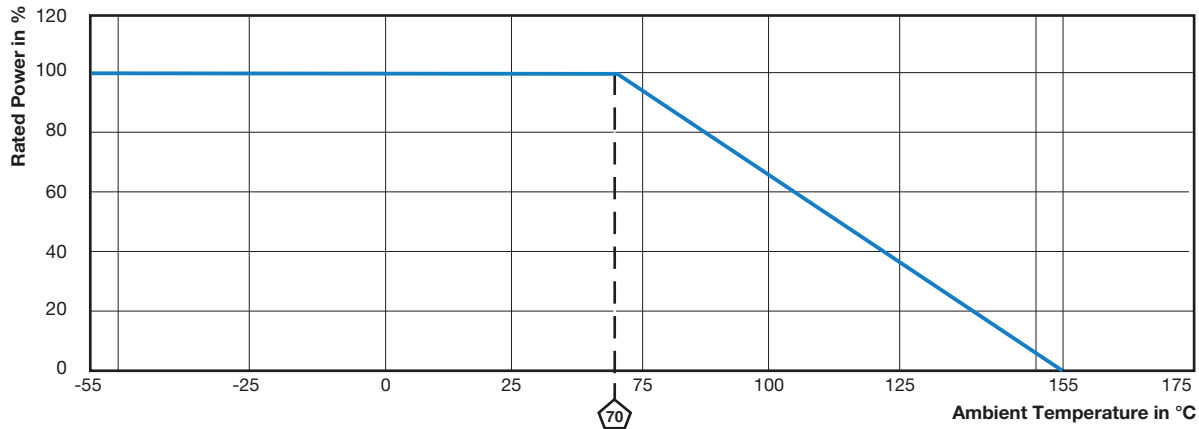


| SIZE | DIMENSIONS in millimeters |             |             |            |             |             | SOLDER PAD DIMENSIONS in millimeters |     |     |
|------|---------------------------|-------------|-------------|------------|-------------|-------------|--------------------------------------|-----|-----|
|      | RESISTANCE RANGE<br>Ω     | 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 |

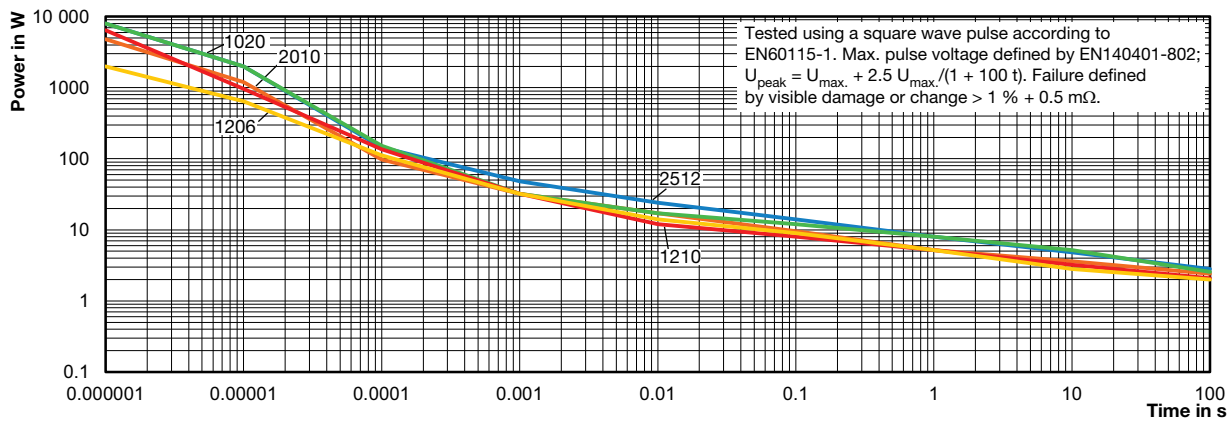
### Notes

- 3D models available: [www.vishay.com/doc?31106](http://www.vishay.com/doc?31106)
- Surface mount solder profile recommendations: [www.vishay.com/doc?31052](http://www.vishay.com/doc?31052)

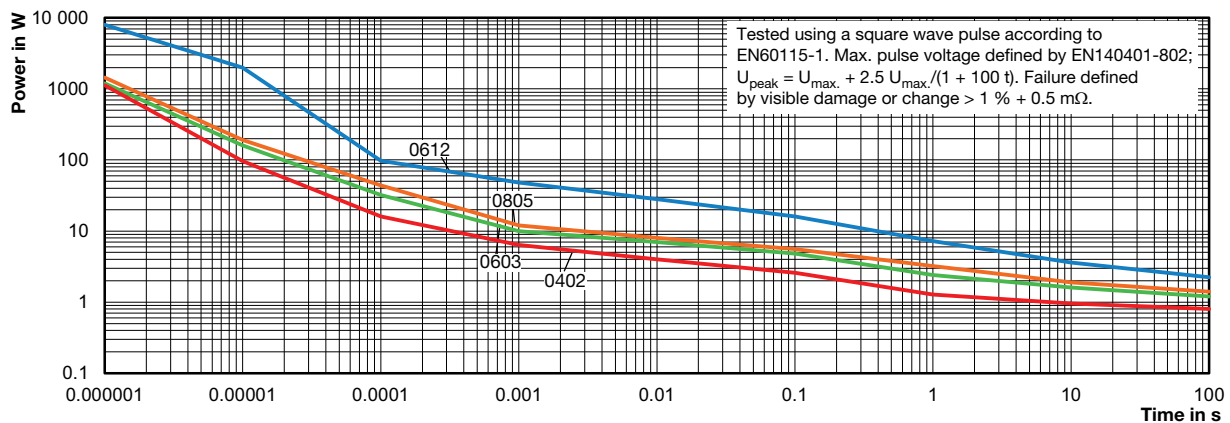
## DERATING



## SINGLE PULSE



## SINGLE PULSE





| 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       | 2 x rated power; size and duration - 0402: 0.5 s, 0603 and 0805: 1 s, 1206 and larger: 2 s | ± 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 |

**Note**

- Contact [ww2bresistors@vishay.com](mailto:ww2bresistors@vishay.com) for application specific performance requirements or qualification data. Typical performance is better than stated test limits

| 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   |

**Notes**

- Embossed carrier tape per EIA-481-1A
- Additional packaging details at: [www.vishay.com/doc?31543](http://www.vishay.com/doc?31543)

| LINKS TO RELATED DOCUMENTS                                |                                                                        |
|-----------------------------------------------------------|------------------------------------------------------------------------|
| <b>SELECTOR GUIDE</b>                                     |                                                                        |
| Overview of Automotive Grade Products                     | <a href="http://www.vishay.com/doc?49924">www.vishay.com/doc?49924</a> |
| <b>TECHNICAL NOTES</b>                                    |                                                                        |
| SMD Current Sense: AEC-Q200 vs. Vishay Qualification      | <a href="http://www.vishay.com/doc?30416">www.vishay.com/doc?30416</a> |
| MIL-PRF vs. AEC-Q200: Do You Know What You Are Getting?   | <a href="http://www.vishay.com/doc?11000">www.vishay.com/doc?11000</a> |
| <b>WHITE PAPER</b>                                        |                                                                        |
| Thermal Management for Surface-Mount Devices              | <a href="http://www.vishay.com/doc?30380">www.vishay.com/doc?30380</a> |
| Temperature Coefficient of Resistance for Current Sensing | <a href="http://www.vishay.com/doc?30405">www.vishay.com/doc?30405</a> |



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