

# Pulse Proof, High Power Thick Film Chip Resistors



## FEATURES

- Excellent pulse load capability
- Enhanced power rating
- Double side printed resistor element
- Protective overglaze
- Pure tin solder contacts on Ni barrier layer provides compatibility with lead (Pb)-free and lead containing soldering processes
- AEC-Q200 qualified, rev. C compliant
- 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

| MODEL          | CASE SIZE INCH | CASE SIZE METRIC | POWER RATING<br>$P_{70}$<br>W | LIMITING ELEMENT VOLTAGE<br>$U_{\max.}$ AC/DC | TEMPERATURE COEFFICIENT<br>ppm/K                                   | TOLERANCE<br>%   | RESISTANCE RANGE<br>$\Omega$ | SERIES          |
|----------------|----------------|------------------|-------------------------------|-----------------------------------------------|--------------------------------------------------------------------|------------------|------------------------------|-----------------|
| CRCW0402-HP e3 | 0402           | RR1005           | 0.125 <sup>(1)</sup>          | 50                                            | $\pm 100$                                                          | $\pm 0.5, \pm 1$ | 1 to 1M                      | E24; E96<br>E24 |
|                |                |                  |                               |                                               | $\pm 200$                                                          | $\pm 5$          |                              |                 |
|                |                |                  |                               |                                               | Zero-Ohm-Resistor: $R_{\max.} = 0.010 \Omega$ , $I_{\max.} = 3 A$  |                  |                              |                 |
| CRCW0603-HP e3 | 0603           | RR1608           | 0.25                          | 75                                            | $\pm 100$                                                          | $\pm 0.5, \pm 1$ | 1 to 1M                      | E24; E96<br>E24 |
|                |                |                  |                               |                                               | $\pm 200$                                                          | $\pm 5$          |                              |                 |
|                |                |                  |                               |                                               | Zero-Ohm-Resistor: $R_{\max.} = 0.008 \Omega$ , $I_{\max.} = 5 A$  |                  |                              |                 |
| CRCW0805-HP e3 | 0805           | RR2012           | 0.33                          | 150                                           | $\pm 100$                                                          | $\pm 0.5, \pm 1$ | 1 to 1M                      | E24; E96<br>E24 |
|                |                |                  |                               |                                               | $\pm 200$                                                          | $\pm 5$          |                              |                 |
|                |                |                  |                               |                                               | Zero-Ohm-Resistor: $R_{\max.} = 0.005 \Omega$ , $I_{\max.} = 6 A$  |                  |                              |                 |
| CRCW1206-HP e3 | 1206           | RR3216           | 0.5                           | 200                                           | $\pm 100$                                                          | $\pm 0.5, \pm 1$ | 1 to 1M                      | E24; E96<br>E24 |
|                |                |                  |                               |                                               | $\pm 200$                                                          | $\pm 5$          |                              |                 |
|                |                |                  |                               |                                               | Zero-Ohm-Resistor: $R_{\max.} = 0.005 \Omega$ , $I_{\max.} = 10 A$ |                  |                              |                 |
| CRCW1210-HP e3 | 1210           | RR3225           | 0.75                          | 200                                           | $\pm 100$                                                          | $\pm 0.5, \pm 1$ | 1 to 1M                      | E24; E96<br>E24 |
|                |                |                  |                               |                                               | $\pm 200$                                                          | $\pm 5$          |                              |                 |
|                |                |                  |                               |                                               | Zero-Ohm-Resistor: $R_{\max.} = 0.004 \Omega$ , $I_{\max.} = 12 A$ |                  |                              |                 |
| CRCW1218-HP e3 | 1218           | RR3246           | 1.5                           | 200                                           | $\pm 100$                                                          | $\pm 0.5, \pm 1$ | 1 to 1M                      | E24; E96<br>E24 |
|                |                |                  |                               |                                               | $\pm 200$                                                          | $\pm 5$          |                              |                 |
|                |                |                  |                               |                                               | Zero-Ohm-Resistor: $R_{\max.} = 0.004 \Omega$ , $I_{\max.} = 20 A$ |                  |                              |                 |
| CRCW2010-HP e3 | 2010           | RR5025           | 1.0                           | 400                                           | $\pm 100$                                                          | $\pm 0.5, \pm 1$ | 1 to 1M                      | E24; E96<br>E24 |
|                |                |                  |                               |                                               | $\pm 200$                                                          | $\pm 5$          |                              |                 |
|                |                |                  |                               |                                               | Zero-Ohm-Resistor: $R_{\max.} = 0.005 \Omega$ , $I_{\max.} = 12 A$ |                  |                              |                 |
| CRCW2512-HP e3 | 2512           | RR6332           | 1.5                           | 500                                           | $\pm 100$                                                          | $\pm 0.5, \pm 1$ | 1 to 1M                      | E24; E96<br>E24 |
|                |                |                  |                               |                                               | $\pm 200$                                                          | $\pm 5$          |                              |                 |
|                |                |                  |                               |                                               | Zero-Ohm-Resistor: $R_{\max.} = 0.005 \Omega$ , $I_{\max.} = 16 A$ |                  |                              |                 |

## 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 document "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.
- <sup>(1)</sup> CRCW0402-HP resistors feature a single side printed resistive layer only.

## TECHNICAL SPECIFICATIONS

| PARAMETER                                 | UNIT        | CRCW 0402-HP  | CRCW 0603-HP | CRCW 0805-HP | CRCW 1206-HP | CRCW 1210-HP | CRCW 1218-HP | CRCW 2010-HP | CRCW 2512-HP |
|-------------------------------------------|-------------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Rated dissipation $P_{70}$ <sup>(2)</sup> | W           | 0.125         | 0.25         | 0.33         | 0.5          | 0.75         | 1.5          | 1.0          | 1.5          |
| 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                     | $\Omega$    | > $10^9$      |              |              |              |              |              |              |              |
| Category temperature range                | $^{\circ}C$ | - 55 to + 155 |              |              |              |              |              |              |              |
| Weight                                    | mg          | 0.65          | 2            | 5.5          | 10           | 18           | 31           | 25.5         | 42           |

## Note

- <sup>(2)</sup> The power dissipation on the resistors 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: CRCW0603562RFKEAHP <sup>(1)</sup>

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | R | C | W | 0 | 6 | 0 | 3 | 5 | 6 | 2 | R | F | K | E | A | H | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| MODEL/SIZE                                                                                   | VALUE                                                       | TOLERANCE                                                       | TCR                                                      | PACKAGING                                          | SPECIAL                                           |
|----------------------------------------------------------------------------------------------|-------------------------------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------|---------------------------------------------------|
| CRCW0402<br>CRCW0603<br>CRCW0805<br>CRCW1206<br>CRCW1210<br>CRCW1218<br>CRCW2010<br>CRCW2512 | R = Decimal<br>K = Thousand<br>M = Million<br>0000 = Jumper | D = $\pm 0.5\%$<br>F = $\pm 1\%$<br>J = $\pm 5\%$<br>Z = Jumper | K = $\pm 100$ ppm/K<br>N = $\pm 200$ ppm/K<br>0 = Jumper | EA<br>EB<br>EC<br>ED<br>EE<br>EF<br>EG<br>EH<br>EK | Up to 2 digits<br>HP = Pulse proof,<br>high power |

Product Description: CRCW0603-HP 100 562R 1 % ET1 e3

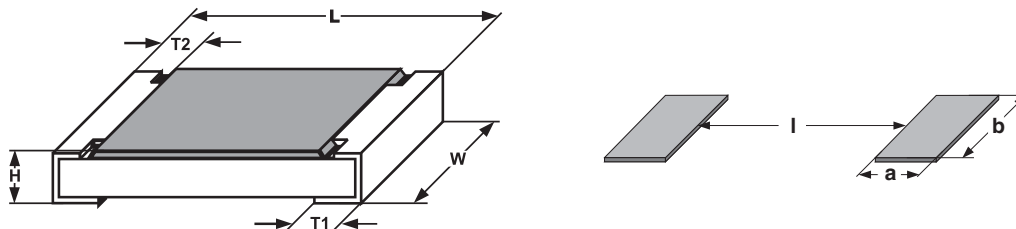
| CRCW0603-HP                                                                                                          | 100                                | 562R                                                                                                 | 1 %                                   | ET1                                                                | e3                                     |
|----------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------------------------------------------------------------------------|---------------------------------------|--------------------------------------------------------------------|----------------------------------------|
| MODEL                                                                                                                | TCR                                | RESISTANCE VALUE                                                                                     | TOLERANCE                             | PACKAGING                                                          | LEAD (Pb)-FREE                         |
| CRCW0402-HP<br>CRCW0603-HP<br>CRCW0805-HP<br>CRCW1206-HP<br>CRCW1210-HP<br>CRCW1218-HP<br>CRCW2010-HP<br>CRCW2512-HP | $\pm 100$ ppm/K<br>$\pm 200$ ppm/K | 10R = 10 $\Omega$<br>562R = 562 $\Omega$<br>10K = 10 k $\Omega$<br>1M = 1 M $\Omega$<br>0R0 = Jumper | $\pm 0.5\%$<br>$\pm 1\%$<br>$\pm 5\%$ | ET1<br>ET5<br>ET6<br>ET7<br>EF4<br>EG1<br>E02<br>E67<br>E82<br>ET9 | e3 = Pure tin<br>termination<br>finish |

**Note**<sup>(1)</sup> Preferred way for ordering products is by use of the PART NUMBER.**PACKAGING**

| MODEL       | UNIT          | PAPER TAPE ON REEL<br>ACC. TO IEC 60286-3, TYPE I |             |               | BLISTER TAPE ON REEL<br>ACC. TO IEC 60286-3, TYPE II |             |               |
|-------------|---------------|---------------------------------------------------|-------------|---------------|------------------------------------------------------|-------------|---------------|
|             |               | QUANTITY                                          | PART NUMBER | PRODUCT DESC. | QUANTITY                                             | PART NUMBER | PRODUCT DESC. |
| CRCW0402-HP | 180 mm/7"     | 10 000                                            | ED          | ET7           |                                                      |             |               |
|             | 330 mm/13"    | 50 000                                            | EE          | EF4           |                                                      |             |               |
| CRCW0603-HP | 180 mm/7"     | 5000                                              | EA          | ET1           |                                                      |             |               |
|             | 285 mm/11.25" | 10 000                                            | EB          | ET5           |                                                      |             |               |
|             | 330 mm/13"    | 20 000                                            | EC          | ET6           |                                                      |             |               |
| CRCW0805-HP | 180 mm/7"     | 5000                                              | EA          | ET1           |                                                      |             |               |
|             | 285 mm/11.25" | 10 000                                            | EB          | ET5           |                                                      |             |               |
|             | 330 mm/13"    | 20 000                                            | EC          | ET6           |                                                      |             |               |
| CRCW1206-HP | 180 mm/7"     | 5000                                              | EA          | ET1           |                                                      |             |               |
|             | 285 mm/11.25" | 10 000                                            | EB          | ET5           |                                                      |             |               |
|             | 330 mm/13"    | 20 000                                            | EC          | ET6           |                                                      |             |               |
| CRCW1210-HP | 180 mm/7"     | 5000                                              | EA          | ET1           |                                                      |             |               |
|             | 285 mm/11.25" | 10 000                                            | EB          | ET5           |                                                      |             |               |
|             | 330 mm/13"    | 20 000                                            | EC          | ET6           |                                                      |             |               |
| CRCW1218-HP | 180 mm/7"     |                                                   |             |               | 4000                                                 | EK          | ET9           |
| CRCW2010-HP | 180 mm/7"     |                                                   |             |               | 4000                                                 | EF          | E02           |
| CRCW2512-HP | 180 mm/7"     |                                                   |             |               | 2000                                                 | EG          | E67           |
|             |               |                                                   |             |               | 4000                                                 | EH          | E82           |



**DIMENSIONS** in millimeters



| SIZE |        | DIMENSIONS |             |             |            |            | SOLDER PAD DIMENSIONS |     |     |                |     |     |
|------|--------|------------|-------------|-------------|------------|------------|-----------------------|-----|-----|----------------|-----|-----|
|      |        |            |             |             |            |            | 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  | 0.3 ± 0.1   | 0.25 ± 0.1 | 0.2 ± 0.1  | 0.4                   | 0.6 | 0.5 |                |     |     |
| 0603 | 1608   | 1.6 ± 0.1  | 0.85 ± 0.1  | 0.45 ± 0.1  | 0.3 ± 0.2  | 0.3 ± 0.2  | 0.5                   | 0.9 | 1.0 | 0.9            | 0.9 | 1.0 |
| 0805 | 2012   | 2.0 ± 0.15 | 1.25 ± 0.15 | 0.50 ± 0.1  | 0.4 ± 0.2  | 0.35 ± 0.2 | 0.7                   | 1.3 | 1.2 | 0.9            | 1.3 | 1.3 |
| 1206 | 3216   | 3.1 ± 0.2  | 1.6 ± 0.15  | 0.50 ± 0.15 | 0.5 ± 0.2  | 0.45 ± 0.2 | 0.9                   | 1.7 | 2.0 | 1.1            | 1.7 | 2.3 |
| 1210 | 3225   | 3.2 ± 0.2  | 2.5 ± 0.2   | 0.6 ± 0.1   | 0.45 ± 0.2 | 0.4 ± 0.2  | 0.9                   | 2.5 | 2.0 | 1.1            | 2.5 | 2.2 |
| 1218 | 3246   | 3.1 ± 0.2  | 4.6 ± 0.2   | 0.6 ± 0.1   | 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 |

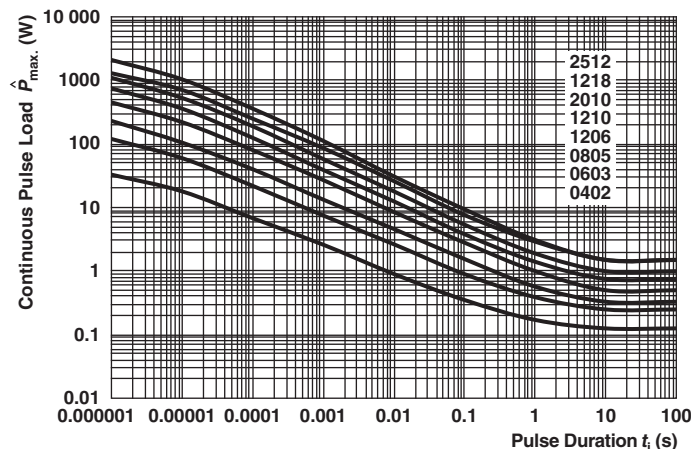
**FUNCTIONAL PERFORMANCE**

**Single Pulse**



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

### Continuous Pulse



Maximum pulse load, continuous pulses; applicable if  $\bar{P} \leq P(9_{amb})$  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

### DERATING



| TEST PROCEDURES AND REQUIREMENTS |                            |                                                                            |                                                                                                                                               |                                                                                           |
|----------------------------------|----------------------------|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| EN 60115-1<br>CLAUSE             | IEC 60068-2<br>TEST METHOD | TEST                                                                       | PROCEDURE                                                                                                                                     | REQUIREMENTS PERMISSIBLE<br>CHANGE ( $\Delta R$ )                                         |
|                                  |                            |                                                                            |                                                                                                                                               | STABILITY CLASS 2 OR BETTER                                                               |
|                                  |                            |                                                                            | Stability for product types:                                                                                                                  | 1 $\Omega$ to 1 M $\Omega$                                                                |
|                                  |                            |                                                                            | CRCW-HP e3                                                                                                                                    |                                                                                           |
| 4.5                              | -                          | Resistance                                                                 | -                                                                                                                                             | $\pm 0.5 \%$ , $\pm 1 \%$ , $\pm 5 \%$                                                    |
| 4.7                              | -                          | Voltage proof                                                              | $U = 1.4 \times U_{\text{Ins}}$ ; 60 s                                                                                                        | -                                                                                         |
| 4.13                             | -                          | Short time overload                                                        | $U = 2.5 \times \sqrt{P_{70} \times R}$<br>$\leq 2 \times U_{\text{max.}}$ ; duration: According to style                                     | $\pm (0.5 \% R + 0.05 \Omega)$                                                            |
| 4.17.2                           | 58 (Td)                    | Solderability                                                              | Solder bath method; Sn60Pb40;<br>non-activated flux; (235 $\pm$ 5) $^{\circ}\text{C}$ ; (2 $\pm$ 0.2) s                                       | Good tinning ( $\geq 95 \%$ covered)<br>no visible damage                                 |
|                                  |                            |                                                                            | Solder bath method; Sn96.5Ag3Cu0.5;<br>non-activated flux; (245 $\pm$ 5) $^{\circ}\text{C}$ ; (3 $\pm$ 0.3) s                                 | Good tinning ( $\geq 95 \%$ covered)<br>no visible damage                                 |
| 4.8.4.2                          | -                          | Temperature coefficient                                                    | (20/- 55/20) $^{\circ}\text{C}$ and (20/125/20) $^{\circ}\text{C}$                                                                            | $\pm 100$ ppm/K, $\pm 200$ ppm/K                                                          |
| 4.32                             | 21 (UU3)                   | Shear (adhesion)                                                           | RR 1608 and smaller: 9 N<br>RR 2012 and larger: 45 N                                                                                          | No visible damage                                                                         |
| 4.33                             | 21 (UU1)                   | Substrate bending                                                          | Depth 2 mm; 3 times                                                                                                                           | No visible damage,<br>no open circuit in bent position<br>$\pm (0.25 \% R + 0.05 \Omega)$ |
| 4.19                             | 14 (Na)                    | Rapid change of temperature                                                | 30 min. at - 55 $^{\circ}\text{C}$ ; 30 min at 125 $^{\circ}\text{C}$<br>5 cycles<br>1000 cycles                                              | $\pm (0.5 \% R + 0.05 \Omega)$<br>$\pm (1 \% R + 0.05 \Omega)$                            |
| 4.23                             | -                          | Dry heat                                                                   | -                                                                                                                                             | $\pm (2 \% R + 0.1 \Omega)$                                                               |
| 4.23.2                           | 2 (Ba)                     | Damp heat, cyclic                                                          | 125 $^{\circ}\text{C}$ ; 16 h                                                                                                                 |                                                                                           |
| 4.23.3                           | 30 (Db)                    | cold                                                                       | 55 $^{\circ}\text{C}$ ; $\geq 90 \%$ RH; 24 h; 1 cycle                                                                                        |                                                                                           |
| 4.23.4                           | 1 (Aa)                     | Low air pressure                                                           | - 55 $^{\circ}\text{C}$ ; 2 h                                                                                                                 |                                                                                           |
| 4.23.5                           | 13 (M)                     | -                                                                          | 1 kPa; (25 $\pm$ 10) $^{\circ}\text{C}$ ; 1 h                                                                                                 |                                                                                           |
| 4.23.6                           | 30 (Db)                    | Damp heat, cyclic                                                          | 55 $^{\circ}\text{C}$ ; $\geq 90 \%$ RH; 24 h; 5 cycle                                                                                        |                                                                                           |
| 4.23.7                           | -                          | D.C. load                                                                  | $U = \sqrt{P_{70} \times R}$                                                                                                                  |                                                                                           |
| 4.25.1                           | -                          | Endurance at 70 $^{\circ}\text{C}$                                         | $U = \sqrt{P_{70} \times R} \leq U_{\text{max.}}$<br>1.5 h on; 0.5 h off;<br>70 $^{\circ}\text{C}$ ; 1000 h<br>70 $^{\circ}\text{C}$ ; 8000 h | $\pm (2 \% R + 0.1 \Omega)$<br>$\pm (4 \% R + 0.1 \Omega)$                                |
| 4.18.2                           | 58 (Td)                    | Resistance to soldering heat                                               | Solder bath method; (260 $\pm$ 5) $^{\circ}\text{C}$ ; (10 $\pm$ 1) s                                                                         | $\pm (0.5 \% R + 0.05 \Omega)$                                                            |
| 4.35                             | -                          | Flammability, needle flame test                                            | IEC 60695-15-5; 10 s                                                                                                                          | No burning after 30 s                                                                     |
| 4.24                             | 78 (Cab)                   | Damp heat, steady state                                                    | (40 $\pm$ 2) $^{\circ}\text{C}$ ; (93 $\pm$ 3) % RH; 56 days                                                                                  | $\pm (1 \% R + 0.05 \Omega)$                                                              |
| 4.25.3                           | -                          | Endurance at<br>upper category temperature                                 | 155 $^{\circ}\text{C}$ ; 1000 h                                                                                                               | $\pm (2 \% R + 0.1 \Omega)$                                                               |
| 4.40                             | -                          | Electrostatic discharge<br>(human body model)                              | IEC 61340-3-1; 3 positive and 3 negative<br>discharges; ESD voltage according to size                                                         | $\pm (1 \% R + 0.05 \Omega)$                                                              |
| 4.29                             | 45 (XA)                    | Component solvent resistance                                               | Isopropyl alcohol; 50 $^{\circ}\text{C}$ ; method 2                                                                                           | No visible damage                                                                         |
| 4.30                             | 45 (XA)                    | Solvent resistance of marking                                              | Isopropyl alcohol; 50 $^{\circ}\text{C}$ ; method 1;<br>toothbrush                                                                            | Marking legible,<br>no visible damage                                                     |
| 4.22                             | 6 (Fc)                     | Vibration, endurance by sweeping                                           | f = 10 Hz to 2000 Hz; x, y, z $\leq 1.5$ mm;<br>A $\leq 200$ m/s <sup>2</sup> ; 10 sweeps per axis                                            | $\pm (0.5 \% R + 0.05 \Omega)$                                                            |
| 4.37                             | -                          | Periodic electric overload                                                 | $U = \sqrt{15 \times P_{70} \times R} \leq 2 \times U_{\text{max.}}$<br>0.1 s "ON"; 2.5 s "OFF"; 1000 cycles                                  | $\pm (1 \% R + 0.05 \Omega)$                                                              |
| 4.27                             | -                          | Single pulse high voltage overload,<br>10 $\mu\text{s}$ /700 $\mu\text{s}$ | $\dot{U} = 10 \times \sqrt{P_{70} \times R} \leq 2 \times U_{\text{max.}}$<br>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, environmental test procedures

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



## Disclaimer

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## Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

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