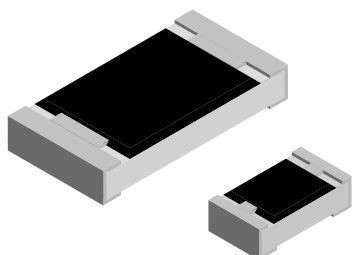


## Pulse Proof, High Power Thick Film Chip Resistors



### FEATURES

- Excellent pulse load capability
- Enhanced power rating
- Double side printed resistor element
- Protective overglaze
- Lead (Pb)-free solder contacts on Ni barrier layer
- Pure tin plating provides compatibility with lead (Pb)-free and lead containing soldering processes
- Compliant to RoHS directive 2002/95/EC
- AEC-Q200, rev. C compliant



### STANDARD ELECTRICAL SPECIFICATIONS

| MODEL          | SIZE |        | POWER RATING<br>$P_{70}$<br>W | LIMITING<br>ELEMENT<br>VOLTAGE<br>MAX. V | TEMPERATURE<br>COEFFICIENT<br>ppm/K                                                     | TOLERANCE<br>% | RESISTANCE<br>RANGE<br>$\Omega$ | E-SERIES         |
|----------------|------|--------|-------------------------------|------------------------------------------|-----------------------------------------------------------------------------------------|----------------|---------------------------------|------------------|
|                | INCH | METRIC |                               |                                          |                                                                                         |                |                                 |                  |
| CRCW0402-HP e3 | 0402 | 1005   | 0.125 <sup>(1)</sup>          | 50                                       | $\pm 100$                                                                               | $\pm 1$        | 1R to 1M                        | E24 + E96<br>E24 |
|                |      |        |                               |                                          | $\pm 200$                                                                               | $\pm 5$        |                                 |                  |
|                |      |        |                               |                                          | Zero-Ohm-Resistor: $R_{\text{max.}} = 0.010 \Omega$ , $I_{\text{max.}} = 2.5 \text{ A}$ |                |                                 |                  |
| CRCW0603-HP e3 | 0603 | 1608   | 0.25                          | 75                                       | $\pm 100$                                                                               | $\pm 1$        | 1R to 1M                        | E24 + E96<br>E24 |
|                |      |        |                               |                                          | $\pm 200$                                                                               | $\pm 5$        |                                 |                  |
|                |      |        |                               |                                          | Zero-Ohm-Resistor: $R_{\text{max.}} = 0.010 \Omega$ , $I_{\text{max.}} = 4 \text{ A}$   |                |                                 |                  |
| CRCW0805-HP e3 | 0805 | 2012   | 0.33                          | 150                                      | $\pm 100$                                                                               | $\pm 1$        | 1R to 1M                        | E24 + E96<br>E24 |
|                |      |        |                               |                                          | $\pm 200$                                                                               | $\pm 5$        |                                 |                  |
|                |      |        |                               |                                          | Zero-Ohm-Resistor: $R_{\text{max.}} = 0.010 \Omega$ , $I_{\text{max.}} = 5 \text{ A}$   |                |                                 |                  |
| CRCW1206-HP e3 | 1206 | 3216   | 0.5                           | 200                                      | $\pm 100$                                                                               | $\pm 1$        | 1R to 1M                        | E24 + E96<br>E24 |
|                |      |        |                               |                                          | $\pm 200$                                                                               | $\pm 5$        |                                 |                  |
|                |      |        |                               |                                          | Zero-Ohm-Resistor: $R_{\text{max.}} = 0.010 \Omega$ , $I_{\text{max.}} = 6 \text{ A}$   |                |                                 |                  |
| CRCW2010-HP e3 | 2010 | 5025   | 1.0                           | 400                                      | $\pm 100$                                                                               | $\pm 1$        | 1R to 1M                        | E24 + E96<br>E24 |
|                |      |        |                               |                                          | $\pm 200$                                                                               | $\pm 5$        |                                 |                  |
|                |      |        |                               |                                          | Zero-Ohm-Resistor: $R_{\text{max.}} = 0.010 \Omega$ , $I_{\text{max.}} = 10 \text{ A}$  |                |                                 |                  |
| CRCW2512-HP e3 | 2512 | 6332   | 1.5                           | 500                                      | $\pm 100$                                                                               | $\pm 1$        | 1R to 1M                        | E24 + E96<br>E24 |
|                |      |        |                               |                                          | $\pm 200$                                                                               | $\pm 5$        |                                 |                  |
|                |      |        |                               |                                          | Zero-Ohm-Resistor: $R_{\text{max.}} = 0.010 \Omega$ , $I_{\text{max.}} = 14 \text{ A}$  |                |                                 |                  |

#### Notes

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

- 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 and packaging: see appropriate catalog or web page
- Power rating depends on the max. temperature at the solder point, the component placement density and the substrate material

### TECHNICAL SPECIFICATIONS

| PARAMETER                                        | UNIT | CRCW0402-HP       | CRCW0603-HP | CRCW0805-HP | CRCW1206-HP | CRCW2010-HP | CRCW2512-HP |
|--------------------------------------------------|------|-------------------|-------------|-------------|-------------|-------------|-------------|
| Rated Dissipation $P_{70}$ <sup>(1)</sup>        | W    | 0.125             | 0.25        | 0.33        | 0.5         | 1.0         | 1.5         |
| Limiting Element Voltage $U_{\text{max. AC/DC}}$ | V    | 50                | 75          | 150         | 200         | 400         | 500         |
| Insulation Voltage $U_{\text{ins.}}$ (1 min)     | V    | > 75              | > 100       | > 200       | > 300       |             |             |
| Insulation Resistance                            | Ω    | > 10 <sup>9</sup> |             |             |             |             |             |
| Category Temperature Range                       | °C   | - 55 to + 155     |             |             |             |             |             |
| Weight                                           | mg   | 0.65              | 2           | 5.5         | 10          | 25.5        | 42          |

#### Note

<sup>(1)</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  $^{\circ}\text{C}$  is not exceeded.

**PART NUMBER AND PRODUCT DESCRIPTION**PART NUMBER: CRCW0603562RFKEAHP <sup>(1)</sup>

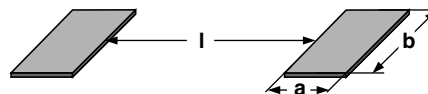
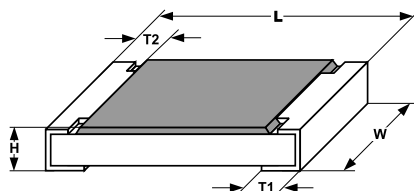
| C                                                                    | R | C | W | 0                                                           | 6 | 0 | 3 | 5                                    | 6 | 2 | R | F                                                | K | E                                                        | A | H                                                 | P |
|----------------------------------------------------------------------|---|---|---|-------------------------------------------------------------|---|---|---|--------------------------------------|---|---|---|--------------------------------------------------|---|----------------------------------------------------------|---|---------------------------------------------------|---|
| MODEL/SIZE                                                           |   |   |   | VALUE                                                       |   |   |   | TOLERANCE                            |   |   |   | TCR                                              |   | PACKAGING <sup>(2)</sup>                                 |   | SPECIAL                                           |   |
| CRCW0402<br>CRCW0603<br>CRCW0805<br>CRCW1206<br>CRCW2010<br>CRCW2512 |   |   |   | R = Decimal<br>K = Thousand<br>M = Million<br>0000 = Jumper |   |   |   | F = ± 1 %<br>J = ± 5 %<br>Z = Jumper |   |   |   | K = ± 100 ppm/K<br>N = ± 200 ppm/K<br>0 = Jumper |   | EA<br>EB<br>EC<br>ED<br>EE<br>EI<br>EL<br>EF<br>EG<br>EH |   | Up to 2 digits<br>HP = Pulse proof,<br>High Power |   |

PRODUCT DESCRIPTION: CRCW0603-HP 100 562R 1 % ET1 e3

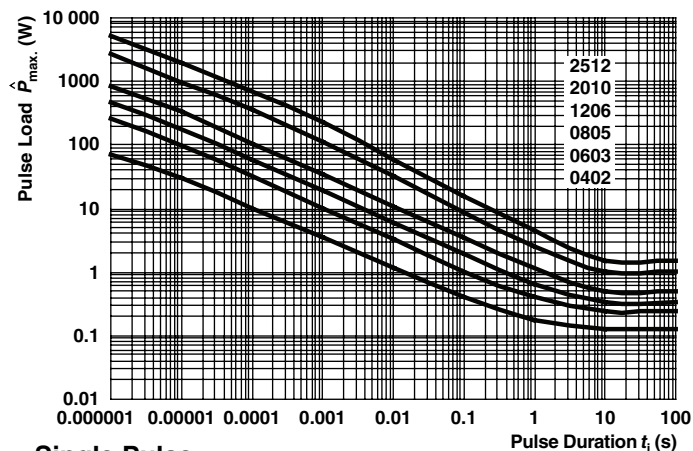
| CRCW0603-HP                                                                            | 100                        | 562R                                                                   | 1 %            | ET1                                                                | e3                                     |
|----------------------------------------------------------------------------------------|----------------------------|------------------------------------------------------------------------|----------------|--------------------------------------------------------------------|----------------------------------------|
| MODEL                                                                                  | TCR                        | RESISTANCE VALUE                                                       | TOLERANCE      | PACKAGING <sup>(2)</sup>                                           | LEAD (Pb)-FREE                         |
| CRCW0402-HP<br>CRCW0603-HP<br>CRCW0805-HP<br>CRCW1206-HP<br>CRCW2010-HP<br>CRCW2512-HP | ± 100 ppm/K<br>± 200 ppm/K | 10R = 10 Ω<br>562R = 562 Ω<br>10K = 10 kΩ<br>1M = 1 MΩ<br>0R0 = Jumper | ± 1 %<br>± 5 % | ET1<br>ET5<br>ET6<br>ET7<br>EF4<br>EG1<br>E20<br>E02<br>E67<br>E82 | e3 = Pure tin<br>termination<br>finish |

**Notes**<sup>(1)</sup> Preferred way for ordering products is by use of the PART NUMBER<sup>(2)</sup> Please refer to table PACKAGING, see below**PACKAGING**

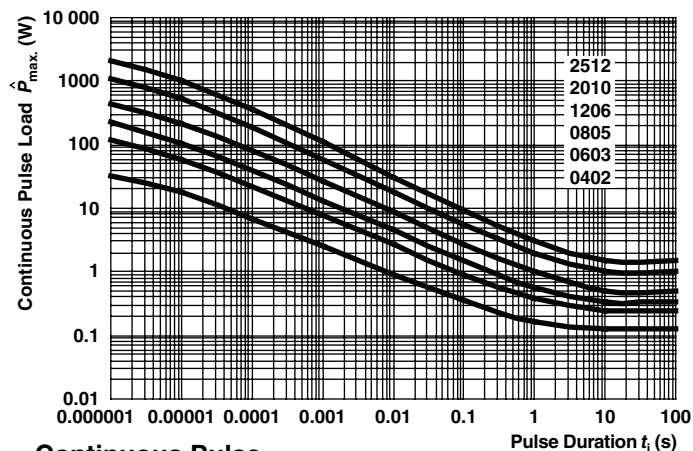
| MODEL       | REEL       |                                          |                      |                          |                |          |                   |            |
|-------------|------------|------------------------------------------|----------------------|--------------------------|----------------|----------|-------------------|------------|
|             | TAPE WIDTH | DIAMETER                                 | PITCH                | PIECES/ REEL             | PACKAGING CODE |          |                   |            |
|             |            |                                          |                      |                          | PART NUMBER    |          | PRODUCT DESC.     |            |
|             |            |                                          |                      |                          | PAPER          | BLISTER  | PAPER             | BLISTER    |
| CRCW0402-HP | 8 mm       | 180 mm/7"<br>330 mm/13"                  | 2 mm<br>2 mm         | 10 000<br>50 000         | ED<br>EE       |          | ET7<br>EF4        |            |
| CRCW0603-HP | 8 mm       | 180 mm/7"<br>285 mm/11.25"<br>330 mm/13" | 4 mm<br>4 mm<br>4 mm | 5000<br>10 000<br>20 000 | EA<br>EB<br>EC | EI<br>EL | ET1<br>ET5<br>ET6 | EG1<br>E20 |
| CRCW0805-HP | 8 mm       | 180 mm/7"<br>285 mm/11.25"<br>330 mm/13" | 4 mm<br>4 mm<br>4 mm | 5000<br>10 000<br>20 000 | EA<br>EB<br>EC | EI<br>EL | ET1<br>ET5<br>ET6 | EG1<br>E20 |
| CRCW1206-HP | 8 mm       | 180 mm/7"<br>285 mm/11.25"<br>330 mm/13" | 4 mm<br>4 mm<br>4 mm | 5000<br>10 000<br>20 000 | EA<br>EB<br>EC | EI<br>EL | ET1<br>ET5<br>ET6 | EG1<br>E20 |
| CRCW2010-HP | 12 mm      | 180 mm/7"                                | 4 mm                 | 4000                     |                | EF       |                   | E02        |
| CRCW2512-HP | 12 mm      | 180 mm/7"                                | 8 mm<br>4 mm         | 2000<br>4000             |                | EG<br>EH |                   | E67<br>E82 |

**DIMENSIONS** in millimeters

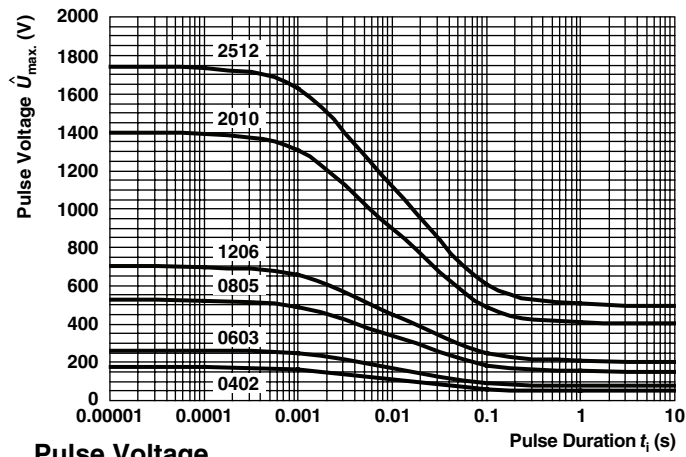
| SIZE |        | RESISTANCE RANGE<br>$\Omega$ | DIMENSIONS     |                 |                 |                |                | SOLDER PAD DIMENSIONS |     |     |                |     |     |
|------|--------|------------------------------|----------------|-----------------|-----------------|----------------|----------------|-----------------------|-----|-----|----------------|-----|-----|
|      |        |                              |                |                 |                 |                |                | REFLOW SOLDERING      |     |     | WAVE SOLDERING |     |     |
| INCH | METRIC |                              | L              | W               | H               | T1             | T2             | a                     | b   | l   | a              | b   | l   |
| 0402 | 1005   | 1R - 1M                      | $1.0 \pm 0.05$ | $0.5 \pm 0.05$  | $0.3 \pm 0.1$   | $0.25 \pm 0.1$ | $0.2 \pm 0.1$  | 0.4                   | 0.6 | 0.5 |                |     |     |
| 0603 | 1608   | 1R - 1M                      | $1.6 \pm 0.1$  | $0.85 \pm 0.1$  | $0.45 \pm 0.1$  | $0.3 \pm 0.2$  | $0.3 \pm 0.2$  | 0.5                   | 0.9 | 1.0 | 0.9            | 0.9 | 1.0 |
| 0805 | 2012   | 1R - 1M                      | $2.0 \pm 0.15$ | $1.25 \pm 0.15$ | $0.50 \pm 0.1$  | $0.4 \pm 0.2$  | $0.35 \pm 0.2$ | 0.7                   | 1.3 | 1.2 | 0.9            | 1.3 | 1.3 |
| 1206 | 3216   | 1R - 1M                      | $3.1 \pm 0.2$  | $1.6 \pm 0.15$  | $0.50 \pm 0.15$ | $0.5 \pm 0.2$  | $0.45 \pm 0.2$ | 0.9                   | 1.7 | 2.0 | 1.1            | 1.7 | 2.3 |
| 2010 | 5025   | 1R - 1M                      | $5.0 \pm 0.15$ | $2.5 \pm 0.15$  | $0.6 \pm 0.1$   | $0.6 \pm 0.2$  | $0.6 \pm 0.2$  | 1.0                   | 2.5 | 3.9 | 1.2            | 2.5 | 3.9 |
| 2512 | 6332   | 1R - 1M                      | $6.3 \pm 0.2$  | $3.15 \pm 0.15$ | $0.6 \pm 0.1$   | $0.6 \pm 0.2$  | $0.6 \pm 0.2$  | 1.0                   | 3.2 | 5.2 | 1.2            | 3.2 | 5.2 |

**FUNCTIONAL PERFORMANCE****Single Pulse**

Maximum pulse dissipation as a function of the pulse duration, single pulse for CRCW...-HP

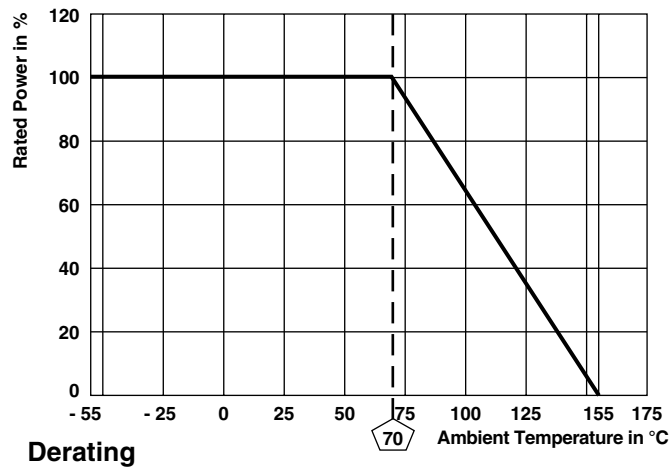
**Continuous Pulse**

Maximum pulse dissipation as a function of the pulse duration, continuous pulse for CRCW...-HP



### 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

| TEST<br>(clause)                                 | CONDITIONS OF TEST                                                                                                                                                                                  | REQUIREMENTS<br>PERMISSIBLE CHANGE<br>( $\Delta R$ )     |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
|                                                  |                                                                                                                                                                                                     | STABILITY CLASS 2<br>OR BETTER                           |
|                                                  | Stability for product types:                                                                                                                                                                        | 1 $\Omega$ - 1 M $\Omega$                                |
|                                                  | <b>CRCW....-HP e3</b>                                                                                                                                                                               |                                                          |
| Resistance (4.5)                                 | -                                                                                                                                                                                                   | $\pm 1\%$ , $\pm 5\%$                                    |
| Temperature coefficient (4.8.4.2)                | 20/- 55/20 °C and<br>20/125/20 °C                                                                                                                                                                   | $\pm 100$ ppm/K, $\pm 200$ ppm/K                         |
| Overload (4.13)                                  | $U = 2.5 \times \sqrt{P_{70} \times R}$<br>$\leq 2 \times U_{\max.}$<br>Duration: according the style                                                                                               | $\pm (0.5\% R + 0.05 \Omega)$                            |
| Solderability (4.17.5)                           | Aging 4 h at 155 °C, dryheat<br>Solder bath method; 235 °C; 2 s<br>Visual examination                                                                                                               | Good tinning ( $\geq 95\%$ covered)<br>no visible damage |
| Resistance to soldering heat (4.18.2)            | Solder bath method;<br>(260 $\pm$ 5) °C; (10 $\pm$ 1) s                                                                                                                                             | $\pm (1\% R + 0.05 \Omega)$                              |
| Rapid change of temperature (4.19)               | 30 min at LCT = - 55 °C;<br>30 min at UCT = 125 °C; 5 cycles                                                                                                                                        | $\pm (1\% R + 0.05 \Omega)$                              |
| Damp heat, steady state (4.24)                   | (40 $\pm$ 2) °C; 56 days;<br>(93 $\pm$ 3) % RH                                                                                                                                                      | $\pm (2\% R + 0.05 \Omega)$                              |
| Climatic sequence (4.23)                         | 16 h at UCT = 125 °C; 1 cycle at 55 °C;<br>2 h at LCT = - 55 °C;<br>1 h/1 kPa at 15 °C to 35 °C;<br>5 cycles at 55 °C<br>$U = \sqrt{P_{70} \times R}$<br>$U = U_{\max.}$ ; whichever is less severe | $\pm (2\% R + 0.05 \Omega)$                              |
| Endurance at 70 °C (4.25.1)                      | $U = \sqrt{P_{70} \times R}$<br>$U = U_{\max.}$ ; whichever is less severe<br>1.5 h ON; 0.5 h OFF;<br>70 °C; 1000 h                                                                                 | $\pm (2\% R + 0.05 \Omega)$                              |
| Endurance at upper category temperature (4.25.3) | UCT = 155 °C; 1000 h                                                                                                                                                                                | $\pm (2\% R + 0.05 \Omega)$                              |

## APPLICABLE SPECIFICATIONS

- EN 60115-1 Generic specification
- AEC-Q200 Generic specification
- EN 140400 Sectional specification
- EN 140401-802 Detail specification
- IEC 60068-2-X Variety of environmental test procedures
- IEC 60286-3 Packaging of SMD components



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