

## Long Side Termination Thick Film Chip Resistors



### FEATURES

- Enhanced power rating
- Long side terminations
- Pure tin solder contacts on Ni barrier layer, provides compatibility with lead (Pb)-free and lead containing soldering processes
- Compliant to RoHS Directive 2002/95/EC
- Halogen-free according to IEC 61249-2-21 definition
- AEC-Q200 qualified



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

| STANDARD ELECTRICAL SPECIFICATIONS |      |          |                                    |   |                                  |                |                              |          |
|------------------------------------|------|----------|------------------------------------|---|----------------------------------|----------------|------------------------------|----------|
| MODEL                              | SIZE |          | RATED DISSIPATION<br>$P_{70}$<br>W | LIMITING ELEMENT VOLTAGE<br>$U_{max. AC/DC}$<br>V | TEMPERATURE COEFFICIENT<br>ppm/K | TOLERANCE<br>% | RESISTANCE RANGE<br>$\Omega$ | SERIES   |
|                                    | INCH | METRIC   |                                    |   |                                  |                |                              |          |
| RCL0612 e3                         | 0612 | RR 1632M | 0.5                                | 75  | $\pm 100$                        | $\pm 1$        | 1R0 to 1M                    | E24; E96 |
|                                    |      |          |                                    |   | $\pm 200$                        | $\pm 5$        |                              | E24      |
| RCL1218 e3                         | 1218 | RR 3246M | 1.0                                | 200   | $\pm 100$                        | $\pm 1$        | 1R0 to 2.2M                  | E24; E96 |
|                                    |      |          |                                    |   | $\pm 200$                        | $\pm 5$        |                              | E24      |
| RCL1225 e3                         | 1225 | RR 3263M | 2.0 <sup>(1)</sup>                 | 200   | $\pm 100$                        | $\pm 1$        | 1R0 to 1M                    | E24; E96 |
|                                    |      |          |                                    |   | $\pm 200$                        | $\pm 5$        |                              | E24      |

#### 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 datasheet "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> Specified power rating requires dedicated mounting conditions to achieve the required thermal resistance.

| TECHNICAL SPECIFICATIONS                     |                    |               |         |                    |
|--|--------------------|---------------|---------|--------------------|
| DESCRIPTION                                  | UNIT               | RCL0612       | RCL1218 | RCL1225            |
| Rated Dissipation $P_{70}$ <sup>(2)</sup>    | W                  | 0.5           | 1.0     | 2.0 <sup>(3)</sup> |
| Limiting Element Voltage<br>$U_{max. AC/DC}$ | V                  | 75            | 200     | 200                |
| Insulation Voltage $U_{ins}$ (1 min)         | V                  | > 100         | > 300   | > 300              |
| Insulation Resistance                        | $\Omega$           | > $10^9$      |         |                    |
| Category Temperature Range                   | $^{\circ}\text{C}$ | - 55 to + 155 |         |                    |
| Weight                                       | mg                 | 11            | 29.5    | 55                 |

#### Notes

- <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  $^{\circ}\text{C}$  is not exceeded.
- <sup>(3)</sup> Specified power rating requires dedicated mounting conditions to achieve the required thermal resistance.

| PART NUMBER AND PRODUCT DESCRIPTION            |   |                                   |   |  |   |   |   |  |   |  |   |   |   |  |   |   |
|--|---|-----------------------------------|---|--|---|---|---|--|---|--|---|---|---|--|---|---|
| PART NUMBER: RCL061210K0FKEA                   |   |                                   |   |  |   |   |   |  |   |  |   |   |   |  |   |   |
| R  | C | L                                 | 0   | 6  | 1 | 2   | 1 | 0  | K   | 0  | F | K                                       | E | A  | 0 | 0 |
| MODEL/SIZE<br>RCL0612<br>RCL1218<br>RCL1225    |   |                                   | RESISTANCE<br>R = Decimal<br>K = Thousand<br>M = Million<br>0000 = Jumper |  |   | TOLERANCE<br>F = ± 1 %<br>J = ± 5 %<br>Z = Jumper |   |  | TCR<br>K = ± 100 ppm/K<br>N = ± 200 ppm/K<br>0 = Jumper |  |   | PACKAGING<br>EA<br>EB<br>EC<br>EK<br>EG |   | SPECIAL<br>Up to 2 digits<br>00 = Standard |   |   |
| PRODUCT DESCRIPTION: RCL0612 100 10K 1% ET1 e3 |   |                                   |   |  |   |   |   |  |   |  |   |   |   |  |   |   |
| RCL0612  |   | 100                               |   | 10K  |   | 1%  |   | ET1  |   | e3   |   |   |   |  |   |   |
| MODEL<br>RCL0612<br>RCL1218<br>RCL1225         |   | TCR<br>± 100 ppm/K<br>± 200 ppm/K |   | RESISTANCE<br>10R = 10 Ω<br>10K = 10 kΩ<br>1M = 1 MΩ<br>0R0 = Jumper |   | TOLERANCE<br>± 1 %<br>± 5 %                       |   | PACKAGING<br>ET1<br>ET5<br>ET6<br>ET9<br>E67 |   | LEAD (Pb)-FREE<br>e3 = Pure tin termination finish |   |   |   |  |   |   |

| 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. |
| RCL0612   | 180 mm/7"     | 5000  | EA          | ET1           |  |             |               |
|           | 285 mm/11.25" | 10 000  | EB          | ET5           |  |             |               |
|           | 330 mm/13"    | 20 000  | EC          | ET6           |  |             |               |
| RCL1218   | 180 mm/7"     |   |             |               | 4000   | EK          | ET9           |
| RCL1225   | 180 mm/7"     |   |             |               | 2000   | EG          | E67           |

**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   |
| 0612 | 1632   | 1.6 ± 0.2                               | 3.2 ± 0.2  | 0.55 ± 0.1  | 0.35 ± 0.15 | 0.25 ± 0.15 | 0.6                   | 3.2 | 1.0 | 1.1            | 3.2 | 1.0 |
| 1218 | 3246   | 3.2 <sup>+0.10</sup> / <sub>-0.20</sub> | 4.6 ± 0.15 | 0.55 ± 0.05 | 0.45 ± 0.2  | 0.4 ± 0.2   | 1.1                   | 4.9 | 1.9 | 1.25           | 4.8 | 1.9 |
| 1225 | 3263   | 3.2 ± 0.2                               | 6.3 ± 0.2  | 0.75 ± 0.15 | 0.8 ± 0.2   | 0.4 ± 0.2   | 1.9                   | 7.6 | 1.2 | 1.9            | 7.6 | 1.2 |

**FUNCTIONAL PERFORMANCE**

**Single Pulse**



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

**Continuous Pulse**



Maximum pulse load, continuous pulses; applicable if  $\bar{P} \leq P(\vartheta_{amb})$  and  $\dot{U} \leq \dot{U}_{max}$ ; 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 CLAUSE                | IEC 60068-2 TEST METHOD | TEST                        | PROCEDURE  | REQUIREMENTS PERMISSIBLE CHANGE ( $\Delta R$ )  |                               |
|                                  |                         |                             |  | STABILITY CLASS 2 OR BETTER   |                               |
|                                  |                         |                             | Stability for product types:   |   |                               |
|                                  |                         |                             | <b>RCL e3</b>  | 1 $\Omega$ to 2.2 M $\Omega$  |                               |
| 4.5                              | -                       | Resistance                  | -  | $\pm 1\%$   | $\pm 5\%$                     |
| 4.7                              | -                       | Voltage proof               | $U = 1.4 \times U_{ins}$ ; 60 s  | No flashover or breakdown   |                               |
| 4.13                             | -                       | Short time overload         | $U = 2.5 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max}$ ;<br>Duration acc. to style        | $\pm (0.25\% R + 0.05 \Omega)$  | $\pm (0.5\% R + 0.05 \Omega)$ |
| 4.17.2                           | 58 (Td)                 | Solderability               | Solder bath method;<br>Sn60Pb40 non activated flux;<br>(235 $\pm$ 5) °C<br>(2 $\pm$ 0.2) s       | Good tinning ( $\geq 95\%$ covered);<br>no visible damage                             |                               |
|                                  |                         |                             | Solder bath method;<br>Sn96.5Ag3Cu0.5 non-activated flux;<br>(245 $\pm$ 5) °C<br>(3 $\pm$ 0.3) s | Good tinning ( $\geq 95\%$ covered);<br>no visible damage                             |                               |
| 4.8.4.2                          | -                       | Temperature coefficient     | (20/- 55/20) °C and<br>(20/125/20) °C  | $\pm 100$ ppm/K   | $\pm 200$ ppm/K               |
| 4.32                             | 21 (Uu <sub>3</sub> )   | Shear (adhesion)            | 45N  | No visible damage   |                               |
| 4.33                             | 21 (Uu <sub>1</sub> )   | Substrate bending           | Depth 2 mm;<br>3 times   | No visible damage, 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 °C;<br>30 min at 125 °C   |   |                               |
|                                  |                         |                             | 5 cycles   | $\pm (0.25\% R + 0.05 \Omega)$  | $\pm (0.5\% R + 0.05 \Omega)$ |
|                                  |                         |                             | 1000 cycles  | $\pm (1\% R + 0.05 \Omega)$   | $\pm (1\% R + 0.05 \Omega)$   |



| TEST PROCEDURES AND REQUIREMENTS |                         |  |   |  |  |
|----------------------------------|-------------------------|--|---|--|--|
| EN 60115-1 CLAUSE                | IEC 60068-2 TEST METHOD | TEST   | PROCEDURE   | REQUIREMENTS PERMISSIBLE CHANGE ( $\Delta R$ )               |  |
|                                  |                         |  |   | STABILITY CLASS 2 OR BETTER                                  |  |
|                                  |                         |  | Stability for product types:  | 1 $\Omega$ to 2.2 M $\Omega$                                 |  |
|                                  |                         |  | RCL e3  |  |  |
| 4.23                             | -                       | Climatic sequence:   | -   |  |  |
| 4.23.2                           | 2 (Ba)                  | Dry heat   | 125 °C; 16 h  |  |  |
| 4.23.3                           | 30 (Db)                 | Damp heat, cyclic  | 55 °C; $\geq 90\%$ RH;<br>24 h; 1 cycle   |  |  |
| 4.23.4                           | 1 (Aa)                  | Cold   | - 55 °C; 2 h  | $\pm (1\% R + 0.05 \Omega)$                                  | $\pm (2\% R + 0.1 \Omega)$                               |
| 4.23.5                           | 13 (M)                  | Low air pressure   | 1 kPa; (25 $\pm$ 10) °C; 1 h  |  |  |
| 4.23.6                           | 30 (Db)                 | Damp heat, cyclic  | 55 °C; $\geq 90\%$ RH;<br>24 h; 5 cycles  |  |  |
| 4.23.7                           | -                       | DC load  | $U = \sqrt{P_{70} \times R}$  |  |  |
| 4.25.1                           | -                       | Endurance at 70 °C   | $U = \sqrt{P_{70} \times R} \leq U_{max.}$ ;<br>1.5 h on; 0.5 h off;<br>70 °C; 1000 h<br>70 °C; 8000 h      | $\pm (0.5\% R + 0.05 \Omega)$<br>$\pm (1\% R + 0.05 \Omega)$ | $\pm (2\% R + 0.1 \Omega)$<br>$\pm (4\% R + 0.1 \Omega)$ |
| 4.18.2                           | 58 (Td)                 | Resistance to soldering heat                               | Solder bath method<br>(260 $\pm$ 5) °C;<br>(10 $\pm$ 1) s   | $\pm (0.25\% R + 0.05 \Omega)$                               | $\pm (0.5\% R + 0.05 \Omega)$                            |
| 4.35                             | -                       | Flamability, needle flame test                             | IEC 60695-11-5;<br>10 s   | No burning after 30 s  |  |
| 4.24                             | 78 (Cab)                | Damp heat, steady state                                    | (40 $\pm$ 2) °C;<br>(93 $\pm$ 3) % RH;<br>56 days   | $\pm (1\% R + 0.05 \Omega)$                                  |  |
| 4.25.3                           | -                       | Endurance at upper category temperature                    | 155 °C, 1000 h  | $\pm (1\% R + 0.05 \Omega)$                                  | $\pm (2\% R + 0.1 \Omega)$                               |
| 4.40                             | -                       | Electrostatic discharge (Human Body Model)                 | IEC 61340-3-1<br>3 pos. + 3 neg. discharges;<br>ESD voltage: 1000 V   | $\pm (1\% R + 0.05 \Omega)$                                  |  |
| 4.29                             | 45 (XA)                 | Component solvent resistance                               | Isopropyl alcohol;<br>50 °C; method 2   | No visible damage  |  |
| 4.30                             | 45 (XA)                 | Solvent resistance of marking                              | Isopropyl alcohol;<br>50 °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;<br>x, y, z $\leq$ 1.5 mm;<br>A $\leq$ 200 m/s <sup>2</sup> ;<br>10 sweeps per axis    | $\pm (0.25\% R + 0.05 \Omega)$                               | $\pm (0.5\% R + 0.05 \Omega)$                            |
| 4.37                             | -                       | Periodic electric overload                                 | $U = \sqrt{15 \times P_{70} \times R}$<br>$\leq 2 \times U_{max.}$ ;<br>0.1 s on; 2.5 s off;<br>1000 cycles | $\pm (1\% R + 0.05 \Omega)$                                  |  |
| 4.27                             | -                       | Single pulse high voltage overload, 10 $\mu$ s/700 $\mu$ s | $\dot{U} = 10 \times \sqrt{P_{70} \times R}$<br>$\leq 2 \times U_{max.}$ ;<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-x environmental test procedures

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



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