



**UNI-ROYAL**  
厚聲集團

# DATA SHEET

**Product Name** Automotive Thick Film Chip Resistors

**Part Name** CQ Series

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**Brands** *RoyalOhm* *UniOhm*



## 1. Scope

- 1.1 This specification for approve relates to the Automotive Thick Film Chip Resistors manufactured by UNI-ROYAL Application automobile.  
 1.2 The test items follow the test standard of AEC-Q200.  
 1.3 Anti-Sulfidation  
 1.4 Application car、IPAD、LED Lamps、Intelligent home appliances , Medical equipment, Kinds of industrial control devices & industrial supplies

## 2. Part No. System

Part No. includes 14 codes shown as below:

2.1 1<sup>st</sup>~4<sup>th</sup> codes: Part name. E.g.: CQ01,CQ02,CQ03,CQ05,CQ06,CQ07,CQ10,CQ12

2.2 5<sup>th</sup>~6<sup>th</sup> codes: Power rating.

|                     |      |                |     |     |     |     |      |      |      |    |
|---------------------|------|----------------|-----|-----|-----|-----|------|------|------|----|
| E.g.: W=Normal Size |      | “1~G” = “1~16” |     |     |     |     |      |      |      |    |
| Wattage             | 1/32 | 3/4            | 1/2 | 1/3 | 1/4 | 1/8 | 1/10 | 1/16 | 1/20 | 1  |
| Normal Size         | WH   | 07             | W2  | W3  | W4  | W8  | WA   | WG   | WM   | 1W |

If power rating is lower or equal than 1 watt, 5<sup>th</sup> code would be “W” and 6<sup>th</sup> code would be a number or letter.

E.g.: WA=1/10W

W4=1/4W

2.3 7<sup>th</sup> code: Tolerance. E.g.: D=±0.5% F=±1%

G=±2%

J=±5%

K= ±10%

2.4 8<sup>th</sup>~11<sup>th</sup> codes: Resistance Value.

2.4.1 If value belongs to standard value of ≥5% series, 8<sup>th</sup> code would be zero, 9<sup>th</sup>~10<sup>th</sup> codes are significant figures of the resistance and 11<sup>th</sup> code is the power of ten.

2.4.2 If value belongs to standard value of ≤2% series, 8<sup>th</sup>~10<sup>th</sup> codes are significant figures of the resistance, and 11<sup>th</sup> code is the power of ten.

2.4.3 11<sup>th</sup> codes listed as following:

0=10<sup>0</sup>    1=10<sup>1</sup>    2=10<sup>2</sup>    3=10<sup>3</sup>    4=10<sup>4</sup>    5=10<sup>5</sup>    6=10<sup>6</sup>    J=10<sup>-1</sup>    K=10<sup>-2</sup>    L=10<sup>-3</sup>    M=10<sup>-4</sup>

2.5 12<sup>th</sup>~14<sup>th</sup> codes.

2.5.1 12<sup>th</sup> code: Packaging Type. E.g.: C=Bulk

T=Tape/Reel

2.5.2 13<sup>th</sup> code: Standard Packing Quantity.

4=4000pcs

5=5000pcs

C=10000pcs

D=20000pcs

E=15000pcs

Chip Product: BD=B/B-20000pcs

TC=T/R-10000pcs

2.5.3 14<sup>th</sup> code: Special features.

E = Environmental Protection, Lead Free, or Standard type.

## 3. Ordering Procedure

(Example: CQ05 1/8W ±5% 10K Ω T/R-5000 )



#### 4. Marking

(1) Normally, the making of CQ01,CQ02 resistors as following



(2) Normally, the making of 0Ω CQ03, 0Ω CQ05, 0Ω CQ06, 0Ω CQ07, 0Ω CQ10, 0Ω CQ12, resistors as following



0 → 0Ω

(3) ±5%Tolerance:The first two digits are significant figures of resistance and the third denotes number of zeros following



333 → 33KΩ

(4) ±1% Tolerance: 4 digits, first three digits are significant; forth digit is number of zeros. Letter r is decimal point.



2701 → 2.7KΩ

#### 5. Dimension



| Type       | Dimension(mm) |                  |           |           |           |
|------------|---------------|------------------|-----------|-----------|-----------|
|            | L             | W                | H         | A         | B         |
| CQ01(0201) | 0.60±0.03     | 0.30±0.03        | 0.23±0.03 | 0.12±0.05 | 0.15±0.05 |
| CQ02(0402) | 1.00±0.10     | 0.50±0.05        | 0.35±0.05 | 0.20±0.10 | 0.25±0.10 |
| CQ03(0603) | 1.60±0.10     | 0.80±0.10        | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 |
| CQ05(0805) | 2.00±0.15     | 1.25 ±0.15/-0.10 | 0.55±0.10 | 0.40±0.20 | 0.40±0.20 |
| CQ06(1206) | 3.10±0.15     | 1.55±0.15/-0.10  | 0.55±0.10 | 0.45±0.20 | 0.45±0.20 |
| CQ07(1210) | 3.10±0.10     | 2.60±0.20        | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 |
| CQ10(2010) | 5.00±0.10     | 2.50±0.20        | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 |
| CQ12(2512) | 6.35±0.10     | 3.20±0.20        | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 |

#### 6. Resistance Range

| Type | Power Rating<br>at 70°C | Resistance Range |         |
|------|-------------------------|------------------|---------|
|      |                         | 1.0%             | 5.0%    |
| CQ01 | 1/20W                   | 1Ω-10MΩ          | 1Ω-10MΩ |
| CQ02 | 1/16W                   | 1Ω-10MΩ          | 1Ω-10MΩ |
| CQ03 | 1/10W                   | 1Ω-10MΩ          | 1Ω-10MΩ |
| CQ05 | 1/8W                    | 1Ω-10MΩ          | 1Ω-10MΩ |
| CQ06 | 1/4W                    | 1Ω-10MΩ          | 1Ω-10MΩ |
| CQ07 | 1/2W                    | 1Ω-10MΩ          | 1Ω-10MΩ |
| CQ10 | 3/4W                    | 1Ω-10MΩ          | 1Ω-10MΩ |
| CQ12 | 1W                      | 1Ω-10MΩ          | 1Ω-10MΩ |

#### 7. Ratings

| Type | Max.<br>Working<br>Voltage | Max.<br>Overload<br>Voltage | Dielectric<br>withstanding<br>Voltage | Resistance<br>Value of<br>Jumper | Rated Current<br>of Jumper | Max.<br>Overload<br>Current of<br>Jumper | Operating<br>Temperature |
|------|----------------------------|-----------------------------|---------------------------------------|----------------------------------|----------------------------|------------------------------------------|--------------------------|
| CQ01 | 25V                        | 50V                         | /                                     | <50mΩ                            | 0.5A                       | 1A                                       | -55°C~155°C              |
| CQ02 | 50V                        | 100V                        | 100V                                  | <50mΩ                            | 1A                         | 2A                                       | -55°C~155°C              |
| CQ03 | 75V                        | 150V                        | 300V                                  | <50mΩ                            | 1A                         | 2A                                       | -55°C~155°C              |
| CQ05 | 150V                       | 300V                        | 500V                                  | <50mΩ                            | 2A                         | 5A                                       | -55°C~155°C              |
| CQ06 | 200V                       | 400V                        | 500V                                  | <50mΩ                            | 2A                         | 10A                                      | -55°C~155°C              |
| CQ07 | 200V                       | 500V                        | 500V                                  | <50mΩ                            | 2A                         | 10A                                      | -55°C~155°C              |
| CQ10 | 200V                       | 500V                        | 500V                                  | <50mΩ                            | 2A                         | 10A                                      | -55°C~155°C              |
| CQ12 | 200V                       | 500V                        | 500V                                  | <50mΩ                            | 2A                         | 10A                                      | -55°C~155°C              |

## 8. Recommend the size of welding plate

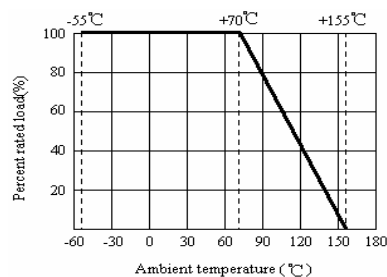


| Type | Dimension(mm) |           |          |          |
|------|---------------|-----------|----------|----------|
|      | A             | B         | C        | D        |
| CQ01 | 0.3±0.05      | 0.35±0.05 | 0.4±0.05 | 1.0±0.05 |
| CQ02 | 0.50±0.05     | 0.45±0.05 | 0.5±0.05 | 1.4±0.05 |
| CQ03 | 0.8±0.05      | 0.65±0.05 | 0.8±0.05 | 2.1±0.05 |
| CQ05 | 1.0±0.1       | 1.0±0.1   | 1.3±0.1  | 3.0±0.1  |
| CQ06 | 2.0±0.1       | 1.1±0.1   | 1.6±0.1  | 4.2±0.1  |
| CQ07 | 2.0±0.1       | 1.1±0.1   | 2.6±0.1  | 4.2±0.1  |
| CQ10 | 3.6±0.1       | 1.3±0.1   | 2.6±0.1  | 6.2±0.1  |
| CQ12 | 4.9±0.1       | 1.6±0.1   | 3.3±0.1  | 8.1±0.1  |

## 9. Derating Curve

Resistors shall have a power rating based on continuous load operation at an ambient temperature from -55°C to 70°C. For temperature in excess of 70°C, the load shall be derated as shown in figure 1

Figure 1



Voltage rating:

Resistors shall have a rated direct-current (DC) continuous working

Voltage or an approximate sine-wave root-mean-square (RMS) alternating-current (AC) continuous working voltage at commercial-line frequency and waveform corresponding to the power rating, as determined from the following formula:

$$RCWV = \sqrt{P \times R}$$

Where: RCWV commercial-line frequency and waveform (Volt.)

P = power rating (WATT.) R = nominal resistance (OHM)

In no case shall the rated DC or RMS AC continuous working voltage be greater than the applicable maximum value.

The overload voltage is 2.5 times RCWV or Max. Overload voltage whichever is less

## 10. Structure



**11. Performance Specification**

| Characteristic                      | Limits                                                                                                                                                                                                                                                              | Ref. Standards          | Test Methods                                                                                                                                                                                                                                                                                   |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operational life                    | $\pm 5\%: \pm(3.0\%+0.1\Omega)$<br>$\pm 1\%: \pm(1.0\%+0.1\Omega)$                                                                                                                                                                                                  | MIL-STD-202             | 125°C, at 36% of operating power, 1000H(1.5 hours “ON”, 0.5 hour “OFF”).                                                                                                                                                                                                                       |
|                                     | $<100\text{m}\Omega$                                                                                                                                                                                                                                                |                         | Apply to rate current for 0 $\Omega$                                                                                                                                                                                                                                                           |
| Electrical Characterization         | CQ01:<br>$1\Omega < R \leq 10\Omega: -100 \sim +350\text{PPM}/^\circ\text{C}$<br>$> 10\Omega: \pm 200\text{PPM}/^\circ\text{C}$<br>CQ02~CQ12:<br>$1\Omega \leq R \leq 10\Omega: \pm 200\text{PPM}/^\circ\text{C}$<br>$> 10\Omega: \pm 100\text{PPM}/^\circ\text{C}$ | User Spec               | Parametrically test per lot and sample size requirements, summary to show Min, Max, Mean and Standard deviation at room as well as Min and Max operating temperatures.                                                                                                                         |
| Short-time overload                 | $\pm 1\%: \pm(1.0\%+0.05\Omega)$<br>$\pm 5\%: \pm(2.0\%+0.05\Omega)$                                                                                                                                                                                                | JIS-C-5201              | 4.13 Permanent resistance change after the application of a potential of 2.5 times RCWV or Max. Overload Voltage whichever less for 5 seconds..                                                                                                                                                |
|                                     | $<50\text{m}\Omega$                                                                                                                                                                                                                                                 |                         | Apply max Overload current for 0 $\Omega$                                                                                                                                                                                                                                                      |
| External Visual                     | No Mechanical Damage                                                                                                                                                                                                                                                | MIL-STD-883 Method 2009 | Electrical test not required. Inspect device construction, marking and workmanship                                                                                                                                                                                                             |
| Physical Dimension                  | Reference 2.0 Dimension Standards                                                                                                                                                                                                                                   | JESD22 MH Method JB-100 | Verify physical dimensions to the applicable device detail specification.<br>Note: User(s) and Suppliers spec. Electrical test not required.                                                                                                                                                   |
| Resistance to Solvent               | Marking Unsmear                                                                                                                                                                                                                                                     | MIL-STD-202 Method 215  | Note: Add Aqueous wash chemical – OKEM Clean or equivalent. Do not use banned solvents.                                                                                                                                                                                                        |
| Terminal Strength                   | Not broken                                                                                                                                                                                                                                                          | JIS-C-6429              | Force of 1.8kg for 60 seconds.                                                                                                                                                                                                                                                                 |
| High Temperature Exposure (Storage) | $\pm(1.0\%+0.1\Omega)$                                                                                                                                                                                                                                              | MIL-STD-202 Method 108  | 1000hrs. @T=155°C. Unpowered. Measurement at 24 $\pm$ 2 hours after test conclusion.                                                                                                                                                                                                           |
|                                     | $<50\text{m}\Omega$                                                                                                                                                                                                                                                 |                         | Apply to rate current for 0 $\Omega$                                                                                                                                                                                                                                                           |
| Temperature Cycling                 | $\pm(1.0\%+0.1\Omega)$                                                                                                                                                                                                                                              | JESD22 Method JA-104    | 1000 Cycles (-55°C to +155°C). Measurement at 24 $\pm$ 2 hours after test conclusion.                                                                                                                                                                                                          |
|                                     | $<50\text{m}\Omega$                                                                                                                                                                                                                                                 |                         | Apply to rate current for 0 $\Omega$                                                                                                                                                                                                                                                           |
| Biased Humidity                     | $\pm 5\%: \pm(3.0\%+0.05\Omega)$<br>$\pm 1\%: \pm(1.0\%+0.05\Omega)$                                                                                                                                                                                                | MIL-STD-202 Method 103  | 1000 hours 85°C, 85%RH.<br>Note: Specified conditions: 10% of operating power. Measurement at 24 $\pm$ 2 hours after test conclusion.                                                                                                                                                          |
|                                     | $<100\text{m}\Omega$                                                                                                                                                                                                                                                |                         | Apply to rate current for 0 $\Omega$                                                                                                                                                                                                                                                           |
| Mechanical Shock                    | $\pm(1.0\%+0.1\Omega)$                                                                                                                                                                                                                                              | MIL-STD-202 Method 213  | Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.                                                                                                                                                                                                |
| Vibration                           | $\pm(1.0\%+0.1\Omega)$                                                                                                                                                                                                                                              | MIL-STD-202 Method 204  | 5g's for 20 min., 12cycle each of 3 orientations.<br>Note: Use 8”*5”PCB. 031” thick 7 secure points on one long side and 2 secure points at corners of opposite sides. Parts mounted within 2” from any secure point. Test from 10-2000Hz.                                                     |
| ESD                                 | $\pm(1.0\%+0.1\Omega)$                                                                                                                                                                                                                                              | AEC-Q200-002            | With the electrometer in direct contact with the discharge tip, verify the voltage setting at levels of $\pm 500\text{V}, \pm 1\text{KV}, \pm 2\text{KV}, \pm 4\text{KV}, \pm 8\text{KV}$ . The electrometer reading shall be within $\pm 10\%$ for voltages from 500V to $\leq 800\text{V}$ . |
| Solderability                       | Coverage must be over 95%.                                                                                                                                                                                                                                          | J-STD-002               | For both leaded & SMD. Electrical test not required. Magnification 50X. Conditions:<br>a) Method B 4hrs at 155°C dry heat, the dip in bath with 245°C, 5s.<br>b) Method B: at 215°C, 5s.<br>c) Method D: at 260°C, 60s.                                                                        |
| Flammability                        | No ignition of the tissue paper or scorching or the pinewood board                                                                                                                                                                                                  | UL-94                   | V-0 or V-1 are acceptable. Electrical test not required.                                                                                                                                                                                                                                       |
| Board Flex                          | $\pm(1.0\%+0.05\Omega)$                                                                                                                                                                                                                                             | JIS-C-6429              | 2mm (Min)                                                                                                                                                                                                                                                                                      |
|                                     | $<50\text{m}\Omega$                                                                                                                                                                                                                                                 |                         | Apply to rate current for 0 $\Omega$                                                                                                                                                                                                                                                           |

|                              |                                                              |                        |                                                                                                                                                      |
|------------------------------|--------------------------------------------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Flame Retardance             | No flame                                                     | AEC-Q200-001           | Only requested, when voltage/power will increase the surface temp to 350°C. Apply voltage from 9V to 32V. No flame; No explosion.                    |
| Resistance to Soldering Heat | $\pm(1.0\%+0.05\Omega)$                                      | MIL-STD-202 Method 210 | Condition B No per-heat of samples. Note: Single Wave Solder-Procedure 2 for SMD and Procedure 1 for Leaded with solder within 1.5mm of device body. |
|                              | $<50\text{m}\Omega$                                          |                        | Apply to rate current for 0 $\Omega$                                                                                                                 |
| Sulfuration test             | $\pm 5\%:(5.0\%+0.05\Omega)$<br>$\pm 1\%:(1.0\%+0.05\Omega)$ | ASTM B-809-95          | sulfur(saturated vapor) , Temperature: $50\pm 2^\circ\text{C}$<br>Humidity: 86 ~ 90%RH, 1000H.                                                       |

Sulfuration test:  $\text{H}_2\text{S}$  3~5PPM  $50^\circ\text{C}\pm 2^\circ\text{C}$  91%~93%RH 1000H $\pm 5\%:(5.0\%+0.05\Omega)$  ;  $\pm 1\%:(1.0\%+0.05\Omega)$ 

## 12. Packing of Surface Mount Resistors

### 12.1 Dimension of Paper Taping : (Unit: mm)



| Type | A              | B              | C<br>$\pm 0.05$ | $\begin{smallmatrix} +0.1 \\ \phi D \\ -0 \end{smallmatrix}$ | E<br>$\pm 0.1$ | F<br>$\pm 0.05$ | G<br>$\pm 0.1$ | W<br>$\pm 0.2$ | T              |
|------|----------------|----------------|-----------------|--------------------------------------------------------------|----------------|-----------------|----------------|----------------|----------------|
| CQ01 | $0.40\pm 0.05$ | $0.70\pm 0.05$ | 2.00            | 1.50                                                         | 1.75           | 3.50            | 4.00           | 8.00           | $0.42\pm 0.1$  |
| CQ02 | $0.65\pm 0.1$  | $1.20\pm 0.1$  | 2.00            | 1.50                                                         | 1.75           | 3.50            | 4.00           | 8.00           | $0.42\pm 0.05$ |



| Type | A<br>$\pm 0.2$ | B<br>$\pm 0.2$ | C<br>$\pm 0.05$ | $\begin{smallmatrix} +0.1 \\ \phi D \\ -0 \end{smallmatrix}$ | E<br>$\pm 0.1$ | F<br>$\pm 0.05$ | G<br>$\pm 0.1$ | W<br>$\pm 0.2$ | T<br>$\pm 0.1$ |
|------|----------------|----------------|-----------------|--------------------------------------------------------------|----------------|-----------------|----------------|----------------|----------------|
| CQ03 | 1.10           | 1.90           | 2.00            | 1.50                                                         | 1.75           | 3.50            | 4.00           | 8.00           | 0.67           |
| CQ05 | 1.65           | 2.40           | 2.00            | 1.50                                                         | 1.75           | 3.50            | 4.00           | 8.00           | 0.81           |
| CQ06 | 2.00           | 3.60           | 2.00            | 1.50                                                         | 1.75           | 3.50            | 4.00           | 8.00           | 0.81           |
| CQ07 | 2.80           | 3.50           | 2.00            | 1.50                                                         | 1.75           | 3.50            | 4.00           | 8.00           | 0.75           |

### 12.2 Dimension of Embossed Taping: (Unit: mm)



| Type | A<br>$\pm 0.2$ | B<br>$\pm 0.2$ | C<br>$\pm 0.05$ | $\begin{smallmatrix} +0.1 \\ \phi D \\ -0 \end{smallmatrix}$ | $\begin{smallmatrix} +0.25 \\ \phi D1 \\ -0 \end{smallmatrix}$ | E<br>$\pm 0.1$ | F<br>$\pm 0.05$ | G<br>$\pm 0.1$ | W<br>$\pm 0.2$ | T<br>$\pm 0.1$ |
|------|----------------|----------------|-----------------|--------------------------------------------------------------|----------------------------------------------------------------|----------------|-----------------|----------------|----------------|----------------|
| CQ10 | 2.90           | 5.60           | 2.00            | 1.50                                                         | 1.50                                                           | 1.75           | 5.50            | 4.00           | 12.00          | 1.00           |
| CQ12 | 3.50           | 6.70           | 2.00            | 1.50                                                         | 1.50                                                           | 1.75           | 5.50            | 4.00           | 12.00          | 1.00           |

## 12.3 Dimension of Reel : (Unit: mm)



| Type | Taping   | Qty/Reel  | A±0.5 | B±0.5 | C±0.5 | D±1  | M±2   | W±1  |
|------|----------|-----------|-------|-------|-------|------|-------|------|
| CQ01 | Paper    | 10,000pcs | 2.0   | 13.0  | 21.0  | 60.0 | 178.0 | 10.0 |
| CQ02 | Paper    | 10,000pcs | 2.0   | 13.0  | 21.0  | 60.0 | 178.0 | 10.0 |
| CQ03 | Paper    | 5,000pcs  | 2.0   | 13.0  | 21.0  | 60.0 | 178.0 | 10.0 |
| CQ05 | Paper    | 5,000pcs  | 2.0   | 13.0  | 21.0  | 60.0 | 178.0 | 10.0 |
| CQ06 | Paper    | 5,000pcs  | 2.0   | 13.0  | 21.0  | 60.0 | 178.0 | 10.0 |
| CQ07 | Paper    | 5,000pcs  | 2.0   | 13.0  | 21.0  | 60.0 | 178.0 | 10.0 |
| CQ10 | Embossed | 4,000pcs  | 2.0   | 13.0  | 21.0  | 60.0 | 178.0 | 13.8 |
| CQ12 | Embossed | 4,000pcs  | 2.0   | 13.0  | 21.0  | 60.0 | 178.0 | 13.8 |

**13. Note**

13.1. UNI-ROYAL recommend the storage condition temperature: 15℃~35℃, humidity :25%~75%.

(Put condition for individual product).Even under UNI-ROYAL recommended storage condition, solderability of products over 1 year old.  
(Put condition for each product) may be degraded.

13.2. Store / transport cartons in the correct direction, which is indicated on a carton as a symbol.

Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

13.3. Product performance and soldered connections may deteriorate if the products are stored in the following places:

- Storage in high Electrostatic.
- Storage in direct sunshine 、rain and snow or condensation.

**14. Record**

| Version | Description of amendment                                  | Page | Date         | Amended by  | Checked by |
|---------|-----------------------------------------------------------|------|--------------|-------------|------------|
| 1       | First issue of this specification                         | 1~7  | Mar.20, 2018 | Chen Haiyan | Chen Nana  |
| 2       | Modify the product name                                   | 1~7  | Nov.22, 2018 | Chen Haiyan | Chen Nana  |
| 3       | Modify the Performance Specification                      | 5~6  | Feb.16, 2019 | Chen Haiyan | Xu Yuhua   |
| 4       | Experimental method and standard for adding vulcanization | 6    | Mar.05, 2019 | Chen Haiyan | Xu Yuhua   |

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