

# ROYAL OHM

## Chip Resistor

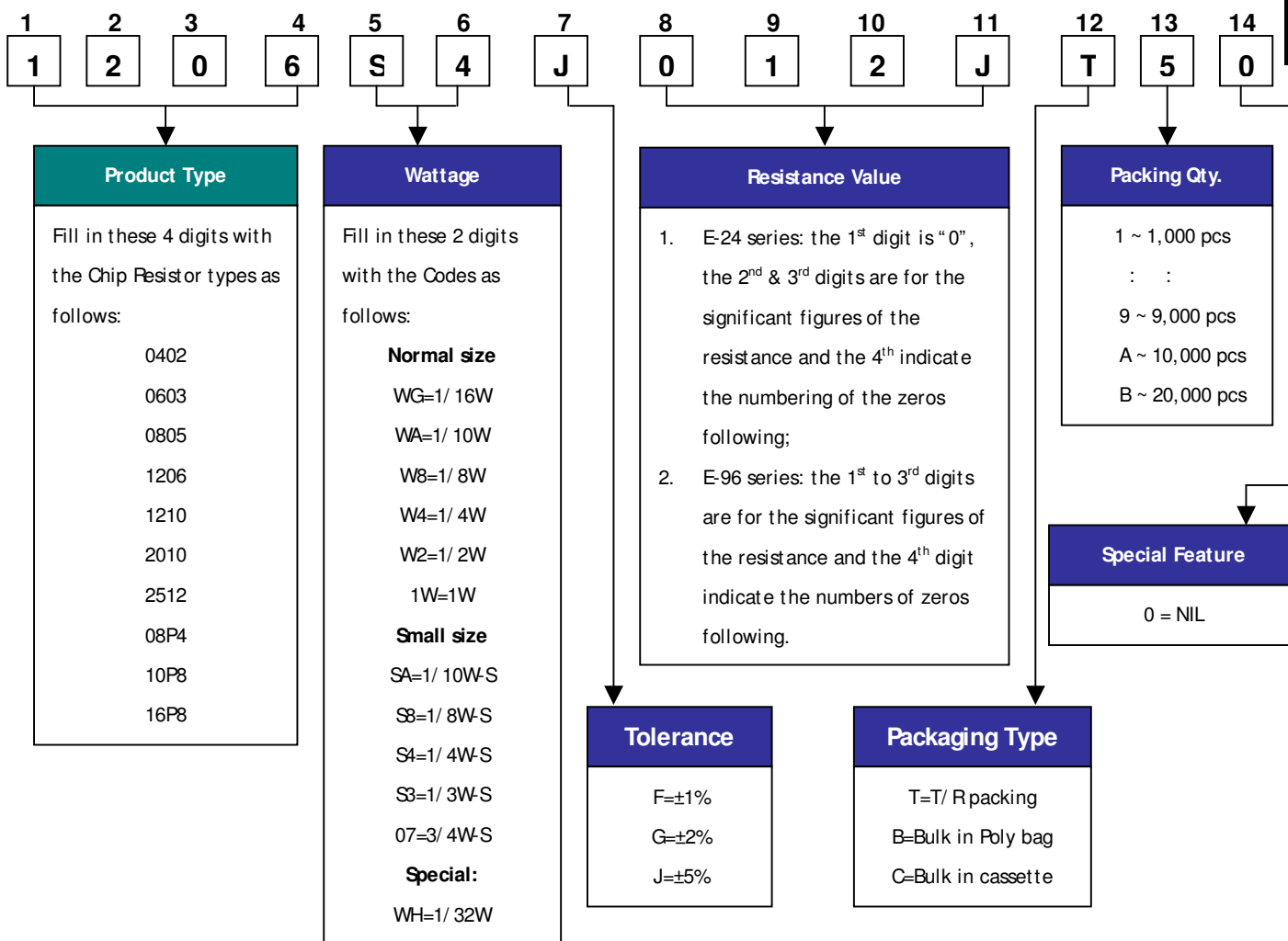
### Features

- ❑ Small size and lightweight
- ❑ Suitable for both flow and re-flow soldering
- ❑ Reduction of assembly costs and matching with placement machines

### Application

- ❑ Automotive industry (indicators)
- ❑ Medical and military equipment, Radio and tape recorders
- ❑ Telecommunication equipment, TV tuners and video cameras
- ❑ Computers, Pocket Calculators

### Explanation of Part Number and Ordering Procedure:



Note: 1. Special resistance tolerance requirement available on a case-to-case basis. Please indicate when ordering.

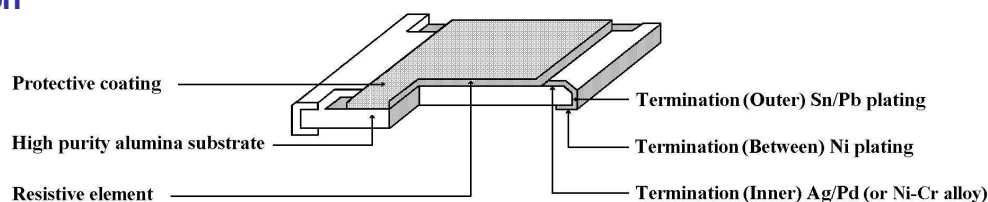
2. Special T.C.R. requirements can be supplied on a case-to-case basis. Please indicate when ordering.

3. Ordering procedure (Example: 1206 1/ 4W-S5%1.2Ω T/R-5000)

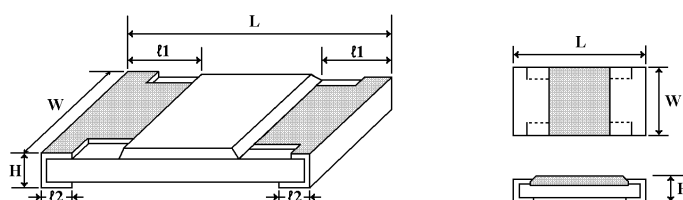
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### Construction



### Power Rating and Dimension



| Type | Power Rating at 70°C | Max. Working Voltage | Max. Overload Voltage | Operating Temp. (°C) | Tolerance %              | Resistance Range                           | Standard Series      | Dimension (mm) |                        |           |                |                |
|------|----------------------|----------------------|-----------------------|----------------------|--------------------------|--------------------------------------------|----------------------|----------------|------------------------|-----------|----------------|----------------|
|      |                      |                      |                       |                      |                          |                                            |                      | L              | W                      | H         | t <sub>1</sub> | t <sub>2</sub> |
| 0402 | 1/16W                | 25V                  | 50V                   | -55~+125             | Jumper<br>±1<br>±2<br>±5 | <50 mΩ<br>100Ω-1MΩ<br>2Ω-3.3MΩ<br>2Ω-3.3MΩ | E-96<br>E-24<br>E-24 | 1.00±0.10      | 0.50±0.05              | 0.35±0.05 | 0.20±0.10      | 0.25±0.10      |
| 0603 | 1/10W<br>(1/16W)     | 50V                  | 100V                  | -55~+125             | Jumper<br>±1<br>±2<br>±5 | <50 mΩ<br>10Ω-1MΩ<br>10Ω-1MΩ<br>1Ω-10MΩ    | E-96<br>E-24<br>E-24 | 1.60±0.10      | +0.15<br>0.80<br>-0.10 | 0.45±0.10 | 0.30±0.20      | 0.30±0.20      |
| 0805 | 1/8W<br>(1/10W)      | 150V                 | 300V                  | -55~+125             | Jumper<br>±1<br>±2<br>±5 | <50 mΩ<br>10Ω-1MΩ<br>10Ω-1MΩ<br>1Ω-10MΩ    | E-96<br>E-24<br>E-24 | 2.00±0.15      | +0.15<br>1.25<br>-0.10 | 0.55±0.10 | 0.40±0.20      | 0.40±0.20      |
| 1206 | 1/4W<br>(1/8W)       | 200V                 | 400V                  | -55~+125             | Jumper<br>±1<br>±2<br>±5 | <50 mΩ<br>10Ω-1MΩ<br>10Ω-1MΩ<br>1Ω-10MΩ    | E-96<br>E-24<br>E-24 | 3.10±0.15      | +0.15<br>1.55<br>-0.10 | 0.55±0.10 | 0.45±0.20      | 0.45±0.20      |
| 1210 | 1/3W<br>(1/4W)       | 200V                 | 400V                  | -55~+125             | Jumper<br>±1<br>±2<br>±5 | <50 mΩ<br>10Ω-1MΩ<br>1Ω-10MΩ<br>1Ω-10MΩ    | E-96<br>E-24<br>E-24 | 3.10±0.10      | 2.60±0.15              | 0.55±0.10 | 0.50±0.25      | 0.50±0.20      |
| 2010 | 3/4W<br>(1/2W)       | 200V                 | 400V                  | -55~+125             | Jumper<br>±1<br>±2<br>±5 | <50 mΩ<br>10Ω-1MΩ<br>1Ω-10MΩ<br>1Ω-10MΩ    | E-96<br>E-24<br>E-24 | 5.00±0.10      | 2.50±0.15              | 0.55±0.10 | 0.60±0.25      | 0.50±0.20      |
| 2512 | 1W                   | 200V                 | 400V                  | -55~+125             | Jumper<br>±1<br>±2<br>±5 | <50 mΩ<br>10Ω-1MΩ<br>1Ω-10MΩ<br>1Ω-10MΩ    | E-96<br>E-24<br>E-24 | 6.35±0.10      | 3.20±0.15              | 0.55±0.10 | 0.60±0.25      | 0.50±0.20      |

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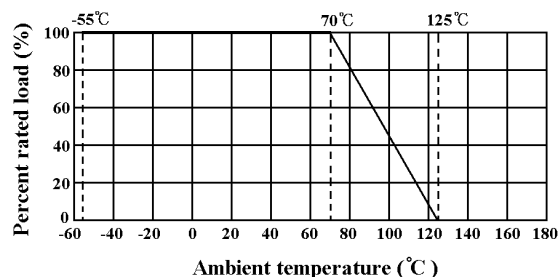
## Chip Resistor

### Performance Specifications

| Characteristics                                   | Test Methods                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Limits                                                                                                                                                                                                                                                     |             |      |   |                             |          |   |            |               |   |                              |          |   |            |               |                                                                                                  |
|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|---|-----------------------------|----------|---|------------|---------------|---|------------------------------|----------|---|------------|---------------|--------------------------------------------------------------------------------------------------|
| Temperature coefficient<br>JIS-C-5202 5.2         | Natural resistance change per temp. degree centigrade<br>$\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (PPM/ } ^\circ\text{C)}$ $R_1$ : Resistance value at room temperature ( $t_1$ )<br>$R_2$ : Resistance value at room temp. plus 100°C ( $t_2$ )                                                                                                                                                                                                                                                    | $\pm 5\%$ 1Ω --- 10Ω $\leq \pm 400\text{PPM/ } ^\circ\text{C}$<br>11Ω --- 10MΩ $\leq \pm 200\text{PPM/ } ^\circ\text{C}$<br><br>$\pm 1\%$ 10Ω --- 100Ω $\leq \pm 200\text{PPM/ } ^\circ\text{C}$<br>101Ω --- 1MΩ $\leq \pm 100\text{PPM/ } ^\circ\text{C}$ |             |      |   |                             |          |   |            |               |   |                              |          |   |            |               |                                                                                                  |
| Short-time overload<br>JIS-C-5202 5.5             | Permanent resistance change after the application of a potential of 2.5 times RCWW for 5 seconds.                                                                                                                                                                                                                                                                                                                                                                                                               | $\pm 5\%$ Tolerance $\pm (2.0\% + 0.1\Omega)$<br>$\pm 1\%$ Tolerance $\pm (1.0\% + 0.1\Omega)$                                                                                                                                                             |             |      |   |                             |          |   |            |               |   |                              |          |   |            |               |                                                                                                  |
| Insulation resistance<br>JIS-C-5202 5.6           | Apply 500V DC between protective coating and termination for 1 min, then measure.                                                                                                                                                                                                                                                                                                                                                                                                                               | 1,000 Mega ohm or more                                                                                                                                                                                                                                     |             |      |   |                             |          |   |            |               |   |                              |          |   |            |               |                                                                                                  |
| Dielectric withstanding voltage<br>JIS-C-5202 5.7 | Apply 500V AC between protective coating and termination for 1 minute.                                                                                                                                                                                                                                                                                                                                                                                                                                          | No evidence of flashover mechanical damage, arcing or insulation break down                                                                                                                                                                                |             |      |   |                             |          |   |            |               |   |                              |          |   |            |               |                                                                                                  |
| Terminal bending<br>JIS-C-5202 6.1.4              | Twist of Test Board: Y / X = 5 / 90mm for 10 seconds.                                                                                                                                                                                                                                                                                                                                                                                                                                                           | $\pm (1.0\% + 0.05\Omega)$                                                                                                                                                                                                                                 |             |      |   |                             |          |   |            |               |   |                              |          |   |            |               |                                                                                                  |
| Soldering Heat<br>JIS-C-5202 6.4                  | Dip the resistor into a solder bath having a temperature of 260°C $\pm 5^\circ\text{C}$ and hold it for 10 $\pm 1$ seconds.                                                                                                                                                                                                                                                                                                                                                                                     | Resistance change rate is $\pm (1.0\% + 0.05\Omega)$                                                                                                                                                                                                       |             |      |   |                             |          |   |            |               |   |                              |          |   |            |               |                                                                                                  |
| Solderability<br>JIS-C-5202 6.5                   | Test temperature of solder 235°C $\pm 5^\circ\text{C}$ .<br>Dipping them in solder: 3 $\pm 0.5$ seconds.                                                                                                                                                                                                                                                                                                                                                                                                        | 95% coverage Min.                                                                                                                                                                                                                                          |             |      |   |                             |          |   |            |               |   |                              |          |   |            |               |                                                                                                  |
| Temperature cycling<br>JIS-C-5202 7.4             | Resistance change after continuous five cycles for duty cycle specified below:<br><table border="1"> <thead> <tr> <th>Step</th><th>Temperature</th><th>Time</th></tr> </thead> <tbody> <tr> <td>1</td><td>-55°C <math>\pm 3^\circ\text{C}</math></td><td>30 mins.</td></tr> <tr> <td>2</td><td>Room temp.</td><td>10 – 15 mins.</td></tr> <tr> <td>3</td><td>+125°C <math>\pm 2^\circ\text{C}</math></td><td>30 mins.</td></tr> <tr> <td>4</td><td>Room temp.</td><td>10 – 15 mins.</td></tr> </tbody> </table> | Step                                                                                                                                                                                                                                                       | Temperature | Time | 1 | -55°C $\pm 3^\circ\text{C}$ | 30 mins. | 2 | Room temp. | 10 – 15 mins. | 3 | +125°C $\pm 2^\circ\text{C}$ | 30 mins. | 4 | Room temp. | 10 – 15 mins. | $\pm 5\%$ Tolerance $\pm (1.0\% + 0.05\Omega)$<br>$\pm 1\%$ Tolerance $\pm (0.5\% + 0.05\Omega)$ |
| Step                                              | Temperature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Time                                                                                                                                                                                                                                                       |             |      |   |                             |          |   |            |               |   |                              |          |   |            |               |                                                                                                  |
| 1                                                 | -55°C $\pm 3^\circ\text{C}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 30 mins.                                                                                                                                                                                                                                                   |             |      |   |                             |          |   |            |               |   |                              |          |   |            |               |                                                                                                  |
| 2                                                 | Room temp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 10 – 15 mins.                                                                                                                                                                                                                                              |             |      |   |                             |          |   |            |               |   |                              |          |   |            |               |                                                                                                  |
| 3                                                 | +125°C $\pm 2^\circ\text{C}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 30 mins.                                                                                                                                                                                                                                                   |             |      |   |                             |          |   |            |               |   |                              |          |   |            |               |                                                                                                  |
| 4                                                 | Room temp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 10 – 15 mins.                                                                                                                                                                                                                                              |             |      |   |                             |          |   |            |               |   |                              |          |   |            |               |                                                                                                  |
| Load life in humidity<br>JIS-C-5202 7.9           | Resistance change after 1,000 hours (1.5 hours "on", 0.5 hour "off") at RCWW in a humidity chamber controlled at 40°C $\pm 2^\circ\text{C}$ and 90 to 95% relative humidity.                                                                                                                                                                                                                                                                                                                                    | $\pm 5\%$ Tolerance $\pm (3.0\% + 0.1\Omega)$<br>$\pm 1\%$ Tolerance $\pm (1.0\% + 0.1\Omega)$                                                                                                                                                             |             |      |   |                             |          |   |            |               |   |                              |          |   |            |               |                                                                                                  |
| Load Life<br>JIS-C-5202 7.10                      | Permanent resistance change after 1,000 hours operating at RCWW, with duty cycle (1.5 hours "on", 0.5 hour "off") at 70°C $\pm 2^\circ\text{C}$ ambient                                                                                                                                                                                                                                                                                                                                                         | $\pm 5\%$ Tolerance $\pm (3.0\% + 0.1\Omega)$<br>$\pm 1\%$ Tolerance $\pm (1.0\% + 0.1\Omega)$                                                                                                                                                             |             |      |   |                             |          |   |            |               |   |                              |          |   |            |               |                                                                                                  |

\* RCWW = Rated Continuous Working Voltage =  $\sqrt{\text{Rated Power} \times \text{Resistance Value}}$

### Derating Curve



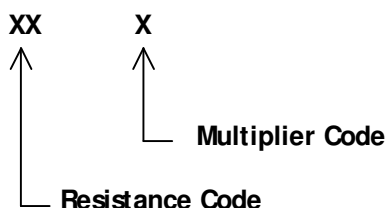
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## Chip Resistor

### RMC 0603 E - 96 Multiplier Code

| Code       | A      | B      | C      | D      | E      | F      | G      | H      | X         | Y         | Z         |
|------------|--------|--------|--------|--------|--------|--------|--------|--------|-----------|-----------|-----------|
| Multiplier | $10^0$ | $10^1$ | $10^2$ | $10^3$ | $10^4$ | $10^5$ | $10^6$ | $10^7$ | $10^{-1}$ | $10^{-2}$ | $10^{-3}$ |

### Coding Formula



Example:  $10.2\text{K}\Omega = 102 \times 10^2\Omega = 02\text{C}$

$33.2\Omega = 332 \times 10^{-1}\Omega$   
51 X

### Standard E – 96 Values and 0603 Resistance Code

| $\Omega$ Value | Code | $\Omega$ Value | Code | $\Omega$ Value | Code | $\Omega$ Value | Code | $\Omega$ Value | Code |
|----------------|------|----------------|------|----------------|------|----------------|------|----------------|------|
| 100            | 01   | 162            | 21   | 261            | 41   | 422            | 61   | 681            | 81   |
| 102            | 02   | 165            | 22   | 267            | 42   | 432            | 62   | 698            | 82   |
| 105            | 03   | 169            | 23   | 274            | 43   | 442            | 63   | 715            | 83   |
| 107            | 04   | 174            | 24   | 280            | 44   | 453            | 64   | 732            | 84   |
| 110            | 05   | 178            | 25   | 287            | 45   | 464            | 65   | 750            | 85   |
| 113            | 06   | 182            | 26   | 294            | 46   | 475            | 66   | 768            | 86   |
| 115            | 07   | 187            | 27   | 301            | 47   | 487            | 67   | 787            | 87   |
| 118            | 08   | 191            | 28   | 309            | 48   | 499            | 68   | 806            | 88   |
| 121            | 09   | 196            | 29   | 316            | 49   | 511            | 69   | 825            | 89   |
| 124            | 10   | 200            | 30   | 324            | 50   | 523            | 70   | 845            | 90   |
| 127            | 11   | 205            | 31   | 332            | 51   | 536            | 71   | 866            | 91   |
| 130            | 12   | 210            | 32   | 340            | 52   | 549            | 72   | 887            | 92   |
| 133            | 13   | 215            | 33   | 348            | 53   | 562            | 73   | 909            | 93   |
| 137            | 14   | 221            | 34   | 357            | 54   | 576            | 74   | 931            | 94   |
| 140            | 15   | 226            | 35   | 365            | 55   | 590            | 75   | 953            | 95   |
| 143            | 16   | 232            | 36   | 374            | 56   | 604            | 76   | 976            | 96   |
| 147            | 17   | 237            | 37   | 383            | 57   | 619            | 77   |                |      |
| 150            | 18   | 243            | 38   | 392            | 58   | 634            | 78   |                |      |
| 154            | 19   | 249            | 39   | 402            | 59   | 649            | 79   |                |      |
| 158            | 20   | 255            | 40   | 412            | 60   | 665            | 80   |                |      |