

# ROYALOHM

**C O N F I D E N T I A L D O C U M E N T**

SPECIFICATION FOR APPROVAL

**RAPID ELECTRONICS LTD.**

Description : Thick Film Chip Resistors (Terminal Lead Free)

**Royalohm Part no.:**

|                |  |
|----------------|--|
| 0402WGxxxxxPCE | (RMC 1/16W (0402) +/- 1%, 5% & Jumper)   |
| 0603SAxxxxxP5E | (RMC 1/10W-S (0603) +/- 1%, 5% & Jumper) |
| 0805S8xxxxxP5E | (RMC 1/8W-S (0805) +/- 1%, 5% & Jumper)  |
| 1206S4xxxxxP5E | (RMC 1/4W-S (1206) +/- 1%, 5% & Jumper)  |

Approved by

|  |
|--|
|  |
|--|

**Parts corresponding to RoHS Compliant: 2005-Apr.-1**

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| Approved     | Checked            | Prepared       |
|--------------|--------------------|----------------|
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Issue Date: 2014/10/31



**Customer: RAPID ELECTRONICS LTD.**

1. Scope:

This specification for approval relates to Thick Film Chip Resistors (Terminal Lead Free) manufactured by ROYALOHM 's specifications.

2. Type designation:

The type designation shall be in the following form:

Ex.

| Type     | Power Rating | Resistance tolerance | Nominal Resistance |
|----------|--------------|----------------------|--------------------|
| RMC 0402 | 1/16W        | F, J                 | 75Ω                |
| RMC 0603 | 1/10W-S      |                      |                    |
| RMC 0805 | 1/8W-S       |                      |                    |
| RMC 1206 | 1/4W-S       |                      |                    |

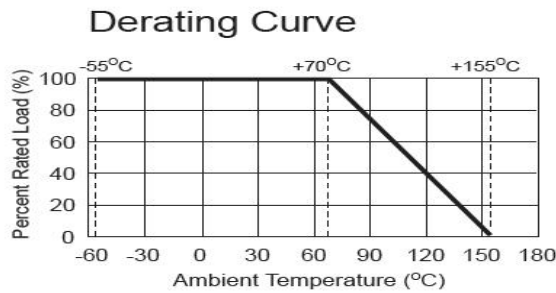
3. Ratings:

| Type                            | RMC 0402           | RMC 0603           | RMC 0805           | RMC 1206          |
|---------------------------------|--------------------|--------------------|--------------------|-------------------|
| Power Rating                    | 1/16W<br>(0.0625W) | 1/10W-S<br>(0.10W) | 1/8W-S<br>(0.125W) | 1/4W-S<br>(0.25W) |
| Rated Current(Jumper)           | 1A                 | 1A                 | 2A                 | 2A                |
| Max. Overload Current(Jumper)   | 2A                 | 2A                 | 5A                 | 10A               |
| Max. Working Voltage            | 50 V               | 75 V               | 150 V              | 200 V             |
| Max. Overload Voltage           | 100 V              | 150 V              | 300 V              | 400 V             |
| Dielectric Withstanding Voltage | 100 V              | 300 V              | 500 V              | 500 V             |
| Temperature Range               | -55°C ~ +155°C     |                    |                    |                   |
| Ambient Temperature             | 70 °C              |                    |                    |                   |

3.1 Power rating:

Resistors shall have a power rating based on continuous load operation at an ambient temperature of 70 °C . For temperature in excess of 70 °C , The load shall be derate as shown in figure 1.

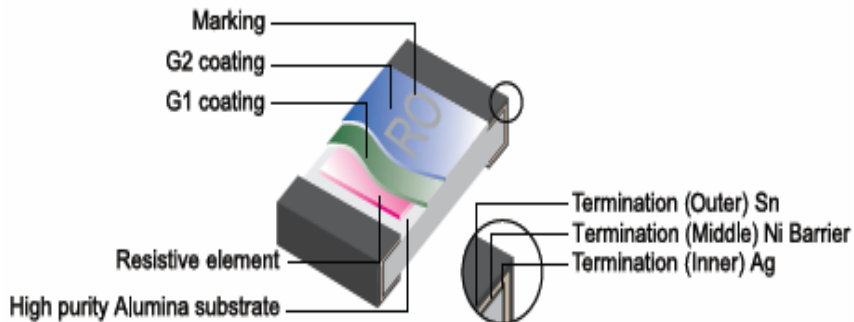
Figure 1



3.2 Nominal Resistance

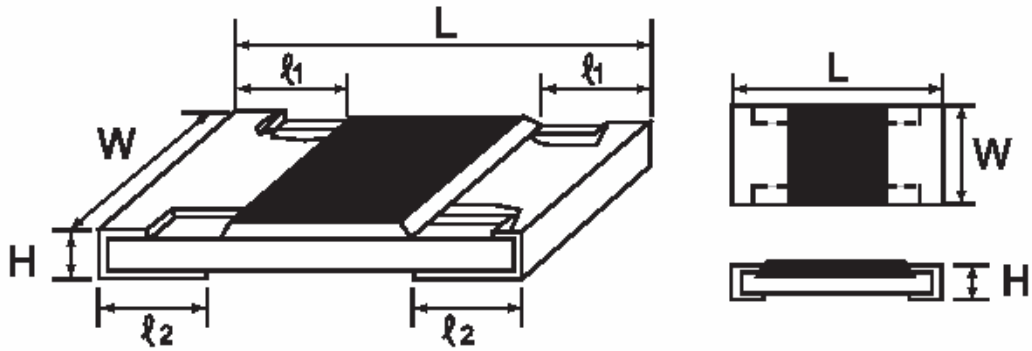
Effective figures of nominal resistance shall be in accordance with E-24 and E-96 series for 1 % and E-24 series for 2 % and 5 %

4. Construction :



### Thick Film Chip Resistors (Terminal Lead Free)

5. Power rating and dimensions



Dimension :

| Type     | Dimension (mm) |                       |             |                |                |
|----------|----------------|-----------------------|-------------|----------------|----------------|
|          | L              | W                     | H           | l <sub>1</sub> | l <sub>2</sub> |
| RMC 0402 | 1.00 ± 1.0     | 0.50 ± 0.05           | 0.35 ± 0.05 | 0.20 ± 0.10    | 0.25 ± 0.10    |
| RMC 0603 | 1.60 ± 0.10    | 0.80 + 0.15<br>- 0.10 | 0.45 ± 0.10 | 0.30 ± 0.20    | 0.30 ± 0.20    |
| RMC 0805 | 2.00 ± 0.15    | 1.25 + 0.15<br>- 0.10 | 0.55 ± 0.10 | 0.40 ± 0.20    | 0.40 ± 0.20    |
| RMC 1206 | 3.10 ± 0.15    | 1.55 + 0.15<br>- 0.10 | 0.55 ± 0.10 | 0.45 ± 0.20    | 0.45 ± 0.20    |

Power Rating :

| Type     | Power Rating at 70 °C | Tolerance % | Resistance Range | Standard Series |
|----------|-----------------------|-------------|------------------|-----------------|
| RMC 0402 | 1/16W                 | Jumper      | < 50mΩ           | E-96<br>E-24    |
|          |                       | ± 1         | 10Ω ~ 1MΩ        |                 |
|          |                       | ± 5         | 1Ω ~ 10MΩ        |                 |
| RMC 0603 | 1/10W-S               | Jumper      | < 50mΩ           | E-96<br>E-24    |
|          |                       | ± 1         | 10Ω ~ 1MΩ        |                 |
|          |                       | ± 5         | 1Ω ~ 10MΩ        |                 |
| RMC 0805 | 1/8W-S                | Jumper      | < 50mΩ           | E-96<br>E-24    |
|          |                       | ± 1         | 10Ω ~ 1MΩ        |                 |
|          |                       | ± 5         | 1Ω ~ 10MΩ        |                 |
| RMC 1206 | 1/4W-S                | Jumper      | < 50mΩ           | E-96<br>E-24    |
|          |                       | ± 1         | 10Ω ~ 1MΩ        |                 |
|          |                       | ± 5         | 1Ω ~ 10MΩ        |                 |

### Thick Film Chip Resistors (Terminal Lead Free)

**Mutiplier Code :**

| Code              | A  | B  | C  | D  | E  | F  | G  | H  | X  | Y  | Z  |
|-------------------|----|----|----|----|----|----|----|----|----|----|----|
| <b>Multiplier</b> | 0  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | -1 | -2 | -3 |
|                   | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |

**Coding**

**Formula**

**Example :** 10.2KΩ = 102 X 10 Ω = 02C

**XX**

**X**

Resistance Code

Multiplier Code

33.2Ω = 332 X 10<sup>-1</sup> Ω = 51X

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

\*Marking for 0603 E-96 series, the resistance value that no have multiplier code indicate marking follow this:  
 The first two digits are significant figures of resistance and the third one denoted number of zeros and under line the marking letters.

Ex.

|  |            |  |
|--|------------|--|
|  | <u>122</u> |  |
|--|------------|--|

1.2KΩ

**Thick Film Chip Resistors (Terminal Lead Free)**

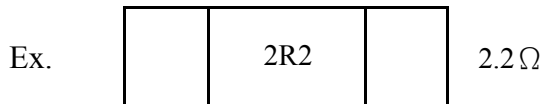
**6. Marking :**

**6.1 Resistors**

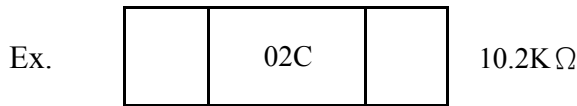
A. ± 5% Tolerance 0603, 0805, 1206: the first two digits are significant figures of resistance and the third one denoted number of zeros.



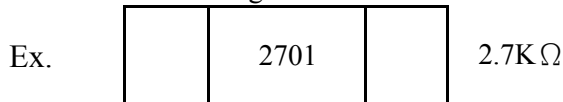
B. For ohmic values below 10 Ω



C. For E-96 series [±1% (F) tolerance] in 0603 size 3 digit system (due to space restrictions) please refer to page 4 for coding formula



D. ±1% Tolerance 0805, 1206 : 4 Digits, the first three digits are significant figures of resistance and the fourth digit denoted number of zeros. Letter "R" is for decimal point.




E. Chip Resistors type 0402 No marking

**6.2 Labels**

Label shall be marked with the following item :

- A. Nominal Resistance and Resistance Tolerance
- B. Power Rating and Size
- C. Quantity
- D. Part No.
- E. P.O.No.
- F. Lot No.

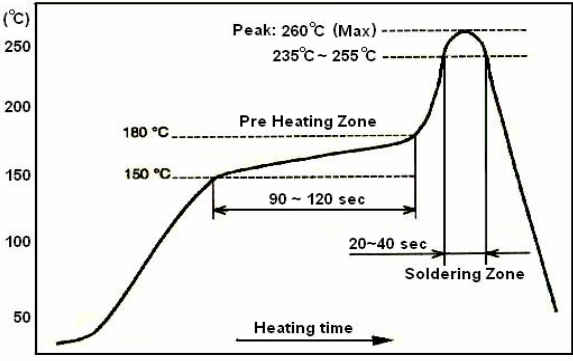
Ex.

|  |                |                       |                |
|--|----------------|-----------------------|----------------|
| <b>ROYALOHM</b>  |                |                       |                |
| <b>CHIP RESISTOR</b>   |                |                       |                |
| RESISTANCE:  | <b>75</b>      | Ω                     | ± 1 %          |
| WATTAGE:   | <b>1/10W-S</b> | SIZE:                 | <b>0603</b>    |
| QUANTITY:  | <b>5,000</b>   | PCS                   | <b>Pb-Free</b> |
| PART NO.:  |                |                       |                |
| P.O.NO.:   |                |                       |                |
| LOT NO. :  | <b>825723</b>  | <b>0603SAF750JT5E</b> |                |
|  |                |                       |                |

Remark : **For 0603** ± 1 % : Label is 75E, value is 75Ω, marking is 85X

**Thick Film Chip Resistors (Terminal Lead Free)**

**7. Performance specification :**

| Characteristics                  | Limits   | Test Methods<br>( JIS C 5201-1 )  |
|----------------------------------|--|---|
| *Insulation resistance           | 1,000 MΩ or more   | Apply 500V DC between protective coating and termination for 1 min, then measure (Sub-clause 4.6)   |
| *Dielectric withstanding voltage | No evidence of flashover mechanical damage, arcing or insulation break down  | Apply 100V(0402) 300V(0603) & 500V (0805,1206,1210,2010,2512) AC between protective coating and termination for 1 minute (Sub-clause 4.7)   |
| Temperature coefficient          | 1Ω-10Ω : ± 400 PPM/°C<br>11Ω-100Ω : ± 200 PPM/°C<br>>100Ω : ± 100 PPM/°C   | Natural resistance change per temp. degree centigrade.<br>$\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (PPM/°C)}$ R1: Resistance value at room temperature (t1)<br>R2: Resistance value at room temp. plus 100 °C (t2)<br>(Sub-clause 4.8)  |
| Short time overload              | Resistance change rate is<br>± 5% (2.0% + 0.1 Ω) Max.<br>± 1% (1.0% + 0.1 Ω) Max.                                  | Permanent resistance change after the application of a potential of 2.5 times RCWW for 5 seconds<br>(Sub-clause 4.13)   |
| *Solderability                   | 95 % coverage Min.   | Test temperature of solder : 245 ± 3°C<br>Dipping them solder : 2-3 seconds<br>(Sub-clause 4.17)  |
| Soldering temp. reference        | Electrical characteristics shall be satisfied. Without distinct deformation in appearance.<br>(95 % coverage Min.) | <p><u>Wave soldering condition:</u> (2 cycles Max.)</p> <p>Pre-heat : 100 ~ 120 °C, 30 ± 5 sec.<br/>                     Suggestion solder temp.: 235 ~ 255 °C, 10 sec. (Max.)<br/>                     Peak temp.: 260 °C</p> <p><u>Reflow soldering condition:</u> (2 cycles Max.)</p> <p>Pre-heat : 150 ~ 180 °C, 90 ~ 120 sec.<br/>                     Suggestion solder temp.: 235 ~ 255 °C, 20 ~ 40 sec.<br/>                     Peak temp.: 260 °C</p>  <p><u>Hand soldering condition:</u></p> <p>The soldering iron tip temperature should be less than 300°C and maximum contract time should be 5 sec.</p> |

**Thick Film Chip Resistors (Terminal Lead Free)**

7. Performance specification :

| Characteristics       | Limits  | Test Methods<br>( JIS C 5201-1 )   |  |             |
|-----------------------|---|--|--|-------------|
| Soldering Heat        | Resistance change rate is:<br>$\pm(1\%+0.05\Omega)$ Max.  | Dip the resistor into a solder bath having a temperature of $260^{\circ}\text{C}\pm 3^{\circ}\text{C}$ and hold it for $10\pm 1$ seconds.<br>(Sub-clause 4.18)   |  |             |
| Temperature cycling   | Resistance change rate is<br>$\pm 5\% (1.0\% + 0.05 \Omega)$ Max.<br>$\pm 1\% (0.5\% + 0.05 \Omega)$ Max. | Resistance change after continuous 5 cycles for duty cycle specified below :   |  |             |
|                       |   | <b>Step</b>  | <b>Temperature</b>                           | <b>Time</b> |
|                       |   | 1  | $-55^{\circ}\text{C} \pm 3^{\circ}\text{C}$  | 30 mins     |
|                       |   | 2  | Room temp.                                   | 10~15 mins  |
|                       |   | 3  | $+155^{\circ}\text{C} \pm 2^{\circ}\text{C}$ | 30 mins     |
|                       |   | 4  | Room temp.                                   | 10~15 mins  |
|                       |   | (Sub-clause 4.19)  |  |             |
| Load life in humidity | Resistance change rate is<br>$\pm 5\% (3.0\% + 0.1 \Omega)$ Max.<br>$\pm 1\% (1.0\% + 0.1 \Omega)$ Max.   | Resistance change after 1,000 hours (1.5 hours "on", 0.5 hour "off" ) at RCWV in a humidity chamber controlled at $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and 90 to 95 % relative humidity<br>(Sub-clause 4.24.2.1) |  |             |
| Load Life             | Resistance change rate is<br>$\pm 5\% (3.0\% + 0.1 \Omega)$ Max.<br>$\pm 1\% (1.0\% + 0.1 \Omega)$ Max.   | Permanent resistance change after 1,000 hours operating at RCWV, with duty cycle of (1.5 hours"on", 0.5 hour"off") at $70^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ambient<br>(Sub-clause 4.25.1)                        |  |             |
| Terminal bending      | Resistance change rate is<br>$\pm (1.0\% + 0.05 \Omega)$ Max.   | Twist of Test Board :<br>Y/X = 5/90 mm for 10 seconds<br>(Sub-clause 4.33)   |  |             |

The resistors of 0Ω only can do the characteristic noted of \*

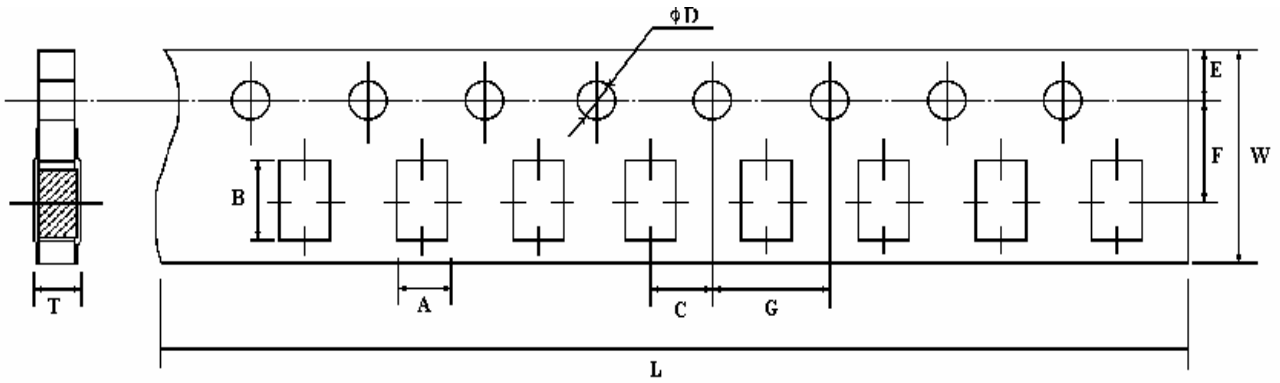


**Thick Film Chip Resistors (Terminal Lead Free)**

8. Packing specification :

\* Taping Dimension (mm)

**A. Paper taping**

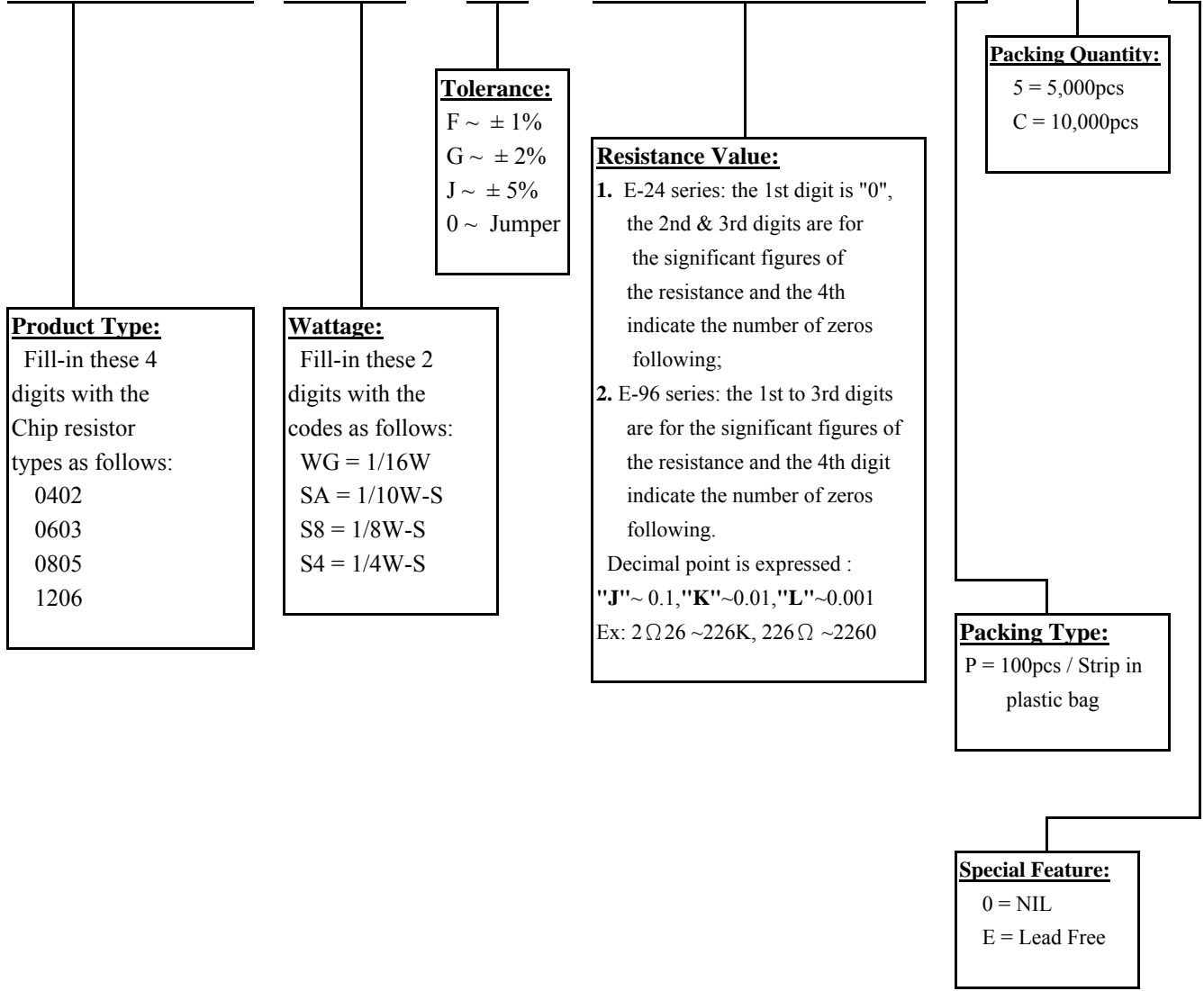
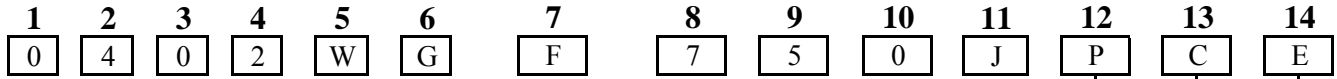


| Type     | $A \pm 0.2$ | $B \pm 0.2$ | $C \pm 0.05$ | $\phi D +0.1$<br>- 0 | $E \pm 0.1$ | $F \pm 0.05$ | $G \pm 0.1$ | $W \pm 0.2$ | $T \pm 0.1$ | $L \pm 1$<br>(100pcs) |
|----------|-------------|-------------|--------------|----------------------|-------------|--------------|-------------|-------------|-------------|-----------------------|
| RMC 0402 | 0.65        | 1.15        | 2.0          | 1.5                  | 1.75        | 3.5          | 4.0         | 8.0         | 0.45        | 200                   |
| RMC 0603 | 1.10        | 1.90        | 2.0          | 1.5                  | 1.75        | 3.5          | 4.0         | 8.0         | 0.67        | 400                   |
| RMC 0805 | 1.65        | 2.40        | 2.0          | 1.5                  | 1.75        | 3.5          | 4.0         | 8.0         | 0.81        | 400                   |
| RMC 1206 | 2.00        | 3.60        | 2.0          | 1.5                  | 1.75        | 3.5          | 4.0         | 8.0         | 0.81        | 400                   |

## Part Number System

### Explanation of Part Number System

#### Thick Film Chip Resistors (Terminal Lead Free)



Sample :

|             |        |        |     |             |   |                |
|-------------|--------|--------|-----|-------------|---|----------------|
| RMC 1/16W   | (0402) | +/- 1% | 75Ω | T/R--10,000 | → | 0402WGF750JPCE |
| RMC 1/10W-S | (0603) | +/- 1% | 75Ω | T/R--5,000  | → | 0603SAF750JP5E |
| RMC 1/8W-S  | (0805) | +/- 1% | 75Ω | T/R--5,000  | → | 0805S8F750JP5E |
| RMC 1/4W-S  | (1206) | +/- 1% | 75Ω | T/R--5,000  | → | 1206S4F750JP5E |

## **Thick Film Chip Resistors (Terminal Lead Free)**

### **Environment Related Substance**

This product complies to EU RoHS directive, EU PAHs directive, EU PFOS directive and Halogen free.

Ozone layer depleting substances.

Ozone depleting substances are not used in our manufacturing process of this product.

This product is not manufactured using Chloro fluorocarbons (CFCs), Hydrochlorofluorocarbons (HCFCs), Hydrobromofluorocarbons (HBFCs) or other ozone depleting substances in any phase of the manufacturing process.

### **Storage Condition**

The performance of these products, including the solderability, is guaranteed for a year from the date of arrival at your company, provided that they remain packed as they were when delivered and stored at a temperature of  $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$  and a relative humidity of  $60\%\text{RH} \pm 10\%\text{RH}$

Even within the above guarantee periods, do not store these products in the following conditions. Otherwise, their electrical performance and/or solderability may be deteriorated, and the packaging materials (e.g. taping materials) may be deformed or deteriorated, resulting in mounting failures.

1. In salty air or in air with a high concentration of corrosive gas, such as  $\text{Cl}_2$ ,  $\text{H}_2\text{S}$ ,  $\text{NH}_3$ ,  $\text{SO}_2$ , or  $\text{NO}_2$
2. In direct sunlight