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UNIROYAL ELECTRONICS INDUSTRY CO., LTD.



ISO14001



ISO/TS16949



244546



245468



REG.-Nr.A759



CQC04001010058



Specification for Approval

Customer : 深圳市嘉立创科技发展有限公司

Product Name : LEAD-FREE CHIP THICK FILM RESISTORS

Part Name : CHIP SERIES $\pm 0.5\%$, $\pm 1\%$, $\pm 2\%$, $\pm 5\%$ & 0Ω

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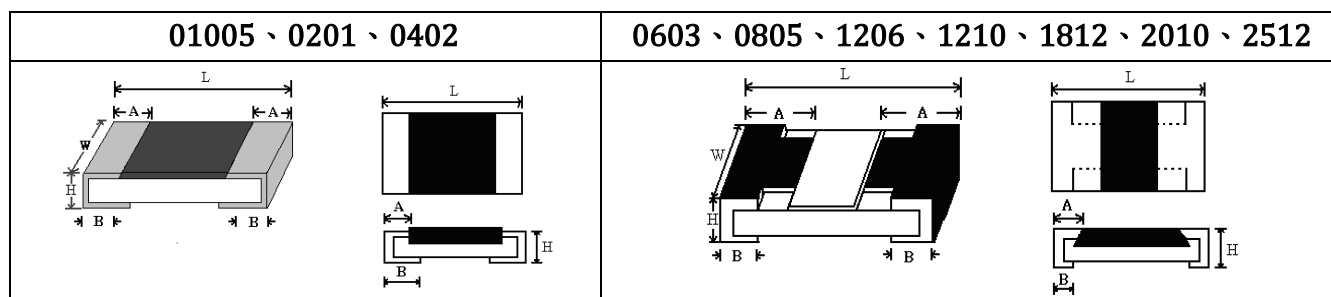
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1.0 Scope:

This file is the specification for **Lead-Free Thick Film Chip Resistors** manufactured by UNIOHM S.

2.0 Ratings & dimension:



2.1 Dimension & resistance range :

| Type | 70°C Power | Dimension(mm) | | | | | Resistance Range | | | |
|-------|------------|---------------|--|-----------|-----------|-----------|------------------|-----------|-----------|------------|
| | | L | W | H | A | B | 0.5% | 1.0% | 2.0% | 5.0% |
| 01005 | 1/32W | 0.40±0.02 | 0.20±0.02 | 0.13±0.02 | 0.10±0.05 | 0.10±0.03 | -- | 10Ω~10MΩ | 10Ω~10MΩ | 1Ω~10MΩ |
| 0201 | 1/20W | 0.60±0.03 | 0.30±0.03 | 0.23±0.03 | 0.10±0.05 | 0.15±0.05 | -- | 1Ω~10MΩ | 1Ω~10MΩ | 1Ω~10MΩ |
| 0402 | 1/16W | 1.00±0.10 | 0.50±0.05 | 0.35±0.05 | 0.20±0.10 | 0.25±0.10 | 1Ω~10MΩ | 0.1Ω~22MΩ | 0.1Ω~22MΩ | 0.1Ω~22MΩ |
| 0603 | 1/10W | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 | 1Ω~10MΩ | 0.1Ω~33MΩ | 0.1Ω~33MΩ | 0.1Ω~100MΩ |
| 0805 | 1/8W | 2.00±0.15 | 1.25 ^{+0.15} _{-0.10} | 0.55±0.10 | 0.40±0.20 | 0.40±0.20 | 1Ω~10MΩ | 0.1Ω~33MΩ | 0.1Ω~33MΩ | 0.1Ω~100MΩ |
| 1206 | 1/4W | 3.10±0.15 | 1.55 ^{+0.15} _{-0.10} | 0.55±0.10 | 0.45±0.20 | 0.45±0.20 | 1Ω~10MΩ | 0.1Ω~33MΩ | 0.1Ω~33MΩ | 0.1Ω~100MΩ |
| 1210 | 1/2W | 3.10±0.10 | 2.60±0.20 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 | 1Ω~10MΩ | 0.1Ω~10MΩ | 0.1Ω~22MΩ | 0.1Ω~100MΩ |
| 1812 | 3/4W | 4.50±0.20 | 3.20±0.20 | 0.55±0.20 | 0.50±0.20 | 0.50±0.20 | 1Ω~10MΩ | 0.1Ω~10MΩ | 0.1Ω~10MΩ | 0.1Ω~10MΩ |
| 2010 | 3/4W | 5.00±0.10 | 2.50±0.20 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 | 1Ω~10MΩ | 0.1Ω~22MΩ | 0.1Ω~22MΩ | 0.1Ω~22MΩ |
| 2512 | 1W | 6.35±0.10 | 3.20±0.20 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 | 1Ω~10MΩ | 0.1Ω~33MΩ | 0.1Ω~33MΩ | 0.1Ω~33MΩ |

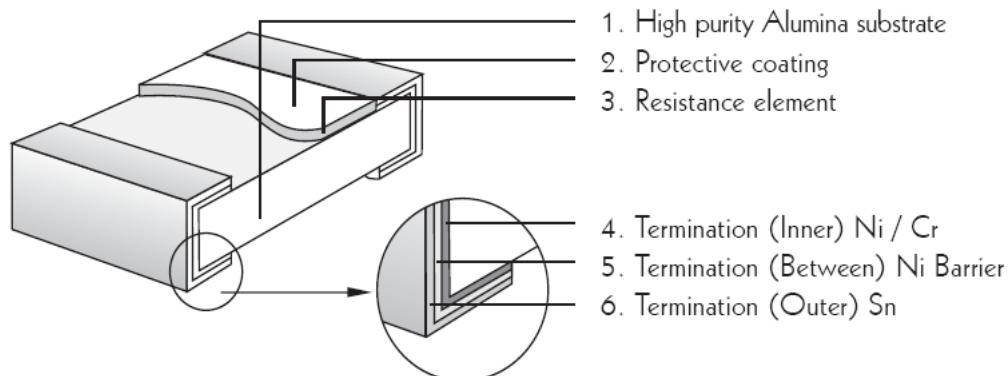
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2.2 Ratings:

| Type | 70°C Power | Max working voltage | Max overload voltage | Dielectric withstanding voltage | Range of Jumper | Rated current of Jumper | Max rated current of Jumper | Operating Temperature |
|-------|------------|---------------------|----------------------|---------------------------------|-----------------|-------------------------|-----------------------------|-----------------------|
| 01005 | 1/32W | 15V | 30V | -- | -- | -- | -- | -55°C~155°C |
| 0201 | 1/20W | 25V | 50V | -- | <50mΩ | 0.5A | 1A | -55°C~155°C |
| 0402 | 1/16W | 50V | 100V | 100V | <50mΩ | 1A | 2A | -55°C~155°C |
| 0603 | 1/10W | 75V | 150V | 300V | <50mΩ | 1A | 2A | -55°C~155°C |
| 0805 | 1/8W | 150V | 300V | 500V | <50mΩ | 2A | 5A | -55°C~155°C |
| 1206 | 1/4W | 200V | 400V | 500V | <50mΩ | 2A | 10A | -55°C~155°C |
| 1210 | 1/2W | 200V | 500V | 500V | <50mΩ | 2A | 10A | -55°C~155°C |
| 1812 | 3/4W | 200V | 500V | 500V | <50mΩ | 2A | 10A | -55°C~155°C |
| 2010 | 3/4W | 200V | 500V | 500V | <50mΩ | 2A | 10A | -55°C~155°C |
| 2512 | 1W | 200V | 500V | 500V | <50mΩ | 2A | 10A | -55°C~155°C |

3.0 Structure:



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4.0 Mark:

4.1 For 01005、0201 and 0402 size: Due to tiny size, there is no marking on the body.

Example:



01005、0201、0402

4.2 For $\pm 2\%$, $\pm 5\%$ tolerance:

4.2.1 There are three codes on body. Two digits ahead are significant figures of value, and 3rd digit is the power of ten.

Example:



33000 \rightarrow 33K Ω

4.2.2 If resistance value is below 10 Ω , the mark would be made up by number and letter "R" which is used as decimal point.

Example:



1R5 \rightarrow 1.5 Ω

4.3 For $\pm 0.5\%$ 、 $\pm 1\%$ tolerance resistors:

There are 4 codes on body. Three codes ahead are significant, and 4th code is power of ten. Letter "R" is used to represent decimal point.



2701 \rightarrow 2.7K Ω



10R0 \rightarrow 10 Ω

4.4 For 0603 size:

4.4.1 If resistance value belongs to E-24 Series Standard Value but not in E-96 Series Standard Values ($\pm 0.5\%$ 、 $\pm 1\%$ tolerance), mark is same as 5% tolerance resistors but with underline.



333 = 33000 \rightarrow 33K Ω



680 \rightarrow 68 Ω

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4.4.2 If resistance value belongs to E-96 Series Standard Values ($\pm 0.5\%$ 、 $\pm 1\%$ tolerance):

Due to tiny size, value will be described with 3 codes such as following power & resistance code.

Power code:

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

Resistance code:

Two code ahead: Resistance code

Third code: Power code

Example: $1.96K\Omega = 196 \times 10^1 \Omega$ ----- 29B

$12.4\Omega = 124 \times 10^{-1} \Omega$ ----- 10X



E-96 STANDARD VALUES AND 0603 RESISTANCE CODE

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

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4.5 For 0805, 1206, 1210, 1812, 2010 and 2512 size:

If resistance value is below 1Ω, 1st code would be letter “R”.



R300→0.3Ω

4.6 0Ω mark:

4.6.1 For 01005, 0201 and 0402 size, there is no marking on body:

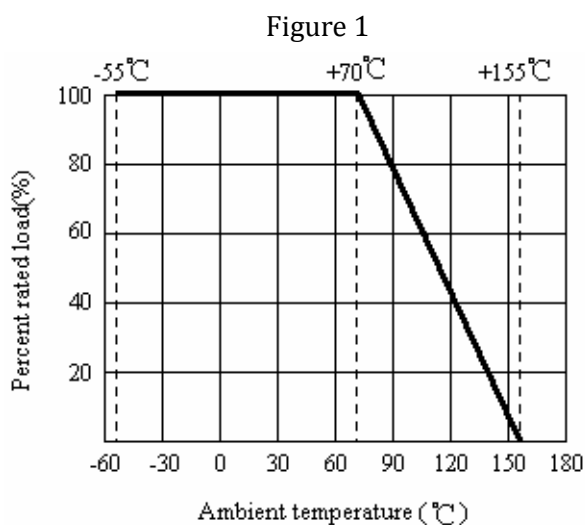


4.6.2 For 0603, 0805, 1206, 1210, 1812, 2010, 2512 size, 0Ω resistors' marking as following:



5.0 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 derate as shown in figure 1



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5.1 Voltage rating:

Resistors should have a direct-current (DC) continuous voltage rating and an alternating-current (AC) continuous voltage rating relates to Power Rating, formula shown as below:

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

RCWV: Rated dc or RMS ac continuous working voltage at commercial-line frequency and waveform (Volt.)

P: Power Rating (Watt.)

R: Nominal Resistance (Ohm)

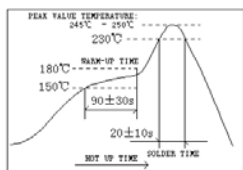
Resistors will be burned out if it overload, such as higher than the maximum value of series' RCWV. And we named 2.5 times RCWV is OVERLOAD Voltage.

6.0 Performance specification:

| Item | Limits | Test Method (JIS-C-5201& JIS-C-5202) |
|-----------------------------------|---|---|
| Temperature Coefficient | 01005: 1Ω≤R≤10Ω: ±600PPM/°C 10Ω<R≤100Ω: ±400PPM/°C >100Ω: ±250PPM/°C | 4.8 Natural resistance changes per temp. Degree centigrade $\frac{R_2 - R_1}{R_1(T_2 - T_1)} * 10^6 (PPM/°C)$ R ₁ : resistance value at room temp. (T ₁) R ₂ : resistance value at room temp. +100°C (T ₂) Test pattern: room temp. (T ₁), room temp. +100°C(T ₂) |
| | 0201: 1Ω≤R≤10Ω: -100~+350PPM/°C >10Ω: ±200PPM/°C | |
| | 0402: 0.1Ω≤R<1Ω: ±800PPM/°C 1Ω≤R≤10Ω: ±400PPM/°C >10Ω: ±100PPM/°C | |
| | 0603: 0.1Ω≤R < 1Ω: ±800PPM/°C 1Ω≤R≤10Ω: ±400PPM/°C 10Ω<R≤100Ω: ±200PPM/°C >10Ω: ±100PPM/°C | |
| | 0805~2512 : 0.1Ω≤R < 1Ω: ±800PPM/°C 1Ω≤R≤10Ω: ±400PPM/°C >10Ω: ±100PPM/°C | |
| Short-time overload | ±0.5%,±1% | ±(1%+0.1Ω) Max. |
| | ±2%,±5% | ±(2%+0.1Ω) Max. |
| | 01005 | ±(2%+0.1Ω) Max |
| | <50mΩ | |
| * Dielectric withstanding voltage | No evidence of flashover mechanical damage, arcing or insulation breaks down. | 4.7 Resistors shall be clamped in the trough of a 90°cmetallic v-block and shall be tested at ac potential respectively specified in the given list of each product type for 60-70 seconds. |

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| Item | Limits | | Test Method (JIS-C-5201& JIS-C-5202) | | | | | | | | | | | | | | | |
|---|---|--------------------|---|--------|-------------|------|---|-----------|--------|---|------------|---------------|---|------------|--------|---|------------|---------------|
| Solderability | 95% coverage Min. | | Wave solder: Test temperature of solder: 245°C±3°C dipping time in solder: 2-3 seconds. | | | | | | | | | | | | | | | |
| | Go up tin rate bigger than half of end pole | | Reflow:  | | | | | | | | | | | | | | | |
| Temperature cycling | ±0.5%,±1% | ±(0.5%+0.05Ω)Max | 4.19Resistance change after continuous five cycles for duty cycle specified below: <table border="1" data-bbox="802 817 1393 985"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-55°C±3°C</td> <td>30 min</td> </tr> <tr> <td>2</td> <td>Room temp.</td> <td>10 --- 15 min</td> </tr> <tr> <td>3</td> <td>+155°C±2°C</td> <td>30 min</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>10 --- 15 min</td> </tr> </tbody> </table> | Step | Temperature | Time | 1 | -55°C±3°C | 30 min | 2 | Room temp. | 10 --- 15 min | 3 | +155°C±2°C | 30 min | 4 | Room temp. | 10 --- 15 min |
| | Step | Temperature | | Time | | | | | | | | | | | | | | |
| | 1 | -55°C±3°C | | 30 min | | | | | | | | | | | | | | |
| 2 | Room temp. | 10 --- 15 min | | | | | | | | | | | | | | | | |
| 3 | +155°C±2°C | 30 min | | | | | | | | | | | | | | | | |
| 4 | Room temp. | 10 --- 15 min | | | | | | | | | | | | | | | | |
| ±2%,±5% | ±(1.0%+0.05Ω) Max | | | | | | | | | | | | | | | | | |
| 01005 | ±(1%+0.05Ω) Max | | | | | | | | | | | | | | | | | |
| Soldering heat | Resistance change rate must be in ±(1%+0.05Ω) | | 4.18 Dip the resistor into a solder bath having a temperature of 260°C±5°C and hold it for 10±1 seconds. | | | | | | | | | | | | | | | |
| Terminal bending | ±(1%+0.05Ω) Max | | 4.33 Twist of test board: Y/X = 3/90 mm for 60Seconds | | | | | | | | | | | | | | | |
| * Insulation resistance | 1,000MΩ or more | | 4.6 the measuring voltage shall be ,measured with a direct voltage of (100±15)V or a voltage equal to the dielectric withstanding voltage., and apply for 1min | | | | | | | | | | | | | | | |
| Humidity (steady state) | ±0.5%,±1% | ±(0.5%+0.1Ω) Max. | 4.24Temporary resistance change after 240 hours exposure in a humidity test chamber controlled at 40±2°C and 90-95% relative humidity, | | | | | | | | | | | | | | | |
| | ±2%,±5% | ±(3.0%+0.1Ω) Max. | | | | | | | | | | | | | | | | |
| | 01005 | ±(3.0%+0.05Ω) Max. | | | | | | | | | | | | | | | | |
| *Load life in humidity | ±0.5%,±1% | ±(1%+0.1Ω)max. | 7.9 Resistance change after 1,000 hours (1.5 hours "ON",0.5 hour "OFF") at RCWV in a humidity chamber controlled at 40°C±2°C and 90 to 95% relative humidity. | | | | | | | | | | | | | | | |
| | ±2%,±5% | ±(3%+0.1Ω)Max. | | | | | | | | | | | | | | | | |
| | 01005 | ±(3.0%+0.05Ω) Max. | | | | | | | | | | | | | | | | |
| | <50mΩ | | Apply to rated current for 0Ω | | | | | | | | | | | | | | | |
| *Load life | ±0.5%,±1% | ±(1%+0.1Ω)Max. | 4.25.1 Permanent resistance change after 1,000 hours operating at RCWV with duty cycle 1.5 hours "ON", 0.5 hour "OFF" at 70°C±2°C ambient. | | | | | | | | | | | | | | | |
| | ±2%,±5% | ±(3%+0.1Ω)Max | | | | | | | | | | | | | | | | |
| | 01005 | ±(3.0%+0.05Ω) Max. | | | | | | | | | | | | | | | | |
| | <50mΩ | | Apply to rated current for 0Ω | | | | | | | | | | | | | | | |
| The resistors of 0Ω only can do the characteristic noted of * | | | | | | | | | | | | | | | | | | |
| The resistors of 01005 & 0201 only can do the characteristic noted of ◎ | | | | | | | | | | | | | | | | | | |

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7.0 Explanation of Part No. System:

The standard Part No. includes 14 codes:

7.1 1st ~4th code: Type name

Example: 01005, 0201, 0402, 0603, 0805, 1206, 1210, 2010, 1812, 2512

7.2 5th~6th code: Power rating.

W=Normal Size; "1"~"G" to denotes "1"~"16" as Hexadecimal:

| | | | | | | | | | | |
|-------------|------|------|-----|-----|-----|-----|------|------|-------|----|
| Wattage | 1/32 | 3/4W | 1/2 | 1/3 | 1/4 | 1/8 | 1/10 | 1/16 | 1/20W | 1 |
| Normal Size | WH | 07 | W2 | W3 | W4 | W8 | WA | WG | WM | 1W |

If power rating is less or equal to 1 watt, 5th code will be the letters W which represent the size required, and 6th code will be a number or a letter code.

Example: WA=1/10W

7.3 7th code: Tolerance.

D=±0.5% F=±1% G=±2% J=±5%

7.4 8th to 11th code: Resistance Value.

7.4.1 For standard values of 5% tolerance:

8th code:, it must be "0".

9th & 10th code: significant figures of the resistance.

11th digit: power of ten.

7.4.2 For standard values of ≤2% tolerance:

8th~10th codes: significant figures of the resistance.

11th digit: power of ten.

7.4.3 The following codes are used to represent power of ten:

0=10⁰ 1=10¹ 2=10² 3=10³ 4=10⁴ 5=10⁵

6=10⁶ J=10⁻¹ K=10⁻² L=10⁻³ M=10⁻⁴

7.5 12th, 13th & 14th codes.

7.5.1 12th code: Packaging Type:

T=Tape/Reel

7.5.2 13th code: Packing Quantity

4=4000pcs 5=5000pcs C=10000pcs D=20000pcs E=15000pcs

7.5.3 14th code: Special features

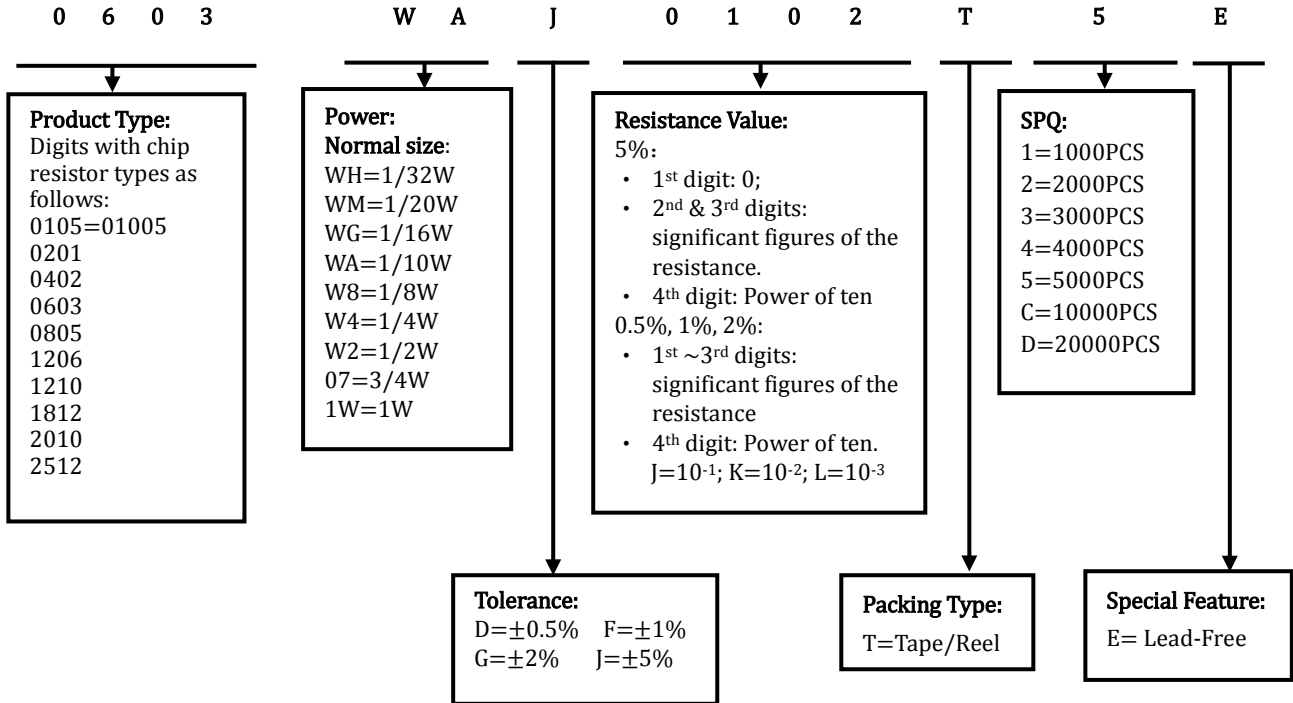
E: Environmental Protection, Lead Free type.

S: Special features, such as: Embossed tape, different marking requirement, etc.

| | | | | | | |
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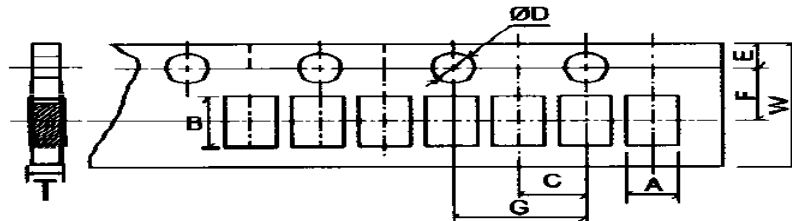


8.0 Order procedure: (Example:0603 1/10W $\pm 5\%$ 1K T/R-5000)



9.0 Packaging:

9.1 Tapping dimension:



Unit: mm

| Type | A | B | C±0.05 | ØD ^{+0.1} _{-0.0} | E±0.1 | F±0.05 | G±0.1 | W±0.2 | T±0.1 |
|-------|-----------|-----------|--------|------------------------------------|-------|--------|-------|-------|-------|
| 01005 | 0.24±0.05 | 0.45±0.05 | 2.00 | 1.50 | 1.75 | 3.50 | 4.00 | 8.00 | 0.40 |
| 0201 | 0.40±0.05 | 0.70±0.05 | 2.00 | 1.50 | 1.75 | 3.50 | 4.00 | 8.00 | 0.42 |
| 0402 | 0.65±0.20 | 1.15±0.20 | 2.00 | 1.50 | 1.75 | 3.50 | 4.00 | 8.00 | 0.45 |

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244546



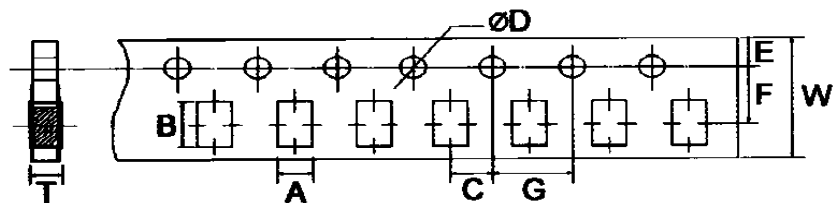
245468



REG.-Nr.A759

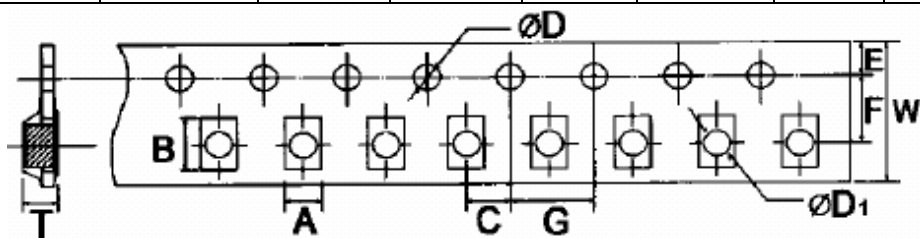


CQC04001010058



Unit: mm

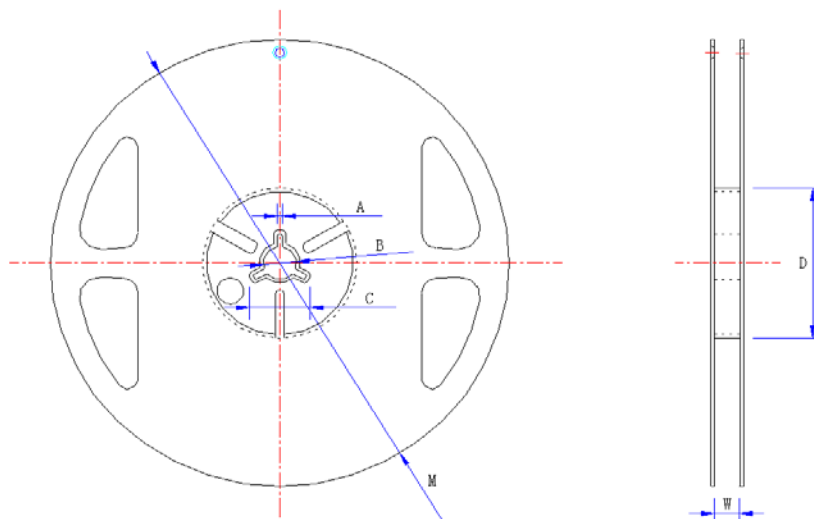
| Type | A±0.2 | B±0.2 | C±0.05 | $\varnothing D_{-0.0}^{+0.1}$ | E±0.1 | F±0.05 | G±0.1 | W±0.2 | T±0.1 |
|------|-------|-------|--------|-------------------------------|-------|--------|-------|-------|-------|
| 0603 | 1.10 | 1.90 | 2.00 | 1.50 | 1.75 | 3.50 | 4.00 | 8.00 | 0.67 |
| 0805 | 1.65 | 2.40 | 2.00 | 1.50 | 1.75 | 3.50 | 4.00 | 8.00 | 0.81 |
| 1206 | 2.00 | 3.60 | 2.00 | 1.50 | 1.75 | 3.50 | 4.00 | 8.00 | 0.81 |
| 1210 | 2.80 | 3.50 | 2.00 | 1.50 | 1.75 | 3.50 | 4.00 | 8.00 | 0.75 |
| 2010 | 2.80 | 5.40 | 2.00 | 1.50 | 1.75 | 5.50 | 4.00 | 12.00 | 0.75 |



Unit: mm

| Type | A±0.2 | B±0.2 | C±0.05 | $\varnothing D_{-0.0}^{+0.1}$ | $\varnothing D1_{-0.0}^{+0.25}$ | E±0.1 | F±0.05 | G±0.1 | W±0.2 | T±0.1 |
|------|-------|-------|--------|-------------------------------|---------------------------------|-------|--------|-------|-------|-------|
| 1812 | 3.50 | 4.80 | 2.00 | 1.50 | 1.50 | 1.75 | 5.50 | 4.00 | 12.00 | 1.00 |
| 2512 | 3.50 | 6.70 | 2.00 | 1.50 | 1.50 | 1.75 | 5.50 | 4.00 | 12.00 | 1.00 |

9.2 Dimension:



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Unit: mm

| Type | Taping | Qty/Reel | A±0.5 | B±0.5 | C±0.5 | D±1 | M±2 | W±1 |
|-------|-------------------|-----------|-------|-------|-------|------|-------|------|
| 01005 | Paper | 20,000pcs | 2.0 | 13.0 | 21.0 | 60.0 | 178.0 | 10.0 |
| 0201 | Paper | 10,000pcs | 2.0 | 13.0 | 21.0 | 60.0 | 178.0 | 10.0 |
| 0402 | Paper | 10,000pcs | 2.0 | 13.0 | 21.0 | 60.0 | 178.0 | 10.0 |
| 0603 | Paper | 5,000pcs | 2.0 | 13.0 | 21.0 | 60.0 | 178.0 | 10.0 |
| 0805 | Paper | 5,000pcs | 2.0 | 13.0 | 21.0 | 60.0 | 178.0 | 10.0 |
| 1206 | Paper | 5,000pcs | 2.0 | 13.0 | 21.0 | 60.0 | 178.0 | 10.0 |
| 1210 | Paper | 5,000pcs | 2.0 | 13.0 | 21.0 | 60.0 | 178.0 | 10.0 |
| 2010 | Paper or Embossed | 4,000pcs | 2.0 | 13.0 | 21.0 | 60.0 | 178.0 | 13.8 |
| 1812 | Embossed | 4,000pcs | 2.0 | 13.0 | 21.0 | 60.0 | 178.0 | 13.8 |
| 2512 | Embossed | 4,000pcs | 2.0 | 13.0 | 21.0 | 60.0 | 178.0 | 13.8 |

10.0 Note:

10.1 UNIOHM’ S recommend the storage condition as temperature: 15°C~35°C, humidity: 25%~75%.

Even under storage condition above-mentioned, resistors’ solderability still degrades day by day.

10.2 Store / delivery cartons must be put by correct direction; otherwise product will crack or bent.

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

10.3.1 In high electrostatic

10.3.2 Direct sunshine, rain, snow or condensation

10.3.3 Exposed to sea winds or corrosive gases, including Cl₂, H₂S, NH₃, SO₂, and NO₂.

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