

昆山厚聲電子工業有限公司

UNIROYAL ELECTRONICS INDUSTRY (KUNSHAN) CO., LTD.



ISO14001



ISO/TS16949



244546



245468



REG.-Nr.A759



CQC04001010658

Specification for Approval

Customer : 深圳市嘉立創科技發展有限公司

Product Name : LEAD-FREE HIGH PRECISION THIN FILM CHIP RESISTORS

Part Name : TC SERIES ±0.1%、±0.25%、±0.50%、±1.00%

Part No. : TC*****T*E

88 LongTeng Road, Economic & Technical Development Zone, Kunshan City, Jiangsu, CHINA 215334

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| File Name: TC SERIES $\pm 0.1\%、\pm 0.25\%、\pm 0.50\%、\pm 1\%$ | | Date | 2015.11.26 | Edition No. | 1 |
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| Amendment Record | | | | Signature | |
| Edition | Prescription of amendment | Amend Page | Amend Date | Amended by | Checked by |
| | | | | | |

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1.0 Scope:

This sheet is the statement of the Lead-Free High Precision Thin Film Chip Resistors specification that UNIOHM'S productions can meet.

2.0 Ratings:

| Type | Power rating At 70°C | Resistance Range(Ω) | TCR (PPM/°C) | Resistance Tolerance | Max. Operating voltage | Max. Overloading voltage | Operating Temp. Range |
|------|----------------------|---------------------|--------------|--------------------------------------|------------------------|--------------------------|-----------------------|
| TC02 | 1/16W | 100Ω~2KΩ | ±5 | ±0.10% ±0.25% ±0.50% ±1.00% | 25V | 50V | -55°C~+155°C |
| | | 50Ω~12KΩ | ±10 | | | | |
| | | 10Ω~332KΩ | ±25 | | | | |
| | | 10Ω~332KΩ | ±50 | | | | |
| TC03 | 1/16W | 100Ω~4KΩ | ±5 | ±0.10% ±0.25% ±0.50% ±1.00% | 50V | 100V | -55°C~+155°C |
| | | 50Ω~50KΩ | ±10 | | | | |
| | | 4.7Ω~1MΩ | ±25 | | | | |
| | | 4.7Ω~1MΩ | ±50 | | | | |
| TC05 | 1/10W | 100Ω~10KΩ | ±5 | ±0.10% ±0.25% ±0.50% ±1.00% | 100V | 200V | -55°C~+155°C |
| | | 50Ω~100KΩ | ±10 | | | | |
| | | 4.7Ω~1MΩ | ±25 | | | | |
| | | 4.7Ω~1MΩ | ±50 | | | | |
| TC06 | 1/8W | 100Ω~15KΩ | ±5 | ±0.10% ±0.25% ±0.50% ±1.00% | 150V | 300V | -55°C~+155°C |
| | | 50Ω~200KΩ | ±10 | | | | |
| | | 4.7Ω~1MΩ | ±25 | | | | |
| | | 4.7Ω~1MΩ | ±50 | | | | |
| TC07 | 1/5W | 100Ω~25KΩ | ±5 | ±0.10% ±0.25% ±0.50% ±1.00% | 150V | 300V | -55°C~+155°C |
| | | 50Ω~200KΩ | ±10 | | | | |
| | | 4.7Ω~1MΩ | ±25 | | | | |
| | | 4.7Ω~1MΩ | ±50 | | | | |
| TC10 | 1/4W | 100Ω~25KΩ | ±5 | ±0.10% ±0.25% ±0.50% ±1.00% | 150V | 300V | -55°C~+155°C |
| | | 50Ω~200KΩ | ±10 | | | | |
| | | 4.7Ω~1MΩ | ±25 | | | | |
| | | 4.7Ω~1MΩ | ±50 | | | | |
| TC12 | 1/2W | 100Ω~25KΩ | ±5 | ±0.10% ±0.25% ±0.50% ±1.00% | 150V | 300V | -55°C~+155°C |
| | | 50Ω~200KΩ | ±10 | | | | |
| | | 4.7Ω~1MΩ | ±25 | | | | |
| | | 4.7Ω~1MΩ | ±50 | | | | |

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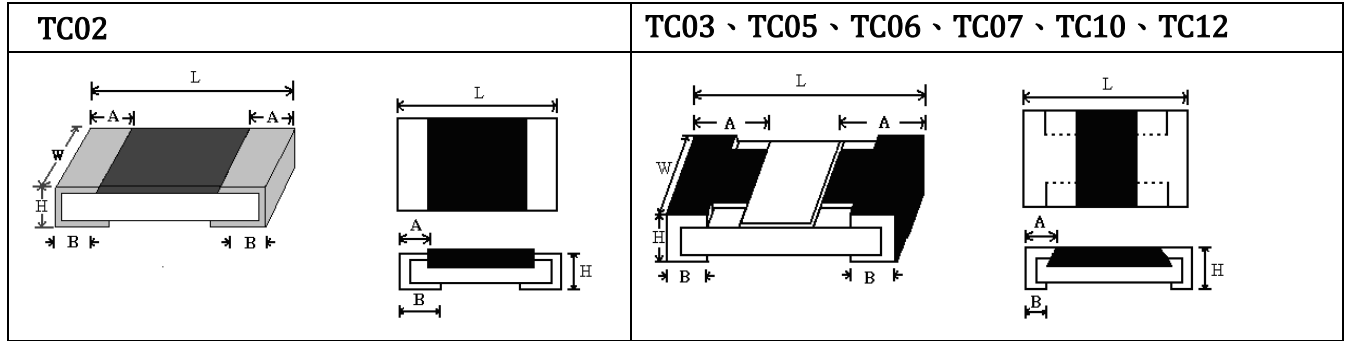
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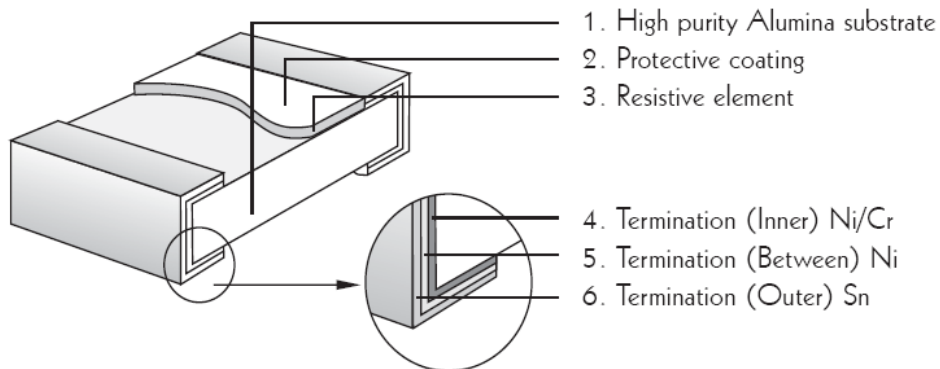
3.0 Dimension:



Dimension: mm

| Type | L | W | H | A | B |
|------|-----------|--|-----------|-----------|-----------|
| TC02 | 1.00±0.10 | 0.50±0.05 | 0.35±0.05 | 0.20±0.10 | 0.25±0.10 |
| TC03 | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 |
| TC05 | 2.00±0.15 | 1.25 ^{+0.15} _{-0.10} | 0.55±0.10 | 0.40±0.20 | 0.40±0.20 |
| TC06 | 3.10±0.15 | 1.55 ^{+0.15} _{-0.10} | 0.55±0.10 | 0.45±0.20 | 0.45±0.20 |
| TC07 | 3.10±0.10 | 2.60±0.20 | 0.55±0.10 | 0.45±0.20 | 0.45±0.20 |
| TC10 | 5.00±0.10 | 2.50±0.20 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 |
| TC12 | 6.35±0.10 | 3.20±0.20 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 |

4.0 Structure:



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5.0 Marking:

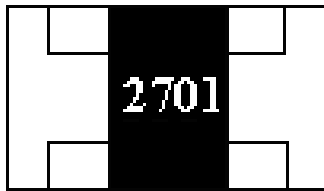
(1) For TC02 size. Due to the very small size of the resistor's body, there is no marking on the body.

Example:

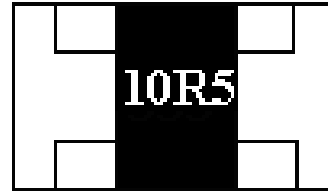


(2) 4 digits, first three digits are significant; the fourth digit is number of zeros. Letter r is decimal point.

Example:



2701 → 2.7KΩ



10R5 → 10.5Ω

(3) Standard E-96 series values of TC03 size. Due to the small size of the resistor's body, 3 digits marking will be used to indicate the accurate resistance value by using the following multiplier & resistance code.

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

First two digits-----Resistance code

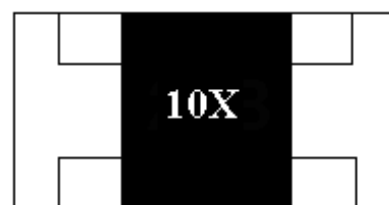
Third digit-----Multiplier code

Example:

$$1.96K\Omega = 196 \times 10^1\Omega \text{-----} 29B$$



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



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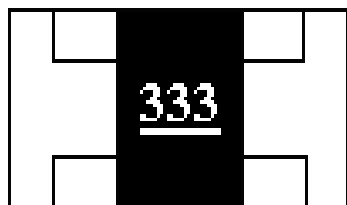
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Standard E-96 values and TC03 resistance code

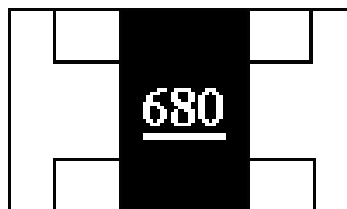
| Ω VALUE | CODE | Ω VALUE | CODE | Ω VALUE | CODE | Ω VALUE | CODE |
|---------|------|---------|------|---------|------|---------|------|
| 100 | 01 | 178 | 25 | 316 | 49 | 562 | 73 |
| 102 | 02 | 182 | 26 | 324 | 50 | 576 | 74 |
| 105 | 03 | 187 | 27 | 332 | 51 | 590 | 75 |
| 107 | 04 | 191 | 28 | 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 |

(4) Standard E-24 and not belong to E-96 series values of TC03 size .The marking is the same as 5% tolerance but marking as underline

Example:



333=33000→33KΩ



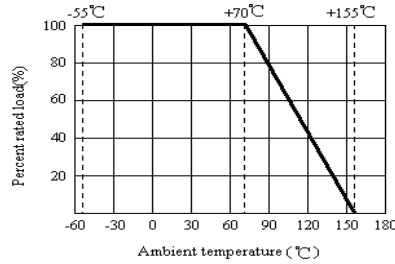
680→68Ω

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6.0 Power rating:

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



6.1 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.

7.0 Performance Specification:

| Characteristic | Limits | Test Method (JIS-C-5201 & JIS-S-5202) |
|-------------------------|-------------------------------|---|
| Temperature Coefficient | Refer to item 2.0 | 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) |
| Short-time overload | ΔR/R: ±0.5% | Permanent resistance change after the application of a potential of 2.5 times RCWV or Max. Overload Voltage whichever less for 5 seconds.. |
| Insulation resistance | ≥1000MΩ | 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 |
| Load life | ΔR/R:±0.2% >7KΩ ΔR/R:±0.5% | 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. |

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| | | |
|------------------|-------------------------|--|
| Humidity | $\Delta R/R: \pm 0.3\%$ | Temporary resistance change after 240 hours exposure in a humidity test chamber controlled at $40 \pm 2^\circ\text{C}$ and 90-95% relative humidity, |
| Terminal bending | $\Delta R/R: \pm 0.2\%$ | 4.33 Twist of test board: Y/X = 3/90 mm for 60Seconds |
| Solderability | 95% coverage min. | Wave solder: Test temperature of solder: $245^\circ\text{C} \pm 3^\circ\text{C}$ dipping time in solder: 2-3 seconds. |
| Soldering heat | $\Delta R/R: \pm 0.2\%$ | 4.18 Dip the resistor into a solder bath having a temperature of $260^\circ\text{C} \pm 5^\circ\text{C}$ and hold it for 10 ± 1 seconds. |

8.0 Explanation of Part No. System:

The standard Part No. includes 14 digits with the following explanation:

8.1 This is to indicate the Lead-Free High Precision Thin Film Chip Resistors

Example:

TC02, TC03, TC05, TC06, TC07, TC10, TC12

8.2 5th~6th digits:

8.2.1 This is to indicate the wattage or power rating. To dieting the size and the numbers,

The following codes are used; and please refer to the following chart for detail:

W=Normal Size; S=Small Size; U=Extra Small Size; "1"~"G" to denotes "1"~"16" as Hexadecimal:

1/16W~1W:

| | | | | | | | |
|-------------|-----|------|-----|-----|-----|------|------|
| Wattage | 1/2 | 1/3 | 1/4 | 1/5 | 1/8 | 1/10 | 1/16 |
| Normal Size | W2 | 1/3W | W4 | W5 | W8 | WA | WG |

8.2.2 For Thin Film Chip Resistors, these 2 digits will be used to indicated the requested Temperature Coefficient.

(1) 05=5PPM (2) 10=10PPM (3) 15=15PPM (4) 25=25PPM (5) 50=50PPM

8.3 The 7th digit is to denote the Resistance Tolerance. The following letter code is to be used for indicating the standard Resistance Tolerance.

B= $\pm 0.10\%$ C= $\pm 0.25\%$ D= $\pm 0.50\%$ F= $\pm 1.00\%$

8.4 The 8th to 11th digits is to denote the Resistance Value.

8.4.1 For the standard resistance values of TC series, the 8th digit to the 10th digits is to denote the significant figures of the resistance and the 11th digit is the zeros following.

8.4.2 The following number s and the letter codes is to be used to indicate the number of zeros in the 11th digit:

0= 10^0 1= 10^1 2= 10^2 3= 10^3 4= 10^4 5= 10^5 6= 10^6 J= 10^{-1} K= 10^{-2} L= 10^{-3} M= 10^{-4}

| | | | | | | |
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8.5 The 12th, 13th & 14th digits.

The 12th digit is to denote the Packaging Type with the following codes:

C=Bulk in (Chip Product) T=Tape/Reel

8.5.1 The 13th digit is normally to indicate the Packing Quantity of Tape/Box & Tape/Reel packaging types.

The following letter code and number is to be used for some packing quantities:

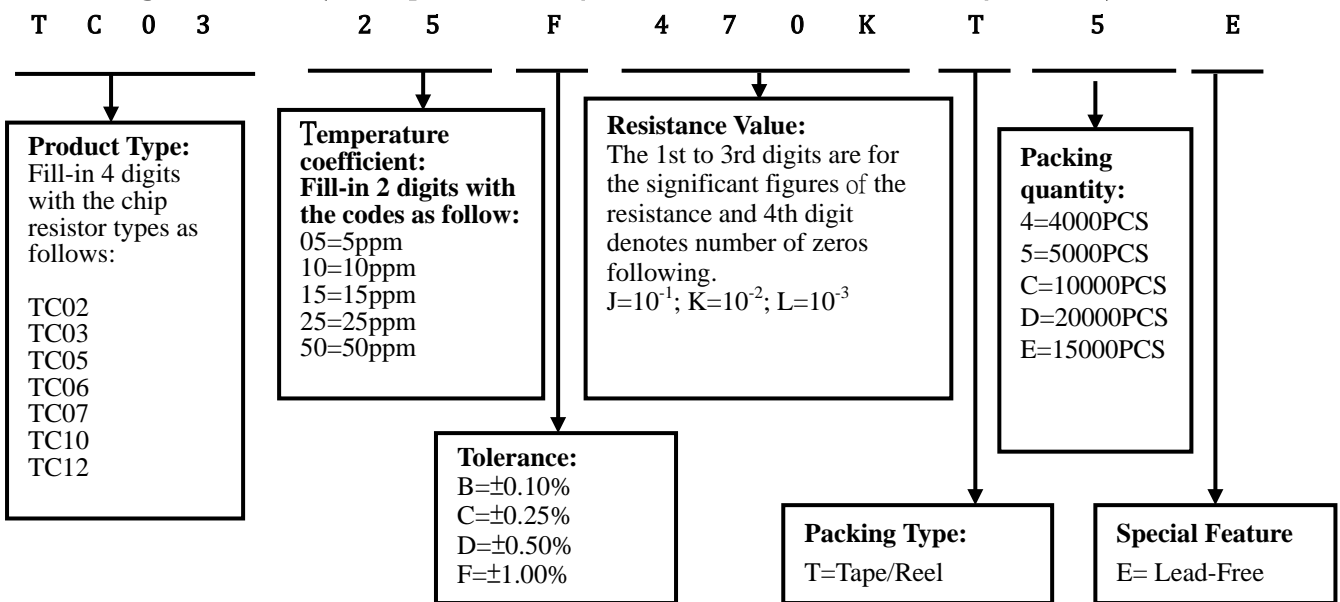
4=4000pcs 5=5000pcs C=10000pcs D=20000pcs E=15000pcs

Chip Product: BD=B/B-20000pcs TC=T/R-10000pcs

8.5.2 For some items, the 14th digit alone can use to denote special features of additional information with the following codes:

E=For “Environmental Protection Lead Free type”

9.0 Ordering Procedure: (Example: TC03 1/16W ±1% 25PPM 4.7Ω T/R-5000)



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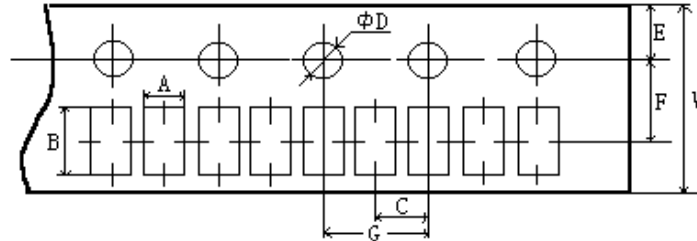
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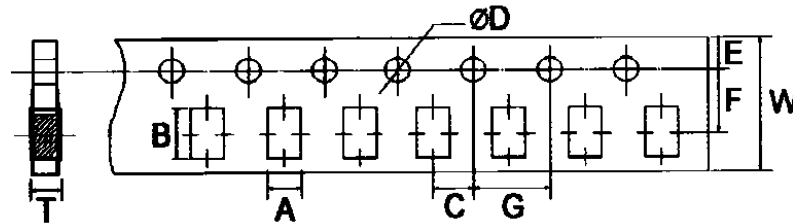
10.0 Packaging:

10.1 Tapping Dimension:



Unit mm

| Type | A ± 0.2 | B ± 0.2 | C ± 0.05 | φD + 0.1 | E ± 0.1 | F ± 0.05 | G ± 0.1 | W ± 0.2 |
|------|---------|---------|----------|----------|---------|----------|---------|---------|
| TC02 | 0.65 | 1.15 | 2.0 | 1.5 | 1.75 | 3.5 | 4.0 | 8.0 |



Unit mm

| TYPE | A ± 0.2 | B ± 0.2 | C ± 0.05 | φD + 0.1 | E ± 0.1 | F ± 0.05 | G ± 0.1 | W ± 0.2 | T ± 0.1 |
|------|---------|---------|----------|----------|---------|----------|---------|---------|---------|
| TC03 | 1.10 | 1.90 | 2.0 | 1.5 | 1.75 | 3.5 | 4.0 | 8.0 | 0.67 |
| TC05 | 1.65 | 2.40 | 2.0 | 1.5 | 1.75 | 3.5 | 4.0 | 8.0 | 0.81 |
| TC06 | 2.00 | 3.60 | 2.0 | 1.5 | 1.75 | 3.5 | 4.0 | 8.0 | 0.81 |
| TC07 | 2.80 | 3.50 | 2.0 | 1.5 | 1.75 | 3.5 | 4.0 | 8.0 | 0.75 |

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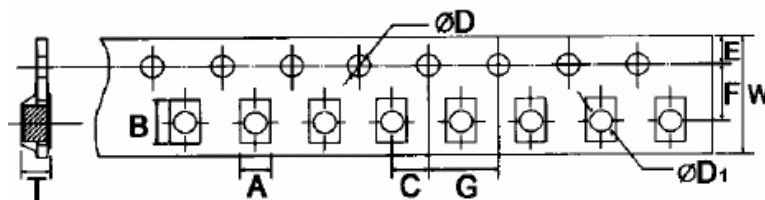
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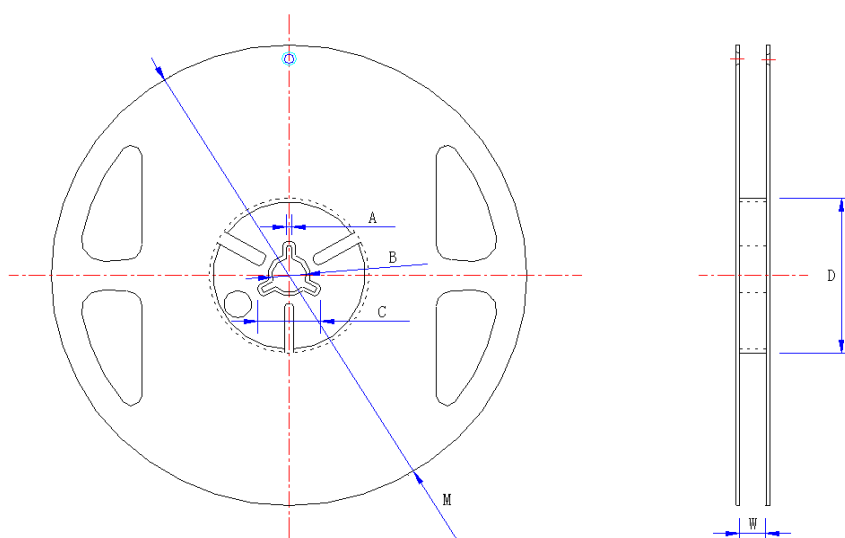
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Unit mm

| Type | A±0.2 | B±0.2 | C±0.05 | φD±0.1 | φD1±0.25 | E±0.1 | F±0.05 | G±0.1 | W±0.2 | T±0.1 |
|------|-------|-------|--------|--------|----------|-------|--------|-------|-------|-------|
| TC10 | 2.9 | 5.6 | 2.0 | 1.5 | 1.5 | 1.75 | 5.5 | 4.0 | 12 | 1.0 |
| TC12 | 3.5 | 6.7 | 2.0 | 1.5 | 1.5 | 1.75 | 5.5 | 4.0 | 12 | 1.0 |

10.2 Dimension:



Unit mm

| Type | Taping | Size | A±0.5 | B±0.5 | C±0.5 | D±1 | M±2 | W±1 |
|------|-------------------|----------------|-------|-------|-------|------|-----|------|
| TC02 | Paper | 10,000pcs Reel | 2.0 | 13.0 | 21.0 | 60.0 | 178 | 10 |
| TC03 | Paper | 5,000pcs Reel | 2.0 | 13.0 | 21.0 | 60.0 | 178 | 10 |
| TC05 | Paper | 5,000pcs Reel | 2.0 | 13.0 | 21.0 | 60.0 | 178 | 10 |
| TC06 | Paper | 5,000pcs Reel | 2.0 | 13.0 | 21.0 | 60.0 | 178 | 10 |
| TC07 | Paper | 5,000pcs Reel | 2.0 | 13.0 | 21.0 | 60.0 | 178 | 10 |
| TC10 | Paper or Embossed | 4,000pcs Reel | 2.0 | 13.0 | 21.0 | 60.0 | 178 | 13.8 |
| TC12 | Embossed | 4,000pcs Reel | 2.0 | 13.0 | 21.0 | 60.0 | 178 | 13.8 |

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11.0 Precaution for storage/Transportation:

11.1. We recommend the storage condition temperature: 15°C~35°C, humidity: 25%~75%.

(Put condition for individual product)

Under storage condition UNIOHM recommended, solderability of products will keep over 1 year. If not, it will be degraded.

11.2. Store / Delivery cartons in the correct direction, which indicated on carton's symbol.

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

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

- a. Storage in high Electrostatic
- b. Storage in direct sunshine, rain and snow or condensation
- c. Where the products are exposed to sea wind or corrosive gas, including Cl₂, H₂S, NH₃, SO₂, NO₂.

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