

信昌電子陶瓷股份有限公司

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## SPECIFICATION FOR APPROVAL

DATE :

CUSTOMER :

PART NAME :

Thick Film General Purpose Chip Resistor

CUSTOMER'S DWG. NO. :

CUSTOMER'S PART NO. :

PDC PART NO. :

**FCF SERIES APPROVED**

DESCRIPTION. :

| RESULT               | ACTION | CUSTOMER'S<br>SIGNATURE | NOTE |
|----------------------|--------|-------------------------|------|
|                      | "V"    |                         |      |
| FULL APPROVED        |        |                         |      |
| CONDITIONAL APPROVED |        |                         |      |
| REJECTED             |        |                         |      |

| OUR ACTION  | SIGNATURE   |
|-------------|-------------|
| PREPARED By | Jenny Tseng |
| CHECKED By  | Tony Chou   |
| APPROVED By | Byron Tsai  |

CUSTOMER SIGNATURE FOR ACCEPTANCE

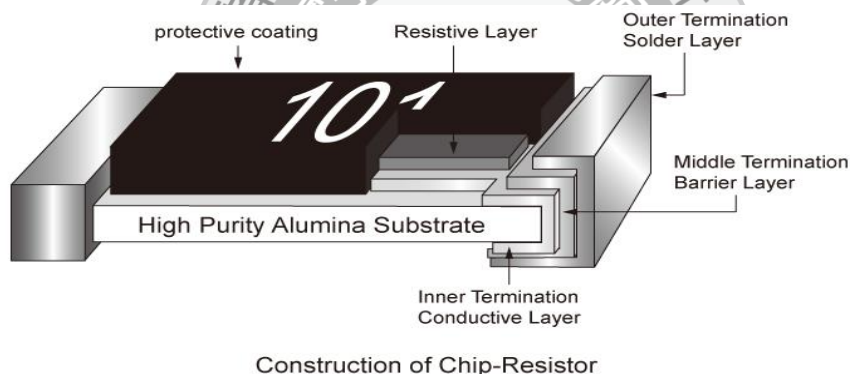
## Features

- Suitable for lead free soldering.
- Compatible with wave and reflow soldering
- RoHS compliant & Halogen Free

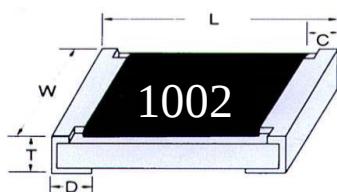
## Applications

- Portable Devices
- Consumer Electronics
- Measurement instrument
- Computer / Motherboard

## Configuration



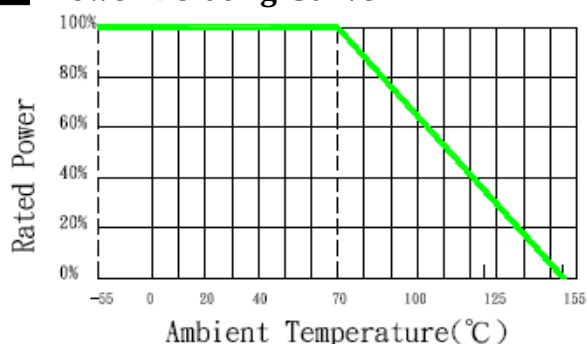
## Dimensions



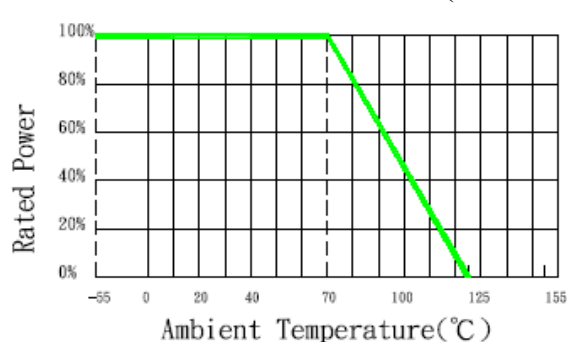
| Size  | L         | W         | C         | D         | T         |
|-------|-----------|-----------|-----------|-----------|-----------|
| 01005 | 0.40±0.02 | 0.20±0.02 | 0.08±0.03 | 0.10±0.03 | 0.13±0.02 |
| 0201  | 0.60±0.03 | 0.30±0.03 | 0.10±0.05 | 0.15±0.05 | 0.23±0.03 |
| 0402  | 1.00±0.05 | 0.50±0.05 | 0.20±0.10 | 0.25±0.10 | 0.35±0.05 |
| 0603  | 1.60±0.10 | 0.80±0.10 | 0.30±0.20 | 0.30±0.20 | 0.45±0.10 |
| 0805  | 2.00±0.10 | 1.25±0.10 | 0.40±0.20 | 0.40±0.20 | 0.50±0.10 |
| 1206  | 3.10±0.10 | 1.60±0.10 | 0.50±0.20 | 0.50±0.25 | 0.55±0.10 |
| 1210  | 3.10±0.10 | 2.60±0.15 | 0.50±0.25 | 0.50±0.25 | 0.55±0.10 |
| 2010  | 5.00±0.20 | 2.50±0.20 | 0.60±0.25 | 0.60±0.25 | 0.60±0.10 |
| 2512  | 6.40±0.20 | 3.20±0.20 | 0.60±0.25 | 0.90±0.25 | 0.60±0.15 |

(unit: mm)

## Power Derating Curve



Maximum dissipation in percentage of rated power as a function of the ambient temperature for 0402,0603,0805,1206,1210,2010,2512



Maximum dissipation in percentage of rated power as a function of the ambient temperature for 01005,0201

■ Rating

FCF Series

• LEAD FREE CHIP RESISTORS

| Type  | Size  | Power Rating<br>at 70°C | Max.<br>RCWV | Max. Overload<br>Voltage | Resistance<br>Tolerance<br>(%) | Temperature<br>Coefficient<br>(TCR; ppm/°C) | Resistance Range(Ω) |      | Standard<br>Resistance<br>Values |
|-------|-------|-------------------------|--------------|--------------------------|--------------------------------|---------------------------------------------|---------------------|------|----------------------------------|
|       |       |                         |              |                          |                                |                                             | Min.                | Max. |                                  |
| FCF0A | 01005 | 1/32W                   | 15V          | 30V                      | ±1%(F)                         | ±200                                        | 100                 | 1M   | E-96                             |
|       |       |                         |              |                          |                                | ±300                                        | 10                  | 91   | E-96                             |
|       |       |                         |              |                          |                                | -200 ~ +600                                 | 0 & 4.7             | 9.76 | E-96                             |
|       |       |                         |              |                          | ±5%(J)                         | ±200                                        | 100                 | 1M   | E-24                             |
| FCF01 | 0201  | 1/20W                   | 25V          | 50V                      | ±1%(F)                         | ±200                                        | 10                  | 10M  | E-96                             |
|       |       |                         |              |                          |                                | -200 ~ +600                                 | 1                   | 9.76 | E-96                             |
|       |       |                         |              |                          |                                | ±200                                        | 10                  | 10M  | E-24                             |
|       |       |                         |              |                          | ±5%(J)                         | -200 ~ +600                                 | 0 & 1               | 9.76 | E-24                             |
| FCF02 | 0402  | 1/16W                   | 50V          | 100V                     | ±0.1%(B)                       | ±100                                        | 10                  | 1M   | E-96                             |
|       |       |                         |              |                          | ±0.5%(D)                       | ±100                                        | 10                  | 1M   | E-96                             |
|       |       |                         |              |                          | ±1%(F)                         | ±100                                        | 10.2                | 10M  | E-96                             |
|       |       |                         |              |                          | ±1%(F)                         | -200 ~ +400                                 | 1                   | 10   | E-96                             |
|       |       |                         |              |                          | ±5%(J)                         | ±200                                        | 10.2                | 10M  | E-24                             |
|       |       |                         |              |                          | ±5%(J)                         | -200 ~ +400                                 | 0 & 1               | 10   | E-24                             |
| FCF03 | 0603  | 1/10W                   | 75V          | 100V                     | ±0.1%(B)                       | ±50                                         | 20                  | 510K | E-96                             |
| FCF05 | 0805  | 1/8W                    | 150V         | 300V                     | ±0.25%(C)                      |                                             |                     |      | E-96                             |
|       |       |                         |              |                          | ±0.5%(D)                       |                                             |                     |      | E-96                             |
|       |       |                         |              |                          | ±1%(F)                         |                                             |                     |      | E-96                             |
| FCF06 | 1206  | 1/4W                    | 200V         | 400V                     | ±1%(F)                         | ±100                                        | 10.2                | 10M  | E-96                             |
|       |       |                         |              |                          | ±1%(F)                         | -200 ~ +400                                 | 1                   | 10   | E-96                             |
|       |       |                         |              |                          | ±5%(J)                         | ±200                                        | 10.2                | 10M  | E-24                             |
| FCF12 | 1210  | 1/3W                    | 200V         | 400V                     | ±1%(F)                         | ±100                                        | 10.2                | 10M  | E-96                             |
|       |       |                         |              |                          | ±1%(F)                         | ±200                                        | 1                   | 10   | E-96                             |
|       |       |                         |              |                          | ±5%(J)                         | ±200                                        | 0 & 1               | 10M  | E-24                             |
| FCF20 | 2010  | 3/4W                    | 200V         | 400V                     | ±1%(F)                         | ±200                                        | 1                   | 10   | E-96                             |
| FCF25 | 2512  | 1W                      | 250V         | 500V                     | ±5%(J)                         | ±200                                        | 0 & 1               | 10M  | E-24                             |

※ Resistance 1~10Ω, TCR 100ppm available upon special request.

◎ For size : 0603/0805/1206/2010/2512

※ Resistance "0" means Jumper or 0Ω :

◎ 01005 size maximum resistance  $R_{max} < 50m\Omega$  and rated current  $I_R \leq 0.8A$

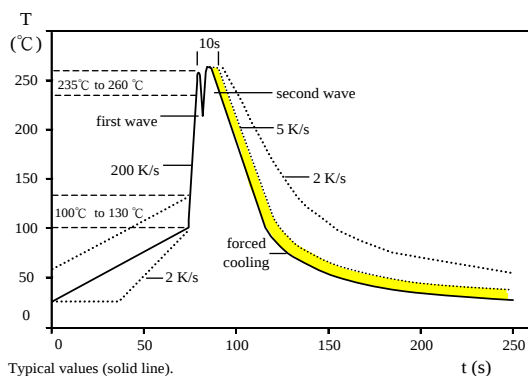
◎ 0201,0402,0603 size maximum resistance  $R_{max} < 50m\Omega$  and rated current  $I_R \leq 1A$

◎ 0805,1206,1210,2010,2512 size maximum resistance  $R_{max} < 50m\Omega$  and rated current  $I_R \leq 2A$

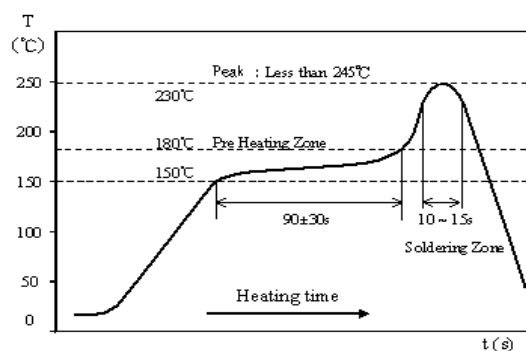
◎ ±1% Jumper or 0Ω is available, all size  $R_{max} < 30m\Omega$ .

◎ TCR parameter is not applicable of jumper.

■ Soldering Temperature Curve



WAVE soldering.



IR Reflow Soldering

## Part Number

| FCF  | 05         | F          | T                       | — | 1002     | —                                                                         |
|------|------------|------------|-------------------------|---|----------|---------------------------------------------------------------------------|
| Type | Size       | Tolerance  | Packing                 |   | R codes  | TCR                                                                       |
| FCF  | 0A : 01005 | B : ± 0.1% | S : Paper tape 1Kpcs    |   | ±0.1%(B) | Null : TCR as rating table                                                |
|      | 01 : 0201  | C : ±0.25% | T : Paper tape 5Kpcs    |   | to       |                                                                           |
|      | 02 : 0402  | D : ± 0.5% | V : Paper tape 10Kpcs   |   | ±1%(F)   | P : 50ppm<br>Applicable for ±1%(F)<br>0603/0805/1206<br>20Ω~510KΩ         |
|      | 03 : 0603  | F : ± 1%   | U : Paper tape 15Kpcs   |   | 4 codes  |                                                                           |
|      | 05 : 0805  | G : ± 2%   | W : Paper tape 20Kpcs   |   |          | N : 100ppm<br>Applicable for ±1%(F)<br>0603/0805/1206/2010/2512<br>1Ω~10Ω |
|      | 06 : 1206  | J : ± 5%   | Z : Paper tape 70Kpcs   |   | ±2%(G)   |                                                                           |
|      | 12 : 1210  |            | P : Plastic tape 4Kpcs  |   | to       |                                                                           |
|      | 20 : 2010  |            | X : Plastic tape 8Kpcs  |   | ±5%(J)   |                                                                           |
|      | 25 : 2512  |            | Y : Plastic tape 16Kpcs |   | 3 codes  |                                                                           |

example:

FCF05FT-1002P

## SPECIFICATION

### Resistance Marking

#### E - 24 SERIES



3 digits for 0603/0805/1206/1210, ±5%, E24

examples: 473  $47 \times 10^3 = 47K\Omega$   
1R5  $1.5 \times 10^0 = 1.5\Omega$



4 digits for 2010/2512, ±5%, E24

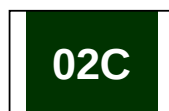
examples: 4702  $470 \times 10^2 = 47K\Omega$   
1R50  $1.5 \times 10^0 = 1.5\Omega$

#### E - 96 SERIES



4 digits for ±1%, E24

examples: 1542  $154 \times 10^2 = 15K4\Omega$   
22R1  $22.1 \times 10^0 = 22.1\Omega$



3 digits for 0603, ±1%, E96

examples: 02C (Table 1)

$102 \times 10^2 = 10K2\Omega$

※ No Marking of 0402 / 0201 / 01005

## SPECIFICATION

### 0603 1% Marking Table (Table 1)

| Code | E48 | E96 | Code | E48 | E96 | Code | E48 | E96 | Code | E48 | E96 |
|------|-----|-----|------|-----|-----|------|-----|-----|------|-----|-----|
| 01   | 100 | 100 | 25   | 178 | 178 | 49   | 316 | 316 | 73   | 562 | 562 |
| 02   |     | 102 | 26   |     | 182 | 50   |     | 324 | 74   |     | 576 |
| 03   | 105 | 105 | 27   | 187 | 187 | 51   | 332 | 332 | 75   | 590 | 590 |
| 04   |     | 107 | 28   |     | 191 | 52   |     | 340 | 76   |     | 604 |
| 05   | 110 | 110 | 29   | 196 | 196 | 53   | 348 | 348 | 77   | 619 | 619 |
| 06   |     | 113 | 30   |     | 200 | 54   |     | 357 | 78   |     | 634 |
| 07   | 115 | 115 | 31   | 205 | 205 | 55   | 365 | 365 | 79   | 649 | 649 |
| 08   |     | 118 | 32   |     | 210 | 56   |     | 374 | 80   |     | 665 |
| 09   | 121 | 121 | 33   | 215 | 215 | 57   | 383 | 383 | 81   | 681 | 681 |
| 10   |     | 124 | 34   |     | 221 | 58   |     | 392 | 82   |     | 698 |
| 11   | 127 | 127 | 35   | 226 | 226 | 59   | 402 | 402 | 83   | 715 | 715 |
| 12   |     | 130 | 36   |     | 232 | 60   |     | 412 | 84   |     | 732 |
| 13   | 133 | 133 | 37   | 237 | 237 | 61   | 422 | 422 | 85   | 750 | 750 |
| 14   |     | 137 | 38   |     | 243 | 62   |     | 432 | 86   |     | 768 |
| 15   | 140 | 140 | 39   | 249 | 249 | 63   | 442 | 442 | 87   | 787 | 787 |
| 16   |     | 143 | 40   |     | 255 | 64   |     | 453 | 88   |     | 806 |
| 17   | 147 | 147 | 41   | 261 | 261 | 65   | 464 | 464 | 89   | 825 | 825 |
| 18   |     | 150 | 42   |     | 267 | 66   |     | 475 | 90   |     | 845 |
| 19   | 154 | 154 | 43   | 274 | 274 | 67   | 487 | 487 | 91   | 866 | 866 |
| 20   |     | 158 | 44   |     | 280 | 68   |     | 499 | 92   |     | 887 |
| 21   | 162 | 162 | 45   | 287 | 287 | 69   | 511 | 511 | 93   | 909 | 909 |
| 22   |     | 165 | 46   |     | 294 | 70   |     | 523 | 94   |     | 931 |
| 23   | 169 | 169 | 47   | 301 | 301 | 71   | 536 | 536 | 95   | 953 | 953 |
| 24   |     | 174 | 48   |     | 309 | 72   |     | 549 | 96   |     | 976 |

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

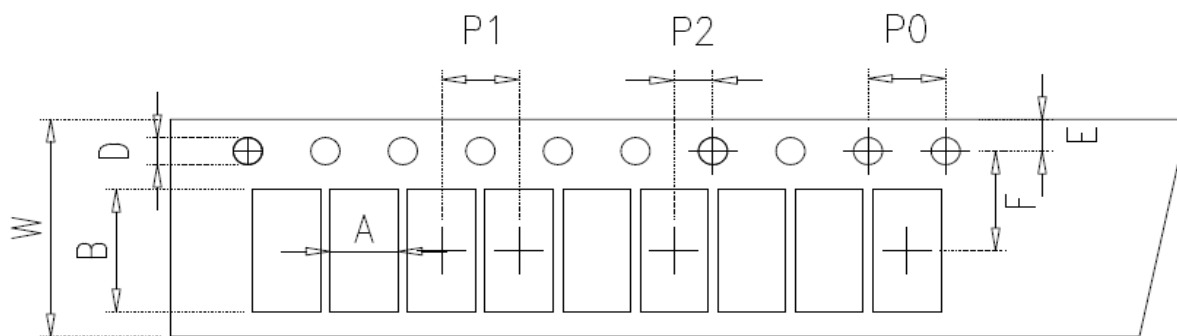
### Standard resistance value

| E3  | 10  |     |     |     | 22  |     |     |     | 47  |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| E6  | 10  |     | 15  |     | 22  |     | 33  |     | 47  |     | 68  |     |     |     |     |     |
| E12 | 10  | 12  | 15  | 18  | 22  | 27  | 33  | 39  | 47  | 56  | 68  | 82  |     |     |     |     |
| E24 | 10  | 11  | 12  | 13  | 15  | 16  | 18  | 20  | 22  | 24  | 27  | 30  | 33  | 36  | 39  | 43  |
|     | 51  | 56  | 62  | 68  | 75  | 82  | 91  |     |     |     |     |     |     |     |     |     |
| E96 | 100 | 102 | 105 | 107 | 110 | 113 | 115 | 118 | 121 | 124 | 127 | 130 | 133 | 137 | 140 | 143 |
|     | 150 | 154 | 158 | 162 | 165 | 169 | 174 | 178 | 182 | 187 | 191 | 196 | 200 | 205 | 210 | 215 |
|     | 226 | 232 | 237 | 243 | 249 | 255 | 261 | 267 | 274 | 280 | 287 | 294 | 301 | 309 | 316 | 324 |
|     | 340 | 348 | 357 | 365 | 374 | 383 | 392 | 402 | 412 | 422 | 432 | 442 | 453 | 464 | 475 | 487 |
|     | 511 | 523 | 536 | 549 | 562 | 576 | 590 | 604 | 619 | 634 | 649 | 665 | 681 | 698 | 715 | 732 |
|     | 768 | 787 | 806 | 825 | 845 | 866 | 887 | 909 | 931 | 953 | 976 |     |     |     |     |     |

## SPECIFICATION

### ■ Tape And Reel Package

- Taping specs are according to EIA RS-481



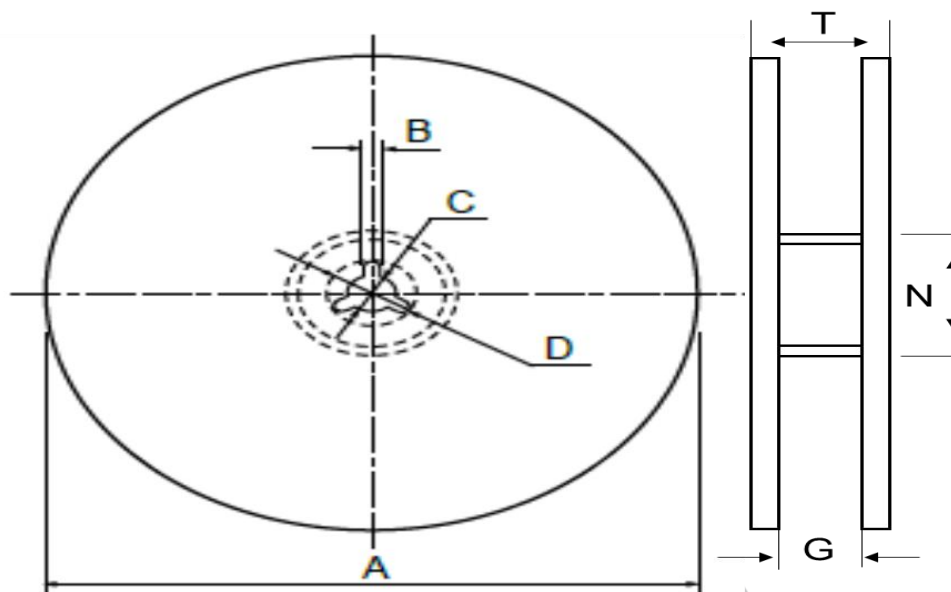
Accumulated dimensional tolerance  $40 \pm 0.2 \text{ mm}$

| Size  | A               | B               | W                | F               | E               | P1              | P2              | P0              | D                  |
|-------|-----------------|-----------------|------------------|-----------------|-----------------|-----------------|-----------------|-----------------|--------------------|
| 01005 | $0.24 \pm 0.03$ | $0.45 \pm 0.03$ | $8.00 \pm 0.20$  | $3.50 \pm 0.05$ | $1.75 \pm 0.10$ | $2.00 \pm 0.05$ | $2.00 \pm 0.05$ | $4.00 \pm 0.10$ | $1.50 + 0.10 / -0$ |
| 0201  | $0.37 \pm 0.05$ | $0.67 \pm 0.05$ | $8.00 \pm 0.20$  | $3.50 \pm 0.05$ | $1.75 \pm 0.10$ | $2.00 \pm 0.05$ | $2.00 \pm 0.05$ | $4.00 \pm 0.10$ | $1.50 + 0.10 / -0$ |
| 0402  | $0.70 \pm 0.10$ | $1.20 \pm 0.10$ | $8.00 \pm 0.30$  | $3.50 \pm 0.05$ | $1.75 \pm 0.10$ | $2.00 \pm 0.10$ | $2.00 \pm 0.05$ | $4.00 \pm 0.10$ | $1.50 + 0.10 / -0$ |
| 0603  | $1.10 \pm 0.20$ | $1.90 \pm 0.20$ | $8.00 \pm 0.30$  | $3.50 \pm 0.05$ | $1.75 \pm 0.10$ | $4.00 \pm 0.10$ | $2.00 \pm 0.05$ | $4.00 \pm 0.10$ | $1.50 + 0.10 / -0$ |
| 0805  | $1.65 \pm 0.20$ | $2.40 \pm 0.20$ | $8.00 \pm 0.30$  | $3.50 \pm 0.05$ | $1.75 \pm 0.10$ | $4.00 \pm 0.10$ | $2.00 \pm 0.05$ | $4.00 \pm 0.10$ | $1.50 + 0.10 / -0$ |
| 1206  | $2.00 \pm 0.20$ | $3.60 \pm 0.20$ | $8.00 \pm 0.30$  | $3.50 \pm 0.05$ | $1.75 \pm 0.10$ | $4.00 \pm 0.10$ | $2.00 \pm 0.05$ | $4.00 \pm 0.10$ | $1.50 + 0.10 / -0$ |
| 1210  | $3.00 \pm 0.20$ | $3.60 \pm 0.20$ | $8.00 \pm 0.30$  | $3.50 \pm 0.05$ | $1.75 \pm 0.10$ | $4.00 \pm 0.10$ | $2.00 \pm 0.05$ | $4.00 \pm 0.10$ | $1.50 + 0.10 / -0$ |
| 2010  | $2.80 \pm 0.20$ | $5.50 \pm 0.20$ | $12.00 \pm 0.30$ | $5.50 \pm 0.05$ | $1.75 \pm 0.10$ | $4.00 \pm 0.10$ | $2.00 \pm 0.05$ | $4.00 \pm 0.10$ | $1.50 + 0.10 / -0$ |
| 2512  | $3.50 \pm 0.20$ | $6.70 \pm 0.20$ | $12.00 \pm 0.30$ | $5.50 \pm 0.05$ | $1.75 \pm 0.10$ | $4.00 \pm 0.10$ | $2.00 \pm 0.05$ | $4.00 \pm 0.10$ | $1.50 + 0.10 / -0$ |

(unit: mm)

## SPECIFICATION

- Reel Package



| Size                         | Packaging Q'ty | A         | N         | C        | D     | B       | G        | T         |
|------------------------------|----------------|-----------|-----------|----------|-------|---------|----------|-----------|
| 01005                        | 20Kpcs / Reel  | 178.0±2.0 | 60.0±0.5  | 13.0±0.5 | 20min | 2.0±0.5 | 9.0±1.0  | 14.9 max. |
| 0201                         | 15Kpcs / Reel  | 178.0±2.0 | 60.0±0.5  | 13.0±0.5 | 20min | 2.0±0.5 | 9.0±0.5  | 14.9 max. |
|                              | 70Kpcs / Reel  | 330.0±2.0 | 100.0±1.0 | 13.0±0.5 | 20min | 2.0±0.5 | 9.0±0.5  | 14.9 max. |
| 0402                         | 10Kpcs / Reel  | 178.0±2.0 | 60.0±0.5  | 13.0±0.5 | 20min | 2.0±0.5 | 10.0±1.5 | 14.9 max. |
| 0603<br>0805<br>1206<br>1210 | 1Kpcs / Reel   | 100.0±0.5 | 52.0±0.5  | 13.0±0.5 | 20min | 2.0±0.5 | 9.0±0.5  | 12.5 max. |
|                              | 5Kpcs / Reel   | 178.0±2.0 | 60.0±0.5  | 13.0±0.5 | 20min | 2.0±0.5 | 10.0±1.5 | 14.9 max. |
|                              | 10Kpcs / Reel  | 254.0±2.0 | 100.0±1.0 | 13.5±0.5 | 20min | 2.0±0.5 | 10.0±1.5 | 14.9 max. |
|                              | 20Kpcs / Reel  | 330.0±2.0 | 100.0±1.0 | 13.5±0.5 | 20min | 2.0±0.5 | 10.0±1.5 | 14.9 max. |
| 2010<br>2512                 | 4Kpcs / Reel   | 178.0±2.0 | 60.0±0.5  | 13.0±0.5 | 20min | 2.0±0.5 | 13.8±1.5 | 16.7 max. |
|                              | 8Kpcs / Reel   | 254.0±2.0 | 100.0±1.0 | 13.5±0.5 | 20min | 2.0±0.5 | 13.8±1.5 | 16.7 max. |
|                              | 16Kpcs / Reel  | 330.0±2.0 | 100.0±1.0 | 13.5±0.5 | 20min | 2.0±0.5 | 13.8±1.5 | 20.0 max. |

(unit: mm)

## SPECIFICATION

### ■ FCF $\geq 1\Omega$ Specification And Test Methods

| ITEM                                        | SPECIFICATION                                                                                                                              | TEST METHOD                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DC Resistance                               | J : $\pm 5\%$ , G: $\pm 2\%$ , F: $\pm 1\%$<br>D: $\pm 0.5\%$ , C: $\pm 0.25\%$ , B: $\pm 0.1\%$<br>Zero ohm Jumper < 50m $\Omega$         | IEC 60115-1 / JIS C 5201-1 , Clause 4.5<br>Measure the resistance value.                                                                                                                                                                                                                                                                                                                                                                  |
| Short time Overload                         | J、G: $\Delta R \leq \pm (2\% + 0.1\Omega)$<br>F、D: $\Delta R \leq \pm (1\% + 0.05\Omega)$<br>C、B: $\Delta R \leq \pm (0.5\% + 0.05\Omega)$ | IEC 60115-1 / JIS C 5201-1 , Clause 4.13<br>2.5×Rated voltage or Max. Overload Voltage for 5 sec.<br>measure resistance after 30 minutes                                                                                                                                                                                                                                                                                                  |
| Solderability                               | Over 95% of termination must be covered with Solder                                                                                        | IEC 60115-1 / JIS C 5201-1 , Clause 4.17<br>After immersing flux, dip in the 245 $\pm 2^\circ\text{C}$ molten solder bath for 3 $\pm 0.5$ sec                                                                                                                                                                                                                                                                                             |
| Resistance to Solder Heat                   | J、G: $\Delta R \leq \pm (1\% + 0.1\Omega)$<br>F、D、C、B: $\Delta R \leq \pm (0.5\% + 0.05\Omega)$<br>No mechanical damage                    | IEC 60115-1 / JIS C 5201-1 , Clause 4.18<br>With 260 $\pm 5^\circ\text{C}$ for 10 $\pm 1$ sec.                                                                                                                                                                                                                                                                                                                                            |
| Temperature Coefficient of Resistance (TCR) | Refer to the rating table information.                                                                                                     | IEC 60115-1 / JIS C 5201-1 , Clause 4.8<br>Test temperature : 25 $^\circ\text{C}$ (T1) $\rightarrow$ -55 $^\circ\text{C}$ (T2)<br>25 $^\circ\text{C}$ (T1) $\rightarrow$ +155 $^\circ\text{C}$ (T2)<br>$\text{TCR (ppm/}^\circ\text{C)} = \frac{R2-R1}{R1} \times \frac{1}{T2-T1} \times 10^6$<br>T1: 25 $^\circ\text{C}$ T2: Test temperature<br>R1: Resistance at reference temperature (T1)<br>R2: Resistance at test temperature (T2) |
| Load Life Humidity                          | J、G: $\Delta R \leq \pm (3\% + 0.1\Omega)$<br>F、D: $\Delta R \leq \pm (1\% + 0.05\Omega)$<br>C、B: $\Delta R \leq \pm (0.5\% + 0.05\Omega)$ | IEC 60115-1 / JIS C 5201-1 , Clause 4.24<br>Maintain the temperature of the resistor at 40 $\pm 2^\circ\text{C}$ and 90~95% R.H. with the rated voltage applied.<br>Cycle ON for 1.5 hours and OFF for 0.5 hour for 1000+48/-0 hours. After 1~4 hour, measure the resistance value.                                                                                                                                                       |
| Load Life                                   | J、G: $\Delta R \leq \pm (3\% + 0.1\Omega)$<br>F、D: $\Delta R \leq \pm (1\% + 0.05\Omega)$<br>C、B: $\Delta R \leq \pm (0.5\% + 0.05\Omega)$ | IEC 60115-1 / JIS C 5201-1 , Clause 4.25<br>Permanent resistance change after 1000+48/-0 hours (1.5 hours ON, 0.5 hour OFF) at RCWV or Max.<br>Keep the resistor at 70 $\pm 2^\circ\text{C}$ ambient                                                                                                                                                                                                                                      |
| Temperature Cycle                           | J、G: $\Delta R \leq \pm (1\% + 0.1\Omega)$<br>F、D、C、B: $\Delta R \leq \pm (0.5\% + 0.05\Omega)$<br>No mechanical damage                    | IEC 60115-1 / JIS C 5201-1 , Clause 4.19<br>Repeat 5 cycles as follows<br>-55 $^\circ\text{C}$ (30 min.) + 25 $^\circ\text{C}$ (2~3 min.)<br>+155 $^\circ\text{C}$ (30 min.) + 25 $^\circ\text{C}$ (2~3 min.)                                                                                                                                                                                                                             |
| Insulation Resistance                       | Between termination and coating must be over 1000M $\Omega$                                                                                | IEC 60115-1 / JIS C 5201-1 , Clause 4.6<br>Test voltage: 100 $\pm 15\text{V}$                                                                                                                                                                                                                                                                                                                                                             |
| Bending Strength                            | J、G: $\Delta R \leq \pm (1\% + 0.1\Omega)$<br>F、D、C、B: $\Delta R \leq \pm (0.5\% + 0.05\Omega)$<br>No mechanical damage                    | IEC 60115-1 / JIS C 5201-1 , Clause 4.33<br>Resistance change after bended on the 90mm PCB.<br>Bend: 3mm for 01005、0201、0402、0603、0805<br>2mm for 1206、1210、2010、2512                                                                                                                                                                                                                                                                     |

### ■ Storage &. Handling

... Products are recommended to be used up within one year as ensured shelf life.

Check solder ability in case shelf life extension is needed.

... To store products with following condition:

Temperature: 5 to 40 $^\circ\text{C}$  ; Humidity: 20 to 70% relative humidity.