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光頡科技股份有限公司
Viking Tech Corporation

# ***Data Sheet***

| | |
|---|---|
| Customer: | |
| Product: | Thick Film Chip Resistor - CR Series |
| Size: | 01005/0201/0402/0603/0805/1206/1210/2010/2512 |
| Issued Date: | 15-Mar-12 |
| Edition: | REV.B4 |

TMTEC

Pb RoHS Compliant


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| Produced by (QC) | Checked (QC) | Approved by (QC) | Prepared by (Sales) | Accepted by (Customer) |
|---|---|---|---|---|
| 15-Mar-12 | 15-Mar-12 | 15-Mar-12 | 15-Mar-12 | |
| ***Susan Huang*** | ***J.C. Liu*** | ***J.C. Liu*** | | |

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# Thick Film Chip Resistor
# (CR Series)

## ■Scope

－This specification applies to all sizes of rectangular-type fixed chip resistors with Ruthenium-base as material.

## ■Features

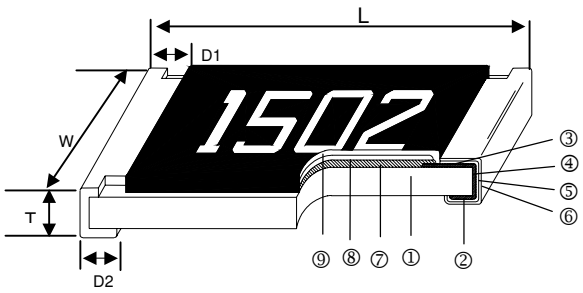
－Small size and light weight
－Highly reliable multilayer electrode construction
－Compatible with all soldering process

## ■Applications




－Telecommunication Equipments
－Radio and Tape Recorders, TV Tuners
－Digital Cameras, Watches, Pocket Calculators
－Automotive Industry
－Computers, Instruments
－Medical and Military Equipment

## ■Construction




| | | | | | |
|---|---|---|---|---|---|
| ① | Alumina Substrate | ④ | Edge Electrode (NiCr) | ⑦ | Resistor Layer ($RuO_2$/Ag) |
| ② | Bottom Electrode (Ag) | ⑤ | Barrier Layer (Ni) | ⑧ | Primary Overcoat (Glass) |
| ③ | Top Electrode (Ag-Pd) | ⑥ | External Electrode (Sn) | ⑨ | Secondary Overcoat (Epoxy) |

## ■Dimensions

Unit: mm

| Type | Size (Inch) | L | W | T | D1 | D2 | Weight (g) (1000pcs) |
|---|---|---|---|---|---|---|---|
| CR-E5 | 01005 | 0.40±0.02 | 0.20±0.02 | 0.13±0.02 | 0.10±0.03 | 0.10±0.03 | 0.037 |
| CR-01 | 0201 | 0.60±0.03 | 0.30±0.03 | 0.23±0.03 | 0.15±0.05 | 0.15±0.05 | 0.150 |
| CR-02 | 0402 | 1.00±0.05 | 0.50±0.05 | 0.35±0.05 | 0.20±0.10 | 0.20±0.10 | 0.620 |
| CR-03 | 0603 | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 | 2.042 |
| CR-05 | 0805 | 2.00±0.10 | 1.25±0.10 | 0.50±0.10 | 0.35±0.20 | 0.40±0.20 | 4.368 |
| CR-06 | 1206 | 3.10±0.10 | 1.55±0.10 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 | 8.947 |
| CR-10 | 1210 | 3.10±0.10 | 2.60±0.15 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 | 15.959 |
| CR-0A | 2010 | 5.00±0.10 | 2.50±0.15 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 | 24.241 |
| CR-12 | 2512 | 6.35±0.10 | 3.10±0.15 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 | 39.448 |

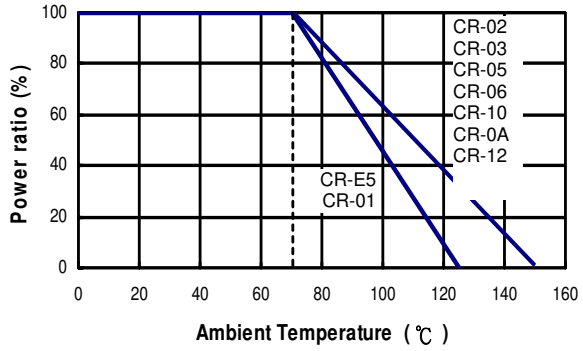
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## ■Part Numbering

| CR- | 03 | F | L | 7 | - - -10R |
|---|---|---|---|---|---|
| Product Type | Dimensions | Resistance Tolerance | Function Code | Packaging Code | Resistance |
| | E5:01005<br>01: 0201<br>02: 0402<br>03: 0603<br>05: 0805<br>06: 1206<br>10: 1210<br>0A: 2010<br>12: 2512 | B: ±0.1%<br>C: ±0.25%<br>D: ±0.5%<br>F: ±1%<br>J: ±5% | L: Standard & High Precision<br>E: TC50<br>P: High Power<br>H: Ultra High Power | 0: 7" Reel 15Kpcs<br>4: 7" Reel 4Kpcs<br>6: 7" Reel 10Kpcs<br>7: 7" Reel 5Kpcs<br>9: 10" Reel 8Kpcs<br>A: 10" Reel 10Kpcs<br>B: 10" Reel 20Kpcs<br>C: 13" Reel 40Kpcs<br>D: 13" Reel 20Kpcs<br>F: Bulk | - - - 1R2: 1.2Ω<br>- - - 3K3: 3.3KΩ<br>- - - 10K: 10KΩ<br>- - 100K: 100KΩ<br>"-" to fill up 6 spaces |

## ■Derating Curve




## ■Standard Electrical Specifications

| Item / Type | Power Rating at 70°C Jumper Rated Current | Operating Temp. Range | Max. Operating Voltage | Max. Overload Voltage | Resistance Range | | TCR (PPM/°C) |
|---|---|---|---|---|---|---|---|
| | | | | | ±1% | ±5% | |
| CR-E5 (01005) | 1/32W | -55 ~ +125°C | 15V | 30V | - | 10Ω - 1MΩ | ±300 |
| **Jumper** | 0.5A | | | | 0Ω (<50mΩ) | | - |
| CR-01 (0201) | 1/20W | -55 ~ +125°C | 25V | 50V | 1Ω - 10MΩ | | ±200 |
| **Jumper** | 1A | | | | 0Ω (<50mΩ) | | - |
| CR-02 (0402) | 1/16W | -55 ~ +155°C | 50V | 100V | 1Ω - 9.76Ω<br>10Ω - 1MΩ<br>1.02MΩ - 20MΩ<br>20.5MΩ - 100MΩ | | ±200<br>±100<br>±200<br>±400 |
| **Jumper** | 1A | | | | 0Ω (<50mΩ) | | - |
| CR-03 (0603) | 1/10W | -55 ~ +155°C | 75V | 150V | 1Ω - 9.76Ω<br>10Ω - 1MΩ<br>1.02MΩ - 20MΩ<br>20.5MΩ - 100MΩ | | ±200<br>±100<br>±200<br>±400 |
| **Jumper** | 1A | | | | 0Ω (<50mΩ) | | - |
| CR-05 (0805) | 1/8W | -55 ~ +155°C | 150V | 300V | 1Ω - 9.76Ω<br>10Ω - 1MΩ<br>1.02MΩ - 20MΩ<br>20.5MΩ - 100MΩ | | ±200<br>±100<br>±200<br>±400 |
| CR-06 (1206) | 1/4W | | 200V | 400V | | | |
| **Jumper** | 2A | | | | 0Ω (<50mΩ) | | - |
| CR-10 (1210) | 1/3W | -55 ~ +155°C | 200V | 400V | 1Ω - 9.76Ω<br>10Ω - 1MΩ<br>1.02MΩ - 20MΩ<br>20.5MΩ - 39MΩ | | ±200<br>±100<br>±200<br>±400 |
| **Jumper** | 2.5A | | | | 0Ω (<50mΩ) | | - |

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## ■Standard Electrical Specifications

| Item / Type | Power Rating at 70°C Jumper Rated Current | Operating Temp. Range | Max. Operating Voltage | Max. Overload Voltage | Resistance Range | | TCR (PPM/°C) |
|---|---|---|---|---|---|---|---|
| | | | | | ±1% | ±5% | |
| CR-0A (2010) | 3/4W | -55 ~ +155°C | 200V | 400V | 1Ω - 9.76Ω<br>10Ω - 1MΩ<br>1.02MΩ - 20MΩ<br>20.5MΩ - 100MΩ | | ±200<br>±100<br>±200<br>±400 |
| **Jumper** | 3.5A | | | | 0Ω (<50mΩ) | | - |
| CR-12 (2512) | 1W | -55 ~ +155°C | 250V | 500V | 1Ω - 9.76Ω<br>10Ω - 1MΩ<br>1.02MΩ - 20MΩ<br>20.5MΩ - 100MΩ | | ±200<br>±100<br>±200<br>±400 |
| **Jumper** | 4A | | | | 0Ω (<50mΩ) | | - |

## ■High Precision Electrical Specifications

| Item / Type | Power Rating at 70°C | Operating Temp. Range | Max. Operating Voltage | Max. Overload Voltage | Resistance Range | | | TCR (PPM/°C) |
|---|---|---|---|---|---|---|---|---|
| | | | | | ±0.1% | ±0.25% | ±0.5% | |
| CR-02 (0402) | 1/16W | -55 ~ +155°C | 50V | 100V | - | | 10Ω - 1MΩ | ±100 |
| | | | | | - | | 1.02M - 10MΩ | ±200 |
| CR-03 (0603) | 1/10W | | 75V | 150V | 10Ω - 1MΩ | | | ±100 |
| | | | | | - | 1.02M - 10MΩ | | ±200 |
| CR-05 (0805) | 1/8W | | 150V | 300V | 10Ω - 1MΩ | | | ±100 |
| | | | | | - | 1.02M - 10MΩ | | ±200 |
| CR-06 (1206) | 1/4W | | 200V | 400V | 10Ω - 1MΩ | | | ±100 |
| | | | | | - | 1.02M - 10MΩ | | ±200 |
| CR-10 (1210) | 1/3W | | 200V | 400V | 10Ω - 1MΩ | | | ±100 |
| | | | | | - | 1.02M - 10MΩ | | ±200 |
| CR-0A (2010) | 3/4W | | 200V | 400V | 10Ω - 1MΩ | | | ±100 |
| | | | | | - | 1.02M - 10MΩ | | ±200 |
| CR-12 (2512) | 1W | | 250V | 500V | 10Ω - 1MΩ | | | ±100 |
| | | | | | - | 1.02M - 10MΩ | | ±200 |

## ■TC50 Electrical Specifications

| Item / Type | Power Rating at 70°C | Operating Temp. Range | Max. Operating Voltage | Max. Overload Voltage | Resistance Range | | | | TCR (PPM/°C) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | ±0.1% | ±0.25% | ±0.5% | ±1% | |
| CR-02 (0402) | 1/16W | -55 ~ +155°C | 50V | 100V | - | | 100Ω - 1MΩ | | ±50 |
| CR-03 (0603) | 1/10W | | 75V | 150V | 10Ω - 1MΩ | 10Ω - 10MΩ | | | |
| CR-05 (0805) | 1/8W | | 150V | 300V | | | | | |
| CR-06 (1206) | 1/4W | | 200V | 400V | | | | | |
| CR-10 (1210) | 1/3W | | 200V | 400V | | | | | |
| CR-0A (2010) | 3/4W | | 200V | 400V | | | | | |
| CR-12 (2512) | 1W | | 250V | 500V | | | | | |

## ■High Power & Ultra High Power Rating Electrical Specifications

| Item / Type | Power Rating at 70°C | Operating Temp. Range | Max. Operating Voltage | Max. Overload Voltage | Resistance Range | | TCR (PPM/°C) |
|---|---|---|---|---|---|---|---|
| | | | | | ±1% | ±5% | |
| CR-02 (0402) | 1/10W | -55 ~ +155°C | 50V | 100V | 1Ω - 9.76Ω<br>10Ω - 1MΩ | | ±200<br>±100 |
| CR-03 (0603) | 1/8W | | 50V | 100V | | | |
| CR-05 (0805) | 1/3W | | 150V | 300V | | | |
| CR-06 (1206) | 1/3 *1/2W | | 200V | 400V | | | |
| CR-10 (1210) | 1/2 *3/4W | | 200V | 400V | | | |
| CR-0A (2010) | 1W | | 200V | 400V | | | |
| CR-12 (2512) | 2W | | 250V | 500V | | | |

*: Ultra High Power

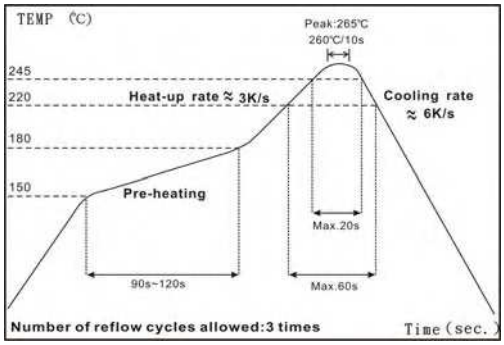
Operating Voltage=$\sqrt{}$(P*R) or Max. operating voltage listed above, whichever is lower.

Overload Voltage=2.5*$\sqrt{}$(P*R) or Max. overload voltage listed above, whichever is lower.

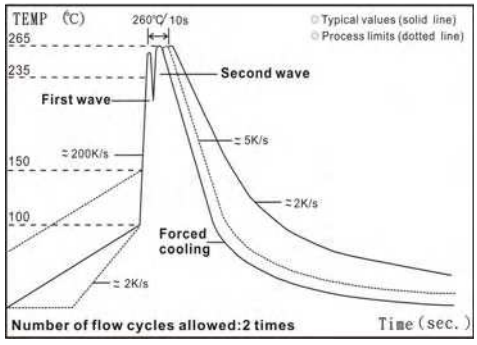
■ Viking is capable of manufacturing the optional spec based on customer's requirement.

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## ■Soldering Condition




IR Reflow Soldering




Wave Soldering (Flow Soldering)

(1) Time of IR reflow soldering at maximum temperature point 260°C：10s

(2) Time of wave soldering at maximum temperature point 260°C：10s

(3) Time of soldering iron at maximum temperature point 410°C：5s

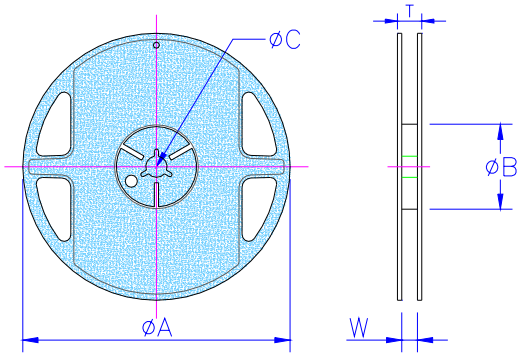
## ■Environmental Characteristics

| Item | Requirement | | | Test Method |
|---|---|---|---|---|
| | ±1% and Below | ±5% | Jumper | |
| Temperature Coefficient of Resistance (T.C.R.) | As Spec. | | | **JIS-C-5201-1 4.8**<br>**IEC-60115-1 4.8**<br>-55°C~+125°C, 25°C is the reference temperature |
| Short Time Overload | ±(1.0%+0.05Ω) | ±(2.0%+0.05Ω) | <50mΩ | **JIS-C-5201-1 4.13**<br>**IEC-60115-1 4.13**<br>RCWV*2.5 or Max. overload voltage for 5 seconds, 2 seconds for high power series |
| Insulation Resistance | ≥10G | | | **JIS-C-5201-1 4.6**<br>**IEC-60115-1 4.6**<br>Max. overload voltage for 1 minute |
| Endurance | ±(1.0%+0.10Ω) | ±(2.0%+0.10Ω) | <100mΩ | **JIS-C-5201-1 4.25**<br>**IEC-60115-1 4.25.1**<br>70±2°C, Max. working voltage for 1000 hrs with 1.5 hrs “ON” and 0.5 hrs “OFF” |
| Damp Heat with Load | ±(1.0%+0.10Ω) | ±(2.0%+0.10Ω) | <100mΩ | **JIS-C-5201-1 4.24**<br>40±2°C, 90~95% R.H. Max. working voltage for 1000 hrs with 1.5 hrs “ON” and 0.5 hrs “OFF” |
| Dry Heat | ±(1.0%+0.05Ω) | ±(1.5%+0.10Ω) | <50mΩ | **JIS-C-5201-1 4.23**<br>**IEC-60115-1 2.23.2**<br>at +125/+155°C for 1000 hrs |
| Bending Strength | ±(1.0%+0.05Ω) | ±(1.0%+0.05Ω) | <50mΩ | **JIS-C-5201-1 4.33**<br>**IEC-60115-1 4.33**<br>Bending once for 5 seconds<br>2010, 2512 sizes: 2mm Other sizes: 3mm |
| Solderability | 95% min. coverage | | | **JIS-C-5201-1 4.17**<br>**IEC-60115-1 4.17**<br>245±5°C for 3 seconds |
| Resistance to Soldering Heat | ±(0.5%+0.05Ω) | ±(1.0%+0.05Ω) | <50mΩ | **JIS-C-5201-1 4.18**<br>**IEC-60115-1 4.18**<br>260±5°C for 10 seconds |
| Voltage Proof | No breakdown or flashover | | | **JIS-C-5201-1 4.7**<br>**IEC-60115-1 4.7**<br>1.42 times RCWV (RMS) for 1 minute |
| Leaching | Individual leaching area ≦5%<br>Total leaching area ≦ 10% | | | **JIS-C-5201-1 4.18**<br>**IEC-60068-2-58 8.2.1**<br>260±5°C for 30 seconds |
| Rapid Change of Temperature | ±(0.5%+0.05Ω) | ±(1.0%+0.05Ω) | <50mΩ | **JIS-C-5201-1 4.18**<br>**IEC-60115-1 4.18**<br>-55°C to +125/+155°C, 5 cycles |

■ **Storage Temperature: 25±3°C; Humidity < 80%RH**

## ■Packaging

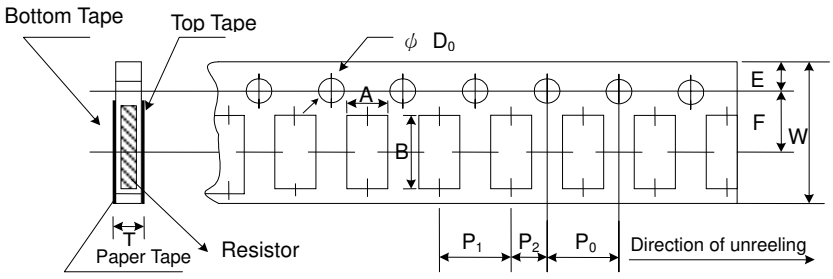
Reel Specifications & Packaging Quantity




Unit: mm

| Type | Packaging Quantity | | Tape Width | Reel Diameter | ΦA | ΦB | ΦC | W | T |
|---|---|---|---|---|---|---|---|---|---|
| CR-01 | Paper | 15K | 8mm | 7 inch | 178.5±1.5 | $60^{+1/-0}$ | 13.0±0.2 | 9.0±0.5 | 12.5±0.5 |
| CR-E5<br>CR-01<br>CR-02 | Paper | 10K<br>20K<br>40K | 8mm | 7 inch | 178.5±1.5 | $60^{+1/-0}$ | 13.0±0.2 | 9.0±0.5 | 12.5±0.5 |
| | | | | 10 inch | 254±1.0 | 100±0.5 | 13.0±0.2 | 9.5±0.5 | 13.5±0.5 |
| CR-03<br>CR-05<br>CR-06<br>CR-10 | Paper | 5K<br>10K<br>20K | | 13 inch | 330±1.0 | 100±0.5 | 13.0±0.2 | 9.5±0.5 | 13.5±0.5 |
| CR-0A<br>CR-12 | Embossed | 4K<br>8K | 12mm | 7 inch | 178.5±1.5 | $60^{+1/-0}$ | 13.0±0.5 | 13.0±0.5 | 15.5±0.5 |
| | | | | 10 inch | 250±1.0 | 62±0.5 | 13.0±0.5 | 12.5±0.5 | 16.5±0.5 |

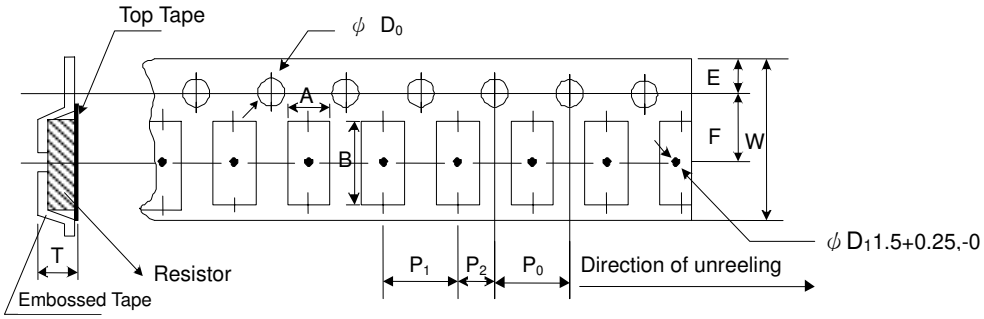
Paper Tape Specifications




Unit: mm

| Type | A | B | W | E | F | $P_0$ | $P_1$ | $P_2$ | $\Phi D_0$ | T |
|---|---|---|---|---|---|---|---|---|---|---|
| CR-E5 | 0.24±0.05 | 0.45±0.05 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10 | 2.00±0.05 | 2.00±0.05 | 1.50+0.1,-0 | 0.40±0.10 |
| CR-01 | 0.38±0.05 | 0.68±0.05 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10 | 2.00±0.05 | 2.00±0.05 | 1.50+0.1,-0 | 0.42±0.20 |
| CR-02 | 0.65±0.10 | 1.15±0.10 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10 | 2.00±0.05 | 2.00±0.05 | 1.50+0.1,-0 | 0.45±0.10 |
| CR-03 | 1.10±0.10 | 1.90±0.10 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10 | 4.00±0.05 | 2.00±0.05 | 1.50+0.1,-0 | 0.70±0.10 |
| CR-05 | 1.60±0.10 | 2.40±0.20 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10 | 4.00±0.05 | 2.00±0.05 | 1.50+0.1,-0 | 0.85±0.10 |
| CR-06 | 1.90±0.10 | 3.50±0.20 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10 | 4.00±0.05 | 2.00±0.05 | 1.50+0.1,-0 | 0.85±0.10 |
| CR-10 | 2.90±0.10 | 3.50±0.20 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10 | 4.00±0.05 | 2.00±0.05 | 1.50+0.1,-0 | 0.85±0.10 |

Embossed Plastic Tape Specifications




Unit: mm

| Type | A | B | W | E | F | $P_0$ | $P_1$ | $P_2$ | $\Phi D_0$ | T |
|---|---|---|---|---|---|---|---|---|---|---|
| CR-0A | 2.8±0.10 | 5.5±0.10 | 12.0±0.30 | 1.75±0.10 | 5.5±0.05 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50+0.1, -0 | $1.2^{+0}$ |
| CR-12 | 3.5±0.10 | 6.7±0.10 | 12.0±0.30 | 1.75±0.10 | 5.5±0.05 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50+0.1, -0 | $1.2^{+0}$ |

## ■Marking

No Marking for 01005, 0201 and 0402

Jumper for all: Letter “0”

1% for 0805/1206/1210/2010/2512: 4 digits marking

Example:

| Resistance | 100Ω | 2.2KΩ | 10KΩ | 49.9KΩ | 100KΩ |
|---|---|---|---|---|---|
| Marking | 1000 | 2201 | 1002 | 4992 | 1003 |

5% for 0603/0805/1206/1210/2010/2512: 3 digits marking in E24

Example: 101=100Ω 102=1KΩ (1st and 2nd are E24 code and 3rd code is multiplier)

| E24 code | 10 | 11 | 12 | 13 | 15 | 16 | 18 | 20 | 22 | 24 | 27 | 30 | 33 | 36 | 39 | 43 | 47 | 51 | 56 | 62 | 68 | 75 | 82 | 91 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

1% for 0603: 3 digits marking in E96




3 digits marking for Example: 14C=13K7Ω 13C=13K3Ω

68B=4K99Ω 68X=49.9Ω

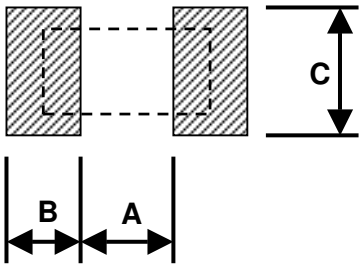
## Marking Table

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

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

## ■Recommend Land Pattern

Unit: mm




| Type | A | B | C |
|---|---|---|---|
| CR-E5 | 0.14 | 0.18 | 0.25 |
| CR-01 | 0.30 | 0.25 | 0.30 |
| CR-02 | 0.50 | 0.45 | 0.60 |
| CR-03 | 0.90 | 0.60 | 0.90 |
| CR-05 | 1.20 | 0.70 | 1.30 |
| CR-06 | 2.00 | 0.90 | 1.60 |
| CR-10 | 2.00 | 0.90 | 2.80 |
| CR-0A | 3.80 | 0.90 | 2.80 |
| CR-12 | 3.80 | 1.60 | 3.50 |

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