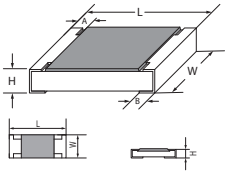
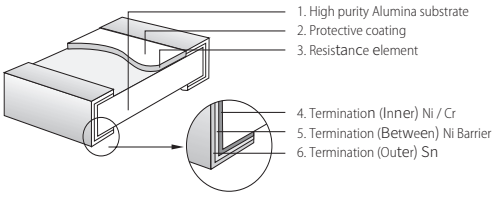
# Thick Film Chip Resistors

## Feature

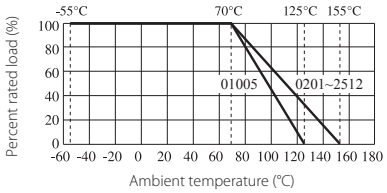
- Small size & light weight
- Save assembly cost.
- Suitable for both wave & re-flow soldering.
- Applications: Navigator, Mobile Phone,Telecom, PDA, Setbox, Meter.

## Figures




## Derating Curve & Specification




| Type | 01005 | 0201 | 0402 | 0603 | 0805 | 1206 | 1210 | 1812 | 2010 | 2512 |
|---|---|---|---|---|---|---|---|---|---|---|
| Size | 0402 | 0603 | 1005 | 1608 | 2012 | 3216 | 3225 | 4532 | 5025 | 6432 |
| Max. Working Voltage | 15V | 25V | 50V | 75V | 150V | 200V | 200V | 200V | 200V | 200V |
| Max. Overload Voltage | 30V | 50V | 100V | 150V | 300V | 400V | 500V | 500V | 500V | 500V |
| Dielectric withstanding Voltage | - | - | 100V | 300V | 500V | 500V | 500V | 500V | 500V | 500V |
| Operating Temperature | -55~+125°C | -55~+155°C | -55~+155°C | -55~+155°C | -55~+155°C | -55~+155°C | -55~+155°C | -55~+155°C | -55~+155°C | -55~+155°C |

| Type | | 01005 | 0201 | 0402 | 0603 | 0805 | 1206 | 1210 | 1812 | 2010 | 2512 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dimension | L(mm) | 0.40±0.02 | 0.60±0.03 | 1.00±0.10 | 1.60±0.10 | 2.00±0.15 | 3.10±0.15 | 3.10±0.10 | 4.50±0.20 | 5.00±0.10 | 6.35±0.10 |
| | W(mm) | 0.20±0.02 | 0.30±0.03 | 0.50±0.05 | 0.80±0.10 | 1.25 +0.15 -0.10 | 1.55 +0.15 -0.10 | 2.60±0.20 | 3.20±0.20 | 2.50±0.20 | 3.20±0.20 |
| | H(mm) | 0.13±0.02 | 0.23±0.03 | 0.35±0.05 | 0.45±0.10 | 0.55±0.10 | 0.55±0.10 | 0.55±0.10 | 0.55±0.20 | 0.55±0.10 | 0.55±0.10 |
| | A(mm) | 0.10±0.03 | 0.10±0.05 | 0.20±0.10 | 0.30±0.20 | 0.40±0.20 | 0.45±0.20 | 0.50±0.25 | 0.50±0.20 | 0.60±0.25 | 0.60±0.25 |
| | B(mm) | 0.10±0.03 | 0.15±0.05 | 0.25±0.10 | 0.30±0.20 | 0.40±0.20 | 0.45±0.20 | 0.50±0.20 | 0.50±0.20 | 0.50±0.20 | 0.50±0.20 |
| Resistance Value of Jumper | | <50mΩ | | | | | | | | | |
| Rated Current of Jumper | | 0.5A | 0.5A | 1A | 1A | 2A | 2A | 2A | 2A | 2A | 2A |
| Max.Overload Current of Jumper | | 1A | 1A | 2A | 2A | 5A | 10A | 10A | 10A | 10A | 10A |

| Type | 01005 | 0201 | 0402 | 0603 | 0805 | | 1206 | | 1210 | 1812 | 2010 | 2512 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Power Rating at 70°C | 1/32W | 1/20W | 1/16W | 1/10W | 1/8W | 1/4W | 1/4W | 1/3W | 1/2W | 3/4W | 3/4W | 1W |
| Resistance Range of 0.5%(E-96) | - | - | 1Ω~10MΩ | 1Ω~10MΩ | 1Ω~10MΩ | - | 1Ω~10MΩ | - | 1Ω~10MΩ | 1Ω~10MΩ | 1Ω~10MΩ | 1Ω~10MΩ |
| Resistance Range of 1%,2%(E-96) | 10Ω ~ 10MΩ | 1Ω~ 10MΩ | | 0.01Ω~ 10MΩ | 0.1Ω≤R <10MΩ | 0.01Ω ≤R <0.1 Ω | 0.1Ω≤R <10MΩ | 0.01Ω≤R <0.1Ω | 0.01Ω~10MΩ | | | |
| Resistance Range of 5%(E-24) | 1Ω~10MΩ | | | 0.01Ω~ 10MΩ | 0.1Ω≤R <10MΩ | 0.01Ω ≤R <0.1 Ω | 0.1Ω≤R <10MΩ | 0.01Ω≤R <0.1Ω | 0.01Ω~10MΩ | | | |

## Marking on the Resistors Body

- For 01005, 0201, 0402 size, no marking on the body due to the small size of the resistor.
- ±5% tolerance product: the marking is 3 digits, the first 2 digits are the significant of the resistance and the 3rd digit denotes number of zeros following.
- 0805, 1206, 1210, 2010, 2512 ≤±1%: the marking is 4 digits, the first 3 digits are the significant of the resistance and the 4th digit denotes number of zeros following.
- Standard E-96 series values of 0603 ≤±1%: 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.

153 = 15000Ω = 15KΩ

Below 10Ω: 6R8 = 6.8Ω

2372 = 23700Ω = 23.7KΩ

Below 10Ω : 3R24 = 3.24Ω

## Multiplier Code (for 0603 ≤±1% marking)

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

## Standard E-96 series Resistance Value code (for 0603≤±1% marking)

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

## So the resistance value are marked as the following examples:

1.96KΩ= 196 ×$10^1$ Ω = 29B

12.4Ω= 124 ×$10^{-1}$ = 10X

- Standard E-24 and not belong to E-96 series values (≤±1%) of 0603 size: the marking is the same as 5% tolerance but marking as underline.

122 = 1200 = 1.2 KΩ

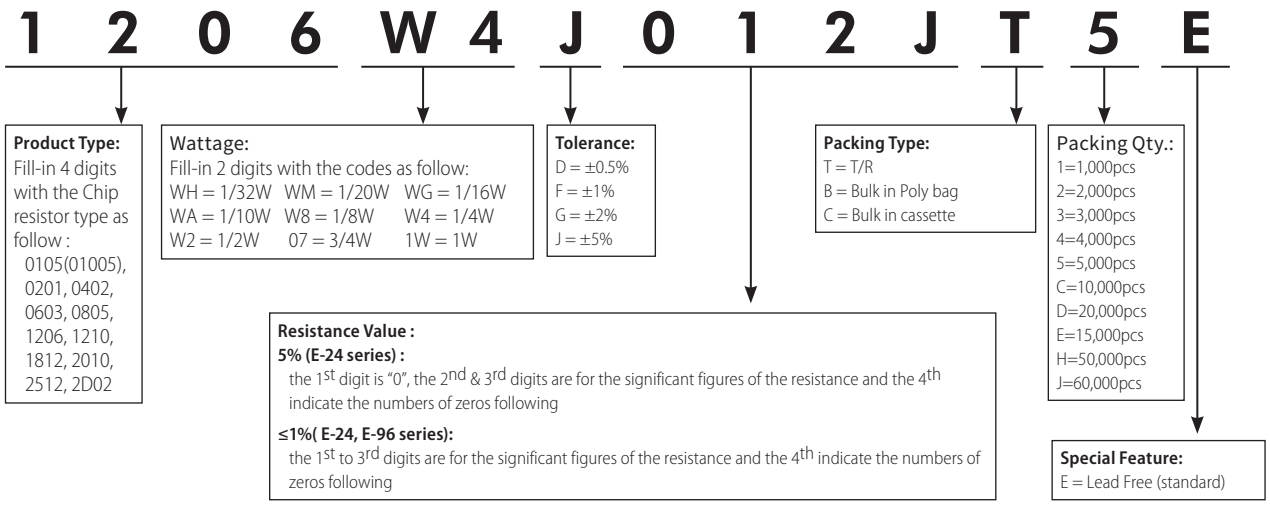
680 = 68Ω

## Performance Specifications

| | | | |
|---|---|---|---|
| **Temperature coefficient** | 01005: 1Ω≤R<10Ω: -200~+600ppm/°C<br>10Ω≤R<100Ω: ±300ppm/°C<br>100Ω≤R≤10MΩ: ±200ppm/°C<br>0201: 1Ω≤R≤10Ω: -100~+350ppm/°C<br>>10Ω: ±200ppm/°C<br>0402: 1Ω≤R≤10Ω: ±200ppm/°C<br>>10Ω: ±100ppm/°C | 0603: 0.01Ω≤R≤0.03Ω:±1500PPM/°C<br>0.03Ω<R≤0.05Ω:±1000 PPM/°C<br>0.05Ω<R<1Ω:±800PPM/°C<br>1Ω≤R≤10Ω: ±200PPM/°C<br>>10Ω:±100PPM/°C | 0805, 1206, 1210, 1812, 2010, 2512:<br>0.01Ω ≤ R ≤0.015Ω: ±1500ppm/°C<br>0.015Ω < R ≤0.03Ω:±1000ppm/°C<br>0.03Ω < R <1Ω: ±800ppm/°C<br>1Ω≤R≤10Ω: ±200ppm/°C<br>>10Ω: ±100ppm/°C |
| **Short-time overload** | ±5%, ± 2%: ±(2.0% + 0.05Ω)<br>±1%, ± 0.5%: ±(1.0% + 0.05Ω)<br>01005 ±5% ±1% : ±(2.0% + 0.05Ω) | | |
| **Insulation resistance** | ≥ 1,000 MΩ | | |
| **Dielectric withstanding voltage** | No evidence of flashover, mechanical damage, arcing or insulation breakdown | | |
| **Terminal bending** | ±(1.0% + 0.05Ω) | | |
| **Soldering heat** | ±(1.0% + 0.05Ω) | | |
| **Solderability** | Coverage must be over 95%. | | |
| **Rapid change of temperature** | ±5%, ± 2%: ±(1.0% + 0.05Ω)<br>±1%, ± 0.5%: ±(0.5% + 0.05Ω)<br>01005 ±5% ±1% : ±(1.0% + 0.05Ω) | | |
| **Humidity (Steady State)** | ±5%, ± 2%: ±(3.0% + 0.05Ω)<br>±1%, ± 0.5%: ±(0.5% + 0.05Ω)<br>01005 ±5% ±1% (-55°C~125°C): ±(2.0% + 0.05Ω) | | |
| **Load life in humidity** | ±5%, ± 2%: ±(3.0% + 0.05Ω)<br>±1%, ± 0.5%: ±(1% + 0.05Ω )<br>01005: ±(3.0% + 0.05Ω) | | |
| **Load life** | ±5%, ± 2%: ±(3.0% + 0.05Ω)<br>±1%, ± 0.5%: ±(1% + 0.05Ω)<br>01005: ±(3.0% + 0.05Ω) | | |

• Resistance value which doesn't belong to E-24 and E-96 Series Standard Values is available case by case.

## Ordering Procedure (Example: 1206 1/4W 5% 1.2 Ω T/R-5000)




**Remark:** For more details, please check page 135, Part No. System

# Part No. System

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

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

1. 1st~4th digits:
   a) This is to indicate the SMD Resistor size. Example: 1206, TC05 or HV03;
   b) For Resistor Network & Coated type, the 1st~3rd digits are to indicate the product type and the 4th digit is the special feature. Example: RNLA = Resistor Newtork Circuit A type; CFRF = Carbon Film Fixed Resistors Non-Flame type; MORI = Metal Oxide Film Fixed Resistor Non-Inductive type.
   c) For Cement Fixed Resistors, these 4 digits are to indicate the product type but if the product type has only 3 digits, the 4th digit will be "0". Example: PRW0=PRW type; PRWC=PRWC type.

2. 5th~ 6th digits:
   a) This is to indicate the wattage or power rating. To distinguish the sizes and the numbers, the following codes are used, and please refer to the following chart for details: W = Normal Size; S = Small Size; U = Ultra Small Size; "1" ~ "G" to denotes "1" ~ "16" as Hexadecimal:

### 1/16W ~ 1/2W (<1W)

| Wattage | 1/2 | 1/3 | 1/4 | 1/5 | 1/6 | 1/7 | 1/8 | 1/9 | 1/10 | 1/11 | 1/12 | 1/13 | 1/14 | 1/15 | 1/16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Normal Size | W2 | W3 | W4 | W5 | W6 | W7 | W8 | W9 | WA | WB | WC | WD | WE | WF | WG |
| Small Size | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | SA | SB | SC | SD | SE | SF | SG |
| Ultra Small Size | U2 | U3 | U4 | U5 | U6 | U7 | U8 | U9 | UA | UB | UC | UD | UE | UF | UG |

### 1W ~ 16W (≥1W)

| Wattage | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Normal Size | IW | 2W | 3W | 4W | 5W | 6W | 7W | 8W | 9W | AW | BW | CW | DW | EW | FW | GW |
| Small Size | 1S | 2S | 3S | 4S | 5S | 6S | 7S | 8S | 9S | AS | BS | CS | DS | ES | FS | GS |
| Ultra Small Size | 1U | 2U | 3U | 4U | 5U | 6U | 7U | 8U | 9U | AU | BU | CU | DU | EU | FU | GU |

   b) For power rating less than 1W, the 5th digit will be the letters W, S or U to represent the size required & the 6th digit will be a number or a letter code. Example: WA = 1/10W; U2 = 1/2W-SS
   c) For power rating of 1W to 16W, the 5th digit will be a number or a letter code and the 6th digit will be the letters of W, S or U. Example: AW = 10W; 3S = 3W-S.
   d) For power rating between 20W to 99W, the 5th & 6th digits will show the whole numbers of the power rating itself. Example: 20 = 20W; 75 = 75W.
   e) For power rating of 100W & over, the 5th & 6th digits will be indicated with "00" and the actual wattage being indicated at the last 3 digits (12th~14th) of the Part No.
   f) For special power ratings, the following codes are to be used:
      1). WH = 1/32W (10P8 Chip Network )
      2). 07 = 3/4WS (Chip 2010 size)
      3). 04 = 0.4W-SS (0.4 watt Ultra Small size )
      4). 06 = 0.6W-S (0.6 watt Small size )
      5). 2A = 2.5W 6). 6A = 6.5W 7). WK= 2/3W
      8). 1A =1.5W 9). 1.25W =1Q
   g) For Resistor Network, since the power rating is fixed as 1/8W for A circuit & 1/5W for B circuit, the 5th & 6th digit is to be used to denote the number of pins required. Example: 09 = 9pins; 12 = 12pins.
   h) For Jumper Wires the 5th & 6th digits will be indicated with "00" .
   i) 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

3. The 7th digit is to denote the Resistance Tolerance. The following letter code is to be used for indicating the standard Resisance Tolerance. As for Metal Film Fixed Resistor products, it is also to denote the standard PPM as follows:

**B** = ±0.1% (15PPM)
**C** = ±0.25% (25PPM)
**D** = ±0.5% (50PPM)
**F** = ±1% (50PPM)
**G** = ±2% (100PPM)
**J** = ±5% (200PPM)
**K** = ±10%
**W** = ±0.05%
**L** = ±0.01%

***Remark:*** *if it is not one of the above standard "tolerance-TCR", the requirement should be clearly stated when placing order. Example: ±1% (25PPM), the 7th digit still shows "F" but separately note the requirement of "25PPM"*

4. The $8^{th}$ to $11^{th}$ digits is to denote the Resistance Value:

a) For the standard resistance values of E-24 series in 5% & 10% tolerance, the $8^{th}$ digit is "0", the $9^{th}$ & $10^{th}$ digits are to denote the significant figures of the resistance and the $11^{th}$ digit is the number of zeros following

b) For the standard resistance values of E-96 series in ≤2% tolerance, the $8^{th}$ digit to the $10^{th}$ digits are to denote the significant figures of the resistance and the $11^{th}$ digit is the number of zeros following.

c) For the code to the significant figures to E-24 & E-96 series, please refer to page 170 & 171 of the standards Resistance Value list.

d) The following numbers and the letter codes is to be used to indicate the number of zeros in the $11^{th}$ digit:

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

e) For Cement Resistors the $8^{th}$ digit will be coded with "W" or "P" to denote Wire-wound type or Power Film type respectively of the Cement Fixed Resistor proudct. The $9^{th}$ to $11^{th}$ please refer to point 4.a

Example:

| E-24 series | E-96 series | Cement Resistors |
|---|---|---|
| 0120 = 12 ohm | 1210 = 121 ohm | W120 = 12 ohm Wire-wound type |
| 0123 = 12K ohm | 1302 = 13K ohm | W12J = 1.2 ohm Wire-wound type |
| 012J = 1.2 ohm | 196J = 19.6 ohm | P273 = 27 kohm Powe Film type |

5. The $12^{th}$, $13^{th}$ & $14^{th}$ digits:

a) The $12^{th}$ digit is to denote the Packaging type with the following codes:

| | | |
|---|---|---|
| A = Tape / Box (Ammo Pack) | C = Bulk in Cassette (for Chip product) | |
| B = Bulk / Box | T = Tape / Reel | P = Tape / Box of PT-26 product |

b) The $13^{th}$ digit is normally to indicate the Packing Quantity of Tape/Box or Tape/Reel packaging types. Except for Chip products Bulk packing, this digit should be filled "0" or other products with "Bulk/Box packaging requirement. The following letter codes is to be used for some packaging quantities.

| | | | | |
|---|---|---|---|---|
| A = 500pcs | B = 2,500pcs | C = 10,000pcs | N = 12,500pcs | E = 15,000pcs |
| D = 20,000pcs | G = 25,000pcs | L = 45,000pcs | H = 50,000pcs | J = 60,000pcs |

Example:

| CHIP product | Other products |
|---|---|
| TD = T/R-20,000 | A5 = T/B-5,000 |
| TE = T/R-15,000 | TB = T/R-2,500 |
| T4 = T/R-4,000 | B0 = B/B |

c) For the Forming type products, the $13^{th}$ & $14^{th}$ digits are used to denote the forming types of the product with the following letter codes:

| | |
|---|---|
| MF = M type with Flattened lead wire | F0 = F type |
| MK = M type with Kinked lead wire | F1 = F1 type |
| ML = M type with normal lead wire | F2 = F2 type |
| MC = M type with kinked lead wire | F3 = F3 type |

d) For power rating over 100watt, the $12^{th}$ to the $14^{th}$ digits are to denote the actual wattage of the products:
Example: 100 = 100watt 150 = 150watt 225 = 225watt

e) For some products, the $14^{th}$ digit alone can use to denote special features or additional information with the following codes:

| | | |
|---|---|---|
| P = Panasert type | 1 = Avisert 1 type | 2 = Avisert 2 type |
| 3 = Avisert 3 type | A = CO 1/4W - A type | B = CO 1/4W - B type |

E = used to denote the "Environment Protection, lead Free type" of SMD category resistors (now, this became the Standard type of SMD)

f) For some products, the 14th digit alone can use to denote special features or additional information with the following codes:
B=1/32W G=1/16W F=1/10W G=1/8W H=1/6W J=1/4W K=1/3W M=1/2W
N=3/4W P=1W S=Special