

## Type CPF-A Series

### Key Features

AEC-Q200

Compliance

Advanced thin  
film technology

RoHS compliant

Special  
materials,  
design, and  
processing for  
high sulfur  
applications

Test proven  
immunity to  
humidity,  
moisture, and  
sulfur

Moisture  
sensitivity  
level - MSL1

### Applications

Automotive

Medical

Testing /  
Measurement

Communication



TE Connectivity are pleased to introduce the sister of our CPF thin film chip resistor, the AEC-Q200 compliant CPF-A series. Supplied on tape and reel for ease of insertion, and available in 7 sizes / power ratings up to 0.5W.

**Note:** SMD (Surface mount devices) resistors and inductors should be kept in their original packaging to protect them from ESD (Electrostatic Discharge). The full reels can be broken into smaller quantities, without exposing them to ESD, as long as the components are still in the plastic or paper tape. These resistors and inductors should not be removed from the plastic or paper tape unless they are in an ESD protected environment.

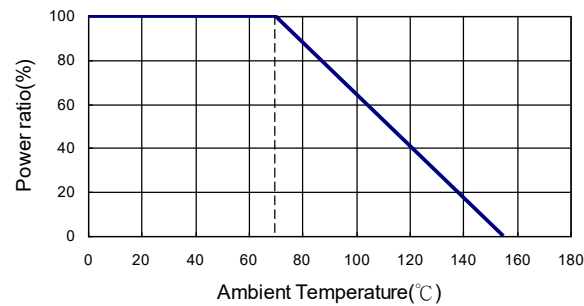
### Characteristics – Electrical

| Size | Power Rating<br>@70°C | Operating Temp. Range | Max. Operating Voltage | Max. Overload Voltage | Resistance Range |                |       |     | TCR<br>PPM/°C |
|------|-----------------------|-----------------------|------------------------|-----------------------|------------------|----------------|-------|-----|---------------|
|      |                       |                       |                        |                       | ±0.05%           | ±0.1%          | ±0.5% | ±1% |               |
| 0402 | 0.0625W               | -55 ~ +155°C          | 25V                    | 50V                   | 49.9Ω - 10KΩ     | 49.9Ω - .. K Ω |       |     | ±25<br>±50    |
| 0603 | 0.0625W               | -55 ~ +155°C          | 50V                    | 100V                  | Ω - 9.9 KΩ       | Ω - 332KΩ      |       |     | ±25<br>±50    |
| 0805 | 0.1W                  | -55 ~ +155°C          | 100V                   | 200V                  | Ω - K Ω          | Ω - M Ω        |       |     | ±25<br>±50    |
| 1206 | 0.125W                | -55 ~ +155°C          | 150V                   | 300V                  | Ω - K Ω          | Ω - M Ω        |       |     | ±25<br>±50    |
| 1210 | 0.25W                 | -55 ~ +155°C          | 150V                   | 300V                  | Ω - 99K Ω        | Ω - M Ω        |       |     | ±25<br>±50    |
| 2010 | 0.25W                 | -55 ~ +155°C          | 150V                   | 300V                  | Ω - 99K Ω        | Ω - M Ω        |       |     | ±25<br>±50    |
| 2512 | 0.5W                  | -55 ~ +155°C          | 150V                   | 300V                  | Ω - 99K Ω        | Ω - M Ω        |       |     | ±25<br>±50    |

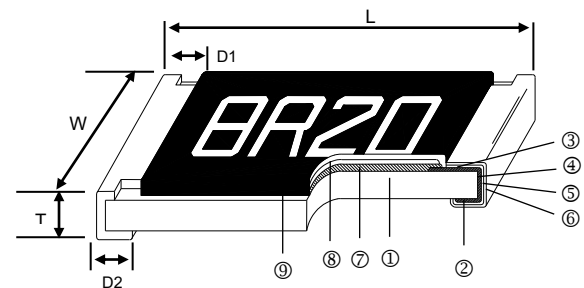
Operating Voltage= $\sqrt{P \cdot R}$  or Max. operating voltage listed above, whichever is lower.

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

Derating Curve



Construction and dimensions



|   |                              |   |                         |   |                       |
|---|------------------------------|---|-------------------------|---|-----------------------|
| ① | Alumina Substrate            | ④ | Edge Electrode (NiCr)   | ⑦ | Resistor Layer (NiCr) |
| ② | Bottom Electrode (Ag)        | ⑤ | Barrier Layer (Ni)      | ⑧ | Overcoat (Epoxy)      |
| ③ | Top Electrode ( Ag-Pd or Cu) | ⑥ | External Electrode (Sn) | ⑨ | Marking               |

| Size | L         | W         | T         | D1        | D2        | Weight<br>(g)<br>(1000pcs) |
|------|-----------|-----------|-----------|-----------|-----------|----------------------------|
| 0402 | 1.00±0.05 | 0.50±0.05 | 0.30±0.05 | 0.20±0.10 | 0.20±0.10 | 0.54                       |
| 0603 | 1.55±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 | 1.83                       |
| 0805 | 2.00±0.15 | 1.25±0.15 | 0.55±0.10 | 0.30±0.20 | 0.40±0.20 | 4.71                       |
| 1206 | 3.05±0.15 | 1.55±0.15 | 0.55±0.10 | 0.42±0.20 | 0.35±0.25 | 9.02                       |
| 1210 | 3.10±0.15 | 2.40±0.15 | 0.55±0.10 | 0.40±0.20 | 0.55±0.25 | 10                         |
| 2010 | 4.90±0.15 | 2.40±0.15 | 0.55±0.10 | 0.60±0.30 | 0.50±0.25 | 23.61                      |
| 2512 | 6.30±0.15 | 3.10±0.15 | 0.55±0.10 | 0.60±0.30 | 0.50±0.25 | 38.06                      |

## Environmental Characteristics

| Item                                        | Requirement                                                | Test Method                                                                                                                                         |
|---------------------------------------------|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature Coefficient of Resistance (TCR) | As Spec                                                    | JIS-C-5201-1 4.8<br>IEC-60115-1 4.8<br>-55°C~155°C, 25°C is the reference temperature                                                               |
| Short Term Overload                         | $\Delta R \pm 0.05\%$                                      | JIS-C-5201-1 4.13<br>RCWV*2.5 or maximum overload voltage, whichever is lower for 5 seconds                                                         |
| Insulation Resistance                       | $>1000M\Omega$                                             | JIS-C-5201-1 4.6<br>IEC-60115-1 4.6<br>Apply 100vdc for 1 minute                                                                                    |
| Operational Life                            | $\Delta R \pm 0.2\%$                                       | MIL-STD-202 method 108<br>Condition D steady state $T_A=125^\circ\text{C}$ at rated power. Measurement taken $24 \pm 4$ hours after test conclusion |
| Biased Humidity                             | $\Delta R \pm 0.1\%$                                       | MIL-STD-202 method 103<br>1000 hours $85^\circ\text{C}$ 85%RH 10% of operating power                                                                |
| High Temperature Exposure                   | $\Delta R \pm 0.2\%$                                       | MIL-STD-202 method 108<br>At $155^\circ\text{C}$ for 1000 Hours                                                                                     |
| Temperature Cycling                         | $\Delta R \pm 0.1\%$                                       | JESD-22 method JA- 104                                                                                                                              |
| Bending Strength (Board Flex)               | $\Delta R \pm 0.1\%$                                       | JIS-C-5201-1 4.33<br>Bending once for 60 seconds<br>Bending displacement<br>2010 / 2512 = 2mm<br>Other sizes = 3mm                                  |
| Solderability                               | 95% min. coverage                                          | JIS-C-5201-1 4.17<br>IEC-60115-1 4.17<br>$245 \pm 5^\circ\text{C}$ for 3 seconds                                                                    |
| Resistance to Soldering Heat                | $\Delta R \pm 0.05\%$                                      | JIS-C-5201-1 4.18<br>IEC-60115-1 4.18<br>$260 \pm 5^\circ\text{C}$ for 10 seconds                                                                   |
| Terminal Strength                           | Not Broken                                                 | AEC-Q200-006<br>Force of 1.8kg for 60 seconds.                                                                                                      |
| Mechanical Shock                            | $\Delta R \pm 0.1\%$                                       | MIL-STD-202 method 213<br>Wave Form: Tolerance for half sine shock pulse. Peak value 100g's. Normal duration (D) is 6                               |
| Vibration                                   | $\Delta R \pm 0.1\%$                                       | MIL-STD-202 method 204<br>5 g's for 20 minutes. 12 cycles each of 3 orientations.<br>10 ~ 2000 Hz                                                   |
| ESD                                         | $\Delta R \pm 0.1\%$                                       | AEC-Q200-002<br>Human body 2KV                                                                                                                      |
| Resistance to Solvents                      | Marking undamaged                                          | MIL-STD-202 method 215<br>Add aqueous wash chemical – OKEM<br>Clean or equivalent. Do not use banned solvents.                                      |
| Sulfur Test                                 | $\Delta R \pm 1\%$                                         | EIA-997 (condition B)<br>$105 \pm 2^\circ\text{C}$ no power rating for 750 hours                                                                    |
| Flammability                                | No ignition of tissue paper or scorching of pinewood board | UL94<br>V-0 or V-1 are acceptable. No electrical testing required                                                                                   |

RCWV (rated continuous working voltage)= $\sqrt{P \cdot R}$  or Max. operating voltage listed above, whichever is lower

**Marking:**

0603 3digit marking for E96



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

**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               | H               | X                | Y                | Z                |
| Multiplier | 10 <sup>0</sup> | 10 <sup>1</sup> | 10 <sup>2</sup> | 10 <sup>3</sup> | 10 <sup>4</sup> | 10 <sup>5</sup> | 10 <sup>6</sup> | 10 <sup>7</sup> | 10 <sup>-1</sup> | 10 <sup>-2</sup> | 10 <sup>-3</sup> |

0603 3digit marking for E24

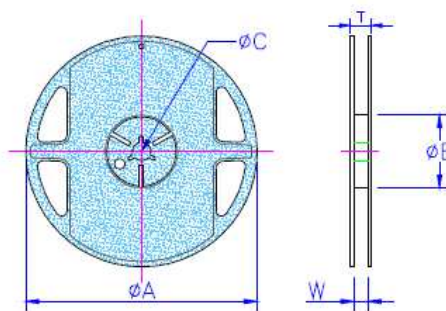
Example: 101=100Ω 102=1KΩ

|     |    |    |    |    |    |    |    |    |    |    |    |    |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|
| E24 | 10 | 11 | 12 | 13 | 15 | 16 | 18 | 20 | 22 | 24 | 27 | 30 |
|     | 33 | 36 | 39 | 43 | 47 | 51 | 56 | 62 | 68 | 75 | 92 | 91 |

0805~2512 4digit marking

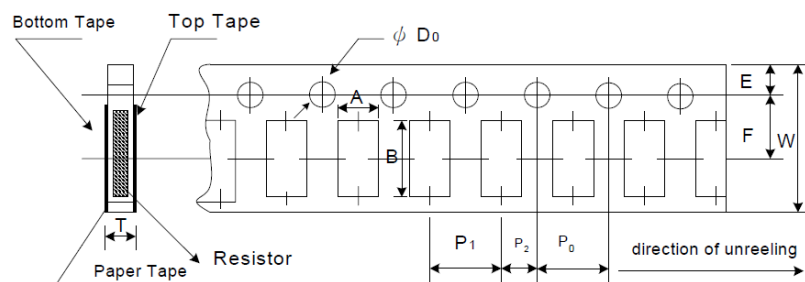
| Resistance | 100Ω | 2.2KΩ | 10KΩ | 49.9KΩ | 100KΩ |
|------------|------|-------|------|--------|-------|
| marking    | 1000 | 2201  | 1002 | 4992   | 1003  |

### Packaging Quantity and reel specifications



| Type | $\phi A$        | $\phi B$       | $\phi C$       | W              | T              | Paper Tape (EA) | Emboss Plastic Tape (EA) |
|------|-----------------|----------------|----------------|----------------|----------------|-----------------|--------------------------|
| 0402 | 178.0 $\pm$ 1.0 | 60.0 $\pm$ 1.0 | 13.5 $\pm$ 0.7 | 9.5 $\pm$ 1.0  | 11.5 $\pm$ 1.0 | 1,000 / 5,000   | -                        |
| 0603 | 178.0 $\pm$ 1.0 | 60.0 $\pm$ 1.0 | 13.5 $\pm$ 0.7 | 9.5 $\pm$ 1.0  | 11.5 $\pm$ 1.0 | 1,000 / 5,000   | -                        |
| 0805 | 178.0 $\pm$ 1.0 | 60.0 $\pm$ 1.0 | 13.5 $\pm$ 0.7 | 9.5 $\pm$ 1.0  | 11.5 $\pm$ 1.0 | 1,000 / 5,000   | -                        |
| 1206 | 178.0 $\pm$ 1.0 | 60.0 $\pm$ 1.0 | 13.5 $\pm$ 0.7 | 9.5 $\pm$ 1.0  | 11.5 $\pm$ 1.0 | 1,000 / 5,000   | -                        |
| 1210 | 178.0 $\pm$ 1.0 | 60.0 $\pm$ 1.0 | 13.5 $\pm$ 0.7 | 9.5 $\pm$ 1.0  | 11.5 $\pm$ 1.0 | 1,000 / 5,000   | -                        |
| 2010 | 178.0 $\pm$ 1.0 | 60.0 $\pm$ 1.0 | 13.5 $\pm$ 0.7 | 13.5 $\pm$ 1.0 | 15.5 $\pm$ 1.0 | -               | 4,000                    |
| 2512 | 178.0 $\pm$ 1.0 | 60.0 $\pm$ 1.0 | 13.5 $\pm$ 0.7 | 13.5 $\pm$ 1.0 | 15.5 $\pm$ 1.0 | -               | 4,000                    |

### Paper Tape Specifications

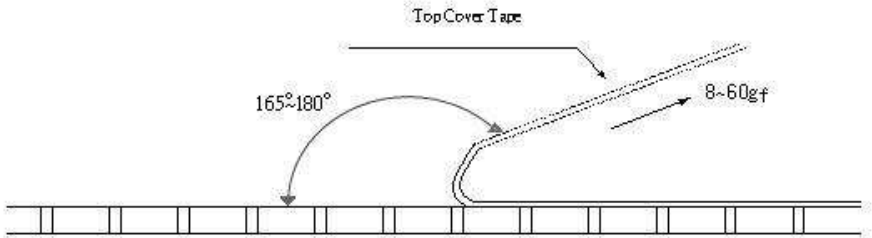


| Type | A               | B              | W               | E               | F              | P <sub>0</sub>  | P <sub>1</sub>  | P <sub>2</sub>  | $\phi D_0$      | T               |
|------|-----------------|----------------|-----------------|-----------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 0402 | 0.70 $\pm$ 0.05 | 1.16 $\pm$ 0.0 | 8.00 $\pm$ 0.10 | 1.75 $\pm$ 0.05 | 3.5 $\pm$ 0.05 | 4.00 $\pm$ 0.10 | 2.00 $\pm$ 0.05 | 2.00 $\pm$ 0.05 | 1.55 $\pm$ 0.05 | 0.40 $\pm$ 0.03 |
| 0603 | 1.10 $\pm$ 0.05 | 1.90 $\pm$ 0.0 | 8.00 $\pm$ 0.10 | 1.75 $\pm$ 0.05 | 3.5 $\pm$ 0.05 | 4.00 $\pm$ 0.10 | 4.00 $\pm$ 0.10 | 2.00 $\pm$ 0.05 | 1.55 $\pm$ 0.05 | 0.60 $\pm$ 0.03 |
| 0805 | 1.60 $\pm$ 0.05 | 2.37 $\pm$ 0.0 | 8.00 $\pm$ 0.10 | 1.75 $\pm$ 0.05 | 3.5 $\pm$ 0.05 | 4.00 $\pm$ 0.10 | 4.00 $\pm$ 0.10 | 2.00 $\pm$ 0.05 | 1.55 $\pm$ 0.05 | 0.75 $\pm$ 0.05 |
| 1206 | 2.00 $\pm$ 0.05 | 3.55 $\pm$ 0.0 | 8.00 $\pm$ 0.10 | 1.75 $\pm$ 0.05 | 3.5 $\pm$ 0.05 | 4.00 $\pm$ 0.10 | 4.00 $\pm$ 0.10 | 2.00 $\pm$ 0.05 | 1.55 $\pm$ 0.05 | 0.75 $\pm$ 0.05 |
| 1210 | 2.75 $\pm$ 0.05 | 3.40 $\pm$ 0.0 | 8.00 $\pm$ 0.10 | 1.75 $\pm$ 0.05 | 3.5 $\pm$ 0.05 | 4.00 $\pm$ 0.05 | 4.00 $\pm$ 0.10 | 2.00 $\pm$ 0.05 | 1.60 $\pm$ 0.10 | 0.75 $\pm$ 0.05 |

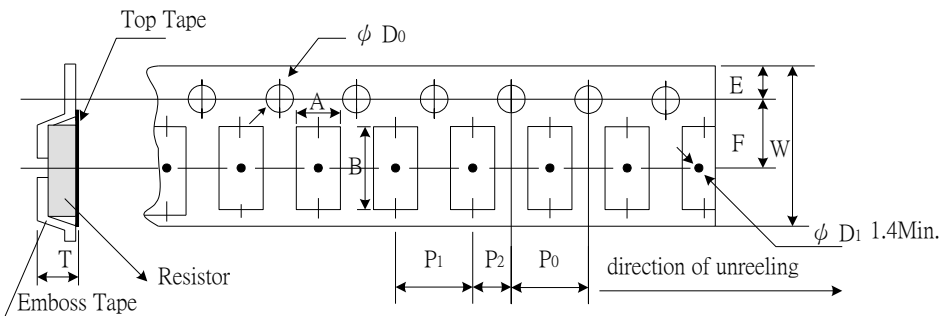
Peel force of top cover tape

The peel speed shall be about 300mm/min±5%

The peel force of top cover tape shall be between 8gf to 60gf



Embossed Plastic Tape Specifications

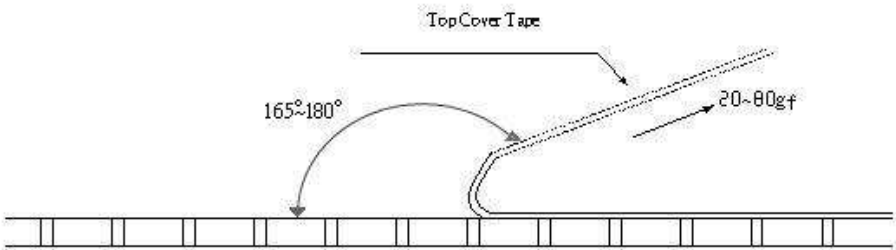


| Type | A         | B         | W         | E         | F        | P <sub>0</sub> | P <sub>1</sub> | P <sub>2</sub> | ØD <sub>0</sub> | T         |
|------|-----------|-----------|-----------|-----------|----------|----------------|----------------|----------------|-----------------|-----------|
| 2010 | 2.85±0.10 | 5.45±0.10 | 12.0±0.10 | 1.75±0.10 | 5.5±0.05 | 4.00±0.05      | 4.00±0.10      | 2.00±0.05      | 1.50±0.10       | 1.00±0.20 |
| 2512 | 3.40±0.10 | 6.65±0.10 | 12.0±0.10 | 1.75±0.10 | 5.5±0.05 | 4.00±0.05      | 4.00±0.10      | 2.00±0.05      | 1.50±0.10       | 1.00±0.20 |

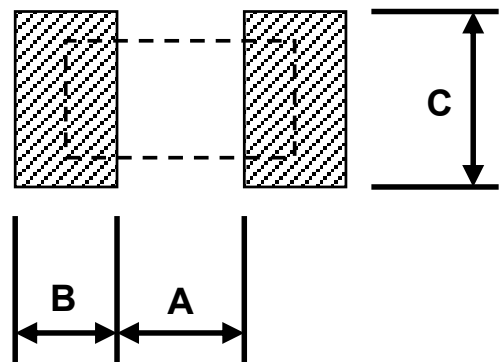
Peel force of top cover tape

The peel speed shall be about 300mm/min±5%

The peel force of top cover tape shall be between 20gf to 80g



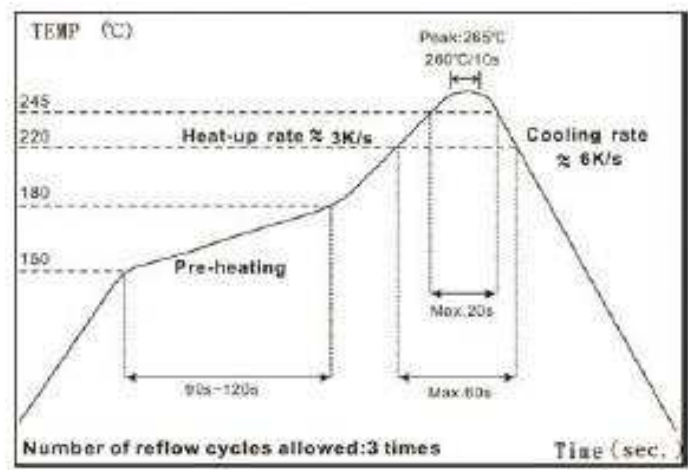
Recommended Land Pattern



| Type | A    | B    | C        |
|------|------|------|----------|
| 0402 | 0.50 | 0.50 | 0.60±0.2 |
| 0603 | 0.80 | 1.00 | 0.90±0.2 |
| AR05 | 1.00 | 1.00 | 1.35±0.2 |
| AR06 | 2.00 | 1.15 | 1.70±0.2 |
| AR13 | 2.00 | 1.15 | 2.50±0.2 |
| AR10 | 3.60 | 1.40 | 2.50±0.2 |
| AR12 | 4.90 | 1.60 | 3.10±0.2 |

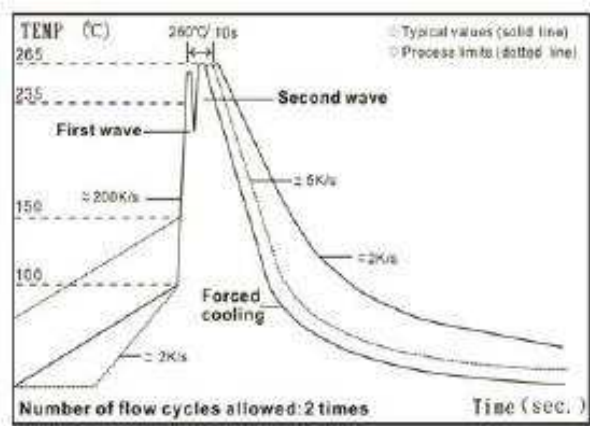
Solder Profile

IR Reflow Soldering



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

Wave Soldering (Flow Soldering)



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

Hand Soldering

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

How To Order

| CPF-A                                                      | 0805         |      | B         | 1K0             | E         | 1          |
|------------------------------------------------------------|--------------|------|-----------|-----------------|-----------|------------|
| Common Part                                                | Package Size |      | Tolerance | Value           | TCR       | Packagin g |
| CPF-A<br>Automotive<br>Grade<br>precision<br>chip resistor | 0402         | 1206 | B - ±0.1% | 100R - 100Ω     | E - 25PPM | 1 – 1K     |
|                                                            | 0603         | 1210 | D - ±0.5% | 1K0 -           | C - 50PPM | REEL       |
|                                                            | 0805         | 2010 | F - ±1%   | 1000Ω           |           | Blank –    |
|                                                            |              | 2512 |           | 10K –<br>, 000Ω |           | 5K REEL    |