

Type CPF Series

Key Features

- Thin film precision resistors with TC's of 15ppm, 25ppm and 50ppm and tolerances to 0.1%. Applications in measurement, telemetry and for sensing circuits.
- Wide range of case sizes from 0201 to 2512
- CPF chip resistors are suitable for all applications where close accuracy and stability are essential
- Terminal finish - electroplated 100% matte Sn
- MSL Level 2



Applications

- Communications
- Industrial Controls
- Instrumentation
- Medical

The CPF series is a high stability precision chip resistor range offering various power dissipations relating to a wide range of chip sizes. The CPF series offers TCR's down to 15ppm/°C and resistance tolerances to 0.1%. Standard values are within the IEC 63 E96 and E24 value grids. The CPF has accurate and uniform physical dimensions to facilitate placement.

Characteristics - Electrical

| | 0201 | | | | 0402 | | | | | | | | |
|--------------------------------|---------------|------|------|------|---------------|-----|------|------|-----|------|------|-----|------|
| Rated Power @ 70°C: | 0.03125W | | | | 0.063W | | | | | | | | |
| Resistance Range (Ohms) | Min: | 49R9 | 49R9 | 49R9 | 49R9 | 10R | 10R | 49R9 | 10R | 1R0 | 49R9 | 10R | 1R0 |
| | Max: | 5K0 | 33K | 5K0 | 33K | 70K | 255K | 205K | 70K | 255K | 205K | 70K | 255K |
| Tolerance (%): | 0.5 | | 1 | | 0.1 | | | 0.5 | | | 1 | | |
| Code letter: | D | | F | | B | | | D | | | F | | |
| Selection Series: | E24 & E96 | | | | E24 & E96 | | | | | | | | |
| Temp. Coefficient (ppm/°C): | 25 | 50 | 25 | 50 | 15 | 25 | 50 | 15 | 25 | 50 | 15 | 25 | 50 |
| Code Letter: | E | C | E | C | D | E | C | D | E | C | D | E | C |
| Limiting Element Voltage: | 15V | | | | 25V | | | | | | | | |
| Max. Overload Voltage: | 30V | | | | 50V | | | | | | | | |
| Operating Temp. Range: | -55 to +155°C | | | | -55 to +155°C | | | | | | | | |
| Climatic Category (°C): | 55/125/55 | | | | 55/125/55 | | | | | | | | |
| Insulation Resistance Dry Min: | 1000MΩ | | | | 1000MΩ | | | | | | | | |
| Stability: | 0.5% | | | | 0.5% | | | | | | | | |

| | 0603 | | | | | | 0805 | | | | | | | | |
|--------------------------------|---------------|------|-----|------|-----|------|---------------|------|-----|------|-----|------|-----|----|----|
| Rated Power @ 70°C: | 0.063W | | | | | | 0.1W | | | | | | | | |
| Resistance Range (Ohms) | Min: | 4R7 | 4R7 | 4R7 | 2R0 | 4R7 | 2R0 | 4R3 | 4R7 | 4R3 | 1R0 | 4R3 | 1R0 | | |
| | Max: | 332K | 1M0 | 332K | 1M0 | 332K | 1M0 | 511K | 2M0 | 511K | 2M0 | 511K | 2M0 | | |
| Tolerance (%): | 0.1 | | 0.5 | | 1 | | 0.1 | | 0.5 | | 1 | | | | |
| Code letter: | B | | D | | F | | B | | D | | F | | | | |
| Selection Series: | E24 & E96 | | | | | | E24 & E96 | | | | | | | | |
| Temp. Coefficient (ppm/°C): | 15 | 25 | 50 | 15 | 25 | 50 | 15 | 25 | 50 | 15 | 25 | 50 | 15 | 25 | 50 |
| Code Letter: | D | E | C | D | E | C | D | E | C | D | E | C | D | E | C |
| Limiting Element Voltage: | 50V | | | | | | 100V | | | | | | | | |
| Max. Overload Voltage: | 100V | | | | | | 200V | | | | | | | | |
| Operating Temp. Range: | -55 to +155°C | | | | | | -55 to +155°C | | | | | | | | |
| Climatic Category (°C): | 55/125/55 | | | | | | 55/125/55 | | | | | | | | |
| Insulation Resistance Dry Min: | 1000MΩ | | | | | | 1000MΩ | | | | | | | | |
| Stability: | 0.5% | | | | | | 0.5% | | | | | | | | |

Type CPF Series

| | 1206 | | | | | | 1210 | | | | | | | | |
|--------------------------------|---------------|-----|-----|-----|-----|-----|---------------|-----|-----|-----|-----|-----|-----|----|----|
| Rated Power @ 70°C: | 0.125W | | | | | | 0.2W | | | | | | | | |
| Resistance Range (Ohms) | Min: | 4R7 | 4R7 | 4R7 | 1R0 | 4R7 | 1R0 | 4R7 | 4R7 | 4R7 | 1R0 | 4R7 | 1R0 | | |
| | Max: | 1M0 | 2M5 | 1M0 | 2M5 | 1M0 | 2M5 | 1M0 | 2M5 | 1M0 | 2M5 | 1M0 | 2M5 | | |
| Tolerance (%): | 0.1 | | 0.5 | | 1 | | 0.1 | | 0.5 | | 1 | | | | |
| Code Letter: | B | | D | | F | | B | | D | | F | | | | |
| Selection Series: | E24 & E96 | | | | | | E24 & E96 | | | | | | | | |
| Temp. Coefficient (ppm/°C): | 15 | 25 | 50 | 15 | 25 | 50 | 15 | 25 | 50 | 15 | 25 | 50 | 15 | 25 | 50 |
| Code Letter: | D | E | C | D | E | C | D | E | C | D | E | C | D | E | C |
| Limiting Element Voltage: | 150V | | | | | | 150V | | | | | | | | |
| Max. Overload Voltage: | 300V | | | | | | 300V | | | | | | | | |
| Operating Temp. Range: | -55 to +155°C | | | | | | -55 to +155°C | | | | | | | | |
| Climatic Category (°C): | 55/125/55 | | | | | | 55/125/55 | | | | | | | | |
| Insulation Resistance Dry Min: | 1000MΩ | | | | | | 1000MΩ | | | | | | | | |
| Stability: | 0.5% | | | | | | 0.5% | | | | | | | | |

| | 2010 | | | | | | 2512 | | | | | | | | |
|--------------------------------|---------------|-----|-----|-----|-----|-----|---------------|-----|-----|-----|-----|-----|-----|----|----|
| Rated Power @ 70°C: | 0.25W | | | | | | 0.5W | | | | | | | | |
| Resistance Range (Ohms) | Min: | 4R7 | 4R7 | 4R7 | 1R0 | 4R7 | 1R0 | 4R7 | 4R7 | 4R7 | 1R0 | 4R7 | 1R0 | | |
| | Max: | 1M0 | 3M0 | 1M0 | 3M0 | 1M0 | 3M0 | 1M0 | 3M0 | 1M0 | 3M0 | 1M0 | 3M0 | | |
| Tolerance (%): | 0.1 | | 0.5 | | 1 | | 0.1 | | 0.5 | | 1 | | | | |
| Code letter: | B | | D | | F | | B | | D | | F | | | | |
| Selection Series: | E24 & E96 | | | | | | E24 & E96 | | | | | | | | |
| Temp. Coefficient (ppm/°C): | 15 | 25 | 50 | 15 | 25 | 50 | 15 | 25 | 50 | 15 | 25 | 50 | 15 | 25 | 50 |
| Code Letter: | D | E | C | D | E | C | D | E | C | D | E | C | D | E | C |
| Limiting Element Voltage: | 150V | | | | | | 150V | | | | | | | | |
| Max. Overload Voltage: | 300V | | | | | | 300V | | | | | | | | |
| Operating Temp. Range: | -55 to +155°C | | | | | | -55 to +155°C | | | | | | | | |
| Climatic Category (°C): | 55/125/55 | | | | | | 55/125/55 | | | | | | | | |
| Insulation Resistance Dry Min: | 1000MΩ | | | | | | 1000MΩ | | | | | | | | |
| Stability: | 0.5% | | | | | | 0.5% | | | | | | | | |

Characteristics - Environmental

| Item | Requirement | | Test Method |
|--|---|-----------------------|---|
| | Tol. ≤ 0.05% | Tol. > 0.05% | |
| Temperature Coefficient of Resistance (TCR): | AS per TCRs specified in value range table on page 1 | | +25/-55/+25/+125/+25°C |
| Short Time Overload: | $\Delta R \pm 0.05\%$ | $\Delta R \pm 0.2\%$ | RCWV* 2.5 or max. overload voltage for 5 seconds |
| Insulation Resistance: | $\Delta R \pm 0.2\%$ for high power rating >1000MΩ | | Apply 100VDC for 1 minute |
| Endurance: | $\Delta R \pm 0.05\%$ | $\Delta R \pm 0.2\%$ | 70 ±2°C, max. working voltage for 1000hrs with 1.5hrs "ON" and 0.5 hrs "OFF" |
| Damp Heat with Load: | $\Delta R \pm 0.05\%$ | $\Delta R \pm 0.3\%$ | 40 ±2°C, 90 - 95% R.H. max. working voltage hrs with 1.5hrs "ON" and 0.5hrs "OFF" |
| Bending Strength: | $\Delta R \pm 0.05\%$ | $\Delta R \pm 0.2\%$ | Bending amplitude 3mm for 10 seconds |
| Solderability: | 95% min. coverage | | 245 ±5°C for 3 seconds |
| Resistance to Soldering Heat: | $\Delta R \pm 0.05\%$ | $\Delta R \pm 0.2\%$ | 260 ±5°C for 10 seconds |
| Dielectric Withstand Voltage: | By Type | | Max. overload voltage for 1 minute |
| Thermal Shock: | $\Delta R \pm 0.05\%$ | $\Delta R \pm 0.25\%$ | -55°C to +150°C, 100 cycles |
| Low Temperature Operation: | $\Delta R \pm 0.05\%$ | $\Delta R \pm 0.2\%$ | 1 hour, -65°C, followed by 45 minutes of RCWV |
| | $\Delta R \pm 0.5\%$ for high power rating | | |

Reference Standards: MIL-STD-202, JIS-C 5201-1

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

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Marking Codes - Case Sizes 0805 to 2512

IEC 4 Digit Marking

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

Case Sizes 0603

E24 3 Digit Marking - 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 | 82 | 91 |

E96 3 Digit Marking - Examples: 14C=13K7Ω, 13C=13K3Ω, 68B=4K99Ω, 68X=49.9Ω



0603 E96 Marking Code 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 ⁰ | 10 ¹ | 10 ² | 10 ³ | 10 ⁴ | 10 ⁵ | 10 ⁶ | 10 ⁷ | 10 ⁻¹ | 10 ⁻² | 10 ⁻³ |

Type CPF Series

Power Derating Curve



For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with this curve.

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) | 6. External Electrode (Sn) | 9. Marking |

| Part Number | L | W | H | a | b | Weight (g) 1000 pieces |
|-------------|------------|------------|------------|------------|------------|---------------------------|
| CPF0201 | 0.58 ±0.05 | 0.29 ±0.05 | 0.23 ±0.05 | 0.12 ±0.05 | 0.15 ±0.05 | 0.14 |
| CPF0402 | 1.00 ±0.05 | 0.50 ±0.05 | 0.30 ±0.05 | 0.20 ±0.10 | 0.20 ±0.10 | 0.54 |
| CPF0603 | 1.55 ±0.10 | 0.80 ±0.10 | 0.45 ±0.10 | 0.30 ±0.20 | 0.30 ±0.20 | 1.83 |
| CPF0805 | 2.00 ±0.15 | 1.25 ±0.15 | 0.55 ±0.10 | 0.30 ±0.20 | 0.40 ±0.25 | 4.71 |
| CPF1206 | 3.05 ±0.15 | 1.55 ±0.15 | 0.55 ±0.10 | 0.42 ±0.20 | 0.35 ±0.25 | 9.02 |
| CPF1210 | 3.10 ±0.15 | 2.40 ±0.15 | 0.55 ±0.10 | 0.40 ±0.20 | 0.55 ±0.25 | 10.00 |
| CPF2010 | 4.90 ±0.15 | 2.40 ±0.15 | 0.55 ±0.10 | 0.60 ±0.30 | 0.50 ±0.25 | 23.61 |
| CPF2512 | 6.30 ±0.15 | 3.10 ±0.15 | 0.55 ±0.10 | 0.60 ±0.30 | 0.50 ±0.25 | 38.08 |

Recommend Land Pattern



| Type | A | B | C |
|---------|------|------|-----------|
| CPF0201 | 0.25 | 0.3 | 0.40 ±0.2 |
| CPF0402 | 0.5 | 0.5 | 0.60 ±0.2 |
| CPF0603 | 0.8 | 1.0 | 0.90 ±0.2 |
| CPF0805 | 1.0 | 1.0 | 1.35 ±0.2 |
| CPF1206 | 2.0 | 1.15 | 1.70 ±0.2 |
| CPF1210 | 2.0 | 1.15 | 2.50 ±0.2 |
| CPF2010 | 3.6 | 1.4 | 2.50 ±0.2 |
| CPF2512 | 4.9 | 1.6 | 3.10 ±0.2 |

Type CPF Series

Packaging Quantity & Reel Specifications



| Type | øA | øB | øC | W | T | Paper Tape (EA) | Embossed Plastic Tape (EA) |
|---------|------------|-----------|-----------|-----------|-----------|-----------------|----------------------------|
| CPF0201 | 178.0 ±1.0 | 60.0 +1.0 | 13.5 ±0.7 | 9.5 ±1.0 | 11.5 ±1.0 | 1000 / 5000 | - |
| CPF0402 | 178.0 ±1.0 | 60.0 +1.0 | 13.5 ±0.7 | 9.5 ±1.0 | 11.5 ±1.0 | 1000 / 5000 | - |
| CPF0603 | 178.0 ±1.0 | 60.0 +1.0 | 13.5 ±0.7 | 9.5 ±1.0 | 11.5 ±1.0 | 1000 / 5000 | - |
| CPF0805 | 178.0 ±1.0 | 60.0 +1.0 | 13.5 ±0.7 | 9.5 ±1.0 | 11.5 ±1.0 | 1000 / 5000 | - |
| CPF1206 | 178.0 ±1.0 | 60.0 +1.0 | 13.5 ±0.7 | 9.5 ±1.0 | 11.5 ±1.0 | 1000 / 5000 | - |
| CPF1210 | 178.0 ±1.0 | 60.0 +1.0 | 13.5 ±0.7 | 9.5 ±1.0 | 11.5 ±1.0 | 1000 / 5000 | - |
| CPF2010 | 178.0 ±1.0 | 60.0 +1.0 | 13.5 ±0.7 | 13.5 ±1.0 | 15.5 ±1.0 | - | 4000 |
| CPF2512 | 178.0 ±1.0 | 60.0 +1.0 | 13.5 ±0.7 | 13.5 ±1.0 | 15.5 ±1.0 | - | 4000 |

Paper Tape Specification



| Type | A | B | W | E | F | P ₀ | P ₁ | P ₂ | øD ₀ | T |
|---------|------------|------------|------------|------------|-----------|----------------|----------------|----------------|-----------------|------------|
| CPF0201 | 0.40 ±0.05 | 0.70 ±0.05 | 8.00 ±0.10 | 1.75 ±0.05 | 3.5 ±0.05 | 4.00 ±0.10 | 2.00 ±0.05 | 2.00 ±0.05 | 1.55 ±0.03 | 0.42 ±0.02 |
| CPF0402 | 0.70 ±0.05 | 1.16 ±0.05 | 8.00 ±0.10 | 1.75 ±0.05 | 3.5 ±0.05 | 4.00 ±0.10 | 2.00 ±0.05 | 2.00 ±0.05 | 1.55 ±0.05 | 0.40 ±0.03 |
| CPF0603 | 1.10 ±0.05 | 1.90 ±0.05 | 8.00 ±0.10 | 1.75 ±0.05 | 3.5 ±0.05 | 4.00 ±0.10 | 4.00 ±0.10 | 2.00 ±0.05 | 1.55 ±0.05 | 0.60 ±0.03 |
| CPF0805 | 1.60 ±0.05 | 2.37 ±0.05 | 8.00 ±0.10 | 1.75 ±0.05 | 3.5 ±0.05 | 4.00 ±0.10 | 4.00 ±0.10 | 2.00 ±0.05 | 1.55 ±0.05 | 0.75 ±0.05 |
| CPF1206 | 2.00 ±0.05 | 3.55 ±0.05 | 8.00 ±0.10 | 1.75 ±0.05 | 3.5 ±0.05 | 4.00 ±0.10 | 4.00 ±0.10 | 2.00 ±0.05 | 1.55 ±0.05 | 0.75 ±0.05 |
| CPF1210 | 2.75 ±0.05 | 3.40 ±0.05 | 8.00 ±0.10 | 1.75 ±0.05 | 3.5 ±0.05 | 4.00 ±0.05 | 4.00 ±0.10 | 2.00 ±0.05 | 1.60 ±0.10 | 0.75 ±0.05 |

Type CPF Series

Embossed Plastic Tape Specifications



| Type | A | B | W | E | F | P ₀ | P ₁ | P ₂ | øD ₀ | T |
|---------|------------|------------|------------|------------|-----------|----------------|----------------|----------------|-----------------|------------|
| CPF2010 | 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 |
| CPF2512 | 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 |

How to Order

| CPF | 0603 | B | 100R | E | 1 |
|------------------------------------|--|-------------------------------------|---|-------------------------------------|--------------------------------|
| Common Part | Package Size | Tolerance | Value | TCR | Packaging |
| CPF - Chip precision film resistor | 0201 1206 0402 1210 0603 2010 0805 2512 | B - ± 0.1% D - ±0.5% F - ± 1% | 100R (100 Ohms) 1K0 (1000 Ohms) 100K (100,000 Ohms) | D - 15ppm E - 25ppm C - 50ppm | 1 - 1K REEL Blank - 5K REEL |

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