

DATA SHEET

High Voltage Chip Resistor

CPH Series

0.5% TO 5%, TCR ± 100 TO ± 200

SIZE: 0603/0805/1206/1210/2010/2512

RoHs Compliant



HIGH VOLTAGE CHIP RESISTOR

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1. SCOPE

- 1.1 This specification is applicable to lead and halogen free CPH series thick film chip resistors.
- 1.2 Lead free products mean lead free termination meets RoHS requirement. Pb contained in glass material of resistor element is exempted by RoHS directive.

2 PART NUMBERING SYSTEM

Part Numbering is made in accordance with the following system:

| | | | | | | |
|-----|----|---|------|---|---|---|
| CPH | 16 | - | XXXX | - | F | K |
|-----|----|---|------|---|---|---|

| Type | Size (Inch / mm) | Nominal Resistance | | Resistance Tolerance | Packaging | |
|--------------------------------|---------------------|--------------------|-------------|---------------------------------------|--|--|
| High Voltage Chip Resistors | 16 (0603/1608) | Resistors | 3- Digit | E24 Series 10Ω=100 100Ω=101 | D = ± 0.5% F = ± 1% G = ± 2% J = ± 5% | E = 4,000 pcs Lead Free L = 5,000 pcs Lead Free K = 10,000 pcs Lead Free |
| | 21 (0805/2012) | | 4- Digit | E96 Series 10.2Ω=10R2 10KΩ=1002 | | |
| | 32 (1206/3216) | | | | | |
| | 40 (1210/3225) | | | | | |
| | 50 (2010/5025) | | | | | |
| | 63 (2512/6432) | | | | | |

3 RATING

3.2 Rated Power

3.1.1 Resistor Rated Power

| Product Type | Power Rating @ 70°C | T.C.R (ppm/°C) Max | Max Working Voltage | Max Overload Voltage |
|----------------------|------------------------|--------------------------|------------------------|----------------------------|
| CPH16 0603 (1608) | 1/10W | ±100 | 350V | 500V |
| | | ±200 | | |
| CPH21 0805 (2012) | 1/8W | ±100 | 400V | 800V |
| | | ±200 | | |
| CPH32 1206 (3216) | 1/4W | ±100 | 500V | 1,000V |
| | | ±200 | | |
| CPH40 1210 (3216) | 1/2W | ±100 | 500V | 1,000V |
| | | ±200 | | |
| CPH50 2010 (5025) | 3/4W | ±100 | 500V | 1,000V |
| | | ±200 | | |
| CPH63 2512 (6432) | 1W | ±100 | 500V | 1,000V |
| | | ±200 | | |



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3.2 Power Derating Characteristics

Rated Power shall be the load power corresponding to nominal wattage suitable for continuous use at 70°C ambient temperatures. In case the ambient temperature exceeds 70°C, reduce the load power in accordance with Derating curve in Fig. 1.

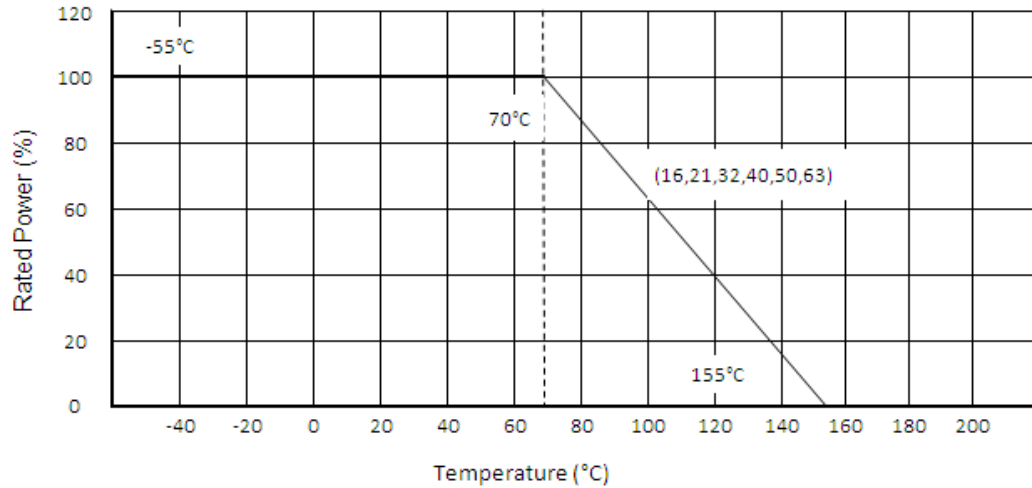


Fig.1 Power Derating Characteristics

3.3 Standard Atmospheric Condition

Unless otherwise specified, the standard range of atmospheric conditions for making measurements and tests is as follows:

Ambient Temperature = + 5°C to +35°C

Relative Humidity = < 85% RH

Air Pressure = 86 kPa to 106kPa

If there may be any doubt about the results, measurement shall be made within the following limits:

Ambient Temperature = 20 ± 2°C

Relative Humidity = 60 to 70% RH

Air Pressure = 86 kPa to 106kPa

3.4 Operating Temperature Range -55°C to +155°C

3.5 Storage Temperature Range -5°C to + 40°C

3.6 Flammability Rating Tested in accordance to UL-94, V-0

3.7 Moisture Sensitivity Level Rating: Level 1

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- 3.8 Product Assurance ASJ resistors shall warranty 24 months from the date of shipment.
- 3.9 ASJ resistors are RoHS compliance in accordance to RoHS Directive 2011/65/EU.
- 3.10 Resistance, Resistance Tolerance and Temperature Coefficient of Resistance.

| Product Type | Power Rating @70°C | TCR (ppm/°C) Max | Resistance Range | | Operating Temperature Range |
|---------------------|--------------------|------------------|-----------------------|--------------------------------|-----------------------------|
| | | | D(±0.5%), F(±1%) E-96 | G(±2%), J(±5%) E-24 | |
| CPH16 0603(1608) | 1/10 W | ±100 | 10Ω ≤ R ≤ 1MΩ | | -55°C + 155°C |
| | | ±200 | 1Ω ≤ R < 10Ω | 1MΩ < R ≤ 10MΩ | |
| CPH21 0805(2012) | 1/8 W | ±100 | 10Ω ≤ R ≤ 1MΩ | | |
| | | ±200 | 1Ω ≤ R < 10Ω | 1MΩ < R ≤ 27MΩ | |
| CPH32 1206(3216) | 1/4 W | ±100 | 10Ω ≤ R ≤ 1MΩ | | |
| | | ±200 | 1Ω ≤ R < 10Ω | 1MΩ < R ≤ 27MΩ | |
| CPH40 1210(3225) | 1/2 W | ±100 | 10Ω ≤ R ≤ 1MΩ | | |
| | | ±200 | 1Ω ≤ R < 10Ω | 1MΩ < R ≤ 27MΩ | |
| CPH50 2010(5025) | 3/4 W | ±100 | 10Ω ≤ R ≤ 1MΩ | | |
| | | ±200 | --- | 1Ω ≤ R < 10Ω 1MΩ < R ≤ 27MΩ | |
| CPH63 2512(6432) | 1 W | ±100 | 10Ω ≤ R ≤ 1MΩ | | |
| | | ±200 | --- | 1Ω ≤ R < 10Ω 1MΩ < R ≤ 27MΩ | |

3.11 Rated Voltage

The rated voltage is calculated from the rated power and nominal resistance by the following formula:

$$E = \sqrt{P \cdot R}$$

Where E : Rated Voltage (V)

P : Rated Power (W)

R : Nominal Resistance (Ω)

In case the value calculated by the formula exceeds the maximum working voltage given in Section 3.1.2, the maximum working voltage in Section 3.1.2 shall be regarded as the rated voltage.

3.12 Document review period: every 3 months



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4 MARKING ON PRODUCT

The nominal resistance shall be marked on the surface of each resistor

| Part Number | Color | Marking on Product |
|-----------------|--------------|---|
| CPH16 (0603) | Light Yellow | 1) Tolerance : $\pm 0.5\%$ (D), $\pm 1.0\%$ (F) <ul style="list-style-type: none"> Four Numerals Marking (E96 Series) 0603 Three Characters Marking based on E-96 marking standard. 2) Tolerance; $\pm 2.0\%$ (G), $\pm 5.0\%$ (J) <ul style="list-style-type: none"> Three Numerals Marking |
| CPH21 (0805) | Light Yellow | |
| CPH32 (1206) | Light Yellow | |
| CPH40 (1210) | Light Yellow | |
| CPH50 (2010) | Light Yellow | |
| CPH63 (2512) | Light Yellow | |

4.1 Numeric Numbering

4.1.1 1% Tolerance : **Four Numerals Marking**

First 3 digits are significant figures; fourth digit is number of zeros.

Examples:

| Nominal Resistance | Marking | Remarks |
|--------------------|---------|-----------------------------|
| 1 Ω | 1R00 | $1 \times 10^0 = 1$ |
| 10 Ω | 10R0 | $10 \times 10^0 = 10$ |
| 100 Ω | 1000 | $100 \times 10^0 = 100$ |
| 4.7K Ω | 4701 | $470 \times 10^1 = 4700$ |
| 47K Ω | 4702 | $470 \times 10^2 = 47000$ |
| 470K Ω | 4703 | $470 \times 10^3 = 470000$ |
| 1M Ω | 1004 | $100 \times 10^4 = 1000000$ |

4.1.1 0603 1% Tolerance: **Three Character E-96 Marking Standard.**

The first 2 digits for the 3 digits E-96 part marking standard, (Refer Table 2 & 3).

The third character is a letter multiplier:

| Nominal resistance | Marking | Remark |
|--------------------|---------|-----------------------------|
| 33.2 Ω | 51 X | $332 \times 10^{-1} \Omega$ |
| 150 Ω | 18 A | $150 \times 10^0 \Omega$ |
| 4.99K Ω | 68 B | $499 \times 10^1 \Omega$ |
| 10.2K Ω | 02 C | $102 \times 10^2 \Omega$ |
| 100K Ω | 01 D | $100 \times 10^3 \Omega$ |

4.1.3.1 EIA-96 Marking Scheme

Table 2 Significant figures

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

Table 3 Multiplier

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

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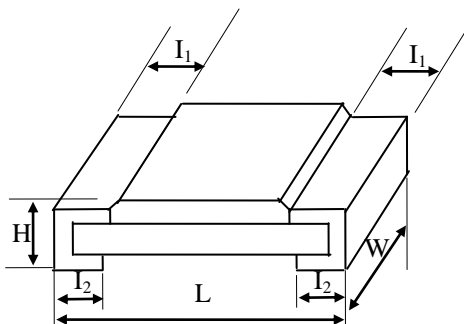
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5 DIMENSIONS, CONSTRUCTIONS AND MATERIALS

5.2 Dimensions



Unit: Inches (Millimeters)

| CODE | L | W | H | I ₁ | I ₂ |
|----------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| CPH16 0603 (1608) | 0.063±0.004 (1.60±0.10) | 0.031±0.004 (0.80±0.10) | 0.018±0.004 (0.45±0.10) | 0.012±0.006 (0.30±0.15) | 0.012±0.006 (0.30±0.15) |
| CPH21 0805 (2012) | 0.079±0.006 (2.00±0.10) | 0.049±0.004 (1.25±0.10) | 0.020±0.004 (0.50±0.10) | 0.014±0.008 (0.35±0.20) | 0.014±0.006 (0.35±0.15) |
| CPH32 1206 (3216) | 0.124±0.004 (3.05±0.10) | 0.061±0.004 (1.55±0.10) | 0.020±0.004 (0.50±0.10) | 0.018±0.008 (0.45±0.20) | 0.014±0.006 (0.35±0.15) |
| CPH40 1210(3225) | 0.124±0.004 (3.05±0.10) | 0.100±0.004 (2.55±0.10) | 0.022±0.004 (0.55±0.10) | 0.020±0.008 (0.50±0.20) | 0.020±0.008 (0.50±0.20) |
| CPH50 2010 (5025) | 0.200±0.008 (5.00±0.20) | 0.098±0.008 (2.50±0.20) | 0.022±0.004 (0.55±0.10) | 0.024±0.008 (0.60±0.20) | 0.024±0.008 (0.60±0.20) |
| CPH63 2512 (6432) | 0.257±0.008 (6.30±0.20) | 0.126±0.008 (3.20±0.20) | 0.022±0.004 (0.55±0.10) | 0.024±0.008 (0.60±0.20) | 0.028±0.008 (0.69±0.20) |

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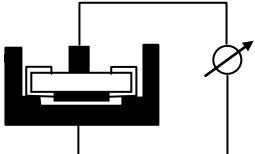
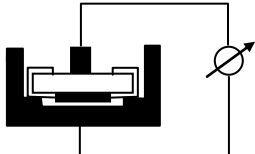
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6 ELECTRICAL CHARACTERISTICS AND TEST CONDITIONS

| CHARACTERISTICS | | SPECIFICATIONS | TESTING CONDITIONS |
|-----------------|------------------------------------|---|---|
| | | Resistance | |
| 1 | Resistance Temperature Coefficient | Refer Section 3.10 Table 1 | <p>MIL-STD-202 Method 304 Measure R at $t_0=25^{\circ}\text{C}$ and after 45 minutes measure R at $t=125^{\circ}\text{C}$. Calculation : $\text{TCR}(\text{ppm}/^{\circ}\text{C}) = \frac{R - R_0}{R_0} \times \frac{1}{t - t_0} \times 10^6$</p> |
| 3 | Short Time Overload | 1%: $\pm(1.0\%+0.05\Omega)$ 2%, 5%: $\pm(2.0\%+0.10\Omega)$ | <p>JIS C 5201-1 4.13 Apply at 2.5 times rated voltage for 5 seconds. Applied voltage shall not exceed maximum overload voltage or current.</p> |
| 4 | Insulation Resistance | > 10G Ω | <p>JIS C 5201-1 4.6 Apply (100 \pm15) VDC for 1 minute. Measured the insulation resistance between electrodes and insulating enclosure or between electrodes and base.</p>  |
| 5 | Dielectric Withstanding Voltage | No failure of resistor such as short-circuit, burning, breakdown. | <p>JIS C 5201-1 4.7 Apply 500VAC for 1 minute \pm 5secs. for chip \geq 0805. Apply 300VAC for 1 minute \pm 5secs. for chip 0603</p>  <p>The variation in relation to the initial resistance shall be within \pm 1%.</p> |



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| | | | |
|----|------------------------------|--|---|
| 6 | Core Body Strength | $\pm(1.0\% + 0.05\Omega)$ | JIS C 5201-1 4.15 Applied R0.5 test probe at its central part then pushing 10N { 1.02Kgf } force on the sample for 10 sec. |
| 8 | Terminal Strength | Test 1 : No evidence of mechanical damage. Test 2 : $\geq 5\text{N}$ | JIS C 5201-1 4.16 Test 1 : The resistor mounted on the board applied 5N pushing force on the sample rear for 10sec. Test 2 : The resistor mounted on the board slowly add force on the sample rear until the sample termination is breakdown. |
| 9 | Resistance to Solvent | $\pm(0.5\% + 0.05\Omega)$ No evidence of mechanical damage. No G2 over coating and Sn layer by leaching. | JIS-C5201-1 4.29 The tested resistor be immersed into isopropyl alcohol of 20~25°C for 5 minutes, then the resistor is left in the room for 48 hrs, and measured its resistance variance rate. |
| 10 | Solderability | $\geq 95\%$ Coverage at all terminal | JIS-C5201-1 4.17 Preconditioning: Put the tested resistor in the apparatus of PCT, at a temperature of 105°C, humidity of 100% RH, and pressure of 1.22×10^5 Pa for a duration of 4 hours. Then after left the tested resistor in room temperature for 2 hours or more. Test method: The resistor be immersed into solder pot in temperature $235 \pm 5^\circ\text{C}$ for 2 sec, then the resistor is left as placed under microscope to observed its solder area. |
| 11 | Resistance to soldering heat | $\Delta R\% = \pm(1.0\% + 0.05\Omega)$ | JIS-C5201-1 4.18 Solder bath method Resistor dipped entirely in solder bath of $260 \pm 5^\circ\text{C}$ for 10 sec. After which the sample shall be left at ambient temperature for 1~ 2 hrs before measurement. |



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| | | | |
|----|---------------------------|--|---|
| 12 | Vibration | 1%: $\pm(0.5\%+0.05\Omega)$ 2%, 5%: $\pm(1.0\%+0.05\Omega)$ | JIS-C5201-1 4.22 The resistor shall be mounted by its terminal leads to the supporting terminals on the solid table. The entire frequency range: from 10 Hz to 55 Hz and return to 10 Hz, shall be transferred in 1 min. Amplitude :1.5 mm This motion shall be applied for a period of 2 hours in each 3 mutually perpendicular directions (a total of 6 hrs) |
| 13 | Low Temperature Operation | 1%: $\pm(0.5\%+0.05\Omega)$ 2%, 5%: $\pm(1.0\%+0.05\Omega)$ | MIL-R-55342D 4.7.4 Put the tested resistor in the chamber at room temperature 25°C. Decreasing the temperature to -55°C and keep the temperature at -55°C for 1 hour. Then load the rated voltage for 45 minutes on, and 15 minutes off. Then leaving the tested resistor in room temperature for 8±1 hours, and measure its resistance variance rate. |
| 14 | Resistance Dry Heat | 1%: $\pm(1.0\%+0.05\Omega)$ 2%, 5%: $\pm(2.0\%+0.10\Omega)$ | JIS-C5201-1 4.25 Put tested resistor in chamber under temperature 155±5°C for 1000 +48/-0 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate. |
| 15 | Loadlife | 1%: $\pm(2.0\%+0.10\Omega)$ 2%, 5%: $\pm(3.0\%+0.10\Omega)$ | JIS-C5201-1 4.25 At 70±2°C Apply DC rated voltage at 90minutes On, 30minutes Off for 1000 hours Sample shall be left at ambient temperature for 1~ 2 hrs after test before measuring final resistance. |



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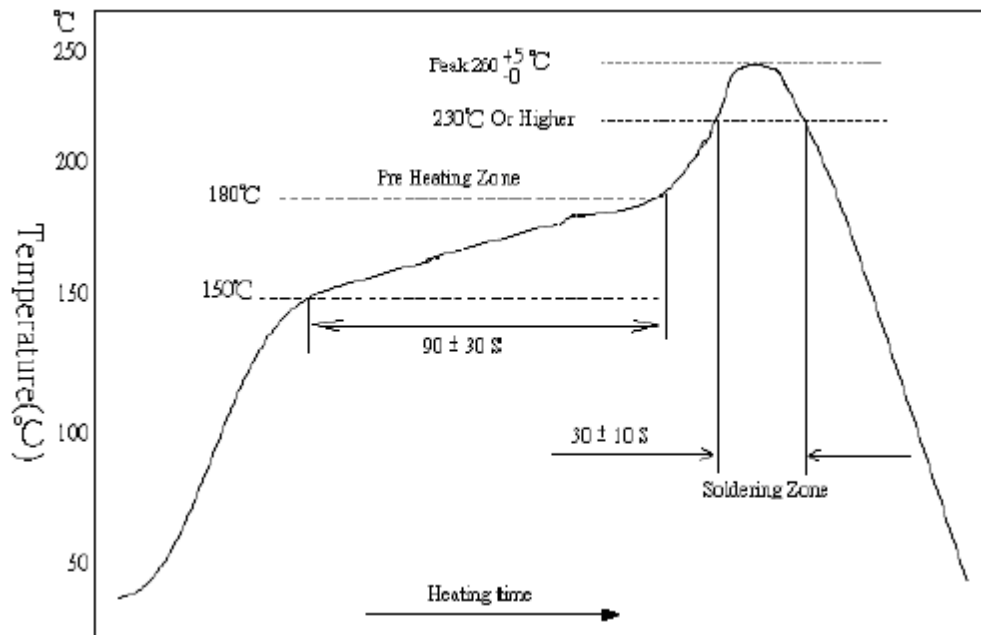
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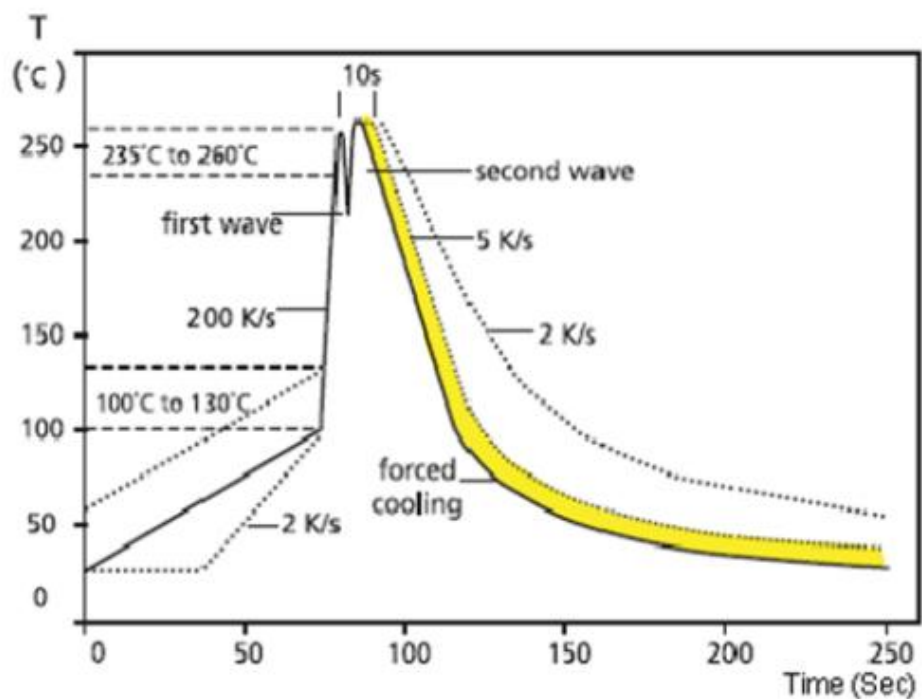
6.1 Soldering Profile

6.1.1 IR Reflow



6.1.2 Wave Soldering

(This applies to 0603 size inclusive above products)



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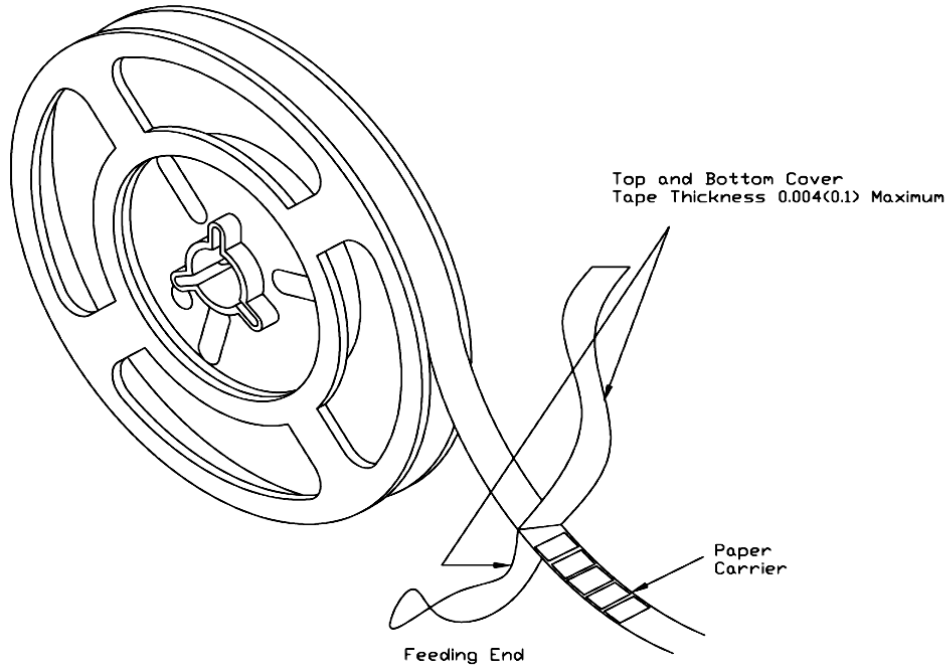
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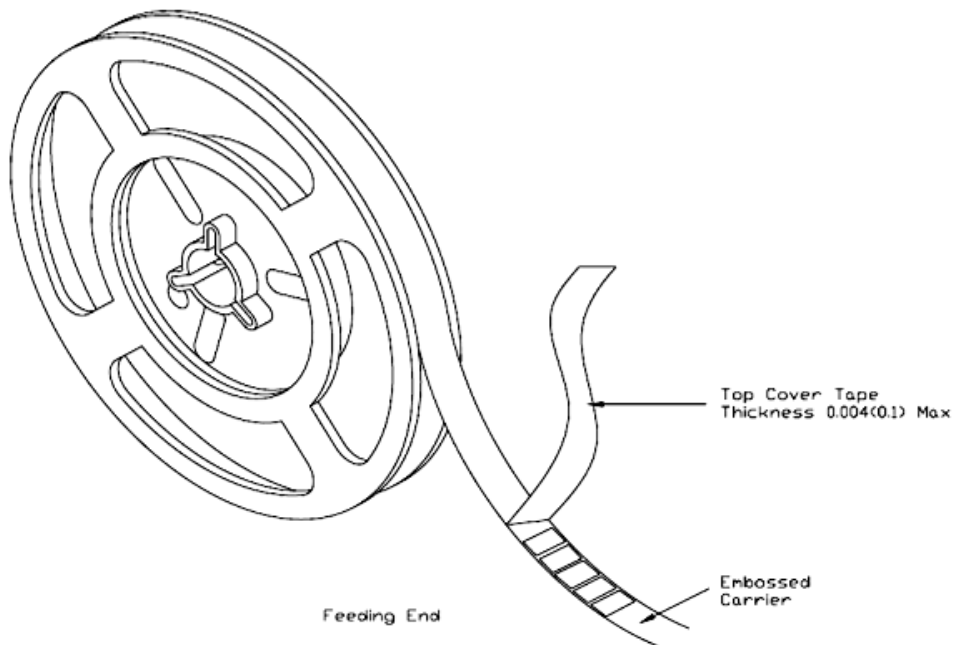
7 TAPING

7.1 Structure of Taping

Paper Carrier

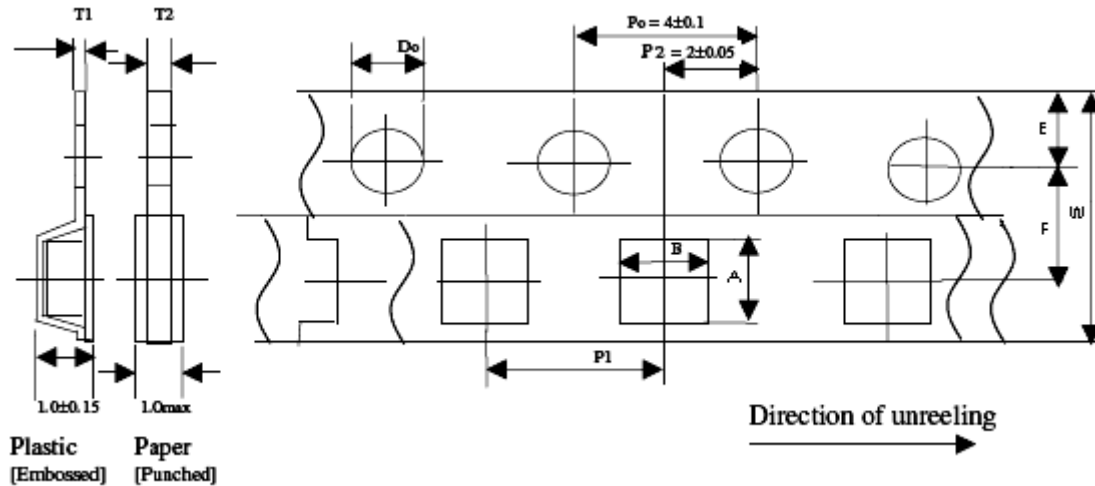


Embossed Plastic Carrier



7.2 Dimension

7.2.1 Dimension of Punched Paper Tape Carrier System /Plastic Embossed Carrier System (CLP16, 21, 32, 40, 50, 63)



Remark : Pitch tolerance over any 10 pitches of Po is ± 0.2 mm

Dimension of Punched Paper Tape Carrier System (CLP - 16, 21, 32)

| Code | A | B | W | E | F | P1 | Do | T2 |
|-------|---------------|----------------|---------------|----------------|----------------|---------------|---------------|----------------|
| CPH16 | 1.9 ± 0.1 | 1.1 ± 0.1 | 8.0 ± 0.2 | 1.75 ± 0.1 | 3.5 ± 0.05 | 4.0 ± 0.1 | 1.5 ± 0.1 | 0.60 ± 0.1 |
| CPH21 | 2.4 ± 0.1 | 1.65 ± 0.1 | | | | | | 0.75 ± 0.1 |
| CPH32 | 3.5 ± 0.1 | 1.9 ± 0.1 | | | | | | 0.75 ± 0.1 |
| CPH40 | 3.5 ± 0.1 | 1.9 ± 0.1 | | | | | | 0.75 ± 0.1 |

Dimension of Plastic Embossed Carrier System (CR -50, 63)

| Code | A | B | W | E | F | P1 | Do | T1 |
|-------|---------------|---------------|--------------|----------------|----------------|---------------|---------------|----------------|
| CPH50 | 5.4 ± 0.2 | 2.9 ± 0.2 | 12 ± 0.2 | 1.75 ± 0.1 | 5.5 ± 0.05 | 4.0 ± 0.1 | 1.5 ± 0.1 | 0.2 ± 0.10 |
| CPH63 | 6.6 ± 0.2 | 3.6 ± 0.1 | | | | | | |

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7.7 Packaging

7.7.1 Taping

7.7.1.1 Quantity – Tape and Reels

| Code | Quantity | Model | Remarks |
|------|----------|---------|--|
| CR16 | 5000 pcs | 7" Reel | 10" & 13" Reel for 10 000 or 20 000 pcs on request |
| CR21 | | | |
| CR32 | | | |
| CR40 | 5000 pcs | 7" Reel | - |
| CR50 | 4000 pcs | 7" Reel | - |
| CR63 | 4000 pcs | 7" Reel | - |

7.7.2 Identification

Production label that indicates the 8 digits lot number, product type, resistance value and tolerance shall be pasted on the surface of each reel.



7.7.3 Packaging Reel Box

| Dimension | Reel Box | Number of Reels |
|--------------------|----------|-----------------|
| 185 × 60 × 186 mm | 25K Box | 5 |
| 185 × 120 × 186 mm | 50K Box | 10 |



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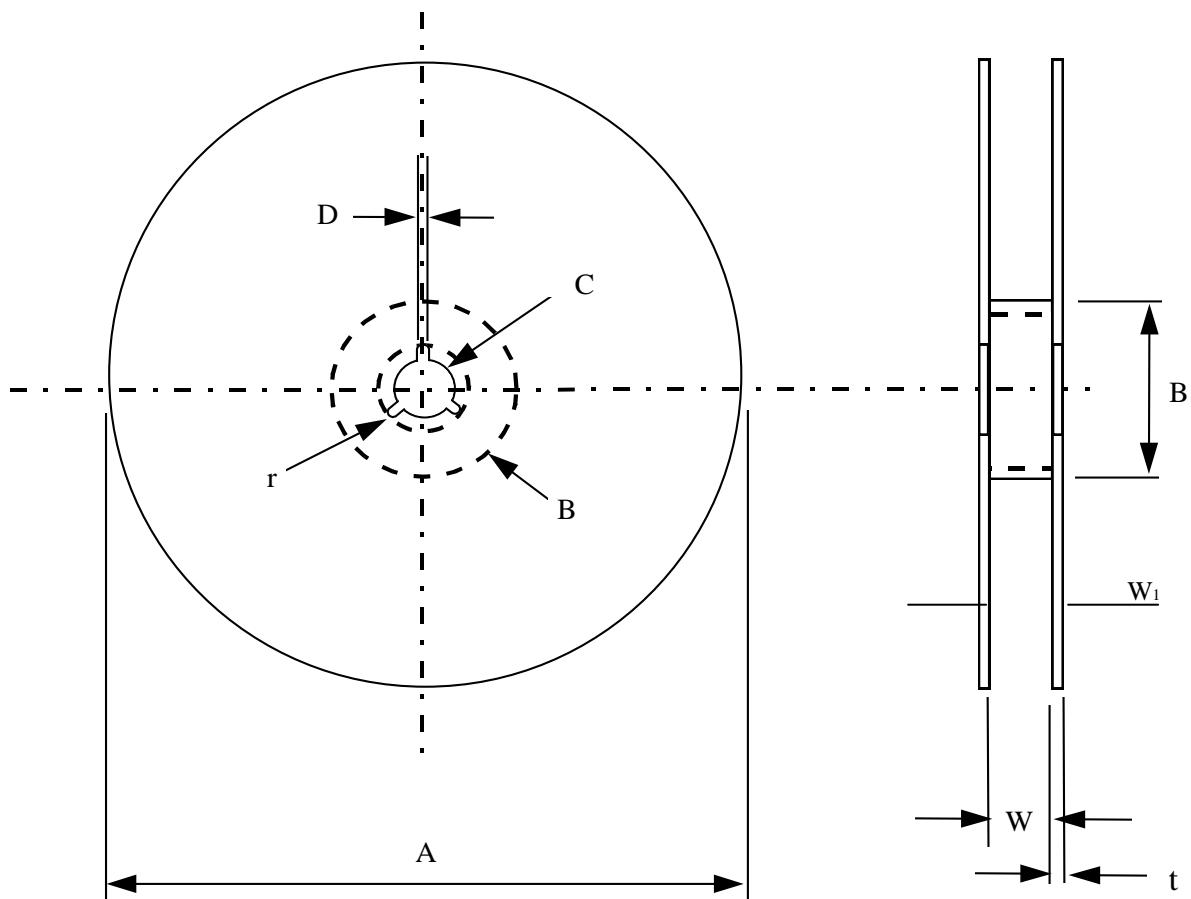
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7.7.4 Reel Dimensions



| Model | A | B | C | D | W | W ₁ | t | r |
|-----------------------------------|--------------------|-----------------------|--------------|--------------------|--------------|----------------|---------------|-----|
| 7" Reel (5K) (except 0402 10K) | $\phi 178 \pm 2.0$ | $\phi 80 \text{ min}$ | 13 ± 0.2 | $\phi 2.0 \pm 0.5$ | 11 ± 0.1 | 14.4 max | 1.0 ± 0.1 | 1.0 |
| 7" Reel (4K) | $\phi 178 \pm 2.0$ | $\phi 60 \text{ min}$ | 13 ± 0.2 | $\phi 2.0 \pm 0.5$ | 13 ± 1.0 | 14.4 max | 1.2 ± 0.1 | 1.0 |
| 10" Reel (10K) | $\phi 254 \pm 2.0$ | $\phi 60 \text{ min}$ | 13 ± 0.2 | $\phi 2.0 \pm 0.5$ | 11 ± 1.0 | 14.4 max | 1.5 ± 0.1 | 1.0 |
| 13" Reel (20K, 50K) | $\phi 330 \pm 2.0$ | $\phi 60 \text{ min}$ | 13 ± 0.2 | $\phi 2.0 \pm 0.5$ | 11 ± 1.0 | 14.4 max | 2.1 ± 0.1 | - |

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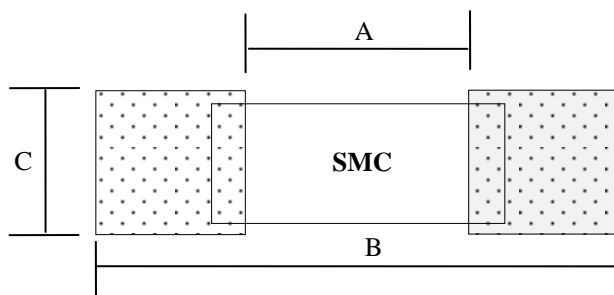
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8 SURFACE MOUNT LAND PATTERNS



Units: Inch [mm]

| Product (Type) | Land Dimension | | |
|------------------|----------------|--------------|----------------|
| | A | B | C |
| CPH16 (0603) | 0.031 [0.80] | 0.083 [2.10] | 0.035 [0.90] |
| CPH21 (0805) | 0.047 [1.20] | 0.118 [3.00] | 0.051 [1.30] |
| CPH32 (1206) | 0.087 [2.20] | 0.165 [4.20] | 0.063 [1.60] |
| CPH40 (1210) | 0.087 [2.20] | 0.165 [4.20] | 0.110 [2.80] |
| CPH50 (2010) | 0.138 [3.50] | 0.240 [6.10] | 0.110 [2.80] |
| CPH63 (2512) | 0.050 [3.80] | 0.315 [8.00] | 0.138 [3.50] |

9 REVISION HISTORY

| REVISION | DATE | CHANGE NOTIFICATION | DESCRIPTION |
|------------|---------------------|---------------------|-------------------|
| Version. 1 | February 13,2015 | | Initial Release |
| Version. 2 | December 15,2015 | | Updated datasheet |



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