# Surface Mount Multilayer Ceramic Chip Capacitors for High Voltage Commercial Applications



## FEATURES

- Available in body sizes from 1206 to 2225
- Ultra stable C0G (NP0) or high capacitance X7R dielectrics
- Ni-barrier with 100 % tin terminations
- Polymer terminations available
- Dry sheet technology process
- Base Metal Electrode system (BME)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS COMPLIANT
HALOGEN FREE GREEN (5-2008)

## APPLICATIONS

- Consumer electronics
- Input filter capacitors
- Output filter capacitors
- Snubber capacitors reduce MOSFET voltage spikes
- Filtering for switching power supplies

## ELECTRICAL SPECIFICATIONS

### C0G (NP0) DIELECTRIC

#### GENERAL SPECIFICATION

**Note**
Electrical characteristics at +25 °C unless otherwise specified

**Operating Temperature:** -55 °C to +125 °C

**Capacitance Range:** 1.5 pF to 82 nF

**Voltage Range:** 500 $V_{DC}$ to 3000 $V_{DC}$

**Temperature Coefficient of Capacitance (TCC):**
0 ppm/°C ± 30 ppm/°C from -55 °C to +125 °C

**Dissipation Factor (DF):**
0.1 % at 1.0 $V_{RMS}$ and 1 MHz for values ≤ 1000 pF
0.1 % at 1.0 $V_{RMS}$ and 1 kHz for values > 1000 pF

**Insulating Resistance:**
≥ 10 GΩ or R x C ≥ 500 ΩF, whichever is less

### X7R DIELECTRIC

#### GENERAL SPECIFICATION

**Note**
Electrical characteristics at +25 °C unless otherwise specified

**Operating Temperature:** -55 °C to +125 °C

**Capacitance Range:** 100 pF to 100 nF

**Voltage Range:** 500 $V_{DC}$ to 2000 $V_{DC}$

**Temperature Coefficient of Capacitance (TCC):**
± 15 %, -55 °C to +125 °C with 0 $V_{DC}$ applied

**Dissipation Factor (DF):**
2.5 % maximum at 1.0 $V_{RMS}$ and 1 kHz

**Insulating Resistance:**
≥ 10 GΩ or R x C ≥ 500 ΩF, whichever is less


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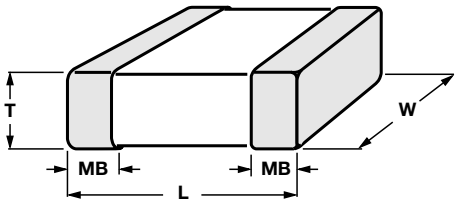
## QUICK REFERENCE DATA

| DIELECTRIC | CASE | MAXIMUM VOLTAGE (V) | CAPACITANCE | |
|---|---|---|---|---|
| | | | MINIMUM | MAXIMUM |
| C0G (NP0) | 1206 | 3000 | 1.2 pF | 6.8 nF |
| | 1210 | 3000 | 10 pF | 3.9 nF |
| | 1808 | 3000 | 2.2 pF | 3.3 nF |
| | 1812 | 3000 | 10 pF | 22 nF |
| | 1825 | 3000 | 10 pF | 22 nF |
| | 2220 | 2000 | 10 pF | 10 nF |
| | 2225 | 2000 | 10 pF | 10 nF |
| X7R | 1206 | 2000 | 100 pF | 1.2 nF |
| | 1210 | 2000 | 100 pF | 1.2 nF |
| | 1808 | 2000 | 150 pF | 1.8 nF |
| | 1812 | 2000 | 270 pF | 1.8 nF |
| | 1825 | 1000 | 1.0 nF | 100 nF |
| | 2220 | 1000 | 1.0 nF | 1.8 nF |
| | 2225 | 1000 | 1.0 nF | 1.8 nF |

## ORDERING INFORMATION

| VJ1210 | A | 151 | J | X | G | T | W1HV |
|---|---|---|---|---|---|---|---|
| SIZE CODE | DIELECTRIC | CAPACITANCE | TOLERANCE | TERMINATION | VOLTAGE | PACKAGING | PROCESS CODE HIGH VOLTAGE FOR COMMERCIAL |
| 1206<br>1210<br>1808<br>1812<br>1825<br>2220<br>2225 | A = C0G (NP0)<br>Y = X7R | Two significant digits followed by the number of zeros:<br>1R0 = 1.0 pF<br>100 = 100 pF<br>101 = 100 pF<br>102 = 1000 pF<br>103 = 10 000 pF<br>104 = 100 000 pF | **C0G (NP0)**<br>Cap. < 10 pF:<br>B = ± 0.10 pF<br>C = ± 0.25 pF<br>D = ± 0.50 pF<br><br>Cap. ≥ 10 pF:<br>F = ± 1 %<br>J = ± 5 %<br>K = ± 10 %<br><br>**X7R**<br>J = ± 5 %<br>K = ± 10 %<br>M = ± 20 % | X = 100 % plated tin<br>B = polymer, 100 % plated tin | E = 500 V<br>L = 630 V<br>G = 1000 V<br>R = 1500 V<br>F = 2000 V<br>H = 3000 V | C = 7" reel / paper tape<br>P = 13" reel / paper tape<br>T = 7" reel / plastic tape<br>R = 13" reel / plastic tape | |

## DIMENSIONS in inches (millimeters)




| SIZE CODE | L | W | T | MB |
|---|---|---|---|---|
| 1206 | 3.30 ± 0.30 | 1.60 ± 0.20 | See thickness codes in table "Packaging Dimensions and Quantities" | 0.60 ± 0.20 |
| 1210 | 3.30 ± 0.40 | 2.50 ± 0.30 | | 0.75 ± 0.35 |
| 1808 | 4.50 + 0.50 / - 0.30 | 2.00 ± 0.25 | | 0.75 ± 0.35 |
| 1812 | 4.50 + 0.50 / - 0.30 | 3.20 ± 0.40 | | 0.75 ± 0.35 |
| 1825 | 4.50 + 0.50 / - 0.30 | 6.30 ± 0.40 | | 0.75 ± 0.35 |
| 2220 | 5.7 ± 0.40 | 5.00 ± 0.40 | | 0.85 ± 0.35 |
| 2225 | 5.7 ± 0.40 | 6.30 ± 0.40 | | 0.85 ± 0.35 |


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| SELECTION CHART: 100 % Sn TERMINATION (X) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DIELECTRIC | | C0G (NP0) | | | | | | | | | | | | | | | |
| STYLE | | VJ1206 | | | | VJ1210 | | | | VJ1808 | | | | VJ1812 | | | |
| SIZE CODE | | 1206 | | | | 1210 | | | | 1808 | | | | 1812 | | | |
| VOLTAGE ($V_{DC}$) | | 1000 | 1500 | 2000 | 3000 | 1000 | 1500 | 2000 | 3000 | 1000 | 1500 | 2000 | 3000 | 1000 | 1500 | 2000 | 3000 |
| VOLTAGE CODE | | G | R | F | H | G | R | F | H | G | R | F | H | G | R | F | H |
| CAP. CODE | CAP. | | | | | | | | | | | | | | | | |
| 1R0 | 1.0 pF | | | | | | | | | | | | | | | | |
| 1R2 | 1.2 pF | | | | | | | | | | | | | | | | |
| 1R5 | 1.5 pF | X | X | X | | | | | | | | | | | | | |
| 1R8 | 1.8 pF | X | X | X | | | | | | | | | | | | | |
| 2R2 | 2.2 pF | X | X | X | | | | | | C | C | C | C | | | | |
| 2R7 | 2.7 pF | X | X | X | | | | | | C | C | C | C | | | | |
| 3R3 | 3.3 pF | X | X | X | | | | | | C | C | C | C | | | | |
| 3R9 | 3.9 pF | X | X | X | | | | | | C | C | C | C | | | | |
| 4R7 | 4.7 pF | X | X | X | | | | | | C | C | C | C | | | | |
| 5R0 | 5.0 pF | X | X | X | | | | | | C | C | C | C | | | | |
| 5R6 | 5.6 pF | X | X | X | | | | | | C | C | C | C | | | | |
| 6R8 | 6.8 pF | X | X | X | | | | | | C | C | C | C | | | | |
| 8R2 | 8.2 pF | X | X | X | | | | | | C | C | C | C | | | | |
| 100 | 10 pF | X | X | X | E | M | M | M | F | C | C | C | C | C | C | C | C |
| 120 | 12 pF | X | X | X | E | M | M | M | F | C | C | C | C | C | C | C | C |
| 150 | 15 pF | X | X | X | E | M | M | M | F | C | C | C | C | C | C | C | C |
| 180 | 18 pF | X | X | X | E | M | M | M | F | C | C | C | C | C | C | C | C |
| 220 | 22 pF | X | X | X | E | M | M | M | F | C | C | C | C | C | C | C | C |
| 270 | 27 pF | X | X | X | E | M | M | M | F | C | C | C | C | C | C | C | C |
| 330 | 33 pF | X | M | M | E | M | M | M | F | C | C | C | C | C | C | C | C |
| 390 | 39 pF | X | M | M | E | M | M | M | F | C | C | C | C | C | C | C | C |
| 470 | 47 pF | X | M | M | E | M | M | M | F | C | C | C | C | C | C | C | C |
| 560 | 56 pF | X | C | C | E | M | C | C | F | C | C | C | C | C | C | C | C |
| 680 | 68 pF | X | C | C | E | M | C | C | F | C | C | C | C | C | C | C | C |
| 820 | 82 pF | X | C | C | E | M | C | C | F | C | C | C | C | C | C | C | C |
| 101 | 100 pF | X | C | C | E | C | C | C | F | C | C | C | F | C | C | C | C |
| 121 | 120 pF | X | E | E | E | C | C | C | F | C | C | C | F | C | C | C | C |
| 151 | 150 pF | C | E | E | | C | E | E | F | C | F | F | F | C | C | C | C |
| 181 | 180 pF | E | E | E | | C | E | E | F | C | F | F | F | C | C | C | F |
| 221 | 220 pF | E | E | E | | E | E | E | F | C | F | F | F | C | C | C | F |
| 271 | 270 pF | E | P | P | | E | F | F | G | F | F | F | F | C | F | F | F |
| 331 | 330 pF | E | P | P | | E | F | F | | F | F | F | F | C | F | F | F |
| 391 | 390 pF | E | P | P | | E | G | G | | F | F | F | F | C | F | F | F |
| 471 | 470 pF | E | E | E | | E | C | C | | F | F | F | F | F | F | F | F |
| 561 | 560 pF | E | | | | E | G | G | | F | F | F | | F | F | F | F |
| 681 | 680 pF | E | | | | E | G | G | | F | F | F | | F | F | F | F |
| 821 | 820 pF | E | | | | E | G | G | | F | F | F | | F | F | F | G |
| 102 | 1.0 nF | E | | | | E | G | G | | F | F | F | | F | F | F | G |
| 122 | 1.2 nF | | | | | E | F | F | | F | F | F | | F | F | F | |
| 152 | 1.5 nF | | | | | F | G | G | | F | F | F | | F | F | F | |
| 182 | 1.8 nF | | | | | G | G | G | | F | F | F | | E | F | F | |
| 222 | 2.2 nF | | | | | G | | | | F | | | | F | F | F | |
| 272 | 2.7 nF | | | | | G | | | | | | | | F | G | G | |
| 332 | 3.3 nF | | | | | G | | | | | | | | F | G | G | |
| 392 | 3.9 nF | | | | | G | | | | | | | | G | | | |
| 472 | 4.7 nF | | | | | | | | | | | | | G | | | |
| 562 | 5.6 nF | | | | | | | | | | | | | G | | | |
| 682 | 6.8 nF | | | | | | | | | | | | | | | | |
| 822 | 8.2 nF | | | | | | | | | | | | | | | | |
| 103 | 10 nF | | | | | | | | | | | | | | | | |
| 123 | 12 nF | | | | | | | | | | | | | | | | |


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| SELECTION CHART: 100 % Sn TERMINATION (X) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DIELECTRIC | | C0G (NP0) | | | | | | | | | |
| STYLE | | VJ1825 | | | | VJ2220 | | | VJ2225 | | |
| SIZE CODE | | 1825 | | | | 2220 | | | 2225 | | |
| VOLTAGE ($V_{DC}$) | | 1000 | 1500 | 2000 | 3000 | 1000 | 1500 | 2000 | 1000 | 1500 | 2000 |
| VOLTAGE CODE | | G | R | F | H | G | R | F | G | R | F |
| CAP. CODE | CAP. | | | | | | | | | | |
| 1R0 | 1.0 pF | | | | | | | | | | |
| 1R2 | 1.2 pF | | | | | | | | | | |
| 1R5 | 1.5 pF | | | | | | | | | | |
| 1R8 | 1.8 pF | | | | | | | | | | |
| 2R2 | 2.2 pF | | | | | | | | | | |
| 2R7 | 2.7 pF | | | | | | | | | | |
| 3R3 | 3.3 pF | | | | | | | | | | |
| 3R9 | 3.9 pF | | | | | | | | | | |
| 4R7 | 4.7 pF | | | | | | | | | | |
| 5R0 | 5.0 pF | | | | | | | | | | |
| 5R6 | 5.6 pF | | | | | | | | | | |
| 6R8 | 6.8 pF | | | | | | | | | | |
| 8R2 | 8.2 pF | | | | | | | | | | |
| 100 | 10 pF | F | F | F | F | F | F | F | F | F | F |
| 120 | 12 pF | F | F | F | F | F | F | F | F | F | F |
| 150 | 15 pF | F | F | F | F | F | F | F | F | F | F |
| 180 | 18 pF | F | F | F | F | F | F | F | F | F | F |
| 220 | 22 pF | F | F | F | F | F | F | F | F | F | F |
| 270 | 27 pF | F | F | F | F | F | F | F | F | F | F |
| 330 | 33 pF | F | F | F | F | F | F | F | F | F | F |
| 390 | 39 pF | F | F | F | F | F | F | F | F | F | F |
| 470 | 47 pF | F | F | F | F | F | F | F | F | F | F |
| 560 | 56 pF | F | F | F | F | F | F | F | F | F | F |
| 680 | 68 pF | F | F | F | F | F | F | F | F | F | F |
| 820 | 82 pF | F | F | F | F | F | F | F | F | F | F |
| 101 | 100 pF | F | F | F | F | F | F | F | F | F | F |
| 121 | 120 pF | F | F | F | F | F | F | F | F | F | F |
| 151 | 150 pF | F | F | F | F | F | F | F | F | F | F |
| 181 | 180 pF | F | F | F | F | F | F | F | F | F | F |
| 221 | 220 pF | F | F | F | F | F | F | F | F | F | F |
| 271 | 270 pF | F | F | F | F | F | F | F | F | F | F |
| 331 | 330 pF | F | F | F | F | F | F | F | F | F | F |
| 391 | 390 pF | F | F | F | F | F | F | F | F | F | F |
| 471 | 470 pF | F | F | F | F | F | F | F | F | F | F |
| 561 | 560 pF | F | F | F | F | F | F | F | F | F | F |
| 681 | 680 pF | F | F | F | F | F | F | F | F | F | F |
| 821 | 820 pF | F | F | F | F | F | F | F | F | F | F |
| 102 | 1.0 nF | F | F | F | F | F | F | F | F | F | F |
| 122 | 1.2 nF | F | F | F | | F | F | F | F | F | F |
| 152 | 1.5 nF | F | F | F | | F | F | F | F | F | F |
| 182 | 1.8 nF | F | F | F | | F | F | F | F | F | F |
| 222 | 2.2 nF | F | F | F | | F | F | F | F | F | F |
| 272 | 2.7 nF | F | F | F | | F | F | F | F | F | F |
| 332 | 3.3 nF | F | F | F | | F | F | F | F | F | F |
| 392 | 3.9 nF | F | F | F | | F | F | F | F | F | F |
| 472 | 4.7 nF | F | F | F | | F | F | F | F | F | F |
| 562 | 5.6 nF | | | | | F | | | F | F | F |
| 682 | 6.8 nF | | | | | F | | | F | F | F |
| 822 | 8.2 nF | | | | | G | | | F | G | G |
| 103 | 10 nF | | | | | G | | | G | G | G |
| 123 | 12 nF | | | | | | | | | | |


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| SELECTION CHART: 100 % Sn TERMINATION (X) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DIELECTRIC | | X7R | | | | | | | | | | | | |
| STYLE | | VJ1206 | VJ1210 | | | VJ1808 | | | VJ1812 | | | VJ1825 | VJ2220 | VJ2225 |
| SIZE CODE | | 1206 | 1210 | | | 1808 | | | 1812 | | | 1825 | 2220 | 2225 |
| VOLTAGE ($V_{DC}$) | | 1000 | 1000 | 1500 | 2000 | 1000 | 1500 | 2000 | 1000 | 1500 | 2000 | 1000 | 1000 | 1000 |
| VOLTAGE CODE | | G | G | R | F | G | R | F | G | R | F | G | G | G |
| CAP. CODE | CAP. | | | | | | | | | | | | | |
| 101 | 100 pF | C | C | C | C | | | | | | | | | |
| 121 | 120 pF | C | C | C | C | | | | | | | | | |
| 151 | 150 pF | C | C | C | C | C | C | C | | | | | | |
| 181 | 180 pF | C | C | C | C | C | C | C | | | | | | |
| 221 | 220 pF | C | C | C | C | C | C | C | | | | | | |
| 271 | 270 pF | C | C | C | C | C | C | C | C | C | C | | | |
| 331 | 330 pF | C | C | C | C | C | C | C | C | C | C | | | |
| 391 | 390 pF | C | C | C | C | C | C | C | C | C | C | | | |
| 471 | 470 pF | C | C | C | C | C | C | C | C | C | C | | | |
| 561 | 560 pF | C | C | C | C | C | C | C | C | C | C | | | |
| 681 | 680 pF | C | C | C | C | C | C | C | C | C | C | | | |
| 751 | 750 pF | C | C | C | C | C | C | C | C | C | C | | | |
| 821 | 820 pF | C | C | C | C | C | C | C | C | C | C | | | |
| 102 | 1.0 nF | C | C | C | C | C | C | C | C | C | C | F | F | F |
| 122 | 1.2 nF | C | C | G | C | C | | | C | C | C | F | F | F |
| 152 | 1.5 nF | | | | | C | | | C | C | C | F | F | F |
| 182 | 1.8 nF | | | | | C | | | C | C | C | F | F | F |
| 222 | 2.2 nF | | | | | | | | | | | F | | |
| 272 | 2.7 nF | | | | | | | | | | | F | | |
| 332 | 3.3 nF | | | | | | | | | | | F | | |
| 392 | 3.9 nF | | | | | | | | | | | F | | |
| 472 | 4.7 nF | | | | | | | | | | | F | | |
| 562 | 5.6 nF | | | | | | | | | | | F | | |
| 682 | 6.8 nF | | | | | | | | | | | F | | |
| 822 | 8.2 nF | | | | | | | | | | | F | | |
| 103 | 10 nF | | | | | | | | | | | F | | |
| 123 | 12 nF | | | | | | | | | | | F | | |
| 153 | 15 nF | | | | | | | | | | | F | | |
| 183 | 18 nF | | | | | | | | | | | F | | |
| 223 | 22 nF | | | | | | | | | | | F | | |
| 273 | 27 nF | | | | | | | | | | | F | | |
| 333 | 33 nF | | | | | | | | | | | F | | |
| 393 | 39 nF | | | | | | | | | | | F | | |
| 473 | 47 nF | | | | | | | | | | | F | | |
| 563 | 56 nF | | | | | | | | | | | F | | |
| 683 | 68 nF | | | | | | | | | | | F | | |
| 823 | 82 nF | | | | | | | | | | | F | | |
| 104 | 100 nF | | | | | | | | | | | G | | |


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## SELECTION CHART: POLYMER TERMINATION (B)

| DIELECTRIC | | C0G (NP0) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STYLE | | VJ1206 | | | | | VJ1210 | | | | | VJ1808 | | | | | |
| SIZE CODE | | 1206 | | | | | 1210 | | | | | 1808 | | | | | |
| VOLTAGE ($V_{DC}$) | | 500 | 630 | 1000 | 1500 | 2000 | 500 | 630 | 1000 | 1500 | 2000 | 500 | 630 | 1000 | 1500 | 2000 | 3000 |
| VOLTAGE CODE | | E | L | G | R | F | E | L | G | R | F | E | L | G | R | F | H |
| CAP. CODE | CAP. | | | | | | | | | | | | | | | | |
| 1R0 | 1.0 pF | | | | | | | | | | | | | | | | |
| 1R2 | 1.2 pF | X | | | | | | | | | | | | | | | |
| 1R5 | 1.5 pF | X | X | X | X | X | | | | | | | | | | | |
| 1R8 | 1.8 pF | X | X | X | X | X | | | | | | | | | | | |
| 2R2 | 2.2 pF | X | X | X | X | X | | | | | | C | C | C | C | C | C |
| 2R7 | 2.7 pF | X | X | X | X | X | | | | | | C | C | C | C | C | C |
| 3R3 | 3.3 pF | X | X | X | X | X | | | | | | C | C | C | C | C | C |
| 3R9 | 3.9 pF | X | X | X | X | X | | | | | | C | C | C | C | C | C |
| 4R7 | 4.7 pF | X | X | X | X | X | | | | | | C | C | C | C | C | C |
| 5R0 | 5.0 pF | X | X | X | X | X | | | | | | C | C | C | C | C | C |
| 5R6 | 5.6 pF | X | X | X | X | X | | | | | | C | C | C | C | C | C |
| 6R8 | 6.8 pF | X | X | X | X | X | | | | | | C | C | C | C | C | C |
| 8R2 | 8.2 pF | X | X | X | X | X | | | | | | C | C | C | C | C | C |
| 100 | 10 pF | X | X | X | X | X | M | M | M | M | M | C | C | C | C | C | C |
| 120 | 12 pF | X | X | X | X | X | M | M | M | M | M | C | C | C | C | C | C |
| 150 | 15 pF | X | X | X | X | X | M | M | M | M | M | C | C | C | C | C | C |
| 180 | 18 pF | X | X | X | X | X | M | M | M | M | M | C | C | C | C | C | C |
| 220 | 22 pF | X | X | X | X | X | M | M | M | M | M | C | C | C | C | C | C |
| 270 | 27 pF | X | X | X | X | X | M | M | M | M | M | C | C | C | C | C | C |
| 330 | 33 pF | X | X | X | M | M | M | M | M | M | M | C | C | C | C | C | C |
| 390 | 39 pF | X | X | X | M | M | M | M | M | M | M | C | C | C | C | C | C |
| 470 | 47 pF | X | X | M | M | M | M | M | M | M | M | C | C | C | C | C | C |
| 560 | 56 pF | X | X | M | C | C | M | M | M | C | C | C | C | C | C | C | C |
| 680 | 68 pF | X | X | M | C | C | M | M | M | C | C | C | C | C | C | C | C |
| 820 | 82 pF | X | X | C | C | C | M | M | M | C | C | C | C | C | C | C | C |
| 101 | 100 pF | X | X | C | C | C | M | M | C | C | C | C | C | C | C | C | F |
| 121 | 120 pF | X | X | C | E | E | M | M | C | C | C | C | C | C | C | C | F |
| 151 | 150 pF | X | X | C | E | E | M | M | C | E | E | C | C | C | F | F | F |
| 181 | 180 pF | X | X | E | E | E | M | M | C | E | E | C | C | C | F | F | F |
| 221 | 220 pF | X | X | E | E | E | M | M | E | E | E | C | C | C | F | F | F |
| 271 | 270 pF | M | M | E | P | P | M | M | E | F | F | C | C | F | F | F | F |
| 331 | 330 pF | M | M | E | P | P | M | M | E | F | F | C | C | F | F | F | F |
| 391 | 390 pF | M | M | E | P | P | M | M | E | G | G | C | C | F | F | F | F |
| 471 | 470 pF | M | M | E | E | E | M | M | E | G | G | C | C | F | F | F | F |
| 561 | 560 pF | C | C | E | | | M | M | E | G | G | C | C | F | F | F | |
| 681 | 680 pF | C | C | E | | | M | M | E | G | G | C | C | F | F | F | |
| 821 | 820 pF | E | E | E | | | M | M | E | G | G | C | C | F | F | F | |
| 102 | 1.0 nF | E | E | E | | | C | C | E | G | G | C | C | F | F | F | |
| 122 | 1.2 nF | E | E | | | | C | C | E | F | F | C | C | F | F | F | |
| 152 | 1.5 nF | E | E | | | | C | C | F | G | G | C | C | F | F | F | |
| 182 | 1.8 nF | E | E | | | | C | C | G | G | G | C | C | F | F | F | |
| 222 | 2.2 nF | E | E | | | | C | C | G | | | C | C | F | F | F | |
| 272 | 2.7 nF | E | E | | | | C | C | G | | | C | C | F | | | |
| 332 | 3.3 nF | E | E | | | | C | C | G | | | C | C | | | | |
| 392 | 3.9 nF | E | E | | | | C | C | G | | | | | | | | |
| 472 | 4.7 nF | E | E | | | | | | | | | | | | | | |
| 562 | 5.6 nF | E | E | | | | | | | | | | | | | | |
| 682 | 6.8 nF | E | E | | | | | | | | | | | | | | |
| 822 | 8.2 nF | | | | | | | | | | | | | | | | |


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| SELECTION CHART: POLYMER TERMINATION (B) | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DIELECTRIC | | C0G (NP0) | | | | | | | | | | | | | | | | | | | | |
| STYLE | | VJ1812 | | | | | | VJ1825 | | | | | VJ2220 | | | | | VJ2225 | | | | |
| SIZE CODE | | 1812 | | | | | | 1825 | | | | | 2220 | | | | | 2225 | | | | |
| VOLTAGE ($V_{DC}$) | | 500 | 630 | 1000 | 1500 | 2000 | 3000 | 500 | 630 | 1000 | 1500 | 2000 | 500 | 630 | 1000 | 1500 | 2000 | 500 | 630 | 1000 | 1500 | 2000 |
| VOLTAGE CODE | | E | L | G | R | F | H | E | L | G | R | F | E | L | G | R | F | E | L | G | R | F |
| CAP. CODE | CAP. | | | | | | | | | | | | | | | | | | | | | |
| 1R0 | 1.0 pF | | | | | | | | | | | | | | | | | | | | | |
| 1R2 | 1.2 pF | | | | | | | | | | | | | | | | | | | | | |
| 1R5 | 1.5 pF | | | | | | | | | | | | | | | | | | | | | |
| 1R8 | 1.8 pF | | | | | | | | | | | | | | | | | | | | | |
| 2R2 | 2.2 pF | | | | | | | | | | | | | | | | | | | | | |
| 2R7 | 2.7 pF | | | | | | | | | | | | | | | | | | | | | |
| 3R3 | 3.3 pF | | | | | | | | | | | | | | | | | | | | | |
| 3R9 | 3.9 pF | | | | | | | | | | | | | | | | | | | | | |
| 4R7 | 4.7 pF | | | | | | | | | | | | | | | | | | | | | |
| 5R0 | 5.0 pF | | | | | | | | | | | | | | | | | | | | | |
| 5R6 | 5.6 pF | | | | | | | | | | | | | | | | | | | | | |
| 6R8 | 6.8 pF | | | | | | | | | | | | | | | | | | | | | |
| 8R2 | 8.2 pF | | | | | | | | | | | | | | | | | | | | | |
| 100 | 10 pF | C | C | C | C | C | C | F | F | F | F | F | F | F | F | | F | F | F | F | F | F |
| 120 | 12 pF | C | C | C | C | C | C | F | F | F | F | F | F | F | F | | F | F | F | F | F | F |
| 150 | 15 pF | C | C | C | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 180 | 18 pF | C | C | C | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 220 | 22 pF | C | C | C | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 270 | 27 pF | C | C | C | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 330 | 33 pF | C | C | C | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 390 | 39 pF | C | C | C | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 470 | 47 pF | C | C | C | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 560 | 56 pF | C | C | C | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 680 | 68 pF | C | C | C | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 820 | 82 pF | C | C | C | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 101 | 100 pF | C | C | C | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 121 | 120 pF | C | C | C | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 151 | 150 pF | C | C | C | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 181 | 180 pF | C | C | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 221 | 220 pF | C | C | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 271 | 270 pF | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 331 | 330 pF | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 391 | 390 pF | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 471 | 470 pF | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 561 | 560 pF | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 681 | 680 pF | C | C | C | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 821 | 820 pF | C | C | C | F | F | G | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 102 | 1.0 nF | C | C | C | F | F | G | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 122 | 1.2 nF | C | C | C | F | F | | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 152 | 1.5 nF | C | C | C | F | F | | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 182 | 1.8 nF | C | C | F | F | F | | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 222 | 2.2 nF | C | C | E | F | F | | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 272 | 2.7 nF | C | C | F | G | G | | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 332 | 3.3 nF | C | C | F | G | G | | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |


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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DIELECTRIC | | C0G (NP0) | | | | | | | | | | | | | | | | | | | | |
| STYLE | | VJ1812 | | | | | | VJ1825 | | | | | VJ2220 | | | | | VJ2225 | | | | |
| SIZE CODE | | 1812 | | | | | | 1825 | | | | | 2220 | | | | | 2225 | | | | |
| VOLTAGE ($V_{DC}$) | | 500 | 630 | 1000 | 1500 | 2000 | 3000 | 500 | 630 | 1000 | 1500 | 2000 | 500 | 630 | 1000 | 1500 | 2000 | 500 | 630 | 1000 | 1500 | 2000 |
| VOLTAGE CODE | | E | L | G | R | F | H | E | L | G | R | F | E | L | G | R | F | E | L | G | R | F |
| CAP. CODE | CAP. | | | | | | | | | | | | | | | | | | | | | |
| 392 | 3.9 nF | C | C | G | | | | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 472 | 4.7 nF | C | C | G | | | | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 562 | 5.6 nF | C | C | G | | | | F | F | F | | | F | F | F | | | F | F | F | F | F |
| 682 | 6.8 nF | C | C | | | | | F | F | F | | | F | F | F | | | F | F | F | F | F |
| 822 | 8.2 nF | C | C | | | | | F | F | G | | | F | F | G | | | F | F | F | G | G |
| 103 | 10 nF | C | C | | | | | F | F | G | | | F | F | G | | | F | F | G | G | G |
| 123 | 12 nF | E | E | | | | | F | F | | | | | | | | | | | | | |
| 153 | 15 nF | E | E | | | | | F | F | | | | | | | | | | | | | |
| 183 | 18 nF | F | F | | | | | F | F | | | | | | | | | | | | | |
| 223 | 22 nF | F | F | | | | | F | F | | | | | | | | | | | | | |
| 273 | 27 nF | | | | | | | | | | | | | | | | | | | | | |
| 333 | 33 nF | | | | | | | | | | | | | | | | | | | | | |
| 393 | 39 nF | | | | | | | | | | | | | | | | | | | | | |
| 473 | 47 nF | | | | | | | | | | | | | | | | | | | | | |
| 563 | 56 nF | | | | | | | | | | | | | | | | | | | | | |
| 683 | 68 nF | | | | | | | | | | | | | | | | | | | | | |
| 823 | 82 nF | | | | | | | | | | | | | | | | | | | | | |


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| SELECTION CHART: POLYMER TERMINATION (B) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DIELECTRIC | | X7R | | | | | | | | | | | | |
| STYLE | | VJ1206 | | | VJ1210 | | | | | VJ1808 | | | | |
| SIZE CODE | | 1206 | | | 1210 | | | | | 1808 | | | | |
| VOLTAGE ($V_{DC}$) | | 500 | 630 | 1000 | 500 | 630 | 1000 | 1500 | 2000 | 500 | 630 | 1000 | 1500 | 2000 |
| VOLTAGE CODE | | E | L | G | E | L | G | R | F | E | L | G | R | F |
| CAP. CODE | CAP. | | | | | | | | | | | | | |
| 470 | 47 pF | | | | | | | | | | | | | |
| 560 | 56 pF | | | | | | | | | | | | | |
| 680 | 68 pF | | | | | | | | | | | | | |
| 820 | 82 pF | | | | | | | | | | | | | |
| 101 | 100 pF | C | C | C | | | | | | | | | | |
| 121 | 120 pF | C | C | C | | | | | | | | | | |
| 151 | 150 pF | C | C | C | | | | | | C | C | C | C | C |
| 181 | 180 pF | C | C | C | | | | | | C | C | C | C | C |
| 221 | 220 pF | C | C | C | M | M | M | M | M | C | C | C | C | C |
| 271 | 270 pF | C | C | C | M | M | M | M | M | C | C | C | C | C |
| 331 | 330 pF | C | C | C | M | M | M | M | M | C | C | C | C | C |
| 391 | 390 pF | C | C | C | M | M | M | M | M | C | C | C | C | C |
| 471 | 470 pF | C | C | C | M | M | M | M | M | C | C | C | C | C |
| 561 | 560 pF | C | C | C | M | M | M | M | M | C | C | C | C | C |
| 681 | 680 pF | C | C | C | M | M | M | M | M | C | C | C | C | C |
| 751 | 750 pF | C | C | C | M | M | M | M | M | C | C | C | C | C |
| 821 | 820 pF | C | C | C | M | M | M | | | C | C | C | C | C |
| 102 | 1.0 nF | C | C | C | M | M | M | | | C | C | C | C | C |
| 122 | 1.2 nF | | | | | | | | | C | C | C | C | C |
| 152 | 1.5 nF | | | | | | | | | C | C | C | C | C |
| 182 | 1.8 nF | | | | | | | | | C | C | C | C | C |
| 222 | 2.2 nF | | | | | | | | | | | | | |
| 272 | 2.7 nF | | | | | | | | | | | | | |
| 332 | 3.3 nF | | | | | | | | | | | | | |
| 392 | 3.9 nF | | | | | | | | | | | | | |
| 472 | 4.7 nF | | | | | | | | | | | | | |
| 562 | 5.6 nF | | | | | | | | | | | | | |
| 682 | 6.8 nF | | | | | | | | | | | | | |
| 822 | 8.2 nF | | | | | | | | | | | | | |
| 103 | 10 nF | | | | | | | | | | | | | |


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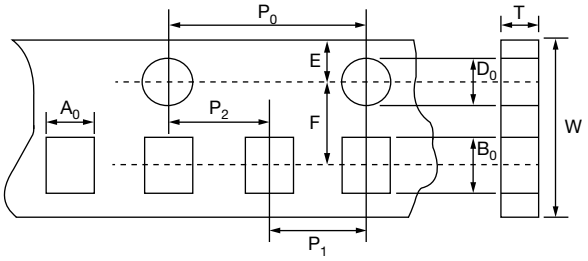
| SELECTION CHART: POLYMER TERMINATION (B) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DIELECTRIC | | X7R | | | | | | | | | | | | | | |
| STYLE | | VJ1812 | | | | | VJ1825 | | | VJ2220 | | | VJ2225 | | | |
| SIZE CODE | | 1812 | | | | | 1825 | | | 2220 | | | 2225 | | | |
| VOLTAGE ($V_{DC}$) | | 500 | 630 | 1000 | 1500 | 2000 | 500 | 630 | 1000 | 500 | 630 | 1000 | 500 | 630 | 1000 | |
| VOLTAGE CODE | | E | L | G | R | F | E | L | G | E | L | G | E | L | G | |
| CAP. CODE | CAP. | | | | | | | | | | | | | | | |
| 470 | 47 pF | | | | | | | | | | | | | | | |
| 560 | 56 pF | | | | | | | | | | | | | | | |
| 680 | 68 pF | | | | | | | | | | | | | | | |
| 820 | 82 pF | | | | | | | | | | | | | | | |
| 101 | 100 pF | | | | | | | | | | | | | | | |
| 121 | 120 pF | | | | | | | | | | | | | | | |
| 151 | 150 pF | | | | | | | | | | | | | | | |
| 181 | 180 pF | | | | | | | | | | | | | | | |
| 221 | 220 pF | | | | | | | | | | | | | | | |
| 271 | 270 pF | C | C | C | C | C | | | | | | | | | | |
| 331 | 330 pF | C | C | C | C | C | | | | | | | | | | |
| 391 | 390 pF | C | C | C | C | C | | | | | | | | | | |
| 471 | 470 pF | C | C | C | C | C | | | | | | | | | | |
| 561 | 560 pF | C | C | C | C | C | | | | | | | | | | |
| 681 | 680 pF | C | C | C | C | C | | | | | | | | | | |
| 751 | 750 pF | C | C | C | C | C | | | | | | | | | | |
| 821 | 820 pF | C | C | C | C | C | | | | | | | | | | |
| 102 | 1.0 nF | C | C | C | C | C | F | F | F | F | F | F | F | F | F | |
| 122 | 1.2 nF | C | C | C | C | C | F | F | F | F | F | F | F | F | F | |
| 152 | 1.5 nF | C | C | C | C | C | F | F | F | F | F | F | F | F | F | |
| 182 | 1.8 nF | C | C | C | C | C | F | F | F | F | F | F | F | F | F | |
| 222 | 2.2 nF | | | | | | F | F | F | | | | | | | |
| 272 | 2.7 nF | | | | | | F | F | F | | | | | | | |
| 332 | 3.3 nF | | | | | | F | F | F | | | | | | | |
| 392 | 3.9 nF | | | | | | F | F | F | | | | | | | |
| 472 | 4.7 nF | | | | | | F | F | F | | | | | | | |
| 562 | 5.6 nF | | | | | | F | F | F | | | | | | | |
| 682 | 6.8 nF | | | | | | F | F | F | | | | | | | |
| 822 | 8.2 nF | | | | | | F | F | F | | | | | | | |
| 103 | 10 nF | | | | | | F | F | G | | | | | | | |


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## PACKAGING DIMENSIONS AND QUANTITIES

| SIZE CODE (inch / mm) | THICKNESS (mm) | THICKNESS SYMBOL | PAPER TAPE | | PLASTIC TAPE | |
|---|---|---|---|---|---|---|
| | | | 7" REEL (C) | 13" REEL (P) | 7" REEL (T) | 13" REEL (R) |
| 1206 (3216) | 0.80 ± 0.10 | X | 4000 | 15 000 | - | - |
| | 0.95 ± 0.10 | M | - | - | 3000 | 10 000 |
| | 1.25 ± 0.10 | C | - | - | 3000 | 10 000 |
| | 1.60 ± 0.20 | E | - | - | 2000 | - |
| | 1.60 + 0.30 / - 0.10 | P | - | - | 2000 | 9000 |
| 1210 (3225) | 0.95 ± 0.10 | M | - | - | 3000 | 10 000 |
| | 1.25 ± 0.10 | C | - | - | 3000 | 10 000 |
| | 1.60 ± 0.20 | E | - | - | 2000 | - |
| | 2.00 ± 0.20 | F | - | - | 1000 | 6000 |
| | 2.50 ± 0.30 | G | - | - | 1000 | 6000 |
| 1808 (4520) | 1.25 ± 0.10 | C | - | - | 2000 | 10 000 |
| | 2.00 ± 0.20 | F | - | - | 1000 | 6000 |
| 1812 (4532) | 1.25 ± 0.10 | C | - | - | 1000 | 5000 |
| | 2.00 ± 0.20 | F | - | - | 1000 | - |
| | 2.50 ± 0.30 | G | - | - | 500 | 3000 |
| 1825 (4563) | 2.00 ± 0.20 | F | - | - | 1000 | - |
| | 2.50 ± 0.30 | G | - | - | 500 | - |
| 2220 (5750) | 2.00 ± 0.20 | F | - | - | 1000 | - |
| | 2.50 ± 0.30 | G | - | - | 500 | - |
| 2225 (5763) | 2.00 ± 0.20 | F | - | - | 1000 | - |
| | 2.50 ± 0.30 | G | - | - | 500 | - |

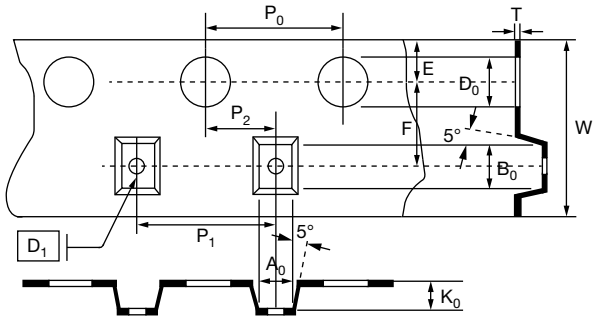
## TAPE AND REEL SPECIFICATIONS




Dimensions of paper tape

| DIMENSIONS PAPER TAPE in millimeters | |
|---|---|
| SIZE CODE | 1206 |
| THICKNESS | X |
| $A_0$ | 2.00 ± 0.10 |
| $B_0$ | 3.50 ± 0.50 |
| T | 0.95 ± 0.05 |
| W | 8.00 ± 0.10 |
| $P_0$ | 4.00 ± 0.10 |
| 10 x $P_0$ | 40.00 ± 0.20 |
| $P_1$ | 4.00 ± 0.10 |
| $P_2$ | 2.00 ± 0.05 |
| $D_0$ | 1.50 + 0.10 / - 0.0 |
| E | 1.75 ± 0.10 |
| F | 3.50 ± 0.05 |


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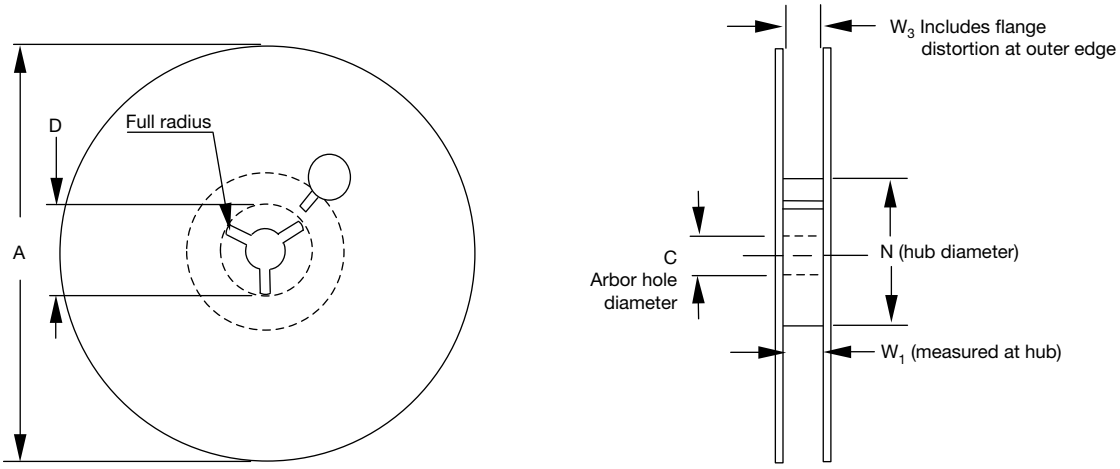



Dimensions of plastic tape

| DIMENSIONS PLASTIC TAPE in millimeters | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SIZE CODE | 1206 | | 1210 | | 1808 | | 1812 | |
| THICKNESS | M, C | E, P | M, C, E | F, G | C, E | F | C, E, F | G |
| $A_0$ | < 2.00 | < 2.50 | < 3.05 | < 3.20 | < 2.50 | < 2.50 | < 3.90 | < 3.90 |
| $B_0$ | < 3.70 | < 4.00 | < 3.80 | < 4.00 | < 5.30 | < 5.30 | < 5.30 | < 5.30 |
| T | 0.23 ± 0.05 | 0.23 ± 0.05 | 0.23 ± 0.05 | 0.23 ± 0.05 | 0.25 ± 0.05 | 0.25 ± 0.05 | 0.25 ± 0.05 | 0.25 ± 0.05 |
| K | < 2.50 | < 2.50 | < 2.50 | < 3.50 | < 2.50 | < 2.50 | < 2.50 | < 3.50 |
| W | 8.00 ± 0.10 | 8.00 ± 0.10 | 8.00 ± 0.10 | 8.00 ± 0.10 | 12.00 ± 0.20 | 12.00 ± 0.20 | 12.00 ± 0.20 | 12.00 ± 0.20 |
| $P_0$ | 4.00 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 |
| 10 x $P_0$ | 40.00 ± 0.20 | 40.00 ± 0.20 | 40.00 ± 0.20 | 40.00 ± 0.20 | 40.00 ± 0.20 | 40.00 ± 0.20 | 40.00 ± 0.20 | 40.00 ± 0.20 |
| $P_1$ | 4.00 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 | 8.00 ± 0.10 | 8.00 ± 0.10 |
| $P_2$ | 2.00 ± 0.05 | 2.00 ± 0.05 | 2.00 ± 0.05 | 2.00 ± 0.05 | 2.00 ± 0.05 | 2.00 ± 0.05 | 2.00 ± 0.05 | 2.00 ± 0.05 |
| $D_0$ | 1.50 + 0.10/- 0 | 1.50 + 0.10/- 0 | 1.50 + 0.10/- 0 | 1.50 + 0.10/- 0 | 1.50 + 0.10/- 0 | 1.50 + 0.10/- 0 | 1.50 + 0.10/- 0 | 1.50 + 0.10/- 0 |
| $D_1$ | 1.00 ± 0.10 | 1.50 ± 0.10 | 1.50 ± 0.10 | 1.00 ± 0.10 | 1.50 ± 0.10 | 1.50 ± 0.10 | 1.50 ± 0.10 | 1.50 ± 0.10 |
| E | 1.75 ± 0.10 | 1.75 ± 0.10 | 1.75 ± 0.10 | 1.75 ± 0.10 | 1.75 ± 0.10 | 1.75 ± 0.10 | 1.75 ± 0.10 | 1.75 ± 0.10 |
| F | 3.50 ± 0.05 | 5.50 ± 0.05 | 5.50 ± 0.05 | 3.50 ± 0.05 | 5.50 ± 0.05 | 5.50 ± 0.05 | 5.50 ± 0.05 | 5.50 ± 0.05 |

| DIMENSIONS PLASTIC TAPE in millimeters | | | | | | |
|---|---|---|---|---|---|---|
| SIZE CODE | 1825 | | 2220 | | 2225 | |
| THICKNESS | F | G, H | F | G, H | F | G, H |
| $A_0$ | < 6.80 | < 6.80 | < 5.80 | < 6.80 | < 6.80 | < 6.80 |
| $B_0$ | < 5.30 | < 5.30 | < 6.50 | < 6.50 | < 6.50 | < 6.50 |
| T | 0.30 ± 0.10 | 0.30 ± 0.10 | 0.30 ± 0.10 | 0.30 ± 0.10 | 0.30 ± 0.10 | 0.30 ± 0.10 |
| K | < 2.50 | < 3.10 | < 2.50 | < 3.10 | < 2.50 | < 3.10 |
| W | 12.00 ± 0.20 | 12.00 ± 0.20 | 12.00 ± 0.20 | 12.00 ± 0.20 | 12.00 ± 0.20 | 12.00 ± 0.20 |
| $P_0$ | 4.00 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 |
| 10 x $P_0$ | 40.00 ± 0.20 | 40.00 ± 0.20 | 40.00 ± 0.20 | 40.00 ± 0.20 | 40.00 ± 0.20 | 40.00 ± 0.20 |
| $P_1$ | 8.00 ± 0.10 | 8.00 ± 0.10 | 8.00 ± 0.10 | 8.00 ± 0.10 | 8.00 ± 0.10 | 8.00 ± 0.10 |
| $P_2$ | 2.00 ± 0.05 | 2.00 ± 0.05 | 2.00 ± 0.05 | 2.00 ± 0.05 | 2.00 ± 0.05 | 2.00 ± 0.05 |
| $D_0$ | 1.50 + 0.10/- 0 | 1.50 + 0.10/- 0 | 1.50 + 0.10/- 0 | 1.50 + 0.10/- 0 | 1.50 + 0.10/- 0 | 1.50 + 0.10/- 0 |
| $D_1$ | 1.50 ± 0.10 | 1.50 ± 0.10 | 1.50 ± 0.10 | 1.50 ± 0.10 | 1.50 ± 0.10 | 1.50 ± 0.10 |
| E | 1.75 ± 0.10 | 1.75 ± 0.10 | 1.75 ± 0.10 | 1.75 ± 0.10 | 1.75 ± 0.10 | 1.75 ± 0.10 |
| F | 5.50 ± 0.05 | 5.50 ± 0.05 | 5.50 ± 0.05 | 5.50 ± 0.05 | 5.50 ± 0.05 | 5.50 ± 0.05 |


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| **REEL DIMENSIONS** in millimeters | | | | |
|---|---|---|---|---|
| **SIZE CODE** | **1206, 1210** | **1206, 1210** | **1808, 1812, 1825, 2220, 2225** | **1808, 1812 ONLY** |
| **REEL SIZE** | **7"** | **13"** | **7"** | **13"** |
| $A_{max.}$ | 178 | 330 | 178 | 330 |
| $D_{min.}$ | 20.2 | 20.2 | 20.2 | 20.2 |
| C | 13.0 + 0.5/- 0.2 | 13.0 + 0.7/- 0.3 | 13.0 + 0.5/- 0.2 | 13.0 + 0.7/- 0.3 |
| $N_{min.}$ | 60 | 100 | 60 | 100 |
| $W_1$ | 8.4 ± 1.5 | 8.4 ± 1.5 | 12.4 + 2.0/+ 0.0 | 12.4 + 2.0/+ 0.0 |
| $W_3$ | Shall accommodate tape width without interference | | | |

| **RELIABILITY TEST CONDITIONS AND REQUIREMENTS** | | | |
|---|---|---|---|
| **NO.** | **ITEM** | **TEST CONDITION** | **REQUIREMENTS** |
| 1. | Visual and dimensions | | No remarkable defects<br>Dimensions to confirm to individual specification sheet |
| 2. | Capacitance | Class I: C0G (NP0)<br>Cap. ≤ 1000 pF, 1.0 ± 0.2 $V_{RMS}$, 1 MHz ± 10 %<br>Cap. > 1000 pF, 1.0 ± 0.2 $V_{RMS}$, 1 kHz ± 10 %<br><br>Class II: X7R<br>1.0 ± 0.2 $V_{RMS}$, 1 kHz ± 10 % | Shall not exceed the limits given in the detailed spec.<br>Class I: C0G (NP0)<br>Cap. ≥ 30 pF, Q ≥ 1000<br>Cap. < 30 pF, Q ≥ 400 + 20C<br><br>Class II: X7R<br>D.F. ≤ 2.5 % |
| 3. | Q/D.F. (tangent of loss angle) | | |
| 4. | Temperature coefficient of capacitance (TCC) | With no electrical load.<br>Operating temperature<br>-55 °C to +125 °C at 25 °C | C0G (NP0): 0 ± 30 ppm/°C<br>X7R: ± 15 % |
| 5. | Insulation resistance | Rated voltage > 500 V, applied voltage 500 $V_{DC}$, test condition 60 s | C0G (NP0):<br>≥ 10 GΩ or R x C ≥ 500 ΩF, whichever is smaller<br><br>X7R:≥ 10 GΩ or R x C ≥ 100 ΩF, whichever is smaller |
| 6. | Solderability | Solder temperature: 235 °C ± 5 °C for (1206 to 1210)<br>Solder temperature: 245 °C ± 5 °C for (1808 to 2225)<br><br>Dipping time: 2 s ± 0.5 s | 75 % min. coverage of all metalized area |

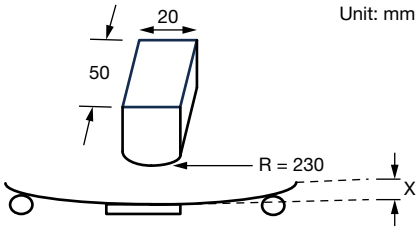
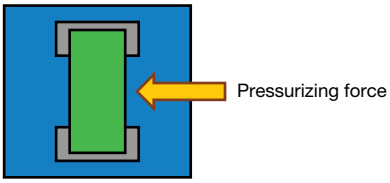

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## RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| NO. | ITEM | TEST CONDITION | REQUIREMENTS |
|---|---|---|---|
| 7. | Dielectric strength (voltage proof) | 630 ≤ V ≤ 3000 V, 1.2 x $U_R$<br>> 3000 V, 1.1 x $U_R$<br>Duration 1 s to 5 s<br>Voltage ramp-up rate ≤ 500 $V_{DC}$/s<br>Charge and discharge current less than 50 mA.<br>Test in insulating fluid. | No evidence of damage or flashover during test. |
| 8. | Resistance to soldering heat | Solder temperature: 260 °C ± 5 °C.<br>Dipping time: 10 s ± 1 s<br>Preheating: 120 °C to 150 °C for 1 min before immersing the capacitor in a eutectic solder.<br>Before initial measurement (Class II only): perform heat treatment at 150 °C + 0 °C/- 10 °C for 1 h and then set for 48 h ± 4 h at room temp.<br>Measurement to be made after keeping at room temp. for 24 h ± 2 h (Class I) or 48 h ± 4 h (Class II). | No remarkable damage.<br><br>Cap. change:<br>C0G: within ± 2.5 % or ± 0.25 pF, whichever is larger<br>X7R: within ± 7.5 %.<br><br>Q/D.F. and I.R.: to meet the initial requirement<br><br>25 % max. leaching on each edge. |
| 9. | Temperature cycle | Conduct the five cycles according to below temperatures and times:<br>Step 1 - min. operating temp. + 0/- 3 °C, 30 ± 3 mins.<br>Step 2 - room temp., 2 to 3 mins.<br>Step 3 - max. operating temp. + 3/- 0 °C, 30 ± 3 mins.<br>Step 4 - room temp., 2 to 3 mins.<br><br>Before initial measurement (Class II only): perform heat treatment at 150 °C + 0 °C/- 10 °C for 1 h and then set for 48 h ± 4 h at room temp.<br>Measurement to be made after keeping at room temp. for 24 h ± 2 h (Class I) or 48 h ± 4 h (Class II). | No remarkable damage.<br><br>Cap. change:<br>C0G: within ± 2.5 % or ± 0.25 pF, whichever is larger<br>X7R: within ± 7.5 %.<br><br>Q/D.F.:<br>C0G: to meet the initial requirement<br>X7R: D.F. ≤ 150 % of initial requirement<br><br>I.R.: to meet the initial requirement |
| 10. | Humidity (damp heat) steady state | Test temp.: 40 °C ± 2 °C.<br>Humidity: 90 % to 95 % RH.<br>Test time: 500 h + 24 h/- 0 h<br><br>Before initial measurement (Class II only): perform heat treatment at 150 °C + 0 °C / - 10 °C for 1 h and then set for 48 h ± 4 h at room temperature.<br><br>Measurement to be made after keeping at room temp. for 24 h ± 2 h (Class I) or 48 h ± 4 h (Class II). | No remarkable damage.<br><br>Cap. change:<br>C0G: within ± 5.0 % or ± 0.5 pF, whichever is larger<br>X7R: within ± 12.5 %<br><br>Q/D.F.:<br>C0G: Cap. > 30 pF, Q ≥ 350; 10 pF ≤ Cap. ≤ 30 pF, Q ≥ 275 + 2.5 C; Cap. < 10 pF, Q ≥ 200 + 10 C<br>X7R: D.F. ≤ 200 % of initial requirement<br><br>I.R.:<br>(Class I): ≥ 1 GΩ or R x C ≥ 50 ΩF, whichever is smaller.<br>(Class II): ≥ 1 GΩ or R x C ≥ 10 ΩF, whichever is smaller. |
| 11. | Humidity (damp heat) load | Test temp.: 40 °C ± 2 °C.<br>Humidity: 90 % to 95 % RH.<br>Test time: 500 h + 24 h/- 0 h<br>Applied voltage: 500 $V_{DC}$.<br><br>Before initial measurement (Class II only): perform heat treatment at 150 °C + 0 °C / - 10 °C for 1 h and then set for 48 h ± 4 h at room temperature.<br><br>Measurement to be made after keeping at room temp. for 24 h ± 2 h (Class I) or 48 h ± 4 h (Class II). | No remarkable damage.<br><br>Cap. change:<br>C0G: within ± 7.5 % or ± 0.75 pF, whichever is larger.<br>X7R: within ± 12.5 %.<br><br>Q/D.F.:<br>C0G: Cap. ≥ 30 pF, Q ≥ 200; Cap. < 30 pF, Q ≥ 100 + 10/3C.<br>X7R: D.F. ≤ 200 % of initial requirement.<br><br>I.R.: ≥ 500 MΩ or R x C ≥ 25 ΩF, whichever is smaller. |


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## RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| NO. | ITEM | TEST CONDITION | REQUIREMENTS |
|---|---|---|---|
| 12. | High temperature load (endurance) | Test temp.: 125 °C ± 3 °C.<br>Apply voltage: 1.2 x rated voltage.<br>Test time: 2000 h + 24 h/- 0 h<br><br>Before initial measurement (Class II only): perform heat treatment at 150 °C + 0 °C / -10 °C for 1 h and then set for 48 h ± 4 h at room temperature.<br><br>Measurement to be made after keeping at room temp. for 24 h ± 2 h (Class I) or 48 h ± 4 h (Class II). | No remarkable damage.<br><br>Cap. change:<br>C0G: within ± 3.0 % or ± 0.3 pF, whichever is larger<br>X7R: within ± 10 %<br><br>Q/D.F.:<br>C0G: Cap. > 30 pF, Q ≥ 350; 10 pF ≤ Cap. ≤ 30 pF, Q ≥ 275 + 2.5C; Cap. < 10 pF, Q ≥ 200 + 10C<br>X7R: D.F. ≤ 200 % of initial requirement<br><br>I.R.:<br>(Class I): ≥ 1 GΩ or R x C ≥ 50 ΩF, whichever is smaller.<br>(Class II): ≥ 1 GΩ or R x C ≥ 10 ΩF, whichever is smaller. |
| 13. | Resistance to flexure of substrate (substrate bending test) | The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about.<br>1 mm per second until the deflection (X) becomes:<br>- Sn termination: 1 mm<br>- Polymer termination:<br>  - 5 mm for product size < 1808<br>  - 3 mm for product size ≥ 1808<br> | No remarkable damage.<br><br>Cap. change:<br>C0G:<br>Sn termination within ± 3.0 % or ± 2.0 pF, whichever is larger.<br>Polymer termination within ± 5 % or ± 0.5 pF, whichever is larger.<br>X7R: within ± 12.5 %.<br><br>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test) |
| 14. | Adhesive strength of termination (robustness of termination) | Capacitors mounted on a substrate.<br>A force of 10 N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10 s ± 1 s.<br> | No remarkable damage or removal of the terminations. |


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## APPLICATION NOTES

### 1. Storage

- Store products at 5 °C to 40 °C ambient temperature and 20 % to 70 % relative humidity conditions.
- The product is recommended to be used within one year after shipment. Check solderability in case shelf-life extension is needed.
- Corrosive gas reacts with the terminal electrodes of capacitors and results in poor solderability. Do not store the capacitors in the ambience of corrosive gas (e.g. hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas, etc.).
- Packaging should not be opened until the capacitors are required for use. If opened, the pack should be re-sealed as soon as is practicable. Taped product should be stored out of direct sunlight, which might promote deterioration in tape or adhesion performance.

### 2. Handling

Chip capacitors are dense, hard, brittle, and abrasive materials; they are liable to suffer mechanical damage in the form of cracks or chips. Chip capacitors should be handled with care to avoid contamination or damage. Using vacuum or plastic tweezers is recommended for manual placement. Tape and reeled packages are suitable for automatic pick and placement machines.

### 3. Preheat

In order to minimize the risk of thermal shock during soldering, a carefully controlled preheat is required. The rate of preheat should not exceed 3 °C per second.

### 4. Soldering

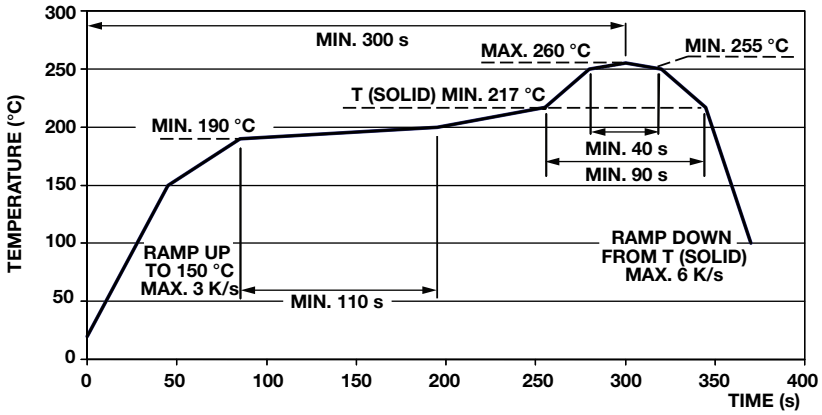
Use mildly activated rosin fluxes do not use activated flux. The amount of solder in each solder joint should be controlled to prevent the damage of chip capacitors caused by the stress between solder, chips, and substrate.

a) Hand soldering

Attachment by soldering iron is not recommended. A heat shock may cause a crack in the MLCC chip capacitors; however, if solder iron is used, the following precautions should be taken:

- Soldering iron tip diameter ≤ 1.0 mm and use a low wattage, temperature-controlled iron.
- Preheat the chip capacitor to +150 °C minimum. Use hot plate or hot air flow for preheat.
- The required amount of solder shall be melted on the soldering tip.
- Tip temperature setting ≤ 280 °C and a maximum soldering time of 5 s.
- The tip of iron should not contact the ceramic body directly
- The capacitors shall be cooled gradually at room temperature after soldering
- Forced air cooling is not allowed
- When removal of chip capacitor is necessary, a hot air pencil is the preferred tool

b) Reflow soldering



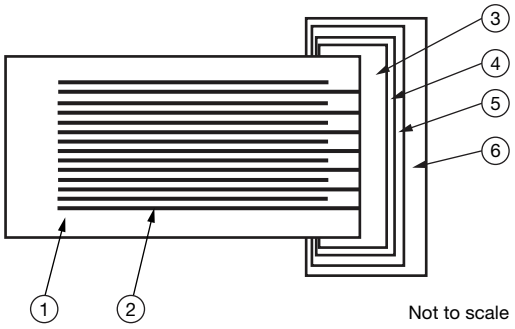

### 5. Cool Down

After soldering, allow the chip to cool at room ambient conditions. Using forced cool air or refrigerated air for expediting the cooling process is not recommended and can create thermal shock cracks and may facilitate board bend stresses.


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### 6. Cleaning

Selection of an appropriate cleaning solvent is dependent upon the type of flux used. Cleaning in alcohol, water, hydrocarbons or any of the common, halogenated degreaser solvents are not detrimental to Vishay chip capacitors.




| CONSTRUCTION | | | | |
|---|---|---|---|---|
| **NO.** | **NAME** | | **C0G (NP0)** | **X7R** |
| 1 | Ceramic material | | $CaZrO_3$ based | $BaTiO_3$ based |
| 2 | Inner electrode | | Ni | |
| 3 | Termination | Inner layer | Cu | |
| 4 | | Polymer layer | B termination only | |
| 5 | | Middle layer | Ni | |
| 6 | | Outer layer | Sn (matte) | |


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