

## Surface Mount Multilayer Ceramic Chip Capacitors for Ultra Small Commodity Applications



### FEATURES

- High capacitance in unit size
- High precision dimensional tolerances
- Suitably used in high-accuracy automatic mounting machine
- Dry sheet manufacturing technology
- Base Metal Electrode system (BME)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
**GREEN**  
(5-2008)

### APPLICATIONS

- Miniature microwave module
- Portable equipment - mobile phone, PDA

| ELECTRICAL SPECIFICATIONS               |  |   |  |
|---|--|---|--|
| Size                                    | 0201   |   |  |
| Dielectric                              | COG (NP0)  | X7R   | X5R  |
| Capacitance                             | 0.5 pF to 120 pF   | 100 pF to 10 nF   | 100 pF to 1.0 $\mu$ F                                |
| Capacitance Tolerance <sup>(2)(3)</sup> | Cap. $\leq$ 5 pF: B ( $\pm$ 0.1 pF), C ( $\pm$ 0.25 pF)<br>5 pF < Cap. < 10 pF: C ( $\pm$ 0.25 pF), D ( $\pm$ 0.5 pF)<br>Cap. $\geq$ 10 pF: F ( $\pm$ 1 %), G (2 %), J (5 %) | J ( $\pm$ 5 %)<br>K ( $\pm$ 10 %)<br>M ( $\pm$ 20 %)                    | J ( $\pm$ 5 %)<br>K ( $\pm$ 10 %)<br>M ( $\pm$ 20 %) |
| Rated Voltage ( $V_{DC}$ )              | 16 V, 25 V, 50 V   | 10 V, 16 V, 25 V, 50 V  | 6.3 V, 10 V, 16 V, 25 V, 50 V                        |
| $\tan \delta/Q$ <sup>(1)</sup>          | Cap. < 30 pF, $Q \geq 400 + 20 C$<br>Cap. $\geq$ 30 pF, $Q \geq 1000$  | See Table 1   |  |
| Insulation Resistance at $U_R$          | $\geq 10 G\Omega$  | $\geq 10 G\Omega$ or $R \times C \geq 500 \Omega F$ , whichever is less |  |
| Operating Temperature                   | -55 °C to +125 °C  |   | -55 °C to +85 °C                                     |
| Capacitance Change                      | $\pm 30$ ppm   | $\pm 15$ %  |  |
| Termination                             | Ni/Sn lead (Pb)-free termination   |   |  |

#### Notes

- (1) Measured at 30 % to 70 % relative humidity  
NP0: apply  $1.0 V_{RMS} \pm 0.2 V_{RMS}$ , 1.0 MHz  $\pm 10$  % at the condition of 25 °C ambient temperature  
X7R, X5R: apply  $1.0 V_{RMS} \pm 0.2 V_{RMS}$ , 1.0 kHz  $\pm 10$  % (224 / 6.3 V - 224 / 10 V - 105 / 10 V - 225 / 6.3 V:  $0.5 V_{RMS} \pm 0.2 V_{RMS}$ , 1.0 kHz  $\pm 10$  %) at the condition of 25 °C ambient temperature
- (2) Preconditioning for X7R / X5R MLCC: perform a heat treatment at 150 °C  $\pm 10$  °C for 1 h, then leave in ambient condition for 24 h  $\pm 2$  h before measurement
- (3) Tolerances restriction see "Selection Chart"

**Table 1**

X7R / X5R:

| RATED VOLTAGE | D.F. $\leq$ | EXCEPTION OF D.F. $\leq$ |                           |
|---------------|-------------|--------------------------|---------------------------|
| 50 V          | 3 %         | -                        | -                         |
| 16 V / 25 V   | 3.5 %       | 5 %                      | 0201 $\geq$ 0.01 $\mu$ F  |
|               |             | 10 %                     | 0201 $\geq$ 0.1 $\mu$ F   |
| 10 V          | 5 %         | 10 %                     | 0201 $\geq$ 0.012 $\mu$ F |
|               |             | 15 %                     | 0201 $\geq$ 0.1 $\mu$ F   |
| 6.3 V         | 10 %        | 15 %                     | 0201 $\geq$ 0.1 $\mu$ F   |

| QUICK REFERENCE DATA |      |                     |             |             |
|----------------------|------|---------------------|-------------|-------------|
| DIELECTRIC           | CASE | MAXIMUM VOLTAGE (V) | CAPACITANCE |             |
|                      |      |                     | MINIMUM     | MAXIMUM     |
| C0G (NP0)            | 0201 | 50                  | 0.5 pF      | 120 pF      |
| X5R                  | 0201 | 50                  | 100 pF      | 1.0 $\mu$ F |
| X7R                  | 0201 | 50                  | 100 pF      | 10 nF       |

**Note**

- Detail ratings see "Selection Chart" table

| ORDERING INFORMATION |                                     |   |   |                                   |   |                          |                                  |
|----------------------|-------------------------------------|---|---|-----------------------------------|---|--------------------------|----------------------------------|
| VJ0201               | A                                   | 100   | J   | X                                 | X   | C                        | W1BC                             |
| SIZE CODE            | DIELECTRIC                          | CAPACITANCE   | TOLERANCE <sup>(1)</sup>  | TERMINATION                       | RATED VOLTAGE   | PACKAGING                | PROCESS CODE FOR BASIC COMMODITY |
| 0201                 | A = C0G (NP0)<br>G = X5R<br>Y = X7R | Two significant digits followed by the number of zeros.<br>R is in place of decimal point:<br>0R5 = 0.5 pF<br>1R0 = 1.0 pF<br>100 = 10 pF | B = $\pm$ 0.10 pF<br>C = $\pm$ 0.25 pF<br>D = $\pm$ 0.5 pF<br>F = $\pm$ 1 %<br>G = $\pm$ 2 %<br>J = $\pm$ 5 %<br>K = $\pm$ 10 %<br>M = $\pm$ 20 % | X = Ni barrier<br>100 % matte tin | Y = 6.3 V<br>Q = 10 V<br>J = 16 V<br>X = 25 V<br>A = 50 V | C = 7" reel / paper tape |                                  |

**Note**

- <sup>(1)</sup> Detail tolerance see under "Electrical Specifications" table

| DIMENSIONS in inches (millimeters) |  |  |                                 |   |
|------------------------------------|--|--|---------------------------------|---|
|                                    |  |  |                                 |   |
| SIZE CODE                          | L  | W  | T MAX.                          | MB  |
| 0201 <sup>(1)</sup><br>(0603)      | 0.024 $\pm$ 0.0012<br>(0.60 $\pm$ 0.03)                | 0.012 $\pm$ 0.0012<br>(0.30 $\pm$ 0.03)                | 0.013<br>(0.33)                 | 0.006 $\pm$ 0.002<br>(0.15 $\pm$ 0.05)                          |
|                                    | 0.024 $\pm$ 0.002 <sup>(2)</sup><br>(0.60 $\pm$ 0.05)  | 0.012 $\pm$ 0.002 <sup>(2)</sup><br>(0.30 $\pm$ 0.05)  | 0.014 <sup>(2)</sup><br>(0.35)  |   |
|                                    | 0.024 $\pm$ 0.0035 <sup>(3)</sup><br>(0.60 $\pm$ 0.09) | 0.012 $\pm$ 0.0035 <sup>(3)</sup><br>(0.30 $\pm$ 0.09) | 0.0153 <sup>(3)</sup><br>(0.39) | 0.006 + 0.004 / - 0.002 <sup>(3)</sup><br>(0.15 + 0.1 / - 0.05) |

**Notes**

- <sup>(1)</sup> Reflow soldering only  
<sup>(2)</sup> For capacitance values 0.1  $\mu$ F < cap. < 0.68  $\mu$ F  
<sup>(3)</sup> For capacitance values  $\geq$  0.68  $\mu$ F



| SELECTION CHART         |          |           |      |                  |                  |                  |                  |      |      |      |      |      |      |
|-------------------------|----------|-----------|------|------------------|------------------|------------------|------------------|------|------|------|------|------|------|
| DIELECTRIC              |          | C0G (NP0) |      |                  |                  | X5R              |                  |      |      | X7R  |      |      |      |
| STYLE                   |          | VJ0201    |      |                  |                  |                  |                  |      |      |      |      |      |      |
| SIZE CODE               |          | 0201      |      |                  |                  |                  |                  |      |      |      |      |      |      |
| VOLTAGE V <sub>DC</sub> |          | 16 V      | 25 V | 50 V             | 6.3 V            | 10 V             | 16 V             | 25 V | 50 V | 10 V | 16 V | 25 V | 50 V |
| VOLTAGE CODE            |          | J         | X    | A                | Y                | Q                | J                | X    | A    | Q    | J    | X    | A    |
| CAP. CODE               | CAP.     |           |      |                  |                  |                  |                  |      |      |      |      |      |      |
| 0R5                     | 0.5 pF   |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 1R0                     | 1.0 pF   |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 1R2                     | 1.2 pF   |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 1R5                     | 1.5 pF   |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 1R8                     | 1.8 pF   |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 2R2                     | 2.2 pF   |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 2R7                     | 2.7 pF   |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 3R3                     | 3.3 pF   |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 3R9                     | 3.9 pF   |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 4R7                     | 4.7 pF   |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 5R6                     | 5.6 pF   |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 6R8                     | 6.8 pF   |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 8R2                     | 8.2 pF   |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 100                     | 10 pF    |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 120                     | 12 pF    |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 150                     | 15 pF    |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 180                     | 18 pF    |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 220                     | 22 pF    |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 270                     | 27 pF    |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 330                     | 33 pF    |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 390                     | 39 pF    |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 470                     | 47 pF    |           | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 560                     | 56 pF    | L         | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 680                     | 68 pF    | L         | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 820                     | 82 pF    | L         | L    | L                |                  |                  |                  |      |      |      |      |      |      |
| 101                     | 100 pF   | L         | L    | L                |                  |                  |                  | L    |      | L    | L    | L    | L    |
| 121                     | 120 pF   | L         | L    | L                |                  |                  |                  | L    |      | L    | L    | L    | L    |
| 151                     | 150 pF   |           |      |                  |                  |                  |                  | L    |      | L    | L    | L    | L    |
| 181                     | 180 pF   |           |      |                  |                  |                  |                  | L    |      | L    | L    | L    | L    |
| 221                     | 220 pF   |           |      |                  |                  |                  |                  | L    |      | L    | L    | L    | L    |
| 271                     | 270 pF   |           |      |                  |                  |                  |                  | L    |      | L    | L    | L    | L    |
| 331                     | 330 pF   |           |      |                  |                  |                  |                  | L    |      | L    | L    | L    | L    |
| 391                     | 390 pF   |           |      |                  |                  |                  |                  | L    |      | L    | L    | L    | L    |
| 471                     | 470 pF   |           |      |                  |                  |                  |                  | L    |      | L    | L    | L    | L    |
| 561                     | 560 pF   |           |      |                  |                  |                  |                  | L    |      | L    | L    | L    | L    |
| 681                     | 680 pF   |           |      |                  |                  |                  |                  | L    |      | L    | L    | L    | L    |
| 821                     | 820 pF   |           |      |                  |                  |                  |                  | L    |      | L    | L    | L    | L    |
| 102                     | 1000 pF  |           |      |                  |                  |                  | L                |      | L    | L    | L    | L    | L    |
| 152                     | 1500 pF  |           |      |                  |                  | L                | L                |      | L    | L    |      |      |      |
| 222                     | 2200 pF  |           |      |                  |                  | L                | L                |      | L    | L    |      |      |      |
| 332                     | 3300 pF  |           |      |                  |                  | L                | L                |      | L    | L    |      |      |      |
| 472                     | 4700 pF  |           |      |                  |                  | L                | L                |      | L    | L    |      |      |      |
| 682                     | 6800 pF  |           |      |                  |                  | L                | L                |      | L    | L    |      |      |      |
| 103                     | 0.010 μF |           |      |                  |                  | L                | L <sup>(3)</sup> |      | L    | L    |      |      |      |
| 153                     | 0.015 μF |           |      | L                |                  |                  |                  |      |      |      |      |      |      |
| 223                     | 0.022 μF |           |      | L                |                  |                  |                  |      |      |      |      |      |      |
| 333                     | 0.033 μF |           |      | L                |                  |                  |                  |      |      |      |      |      |      |
| 473                     | 0.047 μF |           |      | L                |                  |                  |                  |      |      |      |      |      |      |
| 683                     | 0.068 μF |           |      | L                |                  |                  |                  |      |      |      |      |      |      |
| 104                     | 0.10 μF  |           |      | L                | L                | L <sup>(3)</sup> | L <sup>(3)</sup> |      |      |      |      |      |      |
| 224                     | 0.22 μF  |           |      | L <sup>(3)</sup> | L <sup>(3)</sup> |                  |                  |      |      |      |      |      |      |
| 474                     | 0.47 μF  |           |      | L <sup>(3)</sup> |                  |                  |                  |      |      |      |      |      |      |
| 105                     | 1.0 μF   |           |      | L <sup>(3)</sup> | L <sup>(1)</sup> |                  |                  |      |      |      |      |      |      |

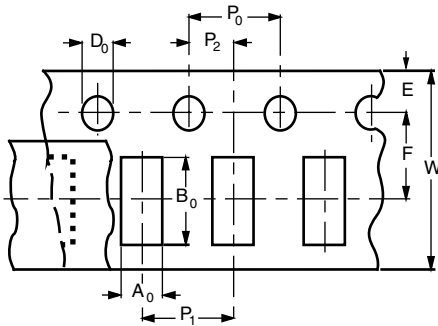
Notes

- Letters indicate product thickness, see "Packaging quantities"
- (1) Only in 20 % (code "M") tolerance
- (2) Only in 10 % (code "K") tolerance
- (3) Not in 5 % (code "J") tolerance



| PACKAGING QUANTITIES     |                   |             |              |
|--------------------------|-------------------|-------------|--------------|
| SIZE CODE<br>(inch / mm) | THICKNESS<br>(mm) | PAPER TAPE  |              |
|                          |                   | 7" REEL (C) | 13" REEL (P) |
| 0201 (0603)              | 0.39              | 15K         | -            |

**PAPER TAPE SPECIFICATIONS**

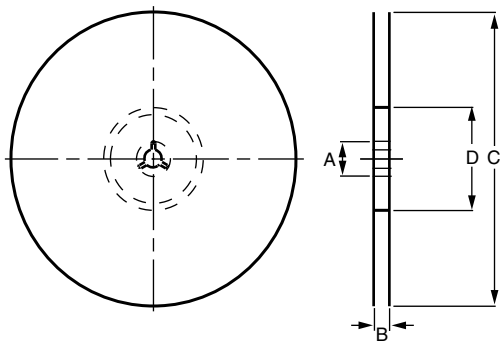


**DIMENSIONS OF PAPER TAPE**

in millimeters

| SYMBOL         | PRODUCT SIZE CODE |
|----------------|-------------------|
|                | 0201              |
| A <sub>0</sub> | 0.38 ± 0.05       |
| B <sub>0</sub> | 0.68 ± 0.05       |
| W              | 8.00 ± 0.10       |
| E              | 1.75 ± 0.05       |
| F              | 3.50 ± 0.05       |
| D <sub>0</sub> | 1.55 ± 0.05       |
| P <sub>0</sub> | 4.00 ± 0.10       |
| P <sub>1</sub> | 2.00 ± 0.05       |
| P <sub>2</sub> | 2.00 ± 0.05       |

**REEL SPECIFICATION**

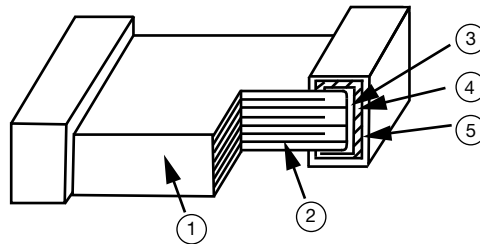


**REEL DIMENSIONS AND TAPE WIDTH**

in millimeters

| SYMBOL | Ø 180 mm; 7" | Ø 330 mm; 13" |
|--------|--------------|---------------|
| A      | 13.0 ± 0.5   | 13.0 ± 0.5    |
| B      | 9.0 ± 1.0    | 9.0 ± 1.0     |
| C      | 178.0 ± 1.0  | 330.0 ± 1.0   |
| D      | 60.0 ± 1.0   | 100.0 ± 1.0   |

| CONSTRUCTION |                  |                          |                          |
|--------------|------------------|--------------------------|--------------------------|
| NO.          | NAME             | COG (NP0)                | X5R, X7R                 |
| 1            | Ceramic material | CaZrO <sub>3</sub> based | BaTiO <sub>3</sub> based |
| 2            | Inner electrode  | Ni                       |                          |
| 3            | Termination      | Inner layer              | Cu                       |
| 4            |                  | Middle layer             | Ni                       |
| 5            |                  | Outer layer              | Sn (matt)                |



## STORAGE AND HANDLING CONDITIONS

- (1) To store products at 5 °C to 40 °C ambient temperature and 20 % to 70 % relative humidity conditions.
- (2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

### Cautions:

- a. Do not store products in a corrosive environment such as sulfide, chloride gas, or acid. It may cause oxidization of electrode, which easily be resulted in poor soldering.
- b. To store products on the shelf and avoid exposure to moisture.
- c. Do not expose products to excessive shock, vibration, direct sunlight and so on.



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