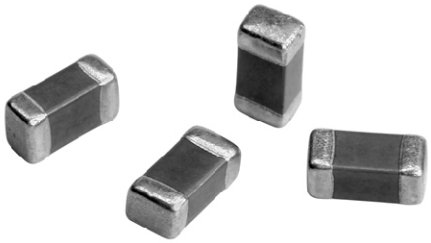
# Surface Mount Multilayer Ceramic Chip Capacitors for Ultra High Q Commodity Applications



## FEATURES

- Ultra stable class 1 dielectric
- Ultra high Q and low ESR at high frequency
- Four standard sizes
- High SRF characteristic
- Ultra low capacitance to 0.1 pF
- High precision capacitance tolerance ± 0.05 pF
- Supplied in tape on reel
- Ni-barrier with 100 % tin terminations
- Dry sheet manufacturing technology
- 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

- Mobile telecommunication
- WLAN
- RF modules
- Tuner

## ELECTRICAL SPECIFICATIONS

**Note**

- Electrical characteristics at 25 °C, 30 % to 70 % related humidity, unless otherwise specified

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

**Capacitance Range:** 0.1 pF to 100 pF

**Voltage Range:** 10 $V_{DC}$ to 250 $V_{DC}$

**Temperature Coefficient of Capacitance (TCC):**
0 ppm/°C ± 30 ppm/°C from - 55 °C to + 125 °C
0201: ≥ 22 pF: 0 ppm/°C ± 60 ppm/°C from - 55 °C to + 125 °C

**Dissipation Factor:**
Cap < 30 pF: Q ≥ 400 + 20 C
Cap ≥ 30 pF: Q ≥ 1000

**Test Conditions for Capacitance and DF Measurement:**
Cap. ≤ 1000 pF 1.0 $V_{RMS}$ ± 0.2 $V_{RMS}$, 1 MHz ± 10 %
Cap. > 1000 pF 1.0 $V_{RMS}$ ± 0.2 $V_{RMS}$, 1 kHz ± 10 %

**Aging Rate:** 0 % maximum per decade

**Insulation Resistance (IR):** after 120 s at $U_R$ (DC)
≥ 10 GΩ or R x C ≥ 500 Ω x F whichever is less

**Dielectric Strength Test:**

This is the maximum voltage the capacitors are tested for 1 s to 5 s period and the charge/discharge current does not exceed 50 mA
≤ 100 $V_{DC}$: DWV at 250 % of rated voltage
250 $V_{DC}$: DWV at 200 % of rated voltage

## QUICK REFERENCE DATA

| DIELECTRIC | CASE | MAXIMUM VOLTAGE (V) | CAPACITANCE | |
|---|---|---|---|---|
| | | | MINIMUM | MAXIMUM |
| Ultra High Q | 0201 | 50 | 0.1 pF | 33 pF |
| | 0402 | 100 | 0.1 pF | 22 pF |
| | 0603 | 250 | 0.3 pF | 47 pF |
| | 0805 | 250 | 0.3 pF | 100 pF |

**Note**

- Detail ratings see “Selection Chart”

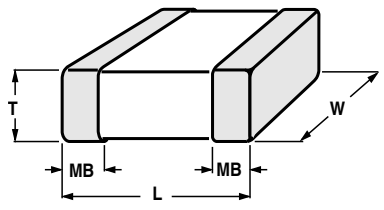
## ORDERING INFORMATION

| VJ0402 | L | 100 | F | X | A | C | W1BC |
|---|---|---|---|---|---|---|---|
| SIZE CODE | DIELECTRIC | CAPACITANCE | TOLERANCE (1) | TERMINATION | VOLTAGE | PACKAGING | PROCESS CODE FOR BASIC COMMODITY |
| 0201<br>0402<br>0603<br>0805 | L = Ultra High Q | Expressed in pF two significant digits followed by the number of zeros:<br>0R3 = 0.3 pF<br>1R0 = 1.0 pF<br>150 = 15 pF | Cap. value ≤ 5 pF<br>V = ± 0.05 pF<br>B = ± 0.10 pF<br>C = ± 0.25 pF<br>D = ± 0.50 pF<br>5 pF > Cap. value < 10 pF<br>B = ± 0.10 pF<br>C = ± 0.25 pF<br>D = ± 0.50 pF<br>Cap. value ≥ 10 pF<br>F = ± 1 %<br>G = ± 2 %<br>J = ± 5 % | X = Ni barrier 100 % tin termination | Q = 10 V<br>X = 25 V<br>A = 50 V<br>B = 100 V<br>P = 250 V | C = 7" reel/ paper tape<br>P = 13" reel/ paper tape | |

**Note**

(1) Details see “Selection Chart”

## DIMENSIONS in inches [millimeters]




| SIZE CODE | L | W | T MAX. | MB |
|---|---|---|---|---|
| 0201 (0603) | 0.024 ± 0.0012 (0.60 ± 0.03) | 0.012 ± 0.0012 (0.30 ± 0.03) | 0.013 (0.33) | 0.006 ± 0.002 (0.15 ± 0.05) |
| 0402 (1005) | 0.040 ± 0.002 (1.00 ± 0.05) | 0.020 ± 0.002 (0.50 ± 0.05) | 0.022 (0.55) | 0.010 + 0.002/- 0.004 (0.25 + 0.05/- 0.10) |
| 0603 (1608) | 0.063 ± 0.004 (1.60 ± 0.10) | 0.030 ± 0.004 (0.80 ± 0.10) | 0.035 (0.87) | 0.015 ± 0.006 (0.40 ± 0.15) |
| 0805 (2012) | 0.080 ± 0.008 (2.00 ± 0.20) | 0.050 ± 0.008 (1.25 ± 0.20) | 0.038 (0.95) | 0.020 ± 0.008 (0.50 ± 0.20) |

## SELECTION CHART

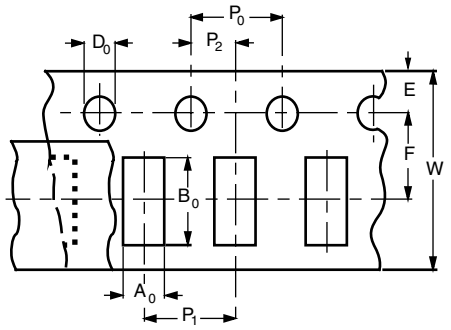
| DIELECTRIC | | ULTRA HIGH Q | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STYLE | | VJ0201 | | | VJ0402 | | VJ0603 | | | VJ0805 | | | TOLERANCE |
| SIZE CODE | | 0201 | | | 0402 | | 0603 | | | 0805 | | | |
| VOLTAGE $V_{DC}$ | | 10 V | 25 V | 50 V | 50 V | 100 V | 50 V | 100 V | 250 V | 50 V | 100 V | 250 V | |
| VOLTAGE CODE | | Q | X | A | A | B | A | B | P | A | B | P | |
| CAP. CODE | CAP. | | | | | | | | | | | | |
| 0R1 | 0.1 pF | L | L | | N | N | | | | | | | B |
| 0R2 | 0.2 pF | L | L | | N | N | | | | | | | V, B |
| 0R3 | 0.3 pF | L | L | | N | N | S | S | S | T | T | T | V, B |
| 0R4 | 0.4 pF | L | L | | N | N | S | S | S | T | T | T | V, B |
| 0R5 | 0.5 pF | L | L | | N | N | S | S | S | T | T | T | V, B, C |
| 0R6 | 0.6 pF | L | L | | N | N | S | S | S | T | T | T | V, B, C |
| 0R7 | 0.7 pF | L | L | | N | N | S | S | S | T | T | T | V, B, C |
| 0R8 | 0.8 pF | L | L | | N | N | S | S | S | T | T | T | V, B, C |
| 0R9 | 0.9 pF | L | L | | N | N | S | S | S | T | T | T | V, B, C |
| 1R0 | 1.0 pF | L | L | L | N | N | S | S | S | T | T | T | V, B, C |
| 1R2 | 1.2 pF | L | L | | N | N | S | S | S | T | T | T | V, B, C |
| 1R5 | 1.5 pF | L | L | L | N | N | S | S | S | T | T | T | V, B, C |
| 1R8 | 1.8 pF | L | L | | N | N | S | S | S | T | T | T | V, B, C |
| 2R2 | 2.2 pF | L | L | L | N | N | S | S | S | T | T | T | V, B, C |
| 2R4 | 2.4 pF | | | | | | | | S | | | | V, B, C |
| 2R7 | 2.7 pF | L | L | | N | N | S | S | S | T | T | T | V, B, C |
| 3R3 | 3.3 pF | L | L | L | N | N | S | S | S | T | T | T | V, B, C |
| 3R9 | 3.9 pF | L | L | | N | N | S | S | S | T | T | T | V, B, C |
| 4R7 | 4.7 pF | L | L | L | N | N | S | S | S | T | T | T | V, B, C |
| 5R6 | 5.6 pF | L | L | | N | N | S | S | S | T | T | T | B, C, D |
| 6R8 | 6.8 pF | L | L | L | N | N | S | S | S | T | T | T | B, C, D |
| 8R2 | 8.2 pF | L | L | | N | N | S | S | S | T | T | T | B, C, D |
| 100 | 10 pF | L | L | L | N | N | S | S | S | T | T | T | F, G, J |
| 110 | 11 pF | L | L | | N | | S | S | S | T | T | T | F, G, J |
| 120 | 12 pF | L | L | | N | | S | S | S | T | T | T | F, G, J |
| 130 | 13 pF | L | L | | N | | S | S | S | T | T | T | F, G, J |
| 150 | 15 pF | L | L | L | N | | S | S | S | T | T | T | F, G, J |
| 160 | 16 pF | L | L | | N | | S | S | S | T | T | T | F, G, J |
| 180 | 18 pF | L | L | | N | | S | S | S | T | T | T | F, G, J |
| 200 | 20 pF | L | | | N | | S | S | S | T | T | T | F, G, J |
| 220 | 22 pF | L | L | | N | | S | S | S | T | T | T | F, G, J |
| 240 | 24 pF | L | | | | | S | S | S | T | T | T | F, G, J |
| 270 | 27 pF | L | | | | | S | S | S | T | T | T | F, G, J |
| 300 | 30 pF | L | | | | | S | S | S | T | T | T | F, G, J |
| 330 | 33 pF | L | L | | | | S | S | S | T | T | T | F, G, J |
| 360 | 36 pF | | | | | | S | S | S | T | T | T | F, G, J |
| 390 | 39 pF | | | | | | S | S | S | T | T | T | F, G, J |
| 430 | 43 pF | | | | | | S | S | S | T | T | T | F, G, J |
| 470 | 47 pF | | | | | | S | S | S | T | T | T | F, G, J |
| 560 | 56 pF | | | | | | | | | T | T | T | F, G, J |
| 680 | 68 pF | | | | | | | | | T | T | T | F, G, J |
| 820 | 82 pF | | | | | | | | | T | T | T | F, G, J |
| 101 | 100 pF | | | | | | | | | T | T | T | F, G, J |

**Note**

- Letters indicate product thickness, see “Packaging Quantities”

| PACKAGING QUANTITIES | | | | |
|---|---|---|---|---|
| SIZE CODE (inch/mm) | THICKNESS (mm) | THICKNESS SYMBOL | PAPER TAPE | |
| | | | 7" REEL (C) | 13" REEL (P) |
| 0201 (0603) | 0.30 ± 0.03 | L | 15K | - |
| 0402 (1002) | 0.50 ± 0.05 | N | 10K | 50K |
| 0603 (1608) | 0.80 ± 0.07 | S | 4K | 15K |
| 0805 (2012) | 0.85 ± 0.10 | T | 4K | 15K |

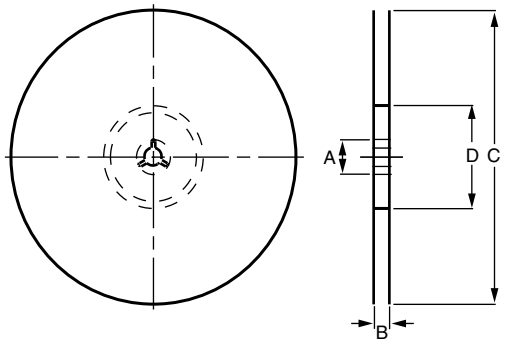
## PAPER TAPE SPECIFICATION




**DIMENSIONS OF PAPER TAPE**
in millimeters

| SYM. | PRODUCT SIZE CODE | | | |
|---|---|---|---|---|
| | 0201 | 0402 | 0603 | 0805 |
| $A_0$ | 0.37 ± 0.03 | 0.62 ± 0.05 | 1.02 ± 0.05 | 1.50 ± 0.10 |
| $B_0$ | 0.67 ± 0.03 | 1.12 ± 0.05 | 1.82 ± 0.05 | 2.30 ± 0.10 |
| W | 8.00 ± 0.10 | 8.00 ± 0.10 | 8.00 ± 0.10 | 8.00 ± 0.10 |
| E | 1.75 ± 0.05 | 1.75 ± 0.05 | 1.75 ± 0.05 | 1.75 ± 0.05 |
| F | 3.50 ± 0.05 | 3.50 ± 0.05 | 3.50 ± 0.05 | 3.50 ± 0.05 |
| $D_0$ | 1.55 ± 0.05 | 1.55 ± 0.05 | 1.55 ± 0.05 | 1.55 ± 0.05 |
| $P_0$ | 4.00 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 |
| $P_1$ | 2.00 ± 0.05 | 2.00 ± 0.05 | 4.00 ± 0.10 | 4.00 ± 0.10 |
| $P_2$ | 2.00 ± 0.05 | 2.00 ± 0.05 | 2.00 ± 0.05 | 2.00 ± 0.05 |

## REEL SPECIFICATIONS

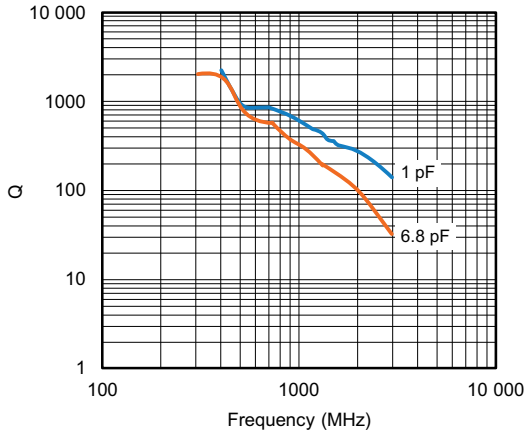



**REEL DIMENSIONS AND TAPE WIDTH**
in millimeters

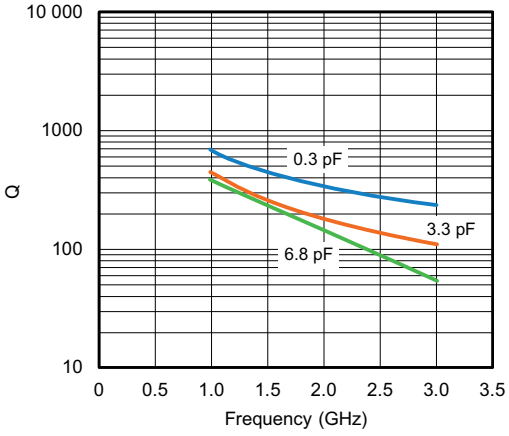
| SYM. | Ø 180 mm; 7" | Ø 330 mm; 13" |
|---|---|---|
| A | 13.0 ± 0.5 | 13.0 ± 0.5 |
| B | 9.0 ± 1.0 | 9.0 ± 1.0 |
| C | 178.0 ± 1.0 | 330.0 ± 1.0 |
| D | 60.0 ± 1.0 | 100.0 ± 1.0 |

## ELECTRICAL CHARACTERISTICS

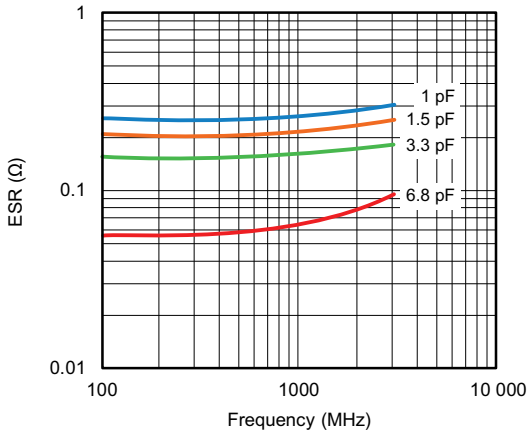
Typical Q Value vs. Frequency (Size 0402)



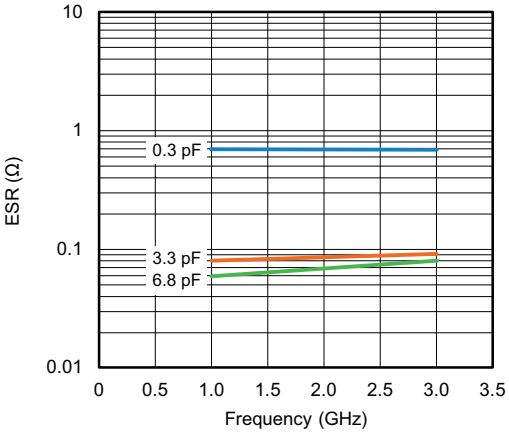

Typical Q Value vs. Frequency (Size 0603, 250 V)



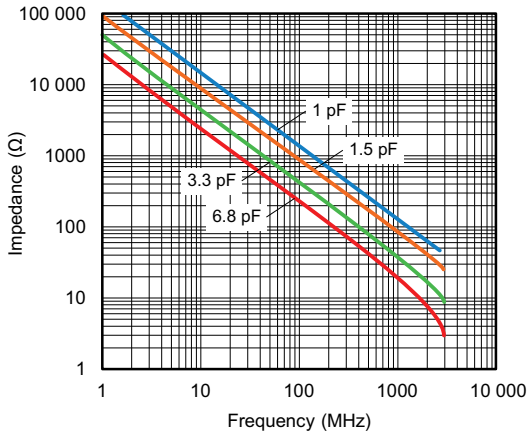

Typical ESR vs. Frequency (Size 0402)




Typical ESR vs. Frequency (Size 0603, 250 V)

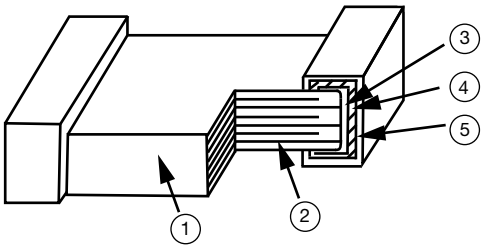



Typical Impedance vs. Frequency (Size 0402)



## CONSTRUCTION

| NO. | NAME | | ULTRA HIGH Q |
|---|---|---|---|
| 1 | Ceramic material | | $BaTiO_3$ based |
| 2 | Inner electrode | | Cu |
| 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 % related 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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