

Surface Mount Multilayer Ceramic Chip Capacitors for High Temperature Applications Up to 150 °C



FEATURES

- Specialty: high temperature applications
- High operating temperature dielectric: 150 °C
- Maintains capacitance at high temperature for frequency stability
- Wet build process
- Reliable Noble Metal Electrode (NME) system
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE
GREEN
(5-2008)
Available

APPLICATIONS

- High temperature modules

ELECTRICAL SPECIFICATIONS

Note

- Electrical characteristics at +25 °C unless otherwise specified.

Operating Temperature: -55 °C to +150 °C

Capacitance Range: 330 pF to 220 nF

Voltage Range: 25 V_{DC} to 100 V_{DC}

Temperature Coefficient of Capacitance (TCC):
± 15 % from -55 °C to +150 °C

Dissipation Factor (DF):
25 V ratings: 3.5 % maximum at 1.0 V_{RMS} and 1 kHz
> 25 V ratings: 2.5 % maximum at 1.0 V_{RMS} and 1 kHz

Aging Rate: 1 % maximum per decade

Insulation Resistance (IR):
at +25 °C and rated voltage 100 000 MΩ minimum or 1000 ΩF, whichever is less
at +125 °C and rated voltage 10 000 MΩ minimum or 100 ΩF, whichever is less

Dielectric Strength Test:
performed per method 103 of EIA-198-2-E
Applied test voltage:
≤ 100 V_{DC}-rated: 250 % of rated voltage



QUICK REFERENCE DATA

| DIELECTRIC | CASE | MAXIMUM VOLTAGE (V) | CAPACITANCE | |
|------------|------|------------------------|-------------|---------|
| | | | MINIMUM | MAXIMUM |
| X8R | 0402 | 100 | 330 pF | 6.8 nF |
| | 0603 | 100 | 470 pF | 33 nF |
| | 0805 | 100 | 470 pF | 100 nF |
| | 1206 | 50 | 1.0 nF | 220 nF |
| | 1210 | 50 | 10 nF | 220 nF |

Note

- Detail ratings see "Selection Chart"

ORDERING INFORMATION

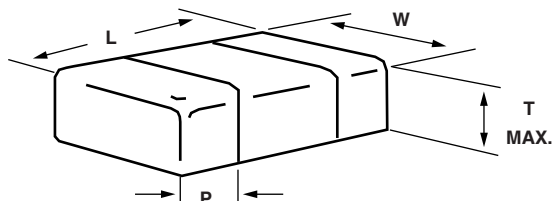
| VJ0805 | H | 102 | K | X | A | A | C | ### ⁽²⁾ |
|---|------------|---|---|---|-----------------------------------|--|-----------|--------------------|
| CASE CODE | DIELECTRIC | CAPACITANCE NOMINAL CODE | CAPACITANCE TOLERANCE | TERMINATION | DC VOLTAGE RATING ⁽¹⁾ | MARKING ⁽⁴⁾ | PACKAGING | PROCESS CODE |
| 0402 0603 0805 1206 1210 | H = X8R | Expressed in picofarads (pF). The first two digits are significant, the third is a multiplier. Examples: 102 = 1000 pF | J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$ | X = Ni barrier 100 % tin plated F, E = AgPd ⁽³⁾⁽⁵⁾ | X = 25 V A = 50 V B = 100 V | A = unmarked M = marked Note Marking is only available for 0805 and 1206 with termination code "X" | | |
| T = 7" reel / plastic tape C = 7" reel / paper tape R = 11 1/4" / 13" reel / plastic tape P = 11 1/4" / 13" reel / paper tape O = 7" reel / flamed paper tape I = 11 1/4" / 13" reel / flamed paper tape Note "I" and "O" are used for "F" termination size 0603 / 0805 and "E" termination size 0402 / 0603 / 0805 | | | | | | | | |

Notes

- (1) DC voltage rating should not be exceeded in application. Other application factors may affect the MLCC performance. Consult for questions: mlcc@vishay.com
- (2) Process code may be added with up to three digits, used to control non-standard products and requirements
- (3) Termination code "E" for conductive epoxy assembly
- (4) Marking in reference to EIA198, see www.vishay.com/doc?45028
- (5) Termination code "F" not available for 0402, 0603 - 100 V, 0805 - 100 V

ENVIRONMENTAL STATUS

| TERMINATION CODE | TERMINATION DESCRIPTION | RoHS COMPLIANT | VISHAY GREEN |
|------------------|--|----------------|--------------|
| X | Ni barrier 100 % tin plated matte finish | Yes | Yes |
| E | AgPd | Yes | Yes |
| F | AgPd | Yes | No |

DIMENSIONS in inches (millimeters)


| CASE CODE | STYLE | LENGTH (L) | WIDTH (W) | MAXIMUM THICKNESS (T) | TERMINATION (P) | |
|-----------|--------|---|---|-----------------------|-----------------|-----------------|
| | | | | | MINIMUM | MAXIMUM |
| 0402 | VJ0402 | 0.040 + 0.004/- 0.002 (1.00 + 0.10/- 0.05) | 0.020 + 0.004/- 0.002 (0.50 + 0.10/- 0.05) | 0.024 (0.60) | 0.004 (0.10) | 0.016 (0.41) |
| 0603 | VJ0603 | 0.063 ± 0.006 (1.60 ± 0.15) | 0.031 ± 0.006 (0.80 ± 0.15) | 0.036 (0.92) | 0.012 (0.30) | 0.022 (0.55) |
| 0805 | VJ0805 | 0.079 ± 0.008 (2.00 ± 0.20) | 0.049 ± 0.008 (1.25 ± 0.20) | 0.057 (1.45) | 0.010 (0.25) | 0.030 (0.76) |
| 1206 | VJ1206 | 0.126 ± 0.010 (3.20 ± 0.25) | 0.063 ± 0.010 (1.60 ± 0.25) | 0.067 (1.70) | 0.010 (0.25) | 0.030 (0.76) |
| 1210 | VJ1210 | 0.126 ± 0.010 (3.20 ± 0.25) | 0.098 ± 0.010 (2.50 ± 0.25) | 0.067 (1.70) | 0.010 (0.25) | 0.030 (0.76) |



| SELECTION CHART | | | | | | | | | | | | | | |
|----------------------------|--------|--------|----|-----|--------|----|-----|--------|----|-----|-----------------------|----|-----------------------|----|
| DIELECTRIC | | X8R | | | | | | | | | | | | |
| STYLE | | VJ0402 | | | VJ0603 | | | VJ0805 | | | VJ1206 ⁽¹⁾ | | VJ1210 ⁽¹⁾ | |
| CASE CODE | | 0402 | | | 0603 | | | 0805 | | | 1206 | | 1210 | |
| VOLTAGE (V _{DC}) | | 25 | 50 | 100 | 25 | 50 | 100 | 25 | 50 | 100 | 25 | 50 | 25 | 50 |
| VOLTAGE CODE | | X | A | B | X | A | B | X | A | B | X | A | X | A |
| CAP. CODE | CAP. | | | | | | | | | | | | | |
| 331 | 330 pF | •• | •• | •• | | | | | | | | | | |
| 391 | 390 pF | •• | •• | •• | | | | | | | | | | |
| 471 | 470 pF | •• | •• | •• | | •• | •• | •• | •• | •• | | | | |
| 561 | 560 pF | •• | •• | •• | | •• | •• | •• | •• | •• | | | | |
| 681 | 680 pF | •• | •• | •• | •• | •• | •• | •• | •• | •• | | | | |
| 821 | 820 pF | •• | •• | •• | •• | •• | •• | •• | •• | •• | | | | |
| 102 | 1.0 nF | •• | •• | •• | •• | •• | •• | •• | •• | •• | • | • | | |
| 122 | 1.2 nF | •• | •• | •• | •• | •• | •• | •• | •• | •• | • | • | | |
| 152 | 1.5 nF | •• | •• | | •• | •• | •• | •• | •• | •• | • | • | | |
| 182 | 1.8 nF | •• | •• | | •• | •• | •• | •• | •• | •• | • | • | | |
| 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 | | | | •• | •• | | •• | •• | •• | • | • | • | • |
| 123 | 12 nF | | | | •• | •• | | •• | •• | •• | • | • | • | • |
| 153 | 15 nF | | | | •• | •• | | •• | •• | •• | • | • | • | • |
| 183 | 18 nF | | | | •• | •• | | •• | •• | •• | • | • | • | • |
| 223 | 22 nF | | | | •• | | | •• | •• | • | • | • | • | • |
| 273 | 27 nF | | | | •• | | | •• | • | • | • | • | • | • |
| 333 | 33 nF | | | | •• | | | •• | • | | • | • | • | • |
| 393 | 39 nF | | | | | | | •• | • | | • | • | • | • |
| 473 | 47 nF | | | | | | | • | • | | • | • | • | • |
| 563 | 56 nF | | | | | | | • | • | | • | • | • | • |
| 683 | 68 nF | | | | | | | • | | | • | • | • | • |
| 823 | 82 nF | | | | | | | • | | | • | • | • | • |
| 104 | 100 nF | | | | | | | • | | | • | • | • | • |
| 124 | 120 nF | | | | | | | | | | • | • | • | • |
| 154 | 150 nF | | | | | | | | | | • | | • | • |
| 184 | 180 nF | | | | | | | | | | • | | • | |
| 224 | 220 nF | | | | | | | | | | • | | • | |
| 274 | 270 nF | | | | | | | | | | | | | |
| 334 | 330 nF | | | | | | | | | | | | | |
| 394 | 390 nF | | | | | | | | | | | | | |

Notes

⁽¹⁾ See soldering recommendations within this data book, or visit www.vishay.com/doc245034

• Plastic tape, •• Paper tape

RoHS-compliant

| X8R PACKAGING QUANTITIES ⁽¹⁾ | | | | | |
|---|-----------|--------------------|--------------------|---------------------------------|---------------|
| CASE CODE | TAPE SIZE | 7" REEL QUANTITIES | | 11 1/4" AND 13" REEL QUANTITIES | |
| | | PACKAGING CODE | | PACKAGING CODE | |
| | | "C" / "O" | "T" | "P" / "I" | "R" |
| 0402 | 8 mm | 5000 | n/a | 10 000 | n/a |
| 0603 | 8 mm | 4000 | n/a | 10 000 | n/a |
| 0805 ⁽²⁾ | 8 mm | 3000 | 3000 | 10 000 | 10 000 |
| 1206 ⁽²⁾ | 8 mm | n/a | 2500 / 3000 | 10 000 | 9000 / 10 000 |
| 1210 ⁽²⁾ | 8 mm | n/a | 2000 / 2500 / 3000 | 10 000 | 9000 / 10 000 |

Notes

⁽¹⁾ Reference: EIA standard RS481 - "Taping of Surface Mount Components for Automatic Placement"

⁽²⁾ Packaging "C" / "P" / "O" / "I" and "T" / "R" or lower quantities can depend from product thickness



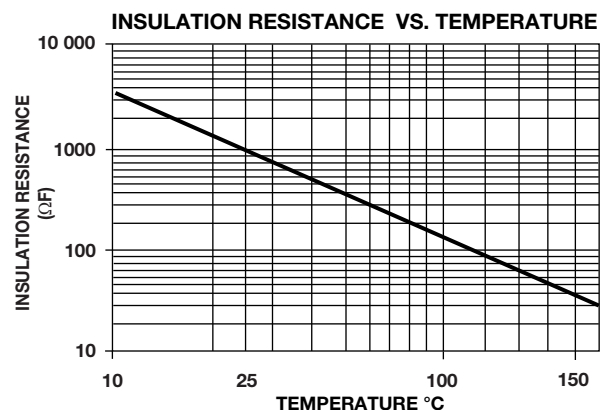
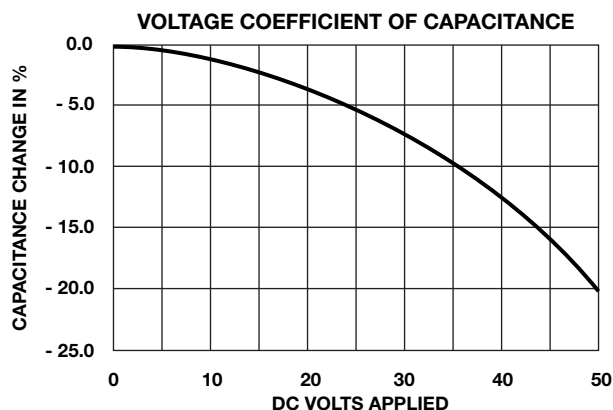
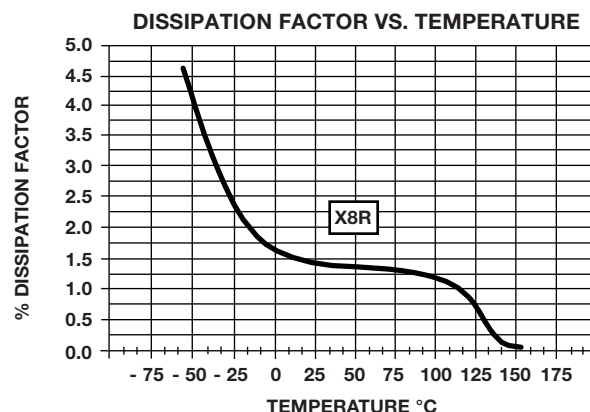
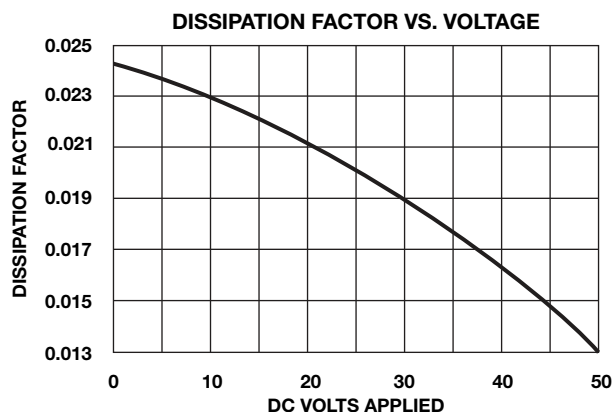
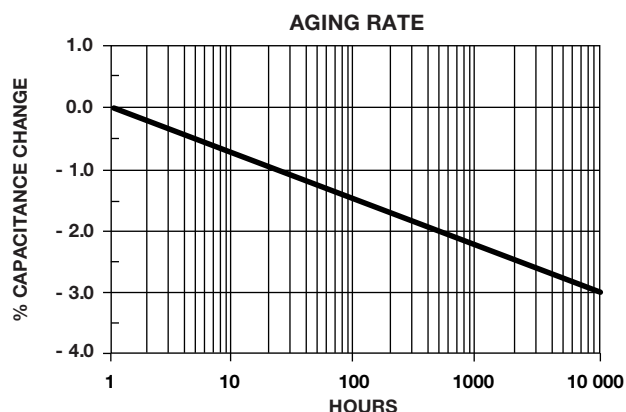
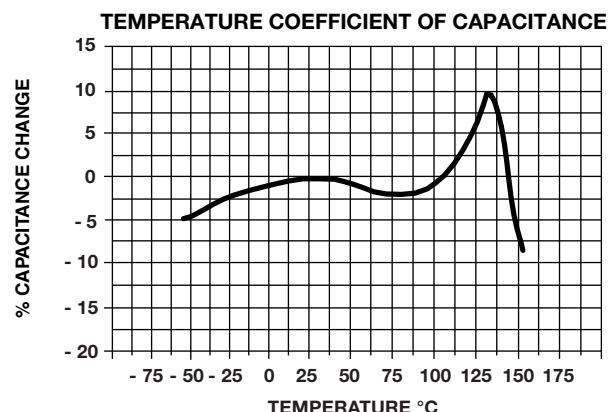
STORAGE AND HANDLING CONDITIONS

- (1) Store the components at 5 °C to 40 °C ambient temperature and ≤ 70 % relative humidity conditions.
- (2) The product is recommended to be used within a time-frame of 2 years after shipment.
Check solderability in case extended shelf life beyond the expiry date is needed.

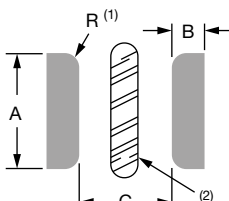
Precautions:

- a. Do not store products in an environment containing corrosive elements, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. This may cause corrosion or oxidation of the terminations, which can easily lead to poor soldering.
- b. Store products on the shelf and avoid exposure to moisture or dust.
- c. Do not expose products to excessive shock, vibration, direct sunlight and so on.

X8R DIELECTRIC - TYPICAL PARAMETERS



Solder Pad Dimensions for Vishay Surface-Mount Multilayer Ceramic Chip Capacitors

| DIMENSIONS in millimeters | | | |
|---|---------------------|------|---------------------|
|  | | | |
| CASE CODE | A | B | C |
| 0402 | 0.50 | 0.50 | 0.40 |
| 0505 | 1.35 | 1.00 | 0.60 |
| 0603 | 0.90 | 1.00 | 1.00 ⁽³⁾ |
| 0805 | 1.30 | 1.20 | 1.00 |
| 1111 | 2.90 | 1.30 | 1.75 |
| 1206 | 1.80 | 1.20 | 2.10 |
| 1210 | 2.80 | 1.30 | 1.90 |
| 1808 | 2.40 | 1.50 | 3.00 |
| 1812 | 3.60 | 1.50 | 3.00 |
| 1825 | 6.50 | 1.50 | 3.00 |
| 2008 | 2.70 | 1.50 | 4.08 |
| 2220 | 5.50 ⁽⁴⁾ | 1.50 | 4.20 |
| 2225 | 6.50 | 1.50 | 4.20 |
| 2525 | 6.60 | 1.50 | 4.50 |
| 3040 | 10.80 | 2.00 | 5.50 |
| 3640 | 10.80 | 2.00 | 7.00 |
| 3838 | 10.20 | 2.00 | 7.50 |
| 4044 | 12.30 | 2.00 | 8.00 |

Notes

- ⁽¹⁾ For safety capacitors and voltages above 3000 V, corner rounding (R) of 0.5 mm is recommended to suppress arcing
- ⁽²⁾ Add a 1 mm slot in PCB between pads to allow cleaning and coating under MLCC
- ⁽³⁾ For VJ HiFREQ Series, this dimension is 0.6 mm
- ⁽⁴⁾ For safety capacitors, the A dimension should be 5.80 mm



PRINTED CIRCUIT BOARD PCB DESIGN CONSIDERATIONS FOR HIGH VOLTAGE SURFACE-MOUNT MLCCS

Special assembly process and design considerations should be employed for today's high voltage rating MLCCs. As case sizes remain the same and voltage ratings increase, MLCC manufacturers must design, evaluate, and qualify their capacitors using methods that reduce the occurrence of corona discharge and arcover events. To meet similar capability in high voltage applications, users should employ similar cautionary design and assembly methods.

MLCC PAD LAYOUT

A capacitor's arcover inception point can degrade due to factors such as the MLCC termination, PCB pad design, PCB cleanliness, solder flux residue, surface contamination / deposits and environmental conditions. PCB pads and their design affect the air gap distance between the opposing polarities of the MLCC termination. For voltage rating greater than 1500 V_{DC} add a corner radius to the inward facing edge of the MLCC pads and as large a gap as possible between the pads. Too small of a pad gap distance will reduce the capacitor's own arcover inception voltage level. Refer to the Figure and Table Figure 1.0, MLCC Pad Layout and Table 1.0, Vishay MLCC Solder Pad Dimensions for the recommended MLCC solder pad dimensions.

SLOT OR TRENCH BETWEEN PADS

PCB assembly can deposit dust, trap solder balls, or flux residue underneath the capacitors. These contaminants will reduce conductive clearances and the arcover inception level. Assembly methods must include a final PCB cleaning process. A slot or trench can be cut into the PCB in between the pads to allow cleaners to penetrate underneath the MLCC. The slot will also allow conformal or epoxy coatings to flow underneath the MLCC and build an insulative barrier between pads. Refer to Figure 1.0 MLCC Pad Layout for slot reference location.

COATING PRINTED CIRCUIT BOARD

Coating a printed circuit board with materials such as acrylic, silicone and urethane resins provide a protective dielectric barrier that is non-conductive and will enhance the resistance to arcing. Various processes exist which include dipping, brushing, and spraying. Optimal performance will come from coating the MLCC on all sides, top and bottom. The PCB slot in between the pads should extend slightly beyond the width of the MLCC. Refer to Figure 1.0 MLCC Pad Layout for slot reference location.



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