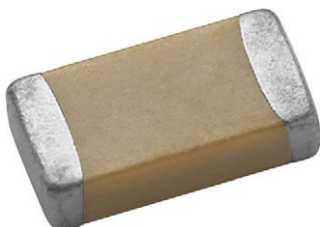


## Surface Mount Multilayer Ceramic Chip Capacitors for Automotive High Frequency Applications



### FEATURES

- Case size 0402, 0603, 0805, 0505, 1111, 1206
- High frequency
- AEC-Q200 qualified with PPAP available
- Ultra-stable dielectric material
- Lead (Pb)-free terminations code "X"
- Surface mount, wet build process
- Reliable Noble Metal Electrode (NME) system
- Made with a combination of design, materials and tight process control to achieve very high field reliability
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

AUTOMOTIVE  
GRADE

RoHS  
COMPLIANT

HALOGEN  
FREE

GREEN  
(5-2008)

### LINKS TO ADDITIONAL RESOURCES



#### Note

- Models as per VJ HIFREQ Series, applicable for this GA Series

### APPLICATIONS

- Navigation / infotainment
- GPS
- TPMS
- ADAS
- Telematics
- Autonomous cars

### ELECTRICAL SPECIFICATIONS

#### Note

- Electrical characteristics at 25 °C unless otherwise specified

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

#### Capacitance Range:

0402: 0.1 pF to 82 pF  
0603: 0.1 pF to 470 pF  
0805: 0.1 pF to 1.0 nF  
0505: 0.1 pF to 1.0 nF  
1111: 0.2 pF to 3.3 nF  
1206: 1.0 pF to 82 pF

**Voltage Rating:** 25 V<sub>DC</sub> to 1500 V<sub>DC</sub>

#### Temperature Coefficient of Capacitance (TCC):

C0G (D): 0 ppm/°C ± 30 ppm/°C from -55 °C to +150 °C with zero (0) V<sub>DC</sub> applied

#### Dissipation Factor (DF):

C0G (D): 0.05 % max. at 1.0 V<sub>RMS</sub> and 1 MHz  
for values ≤ 1000 pF

C0G (D): 0.05 % max. at 1.0 V<sub>RMS</sub> and 1 kHz  
for values > 1000 pF

**Aging Rate:** 0 % 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 voltages:

≤ 200 V<sub>DC</sub>-rated: min. 250 % of rated voltage

200 V<sub>DC</sub>-rated: min. 200 % of rated voltage

300 V<sub>DC</sub> to 1000 V<sub>DC</sub>-rated: min. 150 % of rated voltage

1500 V<sub>DC</sub>-rated: 120 % of rated voltage

**QUICK REFERENCE DATA**

| DIELECTRIC | CASE | MAXIMUM VOLTAGE<br>(V) | CAPACITANCE |         |
|------------|------|------------------------|-------------|---------|
|            |      |                        | MINIMUM     | MAXIMUM |
| D = HIFREQ | 0402 | 200                    | 0.1 pF      | 82 pF   |
|            | 0603 | 250                    | 0.1 pF      | 470 pF  |
|            | 0805 | 500                    | 0.1 pF      | 1.0 nF  |
|            | 0505 | 250                    | 0.1 pF      | 1.0 nF  |
|            | 1111 | 1500                   | 0.2 pF      | 3.3 nF  |
|            | 1206 | 630                    | 1.0 pF      | 82 pF   |

**ORDERING INFORMATION**

| ORDERING INFORMATION   |            |  |   |  |   |                |           |  |
|--|------------|--|---|--|---|----------------|-----------|--|
| GA0603   | D          | 1R0  | B   | X  | B   | A              | C         | 31M  |
| CASE CODE  | DIELECTRIC | CAPACITANCE NOMINAL CODE   | CAPACITANCE TOLERANCE   | TERMINATION  | DC VOLTAGE RATING <sup>(1)</sup>  | MARKING        | PACKAGING | PROCESS CODE   |
| 0402<br>0603<br>0805<br>0505<br>1111<br>1206   | D = HIFREQ | Expressed in picofarads (pF).<br>The first two digits are significant, the third is a multiplier. An "R" indicates a decimal point.<br><b>Example:</b><br>1R0 = 1.0 pF | V = ± 0.05 pF<br>B = ± 0.10 pF<br>C = ± 0.25 pF<br>D = ± 0.50 pF<br>F = ± 1 %<br>G = ± 2 %<br>J = ± 5 %<br>K = ± 10 %<br>M = ± 20 %<br><br><b>Note</b><br>Details see "Selection Chart" | E = AgPd <sup>(2)</sup><br>X = Ni barrier<br>100 % tin plate<br>matte finish | X = 25 V<br>A = 50 V<br>B = 100 V<br>K = 150 V<br>C = 200 V<br>P = 250 V<br>D = 300 V<br>E = 500 V<br>L = 630 V<br>G = 1000 V<br>R = 1500 V | A = no marking |           | 31M = "Green" automotive HIFREQ Ni barrier termination<br>34G = "Green" automotive HIFREQ AgPd termination |
| <div>T = 7" reel / plastic tape<br/>C = 7" reel / paper tape<br/>O = 7" reel / flamed paper tape<br/>J = 7" reel (low quantity)<br/>R = 11 1/4" / 13" reel / plastic tape<br/>P = 11 1/4" / 13" reel / paper tape<br/>I = 11 1/4" / 13" reel / flamed paper tape</div> <div><b>Note</b><br/>"I" and "O" is used for "E" termination code</div> |            |  |   |  |   |                |           |  |

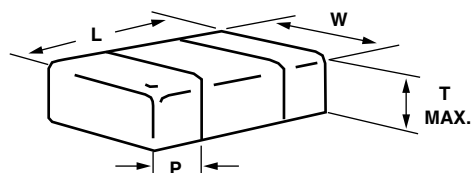
**Notes**

- (1) DC voltage rating should not be exceeded in application  
(2) AgPd termination code "E" available for silver epoxy bonding

**ENVIRONMENTAL STATUS**

| TERMINATION CODE | TERMINATION DESCRIPTION                  | RoHS COMPLIANT | VISHAY GREEN |
|------------------|--|----------------|--------------|
| X                | Ni barrier 100 % tin plated matte finish | Yes            | Yes          |
| E                | AgPd                                     | Yes            | Yes          |

## DIMENSIONS in inches (millimeters)



| CASE CODE | STYLE  | LENGTH (L)  | WIDTH (W)   | MAXIMUM THICKNESS (T) | TERMINATIONS PAD (P) |                 |
|-----------|--------|---|---|-----------------------|----------------------|-----------------|
|           |        |   |   |                       | MINIMUM              | MAXIMUM         |
| 0402      | GA0402 | 0.040 ± 0.004<br>(1.02 ± 0.10)                      | 0.020 ± 0.004<br>(0.51 ± 0.10)                      | 0.024<br>(0.61)       | 0.004<br>(0.10)      | 0.016<br>(0.41) |
| 0603      | GA0603 | 0.063 ± 0.006<br>(1.60 ± 0.15)                      | 0.031 ± 0.005<br>(0.80 ± 0.12)                      | 0.037<br>(0.94)       | 0.010<br>(0.25)      | 0.022<br>(0.55) |
| 0805      | GA0805 | 0.079 ± 0.008<br>(2.00 ± 0.20)                      | 0.049 ± 0.008<br>(1.25 ± 0.20)                      | 0.057<br>(1.45)       | 0.010<br>(0.25)      | 0.030<br>(0.76) |
| 0505      | GA0505 | 0.055 + 0.015 / - 0.010<br>(1.40 + 0.382 / - 0.254) | 0.055 ± 0.015<br>(1.40 ± 0.38)                      | 0.057<br>(1.45)       | 0.004<br>(0.10)      | 0.016<br>(0.41) |
| 1111      | GA1111 | 0.117 + 0.015 / - 0.010<br>(2.98 + 0.382 / - 0.254) | 0.110 + 0.015 / - 0.020<br>(2.79 + 0.382 / - 0.509) | 0.102<br>(2.59)       | 0.012<br>(0.30)      | 0.018<br>(0.46) |
| 1206      | GA1206 | 0.126 ± 0.010<br>(3.20 ± 0.25)                      | 0.063 ± 0.010<br>(1.60 ± 0.25)                      | 0.067<br>(1.70)       | 0.010<br>(0.25)      | 0.028<br>(0.71) |



| SELECTION CHART            |        |         |    |     |     |                  |
|----------------------------|--------|---------|----|-----|-----|------------------|
| DIELECTRIC (VISHAY CODE)   |        | C0G (D) |    |     |     |                  |
| STYLE                      |        | GA0402  |    |     |     |                  |
| CASE CODE                  |        | 0402    |    |     |     |                  |
| VOLTAGE (V <sub>DC</sub> ) |        | 25      | 50 | 100 | 200 | TOLERANCE        |
| VOLTAGE CODE               |        | X       | A  | B   | C   |                  |
| CAP. CODE                  | CAP.   |         |    |     |     |                  |
| 0R1                        | 0.1 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 0R2                        | 0.2 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 0R3                        | 0.3 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 0R4                        | 0.4 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 0R5                        | 0.5 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 0R6                        | 0.6 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 0R7                        | 0.7 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 0R8                        | 0.8 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 0R9                        | 0.9 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 1R0                        | 1.0 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 1R1                        | 1.1 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 1R2                        | 1.2 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 1R3                        | 1.3 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 1R4                        | 1.4 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 1R5                        | 1.5 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 1R6                        | 1.6 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 1R7                        | 1.7 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 1R8                        | 1.8 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 1R9                        | 1.9 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 2R0                        | 2.0 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 2R1                        | 2.1 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 2R2                        | 2.2 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 2R4                        | 2.4 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 2R7                        | 2.7 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 3R0                        | 3.0 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 3R3                        | 3.3 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 3R6                        | 3.6 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 3R9                        | 3.9 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 4R3                        | 4.3 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 4R7                        | 4.7 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 5R1                        | 5.1 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 5R6                        | 5.6 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 6R2                        | 6.2 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 6R8                        | 6.8 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 7R5                        | 7.5 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 8R2                        | 8.2 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 9R1                        | 9.1 pF | ••      | •• | ••  | ••  | V, B, C, D       |
| 100                        | 10 pF  | ••      | •• | ••  | ••  | V, F, G, J, K, M |
| 110                        | 11 pF  | ••      | •• | ••  | ••  | F, G, J, K, M    |
| 120                        | 12 pF  | ••      | •• | ••  | ••  | F, G, J, K, M    |
| 130                        | 13 pF  | ••      | •• | ••  | ••  | F, G, J, K, M    |
| 150                        | 15 pF  | ••      | •• | ••  | ••  | F, G, J, K, M    |
| 180                        | 18 pF  | ••      | •• | ••  | ••  | F, G, J, K, M    |
| 200                        | 20 pF  | ••      | •• | ••  | ••  | F, G, J, K, M    |
| 220                        | 22 pF  | ••      | •• | ••  | ••  | F, G, J, K, M    |
| 240                        | 24 pF  | ••      | •• | ••  | ••  | F, G, J, K, M    |
| 270                        | 27 pF  | ••      | •• | ••  | ••  | F, G, J, K, M    |
| 300                        | 30 pF  | ••      | •• |     |     | F, G, J, K, M    |
| 330                        | 33 pF  | ••      | •• |     |     | F, G, J, K, M    |
| 360                        | 36 pF  | ••      | •• |     |     | F, G, J, K, M    |
| 390                        | 39 pF  | ••      | •• |     |     | F, G, J, K, M    |
| 430                        | 43 pF  | ••      | •• |     |     | F, G, J, K, M    |
| 470                        | 47 pF  | ••      | •• |     |     | F, G, J, K, M    |
| 510                        | 51 pF  | ••      | •• |     |     | F, G, J, K, M    |
| 560                        | 56 pF  | ••      | •• |     |     | F, G, J, K, M    |
| 620                        | 62 pF  | ••      |    |     |     | F, G, J, K, M    |
| 680                        | 68 pF  | ••      |    |     |     | F, G, J, K, M    |
| 750                        | 75 pF  | ••      |    |     |     | F, G, J, K, M    |
| 820                        | 82 pF  | ••      |    |     |     | F, G, J, K, M    |
| 910                        | 91 pF  |         |    |     |     |                  |
| 101                        | 100 pF |         |    |     |     |                  |
| 111                        | 110 pF |         |    |     |     |                  |
| 121                        | 120 pF |         |    |     |     |                  |

## Note

•• Paper carrier



| SELECTION CHART            |        |         |    |     |     |     |                  |
|----------------------------|--------|---------|----|-----|-----|-----|------------------|
| DIELECTRIC (VISHAY CODE)   |        | C0G (D) |    |     |     |     |                  |
| STYLE                      |        | GA0603  |    |     |     |     |                  |
| CASE CODE                  |        | 0603    |    |     |     |     |                  |
| VOLTAGE (V <sub>DC</sub> ) |        | 25      | 50 | 100 | 200 | 250 | TOLERANCE        |
| VOLTAGE CODE               |        | X       | A  | B   | C   | P   |                  |
| CAP. CODE                  | CAP.   |         |    |     |     |     |                  |
| 0R1                        | 0.1 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 0R2                        | 0.2 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 0R3                        | 0.3 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 0R4                        | 0.4 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 0R5                        | 0.5 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 0R6                        | 0.6 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 0R7                        | 0.7 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 0R8                        | 0.8 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 0R9                        | 0.9 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 1R0                        | 1.0 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 1R1                        | 1.1 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 1R2                        | 1.2 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 1R3                        | 1.3 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 1R4                        | 1.4 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 1R5                        | 1.5 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 1R6                        | 1.6 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 1R7                        | 1.7 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 1R8                        | 1.8 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 1R9                        | 1.9 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 2R0                        | 2.0 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 2R1                        | 2.1 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 2R2                        | 2.2 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 2R4                        | 2.4 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 2R7                        | 2.7 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 3R0                        | 3.0 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 3R3                        | 3.3 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 3R6                        | 3.6 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 3R9                        | 3.9 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 4R3                        | 4.3 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 4R7                        | 4.7 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 5R1                        | 5.1 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 5R6                        | 5.6 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 6R2                        | 6.2 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 6R8                        | 6.8 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 7R5                        | 7.5 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 8R2                        | 8.2 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 9R1                        | 9.1 pF | ••      | •• | ••  | ••  | ••  | V, B, C, D       |
| 100                        | 10 pF  | ••      | •• | ••  | ••  | ••  | V, F, G, J, K, M |
| 110                        | 11 pF  | ••      | •• | ••  | ••  | ••  | F, G, J, K, M    |
| 120                        | 12 pF  | ••      | •• | ••  | ••  | ••  | F, G, J, K, M    |
| 130                        | 13 pF  | ••      | •• | ••  | ••  | ••  | F, G, J, K, M    |
| 150                        | 15 pF  | ••      | •• | ••  | ••  | ••  | F, G, J, K, M    |
| 180                        | 18 pF  | ••      | •• | ••  | ••  | ••  | F, G, J, K, M    |
| 200                        | 20 pF  | ••      | •• | ••  | ••  | ••  | F, G, J, K, M    |
| 220                        | 22 pF  | ••      | •• | ••  | ••  | ••  | F, G, J, K, M    |
| 240                        | 24 pF  | ••      | •• | ••  | ••  | ••  | F, G, J, K, M    |
| 270                        | 27 pF  | ••      | •• | ••  | ••  | ••  | F, G, J, K, M    |
| 300                        | 30 pF  | ••      | •• | ••  | ••  | ••  | F, G, J, K, M    |
| 330                        | 33 pF  | ••      | •• | ••  | ••  | ••  | F, G, J, K, M    |
| 360                        | 36 pF  | ••      | •• | ••  | ••  | ••  | F, G, J, K, M    |
| 390                        | 39 pF  | ••      | •• | ••  | ••  | ••  | F, G, J, K, M    |
| 430                        | 43 pF  | ••      | •• | ••  | ••  | ••  | F, G, J, K, M    |
| 470                        | 47 pF  | ••      | •• | ••  | ••  | ••  | F, G, J, K, M    |
| 510                        | 51 pF  | ••      | •• | ••  | ••  | ••  | F, G, J, K, M    |
| 560                        | 56 pF  | ••      | •• | ••  | ••  | ••  | F, G, J, K, M    |
| 620                        | 62 pF  | •       | •  | •   | •   | •   | F, G, J, K, M    |
| 680                        | 68 pF  | •       | •  | •   | •   | •   | F, G, J, K, M    |
| 750                        | 75 pF  | •       | •  | •   | •   | •   | F, G, J, K, M    |
| 820                        | 82 pF  | •       | •  | •   | •   | •   | F, G, J, K, M    |
| 910                        | 91 pF  | •       | •  | •   | •   | •   | F, G, J, K, M    |

## Note

•• Paper carrier • Plastic carrier tape



| SELECTION CHART            |        |         |    |     |     |     |               |
|----------------------------|--------|---------|----|-----|-----|-----|---------------|
| DIELECTRIC (VISHAY CODE)   |        | C0G (D) |    |     |     |     |               |
| STYLE                      |        | GA0603  |    |     |     |     |               |
| CASE CODE                  |        | 0603    |    |     |     |     |               |
| VOLTAGE (V <sub>DC</sub> ) |        | 25      | 50 | 100 | 200 | 250 | TOLERANCE     |
| VOLTAGE CODE               |        | X       | A  | B   | C   | P   |               |
| CAP. CODE                  | CAP.   |         |    |     |     |     |               |
| 101                        | 100 pF | •       | •  | •   | •   | •   | F, G, J, K, M |
| 111                        | 110 pF | •       | •  | •   |     |     | F, G, J, K, M |
| 121                        | 120 pF | •       | •  | •   |     |     | F, G, J, K, M |
| 131                        | 130 pF | •       | •  | •   |     |     | F, G, J, K, M |
| 151                        | 150 pF | •       | •  | •   |     |     | F, G, J, K, M |
| 181                        | 180 pF | •       | •  |     |     |     | F, G, J, K, M |
| 201                        | 200 pF | •       | •  |     |     |     | F, G, J, K, M |
| 221                        | 220 pF | •       | •  |     |     |     | F, G, J, K, M |
| 241                        | 240 pF | •       | •  |     |     |     | F, G, J, K, M |
| 271                        | 270 pF | •       | •  |     |     |     | F, G, J, K, M |
| 301                        | 300 pF | •       | •  |     |     |     | F, G, J, K, M |
| 331                        | 330 pF | •       | •  |     |     |     | F, G, J, K, M |
| 361                        | 360 pF | •       |    |     |     |     | F, G, J, K, M |
| 391                        | 390 pF | •       |    |     |     |     | F, G, J, K, M |
| 431                        | 430 pF | •       |    |     |     |     | F, G, J, K, M |
| 471                        | 470 pF | •       |    |     |     |     | F, G, J, K, M |
| 511                        | 510 pF |         |    |     |     |     |               |
| 561                        | 560 pF |         |    |     |     |     |               |
| 621                        | 620 pF |         |    |     |     |     |               |
| 681                        | 680 pF |         |    |     |     |     |               |
| 751                        | 750 pF |         |    |     |     |     |               |
| 821                        | 820 pF |         |    |     |     |     |               |
| 911                        | 910 pF |         |    |     |     |     |               |
| 102                        | 1.0 nF |         |    |     |     |     |               |
| 112                        | 1.1 nF |         |    |     |     |     |               |
| 122                        | 1.2 nF |         |    |     |     |     |               |
| 132                        | 1.3 nF |         |    |     |     |     |               |
| 152                        | 1.5 nF |         |    |     |     |     |               |
| 182                        | 1.8 nF |         |    |     |     |     |               |

**Note**

•• Paper carrier • Plastic carrier tape



| SELECTION CHART            |        |         |    |     |     |     |                    |            |
|----------------------------|--------|---------|----|-----|-----|-----|--------------------|------------|
| DIELECTRIC (VISHAY CODE)   |        | C0G (D) |    |     |     |     |                    |            |
| STYLE                      |        | GA0805  |    |     |     |     |                    |            |
| CASE CODE                  |        | 0805    |    |     |     |     |                    |            |
| VOLTAGE (V <sub>DC</sub> ) |        | 25      | 50 | 100 | 200 | 250 | 500 <sup>(1)</sup> | TOLERANCE  |
| VOLTAGE CODE               |        | X       | A  | B   | C   | P   | E                  |            |
| CAP. CODE                  | CAP.   |         |    |     |     |     |                    |            |
| 0R1                        | 0.1 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 0R2                        | 0.2 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 0R3                        | 0.3 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 0R4                        | 0.4 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 0R5                        | 0.5 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 0R6                        | 0.6 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 0R7                        | 0.7 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 0R8                        | 0.8 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 0R9                        | 0.9 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 1R0                        | 1.0 pF | •       | •  | •   | •   | •   | •                  | V, B, C, D |
| 1R1                        | 1.1 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 1R2                        | 1.2 pF | •       | •  | •   | •   | •   | •                  | V, B, C, D |
| 1R3                        | 1.3 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 1R4                        | 1.4 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 1R5                        | 1.5 pF | •       | •  | •   | •   | •   | •                  | V, B, C, D |
| 1R6                        | 1.6 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 1R7                        | 1.7 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 1R8                        | 1.8 pF | •       | •  | •   | •   | •   | •                  | V, B, C, D |
| 1R9                        | 1.9 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 2R0                        | 2.0 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 2R1                        | 2.1 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 2R2                        | 2.2 pF | •       | •  | •   | •   | •   | •                  | V, B, C, D |
| 2R4                        | 2.4 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 2R7                        | 2.7 pF | •       | •  | •   | •   | •   | •                  | V, B, C, D |
| 3R0                        | 3.0 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 3R3                        | 3.3 pF | •       | •  | •   | •   | •   | •                  | V, B, C, D |
| 3R6                        | 3.6 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 3R9                        | 3.9 pF | •       | •  | •   | •   | •   | •                  | V, B, C, D |
| 4R3                        | 4.3 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 4R7                        | 4.7 pF | •       | •  | •   | •   | •   | •                  | V, B, C, D |
| 5R1                        | 5.1 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 5R6                        | 5.6 pF | •       | •  | •   | •   | •   | •                  | V, B, C, D |
| 6R2                        | 6.2 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 6R8                        | 6.8 pF | •       | •  | •   | •   | •   | •                  | V, B, C, D |
| 7R5                        | 7.5 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |
| 8R2                        | 8.2 pF | •       | •  | •   | •   | •   | •                  | V, B, C, D |
| 9R1                        | 9.1 pF | •       | •  | •   | •   | •   |                    | V, B, C, D |

**Notes**

- Plastic carrier tape

<sup>(1)</sup> 500 V only in tolerance B, C, D



| SELECTION CHART            |        |         |    |     |     |     |                    |                  |
|----------------------------|--------|---------|----|-----|-----|-----|--------------------|------------------|
| DIELECTRIC (VISHAY CODE)   |        | C0G (D) |    |     |     |     |                    |                  |
| STYLE                      |        | GA0805  |    |     |     |     |                    |                  |
| CASE CODE                  |        | 0805    |    |     |     |     |                    |                  |
| VOLTAGE (V <sub>DC</sub> ) |        | 25      | 50 | 100 | 200 | 250 | 500 <sup>(1)</sup> | TOLERANCE        |
| VOLTAGE CODE               |        | X       | A  | B   | C   | P   | E                  |                  |
| CAP. CODE                  | CAP.   |         |    |     |     |     |                    |                  |
| 100                        | 10 pF  | •       | •  | •   | •   | •   | •                  | V, F, G, J, K, M |
| 110                        | 11 pF  | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 120                        | 12 pF  | •       | •  | •   | •   | •   | •                  | F, G, J, K, M    |
| 130                        | 13 pF  | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 150                        | 15 pF  | •       | •  | •   | •   | •   | •                  | F, G, J, K, M    |
| 180                        | 18 pF  | •       | •  | •   | •   | •   | •                  | F, G, J, K, M    |
| 200                        | 20 pF  | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 220                        | 22 pF  | •       | •  | •   | •   | •   | •                  | F, G, J, K, M    |
| 240                        | 24 pF  | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 270                        | 27 pF  | •       | •  | •   | •   | •   | •                  | F, G, J, K, M    |
| 300                        | 30 pF  | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 330                        | 33 pF  | •       | •  | •   | •   | •   | •                  | F, G, J, K, M    |
| 360                        | 36 pF  | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 390                        | 39 pF  | •       | •  | •   | •   | •   | •                  | F, G, J, K, M    |
| 430                        | 43 pF  | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 470                        | 47 pF  | •       | •  | •   | •   | •   | •                  | F, G, J, K, M    |
| 510                        | 51 pF  | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 560                        | 56 pF  | •       | •  | •   | •   | •   | •                  | F, G, J, K, M    |
| 620                        | 62 pF  | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 680                        | 68 pF  | •       | •  | •   | •   | •   | •                  | F, G, J, K, M    |
| 750                        | 75 pF  | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 820                        | 82 pF  | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 910                        | 91 pF  | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 101                        | 100 pF | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 111                        | 110 pF | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 121                        | 120 pF | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 131                        | 130 pF | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 151                        | 150 pF | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 181                        | 180 pF | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 201                        | 200 pF | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 221                        | 220 pF | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 241                        | 240 pF | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 271                        | 270 pF | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 301                        | 300 pF | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 331                        | 330 pF | •       | •  | •   | •   | •   |                    | F, G, J, K, M    |
| 361                        | 360 pF | •       | •  | •   | •   |     |                    | F, G, J, K, M    |
| 391                        | 390 pF | •       | •  | •   | •   |     |                    | F, G, J, K, M    |
| 431                        | 430 pF | •       | •  | •   |     |     |                    | F, G, J, K, M    |
| 471                        | 470 pF | •       | •  | •   |     |     |                    | F, G, J, K, M    |
| 511                        | 510 pF | •       | •  | •   |     |     |                    | F, G, J, K, M    |
| 561                        | 560 pF | •       | •  | •   |     |     |                    | F, G, J, K, M    |
| 621                        | 620 pF | •       | •  | •   |     |     |                    | F, G, J, K, M    |
| 681                        | 680 pF | •       | •  | •   |     |     |                    | F, G, J, K, M    |
| 751                        | 750 pF | •       | •  |     |     |     |                    | F, G, J, K, M    |
| 821                        | 820 pF | •       | •  |     |     |     |                    | F, G, J, K, M    |
| 911                        | 910 pF | •       | •  |     |     |     |                    | F, G, J, K, M    |
| 102                        | 1.0 nF | •       | •  |     |     |     |                    | F, G, J, K, M    |
| 112                        | 1.1 nF |         |    |     |     |     |                    | F, G, J, K, M    |
| 122                        | 1.2 nF |         |    |     |     |     |                    | F, G, J, K, M    |
| 132                        | 1.3 nF |         |    |     |     |     |                    | F, G, J, K, M    |
| 152                        | 1.5 nF |         |    |     |     |     |                    | F, G, J, K, M    |
| 182                        | 1.8 nF |         |    |     |     |     |                    | F, G, J, K, M    |

**Notes**

- Plastic carrier tape

<sup>(1)</sup> 500 V only in tolerance F, G, J, K





| SELECTION CHART            |        |         |     |     |     |     |               |
|----------------------------|--------|---------|-----|-----|-----|-----|---------------|
| DIELECTRIC (VISHAY CODE)   |        | C0G (D) |     |     |     |     |               |
| STYLE                      |        | GA0505  |     |     |     |     |               |
| CASE CODE                  |        | 0505    |     |     |     |     |               |
| VOLTAGE (V <sub>DC</sub> ) |        | 50      | 100 | 150 | 200 | 250 | TOLERANCE     |
| VOLTAGE CODE               |        | A       | B   | K   | C   | P   |               |
| CAP. CODE                  | CAP.   |         |     |     |     |     |               |
| 0R1                        | 0.1 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 0R2                        | 0.2 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 0R3                        | 0.3 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 0R4                        | 0.4 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 0R5                        | 0.5 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 0R6                        | 0.6 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 0R7                        | 0.7 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 0R8                        | 0.8 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 0R9                        | 0.9 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 1R0                        | 1.0 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 1R1                        | 1.1 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 1R2                        | 1.2 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 1R3                        | 1.3 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 1R4                        | 1.4 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 1R5                        | 1.5 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 1R6                        | 1.6 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 1R7                        | 1.7 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 1R8                        | 1.8 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 1R9                        | 1.9 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 2R0                        | 2.0 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 2R1                        | 2.1 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 2R2                        | 2.2 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 2R4                        | 2.4 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 2R7                        | 2.7 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 3R0                        | 3.0 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 3R3                        | 3.3 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 3R6                        | 3.6 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 3R9                        | 3.9 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 4R3                        | 4.3 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 4R7                        | 4.7 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 5R1                        | 5.1 pF | •       | •   | •   | •   | •   | V, B, C, D    |
| 5R6                        | 5.6 pF | •       | •   | •   | •   | •   | B, C, D       |
| 6R2                        | 6.2 pF | •       | •   | •   | •   | •   | B, C, D       |
| 6R8                        | 6.8 pF | •       | •   | •   | •   | •   | B, C, D       |
| 7R5                        | 7.5 pF | •       | •   | •   | •   | •   | B, C, D       |
| 8R2                        | 8.2 pF | •       | •   | •   | •   | •   | B, C, D       |
| 9R1                        | 9.1 pF | •       | •   | •   | •   | •   | B, C, D       |
| 100                        | 10 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 110                        | 11 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 120                        | 12 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 130                        | 13 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 150                        | 15 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 160                        | 16 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 180                        | 18 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |

**Note**

- Plastic carrier tape



| SELECTION CHART            |         |         |     |     |     |     |               |
|----------------------------|---------|---------|-----|-----|-----|-----|---------------|
| DIELECTRIC (VISHAY CODE)   |         | C0G (D) |     |     |     |     |               |
| STYLE                      |         | GA0505  |     |     |     |     |               |
| CASE CODE                  |         | 0505    |     |     |     |     |               |
| VOLTAGE (V <sub>DC</sub> ) |         | 50      | 100 | 150 | 200 | 250 | TOLERANCE     |
| VOLTAGE CODE               |         | A       | B   | K   | C   | P   |               |
| CAP. CODE                  | CAP.    |         |     |     |     |     |               |
| 200                        | 20 pF   | •       | •   | •   | •   | •   | F, G, J, K, M |
| 220                        | 22 pF   | •       | •   | •   | •   | •   | F, G, J, K, M |
| 240                        | 24 pF   | •       | •   | •   | •   | •   | F, G, J, K, M |
| 270                        | 27 pF   | •       | •   | •   | •   | •   | F, G, J, K, M |
| 300                        | 30 pF   | •       | •   | •   | •   | •   | F, G, J, K, M |
| 330                        | 33 pF   | •       | •   | •   | •   | •   | F, G, J, K, M |
| 360                        | 36 pF   | •       | •   | •   | •   | •   | F, G, J, K, M |
| 390                        | 39 pF   | •       | •   | •   | •   | •   | F, G, J, K, M |
| 430                        | 43 pF   | •       | •   | •   | •   | •   | F, G, J, K, M |
| 470                        | 47 pF   | •       | •   | •   | •   | •   | F, G, J, K, M |
| 510                        | 51 pF   | •       | •   | •   | •   | •   | F, G, J, K, M |
| 560                        | 56 pF   | •       | •   | •   | •   | •   | F, G, J, K, M |
| 620                        | 62 pF   | •       | •   | •   | •   | •   | F, G, J, K, M |
| 680                        | 68 pF   | •       | •   | •   | •   | •   | F, G, J, K, M |
| 750                        | 75 pF   | •       | •   | •   | •   | •   | F, G, J, K, M |
| 820                        | 82 pF   | •       | •   | •   | •   | •   | F, G, J, K, M |
| 910                        | 91 pF   | •       | •   | •   | •   | •   | F, G, J, K, M |
| 101                        | 100 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 111                        | 110 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 121                        | 120 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 131                        | 130 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 151                        | 150 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 161                        | 160 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 181                        | 180 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 201                        | 200 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 221                        | 220 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 241                        | 240 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 271                        | 270 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 301                        | 300 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 331                        | 330 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 361                        | 360 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 391                        | 390 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 431                        | 430 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 471                        | 470 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 511                        | 510 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 561                        | 560 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 621                        | 620 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 681                        | 680 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 751                        | 750 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 821                        | 820 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 911                        | 910 pF  | •       | •   | •   | •   | •   | F, G, J, K, M |
| 102                        | 1000 pF | •       | •   | •   | •   | •   | F, G, J, K, M |
| 112                        | 1100 pF | •       | •   | •   | •   | •   | F, G, J, K, M |
| 122                        | 1200 pF | •       | •   | •   | •   | •   | F, G, J, K, M |

**Note**

- Plastic carrier tape



| SELECTION CHART            |        |         |     |     |     |     |     |      |      |               |
|----------------------------|--------|---------|-----|-----|-----|-----|-----|------|------|---------------|
| DIELECTRIC (VISHAY CODE)   |        | C0G (D) |     |     |     |     |     |      |      |               |
| STYLE                      |        | GA1111  |     |     |     |     |     |      |      |               |
| CASE CODE                  |        | 1111    |     |     |     |     |     |      |      |               |
| VOLTAGE (V <sub>DC</sub> ) |        | 50      | 100 | 200 | 300 | 500 | 630 | 1000 | 1500 | TOLERANCE     |
| VOLTAGE CODE               |        | A       | B   | C   | D   | E   | L   | G    | R    |               |
| CAP. CODE                  | CAP.   |         |     |     |     |     |     |      |      |               |
| 0R2                        | 0.2 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 0R3                        | 0.3 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 0R4                        | 0.4 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 0R5                        | 0.5 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 0R6                        | 0.6 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 0R7                        | 0.7 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 0R8                        | 0.8 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 0R9                        | 0.9 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 1R0                        | 1.0 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 1R1                        | 1.1 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 1R2                        | 1.2 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 1R3                        | 1.3 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 1R4                        | 1.4 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 1R5                        | 1.5 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 1R6                        | 1.6 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 1R7                        | 1.7 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 1R8                        | 1.8 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 1R9                        | 1.9 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 2R0                        | 2.0 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 2R1                        | 2.1 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 2R2                        | 2.2 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 2R4                        | 2.4 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 2R7                        | 2.7 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 3R0                        | 3.0 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 3R3                        | 3.3 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 3R6                        | 3.6 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 3R9                        | 3.9 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 4R3                        | 4.3 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 4R7                        | 4.7 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 5R1                        | 5.1 pF | •       | •   | •   | •   | •   | •   | •    | •    | V, B, C, D    |
| 5R6                        | 5.6 pF | •       | •   | •   | •   | •   | •   | •    | •    | B, C, D       |
| 6R2                        | 6.2 pF | •       | •   | •   | •   | •   | •   | •    | •    | B, C, D       |
| 6R8                        | 6.8 pF | •       | •   | •   | •   | •   | •   | •    | •    | B, C, D       |
| 7R5                        | 7.5 pF | •       | •   | •   | •   | •   | •   | •    | •    | B, C, D       |
| 8R2                        | 8.2 pF | •       | •   | •   | •   | •   | •   | •    | •    | B, C, D       |
| 9R1                        | 9.1 pF | •       | •   | •   | •   | •   | •   | •    | •    | B, C, D       |
| 100                        | 10 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 110                        | 11 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 120                        | 12 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 130                        | 13 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 150                        | 15 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 160                        | 16 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 180                        | 18 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 200                        | 20 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 220                        | 22 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 240                        | 24 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 270                        | 27 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 300                        | 30 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 330                        | 33 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 360                        | 36 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 390                        | 39 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |

**Note**

- Plastic carrier tape



| SELECTION CHART            |         |         |     |     |     |     |     |      |      |               |
|----------------------------|---------|---------|-----|-----|-----|-----|-----|------|------|---------------|
| DIELECTRIC (VISHAY CODE)   |         | C0G (D) |     |     |     |     |     |      |      |               |
| STYLE                      |         | GA1111  |     |     |     |     |     |      |      |               |
| CASE CODE                  |         | 1111    |     |     |     |     |     |      |      |               |
| VOLTAGE (V <sub>DC</sub> ) |         | 50      | 100 | 200 | 300 | 500 | 630 | 1000 | 1500 | TOLERANCE     |
| VOLTAGE CODE               |         | A       | B   | C   | D   | E   | L   | G    | R    |               |
| CAP. CODE                  | CAP.    |         |     |     |     |     |     |      |      |               |
| 430                        | 43 pF   | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 470                        | 47 pF   | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 510                        | 51 pF   | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 560                        | 56 pF   | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 620                        | 62 pF   | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 680                        | 68 pF   | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 750                        | 75 pF   | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 820                        | 82 pF   | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 910                        | 91 pF   | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 101                        | 100 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 111                        | 110 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 121                        | 120 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 131                        | 130 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 151                        | 150 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 161                        | 160 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 181                        | 180 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 201                        | 200 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 221                        | 220 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 241                        | 240 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 271                        | 270 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 301                        | 300 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 331                        | 330 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 361                        | 360 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 391                        | 390 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 431                        | 430 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 471                        | 470 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 511                        | 510 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 561                        | 560 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 621                        | 620 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 681                        | 680 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 751                        | 750 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 821                        | 820 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 911                        | 910 pF  | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 102                        | 1000 pF | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 112                        | 1100 pF | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 122                        | 1200 pF | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 132                        | 1300 pF | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 152                        | 1500 pF | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 162                        | 1600 pF | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 182                        | 1800 pF | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 202                        | 2000 pF | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 222                        | 2200 pF | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 242                        | 2400 pF | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 272                        | 2700 pF | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 302                        | 3000 pF | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |
| 332                        | 3300 pF | •       | •   | •   | •   | •   | •   | •    | •    | F, G, J, K, M |

## Note

- Plastic carrier tape



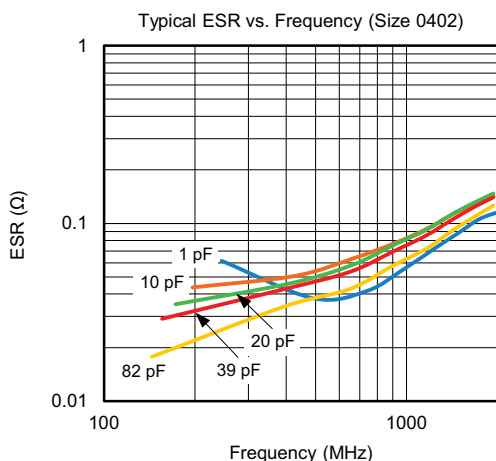
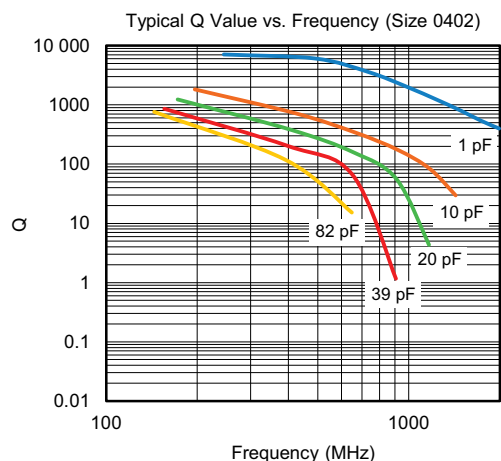
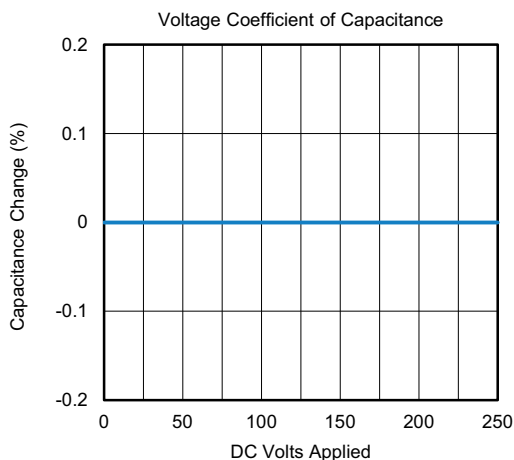
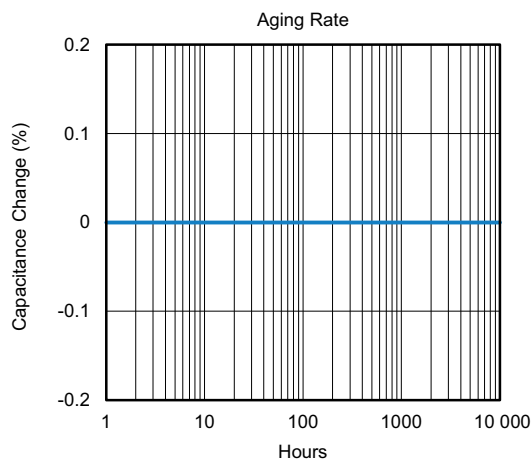
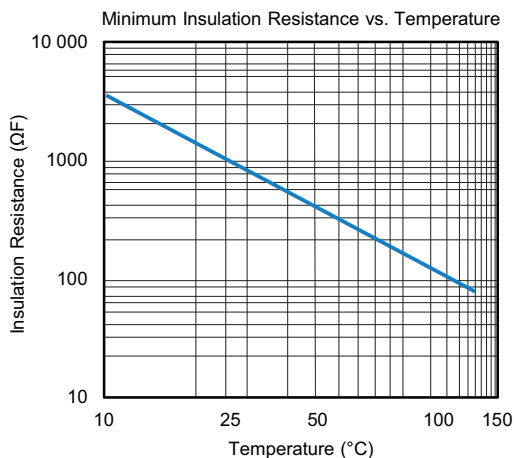
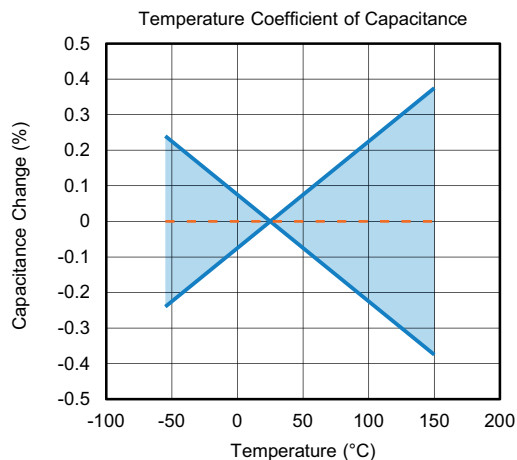
| SELECTION CHART            |        |         |     |     |     |     |            |
|----------------------------|--------|---------|-----|-----|-----|-----|------------|
| DIELECTRIC (VISHAY CODE)   |        | C0G (D) |     |     |     |     |            |
| STYLE                      |        | GA1206  |     |     |     |     |            |
| CASE CODE                  |        | 1206    |     |     |     |     |            |
| VOLTAGE (V <sub>DC</sub> ) |        | 50      | 100 | 200 | 500 | 630 | TOLERANCE  |
| VOLTAGE CODE               |        | A       | B   | C   | E   | L   |            |
| CAP. CODE                  | CAP.   |         |     |     |     |     |            |
| 1R0                        | 1.0 pF | •       | •   | •   | •   | •   | B, C, D    |
| 1R2                        | 1.2 pF | •       | •   | •   | •   | •   | B, C, D    |
| 1R5                        | 1.5 pF | •       | •   | •   | •   | •   | B, C, D    |
| 1R8                        | 1.8 pF | •       | •   | •   | •   | •   | B, C, D    |
| 2R2                        | 2.2 pF | •       | •   | •   | •   | •   | B, C, D    |
| 2R7                        | 2.7 pF | •       | •   | •   | •   | •   | B, C, D    |
| 3R3                        | 3.3 pF | •       | •   | •   | •   | •   | B, C, D    |
| 3R9                        | 3.9 pF | •       | •   | •   | •   | •   | B, C, D    |
| 4R7                        | 4.7 pF | •       | •   | •   | •   | •   | B, C, D    |
| 5R6                        | 5.6 pF | •       | •   | •   | •   | •   | B, C, D    |
| 6R8                        | 6.8 pF | •       | •   | •   | •   | •   | B, C, D    |
| 8R2                        | 8.2 pF | •       | •   | •   | •   | •   | B, C, D    |
| 100                        | 10 pF  | •       | •   | •   | •   | •   | F, G, J, K |
| 120                        | 12 pF  | •       | •   | •   | •   | •   | F, G, J, K |
| 150                        | 15 pF  | •       | •   | •   | •   | •   | F, G, J, K |
| 180                        | 18 pF  | •       | •   | •   | •   | •   | F, G, J, K |
| 220                        | 22 pF  | •       | •   | •   | •   | •   | F, G, J, K |
| 270                        | 27 pF  | •       | •   | •   | •   | •   | F, G, J, K |
| 330                        | 33 pF  | •       | •   | •   | •   | •   | F, G, J, K |
| 390                        | 39 pF  | •       | •   | •   | •   | •   | F, G, J, K |
| 470                        | 47 pF  | •       | •   | •   | •   | •   | F, G, J, K |
| 560                        | 56 pF  | •       | •   | •   | •   | •   | F, G, J, K |
| 680                        | 68 pF  | •       | •   | •   | •   | •   | F, G, J, K |
| 820                        | 82 pF  | •       | •   | •   | •   | •   | F, G, J, K |

**Note**

- Plastic carrier tape

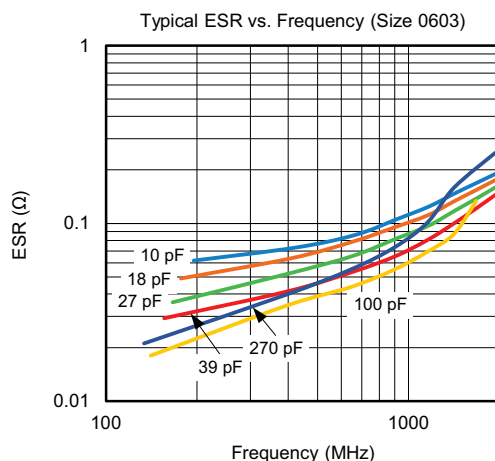
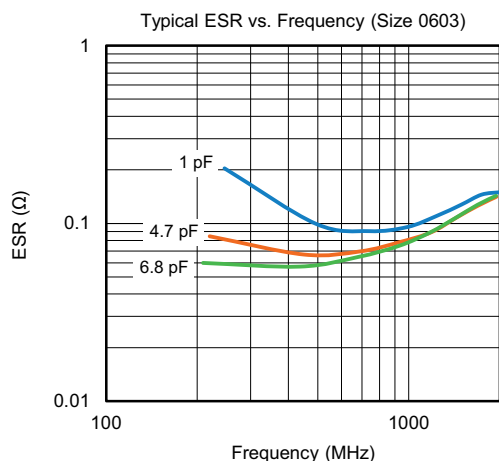
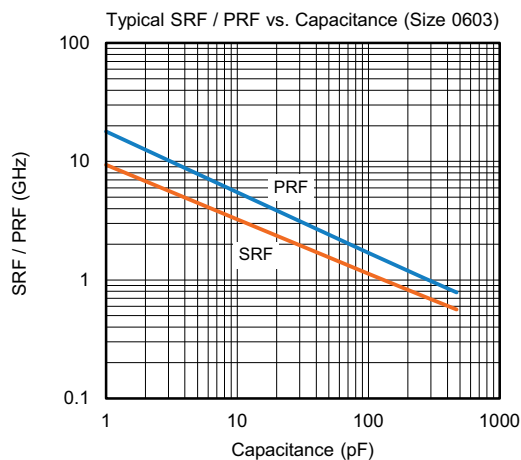
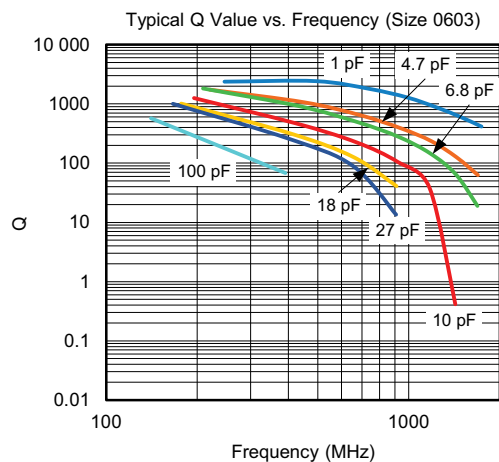
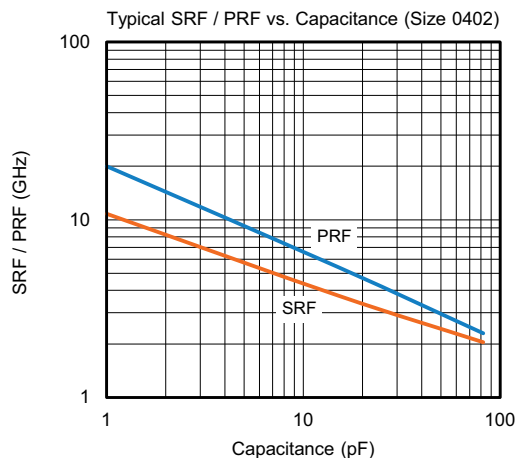


## HIGH FREQ DIELECTRIC - TYPICAL PARAMETERS



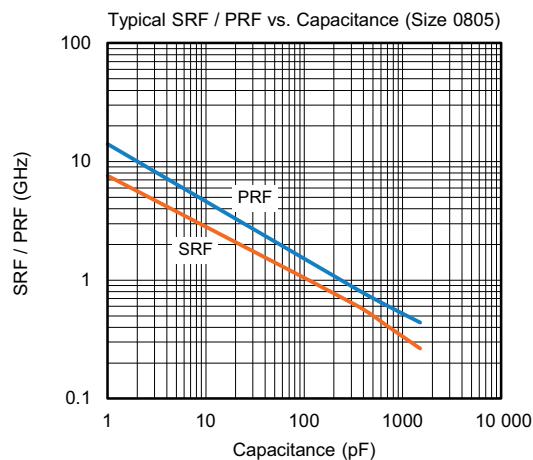
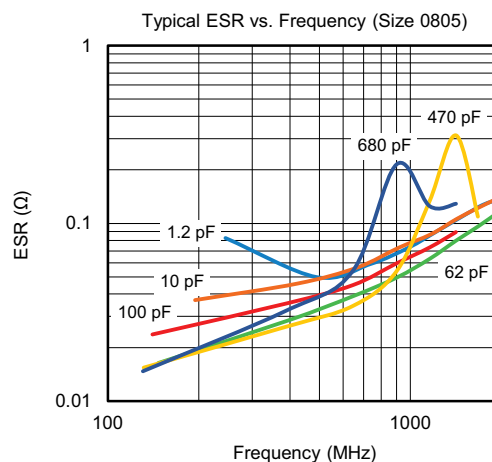
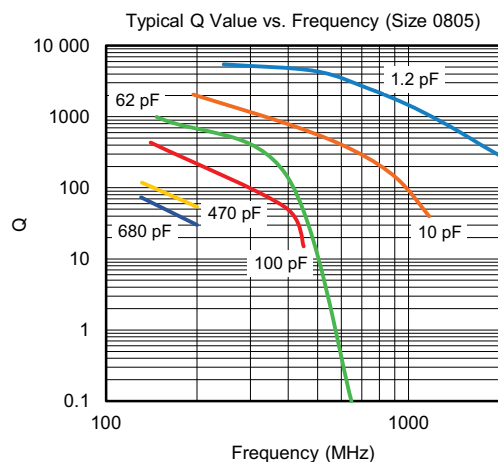


## HIGH FREQ DIELECTRIC - TYPICAL PARAMETERS

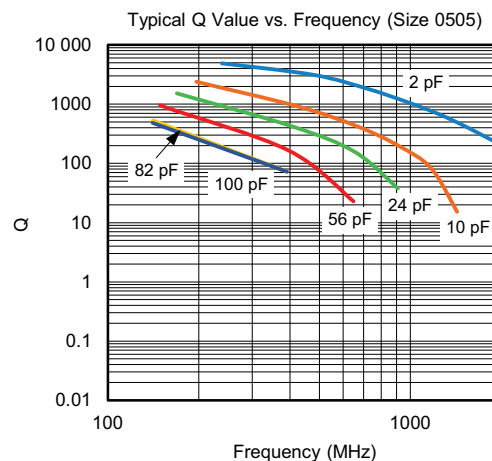
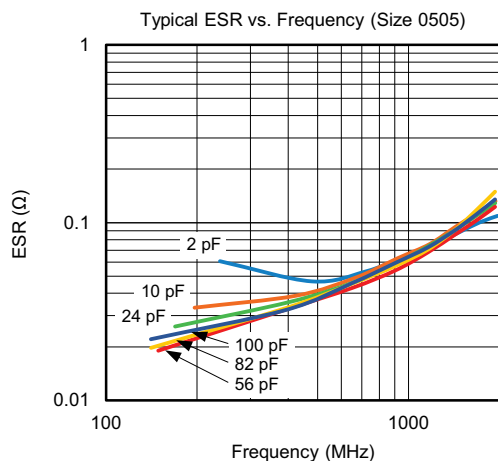




## HIGH FREQ DIELECTRIC - TYPICAL PARAMETERS



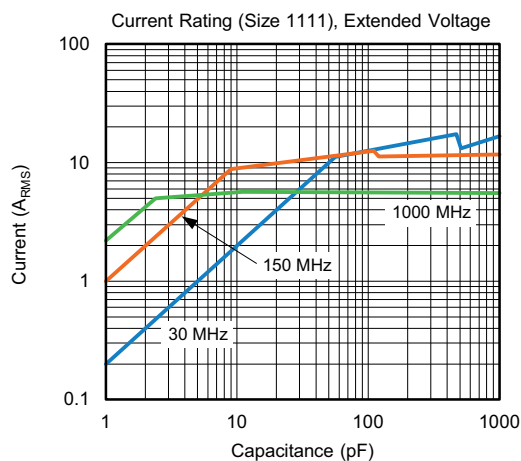
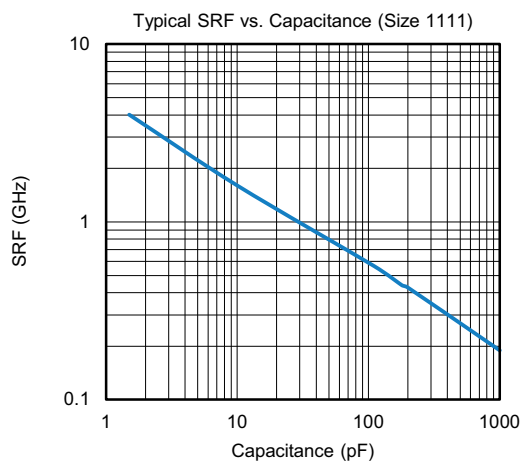
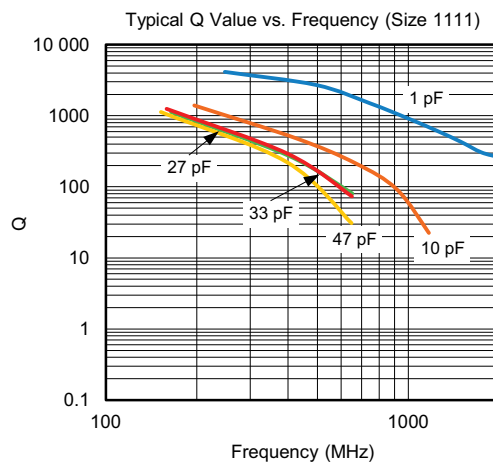
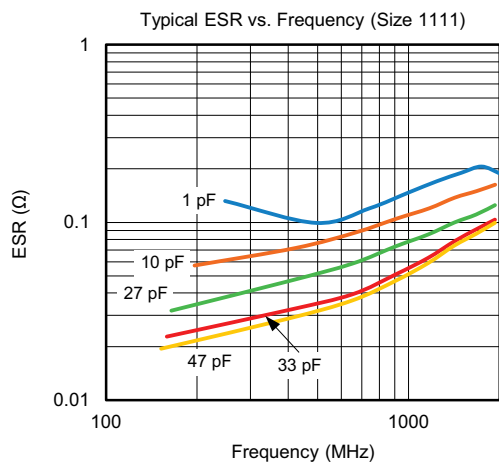
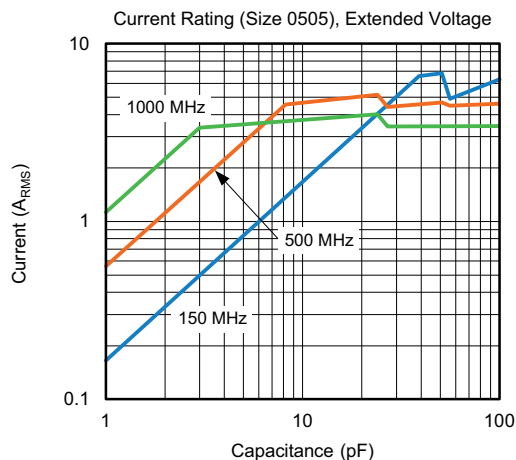
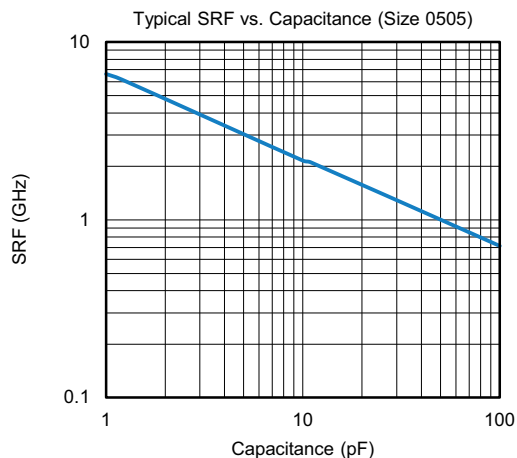
## QUAD HIGH FREQ DIELECTRIC - TYPICAL PARAMETERS







## QUAD HIGH FREQ DIELECTRIC - TYPICAL PARAMETERS



**1 - GENERAL CERTIFICATES**

|   |     |
|---|-----|
| # Quality management system according to ISO/IATF 16949: 2016 | Yes |
| # Quality management system according to ISO 9001: 2015       | Yes |
| # Environmental certification according to ISO 14001: 2015    | Yes |
| # Health and safety system according to ISO 45001             | Yes |

**2 - TECHNICAL REQUIREMENTS**

Unless specified in component specification, these parameters are the minimum requirements for the components.

**2.1 OPERATING TEMPERATURE RANGE**

|   |                           |                         |
|---|---------------------------|-------------------------|
| For standard applications               | $T_A$ : -55 °C to +125 °C | See characteristics 2.3 |
| For high temperature applications       | $T_A$ : -55 °C to +150 °C | See characteristics 2.3 |
| For ultra high temperature applications | $T_A$ : -55 °C to +175 °C | See characteristics 2.3 |

**2.2 STORAGE AND HANDLING CONDITIONS**

- (1) Store the components at 5 °C to 40 °C ambient temperature and  $\leq 70$  % 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:

- 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 oxidization of the terminations, which can easily lead to poor soldering.
- Store products on the shelf and avoid exposure to moisture or dust.
- Do not expose products to excessive shock, vibration, direct sunlight and so on.

**2.3 CHARACTERISTICS**

| PARAMETER  | CERAMIC TYPE | SYMBOL        | RATINGS              | TEST CONDITIONS / REMARKS                        |
|--|--------------|---------------|----------------------|--|
| Rated voltage in temperature range -55 °C to +125 °C           | C0G (D)      | $U_R$         | 25 V to 1500 V       |  |
| Derating at higher temperature up to +150 °C                   | C0G (D)      | $U_R$         | 25 V to 100 V        | $U_{DC} \leq \frac{1}{2} U_R$                    |
| Derating at higher temperature up to +175 °C                   | C0G (D)      | $U_R$         | 25 V to 100 V        | $U_{DC} \leq \frac{1}{4} U_R$                    |
| Temperature coefficient in temperature range -55 °C to +125 °C | C0G (D)      | $\alpha_C$    | $\leq \pm 30$ ppm/°C | If $C_R < 10$ pF: $\alpha_C \leq \pm 120$ ppm/°C |
| Temperature coefficient in temperature range -55 °C to +150 °C | C0G (D)      | $\alpha_C$    | $\leq \pm 30$ ppm/°C | If $C_R < 10$ pF: $\alpha_C \leq \pm 120$ ppm/°C |
| Dissipation factor in temperature range -55 °C to +175 °C      | C0G (D)      | $\tan \delta$ | $\leq 0.0005$        |  |

**3 - LOT ACCEPTANCE TESTS**

Process tests available in classes (on request)

| GROUP | ACTION  |
|-------|---|
| A     | Components are tested within the monitoring program of the supplier. The supplier shall submit the part numbers of the selected component to the customer during the component specification discussions. |
| B     | Components (customer P/N) shall be tested quarterly. Records available only on special request by the customer.   |
| C     | Test with each shipment. Records are provided on a monthly basis.<br>Customer special requirement; requirement should be determined in a specific component specification.                                |

Upon request the records can be submitted in electronic format on monthly basis.

**3.1 THERMAL STRENGTH, THERMAL SHOCK SENSIBILITY**

|                   |   |
|-------------------|---|
| Sample size       | 200   |
| Handling          | Mounted on PCB  |
| Thermal shock     | 1 x 280 °C, no pre-heat, 5 s to 10 s  |
| IR - test (IRATS) | $U = U_R$ , $T = \text{room temperature}$ , verified  |
| Burn in (BIATS)   | Equivalent to 12 h burn-in,<br>$2 \times U_R/125\text{ °C}$ ,<br>verification time to failure |

Acceptance criteria: zero defects (IRATS and BIATS).

**3.2 BOARD FLEX TEST**

|                 |  |
|-----------------|--|
| Sample size     | 20 pcs/lot   |
| Frequency       | At least three different part numbers of one component family matrix per quarter |
| Max. deflection | 8 mm (data to be reported, available on request)                                 |

**3.3 SOLDERABILITY/RESISTANCE TO SOLDERING HEAT**

Temperature profile for reflow soldering of SMD parts IPC/JEDEC-J-STD-020C.

Test is done on a regular basis for samples taken randomly out of the line.

Acceptance criteria: at least 95 % new solder and no detachment or leaching of terminations.

**4 - ENVIRONMENTAL REQUIREMENTS**

A list of the chemical substances content, which must not be used or whose use shall be limited by international law, is available on request.

Vishay confirms that the components specified in this specification do not contain asbestos nor cadmium, not even in the smallest volumes.

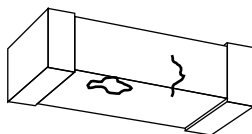
The manufacturer/supplier confirms that the component during normal handling, storage and assembly, as well as during operation in the automobile, is non toxic.

## 5 - INSPECTION CRITERIA

The supplier shall carry out visual examination with suitable equipment with approximately 10 x magnification and lighting appropriate to the specimen under test and the required quality level.

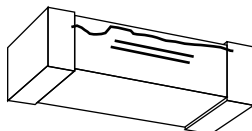
### Chipping

The components shall be free of cracks or fissures. Small damages which do not deteriorate the performance of the component shall be less than as defined in EIA 595.



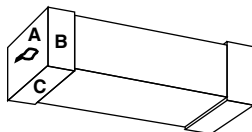
### Delamination or Exposed Electrodes

No visible separation or delamination between layers of the capacitor and no exposed electrodes between the two terminals of the capacitor must be seen.



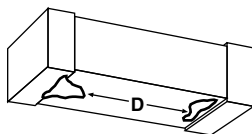
### Metallization

For the metallization, no visible detachment of the metallized terminals and no exposed electrodes must be seen. Defects and gaps in the metallization on each sides of the terminal must not exceed 10 % of the total area (e.g. A, B, C, ...).



### Electrode Distance

The ceramic body shall be free of any conducting material between the terminals which reduces the distance of the electrodes. The minimum distance "D" is 400 µm for all package sizes, except 0402. For the component package 0402 the minimum distance is 200 µm.



## 6 - BOARD FLEX TEST CONDITIONS

### 6.1 BOARD FLEX DEFINITIONS OF TEST

PCB thickness =  $(1.6 \pm 0.1)$  mm

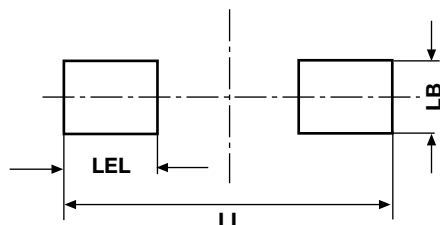
Copper thickness = 35  $\mu$ m

Material FR4 (EP-GC 02 according to DIN 40 802)

| LAYOUT / PAD DESIGN (Dimensions in mm) |          |      |      |
|--|----------|------|------|
| CASE CODE                              | PAD SIZE |      |      |
|  | LL       | LB   | LEL  |
| 0603                                   | 2.20     | 1.00 | 0.75 |
| 0805                                   | 3.40     | 1.30 | 1.20 |
| 1206                                   | 4.50     | 1.80 | 1.20 |

#### Note

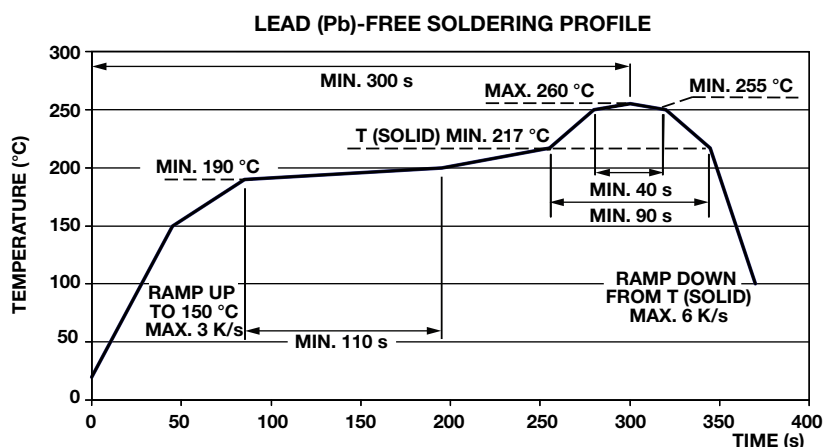
- LL = total length; LB = width of the pad; LEL = single pad length



### 6.2 SOLDERING INSTRUCTIONS

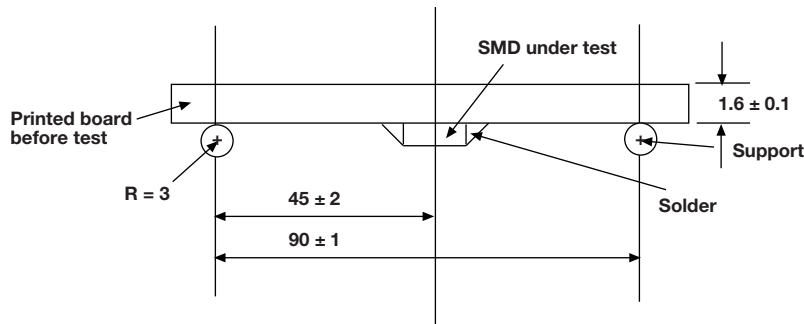
| THICKNESS, RECOMMENDED FOR SOLDER PASTE (Reflow soldering) |                      |
|--|----------------------|
| CASE CODE  | THICKNESS IN $\mu$ m |
| 0603   | 150 to 200           |
| 0805   | 150 to 200           |
| 1206   | 150 to 200           |

### 6.3 TYPICAL TEMPERATURE PROFILE FOR REFLOW SOLDERING (Boardflex test)

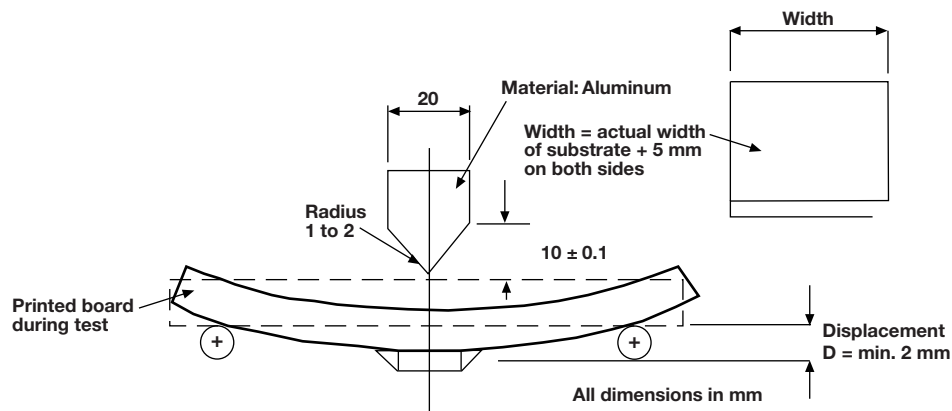


## 6.4 MOUNTING, DIMENSIONS AND TESTING

### Mounting



### Testing



## 6.5 PERFORMANCE OF THE TEST(S)

- A) Electrical test according to component specification (Cap, DF, IR)
- B) Mounting to PCB
- C) Storage at room temperature (min. 10 h)
- D) Board flex test

## 6.6 DETAILS

|         |  |
|---------|--|
| C0G (D) | PCB to be deflected in steps until cracks or other damages are visible or can be measured. Dwell time between steps: $(5 \pm 1) \text{ s}$ |
|---------|--|

## 6.7 FAILURE CRITERIA

|         |  |
|---------|--|
| C0G (D) | $\Delta C/C < 1 \%$ or $< 1 \text{ pF}$ , no failures up to min. 2 mm;<br>Electrical test according to component specification |
|---------|--|

**7 - AEC-Q200 QUALIFICATION TESTING**

| NO. | AEC-Q200 TEST ITEM                   | REFERENCE               |
|-----|--------------------------------------|-------------------------|
| 1   | Pre- and post stress electrical test | User spec               |
| 3   | High temp exposure (storage)         | MIL-STD-202, method 108 |
| 4   | Temperature cycling                  | JESD22, method JA-104   |
| 5   | Destructive physical analysis        | EIA-469                 |
| 6   | Moisture resistance                  | MIL-STD-202, method 106 |
| 7   | Biased humidity                      | MIL-STD-202, method 103 |
| 8   | Operation life                       | MIL-STD-202 method 108  |
| 9   | External Visual                      | MIL-STD-883 method 2009 |
| 10  | Physical dimension                   | JESD22, method JB-100   |
| 13  | Mechanical shock                     | MIL-STD-202, method 213 |
| 14  | Vibration                            | MIL-STD-202, method 204 |
| 15  | Resistance to solder heat            | MIL-STD-202, method 210 |
| 17  | ESD                                  | AEC-Q200-002            |
| 18  | Solderability                        | J-STD-002               |
| 19  | Electrical characterization          | User spec               |
| 21  | Board flex                           | AEC-Q200-005            |
| 22  | Terminal strength                    | AEC-Q200-006            |
| 23  | Beam load                            | AEC-Q200-003            |

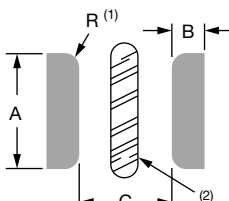
**STANDARD PACKAGING QUANTITIES (1)(2)(3)(6)**

| CASE CODE | TAPE SIZE | 7" REEL QUANTITIES                        |                                       |                            | 11 1/4" AND 13" REEL QUANTITIES           |                                       |
|-----------|-----------|---|---------------------------------------|----------------------------|---|---------------------------------------|
|           |           | PAPER TAPE<br>PACKAGING CODE<br>"C" / "O" | PLASTIC TAPE<br>PACKAGING CODE<br>"T" | LOW<br>QUANTITY<br>"J" (5) | PAPER TAPE<br>PACKAGING CODE<br>"P" / "I" | PLASTIC TAPE<br>PACKAGING CODE<br>"R" |
| 0402      | 8 mm      | 5000                                      | n/a                                   | 1000                       | 10 000                                    | n/a                                   |
| 0603 (4)  | 8 mm      | 4000                                      | 4000                                  | 1000                       | 10 000                                    | 10 000                                |
| 0805      | 8 mm      | n/a                                       | 3000                                  | 1000                       | n/a                                       | 10 000                                |
| 0505      | 8 mm      | n/a                                       | 3000                                  | 1000                       | n/a                                       | 10 000                                |
| 1111      | 8 mm      | n/a                                       | 2500                                  | 1000                       | n/a                                       | 9000                                  |
| 1206      | 8 mm      | n/a                                       | 3000                                  | 1000                       | n/a                                       | 10 000                                |

**Notes**

- (1) Vishay Vitramon uses embossed plastic carrier tape  
(2) REFERENCE: EIA standard RS 481 - "Taping of Surface Mount Components for Automatic Placement"  
(3) n/a = not available  
(4) Packaging "C" / "P" / "O" / "I" and "T" / "R" or lower quantities can depend from product thickness  
(5) Paper / plastic tape used by availability  
(6) Final quantities for packaging can depend on product thickness

## 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 <sup>(3)</sup> |
| 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 <sup>(4)</sup> | 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

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