

## Surface Mount Multilayer Ceramic Chip Capacitors MIL Qualified, Type MIL-123



### FEATURES

- Space-level reliability
- Military qualified products
- Federal stock control number, CAGE CODE 2770A
- High reliability tested per MIL-PRF-123
- Lead-bearing (min. 4 %) termination finish “Z”
- Silver / palladium alloy finish “M”
- Guarded termination finish “S”
- Wet build process
- Reliable Noble Metal Electrode (NME) system
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

### APPLICATIONS

- Space systems
- Satellite systems
- Avionic systems
- Sonar systems
- Missiles applications
- Global positioning systems

### ELECTRICAL SPECIFICATIONS

#### Note

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

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

**Capacitance Range:** 1.0 pF to 470 nF

**Voltage Range:** 50 V<sub>DC</sub> to 100 V<sub>DC</sub>

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

- BP: 0 ppm/°C ± 30 ppm/°C from -55 °C to +125 °C,  
with 0 V<sub>DC</sub> applied
- BX: ± 15 % from -55 °C to +125 °C,  
with 0 V<sub>DC</sub> applied
- BX: +15 %, -25 % from -55 °C to +125 °C,  
with 100 % rated V<sub>DC</sub> applied

#### Dissipation Factor (DF):

BP: 0.15 % maximum

BX: 2.50 % maximum

Test frequency:

1 MHz ± 50 kHz for BP capacitors ≤ 1000 pF

All other BP and BX at 1 kHz ± 50 Hz

#### Aging Rate:

BP: 0 % maximum per decade

BX: 1 % maximum per decade

#### Insulation Resistance (IR):

at +25 °C and rated voltage 100 000 MΩ minimum or 1000 ΩF, whichever is less

#### Dielectric Strength Test:

performed per method 103 of EIA-198-2-E.

Applied test voltages:

≤ 100 V<sub>DC</sub>-rated: 250 % of rated voltage



## QUICK REFERENCE DATA

| DIELECTRIC | STYLE (CASE) | MAXIMUM VOLTAGE (V) | CAPACITANCE |            |
|------------|--------------|---------------------|-------------|------------|
|            |              |                     | MINIMUM     | MAXIMUM    |
| BP         | CKS51 (0805) | 100                 | 1.0 pF      | 680 pF     |
| BP         | CKS55 (1206) | 100                 | 1.0 pF      | 2200 pF    |
| BP         | CKS52 (1210) | 100                 | 300 pF      | 3300 pF    |
| BP         | CKS53 (1808) | 100                 | 300 pF      | 1000 pF    |
| BP         | CKS56 (1812) | 100                 | 1200 pF     | 10 000 pF  |
| BP         | CKS57 (1825) | 100                 | 3600 pF     | 22 000 pF  |
| BP         | CKS54 (2225) | 50                  | 1100 pF     | 10 000 pF  |
| BX         | CKS51 (0805) | 100                 | 330 pF      | 18 000 pF  |
| BX         | CKS55 (1206) | 100                 | 4700 pF     | 39 000 pF  |
| BX         | CKS52 (1210) | 100                 | 5600 pF     | 100 000 pF |
| BX         | CKS53 (1808) | 100                 | 5600 pF     | 100 000 pF |
| BX         | CKS56 (1812) | 100                 | 27 000 pF   | 56 000 pF  |
| BX         | CKS57 (1825) | 100                 | 56 000 pF   | 470 000 pF |
| BX         | CKS54 (2225) | 50                  | 120 000 pF  | 470 000 pF |

## Note

- Detail ratings see "Selection Chart"

ORDERING INFORMATION - MIL-PRF-123 <sup>(1)</sup>

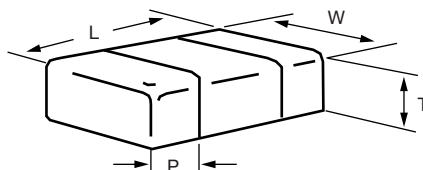
| M123A<br>MILITARY<br>STYLE | 10<br>SLASH SHEET                                                                                                                               | BX<br>DIELECTRIC | B<br>DC VOLTAGE       | 103<br>CAPACITANCE<br>VALUE                                                                                                                                                                       | K<br>CAPACITANCE<br>TOLERANCE                                                                                                                                             | Z<br>TERMINATION                                                                                              | W<br>PACKAGING                                                                |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| MIL-PRF-123                | 10 = CKS51 (0805)<br>11 = CKS52 (1210)<br>12 = CKS53 (1808)<br>13 = CKS54 (2225)<br>21 = CKS55 (1206)<br>22 = CKS56 (1812)<br>23 = CKS57 (1825) | BP<br>BX         | B = 50 V<br>C = 100 V | Expressed in picofarads (pF).<br>The first two digits are significant, the third is a multiplier.<br>R denotes decimal place.<br>Examples:<br>1R0 = 1.0 pF<br>103 = 10 000 pF<br>104 = 100 000 pF | B = $\pm 0.10$ pF<br>C = $\pm 0.25$ pF<br>D = $\pm 0.50$ pF<br>F = $\pm 1$ %<br>J = $\pm 5$ %<br>K = $\pm 10$ %<br>M = $\pm 20$ %<br><br>See table "Available Tolerances" | Z = Ni barrier with tin / lead plate min. 4 % lead<br>S = guarded termination<br>M = silver / palladium alloy | W = waffle pack<br>J = full 7" reel<br>A = 7" reel, customer defined quantity |

## Note

- <sup>(1)</sup> DC voltage rating should not be exceeded in application. Other application factors may affect the MLCC performance  
Consult for questions: [mlcc@vishay.com](mailto:mlcc@vishay.com)

**AVAILABLE TOLERANCES**

| MILITARY STYLE | SLASH SHEET      | DIELECTRIC | CAPACITANCE RANGE | AVAILABLE CAPACITANCE TOLERANCES |
|----------------|------------------|------------|-------------------|----------------------------------|
| MIL-PRF-123    | 10: CKS51 (0805) | BP         | $\leq 10$ pF      | C, D                             |
|                |                  |            | 10 pF to 24 pF    | C, J, K                          |
|                |                  |            | $\geq 27$ pF      | F, J, K                          |
|                | 11: CKS52 (1210) | BP         | All               | K                                |
|                |                  |            | All               | F, J, K                          |
|                |                  |            | All               | K, M                             |
|                | 12: CKS53 (1808) | BP         | All               | F, J, K                          |
|                |                  |            | All               | K                                |
|                |                  |            | All               | F, J, K                          |
|                | 13: CKS54 (2225) | BP         | All               | F, J, K                          |
|                |                  |            | All               | K                                |
|                |                  |            | All               | F, J, K                          |
|                | 21: CKS55 (1206) | BP         | $\leq 2.4$ pF     | B, C                             |
|                |                  |            | 2.7 pF to 9.1 pF  | B, C, D                          |
|                |                  |            | $\geq 10$ pF      | F, J, K                          |
|                | 22: CKS56 (1812) | BP         | All               | K, M                             |
|                |                  |            | All               | F, J, K                          |
|                |                  |            | All               | K, M                             |
|                | 23: CKS57 (1825) | BP         | All               | F, J, K                          |
|                |                  |            | All               | K, M                             |
|                |                  |            | All               | F, J, K                          |

**DIMENSIONS** in inches (millimeters)


| MIL-PRF-123 | STYLE | LENGTH (L)                     | WIDTH (W)                      | THICKNESS (T)   |                 | TERM. (P)                      |
|-------------|-------|--------------------------------|--------------------------------|-----------------|-----------------|--------------------------------|
|             |       |                                |                                | MINIMUM         | MAXIMUM         |                                |
| /10         | CKS51 | 0.080 ± 0.015<br>(2.03 ± 0.38) | 0.050 ± 0.015<br>(1.27 ± 0.38) | 0.020<br>(0.51) | 0.055<br>(1.40) | 0.020 ± 0.010<br>(0.51 ± 0.25) |
| /11         | CKS52 | 0.120 ± 0.015<br>(3.05 ± 0.38) | 0.100 ± 0.015<br>(2.54 ± 0.38) | 0.020<br>(0.51) | 0.065<br>(1.65) | 0.020 ± 0.010<br>(0.51 ± 0.25) |
| /12         | CKS53 | 0.180 ± 0.015<br>(4.57 ± 0.38) | 0.080 ± 0.015<br>(2.03 ± 0.38) | 0.020<br>(0.51) | 0.065<br>(1.65) | 0.020 ± 0.010<br>(0.51 ± 0.25) |
| /13         | CKS54 | 0.220 ± 0.015<br>(5.59 ± 0.38) | 0.250 ± 0.015<br>(6.35 ± 0.38) | 0.020<br>(0.51) | 0.070<br>(1.78) | 0.020 ± 0.010<br>(0.51 ± 0.25) |
| /21         | CKS55 | 0.120 ± 0.015<br>(3.05 ± 0.38) | 0.060 ± 0.015<br>(1.52 ± 0.38) | 0.020<br>(0.51) | 0.065<br>(1.65) | 0.020 ± 0.010<br>(0.51 ± 0.25) |
| /22         | CKS56 | 0.180 ± 0.015<br>(4.57 ± 0.38) | 0.125 ± 0.015<br>(3.18 ± 0.38) | 0.022<br>(0.56) | 0.080<br>(2.03) | 0.020 ± 0.010<br>(0.51 ± 0.25) |
| /23         | CKS57 | 0.180 ± 0.015<br>(4.57 ± 0.38) | 0.250 ± 0.015<br>(6.35 ± 0.38) | 0.020<br>(0.51) | 0.080<br>(2.03) | 0.020 ± 0.010<br>(0.51 ± 0.25) |



| SELECTION CHART            |        |       |       |       |       |       |       |       |       |       |       |       |       |       |
|----------------------------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| DIELECTRIC                 |        | BP    |       |       |       |       |       |       |       |       |       |       |       |       |
| STYLE                      |        | CKS51 |       | CKS55 |       | CKS52 |       | CKS53 |       | CKS56 |       | CKS57 |       | CKS54 |
| SLASH SHEET                |        | /10   |       | /21   |       | /11   |       | /12   |       | /22   |       | /23   |       | /13   |
| CASE CODE                  |        | 0805  |       | 1206  |       | 1210  |       | 1808  |       | 1812  |       | 1825  |       | 2225  |
| VOLTAGE (V <sub>DC</sub> ) |        | 50 V  | 100 V | 50 V  | 100 V | 50 V  | 100 V | 50 V  | 100 V | 50 V  | 100 V | 50 V  | 100 V | 50 V  |
| VOLTAGE CODE               |        | B     | C     | B     | C     | B     | C     | B     | C     | B     | C     | B     | C     | B     |
| CAP. CODE                  | CAP.   |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 1R0                        | 1.0 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 1R1                        | 1.1 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 1R2                        | 1.2 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 1R3                        | 1.3 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 1R5                        | 1.5 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 1R6                        | 1.6 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 1R8                        | 1.8 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 2R0                        | 2.0 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 2R2                        | 2.2 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 2R4                        | 2.4 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 2R7                        | 2.7 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 3R0                        | 3.0 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 3R3                        | 3.3 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 3R6                        | 3.6 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 3R9                        | 3.9 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 4R3                        | 4.3 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 4R7                        | 4.7 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 5R1                        | 5.1 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 5R6                        | 5.6 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 6R2                        | 6.2 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 6R8                        | 6.8 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 7R5                        | 7.5 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 8R2                        | 8.2 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 9R1                        | 9.1 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 100                        | 10 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 110                        | 11 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 120                        | 12 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 130                        | 13 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 150                        | 15 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 160                        | 16 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 180                        | 18 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 200                        | 20 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 220                        | 22 pF  | •     | •     |       |       |       |       |       |       |       |       |       |       |       |
| 240                        | 24 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 270                        | 27 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 300                        | 30 pF  | •     | •     |       |       |       |       |       |       |       |       |       |       |       |
| 330                        | 33 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 360                        | 36 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 390                        | 39 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 430                        | 43 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 470                        | 47 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 510                        | 51 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 560                        | 56 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 620                        | 62 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 680                        | 68 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 750                        | 75 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 820                        | 82 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 910                        | 91 pF  | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 101                        | 100 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 111                        | 110 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 121                        | 120 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 131                        | 130 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 151                        | 150 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |



| SELECTION CHART            |        |       |       |       |       |       |       |       |       |       |       |       |       |       |
|----------------------------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| DIELECTRIC                 |        | BP    |       |       |       |       |       |       |       |       |       |       |       |       |
| STYLE                      |        | CKS51 |       | CKS55 |       | CKS52 |       | CKS53 |       | CKS56 |       | CKS57 |       | CKS54 |
| SLASH SHEET                |        | /10   |       | /21   |       | /11   |       | /12   |       | /22   |       | /23   |       | /13   |
| CASE CODE                  |        | 0805  |       | 1206  |       | 1210  |       | 1808  |       | 1812  |       | 1825  |       | 2225  |
| VOLTAGE (V <sub>DC</sub> ) |        | 50 V  | 100 V | 50 V  | 100 V | 50 V  | 100 V | 50 V  | 100 V | 50 V  | 100 V | 50 V  | 100 V | 50 V  |
| VOLTAGE CODE               |        | B     | C     | B     | C     | B     | C     | B     | C     | B     | C     | B     | C     | B     |
| CAP. CODE                  | CAP.   |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 161                        | 160 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 181                        | 180 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 201                        | 200 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 221                        | 220 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 241                        | 240 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 271                        | 270 pF | •     | •     |       | •     |       |       |       |       |       |       |       |       |       |
| 301                        | 300 pF | •     | •     |       | •     | •     | •     | •     | •     |       |       |       |       |       |
| 331                        | 330 pF | •     | •     |       | •     | •     | •     | •     | •     |       |       |       |       |       |
| 361                        | 360 pF | •     | •     |       | •     | •     | •     | •     | •     |       |       |       |       |       |
| 391                        | 390 pF | •     | •     |       | •     | •     | •     | •     | •     |       |       |       |       |       |
| 431                        | 430 pF | •     | •     |       | •     | •     | •     | •     | •     |       |       |       |       |       |
| 471                        | 470 pF | •     | •     |       | •     | •     | •     | •     | •     |       |       |       |       |       |
| 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 |       |       | •     |       | •     | •     |       |       |       | •     |       |       | •     |
| 162                        | 1.6 nF |       |       | •     |       | •     | •     |       |       |       |       |       |       | •     |
| 182                        | 1.8 nF |       |       | •     |       | •     | •     |       |       |       | •     |       |       | •     |
| 202                        | 2.0 nF |       |       | •     |       | •     | •     |       |       |       |       |       |       | •     |
| 222                        | 2.2 nF |       |       | •     |       | •     | •     |       |       |       | •     |       |       | •     |
| 242                        | 2.4 nF |       |       |       |       | •     |       |       |       |       | •     |       |       | •     |
| 272                        | 2.7 nF |       |       |       |       | •     |       |       |       |       | •     |       |       | •     |
| 302                        | 3.0 nF |       |       |       |       | •     |       |       |       |       | •     |       |       | •     |
| 332                        | 3.3 nF |       |       |       |       | •     |       |       |       |       | •     |       |       | •     |
| 362                        | 3.6 nF |       |       |       |       |       |       |       |       |       | •     |       |       | •     |
| 392                        | 3.9 nF |       |       |       |       |       |       |       |       |       | •     |       | •     | •     |
| 432                        | 4.3 nF |       |       |       |       |       |       |       |       |       | •     |       |       | •     |
| 472                        | 4.7 nF |       |       |       |       |       |       |       |       |       | •     |       | •     | •     |
| 512                        | 5.1 nF |       |       |       |       |       |       |       |       |       | •     |       | •     | •     |
| 562                        | 5.6 nF |       |       |       |       |       |       |       |       |       | •     |       | •     | •     |
| 622                        | 6.2 nF |       |       |       |       |       |       |       |       |       | •     |       | •     | •     |
| 682                        | 6.8 nF |       |       |       |       |       |       |       |       |       | •     |       | •     | •     |
| 752                        | 7.5 nF |       |       |       |       |       |       |       |       |       | •     |       | •     | •     |
| 822                        | 8.2 nF |       |       |       |       |       |       |       |       |       | •     |       | •     | •     |
| 912                        | 9.1 nF |       |       |       |       |       |       |       |       |       | •     |       | •     | •     |
| 103                        | 10 nF  |       |       |       |       |       |       |       |       |       | •     |       | •     | •     |
| 113                        | 11 nF  |       |       |       |       |       |       |       |       |       |       |       | •     |       |
| 123                        | 12 nF  |       |       |       |       |       |       |       |       |       |       |       | •     |       |
| 133                        | 13 nF  |       |       |       |       |       |       |       |       |       |       |       | •     |       |
| 153                        | 15 nF  |       |       |       |       |       |       |       |       |       |       |       | •     |       |
| 163                        | 16 nF  |       |       |       |       |       |       |       |       |       |       |       | •     |       |
| 183                        | 18 nF  |       |       |       |       |       |       |       |       |       |       |       | •     |       |
| 203                        | 20 nF  |       |       |       |       |       |       |       |       |       |       |       | •     |       |
| 223                        | 22 nF  |       |       |       |       |       |       |       |       |       |       |       | •     |       |



| SELECTION CHART            |        |       |       |       |       |       |       |       |       |       |       |       |       |
|----------------------------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| DIELECTRIC                 |        | BX    |       |       |       |       |       |       |       |       |       |       |       |
| STYLE                      |        | CKS51 |       | CKS55 |       | CKS52 |       | CKS53 |       | CKS56 | CKS57 |       | CKS54 |
| SLASH SHEET                |        | /10   |       | /21   |       | /11   |       | /12   |       | /22   | /23   |       | /13   |
| CASE CODE                  |        | 0805  |       | 1206  |       | 1210  |       | 1808  |       | 1812  | 1825  |       | 2225  |
| VOLTAGE (V <sub>DC</sub> ) |        | 50 V  | 100 V | 50 V  | 100 V | 50 V  | 100 V | 50 V  | 100 V | 100 V | 50 V  | 100 V | 50 V  |
| VOLTAGE CODE               |        | B     | C     | B     | C     | B     | C     | B     | C     | C     | B     | C     | B     |
| 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 |       |       |       |       |       |       |       |       |       | •     |       | •     |
| 474                        | 470 nF |       |       |       |       |       |       |       |       |       | •     |       | •     |

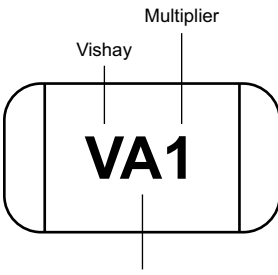
**PACKAGE QUANTITIES (1)(2)(3)**

| STYLE | BODY SIZE | WAFFLE PACK<br>"W" (4) | TAPE AND REEL |         | TAPE SIZE |
|-------|-----------|------------------------|---------------|---------|-----------|
|       |           |                        | "A" (5)       | "J" (6) |           |
| CKS51 | 0805      | 666                    | ≥ 100         | 1000    | 8 mm      |
| CKS55 | 1206      | 511                    | ≥ 100         | 1000    | 8 mm      |
| CKS52 | 1210      | 475                    | ≥ 100         | 1000    | 8 mm      |
| CKS53 | 1808      | 430                    | ≥ 100         | 500     | 12 mm     |
| CKS56 | 1812      | 350                    | ≥ 100         | 500     | 12 mm     |
| CKS57 | 1825      | 244                    | ≥ 100         | 500     | 12 mm     |
| CKS54 | 2225      | 216                    | ≥ 100         | 250     | 12 mm     |

**Notes**

- (1) Vishay Vitramon uses embossed plastic carrier tape
- (2) Reference: EIA standard RS 481 - "Taping of Surface Mount Components for Automatic Placement"
- (3) Maximum single lot date code quantity (SLDC) is 5000 pieces
- (4) The quantities in the table are the maximum number of pieces per waffle package. Order quantity can be any amount
- (5) Order quantity for "A" package code can be any amount greater than or equal to 100 pieces
- (6) Orders for "J" package code product must be in increments of the quantity listed in the table

**PART MARKING EXPLANATION**

| FIRST DIGIT | SECOND DIGIT         |                     | THIRD DIGIT         |                    | EXAMPLES                                                                                                                                                             |
|-------------|----------------------|---------------------|---------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | ALPHABETIC CHARACTER | SIGNIFICANT FIGURES | NUMERICAL CHARACTER | DECIMAL MULTIPLIER |                                                                                                                                                                      |
| V = Vishay  | A                    | 1.0                 | 0                   | 10 <sup>0</sup>    |  <p>VL0 = 2.7 pF</p> <p>VA2 = 100 pF</p> <p>VR1 = 43 pF</p> <p>Vd3 = 4000 pF</p> |
|             | B                    | 1.1                 | 1                   | 10 <sup>1</sup>    |                                                                                                                                                                      |
|             | C                    | 1.2                 | 2                   | 10 <sup>2</sup>    |                                                                                                                                                                      |
|             | D                    | 1.3                 | 3                   | 10 <sup>3</sup>    |                                                                                                                                                                      |
|             | E                    | 1.5                 | 4                   | 10 <sup>4</sup>    |                                                                                                                                                                      |
|             | F                    | 1.6                 | 5                   | 10 <sup>5</sup>    |                                                                                                                                                                      |
|             | G                    | 1.8                 | 6                   | 10 <sup>6</sup>    |                                                                                                                                                                      |
|             | H                    | 2.0                 | 7                   | 10 <sup>7</sup>    |                                                                                                                                                                      |
|             | J                    | 2.2                 | 8                   | 10 <sup>8</sup>    |                                                                                                                                                                      |
|             | K                    | 2.4                 | 9                   | 10 <sup>9</sup>    |                                                                                                                                                                      |
|             | L                    | 2.7                 |                     |                    |                                                                                                                                                                      |
|             | M                    | 3.0                 |                     |                    |                                                                                                                                                                      |
|             | N                    | 3.3                 |                     |                    |                                                                                                                                                                      |
|             | P                    | 3.6                 |                     |                    |                                                                                                                                                                      |
|             | Q                    | 3.9                 |                     |                    |                                                                                                                                                                      |
|             | R                    | 4.3                 |                     |                    |                                                                                                                                                                      |
|             | S                    | 4.7                 |                     |                    |                                                                                                                                                                      |
|             | T                    | 5.1                 |                     |                    |                                                                                                                                                                      |
|             | U                    | 5.6                 |                     |                    |                                                                                                                                                                      |
|             | V                    | 6.2                 |                     |                    |                                                                                                                                                                      |
|             | W                    | 6.8                 |                     |                    |                                                                                                                                                                      |
|             | X                    | 7.5                 |                     |                    |                                                                                                                                                                      |
|             | Y                    | 8.2                 |                     |                    |                                                                                                                                                                      |
|             | Z                    | 9.1                 |                     |                    |                                                                                                                                                                      |
|             | a                    | 2.5                 |                     |                    |                                                                                                                                                                      |
|             | b                    | 3.5                 |                     |                    |                                                                                                                                                                      |
|             | d                    | 4.0                 |                     |                    |                                                                                                                                                                      |
|             | e                    | 4.5                 |                     |                    |                                                                                                                                                                      |
|             | f                    | 5.0                 |                     |                    |                                                                                                                                                                      |
|             | m                    | 6.0                 |                     |                    |                                                                                                                                                                      |
|             | n                    | 7.0                 |                     |                    |                                                                                                                                                                      |
|             | t                    | 8.0                 |                     |                    |                                                                                                                                                                      |
|             | y                    | 9.0                 |                     |                    |                                                                                                                                                                      |



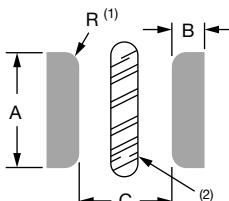
## STORAGE AND HANDLING CONDITIONS

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

## 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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